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Impact of Vehicle Modifications to ADAS Test Report

Client: Transport Safety
Safety, Policy, Environment and Regulation
Transport for NSW

Test specification: Vehicle Standard (Australian Design Rule 98-01 – Advanced
Emergency Braking for Passenger Vehicles and Light Goods
Vehicles) 2021
National Road Vehicle Standard (Australian Design Rule 107/00 –
Lane Keeping Systems) 2022

Test item: 2021 Ford Ranger
2020 Toyota Hilux
2022 Isuzu D-Max

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Preface

It has been suggested that the performance of some Advanced Driver Assistance Systems (ADAS) may be affected by common vehicle modifications, however, there has been little publicly accessible testing nor evidence into this idea, nor which modifications might be relevant. There is a large range of ADAS on modern vehicles from adaptive cruise control to automatic parking, however the systems of concern in this report are Lane Keeping, and Automatic Emergency Braking systems since they will become mandatory vehicle features in the near future. The testing undertaken here is solely to assist with future vehicle policy and give some insight into which modifications, if any, are likely to affect the operation of an ADAS.

When a vehicle is first manufactured, it must comply, and continue to comply, with the mandatory safety standards named the Australian design Rules (ADRs)- however vehicles that are already in the fleet do not need to comply with ADRs that were implemented after they were made. Lane Keeping and Automatic braking systems are gradually becoming mandatory in very recent, as well as future vehicles- however they were not mandatory when this testing commenced and were not mandatory on any of the test vehicles. Hence, if any of the current test vehicles fail to comply with the testing protocols, either in their OEM or modified condition, it does not mean that they do not comply with their registration requirements.

Tested lane keeping systems was conducted as per the draft protocol in ADR107/00 Lane Keeping Systems 2022. However, after testing, this protocol was withdrawn. A copy of ADR107 is in the Appendix for reference.

The test vehicles used were voluntarily fitted with the relevant ADAS by the OEM, and some contain older generation ADAS systems that may not fully satisfy upcoming ADRs. Nonetheless, the working group believe this testing will give some insight into how future mandatory ADAS may be affected by vehicle modifications.

Introduction

Background

The Future Mobility Testing and Research Centre (FMTRC) has been engaged to investigate if the fitment of certain aftermarket accessories and modifying a vehicle has any effect on the performance of Advanced Driver Assistance Systems (ADAS) on three popular Australian utility models.

The three vehicles selected were 2020 Toyota Hilux, 2021 Ford Ranger and 2022 Isuzu DMax, as shown in Figure 1. The availability of a wide range of aftermarket accessories for these 3 vehicles and the fact that they have been awarded a 5-star ANCAP safety rating played a role in their selection. The accessories include Lift Kits, Bullbars, Antennas and driving lights.



2021 Ford Ranger



2022 Isuzu D-Max



2020 Toyota Hilux

Figure 1: Vehicles purchased for testing: Ford Ranger (Top Left), Isuzu D-Max (Top Right) and Toyota Hilux (Bottom).

The Australian Government has mandated that Autonomous Emergency Braking (AEB) and Lane Keeping Systems (LKS) technology is included in new passenger cars and light goods vehicles from start dates staggered beyond 2023. The requirements for these systems are outlined in ADR 98 (AEB) and were outlined within draft ADR 107 (LKS). The proposed Australian Design Rule 107/00 – Lane Keeping Systems 2022 was used in this test program to assess the vehicle's lane assist system. ADR107 has been adapted from EU Regulation EU 2021/646 Emergency Lane Keeping Systems (ELKS). However ADR107 was never

formally adopted, and has subsequently been withdrawn. A copy of draft ADR107 is included within the appendices of this report.

Common AEB systems use either a dual camera system that is mounted towards the top of the windscreen (represented here by the Isuzu D-max) or a fusion system which is a combination of a single camera mounted towards the top of the windscreen and a radar mounted behind the front grill or bumper (represented here by the Toyota Hilux and The Ford Ranger), see Figure 2. LKS use the same single or dual camera to calculate the distance of the vehicle to the lane or road edge.



2022 Isuzu D-Max Dual Camera Location



2020 Toyota Hilux Camera and Radar Location



2021 Ford Ranger Camera and Radar Location

Figure 2: Common ADAS sensor types: dual camera (Left) and fusion - single camera with radar (Right & Bottom).

Aftermarket Accessories

The below illustrates all the different modification, aftermarket accessories and configurations that were tested in this report.

Two Bullbars were purchased for the Hilux and Ranger. A commonly used Bullbar as well as Bullbar of interest to the project team. A single Bullbar was also purchased for D-Max. These Bullbars are shown in Figure 3. Note that the Bullbar X purchased for the Hilux is not shown here because testing was not performed in this configuration due to time constraints.



Ranger (Generic Bullbar) – *Bullbar C*



Ranger (Unique Bullbar) – *Bullbar D*



Hilux (Generic Bullbar) – *Bullbar A*



D-Max (Unique Bullbar) – *Bullbar B*

Figure 3: Bullbars used for testing: Ranger Bullbars (Top), Hilux Bullbar (Bottom Left) and D-Max Bullbar (Bottom Right).

A combination of Lift Kit and larger tyres was purchased for the Hilux and D-Max to achieve a raised height of 75 mm. The Lift Kit and larger tyres installed on the Hilux and D-Max are shown in Figure 4.



Hilux with Lift Kit and larger tyres



D-Max with Lift Kit and larger tyres

Figure 4: Lift Kit and Larger tyres installed on Hilux (Top) and D-Max (Bottom).

Testing was also performed with a Bullbar fitted to the Hilux and D-Max in the raised configuration. Both vehicles with the Lift Kit and larger tyres plus the Bullbar are shown in Figure 5.



Hilux with Bulbar, Lift Kit and larger tyres



D-Max with Bullbar, Lift Kit and larger tyres

Figure 5: Bullbar, Lift Kit and Larger tyres installed on Hilux (Top) and D-Max (Bottom).

Testing was performed with the rear tray of the Hilux and D-Max loaded to the limit of the rear axle. This included applying the load limit of the tow ball above the tow ball location, to represent the vertical load applied by a trailer. Each vehicle loaded in this “Rear Pitch” configuration is presented in Figure 6.



Hilux in Rear Pitch Configuration



D-Max in Rear Pitch Configuration

Figure 6: Rear Pitch load applied to the Hilux (Top) and D-Max (Bottom).

The effect of Antennas on the lane keeping ability the D-Max was also investigated. Both black and white Antennas were attached to each vehicle on the left and right sides, as shown in Figure 7. Two Antennas were installed to represent a worst-case configuration.



Figure 7: Antennas mounted to the Isuzu D-Max: Dual black Antennas on the driver's side (Left) and dual white Antennas on the passenger side (Right).

Objective

The aim of this test program was to identify attributes of aftermarket accessories that could compromise vehicle compliance with ADR 98/01 or draft ADR 107. Testing started in late 2022 to gain an understanding of potential issues prior to the introduction of the ADR 98-00 in March 2023, which means that the vehicles purchased for the test program were not manufactured to comply with ADR 98-00 (or ADR 107). Therefore, the test results do not directly identify compliance issues, however, instead provide insight into aftermarket accessories that are likely to affect the collision avoidance and lane keeping systems of vehicles compliant with these ADRs.

The test methodologies and assessment criteria outlined in both ADRs was used to identify changes in vehicle performance. Testing was performed in both the baseline vehicle condition as well as the modified state and the results compared. ADR 98 and draft ADR 107 outline pass/fail requirements for a test vehicle. Changes in outcome were used as an indicator of a change in vehicle performance. For example, if a pass result was observed during baseline testing and a failure result was observed during testing with an aftermarket accessory fitted, the change in outcome was used as an indicator that the aftermarket accessory could be affecting vehicle performance. Other metrics were also used to identify changes in vehicle performance. This includes a comparison of the Forward Collision Warning (FCW) tones and Autonomous Emergency Braking (AEB) start times observed during testing.

Both ADR 98-00 and draft ADR 107 test the ability of a vehicle's ADAS technology to perceive the environment in front of the vehicle. Therefore, this research focused on aftermarket accessories that are within the vicinity of the forward-facing sensors. It is also possible that loads applied to the vehicle can cause changes to a vehicles height or attitude that effect the performance of forward-facing ADAS technology. For example, if vehicle mass is added with a bias towards the rear of the vehicle, the vehicle front could point upwards at such an angle that objects in front of the vehicle are no longer in the field-of-view of the sensors. Therefore, a worst-case load condition was also included in the test program.

Abbreviations and Acronyms

Abbreviation or Acronym	Description
ADAS	Advanced Driver Assistance Systems
AEB	Autonomous Emergency Braking
LKS	Lane Keeping Systems
FCW	Forward Collision Warning
FMTRC	Future Mobility Testing and Research Centre
ADR 98-01	Vehicle Standard (Australian Design Rule 98-01 – Advanced Emergency Braking for Passenger Vehicles and Light Goods Vehicles) 2021
ADR 107	National Road Vehicle Standard (Australian Design Rule 107/00 – Lane Keeping Systems) 2022
RO	Running Order
GVM	Gross Vehicle Mass
PBC	Peak Braking Coefficient
LDWS	Lane Departure Warning System
CDCF	Corrective Directional Control Function
GVT	Global Vehicle Target.
T(FCW)	Time when the first warning tone occurs, commonly referred to as the Forward Collision Warning or FCW.
T(AEB)	Time when the vehicle Autonomous Emergency Braking (AEB) system begins braking.
DTLE	Distance To Lane Edge

Method

The testing was conducted at the Transport for NSW Future Mobility Testing and Research Centre (FMTRC) located in Cudal, near Orange, in central west NSW. The FMTRC is on the site of a former airstrip and occupies approximately 32 hectares. Site facilities include a 1.6 km test track that offers a surface friction exceeding a coefficient of 0.9, longitudinal gradient at or below one percent and crossfall less than three percent, as well as permanent lane markings that meet a range of test requirements. The FMTRC has supported the ANCAP star rating of vehicles since 2019 by performing the ADASs testing components of the star rating. The ANCAP testing includes four Car-to-Car scenarios and six Car-to-Pedestrian scenarios. These scenarios are performed over a similar range of speeds to the tests outlined in ADR 98-01 and require a stringent set of parameters to be met. Testing to the ANCAP ADASs protocols means that FMTRC is well positioned to perform testing to other ADAS protocols and standards, including ADR 98-01 and draft ADR 107.

Testing was performed according to the requirements of ADR 98-01 2021 for AEB testing and draft ADR 107-00 2022 for lane keep testing with additional tests added to the program from the ANCAP series of tests. These additional tests were added to provide a more comprehensive understanding of each test vehicles ADAS performance.

The test vehicles were fitted with driving robots developed by Anthony Best Dynamics to control vehicle speed and position. The robots are guided by a navigation system that combines GPS and inertial data to determine position within ± 0.01 metres and velocity within ± 0.05 km/h. The steering and driving (acceleration and braking) robots as well as navigation equipment fitted to each of the vehicles is shown in Figure 8.



Steering wheel robot



Inertial navigation system



Accelerator and brake robots



GPS Antennas mounted to vehicle roof

Figure 8: Equipment fitted to each test vehicle: Steering robot (Top Left), accelerator and brake robots (Bottom Left), inertial navigation system (Top Right) and GPS Antennas (Bottom Right).

ADR 98-01 Testing Details

The crash avoidance tests outlined in ADR 98-01 were used to investigate the crash avoidance capability of each vehicle and identify the ability of a test vehicle to avoid a stationary car, a car travelling at a lower speed in the lane ahead of the test vehicle and a pedestrian crossing the vehicle's path from the side. The pedestrian test outlined in ADR 98-01 involves a child pedestrian traversing from either the nearside or farside direction, however, an adult target was used for testing from the farside direction because the child pedestrian target owned by the facility is designed for nearside testing. These pedestrian tests provide an indication of a vehicle's lateral field-of-view and, therefore, whether a modification or load condition changes the vehicle's field-of-view. ADR 98-01 allows for the use of two different soft car targets for use in the Car-to-Car testing, namely a half-car target or a full-sized vehicle target. The soft target vehicle used for this testing was the full-sized target vehicle. An image of the full-sized soft target vehicle is presented in the Test Targets section of the report. All testing was performed with the fuel level above 50 percent.

The stationary vehicle target testing was performed with the test vehicle travelling at speeds between 10 and 60 km/h towards the target vehicle. The centreline of the test vehicle was aligned with the centreline of the target vehicle, as shown in Figure 9.



Figure 9: Car-to-Car testing scenario with test vehicle approaching target vehicle from behind.

Additional tests were performed with the test vehicle path in-line with either edge of the target vehicle at one test speed to gain additional understanding of whether a modification or load condition changed the vehicle's lateral fieldofview, as shown in Figure 10.

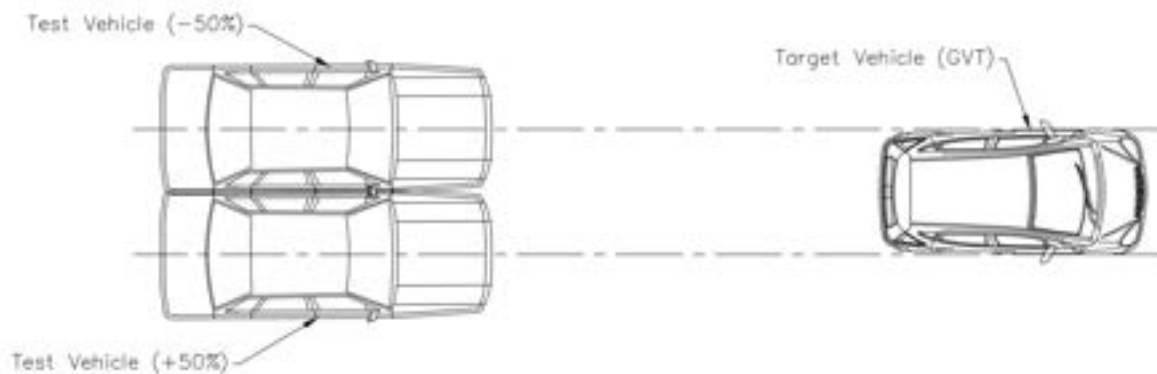


Figure 10: Car-to-Car testing scenario with test vehicle approaching target vehicle from behind and in-line with edge of the target vehicle.

The moving vehicle target tests were performed with the test vehicle travelling at speeds between 30 and 80 km/h towards the target vehicle travelling at 20 km/h. The centreline of the test vehicle was aligned with the centreline of the target vehicle, as shown in Figure 4.

The nearside child pedestrian testing was performed with the test vehicle travelling at speeds between 10 and 60 km/h. ADR 98-01 specifies a minimum test speed of 20 km/h, however, testing at lower speeds was included to gain further understanding of the vehicle's lateral field-of-view. The closer the test vehicle speed is to the speed of the pedestrian (i.e. 5 km/h), the closer the pedestrian target becomes to the edge of the vehicle's lateral field-of-view as it approaches the collision point. The test vehicle and child pedestrian target were synchronised to ensure that the centre of the test vehicle front bumper met the centre of the right-hand side edge of the child pedestrian. ADR 9801 outlines that child pedestrian should start moving when the test vehicle is less than 4 seconds away from the collision point. Accordingly, the

child pedestrian path started 4 metres from the collision point and the child pedestrian accelerated to a speed of 5 km/h within 1 metre, before travelling at a constant speed beyond the collision point. An overview of the test vehicle and child pedestrian paths is shown in Figure 11.

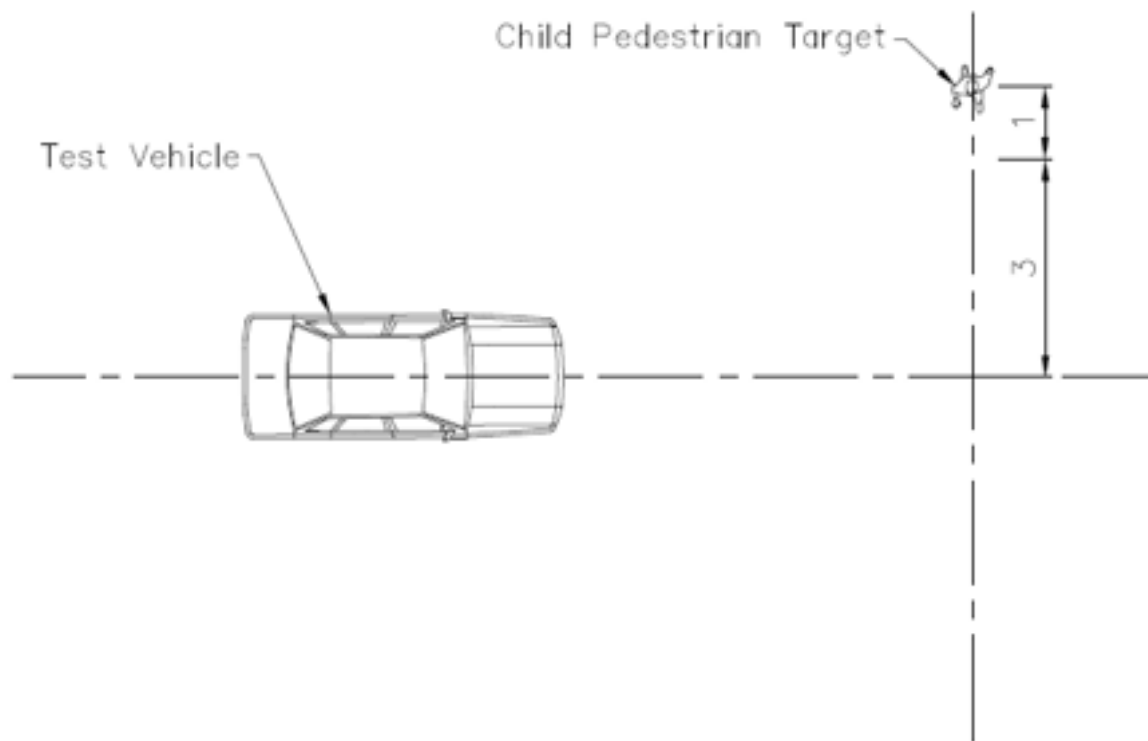


Figure 11: Layout of nearside child pedestrian test.

The farside adult pedestrian tests were performed with the test vehicle travelling at speeds between 10 and 60 km/h and the adult pedestrian travelling at 8 km/h. The adult pedestrian path started 6 metres from the collision point and the pedestrian target accelerated to a speed of 8 km/h within 1.5 metres, before travelling at a constant speed beyond the collision point, as shown in Figure 12. The test vehicle and adult pedestrian target were synchronised to ensure that the centre of the test vehicle front bumper met the centre of the left-hand side edge of the adult pedestrian. It should be noted that the adult pedestrian path speed was adjusted to 5 km/h for the Ford Ranger testing because it was identified during baseline testing that the performance of the vehicle was inconsistent between runs at multiple test speeds with the target travelling at 8 km/h. Consistent performance in baseline testing was desired because it enables variable performance to be captured later in the program if this was an effect of a vehicle modification.

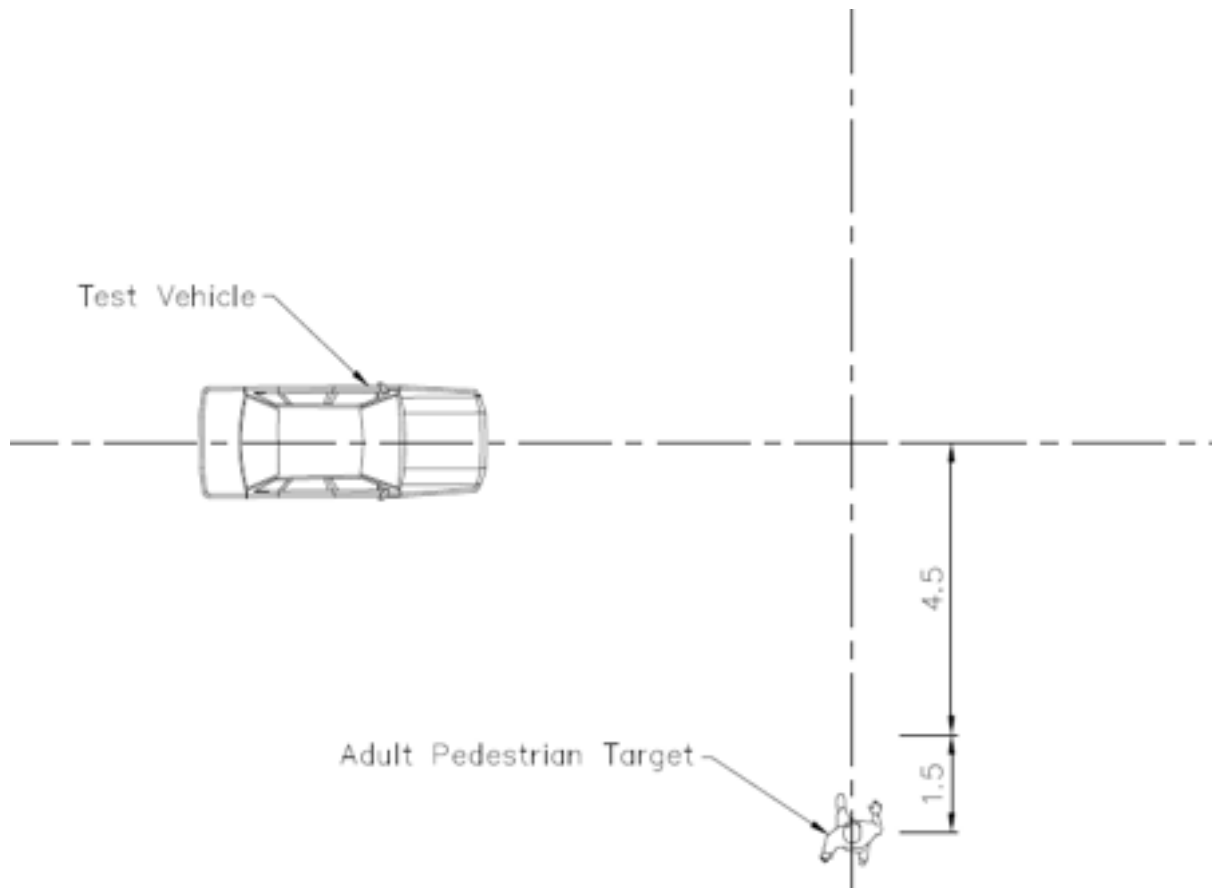


Figure 12: Layout of farside adult pedestrian test.

Due to the large number of tests required of each vehicle in the various configurations to meet the testing requirements of ADR 98/01, testing was performed in such a way that reduced the likelihood of damaging the radar located on the front bumper of the Toyota Hilux and Ford Ranger. This methodology involved reducing the number of potential impacts experienced by the test vehicle as well as the impact speed, where possible.

Impact speed was reduced by starting testing at the lowest test speed, then moving up in steps of 10 km/h until an impact occurred. When an impact occurred, testing was also performed at 5 km/h below the current test speed, to more accurately understand when the test vehicle transitioned from a non-impact result to an impact result. To reduce the number of impacts experienced by a test vehicle, testing was stopped when the impact speed was above approximately 15 km/h. In some of the high-speed tests when it was perceived that the vehicle was unlikely to apply the brakes, the driver applied the brakes to reduce the impact speed and reduce damage to the front of the test vehicle. These tests have been noted in the results section.

Two tests were performed at each speed, followed by a third if the difference between the warning tone issued by the vehicle in the initial tests was greater than 0.1 seconds. The third test was performed to gain further appreciation of the vehicle's performance variability. Partway through the test program, steps were taken to reduce the number of tests performed in order to finish the program on-time. One measure that was taken was not performing the high-speed farside pedestrian tests because the farside pedestrian test procedure is not in-line

with the ADR 98 testing requirements, as discussed earlier in this section of the report. The low speed far side tests remained in the test matrix because they enable an understanding of whether the vehicle's lateral field-of-view changed with each configuration.

During the car-to-car stationary and moving target vehicle testing, the test vehicle approached the target vehicle with a centreline offset of not more than 0.2 metres for at least six seconds prior to reaching the stationary target, as outlined in ADR 98-01 Section 6.4. The test vehicle speed was maintained within ± 2 km/h for at least four seconds prior to reaching the target. In the moving target vehicle testing, the target vehicle speed was also controlled to a tolerance of ± 2 km/h.

The car-to-pedestrian tests were performed with the test vehicle approaching the impact point for at least six seconds with a lateral offset of not more than 0.1 metres and the test vehicle speed maintained within ± 2 km/h for at least four seconds prior to reaching the target. For the pedestrian testing, the pedestrian target travelled along a straight-line path perpendicular to the subject vehicle's direction of travel at a constant speed within 0.2 km/h of the target speed. The pedestrian target's path was coordinated with the test vehicles position, such that the pedestrian target reached the collision point at the same time as the test vehicle (if no braking occurred) with an offset of not more than 0.1 metres.

The pedestrian target offset was calculated by applying a least squares fit to the test vehicle and target position data whilst both were at constant velocity.

The warning tone sensitivity setting in each vehicle was set to the 'latest' warning time. This means that the audible warning tone issued within the vehicle cabin is produced closer to the time of an AEB activation than if an earlier warning tone timing setting was selected. A preference for the timing of the warning is not outlined in ADR 98, however, selecting the 'latest' warning tone response is a requirement outlined in draft ADR 107 for warning tones issued in relation to crossing a line marking.

Testing was performed in the Running Order (RO) maximum mass condition outlined in ADR 98-01. An additional 125 kg of mass was added to the running order condition of the vehicle, which included test equipment and ballast mass. In the maximum mass condition the vehicle was loaded to the Gross Vehicle Mass (GVM) outlined in the test vehicle's operating manual and distributed according to the proportion of load that each axle could carry.

The ADR 98 testing was performed to meet the environmental and track conditions outlined in the Table 1 below.

Table 1: ADR 98 track and environmental conditions.

Parameter	Description
Ambient Temperature	Ambient temperature between 0 °C and 45 °C.
Visibility	At least 1000 m.
Illumination	At least 1000 Lux for car-to-car scenarios and 2000 lux for pedestrian scenarios, without direct blinding sunlight.
Track surface material	Asphalt.
Track surface moisture	Dry.
Track slope	Lateral slope less than 3 percent and longitudinal slope less than 1 percent.
Wind Speed	Low wind conditions. The pedestrian target is more vulnerable to windy conditions than the soft car target and lateral deviation in it's path can occur if it is too windy. Pedestrian testing was stopped when wind conditions appeared to affect the pedestrian's path following.
Peak Braking Coefficient (PBC)	PBC of 0.9. Note that the PBC of our test track surface was measured using a method different to the methods outlined in ADR 98. The PBC was determined through brake tests conducted in two different vehicles, at two speeds and at multiple locations on the test track. The deceleration data was recorded using an accelerometer mounted in the test vehicle, which identified that the test track has a minimum PBC of 0.9. It is appreciated that different test methodologies can obtain different PBC results. Nevertheless, the road surface friction testing that was performed at the facility provides an indication that the road surface achieves a high level of adhesion, similar to that required in ADR 98-01.
Brake Temperature	Brake warmups were performed prior to each test series to increase the brake temperature to between 65 and 100°C. Brake temperature checks were performed at least every three tests, with additional checks performed if a delay in testing occurred that could cause the brake temperature to drop below 65 degrees. A temperature check was performed by measuring the temperature of one front brake disk using an infrared thermometer.

Draft ADR 107-01 Testing Details

The lane keeping ability of each vehicle was investigated using the testing requirements of draft ADR 107. Specifically, the tests outlined in section 8.3.2 and 9.3.3 were performed to determine if each modification and load condition degraded the vehicle's ability to detect and react to a line marking. Section 8.3.2 of draft ADR 107 outlines the test requirements for a vehicle fitted with a Lane Departure Warning System (LDWS). The LDWS tests determine whether the test vehicle can warn the driver before it has crossed the lane line by more than 0.3 metres, using a visual warning combined with either a haptic or acoustic warning. Testing is performed at 70 km/h (± 3 km/h) with lateral velocities within the range of 0.1 to 0.5 m/s. Section 9.3.3 of draft ADR 107 outlines the test requirements for the vehicle Corrective Directional Control Function (CDCF). The CDCF testing is performed at a similar speed (72 km/h, ± 1 km/h) and range of lateral velocities (0.2 to 0.5 m/s) as the LDWS testing, however, the focus of the CDCF testing is to determine if the test vehicle can correct its path and avoid crossing the lane line by more than 0.3 metres.

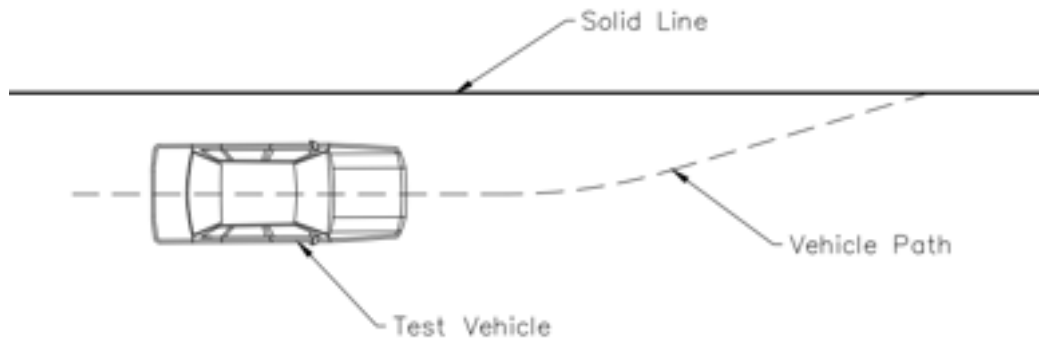
Due to the similarity in test vehicle speed between the LDWS testing and the CDCF testing, one set of testing was performed at 72 km/h (± 1 km/h) with lateral velocities of 0.1, 0.2 and 0.5 m/s to cover the lateral velocity range required for LDWS testing and CDCF testing. During initial testing it was observed that the vehicle provides a CDCF at each lateral velocity, which according to clause 7.4.2.1.2 can be considered a haptic lane departure warning. Therefore, the start of the CDCF response was considered the haptic lane departure warning for assessment of the LDWS.

Testing was performed with the vehicle drifting towards a single solid or dashed line on the passenger or driver's side of the test vehicle, in accordance with the LDWS and CDCF requirements. Figure 8 provides an overview of the test vehicle direction and line configurations tested.

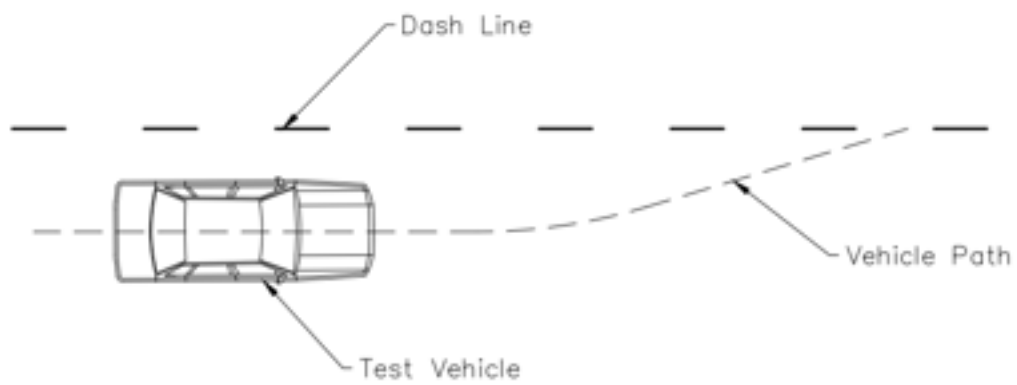
The steering robot installed in the test vehicle guided the vehicle along the initial path and turn towards the line marking. Once on the straight path towards the line marking, the robot released steering control to allow for observation of the vehicle's response, including any path correction away from the line marking.

A total of three tests were performed at each lateral velocity to understand any variation in the vehicle's performance. For each test the lane departure warning sensitivity setting was set to the 'latest' setting, in accordance with draft ADR 107.

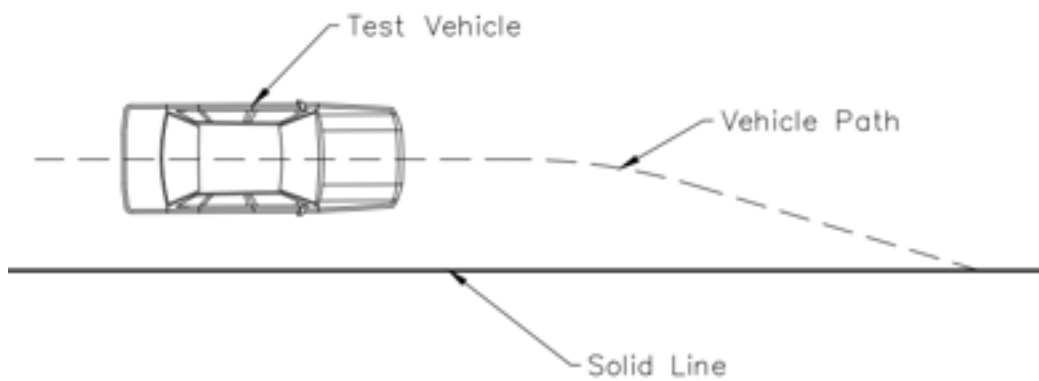
All testing was performed with the fuel level above 50 percent.



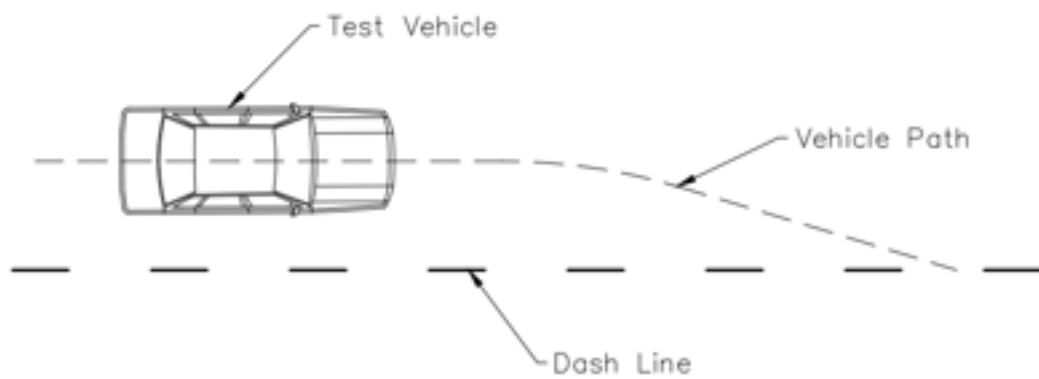
Solid Line Passenger Side



Dashed Line Passenger Side



Solid Line Driver's Side



Dashed Line Driver's Side

Figure 13: LKS line type and direction configurations.

All draft ADR 107 testing was performed to meet the environmental and track conditions outlined in the Table 2 below.

Table 2: Draft ADR 107 track and environmental conditions.

Parameter	Description
Ambient Temperature	Ambient temperature between 5°C and 45 °C.
Visibility	At least 1000 m.
Illumination	At least 2000 Lux, without direct blinding sunlight.
Track surface material	Asphalt surface without any surface irregularities (i.e. cracks, manhole covers, etc.) within a lateral distance of three metres either side of the centre of the test lane and within a longitudinal distance of 30 metres ahead of the test vehicle from the time the test is complete.
Track surface moisture	Dry.
Track slope	Lateral slope less than 3 percent and longitudinal slope less than 1 percent.
Track curvature	Straight sections only.
Wind Speed	Low wind conditions.
Line Markings	Solid and dashed line markings compliant with AS 1742.2-2009.

Test Vehicles

Three popular makes of late model dual cab utes were chosen as test vehicles because these are commonly fitted with the aftermarket accessories that are mounted at the front of the vehicle, which could interfere with the forward facing ADAS sensors. It was also considered important to select vehicles that are representative of the different types of sensor systems that are available, therefore, at least one vehicle with a dual camera system and at least one with a single/camera radar system was required. Figure 14 provides a diagram of where camera and radar systems are typically mounted on a vehicle and a representation of the field-of-view of each sensor.

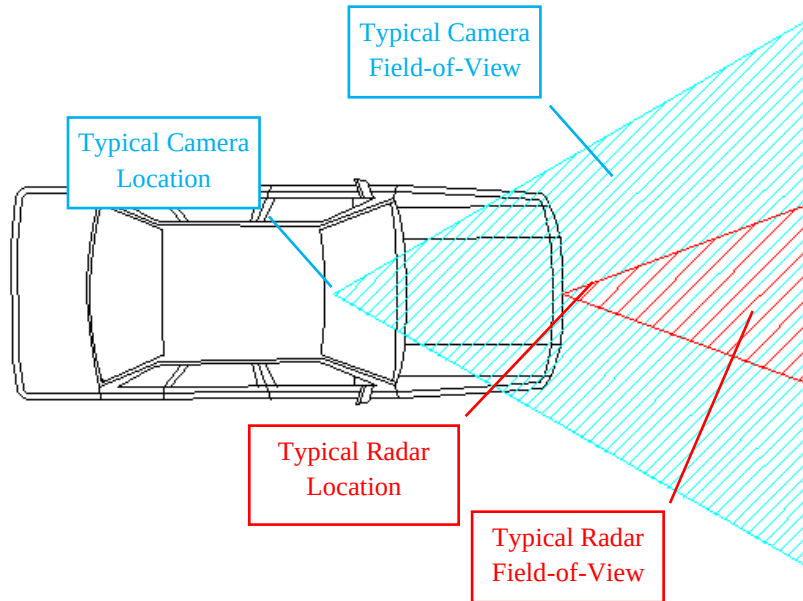


Figure 14: Example of a typical camera and radar field-of-view

At the time of procuring each of the vehicles in Q3 2022, a current model Ford Ranger, Isuzu D-Max and Toyota Hilux were procured. Each vehicle had an AEB system with the ability to detect vehicle and pedestrian targets as well as an LKS system with the ability to detect and respond to lane markings with a corrective action. These vehicles are shown in Figure 15 and a summary of the vehicle details is included in Table 3.



2021 Ford Ranger



2022 Isuzu D-Max



2020 Toyota Hilux

Figure 15: Vehicles procured for the test program.

Table 3: Vehicle details and condition.

Model	Year	Condition	Driven Kilometres	Sensor Type
D-max	2022	New	3000	Dual camera
Ranger	2021	Used – Good (Roadworthy)	17000	Fusion
Hilux	2020	Used – Good (Roadworthy)	46000	Fusion

Prior to testing, the Hilux and Ranger were serviced by their respective OEM local dealerships, which included an inspection of the brakes and tyres to check that they are in good condition as well as a camera and radar re-calibration to ensure that they are as per OEM condition. Therefore, it was considered that sensors systems of each vehicle were suitably initialised and the brakes bedded in prior to the commencement of the program, in-line with ADR 98-01 Section 6.2.2.

The OEM Ford Ranger contains a single camera mounted towards the top of the windscreen and a radar unit mounted on top of the frontal crush bar, towards the bottom of the plastic front bumper, as shown in Figure 16. Note that the nudge bar shown in Figure 10 (right) was removed prior to testing such that each vehicle had an OEM front bumper for baseline testing.



Camera Location



Radar Location

Figure 16: Ford Ranger camera location (Left) and radar location (right).

Similar to the Ford Ranger, the Toyota Hilux uses a single camera and radar to identify line markings and obstructions in front of the vehicle. The camera is located towards the top of the windscreen and the radar is located behind the Toyota badge that is positioned towards the top of the front bumper, as shown in Figure 17.



Figure 17: Toyota Hilux camera location (left) and radar (right) location.

The Isuzu D-max uses a dual camera system that is mounted towards the top of the windscreen, as shown in Figure 18.



Figure 18: Isuzu D-Max dual camera system location.

An overview of vehicle masses in the Running Order and GVM test conditions is presented in Table 4 and an overview of the vehicle load limits is provided in Table 5.

Table 4: Running Order and GVM load condition.

Parameter	Toyota Hilux		Isuzu D-Max		Ford Ranger	
	Running Order	GVM	Running Order	GVM	Running Order	GVM
Front Axle Load (kg)	1214.0	1384.5	1204.5	1294.0	1300.0	1419.0
Rear Axle Load (kg)	981.5	1594.0	909.5	1708.0	1004.0	1781.0
Total Load (kg)	2195.5	2978.5	2114.0	3002.0	2304.0	3200.0

Table 5: Test vehicle load limits.

Vehicle Details	Vehicle		
	Toyota Hilux	Isuzu D-Max	Ford Ranger
Build Date	Sep-20	Feb-22	Jul-21
Model	Hilux 8Gen (Pre-Runner)	D-Max RG1	Ranger 2 (XLT)
Gross Vehicle Mass (GVM) (kg)	2,980	3,000	3,200
Gross Axle Weight (GAW) Front (kg)	1,480	1,450	1,480
Gross Axle Weight (GAW) Rear (kg)	1,700	1,910	1,850
Tow Ball Weight (kg)	280	350	350
Sensor System	Fusion (Mono Camera/Radar)	Stereo Camera	Fusion (Mono Camera/Radar)

Aftermarket Accessories

Two Bullbars were purchased for both the Ranger and Hilux; a Bullbar representative of a commonly installed Bullbar as well as a Bullbar for each of these vehicles that was of particular interest to the project team due to a particular design feature that could affect functionality of the ADAS. These Bullbars are presented in Figure 19 below, except for the unique Bullbar purchased for the Hilux because testing was not performed with this Bullbar installed due to time constraints. Each Bullbar was installed on-site by a qualified mechanic following the manufacturer recommended instructions.



Ranger (Generic Bullbar)



Ranger (Unique Bullbar)



Hilux (Generic Bullbar)

Figure 19: Ford Ranger Bullbars (Top) and Toyota Hilux Bullbar (Bottom).

Since the OEM location of the radar on the Ford Ranger is towards to bottom of the front bumper, most aftermarket Bullbars designed for the Ford Ranger relocate the radar to prevent obstruction of the sensors field-of-view. Both Bullbars chosen for the Ford Ranger re-locate the radar during installation. Bullbar C also has a layer of mesh, which could potentially obstruct the radar signal.

Most Bullbars designed for the Toyota Hilux appear to leave the radar in the same location and ensure that the Bullbar structure is away from the radar's field-of-view. Both Bullbars purchased for the Toyota Hilux keep the radar in the same location, with the Bullbar X particular interest because mesh is located in-front of the radar. The generic Bullbar A was purchased to understand whether sufficient clearance is provided between the Bullbar structure and the radar and the Bullbar X was purchased to investigate whether the mesh impact's system performance.

A tall and wide Bullbar was purchased for testing with the Isuzu DMax to investigate if it would obstruct the dual camera field-of-view. The Bullbar B purchased for testing is shown in Figure 20.

The increased mass of the vehicle with each Bullbar fitted is presented in Table 6 and change in location of the radar associated with both Bullbars fitted to the Ford Ranger is outlined in Table 7.



Figure 20: Isuzu D-Max with Bullbar B..

Table 6: Change in vehicle mass with Bullbars fitted to the vehicle compared to the Running Order condition.

Parameter	Toyota Hilux	Isuzu D-Max	Ford Ranger	
	Bullbar A	Bullbar B	Bullbar C	Bullbar D
Change Total Load (kg)	43.5	56	70.5	75.5

Table 7: Change in radar location with each of the Bullbars fitted to the Ford Ranger.

Parameter	Ford Ranger		
	Bullbar C	Bullbar D	Notes
Forward Shift (mm)	166.5	190	Positive is forwards
Height Change (mm)	-55.5	-115.5	Positive is upwards
Side Shift (mm)*	-5	-4	Positive is towards the LHS

*Centre of the Radar in baseline Running Order condition is 6.5 mm towards the LHS of the vehicle.

Lift kits and driving lights were also selected for testing. The Hilux and D-Max were used for these investigations.

A Lift Kit and tyre combination was selected that raised the vehicle to a combined height change of close to 75 mm. The Lift Kit components purchased for the Hilux and D-Max are outlined in Table 8. Testing in the Lift Kit only configuration was performed prior to adding a Bullbar and testing the combined effect of a Lift Kit and Bullbar. To account for any sag produced by the Bullbar, an adjustable Lift Kit was purchased that could be adjusted to return the front of the vehicle close to the 75 mm lift height. The actual height of Hilux and D-Max achieved for testing is presented Table 9.

Table 8: Lift-Kit components fitted to the Hilux and D-Max.

Lift-Kit Component	D-Max	Hilux
Front Strut	PSR Adjustable (COLKIT-011)	PSR (HILKIT-032SD)
Rear Shock Absorber	EFS Elite (36-5426)	EFS Elite (36-5521)
Rear Leaf Spring	EFS (DMX-18E)	EFS (THX-44E)
Tyre	Yokohama 255/70R18 113H G015 AT	Bridgestone 265/70R18 116H D693II

Table 9: Wheel arch height measurements in the Running Order, Lift Kit and Lift Kit plus Bullbar configurations for the Toyota Hilux and Isuzu D-Max.

Condition	Wheel Arch Height (mm)			
	Front Left (mm)	Front Right (mm)	Rear Left (mm)	Rear Right (mm)
Isuzu D-Max				
Pre (Lift Kit)	882	879	910	922
Lift Kit Aim (+75 mm)	957	954	985	997
Lift Kit	957	952	984	990
Pre (Lift Kit with Bullbar)	949	935	-	-
Lift Kit with Bullbar	946	935	-	-
Hilux				
Pre (Lift Kit)	878	875	912	921
Lift Kit Aim (+75 mm)	953	950	987	996
Lift Kit	951	945	985	993
Pre (Lift Kit with Bullbar)	940	932	-	-
Lift Kit with Bullbar	934	927	-	-

Black and white Antennas were purchased and their effect on the lane keeping performance of the D-Max investigated. Antennas mounted on either side of the vehicle were investigated and two Antennas were installed because this was believed to represent a worst-case condition. Antennas mounted to the D-Max on either side vehicle are shown in Figure 21. Testing was also performed at night, with a focus on understanding whether light reflected from an Antenna into the vehicle cameras could cause the detection ability of the vehicle to change. Figure 22 shows the white Antennas and driving lights mounted to the D-Max during night-time testing.

During the procurement of Antennas, it was identified that the Antenna Manufacturer have observed that white Antennas are harder to procure from suppliers due to concerns that white Antennas can interfere with the detection of line markings. This is another example of how the aftermarket industry is shifting to ensure that the functionality of ADAS sensors is not compromised by aftermarket accessories. Nevertheless, both black and white Antennas were selected for the program to better understand whether there are indeed any issues with white Antennas.



Figure 21: Antennas mounted to the Isuzu D-Max: Dual black Antennas on the driver's side (Left) and dual white Antennas on the passenger side (Right).



Figure 22: White Antennas and driving lights mounted to the Isuzu D-Max during night-time testing.

Load Conditions

A worst-case load condition that rotates the pitch of the vehicle, such that the nose of the vehicle is lifted, was investigated. It is understood that this load condition could occur when towing a trailer whilst the vehicle is also loaded with a payload placed towards the rear of the vehicle. To achieve this load condition, the rear of the vehicle was loaded till the rear axle load limit was reached using weight placed above the tow ball (to represent a maximum tow ball load) and additional weight towards the rear of the cargo tray. The tow ball and axle load limits are outlined in Table 5. It was decided to use a load carrying device to apply the maximum tow ball load, instead of a trailer, to help reduce the impact speeds and subsequent damage to the car and pedestrian targets. Figure 23 shows the Isuzu D-Max loaded in this configuration. Table 10 and Table 11 respectively outline the load and geometric conditions of the Hilux and D-Max in the Rear Pitch configuration.

Note that because the impacts speeds obtained from this test scenario do not represent the mass of a vehicle and loaded trailer, the analysis presented in the results section focuses on changes to the timing of the warning tone (i.e. the time prior to a potential impact when the warning tone is generated) issued by the vehicle as well as changes to when the emergency brake was first applied.



Figure 23: Isuzu D-Max in the worst-case rear pitch load configuration.

Table 10: Rear Pitch configuration loading.

Parameter	Toyota Hilux	Isuzu D-Max
Front Axle Load (kg)	1037.0	951.0
Rear Axle Load (kg)	1702.5	1909.5
Total Load (kg)	2739.5	2860.0
Rear Tray Basket Load (kg)	254.0	396.0
Tow Ball Basket Load (kg)	280.0	350.0

Table 11: Rear Pitch configuration height and pitch angles changes relative to the baseline Running Order condition.

Parameter	Toyota Hilux	Isuzu D-Max
Front Height Change (mm)*	5	11.5
Rear Height Change (mm)*	-55	-68
Pitch Angle Change (degrees)**	-1.7	-1.5

* Measured at the bottom of the sill in front of the rear tyres and behind the front tyres. A positive value represents an increase in height.

** A negative pitch angle change represents a dropping of the rear of the vehicle relative to the front.

Test Targets

ADR 98-01 outlines that the test targets should comply with ISO 19206. Accordingly, the soft vehicle target developed by DRI (i.e. the SoftCar 360), compliant with ISO 19206-3: 2021, as well as a child pedestrian target compliant with ISO 19206-2: 2018, were used for the project. The vehicle and pedestrian targets used for the project are shown in Figure 24.



Child Pedestrian Target



Adult Pedestrian Target



Global Vehicle Target (GVT)

Figure 24: Pedestrian and vehicle targets.

Pre-Test Initialisation Methodology

A tailored pre-test ADAS initialisation method was used for each vehicle based on the team's understanding of the vehicle's systems.

Isuzu D-Max: Ignition Cycle performed after every second test because previous testing with the Isuzu ADAS revealed that the system can perform approximately three AEB events before an ignition cycle is required. This method applied for both Car-to-Car and Car-to-Pedestrian testing, however, ignition cycles were not performed during the LKS testing because it was observed during baseline testing that the system continued to function indefinitely.

Toyota Hilux: Previous testing with Toyota has shown that an ignition cycle and lap of our runway can be required to initialise the AEB systems. An ignition cycle and lap of the runway was therefore performed every second test. During the test program, the ignition cycle was increased to every test and the initialisation distance increased as it was suspected that incorrect initialisation could be affecting the results. Similar to LKS testing with the Isuzu D-Max, continuous performance of the system was observed throughout baseline testing, therefore, ignition cycles were not used throughout the LKS testing.

Ford Ranger: An ignition cycle was performed prior to every second test to help ensure optimal performance of the vehicle. This method proved to provide repeatable test results during baseline testing and was continued throughout the tests program.

Results

The results from the crash avoidance and lane keeping tests are included in this section of the report. This includes a comparison of the results obtained with each aftermarket accessory or load condition to the baseline (Running Order) test results. The results are presented in this section according to the test vehicle.

An analysis of the coordination was performed post testing, which resulted in the removal of some tests prior to performing the analysis performed in this section of the report. The tests that were performed, but not used for further analysis are highlighted in the appendices. Additionally, several tests performed with the Hilux were not analysed due to concerns that the vehicle was not correctly initialised prior to testing. A breakdown of the tests that were not included for analysis is also provided in the appendices of this report.

ADR 98-01 outlines the maximum impact speed criteria for vehicles in different load conditions. The criteria includes a value Alpha (α), which relates to the weight distribution of the vehicle. Alpha (α) was calculated for each test vehicle configuration to determine the relevant maximum impact speed for a particular vehicle configuration. The formulation of Alpha (α) is shown below (*Equation 1*).

Table 12 outlines the value of Alpha (α) calculated for each vehicle configuration.

$$\alpha = \frac{W_r}{W} \times \frac{L}{H} \quad \text{Equation 1}$$

Where:

W_r = rear axle load

W = test vehicle mass in Running Order condition

L = vehicle wheelbase

H = Centre of Gravity height in Running Order condition

Table 12: Alpha values (α) calculated for each vehicle configuration.

Vehicle Configuration	Wheelbase (mm)	Running Order Weight (W) (kg)	Centre of Gravity Height (H) (mm)	Rear Axle Load (W_r) (kg)	Alpha (α)
Toyota Hilux					
Baseline (RO)	3085	2083	744.2	928.5	1.85
Baseline (GVM)				1541.0	3.07
Lift Kit				955.0	1.90
Lift Kit plus Bullbar A				931.5	1.85
Bullbar A				903.0	1.80
Ford Ranger					
Baseline (RO)	3220	2186	727.7	938.5	1.90
Baseline (GVM)				1715.5	3.47
Bullbar C				918.0	1.86
Bullbar D				921.5	1.87
Isuzu D-Max					
Baseline (RO)	3125	2018	711.3	850.5	1.85
Baseline (GVM)				1649.0	3.59
Lift Kit				878.5	1.91
Lift Kit plus Bullbar B				858.5	1.87
Bullbar B				831.0	1.81

D-Max Results

The Isuzu D-Max crash avoidance and lane keeping results are presented in this section of the report. The results are presented in three sections. The ‘Comparison of Impact Speeds’ and ‘Comparison of Detection Braking’ sections present and compare the crash avoidance test results. The lane keeping results are presented in the following ‘Comparison of Lane Keeping Results’ section.

Comparison of Impact Speeds

This section of the results includes a comparison of impact speeds observed during the crash avoidance testing performed with the D-Max. In each graph, a (0) zero represents a test that did not result in an impact. Each graph also contains a red line to indicate the limit threshold for a pass at each test speed, based on the requirements of ADR 98-01. For the Lift Kit, Lift Kit plus Bullbar and Bullbar only configurations the impact speed thresholds from ADR 98-01 for the Running Order configuration were adopted. Note that a comparison of impact speeds from the Rear Pitch testing is not presented in this section because a simplified version of the real-world trailer towing scenario was used to investigate the effects of changing vehicle pitch. Instead, a comparison of the detection and braking start times was used to analyse the Rear Pitch configuration results and is presented in the following section.

Car-to-Car Stationary

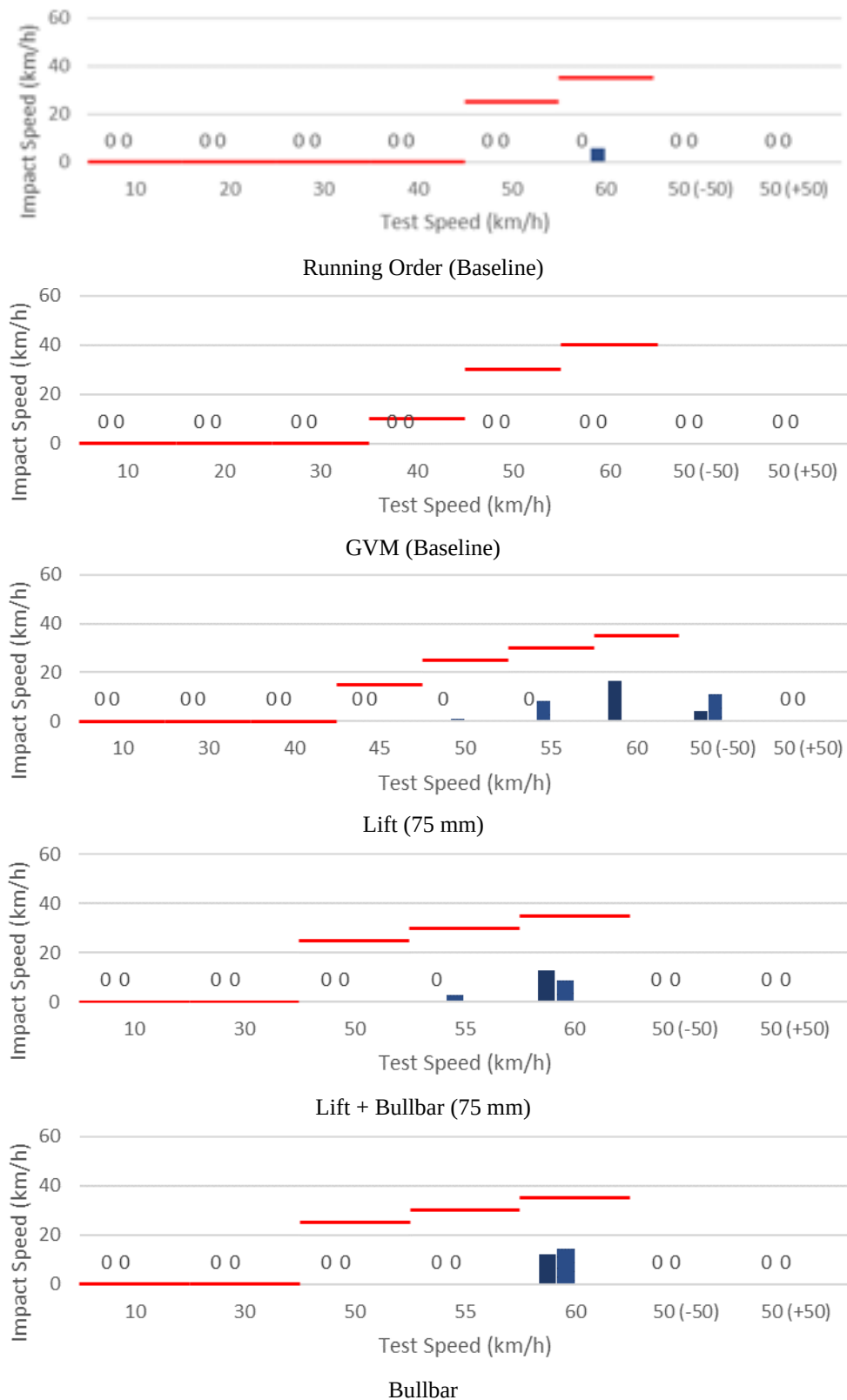
The D-Max Car-to-Car Rear Stationary impact speed results are presented in Figure 25. In baseline testing, one impact was observed at 60 km/h in the Running Order condition. The impact speed was below the limit threshold of 35 km/h outlined in ADR 98-01. Impacts were also observed in the Lift Kit, Lift Kit plus Bullbar and Bullbar configurations at the higher test speeds. Most of these impacts occurred at a higher speed than the impacts observed during the baseline Running Order testing, however, all occurred at less than 50 percent of the ADR 98-01 limit thresholds. Therefore, because each of these impacts occurred at a speed below the ADR limit threshold, it is considered that minor changes in performance occurred in the Lift Kit, Lift Kit plus Bullbar and Bullbar only configurations.

The impacts that occurred at speeds lower than the highest test speed in the Lift Kit and Lift Kit plus Bullbar configurations, including the impacts that occurred in the -50 percent offset tests in the Lift Kit configuration, could be caused by changes in braking performance attributed to the tyres and suspension installed to achieve the desired lift [1]. This is because the increased height of the Centre of Gravity above the axles and increased diameter of the tyres, each increase the amount of brake force required to stop in the same distance. However, it is unlikely that this is the only contributing factor because the warning tone and braking start times in these tests were later than the warning tone and braking start times observed at similar speeds in the baseline Running Order configuration. Furthermore, a general change in the warning tone and braking start timings can be observed in the comparison of average warning tone and braking start timing results for the Lift Kit and Lift Kit plus Bullbar configurations, which is presented in the following section. These results show that there is a delay of at least four percent in the average warning tone timing and average braking start timing at each test speed (and offset) compared to the baseline Running Order configuration. Based on these changes in warning tone and braking start times, it is

possible that the increased height of the vehicle has changed the response timing of the vehicle to a stationary target.

The impacts that occurred during the – 50 percent offset tests in the Lift Kit configuration also suggest that a change in vehicle response to objects located towards the side of the vehicle's field-of-view has occurred due to the increased height of the vehicle. However, a similar change in performance was not observed during the Car-to-Pedestrian testing with the adult target, which also positions the target on the farside of the vehicle. Therefore, it is unclear whether the Lift Kit configuration decreased the ability of the vehicle to respond to targets towards the right-hand side edge of the field-of-view.

The impact speed of the impacts observed at the highest test speed in the Lift Kit plus Bullbar and Bullbar configurations were higher than the single impact observed in the baseline Running Order configuration at the highest test speed. It is acceptable that the protrusion of the Bullbar has contributed to the higher impact speeds because the vehicle's sensor system is calibrated with the front of the vehicle at the location of the OEM front bumper, instead of 260 mm further forward at front of Bullbar B.



0 Represents a test that did not result in an impact.

Represents an impact test that included driver braking prior to impact.

Represents an impact test that does not include driver braking prior to impact. This is also true for the lighter blue colours.

Figure 25: D-Max Car-to-Car Rear Stationary impact speed results.

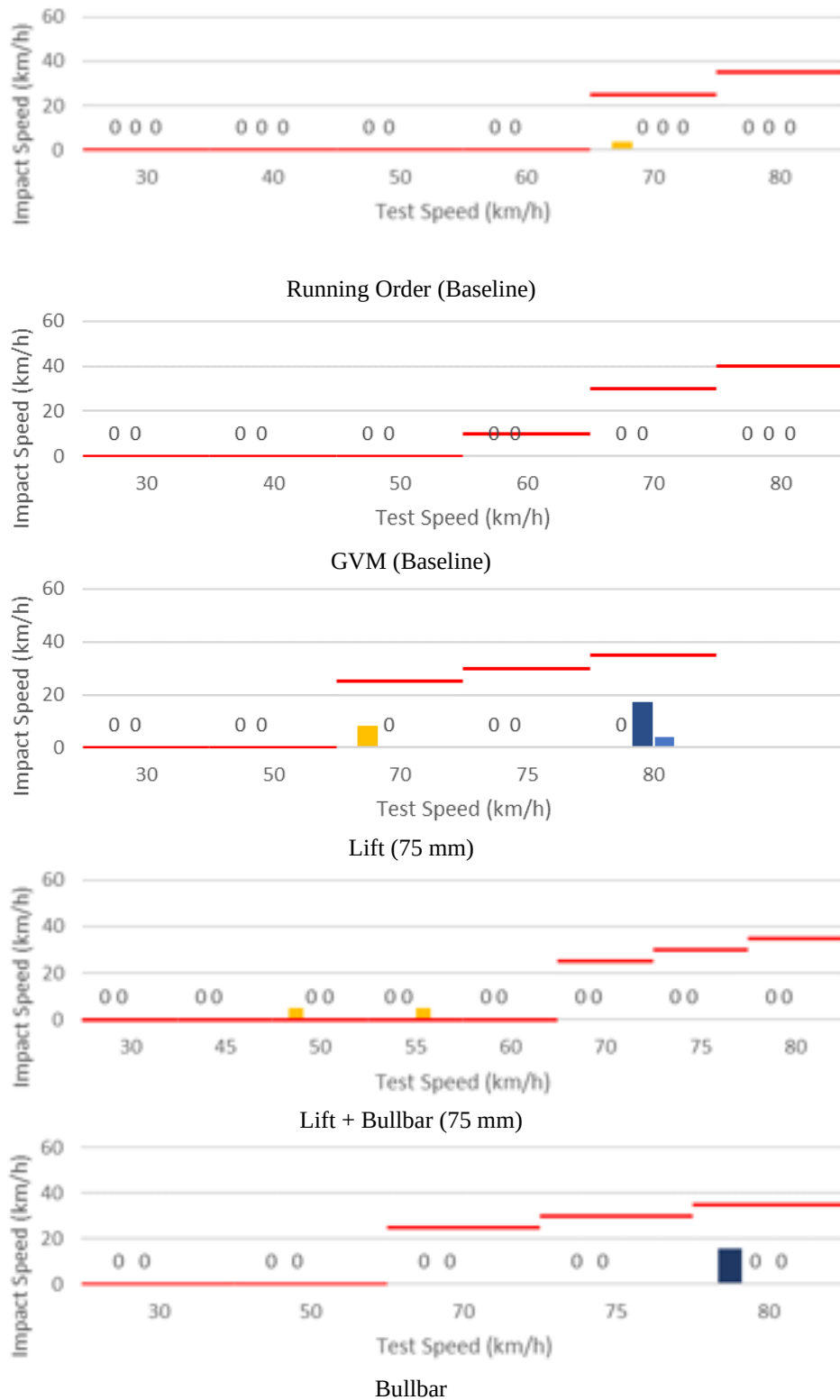
Car-to-Car Moving

An overview of the D-Max impact speeds observed during the Car-to-Car Rear Moving tests Figure 26. During a 70 km/h test in the baseline Running Order condition, the test vehicle finished braking at approximately 4 km/h above the speed of the target vehicle (highlighted in orange). The driver applied the brakes to prevent an impact, however, it is likely that the test vehicle would have impacted the target vehicle without driver intervention. At 4 km/h this impact is less than the impact speed limit threshold of 25 km/h outlined in ADR 98-01. No other impacts were observed during the baseline Running Order testing.

Similar brake releases were observed during the Lift Kit and Lift Kit plus Bullbar testing (highlighted in orange). These instances occurred at lower test speeds during the Lift Kit plus Bullbar testing, which means an impact above the ADR 98-01 limit. Despite impacting above the impact speed threshold outlined in ADR 98-01, the low-speed roll-in type impacts that occurred in the Lift Kit and Lift Kit plus Bullbar configurations are considered minor changes in performance because this type of impact was also observed in the baseline Running Order condition and appears to be a characteristic of the vehicle.

Impacts at the highest test speed (80 km/h) were observed in the Lift Kit and Bullbar configurations. These impacts that occurred at speeds less than 50 percent of the limit thresholds outlined in ADR 98-01.

It is considered that only minor changes in vehicle performance have occurred in the Lift Kit, Lift Kit plus Bullbar and Bullbar configurations because the impact speeds in these configurations are less than the impact speeds outlined in ADR 98-01, similar to the baseline testing results.



0 Represents a test that did not result in an impact.

Represents an impact test that included driver braking prior to impact.

Represents an impact test that does not include driver braking prior to impact. This is also true for the lighter blue colours.

Figure 26: D-Max Car-to-Car Rear Moving impact speed results.

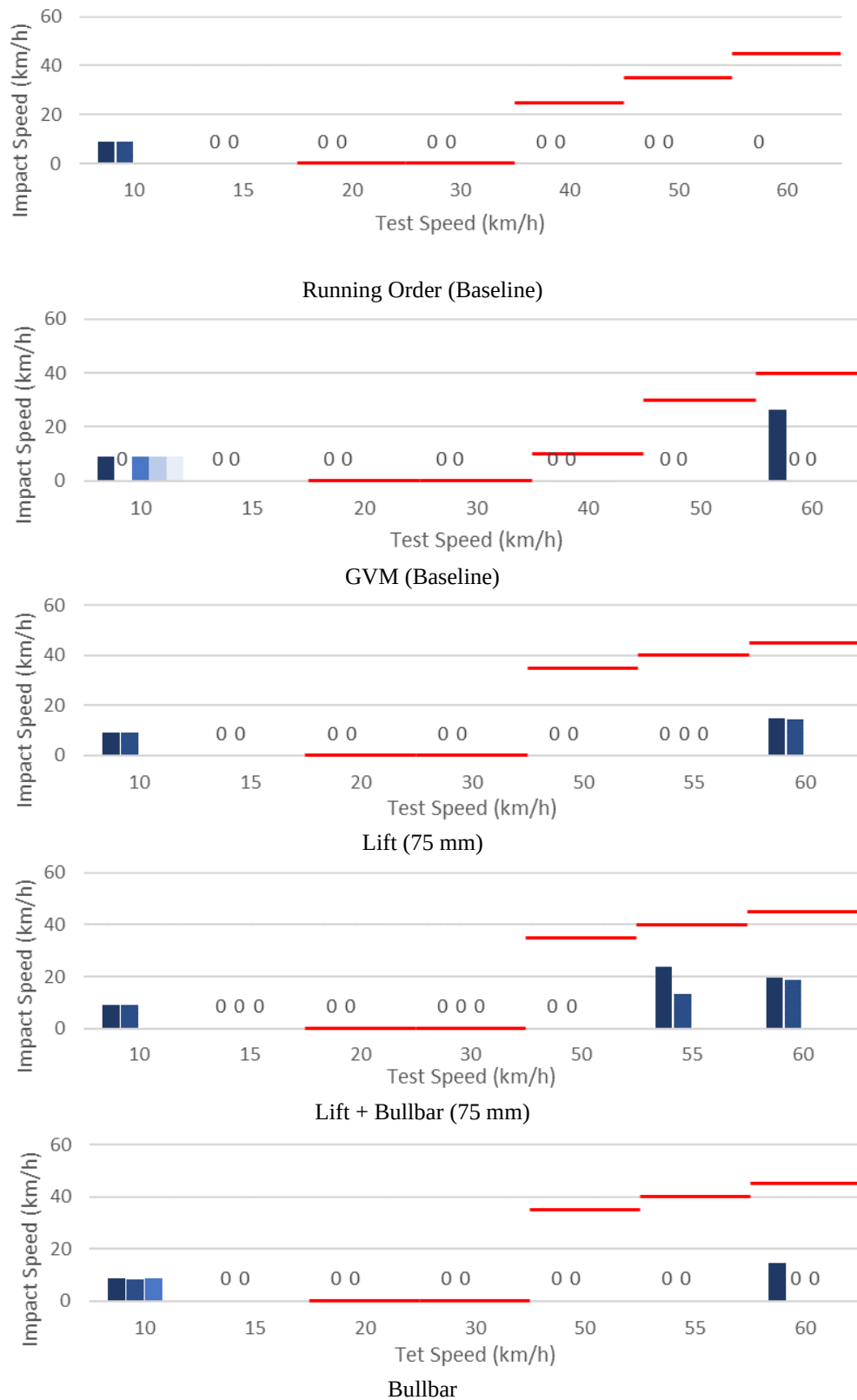
Car-to-Pedestrian (Child)

Impacts were observed at the lowest test speed (10 km/h) in both baseline configurations and the variations tested, as shown in Figure 27. Impacts were also observed at the higher test speeds in the GVM, Lift Kit, Lift Kit plus Bullbar and Bullbar configurations.

At all test speeds in the Lift Kit configuration and all but the lowest test speed in the Lift Kit plus Bullbar configuration, the average warning tone was delayed by greater than one percent compared to the baseline Running Order results. Similarly, at all test speeds in the Lift Kit and Lift Kit plus Bullbar configurations, the average braking start time was delayed by greater than one percent compared to the baseline Running Order results. This is similar to the change in average warning tone and average braking start time observed in these configurations during the Car-to-Car Rear Stationary testing. Delays in the warning tone timing and braking start timing are evident in the impact tests at 60 km/h in the Lift Kit configuration and 60 km/h in the Lift Kit plus Bullbar configuration during the Car-to-Pedestrian (Child) tests. Therefore, changes in detection due to the Lift Kit have likely contributed to the outcome of these tests in addition to changes in braking distance caused by the suspension and tyres used to create the 75 mm lift and the protrusion of the Bullbar.

The similar transition from impacting at 10 km/h to non-impacts at 15 km/h suggest that the variations investigated have not reduced the lateral field-of-view of the D-Max sensor system. Additionally, the similarity of the warning tone and braking start timings in the Bullbar configuration to the baseline Running Order configuration as well as the Lift Kit configuration compared to the Lift Kit plus Bullbar configuration suggest that the height of the Bullbar above the bonnet of the vehicle has not significantly reduced the vehicle's ability to identify a small target in front of the vehicle.

The impacts observed in the Lift Kit, Lift Kit plus Bullbar and Bullbar configurations at the ADR 98-01 test speeds between 20 and 60 km/h occurred at speeds less than 50 percent of the impact speed limit thresholds, with the exception of the first impact that occurred at 55 km/h in the Lift Kit plus Bullbar configuration, which occurred at 23.6 km/h or approximately 60 percent of the of the impact speed limit threshold for this test speed. Additionally, the impact outcomes of the testing performed at 10 and 15 km/h suggests similar performance in the Lift Kit, Lift Kit plus Bullbar and Bullbar configurations. Therefore, it is considered that only minor changes in vehicle performance were observed during the Car-to-Pedestrian (Child) testing in the Lift Kit, Lift Kit plus Bullbar and Bullbar configurations.



0 Represents a test that did not result in an impact.

Represents an impact test that included driver braking prior to impact.

Represents an impact test that does not include driver braking prior to impact. This is also true for the lighter blue colours.

Figure 27: D-Max Car-to-Pedestrian (Child) impact speed results.

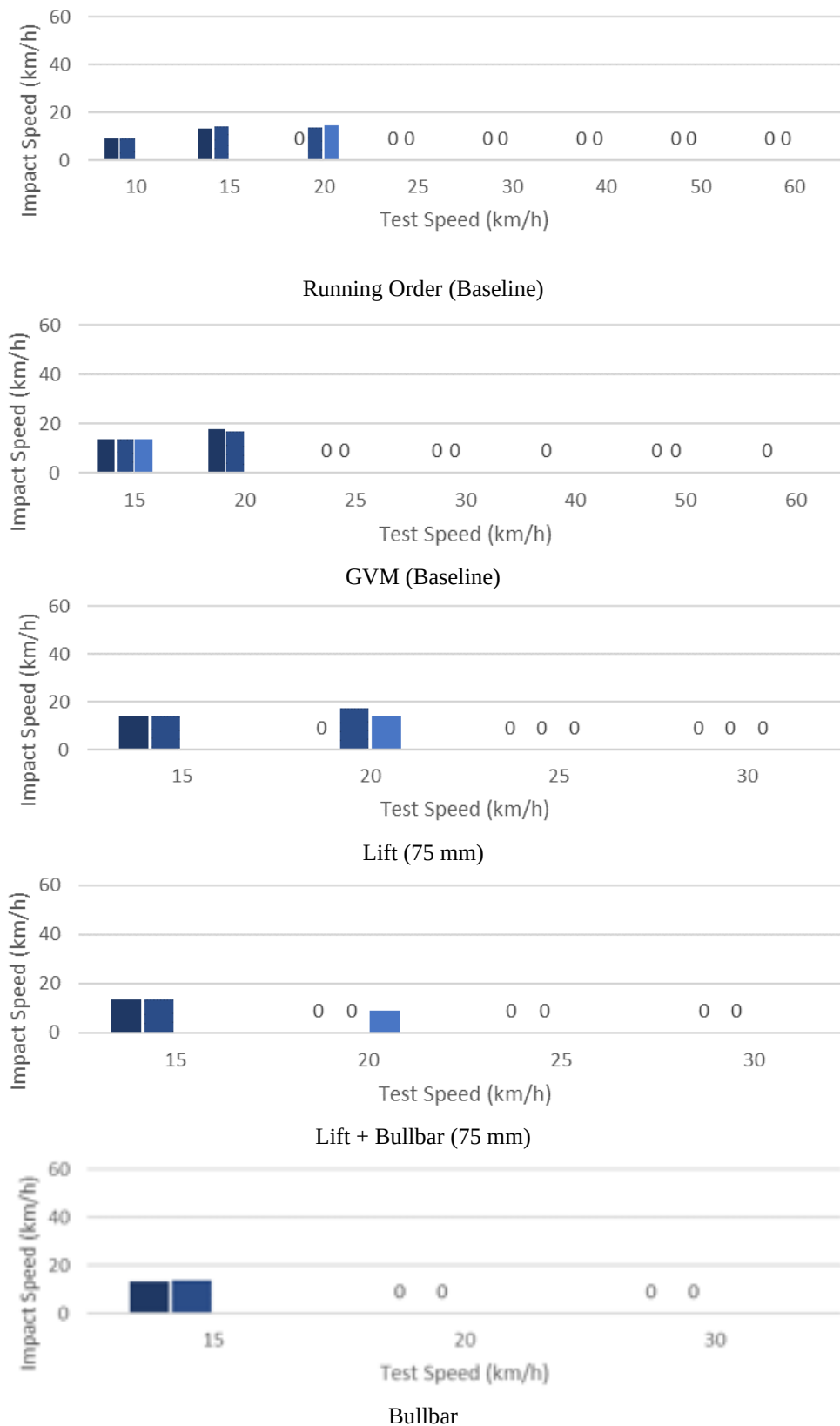
Car-to-Pedestrian (Adult)

Impacts were consistently observed at the lowest test speeds during the adult pedestrian tests, as shown in Figure 28. In the baseline Running Order condition, no vehicle braking was observed during the 10 km/h tests, therefore no further testing was performed at 10 km/h in the following configurations.

In the Lift Kit and Lift Kit plus Bullbar configurations, a transition from impacts to non-impact results was observed between 20 and 25 km/h, which is similar to the baseline Running Order configuration. In the Bullbar only configuration, the test vehicle avoided a collision in each test at 20 km/h, which is an improvement in performance compared to the Running Order baseline condition. This improvement is also shown in the average warning tone and average braking start time results. However, a similar improvement in performance doesn't appear in the Car-to-Pedestrian (Child) results, with the target traversing from the other side.

Similar to the Car-to-Car Rear Stationary and Car-to-Pedestrian (Child) test results, there is a general delay (greater than 10 percent) in the average warning tone and braking start times issued in the Lift Kit configuration. This trend was also observed at 25 and 30 km/h in the Lift Kit plus Bullbar configuration, however, was not observed at the two lower test speeds (i.e. 15 and 20 km/h). These delays add to the evidence that increasing the height of the vehicle can cause minor changes to the detection and braking start times.

The low-speed results of the farside testing, considering the impact outcomes and average warning tone and braking start times, suggest the variations investigated have not significantly reduced the lateral field-of-view of the Isuzu D-Max sensor system in the farside direction.



0 Represents a test that did not result in an impact.

Represents an impact test that included driver braking prior to impact.

Represents an impact test that does not include driver braking prior to impact. This is also true for the lighter blue colours.

Figure 28: D-Max Car-to-Pedestrian (Adult) impact speed results.

Comparison of Detection and Braking

This section of the results includes a comparison of the warning tone timings and braking start timings observed during the Isuzu D-Max crash avoidance testing. In each test configuration, the average warning tone was determined by averaging the timing of the audible warning tone for each of the tests performed at a particular test speed. The audible warning tone is referred to as the Forward Collision Warning (FCW) throughout the report. Similarly, the average braking start time was calculated by averaging the Autonomous Emergency Braking (AEB) time for each test performed at a particular test speed. The AEB time (or T(AEB)) is determined by identifying when the filtered acceleration is below -1 m/s^2 and then going backwards to determine the point in time when the acceleration first crossed -0.3 m/s^2 .

Car-to-Car Stationary

The D-max Car-to-Car Rear Stationary warning tone and braking start time results are presented in this section of the report.

FCW

A comparison of the average warning tone results with the baseline Running Order test results is presented in Figure 29 and the following tables. A greater than 10 percent delay in the warning tone timing was observed in all variations during the -50 percent offset test, which positions the centre of the test vehicle in-line with the left-hand edge of the target vehicle. Similar delays were also observed in the Lift Kit and Lift Kit plus Bullbar configurations at other test speeds during the non-offset tests. Moreover, a greater than one percent delay in warning tone timing was observed at each speed/offset performed in the Lift Kit and Lift Kit plus Bullbar configurations.

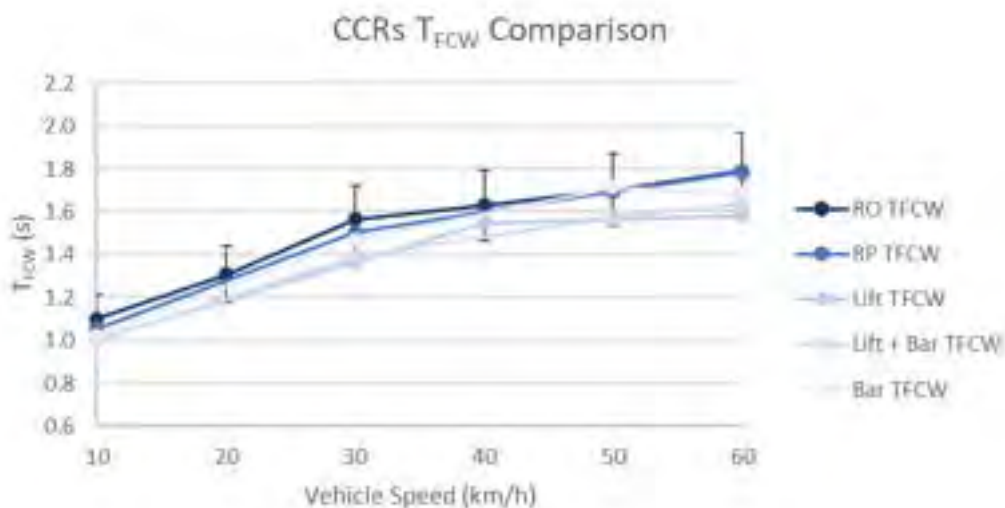


Figure 29: D-Max Car-to-Car Rear Stationary average warning tone timing plot (non-offset tests only). Note the error bars indicate a change of 10 percent from the Running Order condition.

Table 13: D-Max Car-to-Car Rear Stationary warning tone comparison results (Part 1).

Test Details		Running Order (Baseline)		Rear Pitch			Lift		
Speed	Offset (%)	Avg. (T _{FCW})	Range (T _{FCW})	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)
10	0	1.10	0.03	1.06	0.02	-4.13	1.00	0.02	-8.81
20	0	1.31	0.05						
30	0	1.57	0.00	1.51	0.02	-3.77	1.37	0.03	-12.78
40	0	1.63	0.03				1.55	0.02	-5.15
50	0	1.70	0.04	1.70	0.04	-0.47	1.56	0.00	-8.28
60	0	1.79	0.04	1.78	0.09	-0.34	1.58	0.00	-11.48
50	50	1.71	0.03	1.72	0.11	0.18	1.56	0.03	-8.64
50	-50	1.73	0.10	1.49	0.03	-13.54	1.24	0.01	-28.33

Value Highlights a change in Average T(FCW) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(FCW) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

Table 14: D-Max Car-to-Car Rear Stationary warning tone comparison results (Part 2).

Test Details		Running Order (Baseline)		Lift + Bar			Bar		
Speed	Offset (%)	Avg. (T _{FCW})	Range (T _{FCW})	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)
10	0	1.10	0.03	1.00	0.04	-8.99	1.02	0.01	-7.08
20	0	1.31	0.05						
30	0	1.57	0.00	1.39	0.05	-11.20	1.47	0.01	-6.07
40	0	1.63	0.03						
50	0	1.70	0.04	1.57	0.02	-7.65	1.72	0.04	0.73
60	0	1.79	0.04	1.64	0.06	-8.61	1.69	0.06	-5.76
50	50	1.71	0.03	1.55	0.01	-9.72	1.68	0.00	-2.13
50	-50	1.73	0.10	1.33	0.00	-23.32	1.29	0.08	-25.58

Value Highlights a change in Average T(FCW) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(FCW) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

AEB

Changes in the braking start timing during the Car-to-Car Rear Stationary testing are presented in Figure 30 and the following tables. Several large delays (greater than 10 percent) in the braking start timing were observed in the Lift Kit and Lift Kit plus Bullbar configurations, similar to the warning tone timing changes. Additionally, a delay of at least one percent was observed in each speed/offset performed in the Lift and Lift Kit plus Bullbar configurations, similar to the warning tone timing changes.

A comparison of the time difference between the warning tone and braking start time for each variation with the baseline Running Order configuration is outlined in Appendix A. Since the braking start time occurs within 0.8 seconds of the warning tone in most baseline tests, this metric was not used to evaluate a change in compliance with ADR 98-01. At least one instance of a large reduction (greater than 0.1 seconds) in the average time difference between warning tone and braking start time was observed in each configuration.

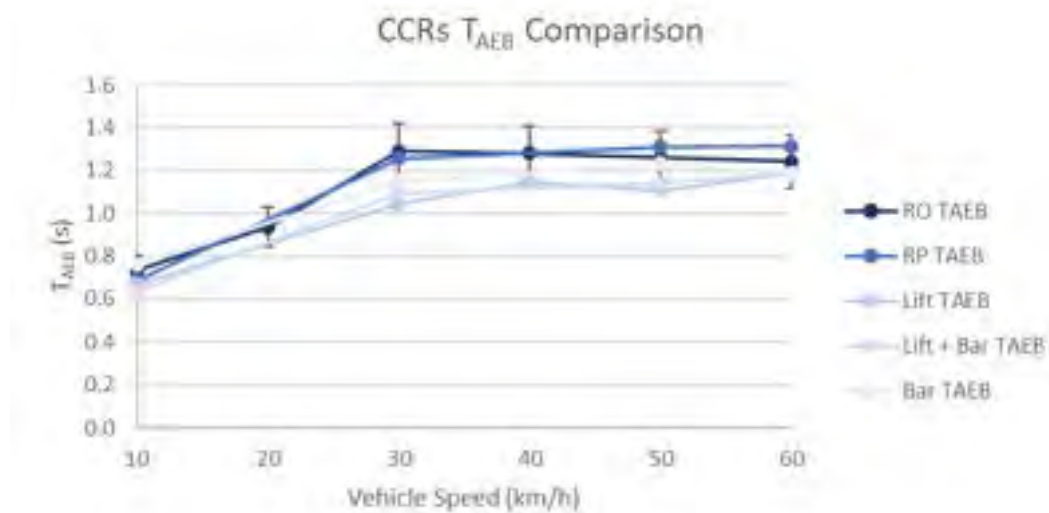


Figure 30: D-Max Car-to-Car Rear Stationary average braking start timing plot (non-offset tests only). Note the error bars indicate a change of 10% from the Running Order condition.

Table 15: D-Max Car-to-Car Rear Stationary braking start time comparison results (Part 1).

Test Details		Running Order (Baseline)		Rear Pitch			Lift		
Speed	Offset (%)	Avg. (T _{AEB})	Range (T _{AEB})	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)
10	0	0.73	0.01	0.69	0.01	-6.14	0.67	0.03	-8.46
20	0	0.94	0.02						
30	0	1.29	0.07	1.26	0.02	-2.52	1.04	0.07	-19.00
40	0	1.28	0.03				1.15	0.11	-10.39
50	0	1.26	0.07	1.31	0.04	4.09	1.11	0.01	-12.03
60	0	1.24	0.00	1.31	0.01	5.80	1.19	0.00	-4.43
50	50	1.25	0.02	1.31	0.04	4.78	1.19	0.01	-4.25
50	-50	1.28	0.00	1.23	0.09	-3.52	1.02	0.12	-19.94

Value Highlights a change in average T(AEB) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(AEB) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

Table 16: D-Max Car-to-Car Rear Stationary braking start time comparison results (Part 2).

Test Details		Running Order (Baseline)		Lift + Bar			Bar		
Speed	Offset (%)	Avg. (T _{AEB})	Range (T _{AEB})	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)
10	0	0.73	0.01	0.64	0.02	-13.17	0.76	0.01	4.23
20	0	0.94	0.02						
30	0	1.29	0.07	1.10	0.04	-15.02	1.15	0.05	-10.82
40	0	1.28	0.03						
50	0	1.26	0.07	1.14	0.04	-9.21	1.23	0.09	-2.03
60	0	1.24	0.00	1.19	0.06	-4.44	1.19	0.00	-4.35
50	50	1.25	0.02	1.16	0.03	-7.21	1.24	0.03	-0.44
50	-50	1.28	0.00	1.19	0.02	-7.26	1.19	0.01	-6.80

Value Highlights a change in average T(AEB) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(AEB) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

Car-to-Car Moving

The D-max Car-to-Car Rear Moving warning tone and braking start time results are presented in this section of the report.

FCW

Changes in warning tone timing during the Car-to-Car Rear Moving tests is presented in Figure 31 and the following tables. It can be observed that the variation in warning tone timing was less than 10 percent during all variation tests. Unlike the Car-to-Car Rear Stationary warning tone results, where a generally delay in the warning tone timing was observed in the Lift Kit and Lift Kit plus Bullbar configurations, the warning tone was within 5 percent of the baseline Running Order configuration at each speed/offset in these configurations during the Car-to-Car Rear Moving tests.

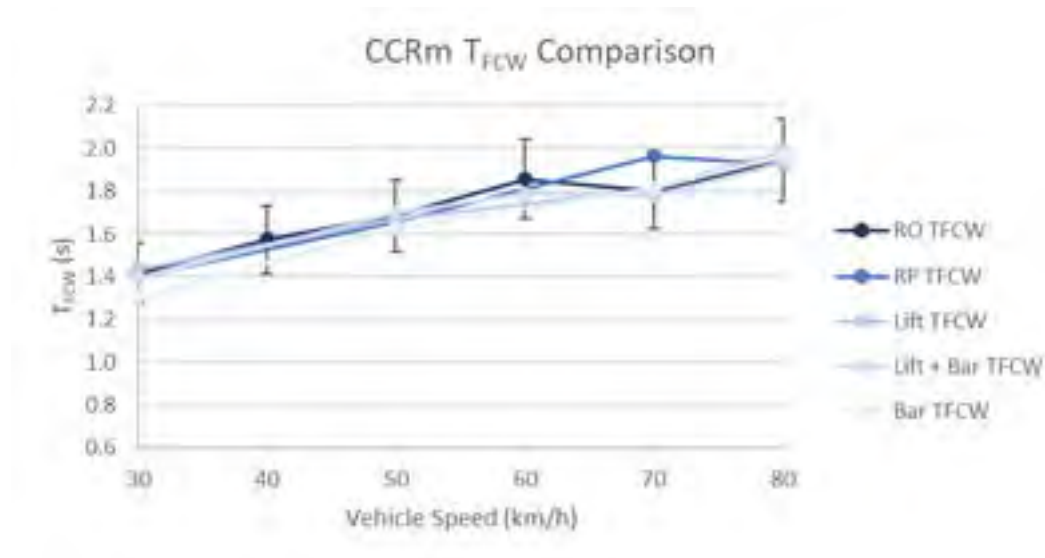


Figure 31: D-Max Car-to-Car Rear Moving average warning tone plot. Note the error bars indicate a change of 10 percent from the Running Order condition.

Table 17: D-Max Car-to-Car Rear Moving warning tone comparison results (Part 1).

Test Details		Running Order (Baseline)		Rear Pitch			Lift		
Speed	Offset (%)	Avg. (T _{FCW})	Range (T _{FCW})	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)
30	0	1.42	0.07	1.40	0.02	-1.33	1.44	0.10	1.28
40	0	1.57	0.13						
50	0	1.69	0.06	1.66	0.02	-1.81	1.67	0.05	-1.16
60	0	1.86	0.00						
70	0	1.80	0.06	1.96	0.26	8.97	1.81	0.10	0.40
80	0	1.95	0.04	1.93	0.00	-1.02	1.99	0.25	2.12

Value Highlights a change in average T(FCW) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(FCW) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

Table 18: D-Max Car-to-Car Rear Moving warning tone comparison results (Part 2).

Test Details		Running Order (Baseline)		Lift + Bar			Bar		
Speed	Offset (%)	Avg. (T _{FCW})	Range (T _{FCW})	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)
30	0	1.42	0.07	1.39	0.06	-1.91	1.31	0.02	-7.95
40	0	1.57	0.13						
50	0	1.69	0.06	1.70	0.09	0.94	1.63	0.05	-3.38
60	0	1.86	0.00	1.79	0.04	-3.72			
70	0	1.80	0.06	1.78	0.02	-1.34	1.81	0.01	0.57
80	0	1.95	0.04	1.93	0.01	-0.69	1.96	0.15	0.84

Value Highlights a change in average T(FCW) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(FCW) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

AEB

The average braking start timing improved by more than 10 percent in each variation test performed at 50 km/h, as shown in Figure 32 and the following tables. In contrast to the braking start time results observed during the Car-to-Car Rear Stationary testing, improvements and delays in the average braking start times were observed in the Lift Kit and Lift Kit plus Bullbar configurations during the Car-to-Car Rear Moving tests.

A comparison of the time difference between the warning tone and braking start time for each variation with the baseline Running Order configuration is outlined in Appendix A. Since the braking start time occurs within 0.8 seconds of the warning tone in most baseline tests, this metric was not used to evaluate a change in compliance with ADR 98-01. It can be observed that at least one instance of a large change (greater than 0.1 seconds) in the average time difference between warning tone and braking start time was observed in each configuration.

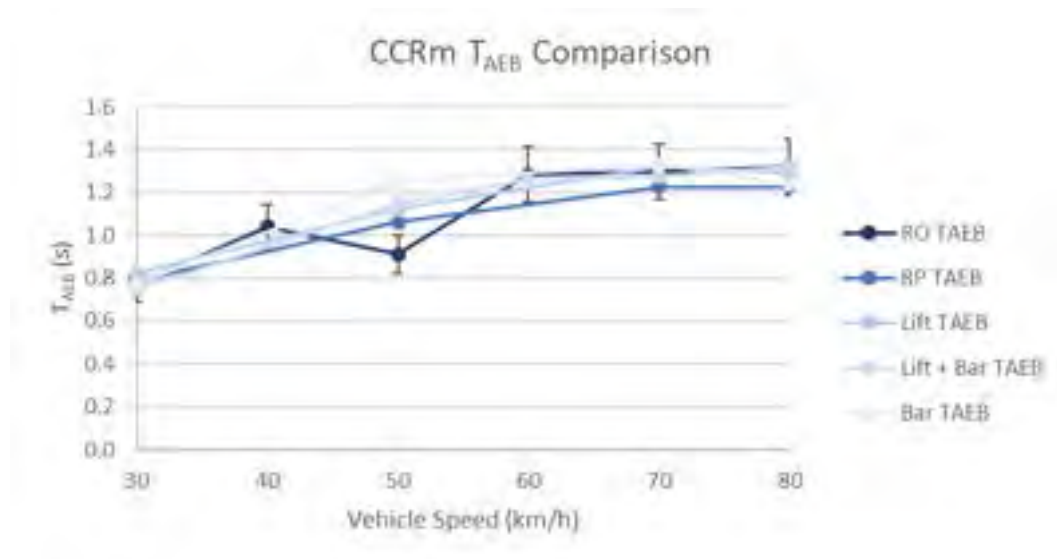


Figure 32: D-Max Car-to-Car Rear Moving average braking start timing plot. Note the error bars indicate a change of 10 percent from the Running Order condition.

Table 19: D-Max Car-to-Car Rear Moving braking start time comparison results (Part 1).

Test Details		Running Order (Baseline)		Rear Pitch			Lift		
Speed	Offset (%)	Avg. (T _{AEB})	Range (T _{AEB})	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)
30	0	0.77	0.06	0.79	0.02	2.23	0.82	0.05	6.91
40	0	1.04	0.02						
50	0	0.91	0.09	1.06	0.39	16.62	1.12	0.24	23.09
60	0	1.28	0.09						
70	0	1.30	0.28	1.23	0.09	-5.19	1.32	0.20	2.18
80	0	1.32	0.04	1.23	0.14	-7.06	1.29	0.03	-2.32

Value Highlights a change in average T(AEB) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(AEB) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

Table 20: D-Max Car-to-Car Rear Moving braking start time comparison results (Part 2).

Test Details		Running Order (Baseline)		Lift + Bar			Bar		
Speed	Offset (%)	Avg. (T _{AEB})	Range (T _{AEB})	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)
30	0	0.77	0.06	0.75	0.06	-3.13	0.78	0.08	0.74
40	0	1.04	0.02						
50	0	0.91	0.09	1.15	0.45	26.03	1.26	0.01	37.74
60	0	1.28	0.09	1.26	0.16	-1.84			
70	0	1.30	0.28	1.28	0.05	-1.56	1.33	0.01	2.87
80	0	1.32	0.04	1.32	0.02	0.05	1.24	0.14	-6.14

Value Highlights a change in average T(AEB) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(AEB) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

Car-to-Pedestrian (Child)

The D-max Car-to-Pedestrian warning tone and braking start time results obtained with the child pedestrian target traversing the vehicle path from the nearside are presented in this section of the report.

FCW

A comparison of the warning tone timing for each variation with the baseline Running Order configuration is presented in Figure 33 and the following tables. More than one instance of large change (greater than 10 percent) in the warning tone timing was observed in the Lift Kit and Lift Kit plus Bullbar configurations, which occurred at the lower test speeds between 10 and 30 km/h. In these configurations there is a general delay in the warning tone timing results at each speed tested, except for the lowest test speed in the Lift Kit plus Bullbar configuration, where an improvement in the average warning tone was observed.

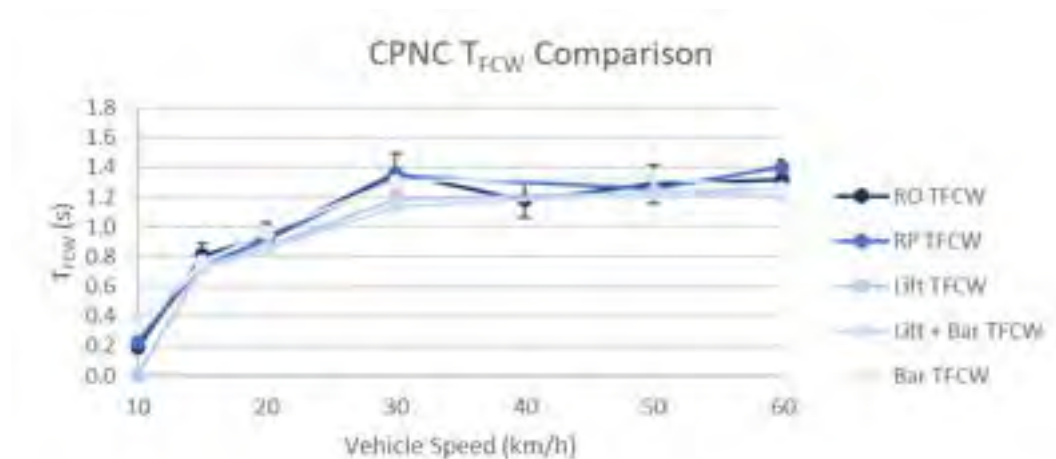


Figure 33: D-Max Car-to-Pedestrian (Child) average warning tone timing plot. Note the error bars indicate a change of 10 percent from the Running Order condition.

Table 21: D-Max Car-to-Pedestrian (Child) warning tone comparison results (Part 1).

CPNC	Running Order		Rear Pitch			Lift		
Speed	Avg. (T _{FCW})	Range (T _{FCW})	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)
10	0.19	0.05	0.23	0.00	21.07	0.00	0.00	-100.00
15	0.81	0.06	0.74	0.29	-8.12	0.74	0.02	-9.09
20	0.94	0.07	0.92	0.04	-2.09	0.87	0.03	-7.27
30	1.36	0.00	1.35	0.03	-0.81	1.19	0.03	-12.37
40	1.18	0.11						
50	1.29	0.08	1.26	0.15	-2.37	1.23	0.05	-4.27
60	1.32	0.00	1.40	0.04	6.17	1.26	0.04	-4.77

Value Highlights a change in average T(FCW) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(FCW) range that is greater than 0.5 seconds.

Highlights a test speed that was not performed in the configuration.

Table 22: D-Max Car-to-Pedestrian (Child) warning tone comparison results (Part 2).

CPNC	Running Order		Lift + Bar			Bar		
Speed	Avg. (T _{FCW})	Range (T _{FCW})	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)
10	0.19	0.05	0.37	0.07	97.87	0.35	0.11	84.71
15	0.81	0.06	0.72	0.11	-10.48	0.77	0.09	-5.39
20	0.94	0.07	0.85	0.03	-9.17	0.96	0.10	2.97
30	1.36	0.00	1.14	0.11	-16.28	1.31	0.04	-3.88
40	1.18	0.11						
50	1.29	0.08	1.23	0.03	-4.53	1.34	0.00	3.73
60	1.32	0.00	1.21	0.03	-8.61	1.24	0.15	-5.74

Value Highlights a change in average T(FCW) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(FCW) range that is greater than 0.5 seconds.

Highlights a test speed that was not performed in the configuration.

AEB

A comparison of the average braking start time for each configuration with the baseline Running Order condition is presented in Figure 34 and the following tables. Similar to the large change (greater than 10 percent) in average warning tone timing in the Lift Kit and Lift Kit plus Bullbar configurations, a large change in the braking start times was also observed at more than one test speed in these configurations. At test speeds above 10 km/h where braking did occur in the Lift Kit and Lift Kit plus Bullbar configurations, the average braking start time was delayed by greater than one percent at each test speed performed.

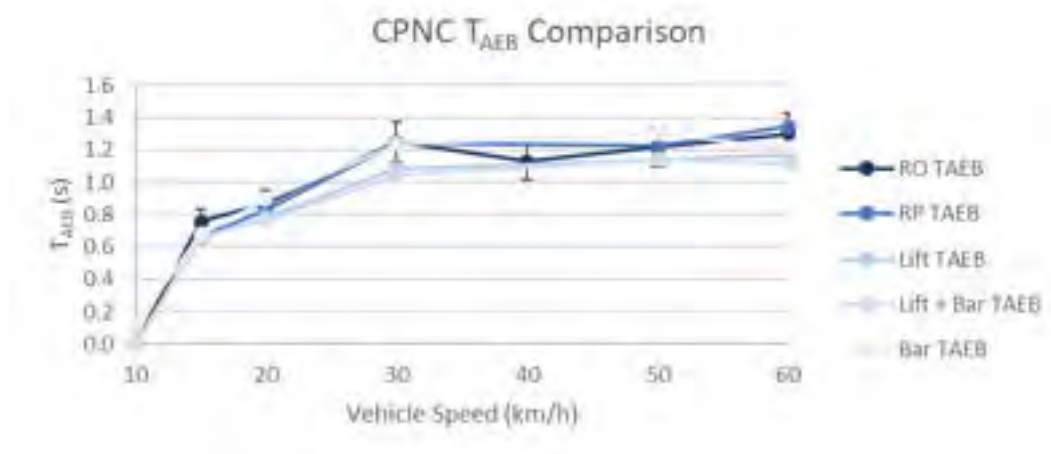


Figure 34: D-Max Car-to-Pedestrian (Child) average braking start timing plot. Note the error bars indicate a change of 10 percent from the Running Order condition.

Table 23: D-Max Car-to-Pedestrian (Child) braking start time comparison results (Part 1).

CPNC	Running Order		Rear Pitch			Lift		
Speed	Avg. (T _{AEB})	Range (T _{AEB})	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.76	0.05	0.66	0.24	-12.46	0.65	0.04	-13.66
20	0.87	0.01	0.83	0.02	-4.52	0.78	0.05	-9.64
30	1.25	0.00	1.24	0.02	-0.45	1.09	0.02	-13.05
40	1.13	0.08						
50	1.22	0.03	1.23	0.16	0.81	1.14	0.04	-6.23
60	1.30	0.00	1.34	0.02	3.21	1.17	0.03	-9.85

Value Highlights a change in average T(AEB) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(AEB) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

Table 24: D-Max Car-to-Pedestrian (Child) braking start time comparison results (Part 2).

CPNC	Running Order		Lift + Bar			Bar		
Speed	Avg. (T _{AEB})	Range (T _{AEB})	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)
10	0.00	0.00	0.00	0.00	0.00	0.12	0.23	100.00
15	0.76	0.05	0.67	0.13	-11.93	0.68	0.12	-9.84
20	0.87	0.01	0.77	0.08	-11.63	0.89	0.05	3.21
30	1.25	0.00	1.04	0.12	-16.37	1.24	0.00	-1.02
40	1.13	0.08						
50	1.22	0.03	1.14	0.03	-6.09	1.30	0.00	7.28
60	1.30	0.00	1.11	0.02	-14.51	1.21	0.16	-6.83

Value Highlights a change in average T(AEB) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(AEB) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

Car-to-Pedestrian (Adult)

The D-max Car-to-Pedestrian warning tone and braking start time results obtained with the adult pedestrian target traversing the vehicle path from the farside are presented in this section of the report.

FCW

A comparison of the warning tone timings during the farside Car-to-Pedestrian testing with the adult target is presented in Figure 35 and the following tables. In each configuration tested, there is a greater than 10 percent change of the warning tone timing in more than one test speed compared with the baseline Running Order condition. In the Lift configuration, there is a more than one percent delay in the average warning tone timing compared to the baseline Running Order configuration at each test speed.

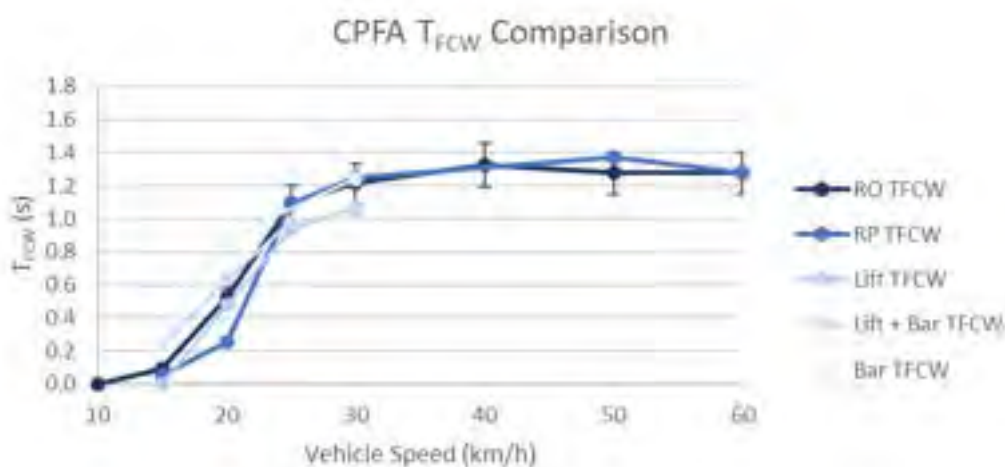


Figure 35: D-Max Car-to-Pedestrian (Adult) average warning tone timing plot. Note the error bars indicate a change of 10 percent from the Running Order condition.

Table 25: D-Max Car-to-Pedestrian (Adult) warning tone comparison results (Part 1).

CPFA	Running Order		Rear Pitch			Lift		
Speed	Avg. (T _{FCW})	Range (T _{FCW})	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)
10	0.00*	0.00						
15	0.10	0.19	0.05	0.11	-43.68	0.00	0.00	-100.00
20	0.53	0.32	0.26	0.01	-51.83	0.48	0.48	-9.95
25	1.09	0.08	1.10	0.02	0.46	0.94	0.12	-14.08
30	1.21	0.01	1.25	0.00	2.97	1.07	0.18	-11.54
40	1.33	0.04						
50	1.28	0.01	1.37	0.01	7.56			
60	1.28	0.08	1.28	0.08	0.47			

*FCW observed at impact in one of the two tests.

Value Highlights a change in average T(FCW) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(FCW) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

Table 26: D-Max Car-to-Pedestrian (Adult) warning tone comparison results (Part 2).

CPFA	Running Order		Lift + Bar			Bar		
Speed	Avg. (T _{FCW})	Range (T _{FCW})	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)
10	0.00*	0.00						
15	0.10	0.19	0.24	0.00	149.32	0.24	0.06	150.38
20	0.53	0.32	0.63	0.08	19.26	0.88	0.06	65.82
25	1.09	0.08	0.98	0.06	-10.18			
30	1.21	0.01	1.04	0.02	-14.28	1.24	0.07	2.50
40	1.33	0.04						
50	1.28	0.01						
60	1.28	0.08						

*FCW observed at impact in one of the two tests.

Value Highlights a change in average T(FCW) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(FCW) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

AEB

A comparison of the average braking start timings during the farside Car-to-Pedestrian testing with the adult target is presented in Figure 36 and the following tables. Similar to the warning tone timing, a greater than 10 percent change in braking start times compared to the baseline Running Order condition can be observed at more than one speed in each configuration. In the Bullbar configuration, there was a large (greater than 10 percent) improvement in the warning tone and braking start timings at 15 and 20 km/h compared to the baseline Running Order condition, however, the opposite is true at these test speeds in the Rear Pitch configuration. Additionally, there is a delay in the braking start time results at each test speed in the Lift Kit configuration compared to the baseline Running Order results.

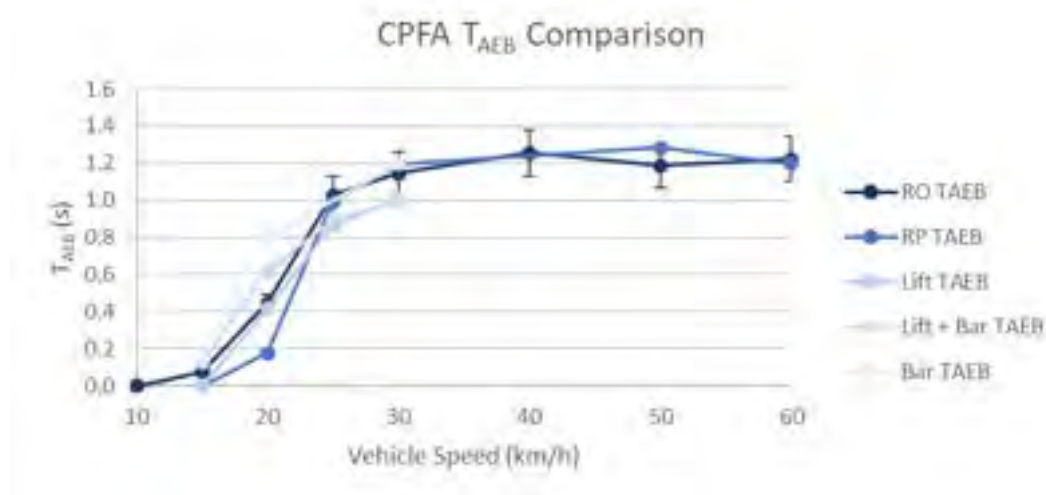


Figure 36: D-Max Car-to-Pedestrian (Adult) average braking start timing plot. Note the error bars indicate a change of 10 percent from the Running Order condition.

Table 27: D-Max Car-to-Pedestrian (Adult) braking start time comparison results (Part 1).

CPFA	Running Order		Rear Pitch			Lift		
Speed	Avg. (T _{AEB})	Range (T _{AEB})	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)
10	0.00	0.00						
15	0.08	0.15	0.00	0.00	-100.00	0.00	0.00	-100.00
20	0.45	0.28	0.18	0.03	-60.68	0.41	0.50	-21.85
25	1.03	0.03	0.99	0.01	-3.32	0.87	0.06	-20.40
30	1.14	0.05	1.20	0.01	4.54	1.00	0.14	-17.23
40	1.26	0.00						
50	1.19	0.01	1.28	0.01	8.17			
60	1.22	0.03	1.20	0.07	-2.01			

Value Highlights a change in average T(AEB) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(AEB) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

Table 28: D-Max Car-to-Pedestrian (Adult) braking start time comparison results (Part 2).

CPFA	Running Order		Lift + Bar			Bar		
Speed	Avg. (T _{AEB})	Range (T _{AEB})	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)
10	0.00	0.00						
15	0.08	0.15	0.13	0.02	33.53	0.16	0.10	66.17
20	0.45	0.28	0.61	0.14	15.41	0.80	0.03	51.84
25	1.03	0.03	0.90	0.03	-17.52			
30	1.14	0.05	1.00	0.01	-17.93	1.20	0.06	-1.26
40	1.26	0.00						
50	1.19	0.01						
60	1.22	0.03						

Value Highlights a change in average T(AEB) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(AEB) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

Comparison of Lane Keeping Results

A comparison of the LKS results is presented in this section of the report. The results are outlined in three sections according to the various configurations tested. The ‘General Results’ section includes the results of the baseline testing as well as testing in the Rear Pitch, Lift Kit, Lift Kit plus Bullbar and Bullbar only configurations. The ‘Daytime Antenna Results’ chapter includes the test results obtained with the vehicle fitted with both black and white Antennas and the ‘Night-time Antenna Results’ chapter includes results obtained with white Antennas fitted to the vehicle during night-time testing.

General Results

A comparison of the LKS test results in the Lift Kit, Lift Kit plus Bullbar and Bullbar only configurations is outlined in this section. Testing was performed at lateral velocities of 0.1, 0.2 and 0.5 m/s.

0.1 m/s

The 0.1 m/s results obtained during testing in each line marking configuration are presented in Figure 37 and Table 29. The Rear Pitch configuration test results were similar to the baseline test results, with only small changes in the average Distance to Lane Edge (DTLE) values observed. A greater than 0.1 metre change in the average DTLE was observed in one of the two line marking arrangements tested in the Lift Kit, Lift Kit plus Bullbar and Bullbar only configurations, compared to the baseline testing. In all configurations the vehicle completed its correction before reaching the DTLE limit of – 0.3 metres that is outlined in draft ADR 107.

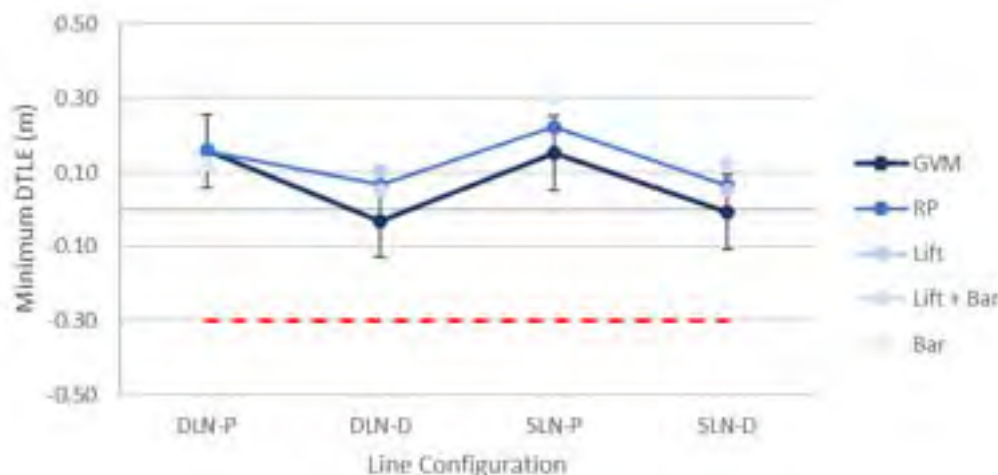


Figure 37: D-Max Lane Keeping System results at 0.1 m/s plot.

Table 29: D-Max Lane Keeping System results at 0.1 m/s.

Configuration	GVM (Baseline)	Rear Pitch		Lift		Lift + Bar		Bar	
	Avg. (DTLE)	Avg. (DTLE)	Change (m)	Avg. (DTLE)	Change (m)	Avg. (DTLE)	Change (m)	Avg. (DTLE)	Change (m)
DLN-P	0.16	0.16	0.00					0.12	-0.03
DLN-D	-0.03	0.07	0.01	0.10	0.14	0.05	0.08		
SLN-P	0.15	0.22	0.07					0.30	0.15
SLN-D	-0.01	0.06	0.07	0.05	0.06	0.12	0.13		

Value Highlights a change in average DTLE compared to the baseline Running Order that is greater than 0.1 metres.

Highlights a test speed that was not performed in the configuration.

0.2 m/s

The LKS results obtained at a lateral velocity of 0.2 m/s are presented in Figure 38 and Table 30. A change greater than 0.1 metres was observed in Rear Pitch configuration with a dashed line on the passenger side of the vehicle. The average DTLE values obtained in the Lift Kit, Lift Kit plus Bullbar and Bullbar only configurations were similar to the average value obtained during baseline testing. In all tests performed at a lateral velocity of 0.2 m/s, the vehicle completed the correction at least 0.2 metres before the DTLE limit outlined in draft ADR 107.

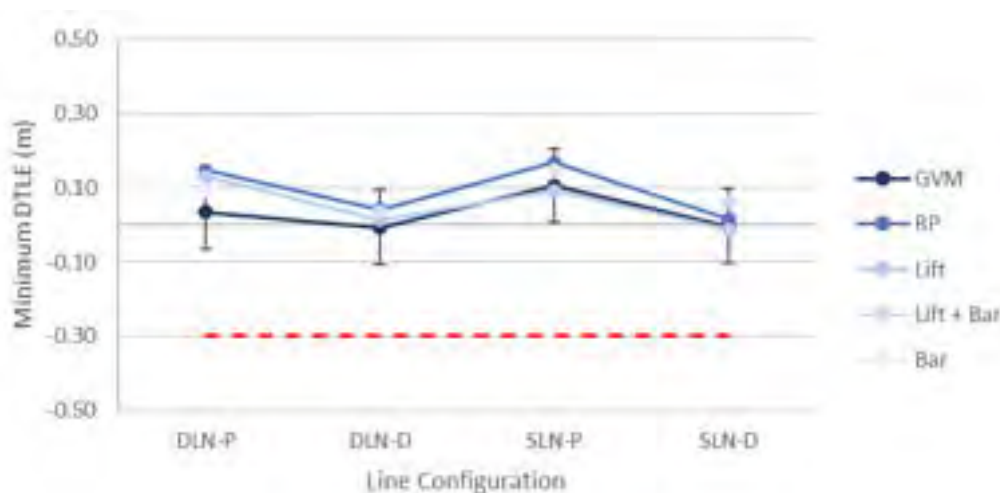


Figure 38: D-Max Lane Keeping System results at 0.2 m/s plot.

Table 30: D-Max Lane Keeping System results at 0.2 m/s.

Configuration	GVM (Baseline)	Rear Pitch		Lift		Lift + Bar		Bar	
	Avg. (DTLE)	Avg. (DTLE)	Change (m)	Avg. (DTLE)	Change (m)	Avg. (DTLE)	Change (m)	Avg. (DTLE)	Change (m)
DLN-P	0.03	0.15	0.11	0.13	0.10			0.09	0.06
DLN-D	-0.01	0.04	0.05	0.01	0.02	0.03	0.04		
SLN-P	0.11	0.17	0.06	0.09	-0.01			0.15	0.04
SLN-D	0.00	0.02	0.02	-0.01	-0.01	0.06	0.07		

Value Highlights a change in average DTLE compared to the baseline Running Order that is greater than 0.1 metres.

Highlights a test speed that was not performed in the configuration.

0.5 m/s

The lane keeping system results from testing in each line configuration at a lateral velocity of 0.5 m/s are presented in the Figure 39 and Table 31. The vehicle crossed beyond the DTLE limit outlined in draft ADR 107 in the driver's side tests performed with the Bullbar fitted to the vehicle. On average the distance travelled over the line during these tests was greater than the distance travelled over the line during baseline testing by more than 0.1 metres. The average distance travelled over the line also varied by more than 0.1 metres compared to the baseline testing in the Rear Pitch configuration. In these Rear Pitch configuration tests, the vehicle avoided the line by more than 0.1 metres compared to during the baseline testing.

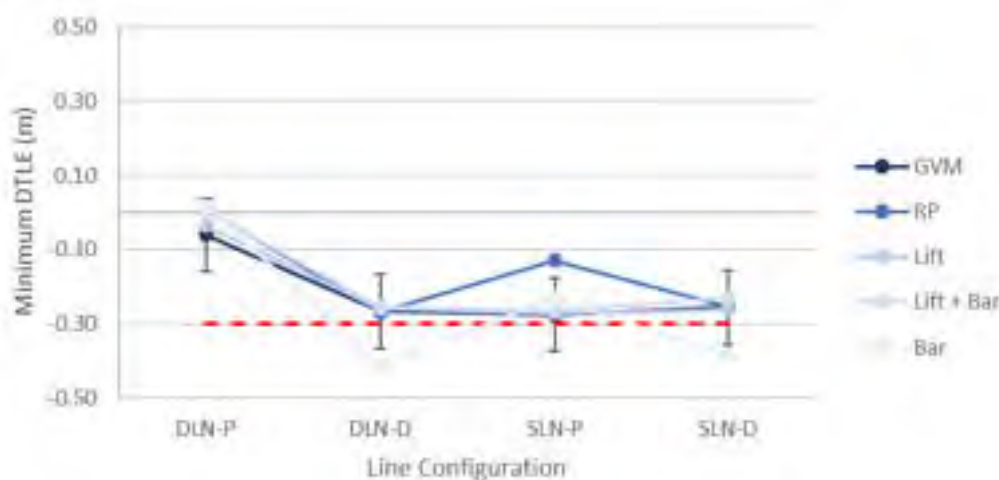


Figure 39: D-Max Lane Keeping System results at 0.5 m/s plot.

Table 31: D-Max Lane Keeping System results at 0.5 m/s.

Configuration	GVM (Baseline)	Rear Pitch		Lift		Lift + Bar		Bar	
	Avg. (DTLE)	Avg. (DTLE)	Change (m)	Avg. (DTLE)	Change (m)	Avg. (DTLE)	Change (m)	Avg. (DTLE)	Change (m)
DLN-P	-0.06	0.01	0.07	-0.04	0.02	0.01	0.07	0.02	0.08
DLN-D	-0.27	-0.27	0.00	-0.26	0.01	-0.25	0.01	-0.41	-0.15
SLN-P	-0.28	-0.13	0.15	-0.27	0.01	-0.26	0.01	-0.23	0.05
SLN-D	-0.26	-0.25	0.00	-0.26	-0.01	-0.23	0.03	-0.38	-0.13

Value Highlights a change in average DTLE compared to the baseline Running Order that is greater than 0.1 metres.

Value Highlights a test speed that was not performed in the configuration.

Daytime Antenna Results

This section of the report contains an overview of the results obtained with the Antennas mounted to the Bullbar. To reduce the number of tests performed, only a worst-case configuration of white and black Antennas was mounted to the vehicle. Therefore, testing was performed with two black or white Antennas installed on the driver's side or passenger side of the vehicle depending on the side of the lane marking. To further reduce the number of tests performed, testing was only performed on both the driver's side and passenger side at a lateral velocity of 0.5 m/s. At 0.1 and 0.2 m/s, testing was only performed on the passenger side as this is believed to be the most common side that Antennas are installed.

0.1 m/s

The average DTLE daytime test results obtained with Antennas installed on the D-Max at a lateral velocity of 0.1 m/s are presented in Figure 40 and Table 32. The average DTLE result obtained with the white Antennas located on the passenger side of the vehicle during the solid line tests was closer to the line marking by more than 0.1 metres than the average DTLE observed with only the Bullbar fitted to the vehicle. The results obtained in the other line marking and Antenna combinations tested were similar to the results obtained during testing with the Bullbar only. In all tests with Antennas the vehicle was able to avoid crossing the line marking.

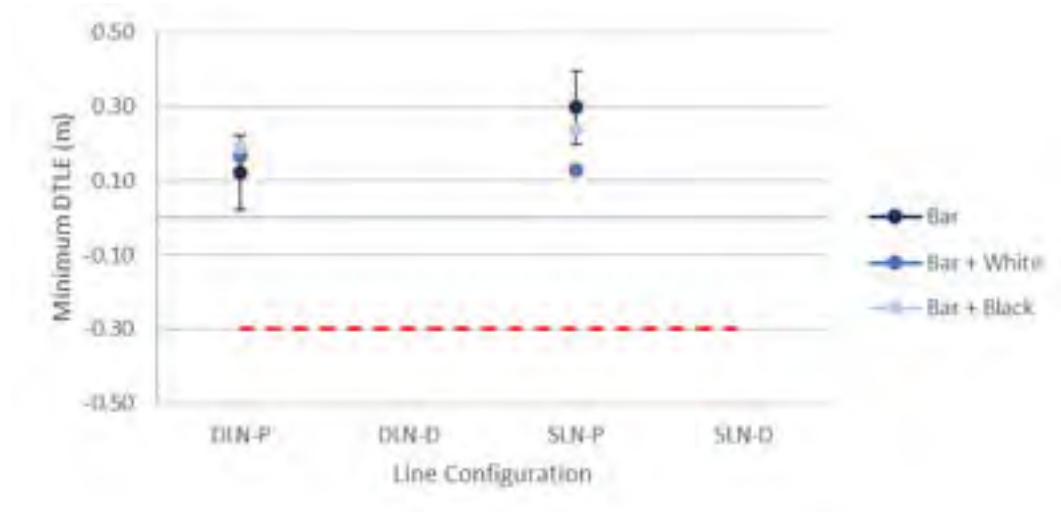


Figure 40: D-Max Lane Keeping System daytime Antenna results at 0.1 m/s plot.

Table 32: D-Max Lane Keeping System daytime Antenna results at 0.1 m/s.

Configuration	Bar	Bar + White Antenna		Bar + Black Antenna	
	Avg. (DTLE)	Avg. (DTLE)	Change (m)	Avg. (DTLE)	Change (m)
DLN-P	0.12	0.17	0.05	0.19	0.07
DLN-D					
SLN-P	0.30	0.13	-0.17	0.24	-0.06
SLN-D					

Value Highlights a change in average DTLE compared to the baseline Running Order that is greater than 0.1 metres.

Highlights a test speed that was not performed in the configuration.

0.2 m/s

The average DTLE daytime results obtained with Antennas installed on the vehicle at a lateral velocity of 0.2 m/s are presented in Figure 41 and Table 33. The DTLE values obtained with both the white and black Antennas fitted to the vehicle were similar to the Bullbar only results. In each test performed with then Antennas fitted to the vehicle, the vehicle was able to avoid crossing the line marking.

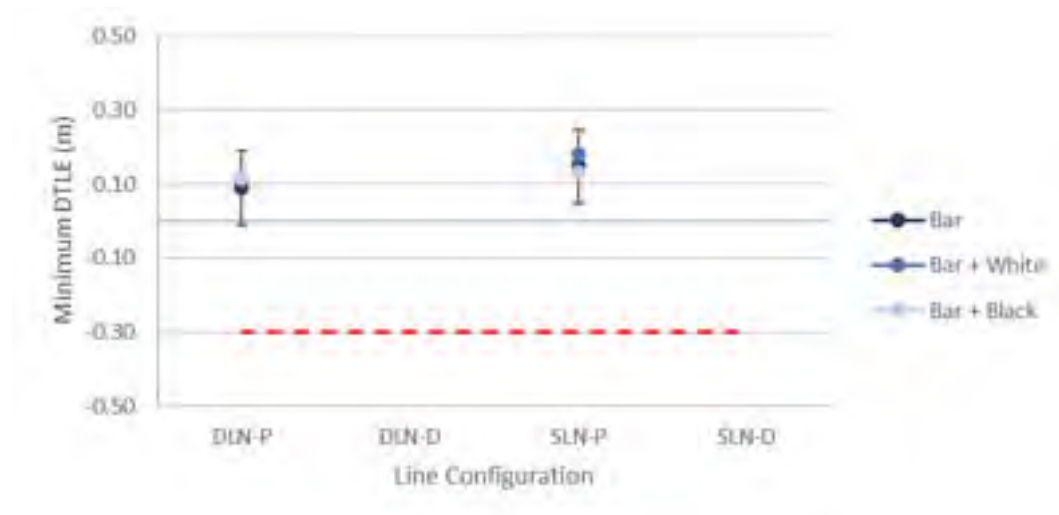


Figure 41: D-Max Lane Keeping System daytime Antenna results at 0.2 m/s plot.

Table 33: D-Max Lane Keeping System daytime Antenna results at 0.2 m/s.

Configuration	Bar	Bar + White Antenna		Bar + Black Antenna	
	Avg. (DTLE)	Avg. (DTLE)	Change (m)	Avg. (DTLE)	Change (m)
DLN-P	0.09	0.11	0.02	0.12	0.03
DLN-D					
SLN-P	0.15	0.18	0.03	0.13	-0.01
SLN-D					

Value Highlights a change in average DTLE compared to the baseline Running Order that is greater than 0.1 metres.

Highlights a test speed that was not performed in the configuration.

0.5 m/s

The average DTLE results obtained with Antennas fitted to the D-Max at lateral velocity of 0.5 m/s are presented in Figure 42 and Table 35. The Antenna results were consistent with the testing performed with only the Bullbar installed on the D-Max. Similar to the baseline testing, the driver's side results typically also exceeded the DTLE limit outlined in draft ADR 107, however, the passenger side DTLE values were within the DTLE limit.

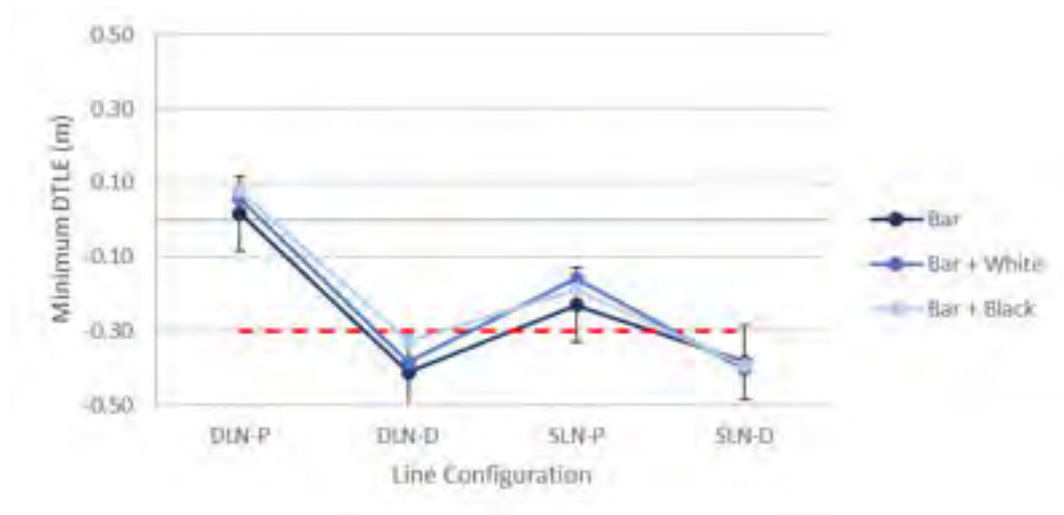


Figure 42: D-Max Lane Keeping System daytime Antenna results at 0.5 m/s plot.

Table 34: D-Max Lane Keeping System daytime Antenna results at 0.5 m/s.

Configuration	Bar	Bar + White Antenna		Bar + Black Antenna	
	Avg. (DTLE)	Avg. (DTLE)	Change (m)	Avg. (DTLE)	Change (m)
DLN-P	0.02	0.06	0.04	0.08	0.06
DLN-D	-0.41	-0.38	0.03	-0.33	0.08
SLN-P	-0.23	-0.16	0.07	-0.19	0.04
SLN-D	-0.38	-0.40	-0.02	-0.39	-0.01

Value Highlights a change in average DTLE compared to the baseline Running Order that is greater than 0.1 metres.

Value Highlights a test speed that was not performed in the configuration.

Night-time Antenna Results

The night-time Antenna results are outlined in this section of the report. The focus of the night-time testing was to determine whether reflection from Antennas could ‘blind’ the vehicle cameras such that sensor system was unable to detect and respond to the line markings. Testing was performed with the white Antennas fitted to the vehicle because these are more likely to produce a reflection than the black Antennas. Two tests were performed in each line marking and direction combination at a lateral velocity of 0.2 m/s and two tests were performed with one line marking and direction combination at a lateral velocity of 0.5 m/s to understand whether the vehicle response changed at a different lateral velocity.

0.2 m/s

The night-time Antenna results obtained at a lateral velocity of 0.2 m/s are outlined in Figure 43 and Table 35. The night-time results obtained with the white Antennas and driving lights fitted to the DMax were similar to the results obtained during the baseline night-time testing. The results were all within the limit threshold outlined in draft ADR 107.

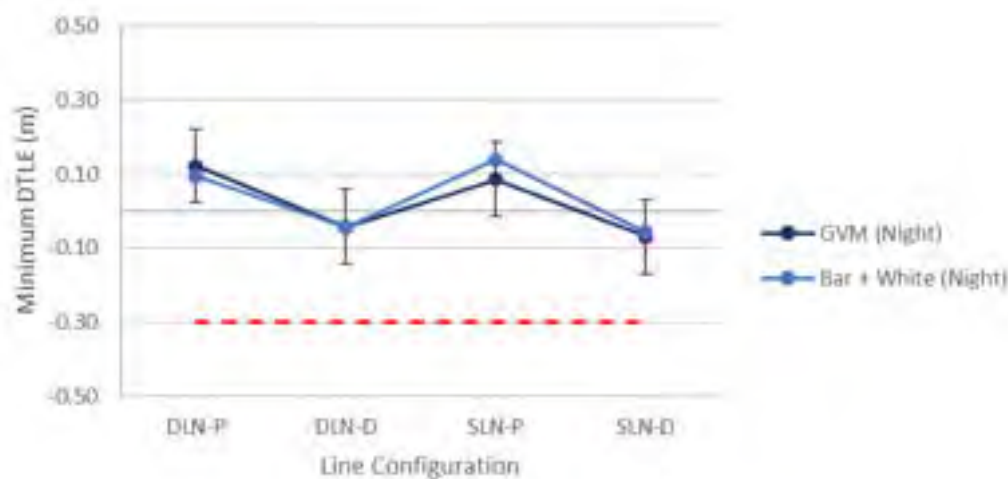


Figure 43: D-Max Lane Keeping System night-time Antenna results at 0.2 m/s plot.

Table 35: D-Max Lane Keeping System night-time Antenna results at 0.2 m/s.

Configuration	GVM (Night)	Bar + White Antenna (Night)	
	Avg. (DTLE)	Avg. (DTLE)	Change (m)
DLN-P	0.12	0.09	-0.03
DLN-D	-0.04	-0.04	0.00
SLN-P	0.09	0.14	0.05
SLN-D	-0.07	-0.06	0.01

Value Highlights a change in average DTLE compared to the baseline Running Order that is greater than 0.1 metres.

Value Highlights a test speed that was not performed in the configuration.

0.5 m/s

The night-time Antenna results obtained at a lateral velocity of 0.5 m/s are presented in Figure 44 and Table 36. Similar to the 0.2 m/s lateral velocity results, the vehicle DTLE results obtained at 0.5 m/s with the driving lights and Antennas were similar to the baseline nighttime test results.

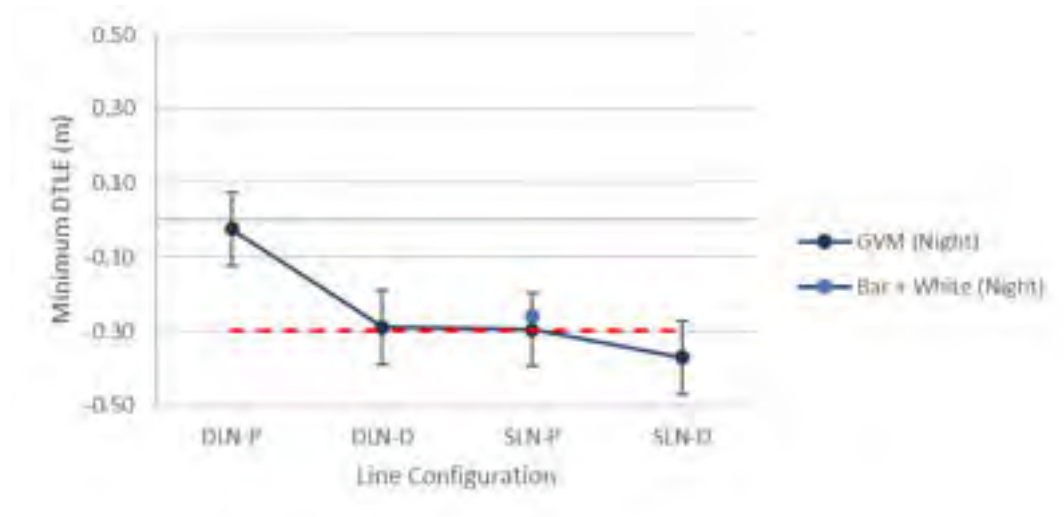


Figure 44: D-Max Lane Keeping System night-time Antenna results at 0.5 m/s plot.

Table 36: D-Max Lane Keeping System night-time Antenna results at 0.5 m/s.

Configuration	GVM (Night)	Bar + White Antenna (Night)	
	Avg. (DTLE)	Avg. (DTLE)	Change (m)
DLN-P	-0.02		
DLN-D	-0.29		
SLN-P	-0.30	-0.26	0.04
SLN-D	-0.37		

Value Highlights a change in average DTLE compared to the baseline Running Order that is greater than 0.1 metres.

Highlights a test speed that was not performed in the configuration.

Ranger Results

This section provides an overview of the Ford Ranger test results. The results are presented in two sections. Both the ‘Comparison of Impact Speeds’ and ‘Comparison of Detection Braking’ sections present and compare the crash avoidance test results.

In all four test scenarios, limited testing was performed at the higher test speeds in the baseline configurations due to the potential of damaging the radar mounted at the front of the vehicle. Testing was performed at the highest test speeds with each Bullbar fitted to the Ranger because of the protection provided by the Bullbar.

Comparison of Impact Speeds

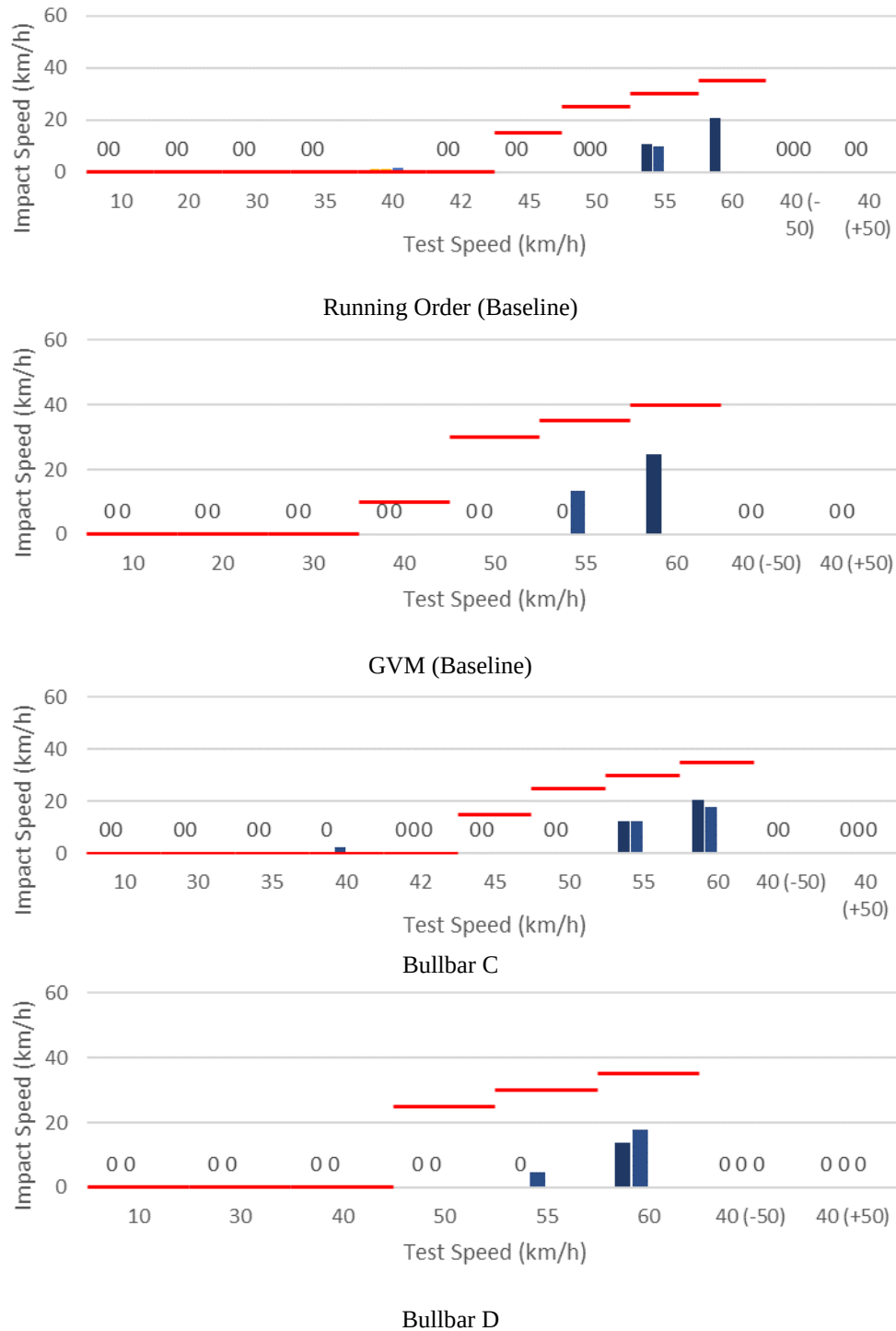
A comparison of impact speeds observed during the Ranger testing is provided in the following sections. In each graph, a (0) zero represents a test that did not result in an impact. Each graph also contains a red line to indicate the limit threshold for a pass at each test speed, based on the requirements of ADR 98-01. For both Bullbars the impact speed thresholds from ADR 98-01 for the Running Order configuration were adopted. Note that a comparison of impact speeds from the Rear Pitch testing is not presented in this section because a simplified version of the real-world trailer towing scenario was used to investigate the effects of changing vehicle pitch. Instead, a comparison of the detection and braking start times was used to analyse the Rear Pitch configuration results and is presented in the following section.

Car-to-Car Stationary

The Ranger Car-to-Car Rear Stationary impact speed results are presented in Figure 45. At 40 km/h in the baseline Running Order condition the test vehicle released the braking effort prior to decreasing the vehicle speed to zero in each of the three tests performed. In the first two tests the driver applied the brakes to prevent the test vehicle from rolling into the target vehicle (highlighted in orange), however, in the third test the driver did not intervene, and the vehicle rolled into the target at 1.82 km/h. A similar roll-in impact was observed in one of the two tests performed at 40 km/h with the Bullbar C fitted to the Ranger. These impacts are above the limit threshold outlined in ADR 98-01.

Only one test was performed at the highest test speed during baseline testing to minimise the risk of damaging the radar. In all configurations, including both baseline configurations, impacts were observed at 55 and 60 km/h. The impact speeds observed at 55 and 60 km/h with each Bullbar fitted to the Ranger were below 60 percent of the impact speed threshold outlined in ADR 98-01. Therefore, because each of these impacts occurred at a speed below the ADR limit threshold, it is considered that minor changes in performance occurred with both Bullbars.

No change in performance was observed with each Bullbar fitted to the vehicle during the 50 percent offset tests performed at 40 km/h.



0 Represents a test that did not result in an impact.

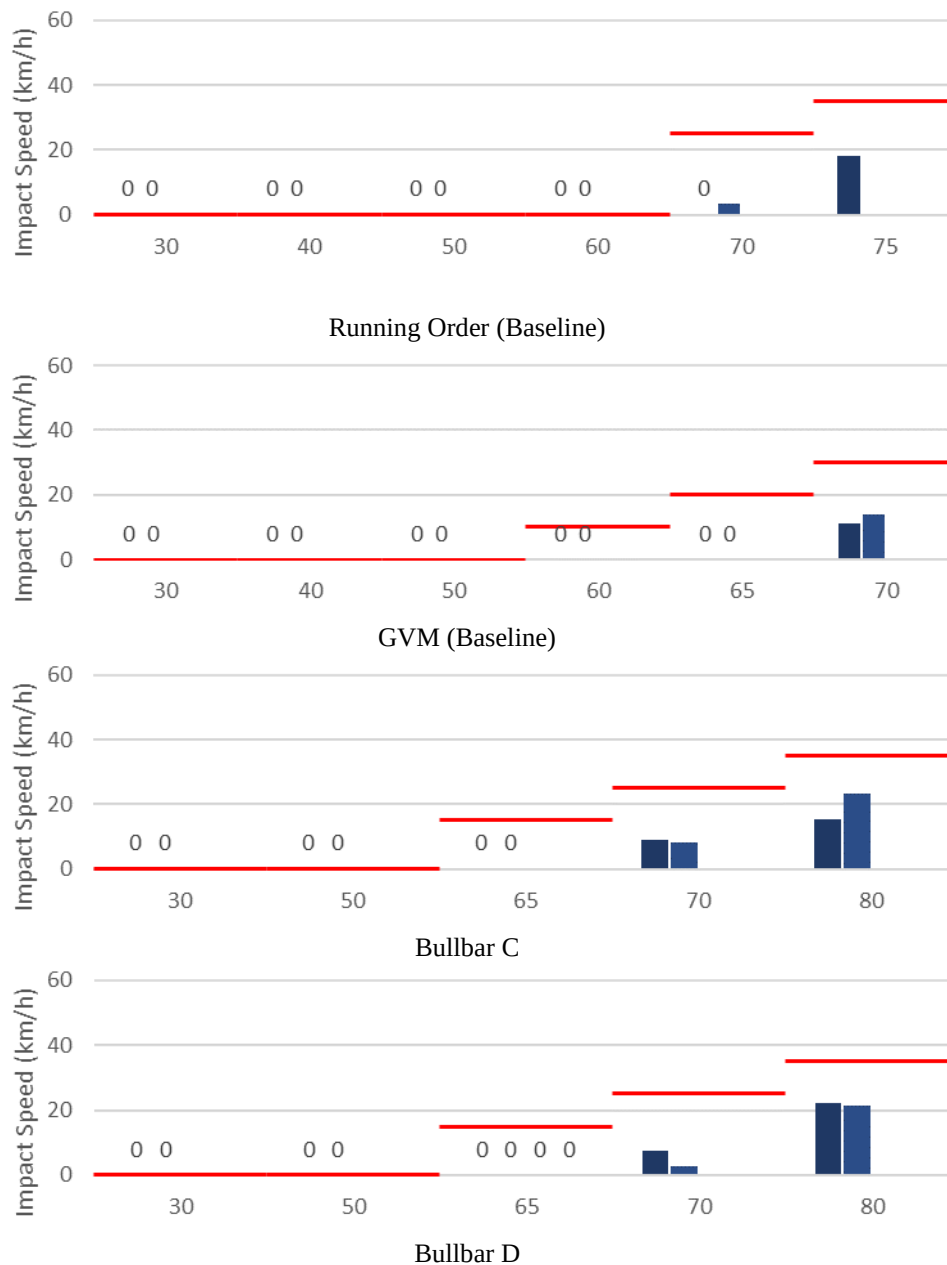
Represents an impact test that included driver braking prior to impact.

Represents an impact test that does not included driver braking prior to impact. This is also true for the lighter blue colours.

Figure 45: Ranger Car-to-Car Rear Stationary impact speed results.

Car-to-Car Moving

The Ranger Car-to-Car Rear Moving results are presented in Figure 46. Testing was limited to 70 km/h in the Running Order condition and 75 km/h in GVM to reduce the chance of damaging the radar. In all baseline configurations and variation conditions, impacts were observed from 70 km/h. The impact speeds observed at 70 km/h for each Bullbar are below 50 percent of the impact speed threshold outlined in ADR 98-01. Therefore, because each of these impacts occurred at a speed below the ADR limit threshold, it is considered that minor changes in performance occurred with both Bullbars fitted to the Ranger. Testing at the highest test speed of 80 km/h was performed with each Bullbar fitted to the Ranger. In all tests performed the impact speeds observed were less than the limit threshold outlined in ADR 98-01. These results support the conclusion that each Bullbar has a minor influence on the ability of the vehicle to respond to a slower moving target.



0 Represents a test that did not result in an impact.

Represents an impact test that included driver braking prior to impact.

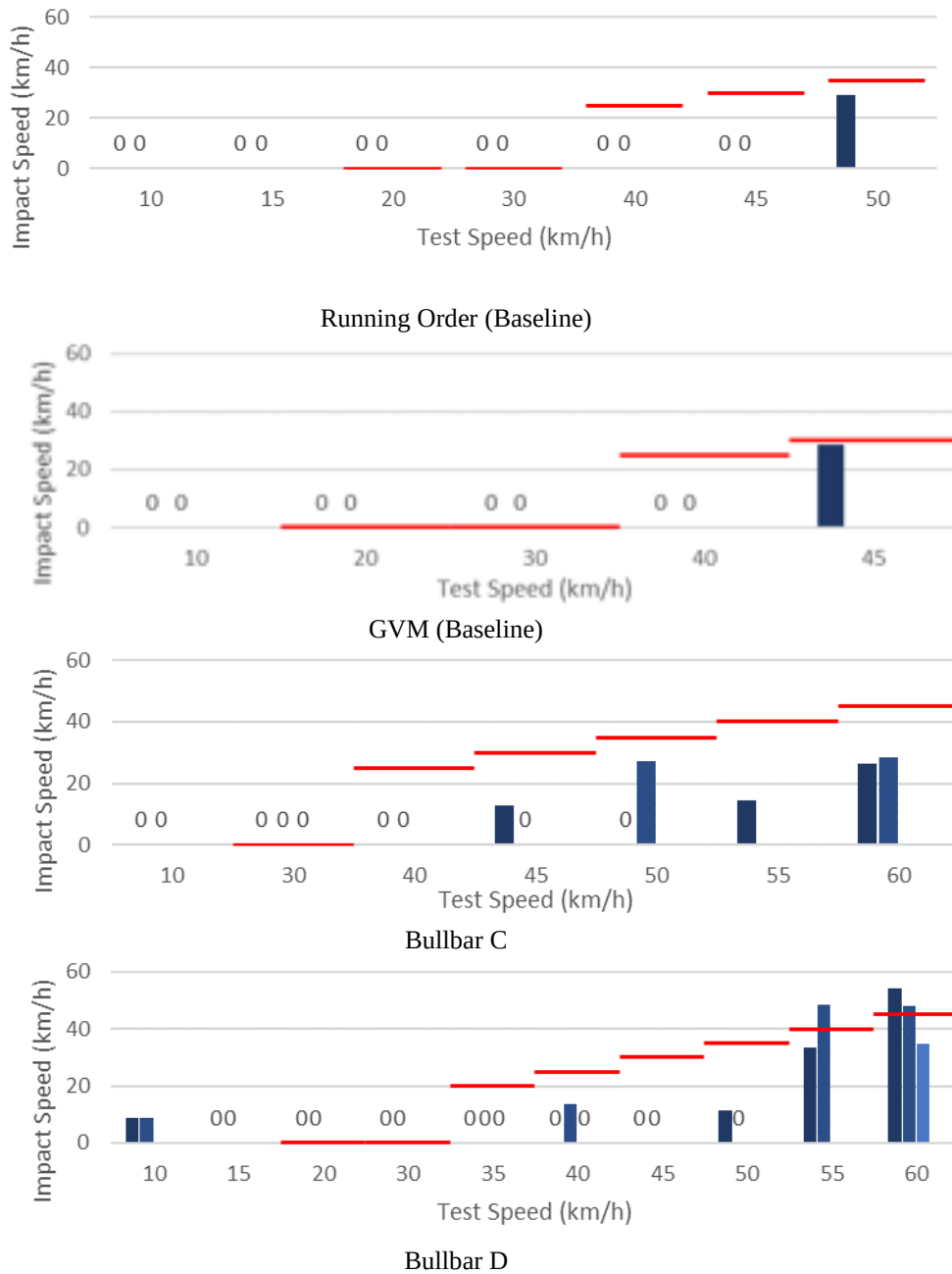
Represents an impact test that does not include driver braking prior to impact. This is also true for the lighter blue colours.

Figure 46: Ranger Car-to-Car Rear Moving impact speed results.

Car-to-Pedestrian (Child)

The impact speed results observed during the Car-to-Pedestrian testing from the nearside direction with the Child target are presented in Figure 47. Testing was stopped at 50 km/h during testing in the Running Order configuration and 45 km/h in the GVM configuration due to the impact speeds observed. The Ranger transitioned to impacts at 45 km/h with the Bullbar C and the first impact was observed at 40 km/h with the Bullbar D, followed by no impacts at 45 km/h then a transition to impacts at 50 km/h. The impacts at these speeds with either Bullbar fitted to the Ranger were below 60 percent of the limit threshold outlined in ADR 98-01, with the exception of the impact that occurred at 50 km/h with the Bullbar C fitted to the vehicle. The impact speed (27 km/h) observed in this test was closer to the limit threshold outlined ADR 98-01 (35 km/h), however, was similar to the impact speed observed at 50 km/h during baseline testing (29 km/h). Since each impact speed at test speeds between 20 and 50 km/h are below the limit threshold outlined in ADR 98-01, similar to baseline testing, it appears that each Bullbar causes only minor changes in performance. At the test speeds below the ADR test speeds, however, the Ranger did not apply the brakes during both tests performed at 10 km/h with the Bullbar D fitted. This is in contrast to the performance at 10 km/h in the Running Order configuration where collision avoidance was observed in both tests.

Some of the impacts observed with the Bullbar D at 55 and 60 km/h were above the limit threshold outlined in ADR 98-01, however, it is unclear whether this is similar to performance in the baseline Running Order condition because testing was stopped at 50 km/h. It can be observed that there is an approximately 0.4 seconds decrease in the average braking start timing at 55 and 60 km/h compared to at 50 km/h with the Bullbar D fitted. Additionally, comparing the Bullbar D results at these speeds with the Bullbar C results, highlights that the average braking start timing with the Bullbar D occurs approximately 0.3 seconds later than with the Bullbar C fitted. These results suggest that Bullbar D could be affecting performance at the highest test speeds, however, further testing at these speeds in the baseline condition is required to confirm if this is the case.



0 Represents a test that did not result in an impact.

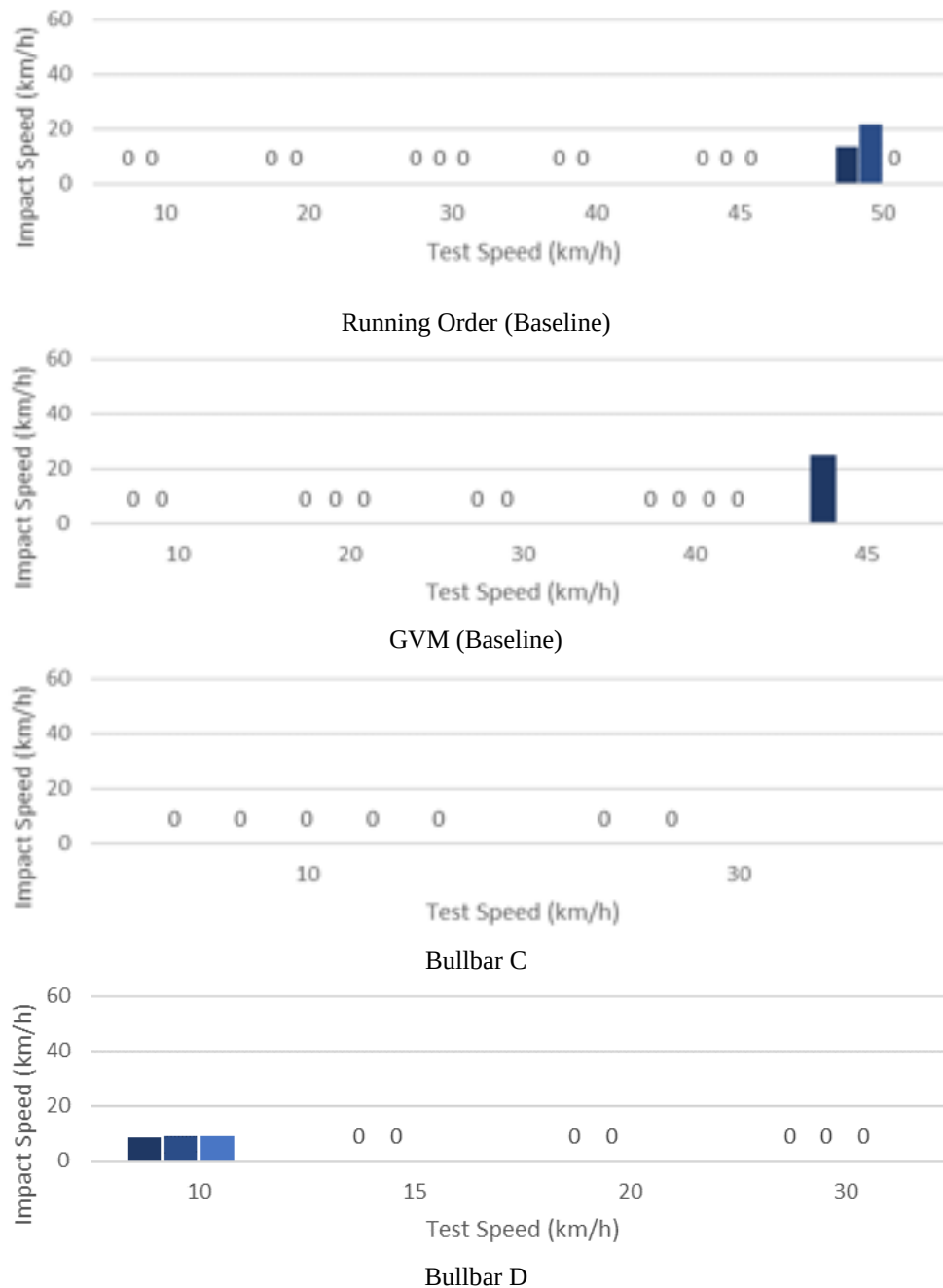
Represents an impact test that included driver braking prior to impact.

Represents an impact test that does not include driver braking prior to impact. This is also true for the lighter blue colours.

Figure 47: Ranger Car-to-Pedestrian (Child) impact speed results.

Car-to-Pedestrian (Adult)

The farside Car-to-Pedestrian test results performed with the adult target are presented in Figure 48. No impacts were observed at the lower test speeds during baseline testing. In the Running Order and GVM conditions the Ranger transitioned to impacts at 50 km/h and 45 km/h, respectively. The low-speed testing performed with the Bullbar C showed similar results to the baseline Running Order configuration, with no impacts occurring at 10 and 30 km/h. However, with the Bullbar D fitted, no braking impacts were observed at 10 km/h. This result is similar to the impacts observed at 10 km/h during the nearside testing with the child target and suggests that the Bullbar D has reduced the ability of the vehicle to respond to targets towards the edge of the field of view.



0 Represents a test that did not result in an impact.

Represents an impact test that included driver braking prior to impact.

Represents an impact test that does not include driver braking prior to impact. This is also true for the lighter blue colours.

Figure 48: Ranger Car-to-Pedestrian (Adult) impact speed results.

Comparison of Detection and Braking

This section of the results includes a comparison of the warning tone timings and braking start timings observed during the Ford Ranger crash avoidance testing. In each test configuration, the average warning tone was determined by averaging the timing of the audible warning tone for each of the tests performed at a particular test speed. The audible warning tone is referred to as the FCW throughout this section of the report. Similarly, the average braking start time was calculated by averaging the AEB time for each test performed at a particular test speed. The AEB time (or T(AEB)) is determined by identifying when the filtered acceleration is below -1 m/s^2 and then going backwards to determine the point in time when the acceleration first crossed -0.3 m/s^2 .

Car-to-Car Stationary

The Ranger Car-to-Car Rear Stationary warning tone and braking start time results are presented in this section of the report.

FCW

A comparison of the Ranger warning tone results with the Bullbar fitted compared to the baseline Running Order results is presented in Figure 49 and Table 37. The warning tone timing with the Bullbars fitted to the Ranger is similar to the baseline Running Order Condition with the warning tone only issued at a variation of more than 10 percent at 55 km/h during the zero offset tests. A greater than 10 percent variation was also observed in the negative offset tests with the Bullbar C and the positive offset tests with the Bullbar D fitted.

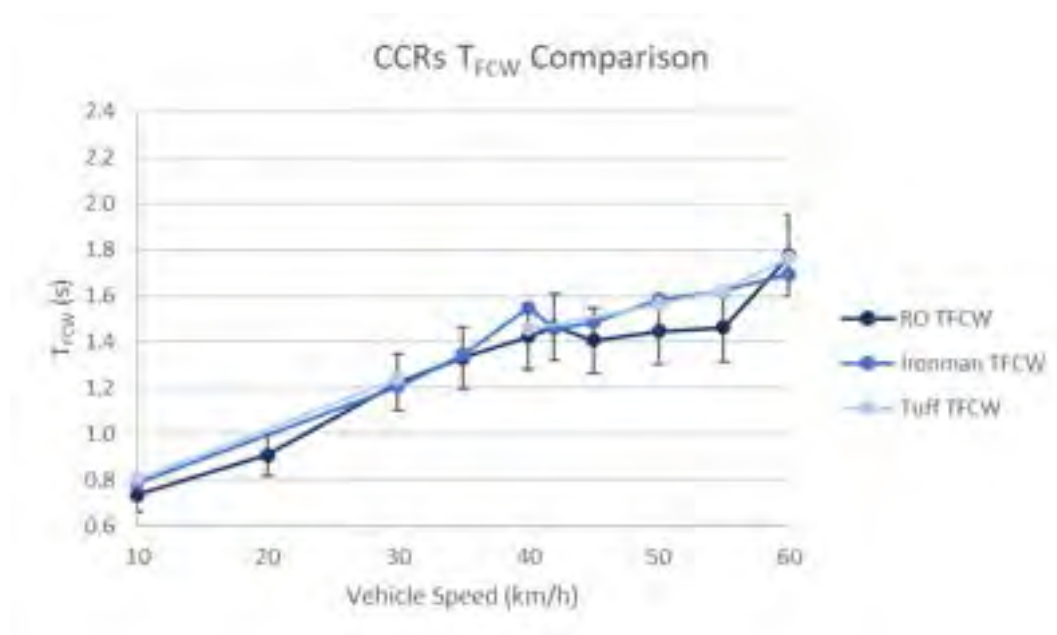


Figure 49: Ranger Car-to-Car Rear Stationary average warning tone timing plot (non-offset tests only). Note the error bars indicate a change of 10 percent from the Running Order condition.

Table 37: Ranger Car-to-Car Rear Stationary warning tone comparison results.

Test Details		Running Order (Baseline)		Bullbar C			Bullbar D		
Speed	Offset (%)	Avg. (T _{FCW})	Range (T _{FCW})	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)
10	0	0.74	0.01	0.79	0.05	7.03	0.81	0.04	9.71
20	0	0.91	0.06						
30	0	1.22	0.02	1.21	0.02	-1.31	1.24	0.04	1.38
35	0	1.33	0.02	1.34	0.02	0.96			
40	0	1.42	0.16	1.55	0.10	8.77	1.46	0.05	2.48
42	0	1.46	0.07	1.46	0.20	-0.53			
45	0	1.41	0.06	1.48	0.05	5.56			
50	0	1.45	0.14	1.59	0.00	9.70	1.56	0.01	8.14
55	0	1.46	0.29	1.62	0.01	10.92	1.63	0.07	11.31
60	0	1.77	0.00	1.69	0.02	-4.51	1.76	0.07	-0.64
40	50	1.26	0.03	1.18	0.03	-6.00	1.39	0.08	10.55
40	-50	1.19	0.17	1.37	0.04	15.65	1.17	0.11	-1.72

Value Highlights a change in Average T(FCW) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(FCW) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

AEB

A comparison of the Ranger braking start time results with each Bullbar fitted compared to the baseline Running Order results is presented in Figure 50 and Table 38. The braking start time results with the Bullbars fitted are similar to those observed during the baseline Running Order testing. A decreasing trend in the braking start time occurs in the baseline Running Order testing and testing with each Bullbar at speeds above 40 km/h. The braking start time varies by more than 10 percent at three test speeds with the Bullbar C fitted to the Ranger.

A comparison of the time difference between the warning tone and braking start time for each variation with the baseline Running Order configuration is outlined in Appendix B. Since the braking start time occurs within 0.8 seconds of the warning tone in most baseline tests, this metric was not used to evaluate a change in compliance with ADR 98-01. At least one instance of a large change (greater than 0.1 seconds) in the average time difference between warning tone and braking start time was observed in each configuration.

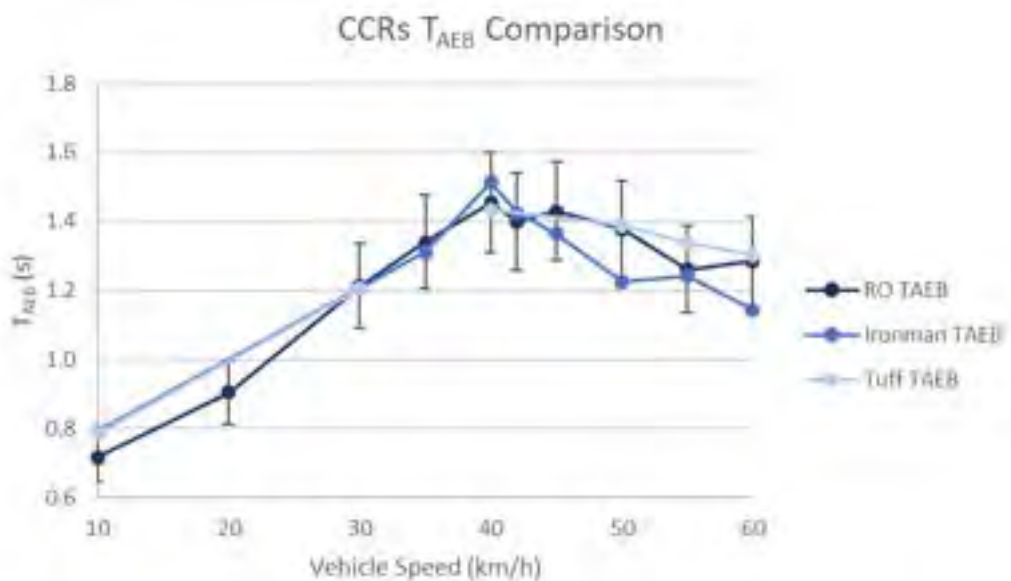


Figure 50: Ranger Car-to-Car Rear Stationary average braking start timing plot (non-offset tests only). Note the error bars indicate a change of 10 percent from the Running Order condition.

Table 38: Ranger Car-to-Car Rear Stationary braking start time comparison results.

Testing Details		Running Order (Baseline)		Bullbar C			Bullbar D		
Speed	Offset (%)	Avg. (T _{AEB})	Range (T _{AEB})	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)
10	0	0.72	0.03	0.79	0.04	10.35	0.79	0.03	9.68
20	0	0.90	0.03						
30	0	1.21	0.00	1.21	0.00	-0.54	1.21	0.03	-0.63
35	0	1.34	0.00	1.31	0.01	-2.32			
40	0	1.45	0.07	1.51	0.05	4.11	1.43	0.03	-1.39
42	0	1.40	0.02	1.43	0.10	1.92			
45	0	1.43	0.01	1.36	0.15	-4.54			
50	0	1.38	0.08	1.23	0.02	-11.06	1.39	0.00	0.69
55	0	1.26	0.15	1.24	0.06	-1.50	1.34	0.01	6.09
60	0	1.29	0.10	1.14	0.04	-10.93	1.30	0.03	1.41
40	50	1.19	0.01	1.14	0.11	-4.12	1.23	0.02	3.08
40	-50	1.22	0.06	1.33	0.04	8.89	1.13	0.16	-7.69

Value Highlights a change in Average T(AEB) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(AEB) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

Car-to-Car Moving

FCW

A comparison of the Ranger warning tone results with the Bullbar fitted compared to the baseline Running Order results during the Car-to-Car Rear Moving tests is presented in Figure 51 and Table 39. Warning tones were issued at similar timings with both Bullbars fitted compared to the baseline Running Order condition, with all variation less than 5 percent.

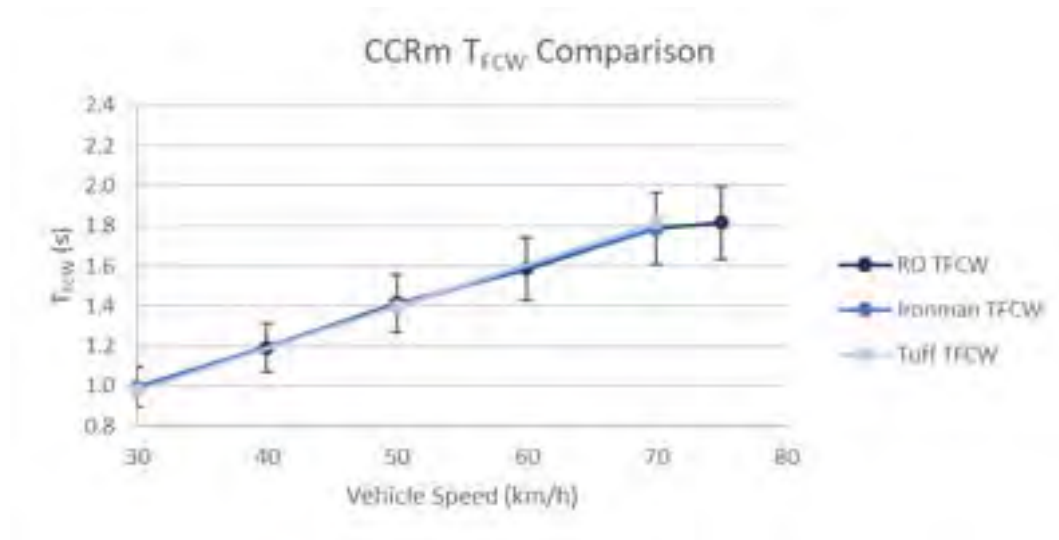


Figure 51: Ranger Car-to-Car Rear Moving average warning tone plot. Note the error bars indicate a change of 10 percent from the Running Order condition.

Table 39: Ranger Car-to-Car Rear Moving warning tone comparison results.

Testing Details		Running Order (Baseline)		Bullbar C			Bullbar D		
Speed	Offset (%)	Avg. (T _{FCW})	Range (T _{FCW})	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)
30	0	0.99	0.04	0.99	0.04	0.10	0.98	0.01	-1.87
40	0	1.19	0.06						
50	0	1.41	0.04	1.40	0.05	-1.01	1.40	0.01	-1.09
60	0	1.58	0.03						
70	0	1.79	0.03	1.79	0.05	0.06	1.82	0.02	1.75
75	0	1.82	0.00						

Value Highlights a change in Average T(FCW) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(FCW) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

AEB

A comparison of the Ranger braking start time results with the Bullbar fitted compared to the baseline Running Order results during the Car-to-Car Rear Moving tests is presented in Figure 52 and Table 40. The brakes were activated at a similar time with each Bullbar fitted to the vehicle compared to the baseline Running Order condition. Similar to the downward trend in braking start times observed during the testing with the stationary target, the braking start times appear to be consistent in all three configurations from 50 km/h during testing with the moving vehicle target.

A comparison of the time difference between the warning tone and braking start time for each variation with the baseline Running Order configuration is outlined in Appendix B. Since the braking start time occurs within 0.8 seconds of the warning tone in most baseline tests, this metric was not used to evaluate a change in compliance with ADR 98-01. It can be observed

that only minor change (less than 0.1 seconds) in the average time difference between warning tone and braking start time was observed in each configuration.

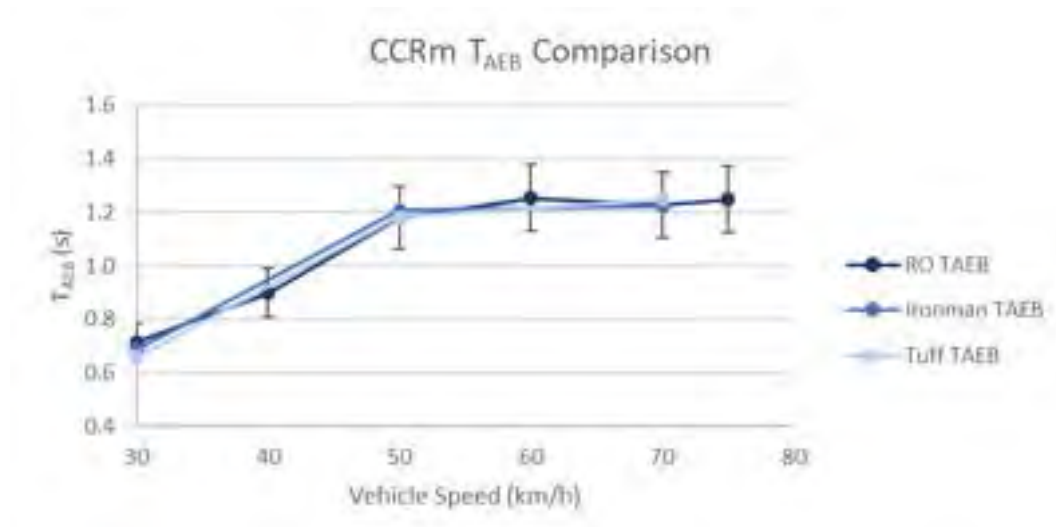


Figure 52: Ranger Car-to-Car Rear Moving average braking start timing plot. Note the error bars indicate a change of 10 percent from the Running Order condition.

Table 40: Ranger Car-to-Car Rear Moving braking start time comparison results.

Test Details		Running Order (Baseline)		Bullbar C			Bullbar D		
Speed	Offset (%)	Avg. (T _{AEB})	Range (T _{AEB})	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)
30	0	0.71	0.00	0.69	0.03	-3.64	0.66	0.05	-7.99
40	0	0.90	0.05						
50	0	1.18	0.02	1.21	0.01	2.26	1.18	0.05	0.10
60	0	1.25	0.03						
70	0	1.23	0.05	1.22	0.08	-0.28	1.25	0.02	1.68
75	0	1.25	0.00						

Value Highlights a change in Average T(AEB) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(AEB) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

Car-to-Pedestrian (Child)

FCW

A comparison of the Ranger warning tone results with the Bullbar fitted compared to the baseline Running Order results during nearside Car-to-Pedestrian target tests with the Child target are presented in Figure 51 and Table 41. The warning tones issued with each Bullbar occurred at similar times to the baseline Running Order condition, with the greatest variation occurring with the Bullbar D fitted to the Ranger at the two lowest test speeds. A large variation in the timing of the warning tones issued during the three tests performed at 60 km/h with the Bullbar D fitted was also observed, however, it is unclear whether this is similar performance to the baseline condition because baseline testing was not performed at 60 km/h.

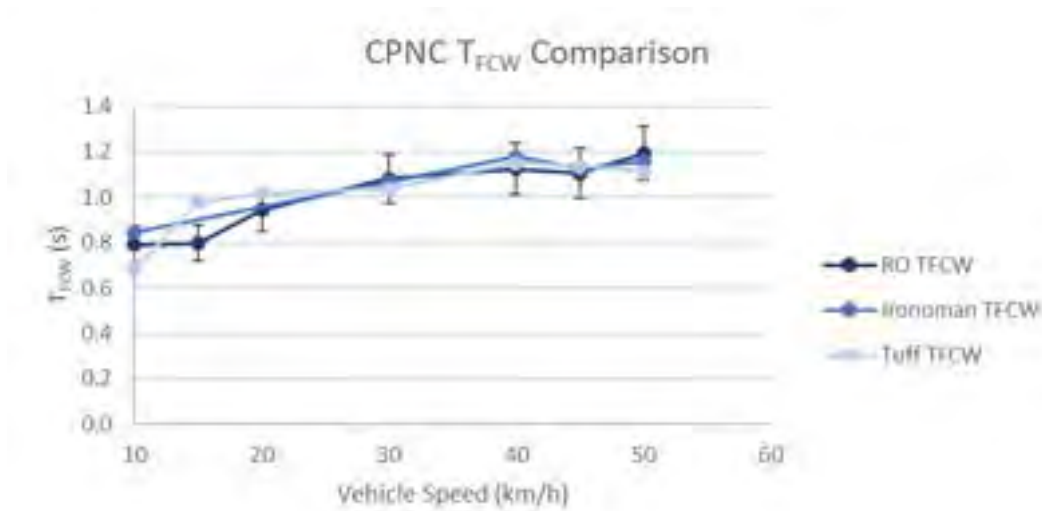


Figure 53: Ranger Car-to-Pedestrian (Child) average warning tone timing plot. Note the error bars indicate a change of 10 percent from the Running Order condition.

Table 41: Ranger Car-to-Pedestrian (Child) warning tone comparison results.

Test Details	Running Order (Baseline)		Bullbar C			Bullbar D		
	Avg. (T _{FCW})	Range (T _{FCW})	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)
10	0.79	0.04	0.84	0.03	6.65	0.68	0.28	-13.65
15	0.80	0.03				0.98	0.01	22.48
20	0.94	0.01				1.02	0.09	7.77
30	1.08	0.07	1.07	0.04	-1.11	1.04	0.02	-4.22
40	1.12	0.06	1.18	0.01	4.89	1.15	0.11	2.40
45	1.11	0.03	1.13	0.02	1.87	1.14	0.01	3.12
50	1.19	0.00	1.16	0.02	-2.87	1.11	0.07	-6.82
55			1.27	0.00	-	0.90	0.10	-
60			1.11	0.10	-	0.91	0.51	-

Value Highlights a change in Average T(FCW) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(FCW) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

AEB

A comparison of the Ranger braking start time results with each Bullbar fitted compared to the baseline Running Order results during nearside Car-to-Pedestrian target tests with the child target are presented in Figure 54 and Table 42. A variation of greater than 10 percent to the baseline Running Order condition occurred with the Bullbar D fitted to the Ranger at 10 km/h and 50 km/h. At 10 km/h, no braking occurred in the two tests performed with the Bullbar D fitted resulting in impacts with the target.

It can be observed that the average braking start timing with the Bullbar D fitted at 55 and 60 km/h is approximately 0.4 seconds later than the next lower speed of 50 km/h.

Furthermore, these braking start timings are later than those observed with the Bullbar C fitted to the Ranger by approximately 0.3 seconds.

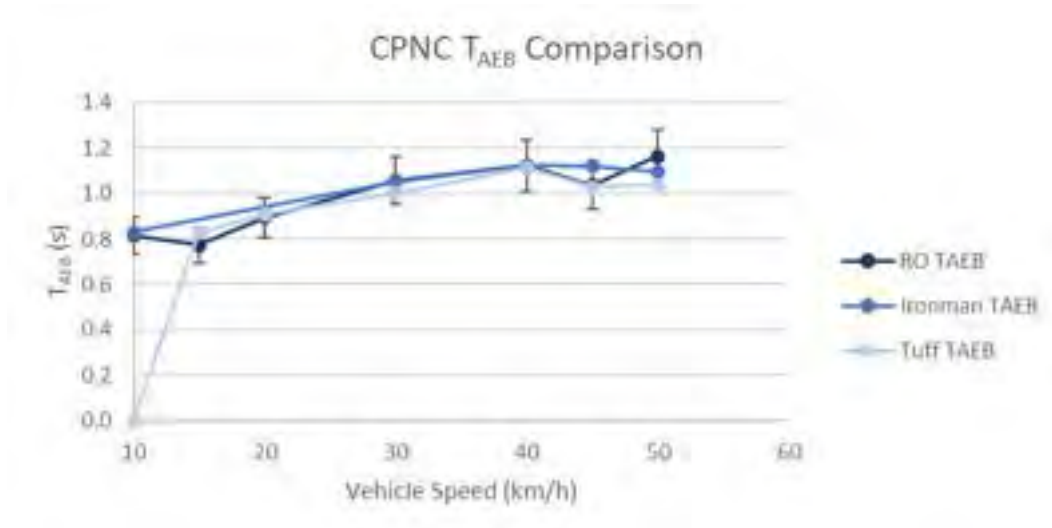


Figure 54: Ranger Car-to-Pedestrian (Child) average braking start timing plot. Note the error bars indicate a change of 10 percent from the Running Order condition.

Table 42: Ranger Car-to-Pedestrian (Child) braking start time comparison results.

Test Details	Running Order (Baseline)		Bullbar C			Bullbar D		
	Avg. (T _{AEB})	Range (T _{AEB})	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)
10	0.82	0.08	0.83	0.04	1.80	0.00	0.00	-100.00
15	0.77	0.04				0.83	0.03	7.22
20	0.89	0.03				0.91	0.01	1.60
30	1.06	0.02	1.05	0.09	-0.65	1.00	0.04	-5.18
40	1.12	0.04	1.12	0.04	0.09	1.11	0.04	-1.10
45	1.04	0.07	1.12	0.05	8.26	1.03	0.05	-0.88
50	1.16	0.00	1.09	0.03	-5.93	1.04	0.10	-10.83
55			1.02	0.00	-	0.63	0.33	-
60			1.01	0.08	-	0.61	0.46	-

Value Highlights a change in Average T_{AEB} compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T_{AEB} range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

Car-to-Pedestrian (Adult)

FCW

A comparison of the Ranger warning tone results with the Bullbar fitted compared to the baseline Running Order results during farside Car-to-Pedestrian target tests with the adult target are presented in Figure 55 and Table 43. The greatest variation occurred with the Bullbar D at the lowest test speed of 10 km/h.

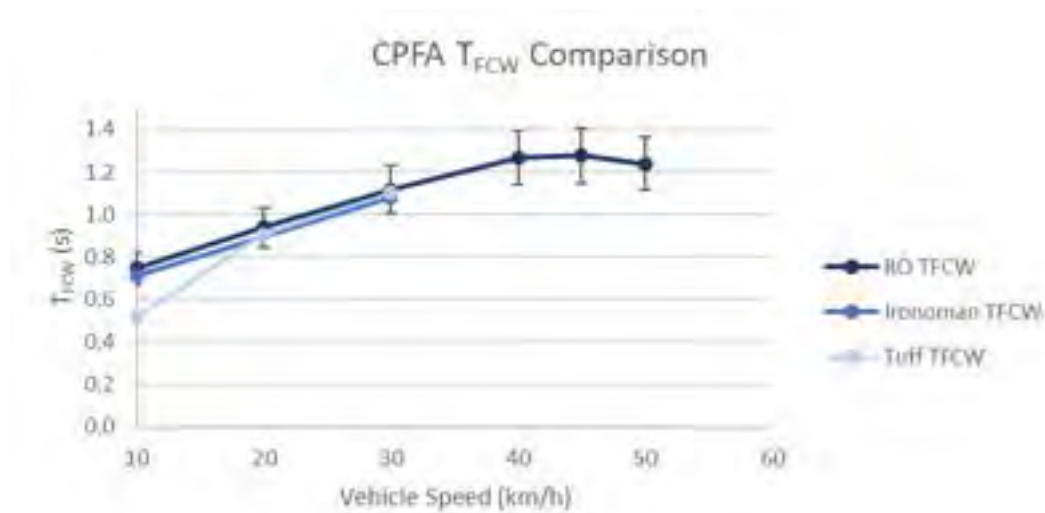


Figure 55: Ranger Car-to-Pedestrian (Adult) average warning tone timing plot. Note the error bars indicate a change of 10 percent from the Running Order condition.

Table 43: Ranger Car-to-Pedestrian (Adult) warning tone comparison results.

Test Details	Running Order (Baseline)		Bullbar C			Bullbar D		
	Avg. (T _{FCW})	Range (T _{FCW})	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)
Speed								
10	0.75	0.04	0.70	0.30	-6.13	0.52	0.12	-30.69
20	0.94	0.00				0.91	0.03	-3.54
30	1.12	0.16	1.08	0.05	-3.37	1.10	0.15	-1.50
40	1.27	0.06						
45	1.28	0.10						
50	1.24	0.32						
55								
60								

Value Highlights a change in Average T(FCW) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(FCW) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

AEB

A comparison of the Ranger braking start time results with the Bullbar fitted compared to the baseline Running Order results during farside Car-to-Pedestrian target tests with the adult target are presented in Figure 56 and Table 44. Similar to the variation observed with the warning tones, the greatest variation in braking start time occurred at the lowest test speed with the Bullbar D fitted. In this instance, no braking occurred in the three tests performed resulting in impacts with the target.

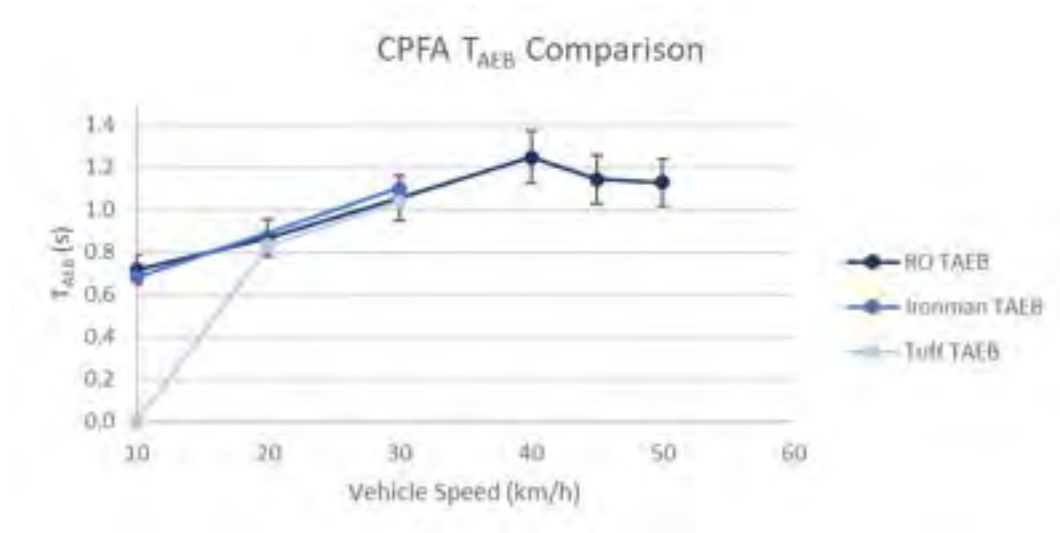


Figure 56: Ranger Car-to-Pedestrian (Adult) average braking start timing plot. Note the error bars indicate a change of 10 percent from the Running Order condition.

Table 44: Ranger Car-to-Pedestrian (Adult) braking start time comparison results.

Test Details	Running Order (Baseline)		Bullbar C			Bullbar D		
	Avg. (T _{AEB})	Range (T _{AEB})	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)
Speed								
10	0.72	0.00	0.71	0.27	-0.63	0.00	0.00	-100.00
20	0.87	0.03				0.83	0.06	-4.28
30	1.05	0.02	1.10	0.08	4.58	1.04	0.10	-1.50
40	1.25	0.02						
45	1.14	0.20						
50	1.13	0.15						
55								
60								

Value Highlights a change in Average T(AEB) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(AEB) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

Hilux Results

This section provides an overview of the Toyota Hilux crash avoidance and lane keep testing results. The results are presented in three sections. The ‘Comparison of Impact Speeds’ and ‘Comparison of Detection Braking’ sections present and compare the crash avoidance test results. The lane keeping results are presented in the following ‘Comparison of Lane Keeping Results’ section.

Comparison of Impact Speeds

A comparison of impact speeds observed during the Hilux testing is provided in the following sections. In each graph, a (0) zero represents a test that did not result in an impact. Each graph also contains a red line to indicate the limit threshold for a pass at each test speed, based on the requirements of ADR 98-01. For the Lift Kit, Lift Kit plus Bullbar and Bullbar only configurations the impact speed thresholds from ADR 98-01 for the Running Order configuration were adopted. Note that a comparison of impact speeds from the Rear Pitch testing is not presented in this section because a simplified version of the real-world trailer towing scenario was used to investigate the effects of changing vehicle pitch. Instead, a comparison of the detection and braking start times was used to analyse the Rear Pitch configuration results and is presented in the following section.

Car-to-Car Stationary

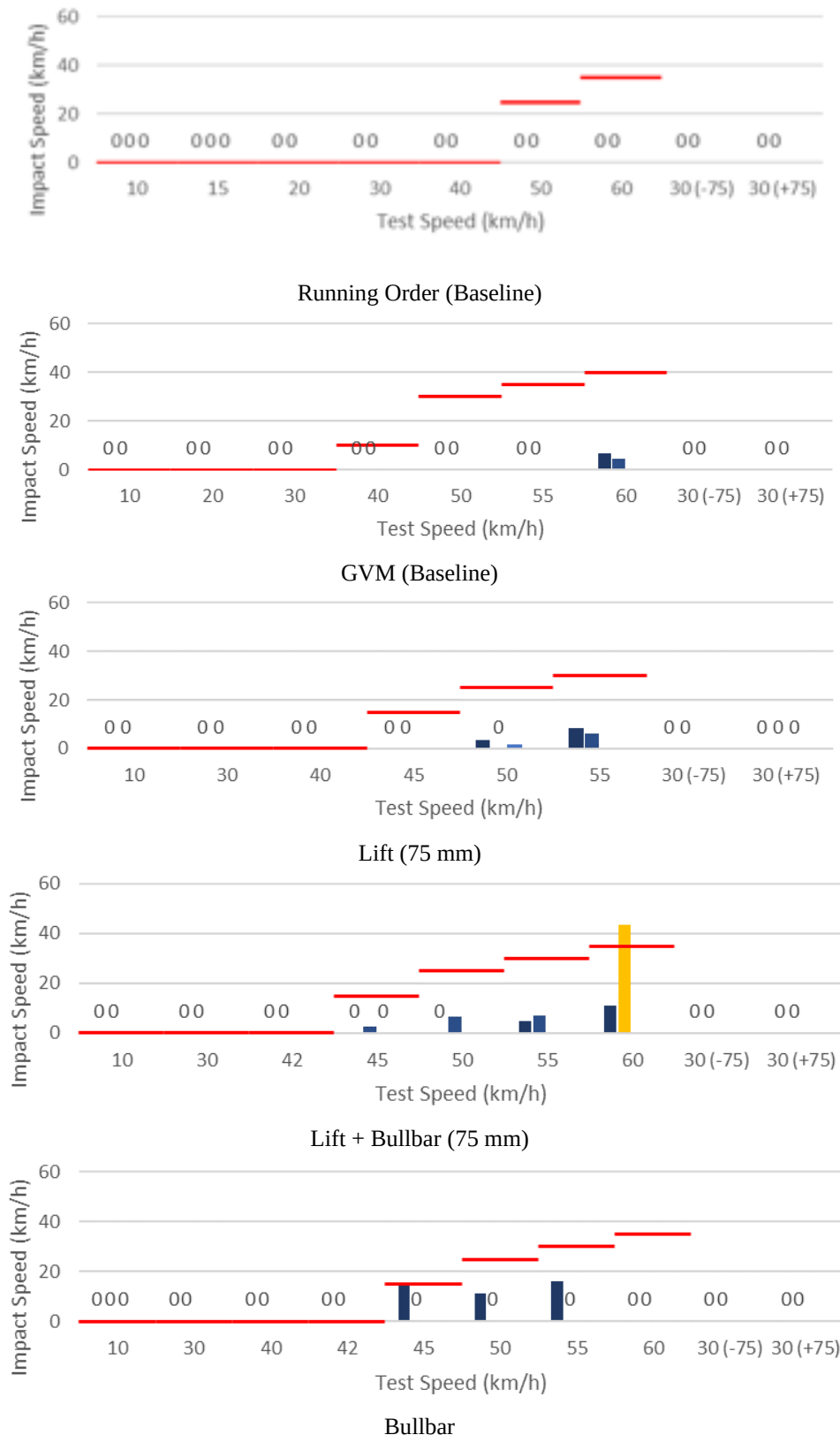
A comparison of the Hilux Car-to-Car Rear Stationary testing impact speed results is presented in Figure 57. No impacts were observed at any test speed in the baseline Running Order condition and low speed impacts were observed at the highest test speed in the baseline GVM condition.

Low-speed impacts were observed at 50 and 55 km/h with the Lift Kit fitted to the Hilux and testing was not performed at 60 km/h due to the risk of damaging the radar. Similarly, with the Bullbar fitted to the Hilux in addition to the Lift Kit, low speed impacts were observed at 45, 50, 55 and 60 km/h, with a high-speed impact also occurring at 60 km/h. In this instance the vehicle issued a warning tone and started braking at a similar time to the previous test, however, released the braking effort shortly after. The driver then applied the brakes to reduce the risk of damaging the radar. Prior to the driver applying the brakes at 0.2 seconds before collision, the vehicle speed was approximately 43.6 km/h, which is above the impact speed threshold specified in ADR 98-01.

During the Bullbar only tests, three low speed impacts occurred at 45, 50 and 55 km/h, respectively. A non-impact result was also observed at each of these test speeds. In each impact test, the vehicle issued a warning tone and started braking at similar time to the non-impact test, however, released the braking effort closer to the target vehicle, resulting in the impact. The weight of the Bullbar at the front of the vehicle results in a 20 mm drop of the front suspension. It is possible that this lower initial height of the front of the vehicle results in a lower position of the front of the vehicle during braking, which in-turn results in the vehicle target leaving the field of view of the radar and/or camera and the braking effort ending. However, it was also identified that the OEM suspension was missing two components that engage the dampener as the front spring is compressed, which may have

contributed to the AEB deactivation. The impact at a test speed of 45 km/h was above the impact speed limit outlined in ADR 98-01.

As discussed previously in regard to the Isuzu D-Max results, it is logical that the larger tyres, taller suspension and protrusion of the front Bullbar each increase the likelihood of an impact result and it is likely that these factors have also influenced the Hilux Lift Kit, Lift Kit plus Bullbar and Bullbar only results. However, it also appears that changes in the vehicle braking start time have contributed to the impacts that occurred in the Lift Kit plus Bullbar and Bullbar only configurations because a delay in the average braking start time occurred at each test speed in these configurations compared to the baseline Running Order tests, as outlined in the following section.



0 Represents a test that did not result in an impact.

Represents an impact test that included driver braking prior to impact.

Represents an impact test that does not include driver braking prior to impact. This is also true for the lighter blue colours.

Figure 57: Hilux Car-to-Car Rear Stationary impact speed results.

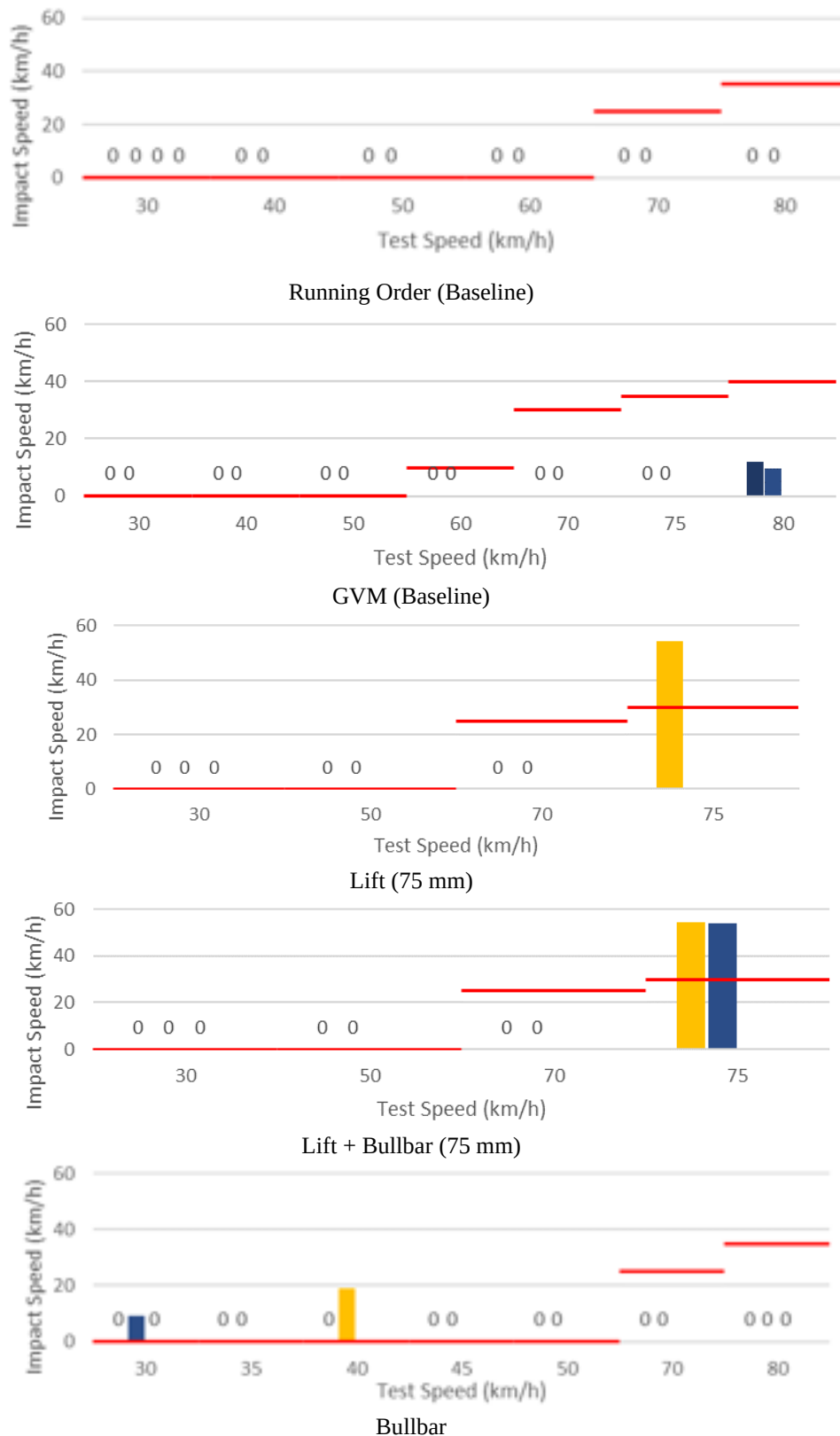
Car-to-Car Moving

A comparison of the Car-to-Car Rear Moving results in each configuration tested with the Hilux is presented in Figure 58. No impacts were observed at any test speed in the baseline Running Order configuration. In the baseline GVM configuration, impacts were observed in both tests at the highest test speed only.

An impact occurred at 75 km/h with the Lift Kit fitted to the Hilux. During this test, a warning tone started approximately two seconds prior to collision, however, no braking was observed prior to approximately 0.6 seconds from a collision. At this point in time the driver applied the brakes to reduce the risk of damage to the radar. It is estimated that the vehicle would impact the target at approximately 54 km/h based on the speed of the vehicle prior to driver braking. Similar impacts were observed in the Lift Kit plus Bullbar configuration at 75 km/h. In the first test a warning tone was issued at approximately two seconds prior to collision and the driver applied the brakes at approximately 0.7 seconds prior to collision as it appeared the vehicle was not going to brake. In the second test, no driver braking occurred to observe the full test outcome. Similar to the first test, a warning tone was issued at approximately two seconds prior to collision and no vehicle braking was observed prior to collision. These impacts in the Lift Kit and Lift Kit plus Bullbar configurations at 75 km/h are above the threshold limit outlined in ADR 98-01.

During the testing with only the Bullbar fitted to the Hilux, an impact was observed at both 30 and 40 km/h. The impact at 30 km/h was characterised by no warning tone and no vehicle braking, whilst the impact at 40 km/h was characterised by a warning tone and no vehicle braking prior to approximately 0.2 second before collision. In this test at 40 km/h, the driver intervened and applied the brakes, therefore, it is estimated that the vehicle would impact the target at approximately 19 km/h based on the vehicle speed prior to brake application. This impact speed is above the impact speed threshold outlined in ADR 98-01.

As discussed in the following section, a delay in the average braking start time was observed in the Lift Kit, Lift Kit plus Bullbar and Bullbar only configurations at all test speeds.



0 Represents a test that did not result in an impact.

Represents an impact test that included driver braking prior to impact.

Represents an impact test that does not include driver braking prior to impact. This is also true for the lighter blue colours.

Figure 58: Hilux Car-to-Car Rear Moving impact speed results.

Car-to-Pedestrian (Child)

The impact speed results of the nearside Car-to-Pedestrian testing is presented in Figure 59. An impact was observed in the baseline Running Order configuration at the highest test speed of 60 km/h. Further tests at 60 km/h were not performed to reduce the potential of damaging the radar. The impact speed in this test is below the threshold limit outlined in ADR 98-01. Collisions occurred at 30 and 40 km/h in the baseline GVM configuration. The impact at 30 km/h was characterised by a late warning tone and late start to the vehicle braking. A late warning tone was also observed in the first impact at 40 km/h compared to the first test performed at 40 km/h. The driver then applied to the brakes at approximately 0.5 seconds prior to collision to reduce the impact speed. The impact speed is estimated to be approximately 38 km/h based on the speed of the test vehicle at the time the brakes were applied. The second impact at 40 km/h was characterised by a warning tone issued at a similar time to the first non-impact test, followed by a late application of the vehicles brakes that resulted in the vehicle not stopping in time to avoid a collision. The impact at 30 km/h and the first impact at 40 km/h were above the impact speed threshold outlined in ADR 98-01.

Impacts occurred at 10, 40, 45 and 50 km/h in the Lift Kit configuration. The impact at 10 km/h was characterised by a warning tone issued at a similar time to the two previous tests, however no vehicle braking was observed. At 40 km/h the impact test was characterised by a warning tone issued later than the two previous tests and a late start to the vehicle braking at approximately 0.6 seconds prior to collision. Continuous vehicle braking was applied from the braking start time in the impact at 45 km/h. The collision that occurred at 50 km/h was characterised by a late warning tone at approximately 0.7 seconds prior to collision and no braking from the test vehicle. This impact was above the impact speed threshold outlined in ADR 98-01.

Impacts were observed at each test speed from 35 km/h with the Lift Kit and Bullbar fitted to the test vehicle. No warning tone was observed during the impact test at 35 km/h. The driver applied the brakes approximately 0.1 second prior to collision and the impact speed is estimated to be approximately 43 km/h based on the vehicle speed when the driver applied the brakes. The first impact at 40 km/h was characterised by a late warning tone and late braking, whilst the second impact was characterised by a similar warning tone and braking start time to the second non-impact test, however the vehicle released the brakes momentarily before re-applying them closer to impact. Continuous vehicle braking occurred from the braking start time during the first impact at 45 km/h. The braking in this test started slightly later than the third test that resulted with no impact. In the second impact at 45 km/h a late warning tone was issued followed by a relatively late start to the vehicle braking, followed by a release of the vehicle brakes and driver intervention to reduce the impact speed. This impact, as well as the impacts that occurred at 35 and 40 km/h were above the limit threshold outlined in ADR 98-01.

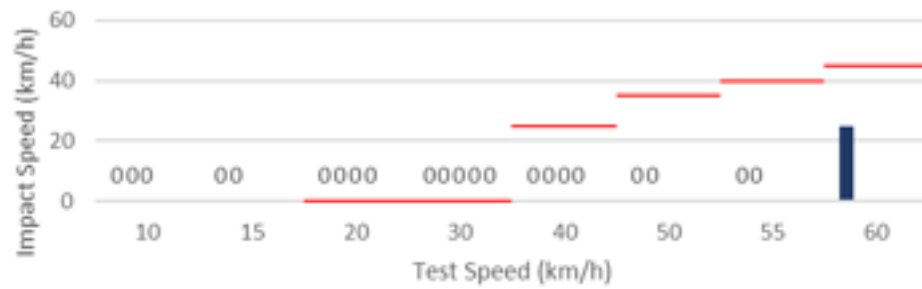
At 50 km/h in the Lift Kit plus Bullbar configuration, the two impact tests were characterised by a later start to the vehicle braking by approximately 0.1 seconds compared to the first test that resulted in a non-impact. The first impact at 55 km/h was characterised by a late warning

tone and late braking application compared to the second non-impact test. The second impact test was characterised by a warning tone issued at a similar time to the non-impact test, however, vehicle braking occurred at approximately 50 milliseconds prior to collision. Both impacts at 60 km/h were characterised by a late warning tone and late braking start time compared to the first non-impact test. Each impact at 55 km/h and the second impact at 60 km/h were above the impact speed threshold outlined in ADR 98-01.

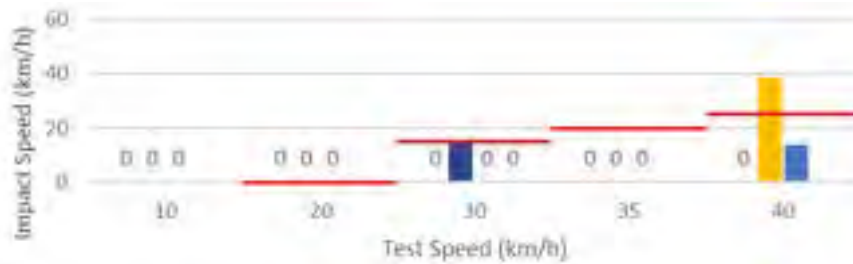
A single impact occurred at 45, 50 and 60 km/h with only the Bullbar fitted to the Hilux. The warning tone and braking start times issued during the impact test at 45 km/h were similar to the non-impact test, however, the braking start time was almost 0.1 seconds later. At 50 km/h the warning tone issued during the impact test was issued at a similar time to the non-impact test, however, no vehicle braking occurred prior to approximately 0.3 seconds before collision. Without driver intervention it is estimated that an impact at approximately 49 km/h would have occurred. This impact speed is above the impact speed threshold outlined in ADR 98-01. The impact at 60 km/h was characterised by vehicle braking occurring approximately 0.3 seconds after the following test that did not result in an impact.

The test vehicle was able to detect and avoid a collision with the child pedestrian target at the lowest test speed in all configurations, apart from one test in the Lift Kit configuration. Therefore, no major changes in the lateral field-of-view of the target have occurred.

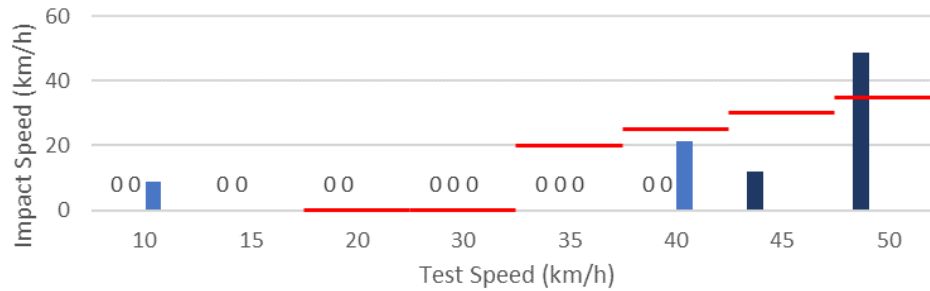
As discussed in the following section, a delay in the average braking start time was observed in the Lift Kit plus Bullbar configurations at all test speeds.



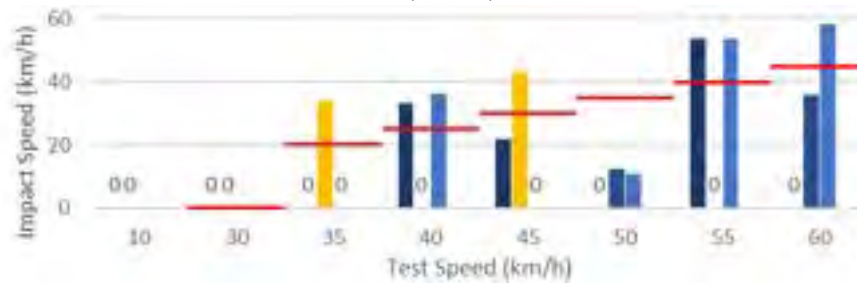
Running Order (Baseline)



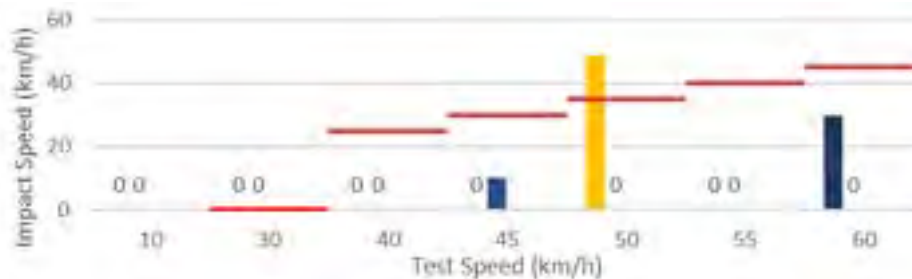
GVM (Baseline)



Lift (75 mm)



Lift + Bullbar (75 mm)



Bullbar

0 Represents a test that did not result in an impact.

Yellow bar Represents an impact test that included driver braking prior to impact.

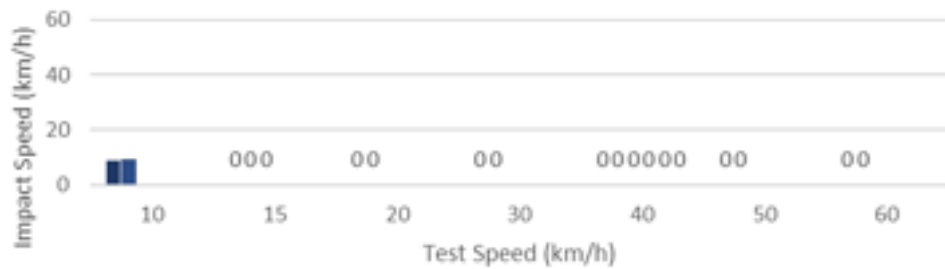
Dark blue bar Represents an impact test that does not included driver braking prior to impact. This is also true for the lighter blue colours.

Figure 59: Hilux Car-to-Pedestrian (Child) impact speed results.

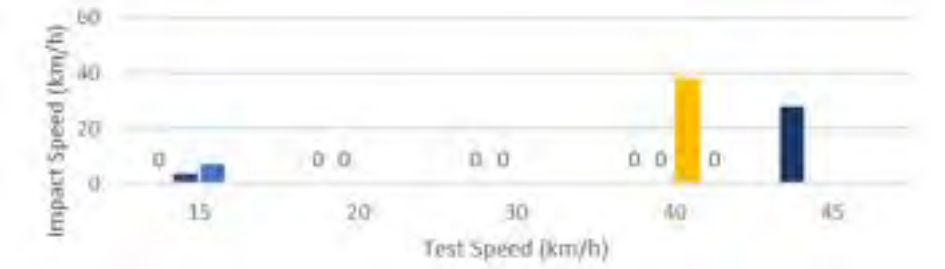
Car-to-Pedestrian (Adult)

The impact results observed during the farside testing with the adult pedestrian target are presented in Figure 60. Impacts were observed at the lowest test speed during baseline Running Order testing. These impacts were characterised by no warning tone and no vehicle braking. The two impacts that occurred at 15 km/h in the GVM condition were characterised by slightly later braking start times compared to the non-impact test. The impact that occurred during the third test at 40 km/h in the GVM condition was characterised by the vehicle initially applying the brakes at a similar time to the other tests performed at 40 km/h, however, the vehicle then released the brakes and the driver intervened to reduce the impact speed. It is estimated that the vehicle would have hit the target at approximately 38 km/h based on the vehicle speed when the driver applied the brakes. The impact at 45 km/h was characterised by a warning tone issued at a similar time to the non-impact tests at 40 km/h, however, the braking start time was later. A warning tone and vehicle braking occurred prior to both impacts at 15 km/h with the Lift Kit fitted to the test vehicle. The impacts that occurred at 10 km/h in the Lift Kit plus Bullbar and Bullbar configurations were characterised by no warning tones and no vehicle braking occurring prior to collision. The vehicle braking began at a slightly later time in the impact test at 15 km/h in the Bullbar configuration compared to the two previous non-impact tests.

The impacts that occurred at 15 km/h in the Lift Kit configuration suggest that a change in response of the vehicle to a target towards the edge of the lateral field-of-view may have occurred. In these tests the vehicle was able to identify and start braking, however, the braking start times occurred later than during the baseline Running Order testing. A delay in the braking start time was also observed in the Car-to-Pedestrian child testing at 10 km/h, compared to baseline testing, in each of the three tests performed in the Lift configuration. Two of these tests resulted in no-impact, however, one was characterised by no braking and impact. These results suggest that the Lift Kit may have changed the vehicle's ability to avoid targets towards the edge of the field-of-view. However, similar changes were not also observed in the Lift Kit and Bullbar configuration.



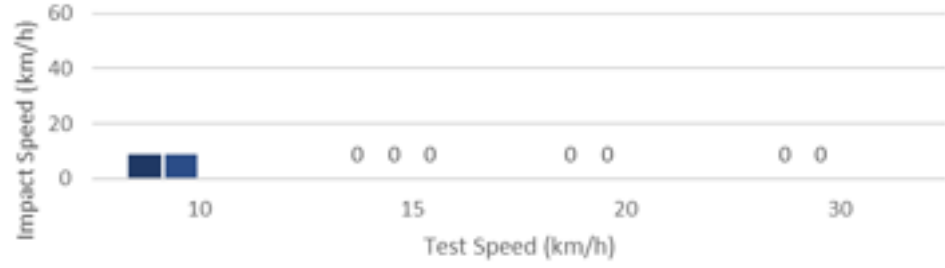
Running Order (Baseline)



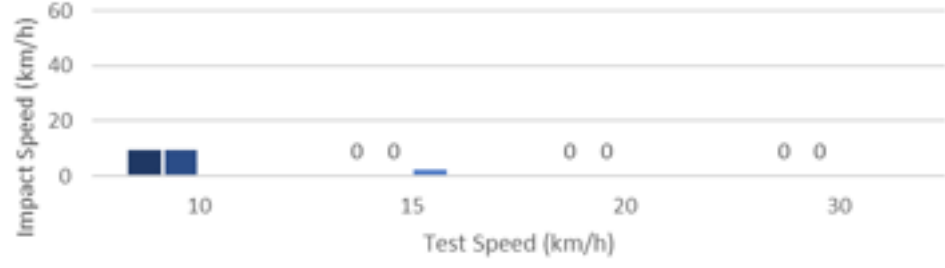
GVM (Baseline)



Lift (75 mm)



Lift + Bullbar (75 mm)



Bullbar

0 Represents a test that did not result in an impact.
Represents an impact test that included driver braking prior to impact.
Represents an impact test that does not included driver braking prior to impact. This is also true for the lighter blue colours.

Figure 60: Hilux Car-to-Pedestrian (Adult) impact speed results.

Comparison of Detection and Braking

This section of the results includes a comparison of the warning tone timings and braking start timings observed during the Toyota Hilux crash avoidance testing. In each test configuration, the average warning tone was determined by averaging the timing of the audible warning tone for each of the tests performed at a particular test speed. The audible warning tone is referred to as the FCW throughout this section of the report. Similarly, the average braking start time was calculated by averaging the AEB time for each test performed at a particular test speed. The AEB time (or T(AEB)) is determined by identifying when the filtered acceleration is below -1 m/s^2 and then going backwards to determine the point in time when the acceleration first crossed -0.3 m/s^2 .

Car-to-Car Stationary

The Hilux Car-to-Car Rear Stationary warning tone and braking start time results are presented in this section of the report.

FCW

A comparison of the Hilux warning tone results from the Car-to-Car Rear stationary testing compared to the baseline Running Order results is presented in Figure 61 and the following tables. In all configurations the average warning tone occurred within 10 percent of the timing of the average warning tone issued during baseline Running Order testing.

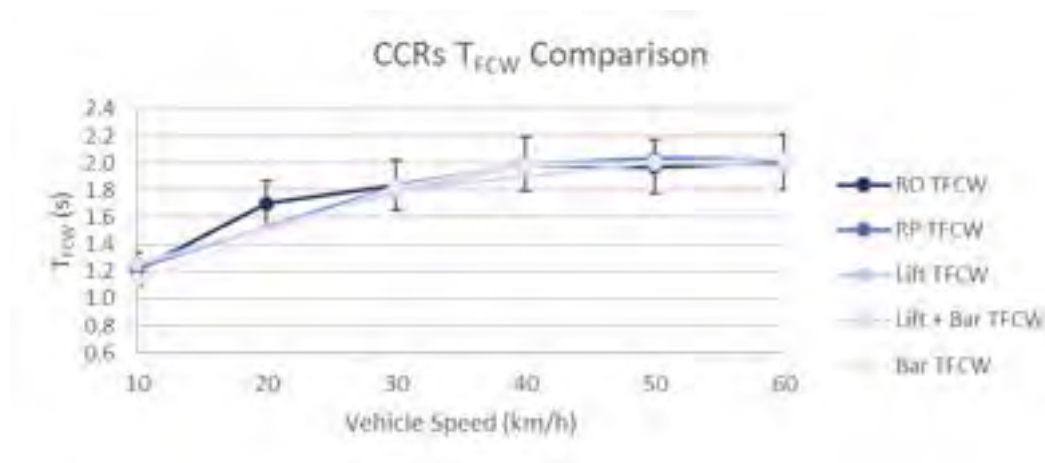


Figure 61: Hilux Car-to-Car Rear Stationary average warning tone timing plot (non-offset tests only). Note the error bars indicate a change of 10 percent from the Running Order condition.

Table 45: Hilux Car-to-Car Rear Stationary warning tone comparison results (Part 1).

Test Details		Running Order (Baseline)		Rear Pitch			Lift		
Speed	Offset (%)	Avg. (T _{FCW})	Range (T _{FCW})	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)
10	0	1.21	0.15	1.23	0.03	1.50	1.26	0.02	3.80
20	0	1.70	0.01						
30	0	1.84	0.01	1.83	0.04	-0.32	1.79	0.05	-2.32
40	0	1.99	0.06	1.99	0.01	-0.05	1.99	0.03	-0.03
50	0	1.97	0.02	2.03	0.01	3.02	2.00	0.02	1.23
60	0	2.00	0.02	2.02	0.05	0.90			
30	75	1.87	0.01	1.86	0.02	-0.75	1.84	0.19	-1.93
30	-75	1.86	0.03	1.81	0.05	-2.64	1.83	0.02	-1.59

Value Highlights a change in Average T(FCW) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(FCW) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

Table 46: Hilux Car-to-Car Rear Stationary warning tone comparison results (Part 2).

Test Details		Running Order (Baseline)		Lift + Bar			Bar		
Speed	Offset (%)	Avg. (T _{FCW})	Range (T _{FCW})	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)
10	0	1.21	0.15	1.25	0.05	3.09	1.14	0.20	-6.15
20	0	1.70	0.01						
30	0	1.84	0.01	1.80	0.01	-2.15	1.83	0.01	-0.33
40	0	1.99	0.06				1.99	0.03	-0.20
50	0	1.97	0.02	2.01	0.01	1.77	2.01	0.02	1.80
60	0	2.00	0.02	1.98	0.04	-1.41	2.03	0.00	1.17
30	75	1.87	0.01	1.83	0.06	-2.19	1.82	0.02	-2.56
30	-75	1.86	0.03	1.81	0.05	-2.55	1.84	0.05	-1.10

Value Highlights a change in Average T(FCW) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(FCW) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

AEB

A comparison of the Hilux braking start time results from the Car-to-Car Rear stationary testing is presented in Figure 62 and the following tables. A greater than 10 percent delay in timing was observed at one speed in the rear pitch configuration and at two speeds in the Lift Kit and Bullbar configuration. It can also be observed that a delay in the average braking start time occurred at each test speed in the Lift Kit plus Bullbar and Bullbar only configurations.

A comparison of the time difference between the warning tone and braking start time for each variation with the baseline Running Order configuration is outlined in Appendix C. Since the braking start time occurs within 0.8 seconds of the warning tone in most baseline tests, this metric was not used to evaluate a change in compliance with ADR 98-01. At least one instance of a large change (greater than 0.1 seconds) in the average time difference between

warning tone and braking start time was observed in the Lift Kit plus Bullbar and Bullbar only configurations.

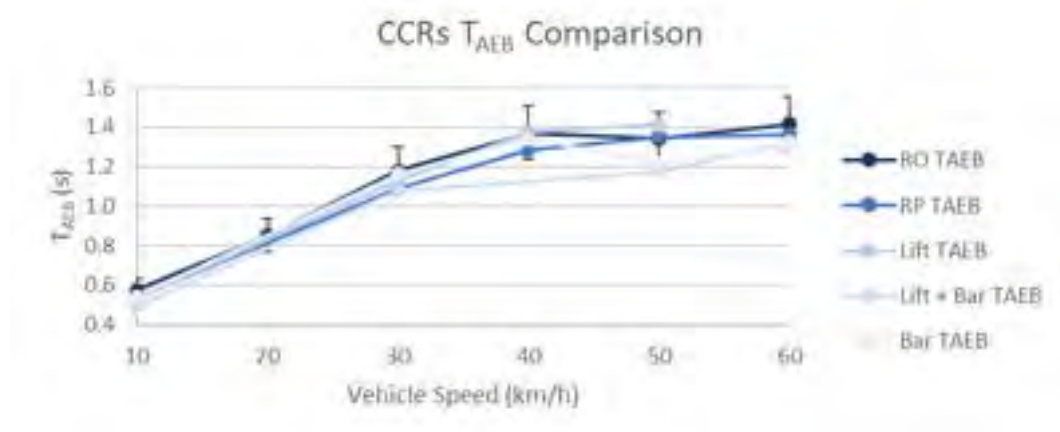


Figure 62: Hilux Car-to-Car Rear Stationary average braking start timing plot (non-offset tests only). Note the error bars indicate a change of 10 percent from the Running Order condition.

Table 47: Hilux Car-to-Car Rear Stationary braking start time comparison results (Part 1).

Test Details		Running Order (Baseline)		Rear Pitch			Lift		
Speed	Offset (%)	Avg. (T _{AEB})	Range (T _{AEB})	Avg. (T _{AEB})	Range (T _{FCW})	Change (%)	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)
10	0	0.57	0.04	0.54	0.01	-6.53	0.53	0.04	-7.06
20	0	0.85	0.10						
30	0	1.18	0.01	1.09	0.16	-7.79	1.13	0.17	-2.89
40	0	1.37	0.02	1.28	0.08	-6.45	1.38	0.02	0.25
50	0	1.34	0.05	1.35	0.04	0.75	1.41	0.02	3.68
60	0	1.42	0.02	1.36	0.05	-3.60			
30	75	1.24	0.09	1.20	0.01	-2.91	1.21	0.02	-1.42
30	-75	1.19	0.00	1.06	0.22	-10.51	1.22	0.09	1.67

Value Highlights a change in Average T(AEB) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(AEB) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

Table 48: Hilux Car-to-Car Rear Stationary braking start time comparison results (Part 2).

Test Details		Running Order (Baseline)		Lift + Bar			Bar		
Speed	Offset (%)	Avg. (T _{AEB})	Range (T _{AEB})	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)
10	0	0.57	0.04	0.49	0.02	-14.06	0.54	0.02	-5.46
20	0	0.85	0.10						
30	0	1.18	0.01	1.08	0.01	-8.71	1.16	0.01	-1.40
40	0	1.37	0.02				1.34	0.02	
50	0	1.34	0.05	1.18	0.03	-12.32	1.22	0.20	-9.21
60	0	1.42	0.02	1.32	0.09	-6.44	1.31	0.01	-7.74
30	75	1.24	0.09	1.15	0.07	-7.16	1.19	0.00	-3.77
30	-75	1.19	0.00	1.18	0.03	-0.41	1.18	0.01	-0.50

Value Highlights a change in Average T(AEB) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(AEB) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

Car-to-Car Moving

FCW

A comparison of the Hilux warning tone results from the Car-to-Car Rear Moving testing is presented in Figure 63 and the following tables. A delay of greater than 10 percent in the average warning tone timing was observed at 30 km/h in the Bullbar only configuration. There was also a large range in warning tone timing between the three tests performed at 30 km/h in the Bullbar configuration due to no warning tone being issued during the second test that resulted in an impact.

A delay in the average warning tone timing was observed in the Lift Kit and Lift Kit plus Bullbar configurations at all test speeds.

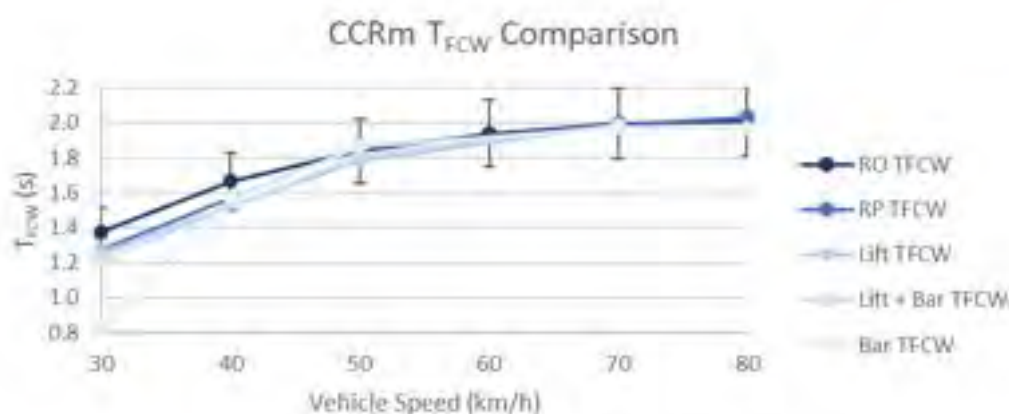


Figure 63: Hilux Car-to-Car Rear Moving average warning tone plot. Note the error bars indicate a change of 10 percent from the Running Order condition.

Table 49: Hilux Car-to-Car Rear Moving warning tone comparison results (Part 1).

Test Details		Running Order (Baseline)		Rear Pitch			Lift		
Speed	Offset (%)	Avg. (T _{FCW})	Range (T _{FCW})	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)
30	0	1.33	0.29	1.27	0.03	-4.14	1.26	0.11	-5.26
40	0	1.67	0.02						
50	0	1.84	0.01	1.86	0.14	1.40	1.78	0.04	-2.91
60	0	1.94	0.02						
70	0	2.00	0.01	1.99	0.03	-0.35	1.99	0.02	-0.38
80	0	2.01	0.01	2.03	0.01	1.22			

Value Highlights a change in Average T(FCW) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(FCW) range that is greater than 0.5 seconds.

Highlights a test speed that was not performed in the configuration.

Table 50: Hilux Car-to-Car Rear Moving warning tone comparison results (Part 2).

Test Details		Running Order (Baseline)		Lift + Bar			Bar		
Speed	Offset (%)	Avg. (T _{FCW})	Range (T _{FCW})	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)
30	0	1.33	0.29	1.22	0.37	-8.31	0.84	1.27	-36.92
40	0	1.67	0.02				1.57	0.04	-5.79
50	0	1.84	0.01	1.81	0.00	-1.31	1.86	0.02	1.44
60	0	1.94	0.02						
70	0	2.00	0.01	1.99	0.04	-0.57	1.97	0.01	-1.10
80	0	2.01	0.01				1.97	0.24	-2.01

Value Highlights a change in Average T(FCW) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(FCW) range that is greater than 0.5 seconds.

Highlights a test speed that was not performed in the configuration.

AEB

A comparison of the Hilux braking start time results from the Car-to-Car Rear Moving testing is presented in Figure 64 and the following tables. A change in the average braking start time greater than 10 percent was observed at two speeds in the Lift Kit plus Bullbar and Bullbar only configurations. There was also a large range observed in the braking start time results at both speeds in the Bullbar configuration due to the mix of braking outcomes in the tests performed. In one test at each speed, the vehicle did not apply the brakes and impacted the moving vehicle target.

A delay in the average braking start time was observed in the Lift Kit, Lift Kit plus Bullbar and Bullbar only configurations at all test speeds.

A comparison of the time difference between the warning tone and braking start time for each variation with the baseline Running Order configuration is outlined in Appendix C. Since the braking start time occurs within 0.8 seconds of the warning tone in most baseline tests, this metric was not used to evaluate a change in compliance with ADR 98-01. It can be observed

that at least one instance of a large change (greater than 0.1 seconds) in the average time difference between warning tone and braking start time was observed in the Rear Pitch and Bullbar only configurations.

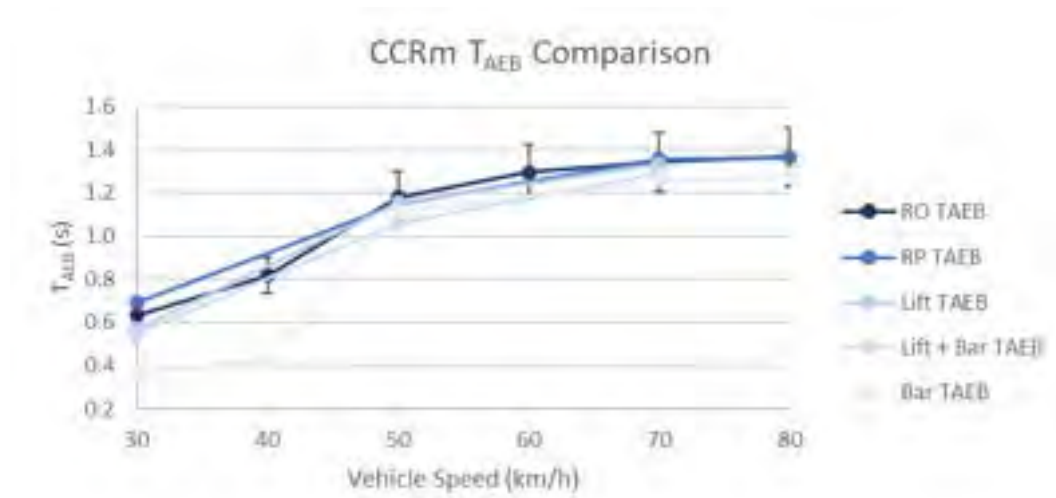


Figure 64: Hilux Car-to-Car Rear Moving average braking start timing plot. Note the error bars indicate a change of 10 percent from the Running Order condition.

Table 51: Hilux Car-to-Car Rear Moving braking start time comparison results (Part 1).

Test Details		Running Order (Baseline)		Rear Pitch			Lift		
Speed	Offset (%)	Avg. (T _{AEB})	Range (T _{AEB})	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)
30	100	0.62	0.17	0.69	0.08	11.79	0.57	0.16	-8.36
40	100	0.82	0.02						
50	100	1.18	0.10	1.15	0.10	-2.76	1.16	0.15	-2.08
60	100	1.30	0.15						
70	100	1.34	0.01	1.36	0.00	1.30	1.33	0.20	-0.56
80	100	1.37	0.02	1.36	0.06	-0.37			

Value Highlights a change in Average T(AEB) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(AEB) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

Table 52: Hilux Car-to-Car Rear Moving braking start time comparison results (Part 2).

Test Details		Running Order (Baseline)		Lift + Bar			Bar		
Speed	Offset (%)	Avg. (T _{AEB})	Range (T _{AEB})	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)
30	100	0.62	0.17	0.55	0.20	-11.72	0.36	0.58	-41.89
40	100	0.82	0.02				0.43	0.86	-47.74
50	100	1.18	0.10	1.06	0.06	-10.14	1.11	0.01	-5.60
60	100	1.30	0.15						
70	100	1.34	0.01	1.29	0.04	-3.98	1.26	0.03	-6.22
80	100	1.37	0.02				1.27	0.07	-6.82

Value Highlights a change in Average T(AEB) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(AEB) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

Car-to-Pedestrian (Child)

FCW

A comparison of the Hilux warning tone results from the nearside testing with the child pedestrian target is presented in Figure 65 and the following tables. Changes in the average warning tone timing greater than 10 percent were observed in each configuration, with multiple changes greater than 10 percent occurring in all configurations except the Bullbar only condition. There is also examples of the range in the warning tone timing being greater than 0.5 seconds in the Rear Pitch, Lift and Lift Kit plus Bullbar configurations, with multiple examples occurring in the Lift Kit plus Bullbar configuration. The test speeds with a large range in the warning tone timings in the Lift Kit and Lift Kit plus Bullbar configurations correlate to test speeds where there was a range of late detection and late braking instances that resulted in collisions.

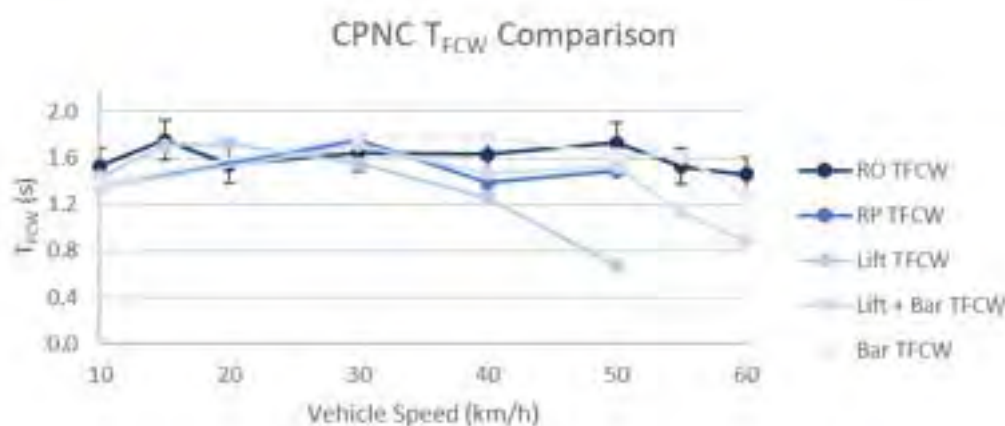


Figure 65: Hilux Car-to-Pedestrian (Child) average warning tone timing plot. Note the error bars indicate a change of 10 percent from the Running Order condition.

Table 53: Hilux Car-to-Pedestrian (Child) warning tone comparison results (Part 1).

Test Details	Running Order (Baseline)		Rear Pitch			Lift		
Speed	Avg. (T _{FCW})	Range (T _{FCW})	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)
10	1.530	0.29	1.35	0.07	-11.75	1.44	0.31	-5.93
15	1.756	0.10				1.71	0.01	-2.59
20	1.563	0.12				1.73	0.02	10.40
30	1.649	0.43	1.76	0.07	6.46	1.55	0.30	-5.76
40	1.630	0.35	1.39	0.61	-15.00	1.26	0.95	-22.57
50	1.733	0.13	1.49	0.00	-14.29	0.67	0.00	-61.15
55	1.527	0.08						
60	1.461	0.00						

Value Highlights a change in Average T(FCW) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(FCW) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

Table 54: Hilux Car-to-Pedestrian (Child) warning tone comparison results (Part 2).

Test Details	Running Order (Baseline)		Lift + Bar			Bar		
Speed	Avg. (T _{FCW})	Range (T _{FCW})	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)
10	1.530	0.29	1.34	0.02	-12.24	1.40	0.06	-8.77
15	1.756	0.10						
20	1.563	0.12						
30	1.649	0.43	1.72	0.02	4.03	1.79	0.05	8.58
40	1.630	0.35	1.47	1.04	-9.75	1.78	0.01	9.25
50	1.733	0.13	1.52	0.59	-12.05	1.63	0.09	-5.86
55	1.527	0.08	1.13	0.93	-25.67	1.61	0.01	5.40
60	1.461	0.00	0.89	0.81	-39.38	1.29	0.09	-11.40

Value Highlights a change in Average T(FCW) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(FCW) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

AEB

A comparison of the Hilux braking start time results from the nearside testing with the child pedestrian target is presented in Figure 66 and the following tables. Multiple instances of the average braking start time changing by more than 10 percent occurred in each variation configuration. At least one instance of a large range in the braking start times was observed in each variation configuration, which was not observed in the baseline results. The most occurrences of a large change in the average braking start time and a large range of braking start times occurred in the Lift Kit plus Bullbar configuration. Additionally, a delay in the average braking start time was observed at each test speed in the Lift Kit plus Bullbar configurations compared to the baseline configurations.

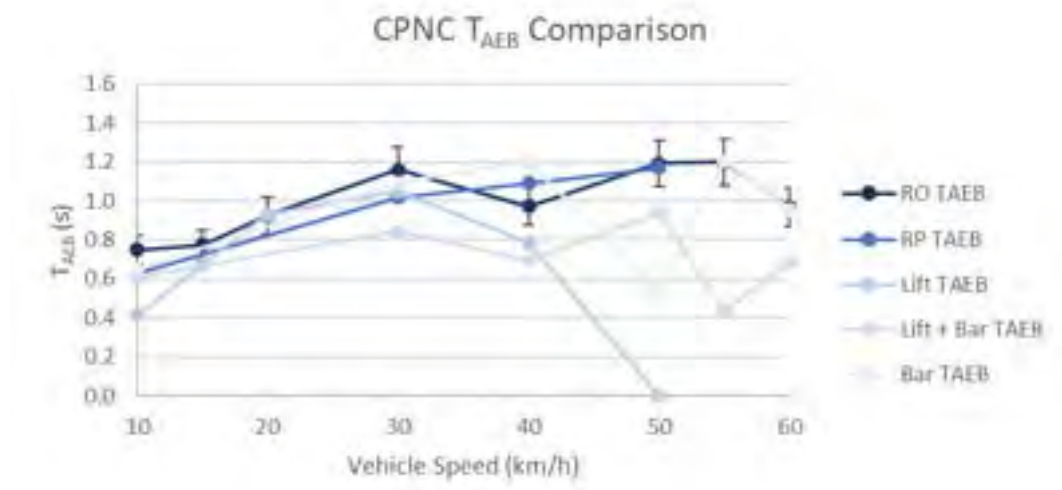


Figure 66: Hilux Car-to-Pedestrian (Child) average braking start timing plot. Note the error bars indicate a change of 10 percent from the Running Order condition.

Table 55: Hilux Car-to-Pedestrian (Child) braking start time comparison results (Part 1).

Test Details	Running Order (Baseline)		Rear Pitch			Lift		
	Avg. (T _{AEB})	Range (T _{AEB})	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)
10	0.75	0.04	0.63	0.02	-15.83	0.41	0.62	-44.78
15	0.77	0.05				0.67	0.11	-13.11
20	0.92	0.08				0.93	0.15	0.51
30	1.16	0.17	1.02	0.62	-12.20	1.05	0.59	-9.83
40	0.97	0.39	1.09	0.38	11.95	0.79	0.33	-19.27
50	1.19	0.05	1.17	0.00	-1.97	0.00	0.00	-100.00
55	1.20	0.08						
60	0.97	0.00						

Value Highlights a change in Average T(AEB) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(AEB) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

Table 56: Hilux Car-to-Pedestrian (Child) braking start time comparison results (Part 2).

Test Details	Running Order (Baseline)		Lift + Bar			Bar		
	Avg. (T _{AEB})	Range (T _{AEB})	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)
10	0.75	0.04	0.61	0.04	-19.03	0.65	0.01	-13.56
15	0.77	0.05						
20	0.92	0.08						
30	1.16	0.17	0.84	0.25	-27.20	1.09	0.22	-5.73
40	0.97	0.39	0.70	0.69	-28.38	1.20	0.56	23.36
50	1.19	0.05	0.94	0.20	-21.05	0.54	1.08	-54.60
55	1.20	0.08	0.44	1.12	-63.34	1.20	0.09	0.46
60	0.97	0.00	0.69	0.98	-29.06	0.96	0.27	-1.14

Value Highlights a change in Average T(AEB) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(AEB) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

Car-to-Pedestrian (Adult)

FCW

A comparison of the Hilux warning tone results from the farside testing with the adult pedestrian target is presented in Figure 67 and the following tables. An instance of a change in the warning tone timing greater than 10 percent occurred in the Lift Kit, Lift Kit plus Bullbar and Bullbar only configurations, which all occurred 15 km/h. In the Rear Pitch, Lift Kit plus Bullbar and Bullbar only configurations, the average warning start time occurred earlier than during baseline Running Order testing at each test speed. On the contrary, the average warning tone start time at each test speed in the Lift Kit configuration occurred after the average warning tone start time that occurred during baseline Running Order configuration at each test speed.

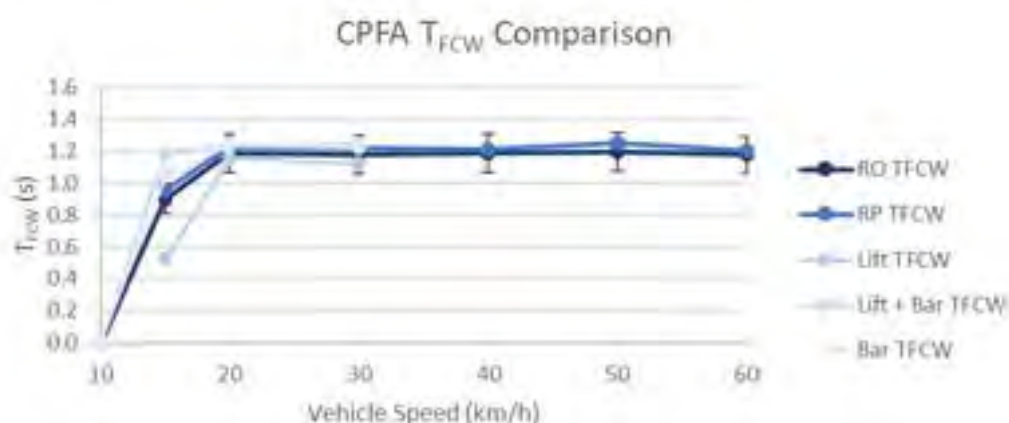


Figure 67: Hilux Car-to-Pedestrian (Adult) average warning tone timing plot. Note the error bars indicate a change of 10 percent from the Running Order condition.

Table 57: Hilux Car-to-Pedestrian (Adult) warning tone comparison results (Part 1).

Test Details	Running Order (Baseline)		Rear Pitch			Lift		
Speed	Avg. (T _{FCW})	Range (T _{FCW})	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)
10	0.00	0.00						
15	0.90	0.38	0.96	0.35	6.07	0.52	0.06	-41.81
20	1.19	0.05	1.23	0.02	2.94	1.16	0.04	-2.86
30	1.18	0.00	1.22	0.01	3.26	1.12	0.03	-4.91
40	1.19	0.04	1.21	0.01	1.95			
50	1.20	0.01	1.25	0.00	4.85			
60	1.18	0.02	1.21	0.00	2.29			

Value Highlights a change in Average T(FCW) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(FCW) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

Table 58: Hilux Car-to-Pedestrian (Adult) warning tone comparison results (Part 2).

Test Details	Running Order (Baseline)		Lift + Bar			Bar		
Speed	Avg. (T _{FCW})	Range (T _{FCW})	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)	Avg. (T _{FCW})	Range (T _{FCW})	Change (%)
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.90	0.38	1.19	0.13	32.14	1.05	0.38	16.38
20	1.19	0.05	1.24	0.06	4.37	1.24	0.02	3.99
30	1.18	0.00	1.25	0.02	5.42	1.23	0.01	3.73
40	1.19	0.04						
50	1.20	0.01						
60	1.18	0.02						

Value Highlights a change in Average T(FCW) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(FCW) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

AEB

A comparison of the Hilux braking start time results from the farside testing with the adult pedestrian target is presented in Figure 68 and the following tables. Similar to the change in the average warning tone timing described in the previous section, a greater than 10 percent change in the braking start timing was also observed at 15 km/h in the Lift Kit and Lift Kit plus Bullbar configurations. An instance of large change in the braking start time also occurred at the highest test speed in the Rear Pitch configuration.

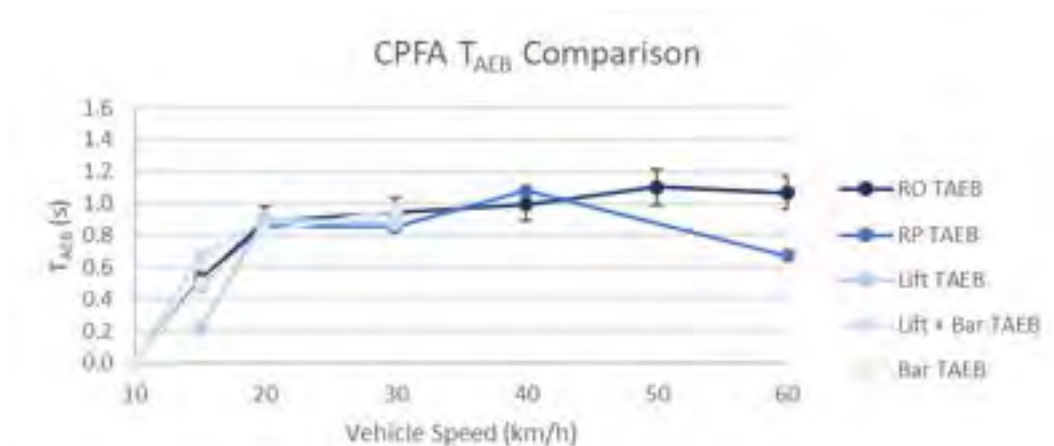


Figure 68: Hilux Car-to-Pedestrian (Adult) average braking start timing plot. Note the error bars indicate a change of 10 percent from the Running Order condition.

Table 59: Hilux Car-to-Pedestrian (Adult) braking start time comparison results (Part 1).

Test Details	Running Order (Baseline)		Rear Pitch			Lift		
Speed	Avg. (T _{AEB})	Range (T _{AEB})	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)
10	0.00	0.00						
15	0.52	0.23	0.49	0.09	-5.56	0.21	0.08	-58.40
20	0.89	0.03	0.86	0.00	-3.21	0.91	0.07	1.91
30	0.94	0.02	0.85	0.03	-9.63	0.88	0.15	-7.20
40	0.99	0.13	1.08	0.00	8.52			
50	1.10	0.02	1.11	0.00	0.23			
60	1.07	0.06	0.67	0.00	-36.92			

Value Highlights a change in Average T(AEB) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(AEB) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

Table 60: Hilux Car-to-Pedestrian (Adult) braking start time comparison results (Part 2).

Test Details	Running Order (Baseline)		Lift + Bar			Bar		
Speed	Avg. (T _{AEB})	Range (T _{AEB})	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)	Avg. (T _{AEB})	Range (T _{AEB})	Change (%)
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.52	0.23	0.67	0.17	29.41	0.50	0.23	-3.49
20	0.89	0.03	0.89	0.10	0.06	0.82	0.03	-7.32
30	0.94	0.02	0.87	0.07	-7.41	0.96	0.04	1.38
40	0.99	0.13						
50	1.10	0.02						
60	1.07	0.06						

Value Highlights a change in Average T(AEB) compared to the baseline Running Order that is greater than 10 percent.

Value Highlights a T(AEB) range that is greater than 0.5 seconds.

Value Highlights a test speed that was not performed in the configuration.

Comparison of Lane Keeping Results

A comparison of the LKS results obtained with the Hilux is presented in this section of the report. The results are separated into three sections according to the three lateral velocities tested.

0.1 m/s

The 0.1 m/s results obtained during testing in each line marking configuration are presented in Figure 69 and Table 61. The results obtained in the Rear Pitch, Lift Kit and Lift Kit plus Bullbar configurations were similar to the results observed during baseline testing, with the exception of the solid line passenger side testing in the Rear Pitch configuration. In this configuration an improvement of approximately 0.1 metres was observed. The vehicle was able to complete each correction before reaching the limit threshold outlined in ADR 107.

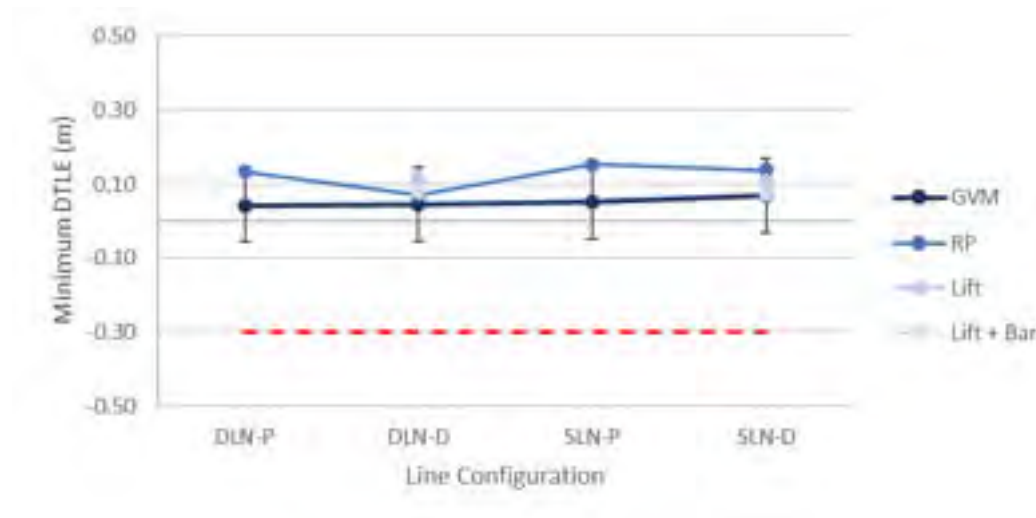


Figure 69: Hilux Lane Keeping System results at 0.1 m/s plot.

Table 61: Hilux Lane Keeping System results at 0.1 m/s.

Configuration	GVM (Baseline)	Rear Pitch		Lift		Lift + Bar	
	Avg. (DTLE)	Avg. (DTLE)	Change (m)	Avg. (DTLE)	Change (m)	Avg. (DTLE)	Change (m)
DLN-P	0.04	0.13	0.09				
DLN-D	0.04	0.07	0.03	0.11	0.07	0.08	0.04
SLN-P	0.05	0.15	0.10				
SLN-D	0.07	0.14	0.07	0.11	0.04	0.07	0.00

Value Highlights a change in average DTLE compared to the baseline Running Order that is greater than 0.1 metres.

Highlights a test speed that was not performed in the configuration.

0.2 m/s

The 0.2 m/s results obtained during testing in each line marking configuration are presented in Figure 70 and Table 62. A large improvement in performance was observed in the Rear Pitch configuration during solid line passenger tests. On average the vehicle avoided the solid line by 0.25 metres more than during baseline testing. In all other configurations and line marking combinations tested, the performance was similar to that observed during baseline testing. In all tests performed the vehicle did not exceed the limit threshold outlined in draft ADR 107.

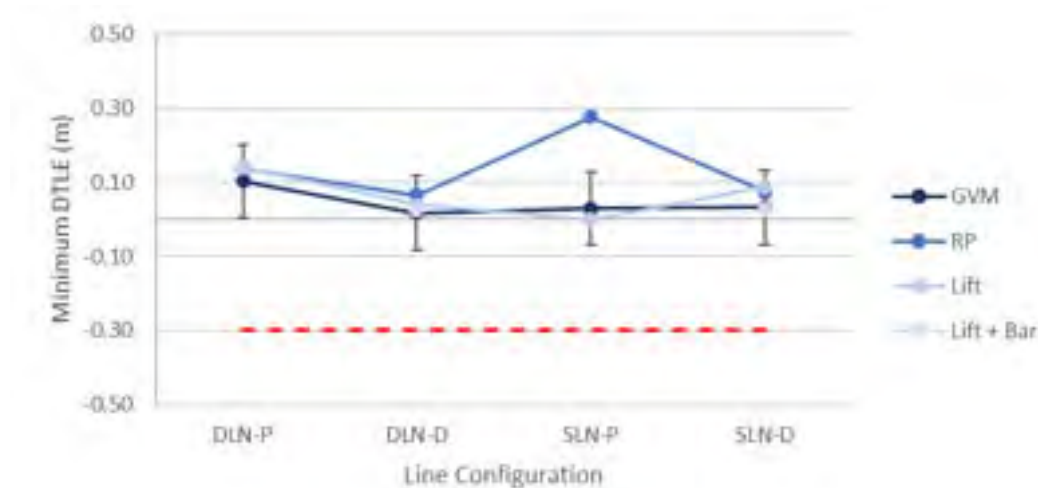


Figure 70: Hilux Lane Keeping System results at 0.2 m/s plot.

Table 62: Hilux Lane Keeping System results at 0.2 m/s.

Configuration	GVM (Baseline)	Rear Pitch		Lift		Lift + Bar	
	Avg. (DTLE)	Avg. (DTLE)	Change (m)	Avg. (DTLE)	Change (m)	Avg. (DTLE)	Change (m)
DLN-P	0.10	0.14	0.04	0.14	0.04		
DLN-D	0.02	0.07	0.05	0.04	0.02	0.03	0.01
SLN-P	0.03	0.28	0.25	0.00	-0.03		
SLN-D	0.03	0.07	0.04	0.09	0.06	0.03	0.00

Value Highlights a change in average DTLE compared to the baseline Running Order that is greater than 0.1 metres.

Highlights a test speed that was not performed in the configuration.

0.5 m/s

The 0.5 m/s Hilux LKS results are presented in Figure 71 and Table 63. Large improvements in performance were observed during the solid line tests in the Rear Pitch configuration. Similar to the large improvement in the Rear Pitch solid line tests, a moderate improvement in performance was also observed in both dashed line tests. In all tests performed the Hilux was able to avoid crossing the lane line.

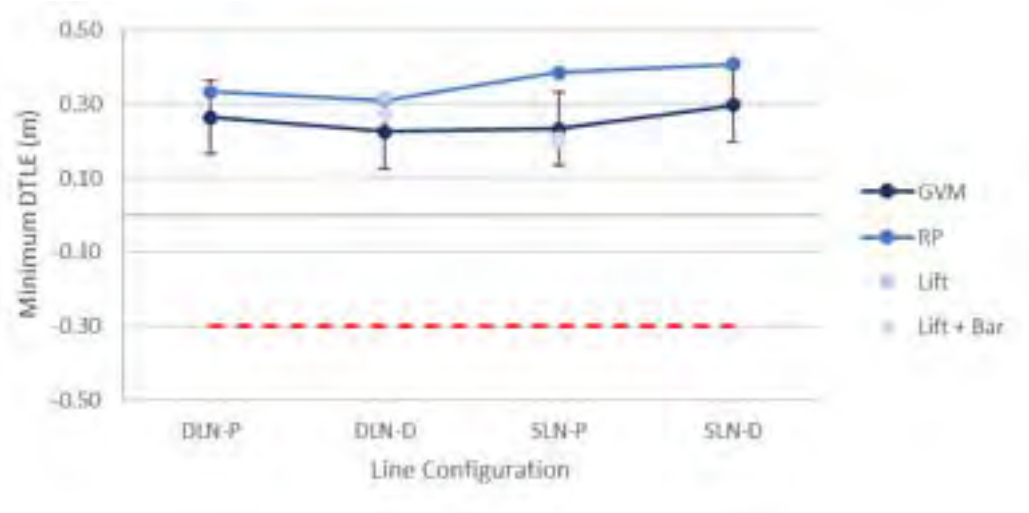


Figure 71: Hilux Lane Keeping System results at 0.5 m/s plot.

Configuration	GVM (Baseline)	Rear Pitch		Lift		Lift + Bar	
	Avg. (DTLE)	Avg. (DTLE)	Change (m)	Avg. (DTLE)	Change (m)	Avg. (DTLE)	Change (m)
DLN-P	0.26	0.33	0.07				
DLN-D	0.23	0.31	0.09	0.32	0.09	0.27	0.05
SLN-P	0.23	0.39	0.15	0.20	-0.04	0.21	-0.03
SLN-D	0.30	0.41	0.11				

Value Highlights a change in average DTLE compared to the baseline Running Order that is greater than 0.1 metres.

Highlights a test speed that was not performed in the configuration.

Discussion

Isuzu D-Max

Car-to-Car Rear Results

Impacts were more common in the Lift Kit, Lift Kit and Bullbar and Bullbar only configurations during testing in the Car-to-Car rear scenarios. Almost all these impacts occurred at speeds less than 50 percent of the limit thresholds outlined in ADR98-01, therefore, it is considered that only minor changes in vehicle performance have occurred during Car-to-Car testing in the Lift Kit, Lift Kit plus Bullbar and Bullbar configurations.

Two low speed roll-in impacts occurred during the Car-to-Car Rear Moving testing in the Lift Kit plus Bullbar configuration that were above the impact speed threshold outlined in ADR 98-01. Despite being above the threshold, it is unlikely that these low-speed roll-in impacts represent a change in performance because this type of impact also occurred during baseline testing.

It is logical that the suspension and tyres installed as part of the Lift Kit and protrusion of the Bullbar have contributed to the increased number of impacts observed during the Car-to-Car testing in the Lift Kit, Lift Kit plus Bullbar and Bullbar configurations. In addition to these factors, a trend is evident in the Car-to-Car Rear Stationary results in the Lift Kit and Lift Kit plus Bullbar configurations, of a delay in the vehicle's detection and braking start times. Therefore, the increased vehicle height appears to cause a delay in the detection and braking start times that may have also contributed to the impacts that occurred in the Lift Kit and Lift Kit plus Bullbar configurations. It should, however, be noted that this trend was not evident in the Car-to-Car Rear Moving results.

The Rear Pitch configuration appears to cause only minor changes in the average warning tone start timings and average braking start times at each test speed compared to the baseline Running Order configuration in the Car-to-Car Rear testing.

Car-to-Pedestrian Results

The low-speed Car-to-Pedestrian results were similar in the Lift Kit, Lift Kit plus Bullbar and Bullbar only configurations compared to the baseline Running Order configuration. These results suggest that these variations have not reduced the lateral field-of-view of the vehicle's sensor system. Additionally, the Car-to-Pedestrian test results with the child target suggest that the increased height of the Bullbar above the bonnet has not obstructed the vertical field of view of the vehicle's cameras. This is also supported by the similarity of Lift Kit and Lift Kit plus Bullbar results.

The Lift Kit height increase appears to cause delays in the vehicle braking start times, as shown in the majority of Car-to-Pedestrian results with the child target and some of the Car-to-Pedestrian results with the adult target in both the Lift Kit and Lift Kit plus Bullbar configurations. This is similar to the delay in detection and braking start times observed during Car-to-Car Rear Stationary testing.

Minor changes (of approximately 10 % or less) in warning tone start timing and braking start timing were common during the Car-to-Pedestrian testing in the Rear Pitch configuration with the child pedestrian target. During testing with the adult pedestrian target, large changes (greater than 10 percent) in the warning tone start timing and braking start timing were observed at the two lowest test speeds of 15 and 20 km/h. This suggests that the Rear Pitch configuration has delayed the detection and braking start times of the vehicle when the pedestrian target is close to the limits of the camera system's field-of-view. However, the same trend doesn't appear in the Car-to-Pedestrian test data using the child target traversing from the nearside. Therefore, it is unclear whether the Rear Pitch load configuration has reduced the ability of the vehicle to respond to targets towards the edge of the field-of-view.

Lane Keeping Results

In the Rear Pitch, Lift Kit and Lift Kit plus Bullbar configurations the LKS response at each lateral velocity tested was generally similar to the baseline testing because a difference of more than 0.1 metres in the average DTLE did not consistently occur at each lateral velocity or in relation to a particular line marking and direction combination. This similarity was also true for the Bullbar testing at the lower lateral velocities of 0.1 and 0.2 m/s, however, at 0.5 m/s the average DTLE exceeded the draft ADR 107 limit in both line types located on the driver's side of the vehicle. These results were different to the baseline test result and different to the change in results between the Lift Kit and Lift Kit plus Bullbar configurations. The similarity between the Lift Kit and Lift Kit plus Bullbar results indicated to the testing team that something other than the Bullbar could be causing the difference between baseline and Bullbar only results.

The testing team investigated whether a factor other than the Bullbar is contributing to difference in Bullbar and baseline results at 0.5 m/s on the driver's side. Initially, it was suspected that a test parameter could be out-of-tolerance, or the vehicle could be reacting prior to the steering robot release. However, additional testing confirmed that all parameters were within tolerance and the release timing was suitable. The additional testing was performed on a windy day (wind gusts up to 10 m/s), characterised by a strong northerly crosswind, whereas the previous testing performed with the Bullbar fitted was conducted during light wind conditions. Based on this change in wind conditions, it was suspected that the pressure applied to the side of the vehicle by a crosswind could change how close the vehicle gets to the line during its response.

Additional testing was performed to understand the influence of a crosswind and is presented in Table 61. During a DLN-D test the vehicle travels from west to east and turns towards the south when approaching the dashed line. When the vehicle heading correction occurs, the path changes from a southern heading to a northern heading. During the strong northerly wind conditions, the distance the vehicle travelled beyond the dashed line was greater than the distance travelled by the vehicle during the low-speed southerly wind conditions. On average, the vehicle travelled an additional 0.19 metres beyond the line during the northerly wind conditions then during the low-speed southerly wind conditions, as shown in Table 61. These results suggest that a crosswind in the lateral direction of travel can reduce the

magnitude of the correction applied by the vehicle, resulting in the vehicle crossing the line by a greater distance.

Additional testing was also performed with the solid line on the driver's side of the vehicle. During a SLN-D test the vehicle travels from east to west and turns towards the north as it approaches the solid line. When a heading correction occurs the path changes from a northern heading to a southern heading. On average the vehicle travelled 0.15 metres less beyond the line during the northerly wind conditions than during the gentle southerly wind conditions, as shown in Table 63. These results suggest that the northerly crosswind assists the vehicle correction, resulting in the vehicle traversing the line by a reduced amount compared to during lite wind conditions.

Table 63: Additional testing performed to understand the effect of a crosswind on the test results.

Test Type	Date	Run No.	Wind Speed	Wind Direction	DTLE Avg. (m)	Change (m)
DLN-D	14/09/23	9	Low*	Southerly	-0.41	-0.19
		10				
		11				
	19/09/23	24	High	Northerly	-0.60	
		25				
		26				
SLN-D	14/09/23	4	Low*	Southerly	-0.39	0.15
		5				
		6				
		7				
	19/09/23	16	Med	Northerly	-0.23	
		20				
		21				

Based on these test results, it is possible that wind has contributed to the variation in results observed between the Bullbar only configuration and the baseline results at 0.5 m/s. However, crosswind conditions don't appear to explain all the differences observed between the baseline test results and Bullbar results. Table 64 is the same as Table 63 (above) with the addition of the baseline test results. It is possible that the medium intensity southerly that occurred during baseline DLN-D assists the vehicle correction because the vehicle does not exceed the lane marking by the same amount observed with the Bullbar fitted. This is the expected influence of a southerly crosswind based on the previously outlined crosswind analysis. On the contrary, a medium intensity westerly was present during the baseline SLN-D testing, which should have a negligible effect on the distance travelled by the vehicle in relation to the line because it represents a headwind, yet there is an observable difference between the average baseline result and the low wind Bullbar test results. Based on this comparison of wind conditions and results, it is likely that some of the difference in performance between the baseline testing and Bullbar testing is due to wind conditions.

Table 64: comparison of additional crosswind investigation test results with initial baseline testing.

Test Type	Date	Run No.	Wind Speed	Wind Direction	DTLE Avg. (mm)
DLN-D	14/12/22 (Baseline)	1	Med	Southerly	-0.27
		2			
		3			
	14/09/23 (Bullbar)	9	Low*	Southerly	-0.41
		10			
		11			
	19/09/23 (Bullbar Investigation)	24	High	Northerly	-0.60
		25			
		26			
SLN-D	14/12/22 (Baseline)	2	Med	Westerly	-0.26
		3			
		7			
	14/09/23 (Bullbar)	4	Low*	Southerly	-0.39
		5			
		6			
		7			
	19/09/23 (Bullbar Investigation)	16	Med	Northerly	-0.23
		20			
		21			

Section 7.5.2 of draft ADR 107 outlines that LKS testing should be performed in the absence of whether conditions affecting the dynamic performance of the vehicle. A weather station was used to log the wind speed and direction during the test program. Wind speed and direction data is available for the majority of LKS tests performed, however, the weather station was not operational during some tests. For the tests with weather station data, no wind gusts above 10 m/s were observed, which is the wind speed limit used in ANCAP testing. Based on changes on test results discussed above, it is recommended that any future LKS testing is performed in light wind conditions at speeds of less than 5 m/s to reduce the influence of wind.

The influence of each variation tested is less clear since it has been identified that wind conditions can influence the performance of the vehicle. Nevertheless, in all the testing performed the vehicle was able to detect the line markings and change the vehicle heading, suggesting that each variation tested has not had a significant detrimental effect on vehicle performance. Therefore, it is unlikely that the variations investigated will impact the compliance of a vehicle compliant with draft ADR 107.

No consistent changes in performance were observed with the black or white Antennas fitted to the vehicle during daytime testing. The Antenna testing at a particular lateral velocity using a particular line and direction combination was performed on the same day during similar wind conditions. Therefore, the effects of varying wind conditions are minimised. The results suggest that having up to two black or white Antennas mounted on the vehicle will have minimal effect on the vehicle's ability to detect and respond to line markings.

Only small variations in performance were observed during night-time testing with the driving light and Antennas fitted to the vehicle compared to the baseline testing without a Bullbar using high beam headlights. Low wind conditions were also present during all night--time testing. Therefore, it appears that reflection of the light from the white Antennas does not cause a change in the vehicles ability to detect and react to line markings.

Ford Ranger

Car-to-Car Rear Results

The Ford Ranger transitioned from non-impact to impact results at the same test speeds during the Car-to-Car Rear testing with the two chosen Bullbars as compared to the baseline Running Order testing. The impacts with the Bullbars installed also occurred at similar speeds to the impacts that occurred during baseline testing. These impacts were all below the impact speed threshold outlined in ADR 98-01, with the exception of the low-speed roll-in impacts that occurred at 40 km/h during the Car-to-Car Rear stationary testing in the baseline Running Order and Bullbar C configurations. The analysis of the change in warning tone and braking start timings also outlined that only minor changes in timing occurred with each Bullbar fitted to the vehicle.

These results indicate that the relocation of the radar that occurs with each of the Bullbars, has a minor influence of on the vehicle's ability it identify and react to vehicle targets located in front of the vehicle. These results also suggest that the Aluminium mesh located in front of the radar as part of the Bullbar D installation has minimal effect on the vehicle's performance, however, it is possible that the camera can compensate for compromised radar performance.

An investigation was performed to understand whether the similarities in performance between the Bullbar D and the baseline testing are because the camera system can compensate for any degraded performance caused by the Aluminium mesh located in front of the radar. To understand if the camera can compensate for the degraded performance of the radar, a Car-to-Car Rear Stationary test was performed; firstly, with the radar blocked by a piece of radar absorbing foam and secondly, with an aluminium sheet. Prior to starting both tests it was observed that the vehicle pre-collision system deactivated because the system identified that a sensor was blocked. Figure 72 shows the warning that appeared on the vehicle dash to warn the driver of the system deactivation. These results suggest that if the Aluminium mesh of the Bullbar D blocks the radar in a detrimental manner, then a warning would be provided to the driver that the system has shut down. A warning of this nature was observed once during the testing with the Bullbar D. This occurred whilst driving to the start position of the first Car-to-Car Rear Stationary test performed at 30 km/h, however, was not observed at any other stage of the test program. This test result indicates that the Bullbar D Aluminium mesh can interrupt the vehicle's pre-collision system in such a manner that the system shuts down.



Figure 72: Ford Ranger sensor blocked warning.

The radar blocking process outlined in the previous paragraph was not conclusive regarding whether the camera system is able to compensate for degraded performance caused by the Aluminium mesh located in front of the radar because the system was able to detect when the sensor was blocked and shut down. As an alternative indicator of whether there are subtle changes in performance due to the mesh in front of the radar, additional Car-to-Car testing was performed with the vehicle adaptive cruise control system active. The adaptive cruise control system relies entirely on the vehicle's radar unit, with no input from the forward-facing camera. Testing was performed in radar cruise control in both the baseline Running Order condition and with the Bullbar D fitted and involved the test vehicle travelling at both 80 and 100 km/h approaching a slower moving vehicle target travelling at 60 km/h. Three tests were performed at each speed.

The results are summarised in Table 65. At 80 km/h, with the Bullbar D fitted, the vehicle responded to the target at approximately 6 percent greater distance than in the baseline condition. Similarly, at 100 km/h, the vehicle responded to the target at approximately 2 percent closer to the target than in the baseline condition. The similarity between the results suggests that the mesh is generally not affecting the ability of the radar to identify objects in front of the vehicle. Therefore, it is unlikely that the forward-facing camera is compensating for degraded radar performance.

Table 65: Assisted Driving Car-to-Car Rear Moving tests results.

VUT Speed	Relative Longitudinal Distance at Reaction (m)				
	Running Order (Baseline)		Bullbar D		
	Values	Average	Values	Average	Change (%)
80	66.14	66.3	70.92	70.4	6.2
80	67.29		69.24		
80	65.43		71.04		
100	117.71	116.3	113.70	114.5	-1.5
100	115.85		115.36		
100	115.21		114.43		

Car-to-Pedestrian Results

The Ranger transitioned to impact results during the Car-to-Pedestrian child testing at similar speeds to the baseline testing with each of the Bullbars fitted to the vehicle. The impact speeds observed were similar to the baseline performance and below the impact speed threshold outlined in ADR 98-01, with the exception of the additional higher speed tests performed with the Bullbar D fitted to the Ranger. It is unclear whether this performance is representative of the baseline condition because testing in the baseline Running Order configuration was not performed at these speeds. However, there is a clear change to when the vehicle begins to brake at these test speeds compared to at 50 km/h and the same speeds tested with the Bullbar C fitted to the vehicle. Further testing would need to be performed to understand whether this change in performance is consistent or different to the baseline performance of the vehicle before any conclusions are made.

The greatest change in vehicle performance that occurred during the Car-to-Pedestrian testing was at the lowest test speed in both the child nearside and adult farside scenarios with the Bullbar D fitted to the Ranger. During baseline testing in these scenarios, the vehicle was able to detect and apply the brakes to avoid an impact. With the Bullbar D fitted to the vehicle, the vehicle no longer applied the brakes and the target was consistently impacted at the test speed. These results suggest that the vehicle's field-of-view has changed with the Bullbar D fitted. It is possible that this is due to the mesh located in front of the Radar, the edge of the Bullbar blocking the field-of-view of the camera or the relocation of the radar. No such change in performance was observed with the Bullbar C fitted to the Ranger.

To understand whether the change in performance is due to the mesh located in front of the Radar, the edge of the Bullbar blocking the field-of-view of the camera or the relocation of the radar, additional testing was performed. This testing included removing the mesh that is located directly in front of the radar, as shown in Figure 73. The additional tests were performed at the lowest test speed (10 km/h) with the adult and child pedestrian targets, which resulted in impacts with the Bullbar D fitted. Firstly, a repeat test with the Bullbar in the OEM condition was performed to confirm that the performance was the same as the initial testing. The mesh was then removed and an additional test with the child and adult pedestrians was performed.



Bullbar D (OEM Condition)



Bullbar D with mesh removed

Figure 73: Bullbar D in OEM condition with mesh located in front of radar (Left) and mesh removed (Right).

The results of the testing are presented in Table 66. The results highlight that with and without the mesh located in front of the radar the vehicle can issue a warning tone, however,

with the mesh no vehicle braking occurs and a collision ensues. In contrast, with the mesh removed from in front of the radar, the vehicle applies the brakes and avoids a collision.

This change in performance confirms that the change in performance observed at the lowest test speed with both the child and adult pedestrian targets is due to the mesh located in front of the radar.

Table 66: Additional Bullbar D testing with mesh removed from in front of the radar.

Test Type	Pedestrian Direction	Test Condition	T(FCW) (s)	T(AEB) (s)	Shortest Distance (m)	Impact Speed (km/h)
Car-to-Pedestrian (Child) – Pedestrian travelling Left to Right						
Car-to-Pedestrian (Child)	Left-Right	OEM Mesh	0.825	NB	-	8.86
Car-to-Pedestrian (Child)	Left-Right	Without Mesh	0.799	0.825	0.881	-
Car-to-Pedestrian (Adult) – Pedestrian travelling Right to Left						
Car-to-Pedestrian (Adult)	Right-Left	OEM Mesh	0.332	NB	-	9.21
Car-to-Pedestrian (Adult)	Right-Left	Without Mesh	0.772	0.789	0.784	-

It was identified during testing that a number plate mounted to the Bullbar C could partially block the front parking sensors and that there is no specific mention of how the number plate should be mounted in the installation guide. One image in the installation guide shows a number plate mounted in the location shown at the “Top” of Figure 74, which provides access to a winch, if installed. In this location, the number plate does not block the two inner parking sensors, however, in both alternative mounting locations shown at the “Middle” and “Bottom” of Figure 65, the number plate partially blocks the two inner parking sensors.

The potential blocking of the parking sensors by the number plate highlights the need for installation instructions to include instructions for number plates and other items than can potentially block the field-of-view of the vehicle’s sensors. An example of this is included in the Bullbar A installation guide for the Bullbar purchased and fitted to the Toyota Hilux. In these instructions a size limit for headlights is outlined to ensure that the front radar field-of-view is not blocked.



Standard Number Plate Location (Top)



Raised Number Plate Location for winch access (Middle)



Bullbar C with Number Plate mounted in three locations: Standard Location (Top), Alternative Location A (Middle) and Alternative Location B (Bottom).

Toyota Hilux

Car-to-Car-Rear Results

The Rear Pitch configuration typically caused minor changes (less than 10 percent) in the average warning tone start timings and average braking start times at each test speed compared to the baseline Running Order configuration in the Car-to-Car Rear testing.

Changes in the performance of the Toyota Hilux were observed in the Lift Kit, Lift Kit plus Bullbar and Bullbar only configurations during the Car-to-Car Rear testing. During the Car-to-Car Rear Stationary testing in these configurations, impacts were observed at the higher test speeds. These impacts occurred at less than 60 percent of the impact speed threshold outlined in ADR 98-01, except for one of the two tests that were performed at 60 km/h in the Lift Kit plus Bullbar configuration and one of the two tests at 45 km/h in the Bullbar only configuration.

The three impacts that occurred during the Bullbar only Car-to-Car Rear Stationary testing were characterised by the vehicle releasing the braking effort close to the target. It is likely that the weight of the Bullbar fitted to the front of the vehicle causes the front of the vehicle to reach a lower position during braking than that reached in the baseline Running Order configuration. At this height it is likely that the vehicle target leaves the field-of-view of the radar and/or camera, causing the vehicle braking effort to end. However, this conclusion is unclear because it was also identified that the OEM front suspension was missing two components that engage the dampener as the front spring is compressed, which may have contributed to the AEB deactivation.

Impacts above the ADR 98-01 limit threshold were also observed during the Car-to-Car Rear Moving testing. In the Lift Kit and Lift Kit plus Bullbar configurations these impacts occurred at the test speed of 75 km/h. Only one test was performed in the Lift Kit configuration due to the risk of damaging the radar and a second test was performed in the Lift Kit plus Bullbar configuration with the added protection of the Bullbar to confirm the result. These tests were characterised by a warning tone and no vehicle braking prior to impact. The consistency of this result in the Lift Kit and Lift Kit plus Bullbar configurations suggests that the increased height of the vehicle is affecting the vehicle's decision to apply the brakes.

During testing with the Bullbar fitted to the vehicle, a no detection results was observed in one of the three tests performed at 30 km/h and a warning tone with no braking was observed in the second of two tests performed at 40 km/h. These no braking results suggest an attribute of the Bullbar (other than the lower position during braking) is causing the change in performance observed in the Car-to-Car Rear Moving tests.

It is possible that the change in performance of the Hilux with the Bullbar fitted is either due to the structure of the Bullbar partially blocking the radar signal or the change in pitch of the radar due to the additional weight of the Bullbar at the front of the vehicle. To understand which of these two options caused the change in performance, the adjustable front suspension used to generate the 75 mm lift was installed and adjusted such that the front suspension of the vehicle returned to the baseline Running Order height. The results of this investigation are

presented in the following figures. Each figure contains the test results obtained with the Bullbar raised to the OEM height “Bullbar (OEM Height)”, along with the previous Bullbar configuration results and baseline Running Order results. Figure 75 presents the Car-to-Car Rear Stationary results, Figure 76 shows the Car-to-Car Rear Moving results and Figure 77 shows the Car-to-Car Pedestrian results obtained with child pedestrian target crossing from the nearside.

Two impacts were observed during Car-to-Car Rear Stationary testing in the OEM height Bullbar configuration. The vehicle did not apply the brakes in either impact. A warning tone was issued prior to the collision in the offset test performed at 30 km/h, however, no collision warning tone was issued in the first in-line test performed at 10 km/h. These no braking type impacts are different to the results observed during baseline Running Order testing and the previous testing performed with the Bullbar installed with factory suspension. Another observation from the OEM height Bullbar results in the Car-to-Car Rear Stationary tests is that the vehicle braking effort did not end early during any tests, in a similar manner to that observed during the previous testing performed with the Bullbar installed with factory suspension. This suggests that the target no longer leaves the vehicle’s field-of-view when the height of the front suspension is corrected. It is the understanding of the project team that the aftermarket suspension is slightly stiffer than the OEM suspension, based on the advice of the qualified mechanic that installed the suspension. Therefore, it is possible that the lowest height reached by the front of the vehicle under braking in these tests was also influenced by stiffer suspension.

One impact was observed during Car-to-Car Rear Moving testing in the OEM height Bullbar configuration. During this test, a collision warning tone was issued, however, no vehicle braking was observed. This is a similar result to the two no braking impacts observed during testing with the Bullbar installed with factory suspension. Similarly, three of the four impacts observed during Car-to-Car Pedestrian testing in the OEM height Bullbar configuration were characterised by no vehicle braking prior to impact.

The similar number of no braking type impacts observed in the Bullbar (OEM Height) configuration and the Bullbar with factory suspension configuration suggests that correcting the vehicle pitch with the Bullbar on has not returned the performance of the vehicle to a similar state to that observed during baseline Running Order testing. Therefore, it is possible that the Bullbar structure interferes with the sensors system’s ability to identify and trigger vehicle braking.

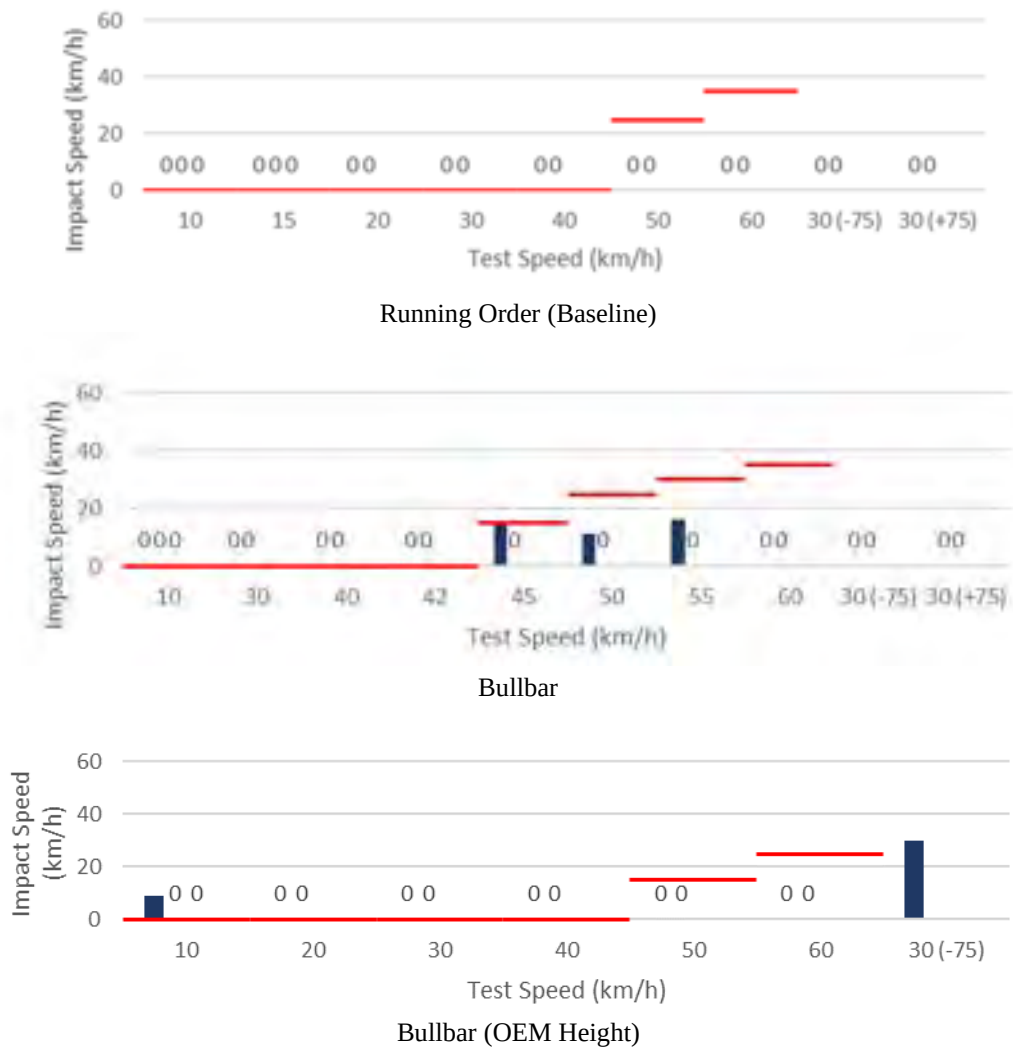
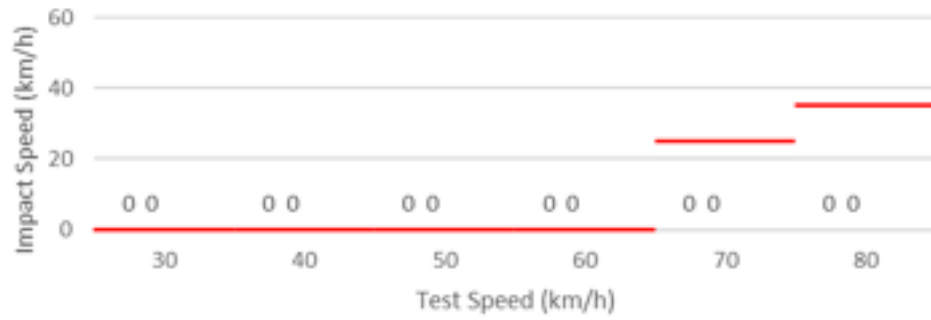
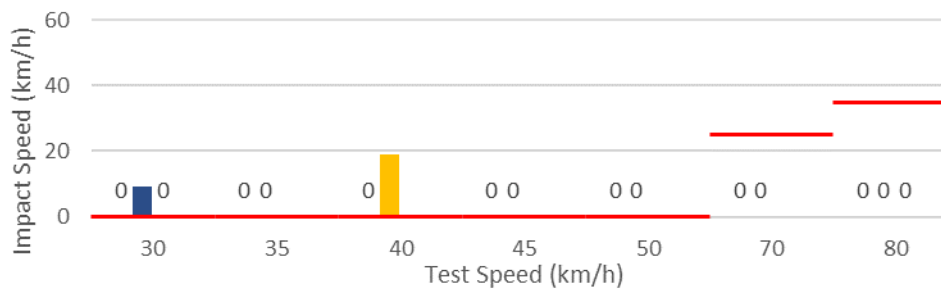


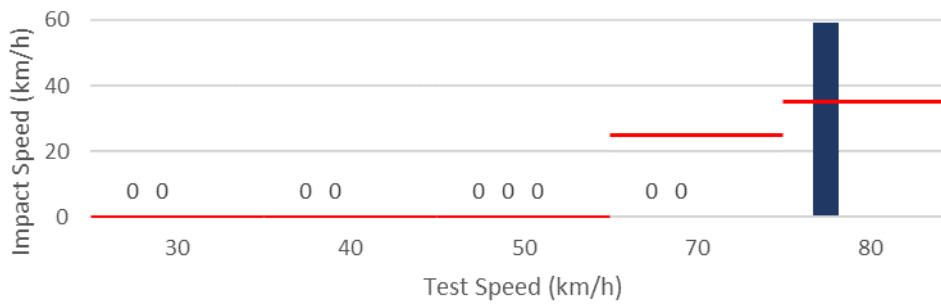
Figure 75: Comparison of Car-to-Car Rear Stationary OEM Height Bullbar results (Bottom) with the Original Bullbar results (Middle) and Running Order Baseline results (Top).



Running Order (Baseline)



Bullbar



Bullbar (OEM Height)

Figure 76: Comparison of Car-to-Car Rear Moving OEM Height Bullbar results (Bottom) with the Original Bullbar results (Middle) and Running Order Baseline results (Top).

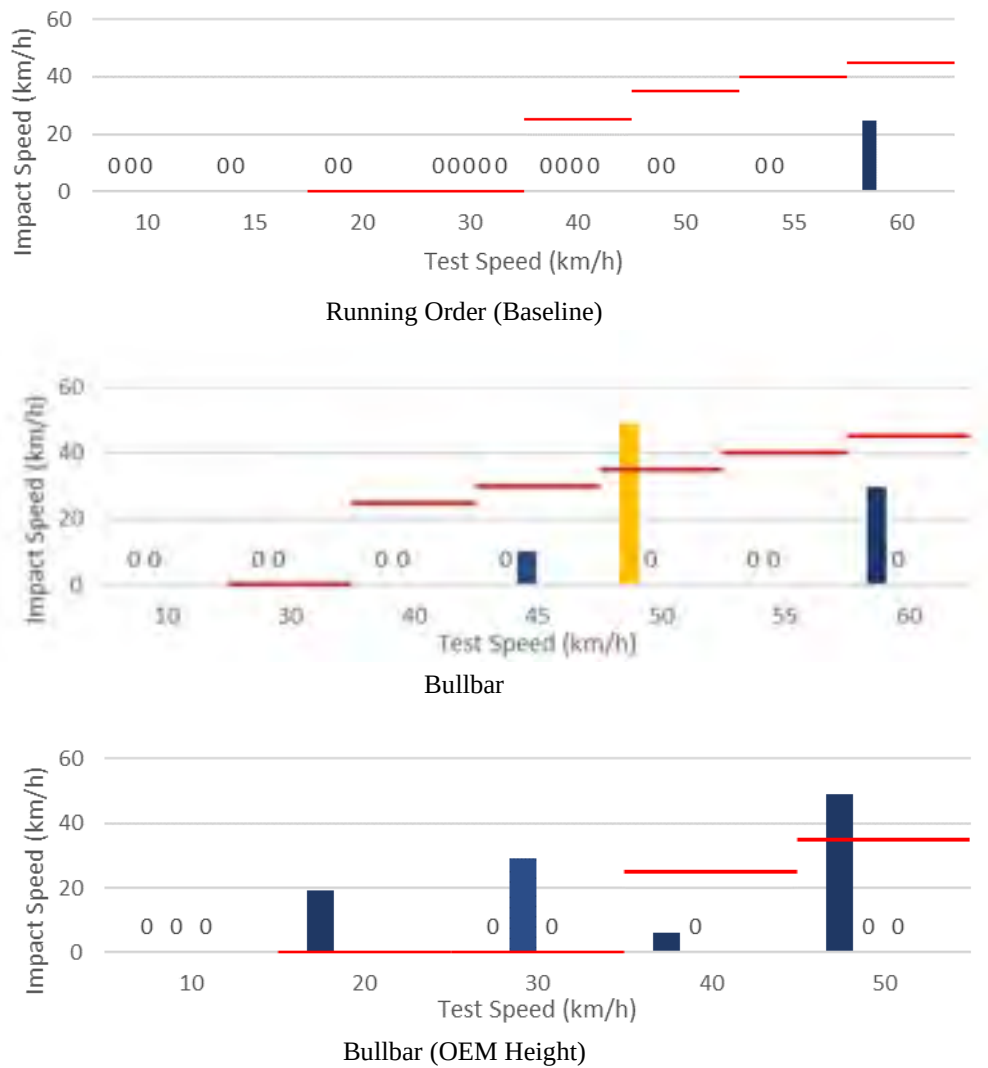


Figure 77: Comparison of Car-to-Pedestrian OEM Height Bullbar results (Bottom) with the Original Bullbar results (Middle) and Running Order Baseline results (Top).

Car-to-Pedestrian Results

Delays and increases in the detection and braking start timings were observed during the Car-to-Pedestrian child testing, suggesting that the Rear Pitch configuration isn't consistently beneficial or detrimental to the vehicle performance. The performance of the Rear Pitch configuration with the adult pedestrian traversing from the farside is consistent with the baseline performance, with the exception of one late braking event that occurred at the highest test speed. Therefore, the changes in detection and braking start times do not indicate any major changes in vehicle performance in the Rear Pitch configuration during the Car-to-Pedestrian testing.

Large delays in average detection and braking start time (greater than 10 %) were observed at the lowest test speed of 10 km/h in the Rear Pitch configuration during Car-to-Pedestrian child testing, suggesting that the Rear Pitch configuration may have changed the vehicle's ability to respond to targets towards the edge of the field-of-view. However, performance in the Rear Pitch configuration with the adult pedestrian traversing from the farside is consistent with the baseline performance. Therefore, it is unclear whether the vehicle's ability to avoid targets towards the edge of the field-of-view has changed.

Changes in the vehicle performance were observed during Car-to-Pedestrian testing with both the child and adult pedestrian targets. During the Car-to-Pedestrian testing in the Lift Kit, Lift Kit and Bullbar and Bullbar only configurations, impacts were observed at speeds other than the highest test speed, which is different to testing in the baseline Running Order condition. Many of these tests were characterised by late braking and or no braking. The greatest number of impacts occurred in the Lift Kit and Bullbar configuration, which included more than one impact occurring at each test speed above 35 km/h. Seven of these impacts were above the impact speed threshold outlined in ADR 98-01. One impact in each of the Lift Kit only and Bullbar only configurations was also above the impact speed threshold outlined in ADR 98-01. It is also worth noting the inconsistency between the warning tone timing, braking start timing and impact result between test runs performed at many of the test speeds in these configurations that resulted in impacts.

Baseline testing with the Toyota Hilux was initially performed with an ignition cycle and lap of our runway every second test. During the Car-to-Pedestrian testing with the child pedestrian target, this methodology was re-evaluated due to three impact results that were characterised by late or no detection and no braking. The results of these tests are presented in (Appendix C) and include: run 1 at 20 km/h as well as runs 3 and 4 and 40 km/h. These results were different to the results of the other tests performed at the same speed and it was suspected that these uncharacteristic results could relate to either an ignition cycle not being performed as frequently as required or the vehicle not being driven for long enough after an ignition cycle. From this point in time onwards an ignition cycle was performed before each test and the vehicle driven for a longer period to help ensure that the pre-collision system was initialised and functioning for each test. The similarity between these tests and the no-braking impacts that were observed in the Lift Kit, Lift Kit plus Bullbar and Bullbar only configurations indicates that this test type could be challenging for the vehicle, with or

without modifications. Further baseline testing could be performed to gain a better understanding of the effect of the Lift Kit and Bullbar during Car-to-Pedestrian child testing.

The low-speed performance of the Hilux during the Car-to-Pedestrian Adult testing was generally similar to the baseline Running Order testing. Impacts were observed in the two tests performed at 15 km/h in the Lift Kit configuration, which were not observed during baseline testing. A warning tone was issued in each test, followed by vehicle braking, however, both the warning tone and braking start times occurred later than during the baseline Running Order testing. A delay in the braking start time was also observed in the testing at Car-to-Pedestrian child testing at 10 km/h, compared to baseline testing, in each of the three tests performed in the Lift configuration. Two of these tests resulted in no-impact, however, one was characterised by no braking and impact. These results suggest that the Lift Kit may have changed the vehicle's ability to avoid targets towards the edge of the field-of-view. However, similar changes were not also observed in the Lift Kit and Bullbar configuration, therefore, it is inconclusive whether the Lift Kit is affecting the field-of-view.

Similar to the Isuzu D-Max results, it appears that the Lift Kit can cause a small delay in the braking start times. This is evident in the Car-to-Car Rear Stationary Lift Kit plus Bullbar results, Car-to-Car Rear Moving Lift Kit and Lift Kit plus Bullbar results as well as Car-to-Pedestrian Lift Kit plus Bullbar results with the child pedestrian target. In each of these test groups/configurations, a delay in the average braking start time was observed at each test speed. It should also be noted that in each Car-to-Car Rear test group, a delay in the average braking start time was observed at each test speed in the Bullbar only configuration, suggesting that the Bullbar may have also caused a delay in the vehicle's decision to apply the brakes.

Lane Keeping Results

The LKS testing did not identify any significant detrimental changes in performance due to the vehicle loaded in the Rear Pitch configuration or installed with a Lift Kit or equipped with a Lift Kit and Bullbar. The Lift Kit and Lift Kit plus Bullbar results were generally similar to the baseline testing results. In the Rear Pitch load condition, a negligible change in performance or improved performance was observed for each line marking and direction at each lateral velocity, with the largest performance increase occurring in the solid line passenger side tests. A similar trend of negligible change or improved performance can also be observed in the Rear Pitch D-Max results across all lateral velocities and line marking combinations. Therefore, it is possible, that the change in front camera angle changes the detection and reaction timing of the vehicle.

Conclusions

The project investigated whether commonly installed aftermarket accessories and load conditions could impact a vehicle's compliance with ADR 98-01 for Autonomous Emergency Braking (AEB) systems or draft ADR 107 for Lane Keeping Systems (LKS). Testing was performed using the tests outlined in both ADRs in the baseline vehicle condition as well as in various modified states, and the results compared. The pass/fail criteria outlined in both ADRs was used to indicate whether an accessory or load condition had changed the performance of a test vehicle.

The conclusions are separated into conclusions related to the test results of each vehicle and then conclusions related to each aftermarket or load condition that was investigated.

Test Vehicles

D-Max

The Car-to-Car performance of the D-Max in the modified configurations was similar to the performance of the vehicle in the baseline Running Order configuration. This is because most impacts in the Lift Kit, Lift Kit plus Bullbar and Bullbar only configurations were below the thresholds outlined in ADR 98-01, which was the case during baseline testing. Two low speed roll-in impacts occurred above the ADR thresholds, however, these likely highlight a characteristic of the vehicle because this type of impact also occurred during baseline testing. Therefore, it is not considered that these impacts represent a change in vehicle performance attributable to the modification.

The impacts that occurred in the Lift Kit, Lift Kit plus Bullbar and Bullbar only configurations during the Car-to-Pedestrian testing with the child target were below the impact speed thresholds outlined in ADR 98-01, in-accordance with the baseline testing. The low-speed test results of each variation obtained during car-to-pedestrian testing with the child and adult targets are also similar to the baseline results, suggesting that the ability of the vehicle to detect objects on the nearside and farside has not reduced. Additionally, the child target detection and braking start time results also suggest that the height of the Bullbar above the bonnet of the vehicle has not significantly reduced the vehicle camera system's ability to identify a small target. This is an important finding because the vehicle only relies on cameras mounted at the top of the windscreen to detect objects in front of the vehicle.

Based on the Car-to-Car and Car-to-Pedestrian results, no significant changes due to either the Lift Kit or Bullbar were identified. However, observable in the Car-to-Car Rear Stationary and Car-to-Pedestrian results with the child target, is a delay in detection and braking start timings at each test speed in the Lift Kit and Lift Kit plus Bullbar configurations. These changes, whilst typically minor demonstrate that the increased height of the vehicle can have a negative effect on the vehicle response.

It was identified during the LKS testing with the D-Max that the vehicle was able to detect the line markings and change the vehicle heading, suggesting that the Rear Pitch, Lift Kit, Lift Kit plus Bullbar and Bullbar only configurations have not had a significant detrimental effect on vehicle performance. Therefore, it is unlikely that any of the variations tested would

contribute to a vehicle that is comfortably compliant with draft ADR 107 becoming non-compliant.

Ranger

Three impacts occurred during baseline Car-to-Car Rear Stationary testing that were above the limits outlined in ADR 98-01. These were characterised by a release of the brakes slightly before coming to a stop from a test speed of 40 km/h. This type of roll-in impact was also observed at the same test speed with the Bullbar, however, because this characteristic was also observed during baseline testing it is unlikely that a change in performance due to the Bullbar has occurred.

The remaining impacts observed during Car-to-Car rear stationary testing in the baseline Running Order configuration and variations were below the ADR 98-01 limits. Similarly, the impacts observed with baseline and variation configurations during the Car-to-Car Rear Moving testing performed up to 70 km/h, were also below the ADR 98-01 limit threshold. Therefore, it appears that the installation of either Bullbar has not had a significant effect on the Car-to-Car performance of the Ford Ranger. This understanding is supported by the additional Car-to-Car Rear Moving testing at 80 km/h with Both Bullbars fitted, which also identified impact speeds below the ADR 98-01 limit threshold.

A pre-collision system shutdown message on the vehicle information display was observed during testing with the Bullbar D that indicates blocking of the radar field-of-view (Figure 78). Only one instance of this message was observed during the program, however, it highlights that the Bullbar D Aluminium mesh can interrupt the vehicle's pre-collision system in such a manner that the system shuts down.



Figure 78: Ranger sensor blocked warning that was observed during testing.

Impacts during the Car-to-Pedestrian testing with the child target at the ADR speeds performed during baseline Running Order testing (20-50 km/h) with each Bullbar were at speeds below the ADR 98-01 limits. Therefore, it appears the installation of either Bullbar has not had a significant effect on the performance of the Ford Ranger. This understanding is supported by the additional Car-to-Pedestrian testing performed at 55 and 60 km/h with the Bullbar C as the impact speeds were also below the ADR 98-01 limit, however, impacts above the ADR 98-01 limits were also observed at both these test speeds with the Bullbar D fitted. This suggests that the Bullbar D could be causing a change in performance, however,

baseline testing at these speeds would need to be performed to confirm whether performance with Bullbar D fitted has changed.

No changes were observed during the low-speed Car-to-Pedestrian testing performed with the adult and child pedestrian targets travelling from the farside and nearside, during testing with the Bullbar C fitted to the vehicle. This suggests that the ability of the vehicle to identify and respond to targets towards the edge of the field-of-view has not changed.

Changes in performance were observed at the lowest test speed with the child pedestrian target traversing from the nearside and the adult pedestrian target traversing from the farside with the Bullbar D fitted to the vehicle. In these tests the vehicle was able to avoid a collision during baseline testing, however, no braking occurred with the Bullbar D fitted. Additional testing identified that this change is due to the mesh located in front of the radar. This test speed is below the minimum ADR 98-01 test speed of 20 km/h, however, represents a change in performance due to the Bullbar D.

Hilux

No impacts were observed during the Car-to-Car Rear baseline testing with either the stationary or moving vehicle targets. Impacts above and below the ADR 98-01 limit threshold occurred in the Lift Kit, Lift Kit plus Bullbar and Bullbar only configurations during the Car-to-Car Rear testing. Several of these impacts were characterised by no vehicle braking. No vehicle braking occurred during the single test performed at 75 km/h in the Car-to-Car Rear Moving scenario with the Lift Kit and the two tests performed in the same scenario at the same speed with the Bullbar fitted to the vehicle in addition to the Lift Kit. The consistency of this result suggests that the increased height of the vehicle is affecting the vehicle decision making. A similar no-braking impact was observed at the highest test speed during Car-to-Car testing with the stationary target, however, the vehicle was able to apply the brakes and significantly reduce the impact speed in the other test performed under these conditions. Two other no-braking impacts were also observed during Car-to-Car Rear Moving testing.

Three brake release results were observed during the Car-to-Car Rear Stationary testing with the Bullbar fitted. The brake release results suggest that the additional drop at the front of the vehicle that occurs during braking, with the Bullbar fitted, is enough to alter the vehicle's response. However, this conclusion is unclear because it was also identified that the OEM front suspension was missing two components that engage the dampener as the front spring is compressed, which may have contributed to the AEB deactivation.

Instances of late warning tones and/or late braking occurred in the Lift Kit, Lift Kit plus Bullbar and Bullbar only configurations, during the Car-to-Pedestrian testing with the child pedestrian target, which were not observed during the baseline Running Order testing. Many of the tests resulted in impacts, many also above the ADR 98-01 limit, with the highest number of impacts observed in the Lift Kit and Bullbar configuration. It is unclear from the results whether the Lift Kit or Bullbar is the main contributor to the large number of impacts that occurred in the Lift Kit and Bullbar configuration. Instances of late detection occurred in the three baseline tests that were excluded from the analysed Car-to-Pedestrian results due to concerns that the vehicle initialisation method adopted by the team might not be allowing full

functionality of the vehicle. Considering these results, it is possible that this is an inherently difficult test scenario for the vehicle and the instances of late detection and/or braking that occurred in the Lift Kit, Lift Kit plus Bullbar and Bullbar only testing could be similar to these baseline results. Further baseline testing with this vehicle could be performed to gain a better understanding of the effect of the Lift Kit and Bullbar during Car-to-Pedestrian child testing.

Analysis of the detection and braking start times highlights a delay in the average braking start times at all test speeds during the Car-to-Car Rear Stationary testing in the Lift Kit plus Bullbar and Bullbar only configurations, Car-to-Car Rear Moving testing in the Lift Kit, Lift Kit plus Bullbar and Bullbar only configurations and during the Car-to-Pedestrian child testing in the Lift Kit plus Bullbar configurations. The delays observed in the Lift Kit and Lift Kit plus Bullbar configurations, align with the delays observed in both Lift Kit configurations with the D-Max and further supports the conclusion that changing the height of the vehicle can delay a vehicle's response to an object in front of the vehicle.

Similar to the D-Max LKS testing, no significant detrimental changes in performance due to the Rear Pitch, Lift Kit or Lift Kit plus Bullbar configurations was observed. Noticeable in the Rear Pitch load condition results was an improvement in performance. This trend was also observed in the D-Max results. This suggests that the change in front camera angle can change the detection and reaction timing of the vehicle.

Vehicle Modifications

Lift Kit

The influence of a Lift Kit was investigated using the Isuzu D-Max and Toyota Hilux vehicles. A combination of tyres and suspension was purchased that achieve as close as possible to a 75 mm increase in height, which is the current limit in NSW before an Engineering certificate is required for approval.

The testing with the Isuzu D-Max does not highlight any significant changes in performance due to the Lift Kit. Observable in the results of two test scenarios was a minor delay in the detection and average braking start times with the Lift Kit and Lift Kit plus Bullbar fitted. Similarly, a delay in the average braking start times was observed in the results of one test scenario with the Lift Kit and three test scenarios with the Lift Kit plus Bullbar installed on the Toyota Hilux. These results indicate that the Lift Kit can influence when a vehicle responds to objects.

A significant change in performance was observed during the Car-to-Car Rear Moving testing of the Toyota Hilux in both Lift Kit configurations. At a test speed of 75 km/h, the vehicle no longer applied the brakes and impacted the target vehicle in the two tests performed. A high-speed impact twice at one test speed is enough to cause a non-compliance with ADR 98-01. A more modern vehicle that is compliant with ADR 98-01 could be less likely to see performance changes related to a Lift Kit, however, this significant change in performance suggests that a Lift Kit could affect the compliance of a vehicle compliant with ADR 98-01.

Significant changes in performance were also observed during the Car-to-Pedestrian testing with the child target, however, considering some baseline results that were initially excluded, it is also possible that this is a difficult scenario for the vehicle. Therefore, it is unclear whether the Car-to-Pedestrian child results suggest a change in performance due to the Lift Kit.

Bullbar

Minor changes in performance of the AEB systems was observed with the Bullbar B fitted to the Isuzu D-Max. The Bullbar B is wide and tall. The minor changes in performances suggest that the height of the Bullbar above the bonnet has not reduced the ability to detect smaller objects. This was important to investigate because the camera-based detection system is mounted at the top of the windscreen and, therefore, susceptible to having the field-of-view blocked by a tall Bullbar. Similarly, the pedestrian testing also confirmed that the width of the Bullbar does not appear to block the lateral field-of-view of the sensors.

The Isuzu D-Max test results suggest that it is unlikely that adding a wide and tall Bullbar to a camera only system vehicle will affect compliance with the collision avoidance requirements of ADR 98-01.

Both the Bullbars D and C fitted to the Ford Ranger moved the location of the Radar forward and downwards. The Bullbar C shifted the Radar 166.5 mm forward and 53 mm downward, whilst the Bullbar D moved the Radar 190 mm forward and 116 mm downward. Aluminium mesh is also located in front of the Radar with the Bullbar C fitted.

Minor changes in performance were observed with the Bullbar C fitted to the Ford Ranger. It was observed that the detection of objects at the lateral limit of the field-of-view changed with the Bullbar D fitted. A single deactivation of the collision avoidance system was also observed during testing with the Bullbar D, which indicates that the system has identified that the radar is blocked. These results suggest that Bullbar D is affecting the performance of the vehicle. Impacts above the ADR 98-01 limit were observed during the Car-to-Pedestrian testing at the two highest test speeds with the Bullbar D fitted. Similar high-speed impacts did not also occur with the Bullbar C fitted. Baseline testing was not performed at these speeds, therefore, it is unclear whether the Bullbar D is causing a change in performance at these speeds.

The Ford Ranger test results obtained with the C and D Bullbars suggest that relocation of the radar has had minimal effect on the results. Therefore, a similar change in radar location is unlikely to affect a similar vehicle's compliance with ADR 98-01. Testing with the mesh of the Bullbar D removed identified that mesh in front of the radar can change the field-of-view of the vehicle radar. This result, as well as the system deactivation that occurred during Car-to-Car Rear testing, indicate that mesh in front of the radar can change vehicle performance. It should be noted that these field-of-view changes occurred at a test speed that is below the test speeds outlined in ADR 98-01.

The proximity of a number plate mounted on the Bullbar C to the parking sensors suggests that installation instructions should provide clarity regarding the mounting of objects near a vehicle's sensors to ensure that a sensor is not blocked.

Changes in performance were observed with the Bullbar fitted to the Toyota Hilux. Due to uncertainty about the Car-to-Pedestrian results, the following conclusions are drawn from the Car-to-Car testing and Car-to-Pedestrian testing with the adult pedestrian. During the Car-to-Car Rear Stationary testing, three instances of the brakes releasing mid-way through the emergency braking were observed. These events suggest that the vehicle target might leave the field-of-view of the sensors under braking due to the lower initial height of the vehicle front. However, this conclusion is unclear because it was also identified that the OEM front suspension was missing two components that engage the dampener as the front spring is compressed, which may have contributed to the AEB deactivation. This type of impact occurred irregularly during testing, however, if this type of impact occurs more regularly it could impact compliance with the Car-to-Car requirements of ADR 98-01.

Two no braking impacts were observed during the Car-to-Car Rear Moving testing with the Bullbar fitted to the Hilux. This type of impact was not observed during baseline testing. Further investigation was performed to determine whether this can be attributed to the change in angle of the vehicle or the structure of the Bullbar around the radar. This testing performed with the suspension returned to the OEM height demonstrated similar results, suggesting that the changes in performance are likely due to the Bullbar structure. The frequency of this type of impact was low during testing, however, if this type of impact occurs more regularly it could impact compliance with the requirements of ADR 98-01.

Rear Pitch

Minor changes in performance were observed in the Rear Pitch configuration for both vehicles during Car-to-Car testing with a stationary and moving target. Therefore, the configuration does not appear to cause significant changes in response to a vehicle target located ahead and in the same lane. Changes in performance were observed for both vehicles during the Car-to-Pedestrian testing, however, these don't clearly suggest that the ability of the vehicle to respond to pedestrian targets towards the edge of the field-of-view, or small objects, has changed.

Antennas

No consistent changes in performance were observed with the two black or two white Antennas fitted to the vehicle during daytime LKS testing. Therefore, it appears that having one or two black or white Antennas mounted on the vehicle will have minimal effect on a vehicle's lane keeping system. The night-time Antenna testing also indicates that the reflection of light from a roof mounted spotlight shouldn't 'blind' a camera system.

Bibliography

- [1] T. Skrucany, J. Vrabel and P. Kazimir, "The influence of th cargo weight and its position on the braking characteristics of light commercial vehicles," *Open Engineering*, vol. 10, no. 1, 2020.

APPENDIX A

Summary of Isuzu D-Max Results

A. Summary of D-Max Results

A.1. Car-to-Car Rear Stationary

A.1.1. Baseline

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Impact Speed (km/h)	T(FCW) - T(AEB) (s)
0	10	5	0.727	1.087	0.641	-	0.360
0	10	6	0.738	1.116	0.653	-	0.378
0	20	1	0.93	1.335	0.714	-	0.405
0	20	2	0.946	1.28	0.636	-	0.334
0	30	1	1.255	1.567	1.012	-	0.312
0	30	2	1.324	1.563	0.838	-	0.239
0	40	1	1.265	1.615	1.787	-	0.350
0	40	2	1.296	1.646	1.655	-	0.350
0	50	1	1.294	1.683	1.465	-	0.389
0	50	2	1.224	1.724	1.163	-	0.500
0	60	1	1.242	1.77	0.069	-	0.528
0	60	2	1.242	1.809	-	5.73	0.567
-50	50	1	1.28	1.678	1.309	-	0.398
-50	50	2	1.278	1.778	1.557	-	0.500
50	50	1	1.258	1.697	1.213	-	0.439
50	50	2	1.236	1.727	0.016	-	0.491

A.1.2. GVM

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Impact Speed (km/h)	T(FCW) - T(AEB) (s)
0	10	7	0.675	1.031	0.594	-	0.356
0	10	8	0.672	1.050	0.599	-	0.378
0	20	3	0.932	1.359	0.680	-	0.427
0	20	4	0.948	1.365	0.657	-	0.417
0	30	3	1.132	1.541	1.156	-	0.409
0	30	4	1.143	1.540	1.280	-	0.397
0	40	3	1.266	1.614	1.807	-	0.348
0	40	4	1.229	1.629	1.737	-	0.400
0	50	3	1.285	1.714	1.631	-	0.429
0	50	4	1.247	1.687	1.389	-	0.440
0	60	3	1.266	1.745	0.635	-	0.479

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Impact Speed (km/h)	T(FCW) - T(AEB) (s)
0	60	4	1.324	1.804	1.159	-	0.480
-50	50	3	1.218	1.757	1.299	-	0.539
-50	50	4	1.268	1.708	1.502	-	0.440
50	50	3	1.245	1.774	1.445	-	0.529
50	50	4	1.260	1.770	1.439	-	0.510

A.1.3. Rear Pitch

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Impact Speed (km/h)	T(FCW) - T(AEB) (s)
0	10	9	0.695	1.064	0.634	-	0.369
0	10	10	0.680	1.048	0.614	-	0.368
0	30	5	1.266	1.515	0.885	-	0.249
0	30	6	1.248	1.497	1.016	-	0.249
0	50	5	1.288	1.678	1.875	-	0.390
0	50	6	1.333	1.713	1.730	-	0.380
0	60	5	1.310	1.829	0.428	-	0.519
0	60	6	1.318	1.738	0.347	-	0.420
-50	50	5	1.277	1.507	1.285	-	0.230
-50	50	6	1.191	1.481	1.096	-	0.290
50	50	5	1.295	1.764	1.258	-	0.469
50	50	6	1.330	1.659	1.621	-	0.329
50	50	7	1.295	1.722	1.466	-	0.427

A.1.4. Lift Kit

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Impact Speed (km/h)	T(FCW) - T(AEB) (s)
0	10	11	0.687	0.997	0.721	-	0.310
0	10	12	0.654	1.012	0.69	-	0.358
0	30	7	1.010	1.352	1.407	-	0.342
0	30	8	1.079	1.378	1.395	-	0.299
0	40	5	1.095	1.554	1.588	-	0.459
0	40	6	1.200	1.539	1.526	-	0.339
0	45	1	1.197	1.595	1.634	-	0.398
0	45	2	1.158	1.556	1.277	-	0.398

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Impact Speed (km/h)	T(FCW) - T(AEB) (s)
0	50	7	1.102	1.561	0.398	-	0.459
0	50	8	1.113	1.564	-	1.13	0.451
0	55	1	1.228	1.567	0.581	-	0.339
0	55	2	1.175	1.623	-	8.39	0.448
0	60	7	1.187	1.584	-	16.38	0.397
-50	50	7	1.082	1.241	-	4.50	0.159
-50	50	8	0.966	1.236	-	11.14	0.270
50	50	8	1.198	1.548	1.191	-	0.350
50	50	9	1.190	1.580	0.567	-	0.390

A.1.5. Lift Kit + Bullbar

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Impact Speed (km/h)	T(FCW) - T(AEB) (s)
0	10	1	0.645	1.024	0.373	-	0.379
0	10	2	0.627	0.981	0.358	-	0.354
0	30	1	1.114	1.414	1.292	-	0.300
0	30	2	1.077	1.365	1.294	-	0.288
0	50	1	1.122	1.582	0.353	-	0.460
0	50	2	1.164	1.564	0.799	-	0.400
0	55	1	1.200	1.649	0.259	-	0.449
0	55	2	1.172	1.599	-	2.96	0.427
0	60	1	1.156	1.605	-	12.88	0.449
0	60	2	1.218	1.666	-	8.80	0.448
-50	50	1	1.176	1.325	0.208	-	0.149
-50	50	2	1.196	1.325	0.566	-	0.129
50	50	1	1.143	1.541	0.434	-	0.398
50	50	2	1.171	1.550	0.535	-	0.379

A.1.6. Bullbar

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Impact Speed (km/h)	T(FCW) - T(AEB) (s)
0	10	3	0.769	1.019	0.434	-	0.250
0	10	4	0.758	1.028	0.406	-	0.270
0	30	3	1.176	1.466	1.253	-	0.290
0	30	4	1.124	1.474	1.135	-	0.350

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Impact Speed (km/h)	T(FCW) - T(AEB) (s)
0	50	3	1.188	1.734	1.577	-	0.546
0	50	4	1.279	1.698	1.211	-	0.419
0	55	3	1.223	1.672	1.326	-	0.449
0	55	4	1.269	1.755	0.770	-	0.486
0	60	3	1.190	1.718	-	12.08	0.528
0	60	4	1.186	1.655	-	14.53	0.469
-50	50	3	1.189	1.328	0.872	-	0.139
-50	50	4	1.195	1.244	1.142	-	0.049
50	50	3	1.257	1.676	1.167	-	0.419
50	50	4	1.226	1.675	1.106	-	0.449

A.2. Car-to-Car Rear Moving

A.2.1. Baseline

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Relative Impact Speed (km/h)	T(FCW) - T(AEB) (s)
0	30	1	0.77	1.424	0.791	-	0.654
0	30	2	0.799	1.45	0.895	-	0.651
0	30	3	0.739	1.384	0.765	-	0.645
0	40	1	1.048	1.503	0.885	-	0.455
0	40	2	1.043	1.585	0.969	-	0.542
0	40	3	1.029	1.634	0.951	-	0.605
0	50	1	0.957	1.656	1.848	-	0.699
0	50	2	0.866	1.716	0.900	-	0.850
0	60	1	1.239	1.857	1.773	-	0.618
0	60	2	1.33	1.858	1.242	-	0.528
0	70	1	1.433	1.763		3.74*	0.330
0	70	2	1.158	1.82	1.341	-	0.662
0	70	4	1.356	1.815	1.935	-	0.459
0	70	5	1.236	1.813	1.159	-	0.577
0	80	1	1.339	1.966	0.910	-	0.627
0	80	2	1.318	1.947	0.341	-	0.629
0	80	3	1.302	1.929	1.093	-	0.627

*Vehicle braking from T(AEB) released when slightly above the GST speed, driver braking to reduce impact speed.

A.2.2. GVM

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Relative Impact Speed (km/h)	T(FCW) - T(AEB) (s)
0	30	4	0.797	1.435	0.684	-	0.638
0	30	5	0.697	1.442	0.720	-	0.745
0	40	4	0.970	1.577	1.265	-	0.607
0	40	5	1.065	1.616	0.781	-	0.551
0	50	3	1.328	1.615	0.845	-	0.287
0	50	4	1.342	1.671	1.322	-	0.329
0	60	3	1.245	1.764	1.661	-	0.519
0	60	4	1.212	1.738	1.780	-	0.526
0	70	6	1.335	1.872	2.146	-	0.537

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Relative Impact Speed (km/h)	T(FCW) - T(AEB) (s)
0	70	7	1.321	1.889	1.634	-	0.568
0	80	14	1.372	2.087	1.206	-	0.715
0	80	15	1.390	1.848	1.597	-	0.458
0	80	16	1.349	1.976	1.121	-	0.627

A.2.3. Rear Pitch

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Relative Impact Speed (km/h)	T(FCW) - T(AEB) (s)
0	30	6	0.796	1.411	0.755	-	0.615
0	30	7	0.777	1.390	0.723	-	0.613
0	50	5	1.258	1.643	1.696	-	0.385
0	50	6	0.868	1.668	1.248	-	0.800
0	70	8	1.239	2.002	-	5.06*	0.763
0	70	9	1.259	1.895	2.213	-	0.636
0	70	10	1.246	2.111	1.469	-	0.865
0	70	11	1.170	1.850	0.941	-	0.680
0	75	1	1.207	2.076	0.447	-	0.869
0	75	2	1.595	2.051	-	5.88	0.456
0	80	17	1.155	1.929	-	21.24	0.774
0	80	18	1.298	1.926	-	Unknown**	0.628

*Vehicle braking from T(AEB) released when slightly above the GST speed, driver braking to reduce impact speed.

**Impact speed is unknown due to driver braking. Driver braking was used to prevent a high speed impact.

A.2.4. Lift Kit

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Relative Impact Speed (km/h)	T(FCW) - T(AEB) (s)
0	30	9	0.850	1.487	0.753	-	0.637
0	30	10	0.795	1.388	0.852	-	0.593
0	50	7	1.001	1.691	1.468	-	0.690
0	50	8	1.243	1.642	1.405	-	0.399
0	70	13	1.391	1.761	-	8.32*	0.370
0	70	14	1.385	1.805	2.398	-	0.420
0	70	15	1.196	1.864	0.392	-	0.668

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Relative Impact Speed (km/h)	T(FCW) - T(AEB) (s)
0	75	3	1.268	1.808	1.109	-	0.540
0	75	4	1.350	1.839	2.342	-	0.489
0	80	19	1.306	1.856	0.357	-	0.550
0	80	20	1.274	2.004	-	17.40	0.730
0	80	21	1.287	2.106	-	4.16	0.819

*Vehicle braking from T(AEB) released when slightly above the GST speed, driver braking to reduce impact speed.

A.2.5. Lift Kit + Bullbar

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Relative Impact Speed (km/h)	T(FCW) - T(AEB) (s)
0	30	1	0.716	1.361	0.593	-	0.645
0	30	2	0.774	1.423	0.659	-	0.649
0	45	1	1.075	1.372	1.697	-	0.297
0	45	2	1.0762	1.358	1.916	-	0.282
0	50	1	1.366	1.664	-	4.90*	0.298
0	50	3	1.165	1.691	1.955	-	0.526
0	50	4	0.915	1.750	1.186	-	0.835
0	55	1	1.238	1.788	2.264	-	0.550
0	55	2	1.301	1.639	2.307	-	0.338
0	55	3	1.385	1.635	-	5.27*	0.250
0	60	1	1.182	1.769	1.724	-	0.587
0	60	2	1.340	1.808	2.311	-	0.468
0	70	1	1.249	1.787	1.665	-	0.538
0	70	2	1.303	1.771	1.412	-	0.468
0	75	1	1.267	1.807	0.961	-	0.540
0	75	3	1.248	1.827	1.146	-	0.579
0	80	1	1.309	1.938	0.732	-	0.629
0	80	2	1.332	1.930	1.086	-	0.598

*Vehicle braking from T(AEB) released when slightly above the GST speed, driver braking to reduce impact speed.

A.2.6. Bullbar

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Relative Impact Speed (km/h)	T(FCW) - T(AEB) (s)
0	30	3	0.734	1.296	0.432	-	0.562
0	30	4	0.816	1.317	0.415	-	0.501
0	50	5	1.263	1.602	1.376	-	0.339
0	50	6	1.248	1.656	1.96	-	0.408
0	70	3	1.328	1.819	1.581	-	0.491
0	70	4	1.338	1.807	1.276	-	0.469
0	75	4	1.241	1.721	0.615	-	0.480
0	75	5	1.171	1.751	0.273	-	0.580
0	80	3	1.161	2.038	-	15.53	0.877
0	80	4	1.256	1.885	0.237	-	0.629
0	80	5	1.299	1.968	0.592	-	0.669

A.3. Car-to-Pedestrian Nearside Child 50%

A.3.1. Baseline

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
10	2	0.165	NB	-	9.02	-0.013	
10	4	0.210	NB	-	9.05	0.006	
15	1	0.840	0.782	0.468	-	-0.001	
15	2	0.778	0.729	0.734	-	0.000	
20	1	0.972	0.873	0.408	-	0.011	
20	3	0.898	0.859	0.758	-	0.022	
30	1	1.360	1.251	0.962	-	-0.076	
30	2	1.357	1.248	0.978	-	-0.069	
40	1	1.127	1.088	1.394	-	0.052	
40	2	1.288	1.239	1.742	-	0.126*	
40	3	1.237	1.168	1.703	-	0.087	
50	1	1.251	1.202	0.902	-	0.034	
50	3	1.328	1.229	1.493	-	0.089	
60	1	1.320	1.300	0.688	-	-0.098	
60	2	1.358	1.317	0.891	-	-0.131*	

*Impact offset greater than 0.1 metres, therefore, not used for analysis.

A.3.2. GVM

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
10	5	0.207	NB	-	8.93	-0.029	
10	6	0.584	0.525	0.325	-	0.003	
10	9	0.224	NB	-	8.95	-0.014	
10	11	0.094	NB	-	8.95	-0.002	
10	12	0.111	NB	-	9.03	-0.028	
15	4	0.594	0.495	0.023	-	-0.005	
15	6	0.599	0.491	0.054	-	0.009	
20	4	0.904	0.776	1.010	-	-0.017	
20	7	0.981	0.843	0.914	-	-0.011	
30	3	1.215	1.156	1.400	-	0.023	
30	4	1.264	1.155	1.411	-	-0.004	
40	4	1.360	1.262	1.828	-	-0.020	
40	5	1.349	1.260	1.760	-	-0.060	

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
50	4	1.416	1.326	2.064	-	0.114*	
50	5	1.306	1.227	1.363	-	0.063	
50	6	1.258	1.219	1.580	-	0.090	
60	3	1.126	1.036	-	26.53	-0.100	
60	5	1.390	1.310	0.673	-	-0.067	
60	6	1.347	1.257	0.126	-	-0.077	

*Impact offset greater than 0.1 metres, therefore, not used for analysis.

A.3.3. Rear Pitch

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
10	19	0.227	NB	-	9.02	-0.002	
15	10	0.756	0.698	0.634	-	0.014	
15	11	0.590	0.522	0.360	-	-0.005	
15	13	0.884	0.765	0.537	-	0.004	
20	10	0.935	0.817	1.065	-	-0.017	
20	11	0.896	0.837	0.824	-	0.01	
30	7	1.331	1.232	1.173	-	0.01	
30	8	1.364	1.255	1.370	-	0.025	
50	10	1.186	1.147	1.169	-	-0.053	
50	11	1.332	1.303	1.451	-	0.015	
50	12	1.377	1.298	1.803	-	-0.101*	
60	11	1.379	1.349	0.995	-	0.072	
60	12	1.424	1.334	1.005	-	0.014	

*Impact offset greater than 0.1 metres, therefore, not used for analysis.

A.3.4. Lift Kit

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
10	20	NF	NB	-	9.08	0.004	
10	21	NF	NB	-	9.05	-0.005	
15	14	0.728	0.670	0.568	-	-0.005	
15	15	0.743	0.635	0.529	-	-0.005	
20	12	0.854	0.805	0.833	-	0.004	
20	13	0.880	0.760	0.792	-	-0.003	

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
30	9	1.174	1.074	1.308	-	0.004	
30	10	1.207	1.098	1.342	-	0.012	
50	13	1.211	1.121	0.936	-	0.014	
50	14	1.258	1.158	0.797	-	-0.006	
55	1	1.173	1.133	0.113	-	-0.049	
55	2	1.299	1.199	0.469	-	-0.081	
55	3	1.254	1.164	0.190	-	-0.003	
60	13	1.239	1.159	-	14.93	-0.022	
60	14	1.275	1.185	-	14.47	-0.073	

A.3.5. Lift Kit + Bullbar

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
10	1	0.338	NB	-	8.98	-0.012	
10	2	0.404	NB	-	8.93	-0.026	
15	1	0.655	0.585	0.118	-	-0.007	
15	2	0.766	0.717	0.359	-	-0.004	
15	3	0.752	0.695	0.449	-	-0.005	
20	1	0.863	0.804	0.764	-	-0.005	
20	2	0.835	0.726	0.578	-	0.000	
30	1	1.095	0.995	1.411	-	-0.005	
30	2	1.206	1.117	1.224	-	-0.004	
30	3	1.110	1.021	1.446	-	-0.008	
50	1	1.248	1.158	1.057	-	0.008	
50	2	1.214	1.124	0.601	-	-0.016	
55	1	1.046	0.956	-	23.6	0.025	
55	2	1.131	1.111	-	13.42	-0.005	
60	1	1.220	1.120	-	19.58	-0.018	
60	2	1.193	1.103	-	18.58	-0.001	

A.3.6. Bullbar

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
10	3	0.281	NB	-	8.85	-0.006	
10	4	0.387	0.228	-	8.24	-0.041	

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
10	5	0.371	0.142	-	8.84	0.000	
15	4	0.720	0.621	0.228	-	-0.002	
15	5	0.811	0.742	0.412	-	-0.019	
20	4	1.010	0.920	0.443	-	0.009	
20	5	0.915	0.867	0.853	-	-0.002	
30	4	1.287	1.238	0.846	-	0.028	
30	5	1.324	1.234	1.076	-	-0.031	
50	3	1.340	1.301	1.494	-	0.016	
50	4	1.335	1.306	1.452	-	-0.073	
55	3	1.270	1.241	1.122	-	-0.007	
55	4	1.283	1.194	0.395	-	0.039	
60	3	1.161	1.122	-	14.55	-0.045	
60	4	1.313	1.283	1.031	-	0.069	
60	5	1.259	1.229	0.510	-	0.029	

A.4. Car-to-Pedestrian Farside Adult 50%

A.4.1. Baseline

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
10	1	0.000	NB	-	8.96	0.028	
10	2	NF	NB	-	9.05	0.023	
15	1	0.190	0.15	-	13.27	0.019	
15	2	NF	NB	-	13.99	0.013	
20	1	0.716	0.626	0.409	-	-0.031	
20	2	0.473	0.364	-	13.6	0.002	
20	4	0.399	0.349	-	14.49	-0.027	
25	1	1.130	1.040	1.505	-	-0.022	
25	4	1.051	1.011	1.687	-	-0.040	
30	1	1.208	1.118	1.671	-	0.047	
30	2	1.218	1.168	1.590	-	0.013	
40	1	1.347	1.257	2.148	-	-0.012	
40	2	1.303	1.254	2.431	-	0.059	
50	1	1.283	1.193	2.154	-	0.026	
50	2	1.271	1.180	1.770	-	0.050	
60	1	1.237	1.208	0.913	-	0.061	
60	2	1.314	1.234	0.963	-	-0.067	

A.4.2. GVM

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
15	3	NF	NB	-	13.99	0.000	
15	4	0.103	0.054	-	13.75	0.021	
15	5	0.037	NB	-	13.95	0.009	
20	6	0.253	0.193	-	17.81	0.025	
20	7	0.322	0.272	-	16.93	0.000	
25	5	1.020	0.99	1.620	-	-0.008	
25	7	1.052	1.013	1.700	-	-0.041	
30	3	1.134	1.085	1.848	-	-0.006	
30	4	1.227	1.168	1.709	-	-0.002	
40	3	1.235	1.195	2.458	-	0.151*	
40	4	1.306	1.267	2.163	-	-0.004	
50	3	1.224	1.195	1.836	-	0.019	

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
50	4	1.229	1.149	1.692	-	0.044	
60	3	1.248	1.169	0.331	-	-0.088	
60	4	1.287	1.208	0.602	-	-0.107*	

*Impact offset greater than 0.1 metres, therefore, not used for analysis.

A.4.3. Rear Pitch

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
15	8	0.107	NB	-	14.04	0.002	
15	10	NF	NB	-	14.00	-0.002	
20	12	0.259	0.159	-	18.30	0.006	
20	13	0.251	0.192	-	18.07	-0.005	
25	10	1.087	0.988	1.308	-	-0.005	
25	11	1.104	0.995	1.333	-	-0.022	
30	7	1.251	1.202	1.729	-	0.022	
30	8	1.247	1.188	1.489	-	-0.014	
50	8	1.368	1.278	2.201	-	-0.034	
50	9	1.379	1.289	2.244	-	-0.089	
60	8	1.242	1.162	0.327	-	-0.083	
60	9	1.321	1.231	0.830	-	-0.003	

A.4.4. Lift Kit

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
15	11	NF	NB	-	14.14	-0.019	
15	12	NF	NB	-	14.10	-0.017	
20	14	0.758	0.709	0.914	-	0.025	
20	15	0.280	0.210	-	17.33	-0.007	
20	16	0.392	0.322	-	13.98	0.005	
25	12	0.881	0.832	1.225	-	-0.010	
25	13	0.996	0.896	1.445	-	-0.011	
25	14	0.934	0.876	1.201	-	0.022	
30	9	1.115	1.056	1.558	-	-0.032	
30	10	0.963	0.914	1.173	-	-0.019	
30	11	1.141	1.042	1.457	-	0.024	

A.4.5. Lift Kit + Bullbar

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
15	1	0.238	0.138	-	13.66	0.011	
15	2	0.236	0.116	-	13.75	0.021	
20	1		0.679	0.446	-	-	FCW tone emitted but not detected. Not used for FCW analysis.
20	2	0.670	0.611	0.113	-	0.007	
20	3	0.592	0.543	-	8.89	0.002	
25	1	1.012	0.912	1.136	-	0.005	
25	2	0.947	0.887	1.166	-	0	
30	1	1.049	1.000	1.529	-	0.001	
30	2	1.030	0.991	1.374	-	-0.001	

A.4.6. Bullbar

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
15	3	0.270	0.210	-	13.38	0.010	
15	4	0.206	0.106	-	13.75	-0.006	
20	4	0.907	0.818	0.788	-	-0.001	
20	5	0.848	0.789	1.035	-	0.014	
30	3	1.206	1.167	1.328	-	0.008	
30	4	1.280	1.229	1.408	-	-0.027	

A.5. Lane Keeping Systems

A.5.1. GVM

Line Marking & Direction	Lateral Velocity (m/s)	Run No.	Minimum DTLE (m)
SLN-D	0.1	6	-0.018
SLN-D	0.1	9	-0.005
SLN-D	0.1	10	0.002
SLN-D	0.2	2	0.054
SLN-D	0.2	3	0.090
SLN-D	0.2	4	-0.153
SLN-D	0.5	2	-0.246
SLN-D	0.5	3	-0.215
SLN-D	0.5	7	-0.305
SLN-P	0.1	7	0.165
SLN-P	0.1	8	0.125
SLN-P	0.1	9	0.167
SLN-P	0.2	1	0.084
SLN-P	0.2	2	0.128
SLN-P	0.2	3	0.106
SLN-P	0.5	1	-0.288
SLN-P	0.5	2	-0.280
SLN-P	0.5	3	-0.259
DLN-D	0.1	2	-0.024
DLN-D	0.1	4	-0.031
DLN-D	0.1	7	-0.036
DLN-D	0.2	4	-0.006
DLN-D	0.2	5	-0.022
DLN-D	0.2	6	0.008
DLN-D	0.5	1	-0.273
DLN-D	0.5	2	-0.259
DLN-D	0.5	3	-0.268
DLN-P	0.1	4	0.149
DLN-P	0.1	5	0.159
DLN-P	0.1	6	0.164
DLN-P	0.2	1	0.074
DLN-P	0.2	2	0.016
DLN-P	0.2	3	0.011
DLN-P	0.5	3	-0.071

DLN-P	0.5	4	-0.060
DLN-P	0.5	5	-0.051

A.5.2. GVM (Night)

Line Marking & Direction	Lateral Velocity (m/s)	Run No.	Minimum DTLE (m)
SLN-D	0.2	10	-0.069
SLN-D	0.2	11	-0.075
SLN-D	0.2	12	-0.061
SLN-D	0.5	18	-0.361
SLN-D	0.5	21	-0.359
SLN-D	0.5	22	-0.393
SLN-P	0.2	4	0.094
SLN-P	0.2	5	0.094
SLN-P	0.2	6	0.07
SLN-P	0.5	4	-0.331
SLN-P	0.5	5	-0.276
SLN-P	0.5	6	-0.278
DLN-D	0.2	12	-0.046
DLN-D	0.2	13	-0.035
DLN-D	0.2	14	-0.047
DLN-D	0.5	8	-0.299
DLN-D	0.5	10	-0.292
DLN-D	0.5	11	-0.277
DLN-P	0.2	13	0.139
DLN-P	0.2	14	0.127
DLN-P	0.2	15	0.103
DLN-P	0.5	9	-0.054
DLN-P	0.5	11	0.000
DLN-P	0.5	12	-0.020

A.5.3. Rear Pitch

Line Marking & Direction	Lateral Velocity (m/s)	Run No.	Minimum DTLE (m)
SLN-D	0.1	11	0.065
SLN-D	0.1	12	0.068
SLN-D	0.1	13	0.060
SLN-D	0.2	13	-0.011
SLN-D	0.2	14	-0.019
SLN-D	0.2	15	0.076
SLN-D	0.5	23	-0.233
SLN-D	0.5	24	-0.296
SLN-D	0.5	25	-0.234
SLN-P	0.1	10	0.232
SLN-P	0.1	12	0.221
SLN-P	0.1	13	0.212
SLN-P	0.2	7	0.165
SLN-P	0.2	8	0.173
SLN-P	0.2	10	0.163
SLN-P	0.5	7	-0.145
SLN-P	0.5	8	-0.112
SLN-P	0.5	9	-0.133
DLN-D	0.1	9	0.028
DLN-D	0.1	10	0.081
DLN-D	0.1	11	0.091
DLN-D	0.2	15	0.045
DLN-D	0.2	16	0.026
DLN-D	0.2	17	0.054
DLN-D	0.5	12	-0.285
DLN-D	0.5	13	-0.26
DLN-D	0.5	14	-0.262
DLN-P	0.1	7	0.119
DLN-P	0.1	8	0.173
DLN-P	0.1	9	0.181
DLN-P	0.2	18	0.157
DLN-P	0.2	19	0.137
DLN-P	0.2	20	0.147
DLN-P	0.5	14	0.014
DLN-P	0.5	15	-0.015
DLN-P	0.5	16	0.021

A.5.4. Lift Kit

Line Marking & Direction	Lateral Velocity (m/s)	Run No.	Minimum DTLE (m)
SLN-D	0.1	14	0.062
SLN-D	0.1	15	0.036
SLN-D	0.1	16	0.054
SLN-D	0.2	17	0.008
SLN-D	0.2	18	-0.011
SLN-D	0.2	19	-0.033
SLN-D	0.5	31	-0.274
SLN-D	0.5	32	-0.269
SLN-D	0.5	33	-0.241
SLN-P	0.2	11	0.099
SLN-P	0.2	13	0.090
SLN-P	0.2	14	0.087
SLN-P	0.5	12	-0.248
SLN-P	0.5	13	-0.293
SLN-P	0.5	14	-0.271
DLN-D	0.1	13	0.112
DLN-D	0.1	14	0.107
DLN-D	0.1	15	0.094
DLN-D	0.2	18	0.045
DLN-D	0.2	19	0.008
DLN-D	0.2	20	-0.012
DLN-D	0.5	16	-0.274
DLN-D	0.5	17	-0.234
DLN-D	0.5	18	-0.269
DLN-P	0.2	28	0.115
DLN-P	0.2	29	0.141
DLN-P	0.2	30	0.133
DLN-P	0.5	17	-0.026
DLN-P	0.5	18	-0.084
DLN-P	0.5	19	0.001

A.5.5. Lift Kit + Bullbar

Line Marking & Direction	Lateral Velocity (m/s)	Run No.	Minimum DTLE (m)
SLN-D	0.1	3	0.161
SLN-D	0.1	4	0.111
SLN-D	0.1	5	0.101
SLN-D	0.2	1	0.082
SLN-D	0.2	2	0.033
SLN-D	0.2	4	0.071
SLN-D	0.5	1	-0.217
SLN-D	0.5	2	-0.232
SLN-D	0.5	3	-0.238
SLN-P	0.5	1	-0.276
SLN-P	0.5	2	-0.218
SLN-P	0.5	3	-0.299
DLN-D	0.1	1	0.086
DLN-D	0.1	2	0.015
DLN-D	0.1	3	0.058
DLN-D	0.2	1	0.039
DLN-D	0.2	2	-0.030
DLN-D	0.2	3	0.092
DLN-D	0.5	1	-0.252
DLN-D	0.5	2	-0.271
DLN-D	0.5	3	-0.241
DLN-P	0.5	1	0.053
DLN-P	0.5	2	0.001
DLN-P	0.5	3	-0.036

A.5.6. Bullbar

Line Marking & Direction	Lateral Velocity (m/s)	Run No.	Minimum DTLE (m)
SLN-D	0.5	4	-0.404
SLN-D	0.5	5	-0.351
SLN-D	0.5	6	-0.373
SLN-D	0.5	7	-0.411
SLN-P	0.1	16	0.288
SLN-P	0.1	17	0.318
SLN-P	0.1	18	0.286
SLN-P	0.2	7	0.154
SLN-P	0.2	8	0.151
SLN-P	0.2	9	0.138
SLN-P	0.5	6	-0.274
SLN-P	0.5	7	-0.225
SLN-P	0.5	8	-0.191
DLN-D	0.5	9	-0.392
DLN-D	0.5	10	-0.387
DLN-D	0.5	11	-0.459
DLN-P	0.1	4	0.087
DLN-P	0.1	5	0.110
DLN-P	0.1	6	0.173
DLN-P	0.2	3	0.073
DLN-P	0.2	4	0.093
DLN-P	0.2	8	0.107
DLN-P	0.5	9	0.031
DLN-P	0.5	10	0.023
DLN-P	0.5	11	-0.002

A.5.7. Antennas**A.5.8. White Antennas**

Line Marking & Direction	Lateral Velocity (m/s)	Run No.	Minimum DTLE (m)
SLN-D	0.5	8	-0.399
SLN-D	0.5	9	-0.403
SLN-D	0.5	10	-0.410
SLN-P	0.1	10	0.108
SLN-P	0.1	11	0.130
SLN-P	0.1	14	0.151
SLN-P	0.2	10	0.180
SLN-P	0.2	11	0.187
SLN-P	0.2	12	0.172
SLN-P	0.5	15	-0.190
SLN-P	0.5	16	-0.146
SLN-P	0.5	17	-0.144
DLN-D	0.5	12	-0.486
DLN-D	0.5	13	-0.394
DLN-D	0.5	14	-0.347
DLN-D	0.5	15	-0.309
DLN-P	0.1	7	0.256
DLN-P	0.1	8	0.099
DLN-P	0.1	9	0.150
DLN-P	0.2	1	0.114
DLN-P	0.2	2	0.128
DLN-P	0.2	11	0.087
DLN-P	0.5	6	0.041
DLN-P	0.5	7	0.041
DLN-P	0.5	8	0.090

A.5.9. Black Antennas

Line Marking & Direction	Lateral Velocity (m/s)	Run No.	Minimum DTLE (m)
SLN-D	0.5	11	-0.355
SLN-D	0.5	12	-0.427
SLN-D	0.5	14	-0.402
SLN-D	0.5	15	-0.389
SLN-P	0.1	19	0.236
SLN-P	0.1	21	0.263
SLN-P	0.1	23	0.214
SLN-P	0.2	4	0.124
SLN-P	0.2	5	0.144
SLN-P	0.2	6	0.131
SLN-P	0.5	18	-0.199
SLN-P	0.5	19	-0.188
SLN-P	0.5	20	-0.181
DLN-D	0.5	6	-0.315
DLN-D	0.5	7	-0.367
DLN-D	0.5	8	-0.303
DLN-P	0.1	1	0.202
DLN-P	0.1	2	0.148
DLN-P	0.1	3	0.229
DLN-P	0.2	5	0.105
DLN-P	0.2	6	0.148
DLN-P	0.2	7	0.105
DLN-P	0.5	12	0.063
DLN-P	0.5	13	0.068
DLN-P	0.5	14	0.102

A.5.10.White Antennas (Night)

Line Marking & Direction	Lateral Velocity (m/s)	Run No.	Minimum DTLE (m)
SLN-D	0.2	7	-0.084
SLN-D	0.2	9	-0.027
SLN-P	0.2	14	0.141
SLN-P	0.2	15	0.137
SLN-P	0.5	21	-0.242
SLN-P	0.5	22	-0.273
DLN-D	0.2	5	-0.045
DLN-D	0.2	6	-0.042
DLN-P	0.2	14	0.108
DLN-P	0.2	18	0.081

A.6. Car-to-Car Warning Tone Analysis

A.6.1. Car-to-Car Rear Stationary

A.6.1.1. Table 1

Test Details		Running Order	Rear Pitch		Lift	
Speed	Offset (%)	Avg.	Avg.	Change	Avg.	Change
10	0	0.37	0.37	0.00	0.33	-0.04
20	0	0.37				
30	0	0.28	0.25	-0.03	0.32	0.05
40	0	0.35			0.40	0.05
50	0	0.44	0.39	-0.06	0.46	0.01
60	0	0.55	0.47	-0.08	0.40	-0.15
50	50	0.47	0.41	-0.06	0.37	-0.10
50	-50	0.45	0.26	-0.19	0.21	-0.23

Value Highlights a change in average time difference to the baseline Running Order that is greater than 0.1 seconds.

A.6.1.2. Table 2

Test Details		Running Order	Lift + Bullbar		Bullbar	
Speed	Offset (%)	Avg.	Avg.	Change	Avg.	Change
10	0	0.37	0.37	0.00	0.26	-0.11
20	0	0.37				
30	0	0.28	0.29	0.02	0.32	0.04
40	0	0.35				
50	0	0.44	0.43	-0.01	0.48	0.04
60	0	0.55	0.45	-0.10	0.50	-0.05
50	50	0.47	0.39	-0.08	0.43	-0.03
50	-50	0.45	0.14	-0.31	0.09	-0.36

Value Highlights a change in average time difference to the baseline Running Order that is greater than 0.1 seconds.

A.6.2. Car-to-Car Moving

A.6.2.1. Table 1

Test Details		Running Order	Rear Pitch		Lift	
Speed	Offset (%)	Avg.	Avg.	Change	Avg.	Change
30	0	0.65	0.61	-0.04	0.62	-0.03
40	0	0.53				
50	0	0.77	0.59	-0.18	0.54	-0.23
60	0	0.57				
70	0	0.51	0.74	0.23	0.49	-0.02
80	0	0.63	0.70	0.07	0.70	0.07

Value Highlights a change in average time difference to the baseline Running Order that is greater than 0.1 seconds.

A.6.2.2. Table 2

Test Details		Running Order	Lift + Bar		Bullbar	
Speed	Offset (%)	Avg.	Avg.	Change	Avg.	Change
30	0	0.65	0.65	0.00	0.53	-0.12
40	0	0.53				
50	0	0.77	0.55	-0.22	0.37	-0.40
60	0	0.57	0.53	-0.05		
70	0	0.51	0.50	0.00	0.48	-0.03
80	0	0.63	0.61	-0.01	0.73	0.10

Value Highlights a change in average time difference to the baseline Running Order that is greater than 0.1 seconds.

APPENDIX B

Summary of Ford Ranger Results

B. Summary of Ranger Results

B.1. Car-to-Car Rear Stationary

B.1.1. Baseline

Offset	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Impact Speed (km/h)	T(FCW) – T(AEB)
0	10	1	0.700	0.728	0.881	-	0.028
0	10	2	0.734	0.742	0.932	-	0.008
0	20	1	0.888	0.879	1.338	-	-0.009
0	20	2	0.920	0.939	1.301	-	0.019
0	30	1	1.213	1.213	1.56	-	0.000
0	30	2	1.213	1.232	1.578	-	0.019
0	35	1	1.341	1.341	0.659	-	0.000
0	35	2	1.342	1.323	0.641	-	-0.019
0	40	1	1.475	1.504	-	1.27*	0.029
0	40	2	1.480	1.349	-	1.16*	-0.131
0	40	3	1.406	1.415	-	1.82	0.009
0	42	4	1.389	1.428	0.407	-	0.039
0	42	5	1.411	1.500	0.472	-	0.089
0	45	1	1.424	1.434	0.445	-	0.010
0	45	2	1.434	1.378	0.468	-	-0.056
0	50	1	1.385	1.385	0.745	-	0.000
0	50	2	1.336	1.526	0.602	-	0.190
0	50	3	1.415	1.424	0.823	-	0.009
0	55	1	1.185	1.605	-	11.01	0.420
0	55	7	1.336	1.317	-	9.67	-0.019
0	60	1	1.285	1.774	-	20.59	0.489
-50	40	1	1.249	1.268	0.77	-	0.019
-50	40	2	1.194	1.101	0.319	-	-0.093
-50	40	3	1.228	1.190	0.606	-	-0.038
50	40	1	1.192	1.242	0.725	-	0.050
50	40	2	1.186	1.275	0.396	-	0.089

*Vehicle braking from T(AEB) released when slightly above the GST speed, driver braking to reduce impact speed. The impact speed is estimated based on the speed when the driver applied the brakes.

B.1.2. GVM

Offset	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Impact Speed (km/h)	T(FCW) – T(AEB)
0	10	3	0.698	0.717	0.742	-	0.019
0	10	4	0.688	0.736	0.753	-	0.048
0	20	3	0.882	0.882	1.212	-	0.000
0	20	4	0.879	0.888	0.992	-	0.009
0	30	5	1.145	1.204	1.250	-	0.059
0	30	6	1.144	1.144	1.249	-	0.000
0	40	4	1.326	1.547	0.557	-	0.221
0	40	5	1.414	1.424	1.119	-	0.010
0	40	6	1.308	1.407	0.575	-	0.099
0	50	4	1.377	1.526	0.493	-	0.149
0	50	5	1.363	1.533	0.255	-	0.170
0	55	8	1.272	1.651	0.018	-	0.379
0	55	9	1.271	1.600	-	13.60	0.329
0	60	2	1.251	1.750	-	24.81	0.499
-50	40	5	1.179	1.208	0.490	-	0.029
-50	40	6	1.194	1.175	0.741	-	-0.019
50	40	3	1.11	1.279	1.707	-	0.169
50	40	4	1.092	1.201	0.657	-	0.109

B.1.3. Ironman Bullbar

Offset	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Impact Speed (km/h)	T(FCW) – T(AEB)
0	10	1	0.769	0.760	0.817	-	-0.009
0	10	2	0.813	0.813	0.904	-	0.000
0	30	1	1.205	1.195	1.713	-	-0.010
0	30	2	1.207	1.217	1.573	-	0.010
0	35	1	1.304	1.354	0.558	-	0.050
0	35	2	1.316	1.335	0.517	-	0.019
0	40	1	1.489	1.499	0.611	-	0.010
0	40	2	1.538	1.596	-	2.36	0.058
0	42	3	1.455	1.533	0.711	-	0.078
0	42	4	1.364	1.336	0.618	-	-0.028
0	42	5	1.461	1.499	0.521	-	0.038
0	45	1	1.289	1.509	0.770	-	0.220

Offset	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Impact Speed (km/h)	T(FCW) – T(AEB)
0	45	2	1.439	1.459	0.454	-	0.020
0	50	1	1.235	1.584	0.386	-	0.349
0	50	2	1.218	1.587	0.280	-	0.369
0	55	2	1.210	1.618	-	12.06	0.408
0	55	3	1.274	1.624	-	12.51	0.350
0	60	1	1.165	1.684	-	20.43	0.519
0	60	2	1.125	1.705	-	17.66	0.580
-50	40	1	1.315	1.394	0.725	-	0.079
-50	40	2	1.350	1.350	0.730	-	0.000
50	40	1	1.110	1.169	0.705	-	0.059
50	40	2	1.212	1.202	0.729	-	-0.010
50	40	3	1.098	1.178	0.877	-	0.080

B.1.4. Tuff Bullbar

Offset	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Impact Speed (km/h)	T(FCW) – T(AEB)
0	10	2	0.803	0.785	0.811	-	-0.018
0	10	3	0.769	0.827	0.738	-	0.058
0	30	1	1.191	1.220	1.878	-	0.029
0	30	2	1.220	1.259	1.635	-	0.039
0	40	1	1.450	1.431	0.541	-	-0.019
0	40	3	1.417	1.485	0.521	-	0.068
0	50	1	1.388	1.558	0.964	-	0.170
0	50	2	1.389	1.568	0.539	-	0.179
0	55	1	1.343	1.592	0.100	-	0.249
0	55	2	1.332	1.661	-	4.55	0.329
0	60	1	1.287	1.727	-	13.75	0.440
0	60	2	1.319	1.798	-	17.87	0.479
-50	40	1	1.040	1.119	1.294	-	0.079
-50	40	2	1.204	1.224	0.730	-	0.020
-50	40	3	1.145	1.155	0.881	-	0.010
50	40	1	1.215	1.444	0.841	-	0.229
50	40	2	1.237	1.366	0.78	-	0.129
50	40	3	1.225	1.364	0.433	-	0.139

B.2. Car-to-Car Rear Moving

B.2.1. Baseline

Offset	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Relative Impact Speed (km/h)	T(FCW) – T(AEB)
0	30	1	0.714	0.975	0.873	-	0.261
0	30	2	0.715	1.013	0.872	-	0.298
0	40	1	0.922	1.164	1.535	-	0.242
0	40	2	0.876	1.219	1.531	-	0.343
0	50	1	1.192	1.432	1.070	-	0.240
0	50	2	1.171	1.391	1.113	-	0.220
0	60	1	1.271	1.601	1.095	-	0.330
0	60	2	1.237	1.567	1.059	-	0.330
0	70	1	1.253	1.799	0.005	-	0.546
0	70	2	1.202	1.772	-	3.41	0.570
0	75	1	1.249	1.816	-	18.15	0.567

B.2.2. GVM

Offset	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Relative Impact Speed (km/h)	T(FCW) – T(AEB)
0	30	3	0.687	0.959	0.728	-	0.272
0	30	4	0.706	1.048	0.790	-	0.342
0	40	3	0.866	1.174	1.295	-	0.308
0	40	5	0.916	1.172	1.355	-	0.256
0	50	3	1.174	1.432	1.155	-	0.258
0	50	4	1.210	1.349	1.209	-	0.139
0	60	3	1.317	1.635	1.114	-	0.318
0	60	4	1.296	1.644	0.949	-	0.348
0	65	1	1.218	1.667	0.048	-	0.449
0	65	2	1.258	1.725	0.411	-	0.467
0	70	3	1.277	1.736	-	11.30	0.459
0	70	4	1.289	1.747	-	14.03	0.458

B.2.3. Ironman Bullbar

Offset	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Relative Impact Speed (km/h)	T(FCW) – T(AEB)
0	30	1	0.674	0.973	0.751	-	0.299
0	30	2	0.702	1.016	0.821	-	0.314
0	50	1	1.204	1.372	1.033	-	0.168
0	50	2	1.213	1.423	1.009	-	0.210
0	65	1	1.194	1.652	0.838	-	0.458
0	65	2	1.179	1.478	1.397	-	0.299
0	70	1	1.186	1.813	-	8.98	0.627
0	70	2	1.262	1.760	-	8.16	0.498
0	80	1	1.103	2.201	-	15.53	1.098
0	80	2	1.256	2.224	-	23.14	0.968

B.2.4. Tuff Bullbar

Offset	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Relative Impact Speed (km/h)	T(FCW) – T(AEB)
0	30	1	0.682	0.970	0.751	-	0.288
0	30	2	0.633	0.981	0.624	-	0.348
0	50	1	1.210	1.389	0.942	-	0.179
0	50	2	1.156	1.404	1.426	-	0.248
0	65	1	1.194	1.692	1.142	-	0.498
0	65	2	1.215	1.662	0.965	-	0.447
0	65	3	1.268	1.644	0.739	-	0.376
0	65	4	1.166	1.703	1.033	-	0.537
0	70	1	1.238	1.825	-	7.56	0.587
0	70	2	1.259	1.809	-	2.70	0.550
0	80	1	1.273	2.217	-	22.27	0.944
0	80	2	1.287	2.173	-	21.38	0.886

B.3. Car-to-Pedestrian Nearside Child 50%

B.3.1. Baseline

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
10	2	0.81	0.857	1.249	-	0.079	
10	3	0.774	0.774	0.981	-	-0.084	
15	1	0.785	0.794	1.339	-	-0.031	
15	2	0.81	0.751	1.223	-	0.021	
20	1	0.936	0.877	1.541	-	0.000	
20	3	0.95	0.911	1.527	-	0.004	
30	1	1.118	1.068	1.304	-	-0.018	
30	2	1.045	1.045	1.395	-	-0.018	
40	1	1.153	1.143	1.319	-	0.034	
40	2	1.095	1.105	0.963	-	0.026	
45	1	1.093	1.003	0.329	-	0.017	
45	3	1.118	1.068	1.021	-	-0.002	
50	1	1.193	1.164	-	29.13	-0.021	

B.3.2. GVM

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
10	4	0.621	0.603	0.493	-	0.062	
10	5	0.683	0.701	0.757	-	0.033	
20	4	0.987	0.877	1.260	-	-0.006	
20	5	0.912	0.872	1.145	-	0.002	
30	3	1.062	1.042	1.134	-	-0.005	
30	4	1.03	1.000	1.100	-	0.004	
40	3	1.074	1.036	1.124	-	0.039	
40	4	1.100	1.031	0.872	-	0.045	
45	4	1.123	0.686	-	28.68	0.016	

B.3.3. Ironman Bullbar

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
10	2	0.859	0.812	0.928	-	-0.024	
10	3	0.830	0.848	1.030	-	-0.009	

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
30	1	1.076	1.095	1.657	-	-0.030	
30	2	1.083	1.044	1.359	-	-0.015	
30		1.048	1.009	1.030	-	-0.015	
40	1	1.185	1.106	0.964	-	0.041	
40	2	1.173	1.144	1.198	-	0.053	
45	1	1.138	1.147	1.111	-	0.015	
45	2	1.114	1.095	-	12.80	-0.007	
50	1	1.168	1.079	0.456	-	-0.028	
50	2	1.150	1.111	-	27.27	-0.024	
55	1	1.273	1.024	-	14.68	0.010	
60	1	1.156	1.047	-	26.32	-0.023	

B.3.4. Tuff Bullbar

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
10	2	0.542	NB	-	8.62	-0.026	
10	4	0.825	NB	-	8.69	-0.016	
15	1	0.972	0.844	1.189	-	0.005	
15	2	0.981	0.812	1.182	-	0.001	
20	1	1.063	0.905	1.763	-	-0.012	
20	2	0.969	0.911	1.805	-	0.003	
30	1	1.024	1.024	1.867	-	-0.020	
30	2	1.048	0.980	1.497	-	-0.010	
35	8	1.013	1.032	1.433	-	0.021	
35	9	1.111	1.091	1.054	-	0.022	
35	10	1.099	1.049	1.067	-	0.009	
40	6	1.154	1.105	0.829	-	0.035	
40	7	1.096	1.096	-	13.47	0.014	
40	8	1.203	1.134	1.129	-	0.060	
45	2	1.143	1.054	1.165	-	0.031	
45	3	1.137	0.999	1.062	-	0.037	
50	1	1.077	0.988	-	11.31	-0.011	
50	2	1.147	1.088	0.625	-	-0.024	
55	1	0.847	0.797	-	33.50	0.027	
55	2	0.947	0.467	-	48.34	0.000	

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
60	1	1.162	0.402	-	54.26	0.008	
60	2	0.649	0.560	-	48.22	0.000	
60	3	0.914	0.865	-	35.04	-0.008	

B.3.5. Tuff Bullbar Mesh Investigation

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
10	6	0.825	NB	-	8.86	-0.010	Mesh
10	7	0.799	0.825	0.881	-	-0.009	No Mesh

B.4. Car-to-Pedestrian Farside Adult 50%

B.4.1. Baseline

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
10	3	0.726	0.717	0.875	-	-0.052	
10	4	0.765	0.716	0.858	-	-0.015	
20	9	0.937	0.857	1.553	-	-0.021	
20	10	0.941	0.882	1.739	-	-0.012	
30	8	1.054	1.054	1.416	-	0.005	
30	9	1.212	1.043	1.041	-	0.014	
30	10	1.087	1.067	1.347	-	0.024	
40	2	1.236	1.236	0.92	-	-0.010	
40	4	1.299	1.26	0.924	-	-0.003	
45	3	1.317	1.188	0.924	-	0.021	
45	4	1.289	1.020	0.596	-	0.025	
45	5	1.222	1.222	1.176	-	0.028	
50	1	1.378	1.218	0.007	-	0.005	
50	2	1.055	1.065	-	13.64	-0.005	
50	4	1.282	1.103	-	21.61	-0.010	

B.4.2. GVM

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
10	6	0.665	0.691	0.713	-	0.016	
10	7	0.750	0.784	0.931	-	0.011	
20	13	0.832	0.822	1.200	-	-0.008	
20	14	0.996	0.877	1.433	-	-0.017	
20	15	0.896	0.877	1.569	-	0.000	
30	13	1.124	1.064	1.068	-	-0.011	
30	14	1.159	1.131	1.066	-	-0.003	
40	5	1.267	1.247	0.898	-	-0.011	
40	6	1.076	0.947	0.144	-	0.016	
40	7	1.158	1.118	1.013	-	0.029	
40	8	1.199	1.139	1.026	-	0.016	
45	7	0.931	0.801	-	24.71	0.001	

B.4.3. Ironman Bullbar

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
10	3	0.590	0.704	0.679	-	0.015	
10	4	0.771	0.813	0.924	-	0.019	
10	5	0.740	0.692	0.645	-	0.013	
10	6	0.549	0.540	0.272	-	0.009	
10	7	0.848	0.810	0.942	-	0.001	
30	1	1.053	1.062	1.068	-	0.012	
30	2	1.106	1.143	1.242	-	0.01	

B.4.4. Tuff Bullbar

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
10	2	0.577	NB	-	8.57	0.000	
10	4	0.459	NB	-	8.91	0.002	
10	5	0.513	NB	-	8.88	0.017	
15	2	0.845	0.716	0.725	-	0.008	
15	3	0.876	0.808	1.102	-	-0.029	
20	1	0.893	0.864	1.413	-	0.006	
20	2	0.918	0.800	1.171	-	-0.007	
30	1	1.011	0.992	1.167	-	0.006	
30	2	1.133	1.035	1.034	-	0.037	
30	3	1.159	1.090	1.691	-	0.001	

B.4.5. Tuff Bullbar Mesh Investigation

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
10	7	0.332	NB	-	9.21	0.01	Mesh
10	8	0.772	0.789	0.784	-	0.001	No Mesh

B.5. Car-to-Car Warning Tone Analysis

B.5.1. Car-to-Car Rear Stationary

Test Details		Running Order	Ironman		Tuff	
Speed	Offset (%)	Avg.	Avg.	Change	Avg.	Change
10	0	0.02	0.00	-0.02	0.02	0.00
20	0	0.00				
30	0	0.01	0.00	-0.01	0.03	0.02
35	0	-0.01	0.03	0.04		
40	0	-0.03	0.03	0.07	0.02	0.06
42	0	0.06	0.03	-0.03		
45	0	-0.02	0.12	0.14		
50	0	0.07	0.36	0.29	0.17	0.11
55	0	0.20	0.38	0.18	0.29	0.09
60	0	0.49	0.55	0.06	0.46	-0.03
40	50	0.07	0.04	-0.03	0.17	0.10
40	-50	-0.04	0.04	0.08	0.04	0.07

Value Highlights a change in average time difference to the baseline Running Order that is greater than 0.1 seconds.

B.5.2. Car-to-Car Moving

Test Details		Running Order	Ironman		Tuff	
Speed	Offset (%)	Avg.	Avg.	Change	Avg.	Change
30	0	0.28	0.31	0.03	0.32	0.04
40	0	0.29				
50	0	0.23	0.19	-0.04	0.21	-0.02
60	0	0.33				
70	0	0.56	0.56	0.00	0.57	0.01
75	0	0.57				

Value Highlights a change in average time difference to the baseline Running Order that is greater than 0.1 seconds.

APPENDIX C

Summary of Toyota Hilux Results

C. Summary of Hilux Results

C.1. Car-to-Car Rear Stationary

C.1.1. Baseline

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Impact Speed (km/h)	T(FCW) – T(AEB)
0	10	3	0.596	1.150	0.786	-	0.554
0	10	4	0.568	1.297	0.795	-	0.729
0	10	5	0.558	1.193	0.746	-	0.635
0	15	1	0.732	1.426	1.026	-	0.694
0	15	2	0.788	1.547	1.024	-	0.759
0	15	3	0.679	1.434	1.003	-	0.755
0	20	1	0.901	1.695	0.908	-	0.794
0	20	2	0.800	1.704	0.965	-	0.904
0	30	1	1.175	1.831	0.776	-	0.656
0	30	2	1.187	1.840	0.910	-	0.653
0	40	1	1.382	1.959	0.592	-	0.577
0	40	2	1.362	2.019	0.799	-	0.657
0	50	1	1.367	1.964	0.984	-	0.597
0	50	2	1.314	1.980	0.580	-	0.666
0	60	1	1.404	1.993	0.229	-	0.589
0	60	2	1.427	2.016	0.347	-	0.589
-75	30	1	1.187	1.874	0.778	-	0.687
-75	30	2	1.191	1.845	0.616	-	0.654
75	30	1	1.28	1.866	0.615	-	0.586
75	30	2	1.19	1.877	0.912	-	0.687

C.1.2. GVM

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Impact Speed (km/h)	T(FCW) – T(AEB)
0	10	6	0.614	1.251	0.826	-	0.637
0	10	7	0.510	1.184	0.551	-	0.674
0	20	3	0.864	1.567	0.698	-	0.703
0	20	4	0.879	1.655	0.912	-	0.776
0	30	3	1.243	1.819	0.592	-	0.576
0	30	4	1.222	1.796	0.703	-	0.574
0	40	3	1.428	1.961	0.699	-	0.533

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Impact Speed (km/h)	T(FCW) – T(AEB)
0	40	4	1.345	1.888	0.614	-	0.543
0	50	3	1.132	1.999	0.698	-	0.867
0	50	4	1.337	2.010	0.555	-	0.673
0	55	1	1.360	2.015	0.237	-	0.655
0	55	2	1.355	2.013	0.450	-	0.658
0	60	3	1.358	1.993	-	6.55	0.589
0	60	4	1.234	1.989	-	4.35	0.562
-75	30	3	1.205	1.839	0.635	-	0.634
-75	30	4	1.144	1.843	0.809	-	0.699
75	30	3	1.190	1.805	0.758	-	0.615
75	30	4	1.230	1.805	0.755	-	0.575

C.1.3. Rear Pitch

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Impact Speed (km/h)	T(FCW) – T(AEB)
0	10	8	0.539	1.246	0.629	-	0.707
0	10	9	0.534	1.217	0.675	-	0.683
0	30	5	1.149	1.820	0.918	-	0.671
0	30	6	0.993	1.812	-	5.97	0.819
0	30	7	1.125	1.857	0.825	-	0.732
0	40	5	1.244	1.992	0.585	-	0.748
0	40	6	1.323	1.984	0.656	-	0.661
0	50	5	1.373	2.038	0.763	-	0.665
0	50	6	1.328	2.025	0.806	-	0.697
0	55	3	1.193	2.018	0.479	-	0.825
0	55	4	1.329	2.034	0.523	-	0.705
0	60	5	1.388	2.046	0.077	-	0.658
0	60	6	1.341	1.999	0.222	-	0.658
-50	30	5	1.172	1.785	0.842	-	0.613
-50	30	6	0.956	1.836	0.828	-	0.880
50	30	5	1.194	1.848	0.724	-	0.654
50	30	6	1.204	1.867	0.783	-	0.663

C.1.4. Lift Kit

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Impact Speed (km/h)	T(FCW) – T(AEB)
0	10	10	0.516	1.251	0.573	-	0.735
0	10	11	0.551	1.268	0.722	-	0.717
0	30	8	1.042	1.768	0.481	-	0.726
0	30	9	1.214	1.818	0.830	-	0.604
0	40	7	1.369	2.005	0.498	-	0.636
0	40	8	1.385	1.972	0.408	-	0.587
0	45	1	1.393	2.018	0.244	-	0.625
0	45	2	1.382	2.020	0.199	-	0.638
0	50	7	1.400	1.987	-	3.34	0.587
0	50	8	1.422	1.990	0.084	-	0.568
0	50	9	1.417	2.012	-	1.90	0.595
0	55	5	1.384	1.975	-	8.34	0.591
0	55	6	1.345	1.753	-	6.03	0.408
-75	30	7	1.265	1.839	0.479	-	0.574
-75	30	8	1.175	1.821	0.44	-	0.646
75	30	7	1.207	1.94	0.613	-	0.733
75	30	8	1.217	1.751	0.377	-	0.534
75	30	9	1.201	1.815	0.56	-	0.614

C.1.5. Lift Kit + Bullbar

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Impact Speed (km/h)	T(FCW) – T(AEB)
0	10	1	0.501	1.277	0.349	-	0.776
0	10	2	0.486	1.225	0.328	-	0.739
0	20***	1	-	-	-	No Impact	
0	20***	2	-	-	-	Low speed impact	
0	20***	3	-	-	-	No Impact	
0	20****	4	-	-	-	No Impact	
0	20***	5	-	-	-	No Impact	
0	20***	6	-	-	-	No Impact	
0	30	1	1.085	1.799	0.215	-	0.714
0	30	2	1.071	1.793	0.218	-	0.722
0	30**	3	0.129	1.160	-	28.10	
0	30***	4	-	-	-	No Impact	

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Impact Speed (km/h)	T(FCW) – T(AEB)
0	30***	5	-	-	-	No Impact	
0	30***	6	-	-	-	No Impact	
0	30***	7	-	-	-	No Impact	
0	30***	8	-	-	-	No Impact	
0	30***	9	-	-	-	No Impact	
0	35**	1	0.443	1.886	-	20.63	
0	40**	5	1.290	2.000	0.224	-	
0	40**	6	0.611	2.020	-	12.36	
0	42**	1	1.323	1.991	0.207	-	
0	42**	2	1.361	2.017	0.183	-	
0	42**	3	0.818	2.029	-	-	
0	42**	4	1.325	2.034	0.037	-	
0	42	7	1.169	1.986	0.073	-	0.817
0	42	8	1.347	1.996	0.055	-	0.649
0	45	1	1.240	1.813	0.215	-	0.573
0	45	2	1.229	2.014	-	2.47	0.785
0	45	3	1.319	1.994	0.209	-	0.675
0	50	1	1.189	2.004	0.026	-	0.815
0	50	2	1.162	2.010	-	6.75	0.848
0	55	1	1.337	1.993	-	4.87	0.656
0	55	2	1.357	2.034	-	6.92	0.677
0	60	1	1.369	1.956	-	10.93	0.587
0	60	2	1.279	1.996	-	43.62*	0.717
-75	30	1	1.197	1.839	0.227	-	0.642
-75	30	2	1.171	1.785	0.318	-	0.614
75	30	1	1.183	1.859	0.283	-	0.676
75	30	2	1.110	1.802	0.266	-	0.692

*Impact offset greater than 0.1 metres, therefore, not used for analysis.

**Not included in the analysis due to suspected initialisation issue.

***Investigation.

****Investigation. Brake release then further braking.

C.1.6. Bullbar

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Impact Speed (km/h)	T(FCW) – T(AEB)
0	10	3	0.537	1.106	0.462	-	0.569

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Impact Speed (km/h)	T(FCW) – T(AEB)
0	10	4	0.534	1.253	0.507	-	0.719
0	10	5	0.557	1.057	0.561	-	0.500
0	30	10	1.159	1.824	0.618	-	0.665
0	30	11	1.170	1.835	0.790	-	0.665
0	40	9	1.354	2.001	0.585	-	0.647
0	40	10	1.333	1.969	0.509	-	0.636
0	42	11	1.301	2.009	0.480	-	0.708
0	42	12	1.307	2.002	0.513	-	0.695
0	45	4	1.361	1.981	-	15.44	0.620
0	45	5	1.353	1.970	0.496	-	0.617
0	50	3	1.115	2.020	-	11.23	0.905
0	50	4	1.319	1.995	0.480	-	0.676
0	55	3	1.347	1.993	-	16.05	0.646
0	55	4	1.329	1.995	0.061	-	0.666
0	60	3	1.300	2.028	0.136	-	0.728
0	60	4	1.312	2.028	0.236	-	0.716
-75	30	3	1.189	1.816	0.860	-	0.627
-75	30	4	1.177	1.862	0.579	-	0.685
75	30	3	1.188	1.813	0.233	-	0.625
75	30	4	1.189	1.834	0.775	-	0.645

C.1.7. Bullbar (OEM Height)

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Impact Speed (km/h)	Notes
0	10	6	NB	NF	-	9.21	
0	10	7	0.552	1.014	0.553	-	
0	10	8	0.582	1.180	0.634	-	
0	20	7	0.823	1.690	0.636	-	
0	20	8	0.875	1.634	0.827	-	
0	30	13	1.075	1.812	0.836	-	
0	30	14	1.112	1.827	0.644	-	
0	40	14	1.308	2.023	0.640	-	
0	40	15	1.119	1.995	0.487	-	
0	50	5	1.367	1.985	0.358	-	
0	50	6	1.297	1.971	0.233	-	

0	60	5	1.302	1.997	0.287	-	
0	60	6	1.203	1.992	0.336	-	
-75	30	5	NB	1.765	-	29.75	

C.2. Car-to-Car Rear Moving

C.2.1. Baseline

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Relative Impact Speed (km/h)	T(FCW) – T(AEB)
0	30	1	0.747	1.193	1.096	-	0.446
0	30	2	0.574	1.473	0.823	-	0.899
0	30	4	0.576	1.462	0.793	-	0.886
0	30	5	0.588	1.186	0.805	-	0.598
0	40	1	0.827	1.656	1.406	-	0.829
0	40	2	0.809	1.675	1.406	-	0.866
0	50	1	1.131	1.835	1.864	-	0.704
0	50	2	1.228	1.841	1.057	-	0.613
0	60	1	1.220	1.931	0.004	-	0.711
0	60	2	1.373	1.948	0.742	-	0.575
0	70	1	1.335	1.999	1.606	-	0.664
0	70	2	1.349	1.994	1.758	-	0.645
0	80	1	1.377	2.013	0.228	-	0.636
0	80	2	1.359	2.007	0.411	-	0.648

C.2.2. GVM

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Relative Impact Speed (km/h)	T(FCW) – T(AEB)
0	30	7	0.500	1.215	0.559	-	0.715
0	30	8	0.710	1.278	0.995	-	0.568
0	40	3	0.912	1.586	1.504	-	0.674
0	40	4	0.901	1.637	1.536	-	0.736
0	50	3	1.013	1.861	1.272	-	0.848
0	50	4	1.086	1.879	1.323	-	0.793
0	60	3	1.441	1.994	1.276	-	0.553
0	60	4	1.213	2.003	1.195	-	0.790
0	70	3	1.328	1.960	1.008	-	0.632

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Relative Impact Speed (km/h)	T(FCW) – T(AEB)
0	70	4	1.372	2.006	0.526	-	0.634
0	75	1	1.313	1.988	0.839	-	0.675
0	75	2	1.322	1.985	0.672	-	0.663
0	80	13	1.299	1.978	-	11.88	0.679
0	80	14	1.302	1.986	-	9.79	0.684

C.2.3. Rear Pitch

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Relative Impact Speed (km/h)	T(FCW) – T(AEB)
0	30	9	0.655	1.257	0.978	-	0.602
0	30	10	0.734	1.29	1.142	-	0.556
0	50	5	1.091	1.947	1.797	-	0.856
0	50	6	1.162	1.841	1.368	-	0.679
0	50	7	1.188	1.803	1.721	-	0.615
0	70	5	1.359	1.973	0.816	-	0.614
0	70	6	1.36	2.006	1.194	-	0.646
0	80	24	1.332	2.04	0.543	-	0.708
0	80	25	1.394	2.029	0.581	-	0.635

C.2.4. Lift Kit

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Relative Impact Speed (km/h)	T(FCW) – T(AEB)
0	30*	11	NB	NF	-	9.27	0.637
0	30	13	0.552	1.189	0.726	-	0.794
0	30	14	0.496	1.29	0.641	-	0.637
0	30	15	0.66	1.297	0.987	-	0.727
0	50	8	1.08	1.807	1.831	-	0.532
0	50	9	1.23	1.762	0.913	-	0.763
0	70	7	1.236	1.999	1.222	-	0.546
0	70	8	1.433	1.979	1.674	-	2.038
0	75	3	0.558	2.038	-	54.36**	0.637

*Not included in the analysis due to suspected initialisation issue.

** T(AEB) represents driver braking to reduce impact speed. Impact speed estimated by determining the speed when driver braking started.

C.2.5. Lift Kit + Bullbar

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Relative Impact Speed (km/h)	T(FCW) – T(AEB)
0	1	1	0.451	1.442	0.384	-	0.991
0	2	2	0.545	1.139	0.609	-	0.594
0	3	3	0.649	1.073	0.898	-	0.424
0	1	1	1.029	1.812	1.583	-	0.783
0	2	2	1.091	1.816	1.809	-	0.725
0	1	1	1.268	1.966	0.92	-	0.698
0	2	2	1.310	2.005	1.427	-	0.695
0	3	3	0.706	1.946	-	54.34*	1.946
0	4	4	0.022	1.939	-	54.1	1.917

* T(AEB) represents driver braking to reduce impact speed. Impact speed estimated by determining the speed when driver braking started.

C.2.6. Bullbar

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Relative Impact Speed (km/h)	T(FCW) – T(AEB)
0	30	4	0.500	1.271	0.561	-	0.771
0	30	5	NB	NF	-	9.15	0.000
0	30	6	0.583	1.243	0.781	-	0.66
0	35	1	0.702	1.407	0.838	-	0.705
0	35	2	0.630	1.513	0.731	-	0.883
0	35	3	0.771	1.539	1.301	-	0.768
0	40	2	0.855	1.547	0.951	-	0.692
0	40	3	0.109	1.591	-	19.01*	1.591
0	45	1	0.943	1.765	1.305	-	0.822
0	45	2	0.948	1.722	1.197	-	0.774
0	50	5	1.109	1.877	0.434	-	0.768
0	50	6	1.118	1.852	0.729	-	0.734
0	70	3	1.272	1.969	0.333	-	0.697
0	70	4	1.245	1.980	0.474	-	0.735
0	80	1	1.284	2.058	0.541	-	0.774

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Relative Impact Speed (km/h)	T(FCW) – T(AEB)
0	80	2	1.303	1.819	0.109	-	0.516
0	80	3	1.237	2.032	0.065	-	0.795

* T(AEB) represents driver braking to reduce impact speed. Impact speed estimated by determining the speed when driver braking started.

C.2.7. Bullbar (OEM Height)

Offset (%)	VUT Speed (km/h)	Run No.	TTC at AEB (s)	TTC at FCW (s)	Minimum Distance (m)	Relative Impact Speed (km/h)	Notes
0	30	7	0.746	1.078	1.175	-	
0	30	8	0.436	1.172	0.435	-	
0	40	4	0.812	1.650	0.991	-	
0	40	5	0.829	1.671	1.316	-	
0	50	7	1.086	2.027	1.635	-	
0	50	8	1.160	1.776	0.644	-	
0	50	9	0.334	1.196	1.841	-	
0	70	5	1.376	2.011	0.179	-	
0	70	6	1.341	2.046	0.34	-	
0	80	4	NB	1.769	-	59.23	

C.3. Car-to-Pedestrian Nearside Child 50%

C.3.1. Baseline

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
10	1	1.602	0.726	1.126	-	-0.006	
10	2	1.348	0.762	1.219	-	0.001	
10	3	1.639	0.761	1.199	-	-0.002	
15	1	1.706	0.797	0.971	-	0.027	
15	2	1.805	0.751	1.107	-	0.001	
20***	1	NF	NB	-	18.81	-0.013	
20	2	1.495	0.970	0.848	-	-0.019	
20	3	1.594	0.910	0.756	-	0.005	
20	4	1.548	0.891	0.845	-	0.019	Investigation
20	5	1.615	0.926	0.917	-	0.007	Investigation
30	1	1.818	1.244	0.666	-	0.034	
30	2	1.772	1.180	0.733	-	0.033	
30	3	1.545	1.193	0.851	-	0.064	
30	4	1.386	1.070	0.864	-	-0.008	
30	5	1.724	1.113	0.749	-	0.029	
40	1	1.474	1.188	0.782	-	0.098	
40	2	1.537	0.809	0.604	-	-0.036	
40***	3	0.505	0.315	-	39.06**	-0.016	
40***	4	0.497	0.615	-	38.85**	-0.044	
40	5	1.778	1.128	0.870	-	-0.106*	Investigation
40	6	1.827	1.095	0.634	-	-0.028	Investigation
40	7	1.683	0.799	0.459	-	-0.069	Investigation
50	1	1.667	1.166	0.695	-	0.010	
50	2	1.798	1.217	0.630	-	-0.023	
50	3	1.538	1.232	0.669	-	0.150*	
55	1	1.489	1.161	0.840	-	0.022	
55	2	1.499	0.683	-	53.52**	0.123*	
55	3	1.564	1.236	0.682	-	0.009	
55	4	1.650	1.275	0.958	-	0.158*	
60	1	1.461	0.967	-	24.85	0.075	

*Impact offset greater than 0.1 metres, therefore, not used for analysis.

** T(AEB) represents driver braking to reduce impact speed. Impact speed estimated by determining the speed when driver braking started.

***Not included in the analysis due to suspected initialisation issue.

C.3.2. GVM

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
10	4	1.375	0.681	0.912	-	0.008	
10	5	1.630	0.609	0.713	-	-0.020	
10	6	1.348	0.677	0.898	-	0.002	
20	6	1.818	0.981	0.775	-	0.027	
20	7	1.665	0.873	0.722	-	0.028	
20	8	1.768	0.835	0.804	-	-0.004	
30	6	1.541	1.158	0.657	-	0.048	
30	7	0.942	0.534	-	15.04	-0.013	
30	8	1.776	0.889	0.570	-	0.046	
30	9	1.660	1.335	0.628	-	0.035	
35	1	1.804	0.982	0.729	-	-0.045	
35	2	1.773	1.309	0.697	-	-0.086	
35	3	1.816	0.868	0.686	-	-0.002	
40	8	1.675	1.255	0.488	-	-0.081	
40	9	0.614	0.495	-	38.75*	-0.055	
40	10	1.764	0.712	-	13.68	-0.064	

* T(AEB) represents driver braking to reduce impact speed. Impact speed estimated by determining the speed when driver braking started.

C.3.3. Rear Pitch

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
10	7	1.383	0.642	0.845	-	-0.011	
10	8	1.317	0.62	0.819	-	-0.006	
30	10	1.767	0.590	-	7.92	-0.005	
30	11	1.763	1.176	0.763	-	-0.062	
30	12	1.783	1.103	0.700	-	-0.072	
30	13	1.709	1.205	0.649	-	0.038	
40	11	1.555	1.159	0.700	-	-0.038	
40	13	0.995	0.866	0.648	-	-0.036	
40	14	1.607	1.242	0.724	-	-0.017	
45	1	1.671	1.090	0.758	-	0.252*	
45	2	1.797	0.762	-	15.31	0.141*	
45	3	1.662	1.305	0.713	-	0.288*	
50	4	1.485	1.168	-	20.02	0.058	

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
50	5	0.610	0.540	-	49.06**	-0.117*	

*Impact offset greater than 0.1 metres, therefore, not used for analysis.

** T(AEB) represents driver braking to reduce impact speed. Impact speed estimated by determining the speed when driver braking started.

C.3.4. Lift Kit

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
10	9	1.598	0.618	0.752	-	0.004	
10	11	1.428	0.624	0.834	-	0.001	
10	12	1.291	NB	-	8.69	-0.018	
15	3	1.703	0.616	0.830	-	0.002	
15	4	1.717	0.729	0.771	-	-0.018	
20	9	1.718	0.854	0.613	-	-0.012	
20	10	1.733	1.004	0.853	-	-0.009	
30	14	1.591	0.783	0.500	-	-0.041	
30	15	1.683	1.369	0.582	-	0.044	
30	16	1.388	0.986	0.966	-	-0.061	
35	4	1.569	0.982	0.642	-	0.069	
35	5	1.094	0.924	0.592	-	0.012	
35	6	1.69	0.985	0.514	-	0.034	
40	15	1.751	0.856	0.373	-	0.077	
40	16	1.234	0.917	0.387	-	0.080	
40	17	0.802	0.583	-	21.33	0.021	
45	4	1.802	0.776	-	11.76	0.067	
45	5	1.898	1.422	0.308	-	-0.180*	
50	6	0.673	NB	-	48.68	-0.017	

*Impact offset greater than 0.1 metres, therefore, not used for analysis.

C.3.5. Lift Kit + Bullbar

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
10	1	1.351	0.625	0.677	-	0.016	
10	2	1.334	0.589	0.618	-	0.007	
30	1	1.724	0.721	0.386	-	-0.002	

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
30	2	1.707	0.968	0.350	-	0.003	
35	1	1.178	0.889	0.386	-	-0.011	
35	2	NF	0.074	-	34.17*	-0.018	
35	3	1.741	1.144	0.321	-	-0.007	
40	1	0.793	0.264	-	33.33	-0.028	
40	2	1.792	0.869	0.477	-	0.031	
40	3	1.829	0.957	-	36.33	0.005	
45	1	1.759	0.680	-	21.90	0.011	
45	2	0.656	0.306	-	43.02*	-0.046	
45	3	1.032	0.892	0.580	-	0.015	
50	1	1.188	1.050	0.317	-	0.034	
50	2	1.607	0.854	-	12.60	0.005	
50	3	1.776	0.918	-	10.82	0.064	
55	1	0.587	0.117	-	53.85	0.010	
55	2	1.518	1.160	0.269	-	0.051	
55	3	1.299	0.041	-	53.80	0.066	
60	1	1.299	1.129	0.143	-	-0.005	
60	2	0.865	0.776	-	36.06	-0.011	
60	3	0.493	0.153	-	58.35	0.075	

* T(AEB) represents driver braking to reduce impact speed. Impact speed estimated by determining the speed when driver braking started.

C.3.6. Bullbar

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
10	3	1.424	0.654	0.823	-	0.010	
10	4	1.367	0.642	0.752	-	-0.012	
30	4	1.767	1.205	0.565	-	-0.032	
30	5	1.814	0.982	0.535	-	0.011	
40	4	1.777	0.920	0.577	-	0.044	
40	5	1.857	1.391	0.554	-	0.102*	
40	6	1.785	1.480	0.557	-	0.079	
45	4	1.822	0.860	0.371	-	0.051	
45	5	1.737	0.782	-	10.03	0.027	
50	4	1.676	0.244	-	48.83*	0.002	
50	5	1.586	1.082	0.547	-	-0.07	

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
55	4	1.423	1.165	0.521	-	0.101*	
55	5	1.603	1.159	0.523	-	0.067	
55	6	1.615	1.249	0.564	-	0.071	
60	4	1.340	0.823	-	29.70	0.000	
60	6	1.300	1.141	1.120	-	-0.126*	
60	7	1.249	1.089	0.639	-	-0.070	

*Impact offset greater than 0.1 metres, therefore, not used for analysis.

** T(AEB) represents driver braking to reduce impact speed. Impact speed estimated by determining the speed when driver braking started.

C.3.7. Bullbar (OEM Height)

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
10	9	1.374	0.643	0.703		0.004	
10	10	1.489	0.640	0.688		0.022	
10	11	1.578	0.584	0.597		0.007	
20	1	0.397	NB		19.04	-0.002	
30	6	1.062	0.704	0.917		-0.007	
30	7	NF	NB		29.12	0.004	
30	8	1.715	1.161	0.824		0.039	
40	7	1.814	0.749		6.04	0.029	
40	8	1.893	0.981	0.543		0.027	
50	6	0.405	NB		49.03	-0.001	
50	7	1.540	1.193	0.668		0.046	
50	8	1.235	1.135	0.624		-0.098	

C.4. Car-to-Pedestrian Farside Adult 50%

C.4.1. Baseline

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
10	1	NF	NB	-	8.80	0.015	VRU Speed out-of-tolerance
10	2	NF	NB	-	9.31	-0.053	VRU Speed out-of-tolerance
15	3	1.012	0.383	0.146	-	0.001	
15	4	0.656	0.547	0.785	-	0.002	
15	5	1.036	0.617	1.073	-	-0.009	
20	1	1.214	0.902	0.888	-	-0.001	
20	2	1.166	0.874	1.056	-	0.040	
30	1	1.181	0.935	0.792	-	-0.007	
30	2	1.181	0.954	0.839	-	0.030	
40	1	1.203	1.054	0.951	-	0.128*	
40	3	1.199	1.049	1.174	-	0.130*	
40	4	1.185	1.056	1.153	-	0.082	
40	5	1.199	0.961	1.240	-	0.098	
40	6	1.147	0.959	0.944	-	0.109*	
40	7	1.180	0.981	0.844	-	0.065	
40	8	1.165	0.987	0.934	-	-0.039	
40	9	1.202	1.052	1.006	-	-0.073	
40	10	1.205	0.926	0.850	-	0.065	
50	1	1.191	1.093	0.857	-	0.000	
50	2	1.201	1.112	0.913	-	0.048	
60	1	1.187	1.098	0.442	-	0.021	
60	2	1.216	1.117	0.749	-	0.144*	
60	3	1.141	0.891	-	30.66	-0.116*	
60	4	1.152	1.053	0.328	-	-0.139*	
60	5	1.169	1.039	0.358	-	-0.052	

*Impact offset greater than 0.1 metres, therefore, not used for analysis.

C.4.2. GVM

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
15	6	0.605	0.446	0.251	-	-0.009	

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
15	7	0.499	0.370	-	3.38	0.021	
15	8	0.443	0.324	-	6.93	-0.010	
20	3	1.154	0.890	0.919	-	-0.008	
20	4	1.149	0.777	0.752	-	-0.002	
30	3	1.185	0.830	0.750	-	-0.018	
30	4	1.179	0.845	0.715	-	-0.002	
40	11	1.181	1.041	1.071	-	-0.011	
40	12	1.180	0.852	0.864	-	0.006	
40	13	1.186	0.998	-	37.656*	-0.045	
40	14	1.170	1.051	0.321	-	0.093	
45	1	1.193	0.613	-	28.02	0.051	

* T(AEB) represents driver braking to reduce impact speed. Impact speed estimated by determining the speed when driver braking started.

C.4.3. Rear Pitch

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
15	9	0.965	0.476	0.368	-	-0.004	
15	10	0.778	0.449	0.361	-	0.004	
15	11	1.125	0.536	0.685	-	0.010	
20	5	1.236	0.860	0.697	-	0.009	
20	6	1.214	0.859	0.876	-	-0.021	
30	5	1.214	0.839	0.801	-	0.045	
30	6	1.225	0.868	0.755	-	0.049	
40	15	1.209	1.080	1.046	-	-0.066	
40	16	1.216	1.077	1.042	-	-0.006	
45	2	1.170	1.042	0.929	-	-0.114*	
45	3	1.165	0.857	0.408	-	-0.076	
45	4	1.200	1.081	0.811	-	0.014	
50	3	1.195	1.096	-	21.16	0.103*	
50	4	1.254	1.105	0.861	-	-0.039	
50	5	1.205	1.026	0.689	-	-0.150*	
50	7	1.240	1.117	0.965	-	-0.200*	
50	8	1.192	1.113	0.815	-	-0.116*	
55	1	1.137	1.038	0.362	-	0.114*	
55	2	1.203	1.075	0.791	-	-0.014	

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
60	6	1.205	0.674	-	42.03	0.039	

*Impact offset greater than 0.1 metres, therefore, not used for analysis.

C.4.4. Lift Kit

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
15	12	0.497	0.177	-	12.00	0.005	
15	13	0.552	0.252	-	9.18	-0.010	
20	7	1.138	0.941	1.976	-	-0.018	
20	8	1.174	0.869	0.917	-	0.008	
30	7	1.107	0.801	0.742	-	-0.002	
30	8	1.139	0.952	0.985	-	0.040	

C.4.5. Lift Kit + Bullbar

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
10	1	NF	NB	-	9.00	0.025	
10	2	NF	NB	-	9.01	0.026	
15	1	1.122	0.567	0.648	-	-0.002	
15	2	1.256	0.702	1.108	-	0.003	
15	3	1.195	0.733	1.141	-	-0.011	
20	1	1.212	0.839	0.480	-	-0.018	
20	2	1.272	0.938	0.720	-	-0.007	
30	1	1.233	0.838	0.511	-	-0.028	
30	2	1.257	0.911	0.533	-	0.031	

C.4.6. Bullbar

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
10	3	NF	NB	-	9.27	-0.032	
10	4	NF	NB	-	9.33	-0.018	VRU Speed out-of-tolerance
15	4	0.842	0.614	0.951	-	-0.002	
15	5	1.218	0.492	0.351	-	0.020	
15	6	1.087	0.387	-	2.13	0.007	

VUT Speed (km/h)	Run No.	TTC at FCW (s)	TTC at AEB (s)	Minimum Distance (m)	Impact Speed (km/h)	Impact Offset (m)	Notes
20	3	1.250	0.836	0.720	-	0.000	
20	4	1.225	0.810	0.714	-	0.018	
30	3	1.218	0.980	0.982	-	0.017	
30	4	1.232	0.935	0.860	-	-0.016	

C.5.Lane Keeping Results

C.5.1. GVM

Line Marking & Direction	Lateral Velocity (m/s)	Run No.	Minimum DTLE (m)
SLN-D	0.1	3	0.057
SLN-D	0.1	4	0.090
SLN-D	0.1	6	0.062
SLN-D	0.2	1	0.049
SLN-D	0.2	2	0.036
SLN-D	0.2	3	0.011
SLN-D	0.5	4	0.300
SLN-D	0.5	6	0.272
SLN-D	0.5	7	0.318
SLN-P	0.1	1	0.074
SLN-P	0.1	2	0.061
SLN-P	0.1	5	0.017
SLN-P	0.2	20	0.019
SLN-P	0.2	21	0.055
SLN-P	0.2	25	0.016
SLN-P	0.5	6	0.257
SLN-P	0.5	11	0.203
SLN-P	0.5	12	0.240
DLN-D	0.1	1	0.024
DLN-D	0.1	2	0.046
DLN-D	0.1	3	0.062
DLN-D	0.2	5	0.025
DLN-D	0.2	8	0.003
DLN-D	0.2	9	0.023
DLN-D	0.5	1	0.221
DLN-D	0.5	4	0.206
DLN-D	0.5	6	0.248
DLN-P	0.1	6	0.046
DLN-P	0.1	7	0.056
DLN-P	0.1	8	0.025
DLN-P	0.2	3	0.094
DLN-P	0.2	4	0.090
DLN-P	0.2	5	0.125
DLN-P	0.5	1	0.261

DLN-P	0.5	2	0.268
DLN-P	0.5	3	0.264

C.5.2. Rear Pitch

Line Marking & Direction	Lateral Velocity (m/s)	Run No.	Minimum DTLE (m)
SLN-D	0.1	8	0.148
SLN-D	0.1	10	0.106
SLN-D	0.1	11	0.159
SLN-D	0.2	12	0.023
SLN-D	0.2	13	0.102
SLN-D	0.2	14	0.096
SLN-D	0.5	13	0.388
SLN-D	0.5	14	0.426
SLN-P	0.1	11	0.185
SLN-P	0.1	17	0.127
SLN-P	0.1	18	0.148
SLN-P	0.2	40	0.299
SLN-P	0.2	41	0.247
SLN-P	0.2	42	0.282
SLN-P	0.5	13	0.365
SLN-P	0.5	16	0.397
SLN-P	0.5	17	0.393
DLN-D	0.1	5	0.072
DLN-D	0.1	8	0.079
DLN-D	0.1	9	0.064
DLN-D	0.2	23	0.082
DLN-D	0.2	24	0.044
DLN-D	0.2	25	0.073
DLN-D	0.5	7	0.345
DLN-D	0.5	8	0.265
DLN-D	0.5	10	0.321
DLN-P	0.1	9	0.131
DLN-P	0.1	12	0.177
DLN-P	0.1	13	0.091
DLN-P	0.2	14	0.136
DLN-P	0.2	19	0.111
DLN-P	0.2	22	0.170
DLN-P	0.5	5	0.314

DLN-P	0.5	6	0.349
DLN-P	0.5	8	0.334

C.5.3. Lift Kit

Line Marking & Direction	Lateral Velocity (m/s)	Run No.	Minimum DTLE (m)
SLN-D	0.1	13	0.100
SLN-D	0.1	14	0.110
SLN-D	0.1	15	0.109
SLN-D	0.2	15	0.104
SLN-D	0.2	16	0.069
SLN-D	0.2	17	0.091
SLN-P	0.1	19	0.077
SLN-P	0.1	20	0.059
SLN-P	0.1	21	0.068
SLN-P	0.2	43	0.021
SLN-P	0.2	44	-0.014
SLN-P	0.2	45	-0.007
SLN-P	0.5	18	0.218
SLN-P	0.5	19	0.158
SLN-P	0.5	20	0.212
DLN-D	0.1	10	0.120
DLN-D	0.1	11	0.113
DLN-D	0.1	12	0.108
DLN-D	0.2	27	0.045
DLN-D	0.2	28	0.032
DLN-D	0.2	29	0.041
DLN-D	0.5	11	0.294
DLN-D	0.5	12	0.329
DLN-D	0.5	13	0.332
DLN-P	0.1	14	0.086
DLN-P	0.1	15	0.062
DLN-P	0.1	16	0.078
DLN-P	0.2	27	0.109
DLN-P	0.2	28	0.203
DLN-P	0.2	29	0.108

C.5.4. Lift Kit + Bullbar

Line Marking & Direction	Lateral Velocity (m/s)	Run No.	Minimum DTLE (m)
SLN-D	0.1	1	0.050
SLN-D	0.1	2	0.083
SLN-D	0.1	3	0.081
SLN-D	0.2	1	0.054
SLN-D	0.2	2	0.024
SLN-D	0.2	3	0.007
SLN-P	0.1	2	0.071
SLN-P	0.1	3	0.083
SLN-P	0.1	4	0.089
SLN-P	0.2	1	0.016
SLN-P	0.2	2	0.007
SLN-P	0.2	3	-0.005
SLN-P	0.5	1	0.178
SLN-P	0.5	2	0.219
SLN-P	0.5	3	0.222
DLN-D	0.1	1	0.078
DLN-D	0.1	2	0.091
DLN-D	0.1	5	0.069
DLN-D	0.2	1	0.024
DLN-D	0.2	2	0.034
DLN-D	0.2	3	0.019
DLN-D	0.5	4	0.269
DLN-D	0.5	6	0.262
DLN-D	0.5	7	0.292
DLN-P	0.1	1	0.062
DLN-P	0.1	2	0.072
DLN-P	0.1	3	0.081
DLN-P	0.2	2	0.054
DLN-P	0.2	3	-0.003
DLN-P	0.2	4	0.031

C.6. Car-to-Car Warning Tone Analysis

C.6.1. Car-to-Car Rear Stationary

C.6.1.1. Table 1

Test Details		Running Order	Rear Pitch		Lift	
Speed	Offset (%)	Avg.	Avg.	Change	Avg.	Change
10	0	0.64	0.70	0.06	0.73	0.09
20	0	0.85				
30	0	0.65	0.74	0.09	0.67	0.01
40	0	0.62	0.70	0.09	0.61	-0.01
50	0	0.63	0.68	0.05	0.58	-0.05
60	0	0.59	0.66	0.07		
50	50	0.64	0.66	0.02	0.63	-0.01
50	-50	0.67	0.75	0.08	0.61	-0.06

Value Highlights a change in average time difference to the baseline Running Order that is greater than 0.1 seconds.

C.6.1.2. Table 2

Test Details		Running Order	Lift + Bullbar		Bullbar	
Speed	Offset (%)	Avg.	Avg.	Change	Avg.	Change
10	0	0.64	0.76	0.12	0.60	-0.04
20	0	0.85				
30	0	0.65	0.72	0.06	0.67	0.01
40	0	0.62			0.64	0.02
50	0	0.63	0.83	0.20	0.79	0.16
60	0	0.59	0.65	0.06	0.72	0.13
50	50	0.64	0.68	0.05	0.64	0.00
50	-50	0.67	0.63	-0.04	0.66	-0.01

Value Highlights a change in average time difference to the baseline Running Order that is greater than 0.1 seconds.

C.6.2. Car-to-Car Moving

C.6.2.1. Table 1

Test Details		Running Order	Rear Pitch		Lift	
Speed	Offset (%)	Avg.	Avg.	Change	Avg.	Change
30	0	0.71	0.58	-0.13	0.69	-0.02
40	0	0.85				
50	0	0.66	0.72	0.06	0.63	-0.03
60	0	0.64				
70	0	0.65	0.63	-0.02	0.65	0.00
80	0	0.64	0.67	0.03		

Value Highlights a change in average time difference to the baseline Running Order that is greater than 0.1 seconds.

C.6.2.2. Table 2

Test Details		Running Order	Lift + Bar		Bullbar	
Speed	Offset (%)	Avg.	Avg.	Change	Avg.	Change
30	0	0.71	0.67	-0.04	0.48	-0.23
40	0	0.85			1.14	0.29
50	0	0.66	0.75	0.10	0.75	0.09
60	0	0.64				
70	0	0.65	0.70	0.04	0.72	0.06
80	0	0.64			0.70	0.05

Value Highlights a change in average time difference to the baseline Running Order that is greater than 0.1 seconds.

APPENDIX D

Isuzu D-Max Car-to-Car Results Validity

D.D-Max Car-to-Car Results Validity

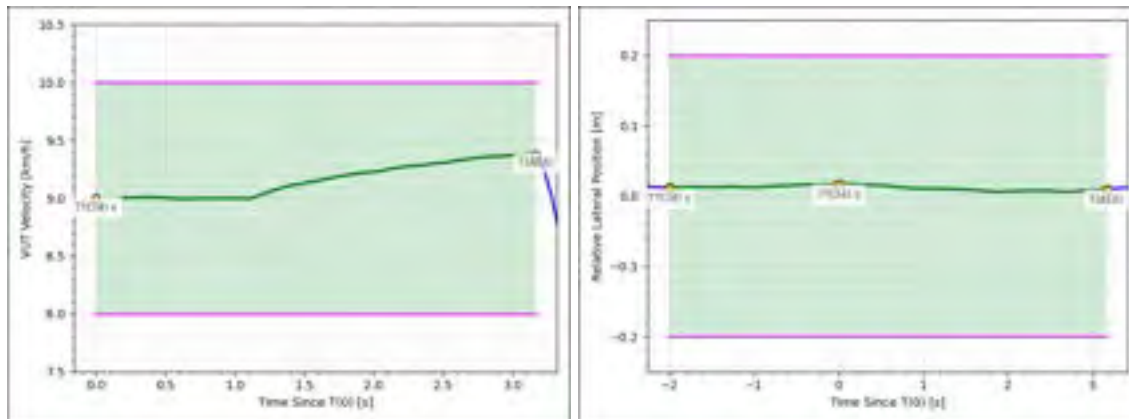
D.1. Car-to-Car Rear Stationary

D.1.1. Baseline

D.1.1.1. AEB CCRs 10 kph +100 %

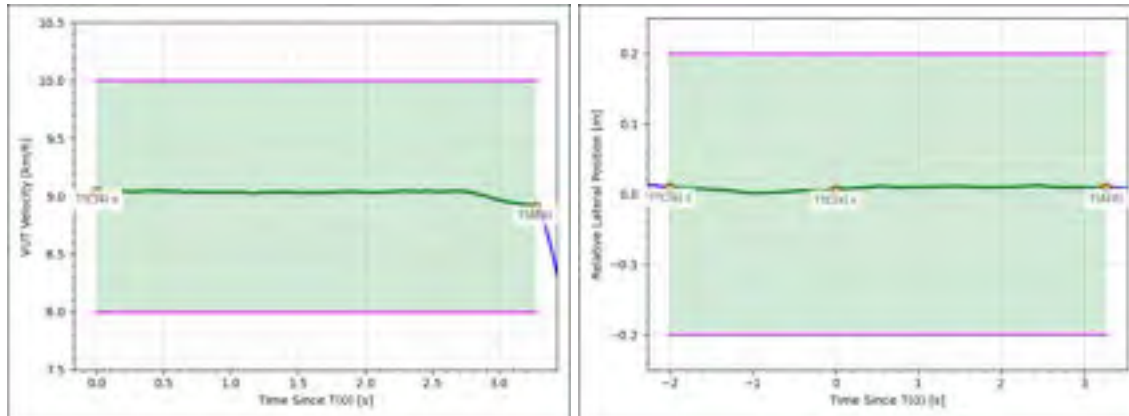
AEB CCRs | 10 km/h 100 % | Run 5

Run Date / Time 28-Nov-2022 09:47



AEB CCRs | 10 km/h 100 % | Run 6

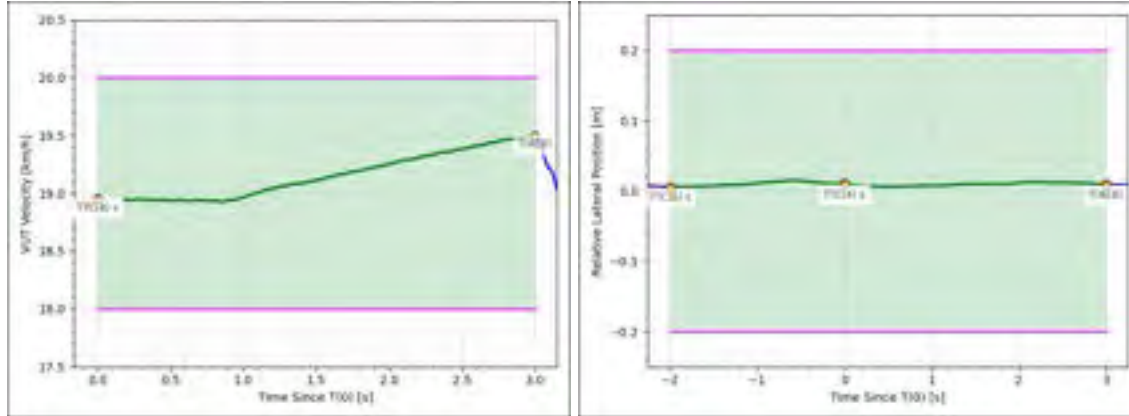
Run Date / Time 28-Nov-2022 09:50



D.1.1.2. AEB CCRs 20 kph +100 %

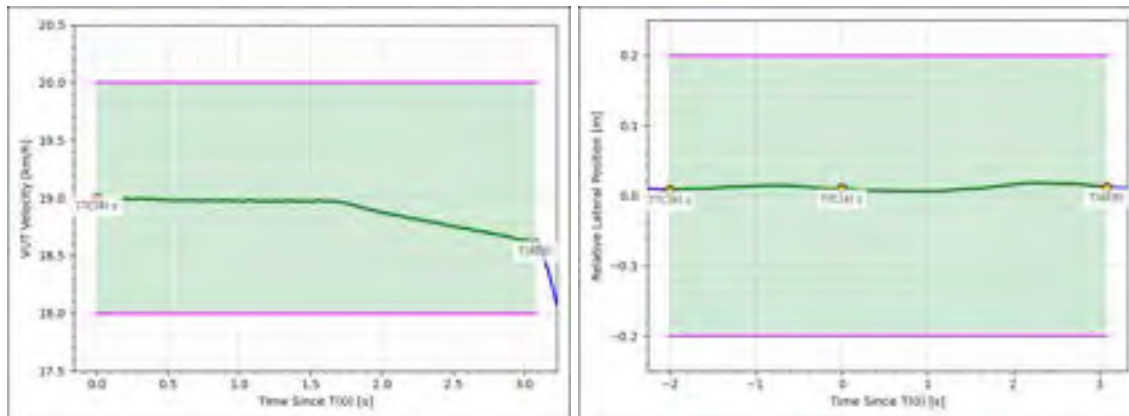
AEB CCRs | 20 km/h +100 % | Run 1

Run Date / Time 28-Nov-2022 09:52



AEB CCRs | 20 km/h +100 % | Run 2

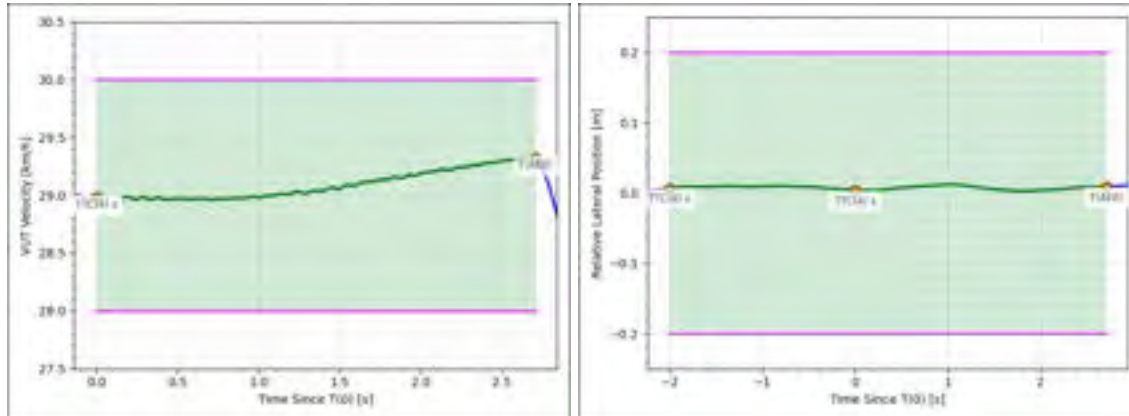
Run Date / Time 28-Nov-2022 09:54



D.1.1.3. AEB CCRs 30 kph +100 %

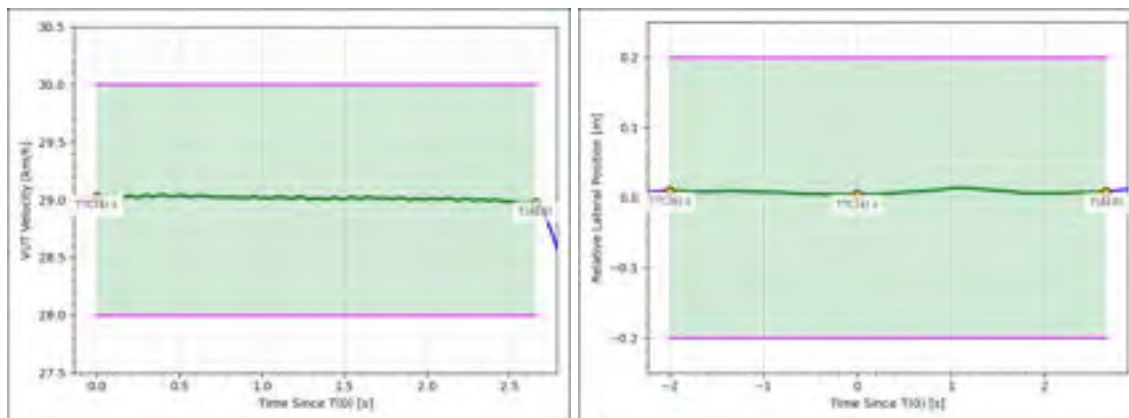
AEB CCRs | 30 km/h +100 % | Run 1

Run Date / Time 28-Nov-2022 09:58



AEB CCRs | 30 km/h +100 % | Run 2

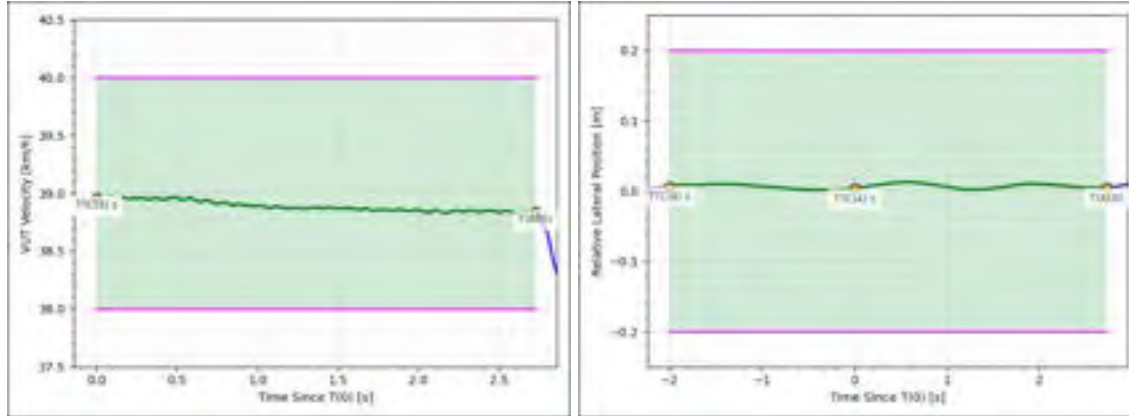
Run Date / Time 28-Nov-2022 10:00



D.1.1.4. AEB CCRs 40 kph +100 %

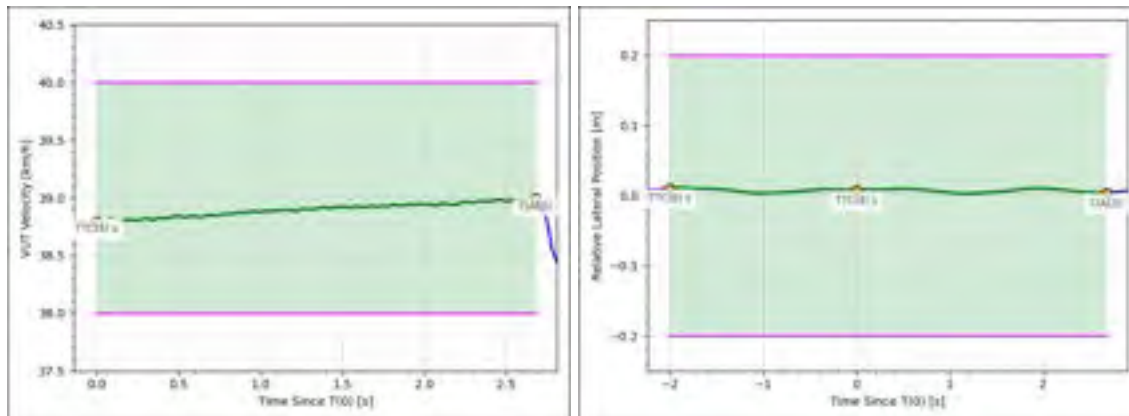
AEB CCRs | 40 km/h +100 % | Run 1

Run Date / Time 28-Nov-2022 10:06



AEB CCRs | 40 km/h +100 % | Run 2

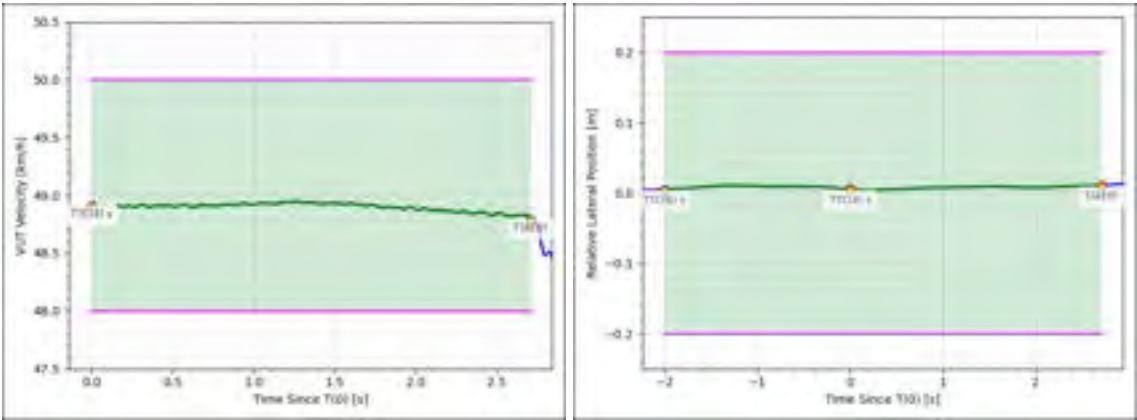
Run Date / Time 28-Nov-2022 10:08



D.1.1.5. AEB CCRs 50 kph -50 %

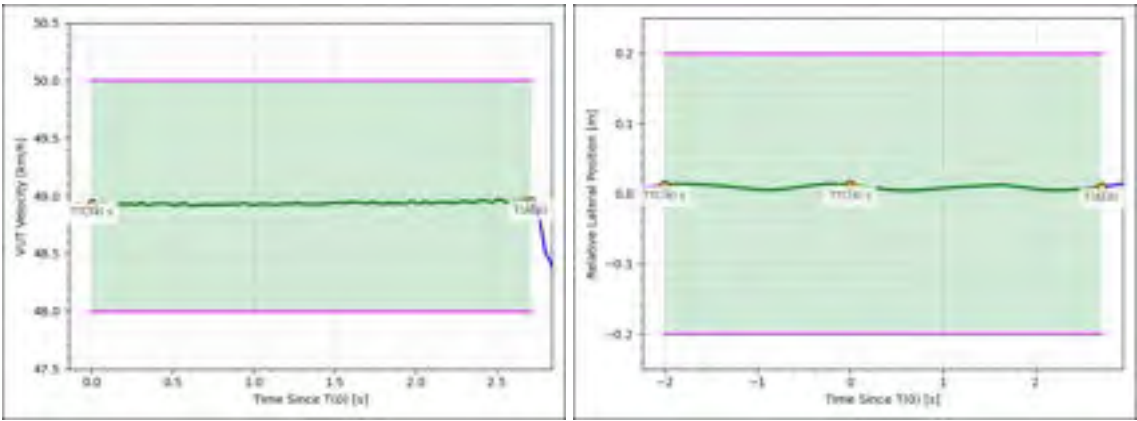
AEB CCRs | 50 km/h -50 % | Run 1

Run Date / Time 28-Nov-2022 10:28



AEB CCRs | 50 km/h -50 % | Run 2

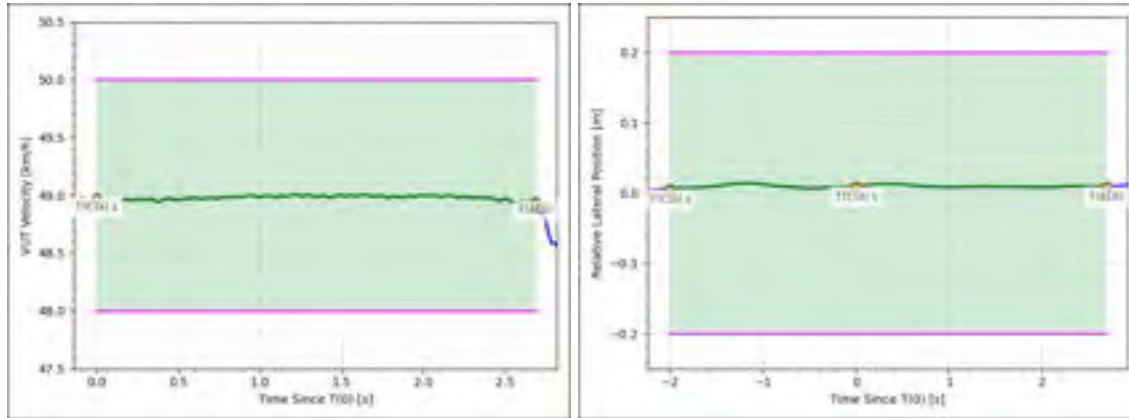
Run Date / Time 28-Nov-2022 10:30



D.1.1.6. AEB CCRs 50 kph +100 %

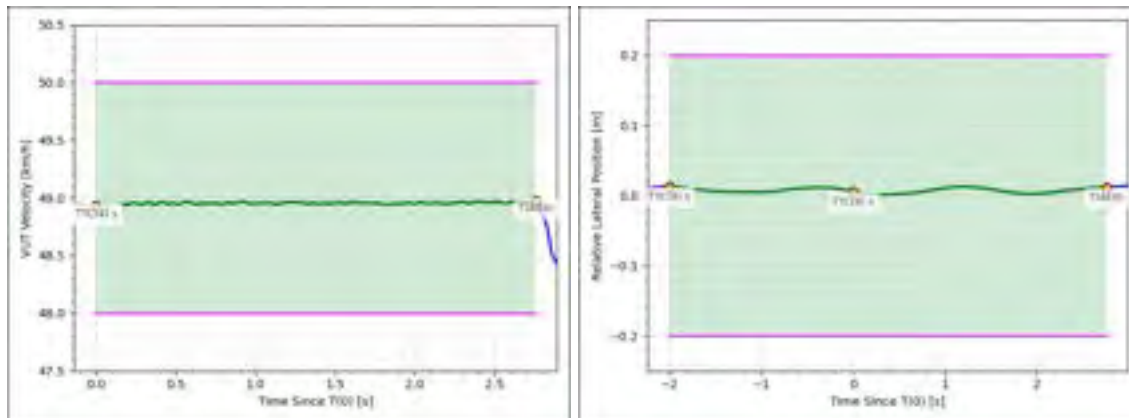
AEB CCRs | 50 km/h +100 % | Run 1

Run Date / Time 28-Nov-2022 10:11



AEB CCRs | 50 km/h +100 % | Run 2

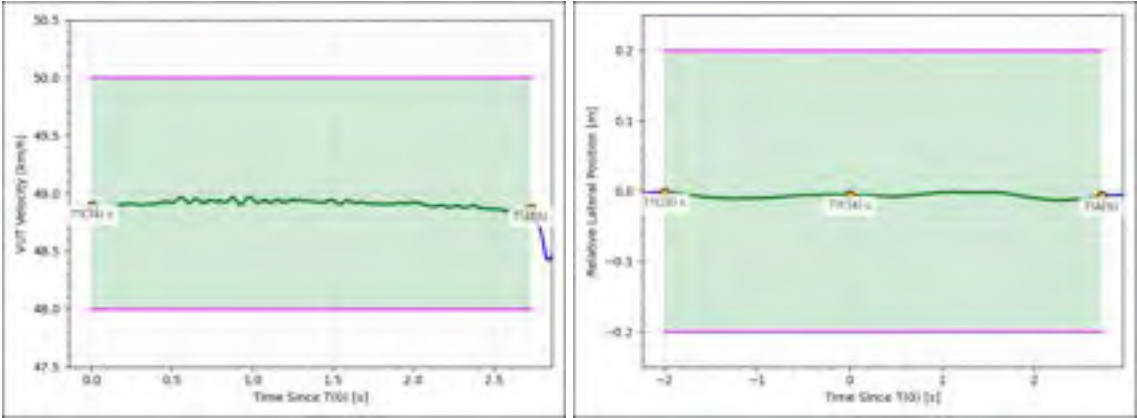
Run Date / Time 28-Nov-2022 10:15



D.1.1.7. AEB CCRs 50 kph +50 %

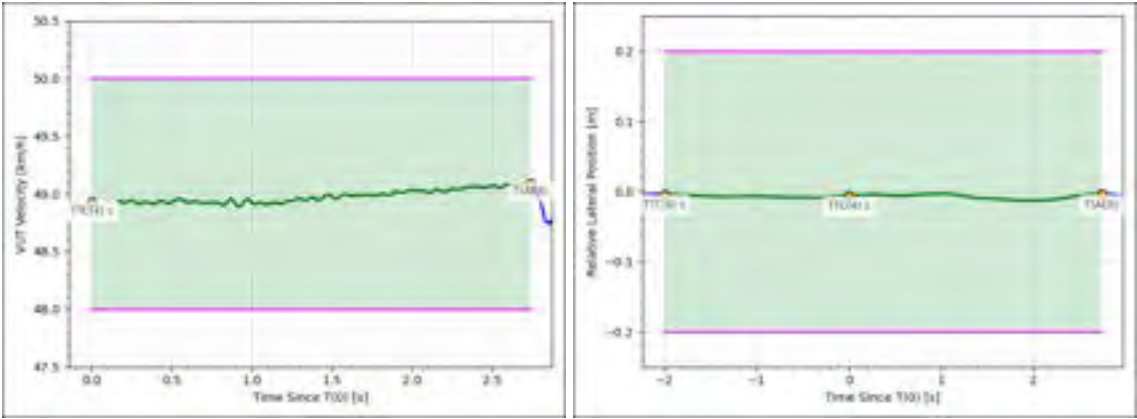
AEB CCRs | 50 km/h +50 % | Run 1

Run Date / Time 28-Nov-2022 10:33



AEB CCRs | 50 km/h +50 % | Run 2

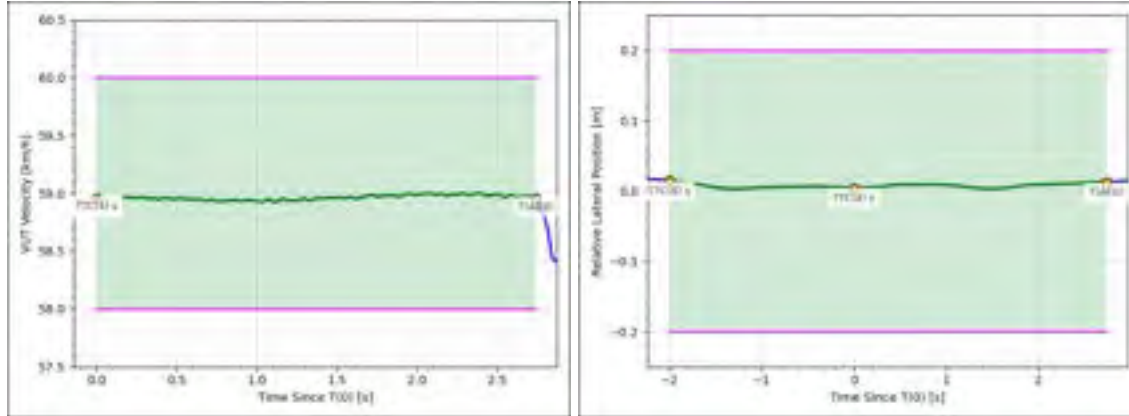
Run Date / Time 28-Nov-2022 10:36



D.1.1.8. AEB CCRs 60 kph +100 %

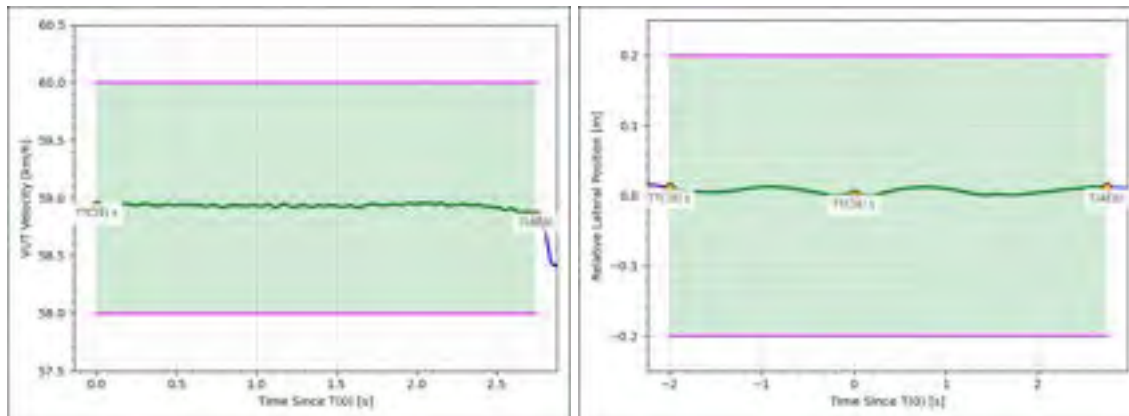
AEB CCRs | 60 km/h +100 % | Run 1

Run Date / Time 28-Nov-2022 10:18



AEB CCRs | 60 km/h +100 % | Run 2

Run Date / Time 28-Nov-2022 10:22

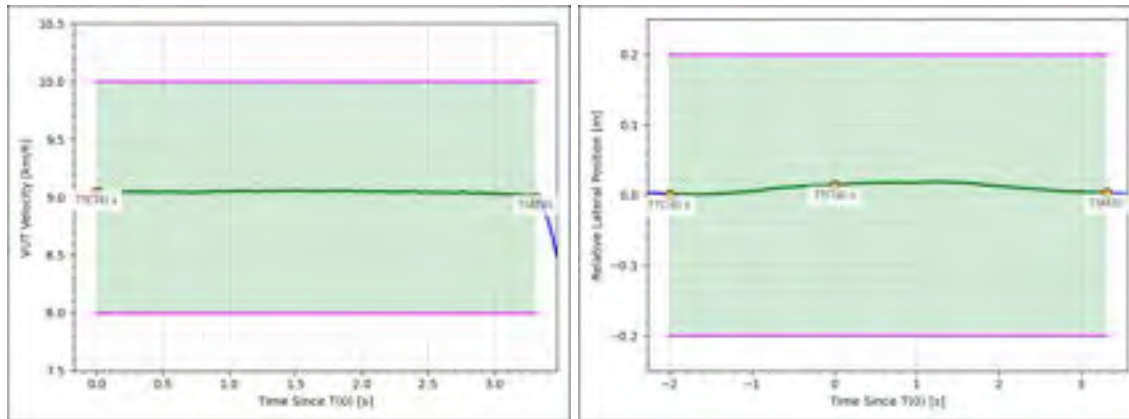


D.1.1. GVM

D.1.1.1. AEB CCRs 10 kph +100 %

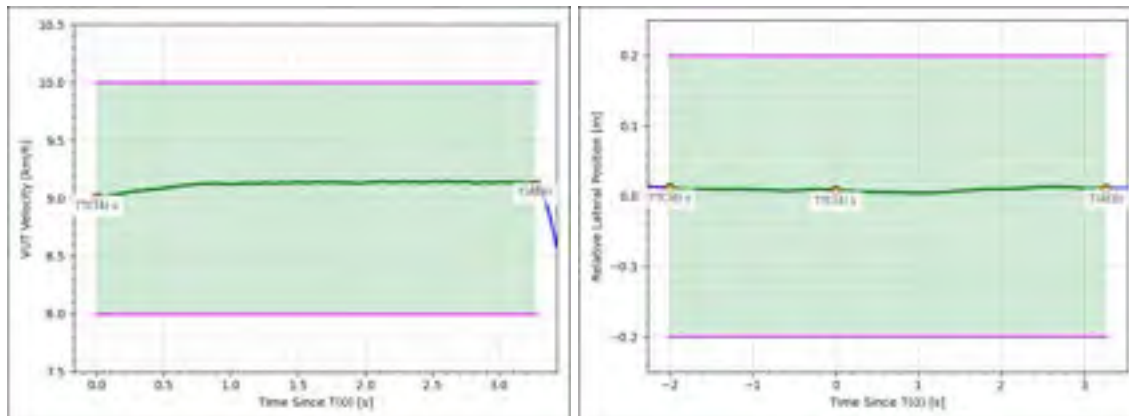
AEB CCRs | 10 km/h 100 % | Run 7

Run Date / Time 13-Dec-2022 09:48



AEB CCRs | 10 km/h 100 % | Run 8

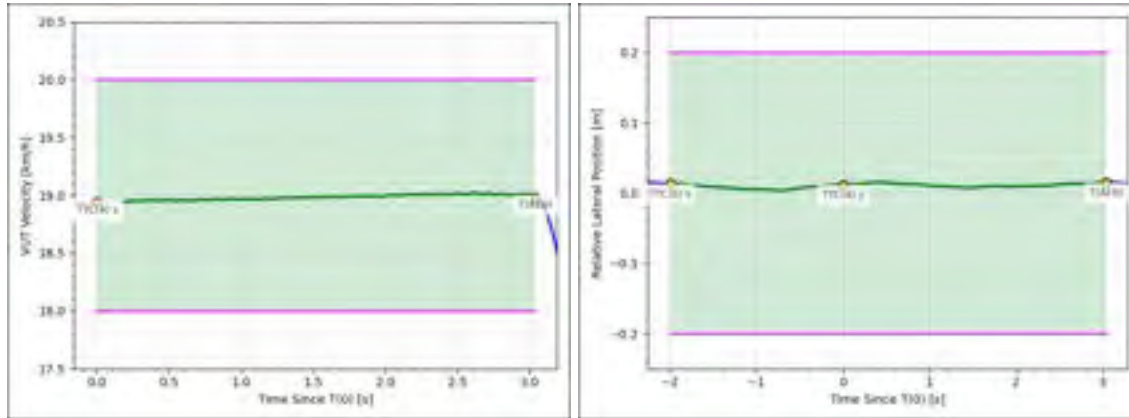
Run Date / Time 13-Dec-2022 09:51



D.1.1.2. AEB CCRs 20 kph +100 %

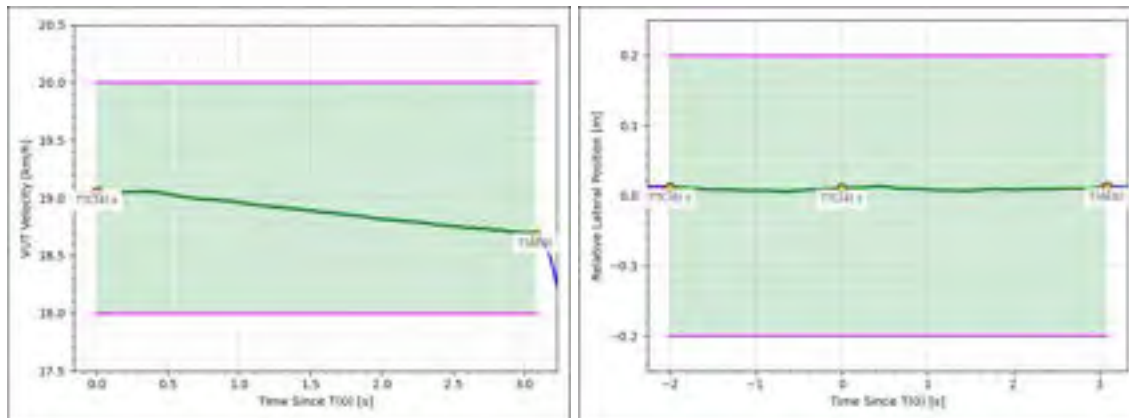
AEB CCRs | 20 km/h +100 % | Run 3

Run Date / Time 13-Dec-2022 09:55



AEB CCRs | 20 km/h +100 % | Run 4

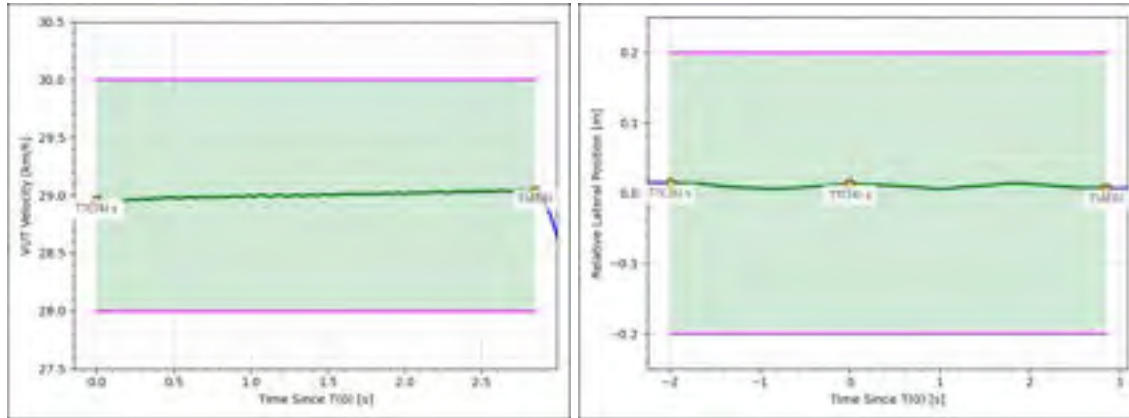
Run Date / Time 13-Dec-2022 09:57



D.1.1.3. AEB CCRs 30 kph +100 %

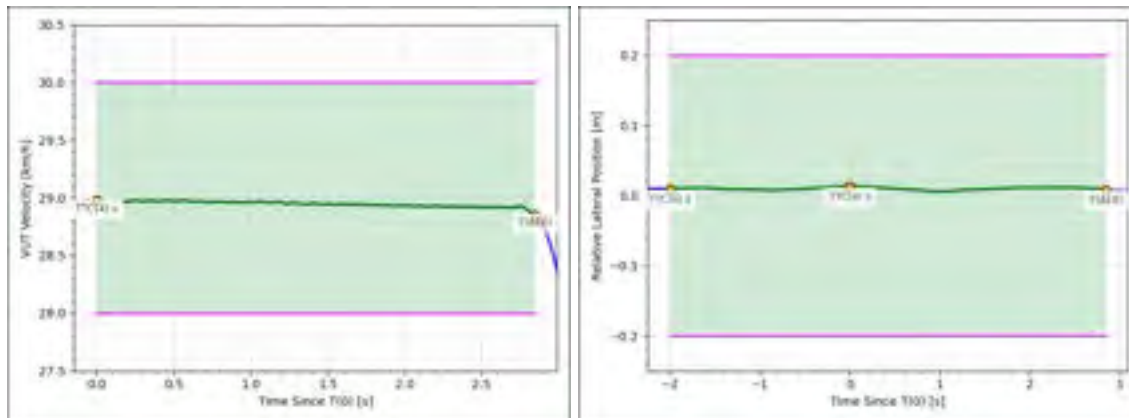
AEB CCRs | 30 km/h +100 % | Run 3

Run Date / Time 13-Dec-2022 10:00



AEB CCRs | 30 km/h +100 % | Run 4

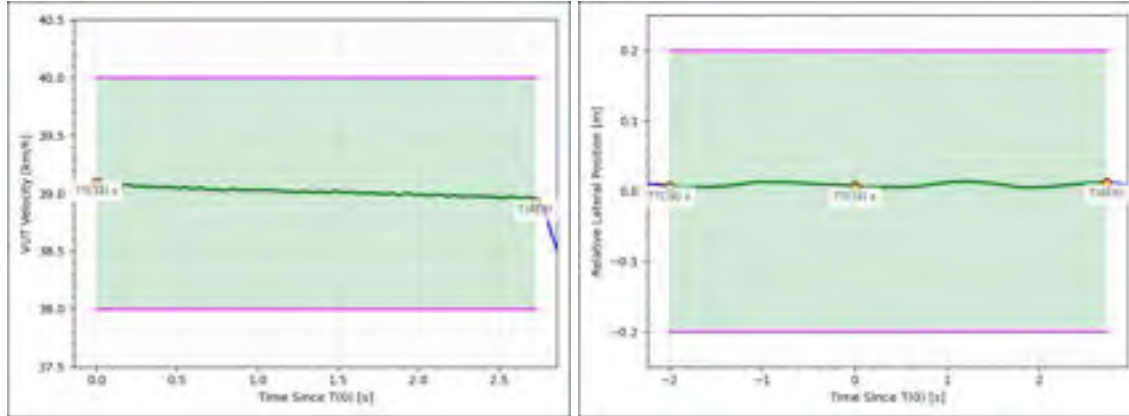
Run Date / Time 13-Dec-2022 10:02



D.1.1.4. AEB CCRs 40 kph +100 %

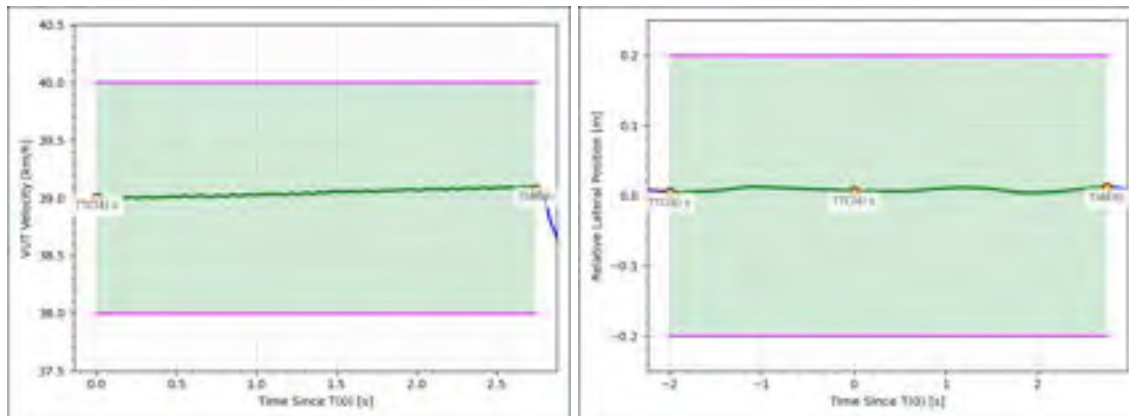
AEB CCRs | 40 km/h +100 % | Run 3

Run Date / Time 13-Dec-2022 10:06



AEB CCRs | 40 km/h +100 % | Run 4

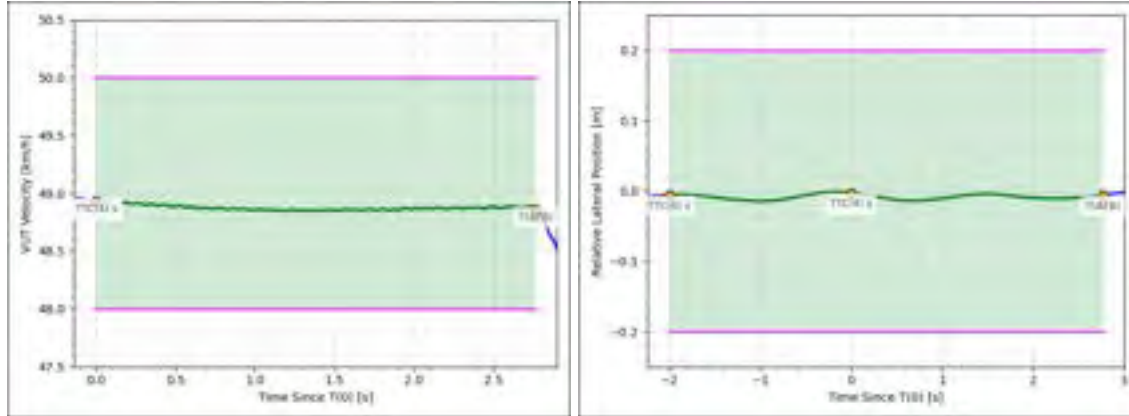
Run Date / Time 13-Dec-2022 10:08



D.1.1.5. AEB CCRs 50 kph -50 %

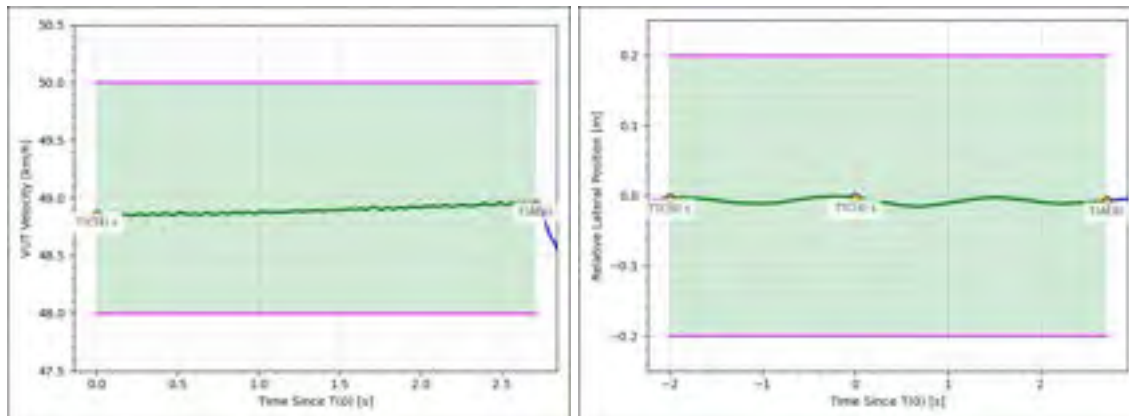
AEB CCRs | 50 km/h -50 % | Run 3

Run Date / Time 13-Dec-2022 10:31



AEB CCRs | 50 km/h -50 % | Run 4

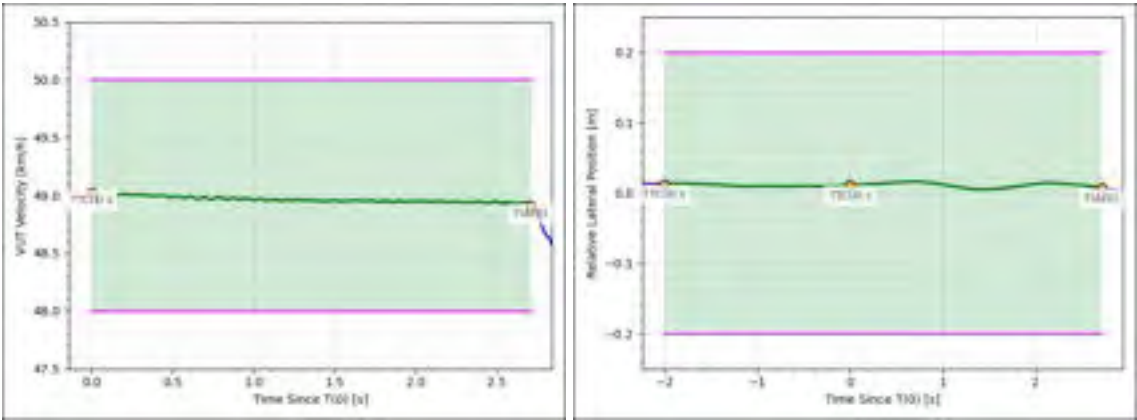
Run Date / Time 13-Dec-2022 10:34



D.1.1.6. AEB CCRs 50 kph +100 %

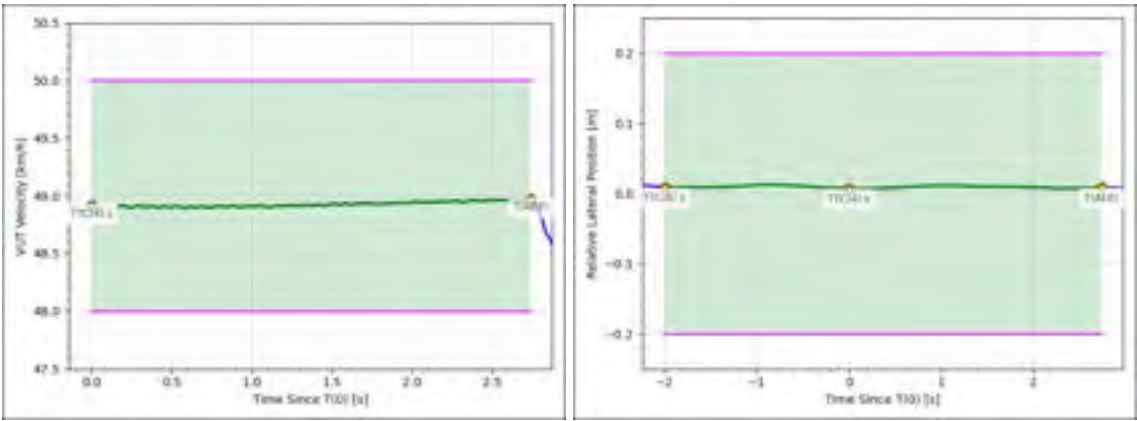
AEB CCRs | 50 km/h +100 % | Run 3

Run Date / Time 13-Dec-2022 10:12



AEB CCRs | 50 km/h +100 % | Run 4

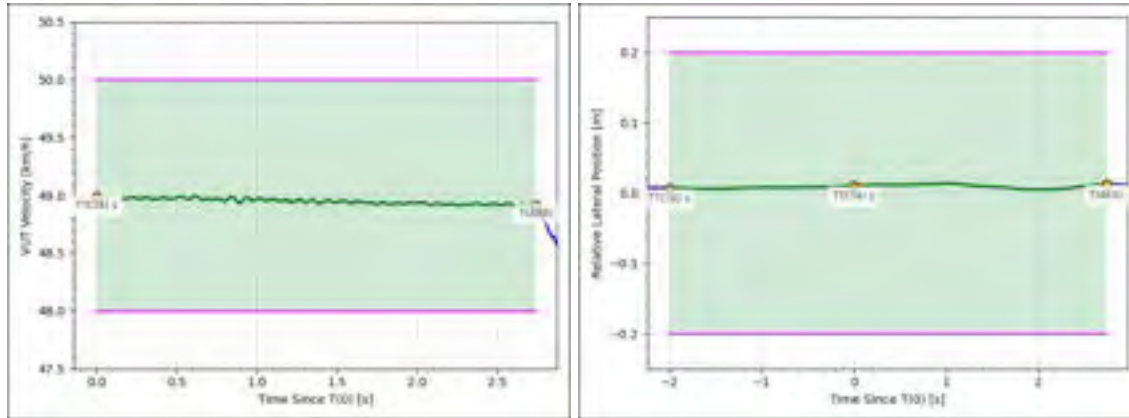
Run Date / Time 13-Dec-2022 10:14



D.1.1.7. AEB CCRs 50 kph +50 %

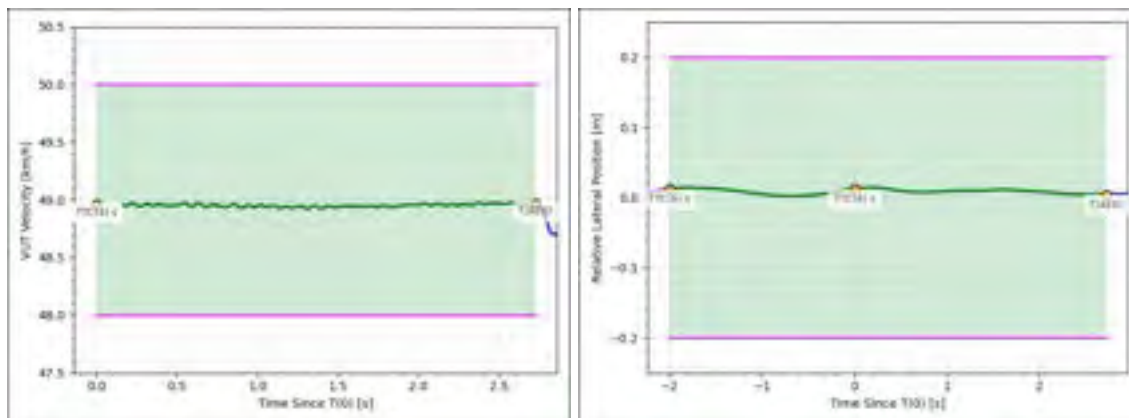
AEB CCRs | 50 km/h +50 % | Run 3

Run Date / Time 13-Dec-2022 10:24



AEB CCRs | 50 km/h +50 % | Run 4

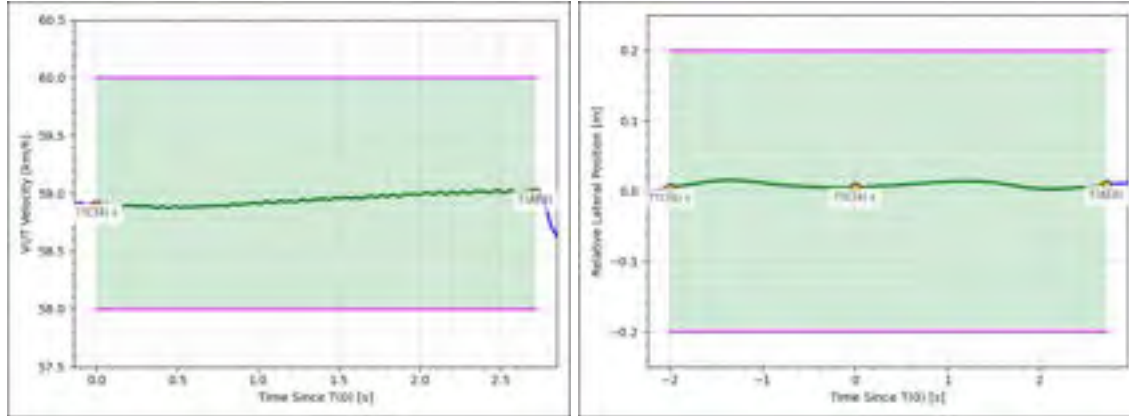
Run Date / Time 13-Dec-2022 10:28



D.1.1.8. AEB CCRs 60 kph +100 %

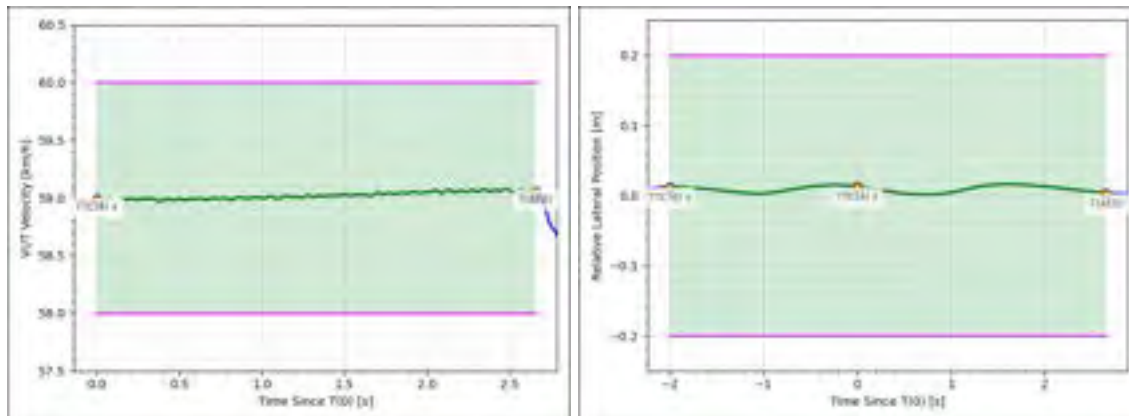
AEB CCRs | 60 km/h +100 % | Run 3

Run Date / Time 13-Dec-2022 10:18



AEB CCRs | 60 km/h +100 % | Run 4

Run Date / Time 13-Dec-2022 10:21

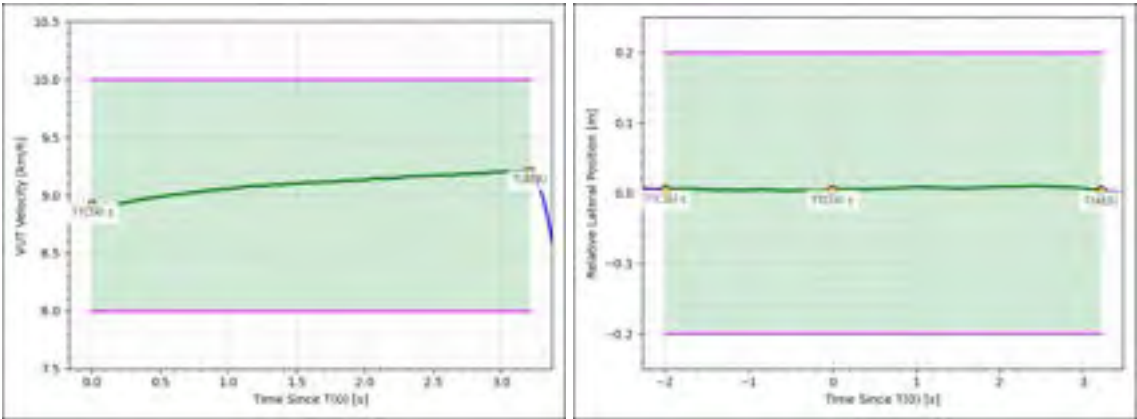


D.1.1. Rear Pitch

D.1.1.1. AEB CCRs 10 kph +100 %

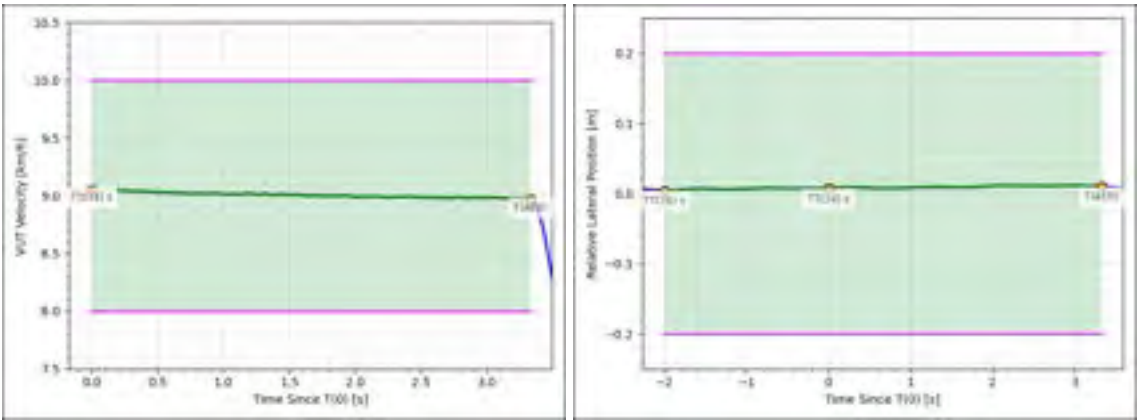
AEB CCRs | 10 km/h 100 % | Run 9

Run Date / Time 20-Dec-2022 09:45



AEB CCRs | 10 km/h 100 % | Run 10

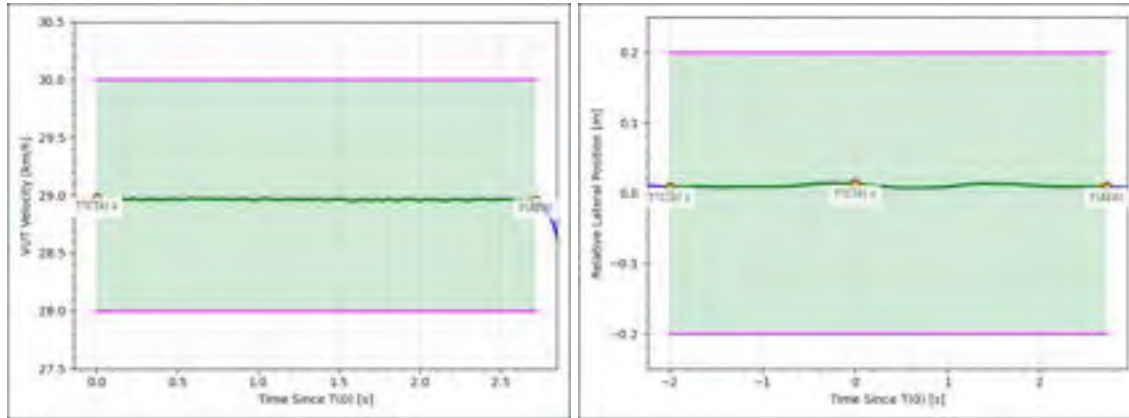
Run Date / Time 20-Dec-2022 09:48



D.1.1.2. AEB CCRs 30 kph +100 %

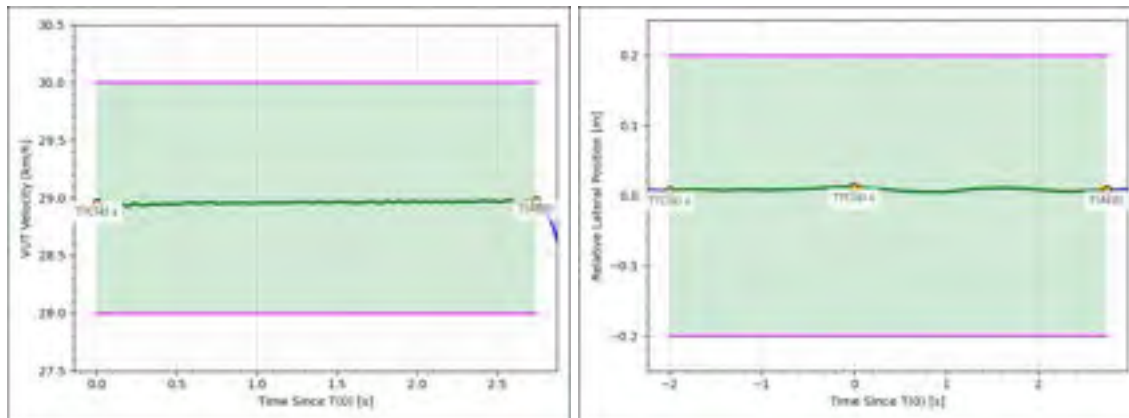
AEB CCRs | 30 km/h +100 % | Run 5

Run Date / Time 20-Dec-2022 09:51



AEB CCRs | 30 km/h +100 % | Run 6

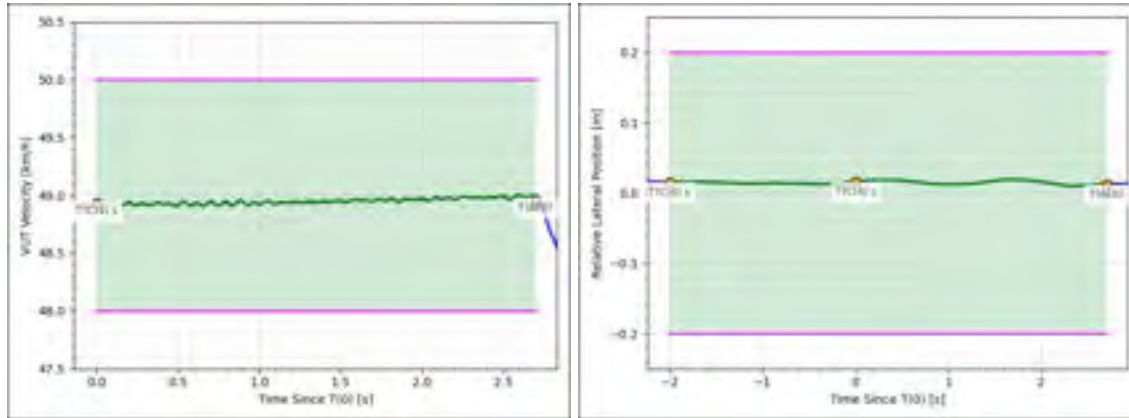
Run Date / Time 20-Dec-2022 09:54



D.1.1.3. AEB CCRs 50 kph +100 %

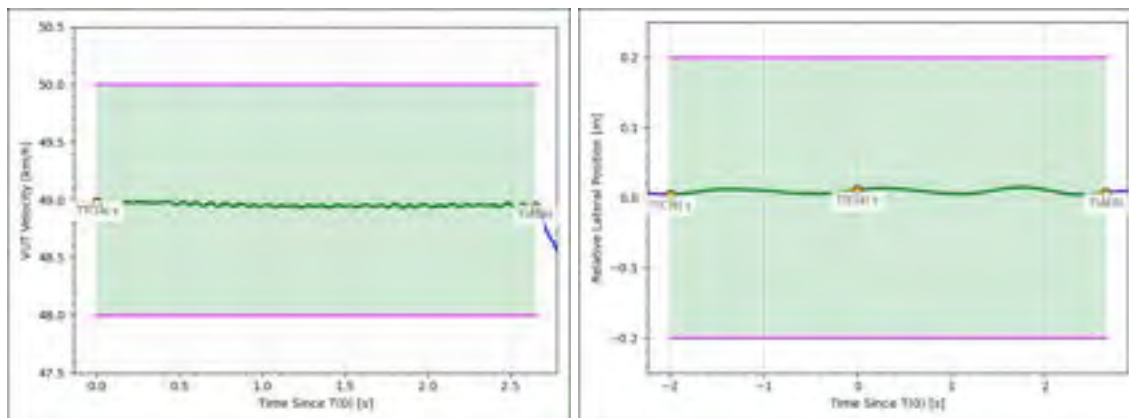
AEB CCRs | 50 km/h +100 % | Run 5

Run Date / Time 20-Dec-2022 09:57



AEB CCRs | 50 km/h +100 % | Run 6

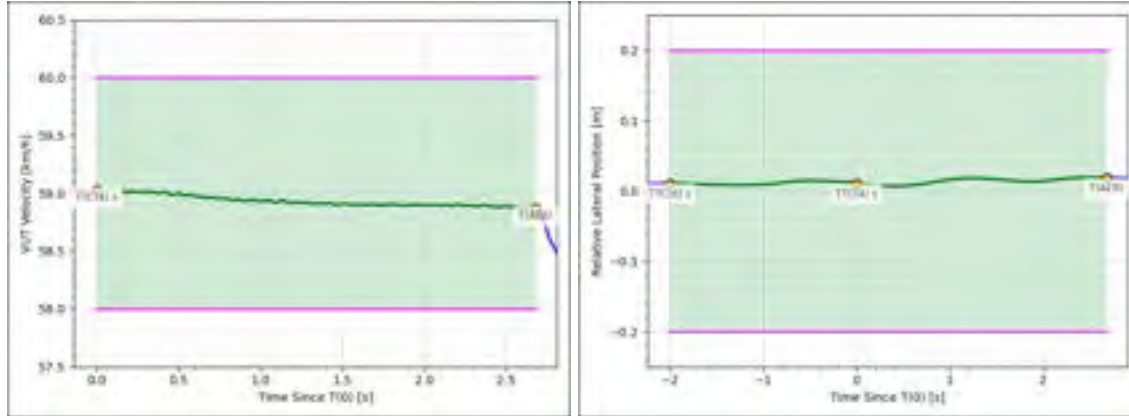
Run Date / Time 20-Dec-2022 09:59



D.1.1.4. AEB CCRs 60 kph +100 %

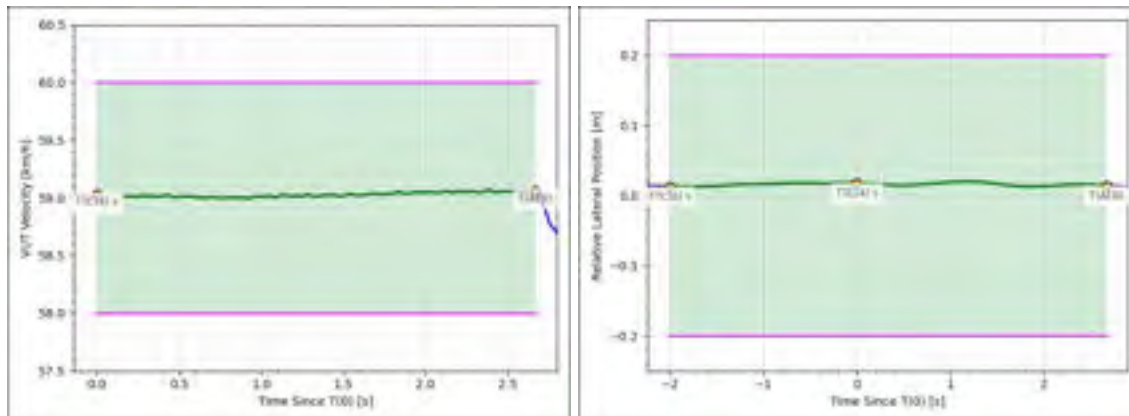
AEB CCRs | 60 km/h +100 % | Run 5

Run Date / Time 20-Dec-2022 10:02



AEB CCRs | 60 km/h +100 % | Run 6

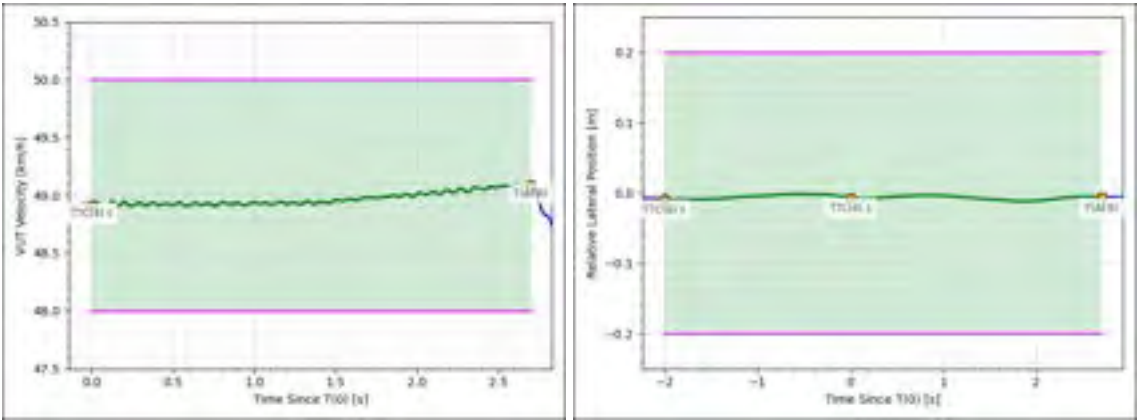
Run Date / Time 20-Dec-2022 10:04



D.1.1.5. AEB CCRs 50 kph -50 %

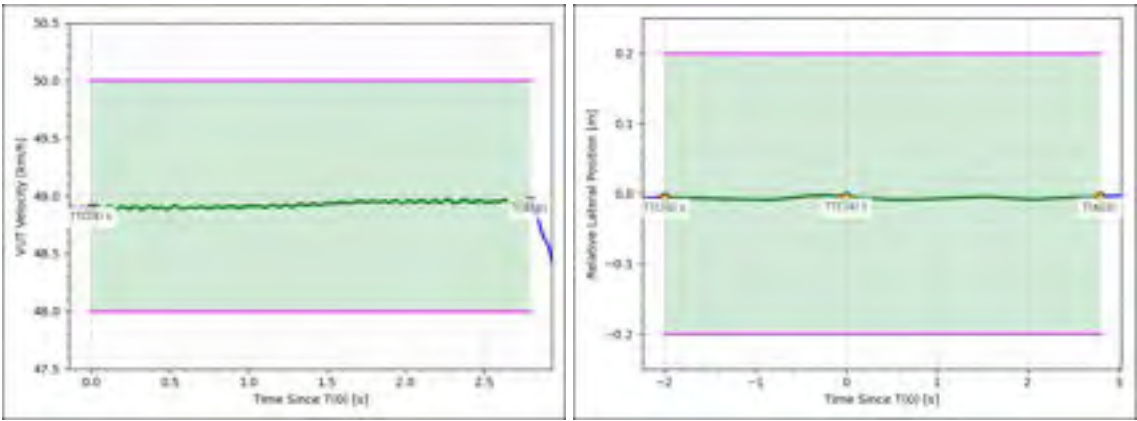
AEB CCRs | 50 km/h -50 % | Run 5

Run Date / Time 20-Dec-2022 10:15



AEB CCRs | 50 km/h -50 % | Run 6

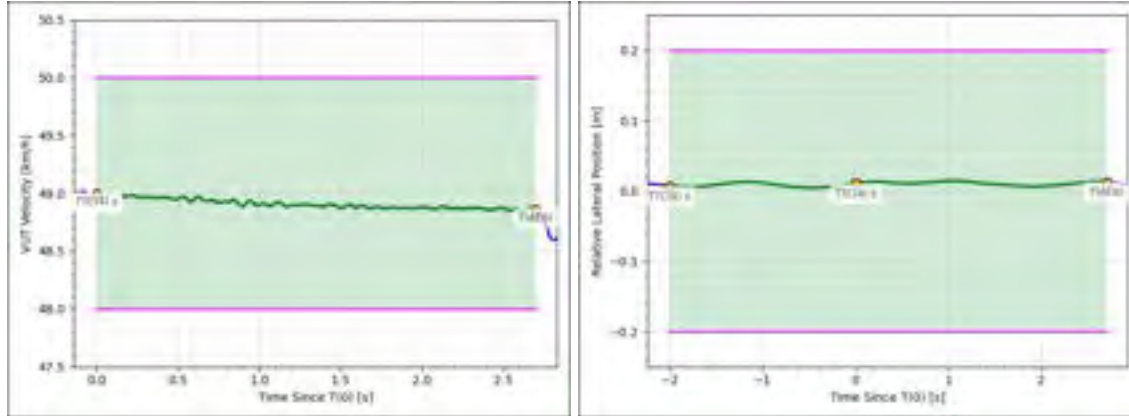
Run Date / Time 20-Dec-2022 10:18



D.1.1.6. AEB CCRs 50 kph +50 %

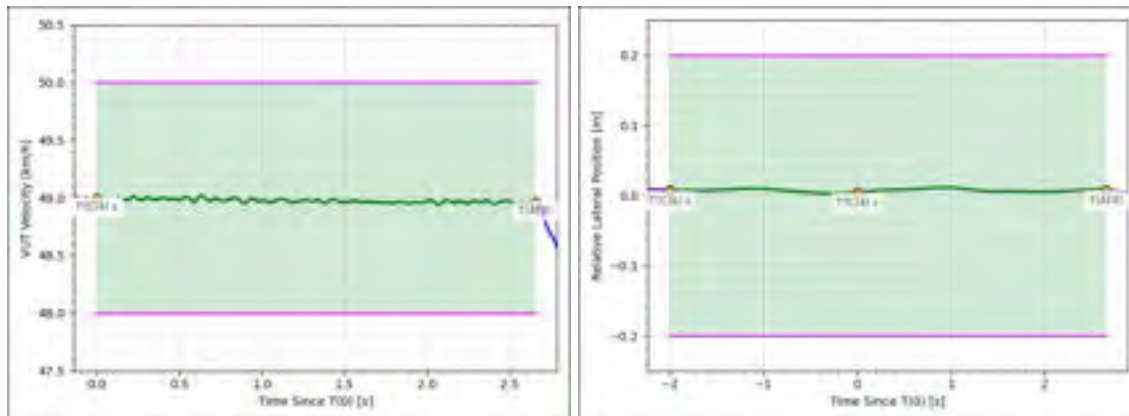
AEB CCRs | 50 km/h +50 % | Run 5

Run Date / Time 20-Dec-2022 10:06



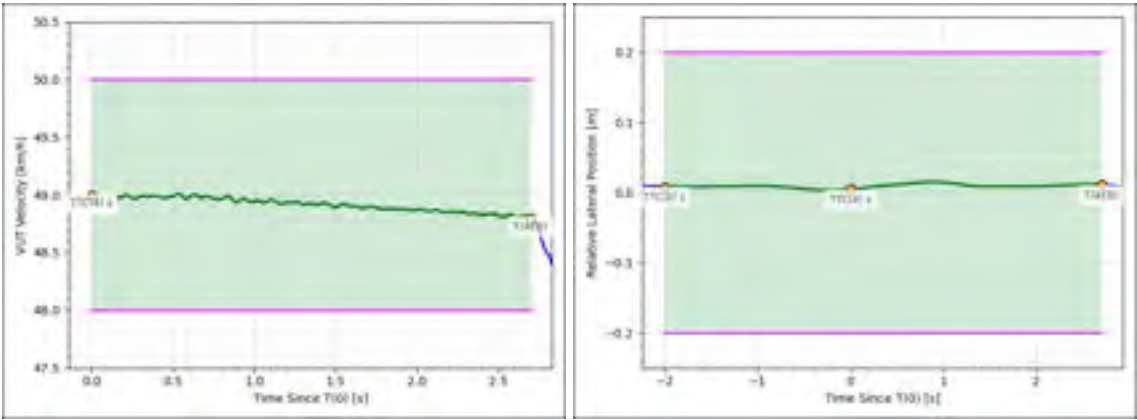
AEB CCRs | 50 km/h +50 % | Run 6

Run Date / Time 20-Dec-2022 10:09



AEB CCRs | 50 km/h +50 % | Run 7

Run Date / Time 20-Dec-2022 10:11

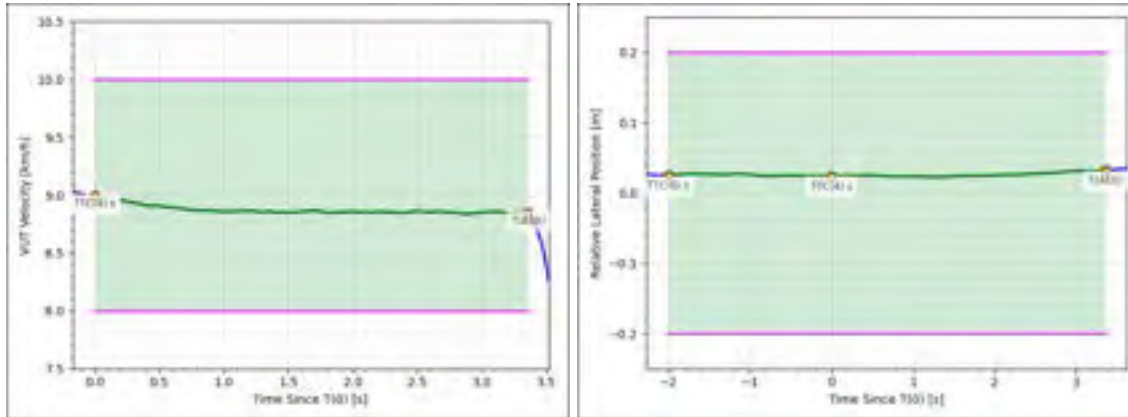


D.1.1. Lift Kit

D.1.1.1. AEB CCRs 10 kph +100 %

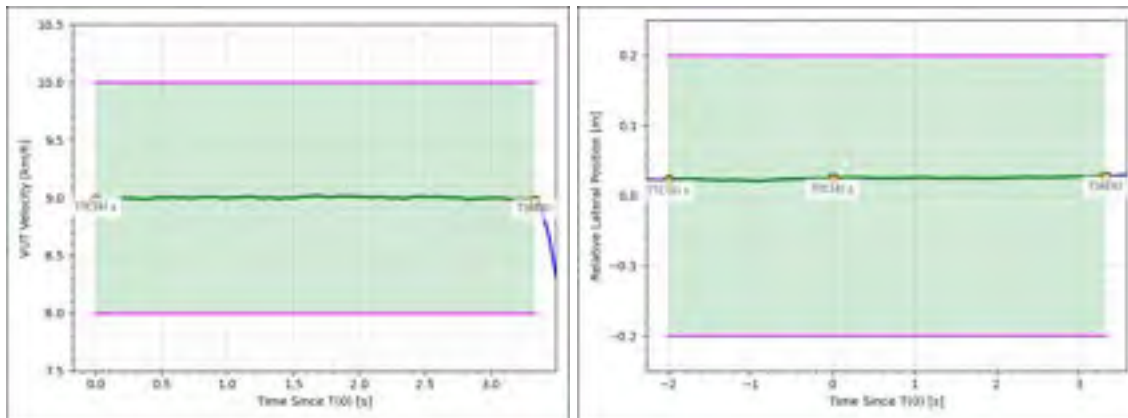
AEB CCRs | 10 km/h 100 % | Run 11

Run Date / Time 6-Mar-2023 14:27



AEB CCRs | 10 km/h 100 % | Run 12

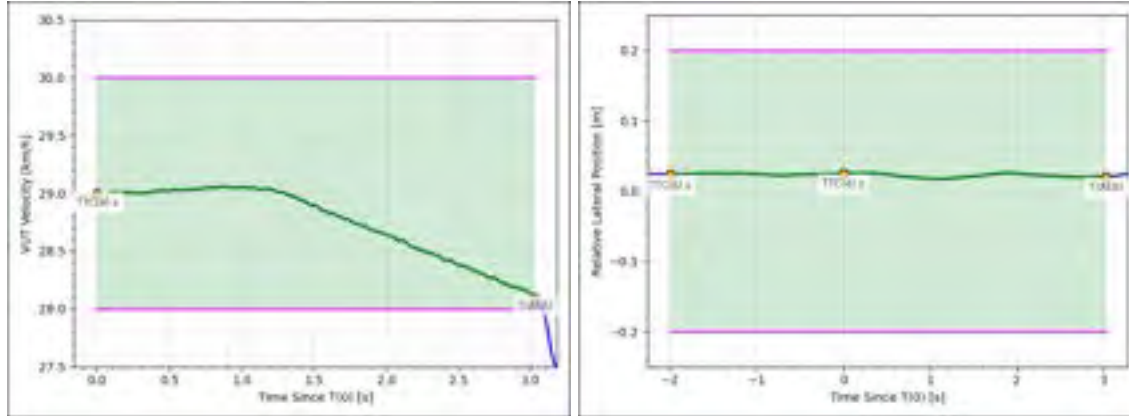
Run Date / Time 6-Mar-2023 14:35



D.1.1.2. AEB CCRs 30 kph +100 %

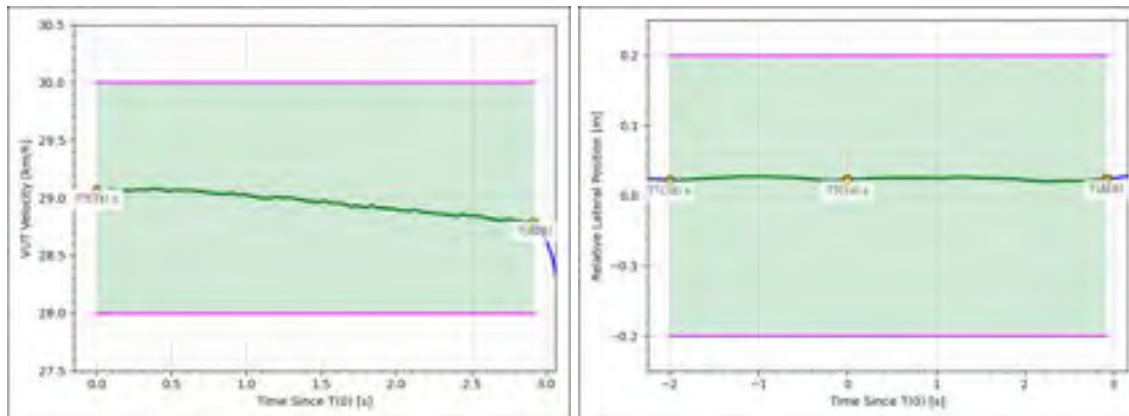
AEB CCRs | 30 km/h +100 % | Run 7

Run Date / Time 6-Mar-2023 14:39



AEB CCRs | 30 km/h +100 % | Run 8

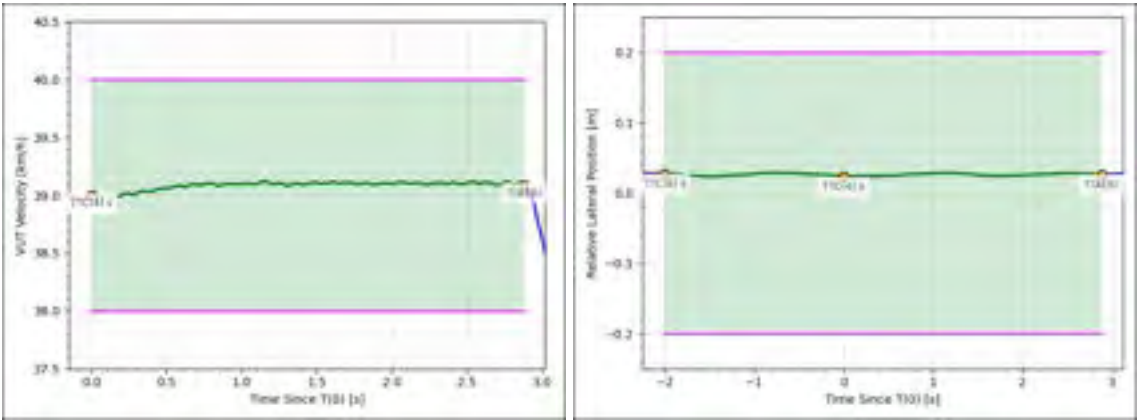
Run Date / Time 6-Mar-2023 14:42



D.1.1.3. AEB CCRs 40 kph +100 %

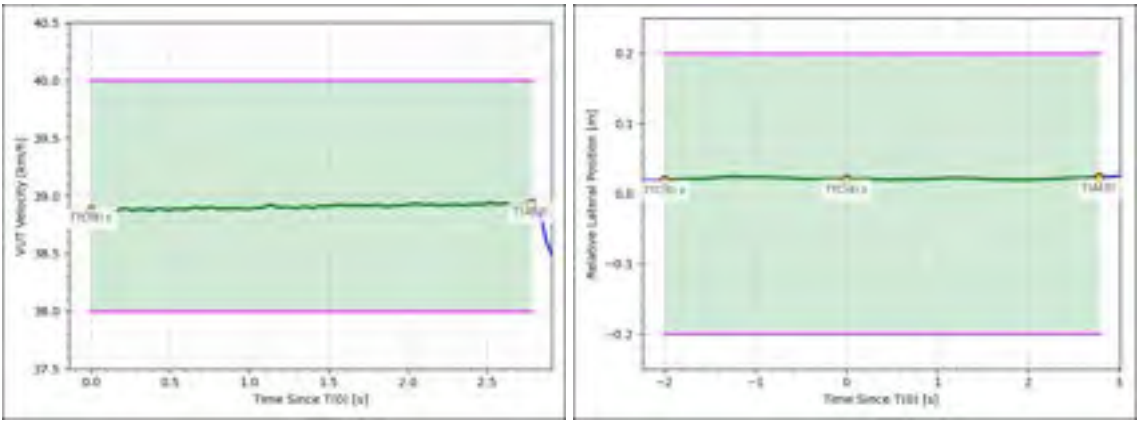
AEB CCRs | 40 km/h +100 % | Run 5

Run Date / Time 6-Mar-2023 14:46



AEB CCRs | 40 km/h +100 % | Run 6

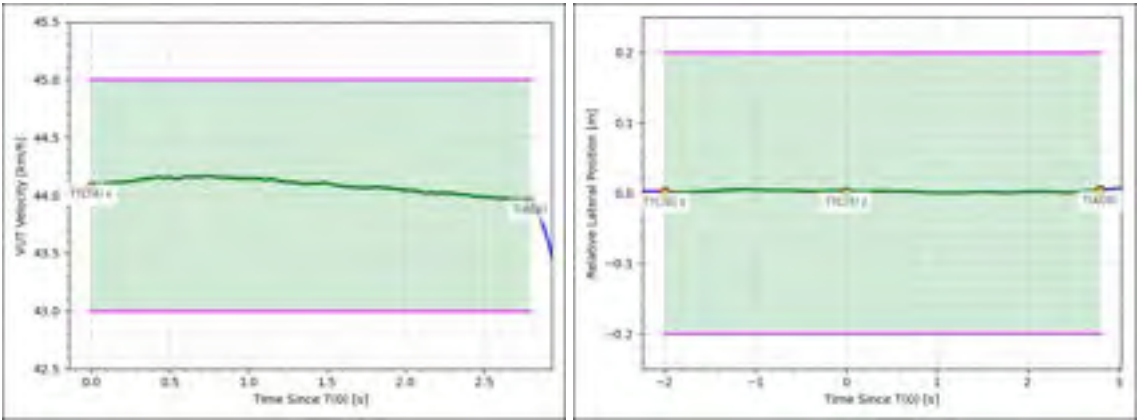
Run Date / Time 6-Mar-2023 14:48



D.1.1.4. AEB CCRs 45 kph +100 %

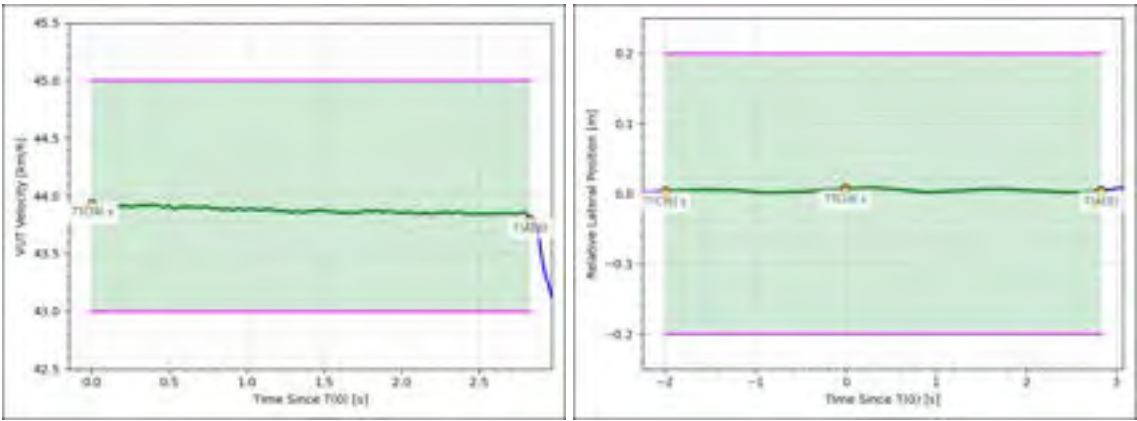
AEB CCRs | 45 km/h +100 % | Run 1

Run Date / Time 7-Mar-2023 13:08



AEB CCRs | 45 km/h +100 % | Run 2

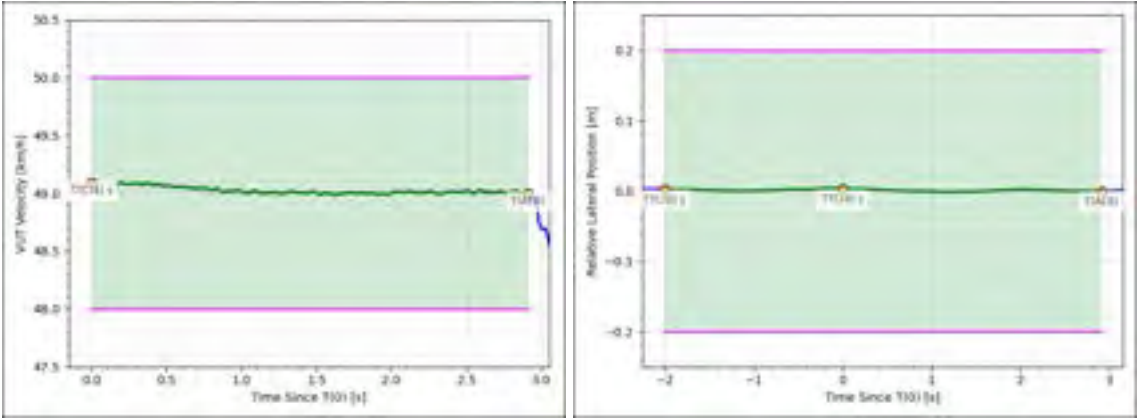
Run Date / Time 7-Mar-2023 13:12



D.1.1.5. AEB CCRs 50 kph -50 %

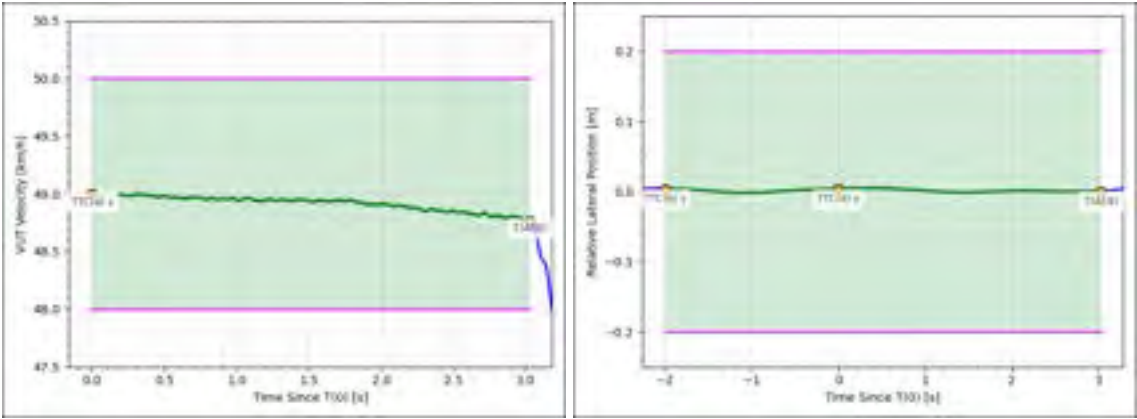
AEB CCRs | 50 km/h -50 % | Run 7

Run Date / Time 6-Mar-2023 15:07



AEB CCRs | 50 km/h -50 % | Run 8

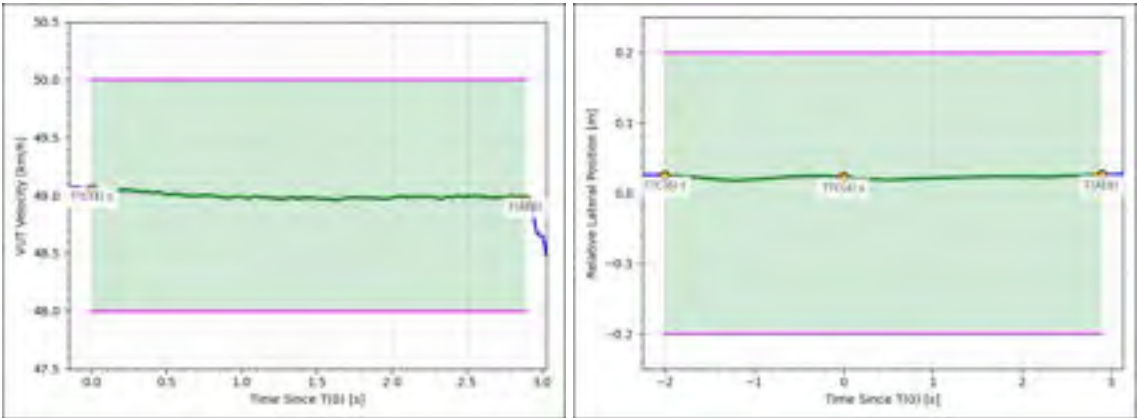
Run Date / Time 6-Mar-2023 15:12



D.1.1.6. AEB CCRs 50 kph +100 %

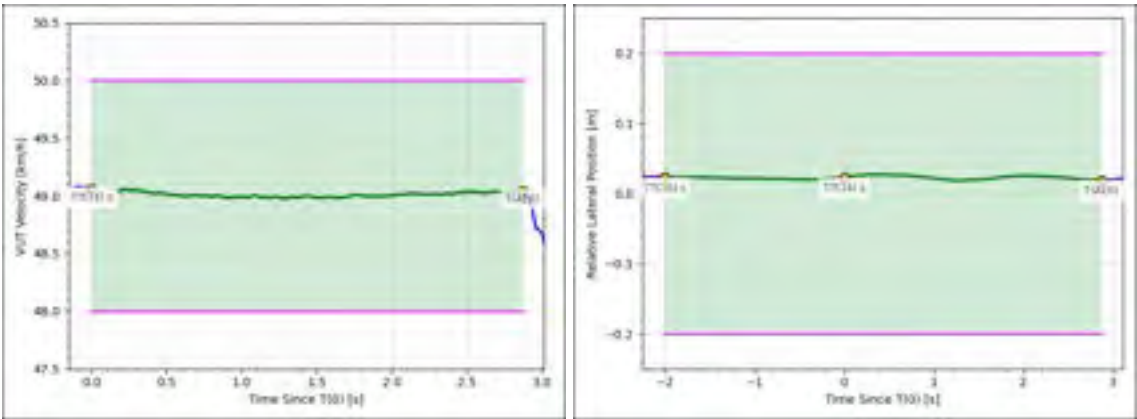
AEB CCRs | 50 km/h +100 % | Run 7

Run Date / Time 6-Mar-2023 14:51



AEB CCRs | 50 km/h +100 % | Run 8

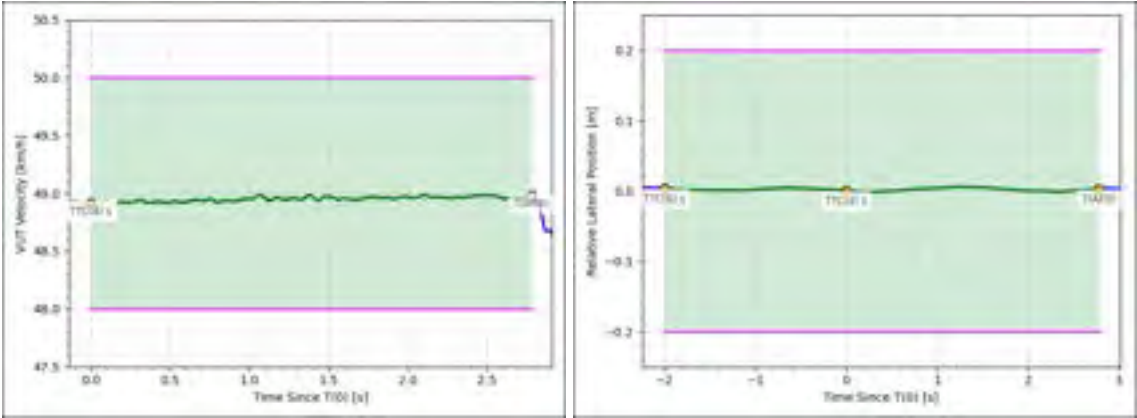
Run Date / Time 6-Mar-2023 14:53



D.1.1.7. AEB CCRs 50 kph +50 %

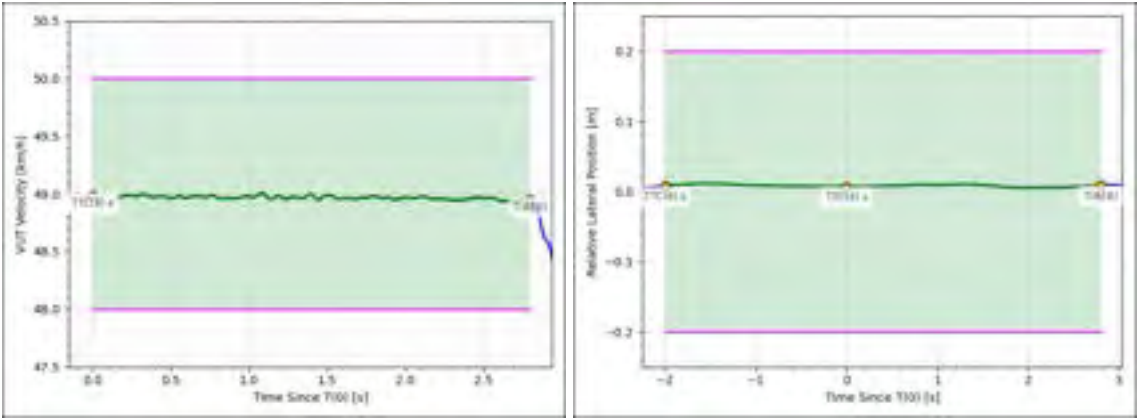
AEB CCRs | 50 km/h +50 % | Run 8

Run Date / Time 6-Mar-2023 15:27



AEB CCRs | 50 km/h +50 % | Run 9

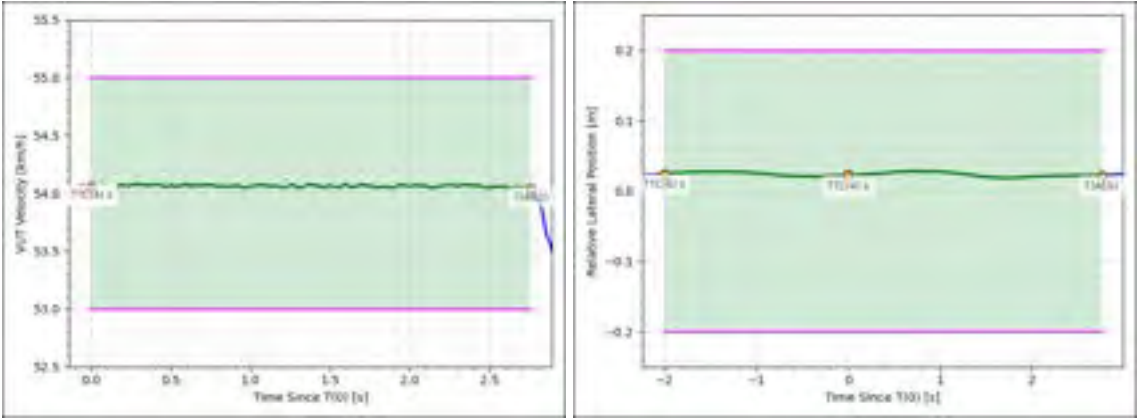
Run Date / Time 6-Mar-2023 15:30



D.1.1.8. AEB CCRs 55 *kph* +100 %

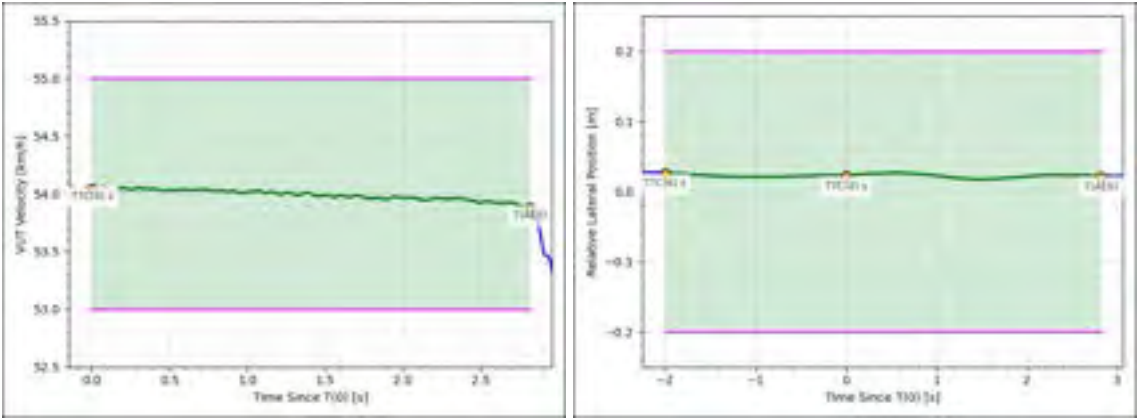
AEB CCRs | 55 km/h +100 % | Run 1

Run Date / Time 6-Mar-2023 14:56



AEB CCRs | 55 km/h +100 % | Run 2

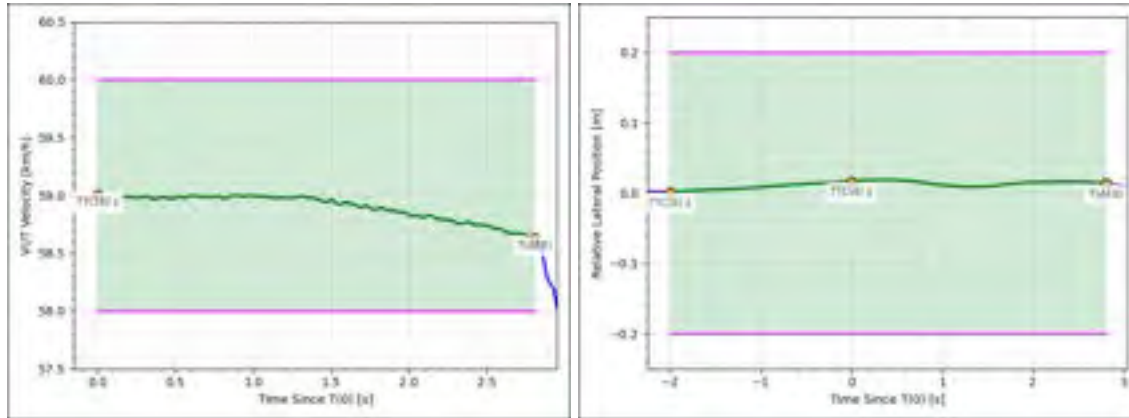
Run Date / Time 6-Mar-2023 15:00



D.1.1.9. AEB CCRs 60 kph +100 %

AEB CCRs | 60 km/h +100 % | Run 7

Run Date / Time 6-Mar-2023 15:33

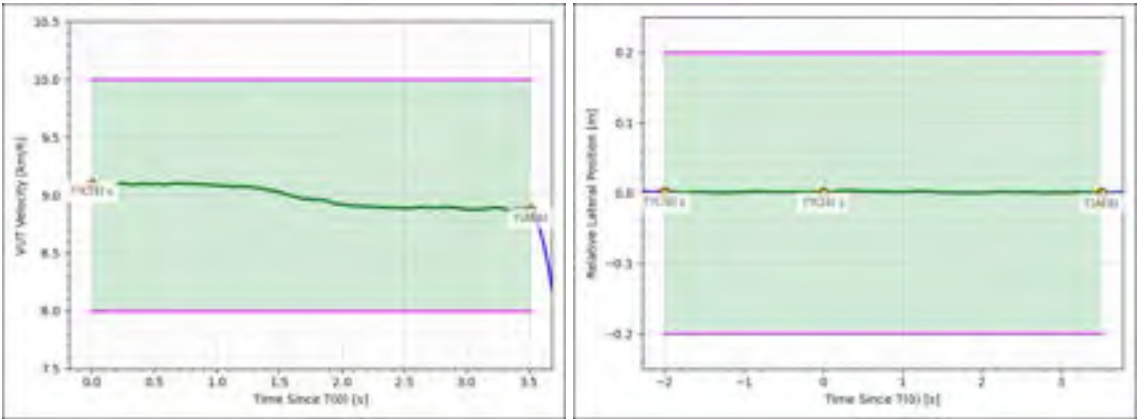


D.1.1. Lift Kit + Bullbar

D.1.1.1. AEB CCRs 10 kph +100 %

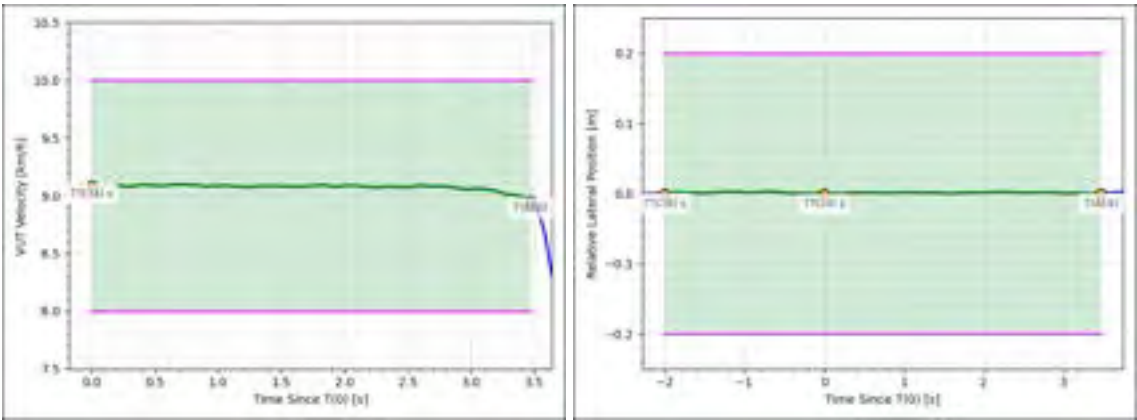
AEB CCRs | 10 km/h 100 % | Run 1

Run Date / Time 17-Mar-2023 09:51



AEB CCRs | 10 km/h 100 % | Run 2

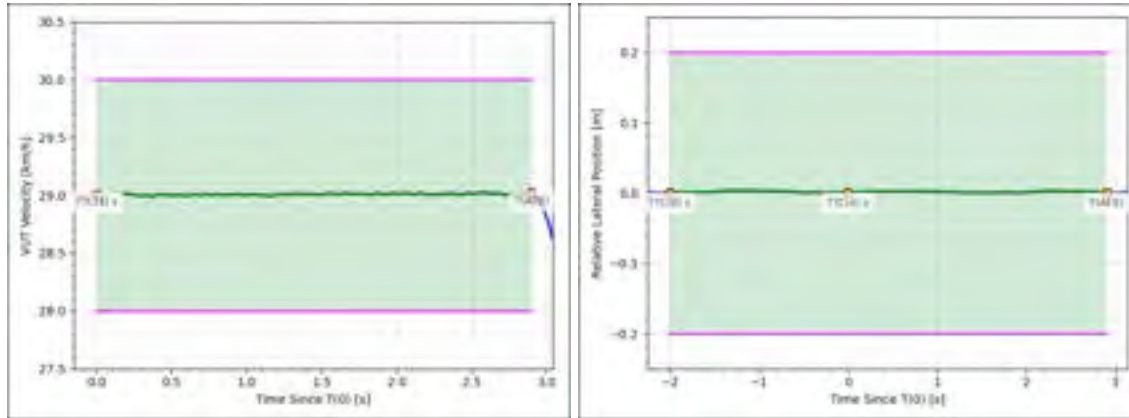
Run Date / Time 17-Mar-2023 09:54



D.1.1.2. AEB CCRs 30 kph +100 %

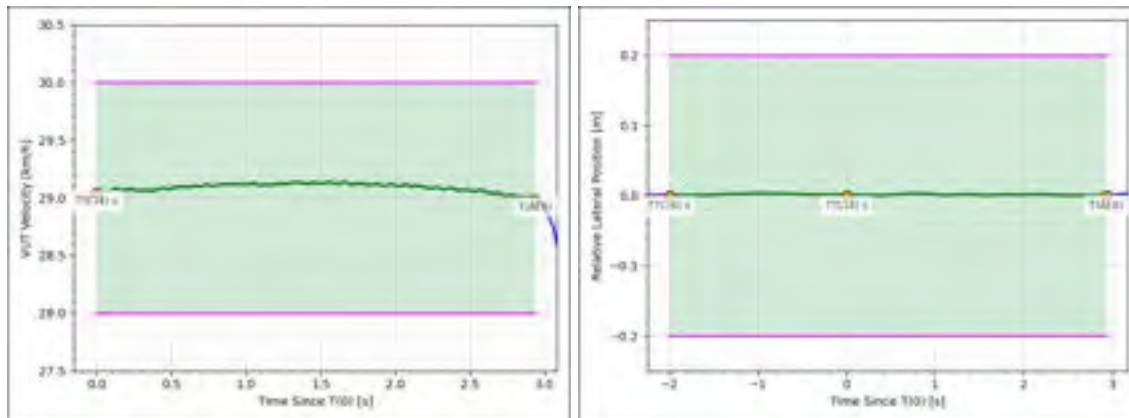
AEB CCRs | 30 km/h +100 % | Run 1

Run Date / Time 17-Mar-2023 09:57



AEB CCRs | 30 km/h +100 % | Run 2

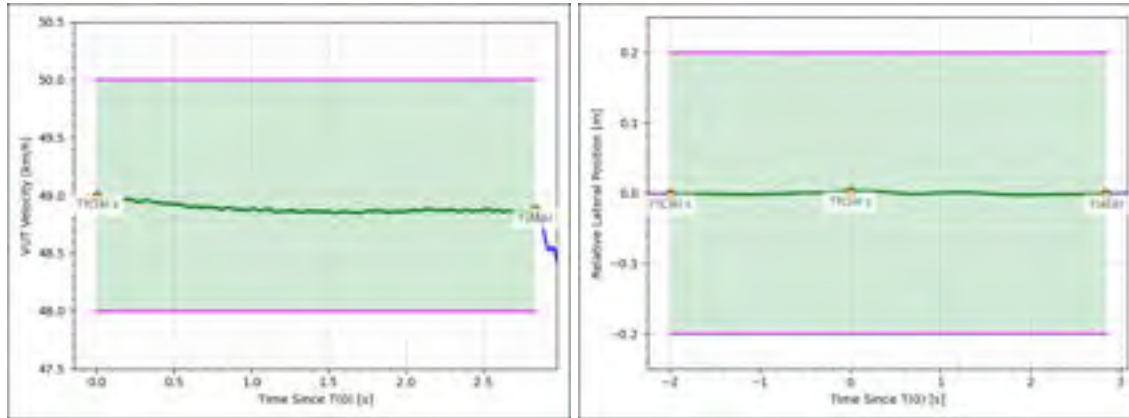
Run Date / Time 17-Mar-2023 10:00



D.1.1.3. AEB CCRs 50 kph -50 %

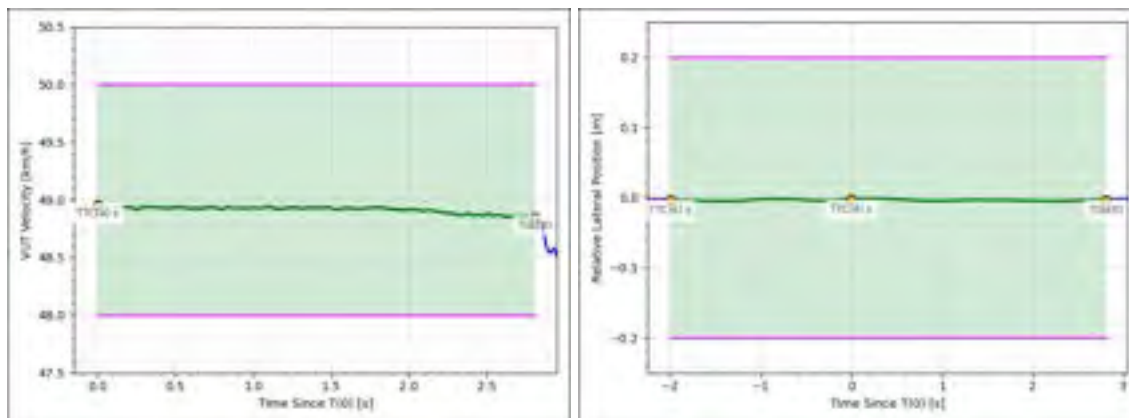
AEB CCRs | 50 km/h -50 % | Run 1

Run Date / Time 17-Mar-2023 10:20



AEB CCRs | 50 km/h -50 % | Run 2

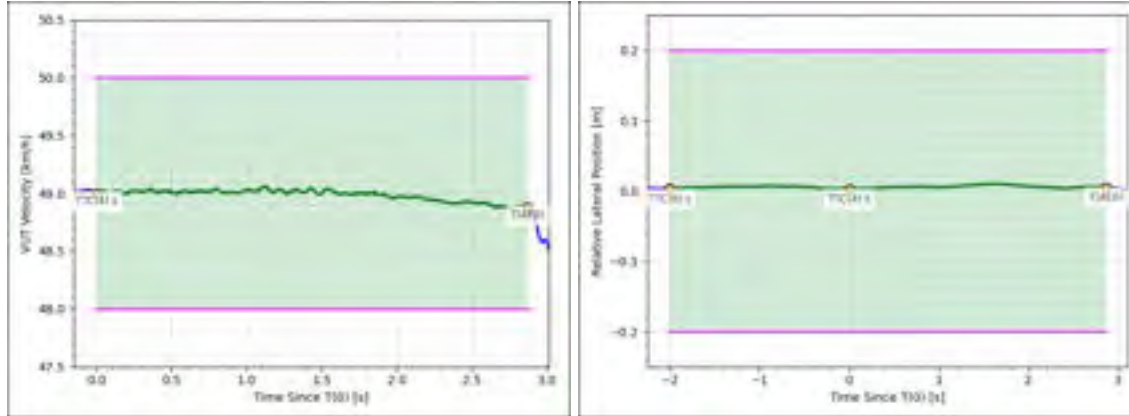
Run Date / Time 17-Mar-2023 10:22



D.1.1.4. AEB CCRs 50 kph +50 %

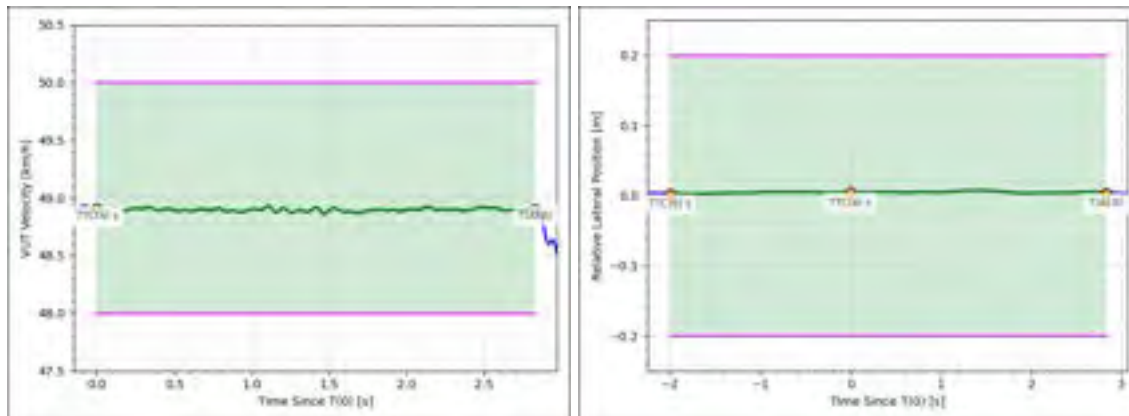
AEB CCRs | 50 km/h +50 % | Run 1

Run Date / Time 17-Mar-2023 10:26



AEB CCRs | 50 km/h +50 % | Run 2

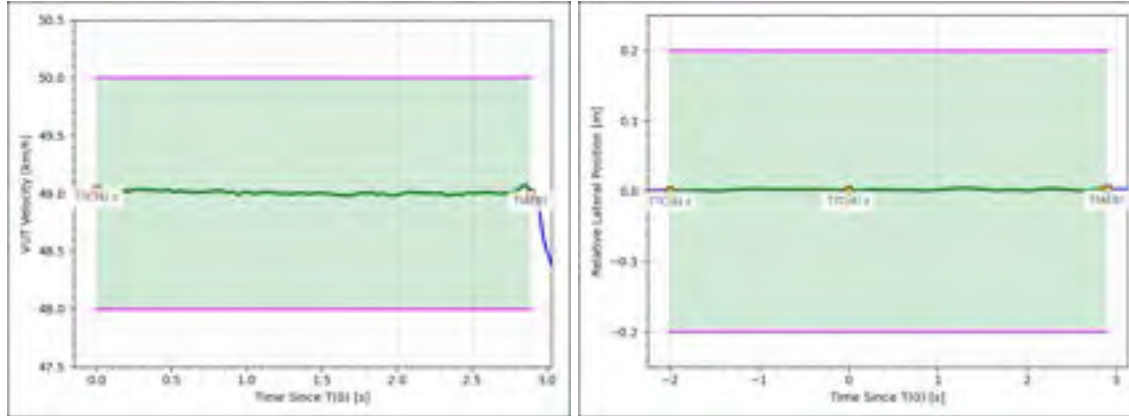
Run Date / Time 17-Mar-2023 10:28



D.1.1.5. AEB CCRs 50 kph +100 %

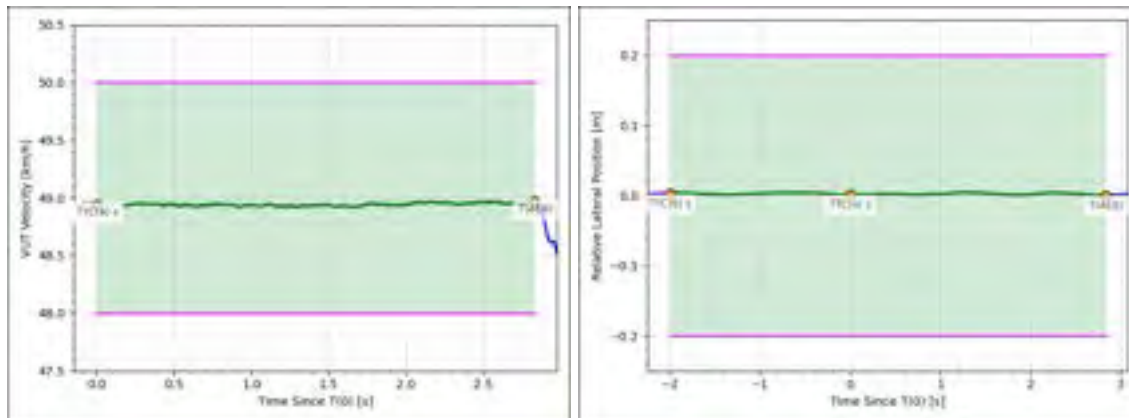
AEB CCRs | 50 km/h +100 % | Run 1

Run Date / Time 17-Mar-2023 10:07



AEB CCRs | 50 km/h +100 % | Run 2

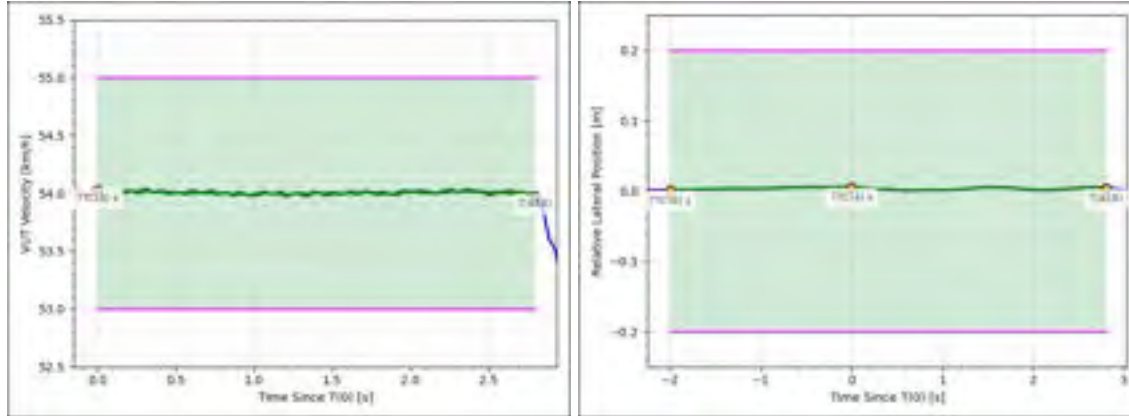
Run Date / Time 17-Mar-2023 10:09



D.1.1.6. AEB CCRs 55 kph +100 %

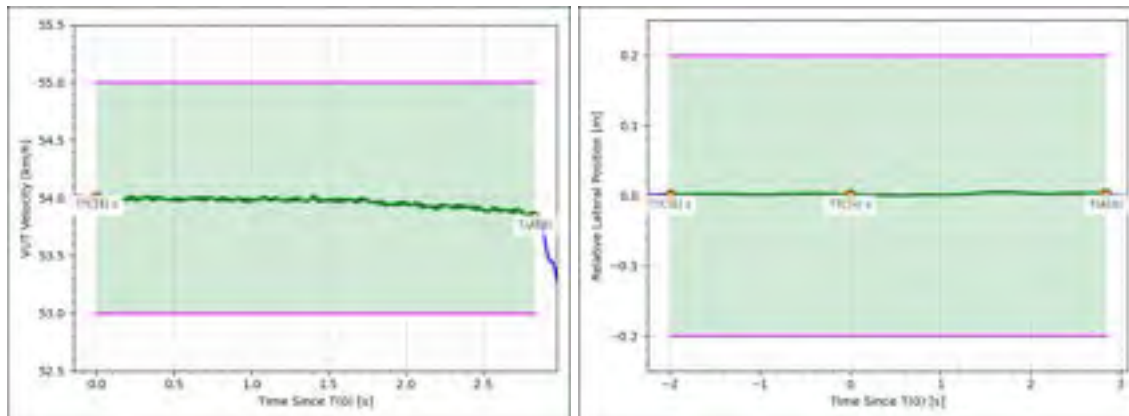
AEB CCRs | 55 km/h +100 % | Run 1

Run Date / Time 17-Mar-2023 10:13



AEB CCRs | 55 km/h +100 % | Run 2

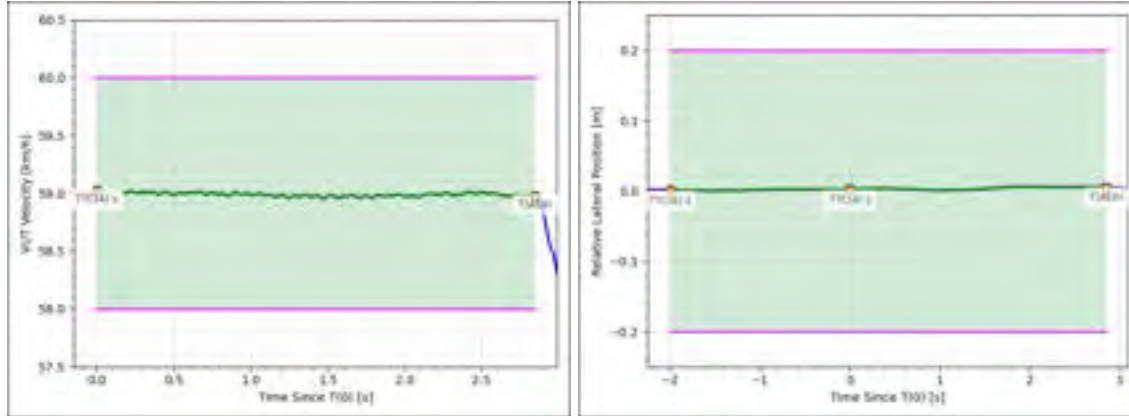
Run Date / Time 17-Mar-2023 10:15



D.1.1.7. AEB CCRs 60 kph +100 %

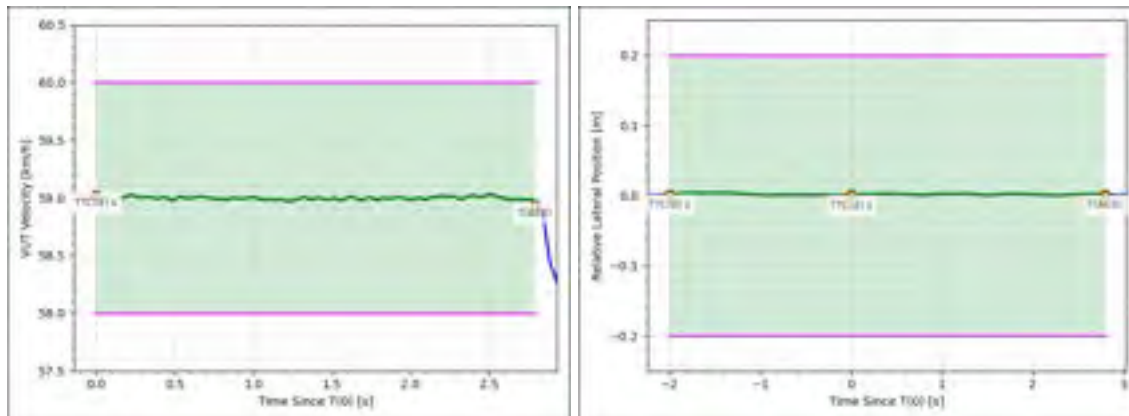
AEB CCRs | 60 km/h +100 % | Run 1

Run Date / Time 17-Mar-2023 10:31



AEB CCRs | 60 km/h +100 % | Run 2

Run Date / Time 17-Mar-2023 10:46

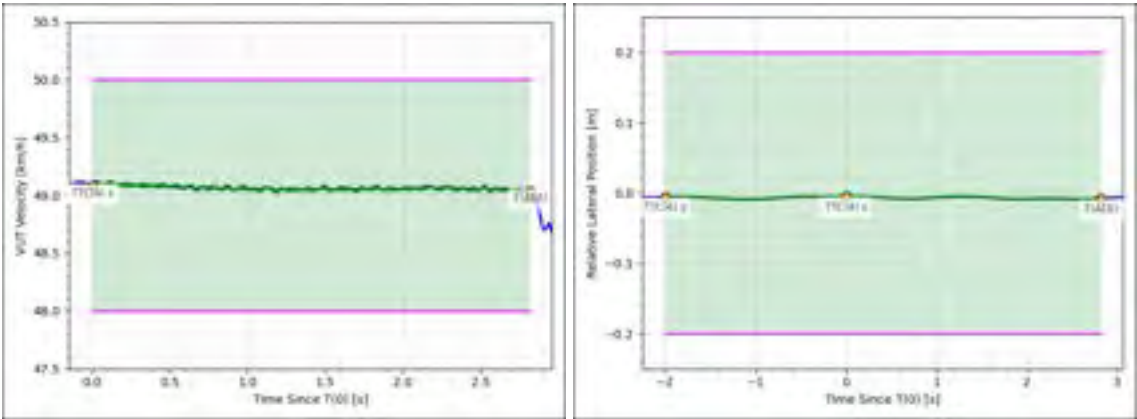


D.1.1. Bullbar

D.1.1.1. B.1.1.AEB CCRs 50 kph -50 %

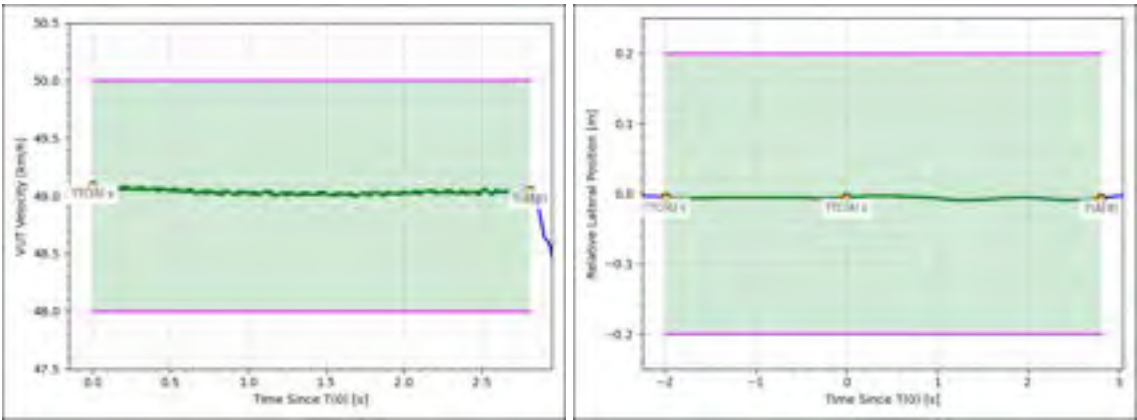
AEB CCRs | 50 km/h -50 % | Run 3

Run Date / Time 3-Apr-2023 12:58



AEB CCRs | 50 km/h -50 % | Run 4

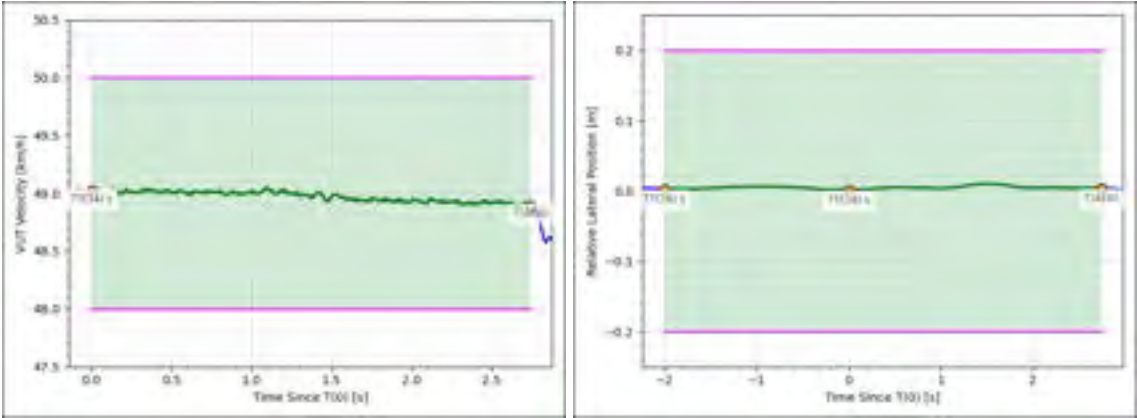
Run Date / Time 3-Apr-2023 13:00



D.1.1.2. B.1.1.AEB CCRs 50 kph +50 %

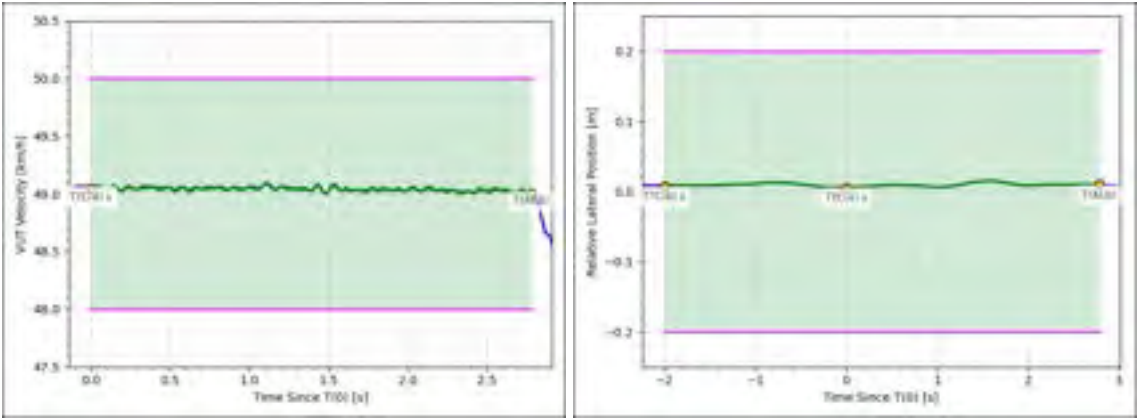
AEB CCRs | 50 km/h +50 % | Run 3

Run Date / Time 3-Apr-2023 13:05



AEB CCRs | 50 km/h +50 % | Run 4

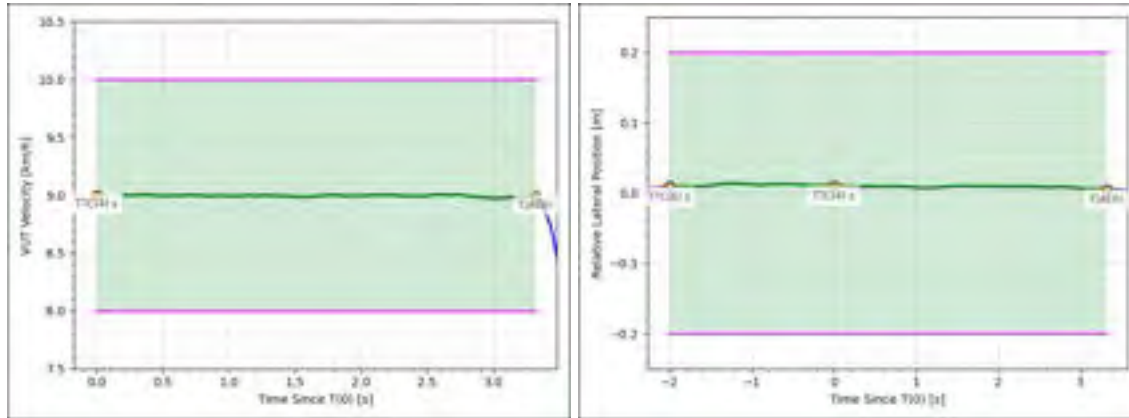
Run Date / Time 3-Apr-2023 13:07



D.1.1.3. B.1.1.AEB CCRs 10 kph +100 %

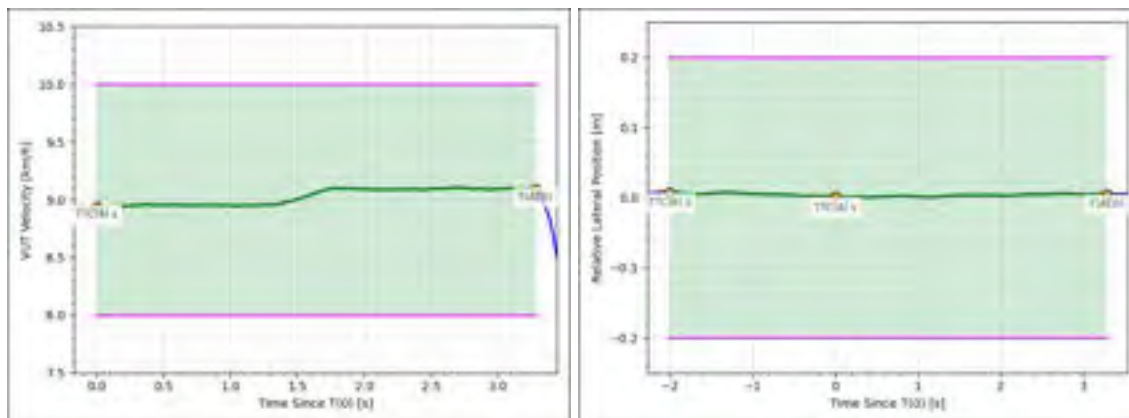
AEB CCRs | 10 km/h 100 % | Run 3

Run Date / Time 3-Apr-2023 12:37



AEB CCRs | 10 km/h 100 % | Run 4

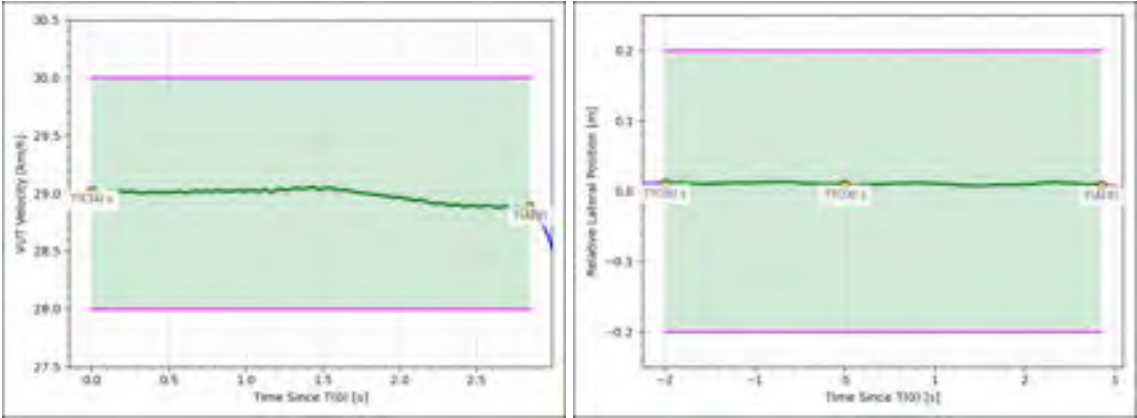
Run Date / Time 3-Apr-2023 12:42



D.1.1.4. B.1.1.AEB CCRs 30 kph +100 %

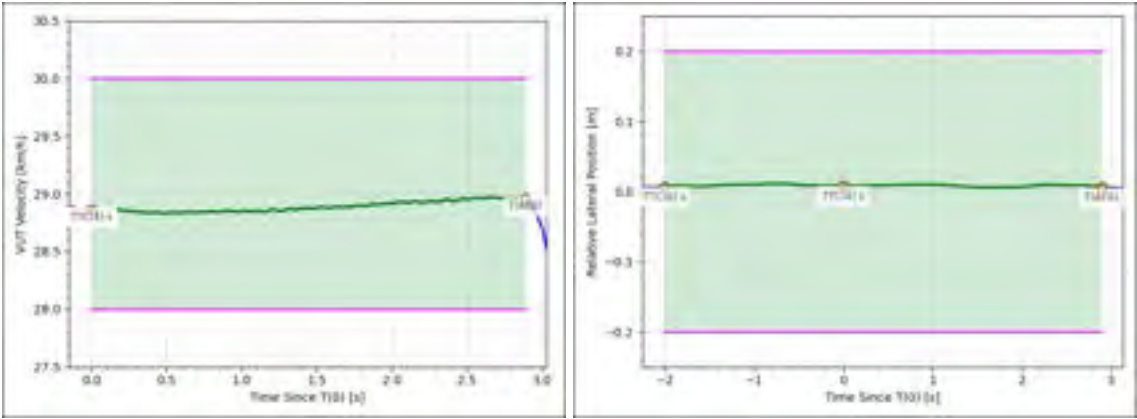
AEB CCRs | 30 km/h +100 % | Run 3

Run Date / Time 3-Apr-2023 12:46



AEB CCRs | 30 km/h +100 % | Run 4

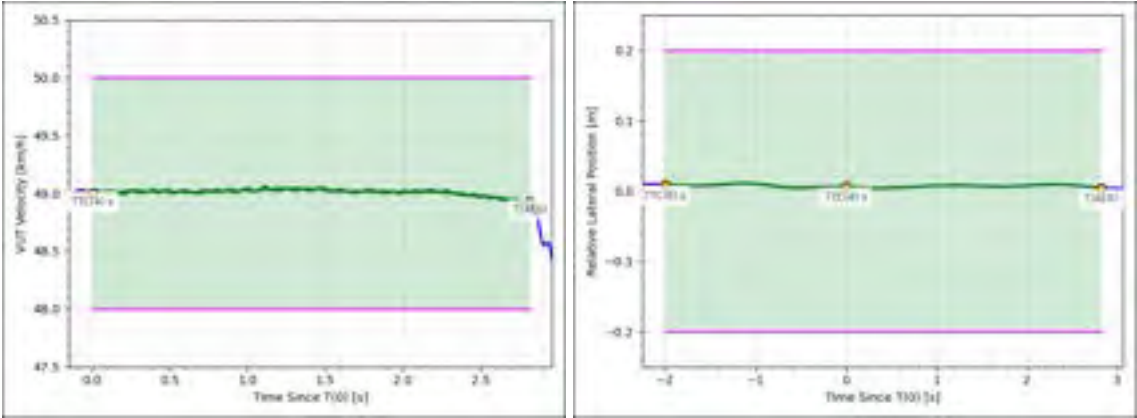
Run Date / Time 3-Apr-2023 12:48



D.1.1.5. B.1.1.AEB CCRs 50 kph +100 %

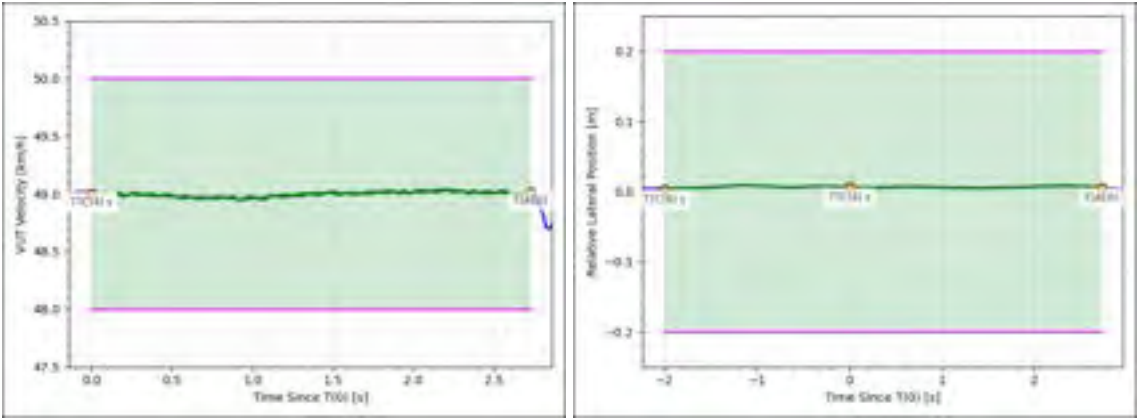
AEB CCRs | 50 km/h +100 % | Run 3

Run Date / Time 3-Apr-2023 12:52



AEB CCRs | 50 km/h +100 % | Run 4

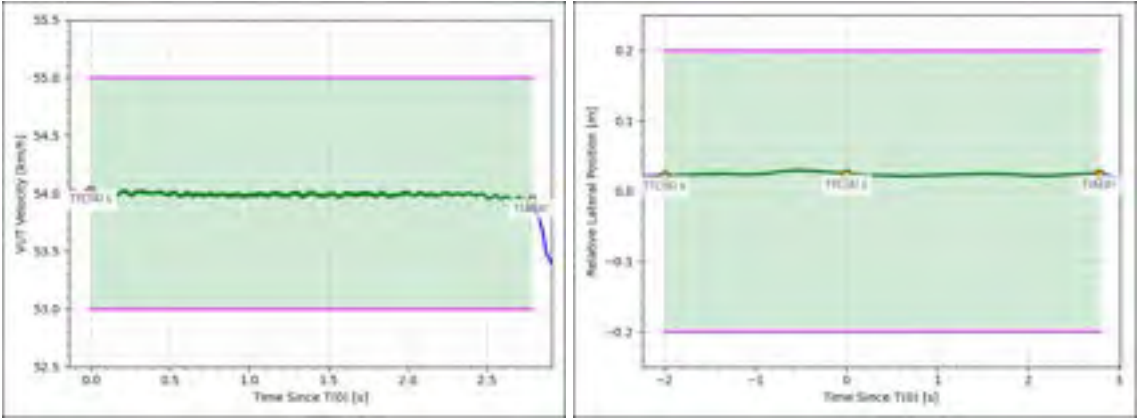
Run Date / Time 3-Apr-2023 12:54



D.1.1.6. B.1.1.AEB CCRs 55 kph +100 %

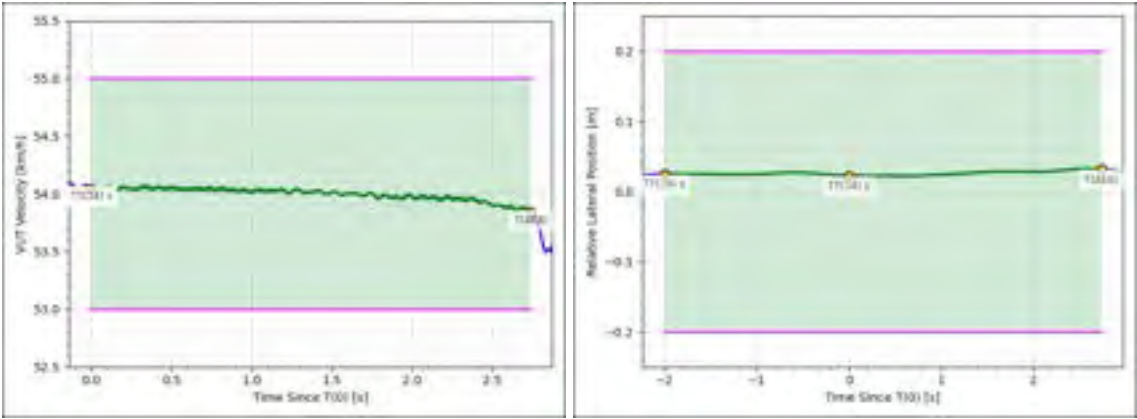
AEB CCRs | 55 km/h +100 % | Run 3

Run Date / Time 3-Apr-2023 13:42



AEB CCRs | 55 km/h +100 % | Run 4

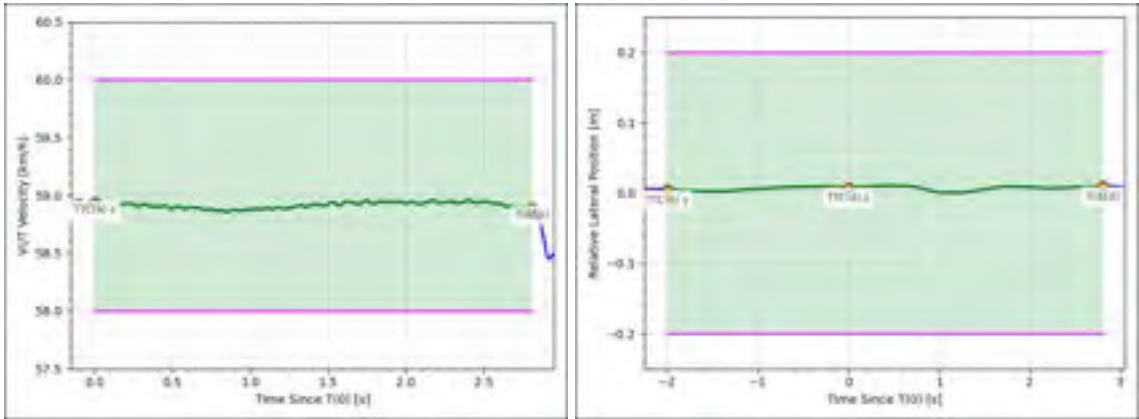
Run Date / Time 3-Apr-2023 13:45



D.1.1.7. **B.B.1.1.** **AEB CCRs 60 kph +100 %**

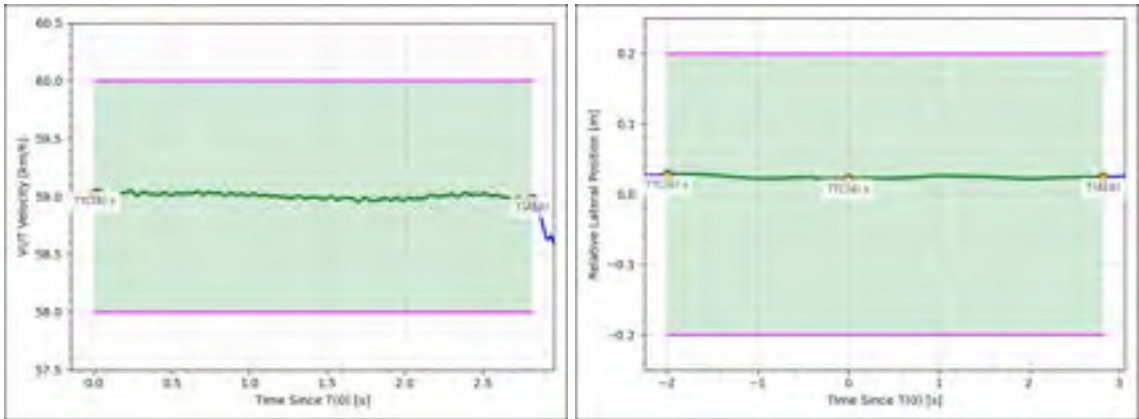
AEB CCRs | 60 km/h +100 % | Run 3

Run Date / Time 3-Apr-2023 13:14



AEB CCRs | 60 km/h +100 % | Run 4

Run Date / Time 3-Apr-2023 13:29

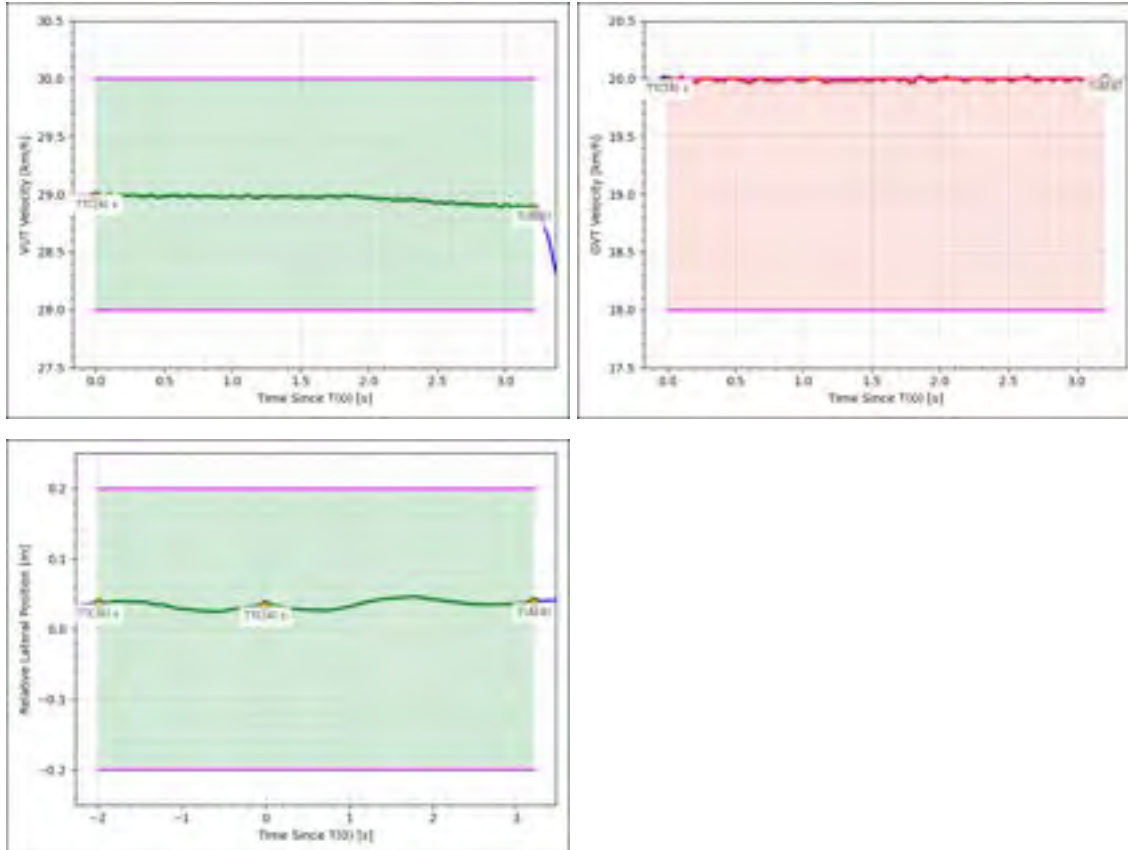


D.2. Car-to-Car Rear Moving

D.2.1.1. AEB CCRm 30 kph +100 %

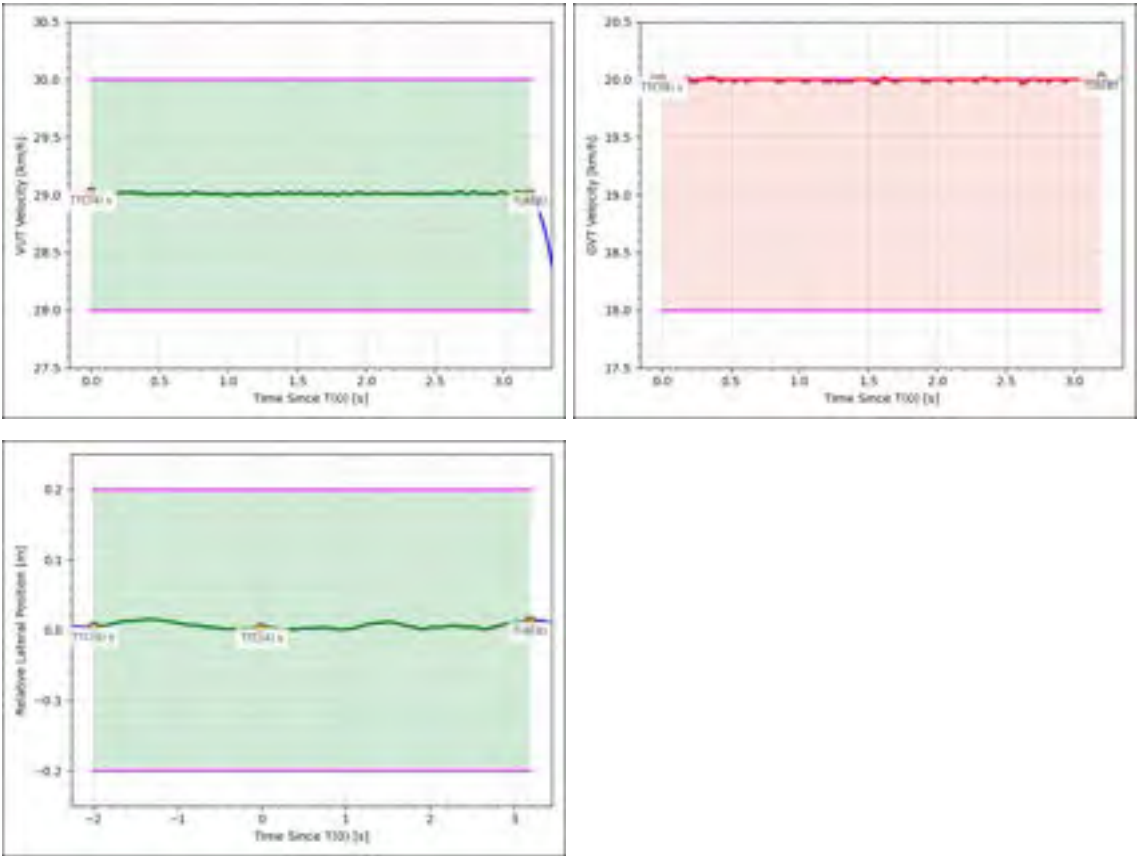
AEB CCRm | 30 km/h +100 % | Run 1

Run Date / Time 28-Nov-2022 10:57



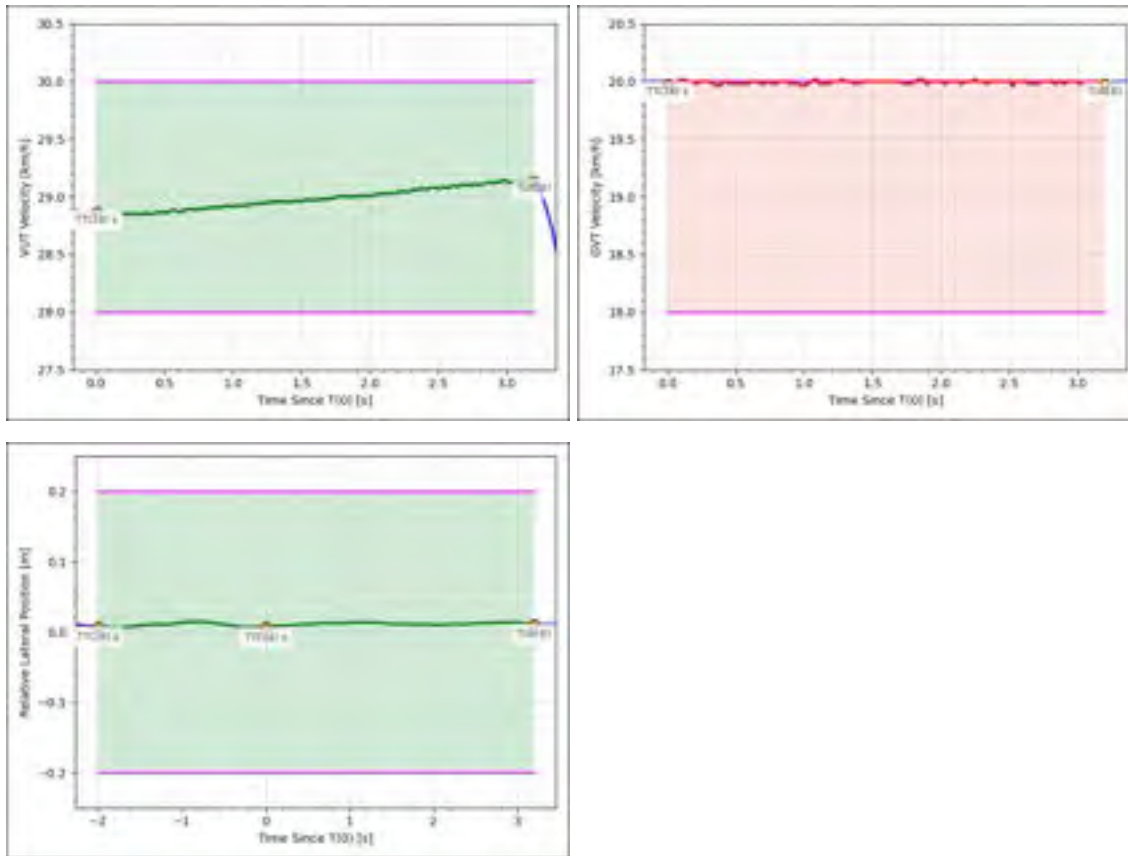
AEB CCRm | 30 km/h +100 % | Run 2

Run Date / Time 28-Nov-2022 11:02



AEB CCRm | 30 km/h +100 % | Run 3

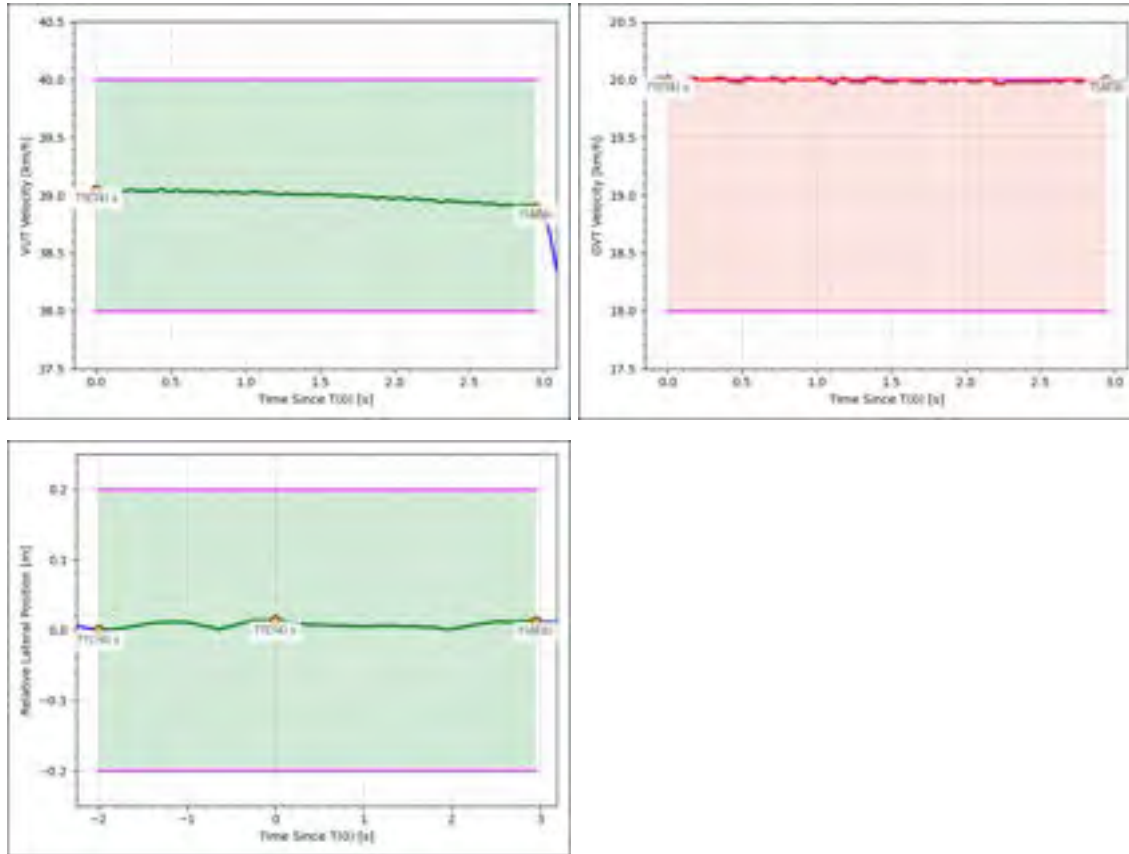
Run Date / Time 28-Nov-2022 11:05



D.2.1.2. AEB CCRm 40 kph +100 %

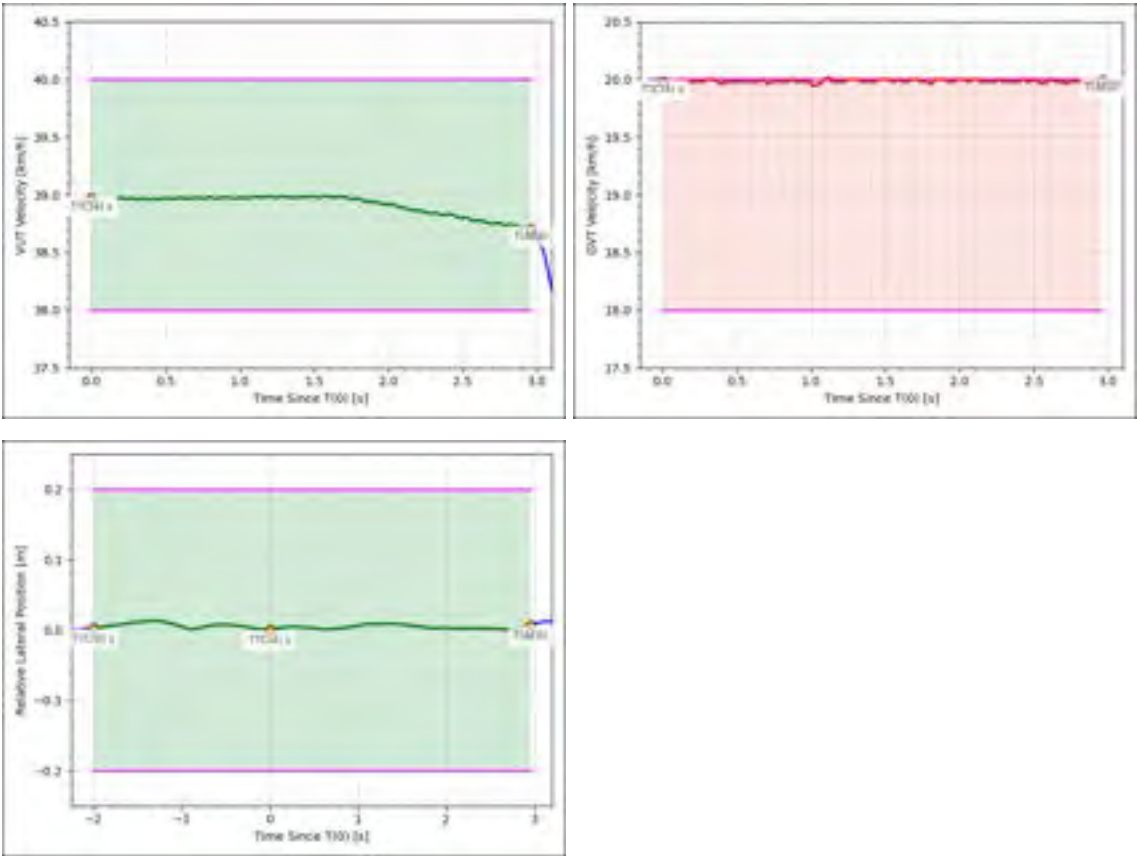
AEB CCRm | 40 km/h +100 % | Run 1

Run Date / Time 28-Nov-2022 11:08



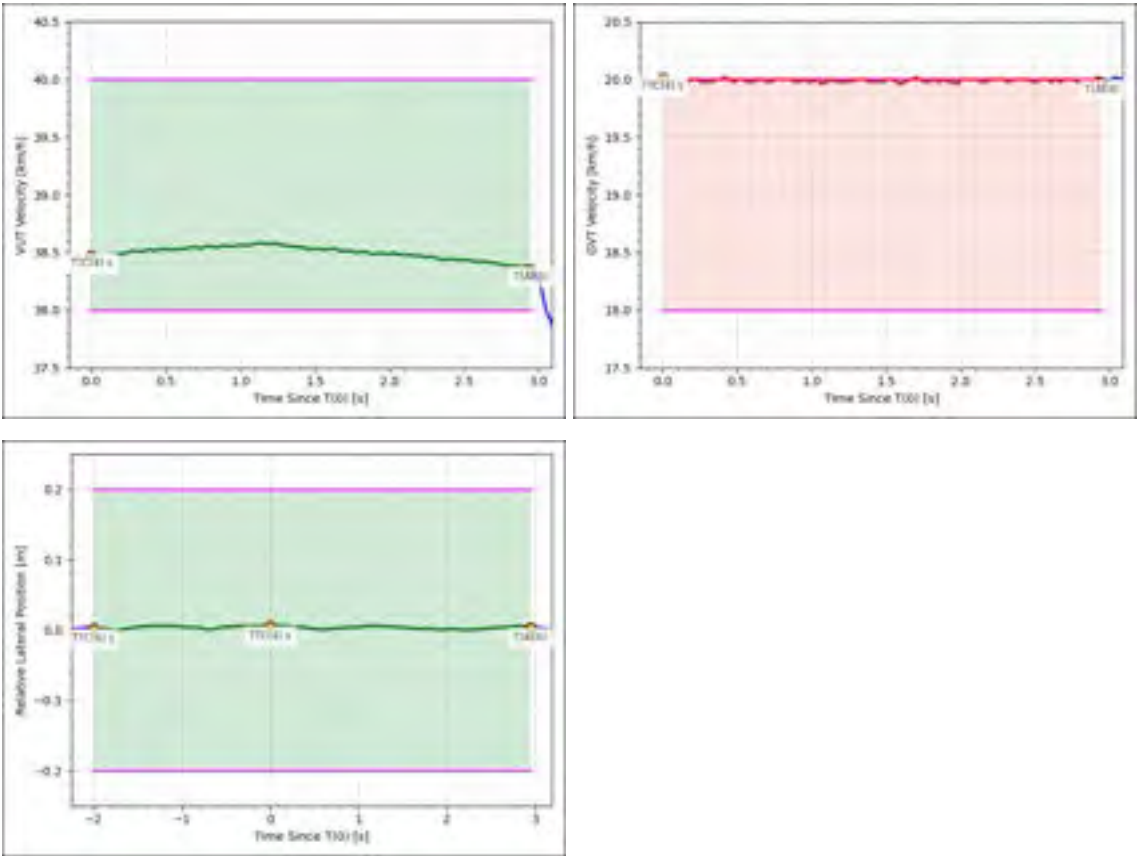
AEB CCRm | 40 km/h +100 % | Run 2

Run Date / Time 28-Nov-2022 11:13



AEB CCRm | 40 km/h +100 % | Run 3

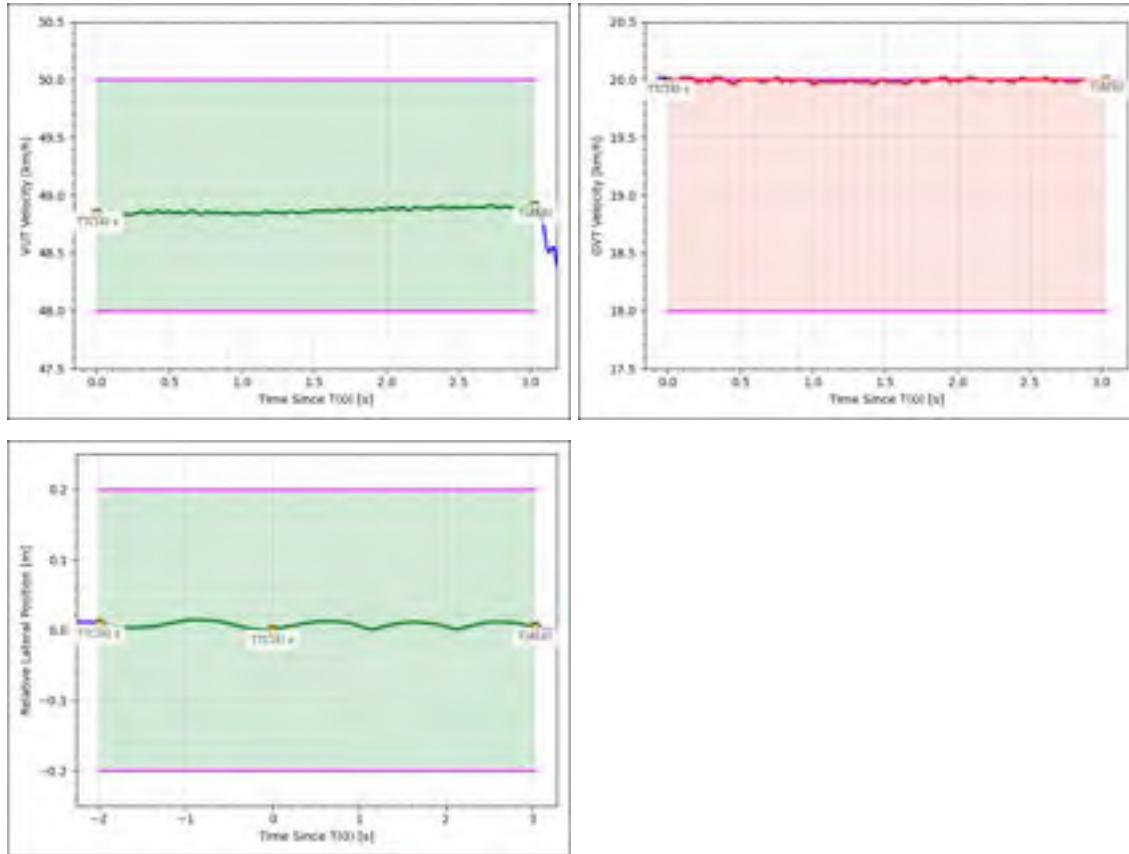
Run Date / Time 28-Nov-2022 11:19



D.2.1.3. AEB CCRm 50 kph +100 %

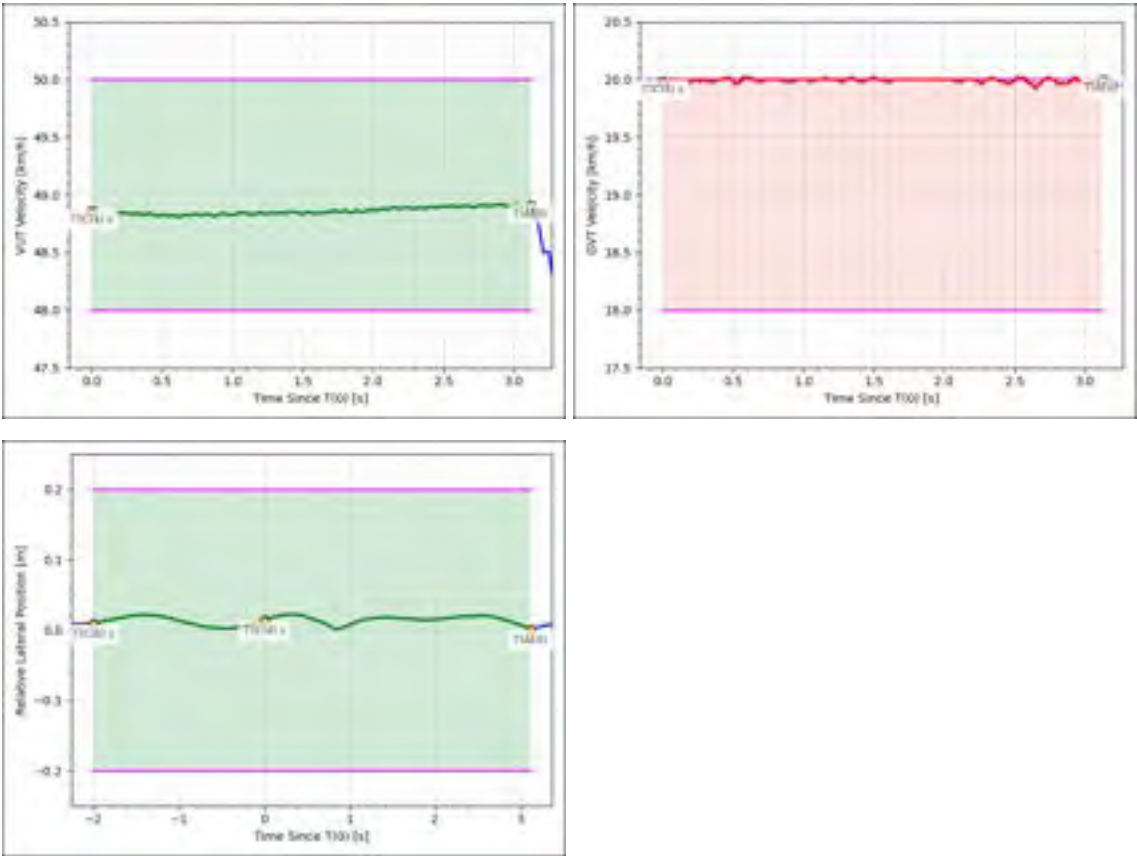
AEB CCRm | 50 km/h +100 % | Run 1

Run Date / Time 28-Nov-2022 11:22



AEB CCRm | 50 km/h +100 % | Run 2

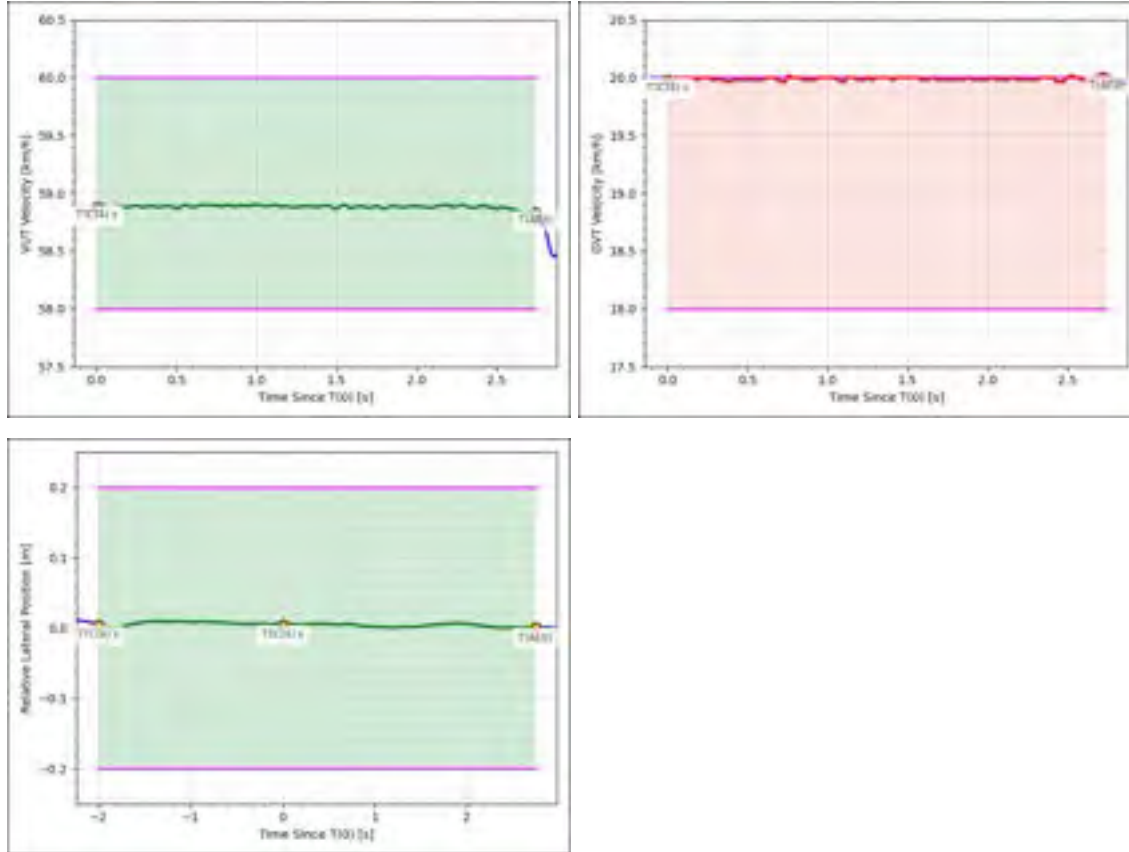
Run Date / Time 28-Nov-2022 11:25



D.2.1.4. AEB CCRm 60 kph +100 %

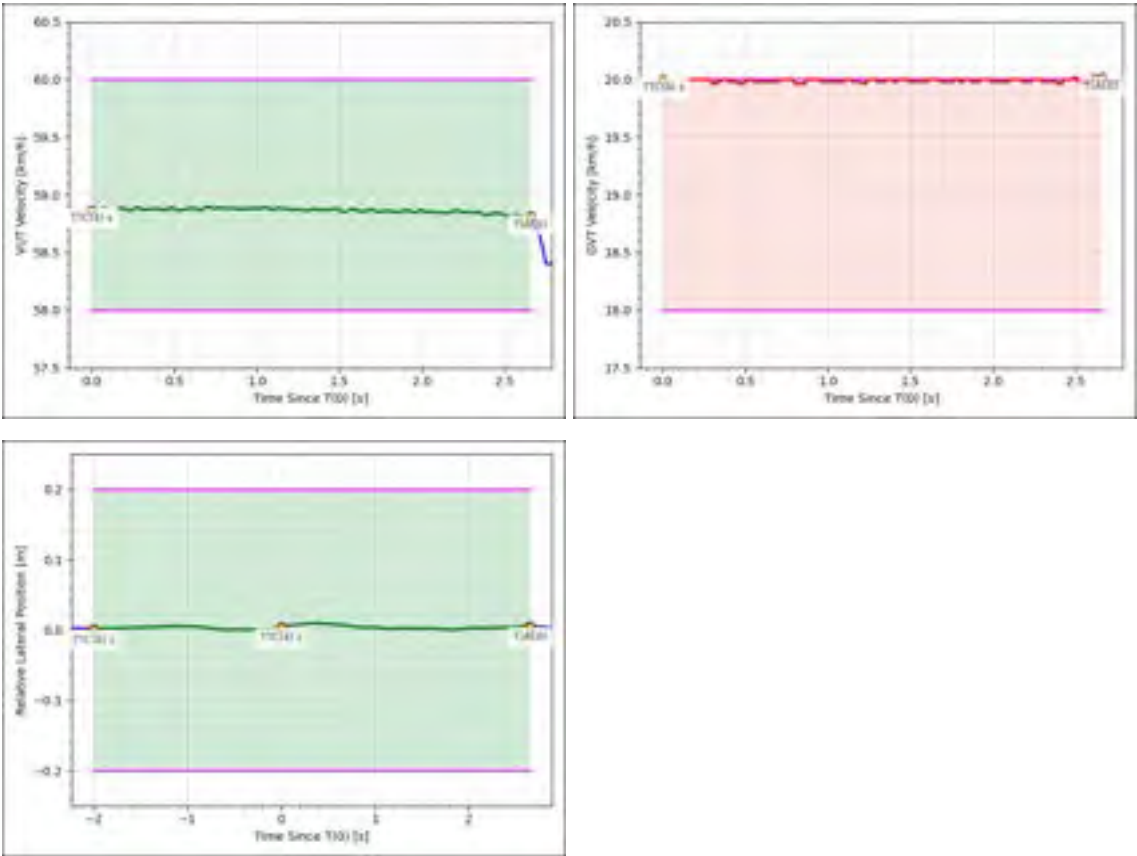
AEB CCRm | 60 km/h +100 % | Run 1

Run Date / Time 28-Nov-2022 11:28



AEB CCRm | 60 km/h +100 % | Run 2

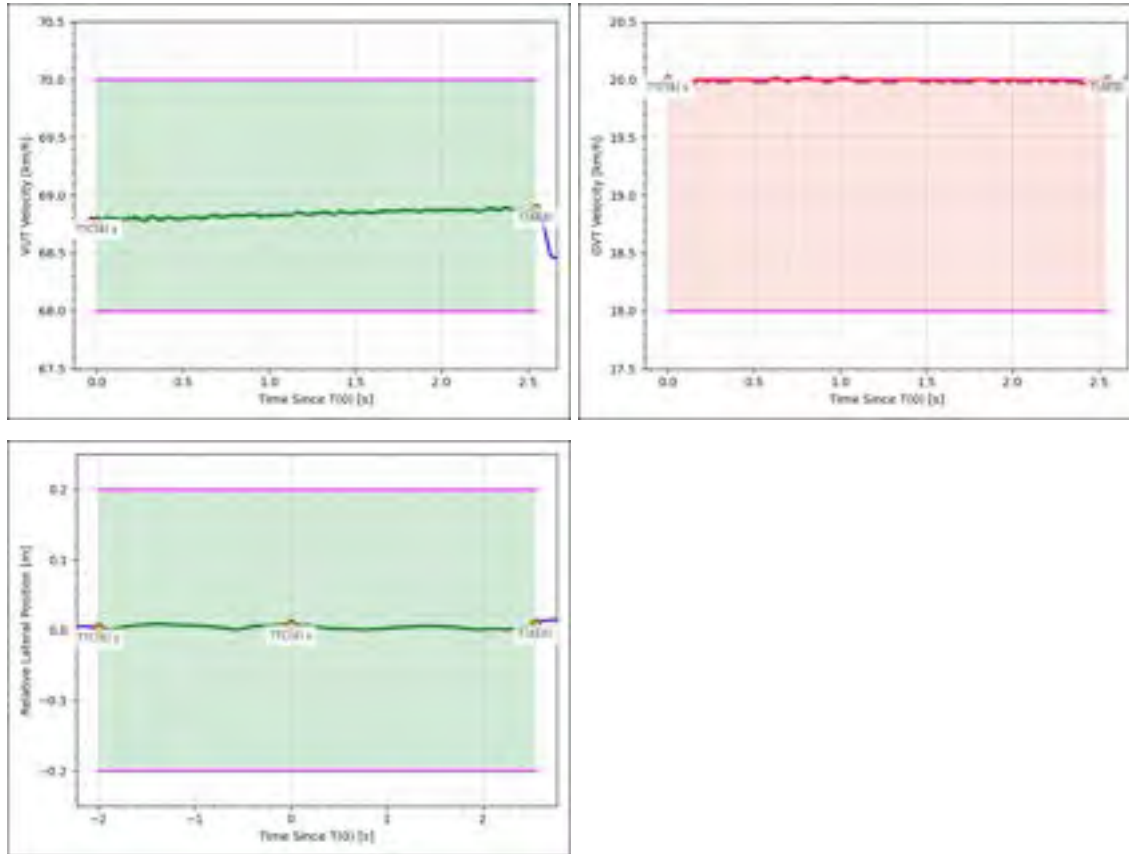
Run Date / Time 28-Nov-2022 11:31



D.2.1.5. AEB CCRm 70 kph +100 %

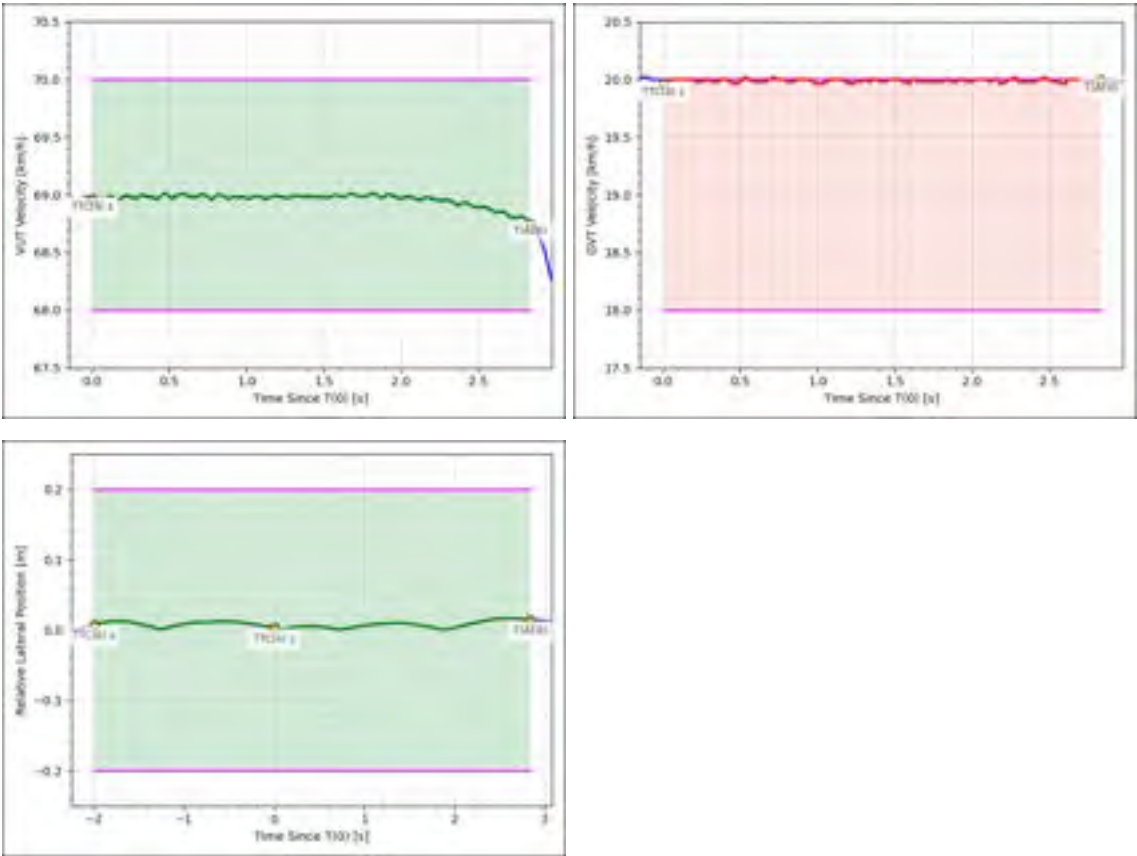
AEB CCRm | 70 km/h +100 % | Run 1

Run Date / Time 28-Nov-2022 11:36



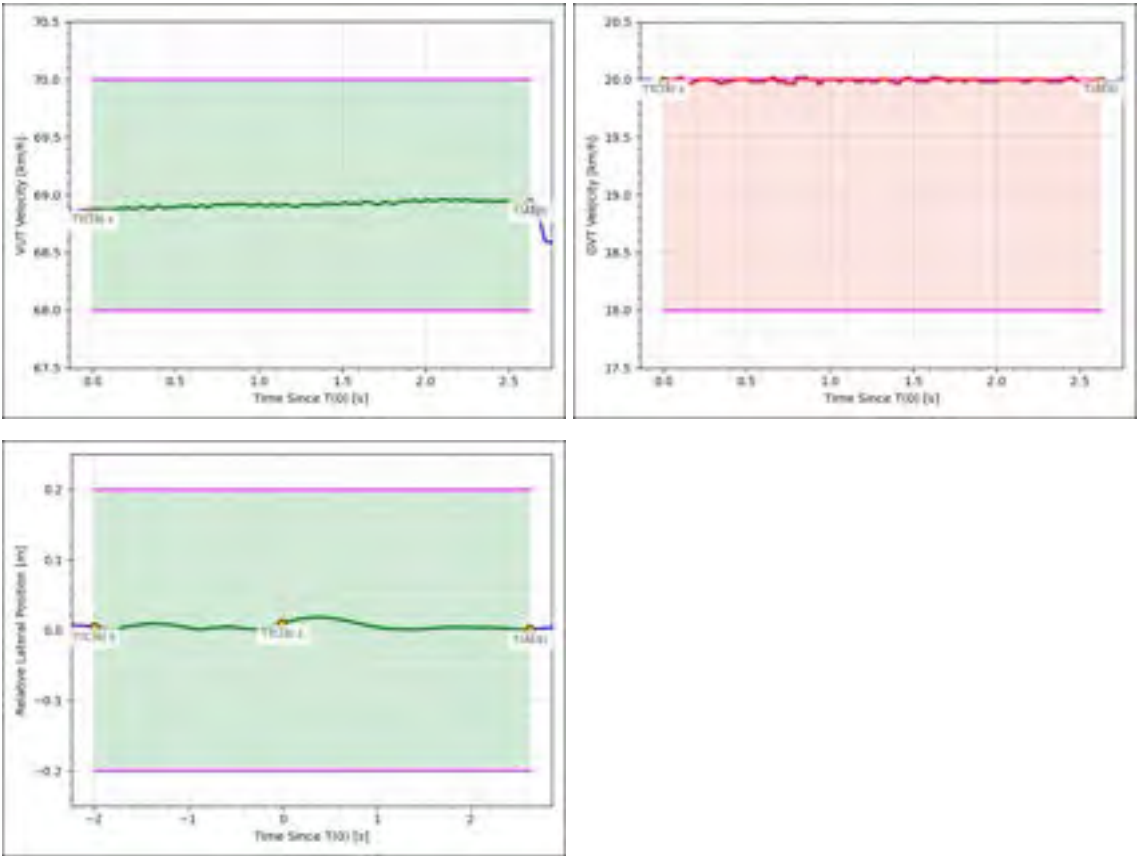
AEB CCRm | 70 km/h +100 % | Run 2

Run Date / Time 28-Nov-2022 11:41



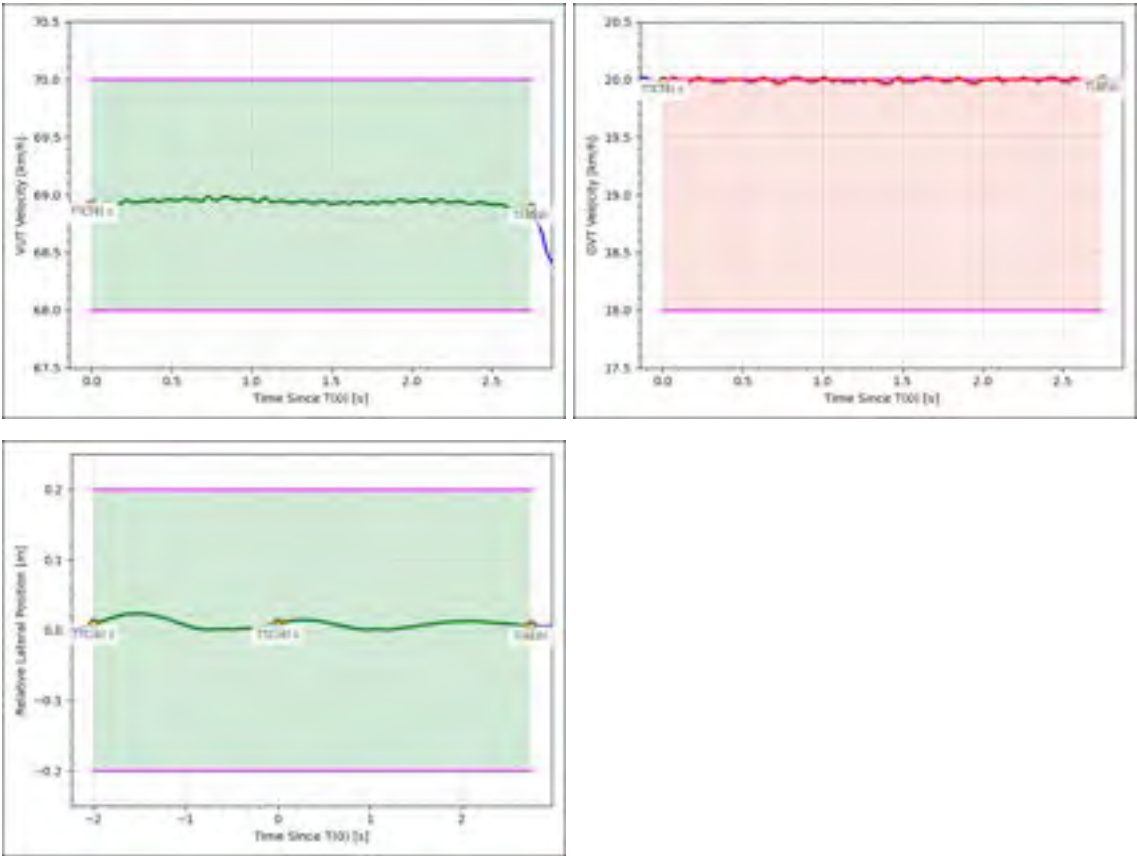
AEB CCRm | 70 km/h +100 % | Run 4

Run Date / Time 28-Nov-2022 11:52



AEB CCRm | 70 km/h +100 % | Run 5

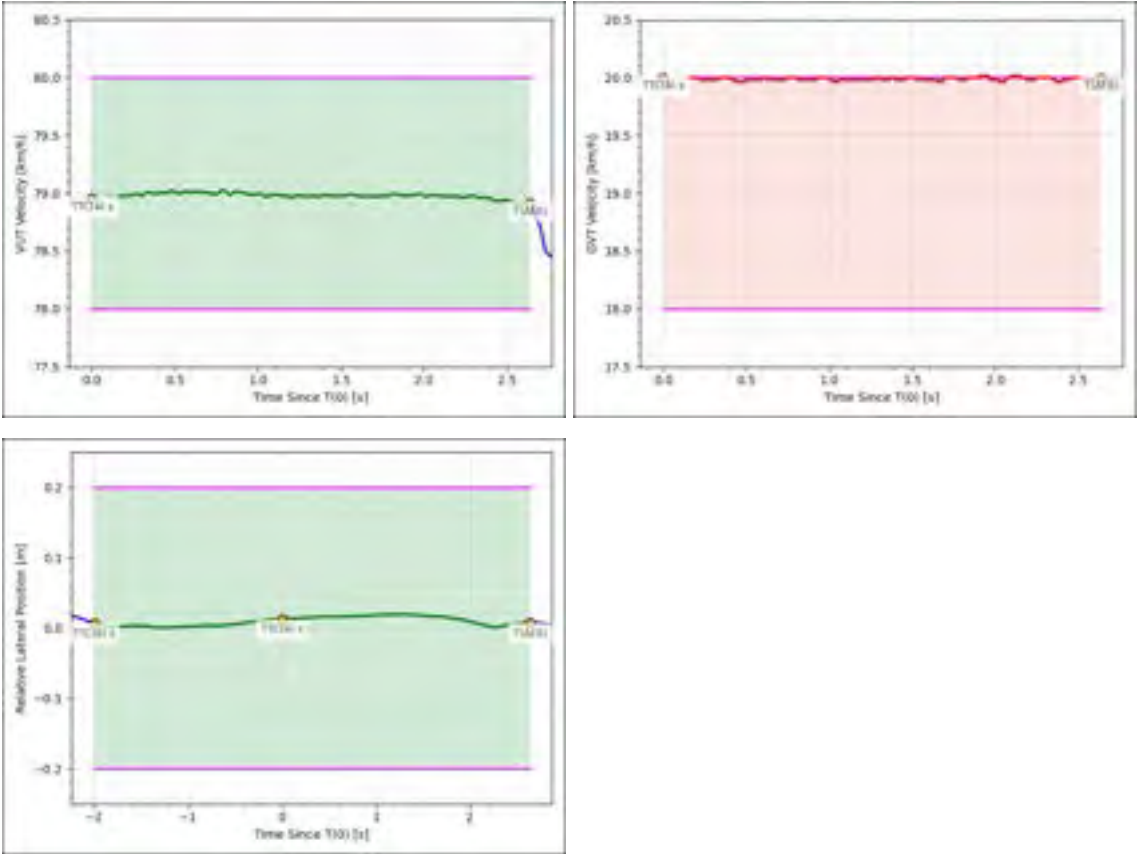
Run Date / Time 28-Nov-2022 11:55



D.2.1.6. AEB CCRm 80 kph +100 %

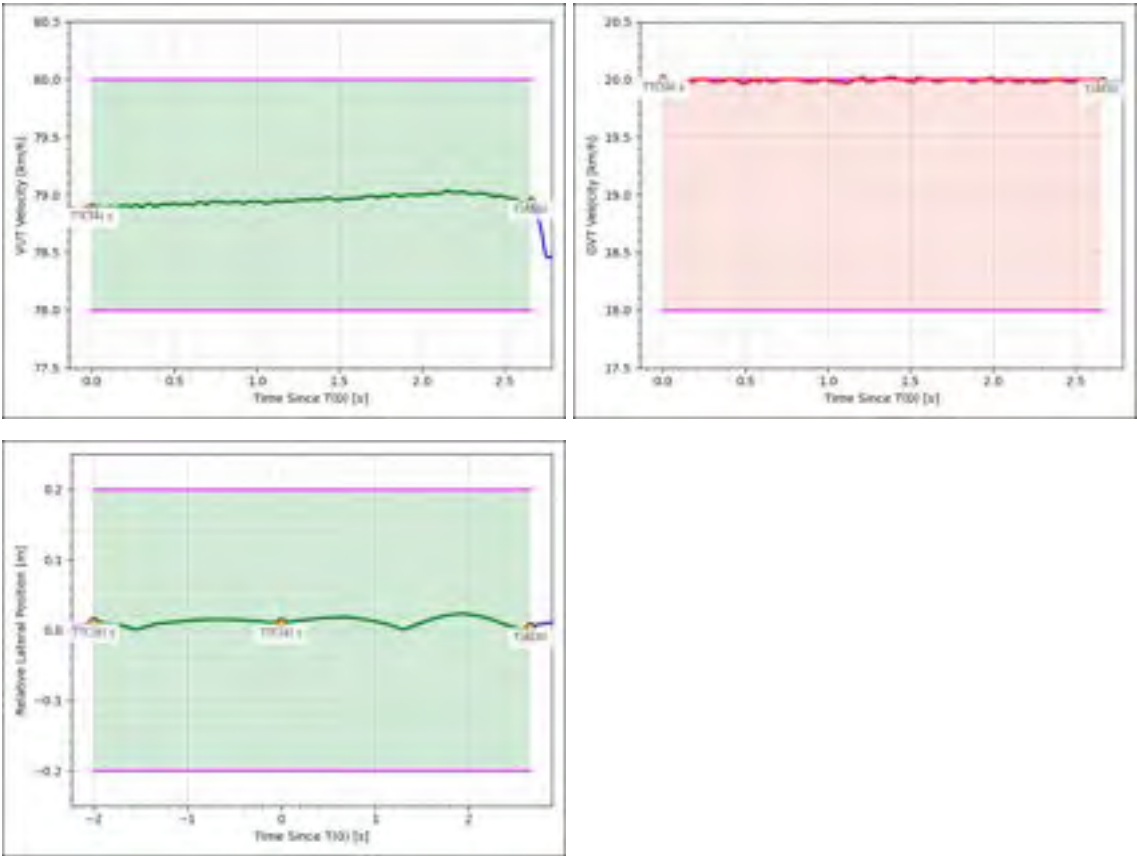
AEB CCRm | 80 km/h +100 % | Run 1

Run Date / Time 28-Nov-2022 11:58



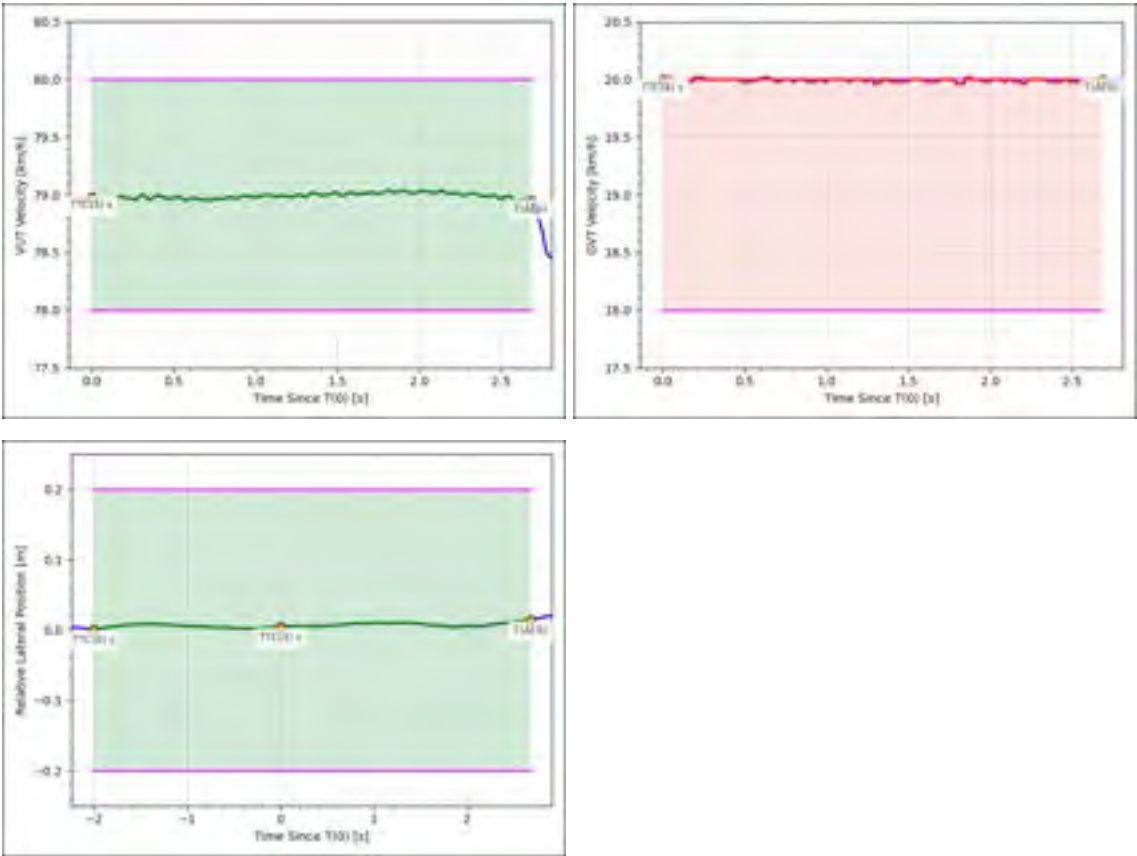
AEB CCRm | 80 km/h +100 % | Run 2

Run Date / Time 28-Nov-2022 12:03



AEB CCRm | 80 km/h +100 % | Run 3

Run Date / Time 28-Nov-2022 12:07

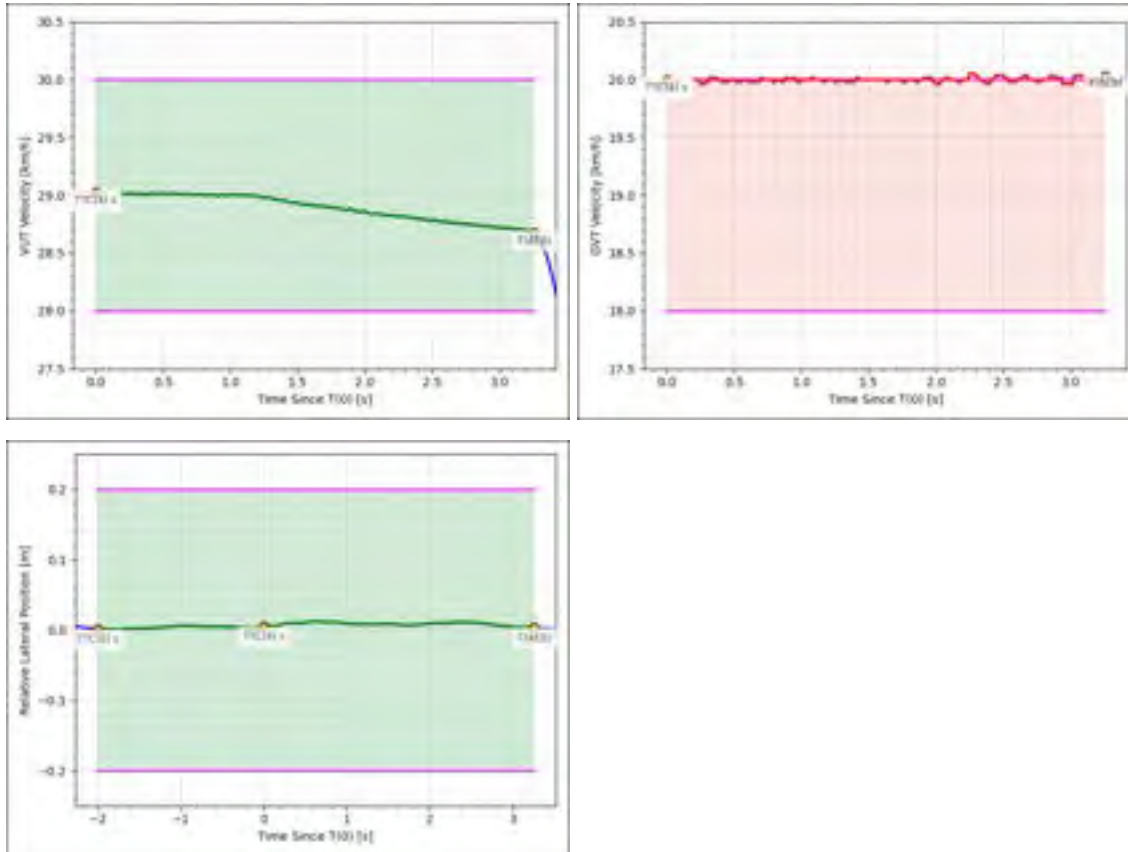


D.2.2. GVM

D.2.2.1. A.1.1.AEB CCRm 30 kph +100 %

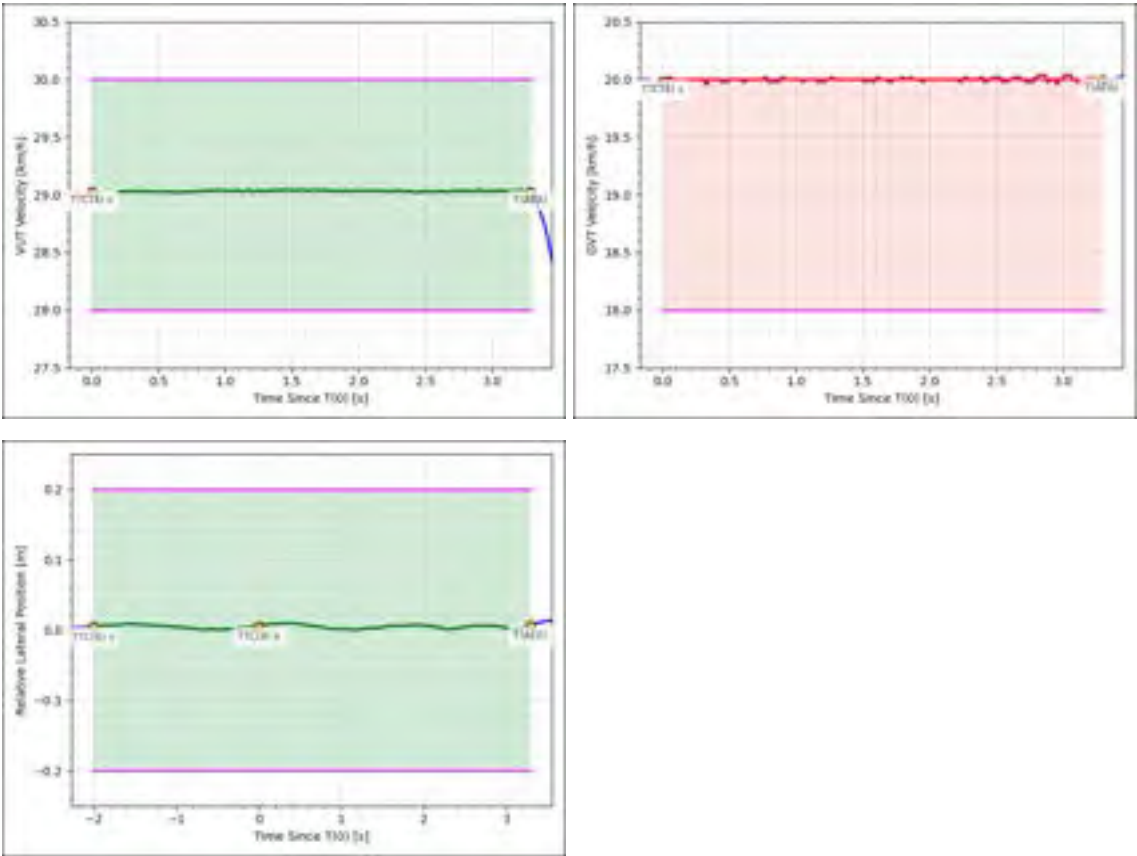
AEB CCRm | 30 km/h +100 % | Run 4

Run Date / Time 13-Dec-2022 10:46



AEB CCRm | 30 km/h +100 % | Run 5

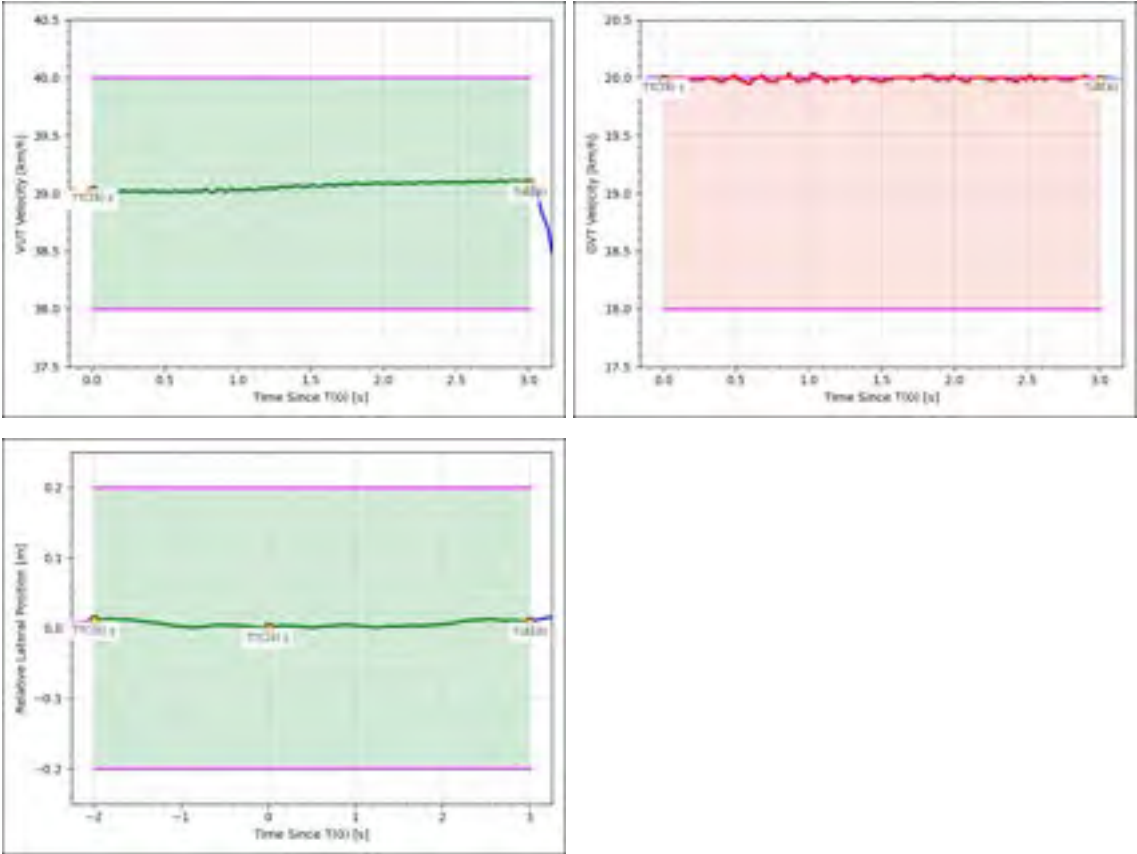
Run Date / Time 13-Dec-2022 10:49



D.2.2.2. A.1.1.AEB CCRm 40 kph +100 %

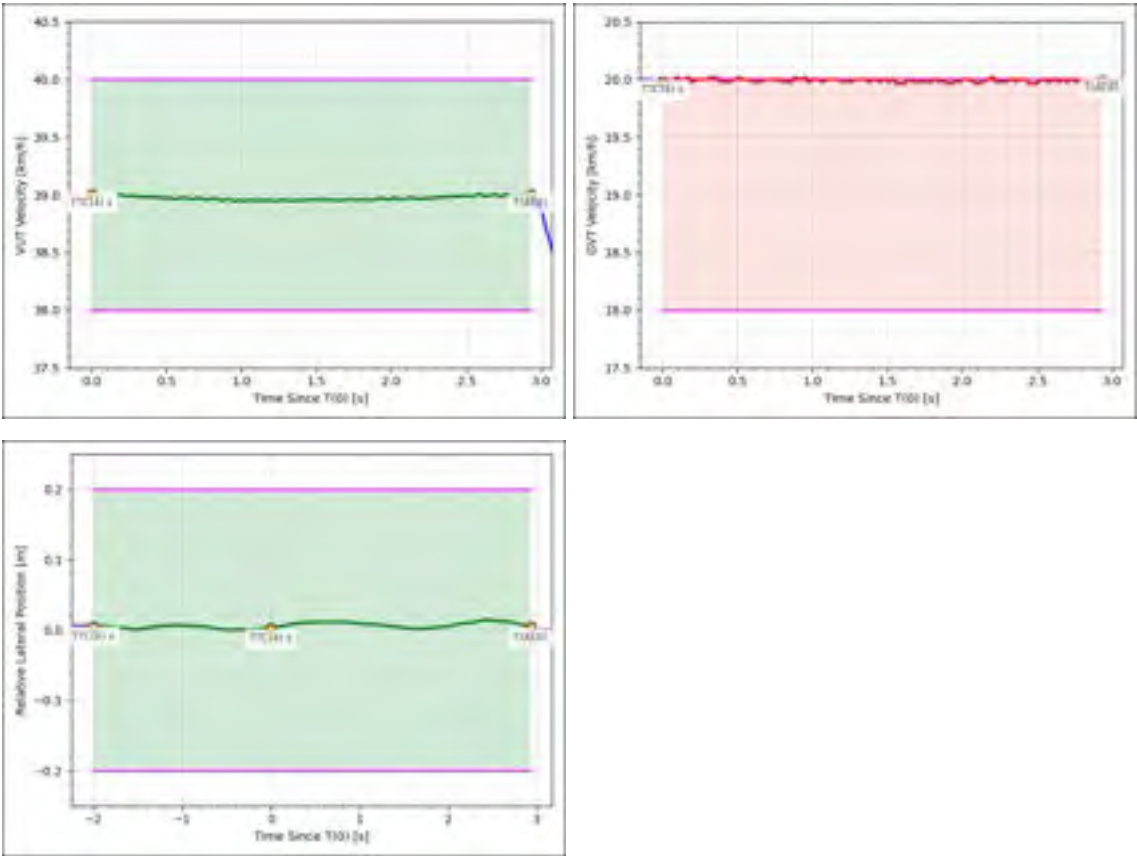
AEB CCRm | 40 km/h +100 % | Run 4

Run Date / Time 13-Dec-2022 10:53



AEB CCRm | 40 km/h +100 % | Run 5

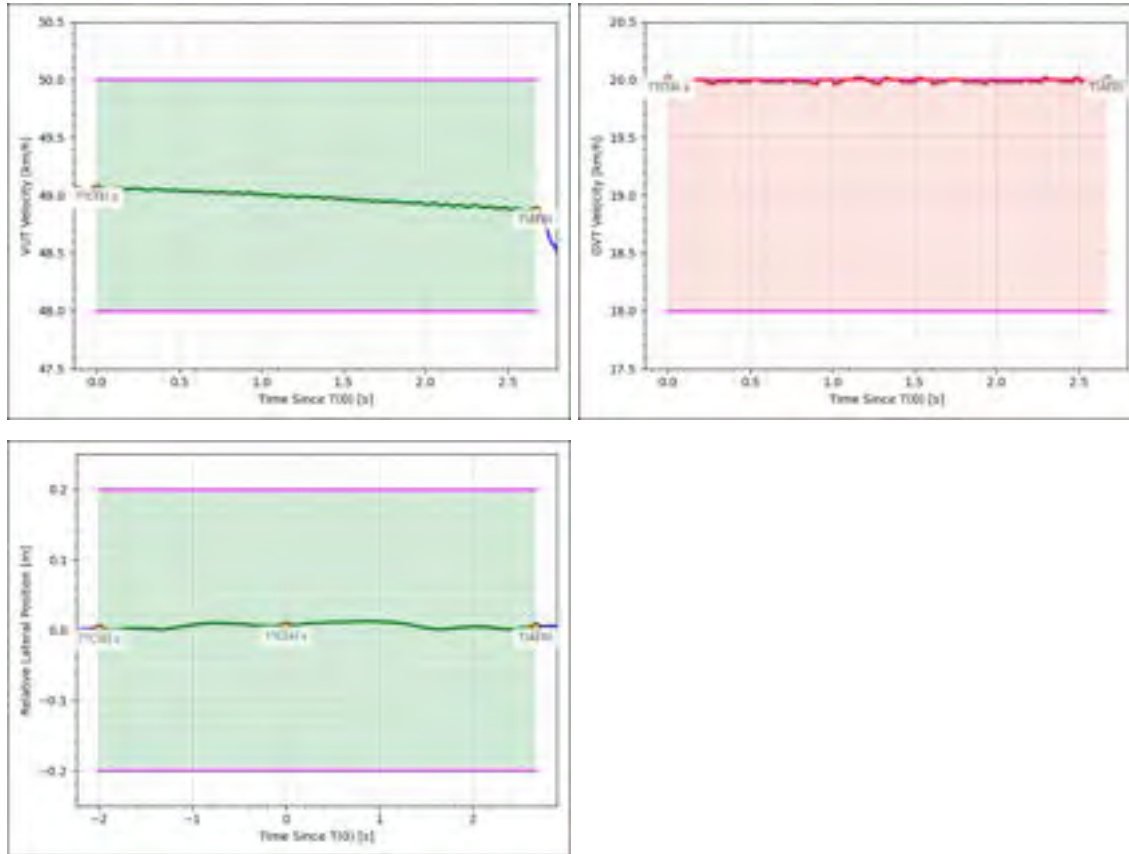
Run Date / Time 13-Dec-2022 10:57



D.2.2.3. A.1.1.AEB CCRm 50 kph +100 %

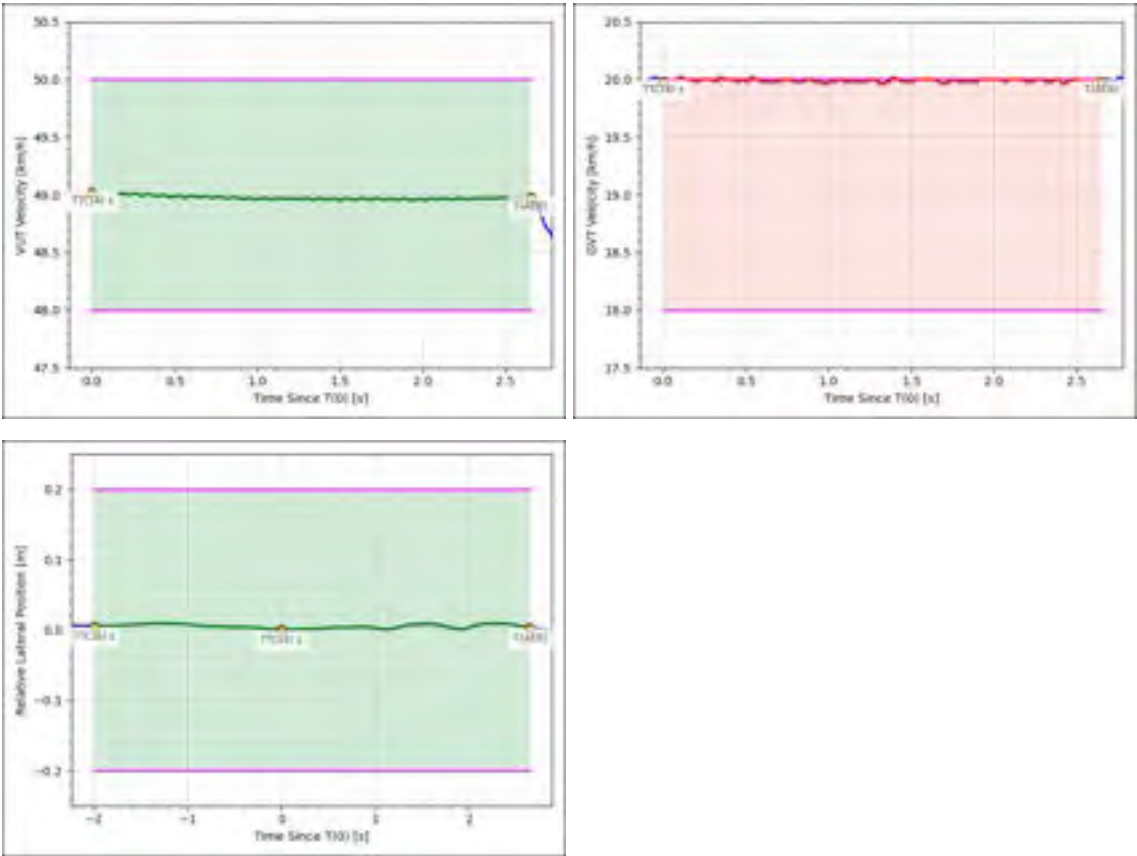
AEB CCRm | 50 km/h +100 % | Run 3

Run Date / Time 13-Dec-2022 11:01



AEB CCRm | 50 km/h +100 % | Run 4

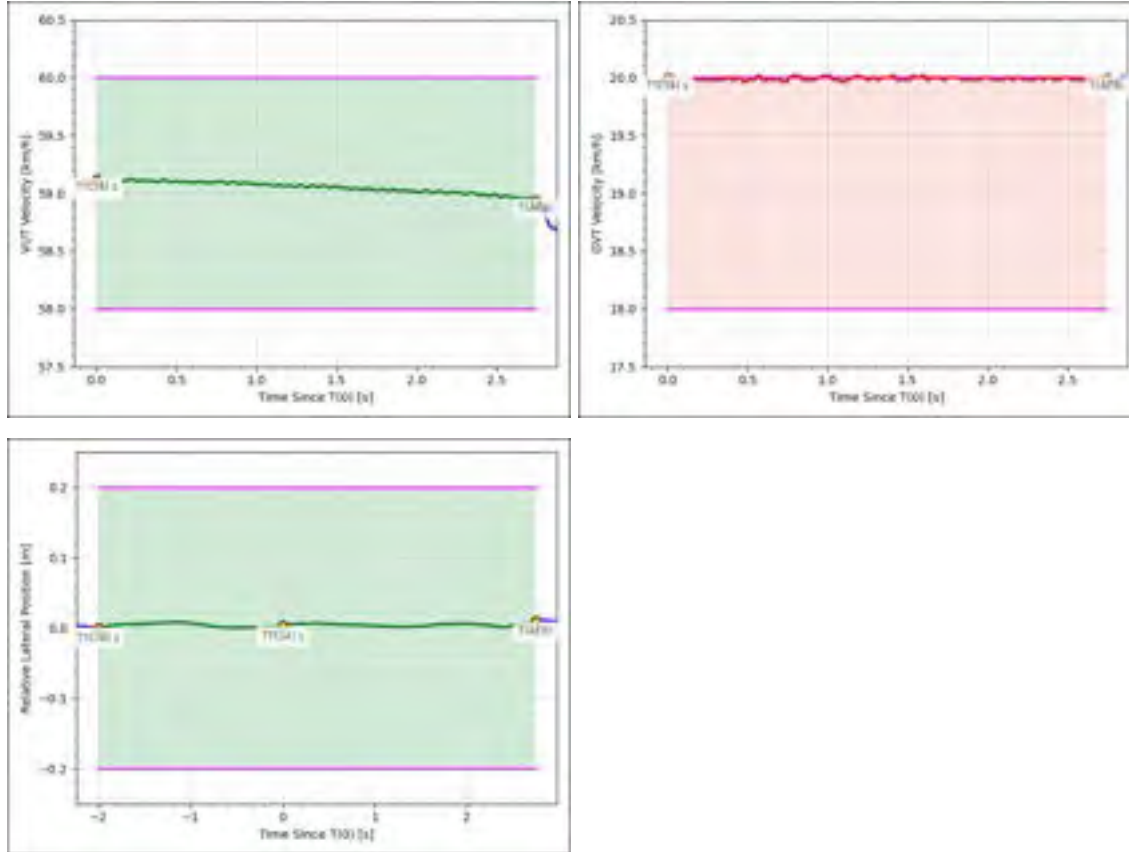
Run Date / Time 13-Dec-2022 11:04



D.2.2.4. A.1.1.AEB CCRm 60 kph +100 %

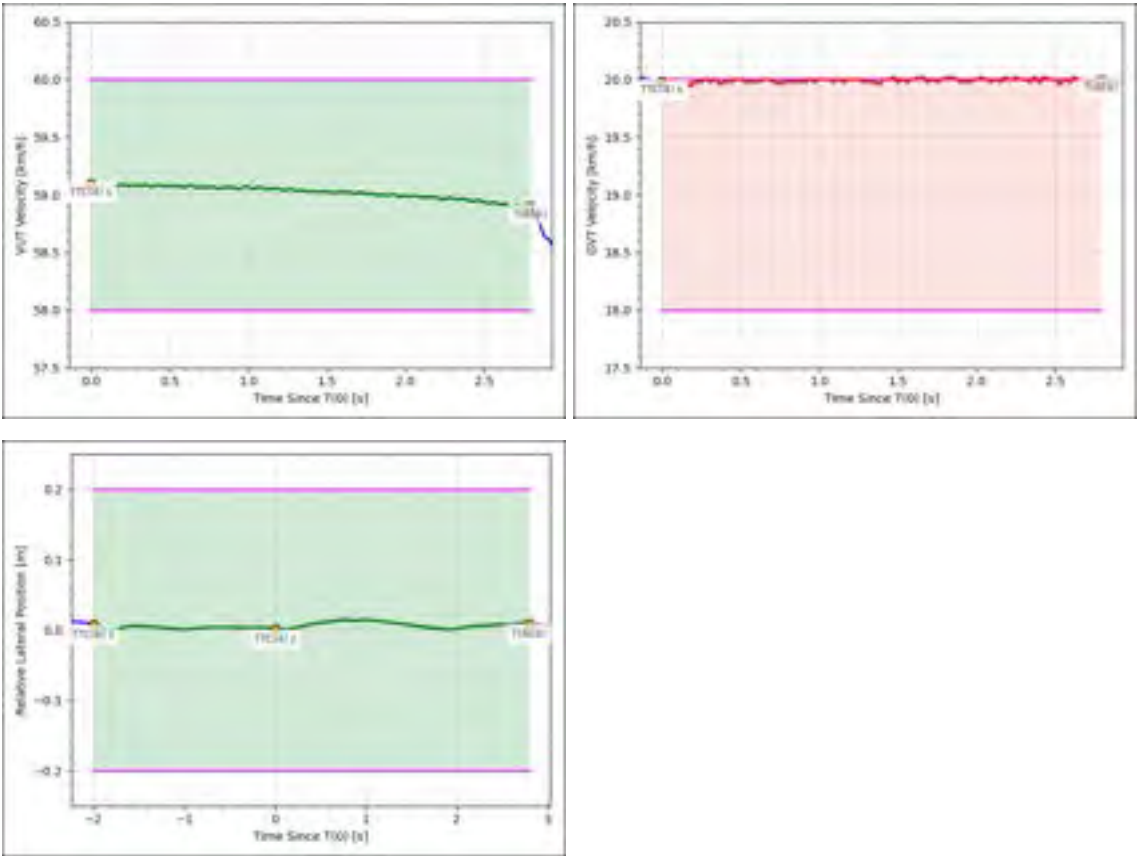
AEB CCRm | 60 km/h +100 % | Run 3

Run Date / Time 13-Dec-2022 11:07



AEB CCRm | 60 km/h +100 % | Run 4

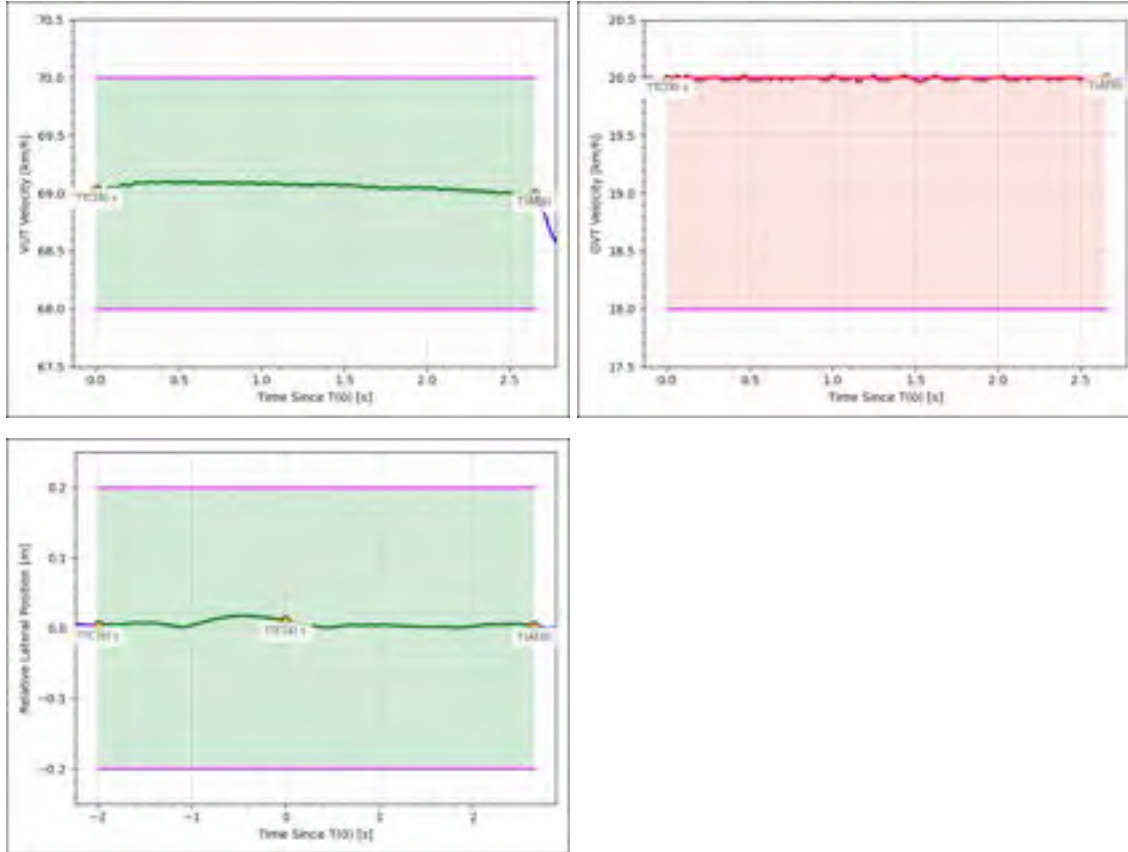
Run Date / Time 13-Dec-2022 11:10



D.2.2.5. A.1.1.AEB CCRm 70 kph +100 %

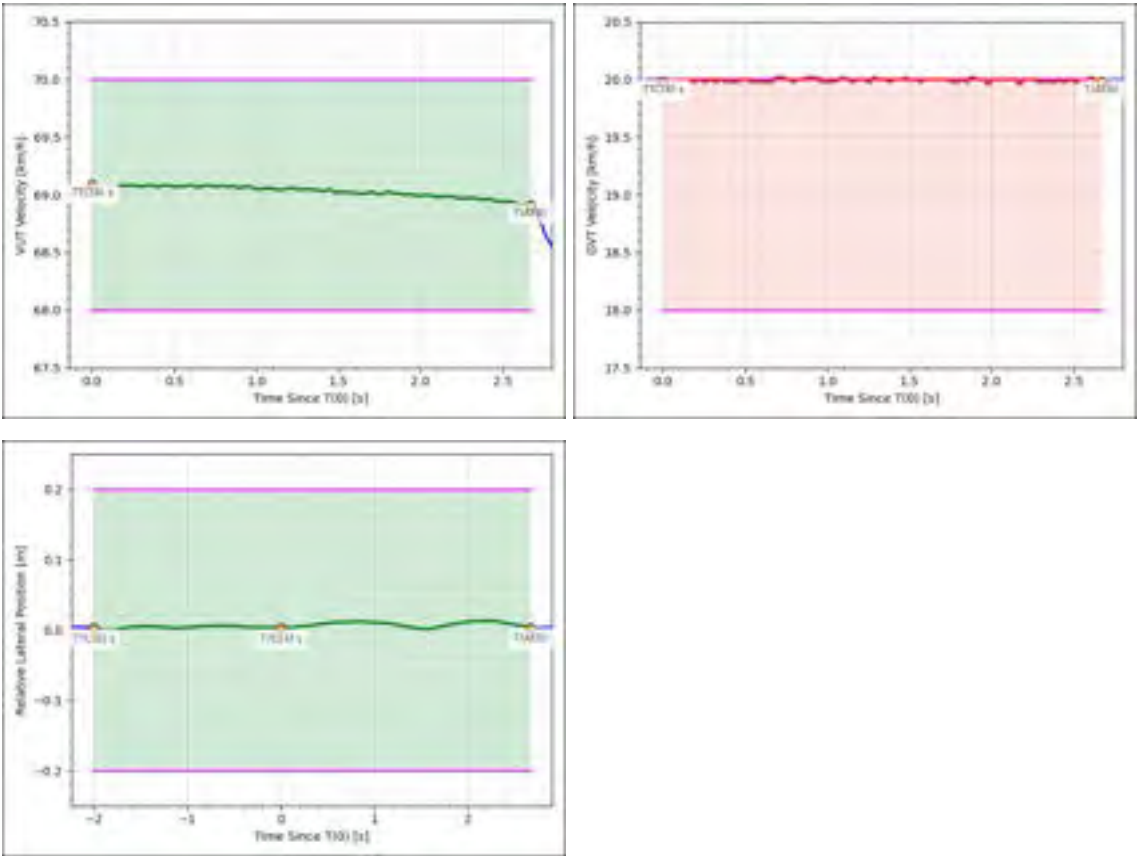
AEB CCRm | 70 km/h +100 % | Run 6

Run Date / Time 13-Dec-2022 11:18



AEB CCRm | 70 km/h +100 % | Run 7

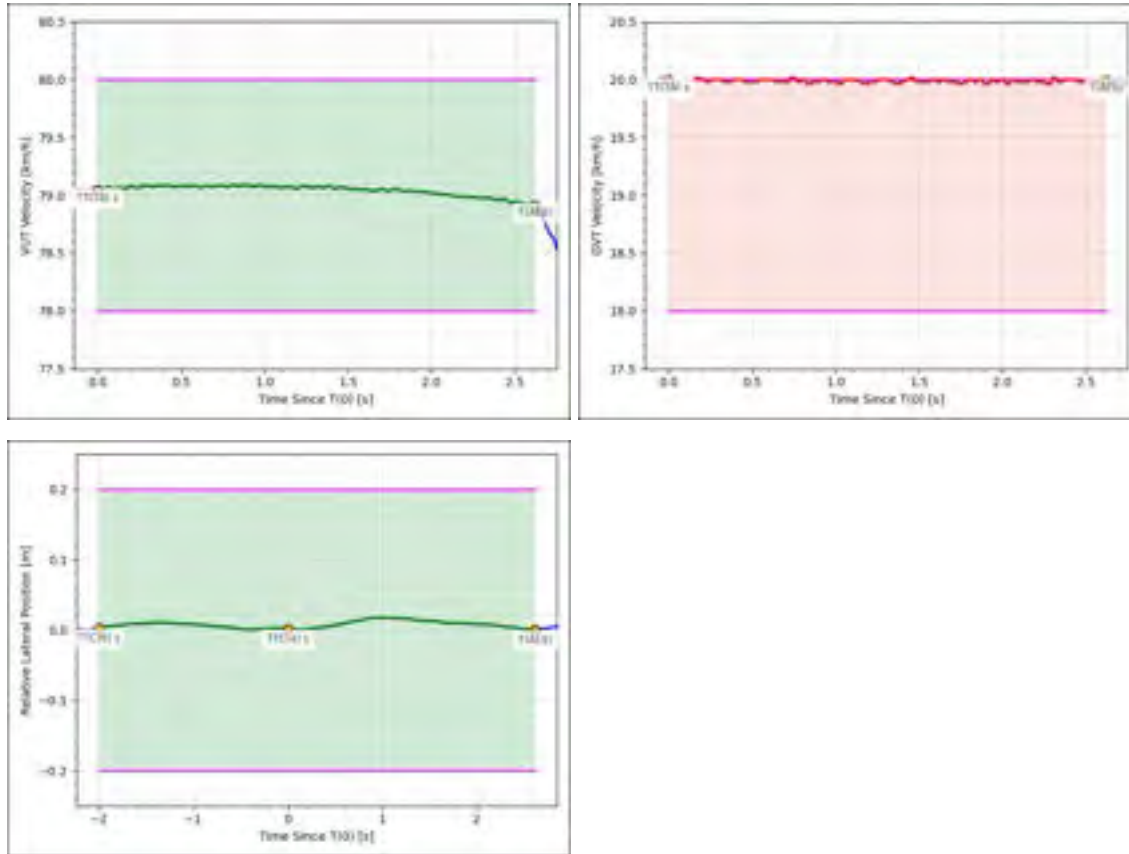
Run Date / Time 13-Dec-2022 11:23



D.2.2.6. A.1.1.AEB CCRm 80 kph +100 %

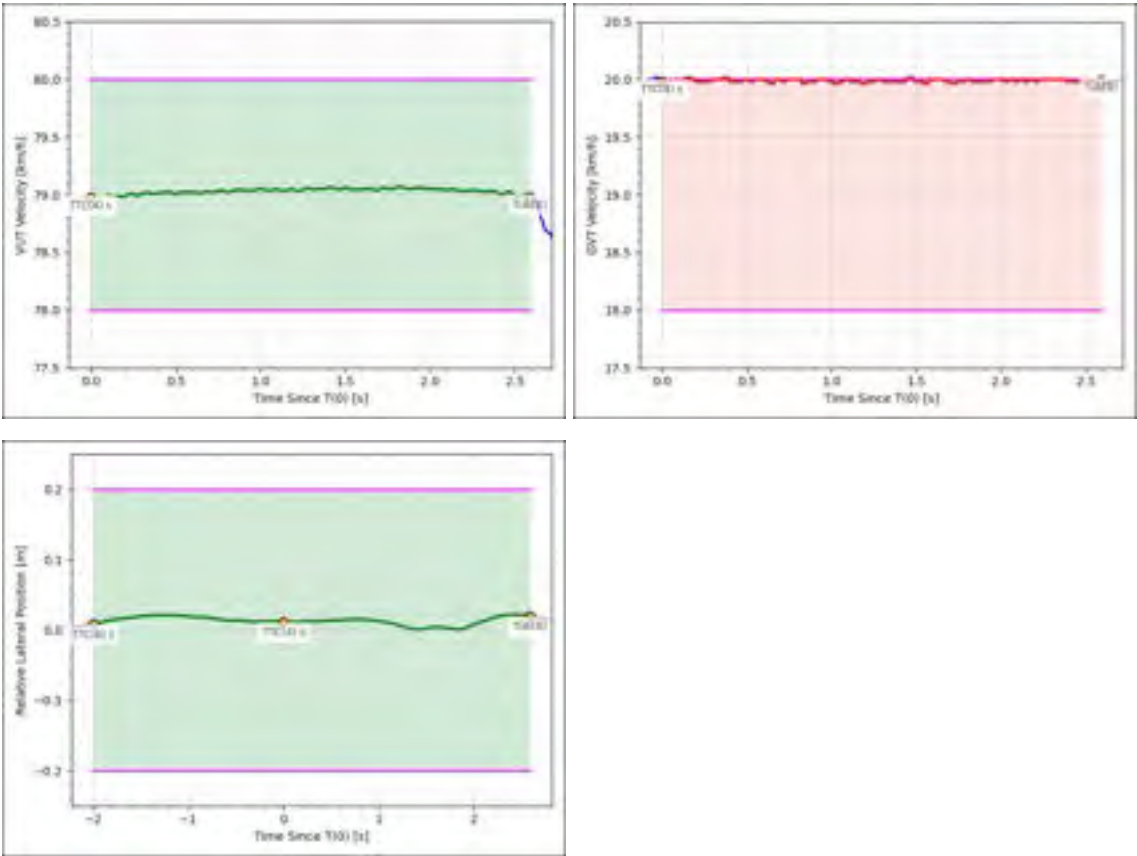
AEB CCRm | 80 km/h +100 % | Run 14

Run Date / Time 13-Dec-2022 11:30



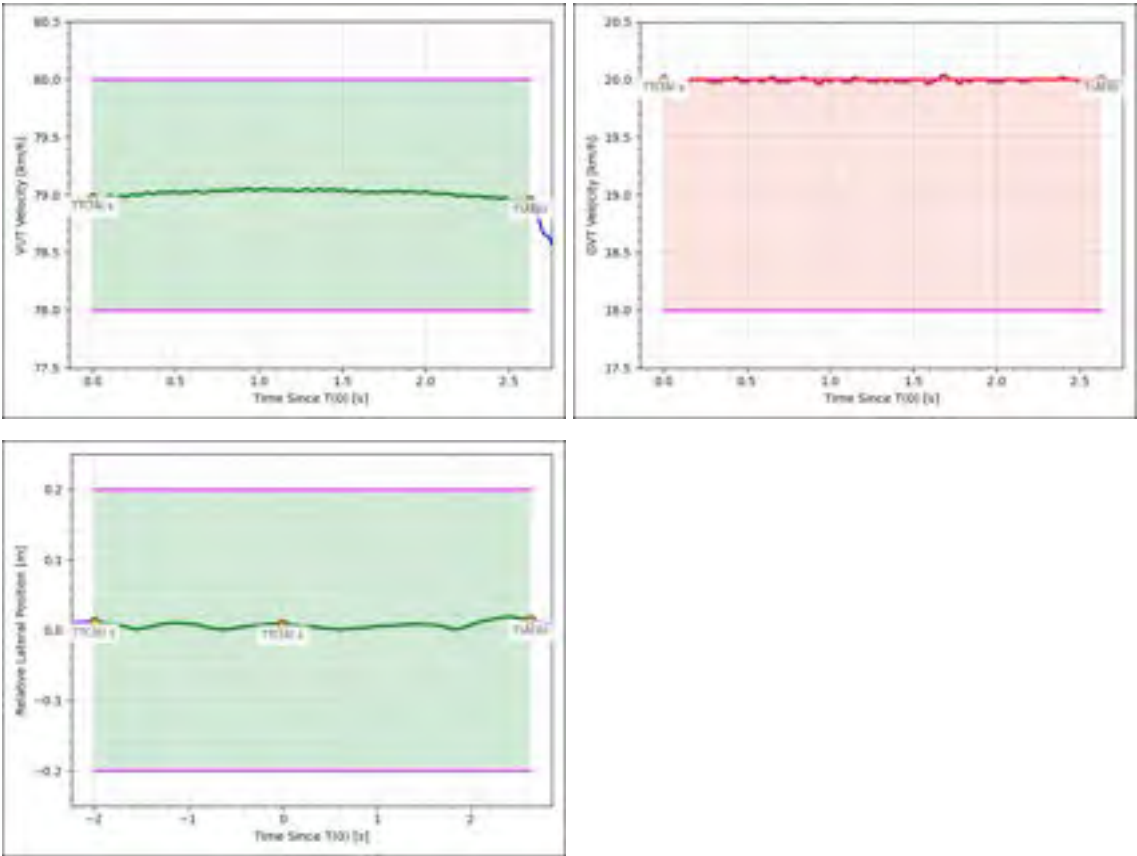
AEB CCRm | 80 km/h +100 % | Run 15

Run Date / Time 13-Dec-2022 11:32



AEB CCRm | 80 km/h +100 % | Run 16

Run Date / Time 13-Dec-2022 11:37

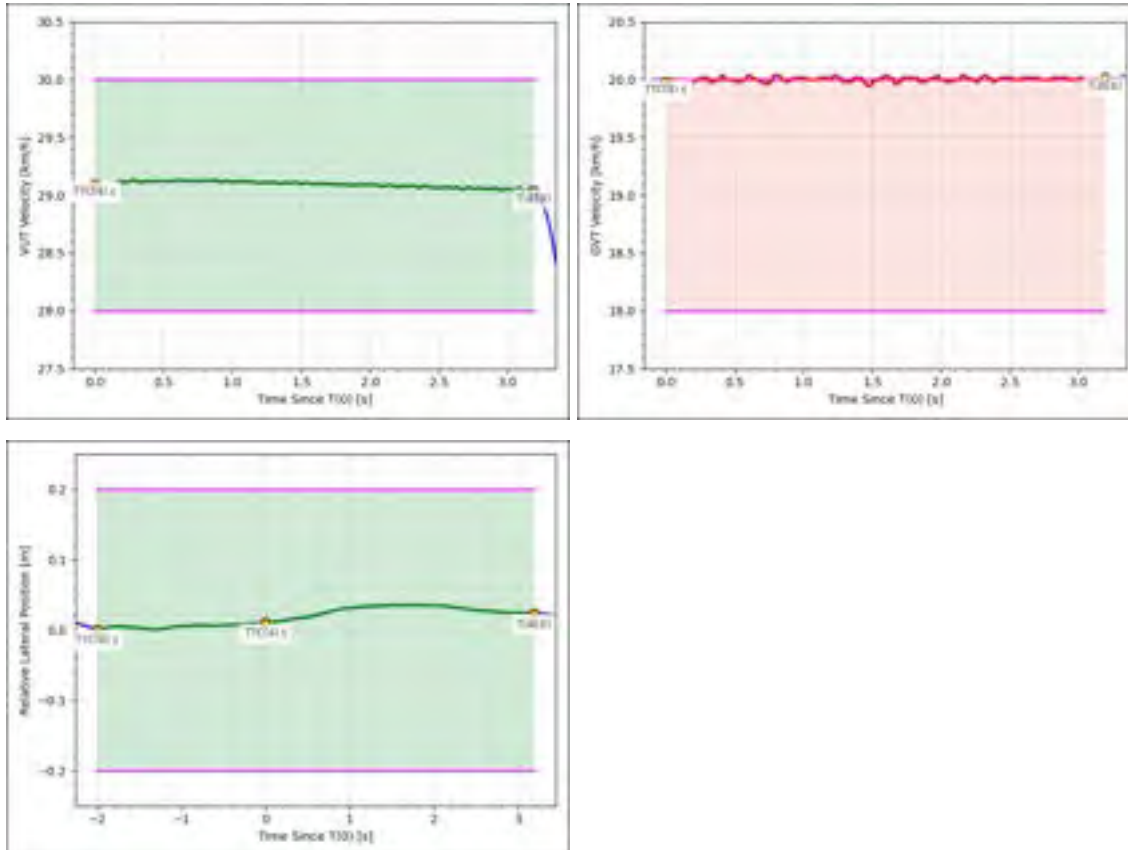


D.2.3. Rear Pitch

D.2.3.1. AEB CCRm 30 kph +100 %

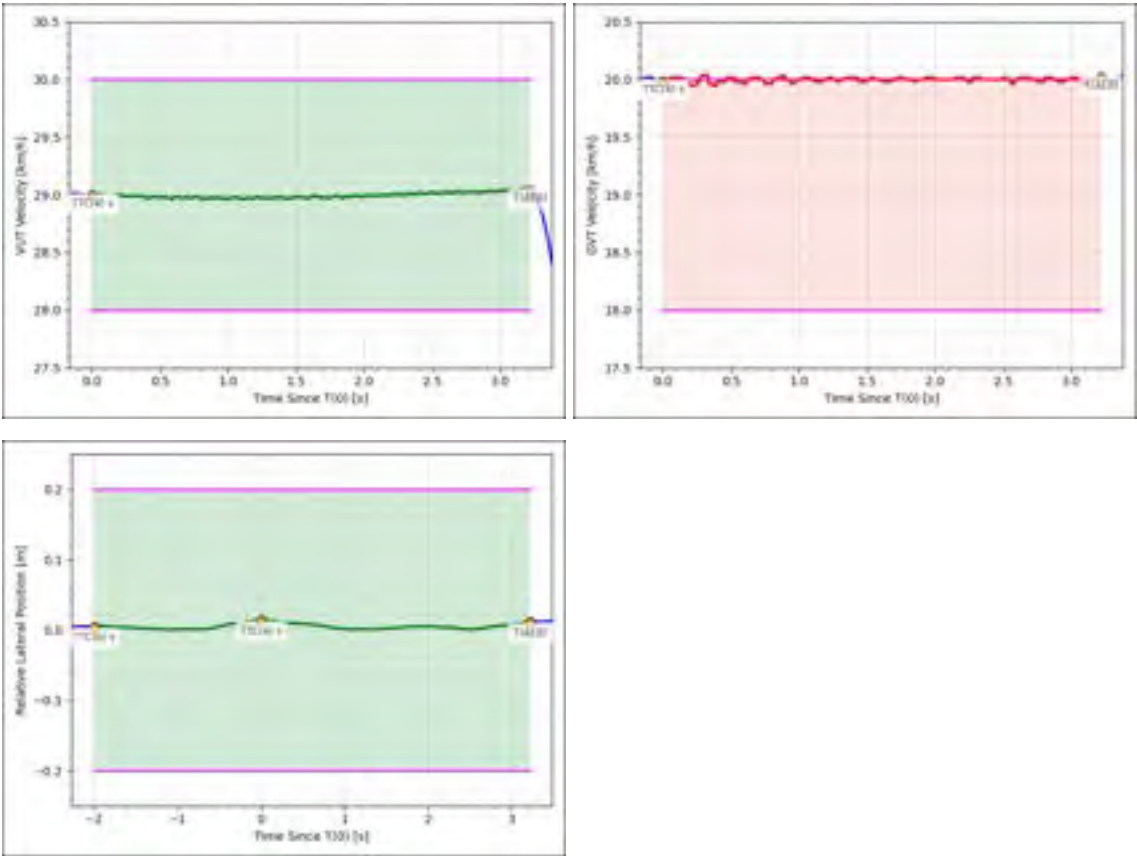
AEB CCRm | 30 km/h +100 % | Run 6

Run Date / Time 20-Dec-2022 10:28



AEB CCRm | 30 km/h +100 % | Run 7

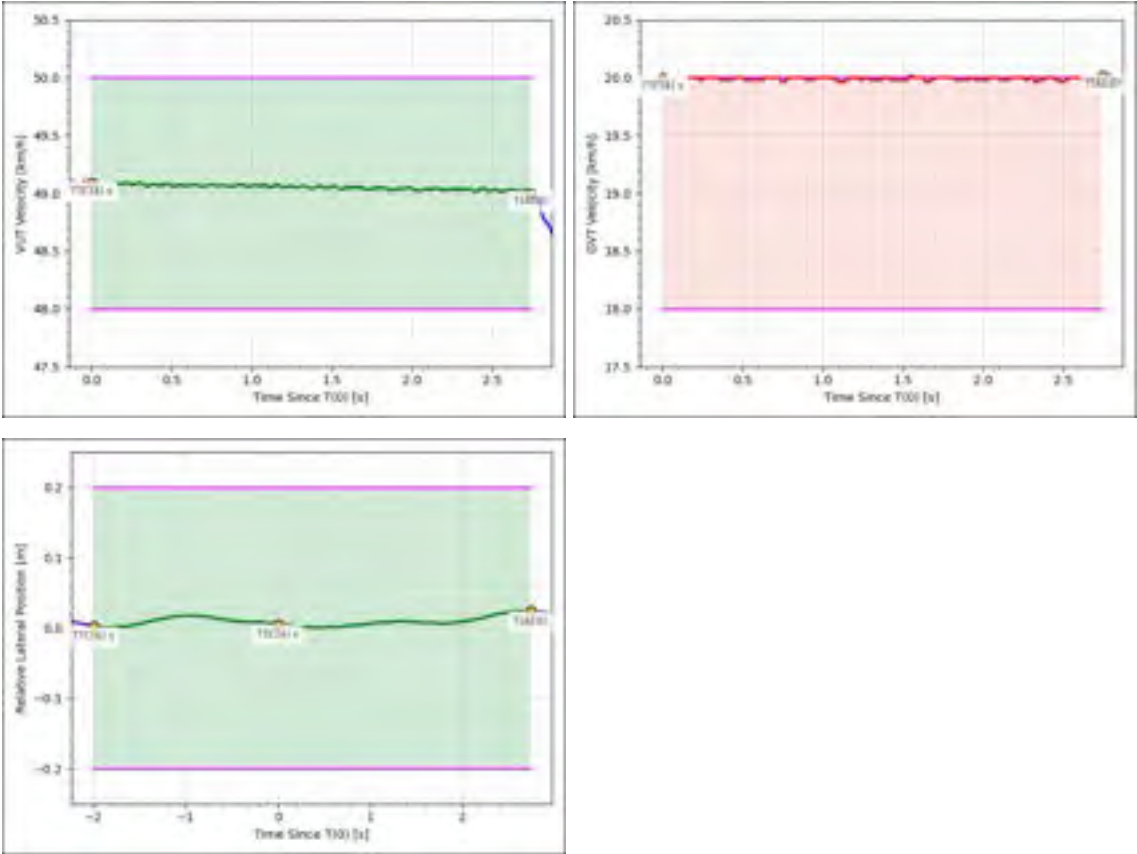
Run Date / Time 20-Dec-2022 10:32



D.2.3.2. AEB CCRm 50 kph +100 %

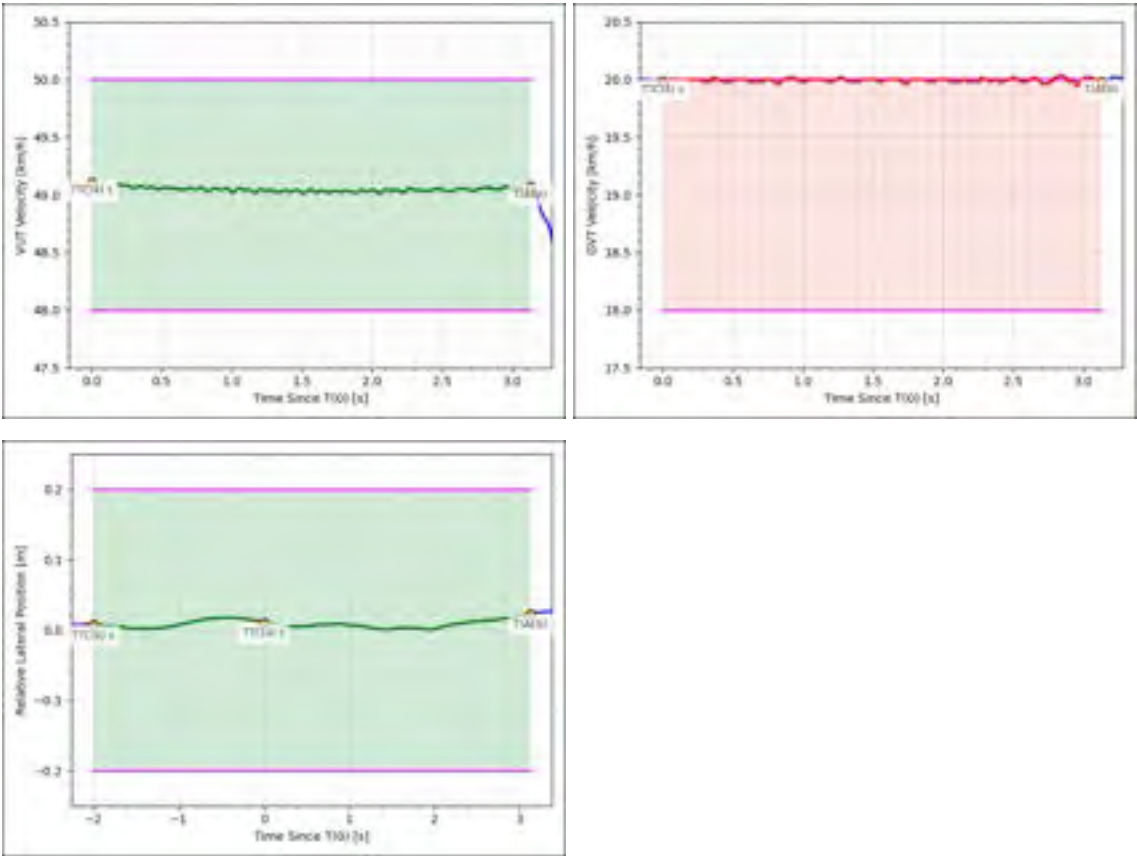
AEB CCRm | 50 km/h +100 % | Run 5

Run Date / Time 20-Dec-2022 10:35



AEB CCRm | 50 km/h +100 % | Run 6

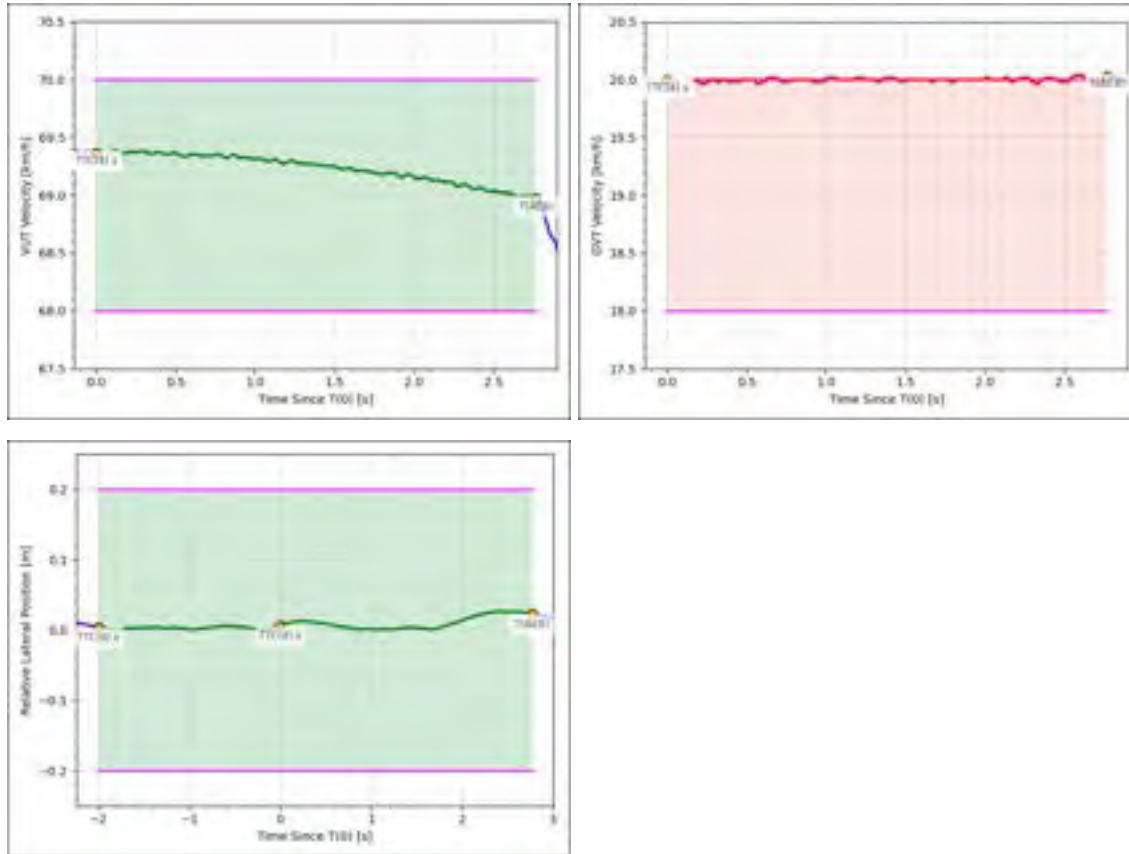
Run Date / Time 20-Dec-2022 10:38



D.2.3.3. AEB CCRm 70 kph +100 %

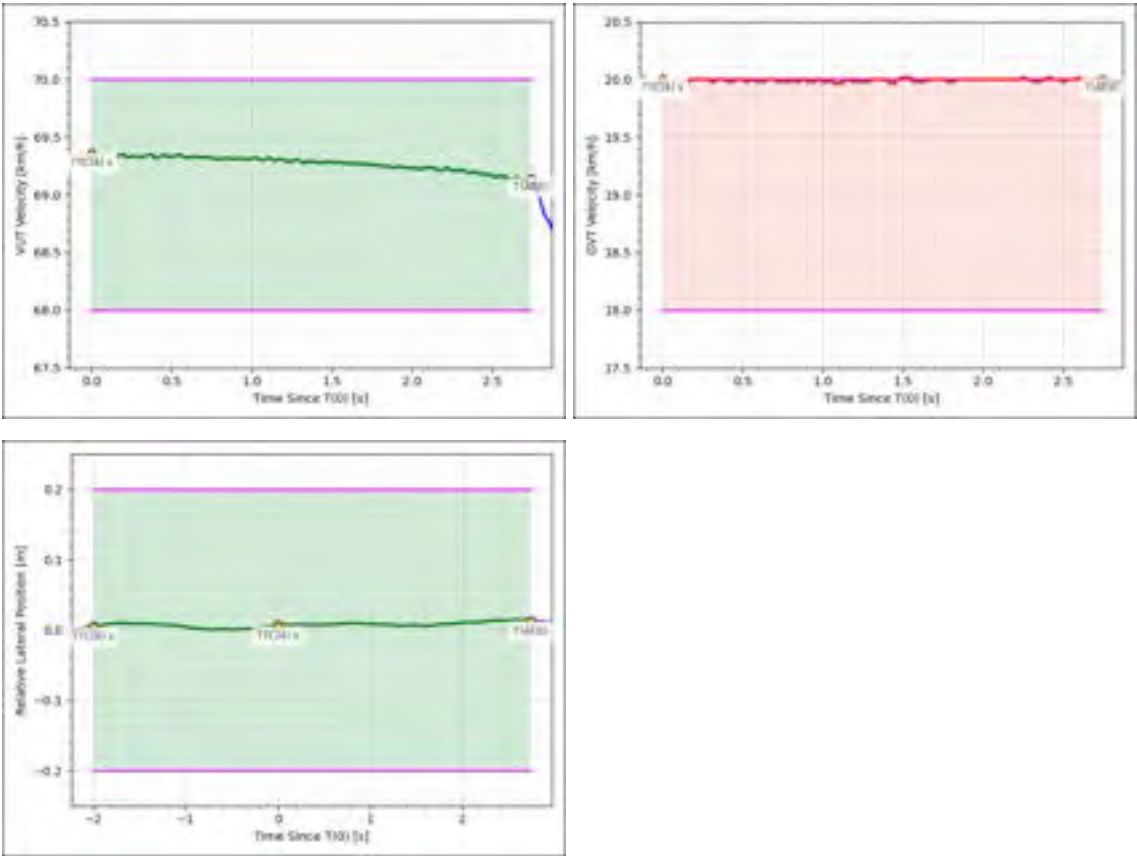
AEB CCRm | 70 km/h +100 % | Run 8

Run Date / Time 20-Dec-2022 10:42



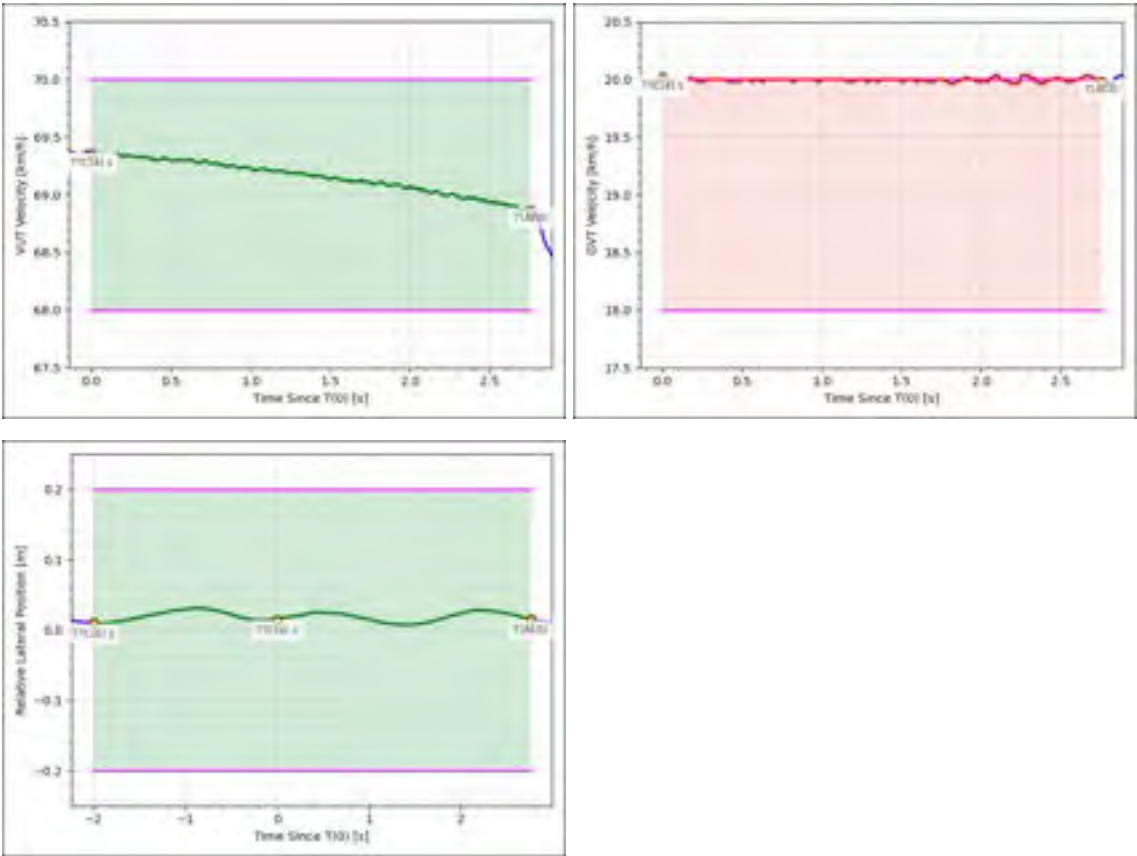
AEB CCRm | 70 km/h +100 % | Run 9

Run Date / Time 20-Dec-2022 10:45



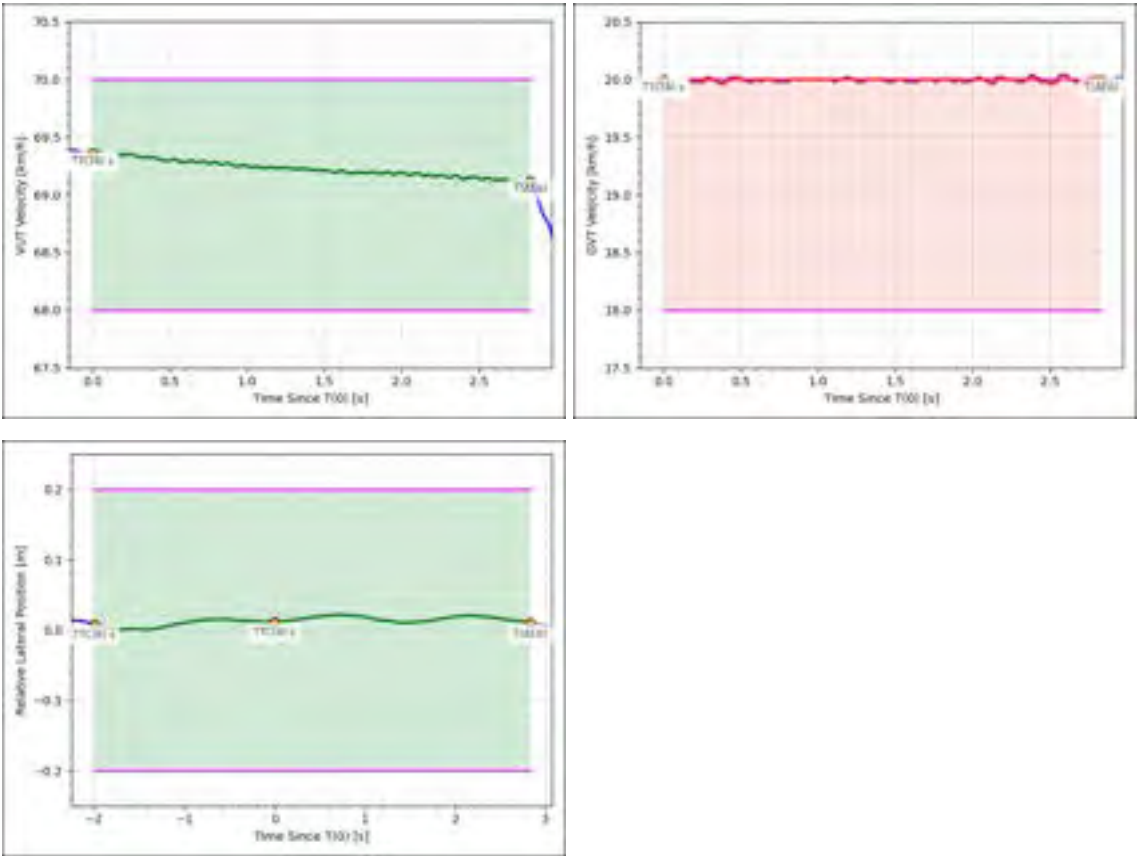
AEB CCRm | 70 km/h +100 % | Run 10

Run Date / Time 20-Dec-2022 10:49



AEB CCRm | 70 km/h +100 % | Run 11

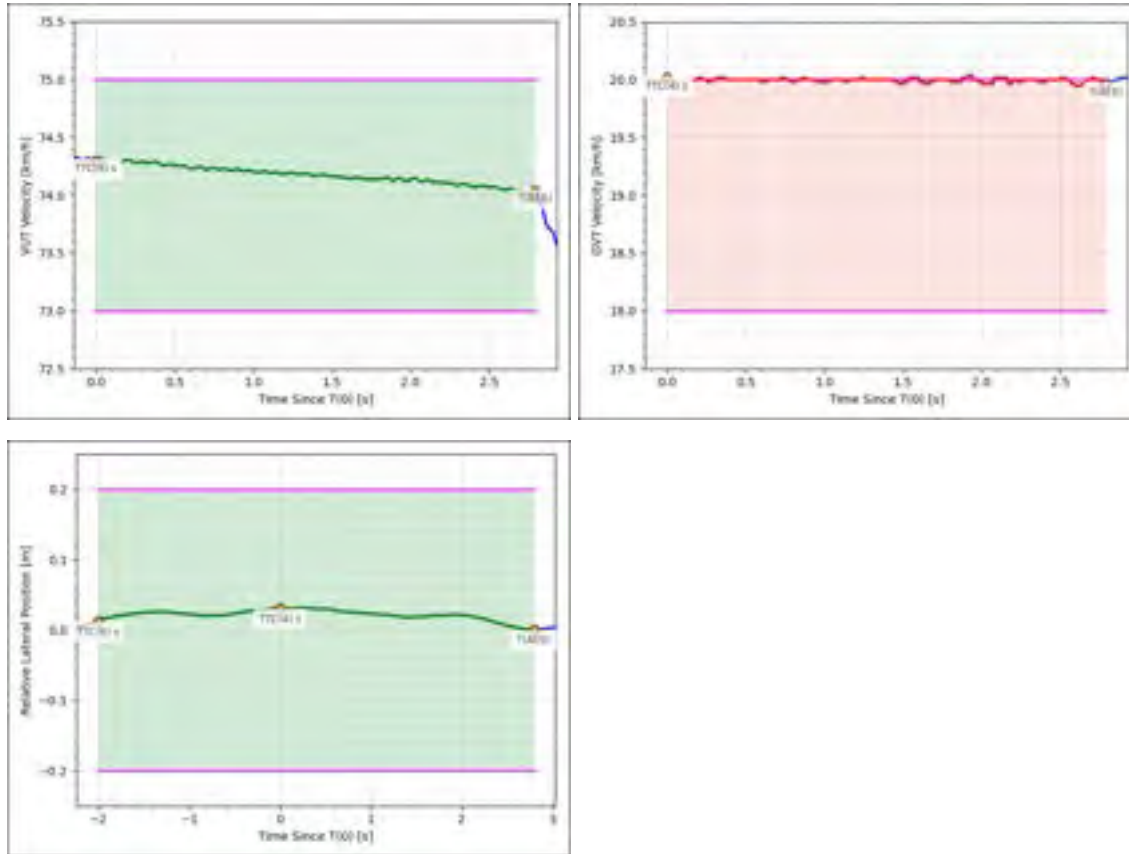
Run Date / Time 20-Dec-2022 10:53



D.2.3.4. AEB CCRm 75 kph +100 %

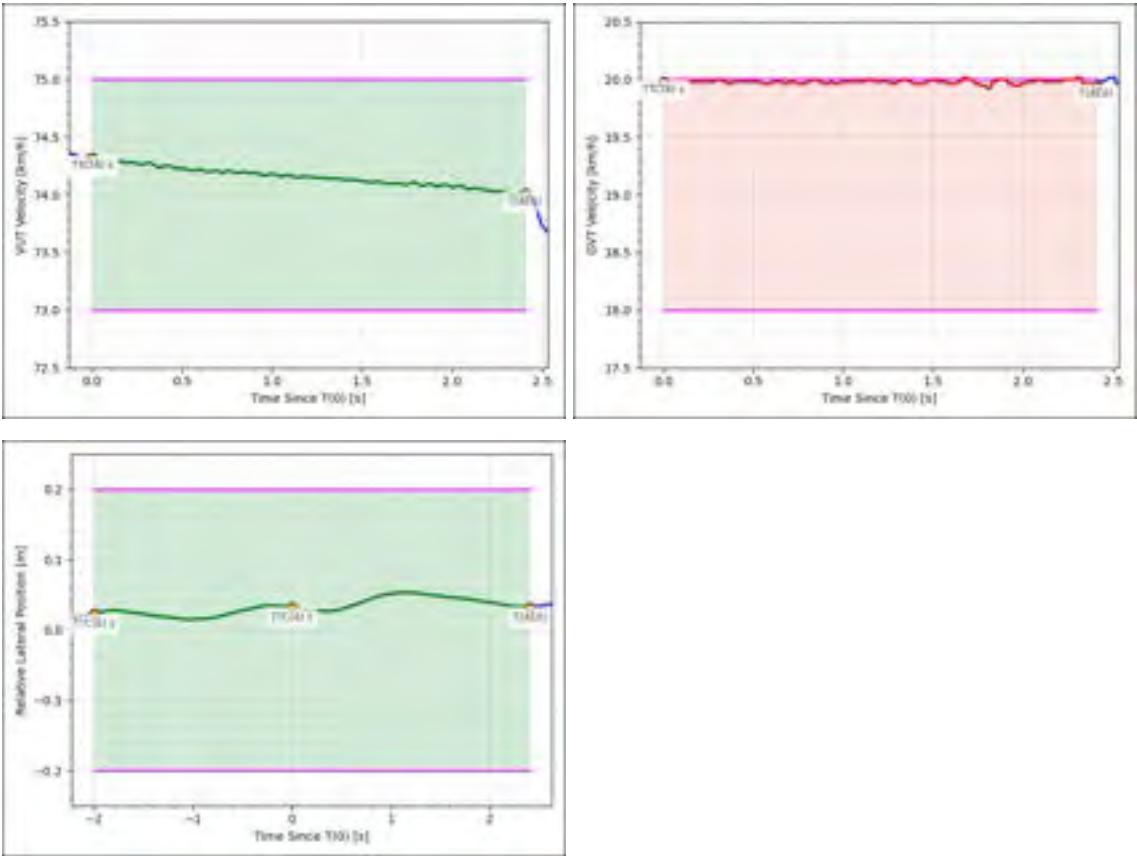
AEB CCRm | 75 km/h +100 % | Run 1

Run Date / Time 20-Dec-2022 11:23



AEB CCRm | 75 km/h +100 % | Run 2

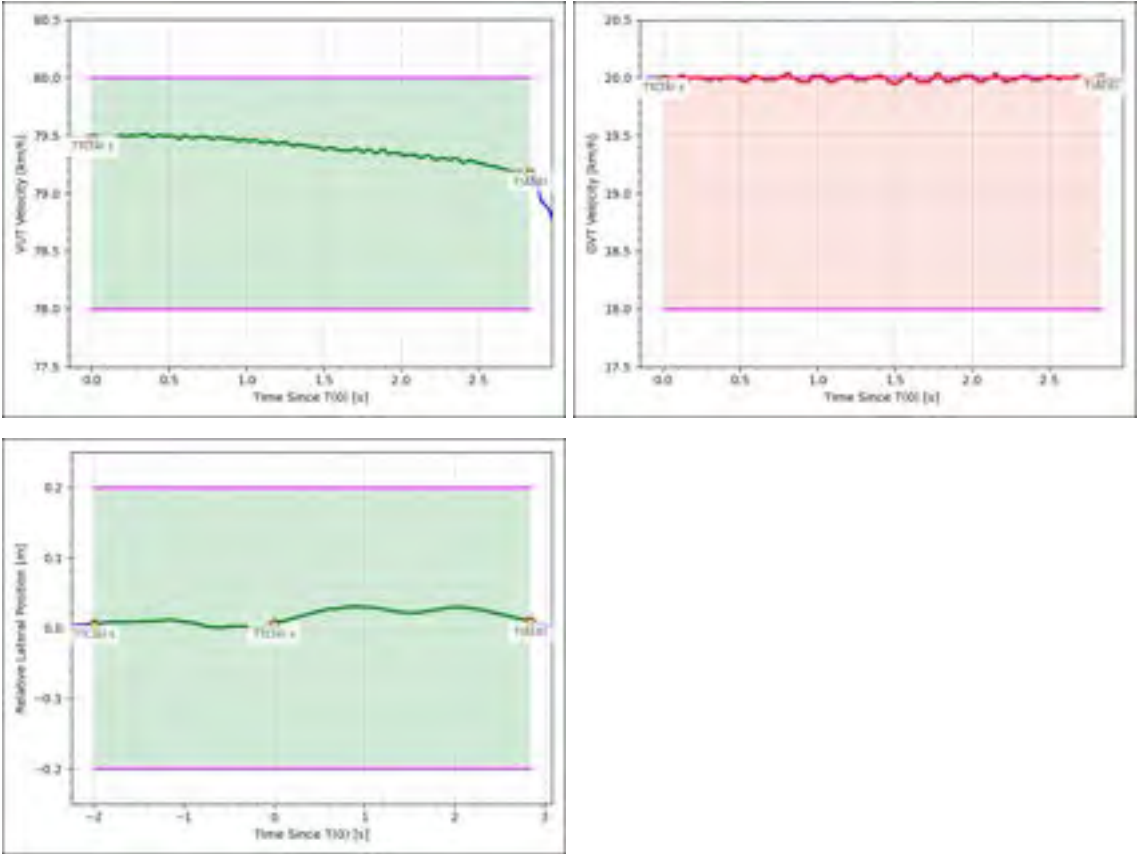
Run Date / Time 20-Dec-2022 11:26



D.2.3.5. AEB CCRm 80 kph +100 %

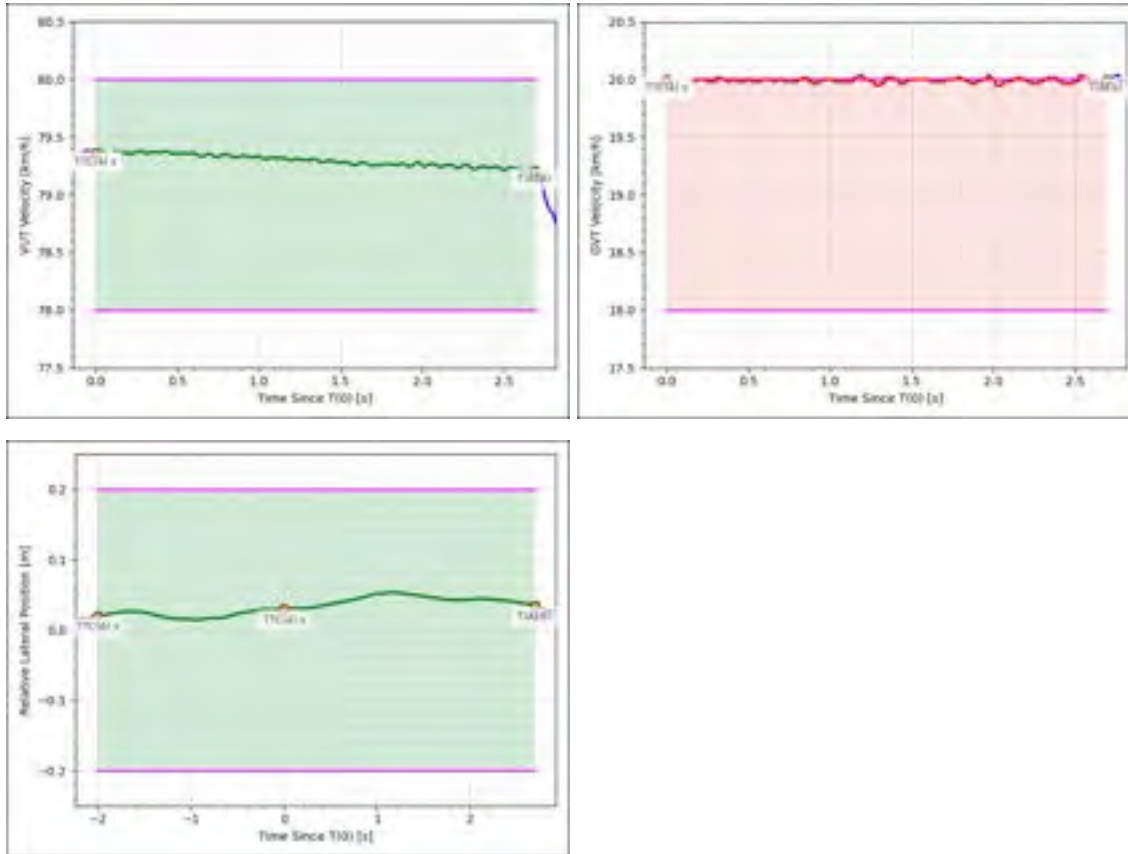
AEB CCRm | 80 km/h +100 % | Run 17

Run Date / Time 20-Dec-2022 10:57



AEB CCRm | 80 km/h +100 % | Run 18

Run Date / Time 20-Dec-2022 11:31

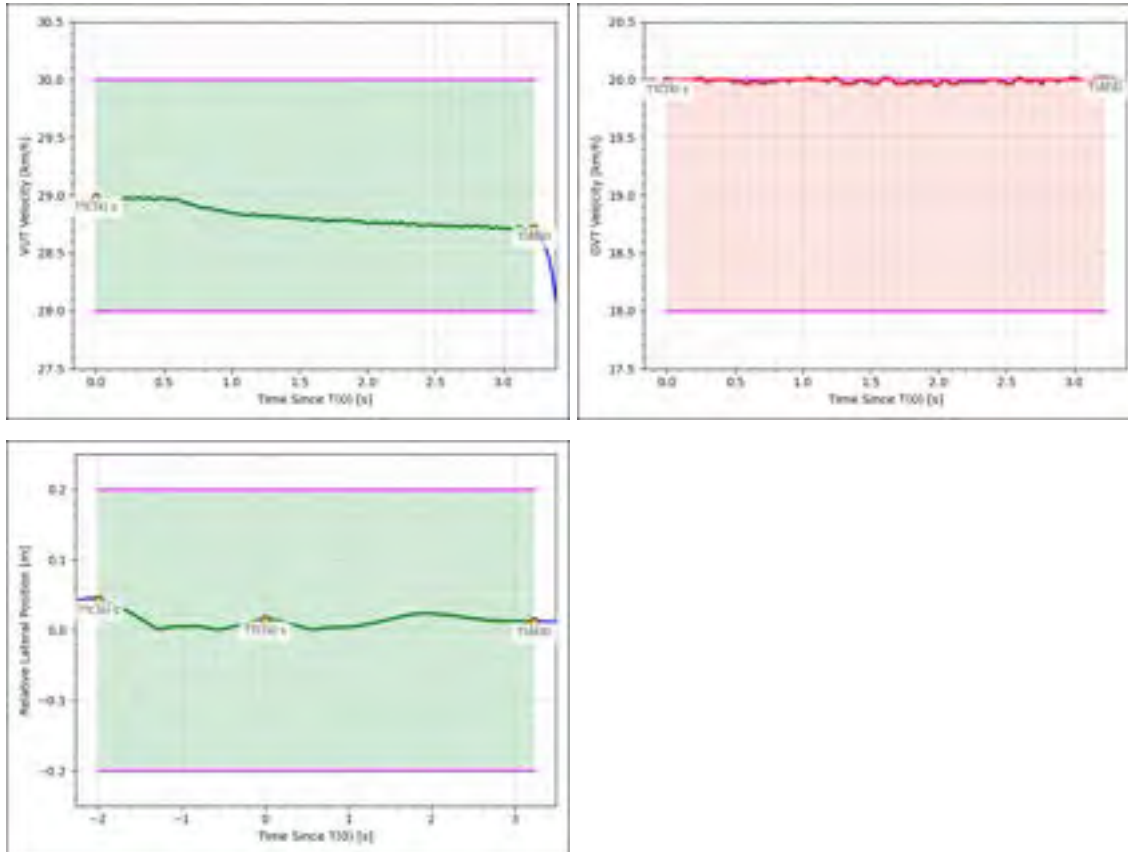


D.2.4. Lift Kit

D.2.4.1. AEB CCRm 30 kph +100 %

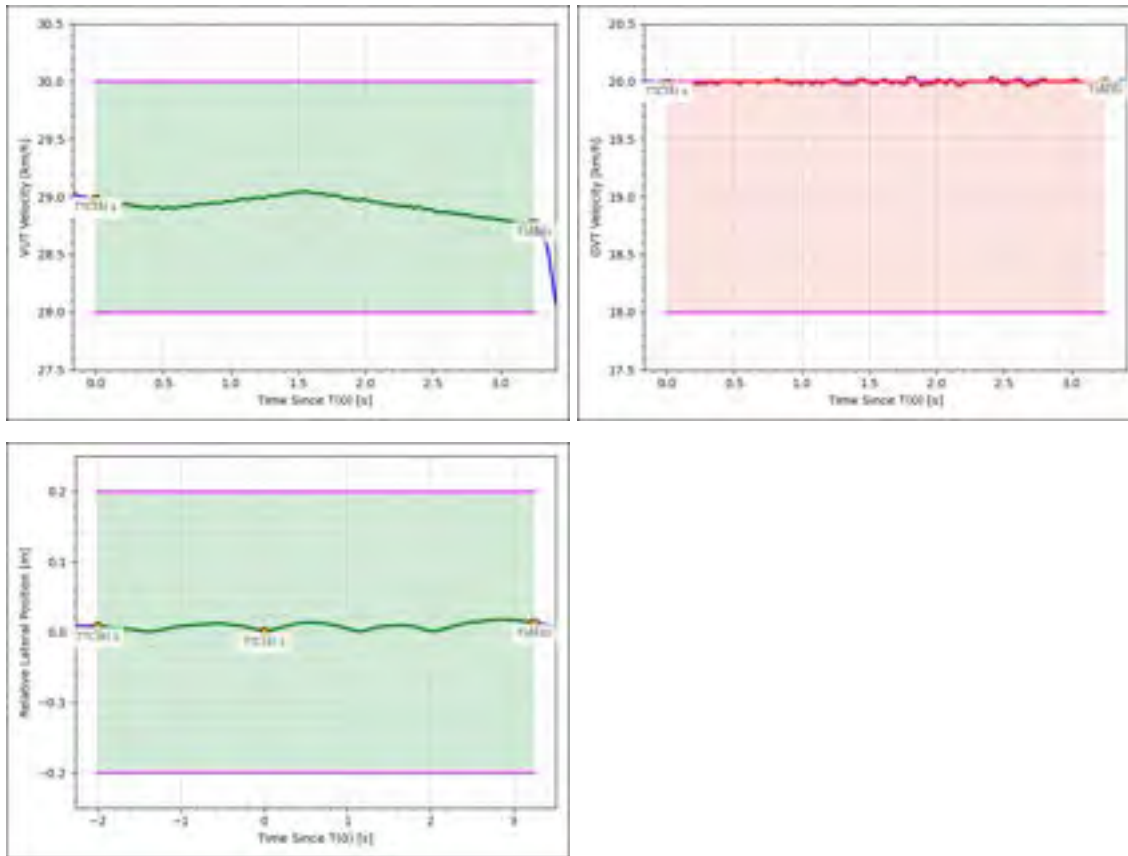
AEB CCRm | 30 km/h +100 % | Run 9

Run Date / Time 7-Mar-2023 13:25



AEB CCRm | 30 km/h +100 % | Run 10

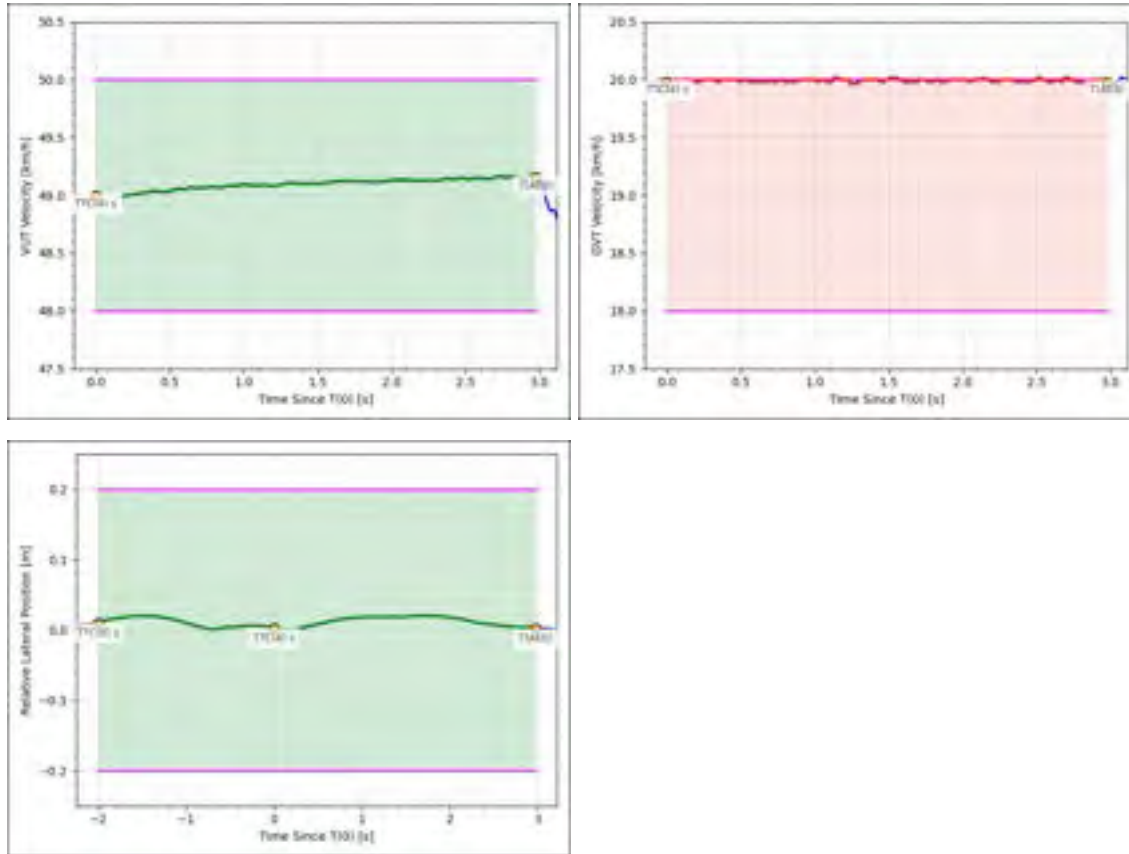
Run Date / Time 7-Mar-2023 13:28



D.2.4.2. AEB CCRm 50 kph +100 %

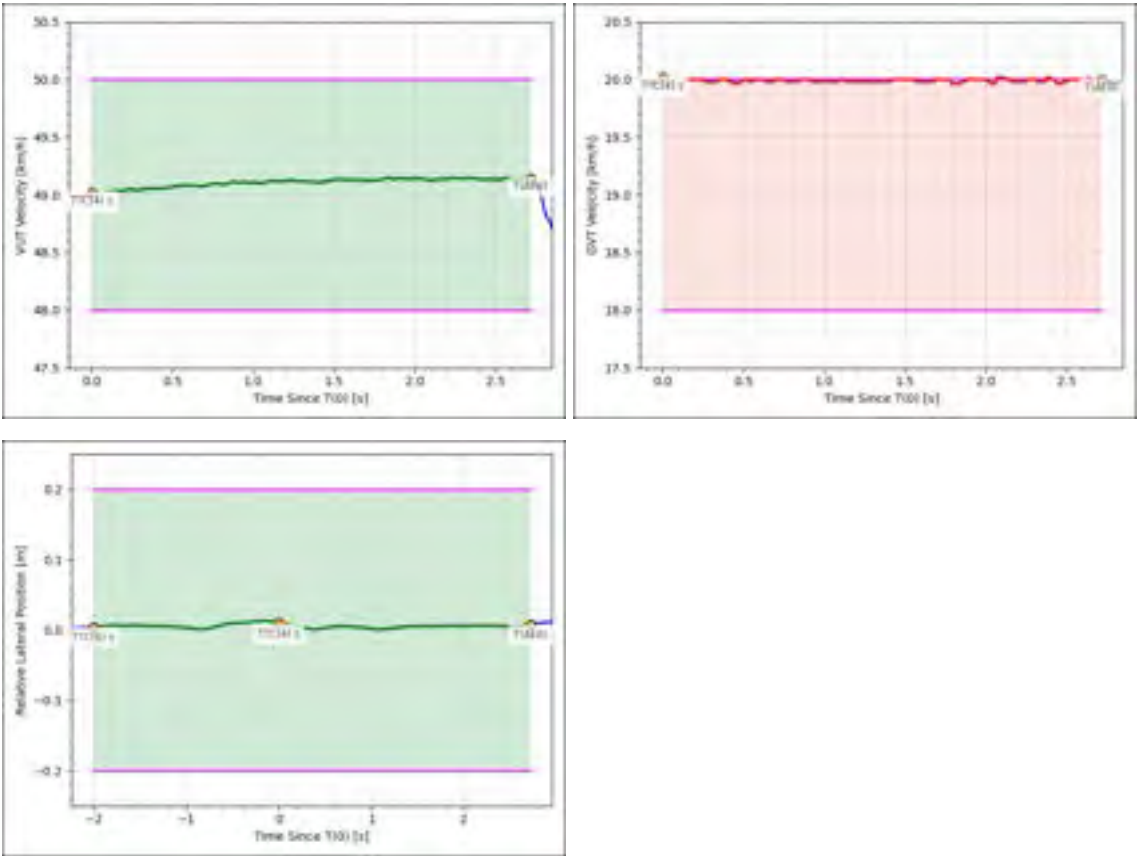
AEB CCRm | 50 km/h +100 % | Run 7

Run Date / Time 7-Mar-2023 13:33



AEB CCRm | 50 km/h +100 % | Run 8

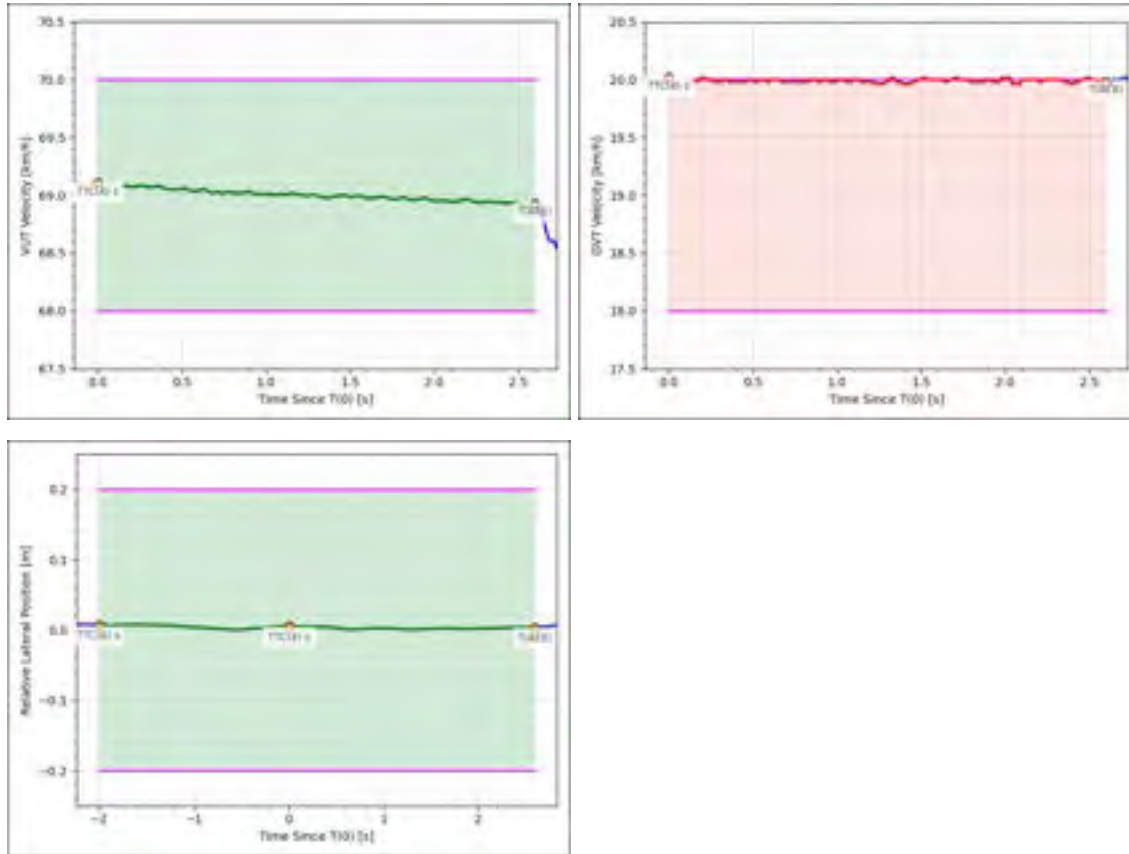
Run Date / Time 7-Mar-2023 13:36



D.2.4.3. AEB CCRm 70 kph +100 %

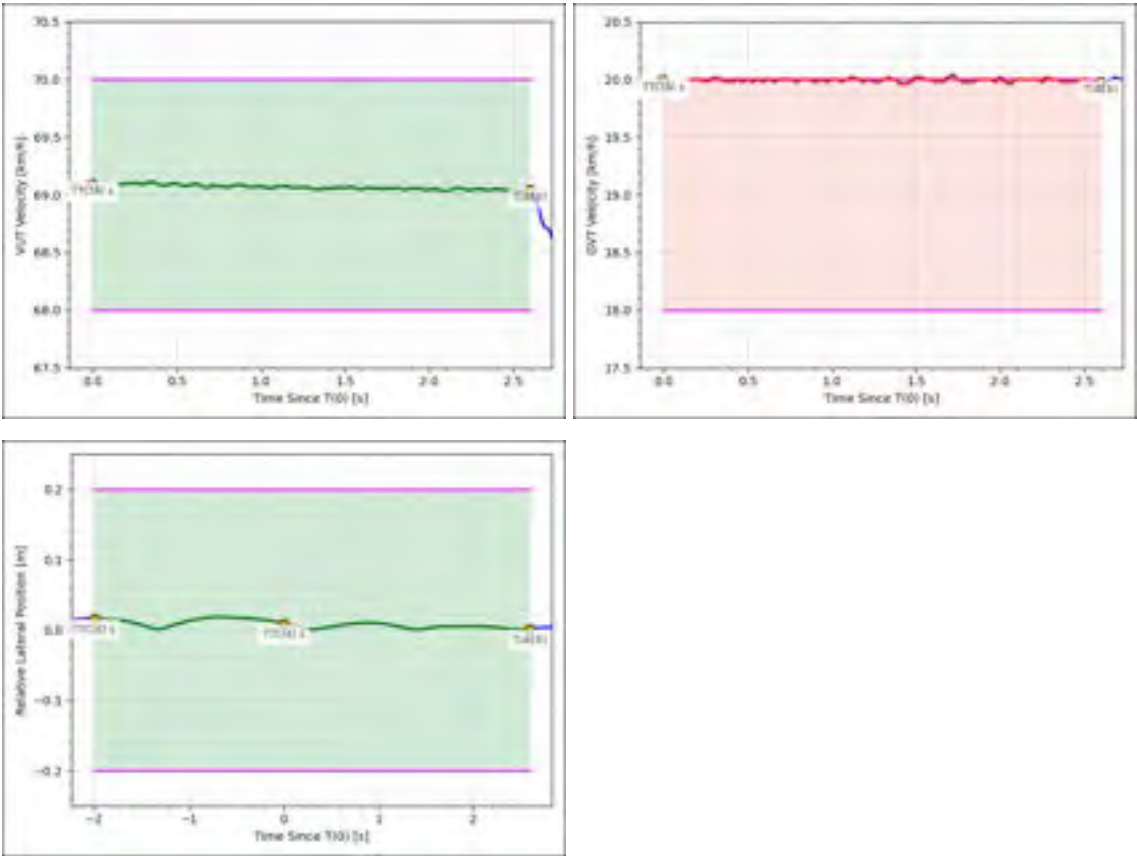
AEB CCRm | 70 km/h +100 % | Run 13

Run Date / Time 7-Mar-2023 13:42



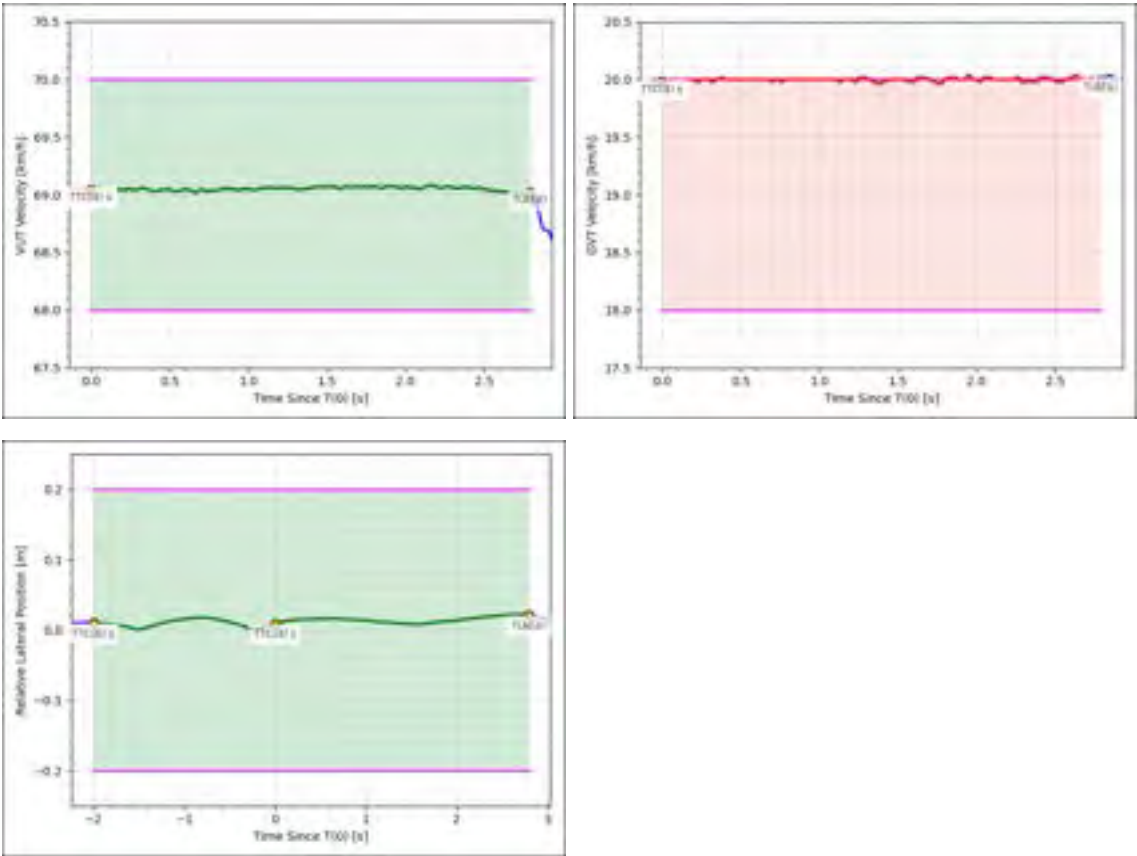
AEB CCRm | 70 km/h +100 % | Run 14

Run Date / Time 7-Mar-2023 13:48



AEB CCRm | 70 km/h +100 % | Run 15

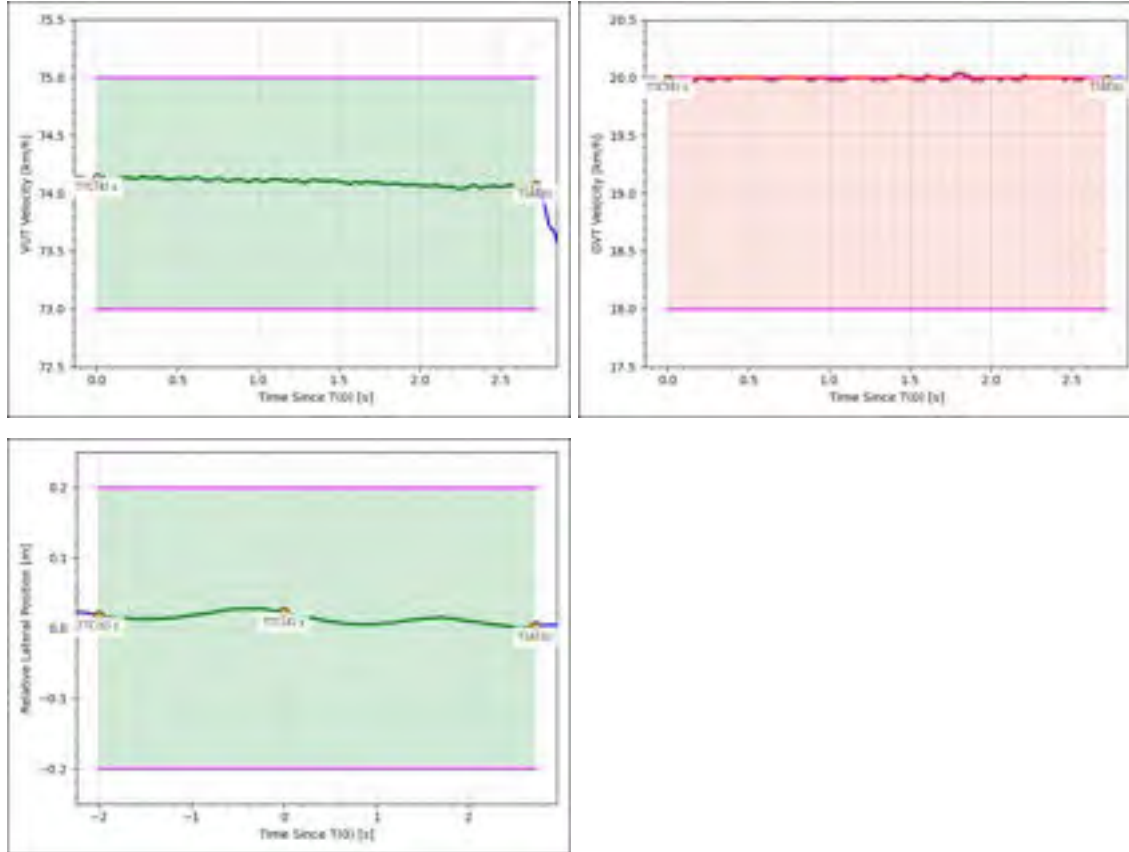
Run Date / Time 7-Mar-2023 13:52



D.2.4.4. AEB CCRm 75 kph +100 %

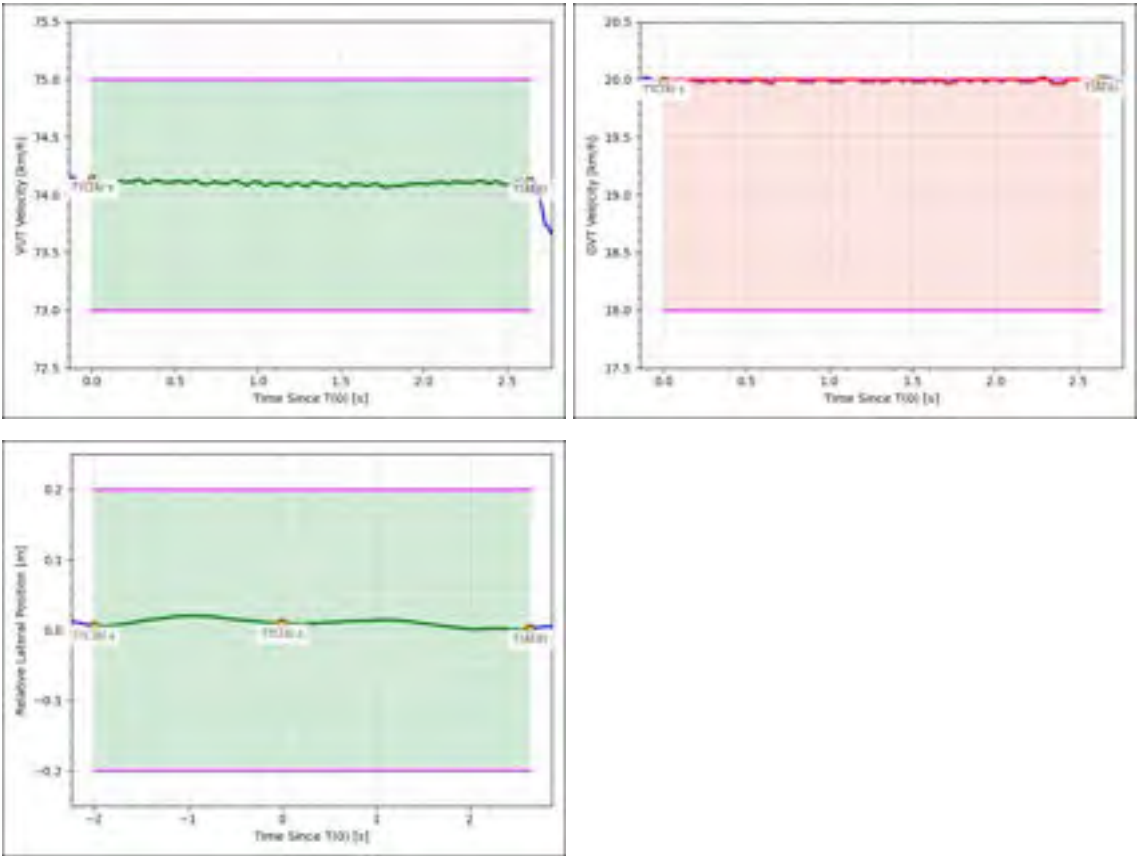
AEB CCRm | 75 km/h +100 % | Run 3

Run Date / Time 7-Mar-2023 14:31



AEB CCRm | 75 km/h +100 % | Run 4

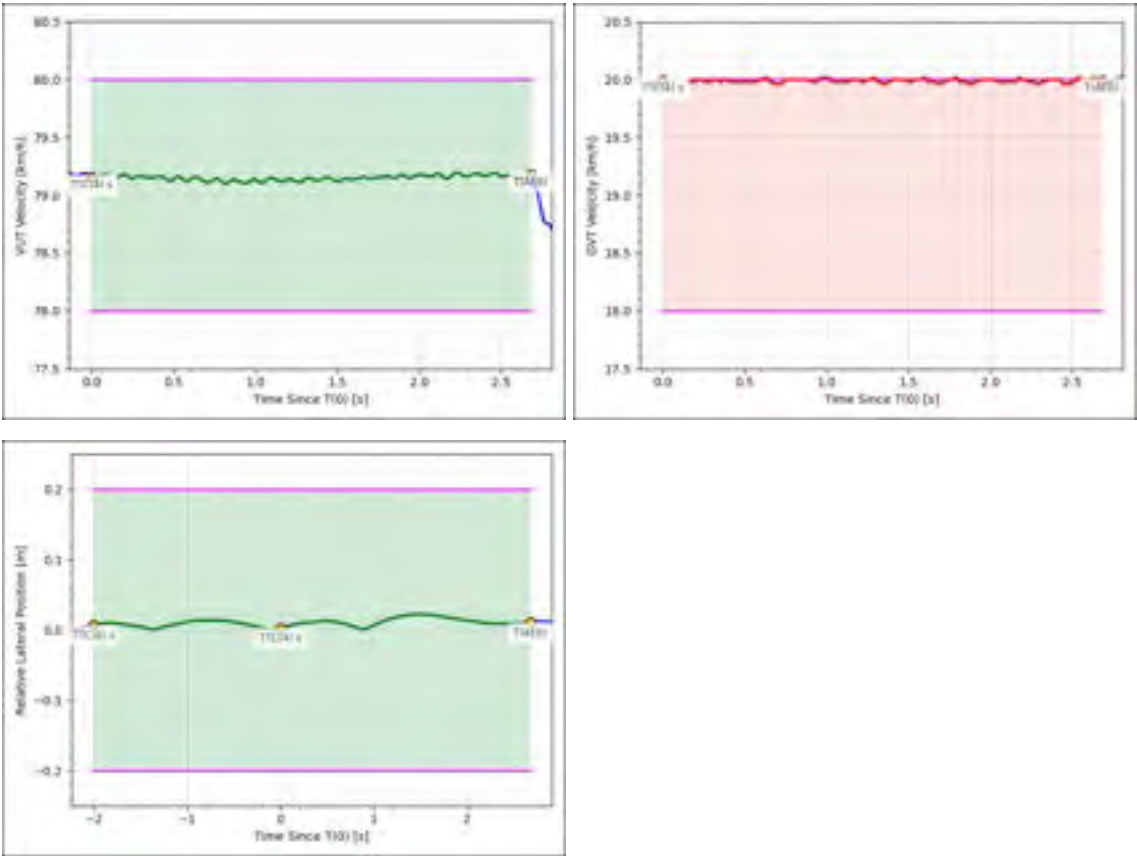
Run Date / Time 7-Mar-2023 14:36



D.2.4.5. AEB CCRm 80 kph +100 %

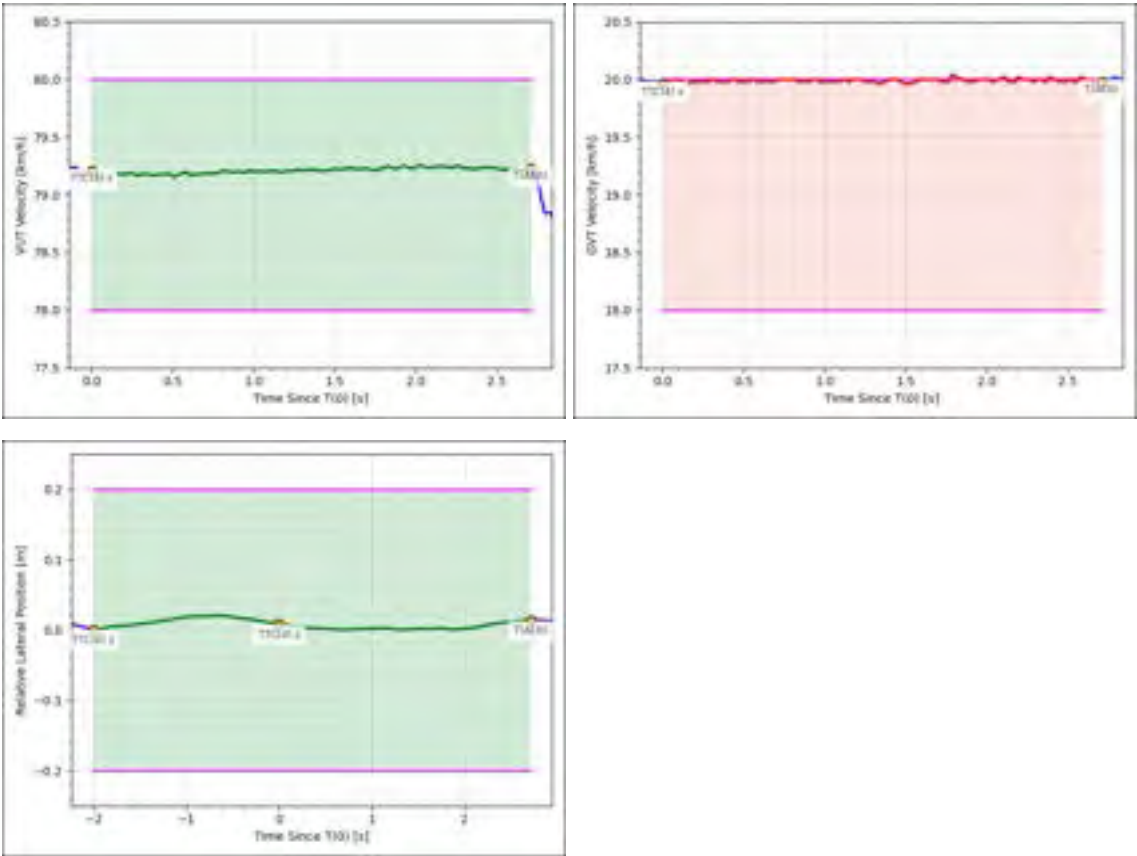
AEB CCRm | 80 km/h +100 % | Run 19

Run Date / Time 7-Mar-2023 14:06



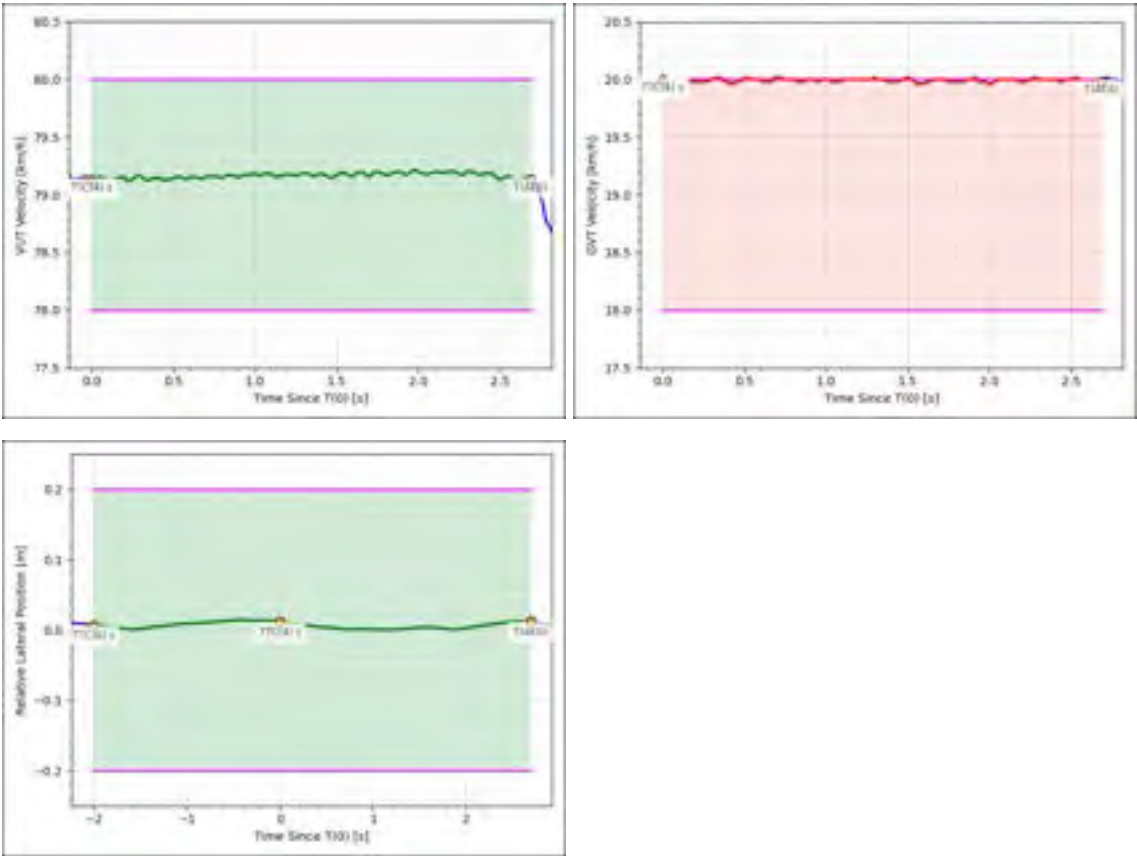
AEB CCRm | 80 km/h +100 % | Run 20

Run Date / Time 7-Mar-2023 14:09



AEB CCRm | 80 km/h +100 % | Run 21

Run Date / Time 7-Mar-2023 14:41

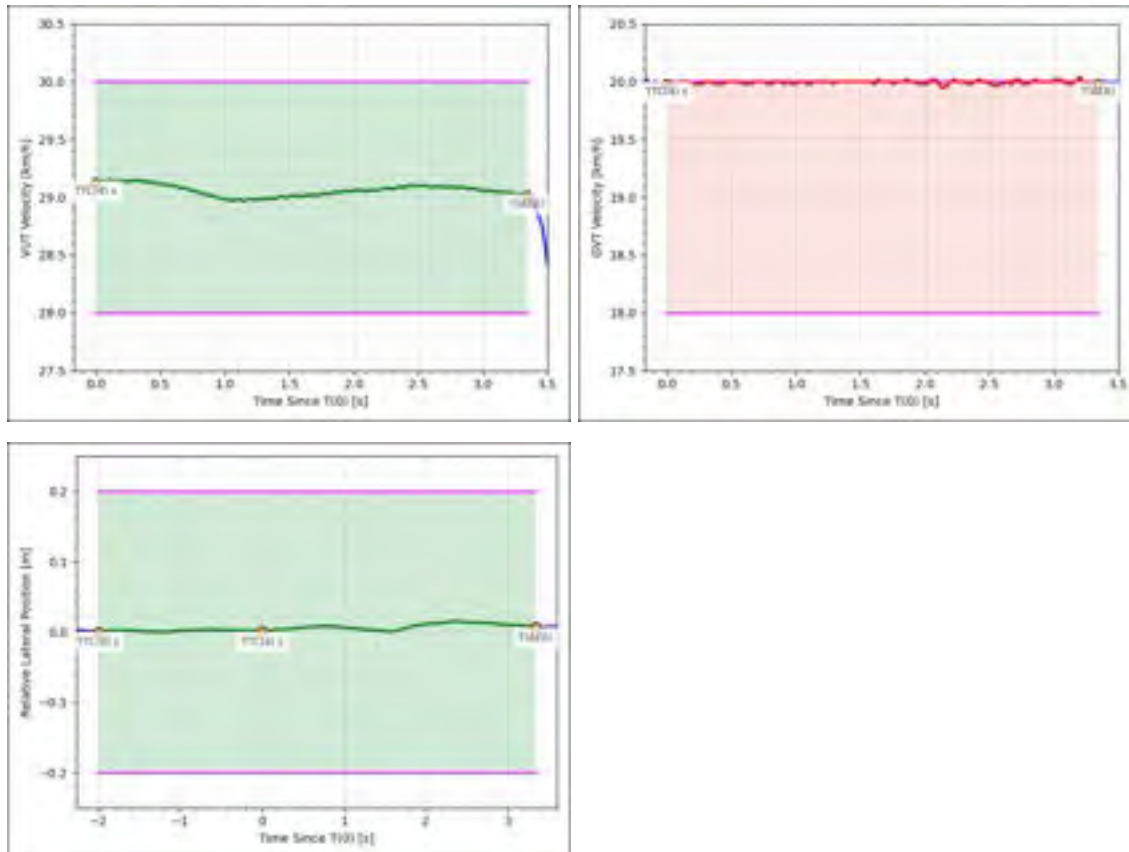


D.2.5. Lift Kit + Bullbar

D.2.5.1. AEB CCRm 30 kph +100 %

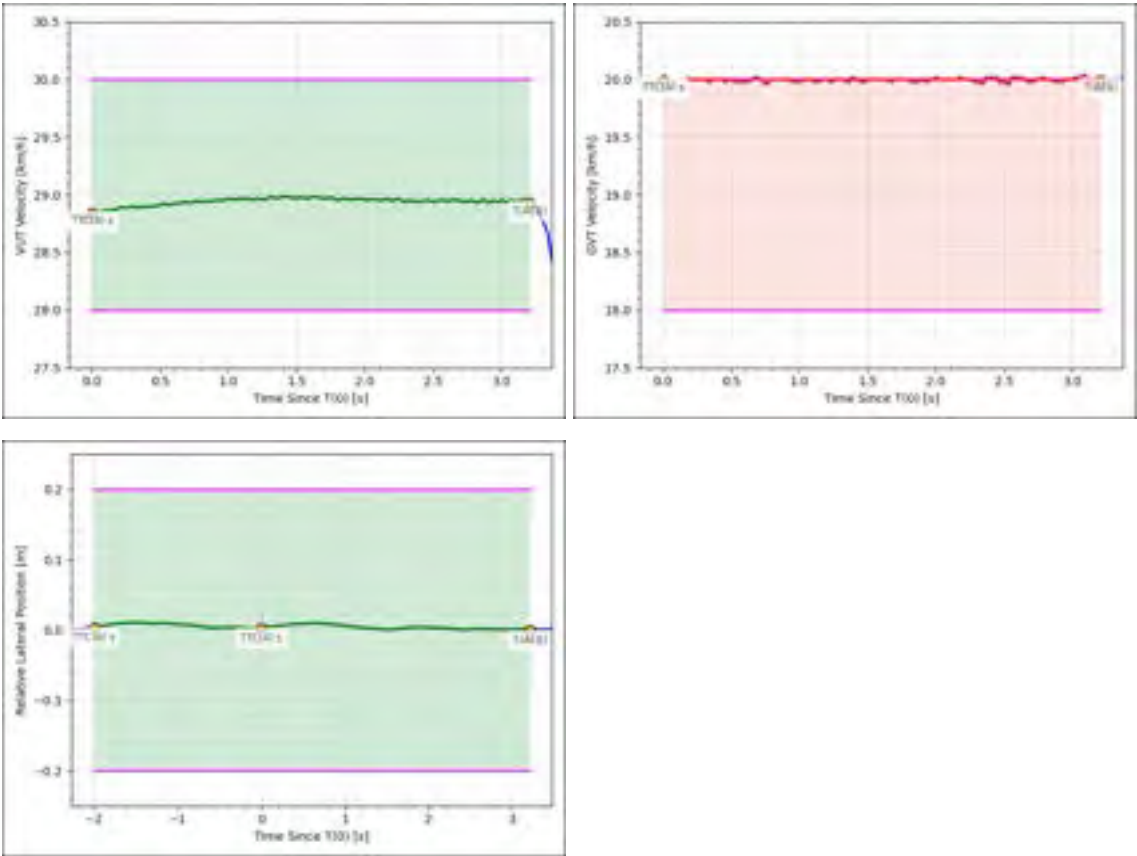
AEB CCRm | 30 km/h +100 % | Run 1

Run Date / Time 17-Mar-2023 11:02



AEB CCRm | 30 km/h +100 % | Run 2

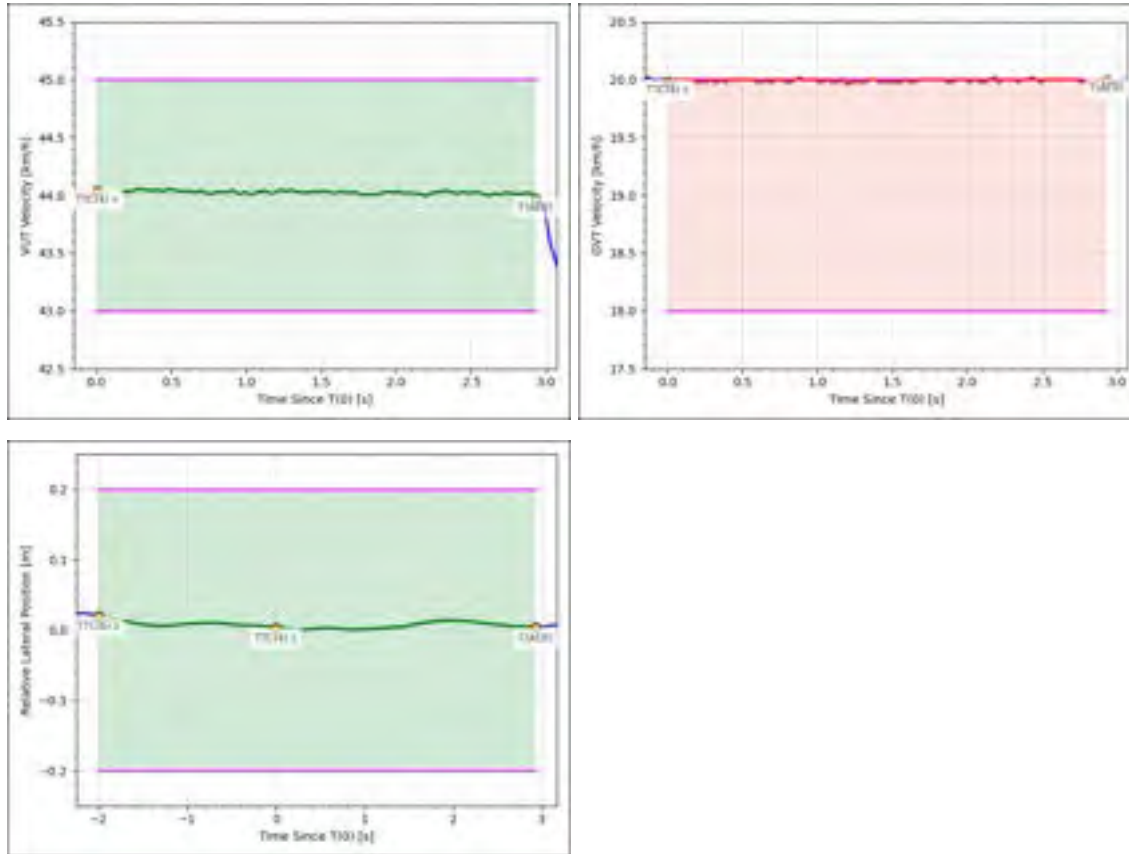
Run Date / Time 17-Mar-2023 11:05



D.2.5.2. AEB CCRm 45 kph +100 %

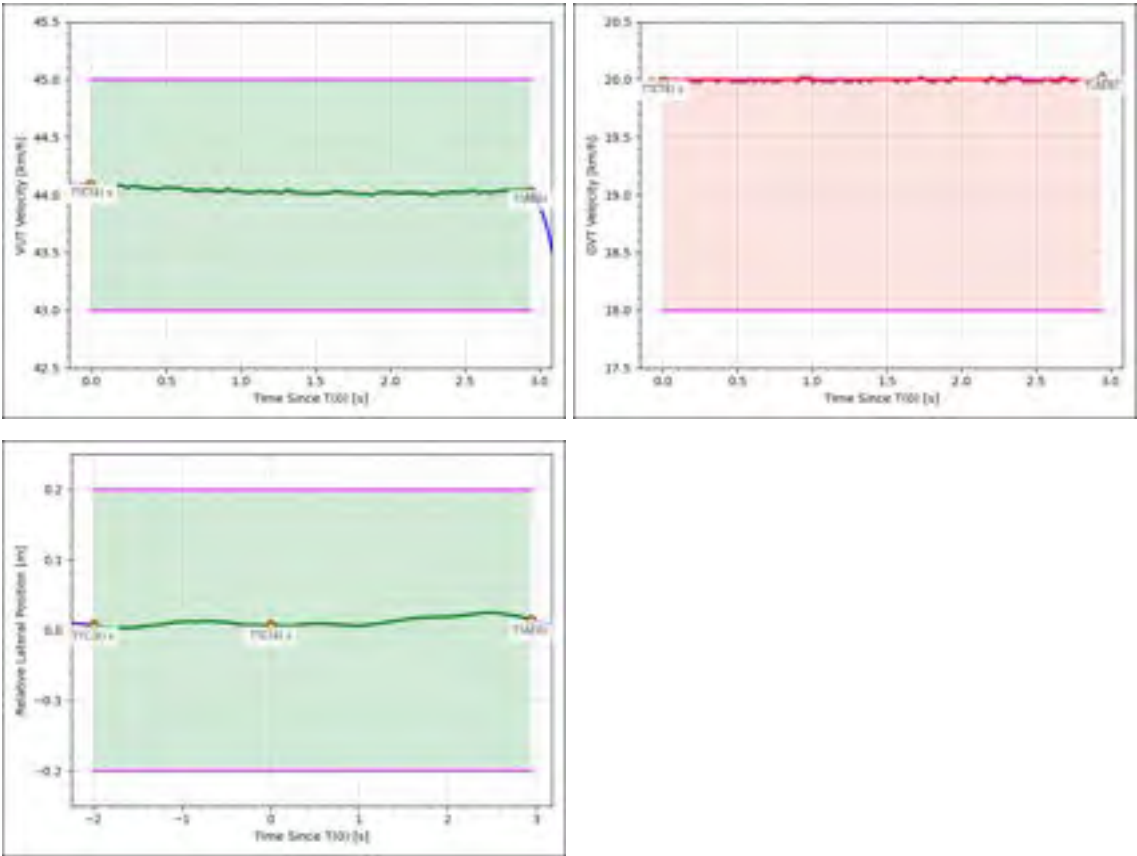
AEB CCRm | 45 km/h +100 % | Run 1

Run Date / Time 17-Mar-2023 13:08



AEB CCRm | 45 km/h +100 % | Run 2

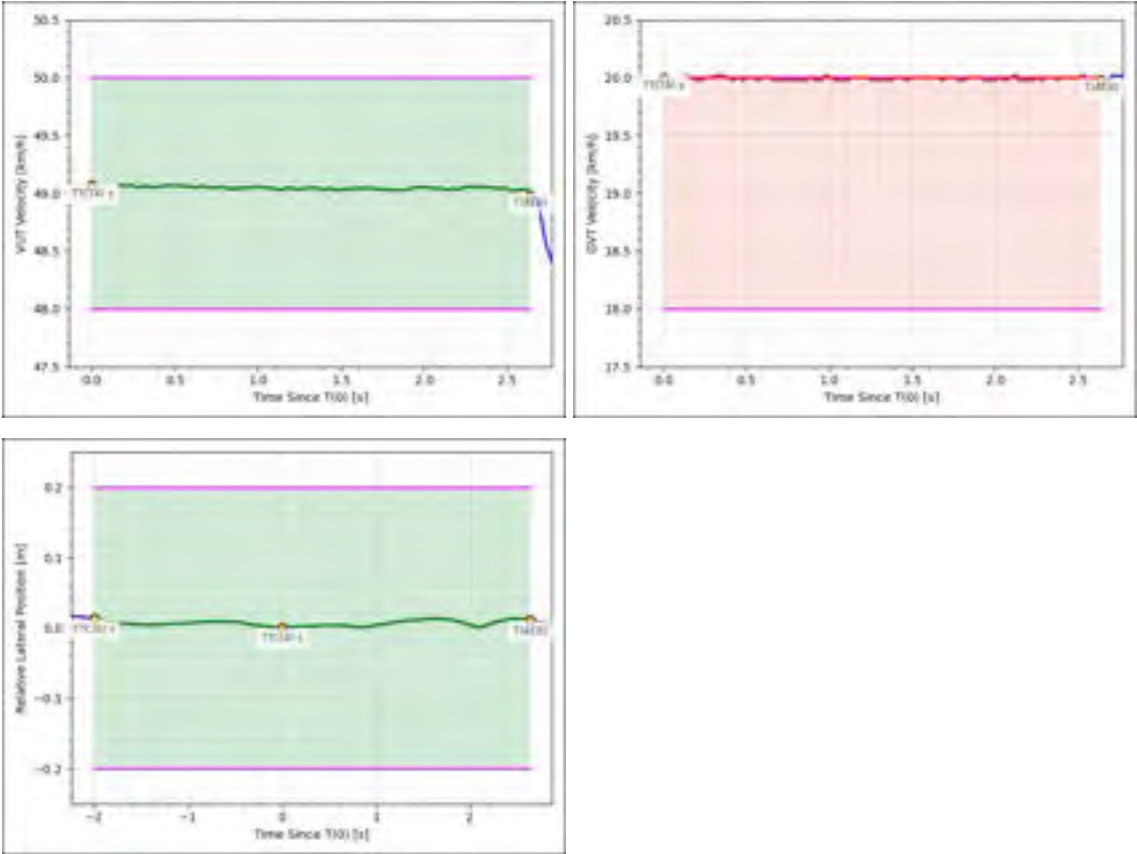
Run Date / Time 17-Mar-2023 13:30



D.2.5.3. AEB CCRm 50 kph +100 %

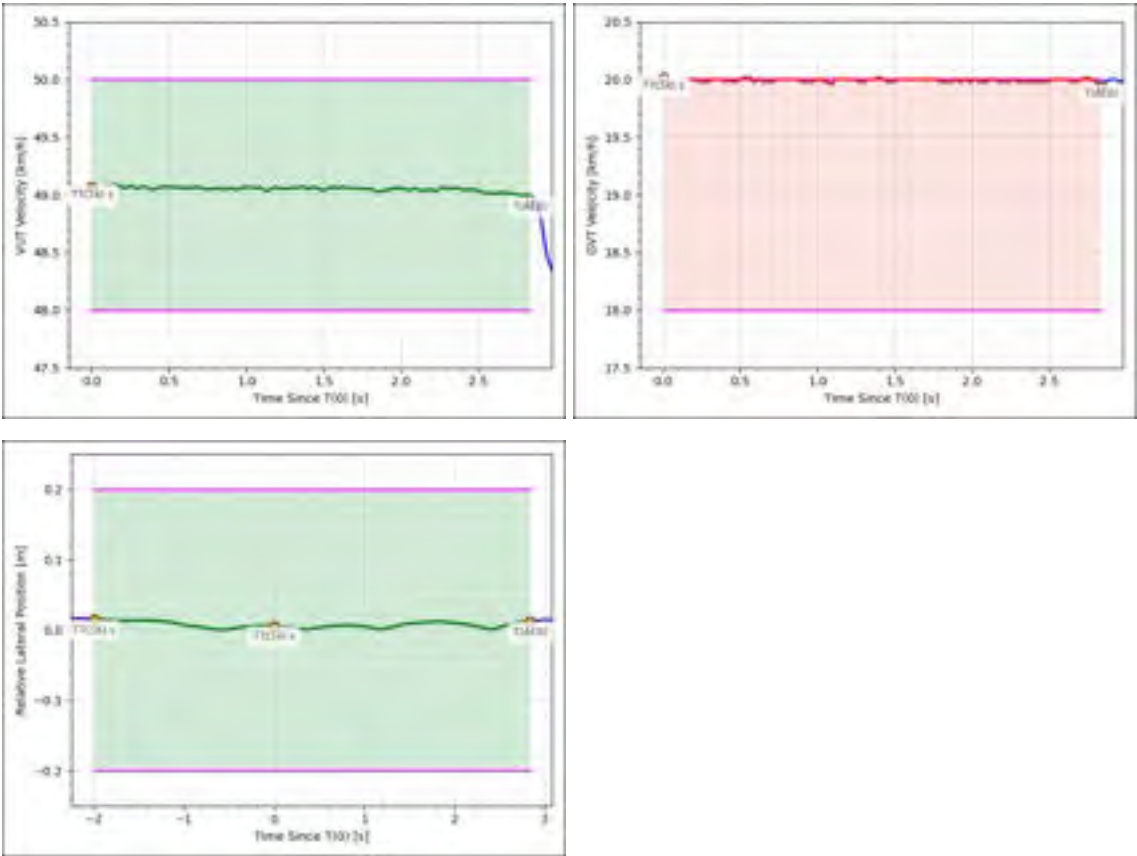
AEB CCRm | 50 km/h +100 % | Run 1

Run Date / Time 17-Mar-2023 11:08



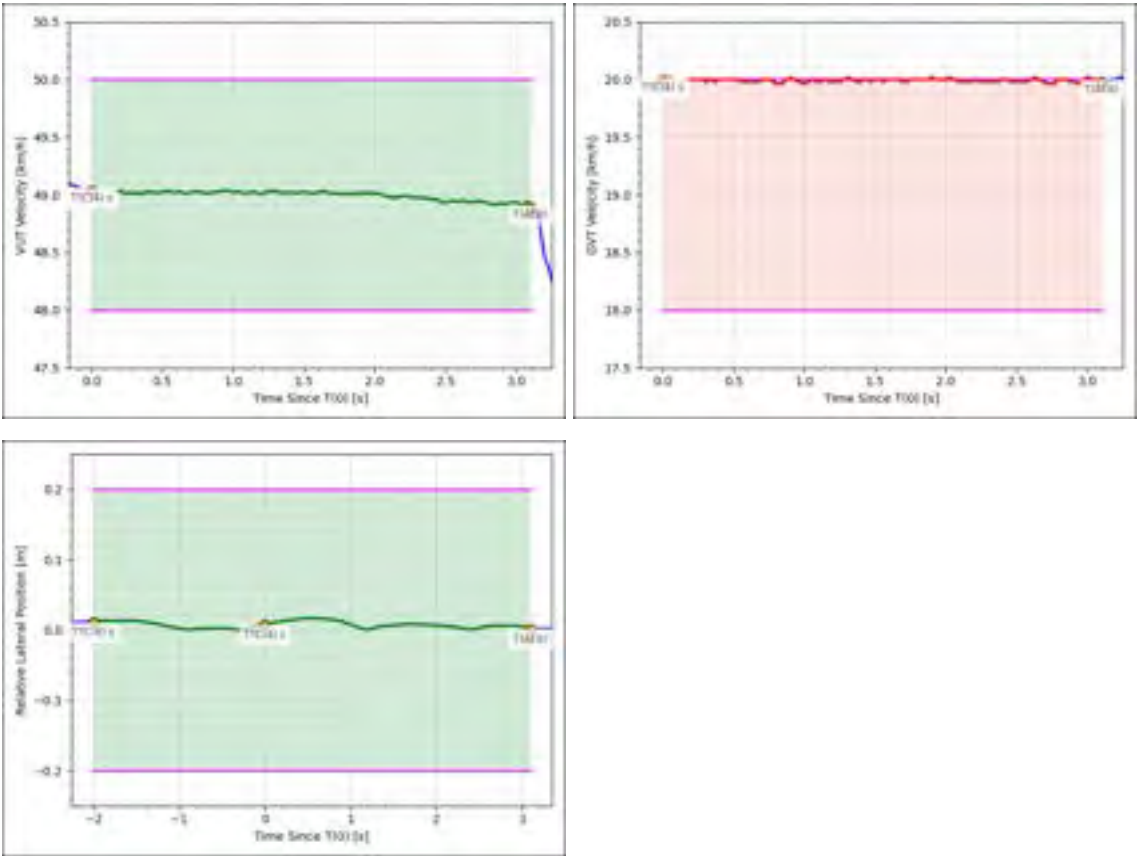
AEB CCRm | 50 km/h +100 % | Run 3

Run Date / Time 17-Mar-2023 11:22



AEB CCRm | 50 km/h +100 % | Run 4

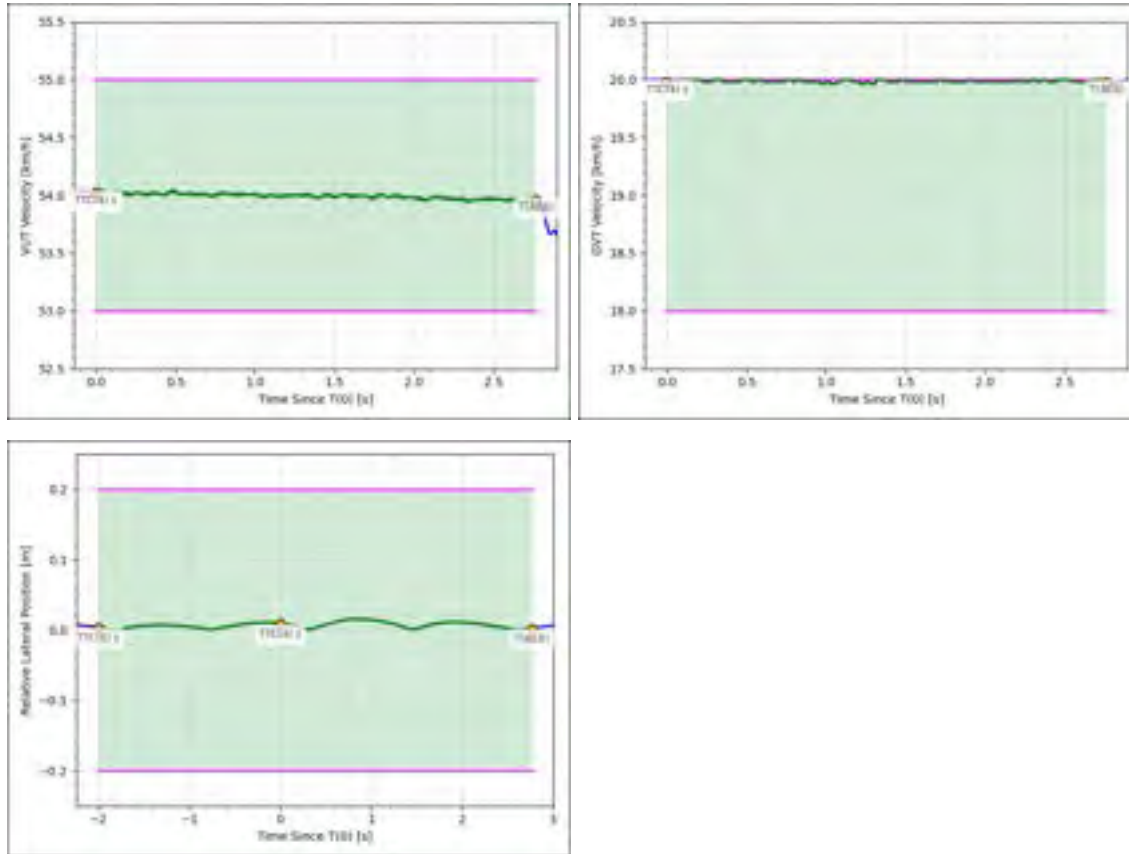
Run Date / Time 17-Mar-2023 11:24



D.2.5.4. AEB CCRm 55 kph +100 %

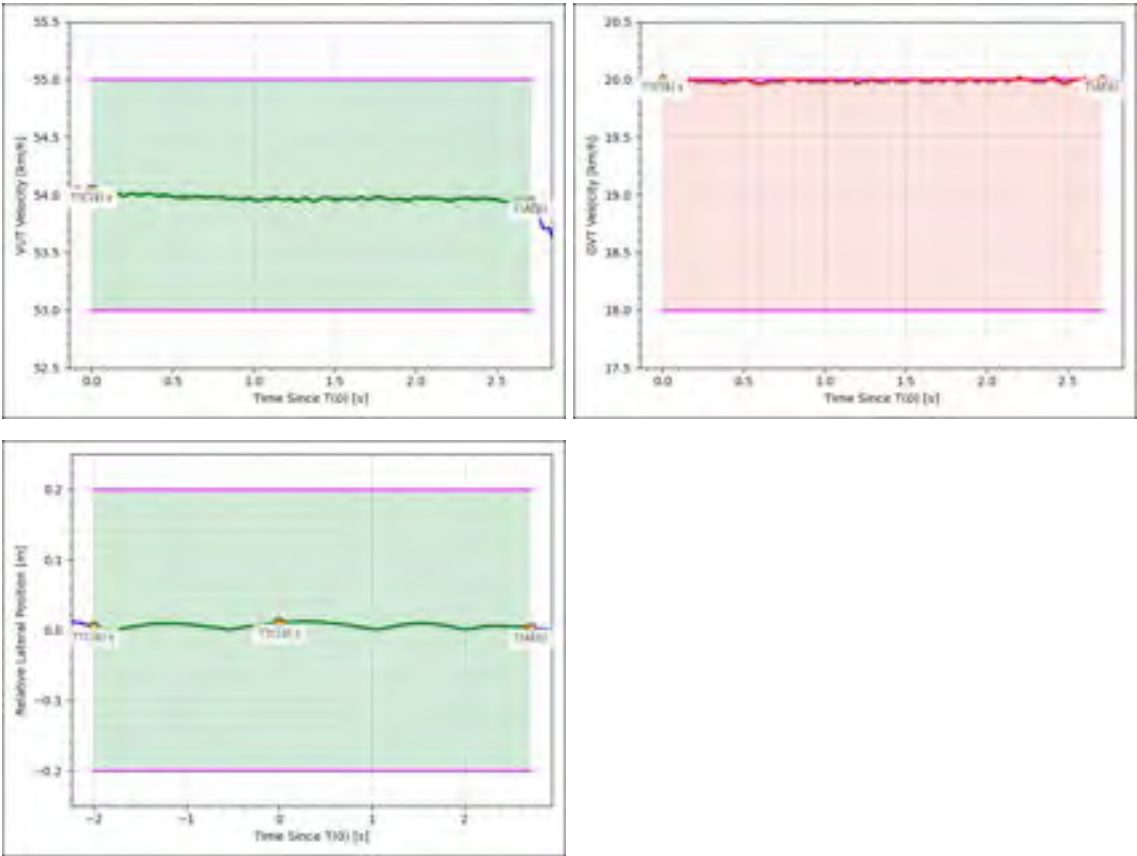
AEB CCRm | 55 km/h +100 % | Run 1

Run Date / Time 17-Mar-2023 13:33



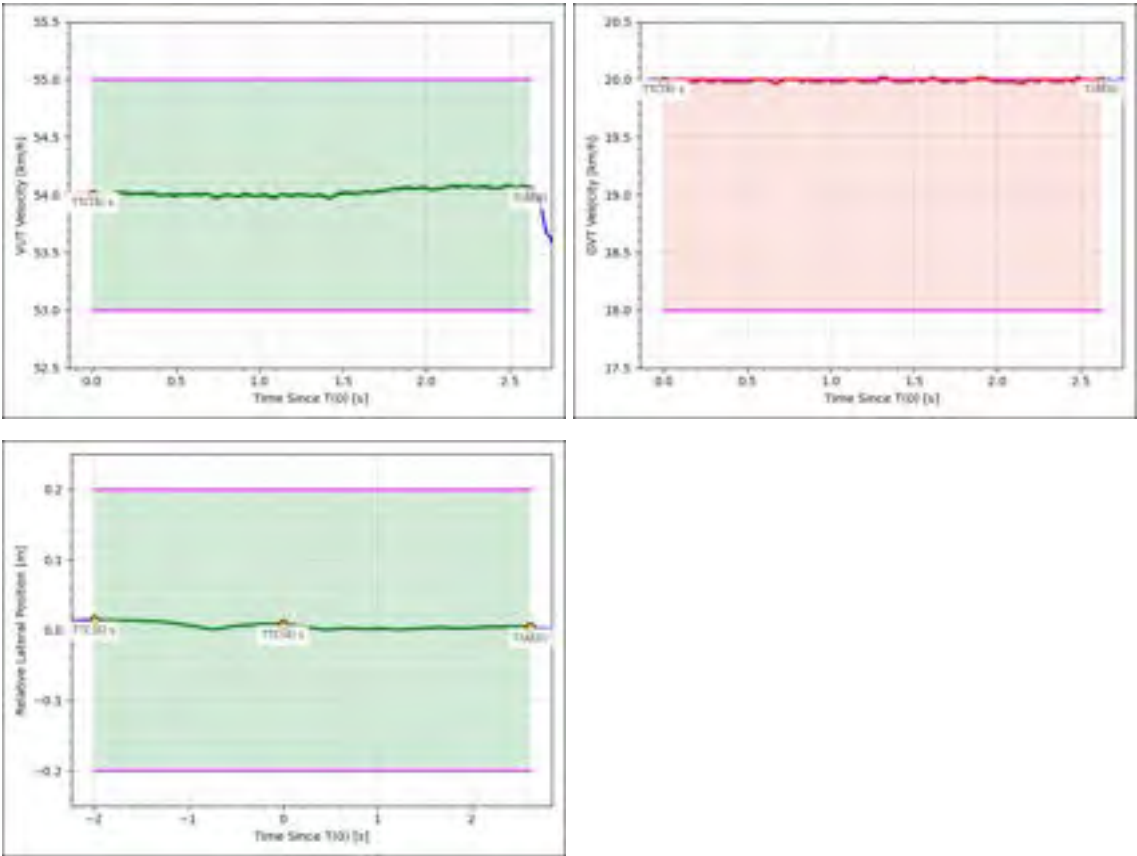
AEB CCRm | 55 km/h +100 % | Run 2

Run Date / Time 17-Mar-2023 13:36



AEB CCRm | 55 km/h +100 % | Run 3

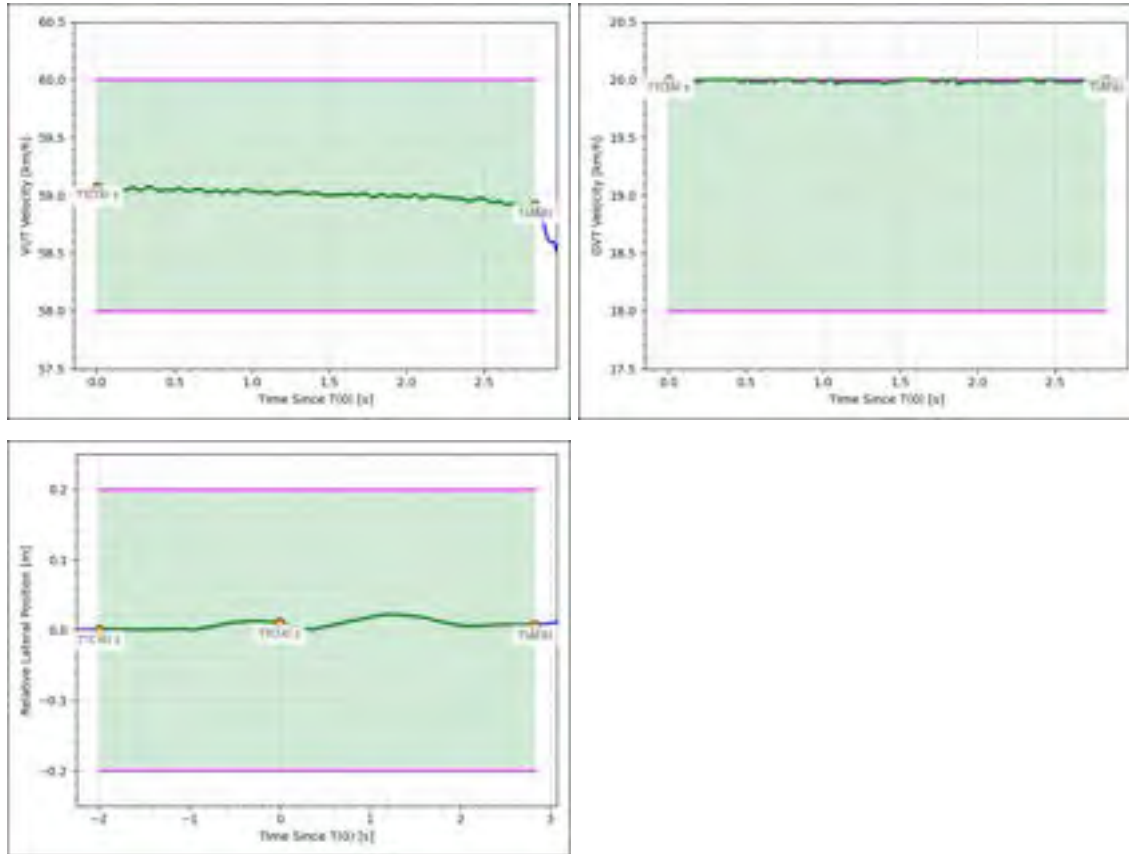
Run Date / Time 17-Mar-2023 13:39



D.2.5.5. AEB CCRm 60 kph +100 %

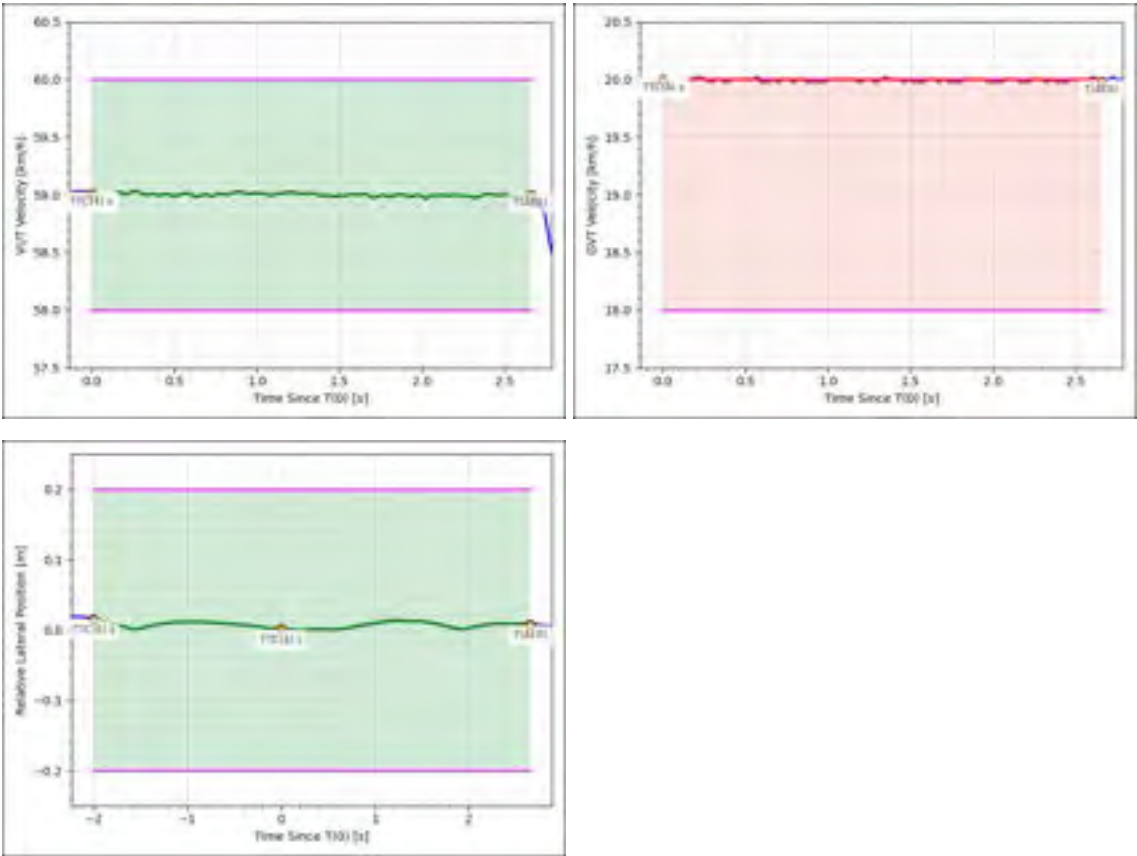
AEB CCRm | 60 km/h +100 % | Run 1

Run Date / Time 17-Mar-2023 13:45



AEB CCRm | 60 km/h +100 % | Run 2

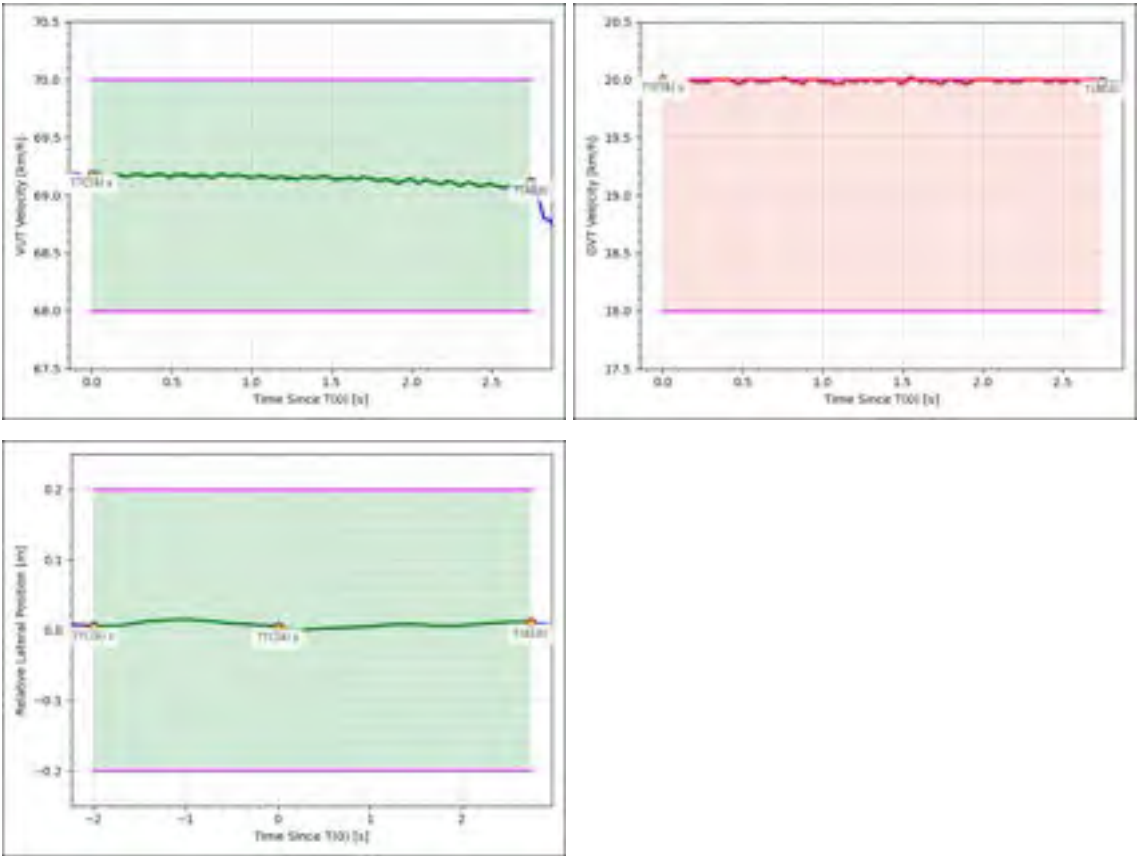
Run Date / Time 17-Mar-2023 13:48



D.2.5.6. AEB CCRm 70 kph +100 %

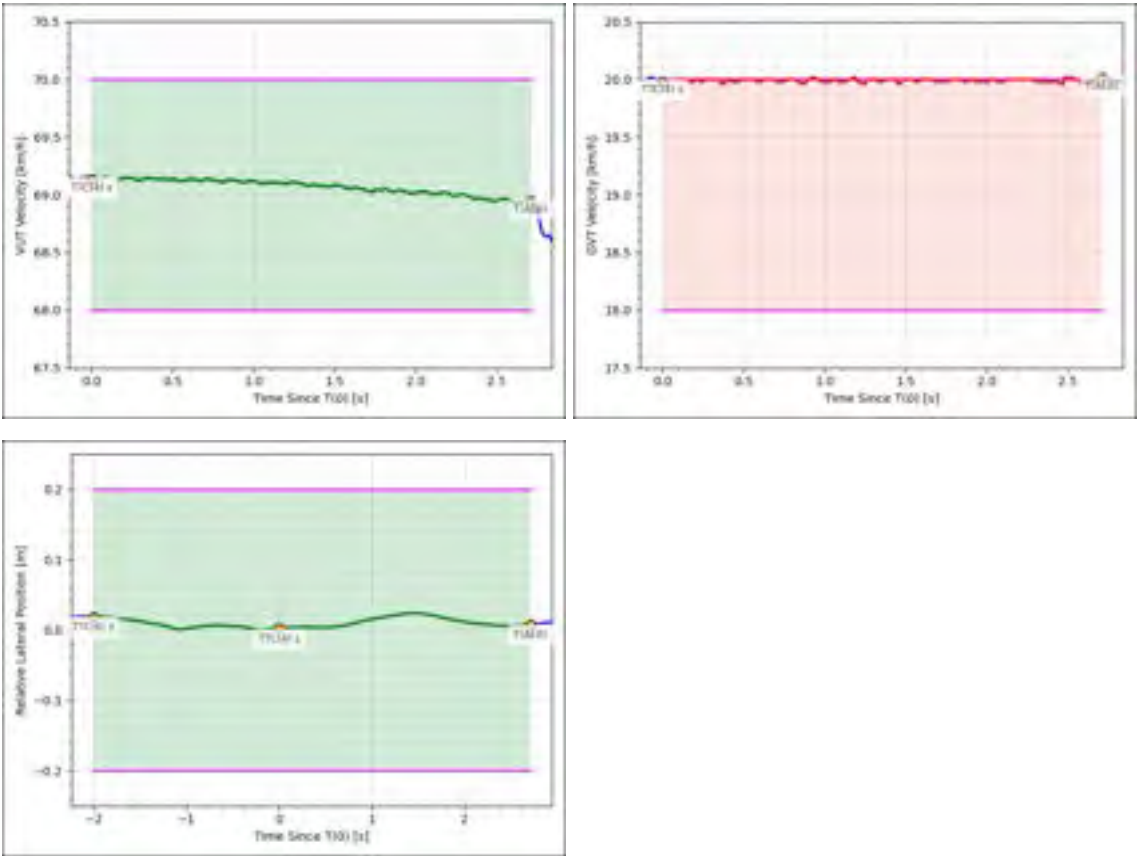
AEB CCRm | 70 km/h +100 % | Run 1

Run Date / Time 17-Mar-2023 11:29



AEB CCRm | 70 km/h +100 % | Run 2

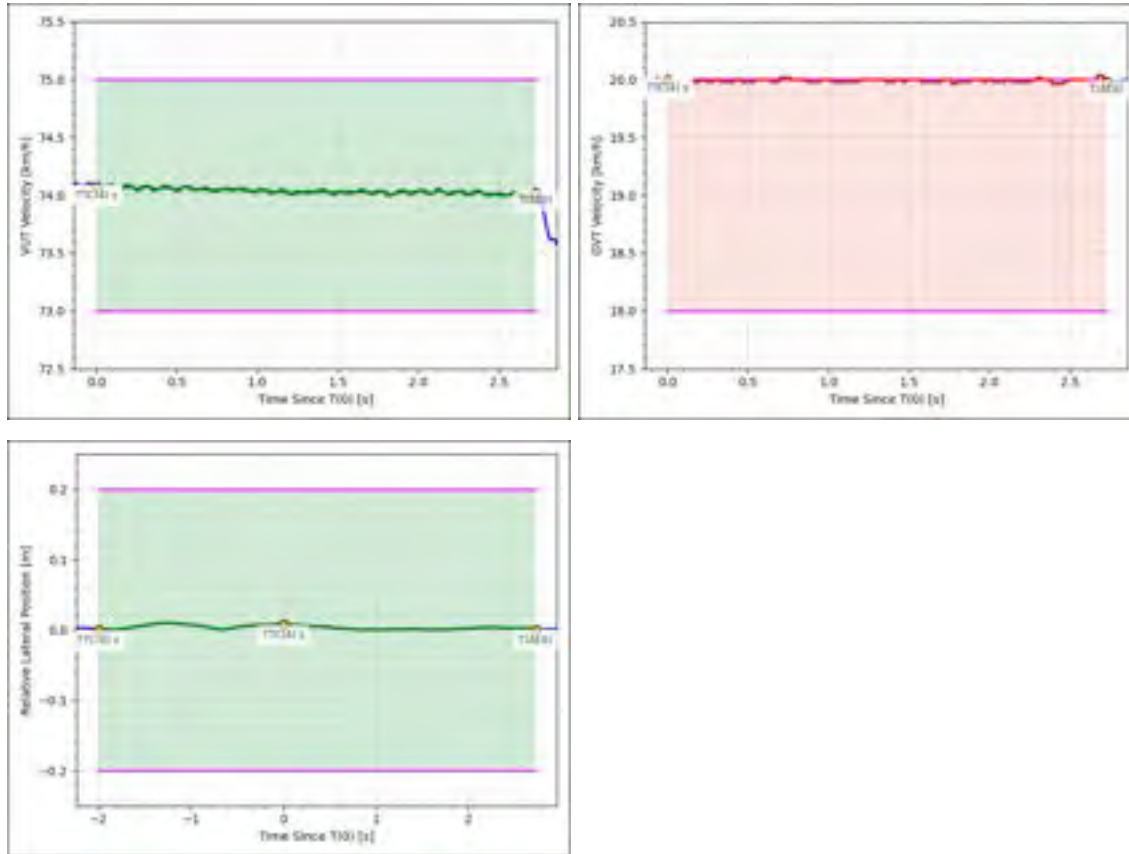
Run Date / Time 17-Mar-2023 11:32



D.2.5.7. AEB CCRm 75 kph +100 %

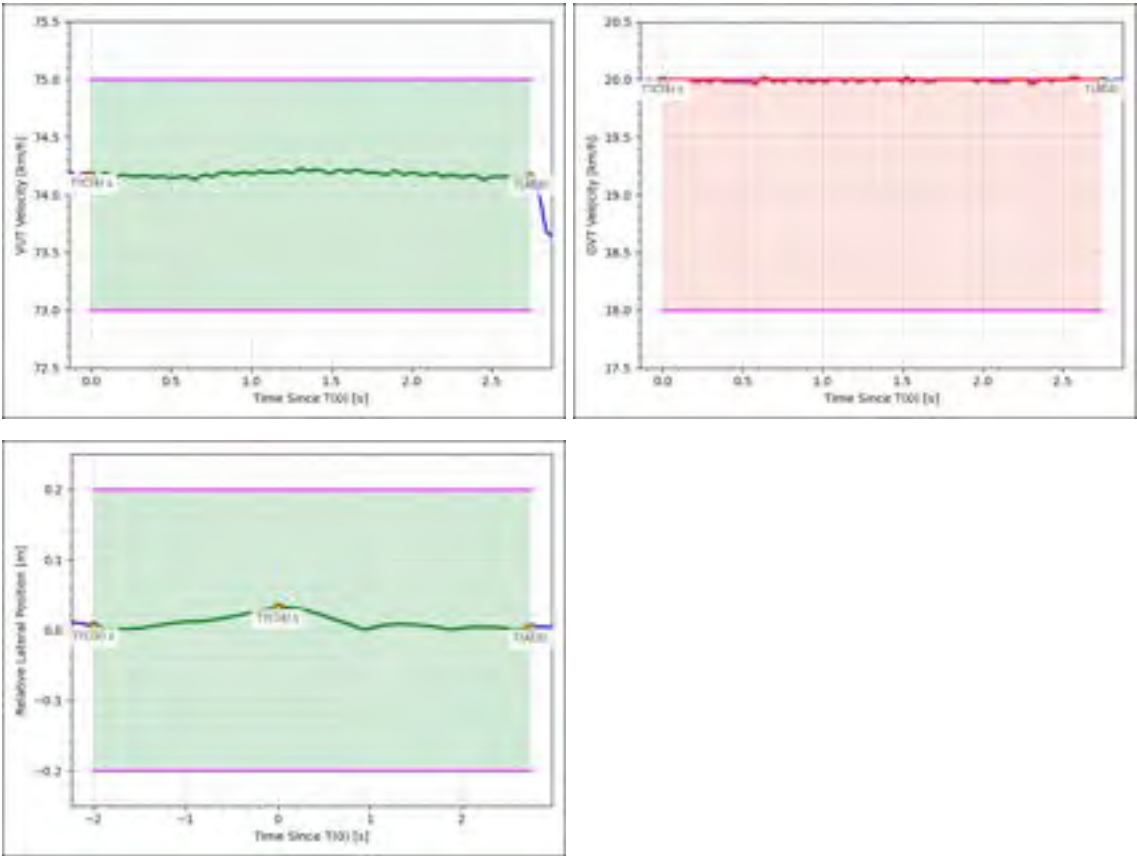
AEB CCRm | 75 km/h +100 % | Run 1

Run Date / Time 17-Mar-2023 11:36



AEB CCRm | 75 km/h +100 % | Run 3

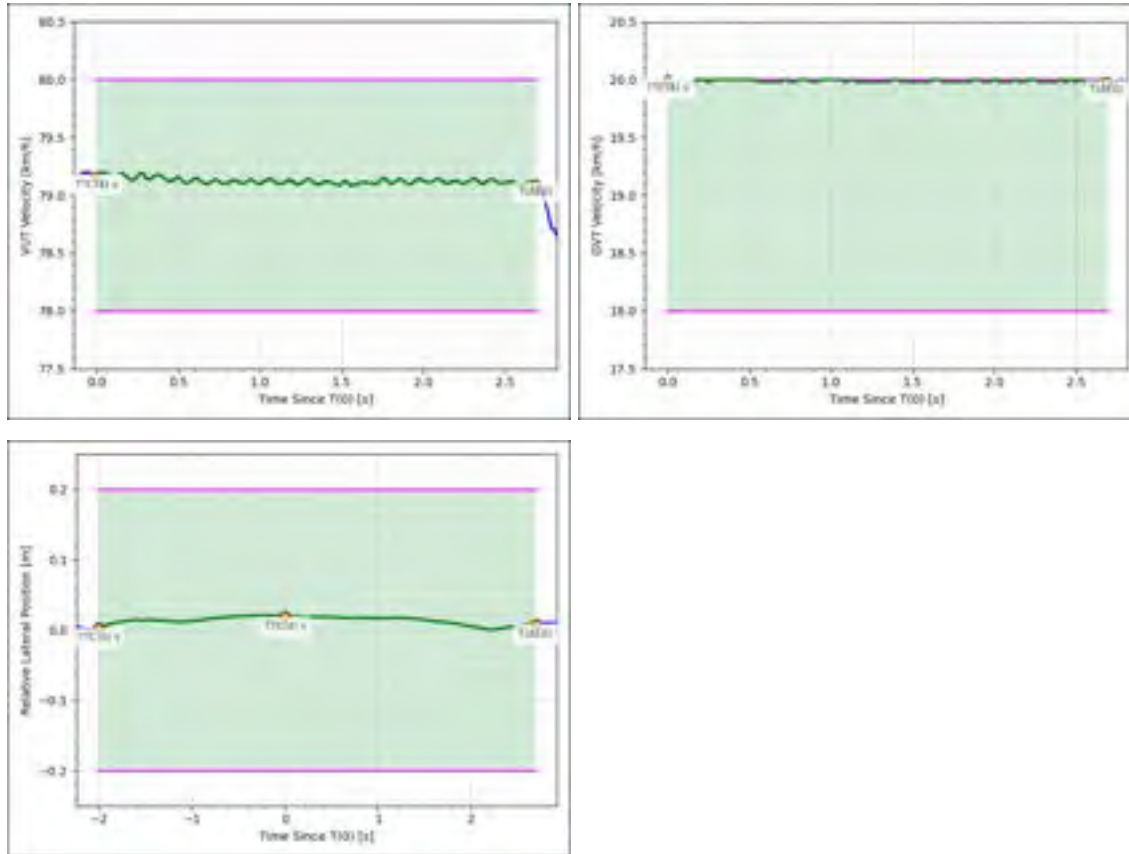
Run Date / Time 17-Mar-2023 13:51



D.2.5.8. AEB CCRm 80 kph +100 %

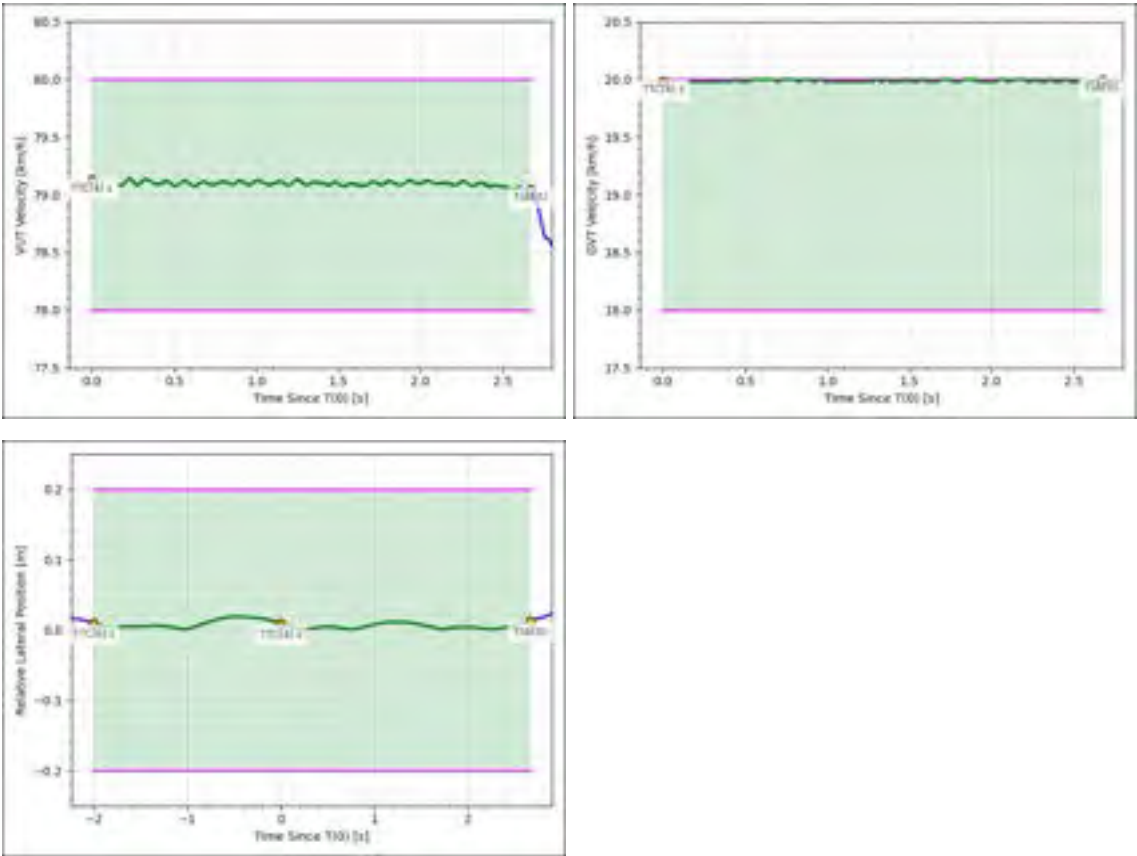
AEB CCRm | 80 km/h +100 % | Run 1

Run Date / Time 17-Mar-2023 13:55



AEB CCRm | 80 km/h +100 % | Run 2

Run Date / Time 17-Mar-2023 13:57

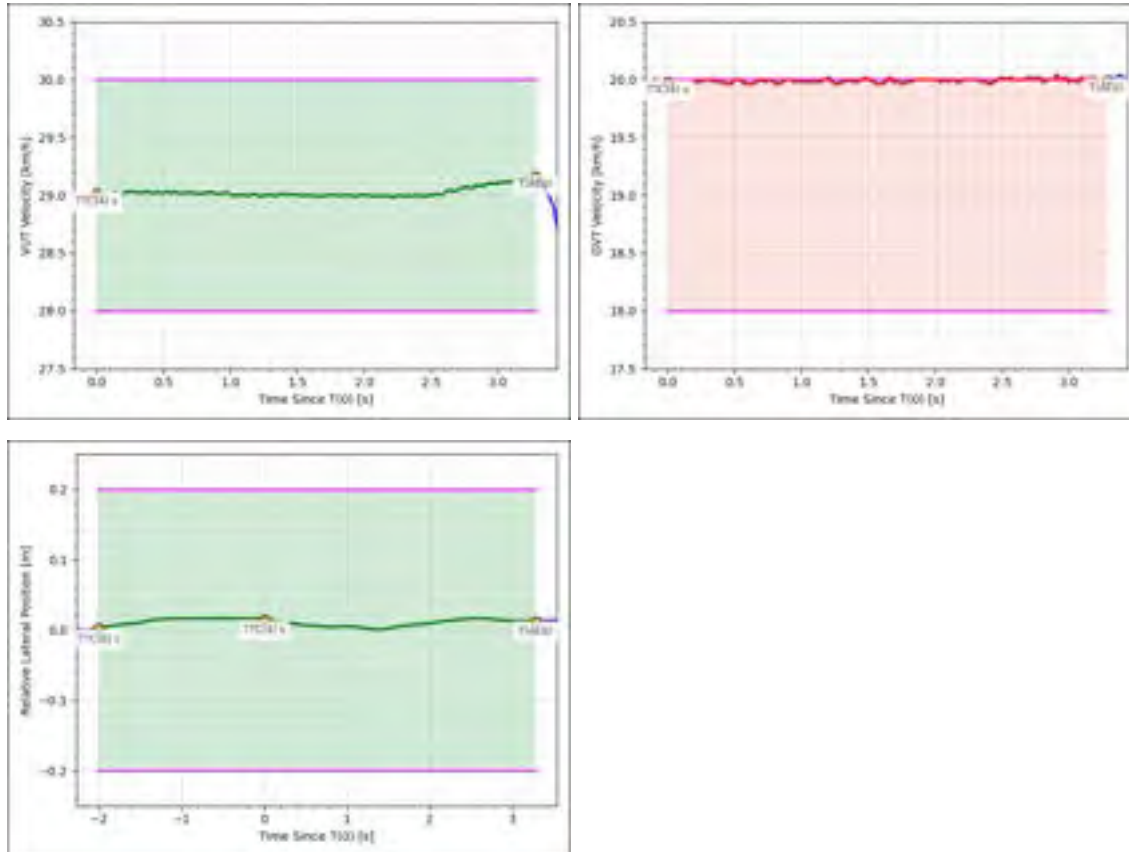


D.2.6. Bullbar

D.2.6.1. B.1.1.AEB CCRm 30 kph +100 %

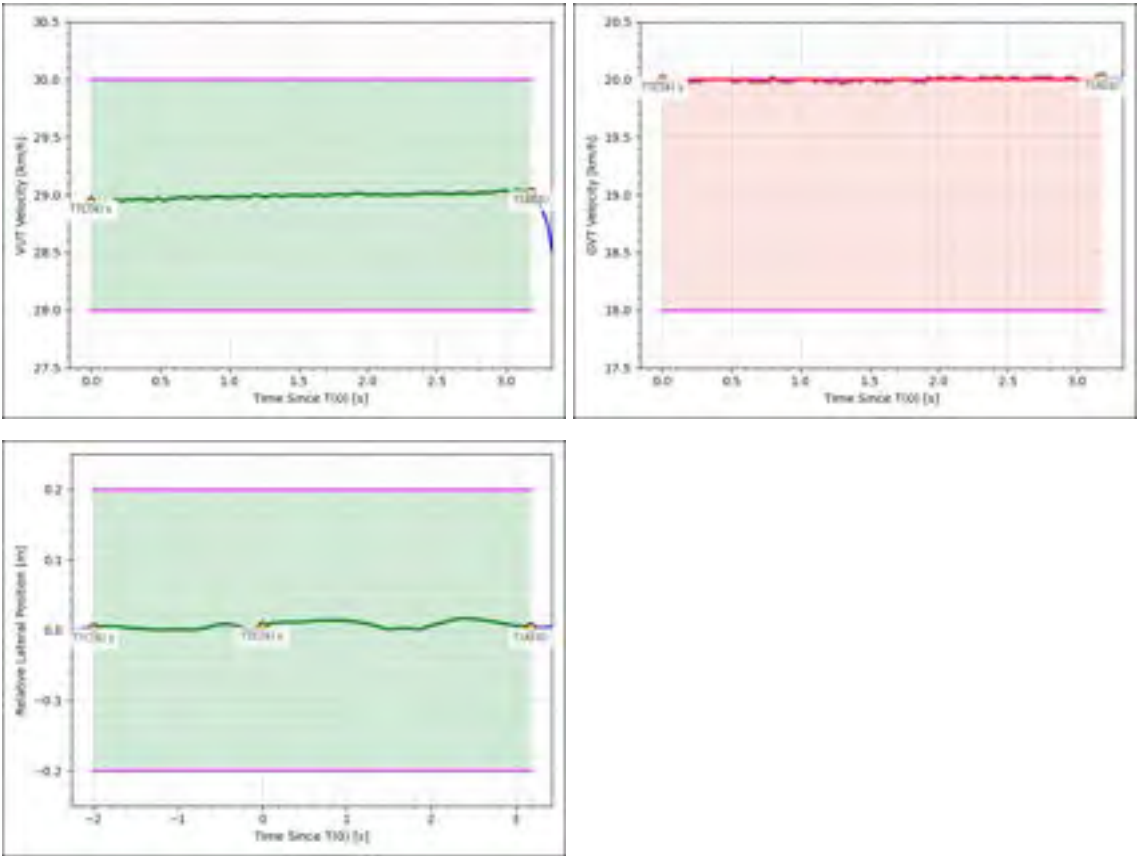
AEB CCRm | 30 km/h +100 % | Run 3

Run Date / Time 3-Apr-2023 14:00



AEB CCRm | 30 km/h +100 % | Run 4

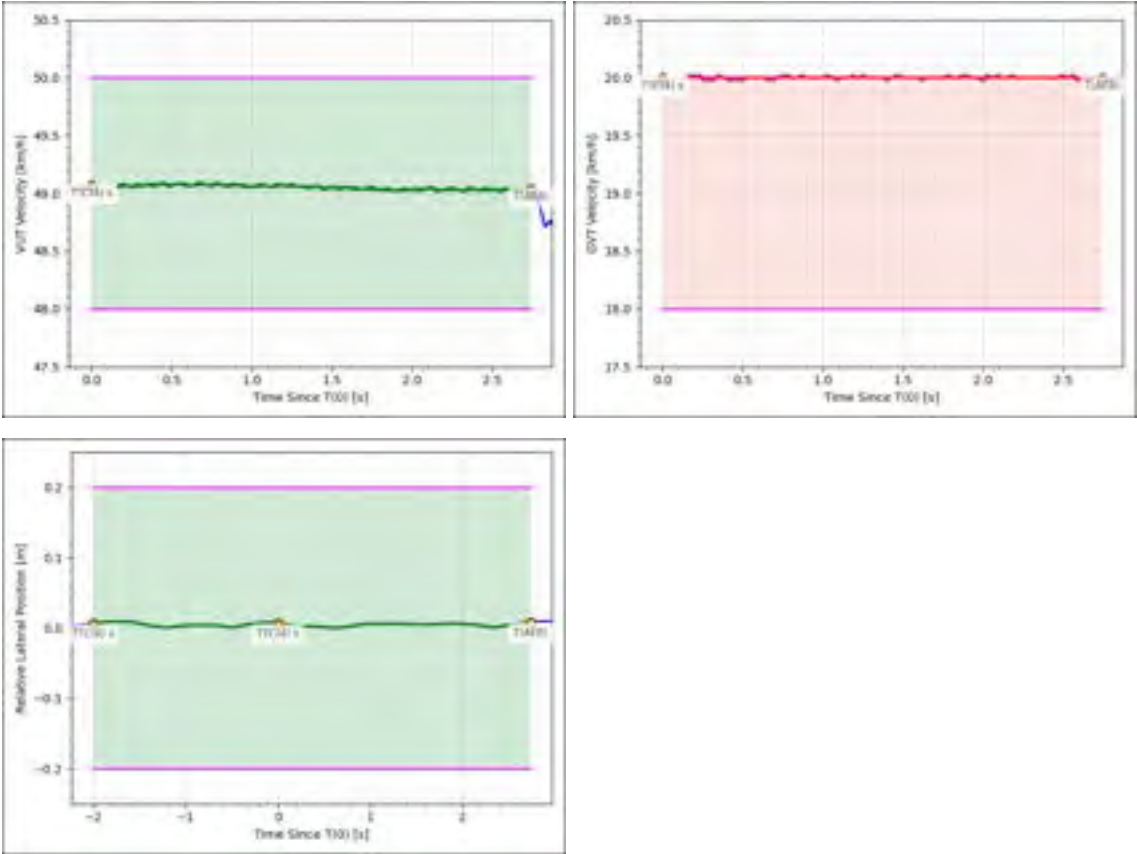
Run Date / Time 3-Apr-2023 14:03



D.2.6.2. B.1.1.AEB CCRm 50 kph +100 %

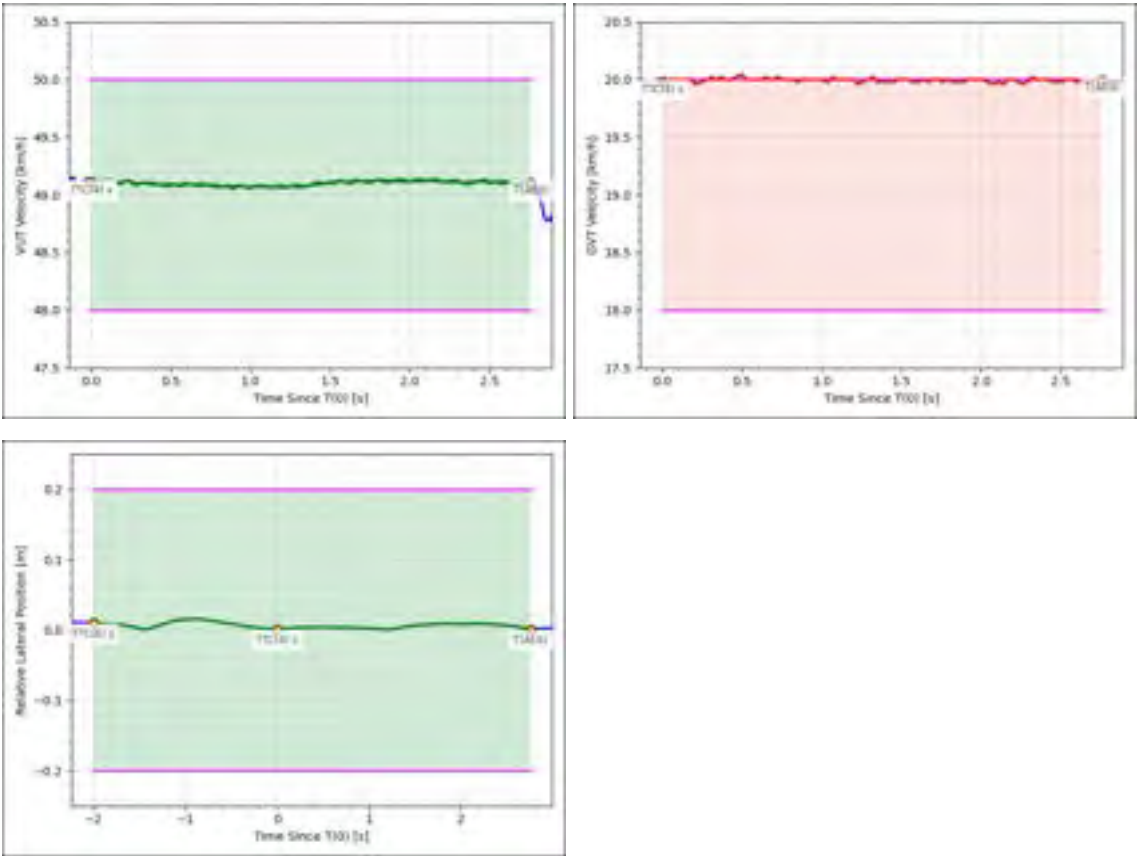
AEB CCRm | 50 km/h +100 % | Run 5

Run Date / Time 3-Apr-2023 14:07



AEB CCRm | 50 km/h +100 % | Run 6

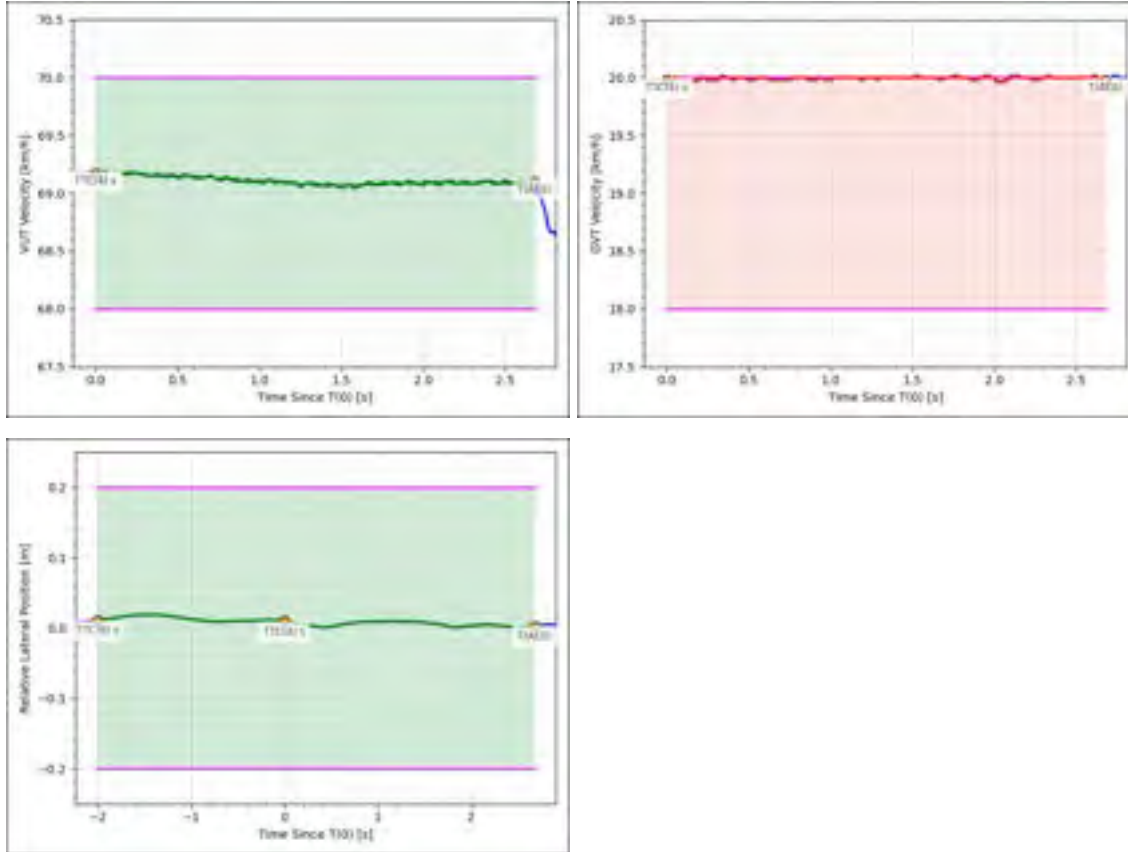
Run Date / Time 3-Apr-2023 14:10



D.2.6.3. B.1.1.AEB CCRm 70 kph +100 %

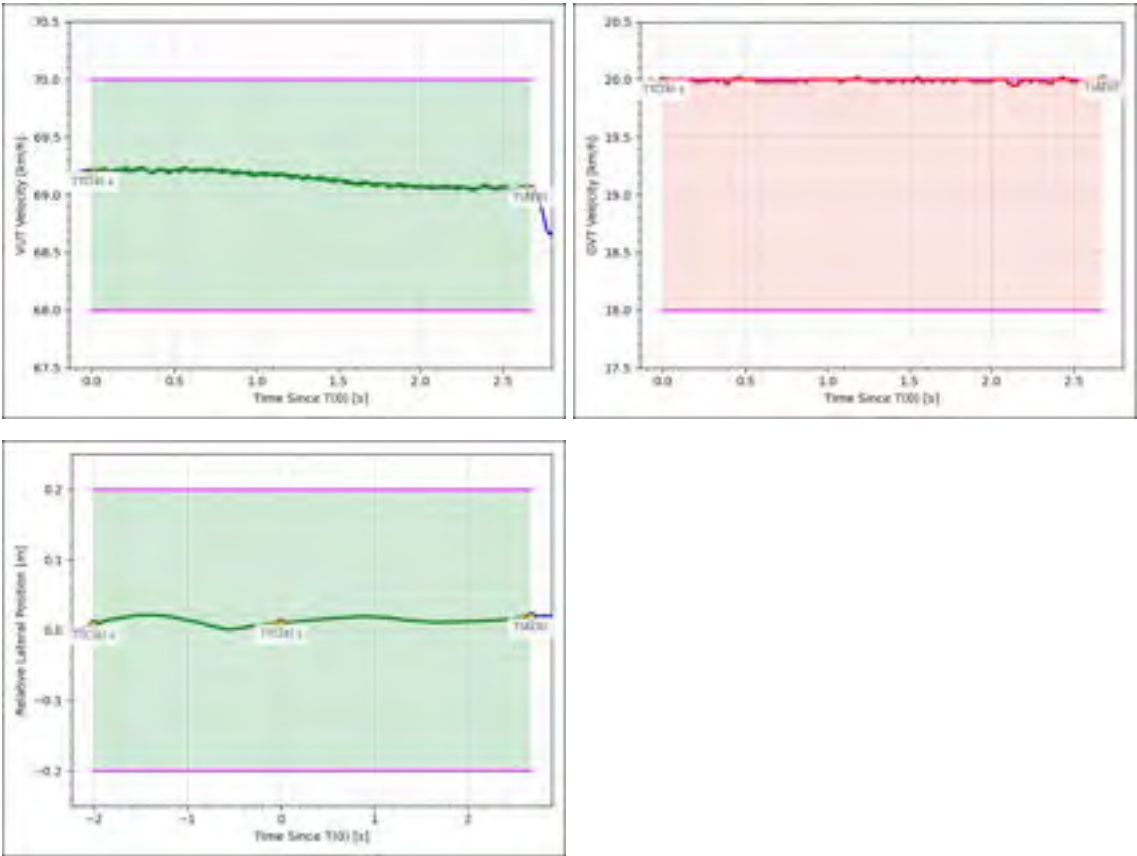
AEB CCRm | 70 km/h +100 % | Run 3

Run Date / Time 3-Apr-2023 14:13



AEB CCRm | 70 km/h +100 % | Run 4

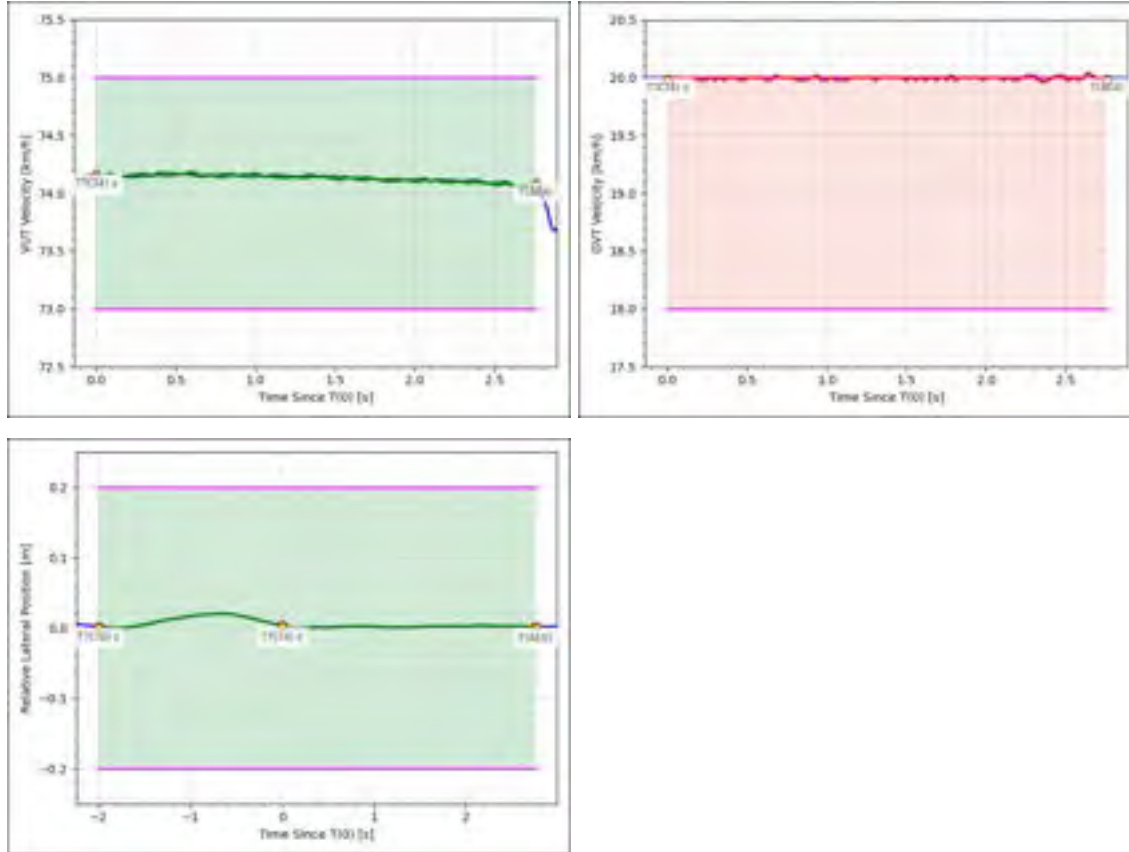
Run Date / Time 3-Apr-2023 14:18



D.2.6.4. B.1.1.AEB CCRm 75 kph +100 %

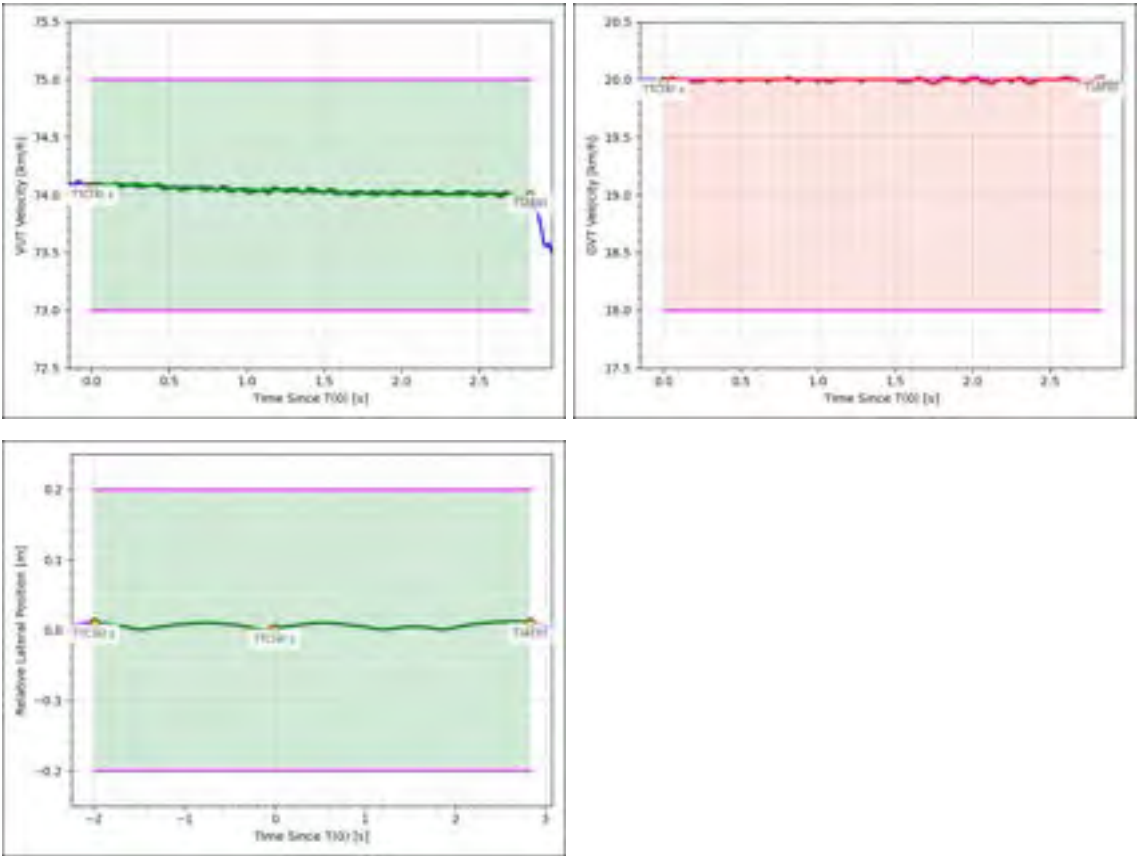
AEB CCRm | 75 km/h +100 % | Run 4

Run Date / Time 3-Apr-2023 14:53



AEB CCRm | 75 km/h +100 % | Run 5

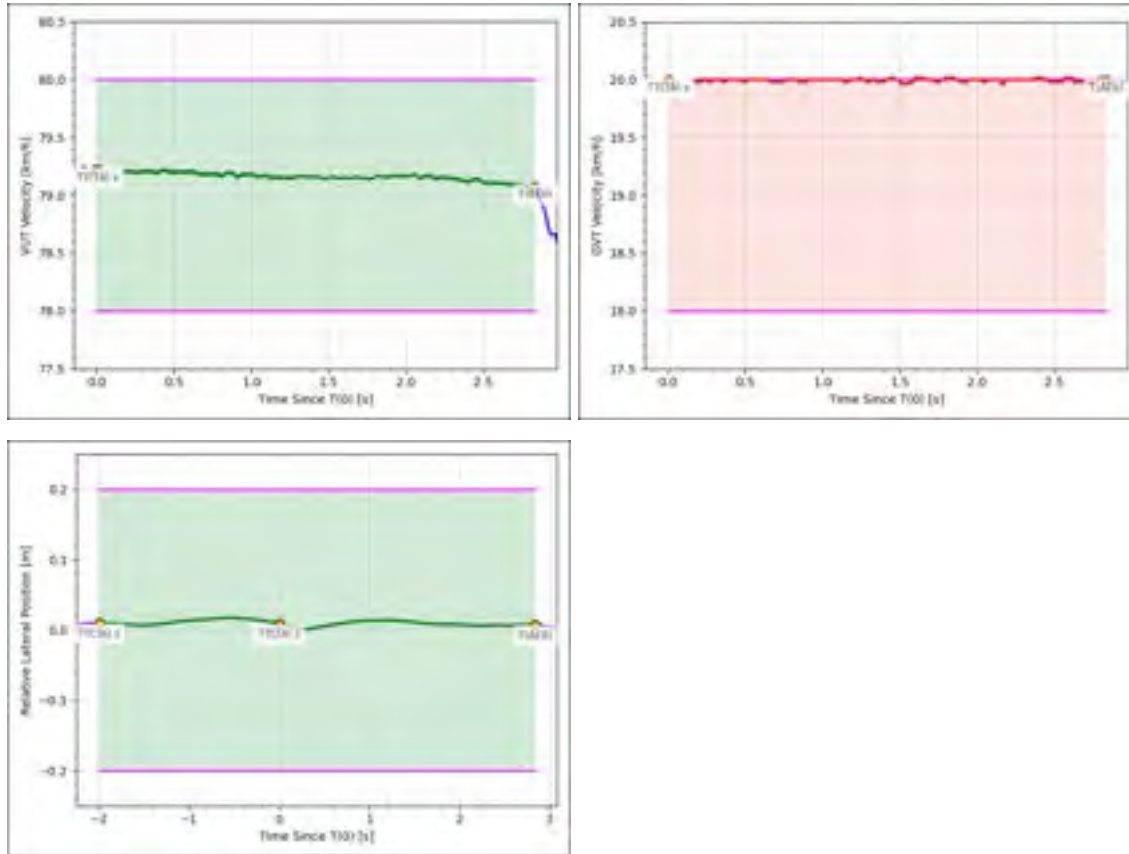
Run Date / Time 3-Apr-2023 14:56



D.2.6.5. B.1.1.AEB CCRm 80 kph +100 %

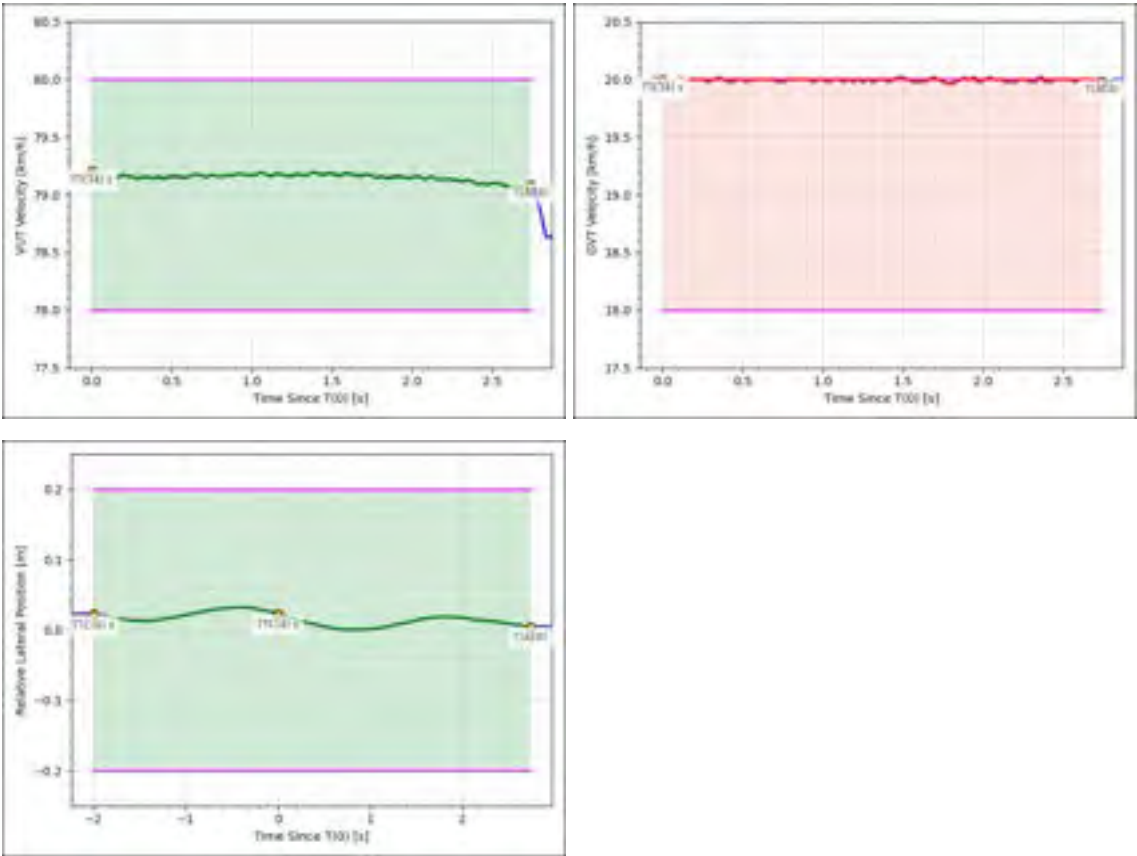
AEB CCRm | 80 km/h +100 % | Run 3

Run Date / Time 3-Apr-2023 14:21



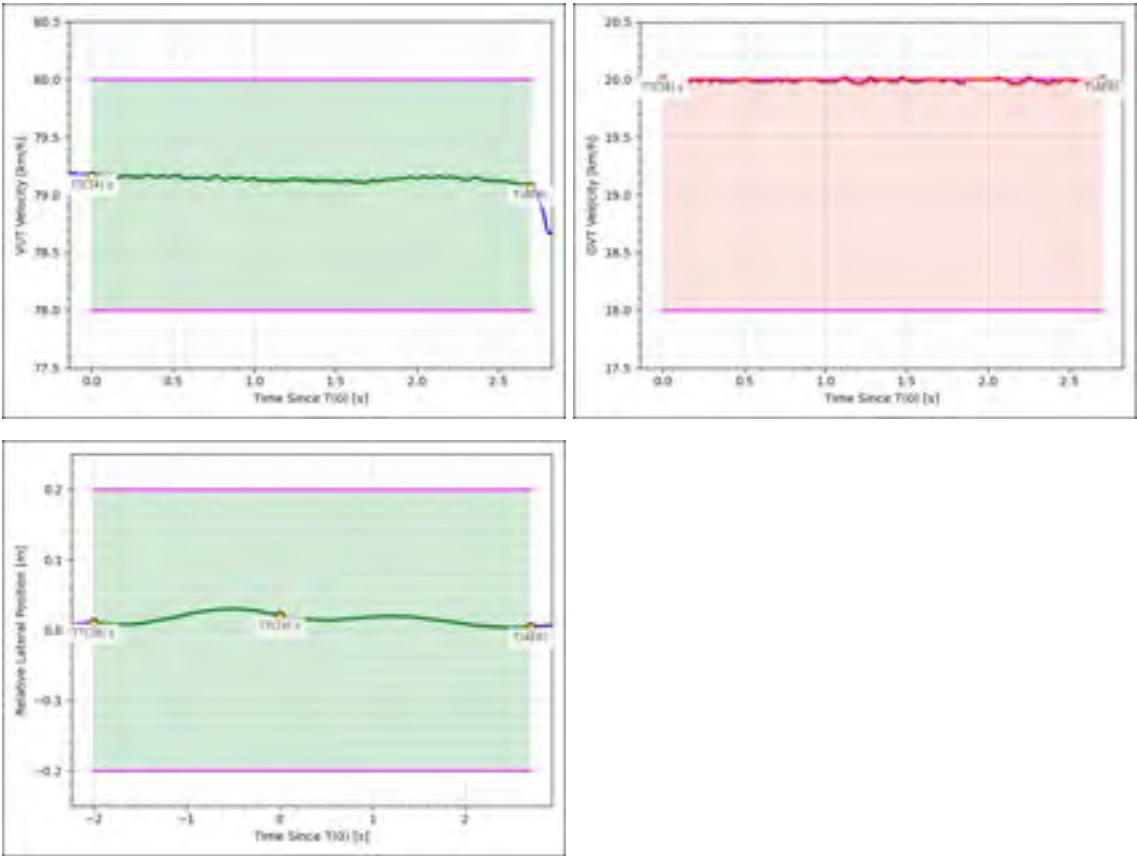
AEB CCRm | 80 km/h +100 % | Run 4

Run Date / Time 3-Apr-2023 14:43



AEB CCRm | 80 km/h +100 % | Run 5

Run Date / Time 3-Apr-2023 14:48



APPENDIX E

Isuzu D-Max Car-to-Pedestrian Results Validity

E. D-Max Car-to-Pedestrian Results Validity

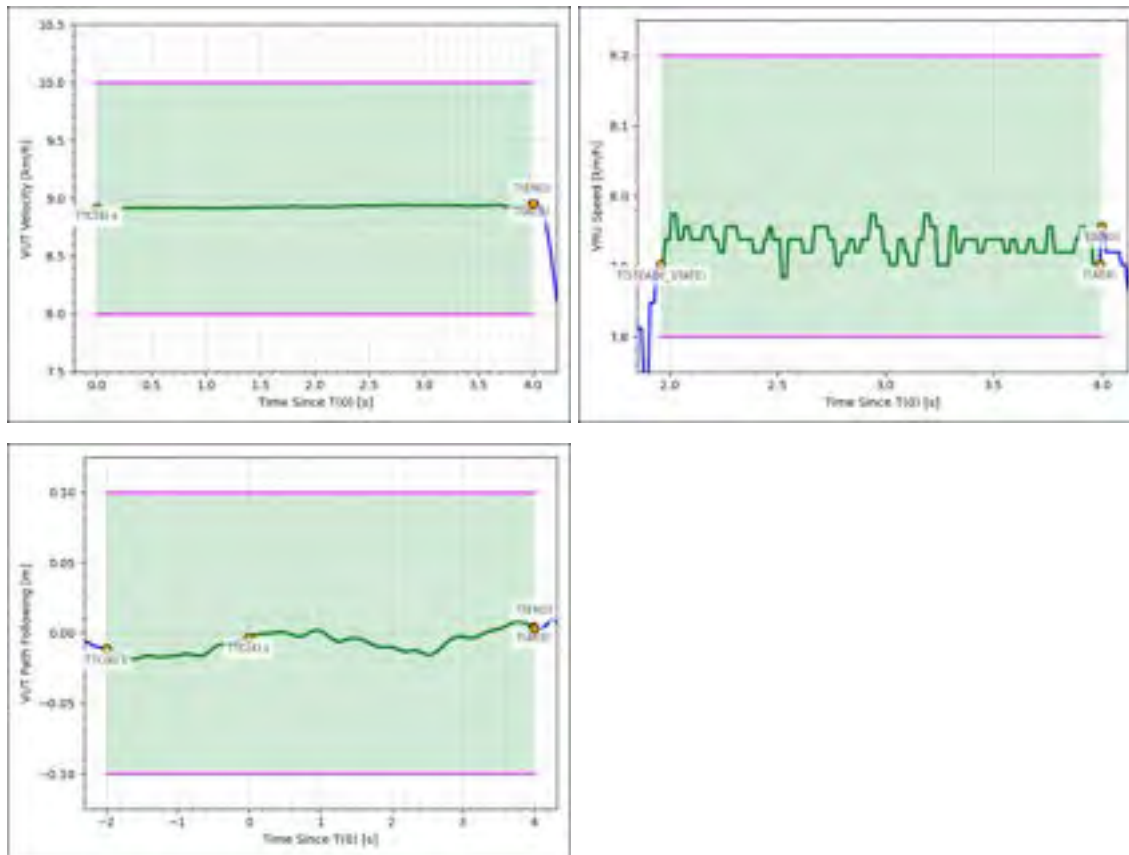
E.1. Car-to-Pedestrian Farside Adult 50% (Day)

E.1.1. Baseline

E.1.1.1. CPFA-50 VUT 10kph EPT 8kph (Day)

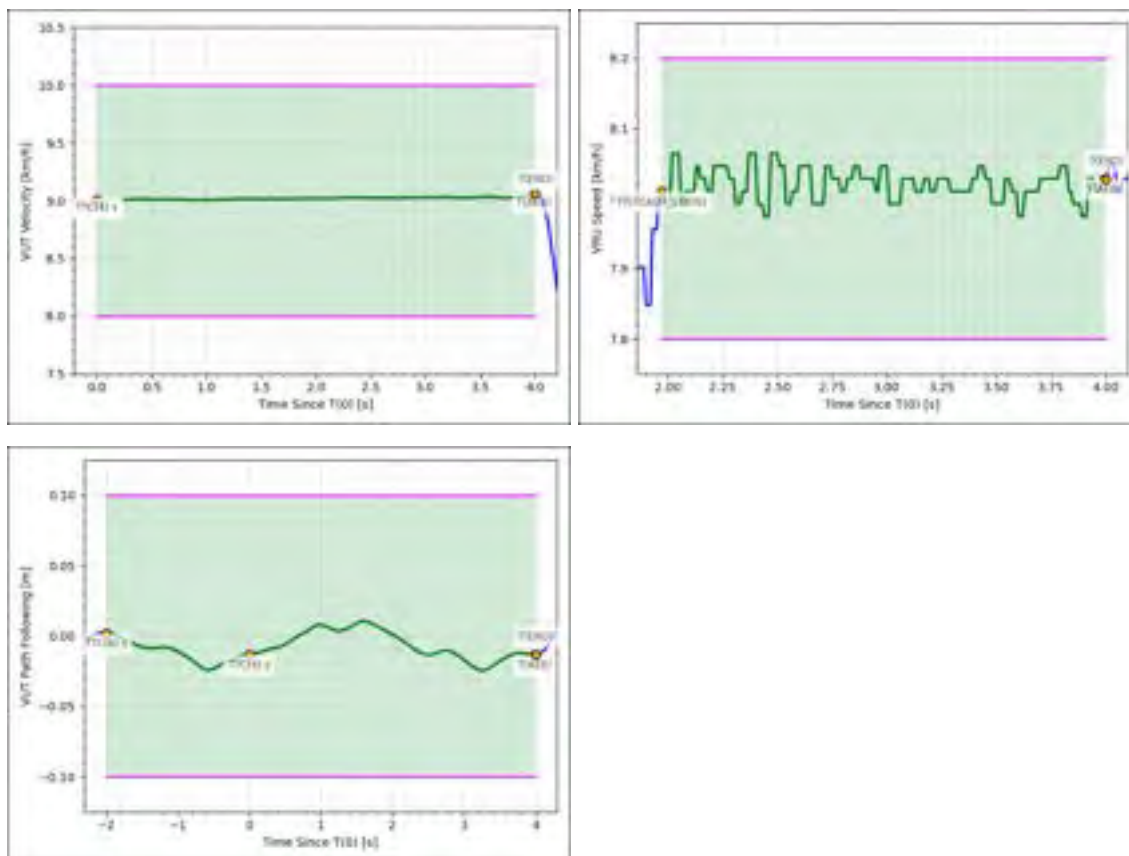
CPFA-50 8 kph (Day) | 10 km/h | Run 1

Run Date / Time 25-Nov-2022 14:53



CPFA-50 8 kph (Day) | 10 km/h | Run 2

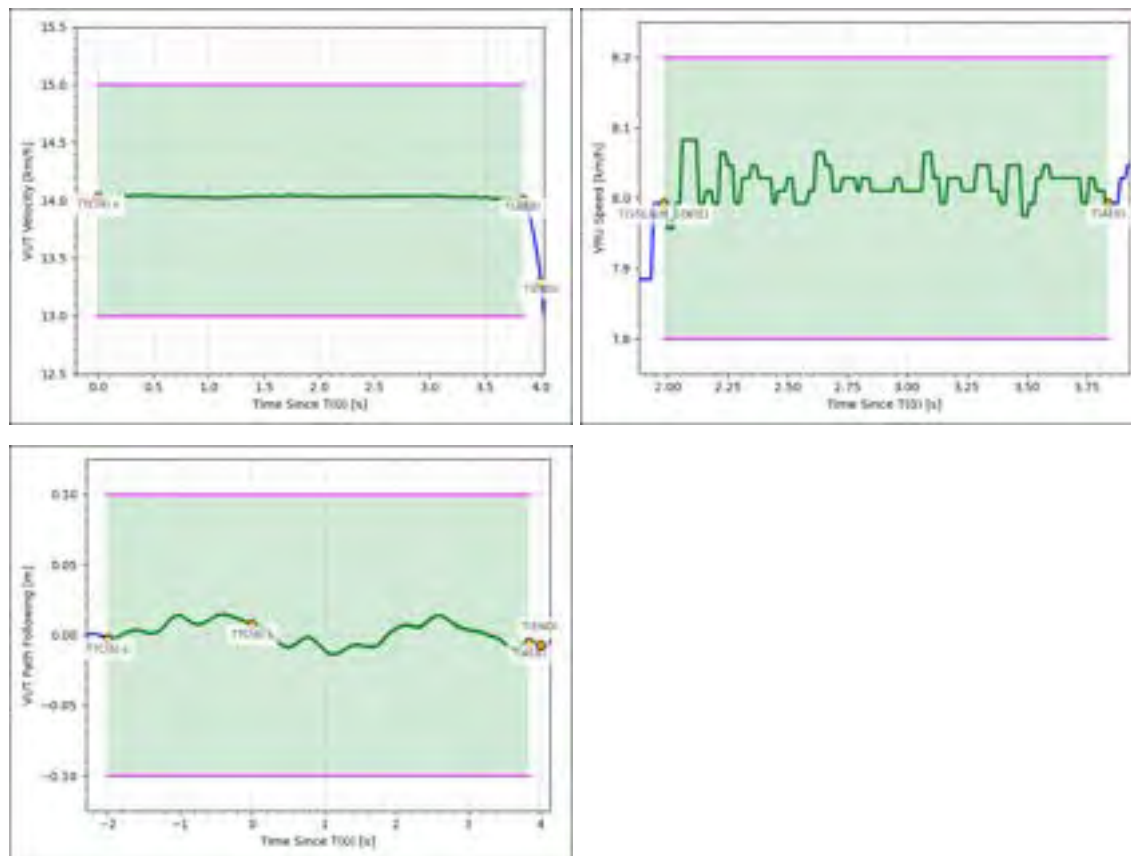
Run Date / Time 25-Nov-2022 14:59



E.1.1.2. CPFA-50 VUT 15kph EPT 8kph (Day)

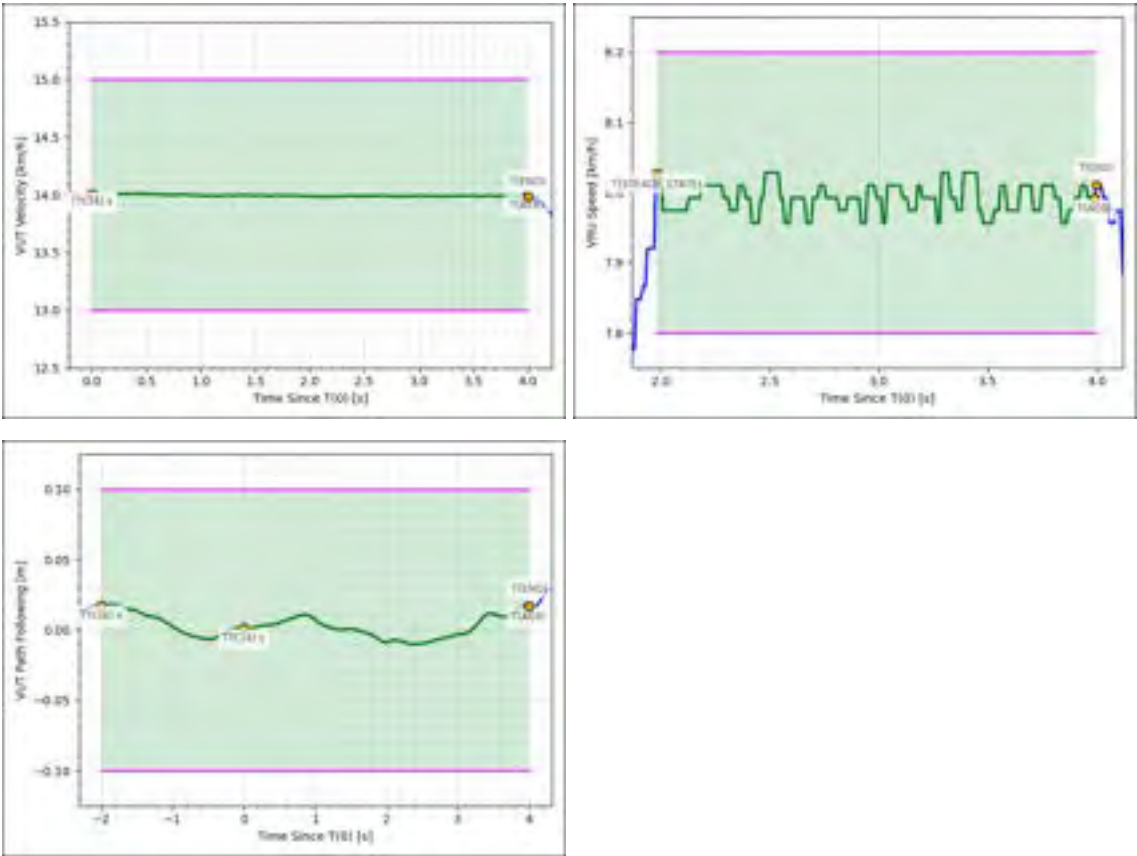
CPFA-50 8 kph (Day) | 15 km/h | Run 1

Run Date / Time 25-Nov-2022 15:04



CPFA-50 8 kph (Day) | 15 km/h | Run 2

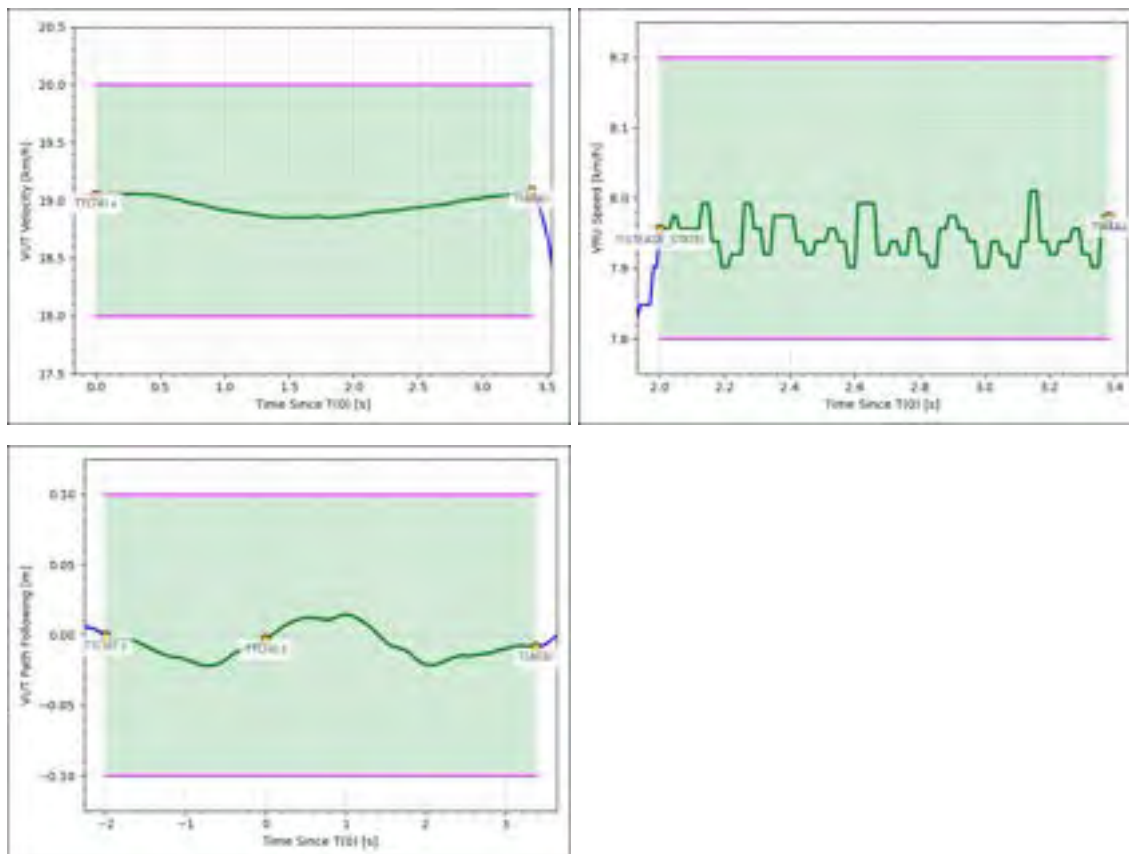
Run Date / Time 25-Nov-2022 15:10



E.1.1.3. CPFA-50 VUT 20kph EPT 8kph (Day)

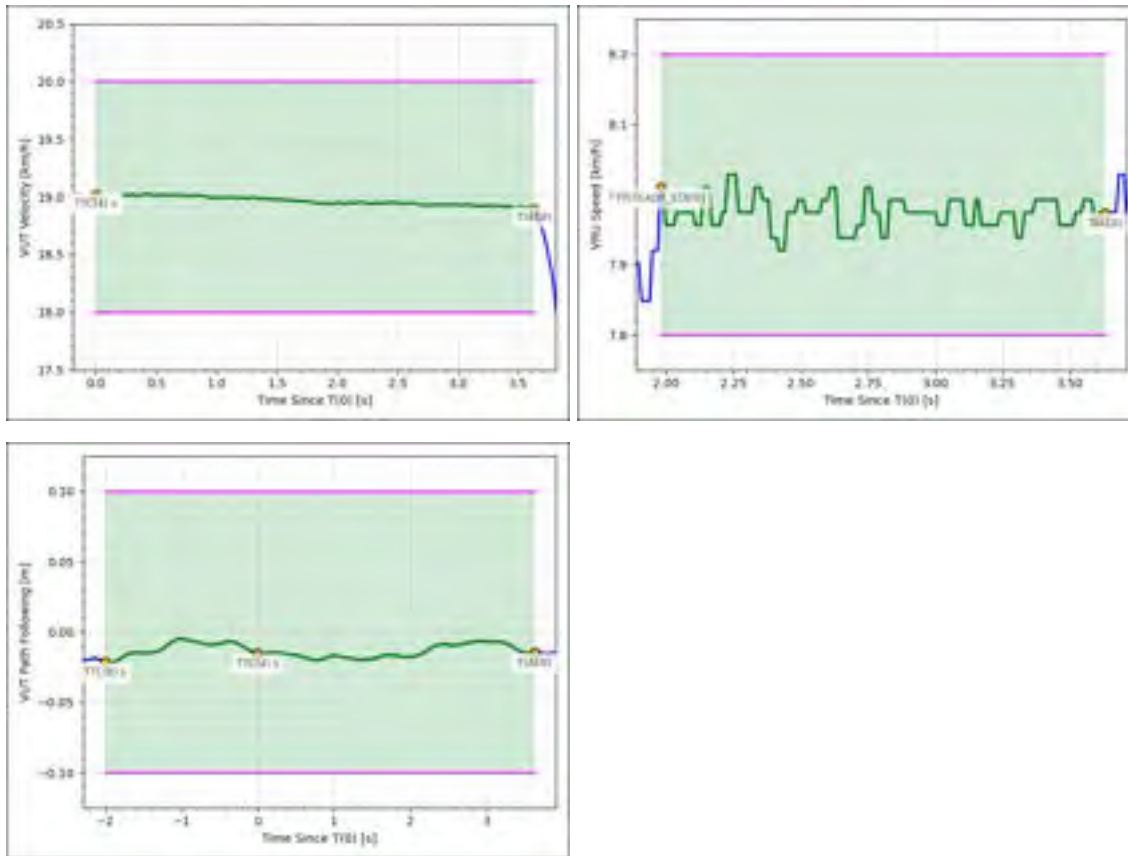
CPFA-50 8 kph (Day) | 20 km/h | Run 1

Run Date / Time 29-Nov-2022 09:49



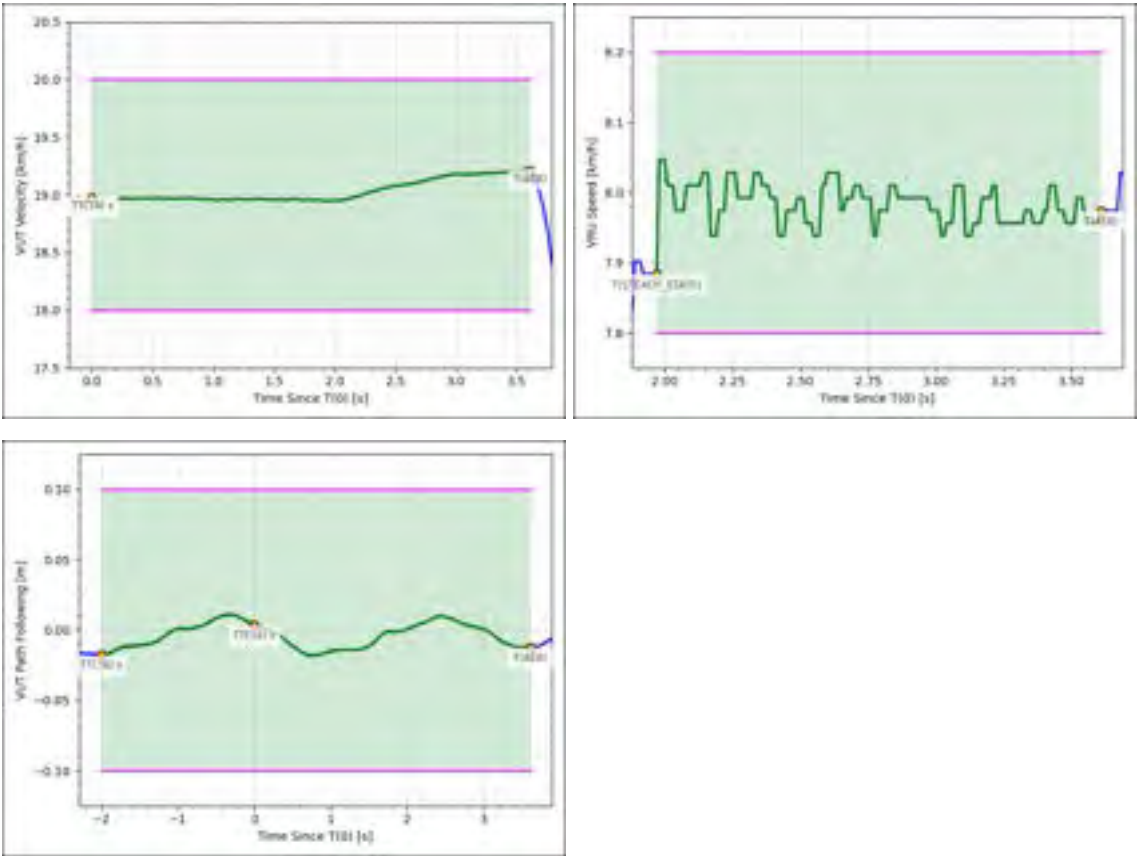
CPFA-50 8 kph (Day) | 20 km/h | Run 2

Run Date / Time 29-Nov-2022 09:52



CPFA-50 8 kph (Day) | 20 km/h | Run 4

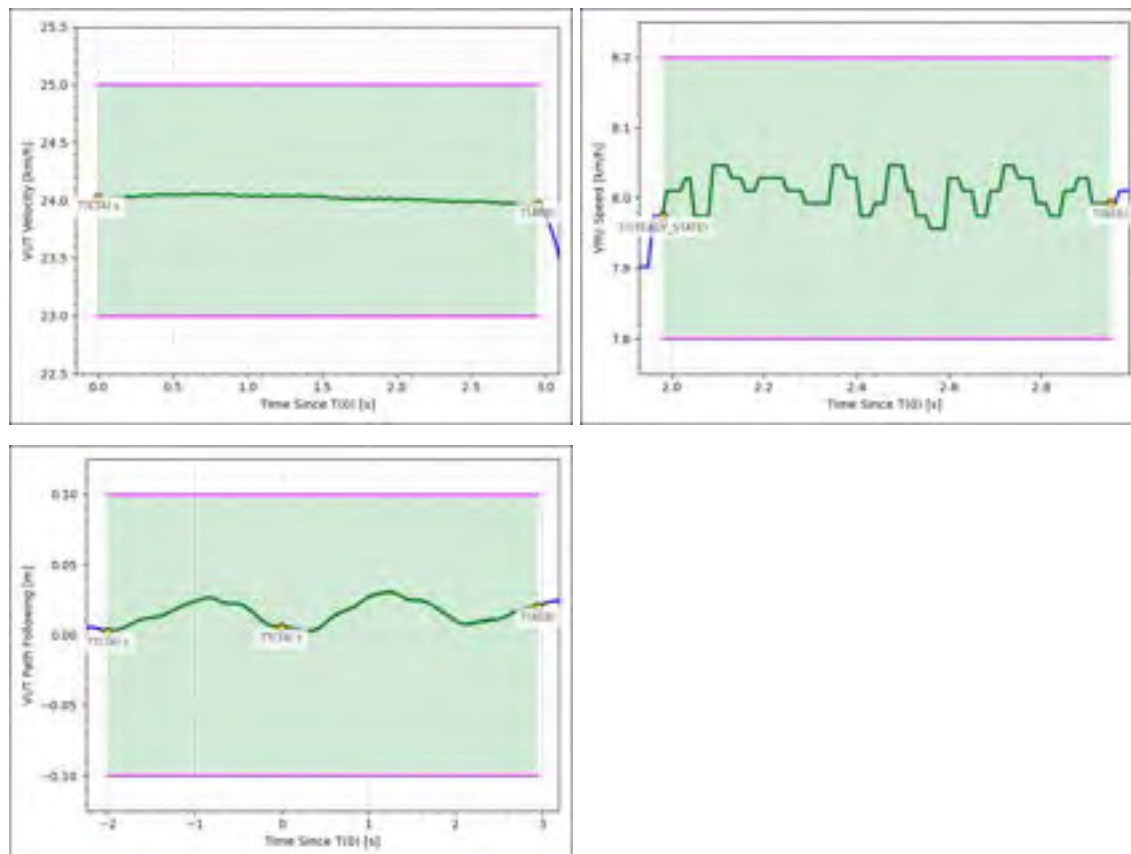
Run Date / Time 29-Nov-2022 10:02



E.1.1.4. CPFA-50 VUT 25kph EPT 8kph (Day)

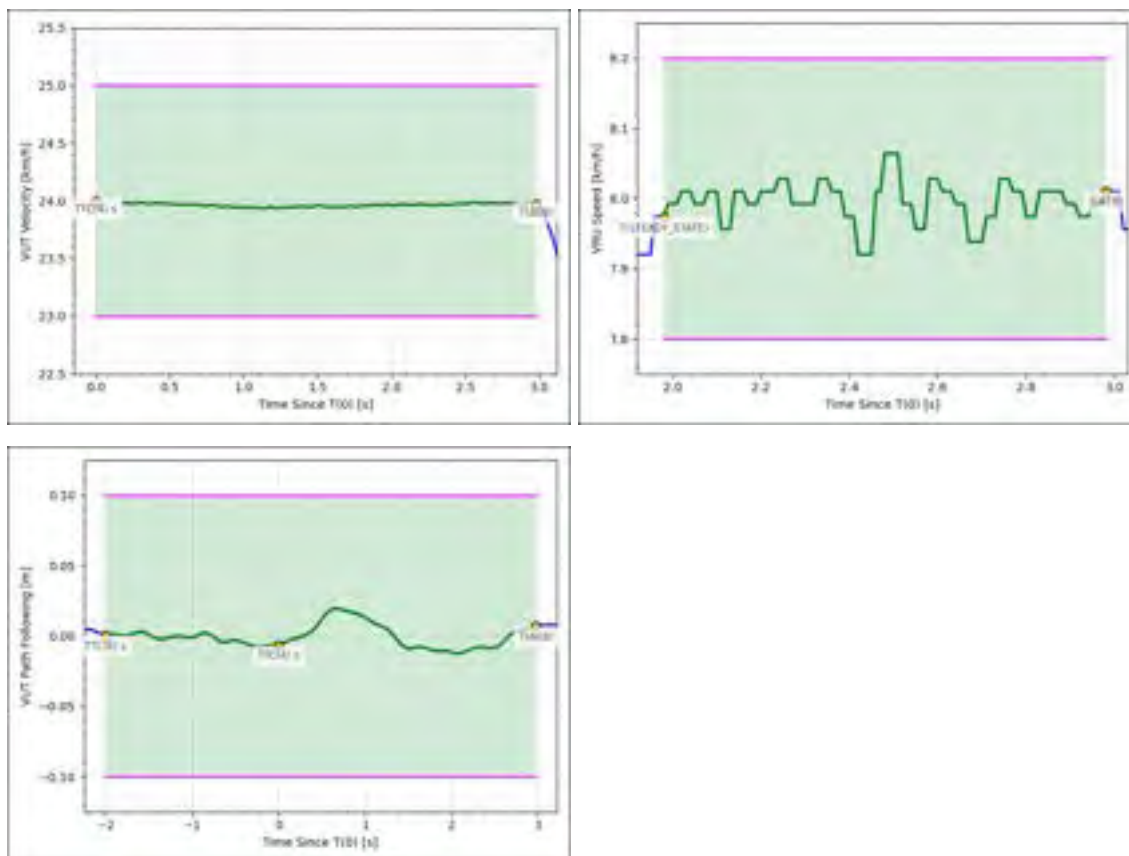
CPFA-50 8 kph (Day) | 25 km/h | Run 1

Run Date / Time 29-Nov-2022 10:20



CPFA-50 8 kph (Day) | 25 km/h | Run 4

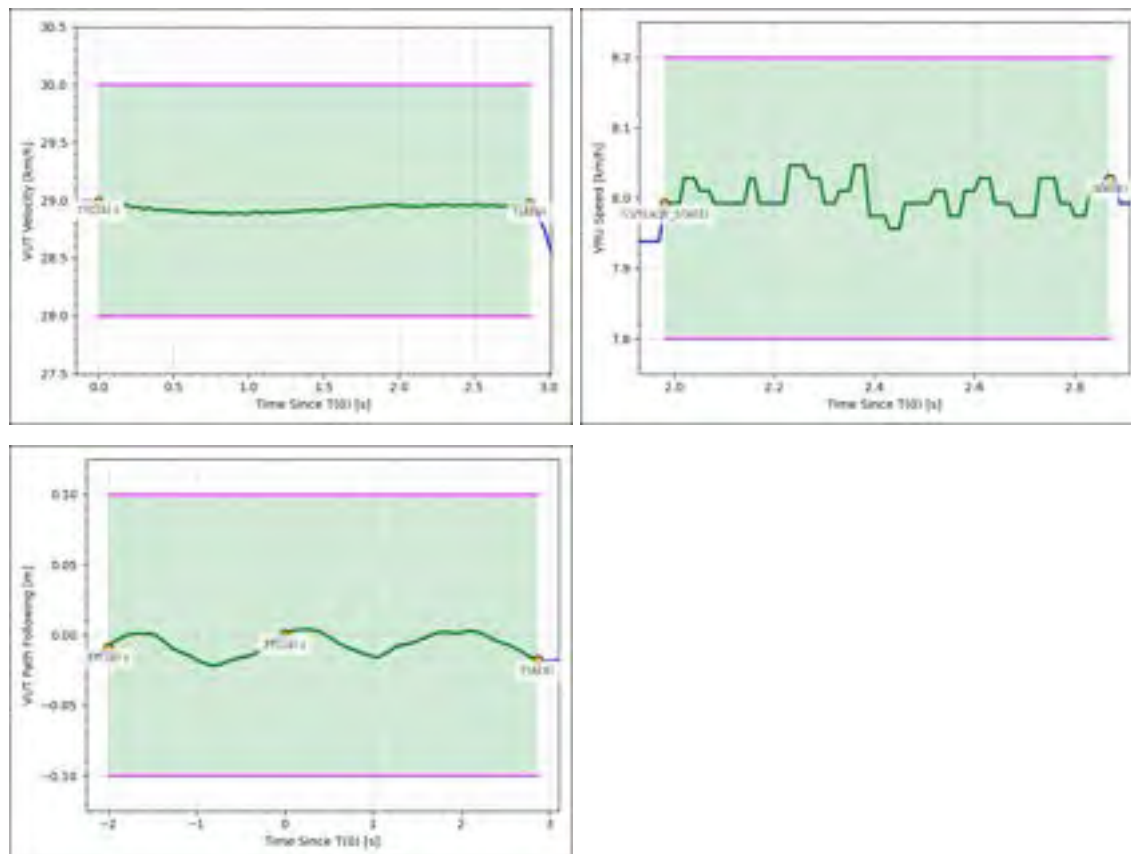
Run Date / Time 29-Nov-2022 10:30



E.1.1.1.5. CPFA-50 VUT 30kph EPT 8kph (Day)

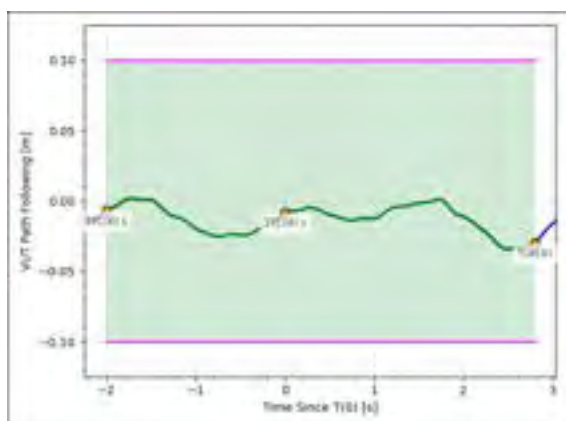
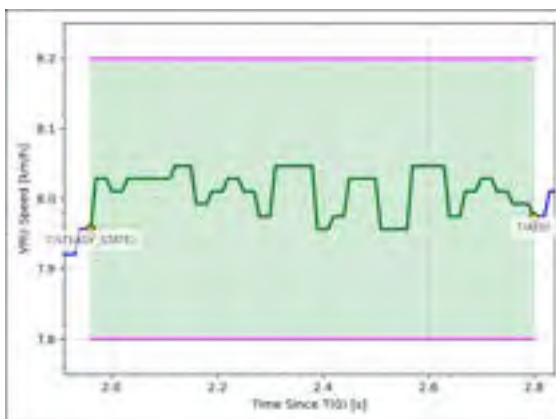
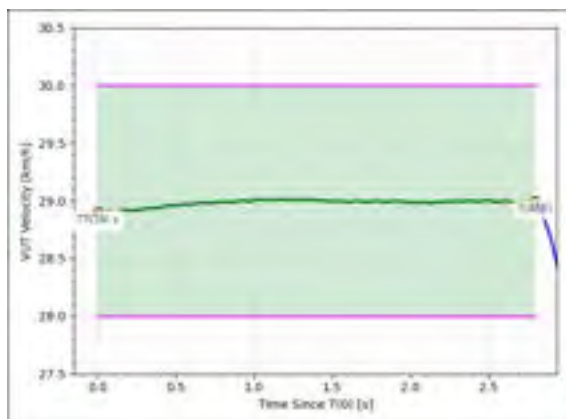
CPFA-50 8 kph (Day) | 30 km/h | Run 1

Run Date / Time 29-Nov-2022 10:33



CPFA-50 8 kph (Day) | 30 km/h | Run 2

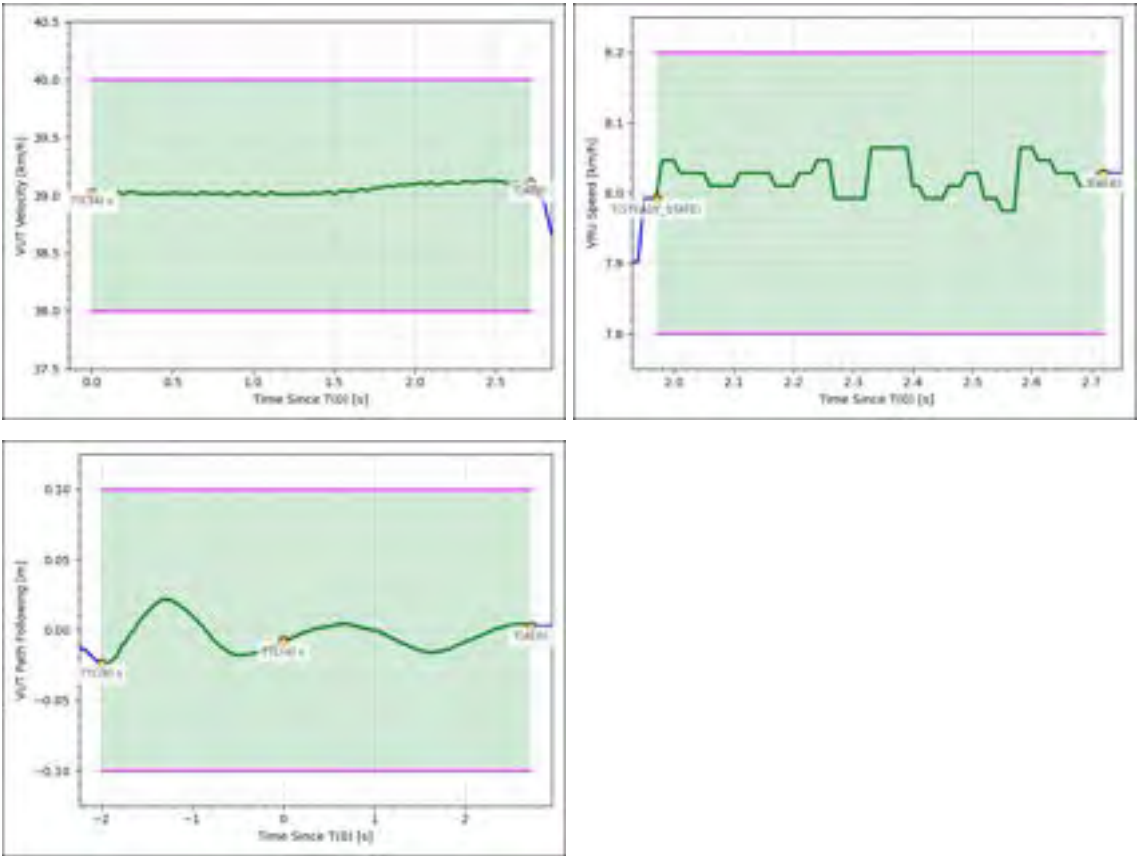
Run Date / Time 29-Nov-2022 10:35



E.1.1.1.6. CPFA-50 VUT 40kph EPT 8kph (Day)

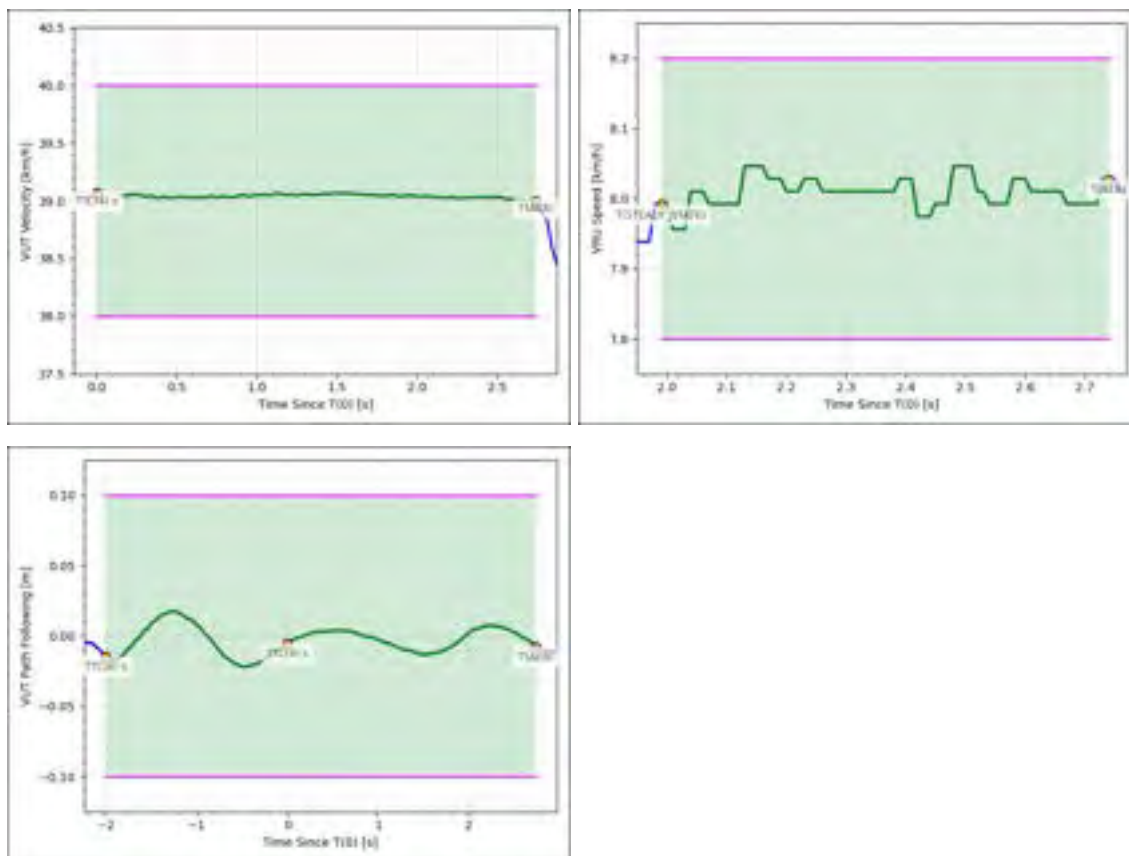
CPFA-50 8 kph (Day) | 40 km/h | Run 1

Run Date / Time 29-Nov-2022 10:38



CPFA-50 8 kph (Day) | 40 km/h | Run 2

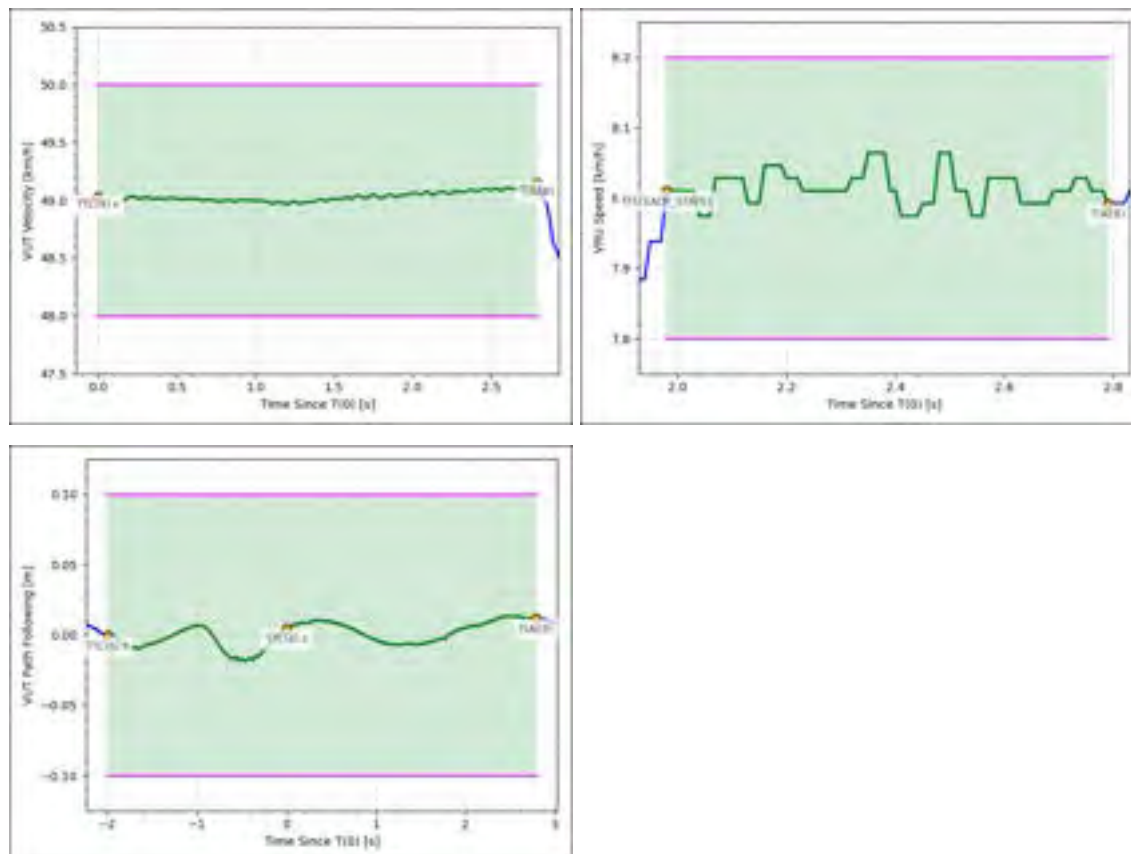
Run Date / Time 29-Nov-2022 10:40



E.1.1.7. CPFA-50 VUT 50kph EPT 8kph (Day)

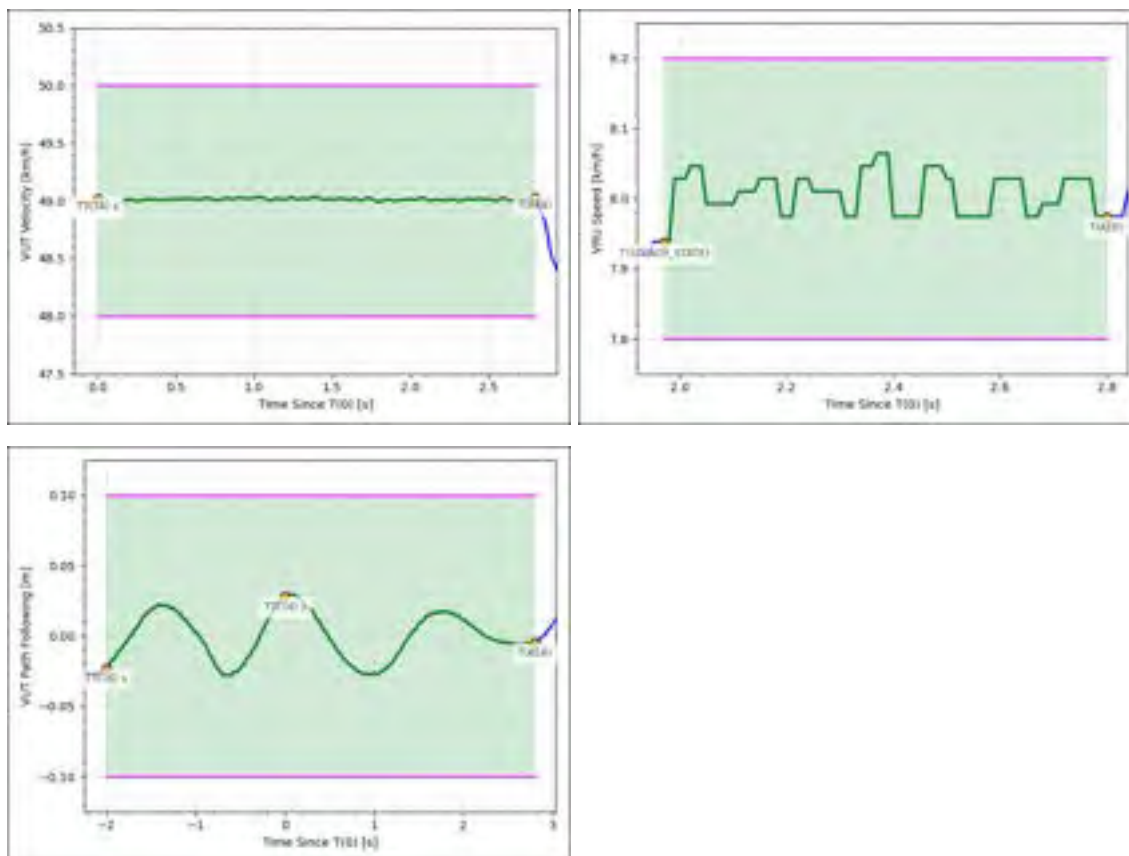
CPFA-50 8 kph (Day) | 50 km/h | Run 1

Run Date / Time 29-Nov-2022 10:43



CPFA-50 8 kph (Day) | 50 km/h | Run 2

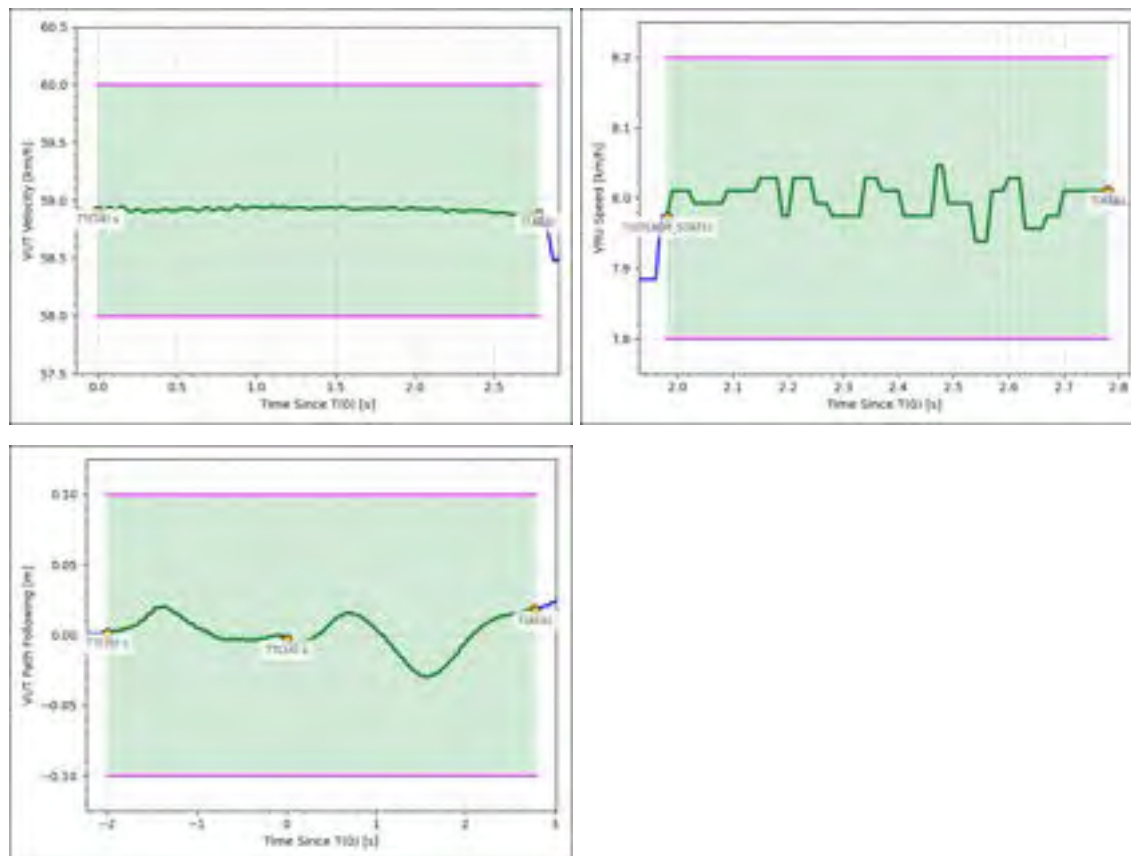
Run Date / Time 29-Nov-2022 10:45



E.1.1.1.8. CPFA-50 VUT 60kph EPT 8kph (Day)

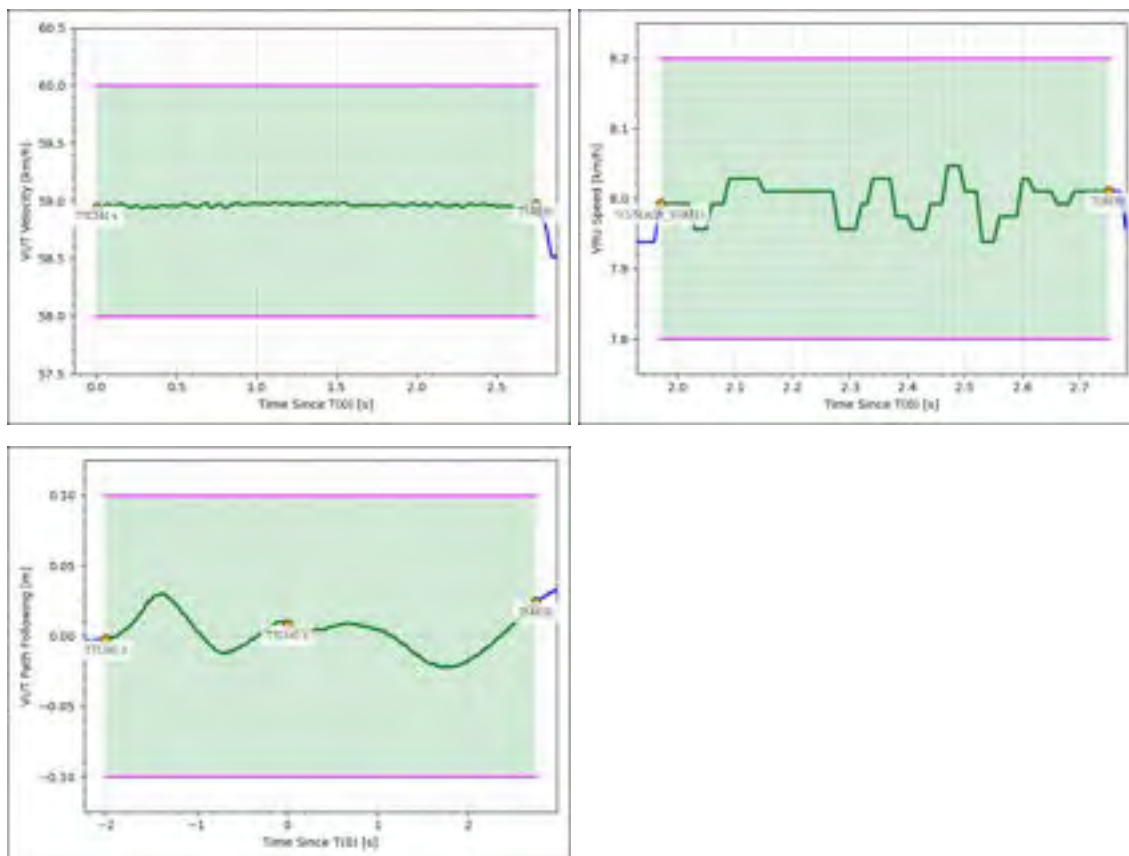
CPFA-50 8 kph (Day) | 60 km/h | Run 1

Run Date / Time 29-Nov-2022 10:48



CPFA-50 8 kph (Day) | 60 km/h | Run 2

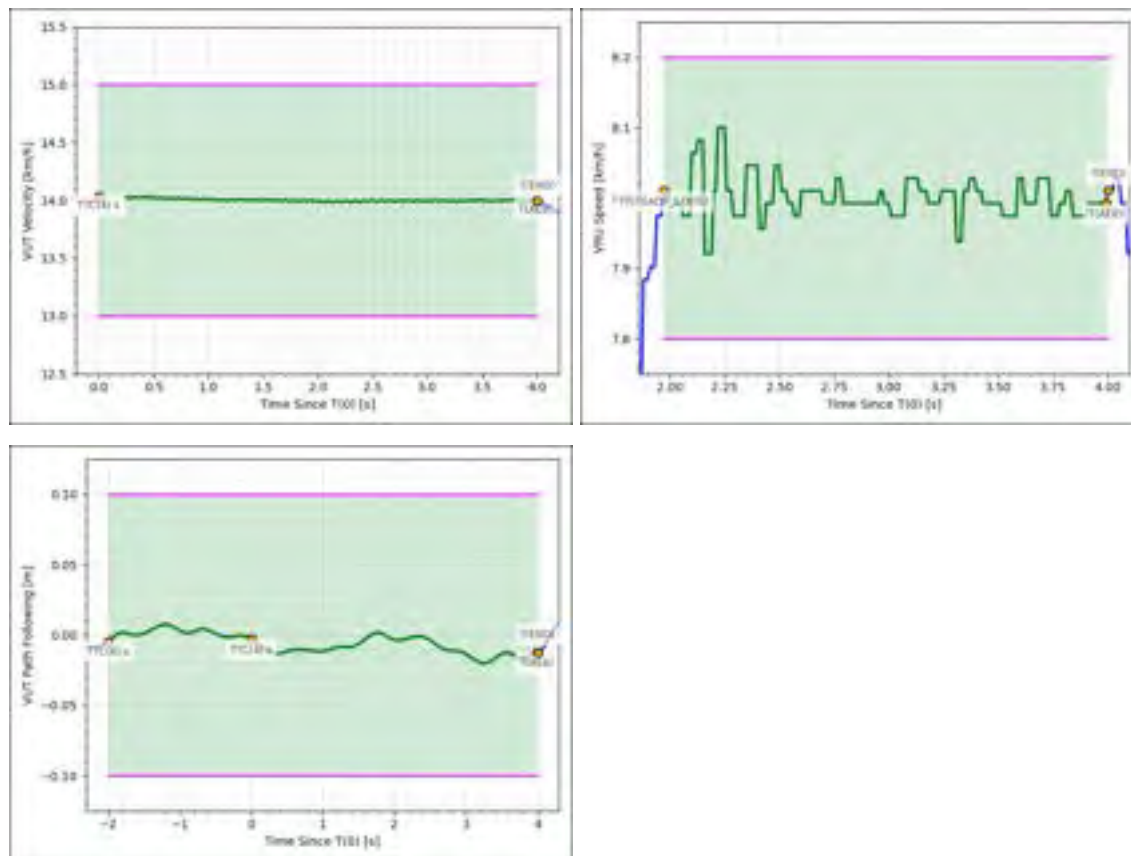
Run Date / Time 29-Nov-2022 10:50



E.1.1.1. GVM

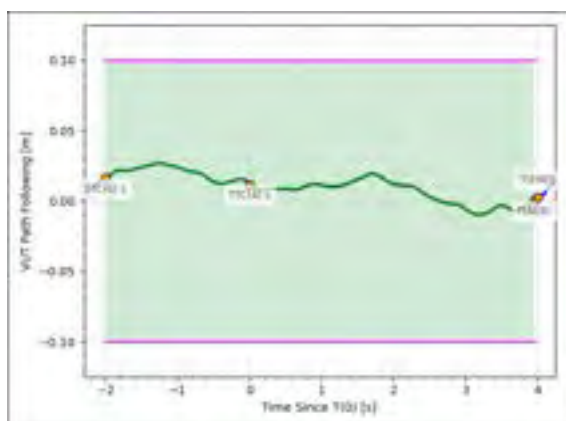
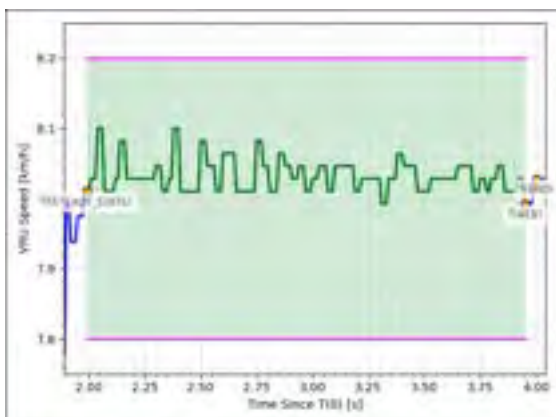
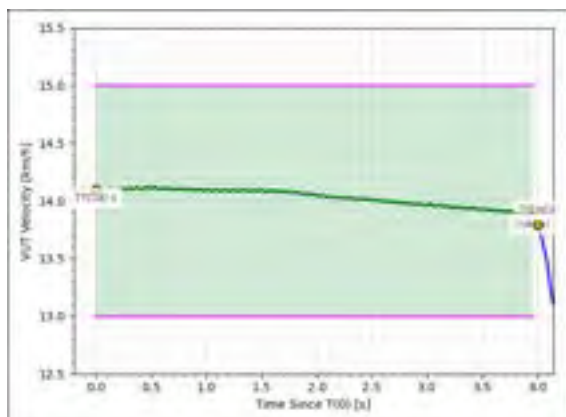
CPFA-50 8 kph (Day) | 15 km/h | Run 3

Run Date / Time 9-Dec-2022 10:12



CPFA-50 8 kph (Day) | 15 km/h | Run 4

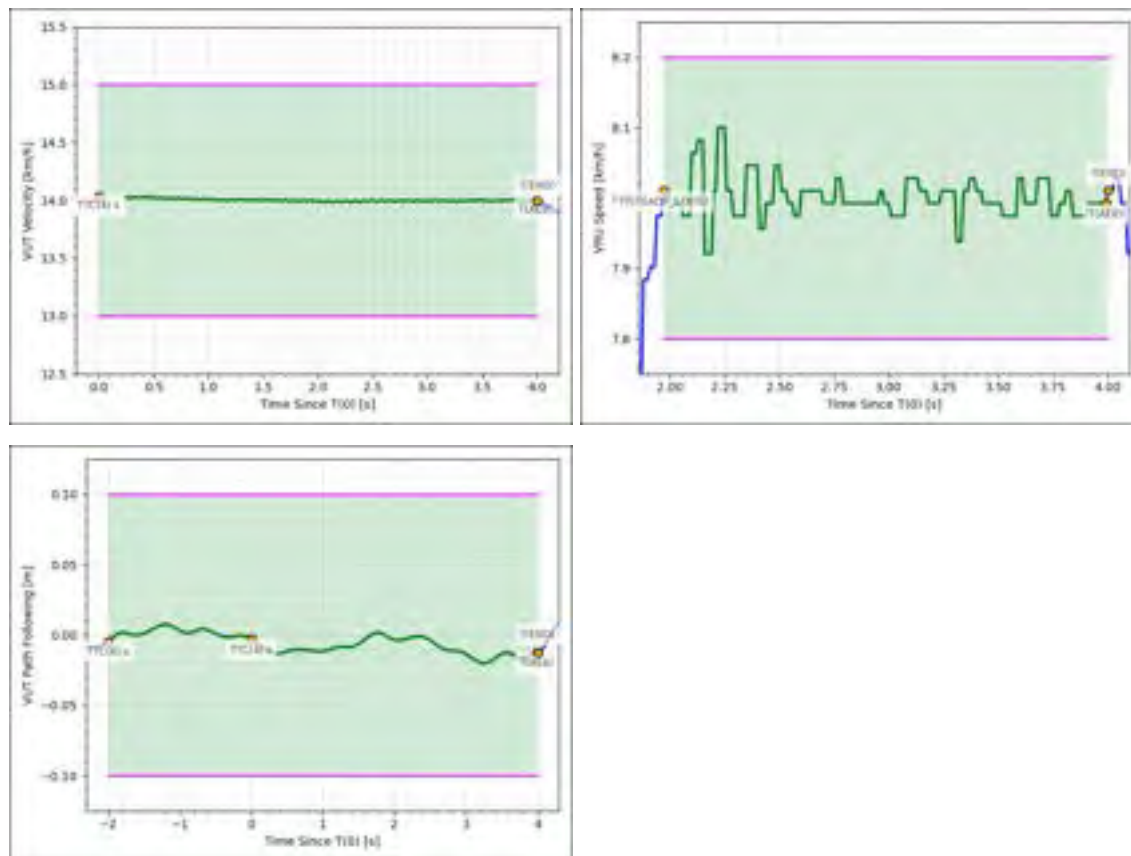
Run Date / Time 9-Dec-2022 10:23



E.1.1.1. CPFA-50 VUT 15kph EPT 8kph (Day)

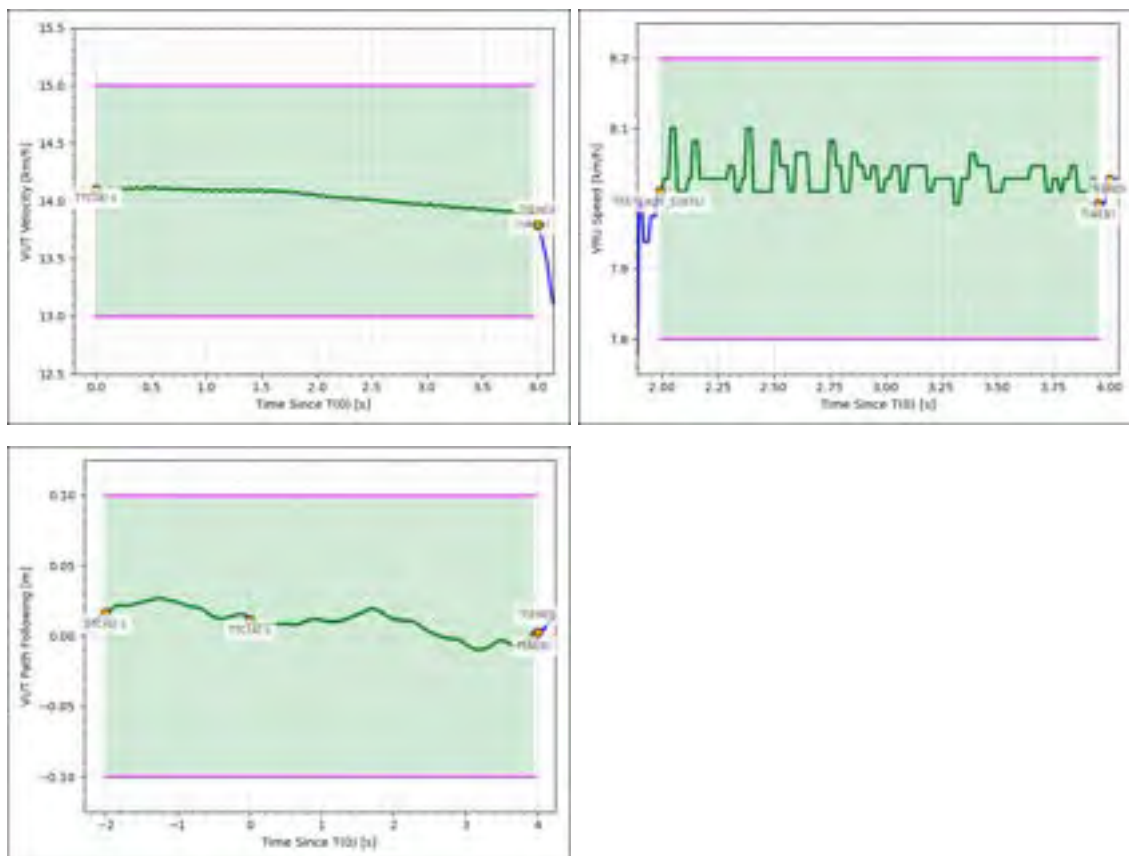
CPFA-50 8 kph (Day) | 15 km/h | Run 3

Run Date / Time 9-Dec-2022 10:12



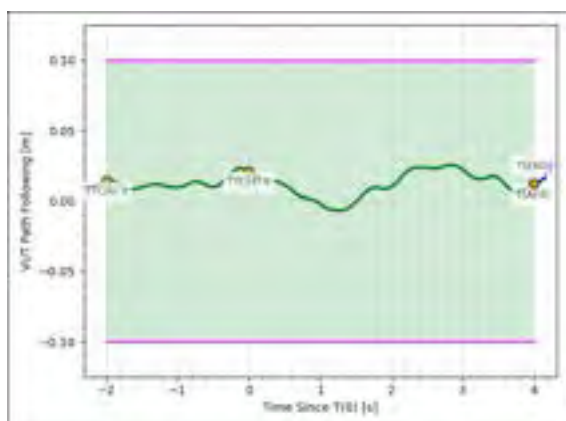
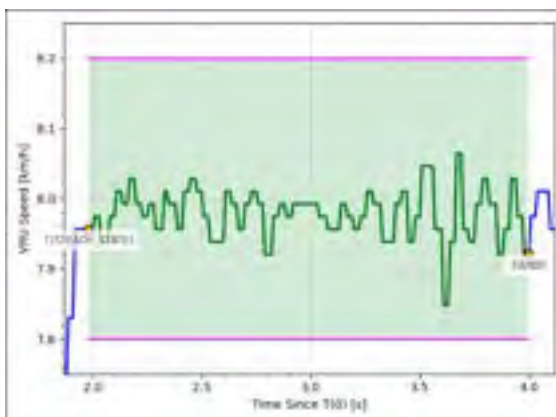
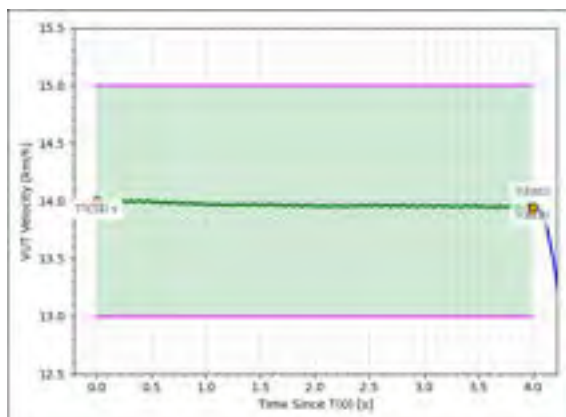
CPFA-50 8 kph (Day) | 15 km/h | Run 4

Run Date / Time 9-Dec-2022 10:23



CPFA-50 8 kph (Day) | 15 km/h | Run 5

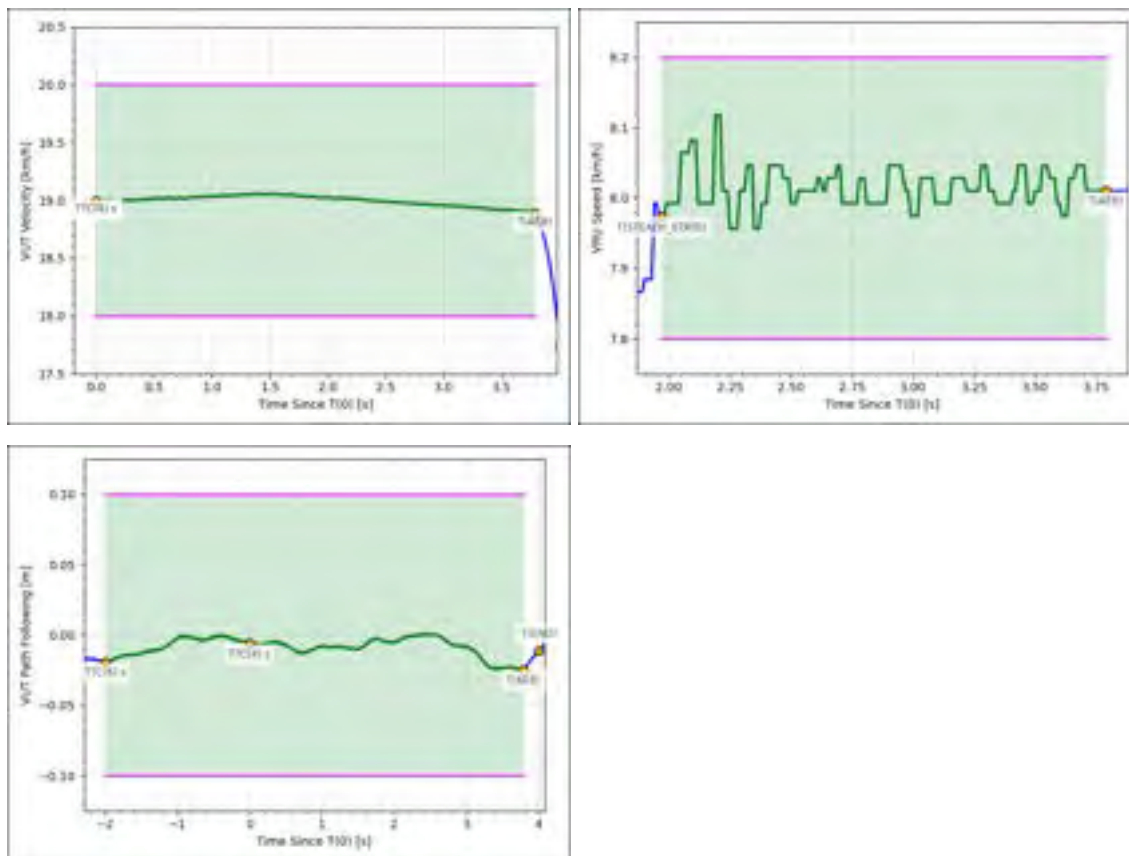
Run Date / Time 9-Dec-2022 10:30



E.1.1.2. CPFA-50 VUT 20kph EPT 8kph (Day)

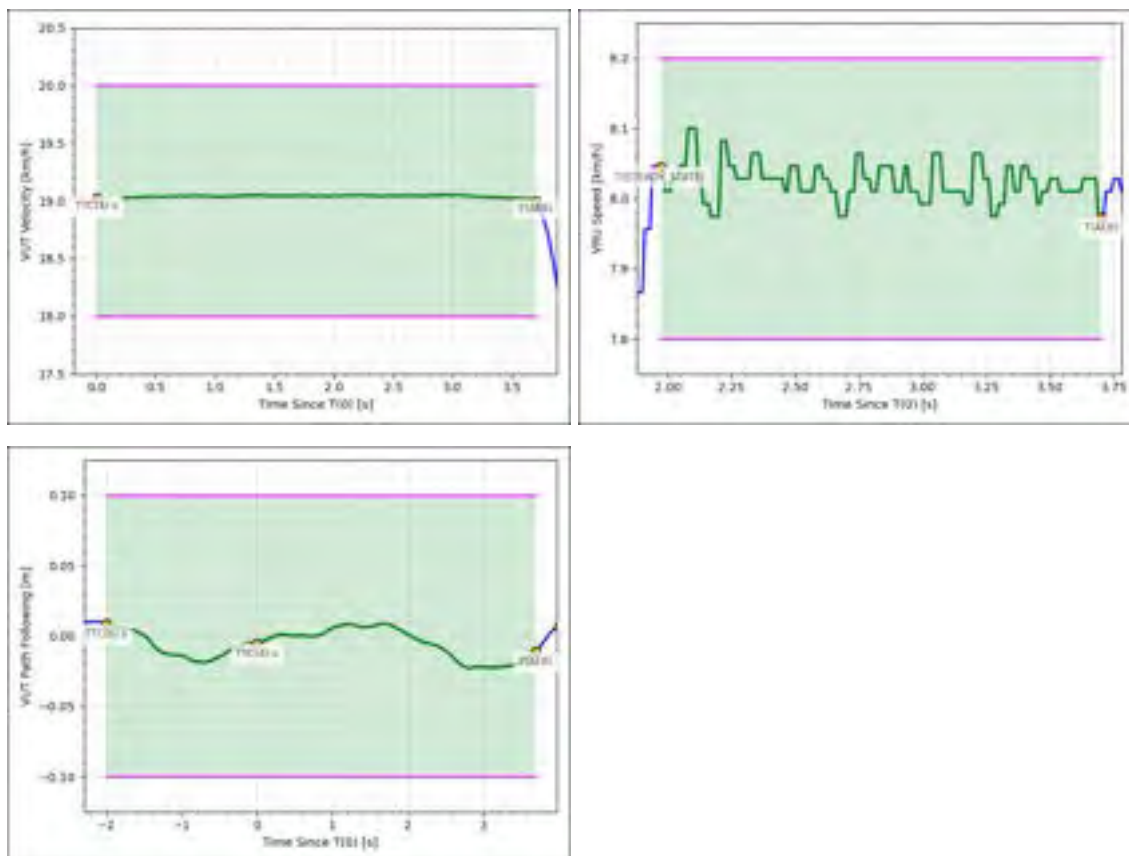
CPFA-50 8 kph (Day) | 20 km/h | Run 6

Run Date / Time 9-Dec-2022 09:55



CPFA-50 8 kph (Day) | 20 km/h | Run 7

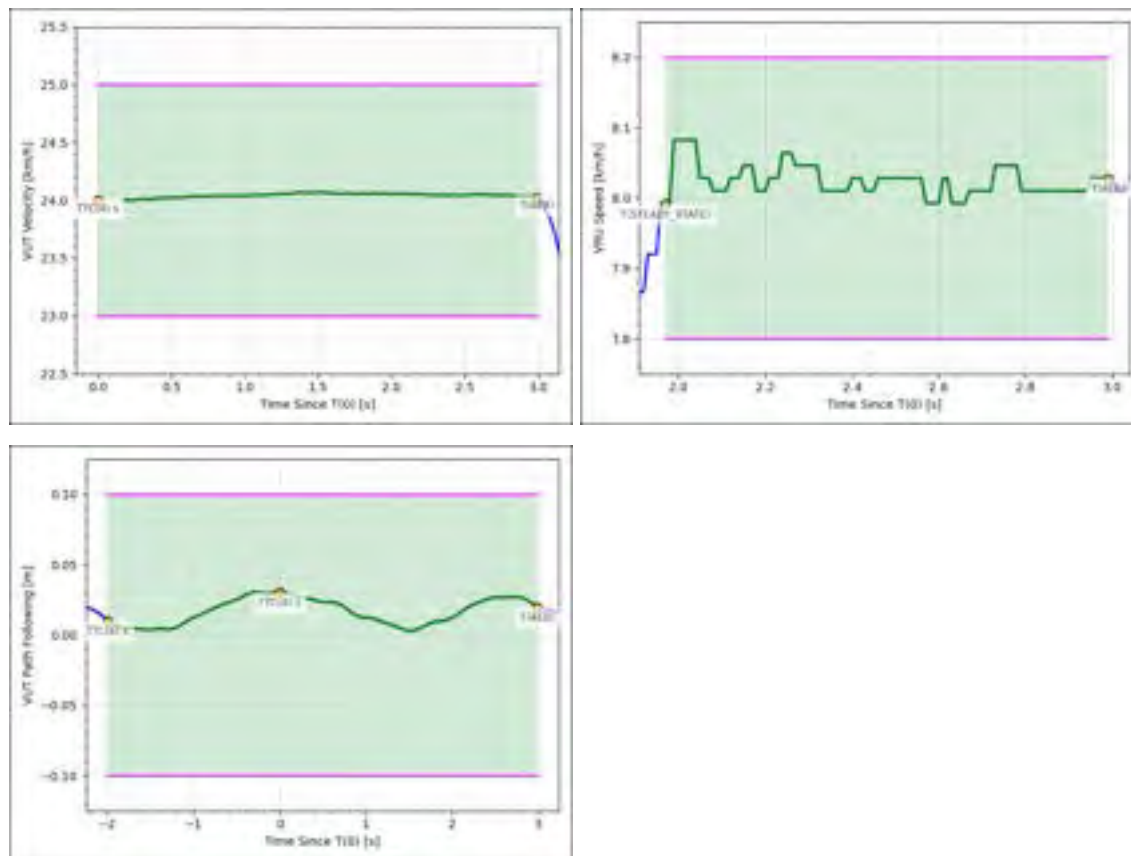
Run Date / Time 9-Dec-2022 10:06



E.1.1.3. CPFA-50 VUT 25kph EPT 8kph (Day)

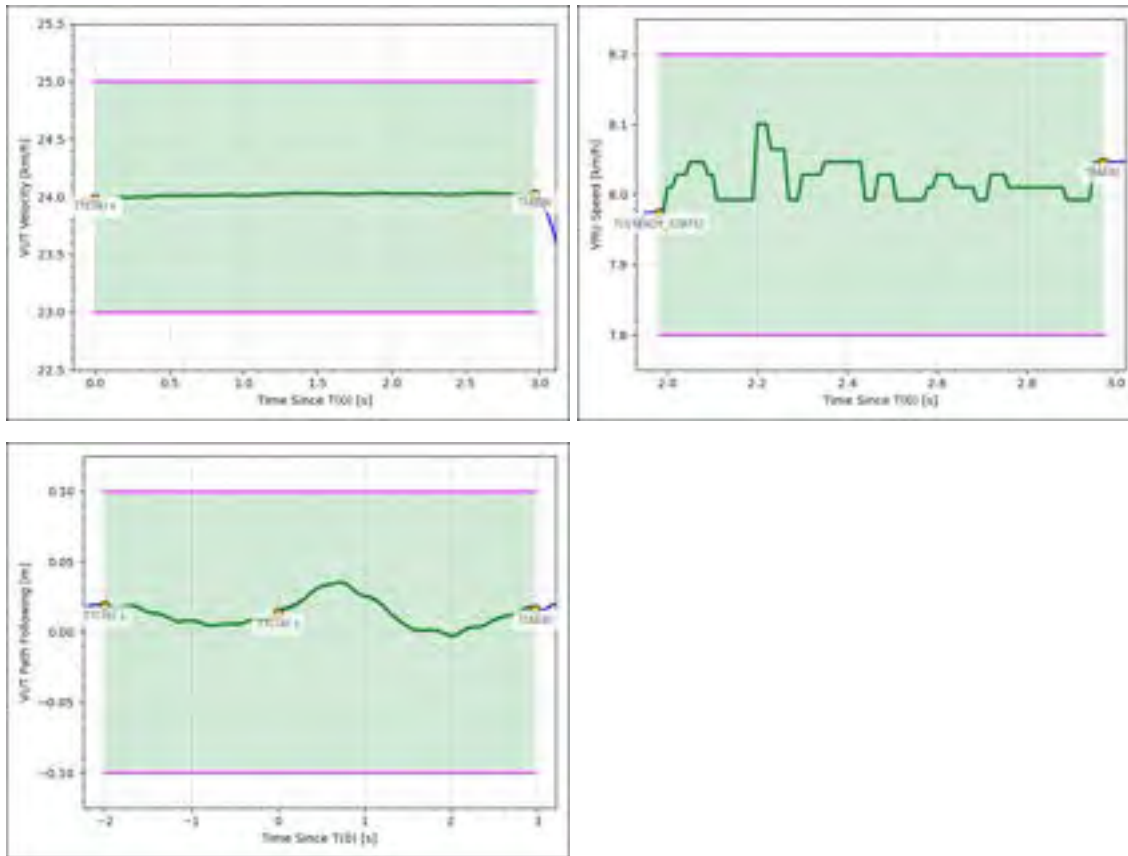
CPFA-50 8 kph (Day) | 25 km/h | Run 5

Run Date / Time 9-Dec-2022 10:35



CPFA-50 8 kph (Day) | 25 km/h | Run 7

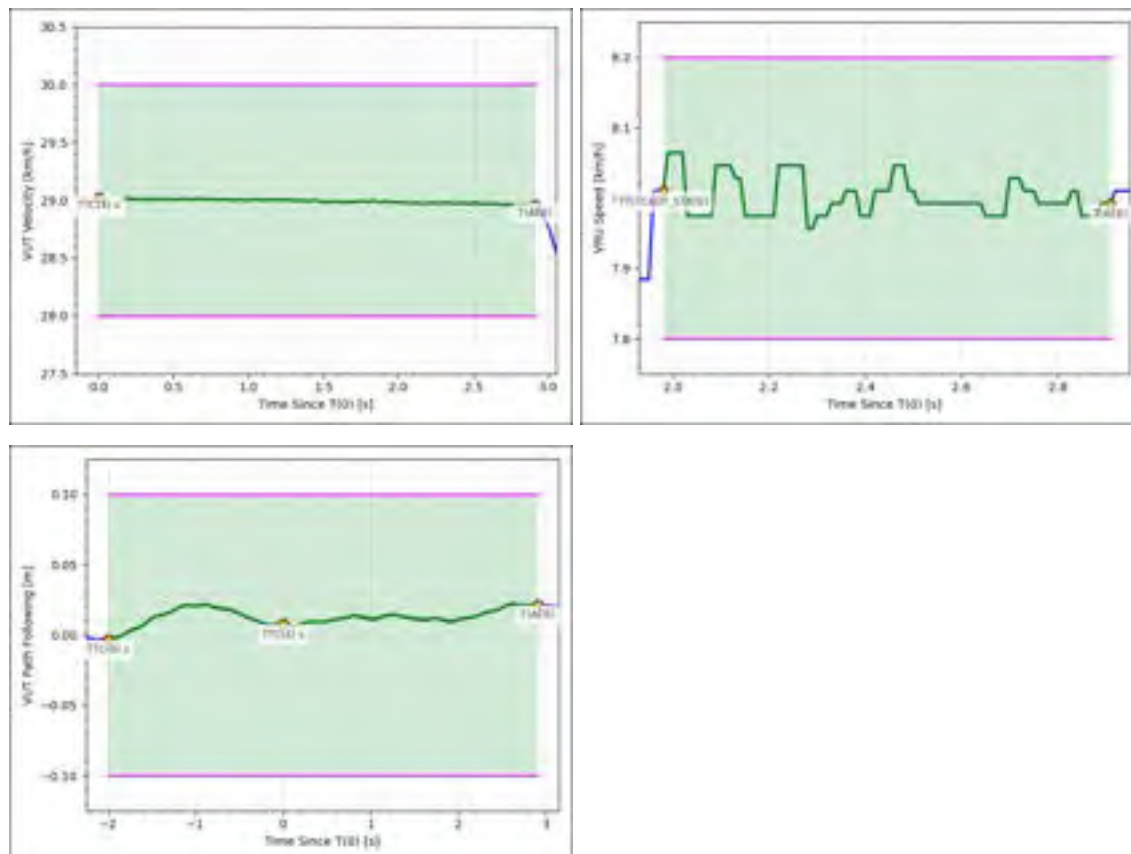
Run Date / Time 9-Dec-2022 10:41



E.1.1.1.4. CPFA-50 VUT 30kph EPT 8kph (Day)

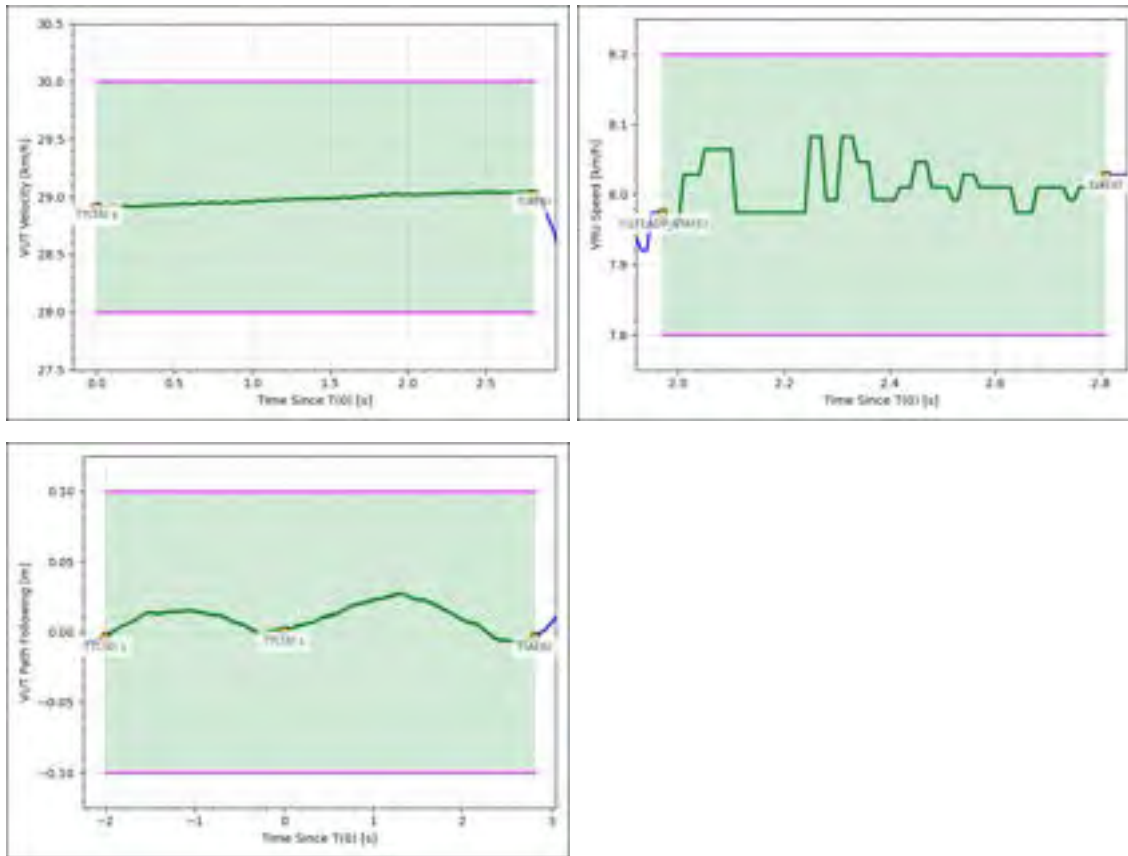
CPFA-50 8 kph (Day) | 30 km/h | Run 3

Run Date / Time 9-Dec-2022 10:46



CPFA-50 8 kph (Day) | 30 km/h | Run 4

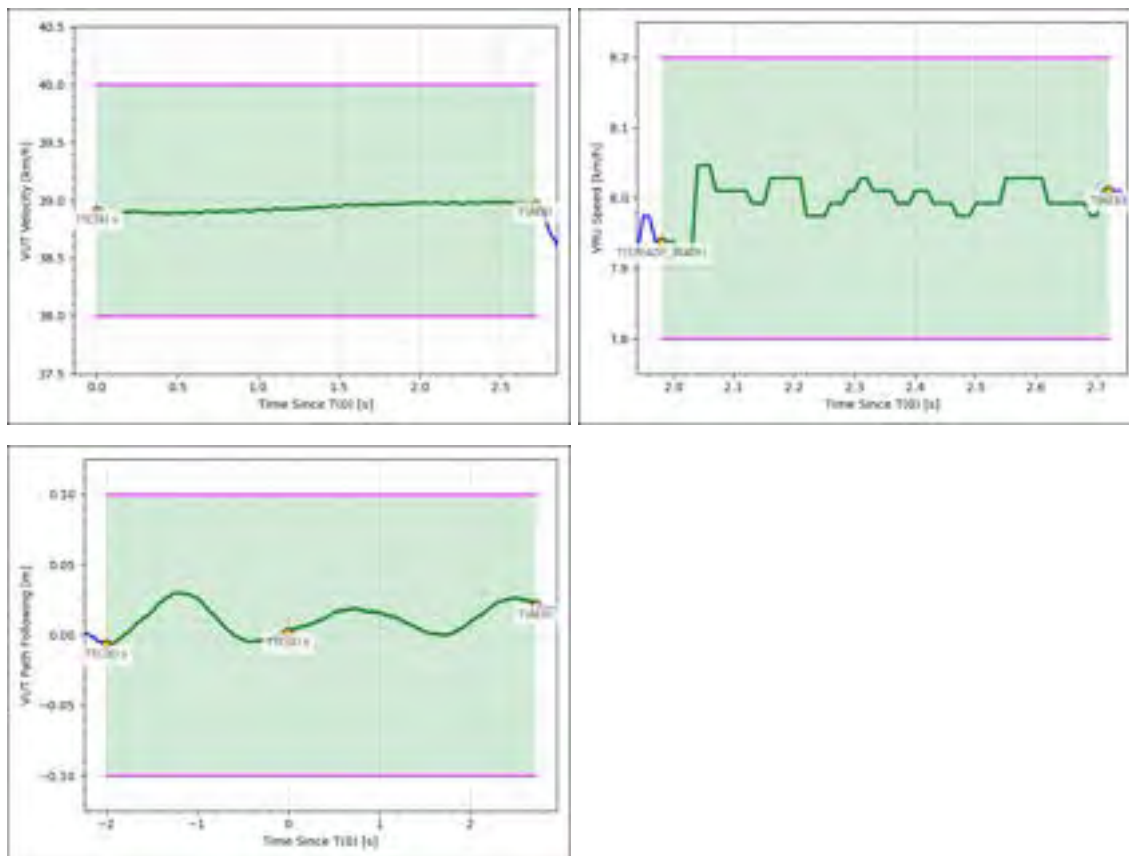
Run Date / Time 9-Dec-2022 10:49



E.1.1.1.5. CPFA-50 VUT 40kph EPT 8kph (Day)

CPFA-50 8 kph (Day) | 40 km/h | Run 4

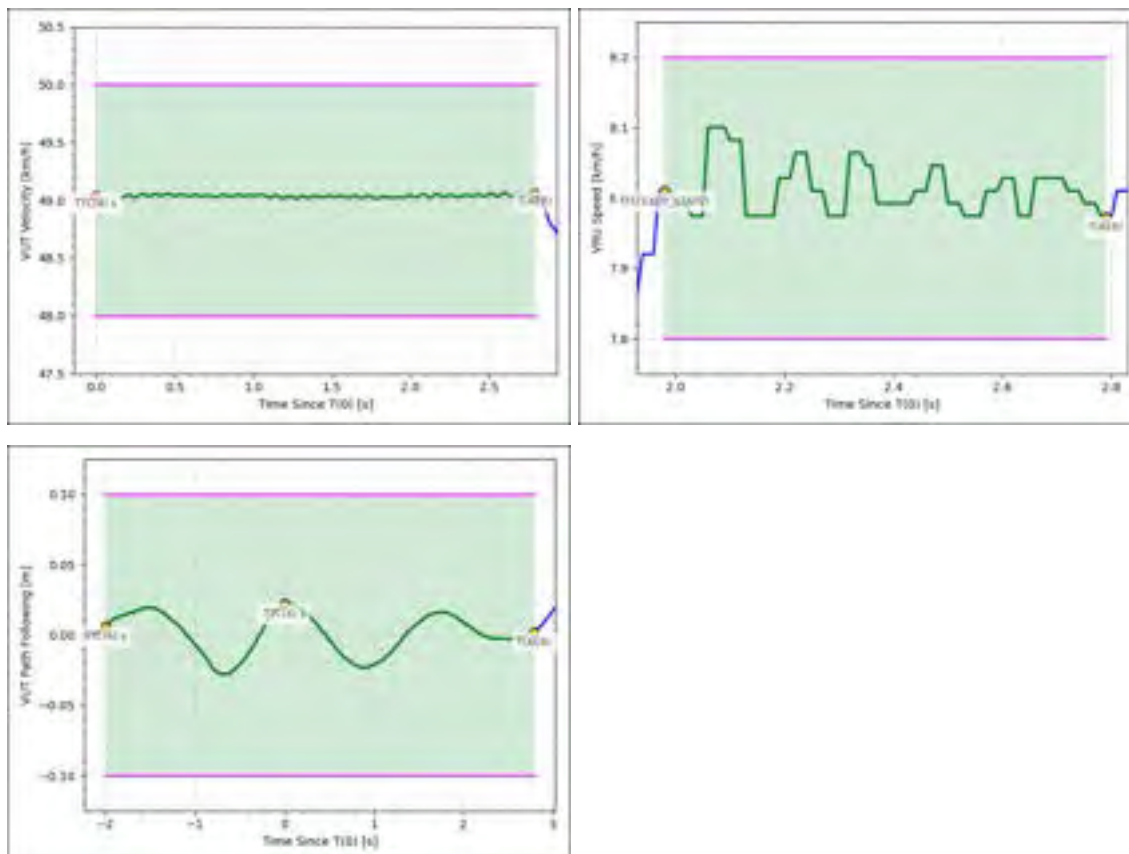
Run Date / Time 9-Dec-2022 10:55



E.1.1.6. CPFA-50 VUT 50kph EPT 8kph (Day)

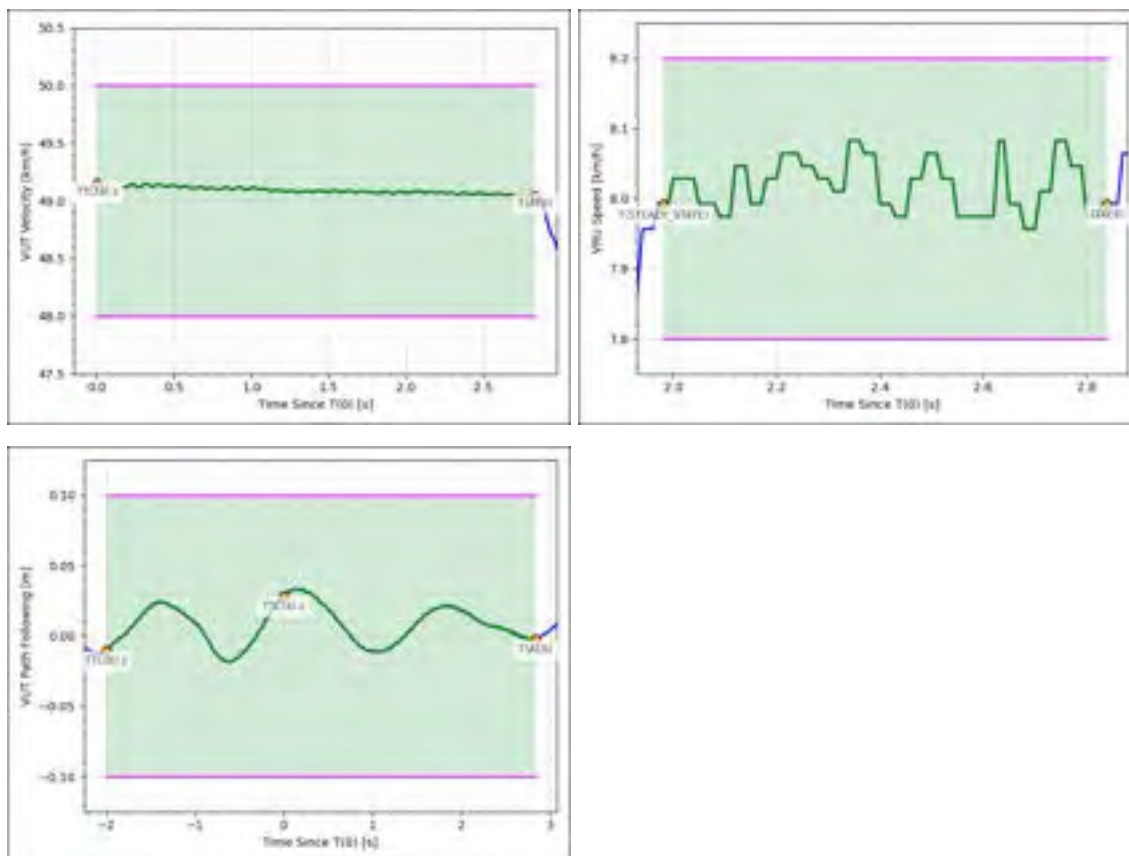
CPFA-50 8 kph (Day) | 50 km/h | Run 3

Run Date / Time 9-Dec-2022 10:57



CPFA-50 8 kph (Day) | 50 km/h | Run 4

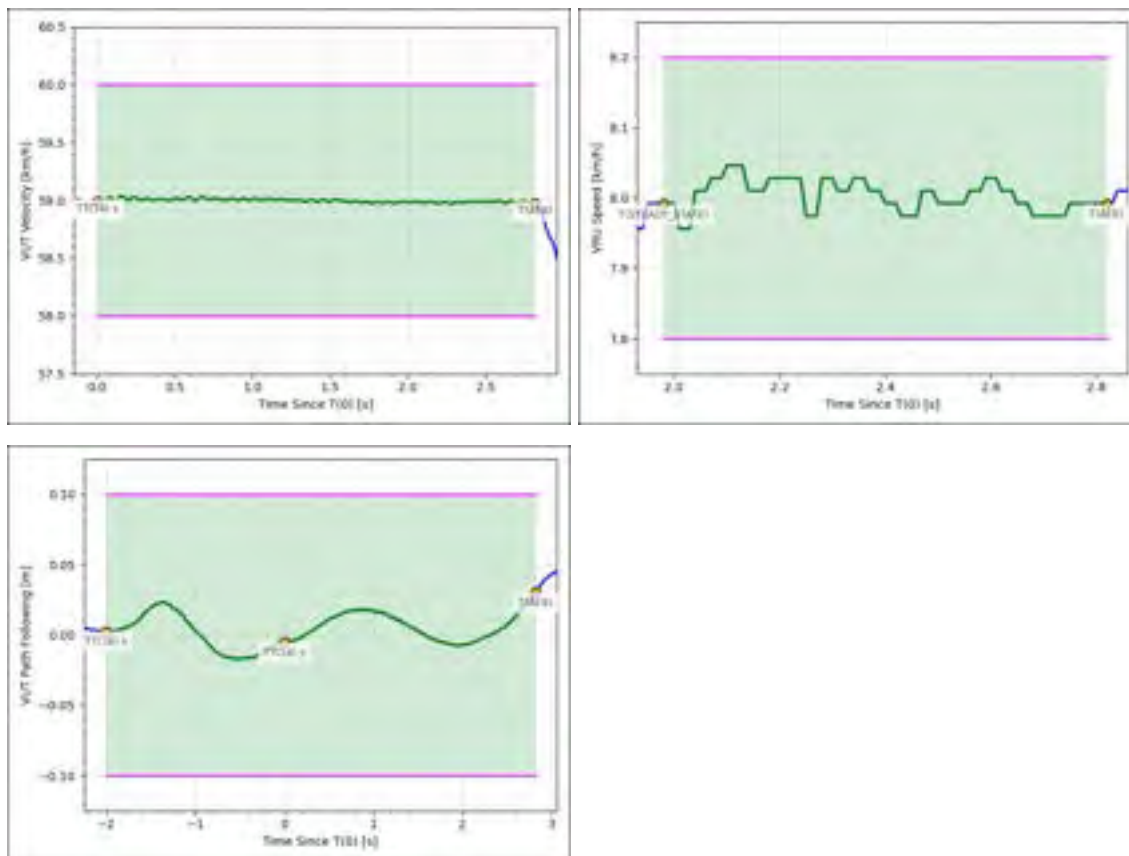
Run Date / Time 9-Dec-2022 11:02



E.1.1.7. CPFA-50 VUT 60kph EPT 8kph (Day)

CPFA-50 8 kph (Day) | 60 km/h | Run 3

Run Date / Time 9-Dec-2022 11:04

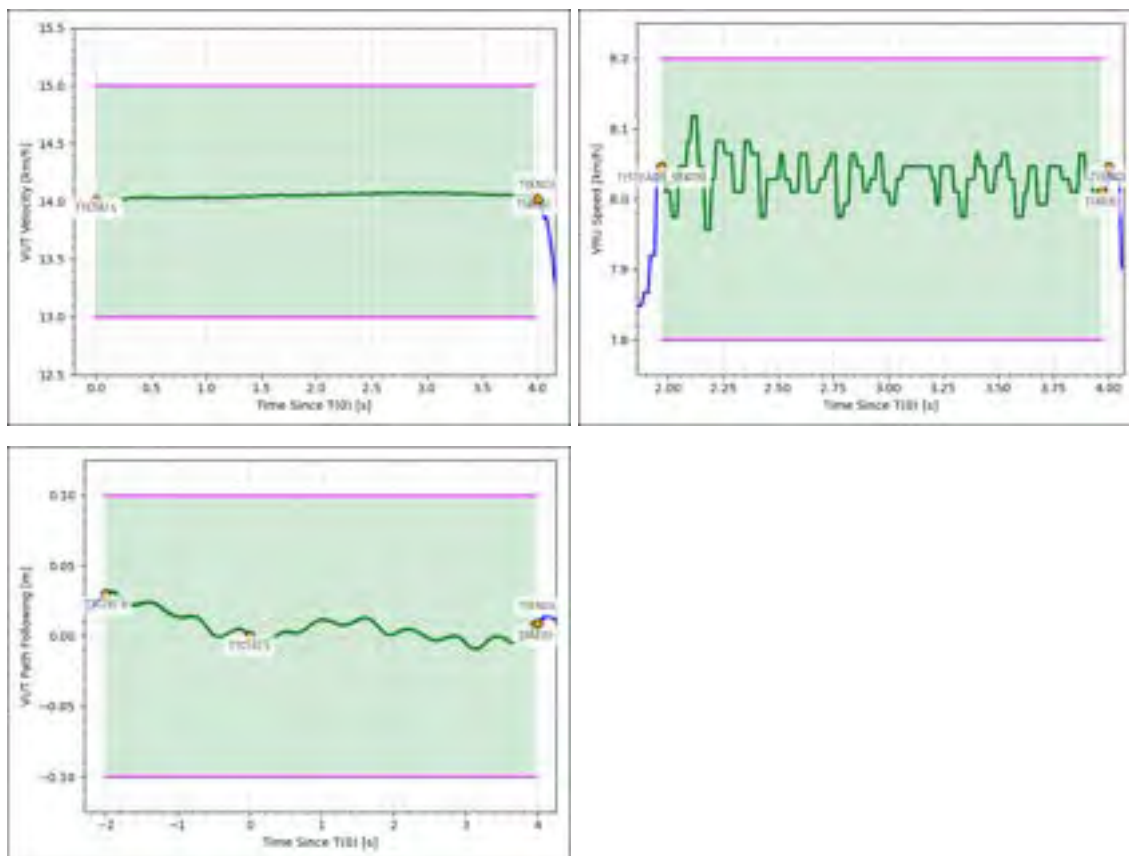


E.1.1. Rear Pitch

E.1.1.1. CPFA-50 VUT 15kph EPT 8kph (Day)

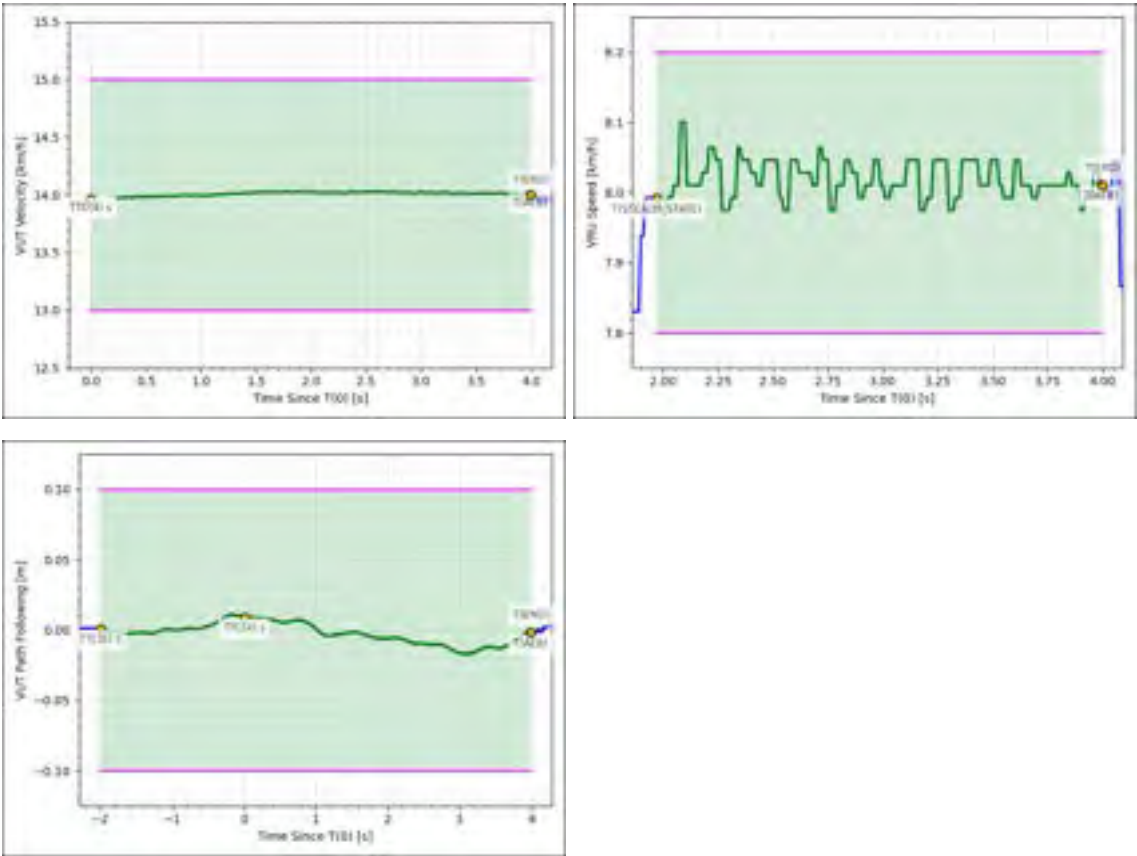
CPFA-50 8 kph (Day) | 15 km/h | Run 8

Run Date / Time 21-Dec-2022 09:10



CPFA-50 8 kph (Day) | 15 km/h | Run 10

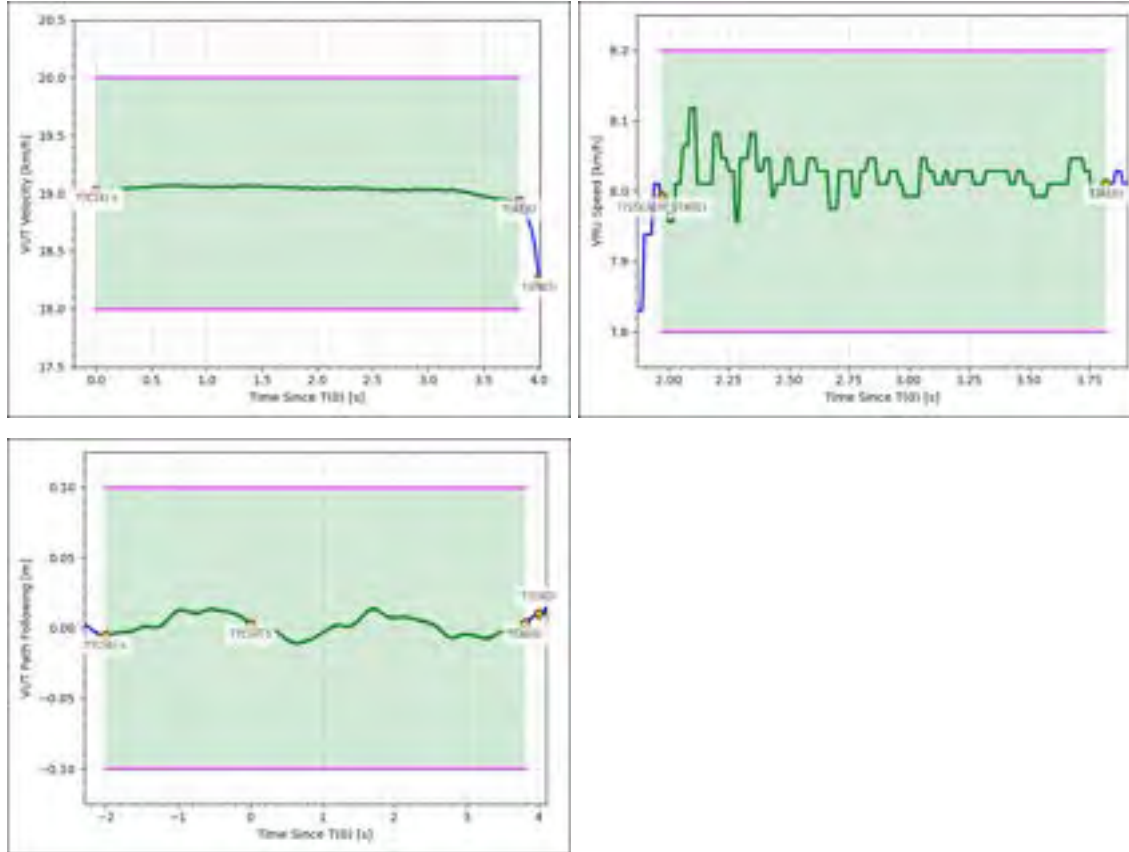
Run Date / Time 21-Dec-2022 09:19



E.1.1.2. CPFA-50 VUT 20kph EPT 8kph (Day)

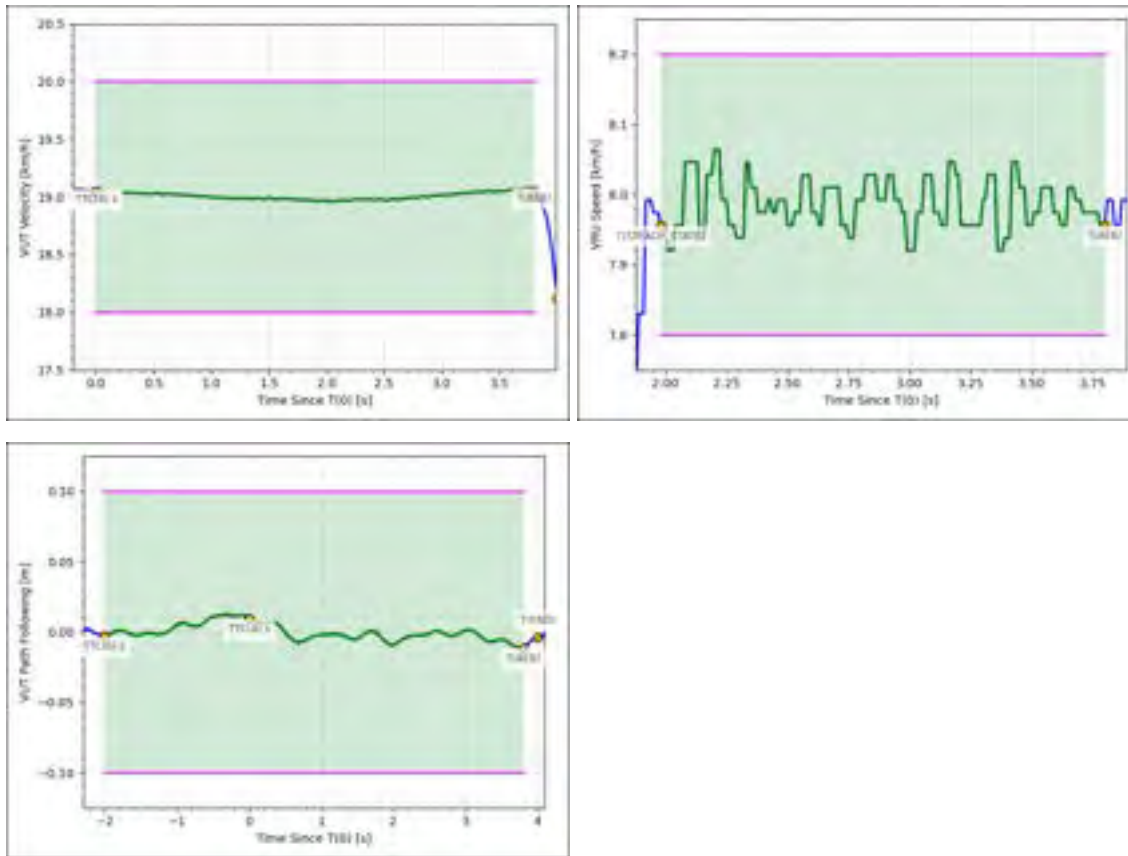
CPFA-50 8 kph (Day) | 20 km/h | Run 12

Run Date / Time 21-Dec-2022 09:23



CPFA-50 8 kph (Day) | 20 km/h | Run 13

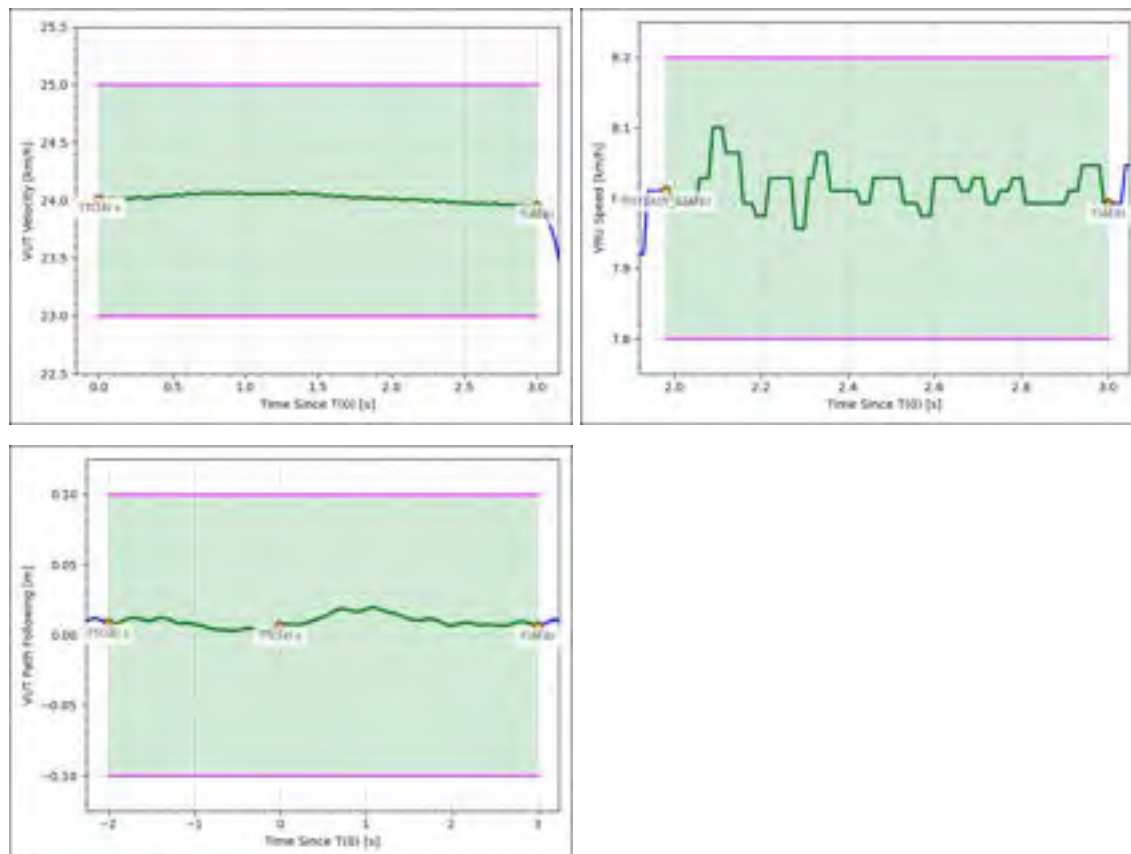
Run Date / Time 21-Dec-2022 09:29



E.1.1.1.3. CPFA-50 VUT 25kph EPT 8kph (Day)

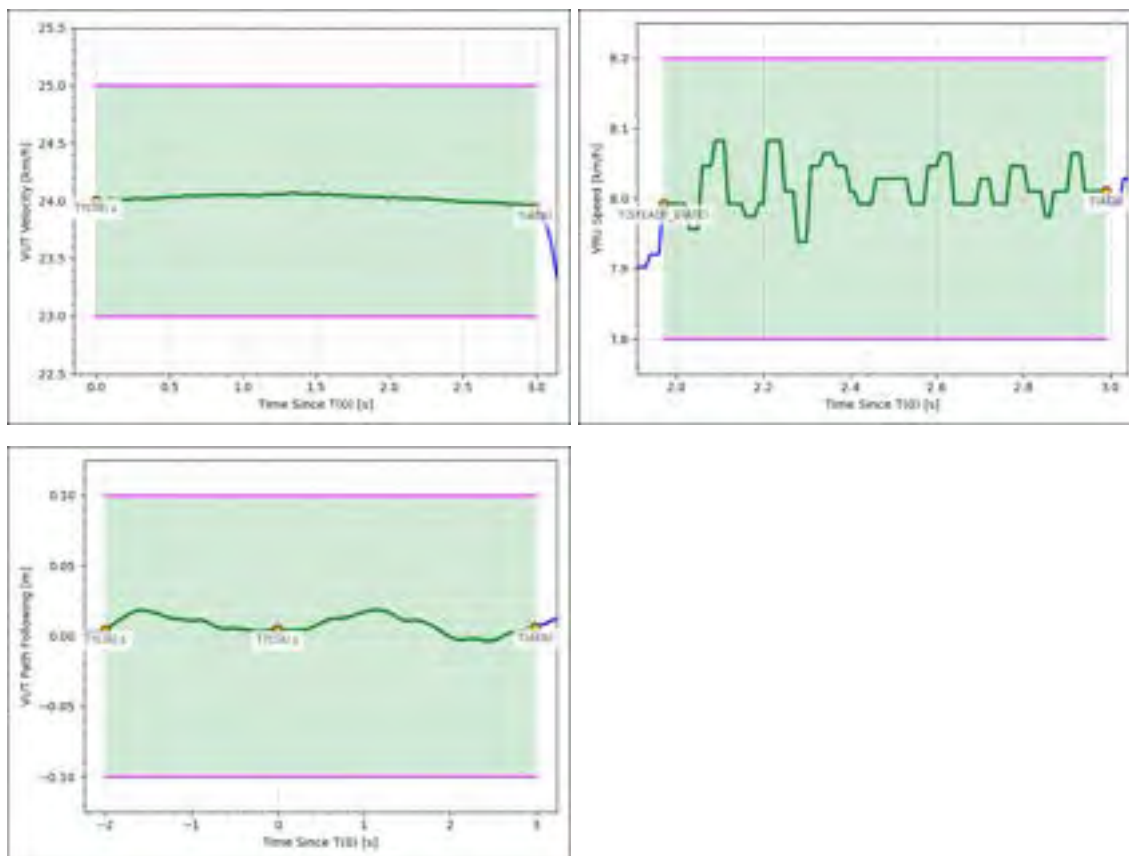
CPFA-50 8 kph (Day) | 25 km/h | Run 10

Run Date / Time 21-Dec-2022 09:36



CPFA-50 8 kph (Day) | 25 km/h | Run 11

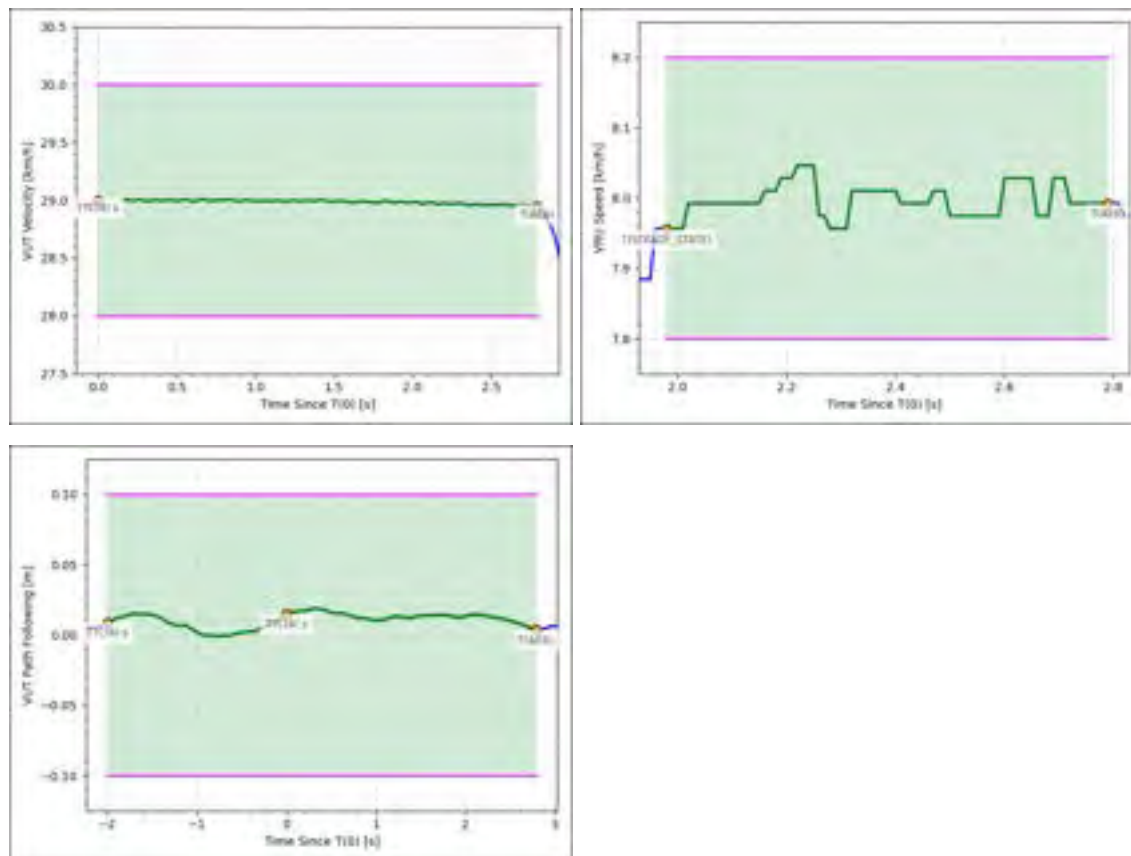
Run Date / Time 21-Dec-2022 09:38



E.1.1.4. CPFA-50 VUT 30kph EPT 8kph (Day)

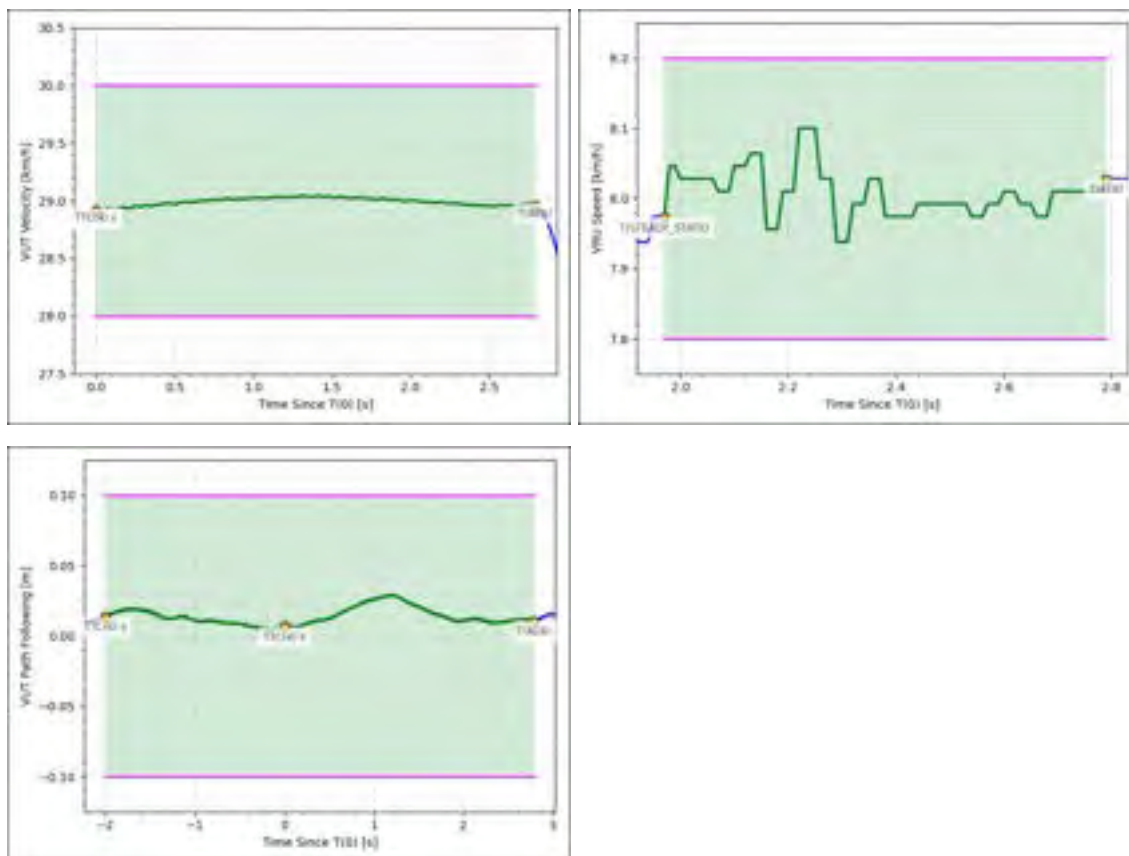
CPFA-50 8 kph (Day) | 30 km/h | Run 7

Run Date / Time 21-Dec-2022 09:41



CPFA-50 8 kph (Day) | 30 km/h | Run 8

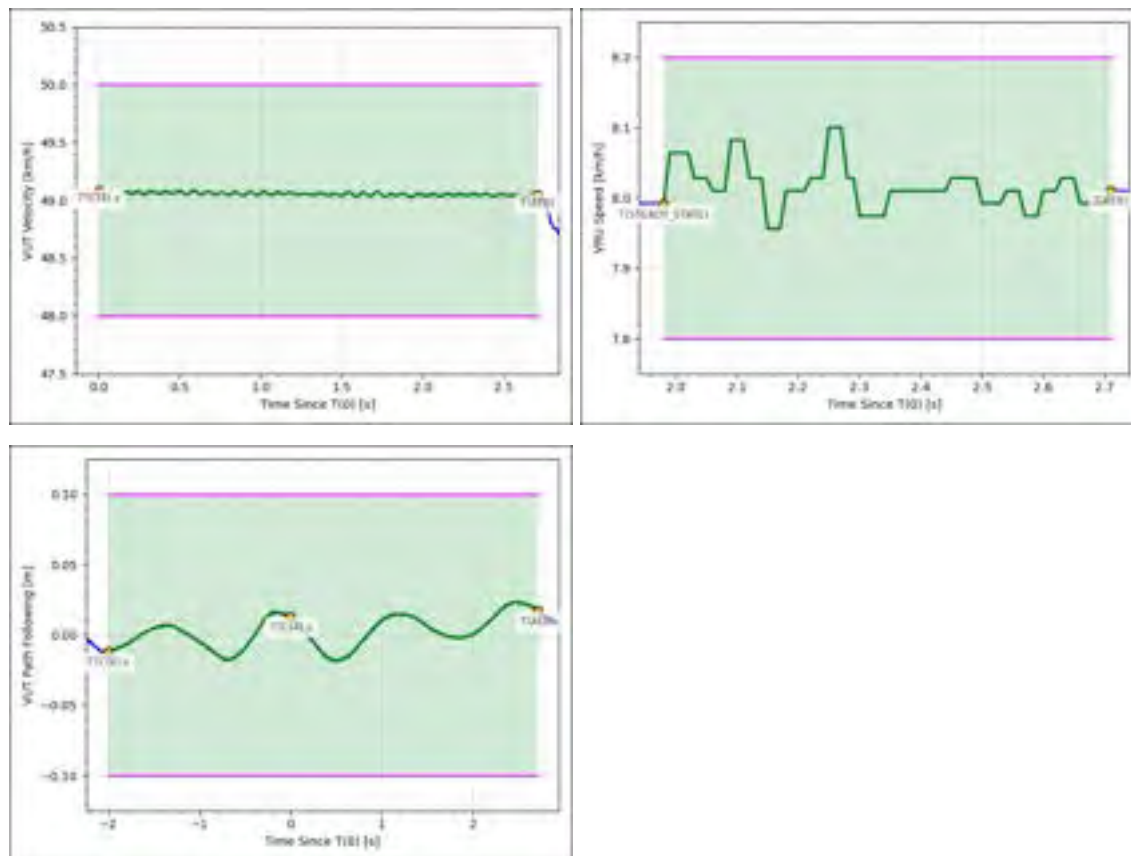
Run Date / Time 21-Dec-2022 09:44



E.1.1.1.5. CPFA-50 VUT 50kph EPT 8kph (Day)

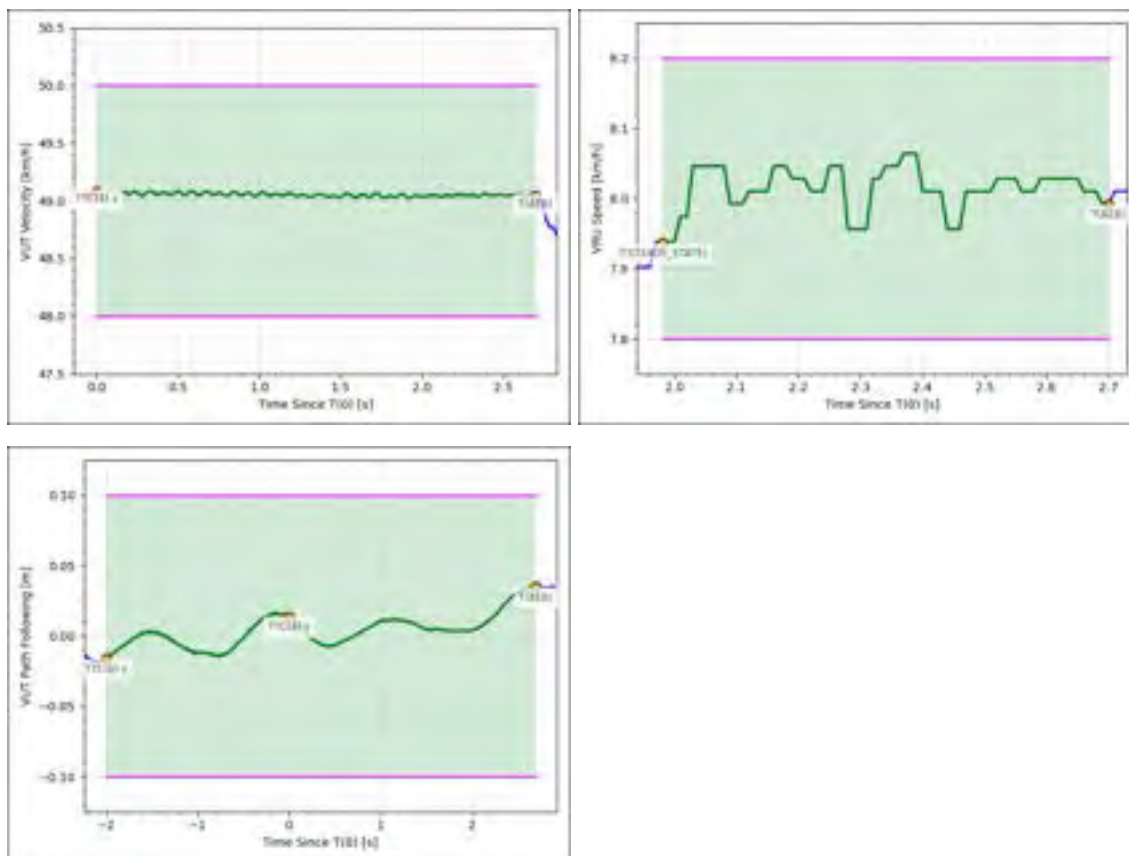
CPFA-50 8 kph (Day) | 50 km/h | Run 8

Run Date / Time 21-Dec-2022 09:46



CPFA-50 8 kph (Day) | 50 km/h | Run 9

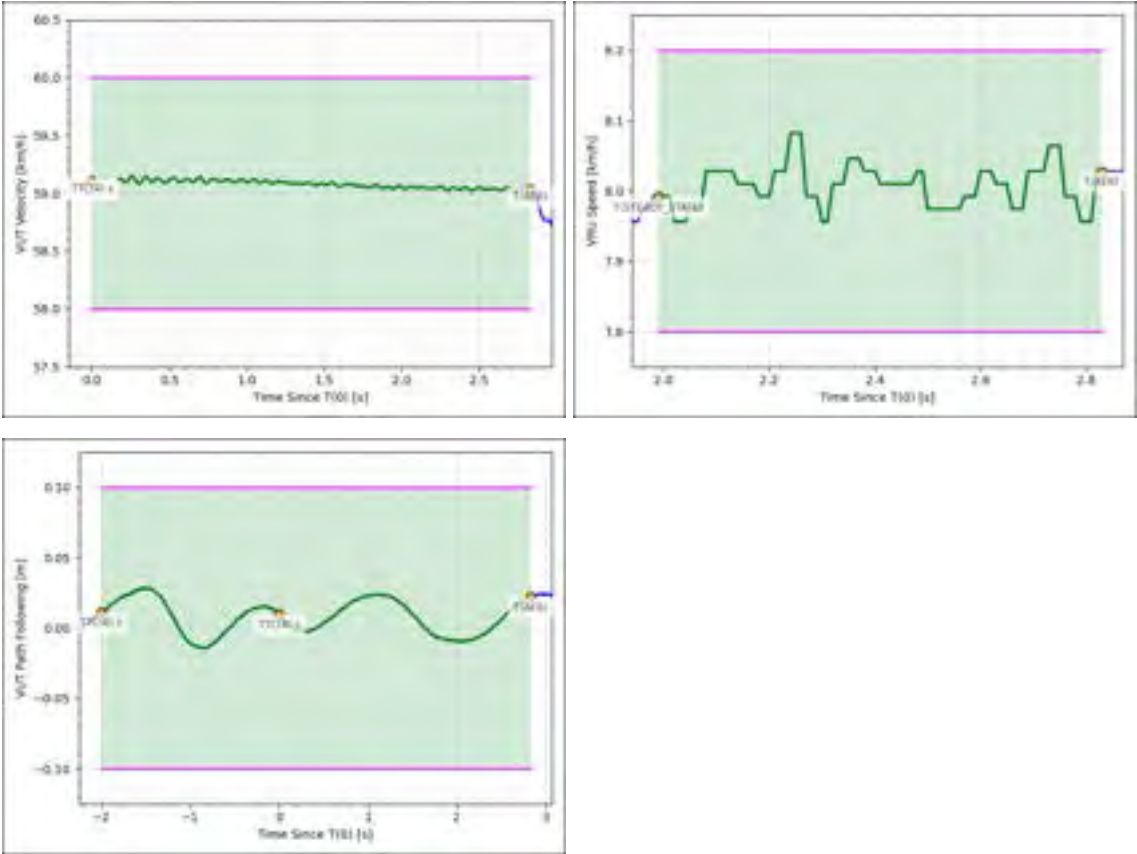
Run Date / Time 21-Dec-2022 09:48



E.1.1.6. CPFA-50 VUT 60kph EPT 8kph (Day)

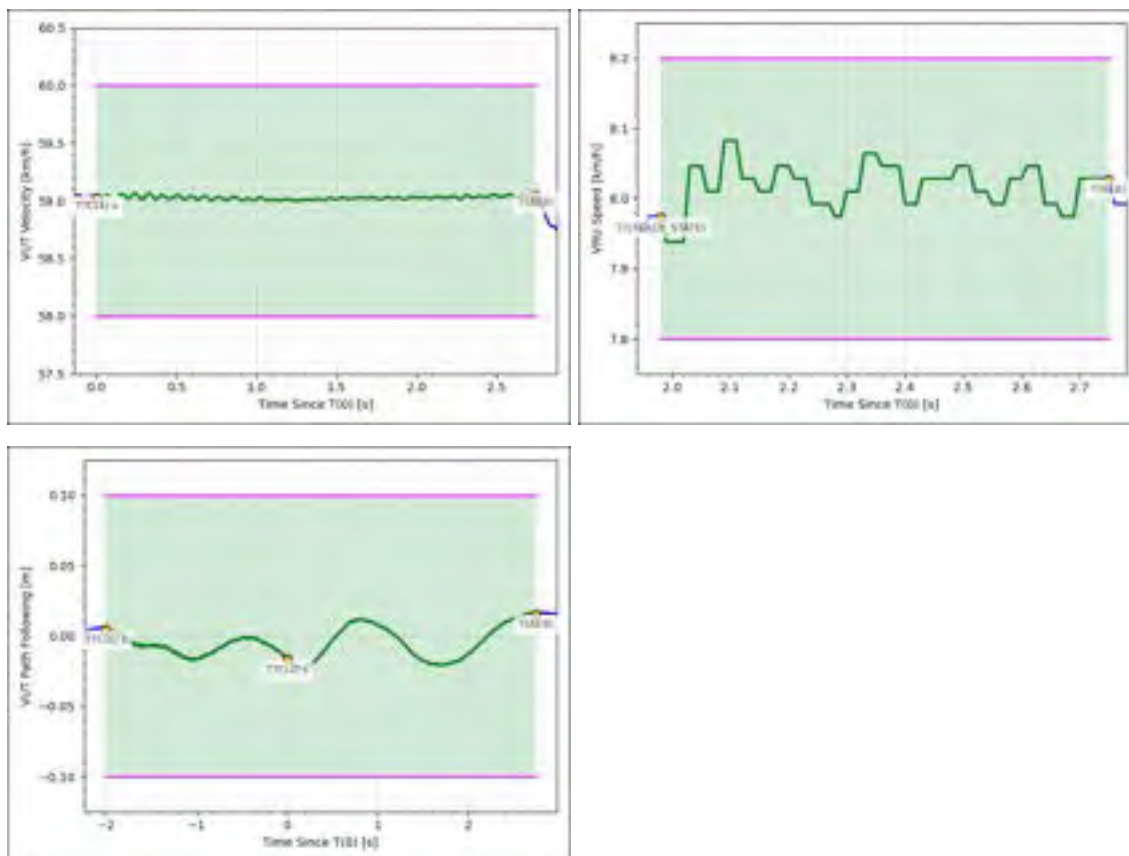
CPFA-50 8 kph (Day) | 60 km/h | Run 8

Run Date / Time 21-Dec-2022 09:53



CPFA-50 8 kph (Day) | 60 km/h | Run 9

Run Date / Time 21-Dec-2022 09:56

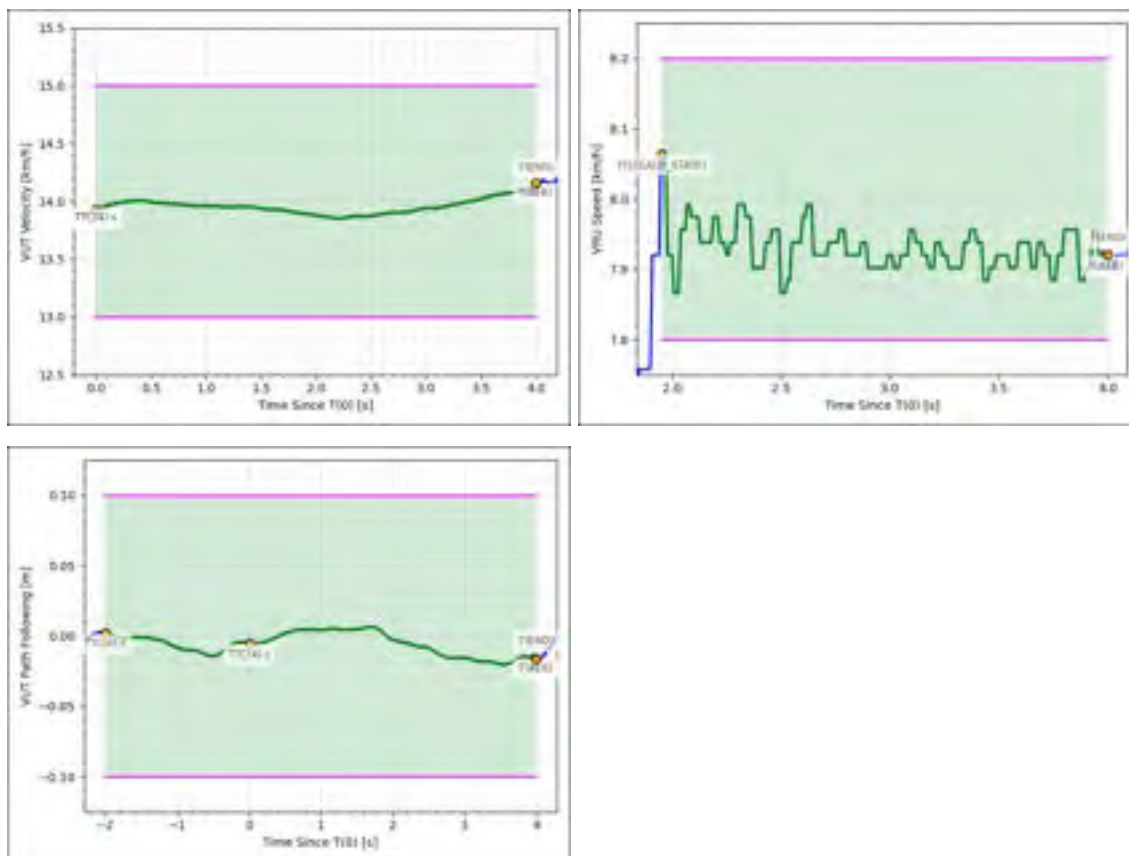


E.1.1. Lift Kit

E.1.1.1. CPFA-50 VUT 15kph EPT 8kph (Day)

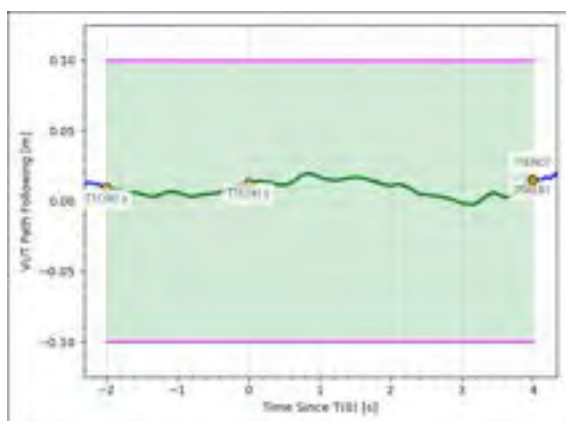
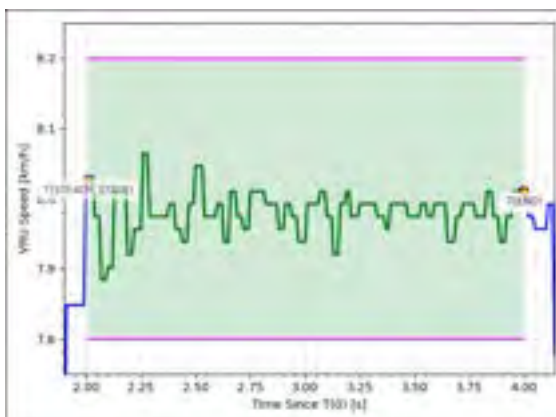
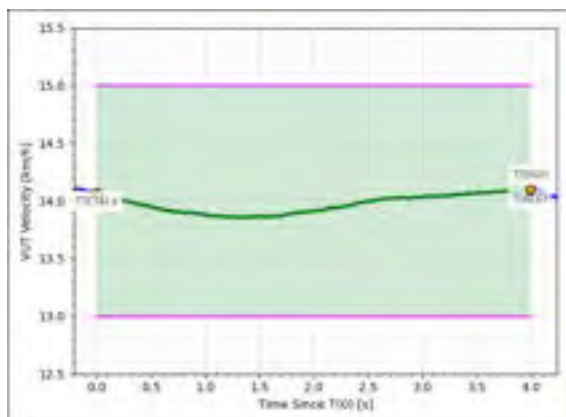
CPFA-50 8 kph (Day) | 15 km/h | Run 11

Run Date / Time 7-Mar-2023 09:10



CPFA-50 8 kph (Day) | 15 km/h | Run 12

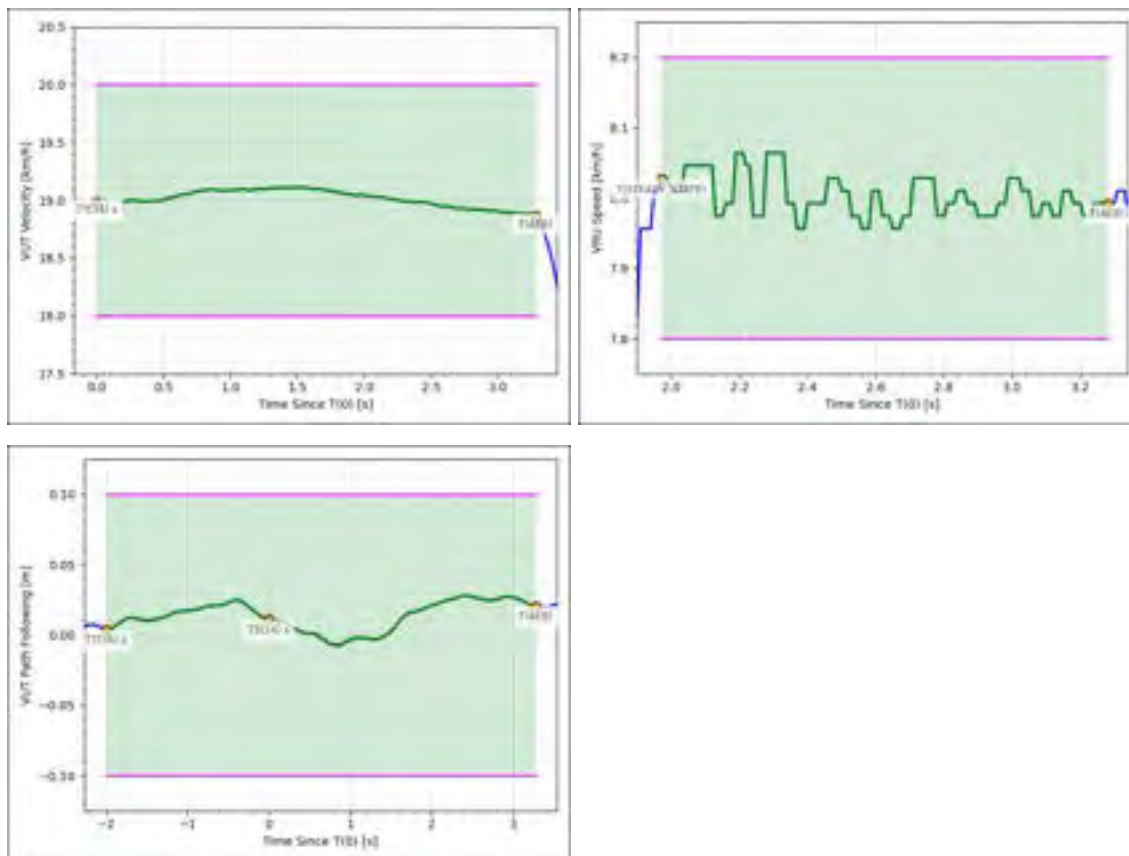
Run Date / Time 7-Mar-2023 09:19



E.1.1.2. CPFA-50 VUT 20kph EPT 8kph (Day)

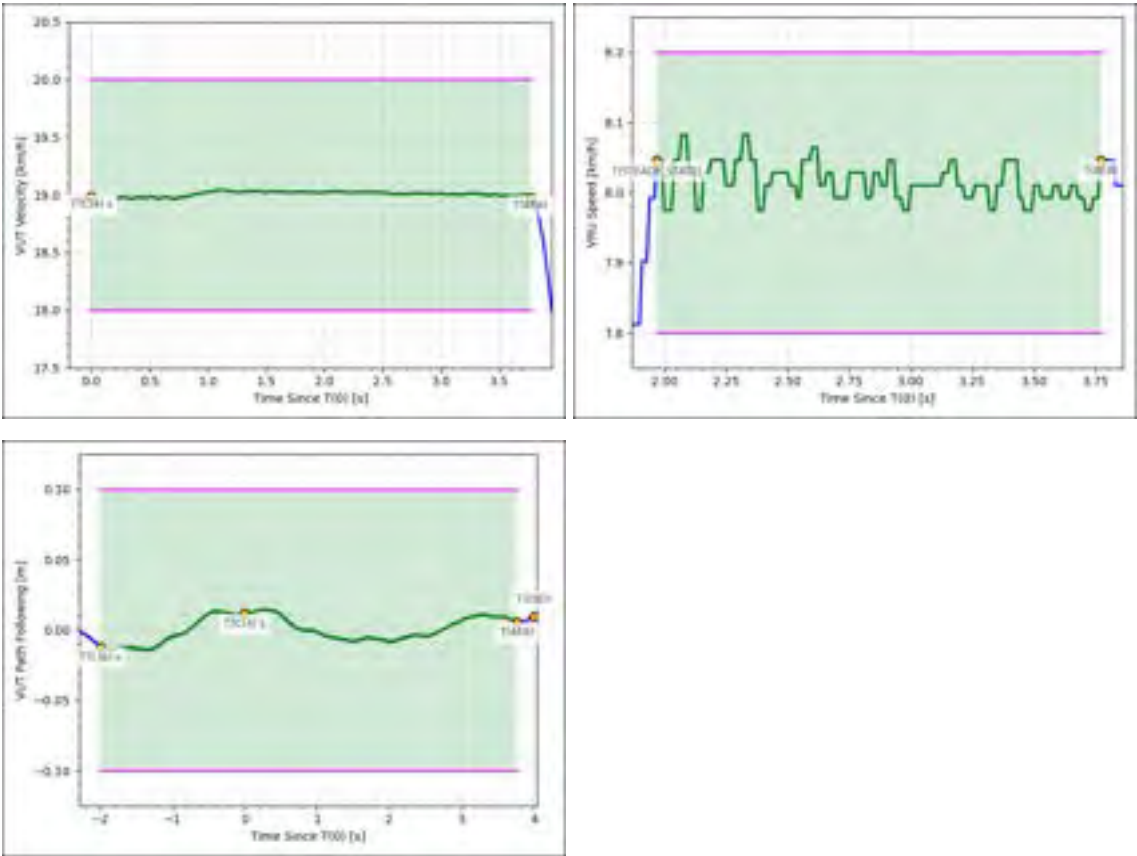
CPFA-50 8 kph (Day) | 20 km/h | Run 14

Run Date / Time 7-Mar-2023 09:26



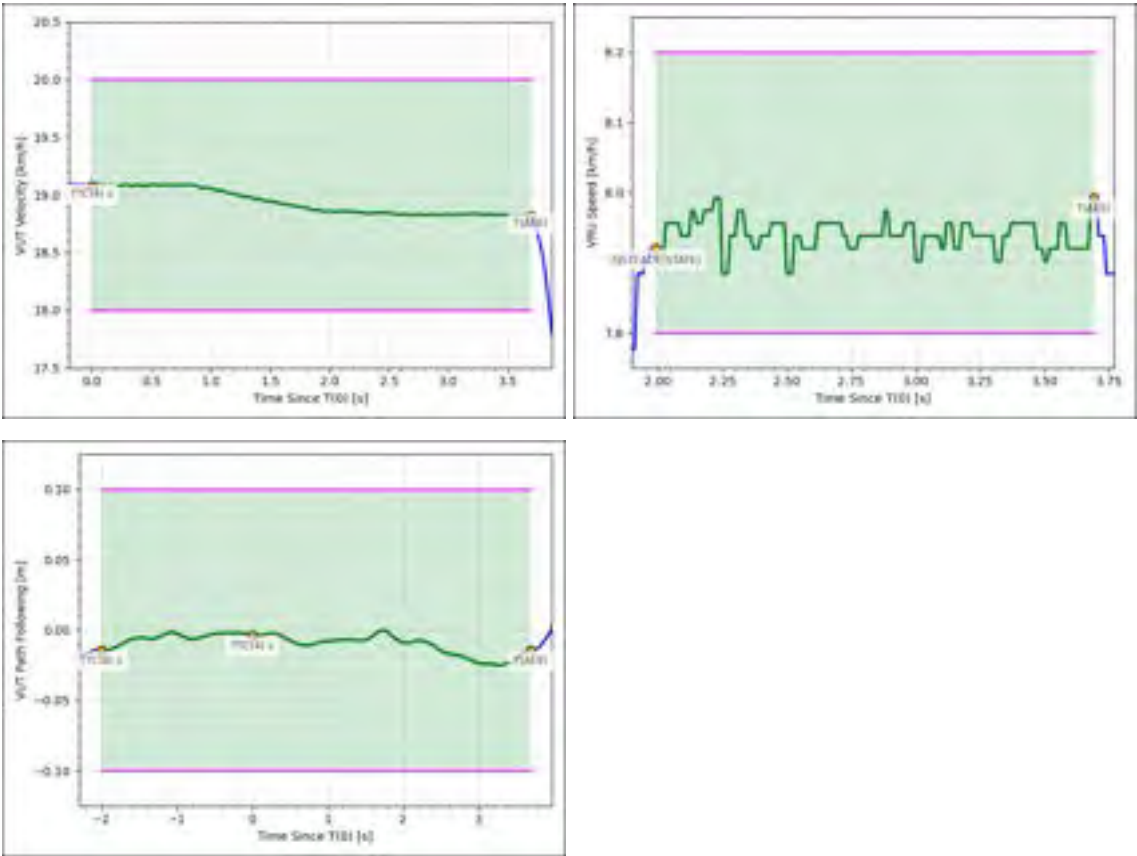
CPFA-50 8 kph (Day) | 20 km/h | Run 15

Run Date / Time 7-Mar-2023 09:30



CPFA-50 8 kph (Day) | 20 km/h | Run 16

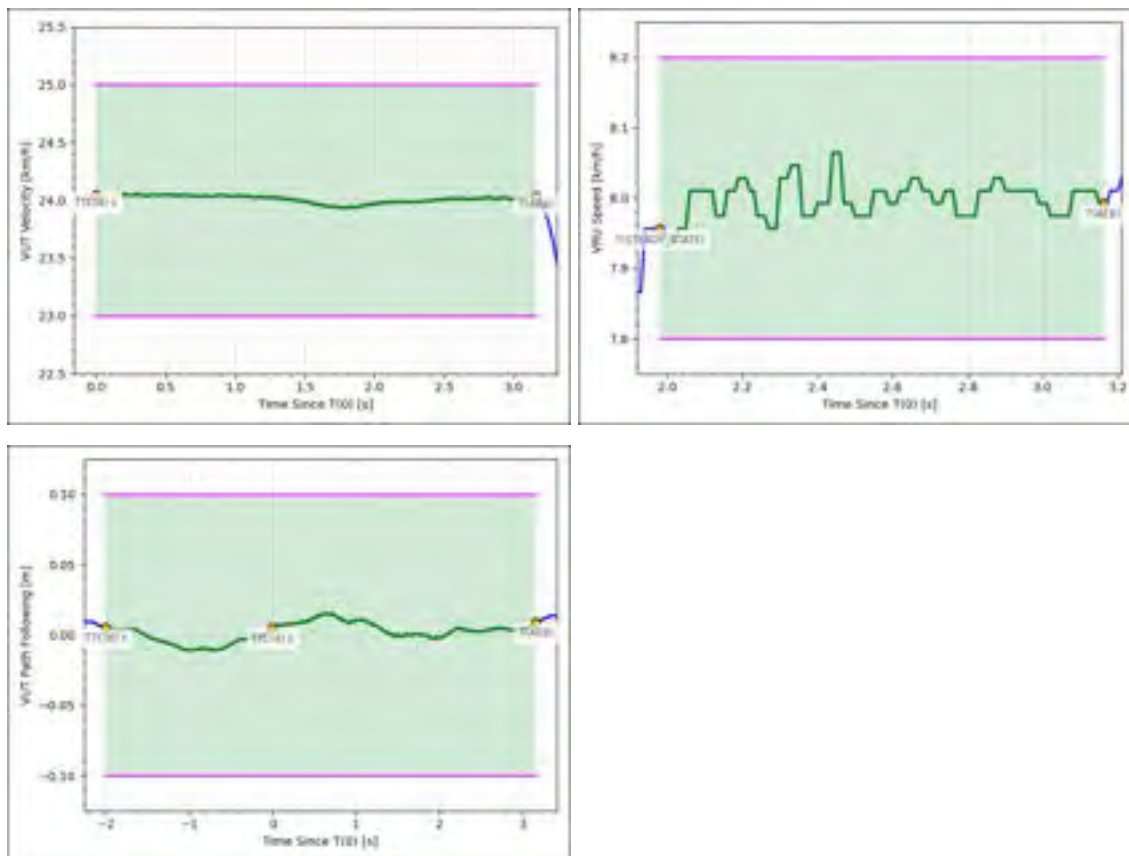
Run Date / Time 7-Mar-2023 09:37



E.1.1.3. CPFA-50 VUT 25kph EPT 8kph (Day)

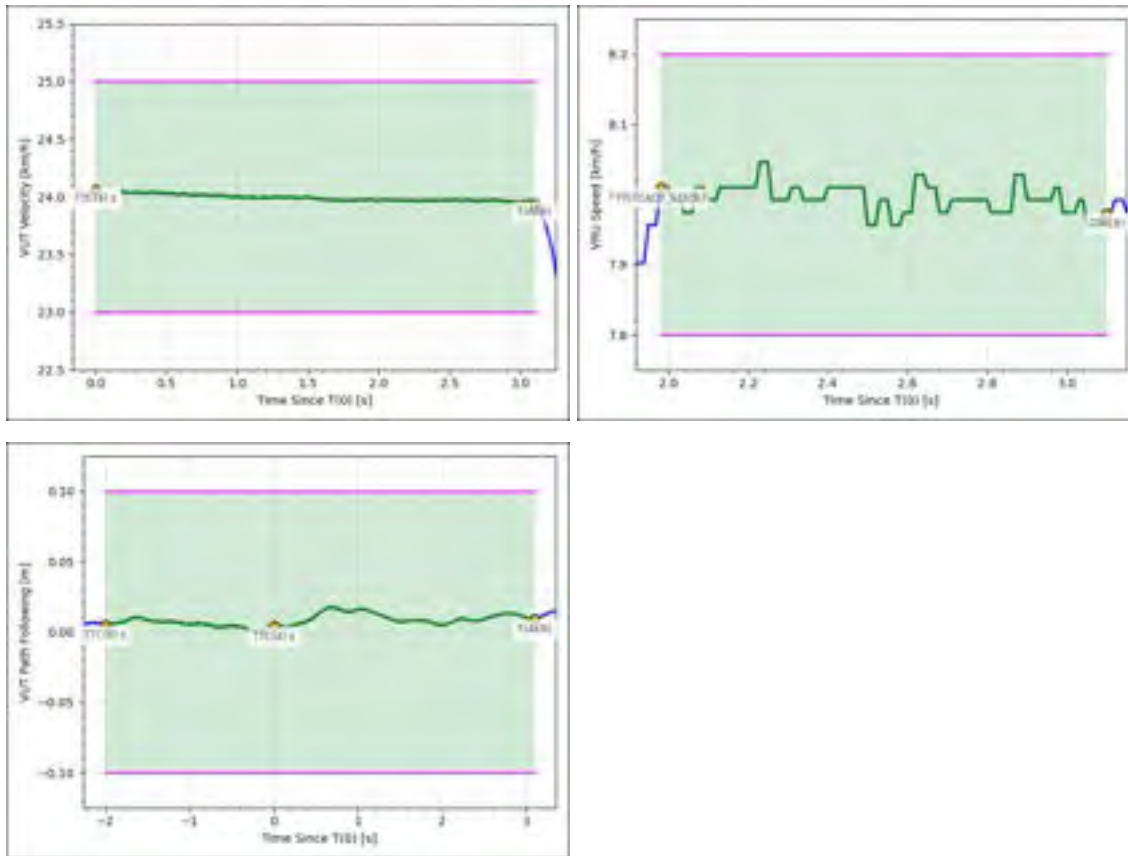
CPFA-50 8 kph (Day) | 25 km/h | Run 12

Run Date / Time 7-Mar-2023 09:42



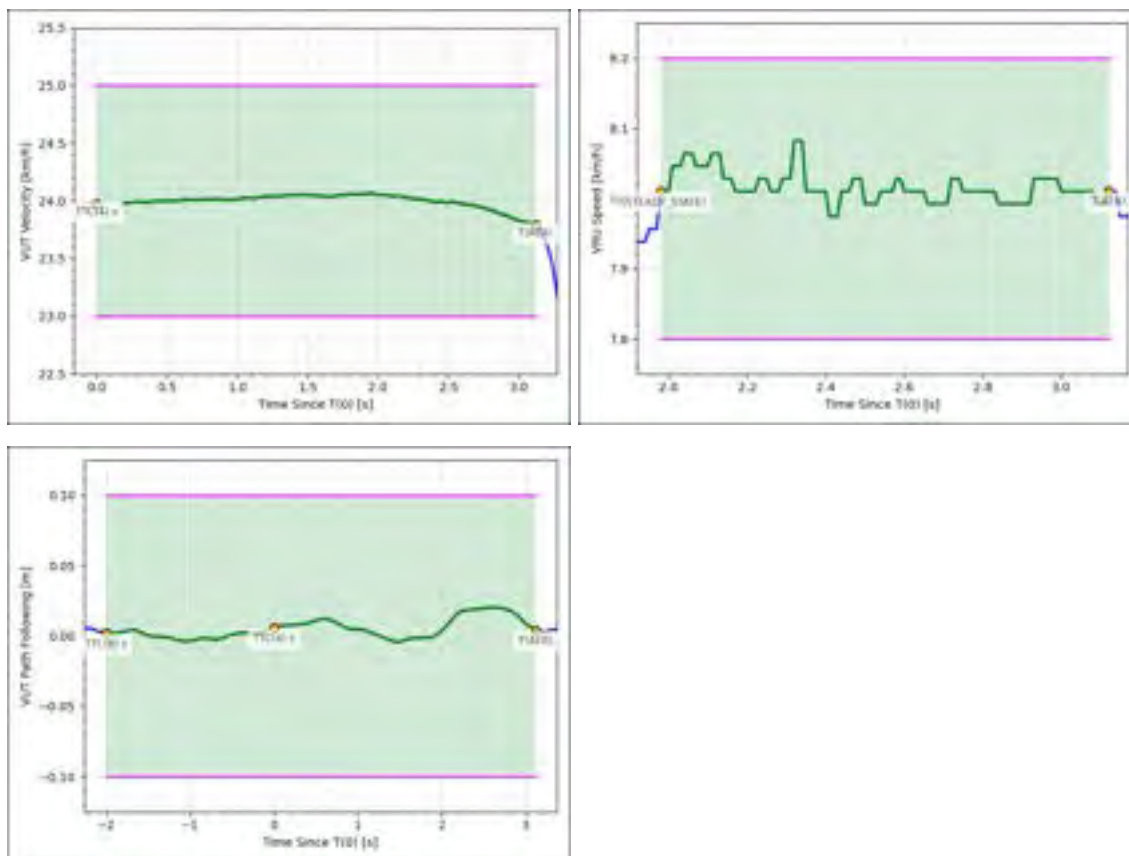
CPFA-50 8 kph (Day) | 25 km/h | Run 13

Run Date / Time 7-Mar-2023 09:46



CPFA-50 8 kph (Day) | 25 km/h | Run 14

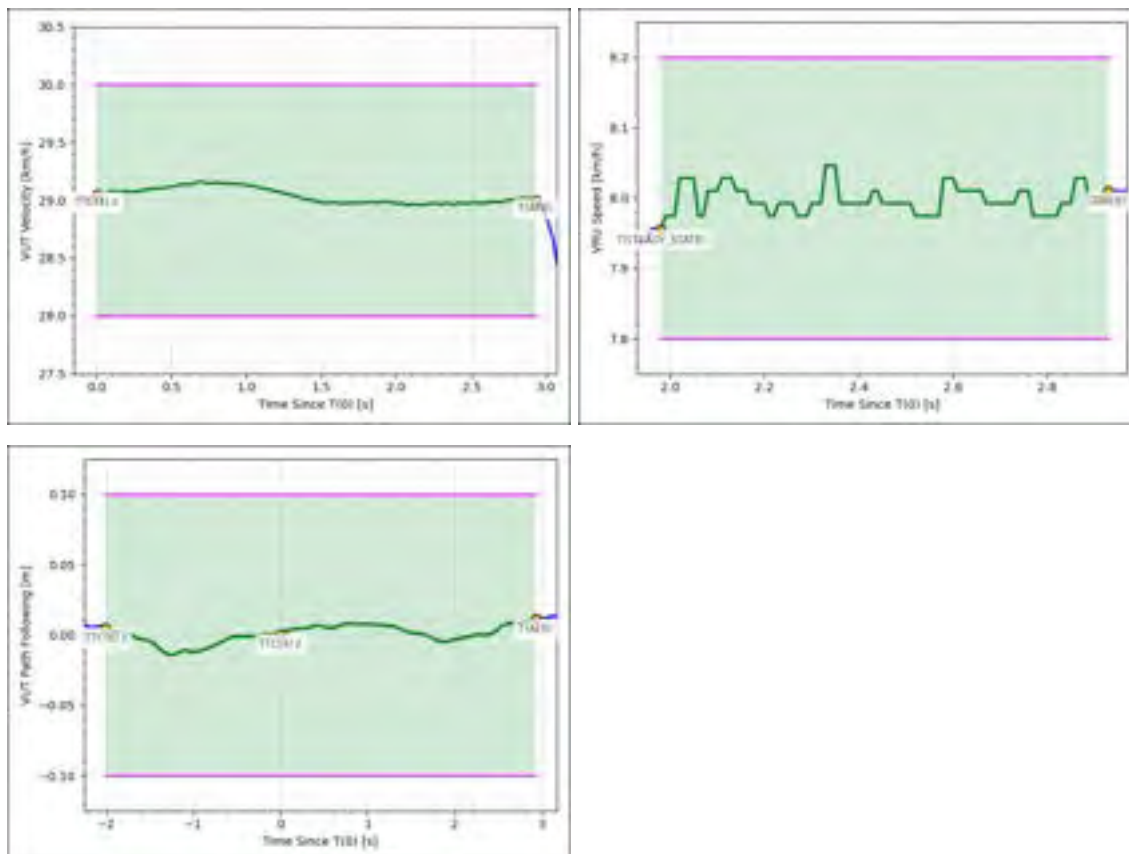
Run Date / Time 7-Mar-2023 09:50



E.1.1.4. CPFA-50 VUT 30kph EPT 8kph (Day)

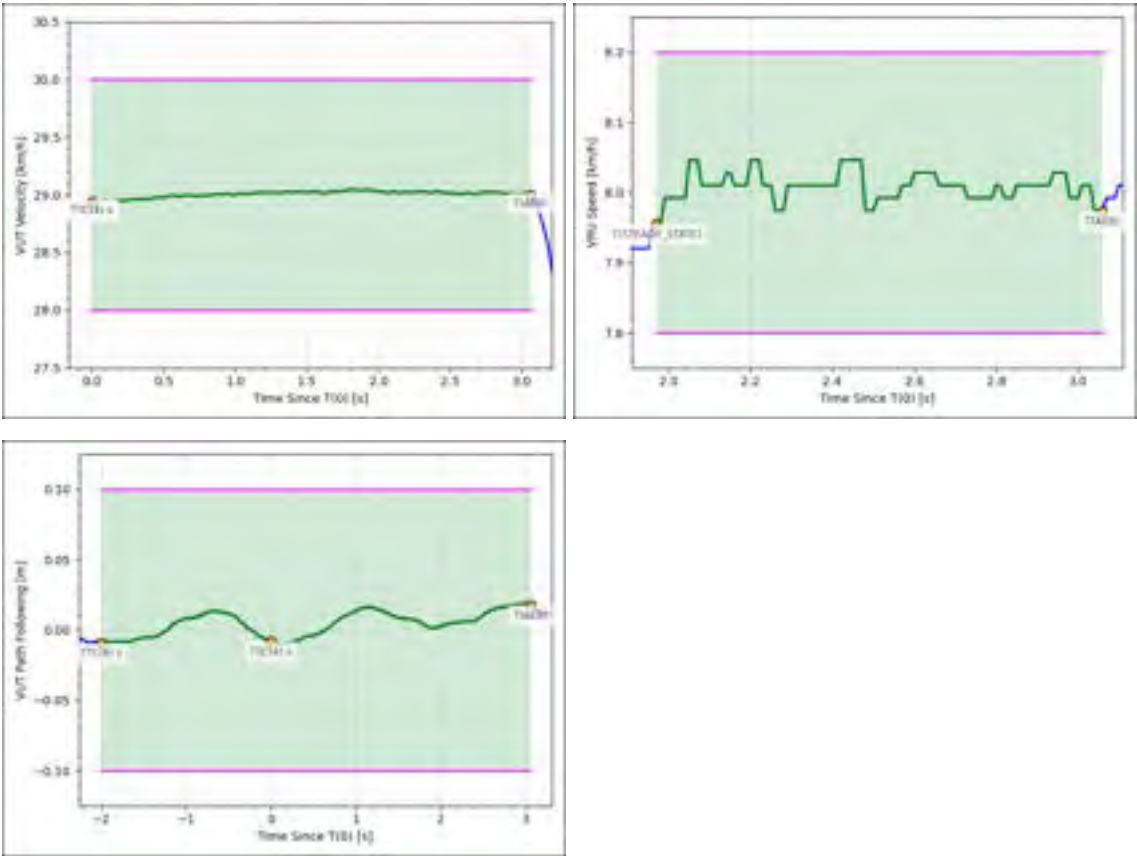
CPFA-50 8 kph (Day) | 30 km/h | Run 9

Run Date / Time 7-Mar-2023 09:53



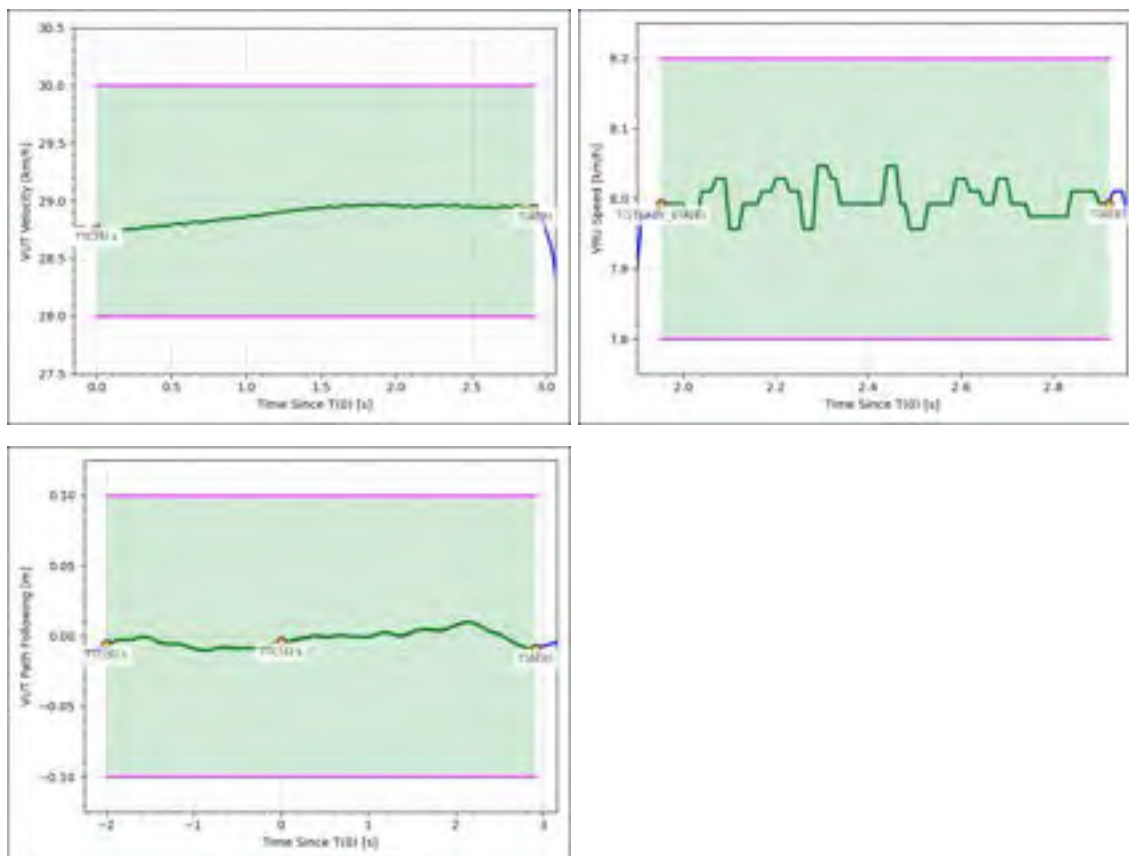
CPFA-50 8 kph (Day) | 30 km/h | Run 10

Run Date / Time 7-Mar-2023 09:56



CPFA-50 8 kph (Day) | 30 km/h | Run 11

Run Date / Time 7-Mar-2023 09:59

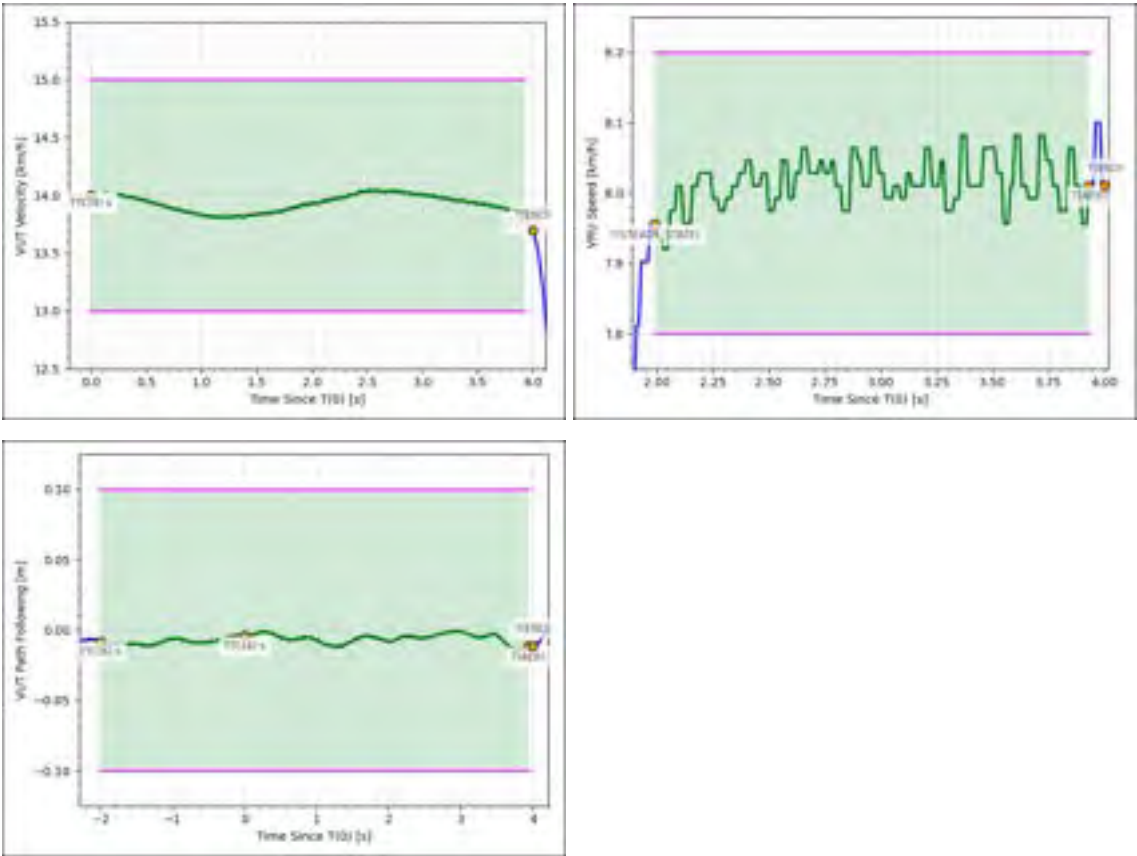


E.1.1. Lift Kit + Bullbar

E.1.1.1. CPFA-50 VUT 15kph EPT 8kph (Day)

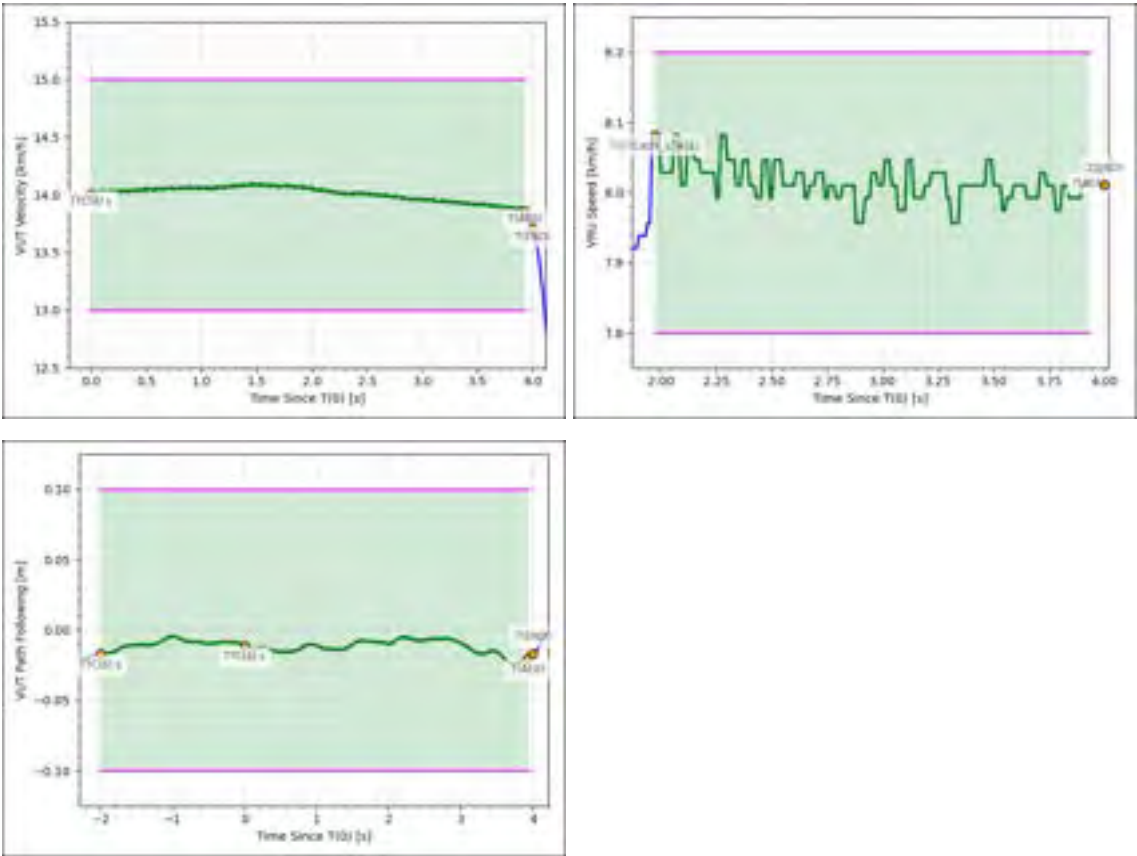
CPFA-50 8 kph (Day) | 15 km/h | Run 1

Run Date / Time 20-Mar-2023 10:06



CPFA-50 8 kph (Day) | 15 km/h | Run 2

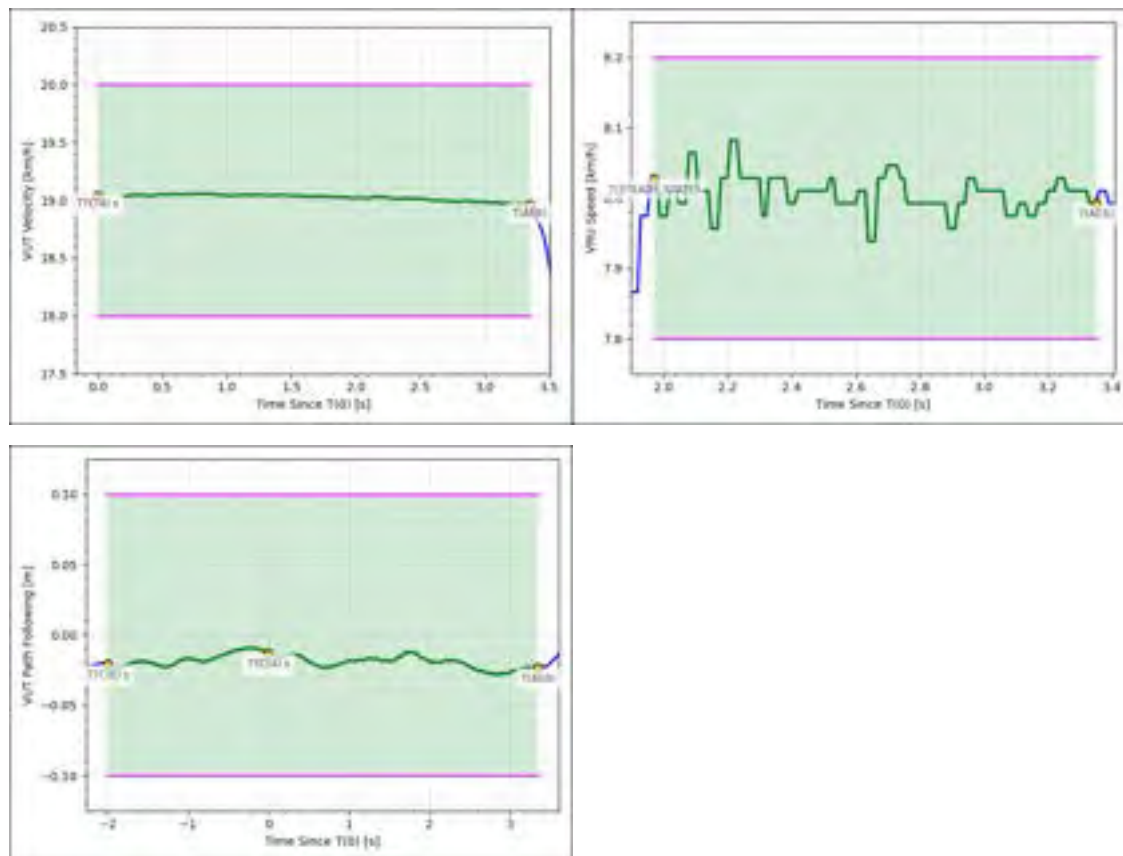
Run Date / Time 20-Mar-2023 10:16



E.1.1.2. CPFA-50 VUT 20kph EPT 8kph (Day)

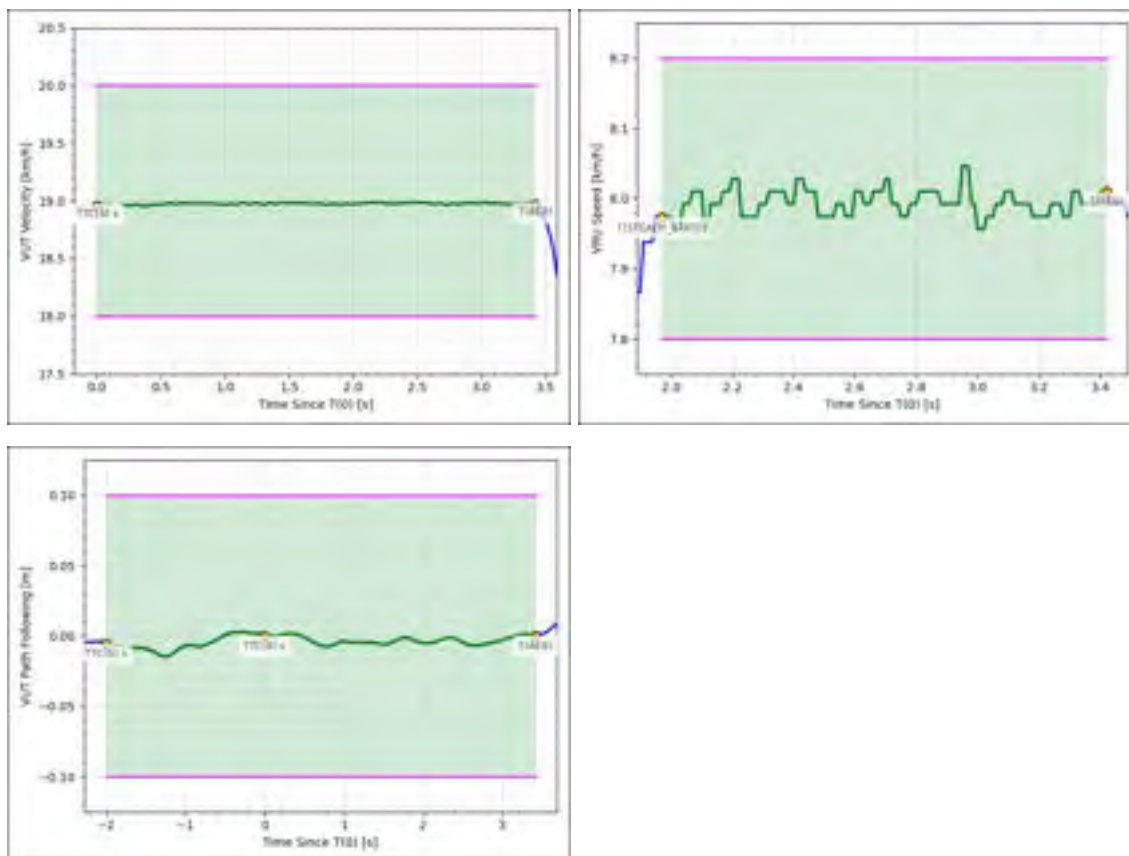
CPFA-50 8 kph (Day) | 20 km/h | Run 1

Run Date / Time 20-Mar-2023 10:23



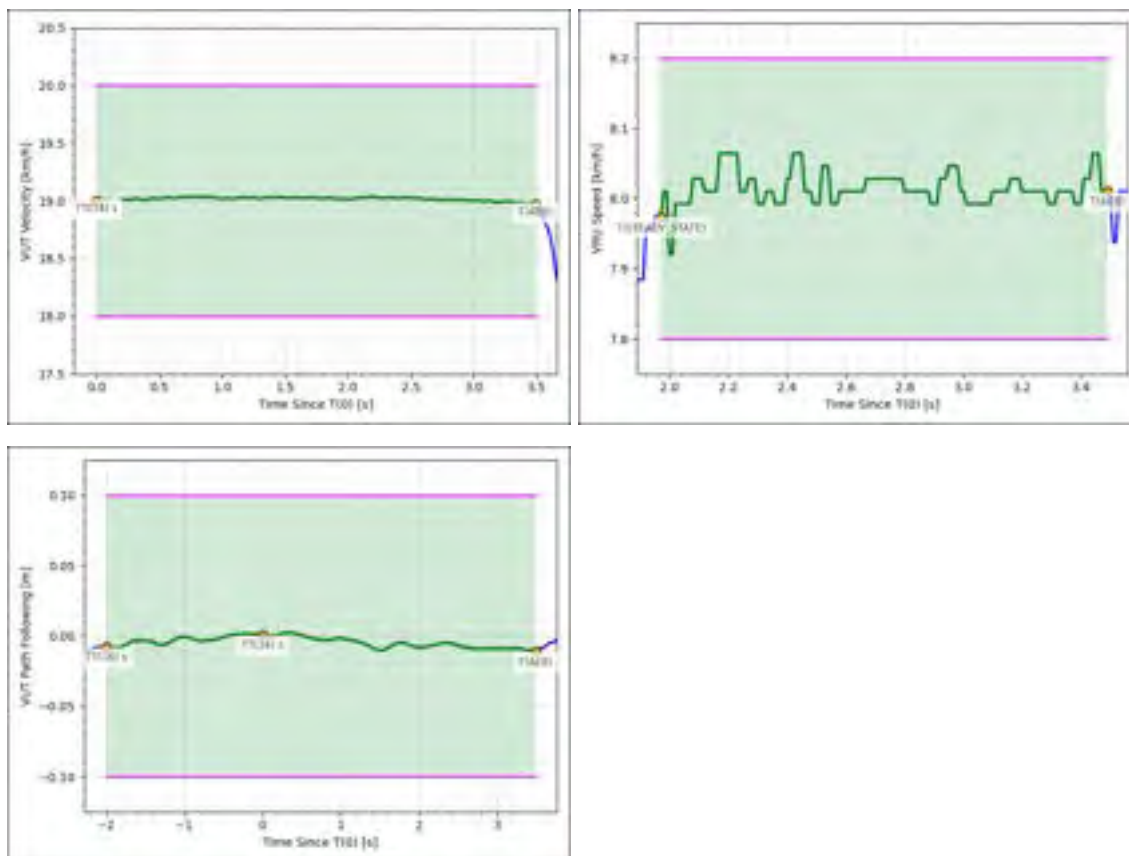
CPFA-50 8 kph (Day) | 20 km/h | Run 2

Run Date / Time 20-Mar-2023 10:28



CPFA-50 8 kph (Day) | 20 km/h | Run 3

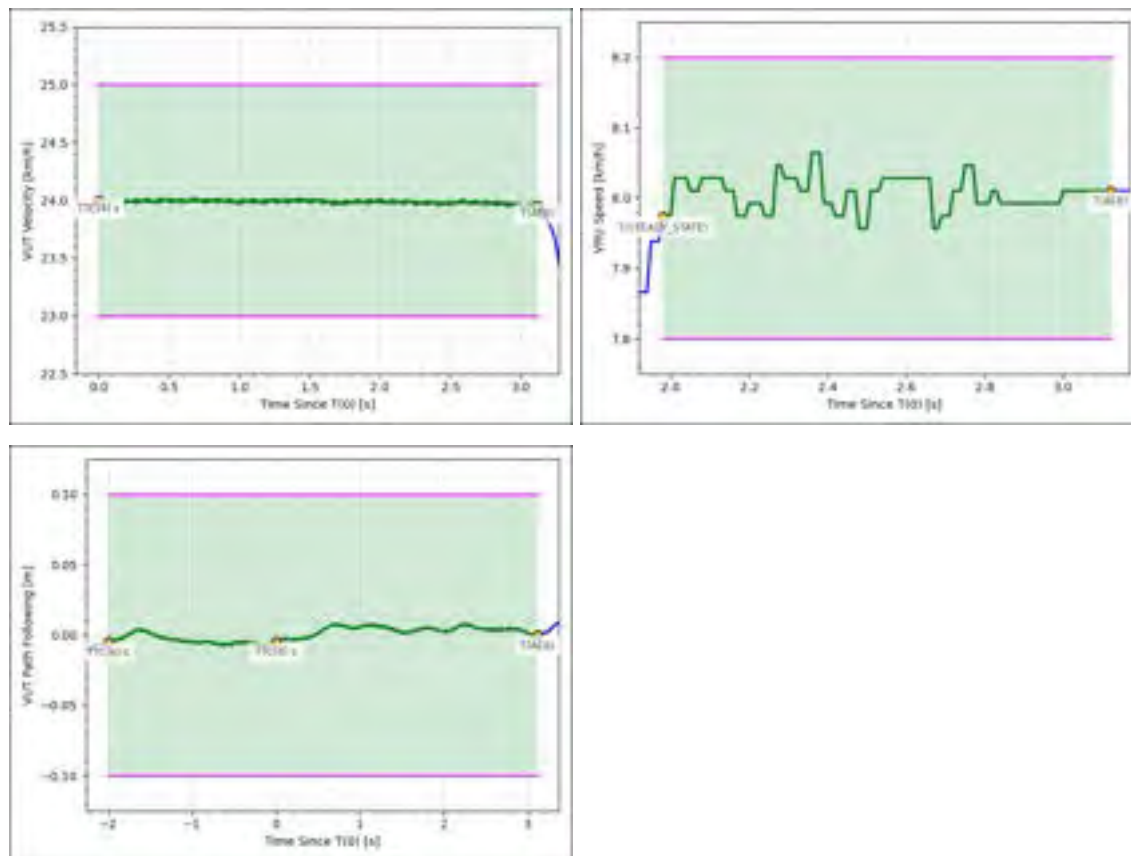
Run Date / Time 20-Mar-2023 10:34



E.1.1.1.3. CPFA-50 VUT 25kph EPT 8kph (Day)

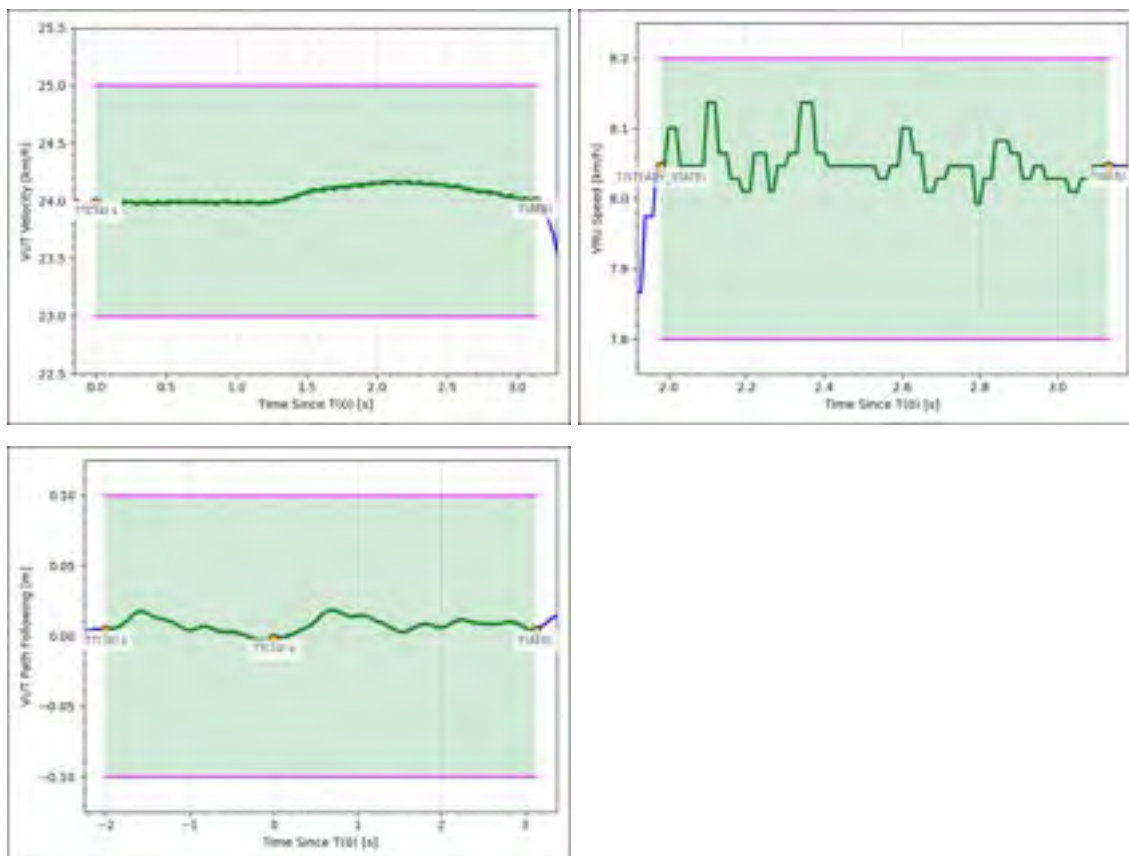
CPFA-50 8 kph (Day) | 25 km/h | Run 1

Run Date / Time 20-Mar-2023 10:41



CPFA-50 8 kph (Day) | 25 km/h | Run 2

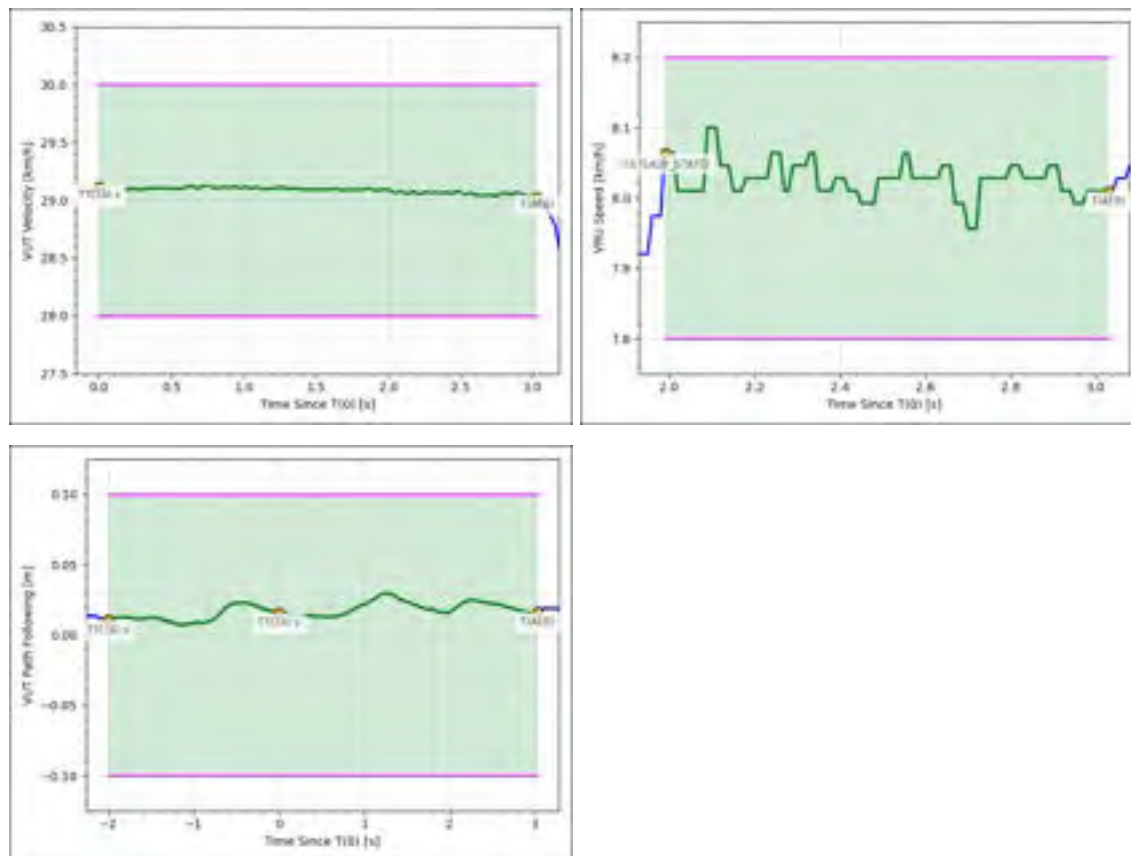
Run Date / Time 20-Mar-2023 10:45



E.1.1.4. CPFA-50 VUT 30kph EPT 8kph (Day)

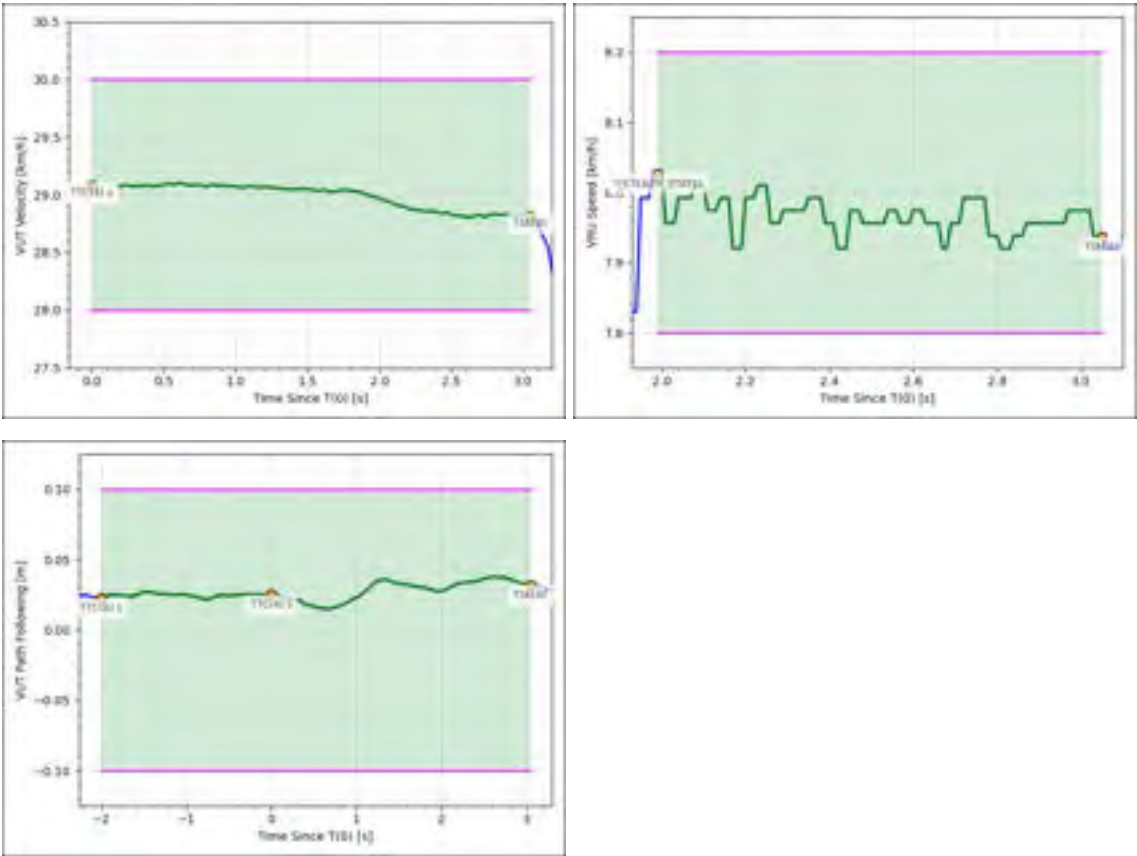
CPFA-50 8 kph (Day) | 30 km/h | Run 1

Run Date / Time 20-Mar-2023 10:48



CPFA-50 8 kph (Day) | 30 km/h | Run 2

Run Date / Time 20-Mar-2023 10:52

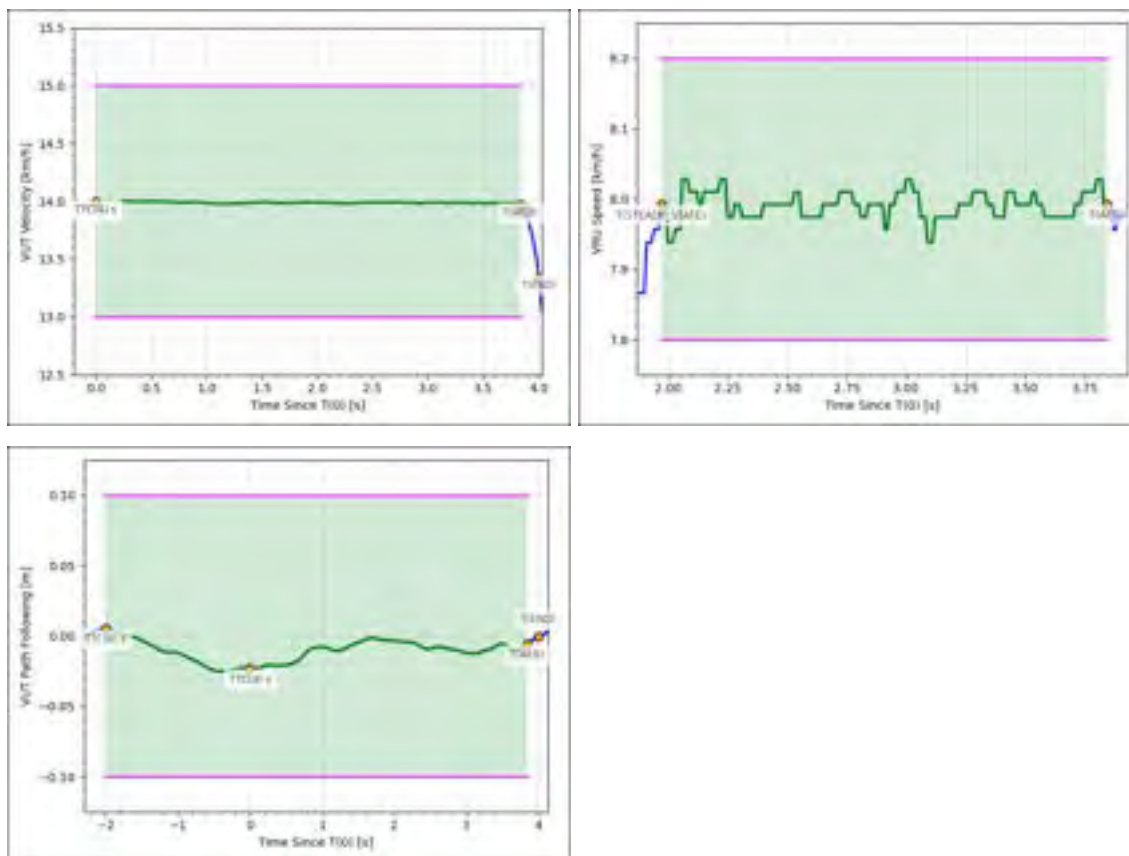


E.1.1. Bullbar

E.1.1.1. CPFA-50 VUT 15kph EPT 8kph (Day)

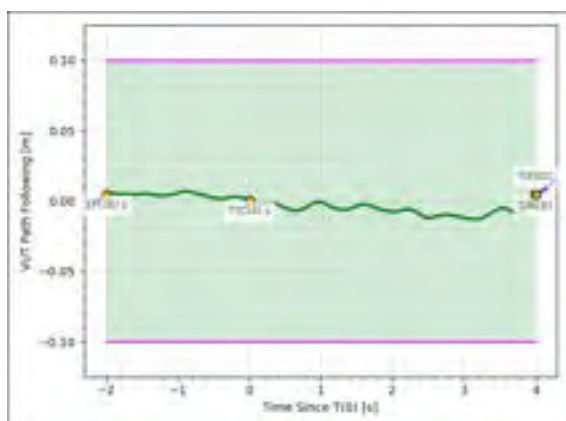
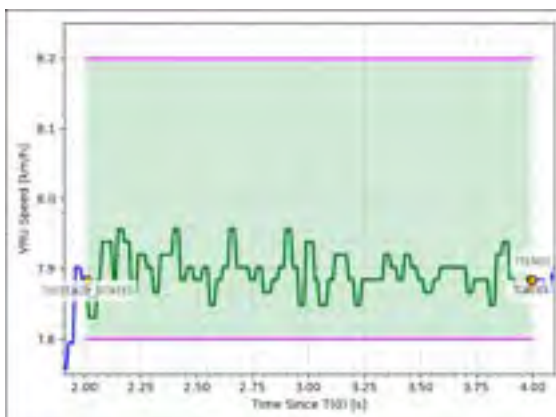
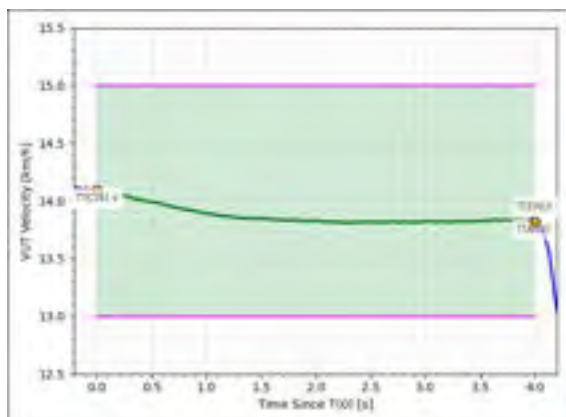
CPFA-50 8 kph (Day) | 15 km/h | Run 3

Run Date / Time 4-Apr-2023 09:16



CPFA-50 8 kph (Day) | 15 km/h | Run 4

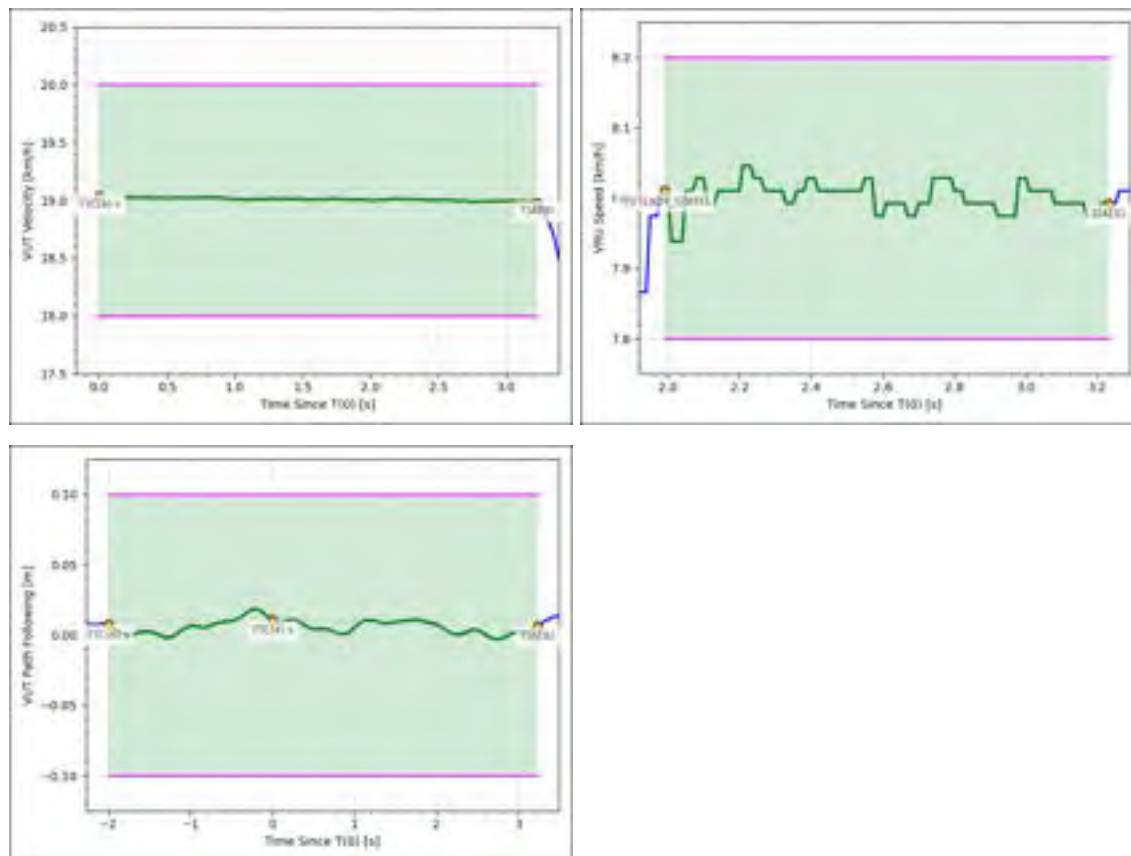
Run Date / Time 4-Apr-2023 09:22



E.1.1.1.2. CPFA-50 VUT 20kph EPT 8kph (Day)

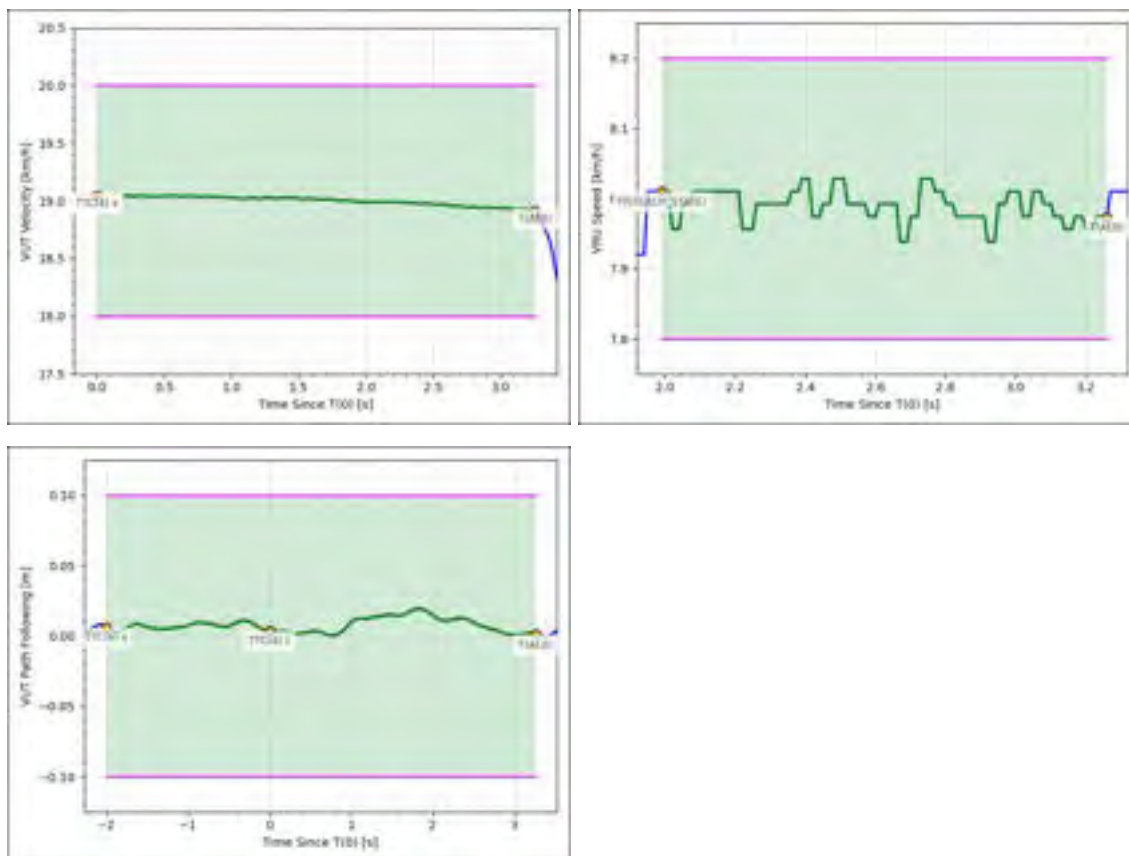
CPFA-50 8 kph (Day) | 20 km/h | Run 4

Run Date / Time 4-Apr-2023 09:11



CPFA-50 8 kph (Day) | 20 km/h | Run 5

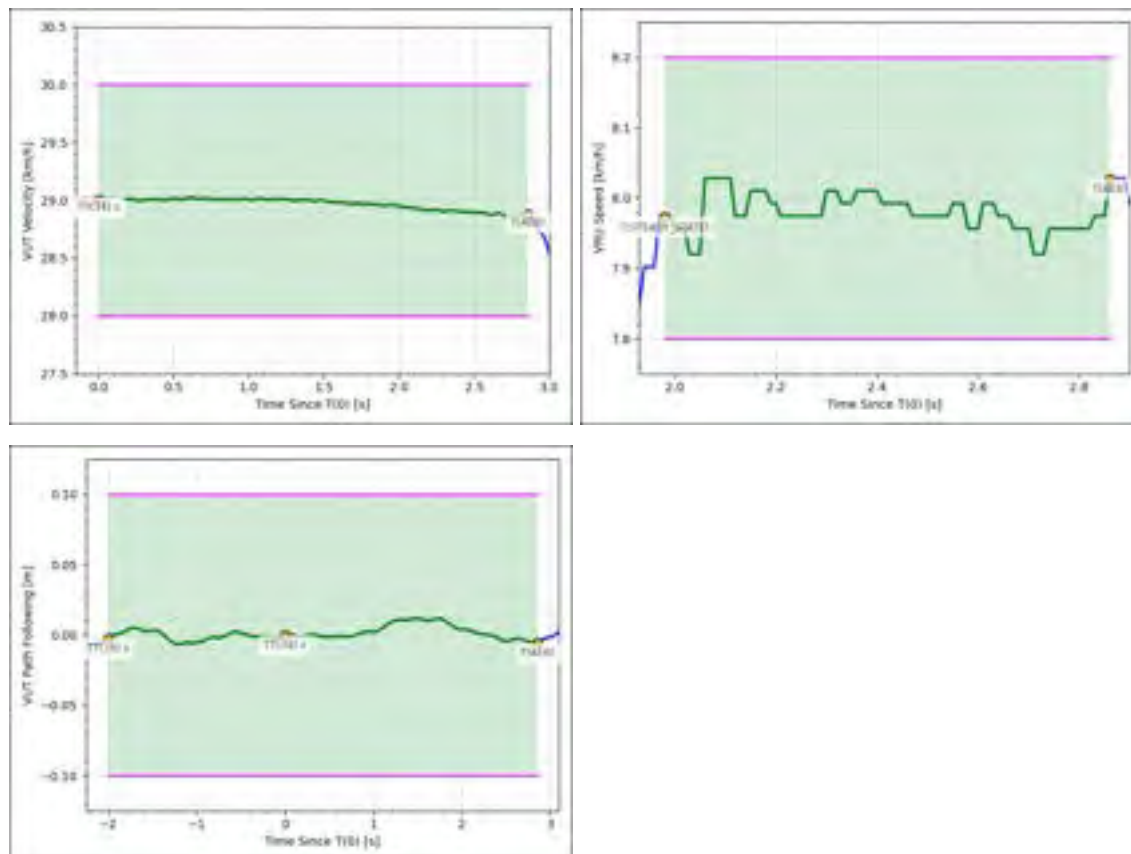
Run Date / Time 4-Apr-2023 09:13



E.1.1.3. CPFA-50 VUT 30kph EPT 8kph (Day)

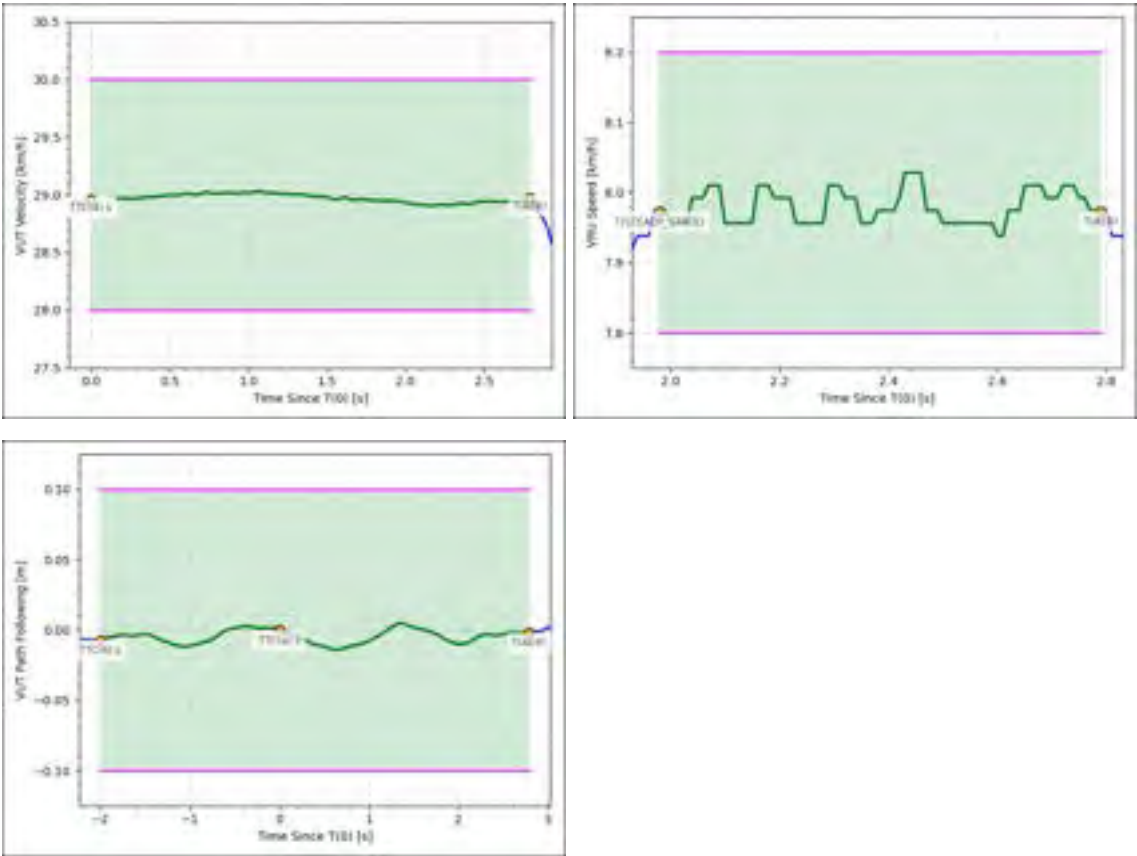
CPFA-50 8 kph (Day) | 30 km/h | Run 3

Run Date / Time 4-Apr-2023 09:05



CPFA-50 8 kph (Day) | 30 km/h | Run 4

Run Date / Time 4-Apr-2023 09:07



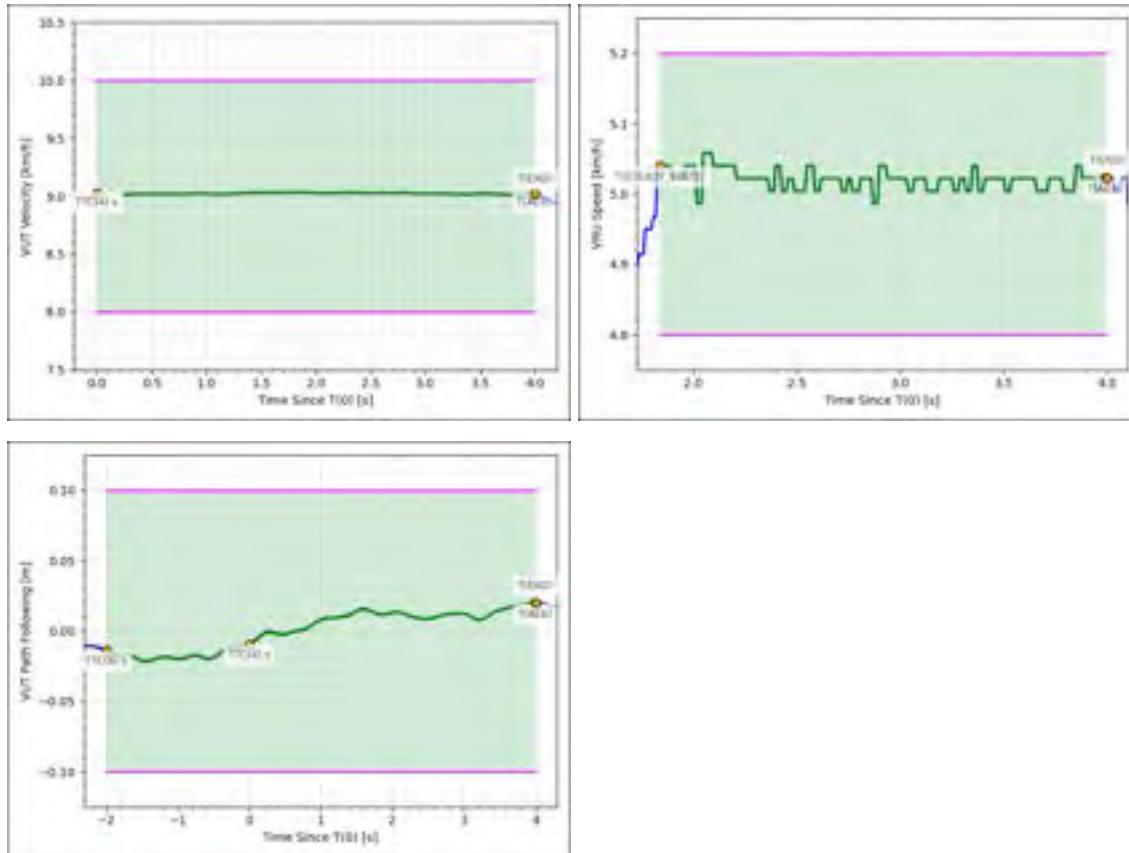
E.2. Car-to-Pedestrian Nearside Child 50% (Day)

E.2.1. Baseline

E.2.1.1. CPNC-50 VUT 10kph EPT 5kph (Day)

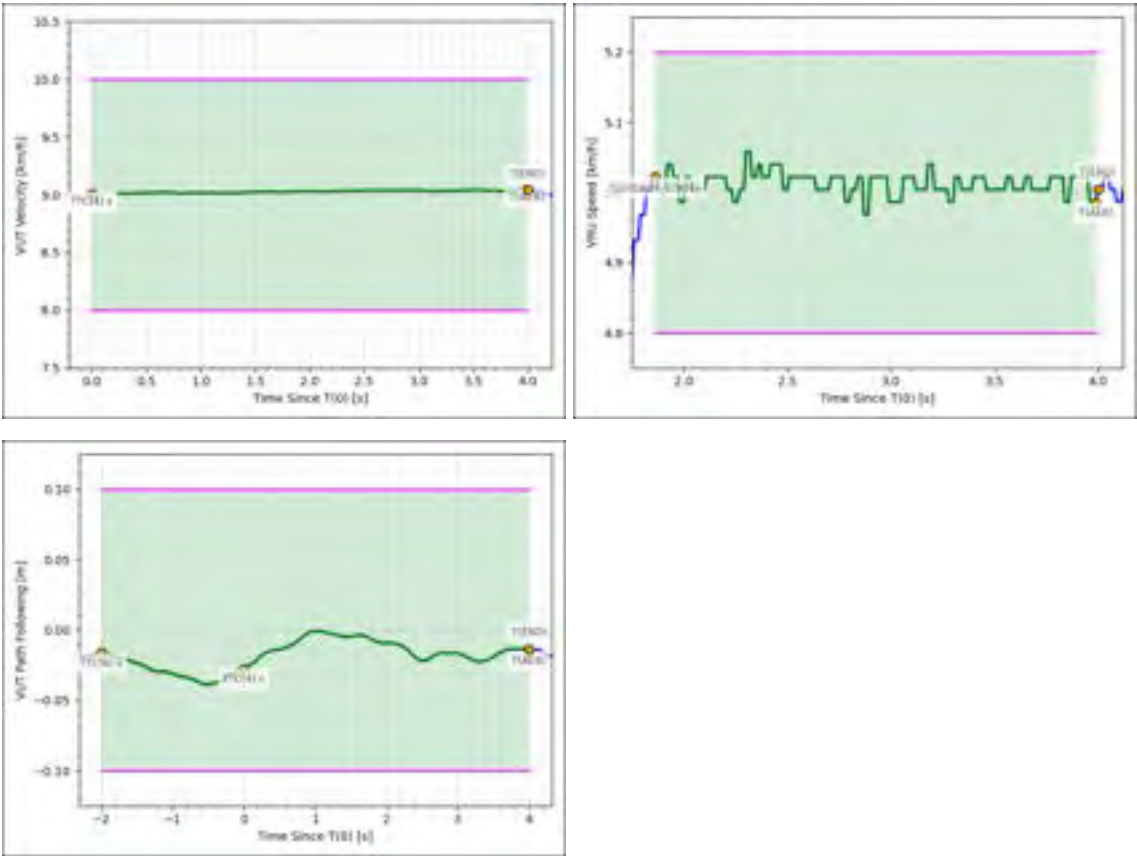
CPNC-50 5 kph (Day) | 10 km/h | Run 2

Run Date / Time 25-Nov-2022 13:41



CPNC-50 5 kph (Day) | 10 km/h | Run 4

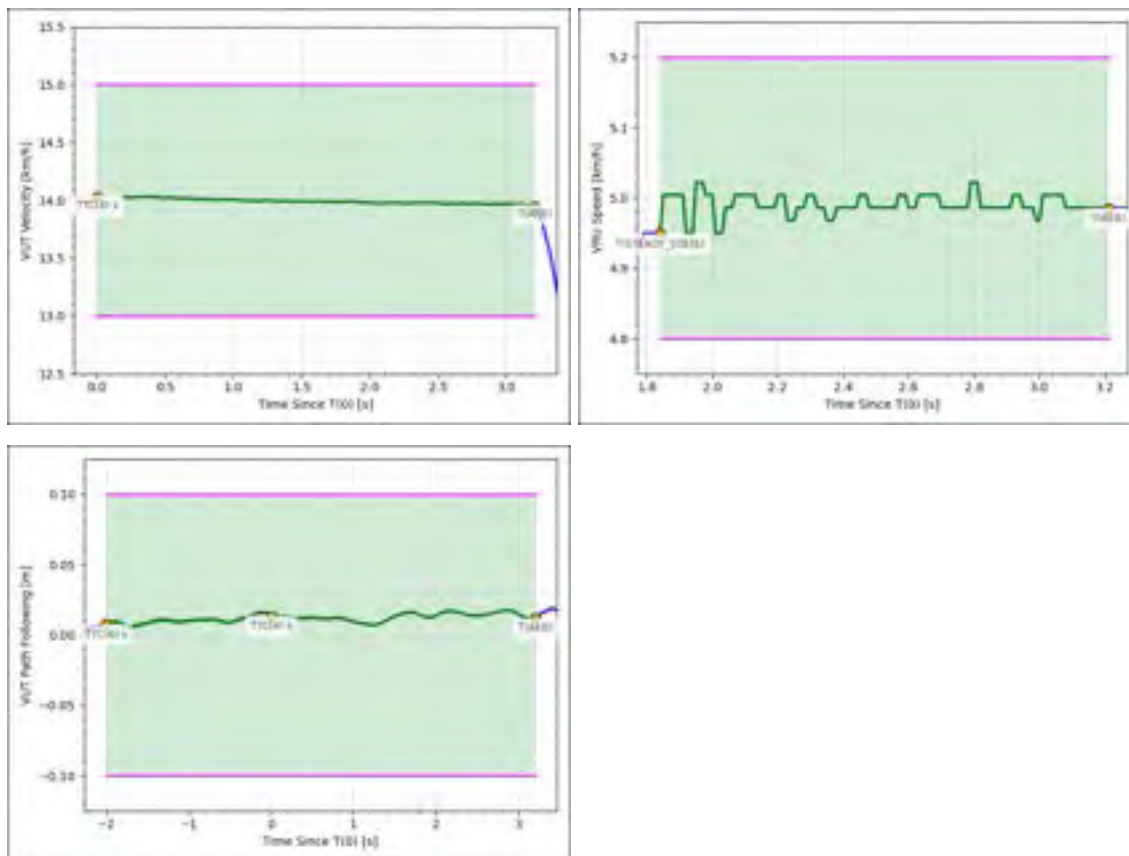
Run Date / Time 25-Nov-2022 13:50



E.2.1.2. CPNC-50 VUT 15kph EPT 5kph (Day)

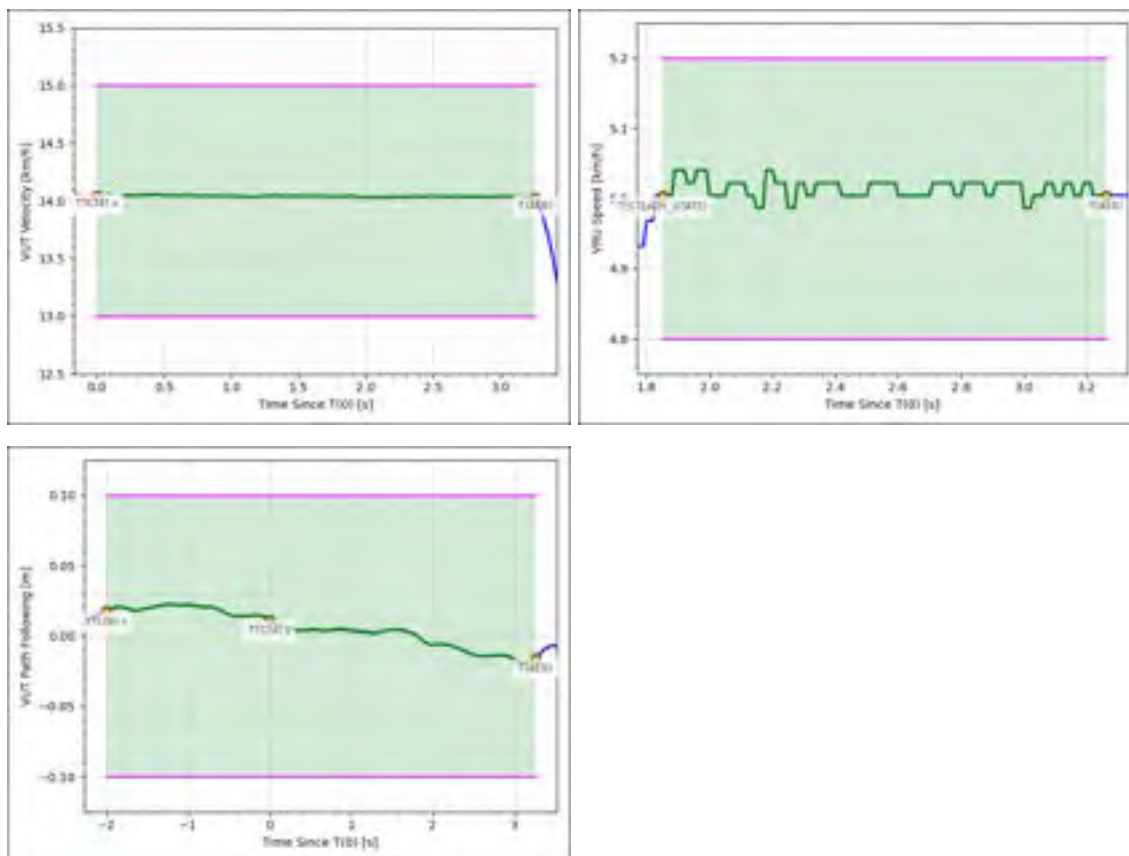
CPNC-50 5 kph (Day) | 15 km/h | Run 1

Run Date / Time 25-Nov-2022 13:55



CPNC-50 5 kph (Day) | 15 km/h | Run 2

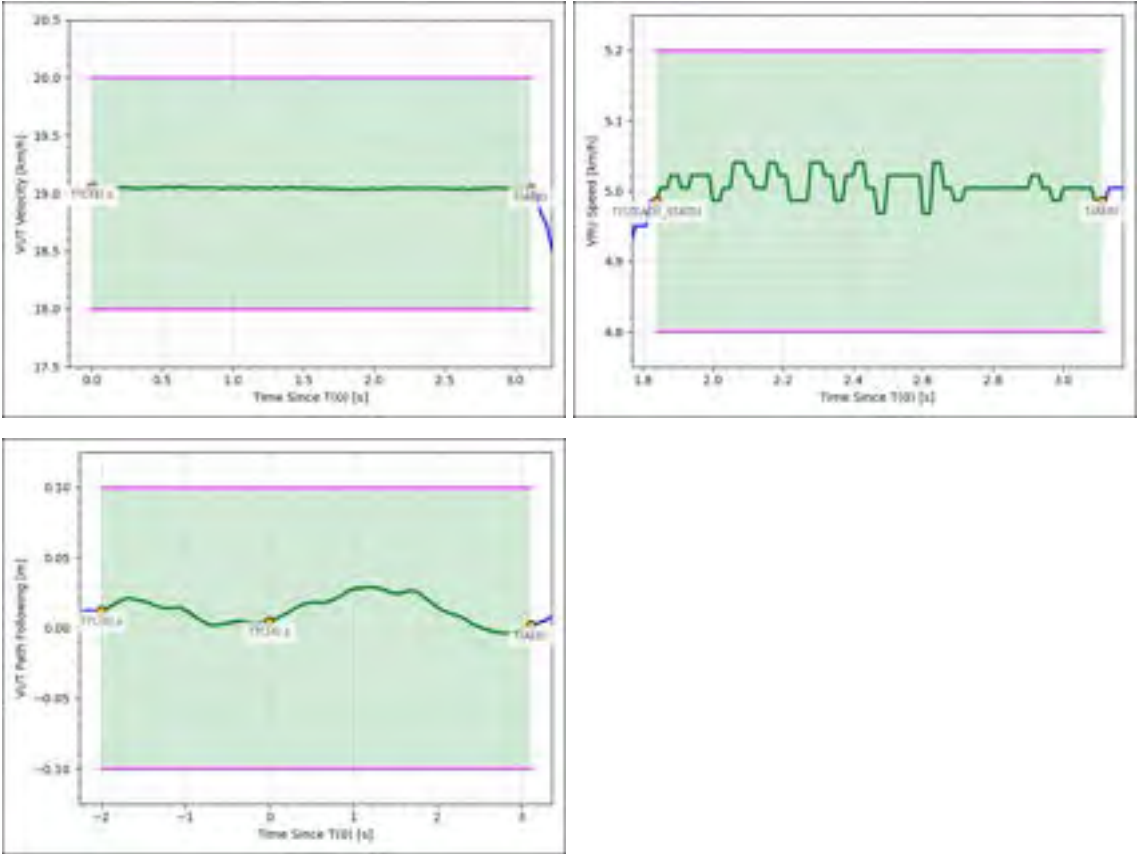
Run Date / Time 25-Nov-2022 13:58



E.2.1.3. CPNC-50 VUT 20kph EPT 5kph (Day)

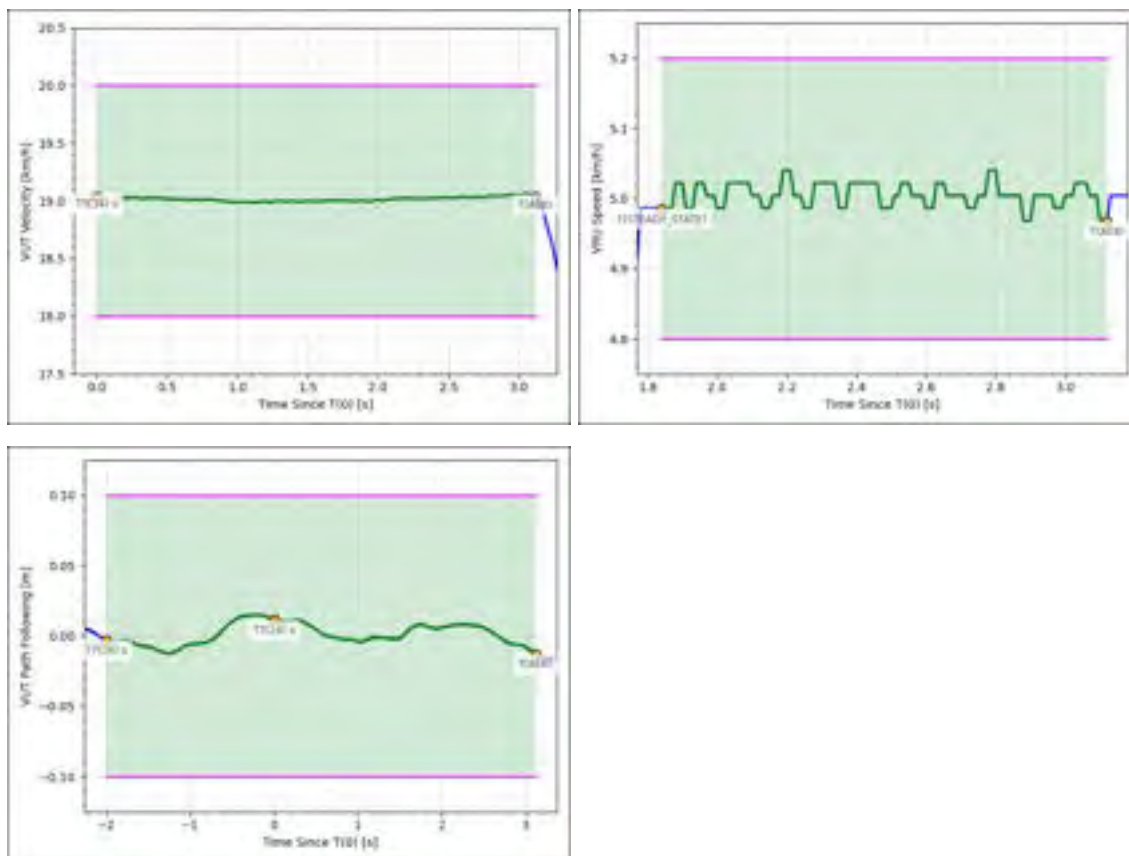
CPNC-50 5 kph (Day) | 20 km/h | Run 1

Run Date / Time 25-Nov-2022 14:04



CPNC-50 5 kph (Day) | 20 km/h | Run 3

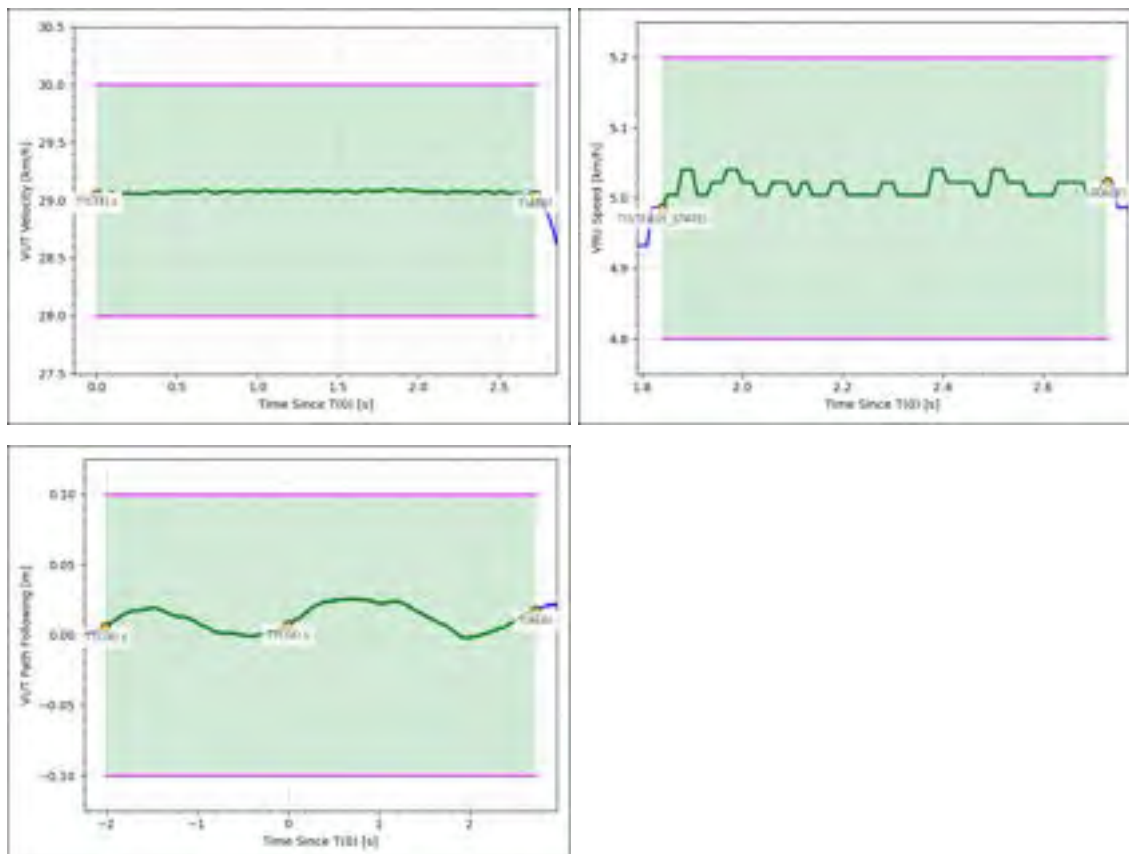
Run Date / Time 25-Nov-2022 14:13



E.2.1.4. CPNC-50 VUT 30kph EPT 5kph (Day)

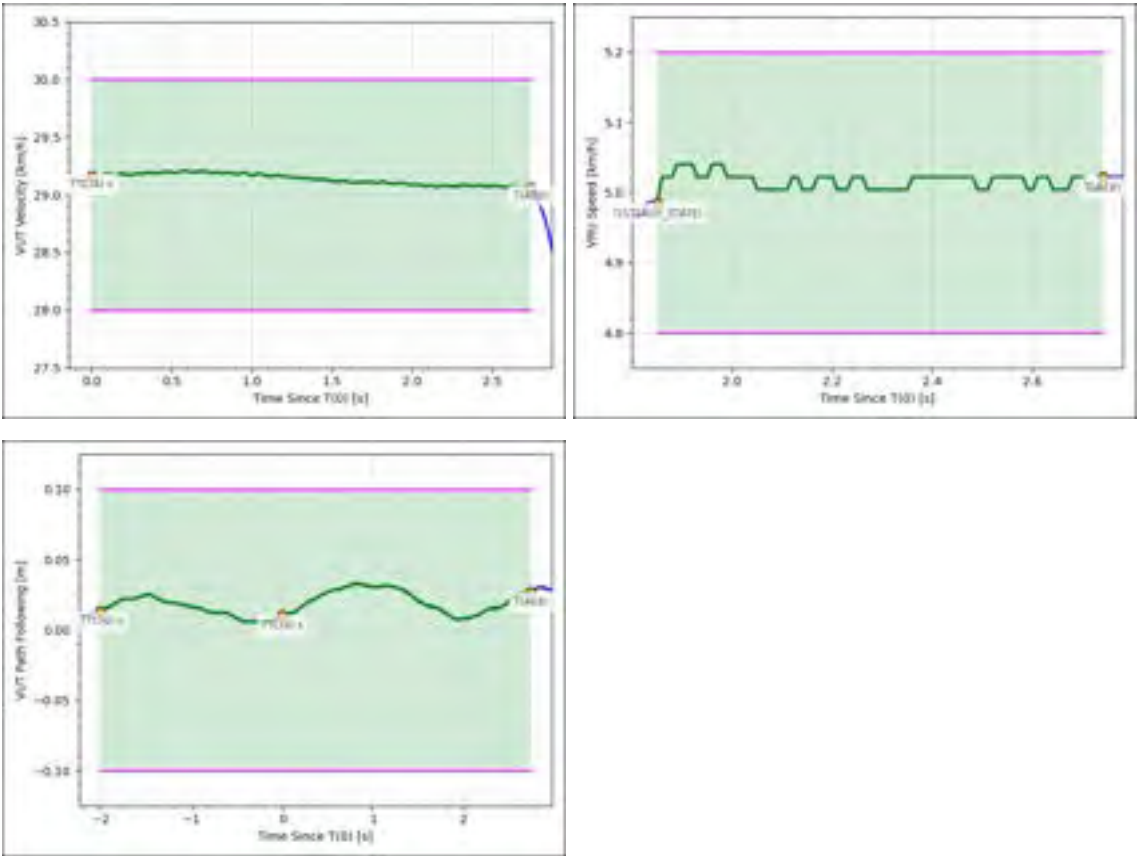
CPNC-50 5 kph (Day) | 30 km/h | Run 1

Run Date / Time 25-Nov-2022 14:16



CPNC-50 5 kph (Day) | 30 km/h | Run 2

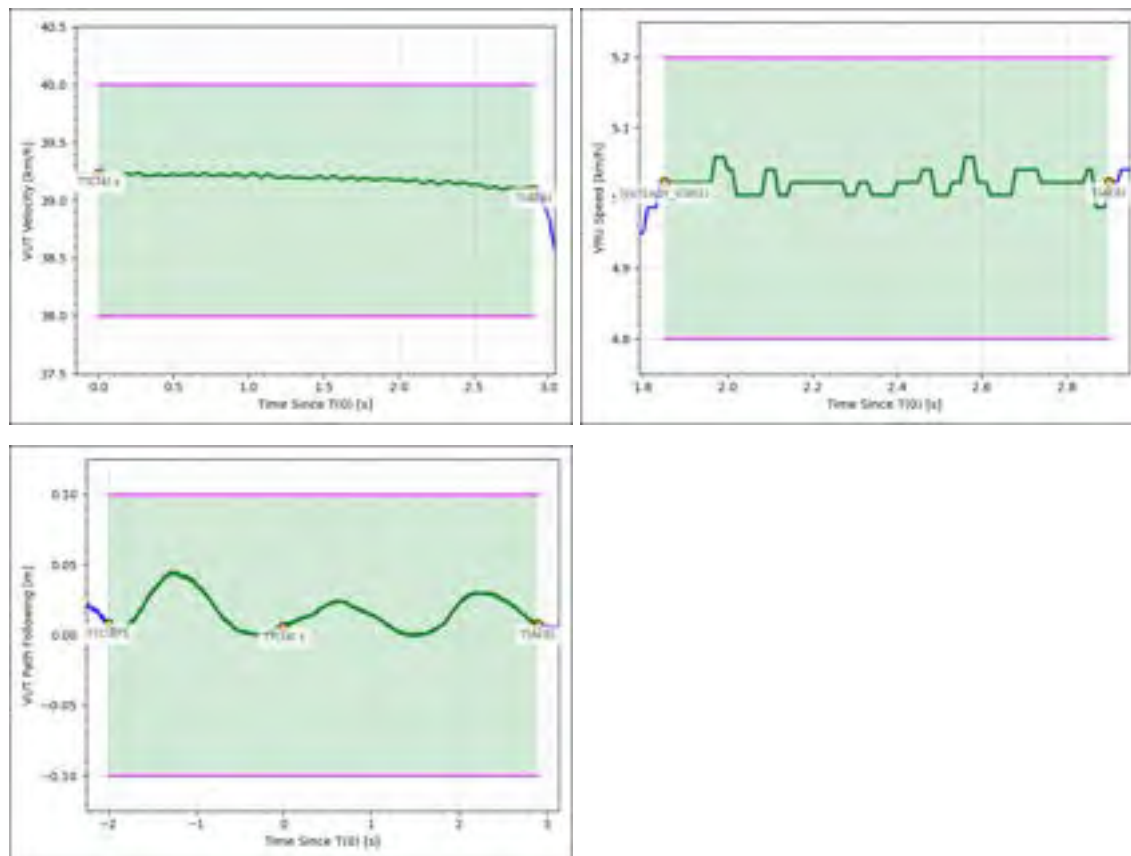
Run Date / Time 25-Nov-2022 14:18



E.2.1.5. CPNC-50 VUT 40kph EPT 5kph (Day)

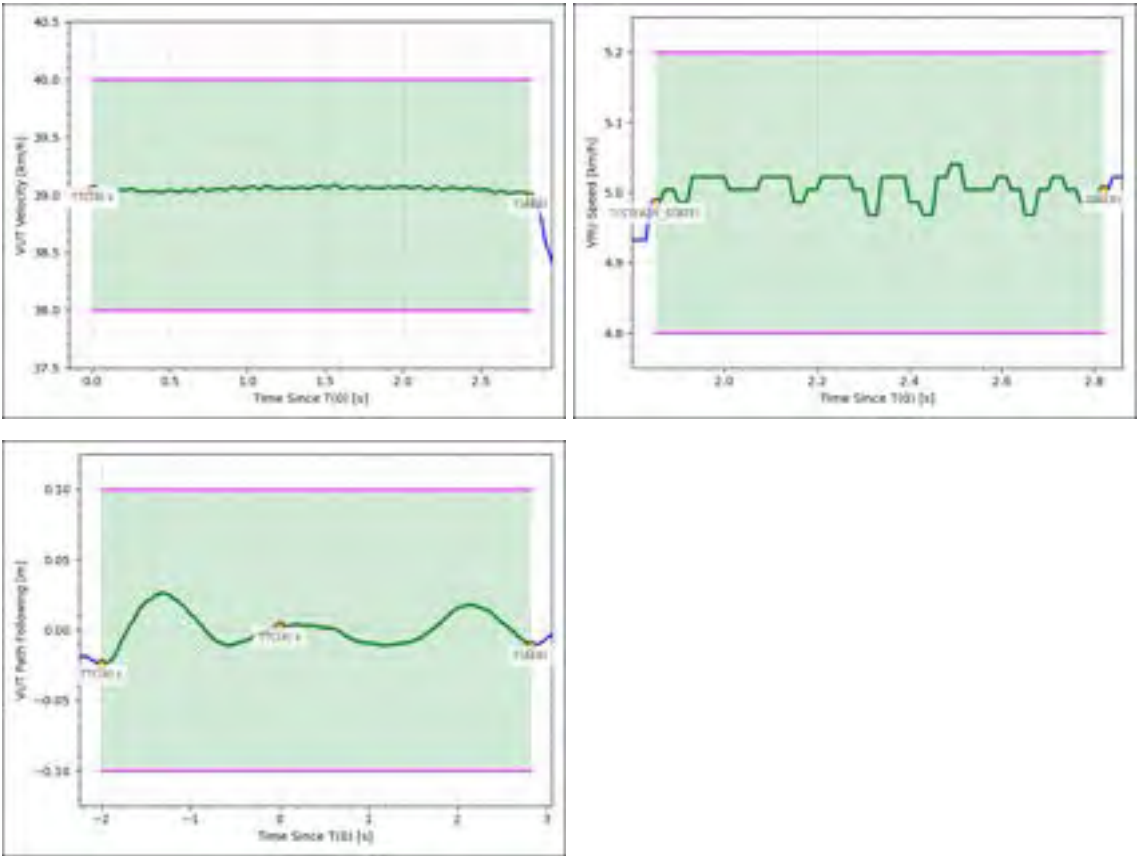
CPNC-50 5 kph (Day) | 40 km/h | Run 1

Run Date / Time 25-Nov-2022 14:21



CPNC-50 5 kph (Day) | 40 km/h | Run 3

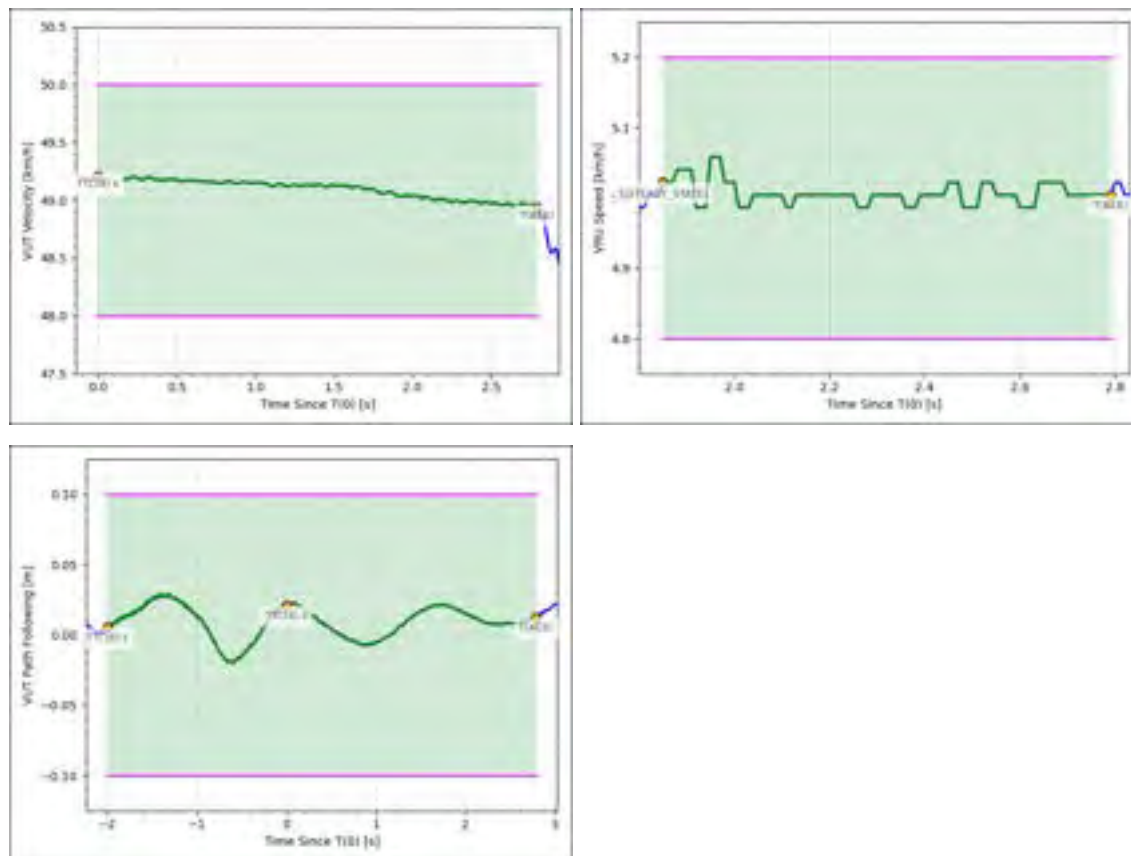
Run Date / Time 29-Nov-2022 11:01



E.2.1.6. CPNC-50 VUT 50kph EPT 5kph (Day)

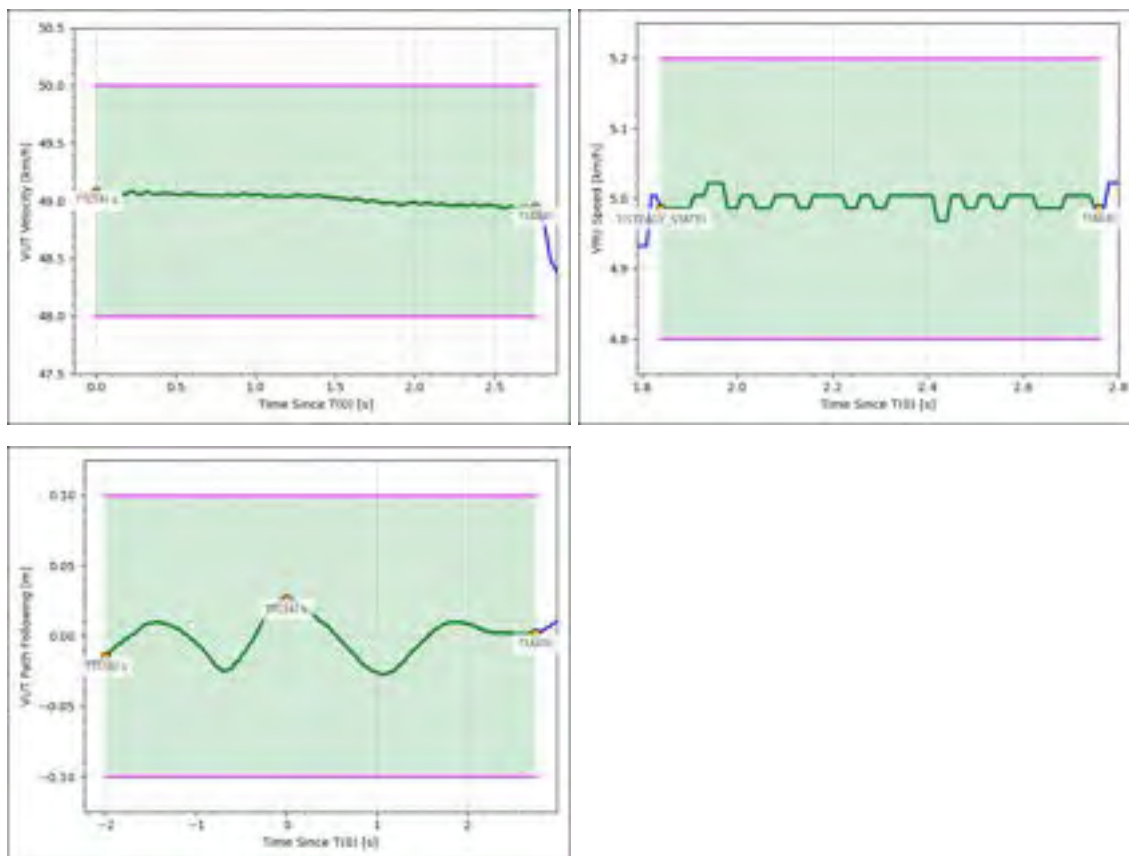
CPNC-50 5 kph (Day) | 50 km/h | Run 1

Run Date / Time 25-Nov-2022 14:27



CPNC-50 5 kph (Day) | 50 km/h | Run 3

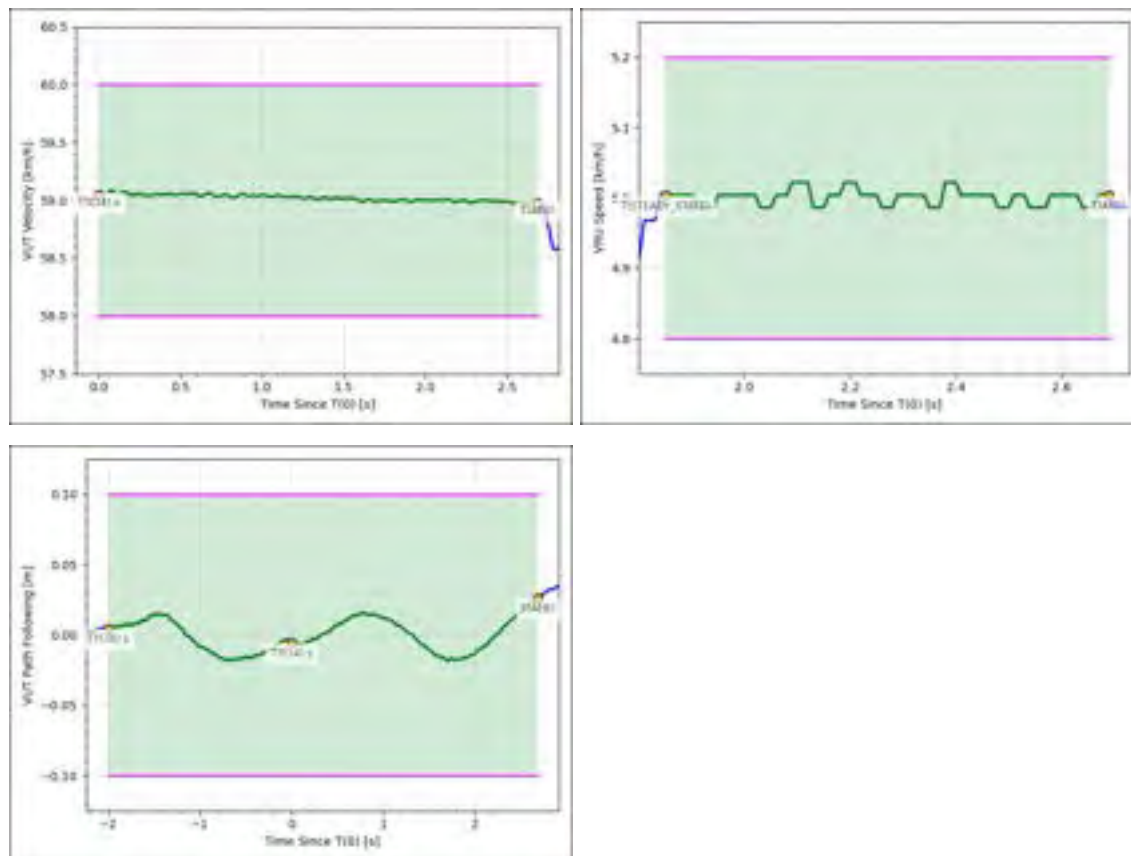
Run Date / Time 25-Nov-2022 14:32



E.2.1.7. CPNC-50 VUT 60kph EPT 5kph (Day)

CPNC-50 5 kph (Day) | 60 km/h | Run 1

Run Date / Time 25-Nov-2022 14:35

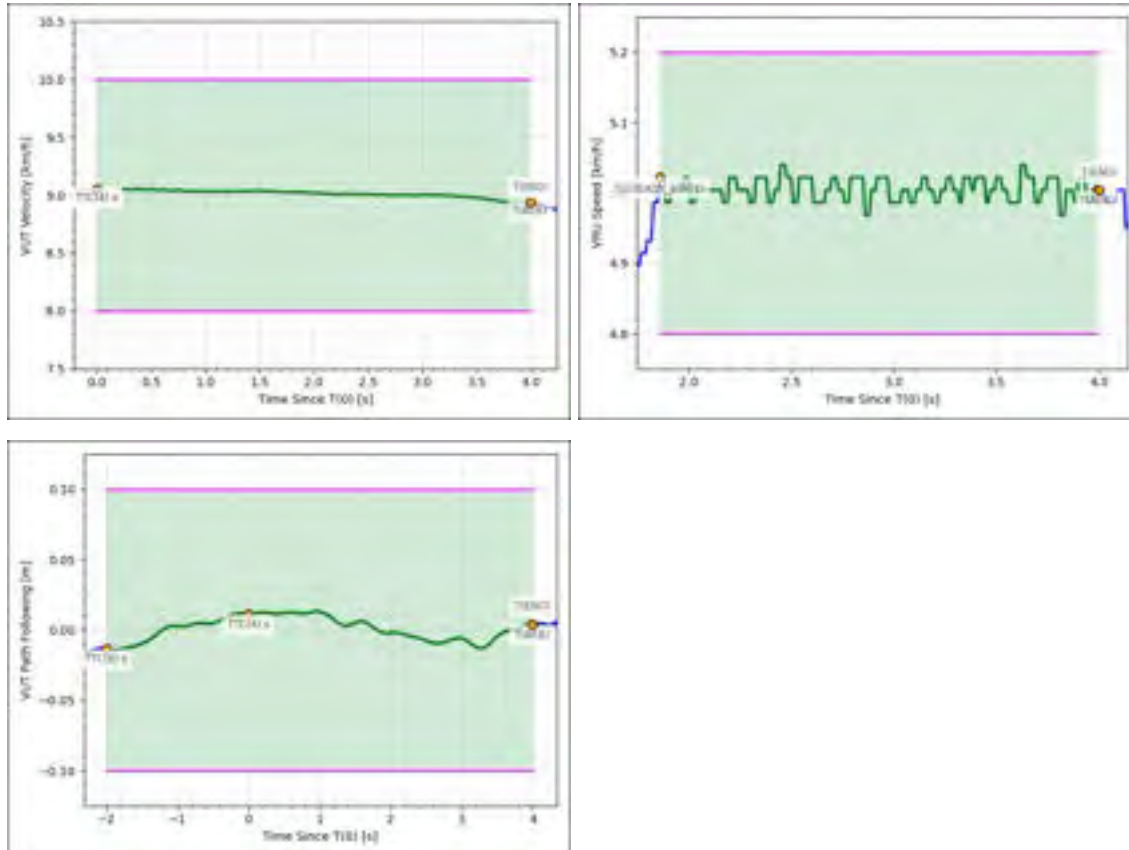


E.2.2. GVM

E.2.2.1. CPNC-50 VUT 10kph EPT 5kph (Day)

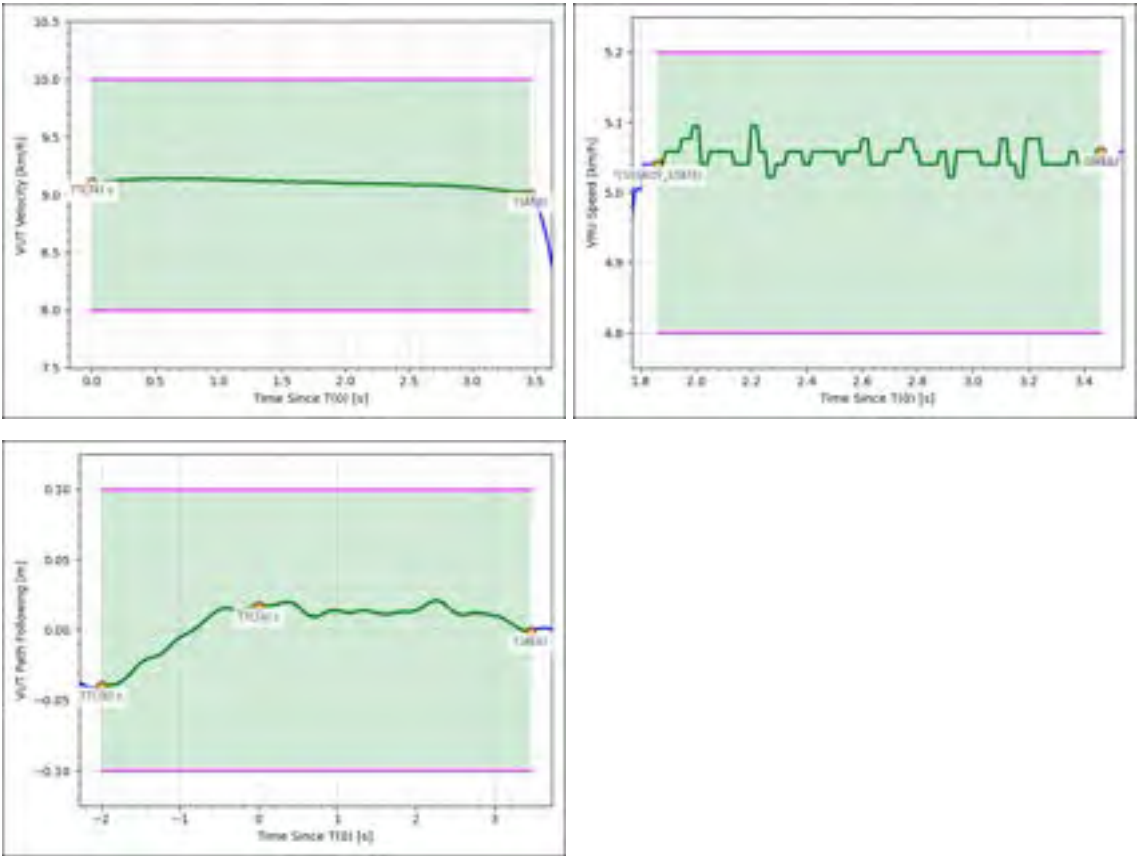
CPNC-50 5 kph (Day) | 10 km/h | Run 5

Run Date / Time 9-Dec-2022 11:30



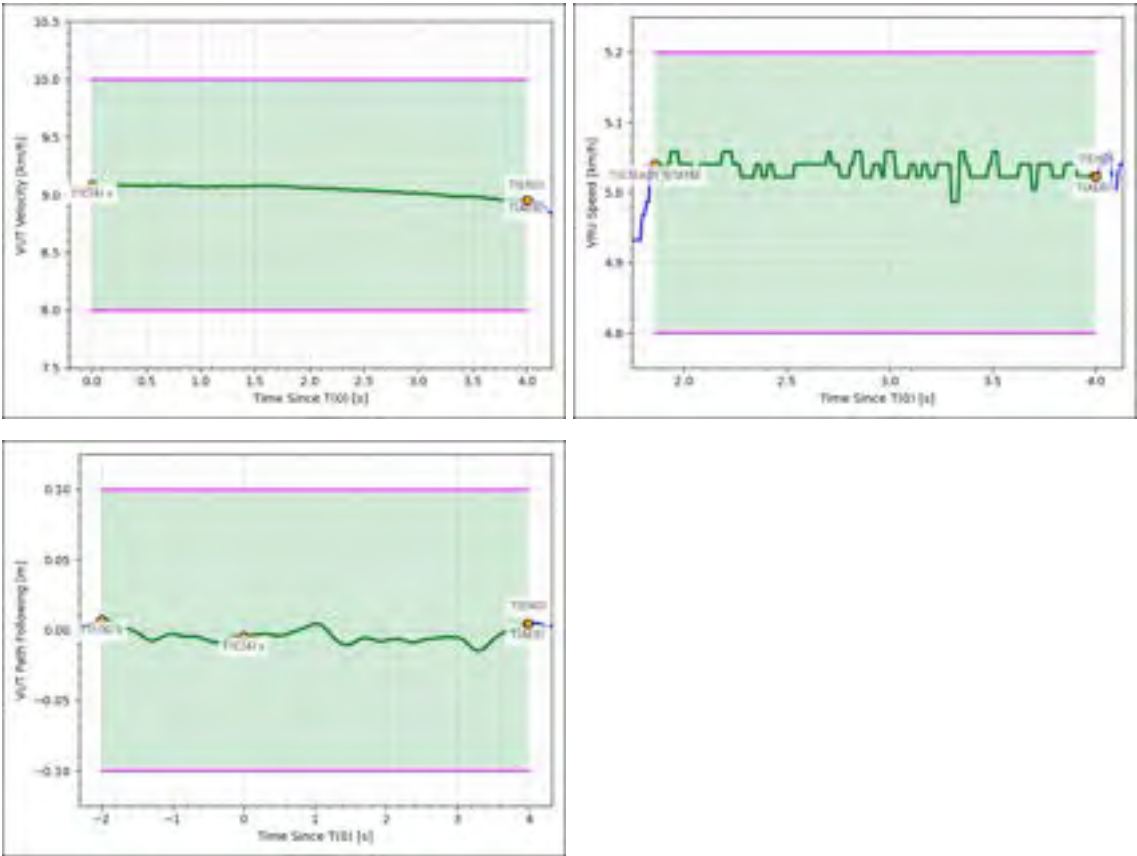
CPNC-50 5 kph (Day) | 10 km/h | Run 6

Run Date / Time 9-Dec-2022 11:42



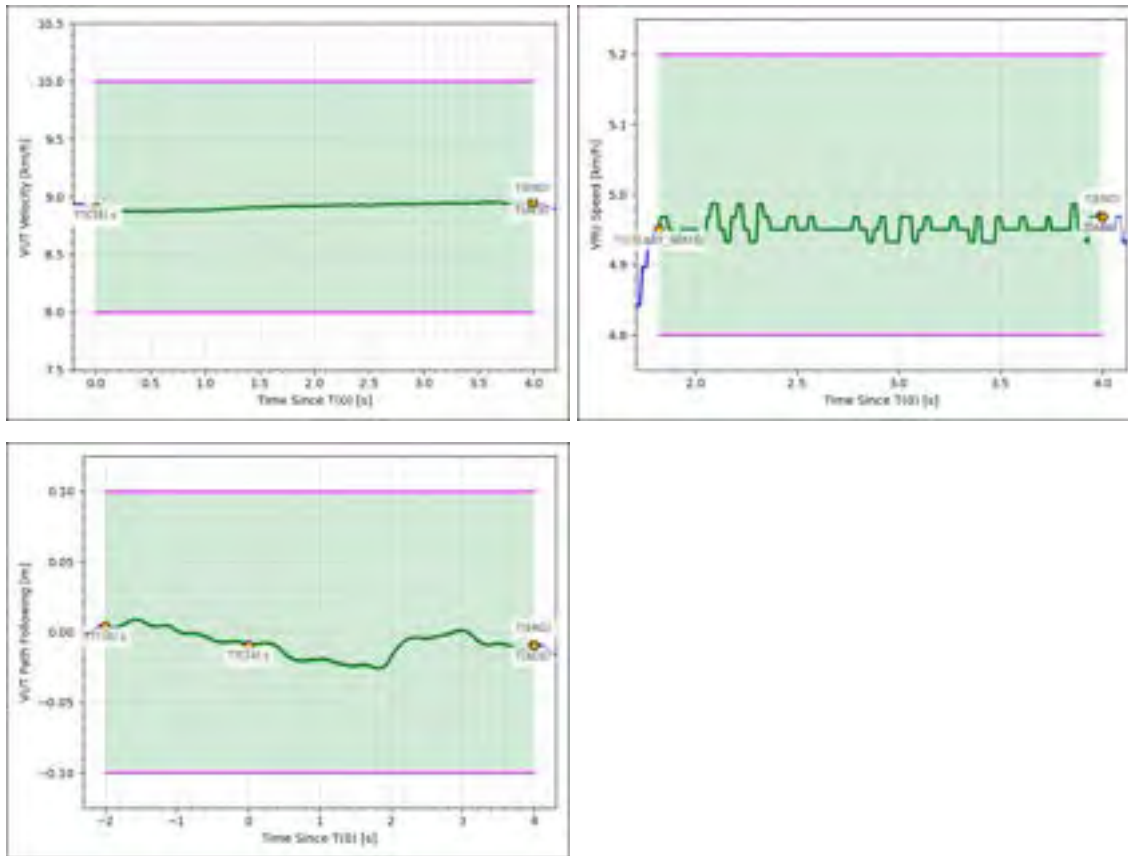
CPNC-50 5 kph (Day) | 10 km/h | Run 9

Run Date / Time 16-Dec-2022 09:19



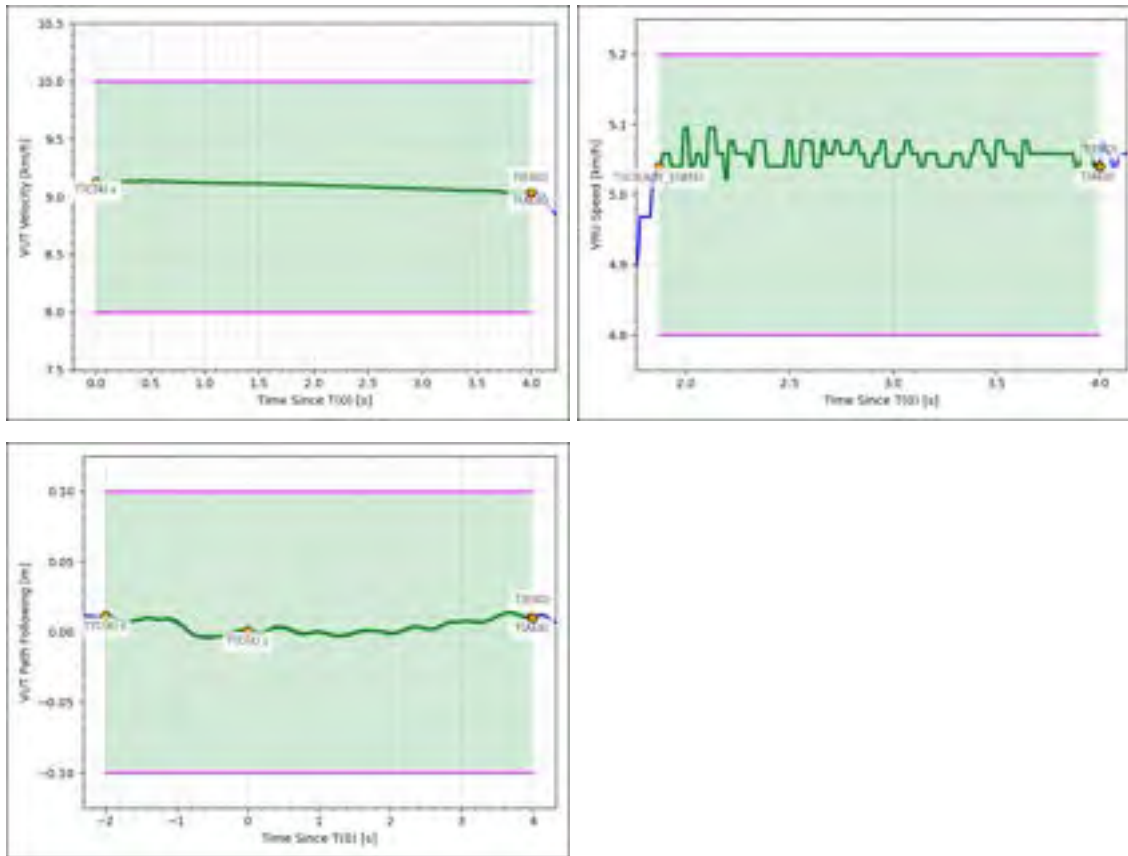
CPNC-50 5 kph (Day) | 10 km/h | Run 11

Run Date / Time 16-Dec-2022 09:33



CPNC-50 5 kph (Day) | 10 km/h | Run 12

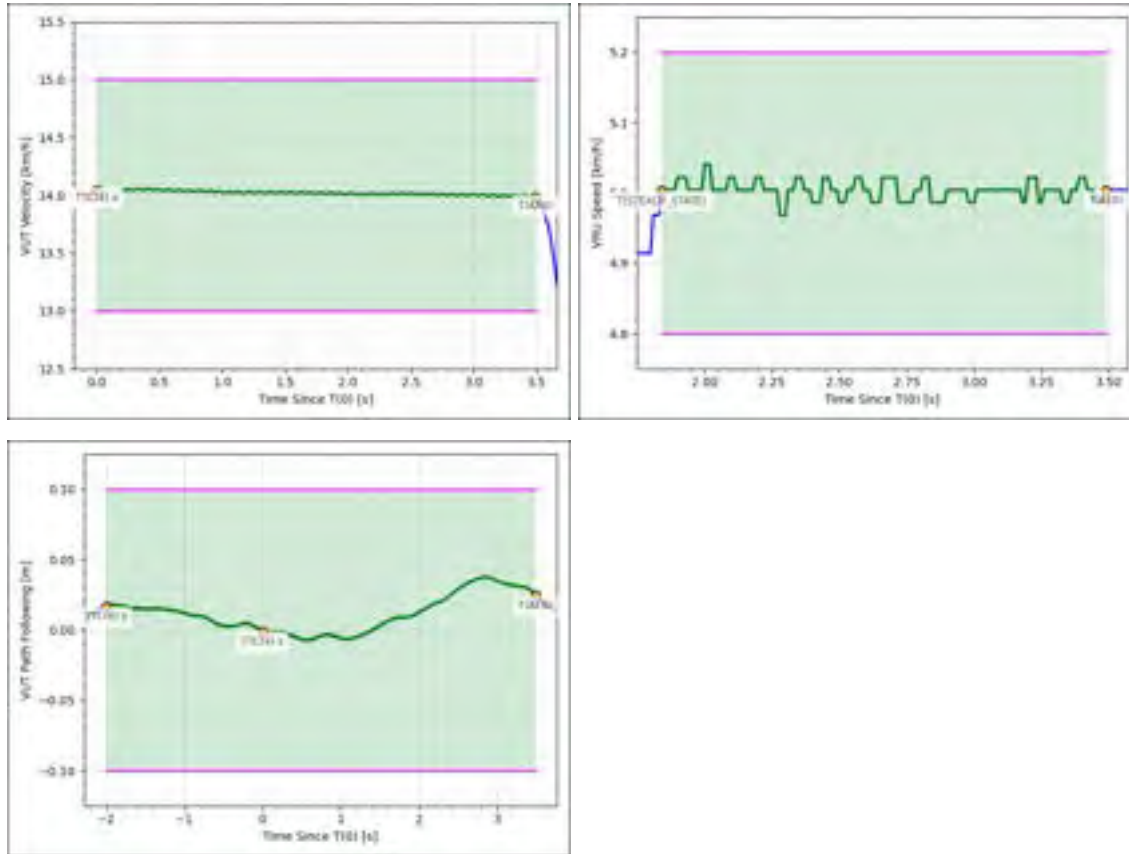
Run Date / Time 16-Dec-2022 09:38



E.2.2.2. CPNC-50 VUT 15kph EPT 5kph (Day)

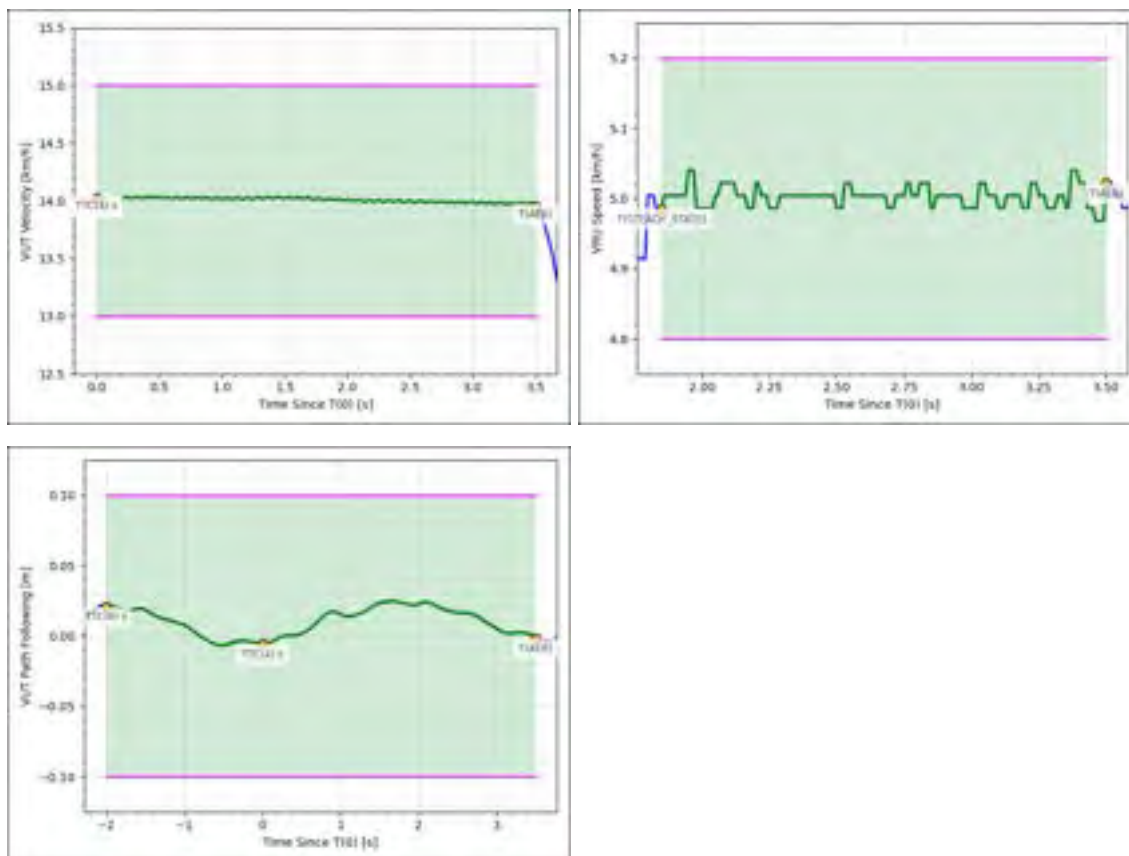
CPNC-50 5 kph (Day) | 15 km/h | Run 4

Run Date / Time 9-Dec-2022 11:22



CPNC-50 5 kph (Day) | 15 km/h | Run 6

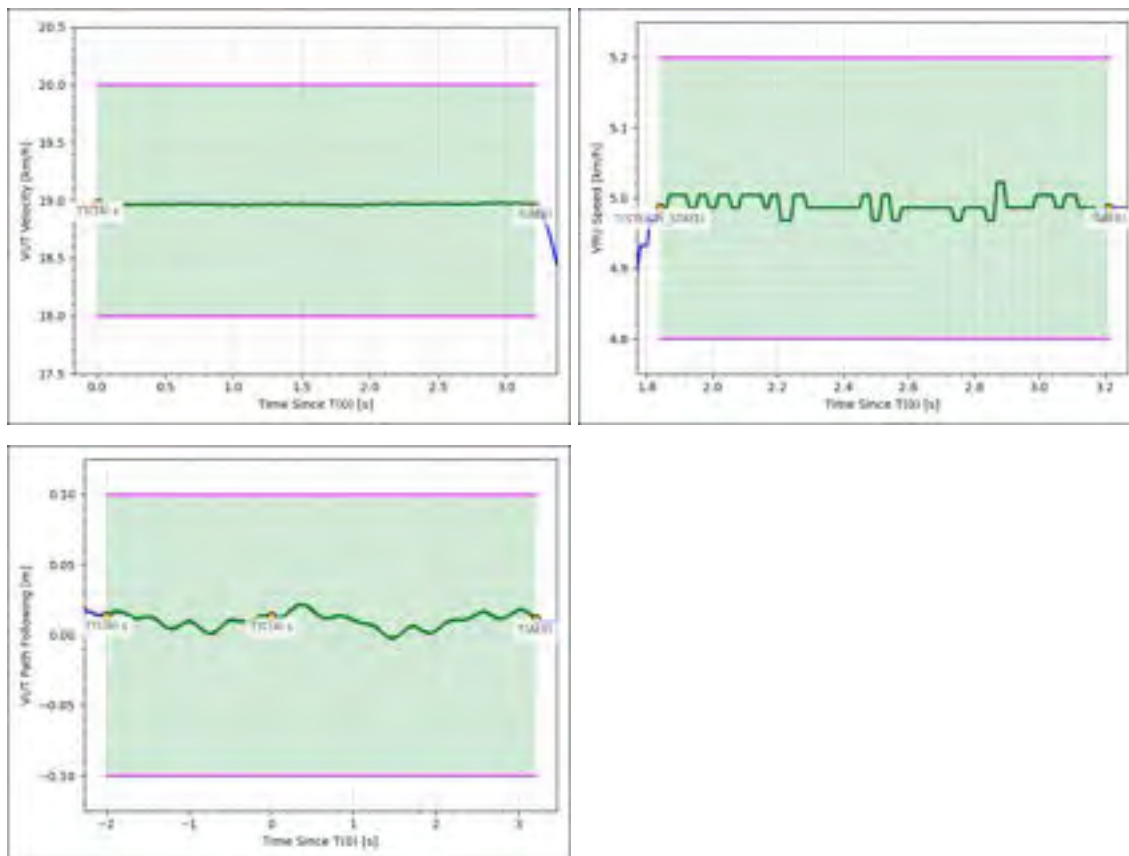
Run Date / Time 9-Dec-2022 11:27



E.2.2.3. CPNC-50 VUT 20kph EPT 5kph (Day)

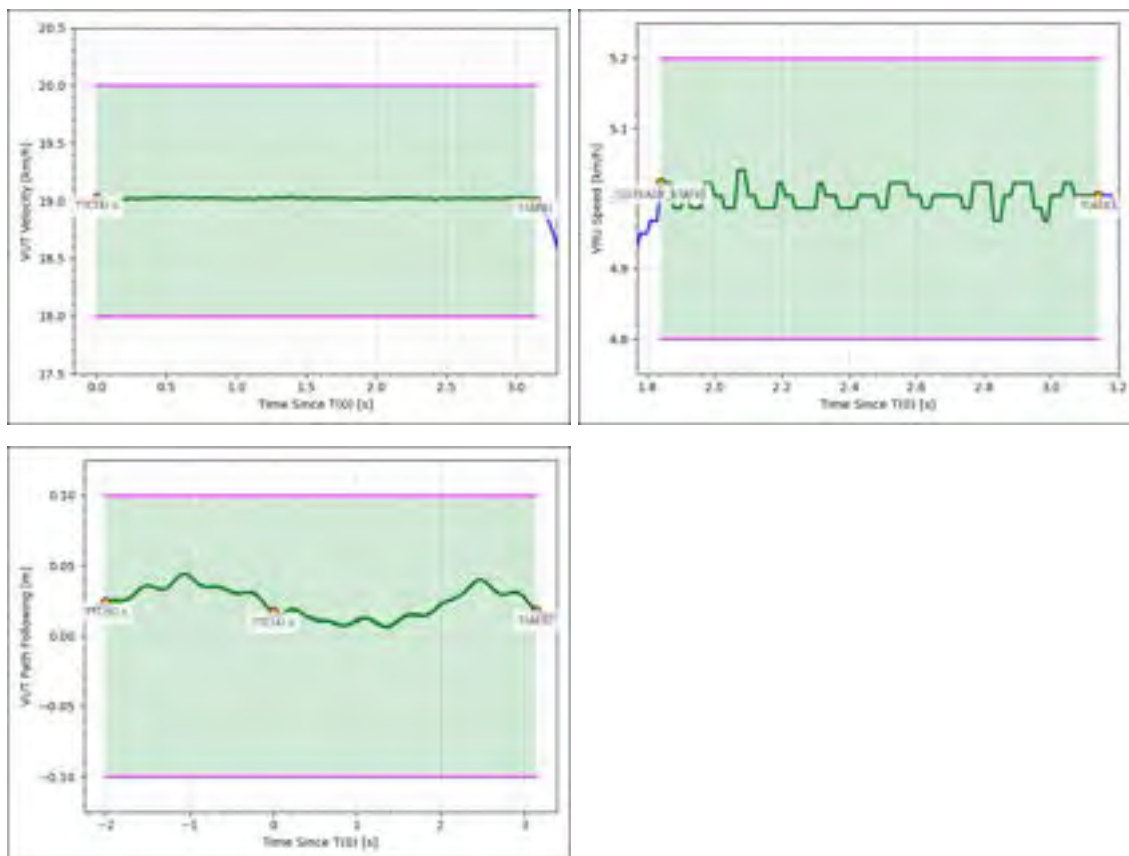
CPNC-50 5 kph (Day) | 20 km/h | Run 4

Run Date / Time 9-Dec-2022 13:14



CPNC-50 5 kph (Day) | 20 km/h | Run 7

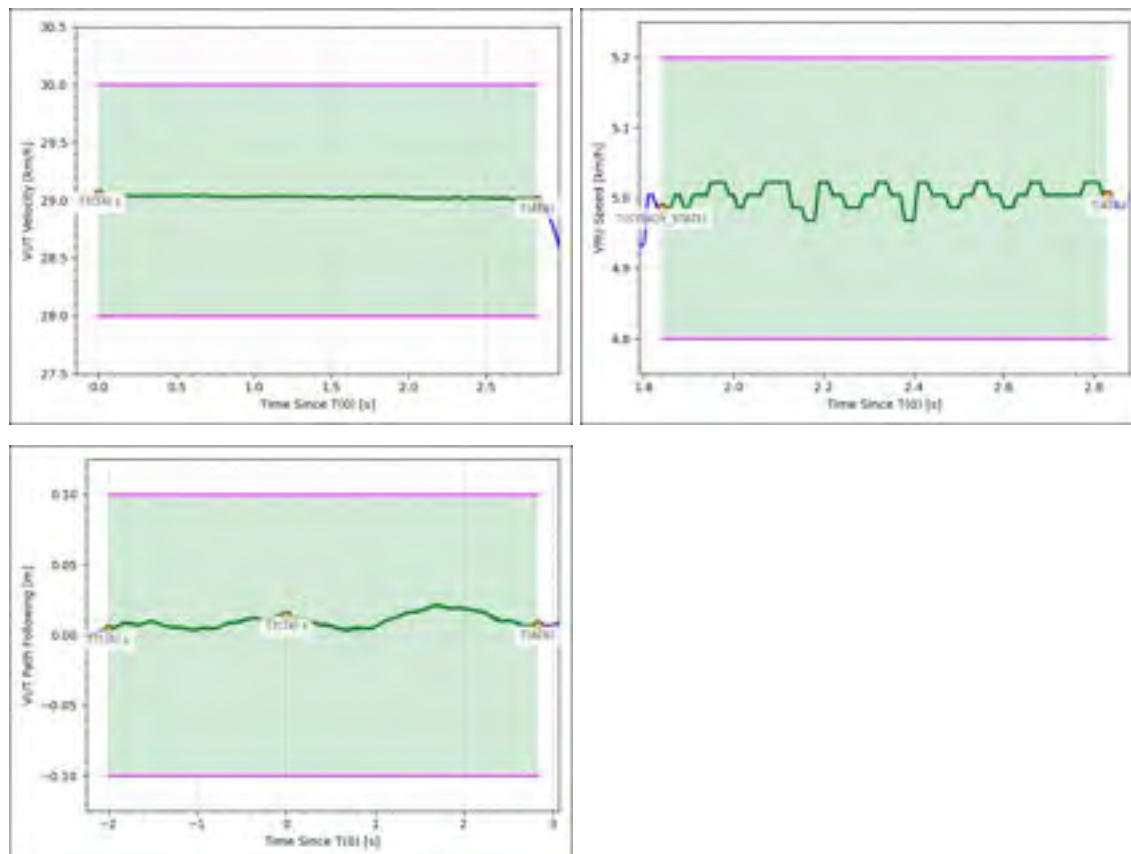
Run Date / Time 9-Dec-2022 13:21



E.2.2.4. CPNC-50 VUT 30kph EPT 5kph (Day)

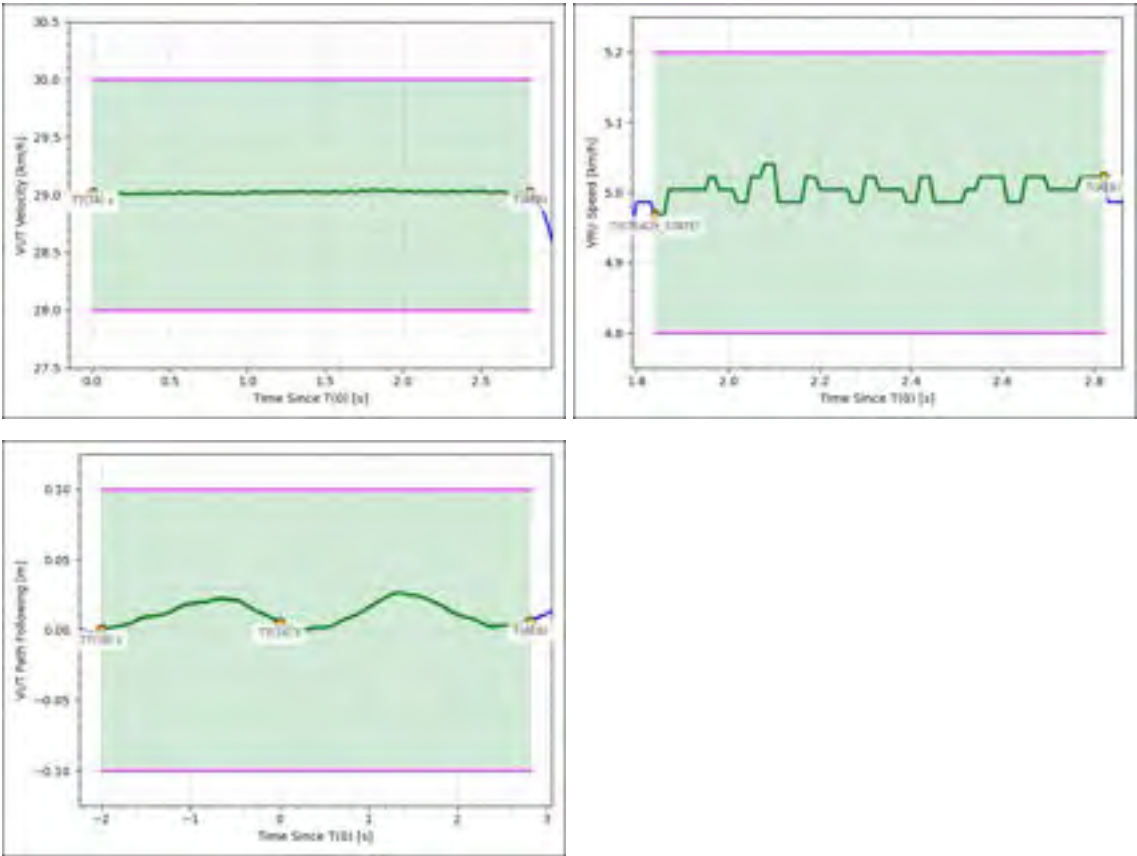
CPNC-50 5 kph (Day) | 30 km/h | Run 3

Run Date / Time 9-Dec-2022 13:24



CPNC-50 5 kph (Day) | 30 km/h | Run 4

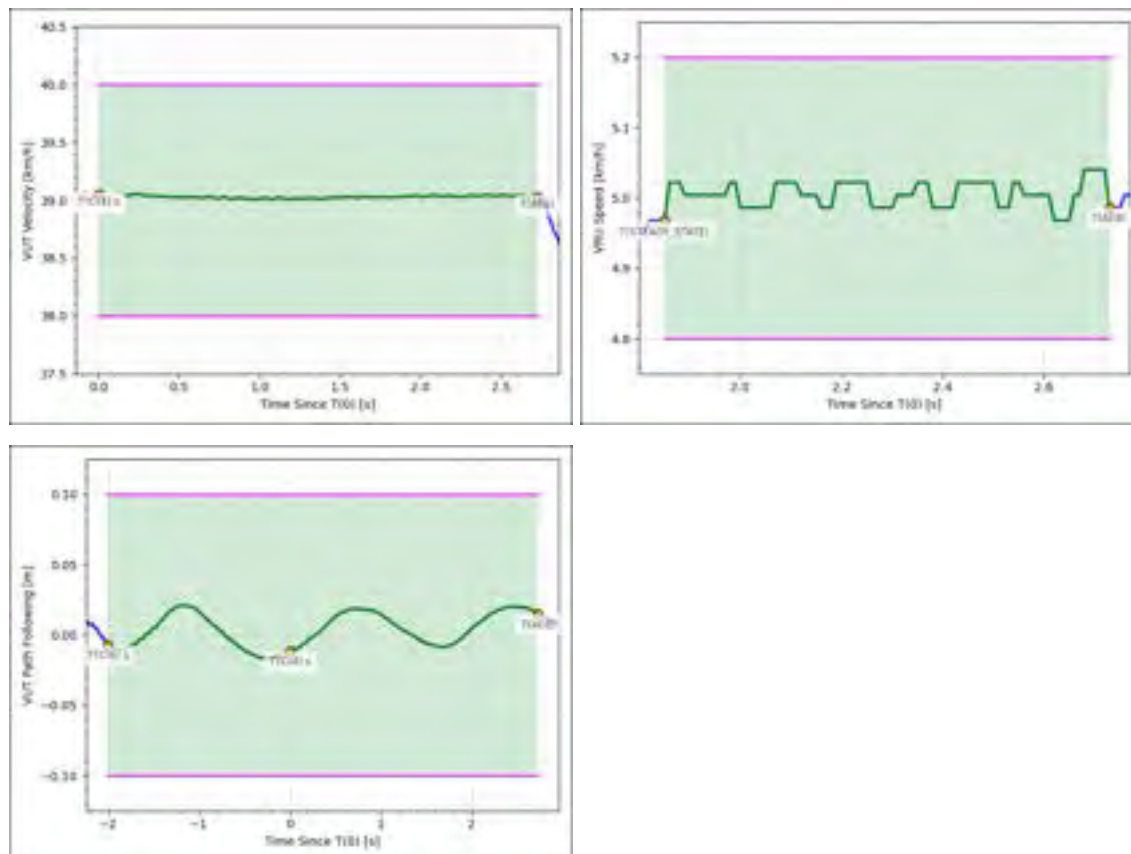
Run Date / Time 9-Dec-2022 13:27



E.2.2.5. CPNC-50 VUT 40kph EPT 5kph (Day)

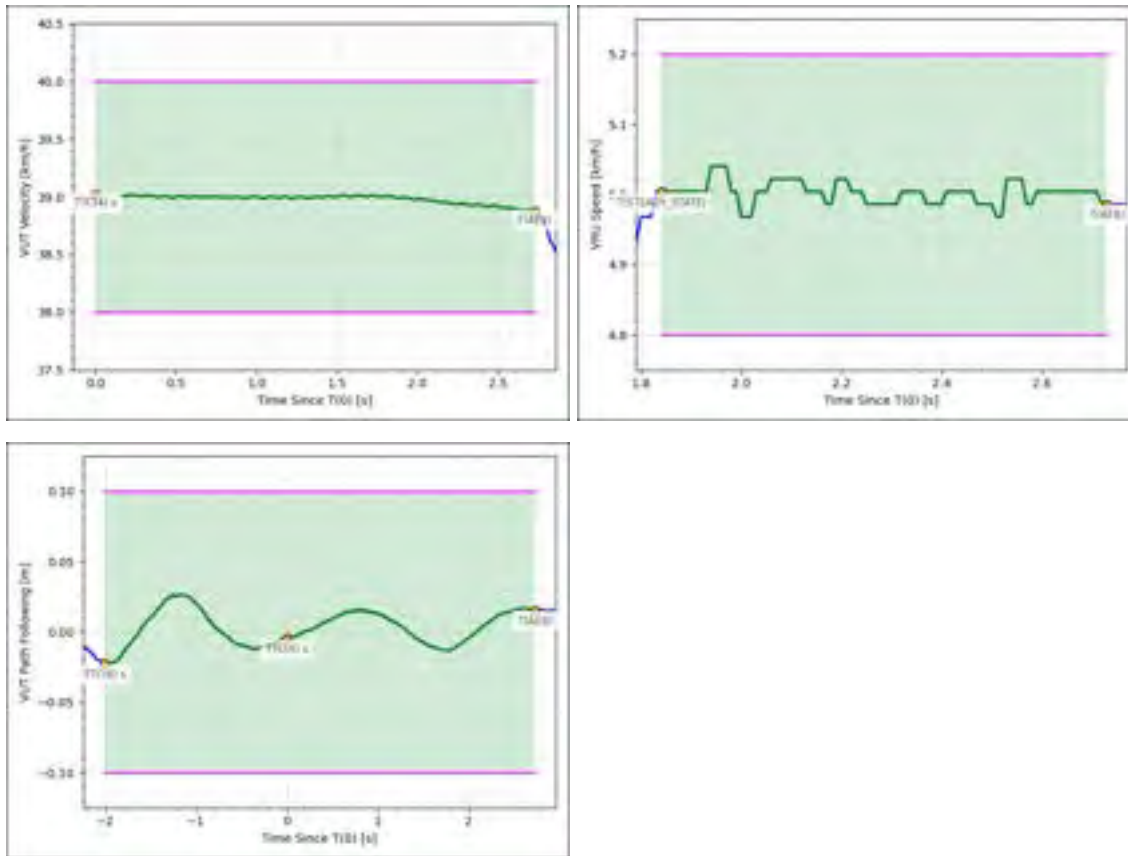
CPNC-50 5 kph (Day) | 40 km/h | Run 4

Run Date / Time 9-Dec-2022 13:33



CPNC-50 5 kph (Day) | 40 km/h | Run 5

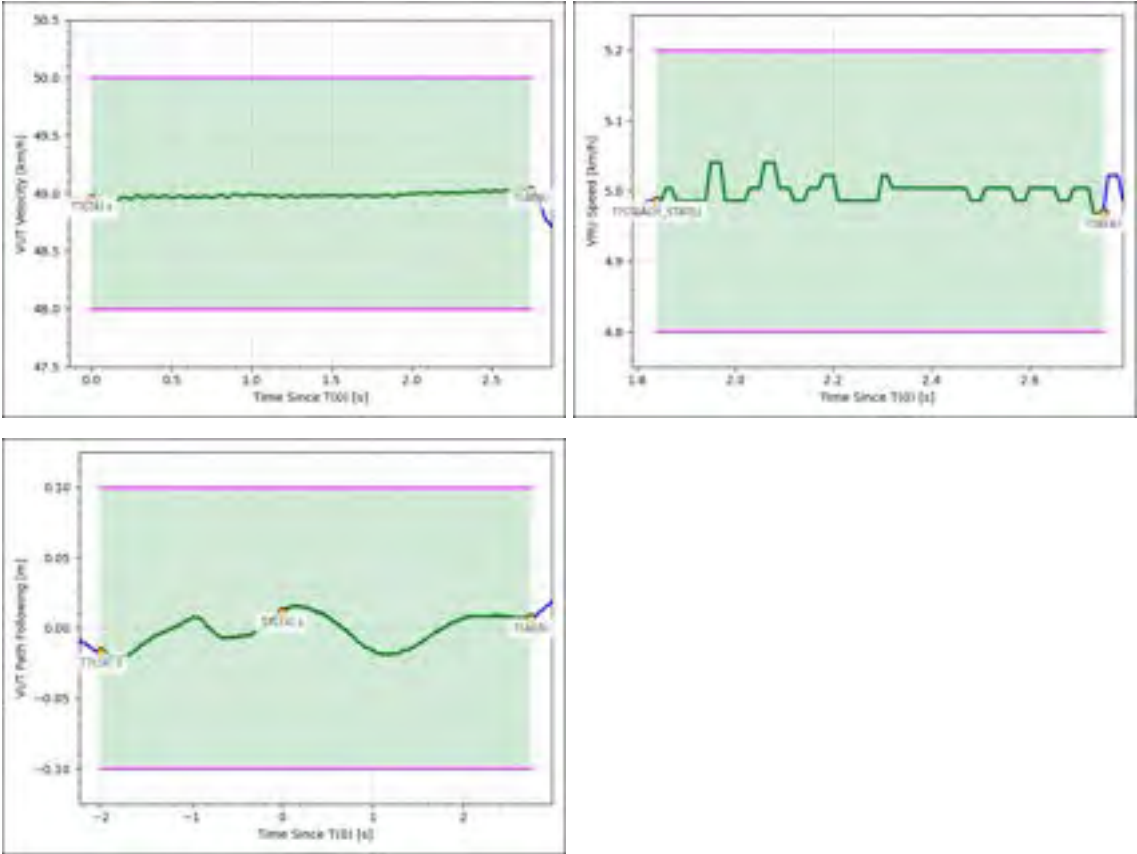
Run Date / Time 9-Dec-2022 13:36



E.2.2.6. CPNC-50 VUT 50kph EPT 5kph (Day)

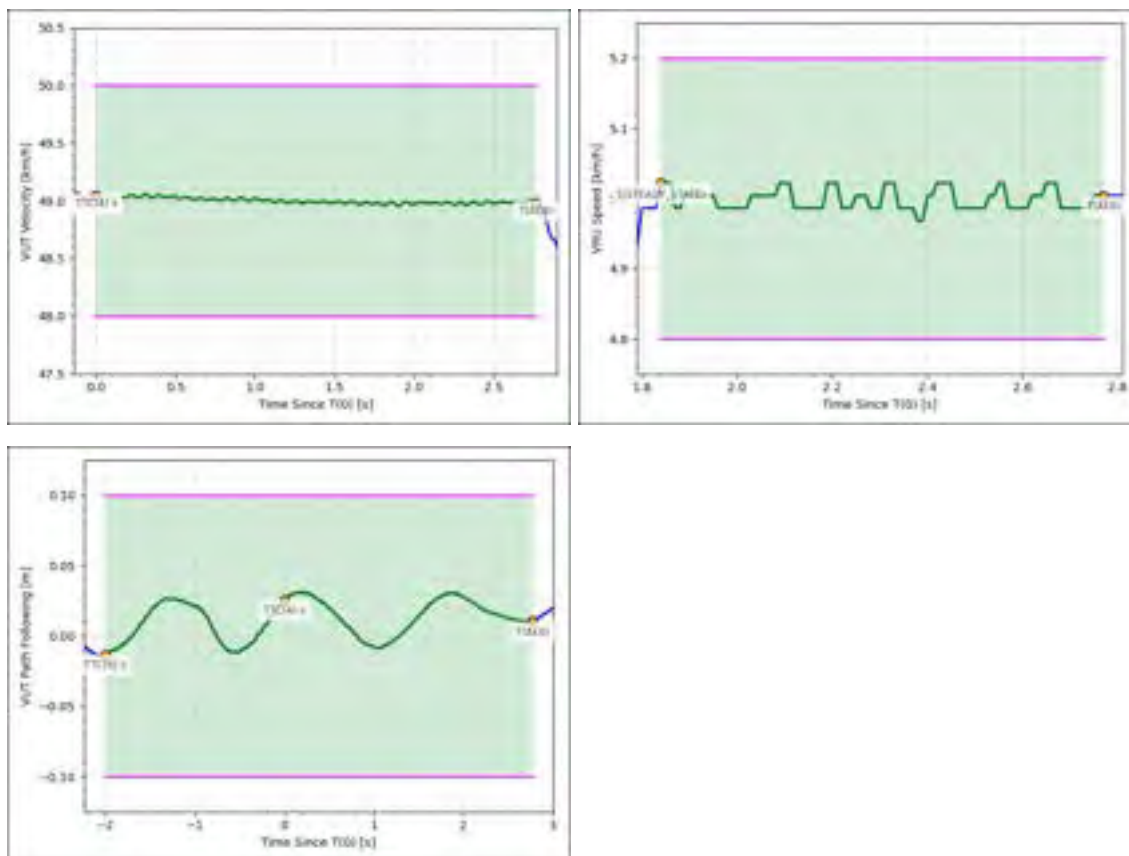
CPNC-50 5 kph (Day) | 50 km/h | Run 5

Run Date / Time 9-Dec-2022 13:43



CPNC-50 5 kph (Day) | 50 km/h | Run 6

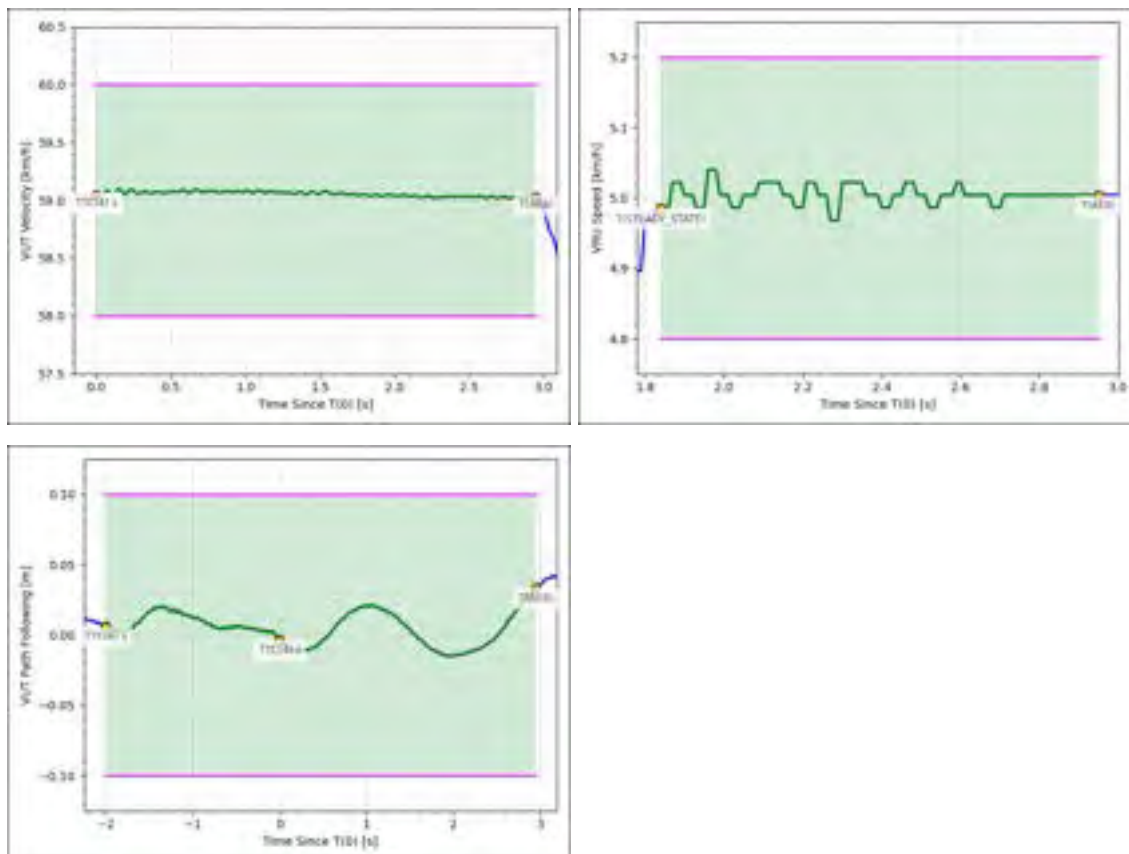
Run Date / Time 9-Dec-2022 13:46



E.2.2.7. CPNC-50 VUT 60kph EPT 5kph (Day)

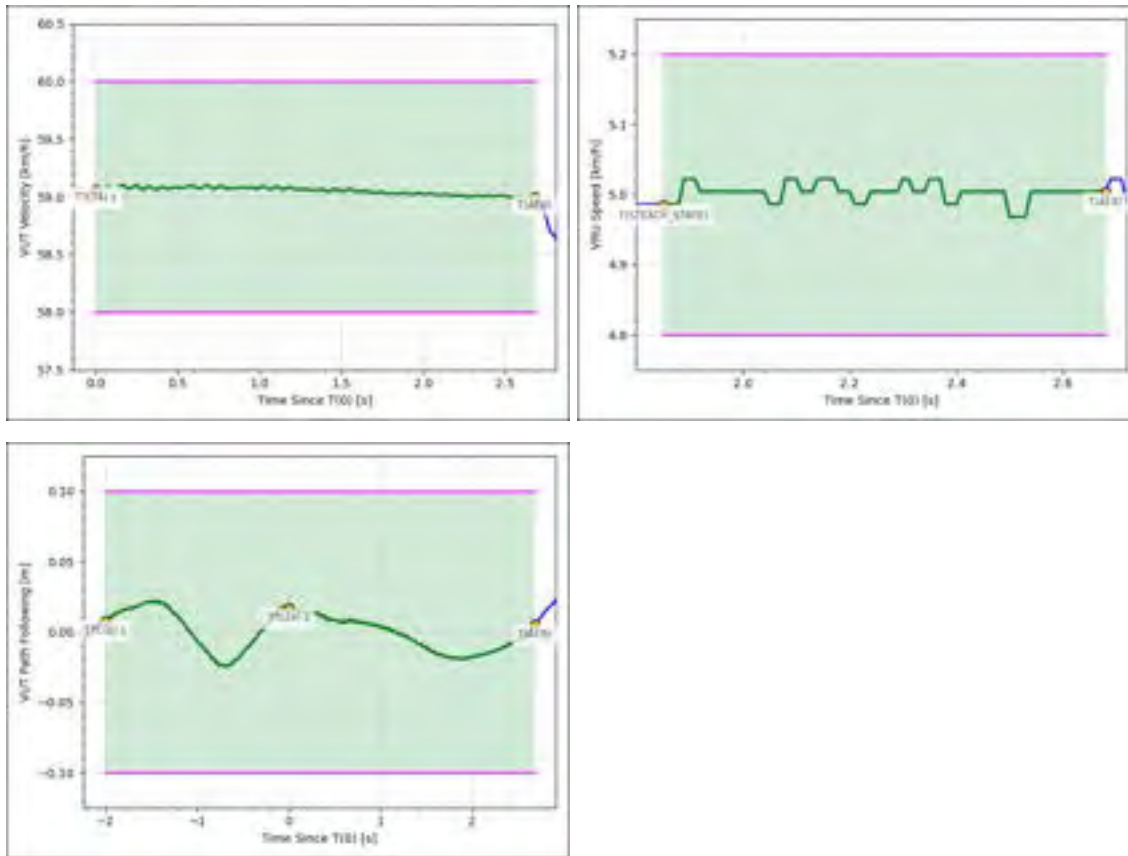
CPNC-50 5 kph (Day) | 60 km/h | Run 3

Run Date / Time 9-Dec-2022 13:51



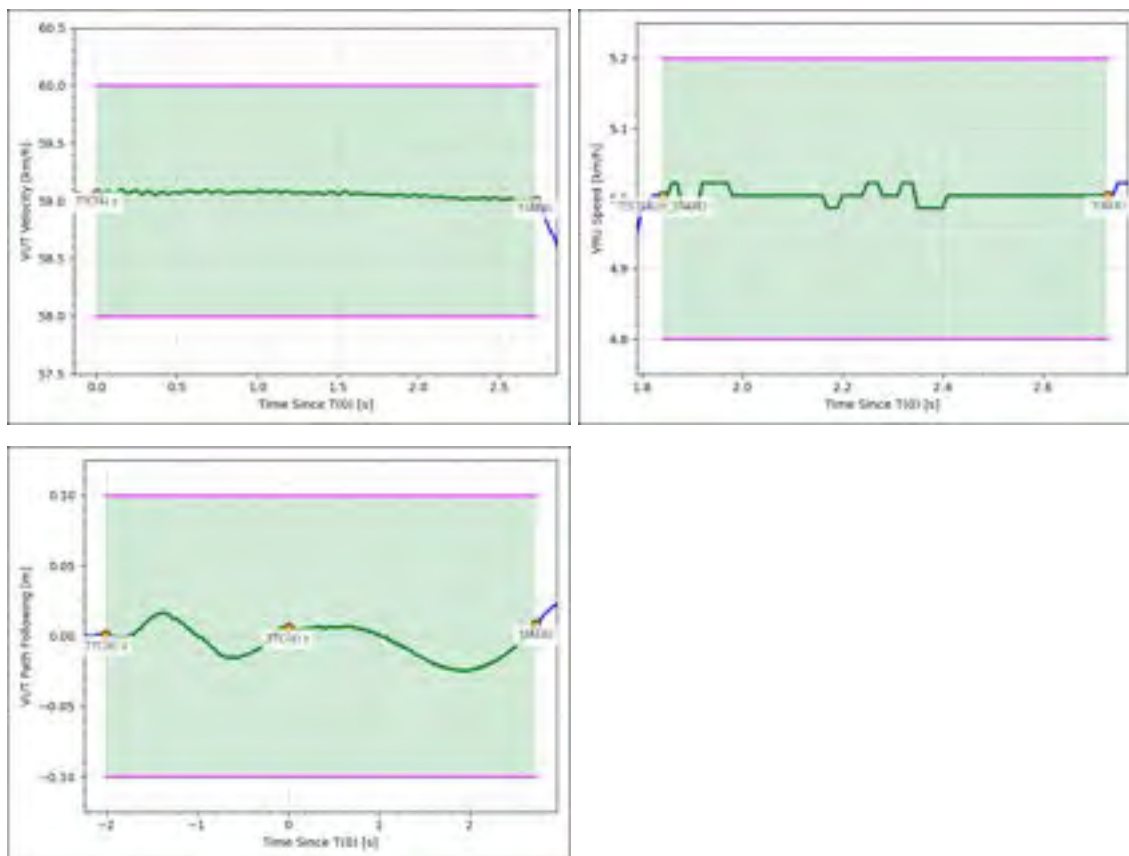
CPNC-50 5 kph (Day) | 60 km/h | Run 5

Run Date / Time 9-Dec-2022 14:01



CPNC-50 5 kph (Day) | 60 km/h | Run 6

Run Date / Time 9-Dec-2022 14:06

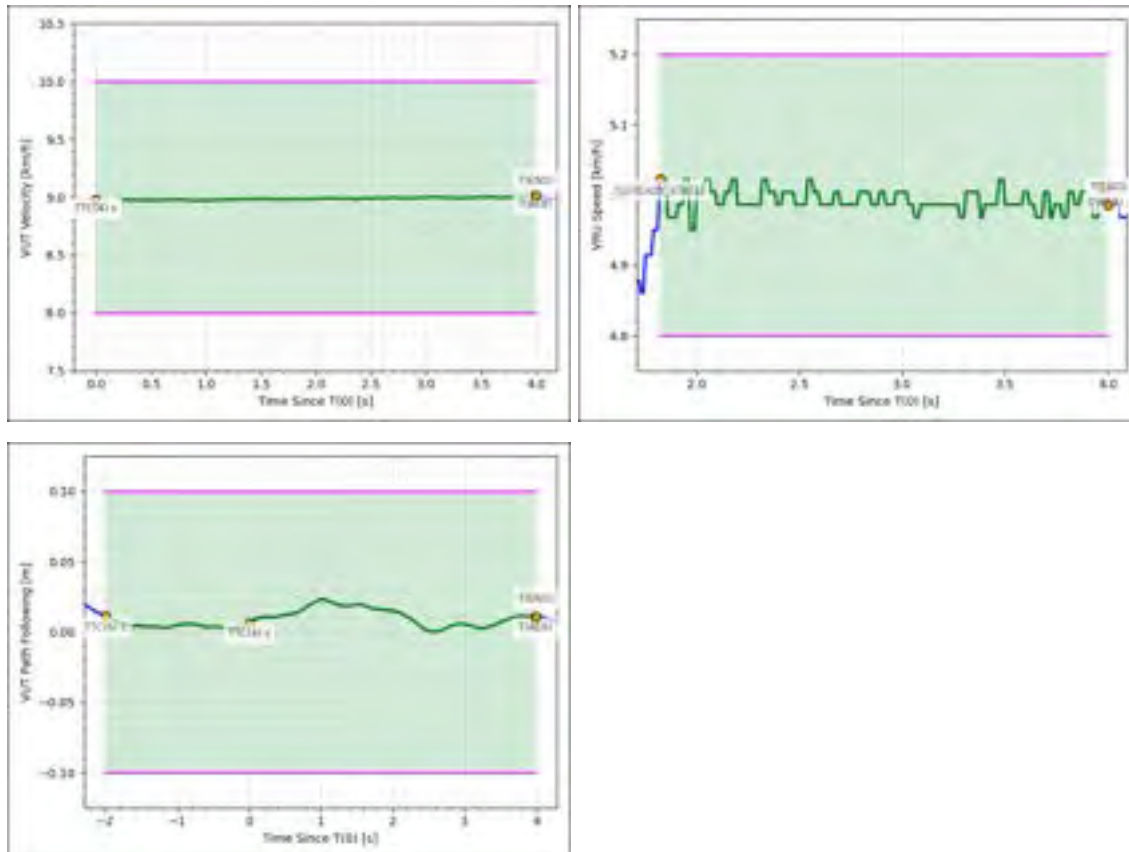


E.2.3. Rear Pitch

E.2.3.1. CPNC-50 VUT 10kph EPT 5kph (Day)

CPNC-50 5 kph (Day) | 10 km/h | Run 19

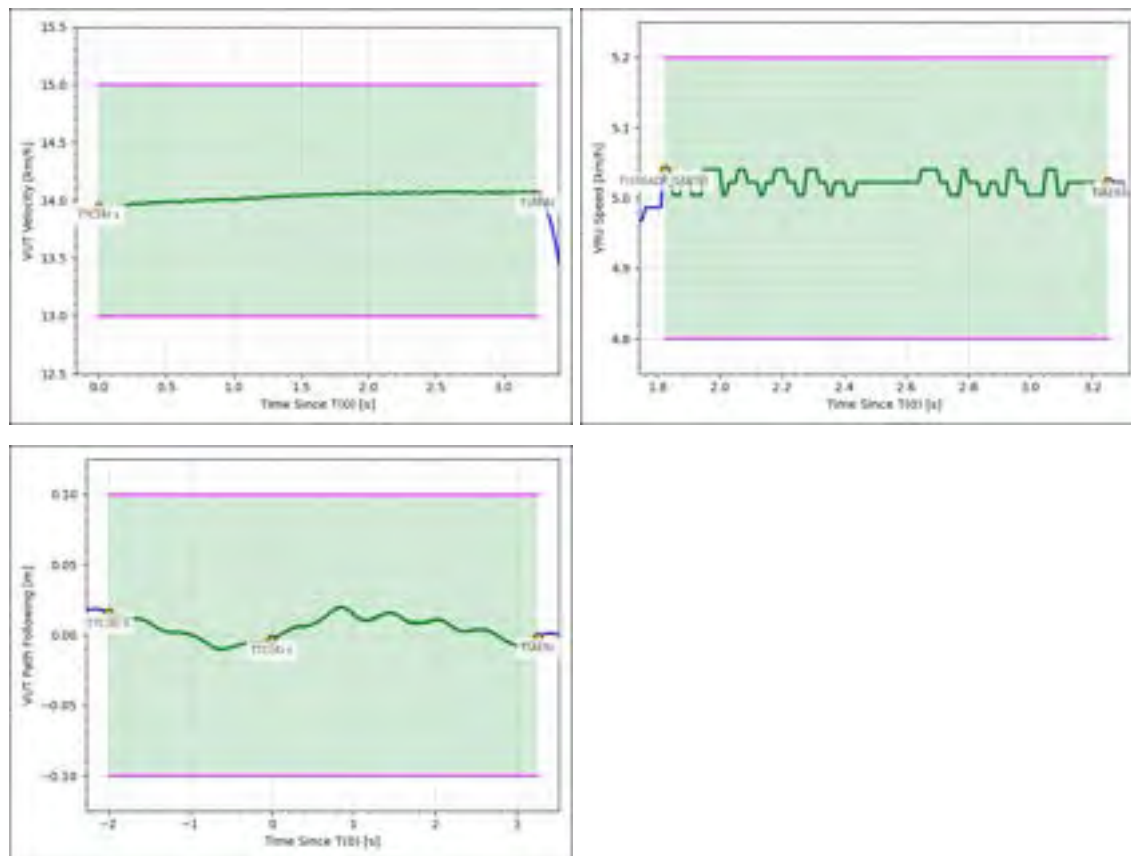
Run Date / Time 21-Dec-2022 10:14



E.2.3.2. CPNC-50 VUT 15kph EPT 5kph (Day)

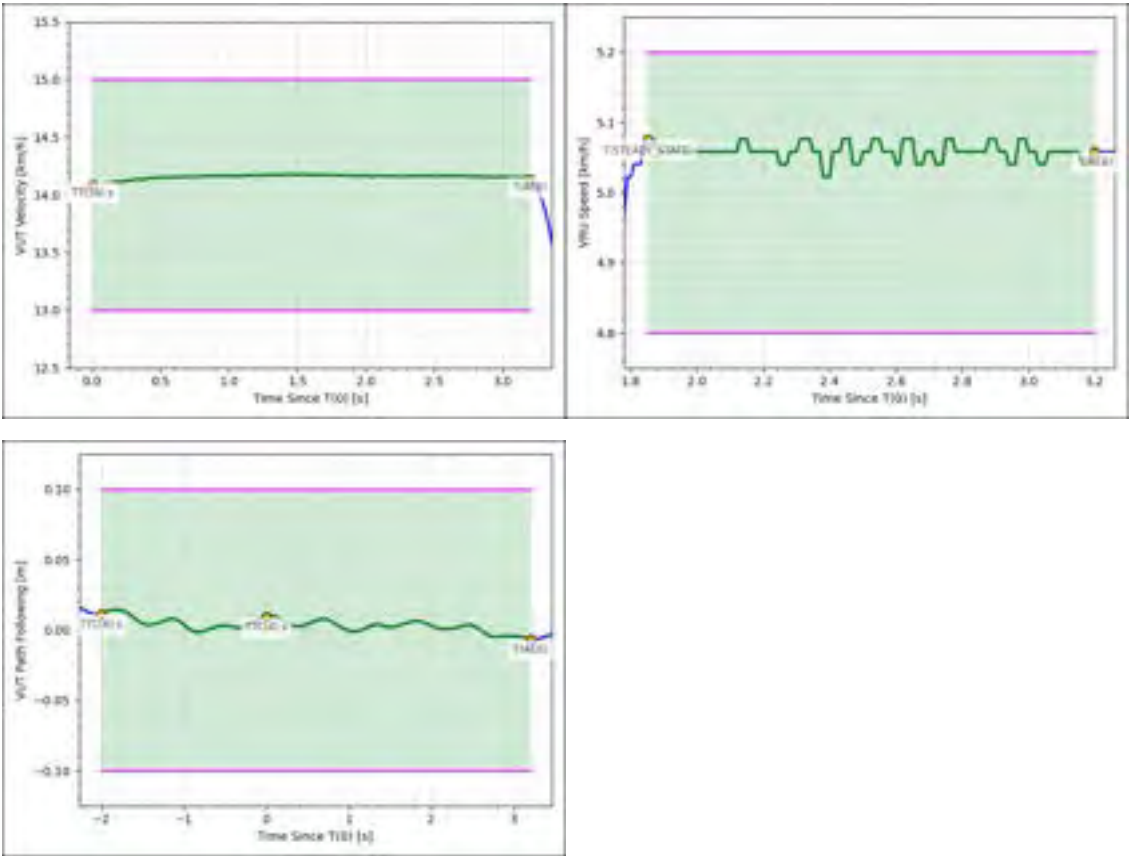
CPNC-50 5 kph (Day) | 15 km/h | Run 10

Run Date / Time 21-Dec-2022 10:26



CPNC-50 5 kph (Day) | 15 km/h | Run 13

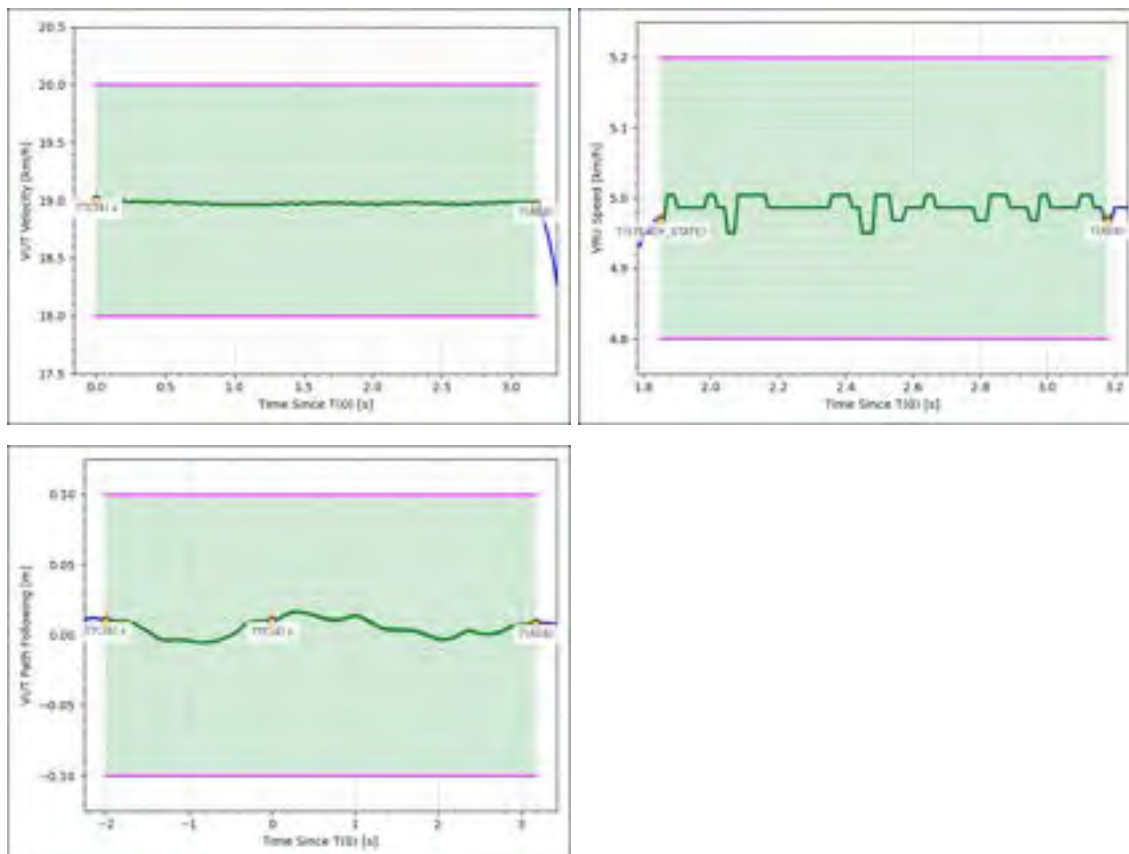
Run Date / Time 21-Dec-2022 10:33



E.2.3.3. CPNC-50 VUT 20kph EPT 5kph (Day)

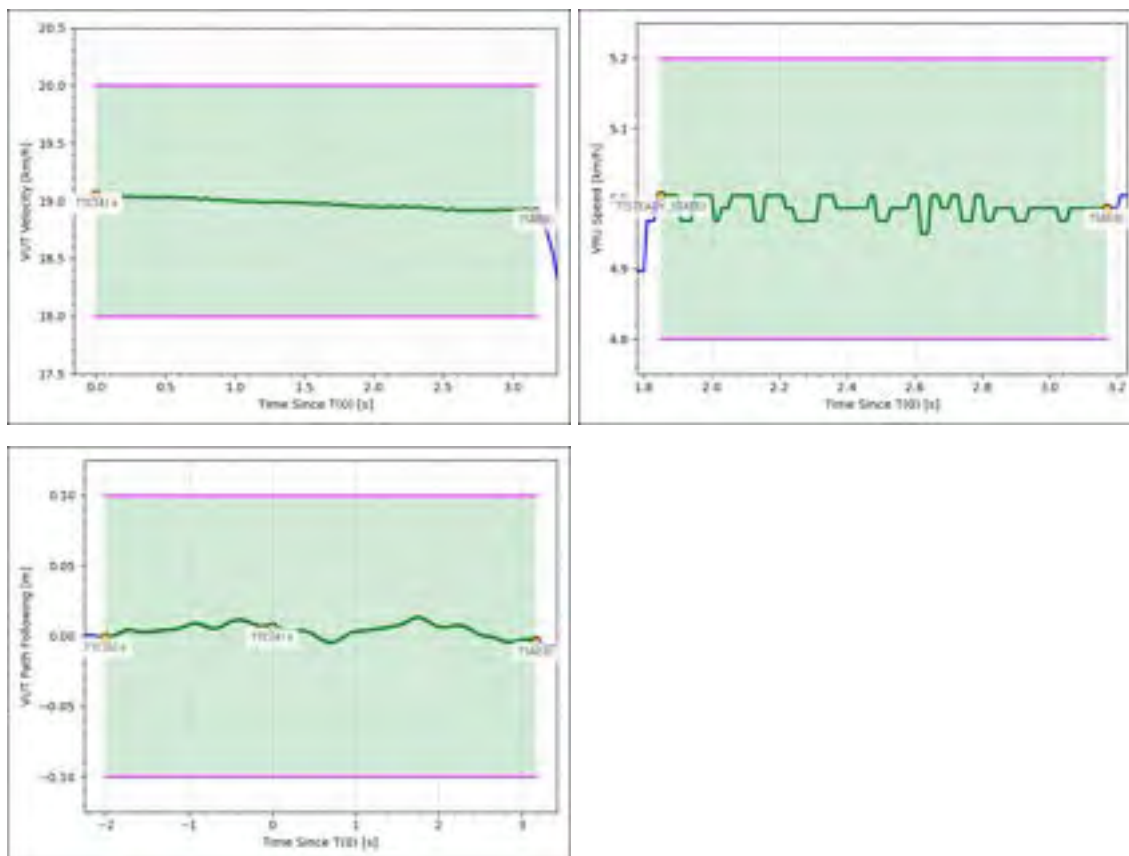
CPNC-50 5 kph (Day) | 20 km/h | Run 10

Run Date / Time 21-Dec-2022 10:37



CPNC-50 5 kph (Day) | 20 km/h | Run 11

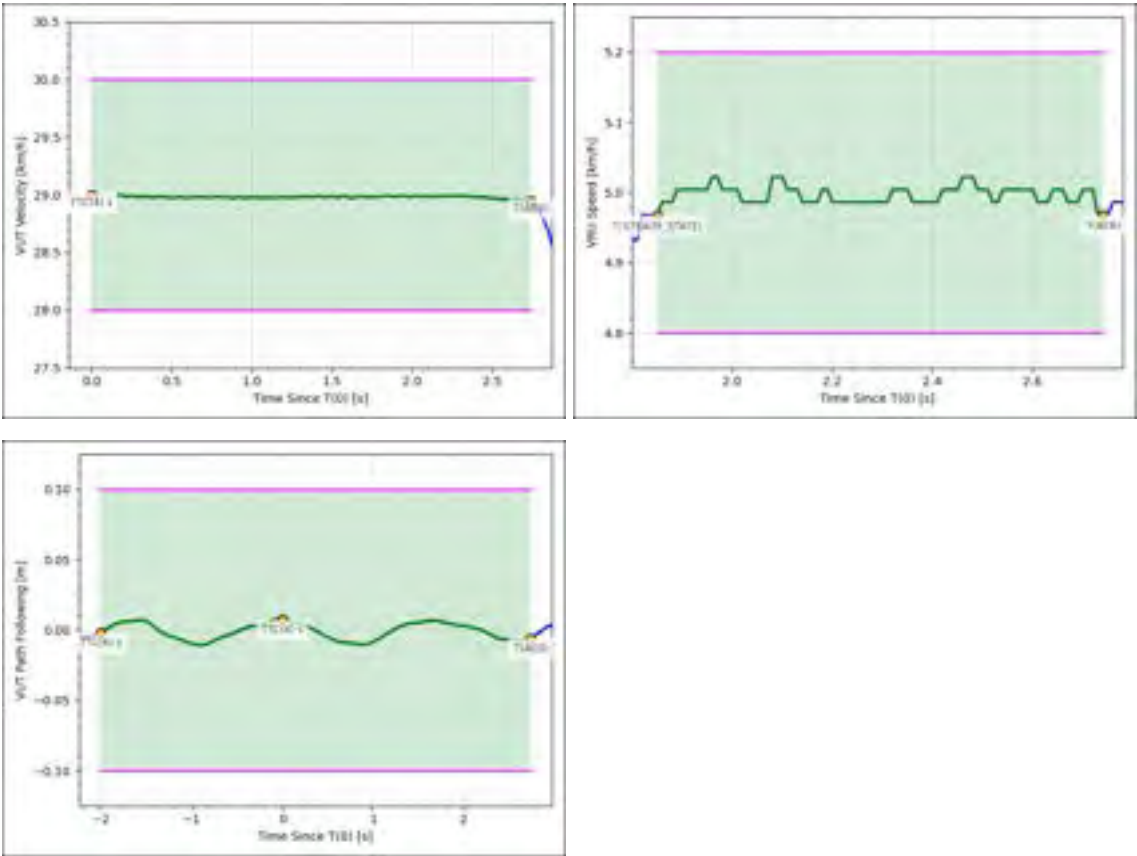
Run Date / Time 21-Dec-2022 10:42



Run Date / Time 21-Dec-2022 10:46

CPNC-50 5 kph (Day) | 30 km/h | Run 8

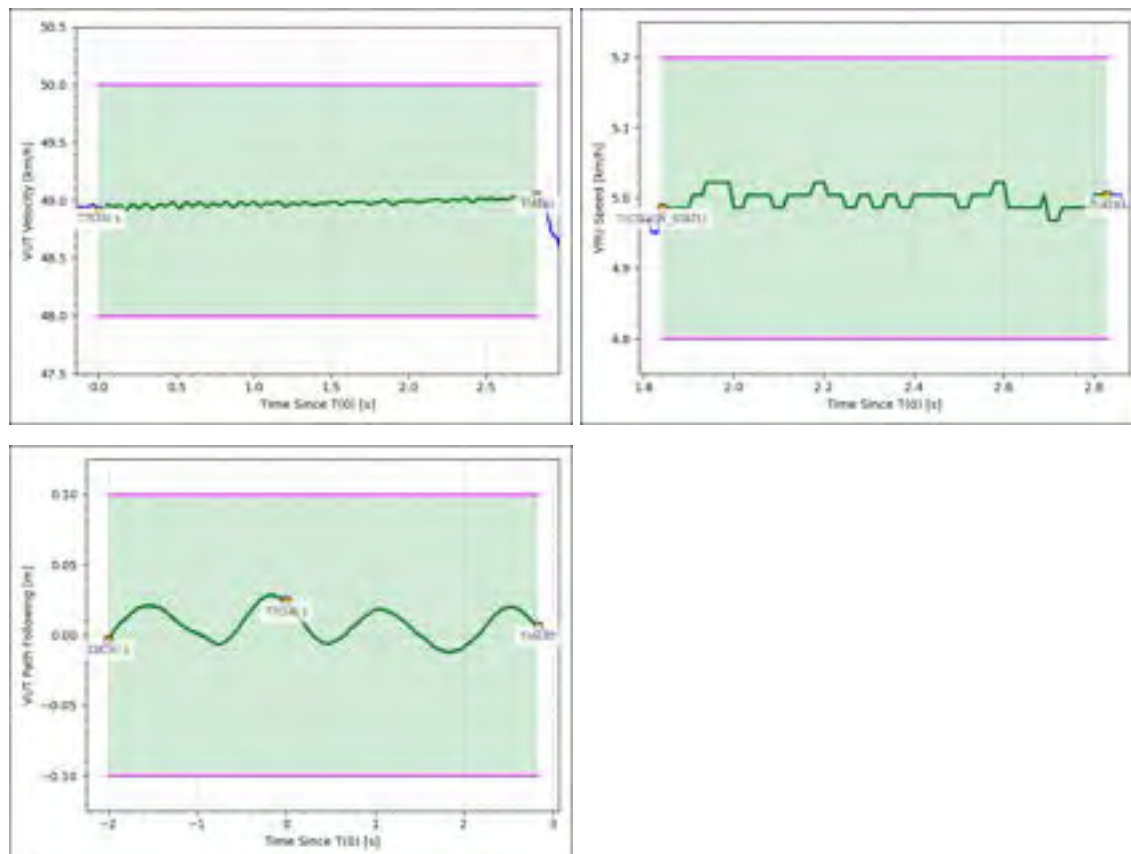
Run Date / Time 21-Dec-2022 10:48



E.2.3.5. CPNC-50 VUT 50kph EPT 5kph (Day)

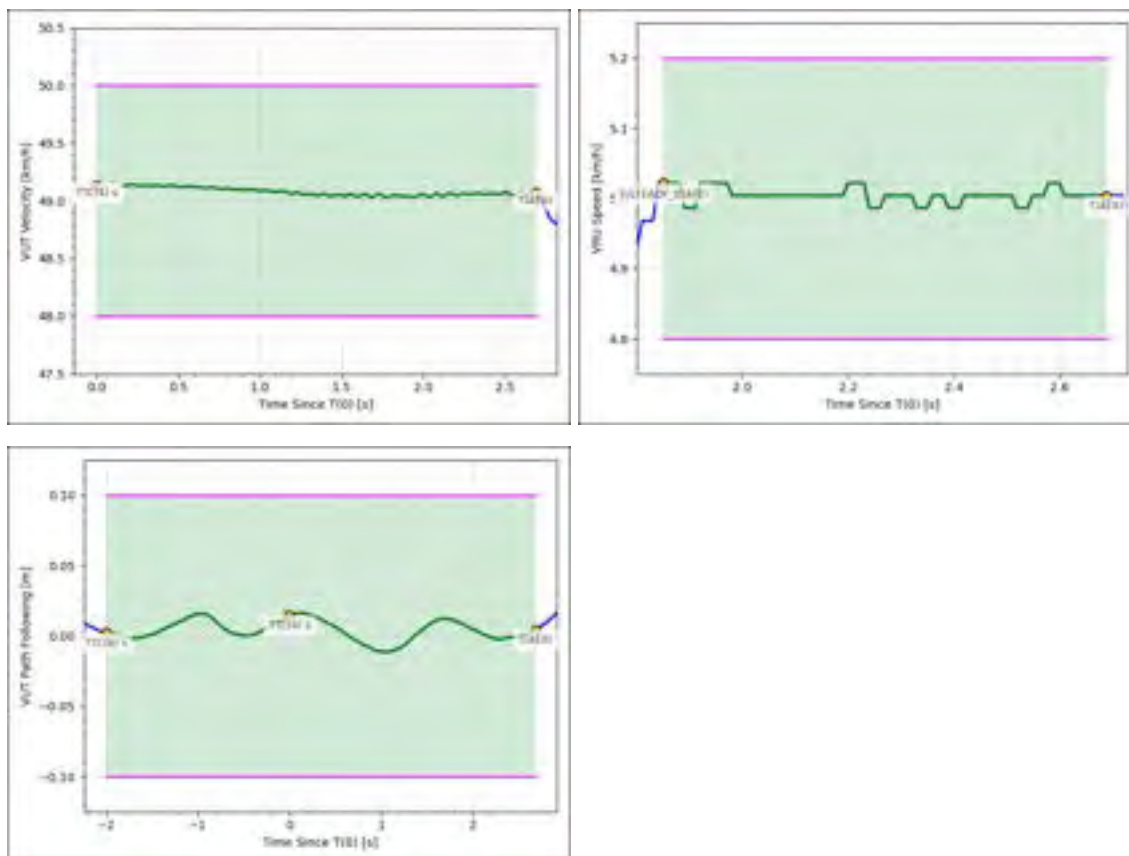
CPNC-50 5 kph (Day) | 50 km/h | Run 10

Run Date / Time 21-Dec-2022 10:52



CPNC-50 5 kph (Day) | 50 km/h | Run 11

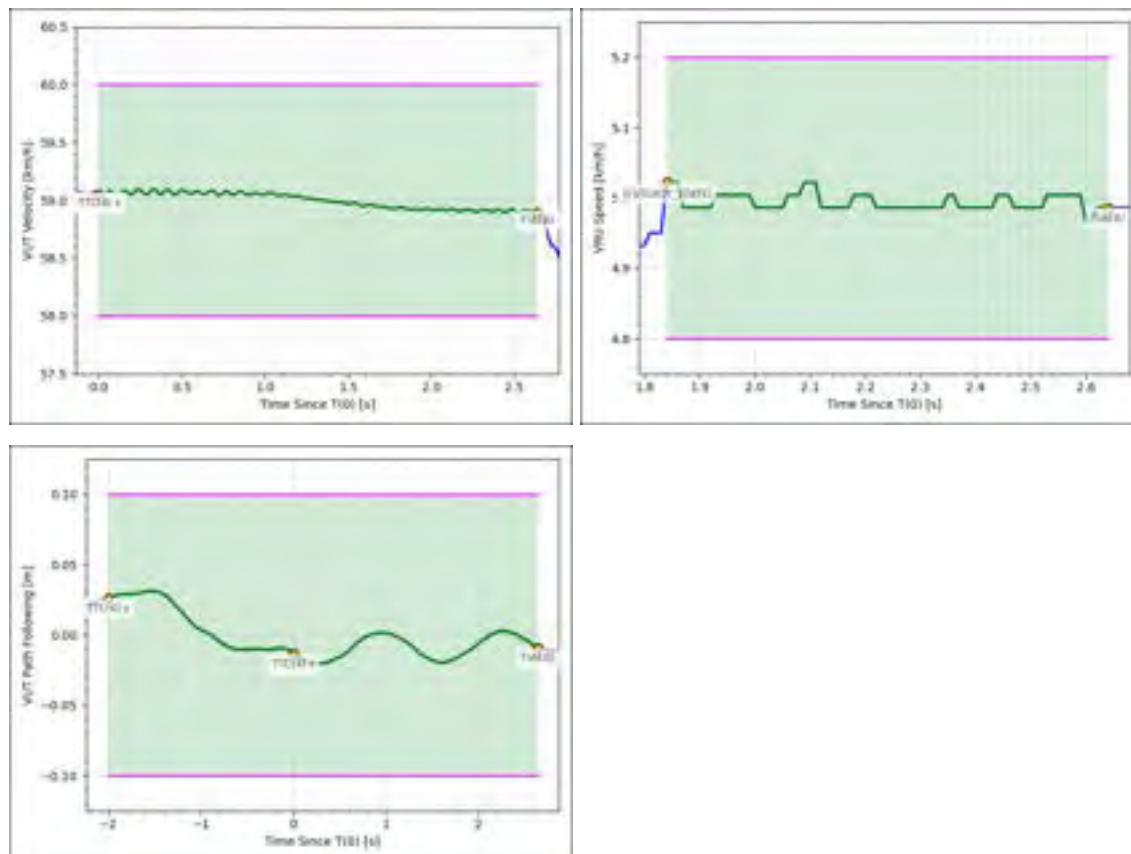
Run Date / Time 21-Dec-2022 10:55



E.2.3.6. CPNC-50 VUT 60kph EPT 5kph (Day)

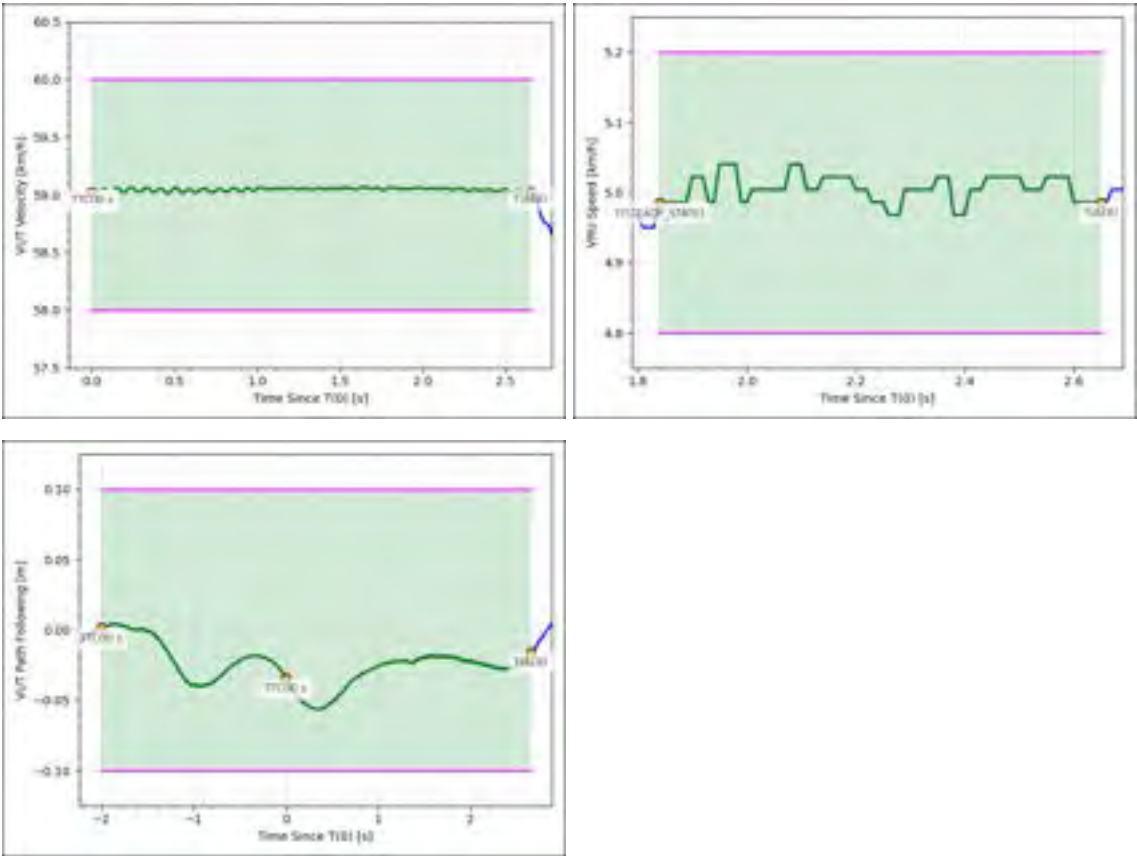
CPNC-50 5 kph (Day) | 60 km/h | Run 11

Run Date / Time 21-Dec-2022 11:02



CPNC-50 5 kph (Day) | 60 km/h | Run 12

Run Date / Time 21-Dec-2022 11:06

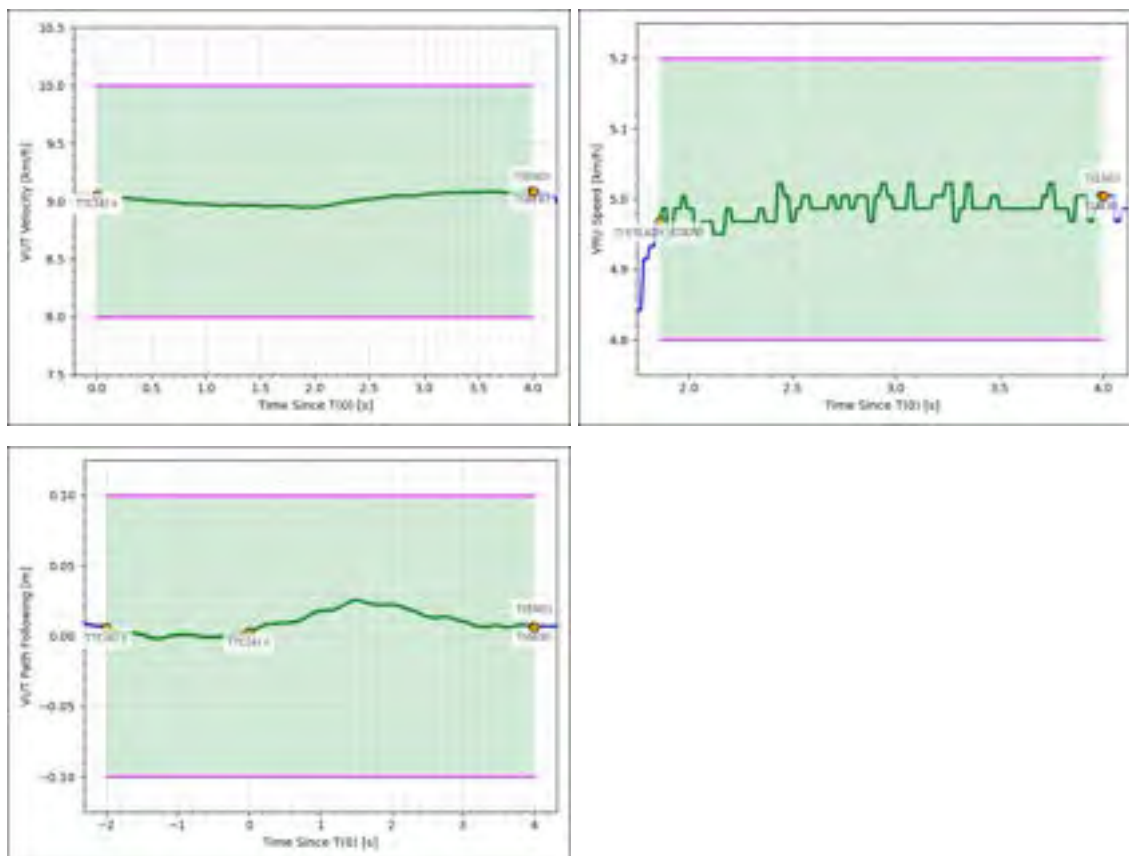


E.2.4. Lift Kit

E.2.4.1. CPNC-50 VUT 10kph EPT 5kph (Day)

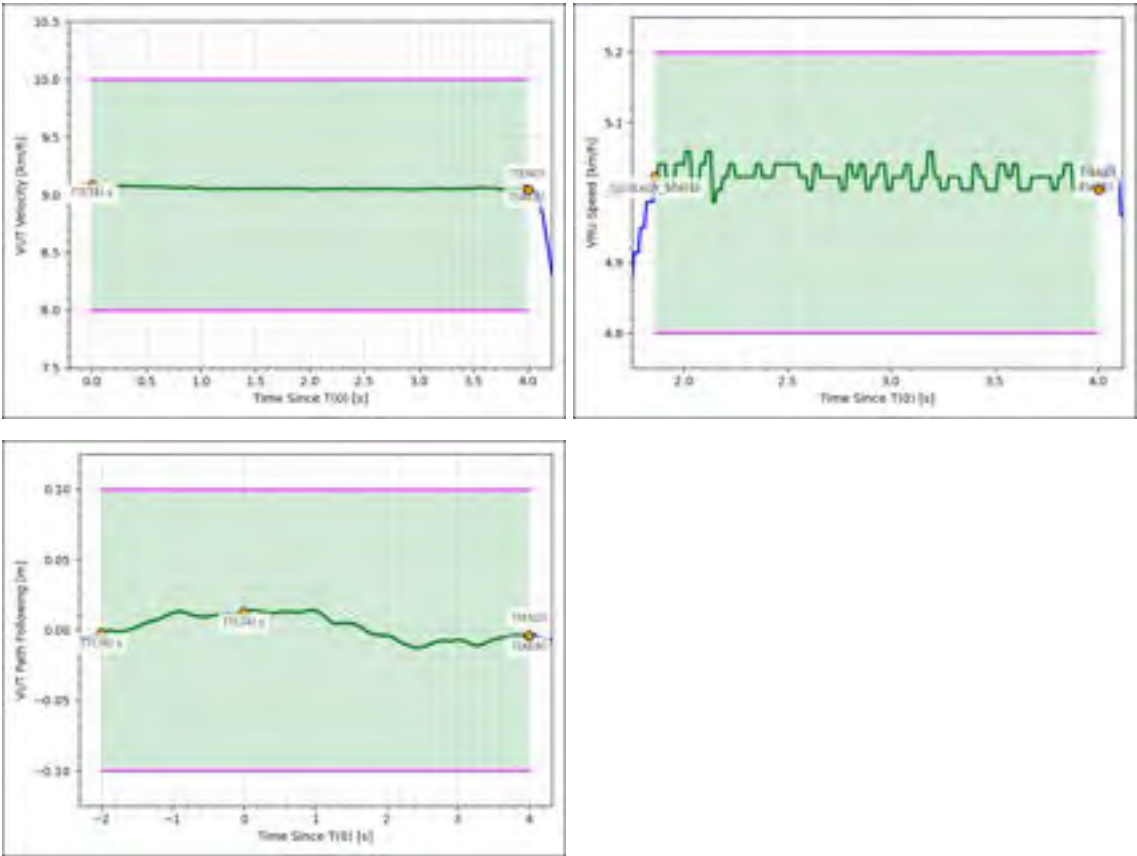
CPNC-50 5 kph (Day) | 10 km/h | Run 20

Run Date / Time 7-Mar-2023 10:19



CPNC-50 5 kph (Day) | 10 km/h | Run 21

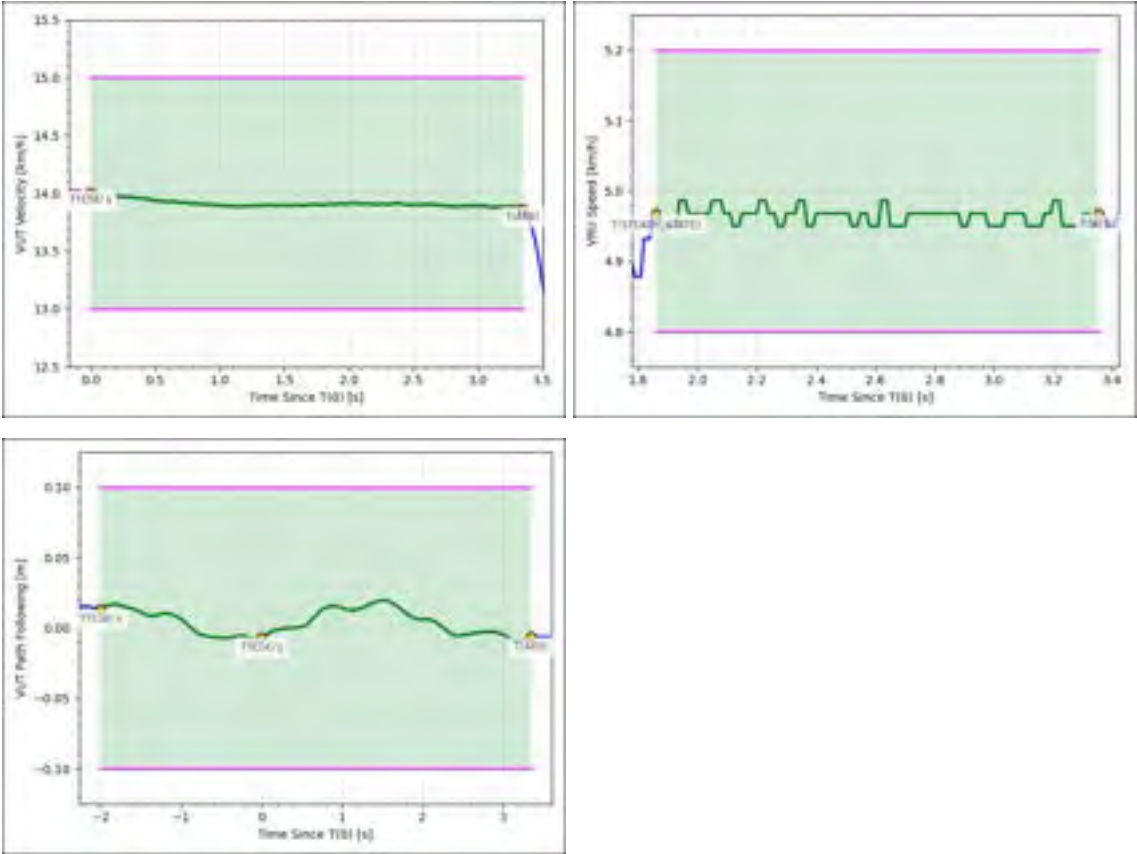
Run Date / Time 7-Mar-2023 10:26



E.2.4.2. CPNC-50 VUT 15kph EPT 5kph (Day)

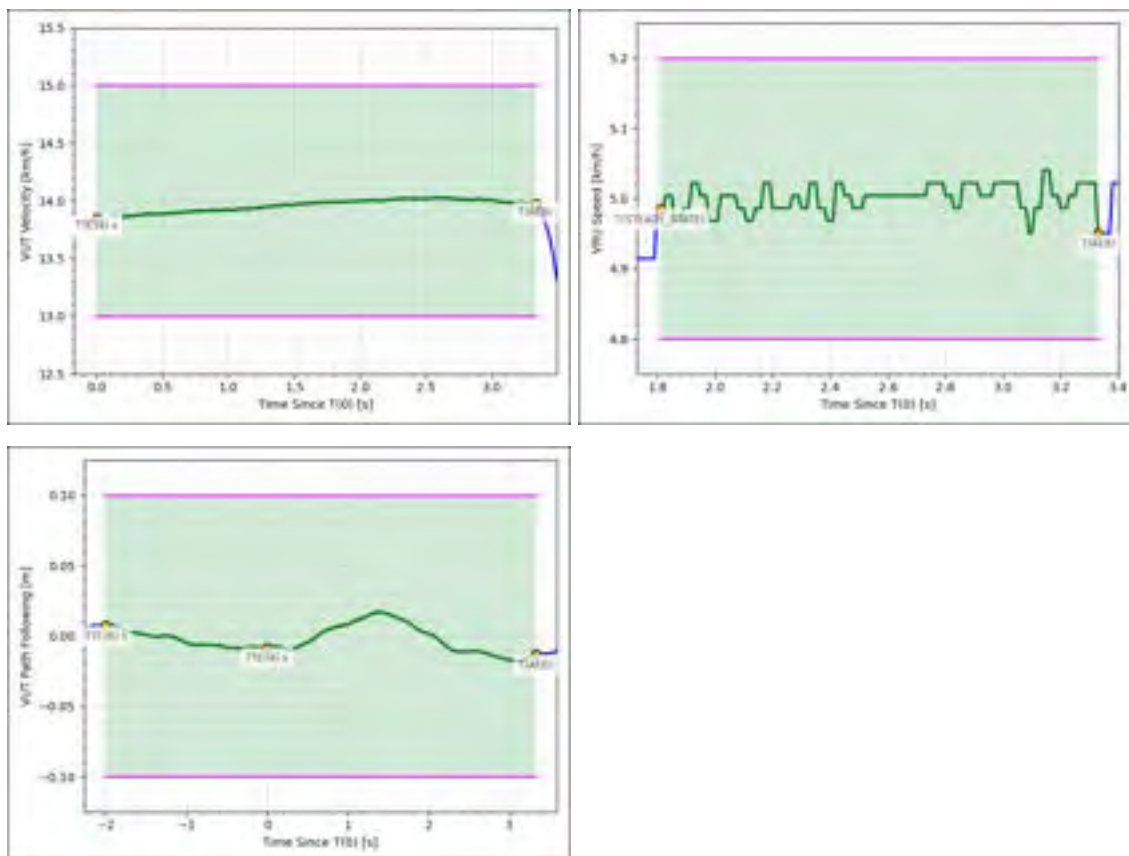
CPNC-50 5 kph (Day) | 15 km/h | Run 14

Run Date / Time 7-Mar-2023 10:31



CPNC-50 5 kph (Day) | 15 km/h | Run 15

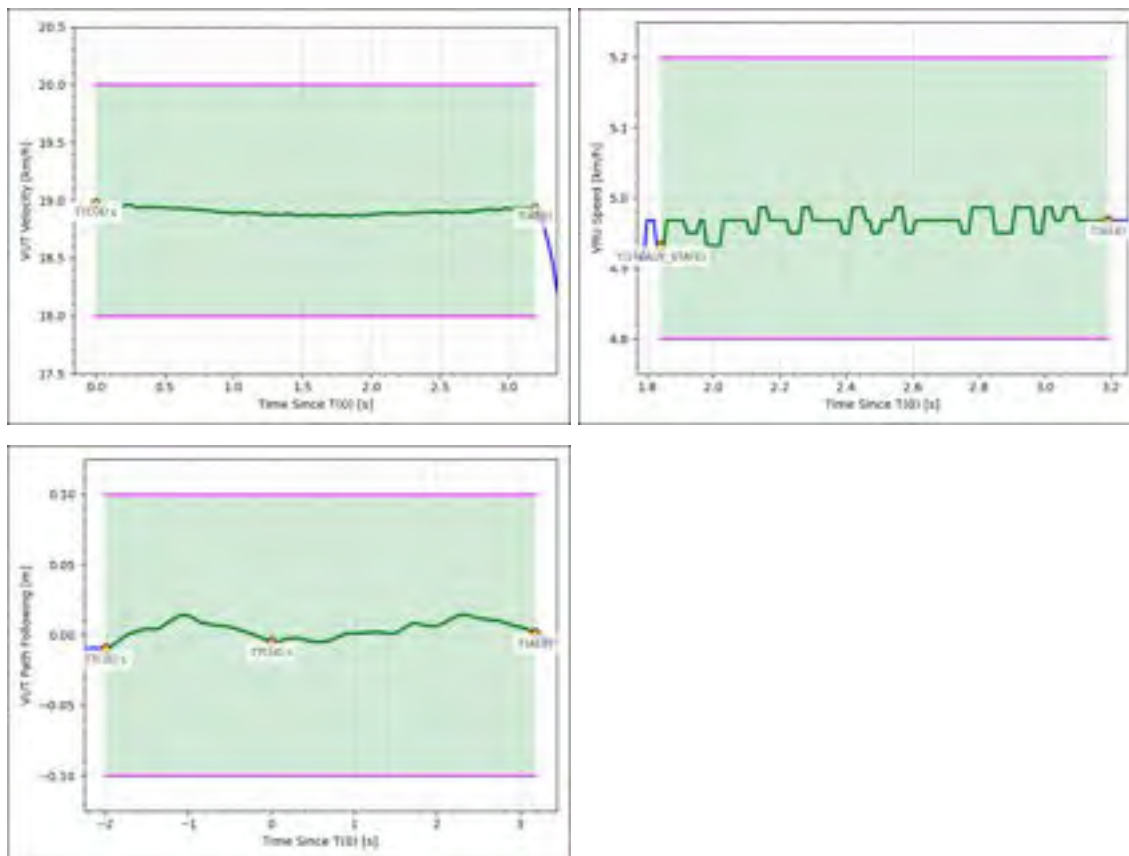
Run Date / Time 7-Mar-2023 10:34



E.2.4.3. CPNC-50 VUT 20kph EPT 5kph (Day)

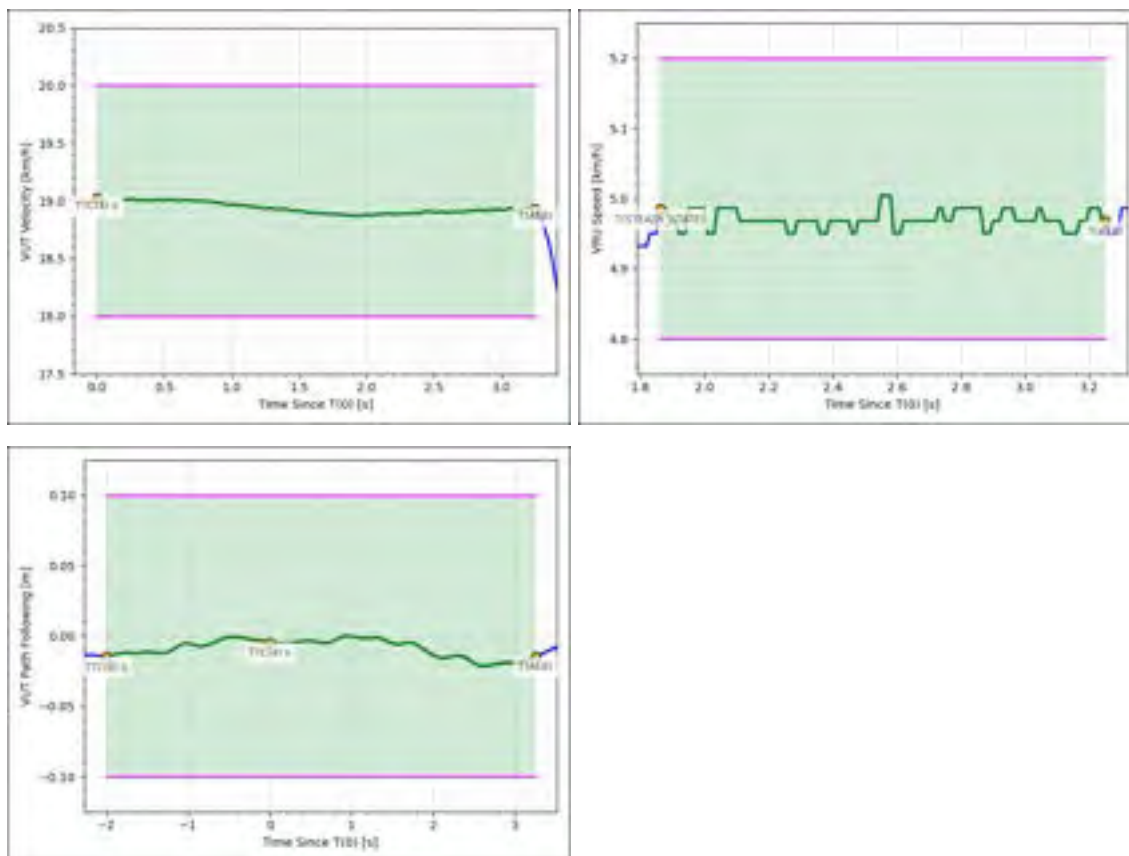
CPNC-50 5 kph (Day) | 20 km/h | Run 12

Run Date / Time 7-Mar-2023 10:38



CPNC-50 5 kph (Day) | 20 km/h | Run 13

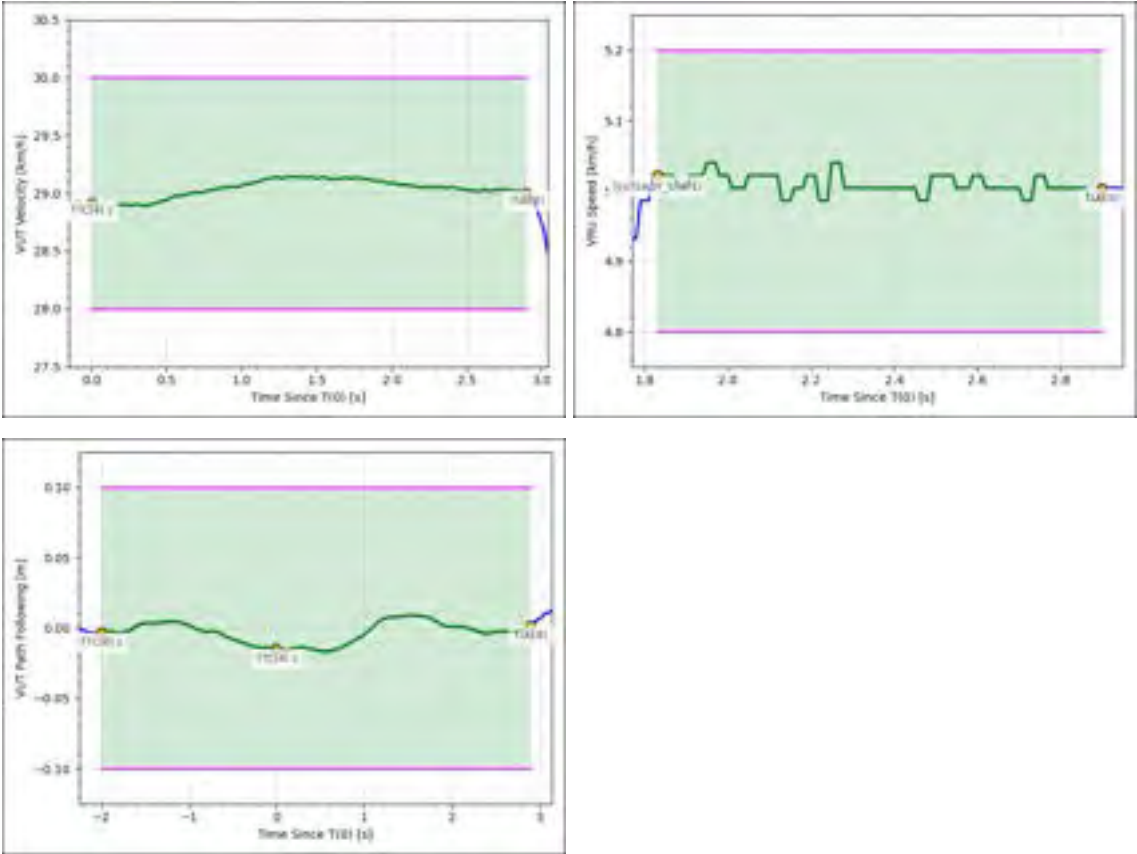
Run Date / Time 7-Mar-2023 10:41



E.2.4.4. CPNC-50 VUT 30kph EPT 5kph (Day)

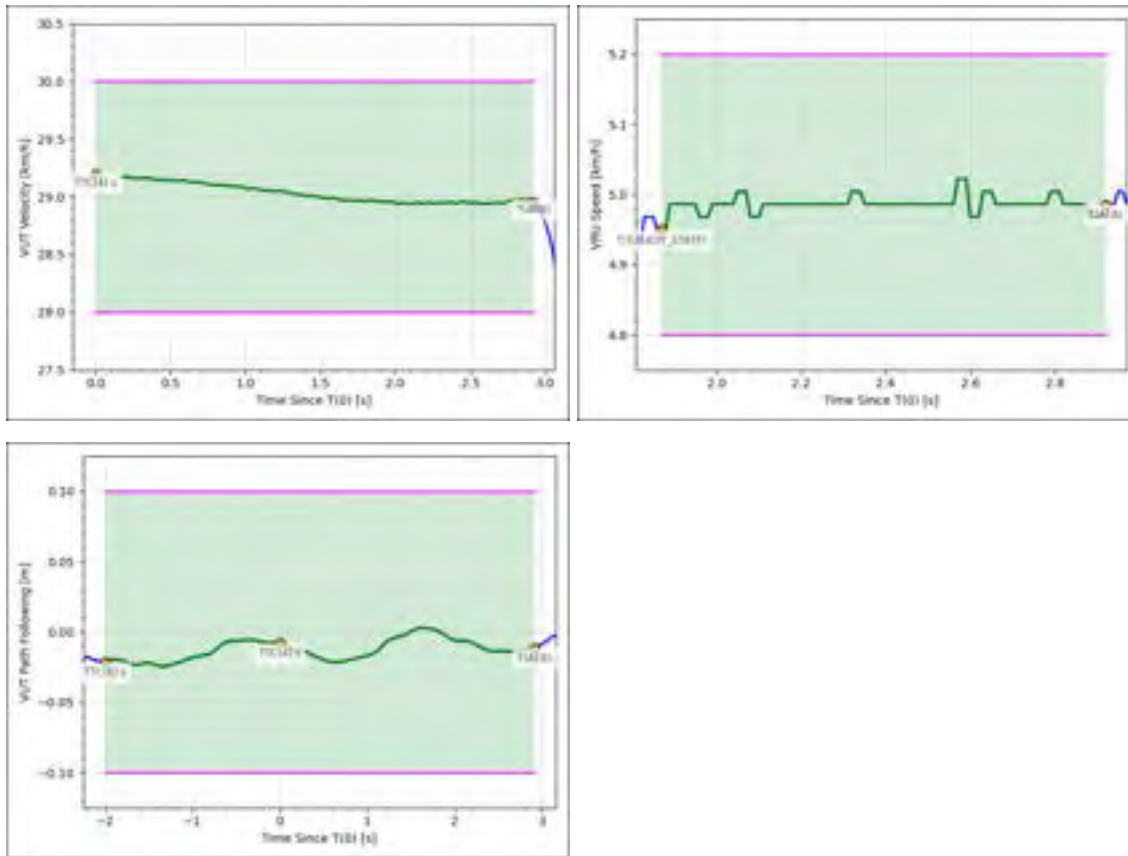
CPNC-50 5 kph (Day) | 30 km/h | Run 9

Run Date / Time 7-Mar-2023 10:46



CPNC-50 5 kph (Day) | 30 km/h | Run 10

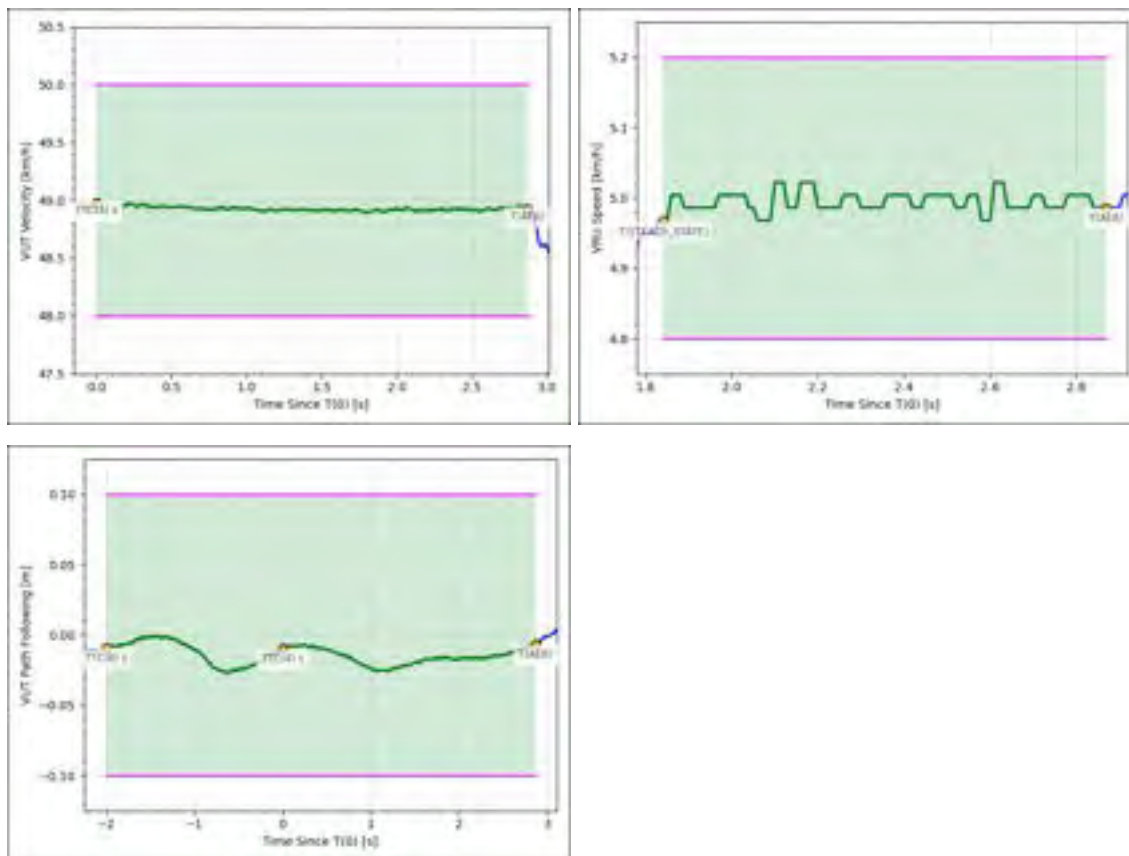
Run Date / Time 7-Mar-2023 10:48



E.2.4.5. CPNC-50 VUT 50kph EPT 5kph (Day)

CPNC-50 5 kph (Day) | 50 km/h | Run 13

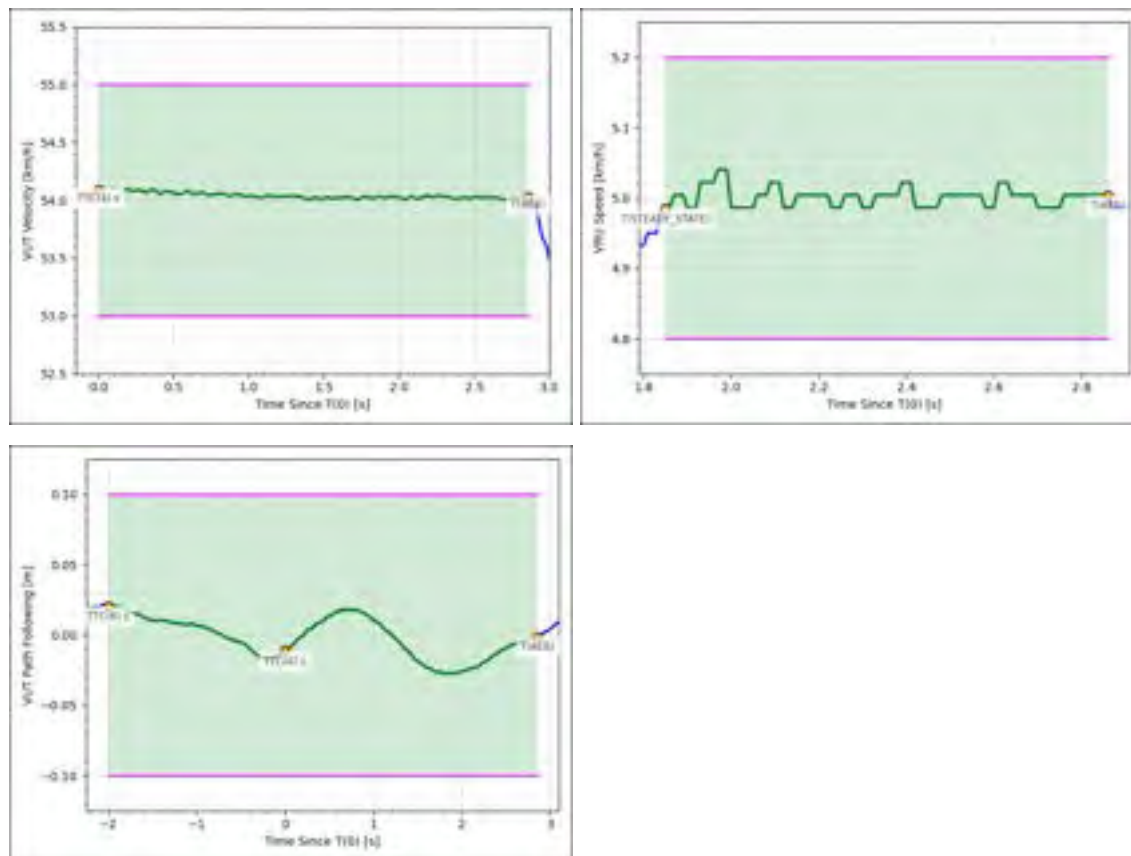
Run Date / Time 7-Mar-2023 10:54



E.2.4.6. CPNC-50 VUT 55kph EPT 5kph (Day)

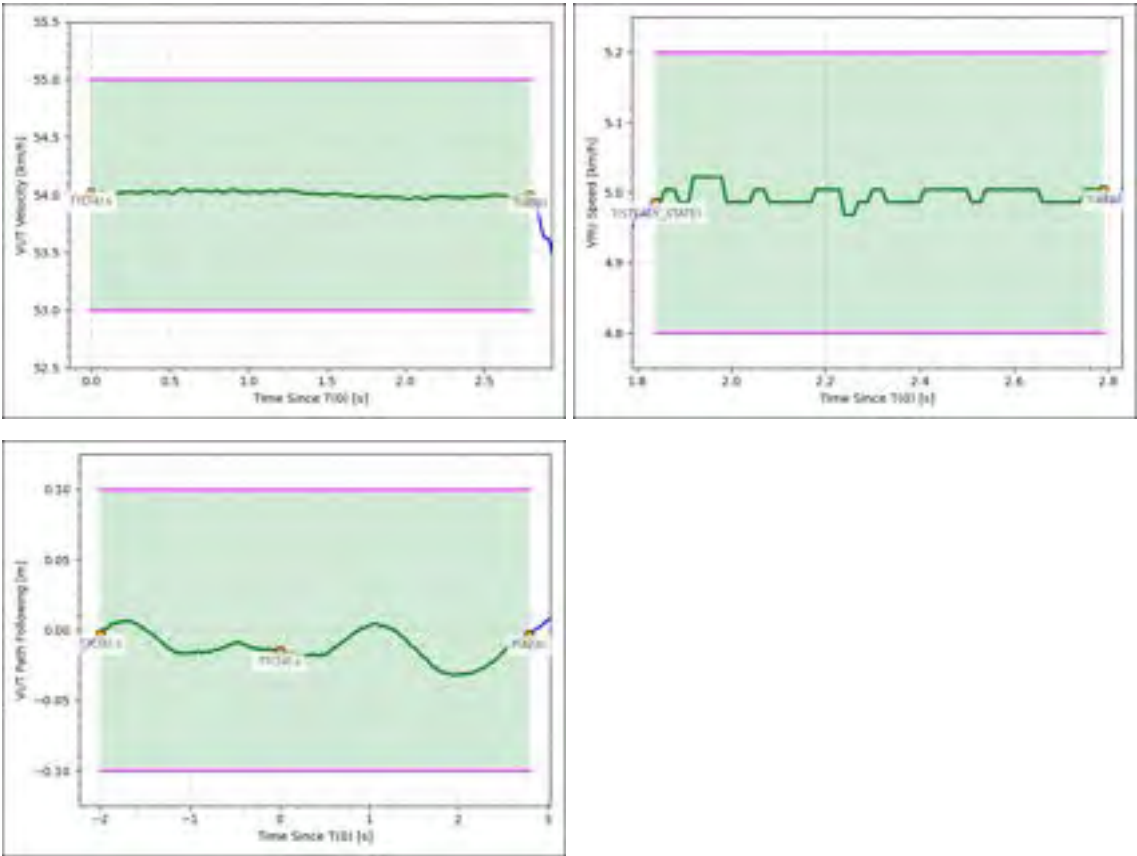
CPNC-50 5 kph (Day) | 55 km/h | Run 1

Run Date / Time 7-Mar-2023 11:08



CPNC-50 5 kph (Day) | 55 km/h | Run 2

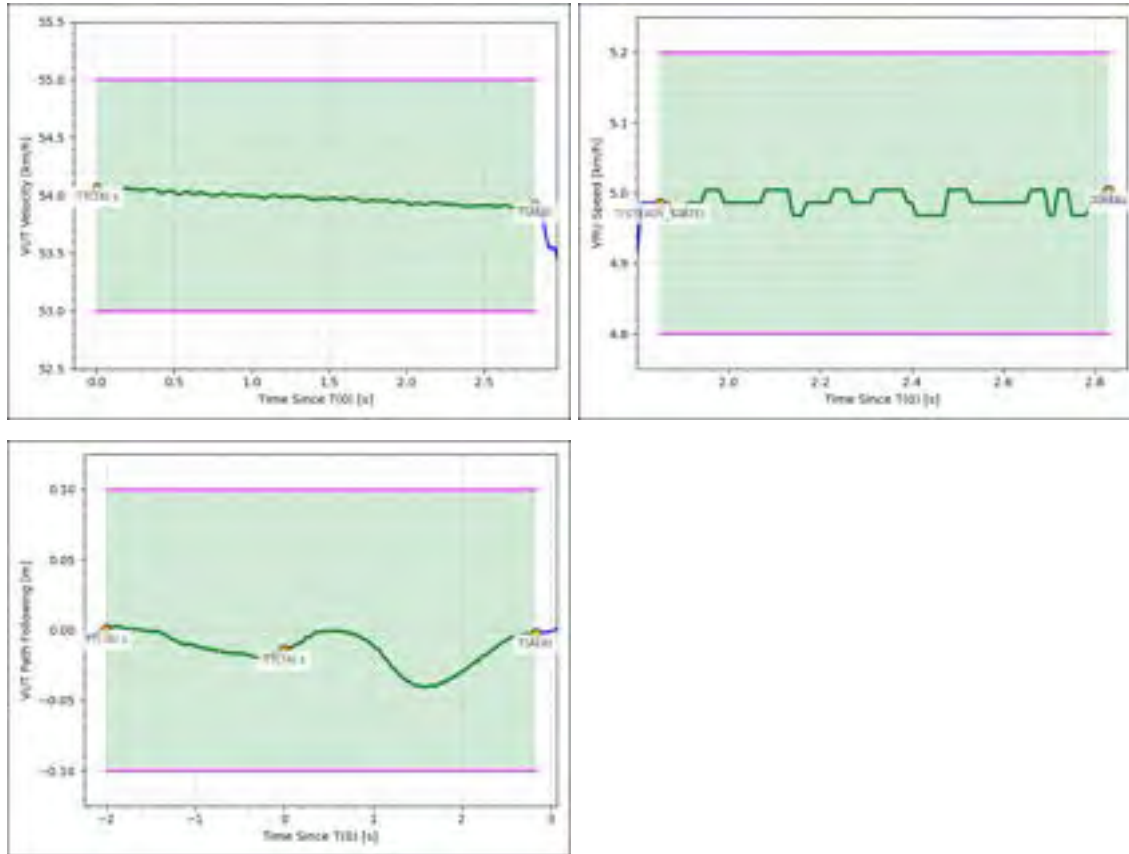
Run Date / Time 7-Mar-2023 11:11



E.2.4.7. CPNC-50 VUT 55kph EPT 5kph (Day)

CPNC-50 5 kph (Day) | 55 km/h | Run 3

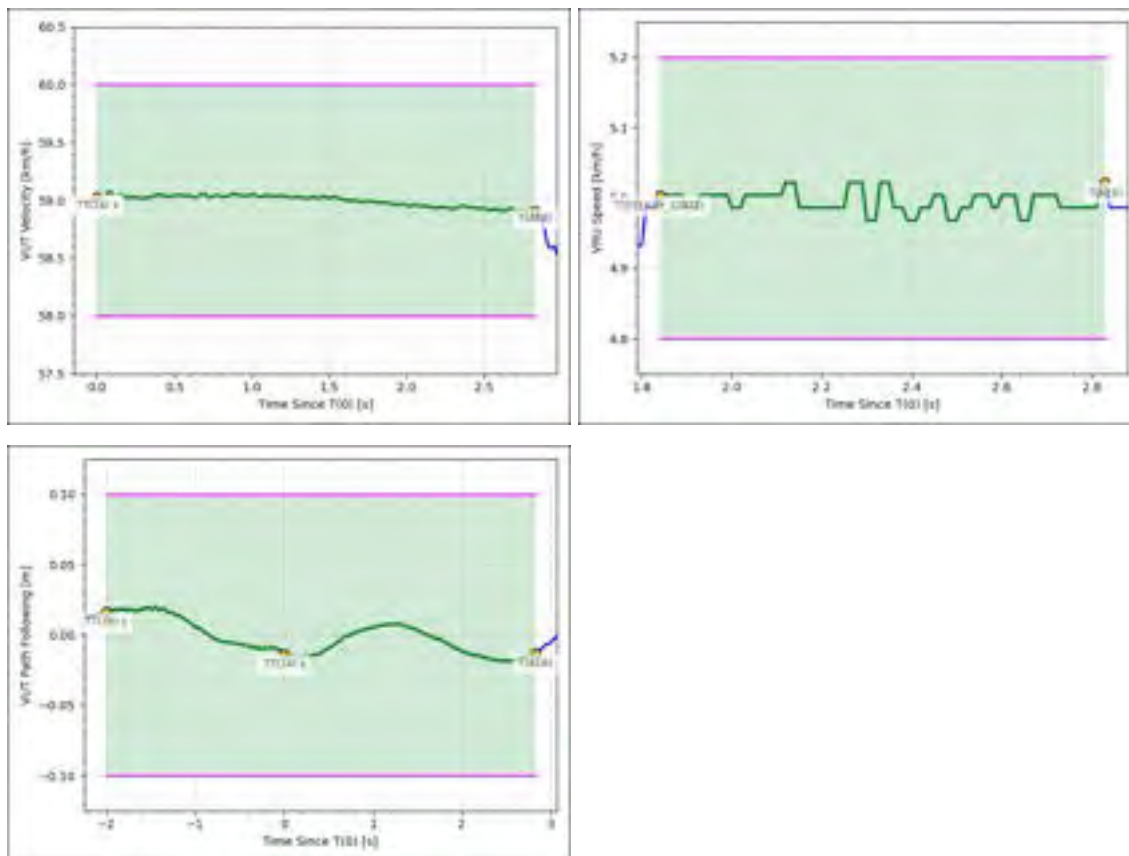
Run Date / Time 7-Mar-2023 11:14



E.2.4.8. CPNC-50 VUT 60kph EPT 5kph (Day)

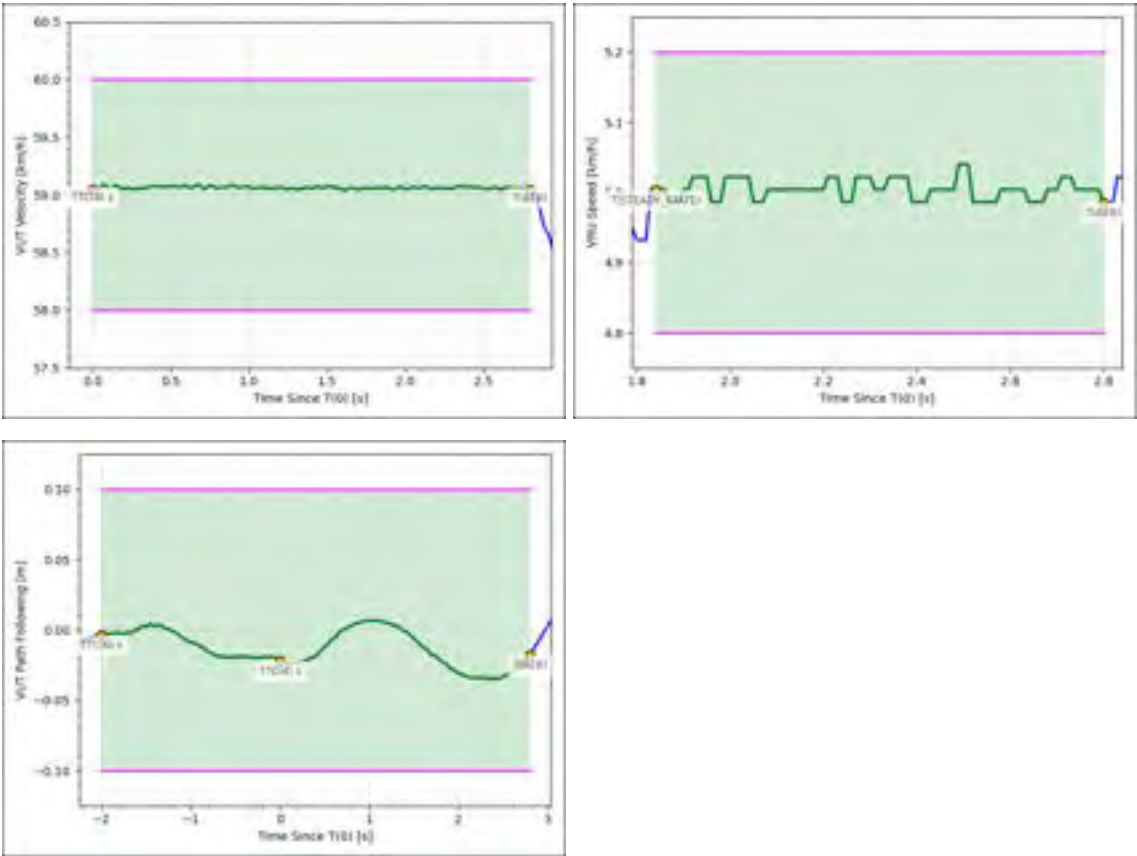
CPNC-50 5 kph (Day) | 60 km/h | Run 13

Run Date / Time 7-Mar-2023 11:01



CPNC-50 5 kph (Day) | 60 km/h | Run 14

Run Date / Time 7-Mar-2023 11:05

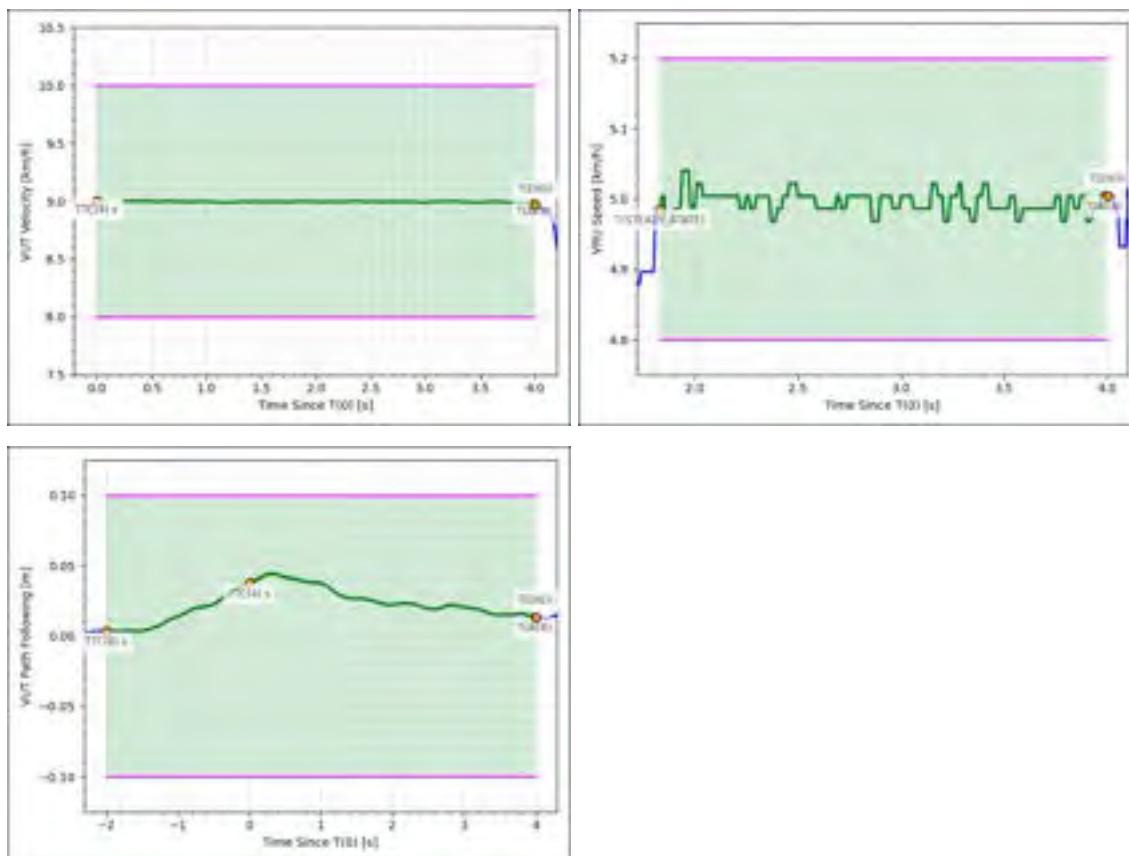


E.2.5. Lift Kit + Bullbar

E.2.5.1. CPNC-50 VUT 10kph EPT 5kph (Day)

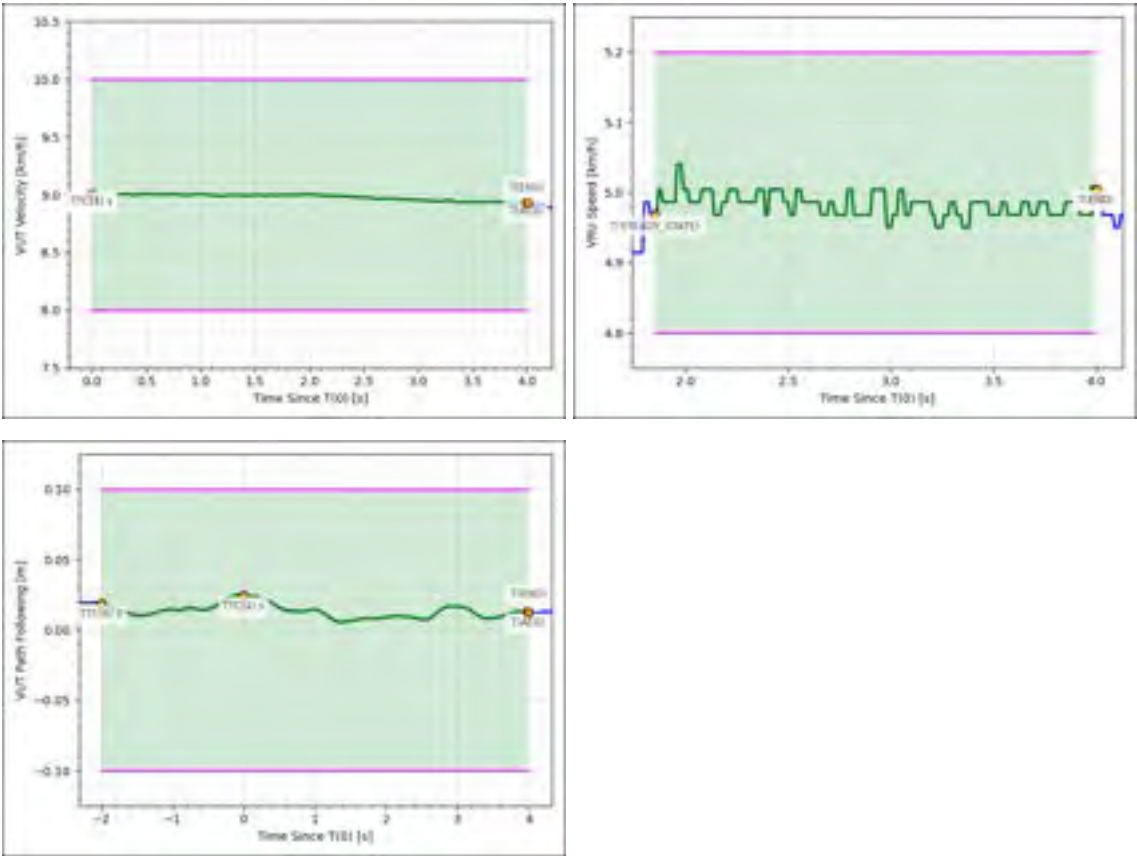
CPNC-50 5 kph (Day) | 10 km/h | Run 1

Run Date / Time 20-Mar-2023 11:14



CPNC-50 5 kph (Day) | 10 km/h | Run 2

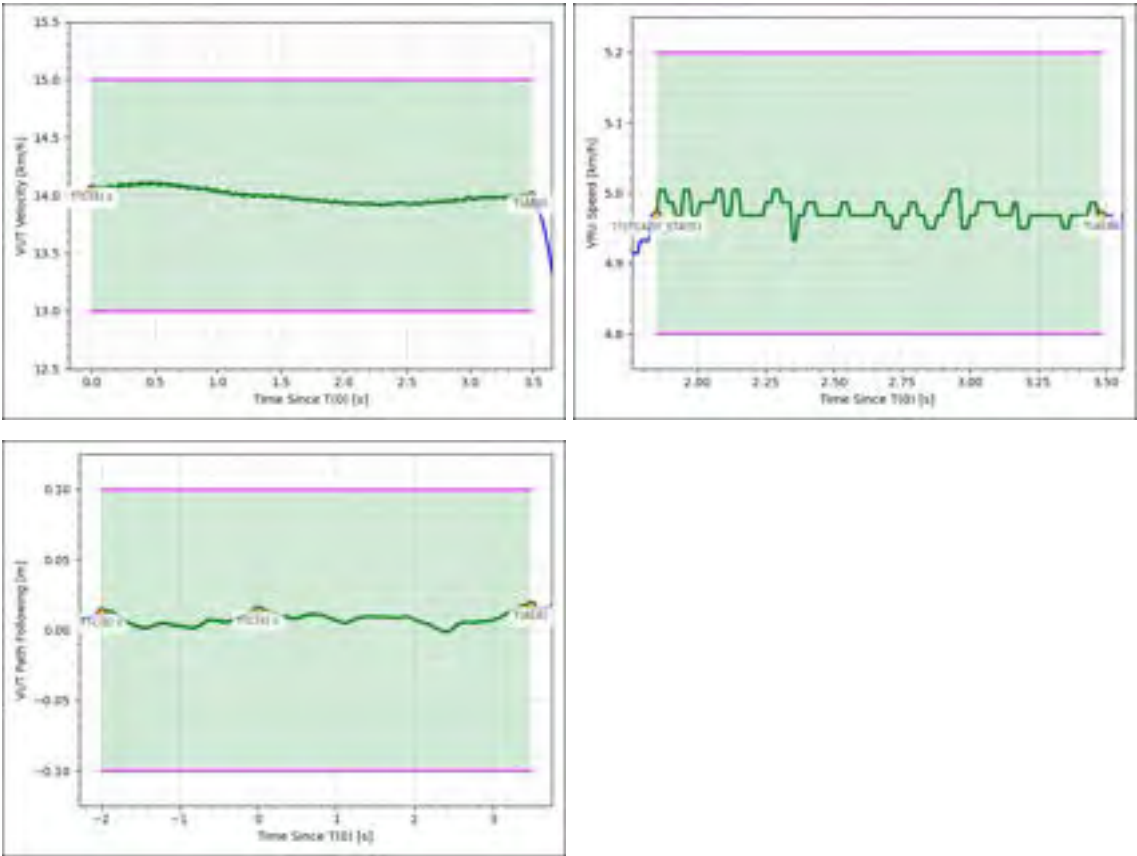
Run Date / Time 20-Mar-2023 11:20



E.2.5.2. CPNC-50 VUT 15kph EPT 5kph (Day)

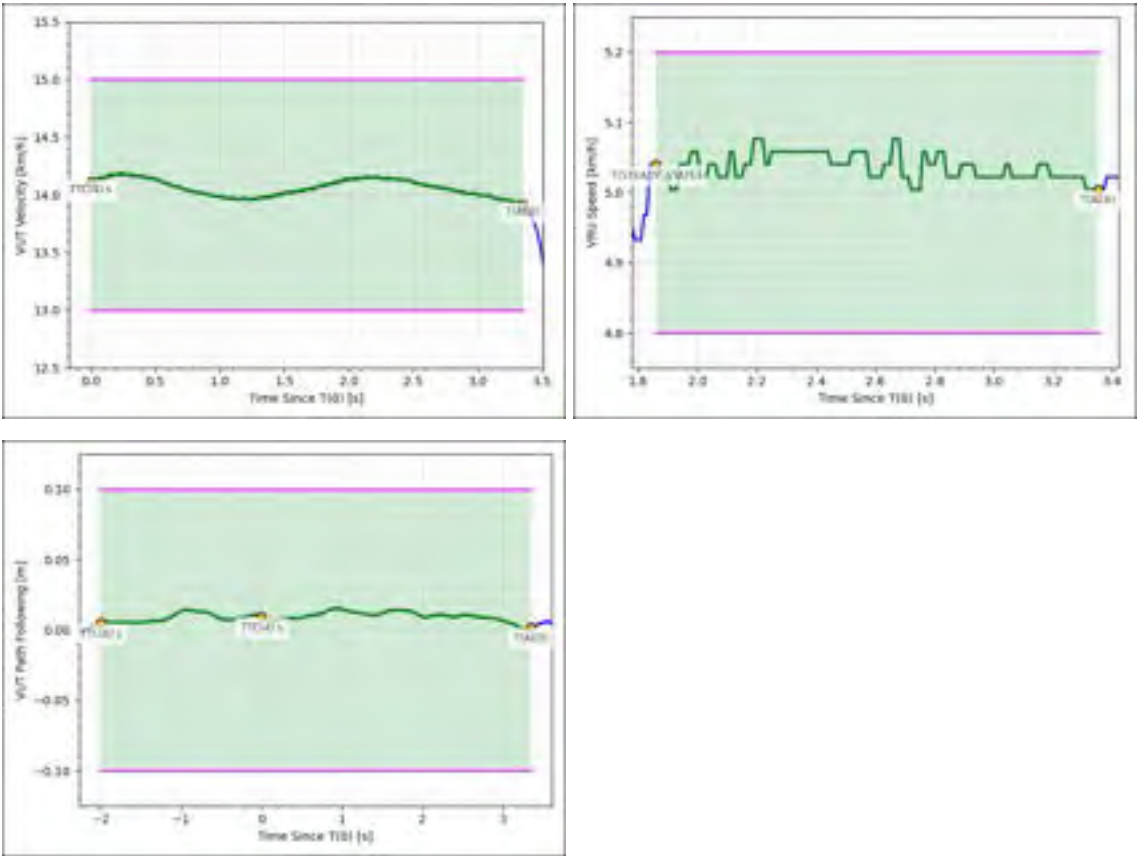
CPNC-50 5 kph (Day) | 15 km/h | Run 1

Run Date / Time 20-Mar-2023 11:24



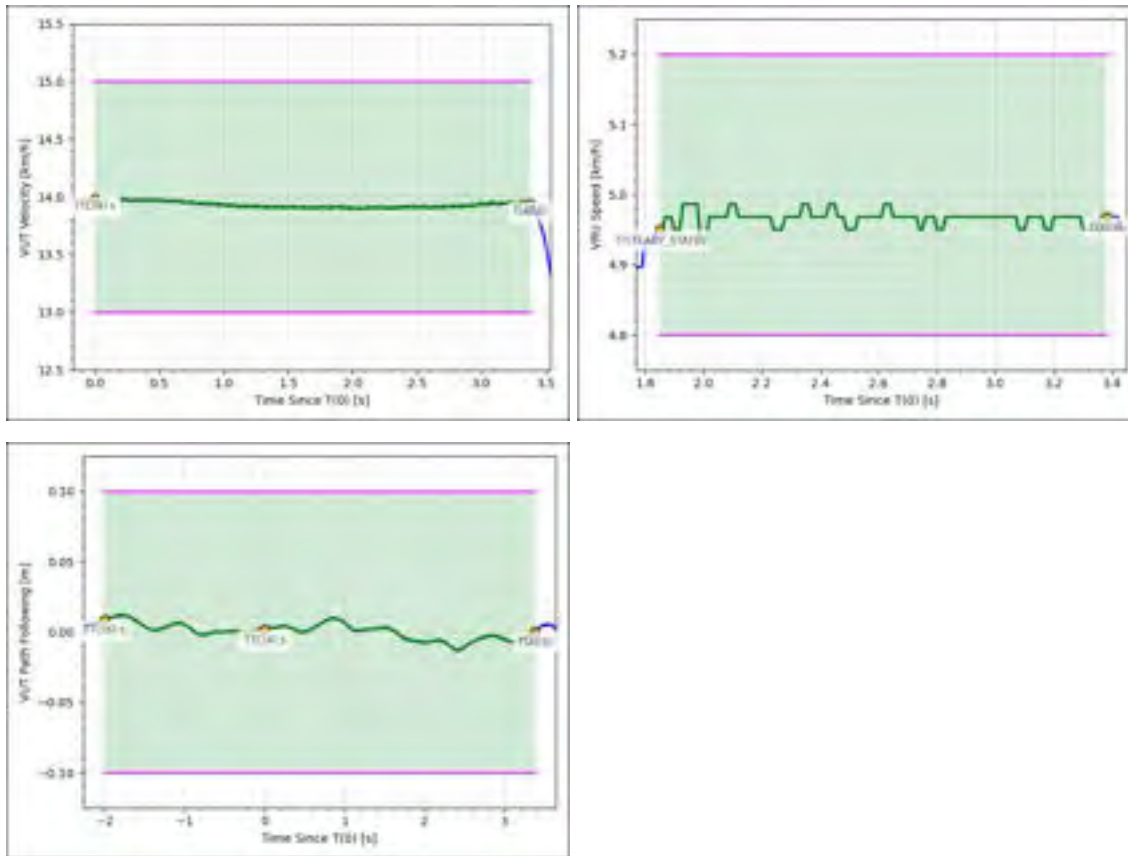
CPNC-50 5 kph (Day) | 15 km/h | Run 2

Run Date / Time 20-Mar-2023 11:28



CPNC-50 5 kph (Day) | 15 km/h | Run 3

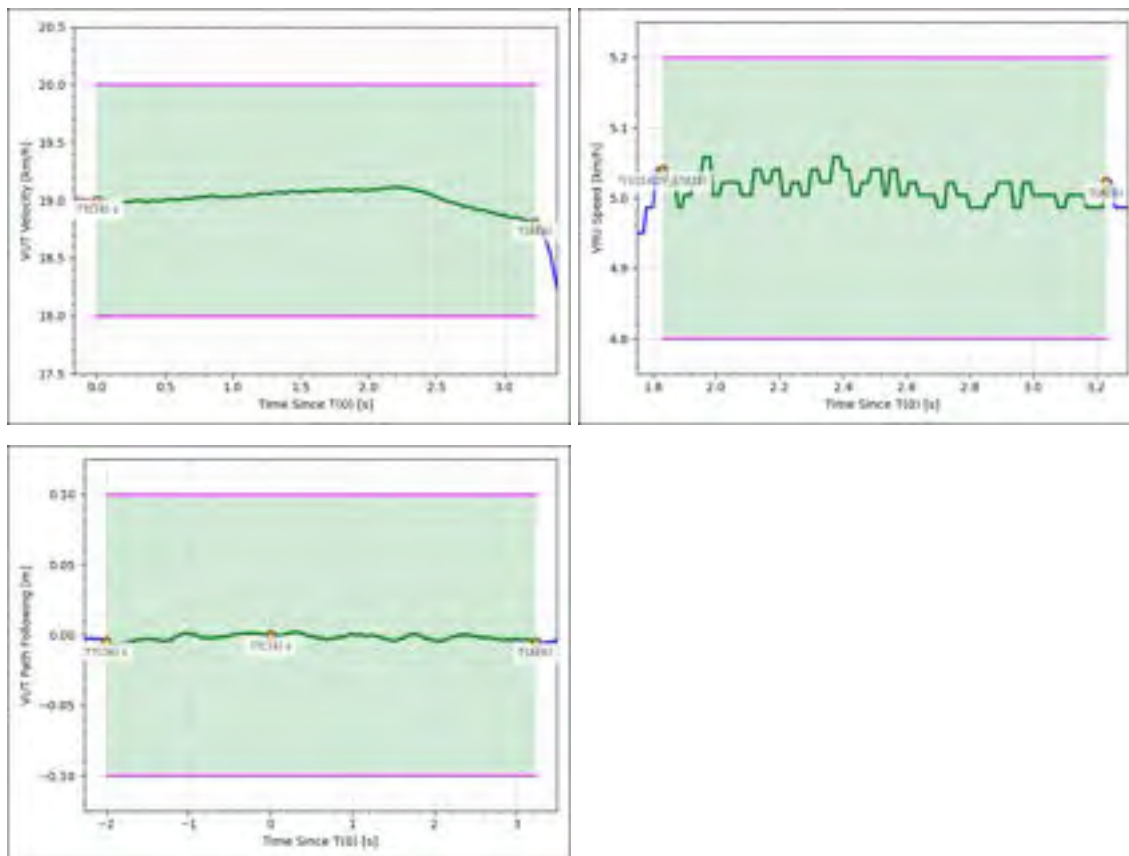
Run Date / Time 20-Mar-2023 11:32



E.2.5.3. CPNC-50 VUT 20kph EPT 5kph (Day)

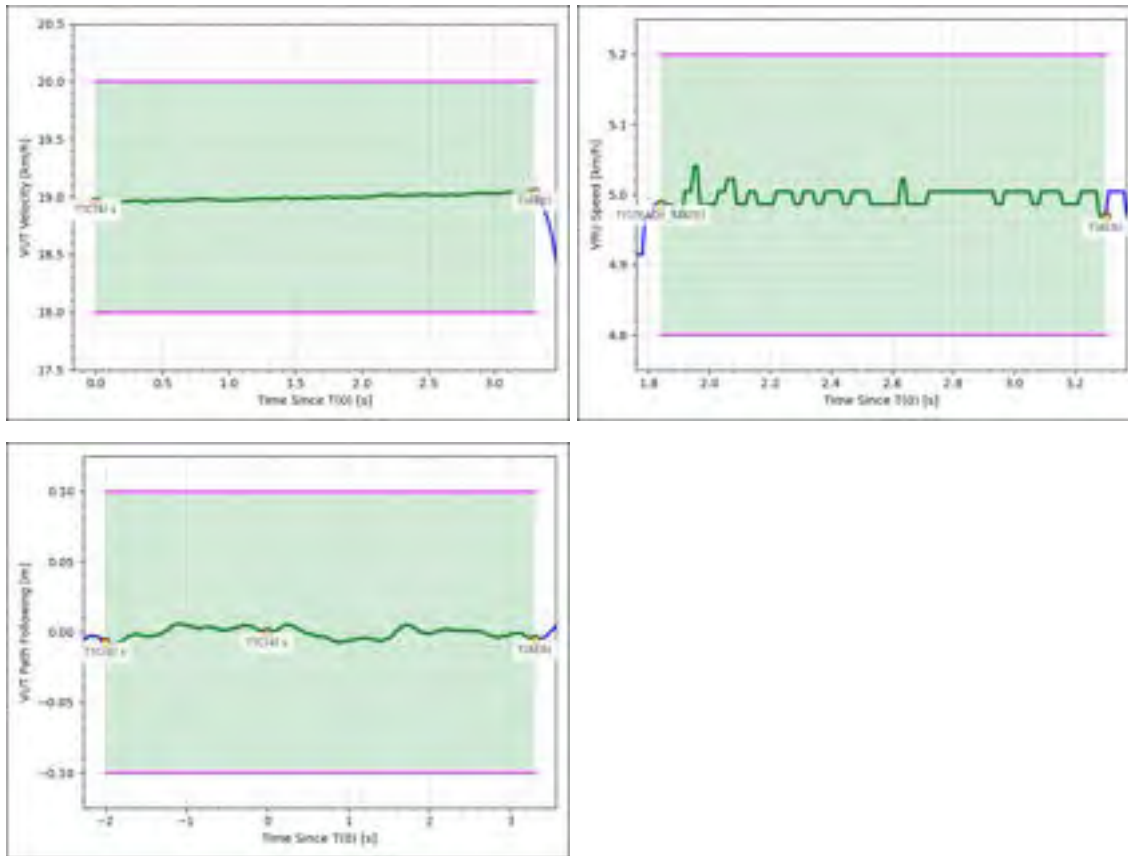
CPNC-50 5 kph (Day) | 20 km/h | Run 1

Run Date / Time 20-Mar-2023 11:37



CPNC-50 5 kph (Day) | 20 km/h | Run 2

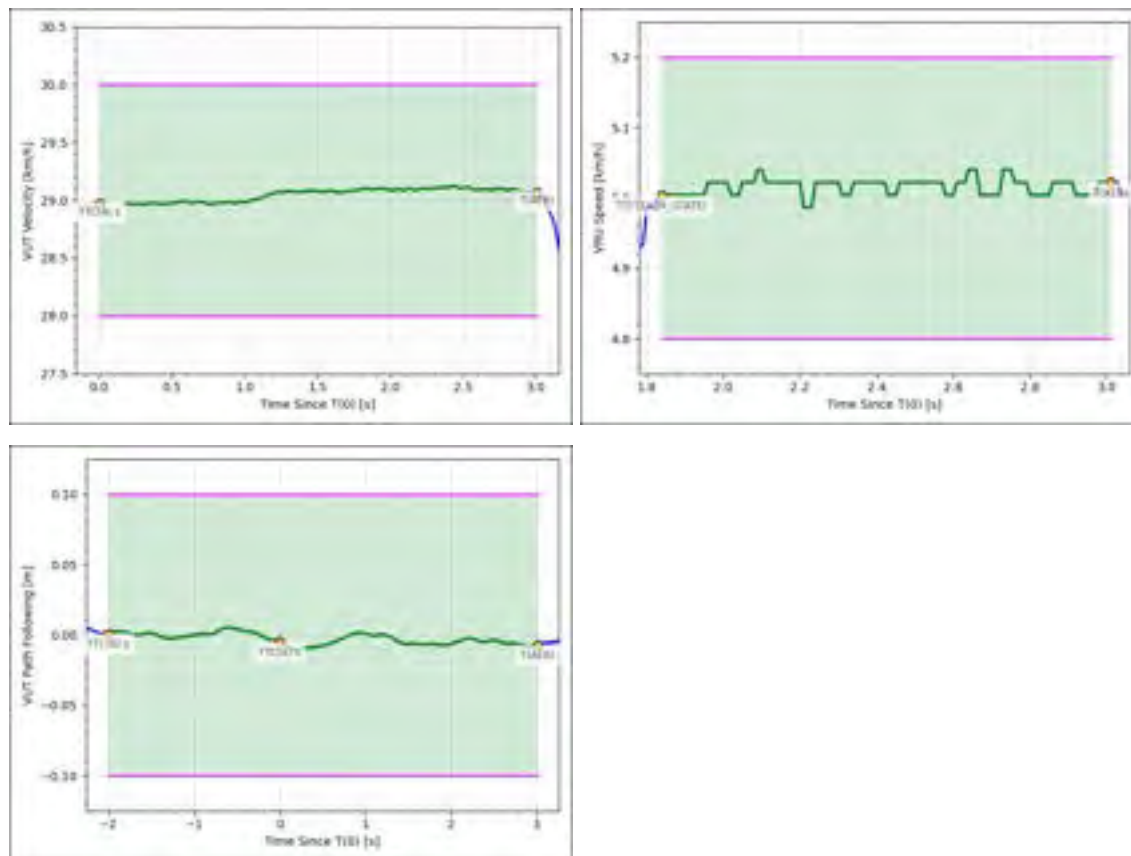
Run Date / Time 20-Mar-2023 11:40



E.2.5.4. CPNC-50 VUT 30kph EPT 5kph (Day)

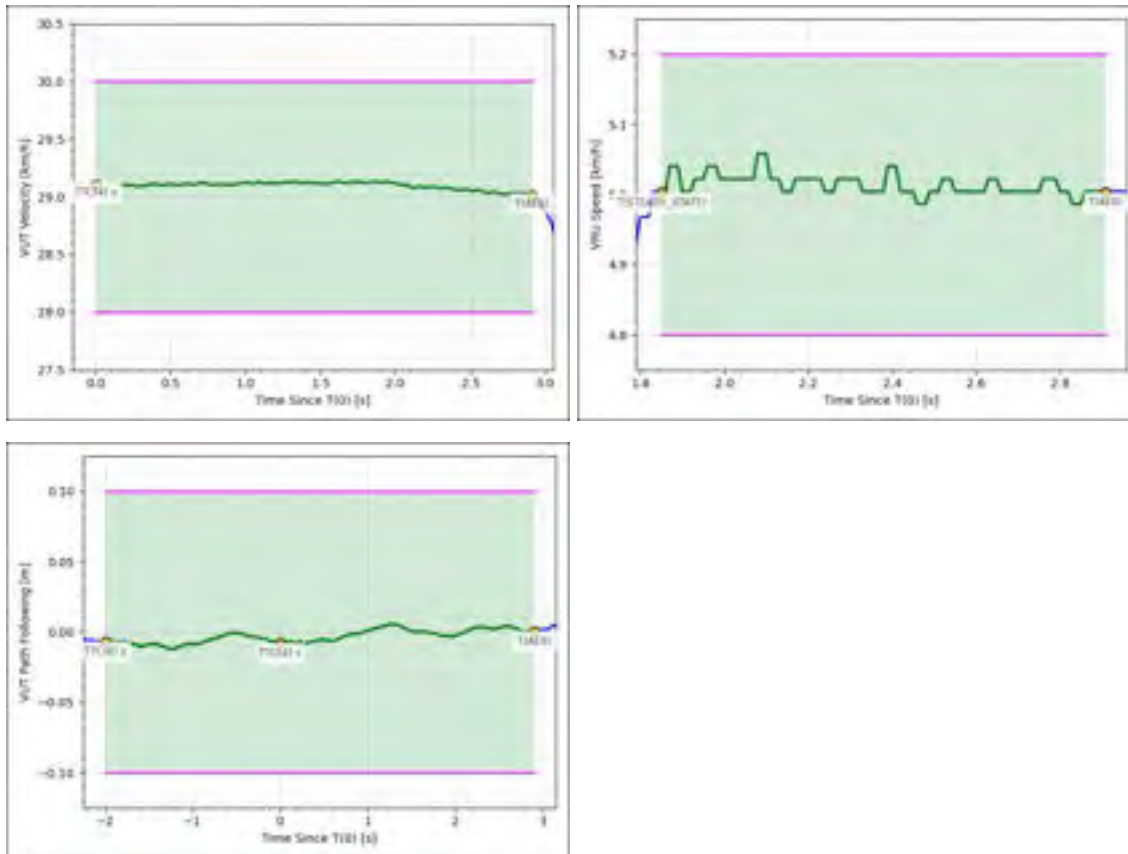
CPNC-50 5 kph (Day) | 30 km/h | Run 1

Run Date / Time 20-Mar-2023 11:43



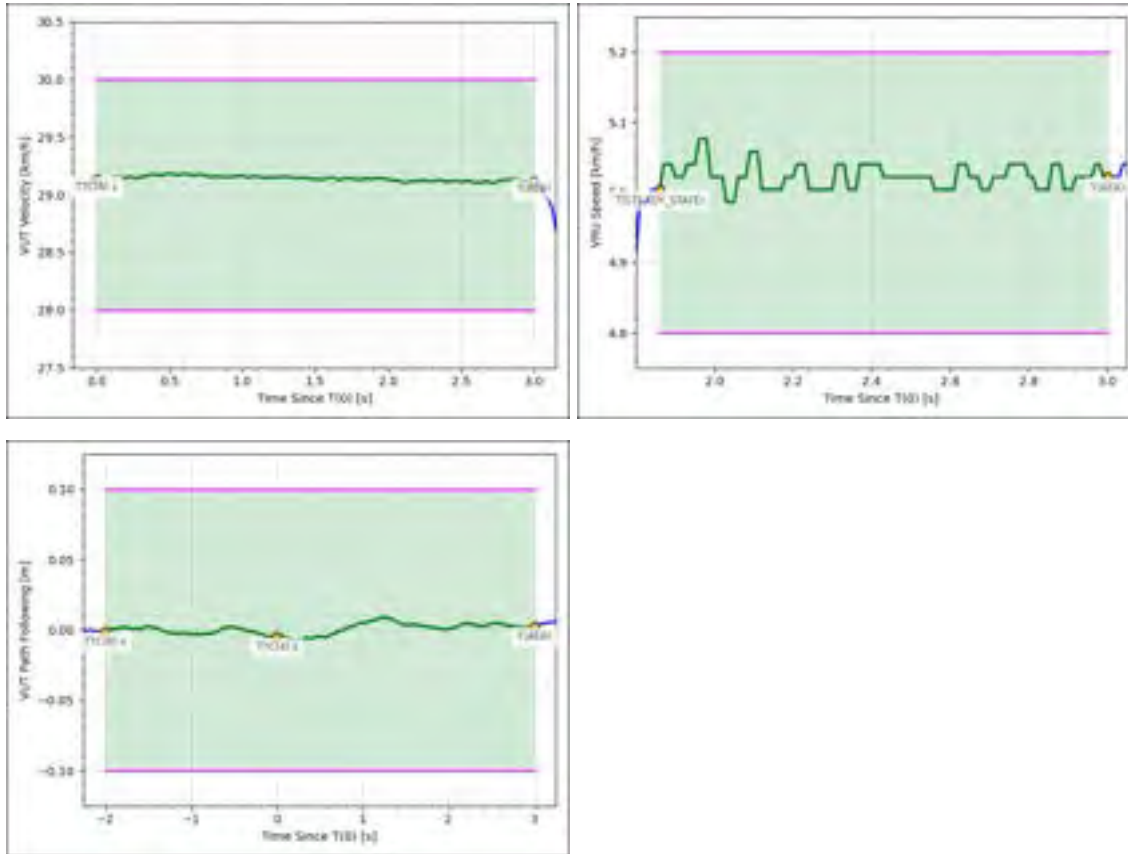
CPNC-50 5 kph (Day) | 30 km/h | Run 2

Run Date / Time 20-Mar-2023 11:46



CPNC-50 5 kph (Day) | 30 km/h | Run 3

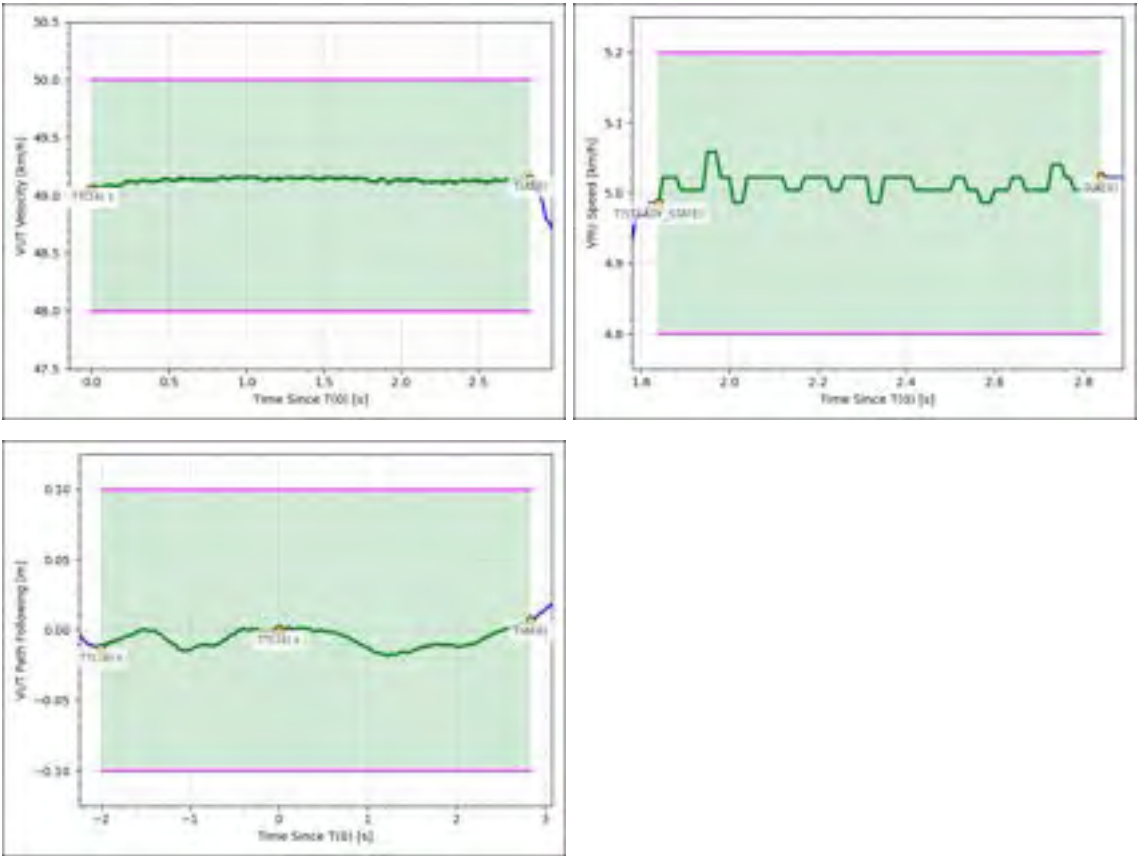
Run Date / Time 20-Mar-2023 11:48



E.2.5.5. CPNC-50 VUT 50kph EPT 5kph (Day)

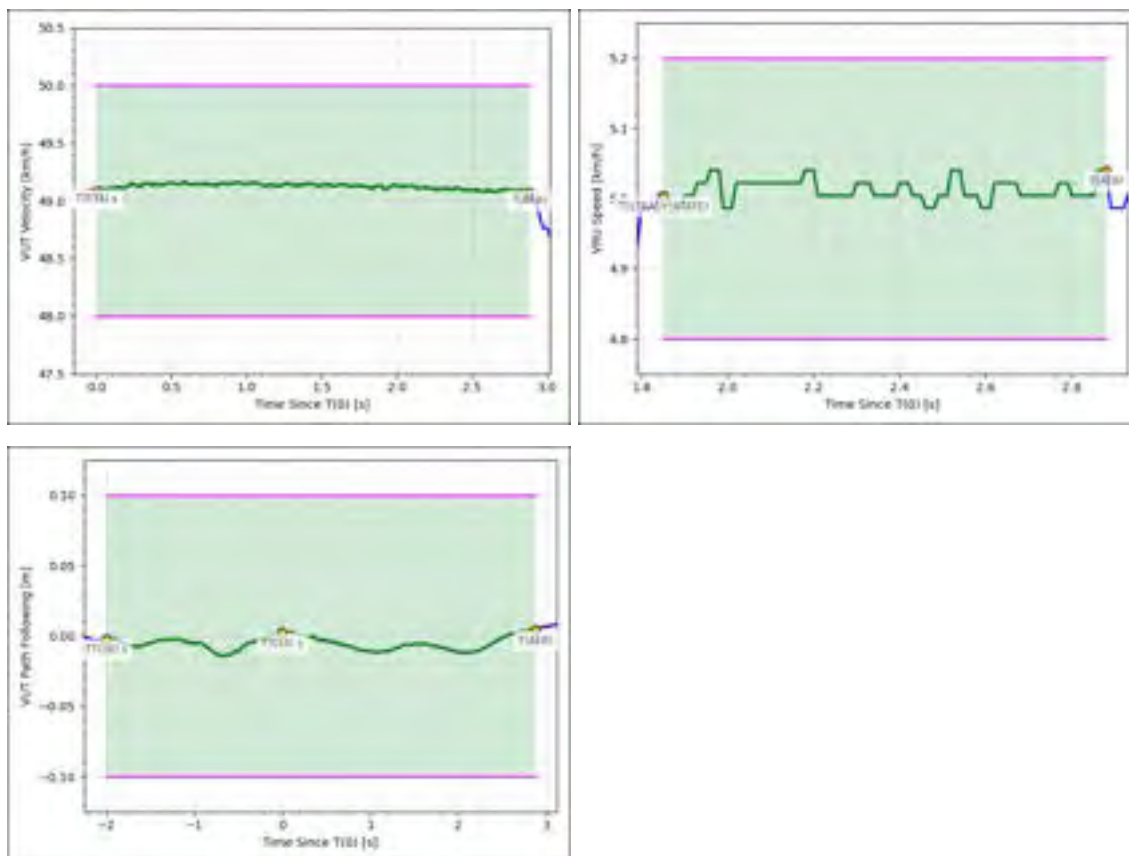
CPNC-50 5 kph (Day) | 50 km/h | Run 1

Run Date / Time 20-Mar-2023 11:52



CPNC-50 5 kph (Day) | 50 km/h | Run 2

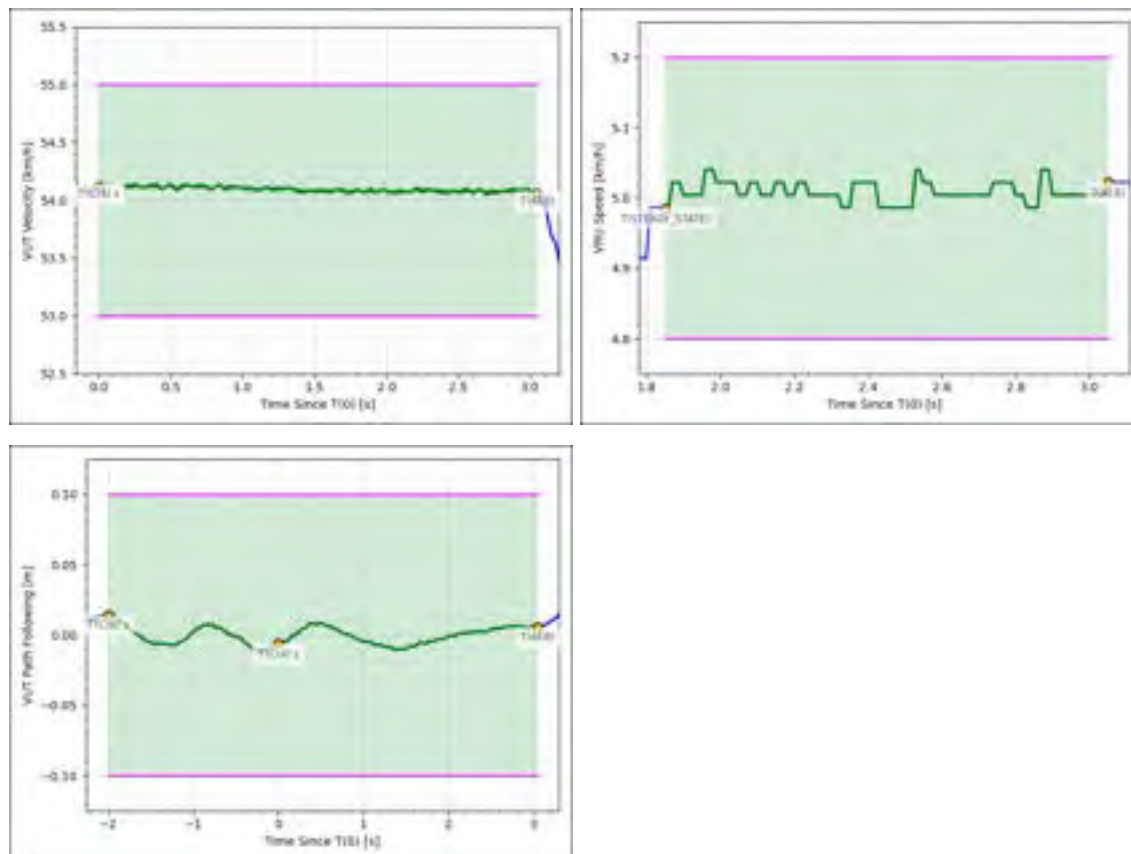
Run Date / Time 20-Mar-2023 11:55



E.2.5.6. CPNC-50 VUT 55kph EPT 5kph (Day)

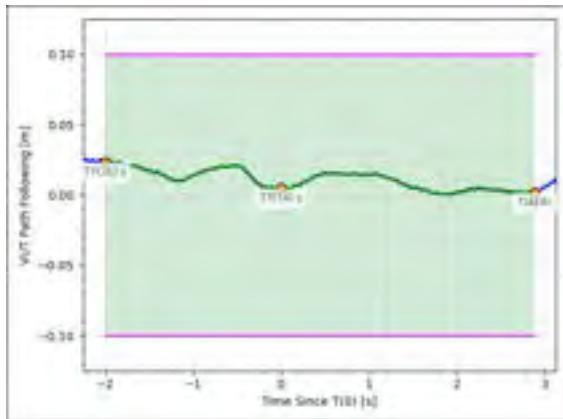
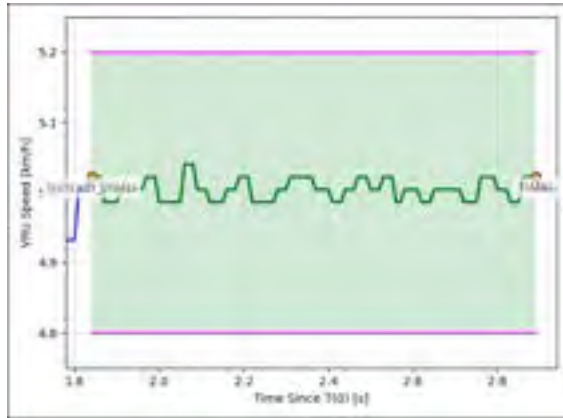
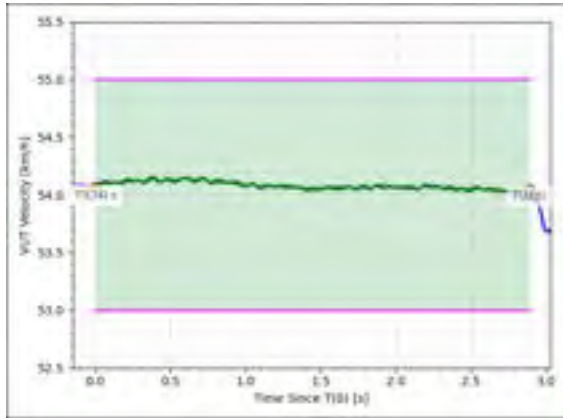
CPNC-50 5 kph (Day) | 55 km/h | Run 1

Run Date / Time 20-Mar-2023 11:59



CPNC-50 5 kph (Day) | 55 km/h | Run 2

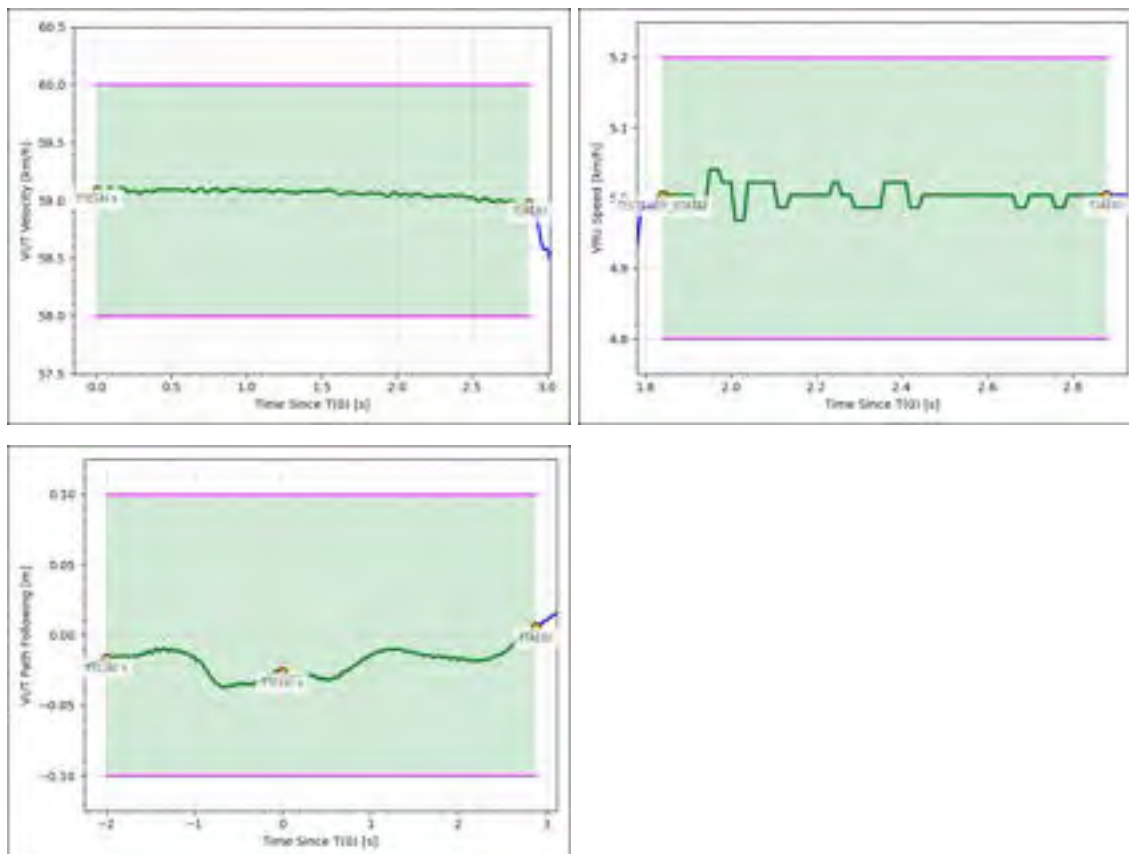
Run Date / Time 20-Mar-2023 12:03



E.2.5.7. CPNC-50 VUT 60kph EPT 5kph (Day)

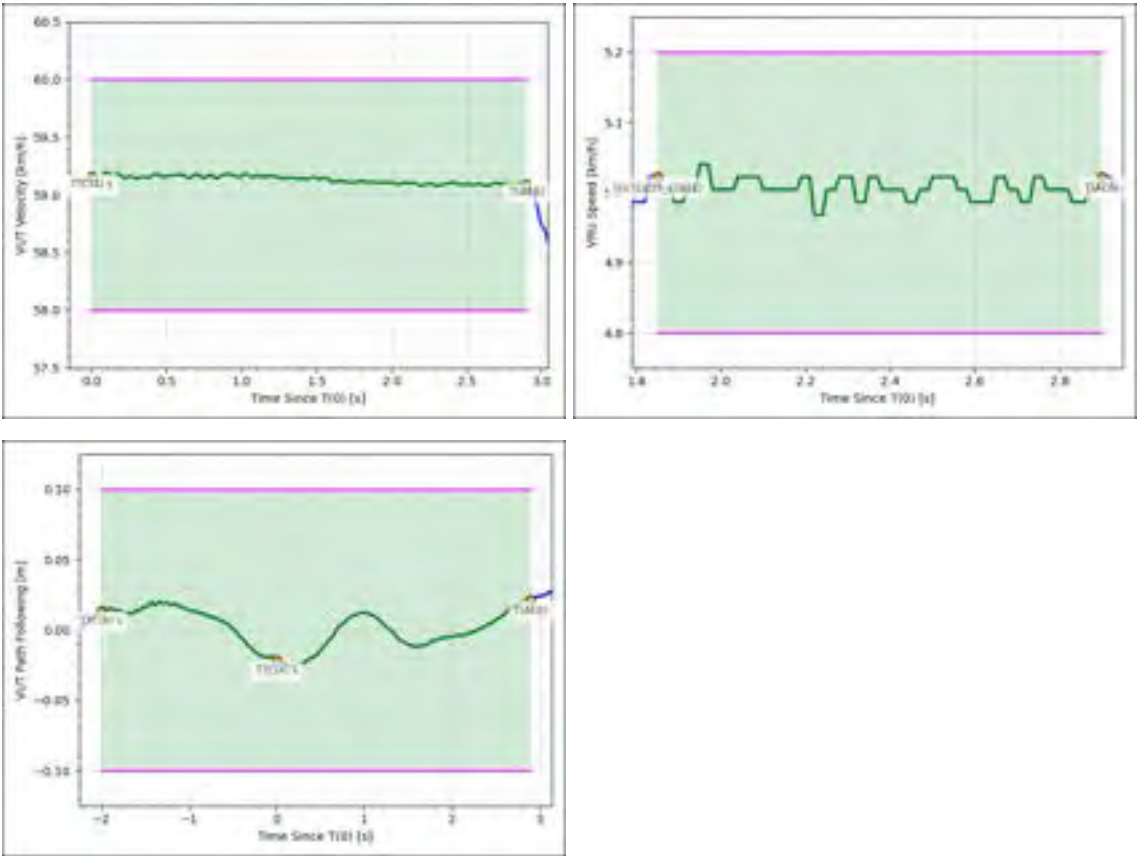
CPNC-50 5 kph (Day) | 60 km/h | Run 1

Run Date / Time 20-Mar-2023 13:43



CPNC-50 5 kph (Day) | 60 km/h | Run 2

Run Date / Time 20-Mar-2023 13:48

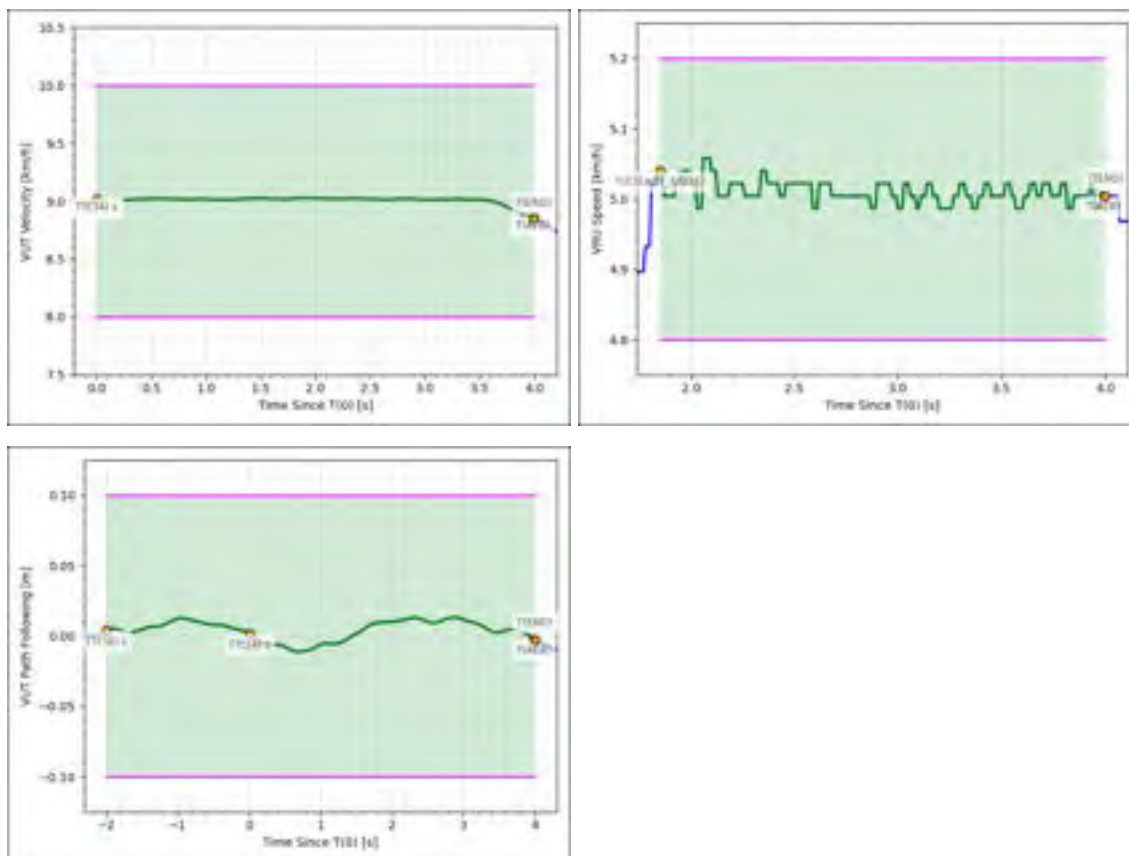


E.2.1. Bullbar

E.2.1.1. CPNC-50 VUT 10kph EPT 5kph (Day)

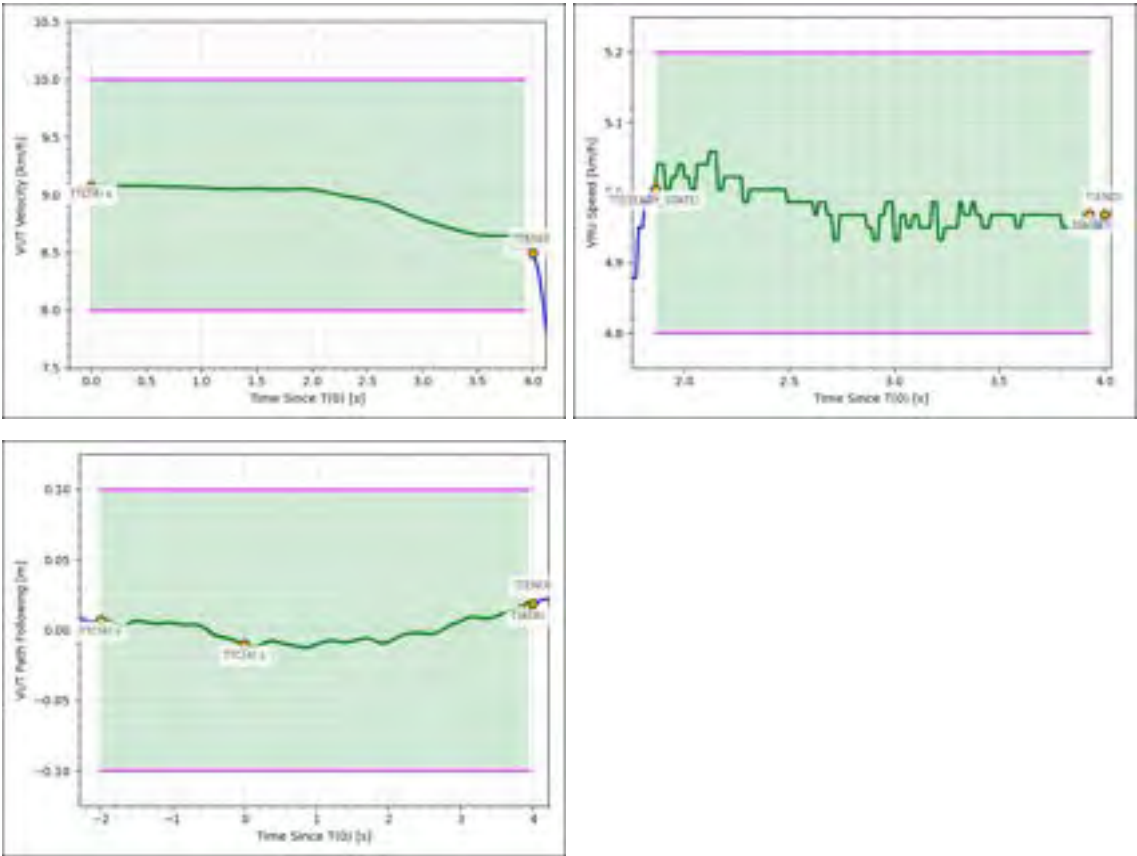
CPNC-50 5 kph (Day) | 10 km/h | Run 3

Run Date / Time 4-Apr-2023 09:43



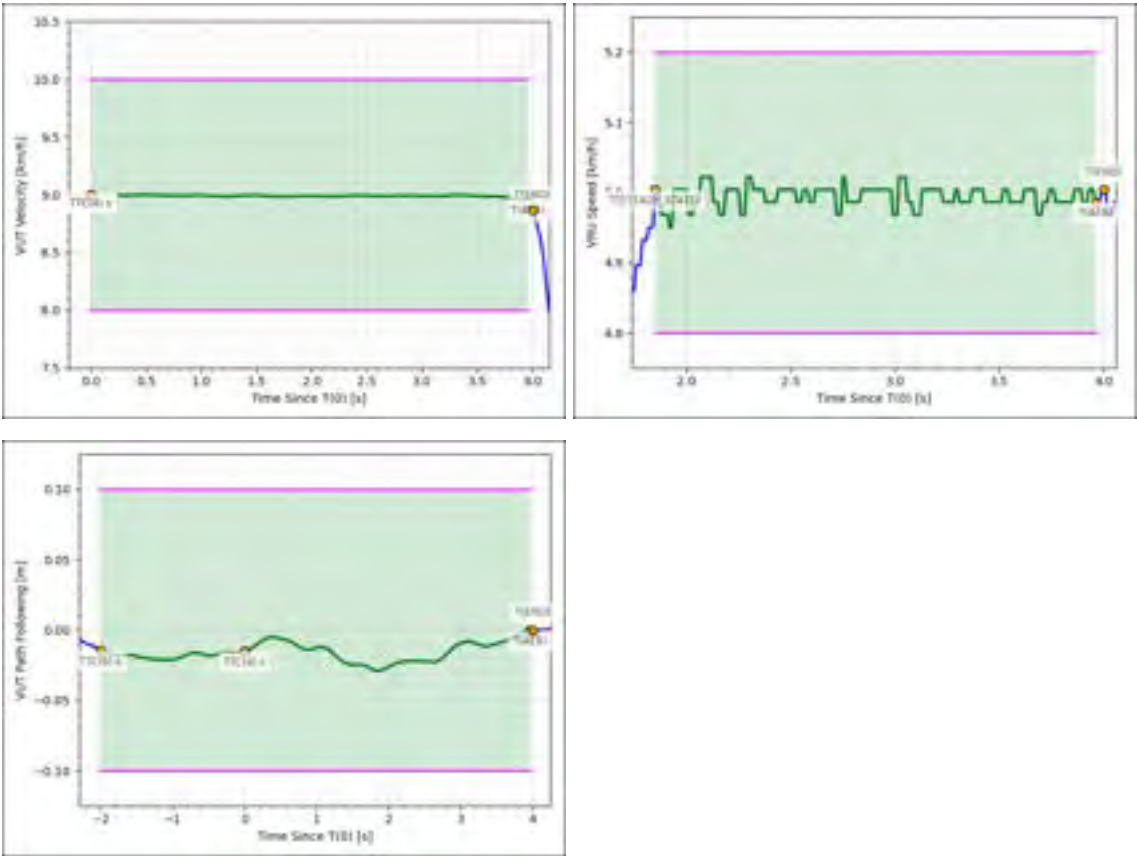
CPNC-50 5 kph (Day) | 10 km/h | Run 4

Run Date / Time 4-Apr-2023 09:48



CPNC-50 5 kph (Day) | 10 km/h | Run 5

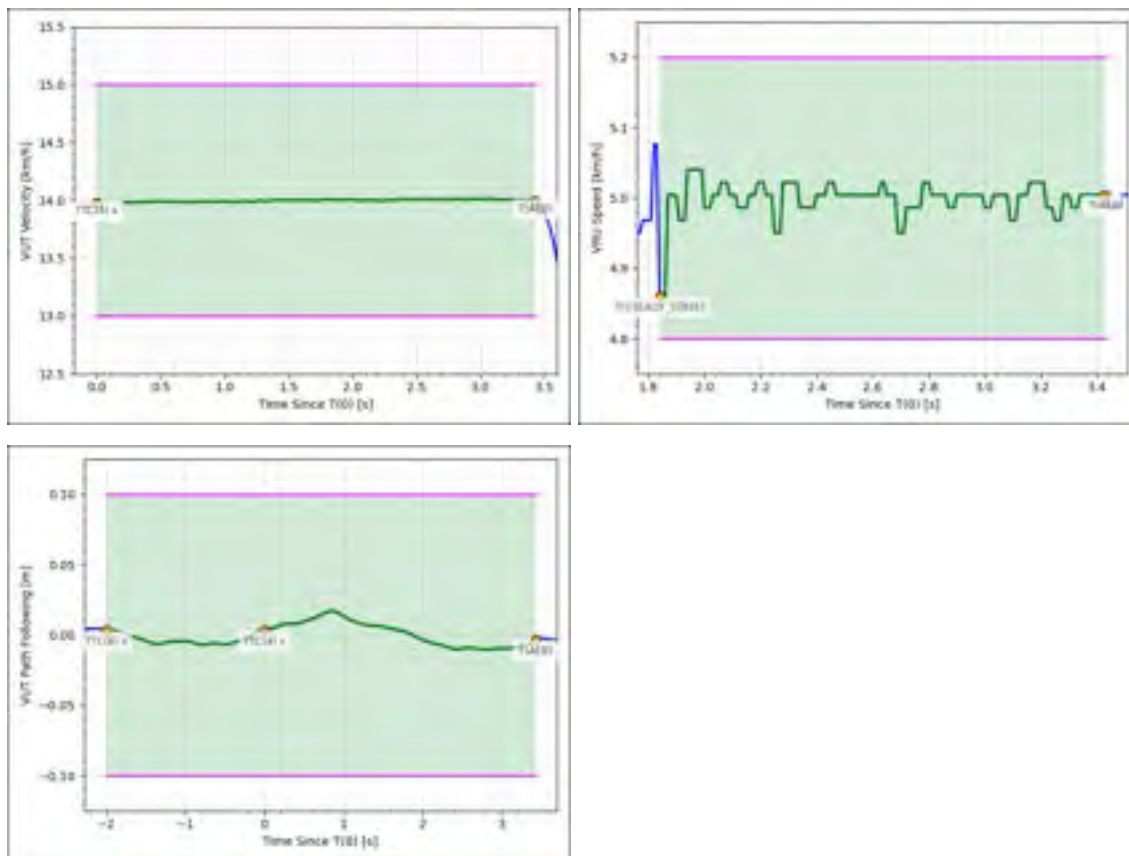
Run Date / Time 4-Apr-2023 09:55



E.2.1.2. CPNC-50 VUT 15kph EPT 5kph (Day)

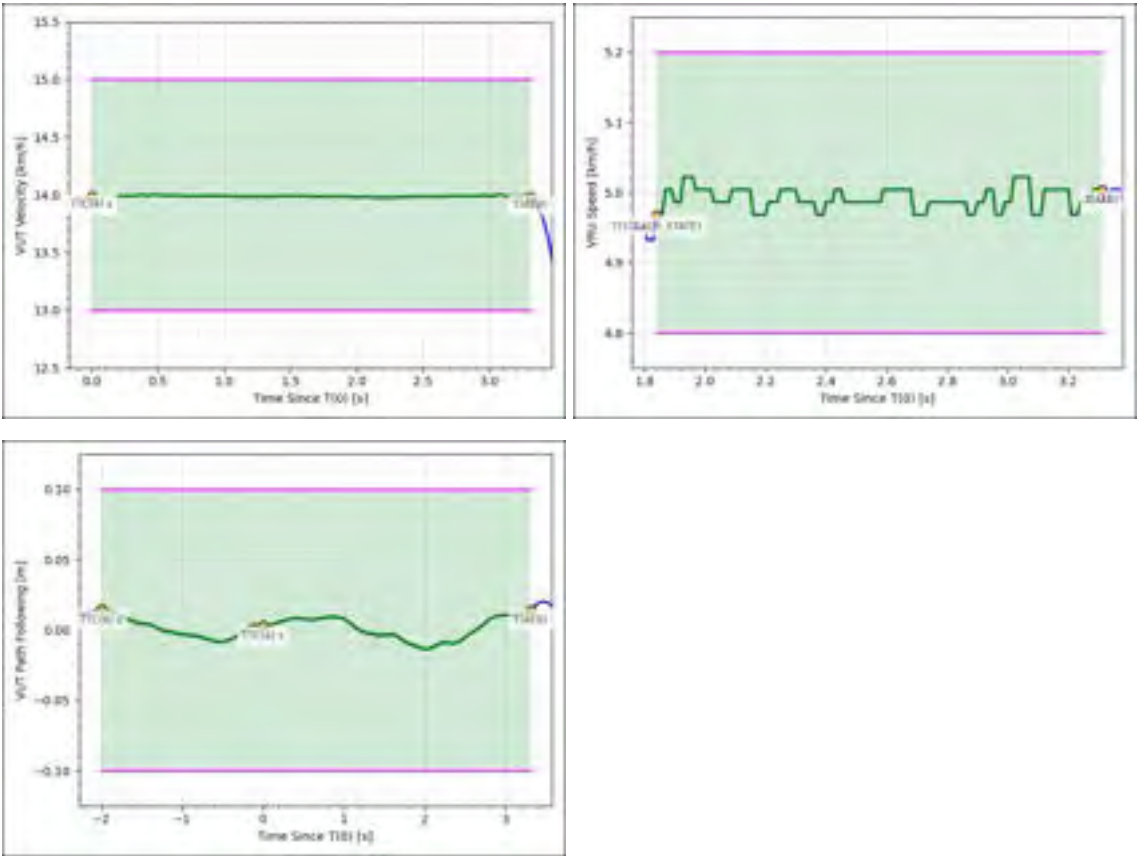
CPNC-50 5 kph (Day) | 15 km/h | Run 4

Run Date / Time 4-Apr-2023 09:59



CPNC-50 5 kph (Day) | 15 km/h | Run 5

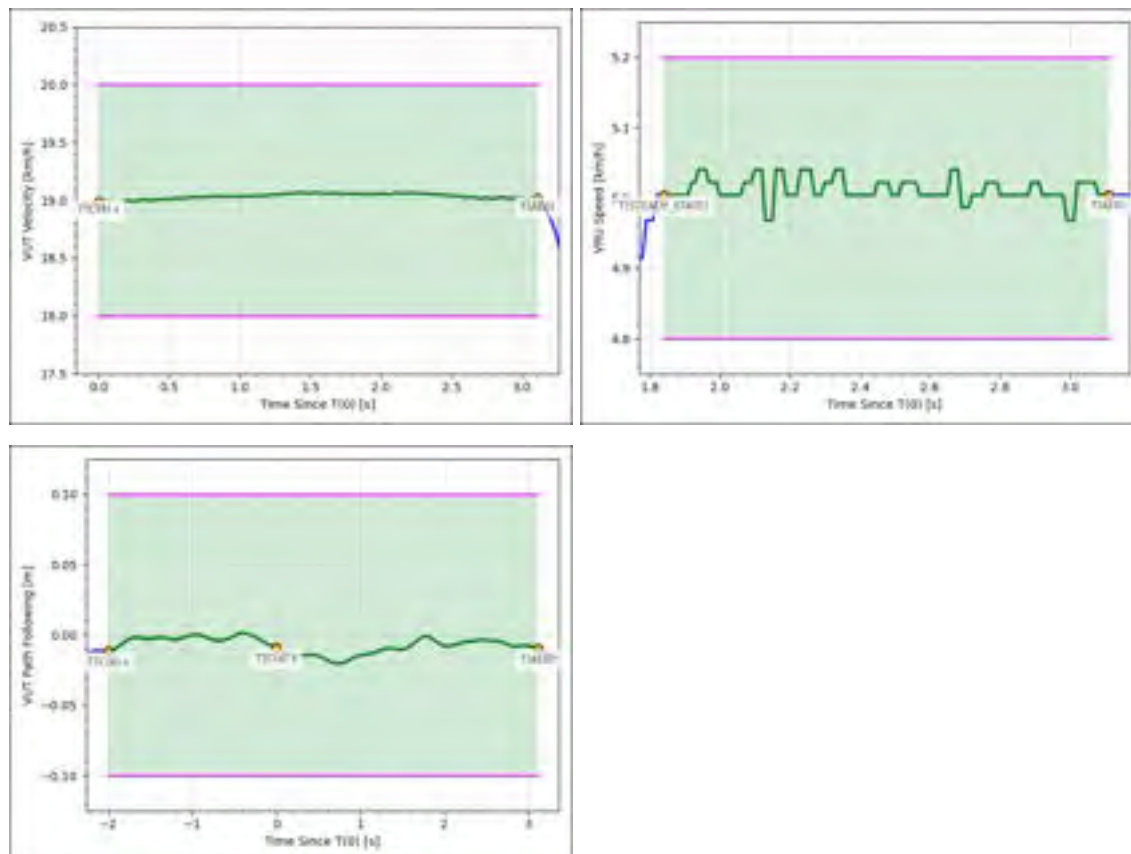
Run Date / Time 4-Apr-2023 10:02



E.2.1.3. CPNC-50 VUT 20kph EPT 5kph (Day)

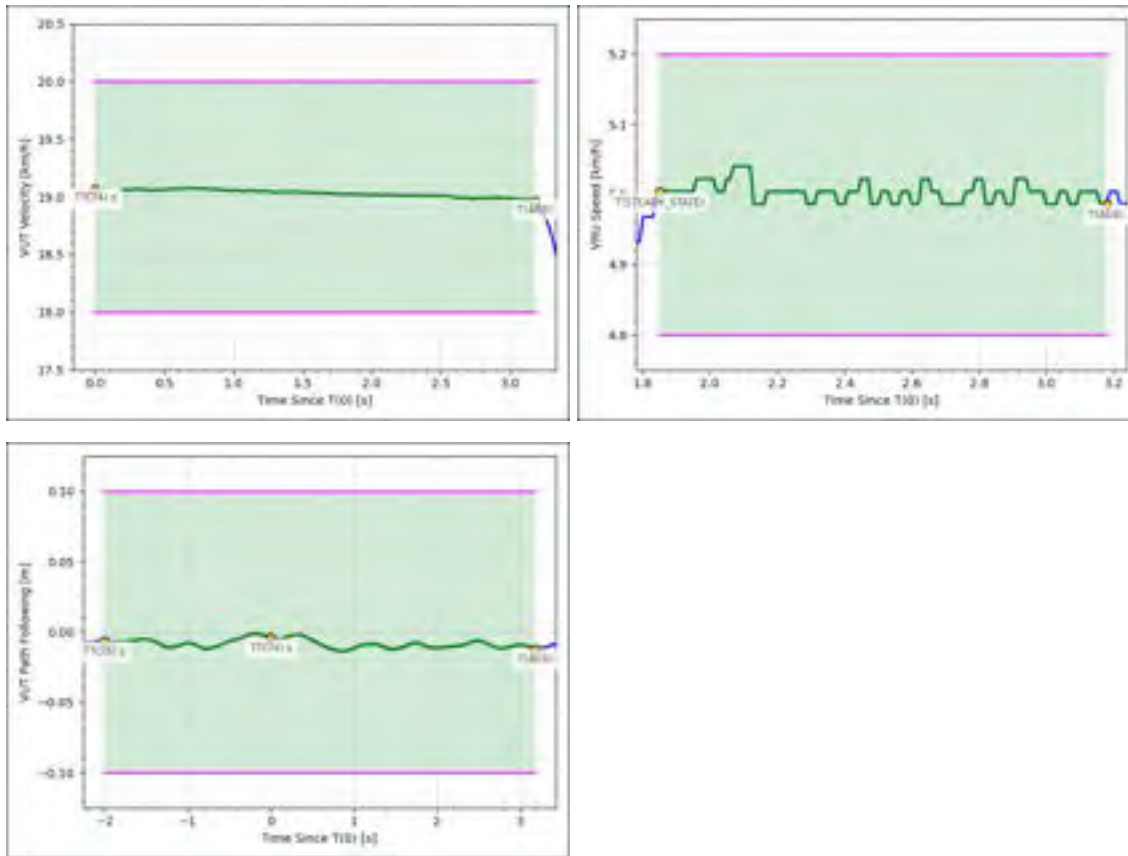
CPNC-50 5 kph (Day) | 20 km/h | Run 4

Run Date / Time 4-Apr-2023 09:37



CPNC-50 5 kph (Day) | 20 km/h | Run 5

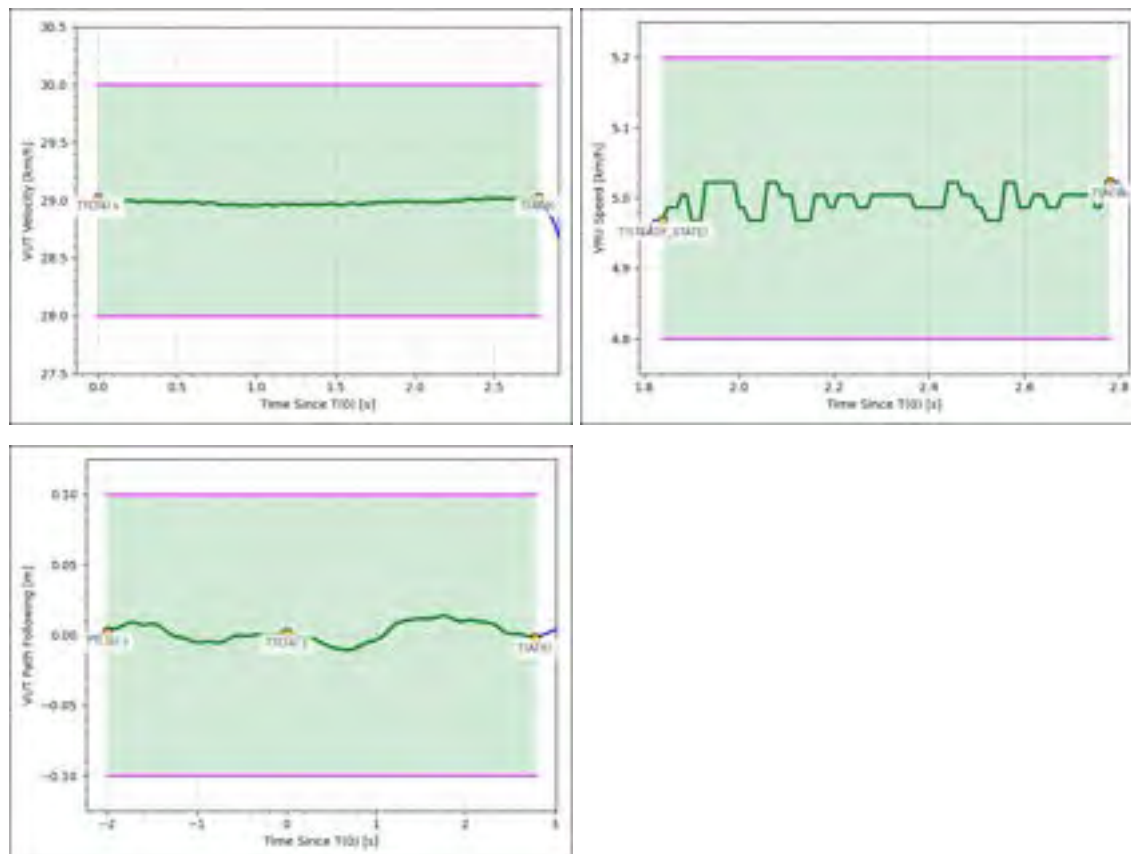
Run Date / Time 4-Apr-2023 09:39



E.2.1.4. CPNC-50 VUT 30kph EPT 5kph (Day)

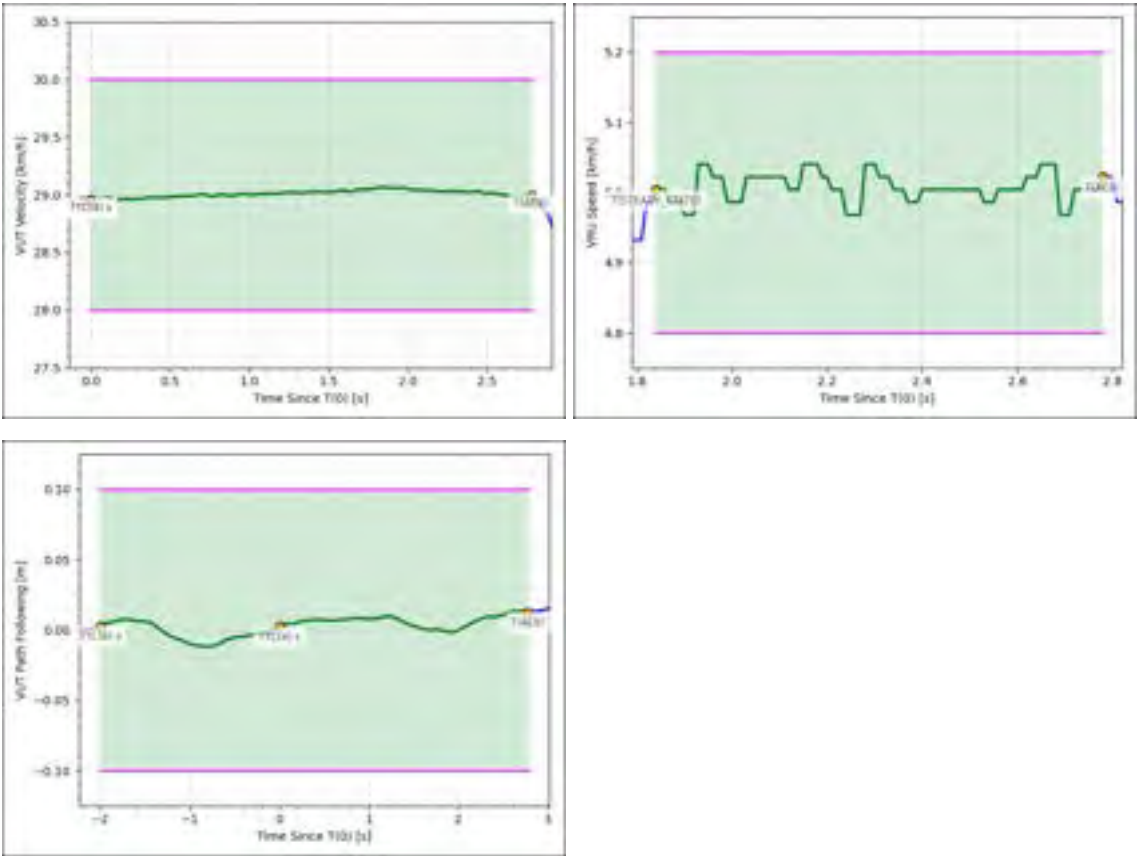
CPNC-50 5 kph (Day) | 30 km/h | Run 4

Run Date / Time 4-Apr-2023 10:05



CPNC-50 5 kph (Day) | 30 km/h | Run 5

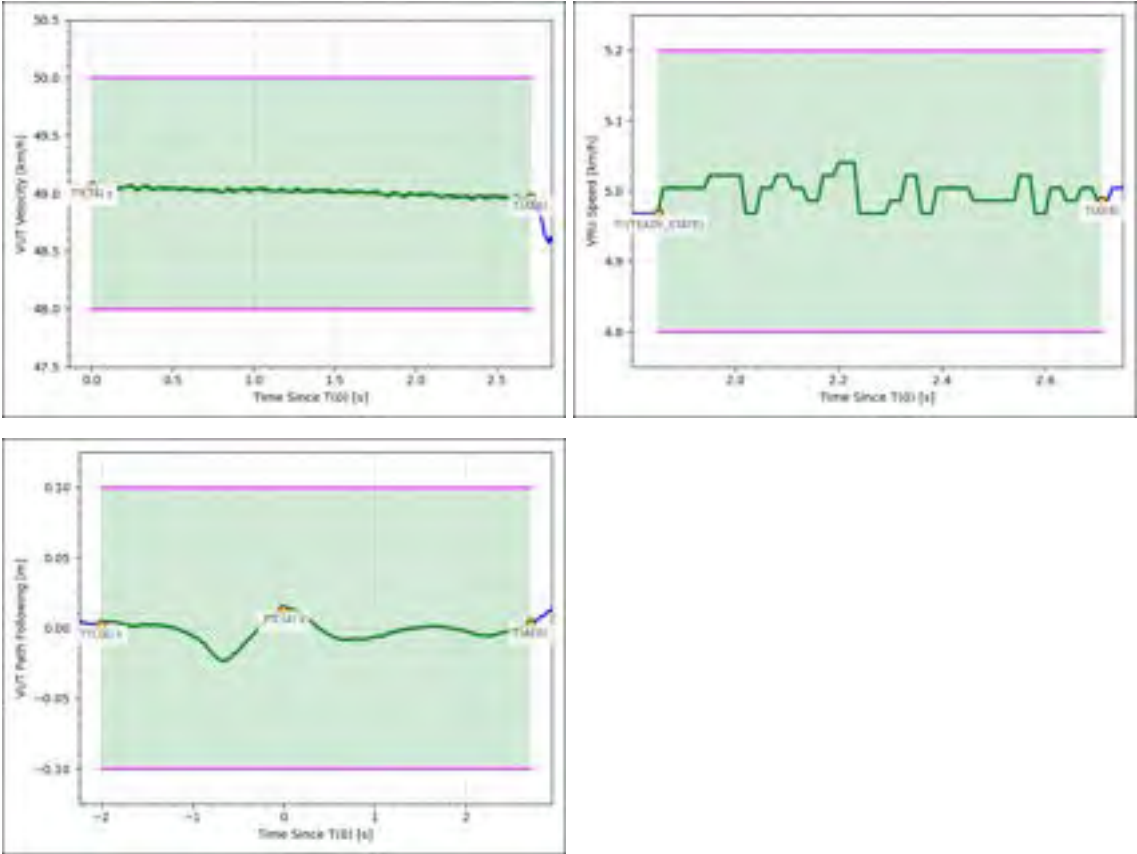
Run Date / Time 4-Apr-2023 10:08



E.2.1.5. CPNC-50 VUT 50kph EPT 5kph (Day)

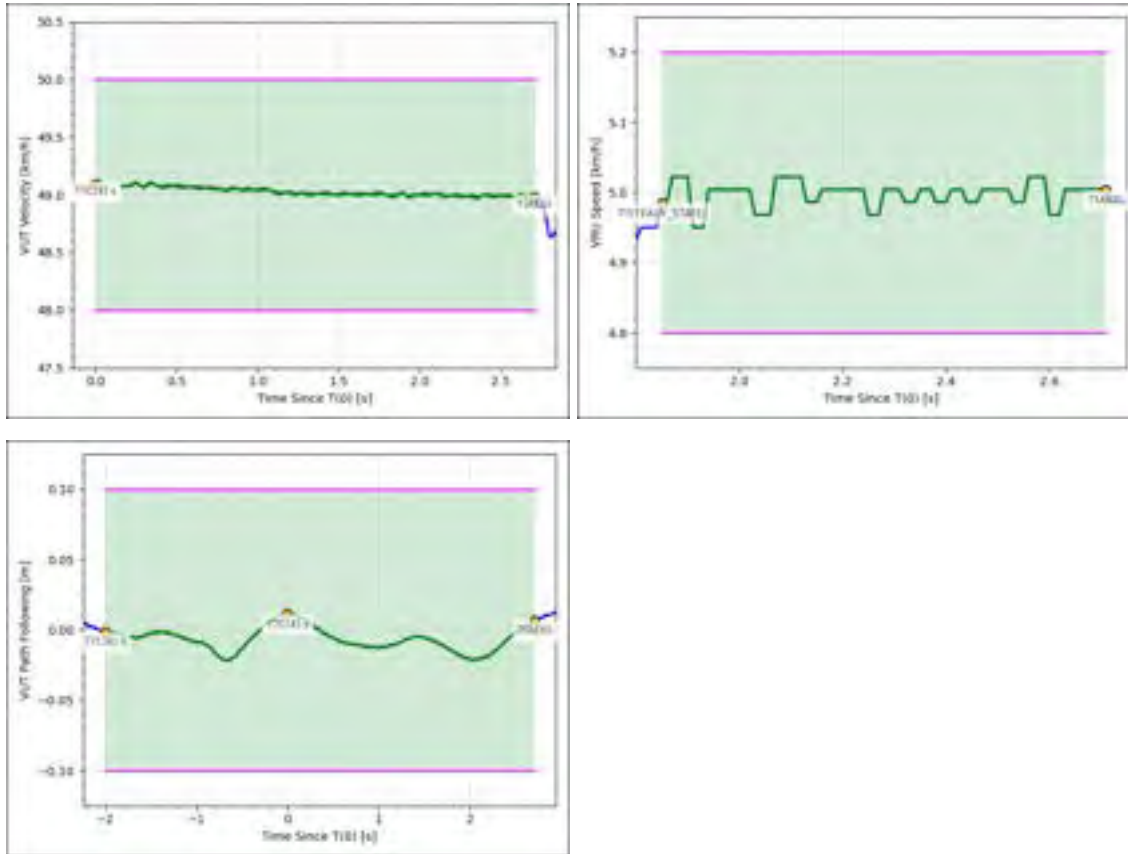
CPNC-50 5 kph (Day) | 50 km/h | Run 3

Run Date / Time 4-Apr-2023 10:11



CPNC-50 5 kph (Day) | 50 km/h | Run 4

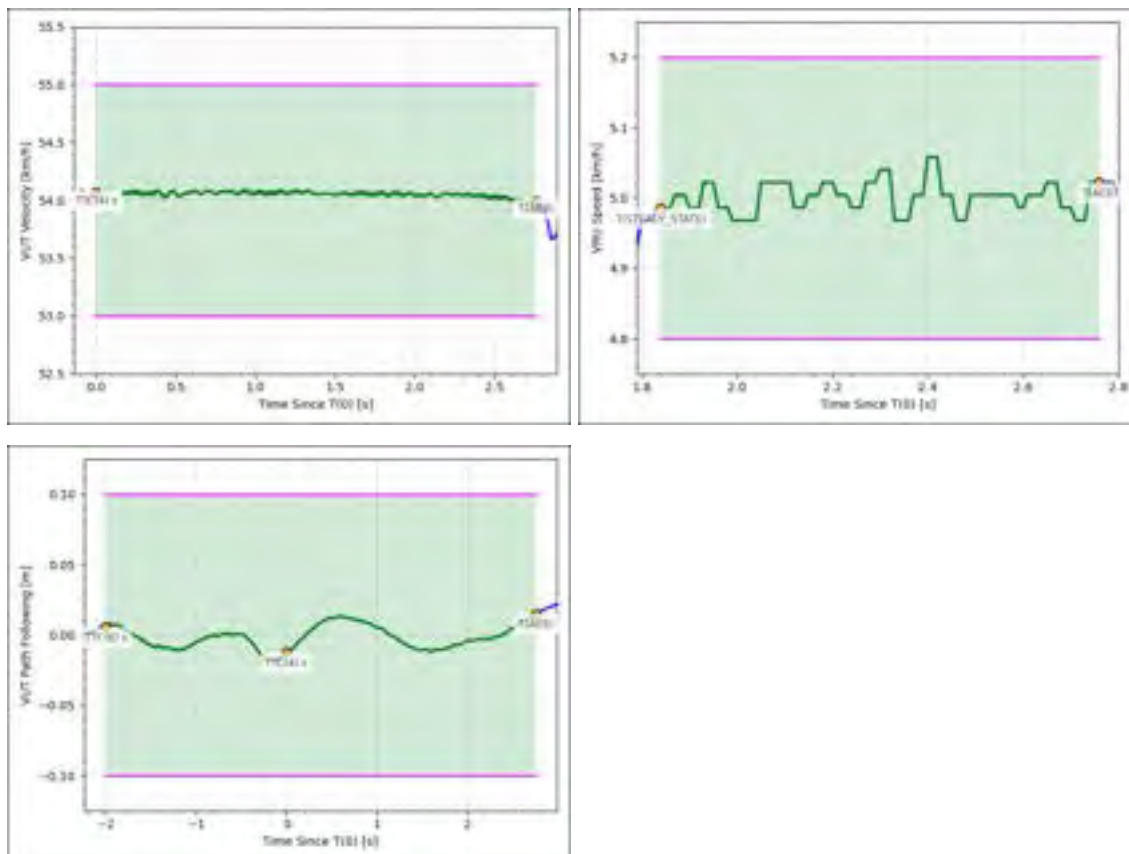
Run Date / Time 4-Apr-2023 10:14



E.2.1.6. CPNC-50 VUT 55kph EPT 5kph (Day)

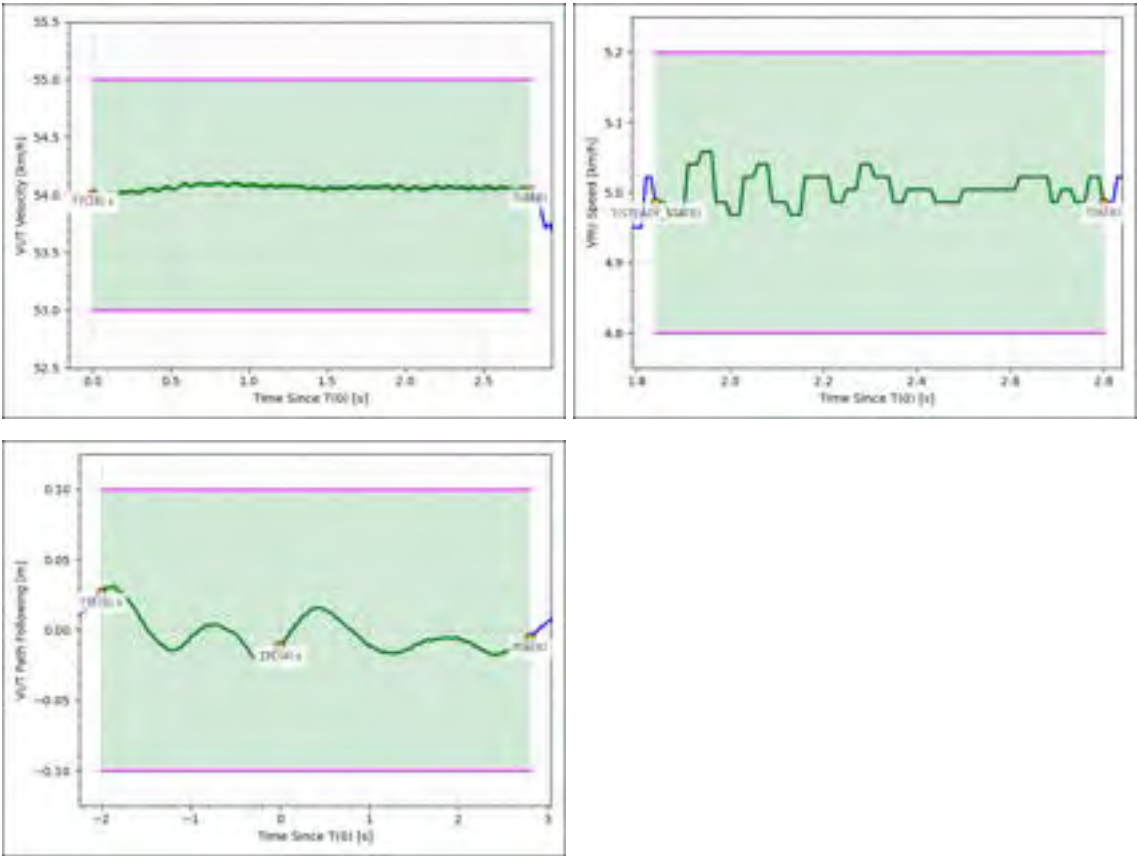
CPNC-50 5 kph (Day) | 55 km/h | Run 3

Run Date / Time 4-Apr-2023 10:29



CPNC-50 5 kph (Day) | 55 km/h | Run 4

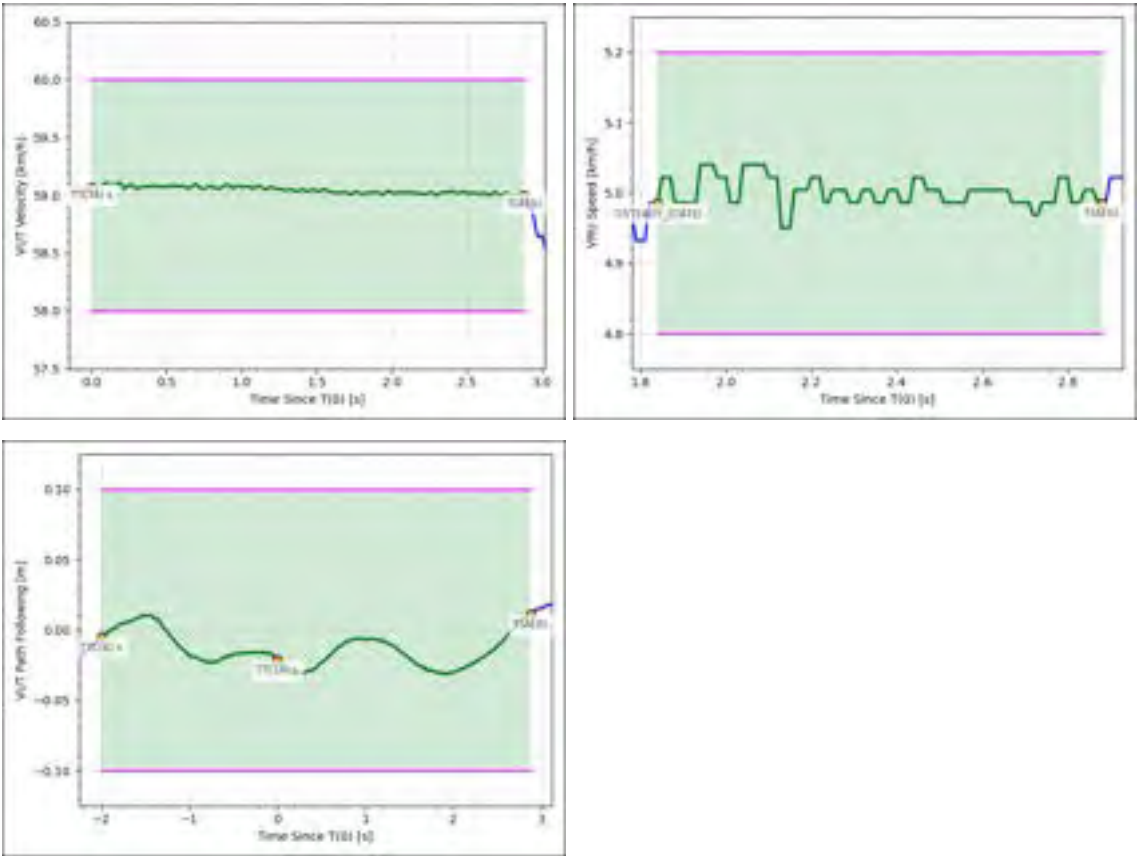
Run Date / Time 4-Apr-2023 10:31



E.2.1.7. CPNC-50 VUT 60kph EPT 5kph (Day)

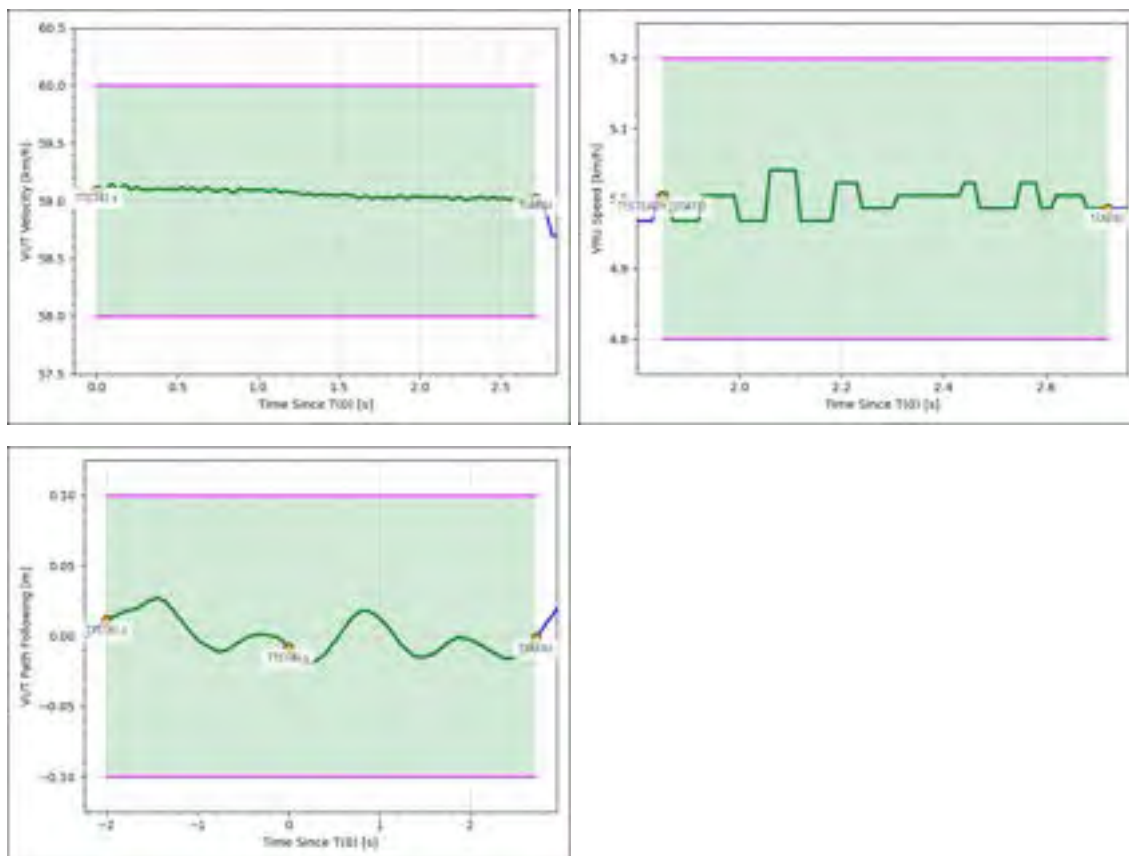
CPNC-50 5 kph (Day) | 60 km/h | Run 3

Run Date / Time 4-Apr-2023 10:17



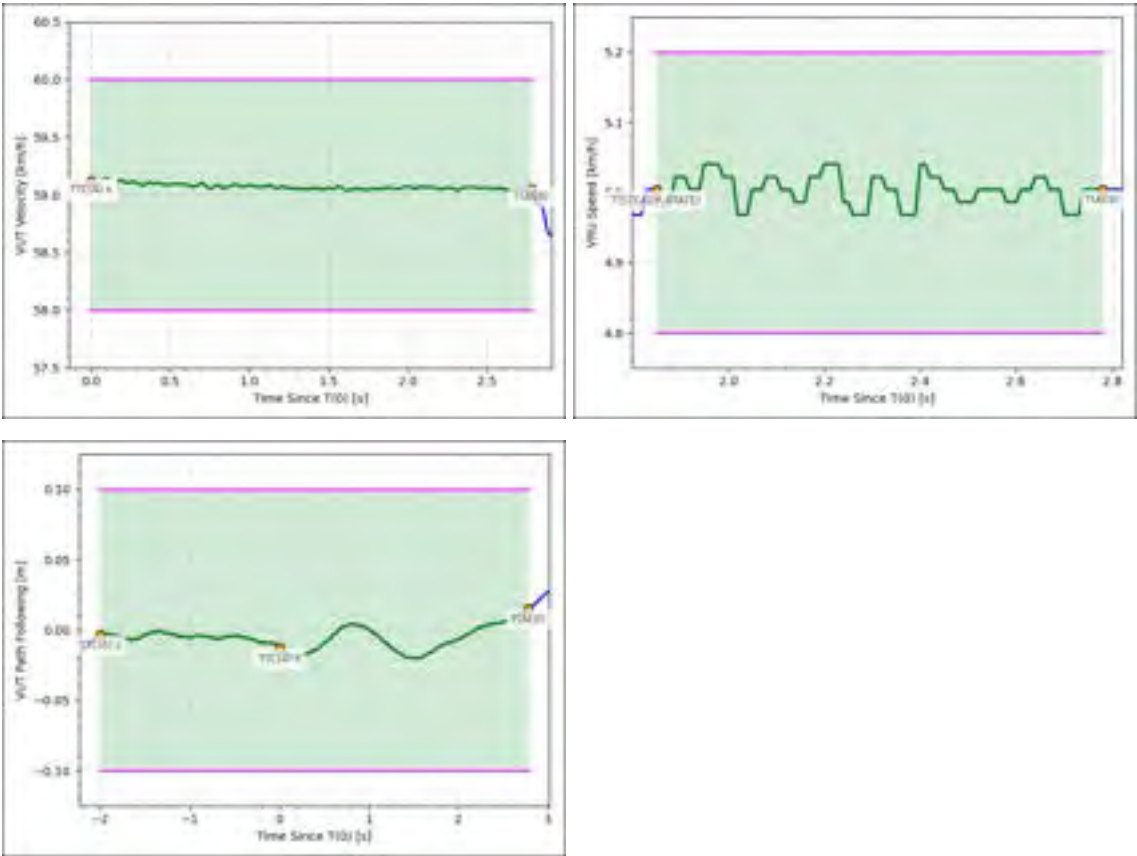
CPNC-50 5 kph (Day) | 60 km/h | Run 4

Run Date / Time 4-Apr-2023 10:22



CPNC-50 5 kph (Day) | 60 km/h | Run 5

Run Date / Time 4-Apr-2023 10:25



APPENDIX D

Isuzu D-Max Car-to-Car Results Validity

F. D-Max Lane Keeping Results Validity

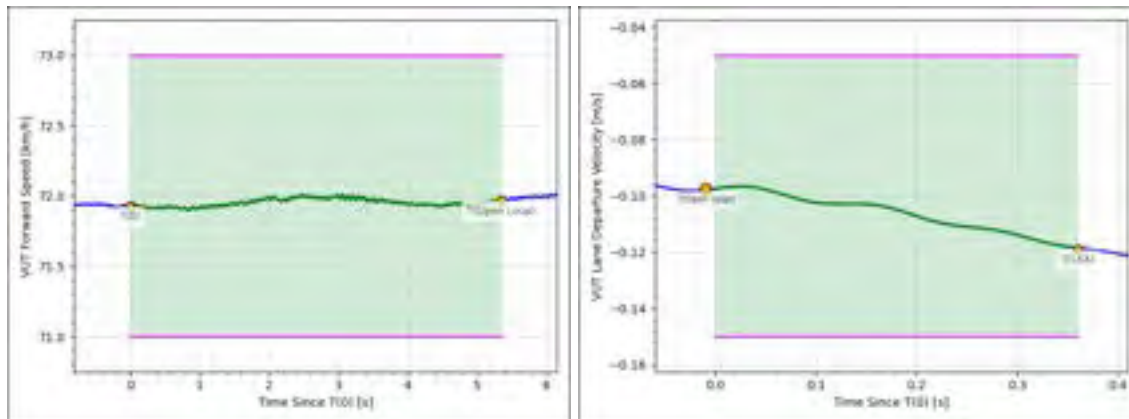
F.1. GVM

F.1.1. SLN-D

F.1.1.1. 0.1 m/s

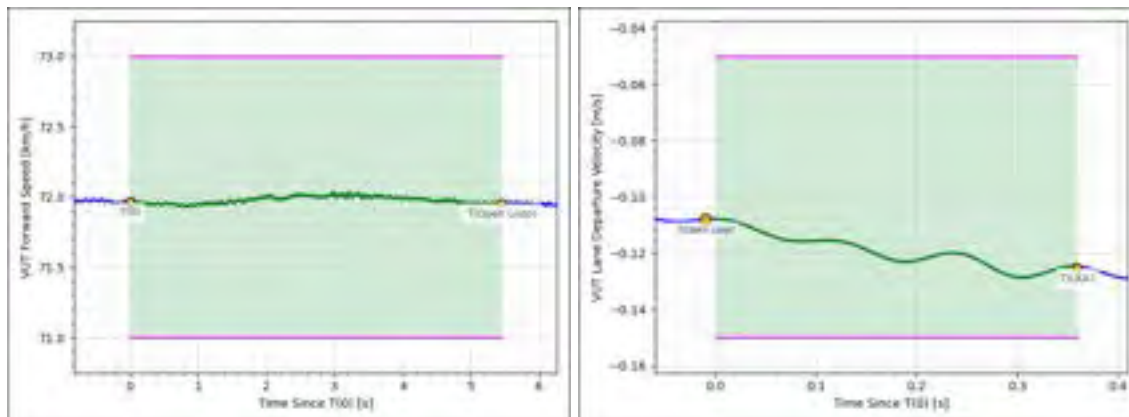
LKA SLN-D 0.1 mps Main | 0.1 m/s | Run 6

Run Date / Time 15-Dec-2022 13:39



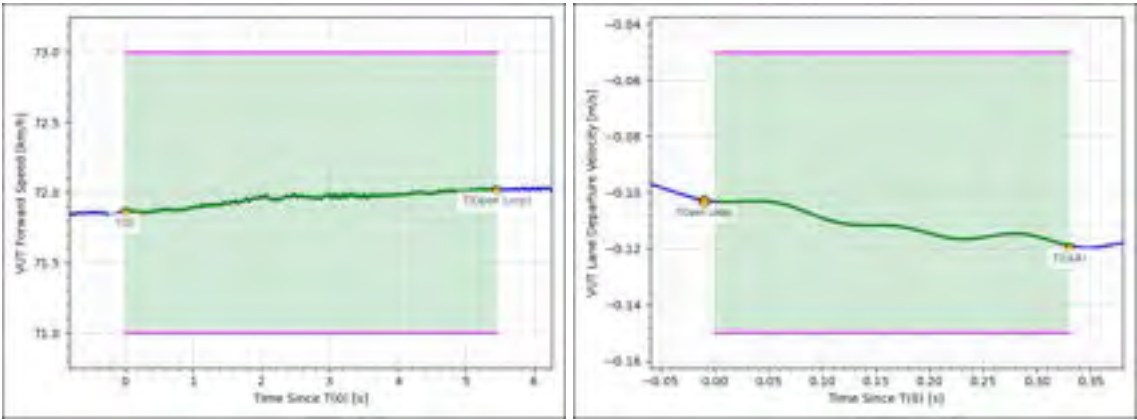
LKA SLN-D 0.1 mps Main | 0.1 m/s | Run 9

Run Date / Time 15-Dec-2022 13:47



LKA SLN-D 0.1 mps Main | 0.1 m/s | Run 10

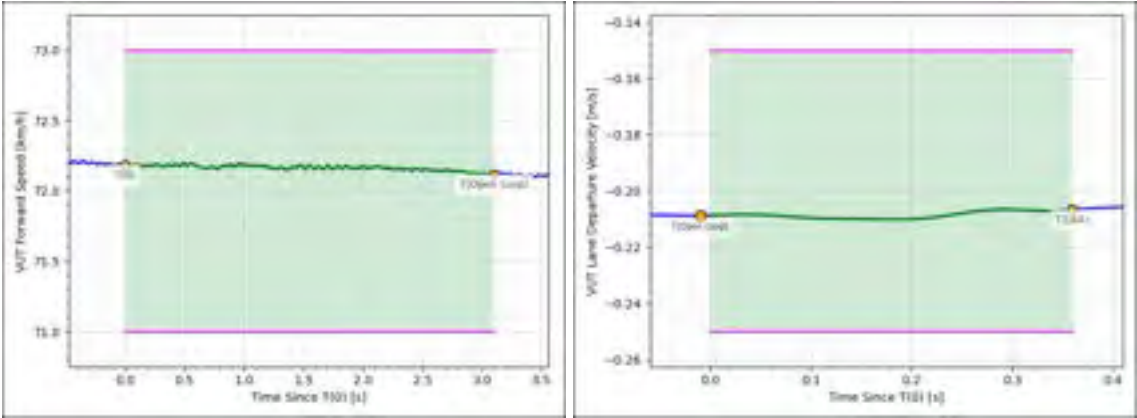
Run Date / Time 15-Dec-2022 13:50



F.1.1.2. 0.2 m/s

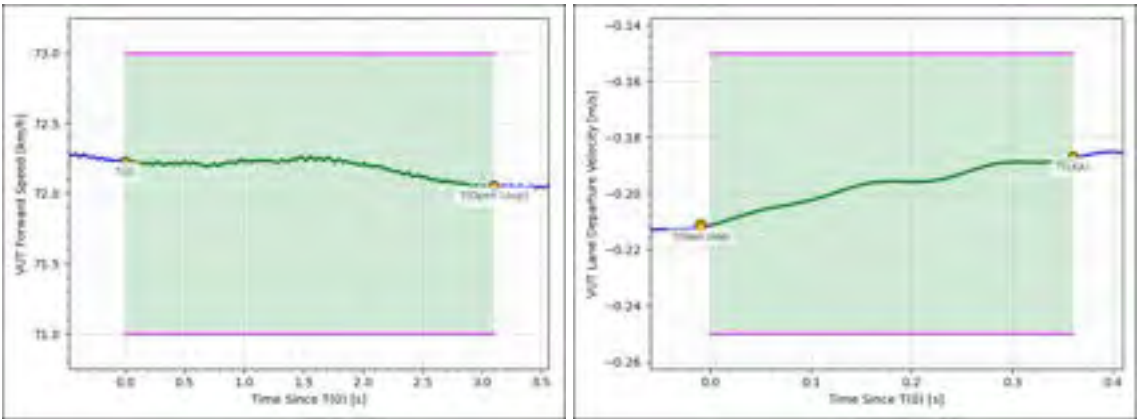
LKA SLN-D 0.2 mps Main | 0.2 m/s | Run 2

Run Date / Time 14-Dec-2022 11:42



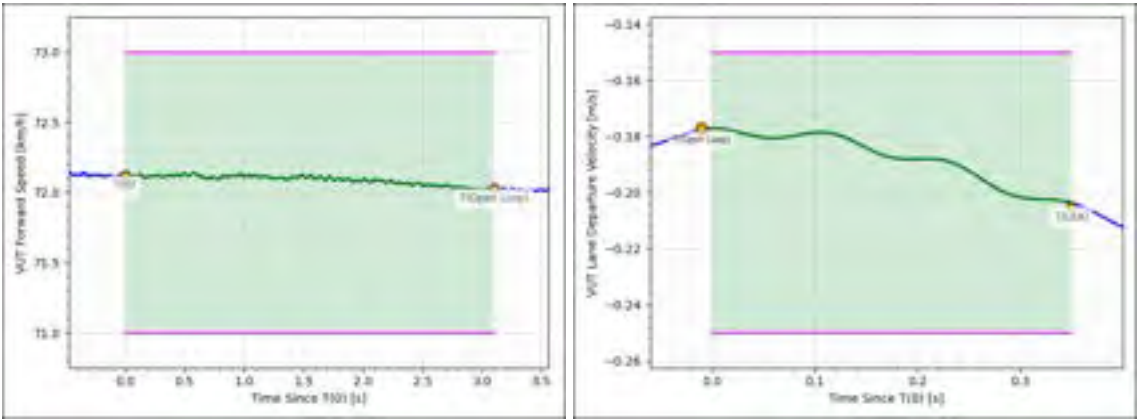
LKA SLN-D 0.2 mps Main | 0.2 m/s | Run 3

Run Date / Time 14-Dec-2022 11:45



LKA SLN-D 0.2 mps Main | 0.2 m/s | Run 4

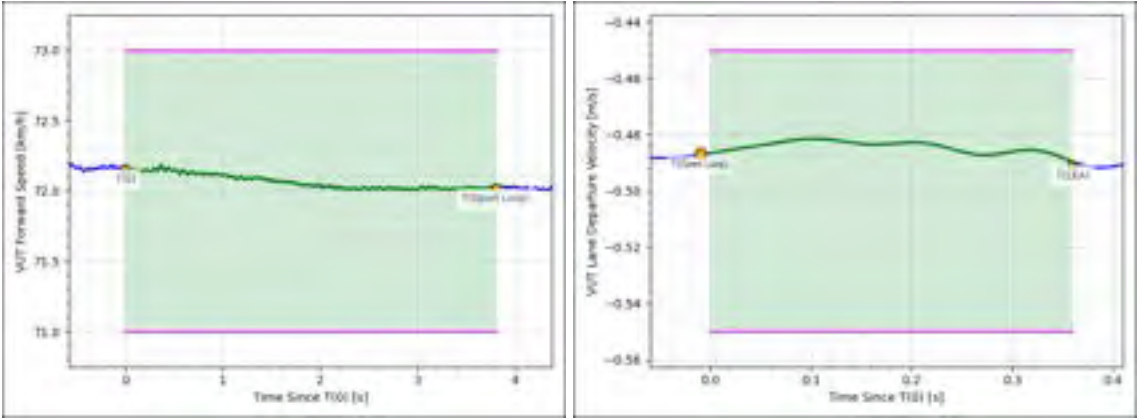
Run Date / Time 14-Dec-2022 11:47



F.1.1.3. 0.5 m/s

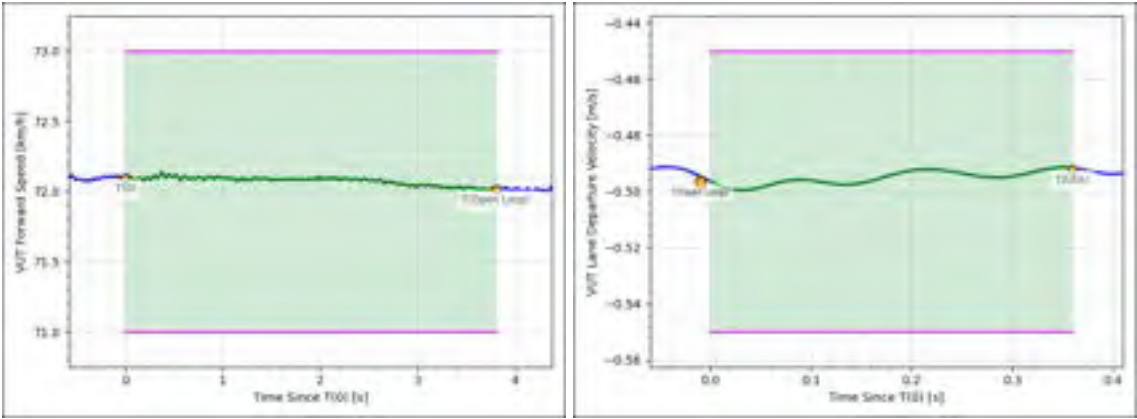
LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 2

Run Date / Time 14-Dec-2022 11:57



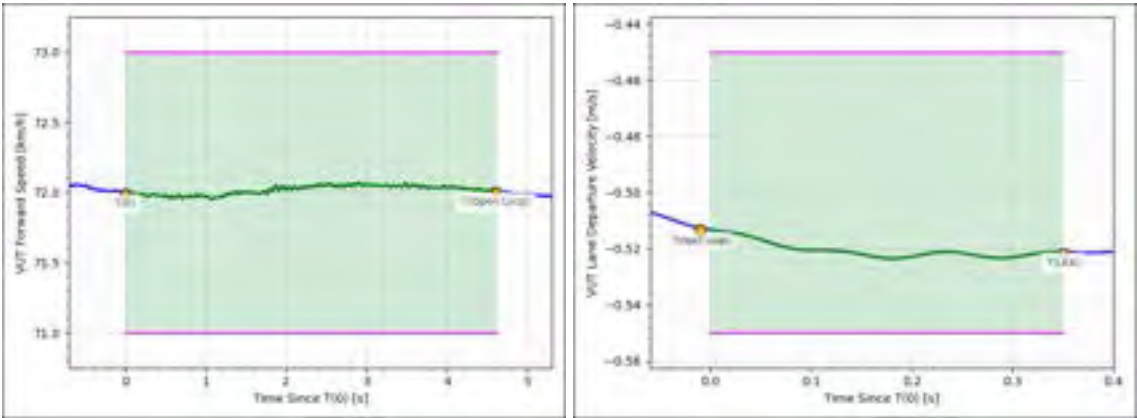
LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 3

Run Date / Time 14-Dec-2022 11:58



LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 7

Run Date / Time 14-Dec-2022 14:28

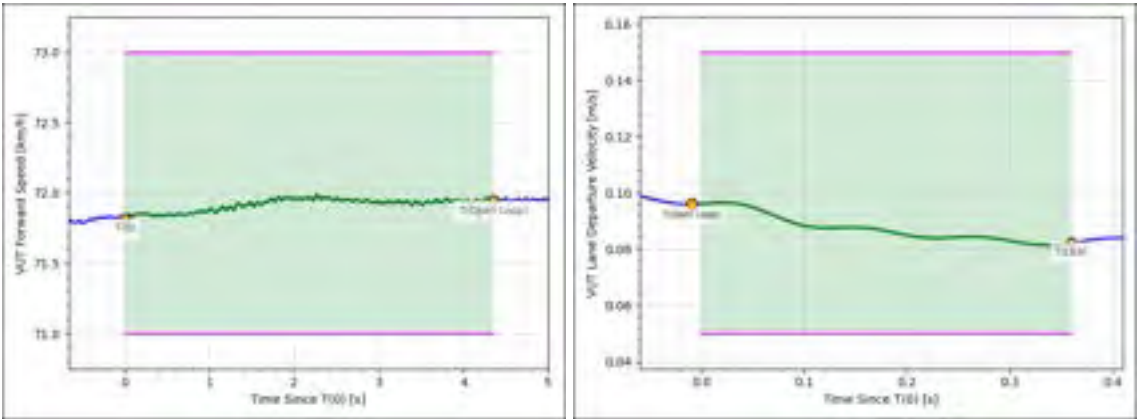


F.1.2. SLN-P

F.1.2.1. 0.1 m/s

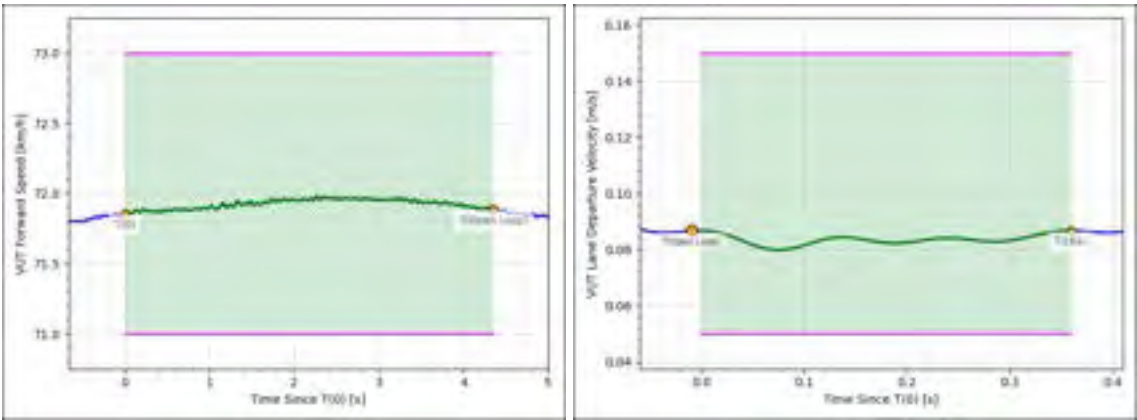
LKA SLN-P 0.1 mps Main | 0.1 m/s | Run 7

Run Date / Time 15-Dec-2022 14:18



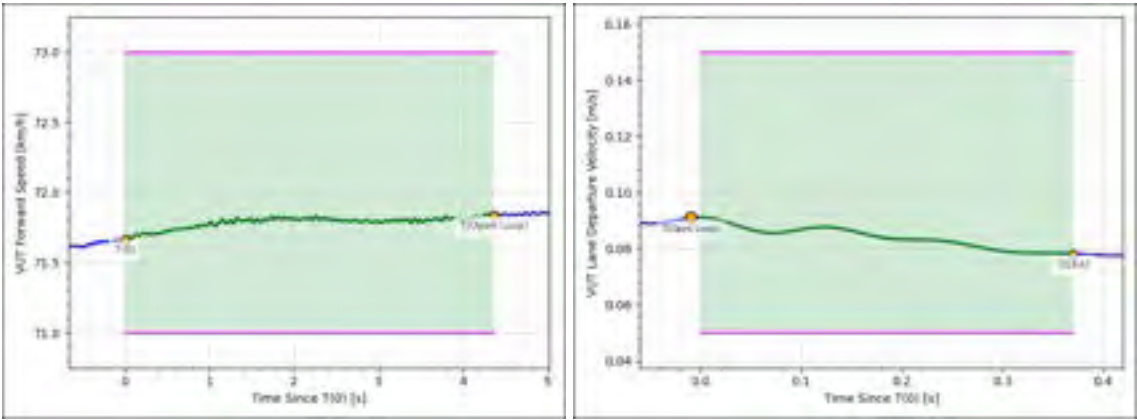
LKA SLN-P 0.1 mps Main | 0.1 m/s | Run 8

Run Date / Time 15-Dec-2022 14:20



LKA SLN-P 0.1 mps Main | 0.1 m/s | Run 9

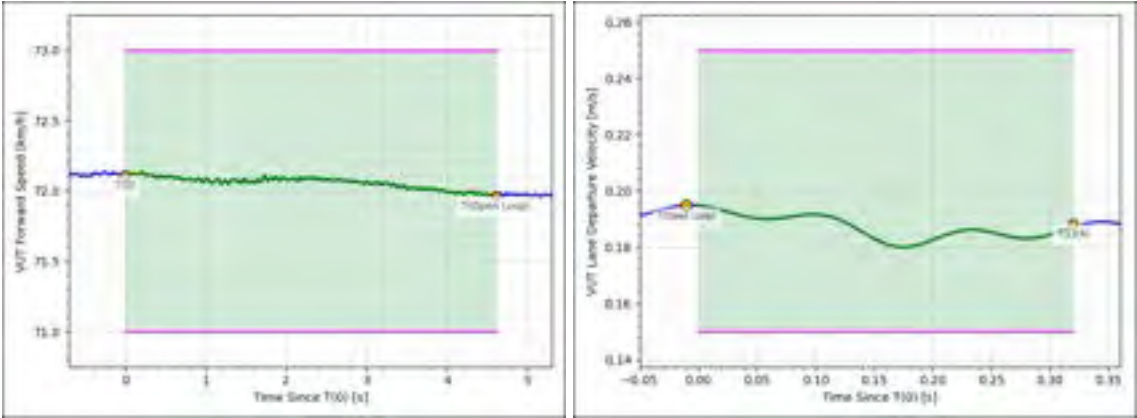
Run Date / Time 15-Dec-2022 14:22



F.1.2.2. 0.2 m/s

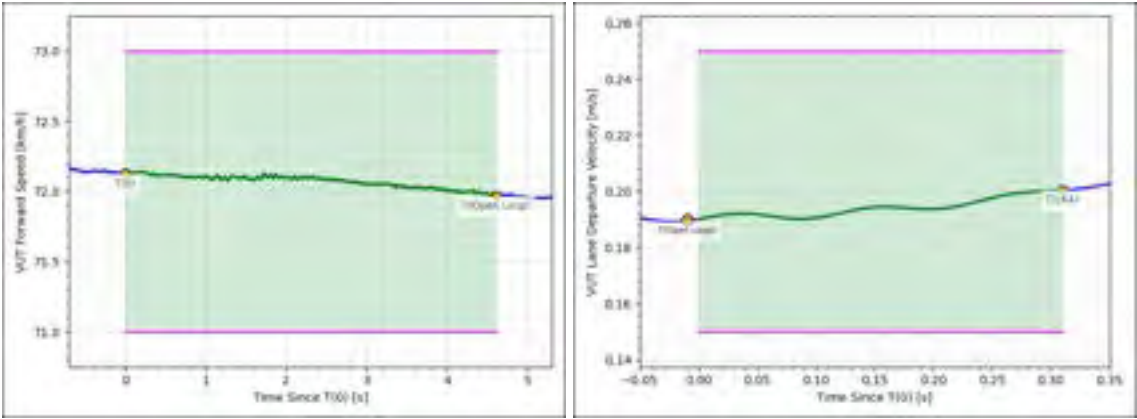
LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 1

Run Date / Time 14-Dec-2022 21:20



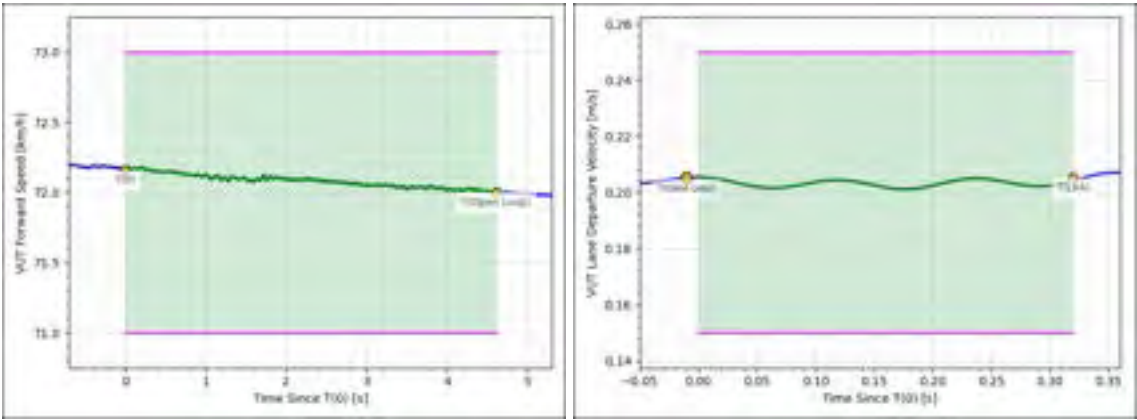
LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 2

Run Date / Time 14-Dec-2022 21:22



LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 3

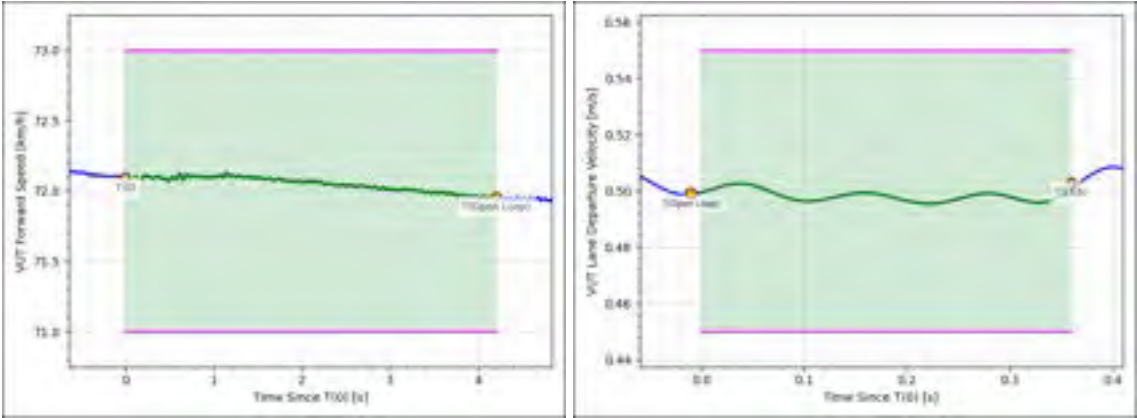
Run Date / Time 14-Dec-2022 21:23



F.1.2.3. 0.5 m/s

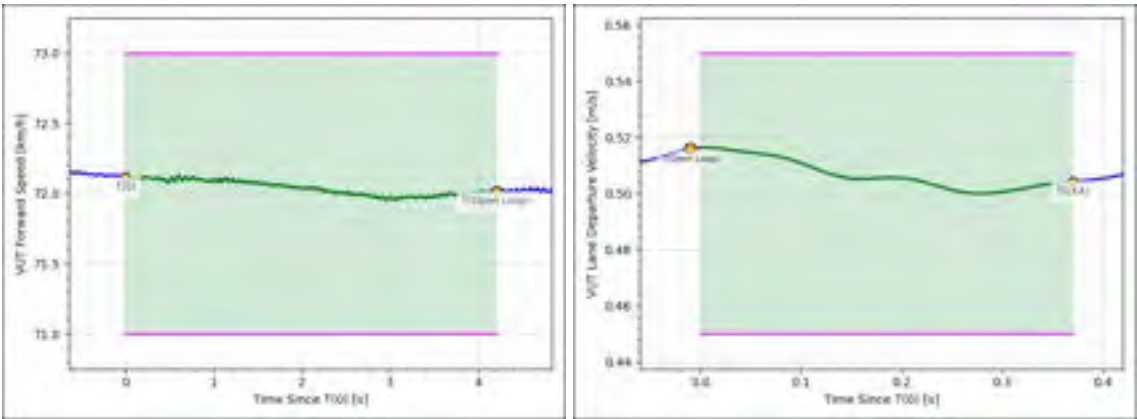
LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 1

Run Date / Time 14-Dec-2022 21:35



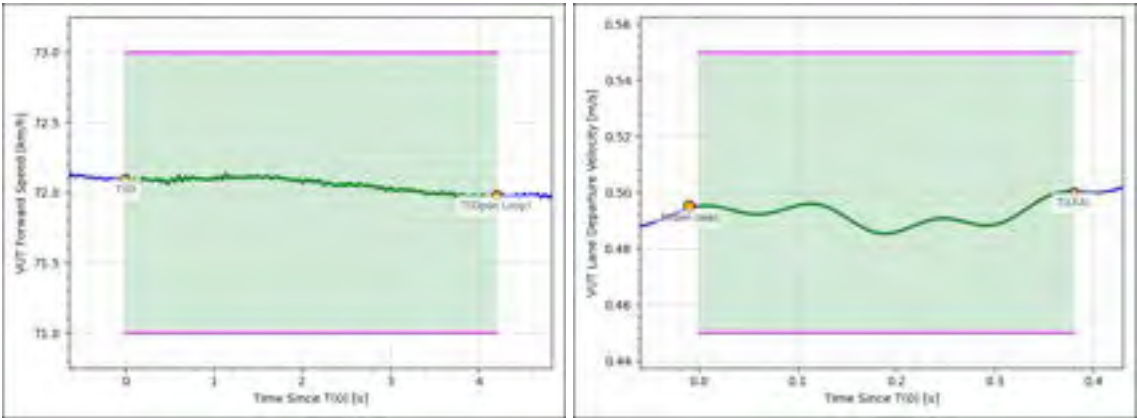
LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 2

Run Date / Time 14-Dec-2022 21:37



LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 3

Run Date / Time 14-Dec-2022 21:39

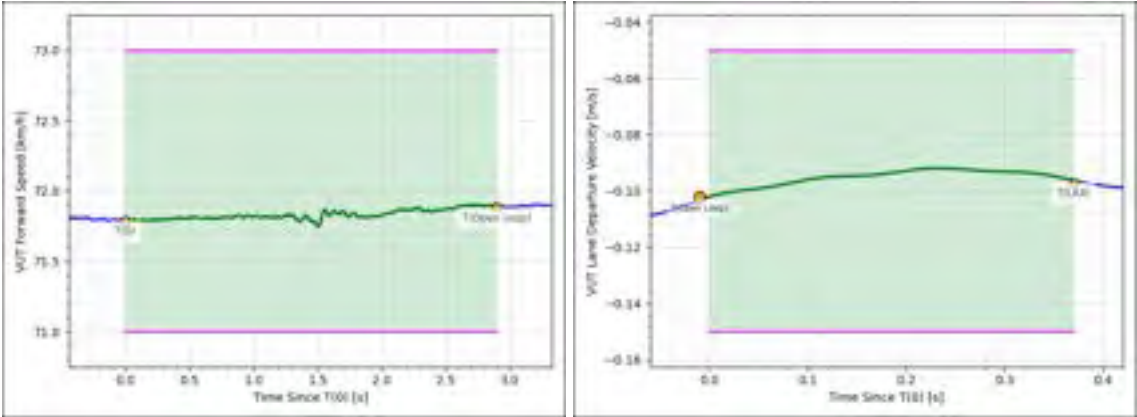


F.1.3. DLN-D

F.1.3.1. 0.1 m/s

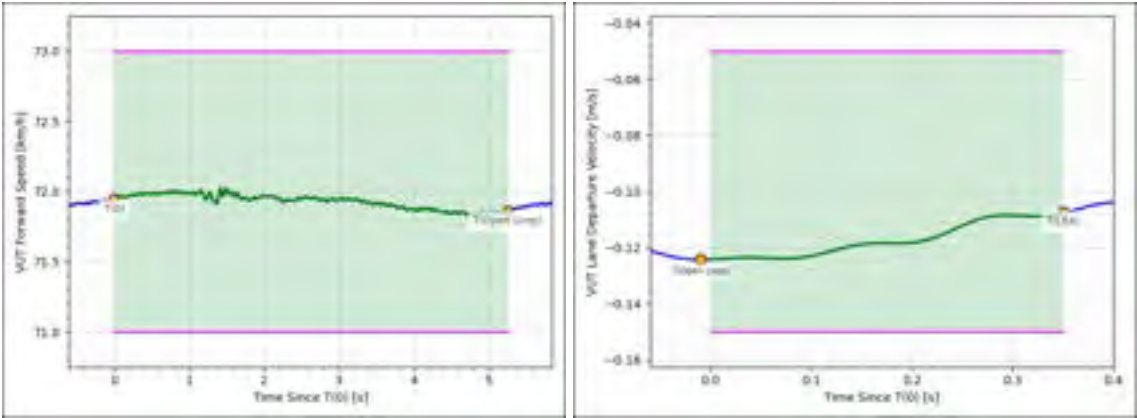
LKA DLN-D 0.1 mps Main | 0.1 m/s | Run 2

Run Date / Time 15-Dec-2022 12:33



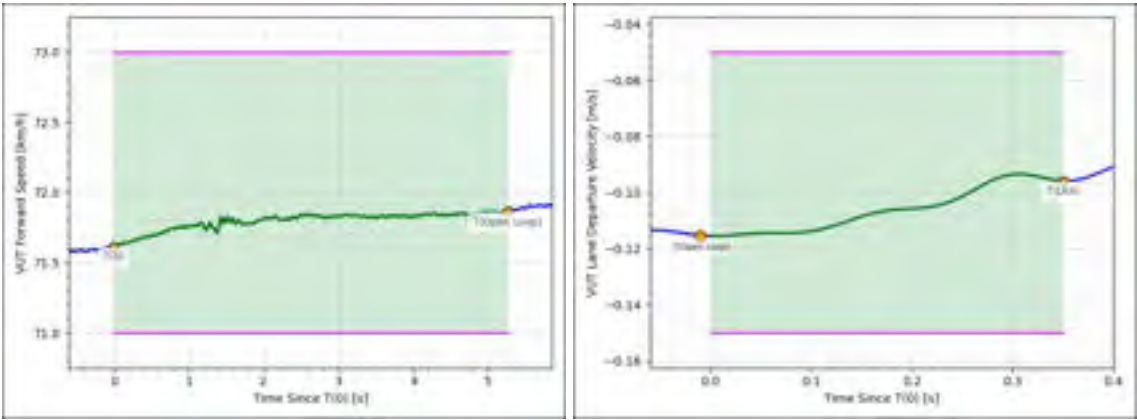
LKA DLN-D 0.1 mps Main | 0.1 m/s | Run 4

Run Date / Time 15-Dec-2022 13:19



LKA DLN-D 0.1 mps Main | 0.1 m/s | Run 7

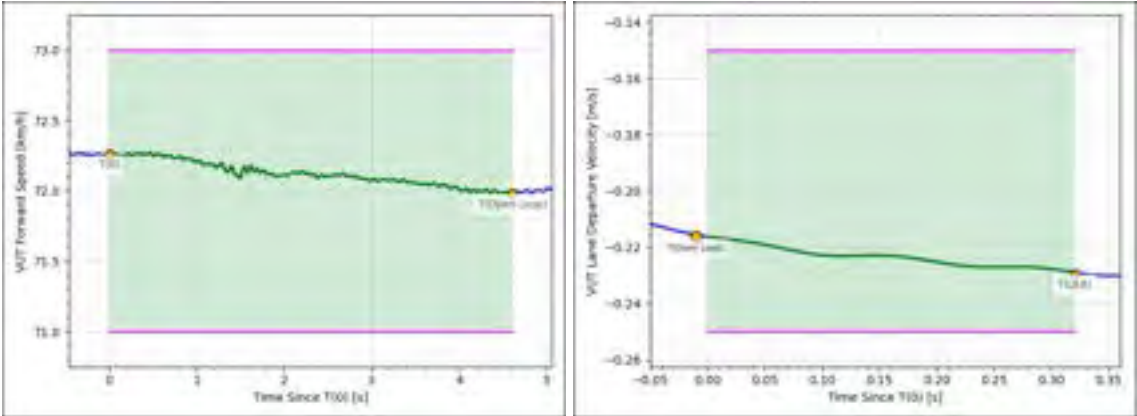
Run Date / Time 15-Dec-2022 13:30



F.1.3.2. 0.2 m/s

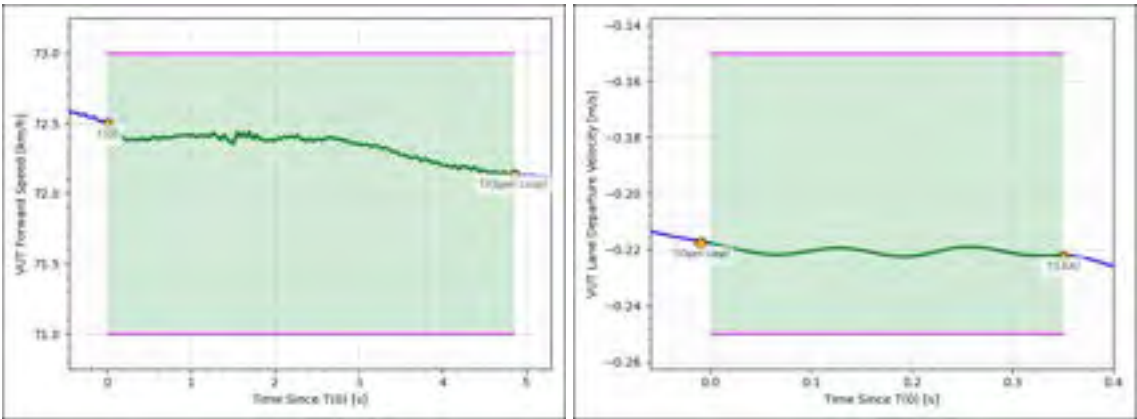
LKA DLN-D 0.2 mps Main | 0.2 m/s | Run 4

Run Date / Time 14-Dec-2022 15:42



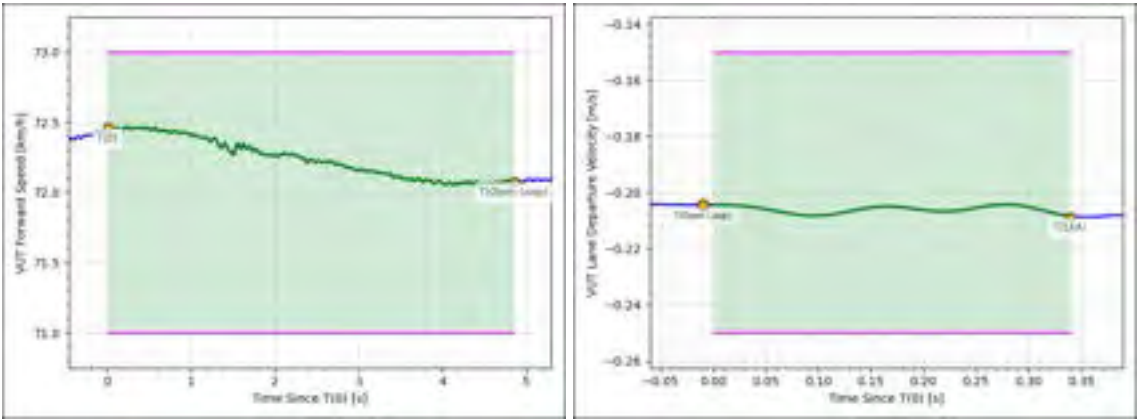
LKA DLN-D 0.2 mps Main | 0.2 m/s | Run 5

Run Date / Time 14-Dec-2022 15:46



LKA DLN-D 0.2 mps Main | 0.2 m/s | Run 6

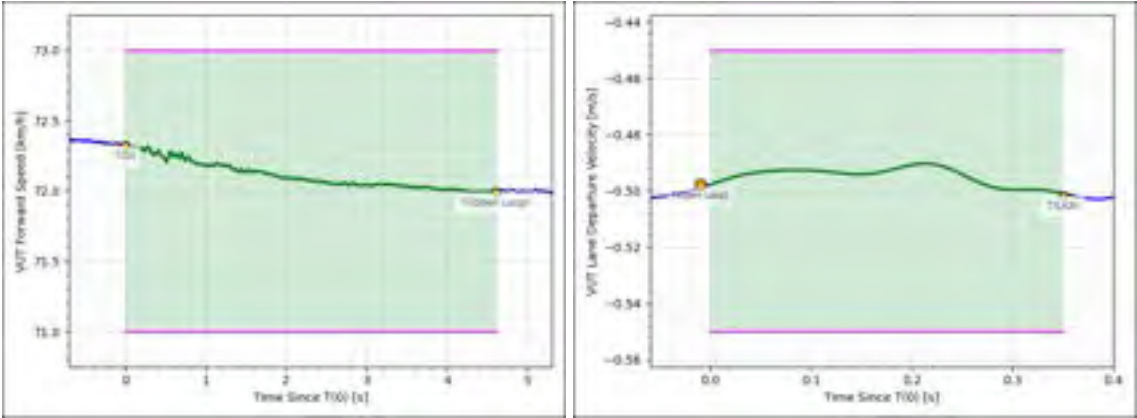
Run Date / Time 14-Dec-2022 15:48



F.1.3.3. 0.5 m/s

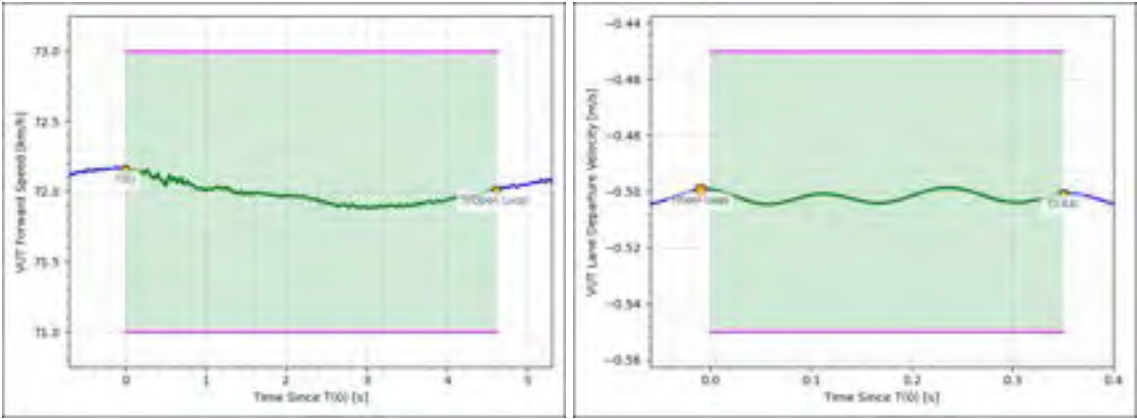
LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 1

Run Date / Time 14-Dec-2022 15:50



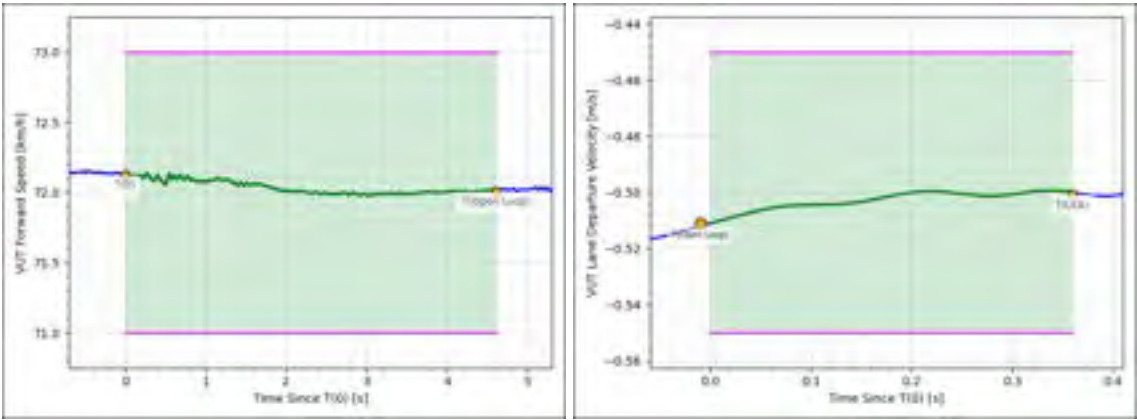
LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 2

Run Date / Time 14-Dec-2022 15:52



LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 3

Run Date / Time 14-Dec-2022 15:54

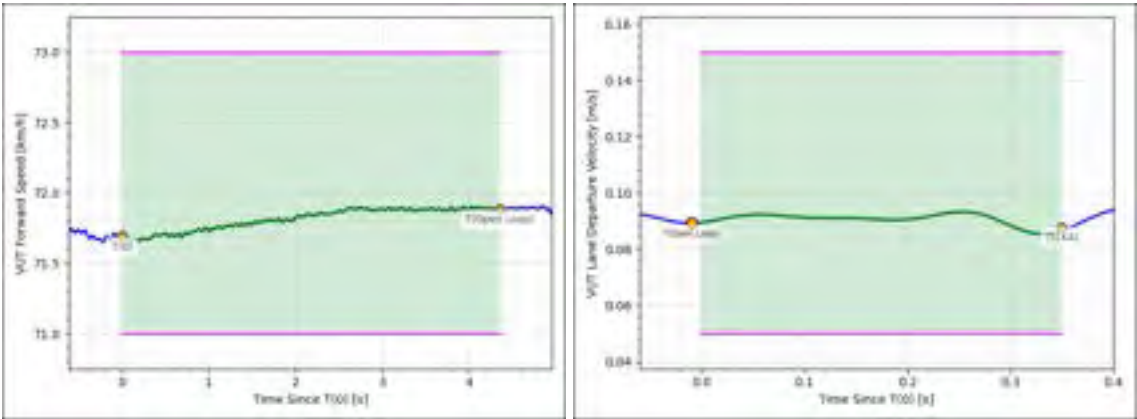


F.1.4. DLN-P

F.1.4.1. 0.1 m/s

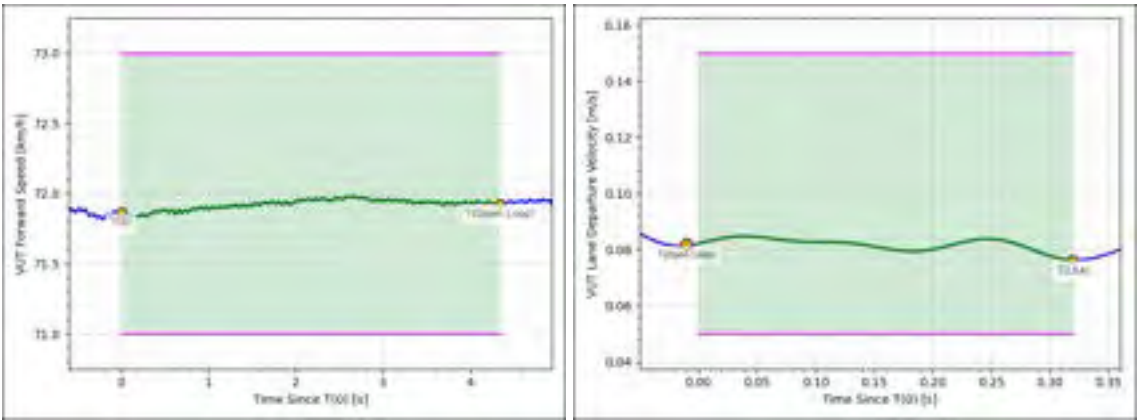
LKA DLN-P 0.1 mps Main | 0.1 m/s | Run 4

Run Date / Time 15-Dec-2022 14:26



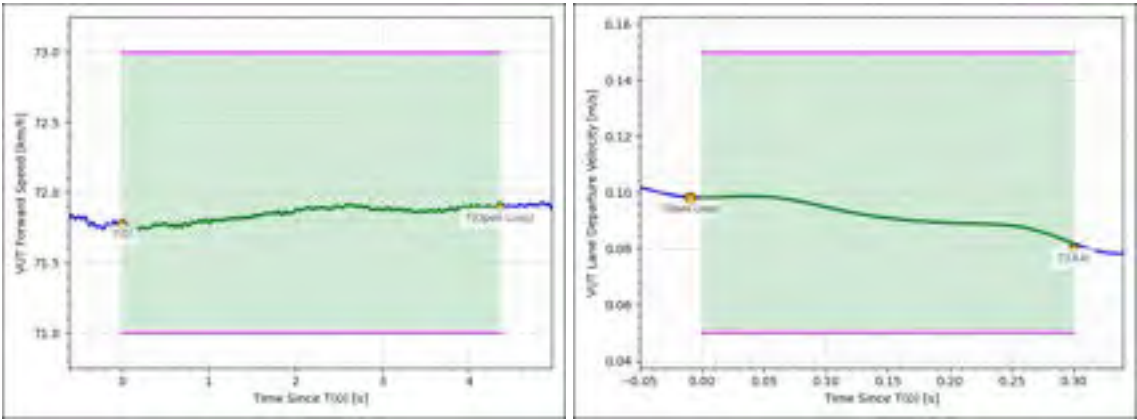
LKA DLN-P 0.1 mps Main | 0.1 m/s | Run 5

Run Date / Time 15-Dec-2022 14:28



LKA DLN-P 0.1 mps Main | 0.1 m/s | Run 6

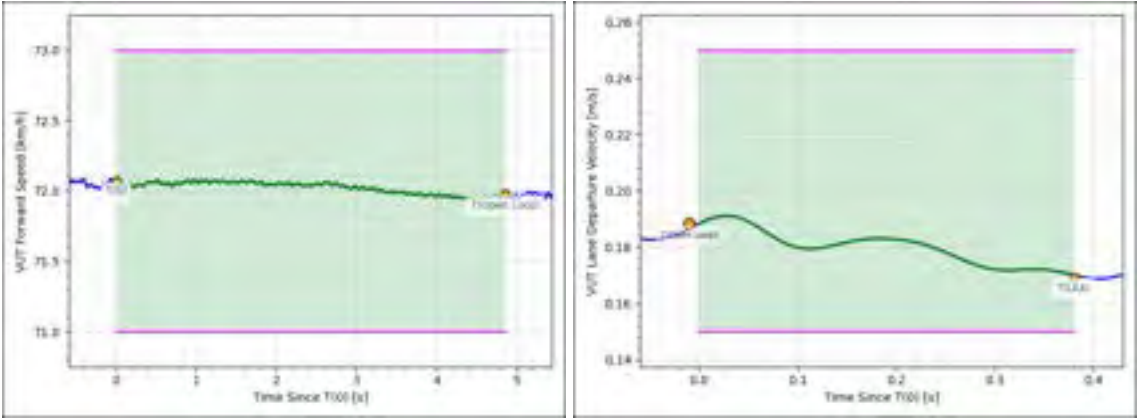
Run Date / Time 15-Dec-2022 14:30



F.1.4.2. 0.2 m/s

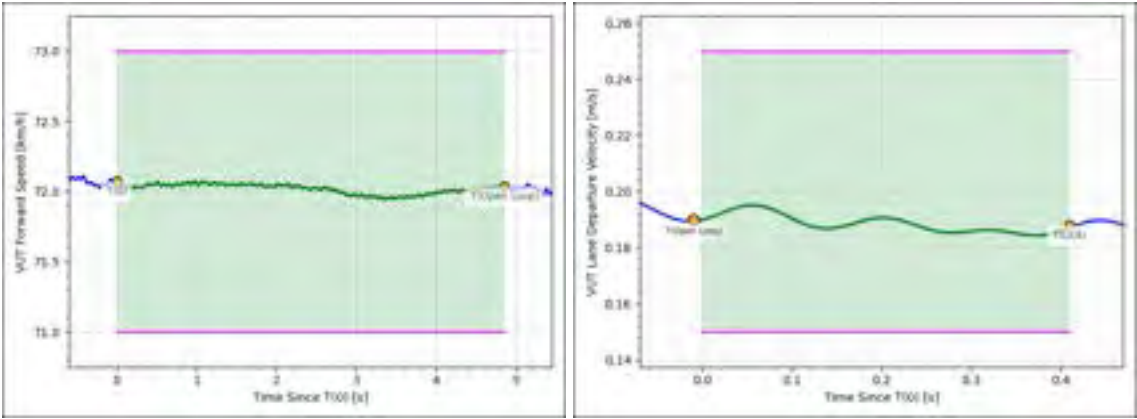
LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 1

Run Date / Time 14-Dec-2022 16:06



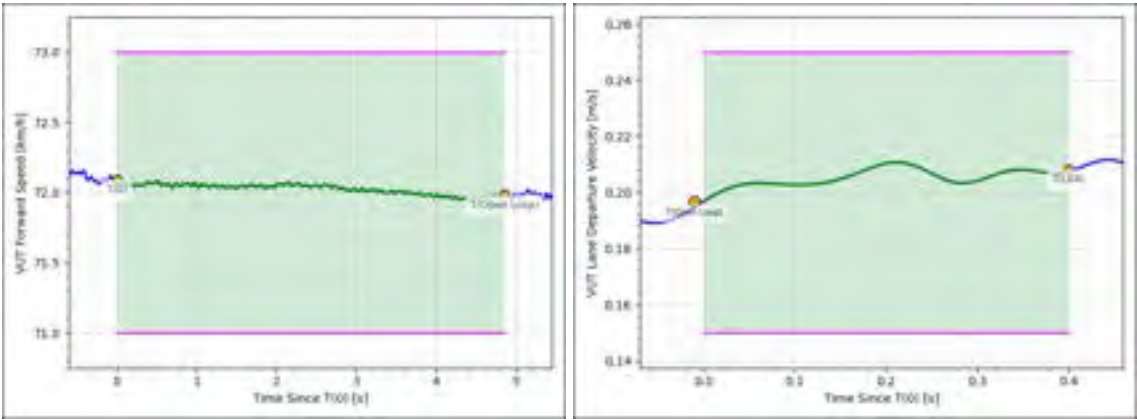
LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 2

Run Date / Time 14-Dec-2022 16:09



LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 3

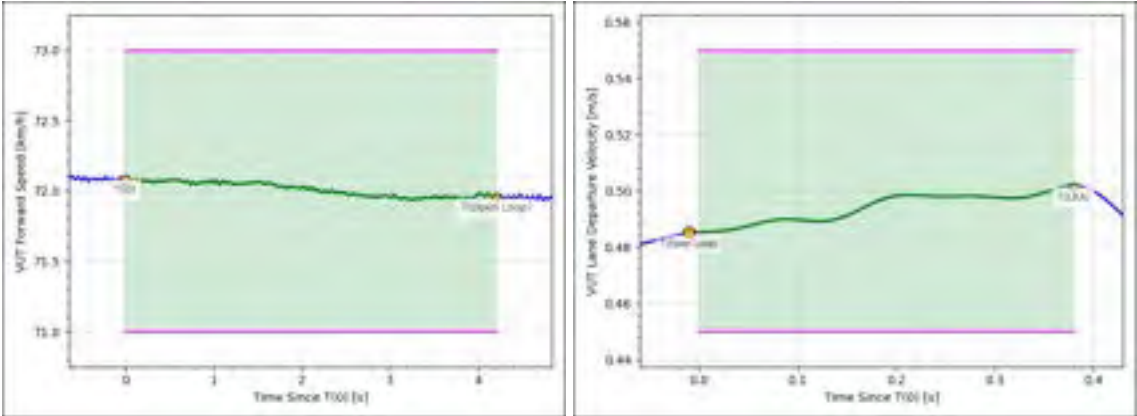
Run Date / Time 14-Dec-2022 16:11



F.1.4.3. 0.5 m/s

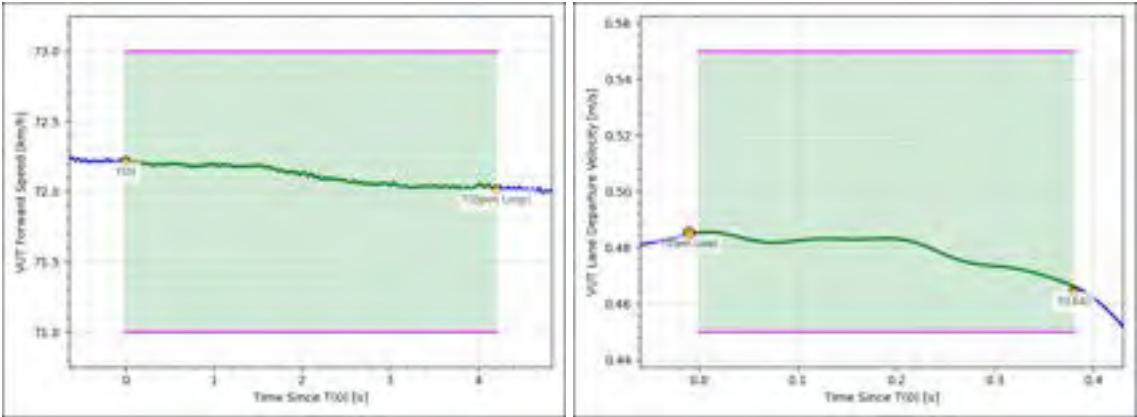
LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 3

Run Date / Time 14-Dec-2022 16:19



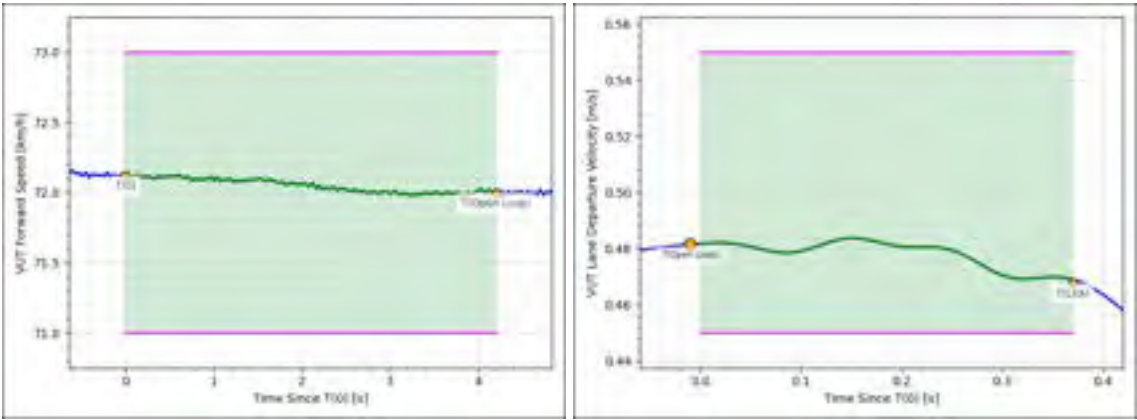
LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 4

Run Date / Time 14-Dec-2022 16:21



LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 5

Run Date / Time 14-Dec-2022 16:23



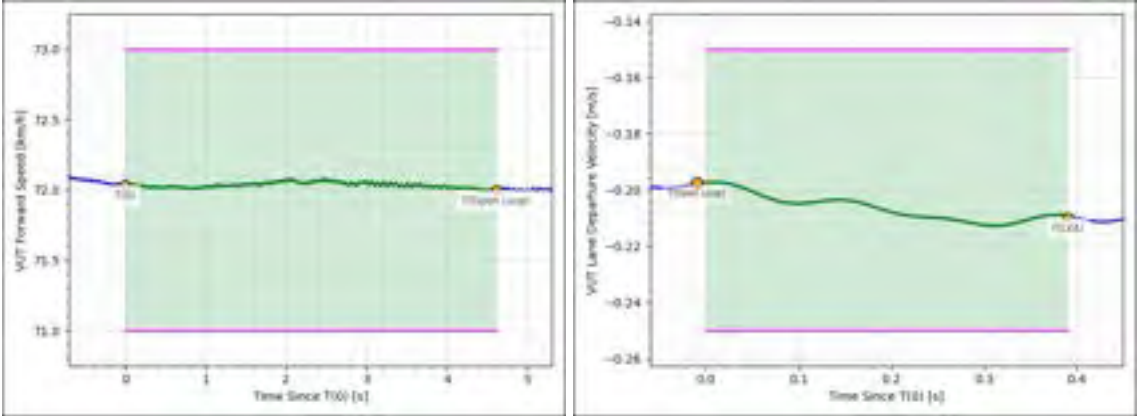
F.2. GVM (Night)

F.2.1. SLN-D

F.2.1.1. 0.2 m/s

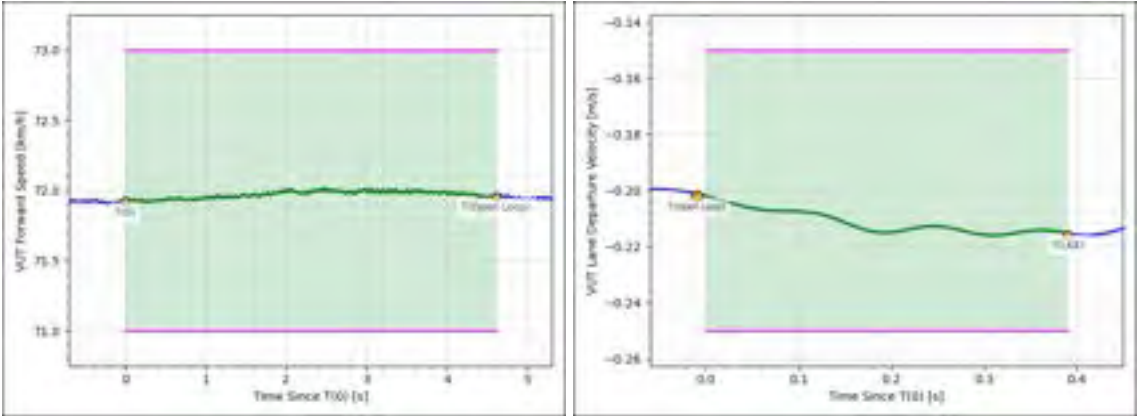
LKA SLN-D 0.2 mps Main | 0.2 m/s | Run 10

Run Date / Time 14-Dec-2022 23:01



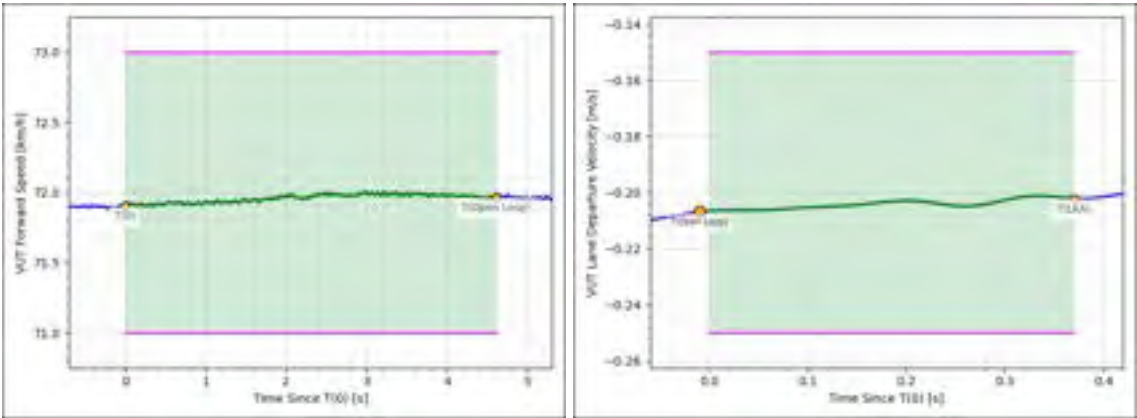
LKA SLN-D 0.2 mps Main | 0.2 m/s | Run 11

Run Date / Time 14-Dec-2022 23:02



LKA SLN-D 0.2 mps Main | 0.2 m/s | Run 12

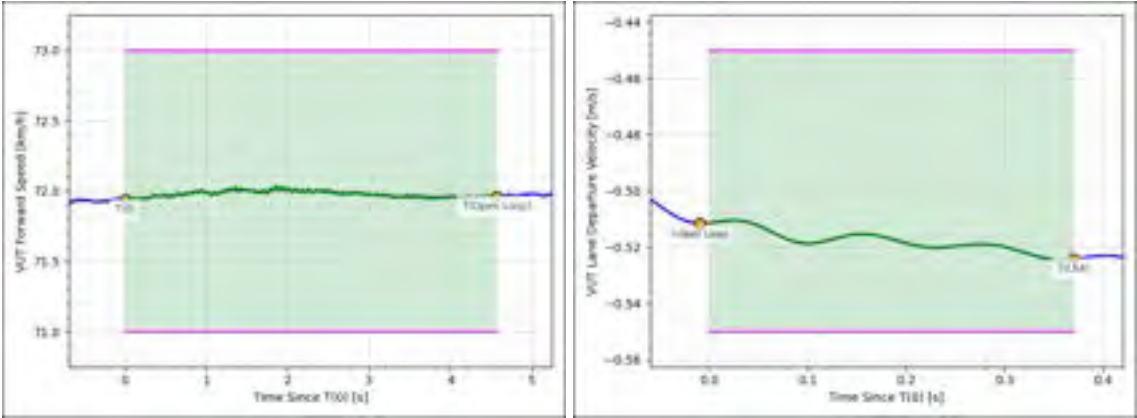
Run Date / Time 14-Dec-2022 23:04



F.2.1.2. 0.5 m/s

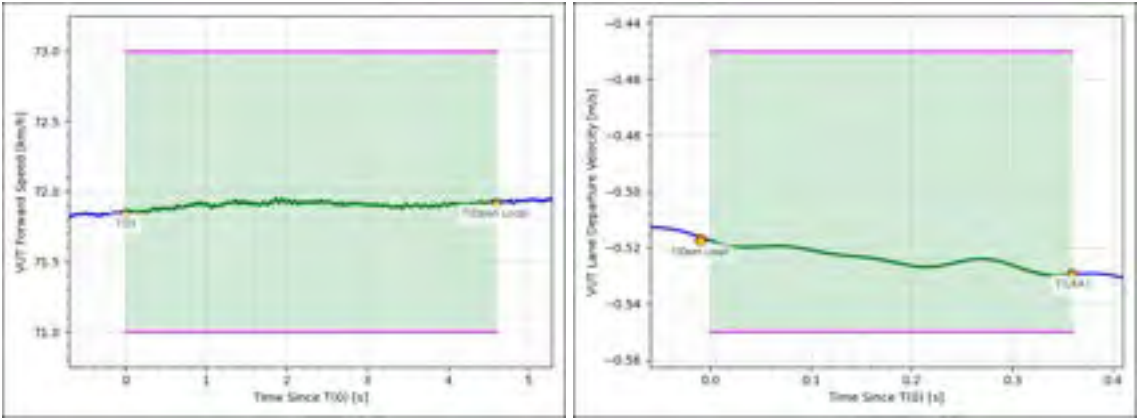
LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 18

Run Date / Time 14-Dec-2022 23:28



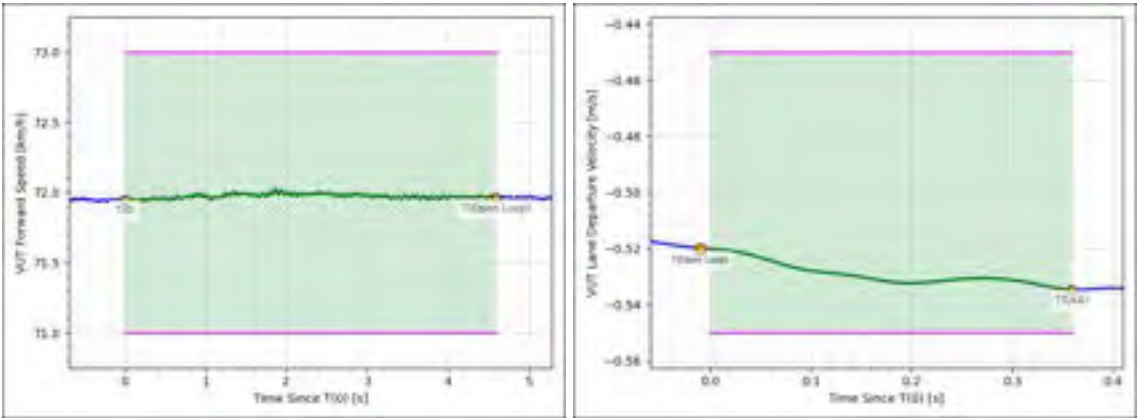
LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 21

Run Date / Time 14-Dec-2022 23:36



LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 22

Run Date / Time 14-Dec-2022 23:39

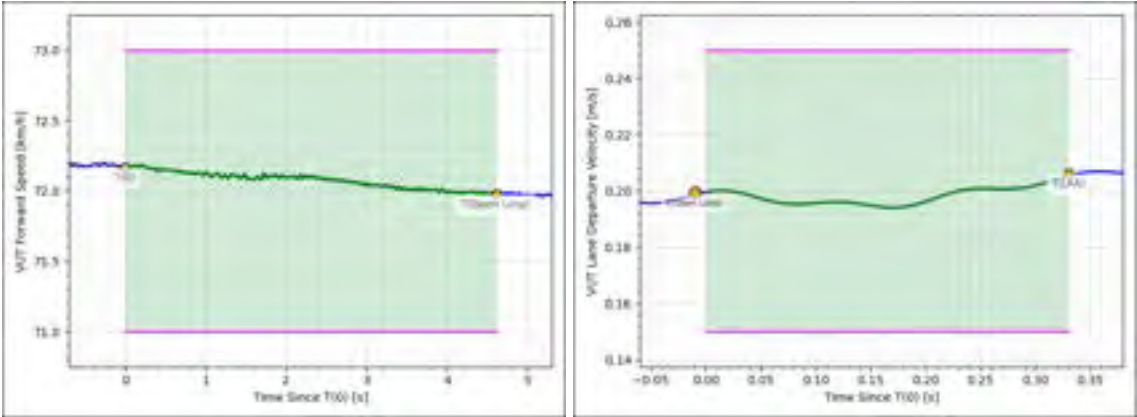


F.2.2. SLN-P

F.2.2.1. 0.2 m/s

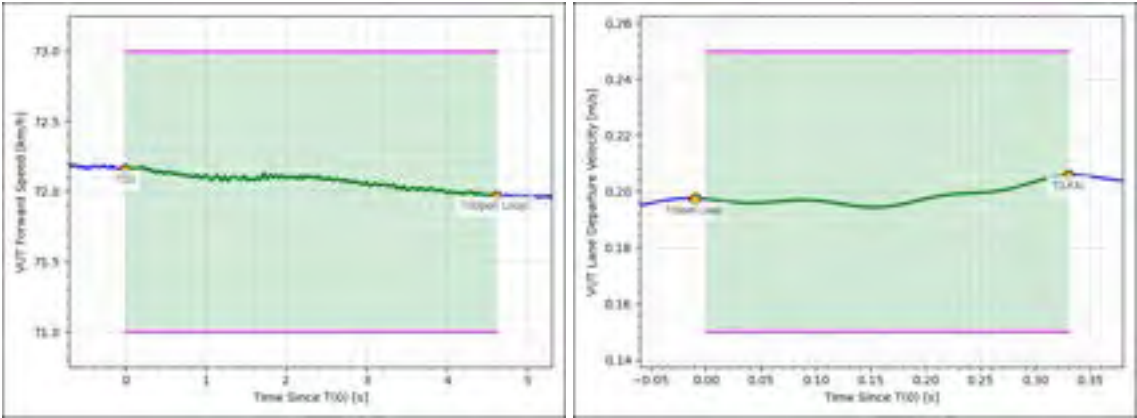
LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 4

Run Date / Time 14-Dec-2022 21:26



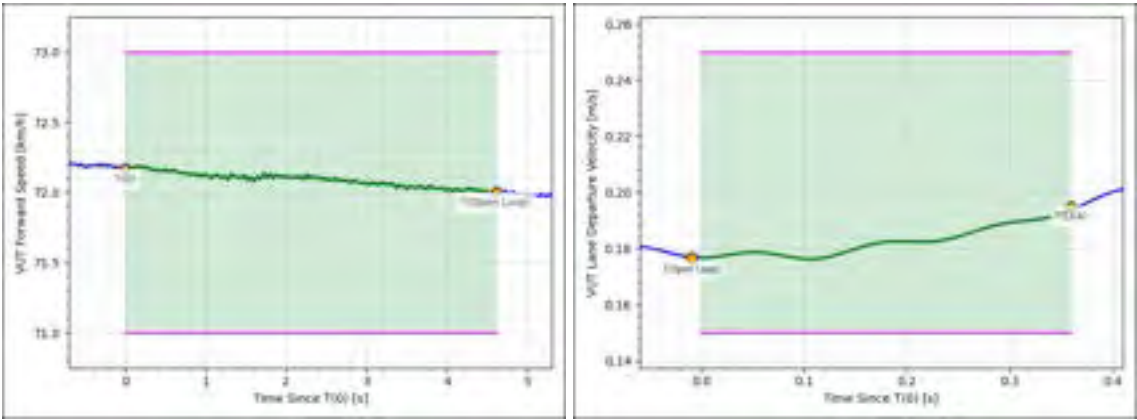
LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 5

Run Date / Time 14-Dec-2022 21:28



LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 6

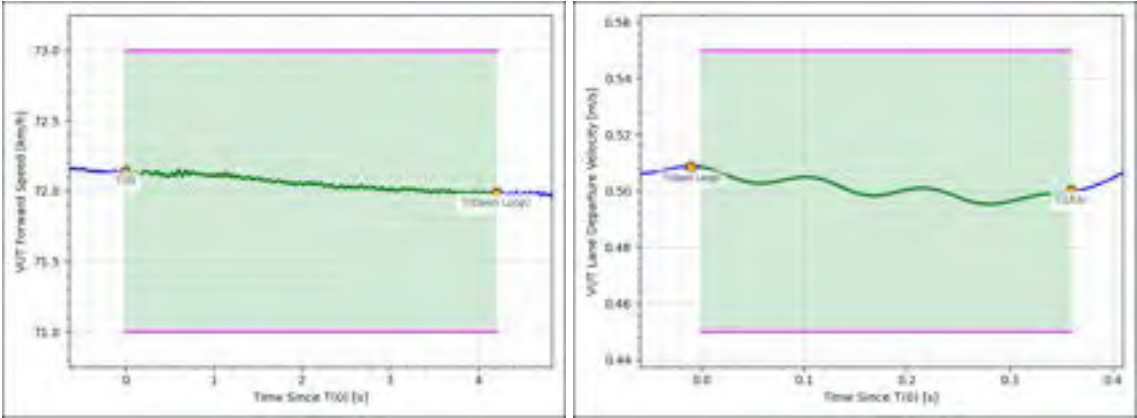
Run Date / Time 14-Dec-2022 21:30



F.2.2.2. 0.5 m/s

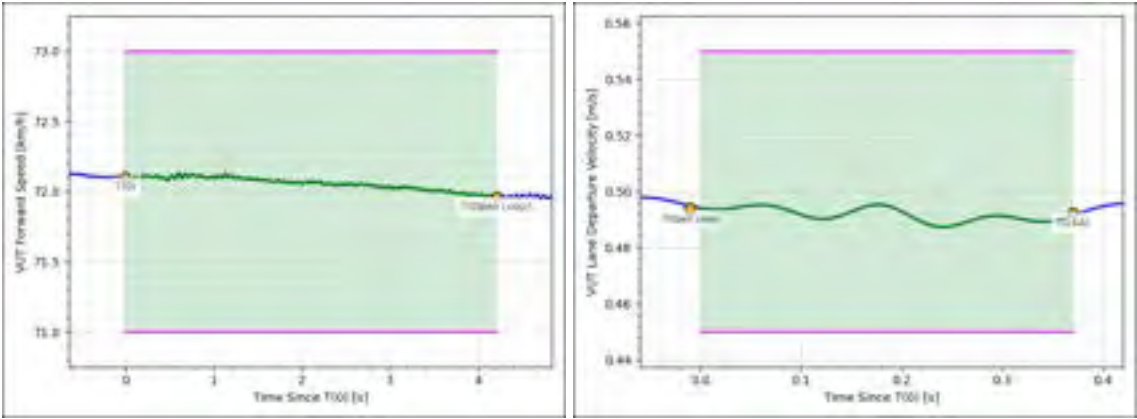
LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 4

Run Date / Time 14-Dec-2022 21:41



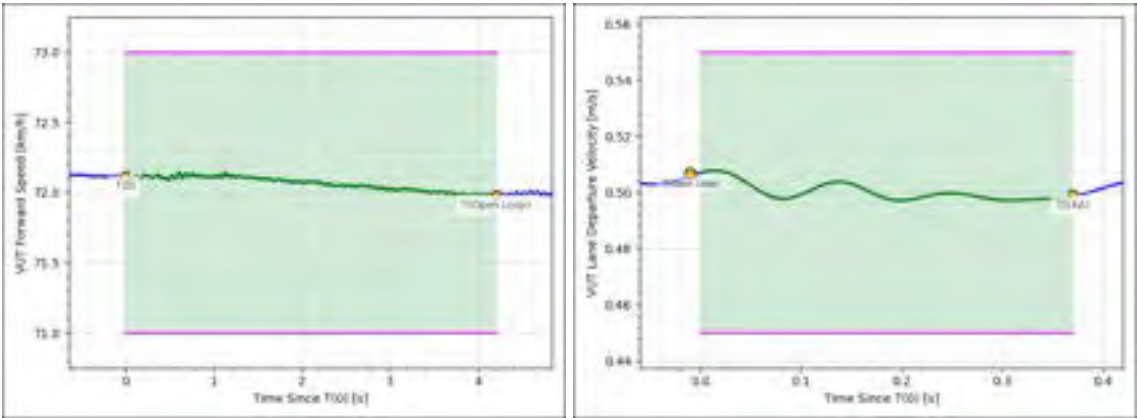
LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 5

Run Date / Time 14-Dec-2022 21:43



LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 6

Run Date / Time 14-Dec-2022 21:46

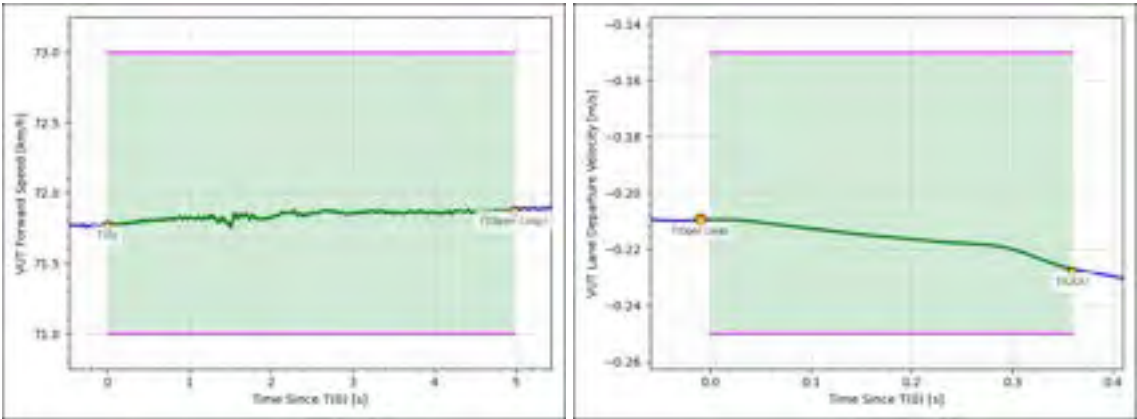


F.2.3. DLN-D

F.2.3.1. 0.2 m/s

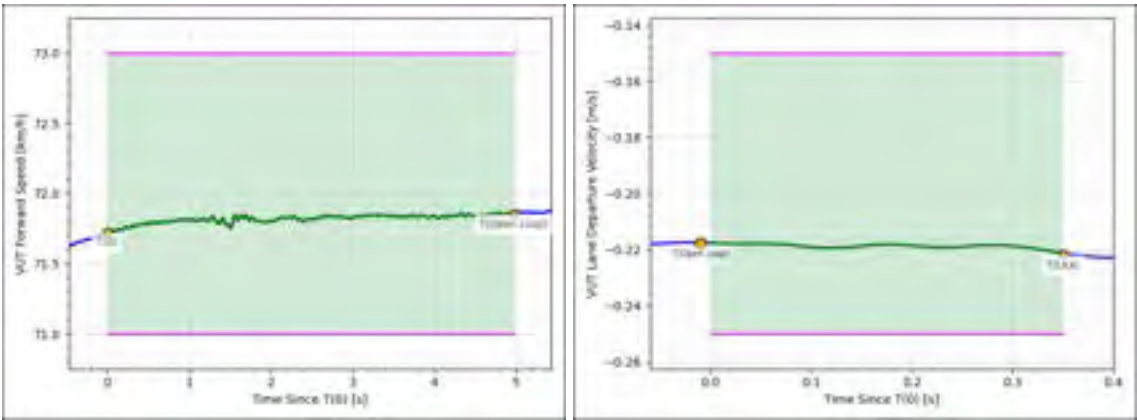
LKA DLN-D 0.2 mps Main | 0.2 m/s | Run 12

Run Date / Time 14-Dec-2022 23:55



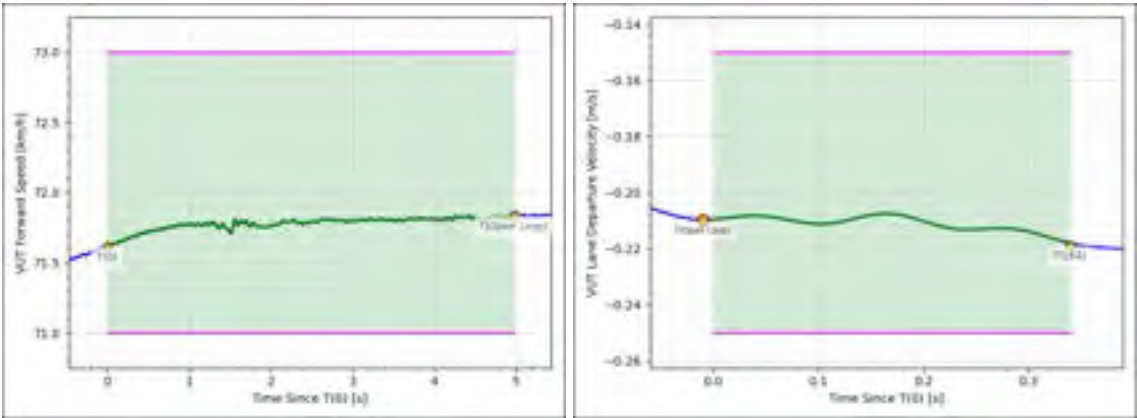
LKA DLN-D 0.2 mps Main | 0.2 m/s | Run 13

Run Date / Time 14-Dec-2022 23:57



LKA DLN-D 0.2 mps Main | 0.2 m/s | Run 14

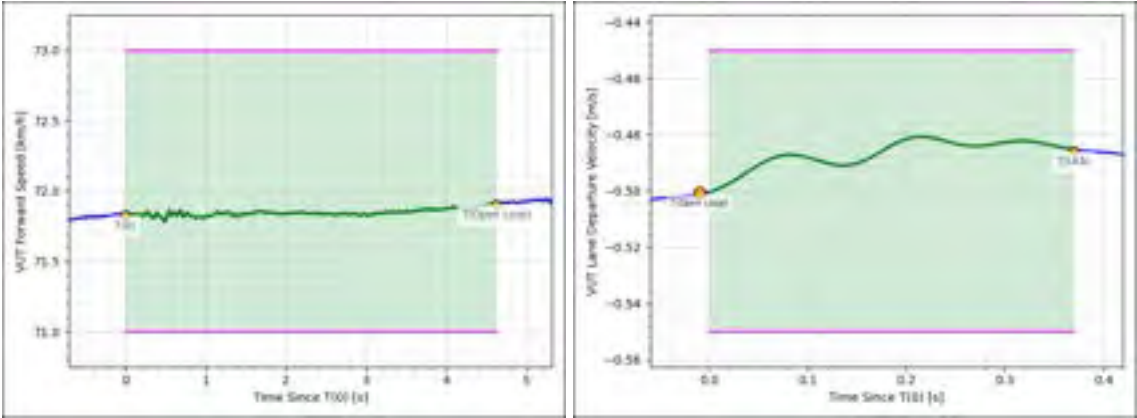
Run Date / Time 14-Dec-2022 23:58



F.2.3.2. 0.5 m/s

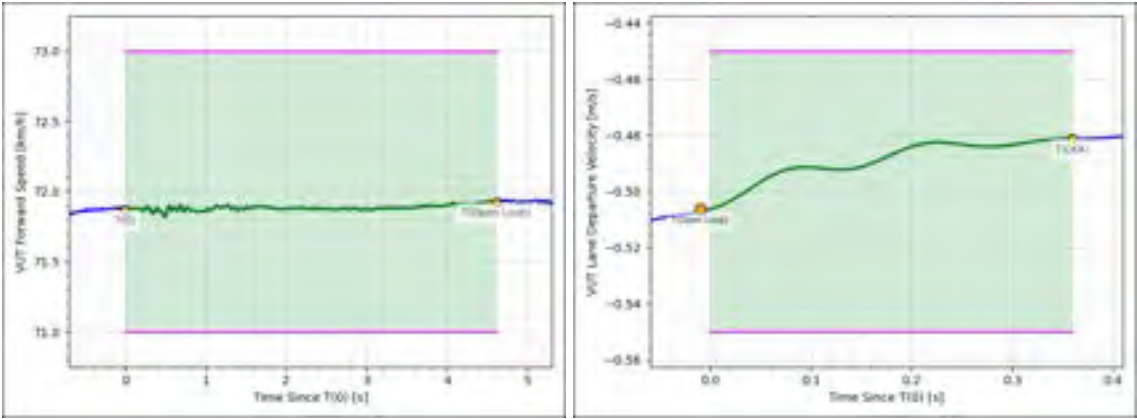
LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 8

Run Date / Time 15-Dec-2022 00:09



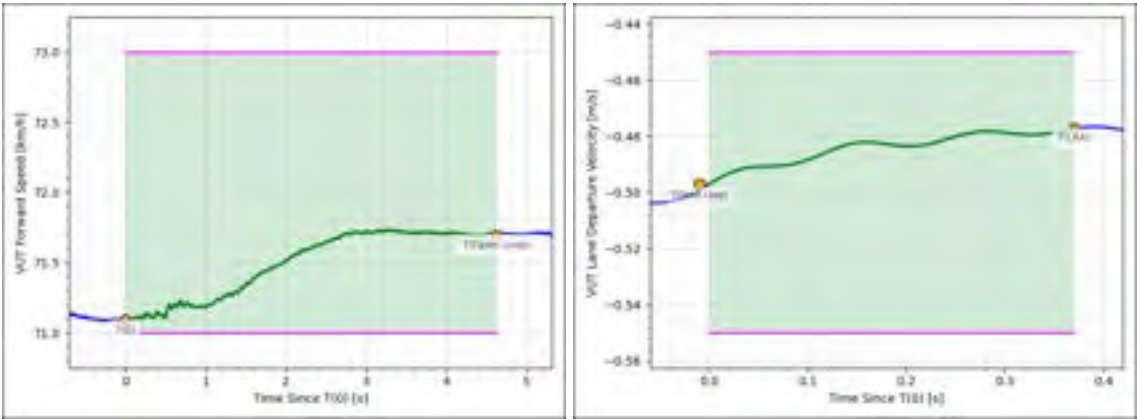
LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 10

Run Date / Time 15-Dec-2022 00:13



LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 11

Run Date / Time 15-Dec-2022 00:15

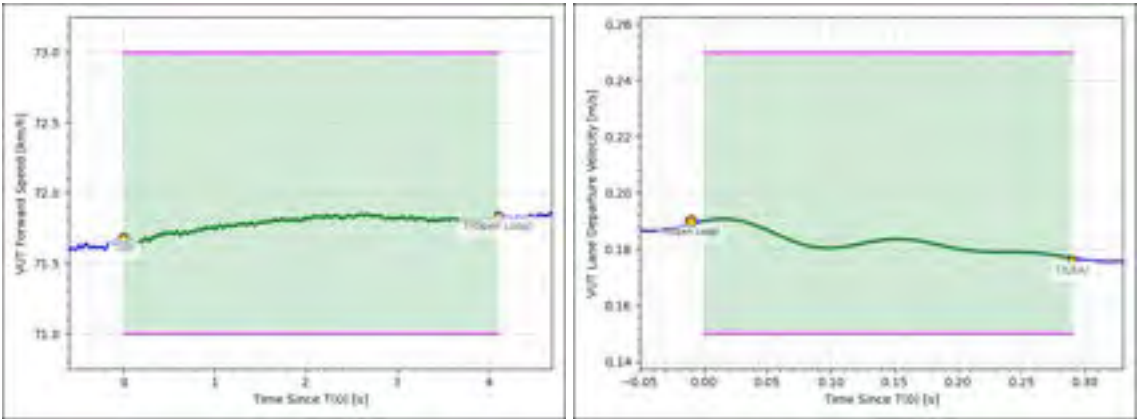


F.2.4. DLN-P

F.2.4.1. 0.2 m/s

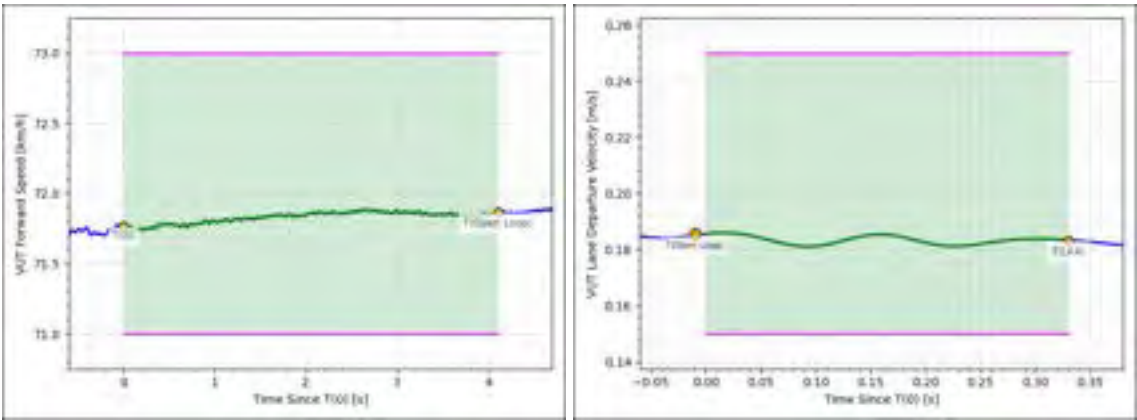
LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 13

Run Date / Time 14-Dec-2022 22:32



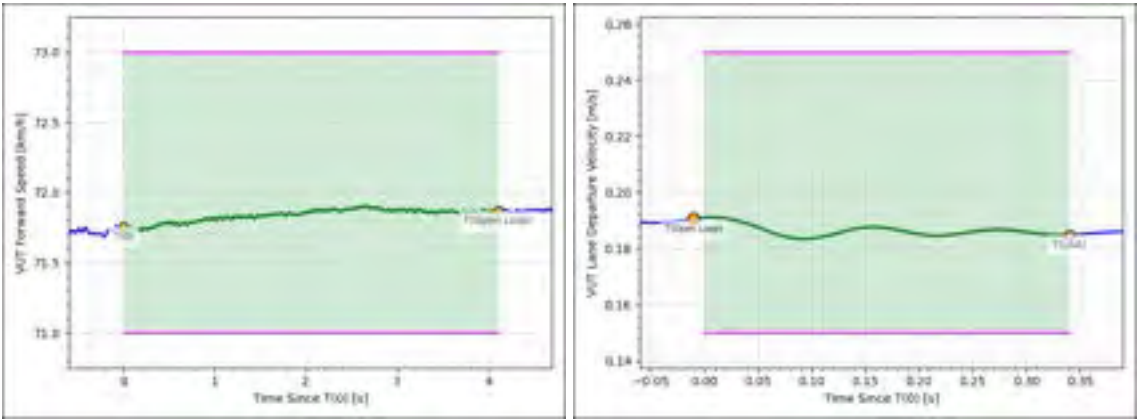
LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 14

Run Date / Time 14-Dec-2022 22:34



LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 15

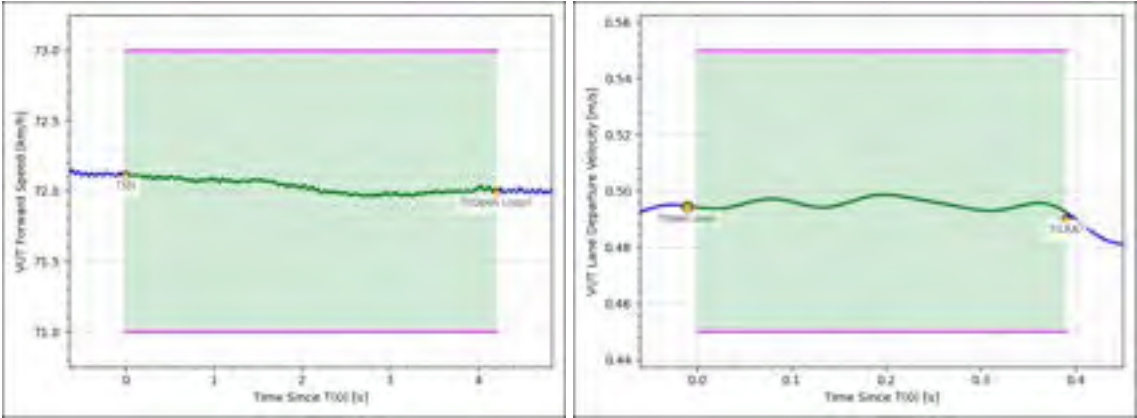
Run Date / Time 14-Dec-2022 22:36



F.2.4.2. 0.5 m/s

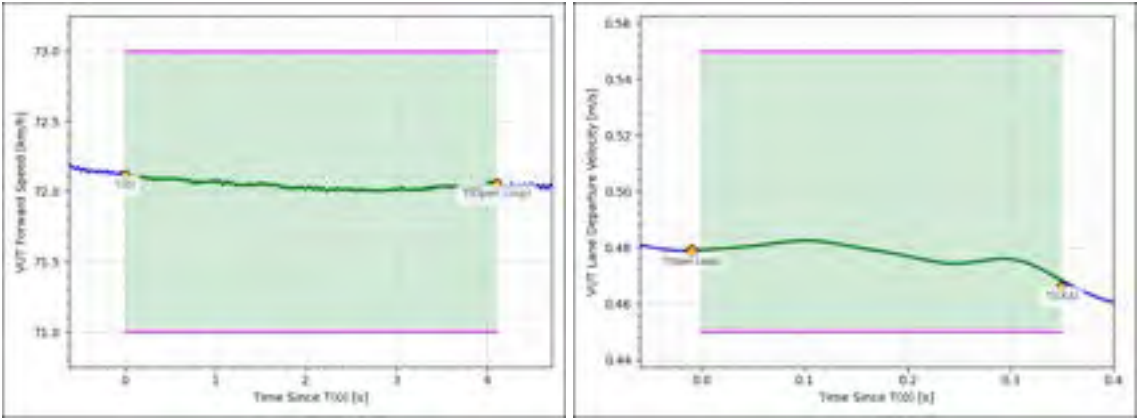
LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 9

Run Date / Time 14-Dec-2022 22:14



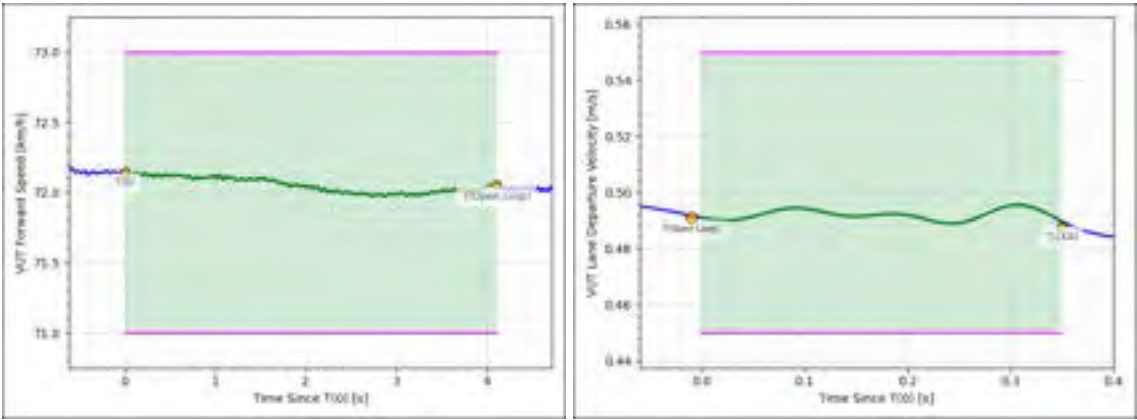
LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 11

Run Date / Time 14-Dec-2022 22:20



LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 12

Run Date / Time 14-Dec-2022 22:23



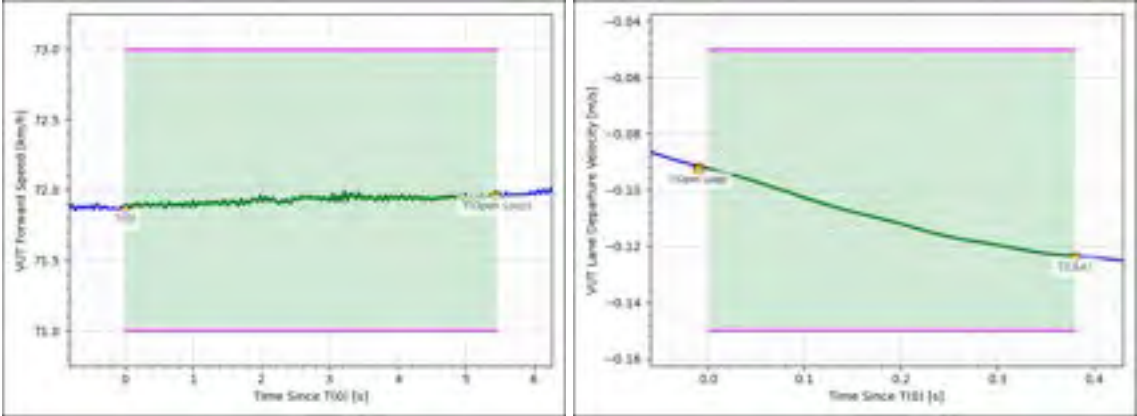
F.3. Rear Pitch

F.3.1. SLN-D

F.3.1.1. 0.1 m/s

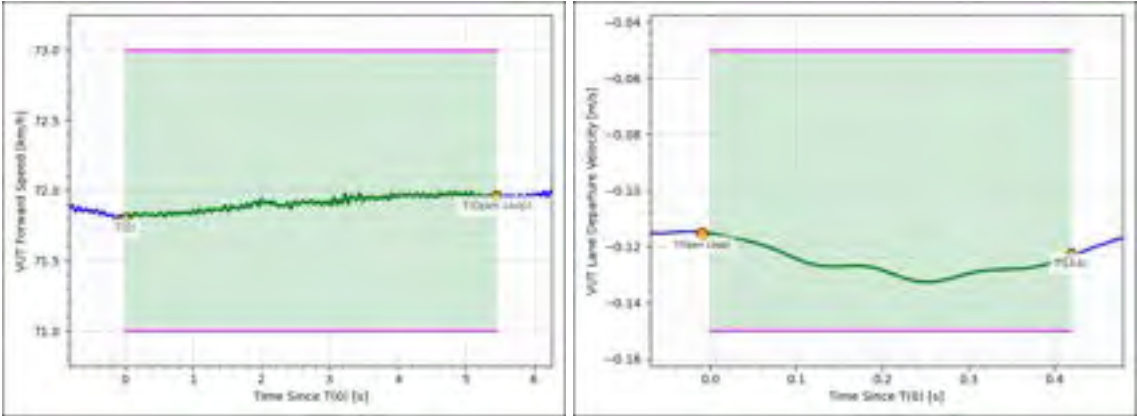
LKA SLN-D 0.1 mps Main | 0.1 m/s | Run 11

Run Date / Time 20-Dec-2022 14:47



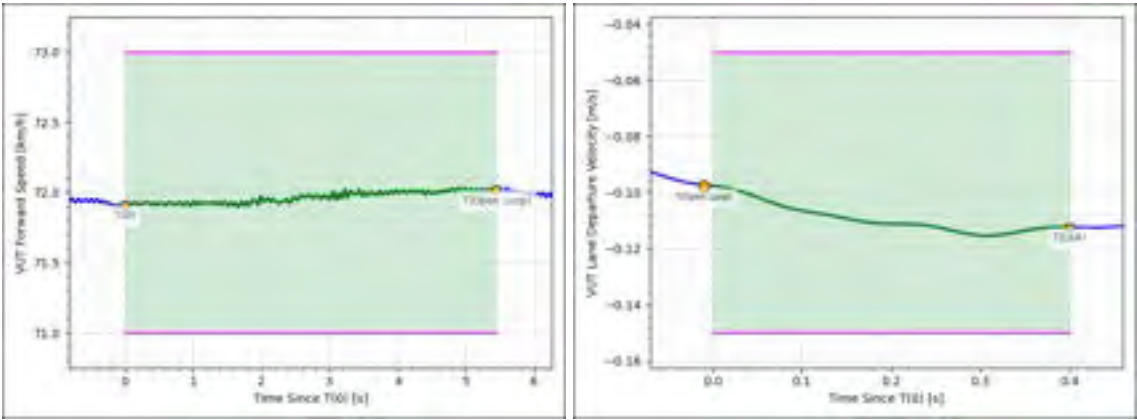
LKA SLN-D 0.1 mps Main | 0.1 m/s | Run 12

Run Date / Time 20-Dec-2022 14:49



LKA SLN-D 0.1 mps Main | 0.1 m/s | Run 13

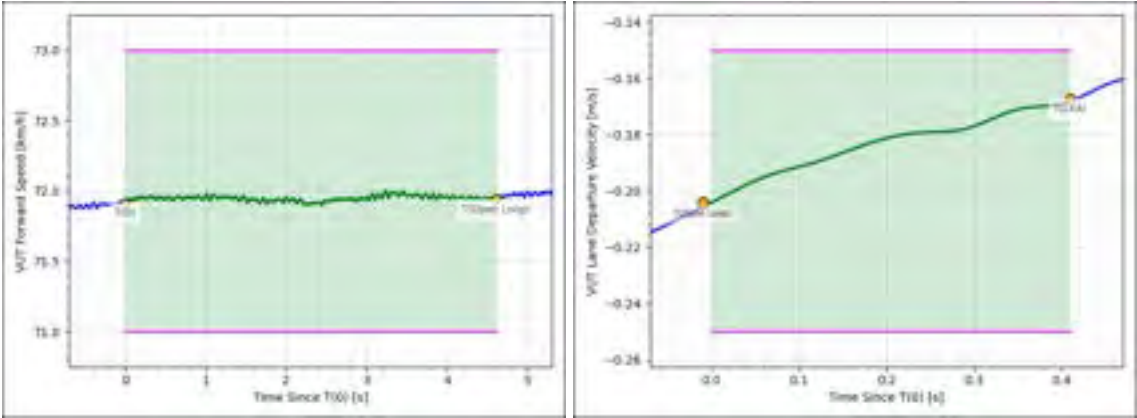
Run Date / Time 20-Dec-2022 14:52



F.3.1.2. 0.2 m/s

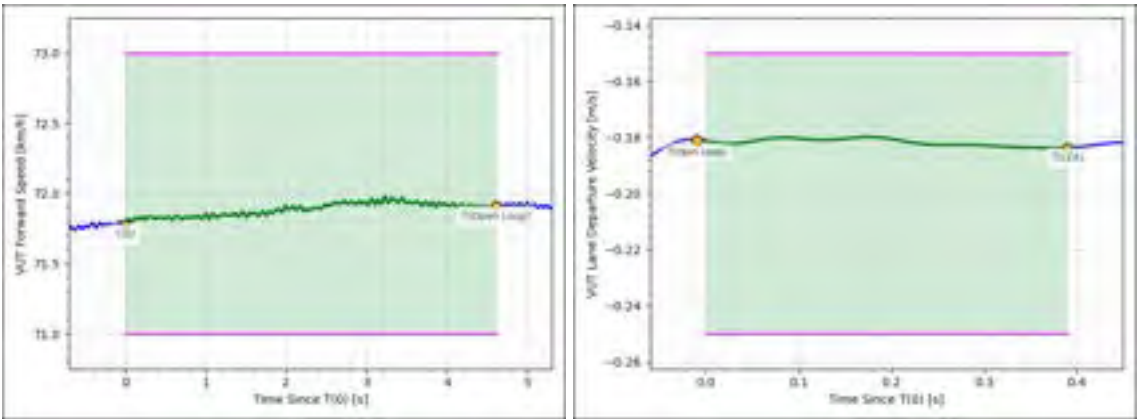
LKA SLN-D 0.2 mps Main | 0.2 m/s | Run 13

Run Date / Time 20-Dec-2022 14:32



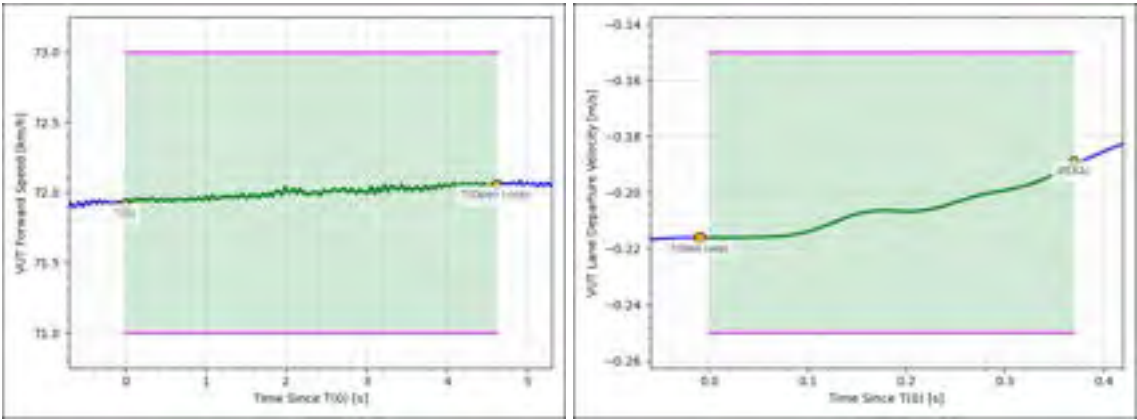
LKA SLN-D 0.2 mps Main | 0.2 m/s | Run 14

Run Date / Time 20-Dec-2022 14:36



LKA SLN-D 0.2 mps Main | 0.2 m/s | Run 15

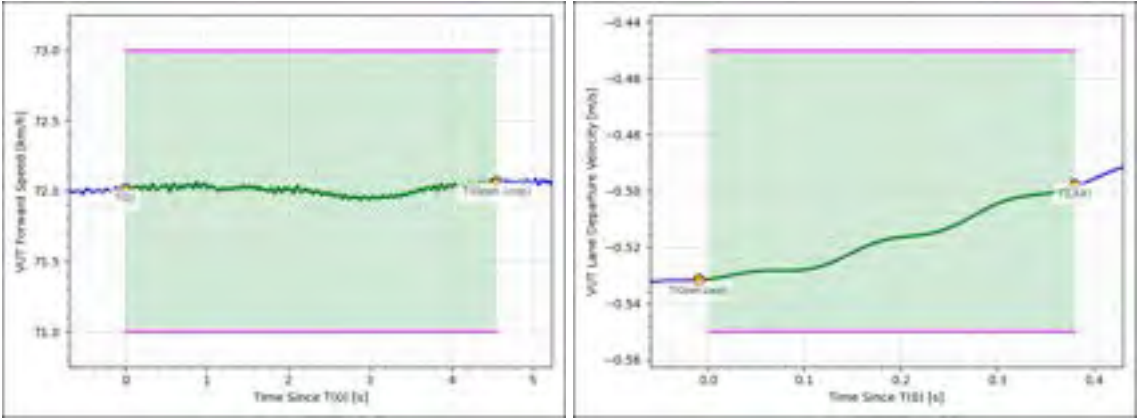
Run Date / Time 20-Dec-2022 14:38



F.3.1.3. 0.5 m/s

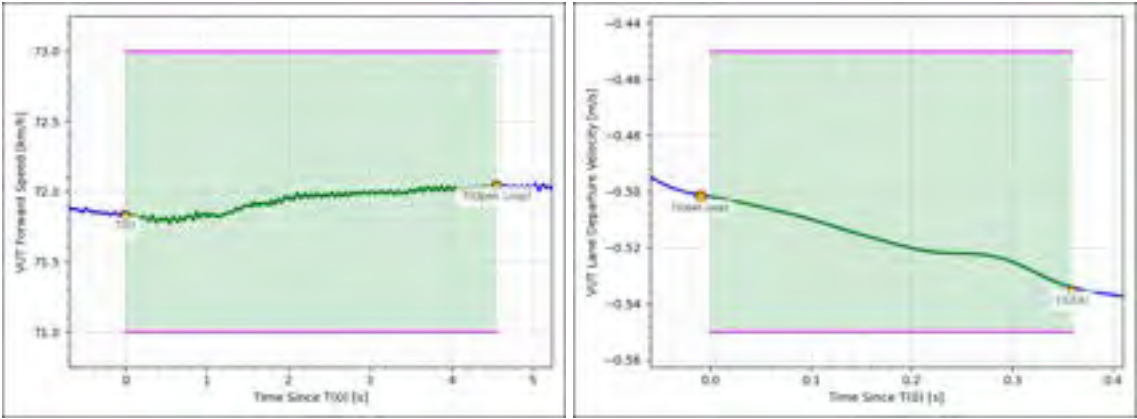
LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 23

Run Date / Time 20-Dec-2022 14:40



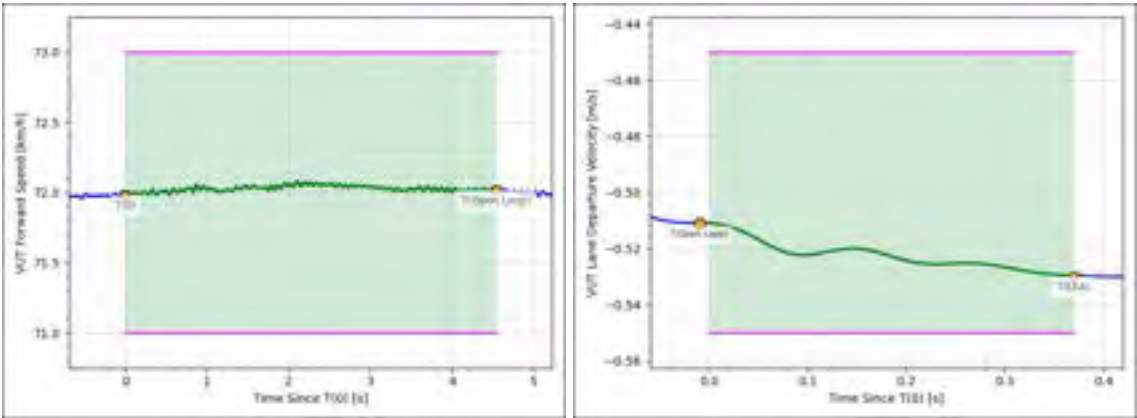
LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 24

Run Date / Time 20-Dec-2022 14:42



LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 25

Run Date / Time 20-Dec-2022 14:45

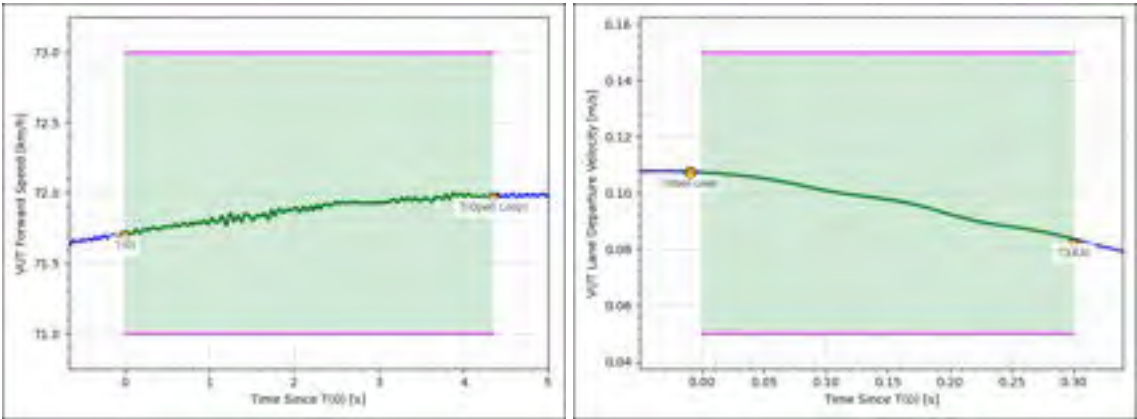


F.3.2. SLN-P

F.3.2.1. 0.1 m/s

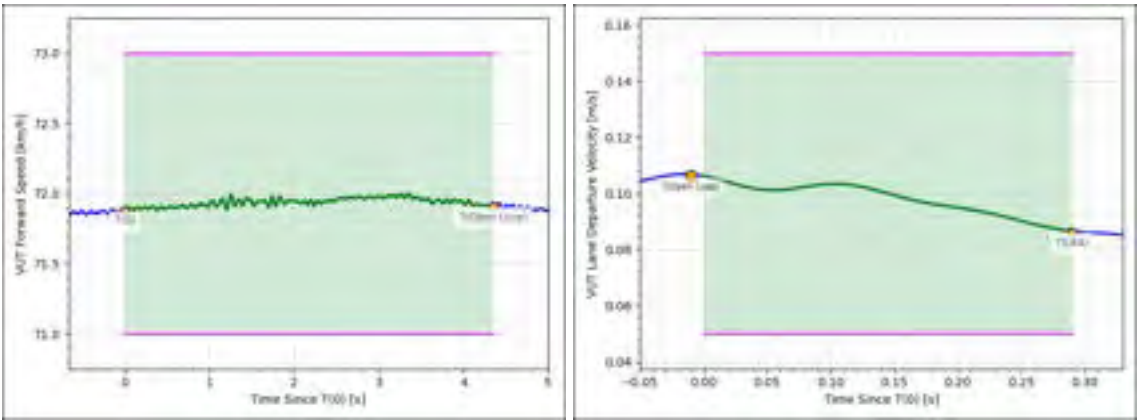
LKA SLN-P 0.1 mps Main | 0.1 m/s | Run 10

Run Date / Time 20-Dec-2022 13:41



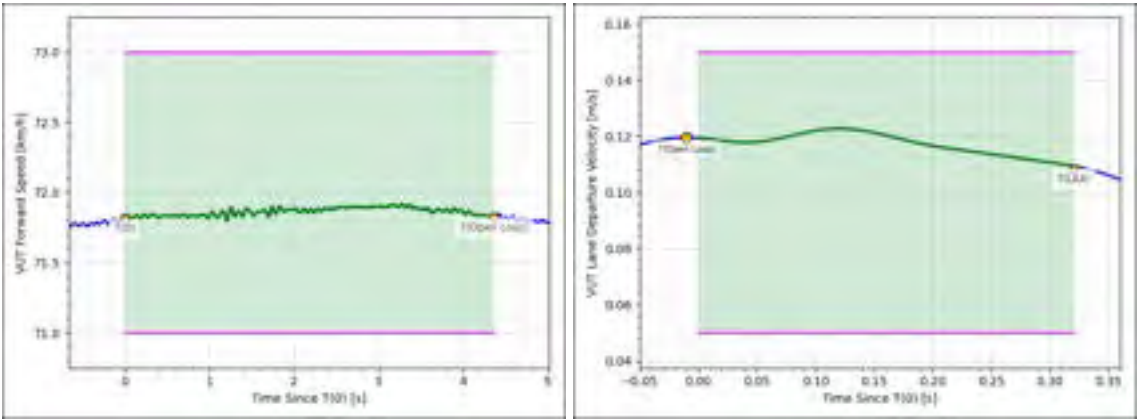
LKA SLN-P 0.1 mps Main | 0.1 m/s | Run 12

Run Date / Time 20-Dec-2022 13:47



LKA SLN-P 0.1 mps Main | 0.1 m/s | Run 13

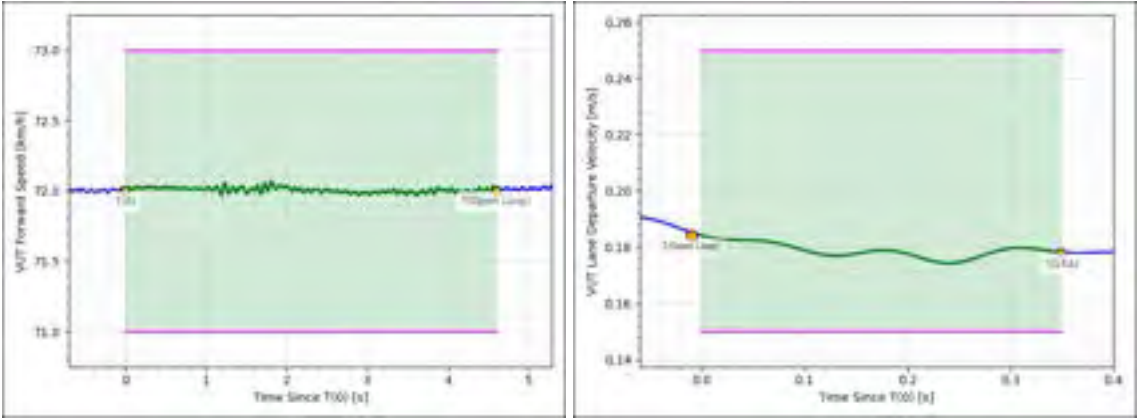
Run Date / Time 20-Dec-2022 13:49



F.3.2.2. 0.2 m/s

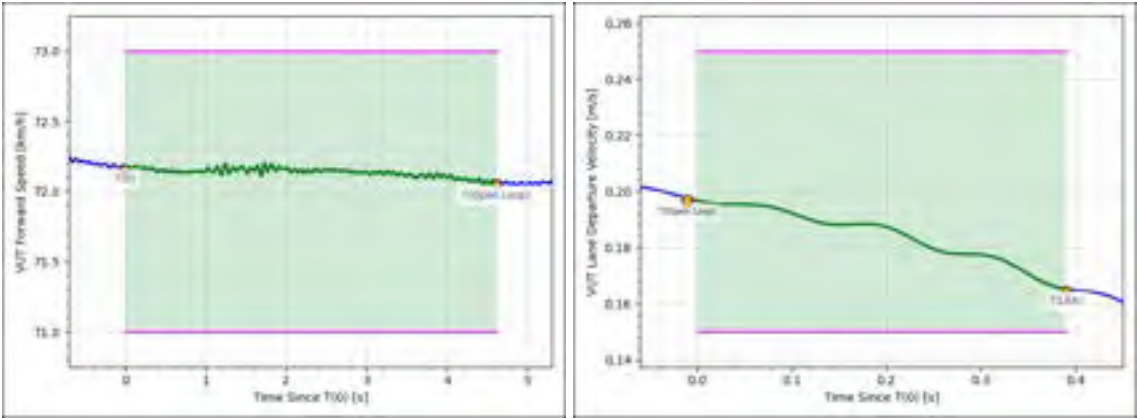
LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 7

Run Date / Time 20-Dec-2022 13:20



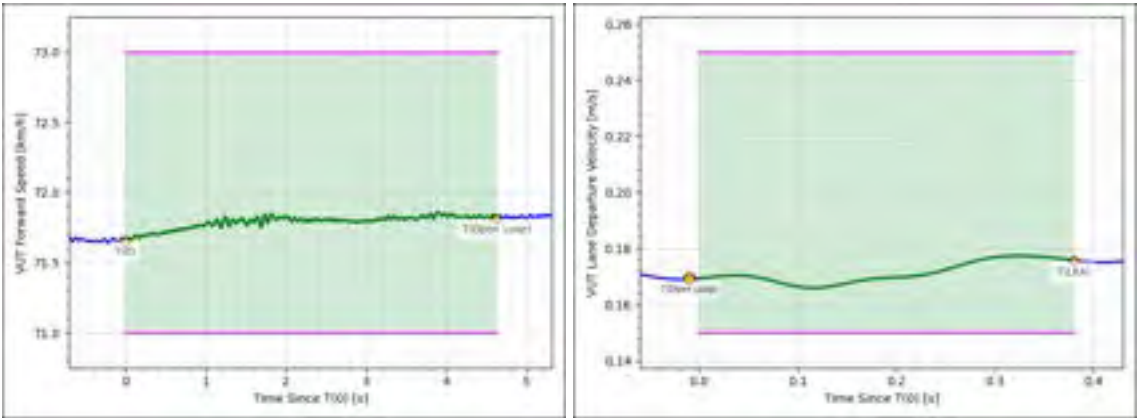
LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 8

Run Date / Time 20-Dec-2022 13:25



LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 10

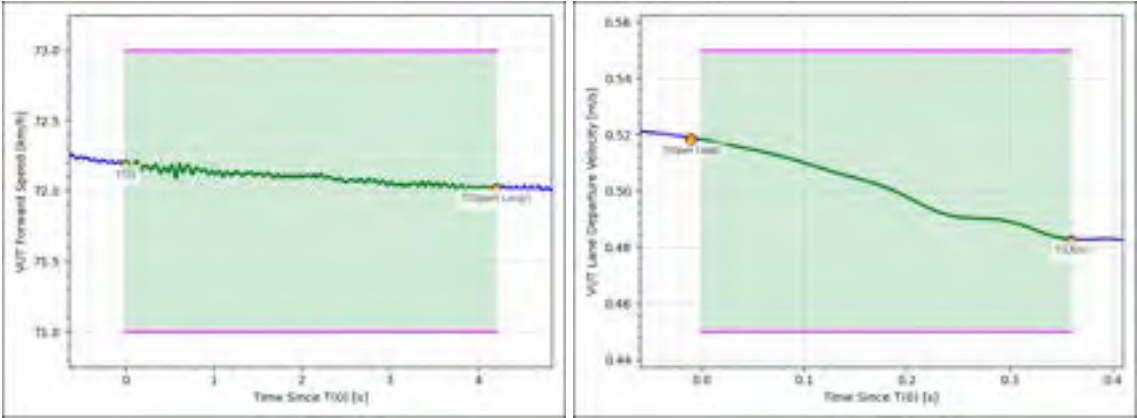
Run Date / Time 20-Dec-2022 13:30



F.3.2.3. 0.5 m/s

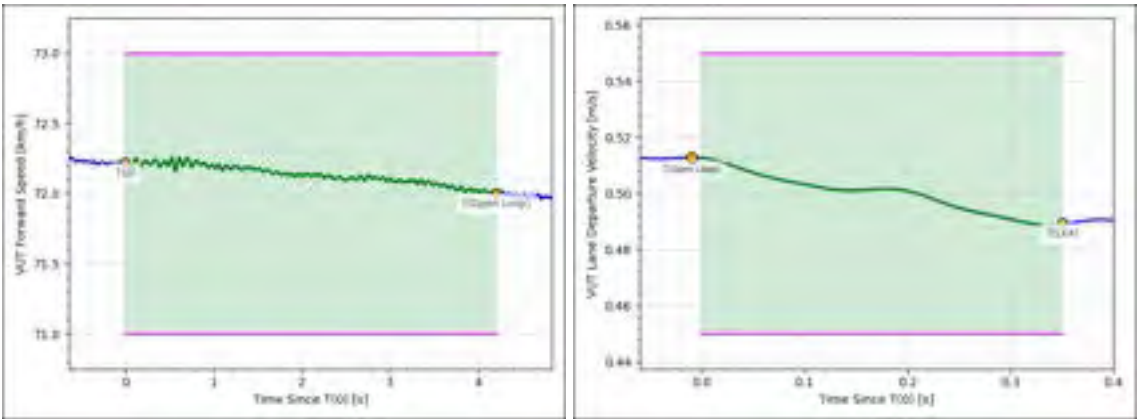
LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 7

Run Date / Time 20-Dec-2022 13:34



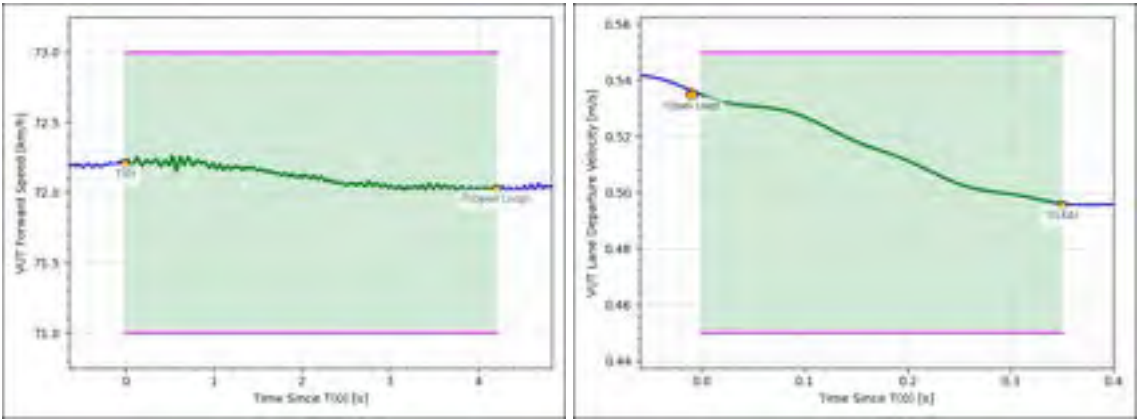
LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 8

Run Date / Time 20-Dec-2022 13:36



LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 9

Run Date / Time 20-Dec-2022 13:38

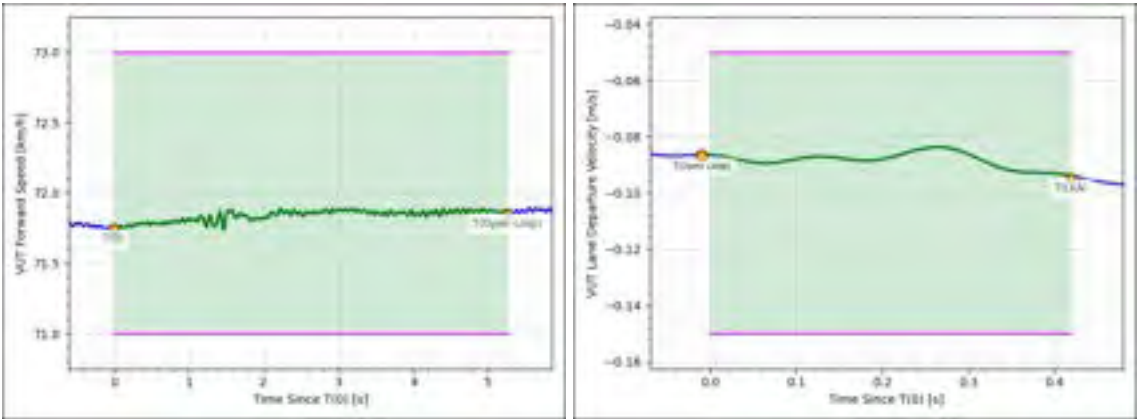


F.3.3. DLN-D

F.3.3.1. 0.1 m/s

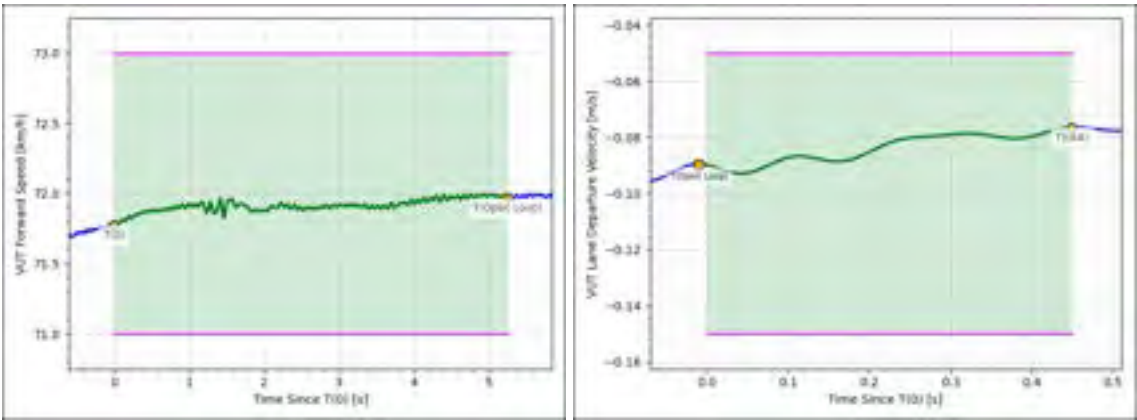
LKA DLN-D 0.1 mps Main | 0.1 m/s | Run 9

Run Date / Time 20-Dec-2022 15:11



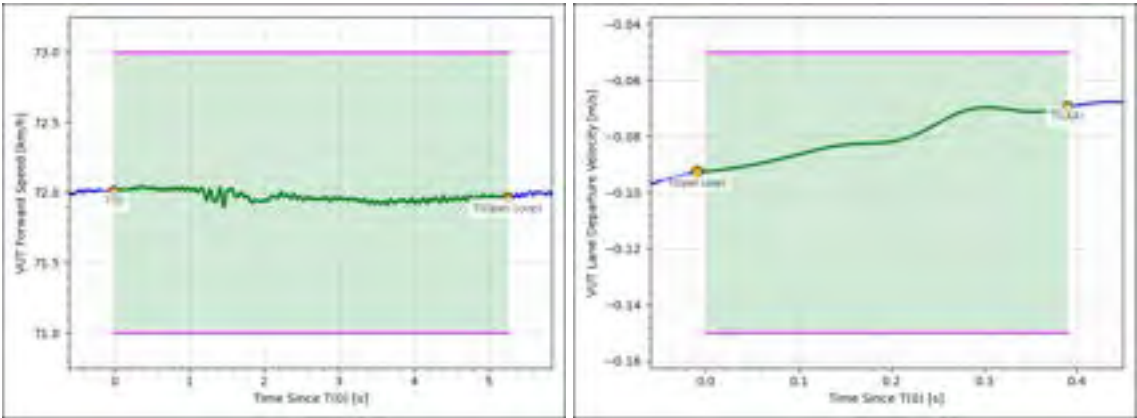
LKA DLN-D 0.1 mps Main | 0.1 m/s | Run 10

Run Date / Time 20-Dec-2022 15:14



LKA DLN-D 0.1 mps Main | 0.1 m/s | Run 11

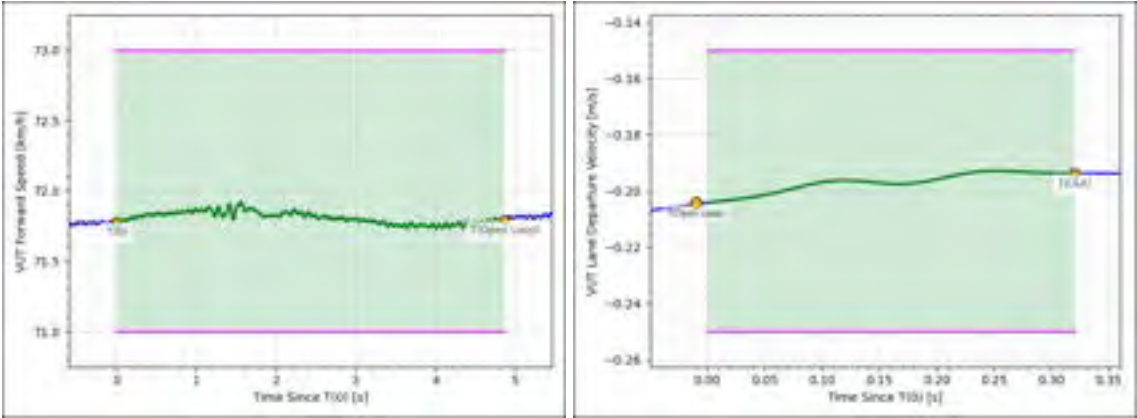
Run Date / Time 20-Dec-2022 15:16



F.3.3.2. 0.2 m/s

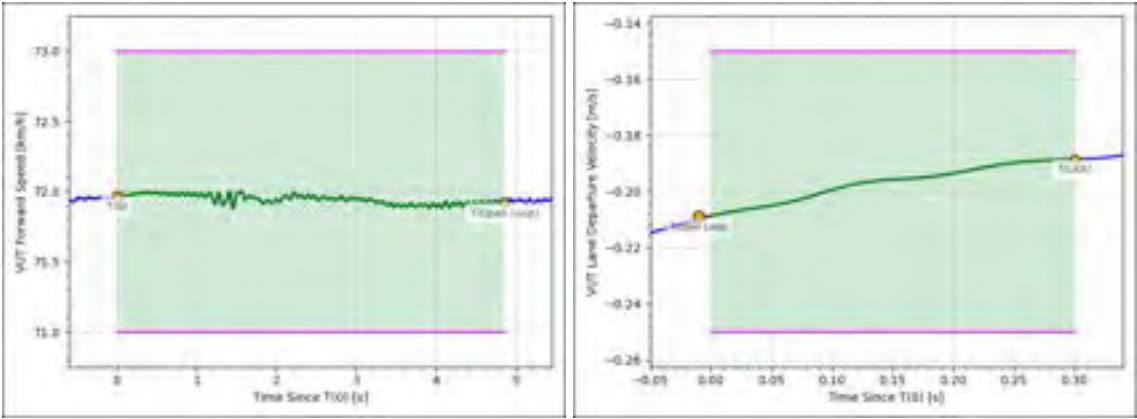
LKA DLN-D 0.2 mps Main | 0.2 m/s | Run 15

Run Date / Time 20-Dec-2022 14:55



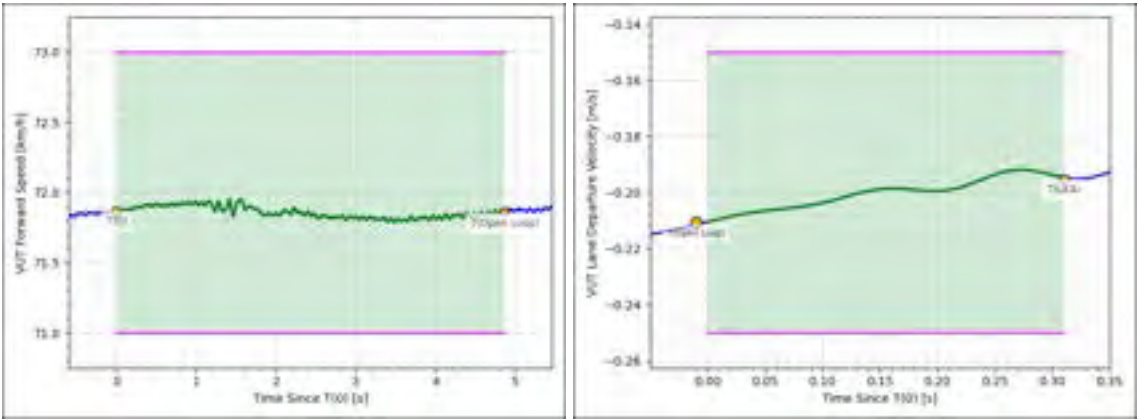
LKA DLN-D 0.2 mps Main | 0.2 m/s | Run 16

Run Date / Time 20-Dec-2022 14:57



LKA DLN-D 0.2 mps Main | 0.2 m/s | Run 17

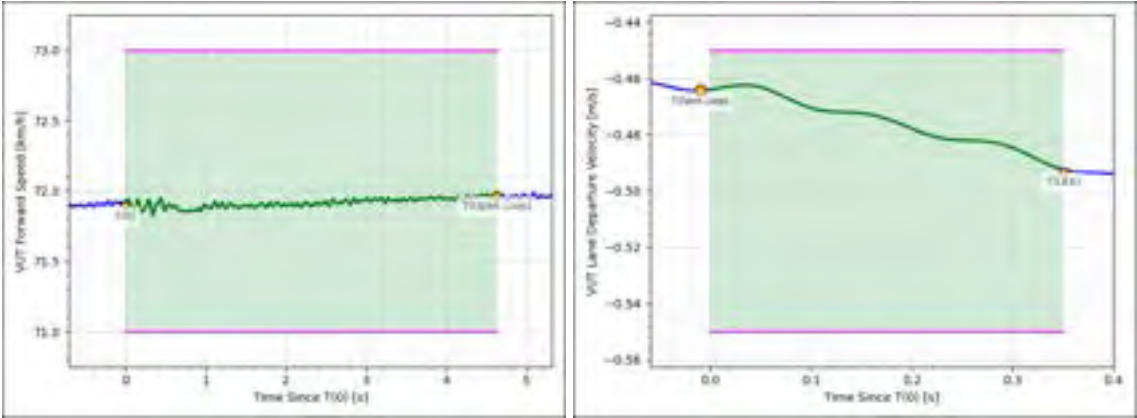
Run Date / Time 20-Dec-2022 14:59



F.3.3.3. 0.5 m/s

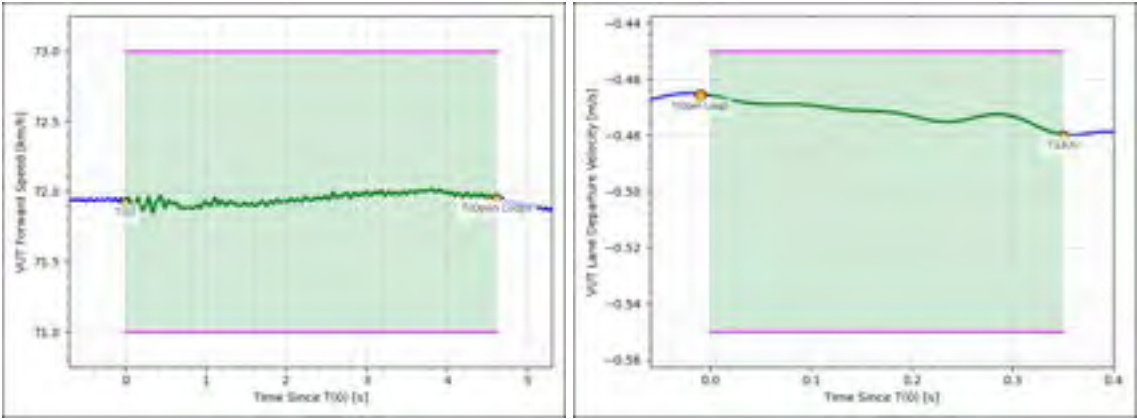
LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 12

Run Date / Time 20-Dec-2022 15:01



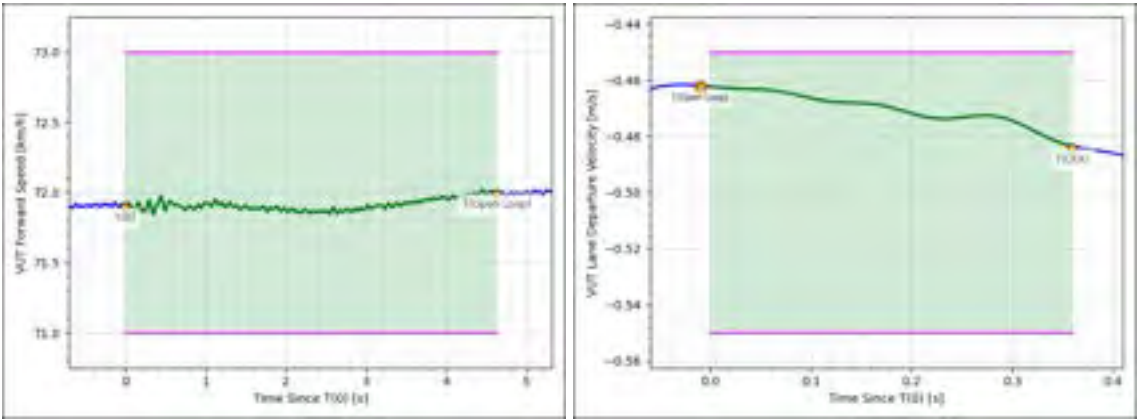
LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 13

Run Date / Time 20-Dec-2022 15:03



LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 14

Run Date / Time 20-Dec-2022 15:05

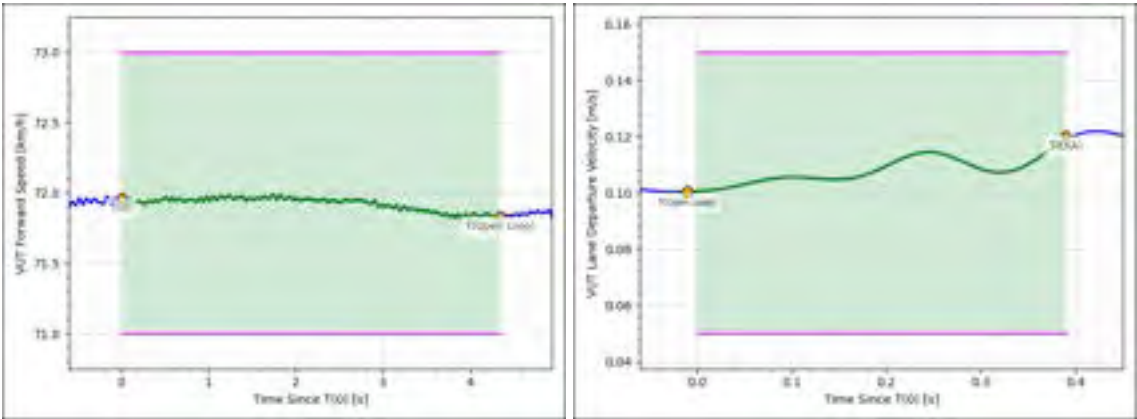


F.3.4. DLN-P

F.3.4.1. 0.1 m/s

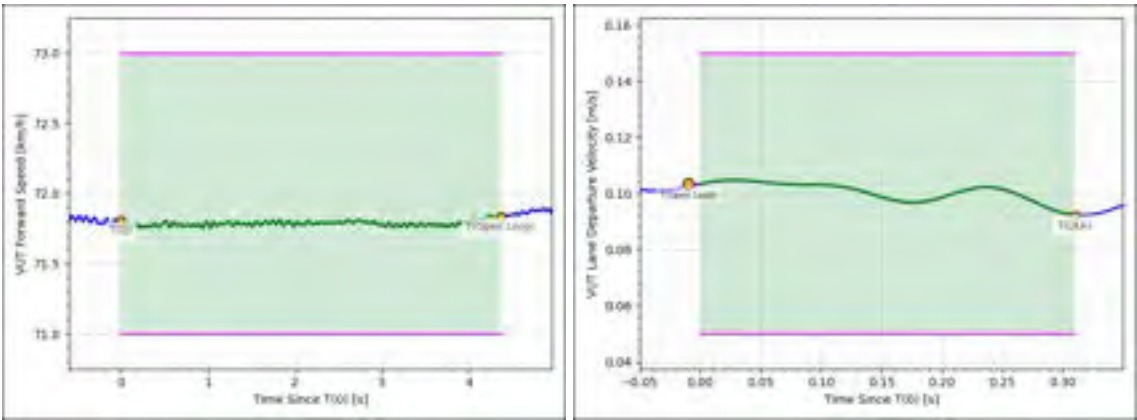
LKA DLN-P 0.1 mps Main | 0.1 m/s | Run 7

Run Date / Time 20-Dec-2022 14:20



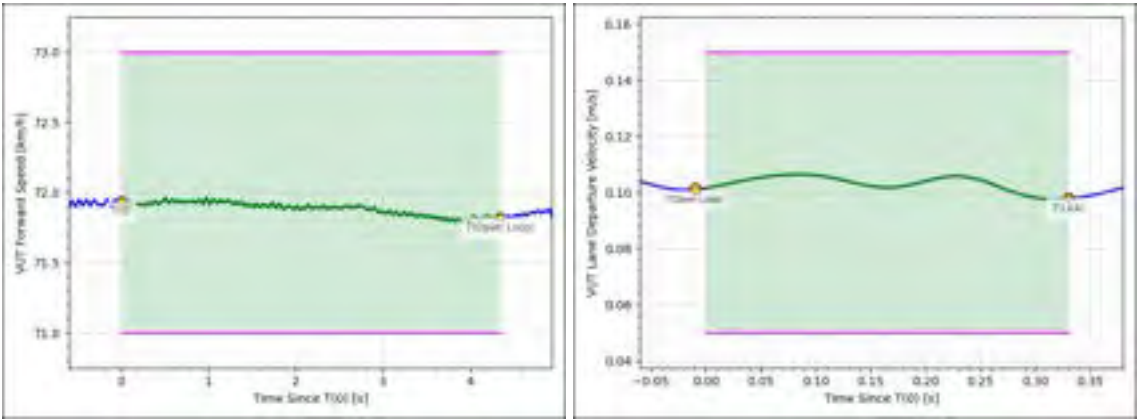
LKA DLN-P 0.1 mps Main | 0.1 m/s | Run 8

Run Date / Time 20-Dec-2022 14:22



LKA DLN-P 0.1 mps Main | 0.1 m/s | Run 9

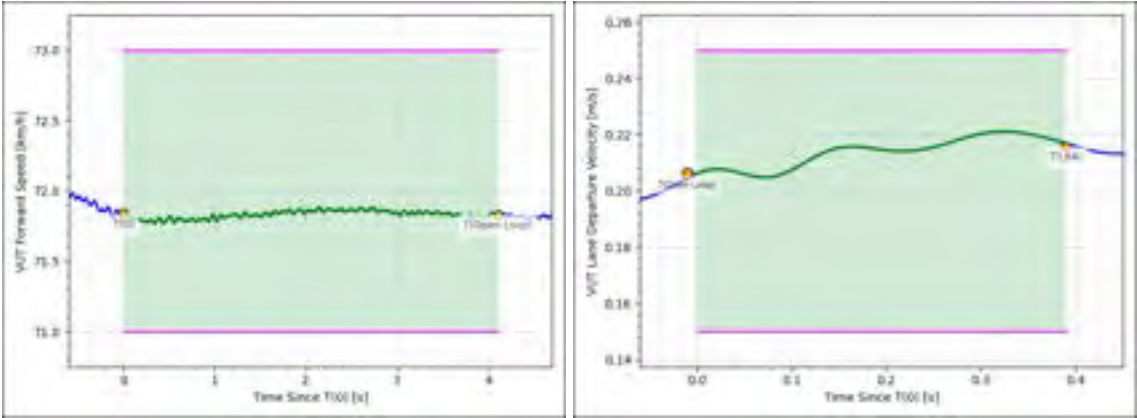
Run Date / Time 20-Dec-2022 14:25



F.3.4.2. 0.2 m/s

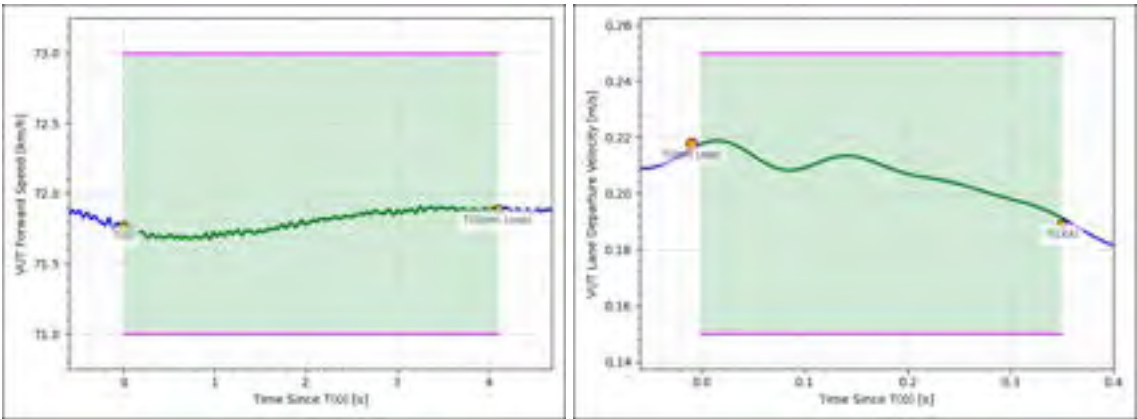
LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 18

Run Date / Time 20-Dec-2022 14:03



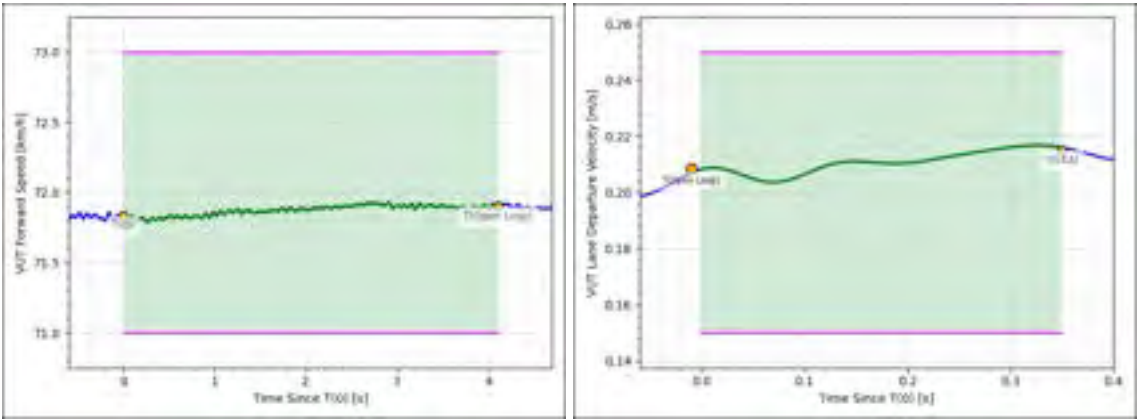
LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 19

Run Date / Time 20-Dec-2022 14:06



LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 20

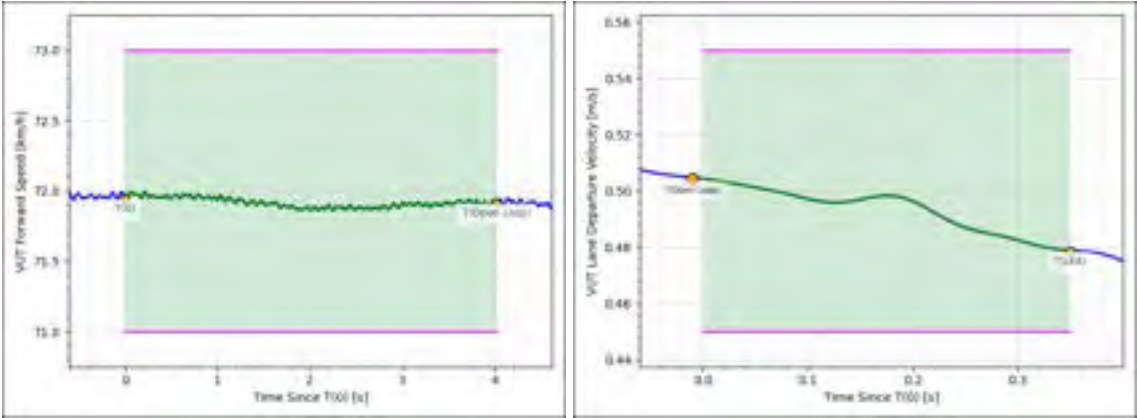
Run Date / Time 20-Dec-2022 14:08



F.3.4.3. 0.5 m/s

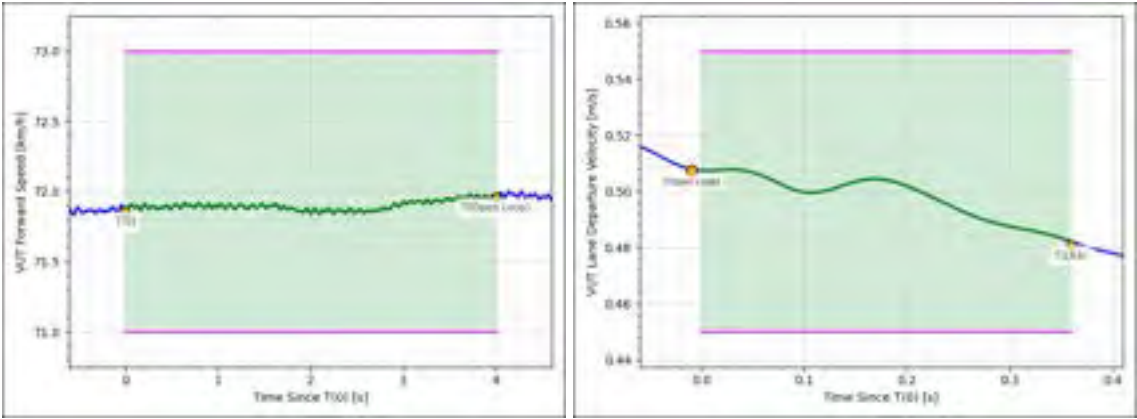
LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 14

Run Date / Time 20-Dec-2022 14:13



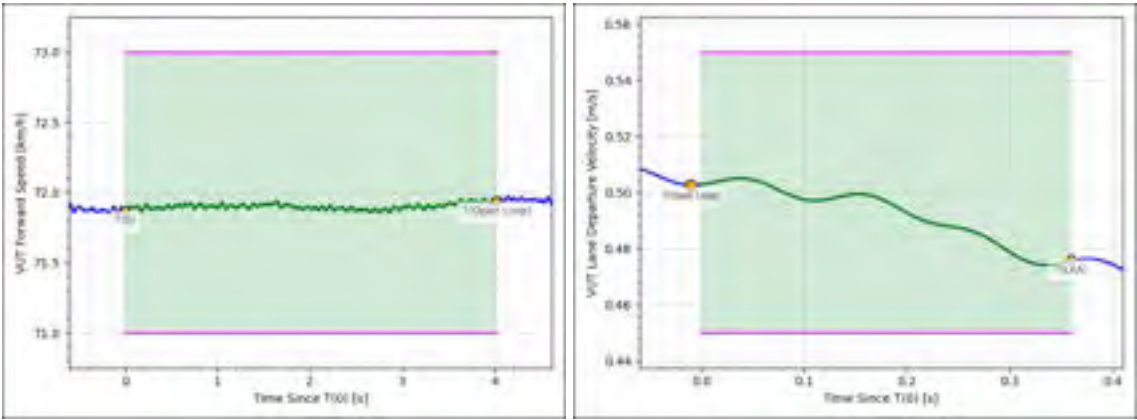
LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 15

Run Date / Time 20-Dec-2022 14:15



LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 16

Run Date / Time 20-Dec-2022 14:17



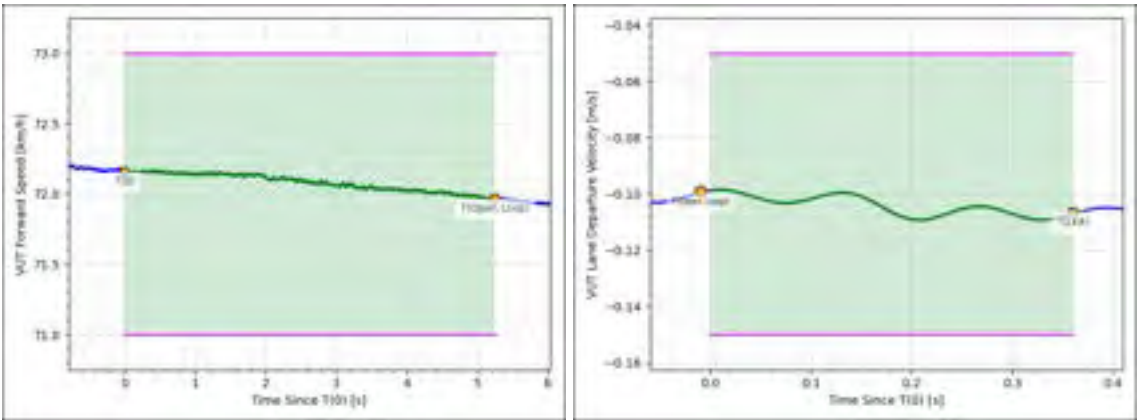
F.4. Lift Kit

F.4.1. SLN-D

F.4.1.1. 0.1 m/s

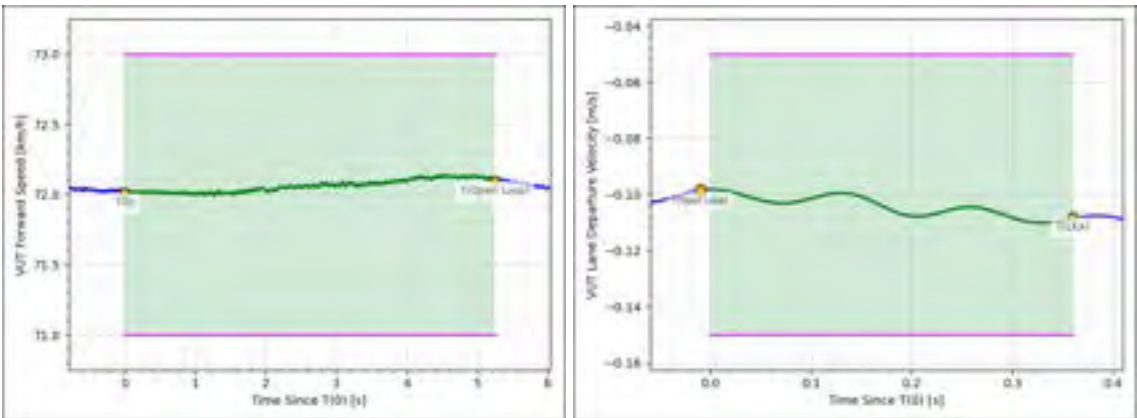
LKA SLN-D 0.1 mps Main | 0.1 m/s | Run 14

Run Date / Time 9-Mar-2023 09:51



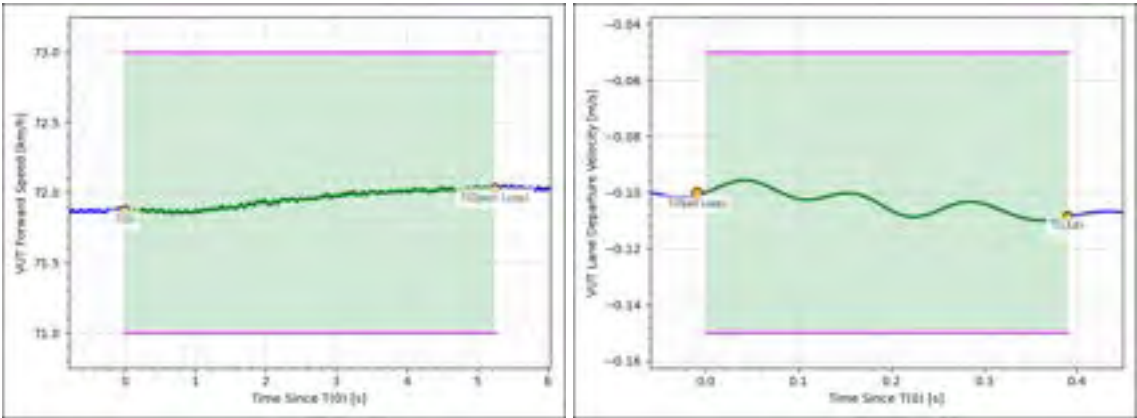
LKA SLN-D 0.1 mps Main | 0.1 m/s | Run 15

Run Date / Time 9-Mar-2023 09:54



LKA SLN-D 0.1 mps Main | 0.1 m/s | Run 16

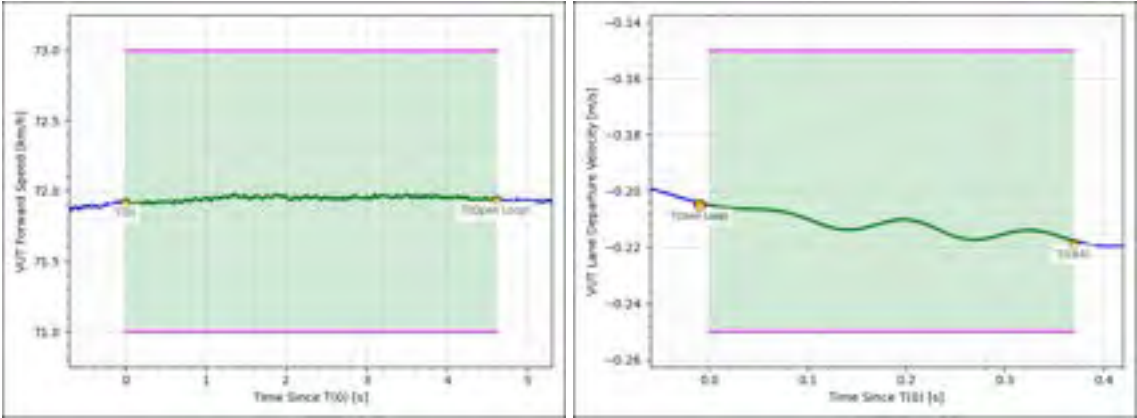
Run Date / Time 9-Mar-2023 09:56



F.4.1.2. 0.2 m/s

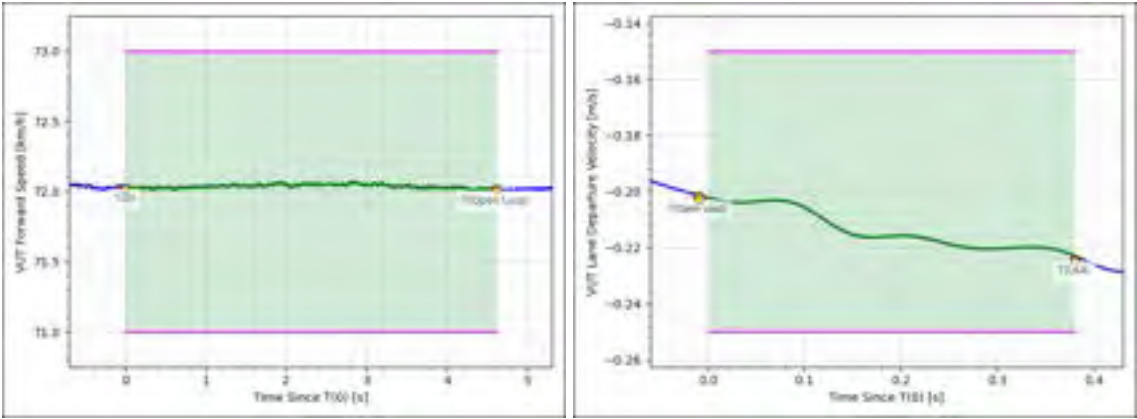
LKA SLN-D 0.2 mps Main | 0.2 m/s | Run 17

Run Date / Time 8-Mar-2023 13:06



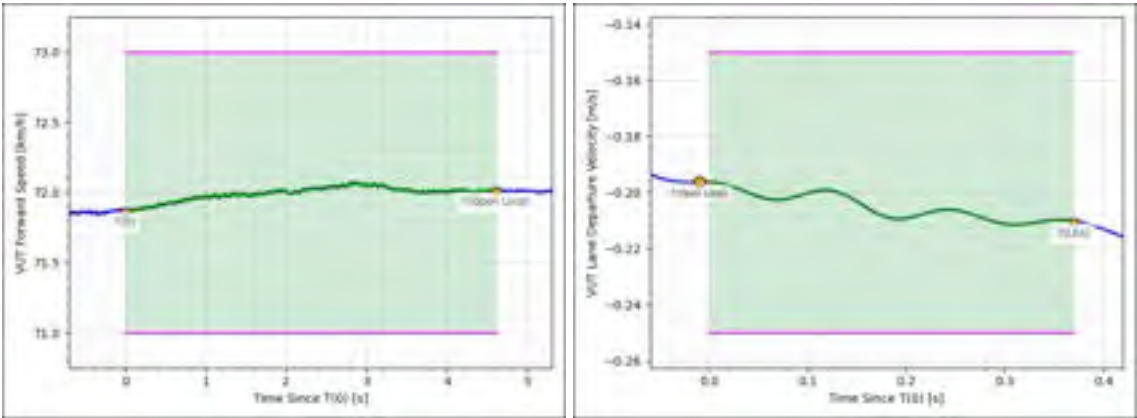
LKA SLN-D 0.2 mps Main | 0.2 m/s | Run 18

Run Date / Time 8-Mar-2023 13:11



LKA SLN-D 0.2 mps Main | 0.2 m/s | Run 19

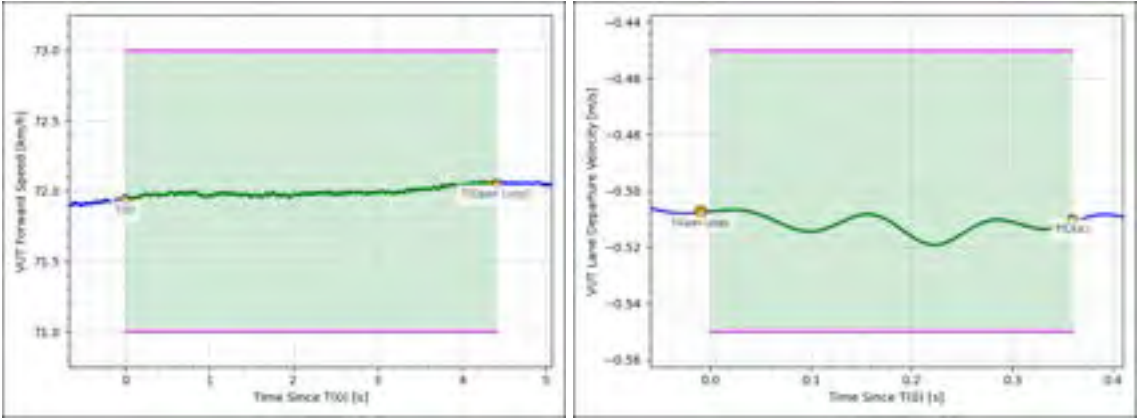
Run Date / Time 8-Mar-2023 13:14



F.4.1.4. 0.5 m/s

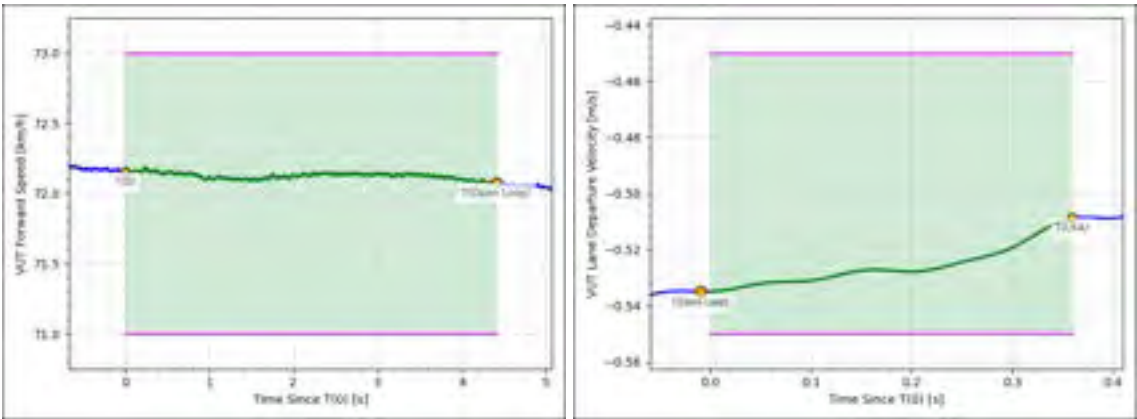
LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 31

Run Date / Time 8-Mar-2023 13:33



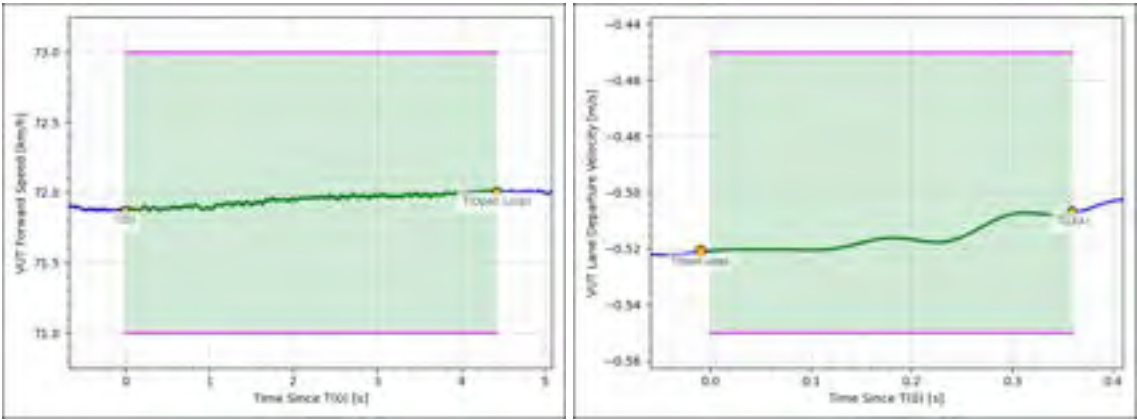
LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 32

Run Date / Time 8-Mar-2023 13:39



LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 33

Run Date / Time 8-Mar-2023 13:41

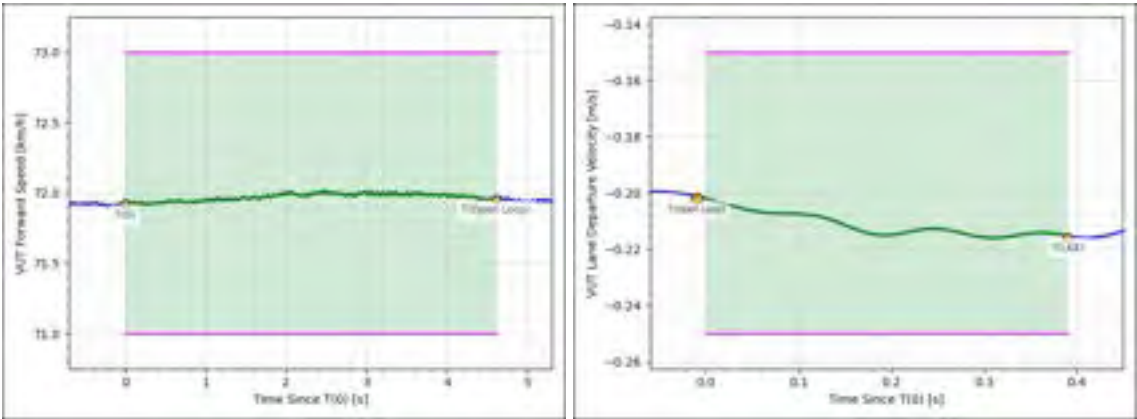


F.4.2. SLN-P

F.4.2.1. 0.2 m/s

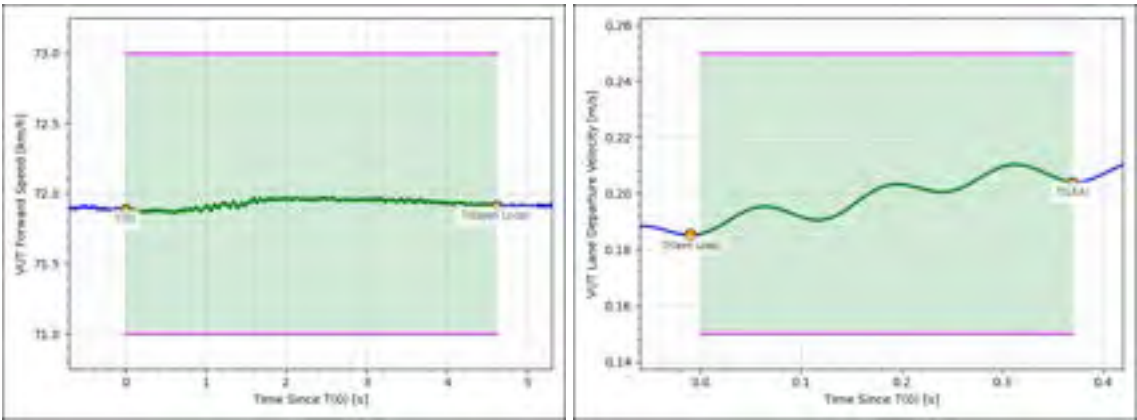
LKA SLN-D 0.2 mps Main | 0.2 m/s | Run 11

Run Date / Time 14-Dec-2022 23:02



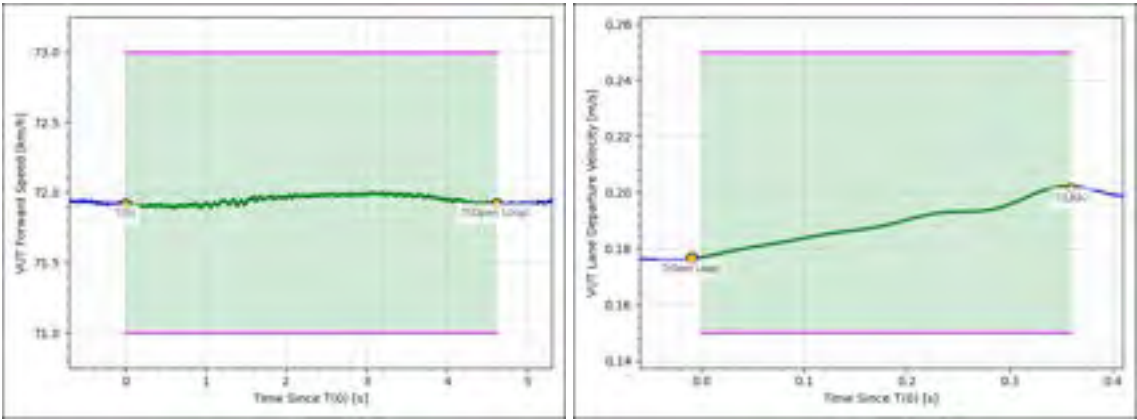
LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 13

Run Date / Time 8-Mar-2023 13:56



LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 14

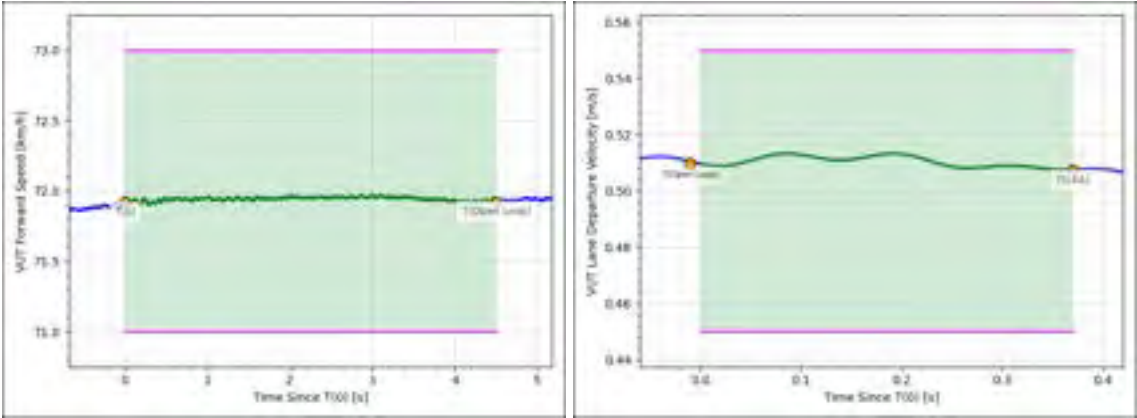
Run Date / Time 8-Mar-2023 13:58



F.4.2.2. 0.5 m/s

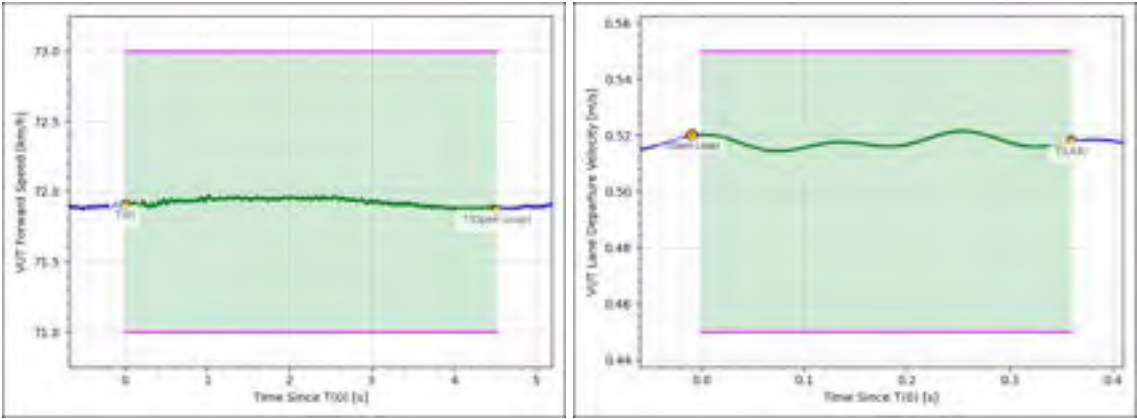
LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 12

Run Date / Time 8-Mar-2023 14:13



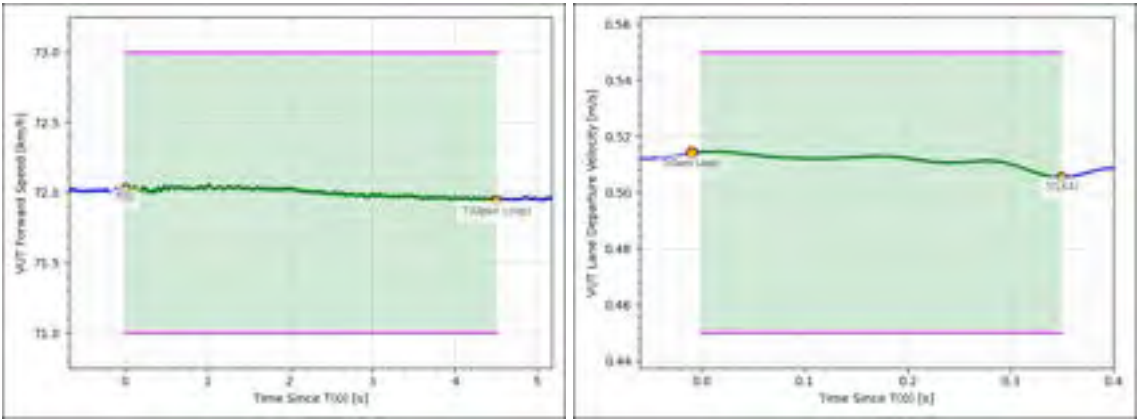
LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 13

Run Date / Time 8-Mar-2023 14:16



LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 14

Run Date / Time 8-Mar-2023 14:18

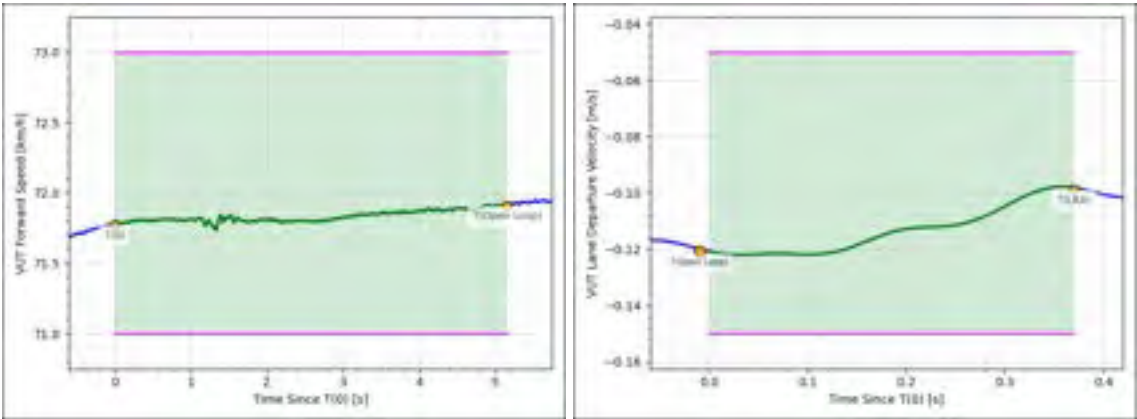


F.4.3. DLN-D

F.4.3.1. 0.1 m/s

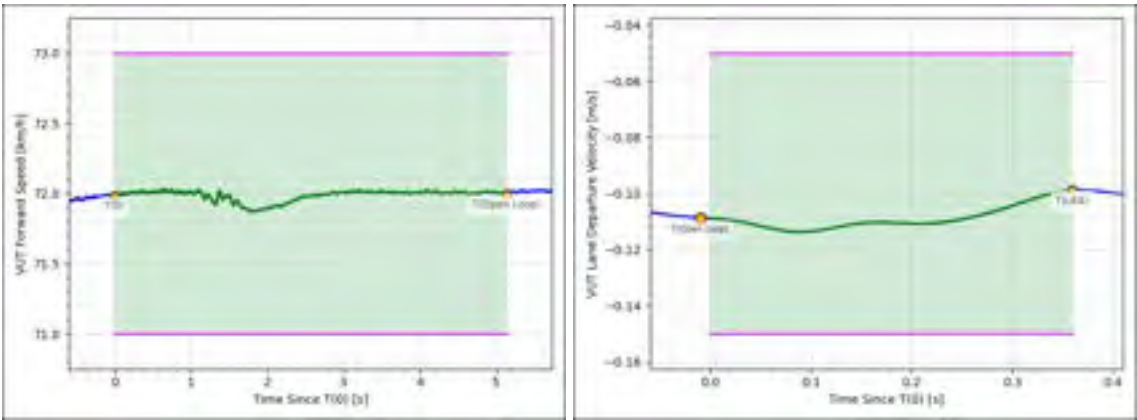
LKA DLN-D 0.1 mps Main | 0.1 m/s | Run 13

Run Date / Time 9-Mar-2023 09:22



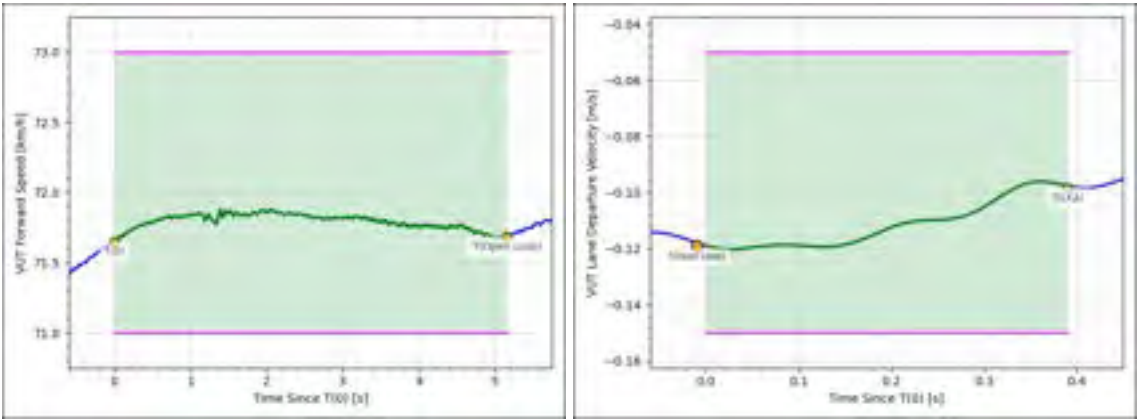
LKA DLN-D 0.1 mps Main | 0.1 m/s | Run 14

Run Date / Time 9-Mar-2023 09:32



LKA DLN-D 0.1 mps Main | 0.1 m/s | Run 15

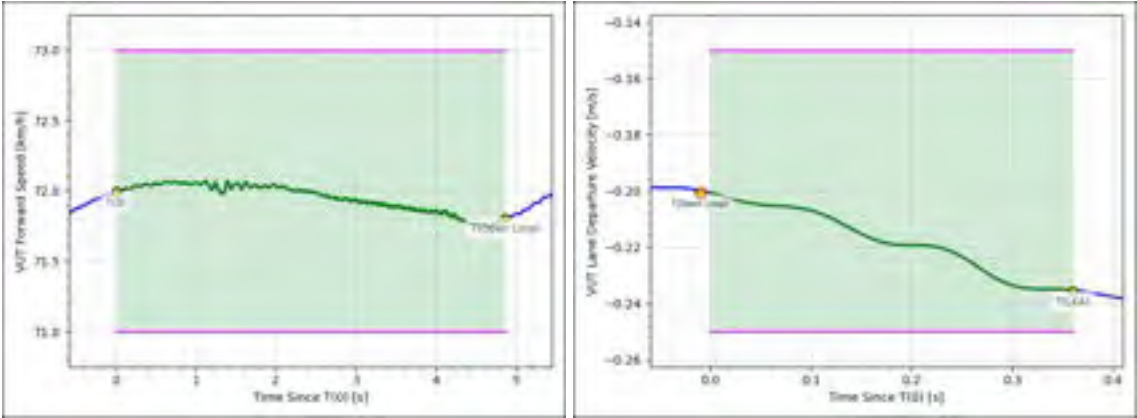
Run Date / Time 9-Mar-2023 09:47



F.4.3.2. 0.2 m/s

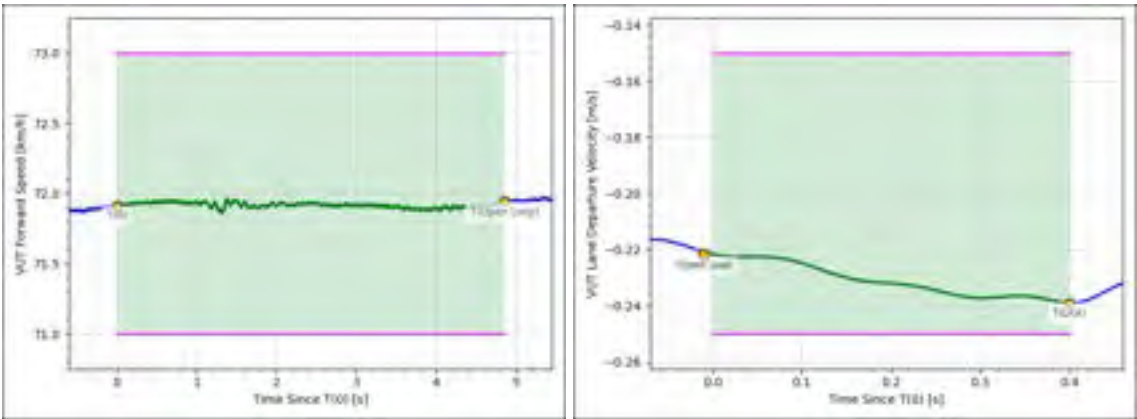
LKA DLN-D 0.2 mps Main | 0.2 m/s | Run 18

Run Date / Time 8-Mar-2023 14:26



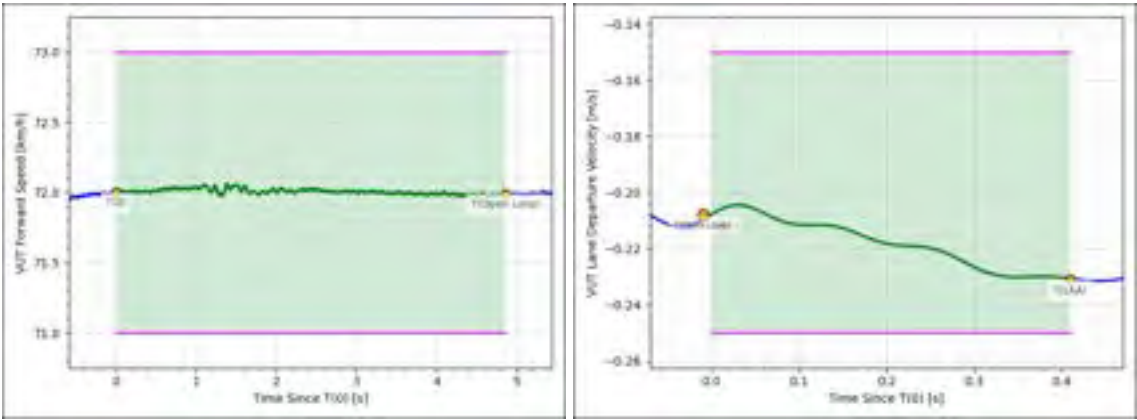
LKA DLN-D 0.2 mps Main | 0.2 m/s | Run 19

Run Date / Time 8-Mar-2023 14:30



LKA DLN-D 0.2 mps Main | 0.2 m/s | Run 20

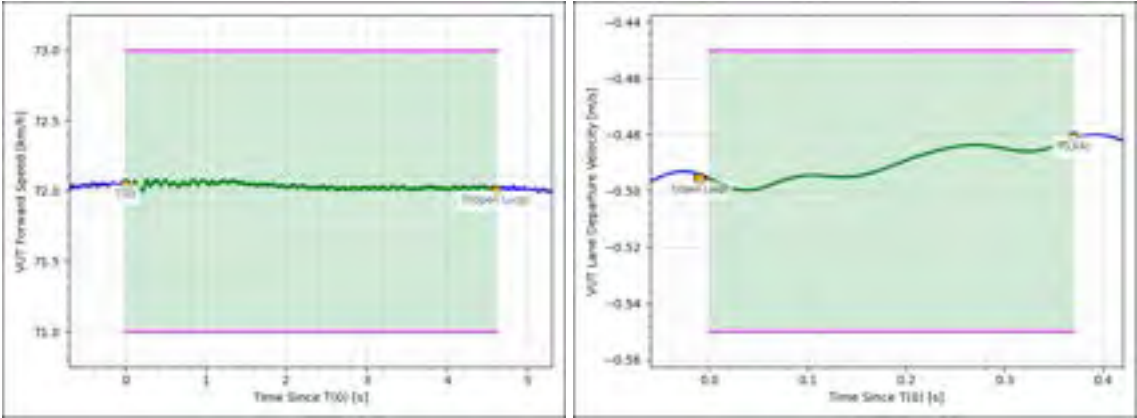
Run Date / Time 8-Mar-2023 14:34



F.4.3.3. 0.5 m/s

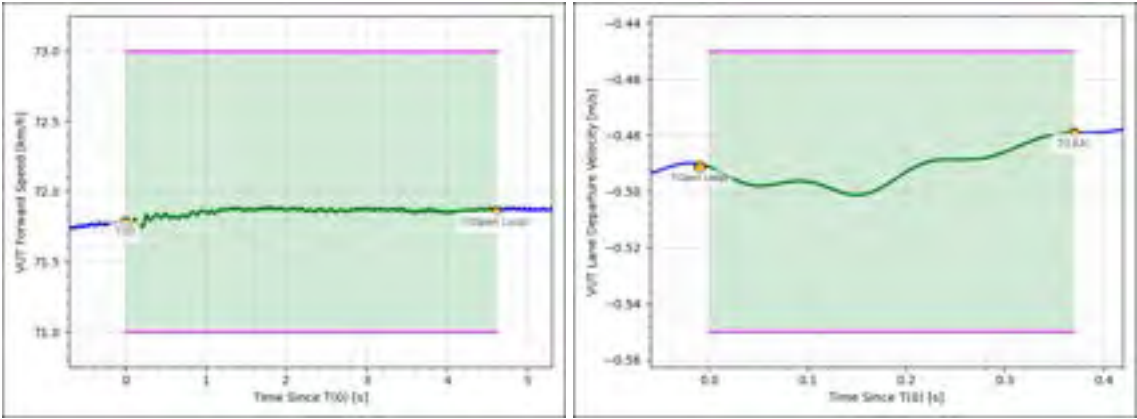
LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 16

Run Date / Time 8-Mar-2023 14:48



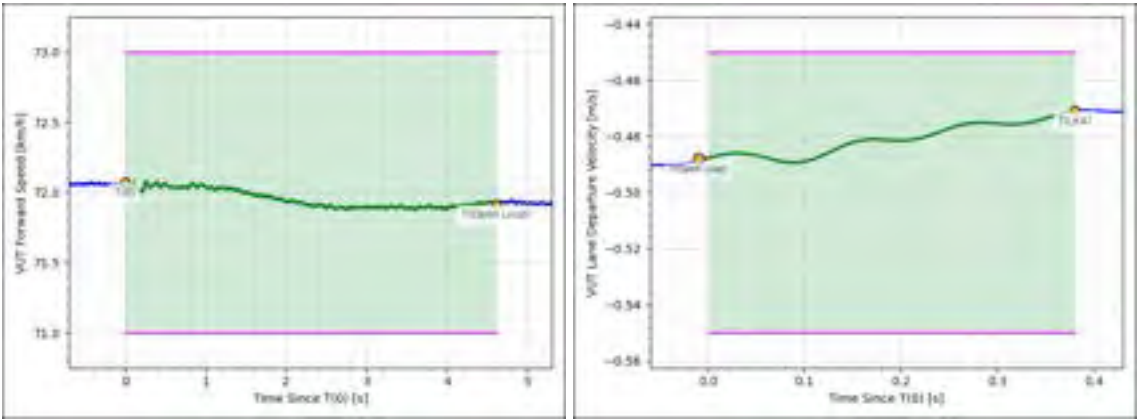
LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 17

Run Date / Time 8-Mar-2023 15:02



LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 18

Run Date / Time 8-Mar-2023 15:05

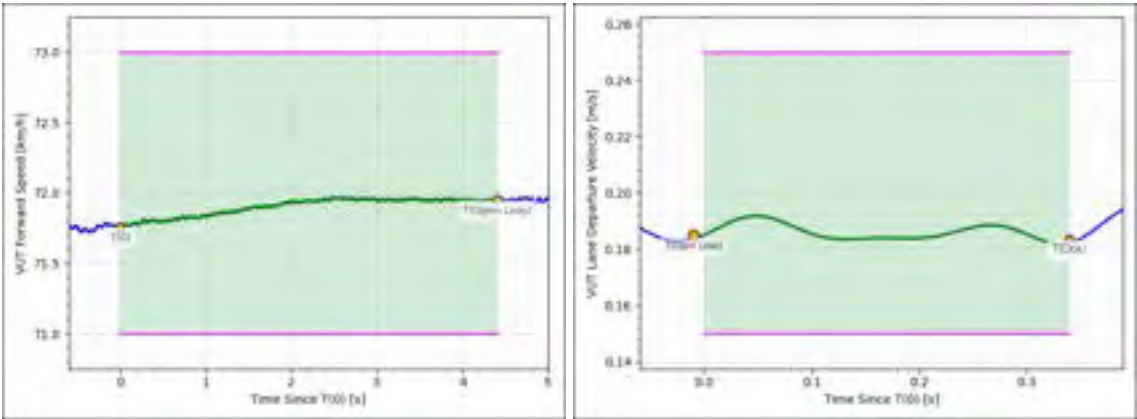


F.4.4. DLN-P

F.4.4.1. 0.2 m/s

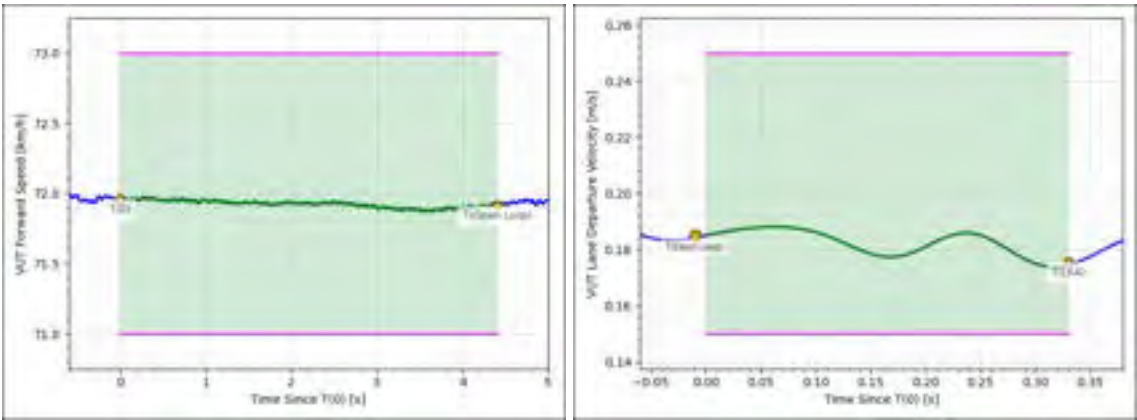
LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 28

Run Date / Time 8-Mar-2023 15:36



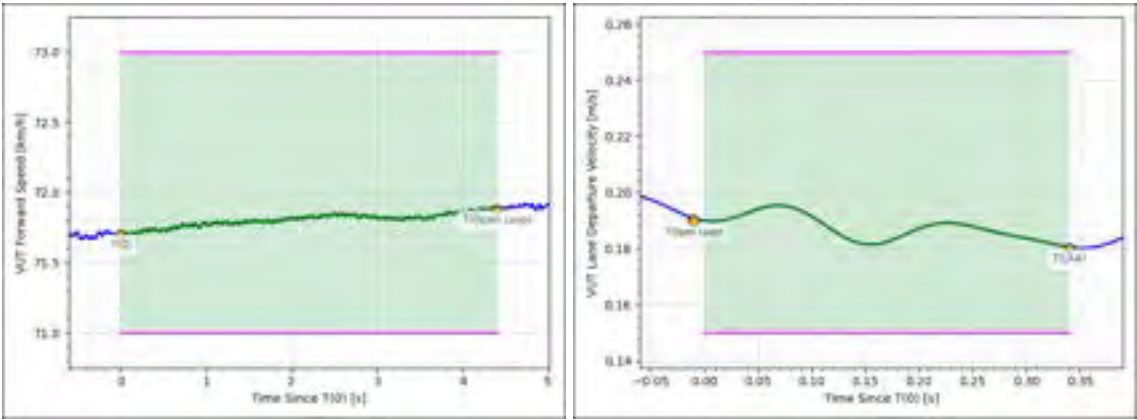
LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 29

Run Date / Time 8-Mar-2023 15:39



LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 30

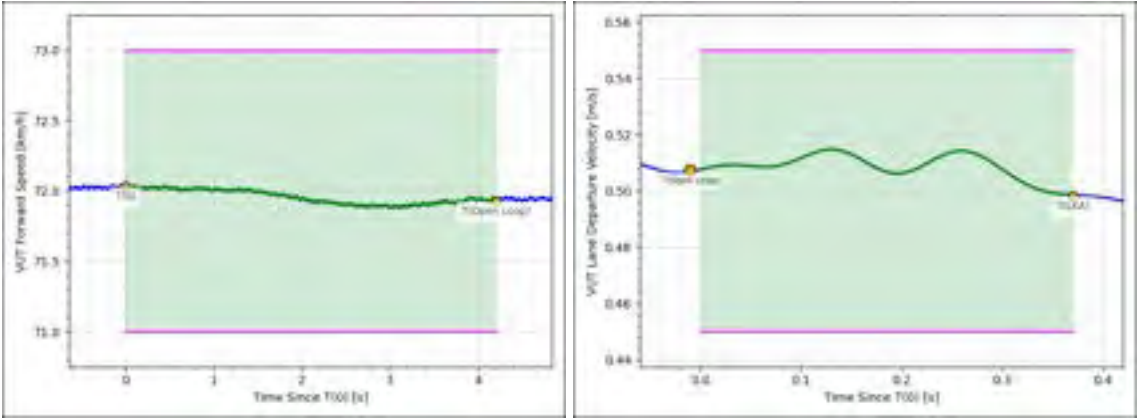
Run Date / Time 8-Mar-2023 15:43



F.4.4.2. 0.5 m/s

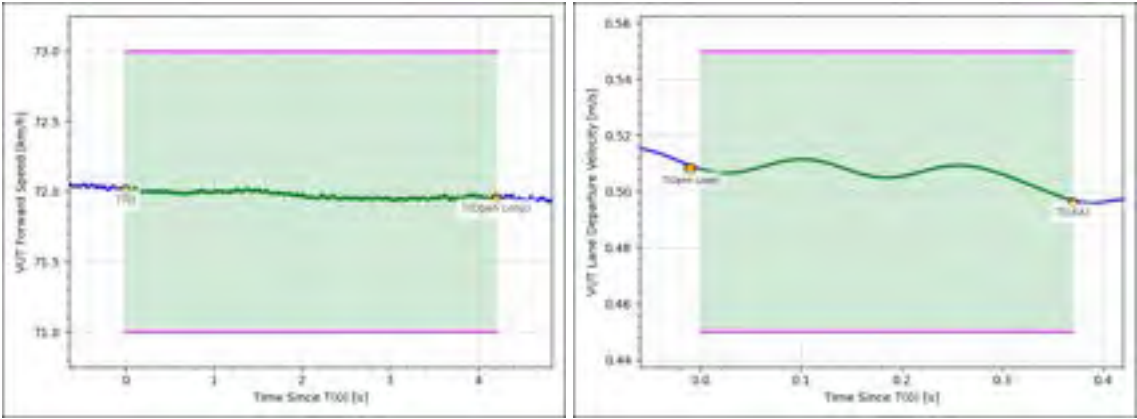
LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 17

Run Date / Time 8-Mar-2023 15:45



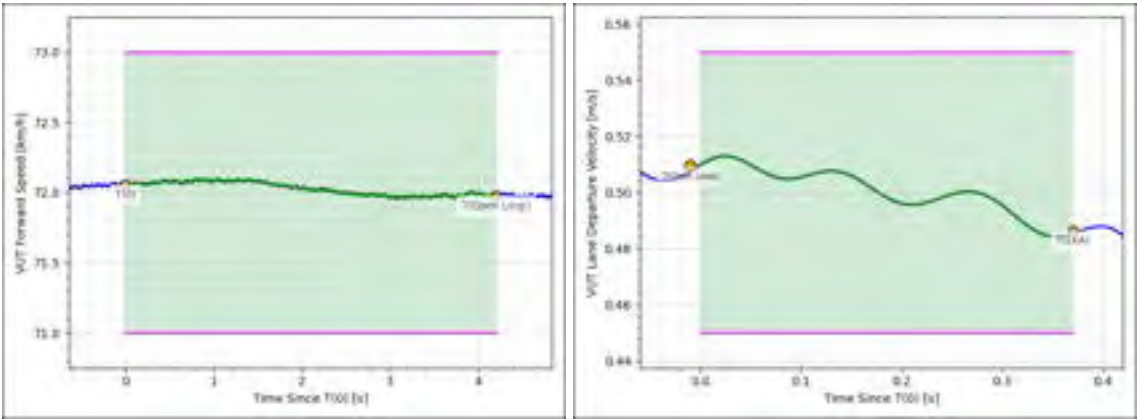
LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 18

Run Date / Time 8-Mar-2023 15:48



LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 19

Run Date / Time 8-Mar-2023 15:50



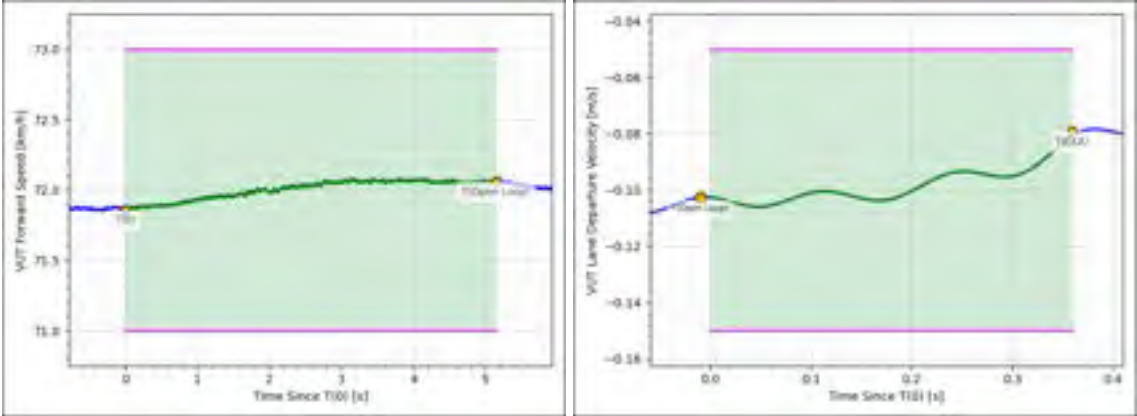
F.5. Lift Kit + Bullbar

F.5.1. SLN-D

F.5.1.1. 0.1 m/s

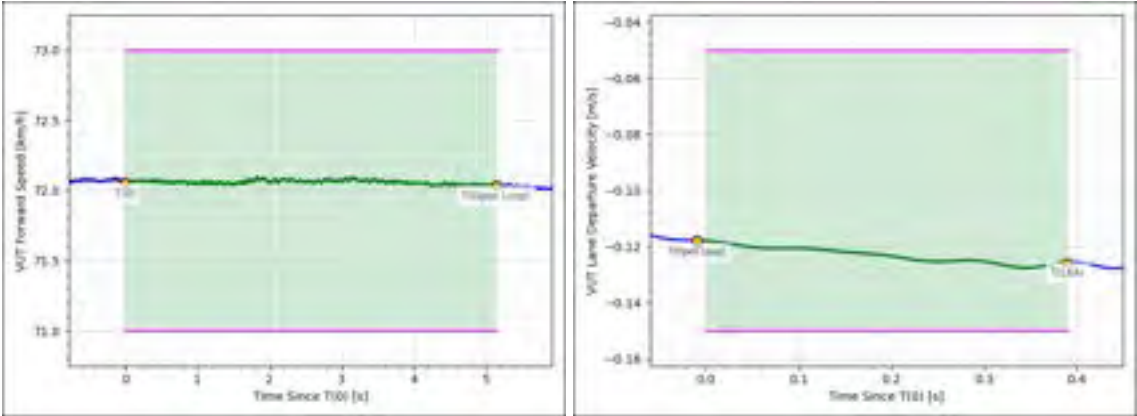
LKA SLN-D 0.1 mps Main | 0.1 m/s | Run 3

Run Date / Time 21-Mar-2023 12:07



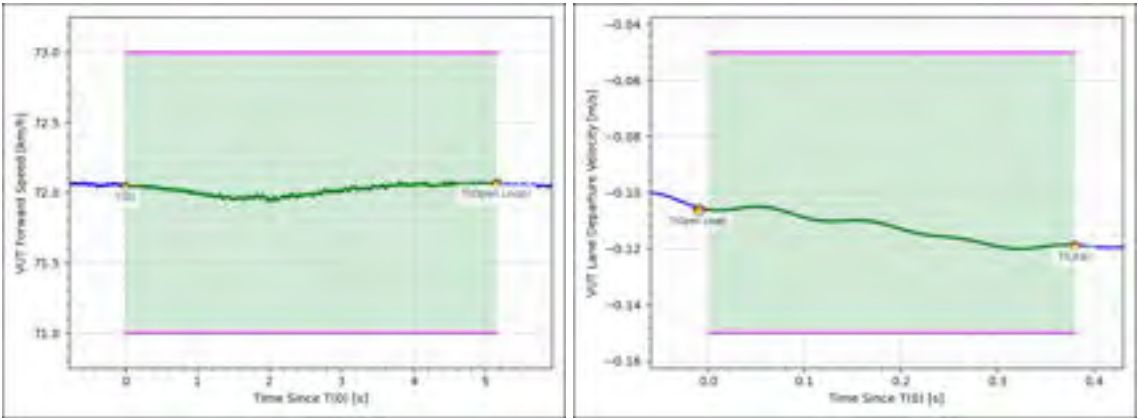
LKA SLN-D 0.1 mps Main | 0.1 m/s | Run 4

Run Date / Time 21-Mar-2023 12:10



LKA SLN-D 0.1 mps Main | 0.1 m/s | Run 5

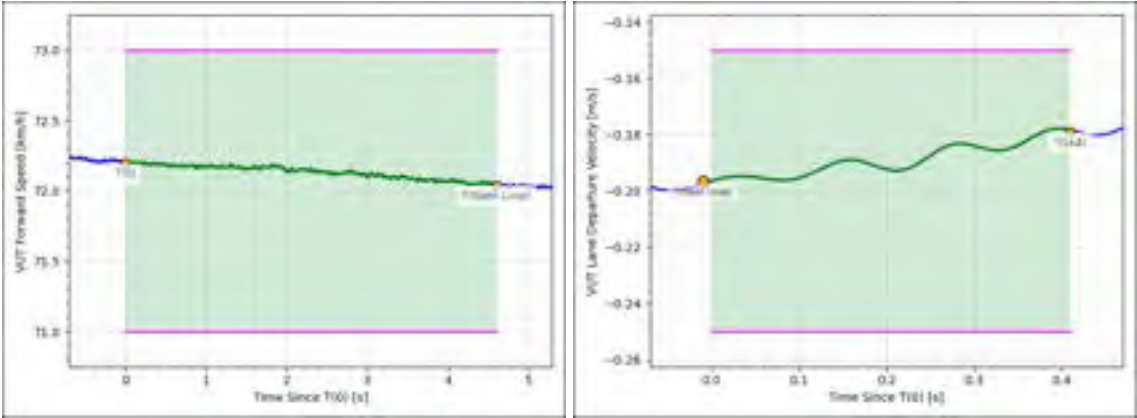
Run Date / Time 21-Mar-2023 12:13



F.5.1.2. 0.2 m/s

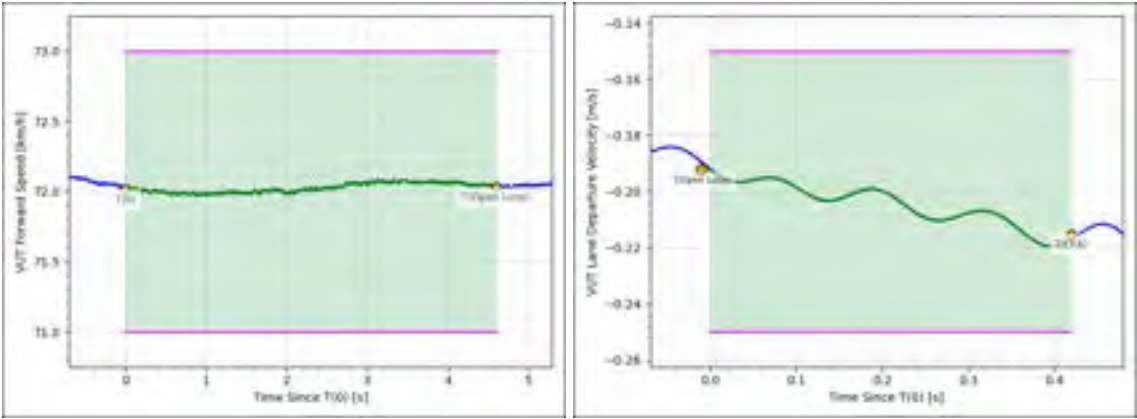
LKA SLN-D 0.2 mps Main | 0.2 m/s | Run 1

Run Date / Time 21-Mar-2023 11:36



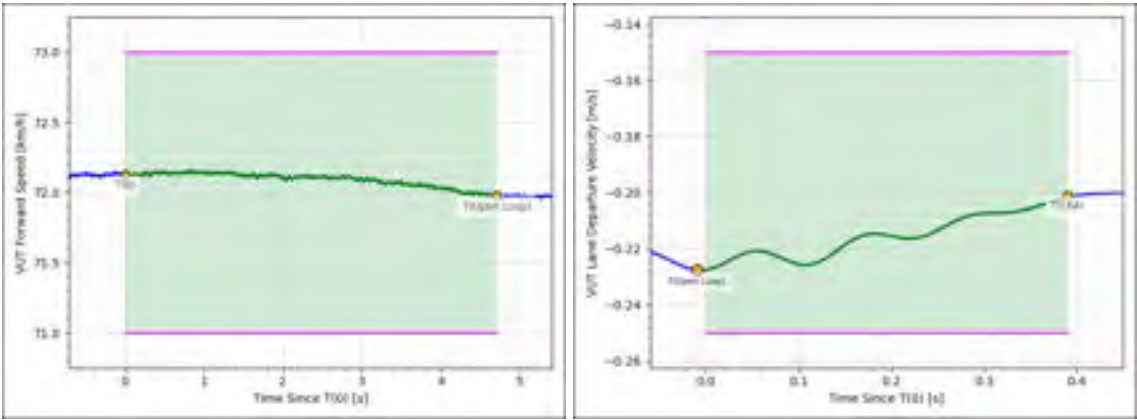
LKA SLN-D 0.2 mps Main | 0.2 m/s | Run 2

Run Date / Time 21-Mar-2023 11:41



LKA SLN-D 0.2 mps Main | 0.2 m/s | Run 4

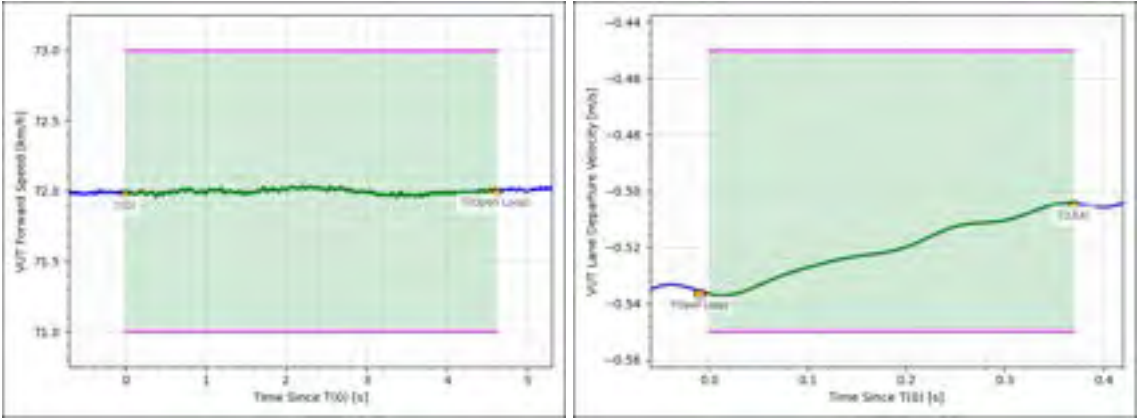
Run Date / Time 21-Mar-2023 11:47



F.5.1.3. 0.5 m/s

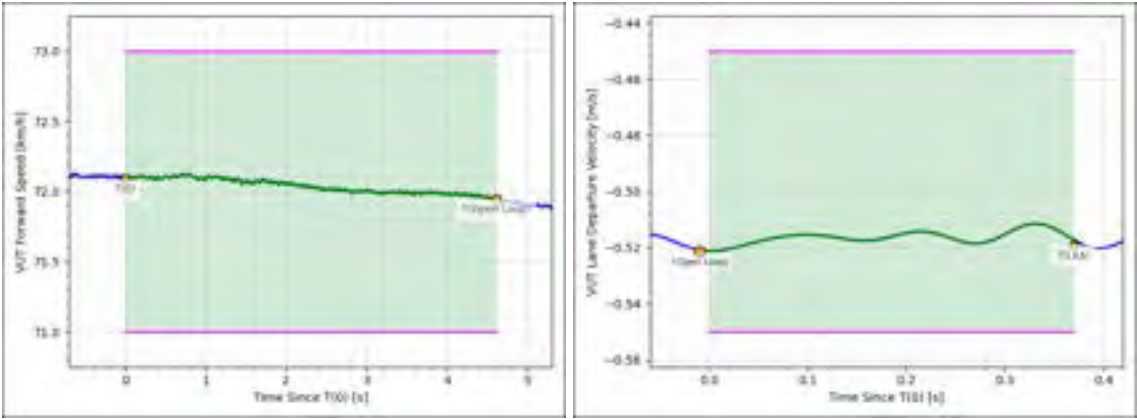
LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 1

Run Date / Time 21-Mar-2023 11:51



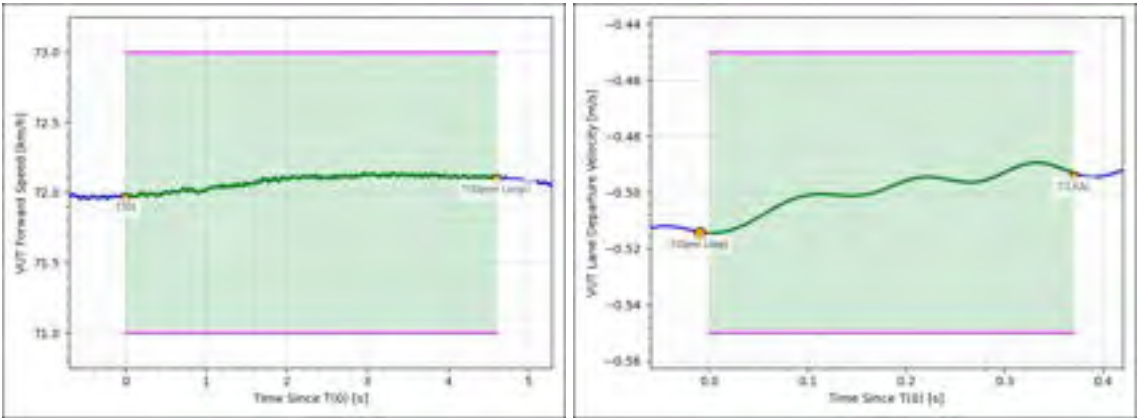
LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 2

Run Date / Time 21-Mar-2023 11:54



LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 3

Run Date / Time 21-Mar-2023 11:56

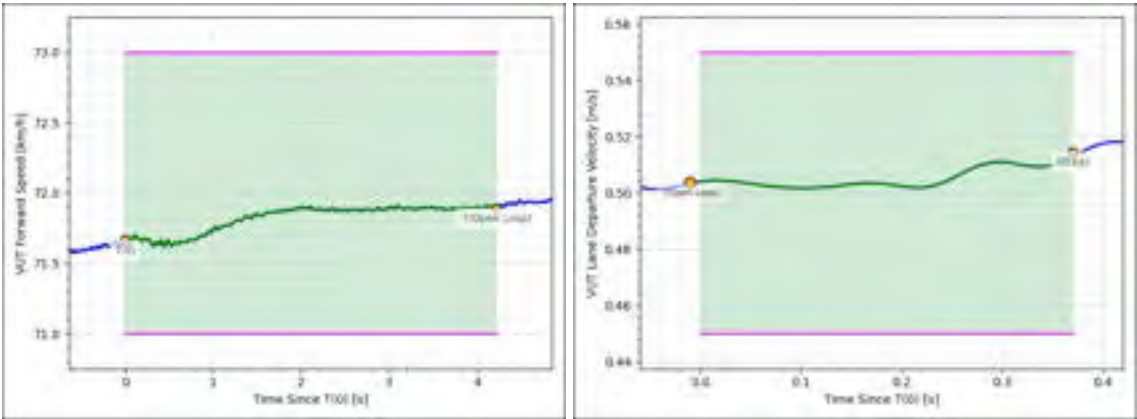


F.5.2. SLN-P

F.5.2.1. 0.5 m/s

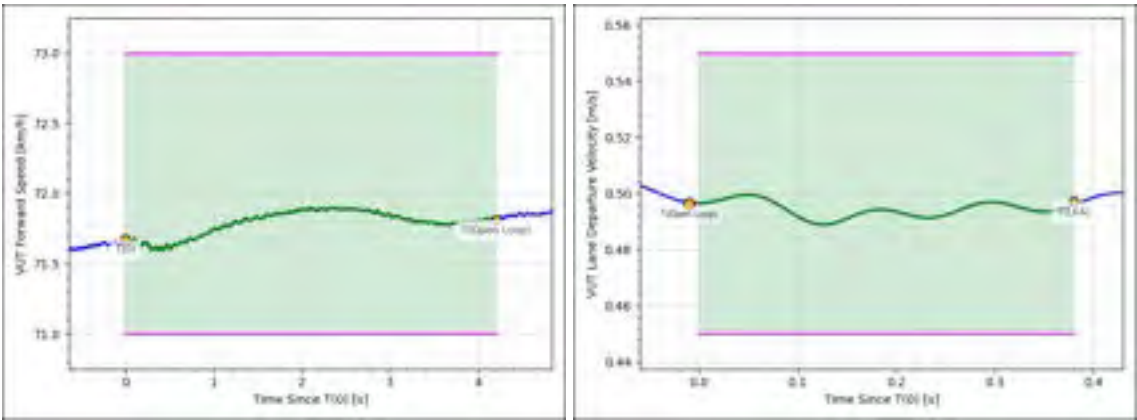
LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 1

Run Date / Time 21-Mar-2023 14:01



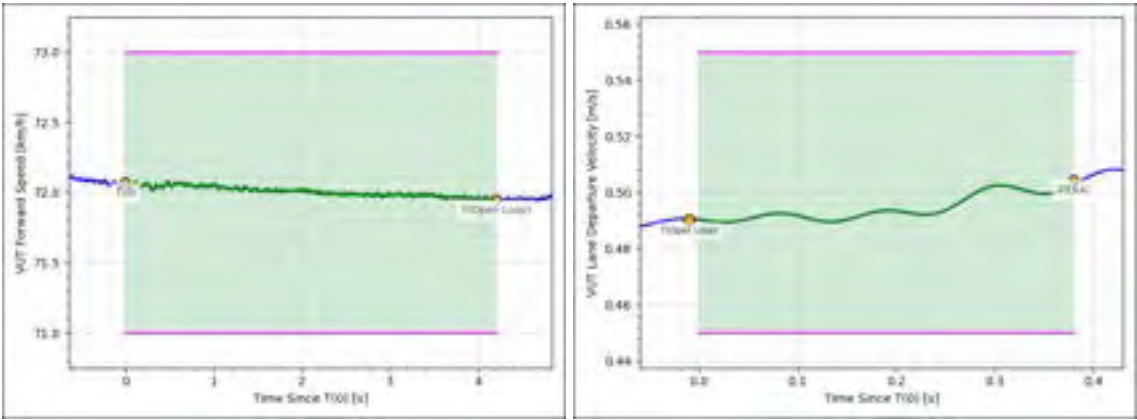
LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 2

Run Date / Time 21-Mar-2023 14:03



LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 3

Run Date / Time 21-Mar-2023 14:06

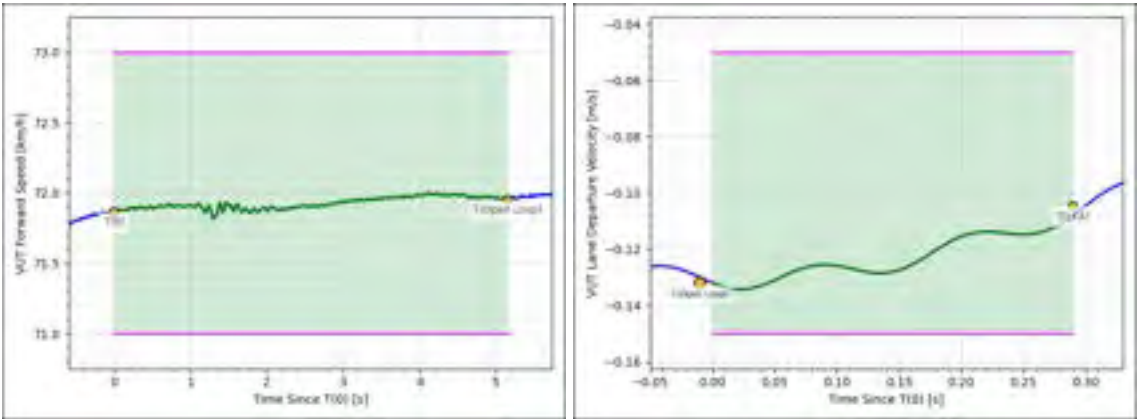


F.5.3. DLN-D

F.5.3.1. 0.1 m/s

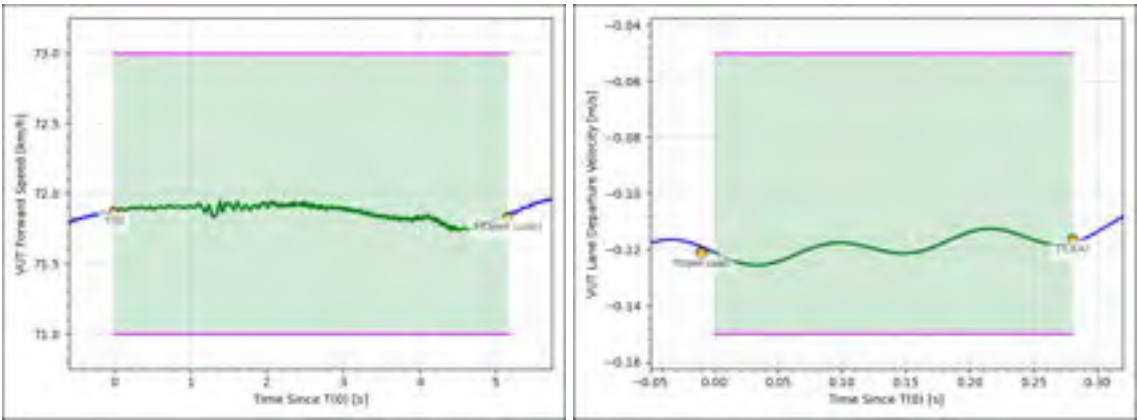
LKA DLN-D 0.1 mps Main | 0.1 m/s | Run 1

Run Date / Time 21-Mar-2023 13:29



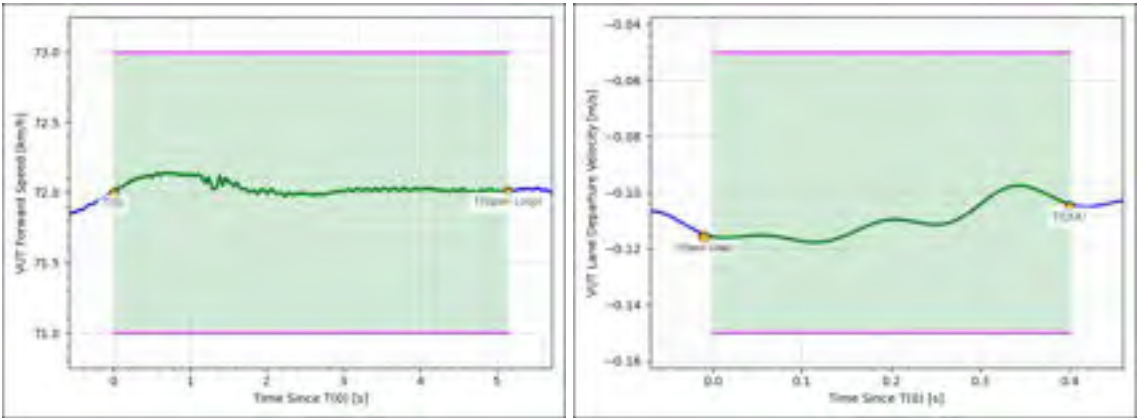
LKA DLN-D 0.1 mps Main | 0.1 m/s | Run 2

Run Date / Time 21-Mar-2023 13:32



LKA DLN-D 0.1 mps Main | 0.1 m/s | Run 3

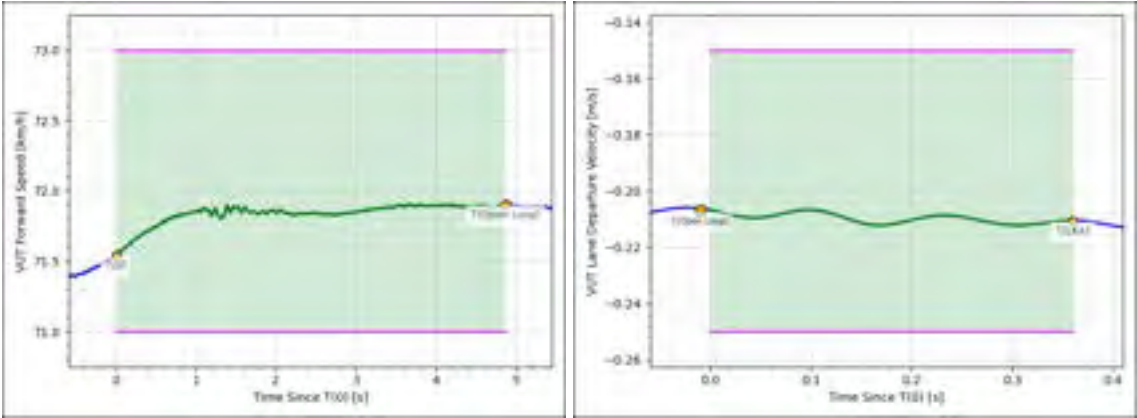
Run Date / Time 21-Mar-2023 13:36



F.5.3.2. 0.2 m/s

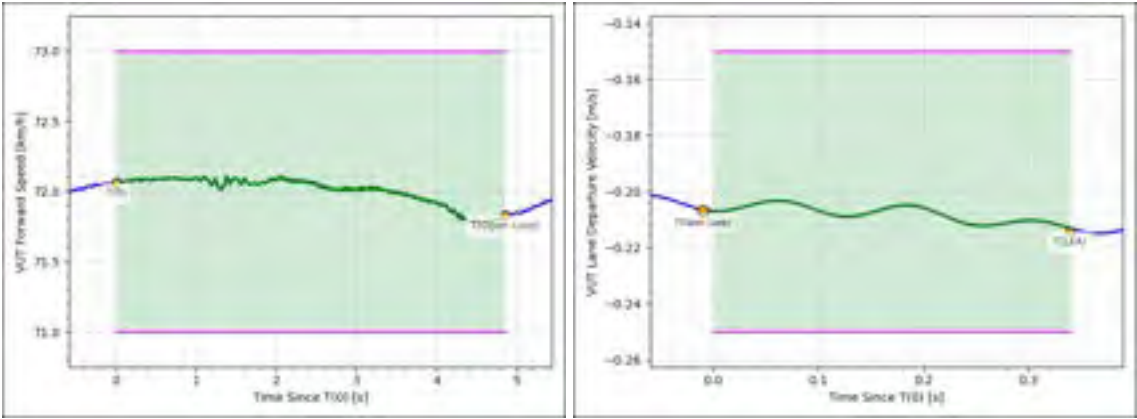
LKA DLN-D 0.2 mps Main | 0.2 m/s | Run 1

Run Date / Time 21-Mar-2023 13:12



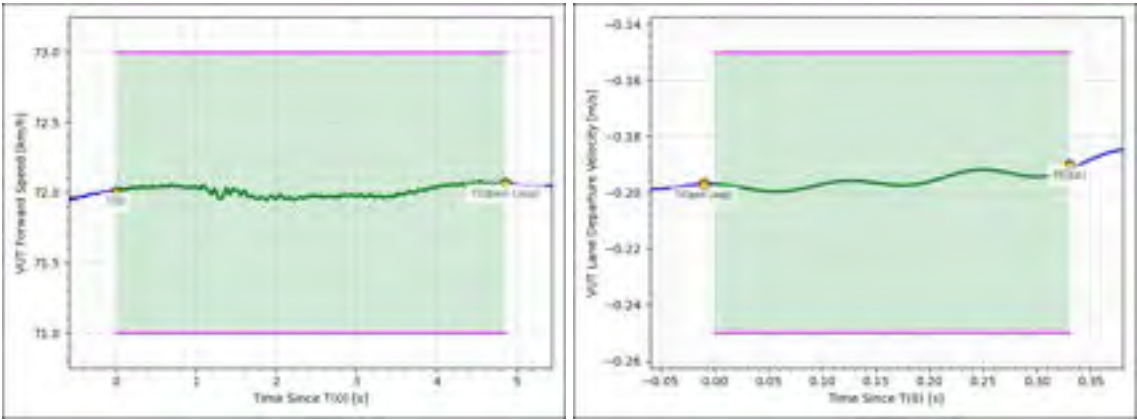
LKA DLN-D 0.2 mps Main | 0.2 m/s | Run 2

Run Date / Time 21-Mar-2023 13:15



LKA DLN-D 0.2 mps Main | 0.2 m/s | Run 3

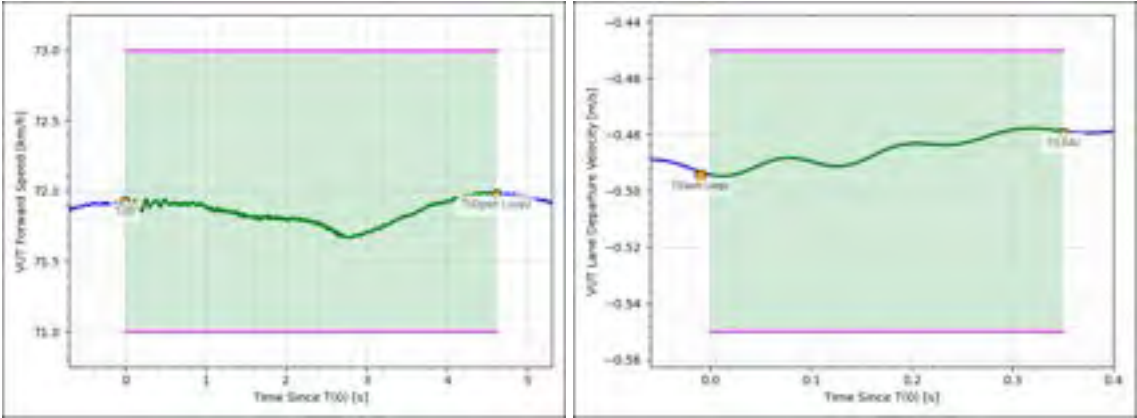
Run Date / Time 21-Mar-2023 13:17



F.5.3.3. 0.5 m/s

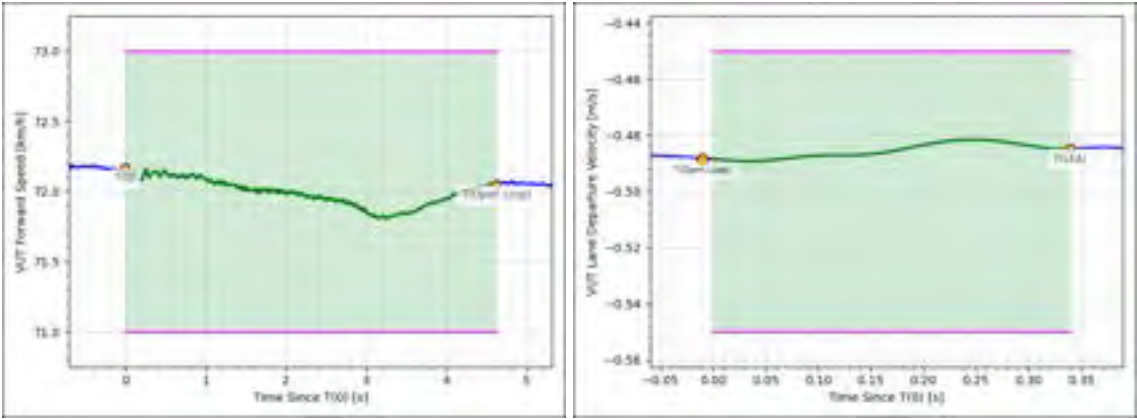
LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 1

Run Date / Time 21-Mar-2023 13:20



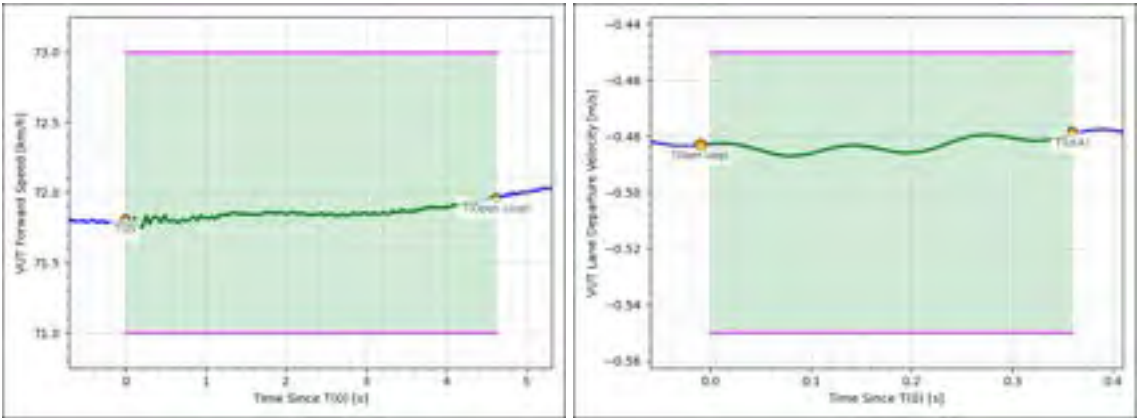
LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 2

Run Date / Time 21-Mar-2023 13:23



LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 3

Run Date / Time 21-Mar-2023 13:25

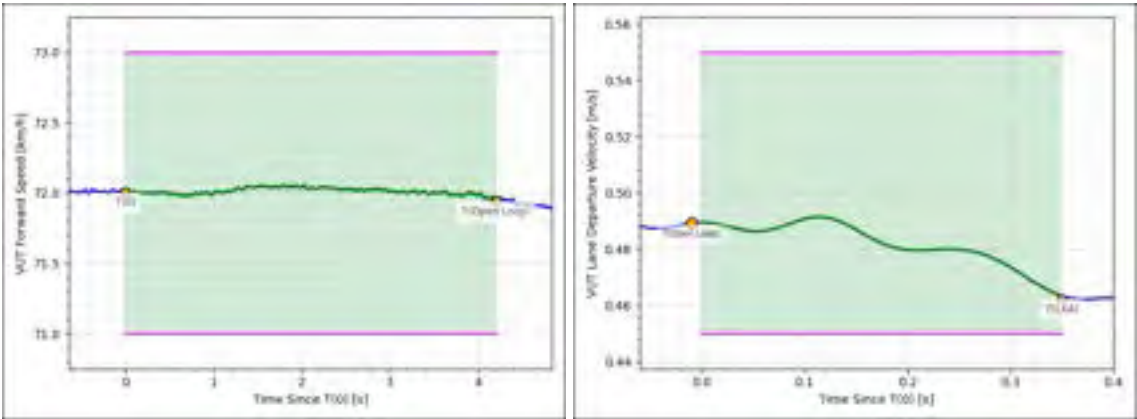


F.5.4. DLN-P

F.5.4.1. 0.5 m/s

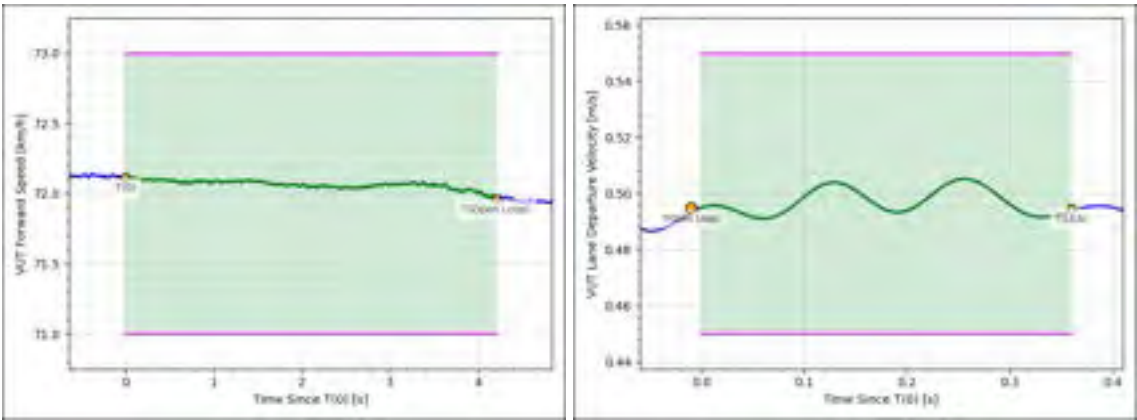
LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 1

Run Date / Time 21-Mar-2023 13:51



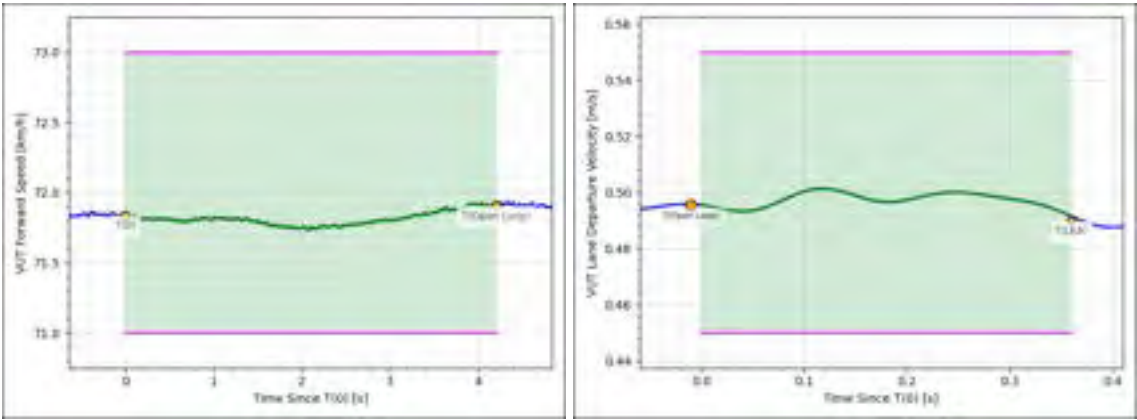
LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 2

Run Date / Time 21-Mar-2023 13:54



LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 3

Run Date / Time 21-Mar-2023 13:56



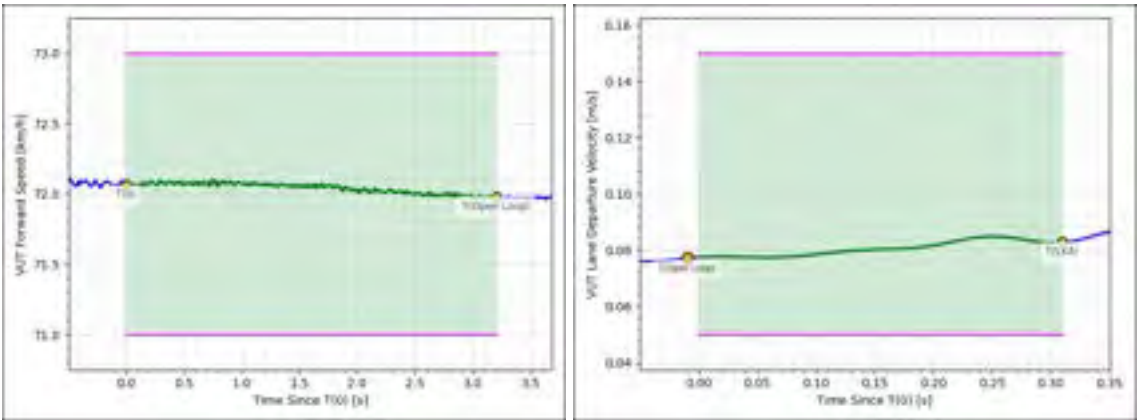
F.6. Bullbar

F.6.1. SLN-P

F.6.1.1. 0.1 m/s

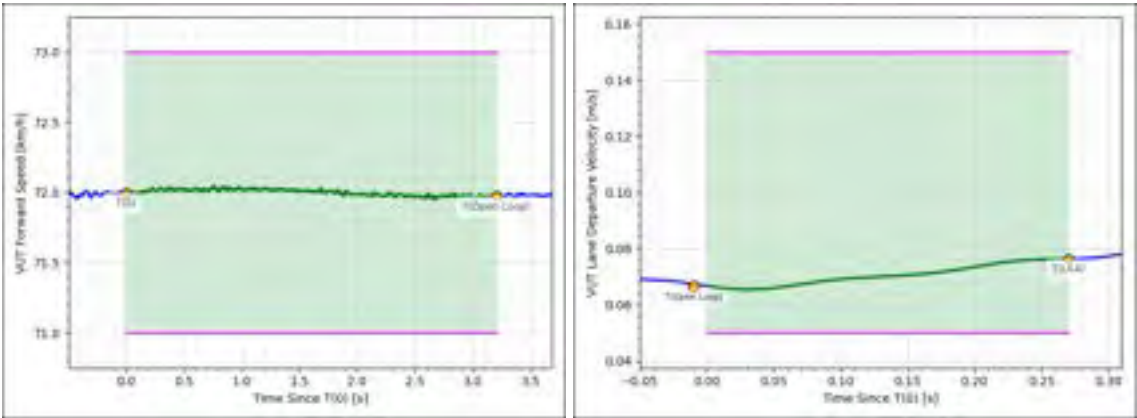
LKA SLN-P 0.1 mps Main | 0.1 m/s | Run 16

Run Date / Time 13-Sep-2023 13:43



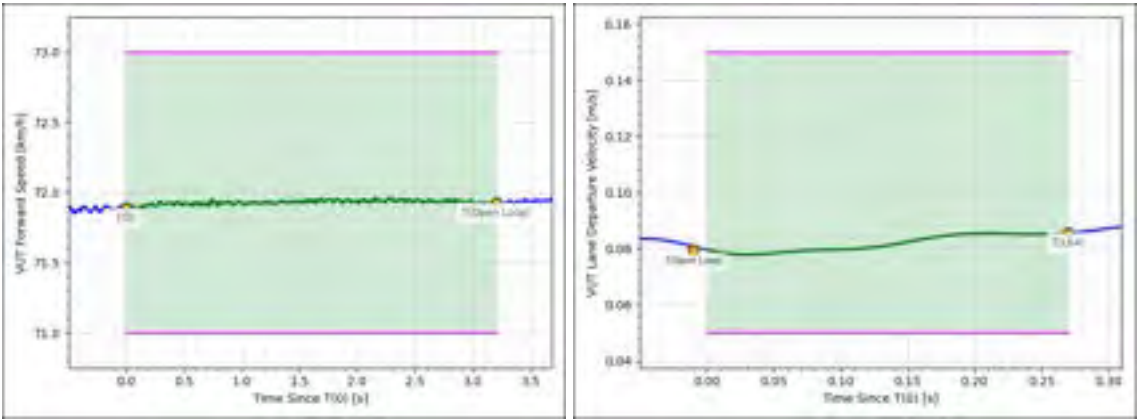
LKA SLN-P 0.1 mps Main | 0.1 m/s | Run 17

Run Date / Time 13-Sep-2023 13:46



LKA SLN-P 0.1 mps Main | 0.1 m/s | Run 18

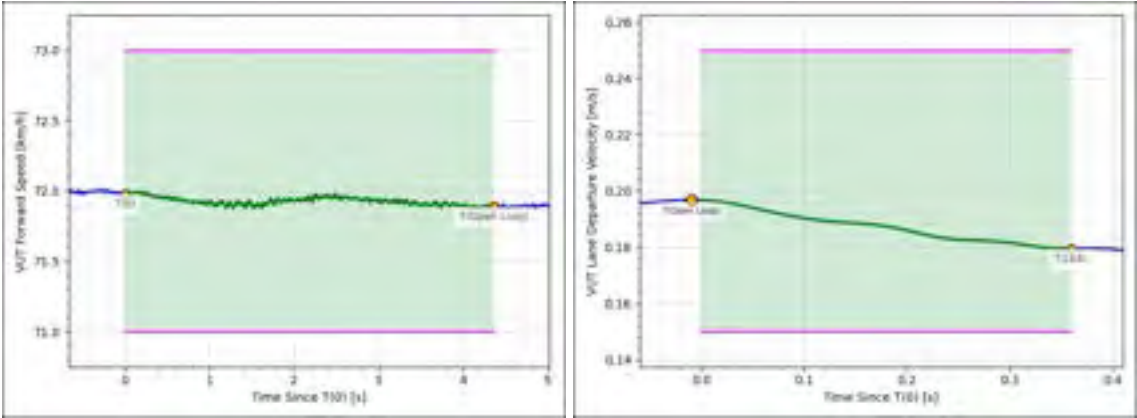
Run Date / Time 13-Sep-2023 13:49



F.6.1.2. 0.2 m/s

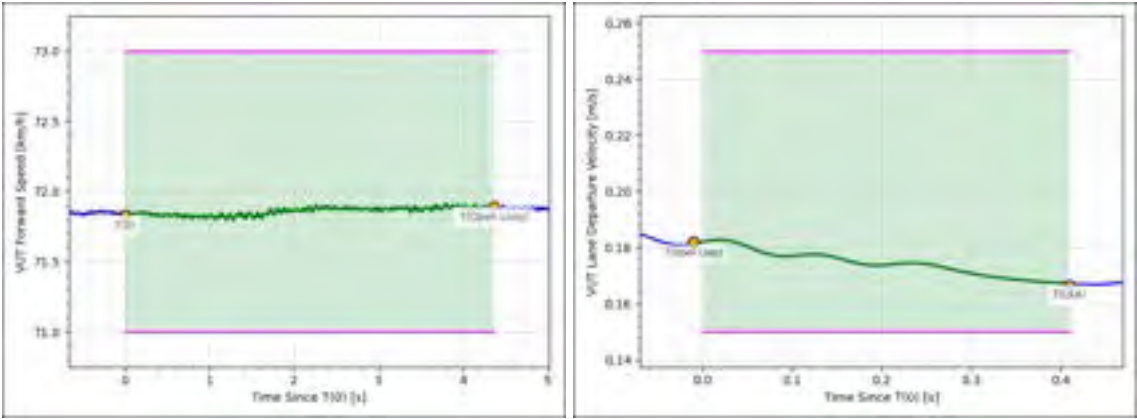
LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 7

Run Date / Time 12-Sep-2023 11:52



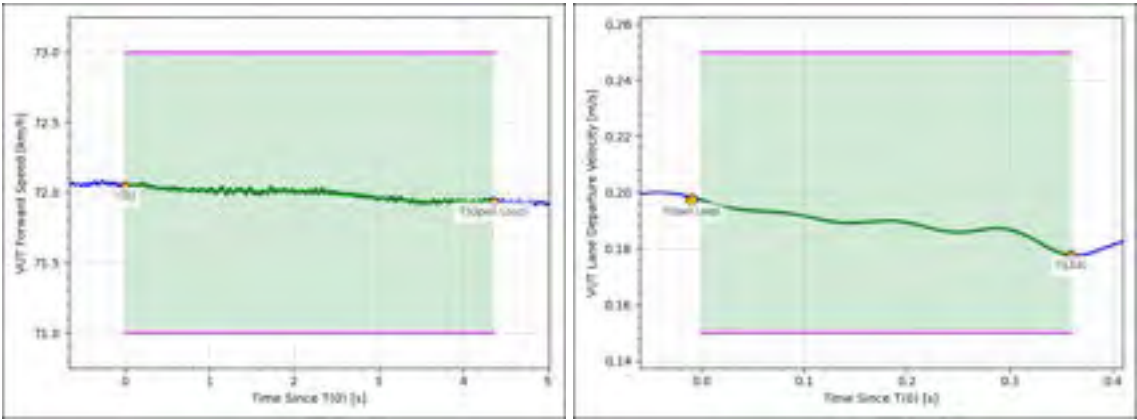
LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 8

Run Date / Time 12-Sep-2023 11:55



LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 9

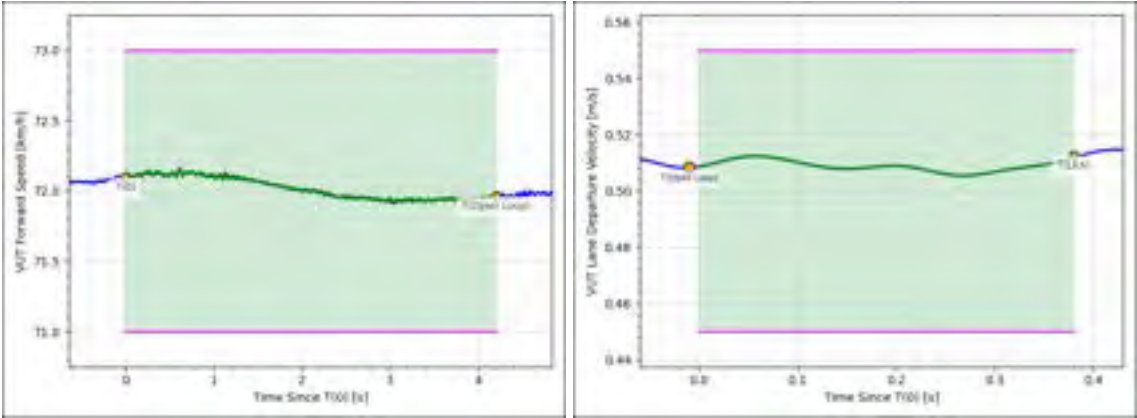
Run Date / Time 12-Sep-2023 12:00



F.6.1.3. 0.5 m/s

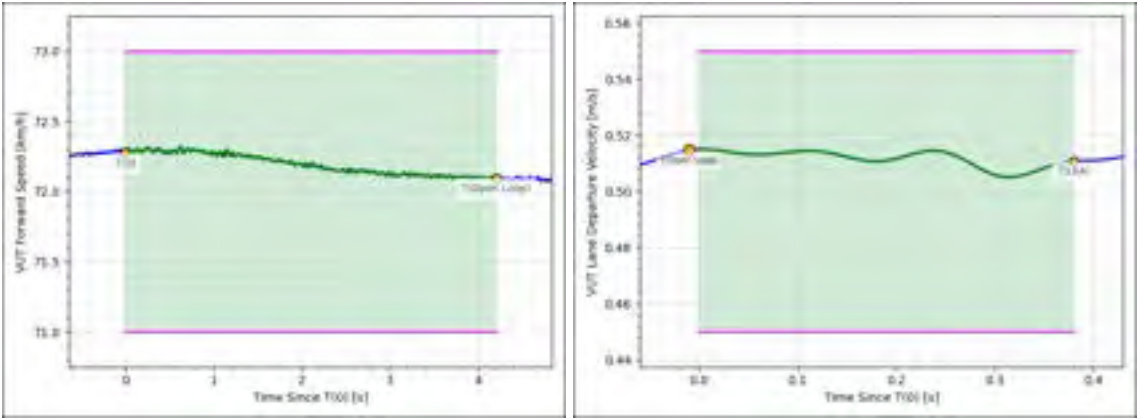
LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 6

Run Date / Time 12-Sep-2023 10:10



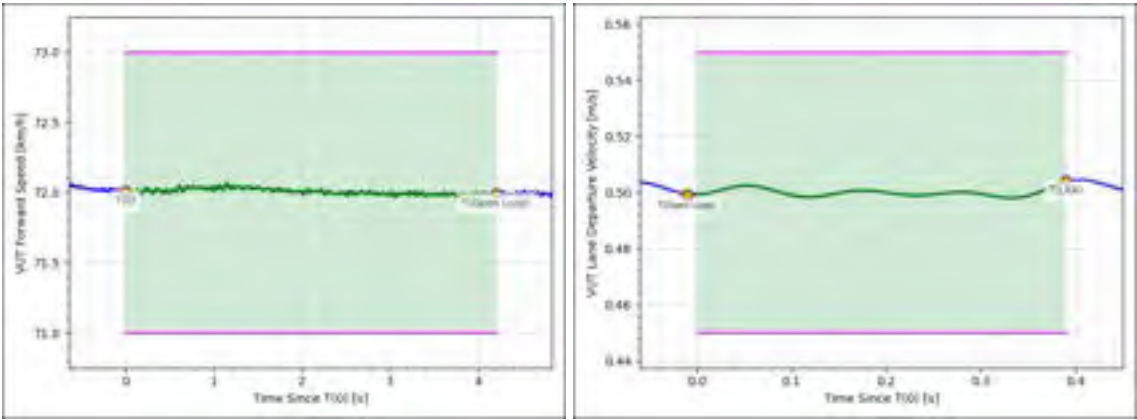
LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 7

Run Date / Time 12-Sep-2023 10:15



LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 8

Run Date / Time 12-Sep-2023 10:18

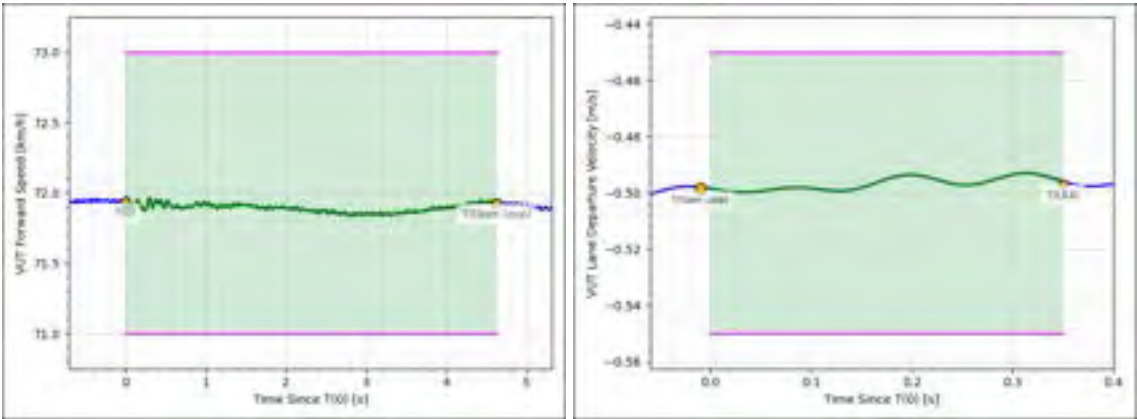


F.6.2. DLN-D

F.6.2.1. 0.5 m/s

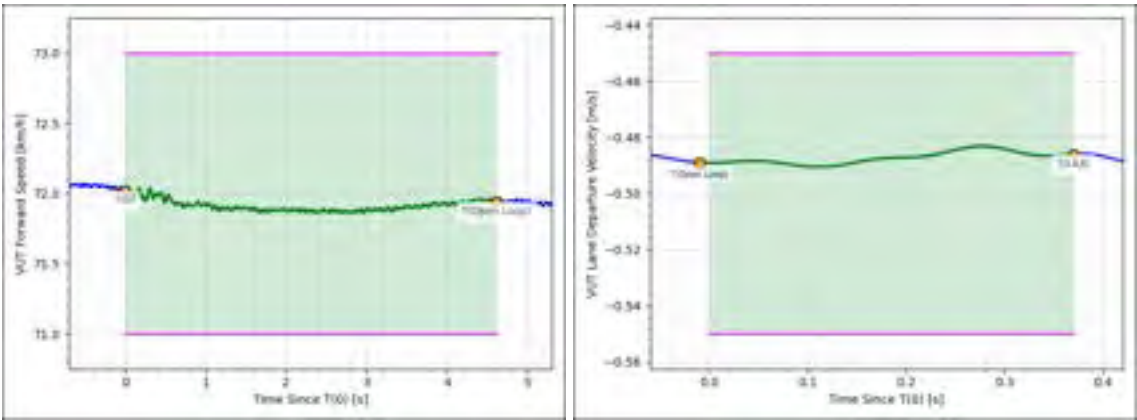
LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 9

Run Date / Time 14-Sep-2023 14:52



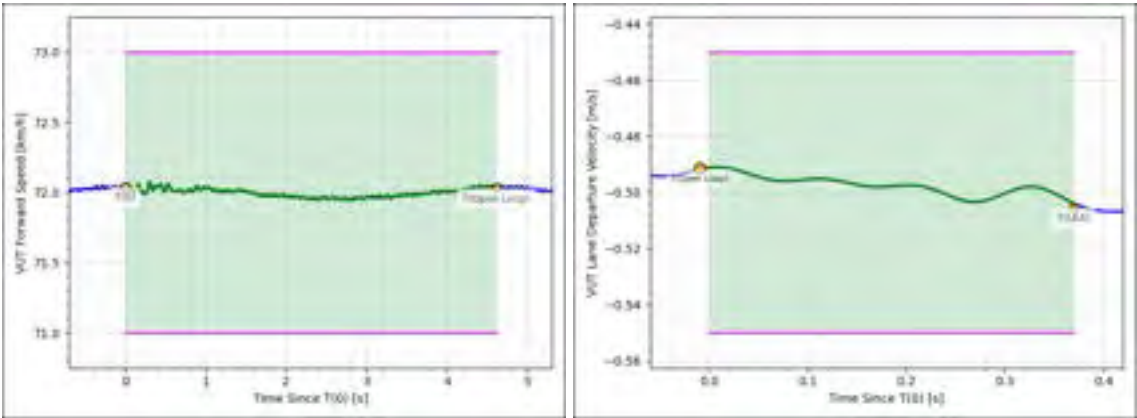
LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 10

Run Date / Time 14-Sep-2023 14:54



LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 11

Run Date / Time 14-Sep-2023 14:56

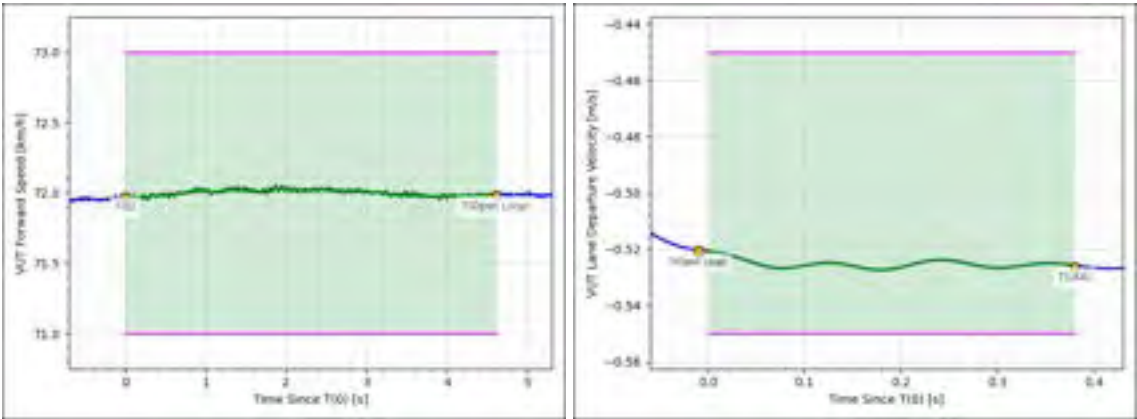


F.6.3. SLN-D

F.6.3.1. 0.5 m/s

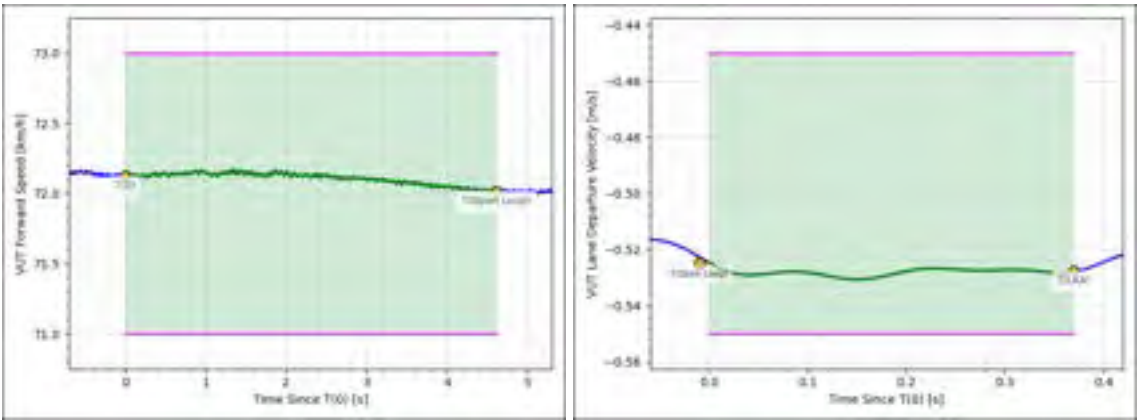
LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 4

Run Date / Time 14-Sep-2023 13:37



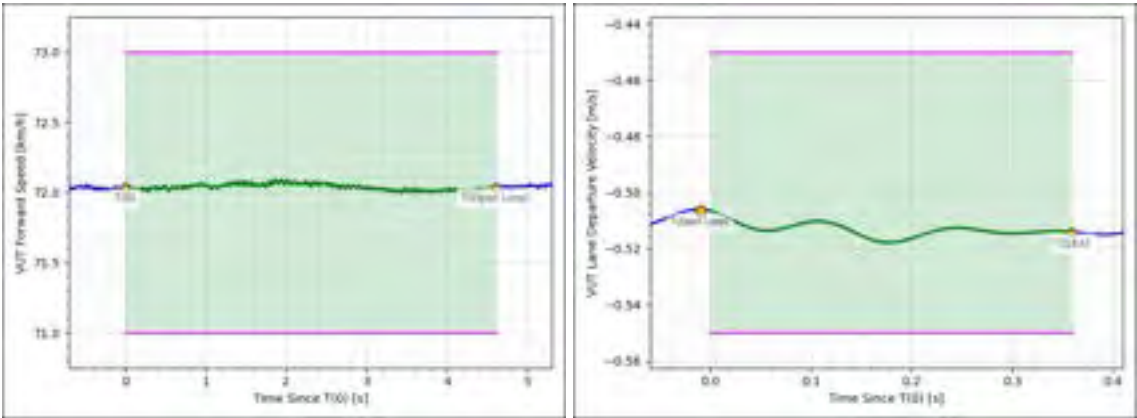
LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 5

Run Date / Time 14-Sep-2023 13:42



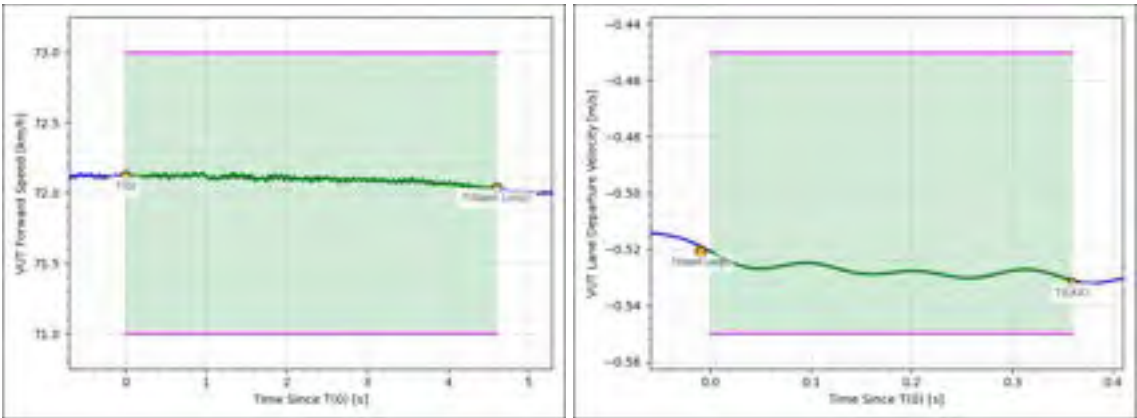
LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 6

Run Date / Time 14-Sep-2023 13:44



LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 7

Run Date / Time 14-Sep-2023 13:47

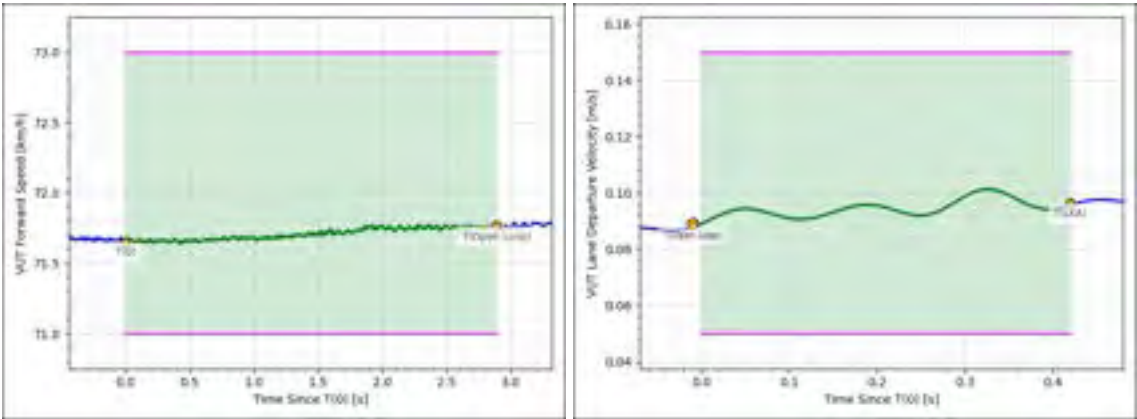


F.6.4. DLN-P

F.6.4.1. 0.1 m/s

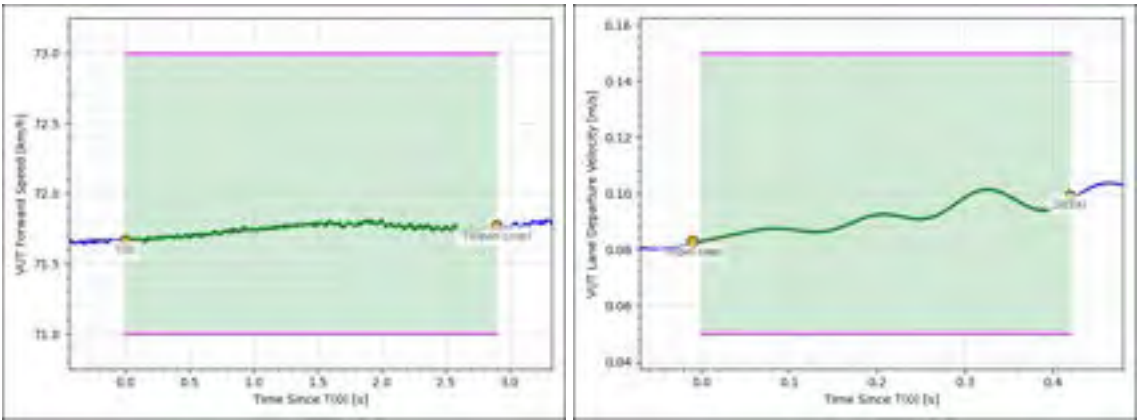
LKA DLN-P 0.1 mps Main | 0.1 m/s | Run 4

Run Date / Time 12-Sep-2023 14:52



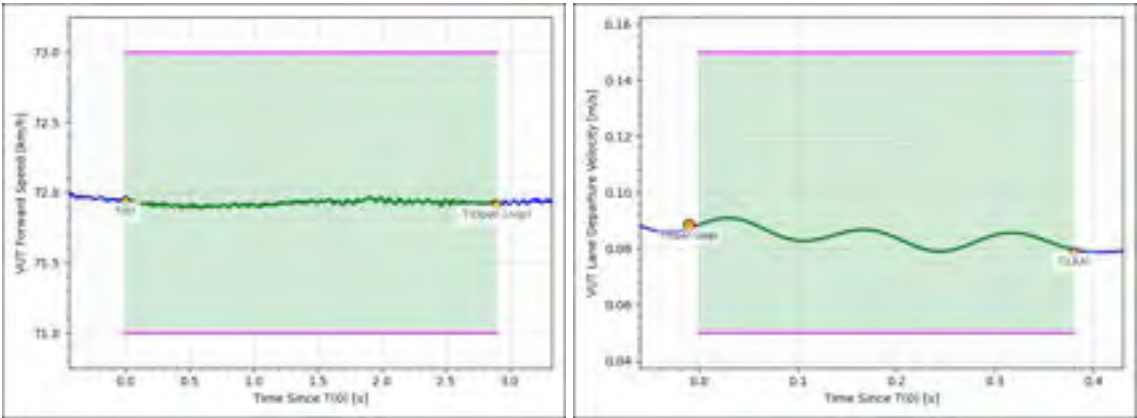
LKA DLN-P 0.1 mps Main | 0.1 m/s | Run 5

Run Date / Time 12-Sep-2023 14:55



LKA DLN-P 0.1 mps Main | 0.1 m/s | Run 6

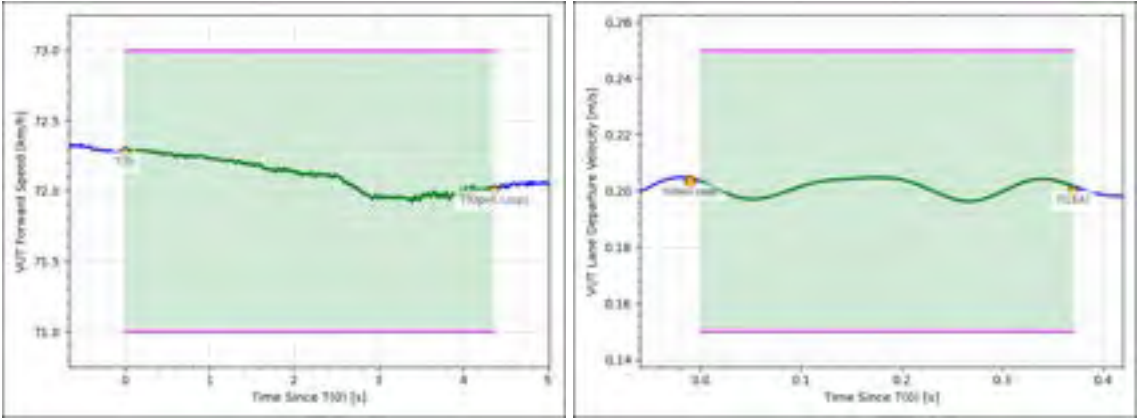
Run Date / Time 12-Sep-2023 14:58



F.6.4.2. 0.2 m/s

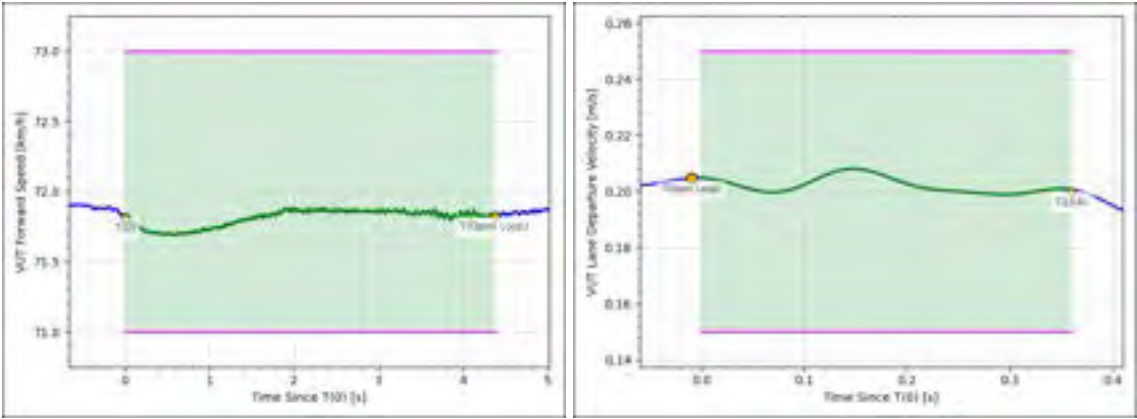
LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 3

Run Date / Time 13-Sep-2023 11:06



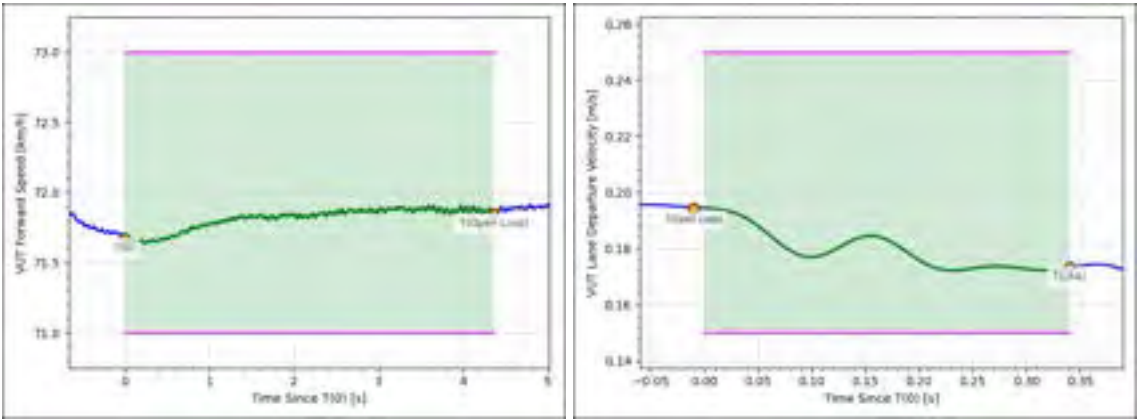
LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 4

Run Date / Time 13-Sep-2023 11:10



LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 8

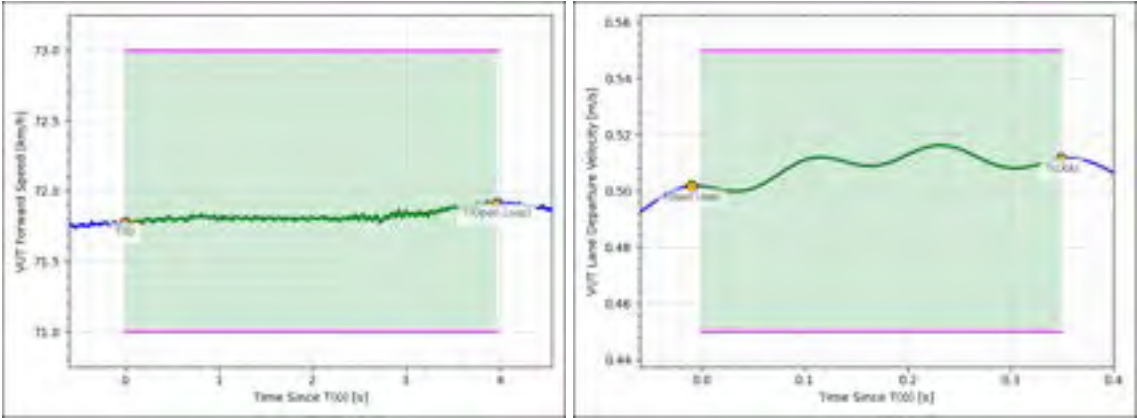
Run Date / Time 13-Sep-2023 11:31



F.6.4.3. 0.5 m/s

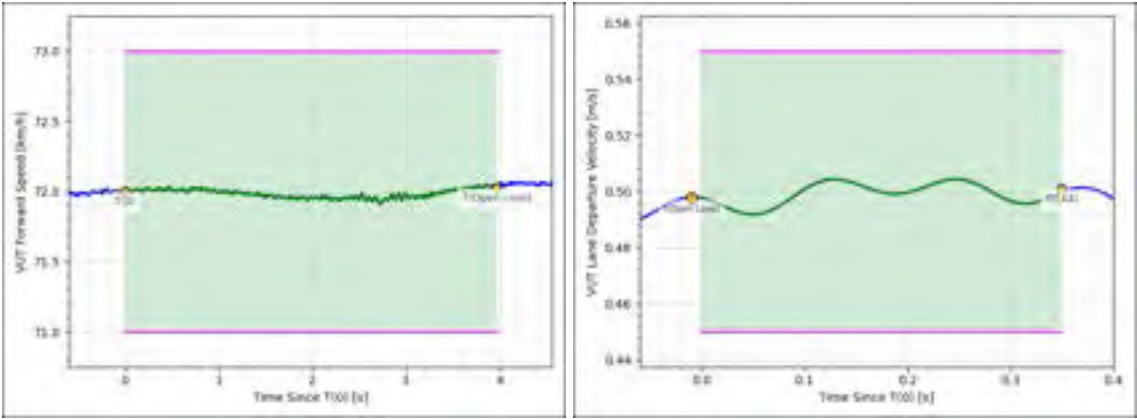
LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 9

Run Date / Time 12-Sep-2023 13:49



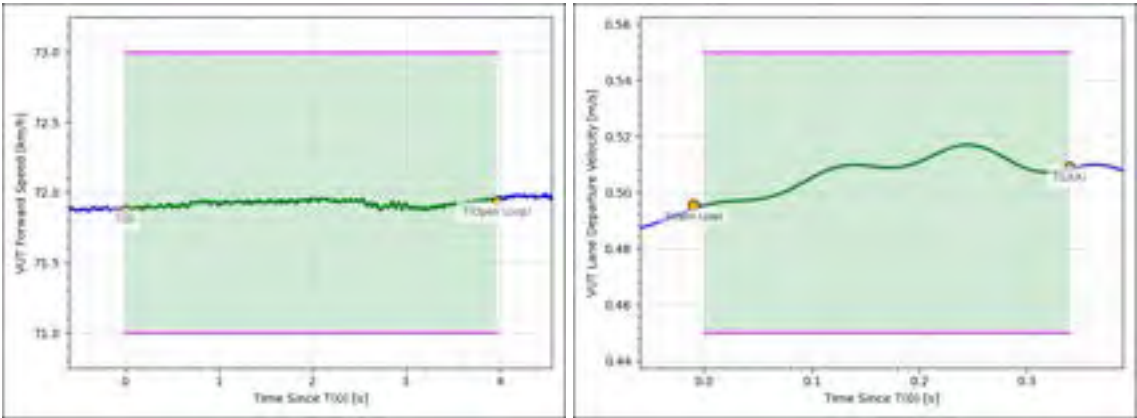
LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 10

Run Date / Time 12-Sep-2023 13:51



LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 11

Run Date / Time 12-Sep-2023 13:54



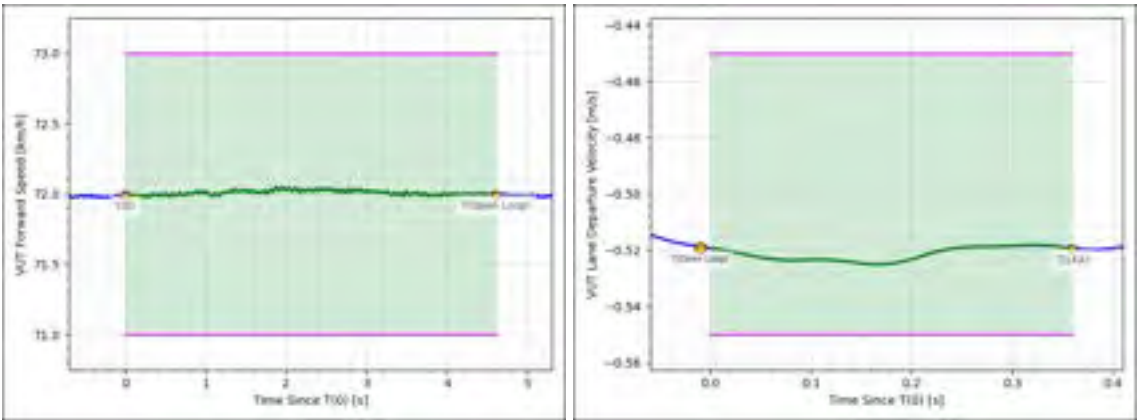
F.7. White Antenna

F.7.1. SLN-D

F.7.1.1. 0.5 m/s

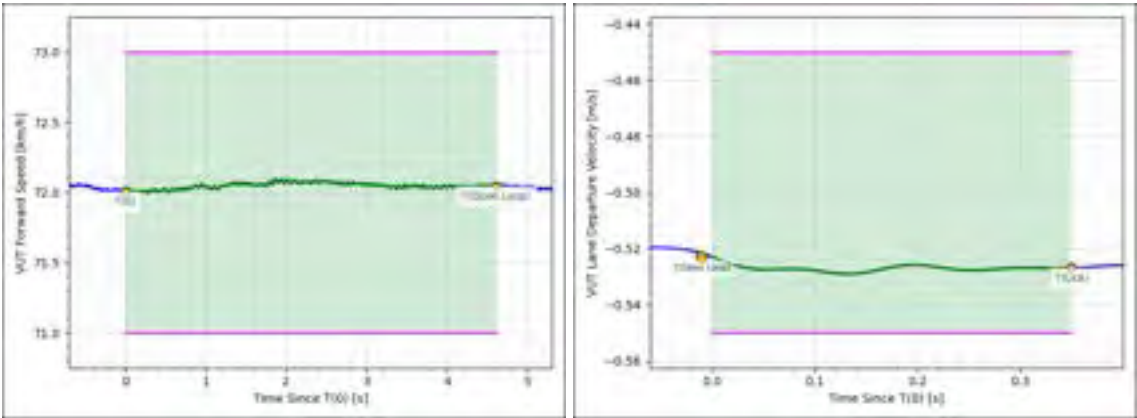
LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 8

Run Date / Time 14-Sep-2023 14:00



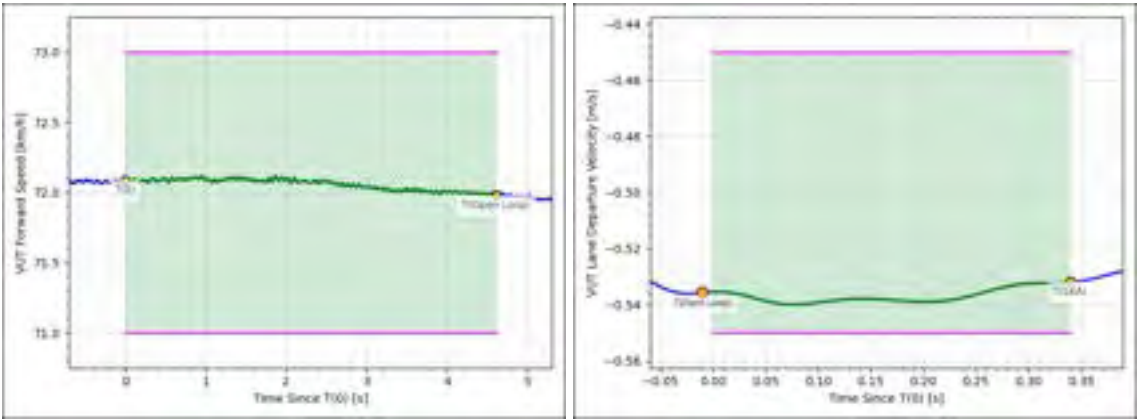
LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 9

Run Date / Time 14-Sep-2023 14:03



LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 10

Run Date / Time 14-Sep-2023 14:06

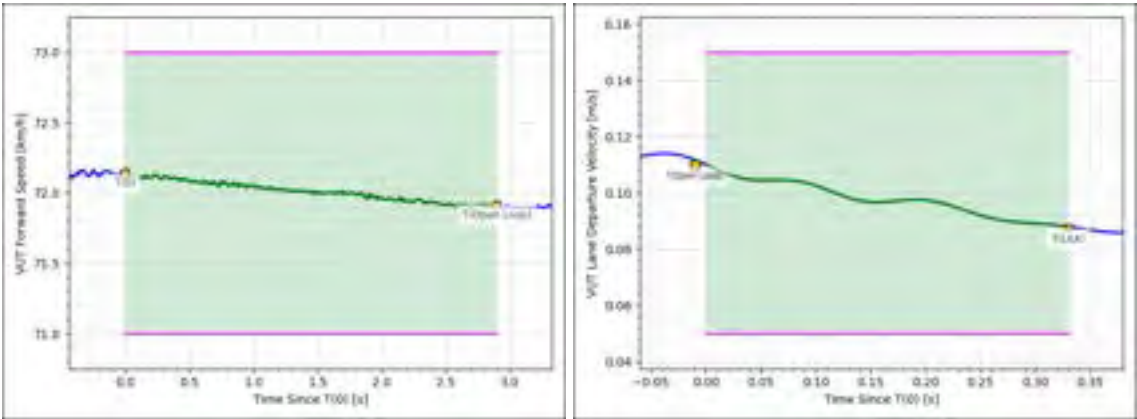


F.7.2. SLN-P

F.7.2.1. 0.1 m/s

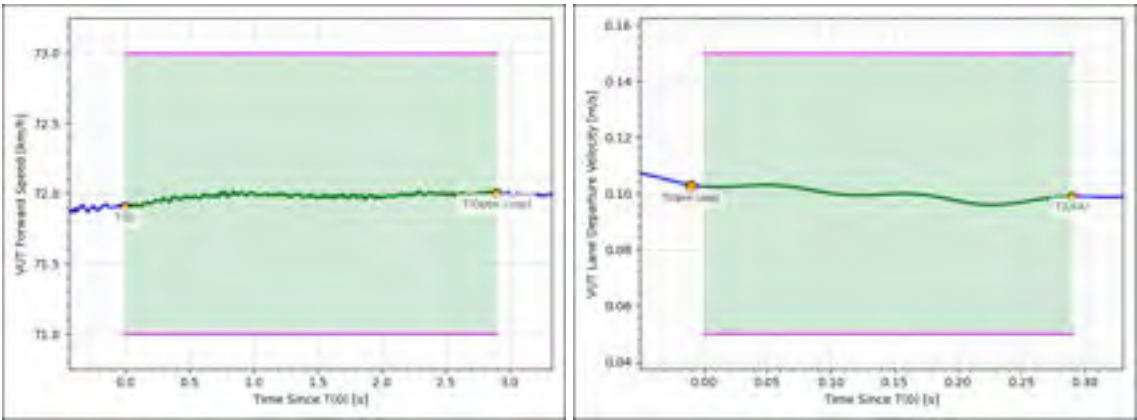
LKA SLN-P 0.1 mps Main | 0.1 m/s | Run 10

Run Date / Time 13-Sep-2023 13:07



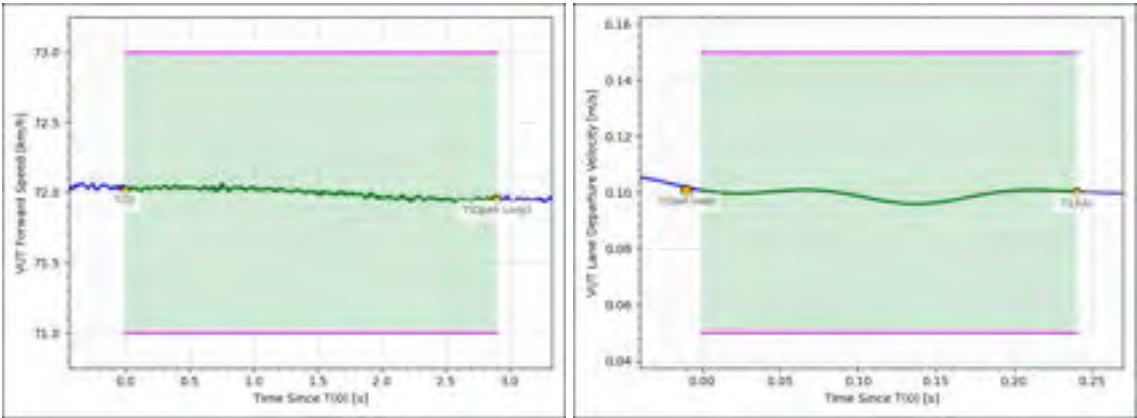
LKA SLN-P 0.1 mps Main | 0.1 m/s | Run 11

Run Date / Time 13-Sep-2023 13:11



LKA SLN-P 0.1 mps Main | 0.1 m/s | Run 14

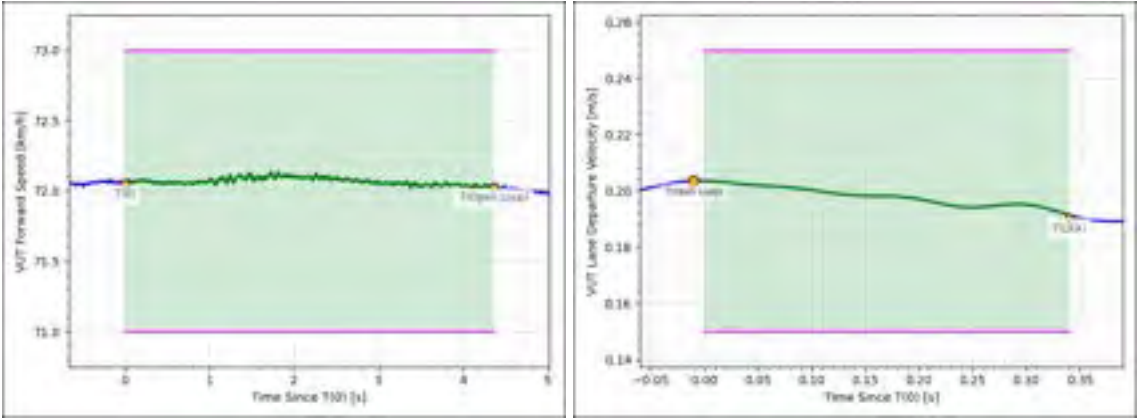
Run Date / Time 13-Sep-2023 13:21



F.7.2.2. 0.2 m/s

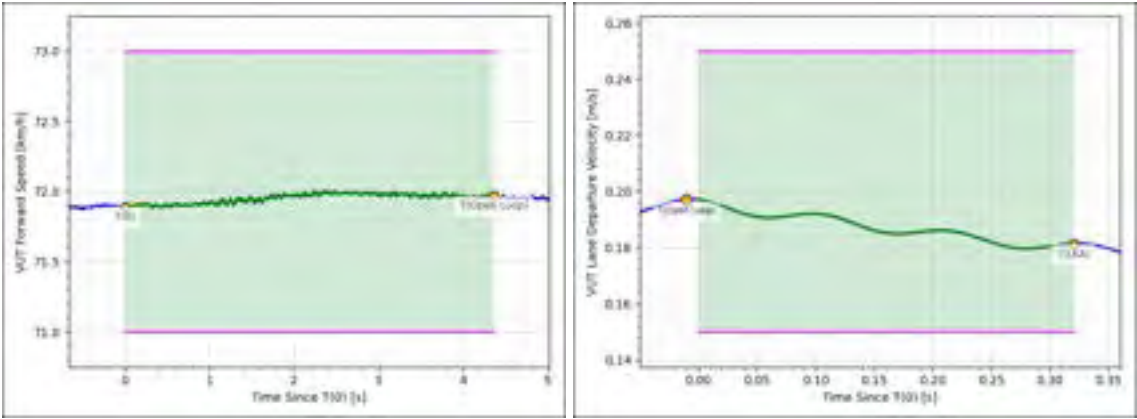
LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 10

Run Date / Time 12-Sep-2023 13:12



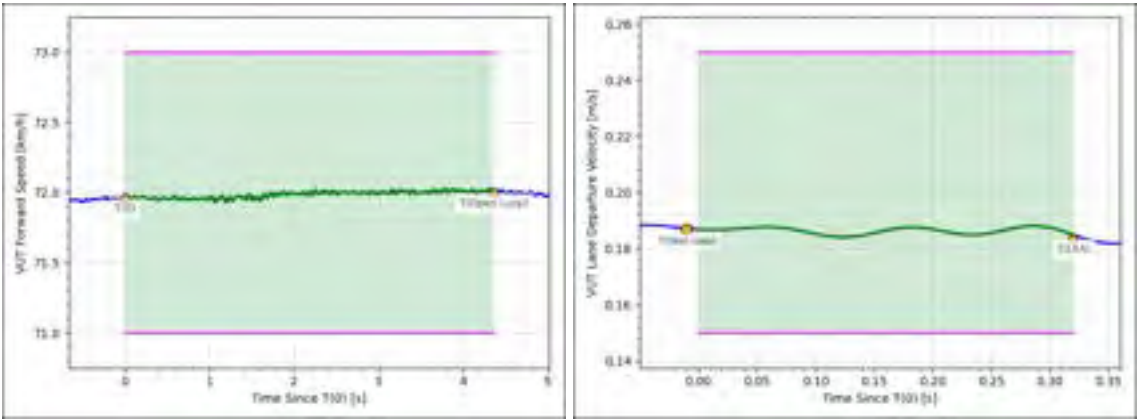
LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 11

Run Date / Time 12-Sep-2023 13:16



LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 12

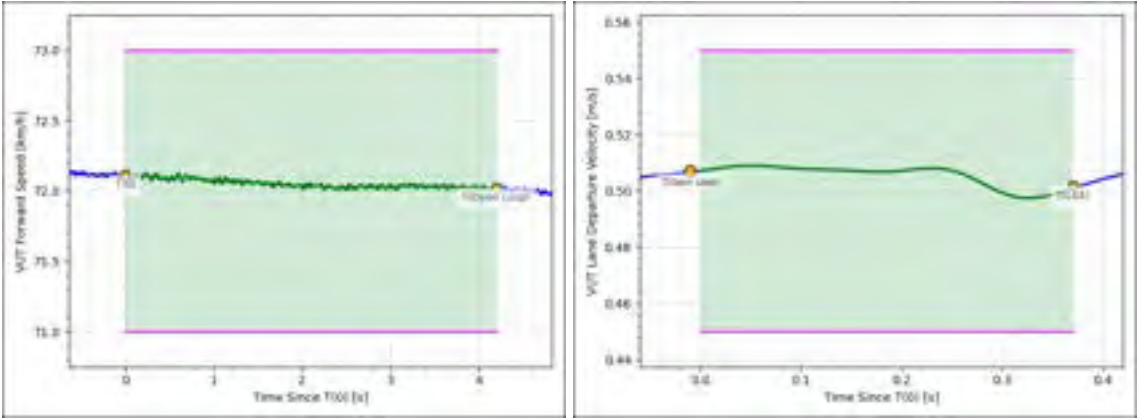
Run Date / Time 12-Sep-2023 13:19



F.7.2.3. 0.5 m/s

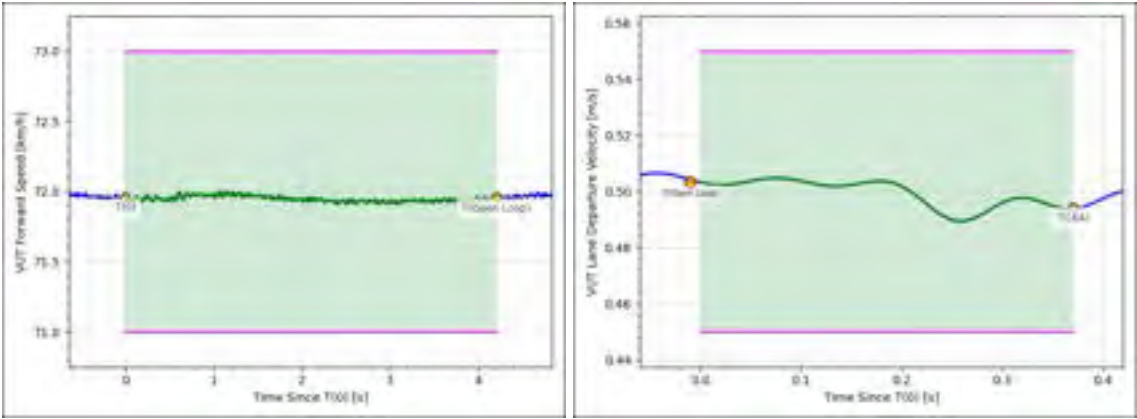
LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 15

Run Date / Time 12-Sep-2023 11:12



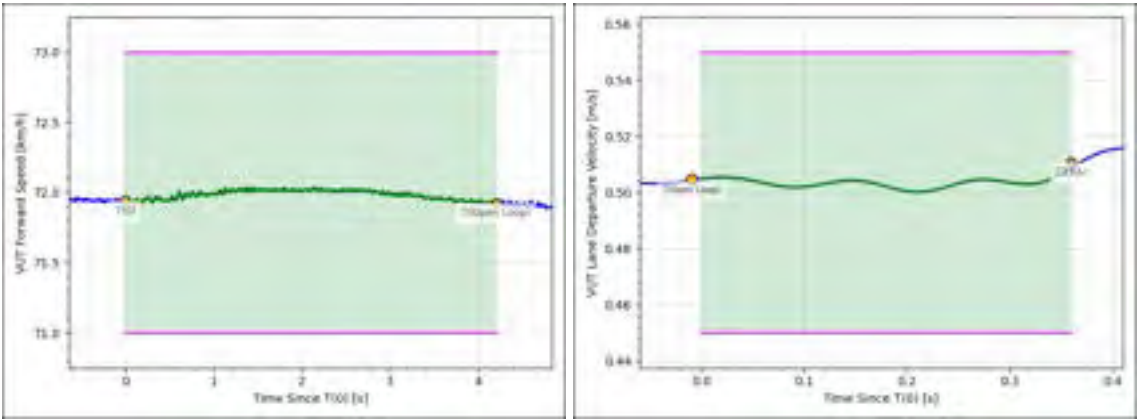
LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 16

Run Date / Time 12-Sep-2023 11:15



LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 17

Run Date / Time 12-Sep-2023 11:18

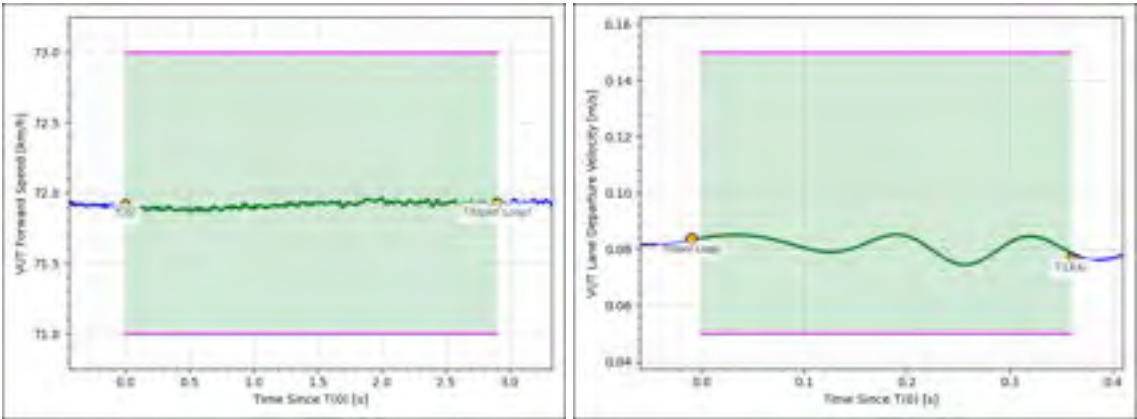


F.7.3. DLN-P

F.7.3.1. 0.1 m/s

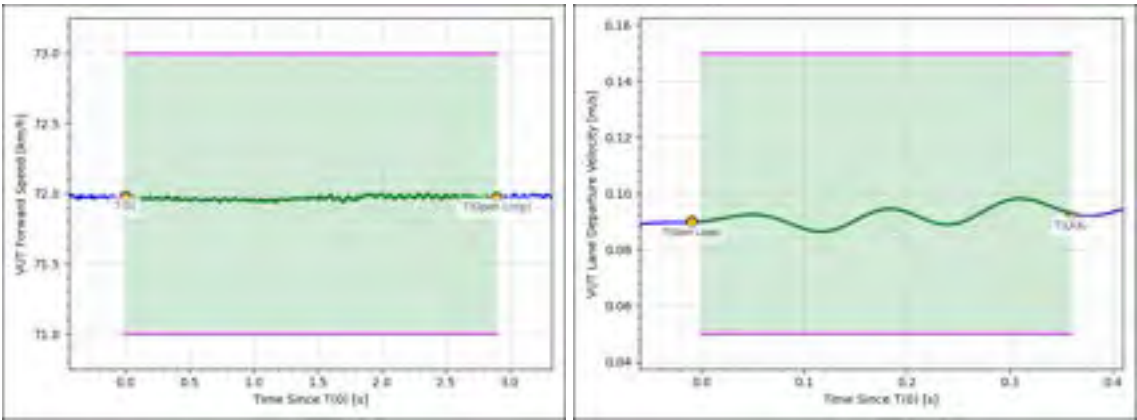
LKA DLN-P 0.1 mps Main | 0.1 m/s | Run 7

Run Date / Time 12-Sep-2023 15:05



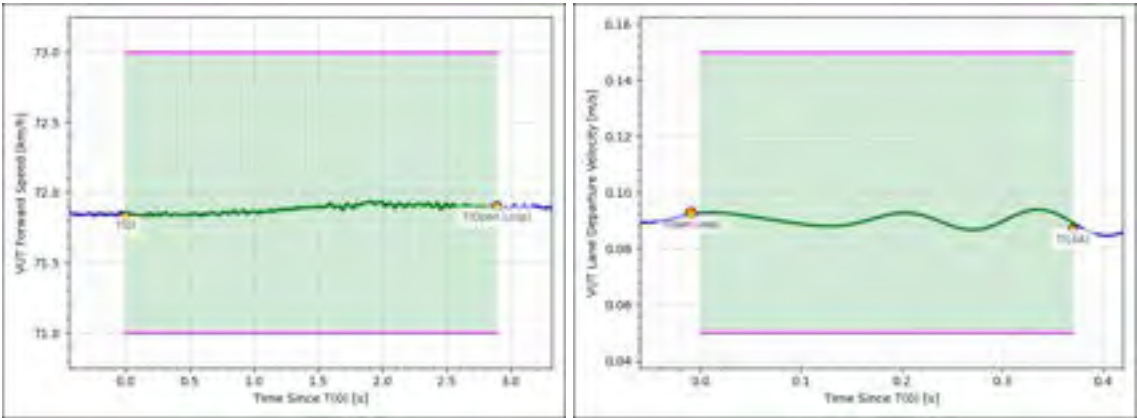
LKA DLN-P 0.1 mps Main | 0.1 m/s | Run 8

Run Date / Time 12-Sep-2023 15:09



LKA DLN-P 0.1 mps Main | 0.1 m/s | Run 9

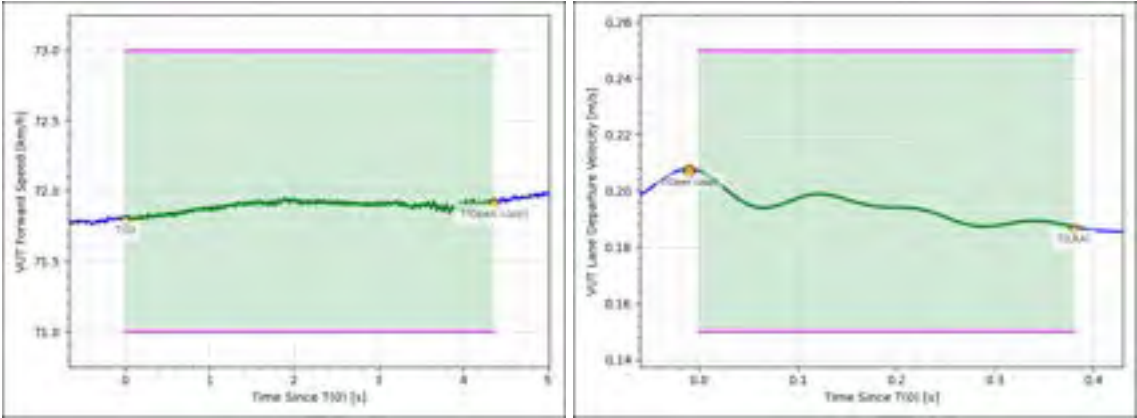
Run Date / Time 12-Sep-2023 15:13



F.7.3.2. 0.2 m/s

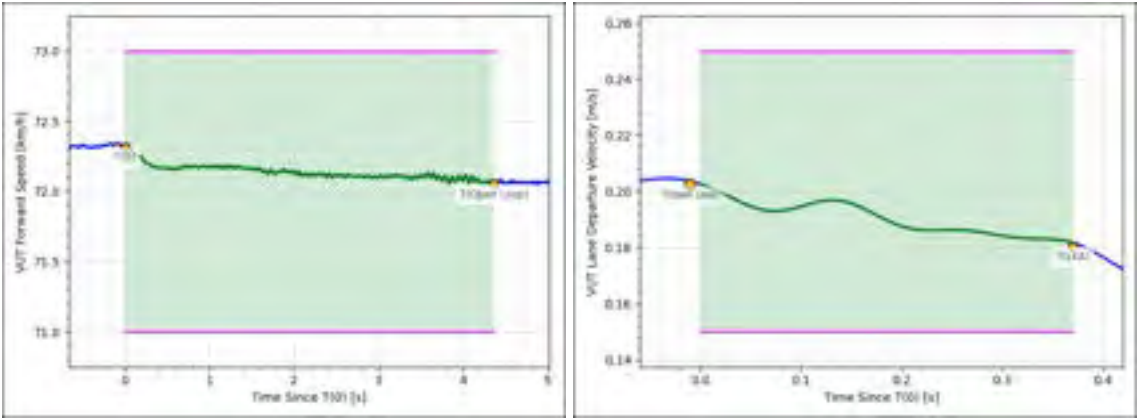
LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 1

Run Date / Time 13-Sep-2023 10:55



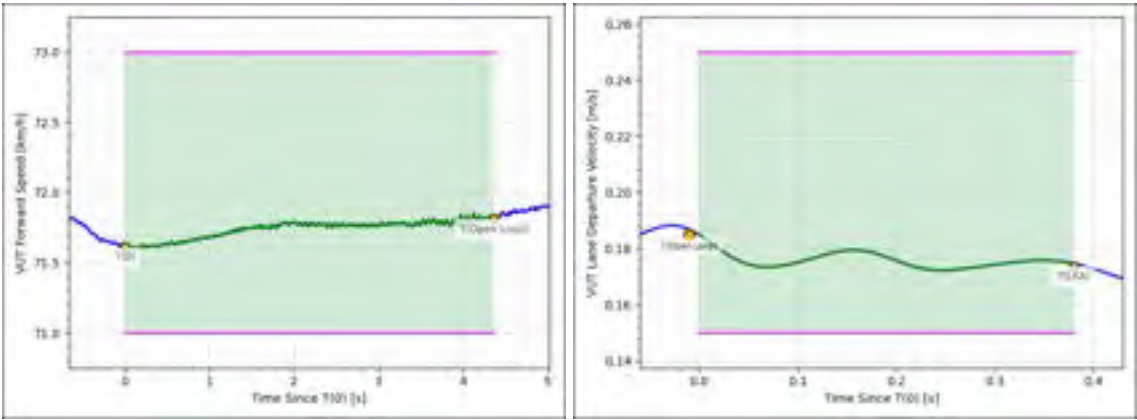
LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 2

Run Date / Time 13-Sep-2023 10:57



LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 11

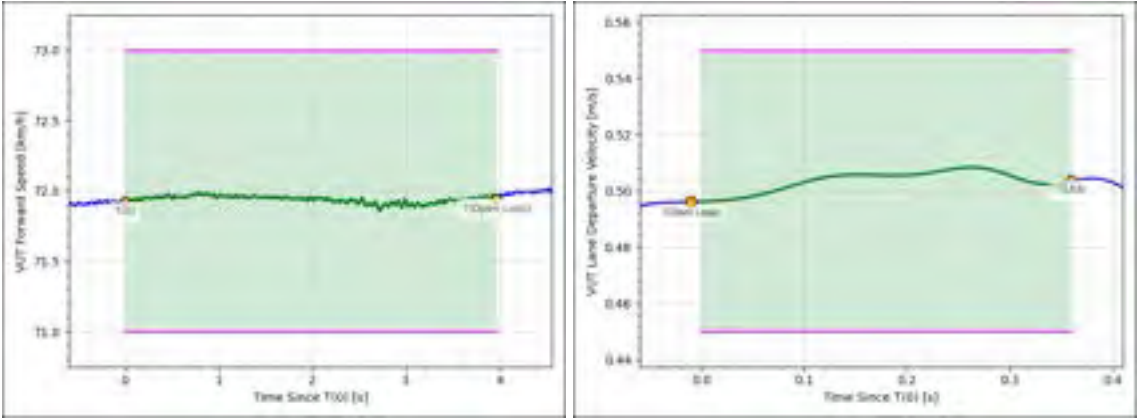
Run Date / Time 13-Sep-2023 11:43



F.7.3.3. 0.5 m/s

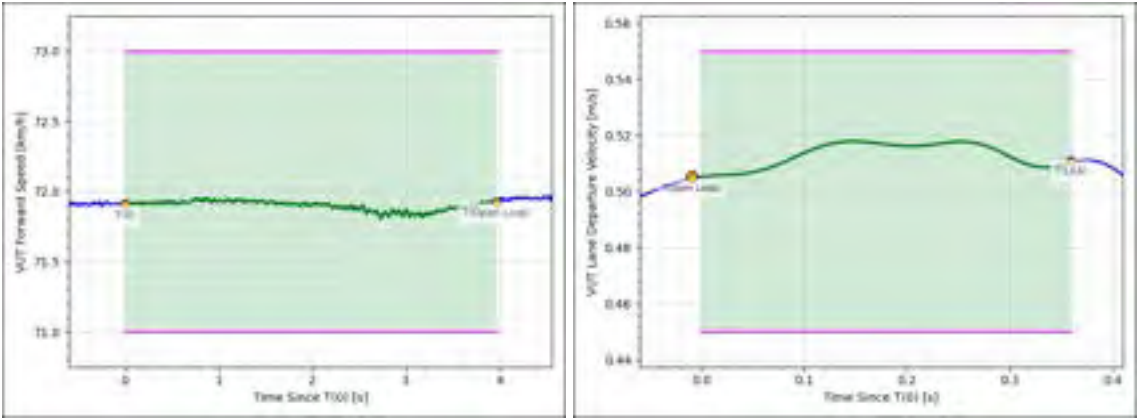
LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 6

Run Date / Time 12-Sep-2023 13:35



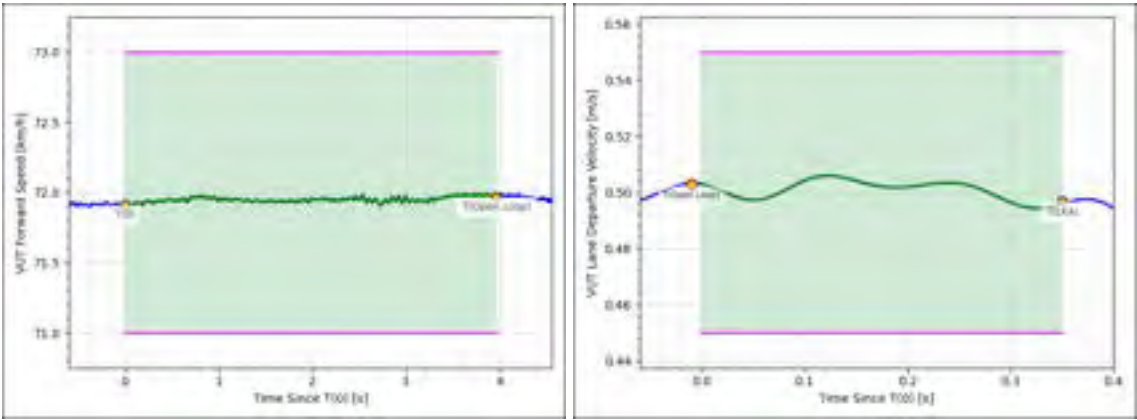
LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 7

Run Date / Time 12-Sep-2023 13:38



LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 8

Run Date / Time 12-Sep-2023 13:40

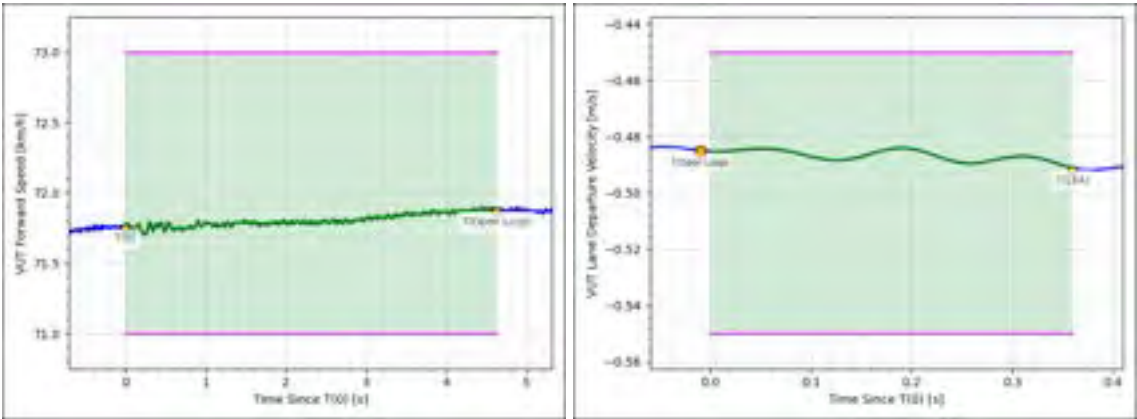


F.7.4. DLN-D

F.7.4.1. 0.5 m/s

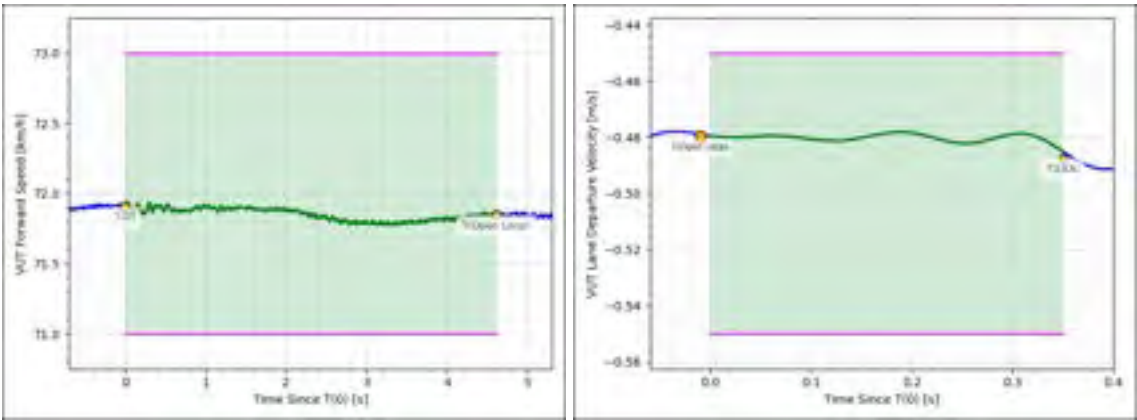
LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 12

Run Date / Time 14-Sep-2023 15:04



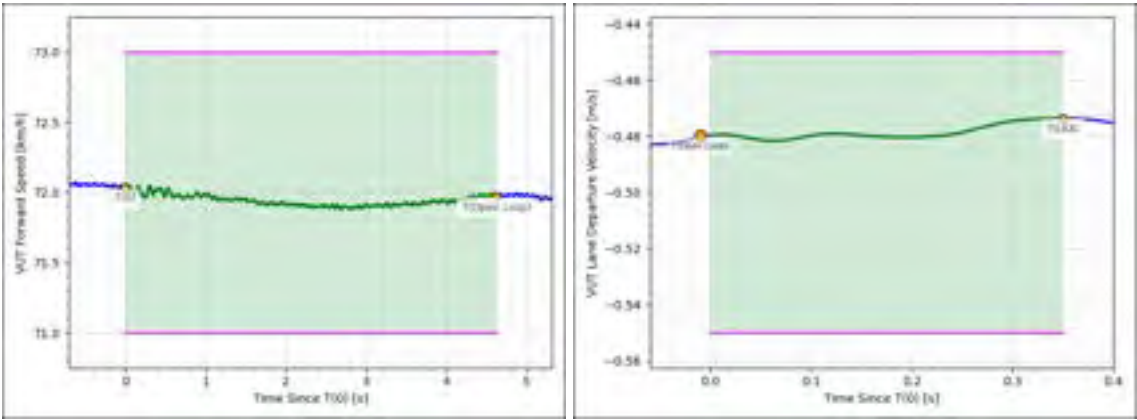
LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 13

Run Date / Time 14-Sep-2023 15:06



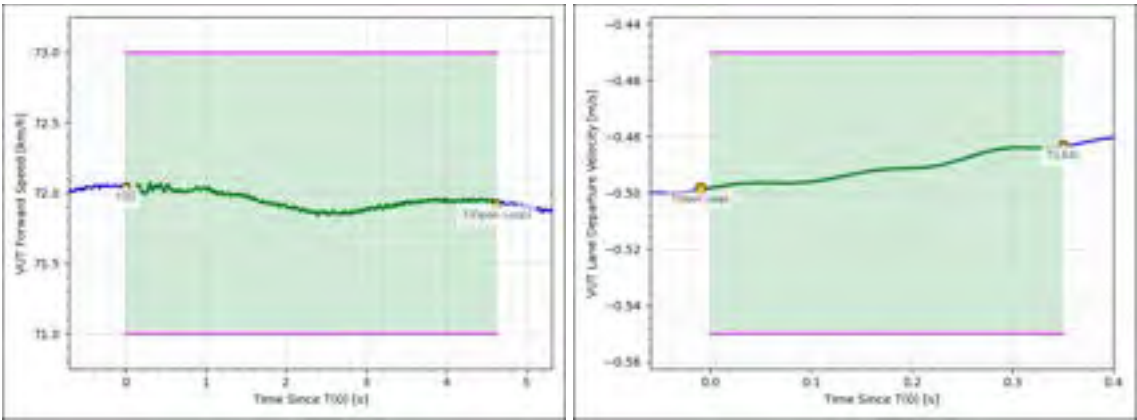
LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 14

Run Date / Time 14-Sep-2023 15:08



LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 15

Run Date / Time 14-Sep-2023 15:11



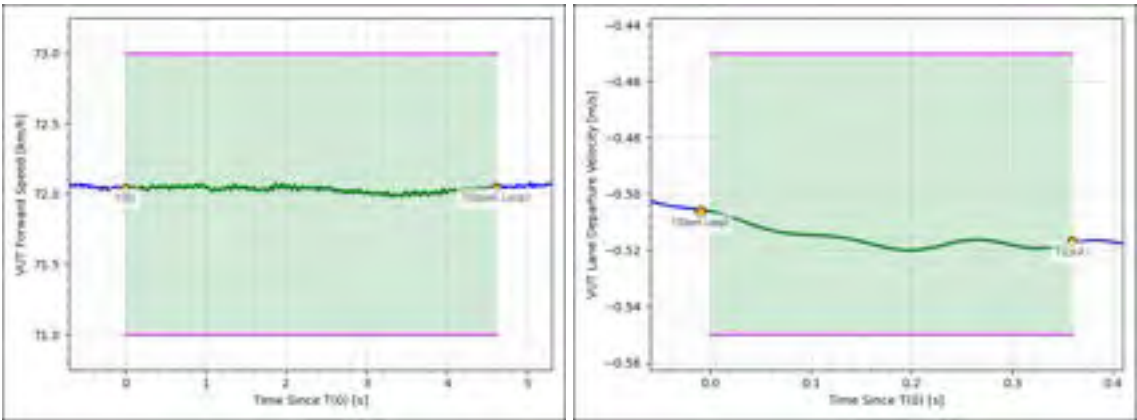
F.8. Black Antenna

F.8.1. SLN-D

F.8.1.1. 0.5 m/s

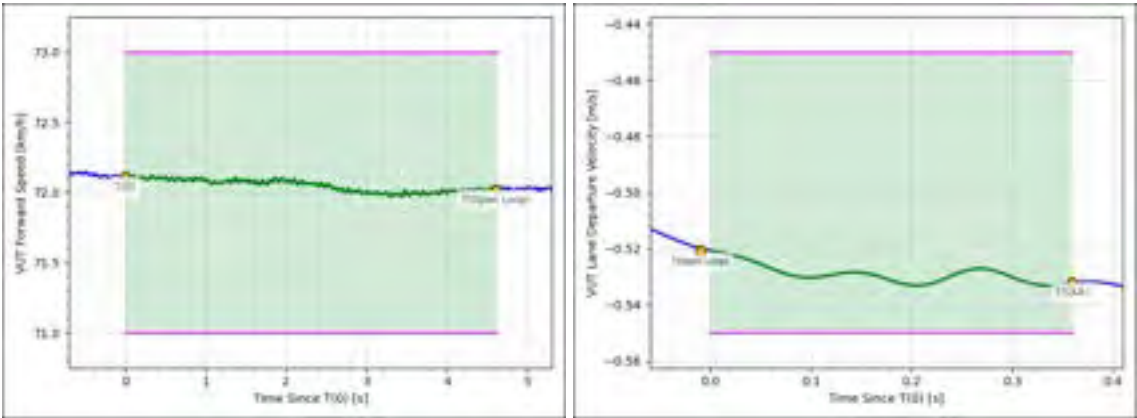
LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 11

Run Date / Time 14-Sep-2023 14:15



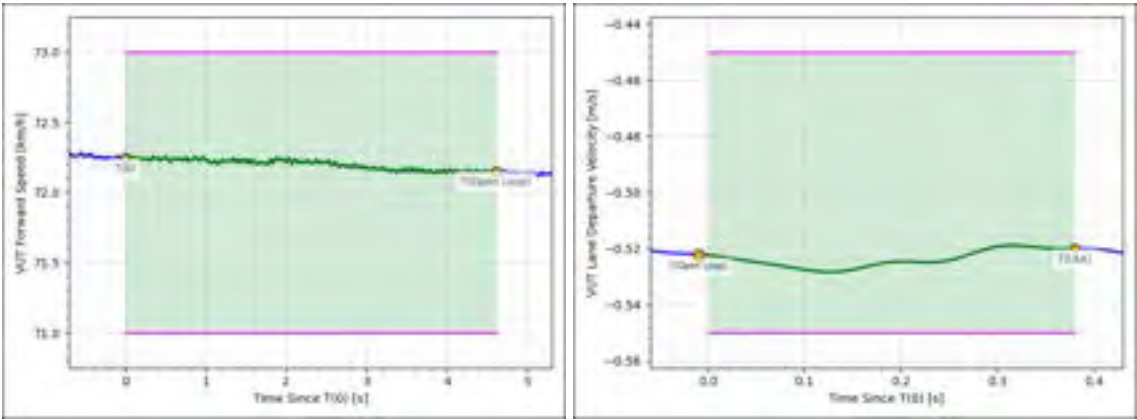
LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 12

Run Date / Time 14-Sep-2023 14:17



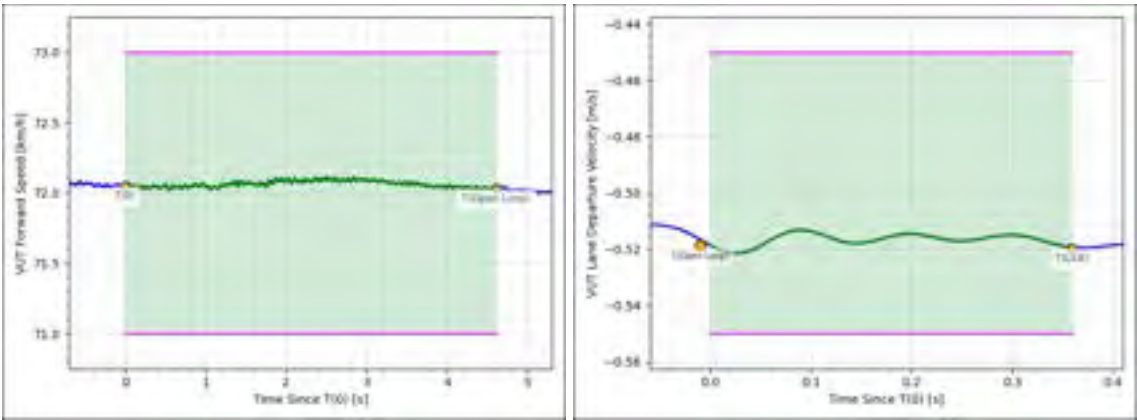
LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 14

Run Date / Time 14-Sep-2023 14:22



LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 15

Run Date / Time 14-Sep-2023 14:24

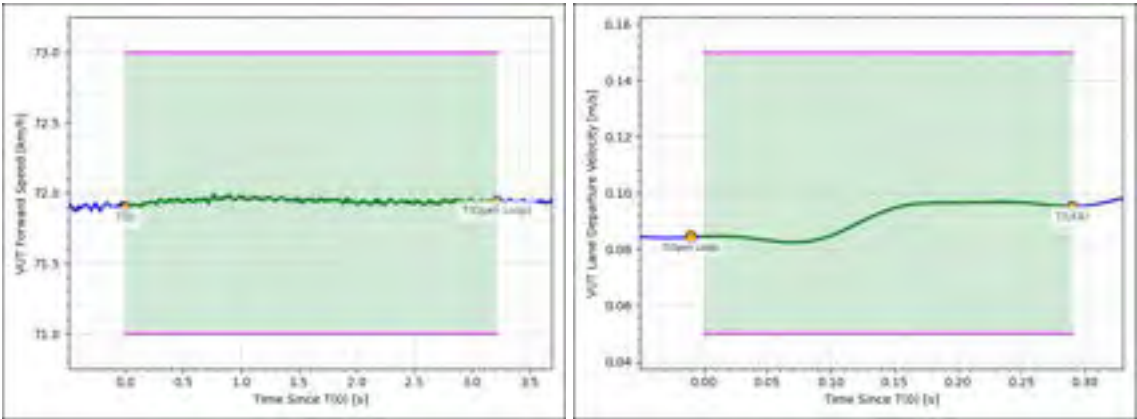


F.8.2. SLN-P

F.8.2.1. 0.1 m/s

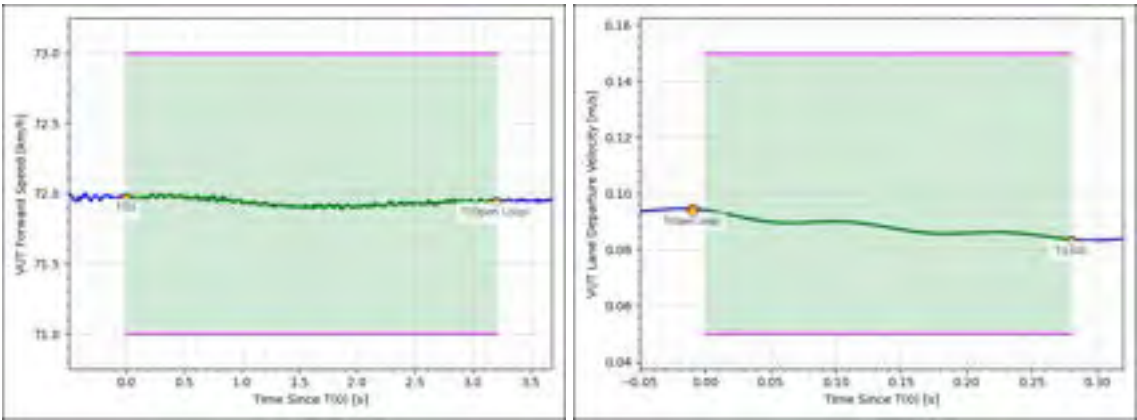
LKA SLN-P 0.1 mps Main | 0.1 m/s | Run 19

Run Date / Time 13-Sep-2023 13:57



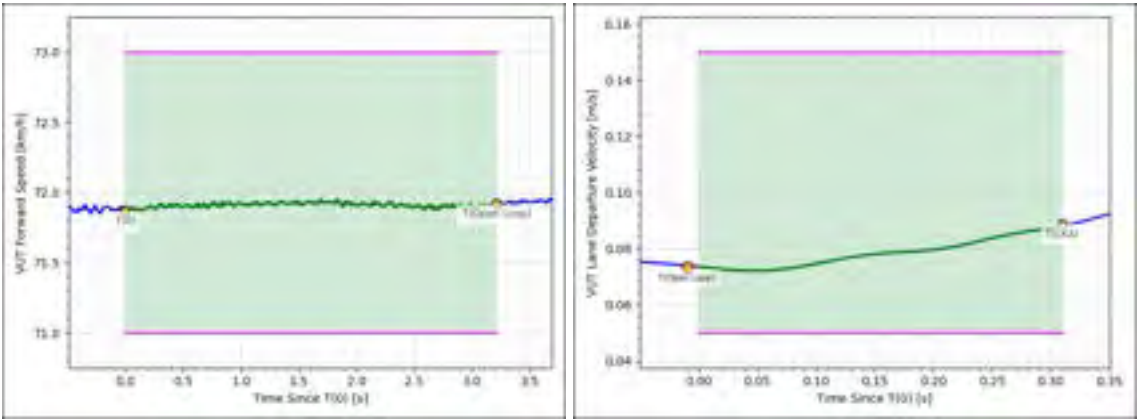
LKA SLN-P 0.1 mps Main | 0.1 m/s | Run 21

Run Date / Time 13-Sep-2023 14:05



LKA SLN-P 0.1 mps Main | 0.1 m/s | Run 23

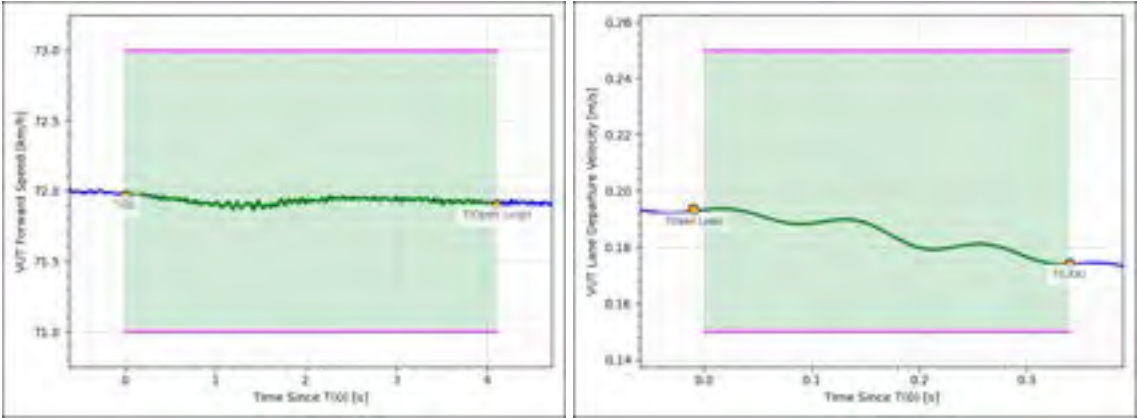
Run Date / Time 13-Sep-2023 14:11



F.8.2.2. 0.2 m/s

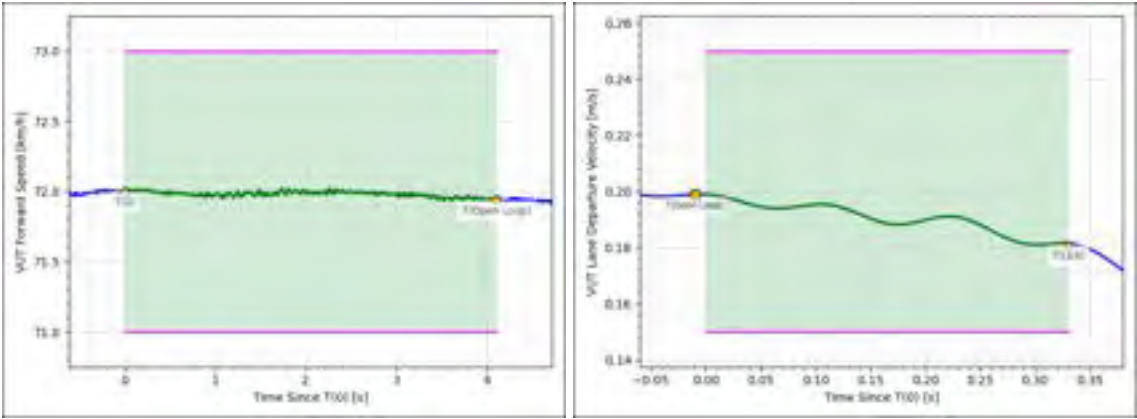
LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 4

Run Date / Time 12-Sep-2023 11:40



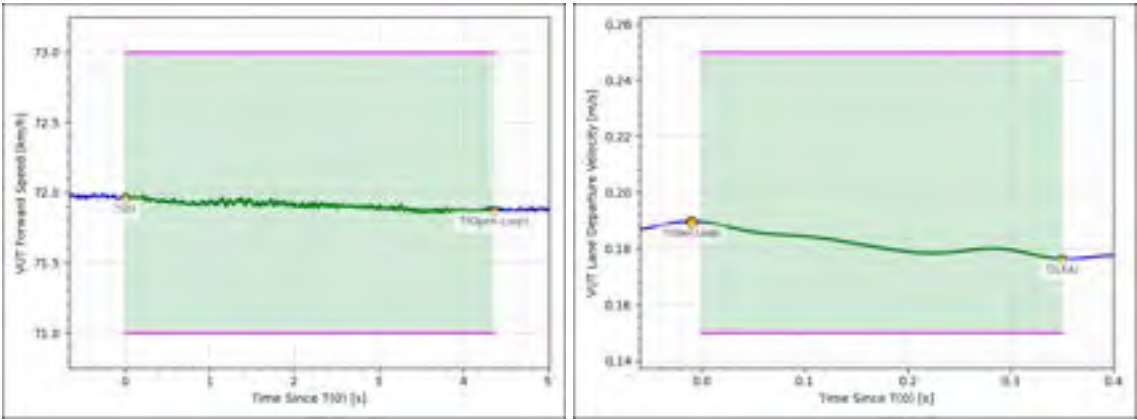
LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 5

Run Date / Time 12-Sep-2023 11:43



LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 6

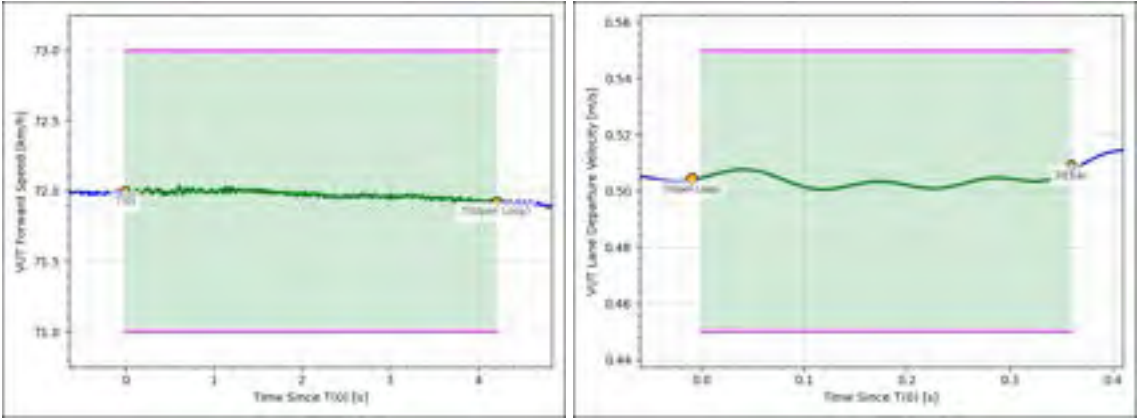
Run Date / Time 12-Sep-2023 11:47



F.8.2.3. 0.5 m/s

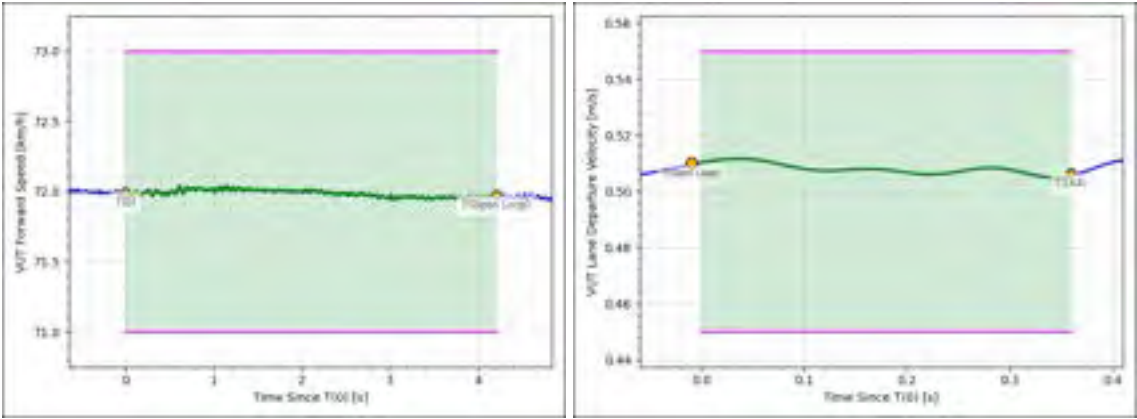
LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 18

Run Date / Time 12-Sep-2023 11:27



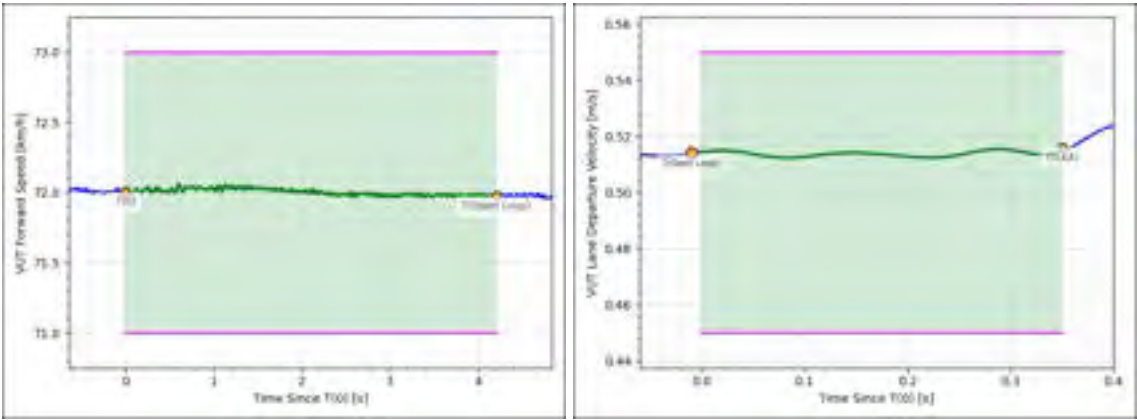
LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 19

Run Date / Time 12-Sep-2023 11:30



LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 20

Run Date / Time 12-Sep-2023 11:32

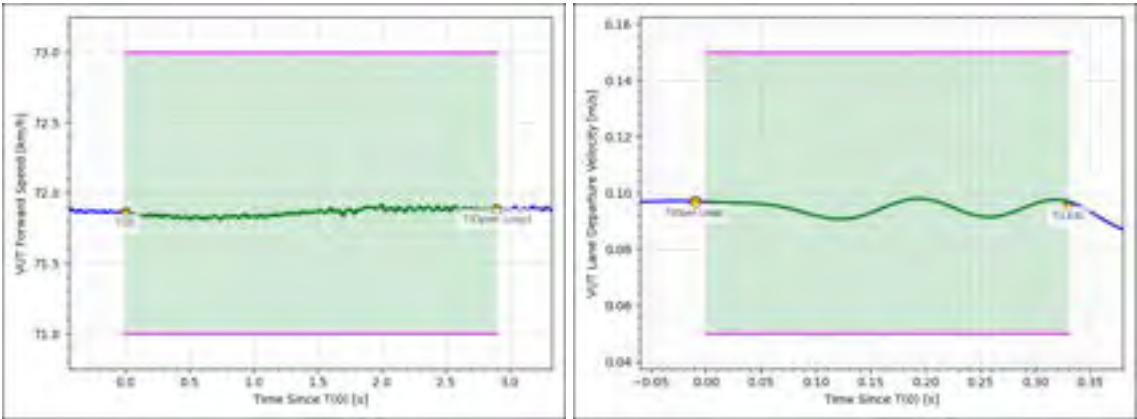


F.8.3. DLN-P

F.8.3.1. 0.1 m/s

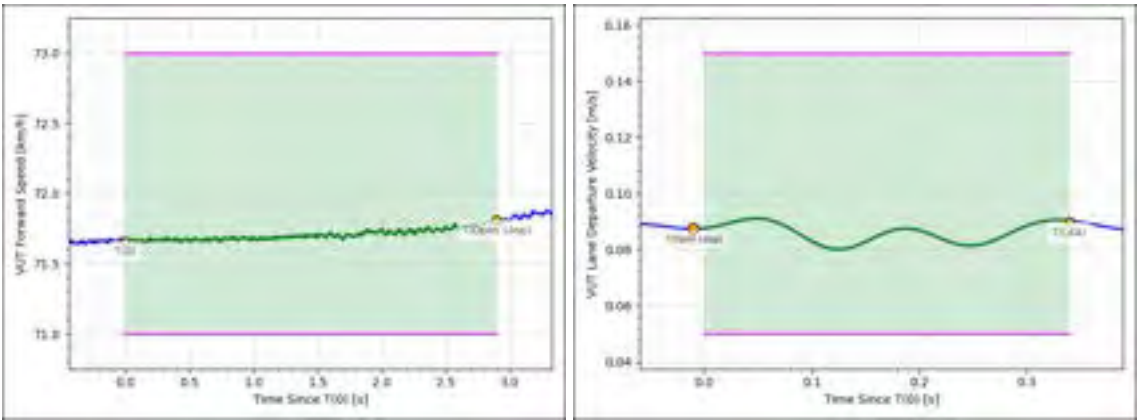
LKA DLN-P 0.1 mps Main | 0.1 m/s | Run 1

Run Date / Time 12-Sep-2023 14:37



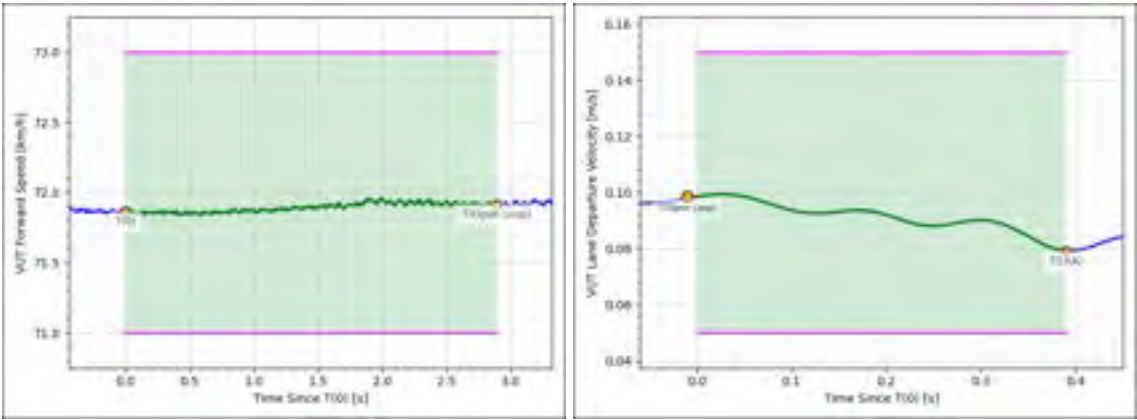
LKA DLN-P 0.1 mps Main | 0.1 m/s | Run 2

Run Date / Time 12-Sep-2023 14:42



LKA DLN-P 0.1 mps Main | 0.1 m/s | Run 3

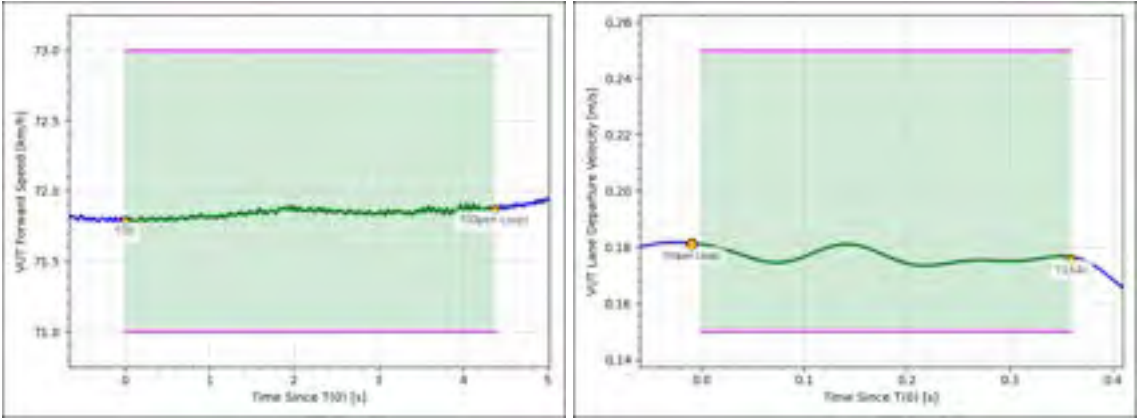
Run Date / Time 12-Sep-2023 14:45



F.8.3.2. 0.2 m/s

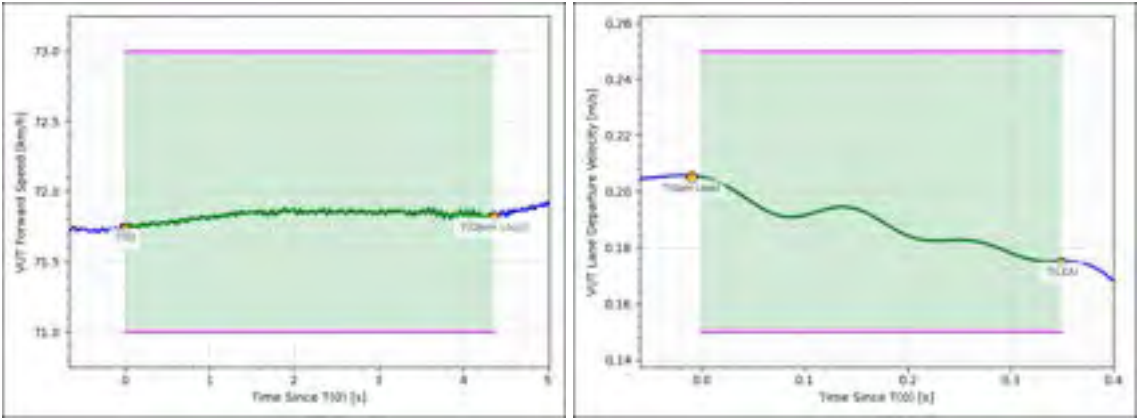
LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 5

Run Date / Time 13-Sep-2023 11:16



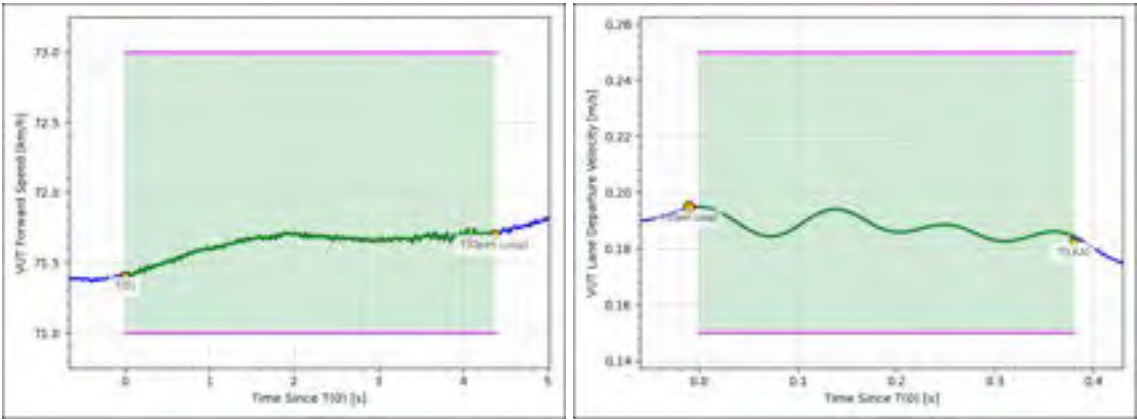
LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 6

Run Date / Time 13-Sep-2023 11:17



LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 7

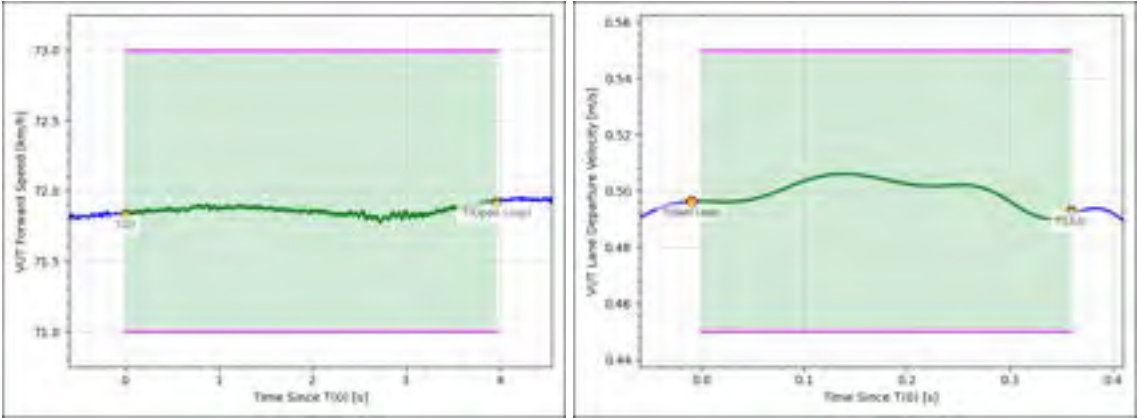
Run Date / Time 13-Sep-2023 11:20



F.8.3.3. 0.5 m/s

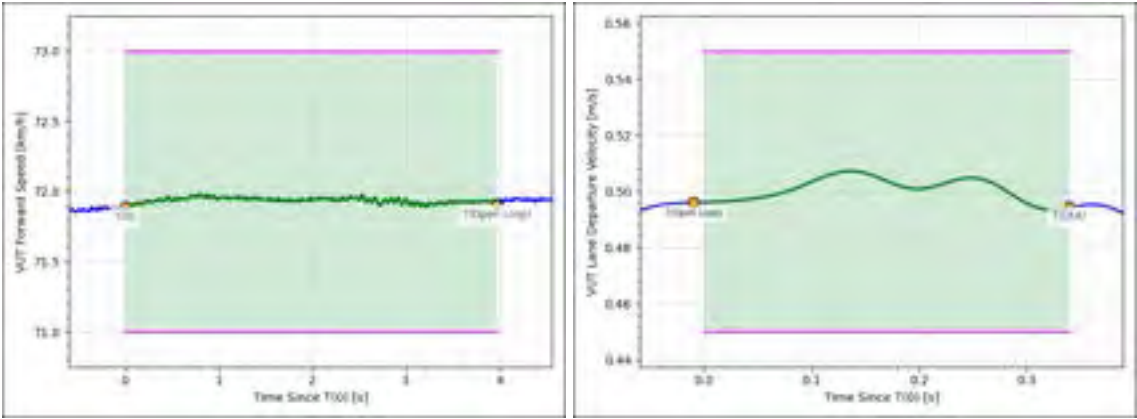
LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 12

Run Date / Time 12-Sep-2023 13:59



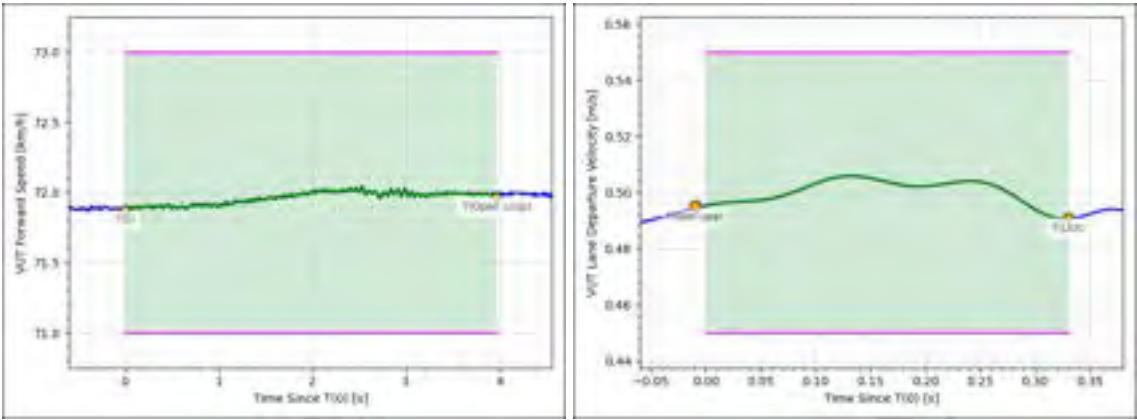
LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 13

Run Date / Time 12-Sep-2023 14:03



LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 14

Run Date / Time 12-Sep-2023 14:05

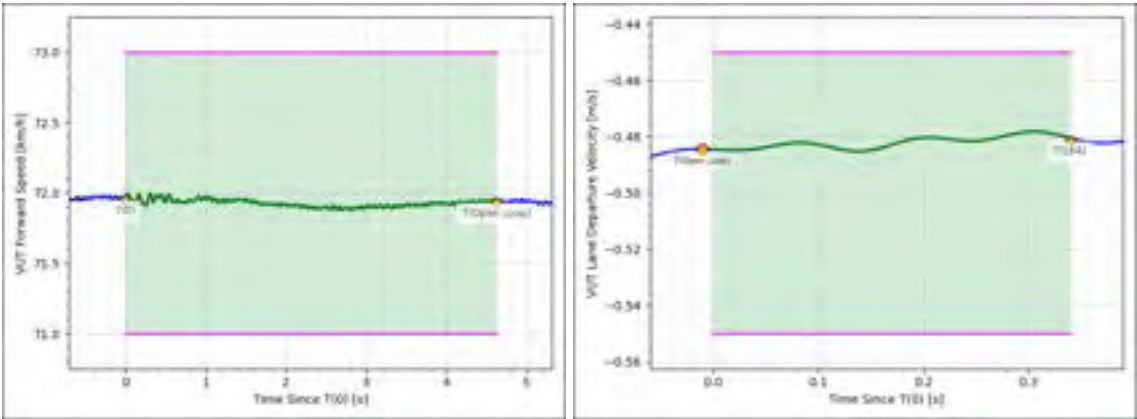


F.8.4. DLN-D

F.8.4.1. 0.5 m/s

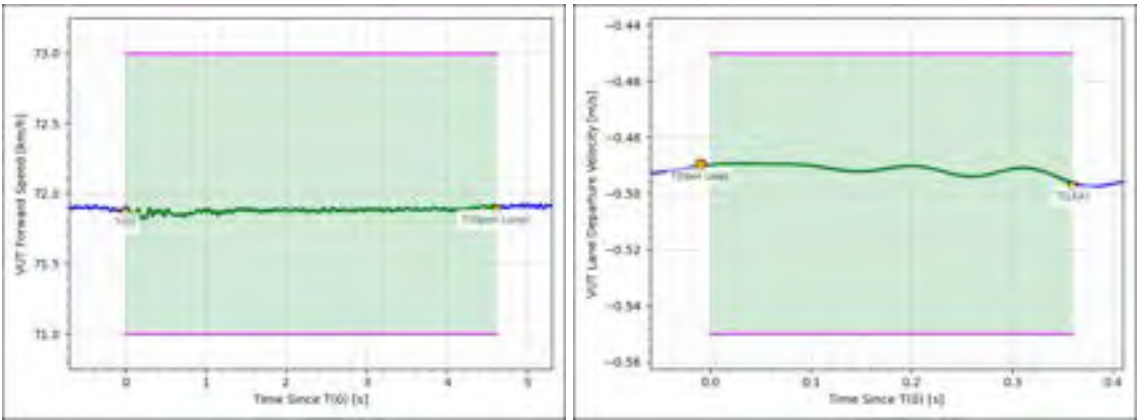
LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 6

Run Date / Time 14-Sep-2023 14:43



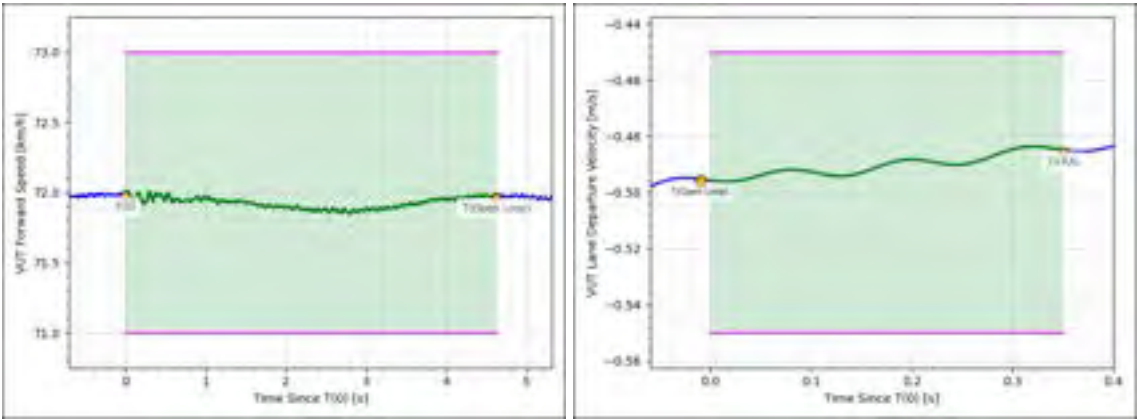
LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 7

Run Date / Time 14-Sep-2023 14:45



LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 8

Run Date / Time 14-Sep-2023 14:46



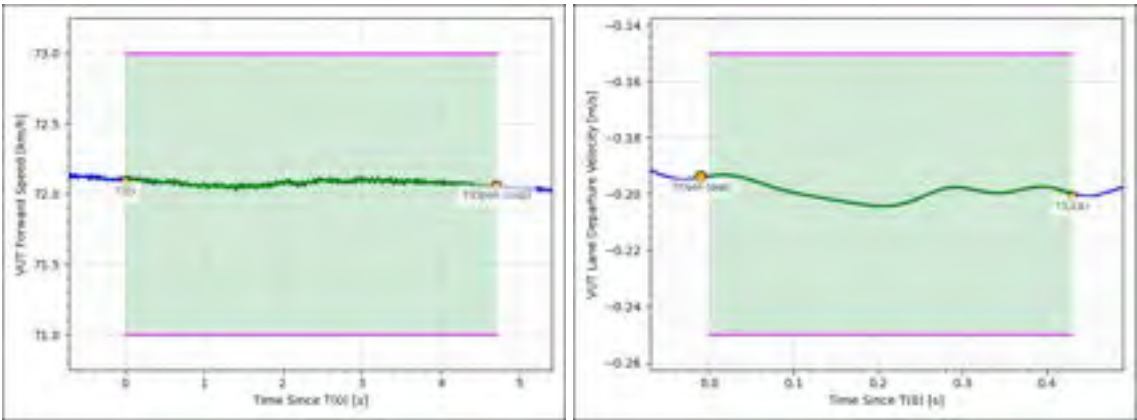
F.9. White Antennas (Night)

F.9.1. SLN-D

F.9.1.1. 0.2 m/s

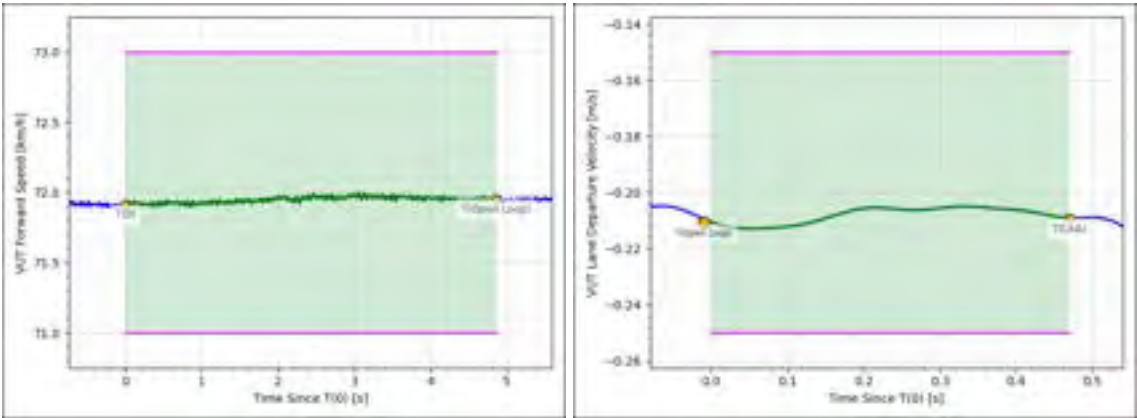
LKA SLN-D 0.2 mps Main | 0.2 m/s | Run 7

Run Date / Time 21-Sep-2023 20:24



LKA SLN-D 0.2 mps Main | 0.2 m/s | Run 9

Run Date / Time 21-Sep-2023 20:32

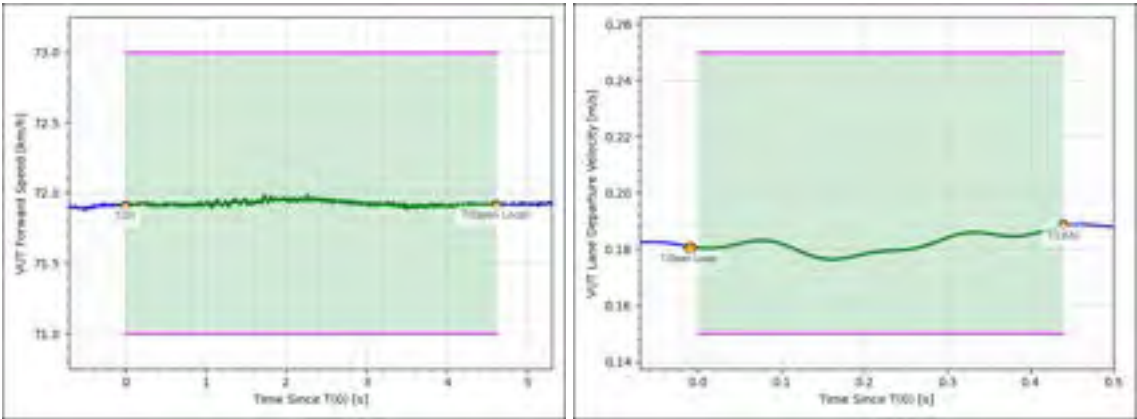


F.9.2. SLN-P

F.9.2.1. 0.2 m/s

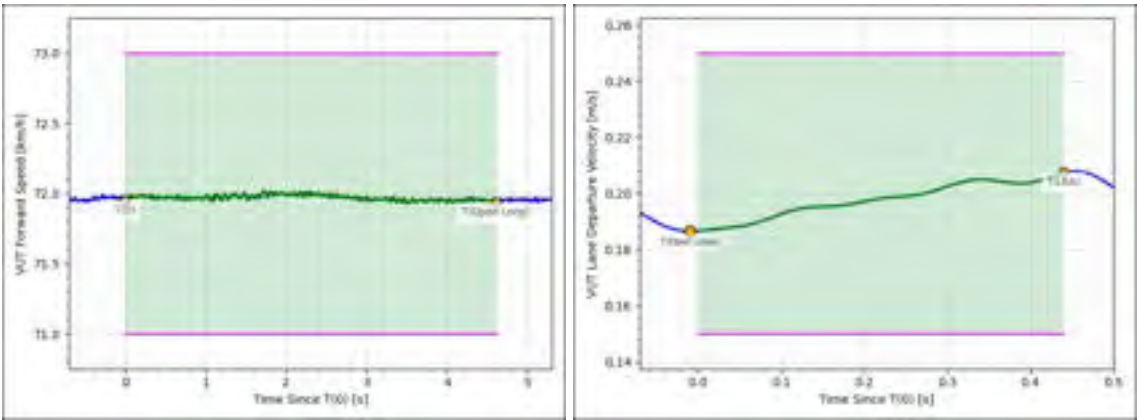
LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 14

Run Date / Time 21-Sep-2023 19:13



LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 15

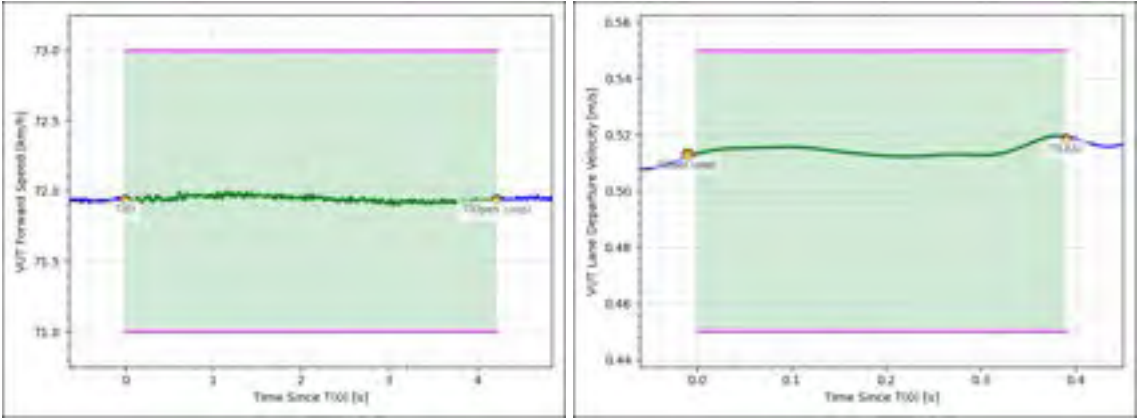
Run Date / Time 21-Sep-2023 19:15



F.9.2.2. 0.5 m/s

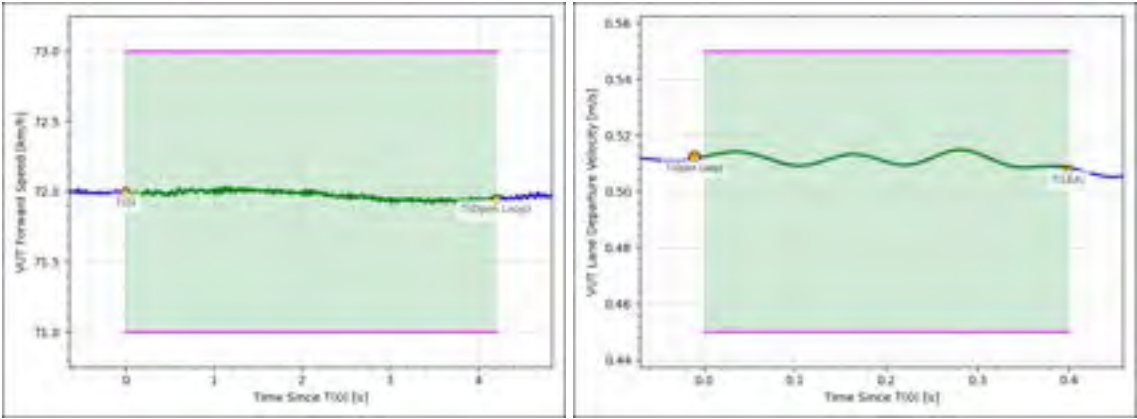
LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 21

Run Date / Time 21-Sep-2023 19:18



LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 22

Run Date / Time 21-Sep-2023 19:20

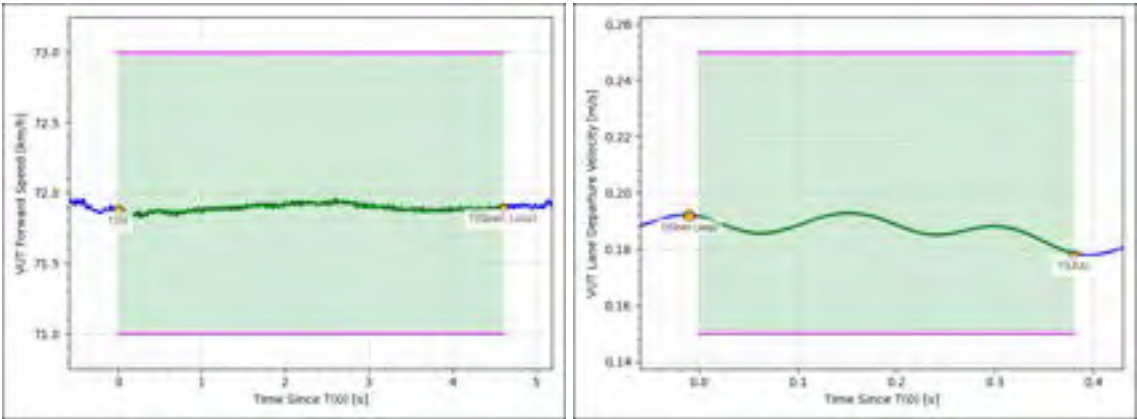


F.9.3. DLN-P

F.9.3.1. 0.2 m/s

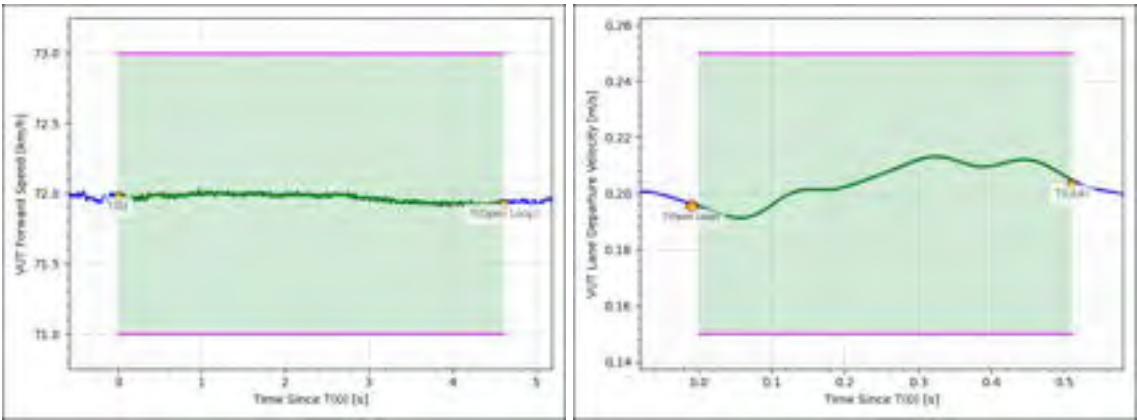
LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 14

Run Date / Time 21-Sep-2023 19:28



LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 18

Run Date / Time 21-Sep-2023 20:09

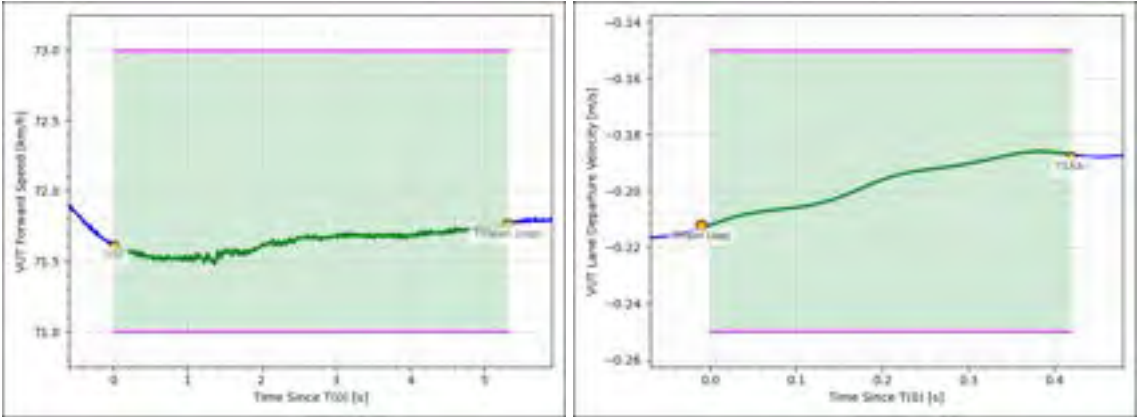


F.9.4. DLN-D

F.9.4.1. 0.2 m/s

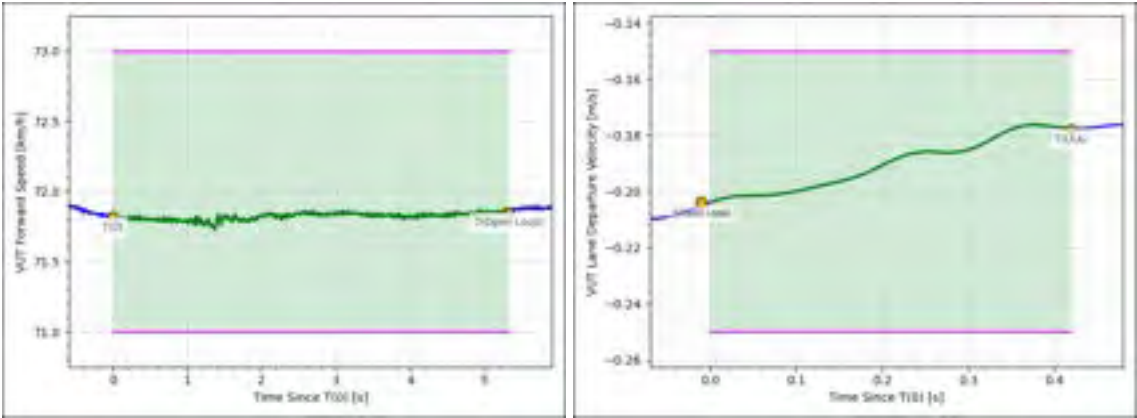
LKA DLN-D 0.2 mps Main | 0.2 m/s | Run 5

Run Date / Time 21-Sep-2023 20:41



LKA DLN-D 0.2 mps Main | 0.2 m/s | Run 6

Run Date / Time 21-Sep-2023 20:45



APPENDIX G

Ford Ranger Car-to-Car Results Validity

G.Ranger Car to Car Results Validity

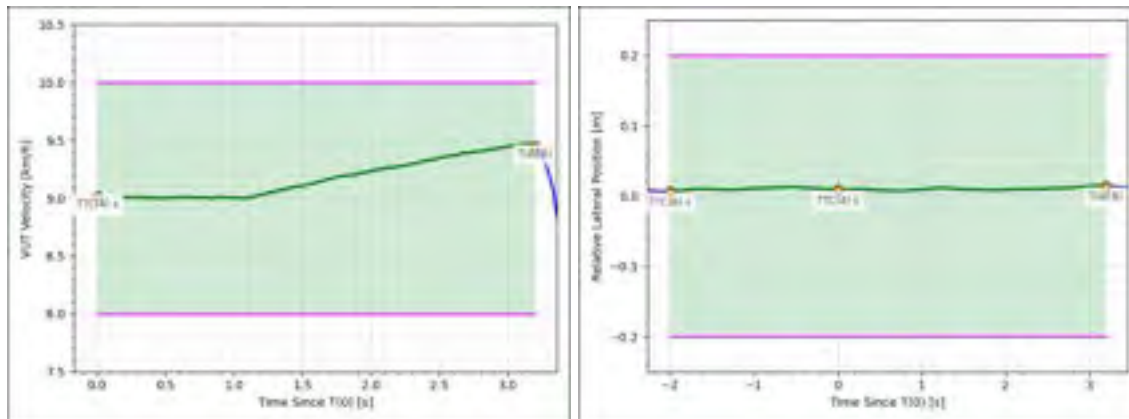
G.1.Car-to-Car Rear Stationary

G.1.1. Baseline

G.1.1.1. AEB CCRs 10 kph +100 %

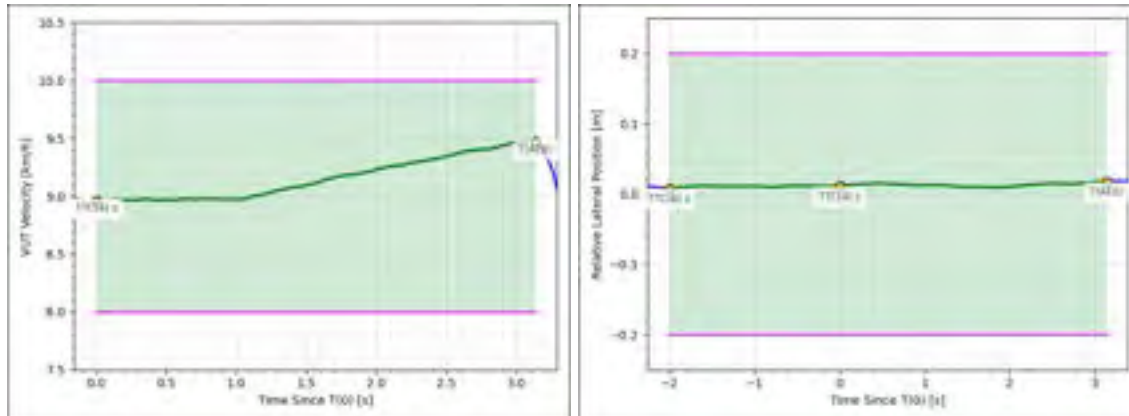
AEB CCRs | 10 km/h 100 % | Run 1

Run Date / Time 23-Jan-2023 13:26



AEB CCRs | 10 km/h 100 % | Run 2

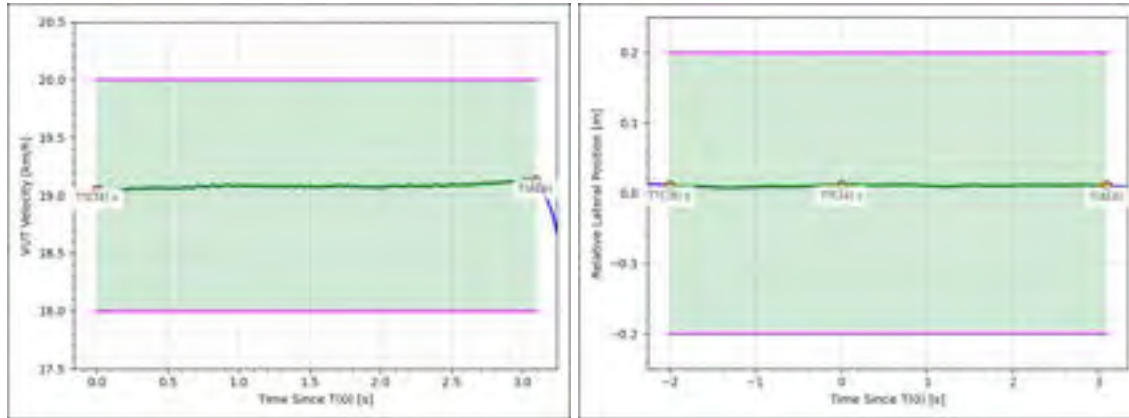
Run Date / Time 23-Jan-2023 13:29



G.1.1.2. AEB CCRs 20 kph +100 %

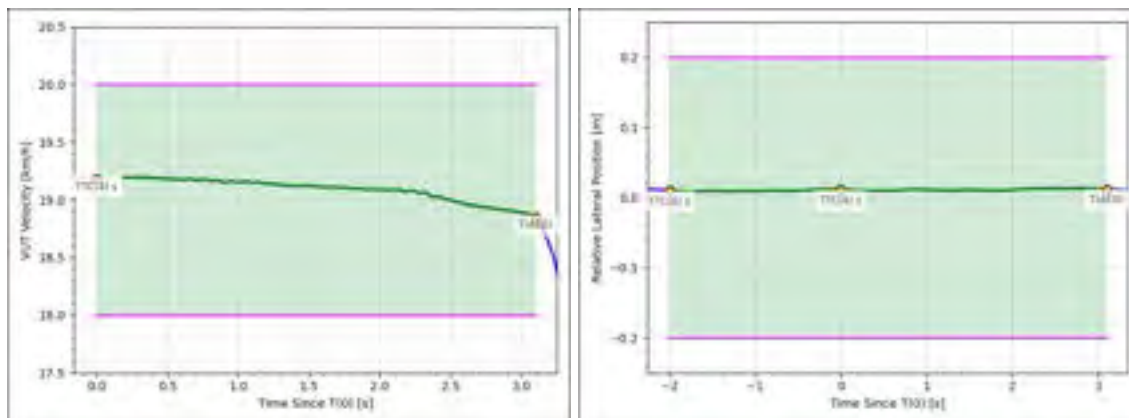
AEB CCRs | 20 km/h +100 % | Run 1

Run Date / Time 23-Jan-2023 13:33



AEB CCRs | 20 km/h +100 % | Run 2

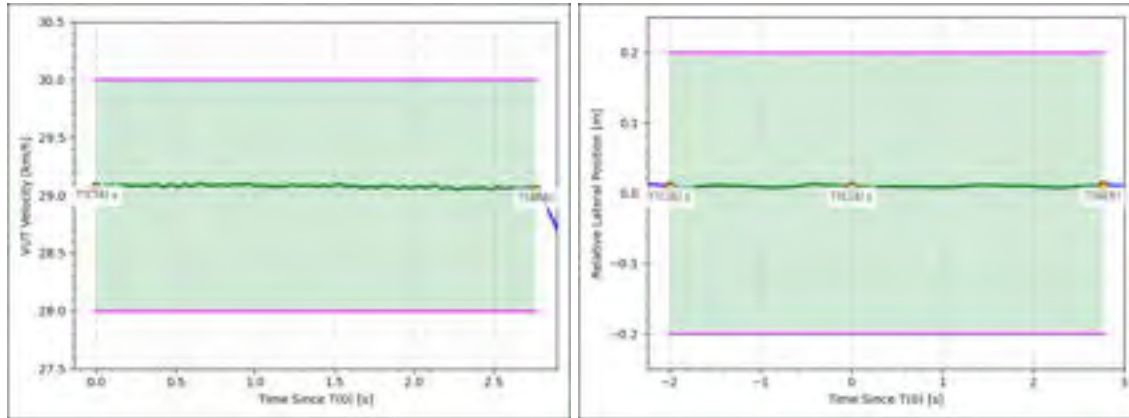
Run Date / Time 23-Jan-2023 13:35



G.1.1.3. AEB CCRs 30 kph +100 %

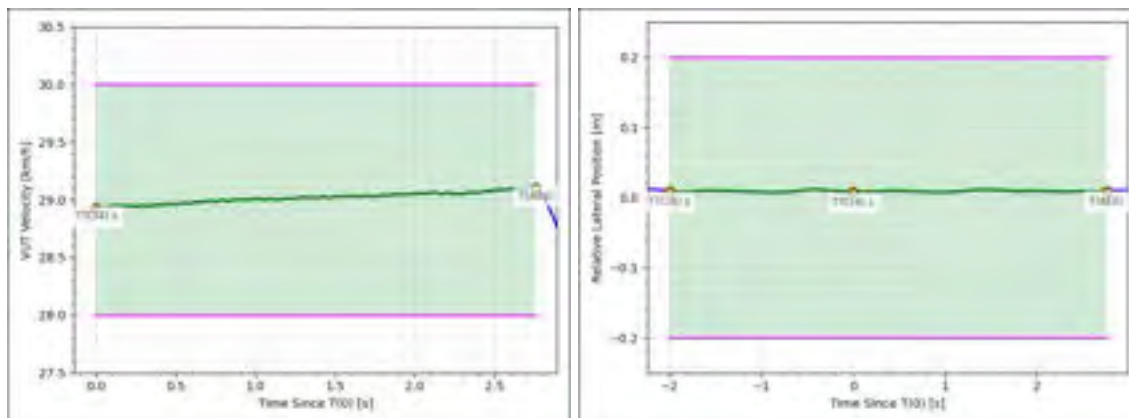
AEB CCRs | 30 km/h +100 % | Run 1

Run Date / Time 23-Jan-2023 13:38



AEB CCRs | 30 km/h +100 % | Run 2

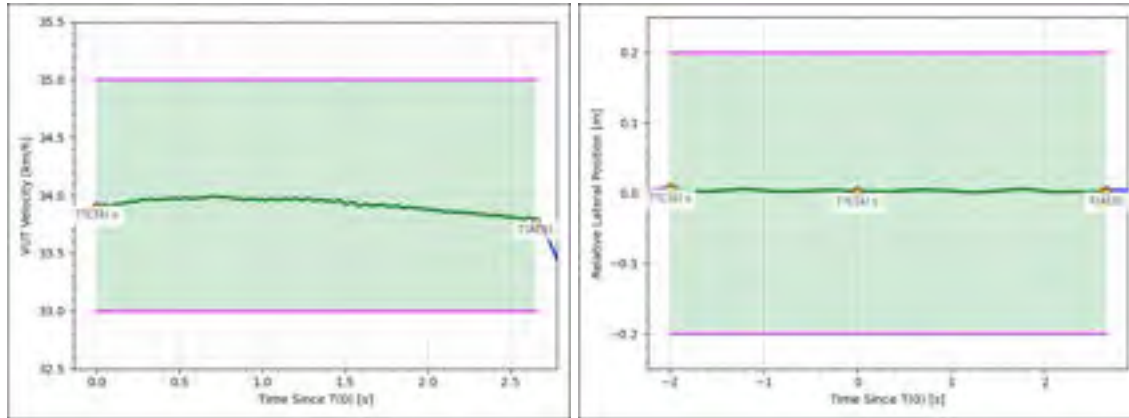
Run Date / Time 23-Jan-2023 13:40



G.1.1.1. AEB CCRs 35 kph +100 %

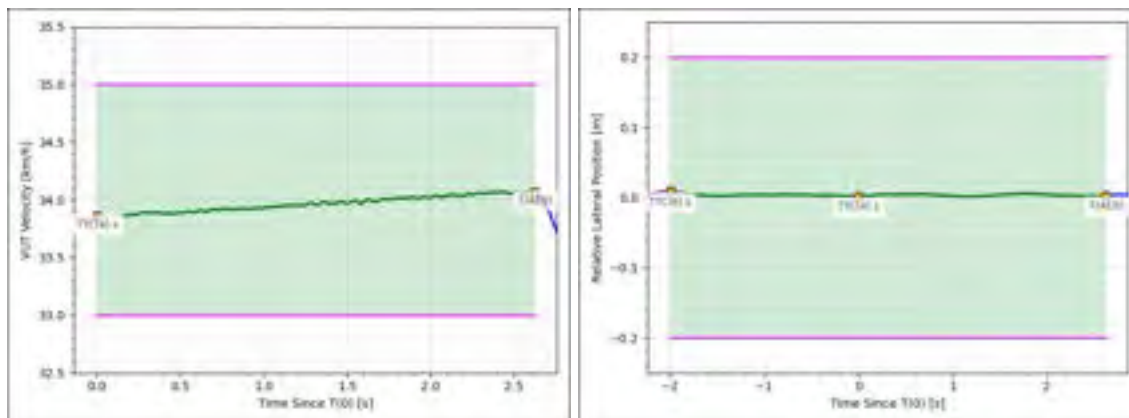
AEB CCRs | 35 km/h +100 % | Run 1

Run Date / Time 23-Jan-2023 14:06



AEB CCRs | 35 km/h +100 % | Run 2

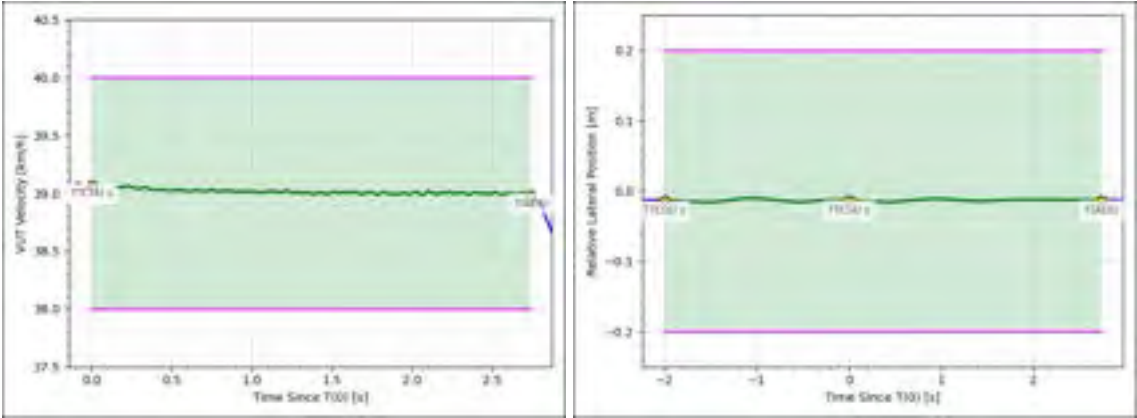
Run Date / Time 23-Jan-2023 14:09



G.1.1.2. AEB CCRs 40 kph -50 %

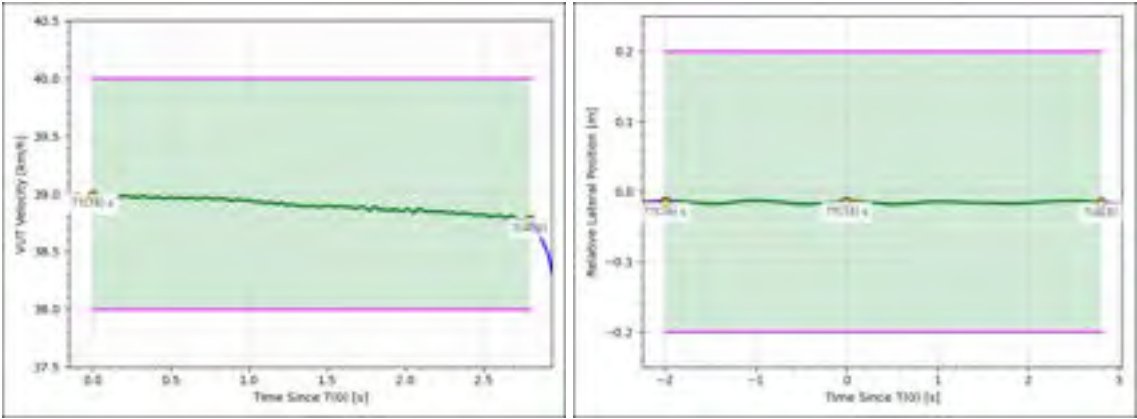
AEB CCRs | 40 km/h -50 % | Run 1

Run Date / Time 23-Jan-2023 15:24



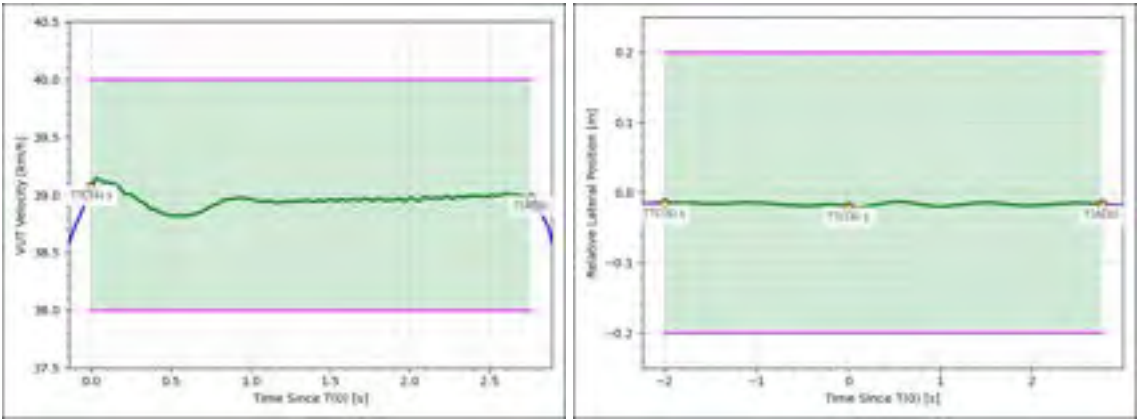
AEB CCRs | 40 km/h -50 % | Run 2

Run Date / Time 23-Jan-2023 15:26



AEB CCRs | 40 km/h -50 % | Run 3

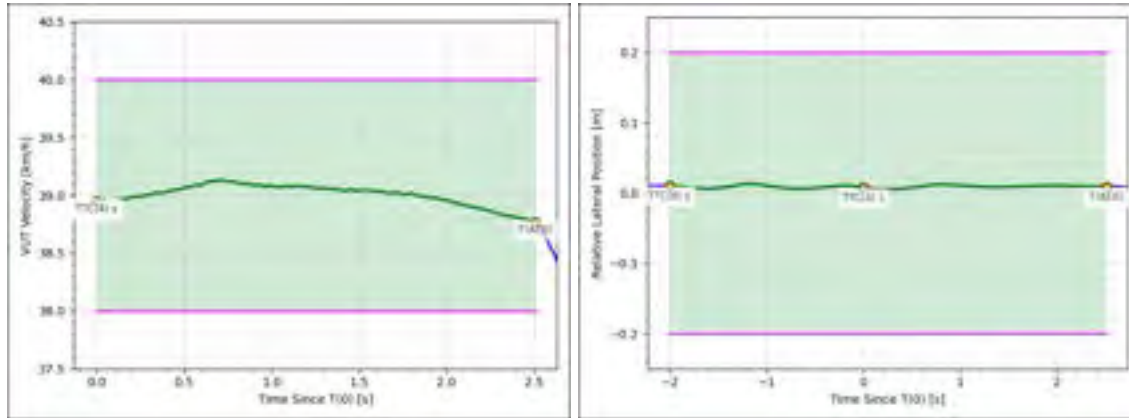
Run Date / Time 23-Jan-2023 15:30



G.1.1.3. AEB CCRs 40 kph +100 %

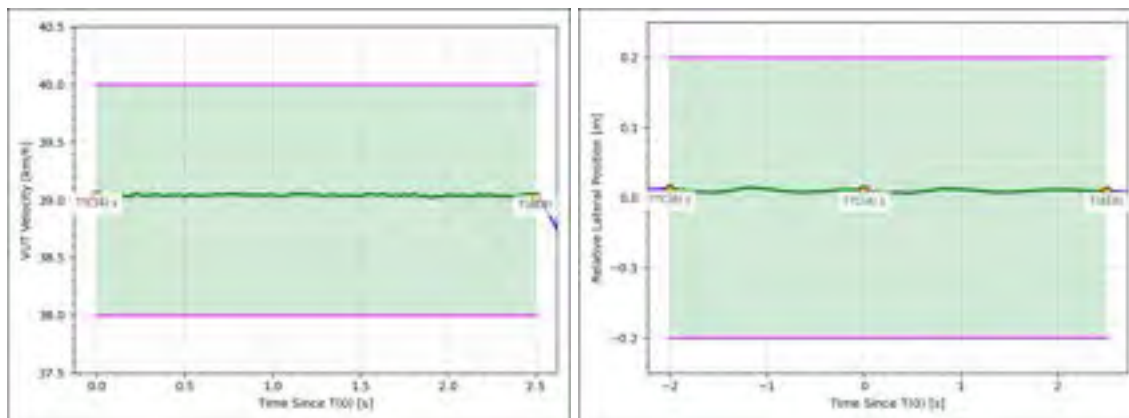
AEB CCRs | 40 km/h +100 % | Run 1

Run Date / Time 23-Jan-2023 13:44



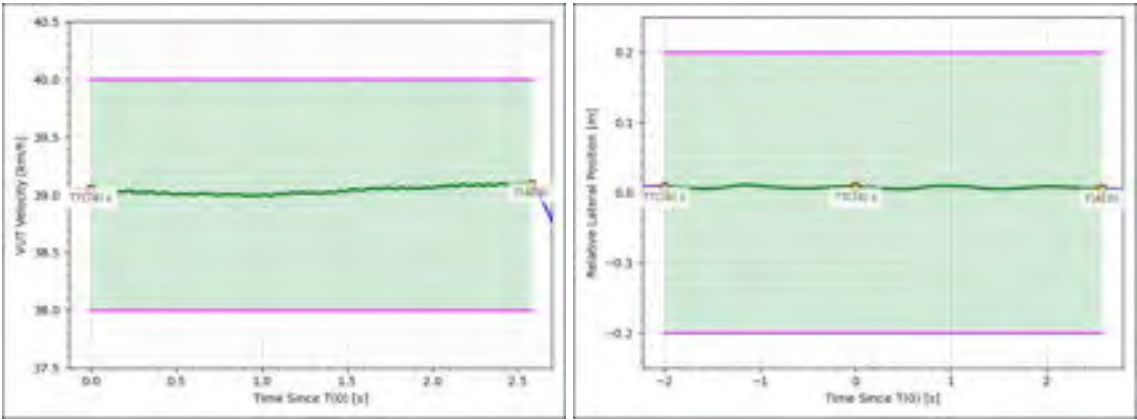
AEB CCRs | 40 km/h +100 % | Run 2

Run Date / Time 23-Jan-2023 13:47



AEB CCRs | 40 km/h +100 % | Run 3

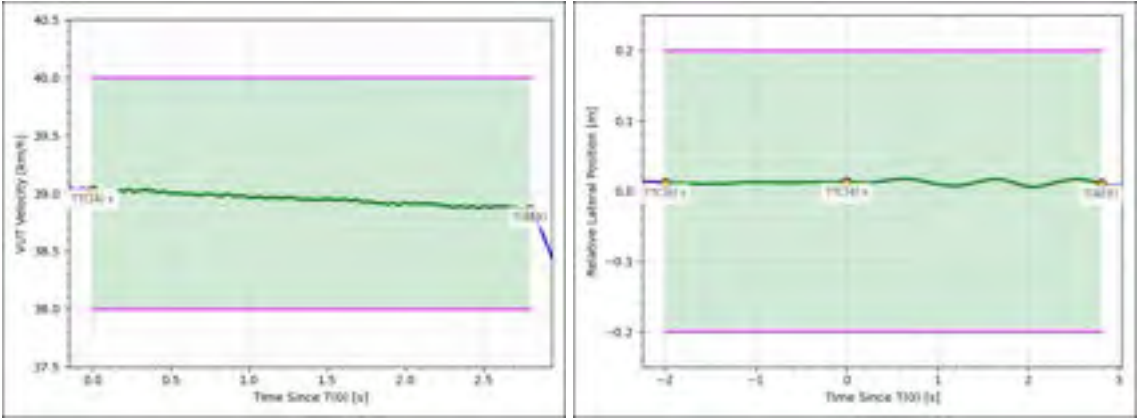
Run Date / Time 23-Jan-2023 13:58



G.1.1.4. AEB CCRs 40 kph +50 %

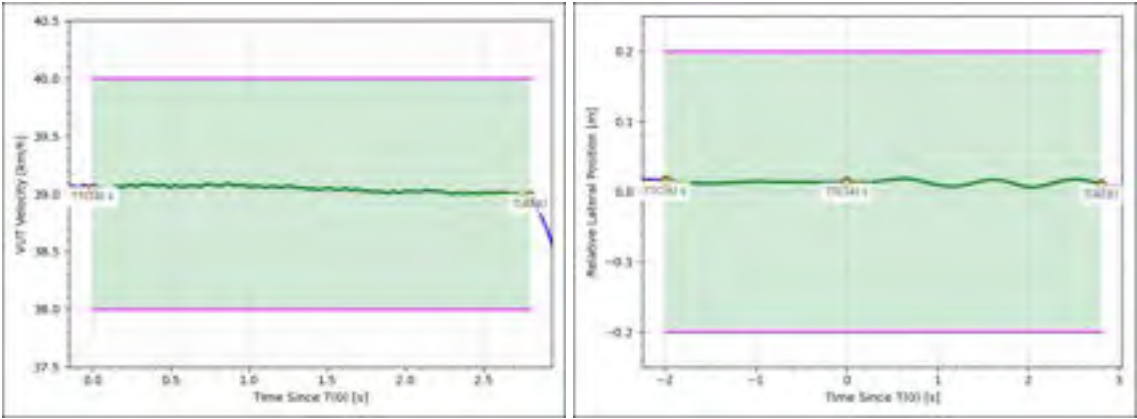
AEB CCRs | 40 km/h +50 % | Run 1

Run Date / Time 23-Jan-2023 15:17



AEB CCRs | 40 km/h +50 % | Run 2

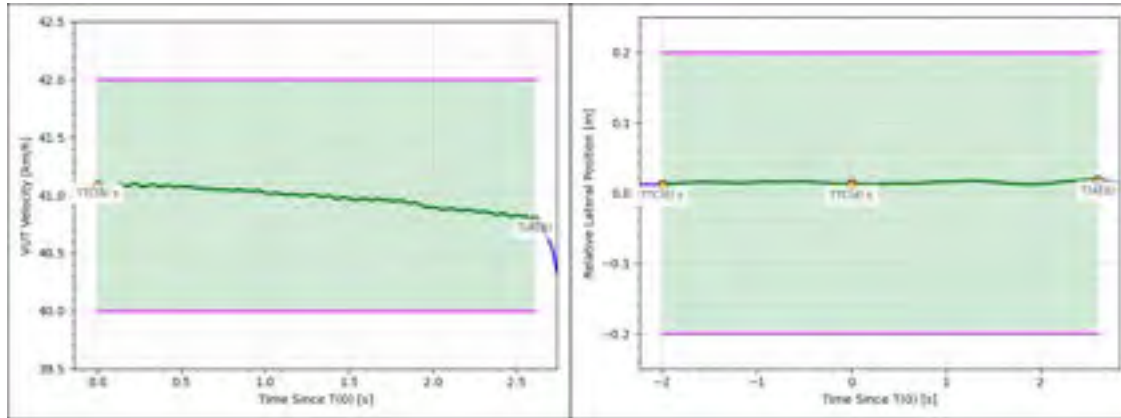
Run Date / Time 23-Jan-2023 15:19



G.1.1.5. AEB CCRs 42 kph 100 %

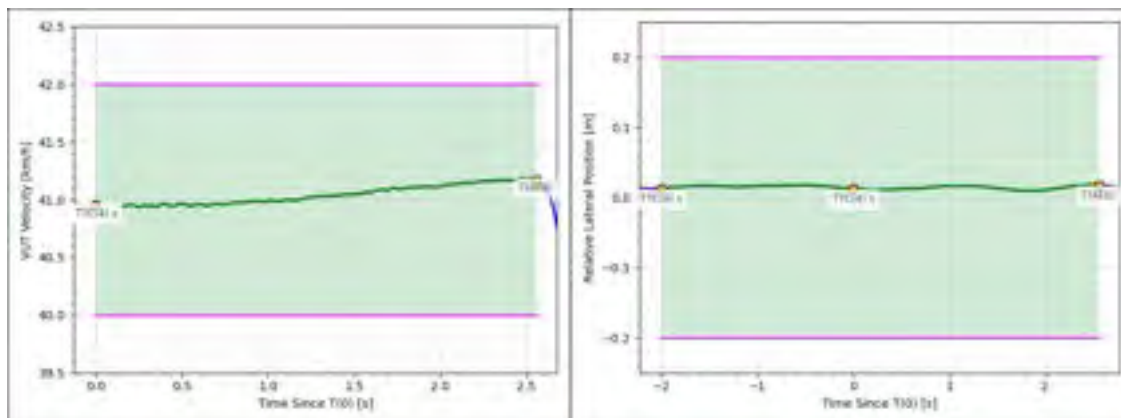
AEB CCRs | 50 km/h -50 % | Run 4

Run Date / Time 7-Feb-2023 14:46



AEB CCRs | 50 km/h -50 % | Run 5

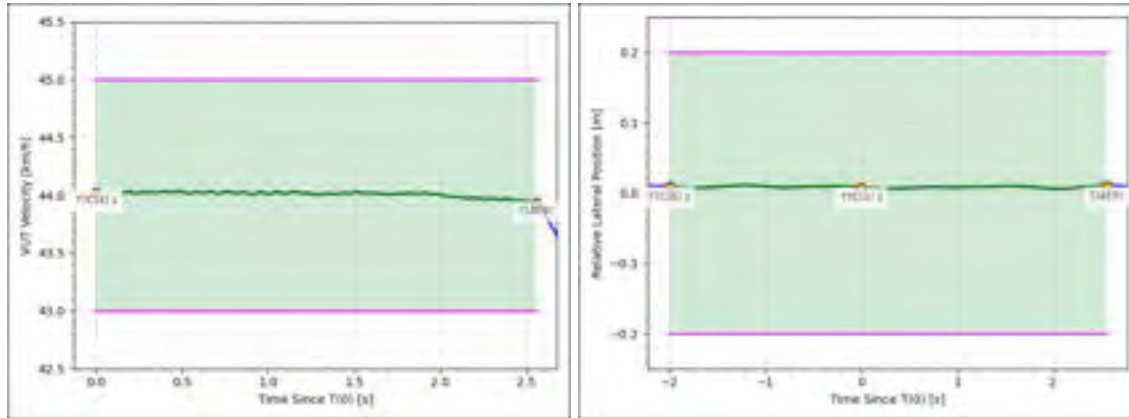
Run Date / Time 7-Feb-2023 14:50



G.1.1.6. AEB CCRs 45 kph +100 %

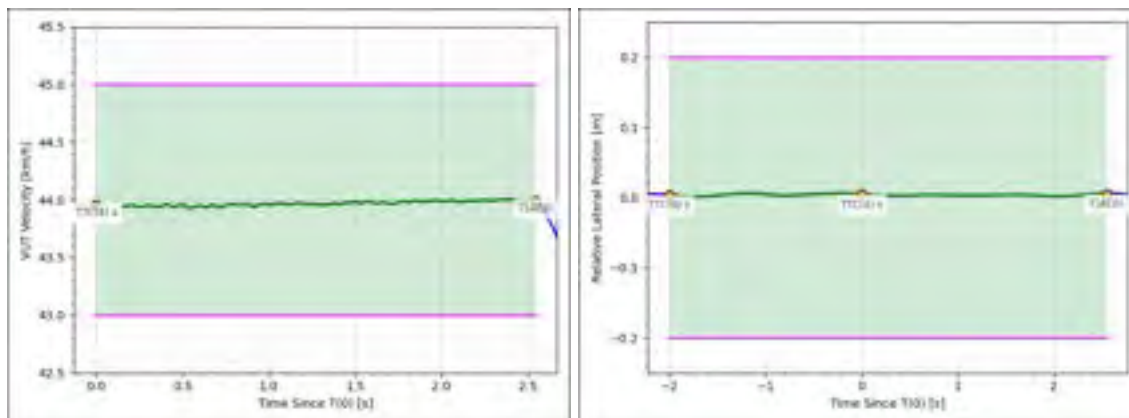
AEB CCRs | 45 km/h +100 % | Run 1

Run Date / Time 23-Jan-2023 14:12



AEB CCRs | 45 km/h +100 % | Run 2

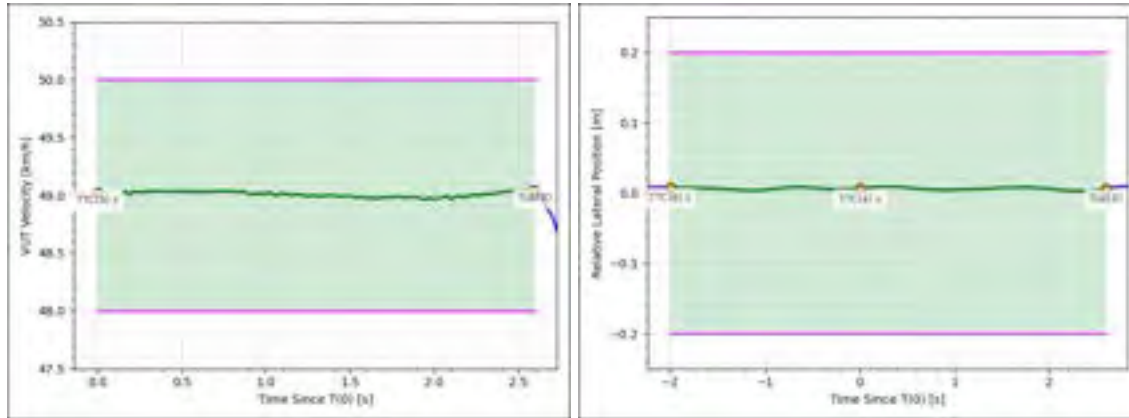
Run Date / Time 23-Jan-2023 14:15



G.1.1.7. AEB CCRs 50 kph +100 %

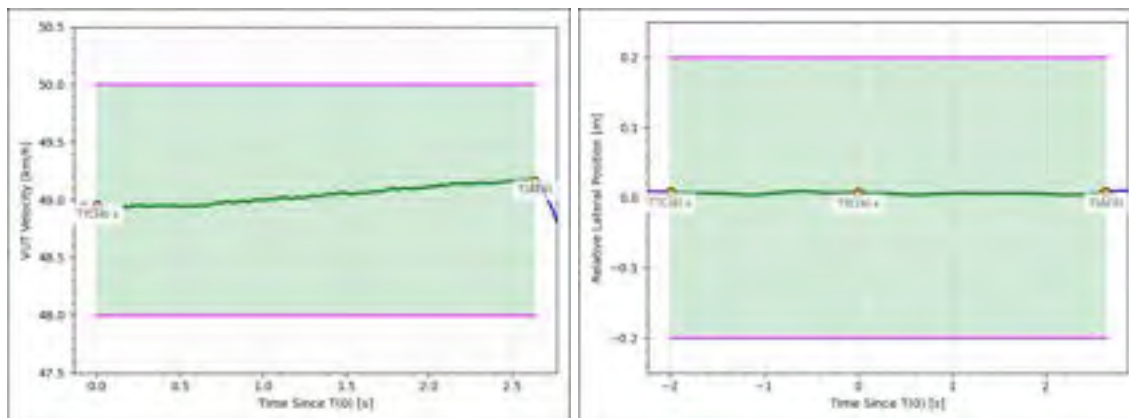
AEB CCRs | 50 km/h +100 % | Run 1

Run Date / Time 23-Jan-2023 14:19



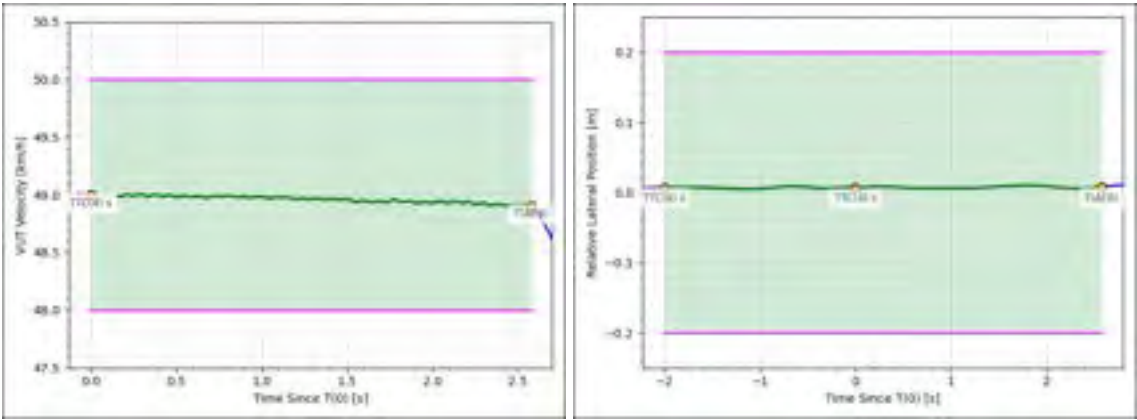
AEB CCRs | 50 km/h +100 % | Run 2

Run Date / Time 23-Jan-2023 14:22



AEB CCRs | 50 km/h +100 % | Run 3

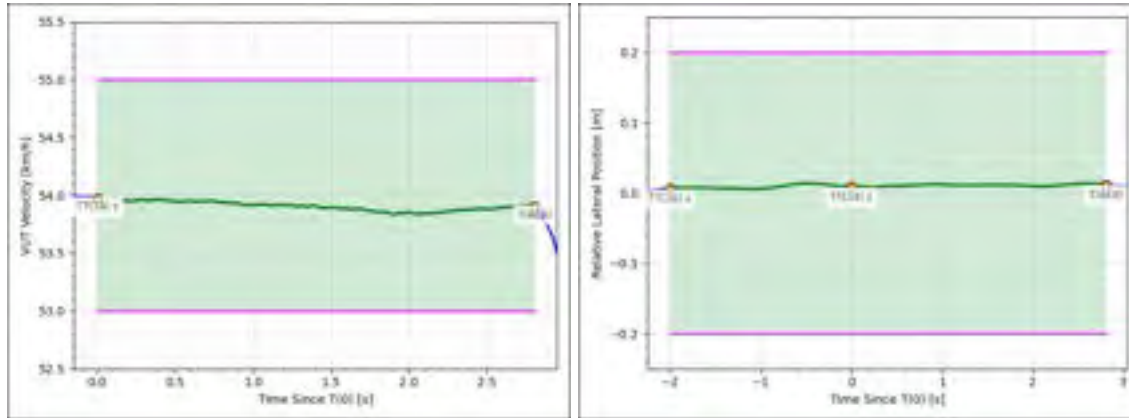
Run Date / Time 23-Jan-2023 14:25



G.1.1.8. AEB CCRs 55 kph +100 %

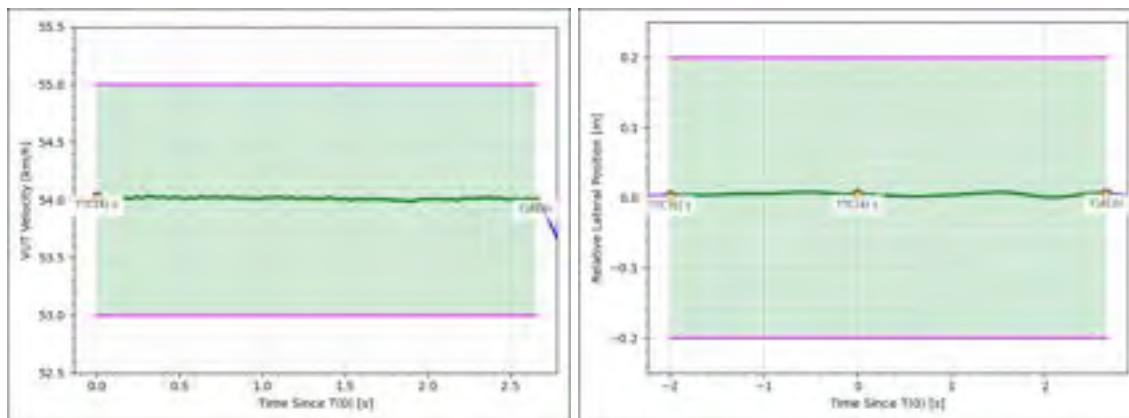
AEB CCRs | 55 km/h +100 % | Run 1

Run Date / Time 23-Jan-2023 14:53



AEB CCRs | 55 km/h +100 % | Run 7

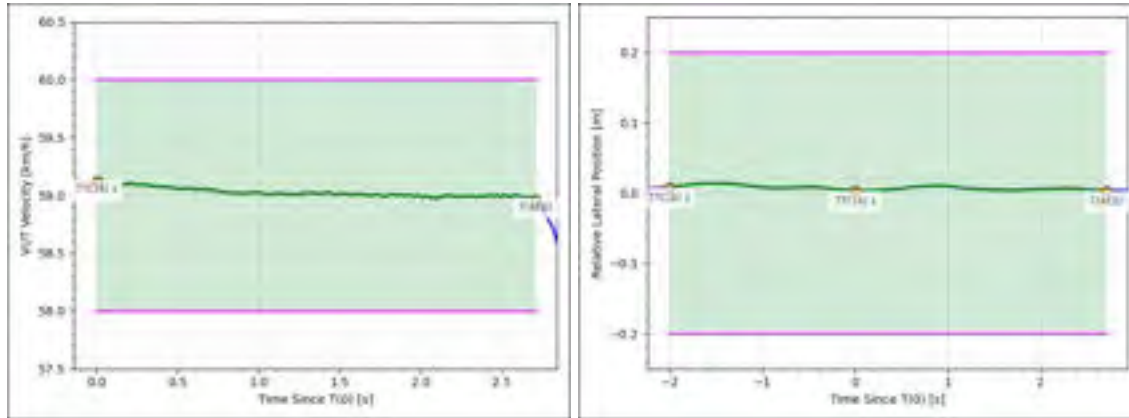
Run Date / Time 24-Jan-2023 11:02



G.1.1.9. AEB CCRs 60 kph +100 %

AEB CCRs | 60 km/h +100 % | Run 1

Run Date / Time 23-Jan-2023 14:30

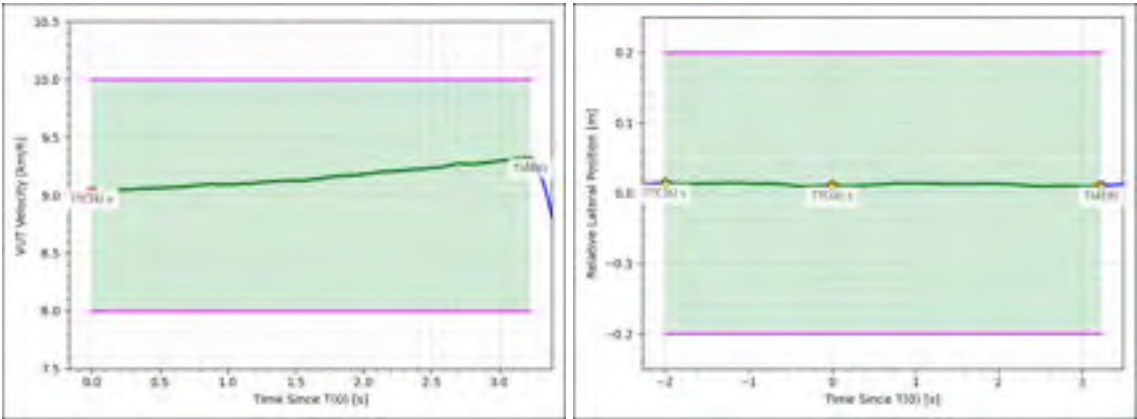


G.1.1. GVM

G.1.1.1. AEB CCRs 10 kph +100 %

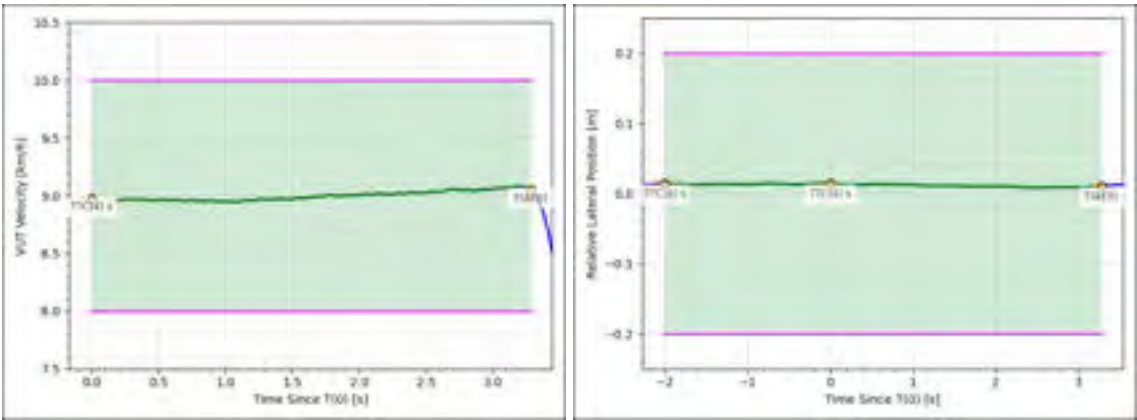
AEB CCRs | 10 km/h 100 % | Run 3

Run Date / Time 2-Feb-2023 14:15



AEB CCRs | 10 km/h 100 % | Run 4

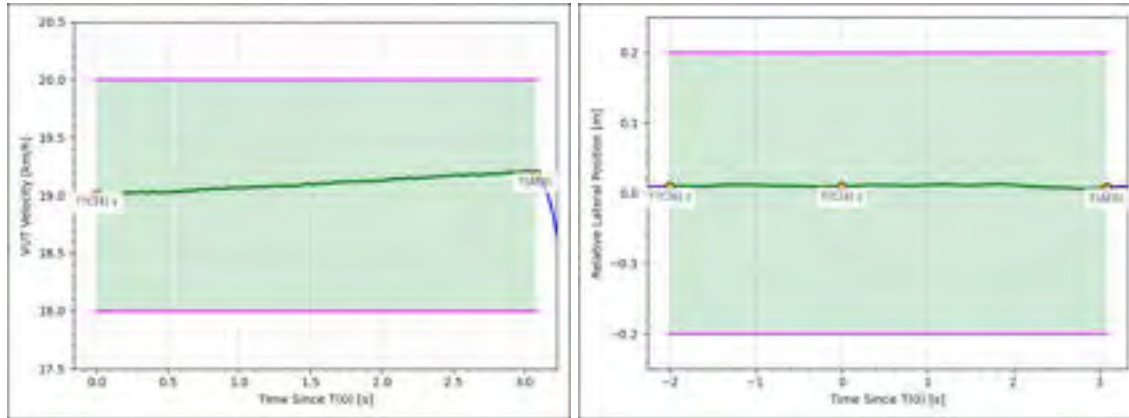
Run Date / Time 2-Feb-2023 14:18



G.1.1.2. AEB CCRs 20 kph +100 %

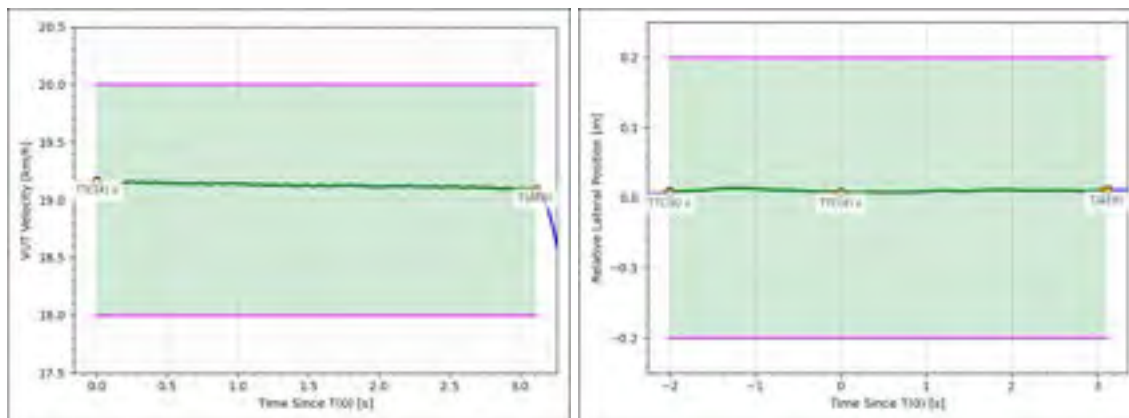
AEB CCRs | 20 km/h +100 % | Run 3

Run Date / Time 2-Feb-2023 14:21



AEB CCRs | 20 km/h +100 % | Run 4

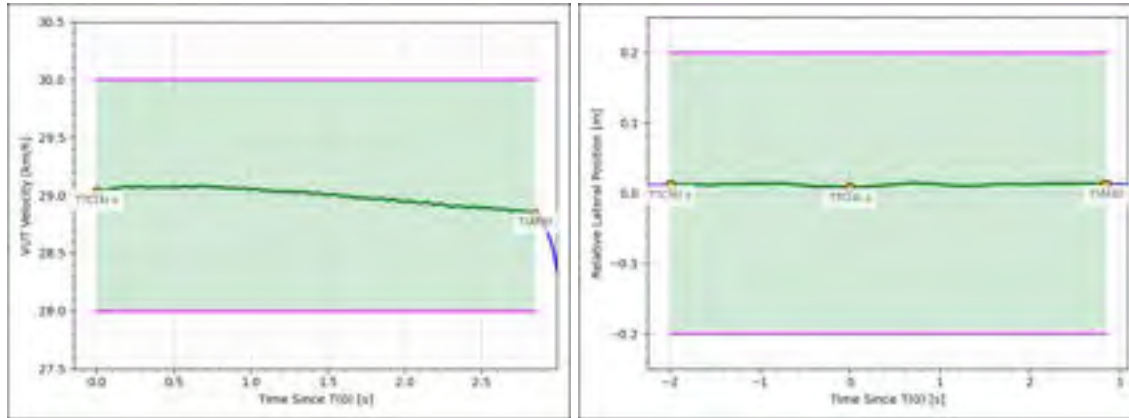
Run Date / Time 2-Feb-2023 14:24



G.1.1.3. AEB CCRs 30 kph +100 %

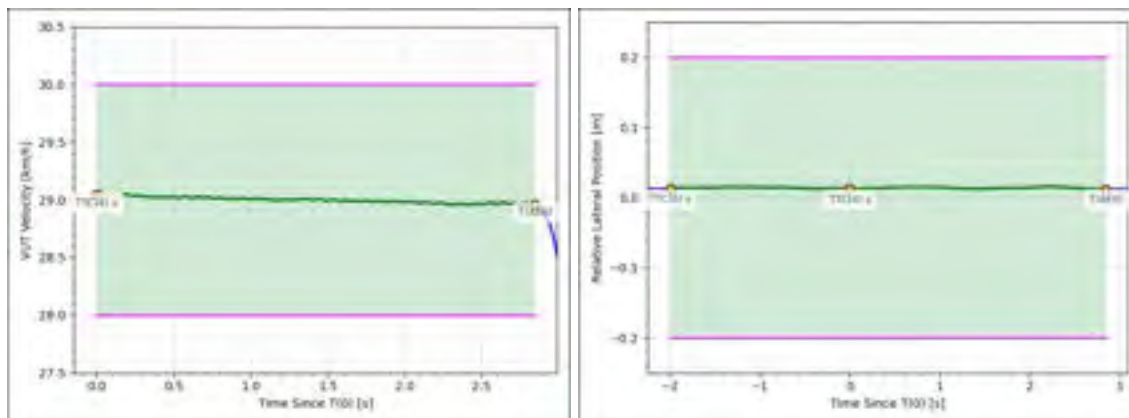
AEB CCRs | 30 km/h +100 % | Run 5

Run Date / Time 2-Feb-2023 14:26



AEB CCRs | 30 km/h +100 % | Run 6

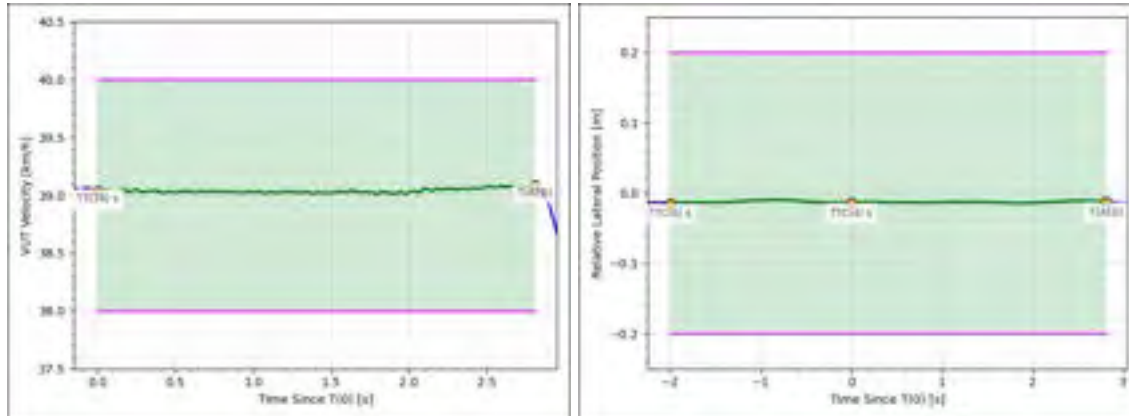
Run Date / Time 2-Feb-2023 14:29



G.1.1.4. AEB CCRs 40 kph -50 %

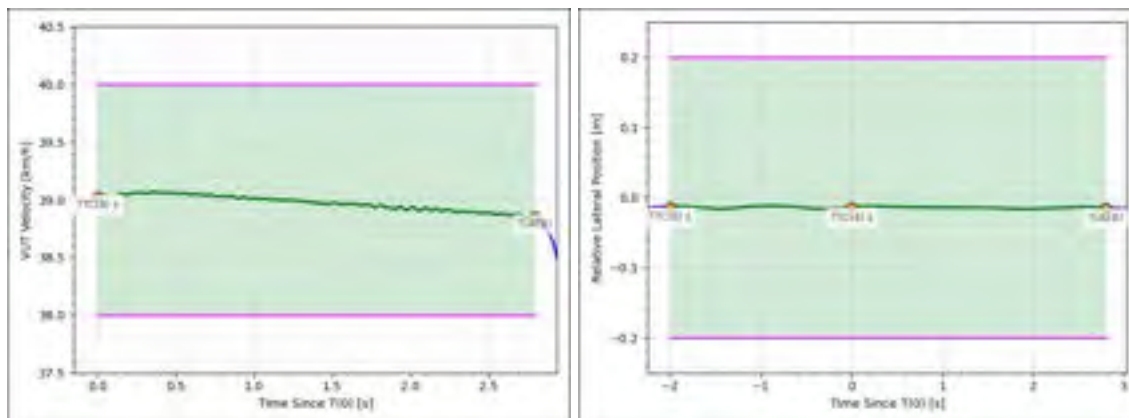
AEB CCRs | 40 km/h -50 % | Run 5

Run Date / Time 2-Feb-2023 14:51



AEB CCRs | 40 km/h -50 % | Run 6

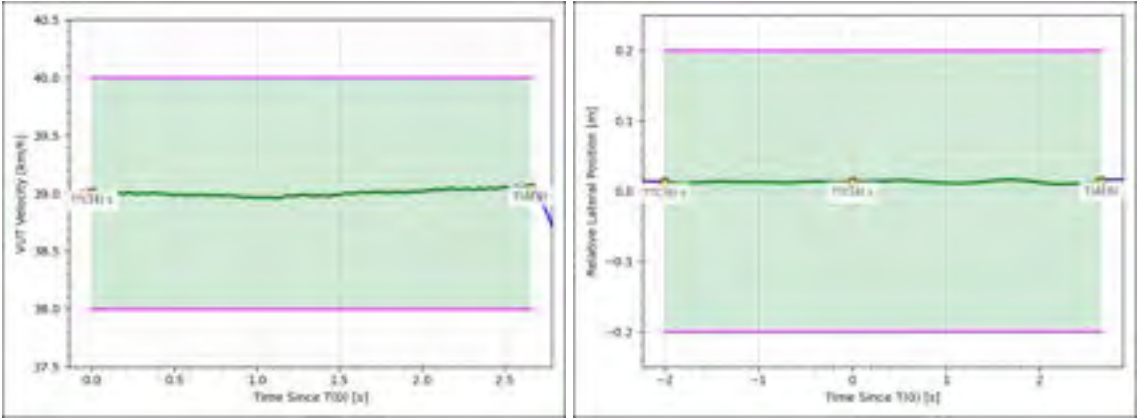
Run Date / Time 2-Feb-2023 14:54



G.1.1.5. AEB CCRs 40 kph +100 %

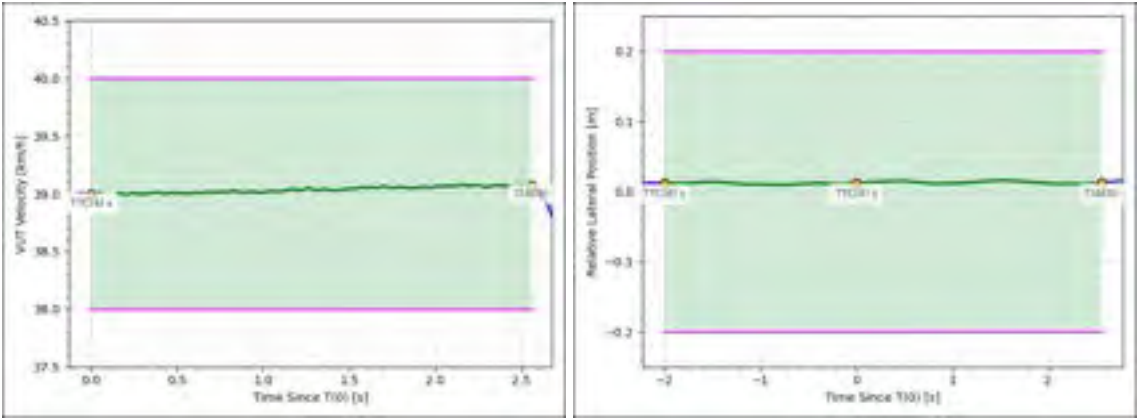
AEB CCRs | 40 km/h +100 % | Run 4

Run Date / Time 2-Feb-2023 14:36



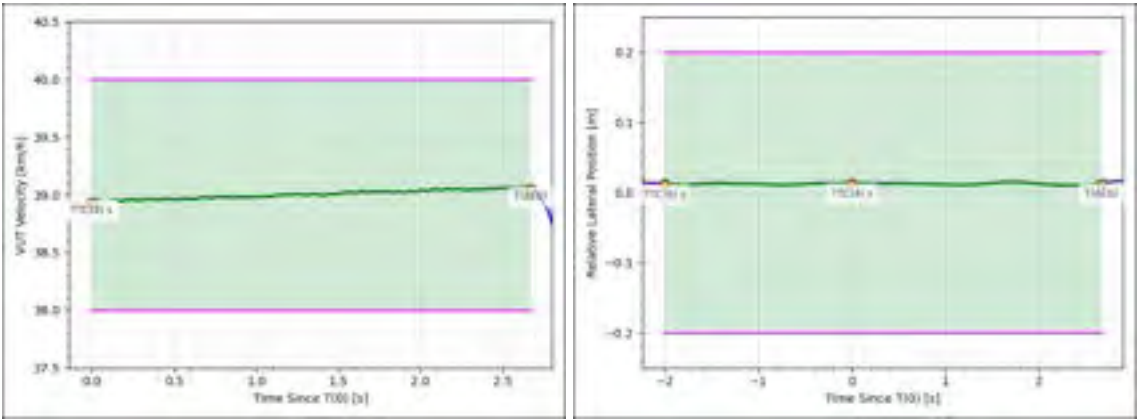
AEB CCRs | 40 km/h +100 % | Run 5

Run Date / Time 2-Feb-2023 14:38



AEB CCRs | 40 km/h +100 % | Run 6

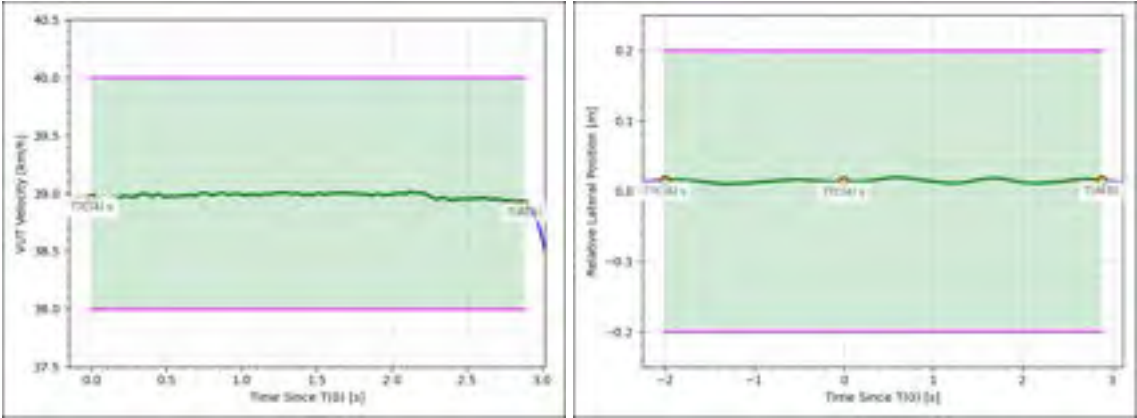
Run Date / Time 2-Feb-2023 14:41



G.1.1.6. AEB CCRs 40 kph +50 %

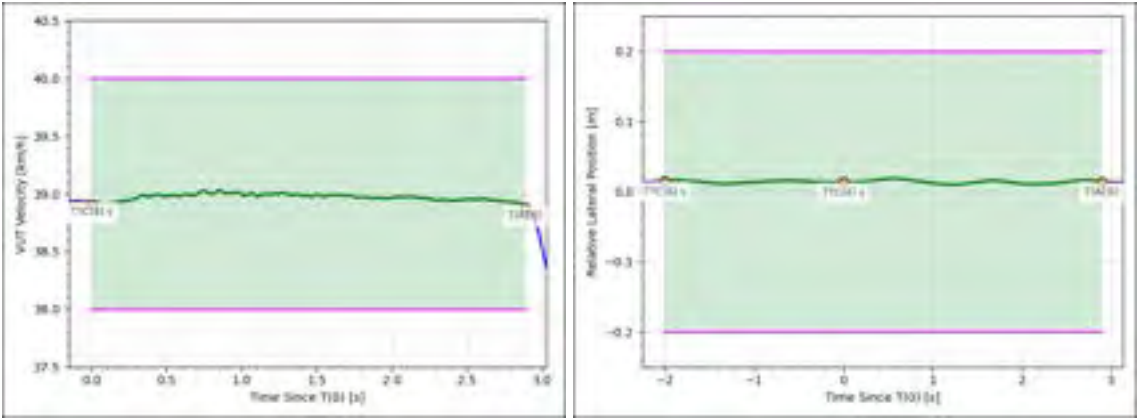
AEB CCRs | 40 km/h +50 % | Run 3

Run Date / Time 2-Feb-2023 14:58



AEB CCRs | 40 km/h +50 % | Run 4

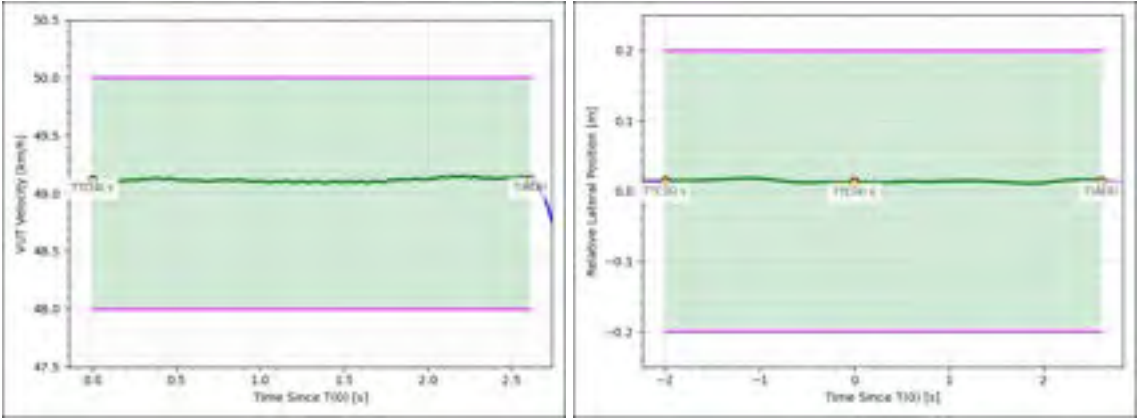
Run Date / Time 2-Feb-2023 15:00



G.1.1.7. AEB CCRs 50 kph +100 %

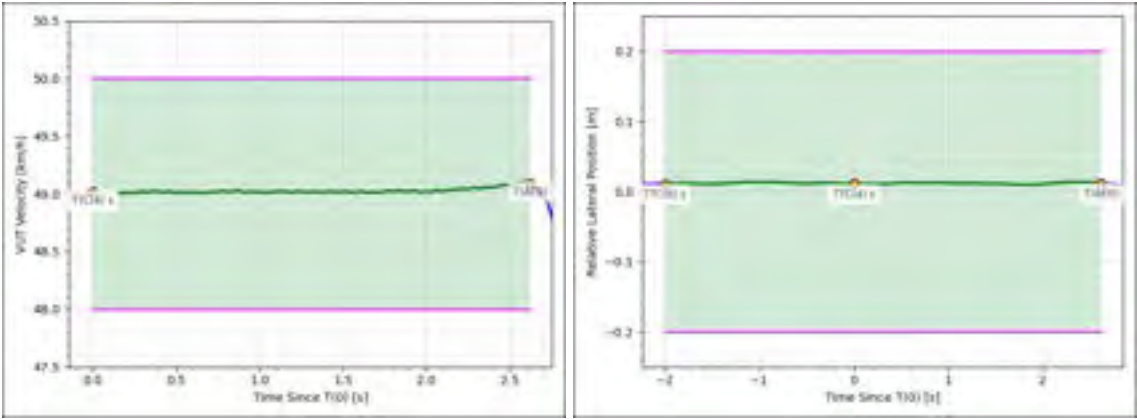
AEB CCRs | 50 km/h +100 % | Run 4

Run Date / Time 2-Feb-2023 14:43



AEB CCRs | 50 km/h +100 % | Run 5

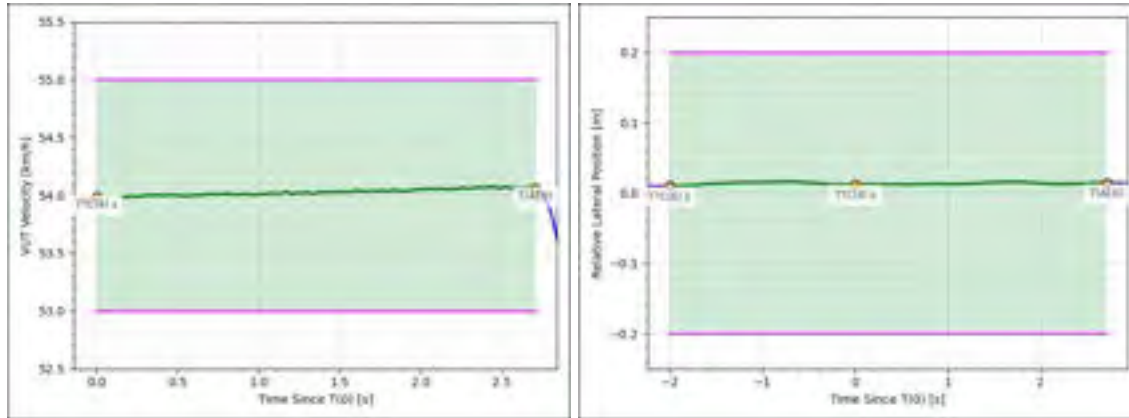
Run Date / Time 2-Feb-2023 14:48



G.1.1.8. AEB CCRs 55 kph +100 %

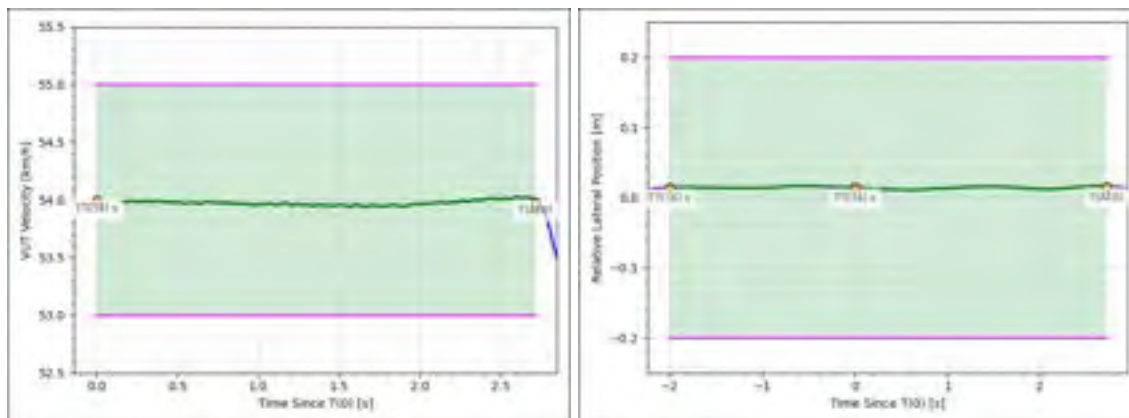
AEB CCRs | 55 km/h +100 % | Run 8

Run Date / Time 2-Feb-2023 15:05



AEB CCRs | 55 km/h +100 % | Run 9

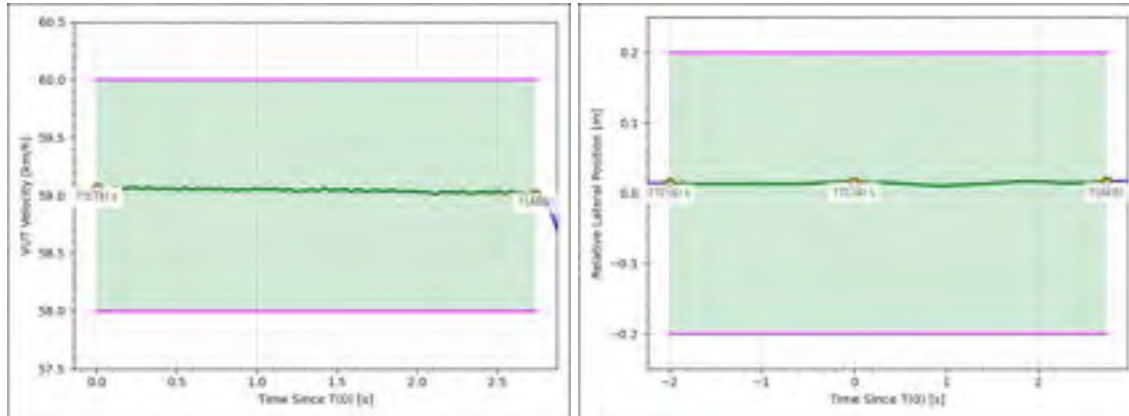
Run Date / Time 2-Feb-2023 15:10



G.1.1.9. AEB CCRs 60 kph +100 %

AEB CCRs | 60 km/h +100 % | Run 2

Run Date / Time 2-Feb-2023 15:33

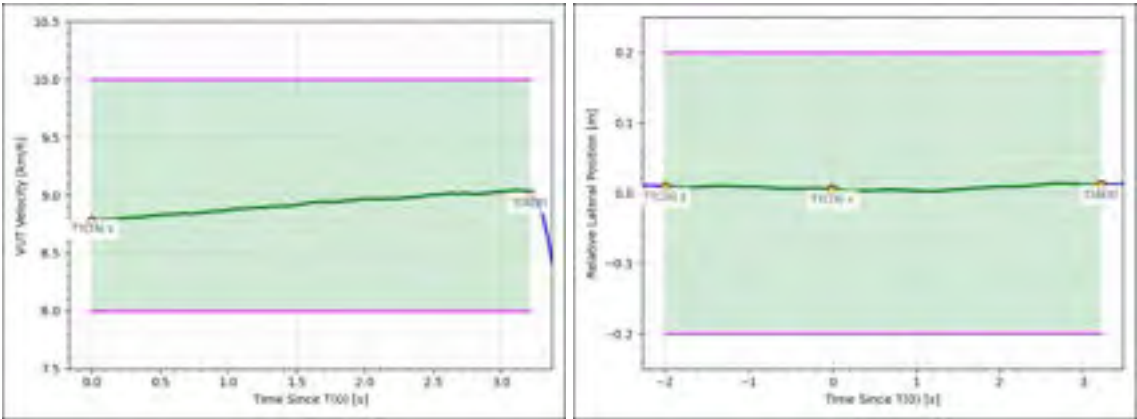


G.1.1. Ironman Bullbar

G.1.1.1. AEB CCRs 10 kph +100 %

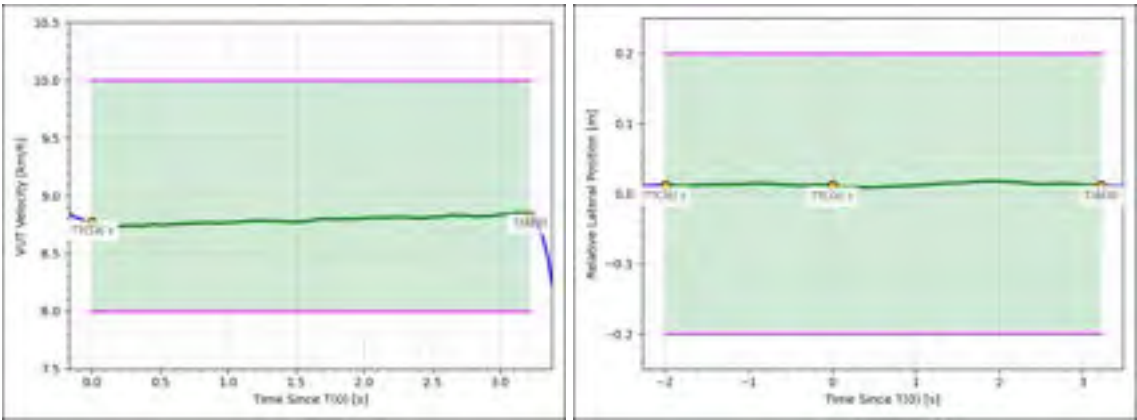
AEB CCRs | 10 km/h 100 % | Run 1

Run Date / Time 10-Mar-2023 11:25



AEB CCRs | 10 km/h 100 % | Run 2

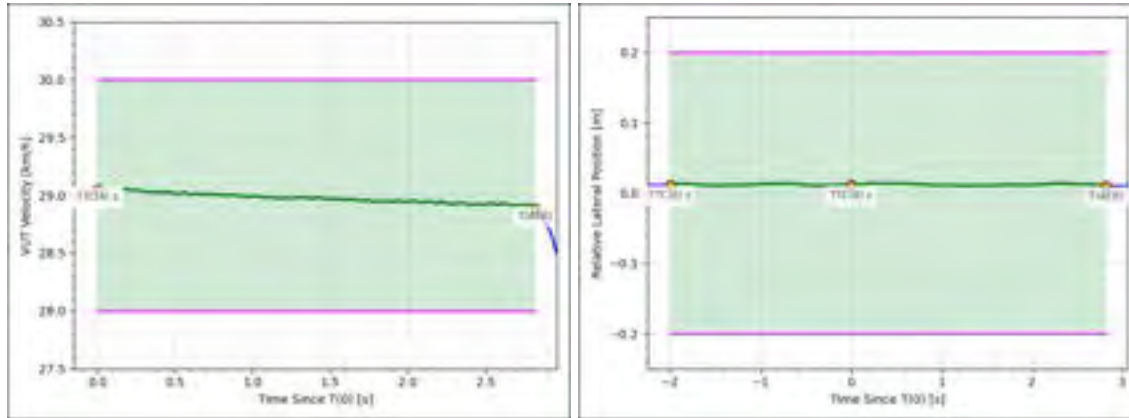
Run Date / Time 10-Mar-2023 11:28



G.1.1.2. AEB CCRs 30 kph +100 %

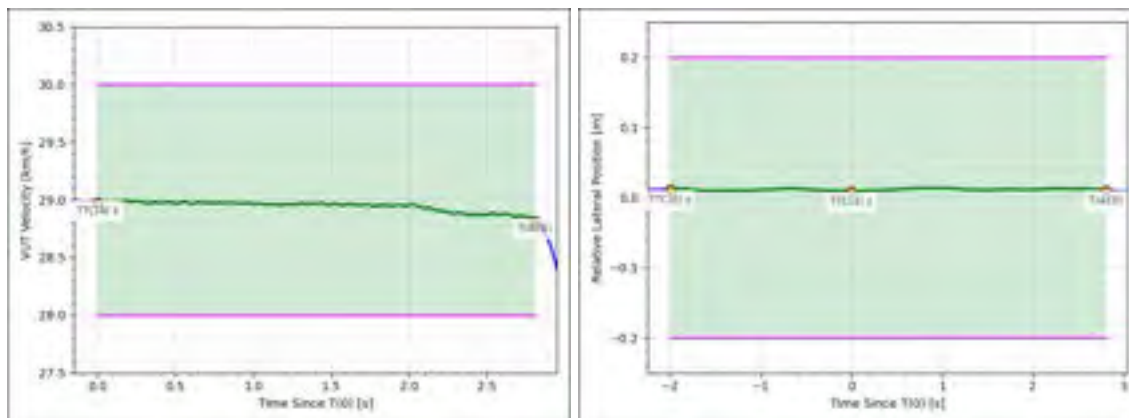
AEB CCRs | 30 km/h +100 % | Run 1

Run Date / Time 10-Mar-2023 11:31



AEB CCRs | 30 km/h +100 % | Run 2

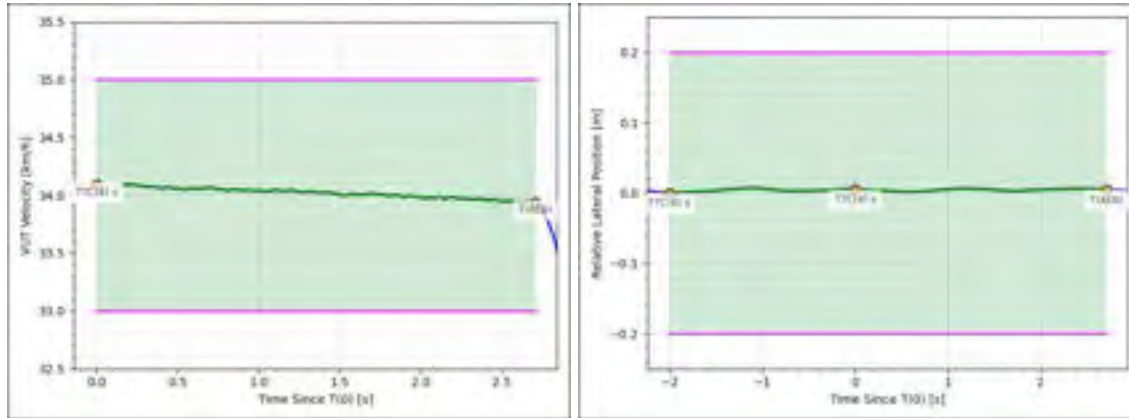
Run Date / Time 10-Mar-2023 11:34



G.1.1.3. AEB CCRs 35 kph +100 %

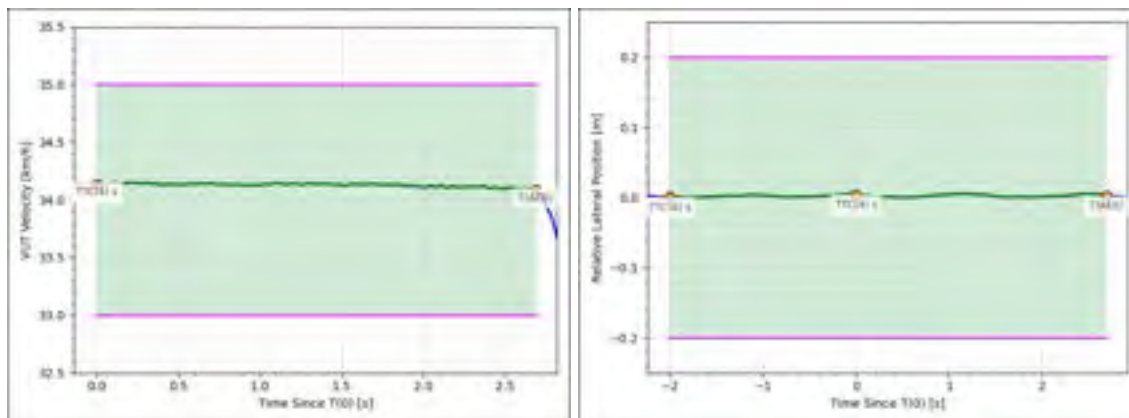
AEB CCRs | 35 km/h +100 % | Run 1

Run Date / Time 10-Mar-2023 13:13



AEB CCRs | 35 km/h +100 % | Run 2

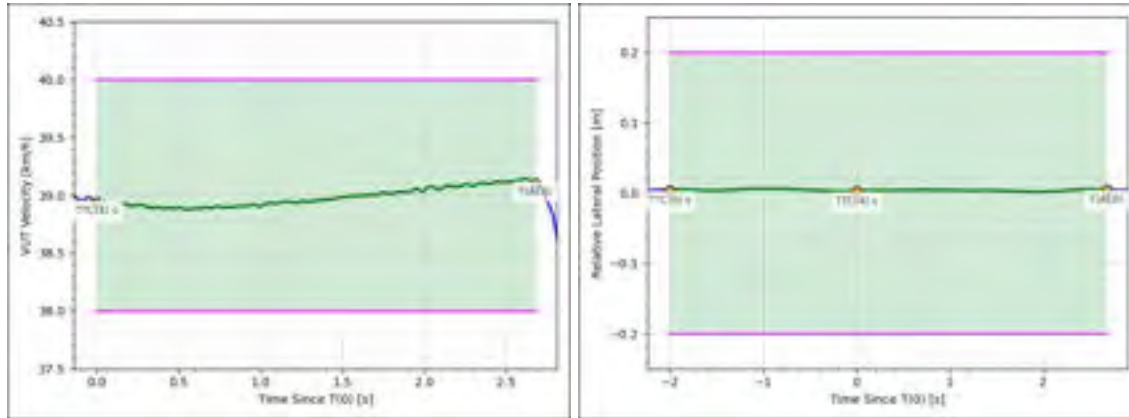
Run Date / Time 10-Mar-2023 13:15



G.1.1.4. AEB CCRs 40 kph -50 %

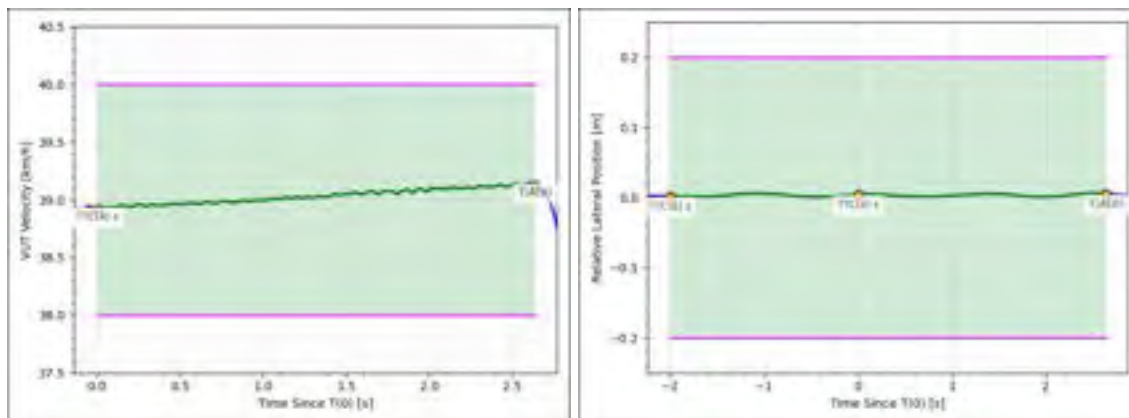
AEB CCRs | 40 km/h -50 % | Run 1

Run Date / Time 10-Mar-2023 13:37



AEB CCRs | 40 km/h -50 % | Run 2

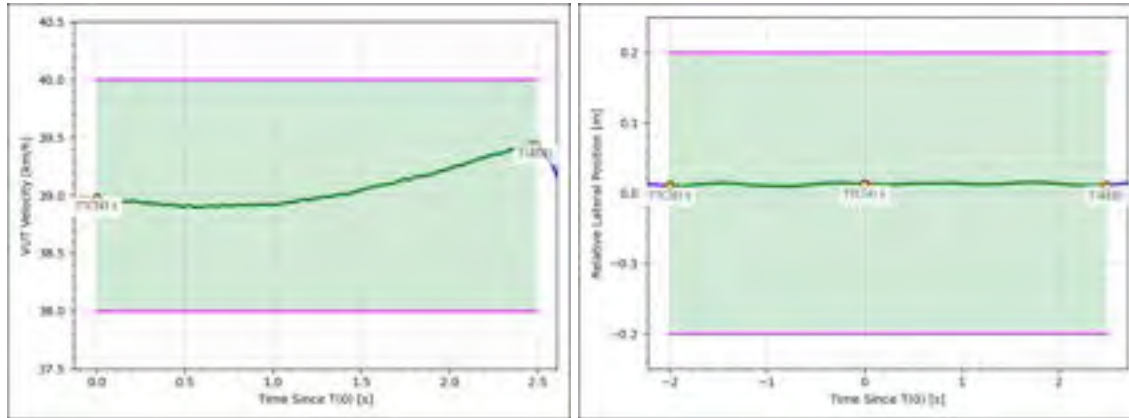
Run Date / Time 10-Mar-2023 13:39



G.1.1.5. AEB CCRs 40 kph +100 %

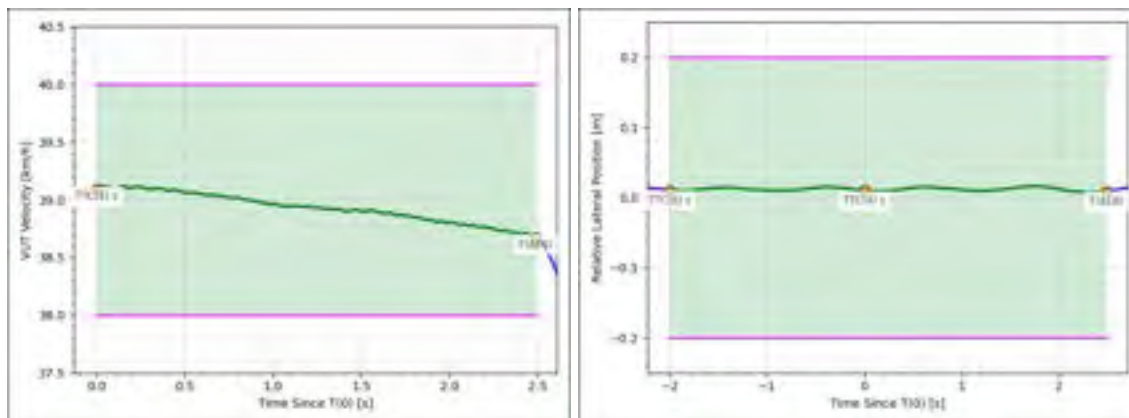
AEB CCRs | 40 km/h +100 % | Run 1

Run Date / Time 10-Mar-2023 11:37



AEB CCRs | 40 km/h +100 % | Run 2

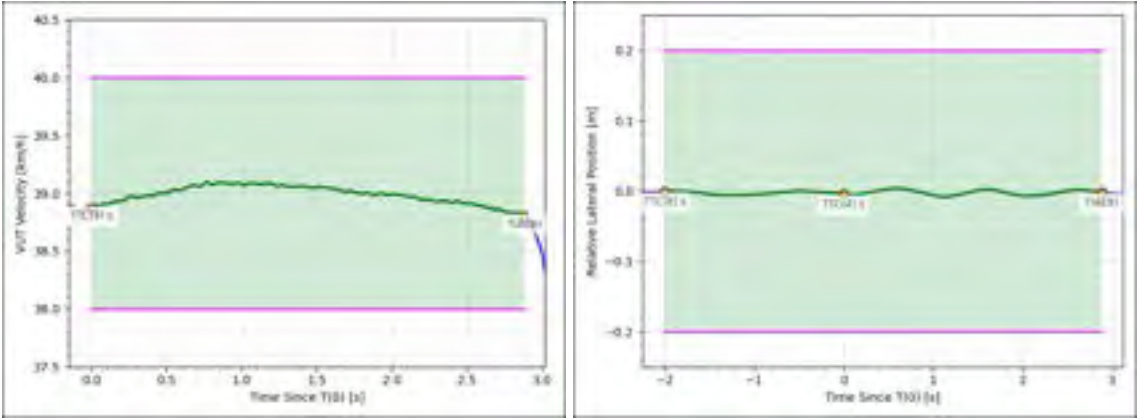
Run Date / Time 10-Mar-2023 12:51



G.1.1.6. AEB CCRs 40 kph +50 %

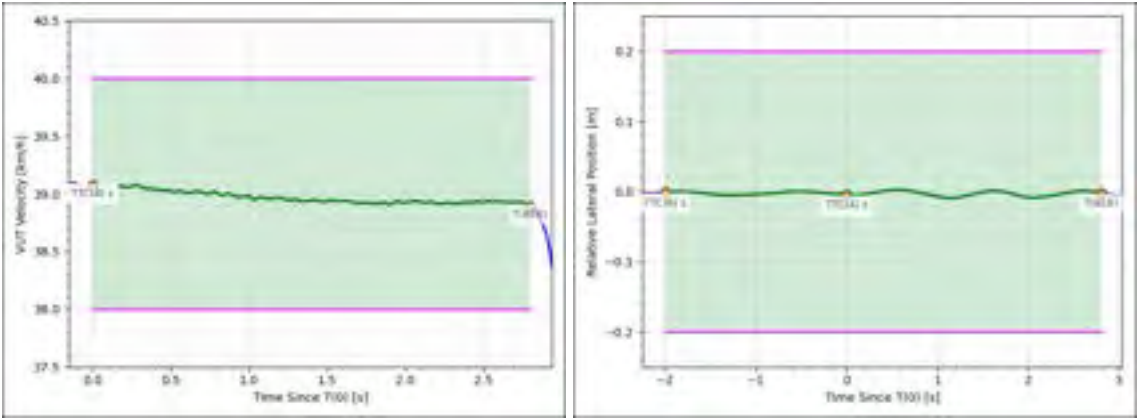
AEB CCRs | 40 km/h +50 % | Run 1

Run Date / Time 10-Mar-2023 13:42



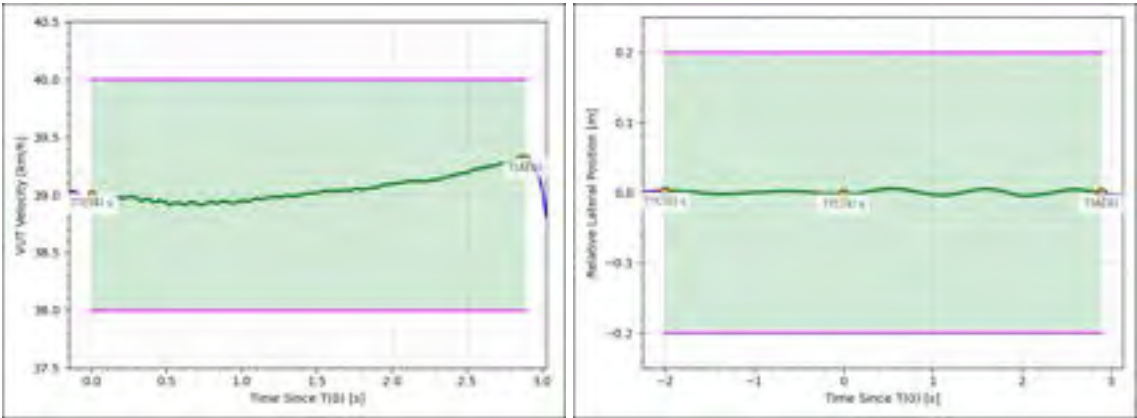
AEB CCRs | 40 km/h +50 % | Run 2

Run Date / Time 10-Mar-2023 13:44



AEB CCRs | 40 km/h +50 % | Run 3

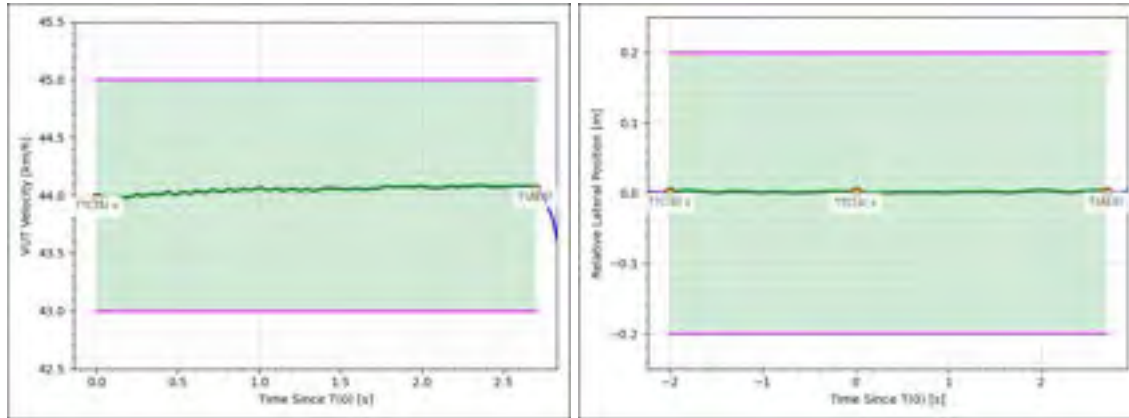
Run Date / Time 10-Mar-2023 13:50



G.1.1.7. AEB CCRs 45 kph +100 %

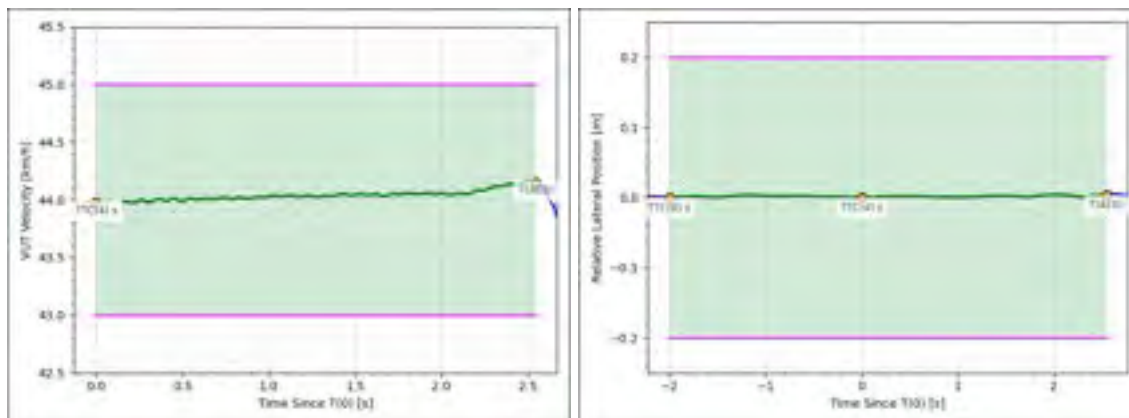
AEB CCRs | 45 km/h +100 % | Run 1

Run Date / Time 10-Mar-2023 13:18



AEB CCRs | 45 km/h +100 % | Run 2

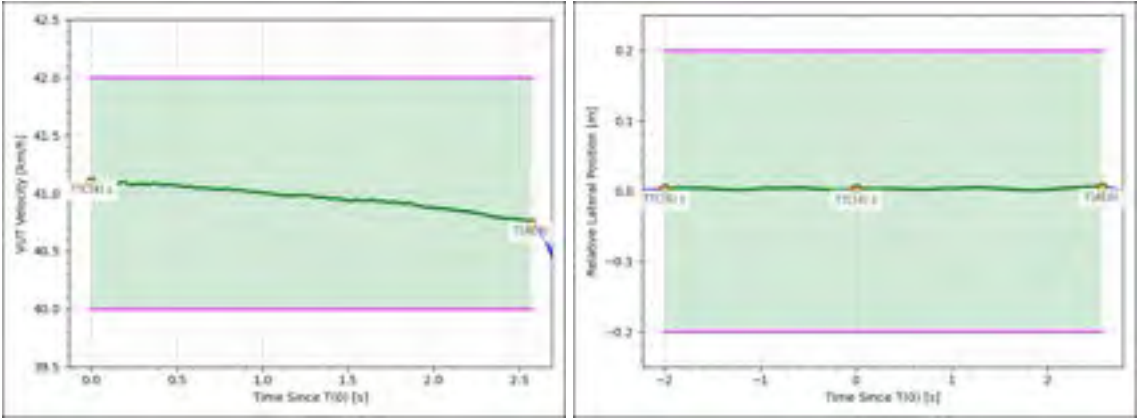
Run Date / Time 10-Mar-2023 13:20



G.1.1.8. AEB CCRs 42 kph +100 %

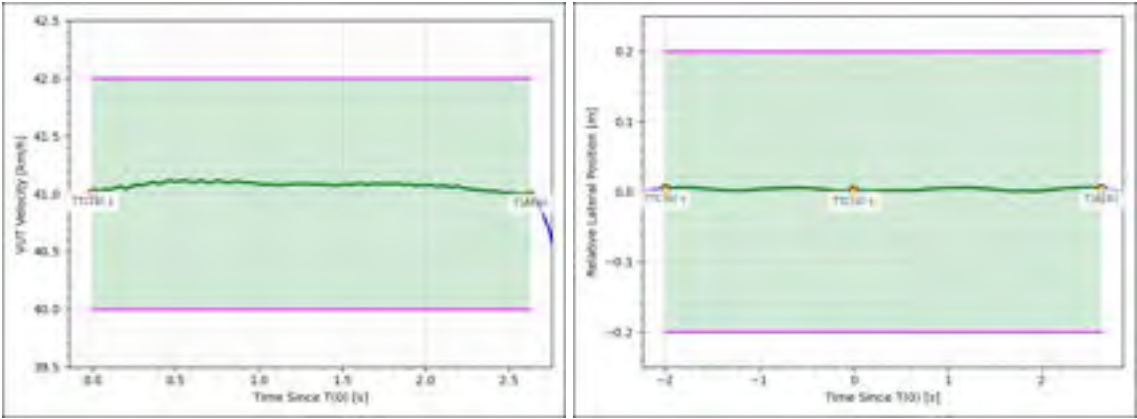
AEB CCRs | 42 km/h +100 % | Run 3

Run Date / Time 10-Mar-2023 13:24



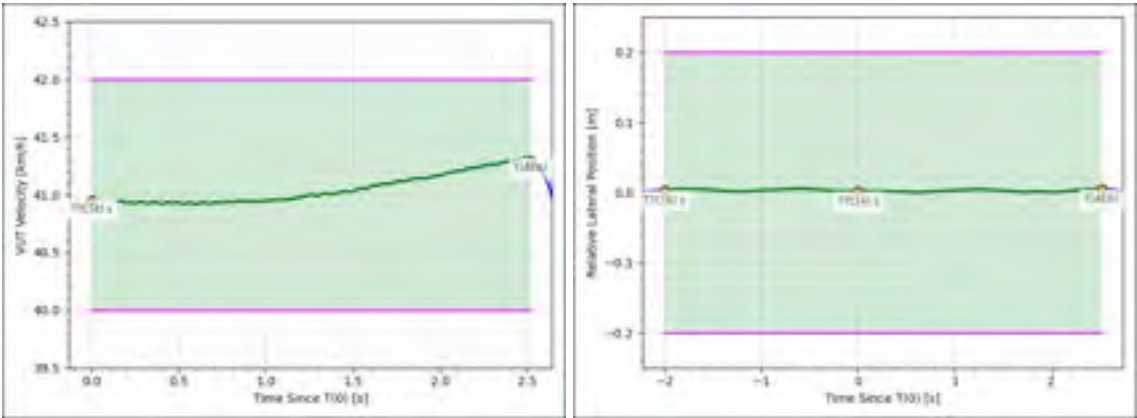
AEB CCRs | 42 km/h +100 % | Run 4

Run Date / Time 10-Mar-2023 13:26



AEB CCRs | 42 km/h +100 % | Run 5

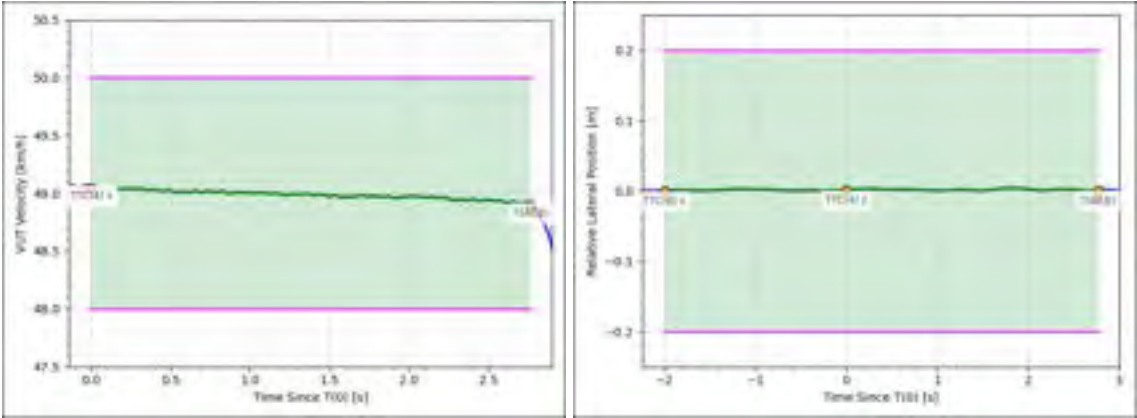
Run Date / Time 10-Mar-2023 13:29



G.1.1.9. AEB CCRs 50 kph +100 %

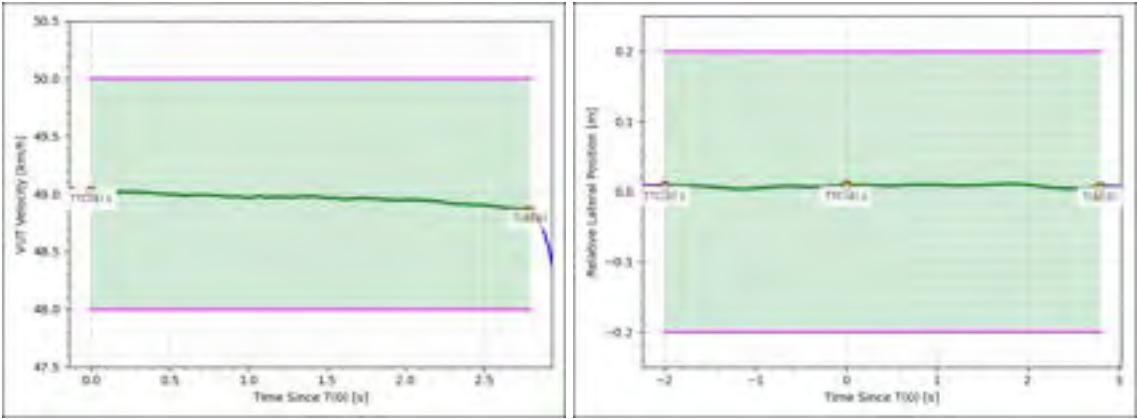
AEB CCRs | 50 km/h +100 % | Run 1

Run Date / Time 10-Mar-2023 14:00



AEB CCRs | 50 km/h +100 % | Run 2

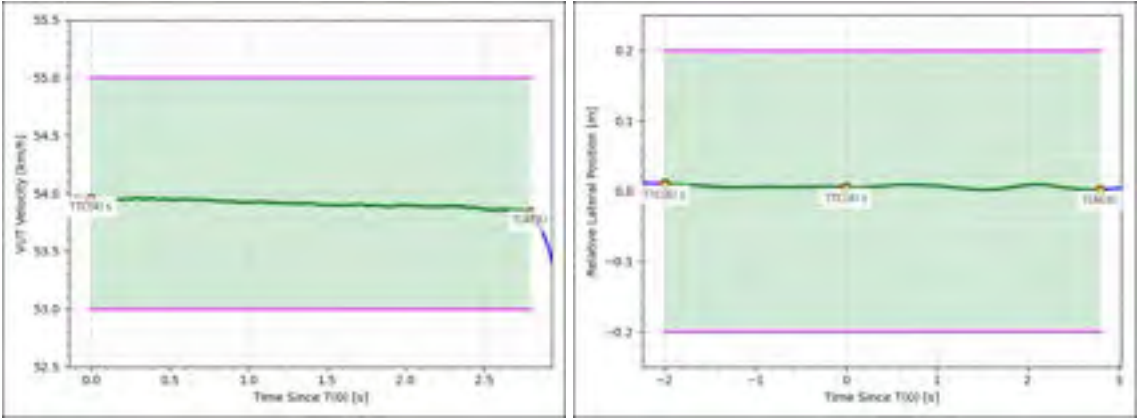
Run Date / Time 10-Mar-2023 14:02



G.1.1.10. AEB CCRs 55 kph +100 %

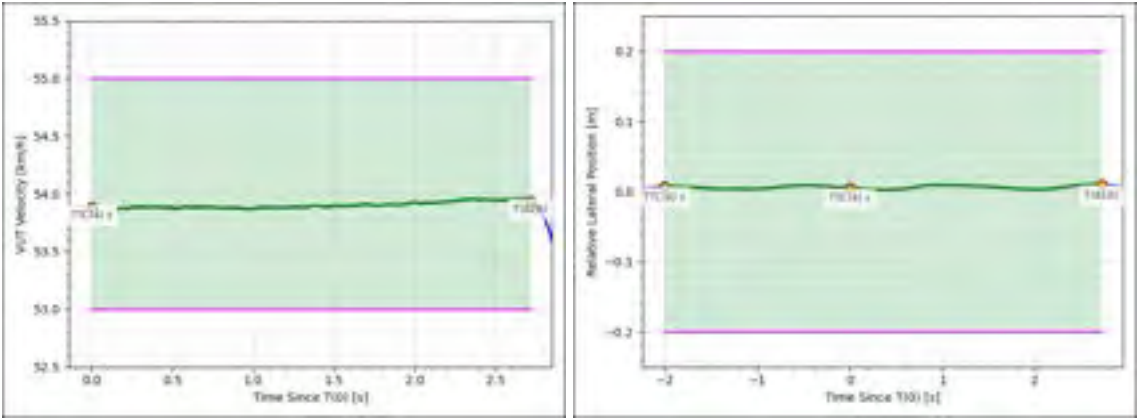
AEB CCRs | 55 km/h +100 % | Run 2

Run Date / Time 21-Jun-2023 13:20



AEB CCRs | 55 km/h +100 % | Run 3

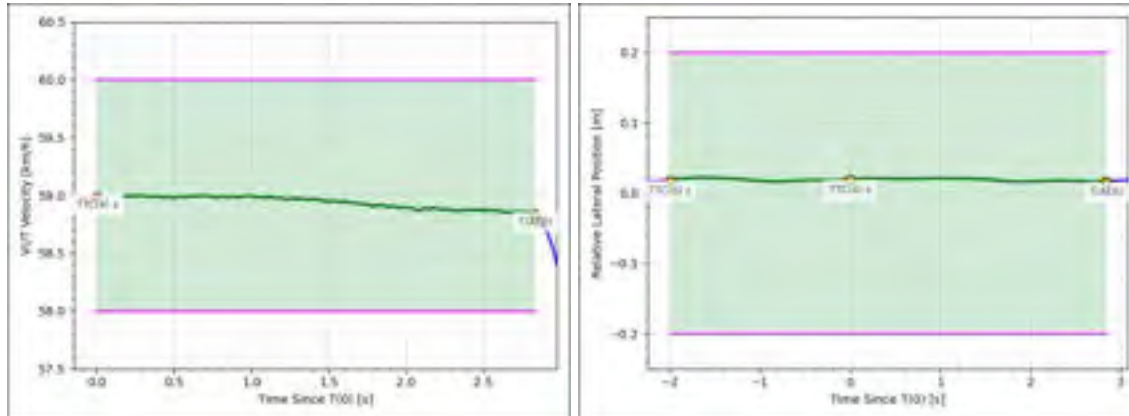
Run Date / Time 21-Jun-2023 13:33



G.1.1.11. AEB CCRs 60 kph +100 %

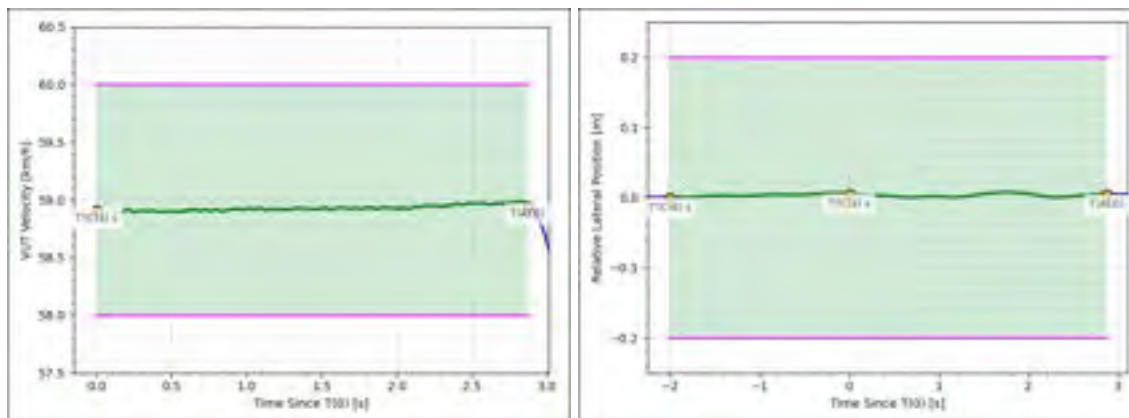
AEB CCRs | 60 km/h +100 % | Run 1

Run Date / Time 21-Jun-2023 13:51



AEB CCRs | 60 km/h +100 % | Run 2

Run Date / Time 21-Jun-2023 14:10

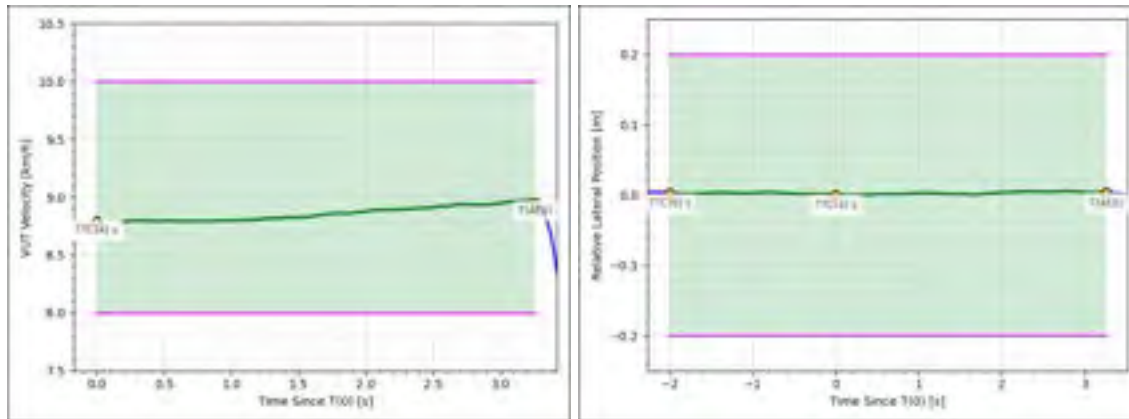


G.1.1. Tuff Bullbar

G.1.1.1. AEB CCRs 10 kph +100 %

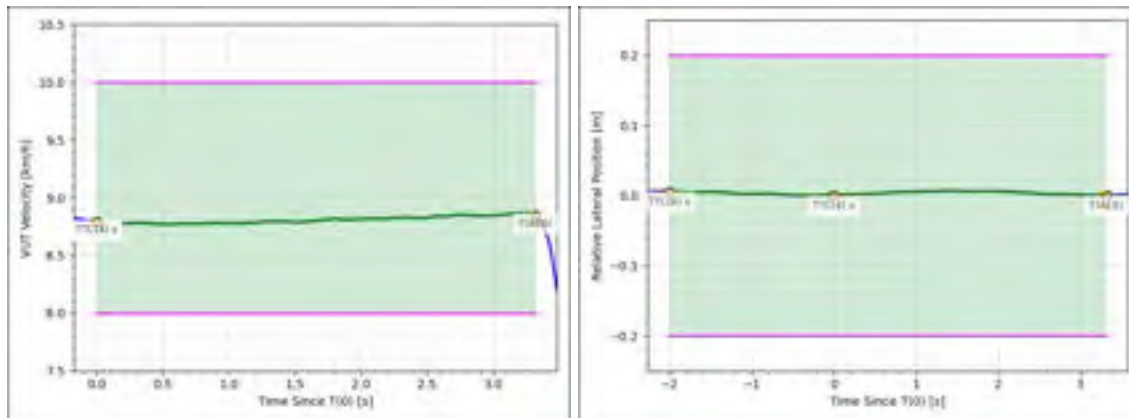
AEB CCRs | 10 km/h 100 % | Run 2

Run Date / Time 10-Jul-2023 14:57



AEB CCRs | 10 km/h 100 % | Run 3

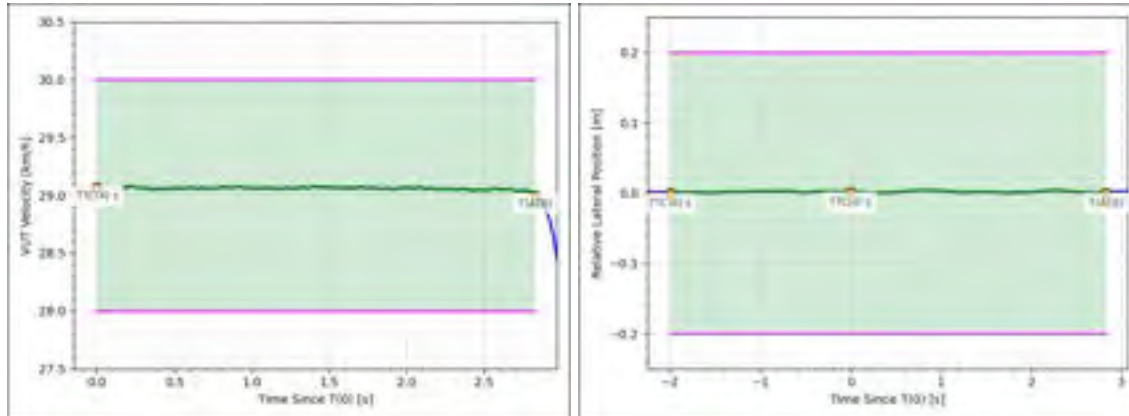
Run Date / Time 10-Jul-2023 15:02



G.1.1.2. AEB CCRs 30 kph +100 %

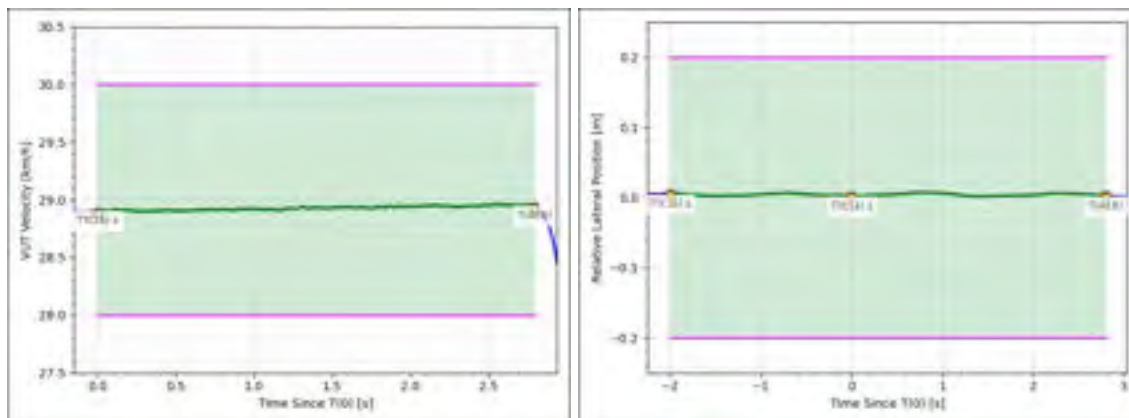
AEB CCRs | 30 km/h +100 % | Run 1

Run Date / Time 10-Jul-2023 15:09



AEB CCRs | 30 km/h +100 % | Run 2

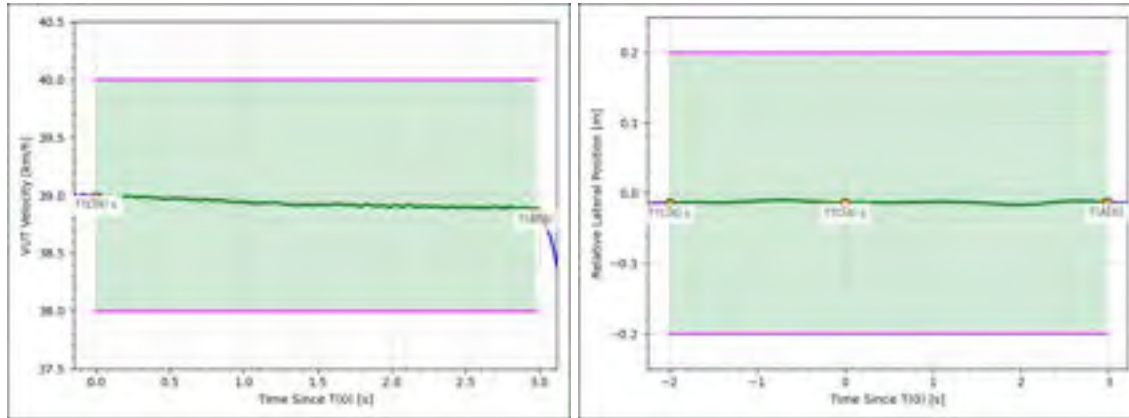
Run Date / Time 10-Jul-2023 15:12



G.1.1.3. AEB CCRs 40 kph -50 %

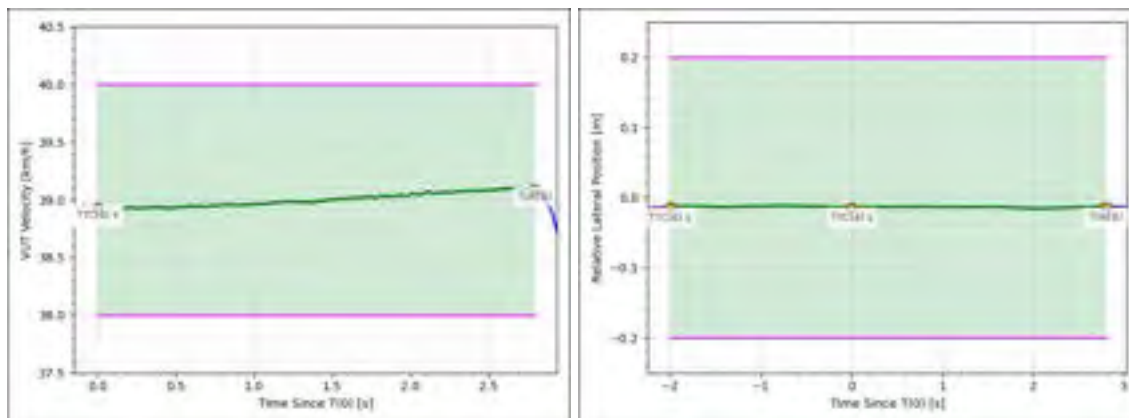
AEB CCRs | 40 km/h -50 % | Run 1

Run Date / Time 11-Jul-2023 09:54



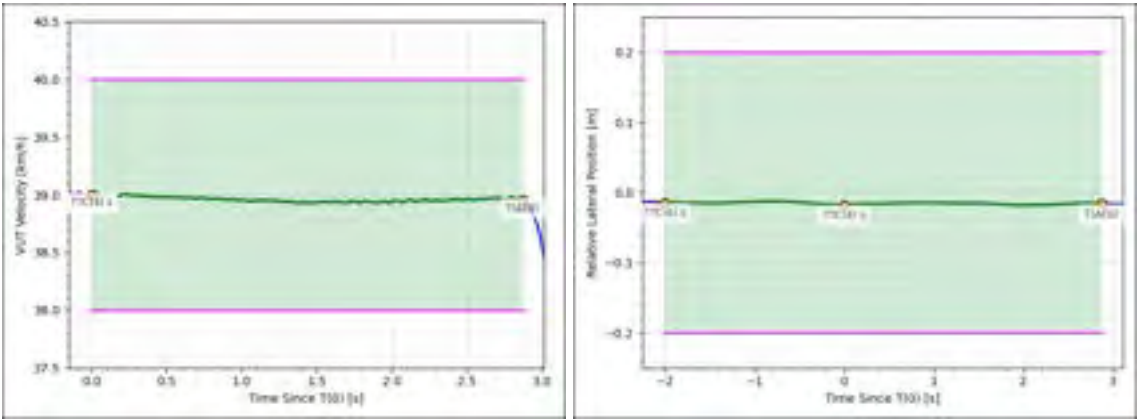
AEB CCRs | 40 km/h -50 % | Run 2

Run Date / Time 11-Jul-2023 09:58



AEB CCRs | 40 km/h -50 % | Run 3

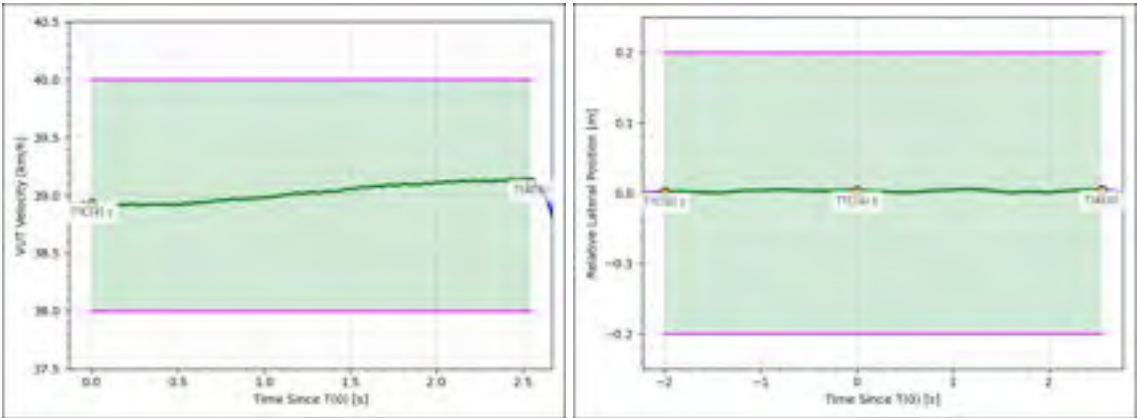
Run Date / Time 11-Jul-2023 10:02



G.1.1.4. AEB CCRs 40 kph +100 %

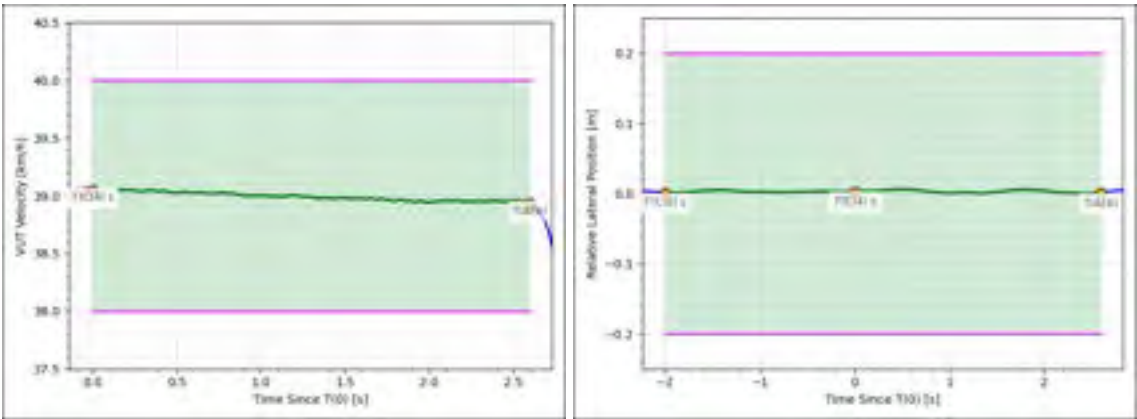
AEB CCRs | 40 km/h +100 % | Run 1

Run Date / Time 10-Jul-2023 15:18



AEB CCRs | 40 km/h +100 % | Run 3

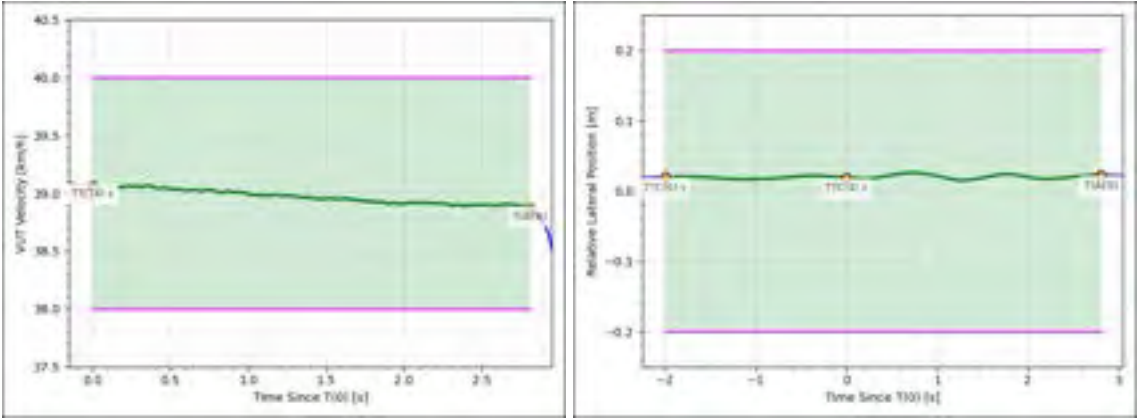
Run Date / Time 10-Jul-2023 15:21



G.1.1.5. AEB CCRs 40 kph +50 %

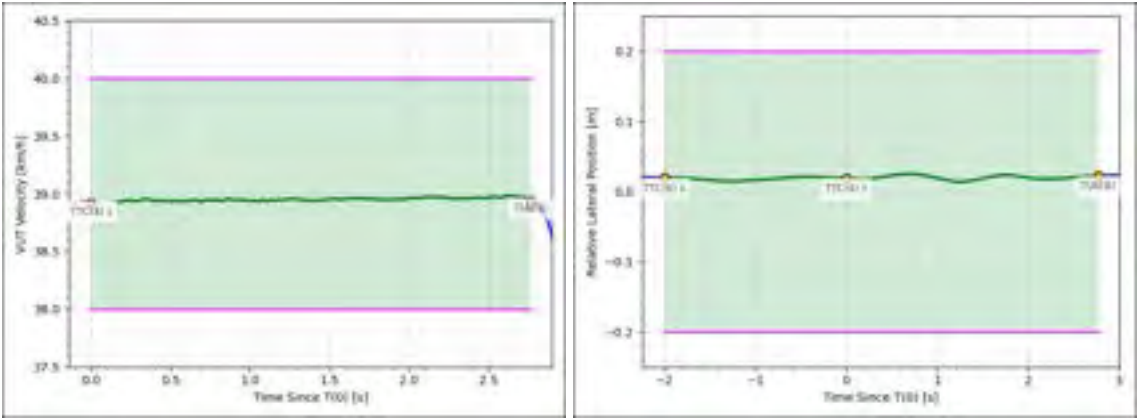
AEB CCRs | 40 km/h +50 % | Run 1

Run Date / Time 11-Jul-2023 10:07



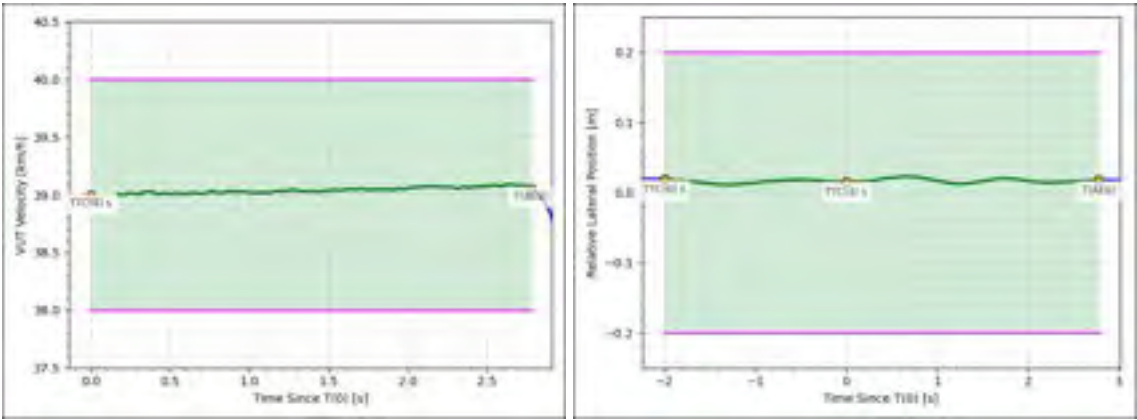
AEB CCRs | 40 km/h +50 % | Run 2

Run Date / Time 11-Jul-2023 10:11



AEB CCRs | 40 km/h +50 % | Run 3

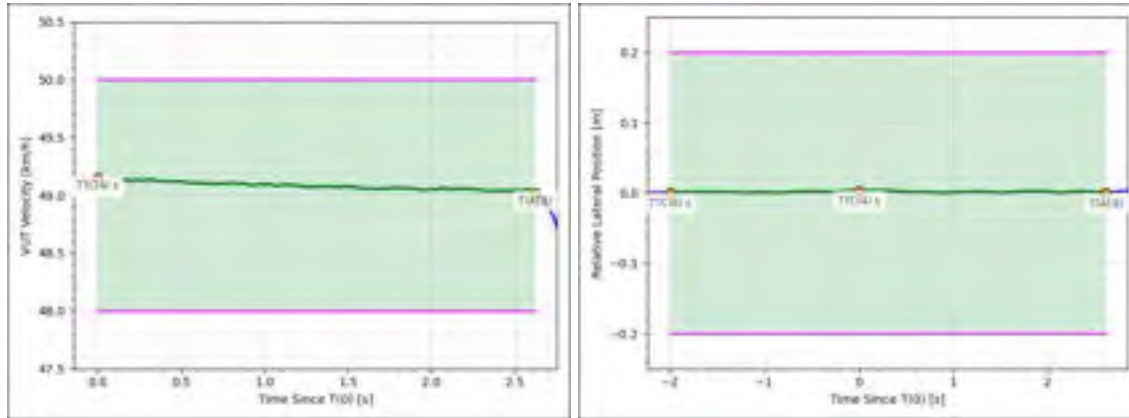
Run Date / Time 11-Jul-2023 10:16



G.1.1.6. AEB CCRs 50 kph +100 %

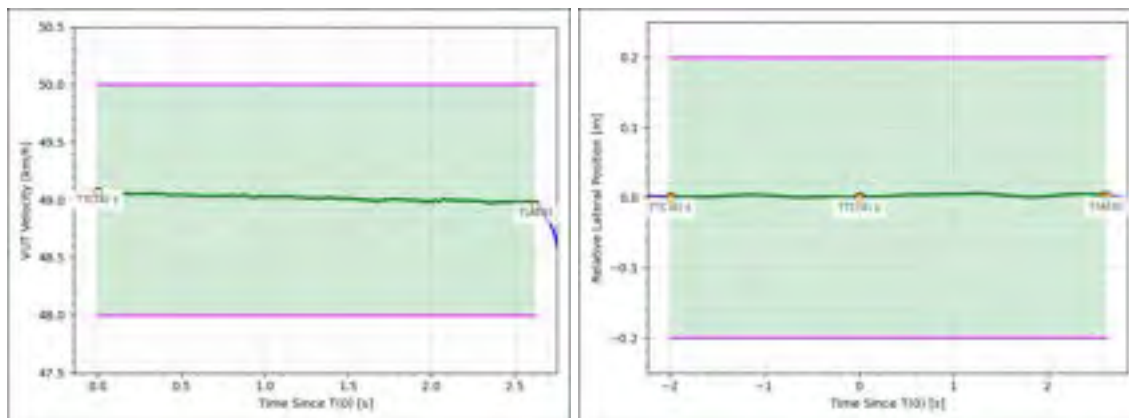
AEB CCRs | 50 km/h +100 % | Run 1

Run Date / Time 10-Jul-2023 15:27



AEB CCRs | 50 km/h +100 % | Run 2

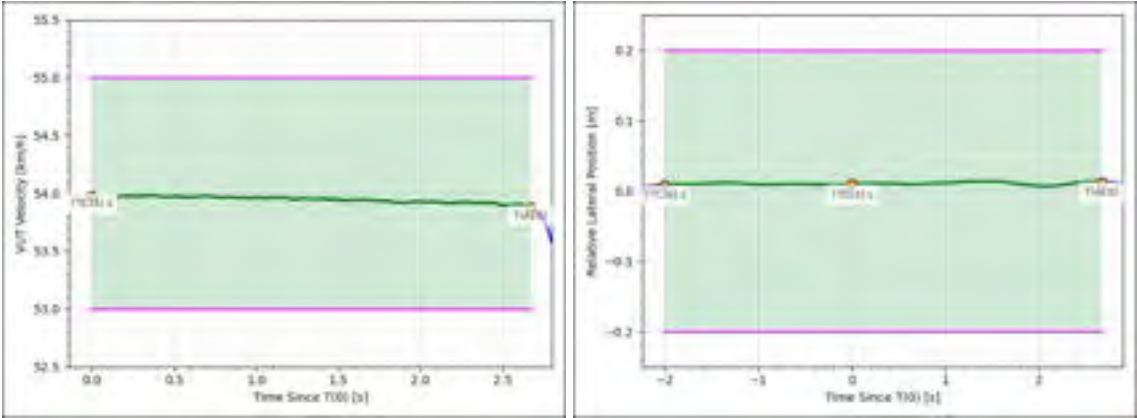
Run Date / Time 10-Jul-2023 15:31



G.1.1.7. AEB CCRs 55 kph +100 %

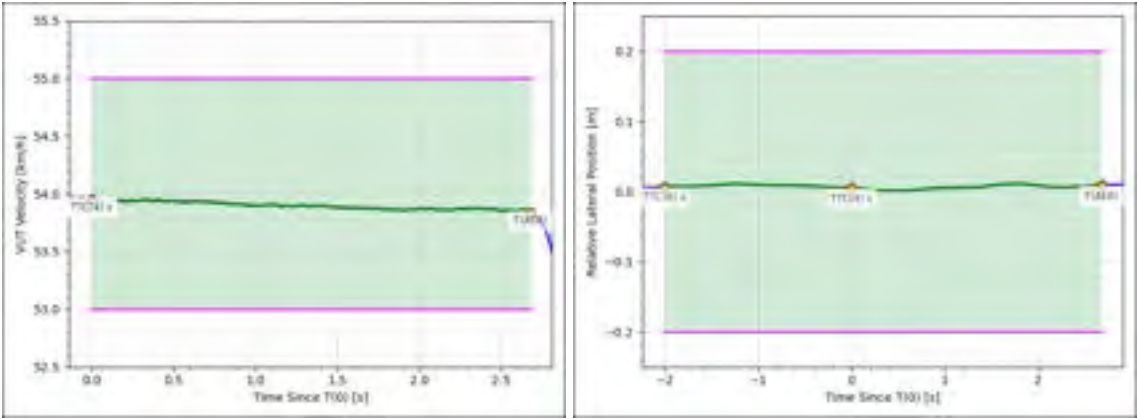
AEB CCRs | 55 km/h +100 % | Run 1

Run Date / Time 11-Jul-2023 10:24



AEB CCRs | 55 km/h +100 % | Run 2

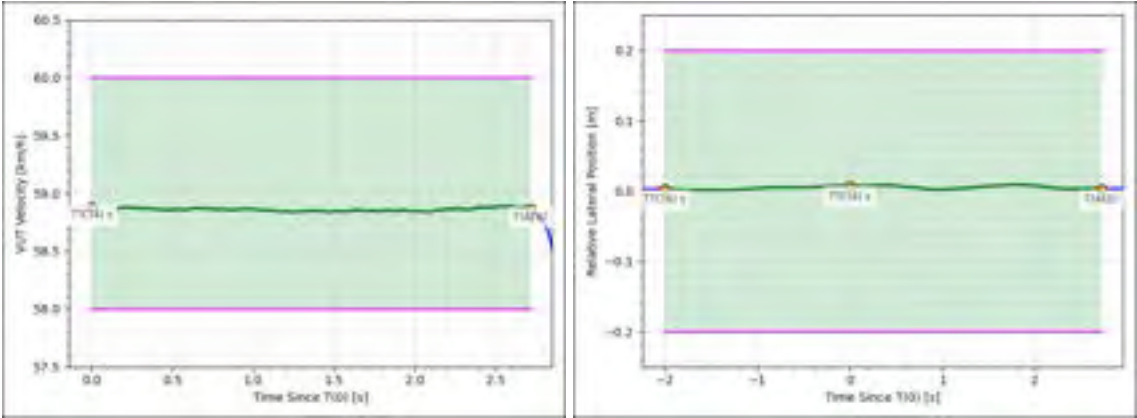
Run Date / Time 11-Jul-2023 10:27



G.1.1.8. AEB CCRs 60 kph +100 %

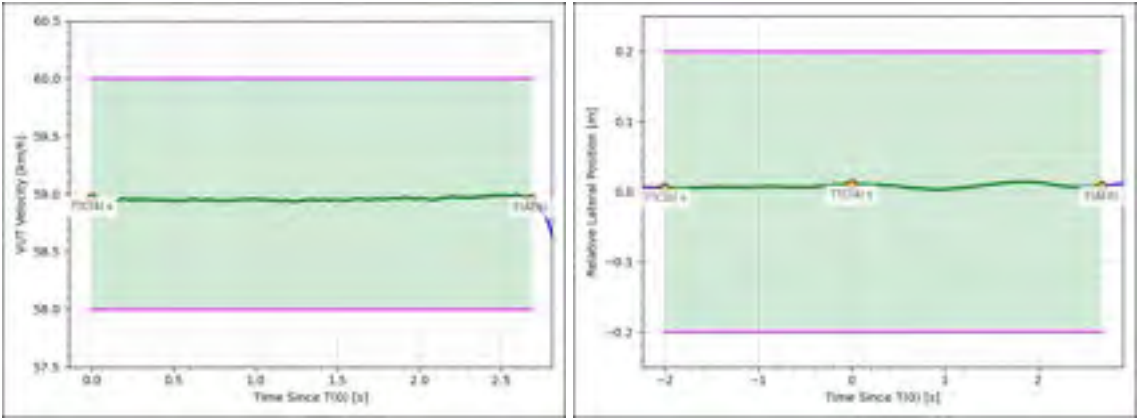
AEB CCRs | 60 km/h +100 % | Run 1

Run Date / Time 11-Jul-2023 10:34



AEB CCRs | 60 km/h +100 % | Run 2

Run Date / Time 11-Jul-2023 10:48



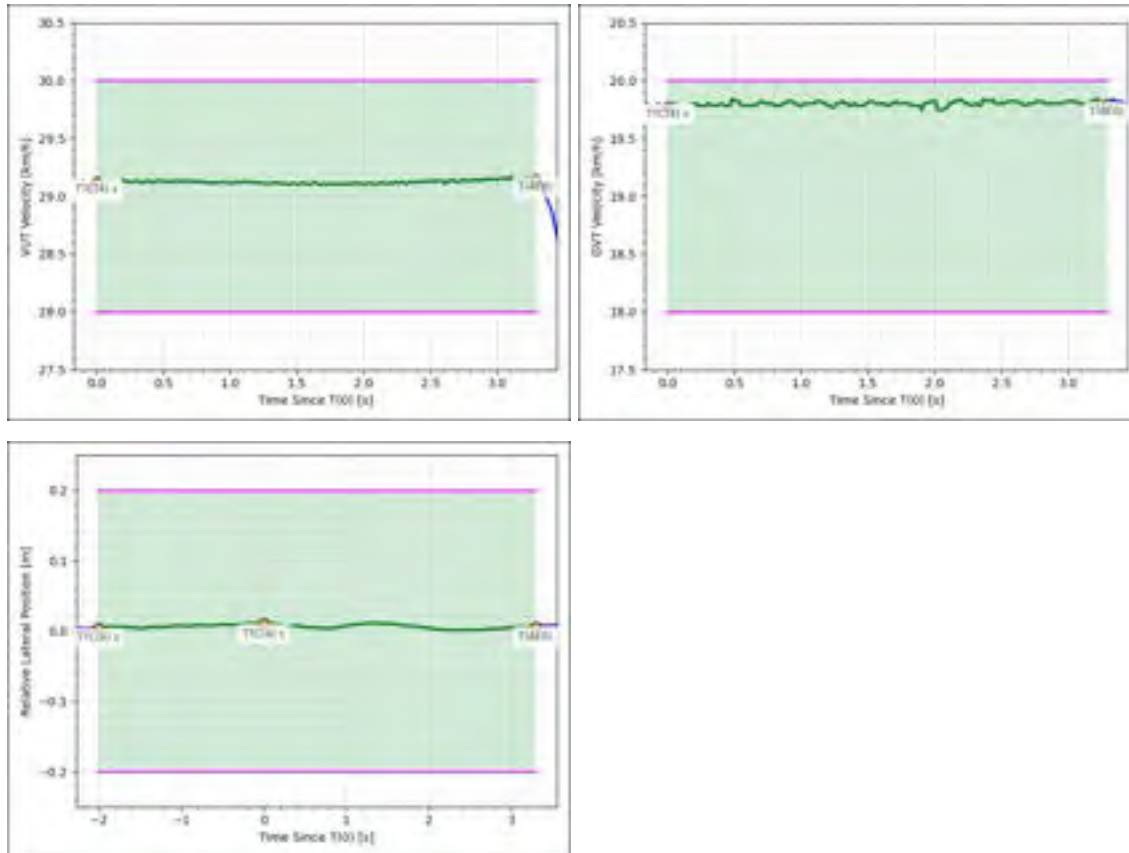
G.2.Car-to-Car Rear Moving

G.2.1. Baseline

G.2.1.1. AEB CCRm 30 kph +100 %

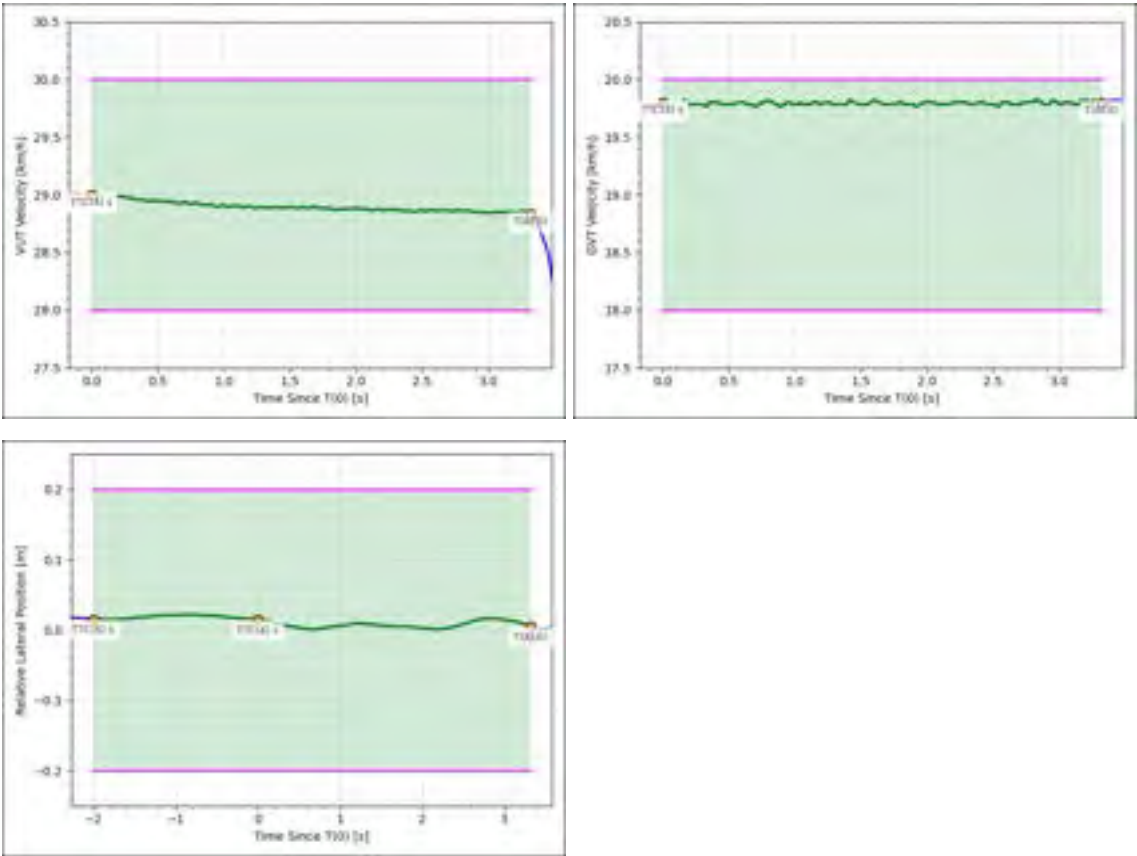
AEB CCRm | 30 km/h +100 % | Run 1

Run Date / Time 24-Jan-2023 11:18



AEB CCRm | 30 km/h +100 % | Run 2

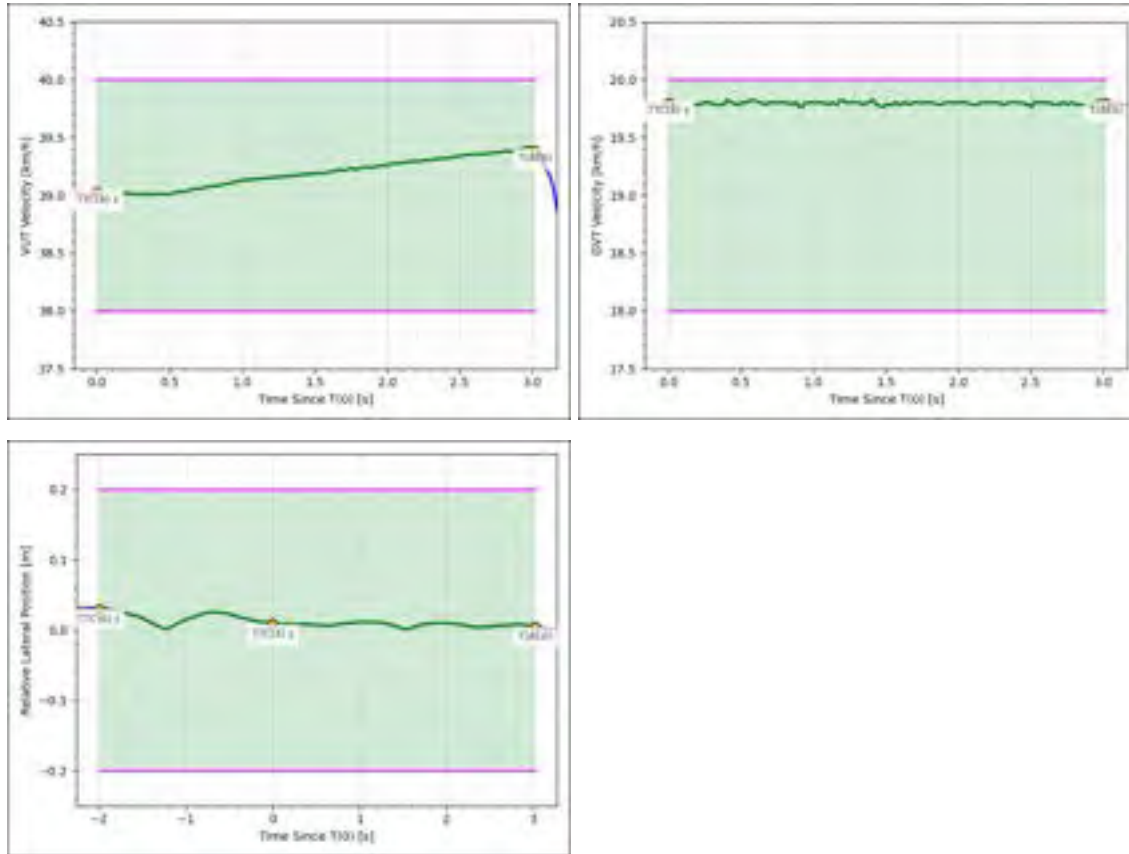
Run Date / Time 24-Jan-2023 11:20



G.2.1.2. AEB CCRm 40 kph +100 %

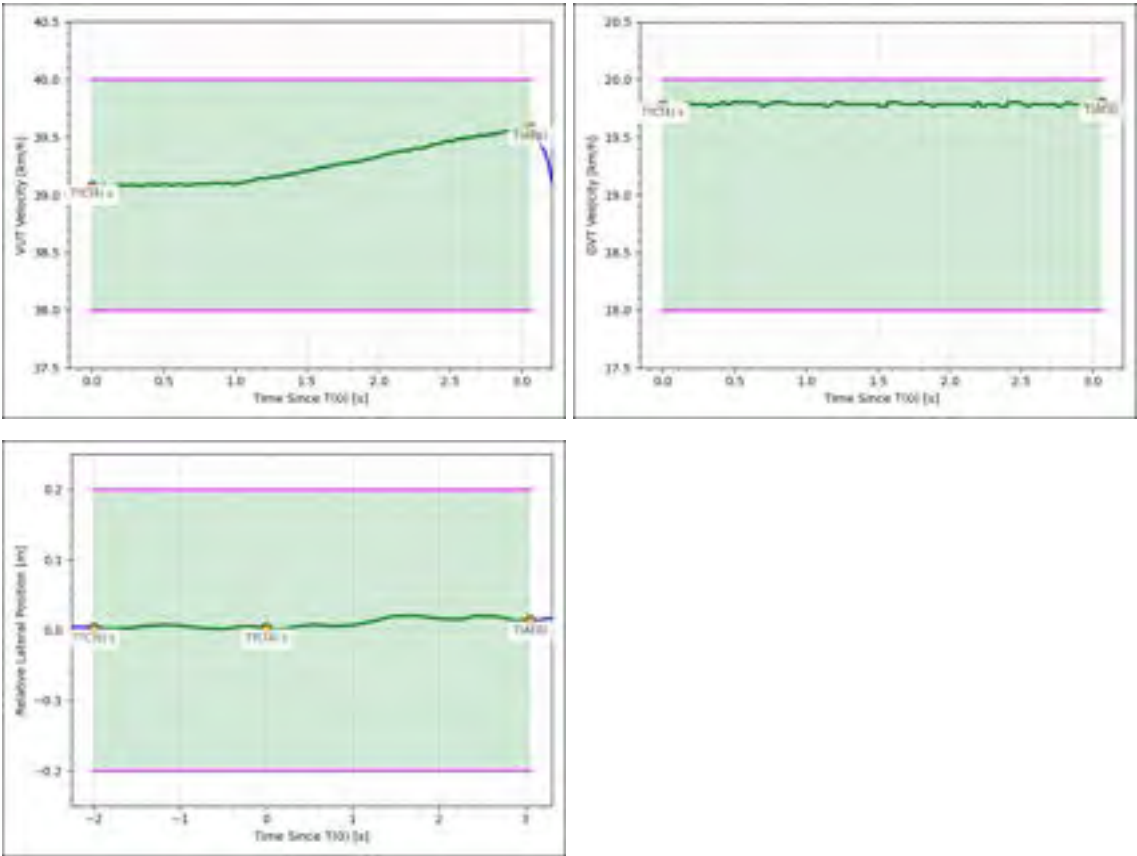
AEB CCRm | 40 km/h +100 % | Run 1

Run Date / Time 24-Jan-2023 11:24



AEB CCRm | 40 km/h +100 % | Run 2

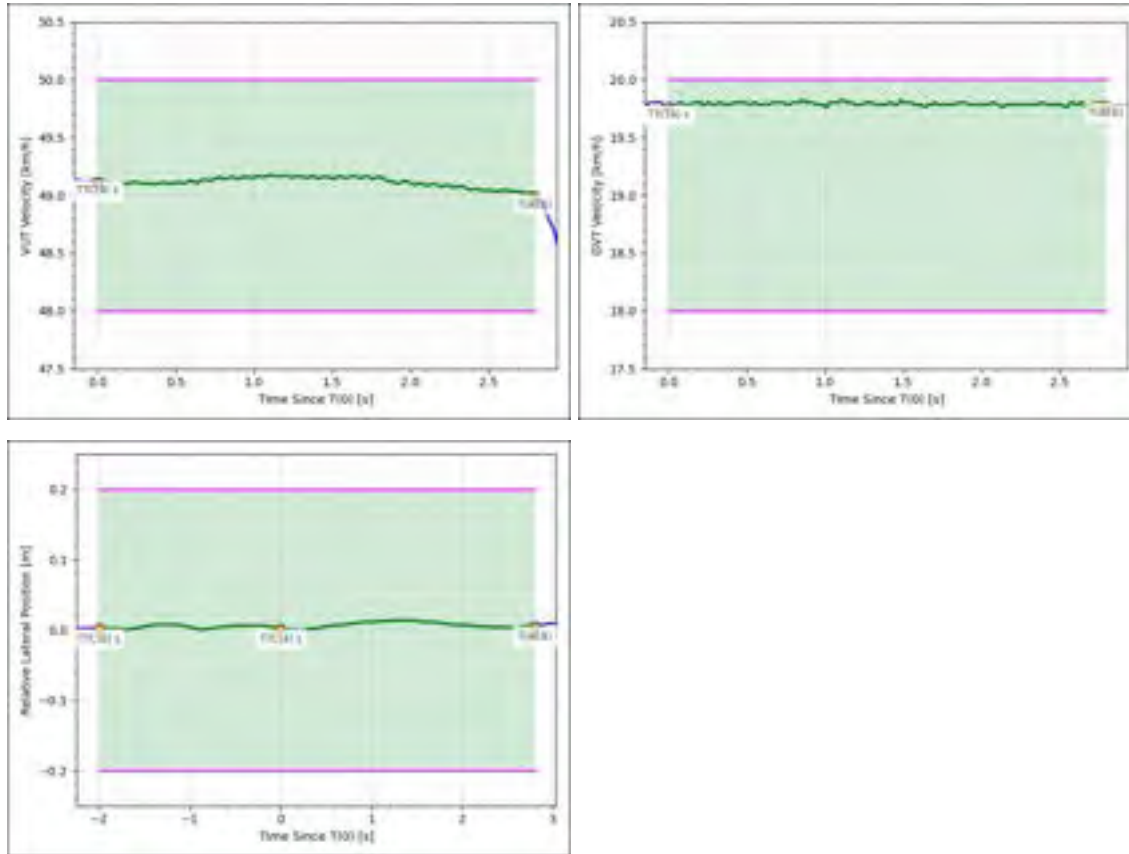
Run Date / Time 24-Jan-2023 11:28



G.2.1.3. AEB CCRm 50 kph +100 %

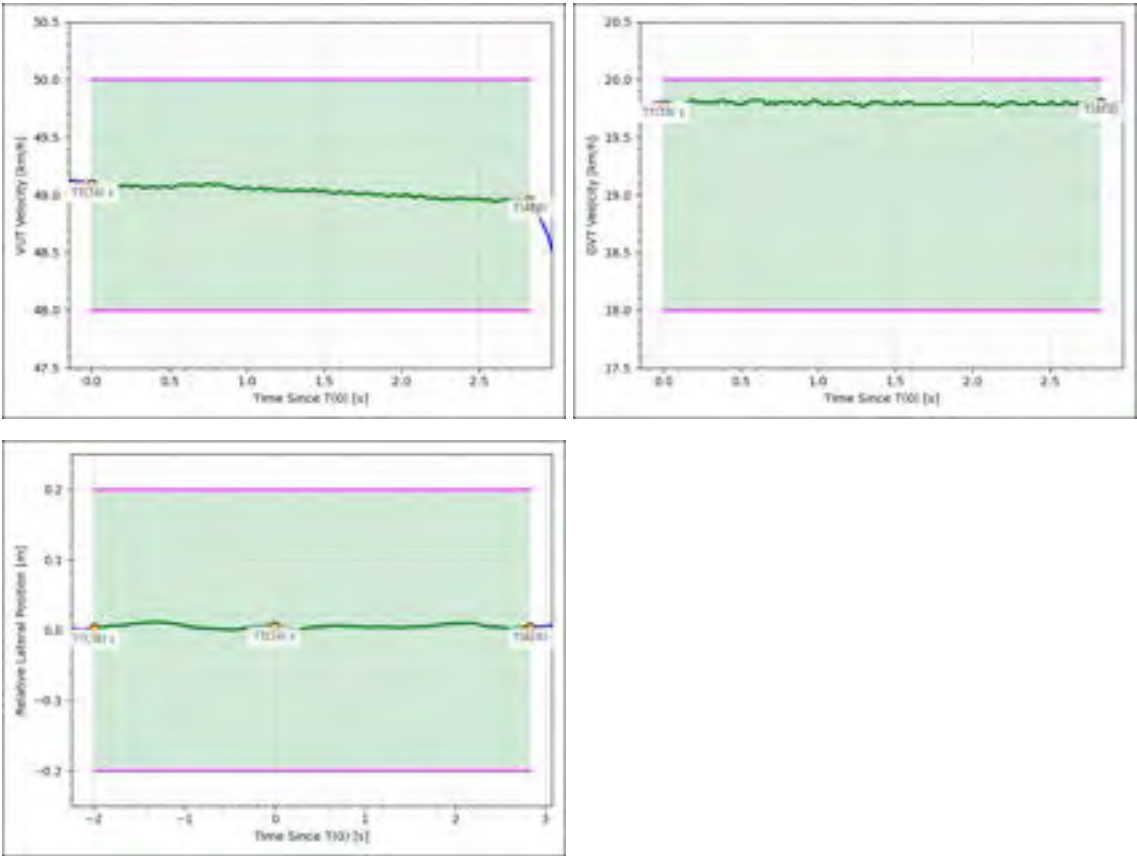
AEB CCRm | 50 km/h +100 % | Run 1

Run Date / Time 24-Jan-2023 11:32



AEB CCRm | 50 km/h +100 % | Run 2

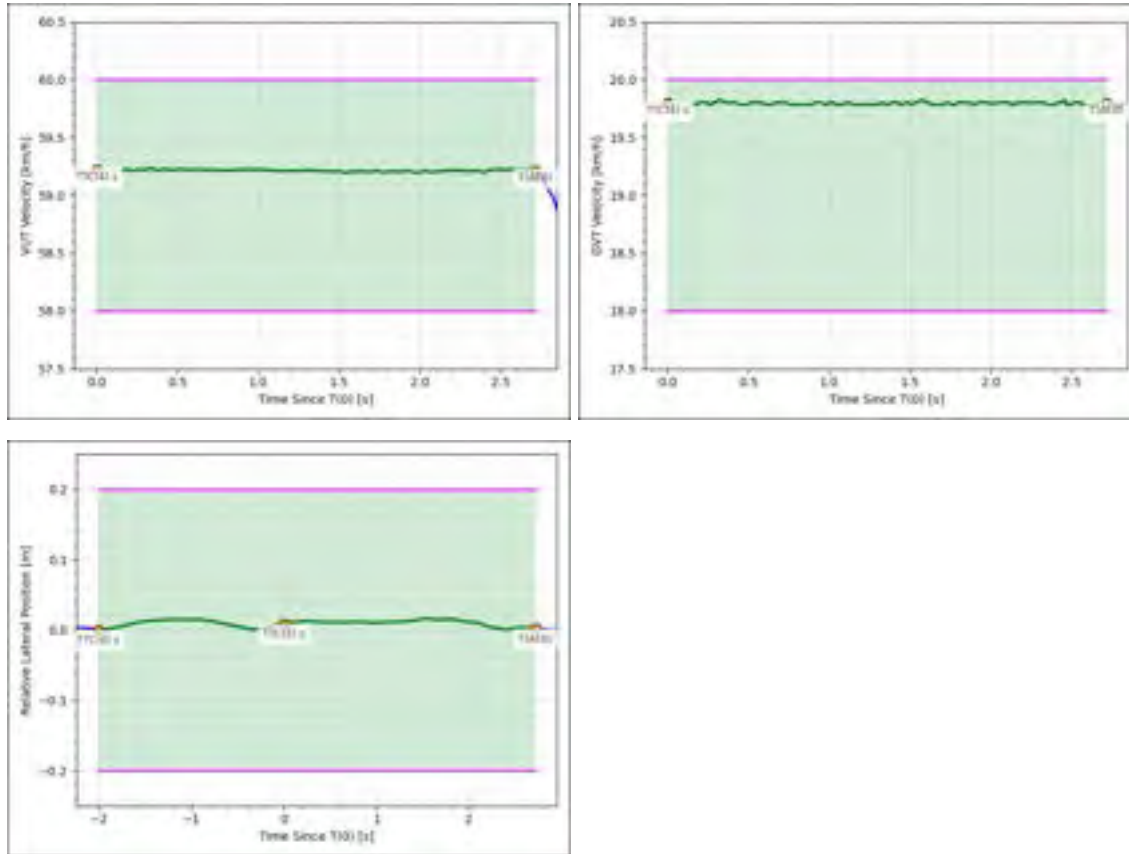
Run Date / Time 24-Jan-2023 11:36



G.2.1.4. AEB CCRm 60 kph +100 %

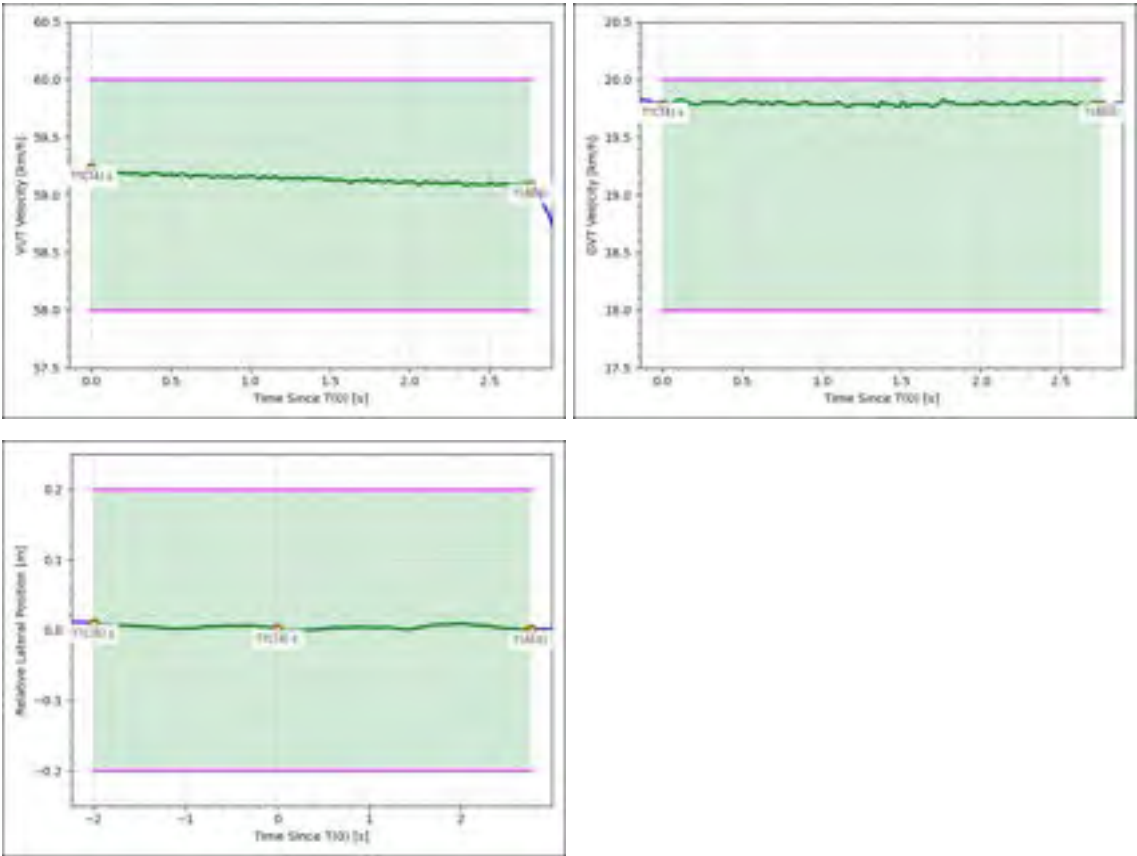
AEB CCRm | 60 km/h +100 % | Run 1

Run Date / Time 24-Jan-2023 11:40



AEB CCRm | 60 km/h +100 % | Run 2

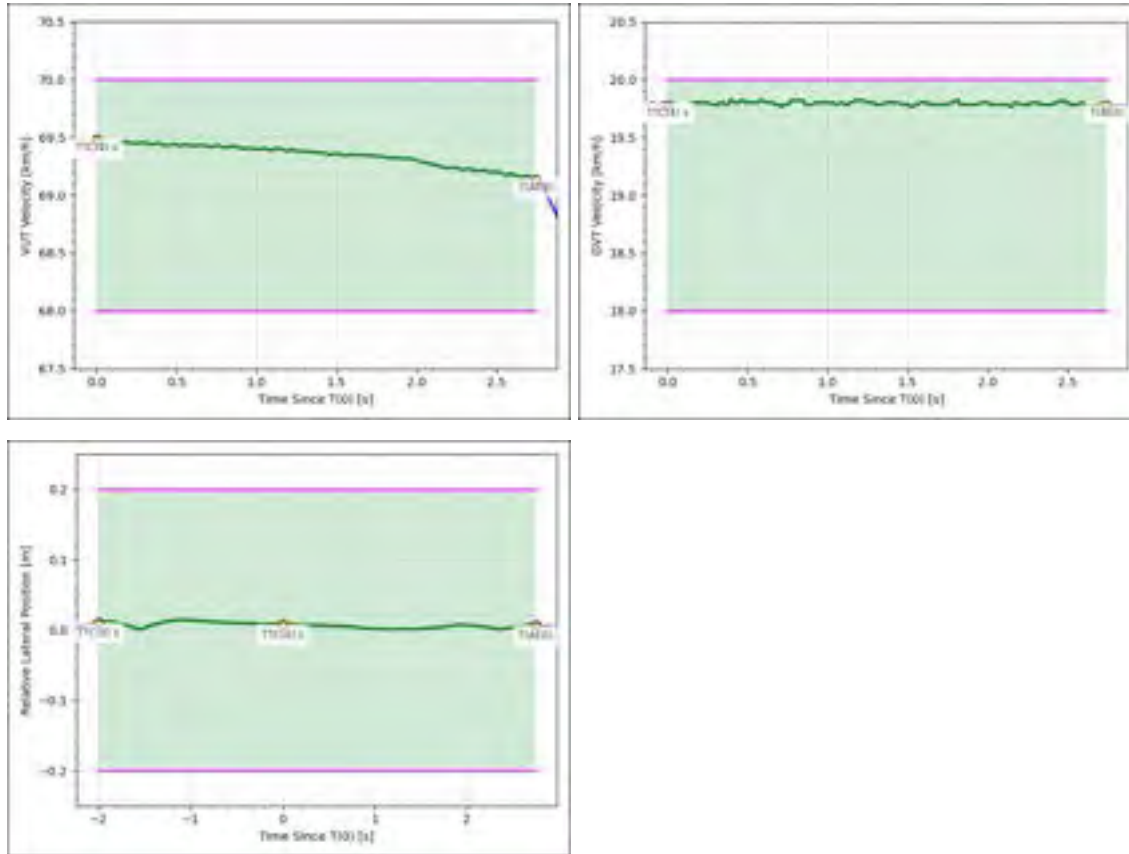
Run Date / Time 24-Jan-2023 11:44



G.2.1.5. AEB CCRm 70 kph +100 %

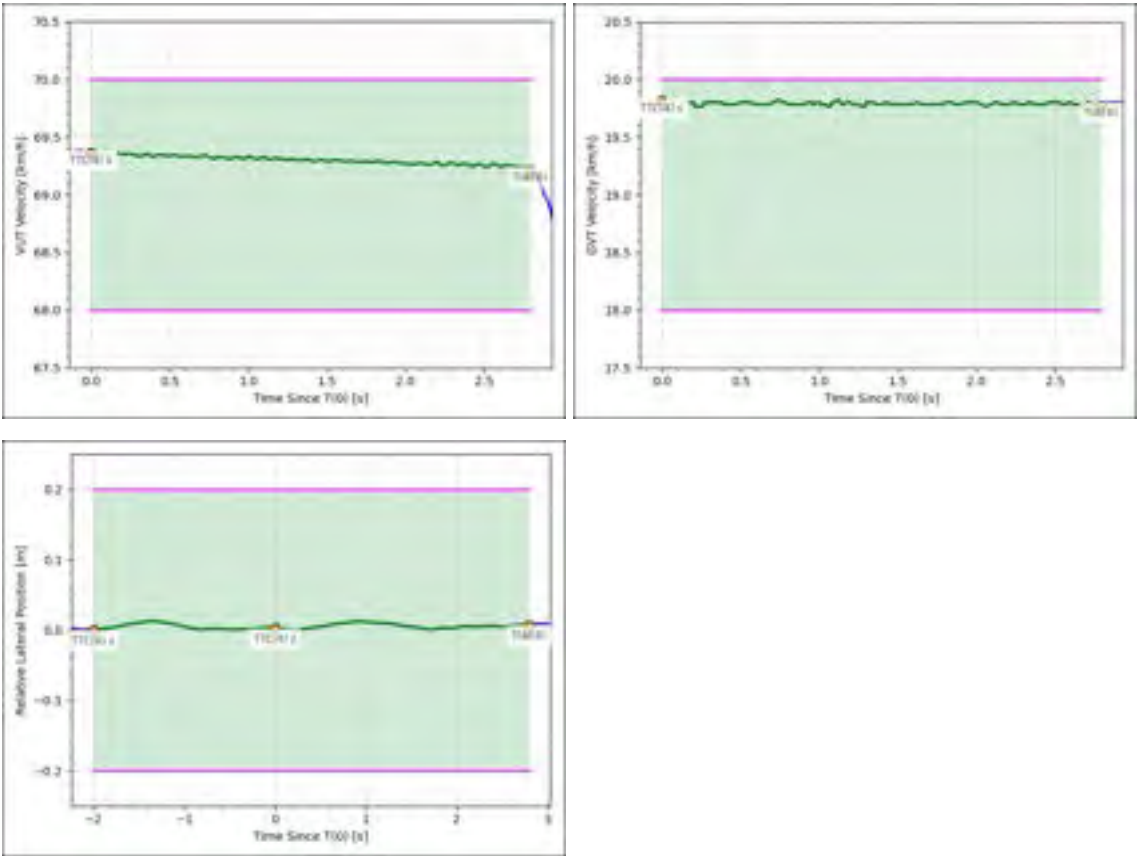
AEB CCRm | 70 km/h +100 % | Run 1

Run Date / Time 24-Jan-2023 11:47



AEB CCRm | 70 km/h +100 % | Run 2

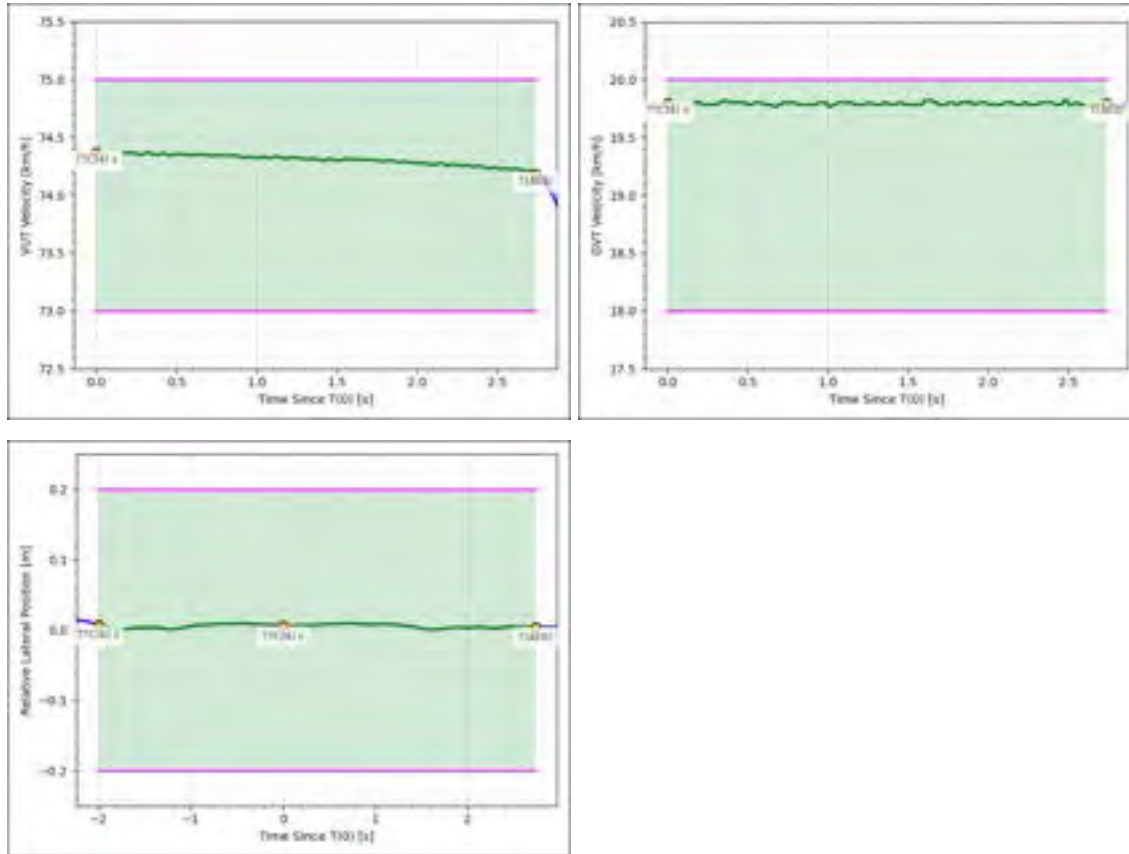
Run Date / Time 24-Jan-2023 11:51



G.2.1.6. AEB CCRm 75 kph +100 %

AEB CCRm | 75 km/h +100 % | Run 1

Run Date / Time 24-Jan-2023 11:57

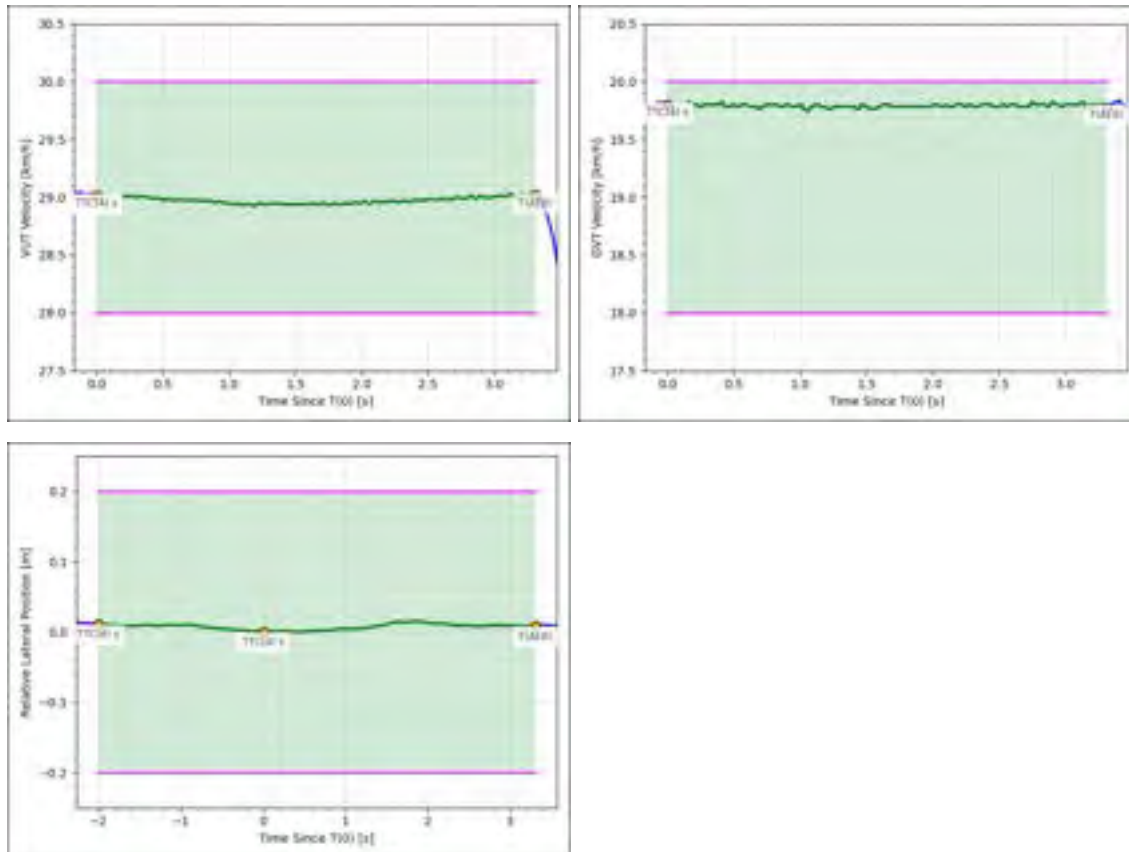


G.2.2. GVM

G.2.2.1. AEB CCRm 30 kph +100 %

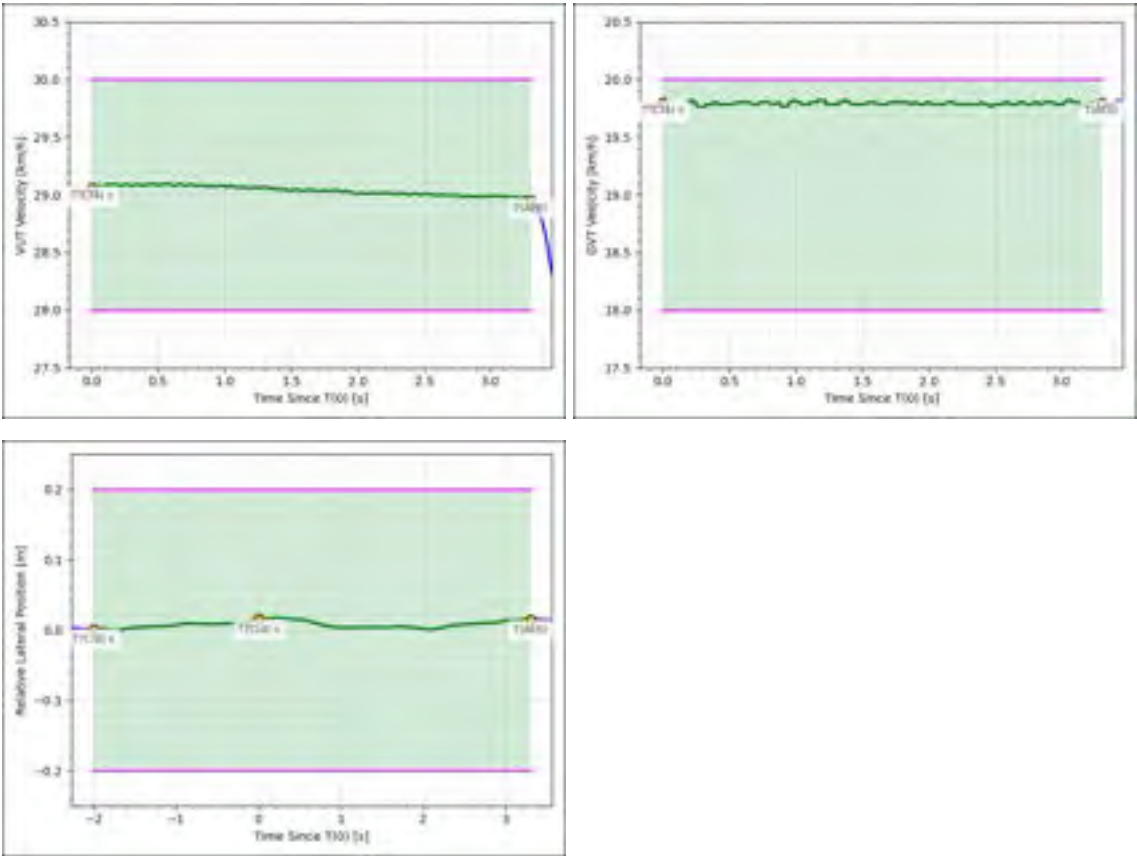
AEB CCRm | 30 km/h +100 % | Run 3

Run Date / Time 6-Feb-2023 14:46



AEB CCRm | 30 km/h +100 % | Run 4

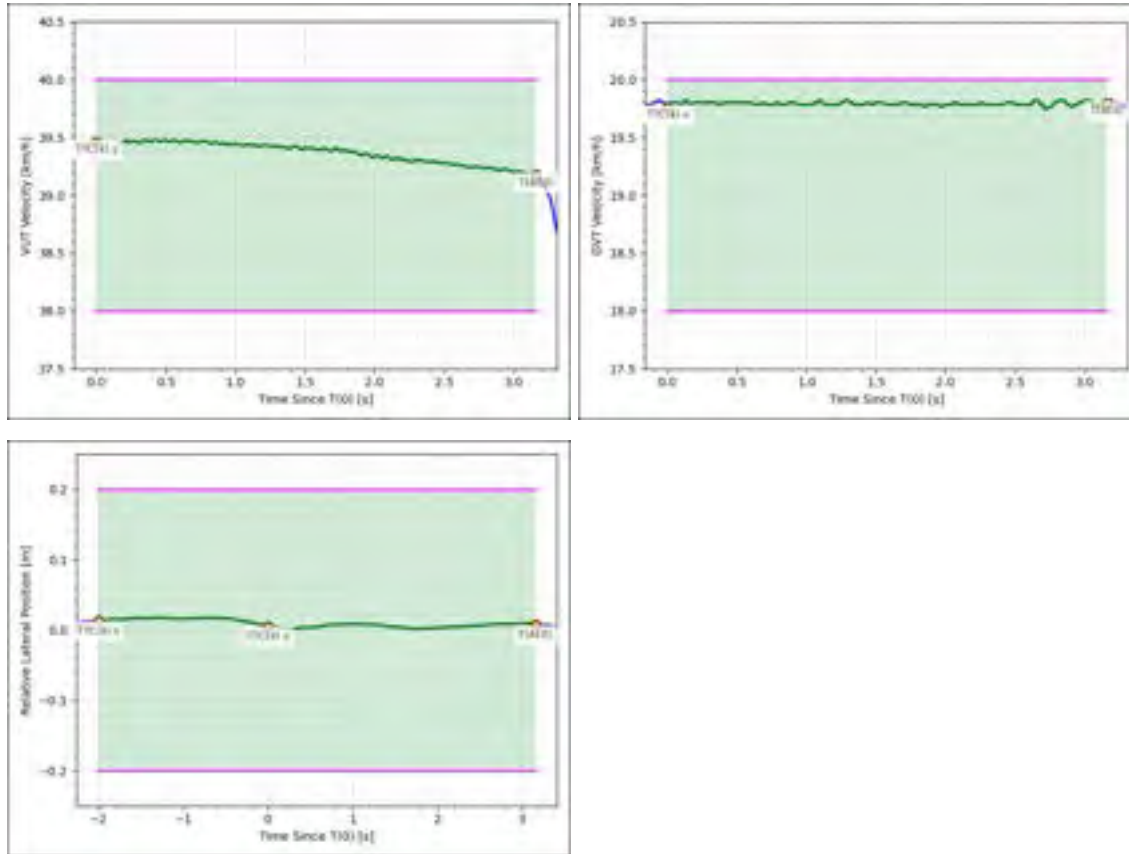
Run Date / Time 6-Feb-2023 14:49



G.2.2.2. AEB CCRm 40 kph +100 %

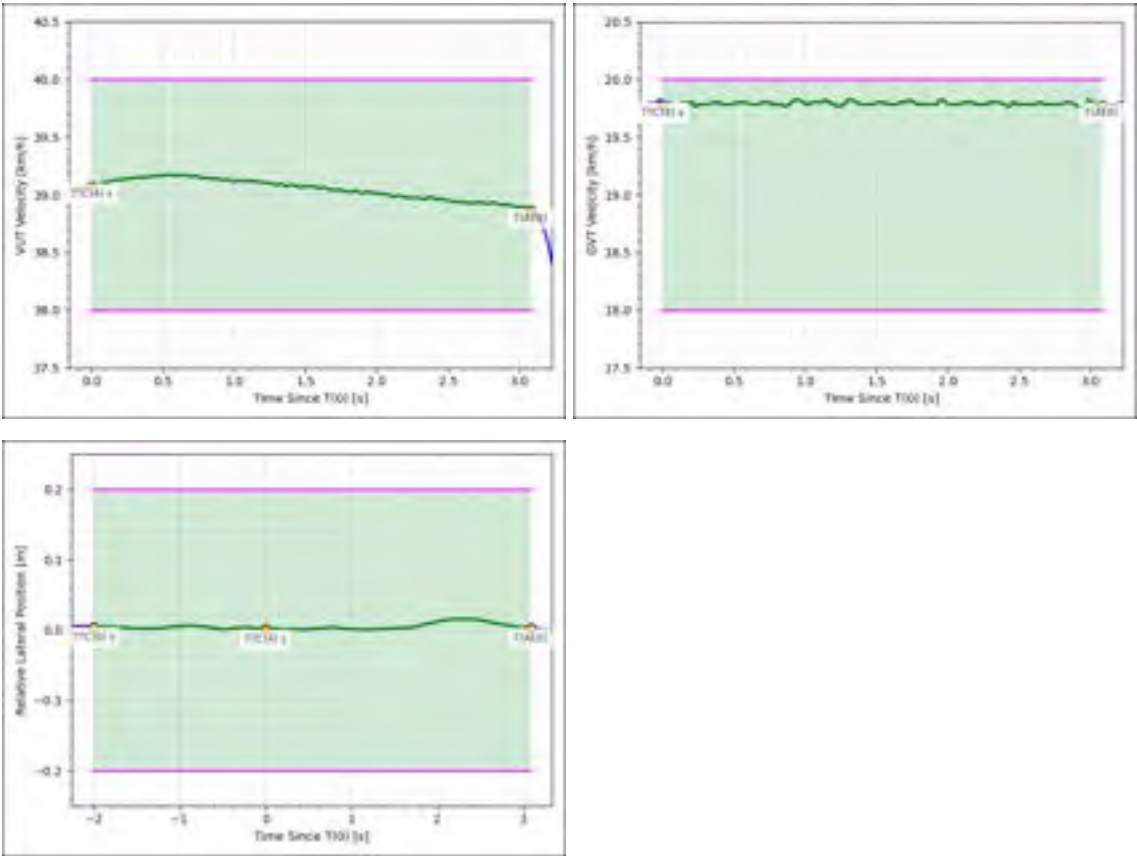
AEB CCRm | 40 km/h +100 % | Run 3

Run Date / Time 6-Feb-2023 14:51



AEB CCRm | 40 km/h +100 % | Run 5

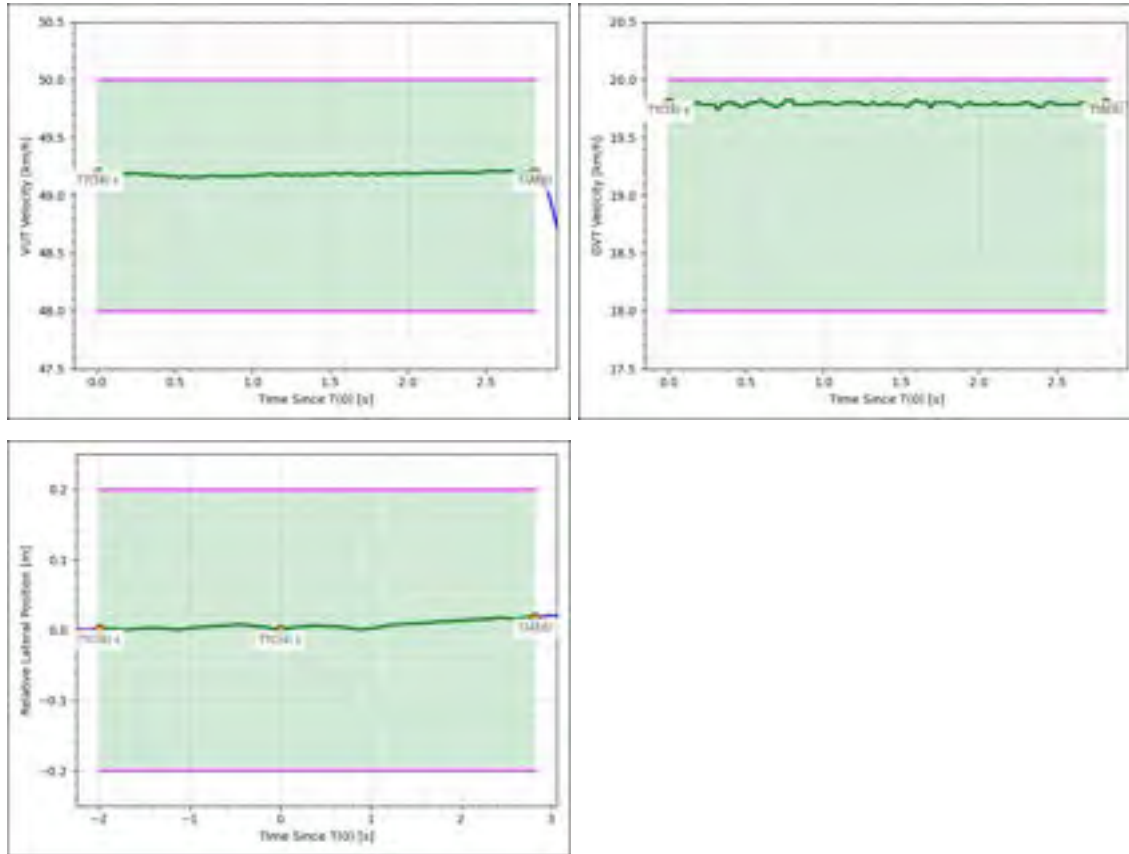
Run Date / Time 6-Feb-2023 14:57



G.2.2.3. AEB CCRm 50 kph +100 %

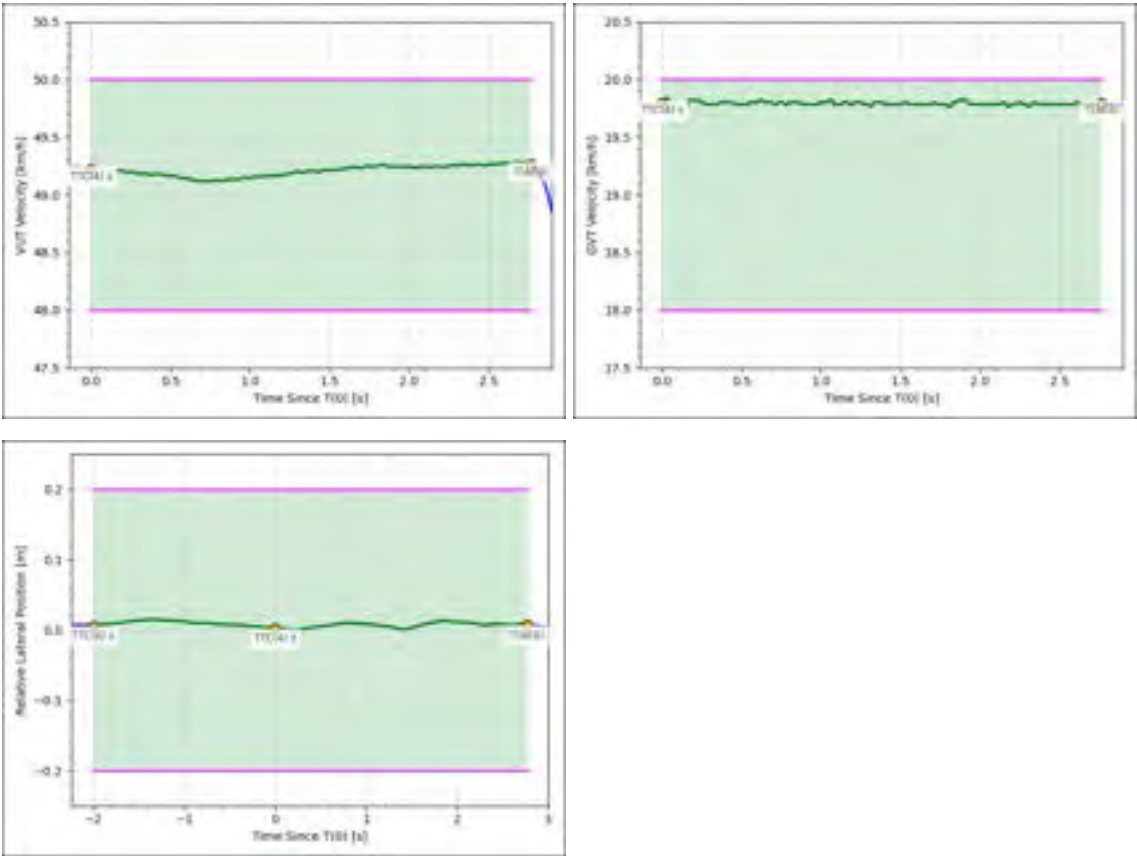
AEB CCRm | 50 km/h +100 % | Run 3

Run Date / Time 6-Feb-2023 15:01



AEB CCRm | 50 km/h +100 % | Run 4

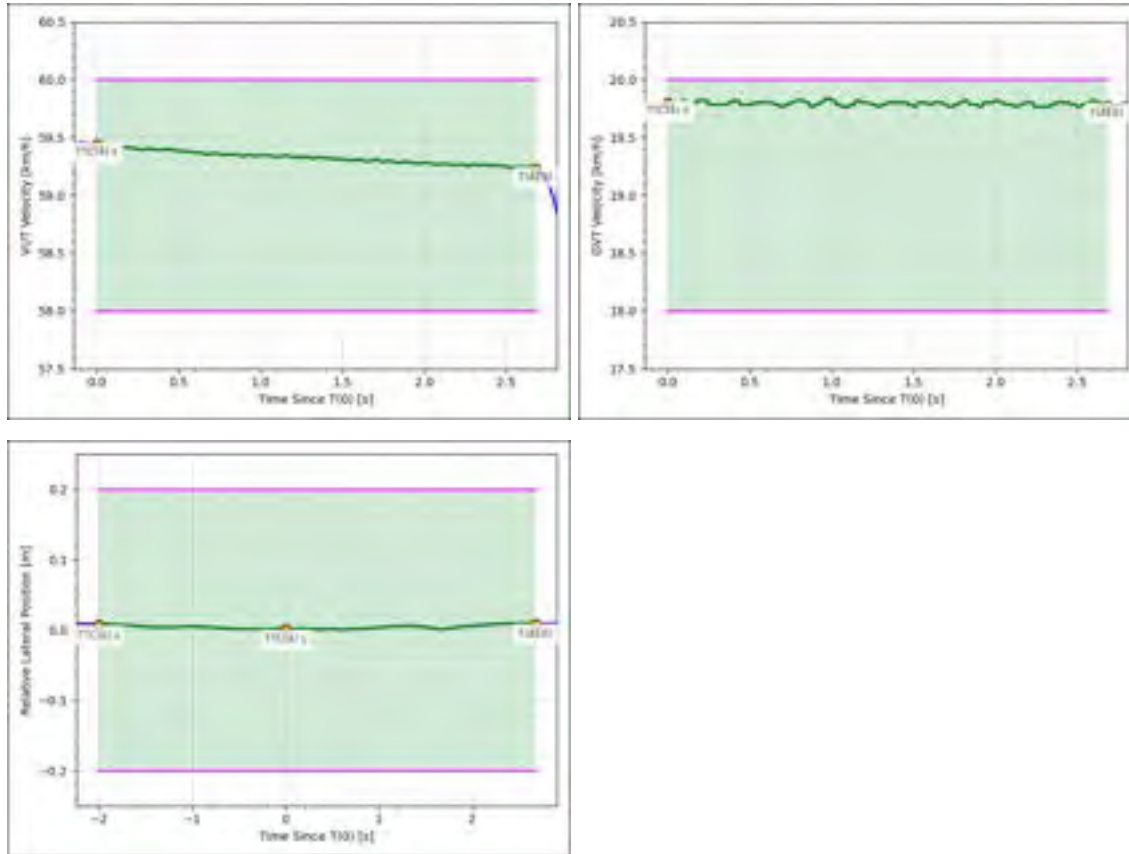
Run Date / Time 6-Feb-2023 15:03



G.2.2.4. AEB CCRm 60 kph +100 %

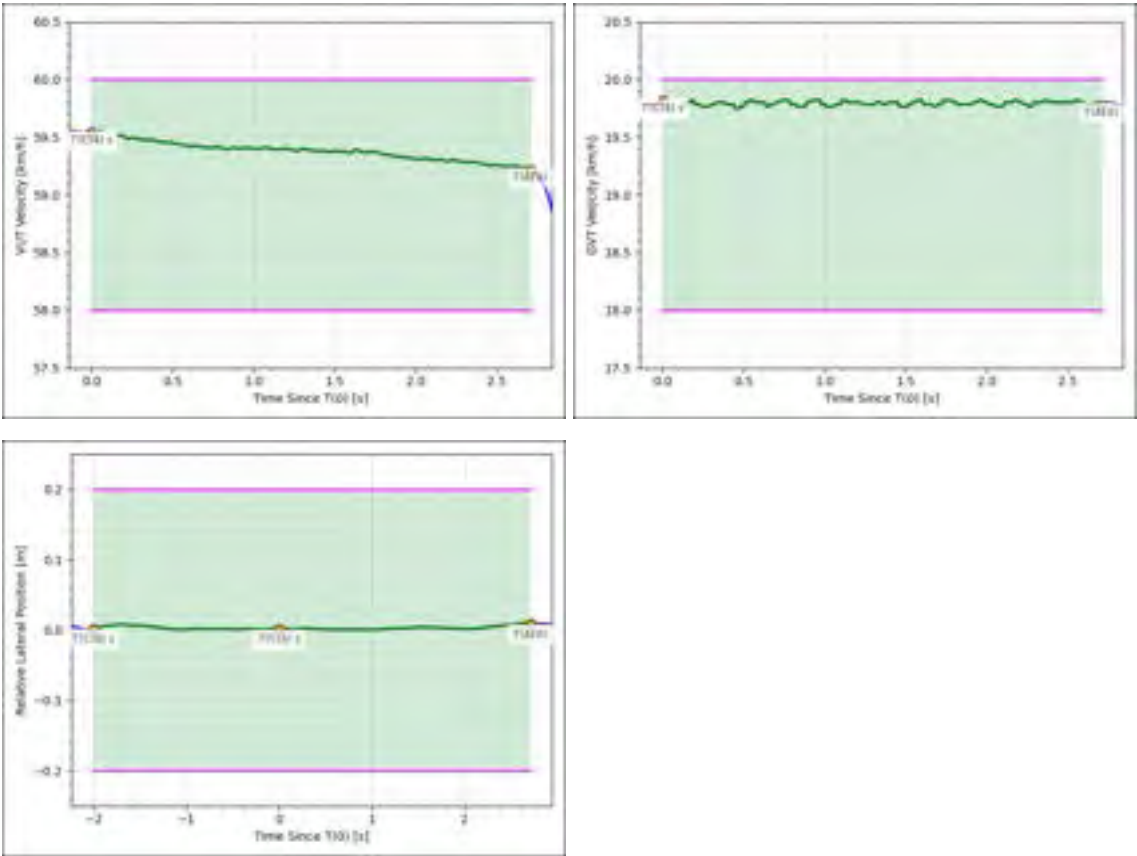
AEB CCRm | 60 km/h +100 % | Run 3

Run Date / Time 6-Feb-2023 15:08



AEB CCRm | 60 km/h +100 % | Run 4

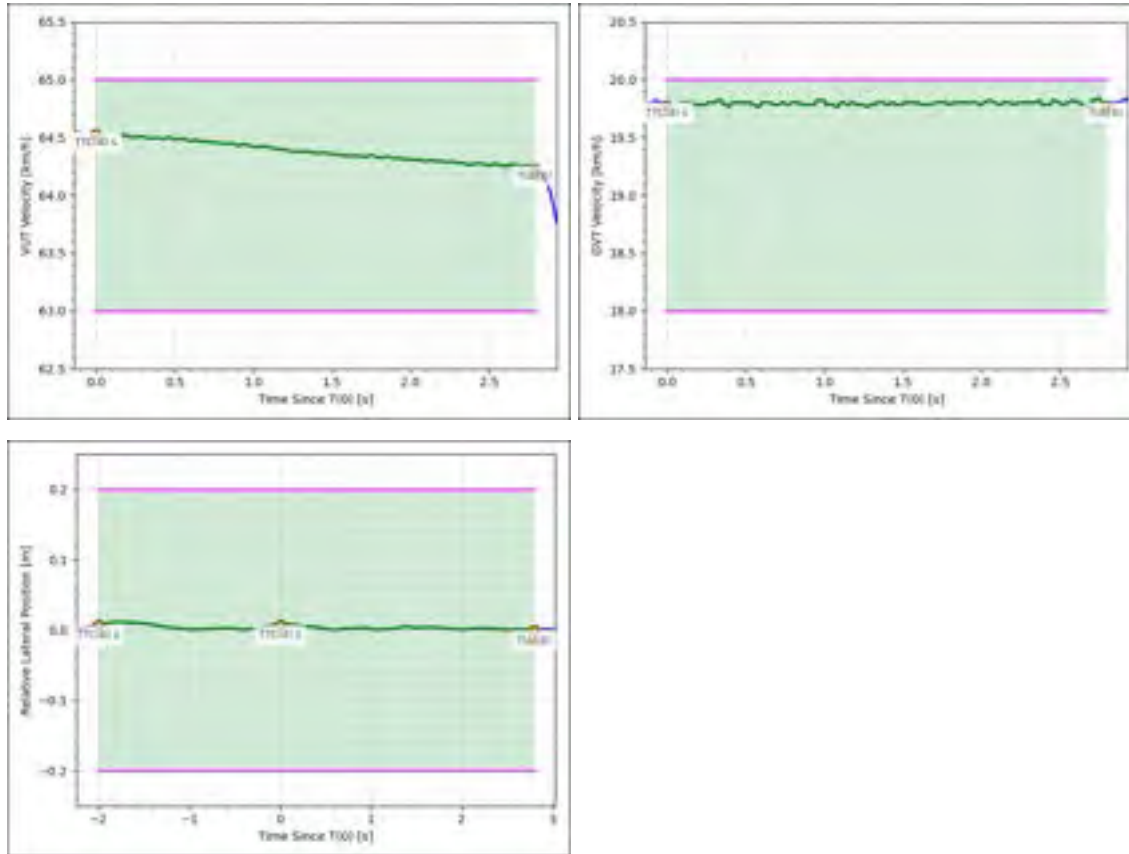
Run Date / Time 6-Feb-2023 15:12



G.2.2.5. AEB CCRm 65 kph +100 %

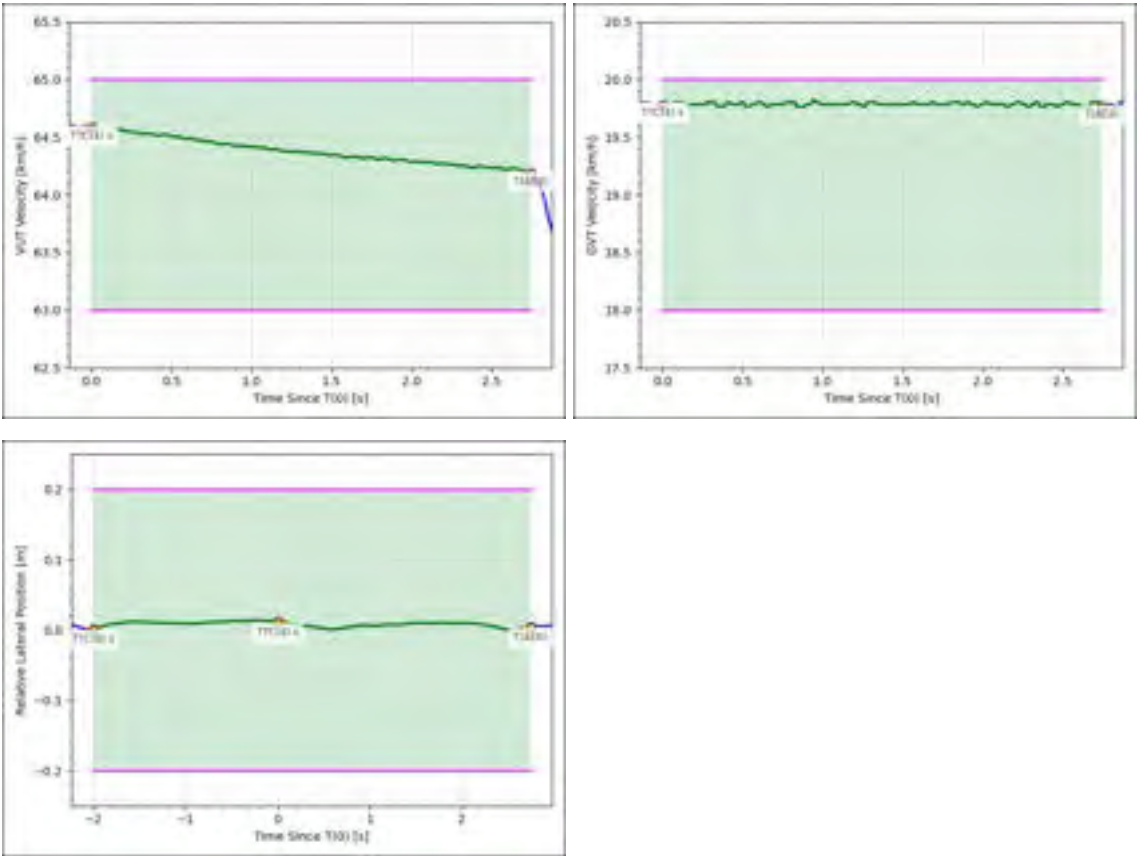
AEB CCRm | 65 km/h +100 % | Run 1

Run Date / Time 6-Feb-2023 15:17



AEB CCRm | 65 km/h +100 % | Run 2

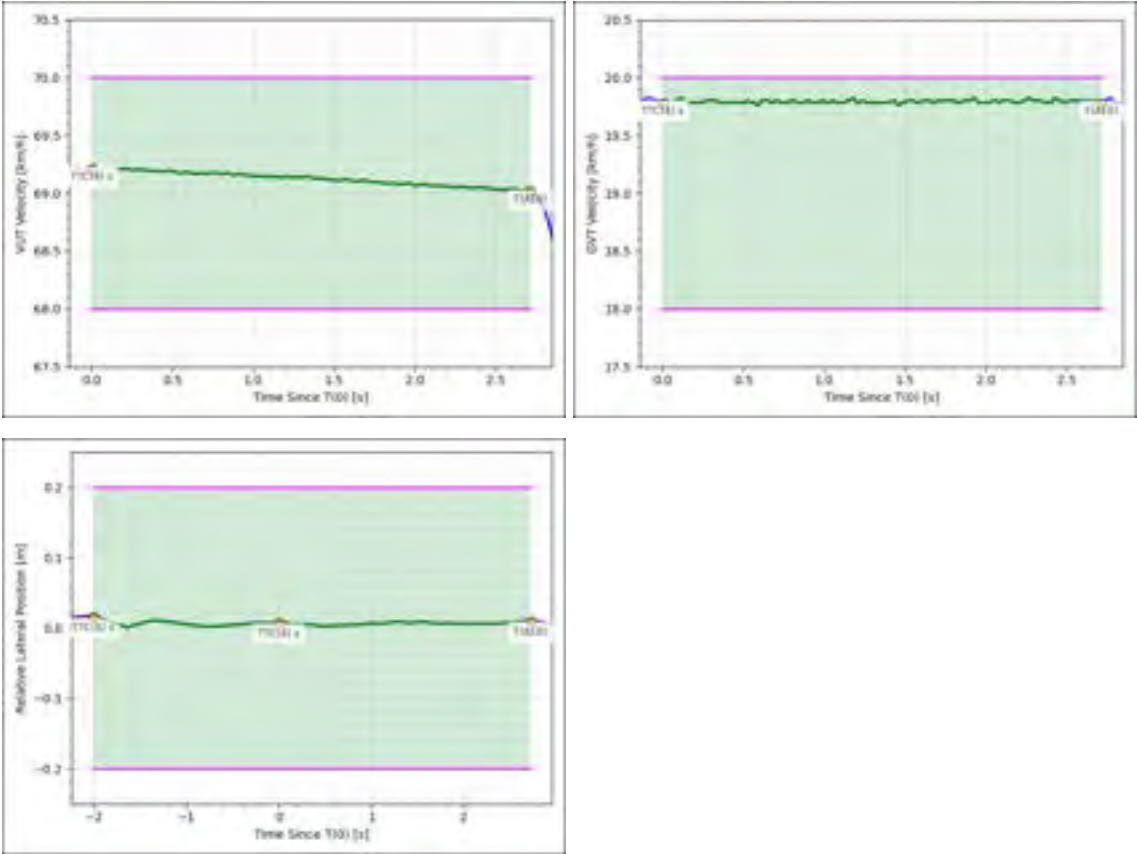
Run Date / Time 6-Feb-2023 15:21



G.2.2.6. AEB CCRm 70 kph +100 %

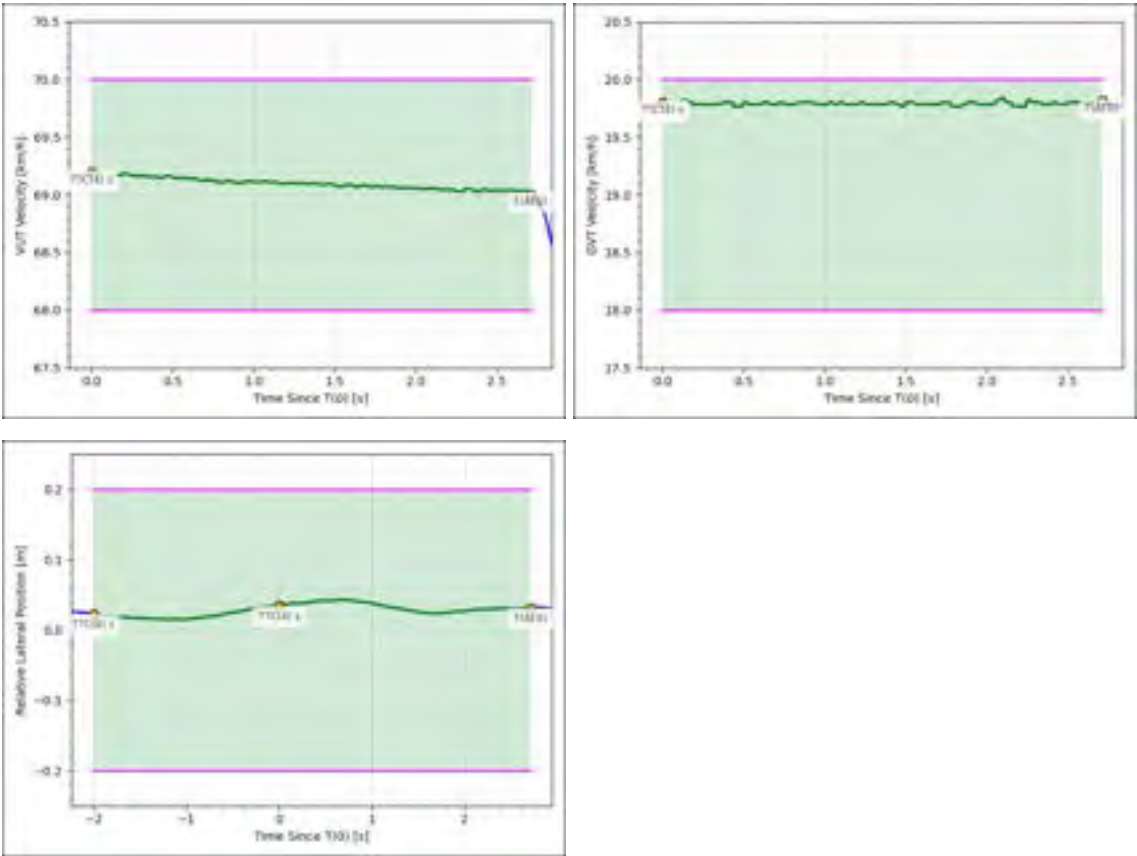
AEB CCRm | 70 km/h +100 % | Run 3

Run Date / Time 6-Feb-2023 15:27



AEB CCRm | 70 km/h +100 % | Run 4

Run Date / Time 6-Feb-2023 15:39

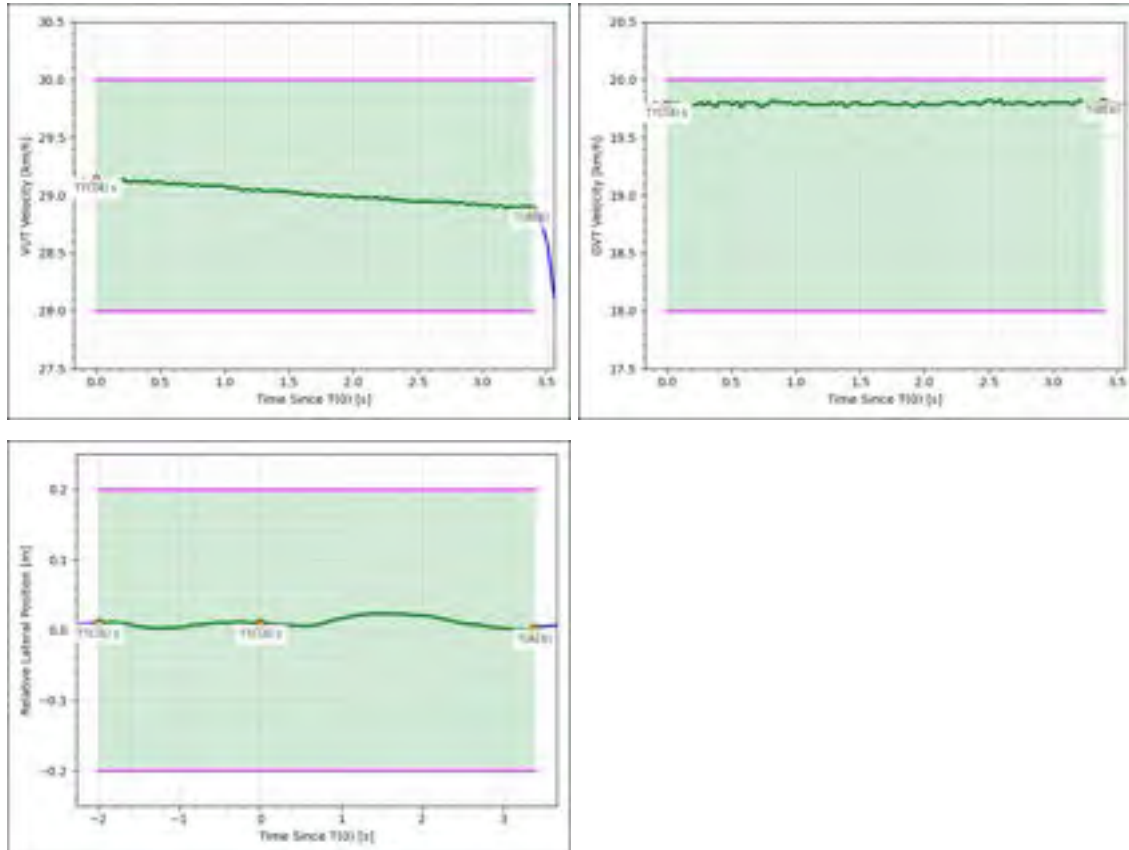


G.2.3. Ironman Bullbar

G.2.3.1. AEB CCRm 30 kph +100 %

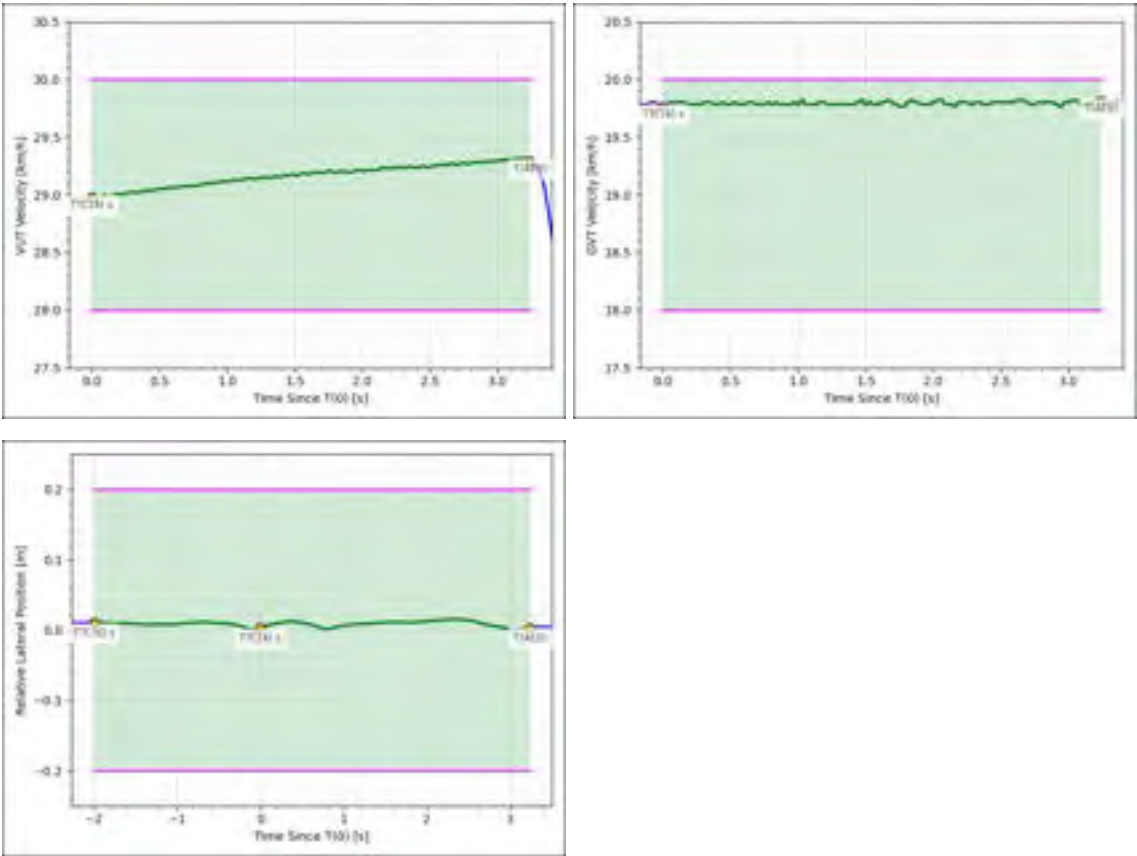
AEB CCRm | 30 km/h +100 % | Run 1

Run Date / Time 10-Mar-2023 14:17



AEB CCRm | 30 km/h +100 % | Run 2

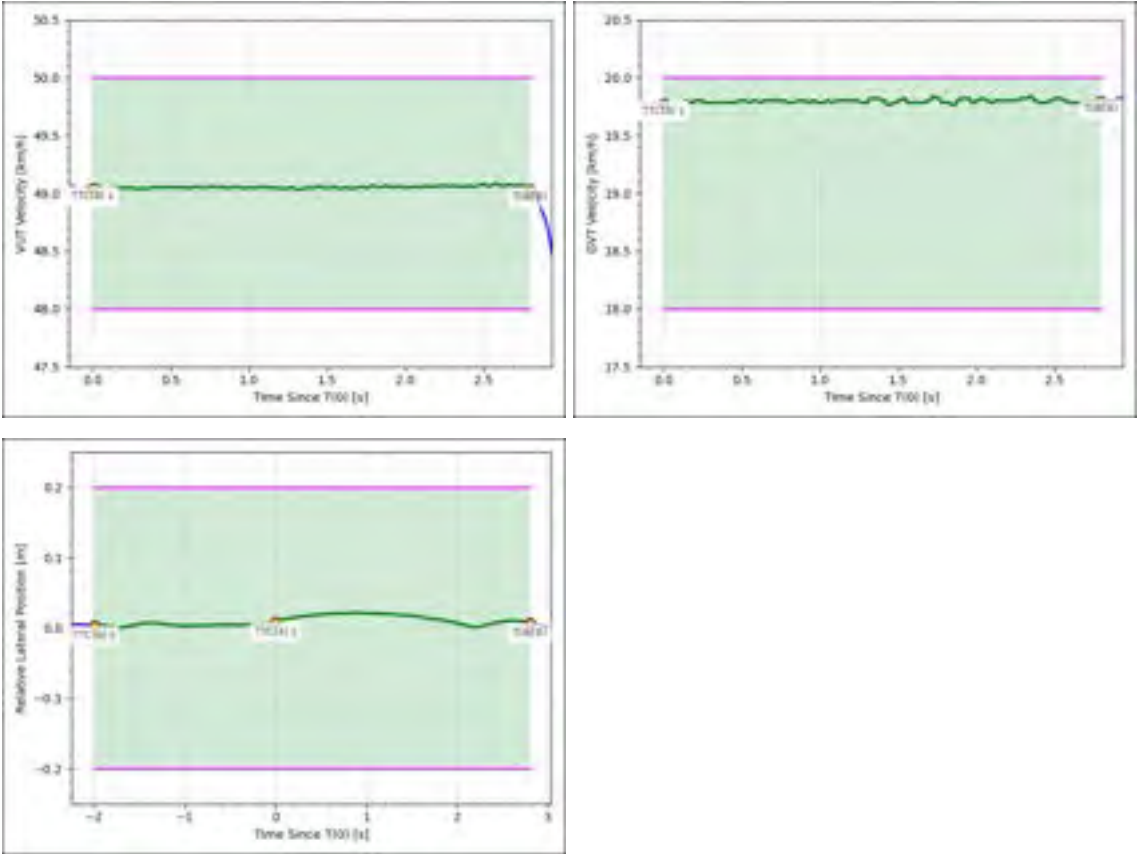
Run Date / Time 10-Mar-2023 14:21



G.2.3.2. AEB CCRm 50 kph +100 %

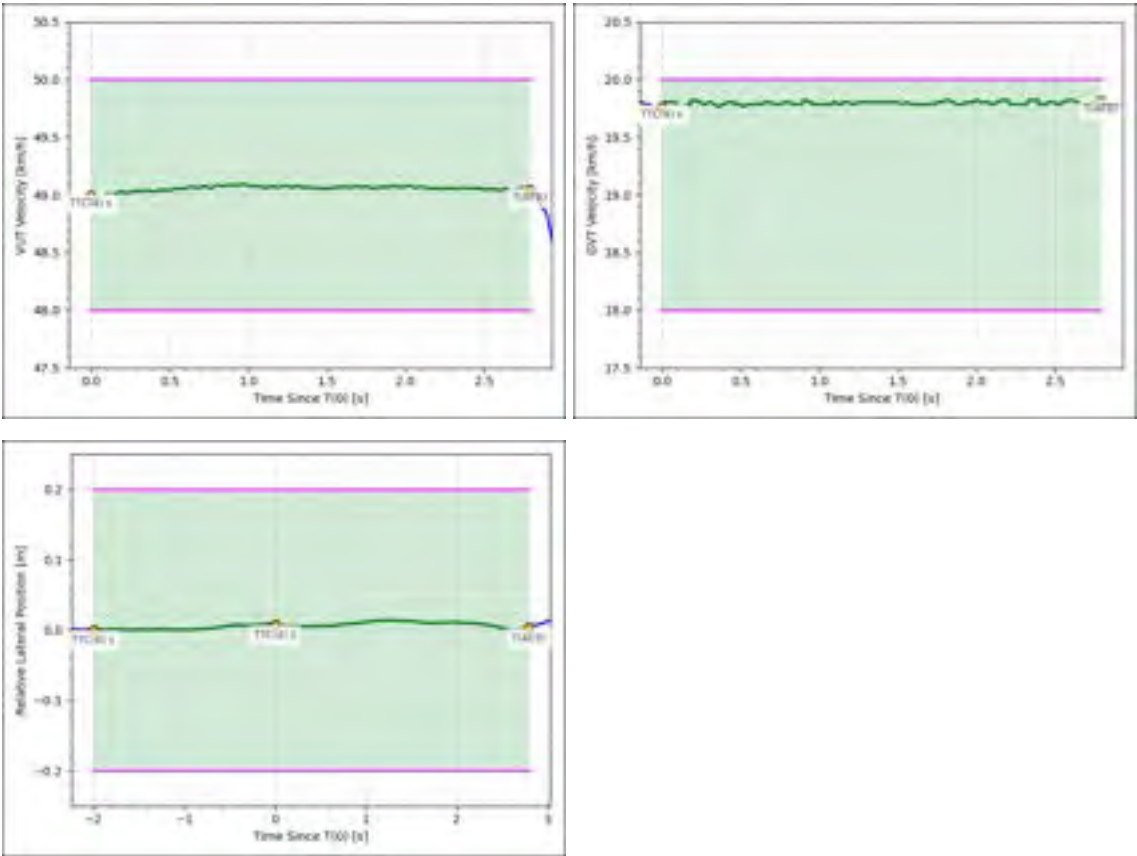
AEB CCRm | 50 km/h +100 % | Run 1

Run Date / Time 10-Mar-2023 14:24



AEB CCRm | 50 km/h +100 % | Run 2

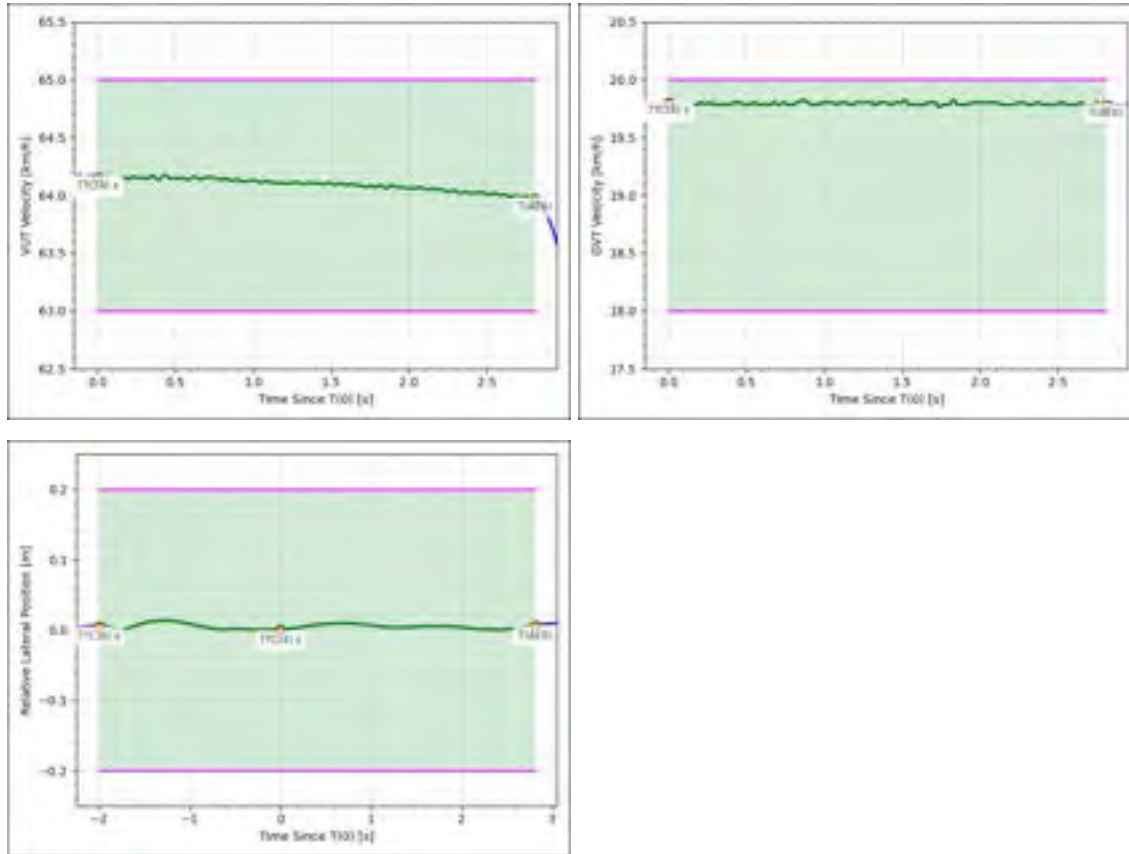
Run Date / Time 10-Mar-2023 14:28



G.2.3.3. AEB CCRm 65 kph +100 %

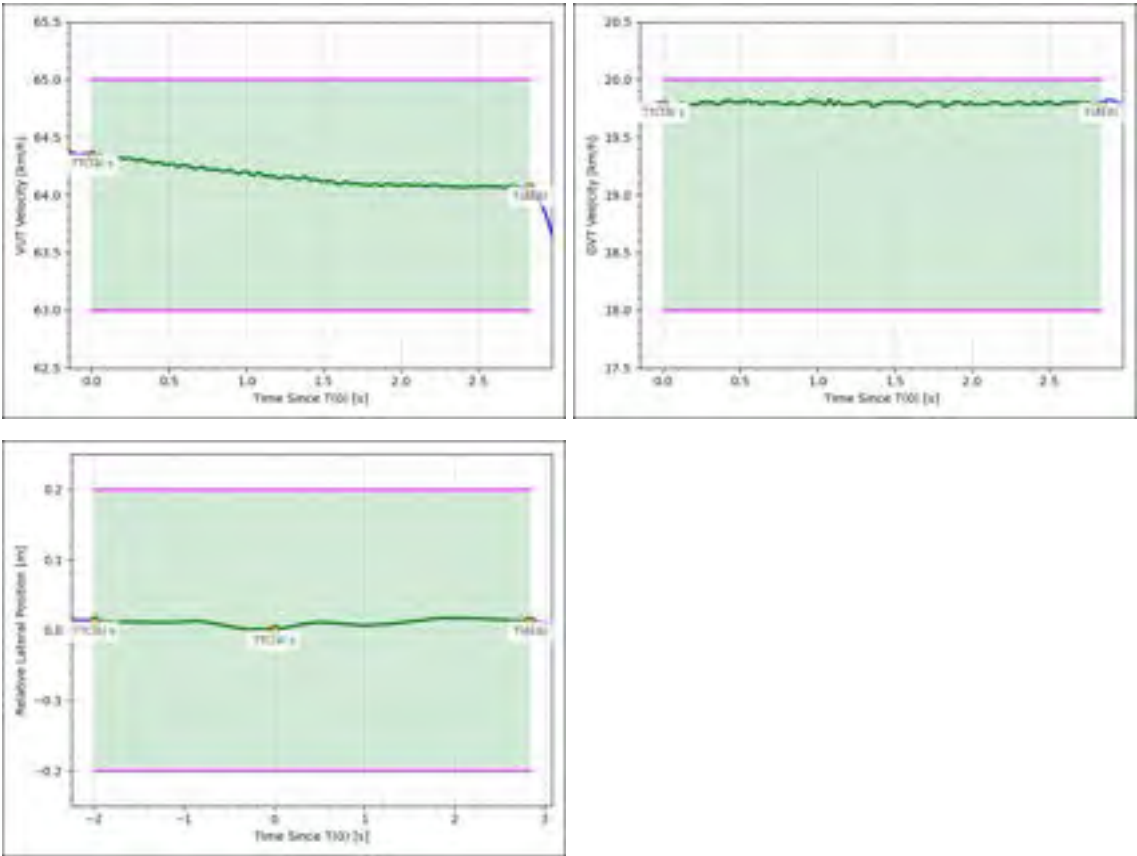
AEB CCRm | 65 km/h +100 % | Run 1

Run Date / Time 21-Jun-2023 14:37



AEB CCRm | 65 km/h +100 % | Run 2

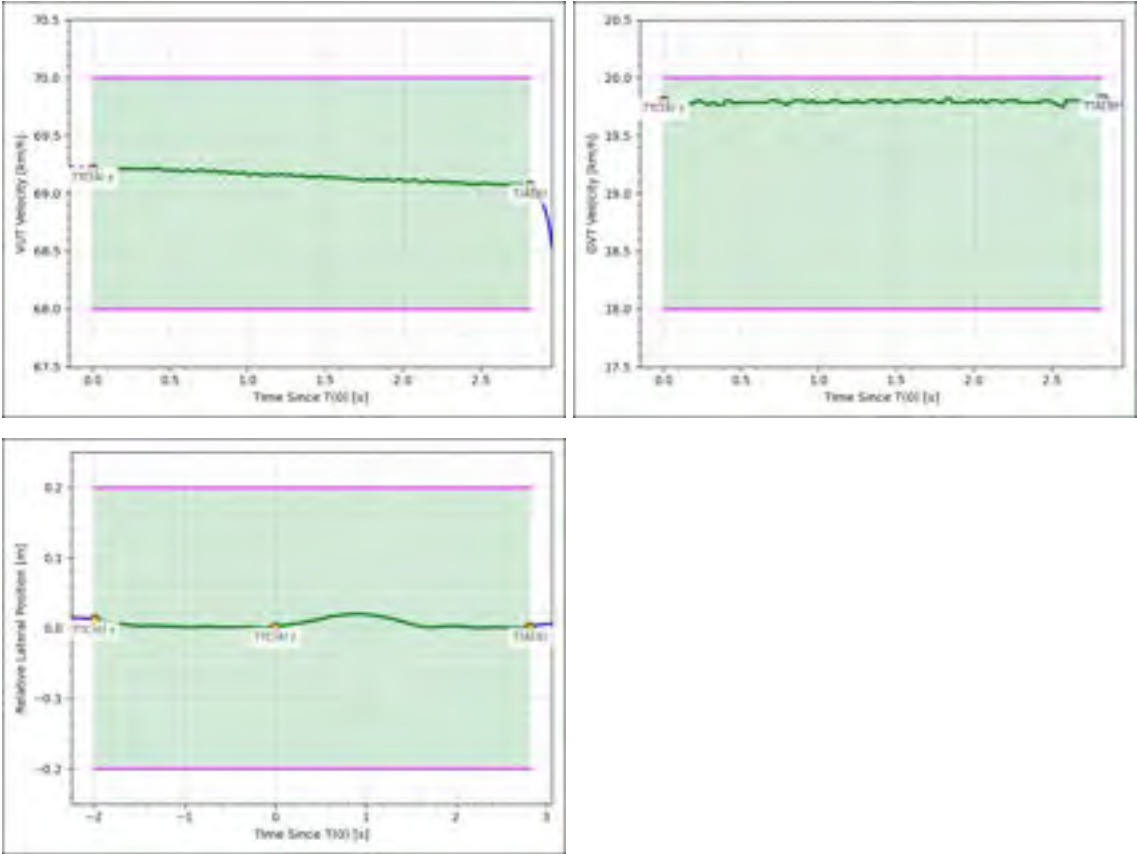
Run Date / Time 21-Jun-2023 14:42



G.2.3.4. AEB CCRm 70 kph +100 %

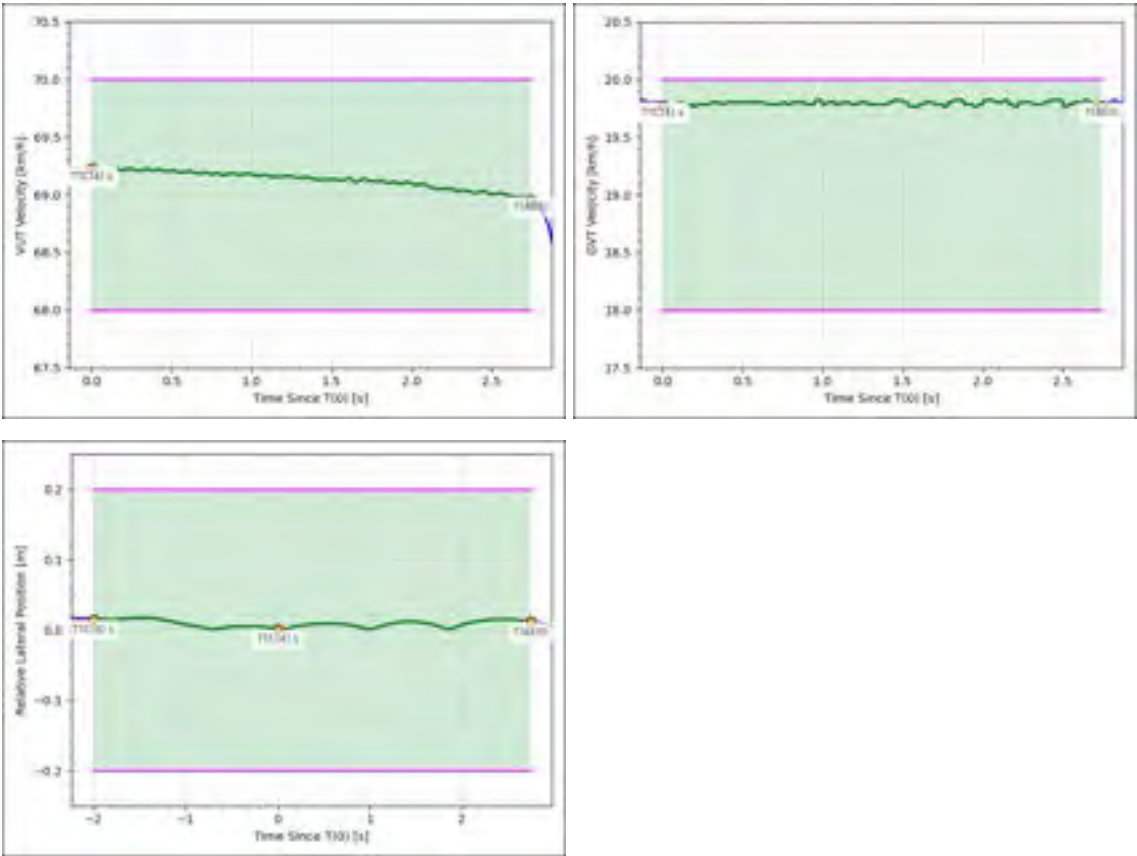
AEB CCRm | 70 km/h +100 % | Run 1

Run Date / Time 10-Mar-2023 14:32



AEB CCRm | 70 km/h +100 % | Run 2

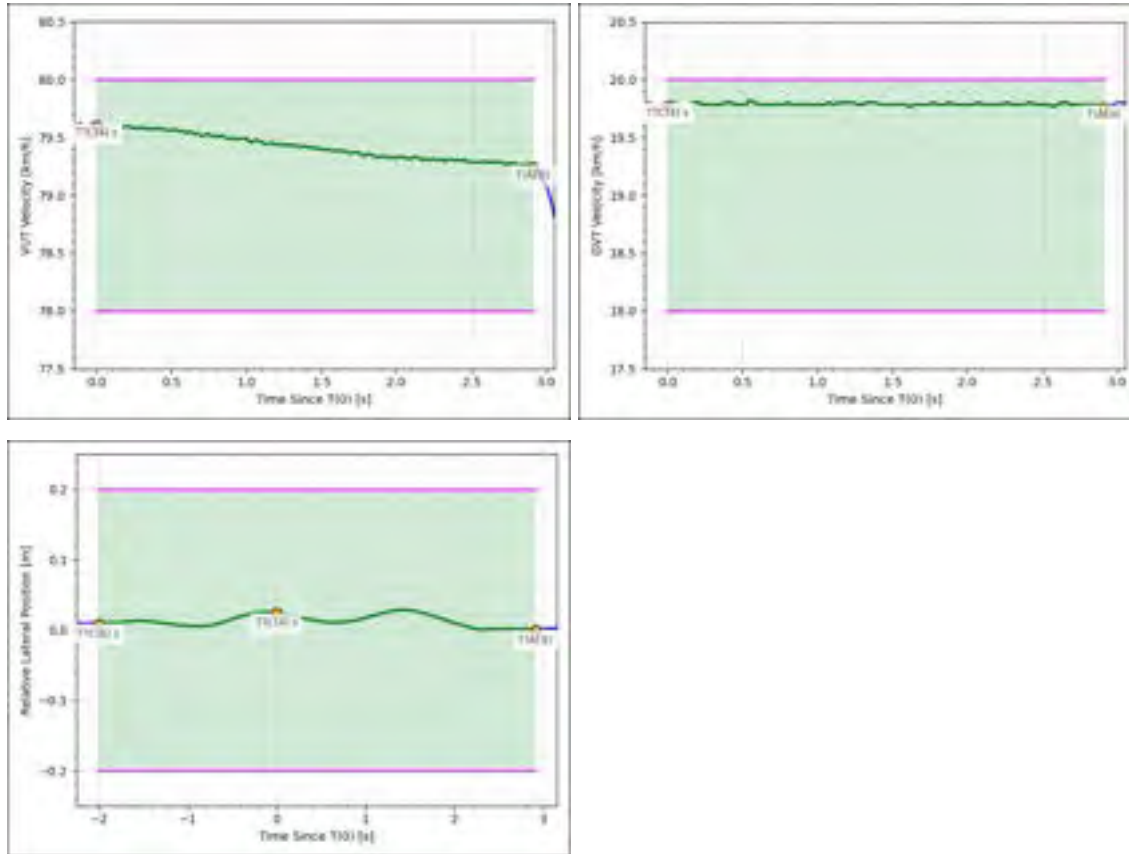
Run Date / Time 10-Mar-2023 14:38



G.2.3.5. AEB CCRm 80 kph +100 %

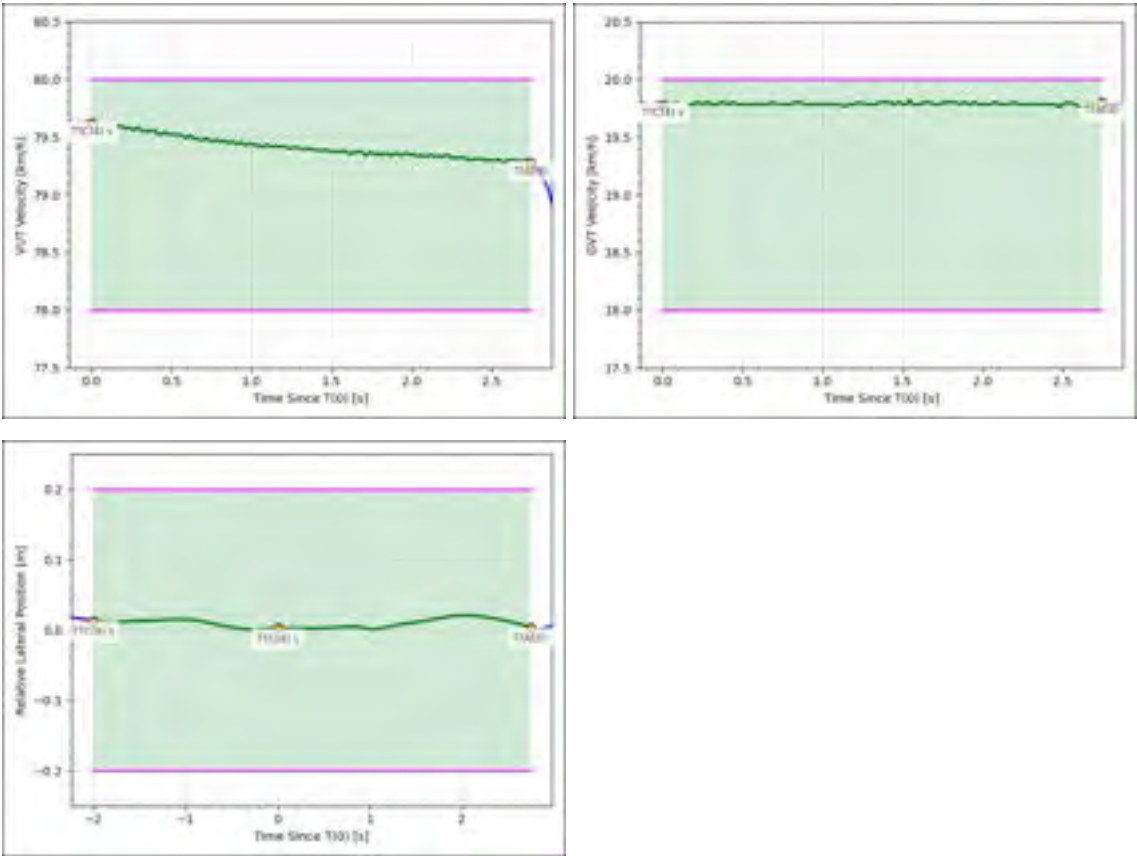
AEB CCRm | 80 km/h +100 % | Run 1

Run Date / Time 21-Jun-2023 14:56



AEB CCRm | 80 km/h +100 % | Run 2

Run Date / Time 21-Jun-2023 15:21

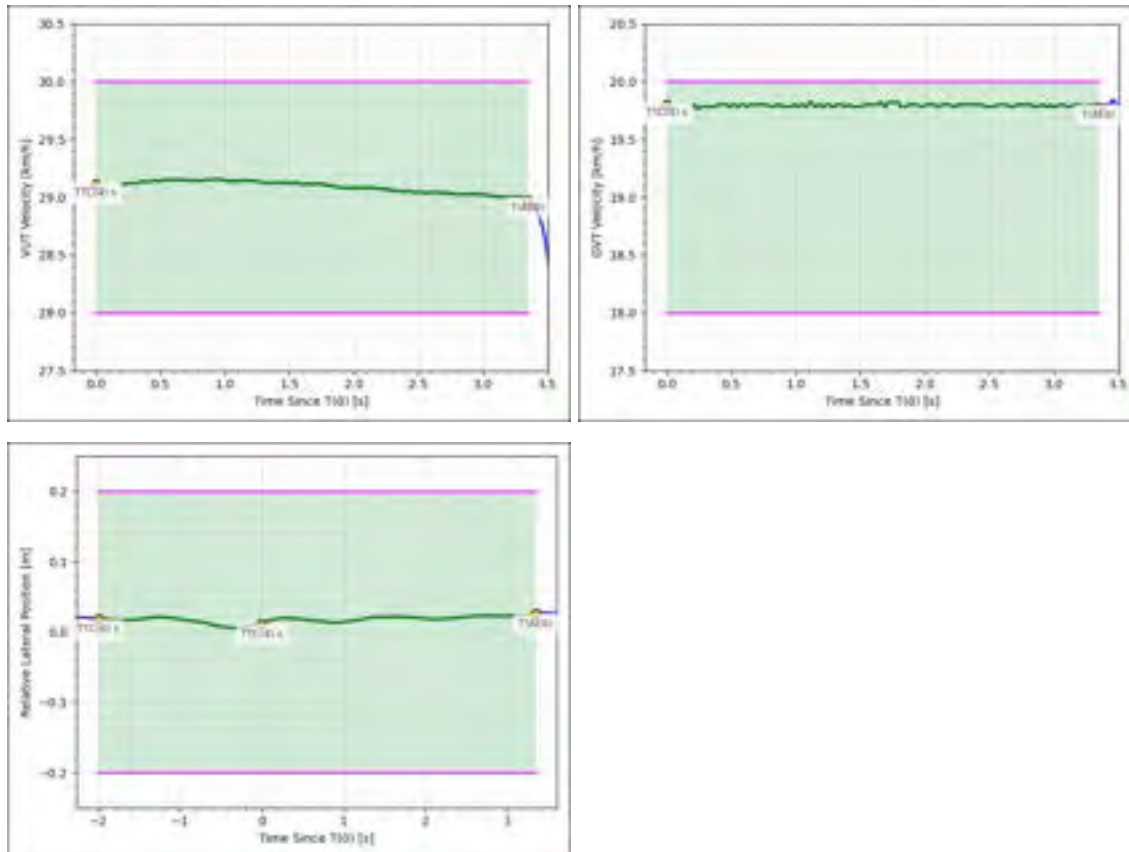


G.2.4. Tuff Bullbar

G.2.4.1. AEB CCRm 30 kph +100 %

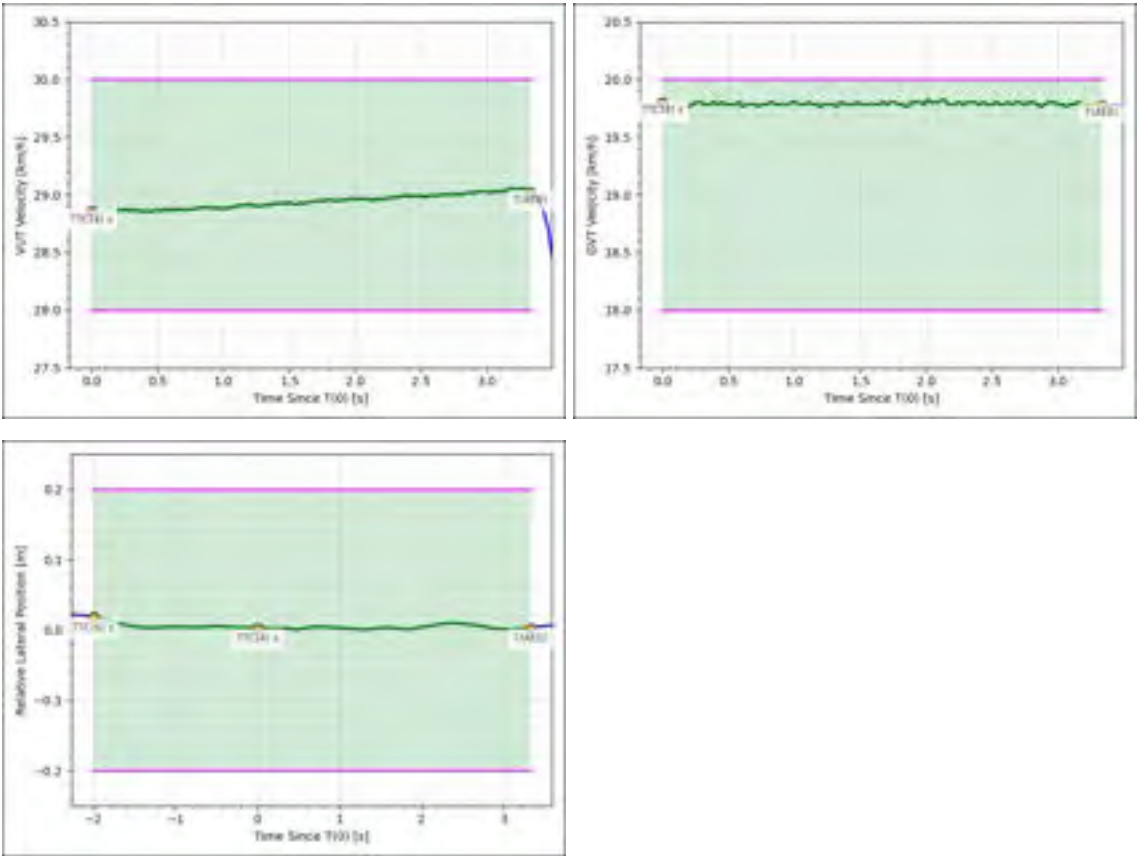
AEB CCRm | 30 km/h +100 % | Run 1

Run Date / Time 11-Jul-2023 11:19



AEB CCRm | 30 km/h +100 % | Run 2

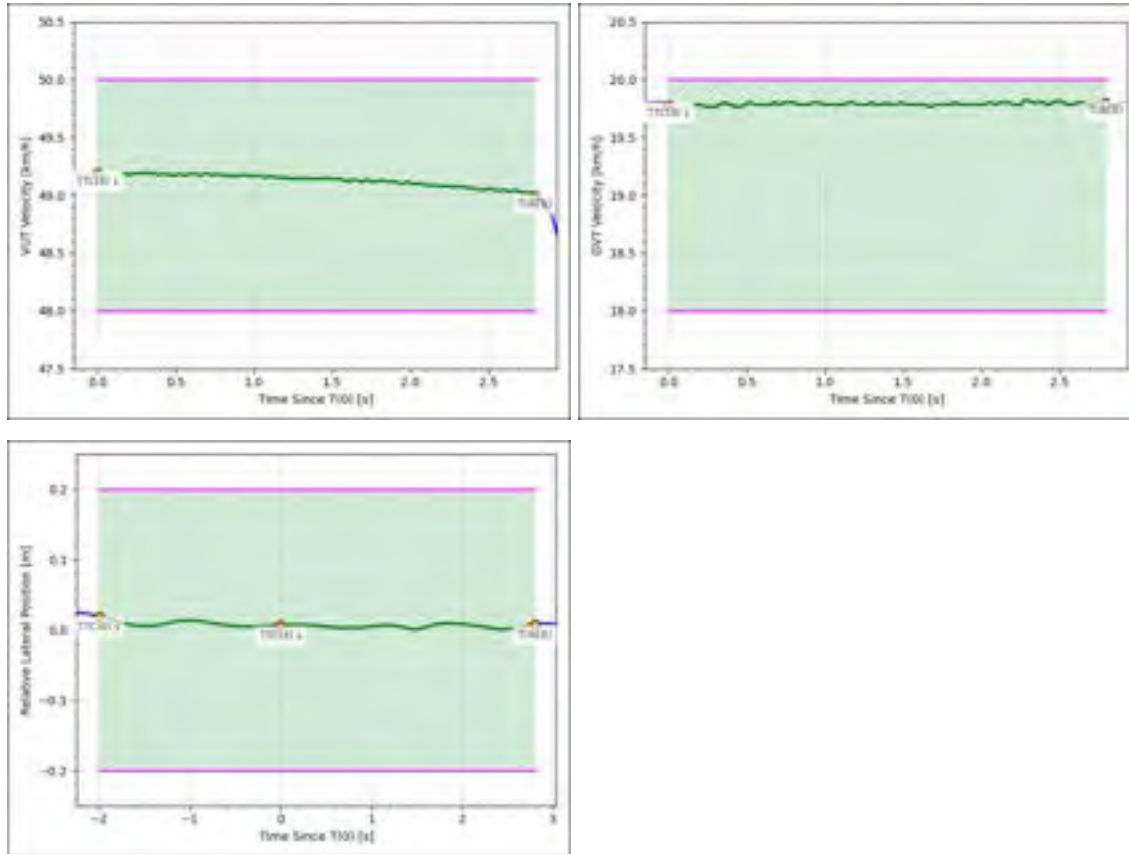
Run Date / Time 11-Jul-2023 11:23



G.2.4.2. AEB CCRm 50 kph +100 %

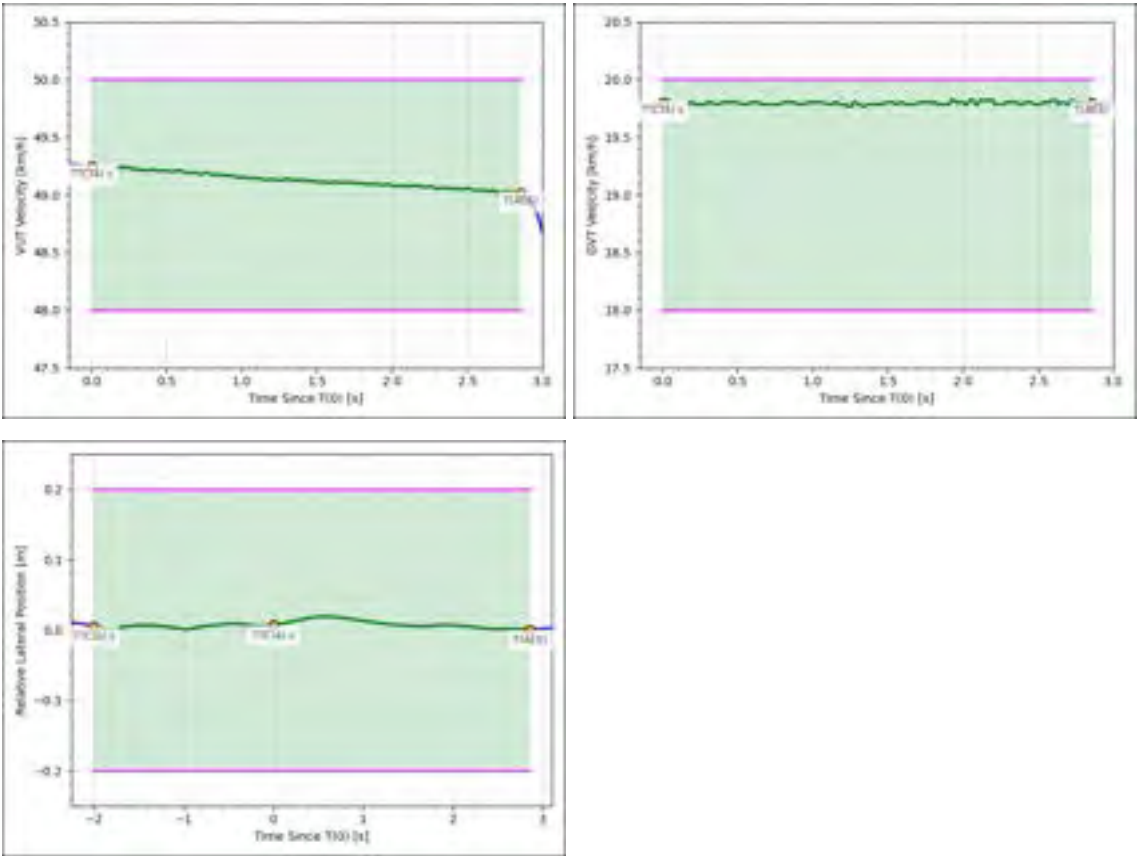
AEB CCRm | 50 km/h +100 % | Run 1

Run Date / Time 11-Jul-2023 11:29



AEB CCRm | 50 km/h +100 % | Run 2

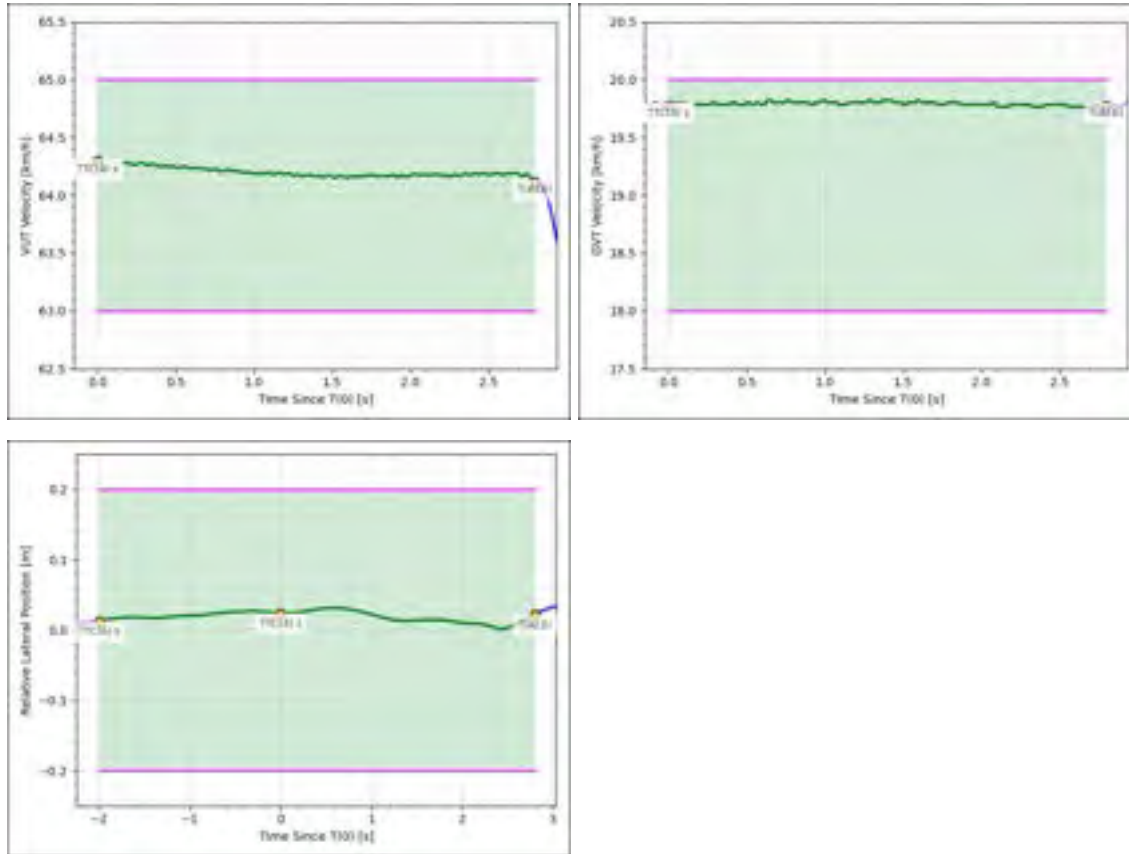
Run Date / Time 11-Jul-2023 11:33



G.2.4.3. AEB CCRm 65 kph +100 %

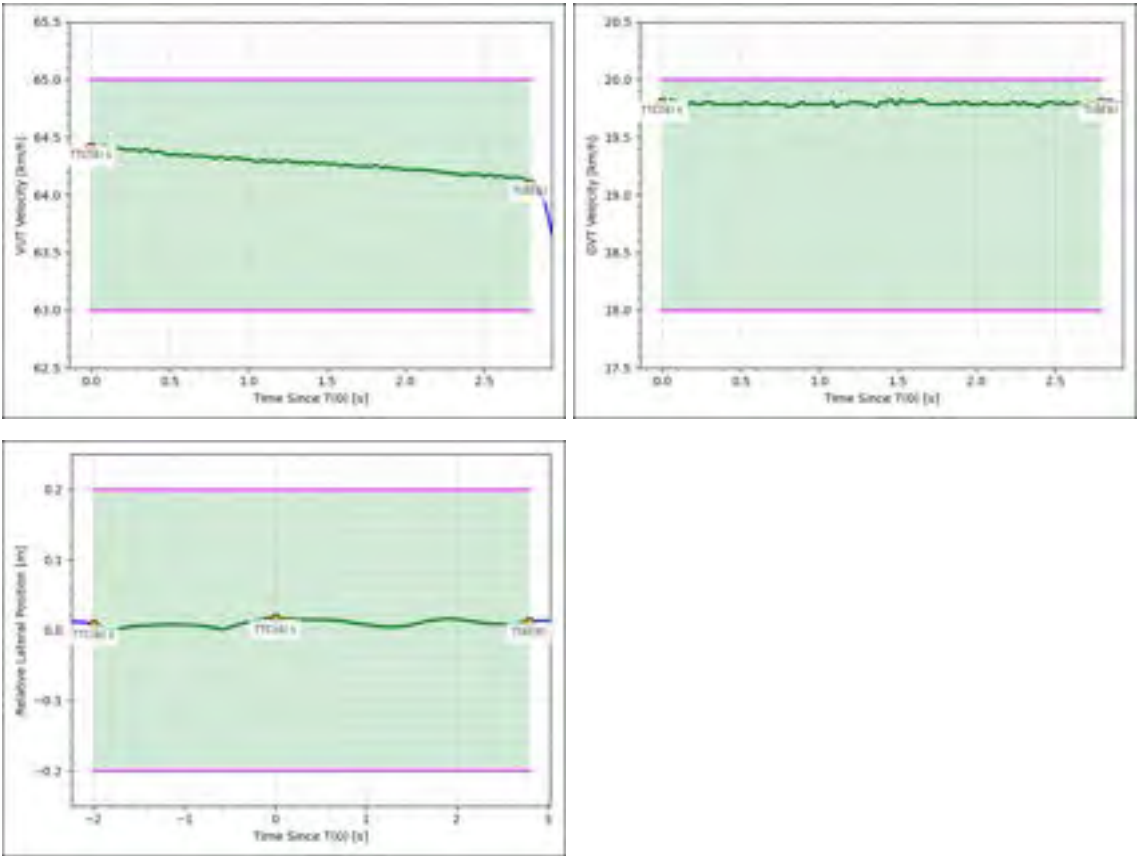
AEB CCRm | 65 km/h +100 % | Run 1

Run Date / Time 11-Jul-2023 13:42



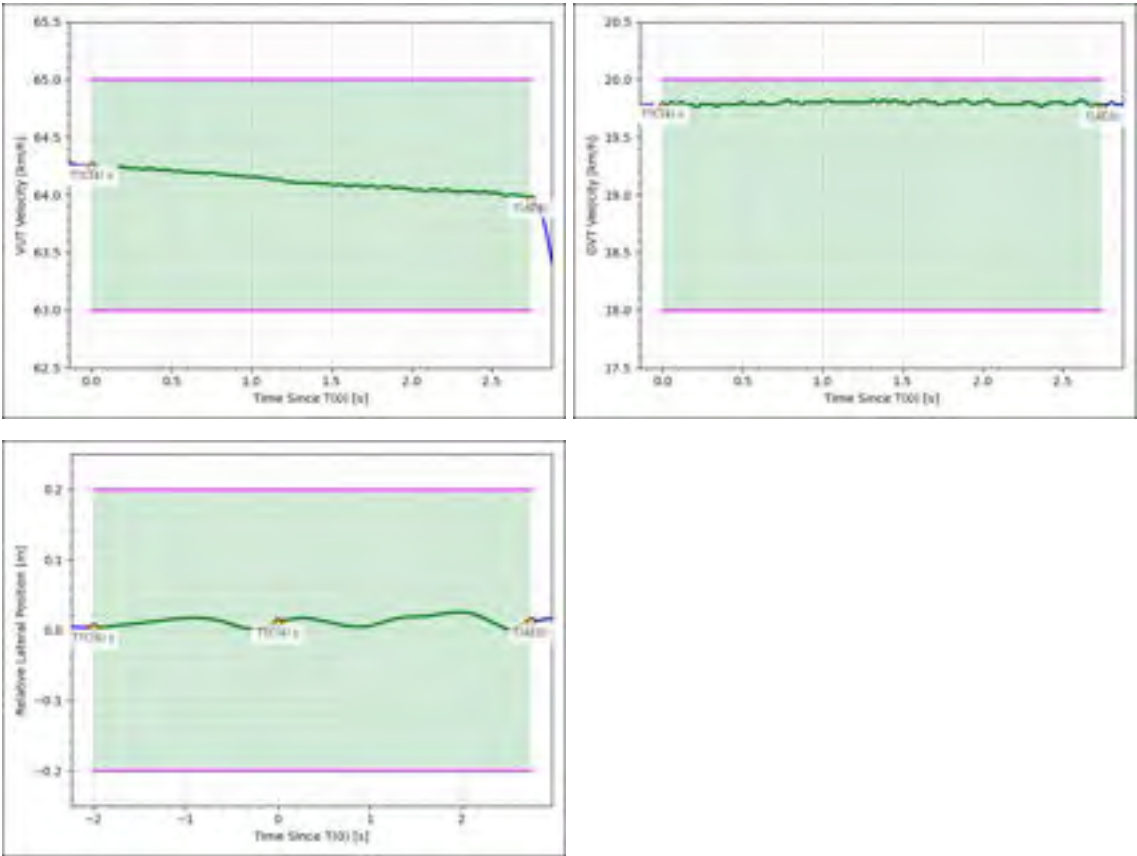
AEB CCRm | 65 km/h +100 % | Run 2

Run Date / Time 11-Jul-2023 13:47



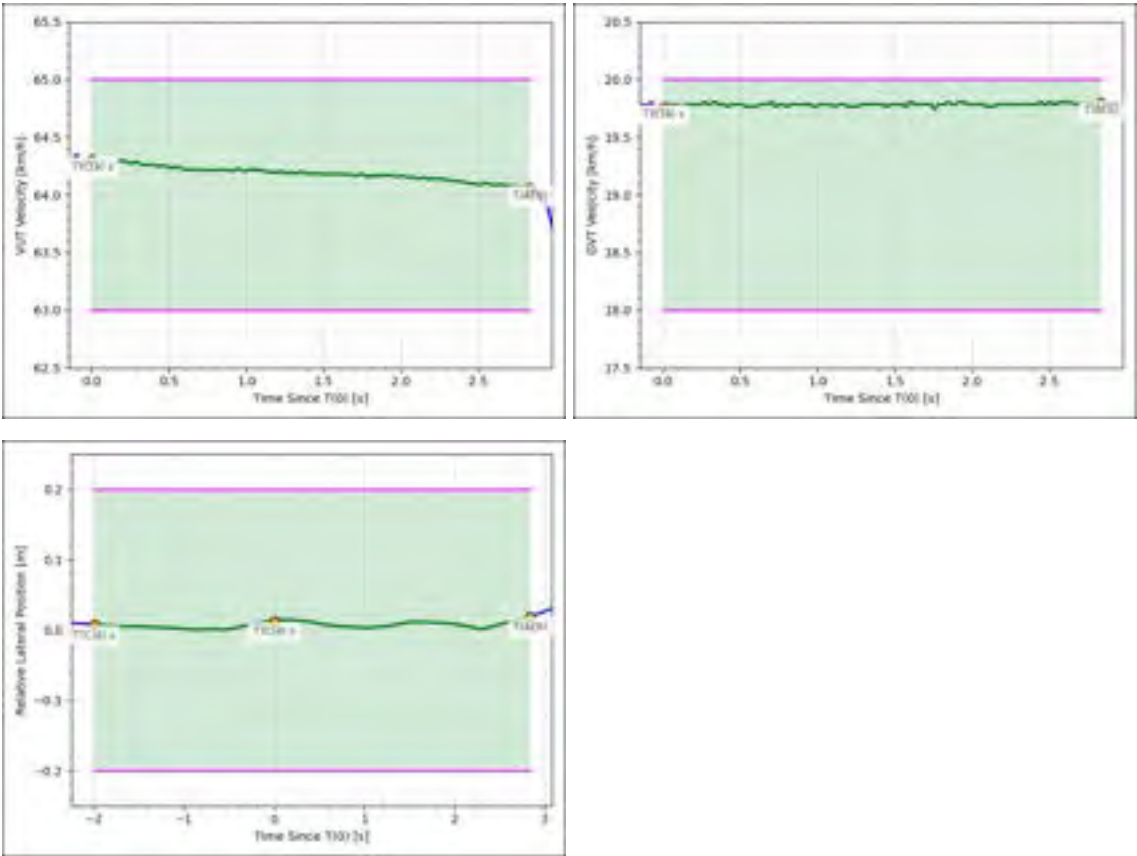
AEB CCRm | 65 km/h +100 % | Run 3

Run Date / Time 11-Jul-2023 13:52



AEB CCRm | 65 km/h +100 % | Run 4

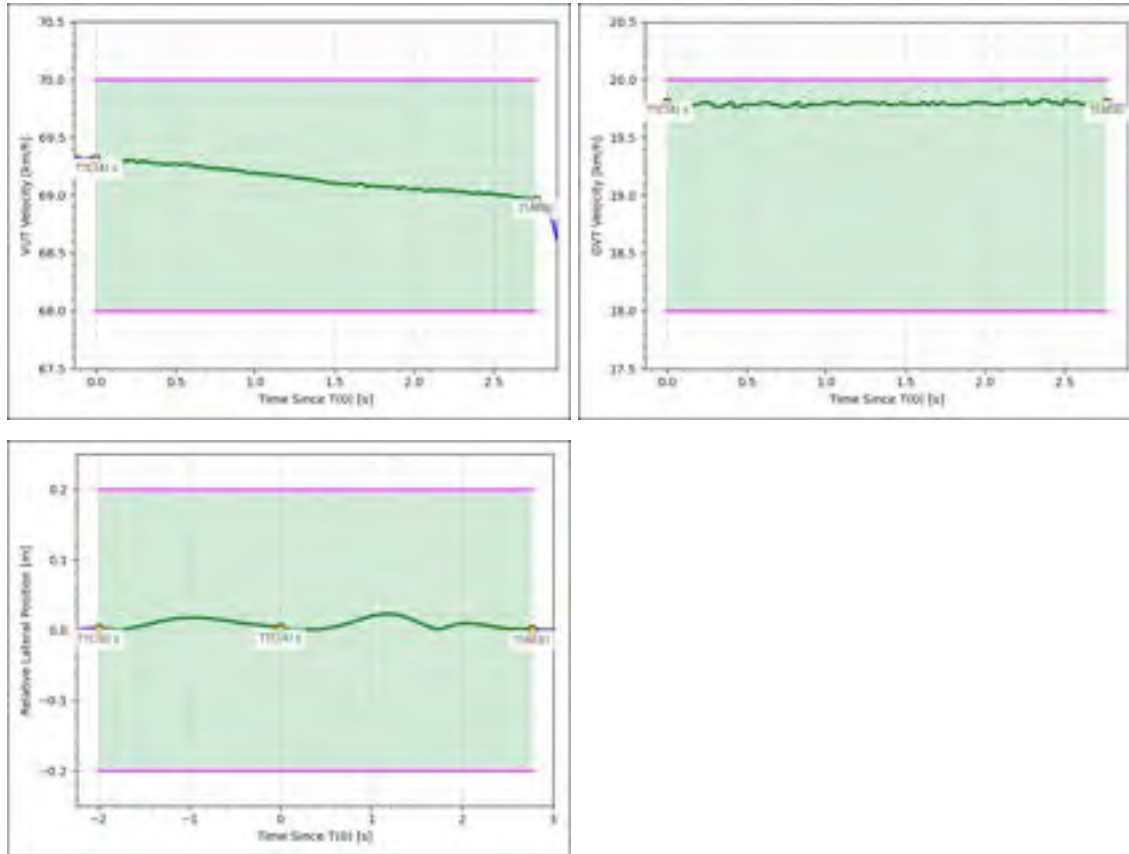
Run Date / Time 11-Jul-2023 13:57



G.2.4.4. AEB CCRm 70 kph +100 %

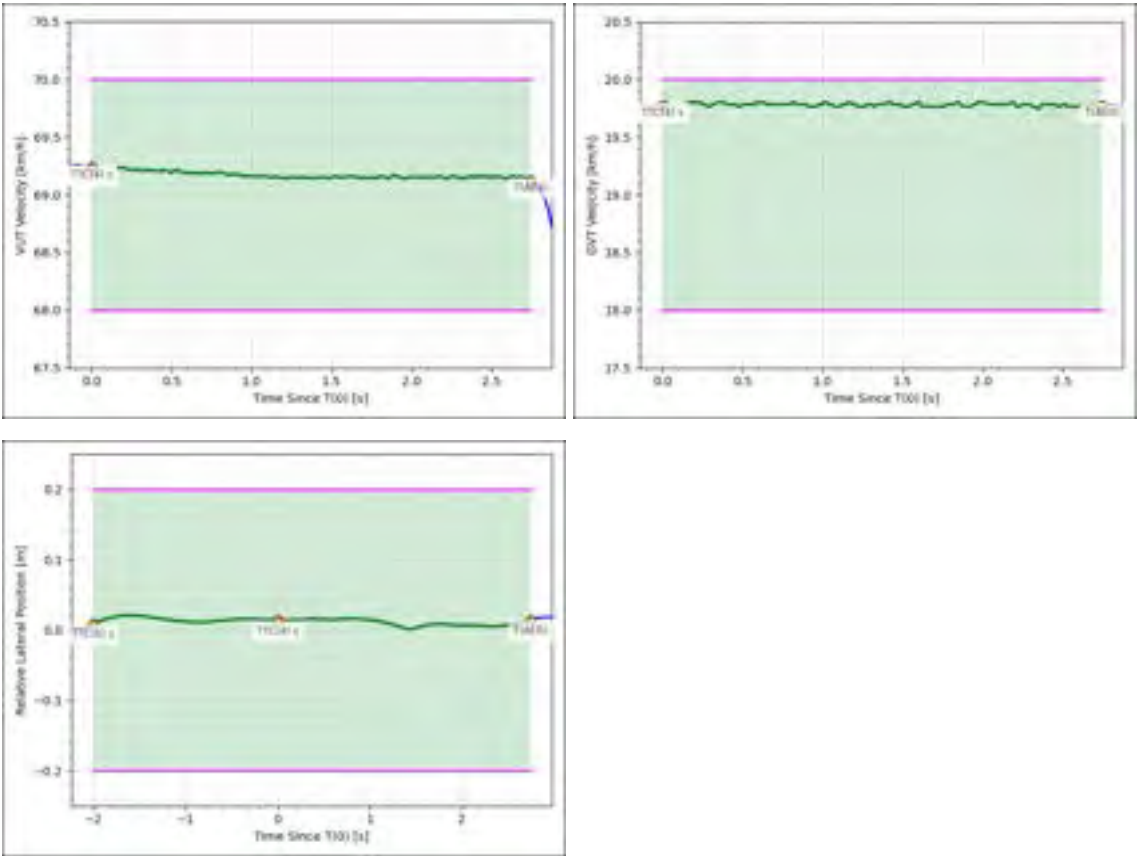
AEB CCRm | 70 km/h +100 % | Run 1

Run Date / Time 11-Jul-2023 11:39



AEB CCRm | 70 km/h +100 % | Run 2

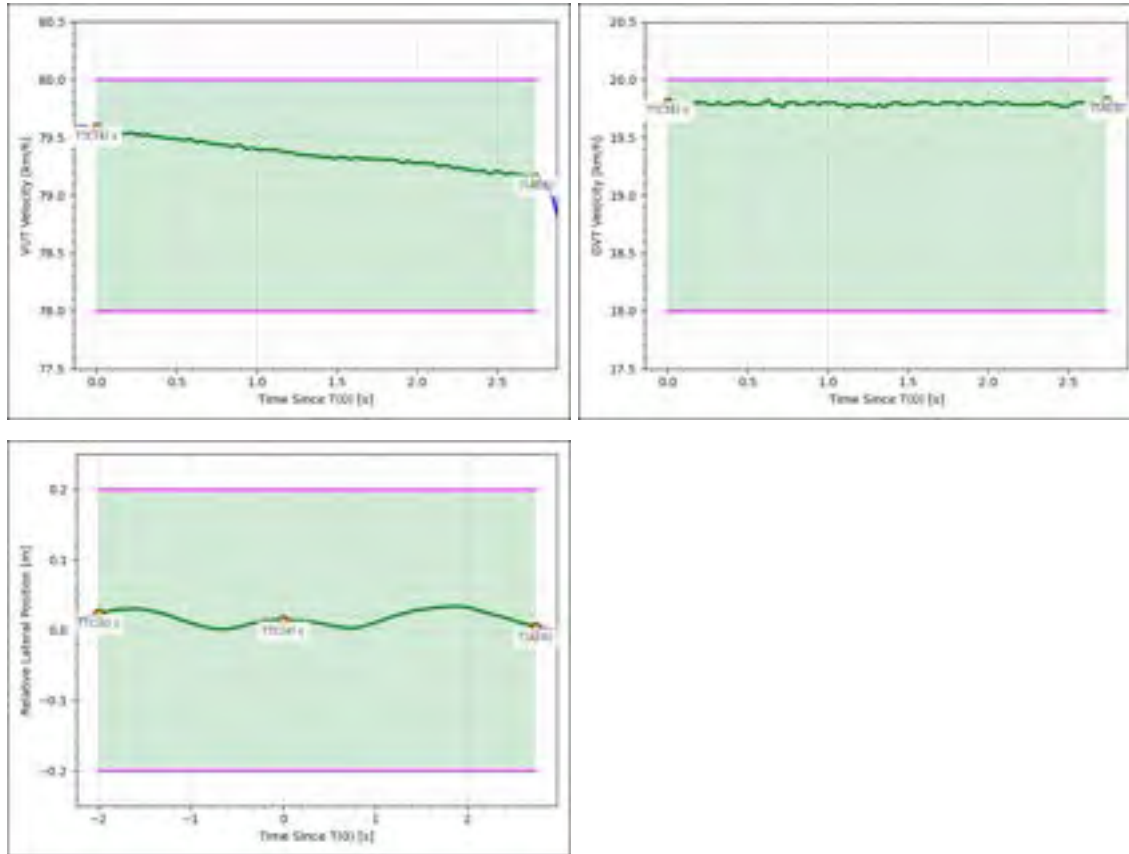
Run Date / Time 11-Jul-2023 11:45



G.2.4.5. AEB CCRm 80 kph +100 %

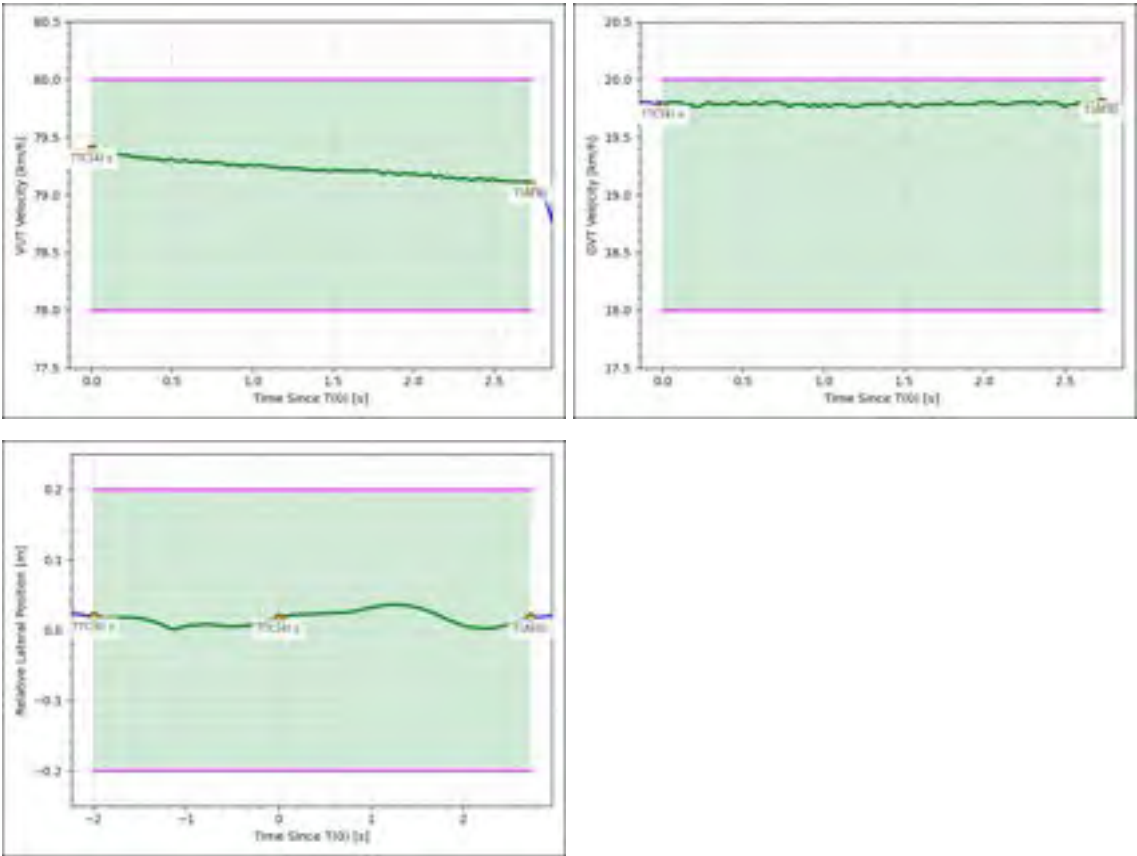
AEB CCRm | 80 km/h +100 % | Run 1

Run Date / Time 11-Jul-2023 11:51



AEB CCRm | 80 km/h +100 % | Run 2

Run Date / Time 11-Jul-2023 12:14



APPENDIX H

Ford Ranger Car-to-Pedestrian Results Validity

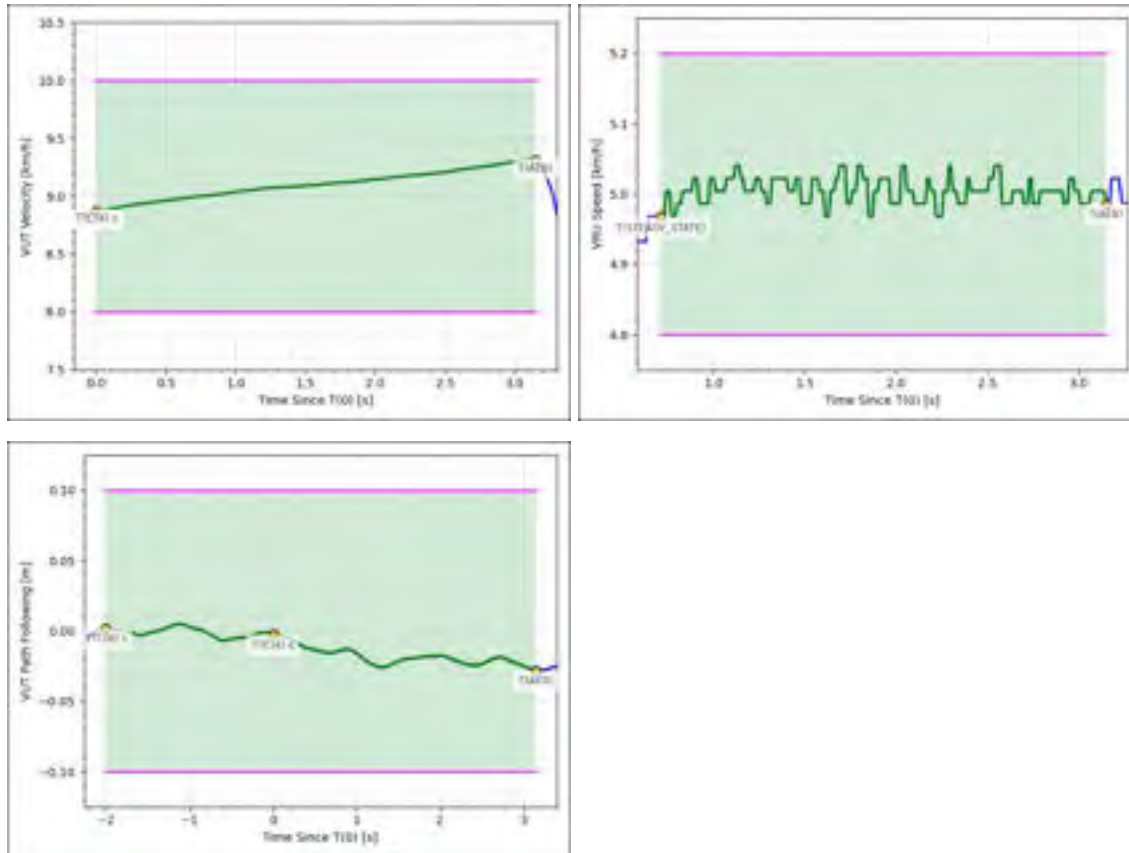
H.1.Car-to-Pedestrian Farside Adult 50% (Day)

H.1.1. Baseline

H.1.1.1. CPFA-50 VUT 10kph EPT 5kph (Day)

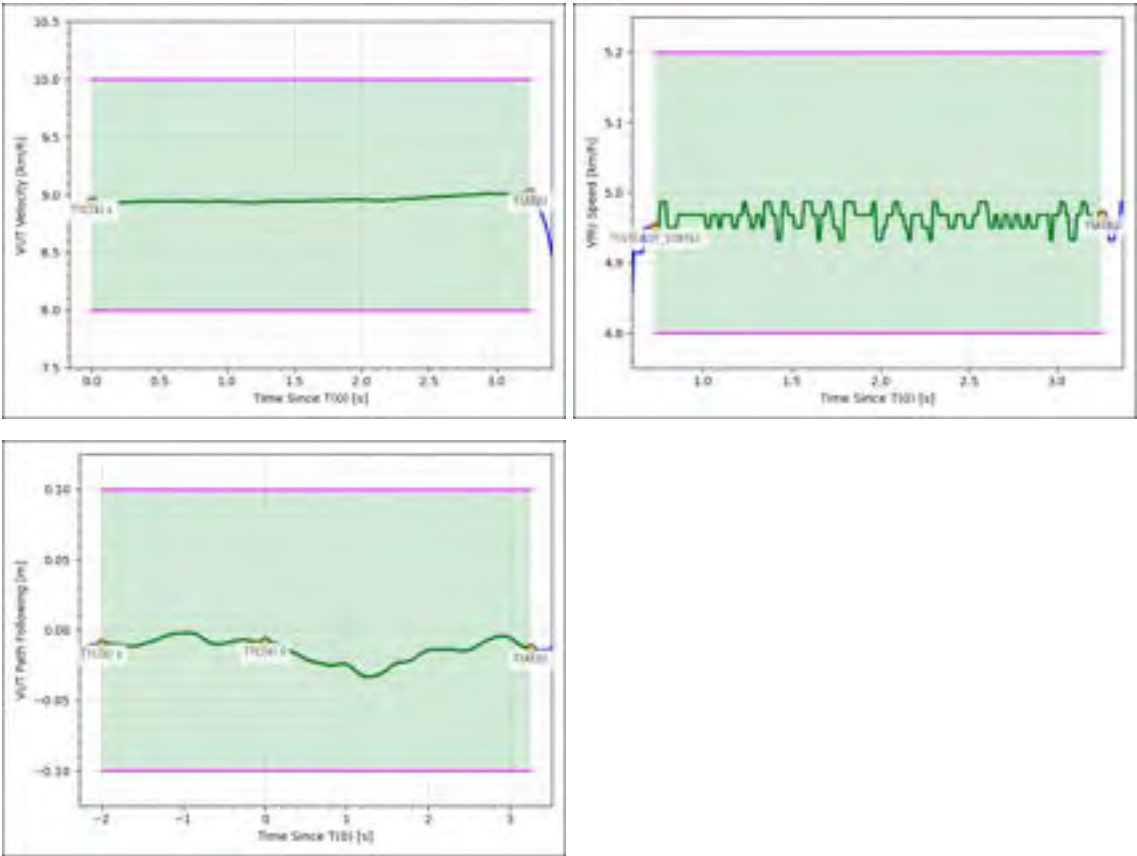
CPFA-50 5 kph (Day) | 10 km/h | Run 3

Run Date / Time 1-Feb-2023 14:58



CPFA-50 5 kph (Day) | 10 km/h | Run 4

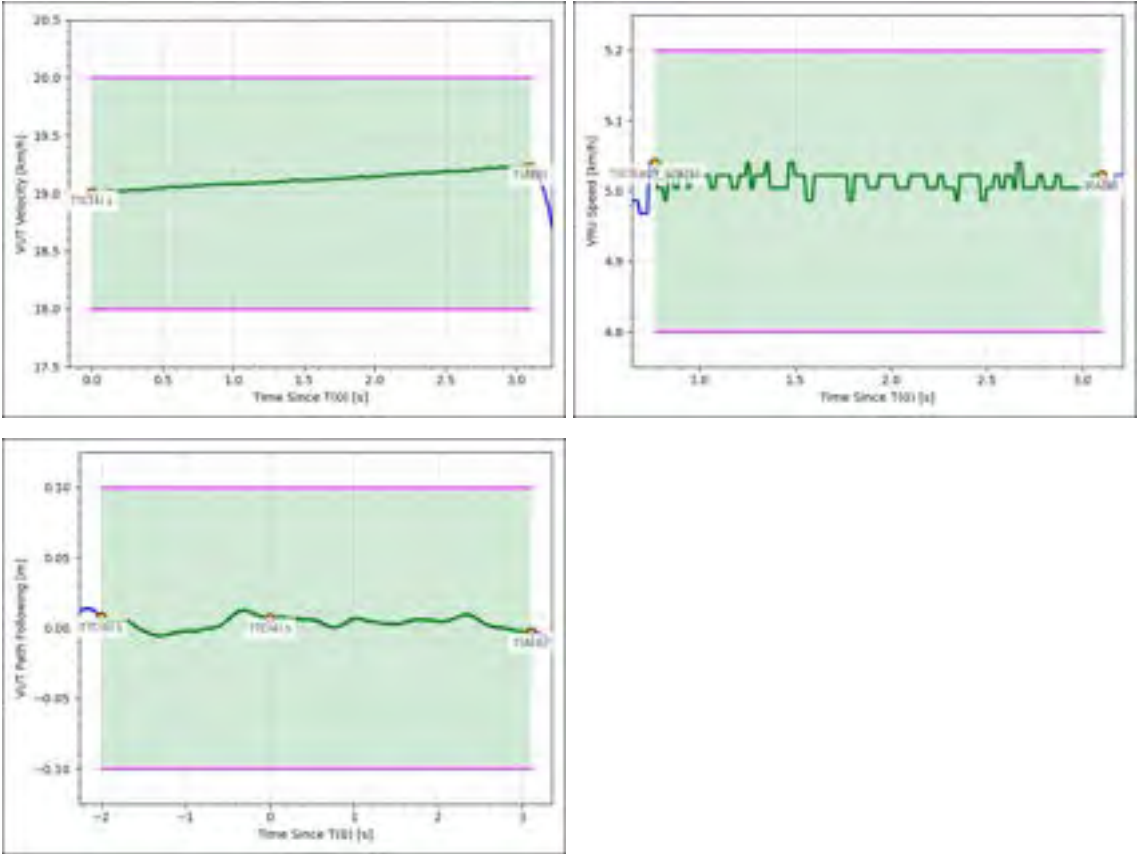
Run Date / Time 1-Feb-2023 15:01



H.1.1.2. CPFA-50 VUT 20kph EPT 5kph (Day)

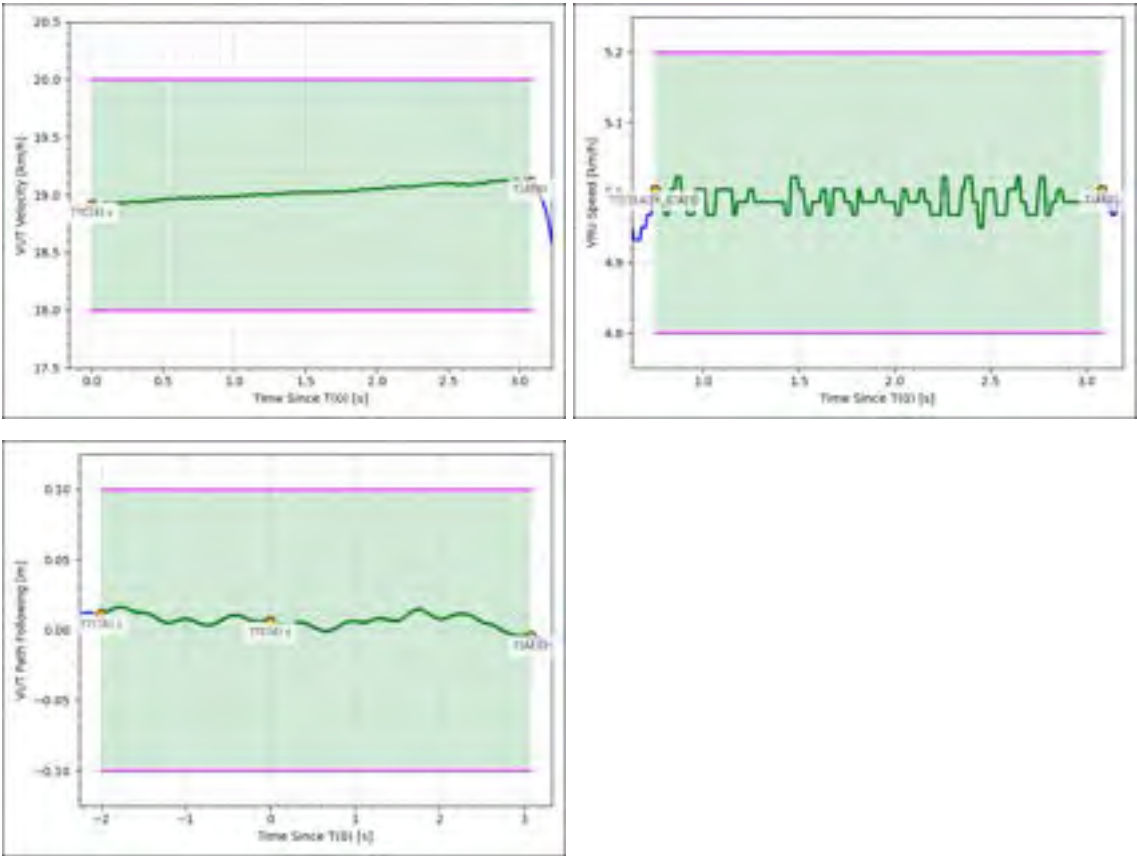
CPFA-50 5 kph (Day) | 20 km/h | Run 9

Run Date / Time 1-Feb-2023 13:48



CPFA-50 5 kph (Day) | 20 km/h | Run 10

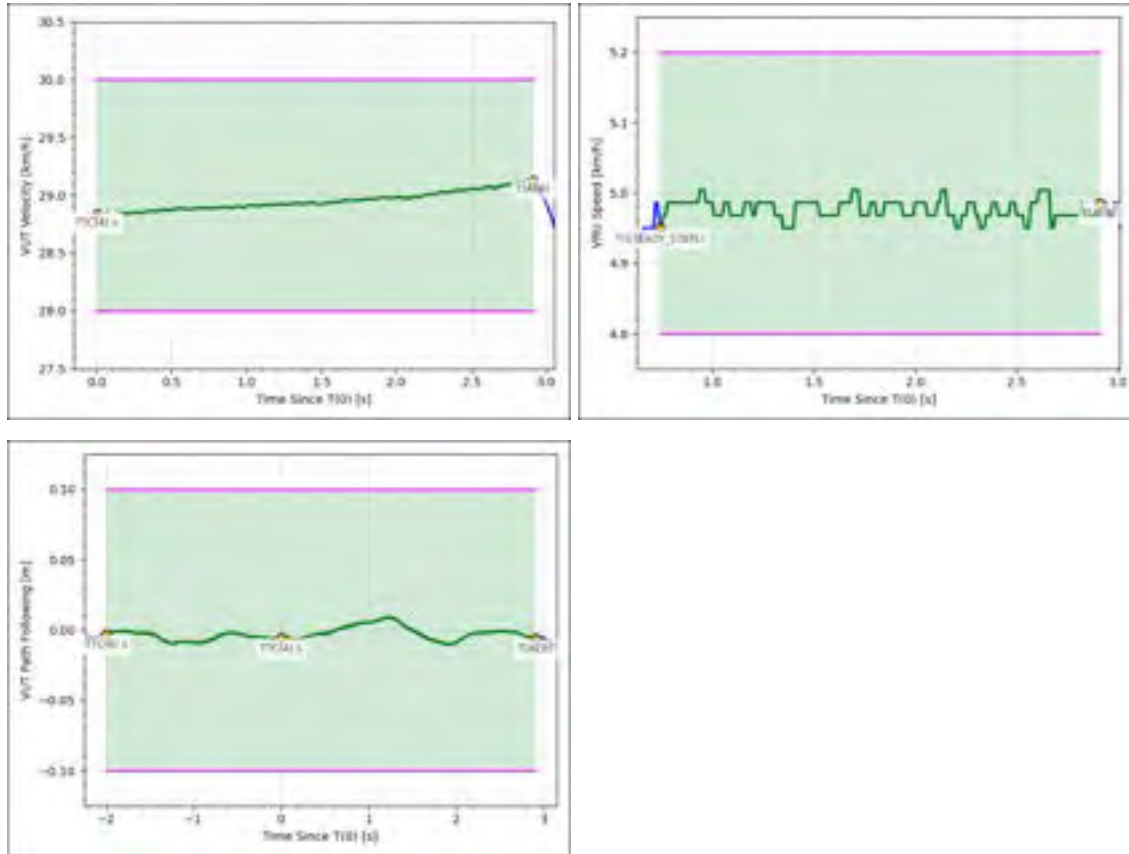
Run Date / Time 1-Feb-2023 13:51



H.1.1.3. CPFA-50 VUT 30kph EPT 5kph (Day)

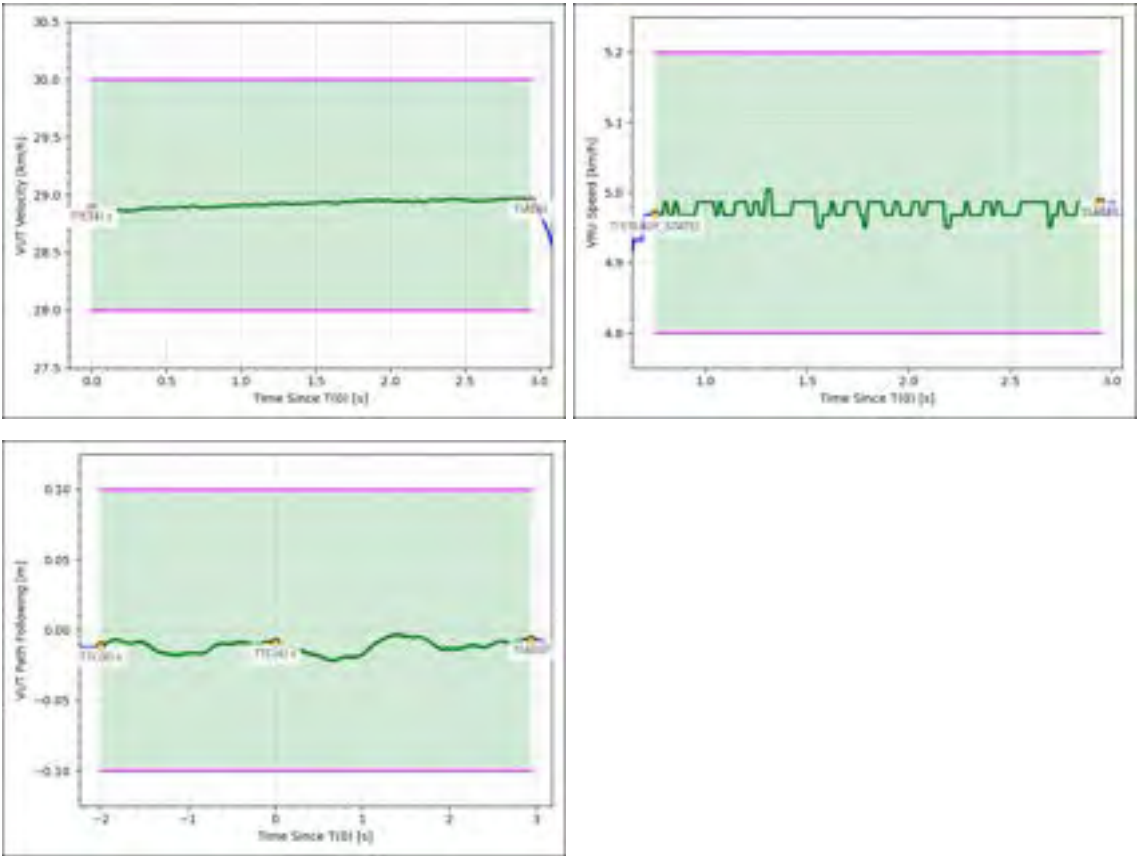
CPFA-50 5 kph (Day) | 30 km/h | Run 8

Run Date / Time 1-Feb-2023 13:37



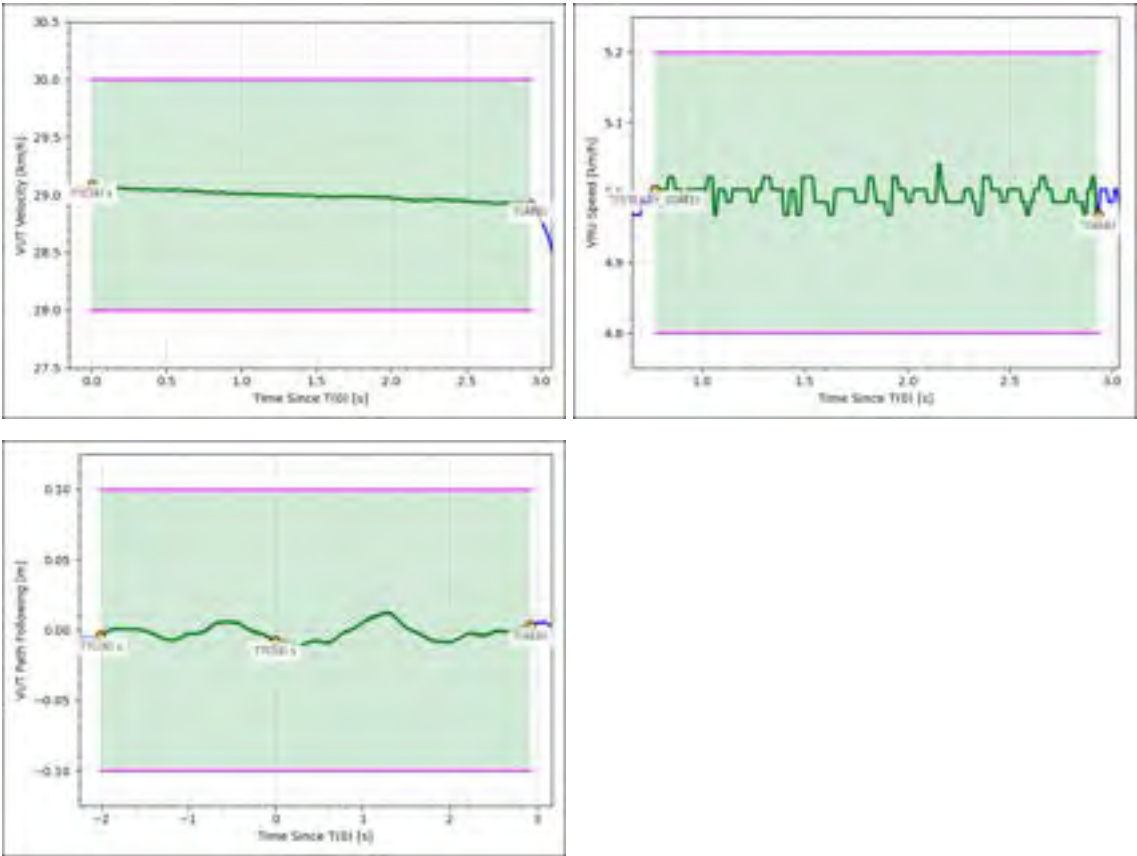
CPFA-50 5 kph (Day) | 30 km/h | Run 9

Run Date / Time 1-Feb-2023 13:41



CPFA-50 5 kph (Day) | 30 km/h | Run 10

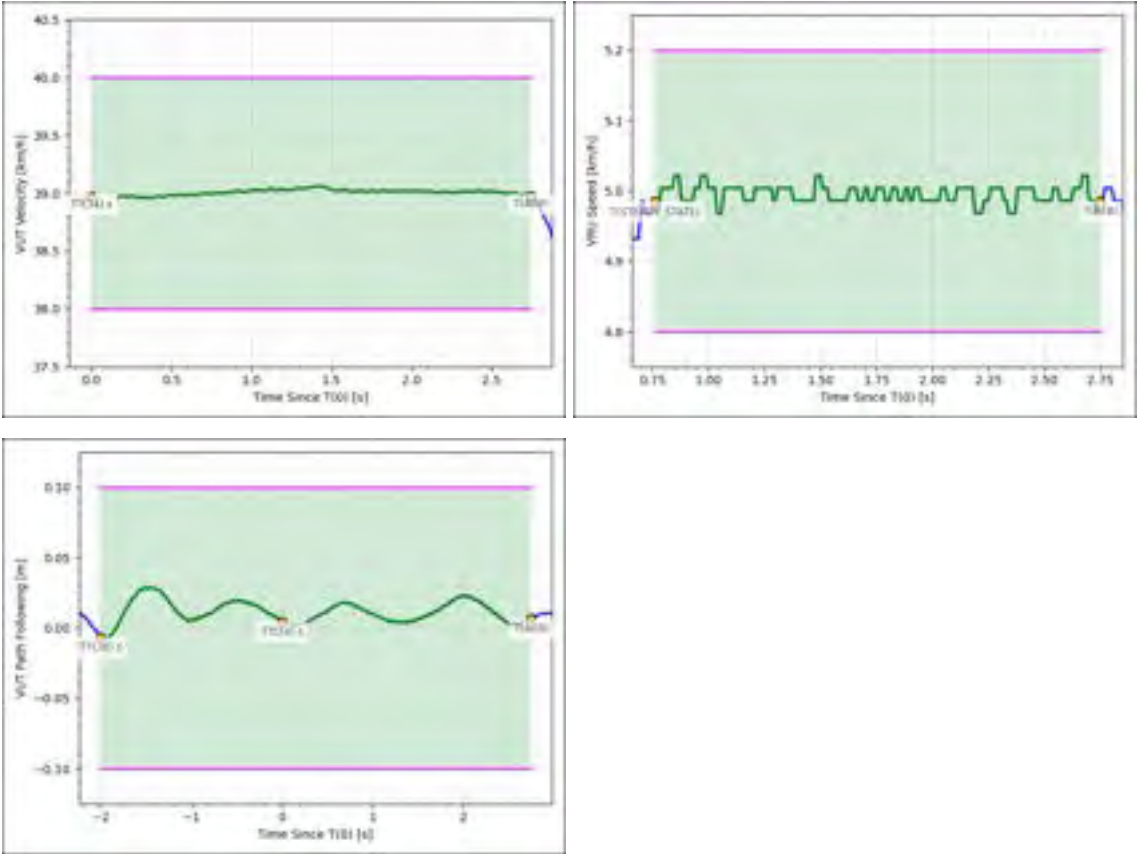
Run Date / Time 1-Feb-2023 13:43



H.1.1.4. CPFA-50 VUT 40kph EPT 5kph (Day)

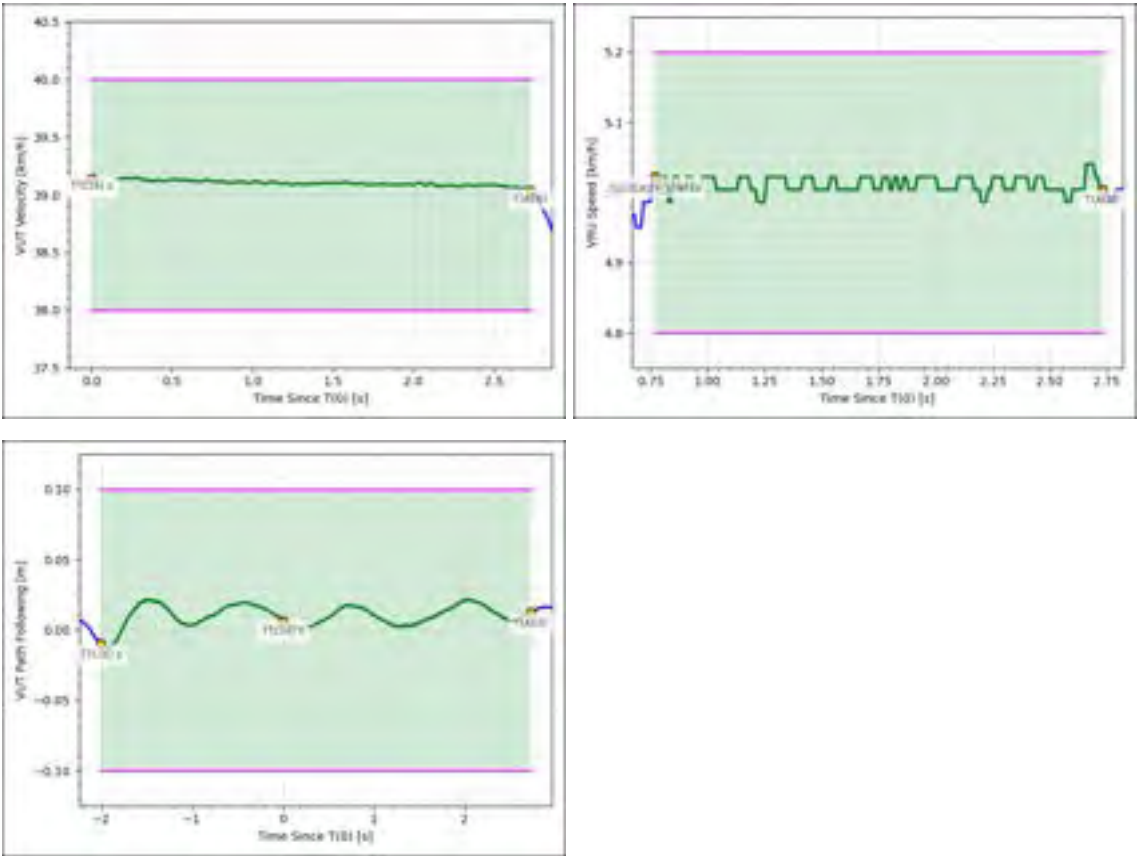
CPFA-50 5 kph (Day) | 40 km/h | Run 2

Run Date / Time 1-Feb-2023 13:55



CPFA-50 5 kph (Day) | 40 km/h | Run 4

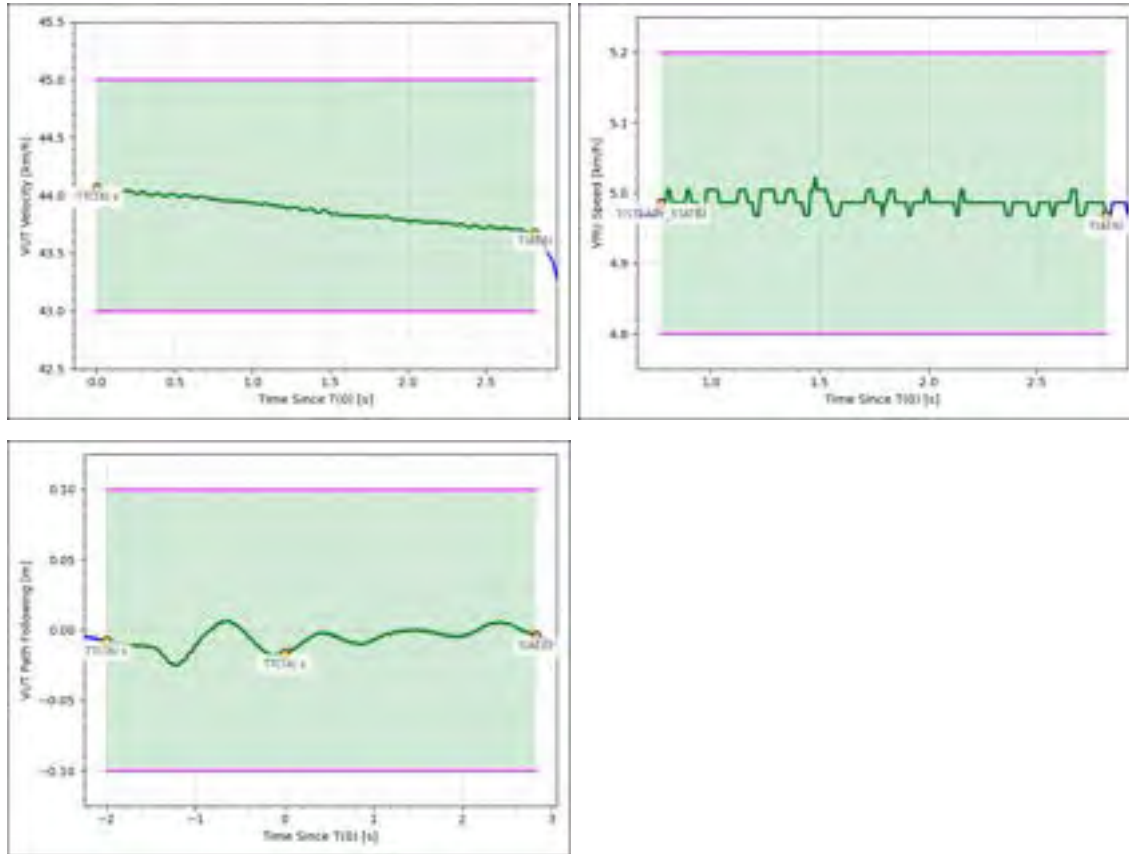
Run Date / Time 1-Feb-2023 13:59



H.1.1.5. CPFA-50 VUT 45kph EPT 5kph (Day)

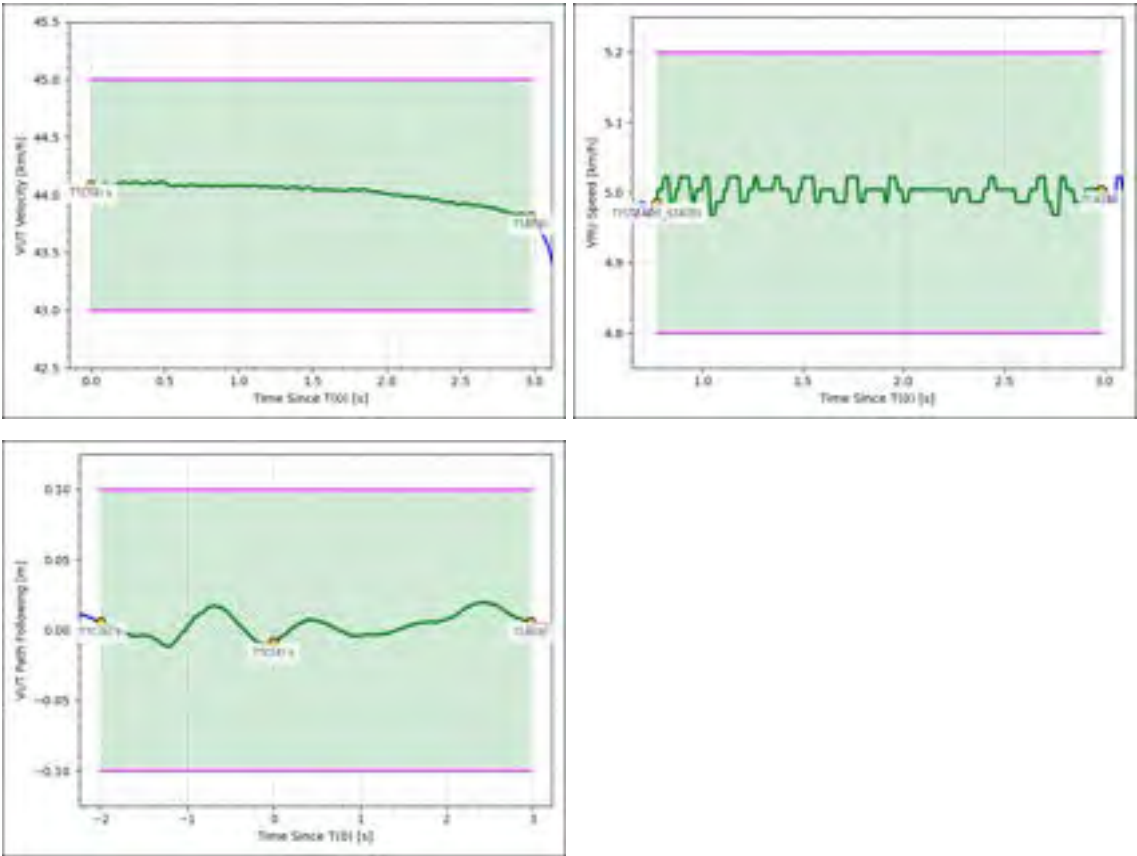
CPFA-50 5 kph (Day) | 45 km/h | Run 3

Run Date / Time 1-Feb-2023 14:33



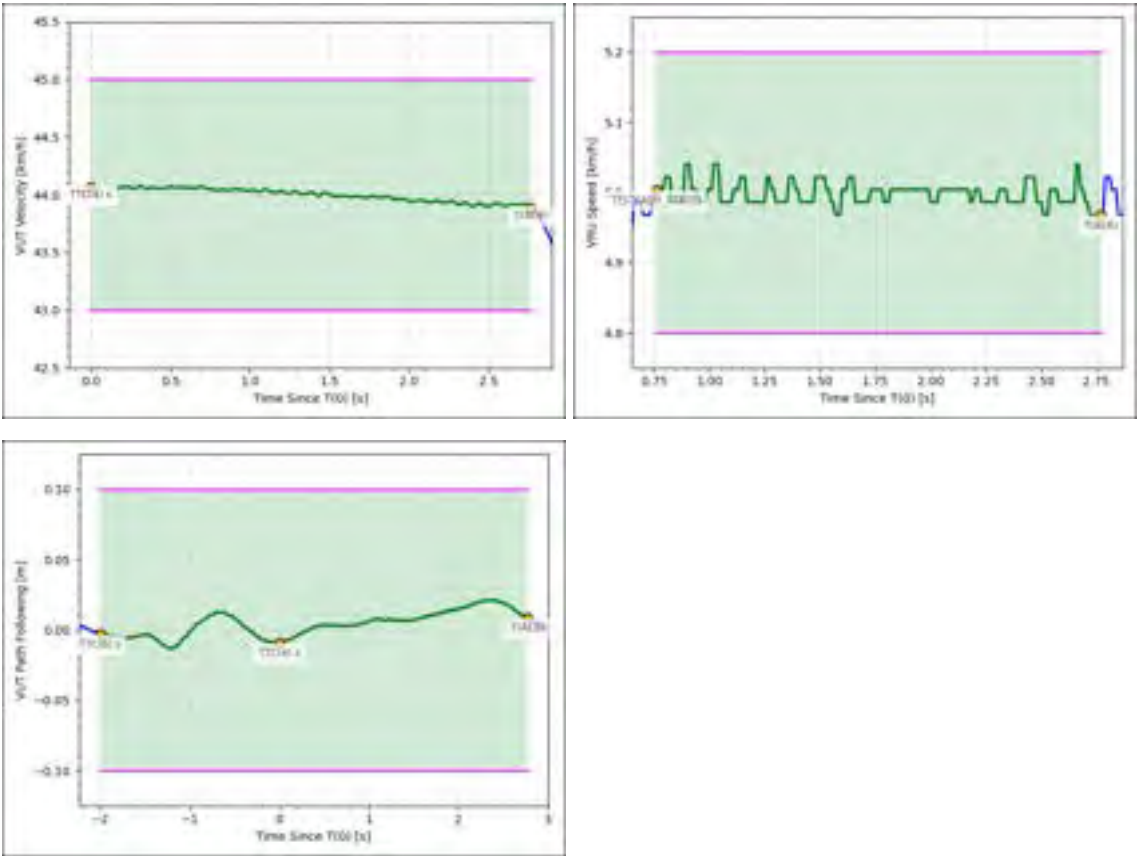
CPFA-50 5 kph (Day) | 45 km/h | Run 4

Run Date / Time 1-Feb-2023 14:38



CPFA-50 5 kph (Day) | 45 km/h | Run 5

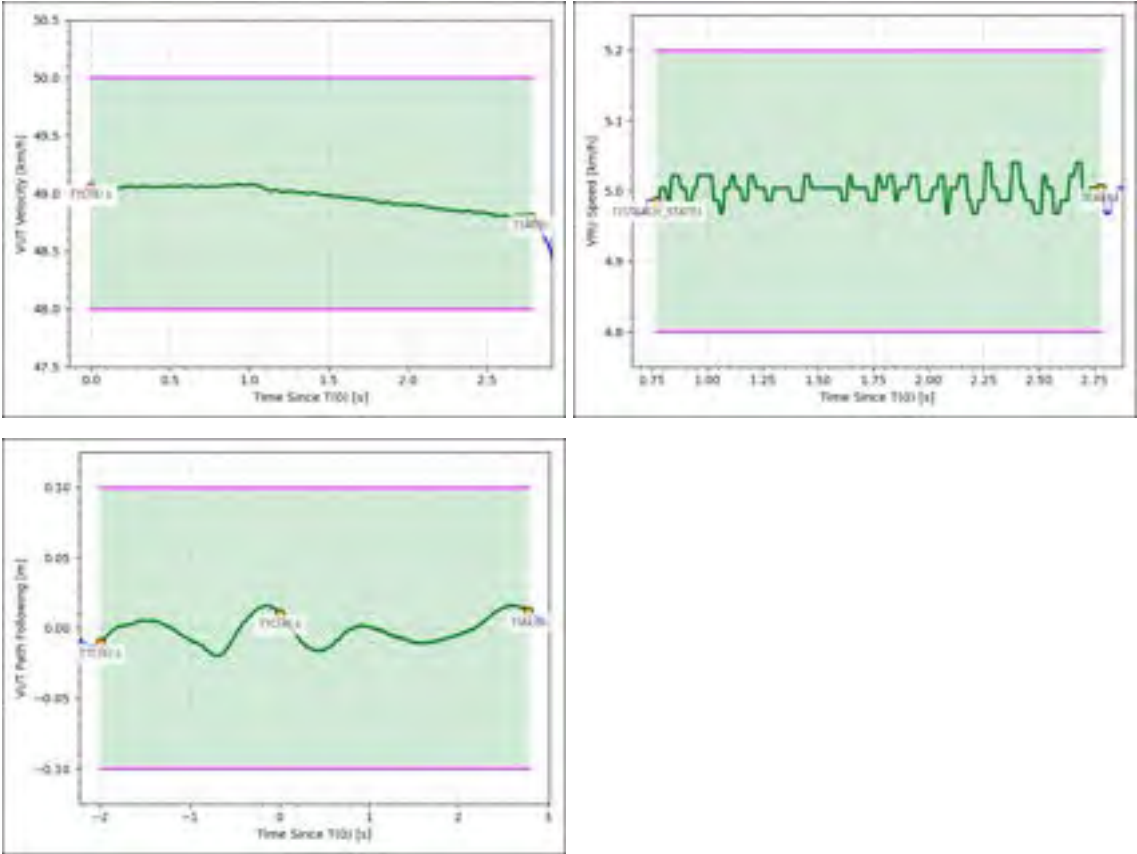
Run Date / Time 1-Feb-2023 14:47



H.1.1.6. CPFA-50 VUT 50kph EPT 5kph (Day)

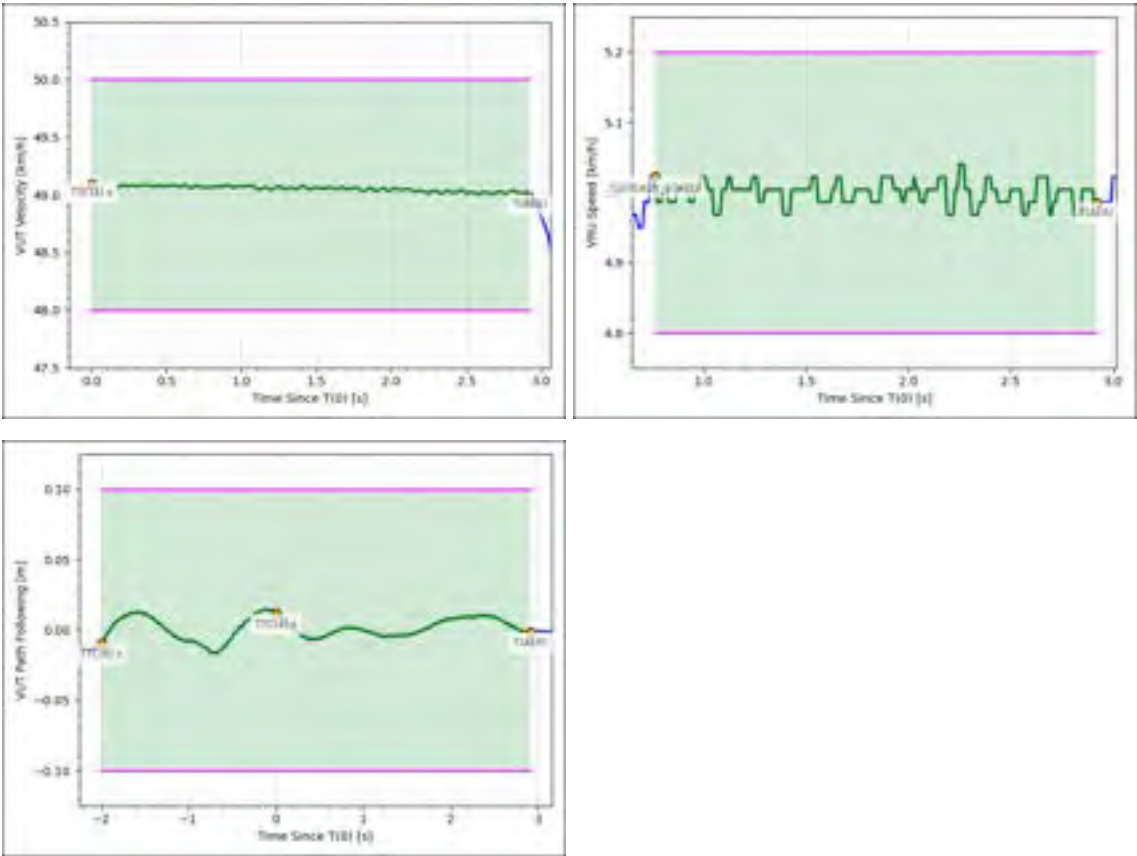
CPFA-50 5 kph (Day) | 50 km/h | Run 1

Run Date / Time 1-Feb-2023 14:02



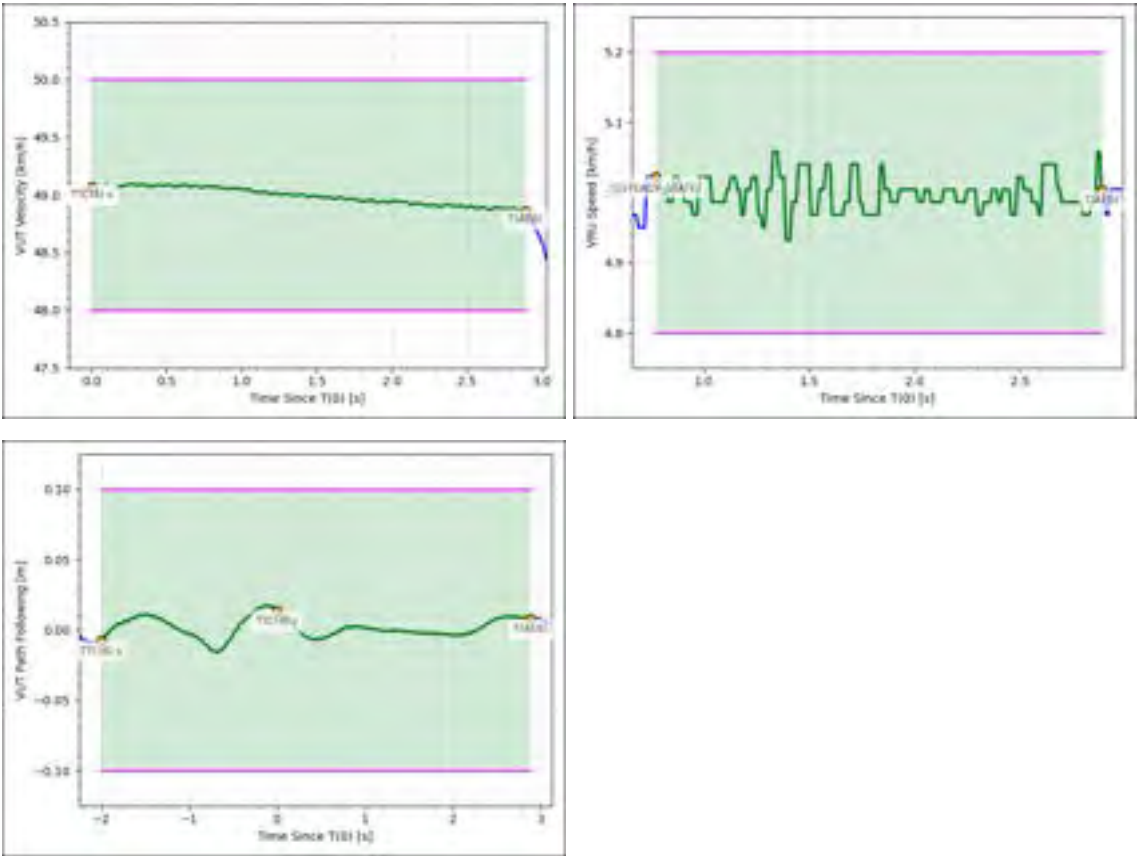
CPFA-50 5 kph (Day) | 50 km/h | Run 2

Run Date / Time 1-Feb-2023 14:06



CPFA-50 5 kph (Day) | 50 km/h | Run 4

Run Date / Time 1-Feb-2023 14:12

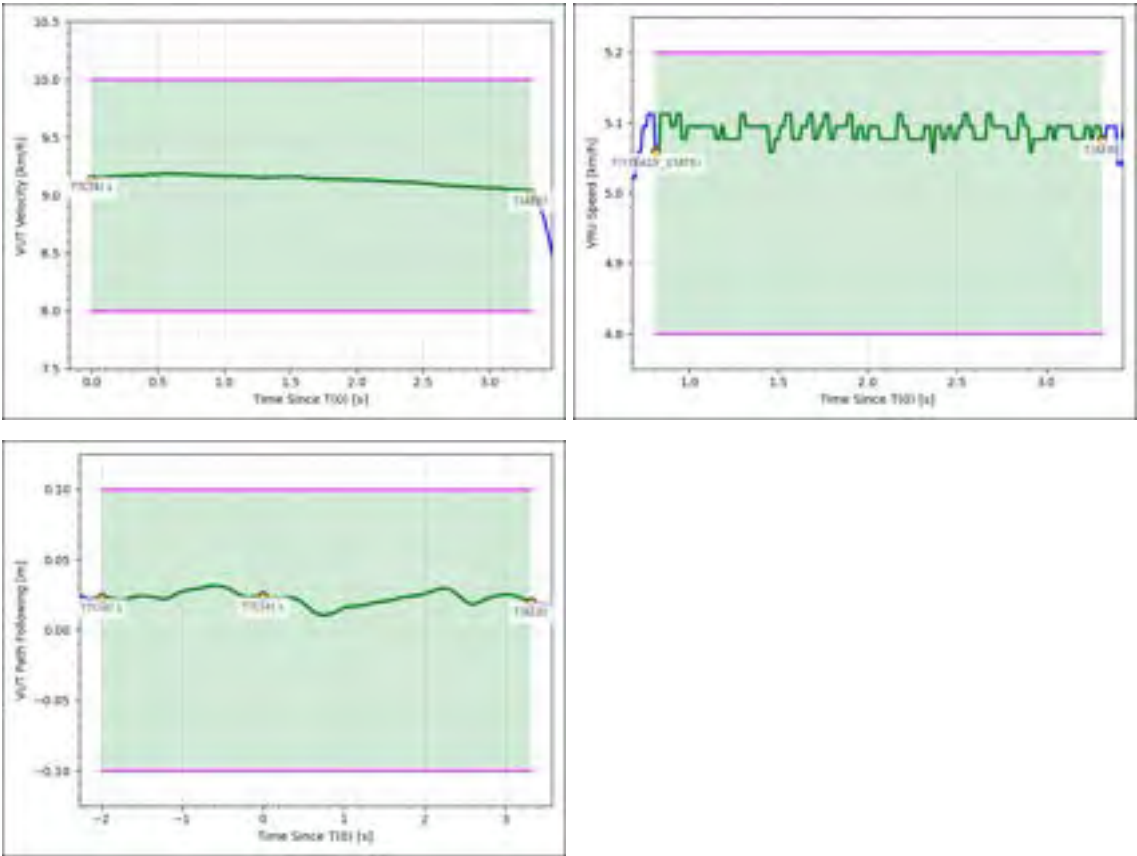


H.1.1. GVM

H.1.1.1. CPFA-50 VUT 10kph EPT 5kph (Day)

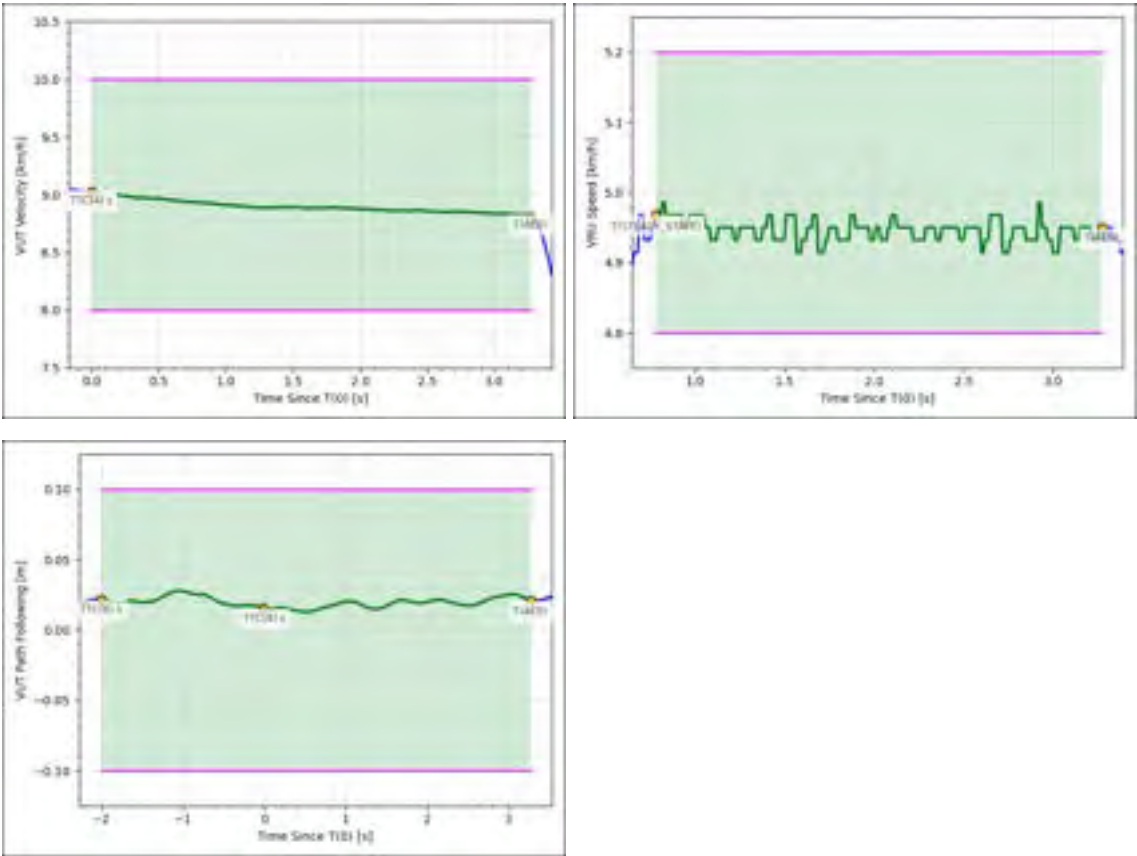
CPFA-50 5 kph (Day) | 10 km/h | Run 6

Run Date / Time 6-Feb-2023 10:52



CPFA-50 5 kph (Day) | 10 km/h | Run 7

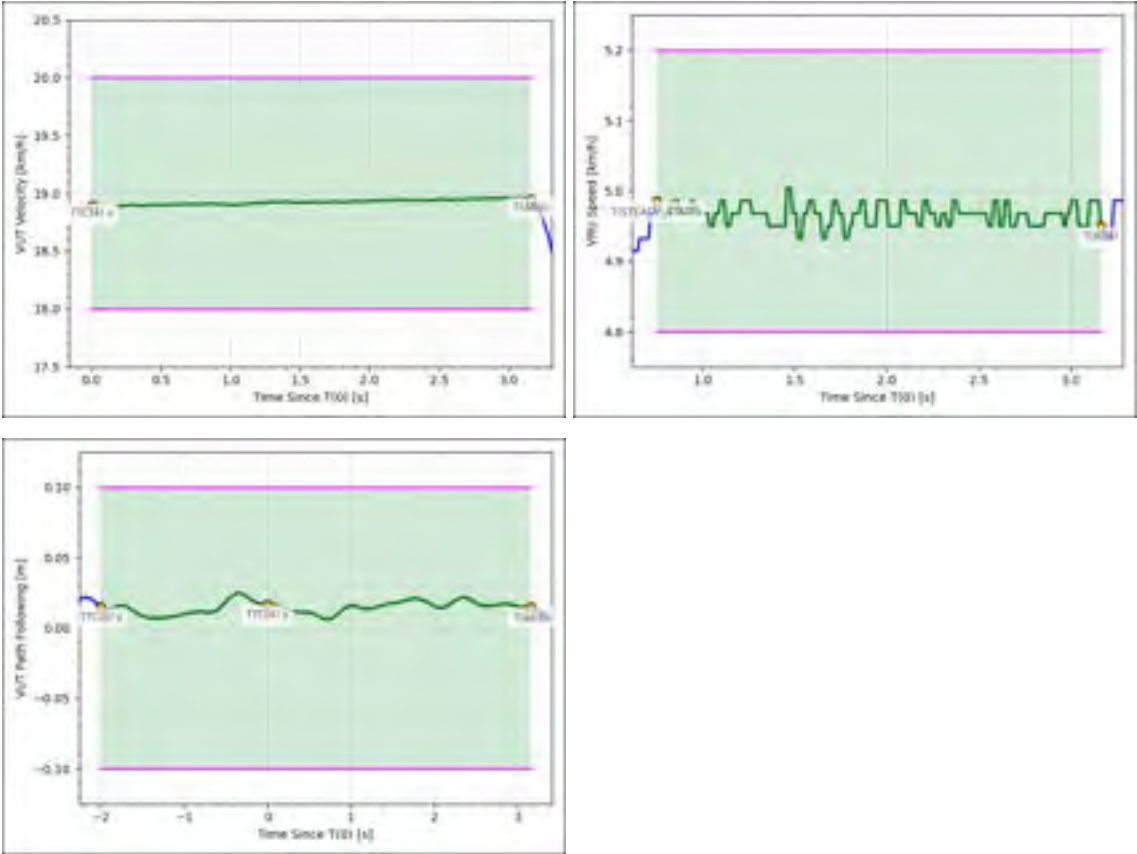
Run Date / Time 6-Feb-2023 10:54



H.1.1.2. CPFA-50 VUT 20kph EPT 5kph (Day)

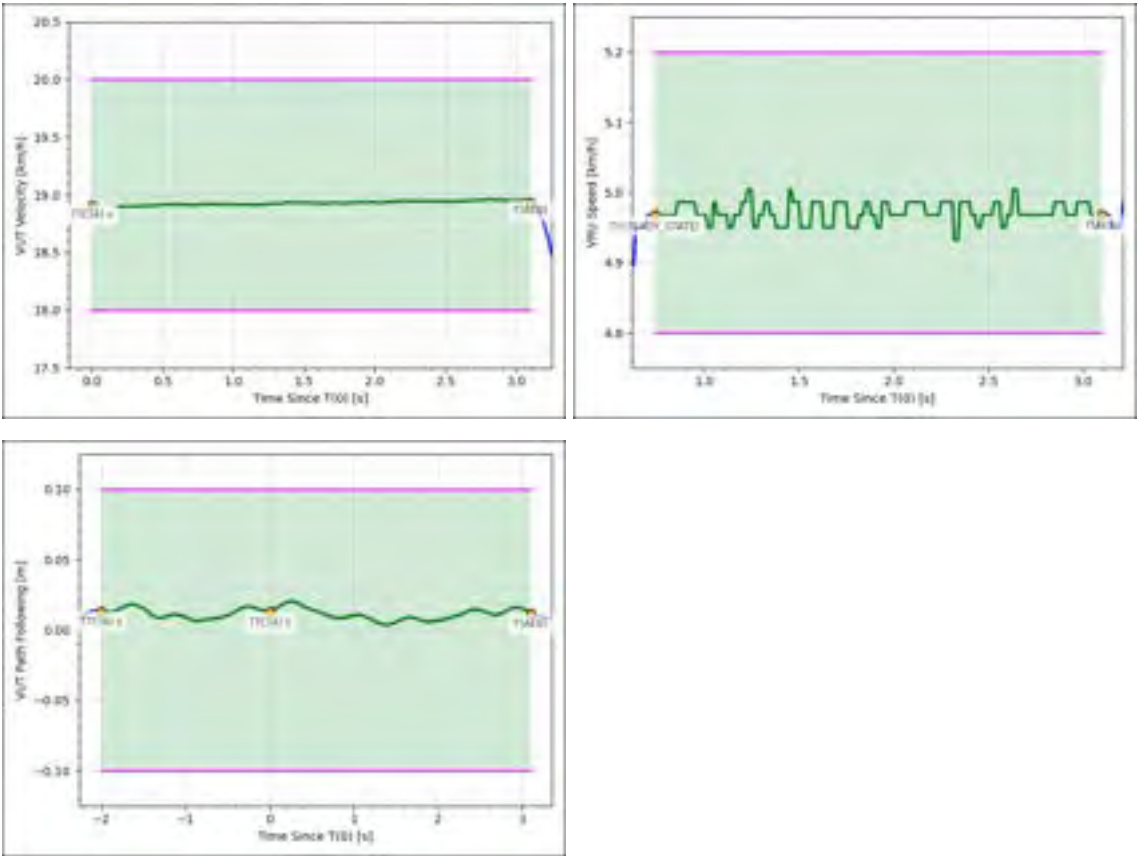
CPFA-50 5 kph (Day) | 20 km/h | Run 13

Run Date / Time 6-Feb-2023 11:01



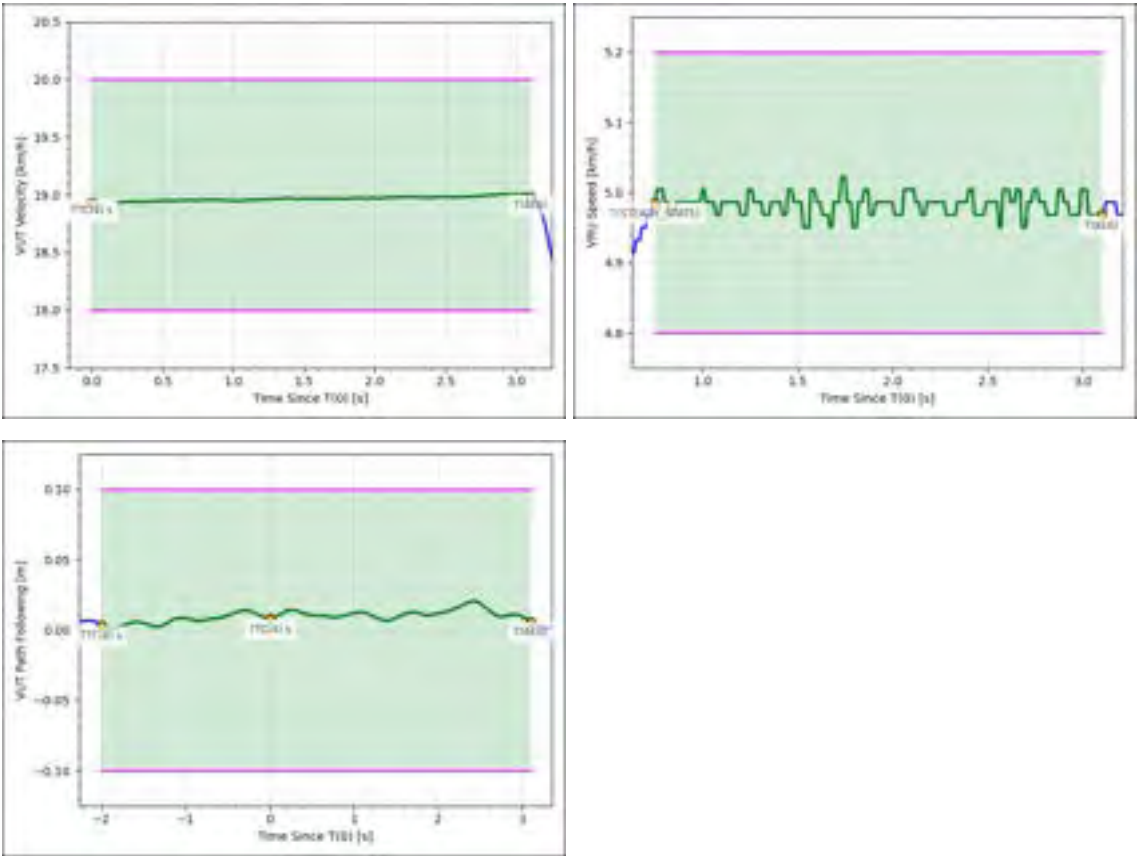
CPFA-50 5 kph (Day) | 20 km/h | Run 14

Run Date / Time 6-Feb-2023 11:06



CPFA-50 5 kph (Day) | 20 km/h | Run 15

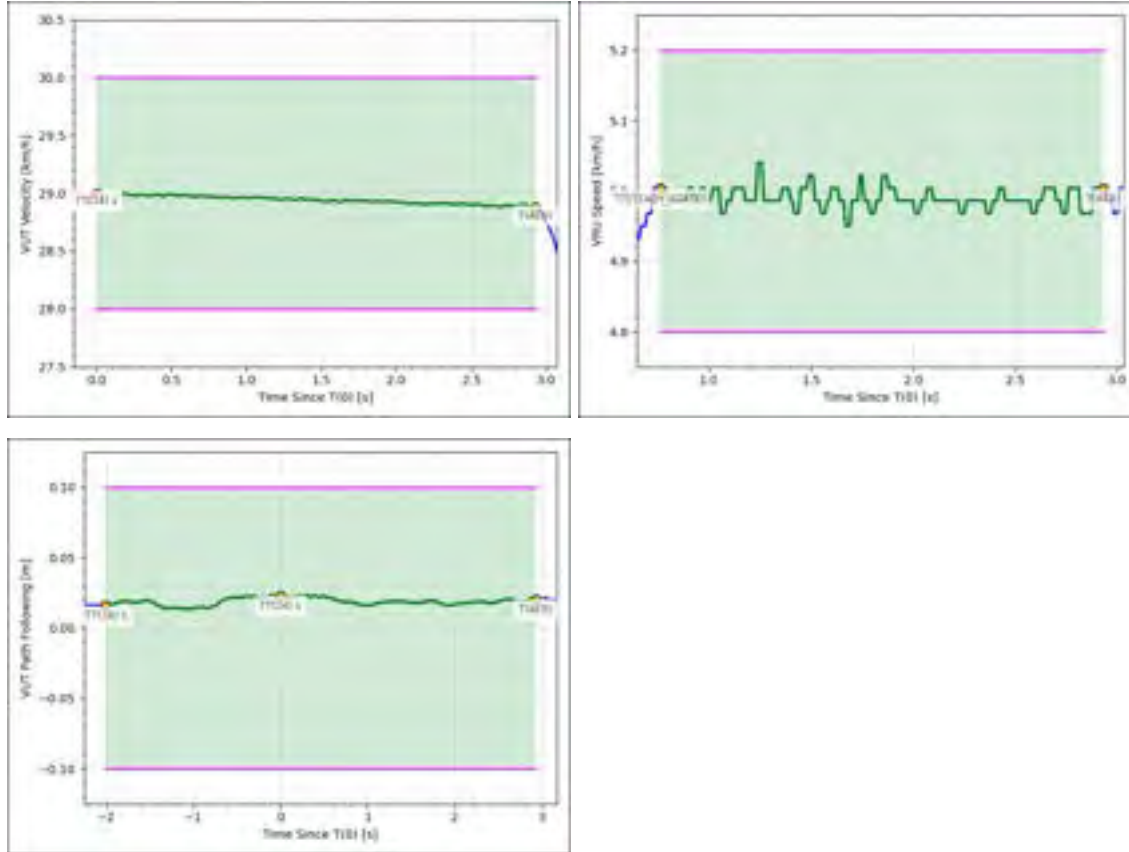
Run Date / Time 6-Feb-2023 11:08



H.1.1.3. CPFA-50 VUT 30kph EPT 5kph (Day)

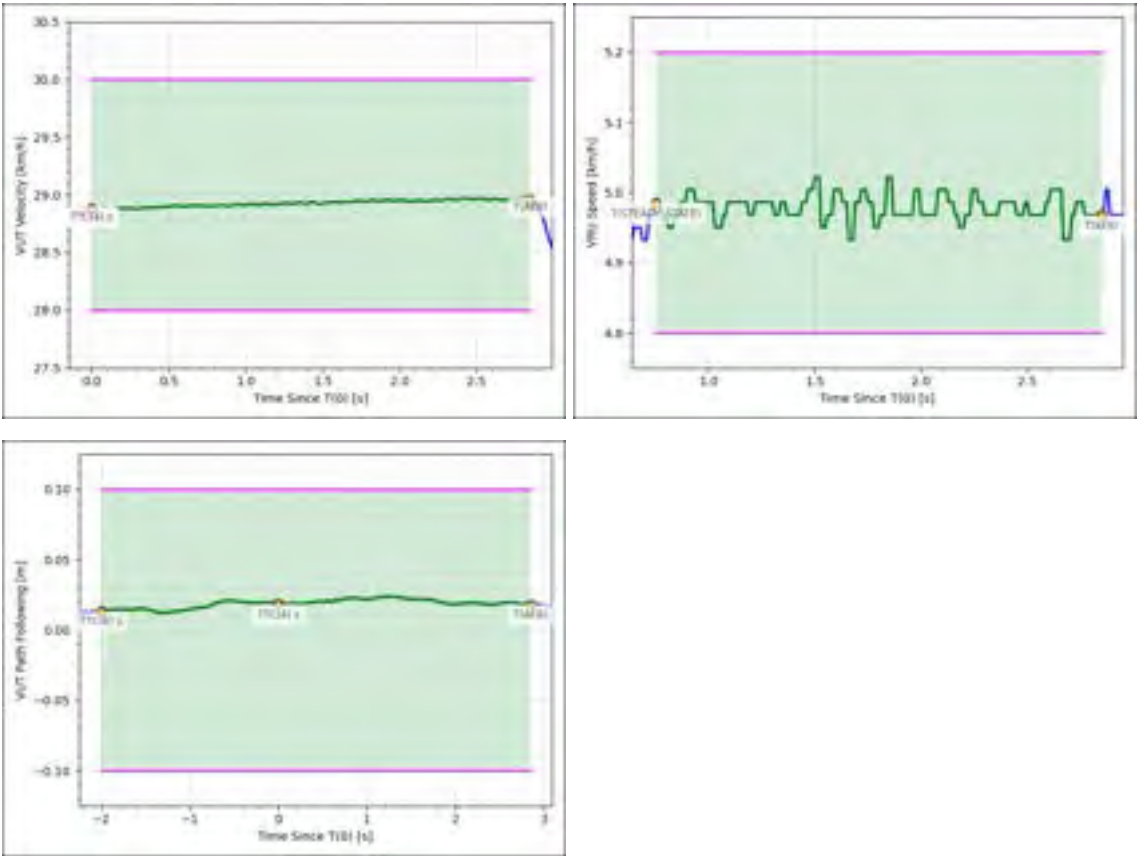
CPFA-50 5 kph (Day) | 30 km/h | Run 13

Run Date / Time 6-Feb-2023 11:12



CPFA-50 5 kph (Day) | 30 km/h | Run 14

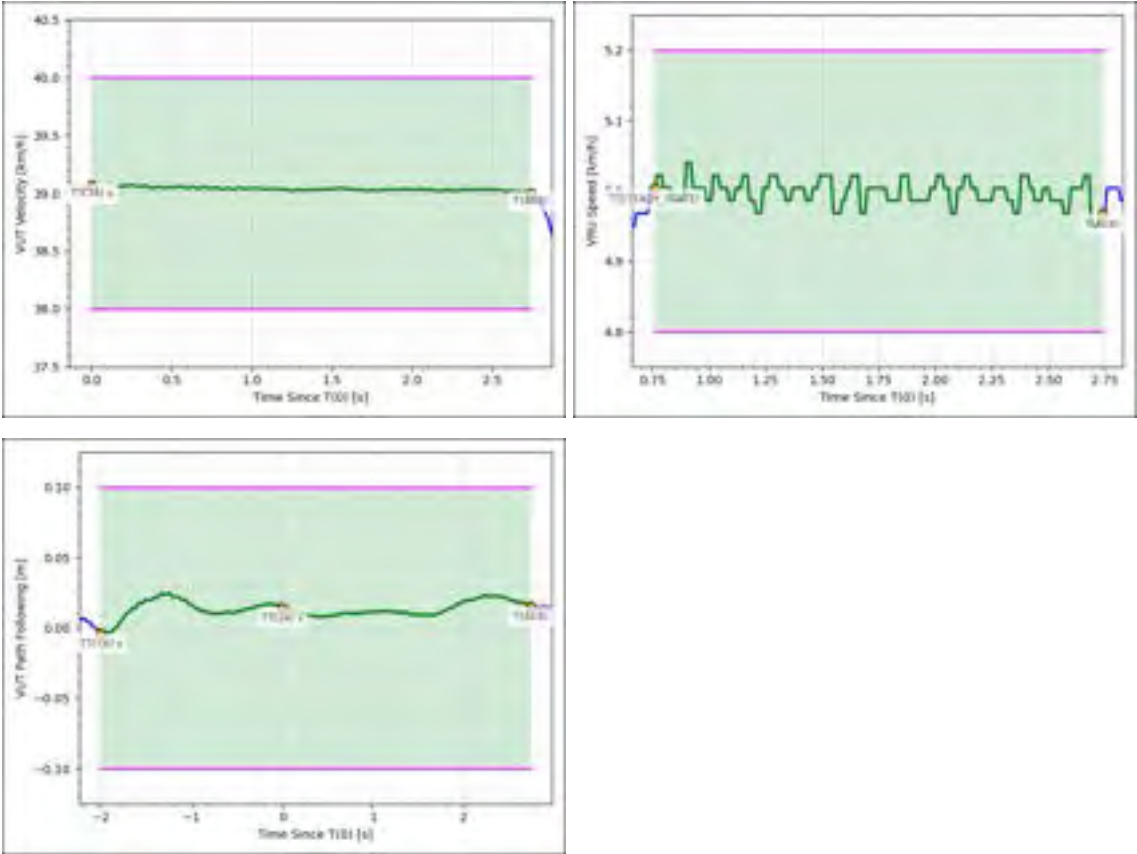
Run Date / Time 6-Feb-2023 11:16



H.1.1.4. CPFA-50 VUT 40kph EPT 5kph (Day)

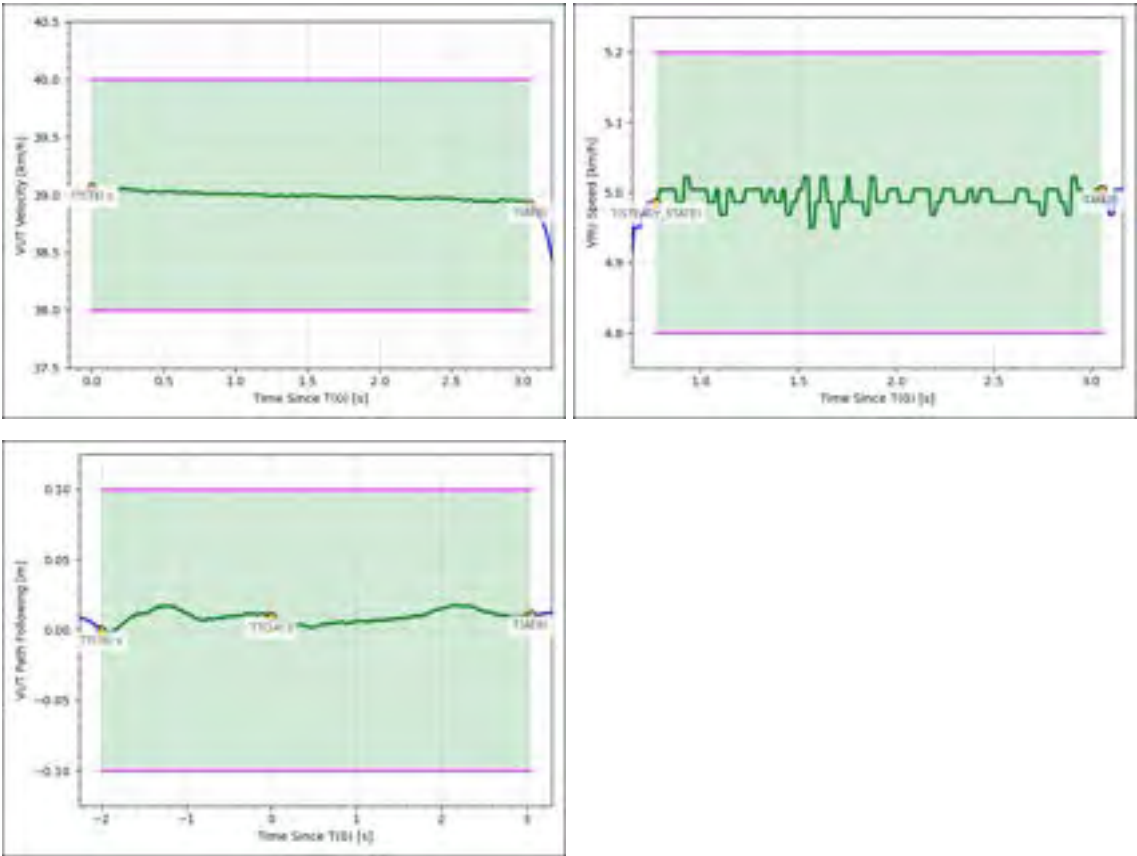
CPFA-50 5 kph (Day) | 40 km/h | Run 5

Run Date / Time 6-Feb-2023 11:19



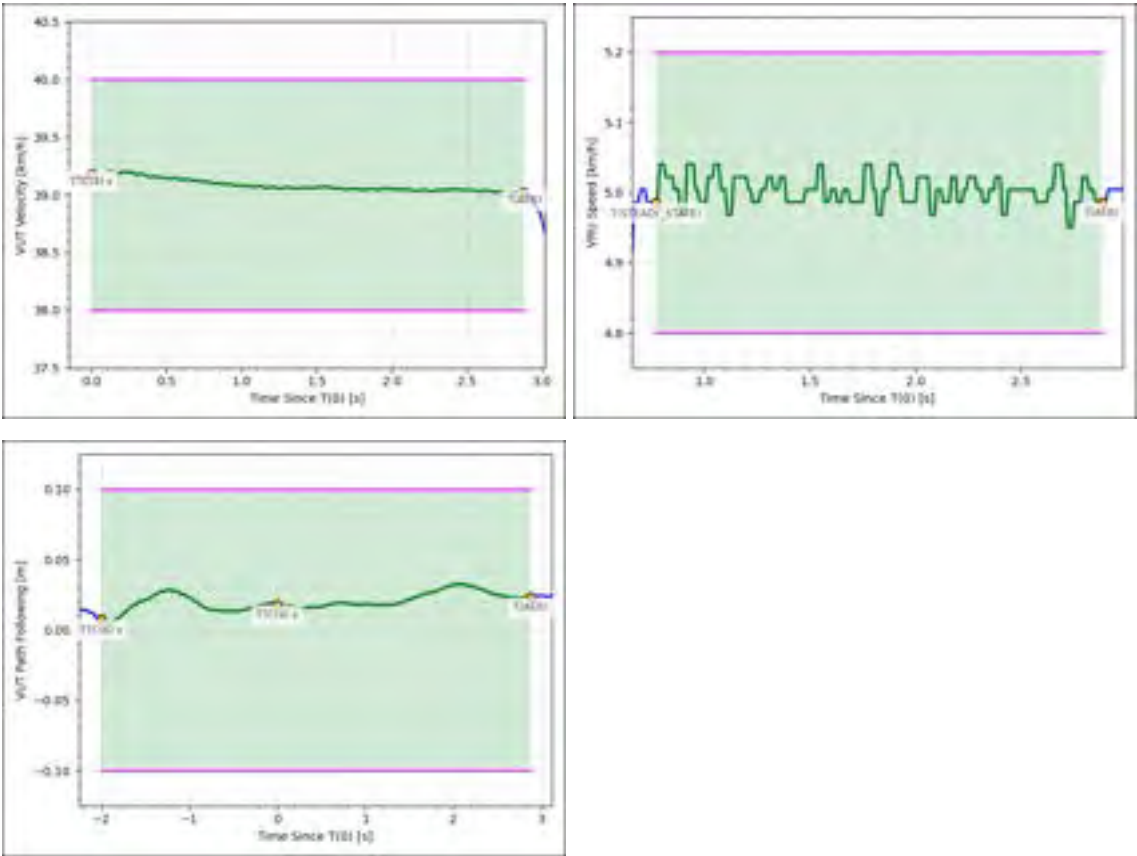
CPFA-50 5 kph (Day) | 40 km/h | Run 6

Run Date / Time 6-Feb-2023 11:21



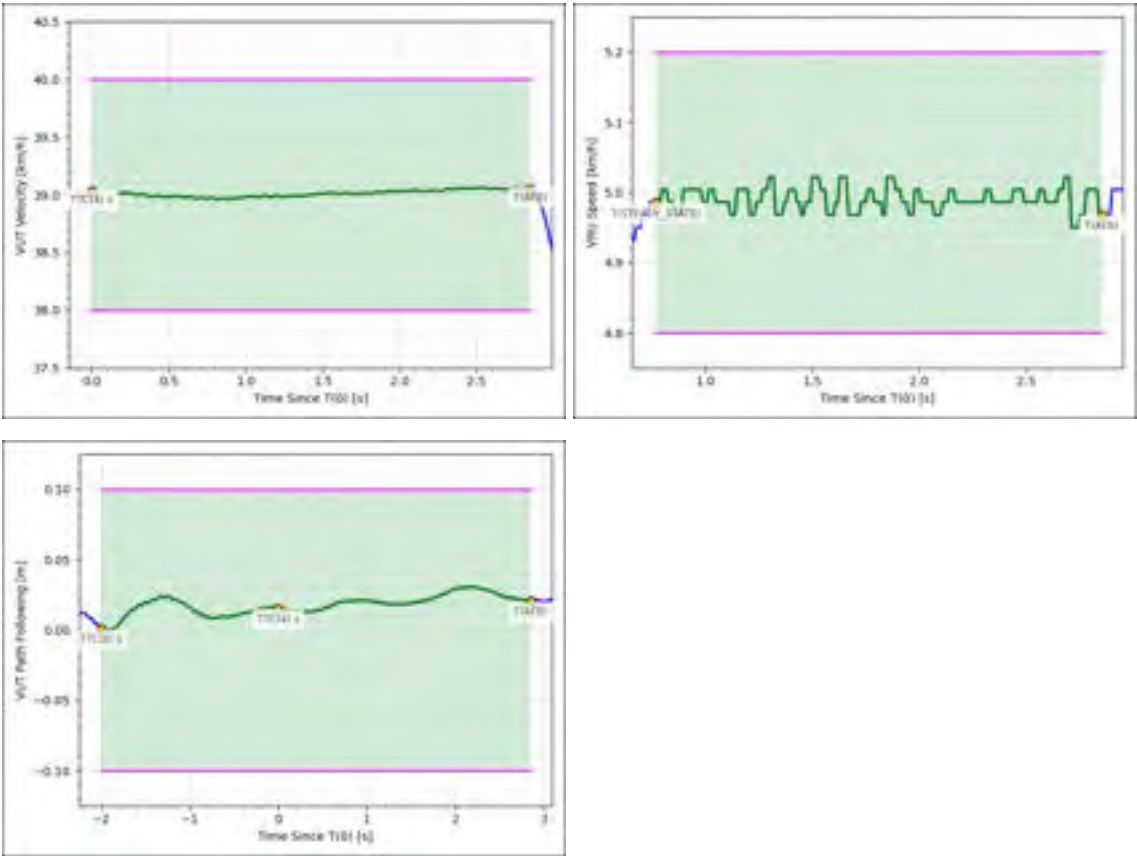
CPFA-50 5 kph (Day) | 40 km/h | Run 7

Run Date / Time 6-Feb-2023 11:31



CPFA-50 5 kph (Day) | 40 km/h | Run 8

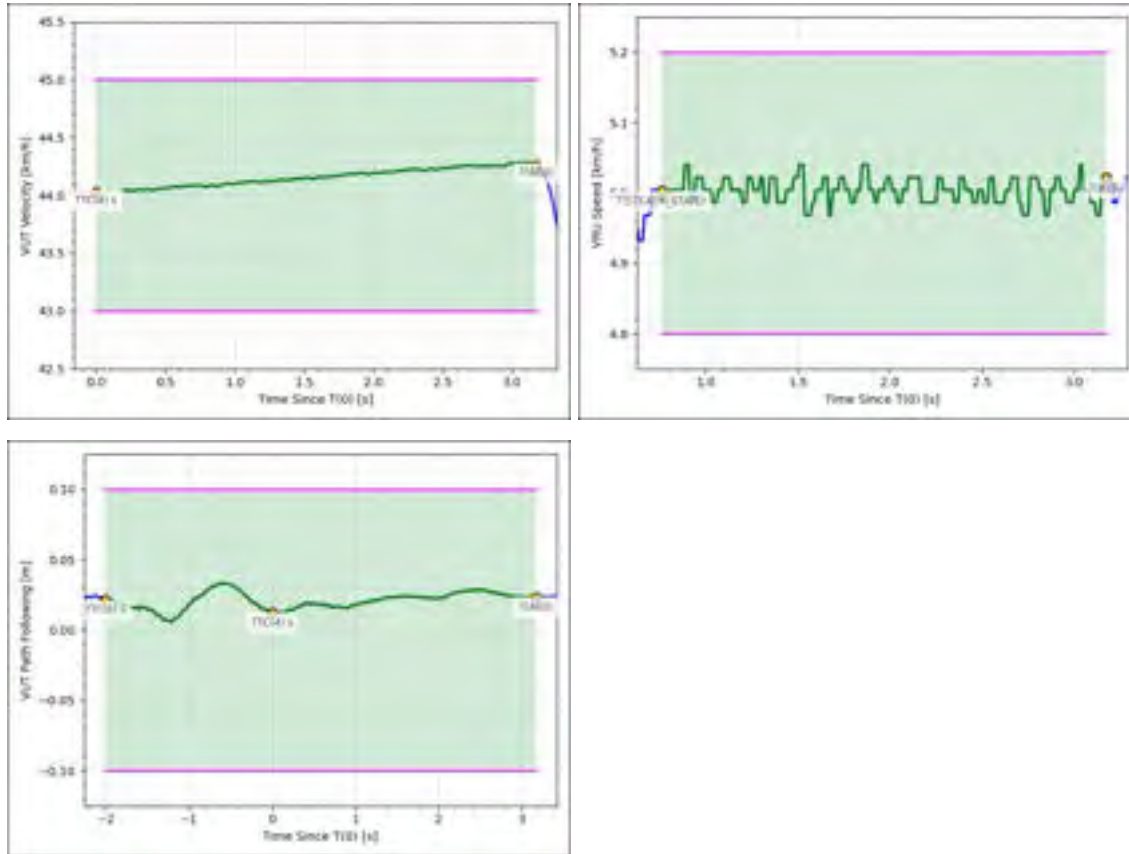
Run Date / Time 6-Feb-2023 11:34



H.1.1.5. CPFA-50 VUT 45kph EPT 5kph (Day)

CPFA-50 5 kph (Day) | 45 km/h | Run 7

Run Date / Time 6-Feb-2023 11:39

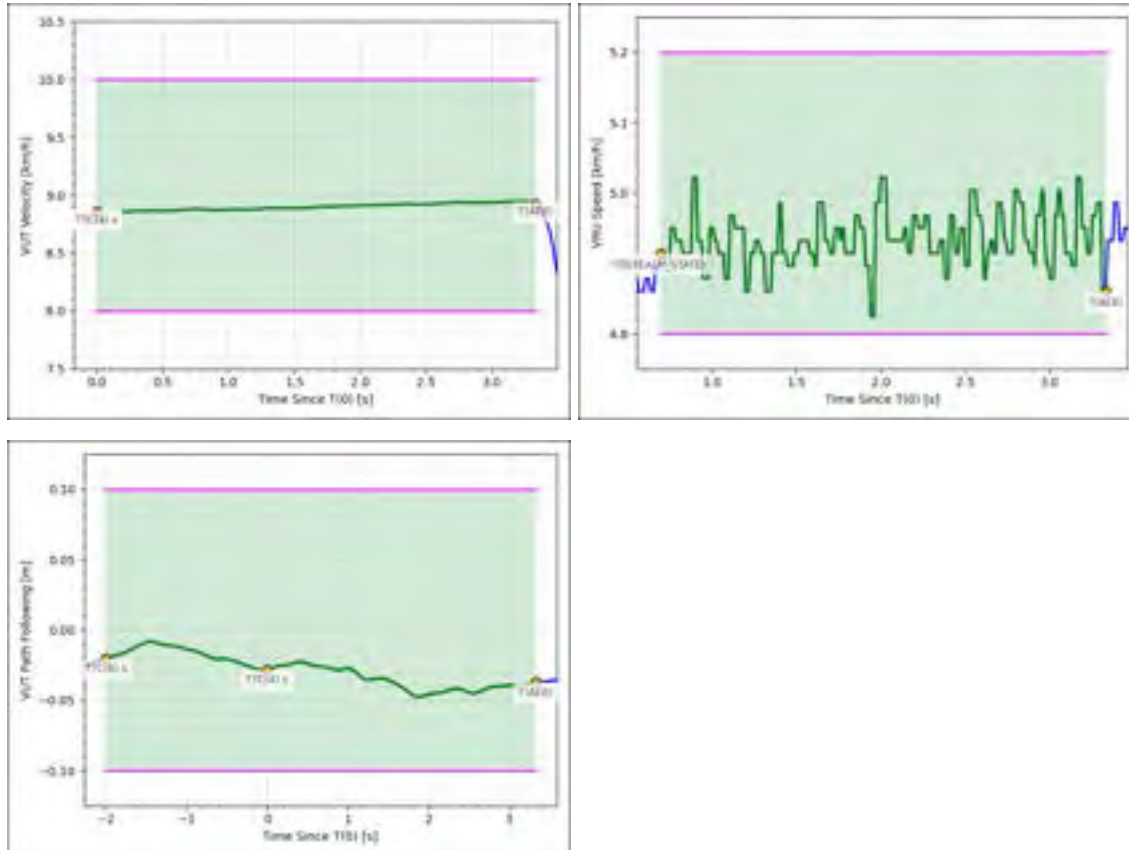


H.1.1. Ironman Bullbar

H.1.1.1. CPFA-50 VUT 10kph EPT 5kph (Day)

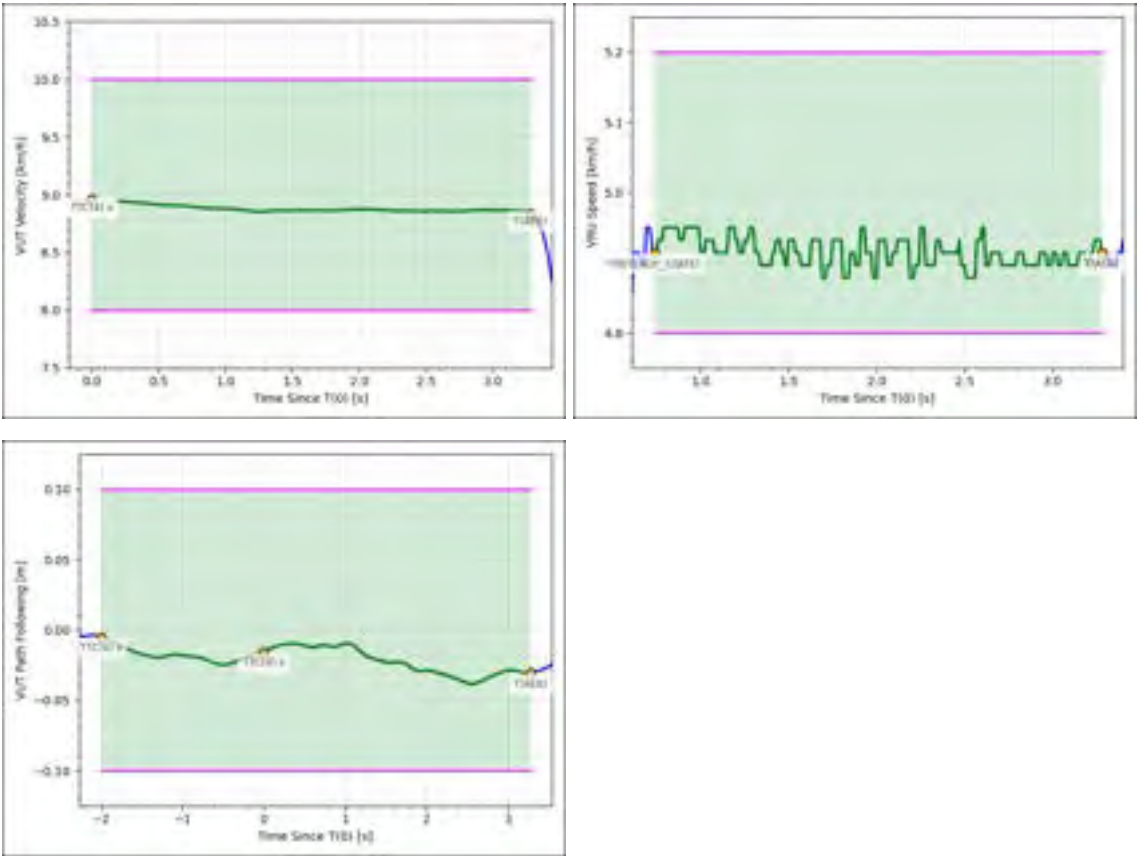
CPFA-50 8 kph (Day) | 10 km/h | Run 3

Run Date / Time 26-Jun-2023 11:05



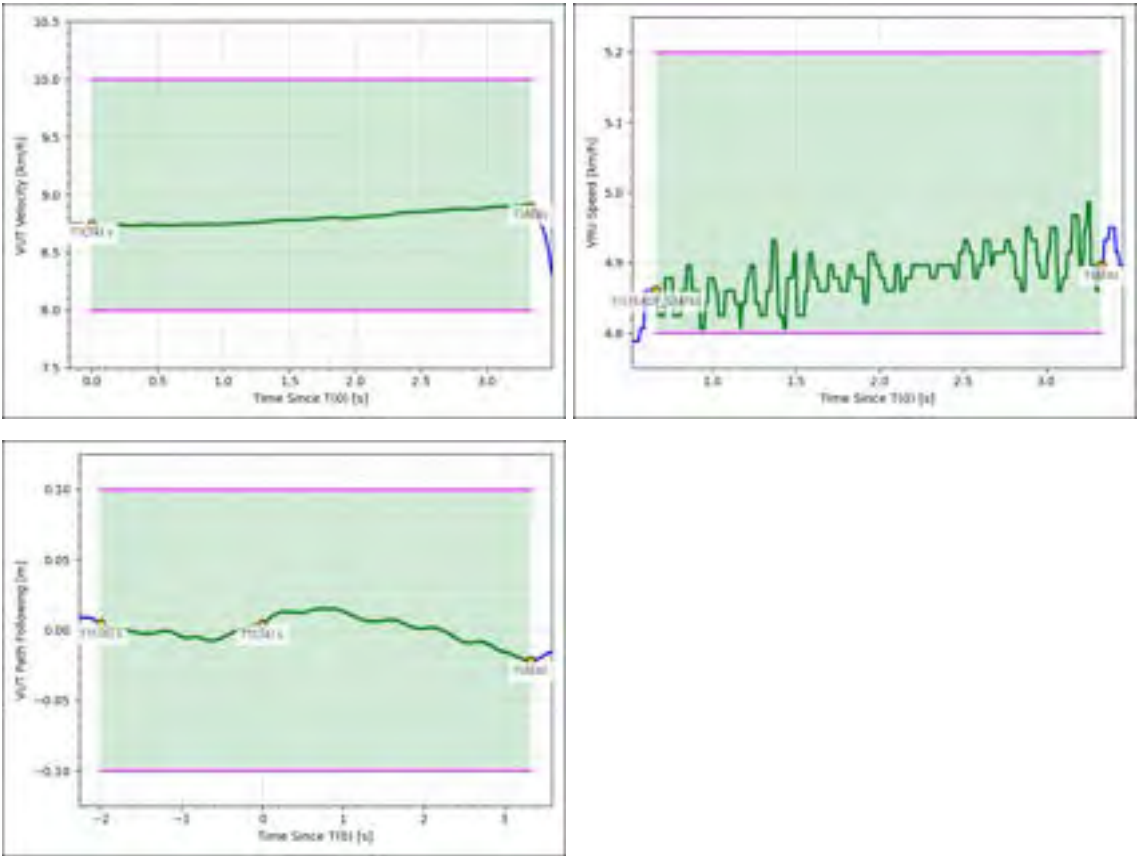
CPFA-50 8 kph (Day) | 10 km/h | Run 4

Run Date / Time 26-Jun-2023 11:11



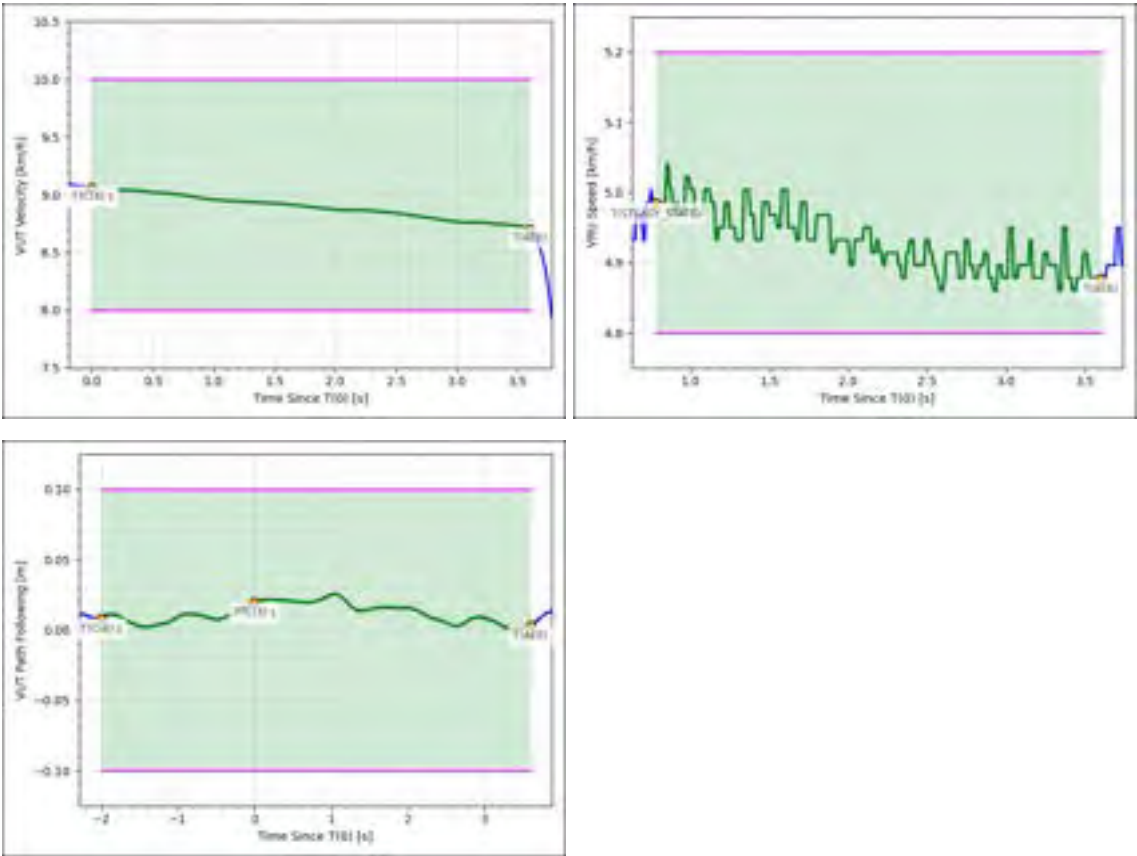
CPFA-50 5 kph (Day) | 10 km/h | Run 5

Run Date / Time 26-Jun-2023 11:26



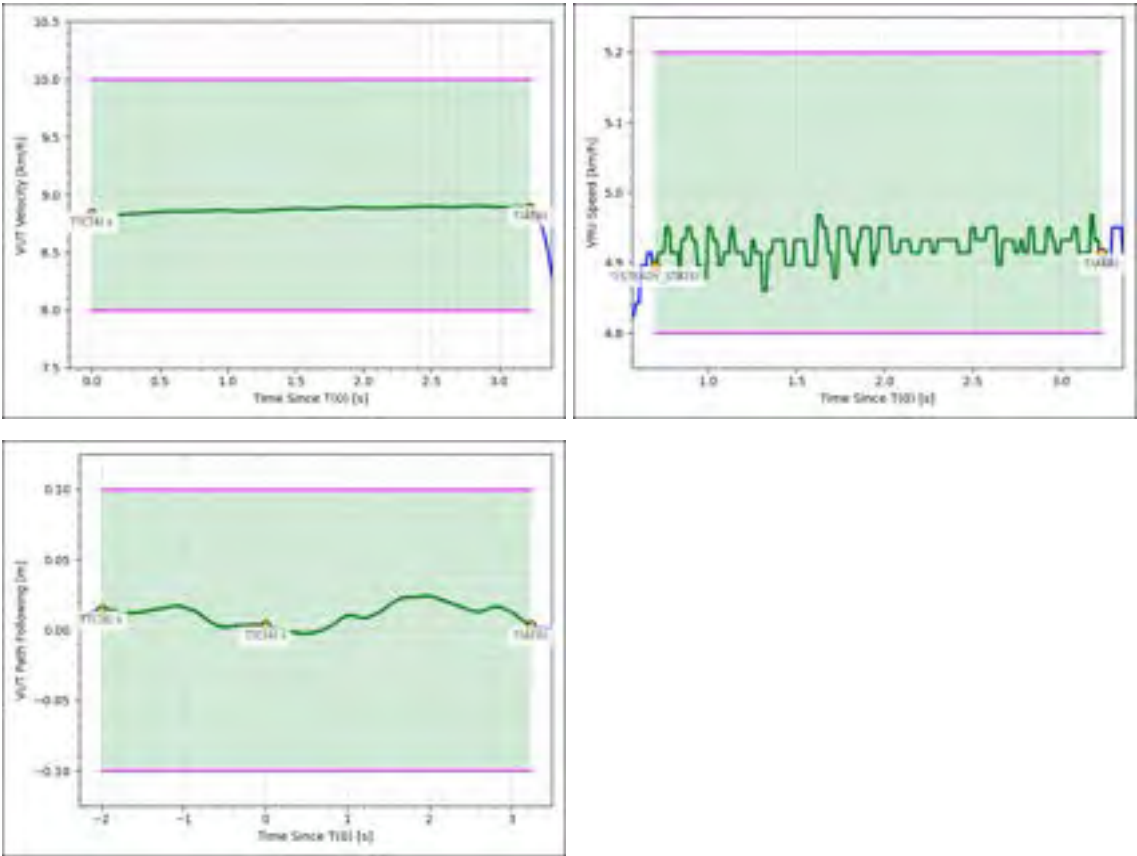
CPFA-50 5 kph (Day) | 10 km/h | Run 6

Run Date / Time 26-Jun-2023 11:32



CPFA-50 5 kph (Day) | 10 km/h | Run 7

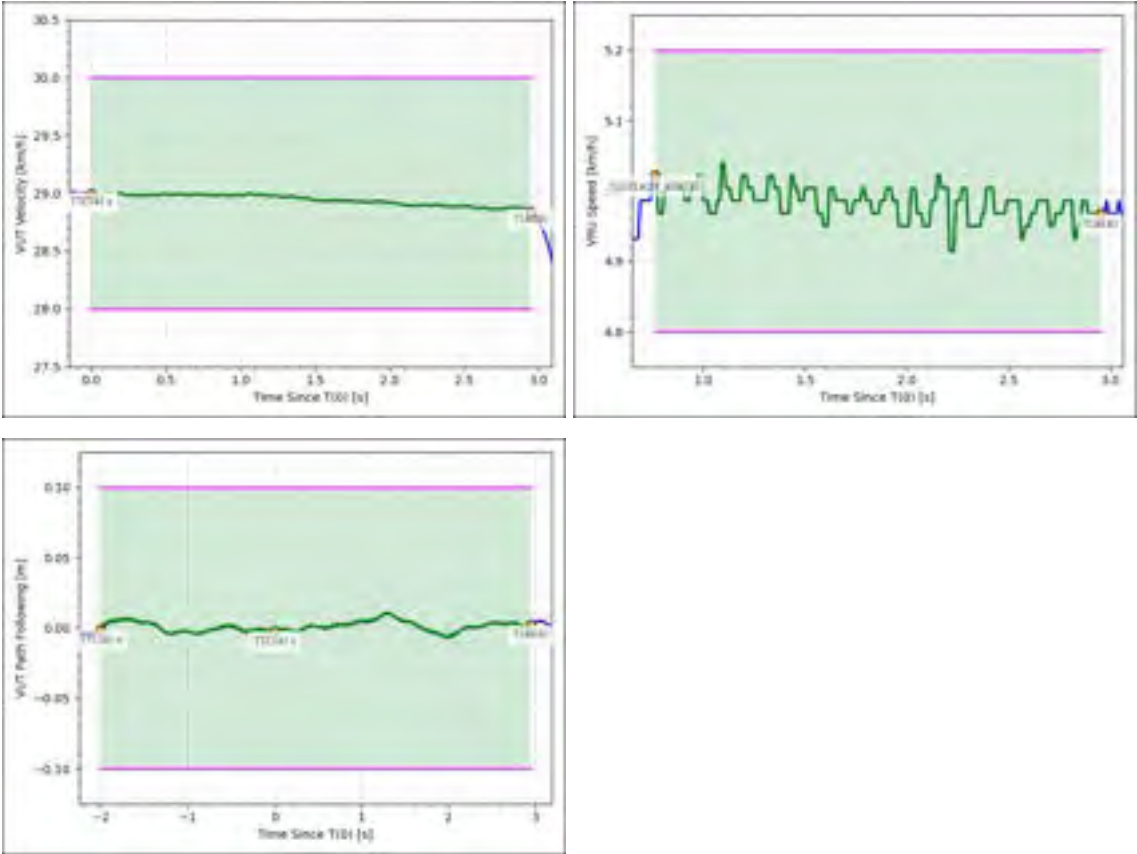
Run Date / Time 26-Jun-2023 11:37



H.1.1.2. CPFA-50 VUT 30kph EPT 5kph (Day)

CPFA-50 5 kph (Day) | 30 km/h | Run 1

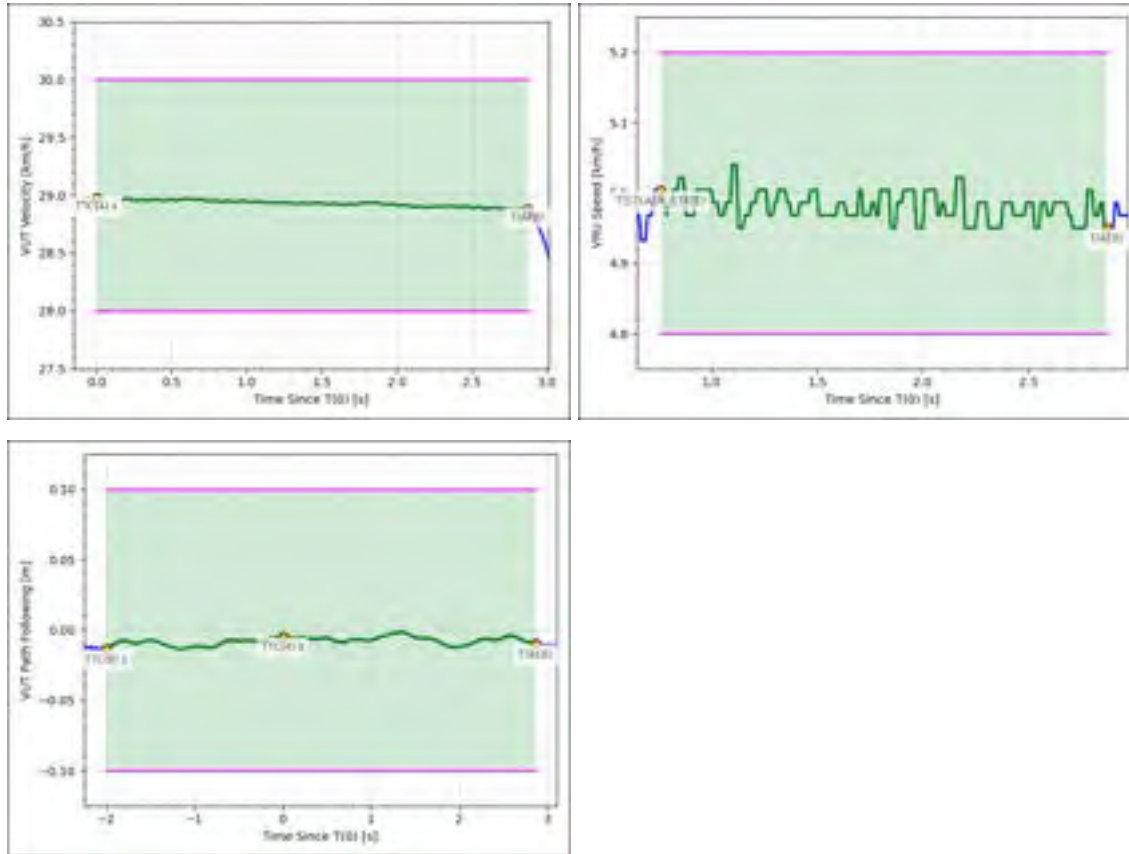
Run Date / Time 26-Jun-2023 11:44



H.1.1.3. CPFA-50 VUT 30kph EPT 5kph (Day)

CPFA-50 5 kph (Day) | 30 km/h | Run 2

Run Date / Time 26-Jun-2023 11:57

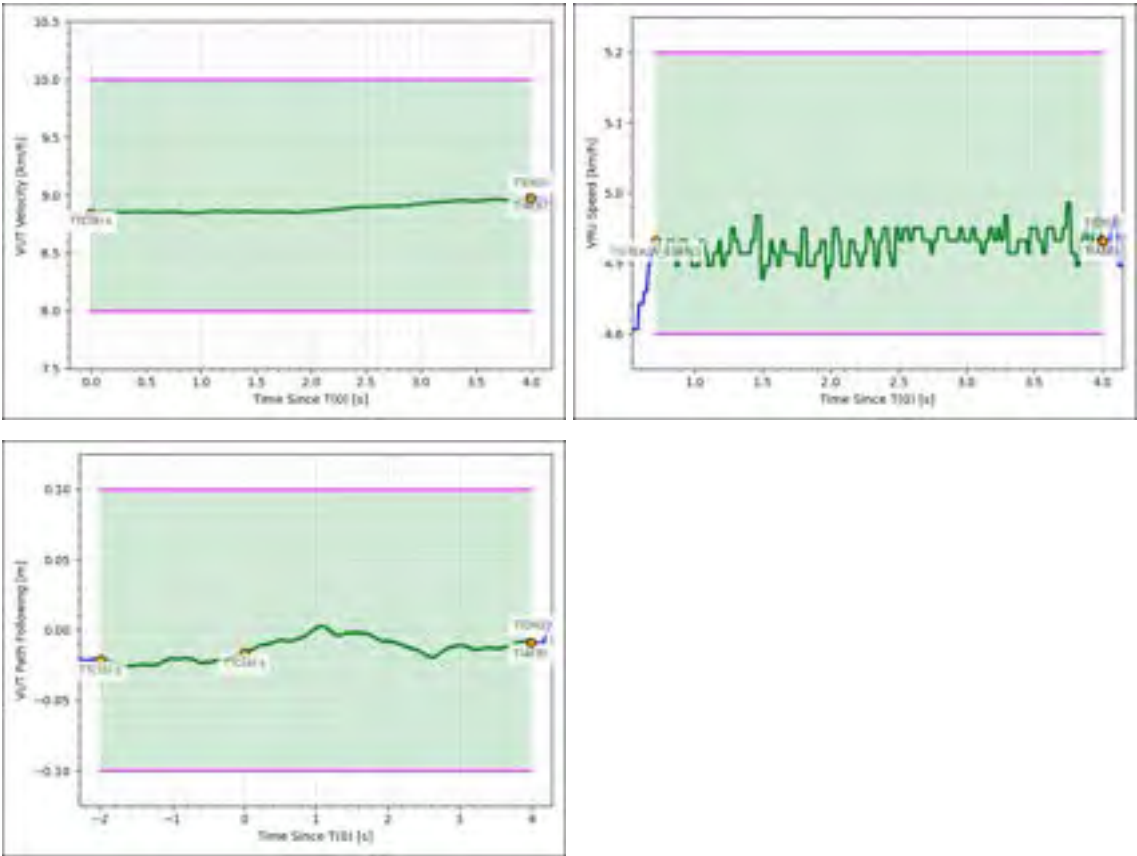


H.1.1. Tuff Bullbar

H.1.1.1. CPFA-50 VUT 10kph EPT 5kph (Day)

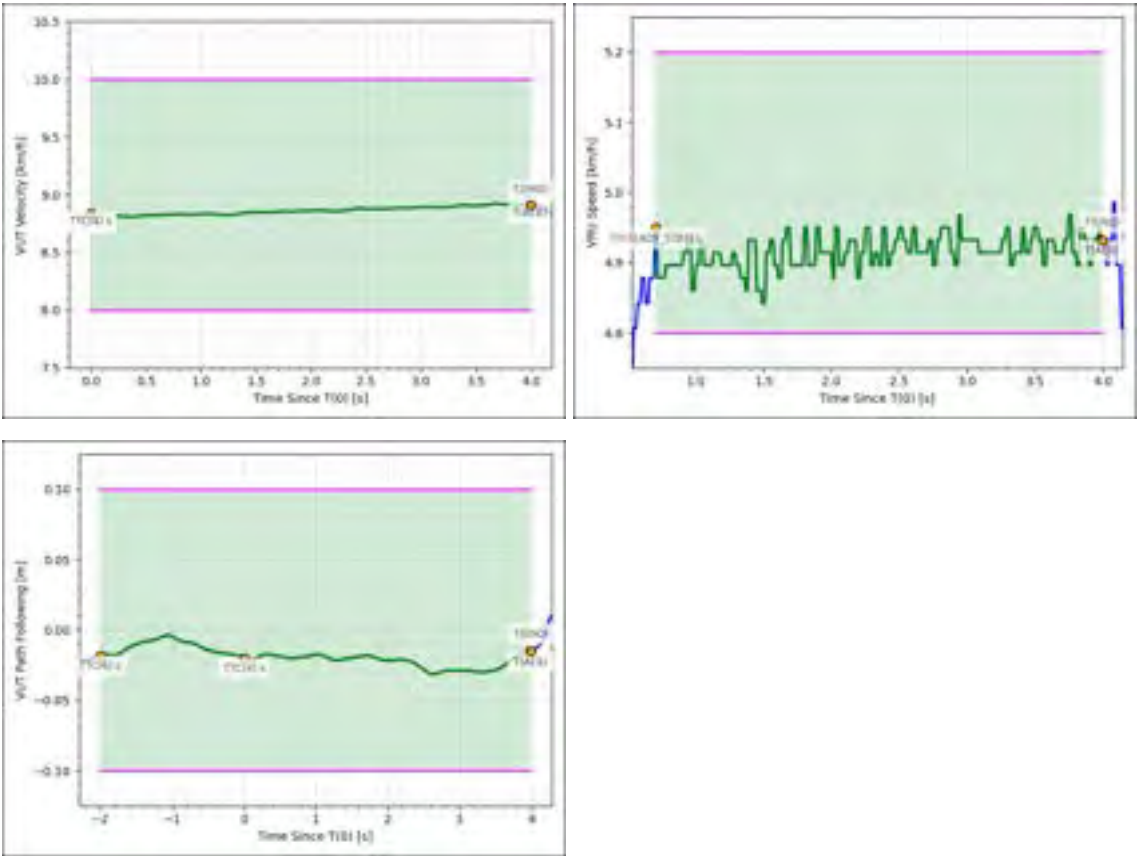
CPFA-50 5 kph (Day) | 10 km/h | Run 2

Run Date / Time 12-Jul-2023 10:47



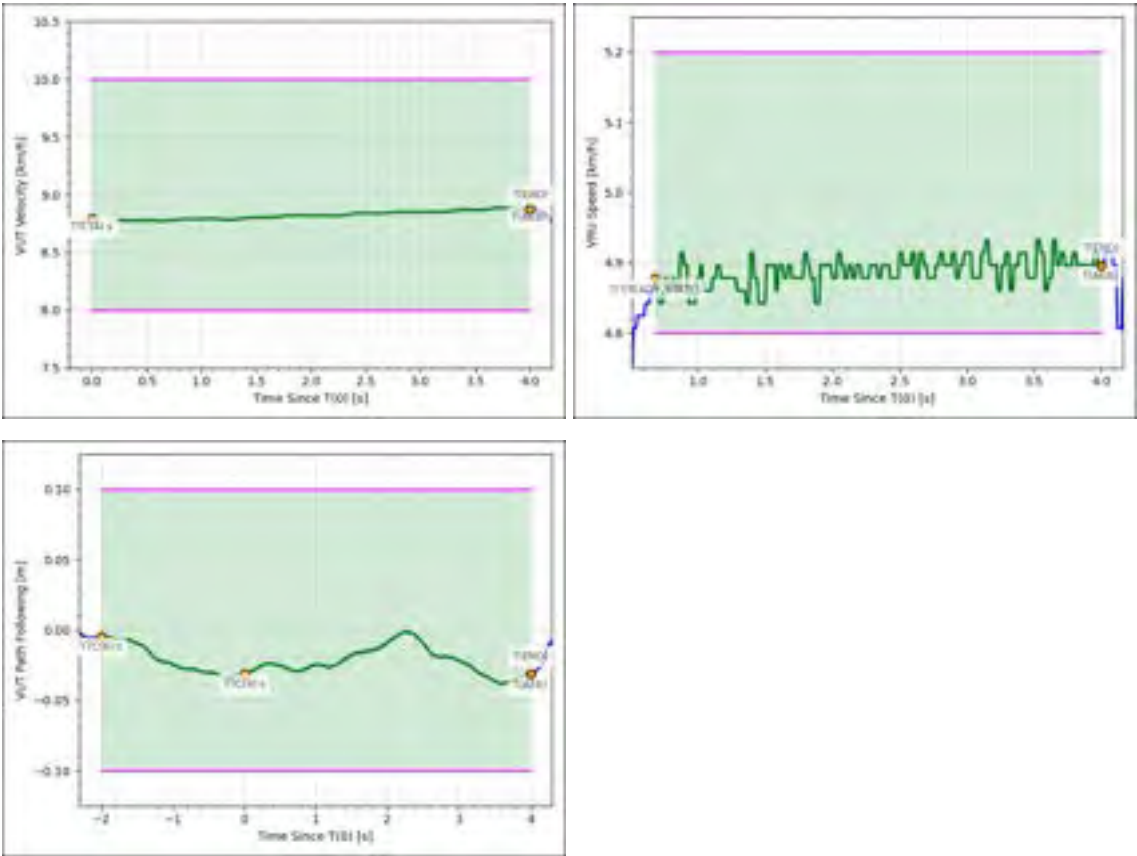
CPFA-50 5 kph (Day) | 10 km/h | Run 4

Run Date / Time 12-Jul-2023 10:58



CPFA-50 5 kph (Day) | 10 km/h | Run 5

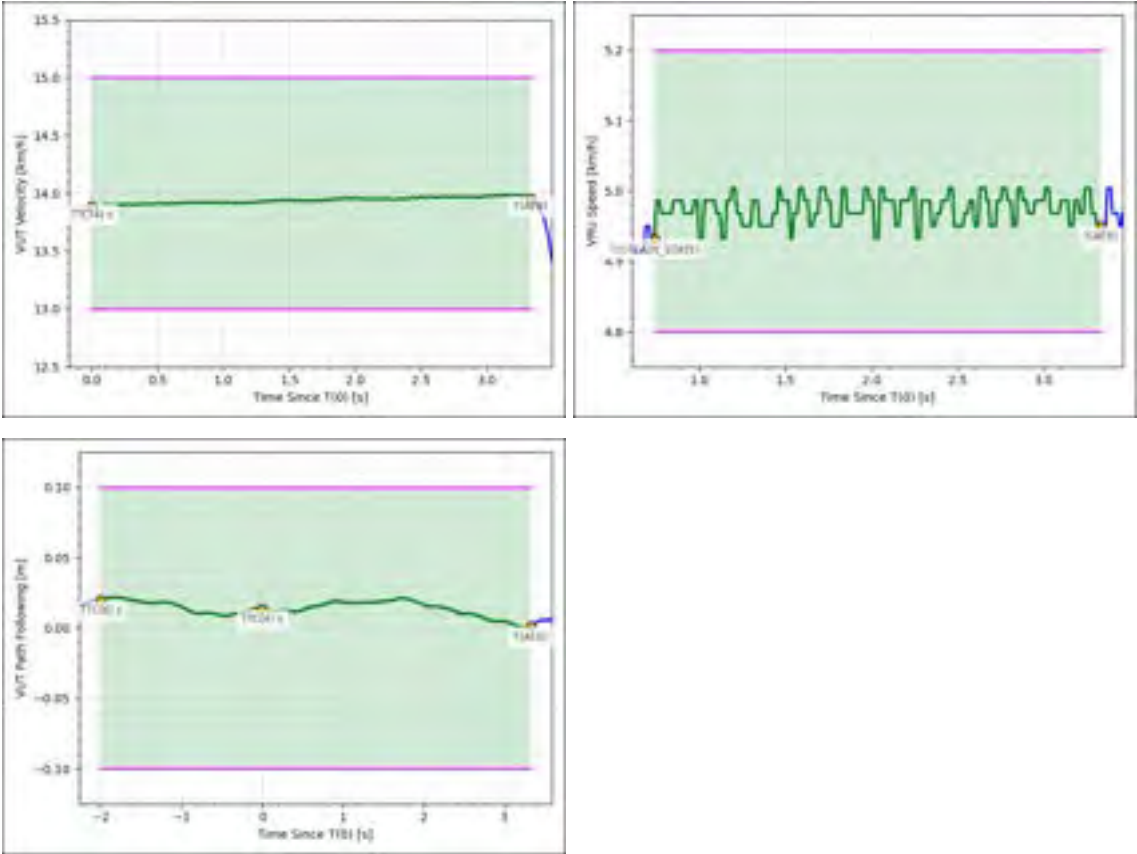
Run Date / Time 12-Jul-2023 11:06



H.1.1.2. CPFA-50 VUT 15kph EPT 5kph (Day)

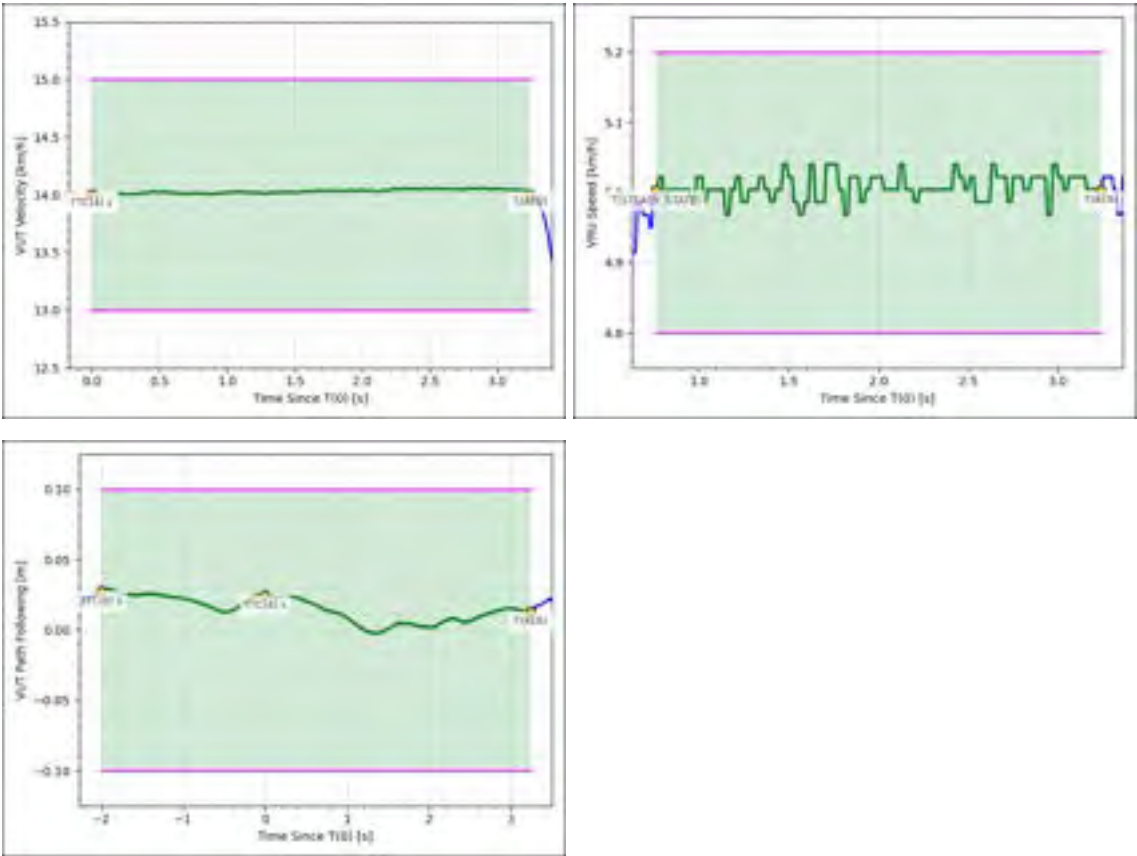
CPFA-50 5 kph (Day) | 15 km/h | Run 2

Run Date / Time 12-Jul-2023 11:19



CPFA-50 5 kph (Day) | 15 km/h | Run 3

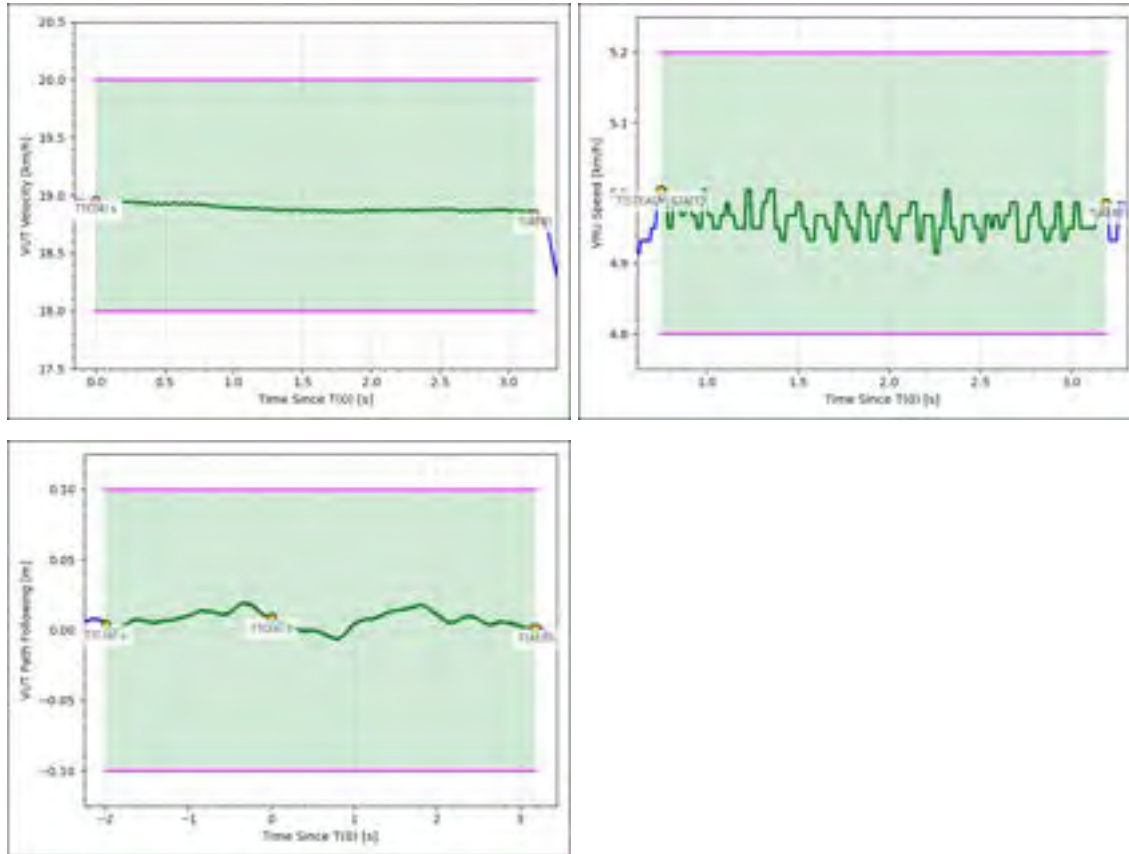
Run Date / Time 12-Jul-2023 11:24



H.1.1.3. CPFA-50 VUT 20kph EPT 5kph (Day)

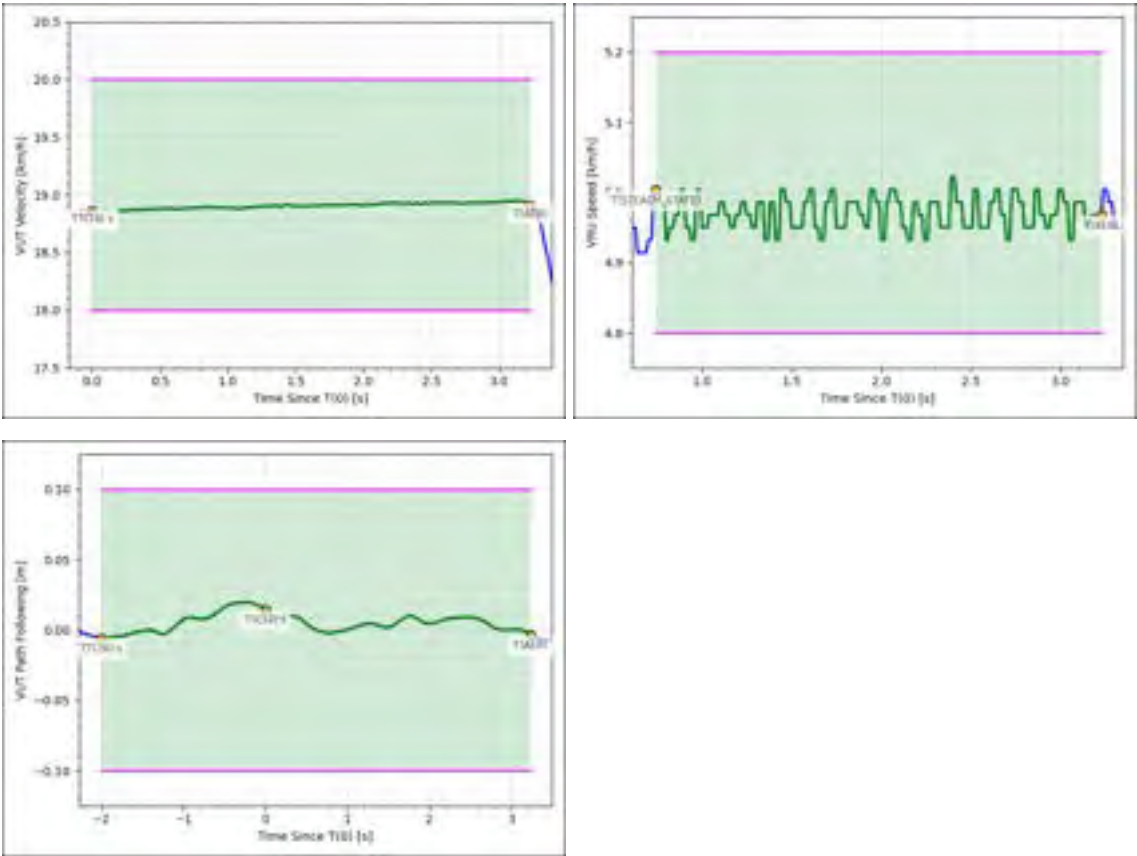
CPFA-50 5 kph (Day) | 20 km/h | Run 1

Run Date / Time 12-Jul-2023 11:28



CPFA-50 5 kph (Day) | 20 km/h | Run 2

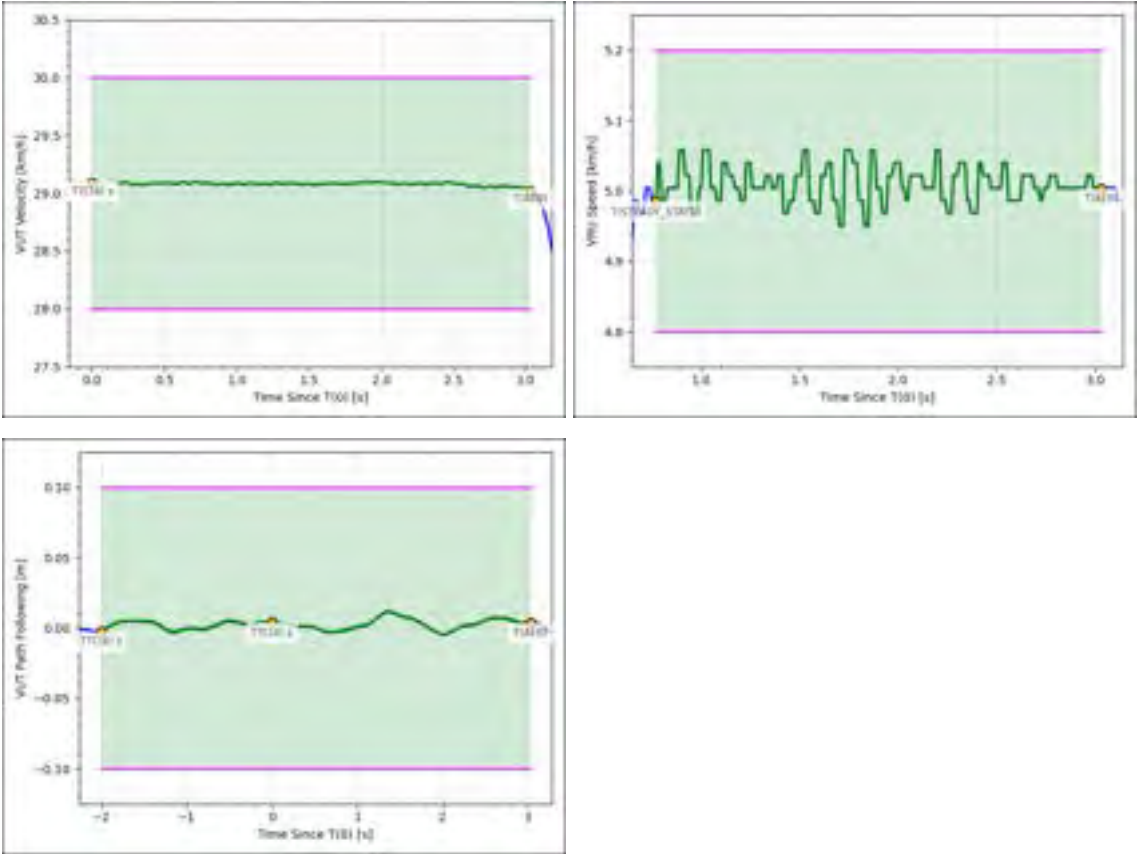
Run Date / Time 12-Jul-2023 11:31



H.1.1.4. CPFA-50 VUT 30kph EPT 5kph (Day)

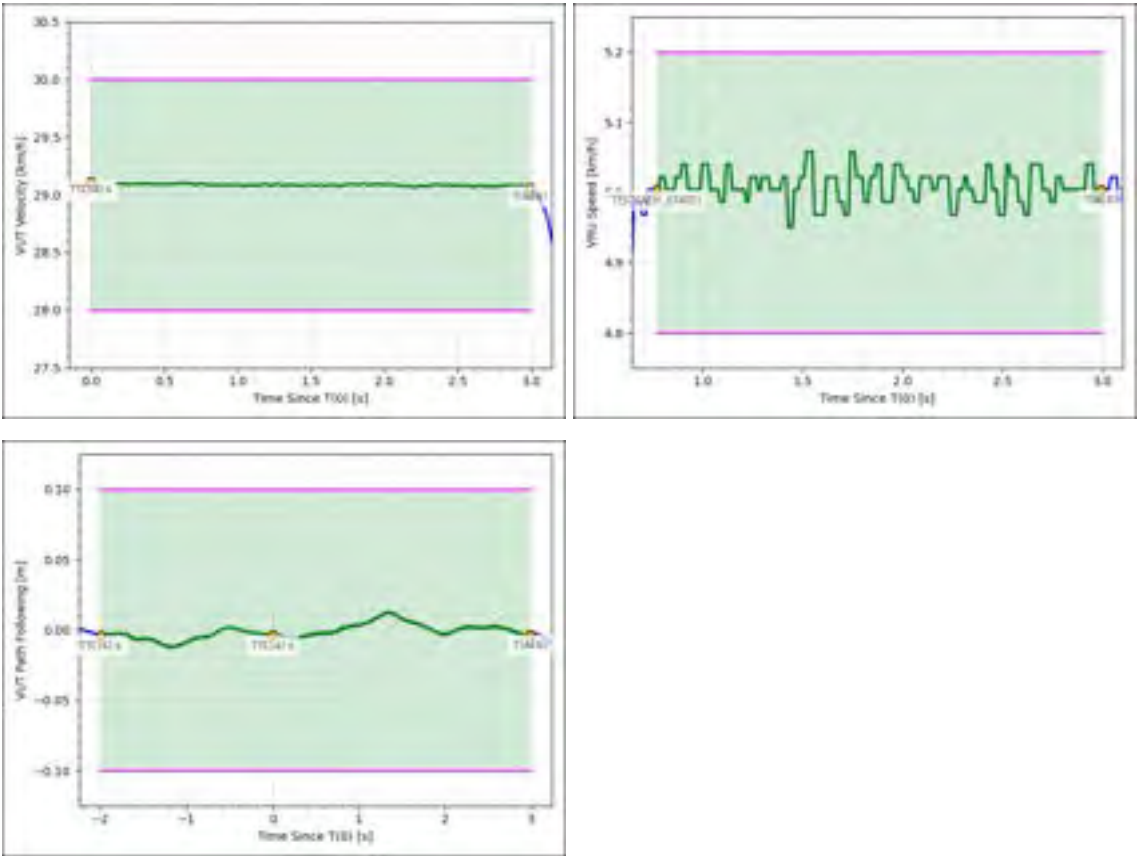
CPFA-50 5 kph (Day) | 30 km/h | Run 1

Run Date / Time 12-Jul-2023 11:35



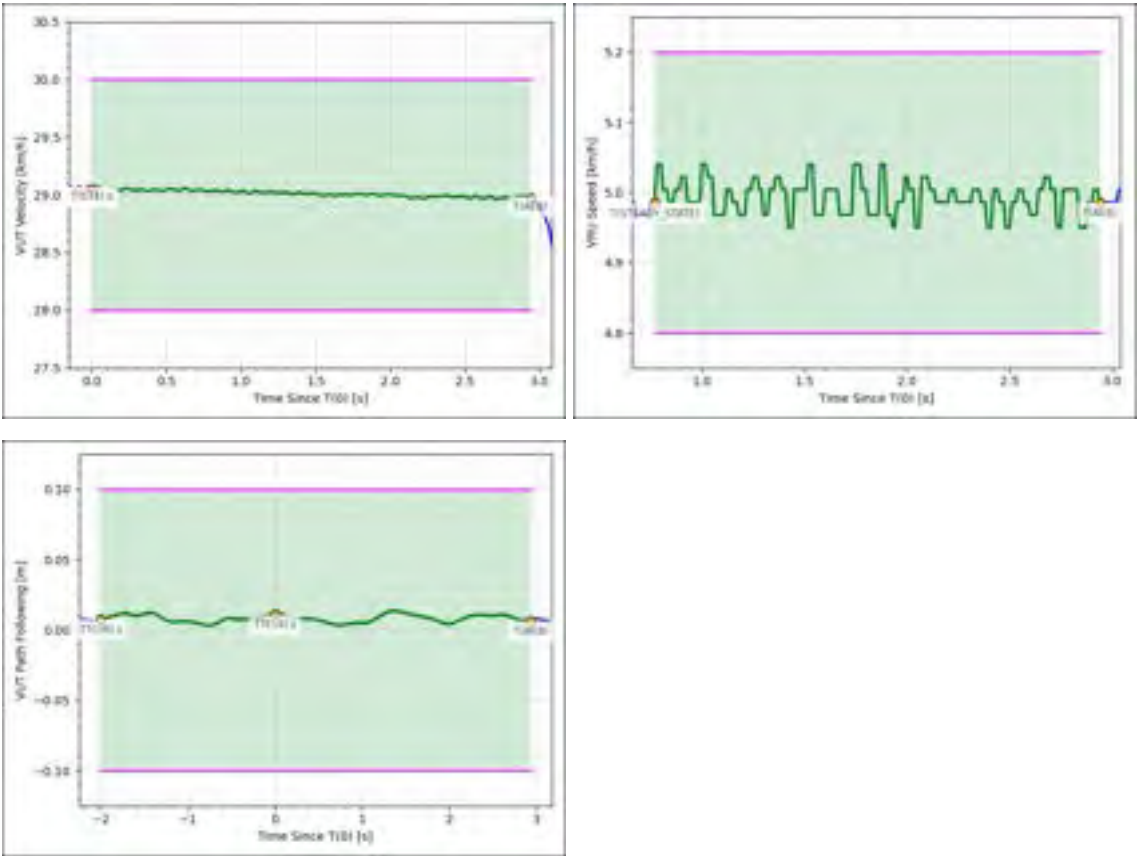
CPFA-50 5 kph (Day) | 30 km/h | Run 2

Run Date / Time 12-Jul-2023 11:38



CPFA-50 5 kph (Day) | 30 km/h | Run 3

Run Date / Time 12-Jul-2023 11:44

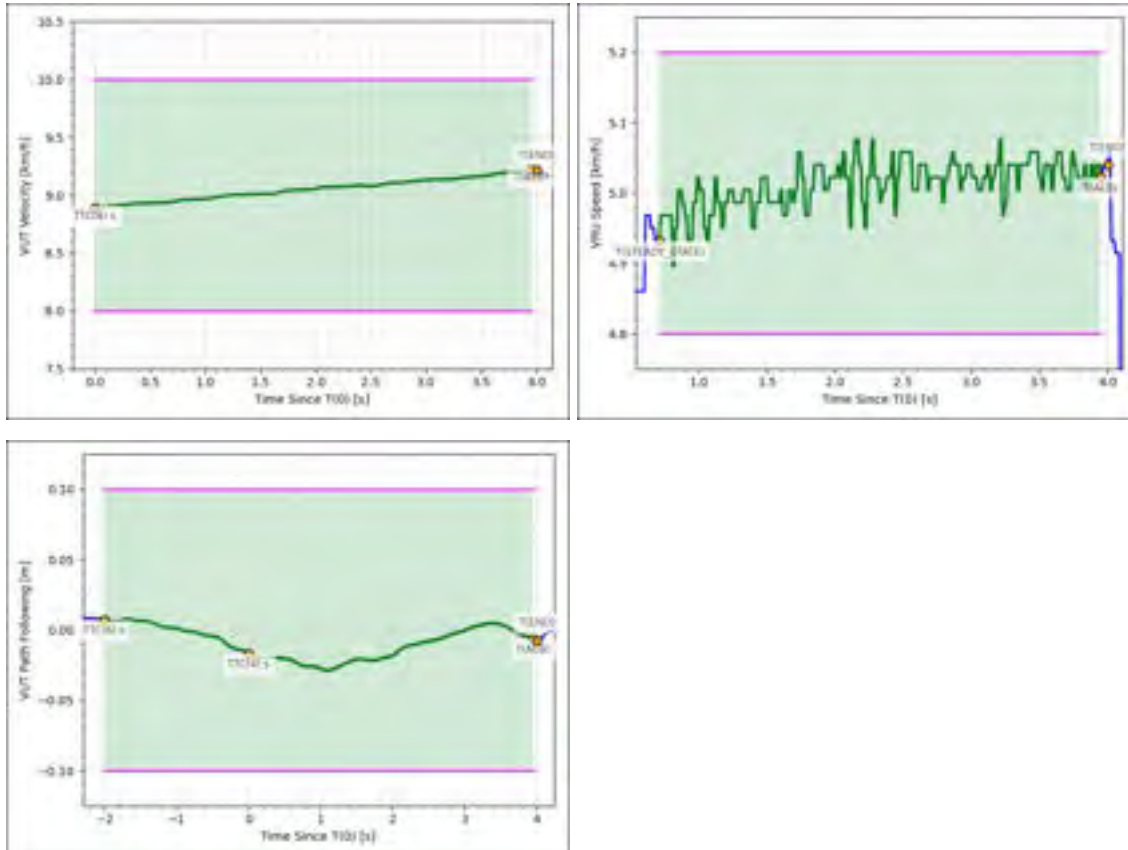


H.1.2. Tuff Bullbar Mesh Investigation

H.1.2.1. CPFA-50 VUT 10kph EPT 5kph (Day)

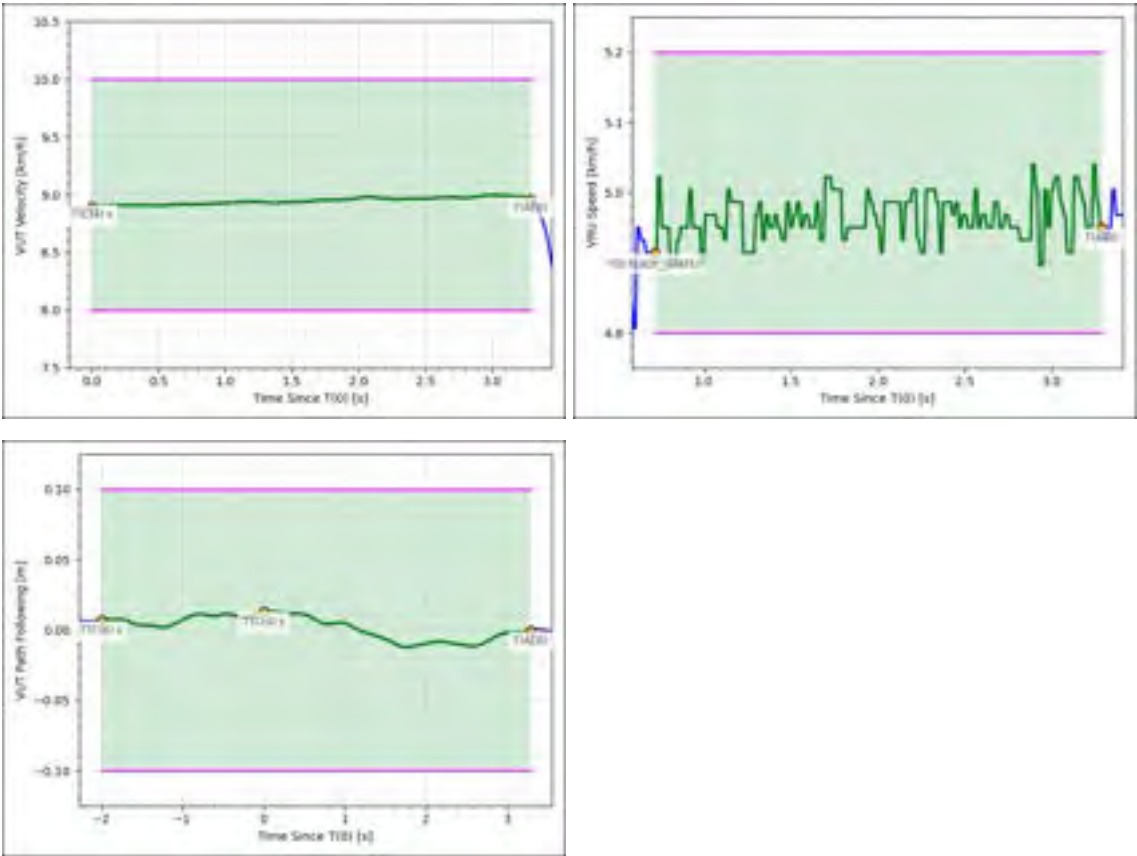
CPFA-50 5 kph (Day) | 10 km/h | Run 7

Run Date / Time 14-Jun-2024 13:48



CPFA-50 5 kph (Day) | 10 km/h | Run 8

Run Date / Time 14-Jun-2024 14:59



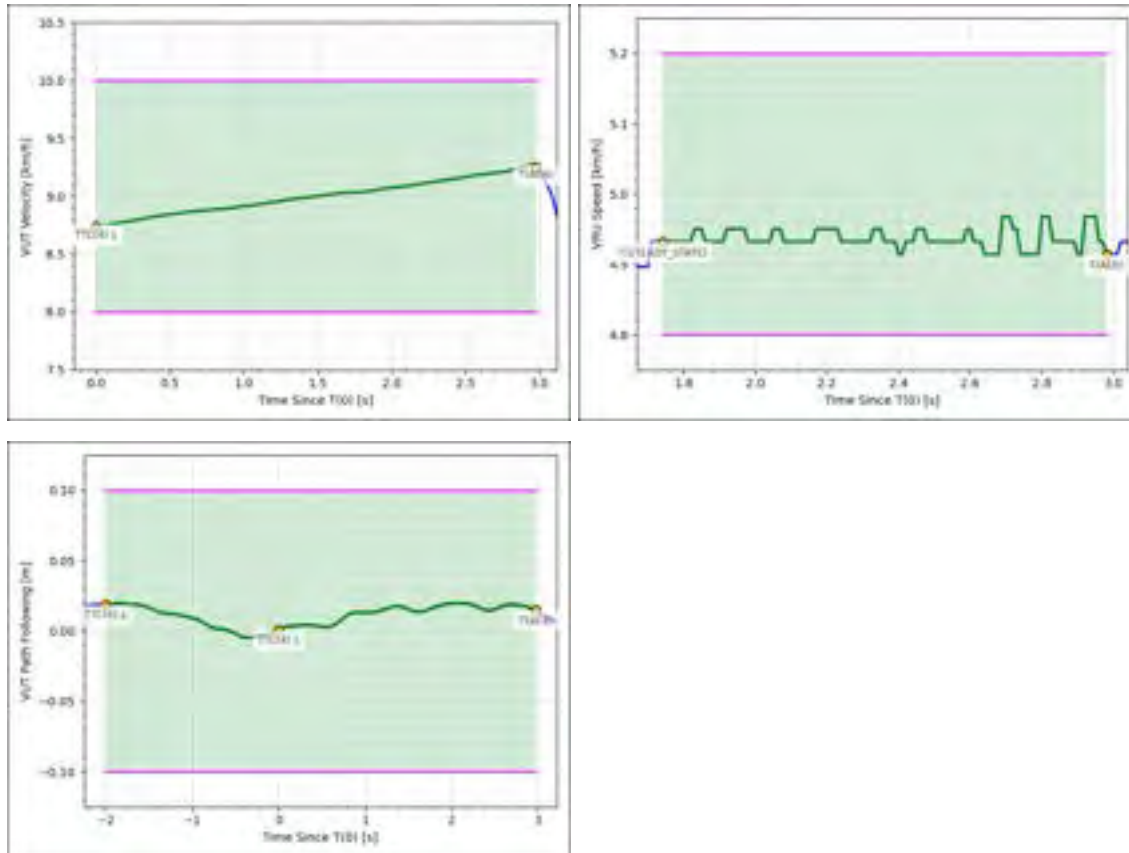
H.2.Car-to-Pedestrian Nearside Child 50% (Day)

H.2.1. Baseline

H.2.1.1. CPNC-50 VUT 10kph EPT 5kph (Day)

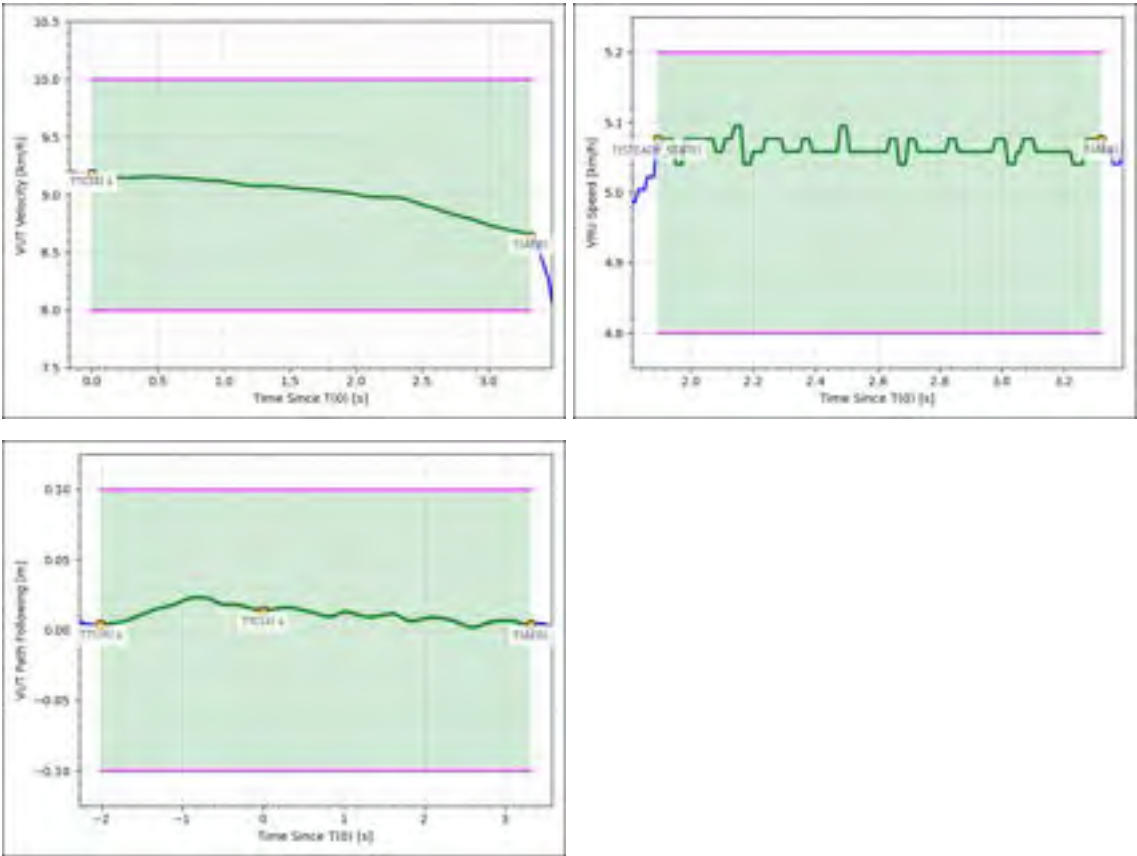
CPNC-50 5 kph (Day) | 10 km/h | Run 2

Run Date / Time 25-Jan-2023 13:59



CPNC-50 5 kph (Day) | 10 km/h | Run 3

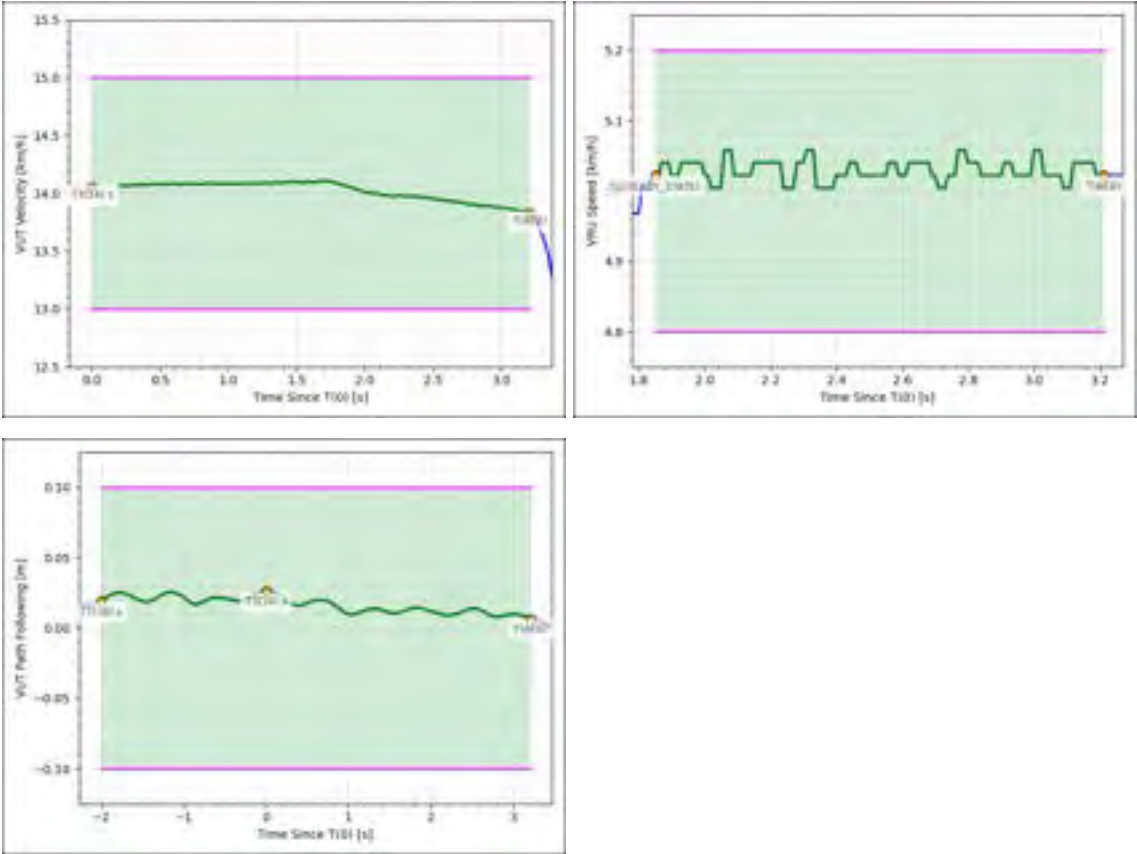
Run Date / Time 25-Jan-2023 14:02



H.2.1.2. CPNC-50 VUT 15kph EPT 5kph (Day)

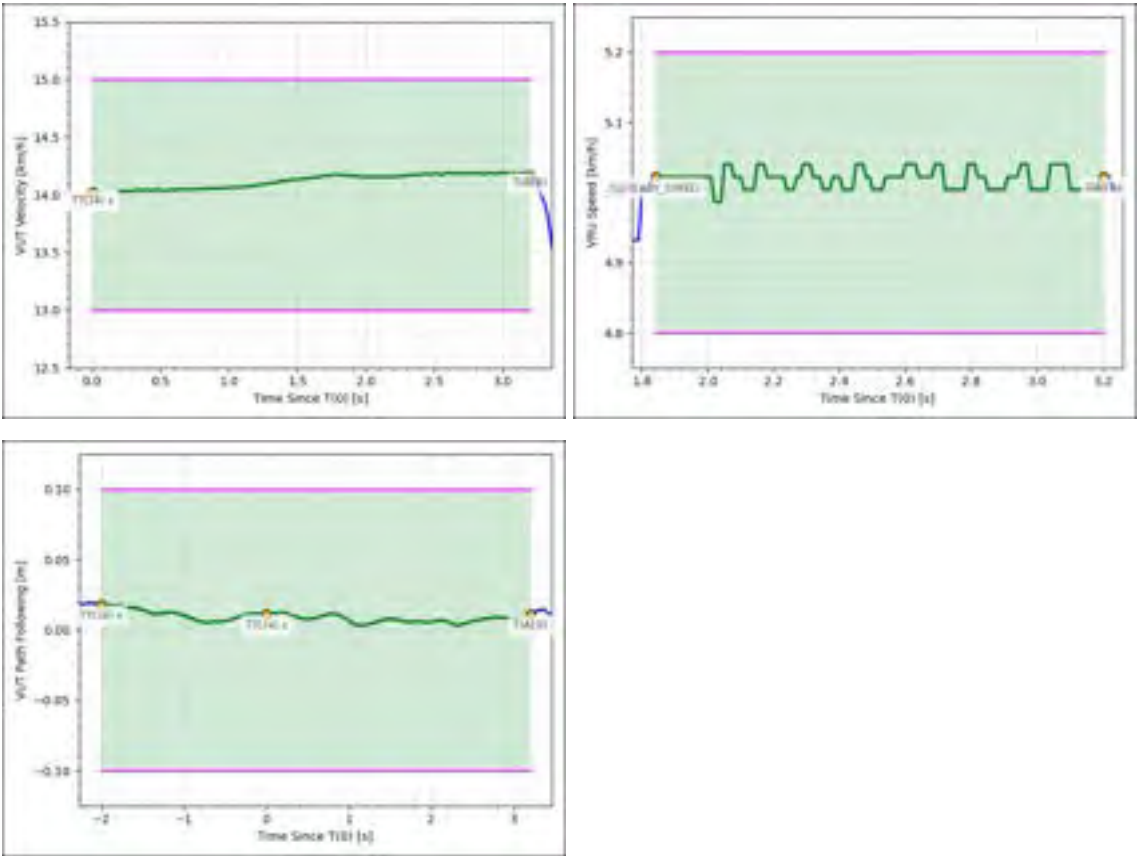
CPNC-50 5 kph (Day) | 15 km/h | Run 1

Run Date / Time 25-Jan-2023 13:52



CPNC-50 5 kph (Day) | 15 km/h | Run 2

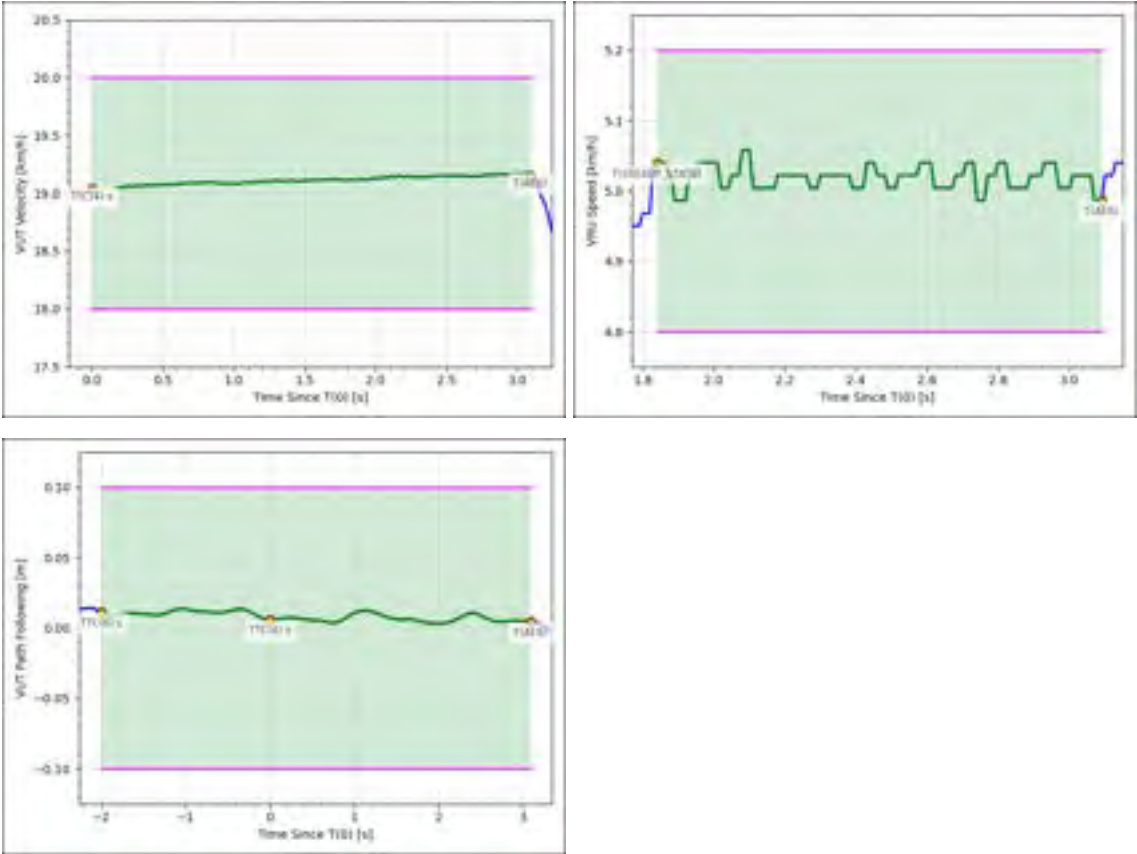
Run Date / Time 25-Jan-2023 13:54



H.2.1.3. CPNC-50 VUT 20kph EPT 5kph (Day)

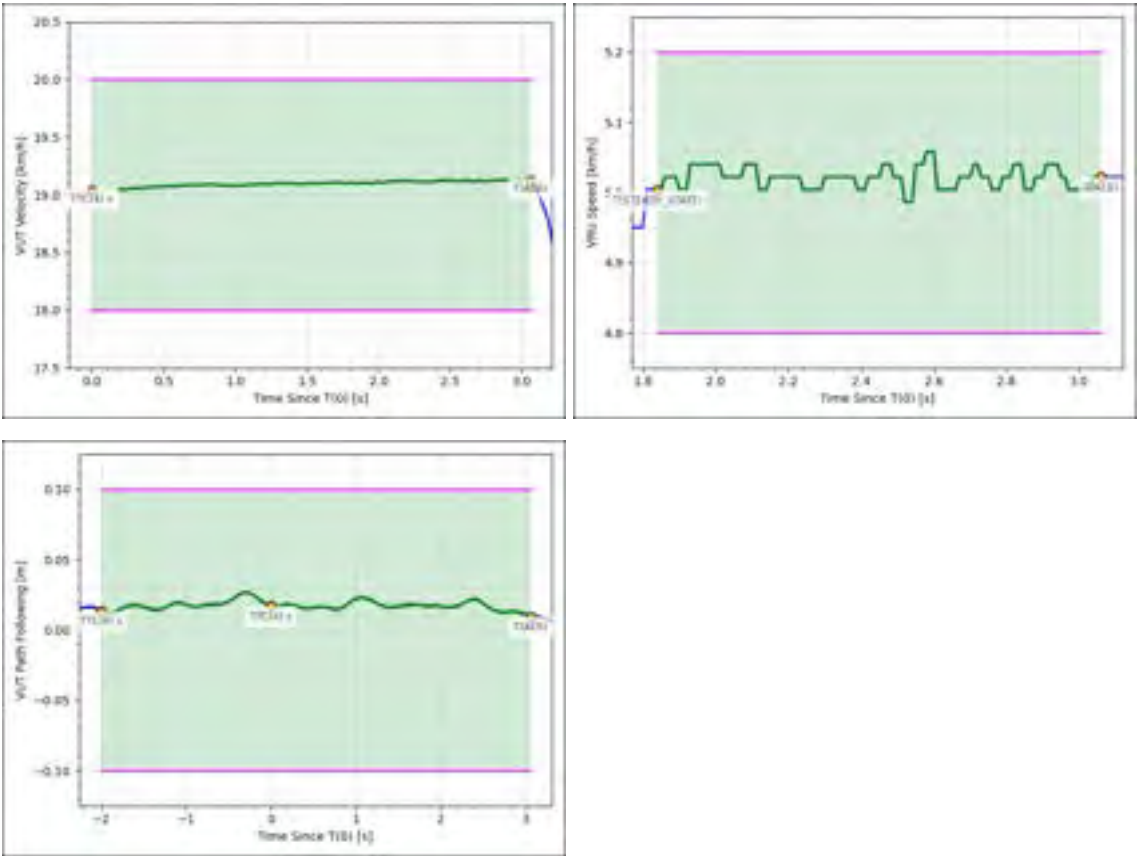
CPNC-50 5 kph (Day) | 20 km/h | Run 1

Run Date / Time 25-Jan-2023 13:15



CPNC-50 5 kph (Day) | 20 km/h | Run 3

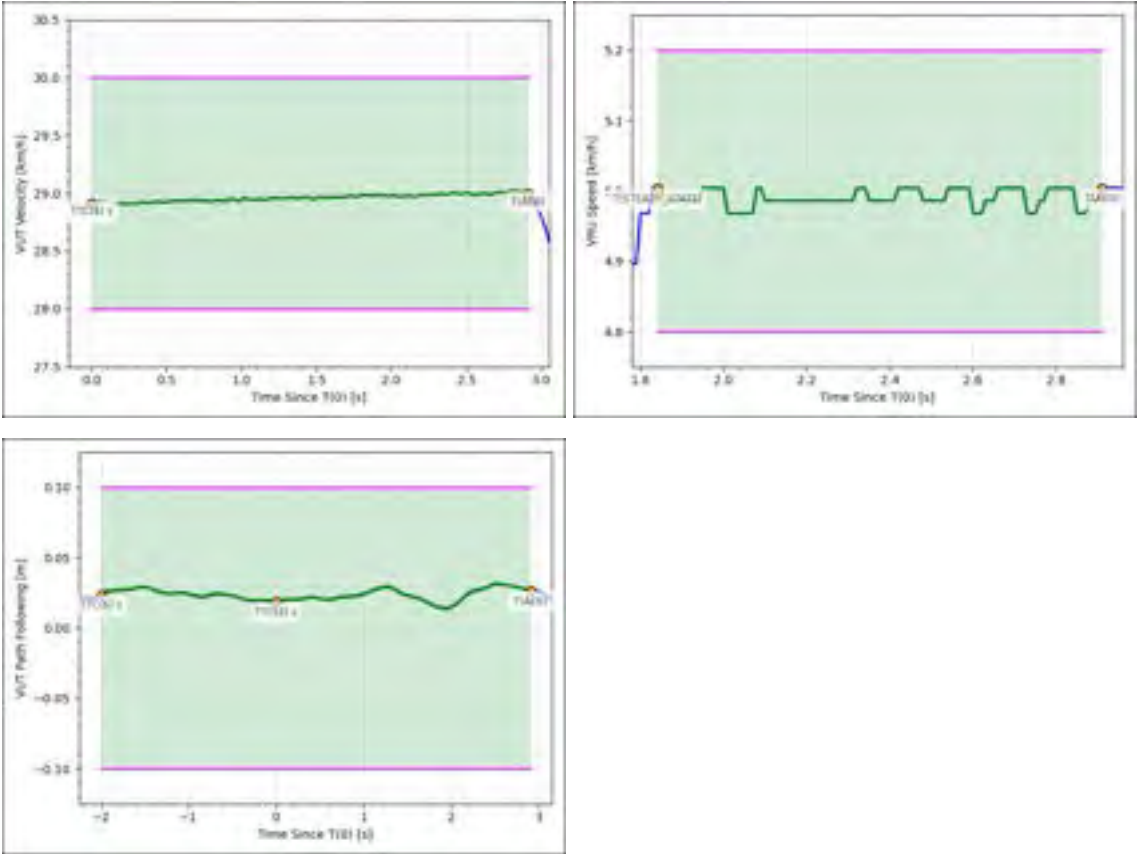
Run Date / Time 25-Jan-2023 13:20



A.1.1.1. CPNC-50 VUT 30kph EPT 5kph (Day)

CPNC-50 5 kph (Day) | 30 km/h | Run 1

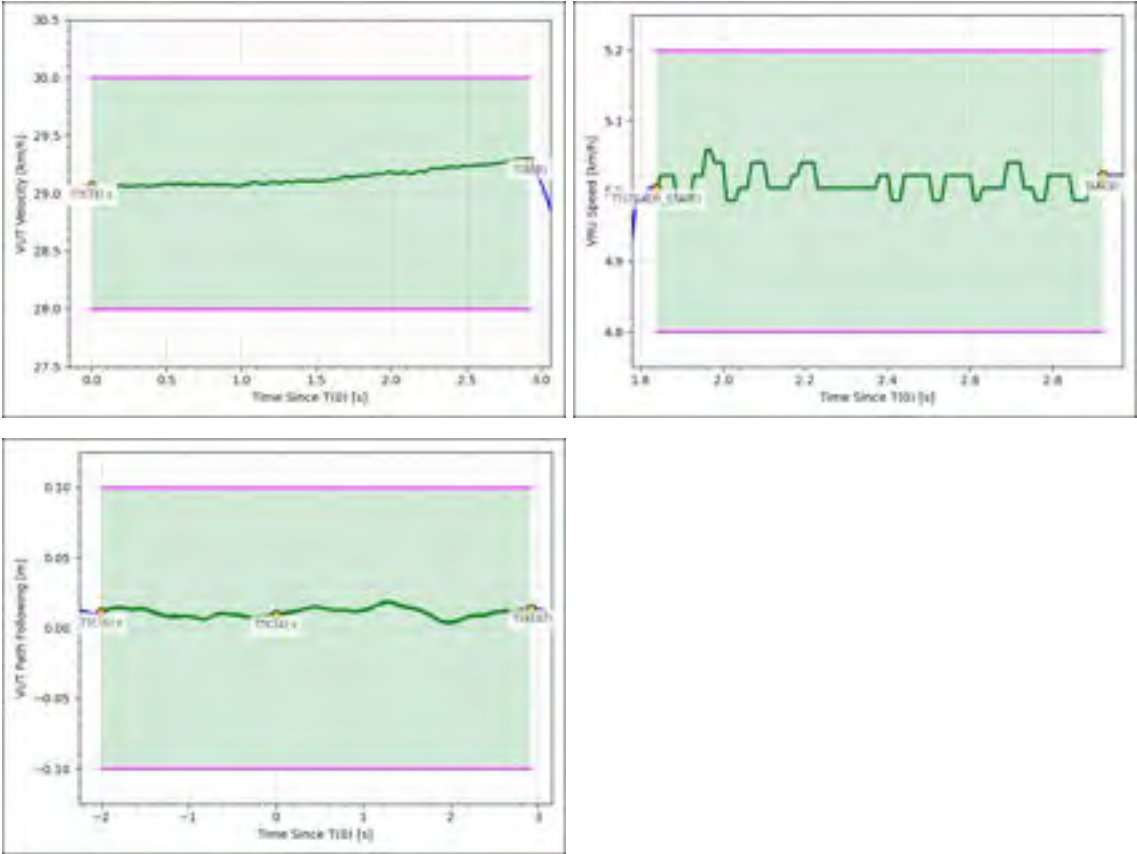
Run Date / Time 25-Jan-2023 13:26



H.2.1.4. CPNC-50 VUT 30kph EPT 5kph (Day)

CPNC-50 5 kph (Day) | 30 km/h | Run 2

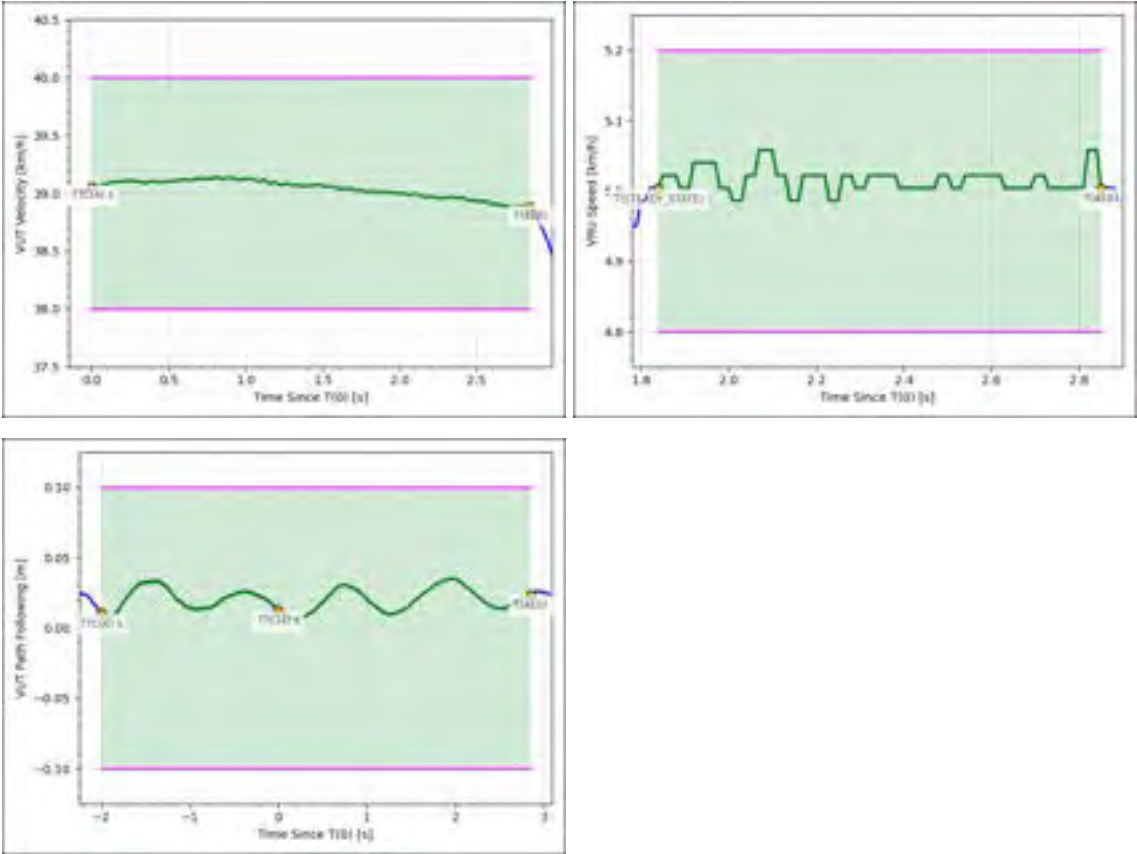
Run Date / Time 25-Jan-2023 13:28



H.2.1.5. CPNC-50 VUT 40kph EPT 5kph (Day)

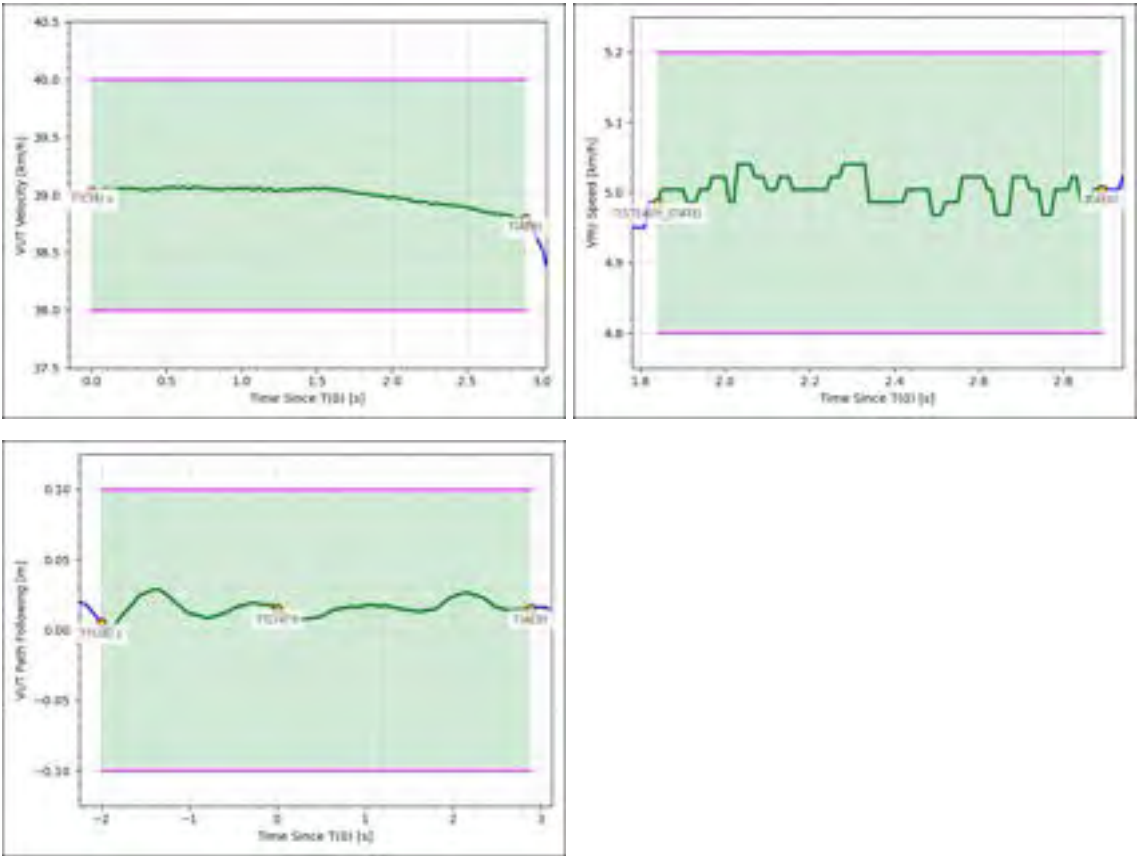
CPNC-50 5 kph (Day) | 40 km/h | Run 1

Run Date / Time 25-Jan-2023 13:30



CPNC-50 5 kph (Day) | 40 km/h | Run 2

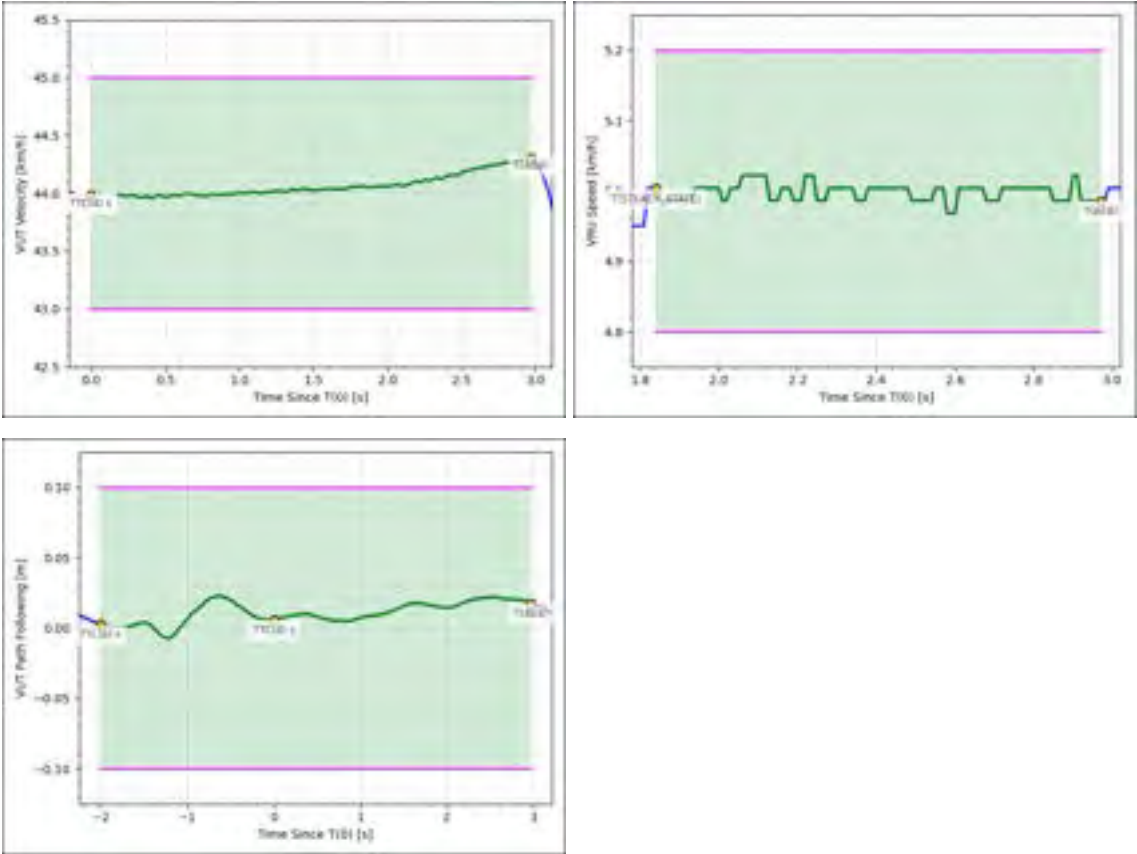
Run Date / Time 25-Jan-2023 13:33



H.2.1.6. CPNC-50 VUT 45kph EPT 5kph (Day)

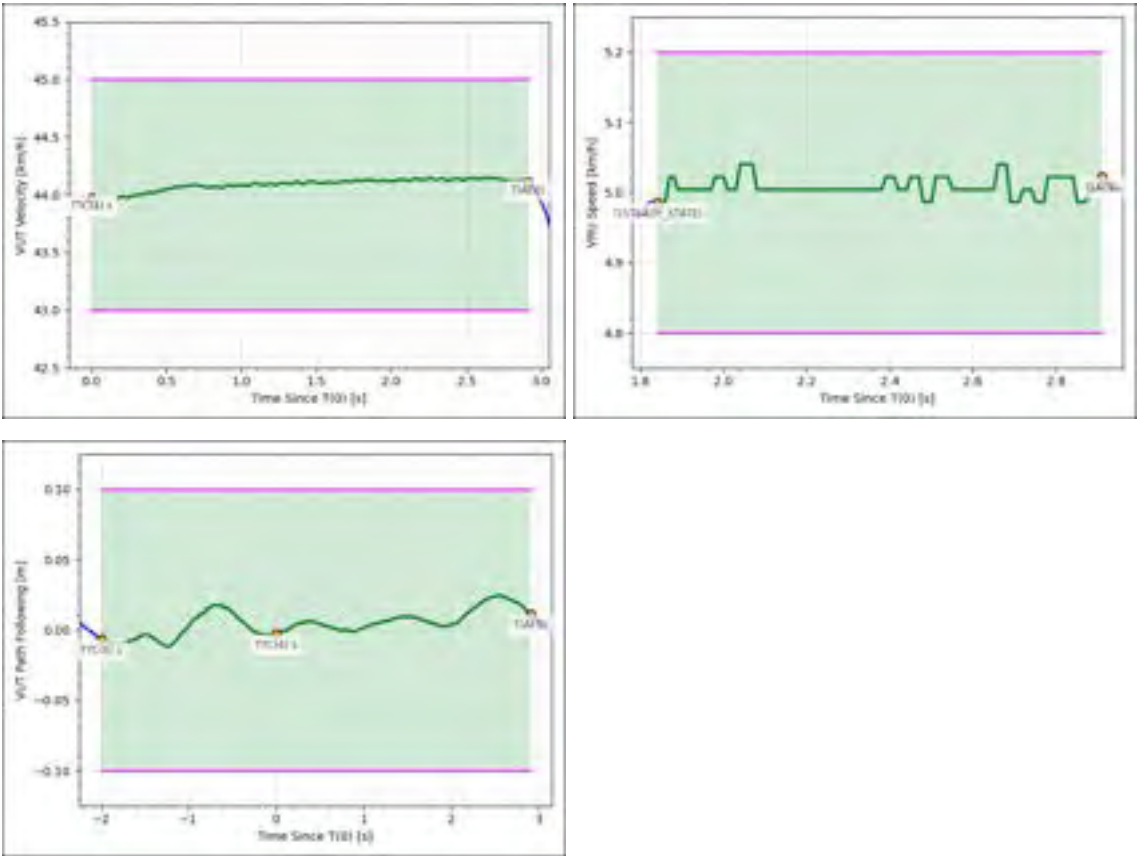
CPNC-50 5 kph (Day) | 45 km/h | Run 1

Run Date / Time 25-Jan-2023 13:43



CPNC-50 5 kph (Day) | 45 km/h | Run 3

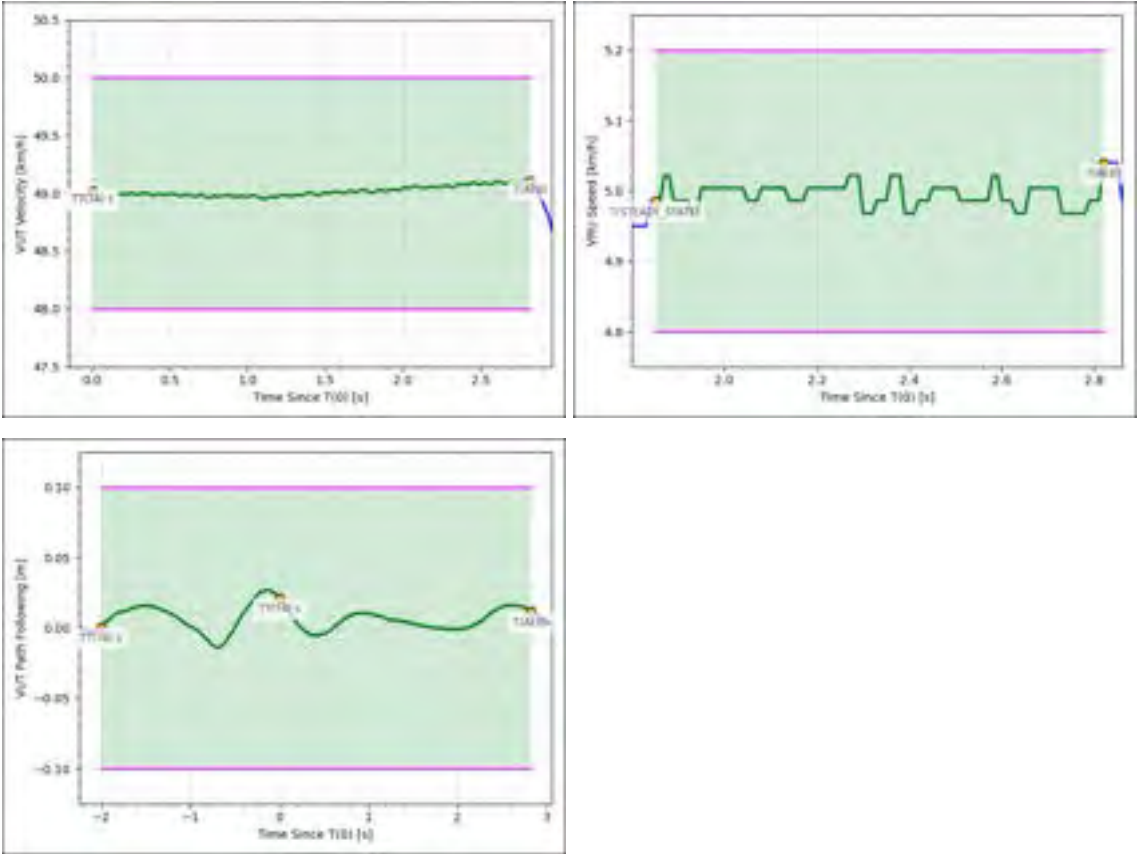
Run Date / Time 25-Jan-2023 13:47



H.2.1.7. CPNC-50 VUT 50kph EPT 5kph (Day)

CPNC-50 5 kph (Day) | 50 km/h | Run 1

Run Date / Time 25-Jan-2023 13:36

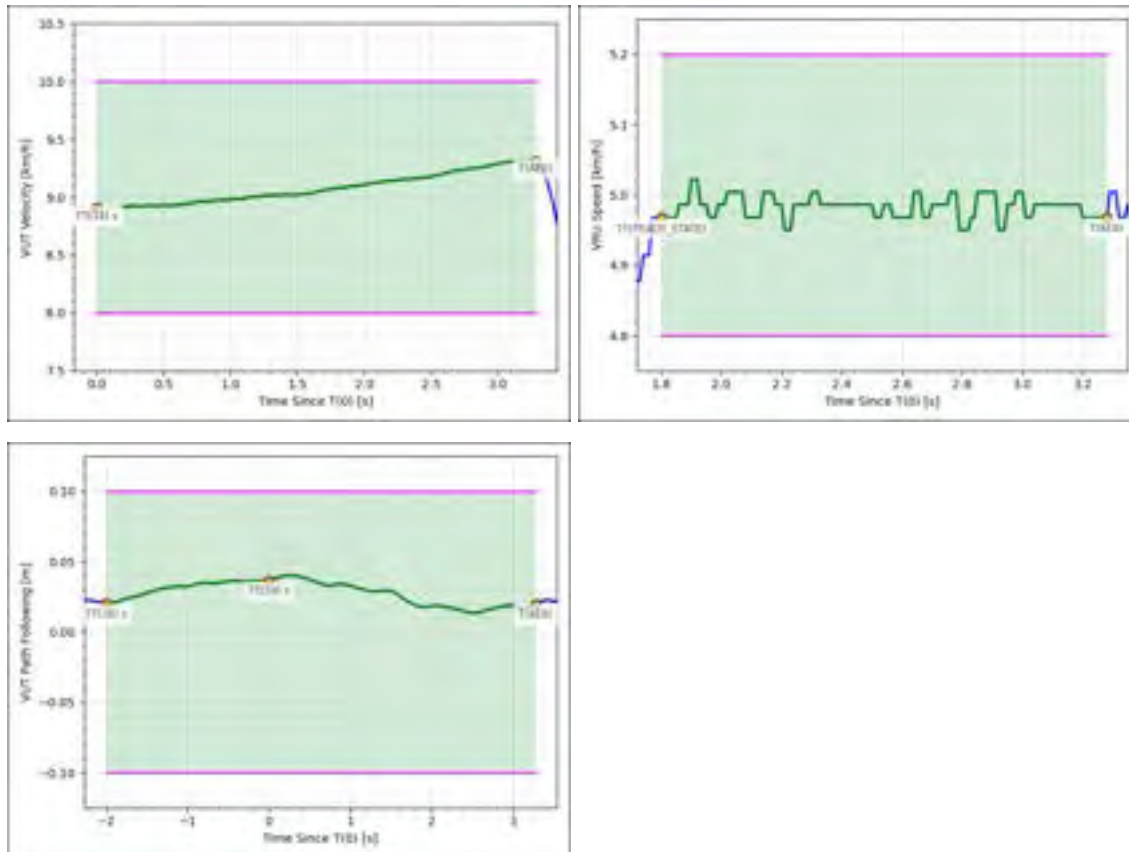


H.2.2. GVM

H.2.2.1. CPNC-50 VUT 10kph EPT 5kph (Day)

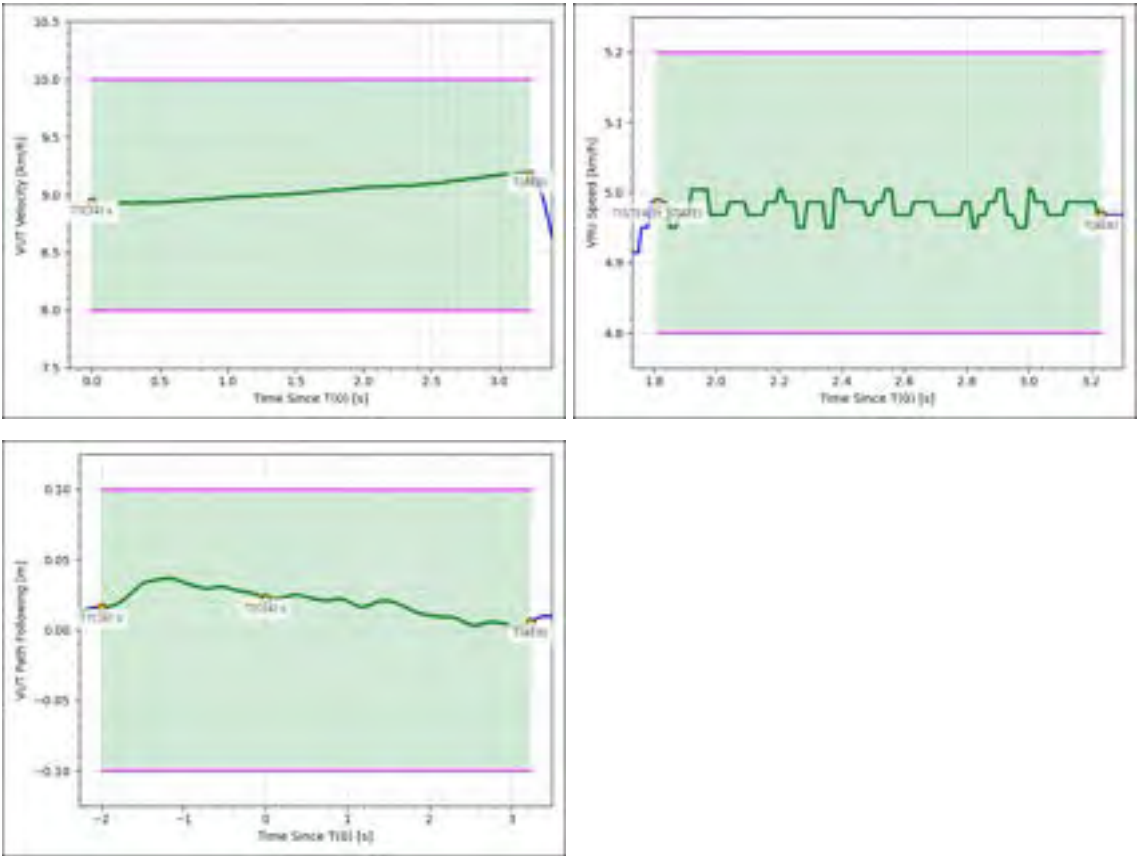
CPNC-50 5 kph (Day) | 10 km/h | Run 4

Run Date / Time 6-Feb-2023 11:54



CPNC-50 5 kph (Day) | 10 km/h | Run 5

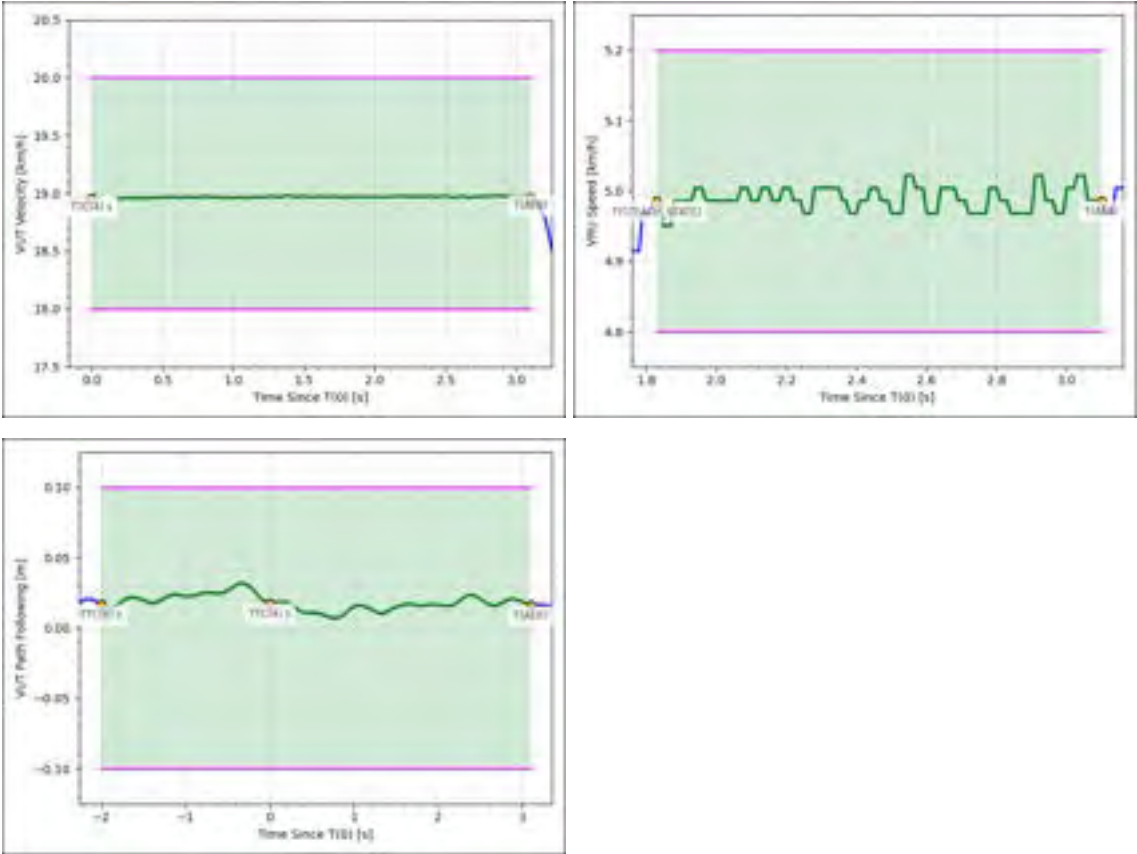
Run Date / Time 6-Feb-2023 11:56



H.2.2.2. CPNC-50 VUT 20kph EPT 5kph (Day)

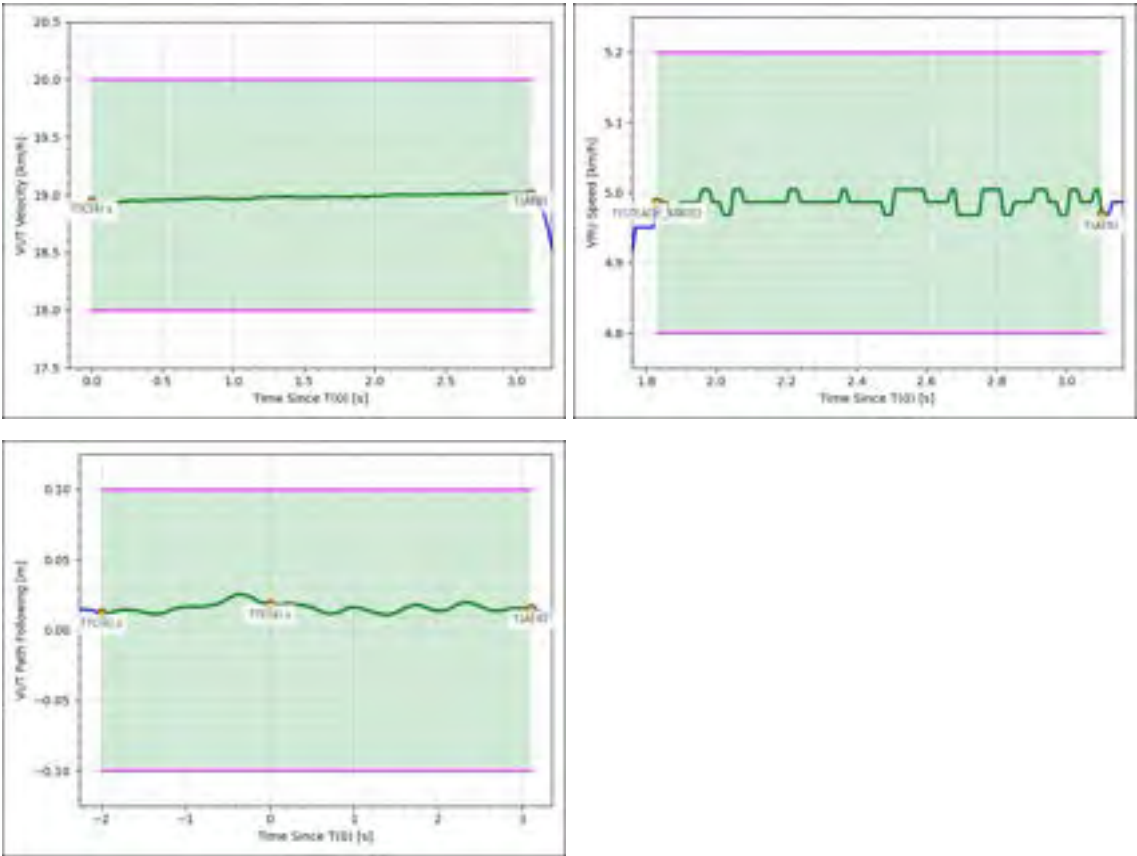
CPNC-50 5 kph (Day) | 20 km/h | Run 4

Run Date / Time 6-Feb-2023 11:59



CPNC-50 5 kph (Day) | 20 km/h | Run 5

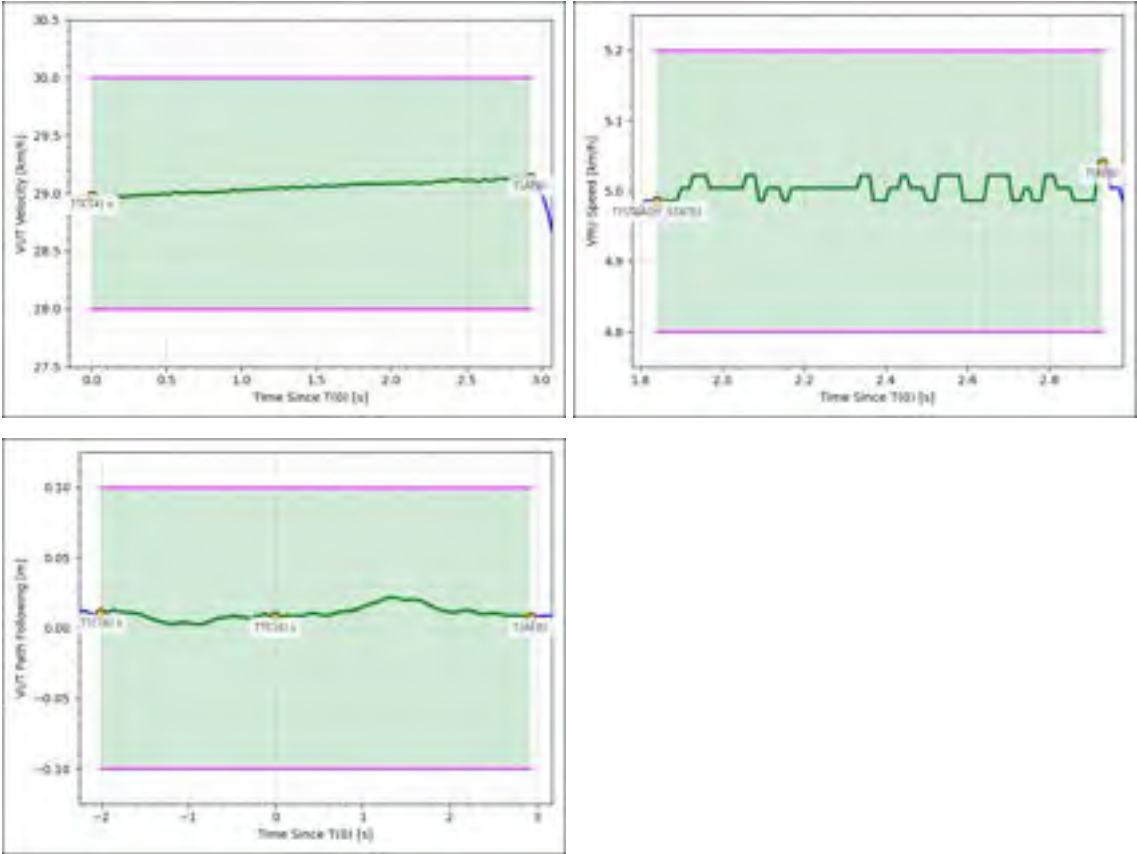
Run Date / Time 6-Feb-2023 12:02



H.2.2.3. CPNC-50 VUT 30kph EPT 5kph (Day)

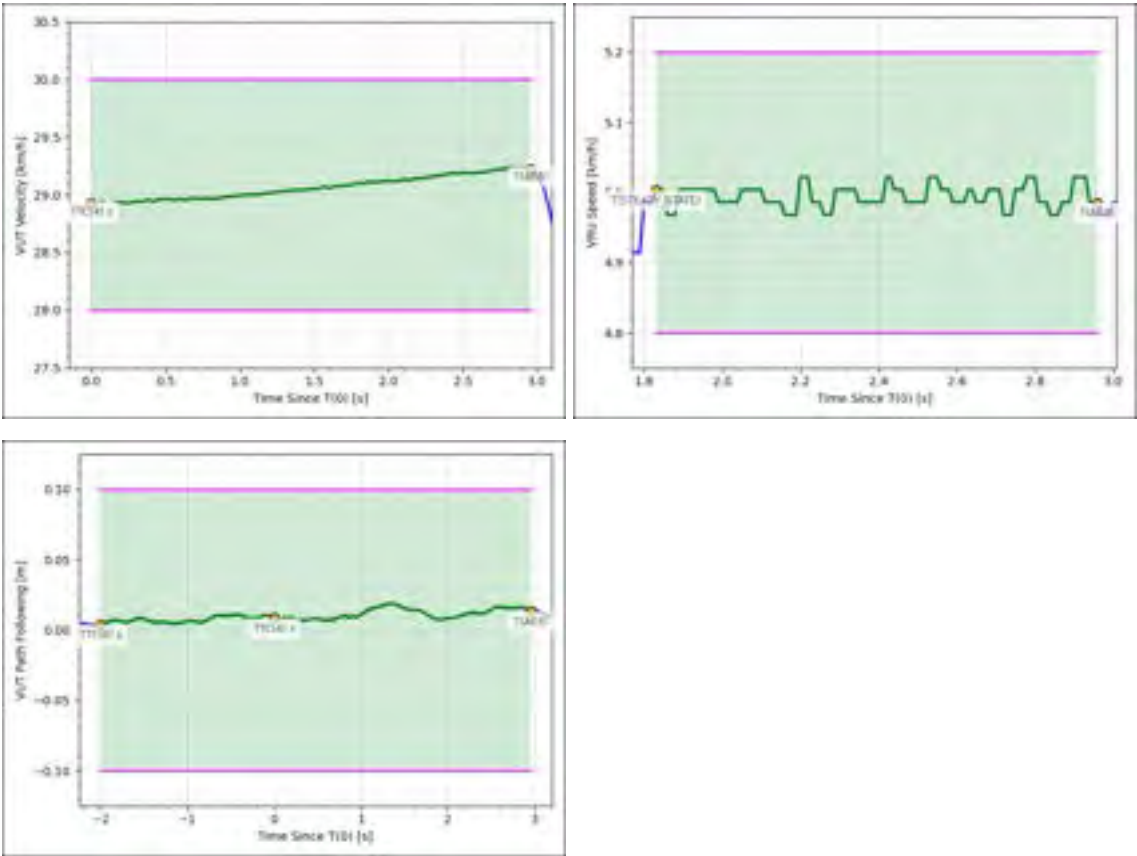
CPNC-50 5 kph (Day) | 30 km/h | Run 3

Run Date / Time 6-Feb-2023 12:05



CPNC-50 5 kph (Day) | 30 km/h | Run 4

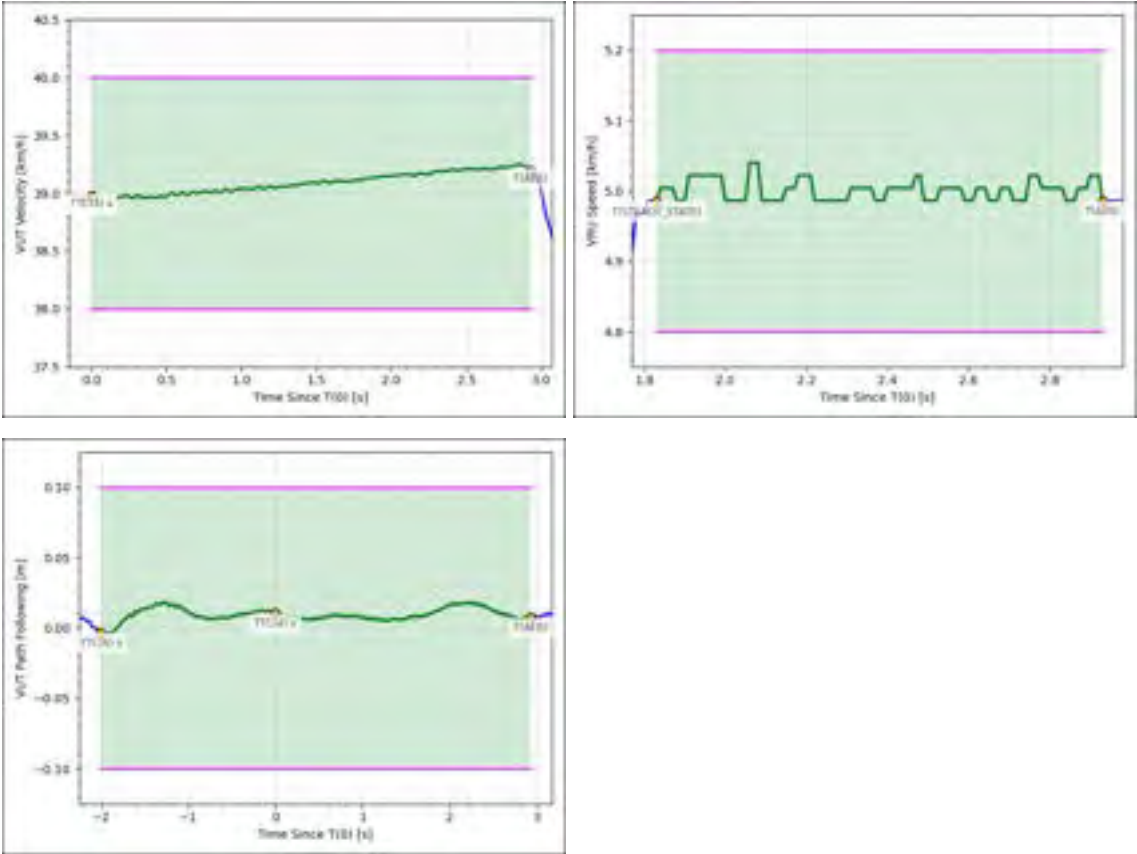
Run Date / Time 6-Feb-2023 12:06



H.2.2.4. CPNC-50 VUT 40kph EPT 5kph (Day)

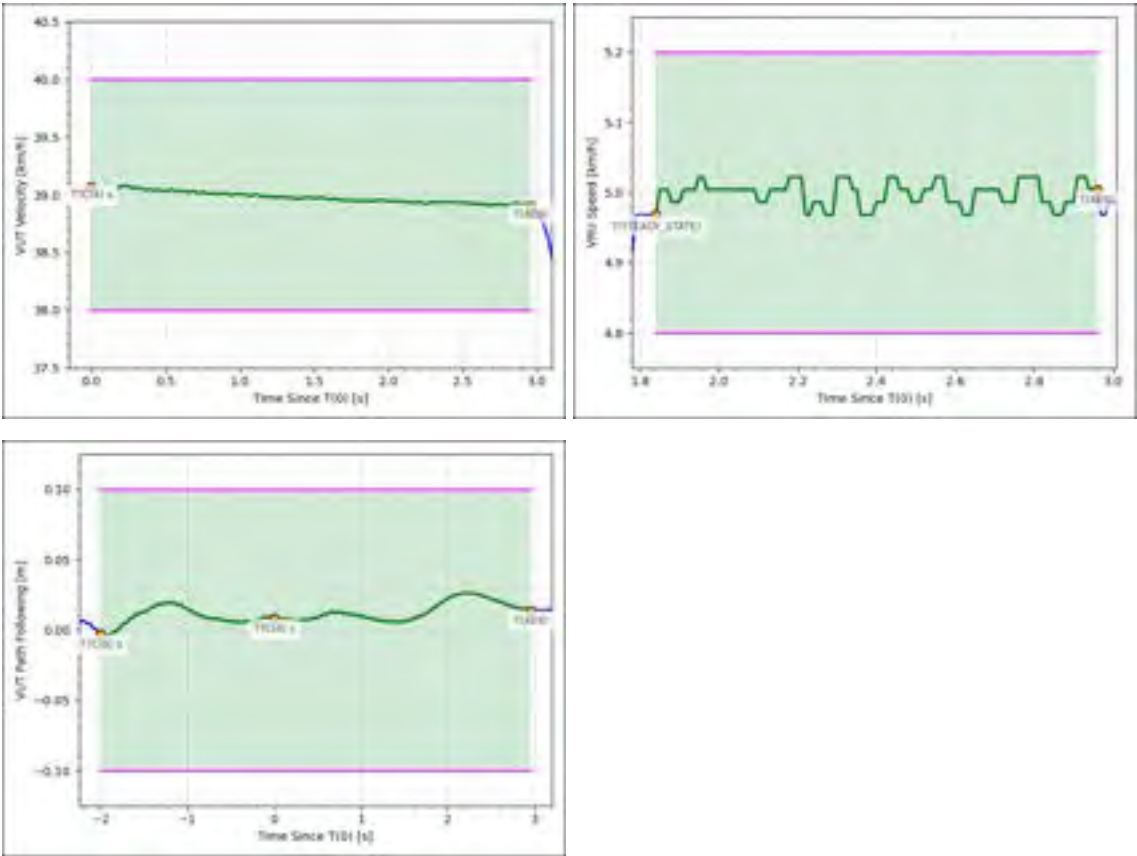
CPNC-50 5 kph (Day) | 40 km/h | Run 3

Run Date / Time 6-Feb-2023 12:11



CPNC-50 5 kph (Day) | 40 km/h | Run 4

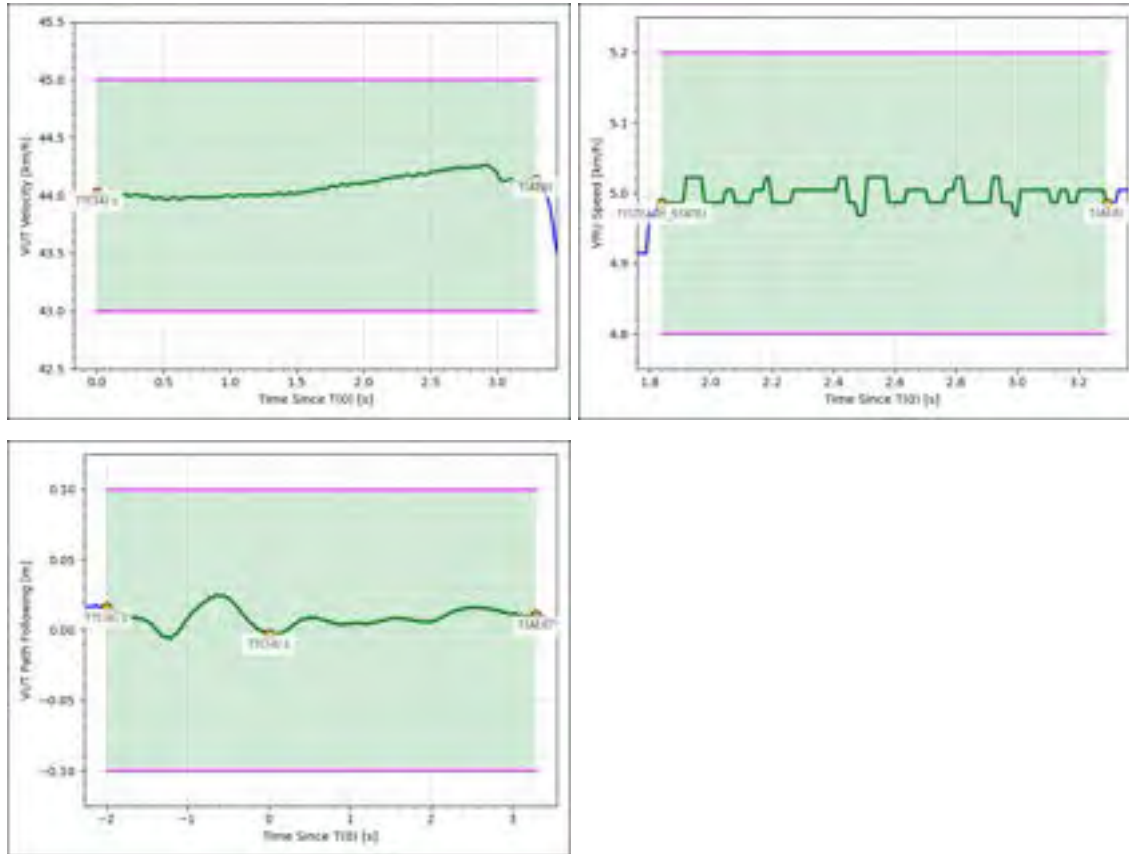
Run Date / Time 6-Feb-2023 12:13



H.2.2.5. CPNC-50 VUT 45kph EPT 5kph (Day)

CPNC-50 5 kph (Day) | 45 km/h | Run 4

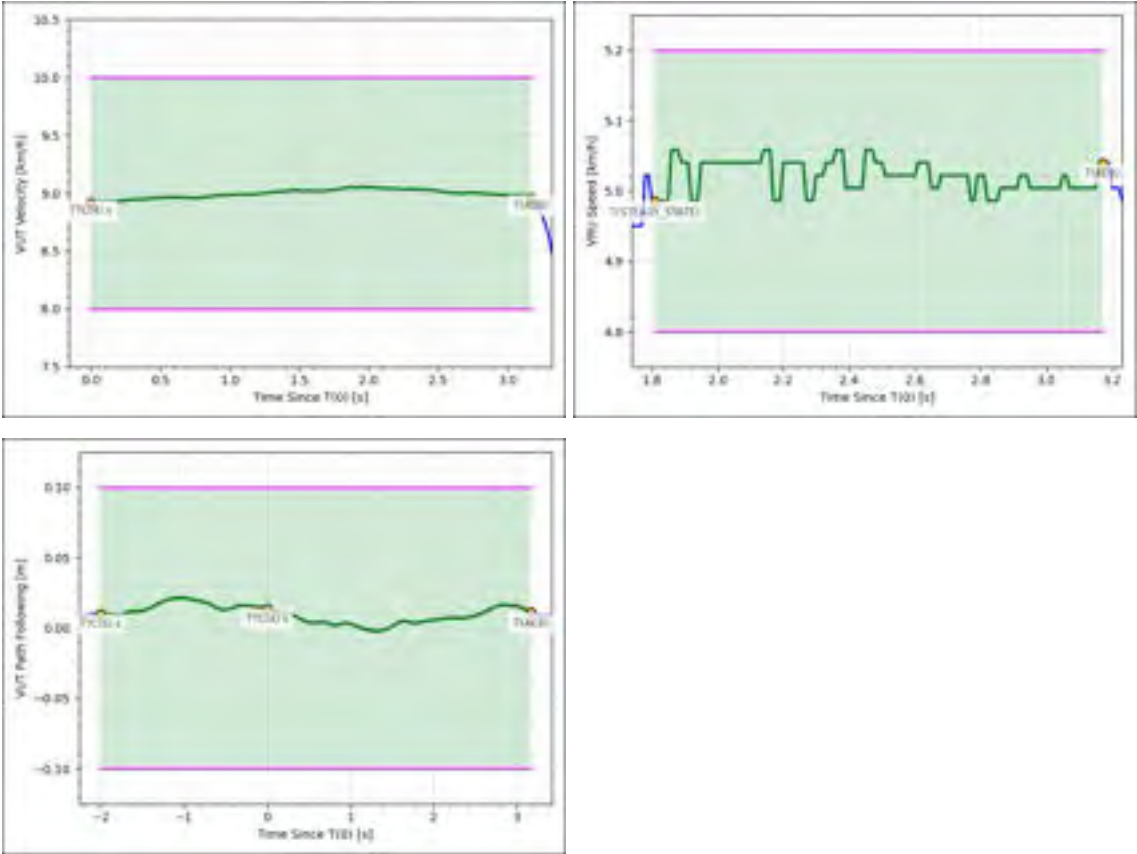
Run Date / Time 6-Feb-2023 12:19



H.2.3.2. CPNC-50 VUT 10kph EPT 5kph (Day)

CPNC-50 5 kph (Day) | 10 km/h | Run 3

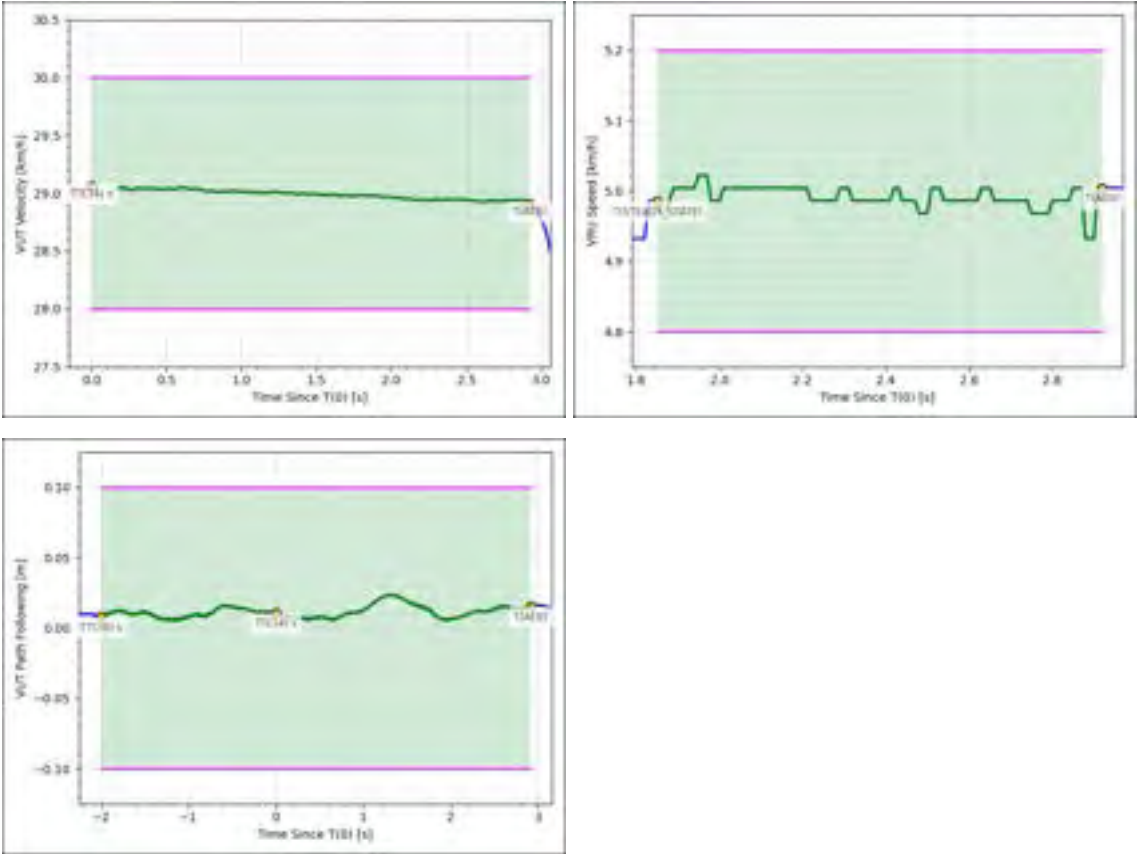
Run Date / Time 26-Jun-2023 13:45



H.2.3.3. CPNC-50 VUT 30kph EPT 5kph (Day)

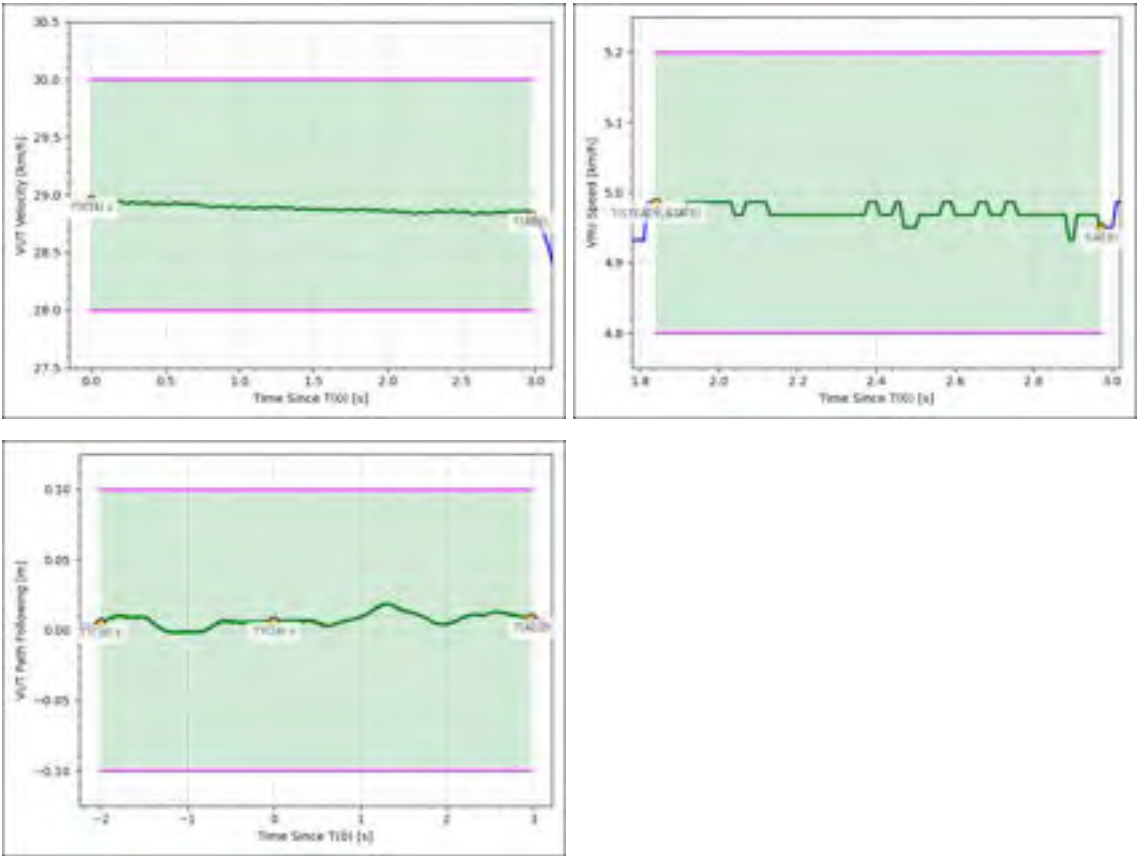
CPNC-50 5 kph (Day) | 30 km/h | Run 1

Run Date / Time 26-Jun-2023 13:52



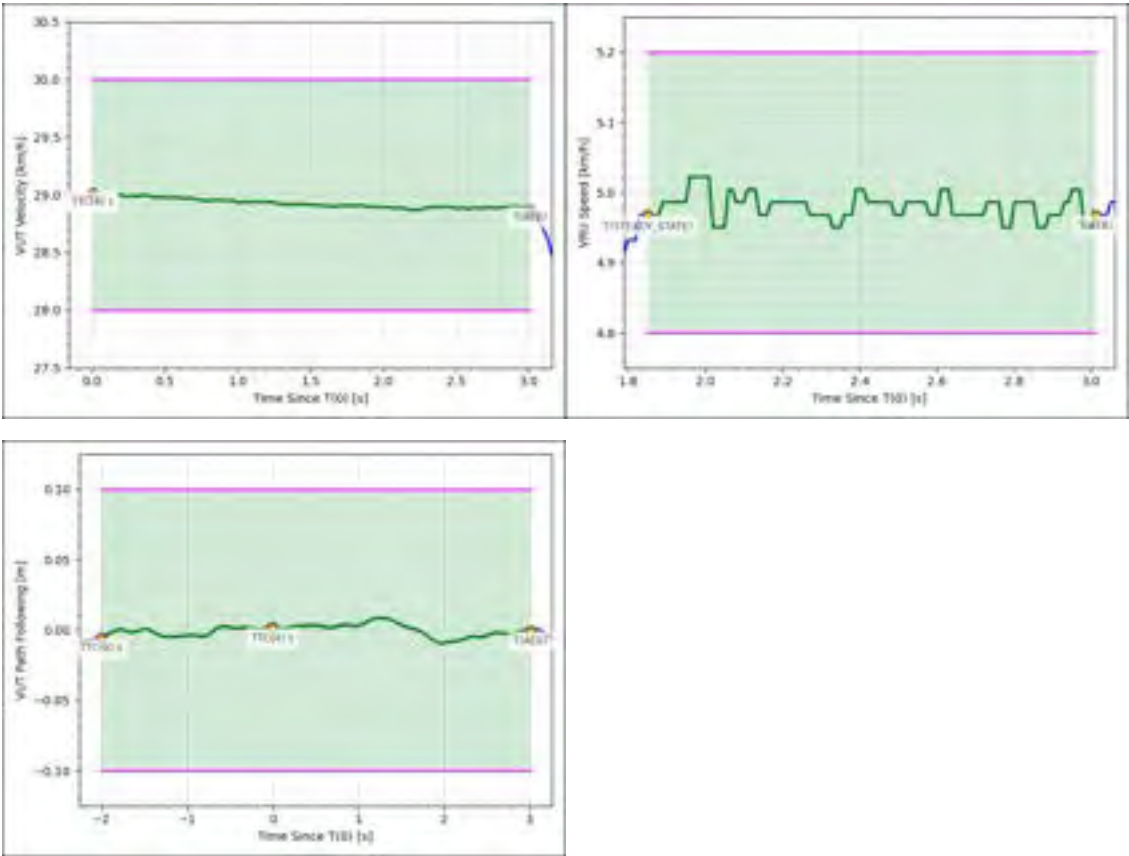
CPNC-50 5 kph (Day) | 30 km/h | Run 2

Run Date / Time 26-Jun-2023 13:55



CPNC-50 5 kph (Day) | 30 km/h | Run 3

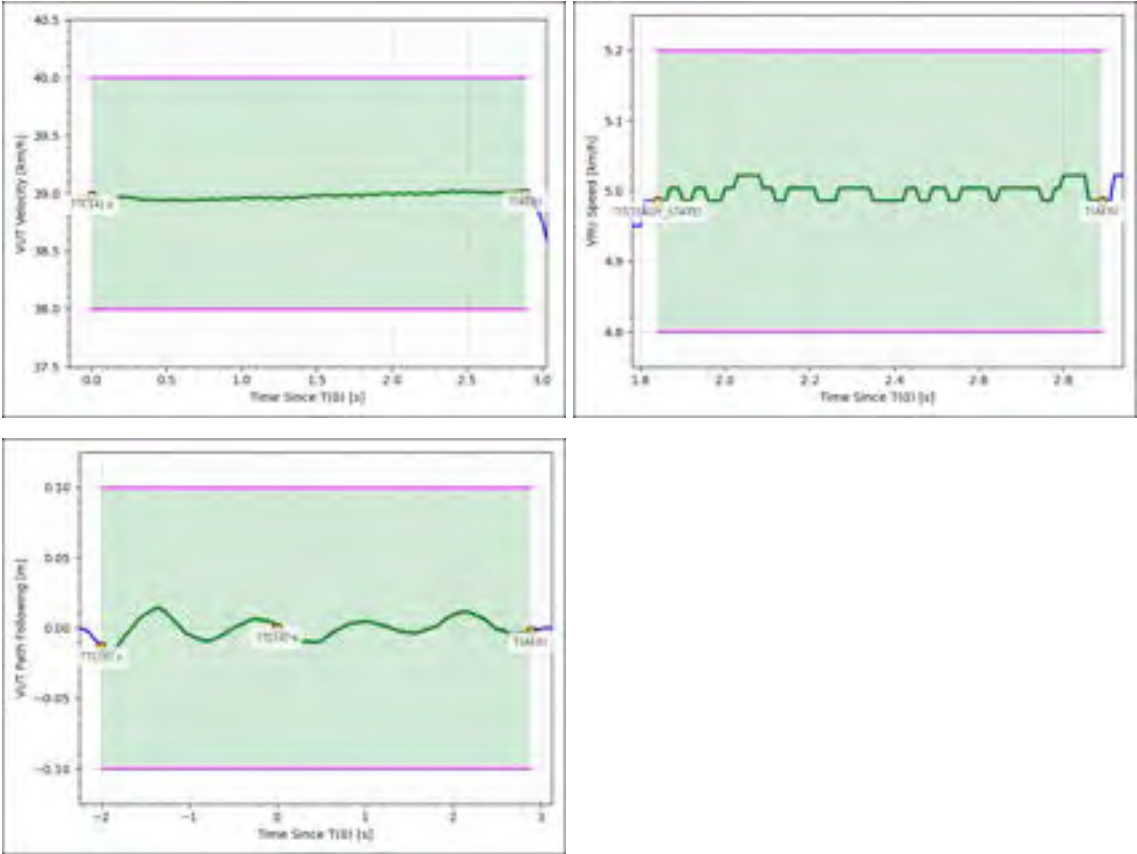
Run Date / Time 27-Jun-2023 10:06



H.2.3.4. CPNC-50 VUT 40kph EPT 5kph (Day)

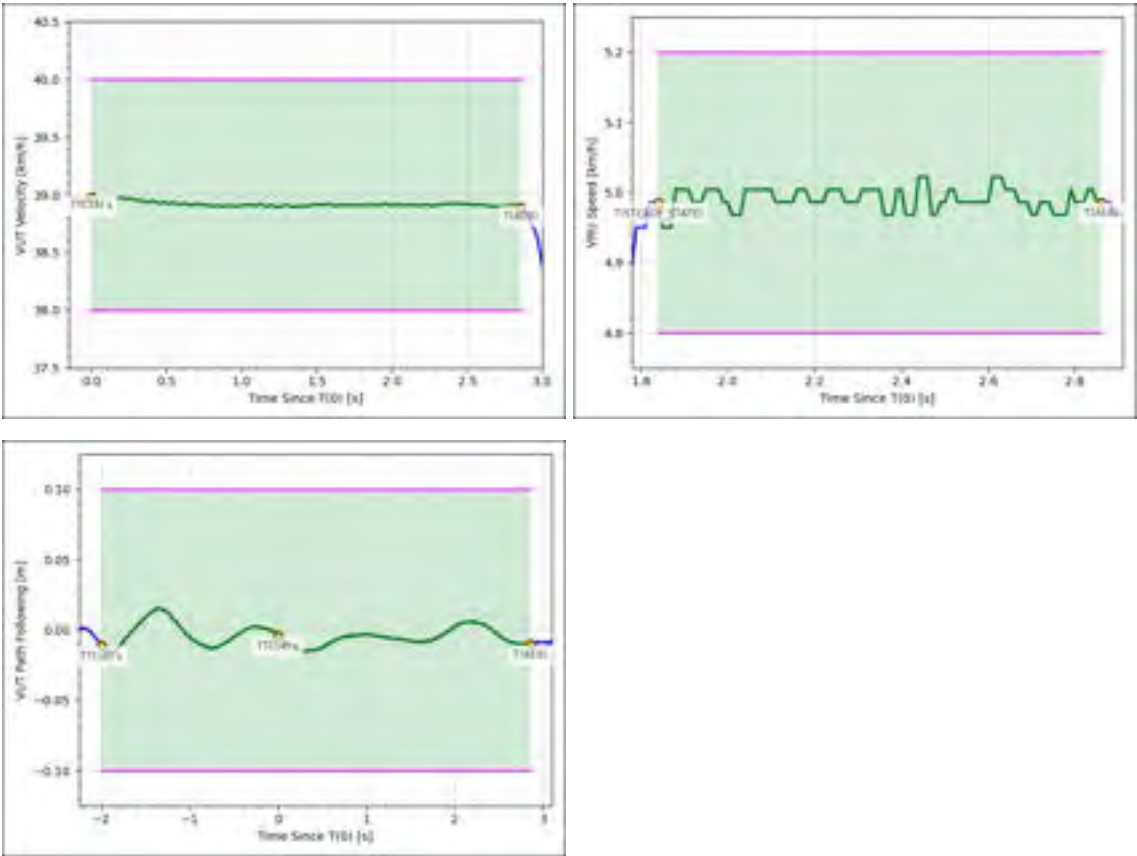
CPNC-50 5 kph (Day) | 40 km/h | Run 1

Run Date / Time 26-Jun-2023 14:07



CPNC-50 5 kph (Day) | 40 km/h | Run 2

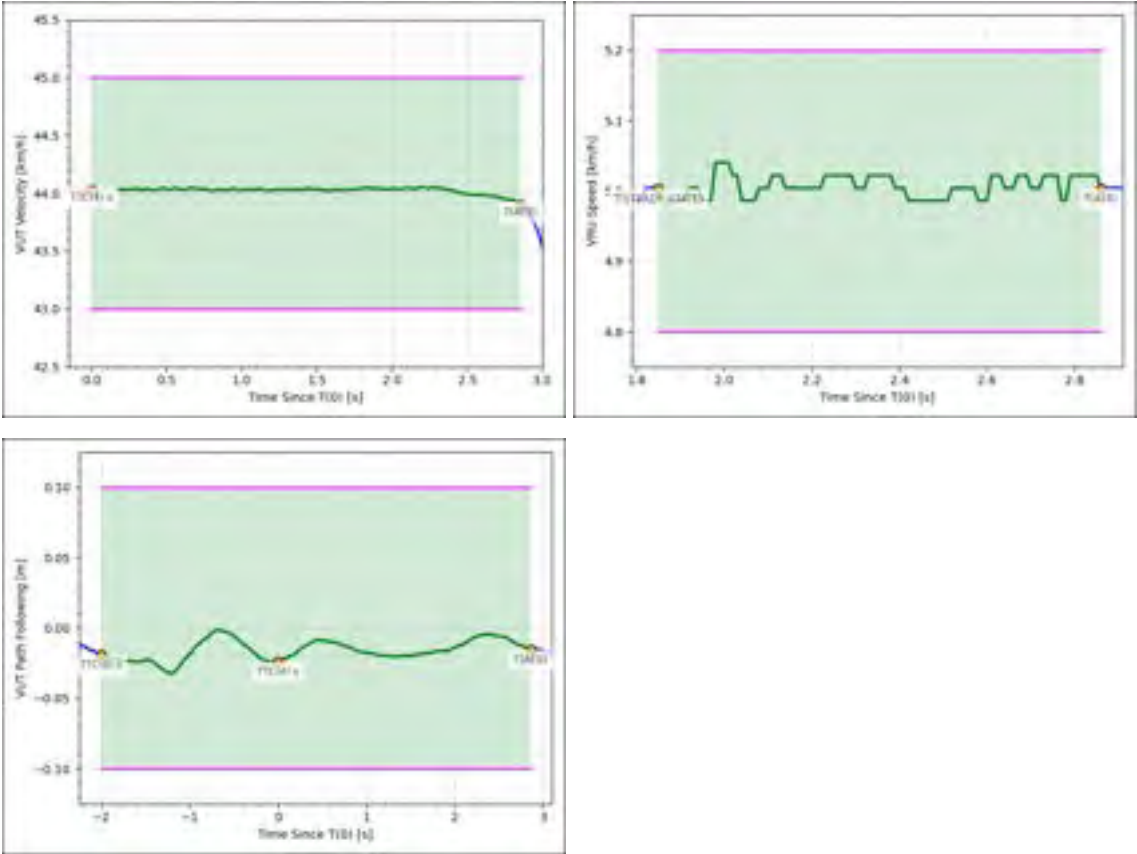
Run Date / Time 26-Jun-2023 14:11



H.2.3.5. CPNC-50 VUT 45kph EPT 5kph (Day)

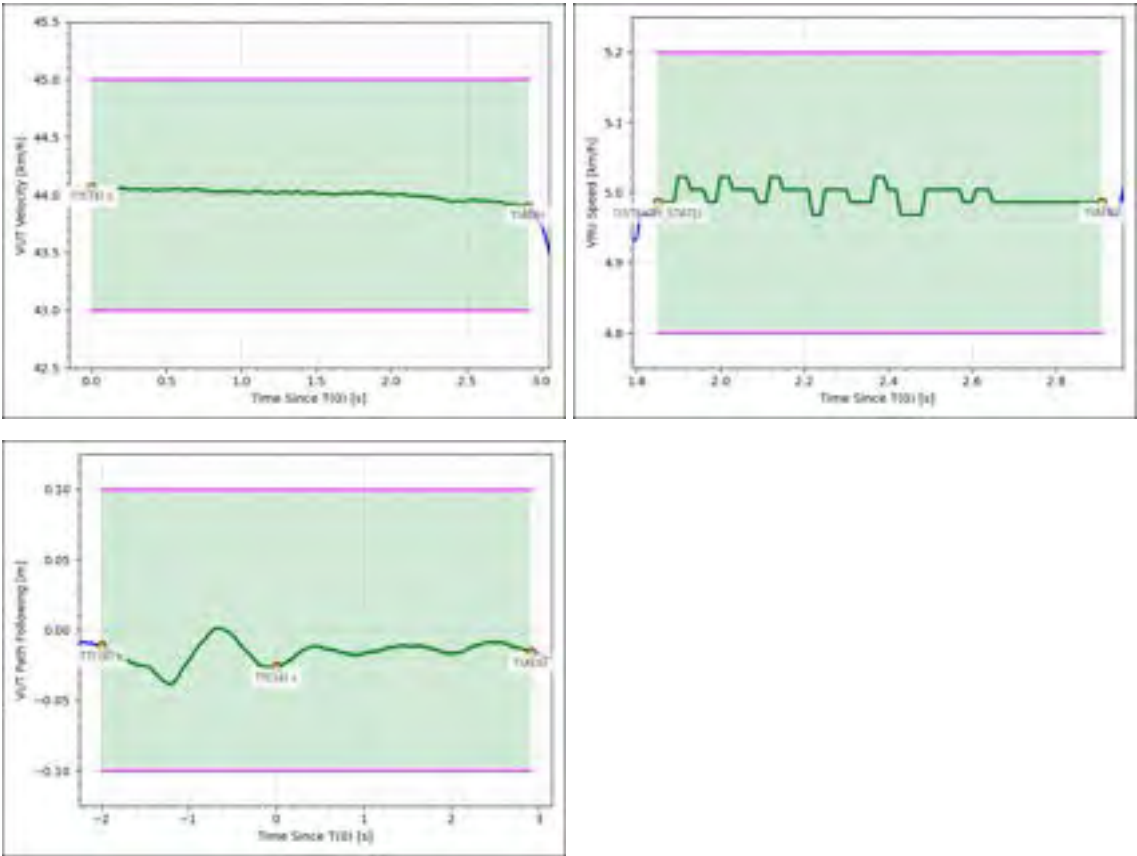
CPNC-50 5 kph (Day) | 45 km/h | Run 1

Run Date / Time 27-Jun-2023 10:36



CPNC-50 5 kph (Day) | 45 km/h | Run 2

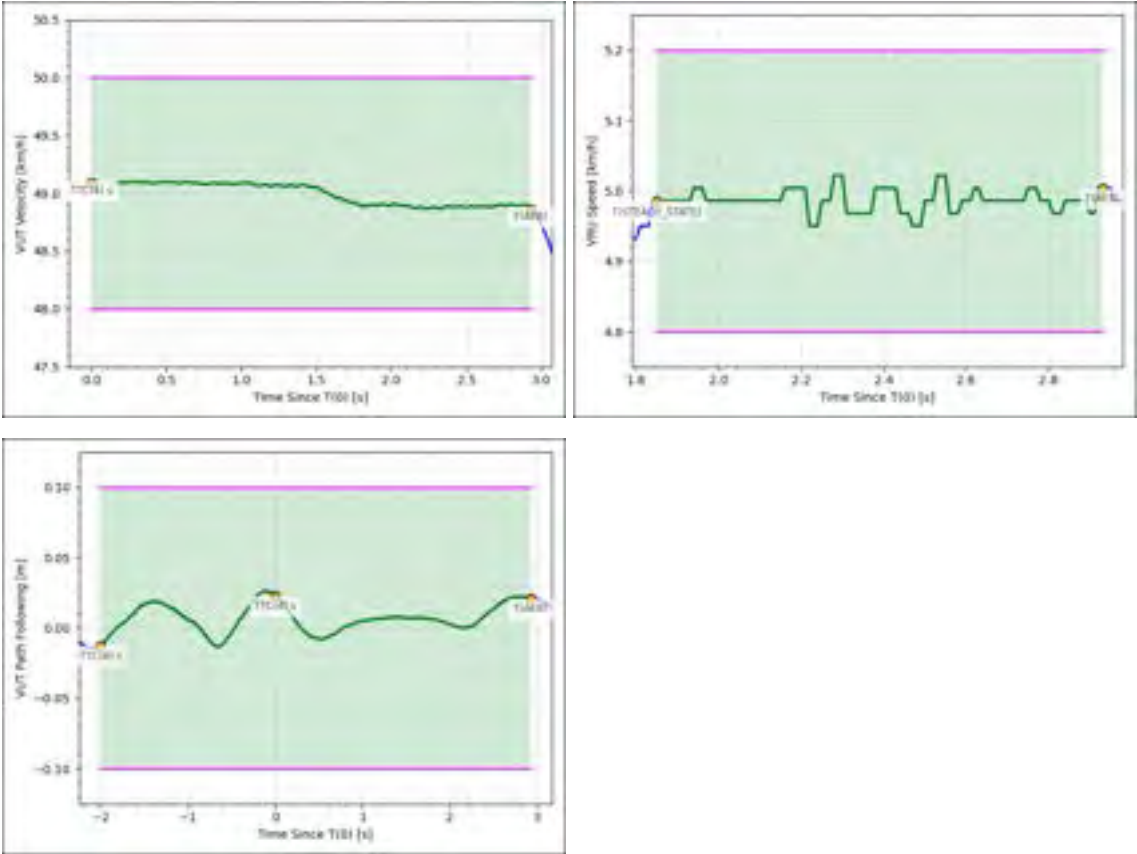
Run Date / Time 27-Jun-2023 10:40



H.2.3.6. CPNC-50 VUT 50kph EPT 5kph (Day)

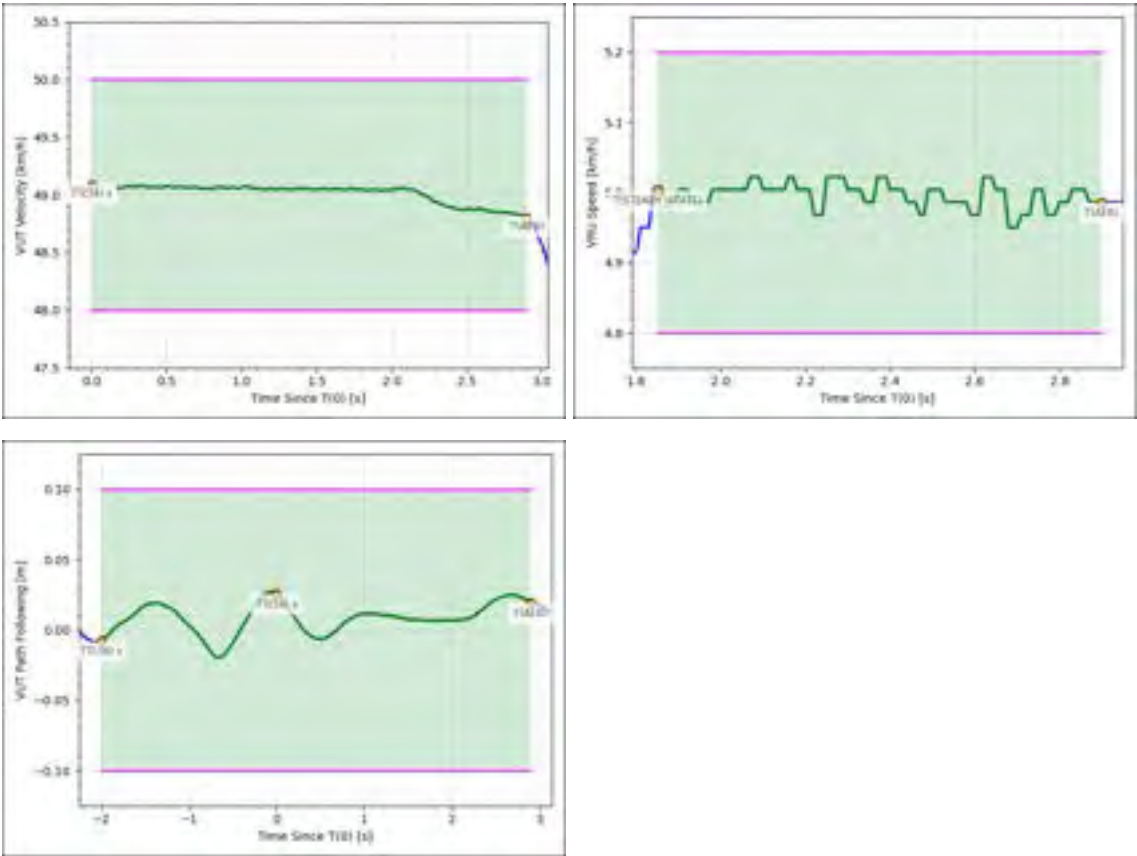
CPNC-50 5 kph (Day) | 50 km/h | Run 1

Run Date / Time 27-Jun-2023 10:12



CPNC-50 5 kph (Day) | 50 km/h | Run 2

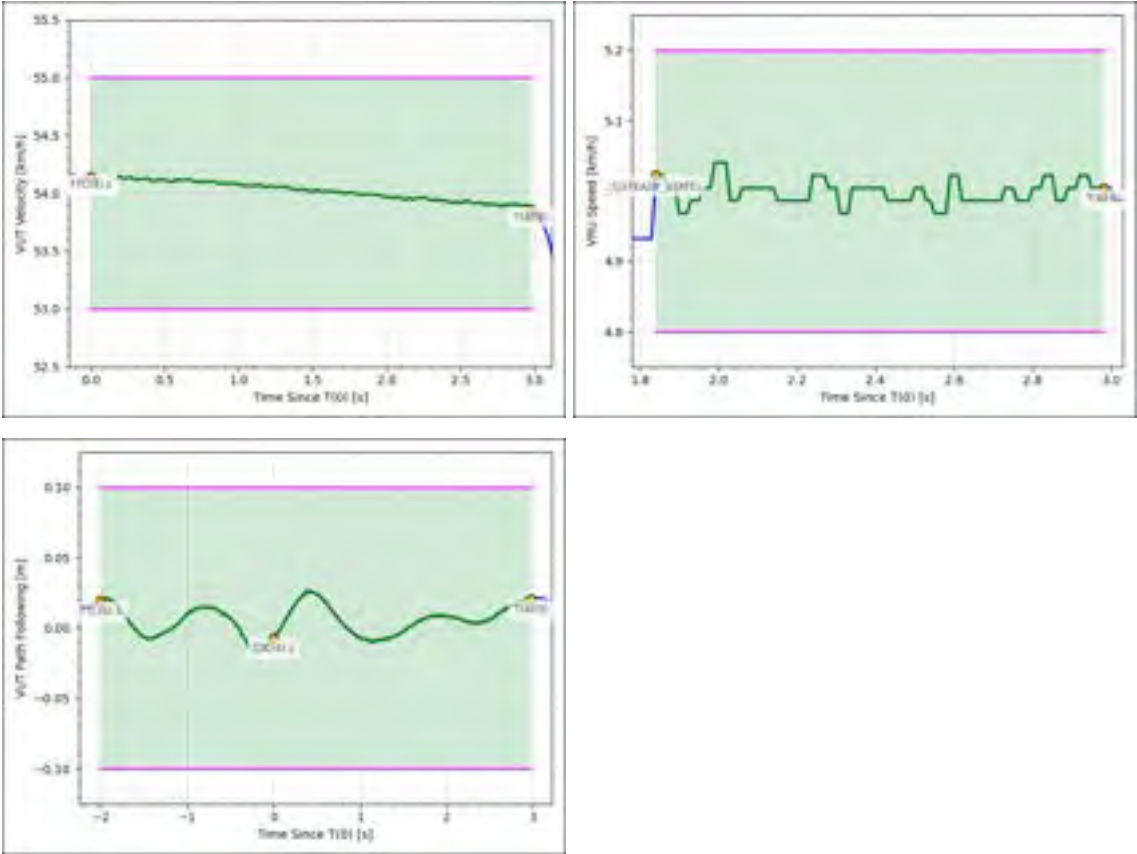
Run Date / Time 27-Jun-2023 10:16



H.2.3.7. CPNC-50 VUT 55kph EPT 5kph (Day)

CPNC-50 5 kph (Day) | 55 km/h | Run 1

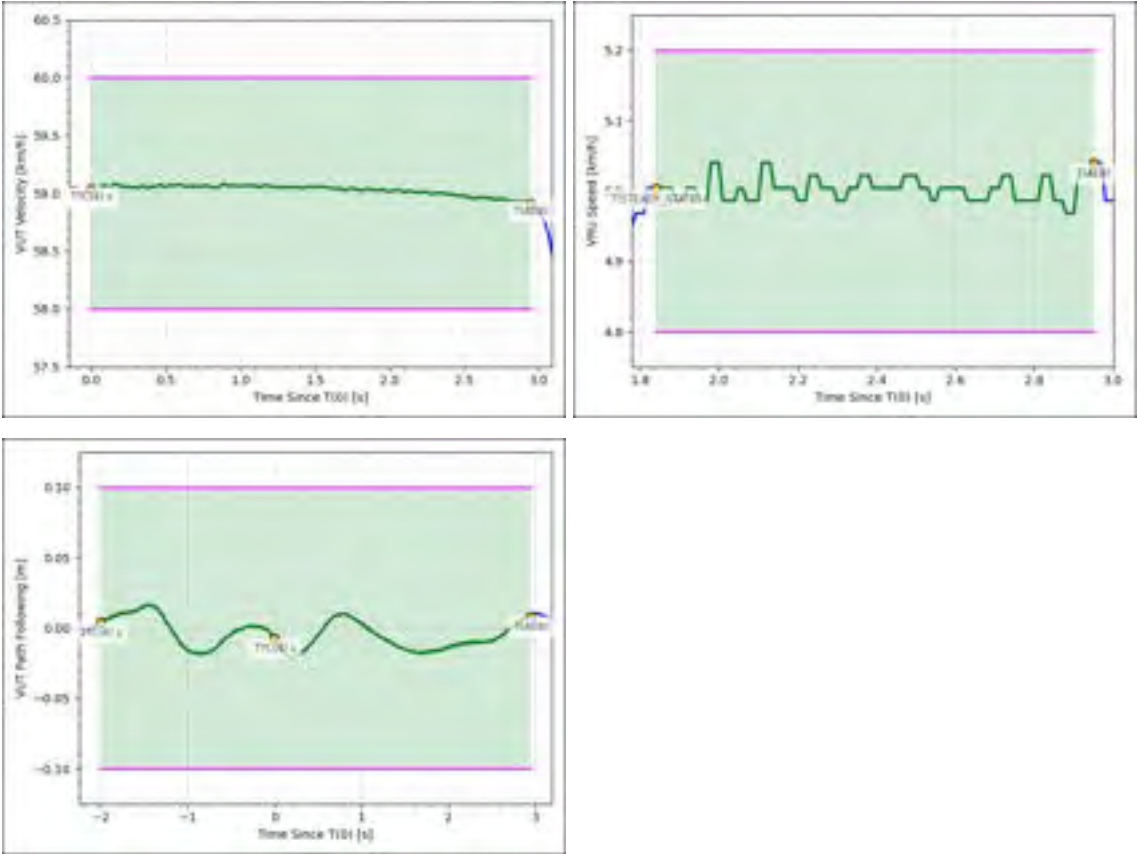
Run Date / Time 27-Jun-2023 11:26



H.2.3.8. CPNC-50 VUT 60kph EPT 5kph (Day)

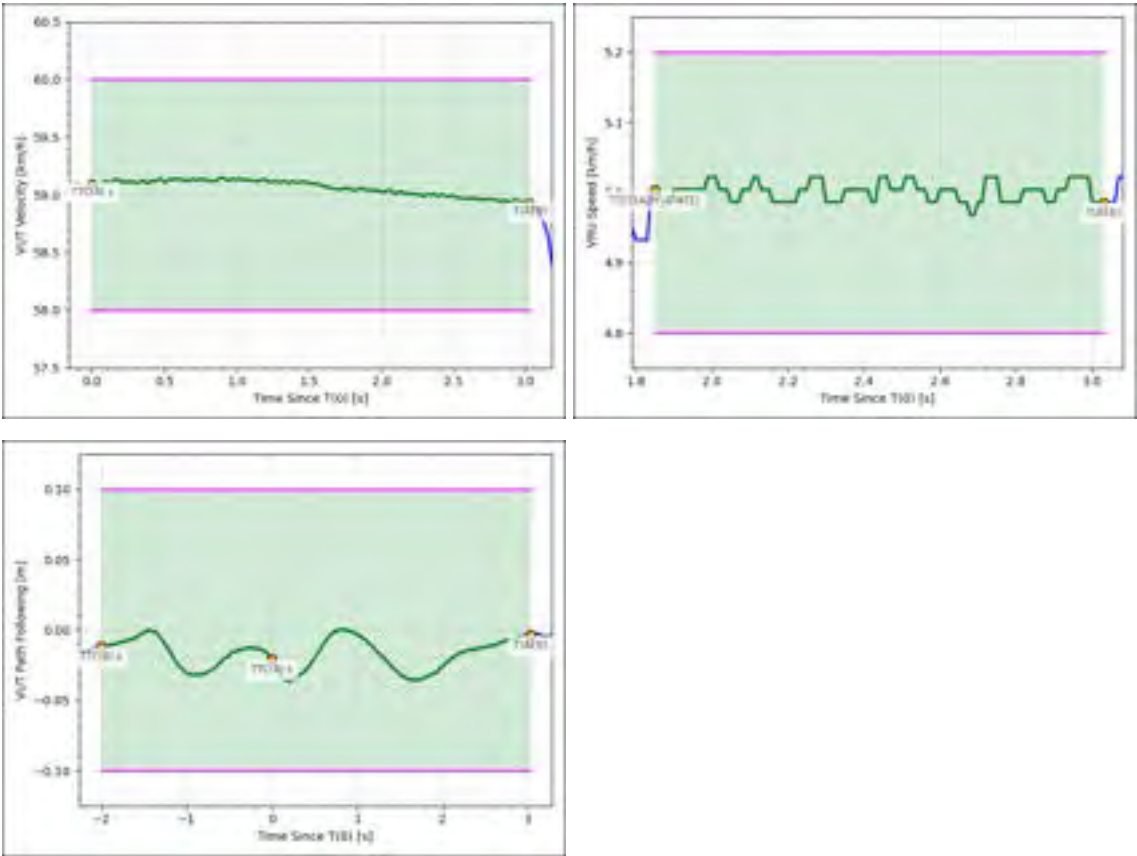
CPNC-50 5 kph (Day) | 60 km/h | Run 1

Run Date / Time 27-Jun-2023 11:41



CPNC-50 5 kph (Day) | 60 km/h | Run 2

Run Date / Time 27-Jun-2023 11:49

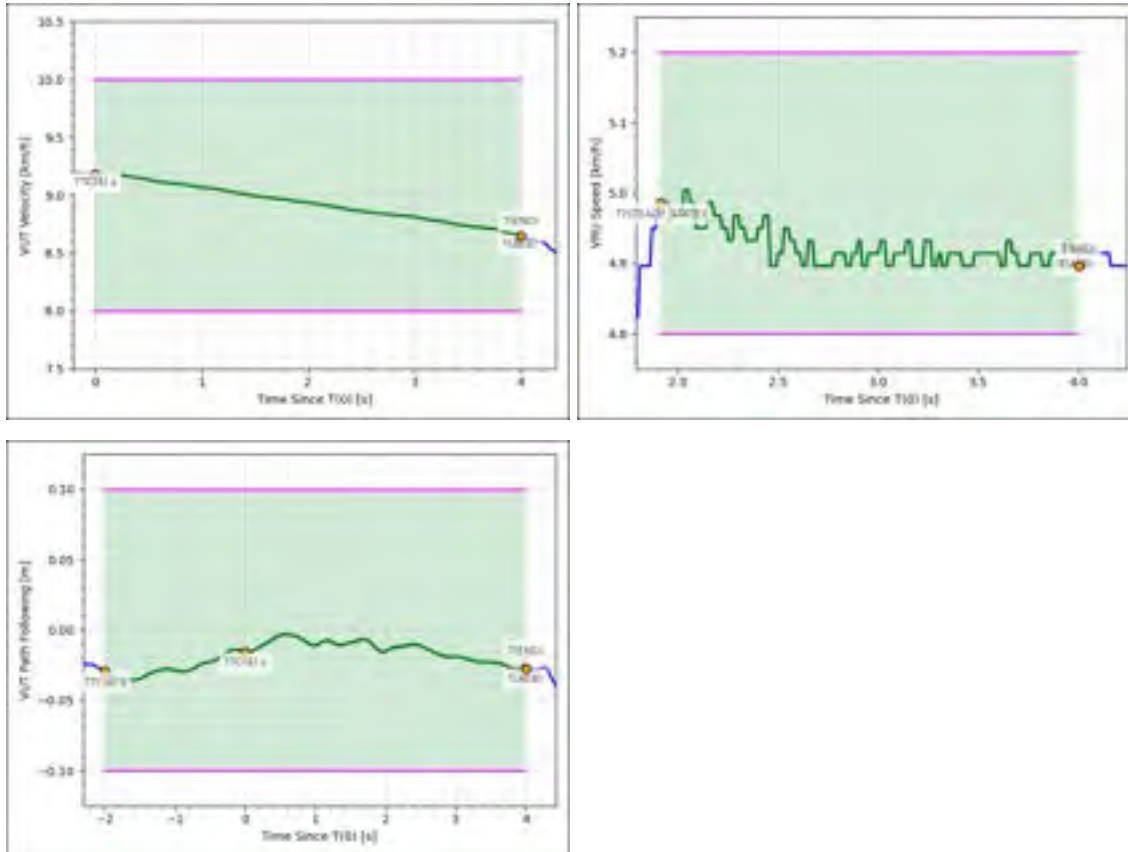


H.2.4. Tuff Bullbar

H.2.4.1. CPNC-50 VUT 10kph EPT 5kph (Day)

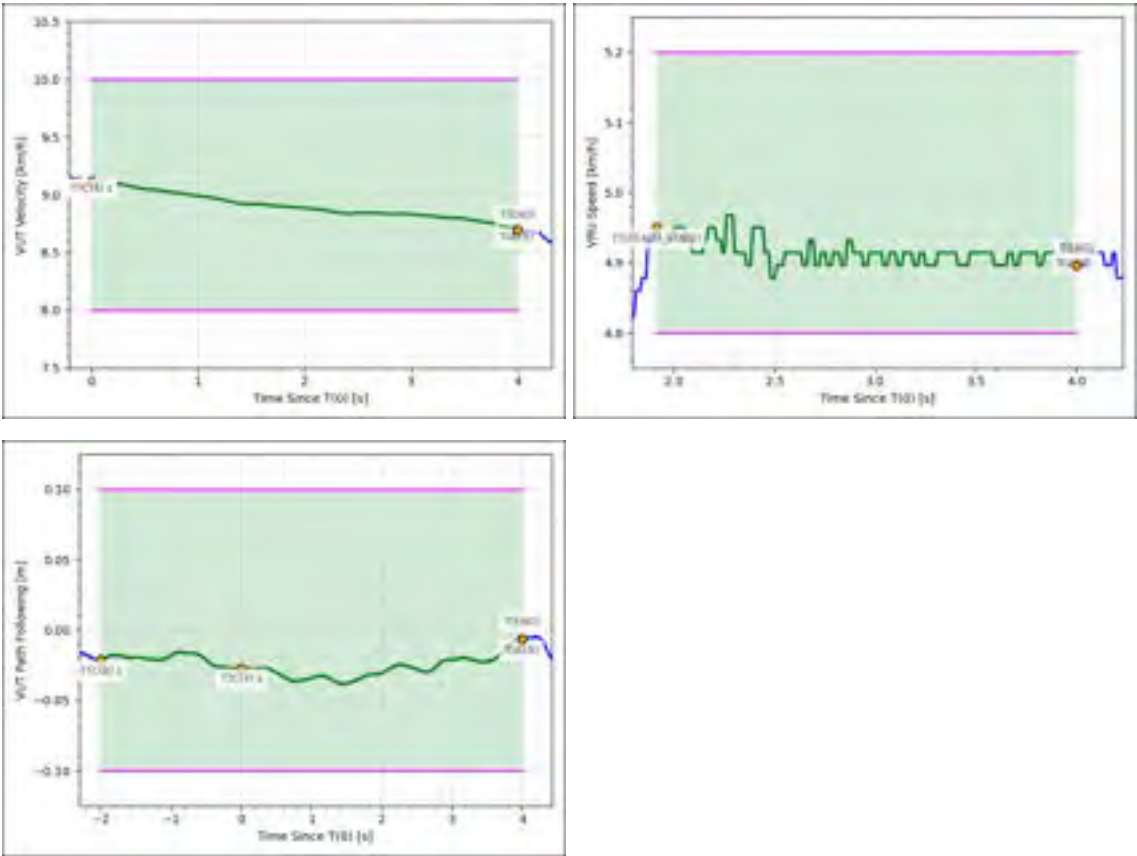
CPNC-50 5 kph (Day) | 10 km/h | Run 2

Run Date / Time 12-Jul-2023 12:01



CPNC-50 5 kph (Day) | 10 km/h | Run 4

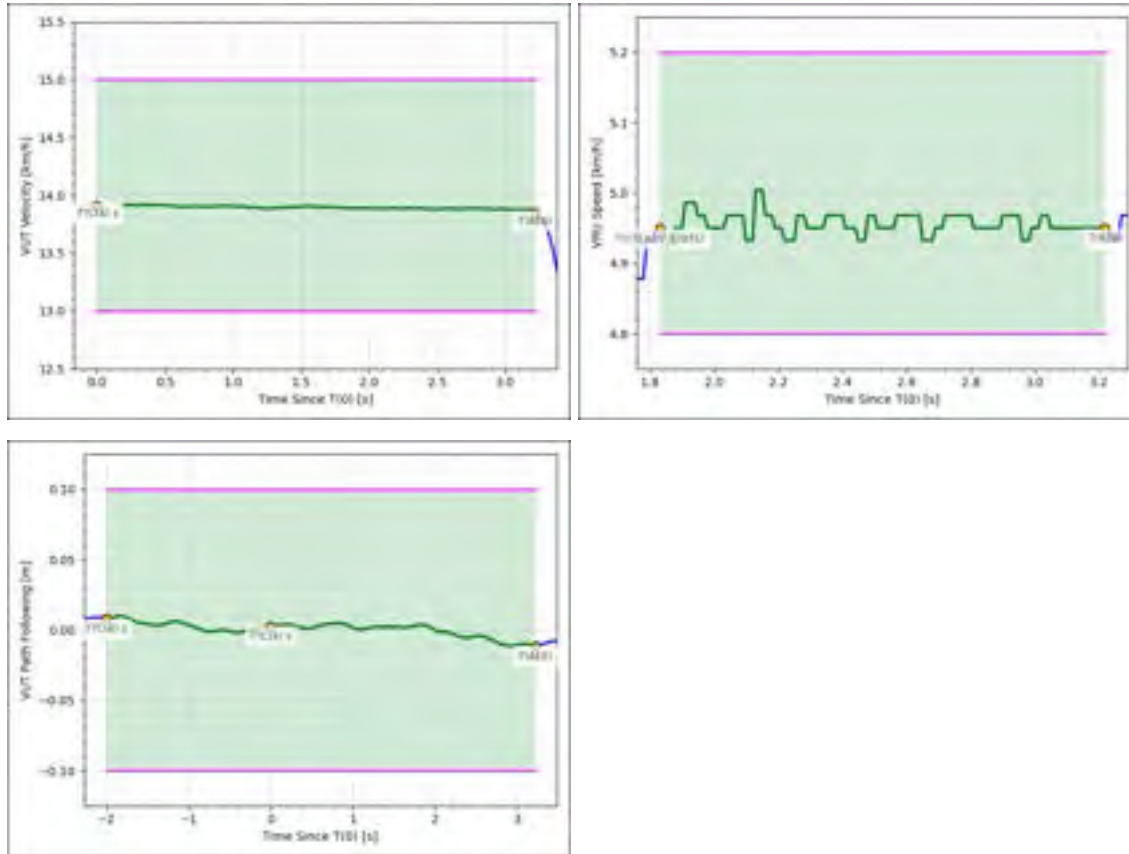
Run Date / Time 12-Jul-2023 12:16



H.2.4.2. CPNC-50 VUT 15kph EPT 5kph (Day)

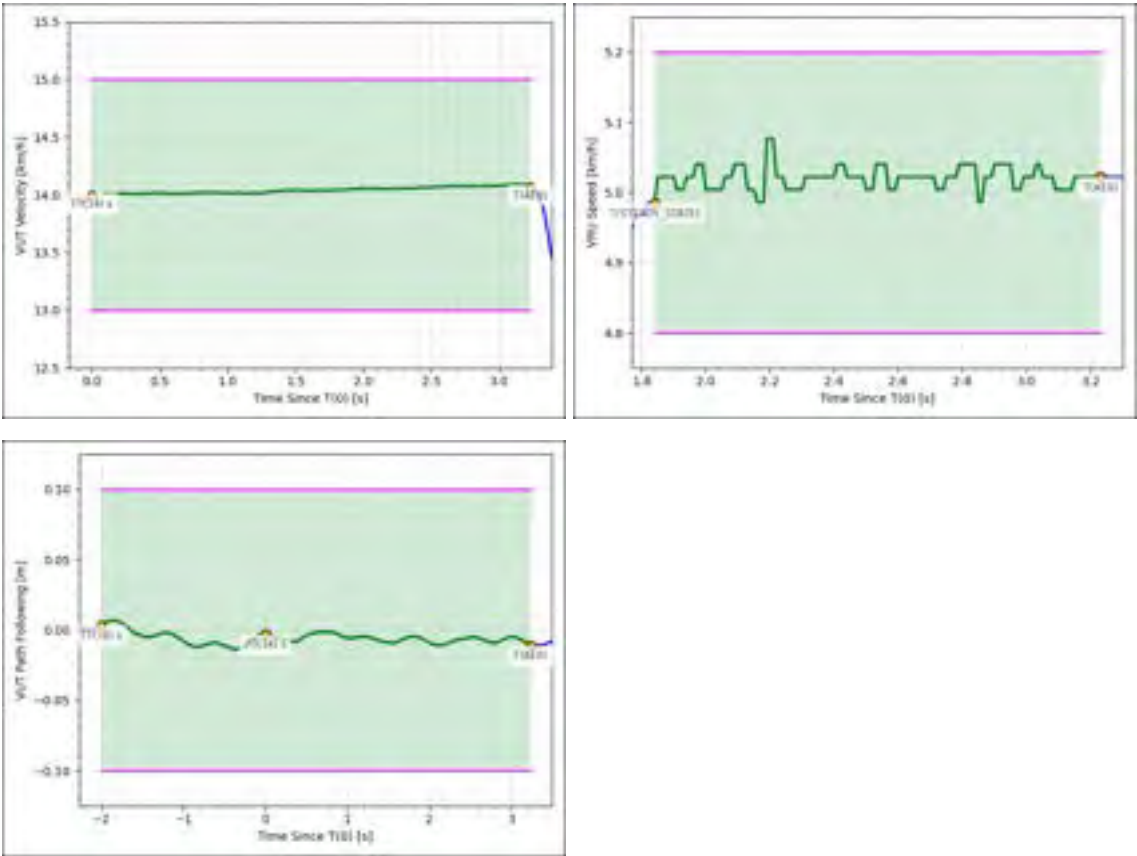
CPNC-50 5 kph (Day) | 15 km/h | Run 1

Run Date / Time 12-Jul-2023 13:47



CPNC-50 5 kph (Day) | 15 km/h | Run 2

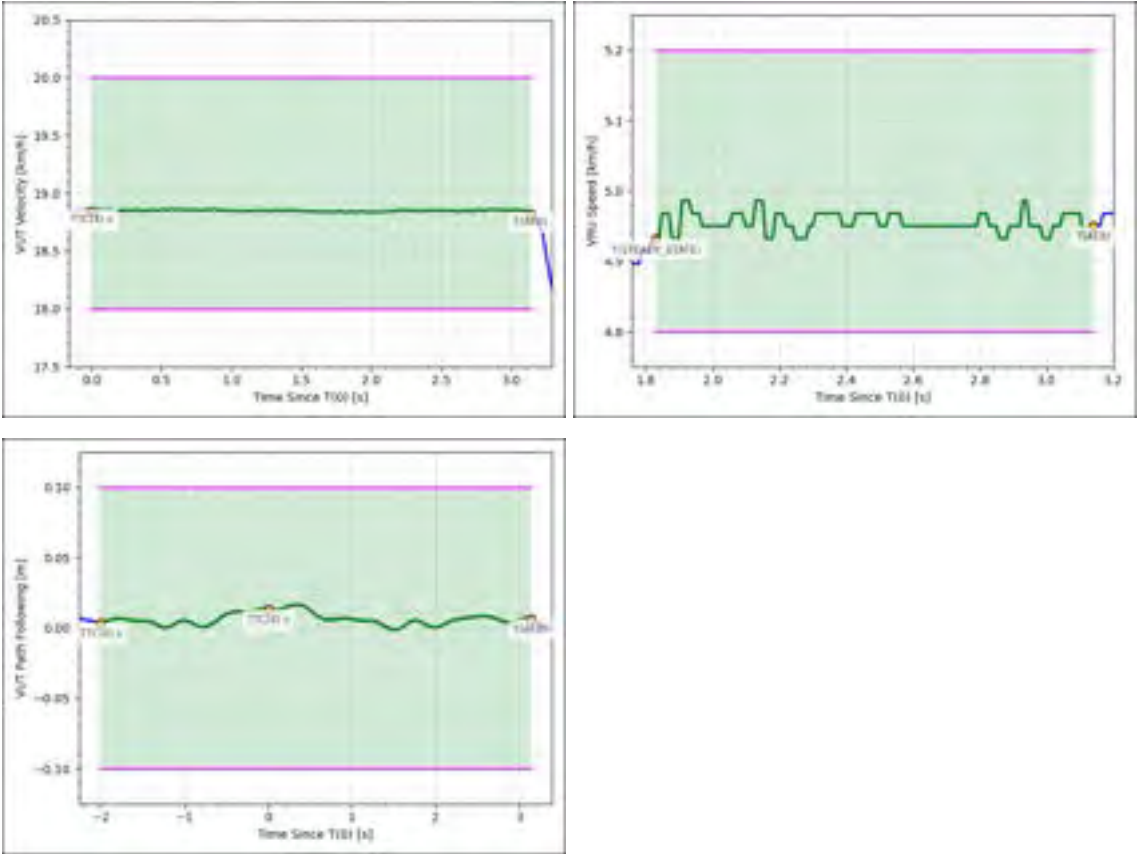
Run Date / Time 12-Jul-2023 13:50



H.2.4.3. CPNC-50 VUT 20kph EPT 5kph (Day)

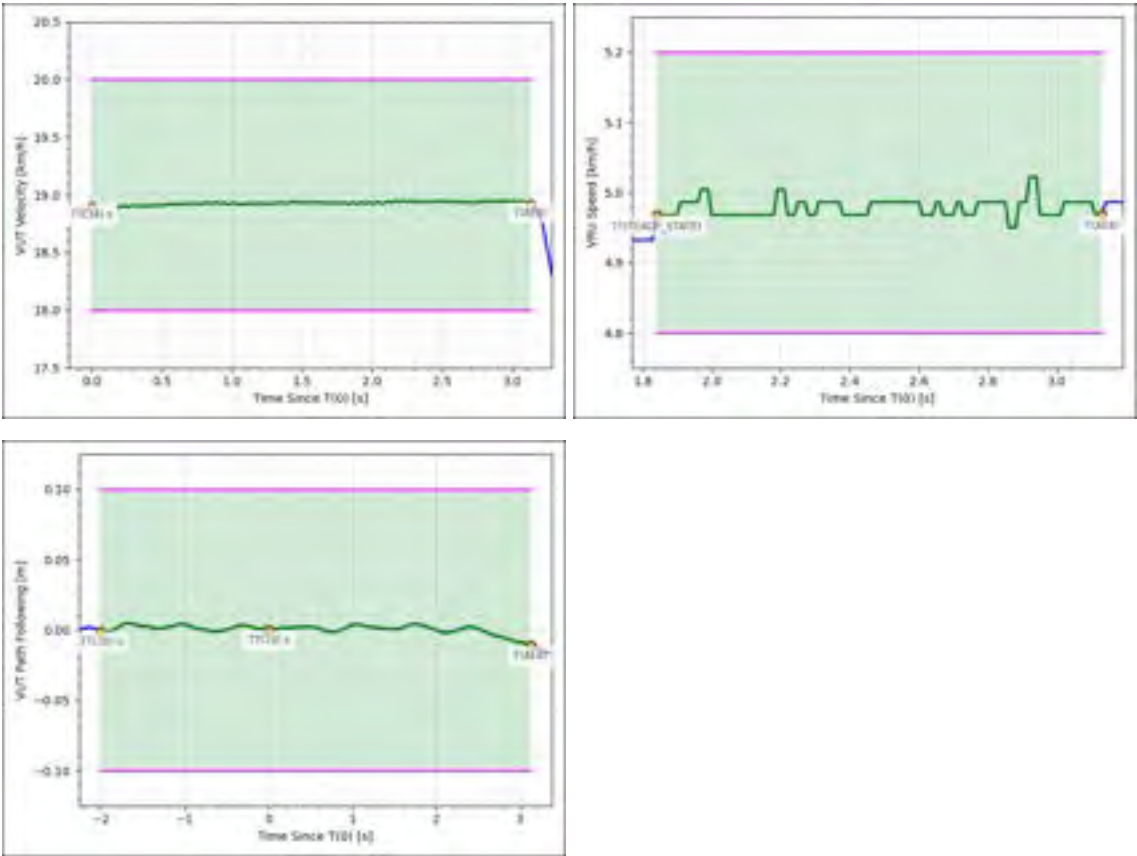
CPNC-50 5 kph (Day) | 20 km/h | Run 1

Run Date / Time 12-Jul-2023 13:53



CPNC-50 5 kph (Day) | 20 km/h | Run 2

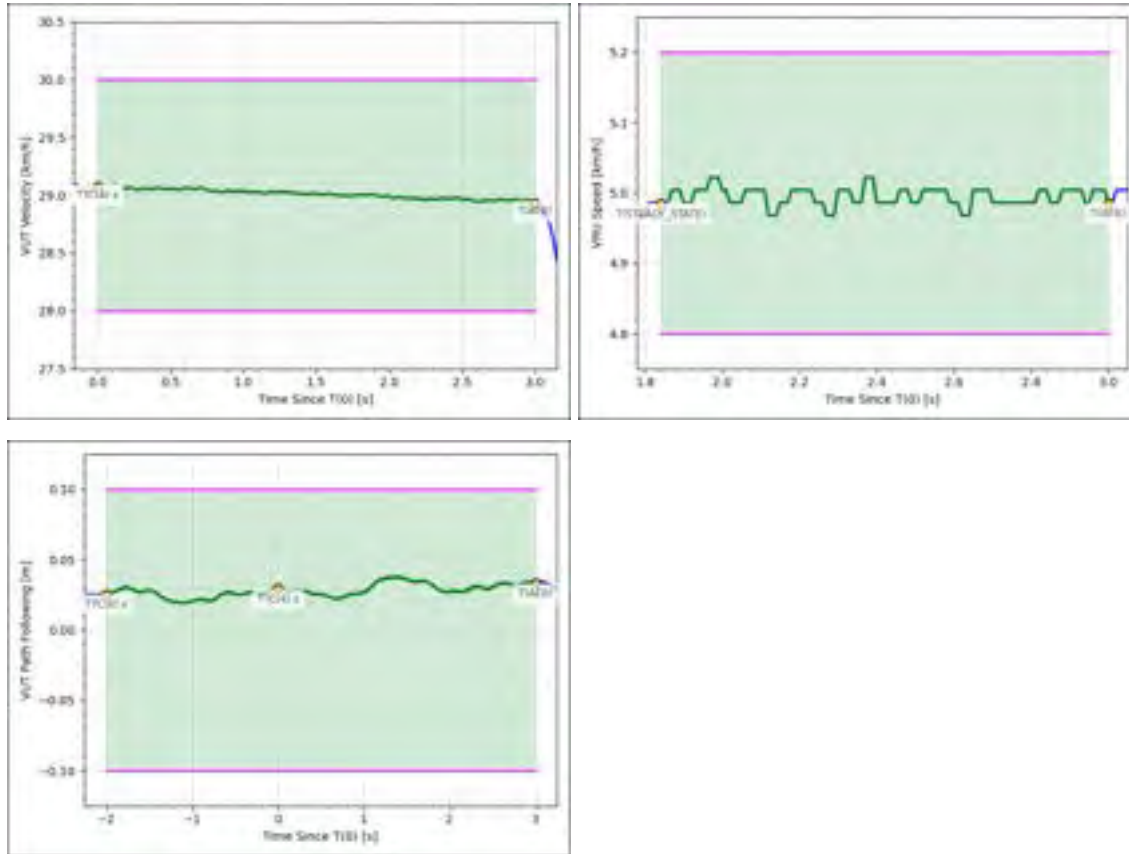
Run Date / Time 12-Jul-2023 13:57



H.2.4.4. CPNC-50 VUT 30kph EPT 5kph (Day)

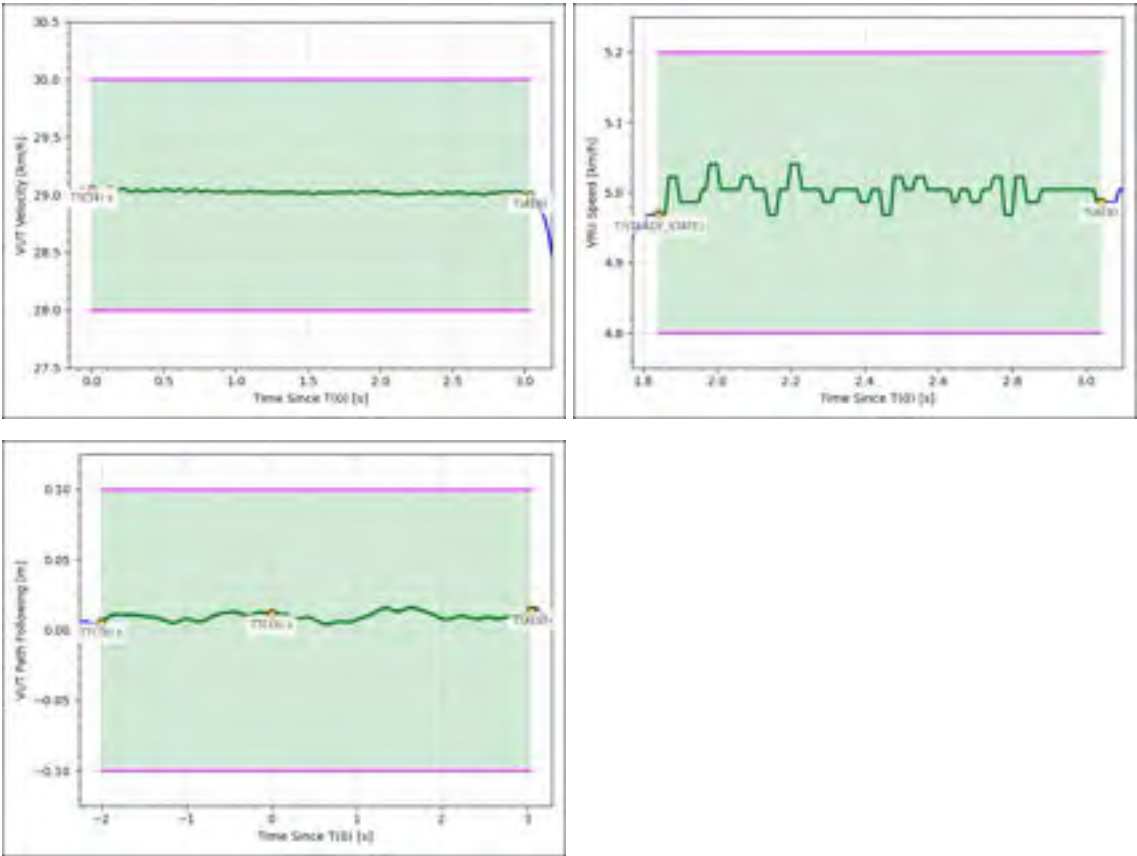
CPNC-50 5 kph (Day) | 30 km/h | Run 1

Run Date / Time 12-Jul-2023 14:02



CPNC-50 5 kph (Day) | 30 km/h | Run 2

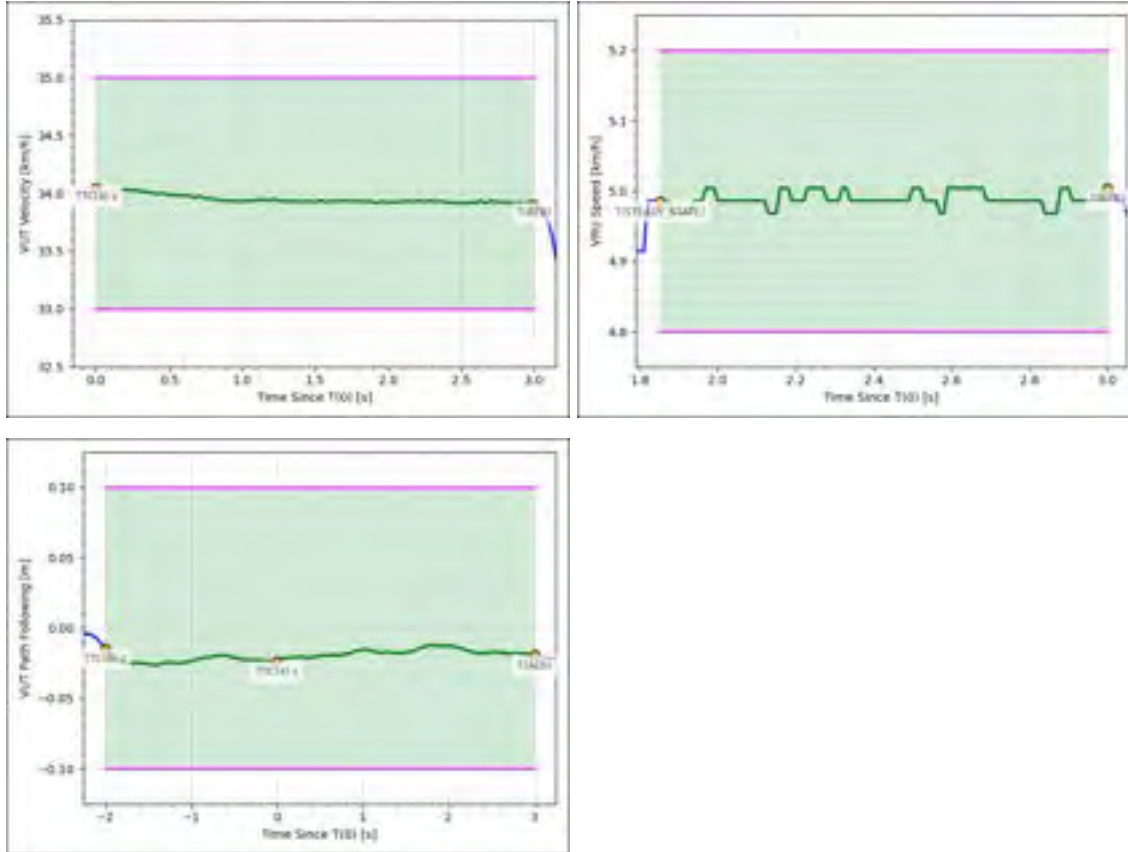
Run Date / Time 12-Jul-2023 14:05



H.2.4.5. CPNC-50 VUT 35kph EPT 5kph (Day)

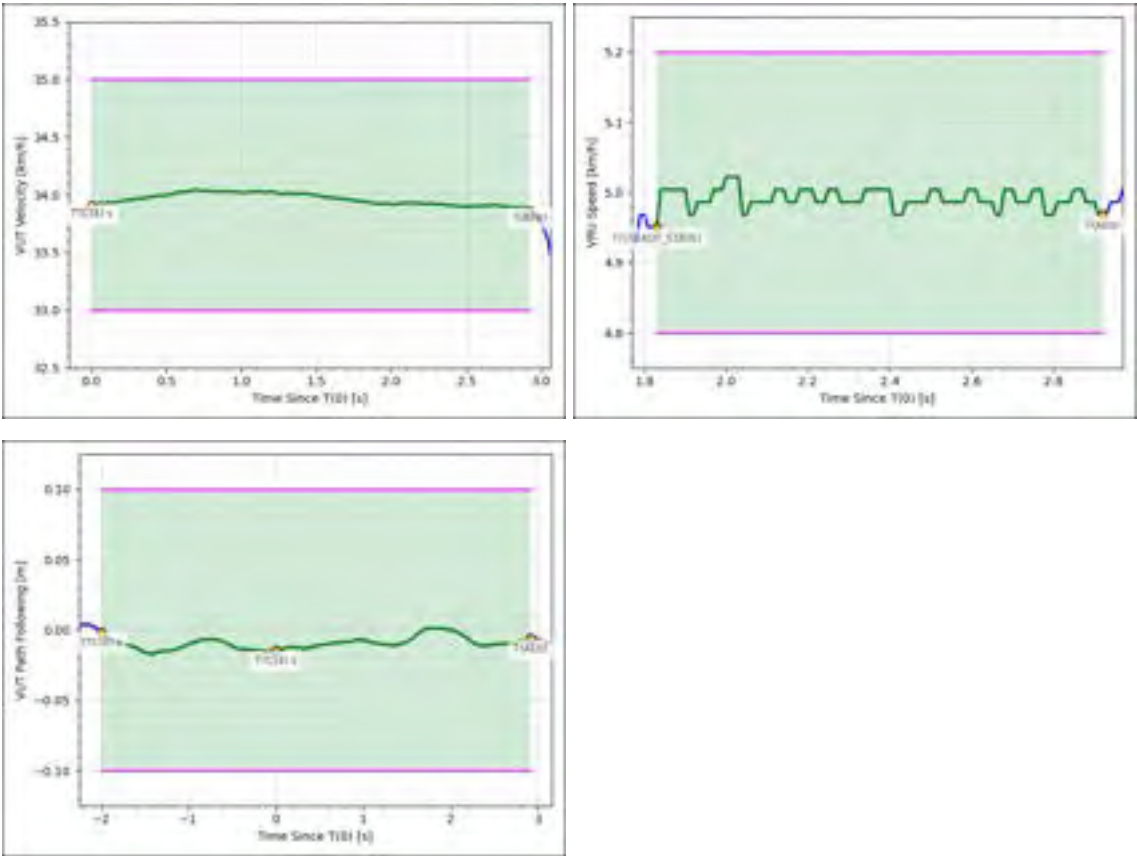
CPNC-50 5 kph (Day) | 35 km/h | Run 8

Run Date / Time 13-Jul-2023 10:41



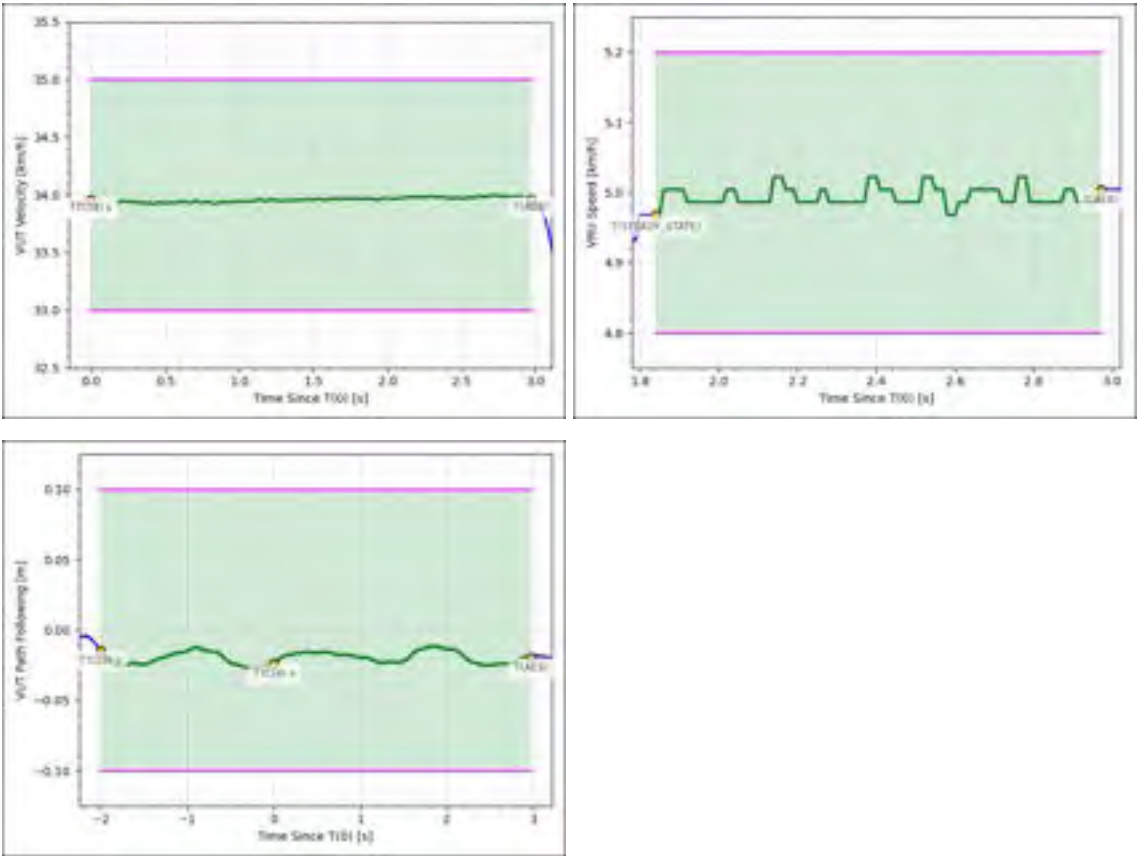
CPNC-50 5 kph (Day) | 35 km/h | Run 9

Run Date / Time 13-Jul-2023 10:44



CPNC-50 5 kph (Day) | 35 km/h | Run 10

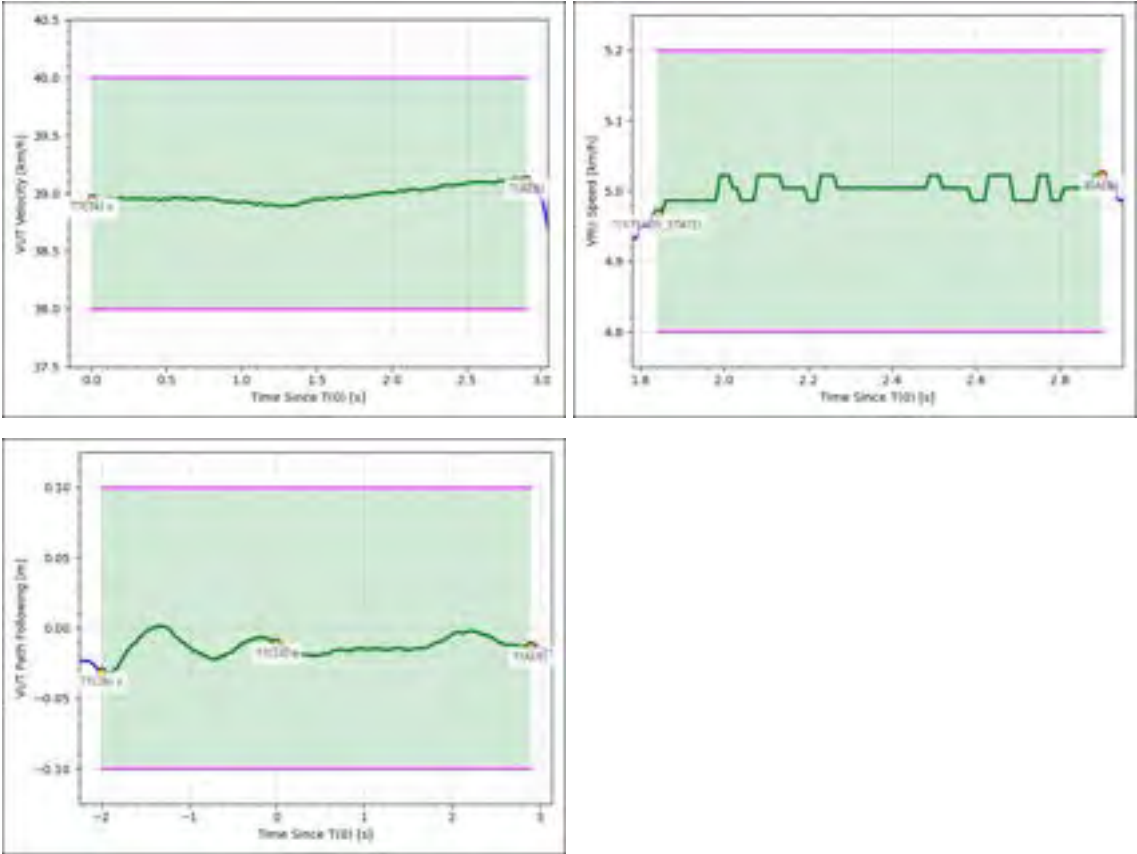
Run Date / Time 13-Jul-2023 10:48



H.2.4.6. CPNC-50 VUT 40kph EPT 5kph (Day)

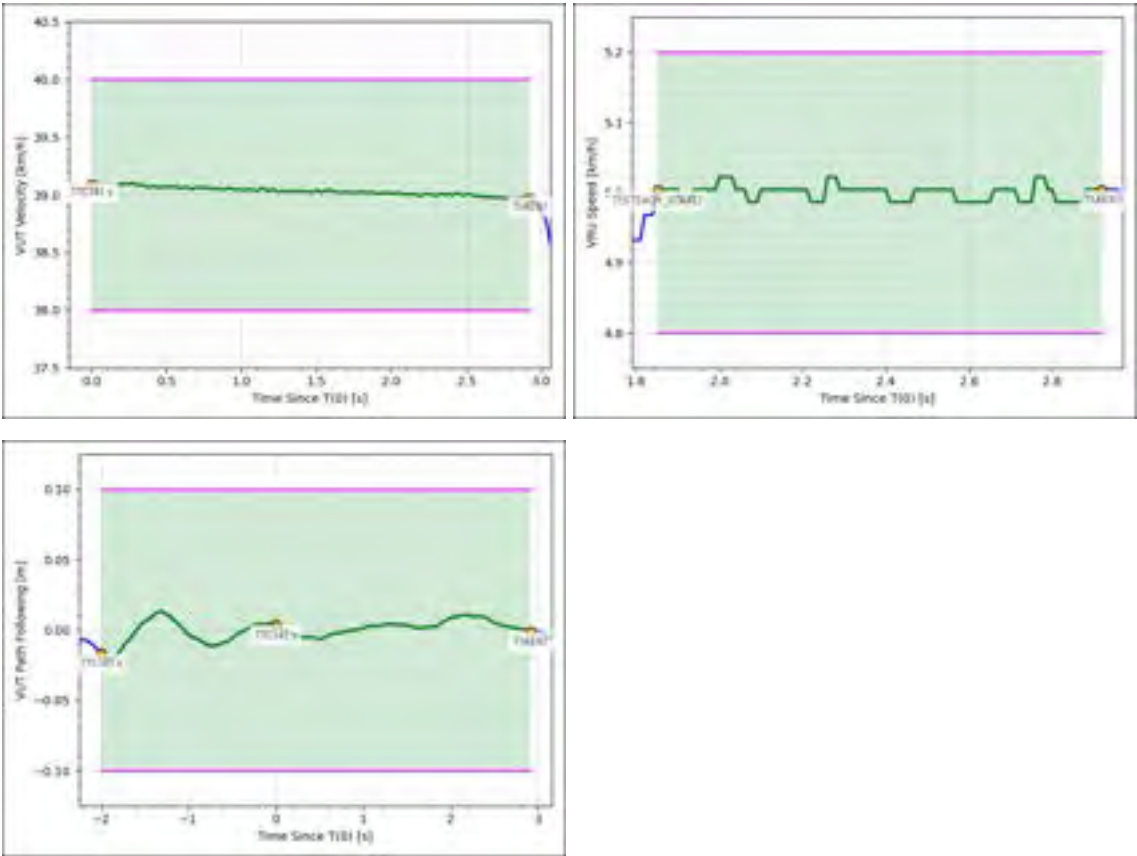
CPNC-50 5 kph (Day) | 40 km/h | Run 6

Run Date / Time 13-Jul-2023 11:03



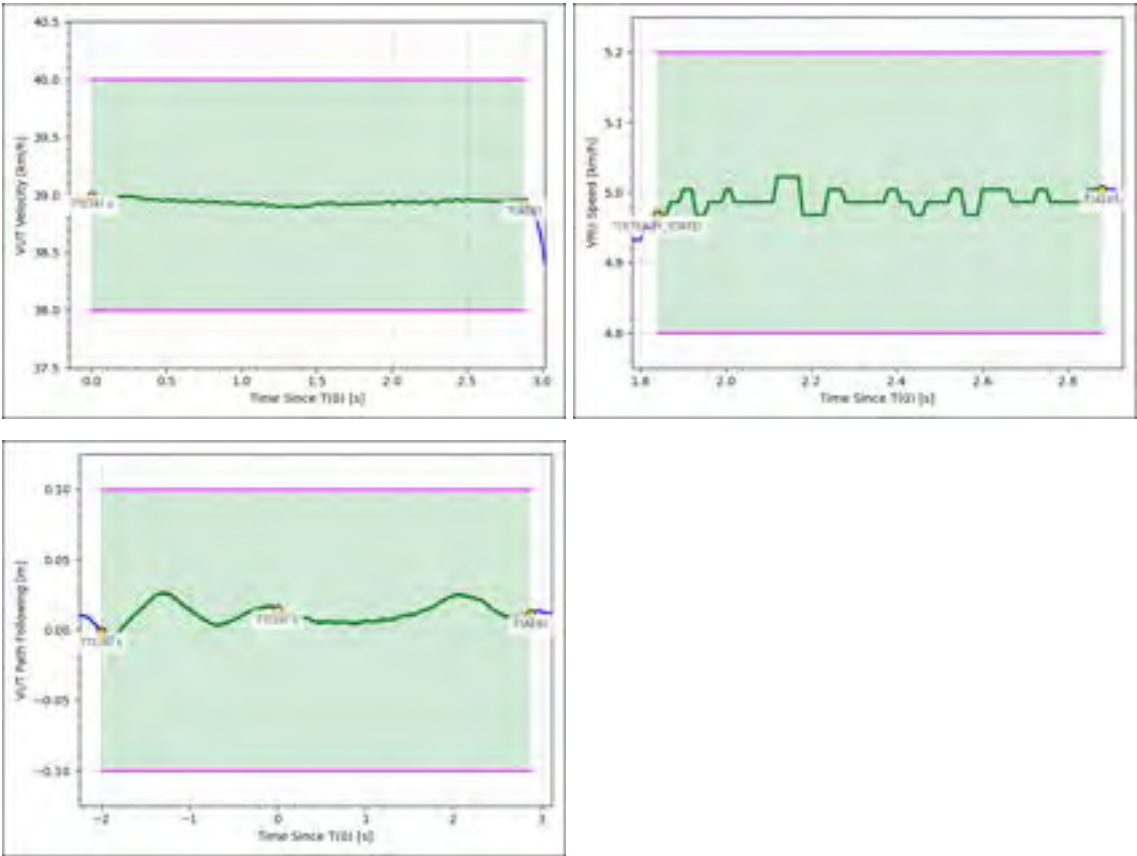
CPNC-50 5 kph (Day) | 40 km/h | Run 7

Run Date / Time 13-Jul-2023 11:05



CPNC-50 5 kph (Day) | 40 km/h | Run 8

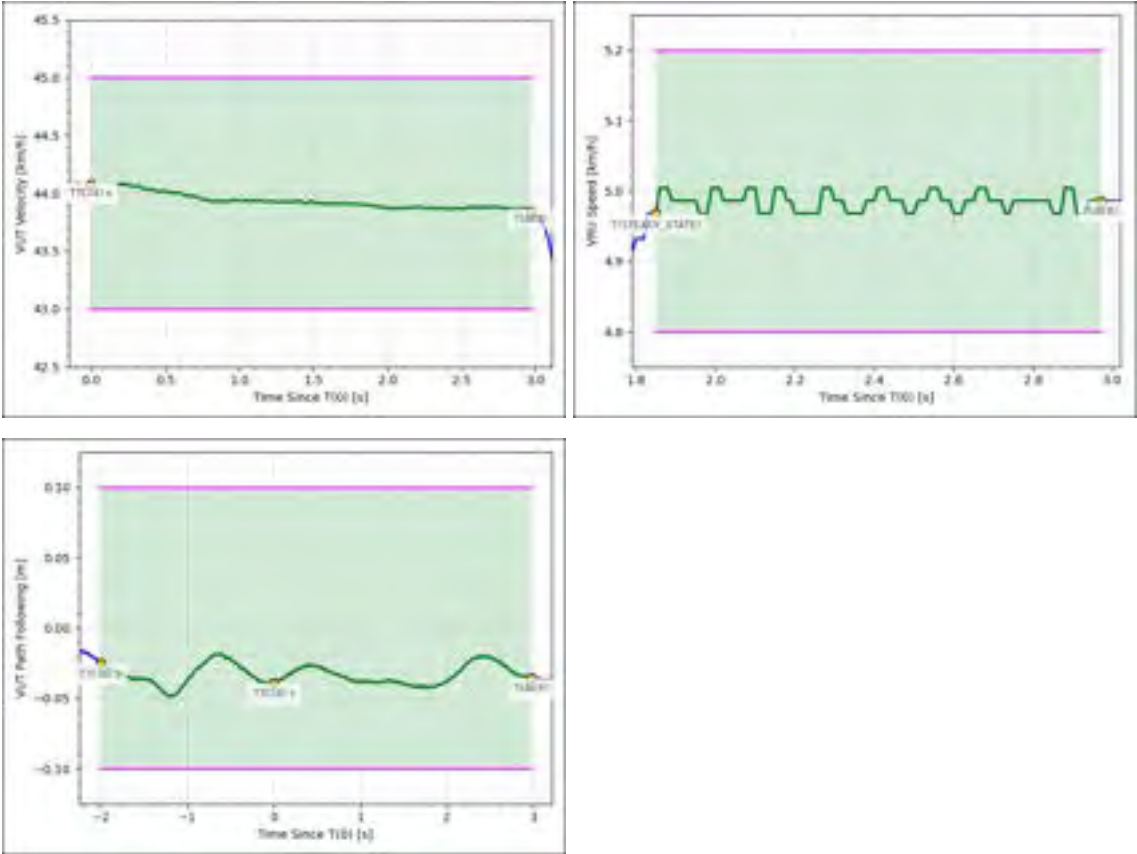
Run Date / Time 13-Jul-2023 11:13



H.2.4.7. CPNC-50 VUT 45kph EPT 5kph (Day)

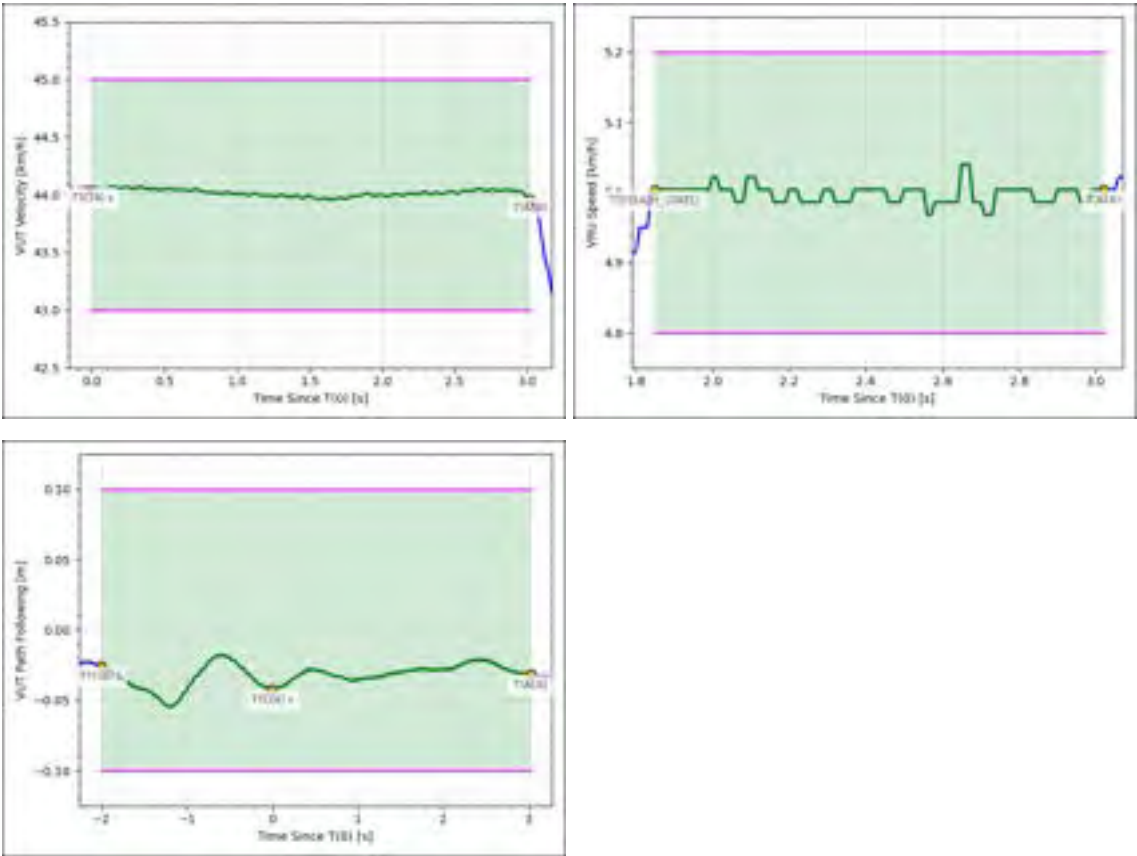
CPNC-50 5 kph (Day) | 45 km/h | Run 2

Run Date / Time 13-Jul-2023 12:05



CPNC-50 5 kph (Day) | 45 km/h | Run 3

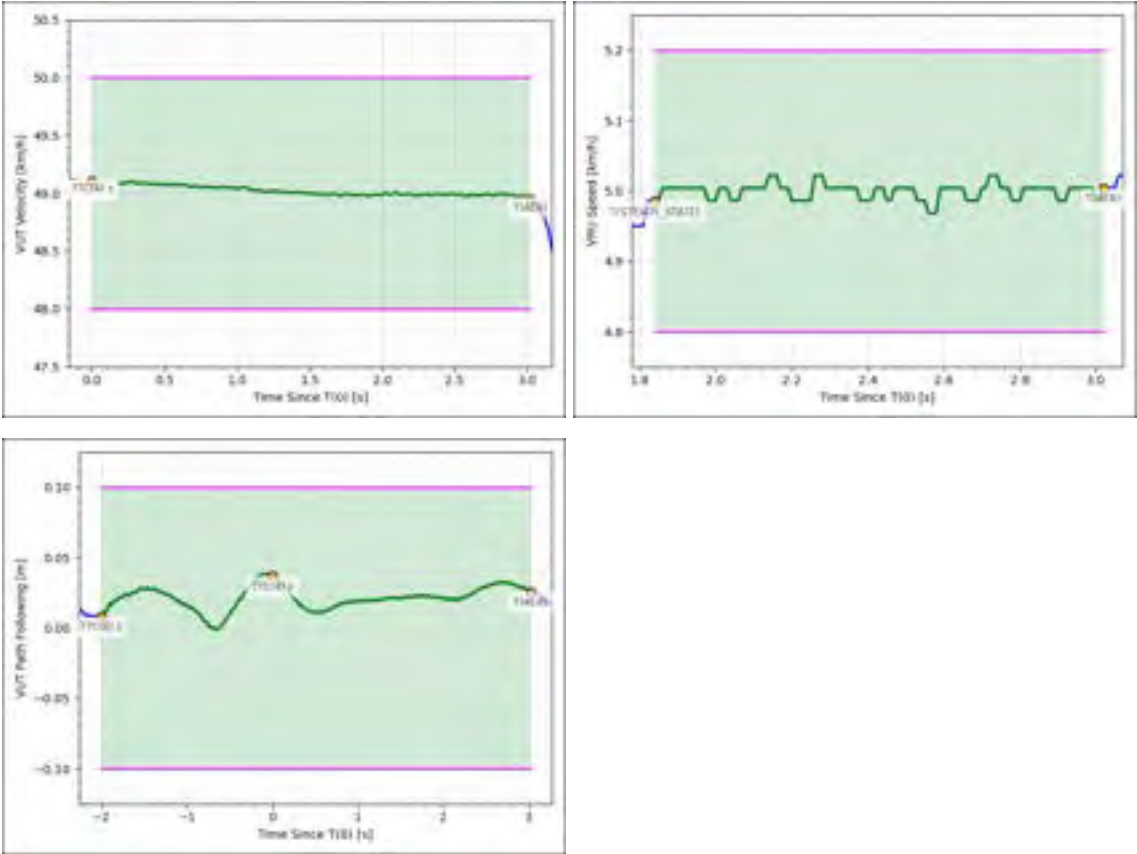
Run Date / Time 13-Jul-2023 12:08



H.2.4.8. CPNC-50 VUT 50kph EPT 5kph (Day)

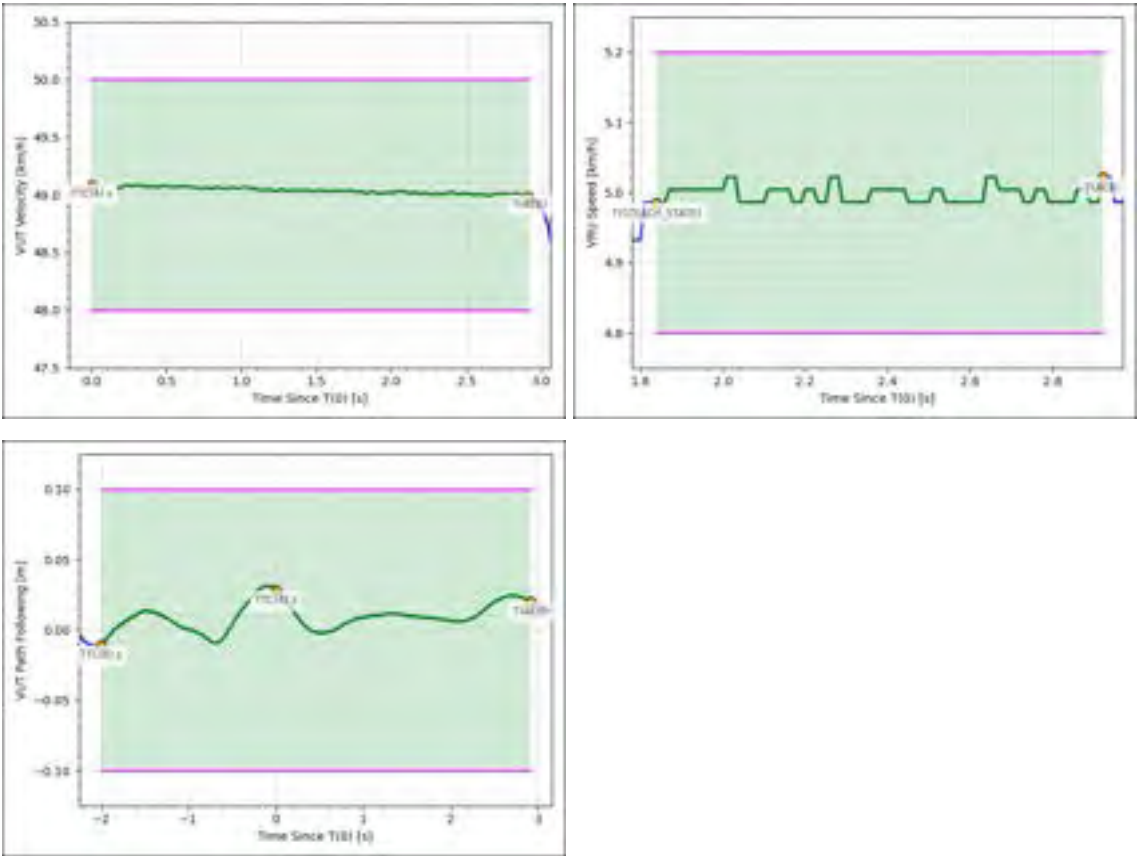
CPNC-50 5 kph (Day) | 50 km/h | Run 1

Run Date / Time 13-Jul-2023 13:13



CPNC-50 5 kph (Day) | 50 km/h | Run 2

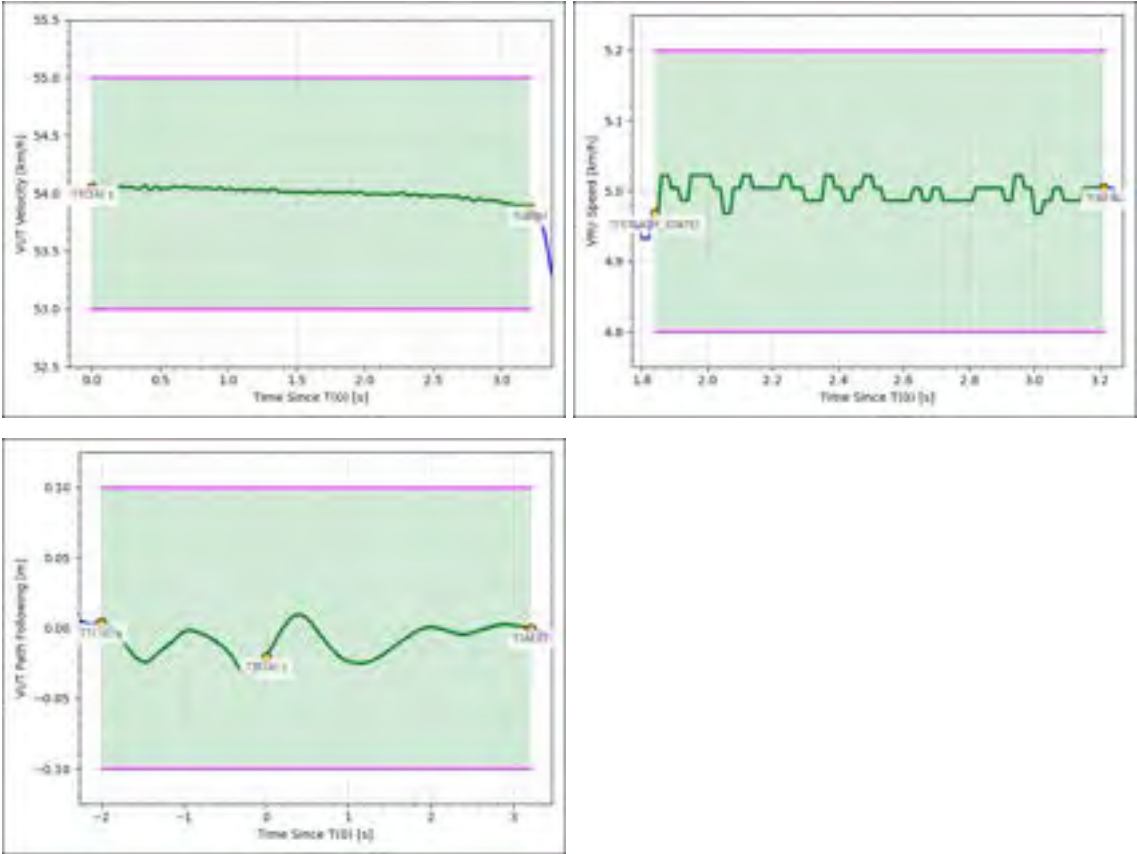
Run Date / Time 13-Jul-2023 13:17



H.2.4.9. CPNC-50 VUT 55kph EPT 5kph (Day)

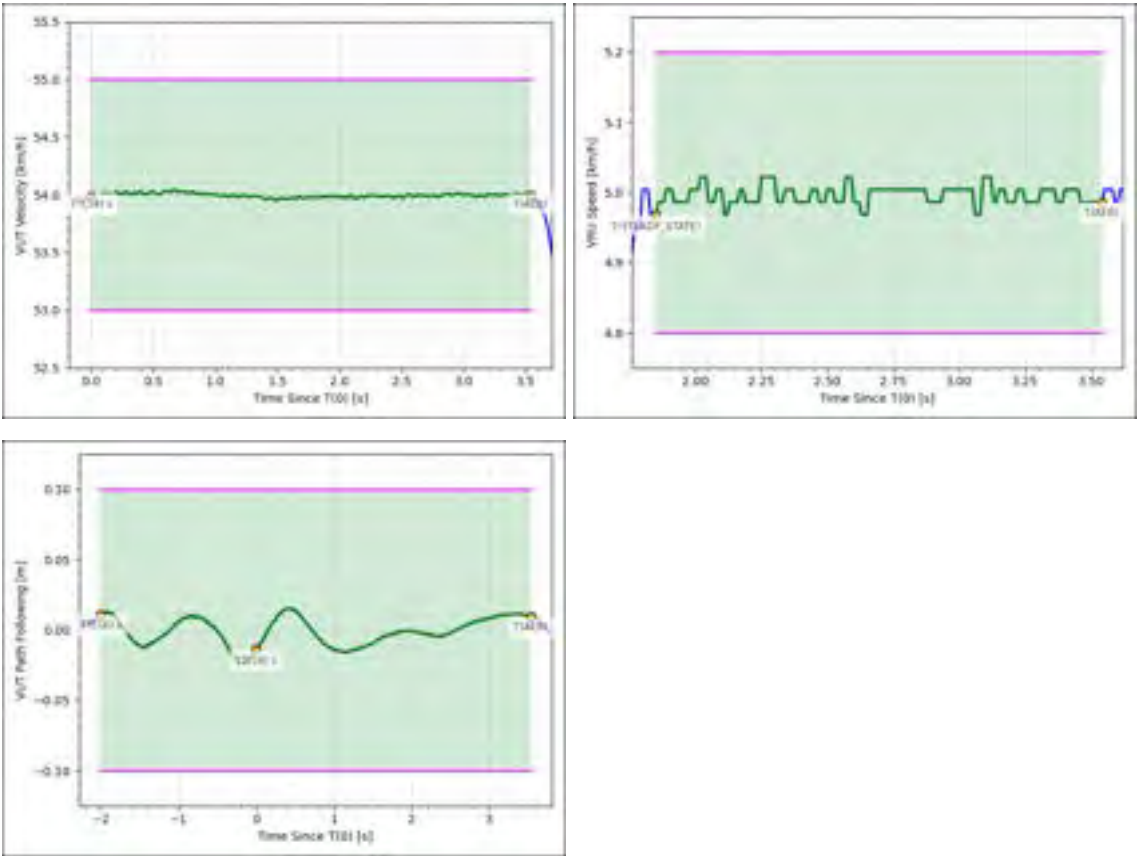
CPNC-50 5 kph (Day) | 55 km/h | Run 1

Run Date / Time 13-Jul-2023 14:16



CPNC-50 5 kph (Day) | 55 km/h | Run 2

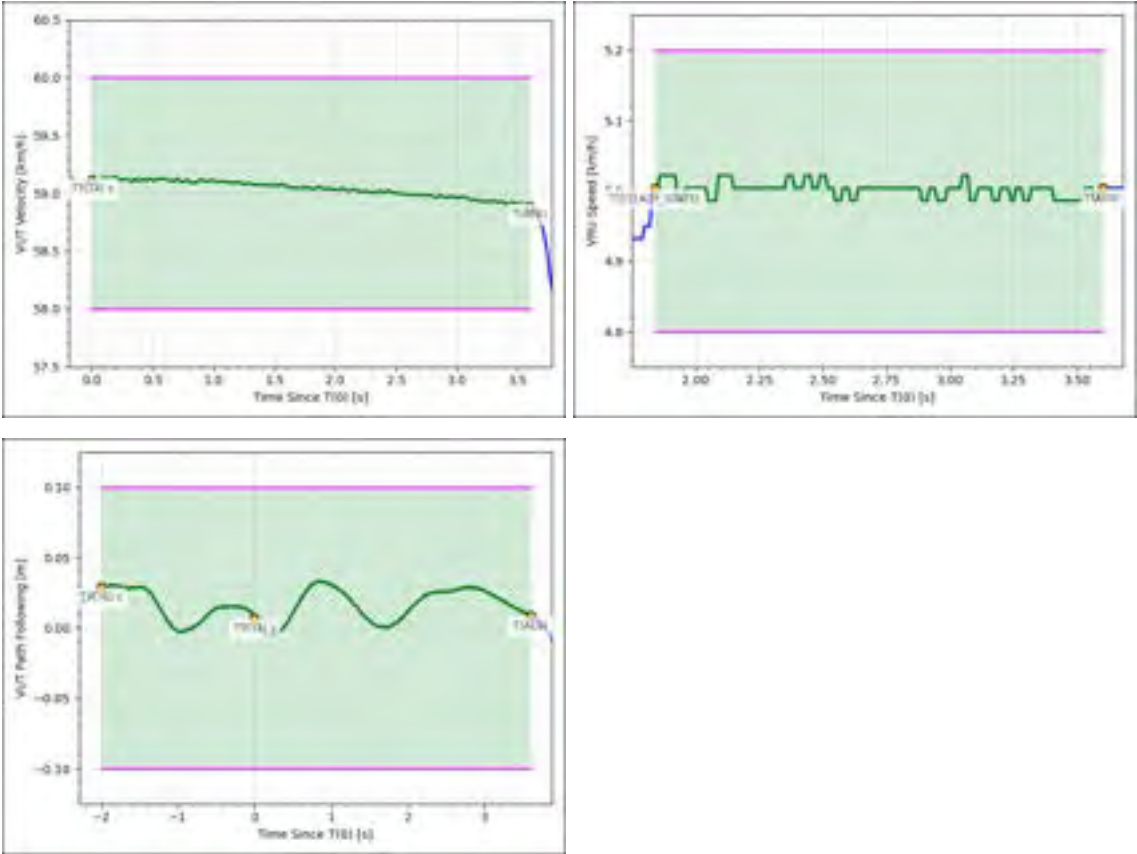
Run Date / Time 13-Jul-2023 14:28



H.2.4.10. CPNC-50 VUT 60kph EPT 5kph (Day)

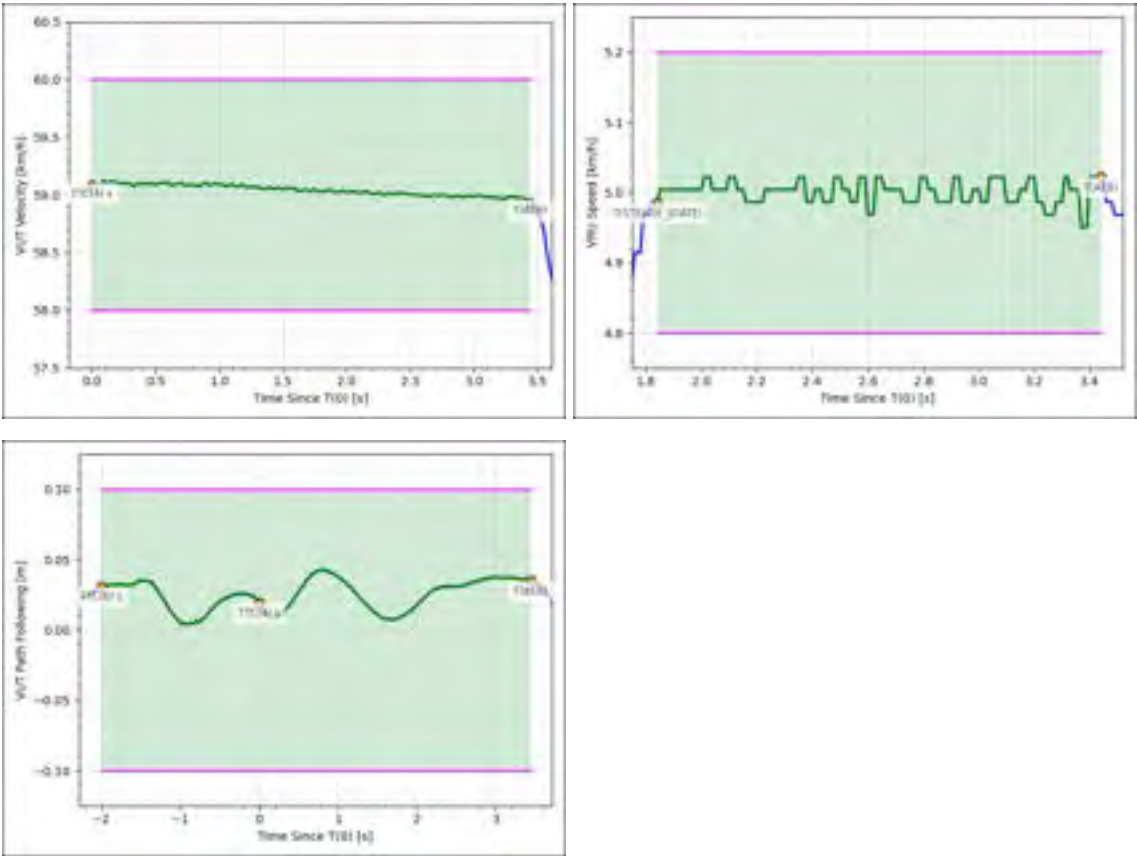
CPNC-50 5 kph (Day) | 60 km/h | Run 1

Run Date / Time 13-Jul-2023 13:24



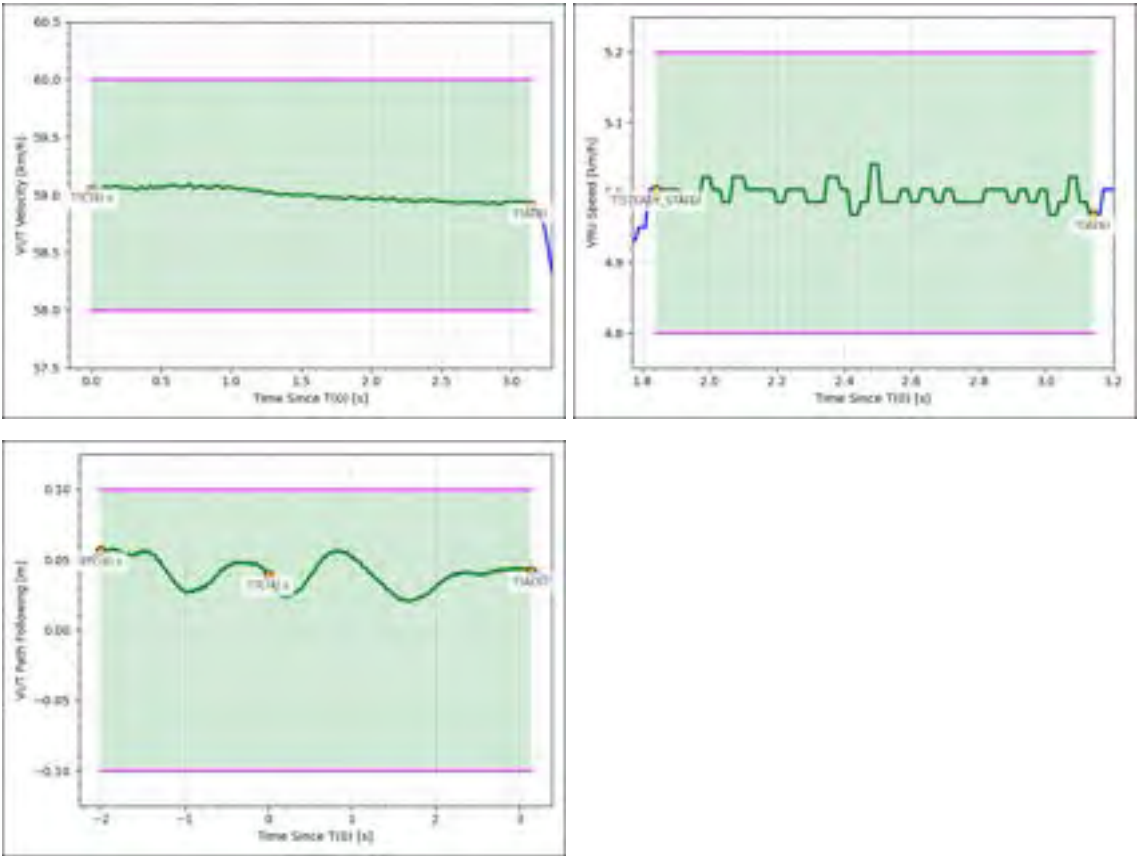
CPNC-50 5 kph (Day) | 60 km/h | Run 2

Run Date / Time 13-Jul-2023 13:43



CPNC-50 5 kph (Day) | 60 km/h | Run 3

Run Date / Time 13-Jul-2023 13:50

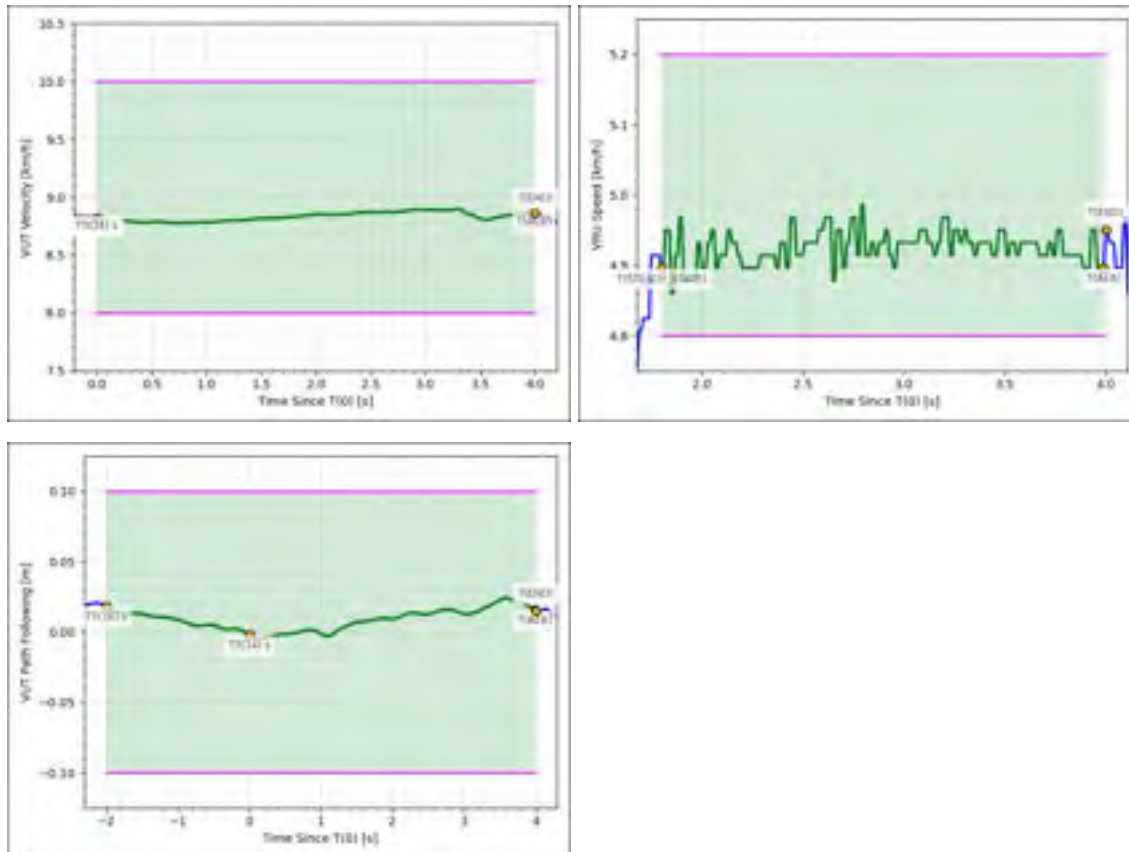


H.2.5. Tuff Bullbar Mesh Investigation

H.2.5.1. CPNC-50 VUT 10kph EPT 5kph (Day)

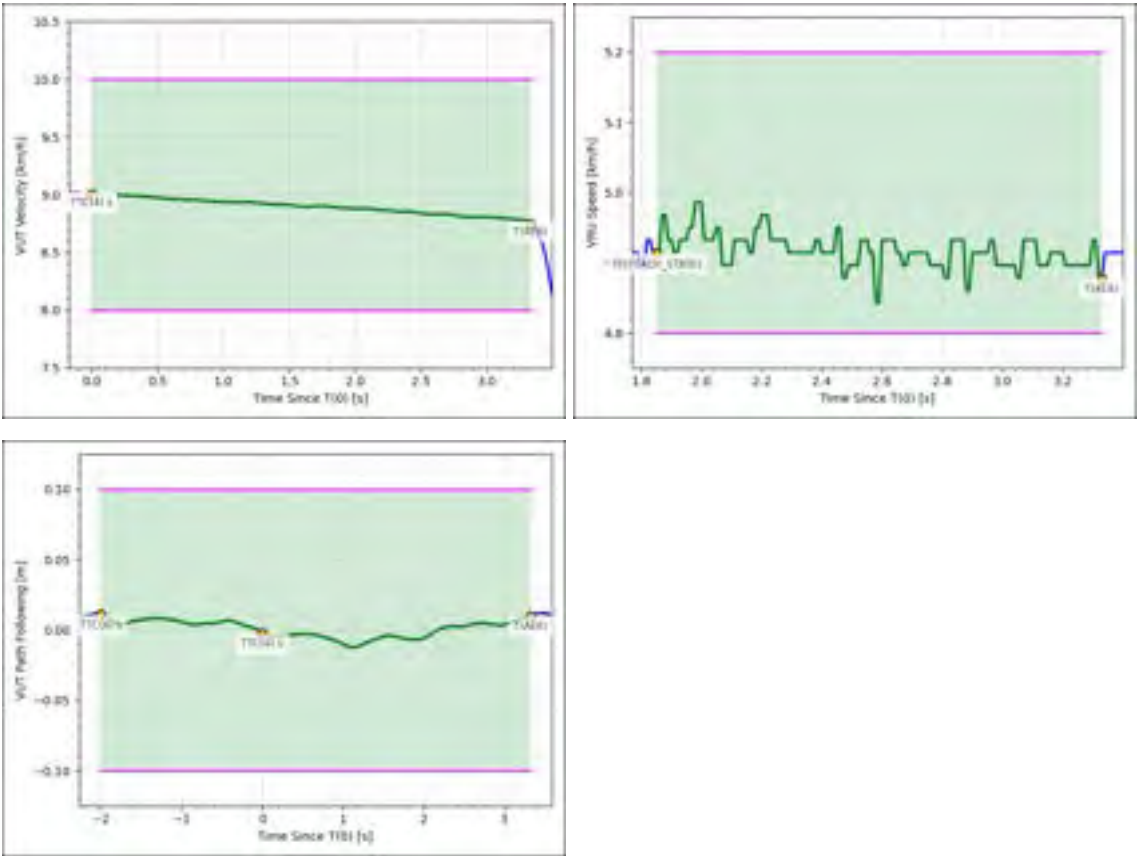
CPNC-50 5 kph (Day) | 10 km/h | Run 6

Run Date / Time 14-Jun-2024 14:14



CPNC-50 5 kph (Day) | 10 km/h | Run 7

Run Date / Time 14-Jun-2024 14:44



APPENDIX I

Toyota Hilux Car-to-Car Results Validity

I. Hilux Car to Car Results Validity

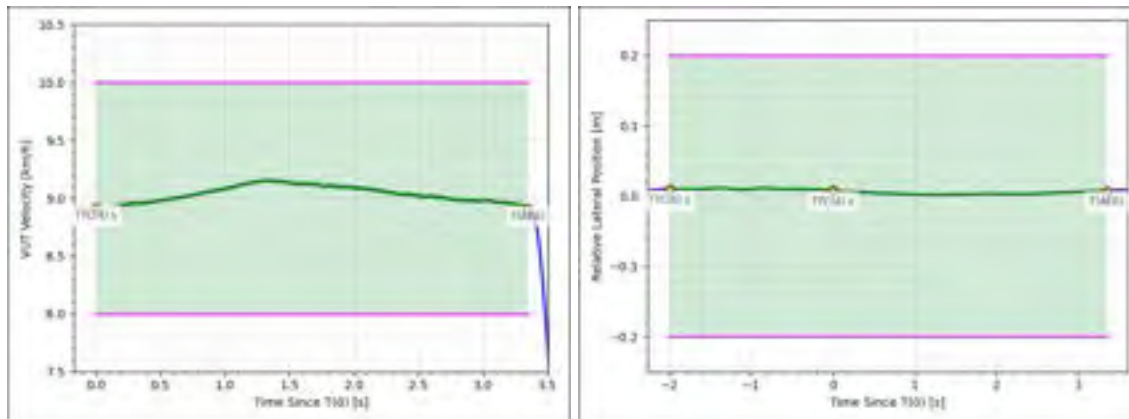
I.1. Car-to-Car Rear Stationary

I.1.1. Baseline

I.1.1.1. AEB CCRs 10 kph +100 %

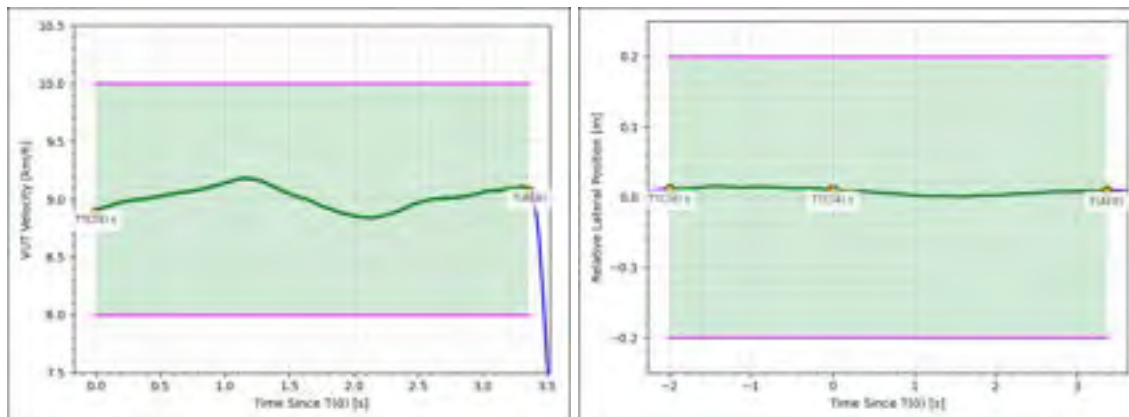
AEB CCRs | 10 km/h 100 % | Run 3

Run Date / Time 8-Feb-2023 11:58



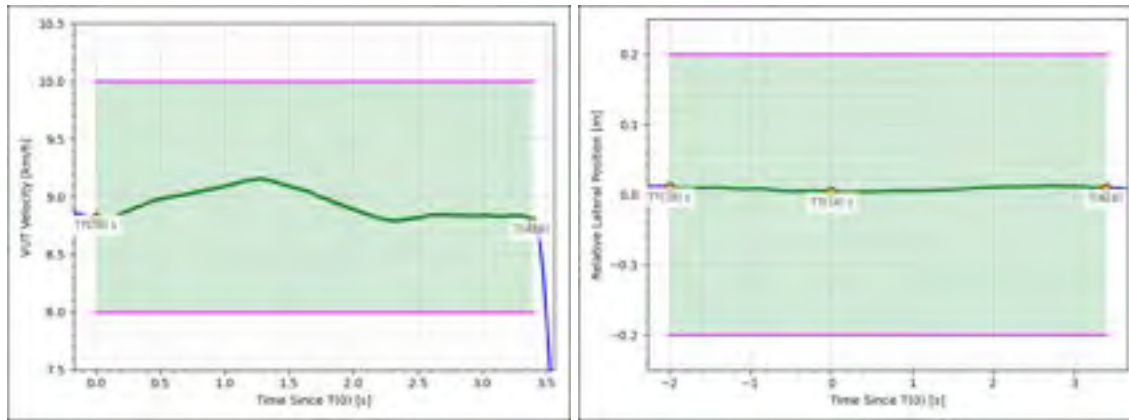
AEB CCRs | 10 km/h 100 % | Run 4

Run Date / Time 8-Feb-2023 12:04



AEB CCRs | 10 km/h 100 % | Run 5

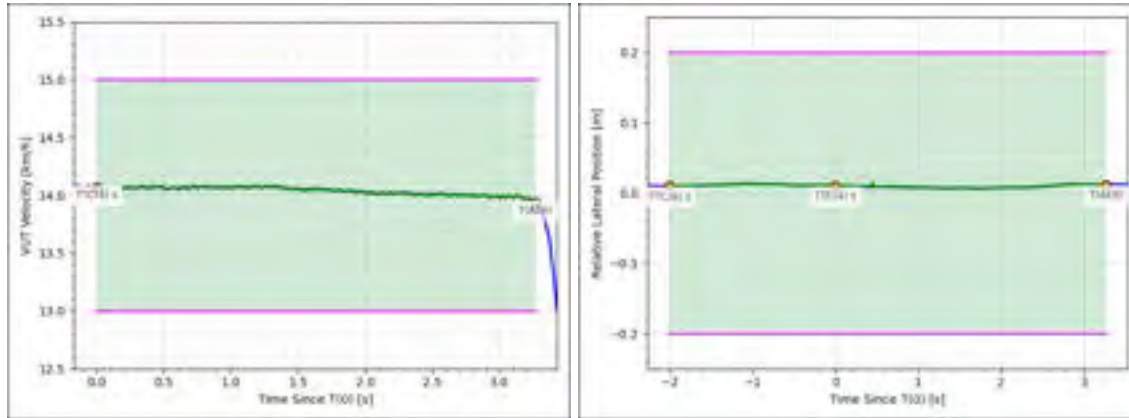
Run Date / Time 8-Feb-2023 12:07



I.1.1.2. AEB CCRs 15 kph +100 %

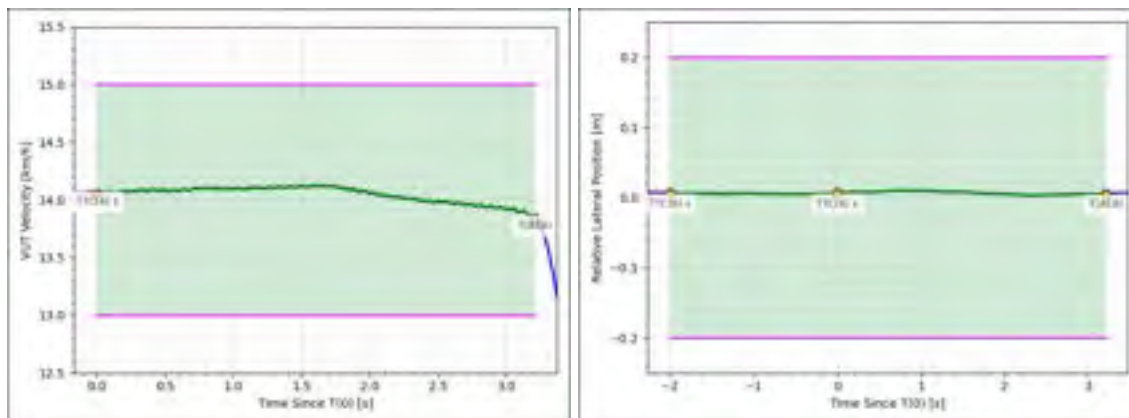
AEB CCRs | 15 km/h +100 % | Run 1

Run Date / Time 8-Feb-2023 11:33



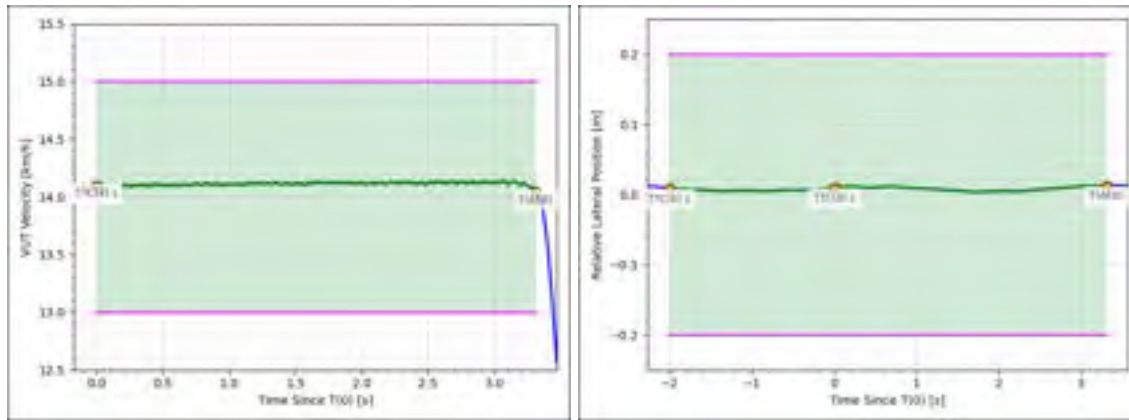
AEB CCRs | 15 km/h +100 % | Run 2

Run Date / Time 8-Feb-2023 11:36



AEB CCRs | 15 km/h +100 % | Run 3

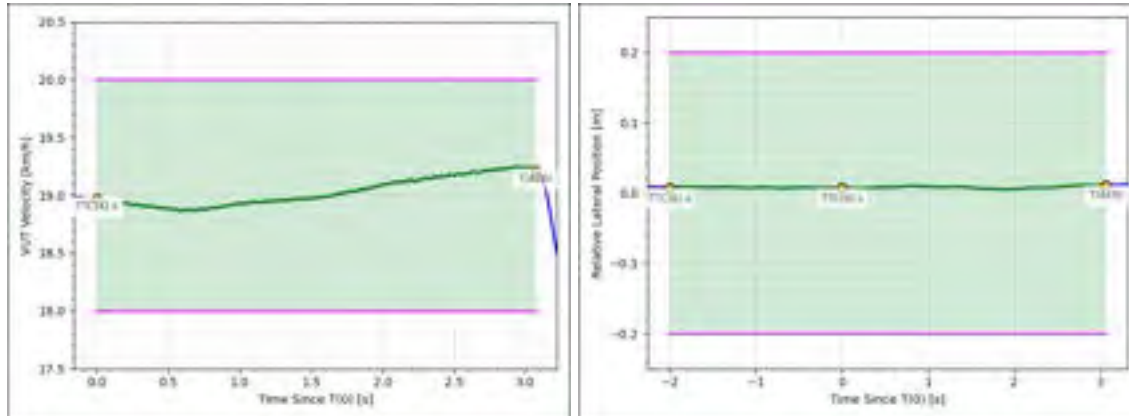
Run Date / Time 8-Feb-2023 11:39



I.1.1.3. AEB CCRs 20 kph +100 %

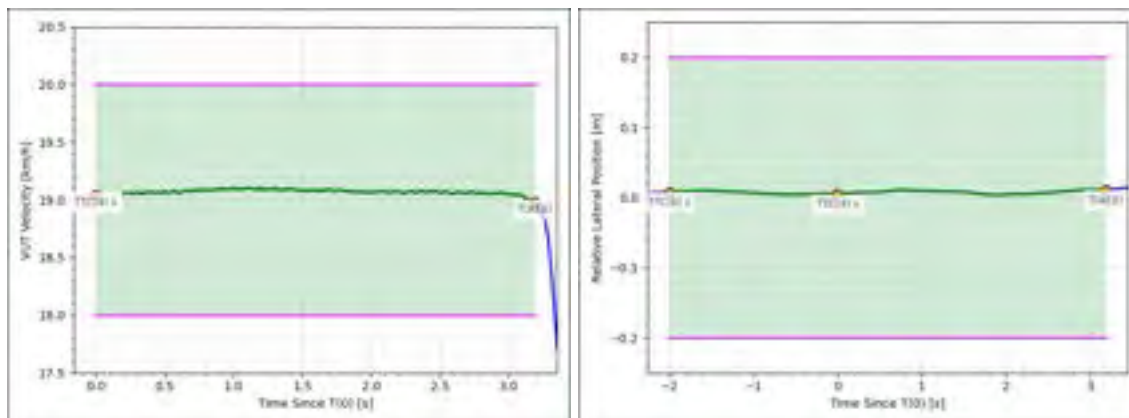
AEB CCRs | 20 km/h +100 % | Run 1

Run Date / Time 8-Feb-2023 10:58



AEB CCRs | 20 km/h +100 % | Run 2

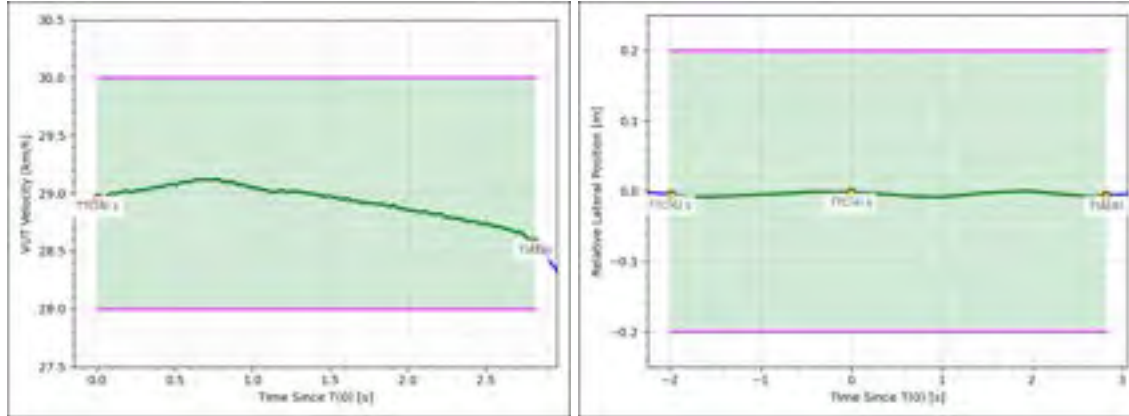
Run Date / Time 8-Feb-2023 11:06



I.1.1.4. AEB CCRs 30 kph -75 %

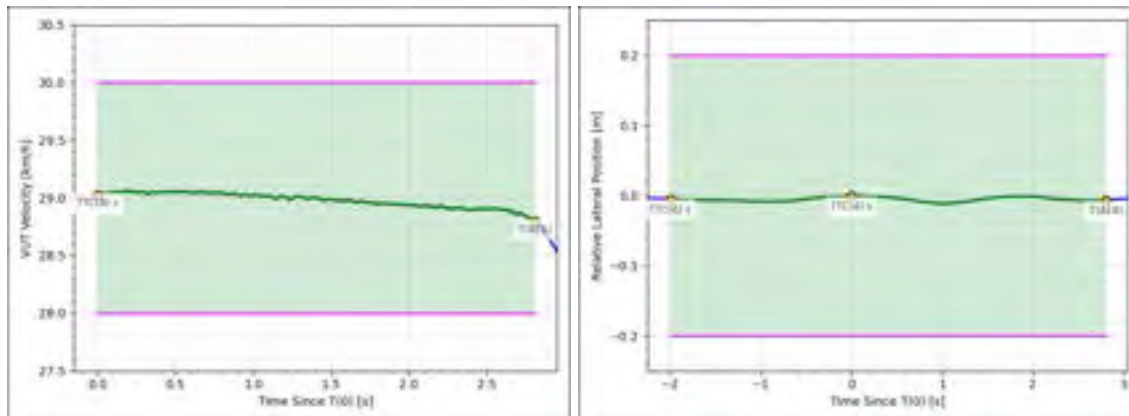
AEB CCRs | 30 km/h -75 % | Run 1

Run Date / Time 8-Feb-2023 14:40



AEB CCRs | 30 km/h -75 % | Run 2

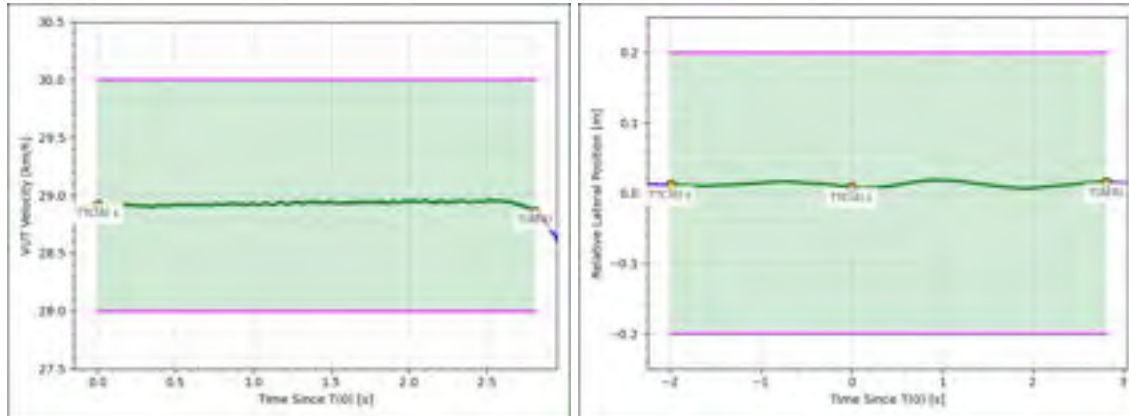
Run Date / Time 8-Feb-2023 14:43



1.1.1.5. AEB CCRs 30 kph +100 %

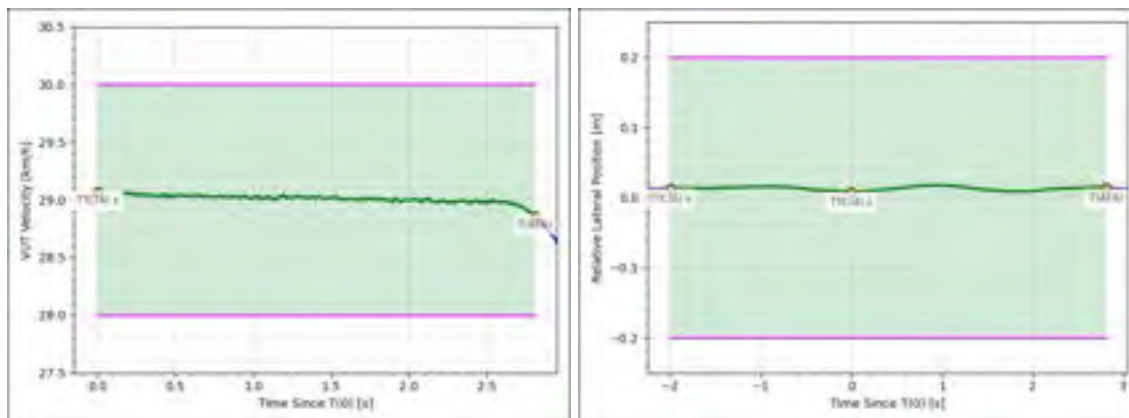
AEB CCRs | 30 km/h +100 % | Run 1

Run Date / Time 8-Feb-2023 13:01



AEB CCRs | 30 km/h +100 % | Run 2

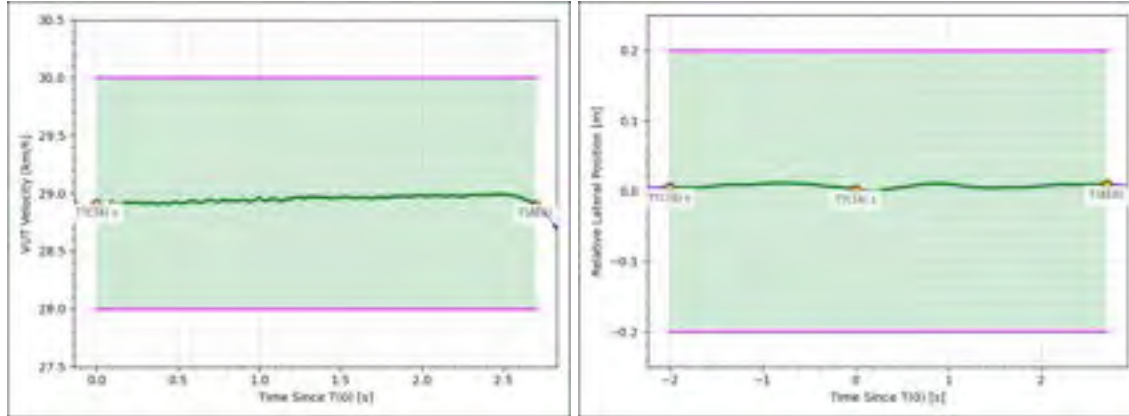
Run Date / Time 8-Feb-2023 13:03



1.1.1.6. AEB CCRs 30 kph +75 %

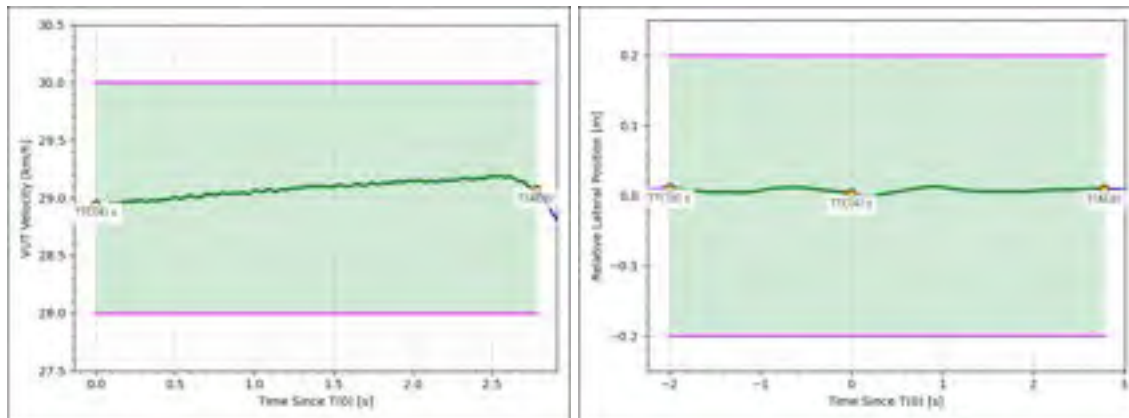
AEB CCRs | 30 km/h +75 % | Run 1

Run Date / Time 8-Feb-2023 14:45



AEB CCRs | 30 km/h +75 % | Run 2

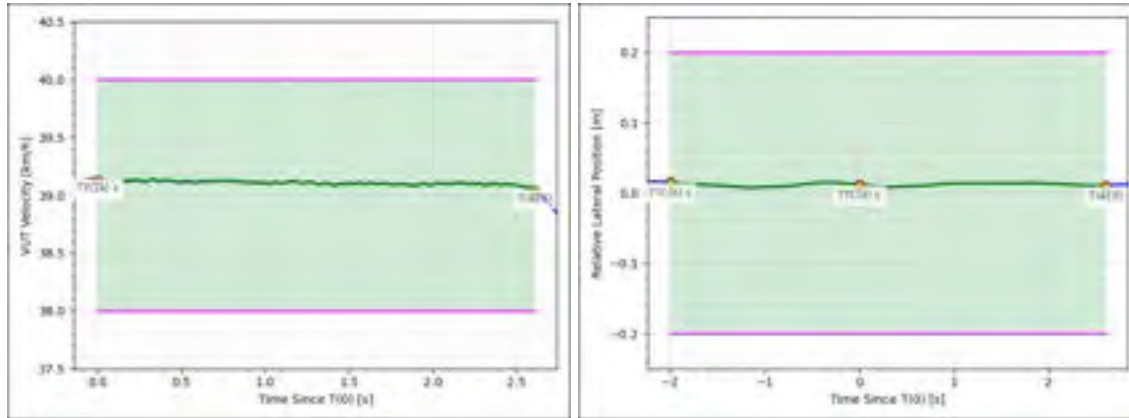
Run Date / Time 8-Feb-2023 14:48



1.1.1.7. AEB CCRs 40 kph +100 %

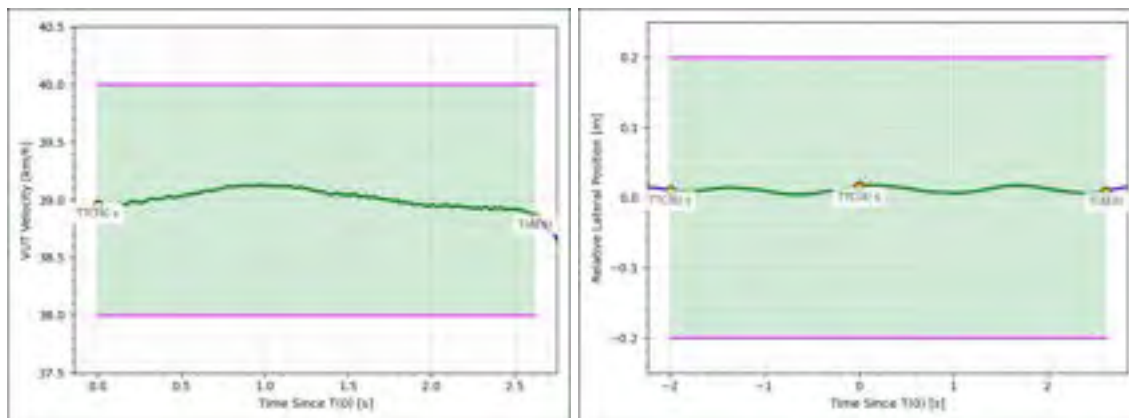
AEB CCRs | 40 km/h +100 % | Run 1

Run Date / Time 8-Feb-2023 13:06



AEB CCRs | 40 km/h +100 % | Run 2

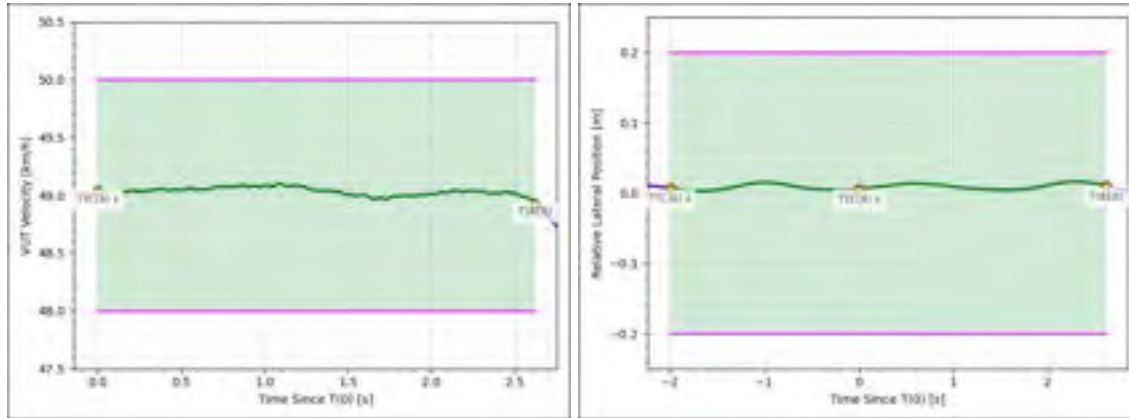
Run Date / Time 8-Feb-2023 13:08



1.1.1.8. AEB CCRs 50 kph +100 %

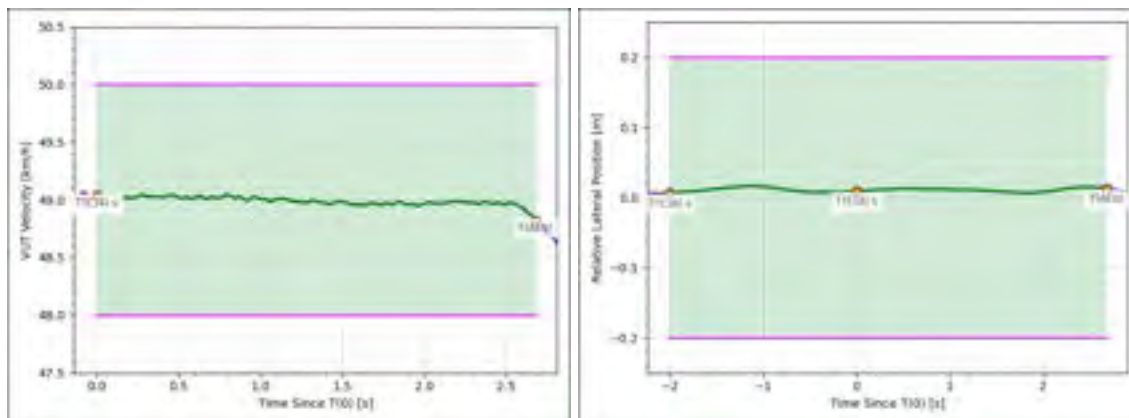
AEB CCRs | 50 km/h +100 % | Run 1

Run Date / Time 8-Feb-2023 13:13



AEB CCRs | 50 km/h +100 % | Run 2

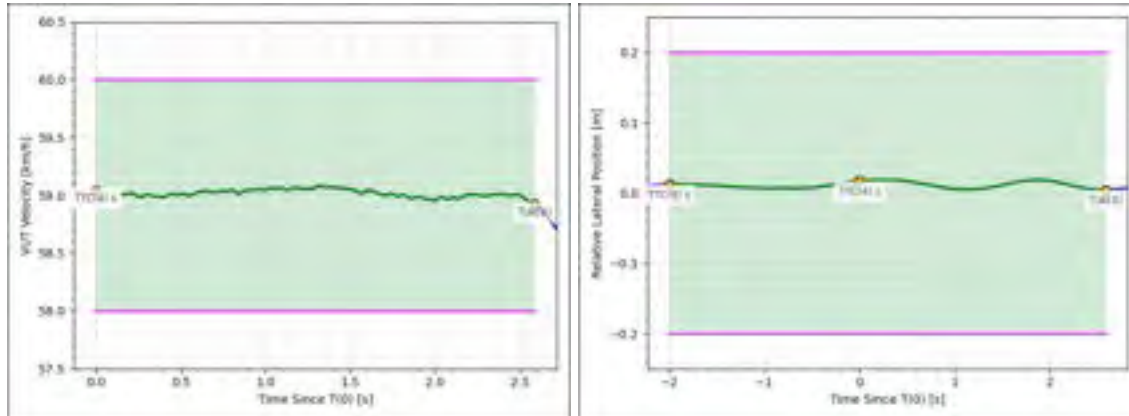
Run Date / Time 8-Feb-2023 13:15



1.1.1.9. AEB CCRs 60 kph +100 %

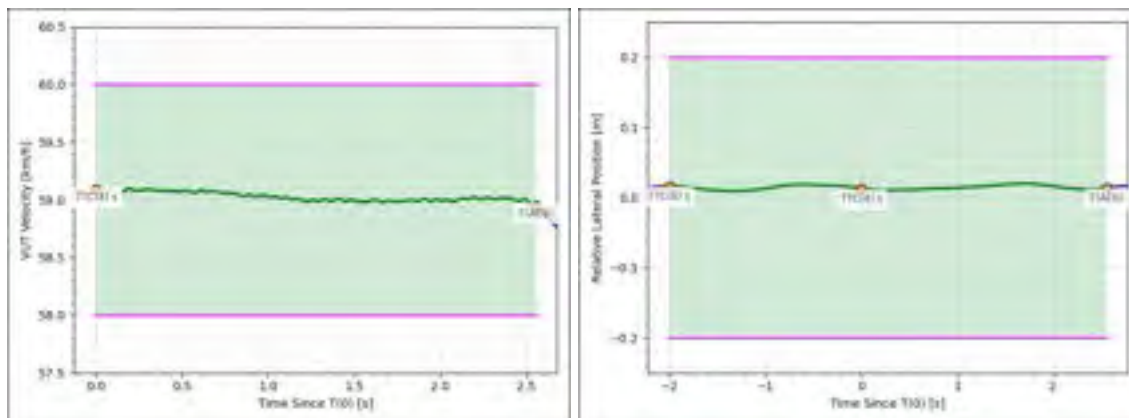
AEB CCRs | 60 km/h +100 % | Run 1

Run Date / Time 8-Feb-2023 13:20



AEB CCRs | 60 km/h +100 % | Run 2

Run Date / Time 8-Feb-2023 13:22

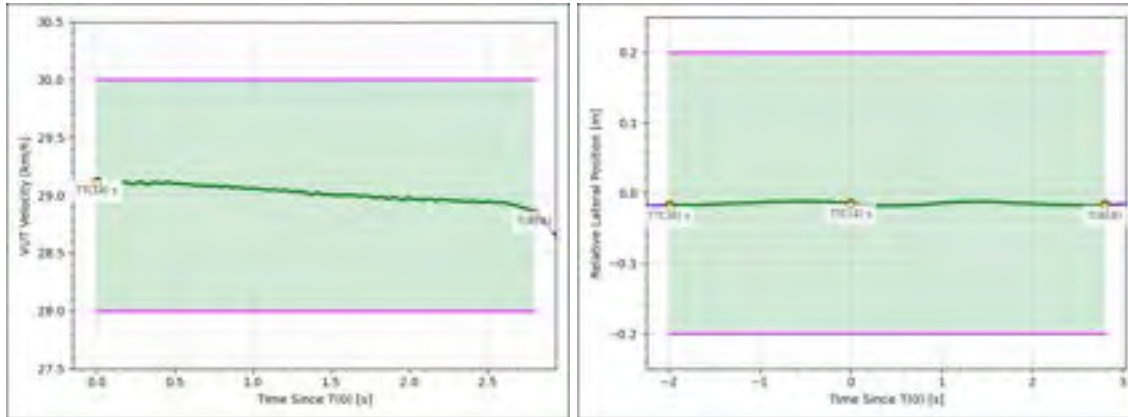


I.1.1. GVM

I.1.1.1. AEB CCRs 30 kph -75 %

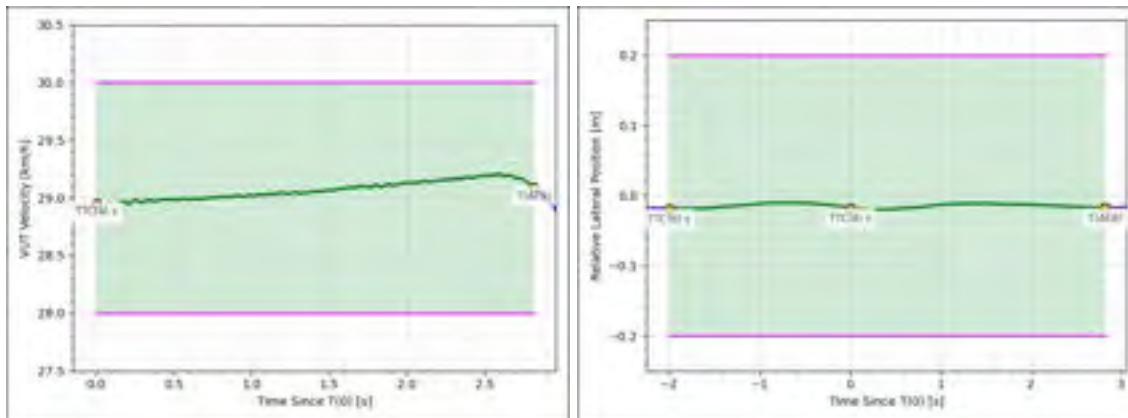
AEB CCRs | 30 km/h -75 % | Run 3

Run Date / Time 16-Feb-2023 13:36



AEB CCRs | 30 km/h -75 % | Run 4

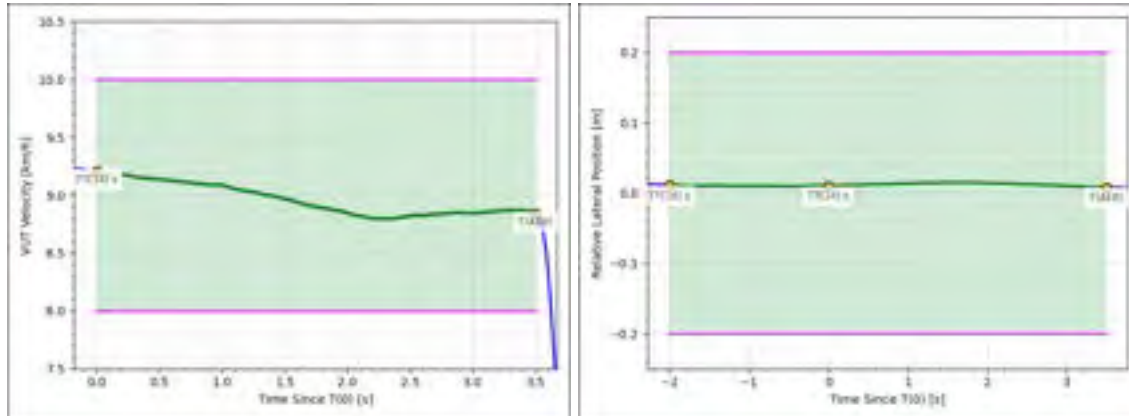
Run Date / Time 16-Feb-2023 13:38



I.1.1.2. AEB CCRs 10 kph +100 %

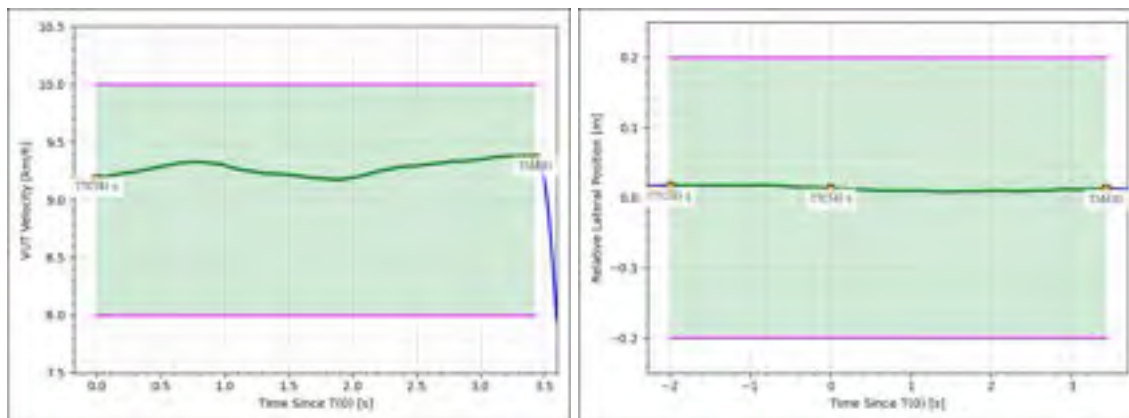
AEB CCRs | 10 km/h 100 % | Run 6

Run Date / Time 16-Feb-2023 13:19



AEB CCRs | 10 km/h 100 % | Run 7

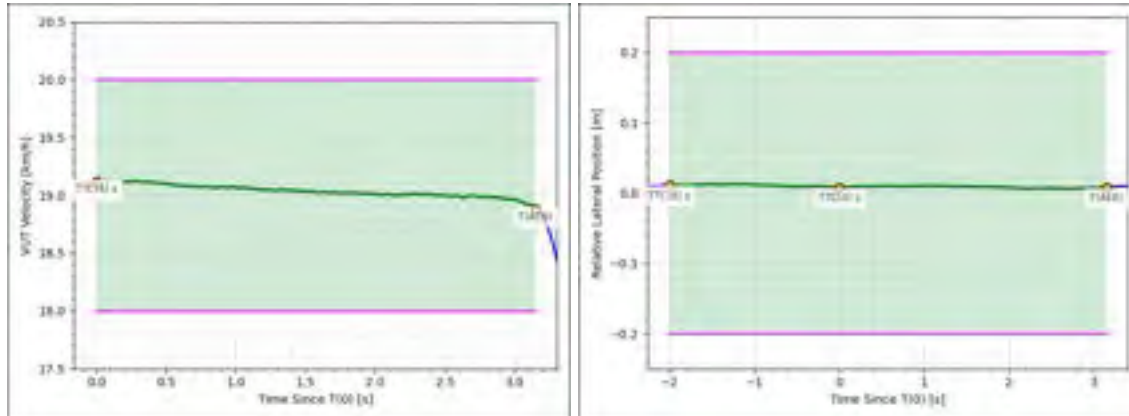
Run Date / Time 16-Feb-2023 13:23



I.1.1.3. AEB CCRs 20 kph +100 %

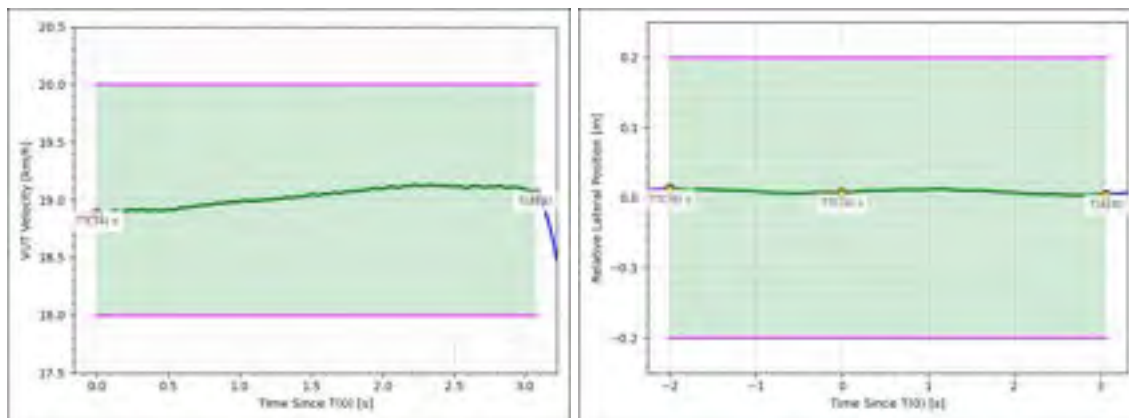
AEB CCRs | 20 km/h +100 % | Run 3

Run Date / Time 16-Feb-2023 13:13



AEB CCRs | 20 km/h +100 % | Run 4

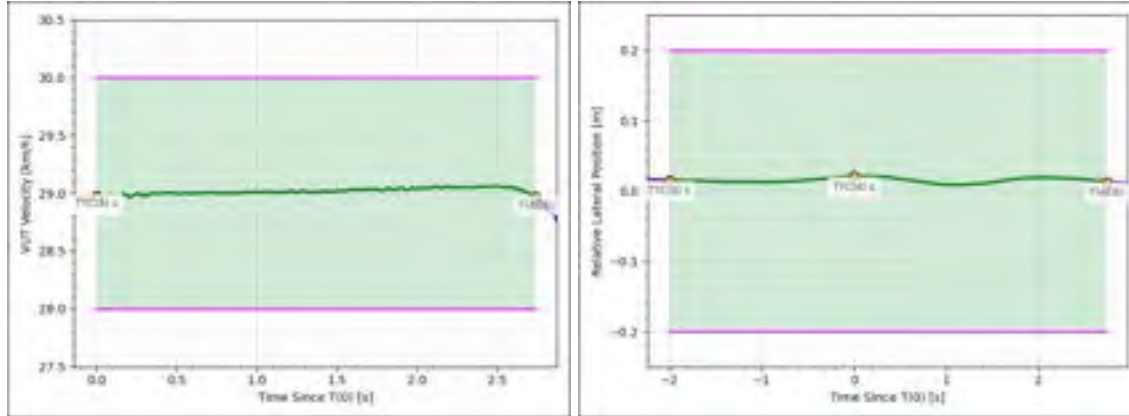
Run Date / Time 16-Feb-2023 13:16



I.1.1.4. AEB CCRs 30 kph +100 %

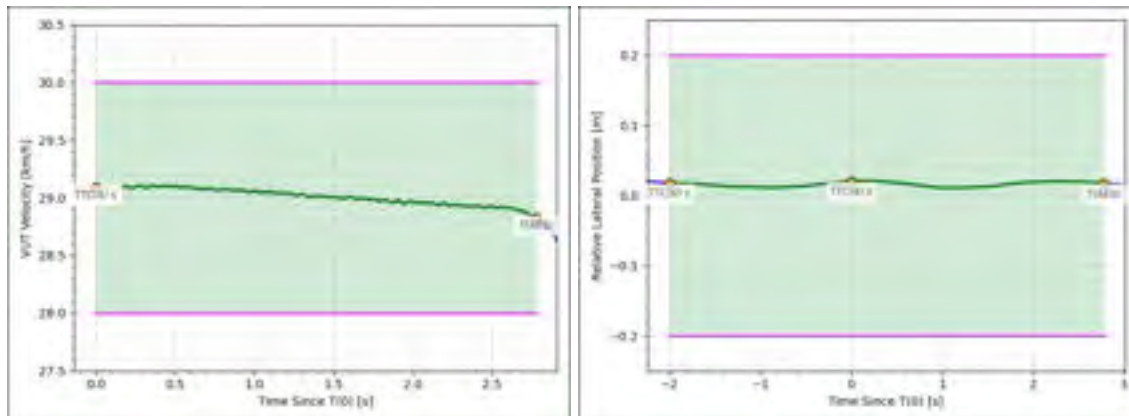
AEB CCRs | 30 km/h +100 % | Run 3

Run Date / Time 16-Feb-2023 13:27



AEB CCRs | 30 km/h +100 % | Run 4

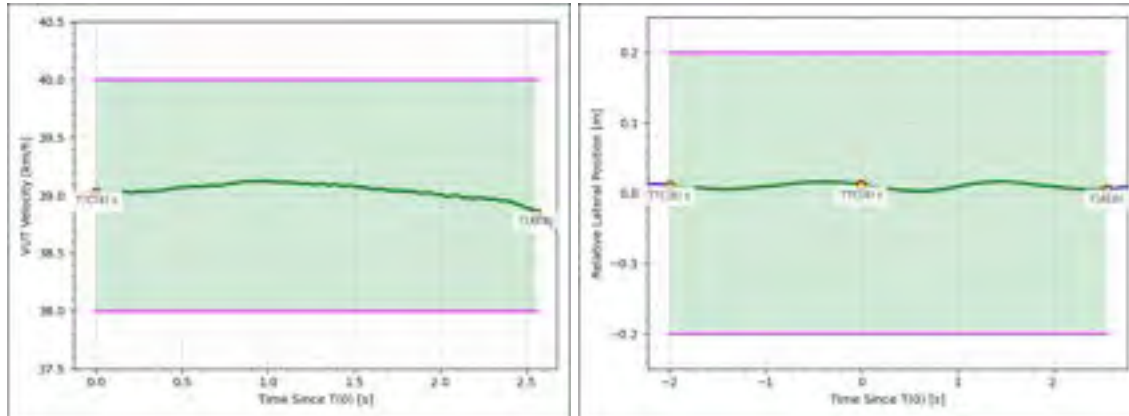
Run Date / Time 16-Feb-2023 13:30



1.1.1.5. AEB CCRs 40 kph +100 %

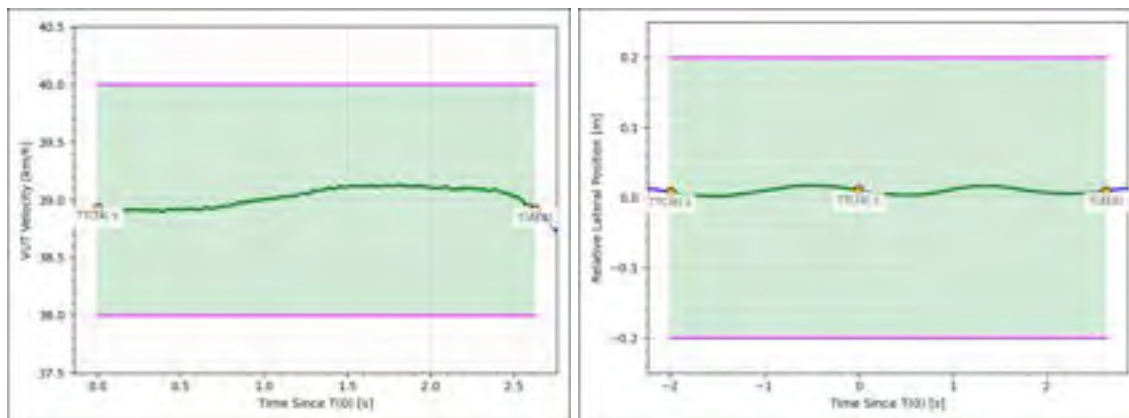
AEB CCRs | 40 km/h +100 % | Run 3

Run Date / Time 16-Feb-2023 13:48



AEB CCRs | 40 km/h +100 % | Run 4

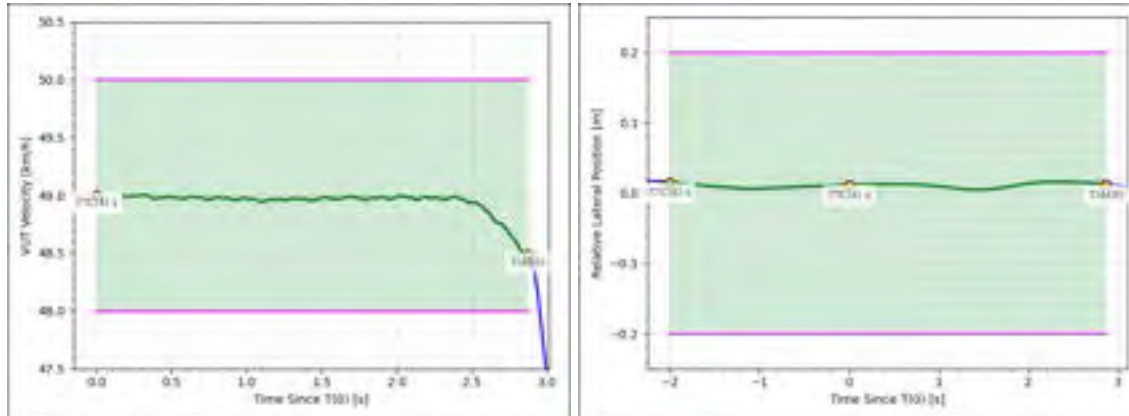
Run Date / Time 16-Feb-2023 13:51



1.1.1.6. AEB CCRs 50 kph +100 %

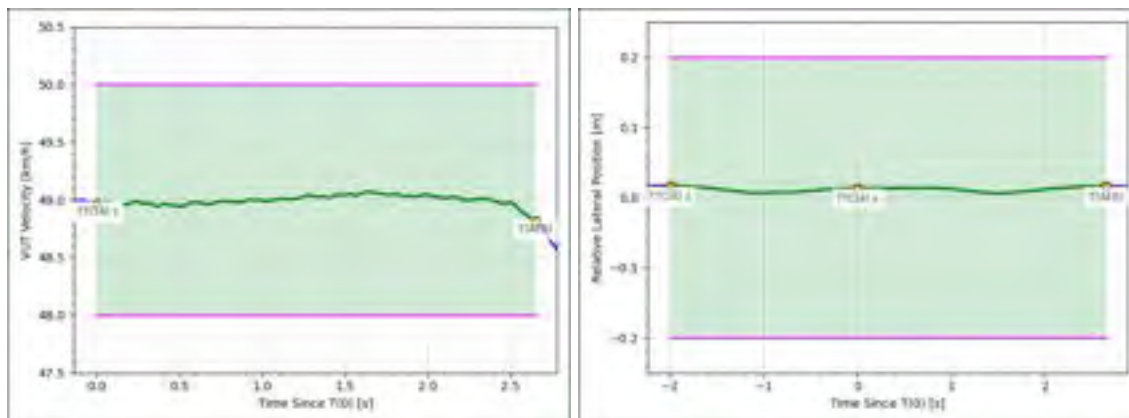
AEB CCRs | 50 km/h +100 % | Run 3

Run Date / Time 16-Feb-2023 13:55



AEB CCRs | 50 km/h +100 % | Run 4

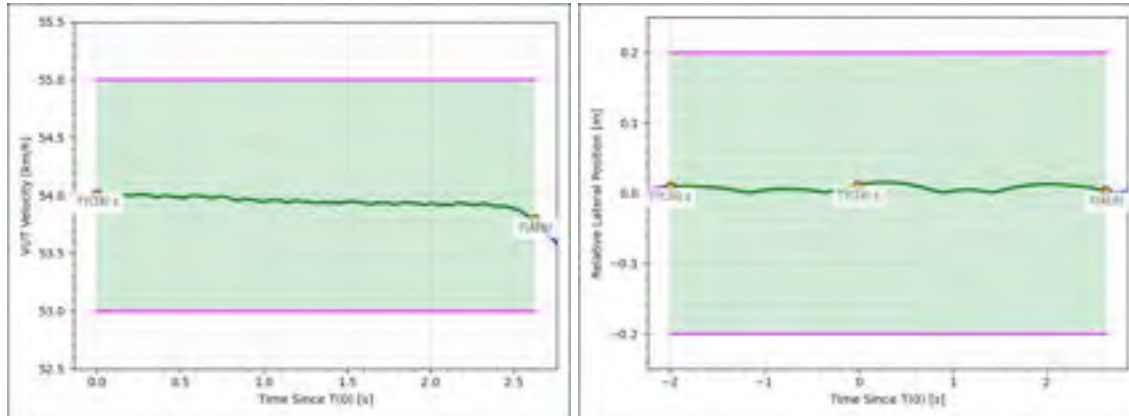
Run Date / Time 16-Feb-2023 13:58



1.1.1.7. AEB CCRs 55 kph +100 %

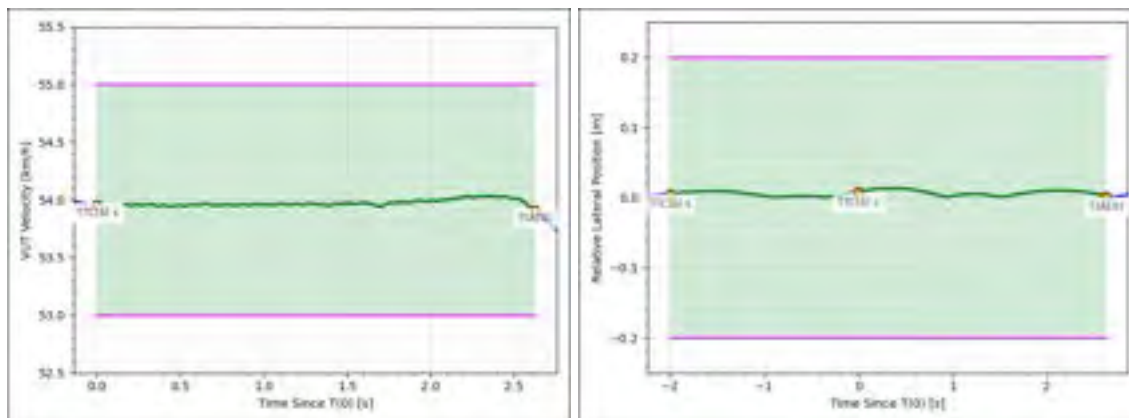
AEB CCRs | 55 km/h +100 % | Run 1

Run Date / Time 16-Feb-2023 14:16



AEB CCRs | 55 km/h +100 % | Run 2

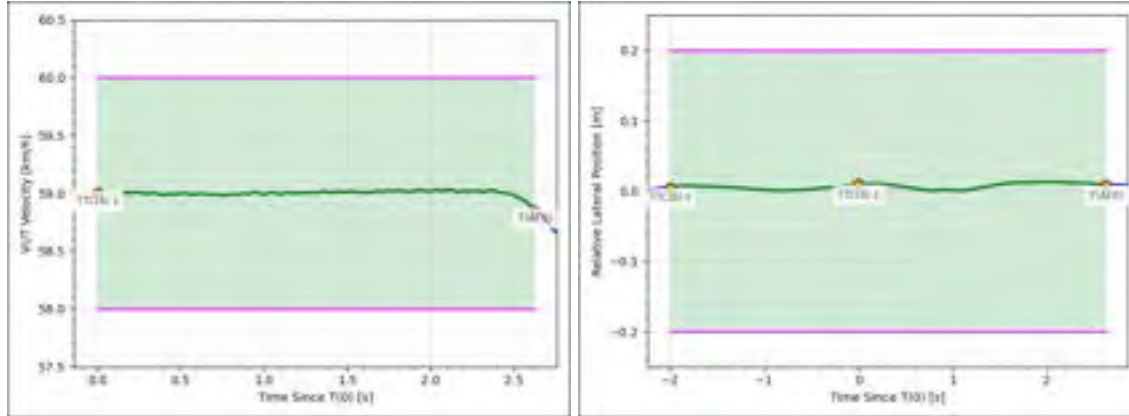
Run Date / Time 16-Feb-2023 14:19



1.1.1.8. AEB CCRs 60 kph +100 %

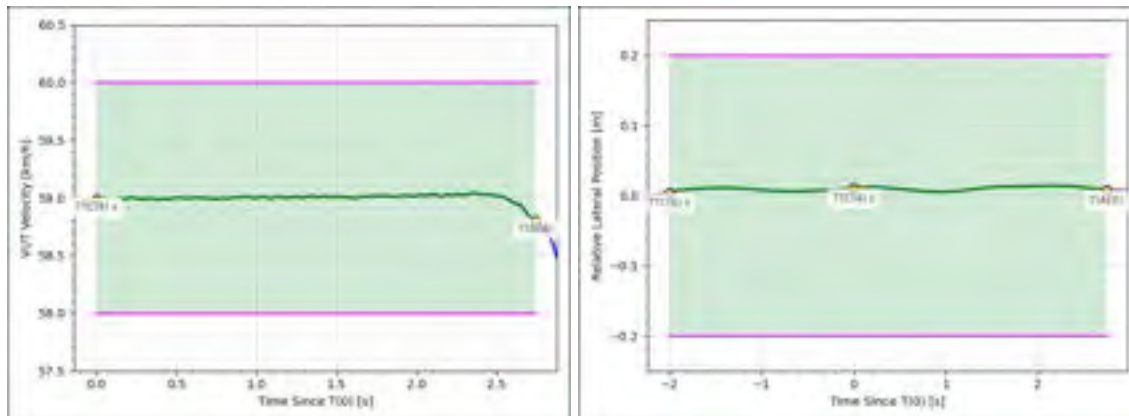
AEB CCRs | 60 km/h +100 % | Run 3

Run Date / Time 16-Feb-2023 14:03



AEB CCRs | 60 km/h +100 % | Run 4

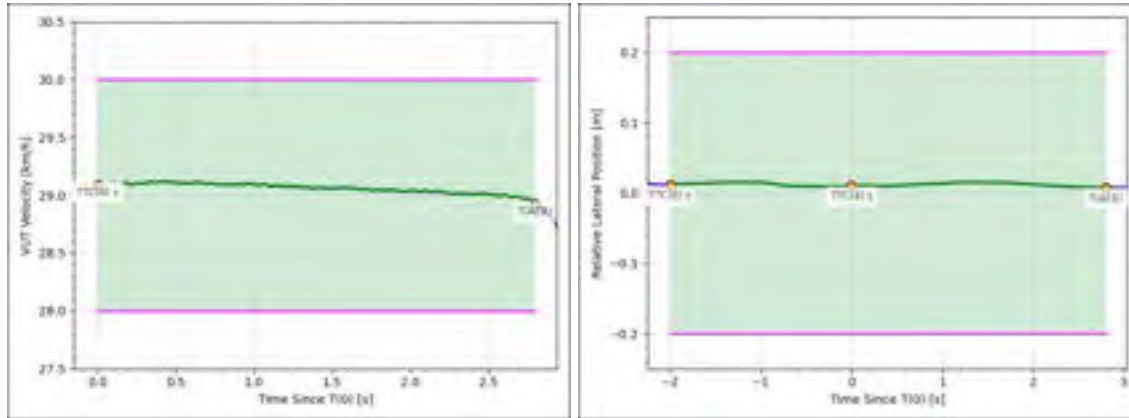
Run Date / Time 16-Feb-2023 14:10



I.1.1.9. AEB CCRs 30 kph +75 %

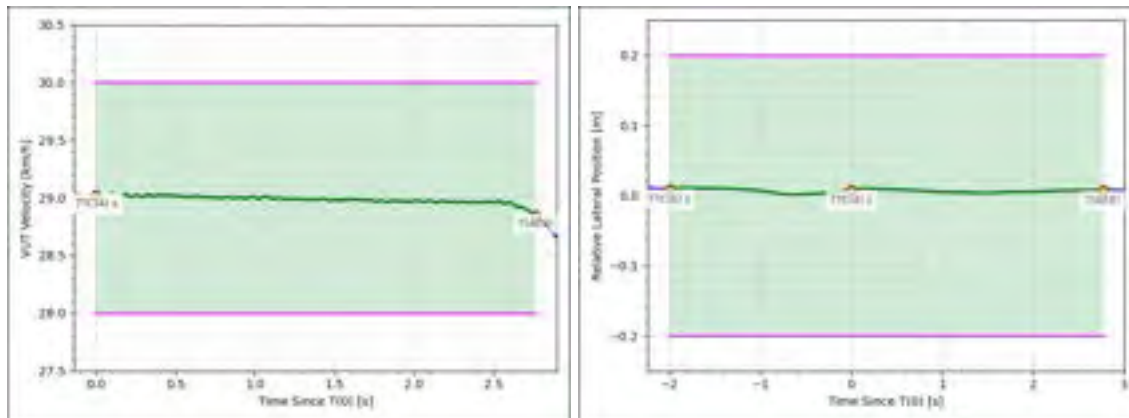
AEB CCRs | 30 km/h +75 % | Run 3

Run Date / Time 16-Feb-2023 13:41



AEB CCRs | 30 km/h +75 % | Run 4

Run Date / Time 16-Feb-2023 13:44

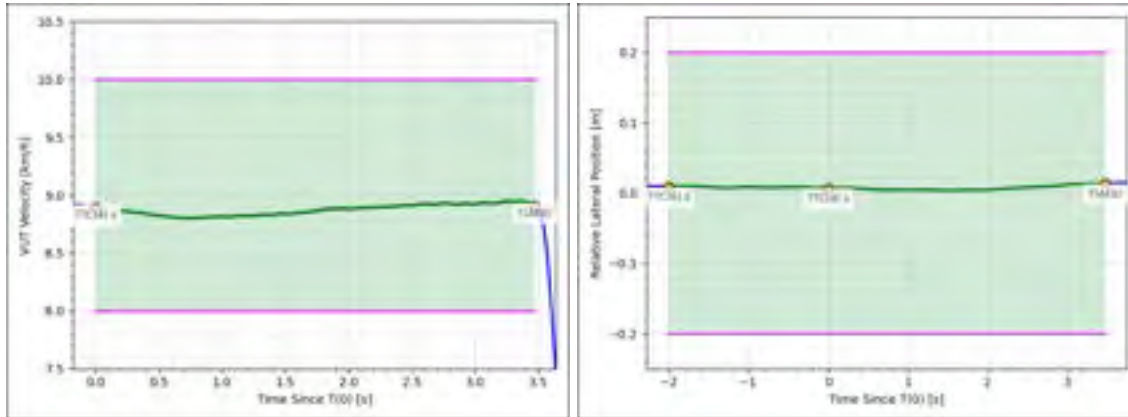


I.1.1. Rear Pitch

I.1.1.1. AEB CCRs 10 kph +100 %

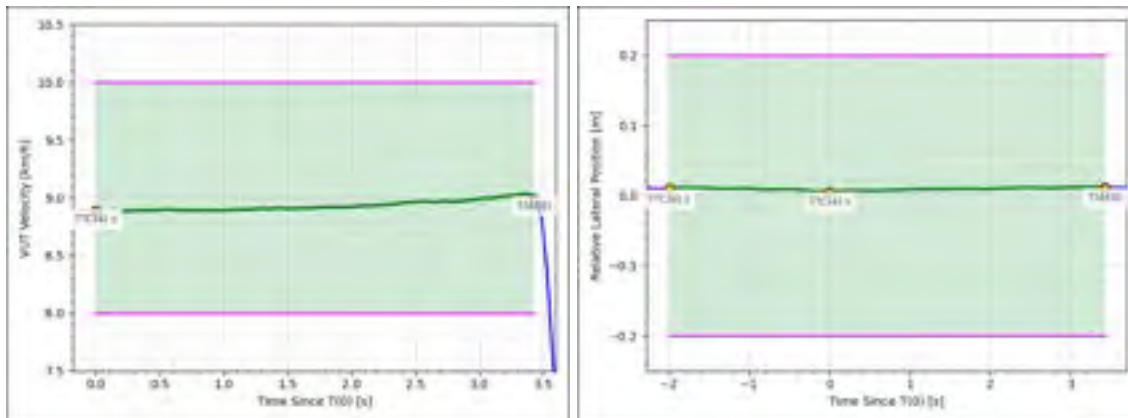
AEB CCRs | 10 km/h 100 % | Run 8

Run Date / Time 23-Feb-2023 11:43



AEB CCRs | 10 km/h 100 % | Run 9

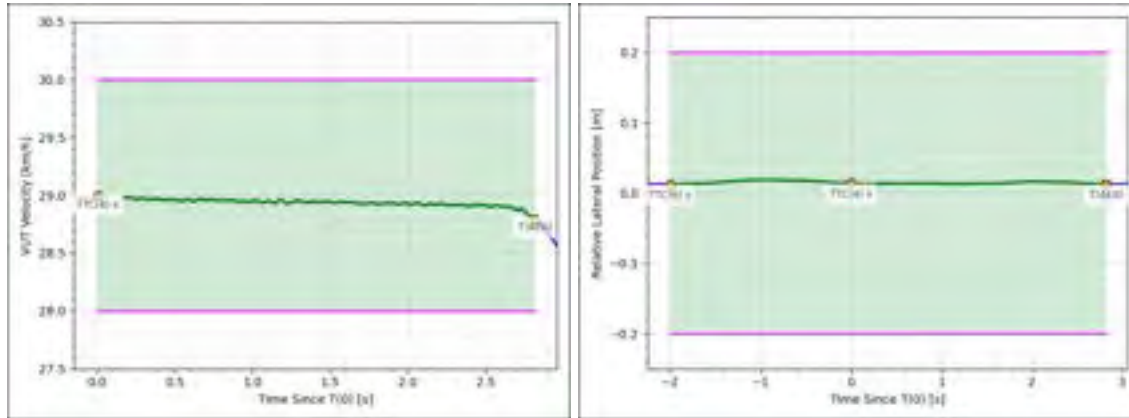
Run Date / Time 23-Feb-2023 11:47



1.1.1.2. AEB CCRs 30 kph -75 %

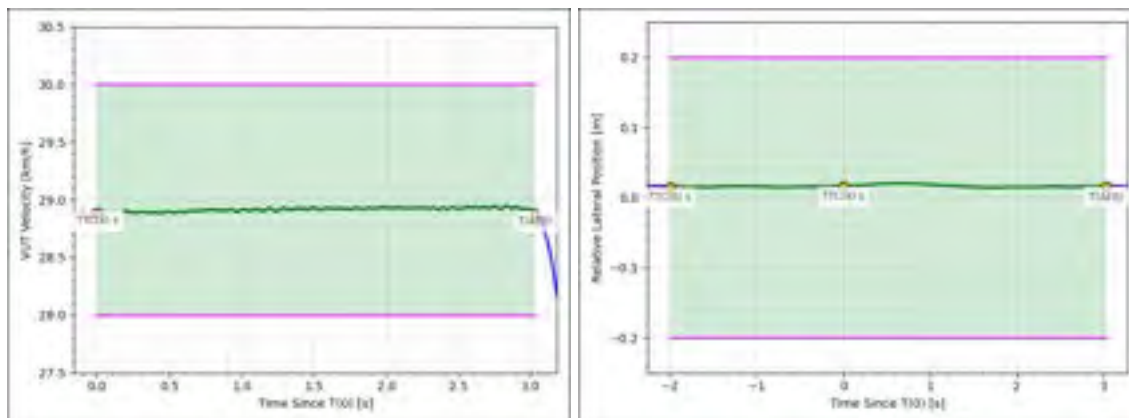
AEB CCRs | 30 km/h -75 % | Run 5

Run Date / Time 23-Feb-2023 13:13



AEB CCRs | 30 km/h -75 % | Run 6

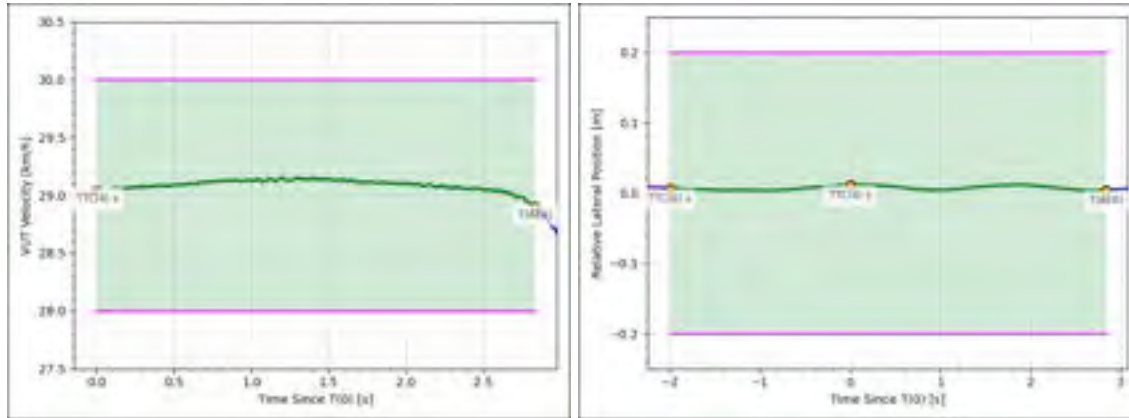
Run Date / Time 23-Feb-2023 13:16



1.1.1.3. AEB CCRs 30 kph +100 %

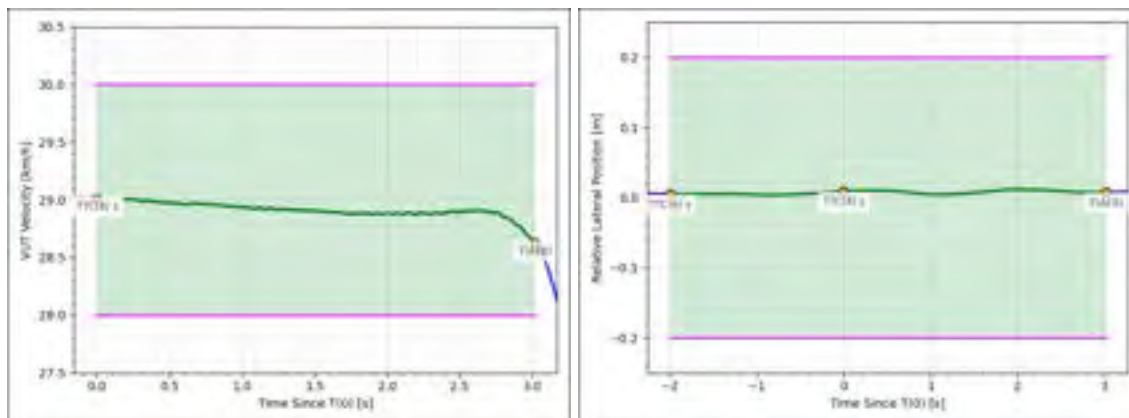
AEB CCRs | 30 km/h +100 % | Run 5

Run Date / Time 23-Feb-2023 12:43



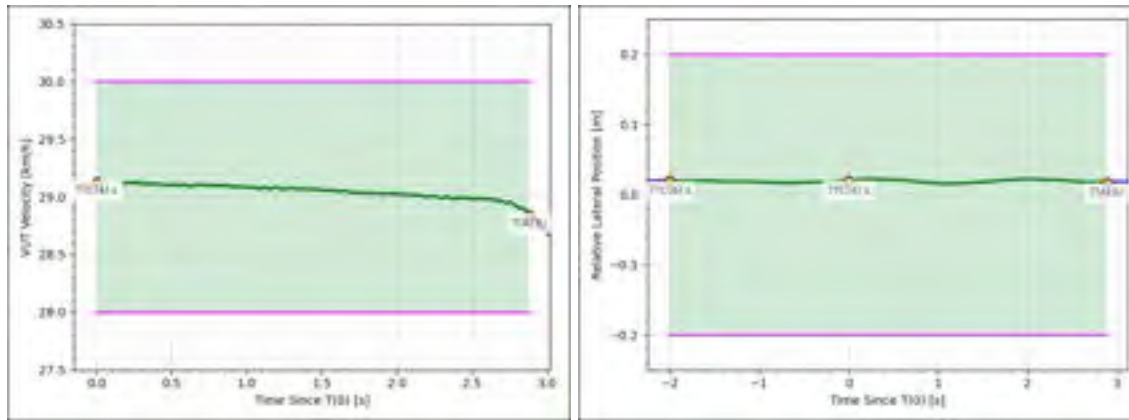
AEB CCRs | 30 km/h +100 % | Run 6

Run Date / Time 23-Feb-2023 12:46



AEB CCRs | 30 km/h +100 % | Run 7

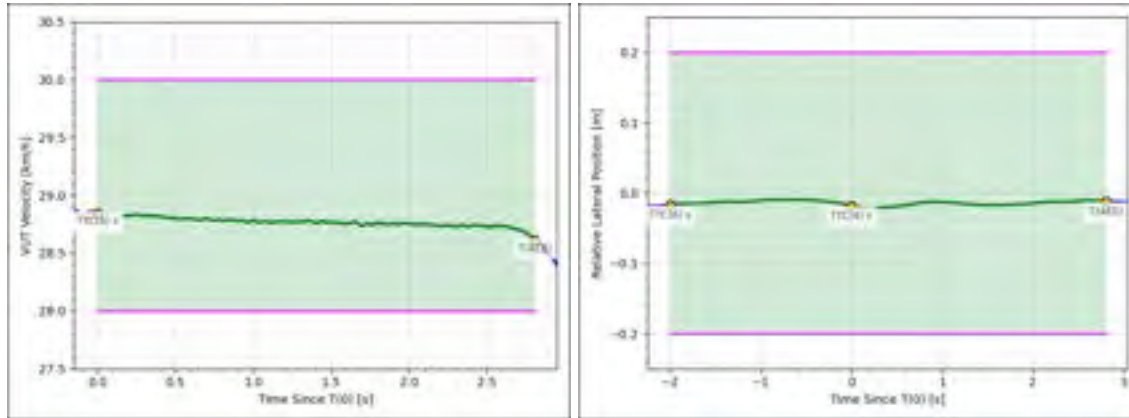
Run Date / Time 23-Feb-2023 12:54



1.1.1.4. AEB CCRs 30 kph +75 %

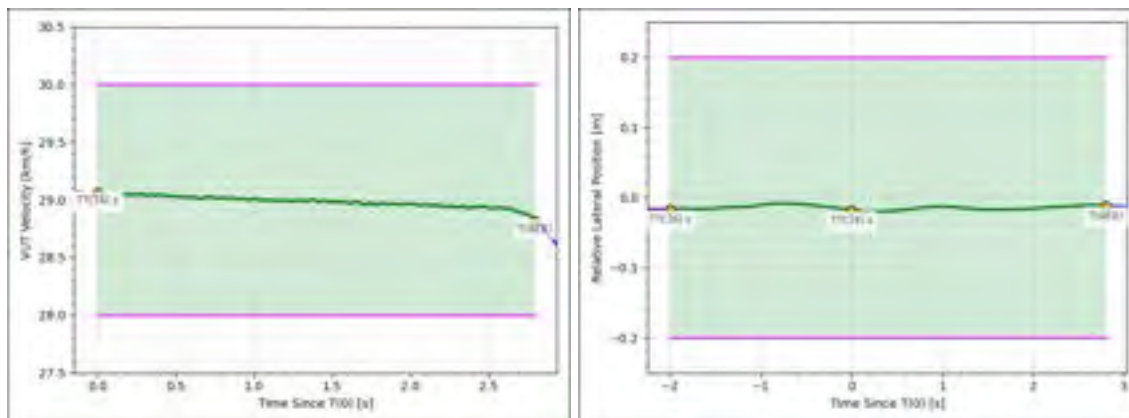
AEB CCRs | 30 km/h +75 % | Run 5

Run Date / Time 23-Feb-2023 13:20



AEB CCRs | 30 km/h +75 % | Run 6

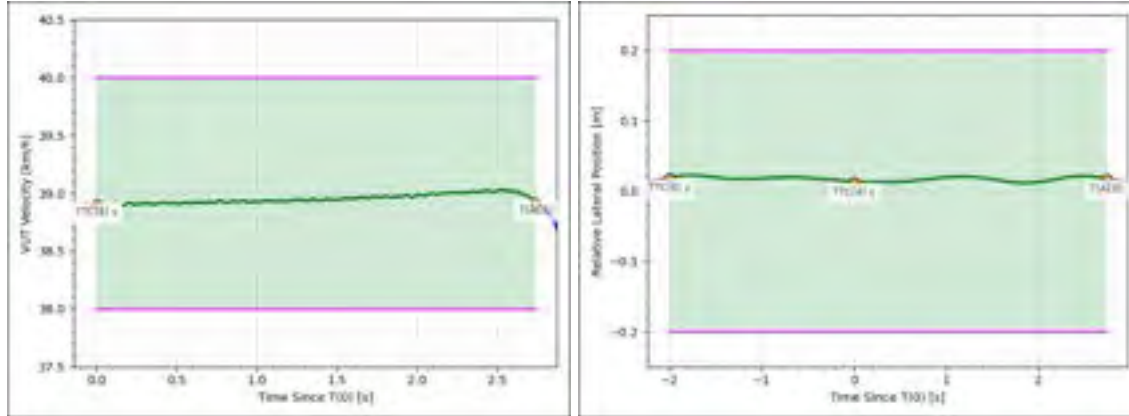
Run Date / Time 23-Feb-2023 13:22



1.1.1.5. AEB CCRs 40 kph +100 %

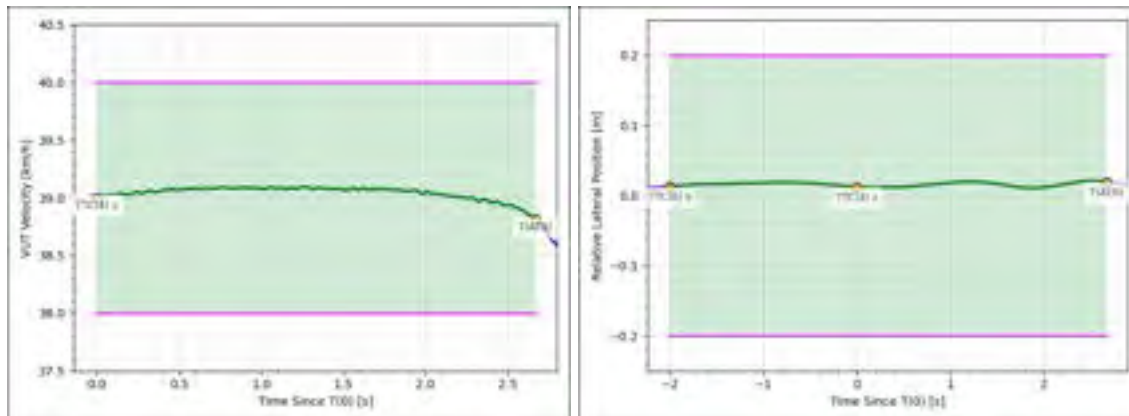
AEB CCRs | 40 km/h +100 % | Run 5

Run Date / Time 23-Feb-2023 13:06



AEB CCRs | 40 km/h +100 % | Run 6

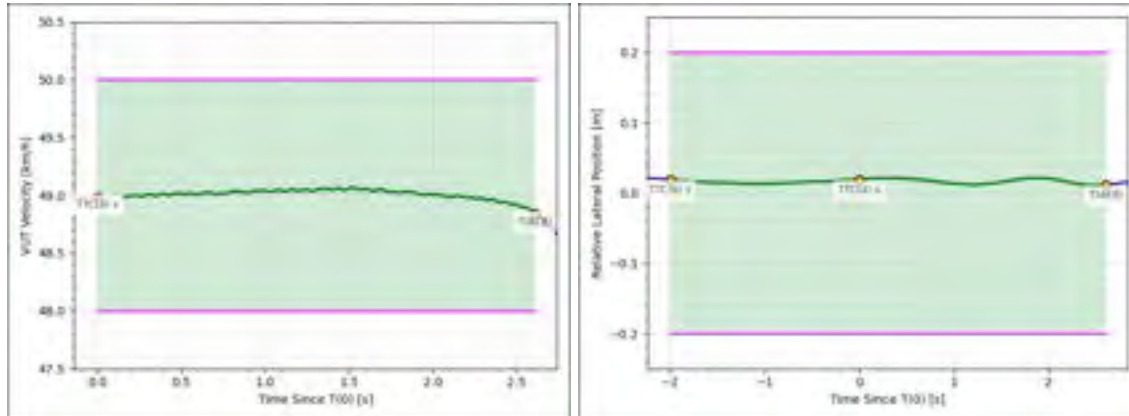
Run Date / Time 23-Feb-2023 13:09



1.1.1.6. AEB CCRs 50 kph +100 %

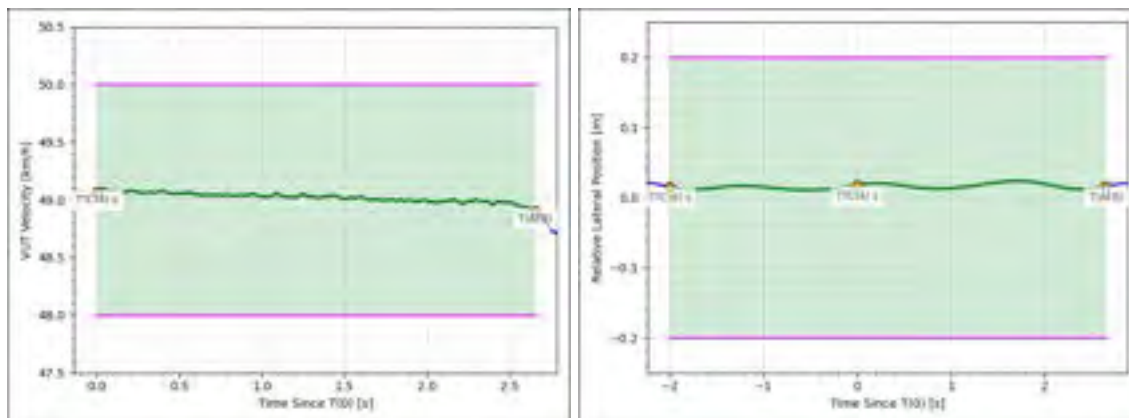
AEB CCRs | 50 km/h +100 % | Run 5

Run Date / Time 23-Feb-2023 13:26



AEB CCRs | 50 km/h +100 % | Run 6

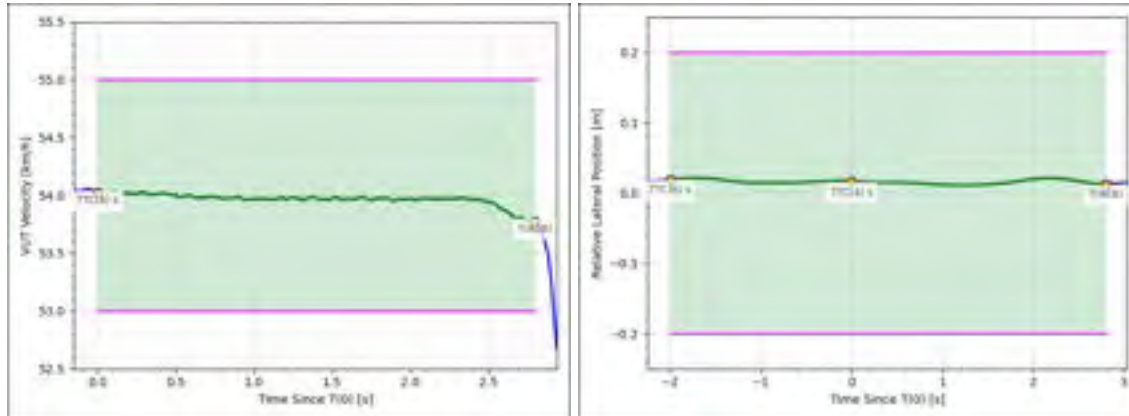
Run Date / Time 23-Feb-2023 13:29



1.1.1.7. AEB CCRs 55 kph +100 %

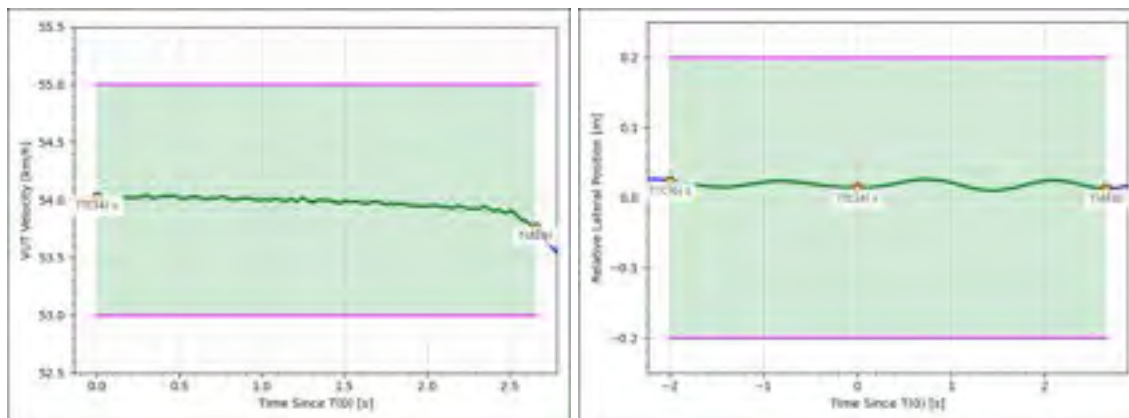
AEB CCRs | 55 km/h +100 % | Run 3

Run Date / Time 23-Feb-2023 13:33



AEB CCRs | 55 km/h +100 % | Run 4

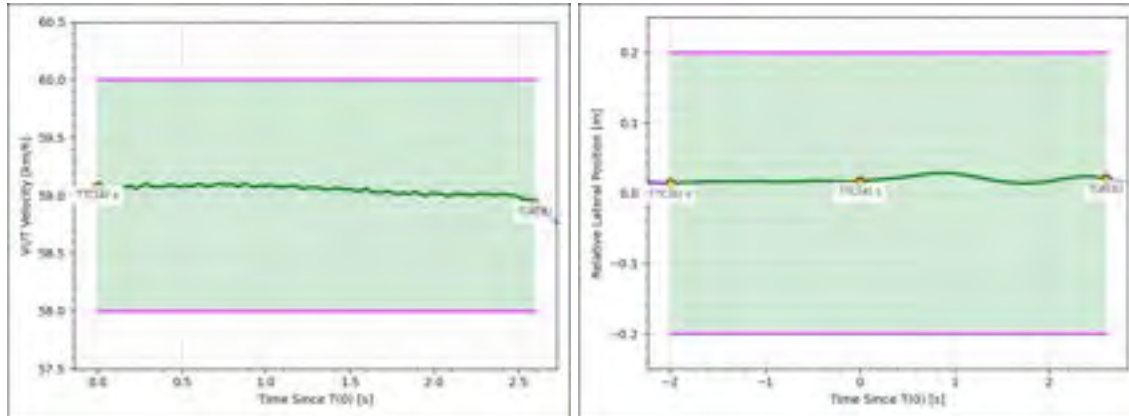
Run Date / Time 23-Feb-2023 13:35



1.1.1.8. AEB CCRs 60 kph +100 %

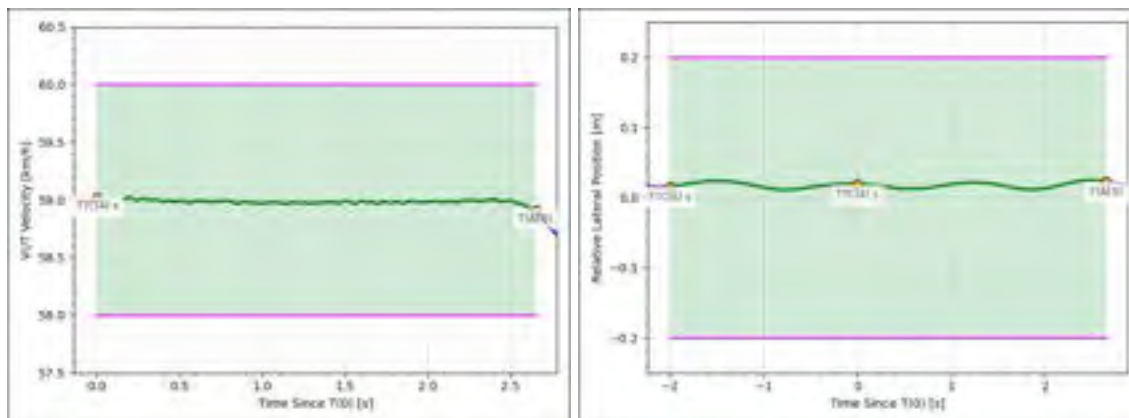
AEB CCRs | 60 km/h +100 % | Run 5

Run Date / Time 23-Feb-2023 13:39



AEB CCRs | 60 km/h +100 % | Run 6

Run Date / Time 23-Feb-2023 13:42

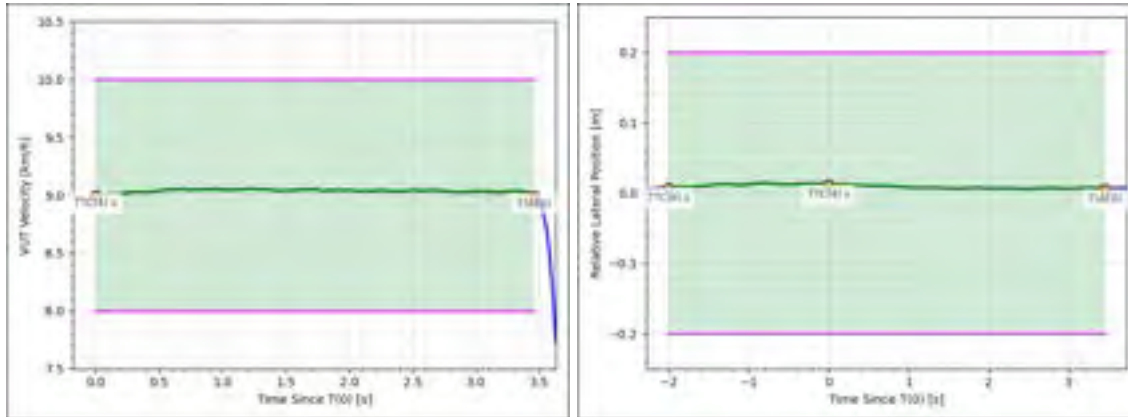


I.1.1. Lift Kit

I.1.1.1. AEB CCRs 10 kph +100 %

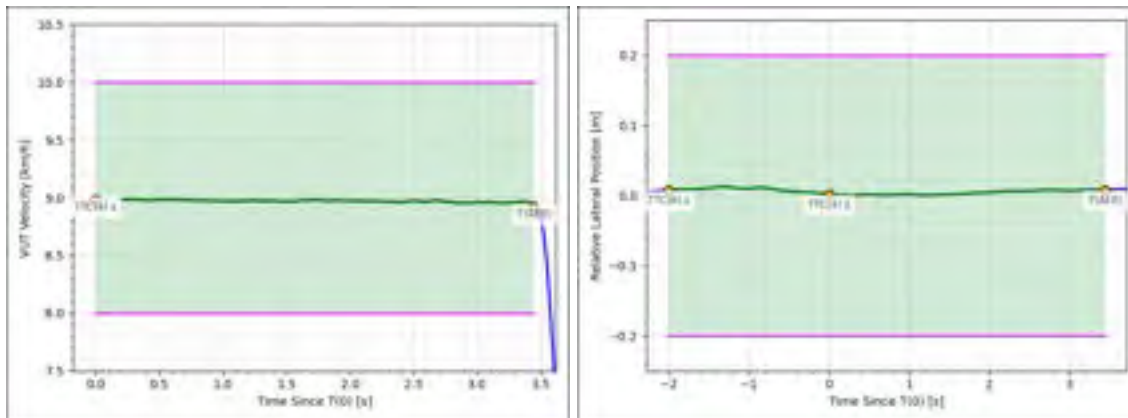
AEB CCRs | 10 km/h 100 % | Run 10

Run Date / Time 14-Mar-2023 14:40



AEB CCRs | 10 km/h 100 % | Run 11

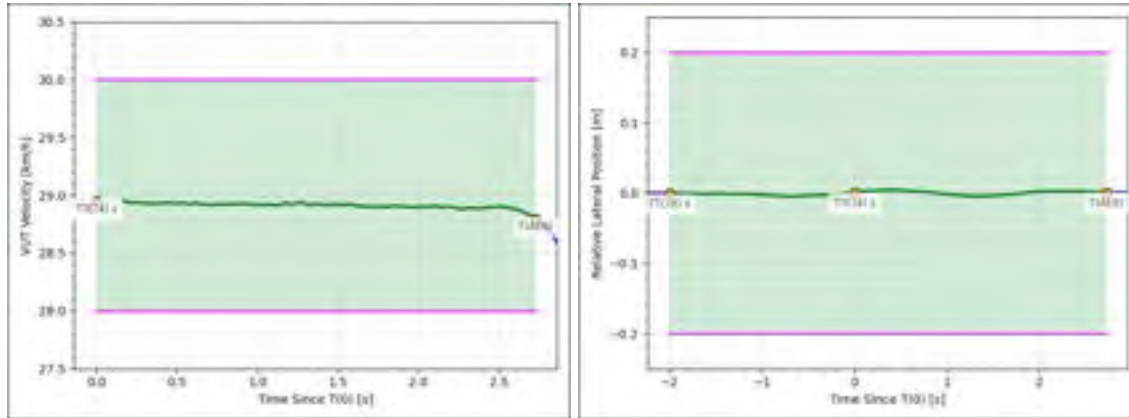
Run Date / Time 14-Mar-2023 14:44



1.1.1.2. AEB CCRs 30 kph -75 %

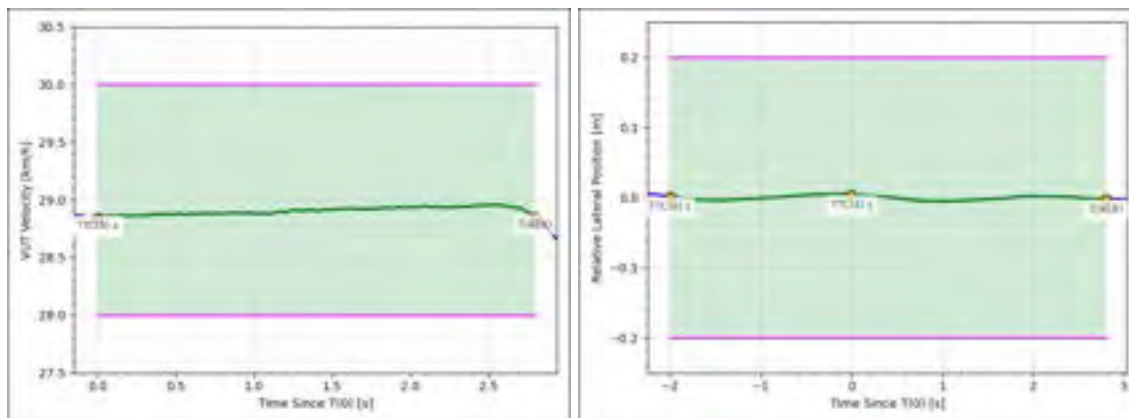
AEB CCRs | 30 km/h -75 % | Run 7

Run Date / Time 14-Mar-2023 14:56



AEB CCRs | 30 km/h -75 % | Run 8

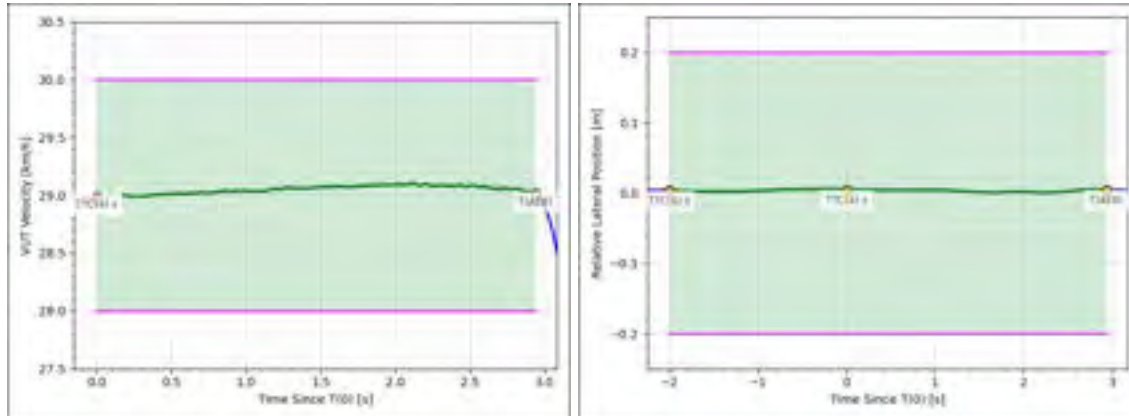
Run Date / Time 14-Mar-2023 14:58



I.1.1.3. AEB CCRs 30 kph +100 %

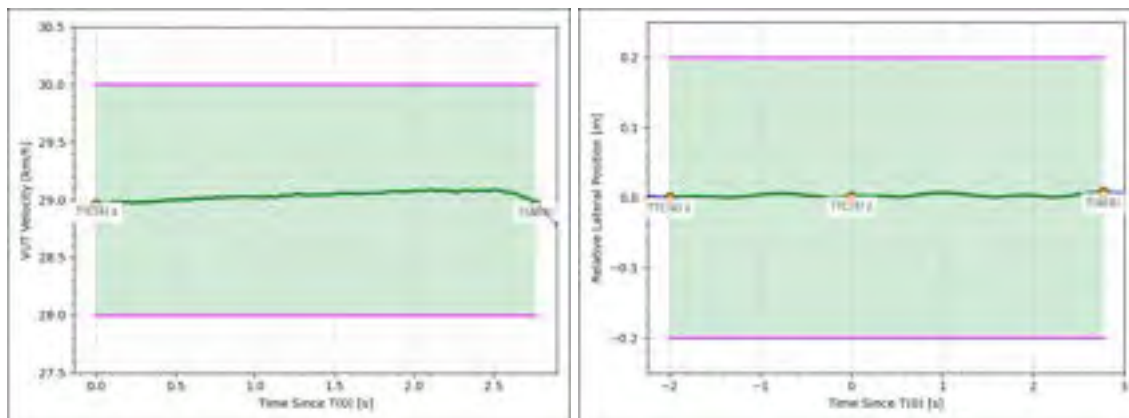
AEB CCRs | 30 km/h +100 % | Run 8

Run Date / Time 14-Mar-2023 14:50



AEB CCRs | 30 km/h +100 % | Run 9

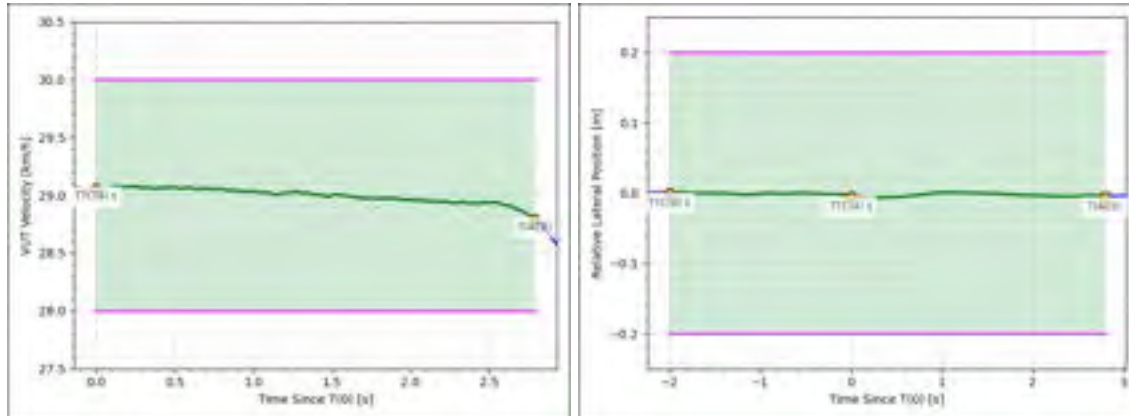
Run Date / Time 14-Mar-2023 14:52



1.1.1.4. AEB CCRs 30 kph +75 %

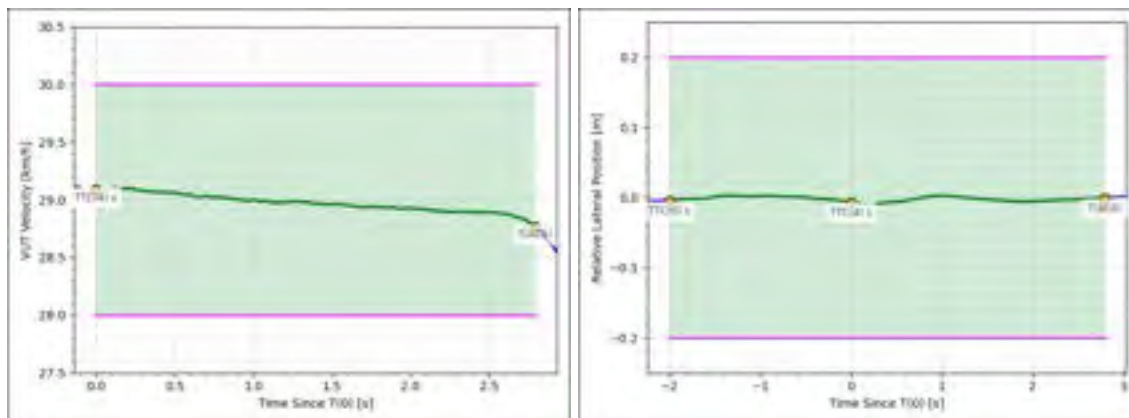
AEB CCRs | 30 km/h +75 % | Run 7

Run Date / Time 14-Mar-2023 15:03



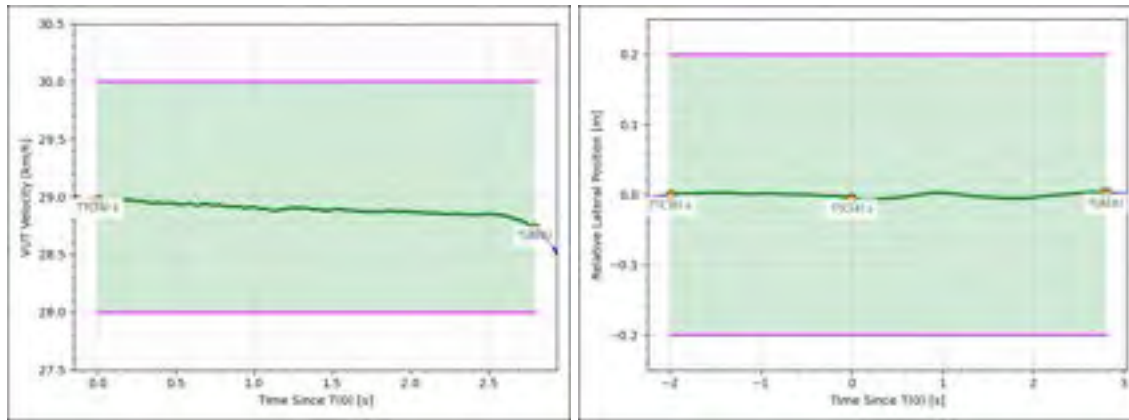
AEB CCRs | 30 km/h +75 % | Run 8

Run Date / Time 14-Mar-2023 15:05



AEB CCRs | 30 km/h +75 % | Run 9

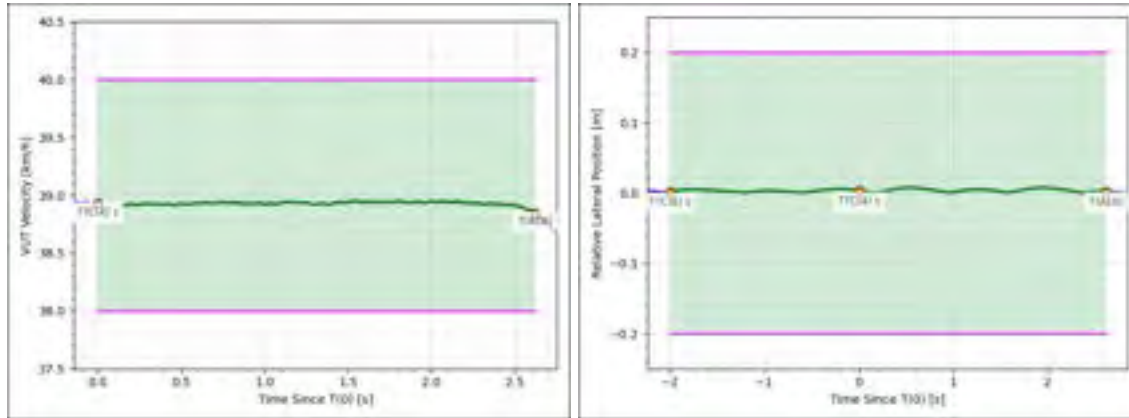
Run Date / Time 14-Mar-2023 15:08



1.1.1.5. AEB CCRs 40 kph +100 %

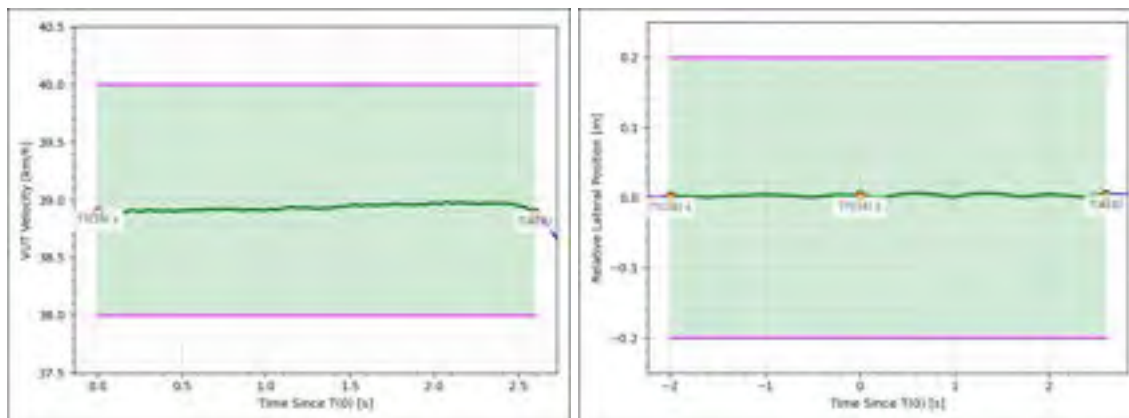
AEB CCRs | 40 km/h +100 % | Run 7

Run Date / Time 14-Mar-2023 15:12



AEB CCRs | 40 km/h +100 % | Run 8

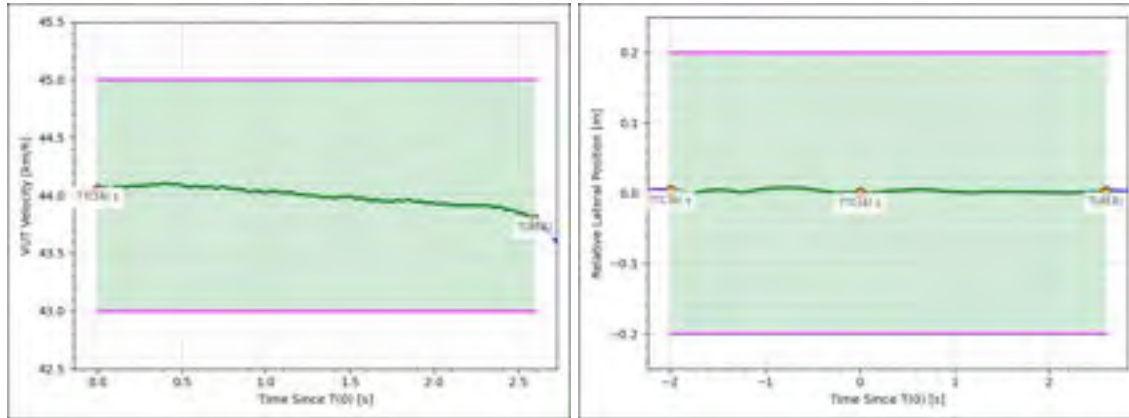
Run Date / Time 14-Mar-2023 15:14



1.1.1.6. AEB CCRs 45 kph +100 %

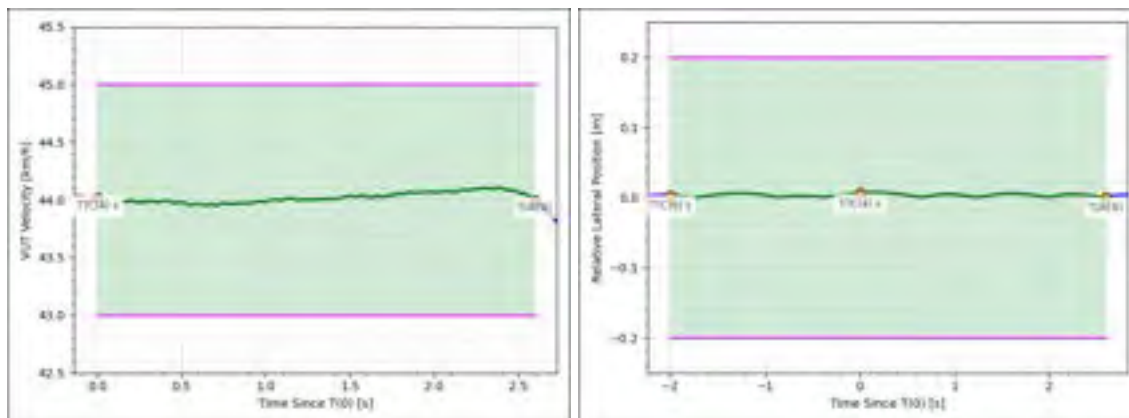
AEB CCRs | 45 km/h +100 % | Run 1

Run Date / Time 14-Mar-2023 15:19



AEB CCRs | 45 km/h +100 % | Run 2

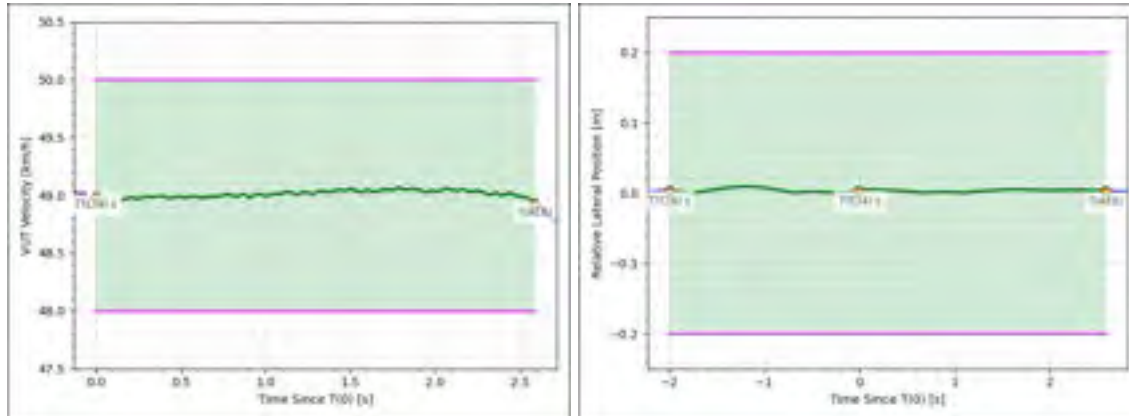
Run Date / Time 14-Mar-2023 15:21



1.1.1.7. AEB CCRs 50 kph +100 %

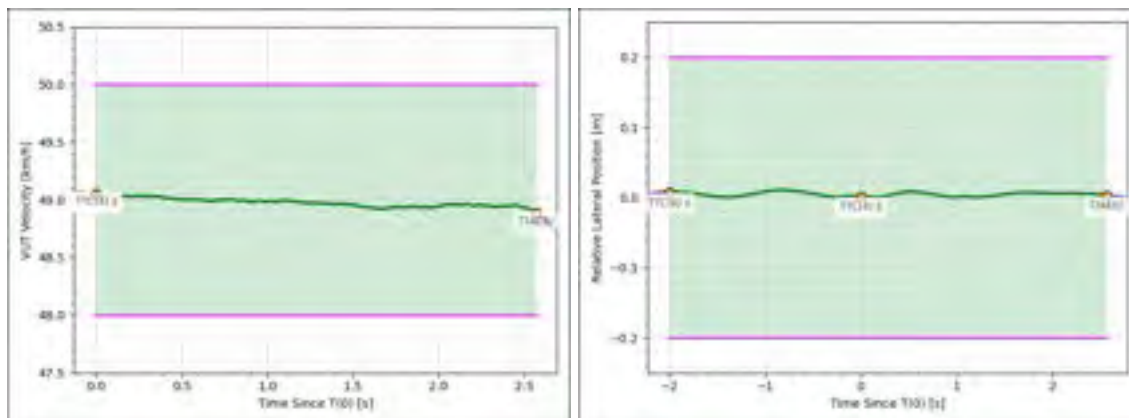
AEB CCRs | 50 km/h +100 % | Run 7

Run Date / Time 14-Mar-2023 15:24



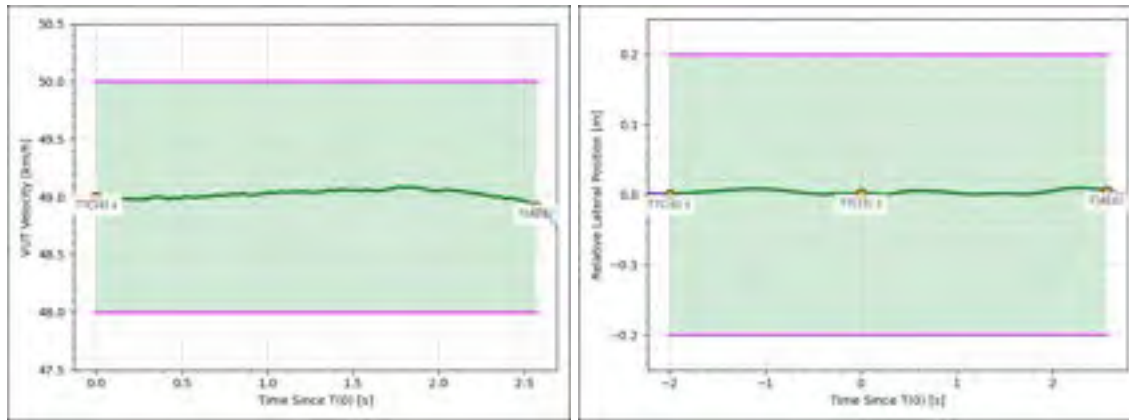
AEB CCRs | 50 km/h +100 % | Run 8

Run Date / Time 14-Mar-2023 15:27



AEB CCRs | 50 km/h +100 % | Run 9

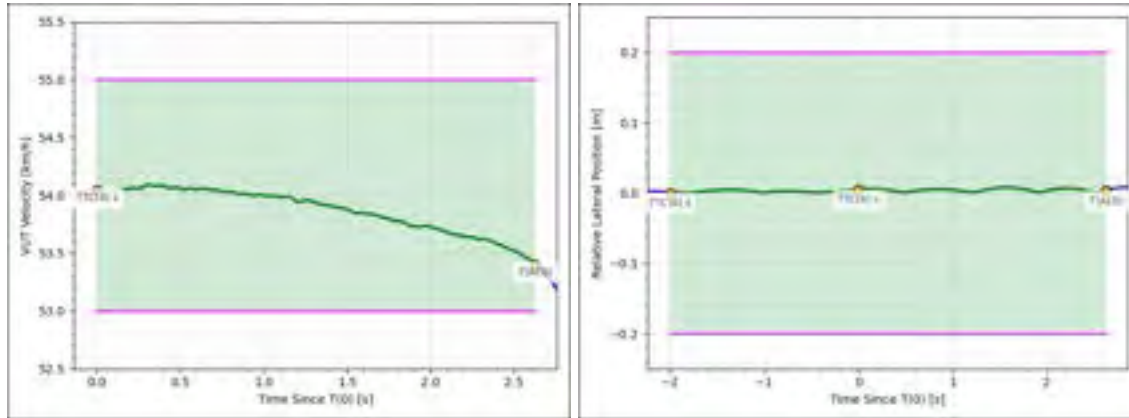
Run Date / Time 14-Mar-2023 15:30



I.1.1.8. AEB CCRs 55 kph +100 %

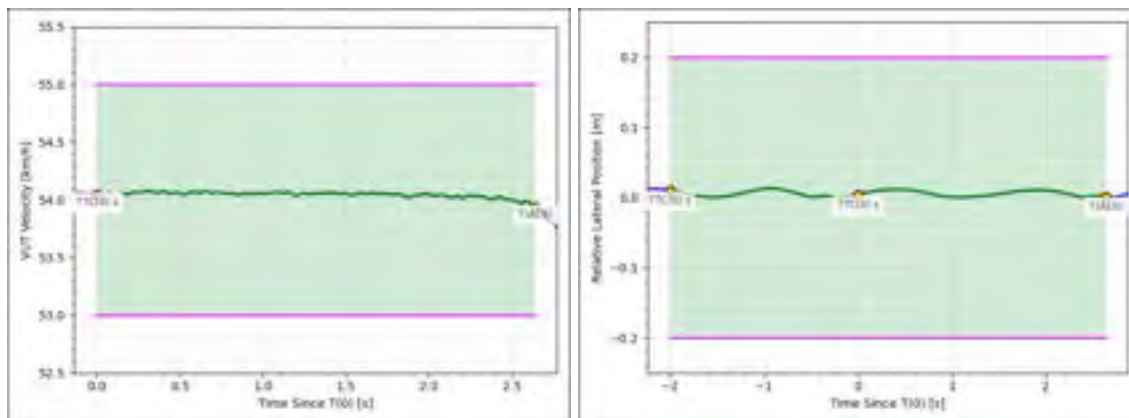
AEB CCRs | 55 km/h +100 % | Run 5

Run Date / Time 14-Mar-2023 15:38



AEB CCRs | 55 km/h +100 % | Run 6

Run Date / Time 14-Mar-2023 15:45

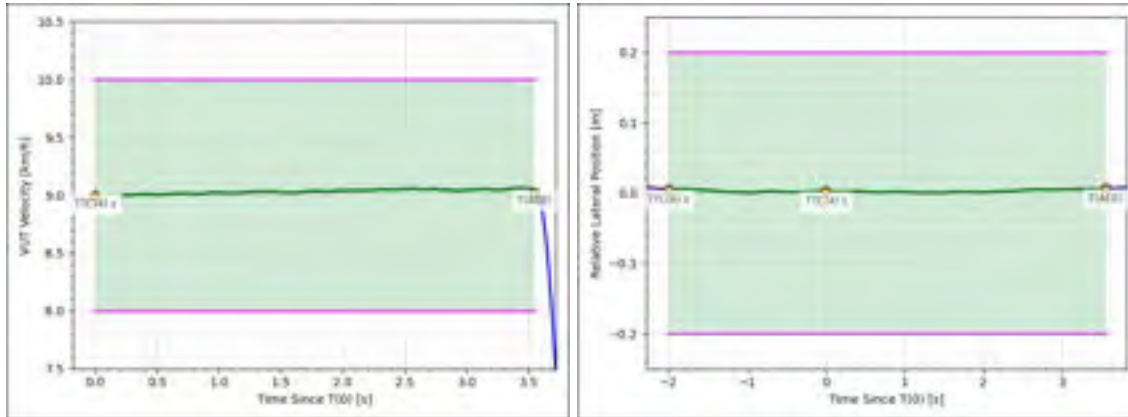


I.1.1. Lift Kit + Bullbar

I.1.1.1. AEB CCRs 10 kph +100 %

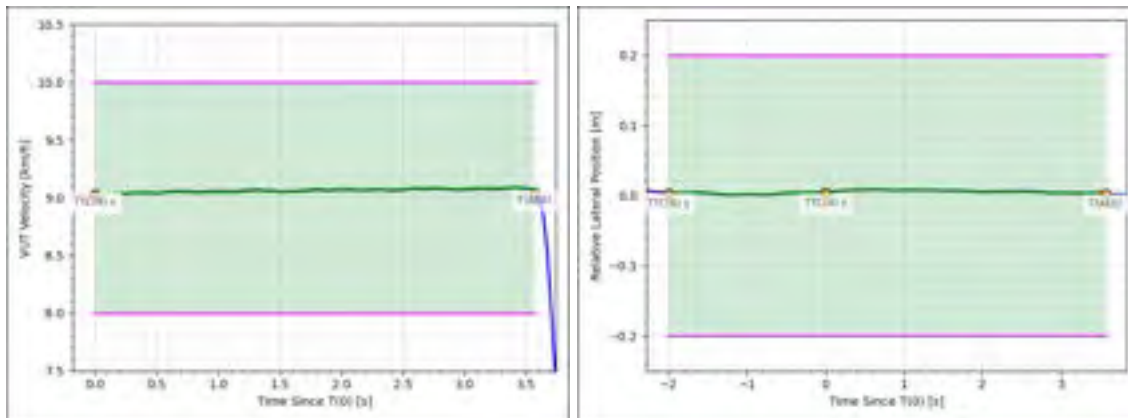
AEB CCRs | 10 km/h 100 % | Run 1

Run Date / Time 23-Mar-2023 11:54



AEB CCRs | 10 km/h 100 % | Run 2

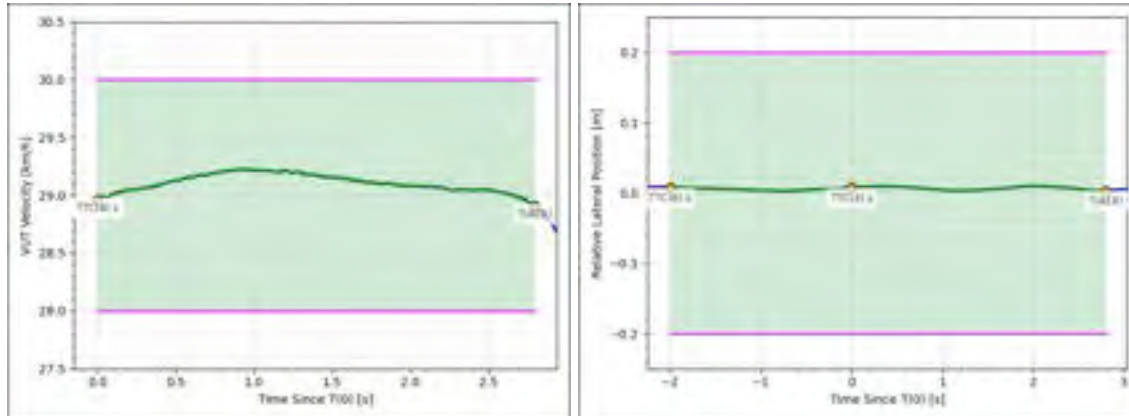
Run Date / Time 23-Mar-2023 11:57



1.1.1.2. AEB CCRs 30 kph -75 %

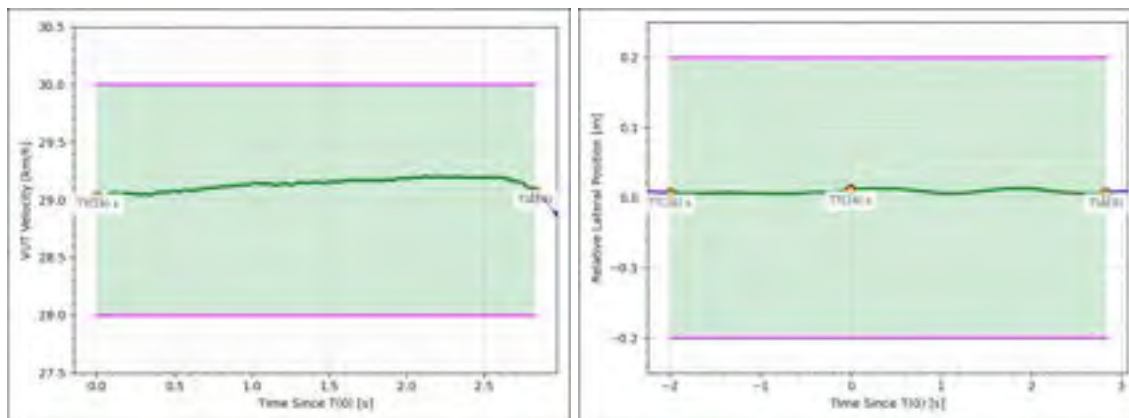
AEB CCRs | 30 km/h -75 % | Run 1

Run Date / Time 23-Mar-2023 12:08



AEB CCRs | 30 km/h -75 % | Run 2

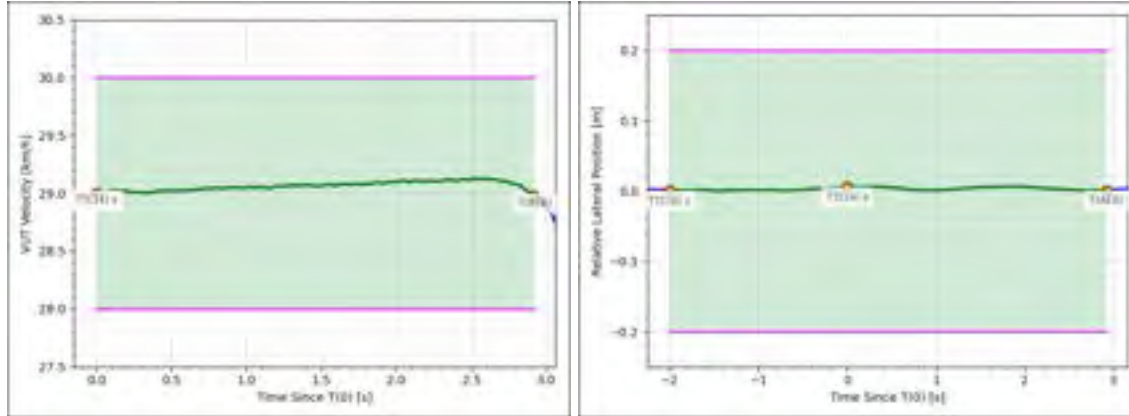
Run Date / Time 23-Mar-2023 12:10



1.1.1.3. AEB CCRs 30 kph +100 %

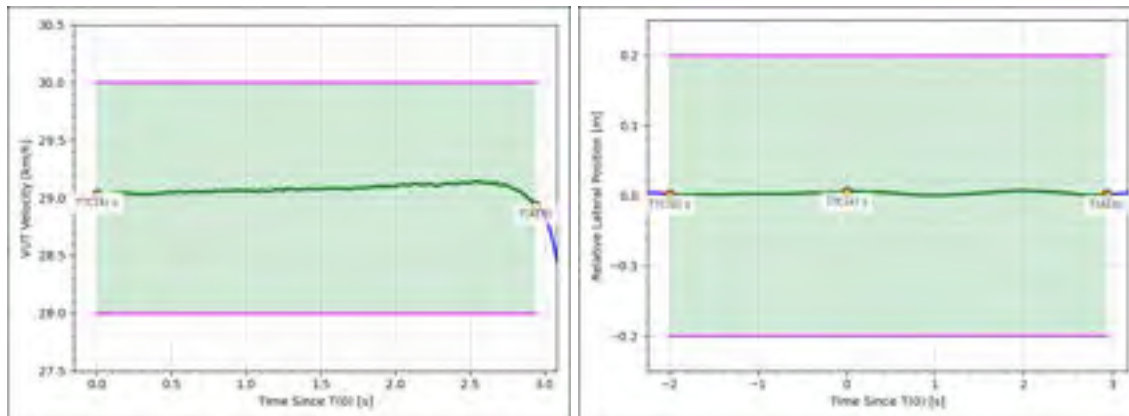
AEB CCRs | 30 km/h +100 % | Run 1

Run Date / Time 23-Mar-2023 12:02



AEB CCRs | 30 km/h +100 % | Run 2

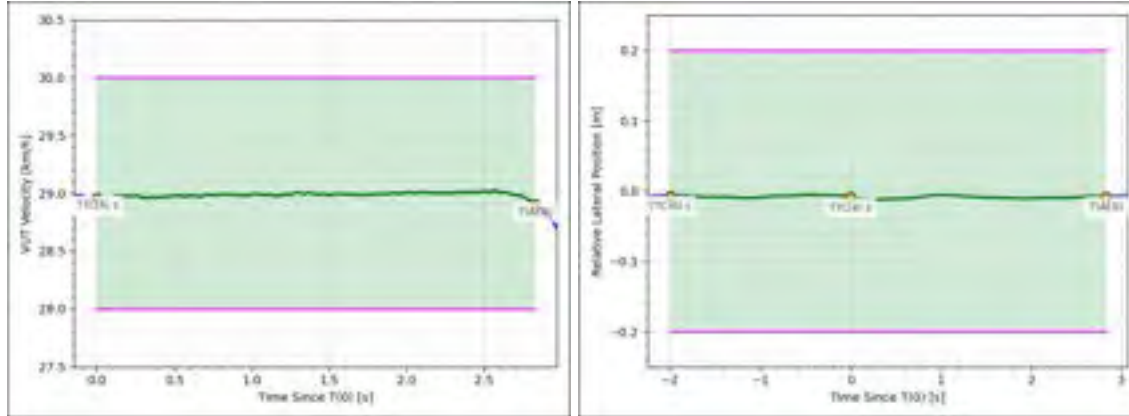
Run Date / Time 23-Mar-2023 12:04



1.1.1.4. AEB CCRs 30 kph +75 %

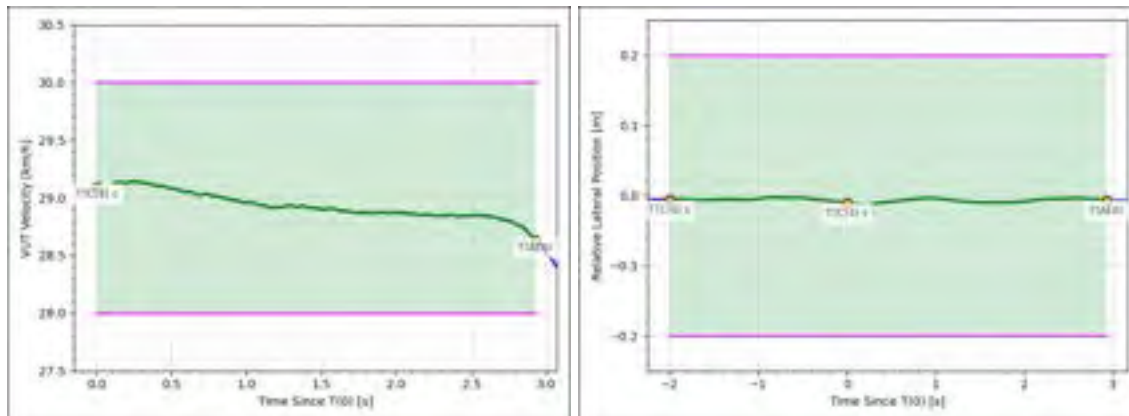
AEB CCRs | 30 km/h +75 % | Run 1

Run Date / Time 23-Mar-2023 12:13



AEB CCRs | 30 km/h +75 % | Run 2

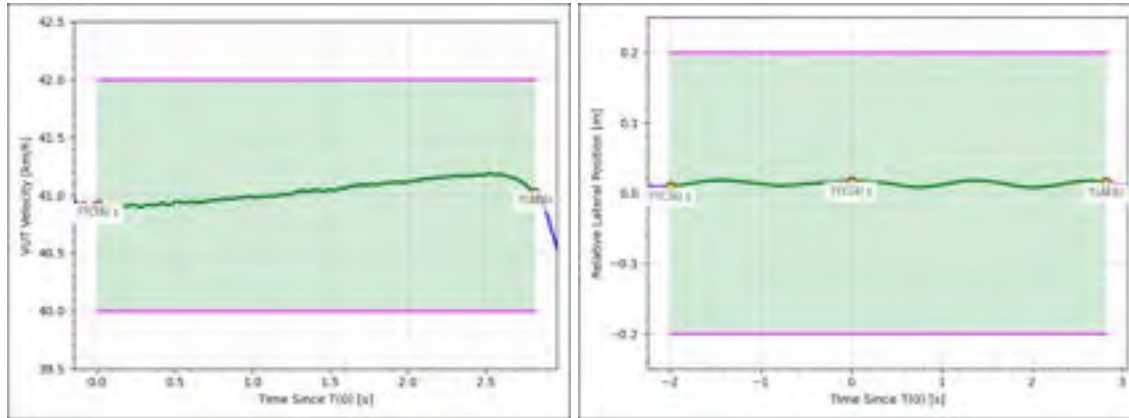
Run Date / Time 23-Mar-2023 12:16



1.1.1.5. AEB CCRs 42 kph +100 %

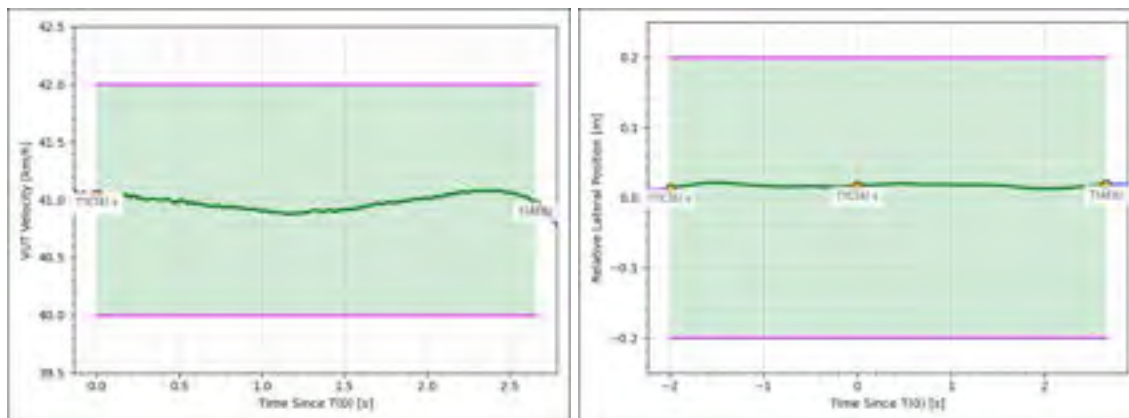
AEB CCRs | 42 km/h +100 % | Run 7

Run Date / Time 27-Mar-2023 12:51



AEB CCRs | 42 km/h +100 % | Run 8

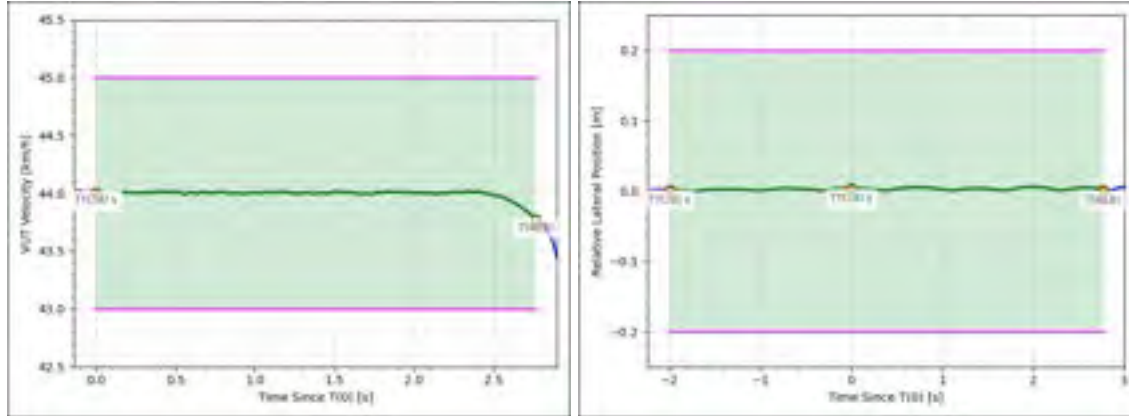
Run Date / Time 27-Mar-2023 12:55



I.1.1.6. AEB CCRs 45 kph +100 %

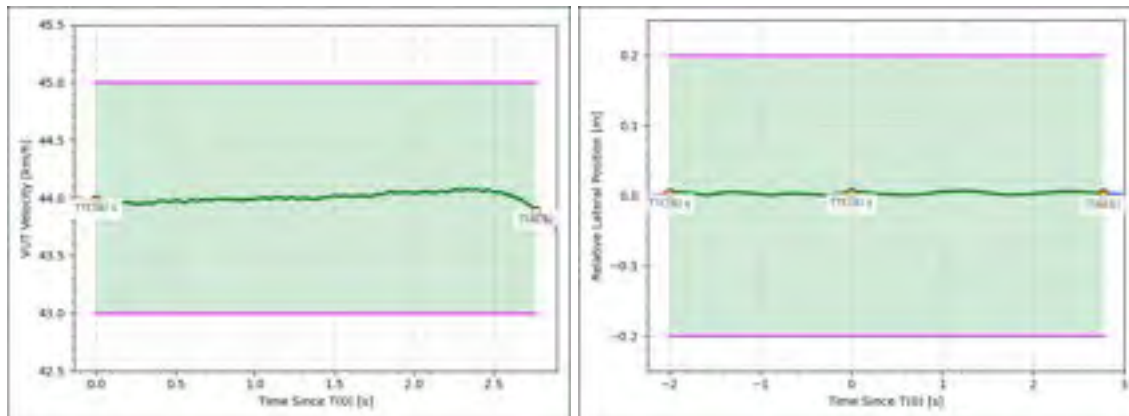
AEB CCRs | 45 km/h +100 % | Run 1

Run Date / Time 24-Mar-2023 11:24



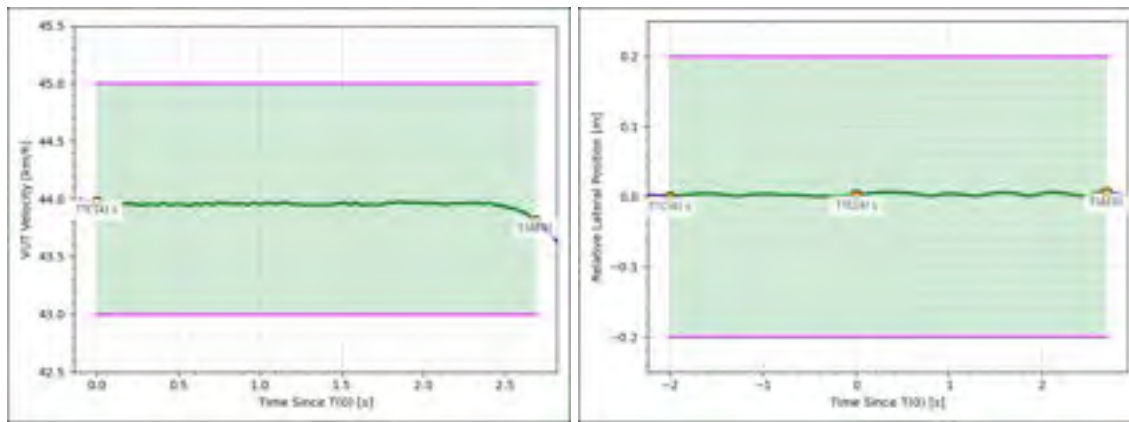
AEB CCRs | 45 km/h +100 % | Run 2

Run Date / Time 24-Mar-2023 11:26



AEB CCRs | 45 km/h +100 % | Run 3

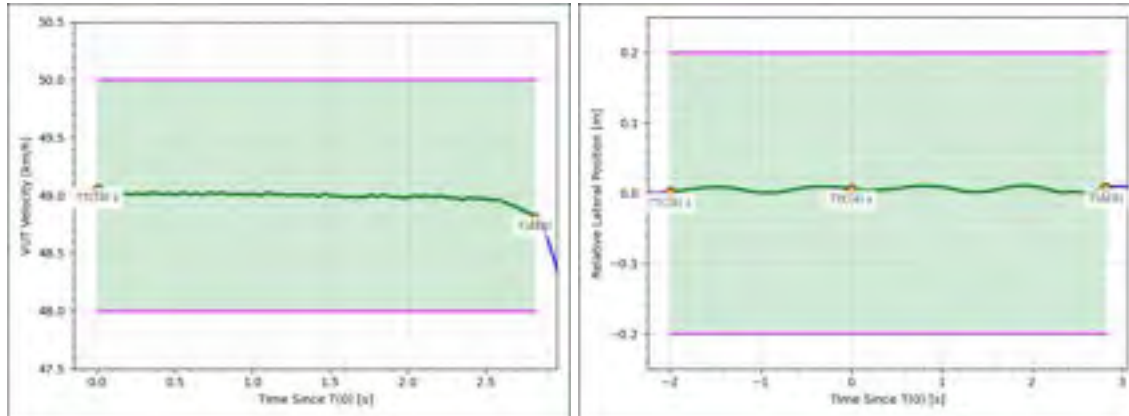
Run Date / Time 24-Mar-2023 11:34



1.1.1.7. AEB CCRs 50 kph +100 %

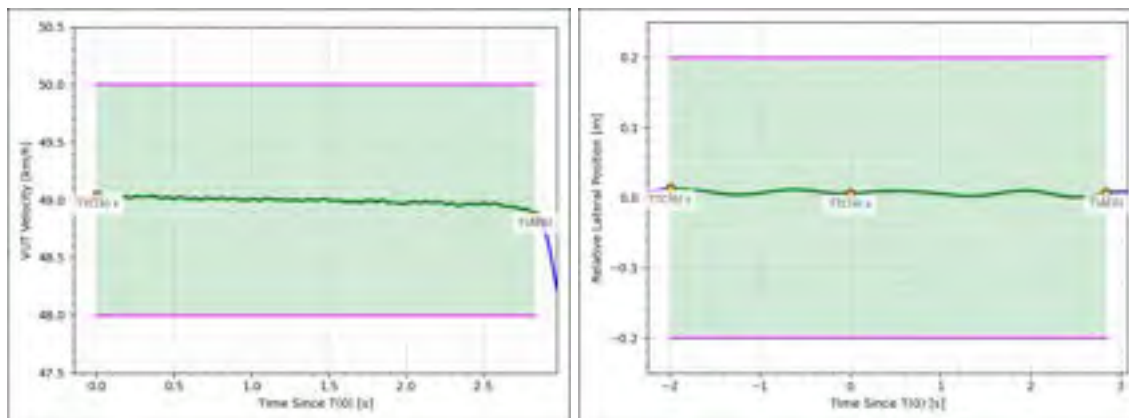
AEB CCRs | 50 km/h +100 % | Run 1

Run Date / Time 24-Mar-2023 11:12



AEB CCRs | 50 km/h +100 % | Run 2

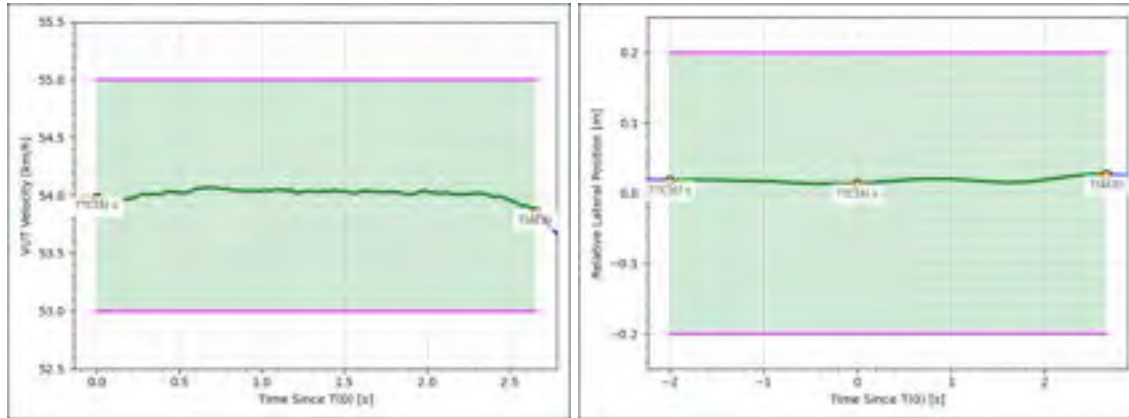
Run Date / Time 24-Mar-2023 11:15



I.1.1.8. AEB CCRs 55 kph +100 %

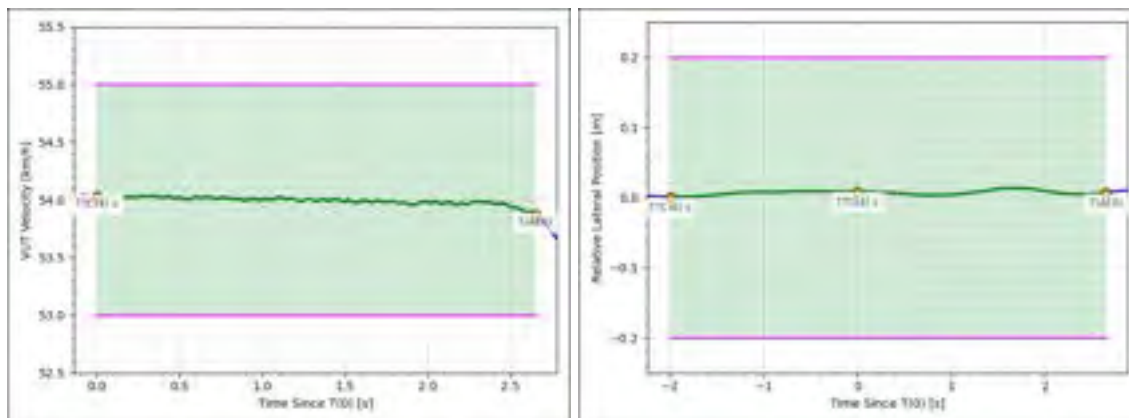
AEB CCRs | 55 km/h +100 % | Run 1

Run Date / Time 27-Mar-2023 13:01



AEB CCRs | 55 km/h +100 % | Run 2

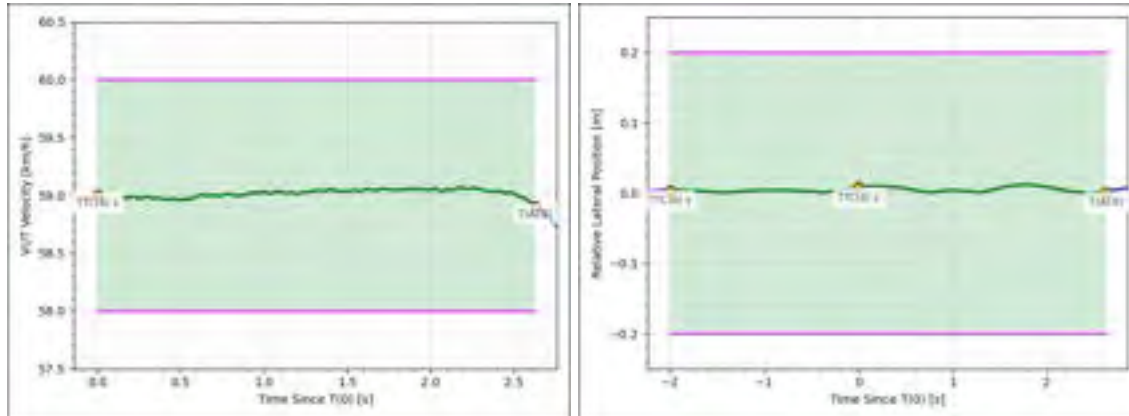
Run Date / Time 27-Mar-2023 13:11



AEB CCRs 60 kph +100 %

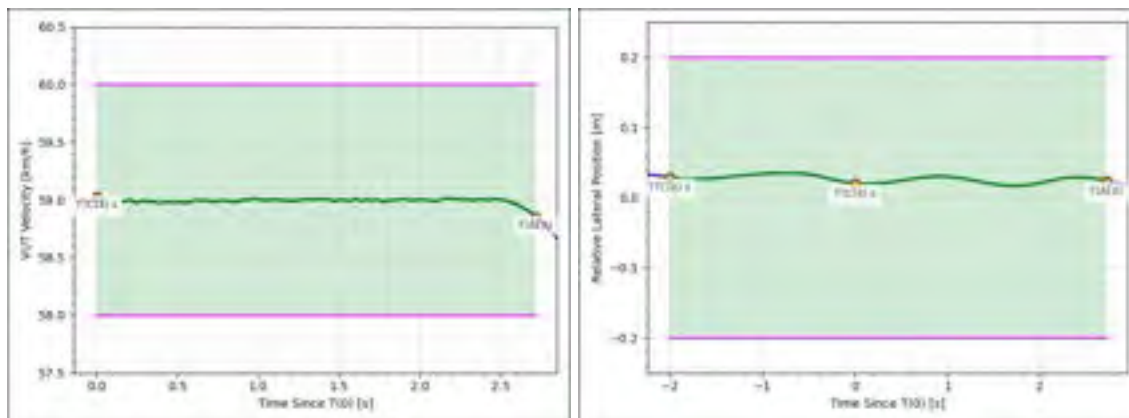
AEB CCRs | 60 km/h +100 % | Run 1

Run Date / Time 27-Mar-2023 13:21



AEB CCRs | 60 km/h +100 % | Run 2

Run Date / Time 27-Mar-2023 13:36

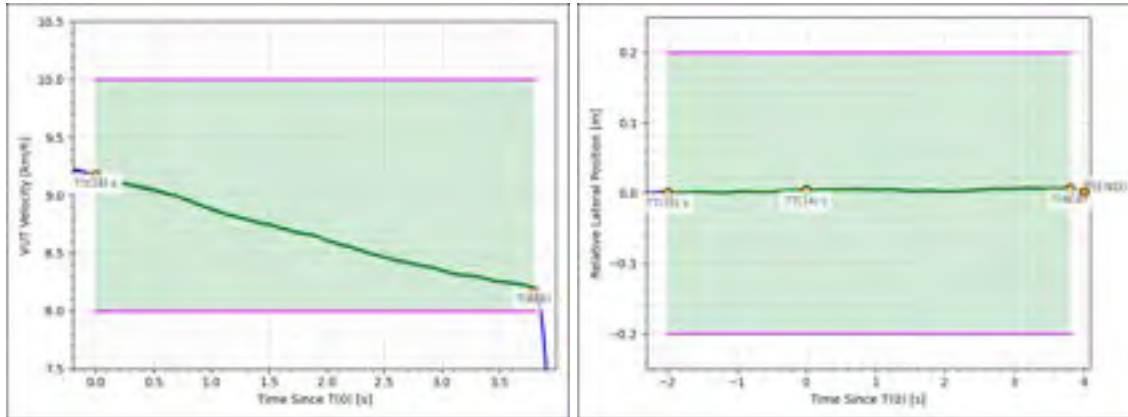


I.1.1. Bullbar

I.1.1.1. AEB CCRs 10 kph +100 %

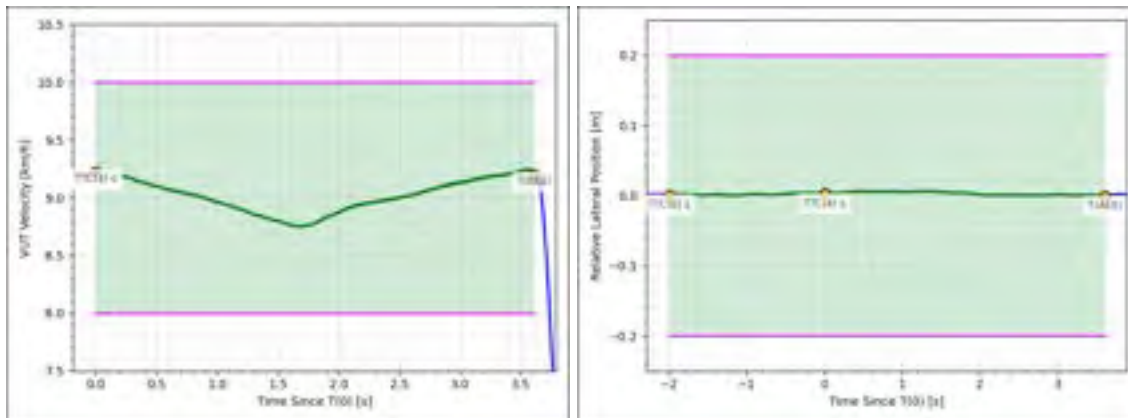
AEB CCRs | 10 km/h 100 % | Run 3

Run Date / Time 5-Apr-2023 10:37



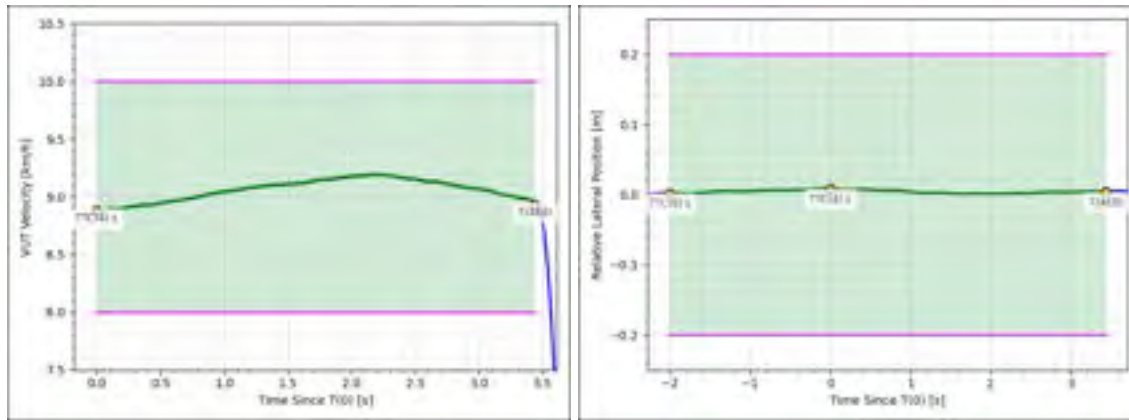
AEB CCRs | 10 km/h 100 % | Run 4

Run Date / Time 5-Apr-2023 10:44



AEB CCRs | 10 km/h 100 % | Run 5

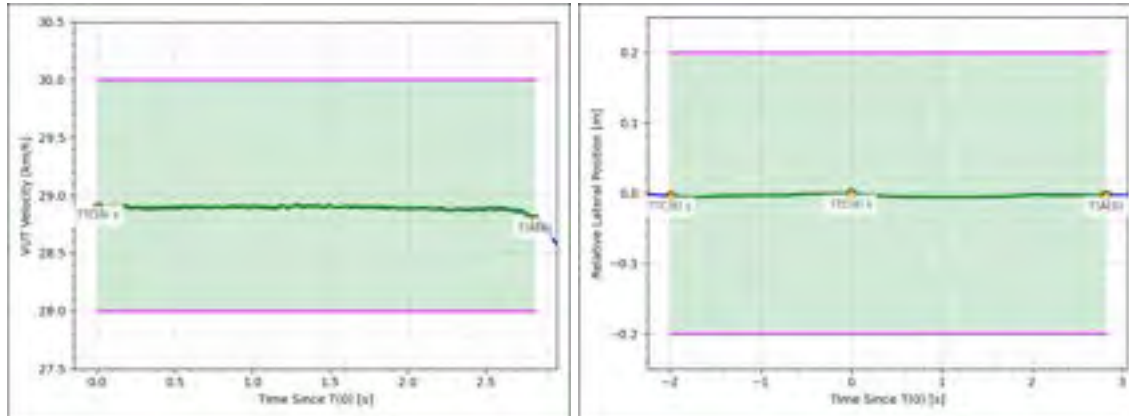
Run Date / Time 5-Apr-2023 13:42



1.1.1.2. AEB CCRs 30 kph -75 %

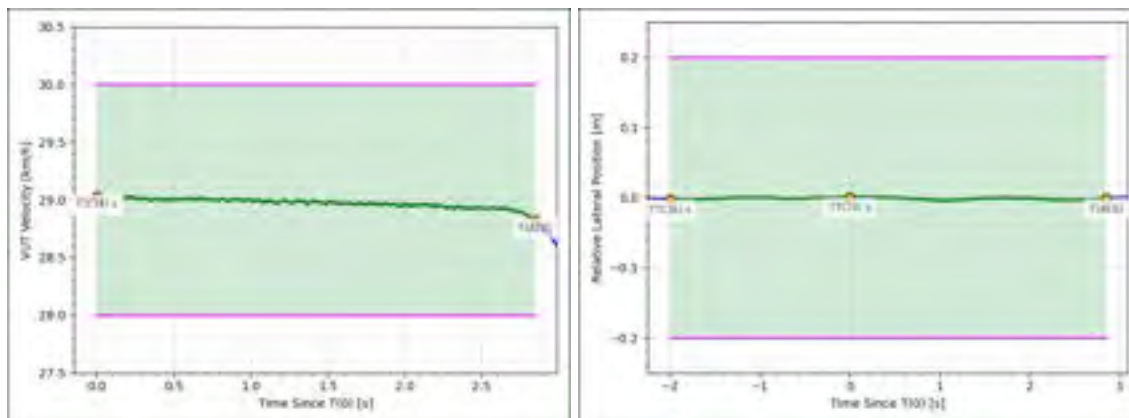
AEB CCRs | 30 km/h -75 % | Run 3

Run Date / Time 5-Apr-2023 13:56



AEB CCRs | 30 km/h -75 % | Run 4

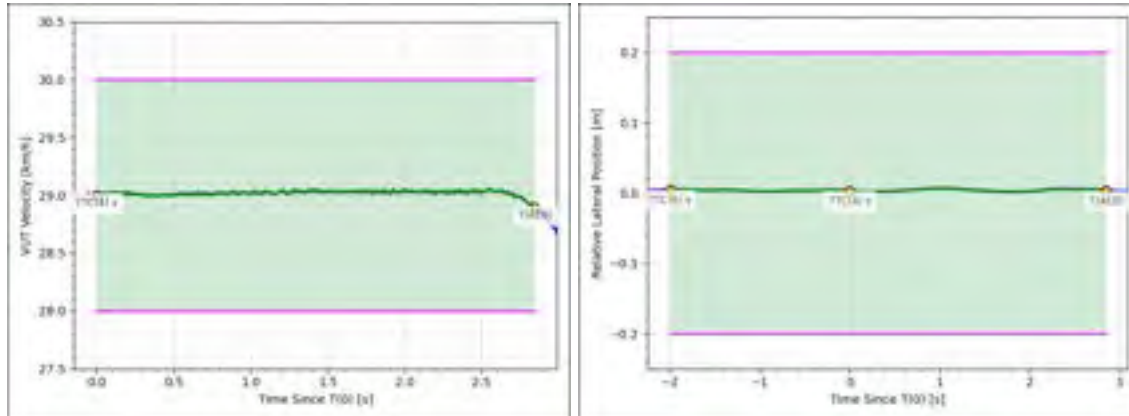
Run Date / Time 5-Apr-2023 13:59



I.1.1.3. AEB CCRs 30 kph +100 %

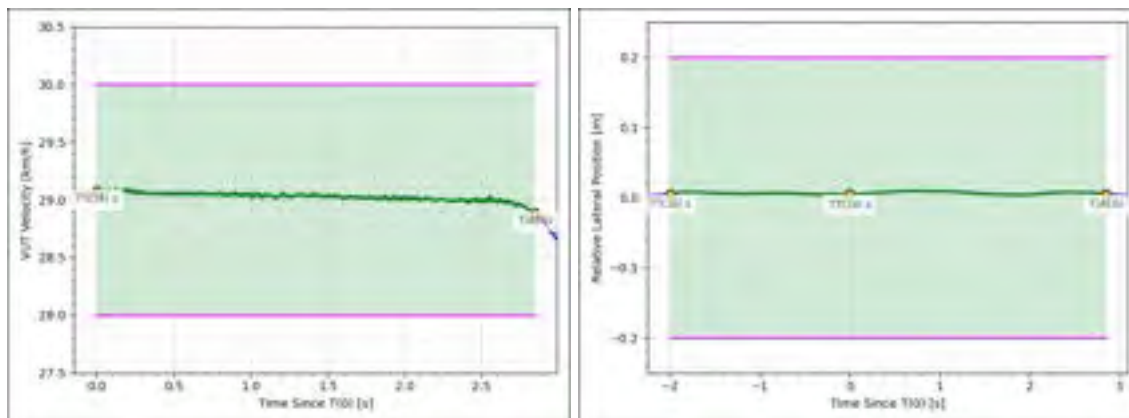
AEB CCRs | 30 km/h +100 % | Run 10

Run Date / Time 5-Apr-2023 13:47



AEB CCRs | 30 km/h +100 % | Run 11

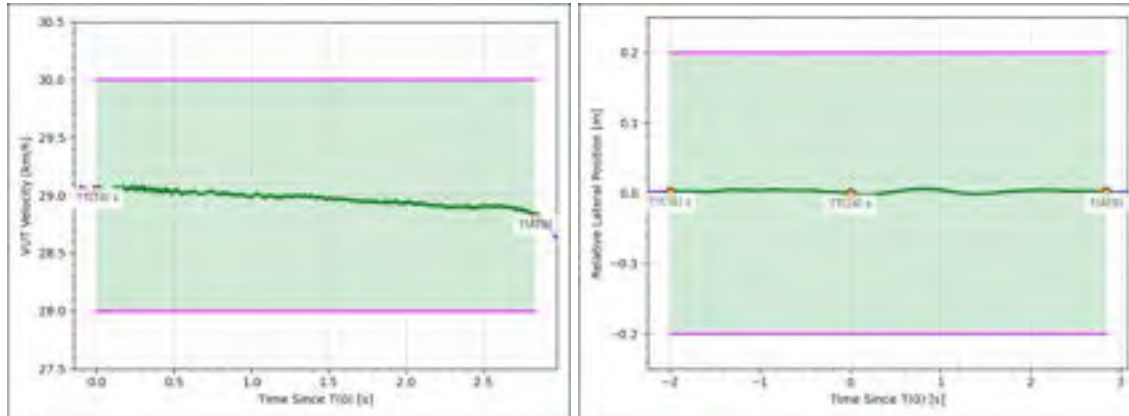
Run Date / Time 5-Apr-2023 13:51



1.1.1.4. AEB CCRs 30 kph +75 %

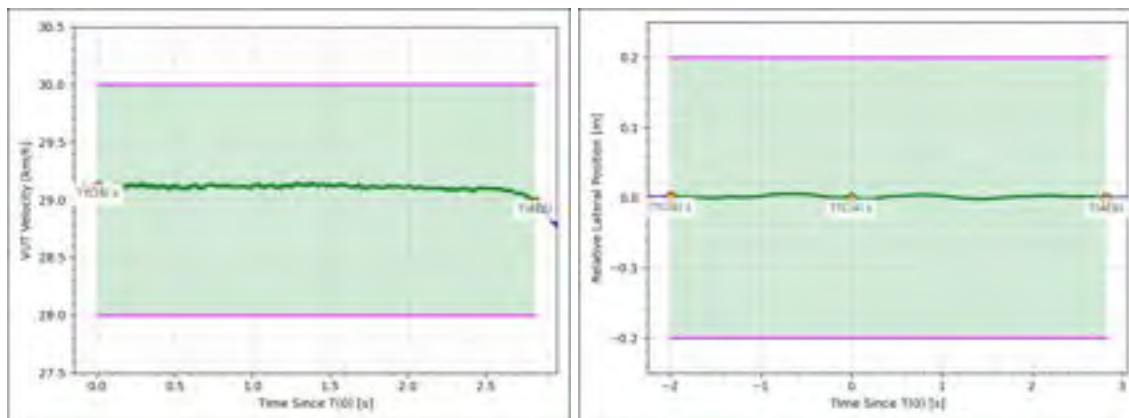
AEB CCRs | 30 km/h +75 % | Run 3

Run Date / Time 5-Apr-2023 14:03



AEB CCRs | 30 km/h +75 % | Run 4

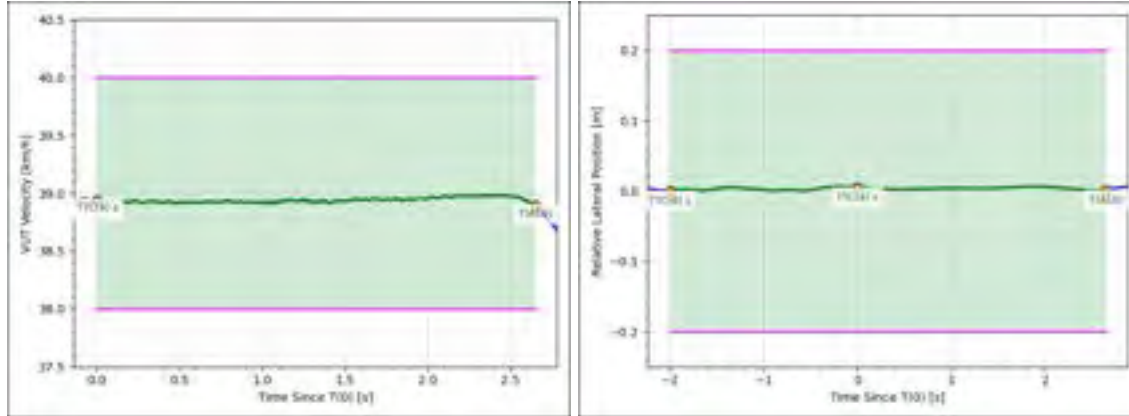
Run Date / Time 5-Apr-2023 14:07



I.1.1.5. AEB CCRs 40 kph +100 %

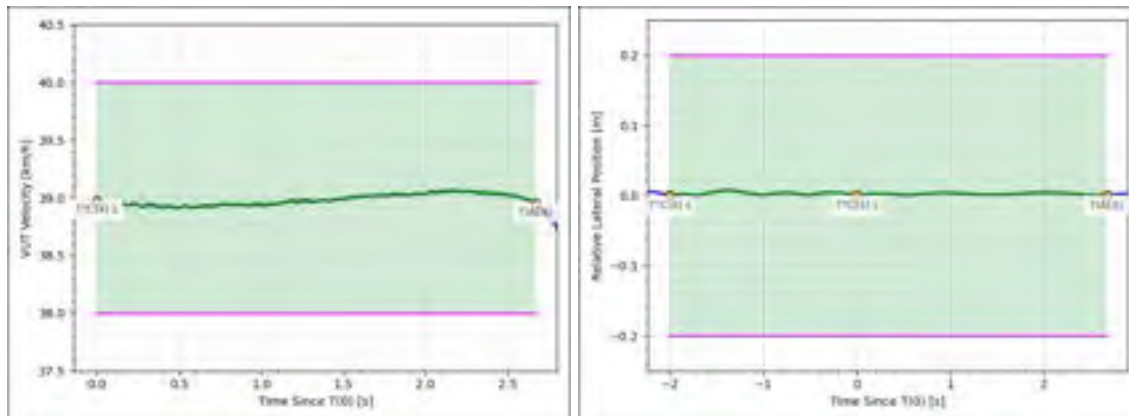
AEB CCRs | 40 km/h +100 % | Run 9

Run Date / Time 5-Apr-2023 14:12



AEB CCRs | 40 km/h +100 % | Run 10

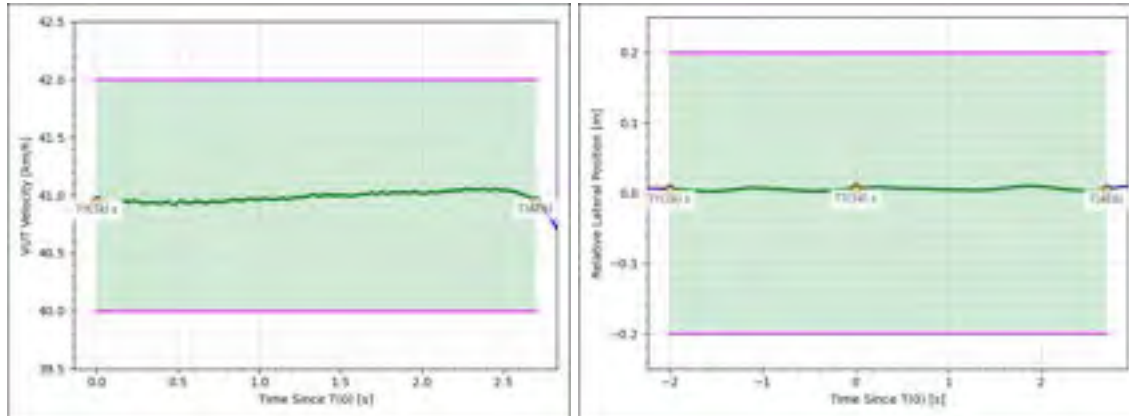
Run Date / Time 5-Apr-2023 14:15



1.1.1.6. AEB CCRs 42 kph +100 %

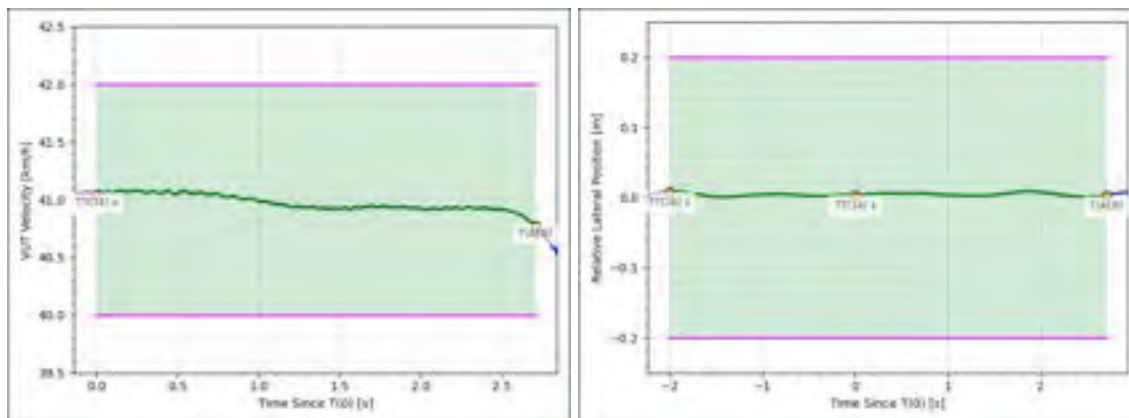
AEB CCRs | 42 km/h +100 % | Run 11

Run Date / Time 5-Apr-2023 14:57



AEB CCRs | 42 km/h +100 % | Run 12

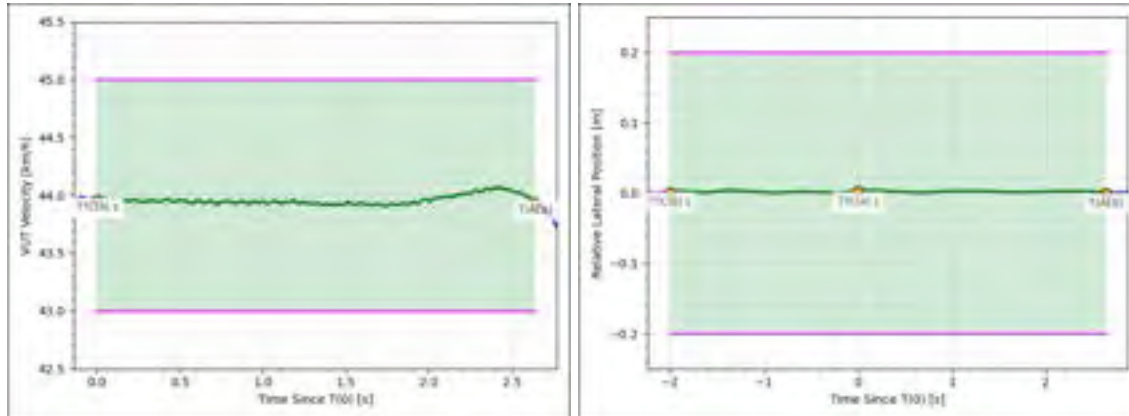
Run Date / Time 5-Apr-2023 15:00



I.1.1.7. AEB CCRs 45 kph +100 %

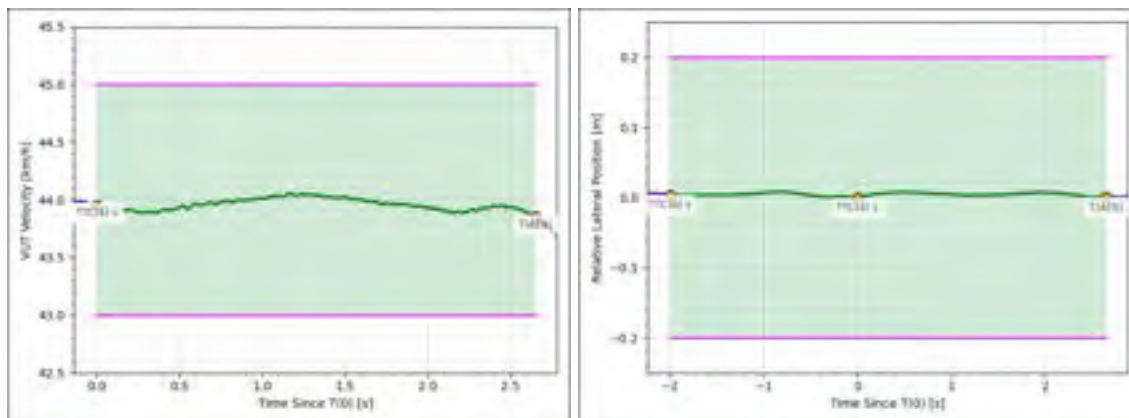
AEB CCRs | 45 km/h +100 % | Run 4

Run Date / Time 5-Apr-2023 14:34



AEB CCRs | 45 km/h +100 % | Run 5

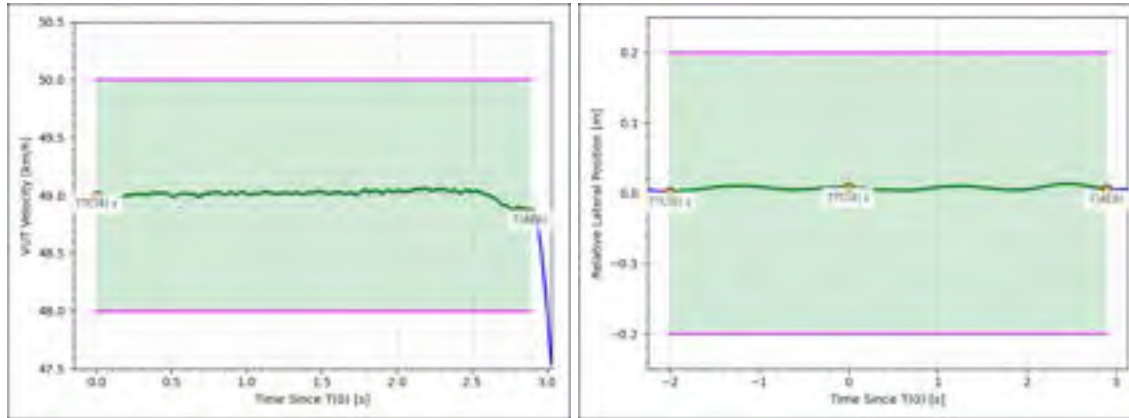
Run Date / Time 5-Apr-2023 14:52



1.1.1.8. AEB CCRs 50 kph +100 %

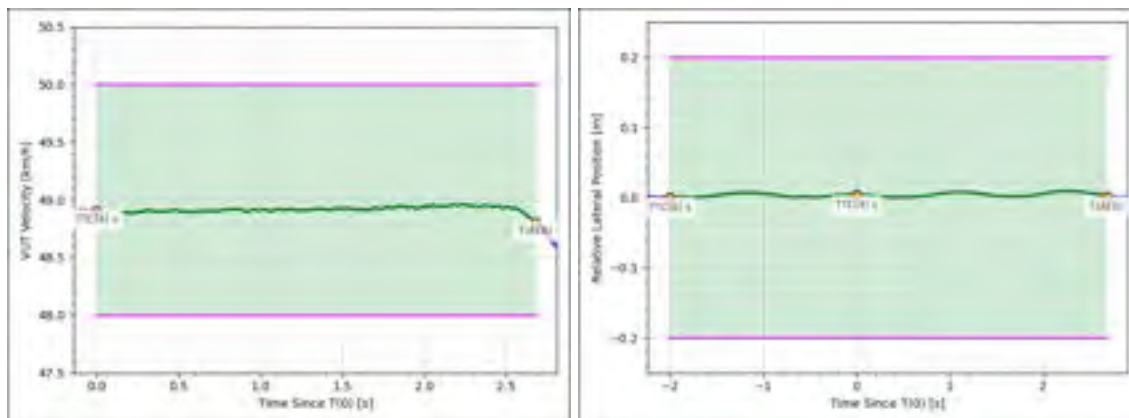
AEB CCRs | 50 km/h +100 % | Run 3

Run Date / Time 5-Apr-2023 14:19



AEB CCRs | 50 km/h +100 % | Run 4

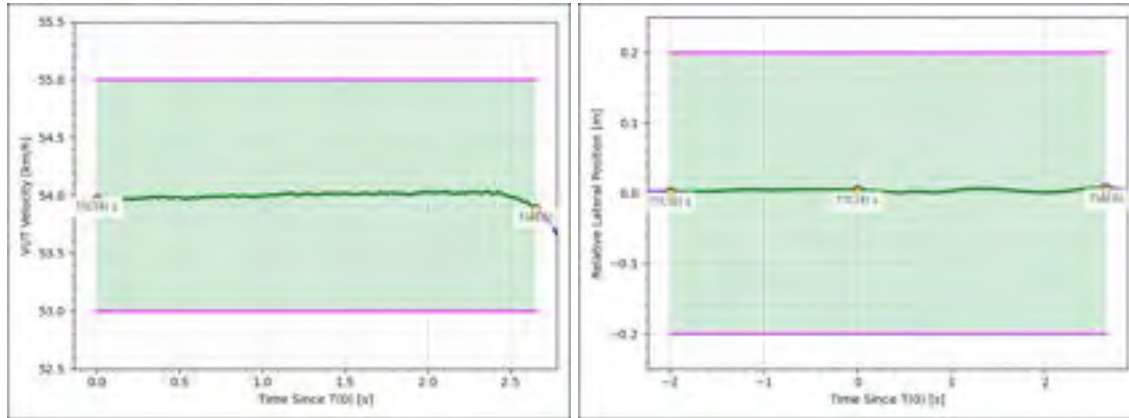
Run Date / Time 5-Apr-2023 14:30



I.1.1.9. AEB CCRs 55 kph +100 %

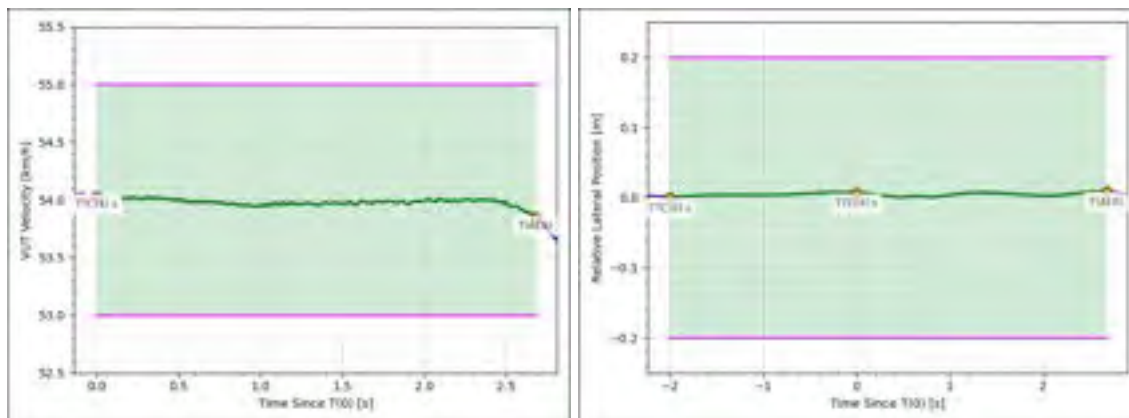
AEB CCRs | 55 km/h +100 % | Run 3

Run Date / Time 5-Apr-2023 15:05



AEB CCRs | 55 km/h +100 % | Run 4

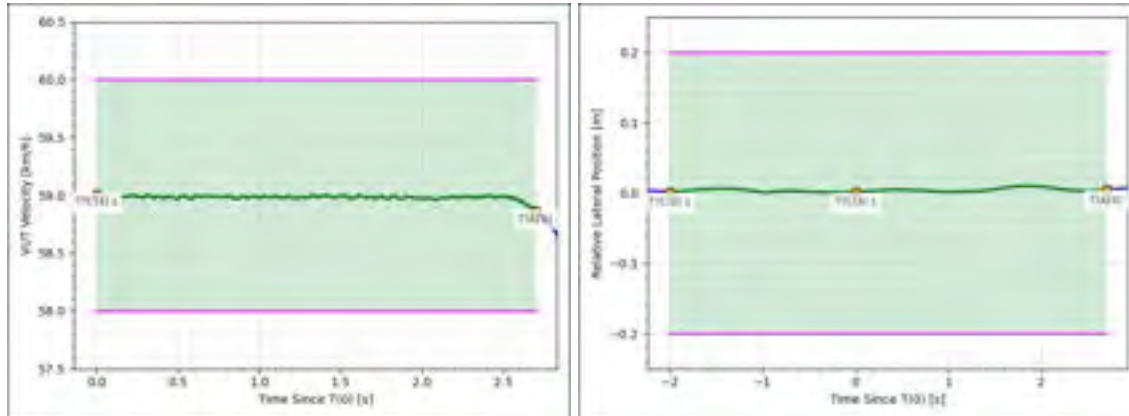
Run Date / Time 5-Apr-2023 15:26



1.1.1.10. AEB CCRs 60 kph +100 %

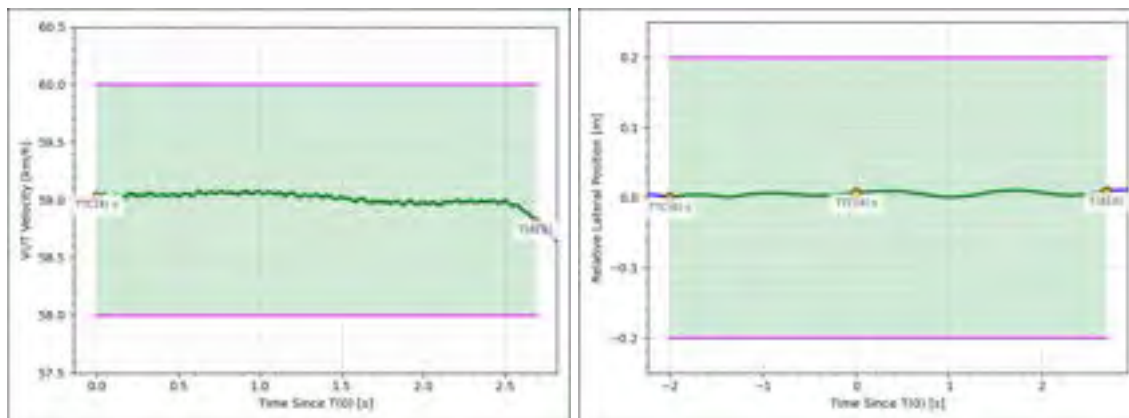
AEB CCRs | 60 km/h +100 % | Run 3

Run Date / Time 5-Apr-2023 15:30



AEB CCRs | 60 km/h +100 % | Run 4

Run Date / Time 5-Apr-2023 15:34

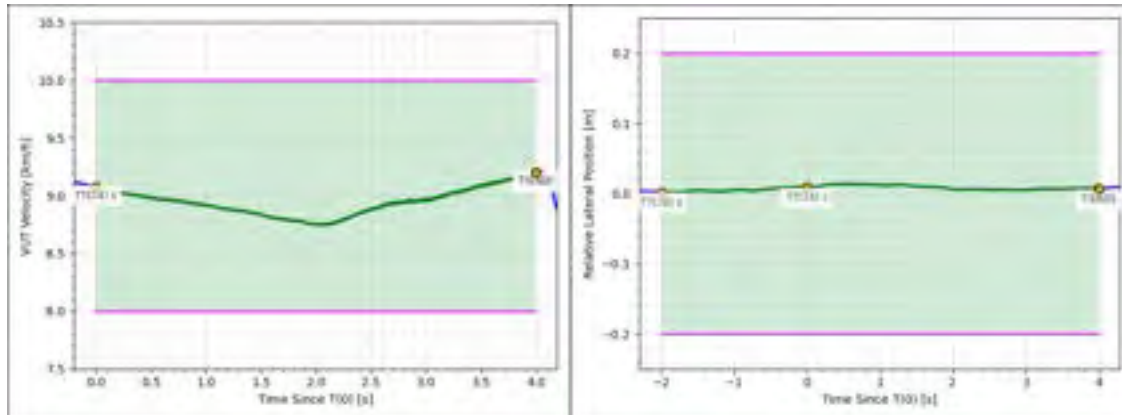


I.1.2. Bullbar (OEM Height)

I.1.2.1. AEB CCRs 10 kph +100 %

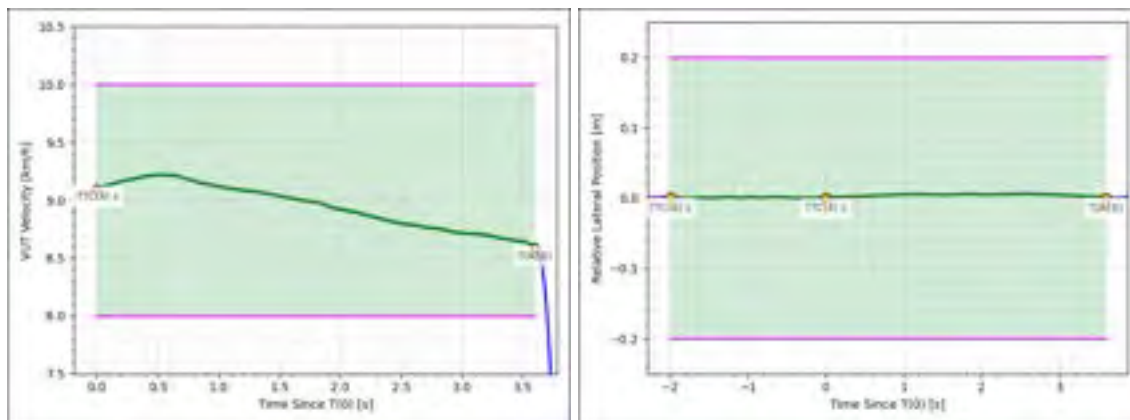
I.1.2.2. AEB CCRs | 10 km/h 100 % | Run 6

Run Date / Time 20-Jul-2023 13:07



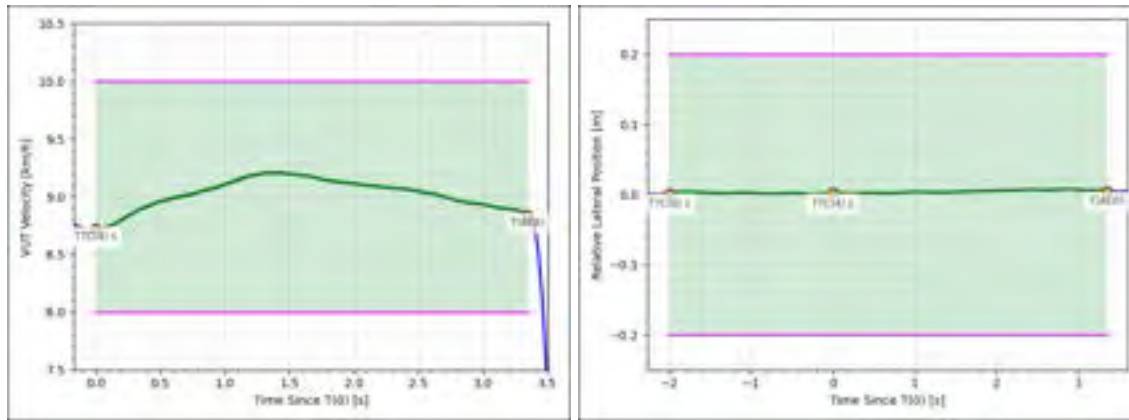
AEB CCRs | 10 km/h 100 % | Run 7

Run Date / Time 20-Jul-2023 15:17



AEB CCRs | 10 km/h 100 % | Run 8

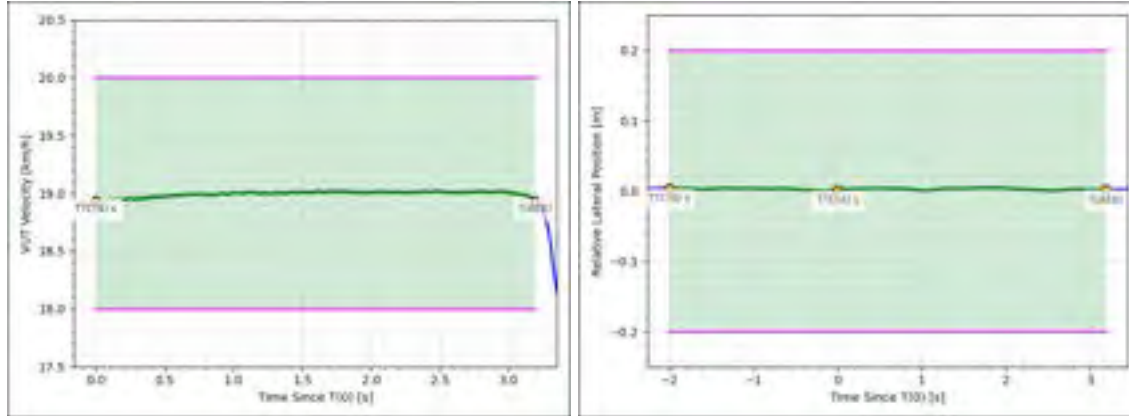
Run Date / Time 20-Jul-2023 15:21



I.1.2.3. AEB CCRs 20 kph +100 %

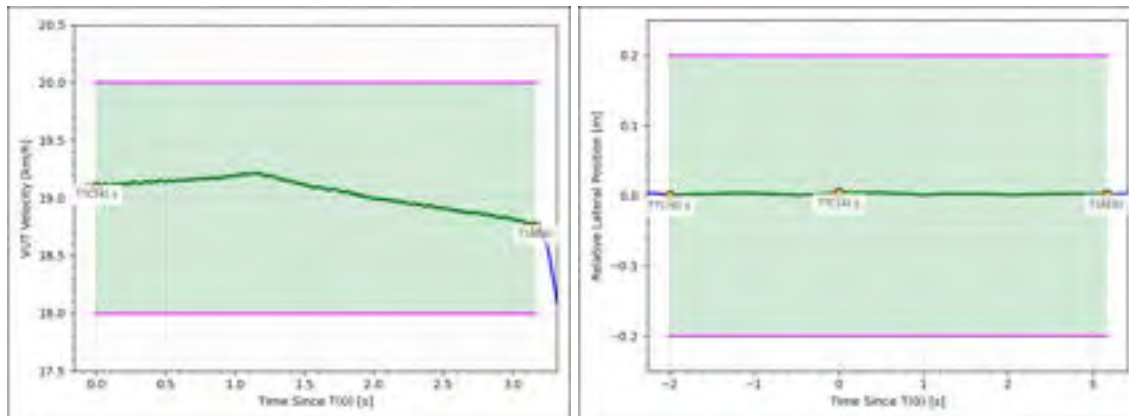
AEB CCRs | 20 km/h +100 % | Run 7

Run Date / Time 20-Jul-2023 13:40



AEB CCRs | 20 km/h +100 % | Run 8

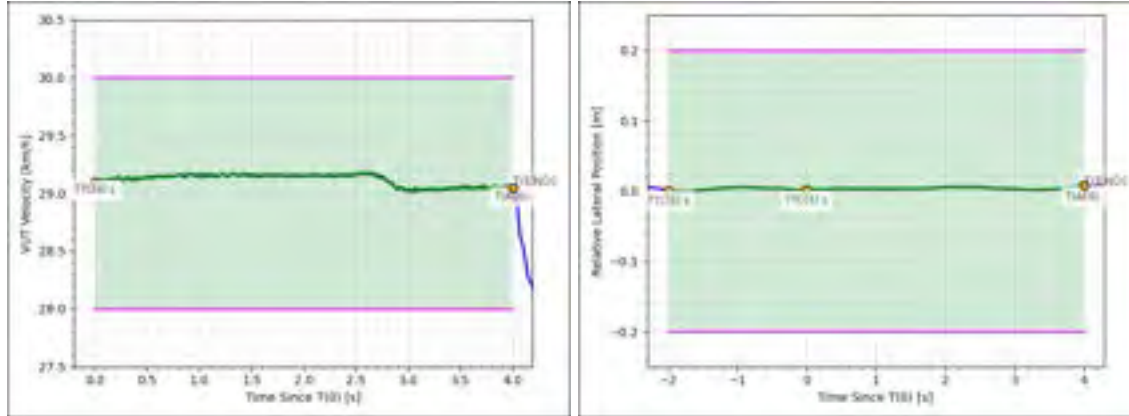
Run Date / Time 20-Jul-2023 13:45



I.1.2.4. AEB CCRs 30 kph -75 %

AEB CCRs | 30 km/h -75 % | Run 5

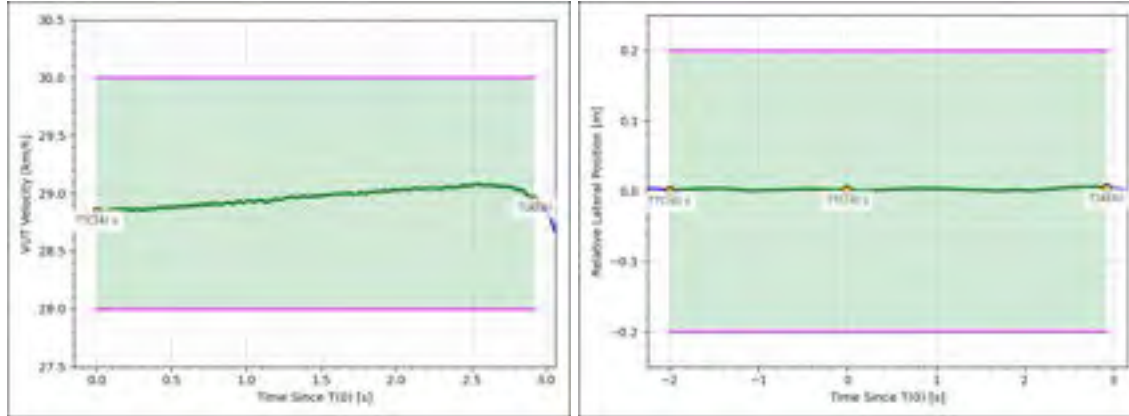
Run Date / Time 20-Jul-2023 14:40



1.1.2.5. AEB CCRs 30 kph +100 %

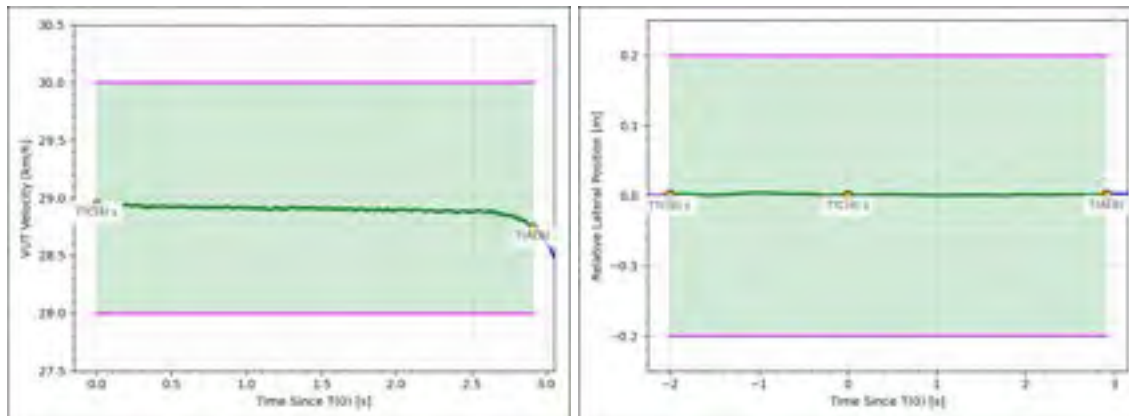
AEB CCRs | 30 km/h +100 % | Run 13

Run Date / Time 20-Jul-2023 13:50



AEB CCRs | 30 km/h +100 % | Run 14

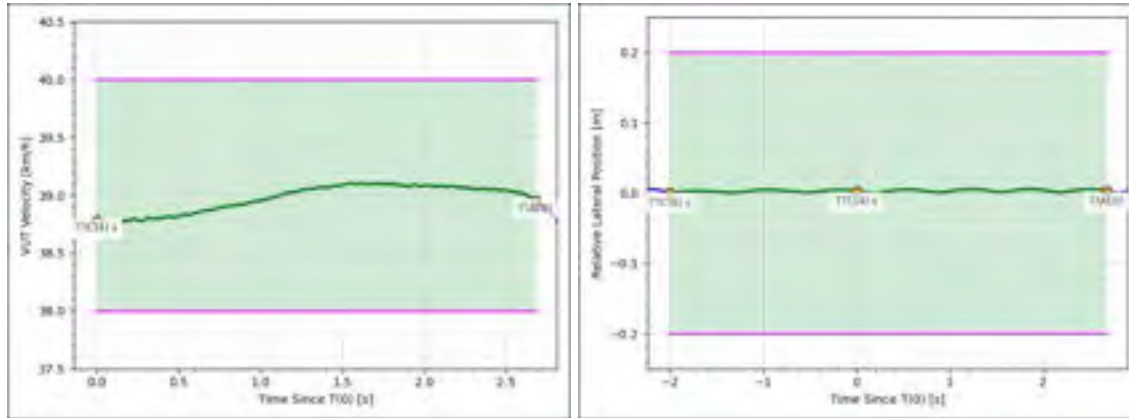
Run Date / Time 20-Jul-2023 13:54



1.1.2.6. AEB CCRs 40 kph +100 %

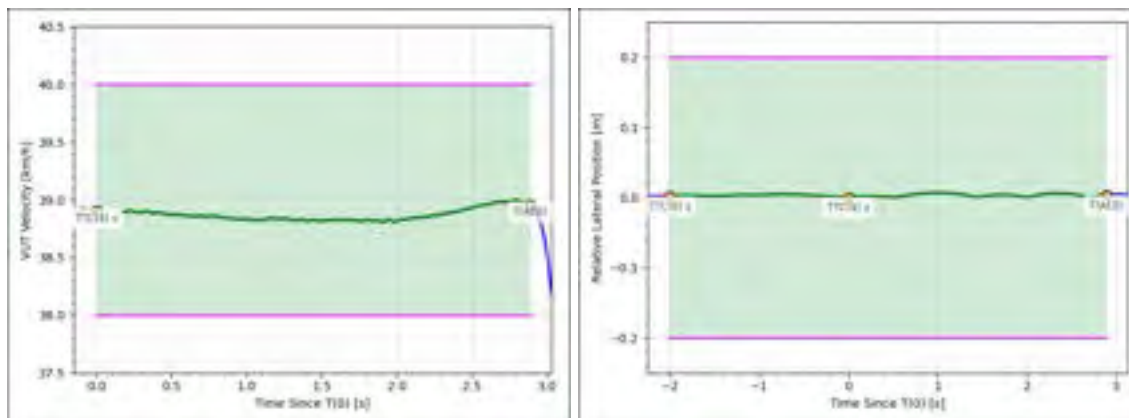
AEB CCRs | 40 km/h +100 % | Run 14

Run Date / Time 20-Jul-2023 14:04



AEB CCRs | 40 km/h +100 % | Run 15

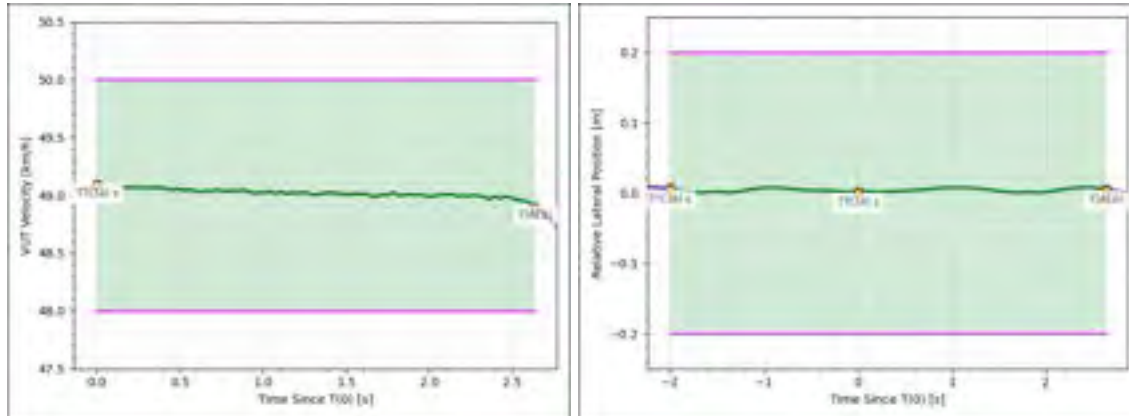
Run Date / Time 20-Jul-2023 14:07



1.1.2.7. AEB CCRs 50 kph +100 %

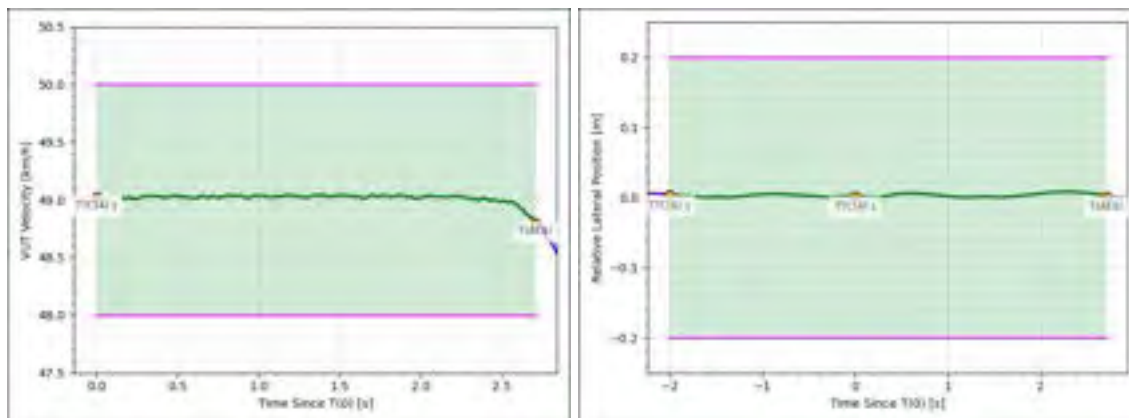
AEB CCRs | 50 km/h +100 % | Run 5

Run Date / Time 20-Jul-2023 14:20



AEB CCRs | 50 km/h +100 % | Run 6

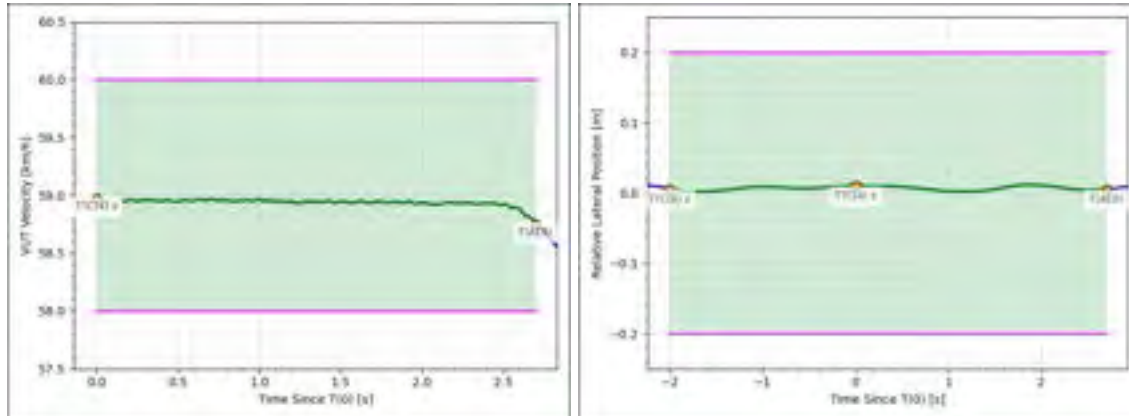
Run Date / Time 20-Jul-2023 14:24



I.1.2.8. AEB CCRs 60 kph +100 %

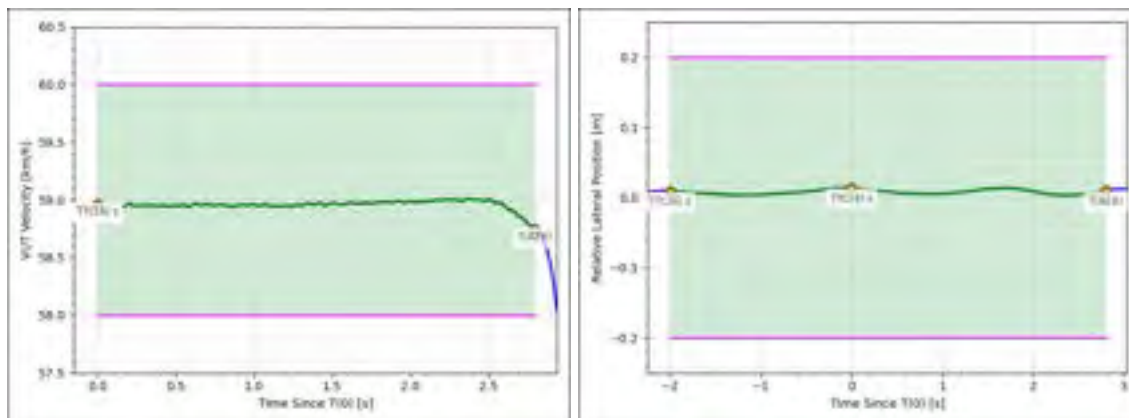
AEB CCRs | 60 km/h +100 % | Run 5

Run Date / Time 20-Jul-2023 14:29



AEB CCRs | 60 km/h +100 % | Run 6

Run Date / Time 20-Jul-2023 14:32



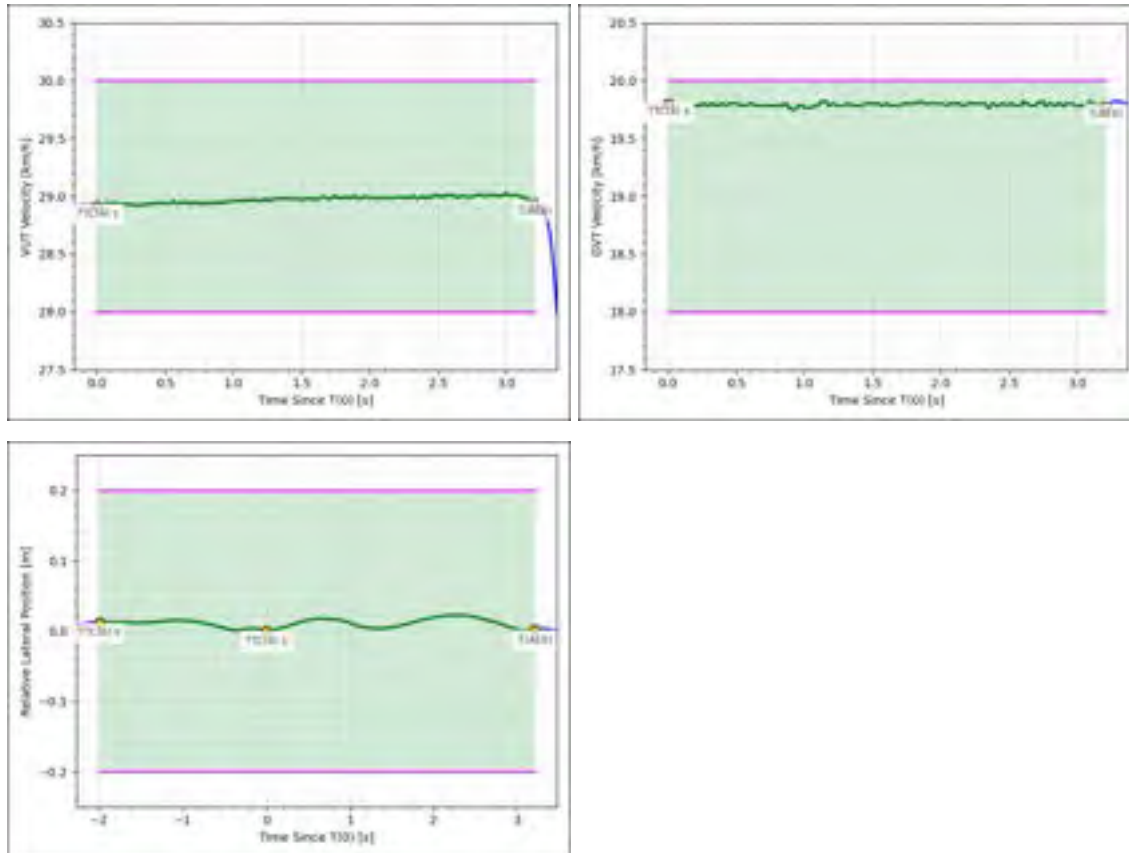
I.1. Car-to-Car Rear Moving

I.1.1. Baseline

I.1.1.1. AEB CCRm 30 kph +100 %

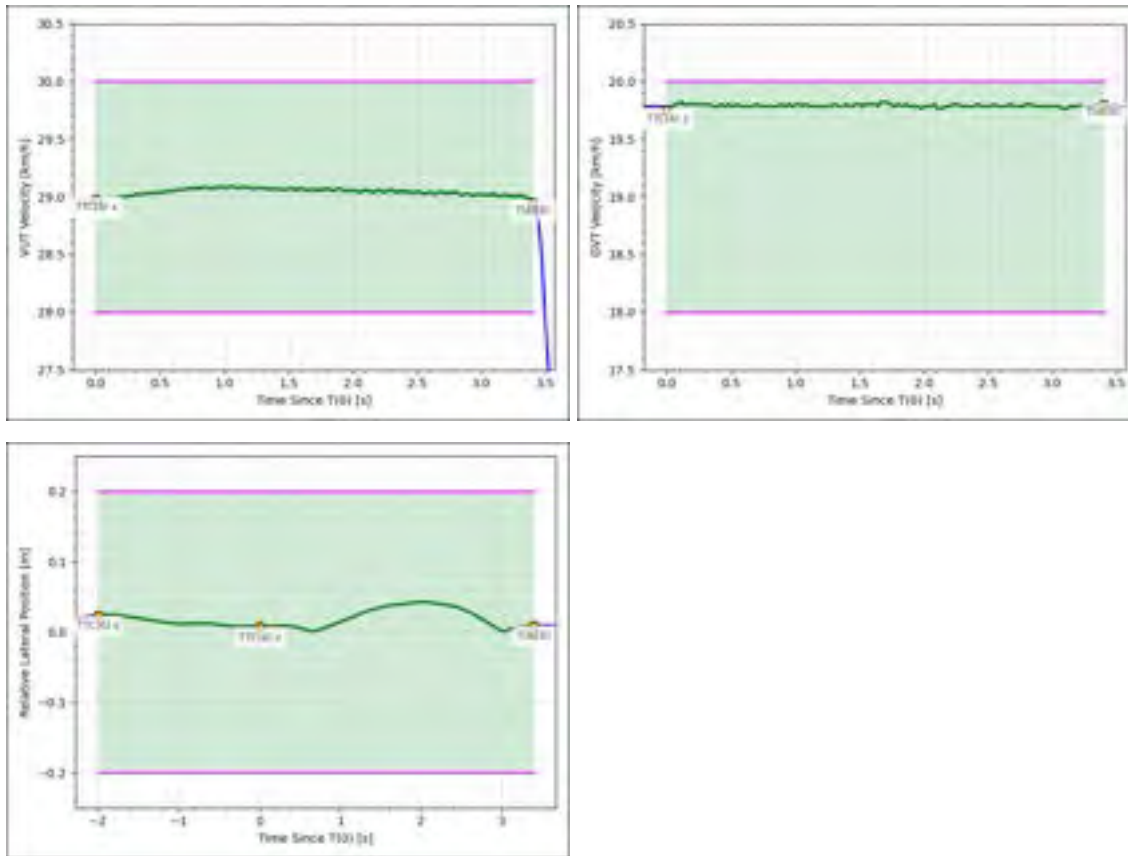
AEB CCRm | 30 km/h +100 % | Run 1

Run Date / Time 8-Feb-2023 15:03



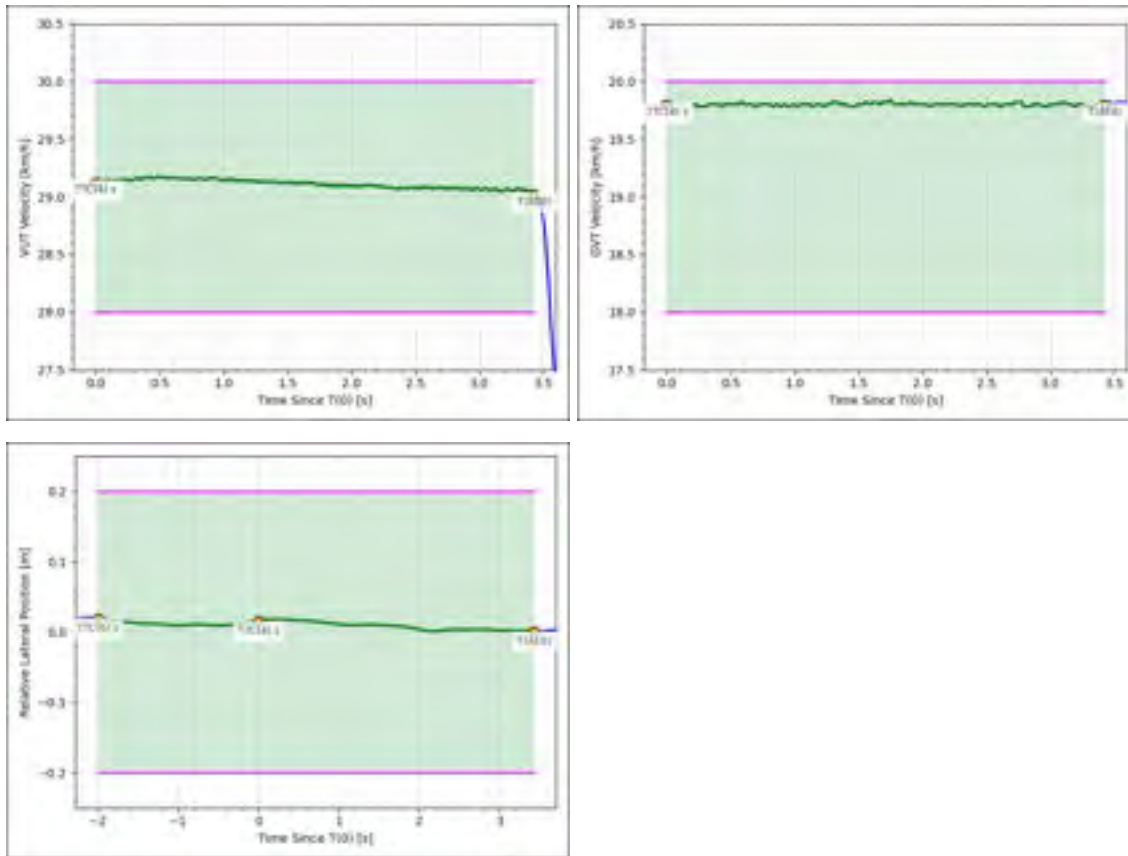
AEB CCRm | 30 km/h +100 % | Run 2

Run Date / Time 8-Feb-2023 15:06



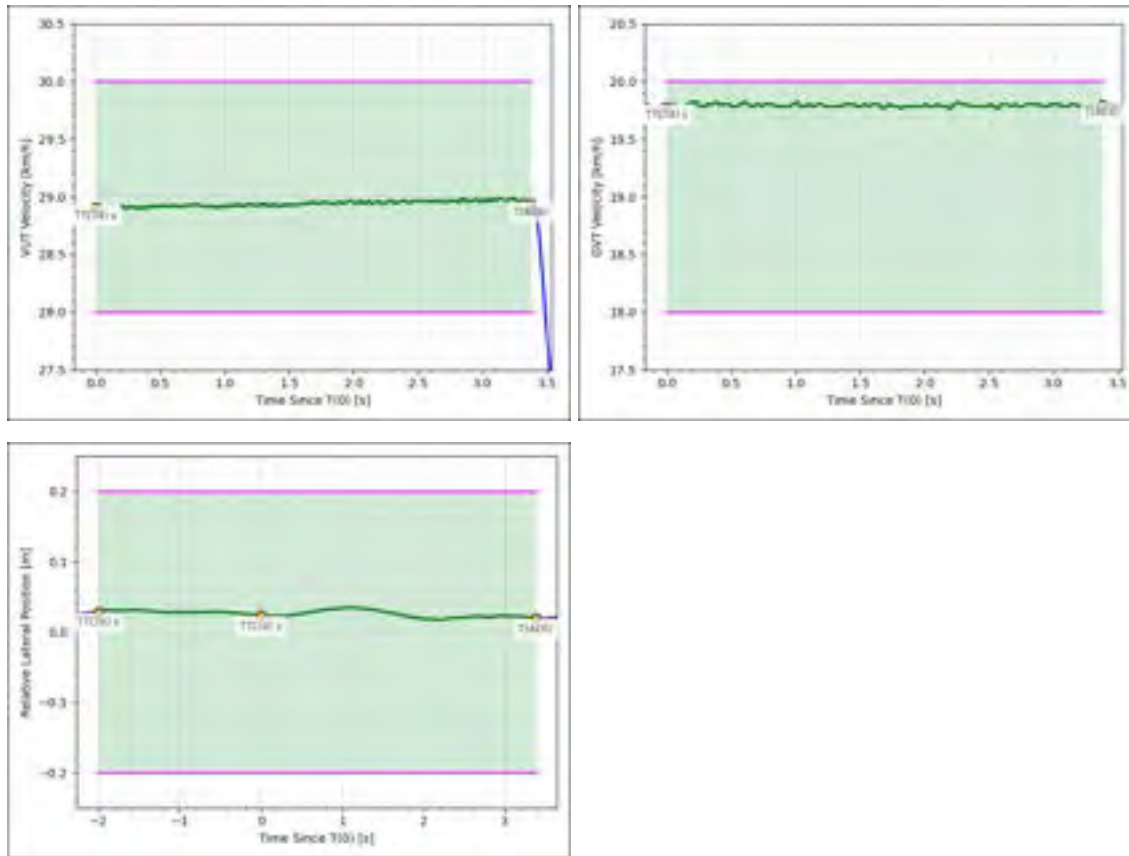
AEB CCRm | 30 km/h +100 % | Run 4

Run Date / Time 8-Feb-2023 15:17



AEB CCRm | 30 km/h +100 % | Run 5

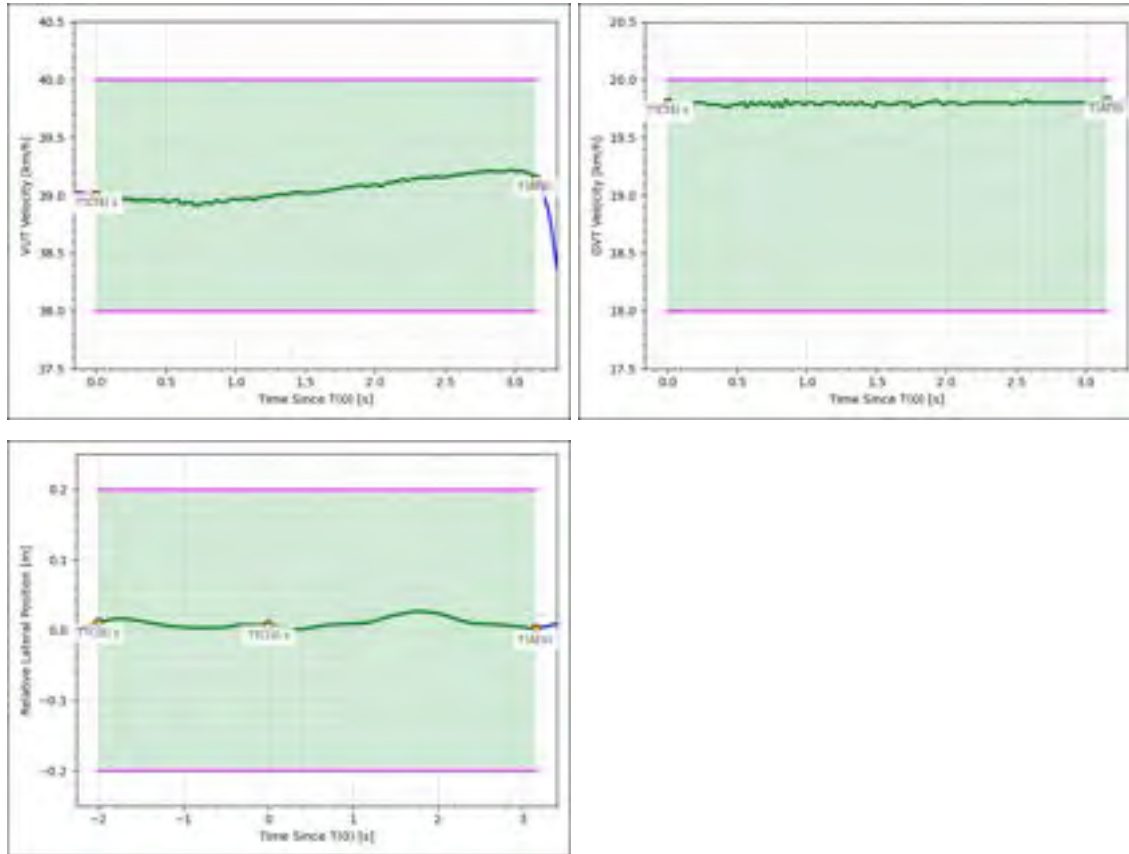
Run Date / Time 10-Feb-2023 11:58



1.1.1.2. AEB CCRm 40 kph +100 %

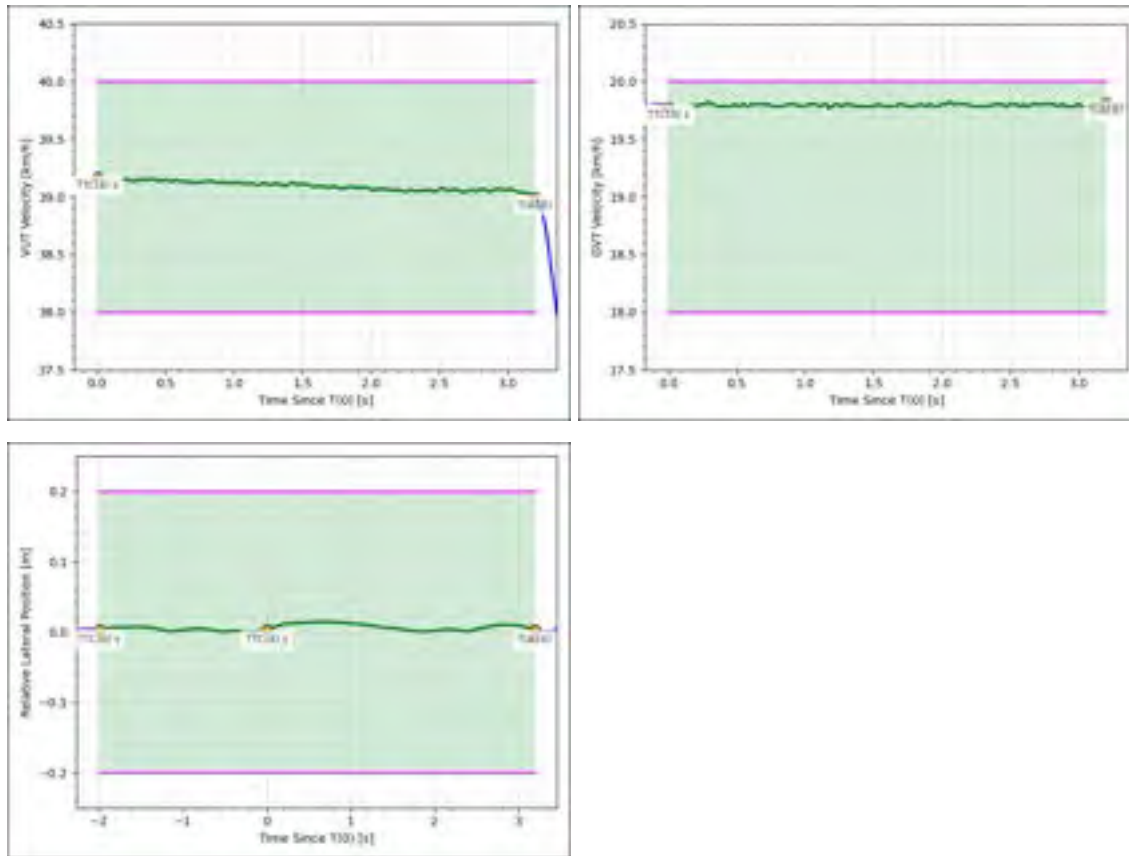
AEB CCRm | 40 km/h +100 % | Run 1

Run Date / Time 8-Feb-2023 15:22



AEB CCRm | 40 km/h +100 % | Run 2

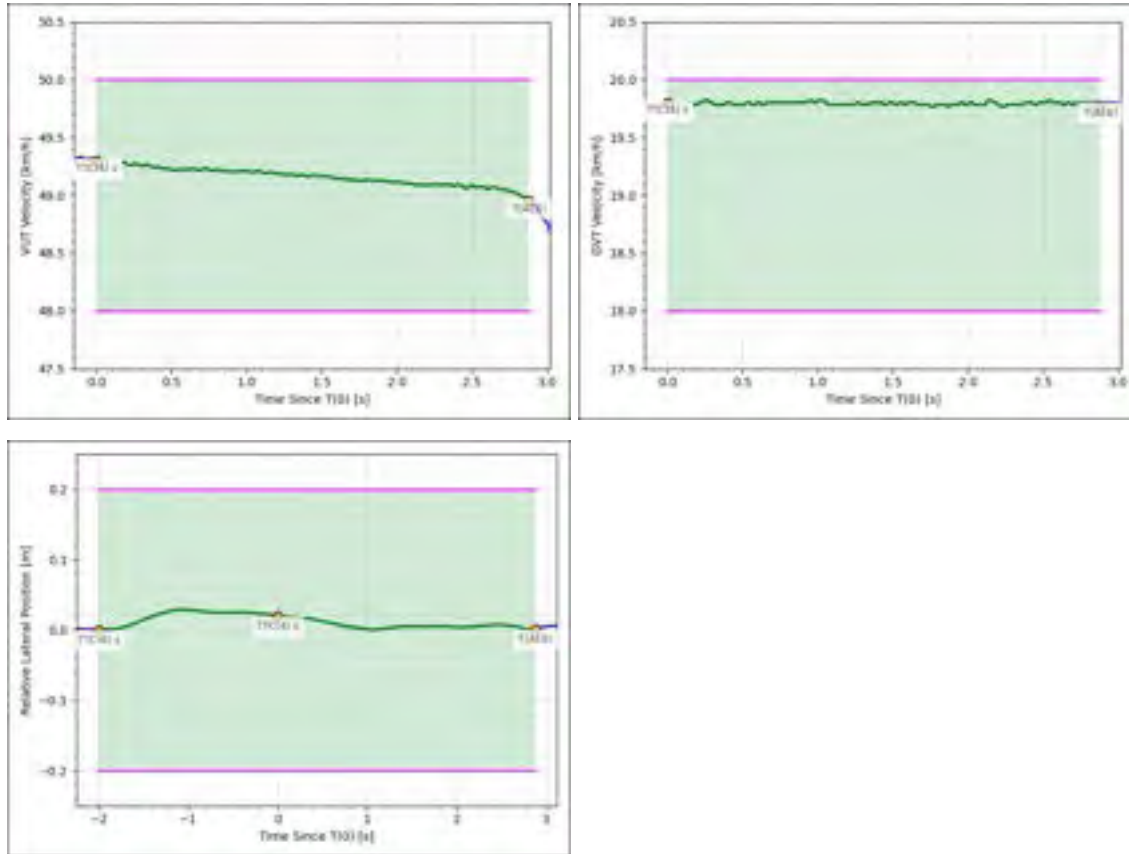
Run Date / Time 8-Feb-2023 15:25



1.1.1.3. AEB CCRm 50 kph +100 %

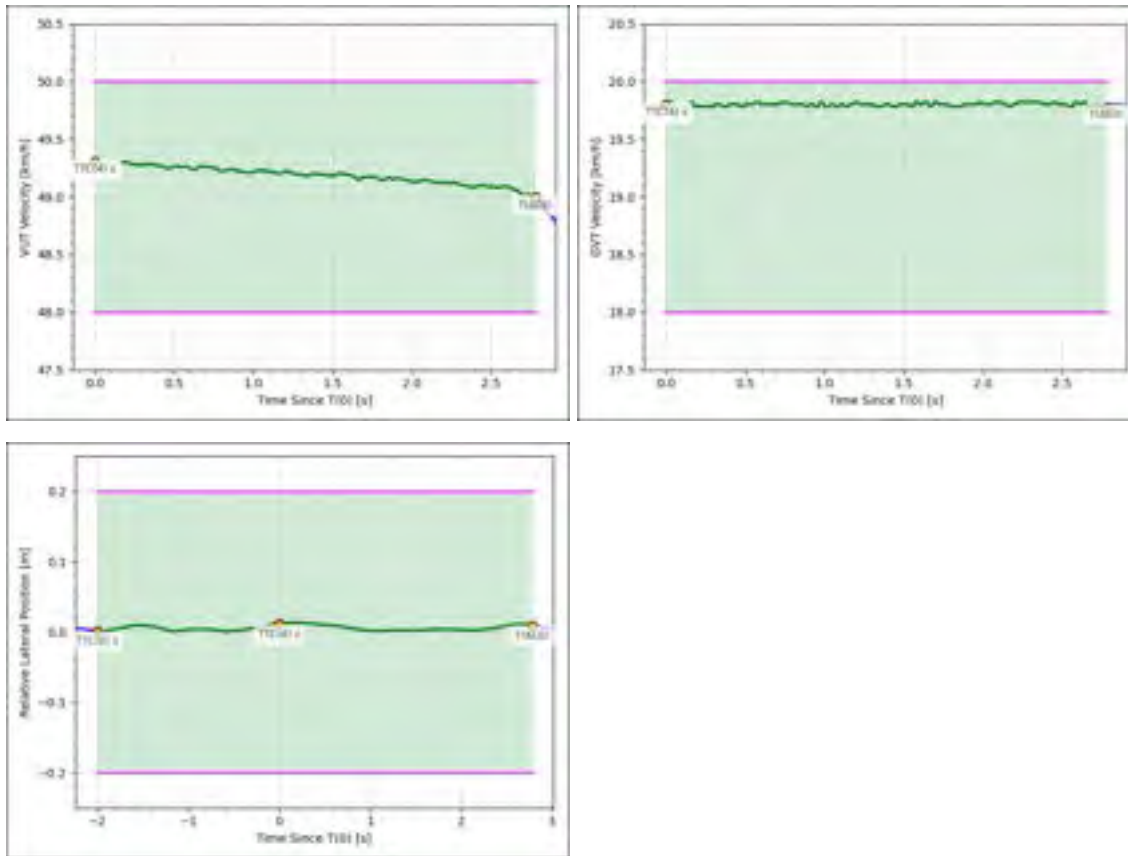
AEB CCRm | 50 km/h +100 % | Run 1

Run Date / Time 8-Feb-2023 15:28



AEB CCRm | 50 km/h +100 % | Run 2

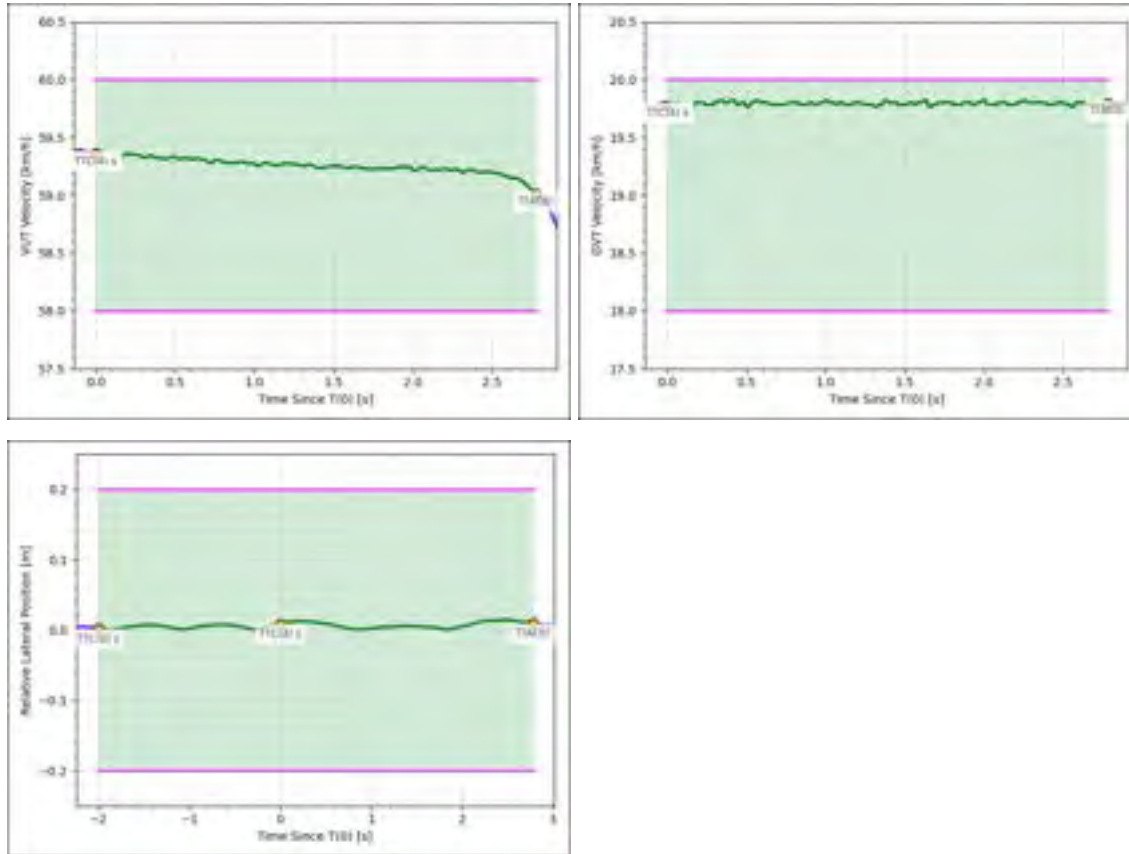
Run Date / Time 8-Feb-2023 15:31



1.1.1.4. AEB CCRm 60 kph +100 %

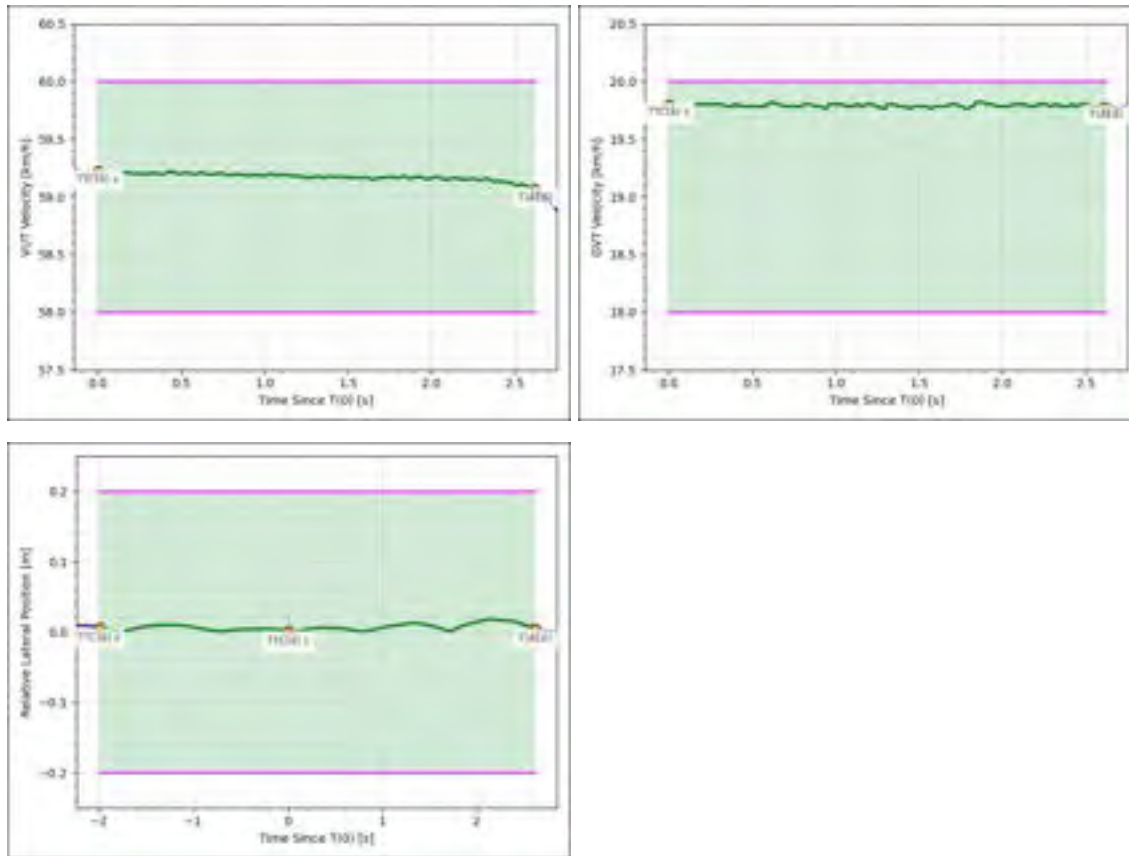
AEB CCRm | 60 km/h +100 % | Run 1

Run Date / Time 10-Feb-2023 12:03



AEB CCRm | 60 km/h +100 % | Run 2

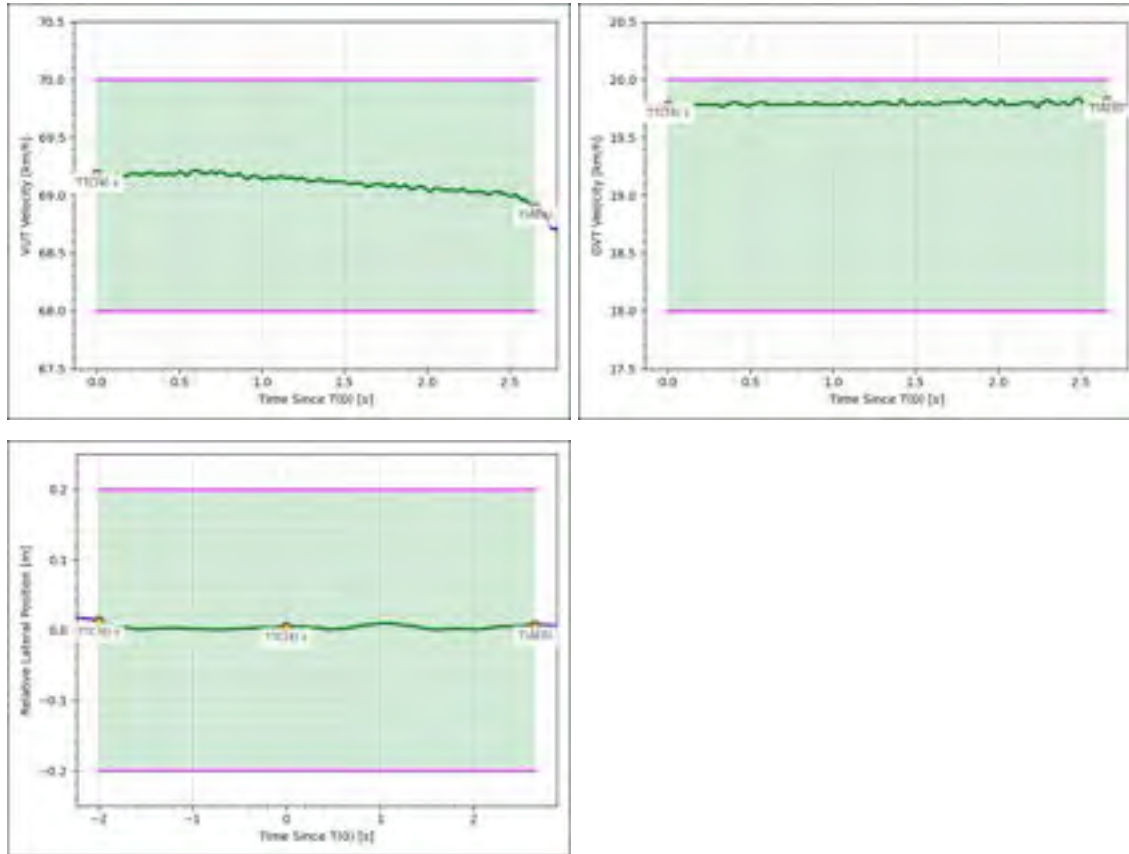
Run Date / Time 10-Feb-2023 12:07



1.1.1.5. AEB CCRm 70 kph +100 %

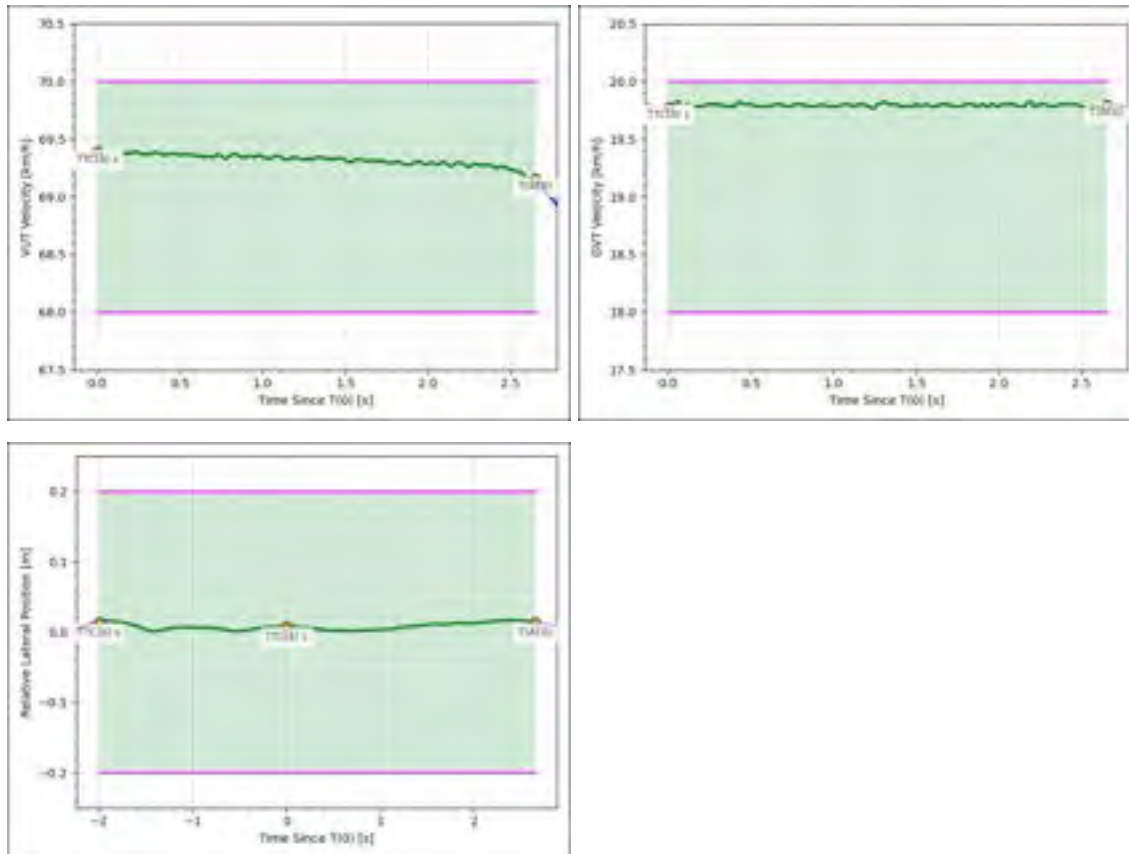
AEB CCRm | 70 km/h +100 % | Run 1

Run Date / Time 10-Feb-2023 12:11



AEB CCRm | 70 km/h +100 % | Run 2

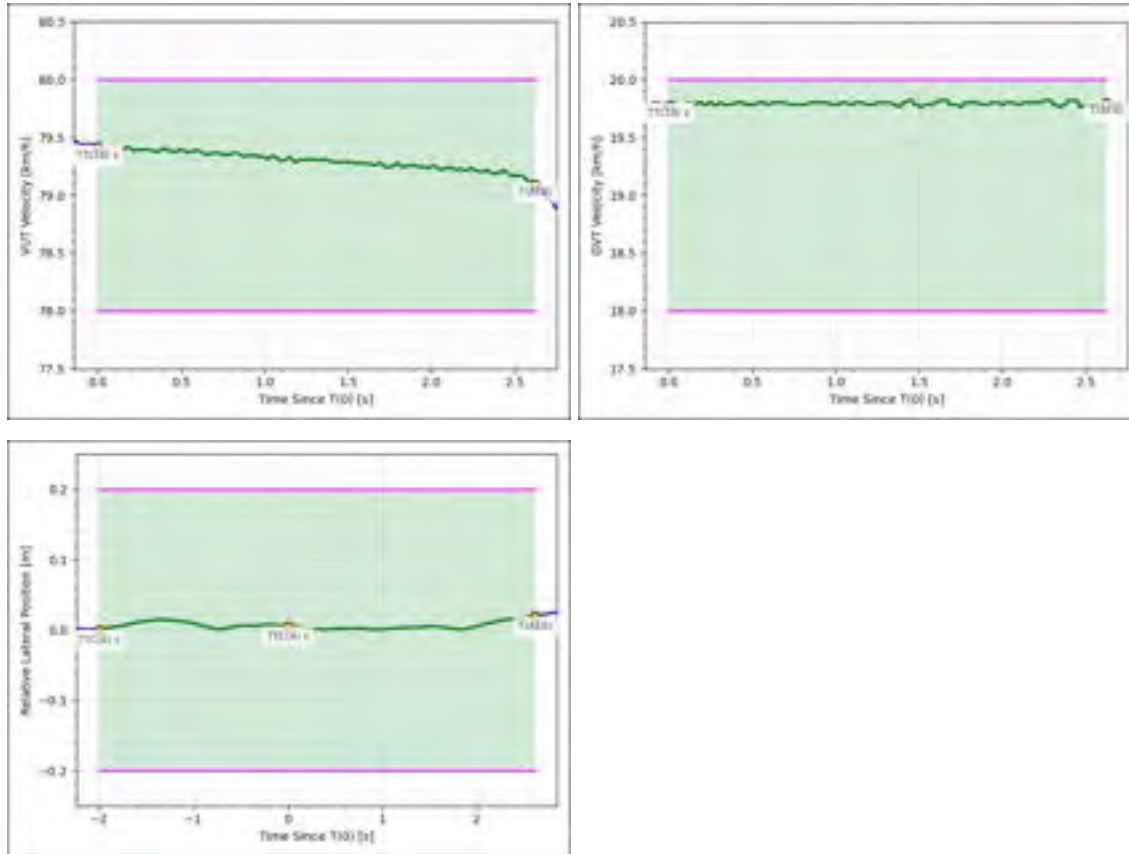
Run Date / Time 10-Feb-2023 12:14



1.1.1.6. AEB CCRm 80 kph +100 %

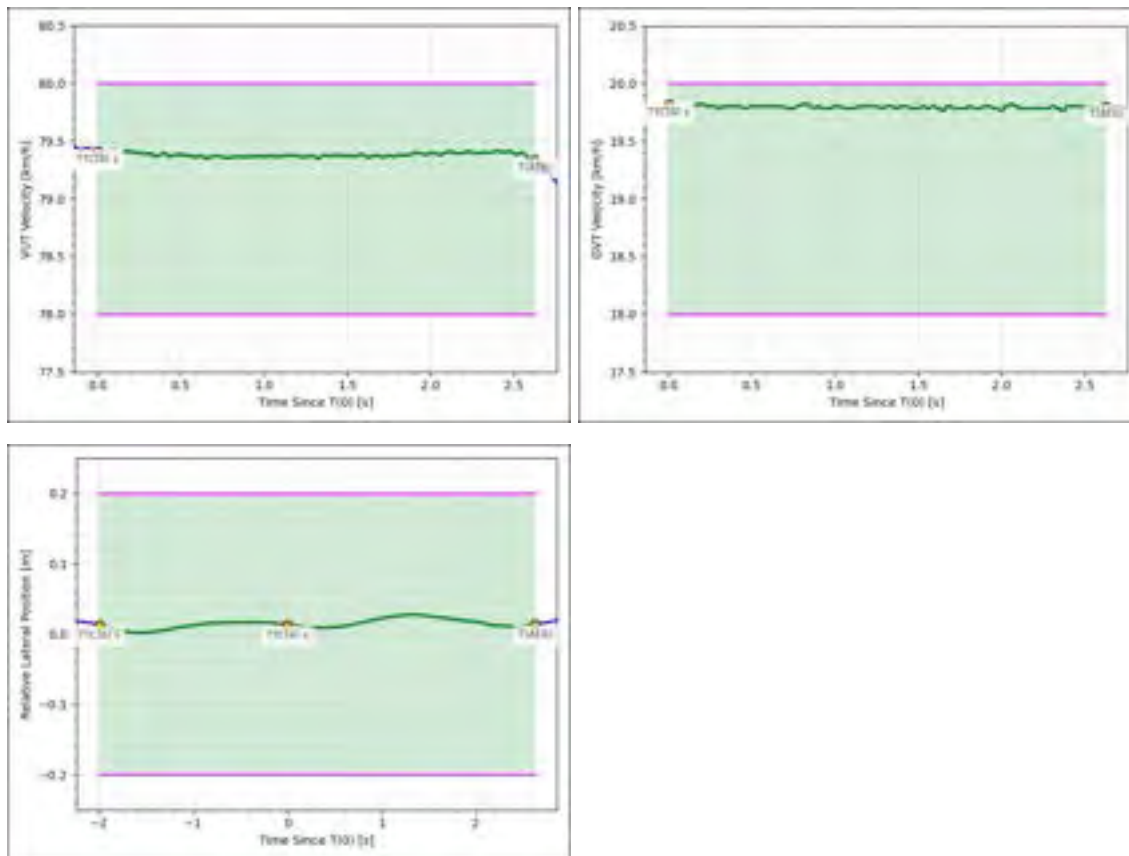
AEB CCRm | 80 km/h +100 % | Run 1

Run Date / Time 10-Feb-2023 12:18



AEB CCRm | 80 km/h +100 % | Run 2

Run Date / Time 10-Feb-2023 12:22

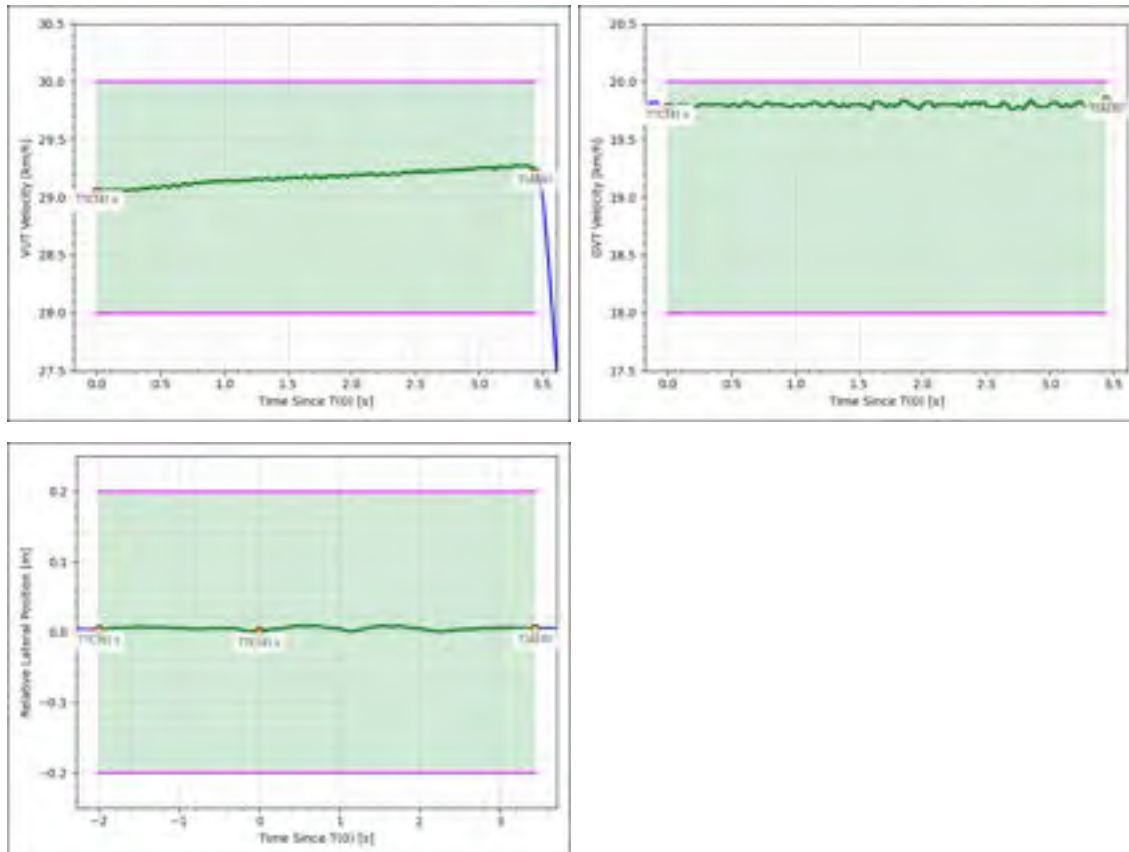


I.1.2. GVM

I.1.2.1. AEB CCRm 30 kph +100 %

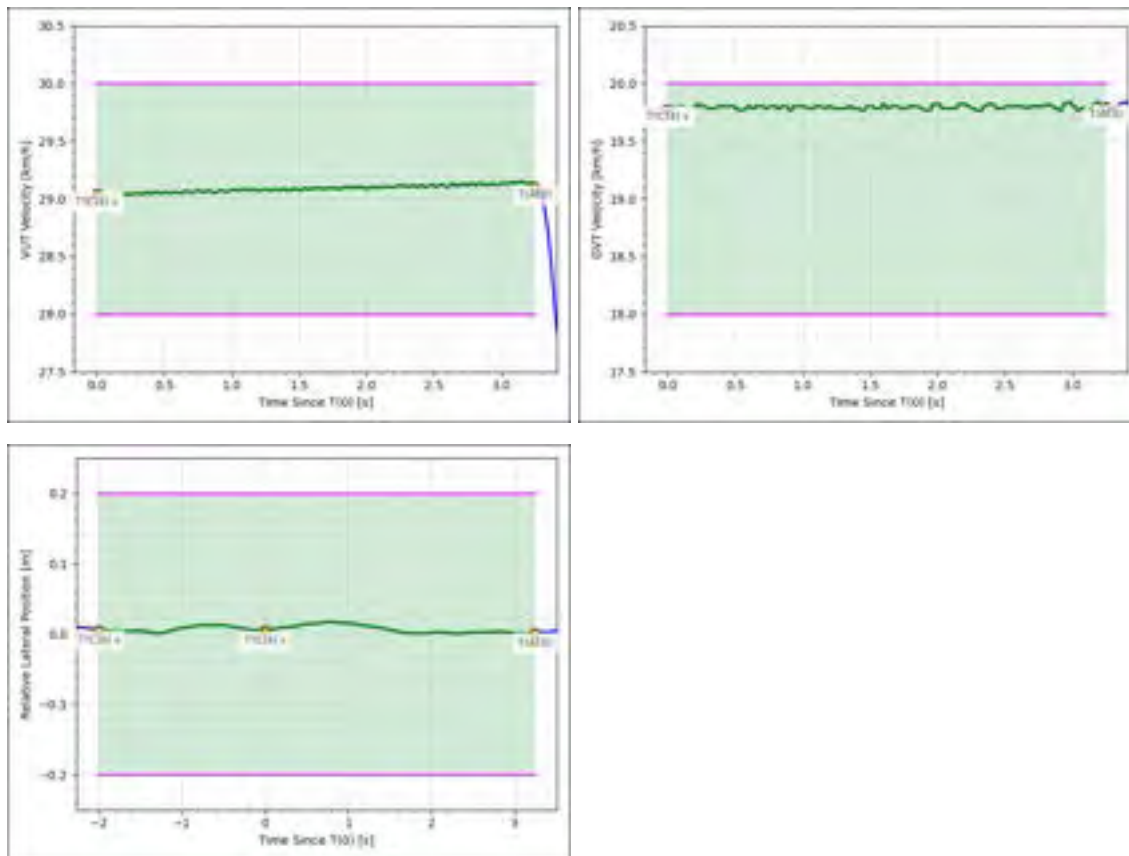
AEB CCRm | 30 km/h +100 % | Run 7

Run Date / Time 16-Feb-2023 14:30



AEB CCRm | 30 km/h +100 % | Run 8

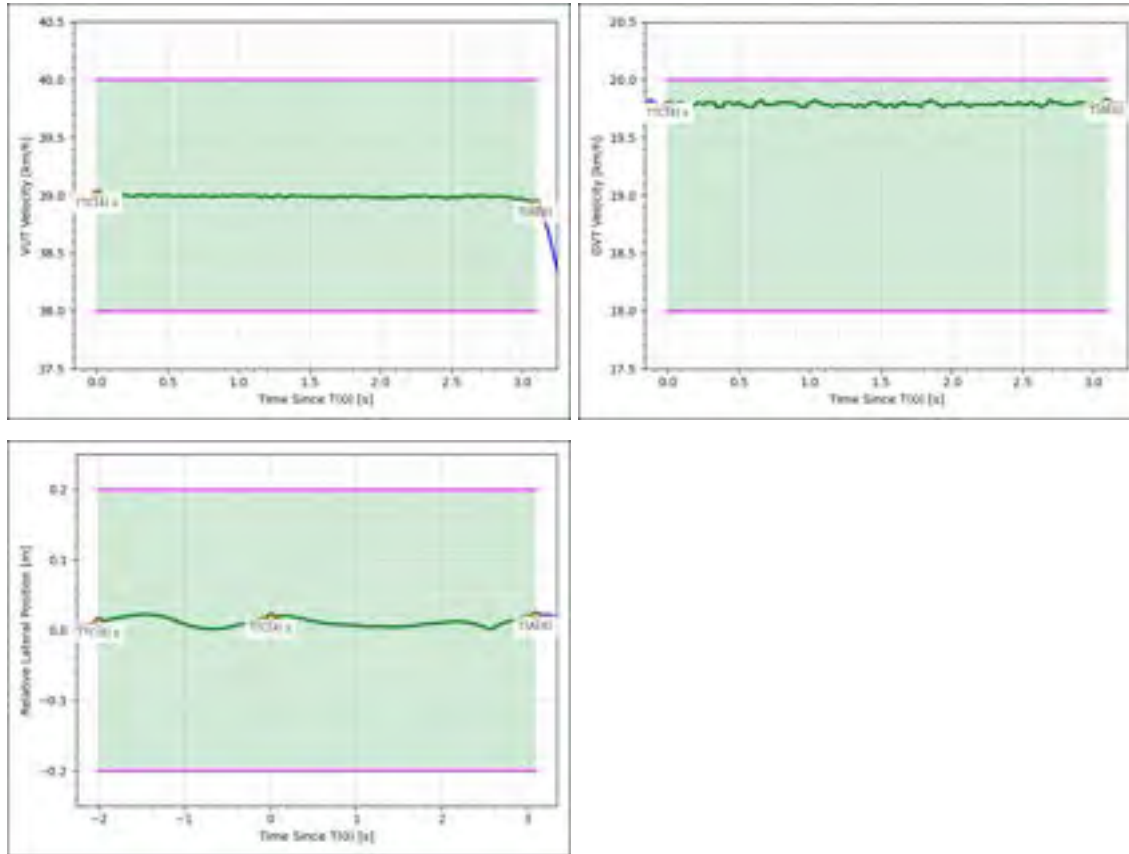
Run Date / Time 16-Feb-2023 14:34



1.1.2.2. AEB CCRm 40 kph +100 %

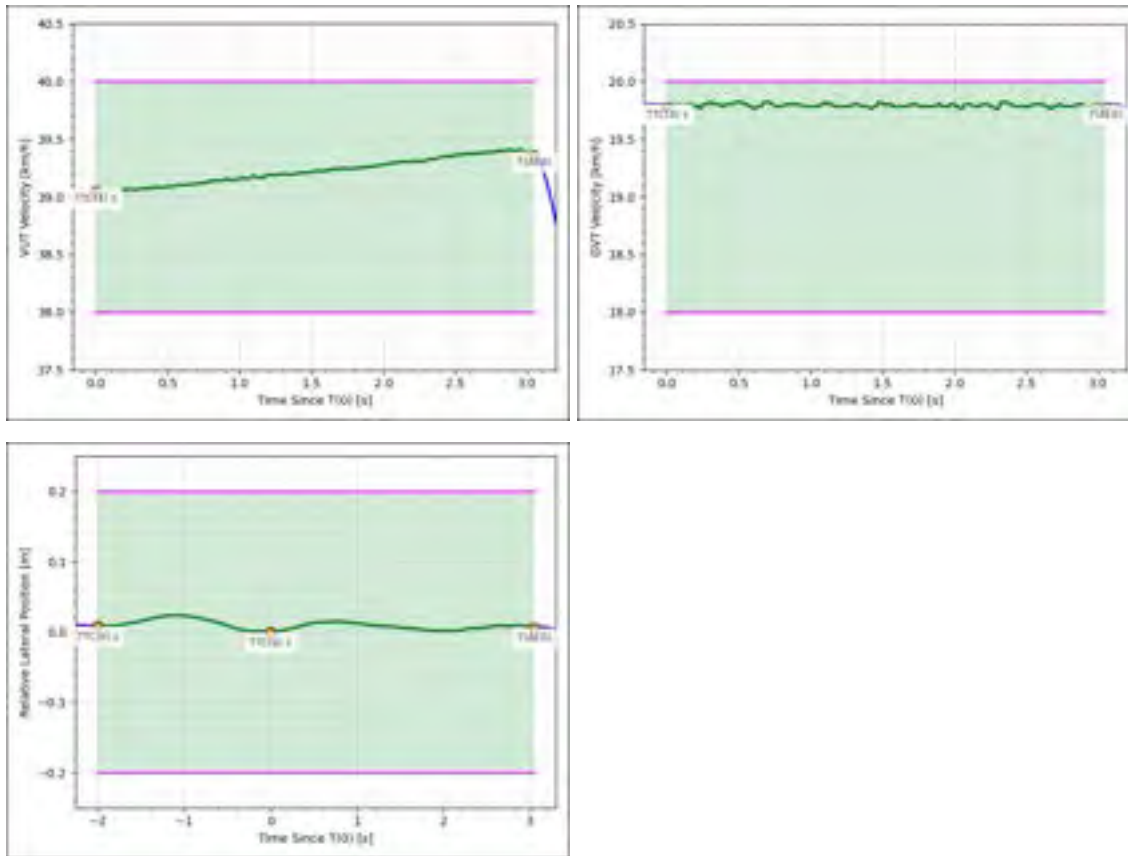
AEB CCRm | 40 km/h +100 % | Run 3

Run Date / Time 16-Feb-2023 14:37



AEB CCRm | 40 km/h +100 % | Run 4

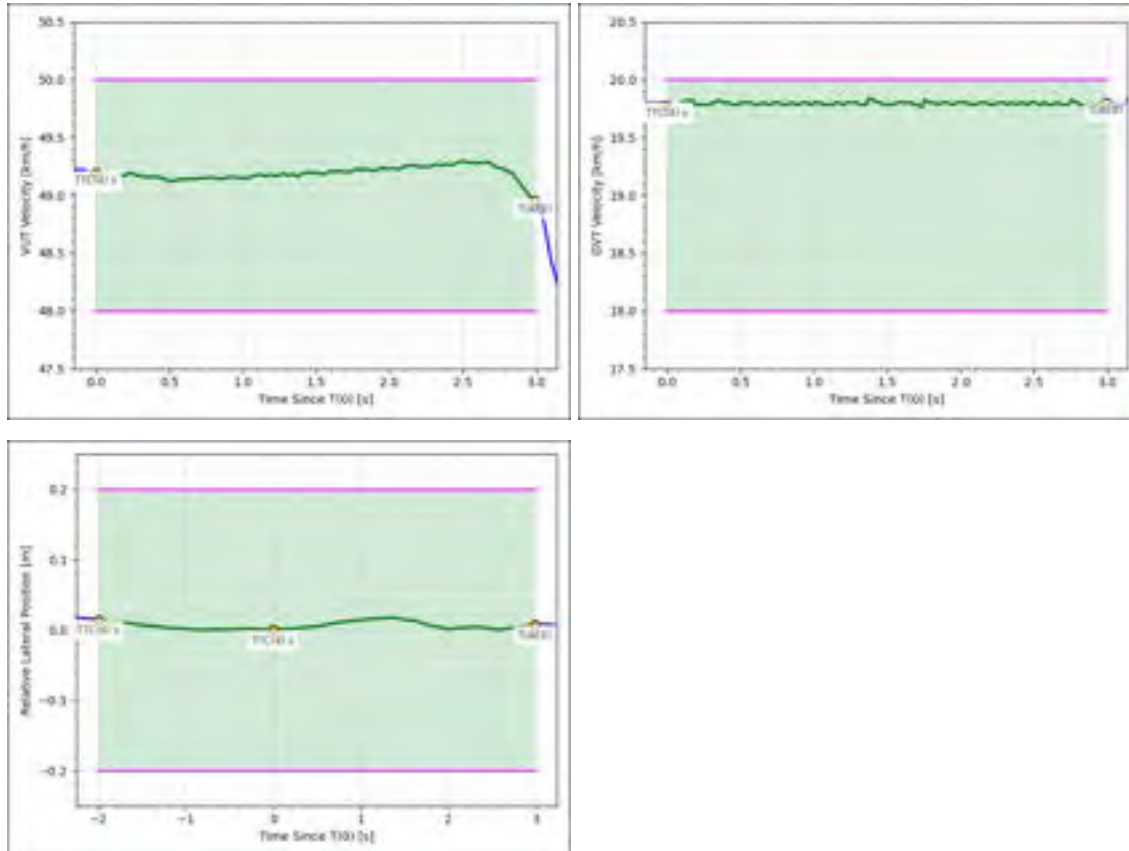
Run Date / Time 16-Feb-2023 14:41



1.1.2.3. AEB CCRm 50 kph +100 %

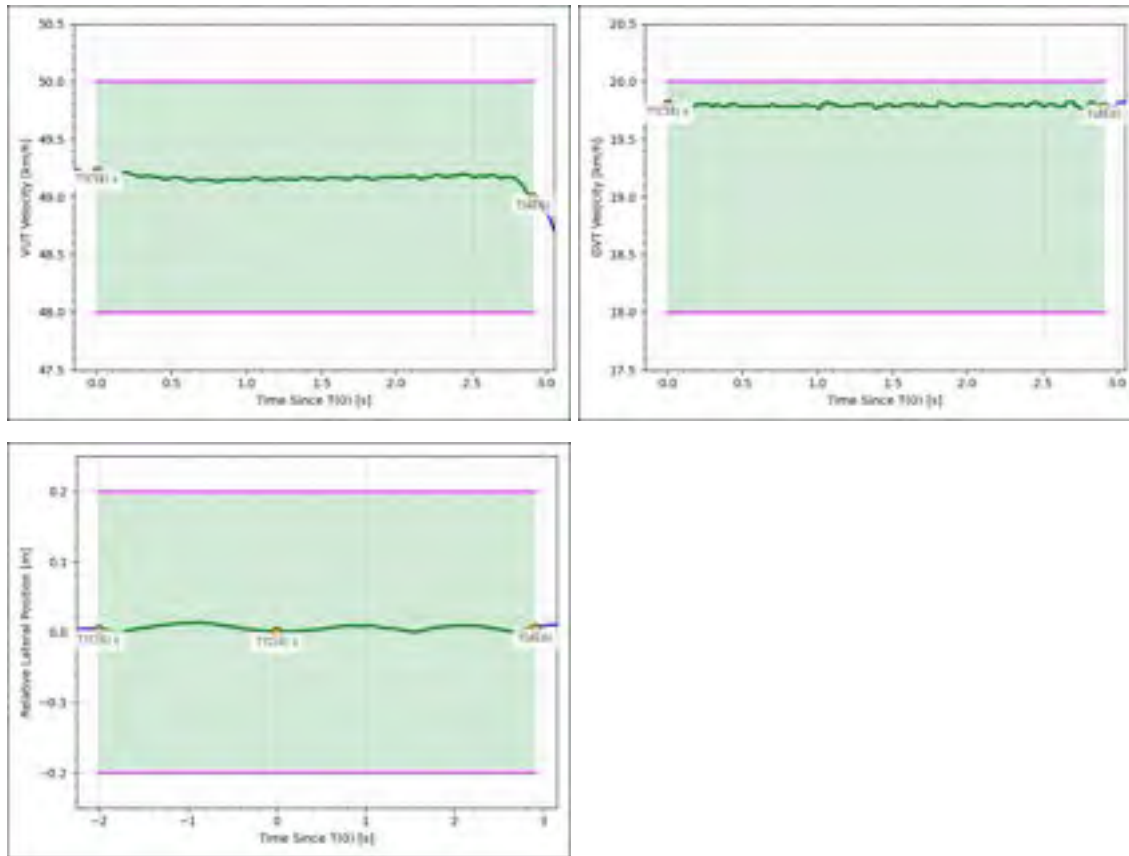
AEB CCRm | 50 km/h +100 % | Run 3

Run Date / Time 16-Feb-2023 14:45



AEB CCRm | 50 km/h +100 % | Run 4

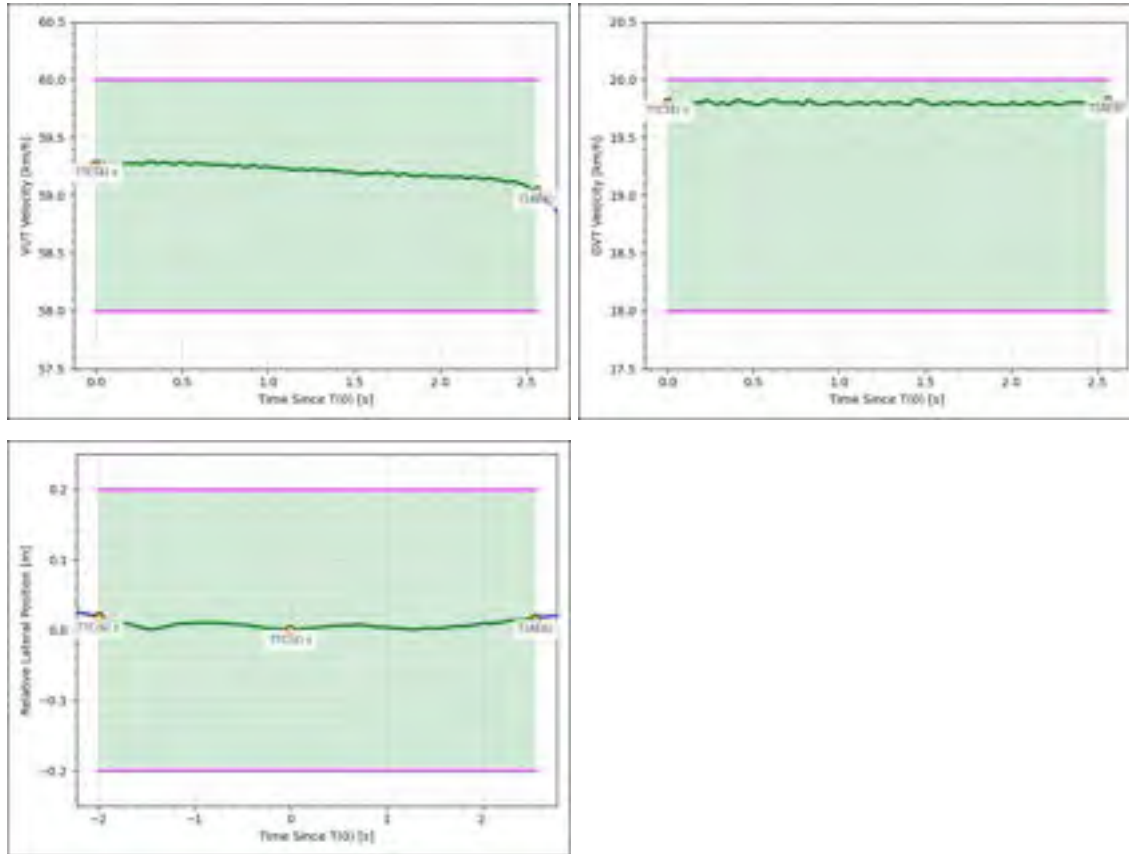
Run Date / Time 16-Feb-2023 14:48



1.1.2.4. AEB CCRm 60 kph +100 %

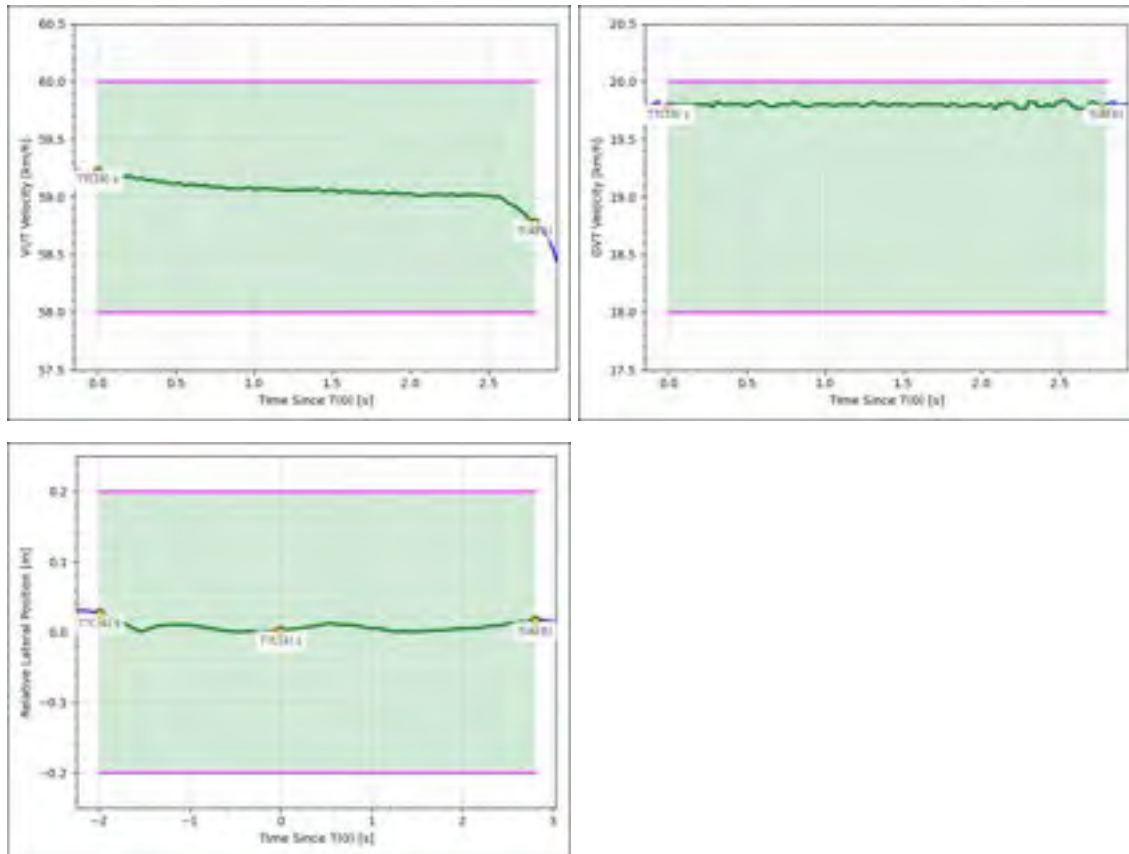
AEB CCRm | 60 km/h +100 % | Run 3

Run Date / Time 16-Feb-2023 14:52



AEB CCRm | 60 km/h +100 % | Run 4

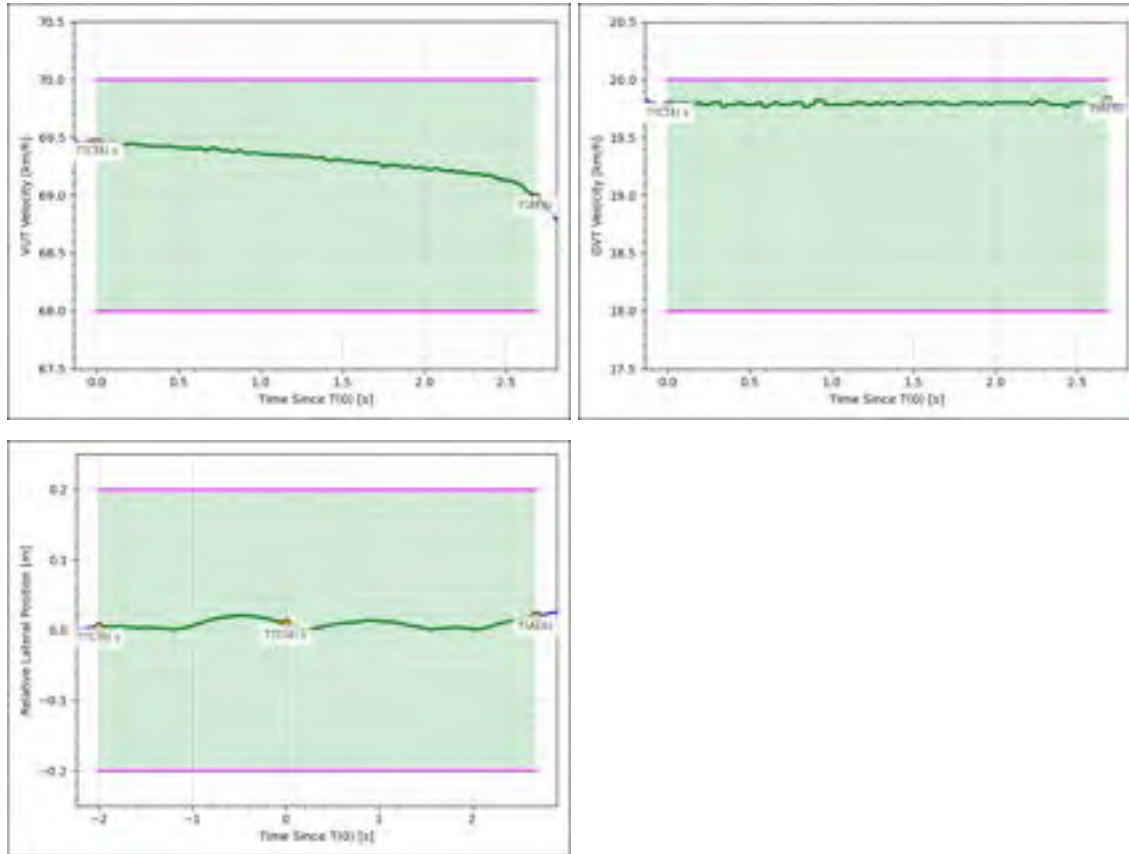
Run Date / Time 16-Feb-2023 14:56



1.1.2.5. AEB CCRm 70 kph +100 %

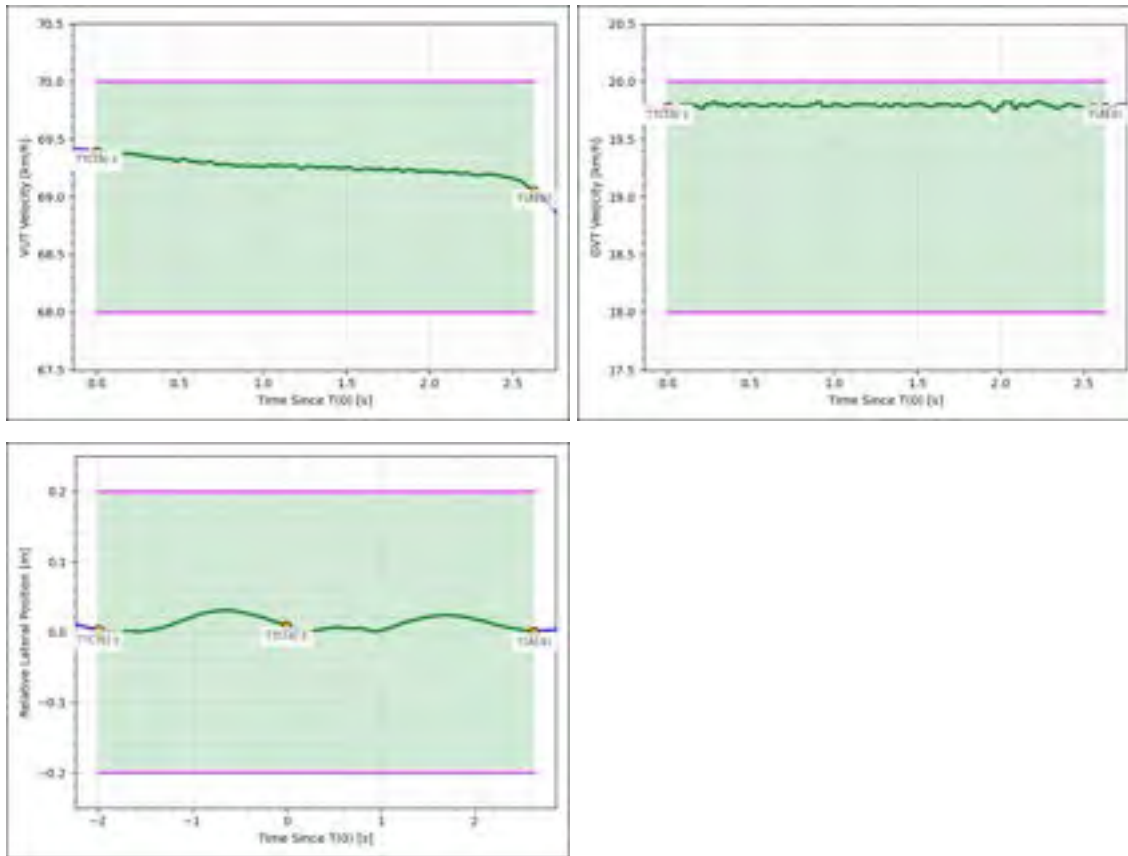
AEB CCRm | 70 km/h +100 % | Run 3

Run Date / Time 16-Feb-2023 15:01



AEB CCRm | 70 km/h +100 % | Run 4

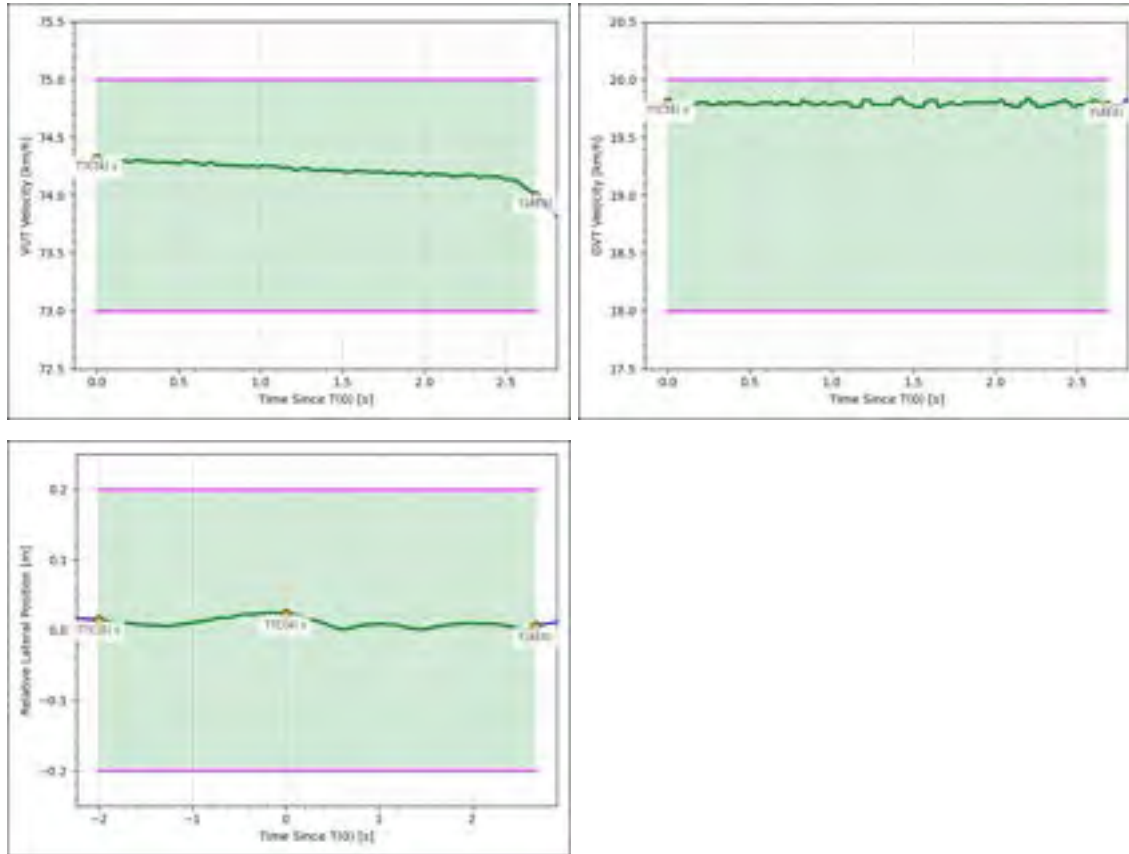
Run Date / Time 16-Feb-2023 15:05



I.1.2.6. AEB CCRm 75 kph +100 %

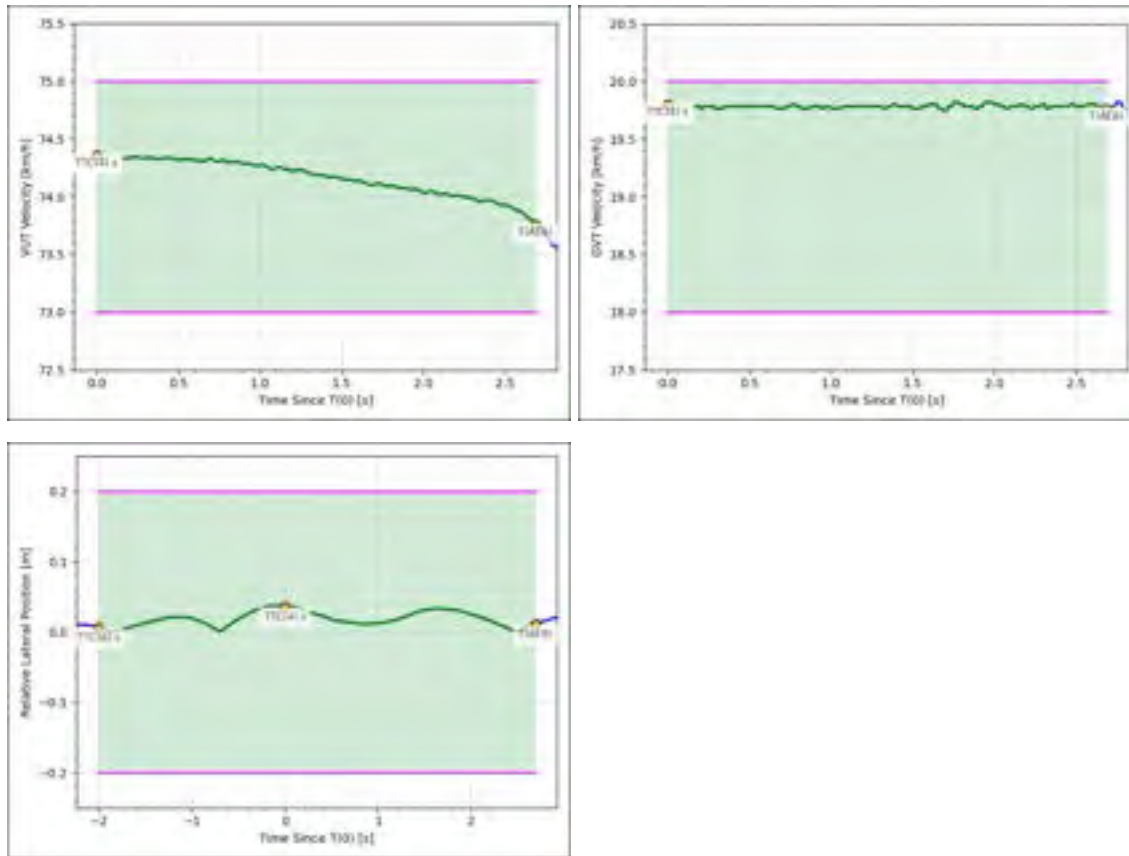
AEB CCRm | 75 km/h +100 % | Run 1

Run Date / Time 16-Feb-2023 15:22



AEB CCRm | 75 km/h +100 % | Run 2

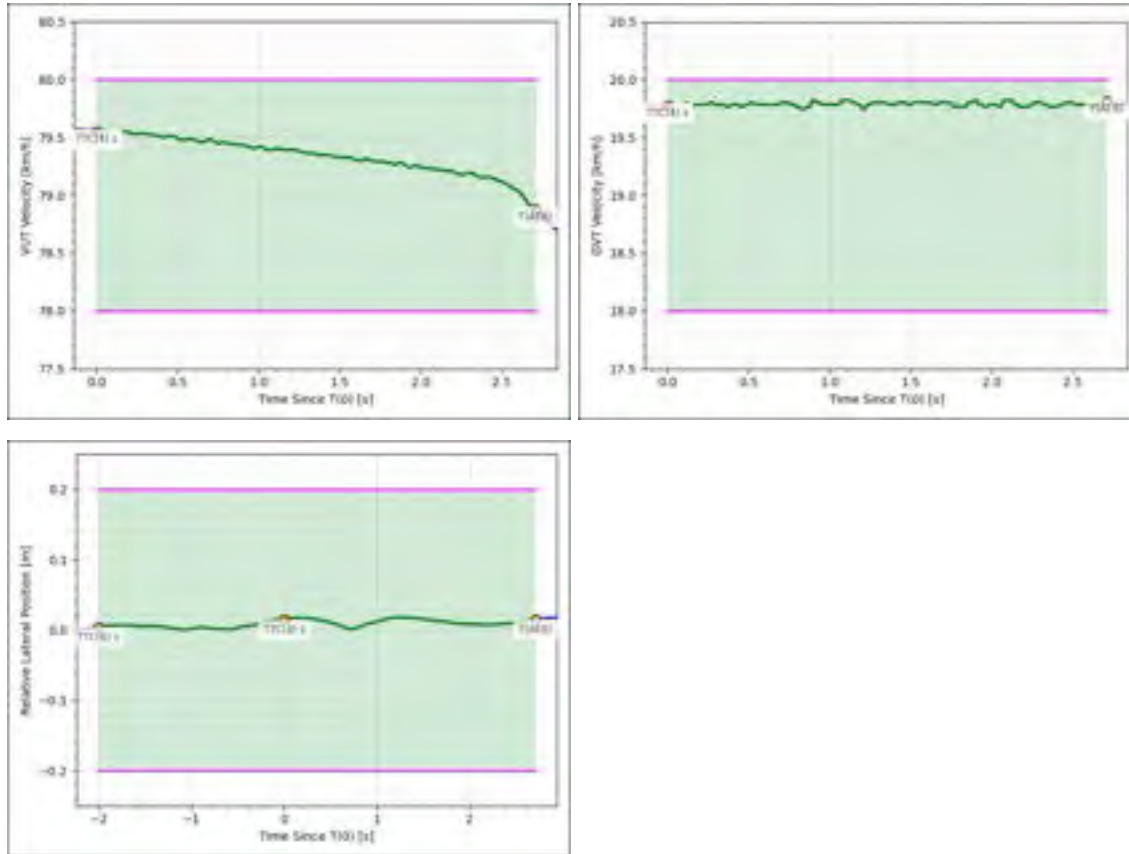
Run Date / Time 16-Feb-2023 15:26



1.1.2.7. AEB CCRm 80 kph +100 %

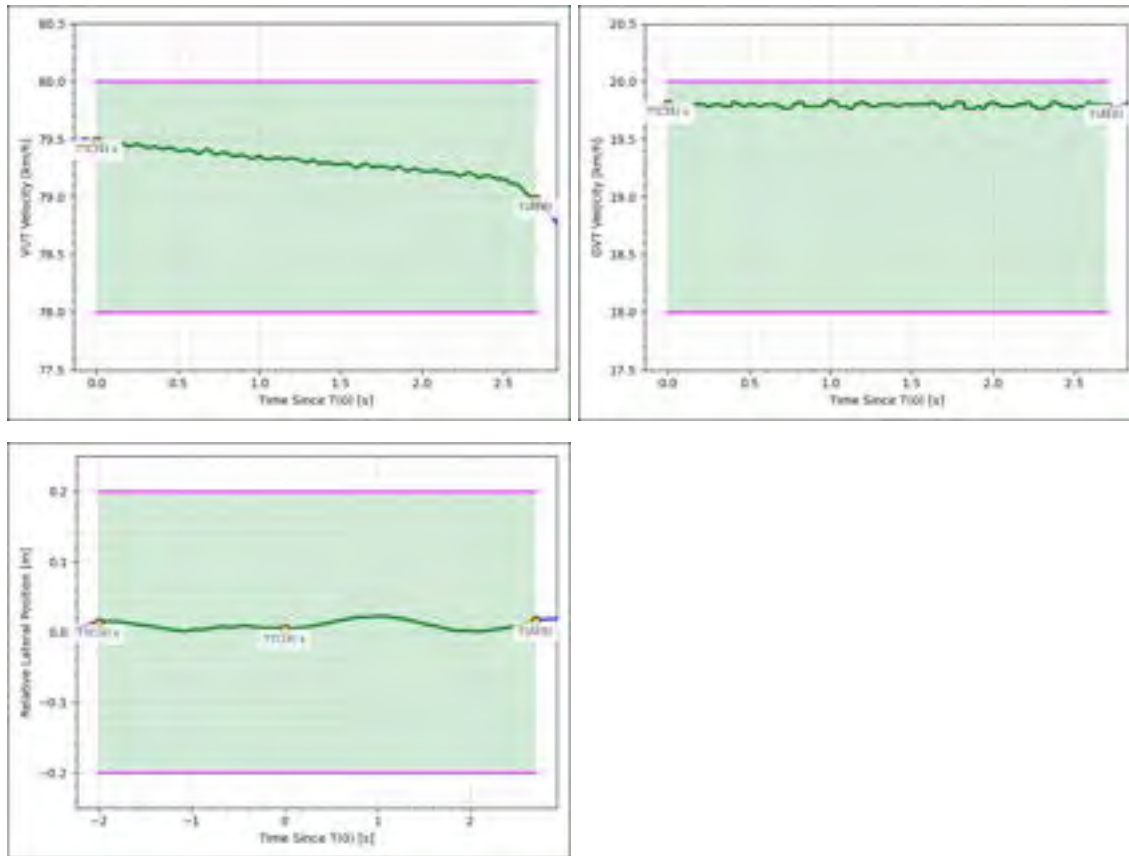
AEB CCRm | 80 km/h +100 % | Run 13

Run Date / Time 16-Feb-2023 15:10



AEB CCRm | 80 km/h +100 % | Run 14

Run Date / Time 16-Feb-2023 15:30

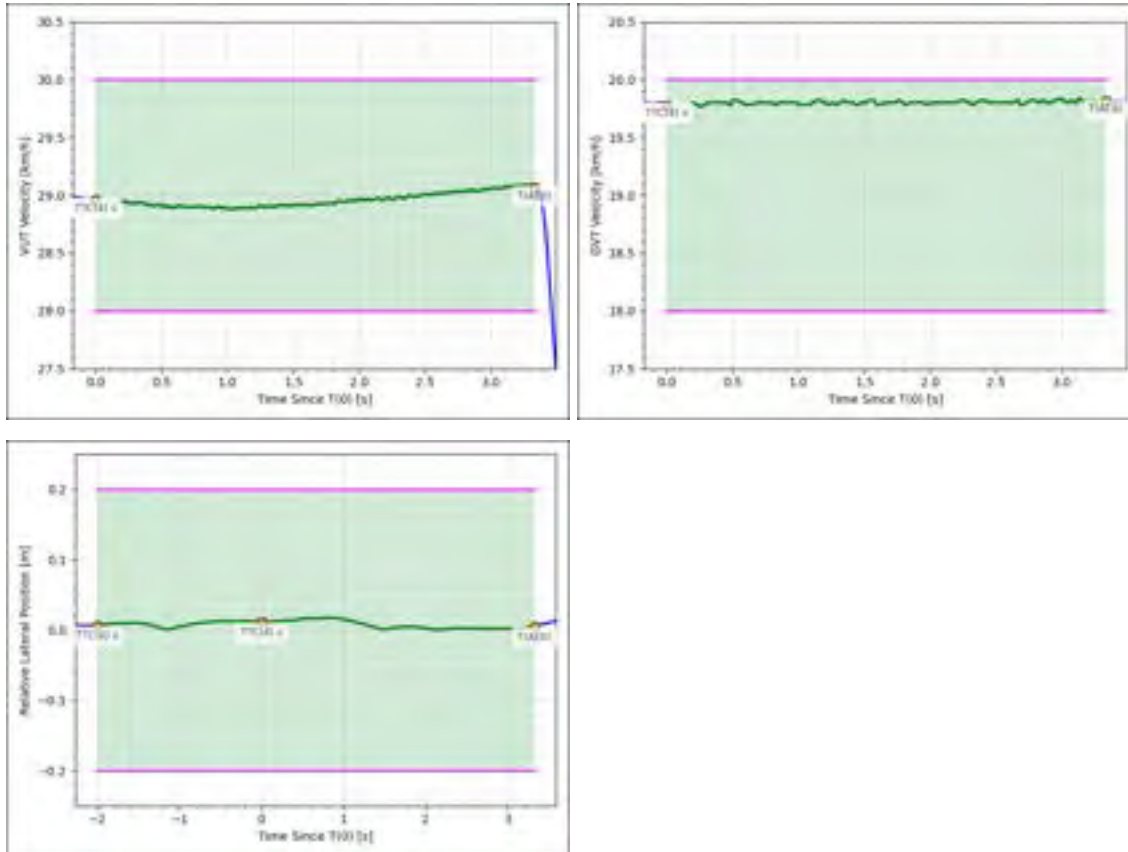


I.1.1. Rear Pitch

I.1.1.1. AEB CCRm 30 kph +100 %

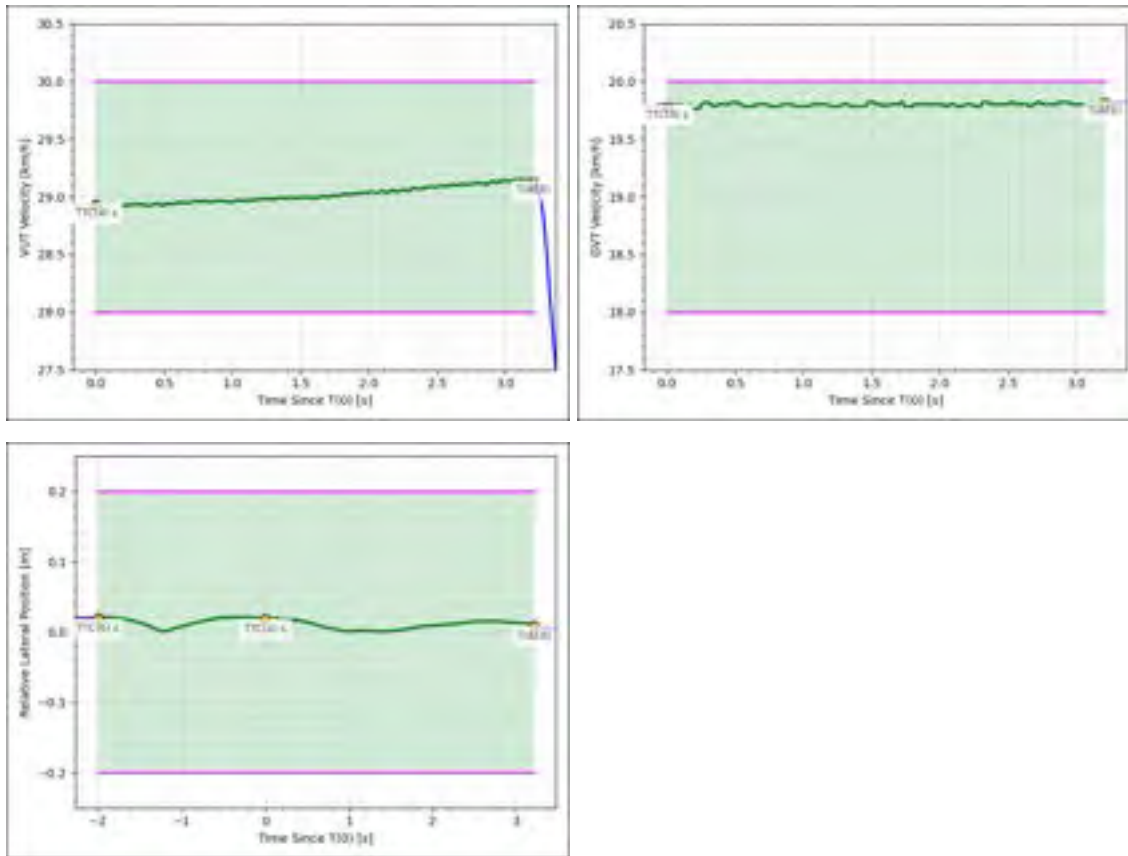
AEB CCRm | 30 km/h +100 % | Run 9

Run Date / Time 23-Feb-2023 13:52



AEB CCRm | 30 km/h +100 % | Run 10

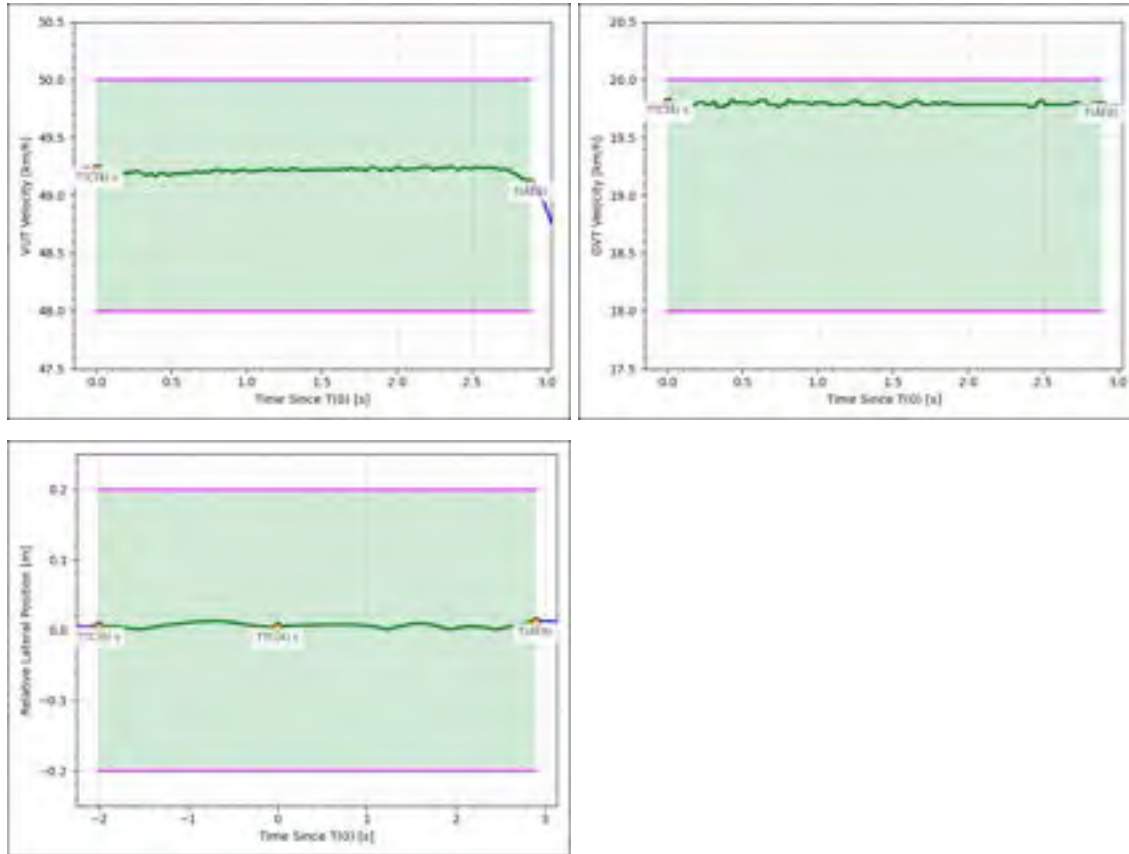
Run Date / Time 23-Feb-2023 13:55



1.1.1.2. AEB CCRm 50 kph +100 %

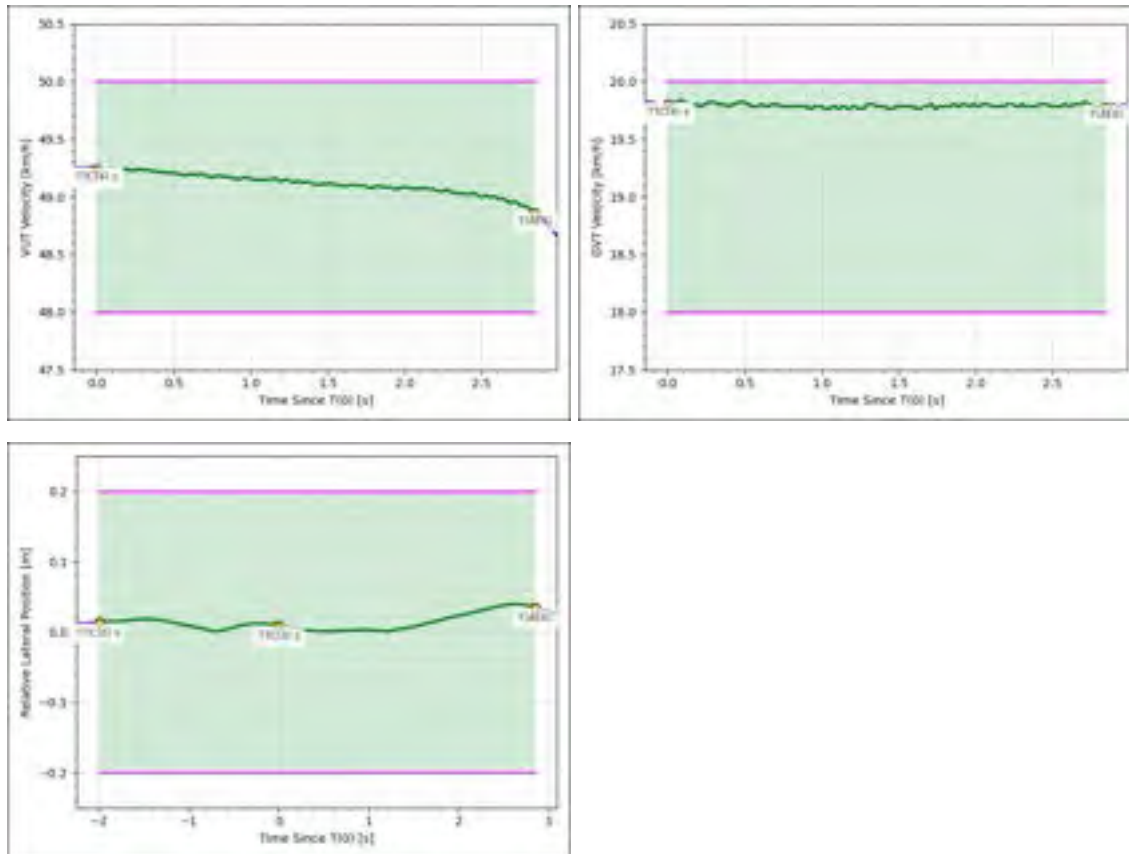
AEB CCRm | 50 km/h +100 % | Run 5

Run Date / Time 23-Feb-2023 13:59



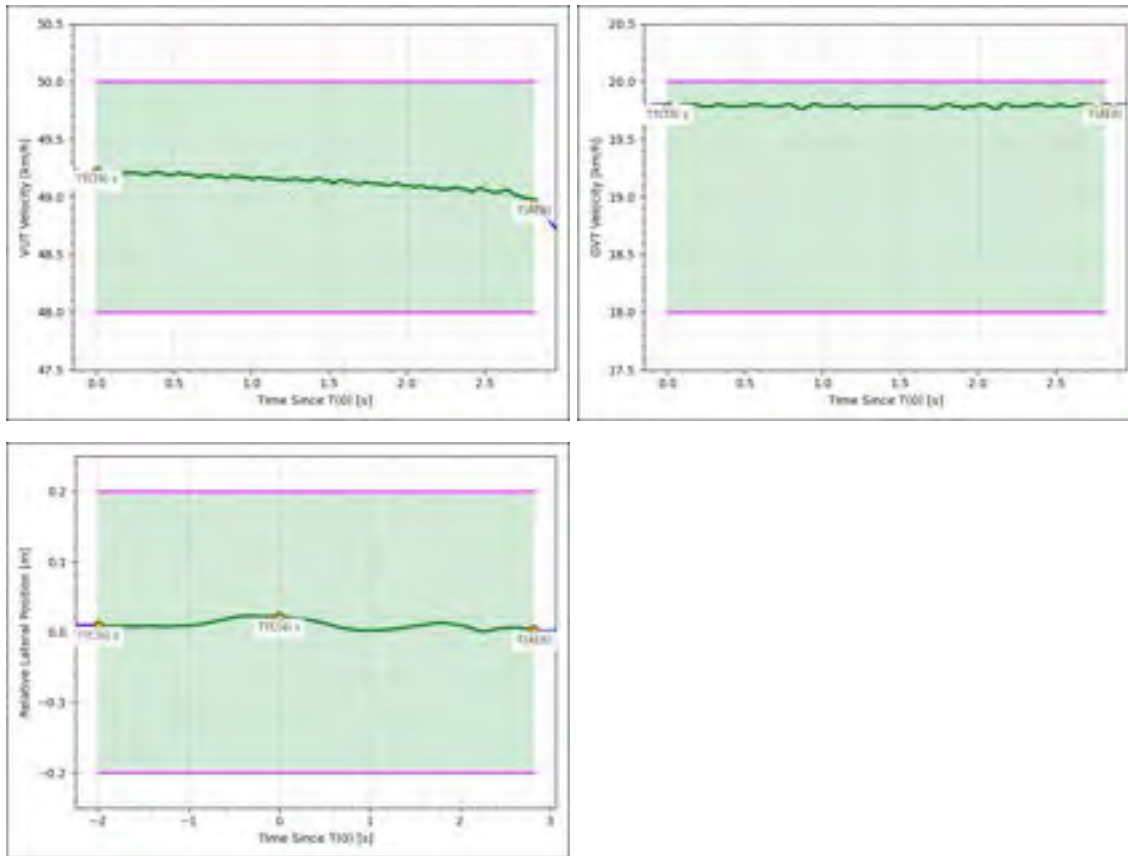
AEB CCRm | 50 km/h +100 % | Run 6

Run Date / Time 23-Feb-2023 14:06



AEB CCRm | 50 km/h +100 % | Run 7

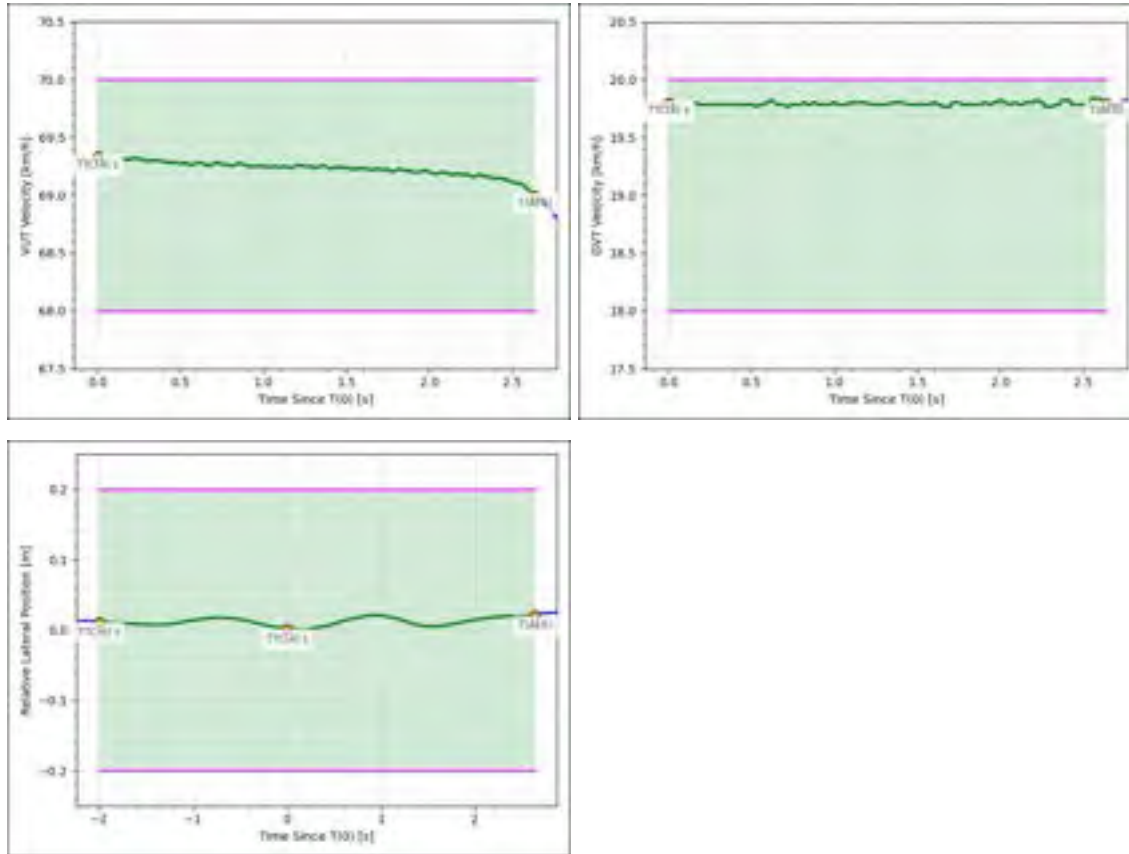
Run Date / Time 23-Feb-2023 14:11



1.1.1.3. AEB CCRm 70 kph +100 %

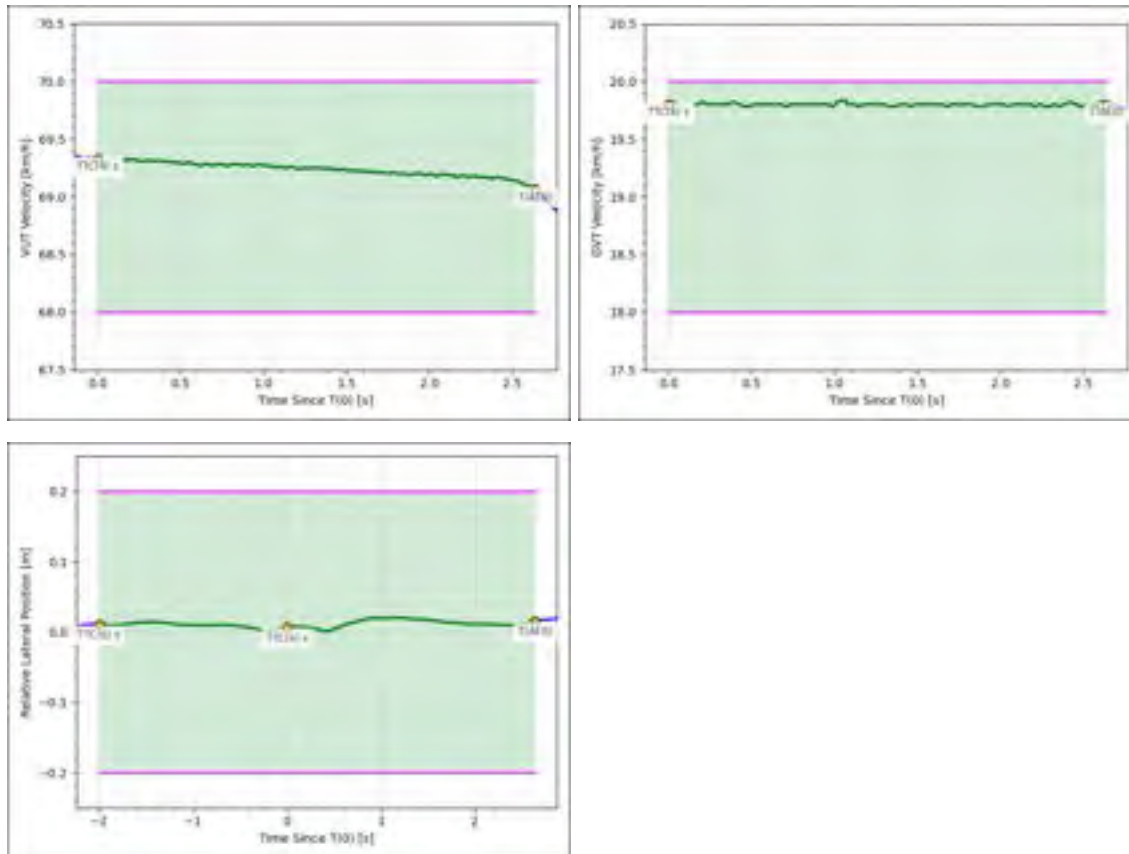
AEB CCRm | 70 km/h +100 % | Run 5

Run Date / Time 23-Feb-2023 14:16



AEB CCRm | 70 km/h +100 % | Run 6

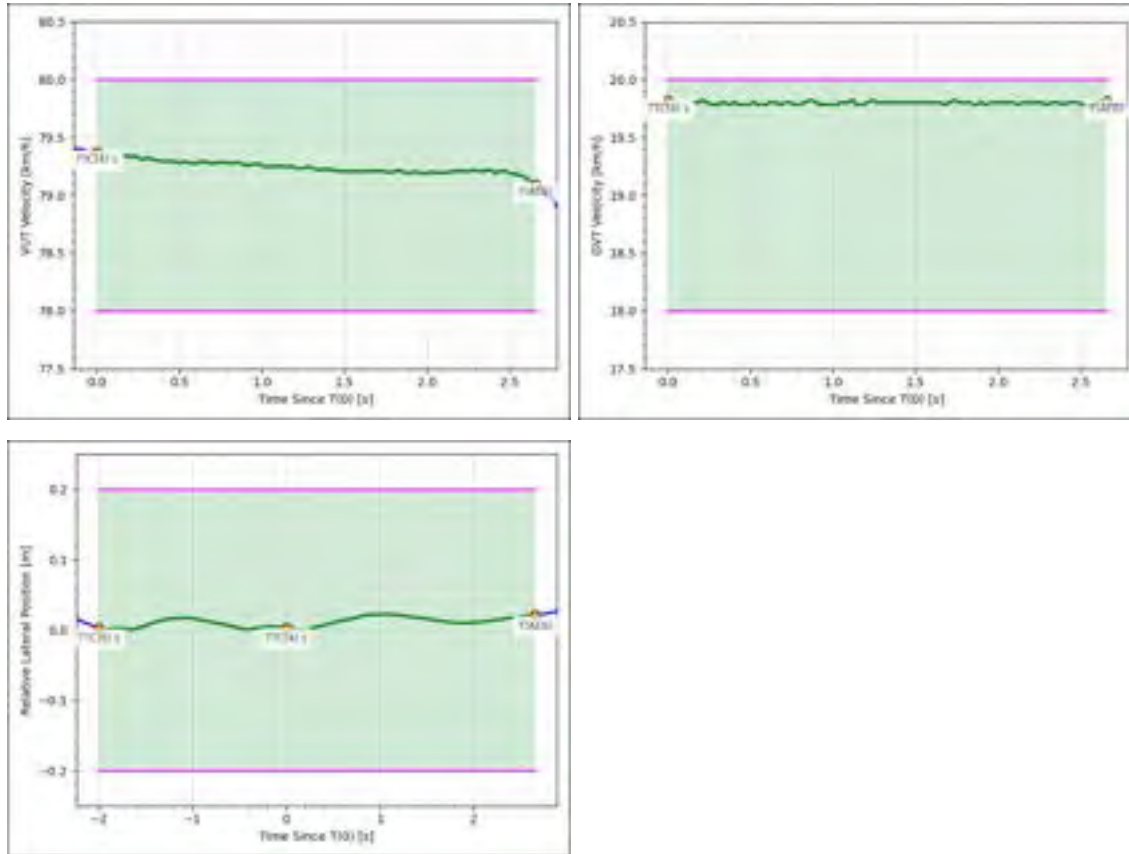
Run Date / Time 23-Feb-2023 14:20



1.1.1.4. AEB CCRm 80 kph +100 %

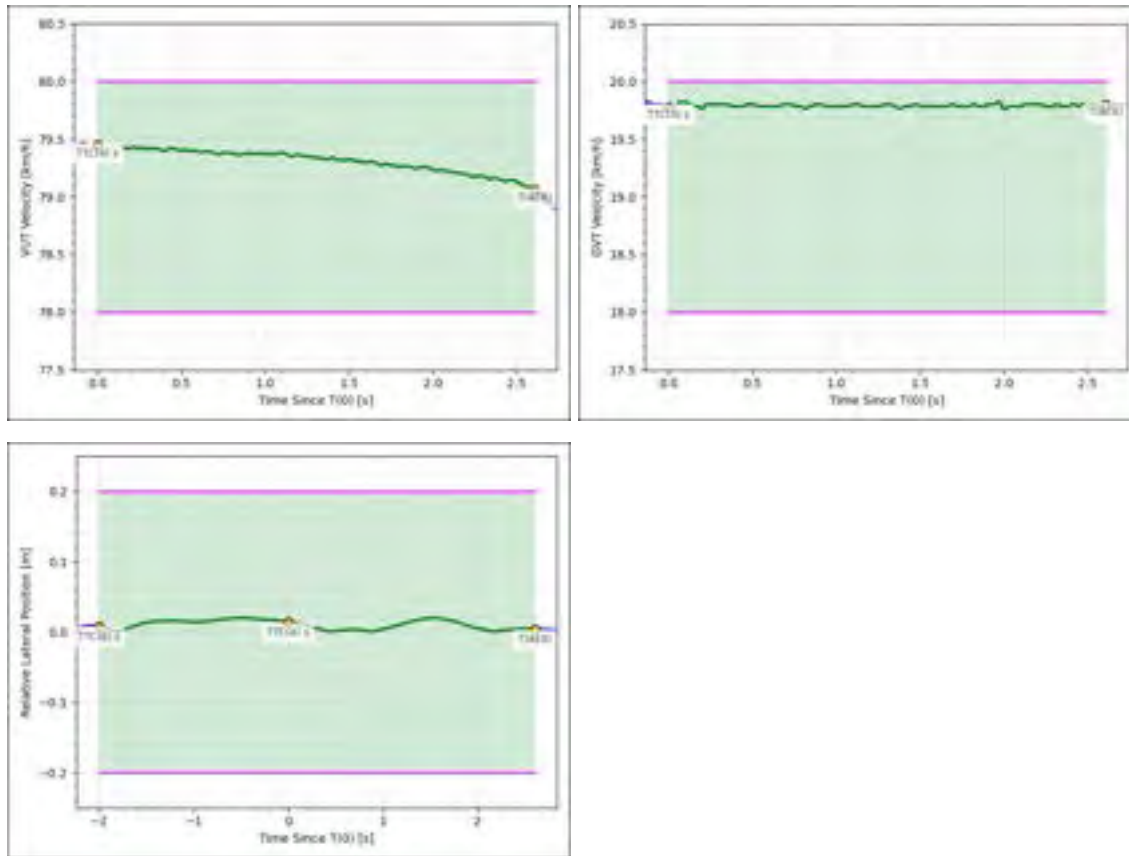
AEB CCRm | 80 km/h +100 % | Run 24

Run Date / Time 23-Feb-2023 14:25



AEB CCRm | 80 km/h +100 % | Run 25

Run Date / Time 23-Feb-2023 14:28

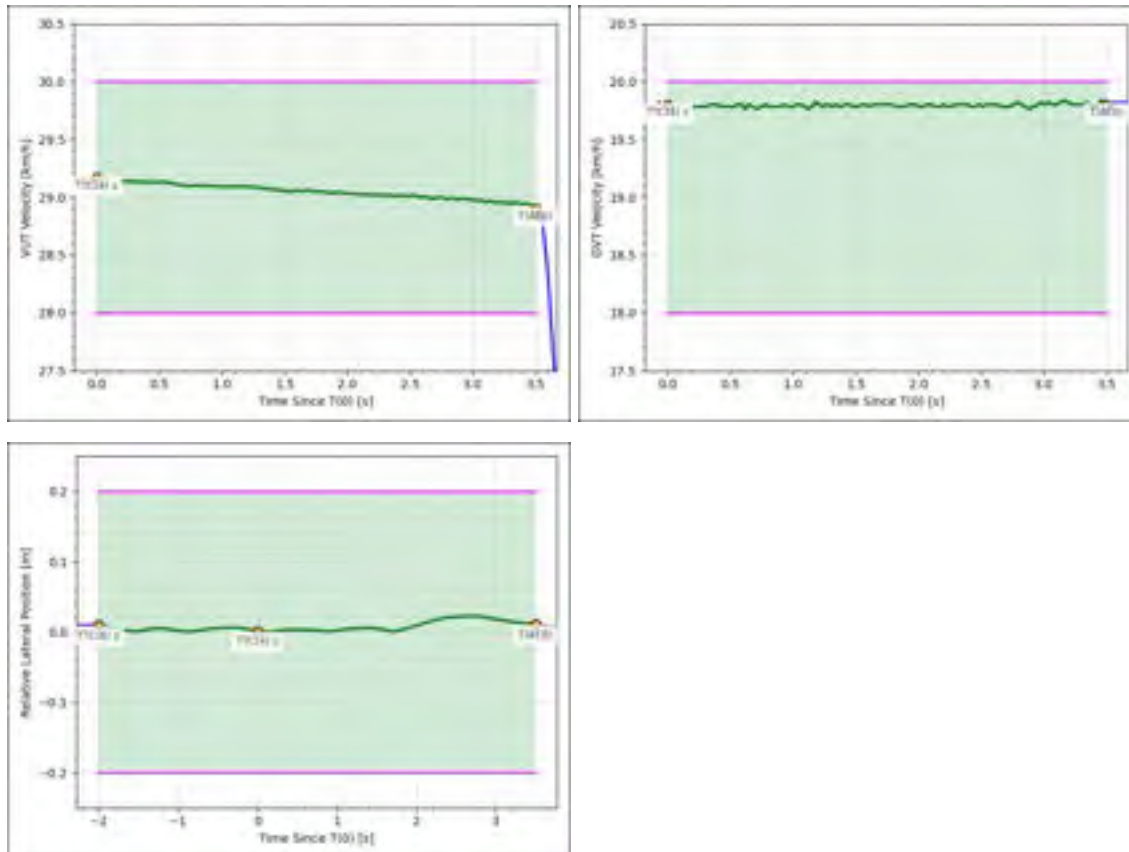


I.1.1. Lift Kit

I.1.1.1. AEB CCRm 30 kph +100 %

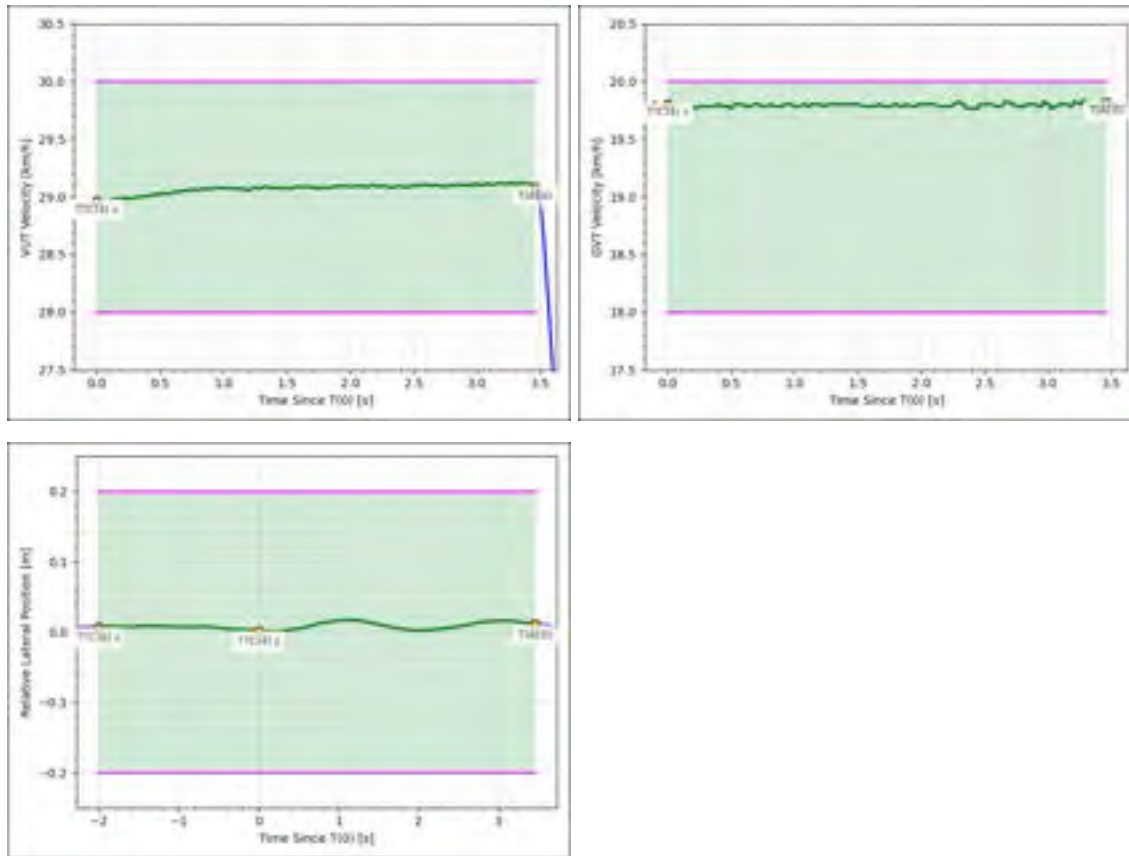
AEB CCRm | 30 km/h +100 % | Run 13

Run Date / Time 15-Mar-2023 10:00



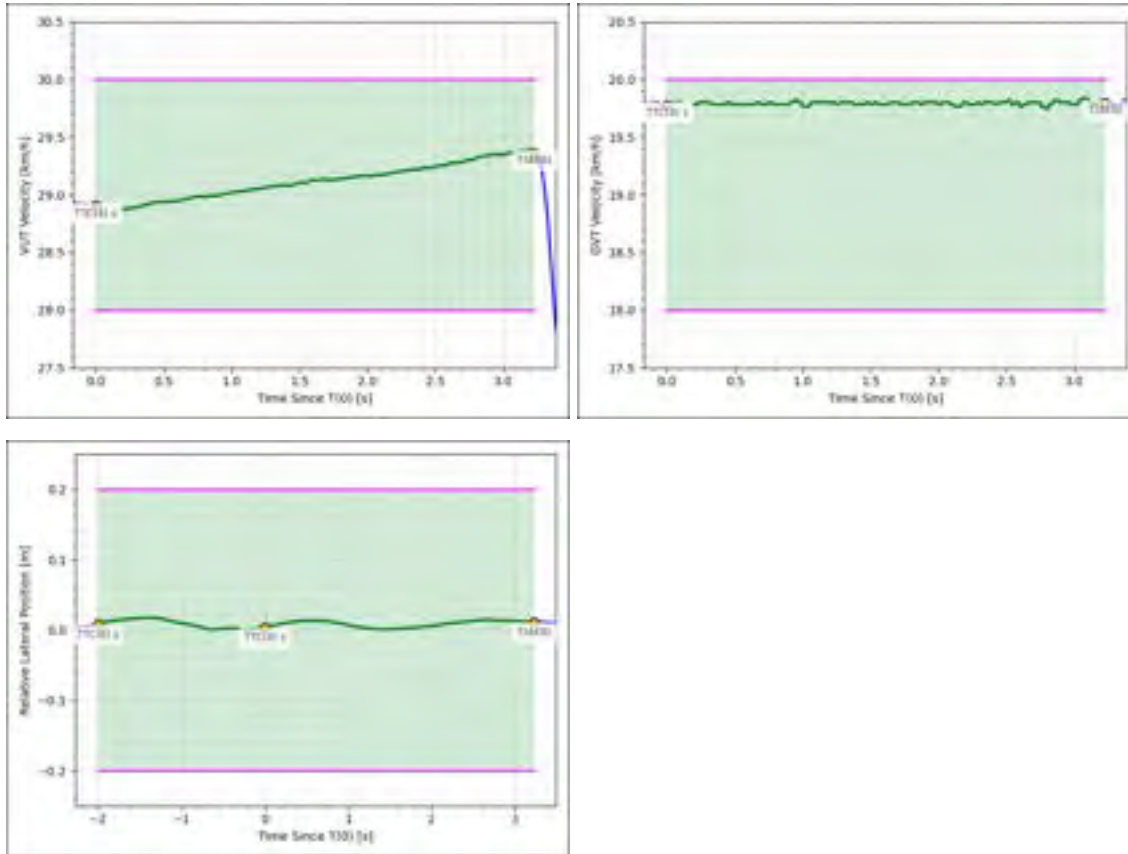
AEB CCRm | 30 km/h +100 % | Run 14

Run Date / Time 15-Mar-2023 10:04



AEB CCRm | 30 km/h +100 % | Run 15

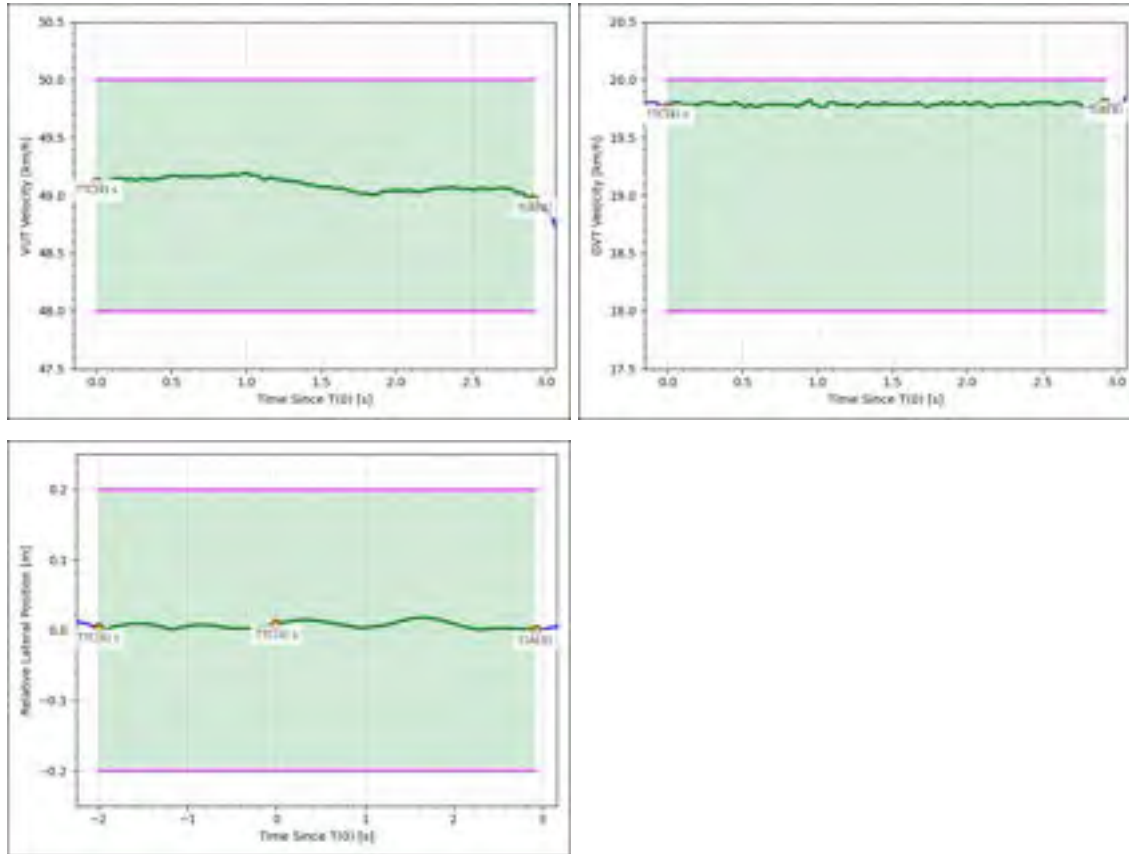
Run Date / Time 15-Mar-2023 10:07



1.1.1.2. AEB CCRm 50 kph +100 %

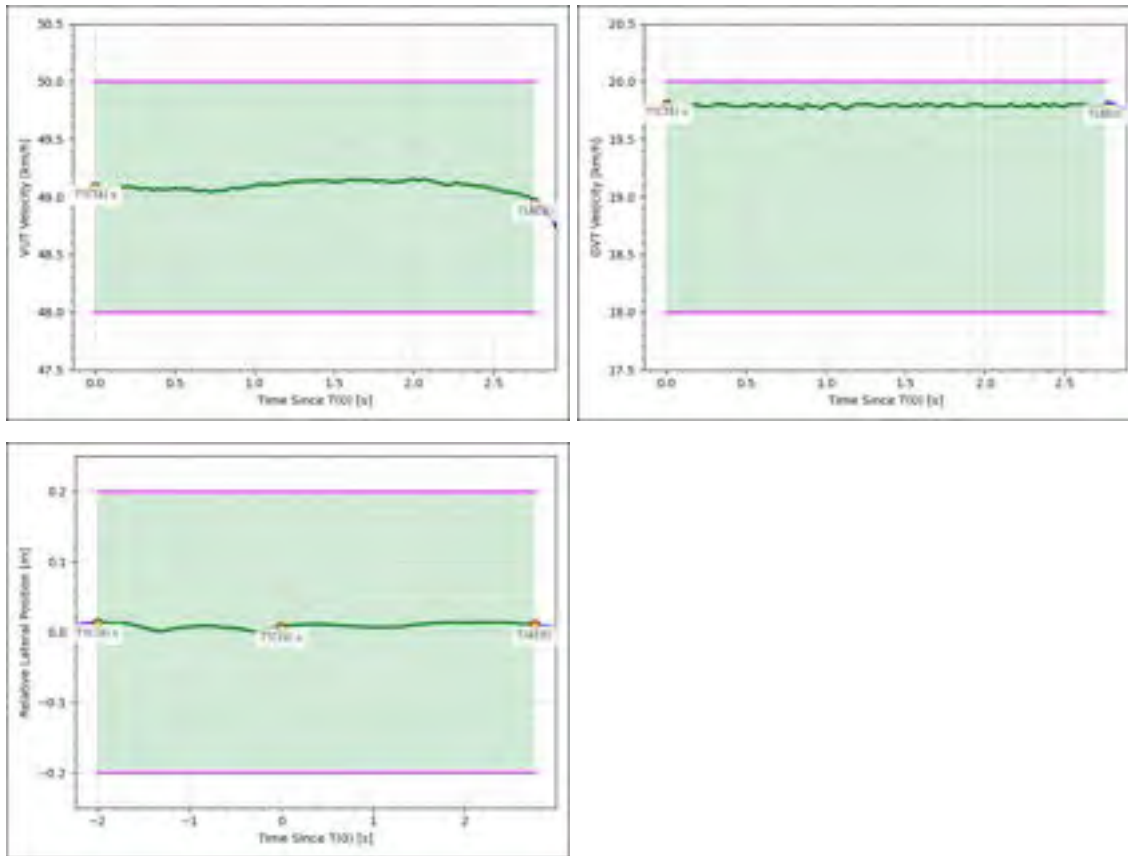
AEB CCRm | 50 km/h +100 % | Run 8

Run Date / Time 15-Mar-2023 10:11



AEB CCRm | 50 km/h +100 % | Run 9

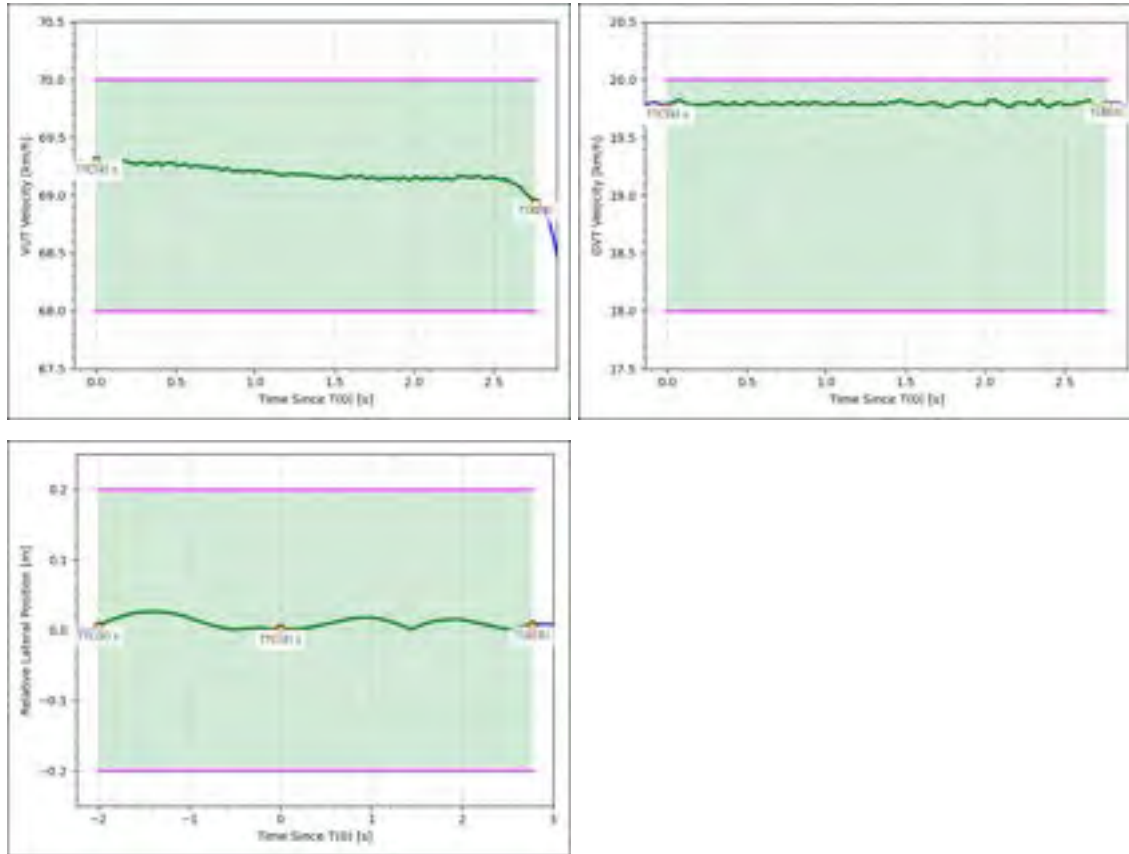
Run Date / Time 15-Mar-2023 10:14



1.1.1.3. AEB CCRm 70 kph +100 %

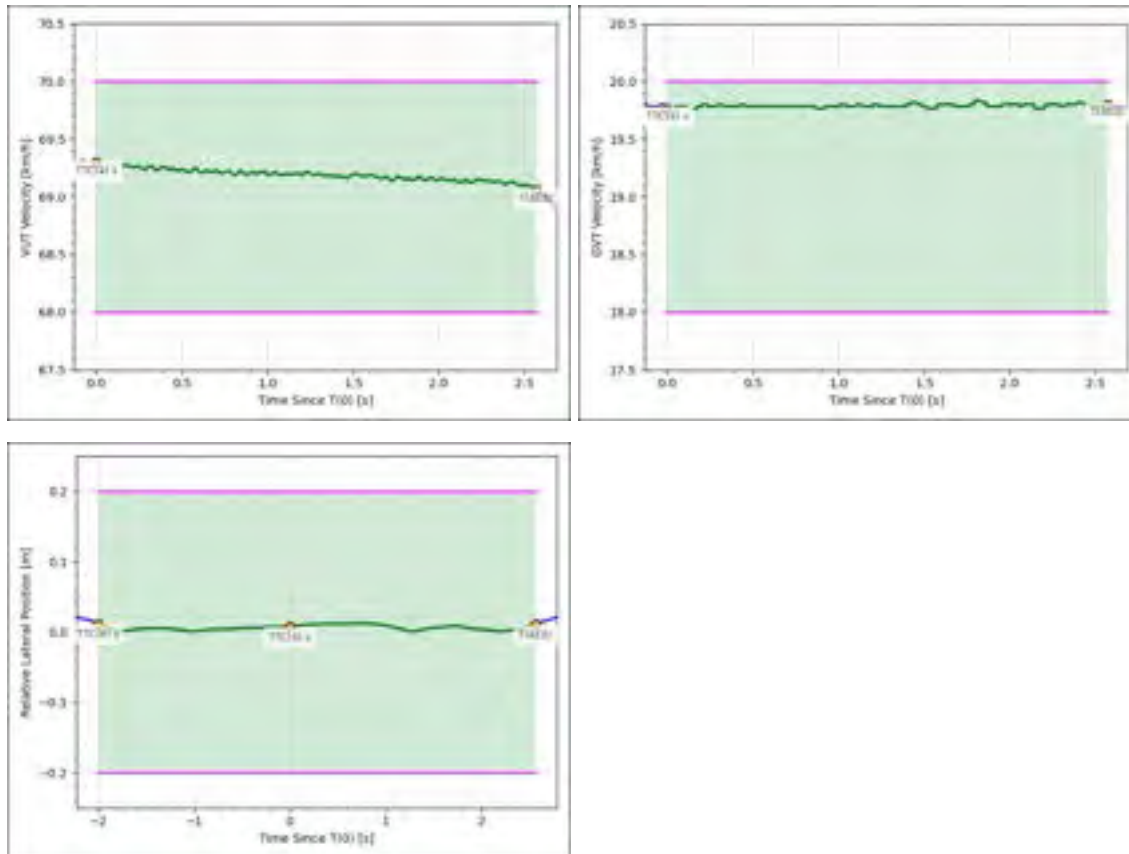
AEB CCRm | 70 km/h +100 % | Run 7

Run Date / Time 15-Mar-2023 10:18



AEB CCRm | 70 km/h +100 % | Run 8

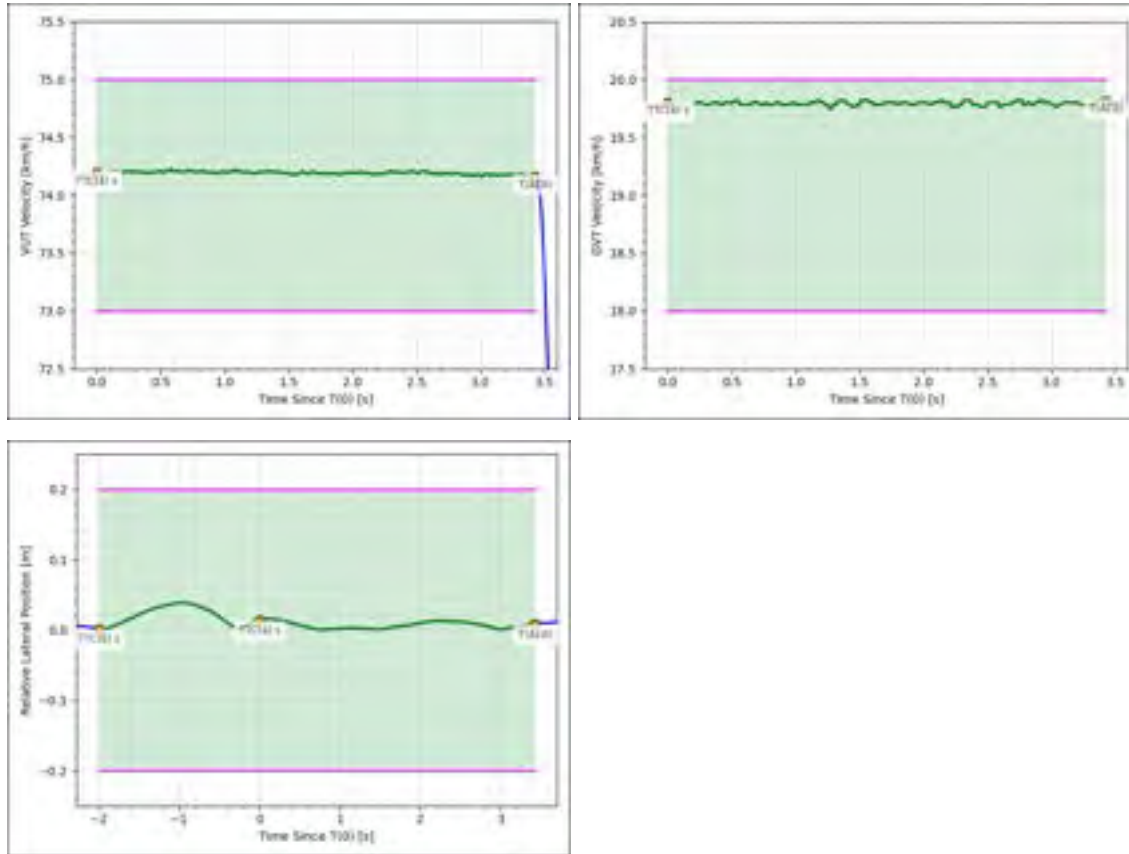
Run Date / Time 15-Mar-2023 10:21



I.1.1.4. AEB CCRm 75 kph +100 %

AEB CCRm | 75 km/h +100 % | Run 3

Run Date / Time 15-Mar-2023 10:25

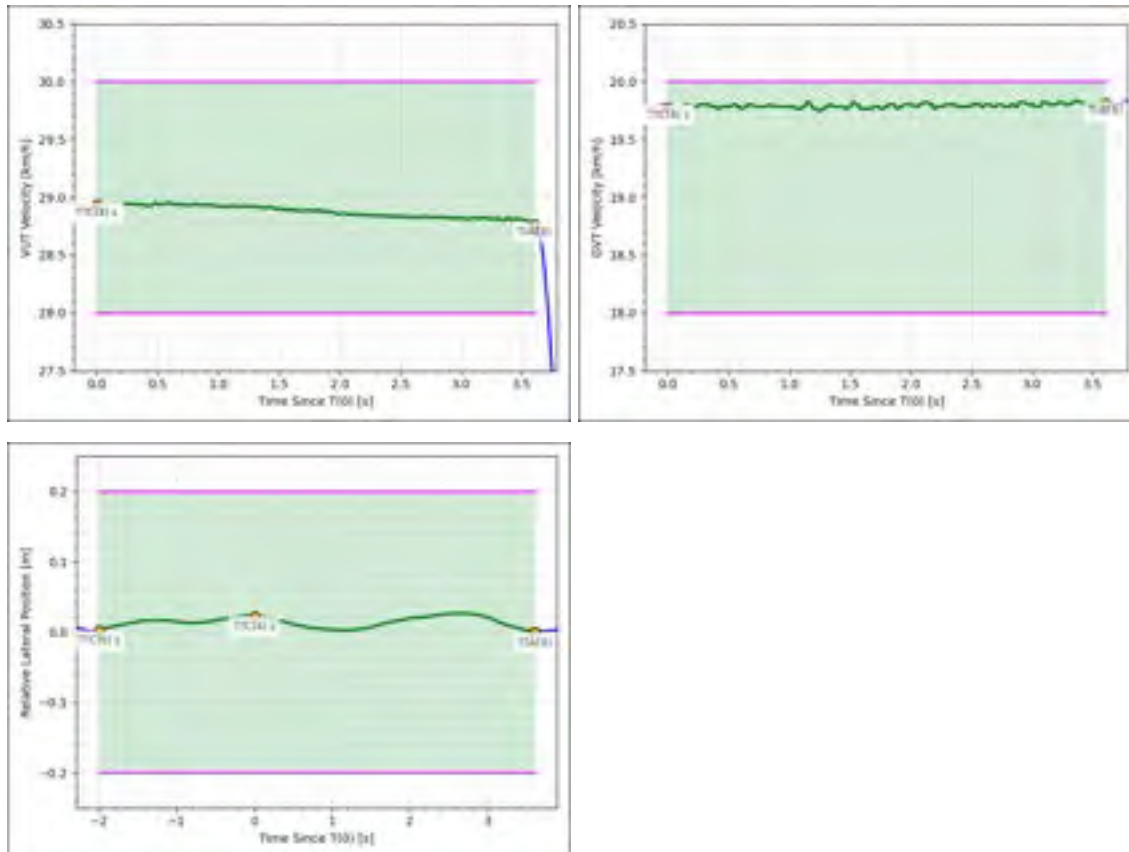


I.1.1. Lift Kit + Bullbar

I.1.1.1. AEB CCRm 30 kph +100 %

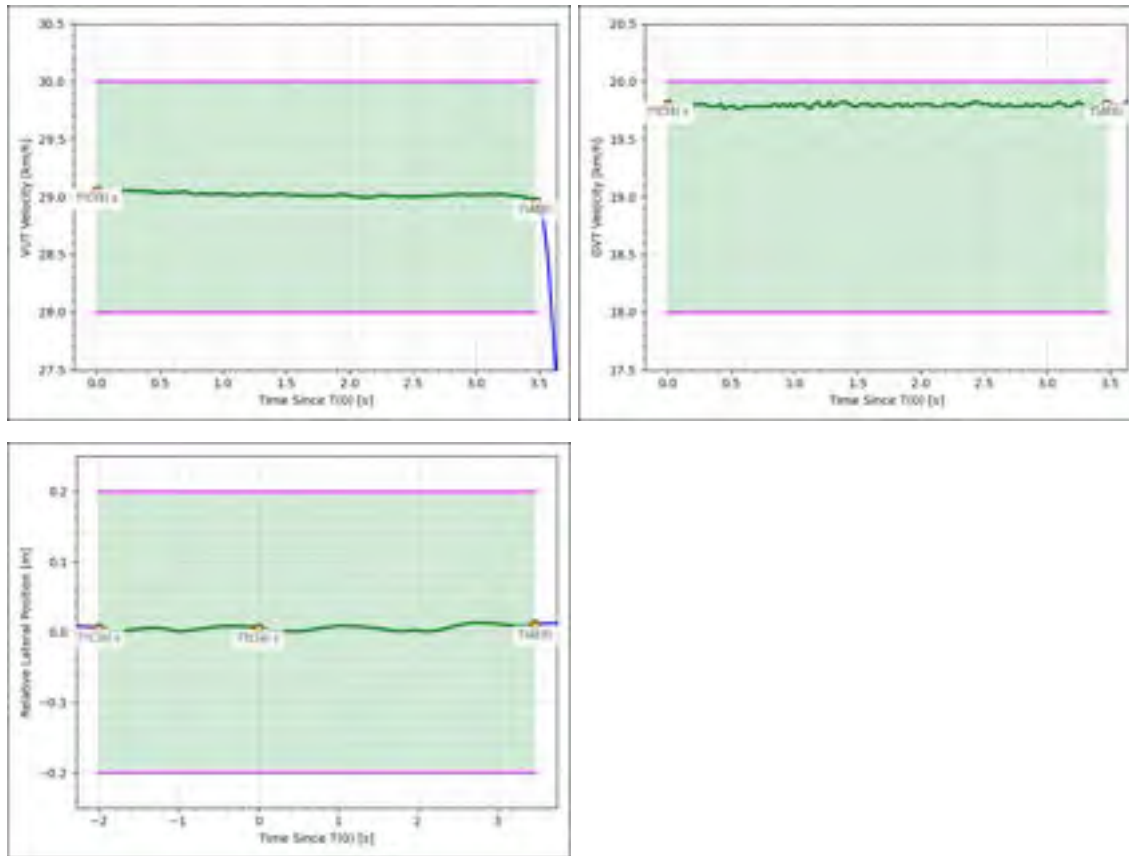
AEB CCRm | 30 km/h +100 % | Run 1

Run Date / Time 23-Mar-2023 13:55



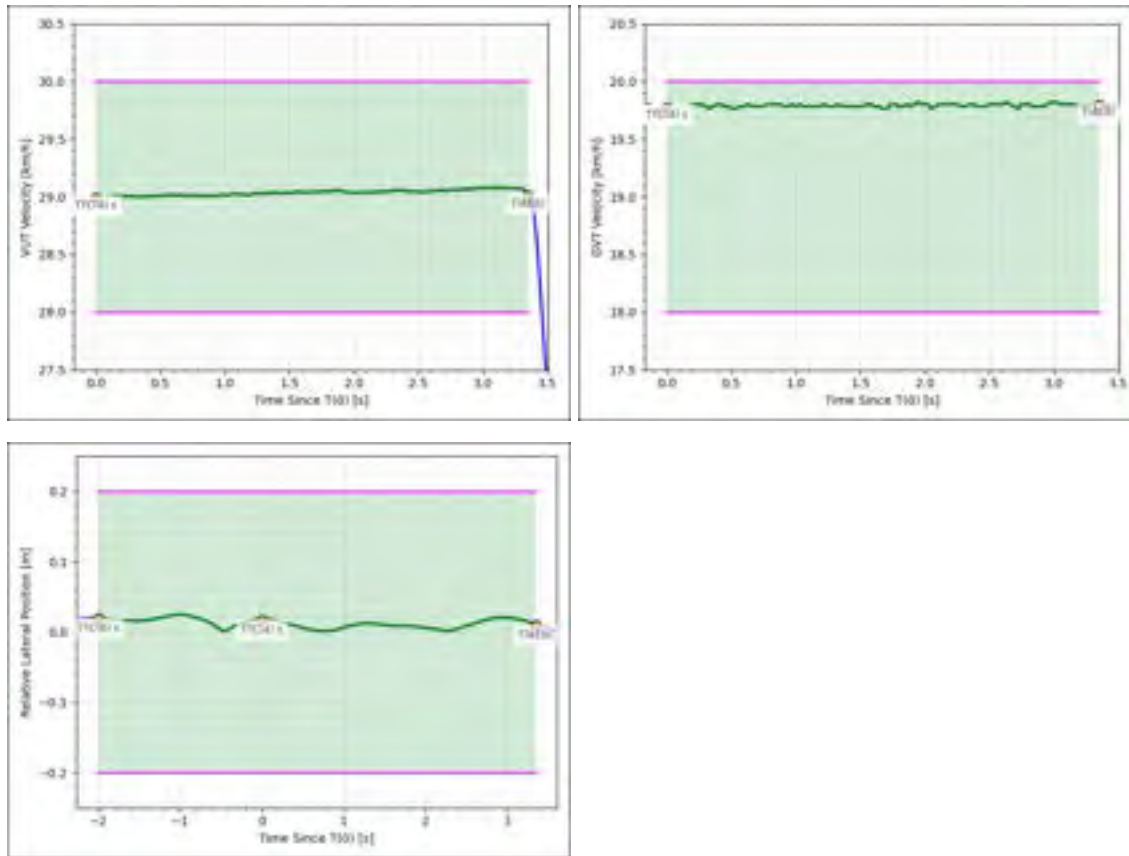
AEB CCRm | 30 km/h +100 % | Run 2

Run Date / Time 23-Mar-2023 13:57



AEB CCRm | 30 km/h +100 % | Run 3

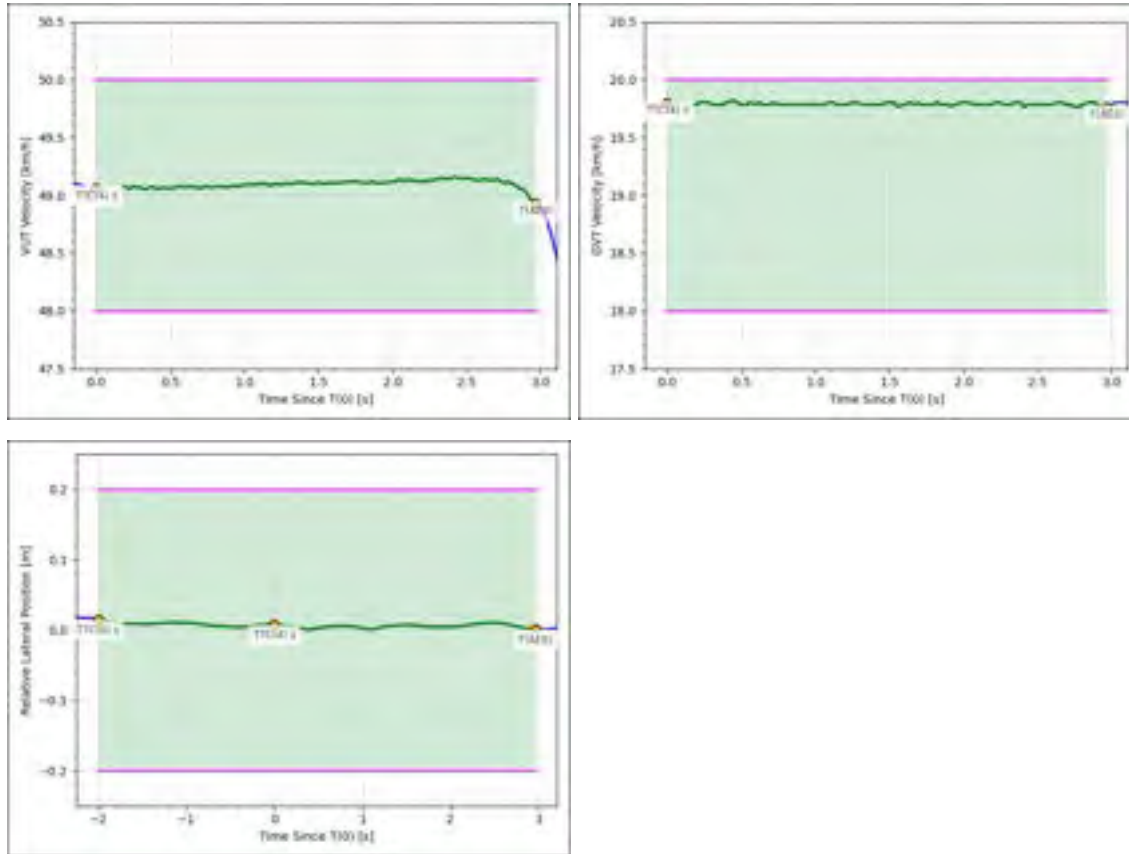
Run Date / Time 23-Mar-2023 14:01



1.1.1.2. AEB CCRm 50 kph +100 %

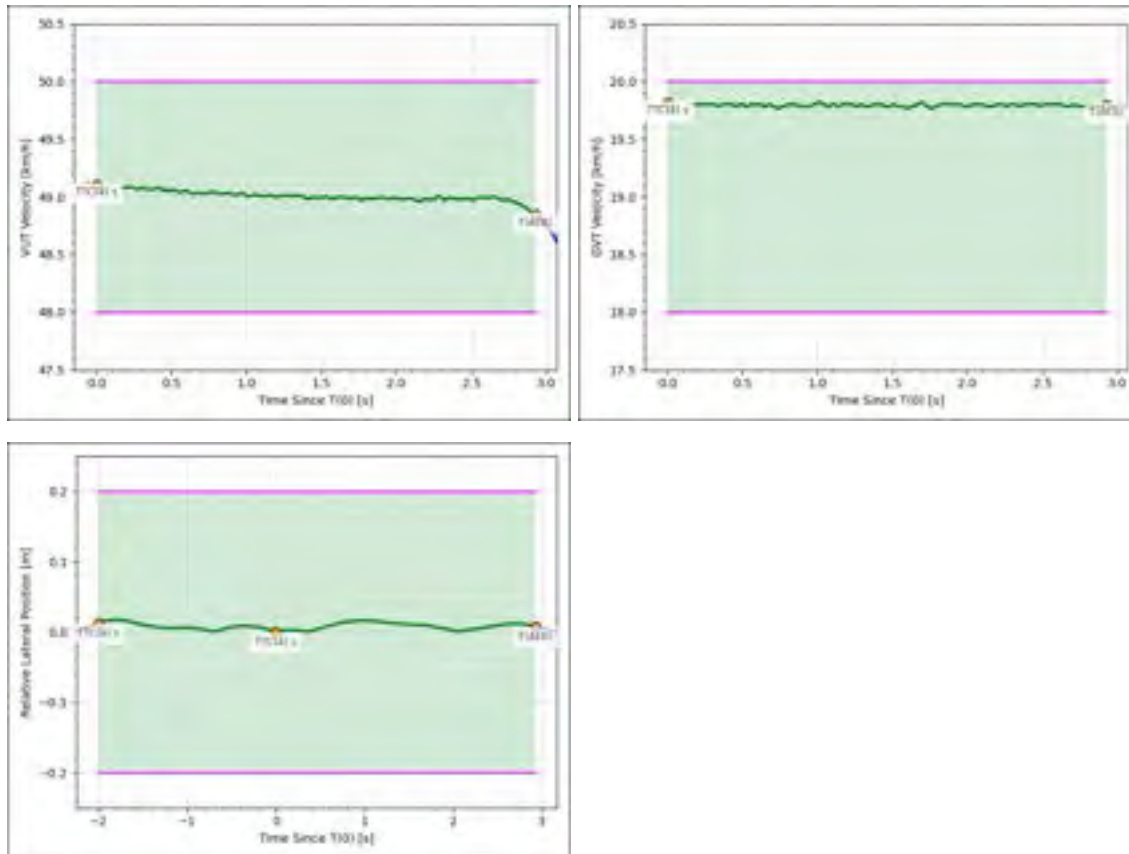
AEB CCRm | 50 km/h +100 % | Run 1

Run Date / Time 23-Mar-2023 14:05



AEB CCRm | 50 km/h +100 % | Run 2

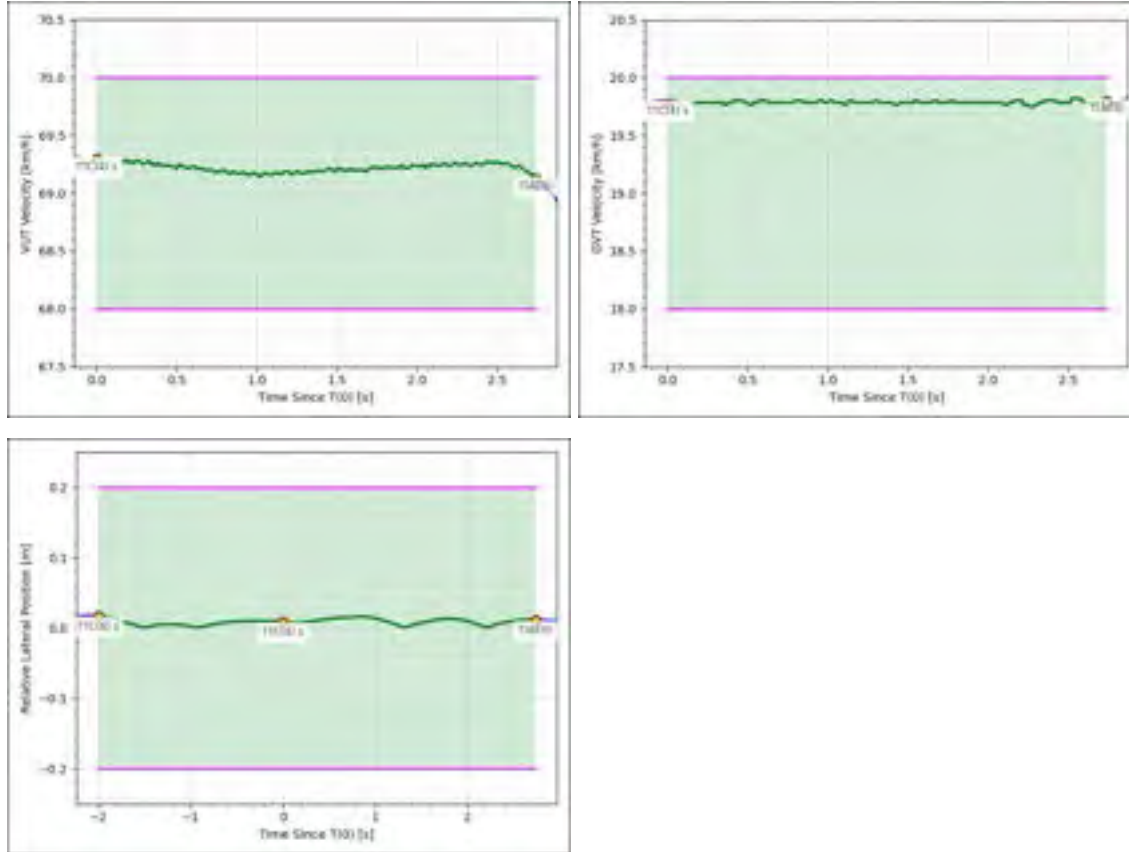
Run Date / Time 23-Mar-2023 14:07



1.1.1.3. AEB CCRm 70 kph +100 %

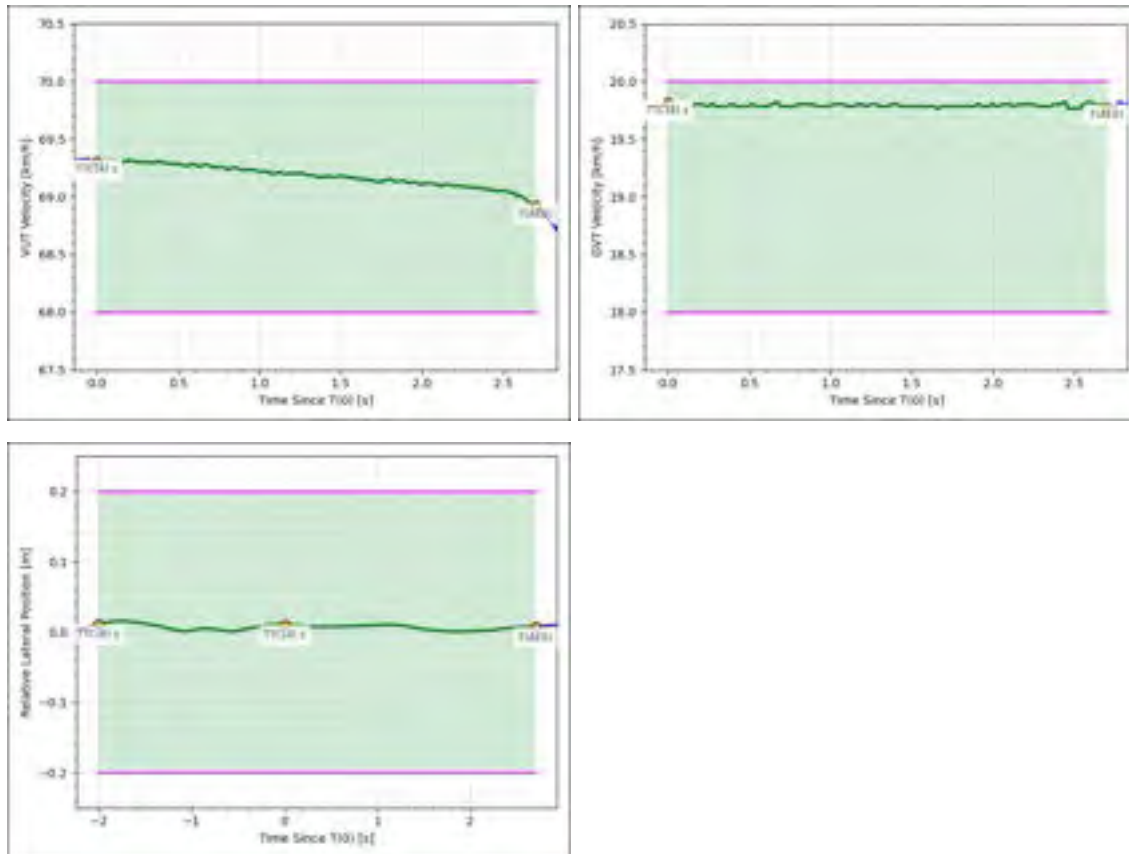
AEB CCRm | 70 km/h +100 % | Run 1

Run Date / Time 23-Mar-2023 14:17



AEB CCRm | 70 km/h +100 % | Run 2

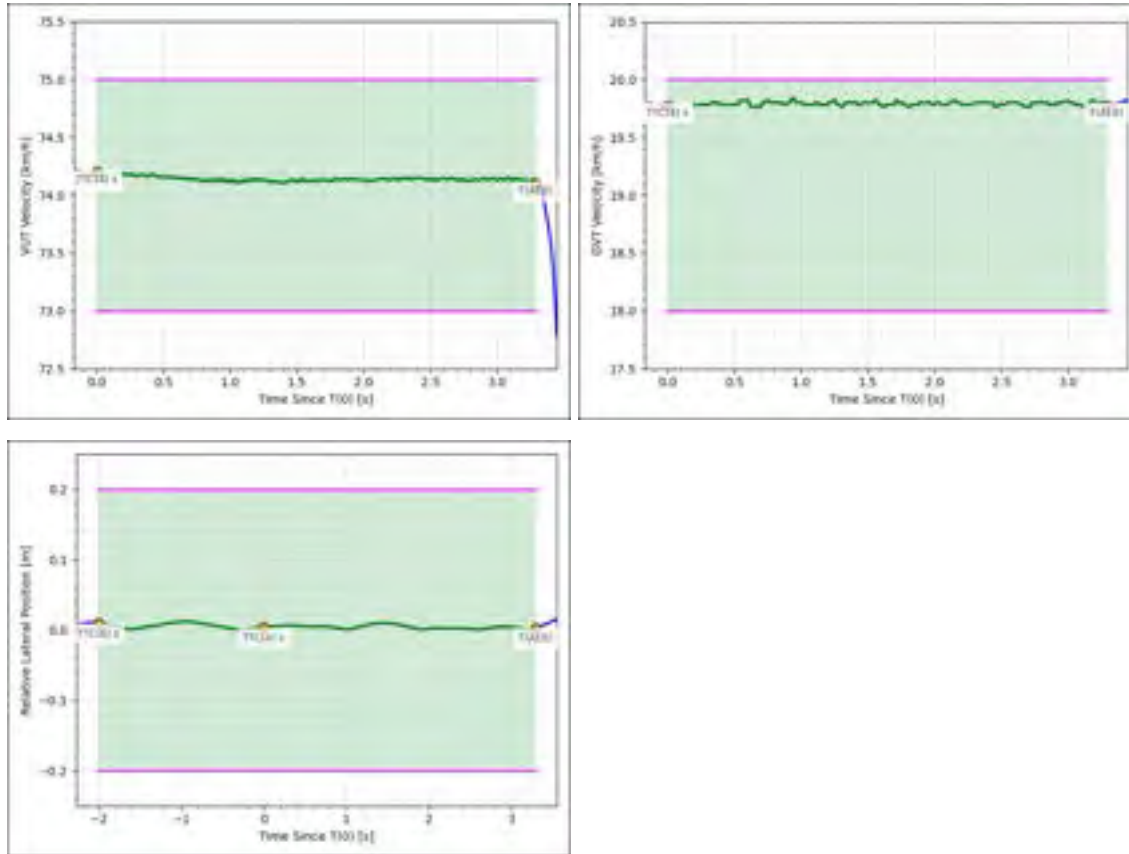
Run Date / Time 23-Mar-2023 14:19



1.1.1.4. AEB CCRm 75 kph +100 %

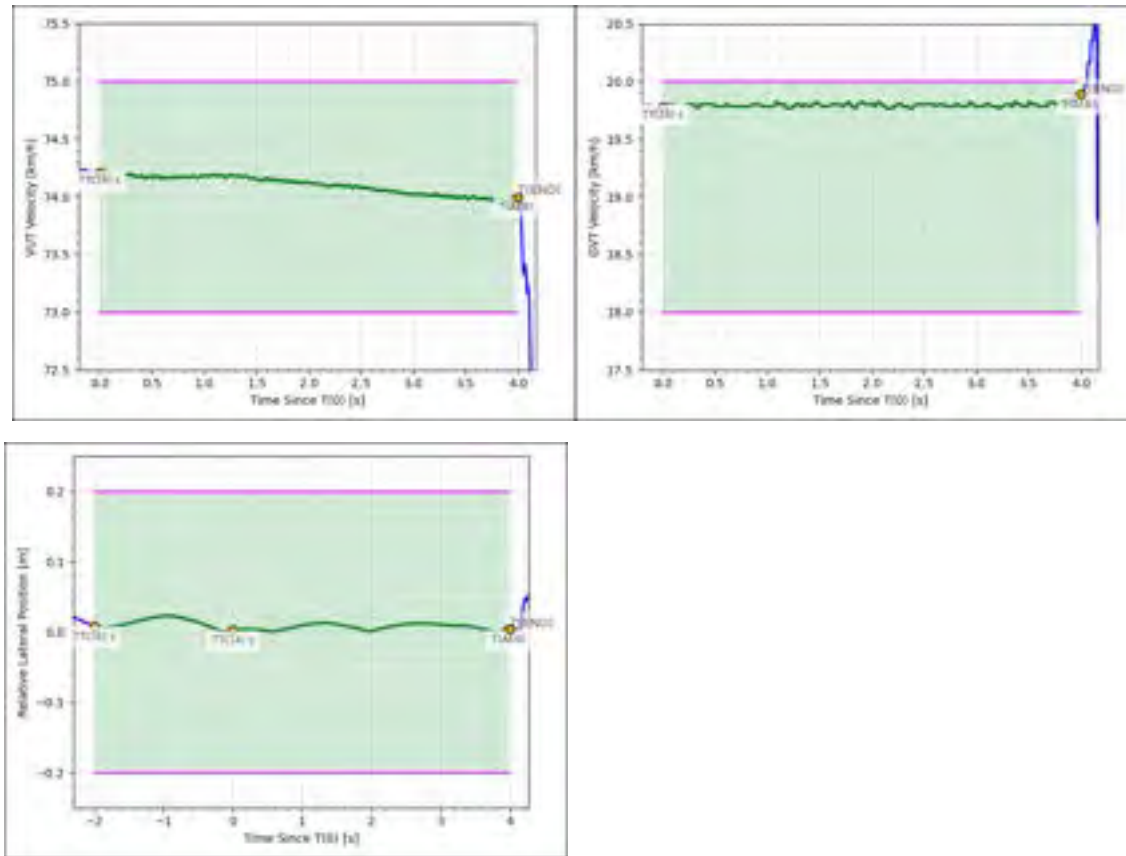
AEB CCRm | 75 km/h +100 % | Run 3

Run Date / Time 28-Mar-2023 09:07



AEB CCRm | 75 km/h +100 % | Run 4

Run Date / Time 28-Mar-2023 09:45

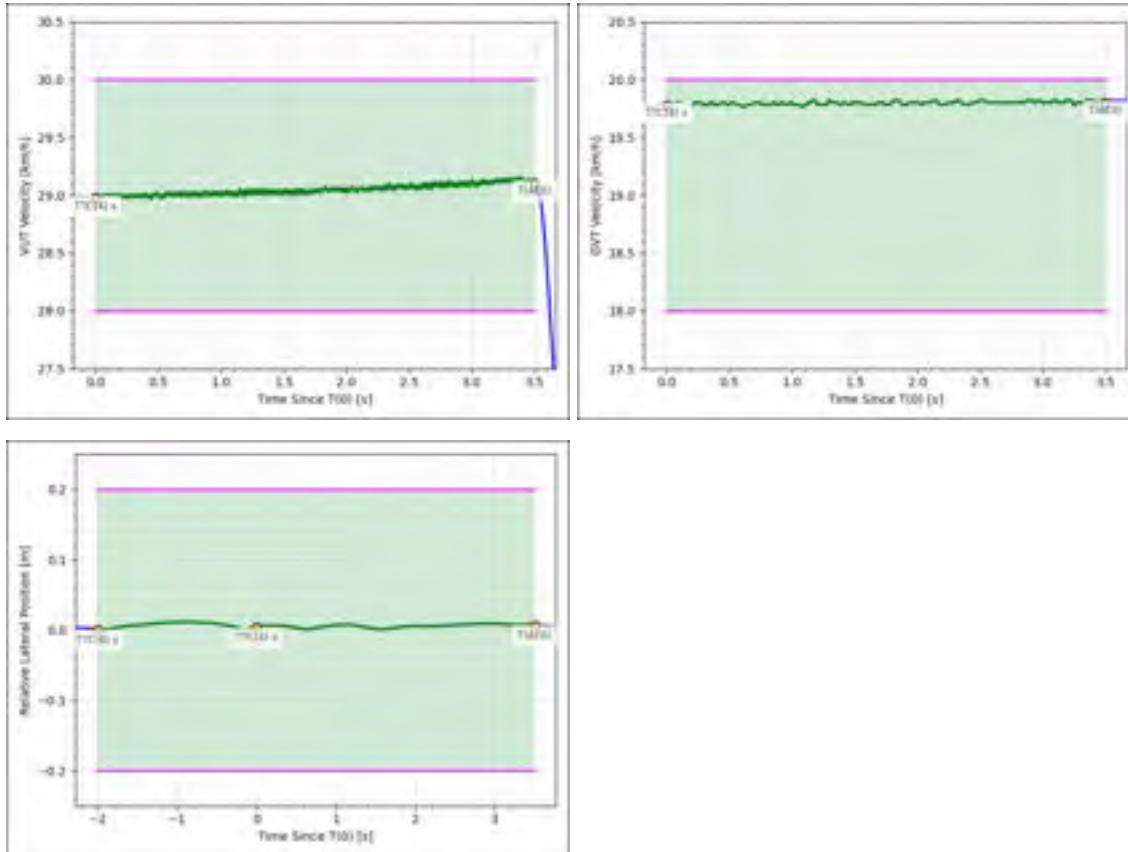


I.1.1. Bullbar

I.1.1.1. AEB CCRm 30 kph +100 %

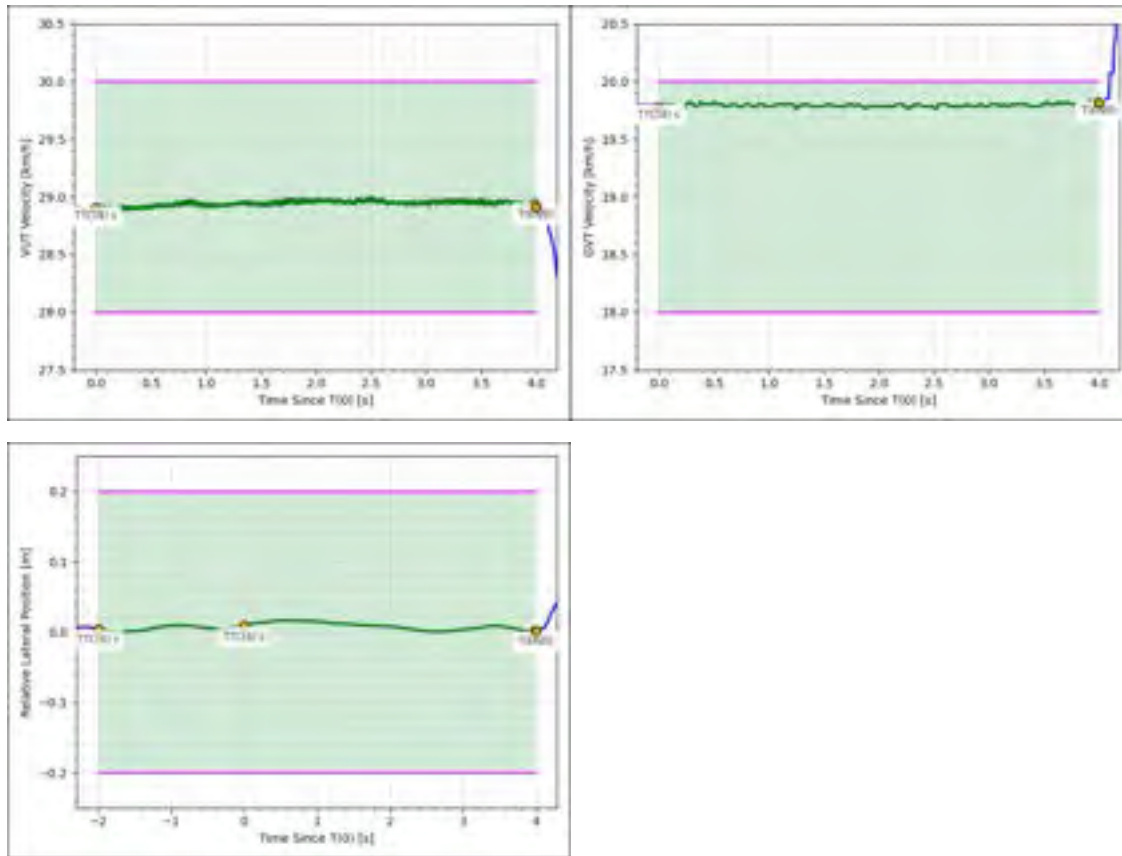
AEB CCRm | 30 km/h +100 % | Run 4

Run Date / Time 11-Apr-2023 09:33



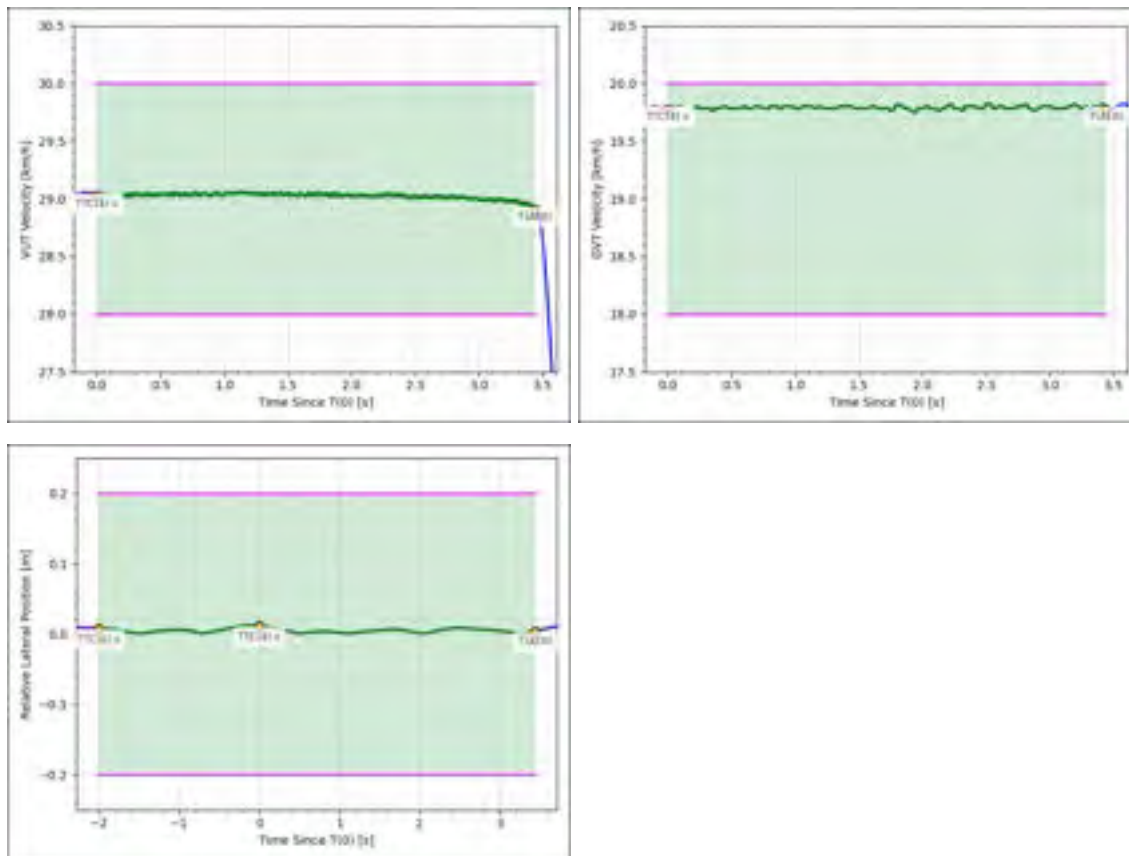
AEB CCRm | 30 km/h +100 % | Run 5

Run Date / Time 11-Apr-2023 09:37



AEB CCRm | 30 km/h +100 % | Run 6

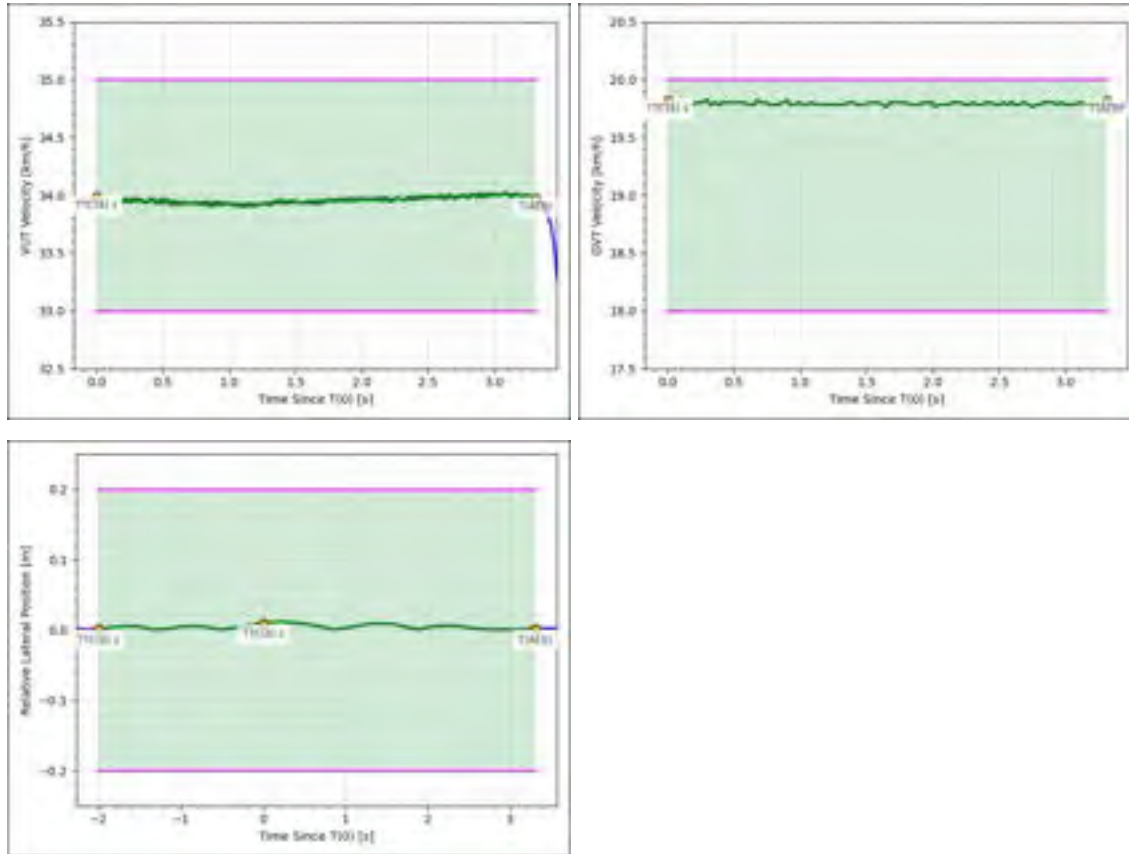
Run Date / Time 11-Apr-2023 10:24



1.1.1.2. AEB CCRm 35 kph +100 %

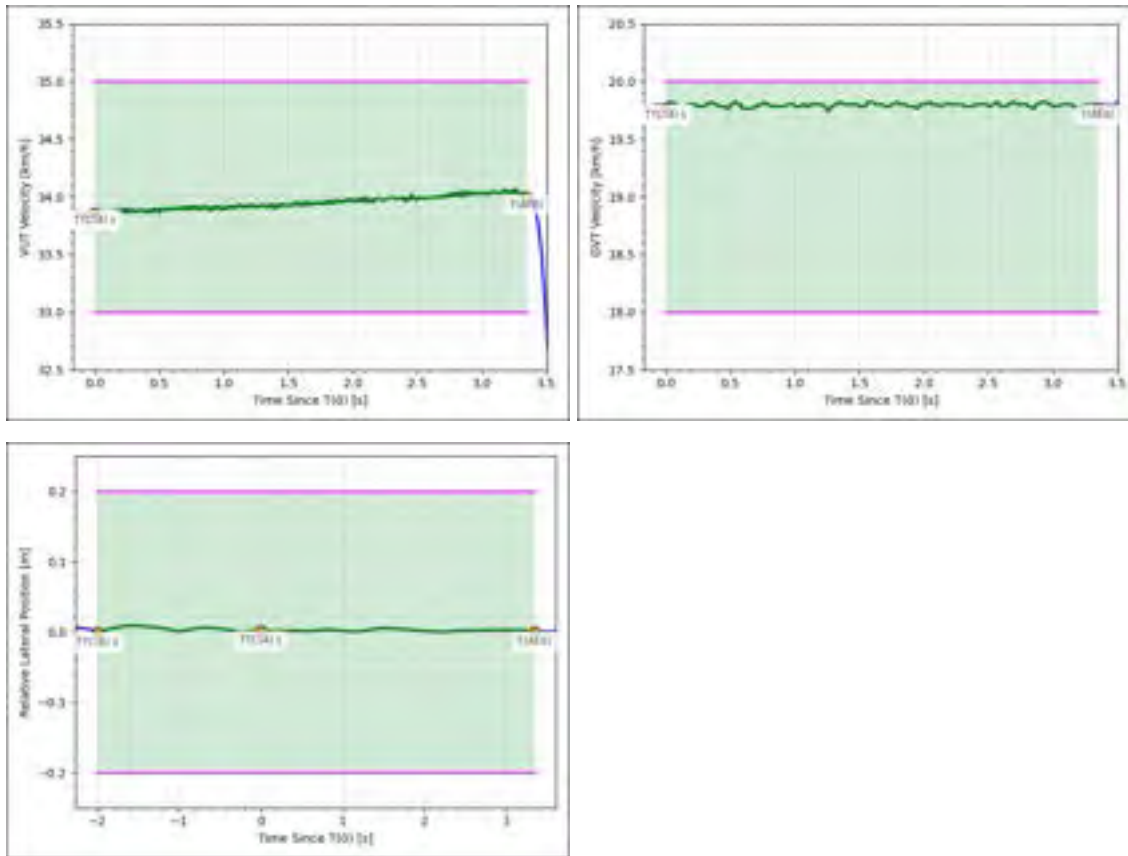
AEB CCRm | 35 km/h +100 % | Run 1

Run Date / Time 11-Apr-2023 11:03



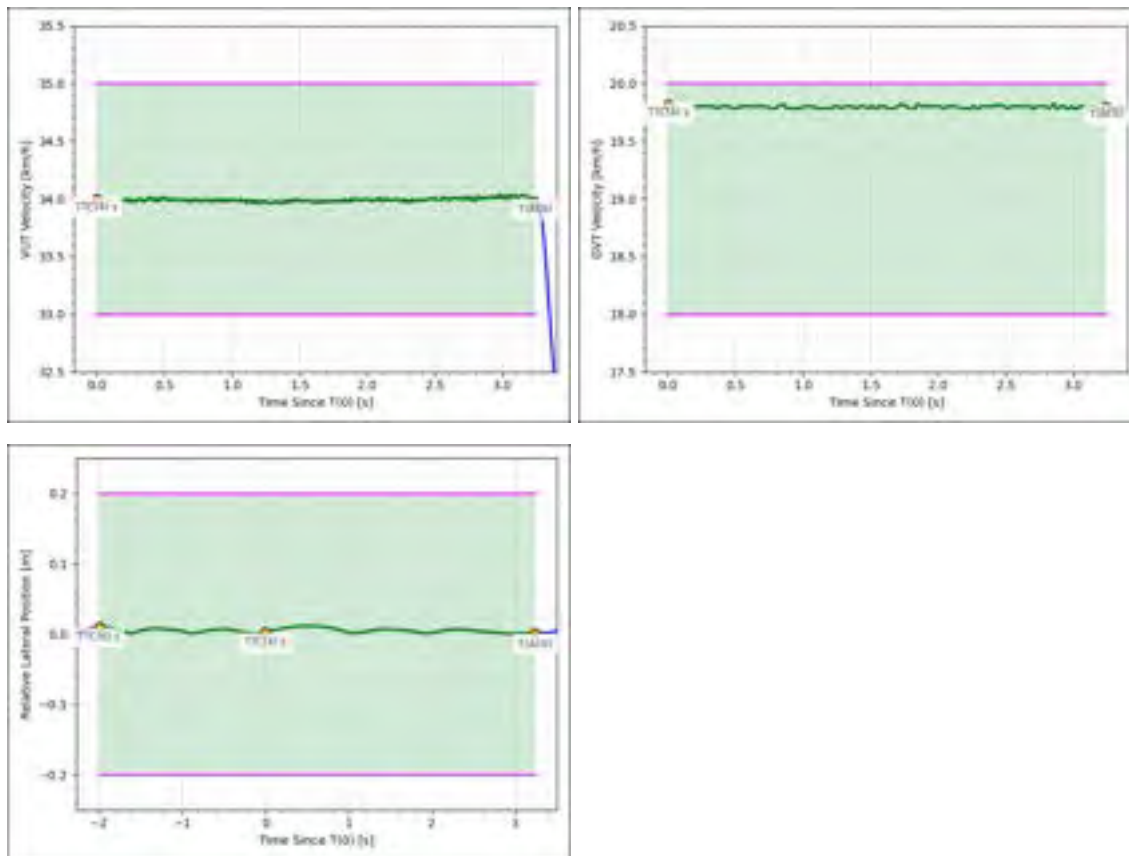
AEB CCRm | 35 km/h +100 % | Run 2

Run Date / Time 11-Apr-2023 11:07



AEB CCRm | 35 km/h +100 % | Run 3

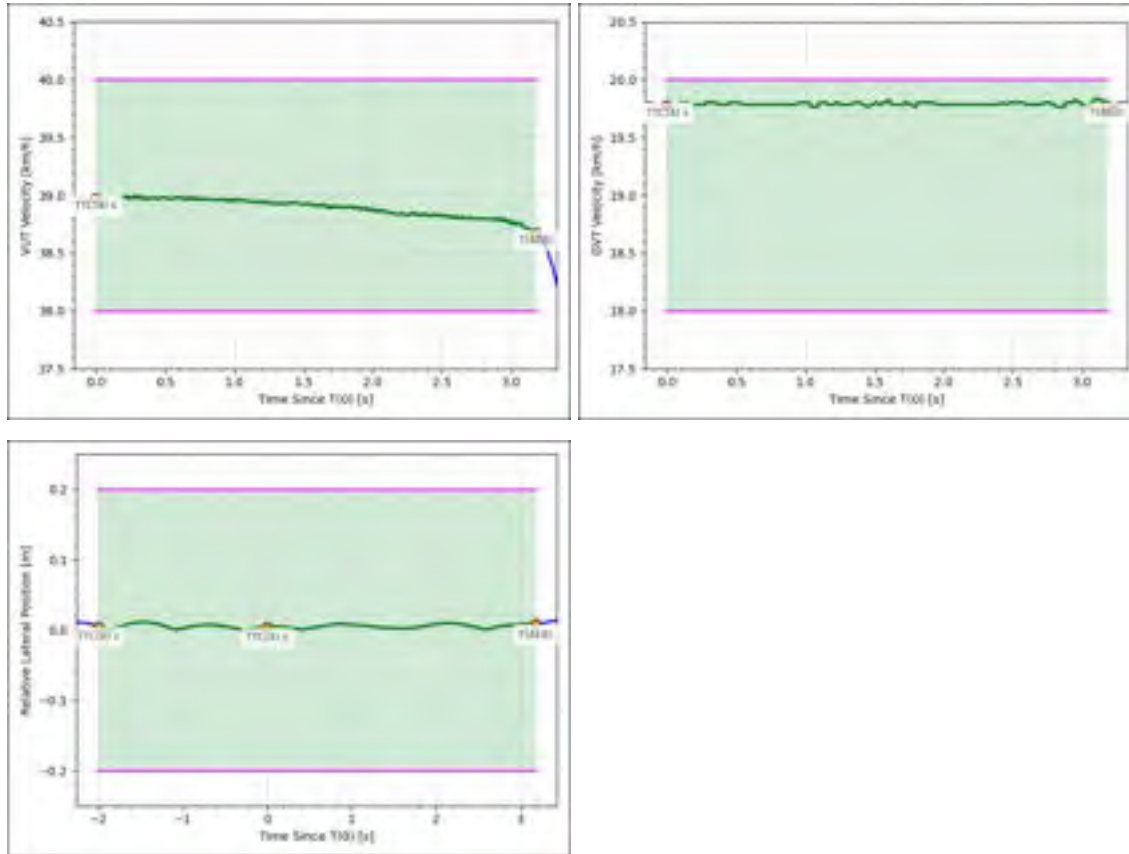
Run Date / Time 11-Apr-2023 11:13



1.1.1.3. AEB CCRm 40 kph +100 %

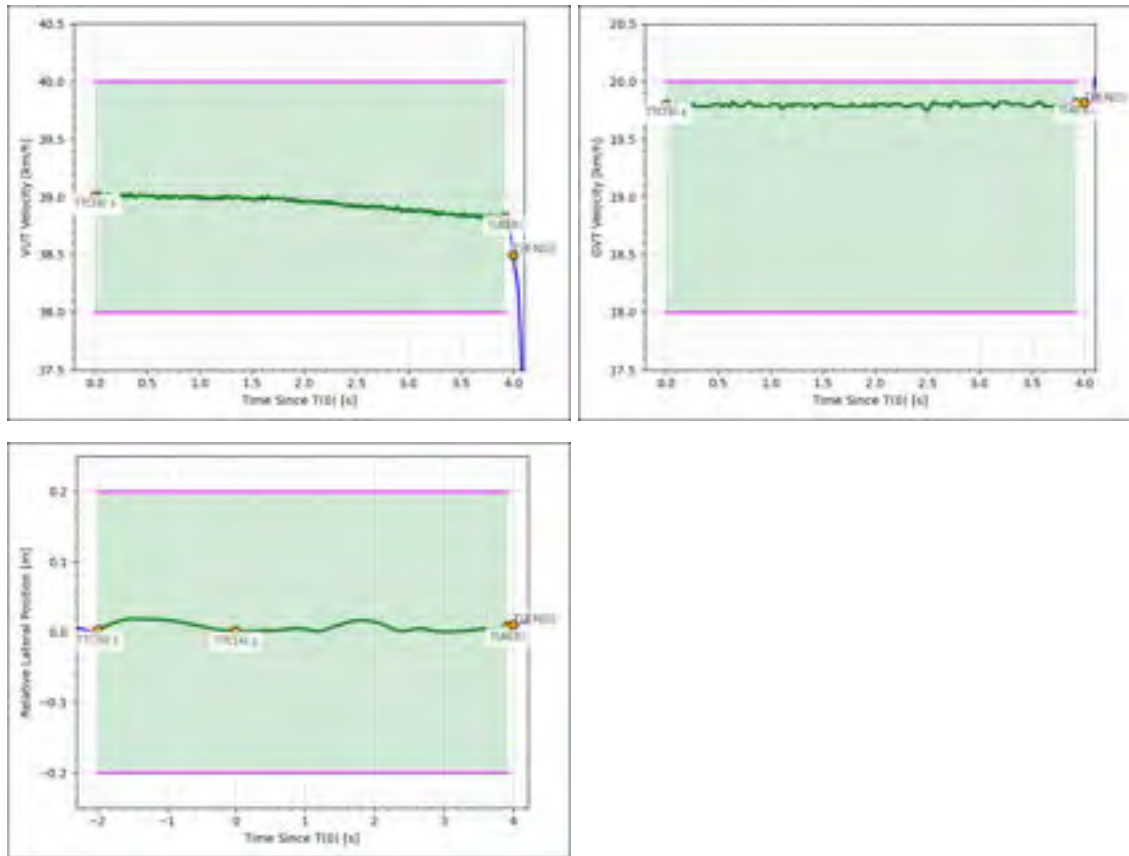
AEB CCRm | 40 km/h +100 % | Run 2

Run Date / Time 11-Apr-2023 11:20



AEB CCRm | 40 km/h +100 % | Run 3

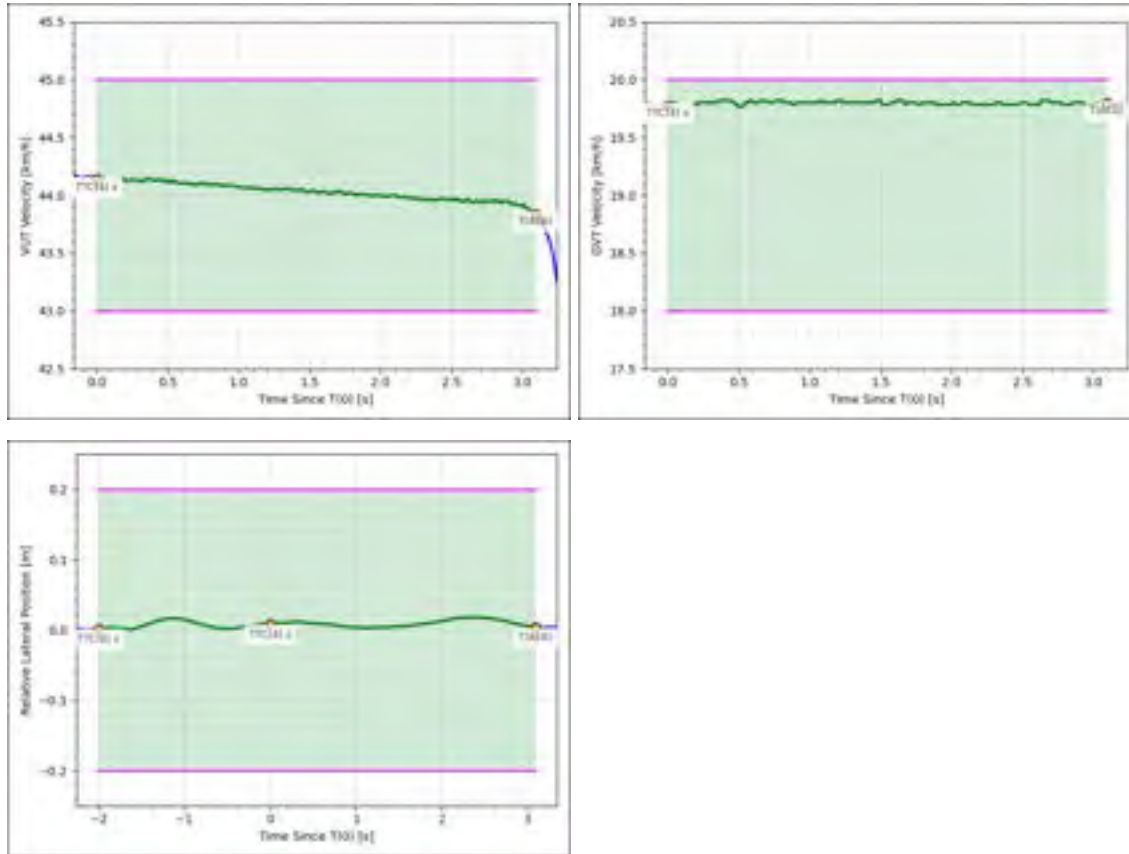
Run Date / Time 11-Apr-2023 11:24



1.1.1.4. AEB CCRm 45 kph +100 %

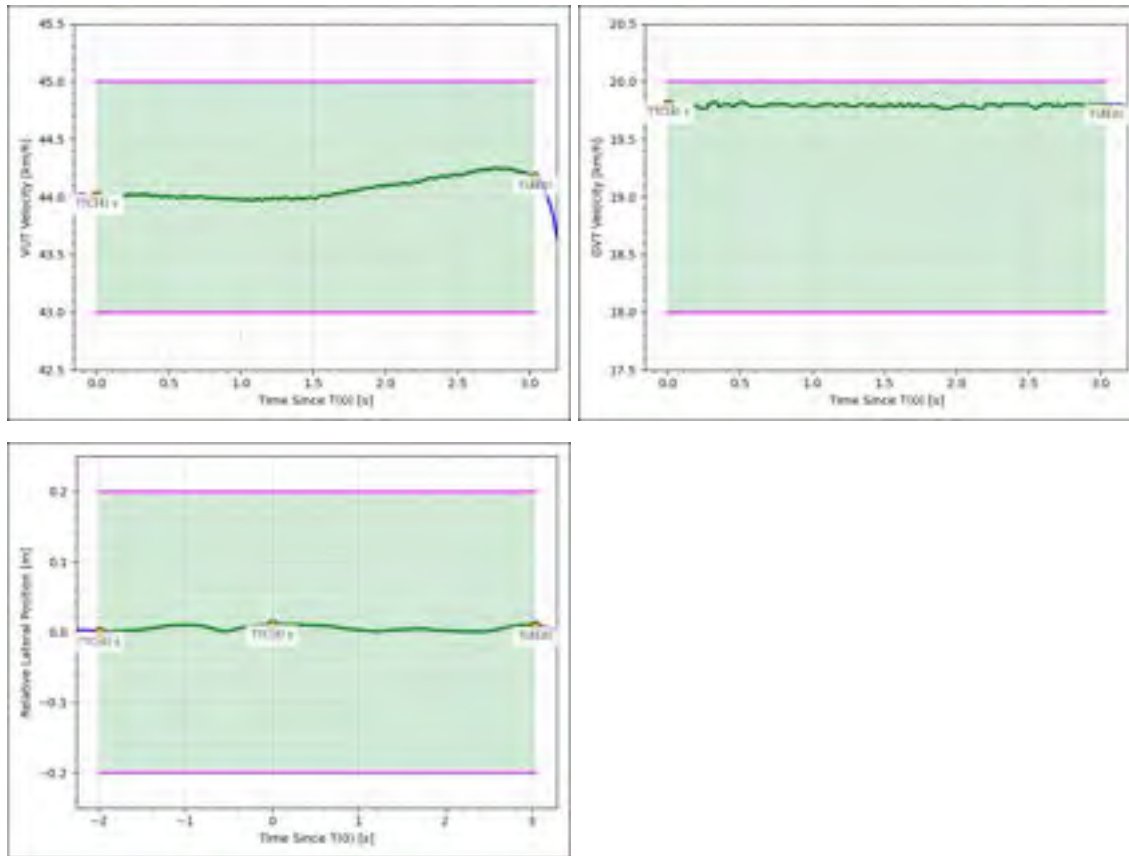
AEB CCRm | 45 km/h +100 % | Run 1

Run Date / Time 11-Apr-2023 14:42



AEB CCRm | 45 km/h +100 % | Run 2

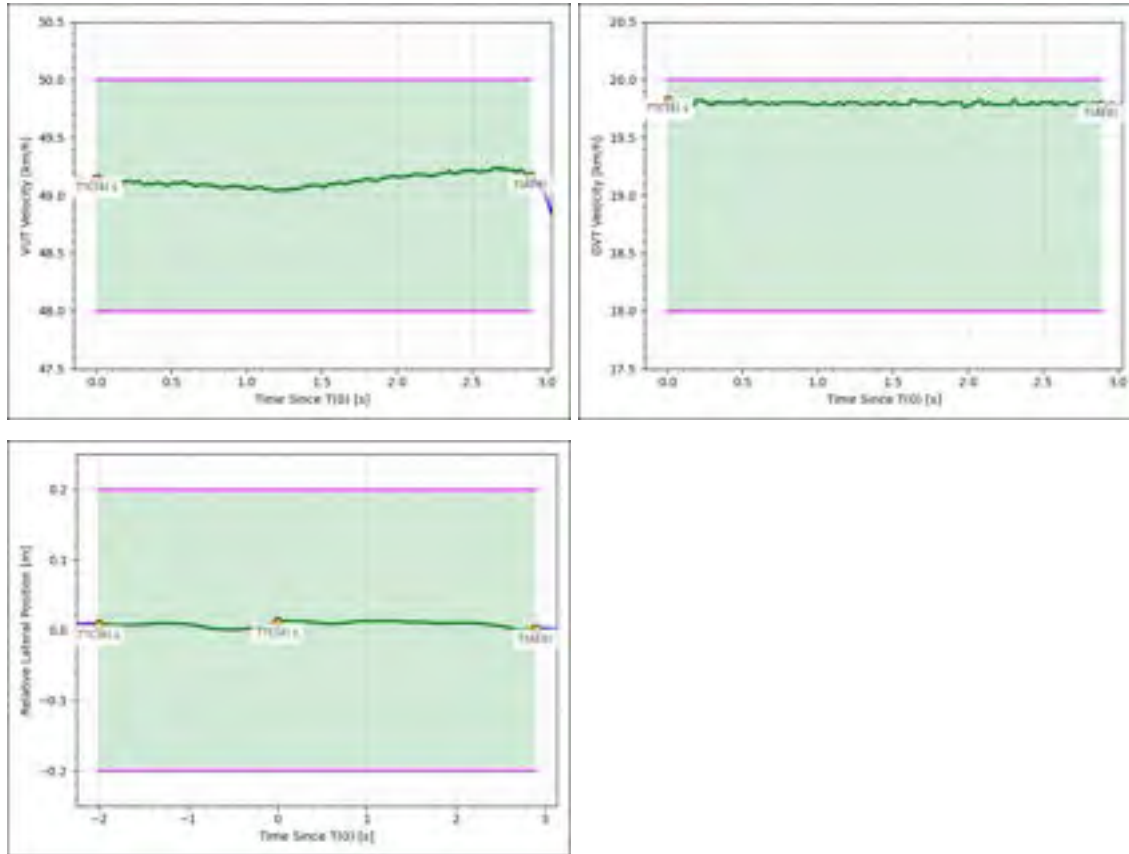
Run Date / Time 11-Apr-2023 14:47



1.1.1.5. AEB CCRm 50 kph +100 %

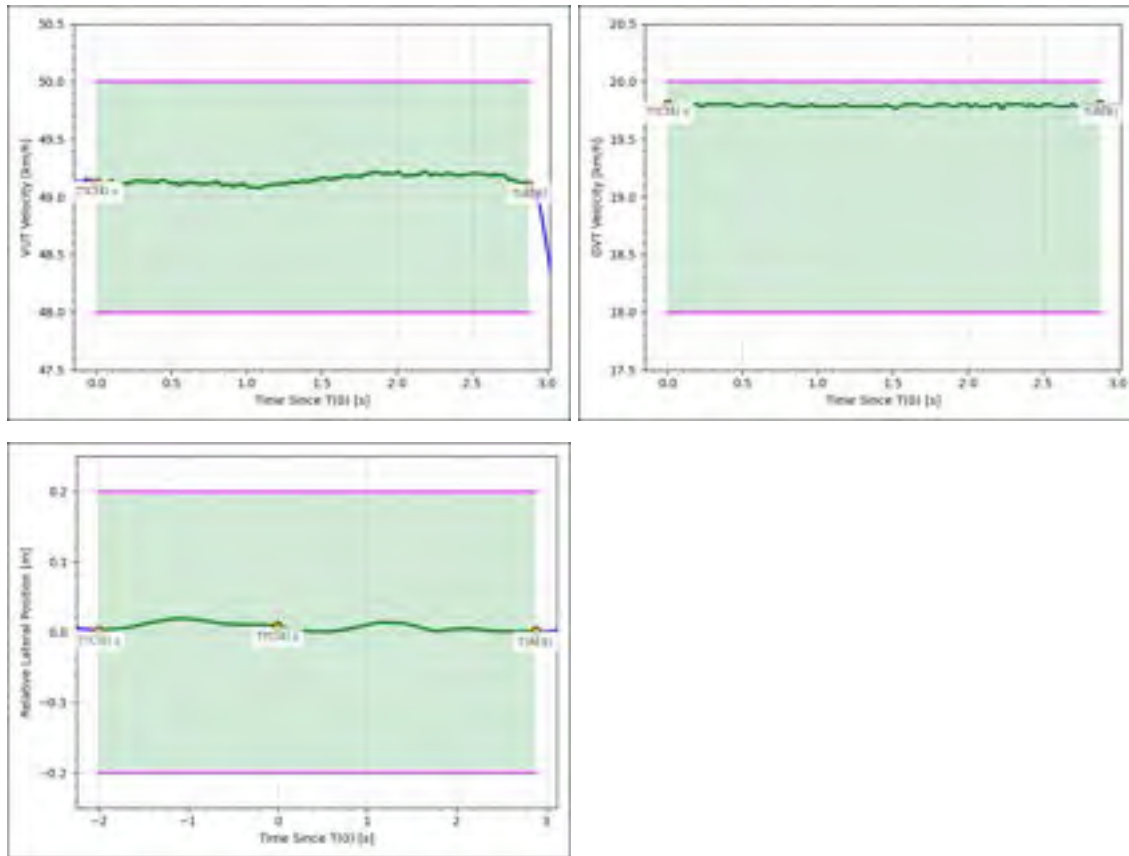
AEB CCRm | 50 km/h +100 % | Run 5

Run Date / Time 11-Apr-2023 10:29



AEB CCRm | 50 km/h +100 % | Run 6

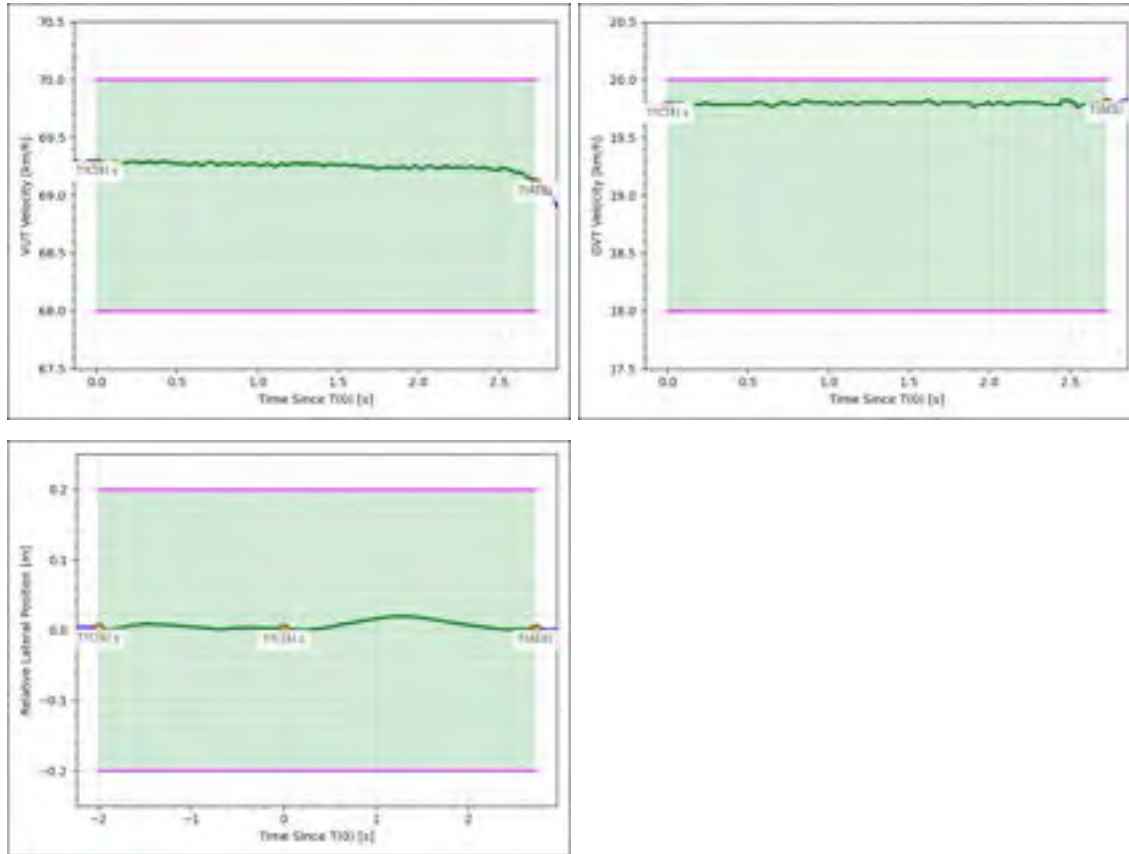
Run Date / Time 11-Apr-2023 10:33



1.1.1.6. AEB CCRm 70 kph +100 %

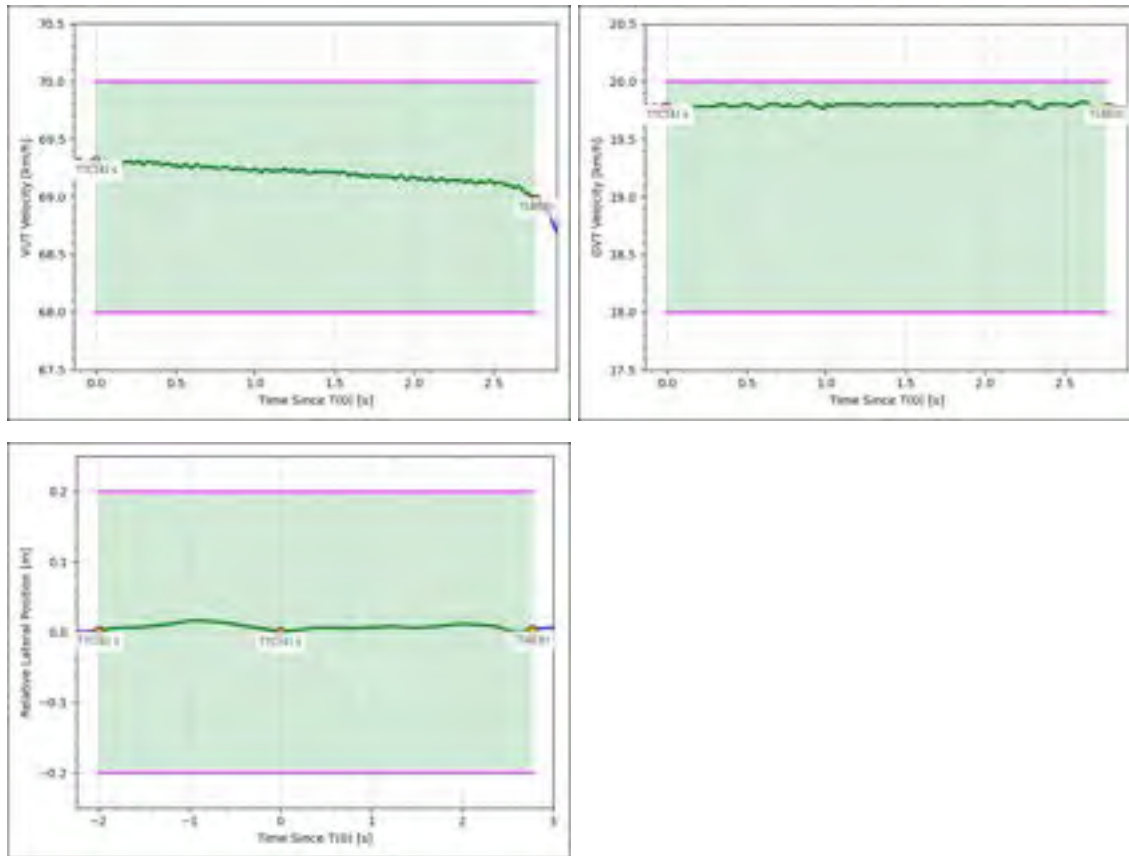
AEB CCRm | 70 km/h +100 % | Run 3

Run Date / Time 11-Apr-2023 10:39



AEB CCRm | 70 km/h +100 % | Run 4

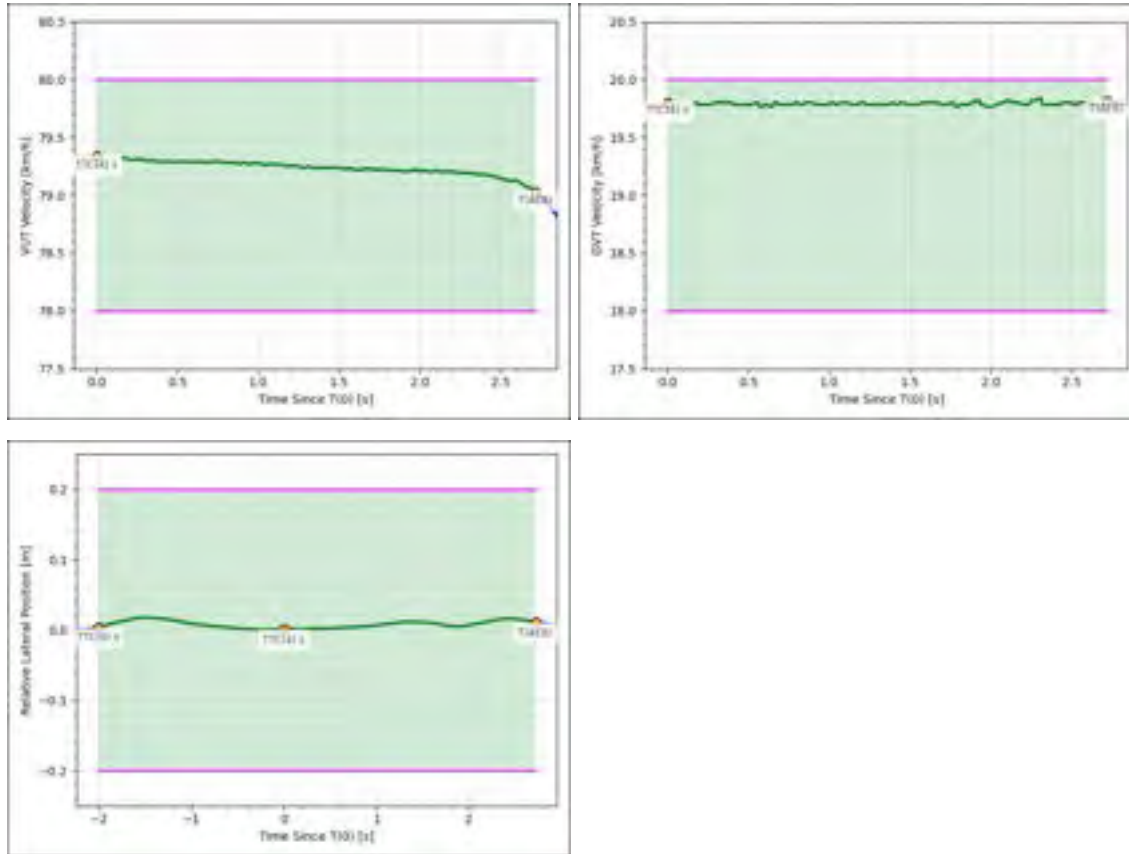
Run Date / Time 11-Apr-2023 10:43



1.1.1.7. AEB CCRm 80 kph +100 %

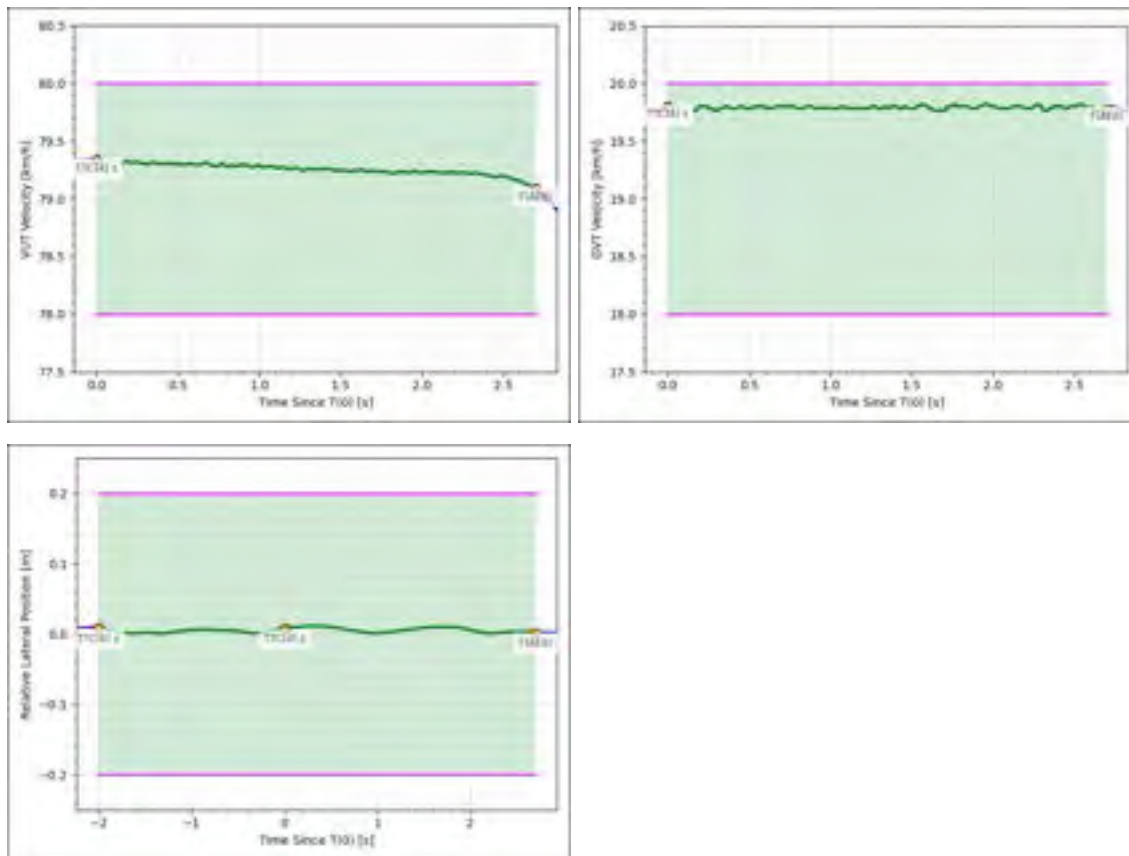
AEB CCRm | 80 km/h +100 % | Run 1

Run Date / Time 11-Apr-2023 10:48



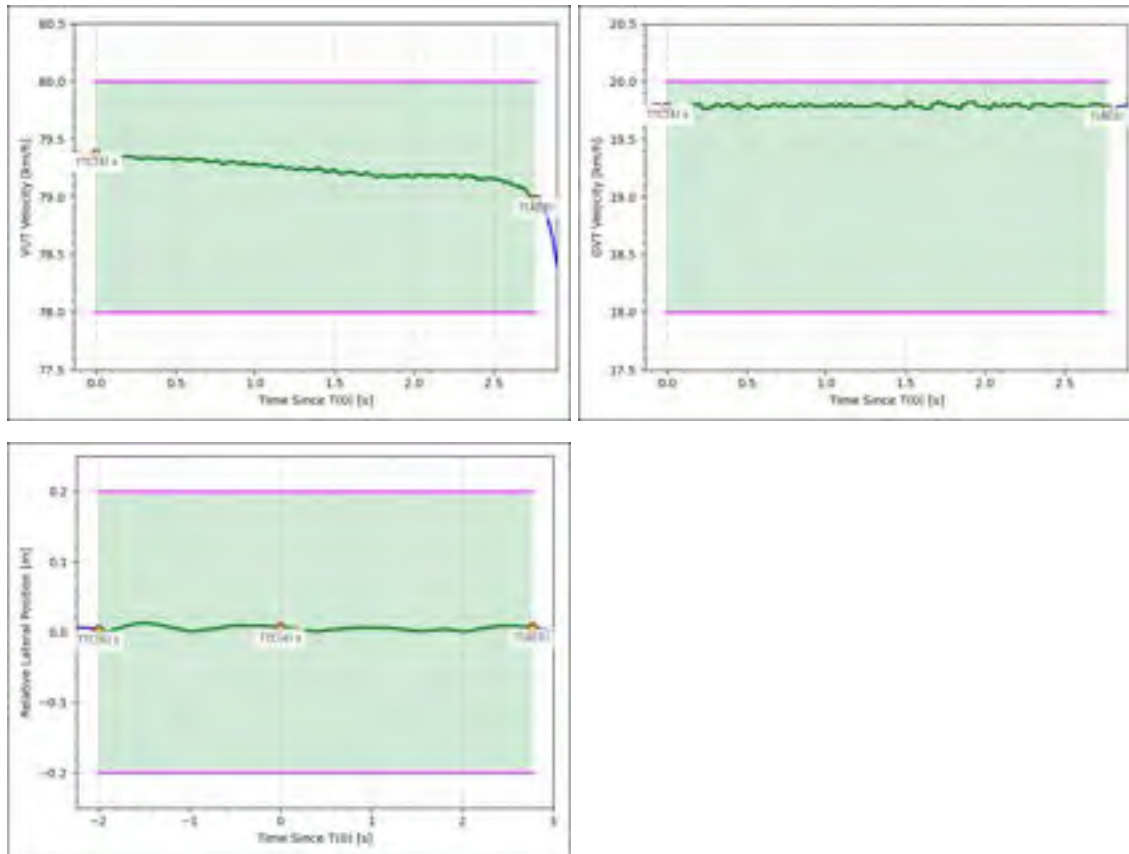
AEB CCRm | 80 km/h +100 % | Run 2

Run Date / Time 11-Apr-2023 10:52



AEB CCRm | 80 km/h +100 % | Run 3

Run Date / Time 11-Apr-2023 10:57

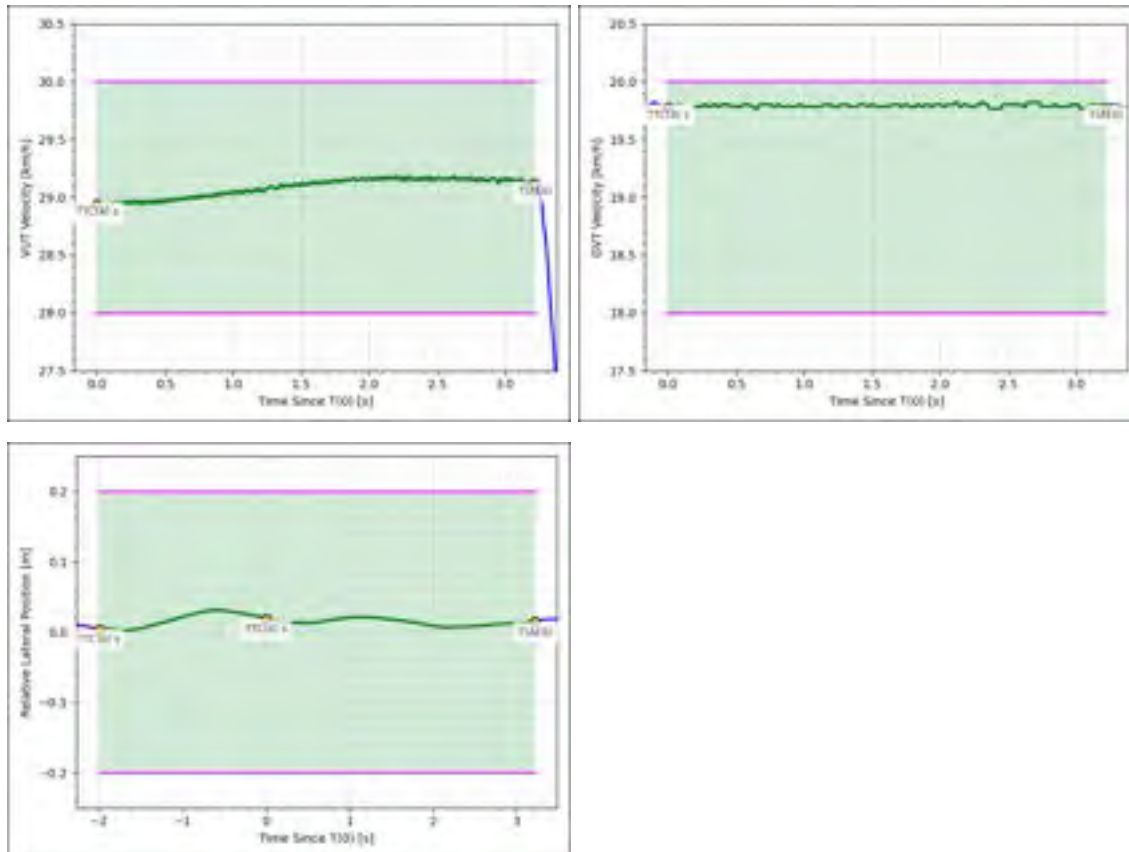


I.1.1. Bullbar (OEM Height)

I.1.1.1. AEB CCRm 30 kph +100 %

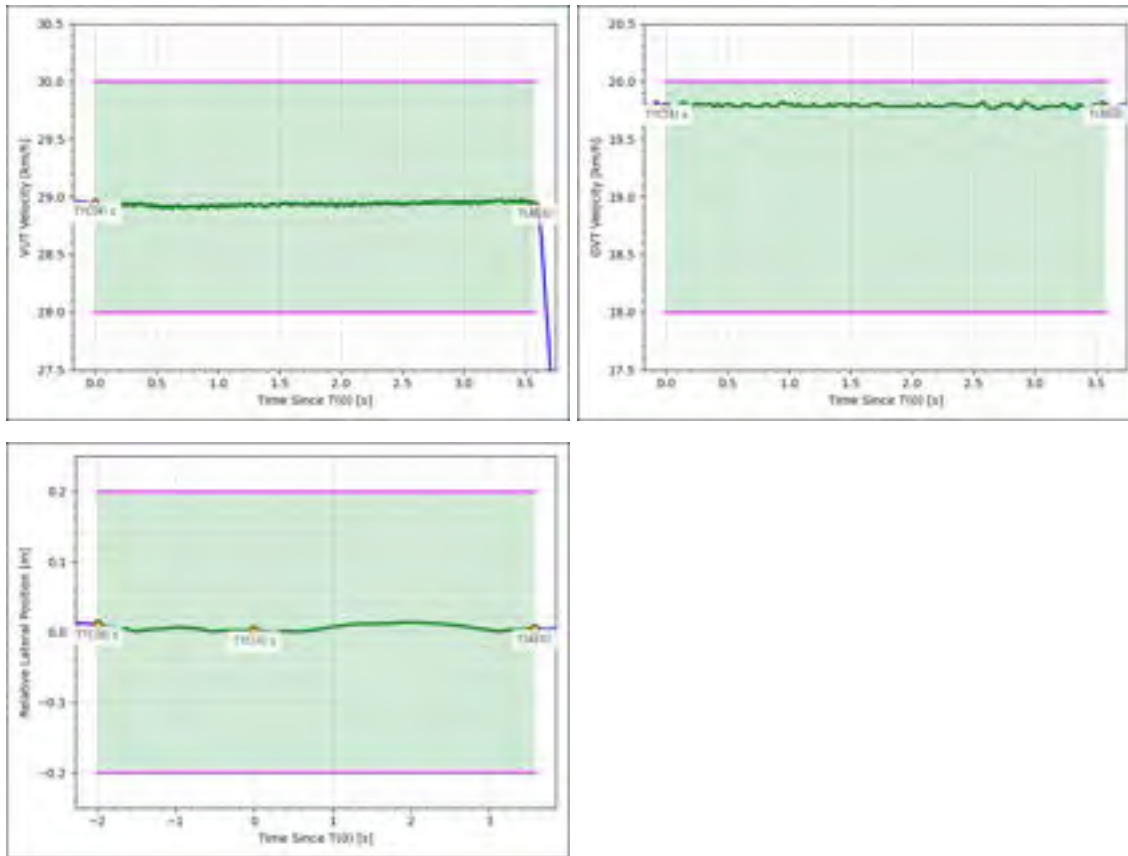
AEB CCRm | 30 km/h +100 % | Run 7

Run Date / Time 21-Jul-2023 13:45



AEB CCRm | 30 km/h +100 % | Run 8

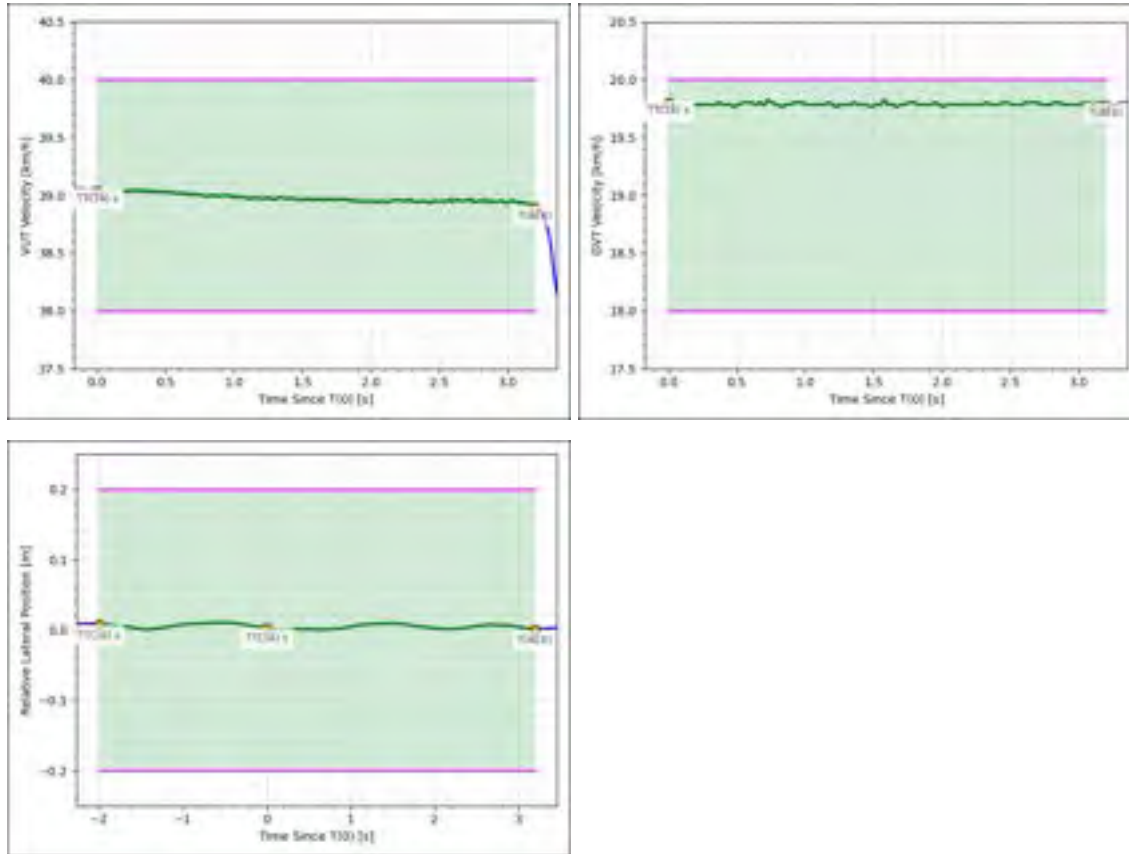
Run Date / Time 21-Jul-2023 13:50



1.1.1.2. AEB CCRm 40 kph +100 %

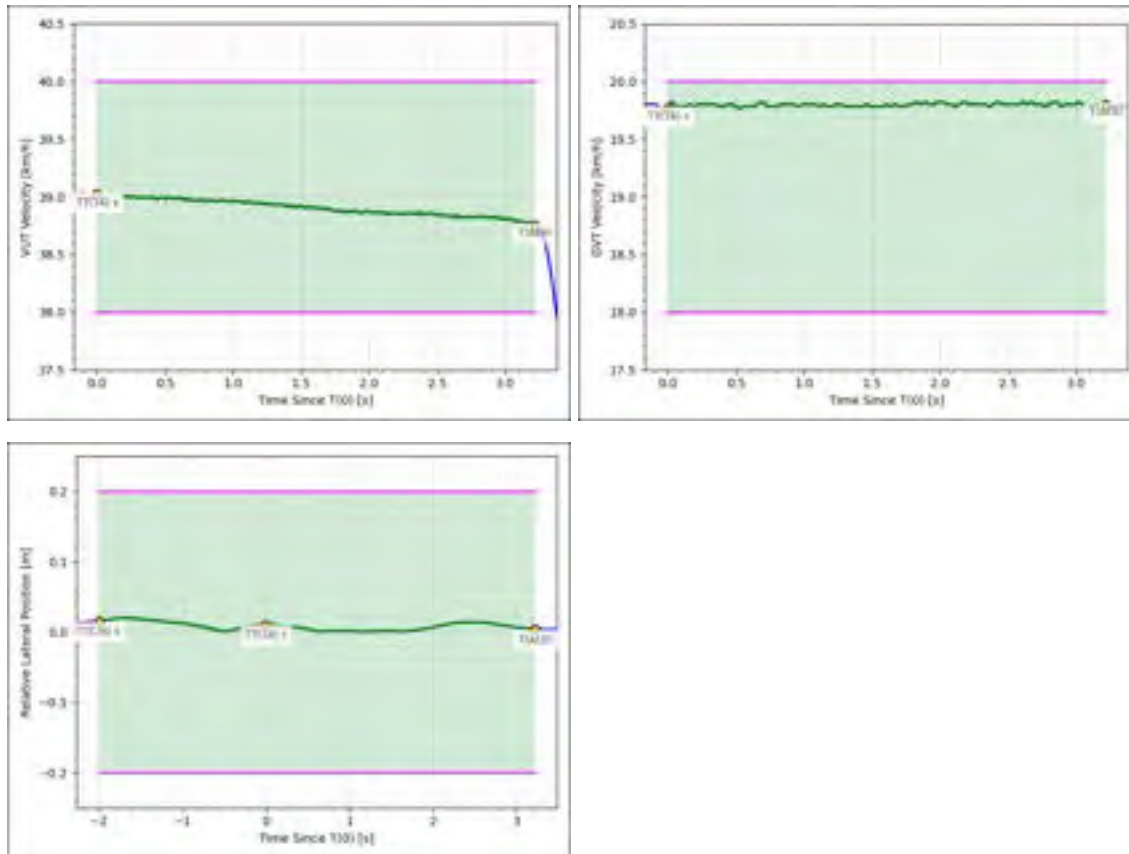
AEB CCRm | 40 km/h +100 % | Run 4

Run Date / Time 21-Jul-2023 13:55



AEB CCRm | 40 km/h +100 % | Run 5

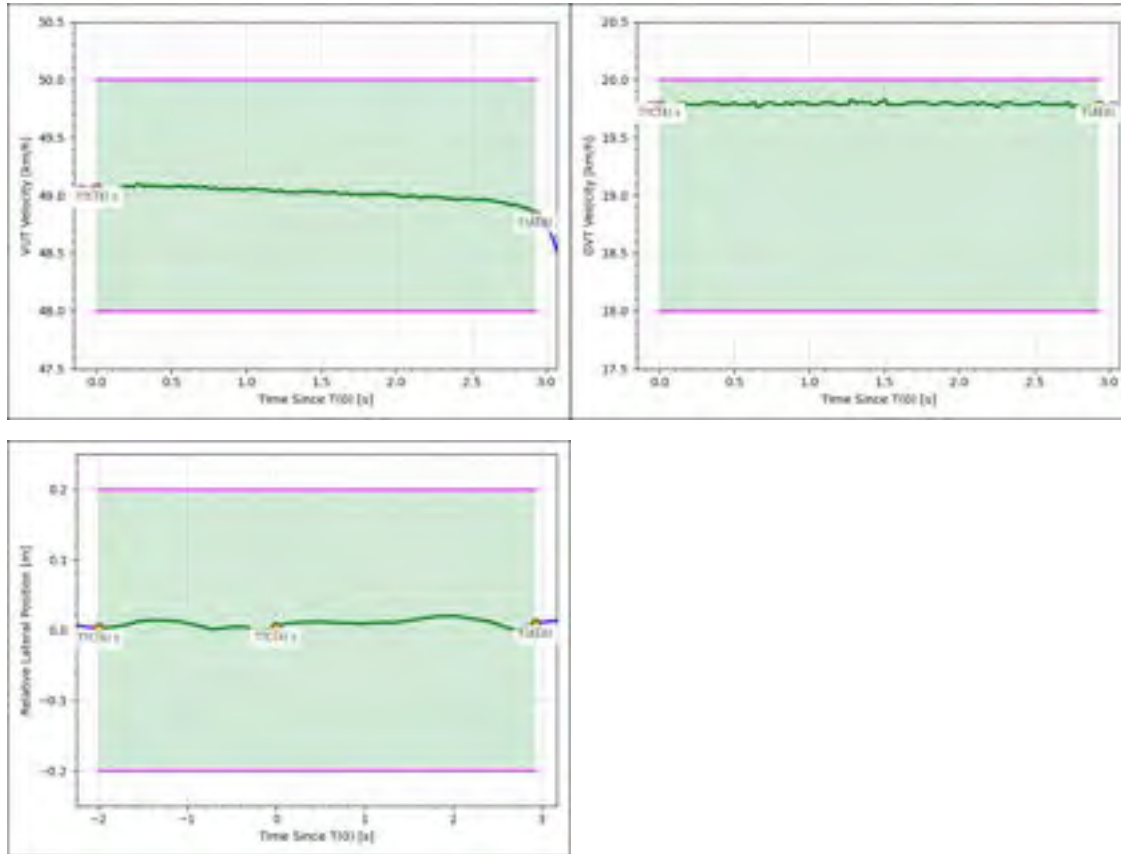
Run Date / Time 21-Jul-2023 13:59



1.1.1.3. AEB CCRm 50 kph +100 %

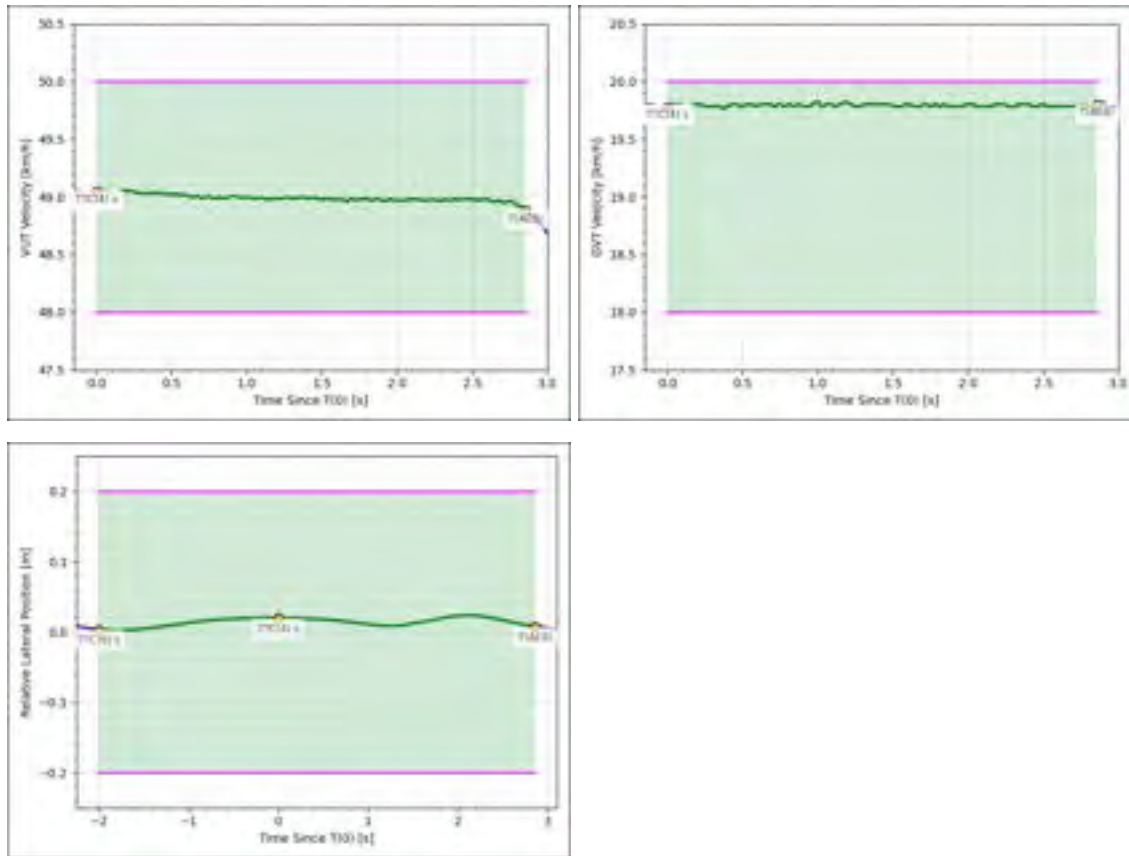
AEB CCRm | 50 km/h +100 % | Run 7

Run Date / Time 21-Jul-2023 14:07



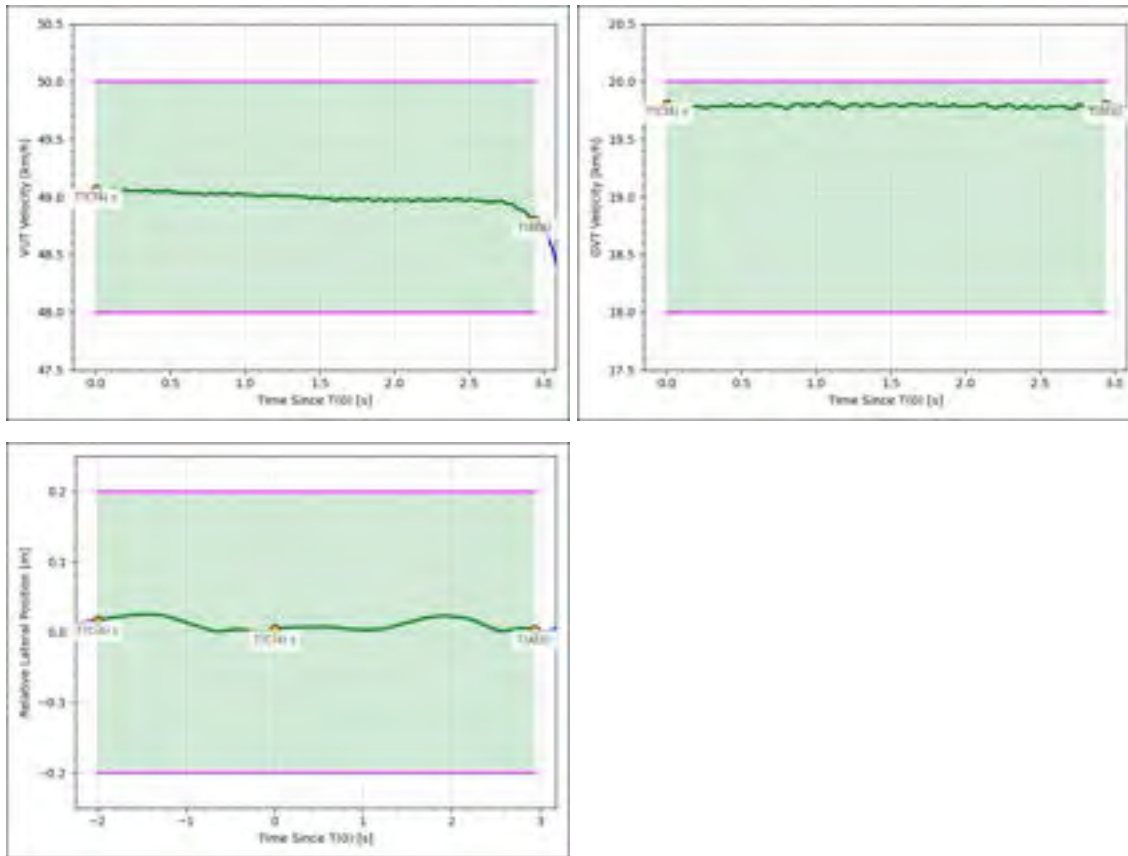
AEB CCRm | 50 km/h +100 % | Run 8

Run Date / Time 21-Jul-2023 14:12



AEB CCRm | 50 km/h +100 % | Run 9

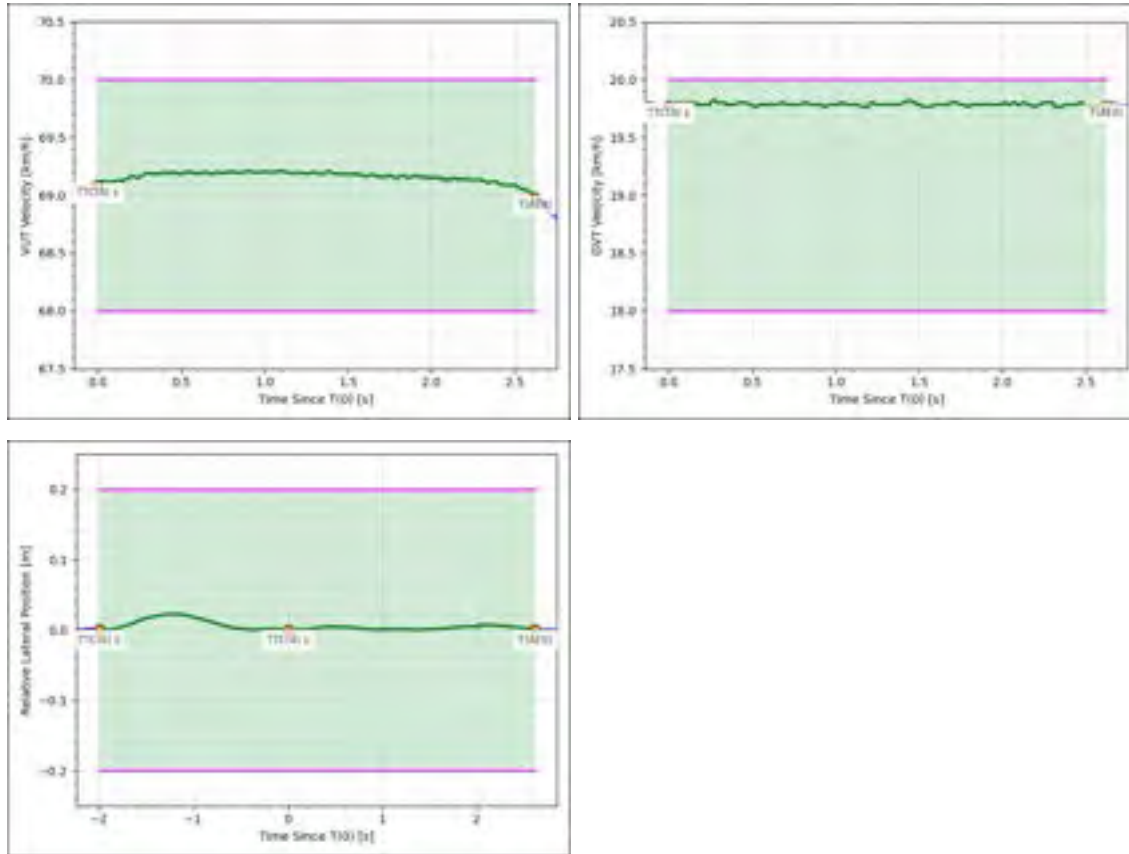
Run Date / Time 21-Jul-2023 14:19



1.1.1.4. AEB CCRm 70 kph +100 %

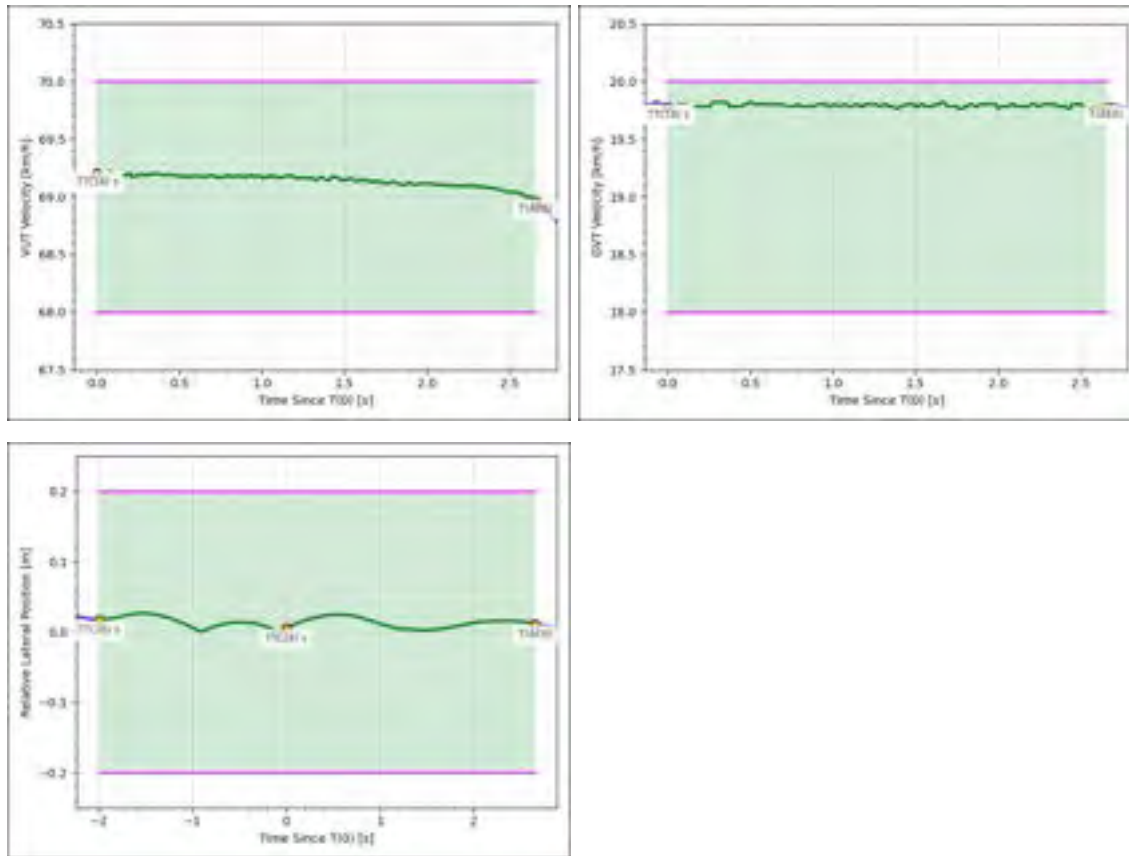
AEB CCRm | 70 km/h +100 % | Run 5

Run Date / Time 21-Jul-2023 14:26



AEB CCRm | 70 km/h +100 % | Run 6

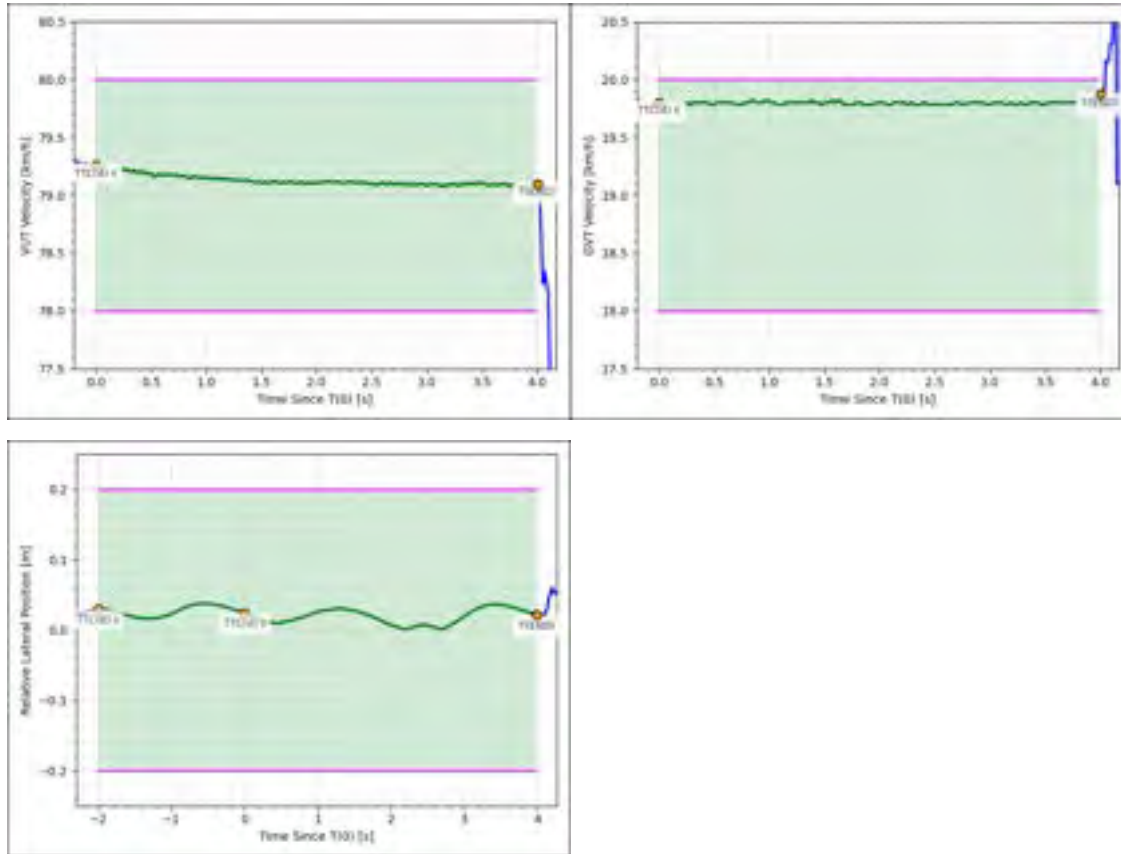
Run Date / Time 21-Jul-2023 14:31



1.1.1.5. AEB CCRm 80 kph +100 %

AEB CCRm | 80 km/h +100 % | Run 4

Run Date / Time 21-Jul-2023 14:40



APPENDIX J

Toyota Hilux Car-to-Pedestrian Results Validity

J. Hilux Car-to-Pedestrian Results Validity

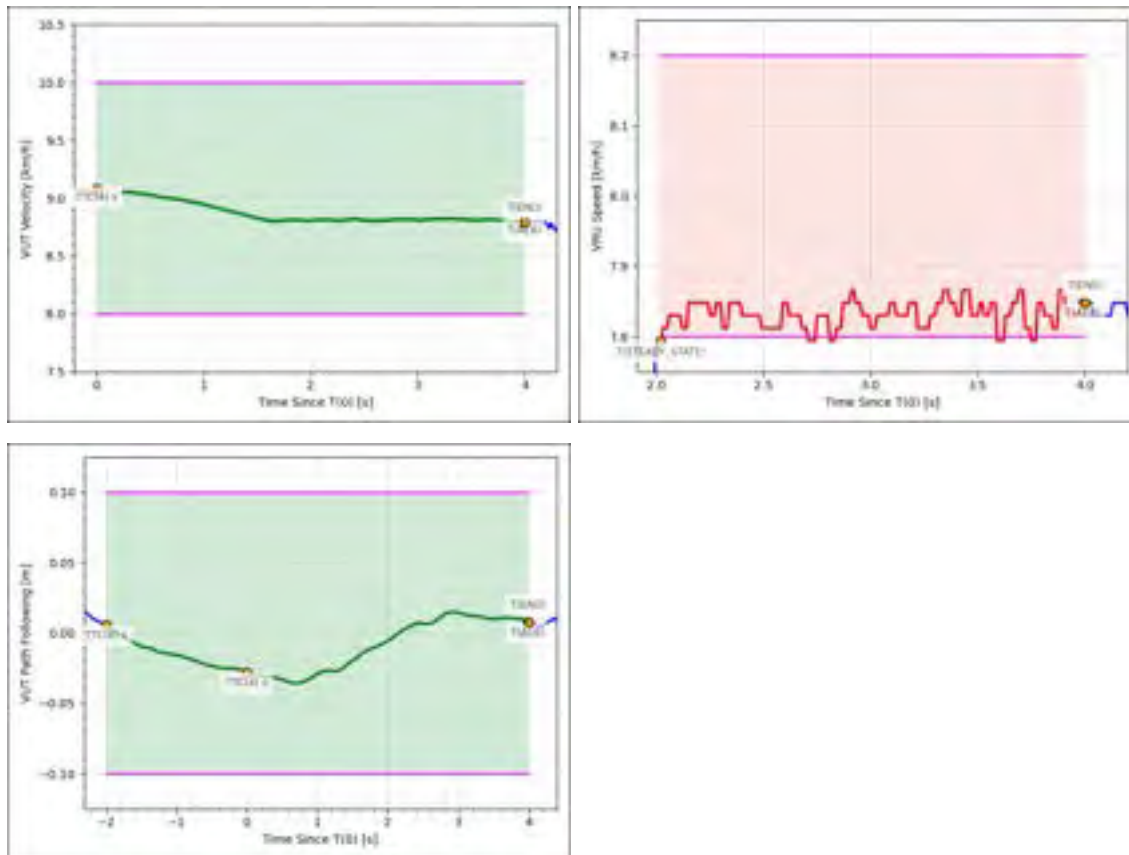
J.1. Car-to-Pedestrian Farside Adult

J.1.1. Baseline

J.1.1.1. CPFA-50 VUT 10kph EPT 8kph (Day)

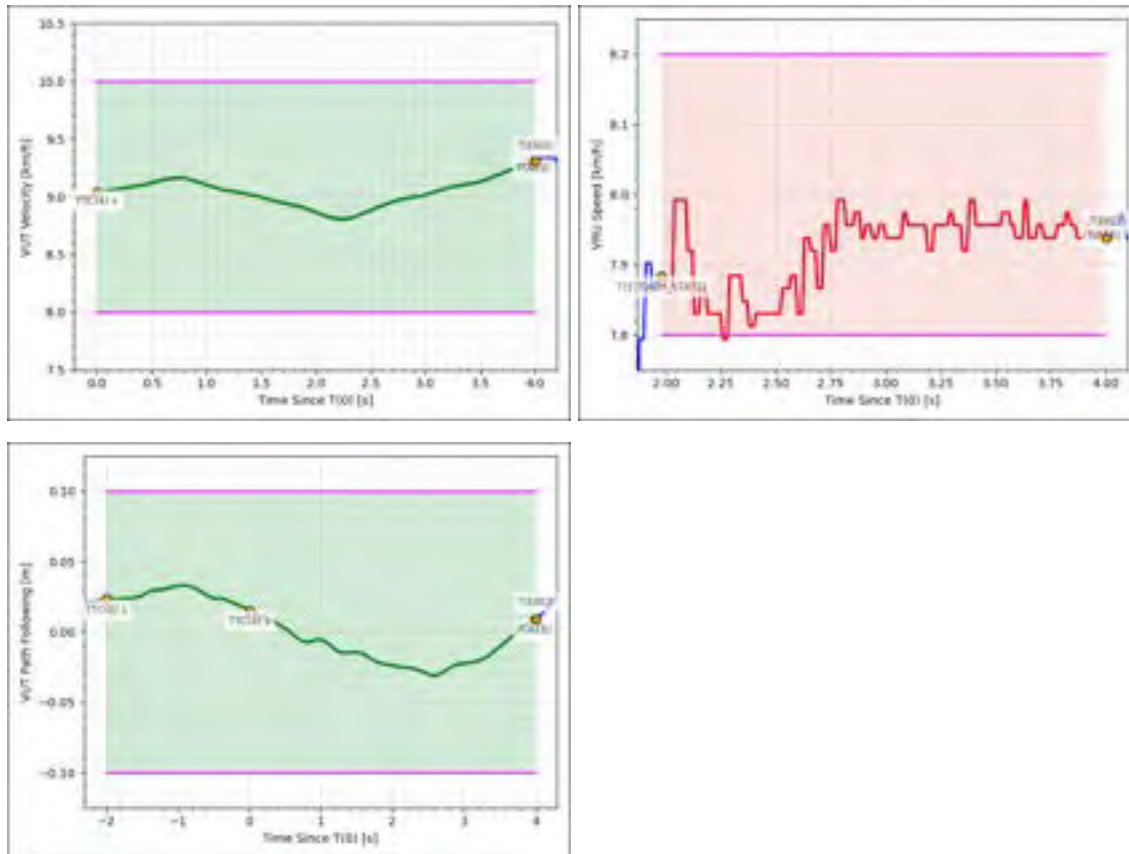
CPFA-50 8 kph (Day) | 10 km/h | Run 1

Run Date / Time 13-Feb-2023 14:04



CPFA-50 8 kph (Day) | 10 km/h | Run 2

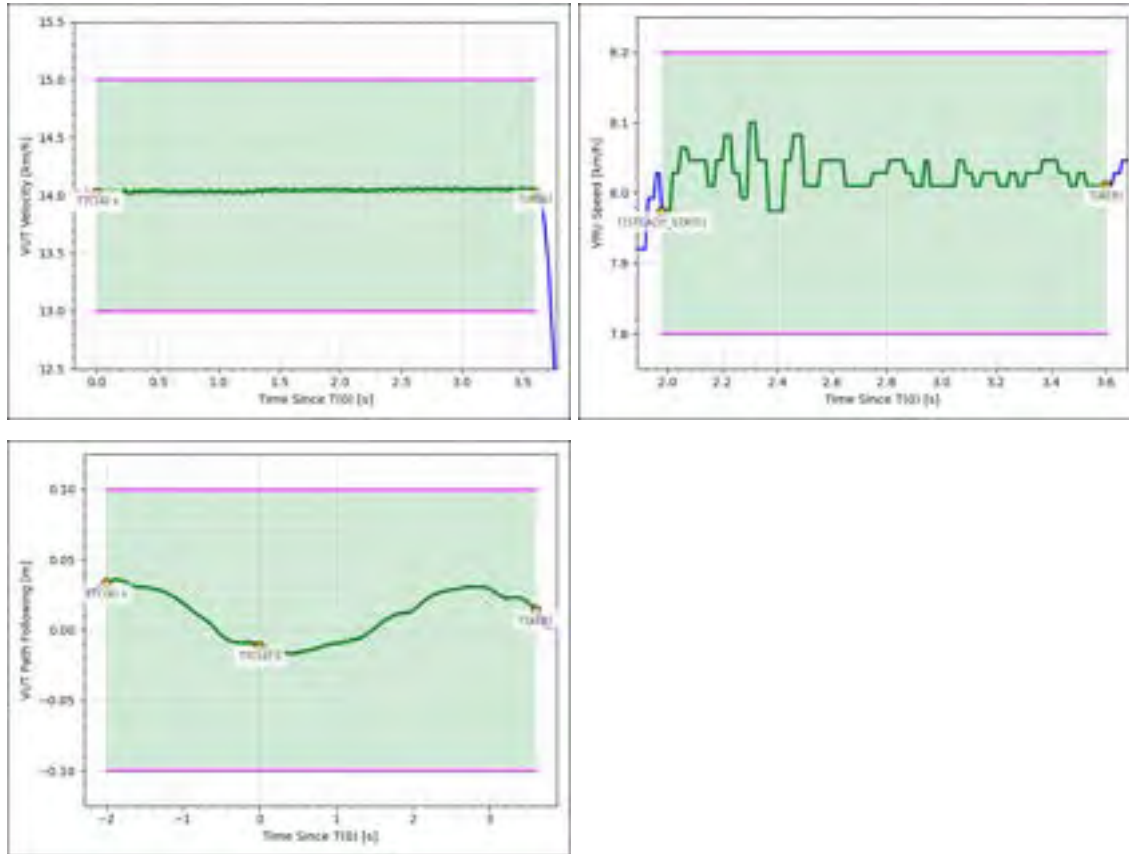
Run Date / Time 13-Feb-2023 14:22



J.1.1.2. CPFA-50 VUT 15kph EPT 8kph (Day)

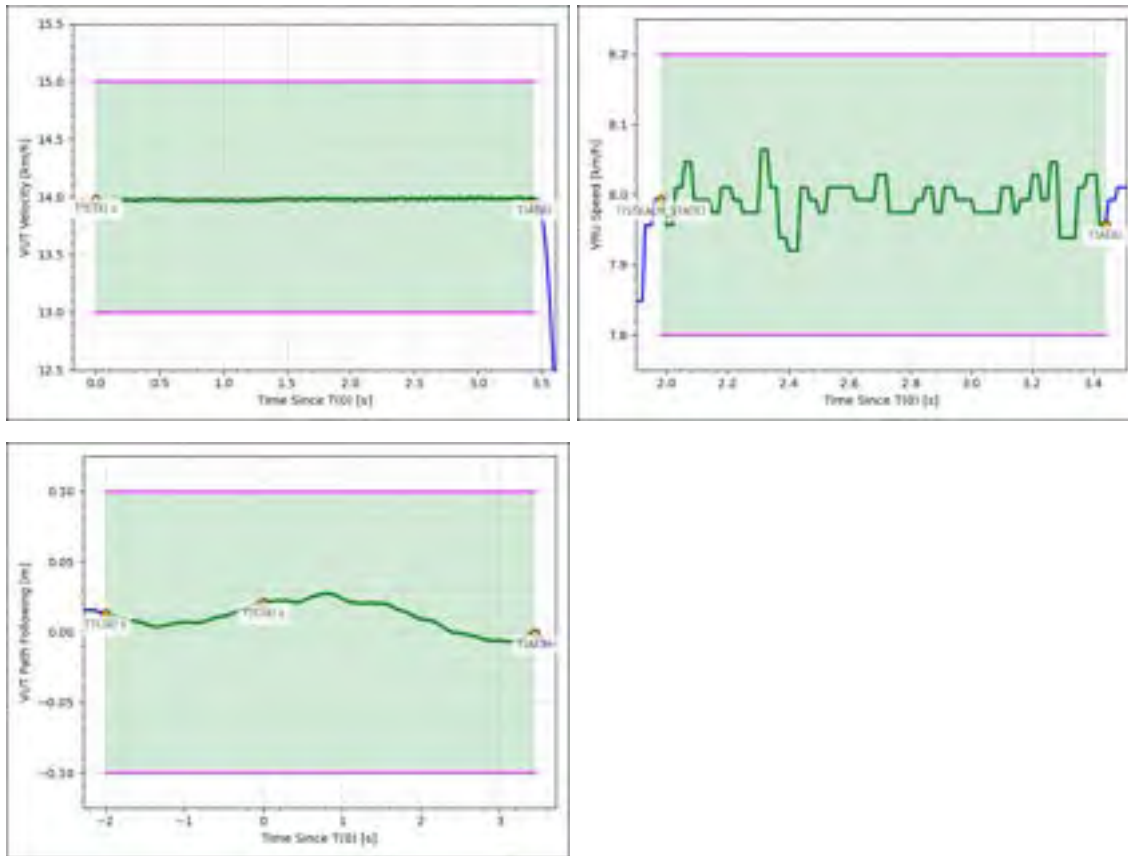
CPFA-50 8 kph (Day) | 15 km/h | Run 3

Run Date / Time 13-Feb-2023 14:13



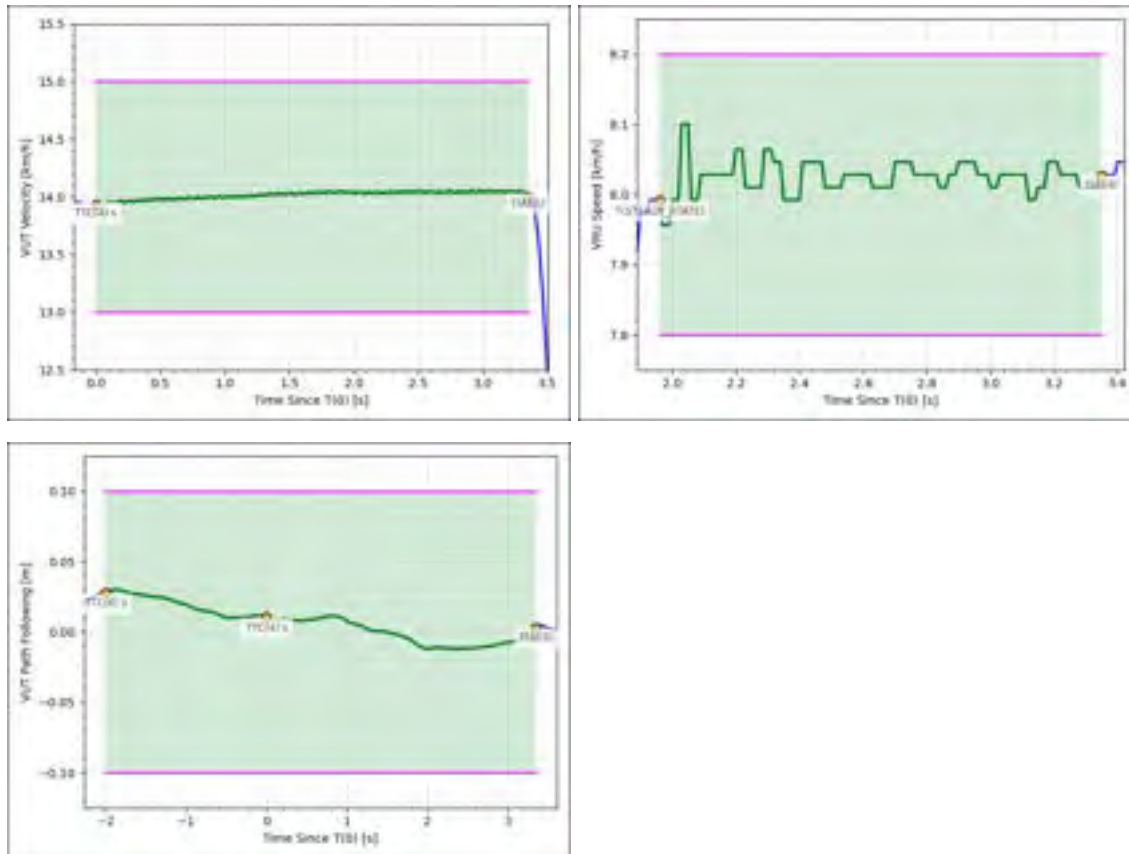
CPFA-50 8 kph (Day) | 15 km/h | Run 4

Run Date / Time 13-Feb-2023 14:16



CPFA-50 8 kph (Day) | 15 km/h | Run 5

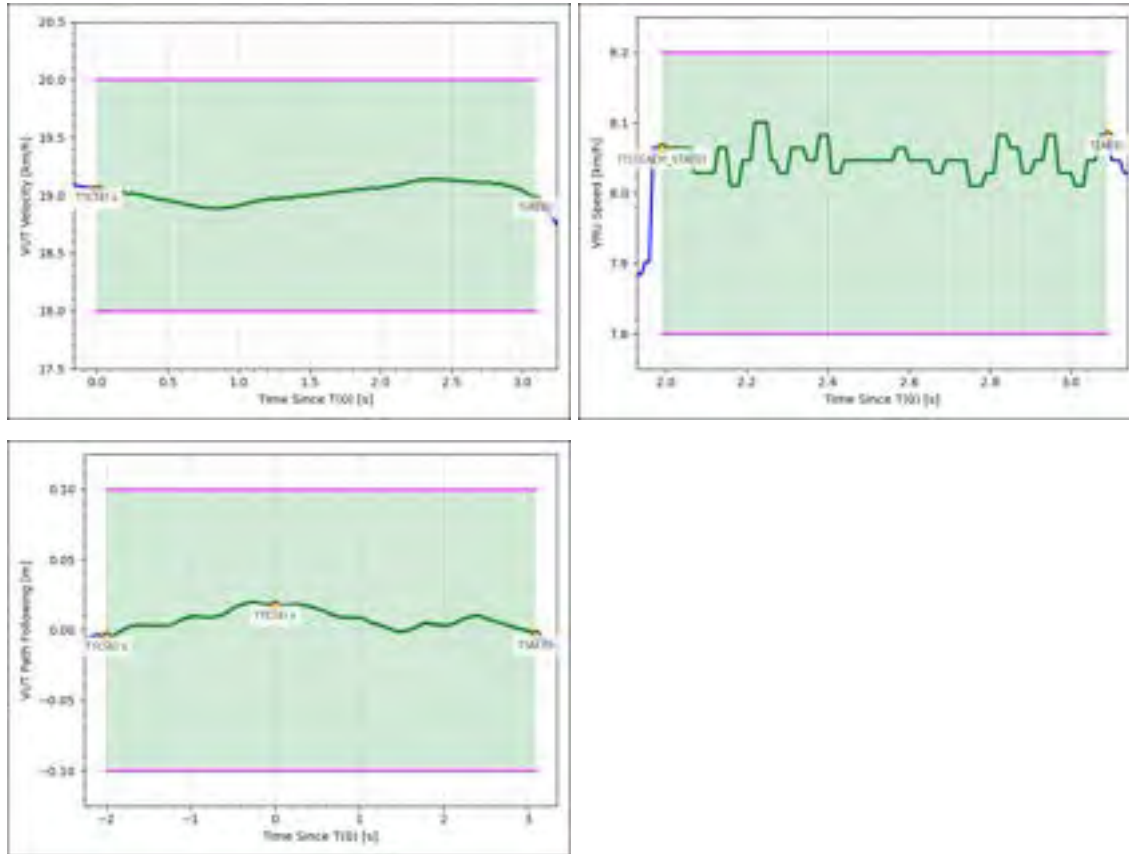
Run Date / Time 13-Feb-2023 14:19



J.1.1.3. CPFA-50 VUT 20kph EPT 8kph (Day)

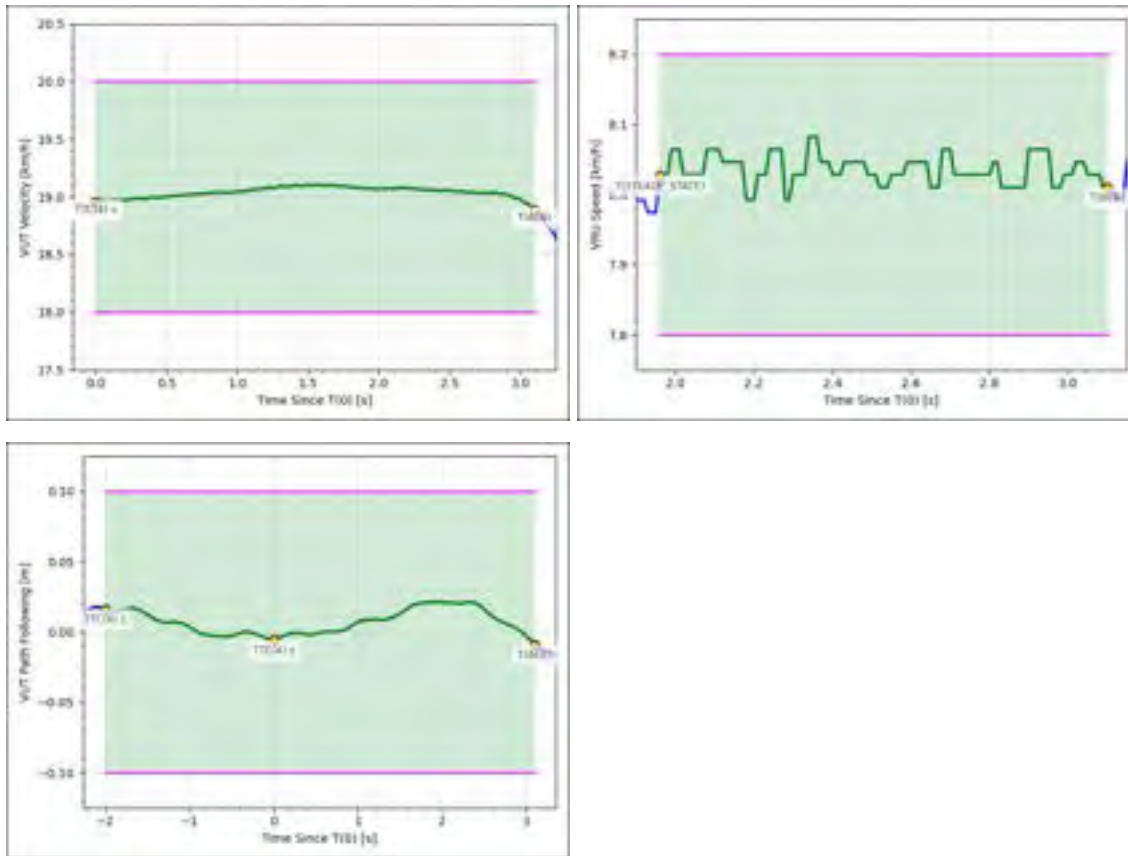
CPFA-50 8 kph (Day) | 20 km/h | Run 1

Run Date / Time 13-Feb-2023 11:27



CPFA-50 8 kph (Day) | 20 km/h | Run 2

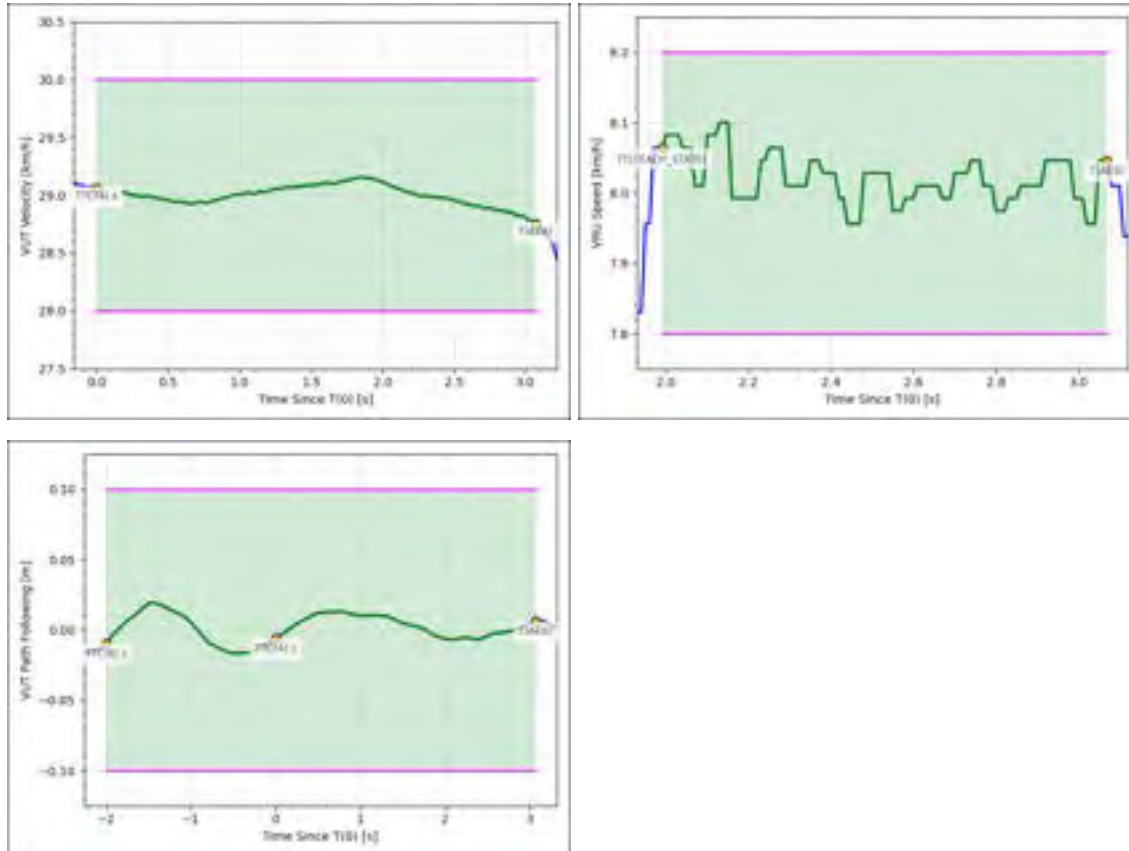
Run Date / Time 13-Feb-2023 11:30



J.1.1.4. CPFA-50 VUT 30kph EPT 8kph (Day)

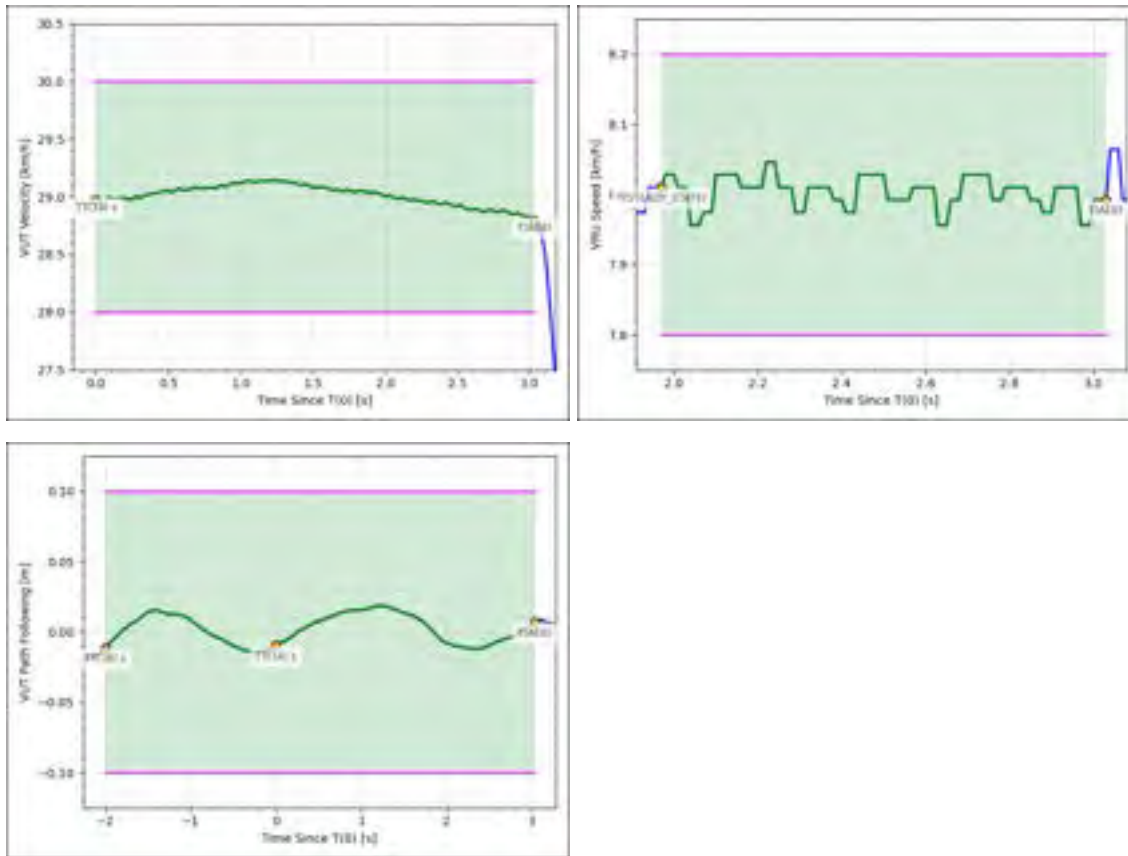
CPFA-50 8 kph (Day) | 30 km/h | Run 1

Run Date / Time 13-Feb-2023 11:33



CPFA-50 8 kph (Day) | 30 km/h | Run 2

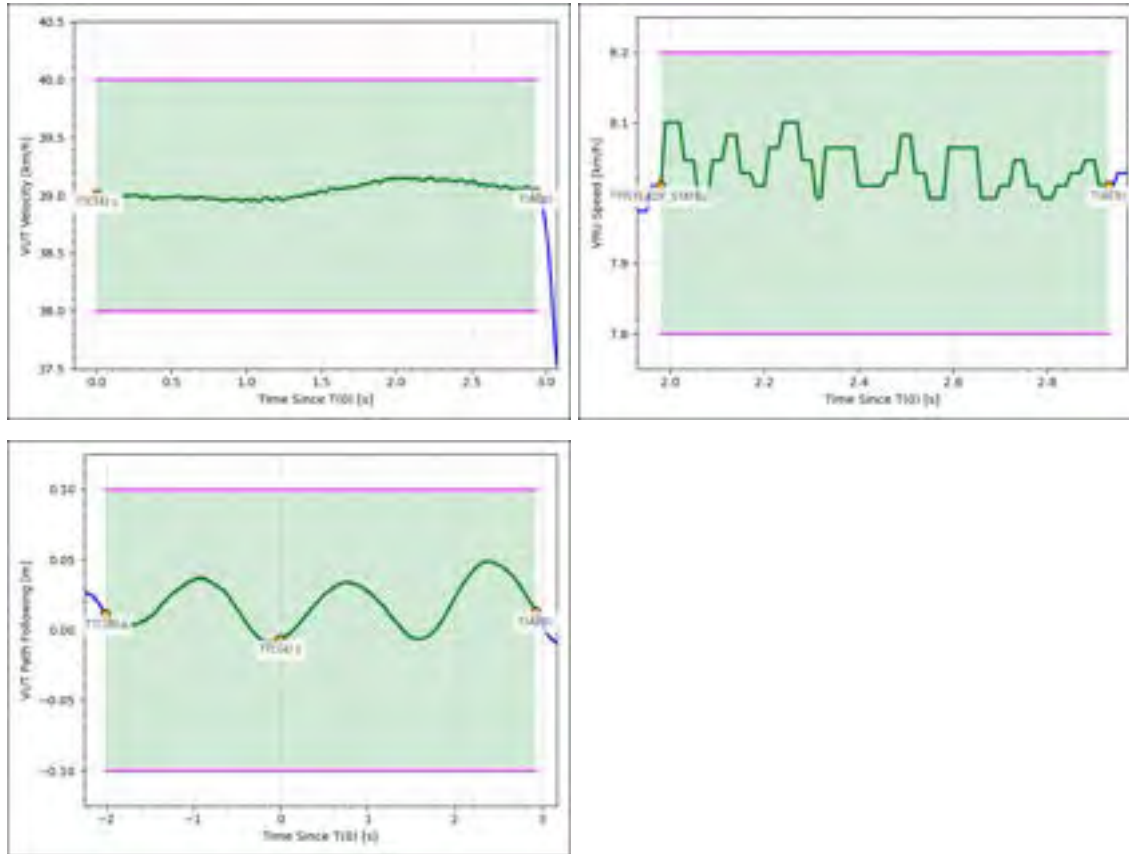
Run Date / Time 13-Feb-2023 11:36



J.1.1.5. CPFA-50 VUT 40kph EPT 8kph (Day)

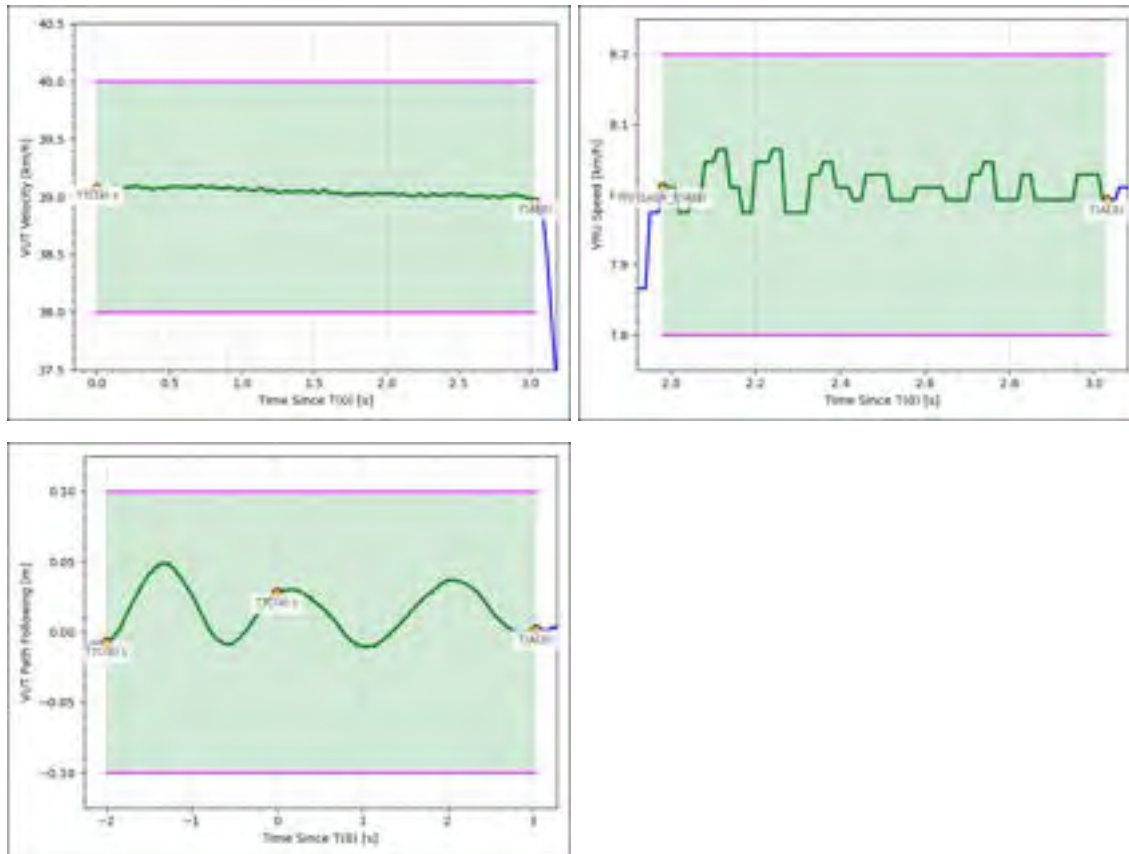
CPFA-50 8 kph (Day) | 40 km/h | Run 4

Run Date / Time 13-Feb-2023 11:51



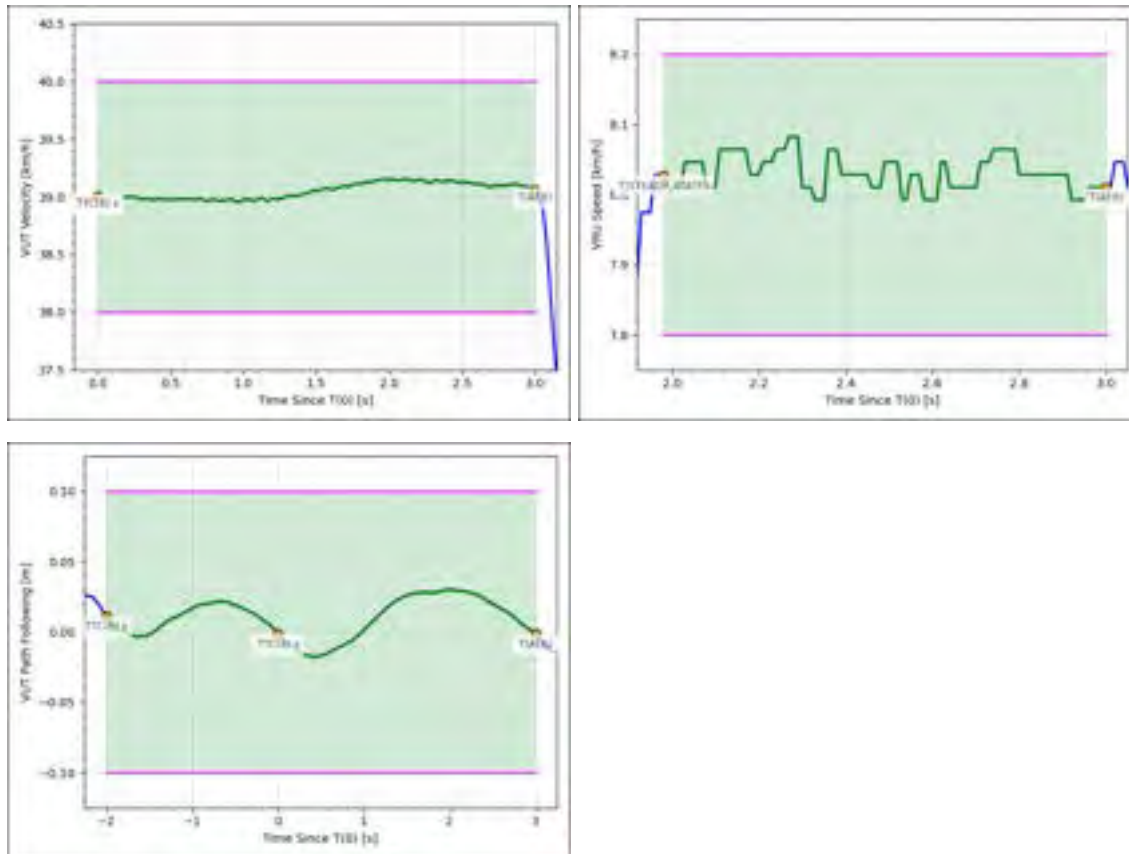
CPFA-50 8 kph (Day) | 40 km/h | Run 5

Run Date / Time 13-Feb-2023 11:53



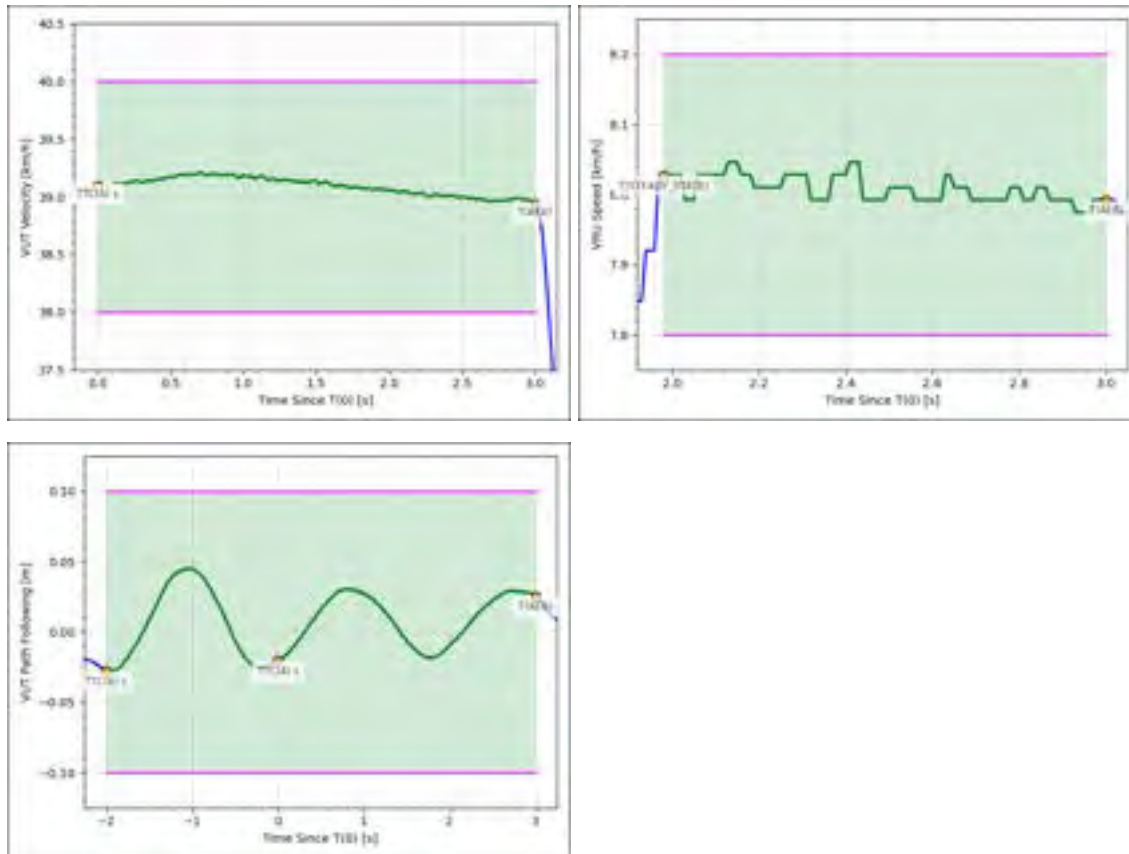
CPFA-50 8 kph (Day) | 40 km/h | Run 7

Run Date / Time 13-Feb-2023 13:30



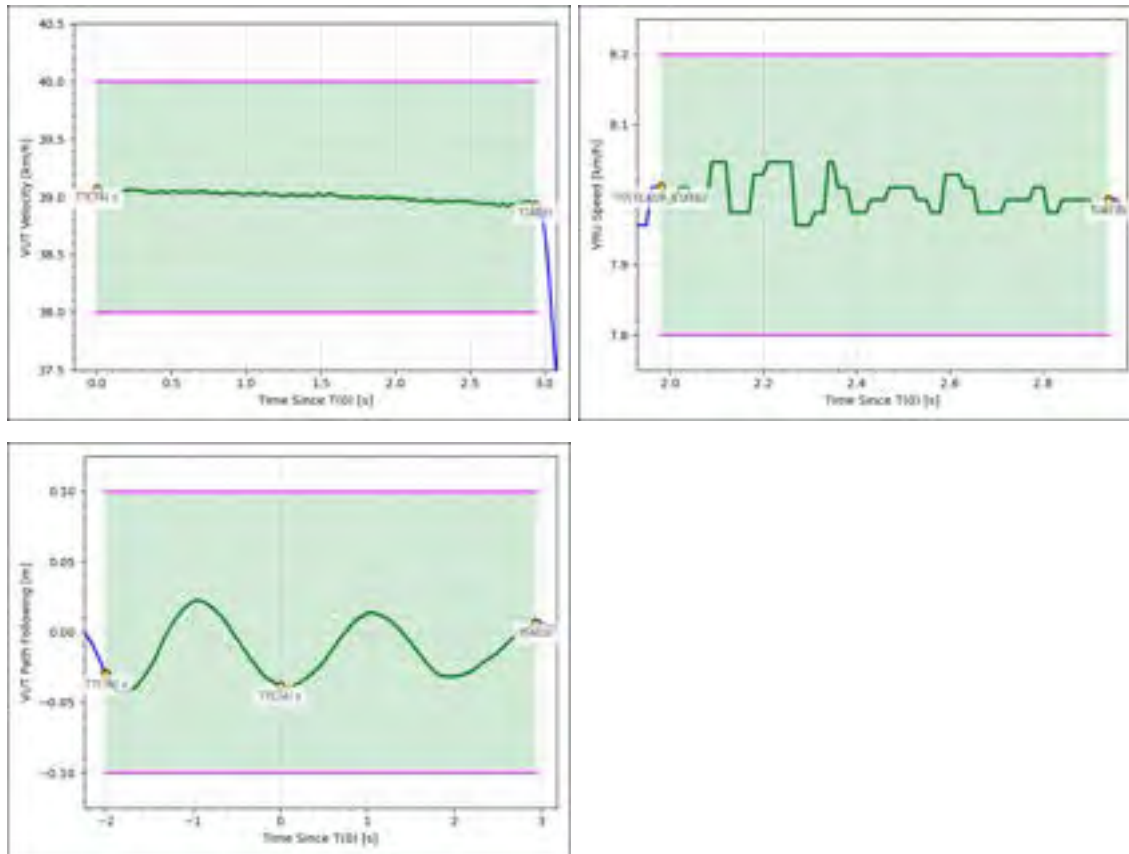
CPFA-50 8 kph (Day) | 40 km/h | Run 8

Run Date / Time 13-Feb-2023 13:33



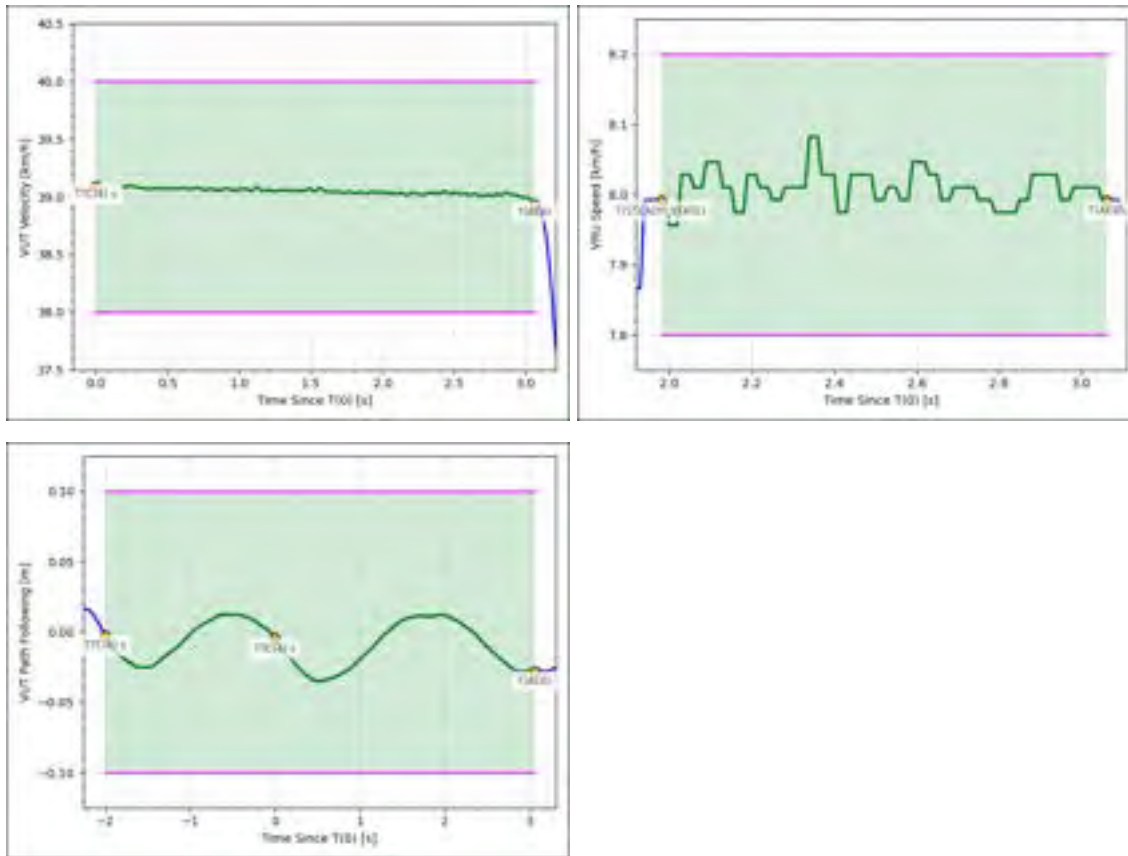
CPFA-50 8 kph (Day) | 40 km/h | Run 9

Run Date / Time 13-Feb-2023 13:40



CPFA-50 8 kph (Day) | 40 km/h | Run 10

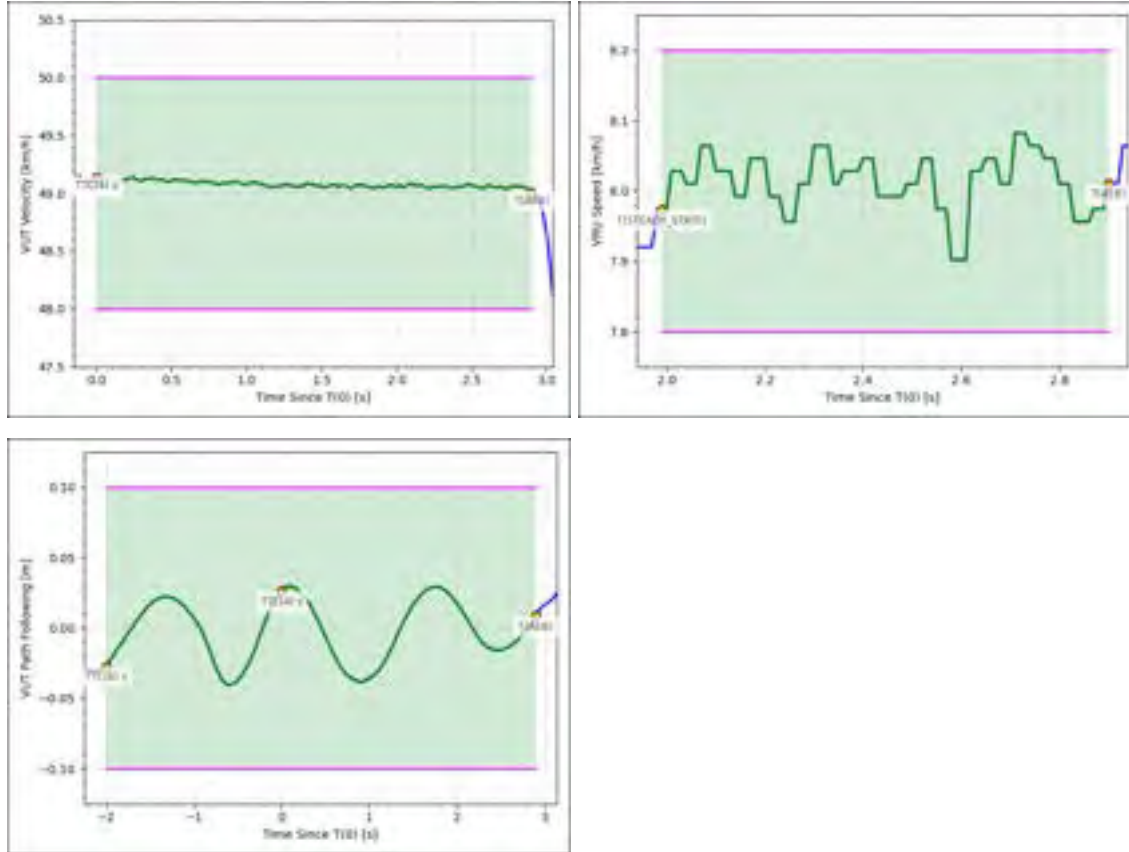
Run Date / Time 13-Feb-2023 13:44



J.1.1.6. CPFA-50 VUT 50kph EPT 8kph (Day)

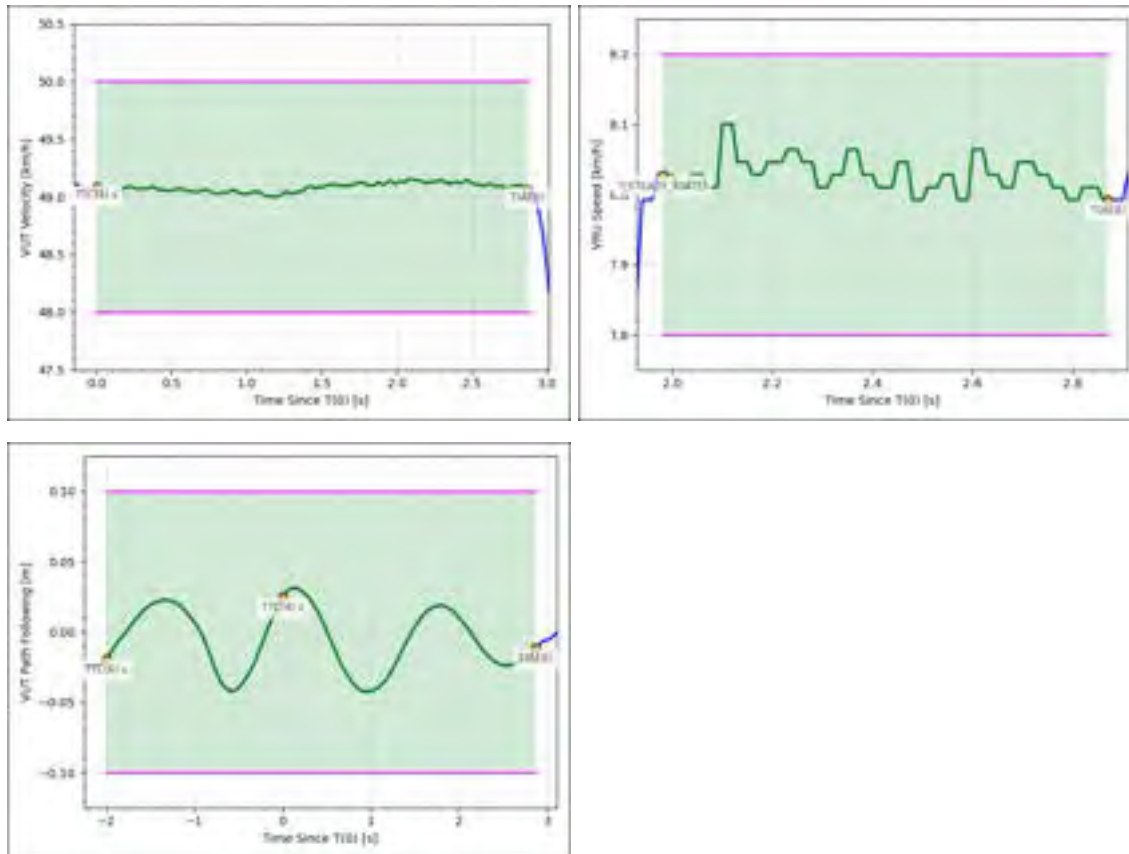
CPFA-50 8 kph (Day) | 50 km/h | Run 1

Run Date / Time 13-Feb-2023 12:13



CPFA-50 8 kph (Day) | 50 km/h | Run 2

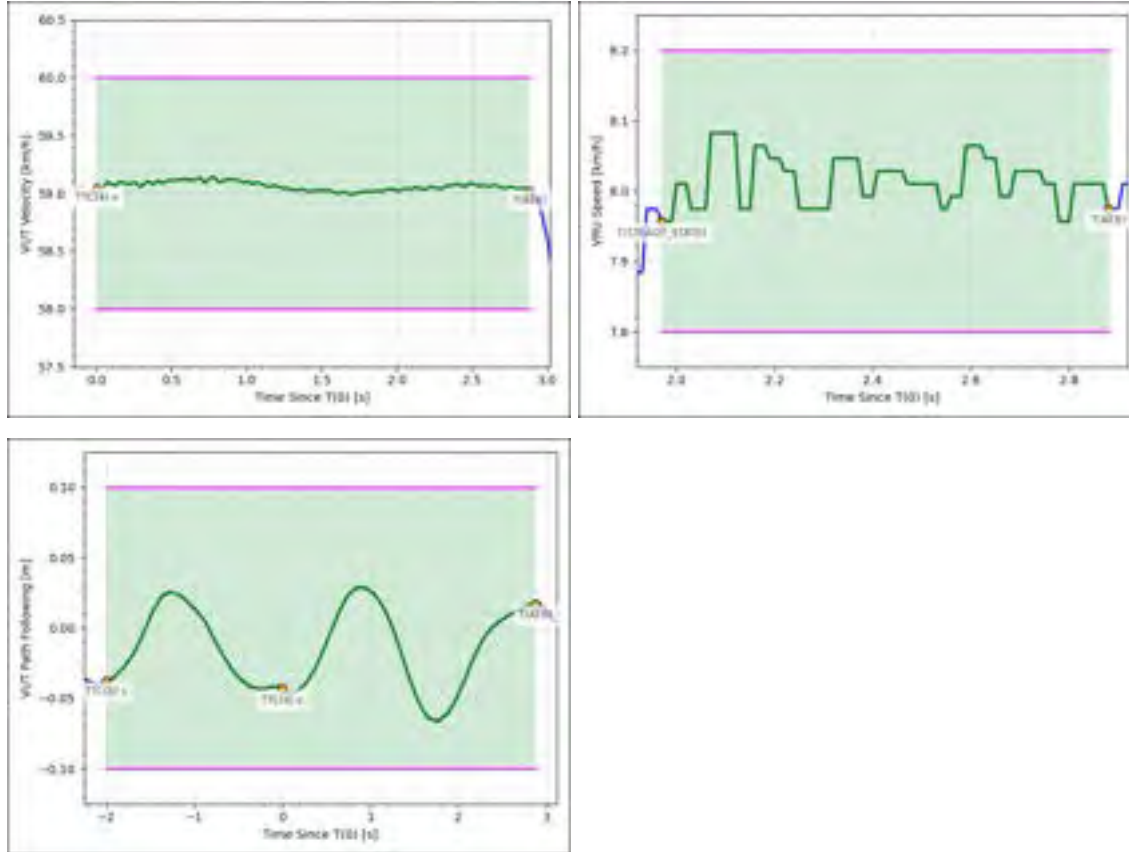
Run Date / Time 13-Feb-2023 12:15



J.1.1.7. CPFA-50 VUT 60kph EPT 8kph (Day)

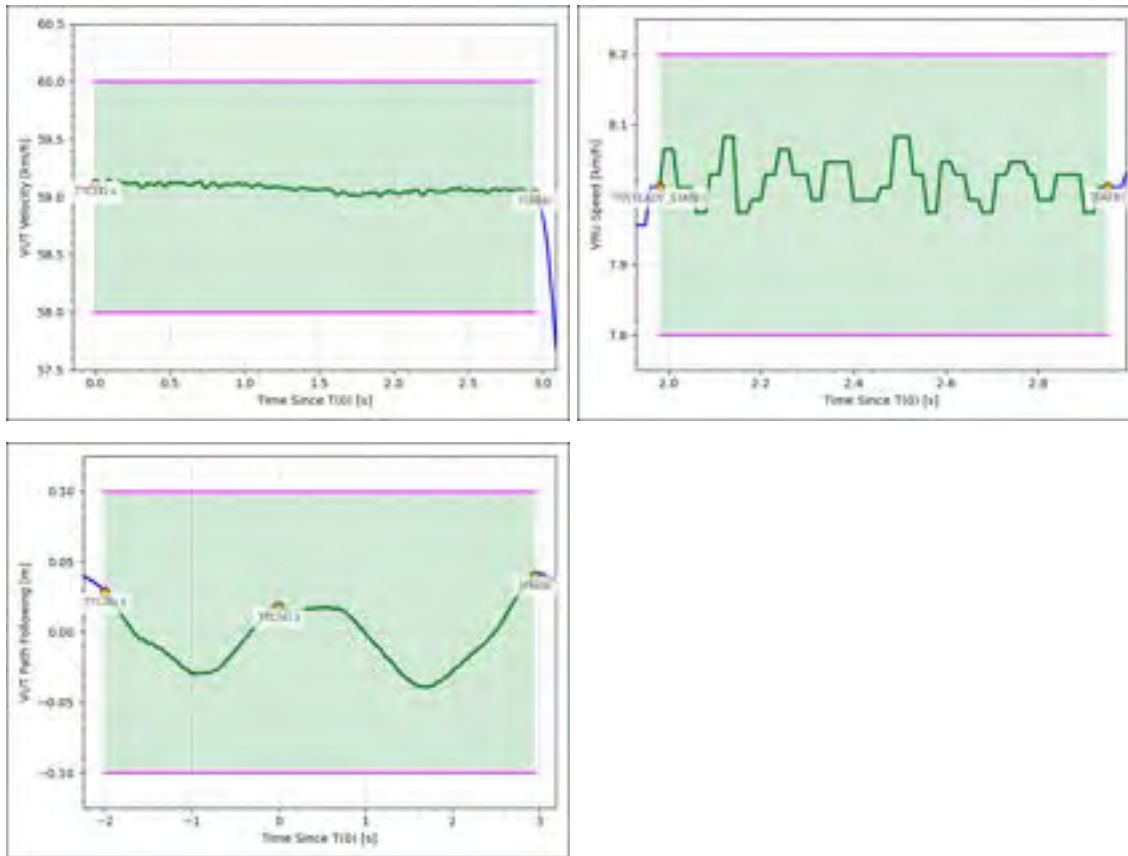
CPFA-50 8 kph (Day) | 60 km/h | Run 1

Run Date / Time 13-Feb-2023 12:19



CPFA-50 8 kph (Day) | 60 km/h | Run 5

Run Date / Time 13-Feb-2023 13:52

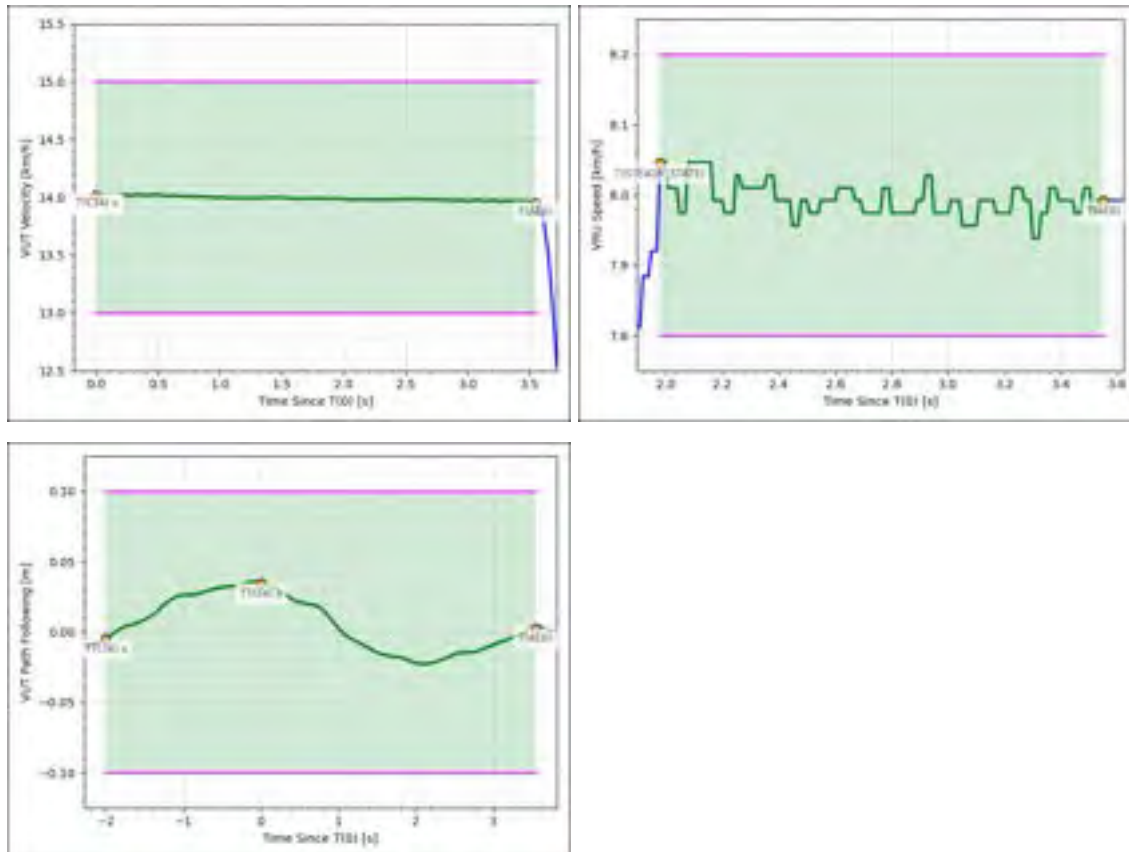


J.1.1. GVM

J.1.1.1. CPFA-50 VUT 15kph EPT 8kph (Day)

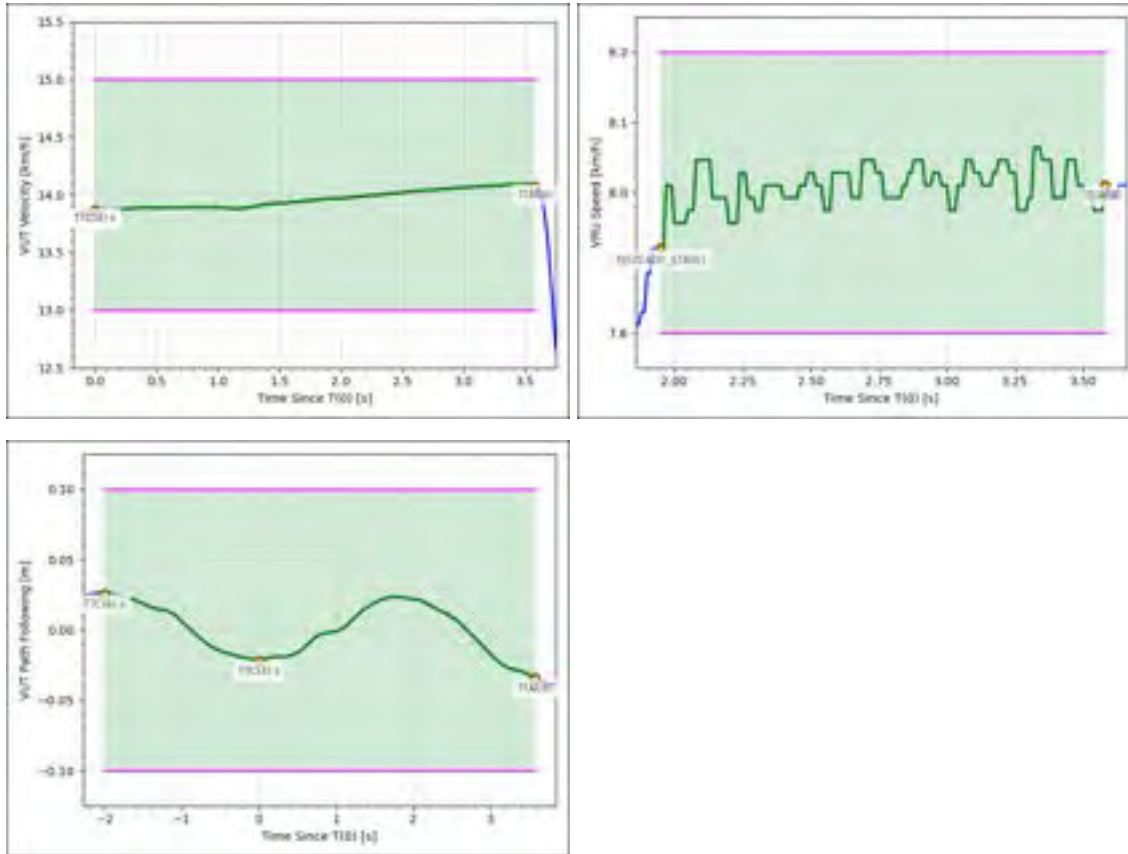
CPFA-50 8 kph (Day) | 15 km/h | Run 6

Run Date / Time 16-Feb-2023 11:04



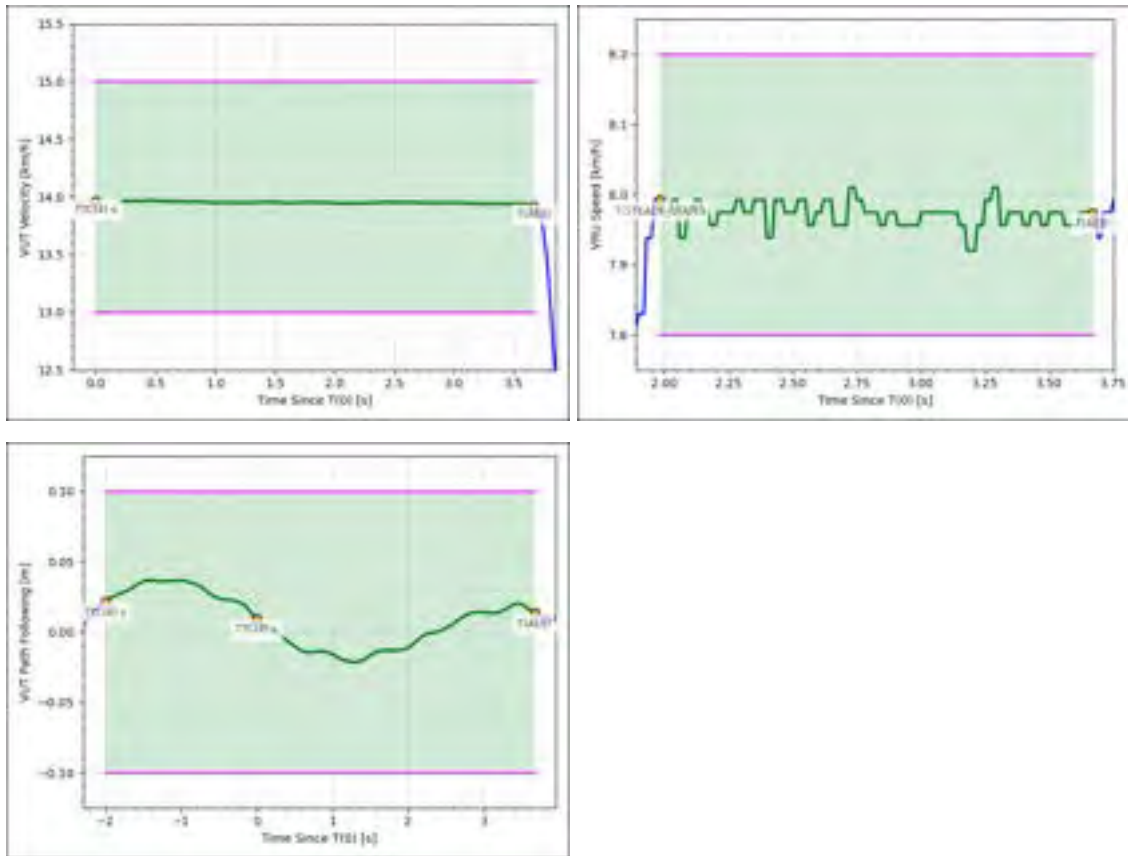
CPFA-50 8 kph (Day) | 15 km/h | Run 7

Run Date / Time 16-Feb-2023 11:08



CPFA-50 8 kph (Day) | 15 km/h | Run 8

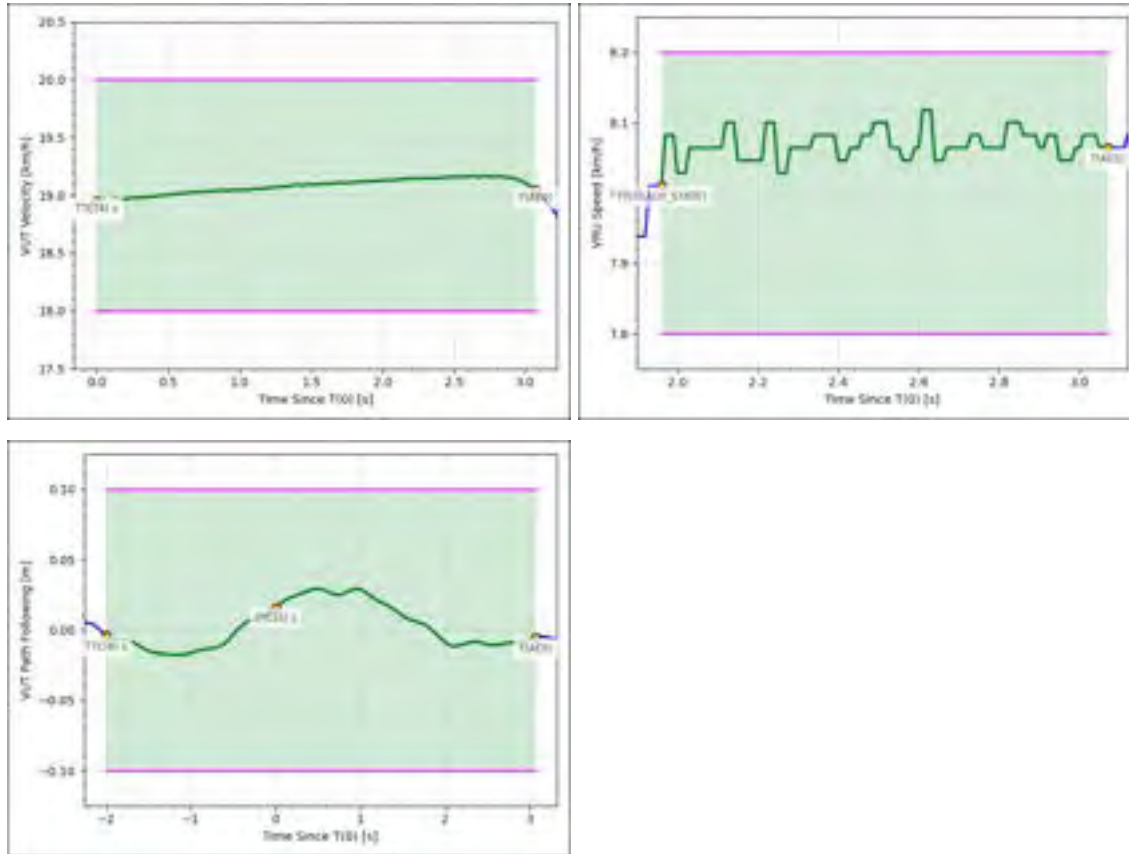
Run Date / Time 16-Feb-2023 11:13



J.1.1.2. CPFA-50 VUT 20kph EPT 8kph (Day)

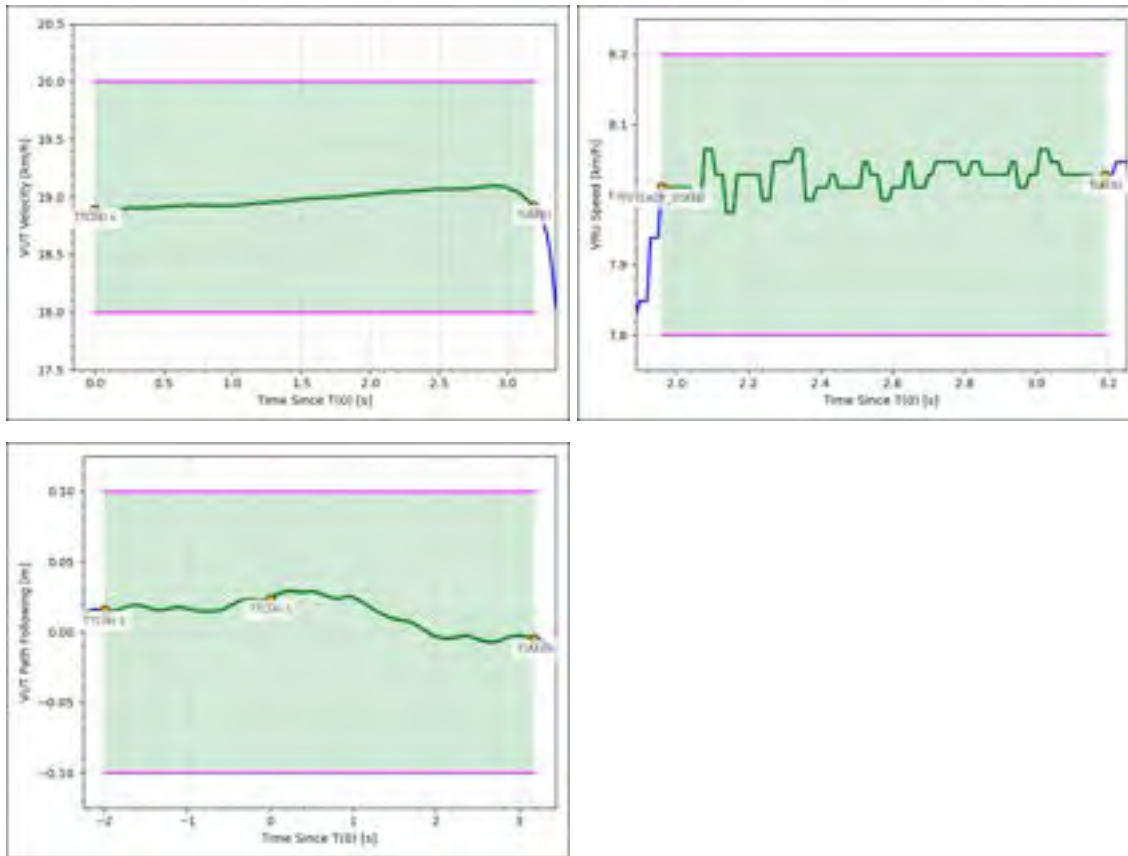
CPFA-50 8 kph (Day) | 20 km/h | Run 3

Run Date / Time 16-Feb-2023 10:05



CPFA-50 8 kph (Day) | 20 km/h | Run 4

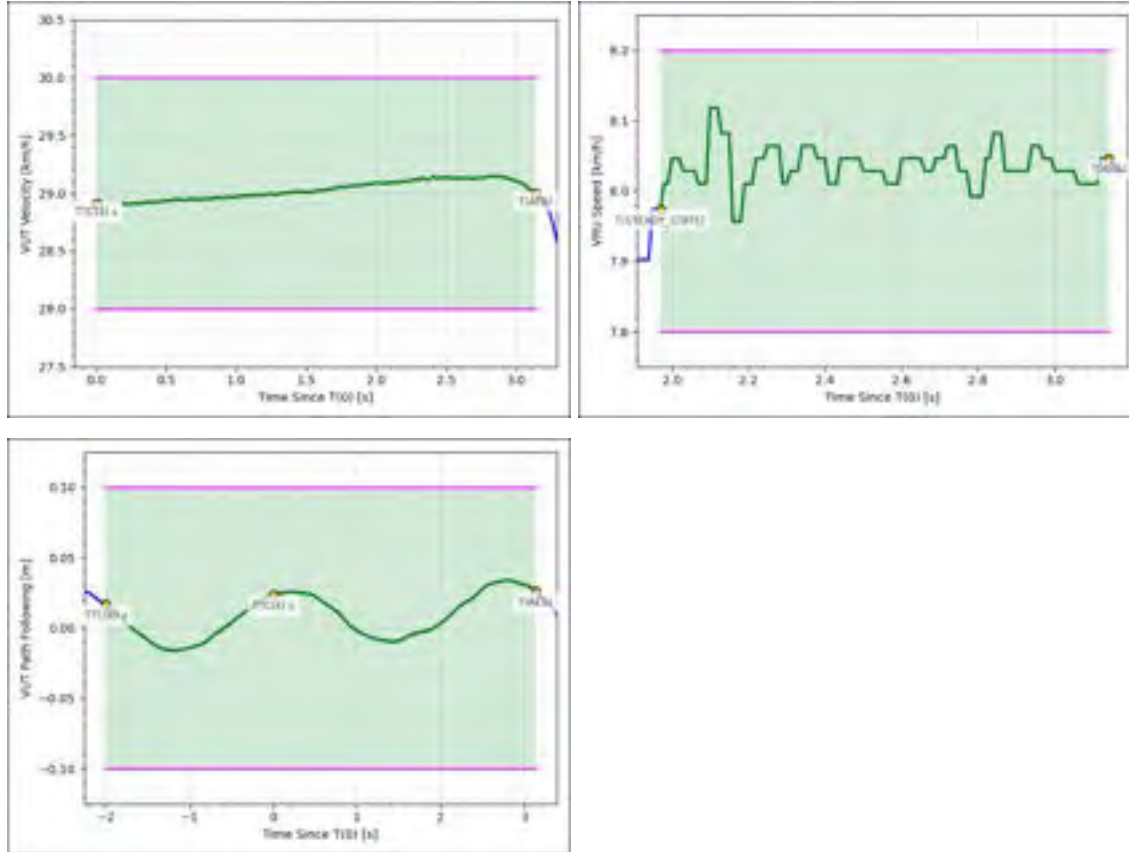
Run Date / Time 16-Feb-2023 10:09



J.1.1.3. CPFA-50 VUT 30kph EPT 8kph (Day)

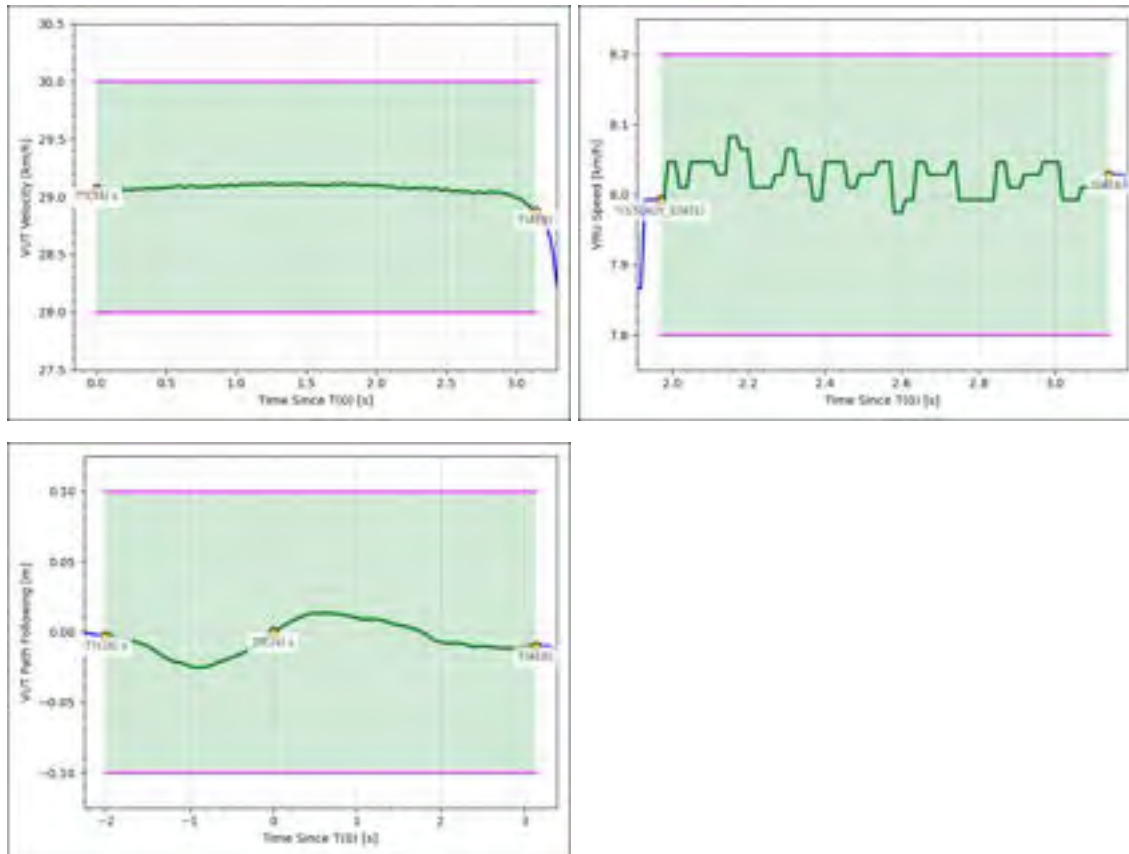
CPFA-50 8 kph (Day) | 30 km/h | Run 3

Run Date / Time 16-Feb-2023 10:14



CPFA-50 8 kph (Day) | 30 km/h | Run 4

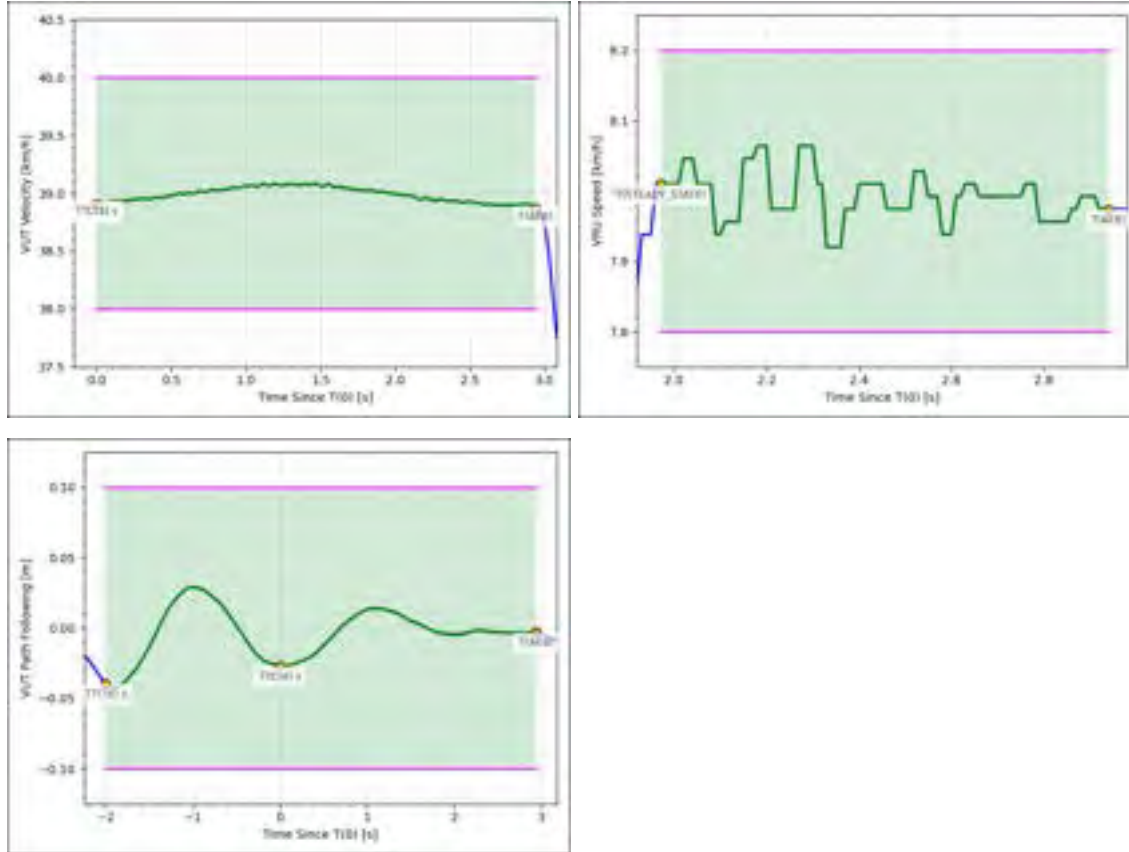
Run Date / Time 16-Feb-2023 10:18



J.1.1.4. CPFA-50 VUT 40kph EPT 8kph (Day)

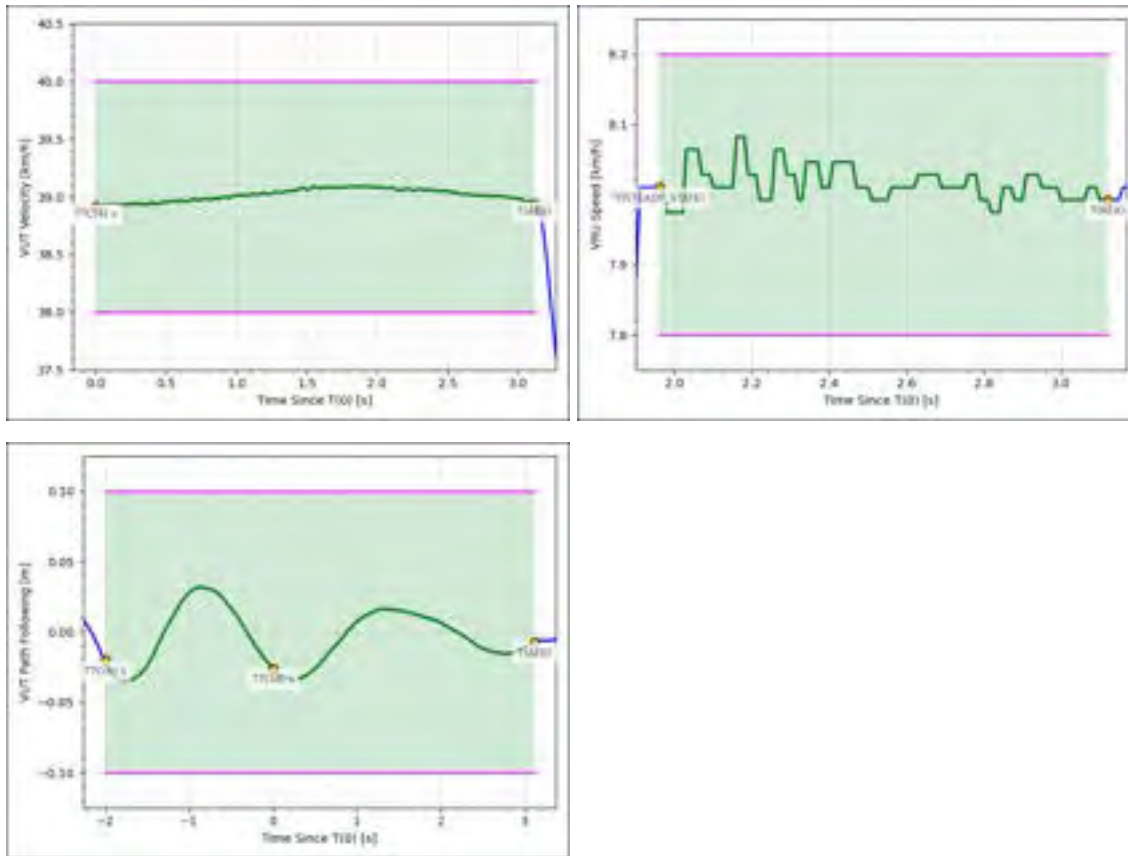
CPFA-50 8 kph (Day) | 40 km/h | Run 11

Run Date / Time 16-Feb-2023 10:24



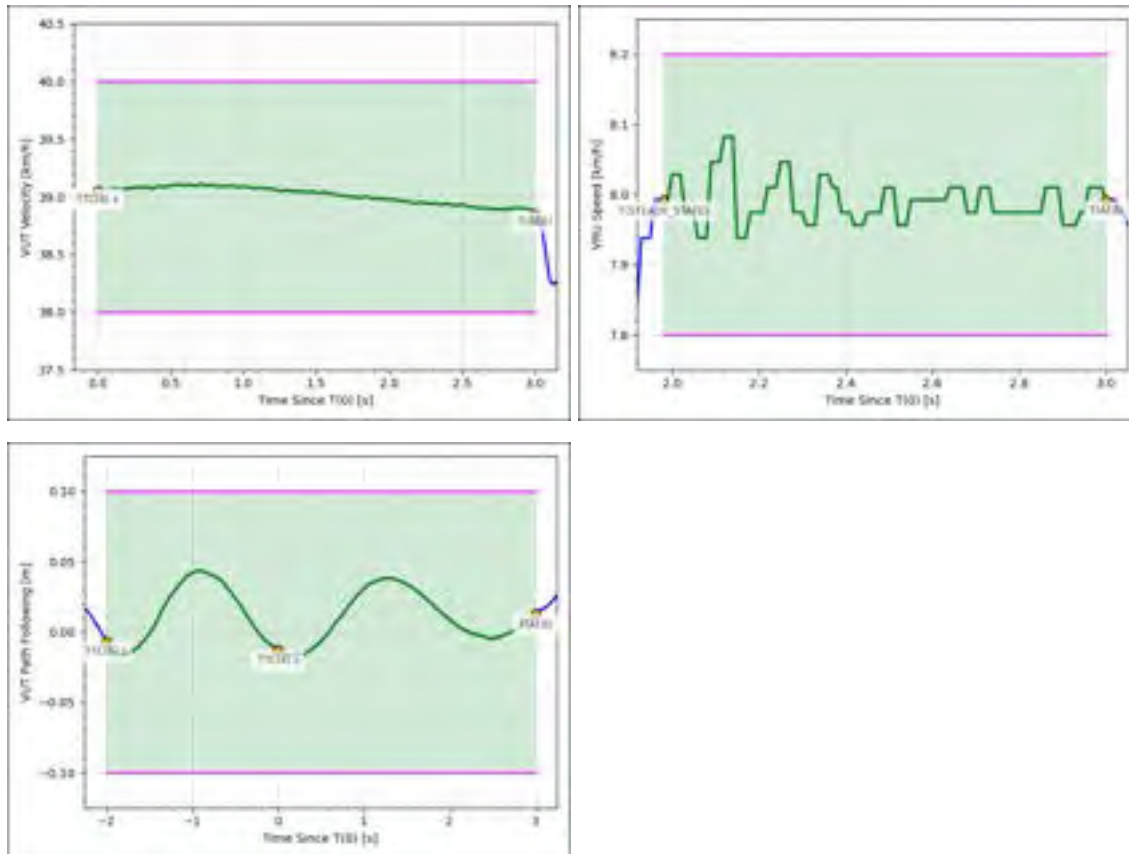
CPFA-50 8 kph (Day) | 40 km/h | Run 12

Run Date / Time 16-Feb-2023 10:29



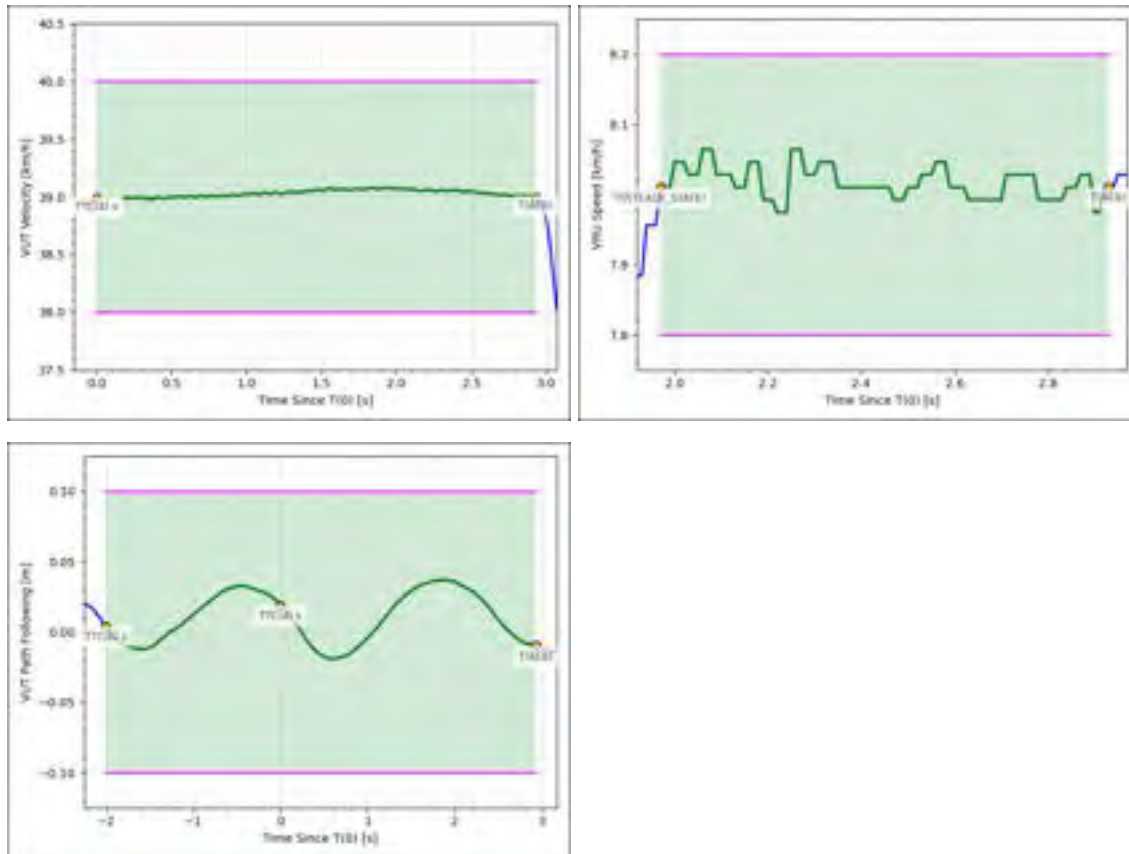
CPFA-50 8 kph (Day) | 40 km/h | Run 13

Run Date / Time 16-Feb-2023 10:34



CPFA-50 8 kph (Day) | 40 km/h | Run 14

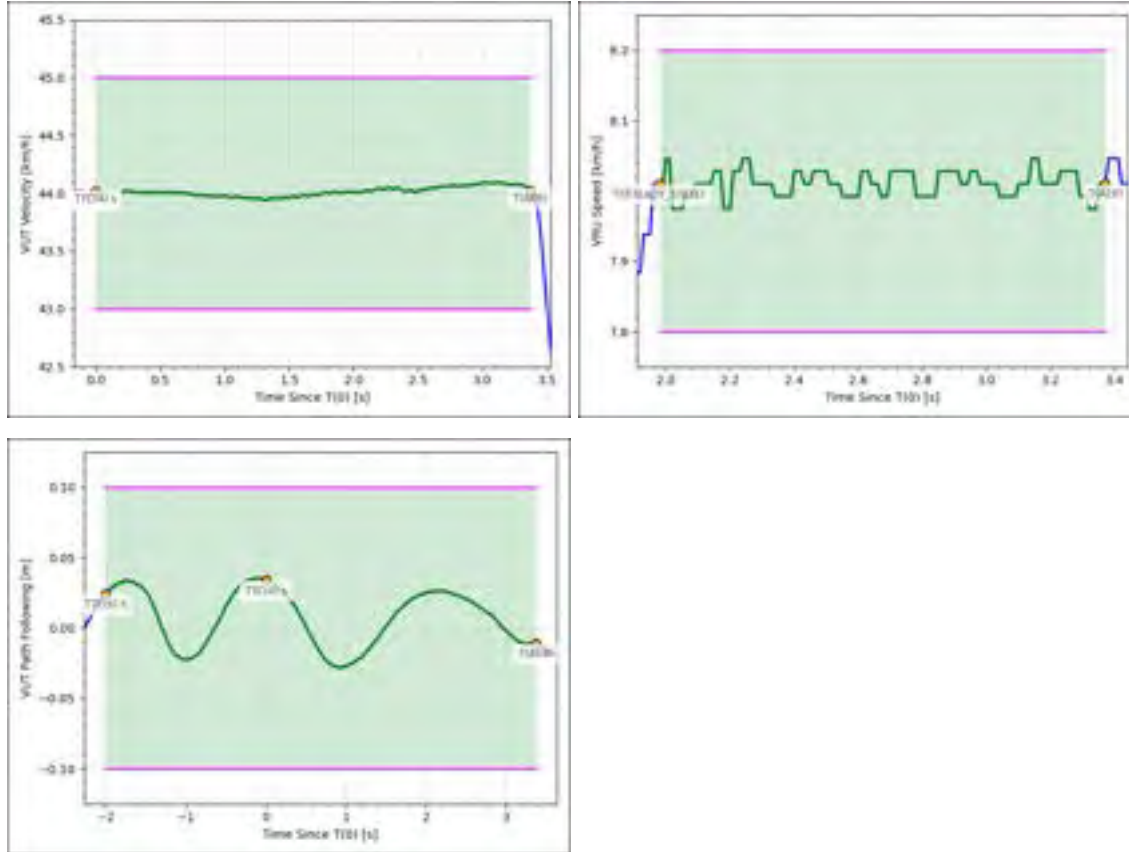
Run Date / Time 16-Feb-2023 10:47



J.1.1.5. CPFA-50 VUT 45kph EPT 8kph (Day)

CPFA-50 8 kph (Day) | 45 km/h | Run 1

Run Date / Time 16-Feb-2023 10:55

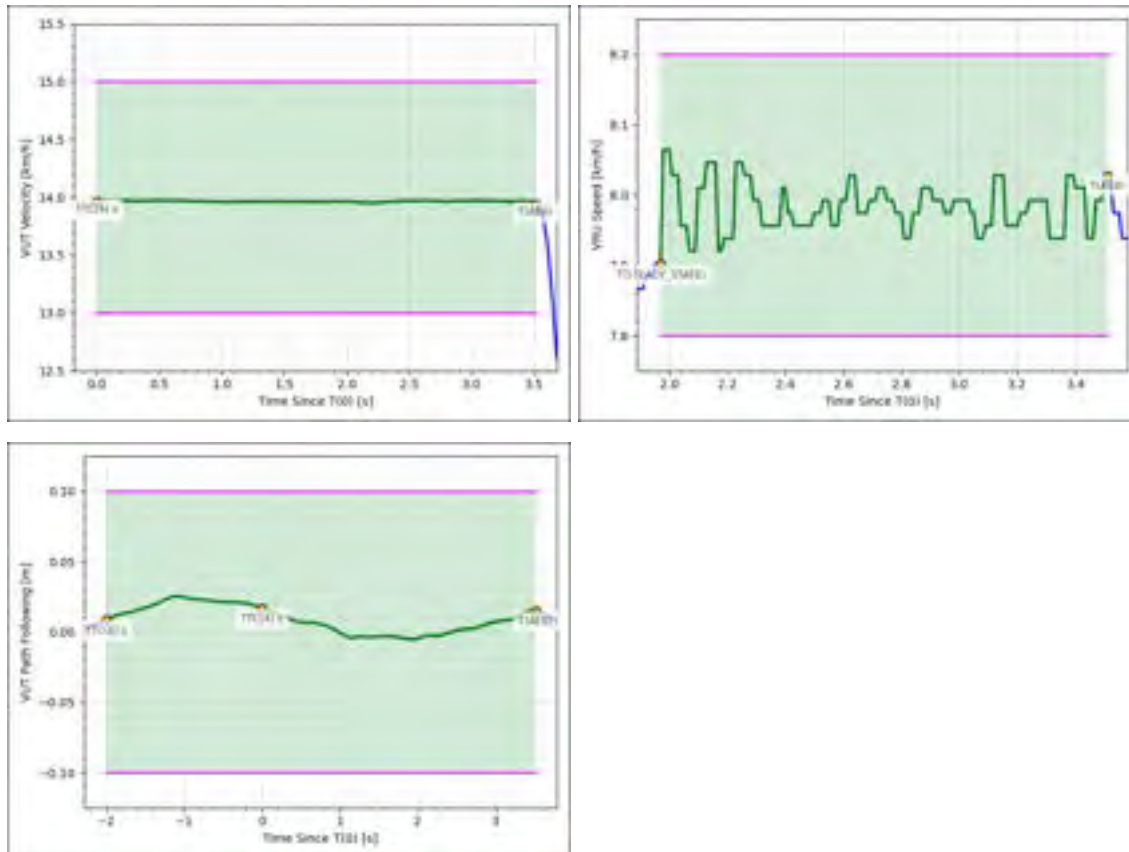


J.1.1. Rear Pitch

J.1.1.1. CPFA-50 VUT 15kph EPT 8kph (Day)

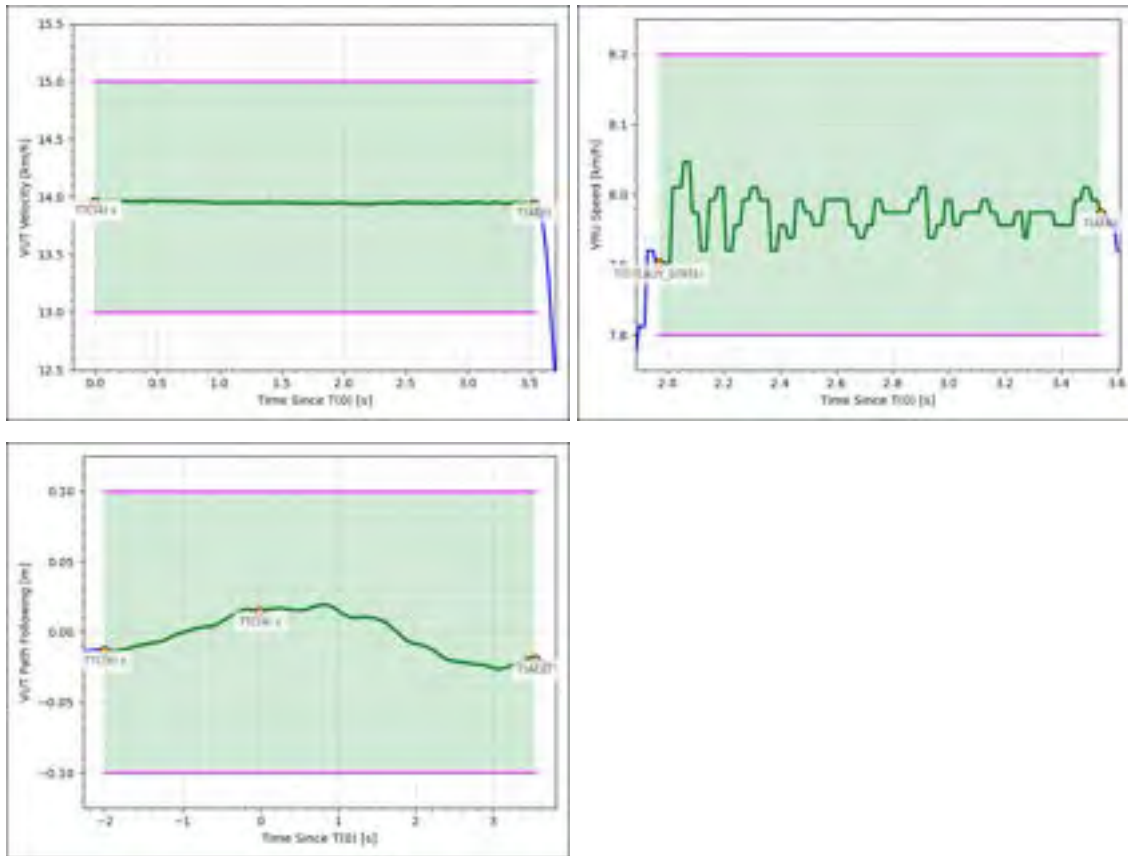
CPFA-50 8 kph (Day) | 15 km/h | Run 9

Run Date / Time 27-Feb-2023 10:55



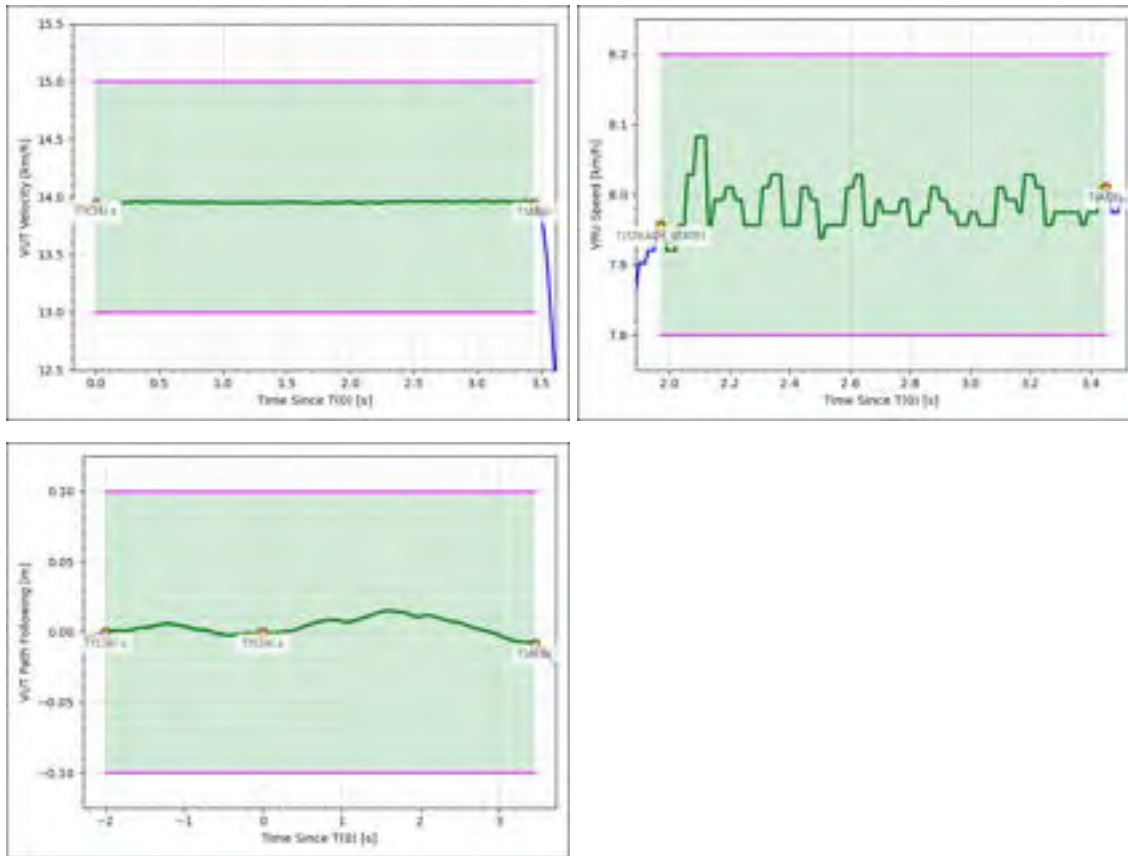
CPFA-50 8 kph (Day) | 15 km/h | Run 10

Run Date / Time 27-Feb-2023 11:01



CPFA-50 8 kph (Day) | 15 km/h | Run 11

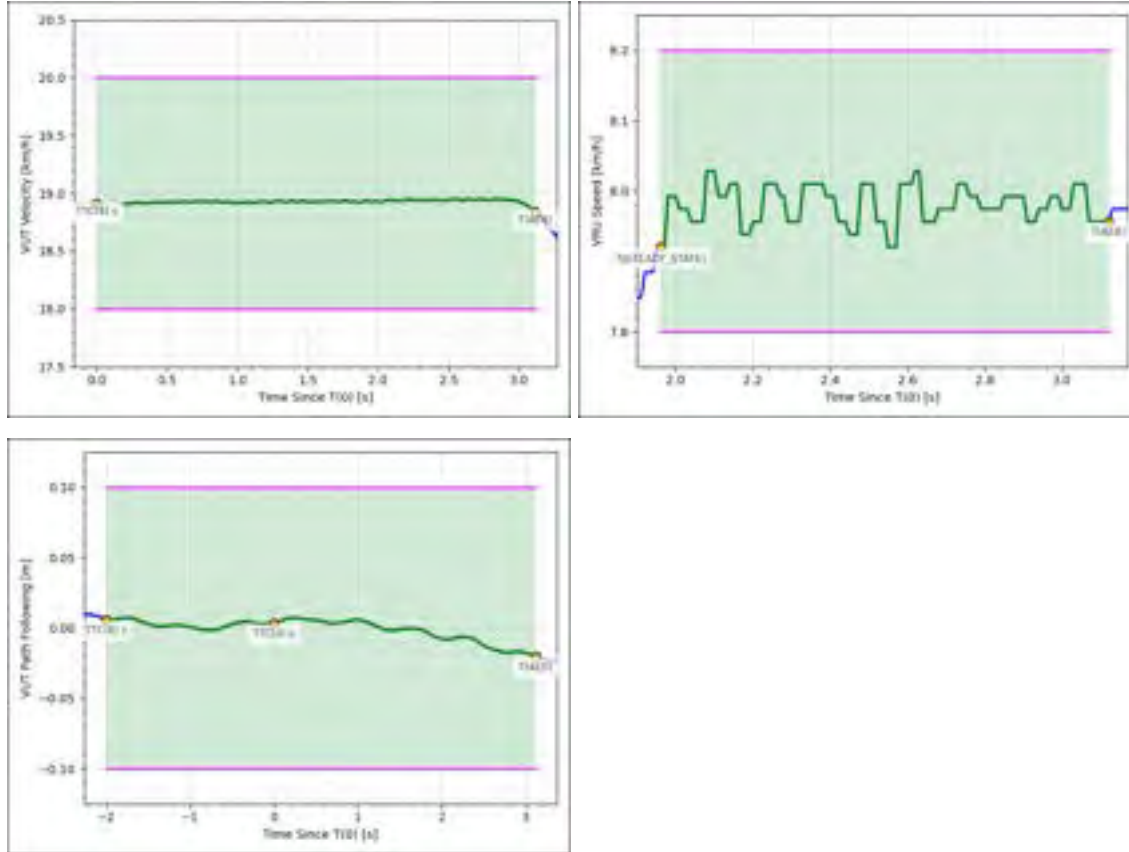
Run Date / Time 27-Feb-2023 11:04



J.1.1.2. CPFA-50 VUT 20kph EPT 8kph (Day)

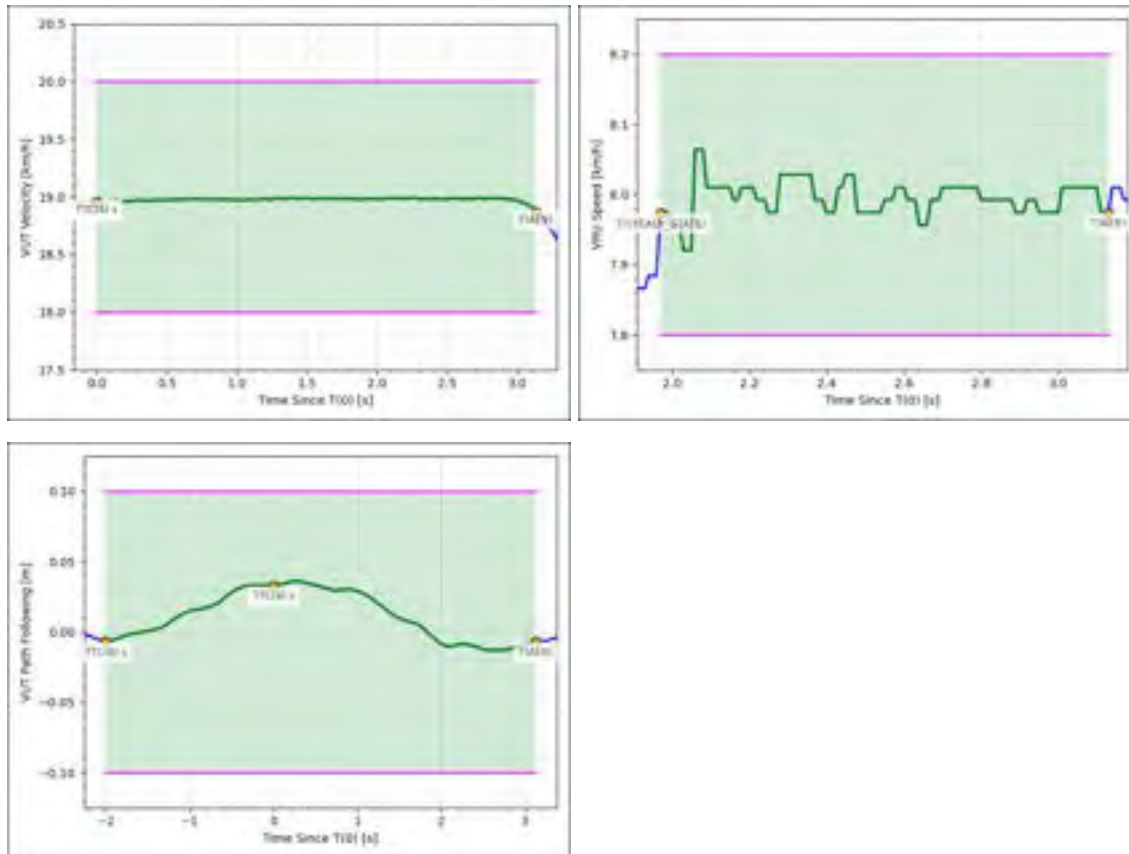
CPFA-50 8 kph (Day) | 20 km/h | Run 5

Run Date / Time 27-Feb-2023 11:09



CPFA-50 8 kph (Day) | 20 km/h | Run 6

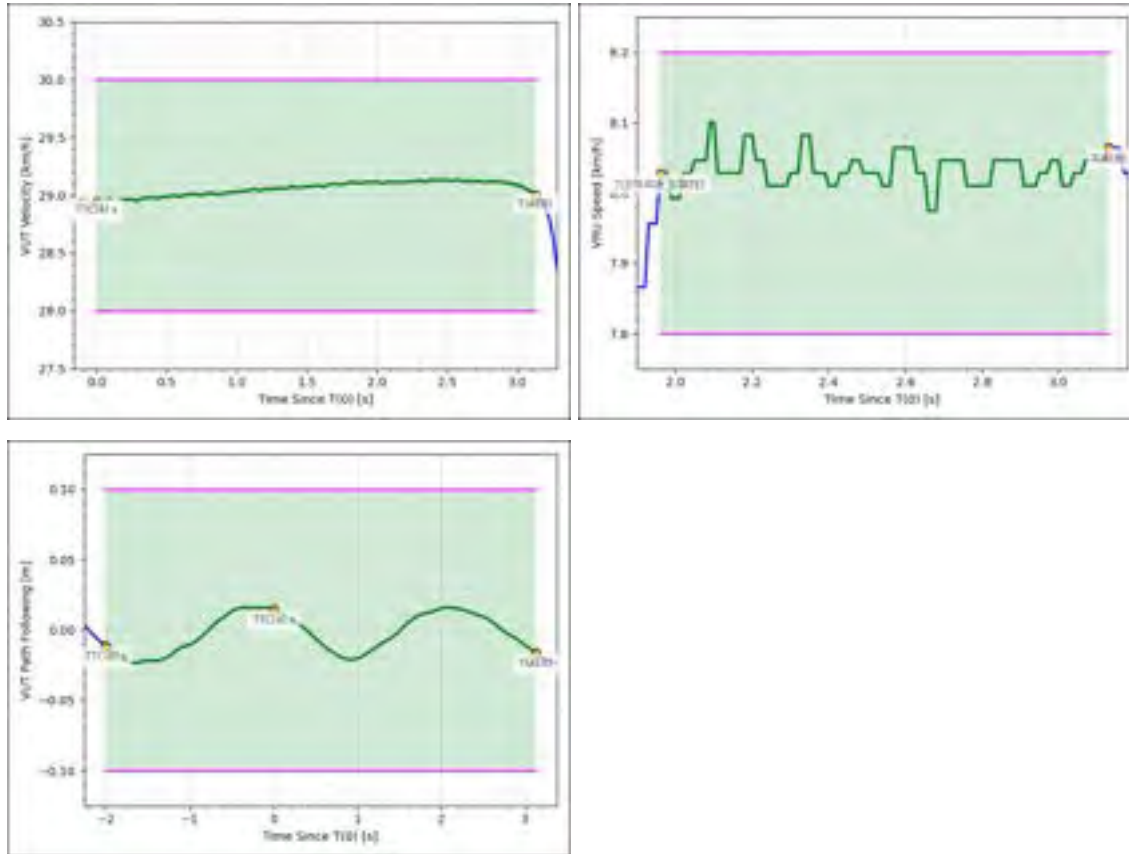
Run Date / Time 27-Feb-2023 11:12



J.1.1.3. CPFA-50 VUT 30kph EPT 8kph (Day)

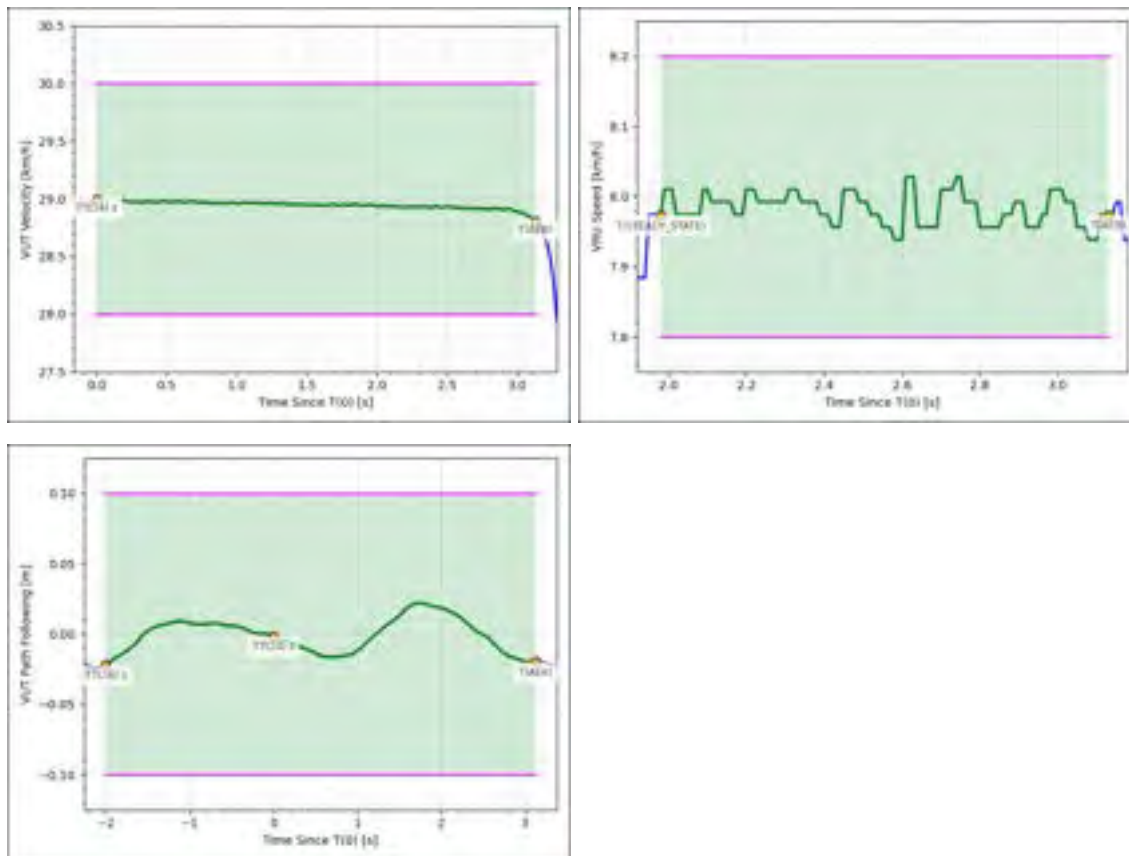
CPFA-50 8 kph (Day) | 30 km/h | Run 5

Run Date / Time 27-Feb-2023 11:29



CPFA-50 8 kph (Day) | 30 km/h | Run 6

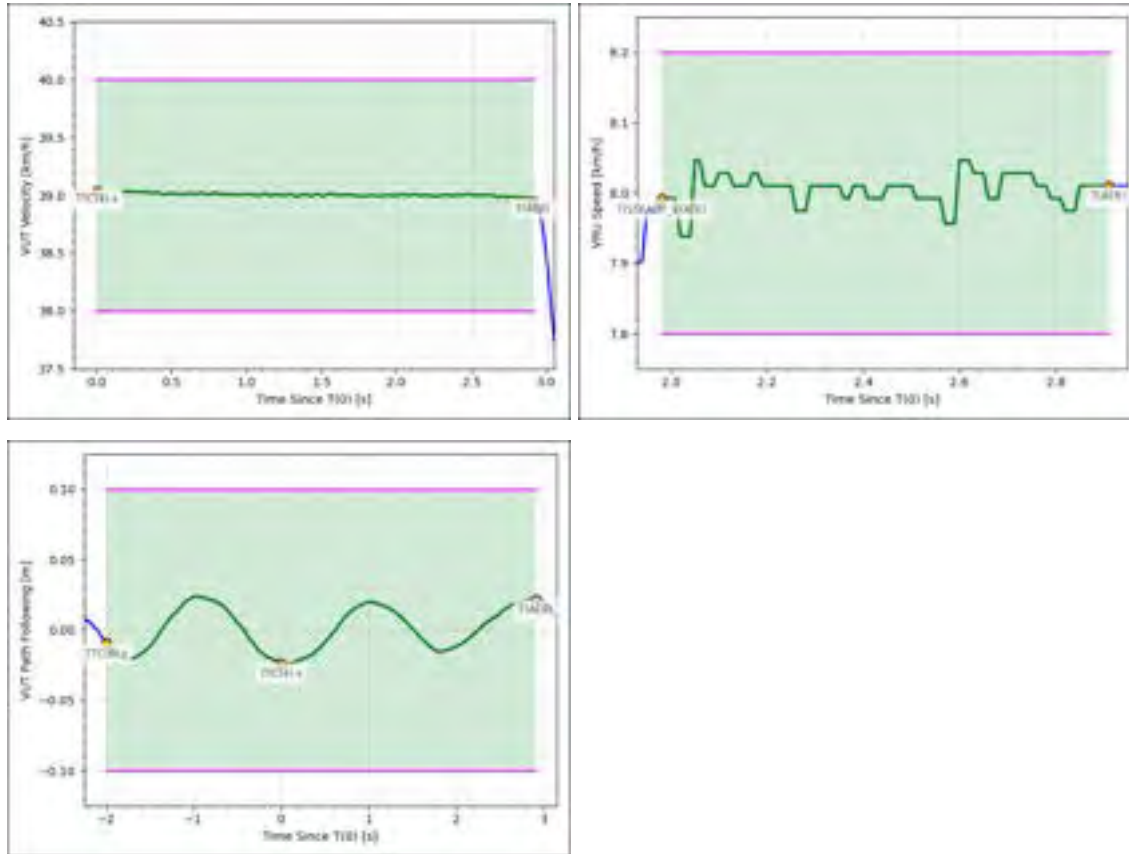
Run Date / Time 27-Feb-2023 11:33



J.1.1.4. CPFA-50 VUT 40kph EPT 8kph (Day)

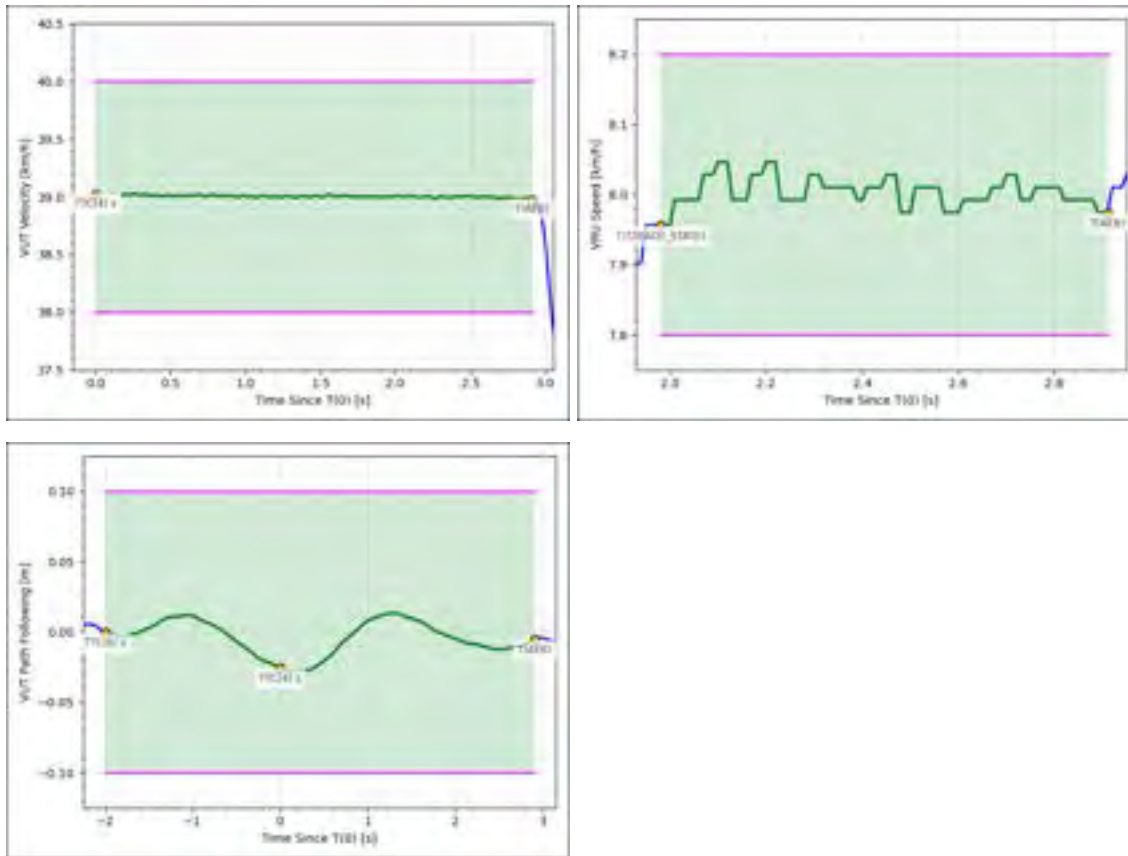
CPFA-50 8 kph (Day) | 40 km/h | Run 15

Run Date / Time 27-Feb-2023 11:36



CPFA-50 8 kph (Day) | 40 km/h | Run 16

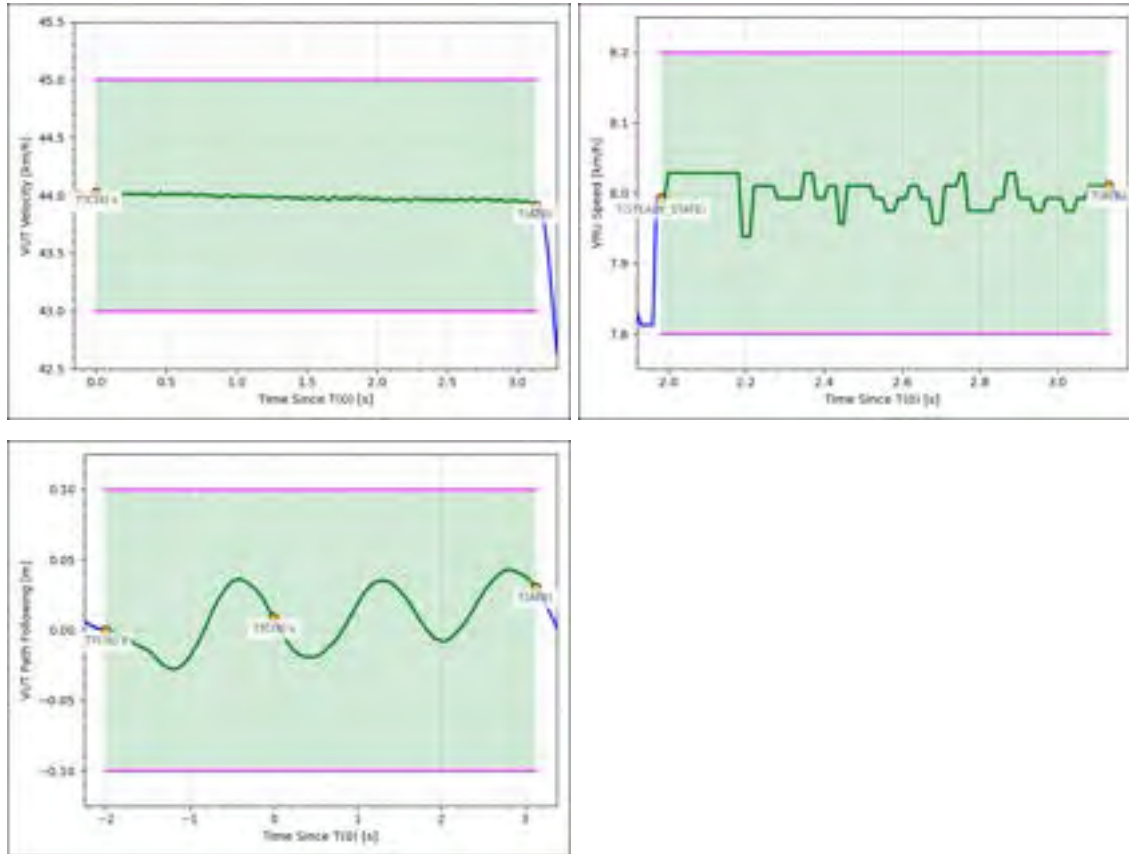
Run Date / Time 27-Feb-2023 11:40



J.1.1.5. CPFA-50 VUT 45kph EPT 8kph (Day)

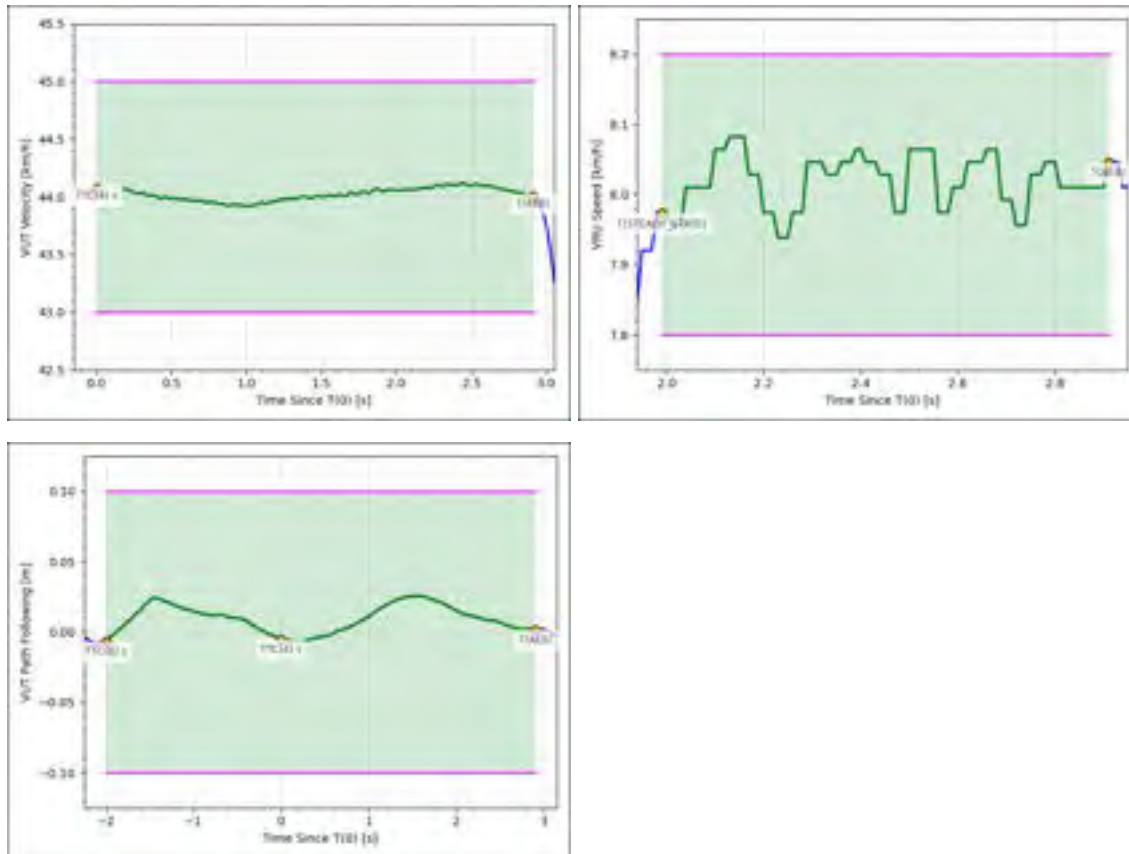
CPFA-50 8 kph (Day) | 45 km/h | Run 3

Run Date / Time 27-Feb-2023 12:03



CPFA-50 8 kph (Day) | 45 km/h | Run 4

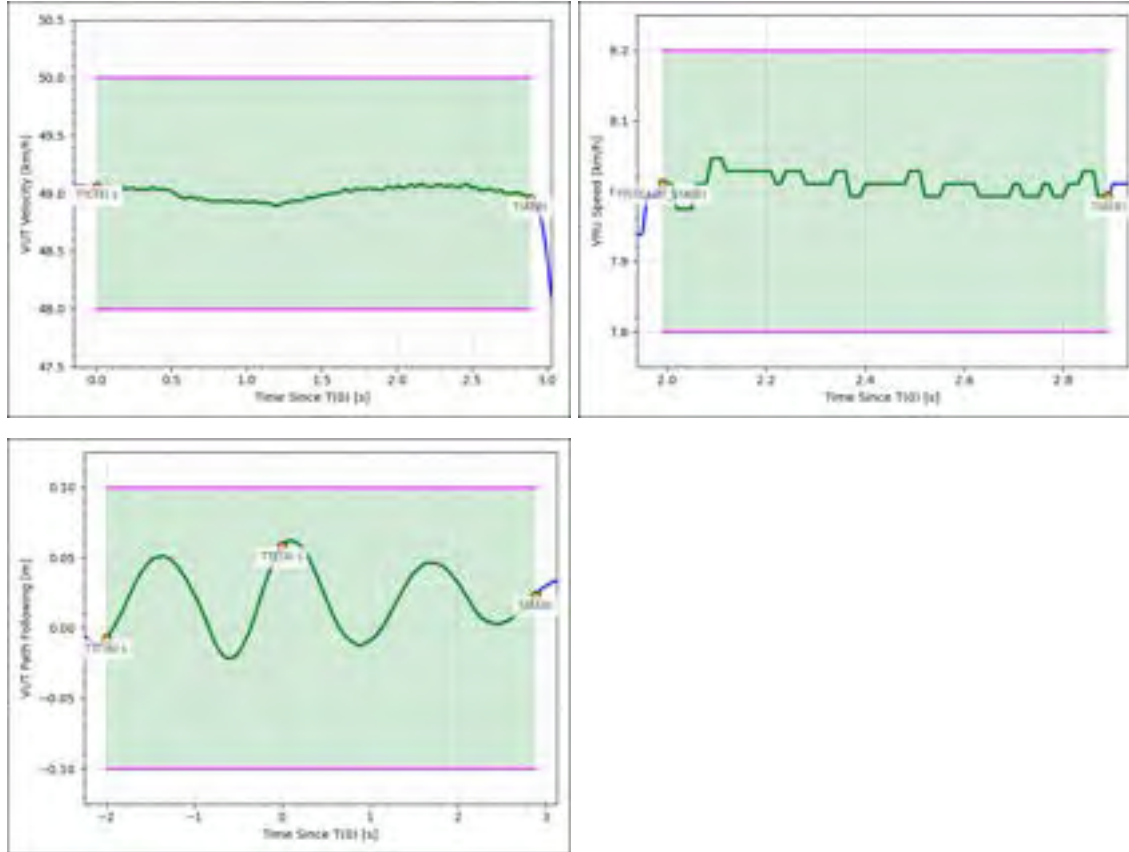
Run Date / Time 27-Feb-2023 12:07



J.1.1.6. CPFA-50 VUT 50kph EPT 8kph (Day)

CPFA-50 8 kph (Day) | 50 km/h | Run 4

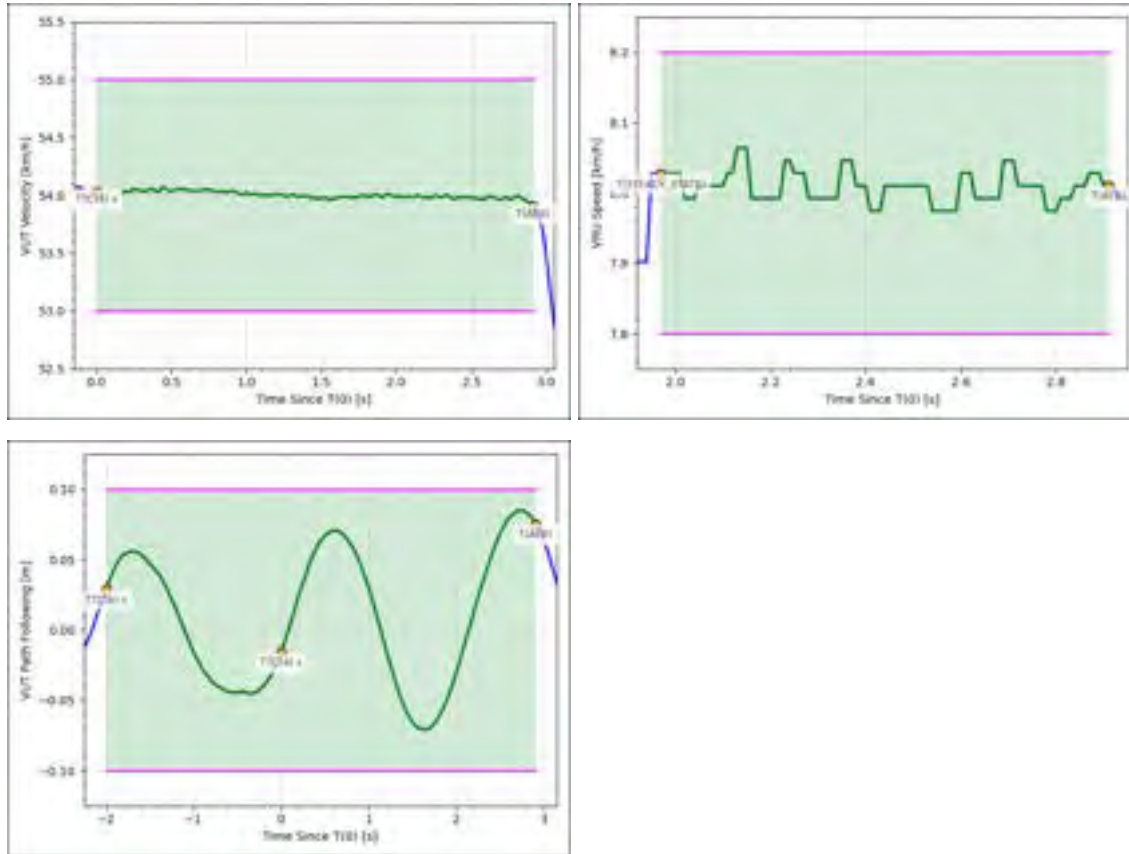
Run Date / Time 27-Feb-2023 12:12



J.1.1.7. CPFA-50 VUT 55kph EPT 8kph (Day)

CPFA-50 8 kph (Day) | 55 km/h | Run 2

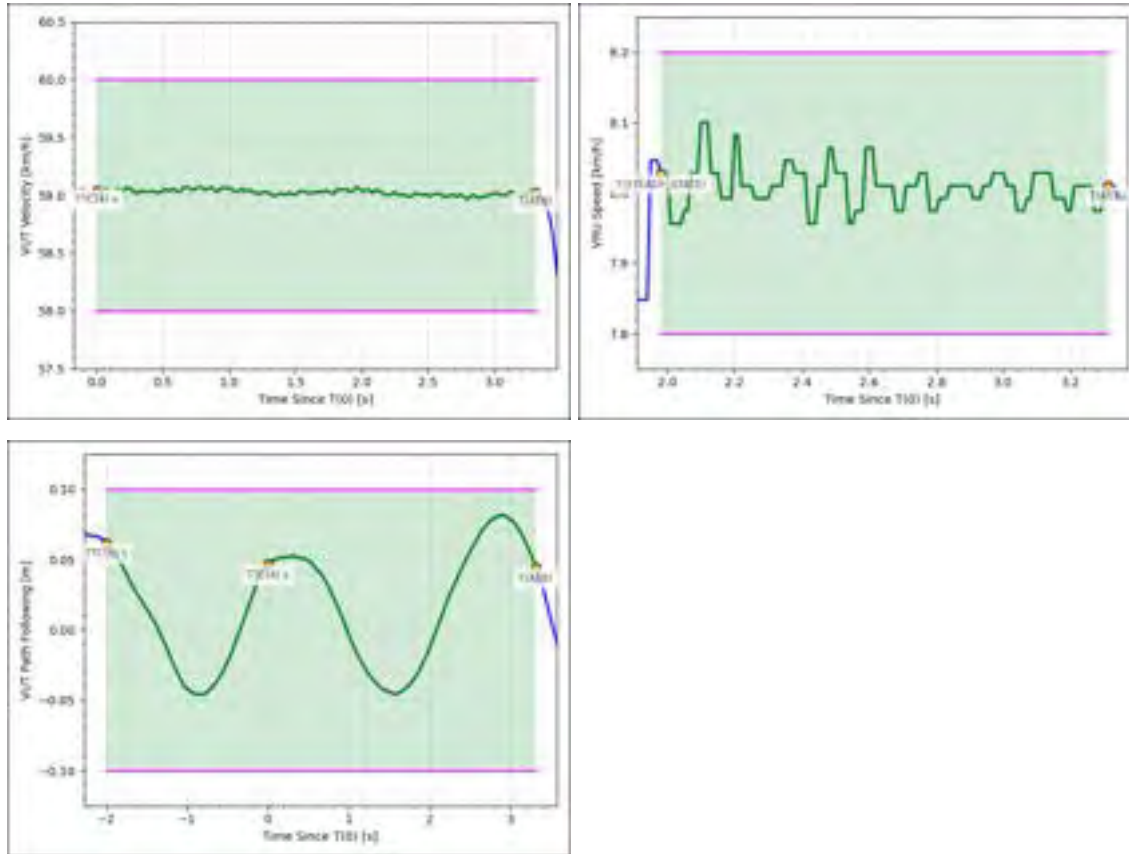
Run Date / Time 27-Feb-2023 12:53



J.1.1.8. CPFA-50 VUT 60kph EPT 8kph (Day)

CPFA-50 8 kph (Day) | 60 km/h | Run 6

Run Date / Time 27-Feb-2023 12:59

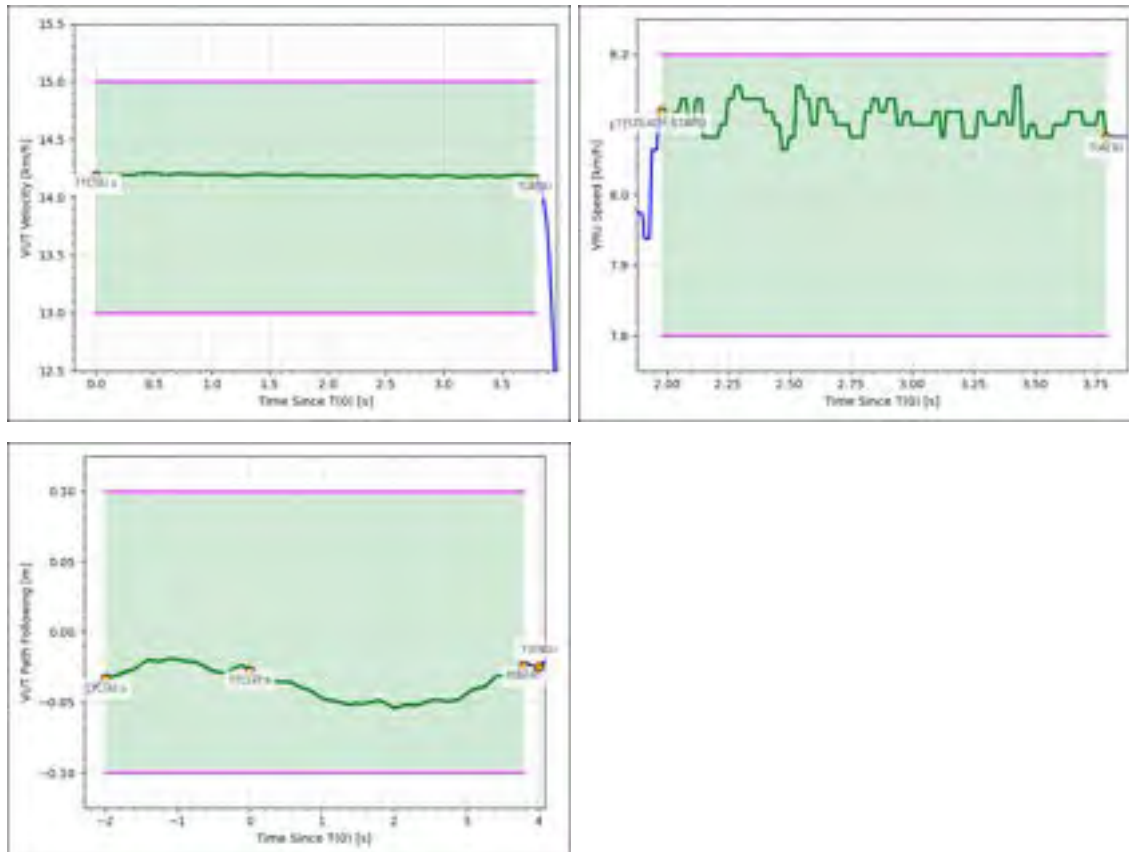


J.1.1. Lift Kit

J.1.1.1. CPFA-50 VUT 15kph EPT 8kph (Day)

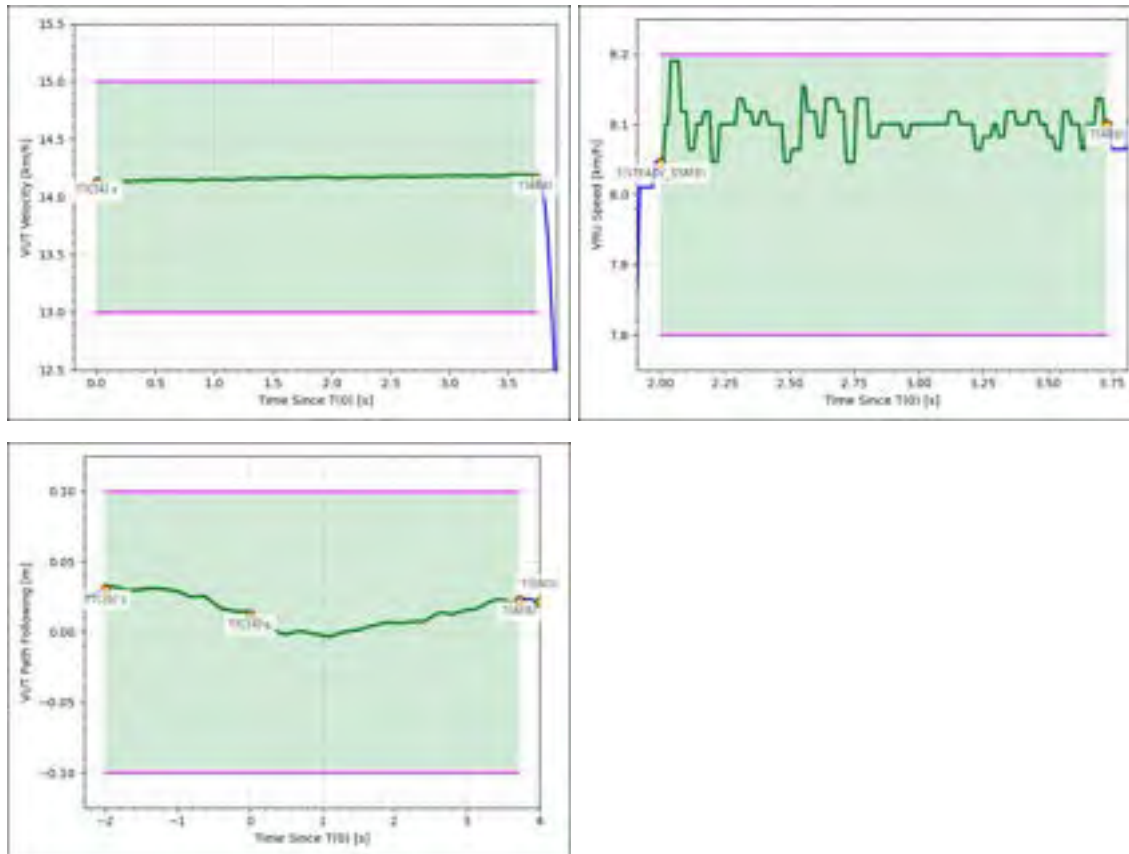
CPFA-50 8 kph (Day) | 15 km/h | Run 12

Run Date / Time 14-Mar-2023 11:45



CPFA-50 8 kph (Day) | 15 km/h | Run 13

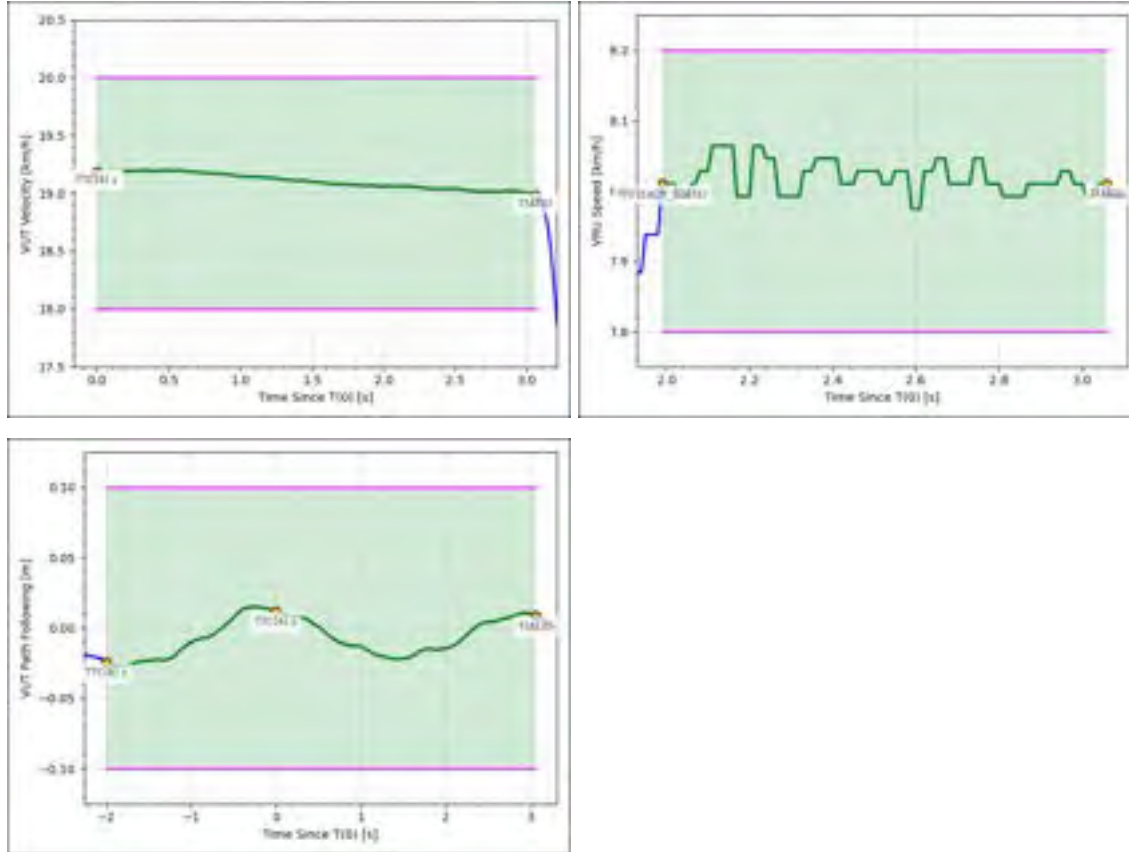
Run Date / Time 14-Mar-2023 11:52



J.1.1.2. CPFA-50 VUT 20kph EPT 8kph (Day)

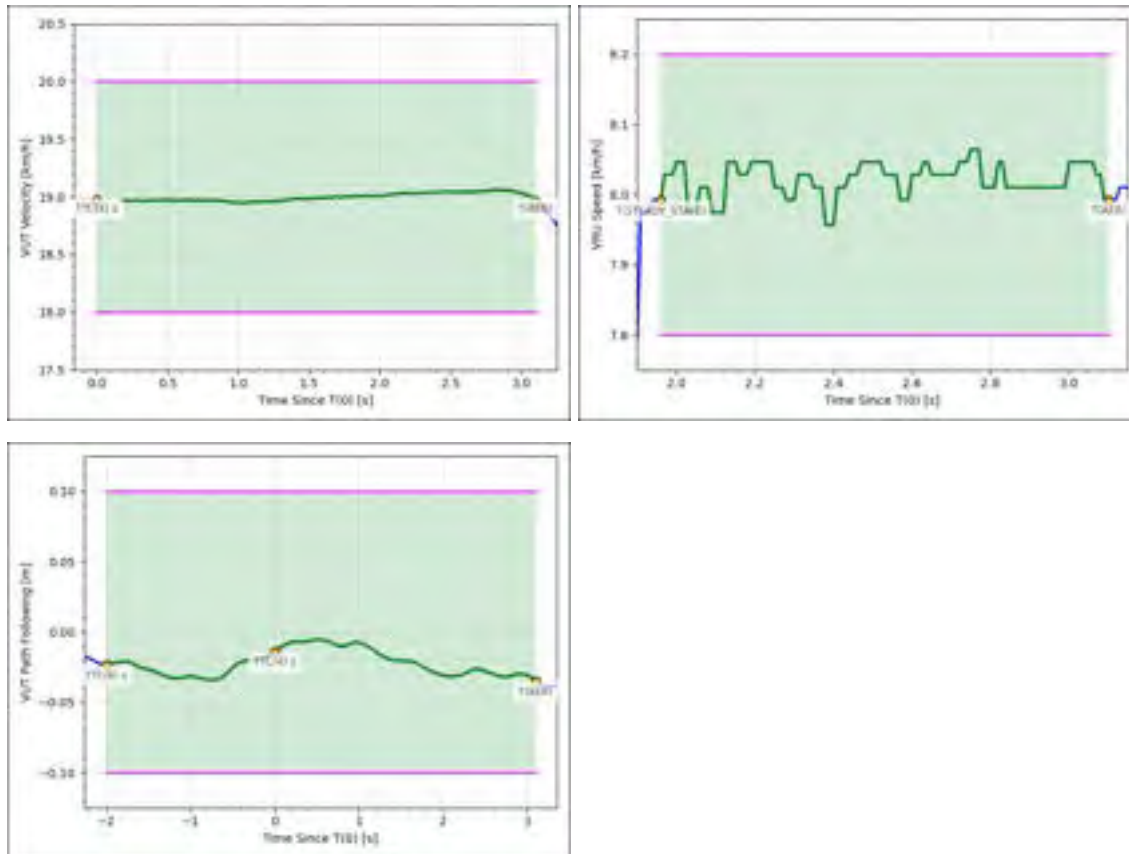
CPFA-50 8 kph (Day) | 20 km/h | Run 7

Run Date / Time 14-Mar-2023 11:38



CPFA-50 8 kph (Day) | 20 km/h | Run 8

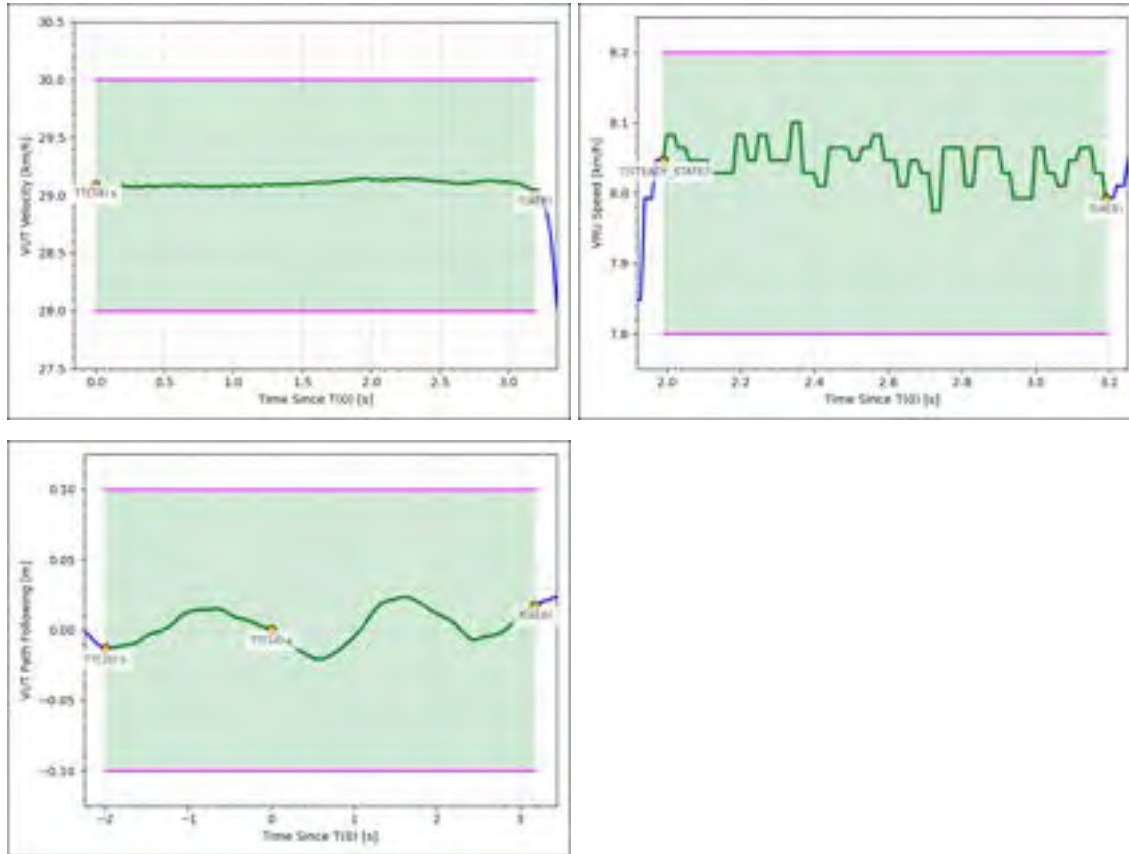
Run Date / Time 14-Mar-2023 11:41



J.1.1.3. CPFA-50 VUT 30kph EPT 8kph (Day)

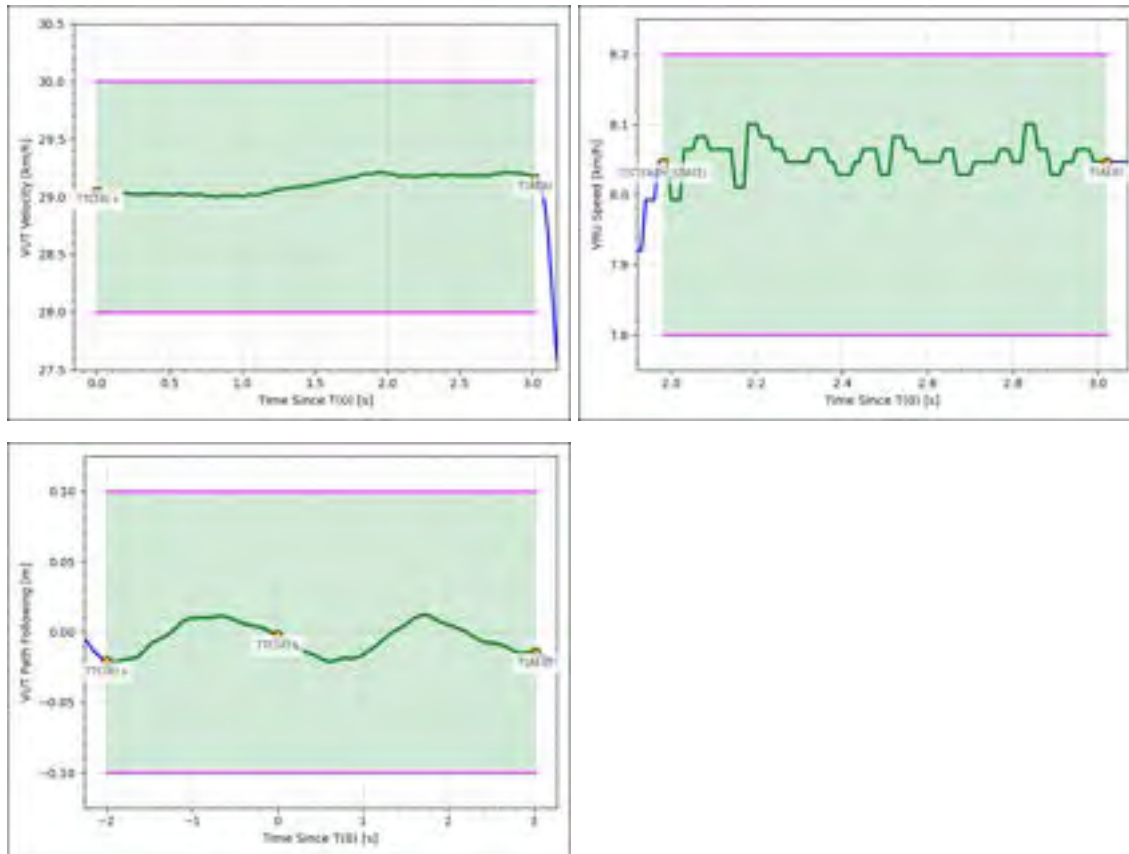
CPFA-50 8 kph (Day) | 30 km/h | Run 7

Run Date / Time 14-Mar-2023 11:58



CPFA-50 8 kph (Day) | 30 km/h | Run 8

Run Date / Time 14-Mar-2023 12:01

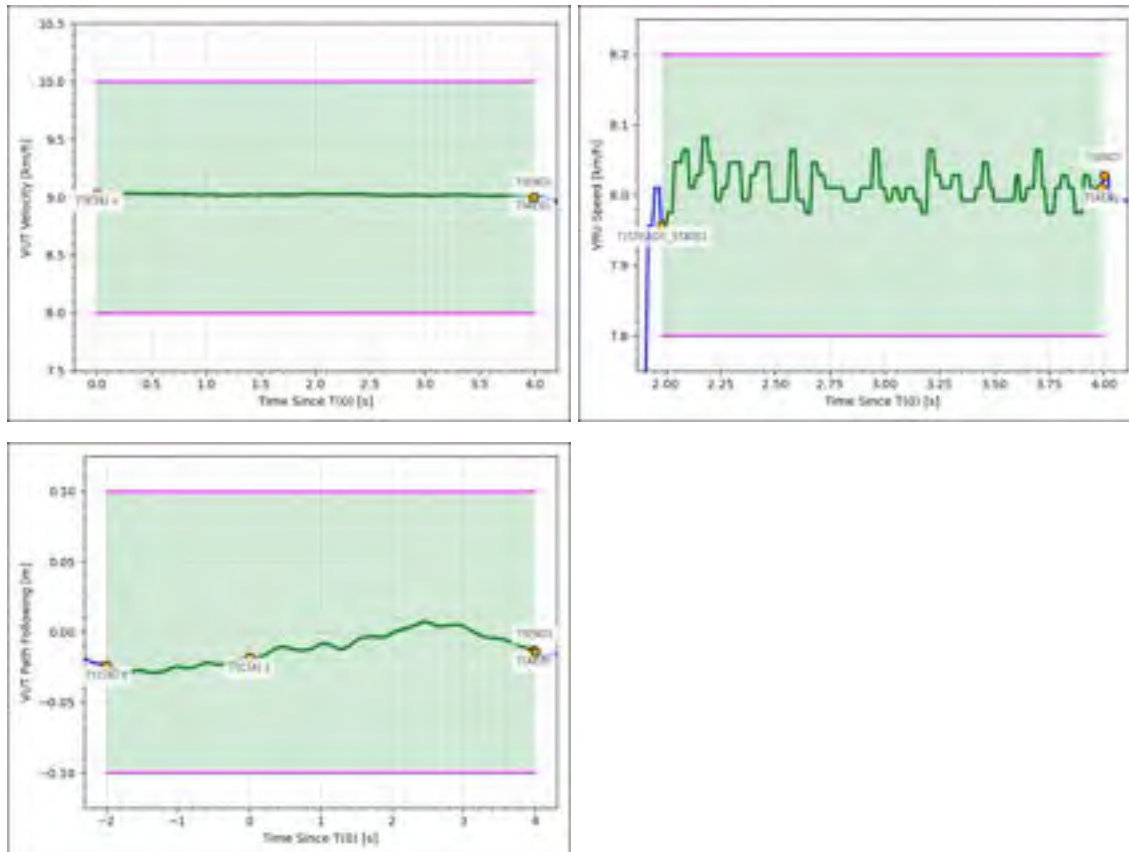


J.1.1. Lift Kit + Bullbar

J.1.1.1. CPFA-50 VUT 10kph EPT 8kph (Day)

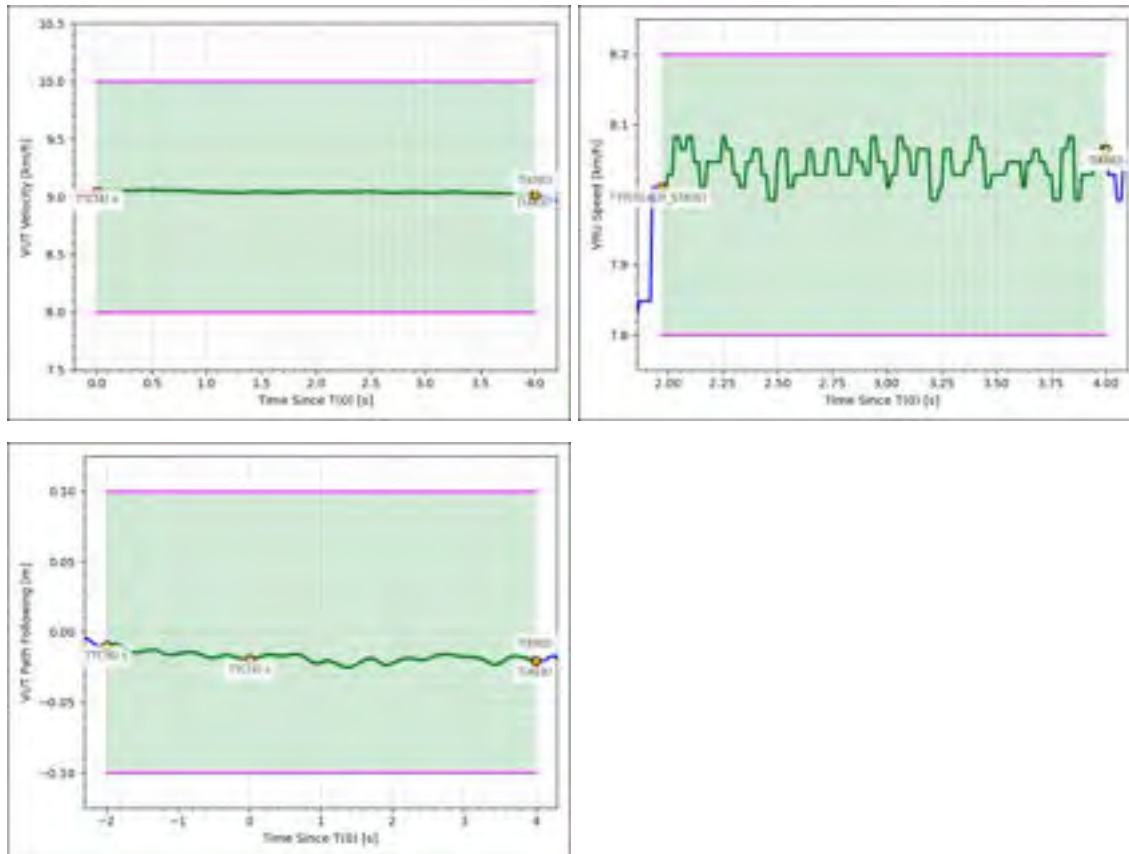
CPFA-50 8 kph (Day) | 10 km/h | Run 1

Run Date / Time 30-Mar-2023 10:45



CPFA-50 8 kph (Day) | 10 km/h | Run 2

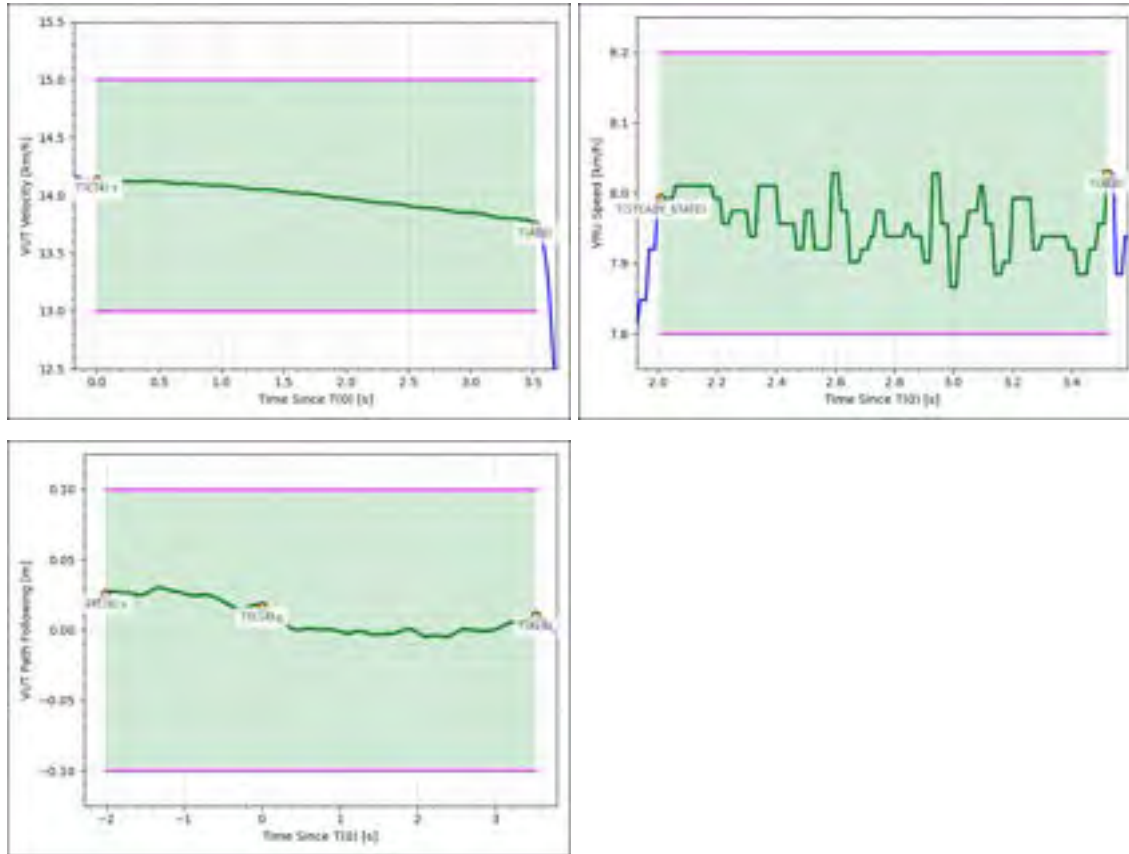
Run Date / Time 30-Mar-2023 10:50



J.1.1.2. CPFA-50 VUT 15kph EPT 8kph (Day)

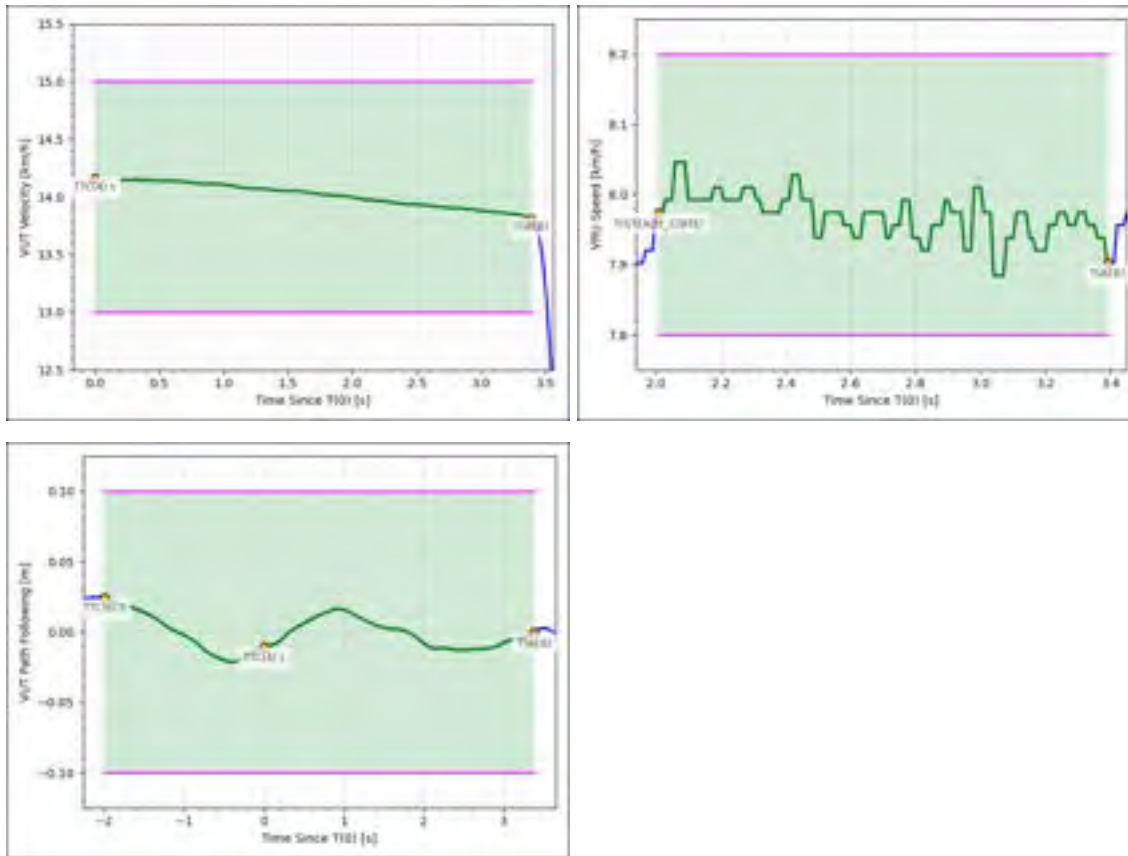
CPFA-50 8 kph (Day) | 15 km/h | Run 1

Run Date / Time 30-Mar-2023 10:25



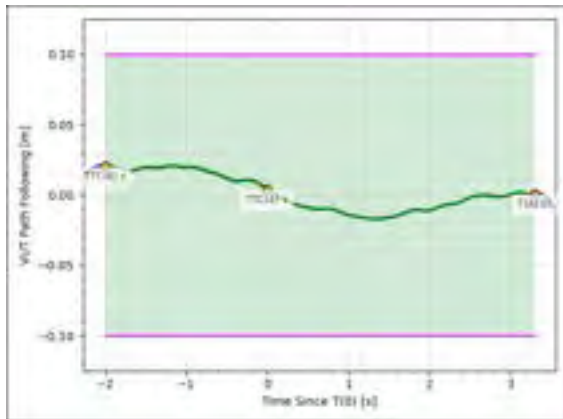
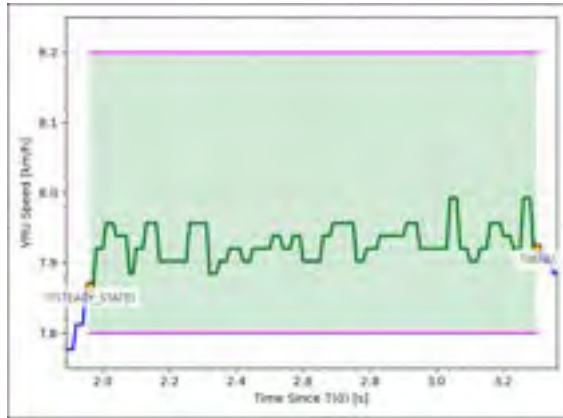
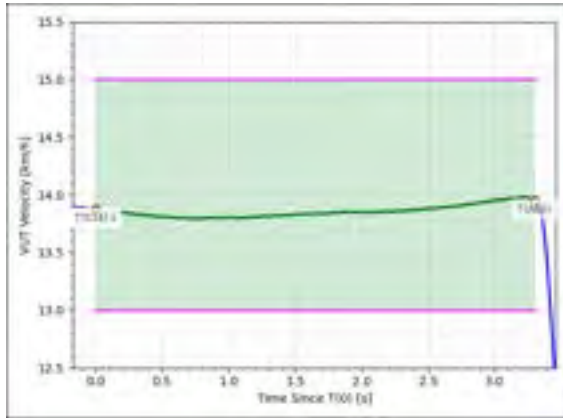
CPFA-50 8 kph (Day) | 15 km/h | Run 2

Run Date / Time 30-Mar-2023 10:29



CPFA-50 8 kph (Day) | 15 km/h | Run 3

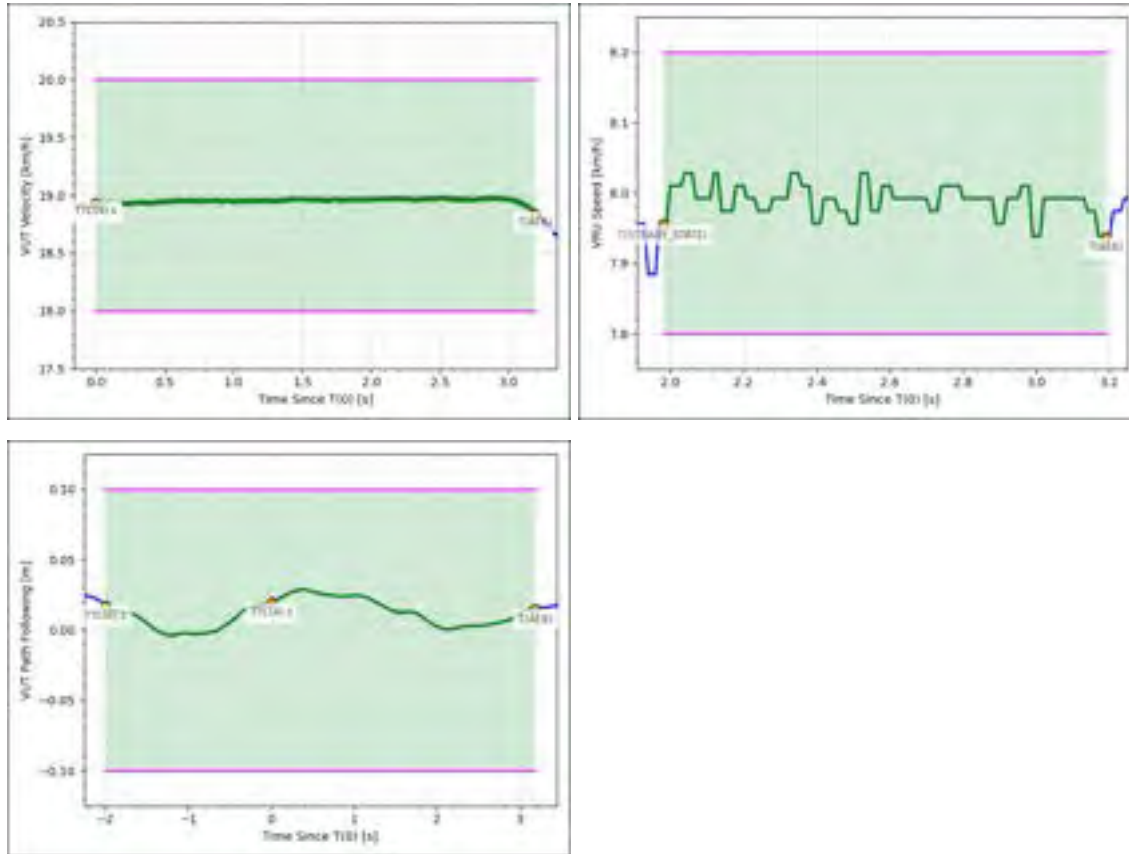
Run Date / Time 30-Mar-2023 10:33



J.1.1.3. CPFA-50 VUT 20kph EPT 8kph (Day)

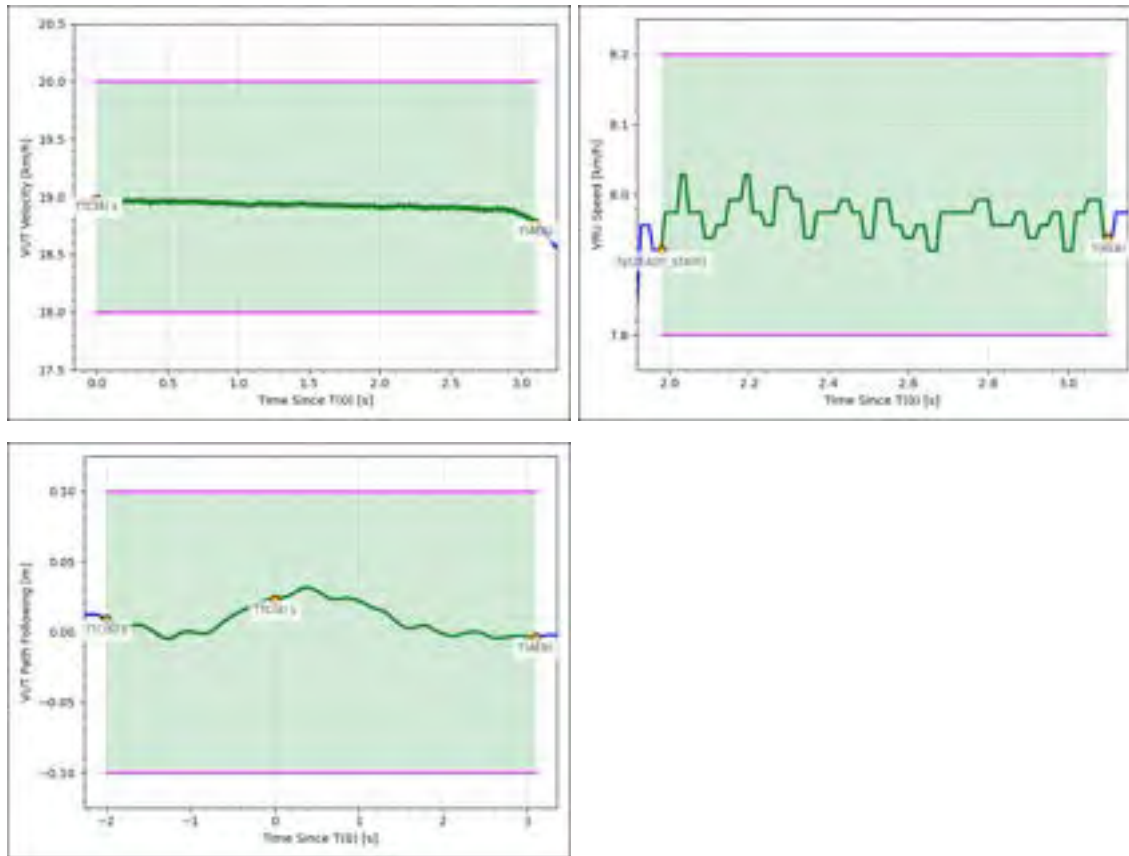
CPFA-50 8 kph (Day) | 20 km/h | Run 1

Run Date / Time 30-Mar-2023 10:16



CPFA-50 8 kph (Day) | 20 km/h | Run 2

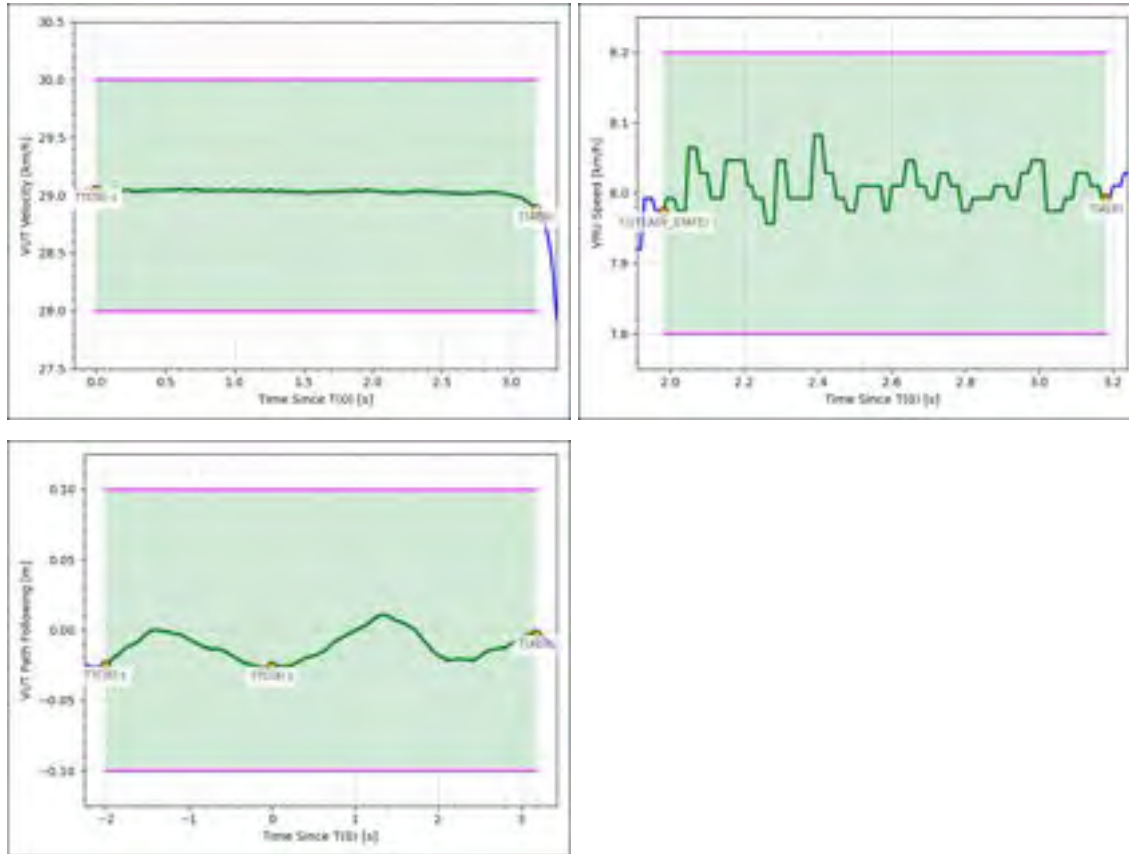
Run Date / Time 30-Mar-2023 10:21



J.1.1.4. CPFA-50 VUT 30kph EPT 8kph (Day)

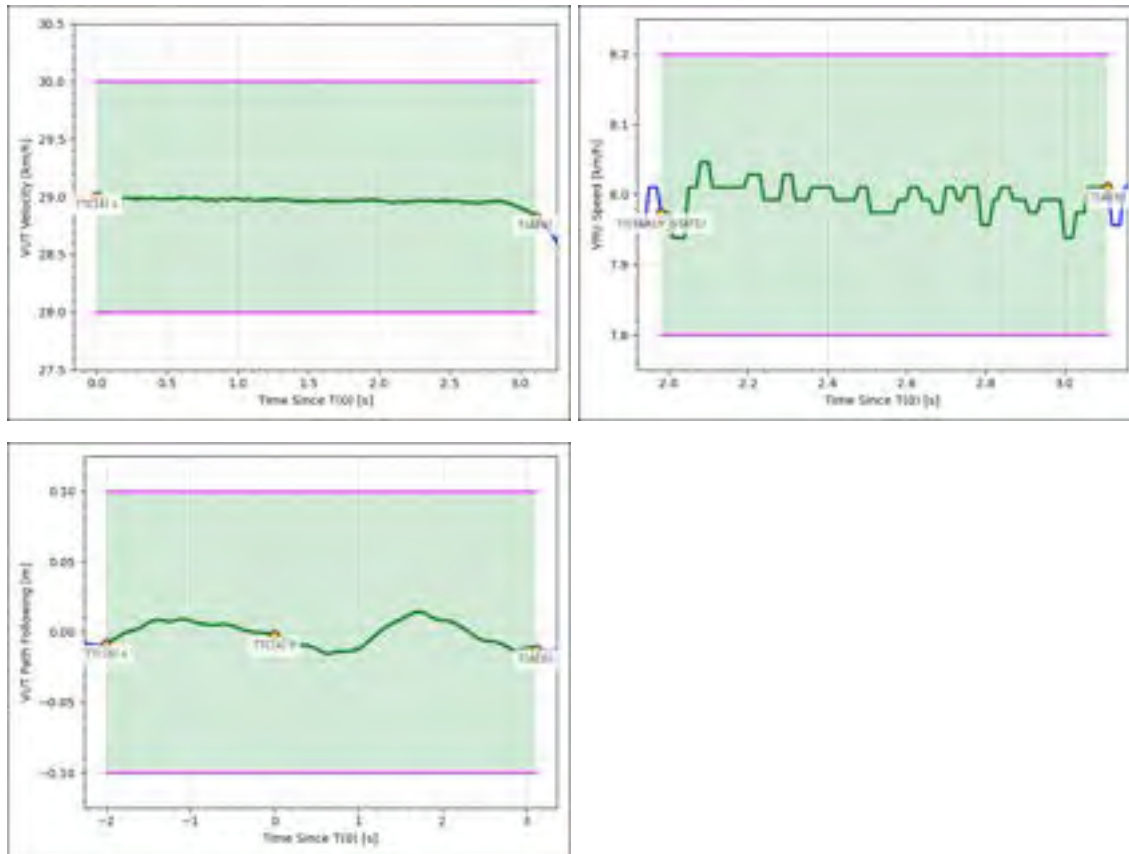
CPFA-50 8 kph (Day) | 30 km/h | Run 1

Run Date / Time 30-Mar-2023 10:36



CPFA-50 8 kph (Day) | 30 km/h | Run 2

Run Date / Time 30-Mar-2023 10:39

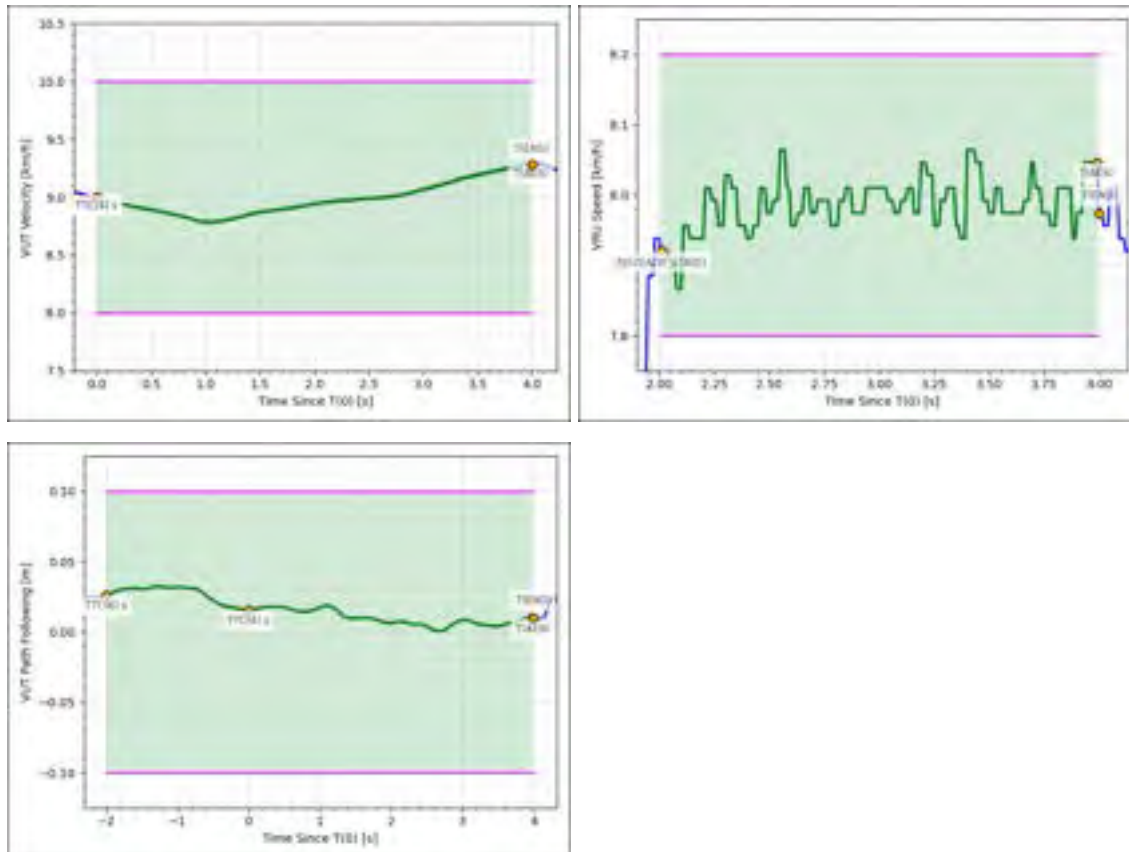


J.1.1. Bullbar

J.1.1.1. CPFA-50 VUT 10kph EPT 8kph (Day)

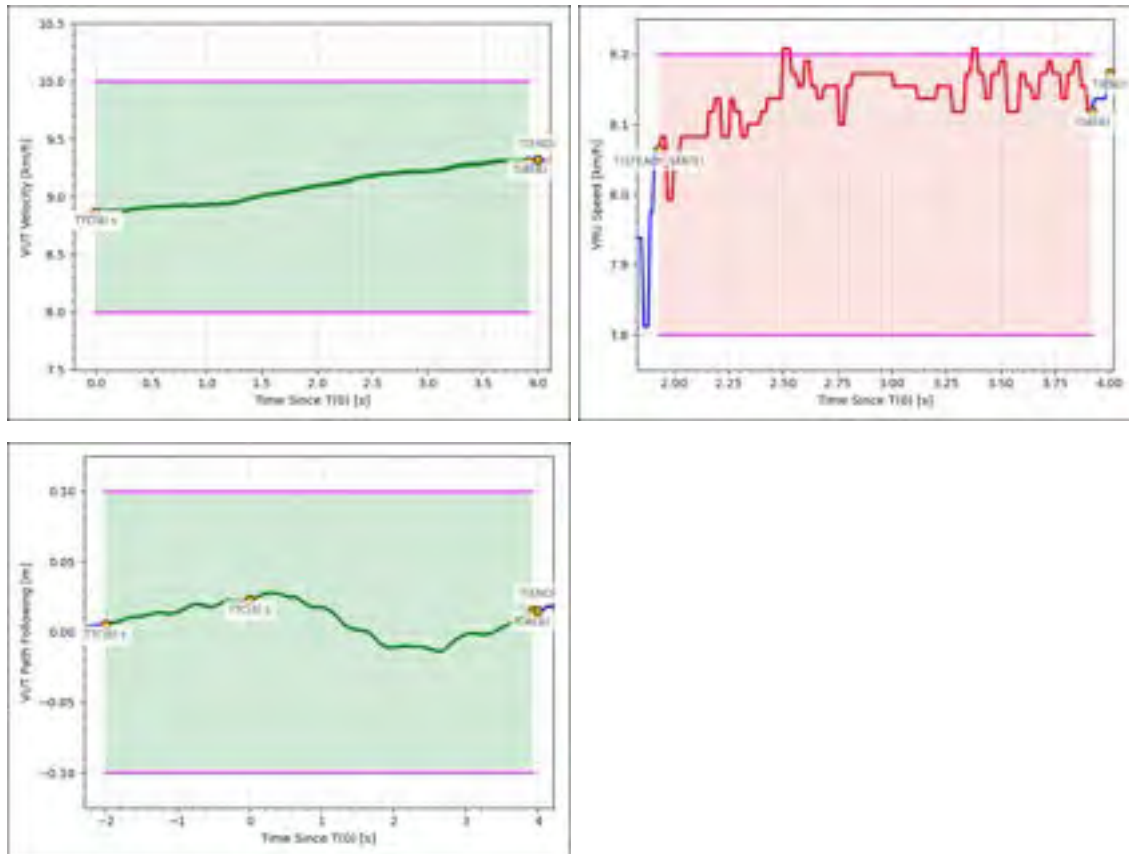
CPFA-50 8 kph (Day) | 10 km/h | Run 3

Run Date / Time 6-Apr-2023 09:48



CPFA-50 8 kph (Day) | 10 km/h | Run 4

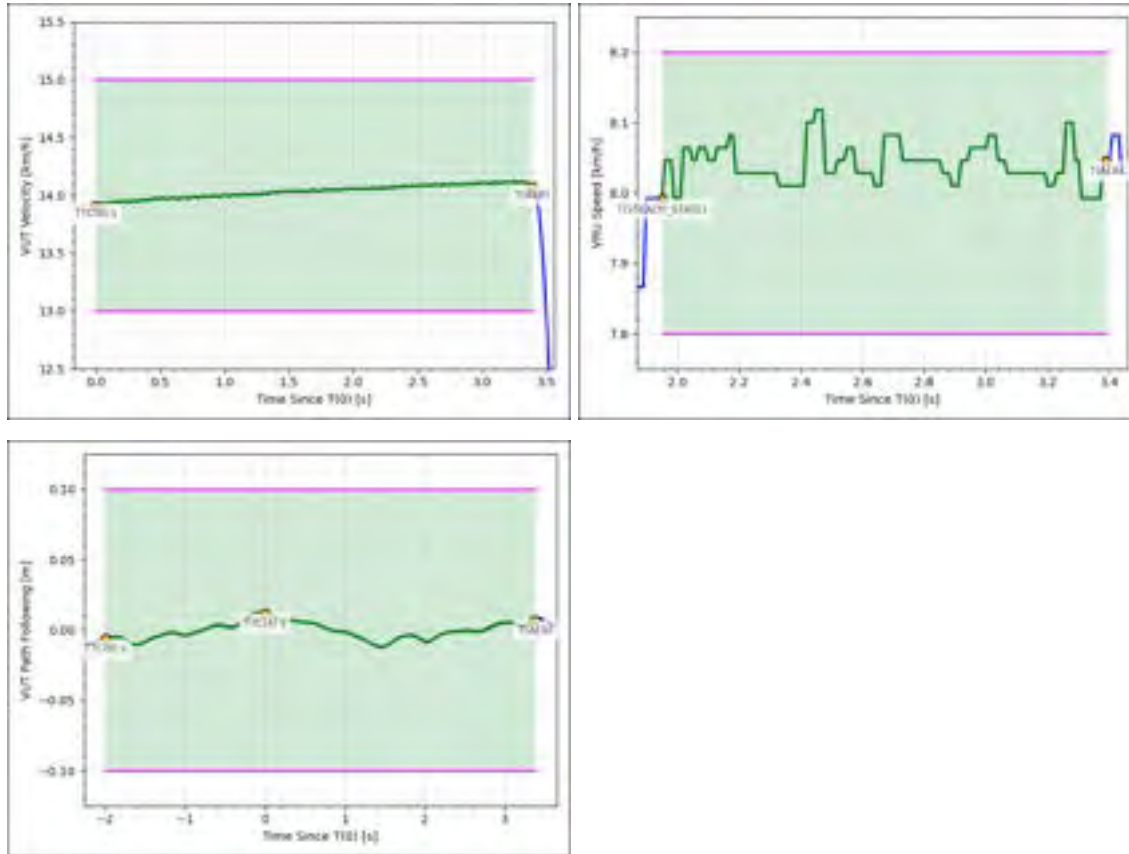
Run Date / Time 6-Apr-2023 09:58



J.1.1.2. CPFA-50 VUT 15kph EPT 8kph (Day)

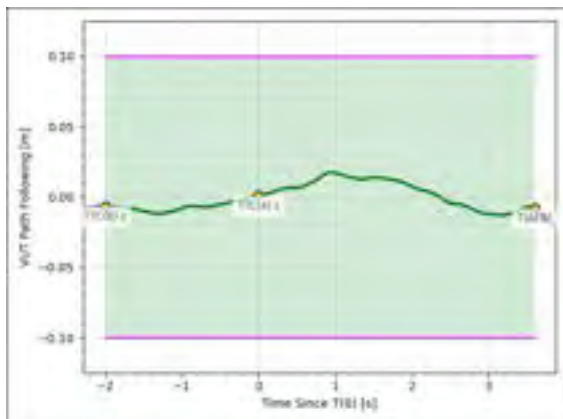
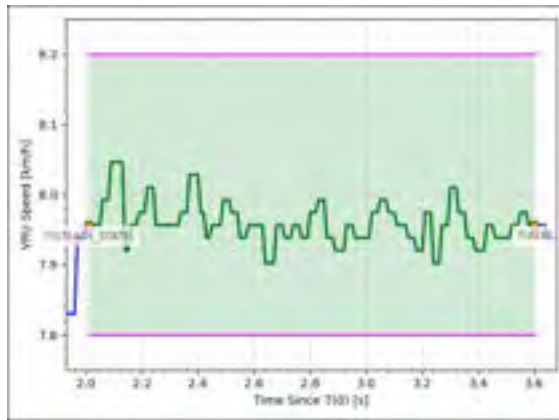
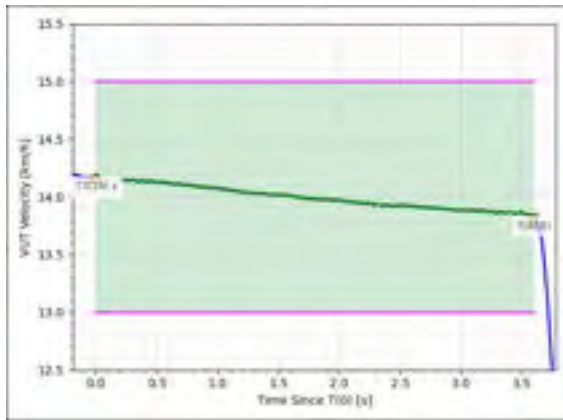
CPFA-50 8 kph (Day) | 15 km/h | Run 4

Run Date / Time 6-Apr-2023 09:35



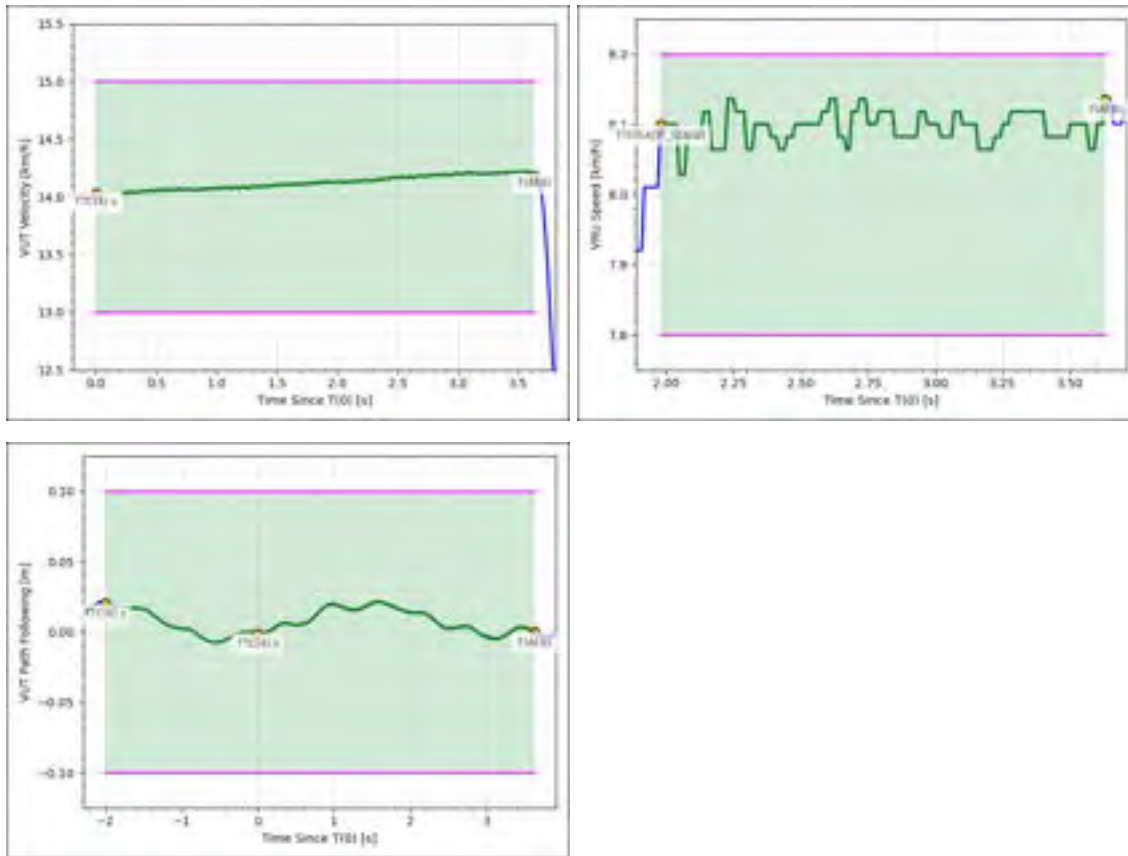
CPFA-50 8 kph (Day) | 15 km/h | Run 5

Run Date / Time 6-Apr-2023 09:38



CPFA-50 8 kph (Day) | 15 km/h | Run 6

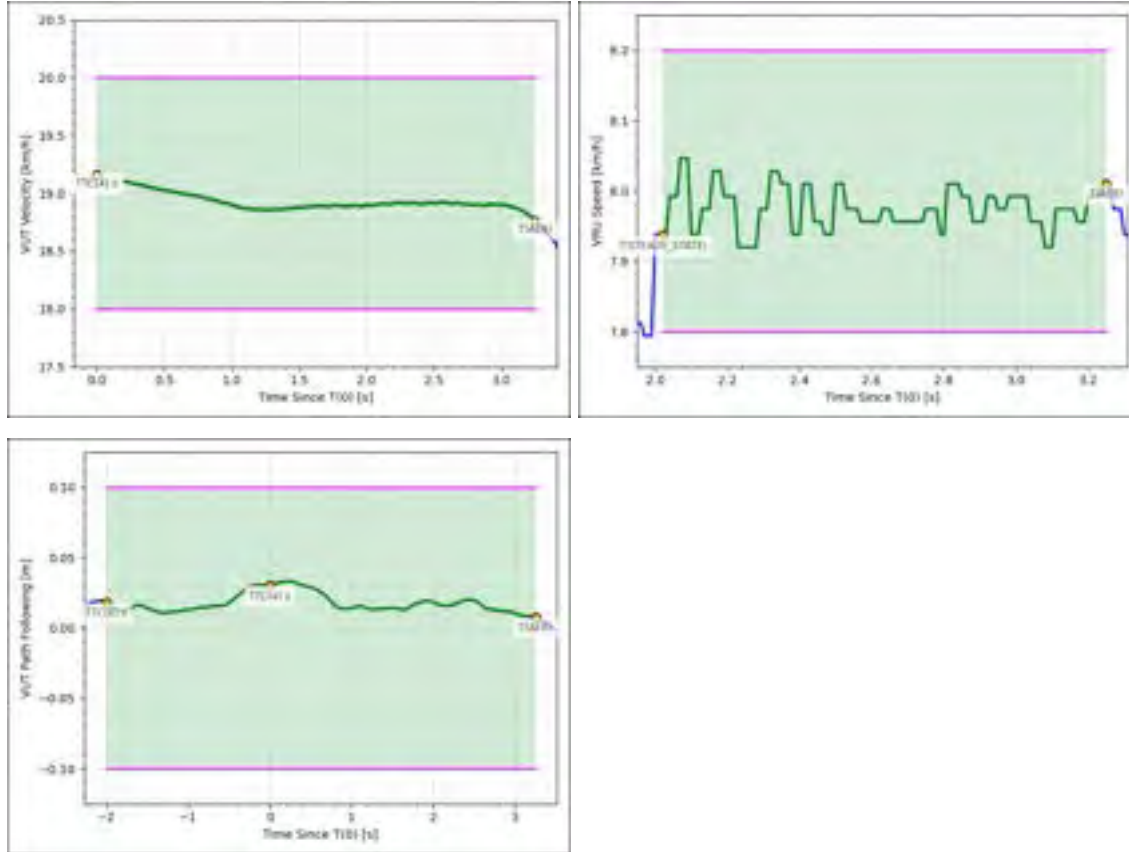
Run Date / Time 6-Apr-2023 09:44



J.1.1.3. CPFA-50 VUT 20kph EPT 8kph (Day)

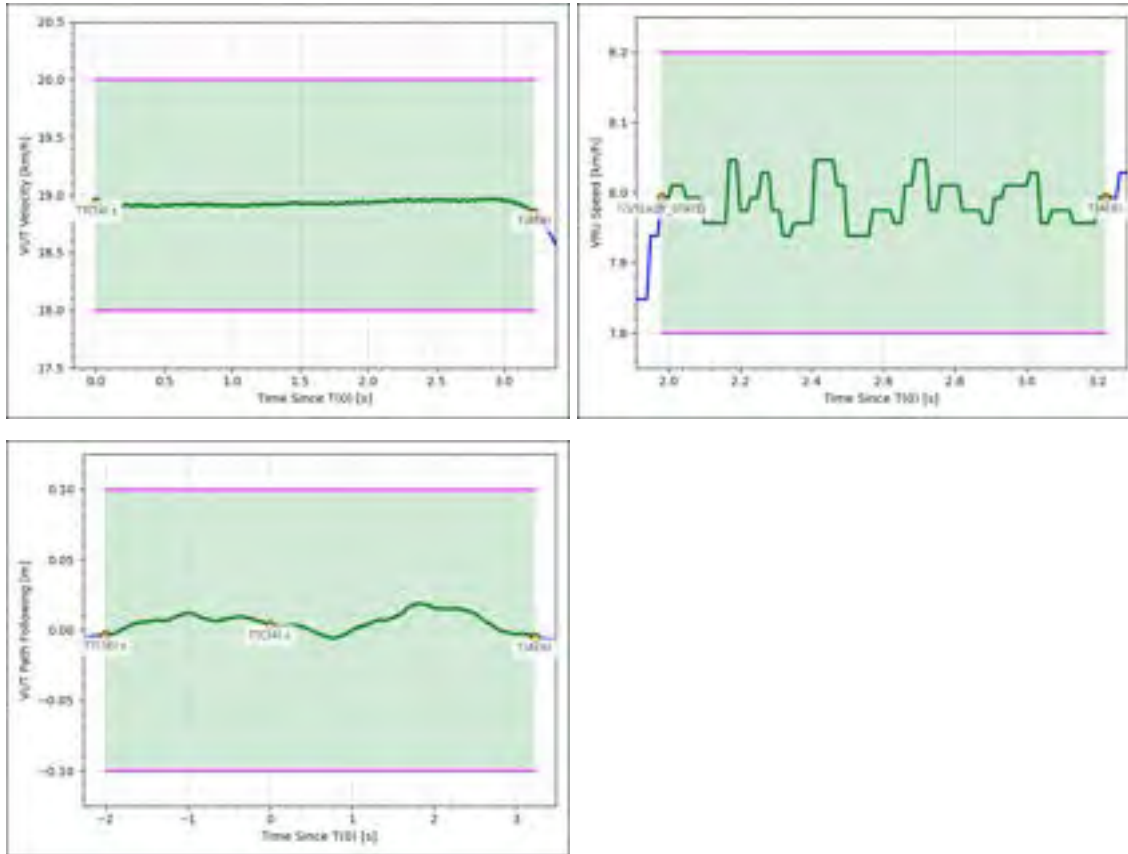
CPFA-50 8 kph (Day) | 20 km/h | Run 3

Run Date / Time 6-Apr-2023 09:26



CPFA-50 8 kph (Day) | 20 km/h | Run 4

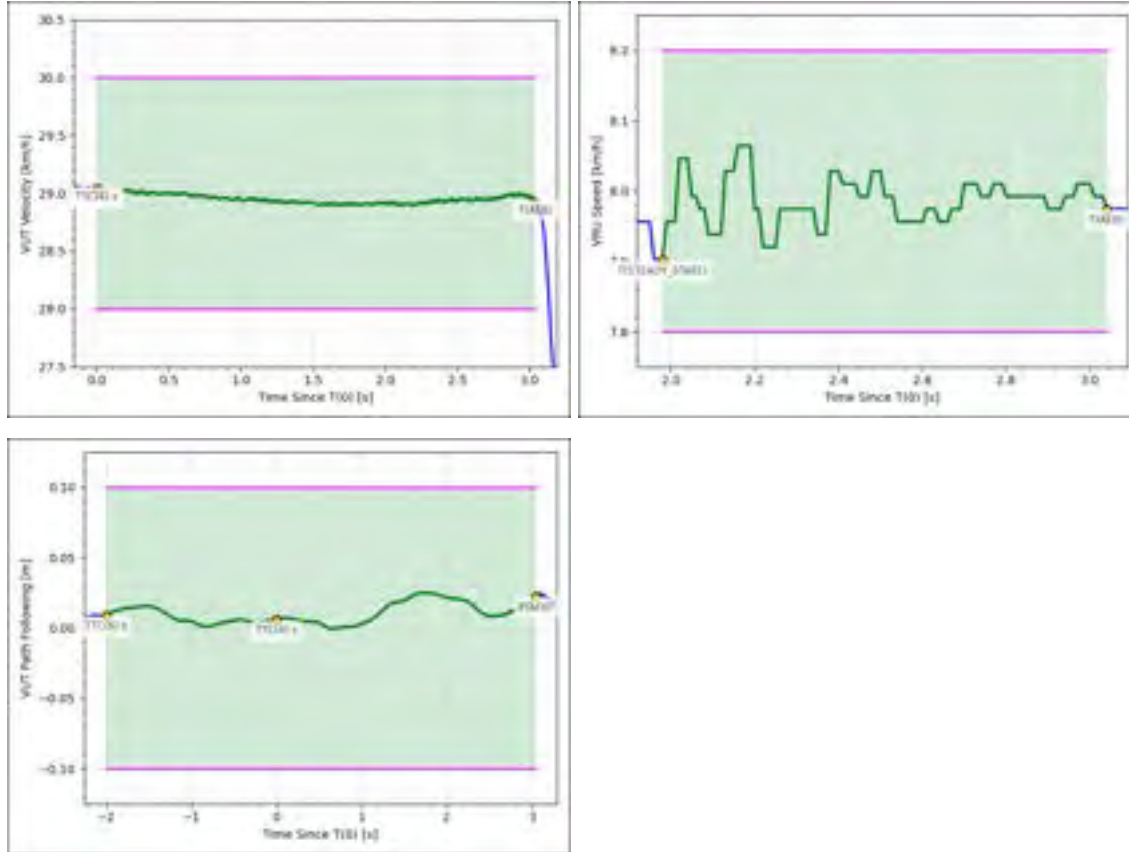
Run Date / Time 6-Apr-2023 09:30



J.1.1.4. CPFA-50 VUT 30kph EPT 8kph (Day)

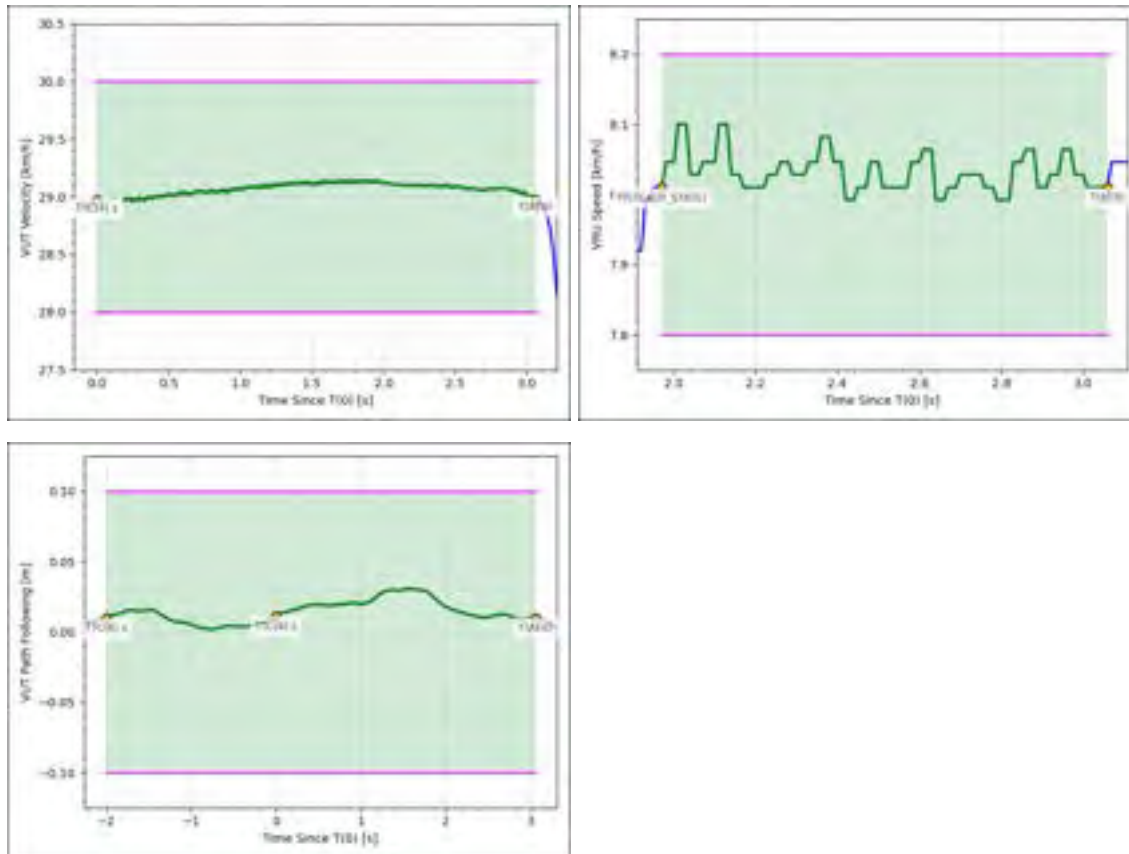
CPFA-50 8 kph (Day) | 30 km/h | Run 3

Run Date / Time 6-Apr-2023 10:05



CPFA-50 8 kph (Day) | 30 km/h | Run 4

Run Date / Time 6-Apr-2023 10:08



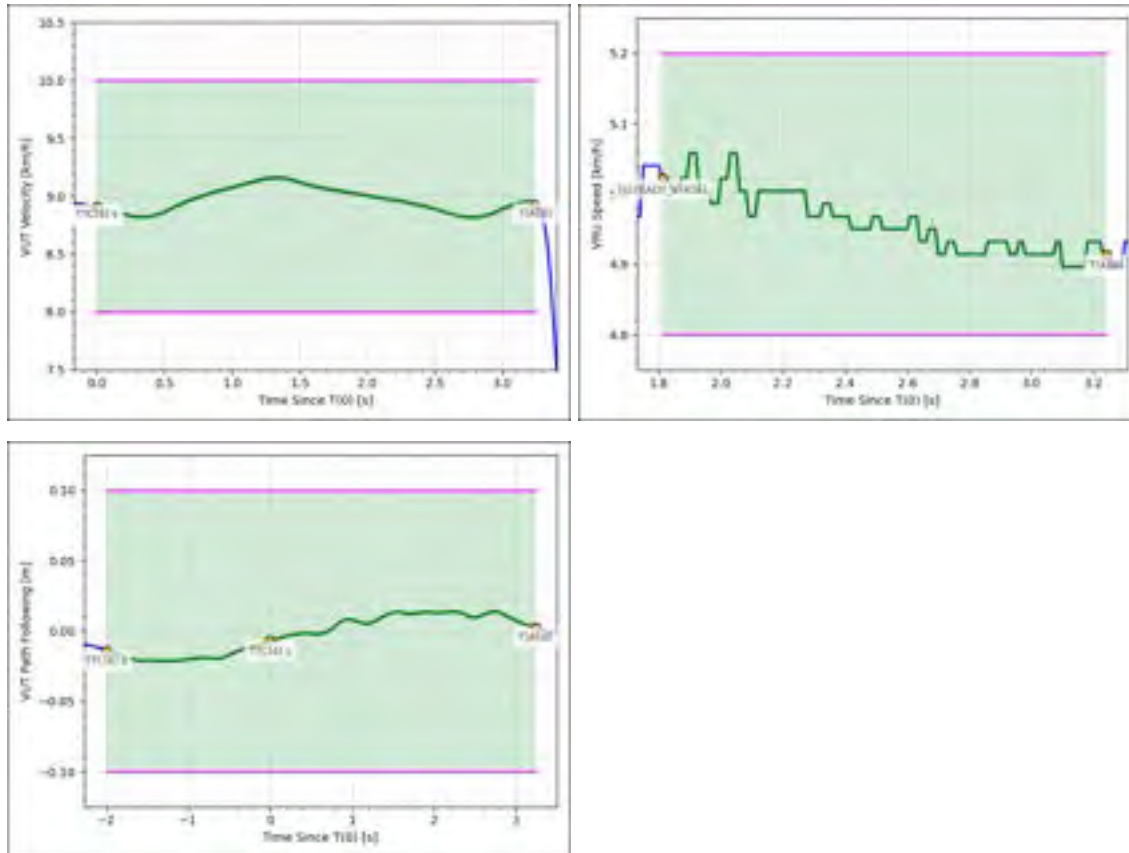
J.2. Car-to-Pedestrian Nearside Child

J.2.1. Baseline

J.2.1.1. CPNC-50 VUT 10kph EPT 5kph (Day)

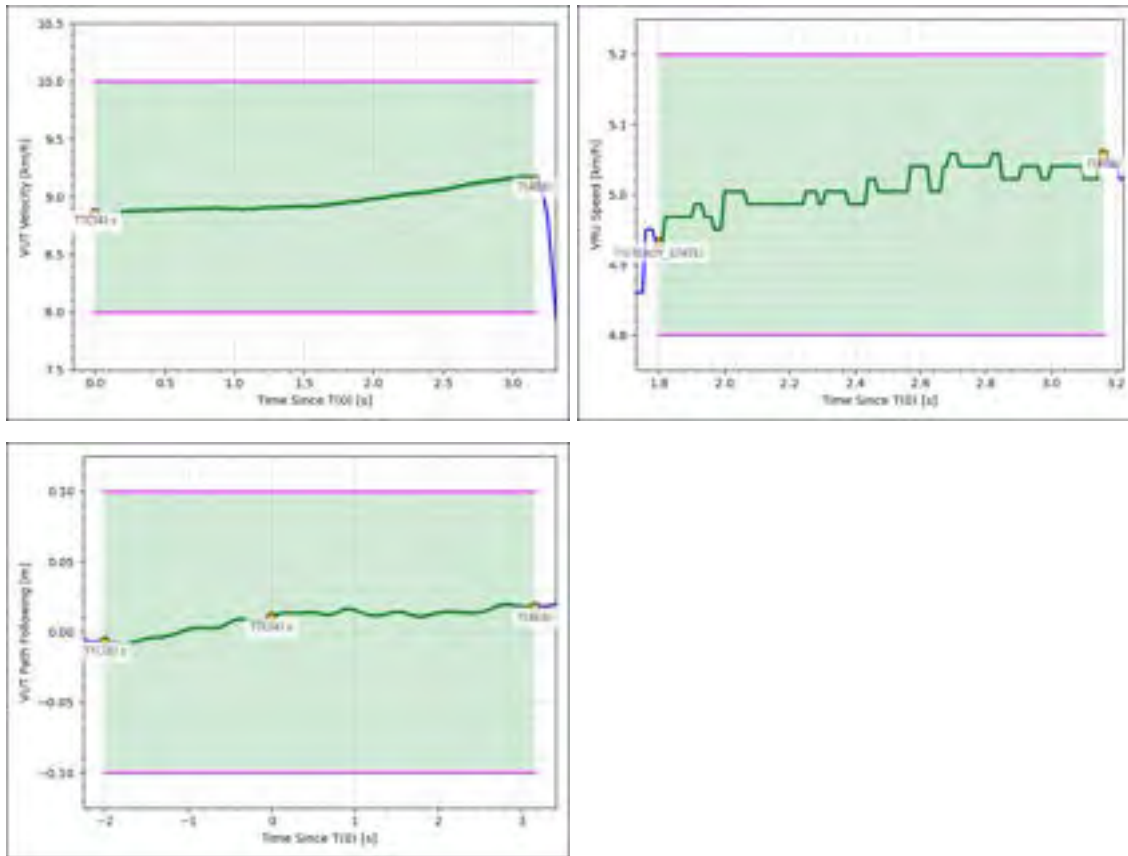
CPNC-50 5 kph (Day) | 10 km/h | Run 1

Run Date / Time 15-Feb-2023 11:25



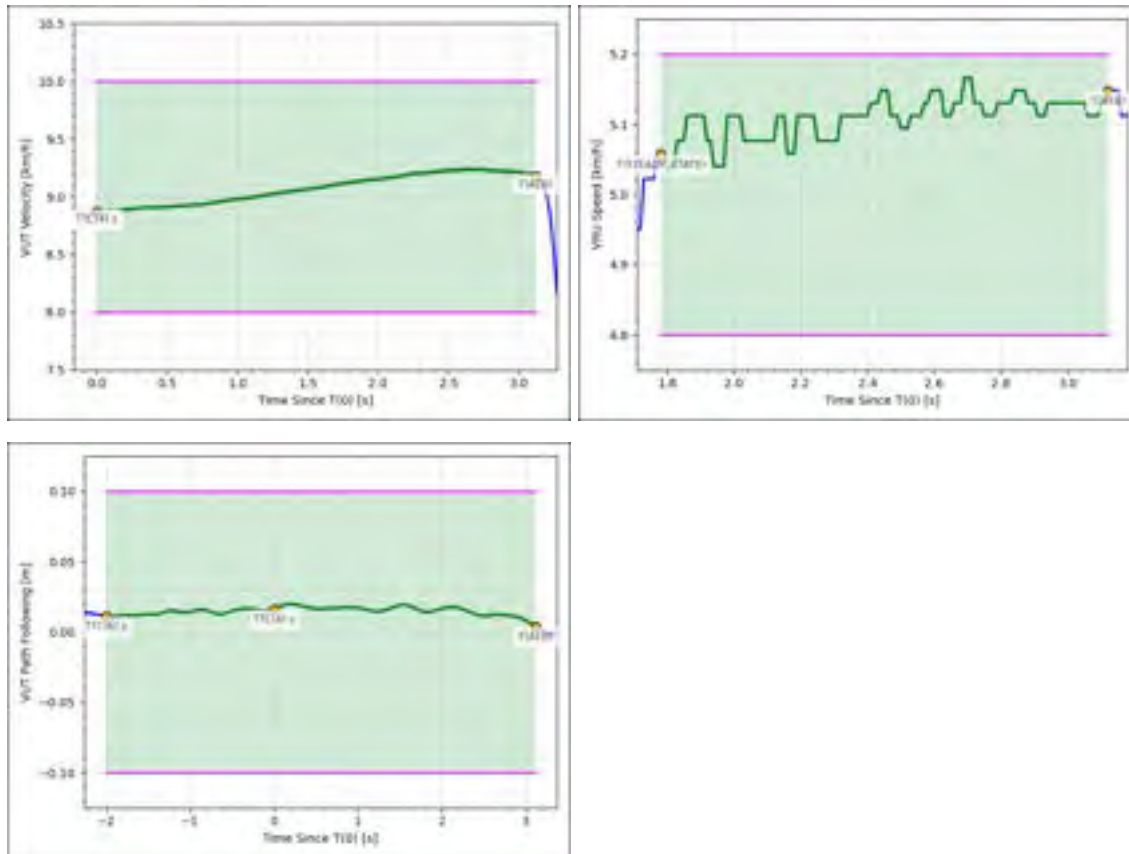
CPNC-50 5 kph (Day) | 10 km/h | Run 2

Run Date / Time 15-Feb-2023 11:31



CPNC-50 5 kph (Day) | 10 km/h | Run 3

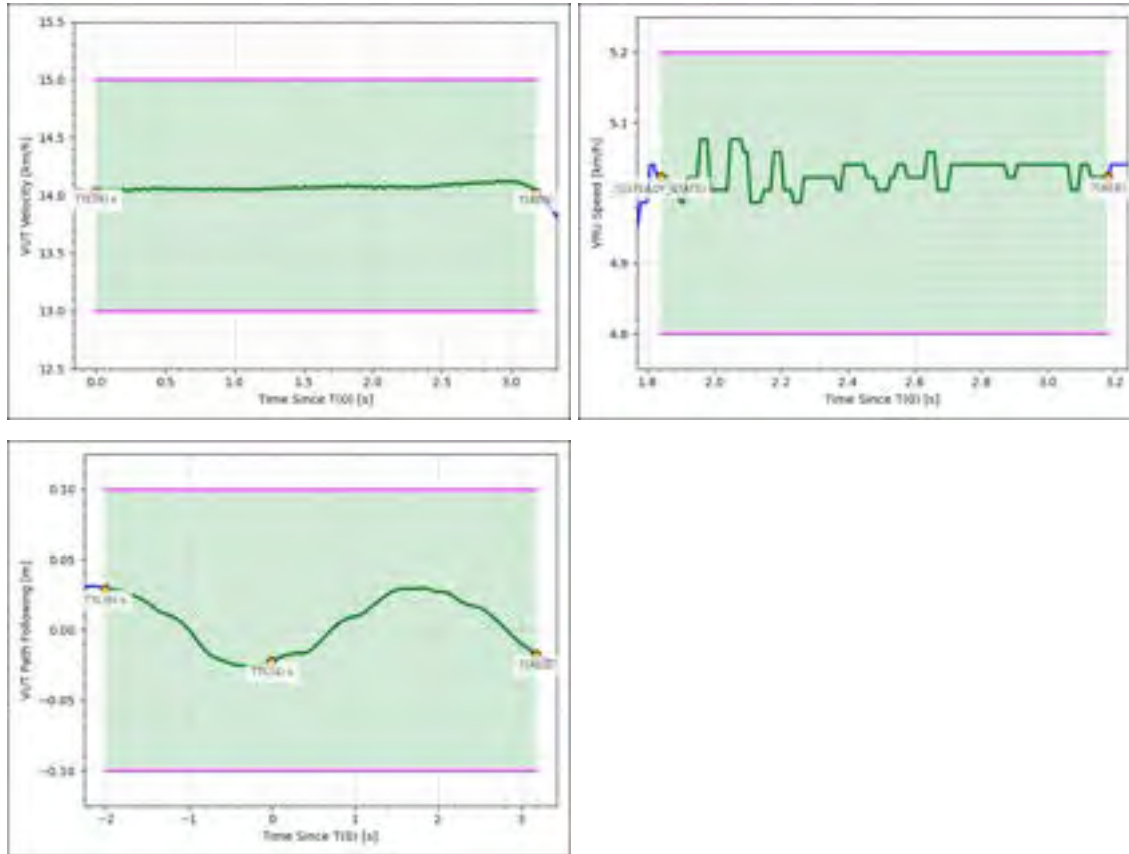
Run Date / Time 15-Feb-2023 11:36



J.2.1.2. CPNC-50 VUT 15kph EPT 5kph (Day)

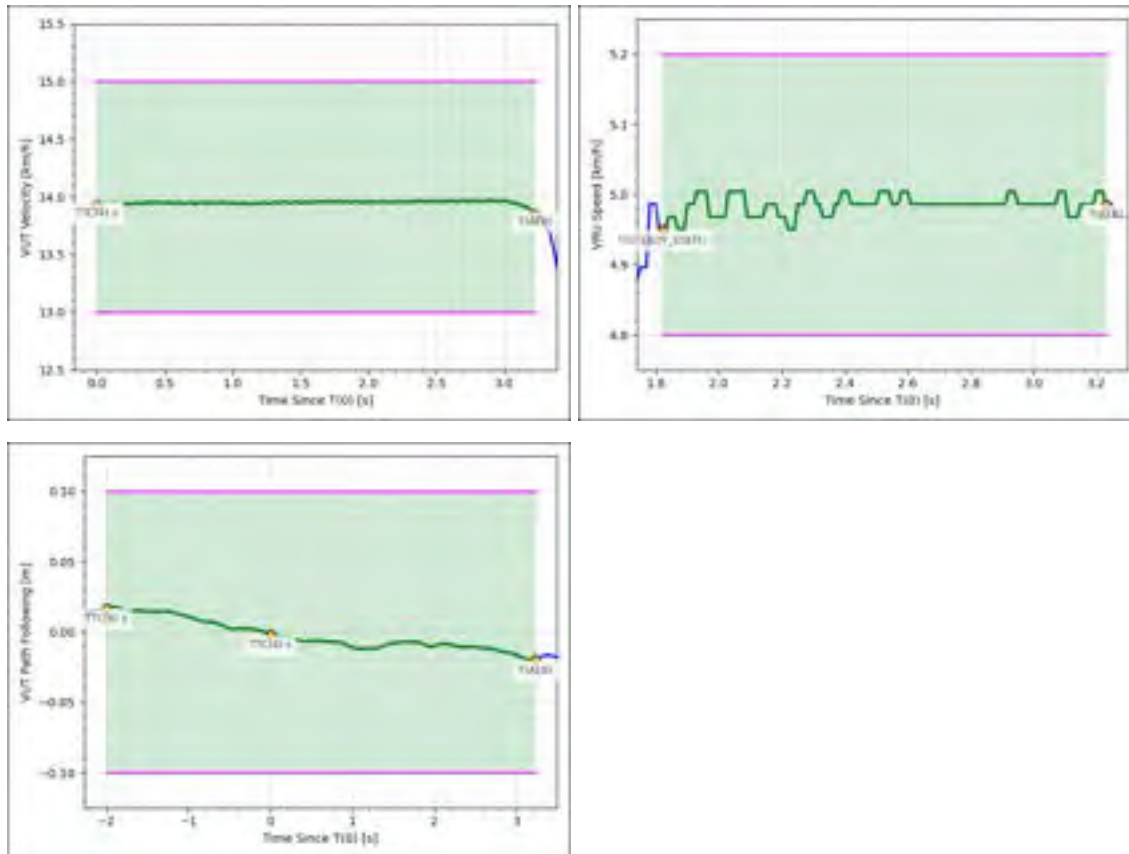
CPNC-50 5 kph (Day) | 15 km/h | Run 1

Run Date / Time 15-Feb-2023 11:14



CPNC-50 5 kph (Day) | 15 km/h | Run 2

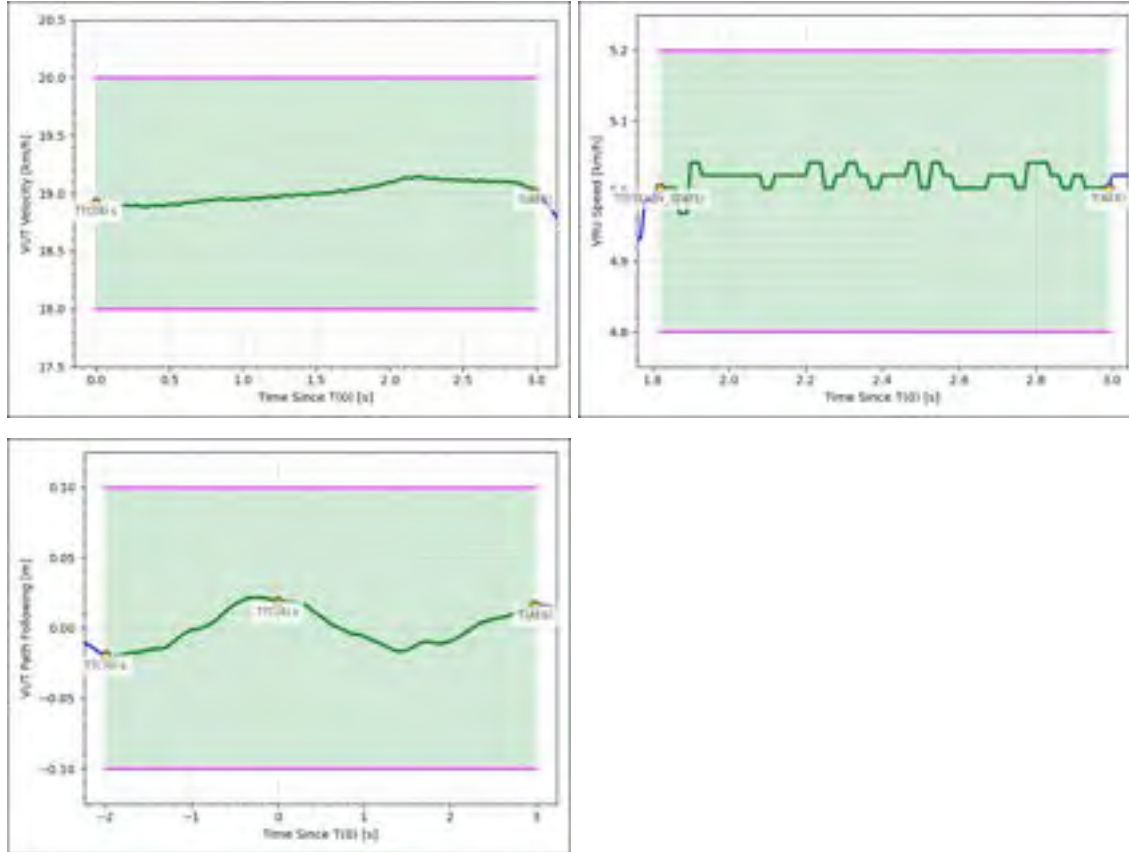
Run Date / Time 15-Feb-2023 11:19



J.2.1.3. CPNC-50 VUT 20kph EPT 5kph (Day)

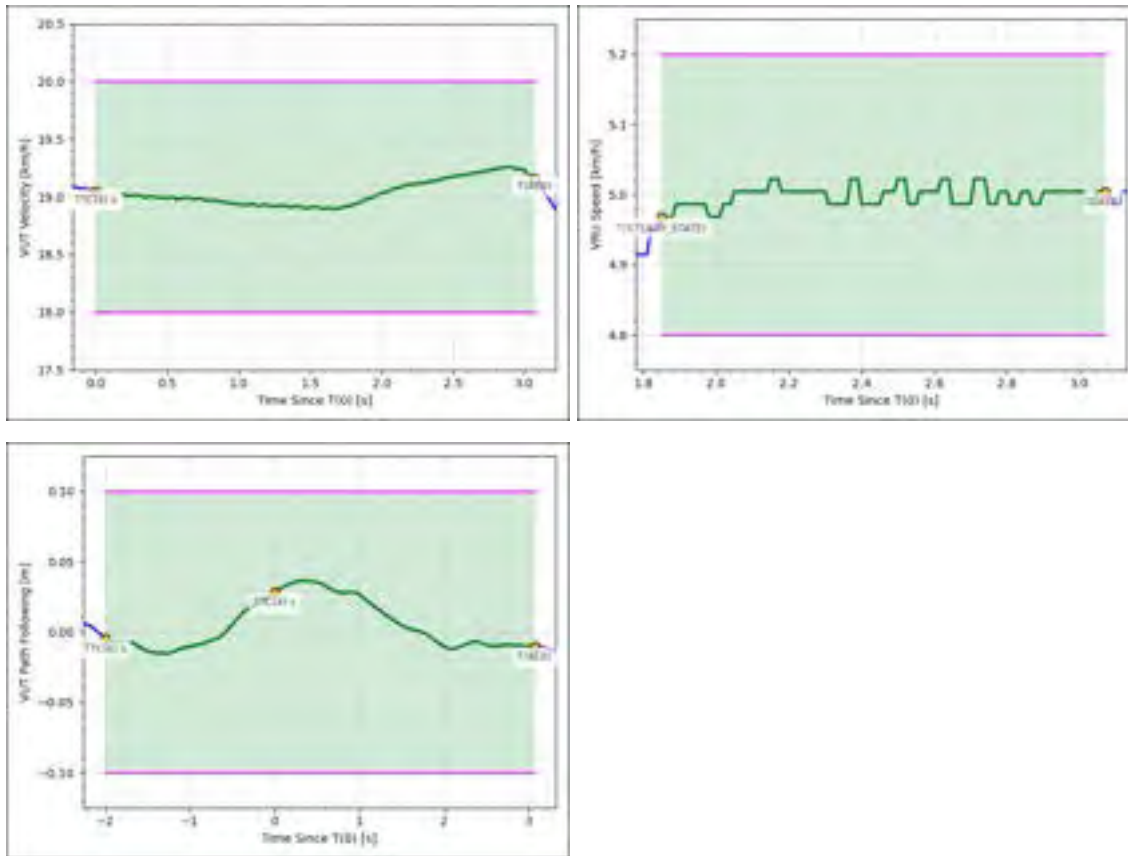
CPNC-50 5 kph (Day) | 20 km/h | Run 2

Run Date / Time 13-Feb-2023 15:11



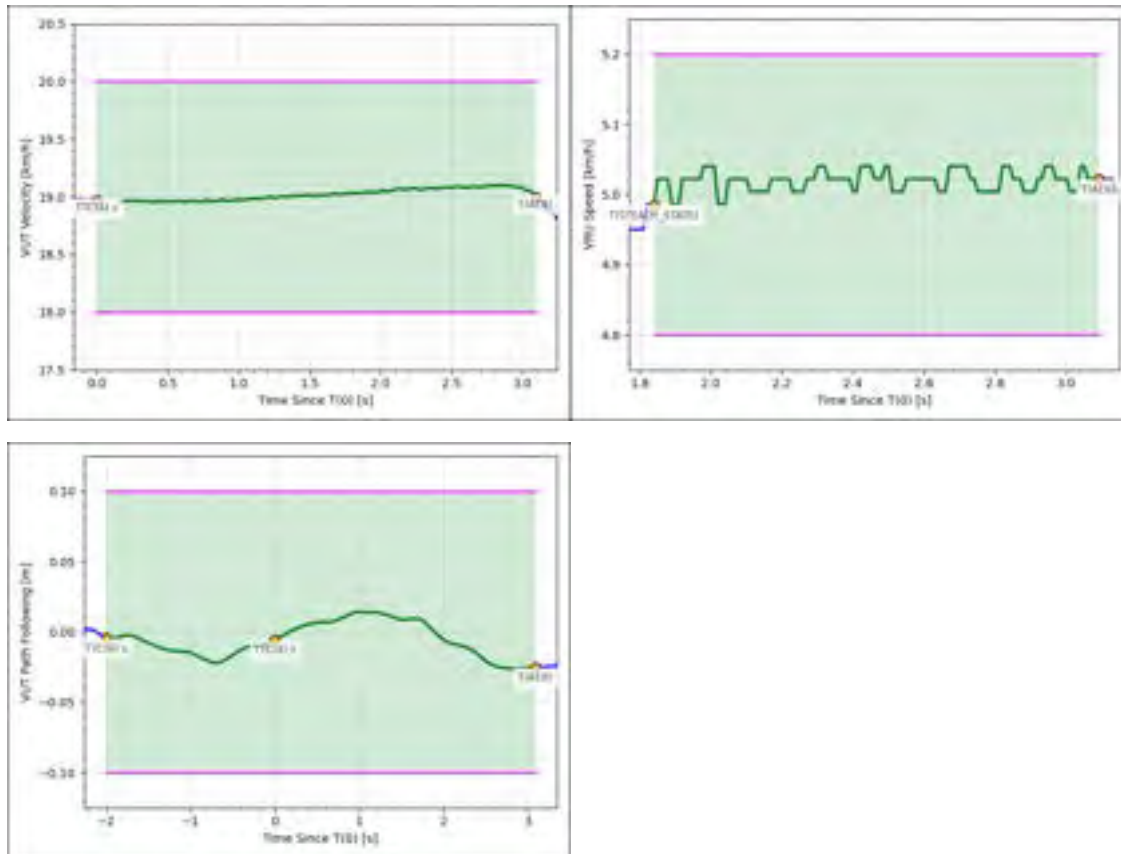
CPNC-50 5 kph (Day) | 20 km/h | Run 3

Run Date / Time 13-Feb-2023 15:15



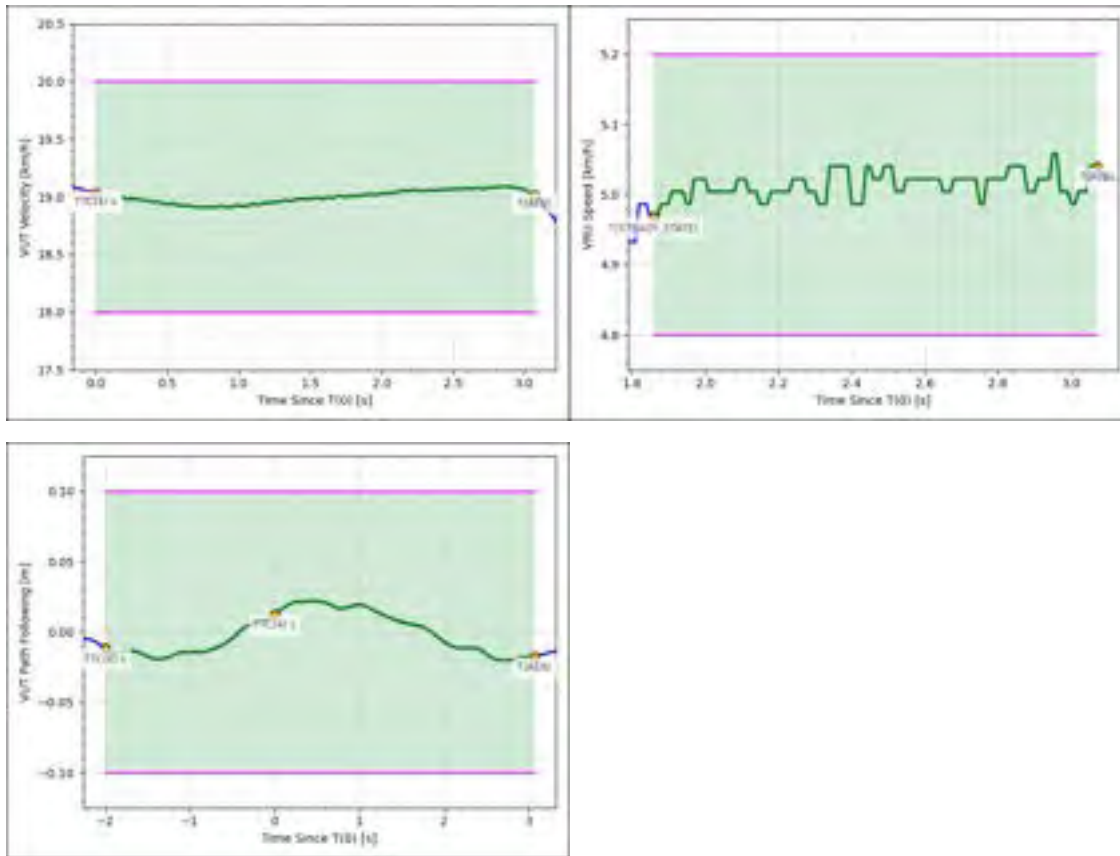
CPNC-50 5 kph (Day) | 20 km/h | Run 4

Run Date / Time 15-Feb-2023 09:43



CPNC-50 5 kph (Day) | 20 km/h | Run 5

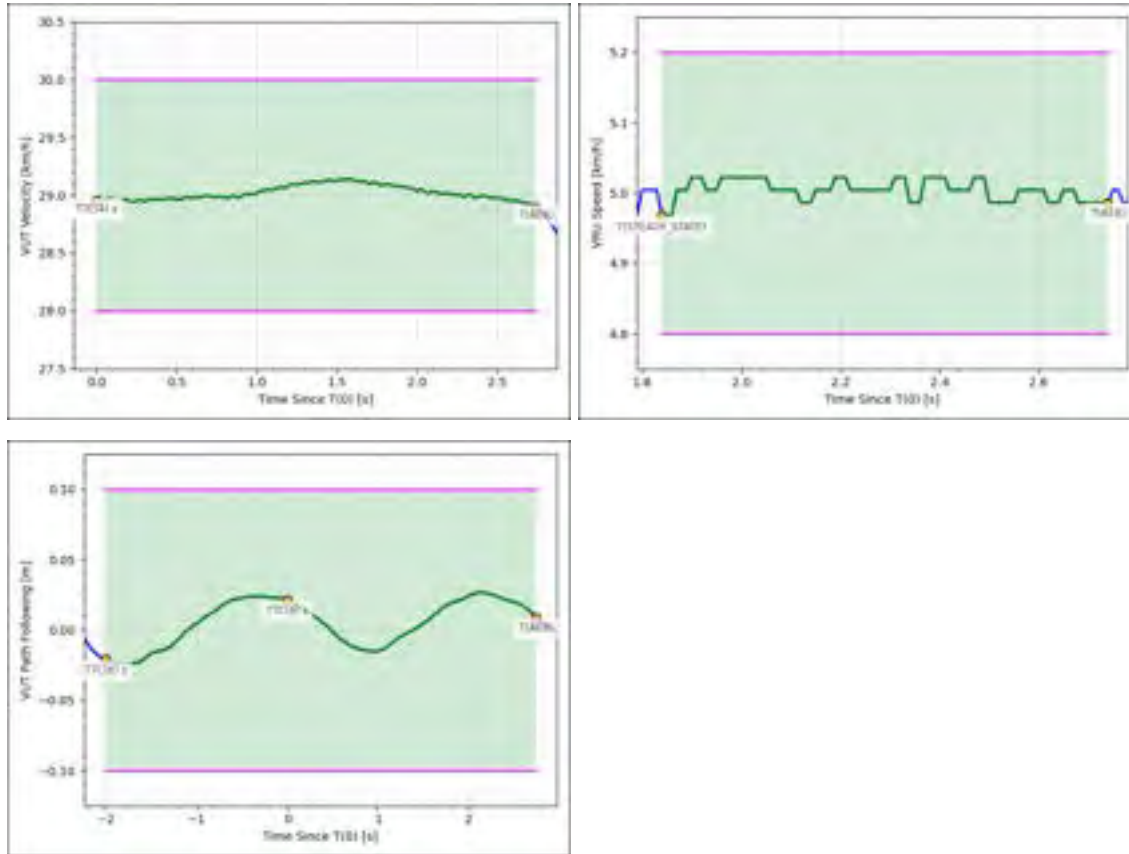
Run Date / Time 15-Feb-2023 09:48



J.2.1.4. CPNC-50 VUT 30kph EPT 5kph (Day)

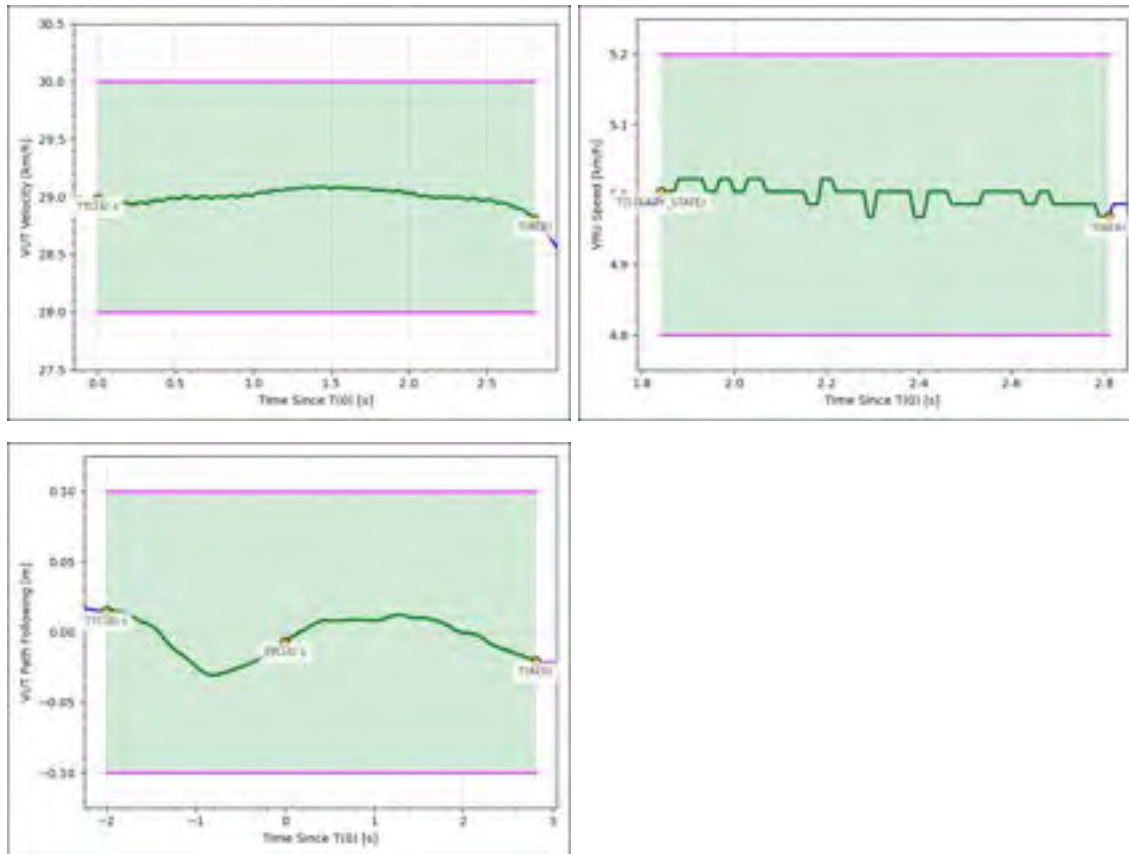
CPNC-50 5 kph (Day) | 30 km/h | Run 1

Run Date / Time 13-Feb-2023 14:43



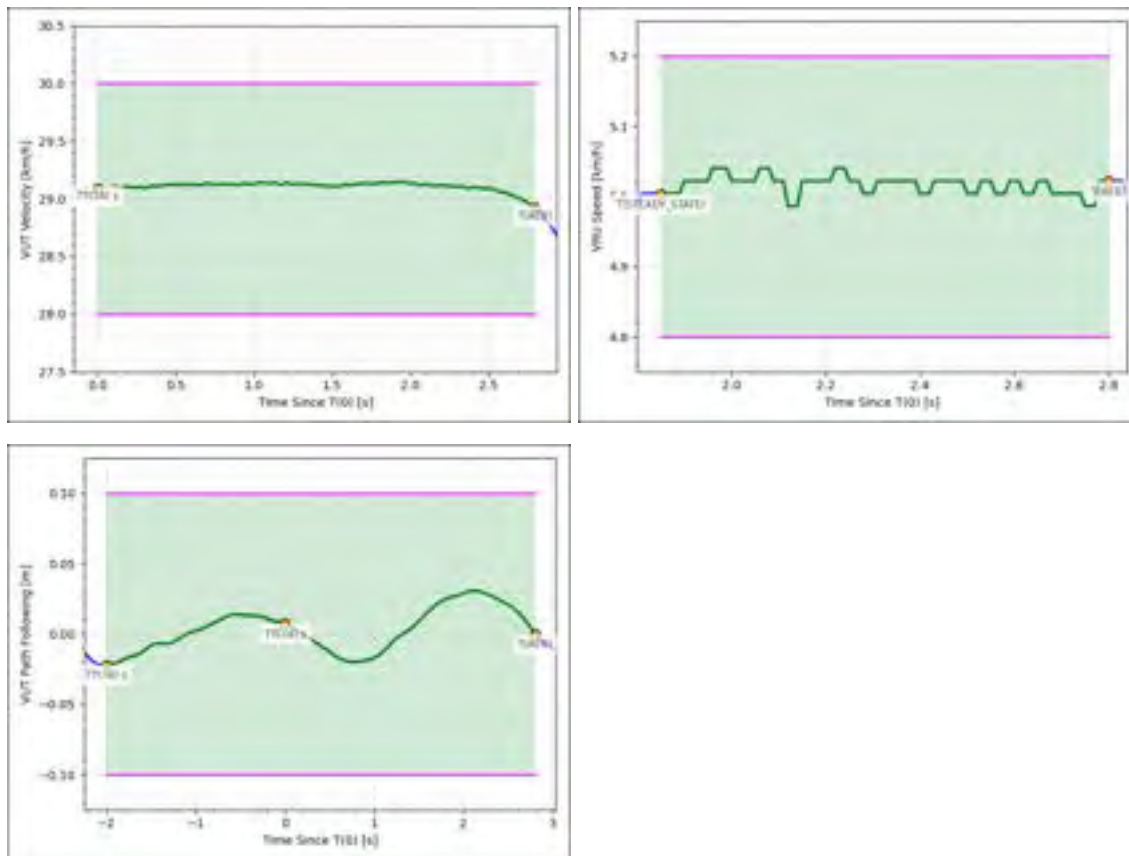
CPNC-50 5 kph (Day) | 30 km/h | Run 2

Run Date / Time 13-Feb-2023 14:47



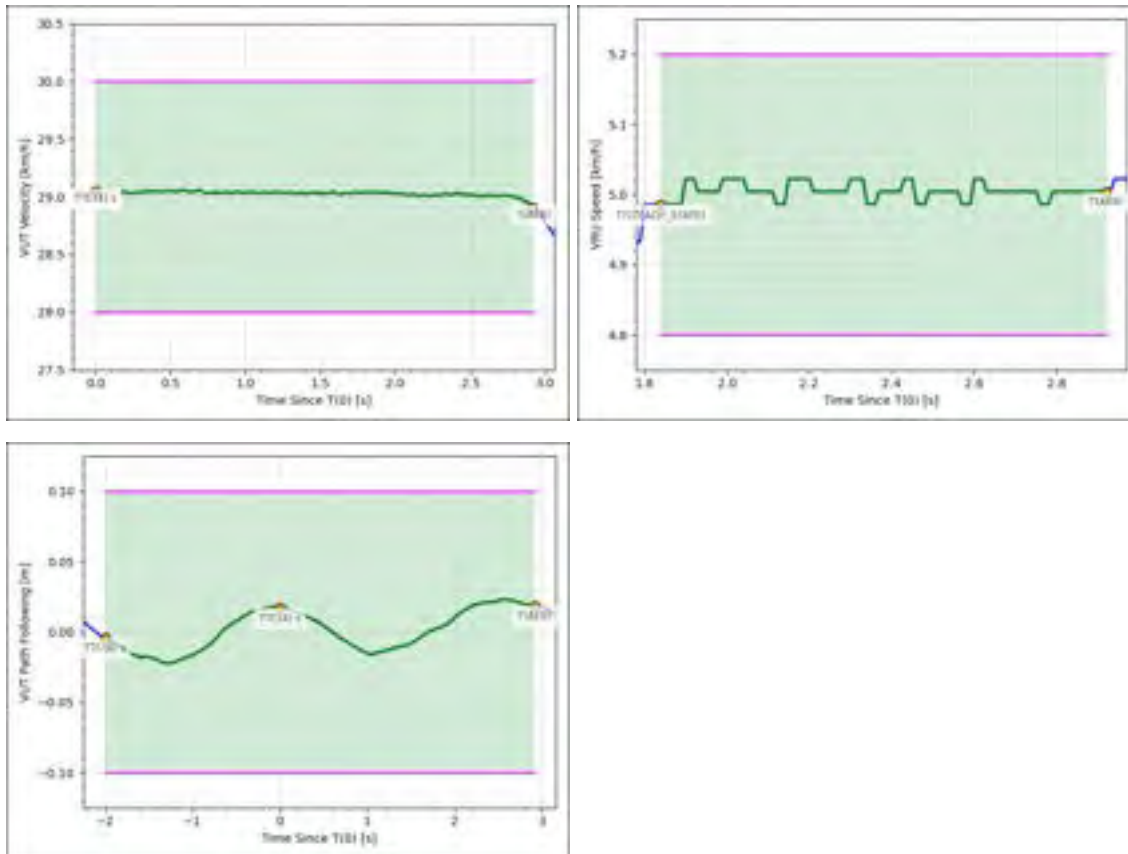
CPNC-50 5 kph (Day) | 30 km/h | Run 3

Run Date / Time 13-Feb-2023 14:56



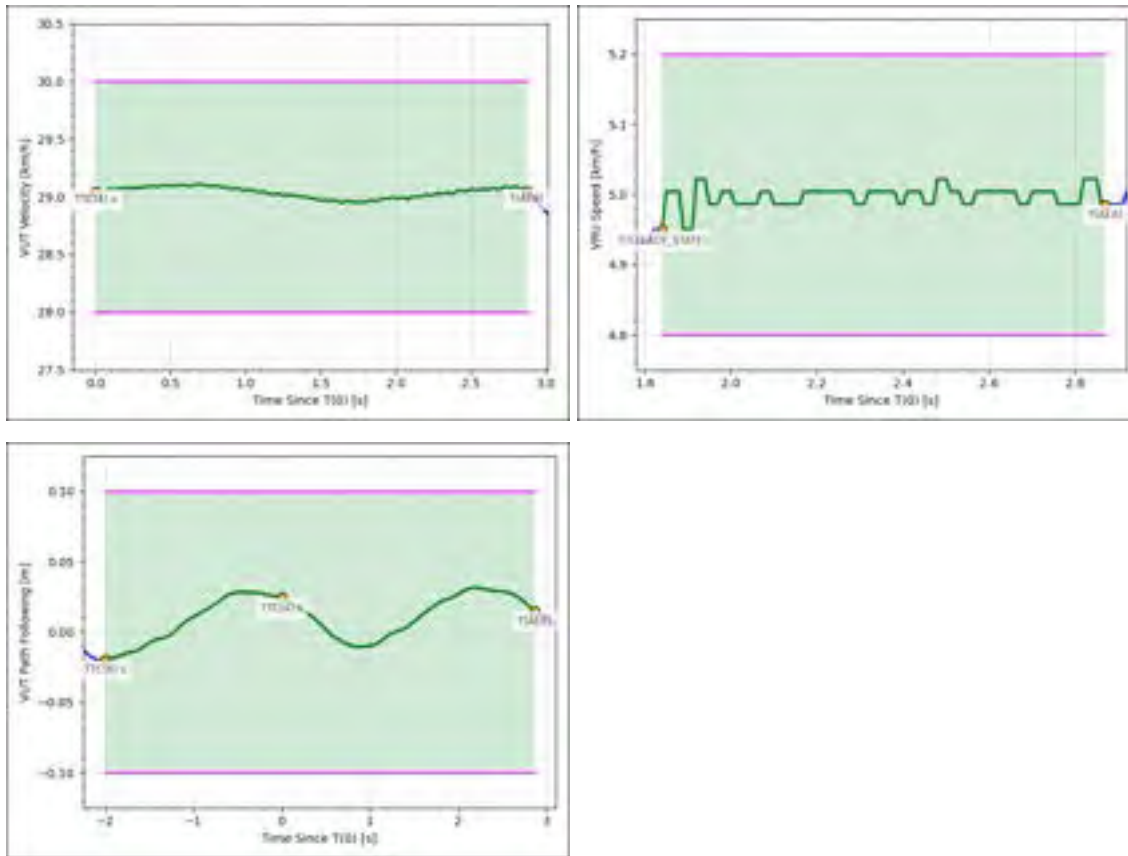
CPNC-50 5 kph (Day) | 30 km/h | Run 4

Run Date / Time 13-Feb-2023 15:02



CPNC-50 5 kph (Day) | 30 km/h | Run 5

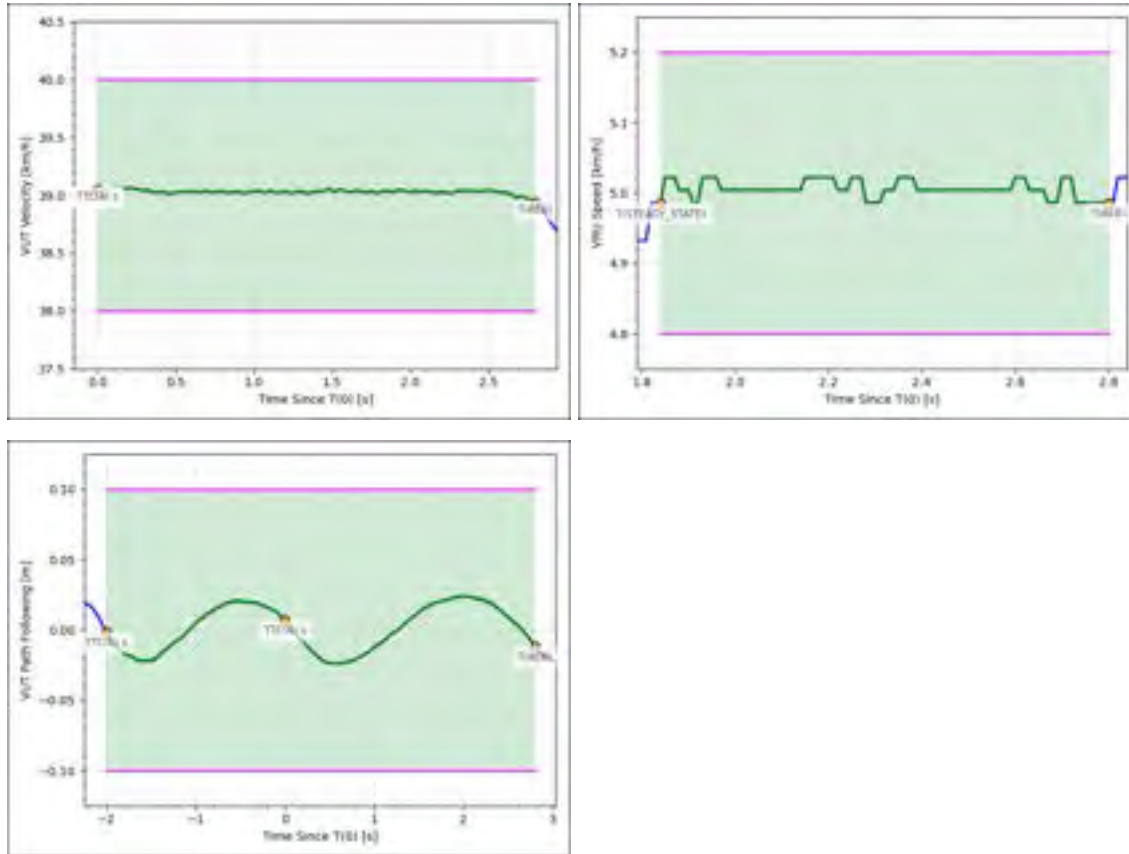
Run Date / Time 13-Feb-2023 15:06



J.2.1.5. CPNC-50 VUT 40kph EPT 5kph (Day)

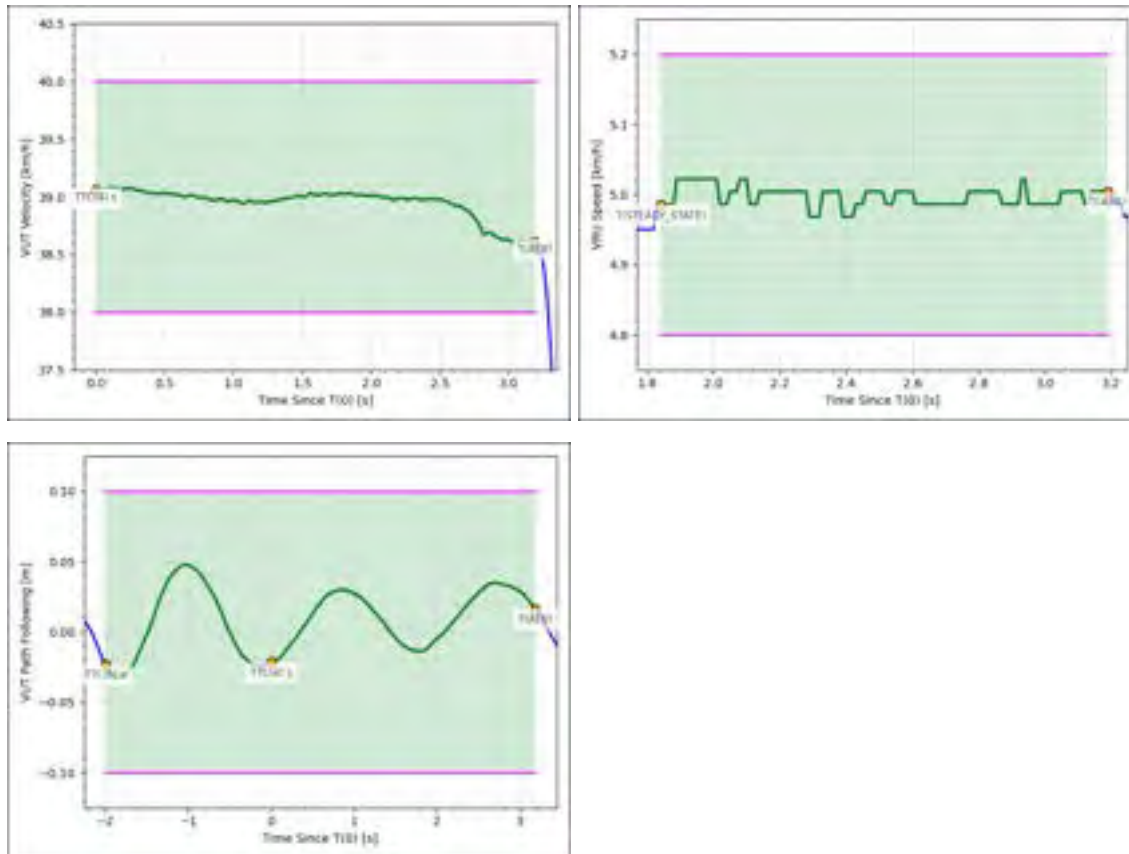
CPNC-50 5 kph (Day) | 40 km/h | Run 1

Run Date / Time 13-Feb-2023 15:19



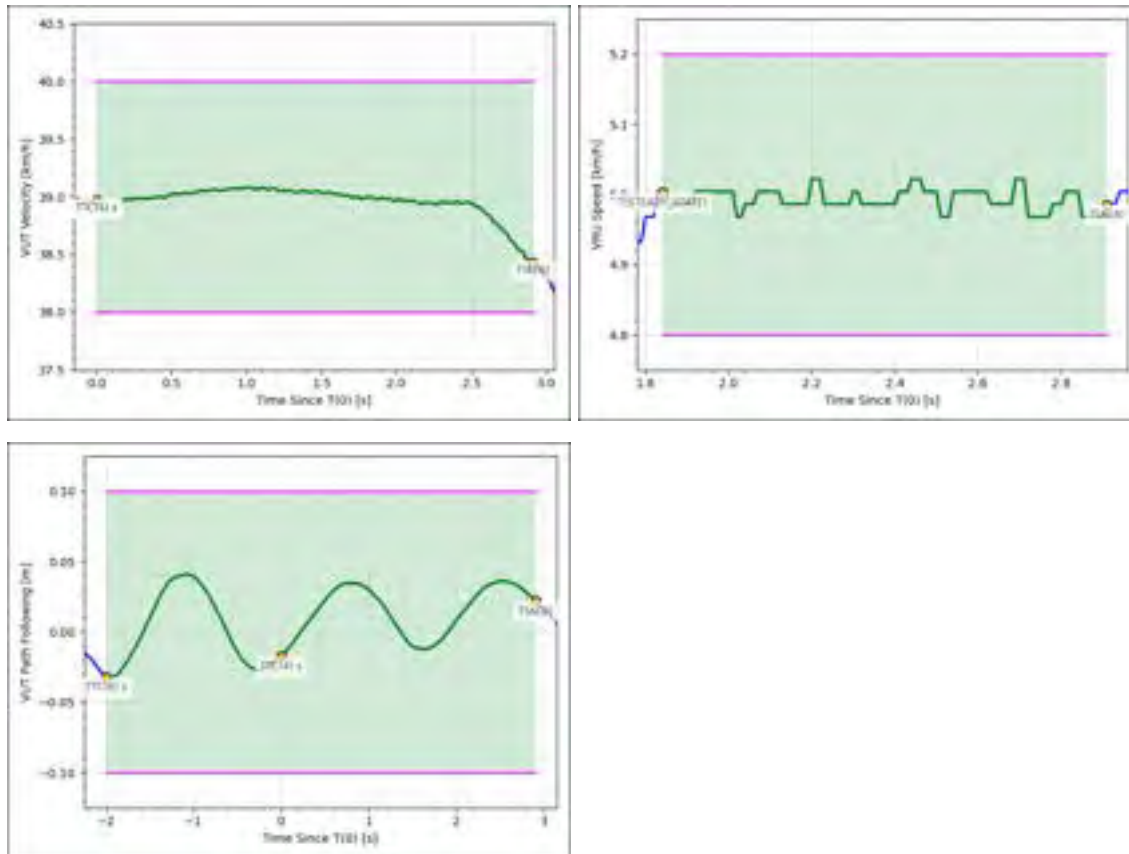
CPNC-50 5 kph (Day) | 40 km/h | Run 2

Run Date / Time 13-Feb-2023 15:25



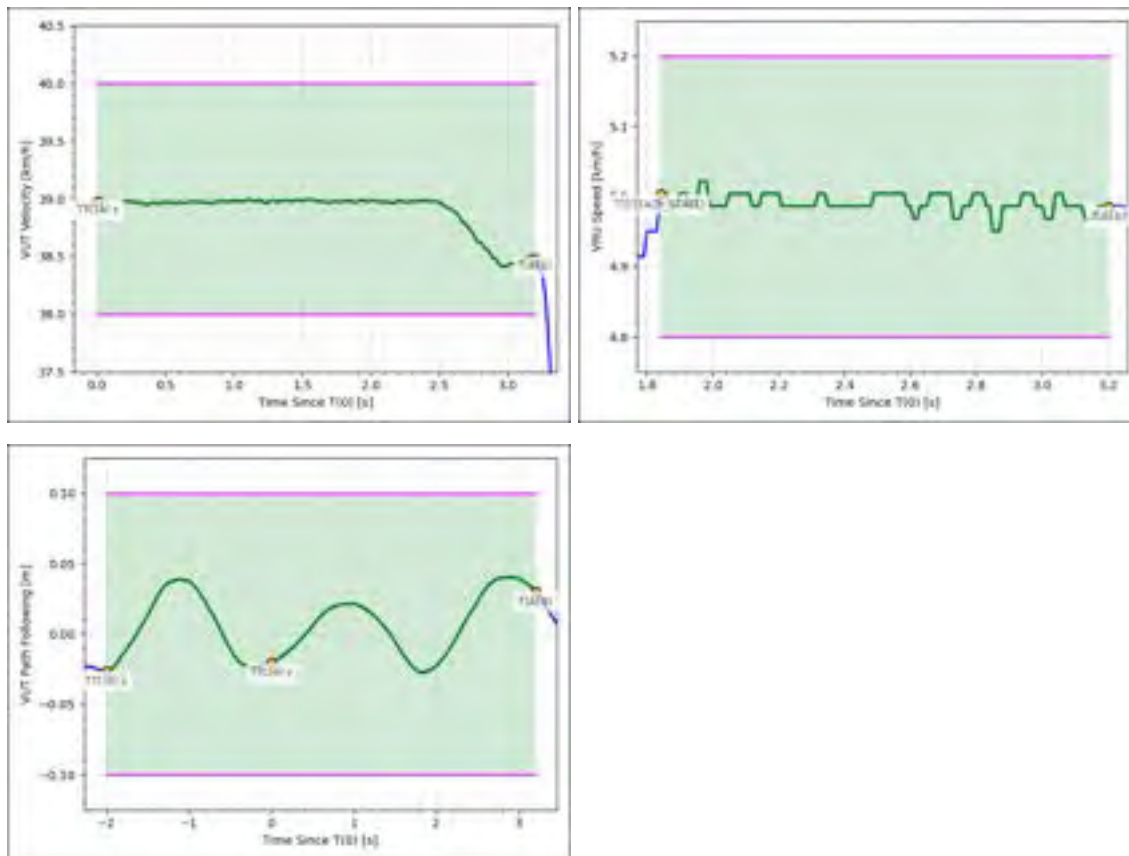
CPNC-50 5 kph (Day) | 40 km/h | Run 6

Run Date / Time 15-Feb-2023 10:11



CPNC-50 5 kph (Day) | 40 km/h | Run 7

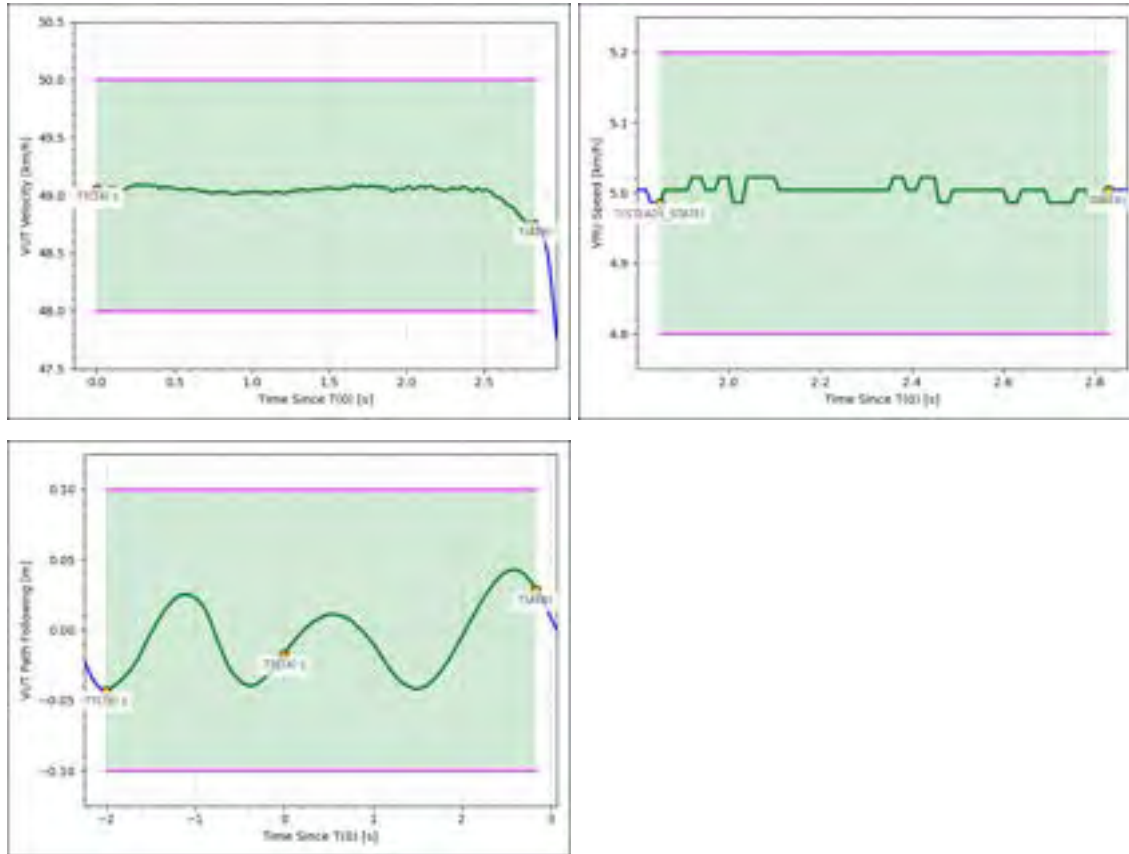
Run Date / Time 15-Feb-2023 10:16



J.2.1.6. CPNC-50 VUT 50kph EPT 5kph (Day)

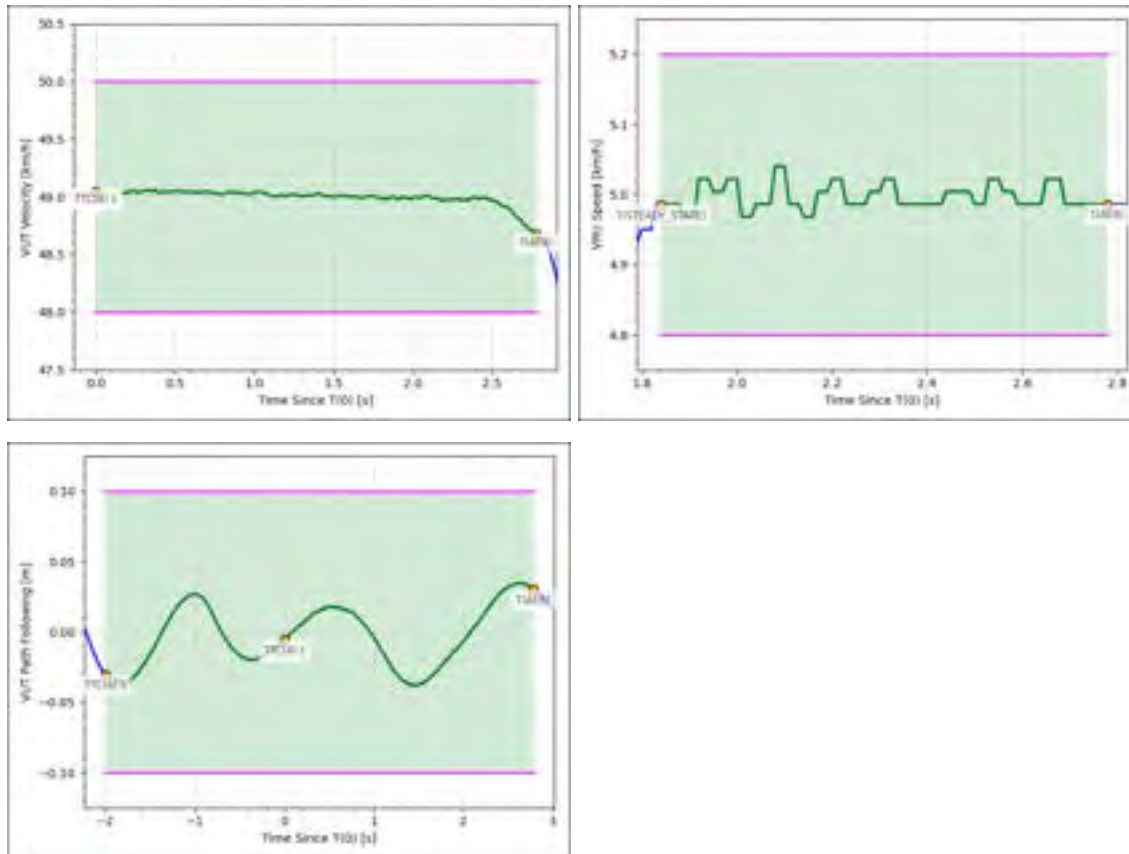
CPNC-50 5 kph (Day) | 50 km/h | Run 1

Run Date / Time 15-Feb-2023 10:22



CPNC-50 5 kph (Day) | 50 km/h | Run 2

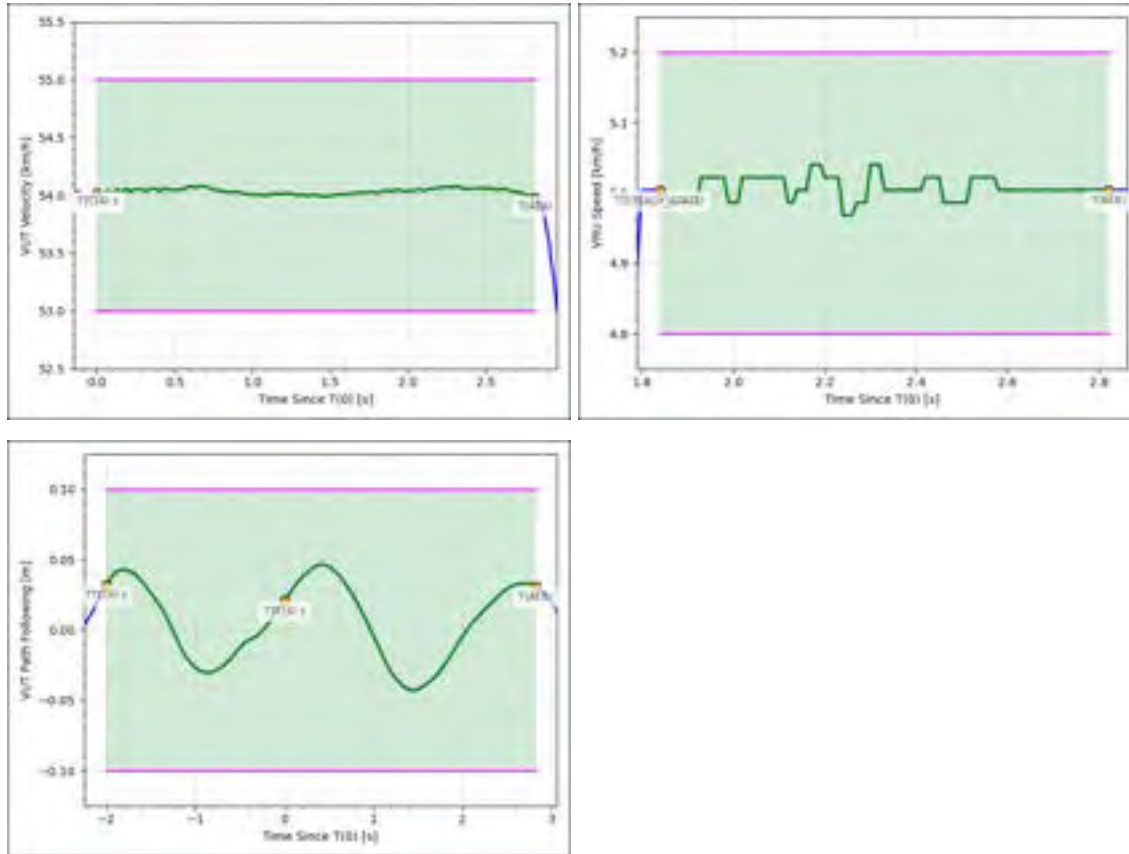
Run Date / Time 15-Feb-2023 10:28



J.2.1.7. CPNC-50 VUT 55kph EPT 5kph (Day)

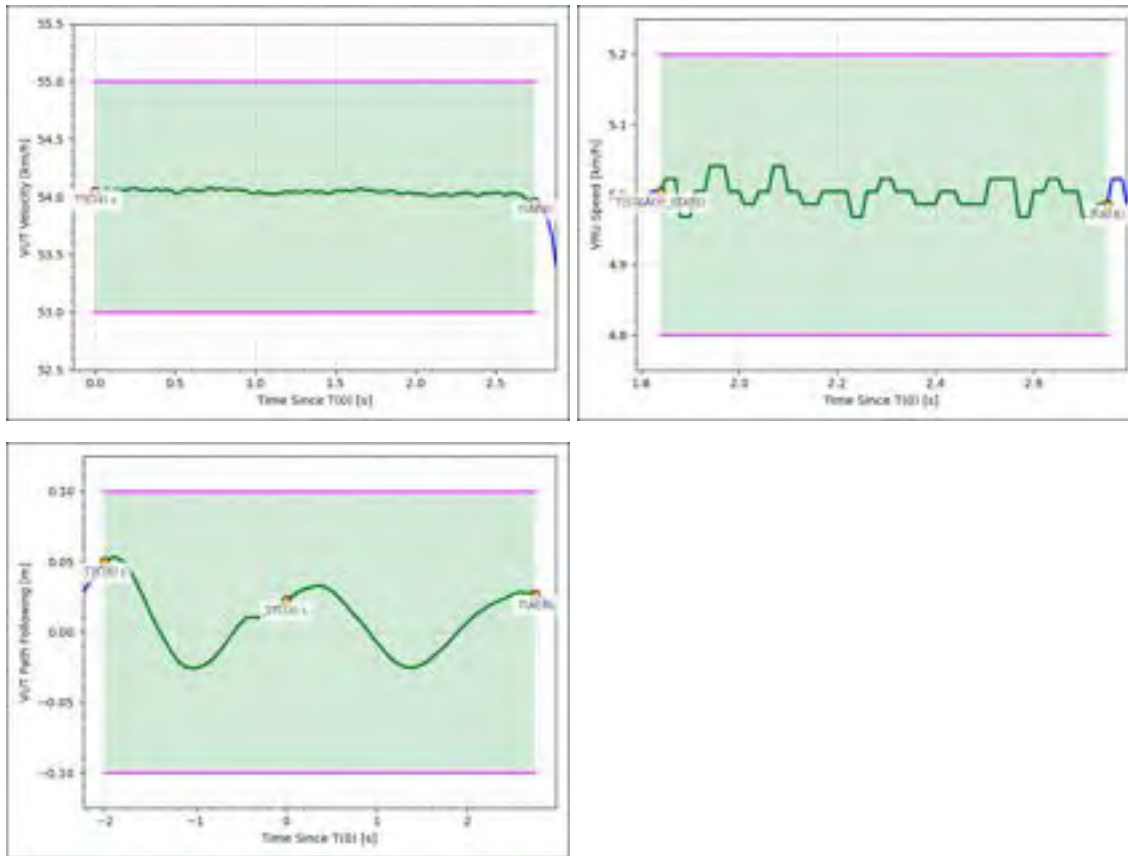
CPNC-50 5 kph (Day) | 55 km/h | Run 1

Run Date / Time 15-Feb-2023 10:49



CPNC-50 5 kph (Day) | 55 km/h | Run 3

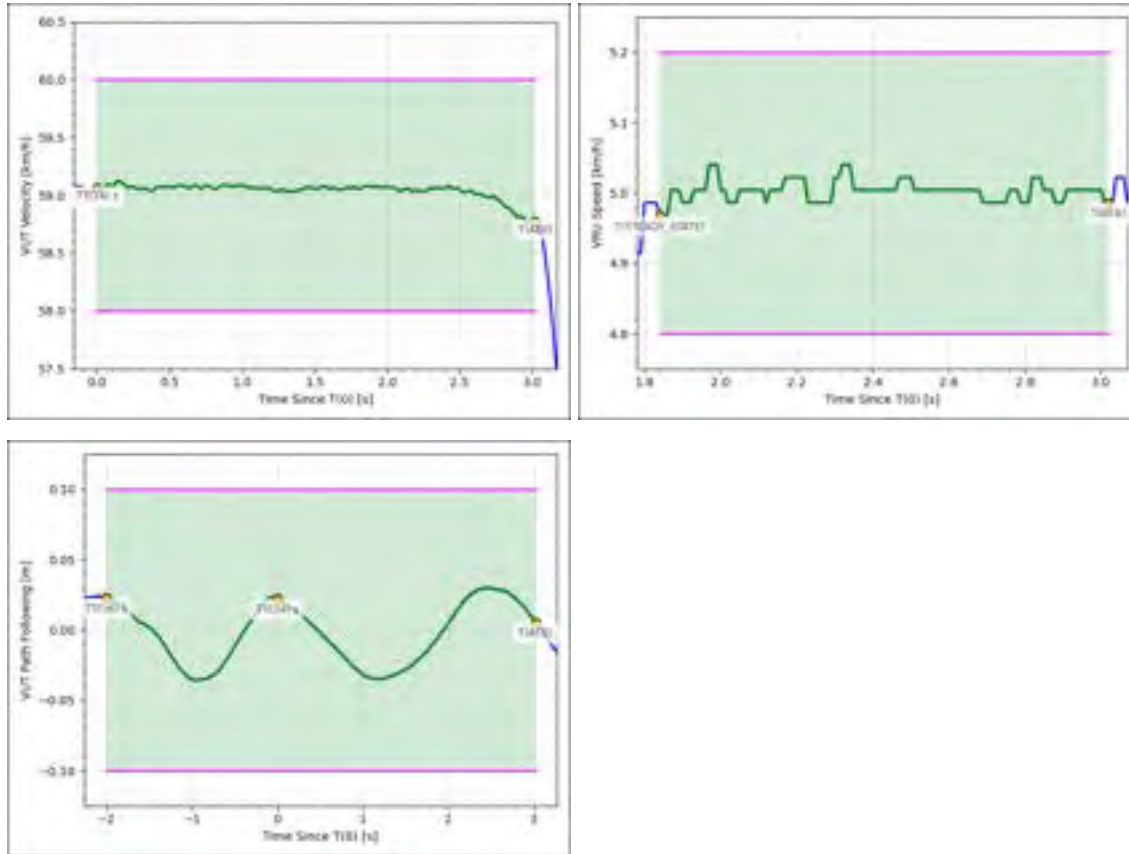
Run Date / Time 15-Feb-2023 11:02



J.2.1.8. CPNC-50 VUT 60kph EPT 5kph (Day)

CPNC-50 5 kph (Day) | 60 km/h | Run 1

Run Date / Time 15-Feb-2023 10:41

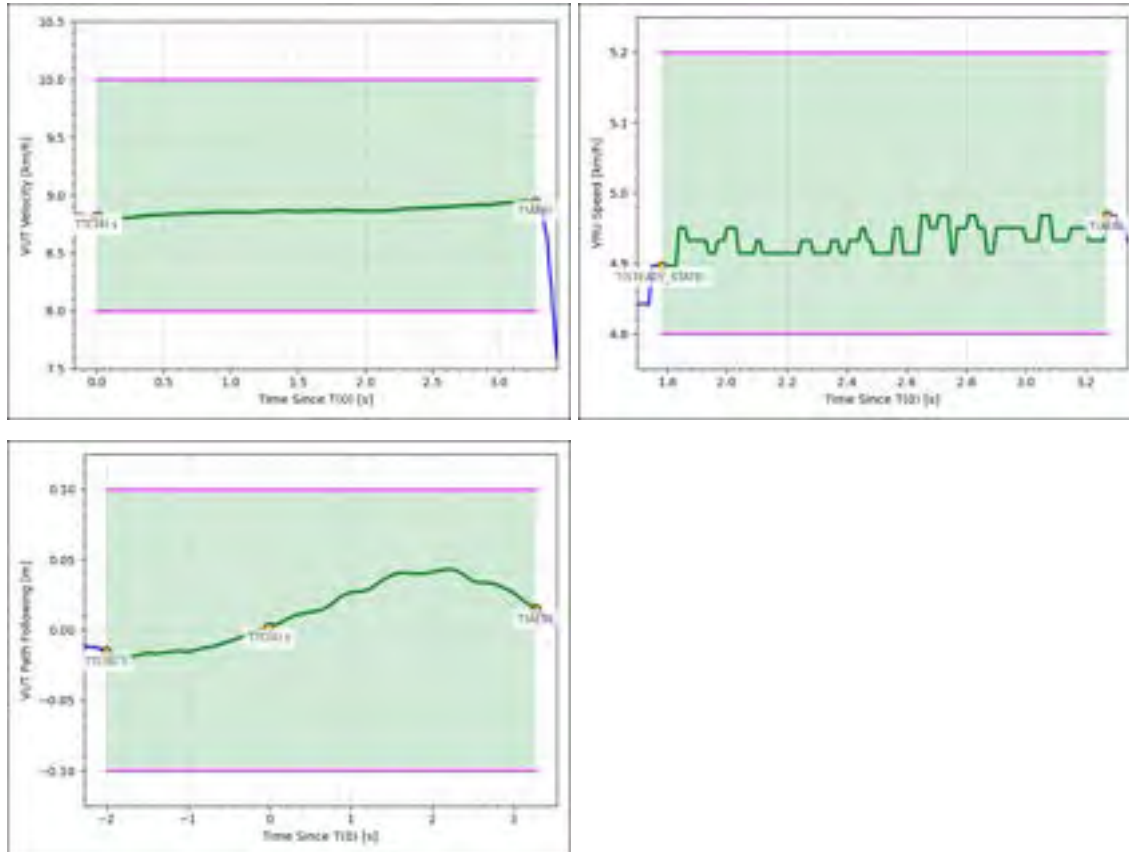


J.2.2. GVM

J.2.2.1. CPNC-50 VUT 10kph EPT 5kph (Day)

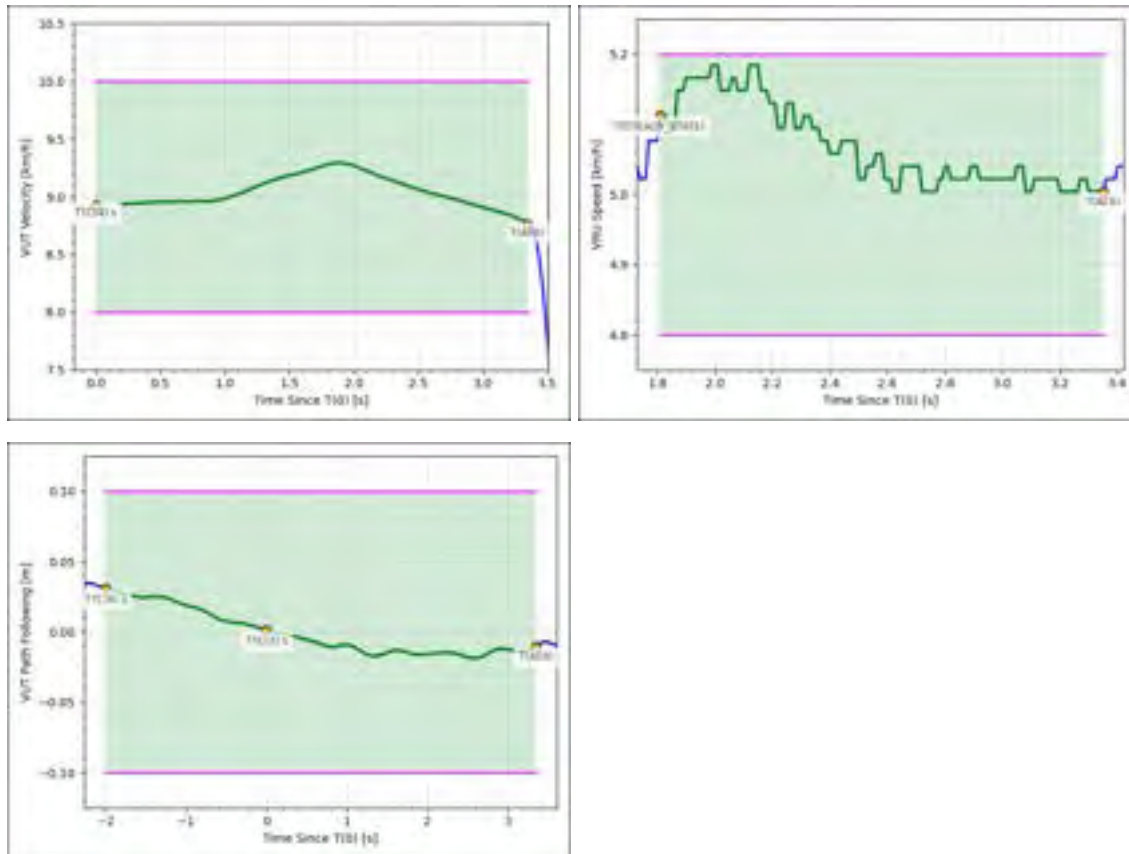
CPNC-50 5 kph (Day) | 10 km/h | Run 4

Run Date / Time 15-Feb-2023 15:02



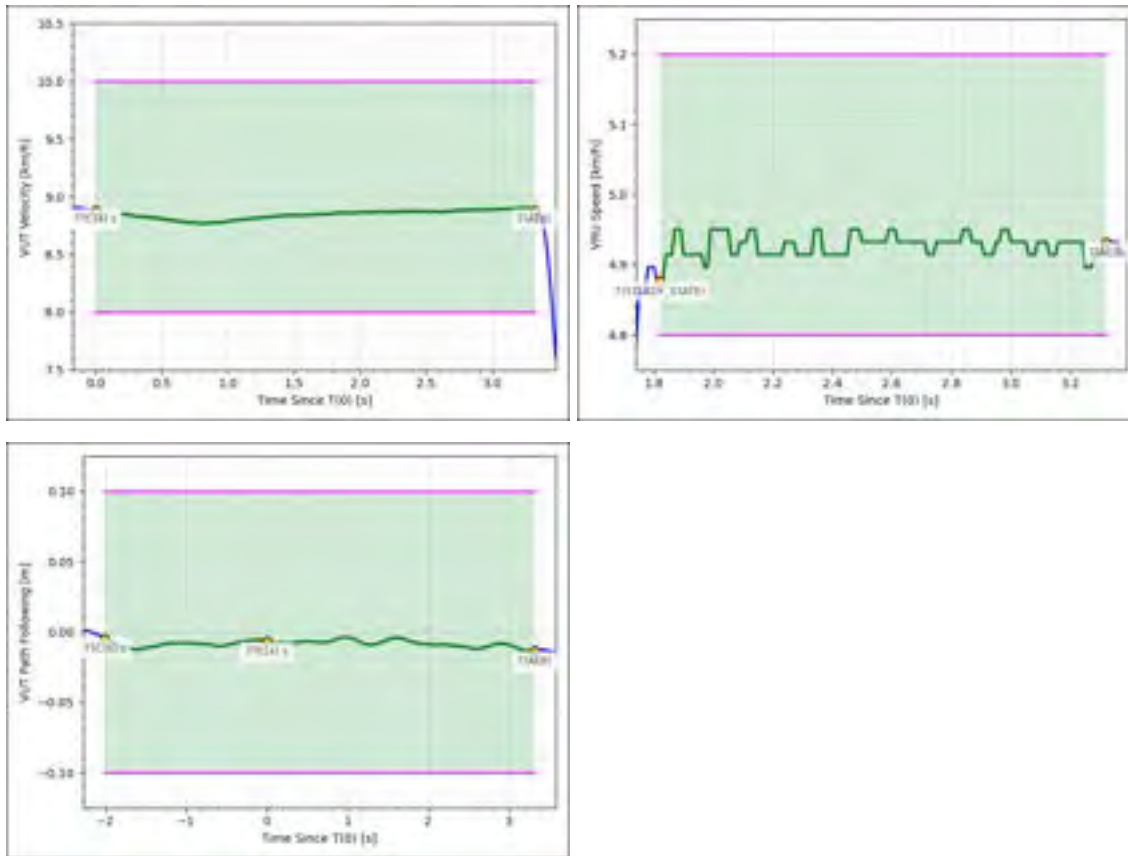
CPNC-50 5 kph (Day) | 10 km/h | Run 5

Run Date / Time 15-Feb-2023 15:07



CPNC-50 5 kph (Day) | 10 km/h | Run 6

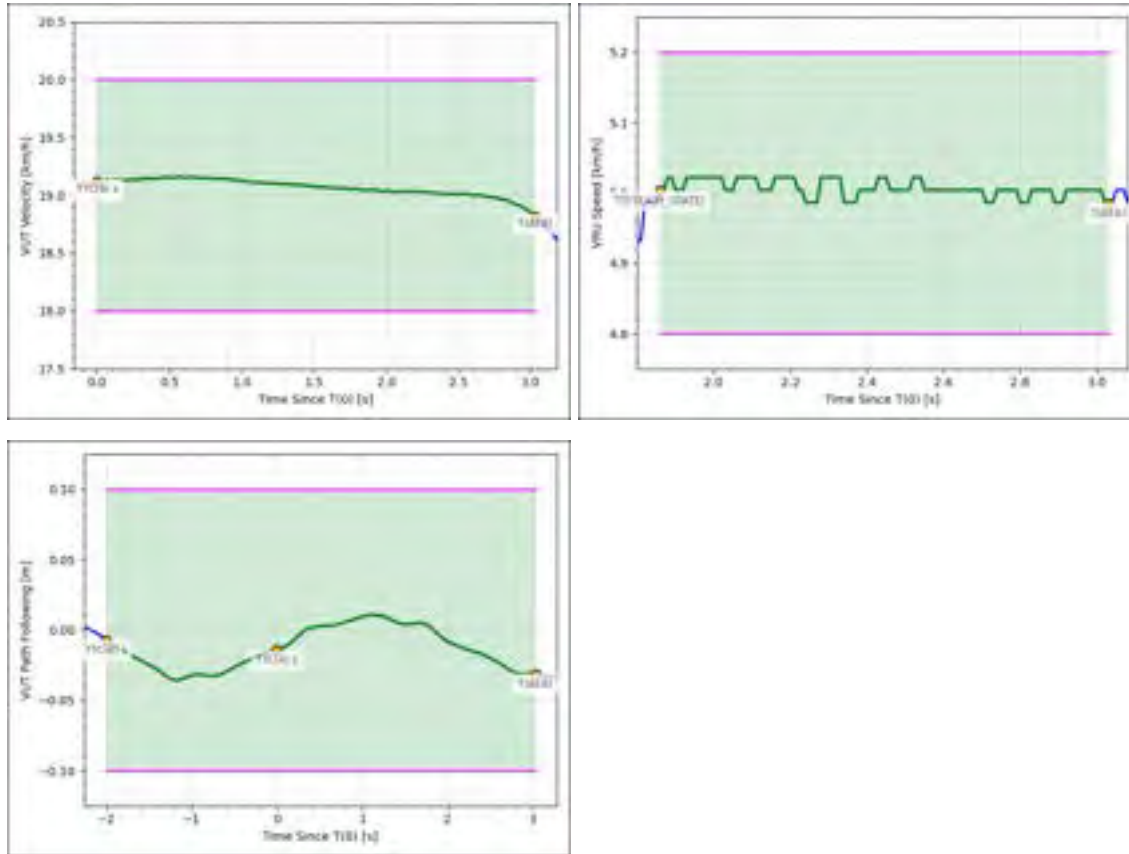
Run Date / Time 15-Feb-2023 15:11



J.2.2.2. CPNC-50 VUT 20kph EPT 5kph (Day)

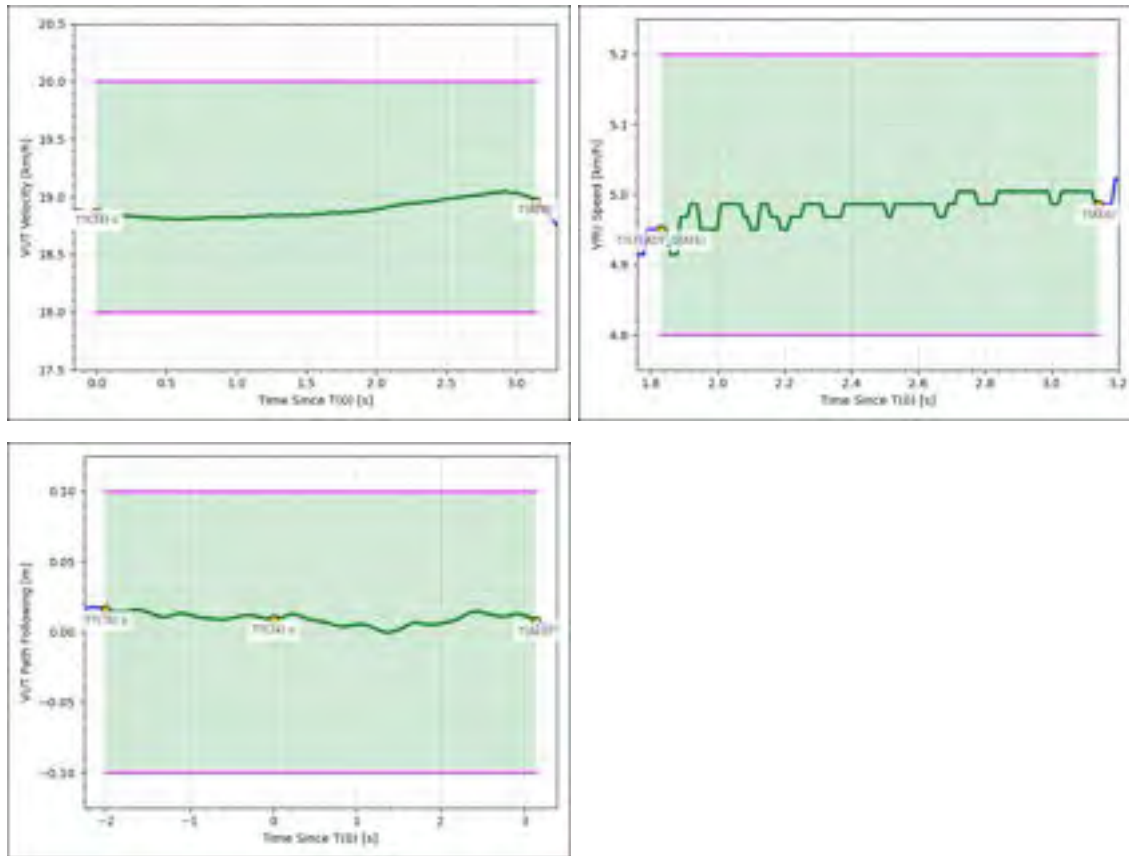
CPNC-50 5 kph (Day) | 20 km/h | Run 6

Run Date / Time 15-Feb-2023 14:44



CPNC-50 5 kph (Day) | 20 km/h | Run 8

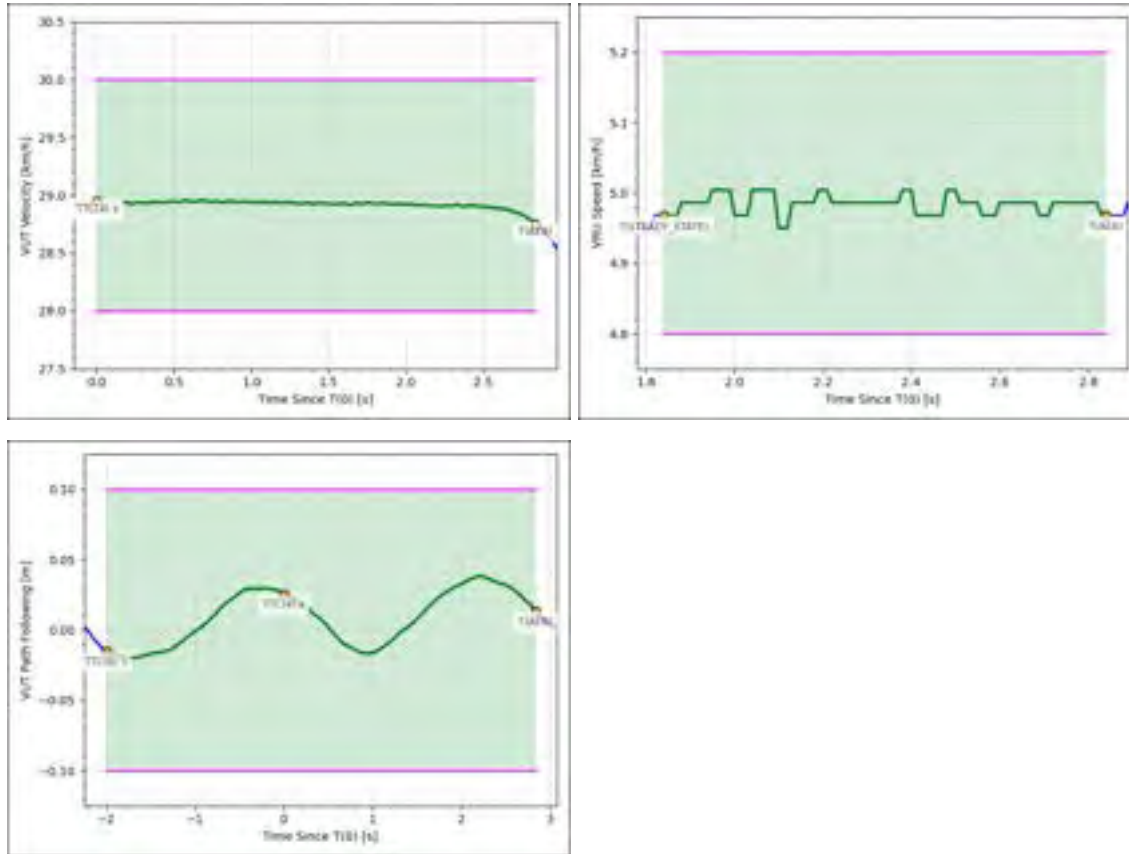
Run Date / Time 15-Feb-2023 14:57



J.2.2.3. CPNC-50 VUT 30kph EPT 5kph (Day)

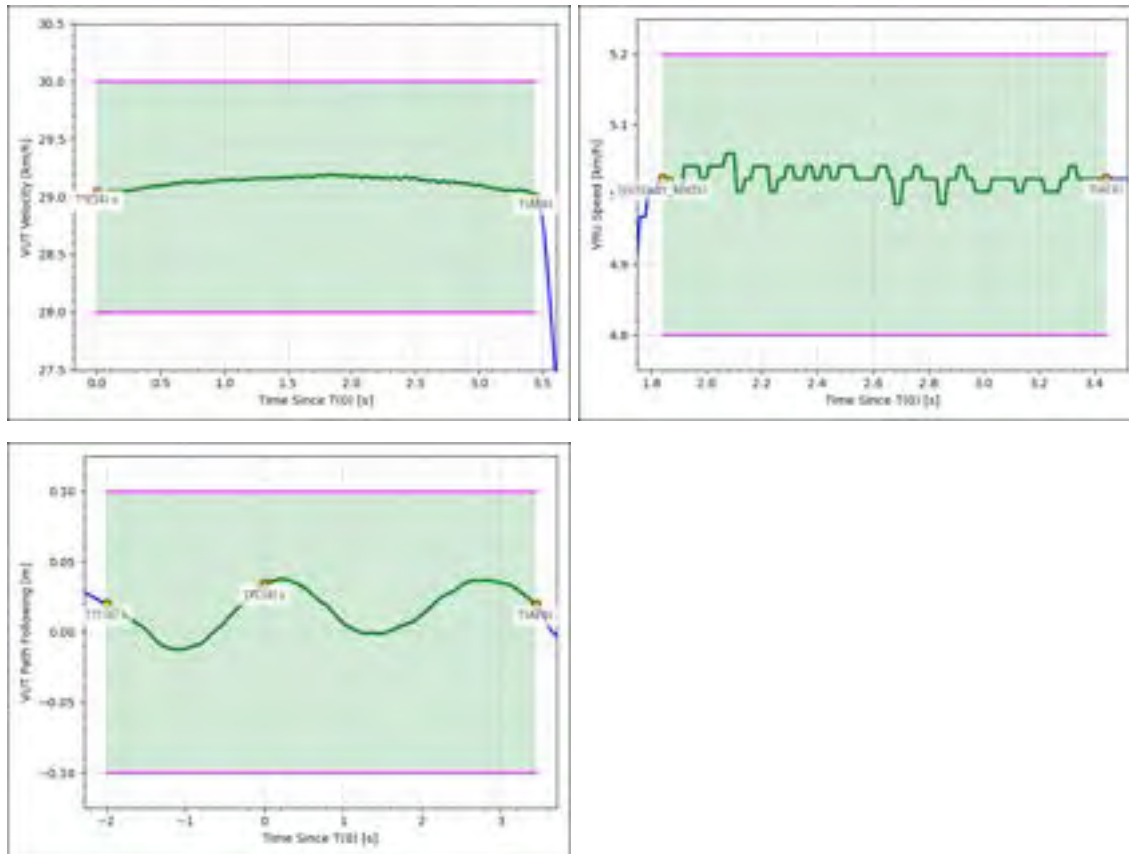
CPNC-50 5 kph (Day) | 30 km/h | Run 6

Run Date / Time 15-Feb-2023 15:15



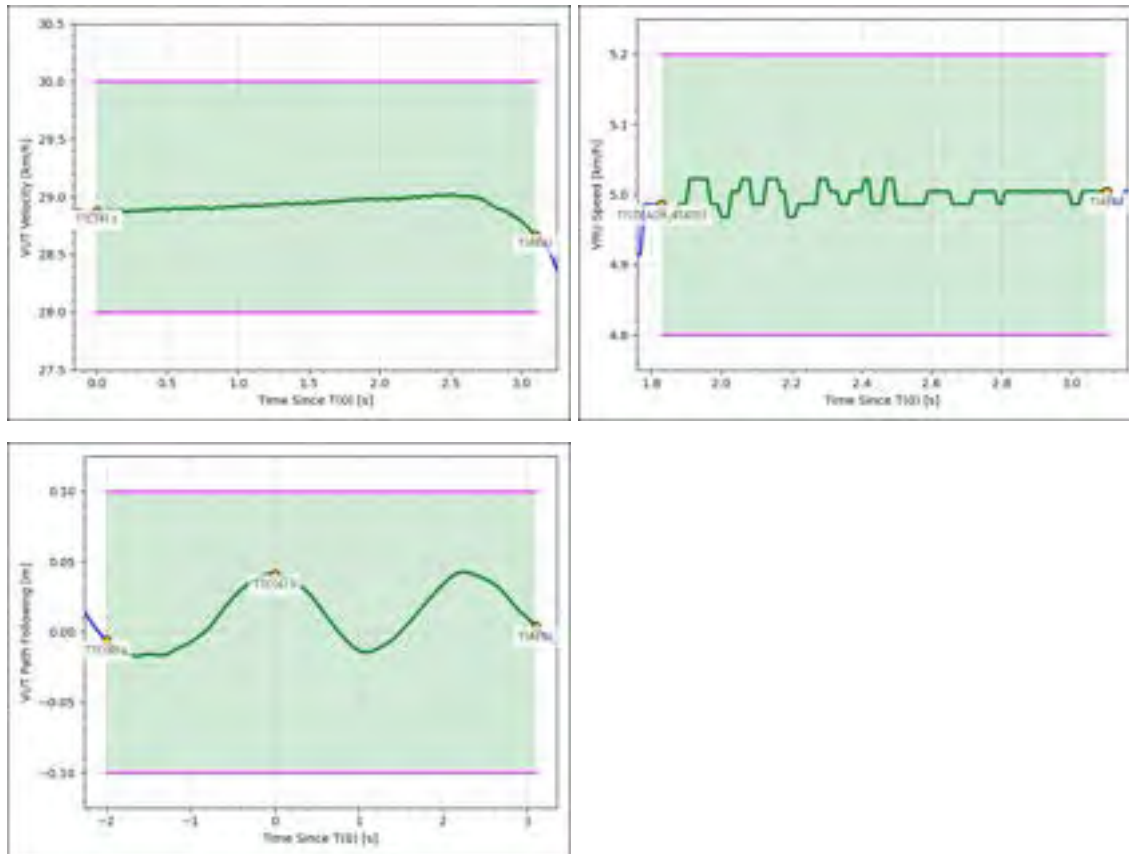
CPNC-50 5 kph (Day) | 30 km/h | Run 7

Run Date / Time 15-Feb-2023 15:18



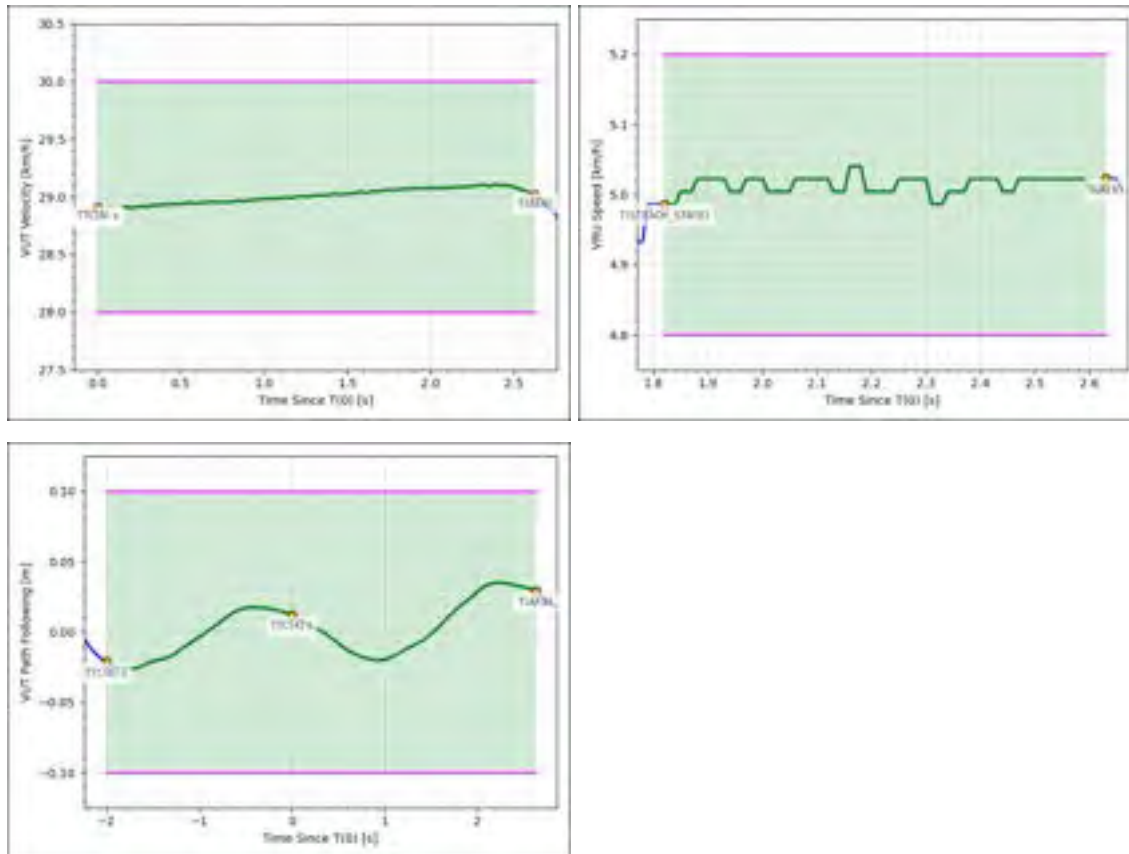
CPNC-50 5 kph (Day) | 30 km/h | Run 8

Run Date / Time 15-Feb-2023 15:25



CPNC-50 5 kph (Day) | 30 km/h | Run 9

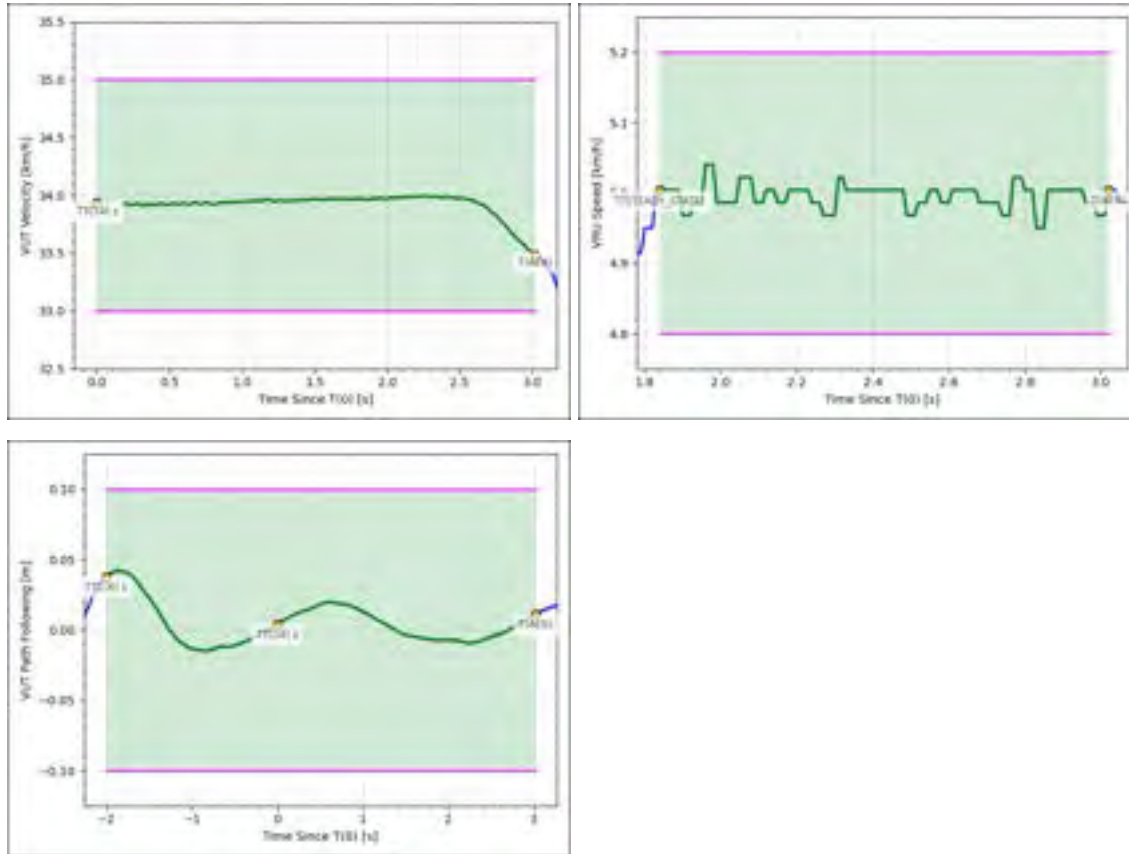
Run Date / Time 15-Feb-2023 15:29



J.2.2.4. CPNC-50 VUT 35kph EPT 5kph (Day)

CPNC-50 5 kph (Day) | 35 km/h | Run 1

Run Date / Time 16-Feb-2023 09:25



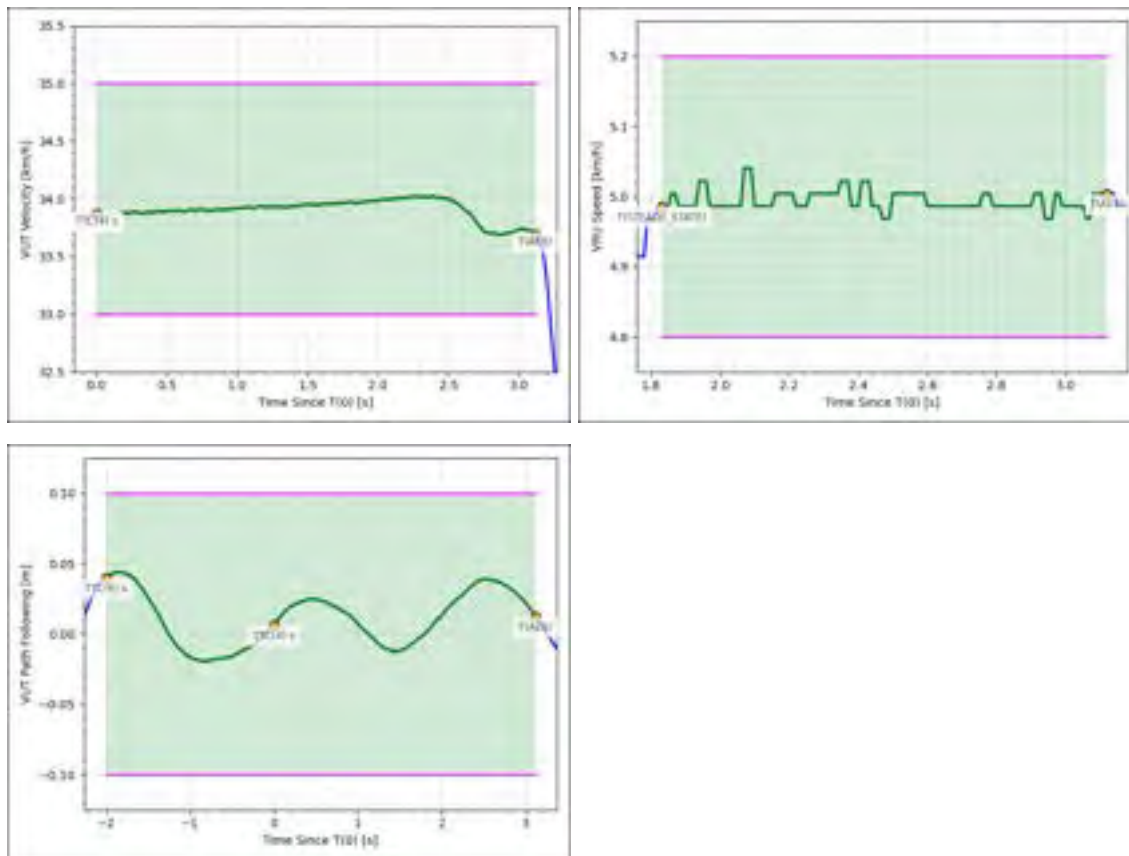
Run Date / Time 16-Feb-2023 09:30

The figure consists of three subplots arranged in a 2x2 grid, with the bottom-right cell empty. All plots share a common x-axis: 'Time Since T100 [s]'.

- Top-left plot:** The y-axis is 'VLT Velocity [km/s]' ranging from 32.5 to 35.5. The data (green line) starts at 34.0 km/s at T100 (0s) and increases slightly to approximately 34.2 km/s by T140 (2.5s). The plot is bounded by purple lines at approximately 33.0 and 35.0 km/s.
- Top-right plot:** The y-axis is 'VLT Speed [km/s]' ranging from 4.8 to 5.2. The data (green line) starts at 5.0 km/s at T100 (1.8s) and fluctuates between 4.8 and 5.2 km/s until T140 (2.6s). The plot is bounded by purple lines at approximately 4.8 and 5.2 km/s.
- Bottom plot:** The y-axis is 'VLT Path Following [m]' ranging from -0.10 to 0.10. The data (green line) shows a sinusoidal oscillation between approximately -0.02 m and 0.02 m from T100 (-2s) to T140 (2s). The plot is bounded by purple lines at approximately -0.10 and 0.10 m.

CPNC-50 5 kph (Day) | 35 km/h | Run 3

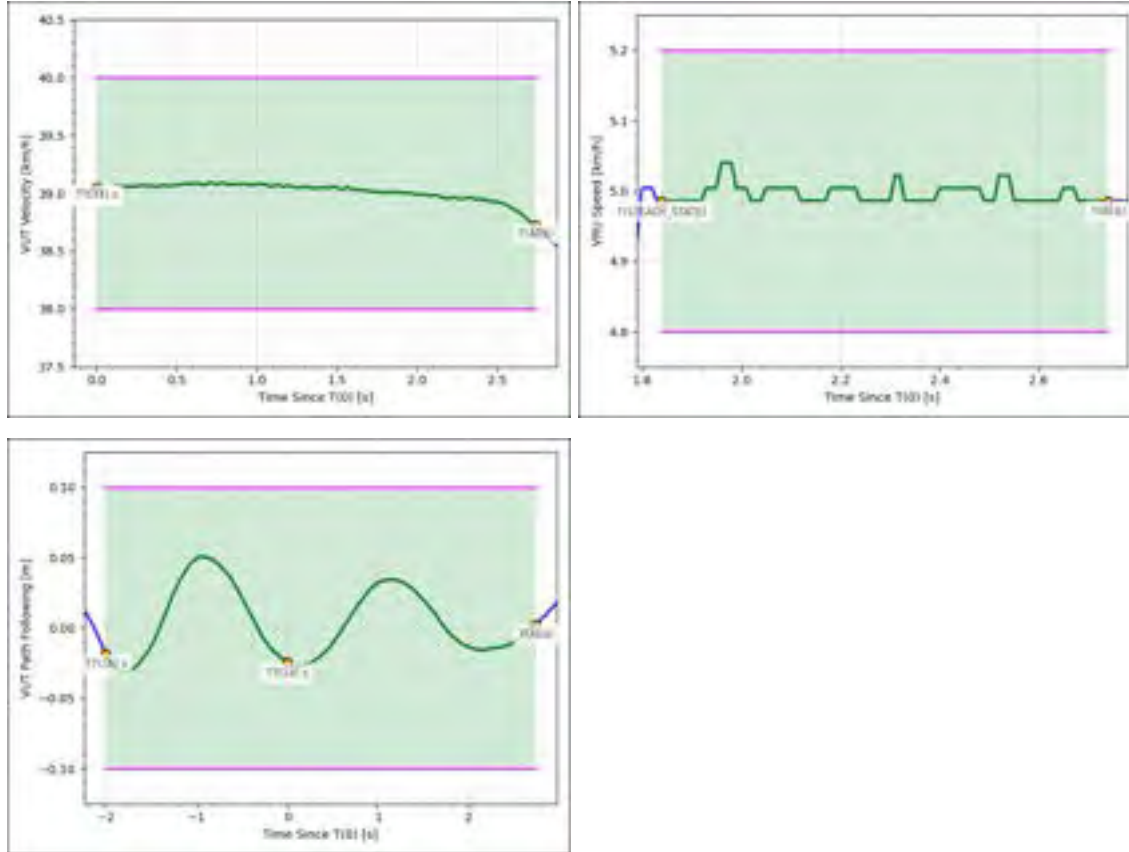
Run Date / Time 16-Feb-2023 09:37



J.2.2.5. CPNC-50 VUT 40kph EPT 5kph (Day)

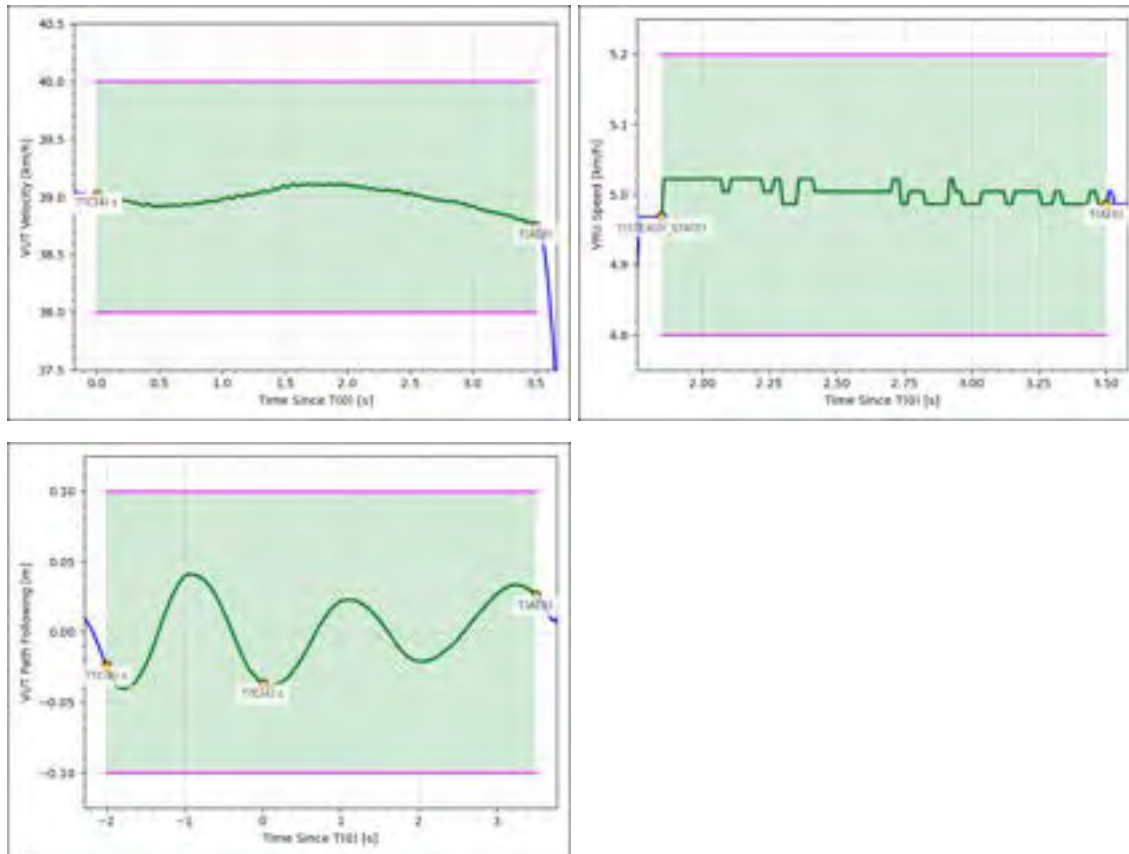
CPNC-50 5 kph (Day) | 40 km/h | Run 8

Run Date / Time 15-Feb-2023 15:34



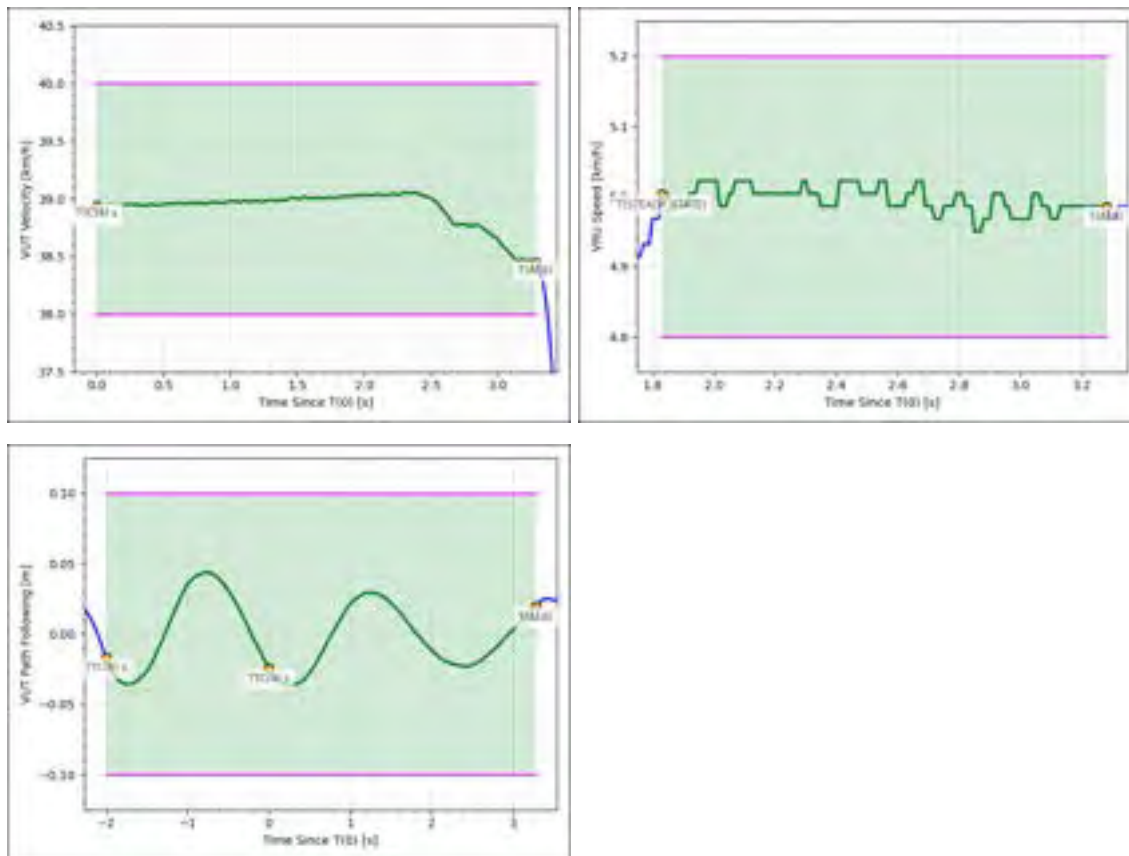
CPNC-50 5 kph (Day) | 40 km/h | Run 9

Run Date / Time 15-Feb-2023 15:38



CPNC-50 5 kph (Day) | 40 km/h | Run 10

Run Date / Time 15-Feb-2023 15:45

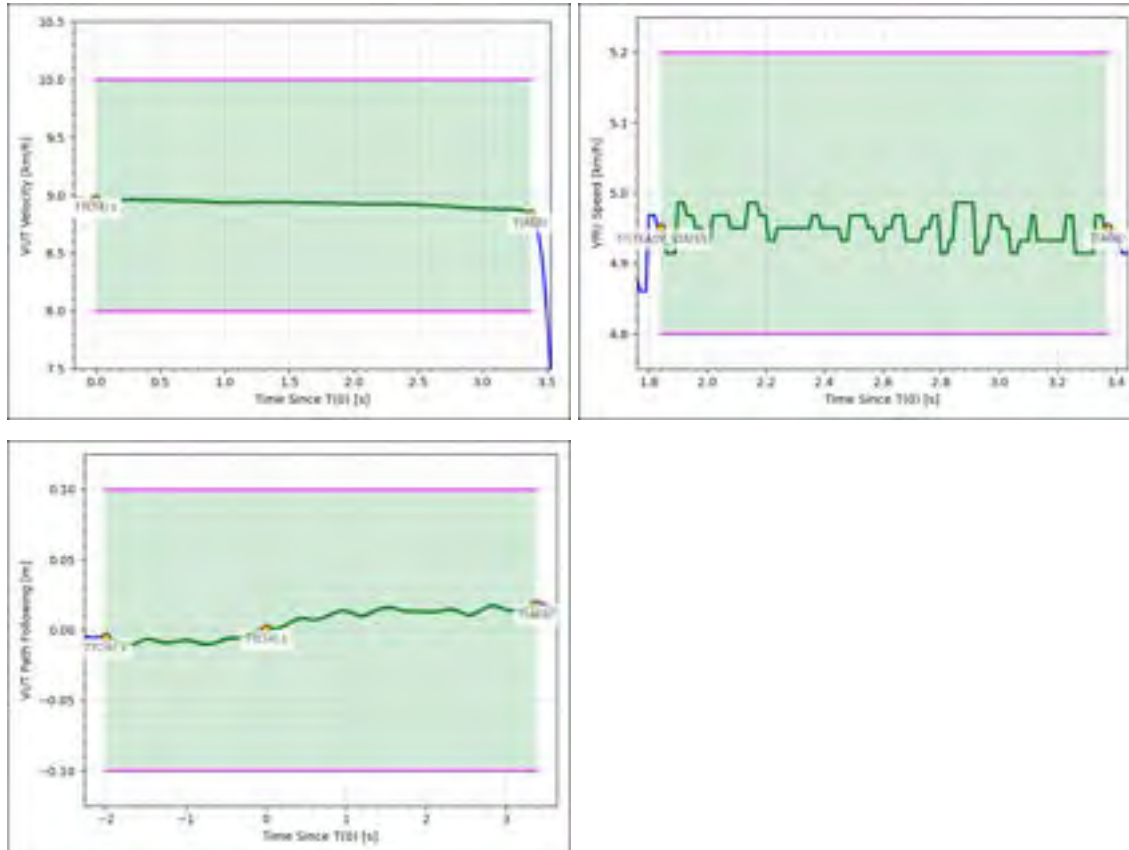


J.2.1. Rear Pitch

J.2.1.1. CPNC-50 VUT 10kph EPT 5kph (Day)

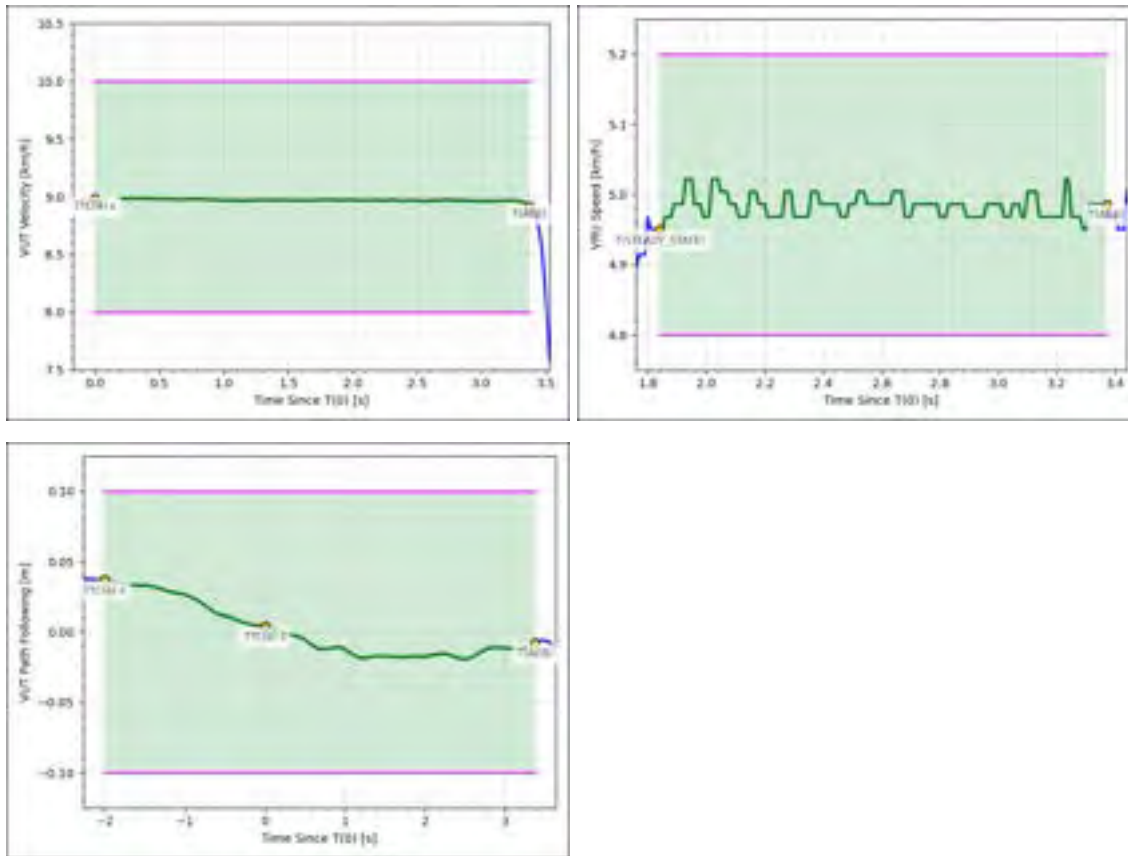
CPNC-50 5 kph (Day) | 10 km/h | Run 7

Run Date / Time 27-Feb-2023 14:04



CPNC-50 5 kph (Day) | 10 km/h | Run 8

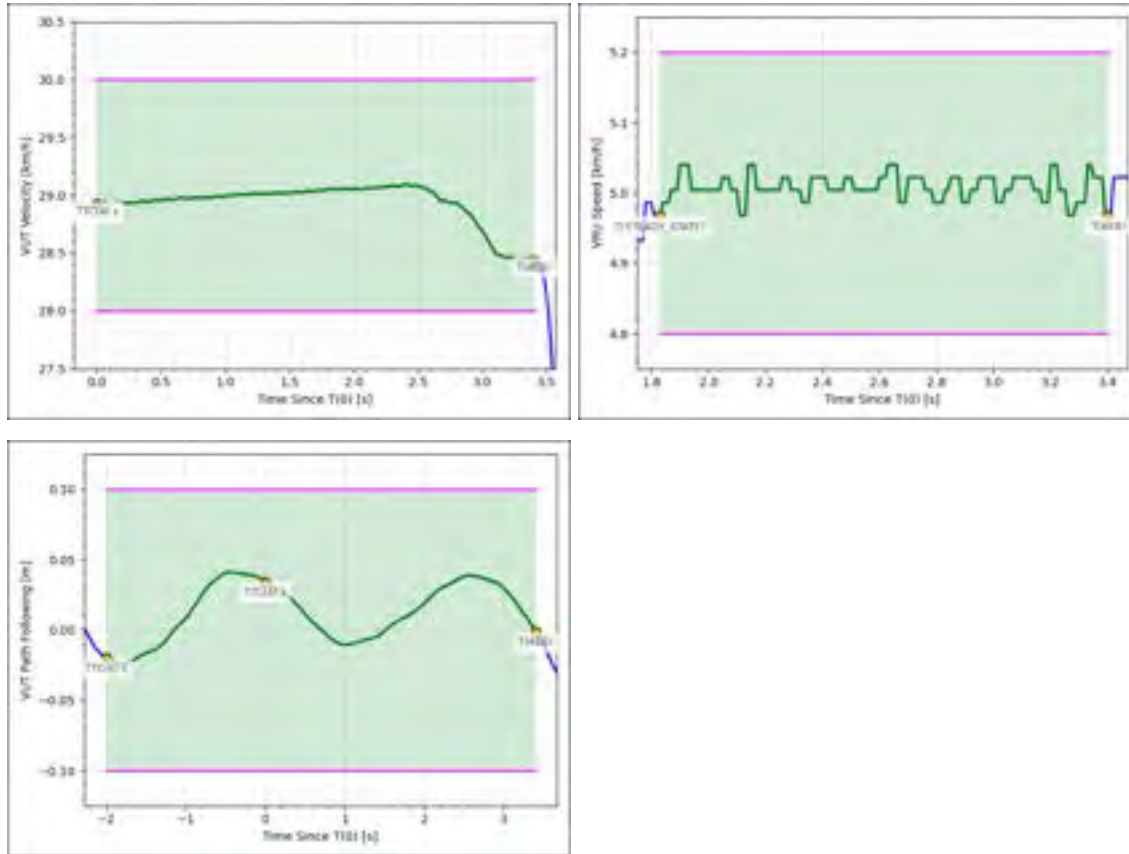
Run Date / Time 27-Feb-2023 14:08



J.2.1.2. CPNC-50 VUT 30kph EPT 5kph (Day)

CPNC-50 5 kph (Day) | 30 km/h | Run 10

Run Date / Time 27-Feb-2023 14:11



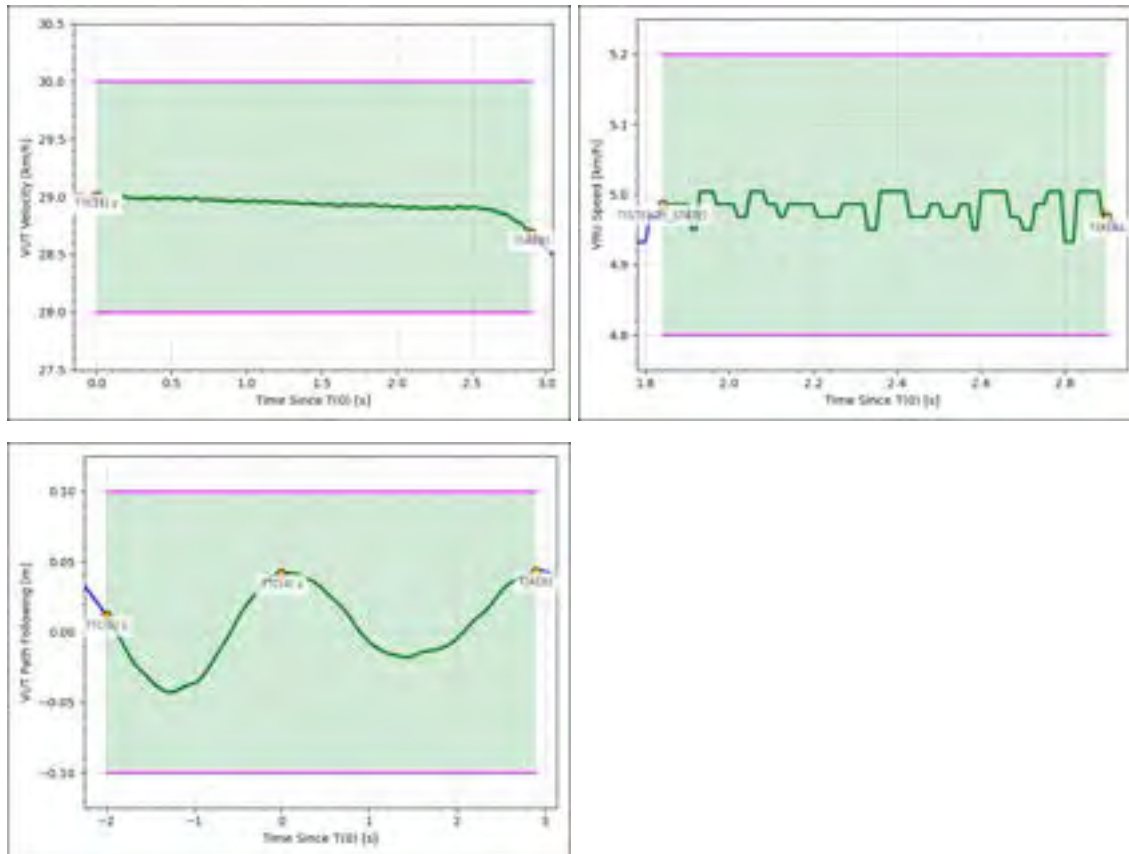
Run Date / Time 27-Feb-2023 14:16

The figure consists of three subplots arranged in a 2x2 grid, with the bottom-right cell empty. Each plot has a green shaded region representing a target range and a blue line representing the initial path.

- Top-left plot:** The y-axis is labeled "VUT Velocity [km/s]" and ranges from 27.5 to 30.5. The x-axis is labeled "Time Since T000 [s]" and ranges from 0.0 to 2.5. A green curve starts at approximately 29.0 km/s at $t=0$ and remains relatively flat, ending at approximately 28.8 km/s at $t=2.5$. The green shaded region is bounded by horizontal lines at approximately 28.5 km/s and 30.0 km/s.
- Top-right plot:** The y-axis is labeled "VUT Speed [km/s]" and ranges from 4.8 to 5.2. The x-axis is labeled "Time Since T000 [s]" and ranges from 2.0 to 2.8. A green curve starts at approximately 4.9 km/s at $t=2.0$ and fluctuates between 4.8 km/s and 5.0 km/s, ending at approximately 4.9 km/s at $t=2.8$. The green shaded region is bounded by horizontal lines at approximately 4.8 km/s and 5.2 km/s.
- Bottom-left plot:** The y-axis is labeled "VUT Path Following [m]" and ranges from -0.10 to 0.10. The x-axis is labeled "Time Since T000 [s]" and ranges from -2 to 3. A green curve starts at approximately -0.02 m at $t=-2$, peaks at approximately 0.04 m at $t=0$, and ends at approximately 0.02 m at $t=3$. The green shaded region is bounded by horizontal lines at approximately -0.10 m and 0.10 m.

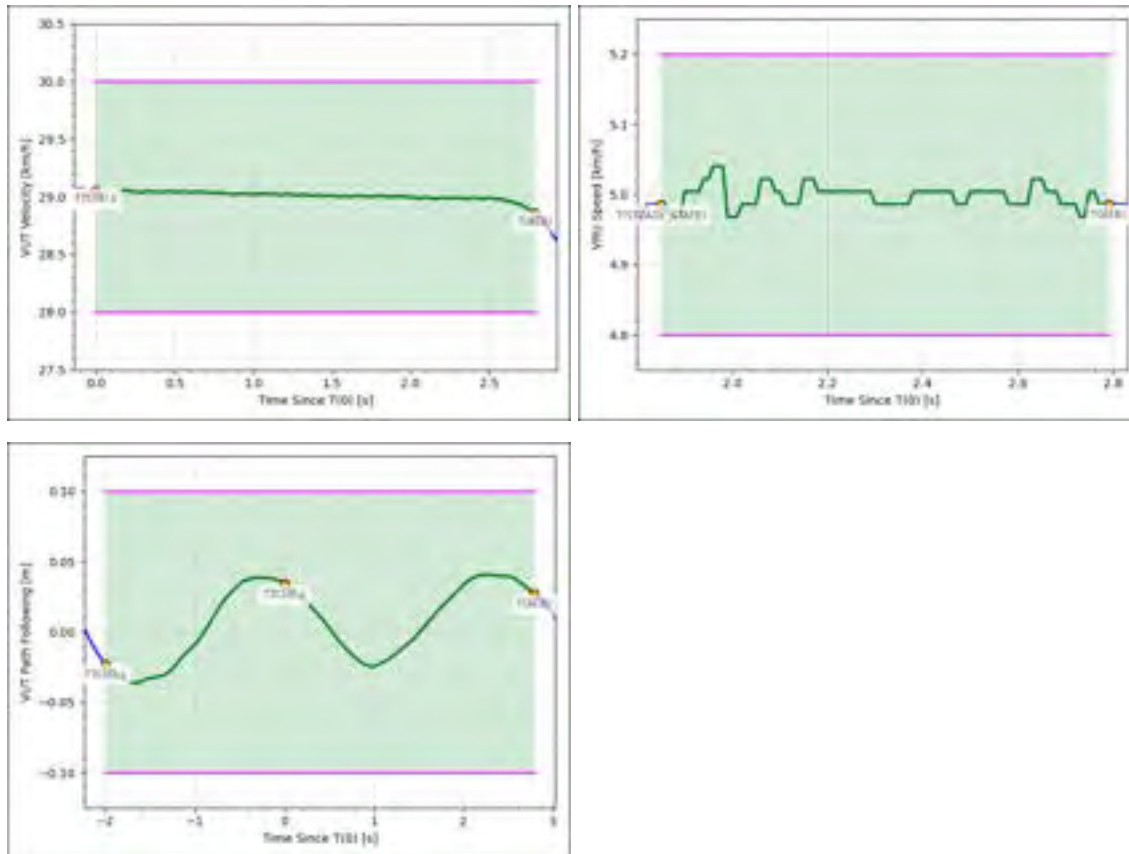
CPNC-50 5 kph (Day) | 30 km/h | Run 12

Run Date / Time 27-Feb-2023 14:19



CPNC-50 5 kph (Day) | 30 km/h | Run 13

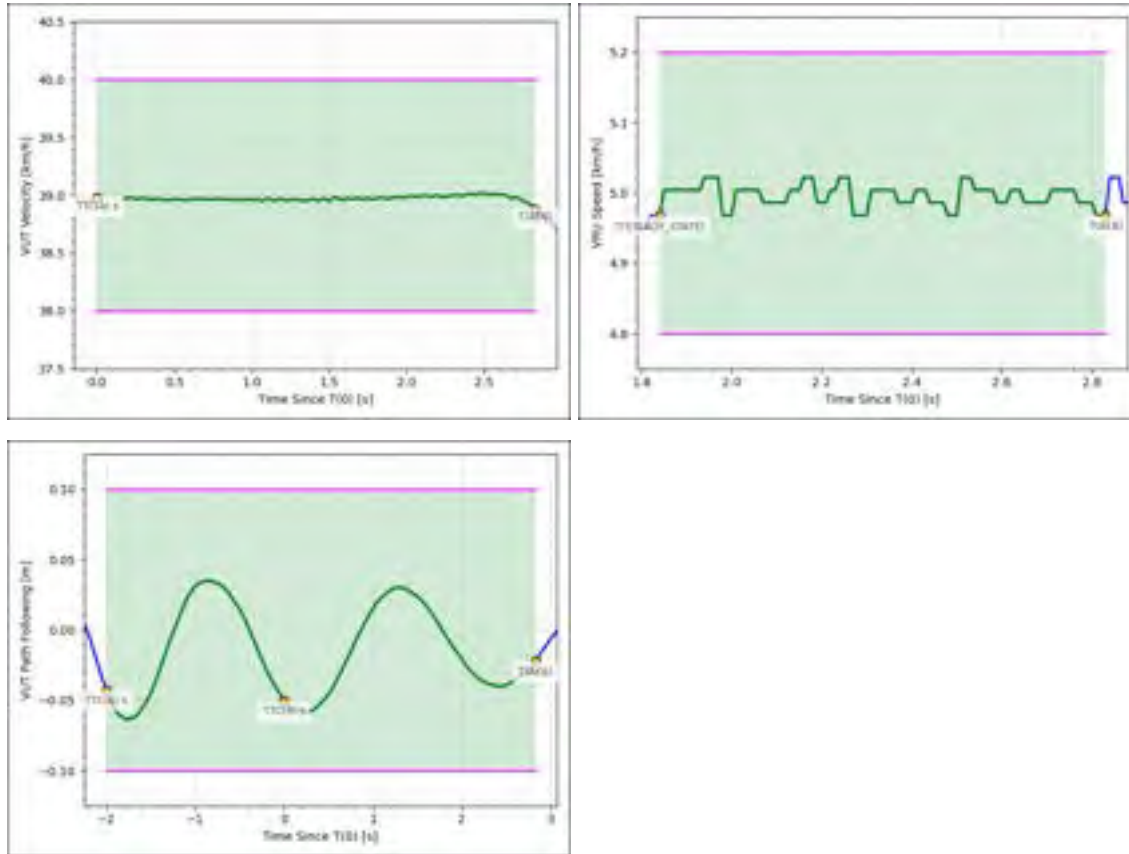
Run Date / Time 27-Feb-2023 14:25



J.2.1.3. CPNC-50 VUT 40kph EPT 5kph (Day)

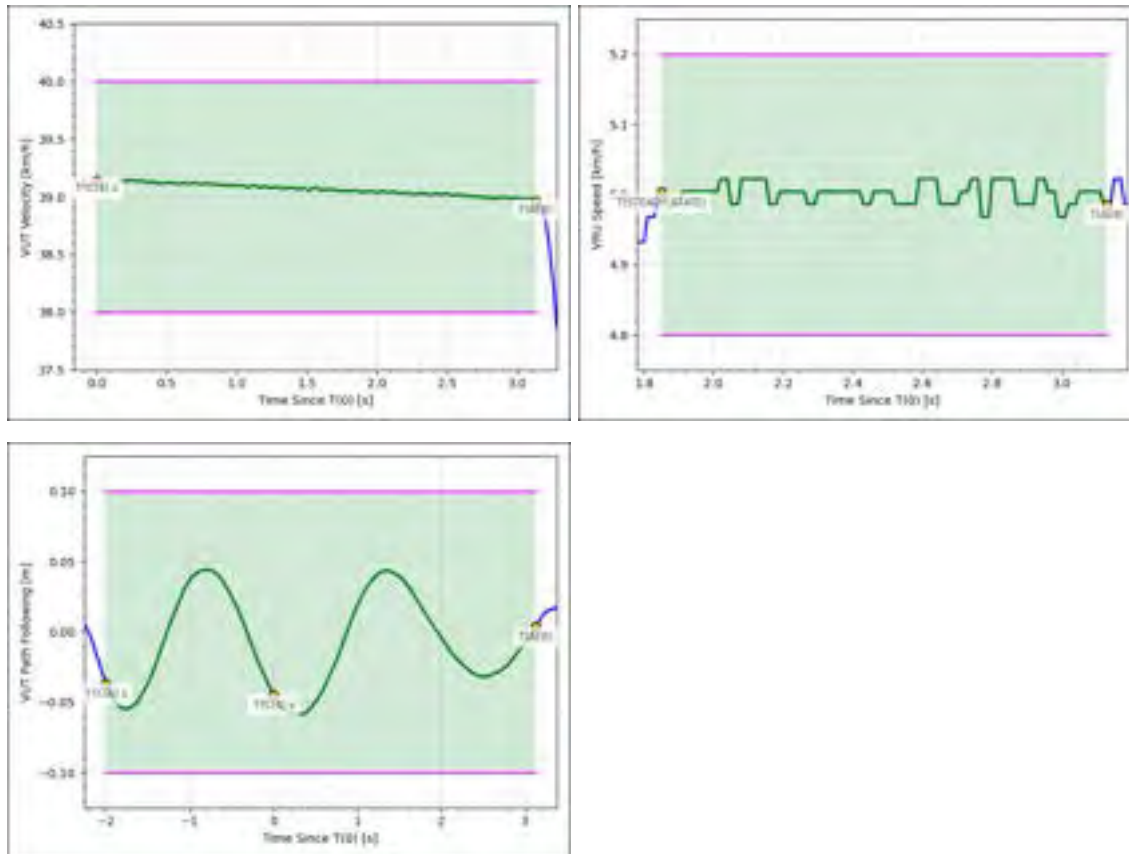
CPNC-50 5 kph (Day) | 40 km/h | Run 11

Run Date / Time 27-Feb-2023 15:32



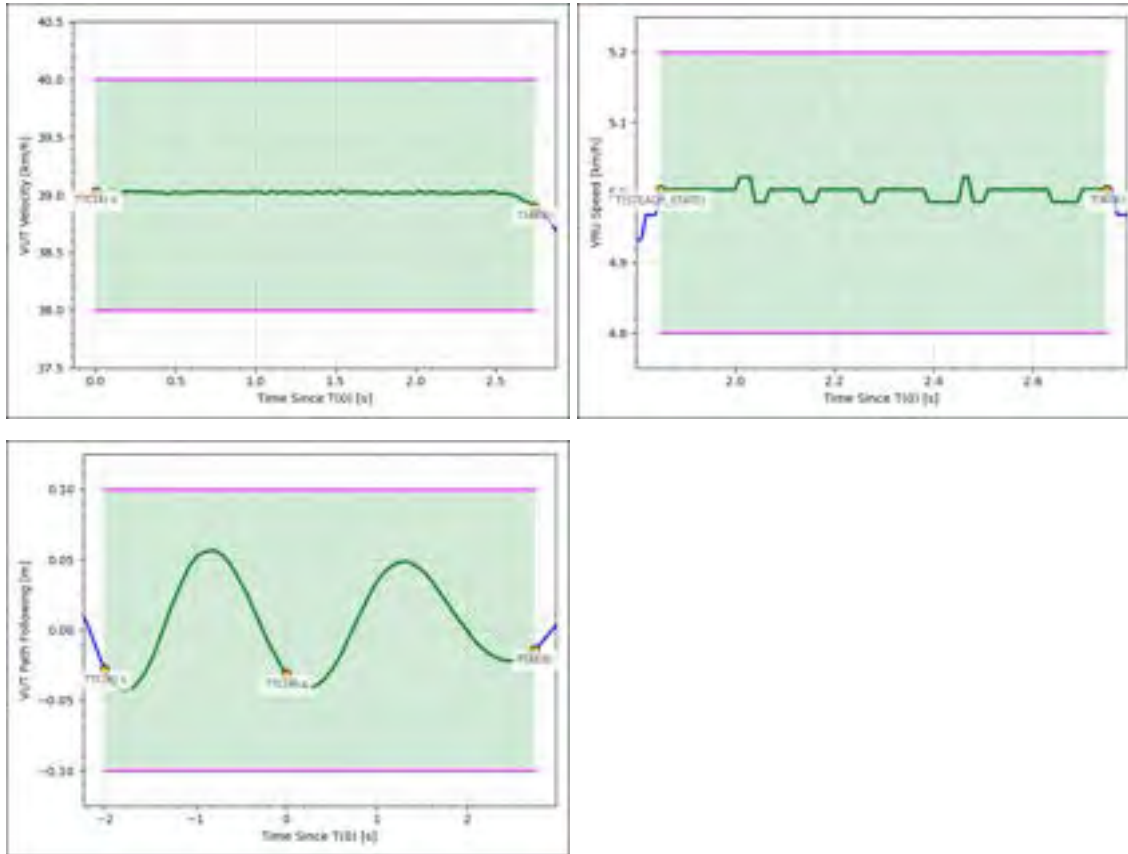
CPNC-50 5 kph (Day) | 40 km/h | Run 13

Run Date / Time 27-Feb-2023 15:38



CPNC-50 5 kph (Day) | 40 km/h | Run 14

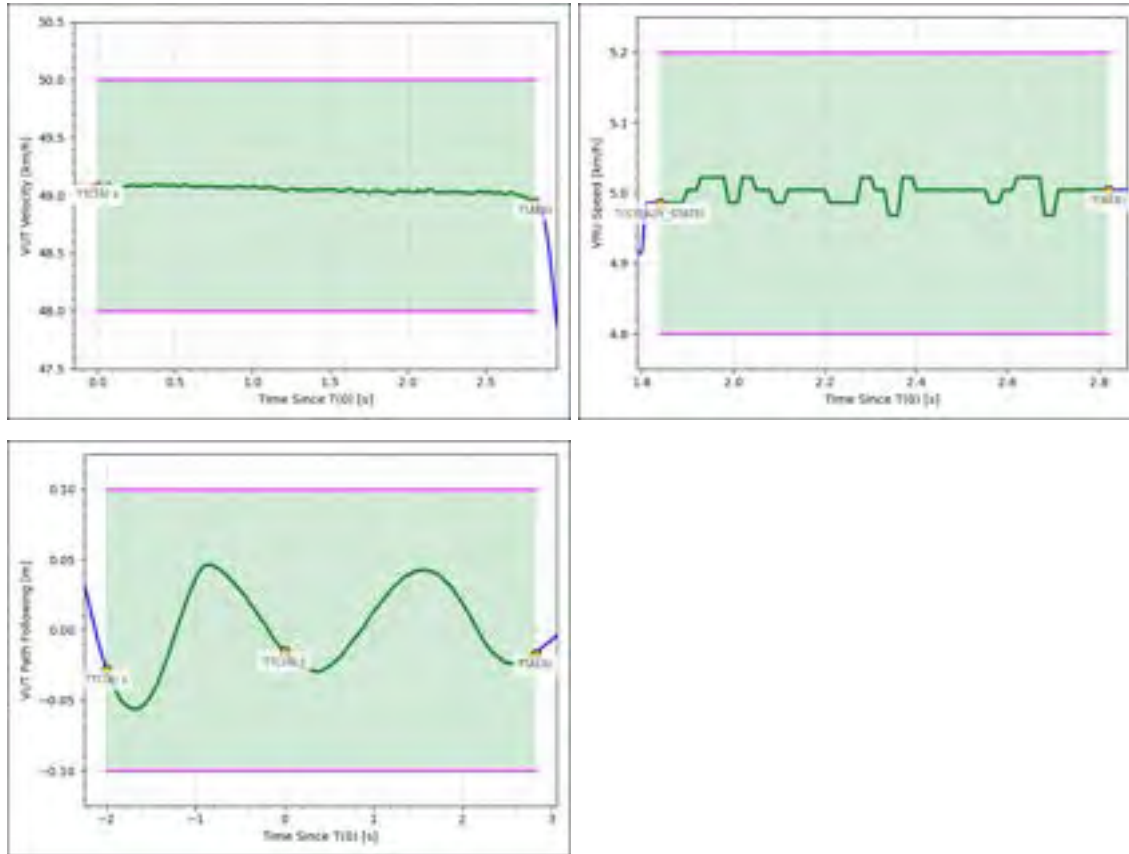
Run Date / Time 27-Feb-2023 15:44



J.2.1.4. CPNC-50 VUT 50kph EPT 5kph (Day)

CPNC-50 5 kph (Day) | 50 km/h | Run 4

Run Date / Time 27-Feb-2023 14:31

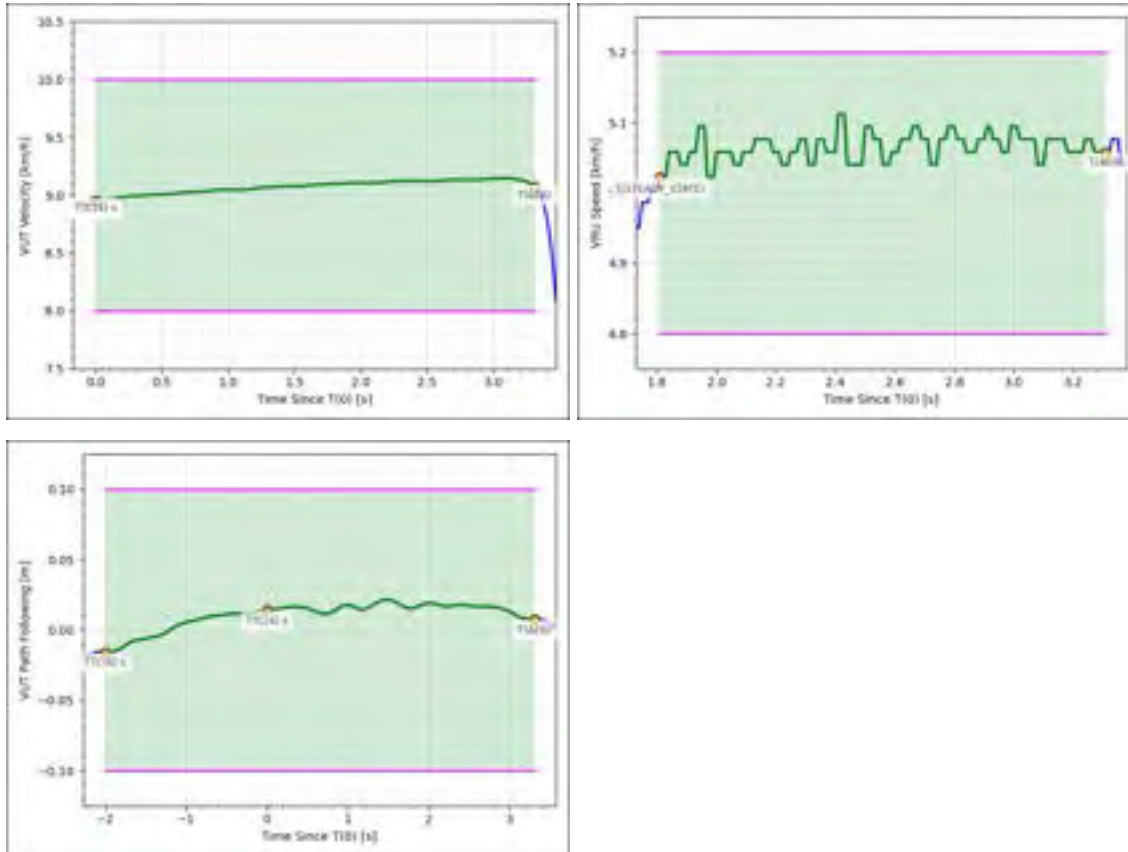


J.2.1. Lift Kit

J.2.1.1. CPNC-50 VUT 10kph EPT 5kph (Day)

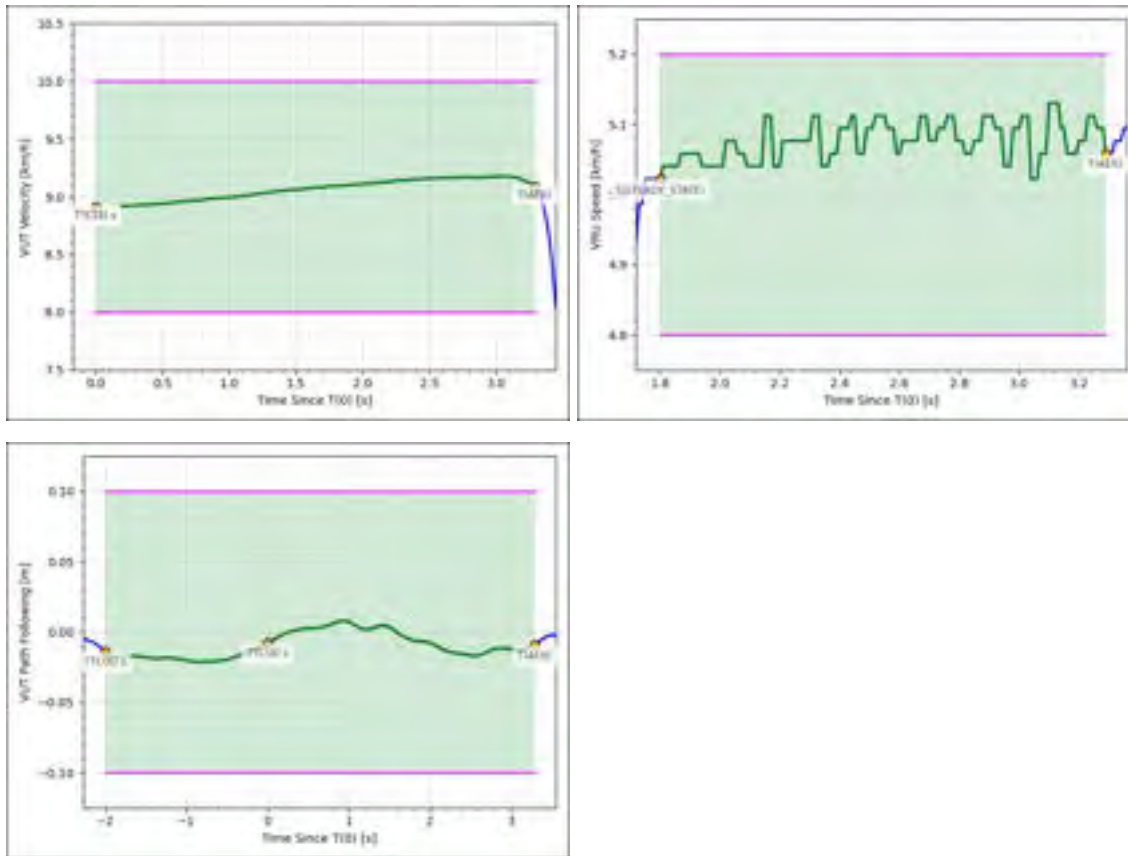
CPNC-50 5 kph (Day) | 10 km/h | Run 9

Run Date / Time 14-Mar-2023 09:20



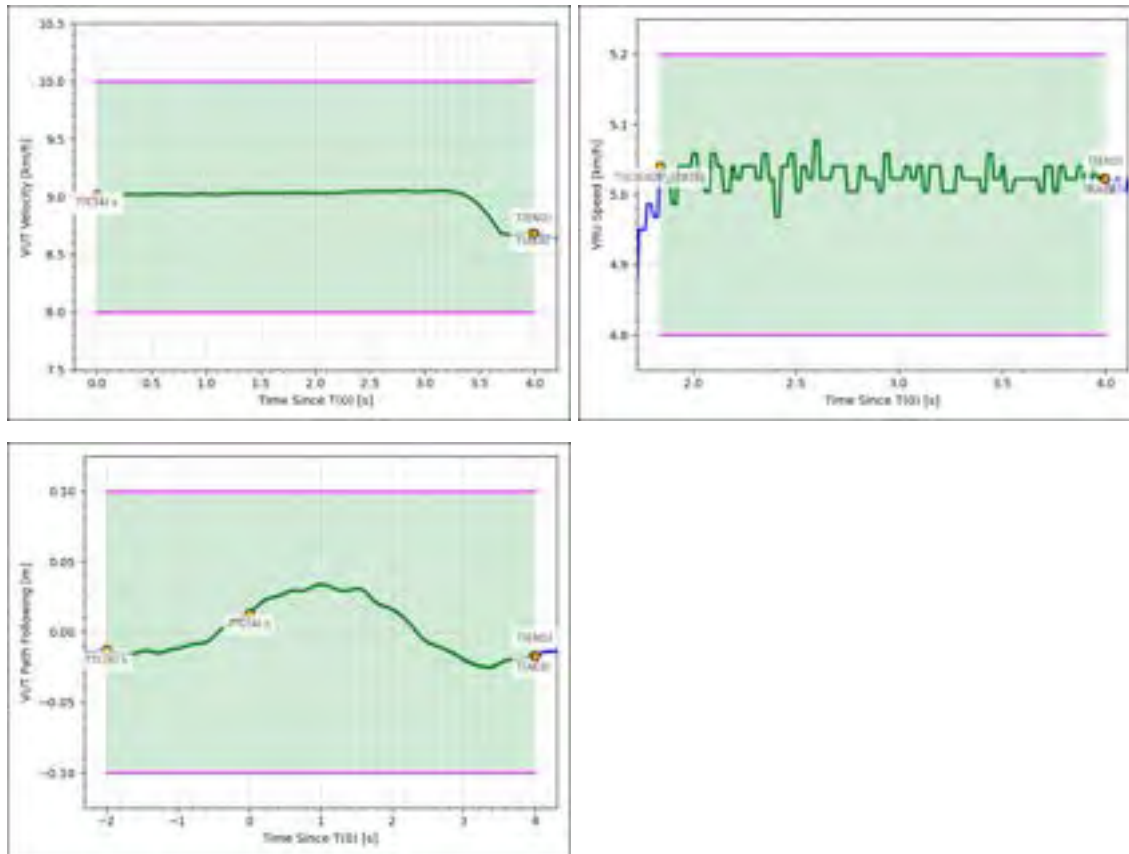
CPNC-50 5 kph (Day) | 10 km/h | Run 11

Run Date / Time 14-Mar-2023 09:33



CPNC-50 5 kph (Day) | 10 km/h | Run 12

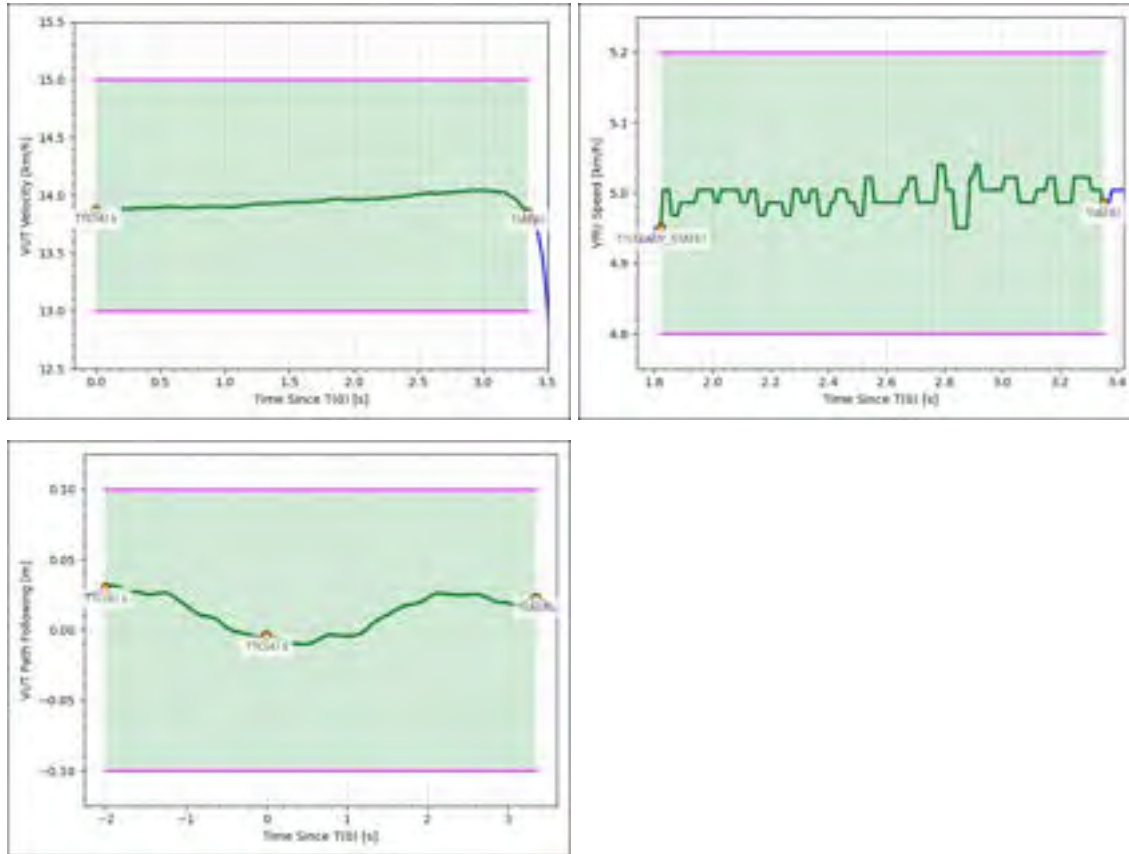
Run Date / Time 14-Mar-2023 09:40



J.2.1.2. CPNC-50 VUT 15kph EPT 5kph (Day)

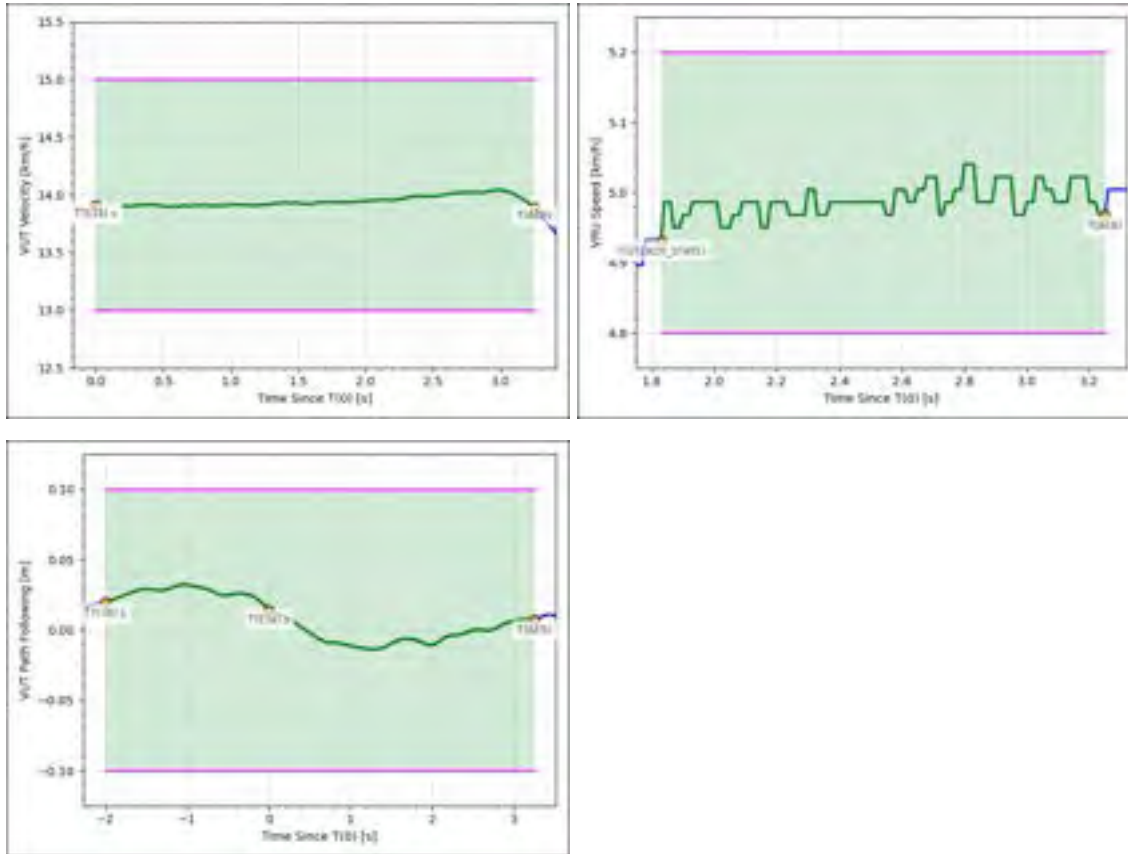
CPNC-50 5 kph (Day) | 15 km/h | Run 3

Run Date / Time 14-Mar-2023 09:47



CPNC-50 5 kph (Day) | 15 km/h | Run 4

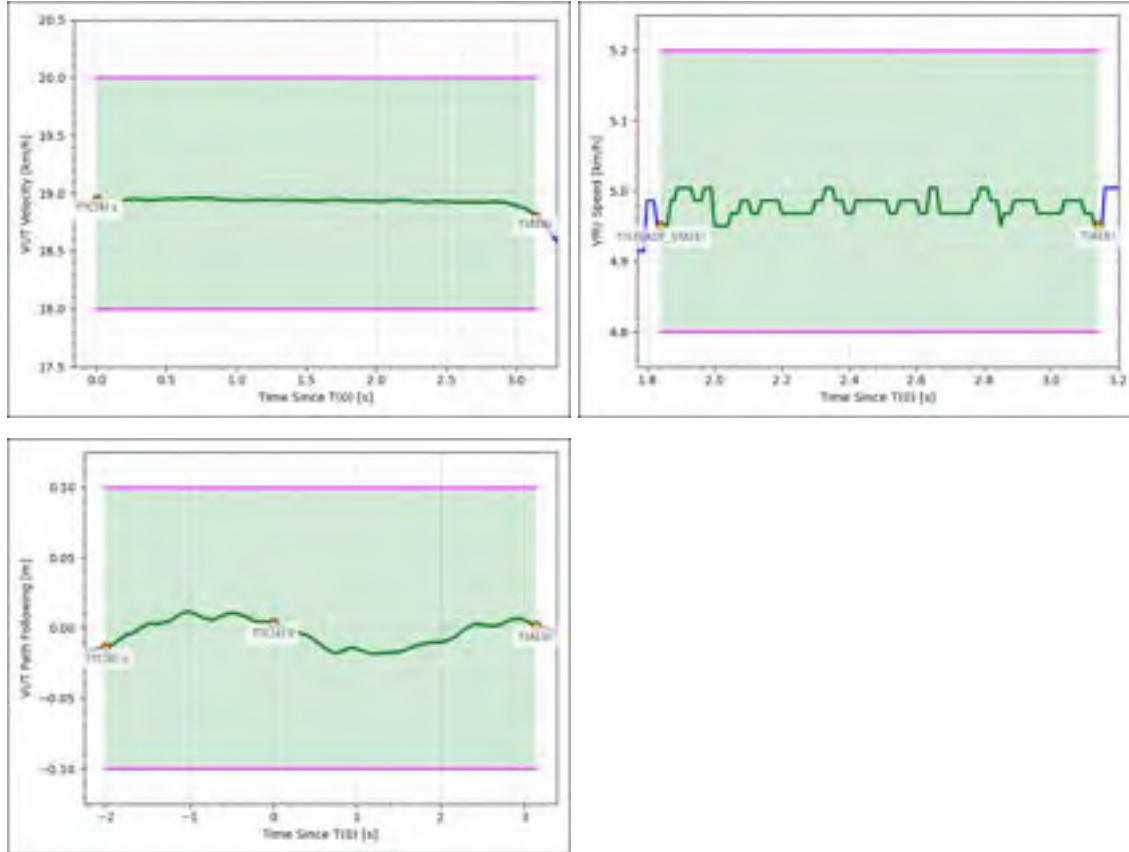
Run Date / Time 14-Mar-2023 09:50



J.2.1.3. CPNC-50 VUT 20kph EPT 5kph (Day)

CPNC-50 5 kph (Day) | 20 km/h | Run 9

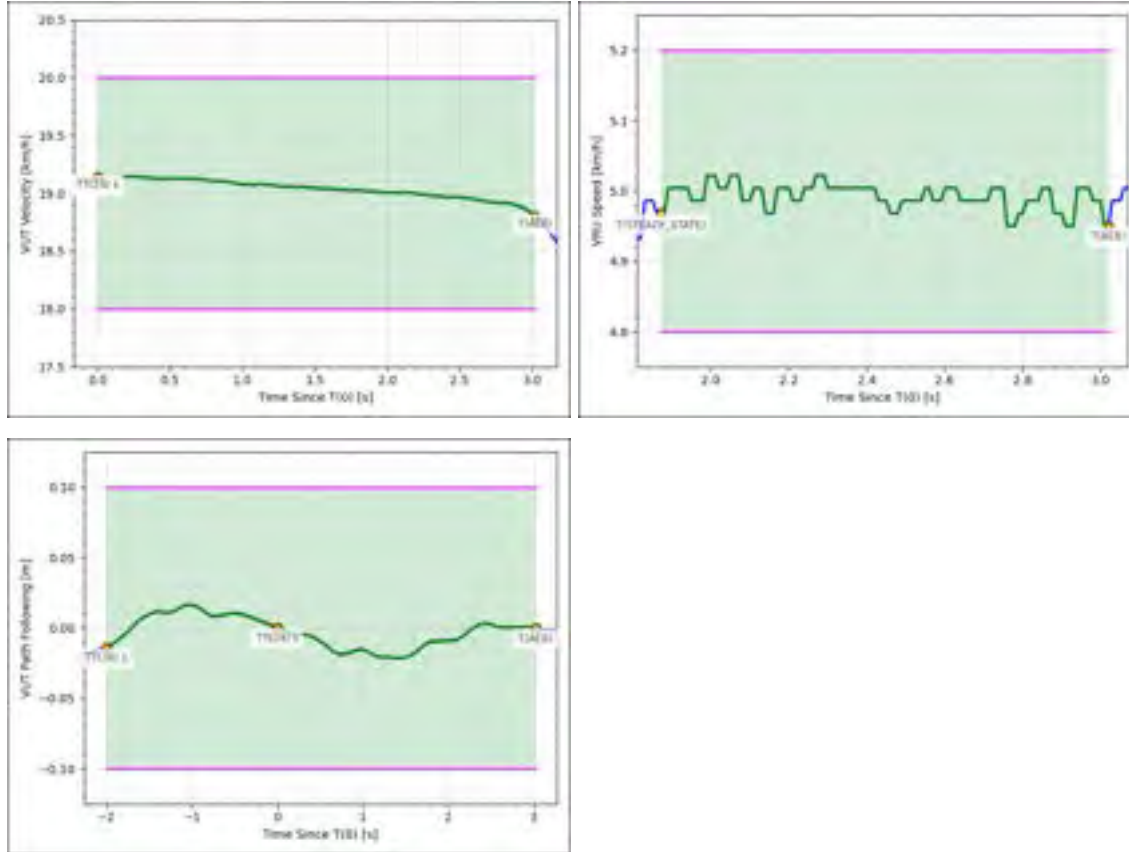
Run Date / Time 14-Mar-2023 09:55



A.1.1.1. CPNC-50 VUT 20kph EPT 5kph (Day)

CPNC-50 5 kph (Day) | 20 km/h | Run 10

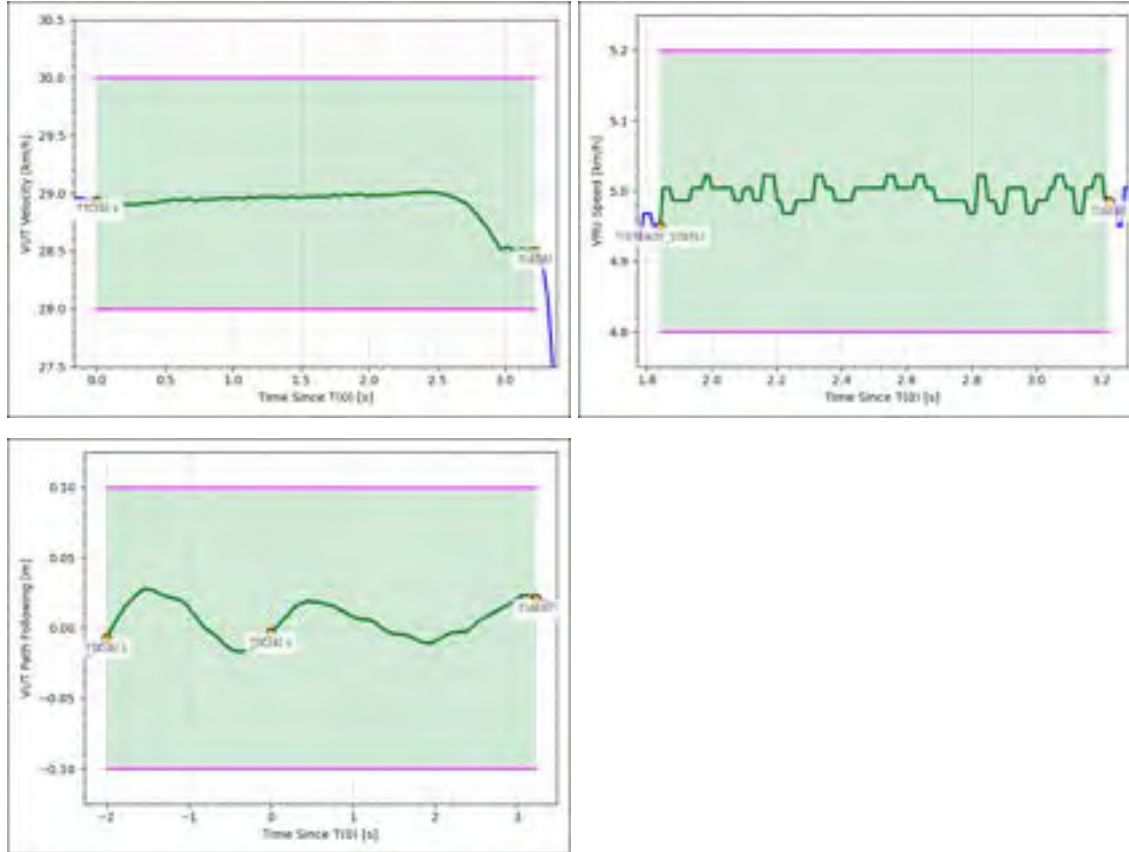
Run Date / Time 14-Mar-2023 09:57



J.2.1.4. CPNC-50 VUT 30kph EPT 5kph (Day)

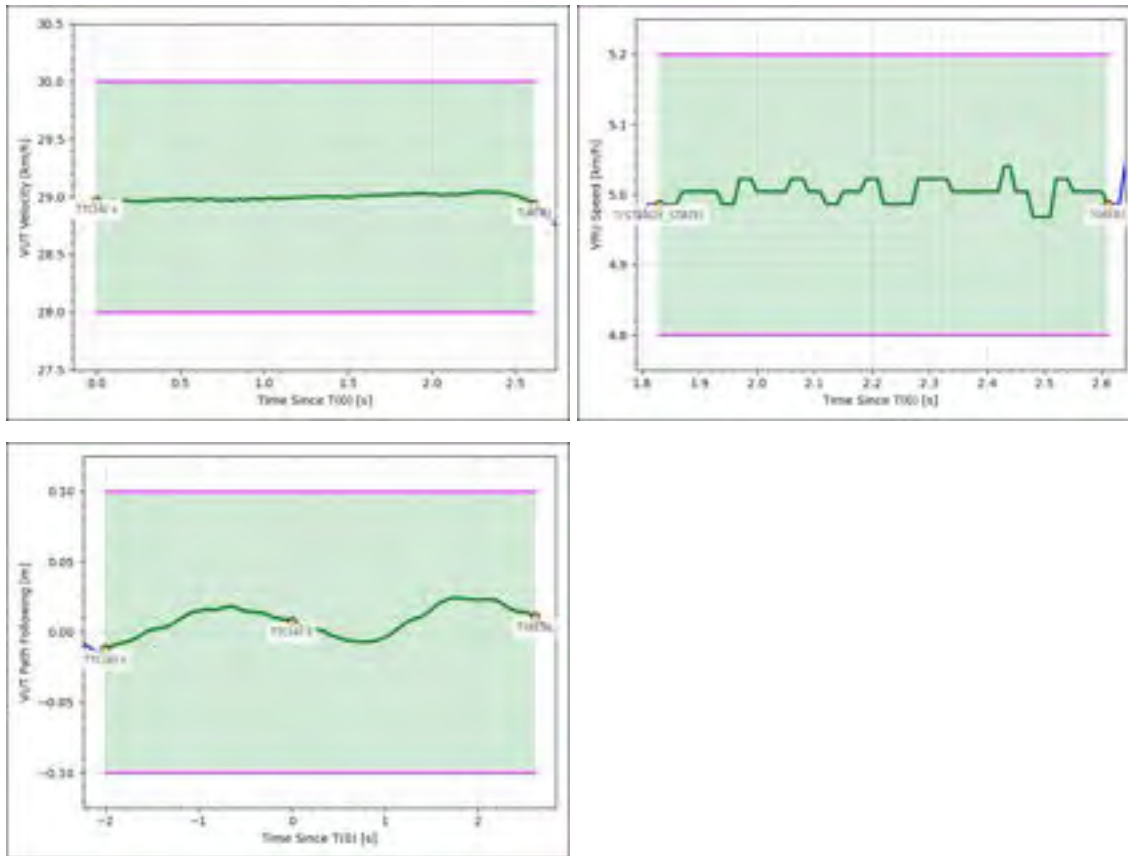
CPNC-50 5 kph (Day) | 30 km/h | Run 14

Run Date / Time 14-Mar-2023 10:01



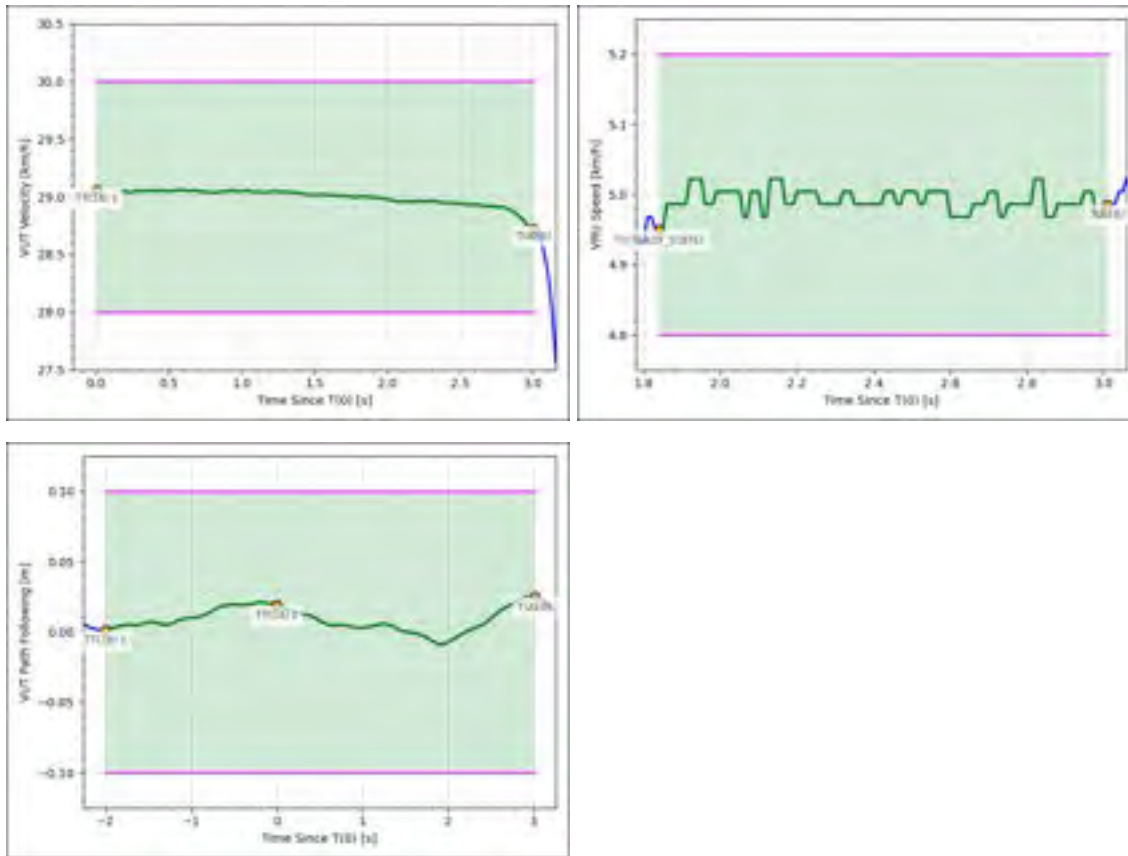
CPNC-50 5 kph (Day) | 30 km/h | Run 15

Run Date / Time 14-Mar-2023 10:05



CPNC-50 5 kph (Day) | 30 km/h | Run 16

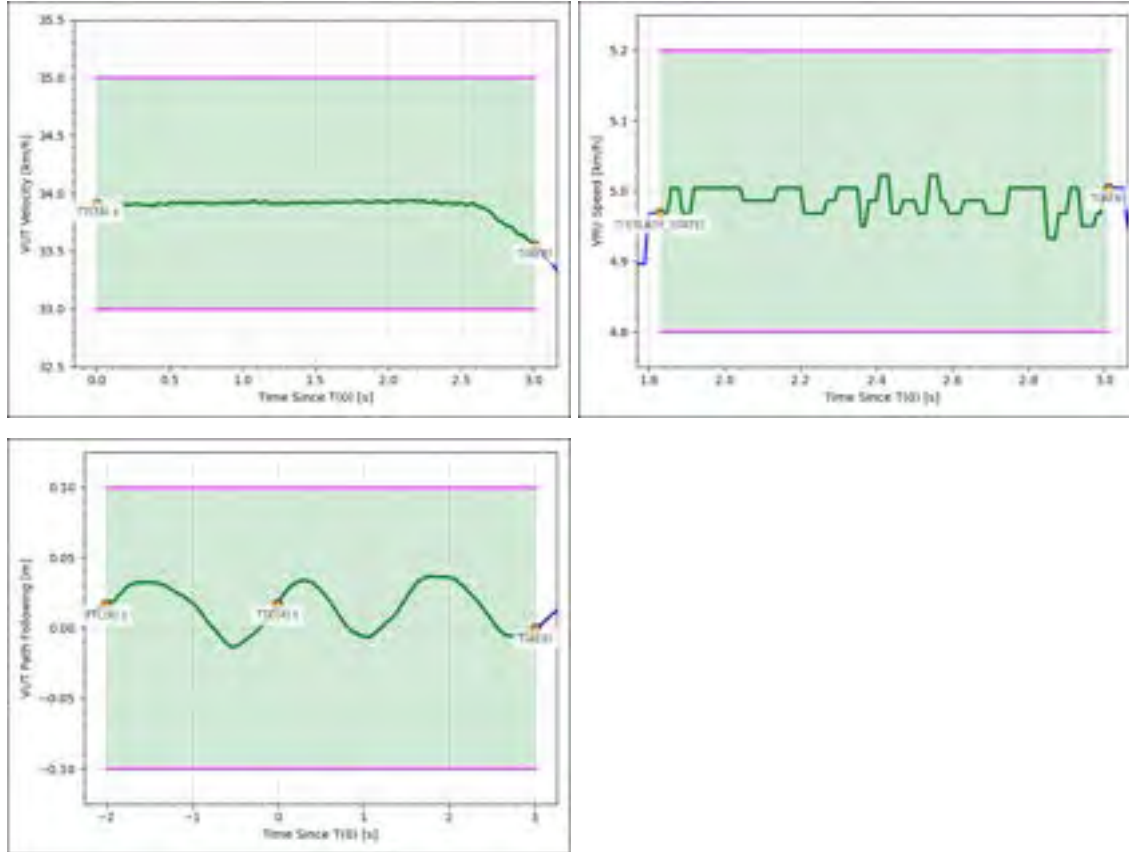
Run Date / Time 14-Mar-2023 10:08



J.2.1.5. CPNC-50 VUT 35kph EPT 5kph (Day)

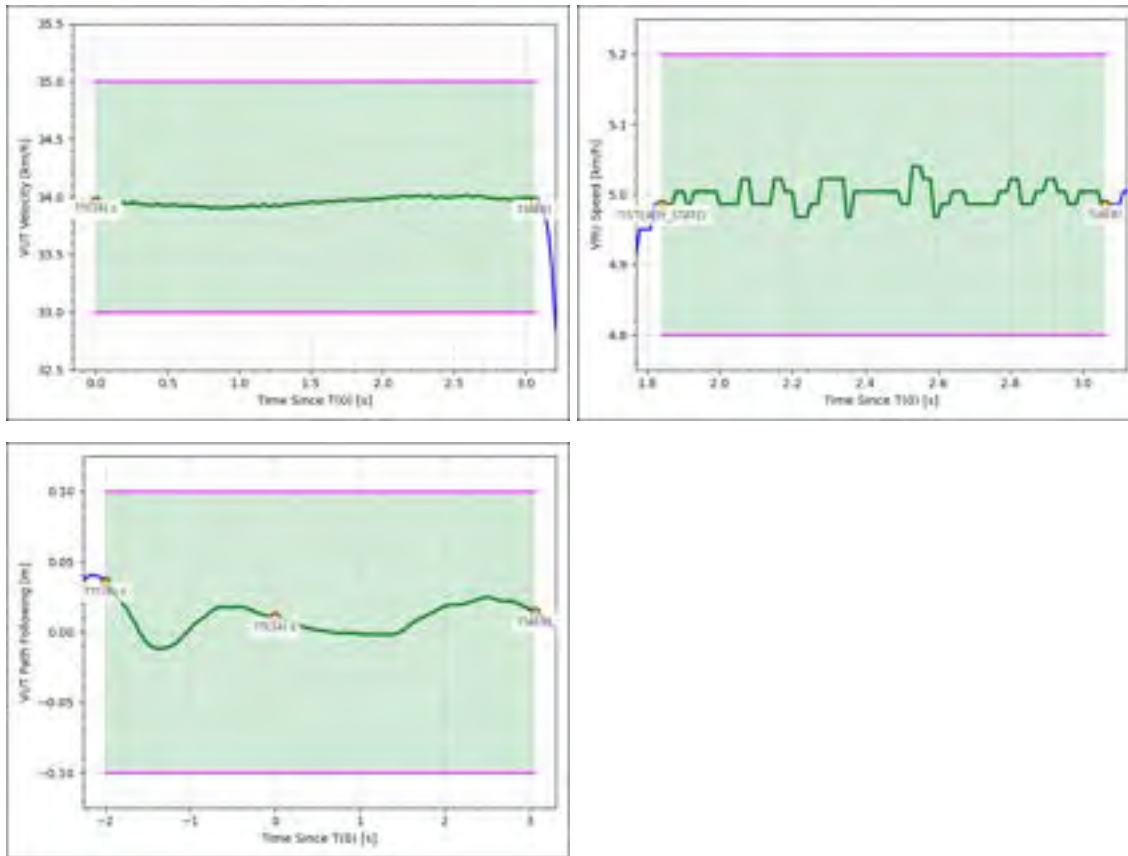
CPNC-50 5 kph (Day) | 35 km/h | Run 4

Run Date / Time 14-Mar-2023 11:00



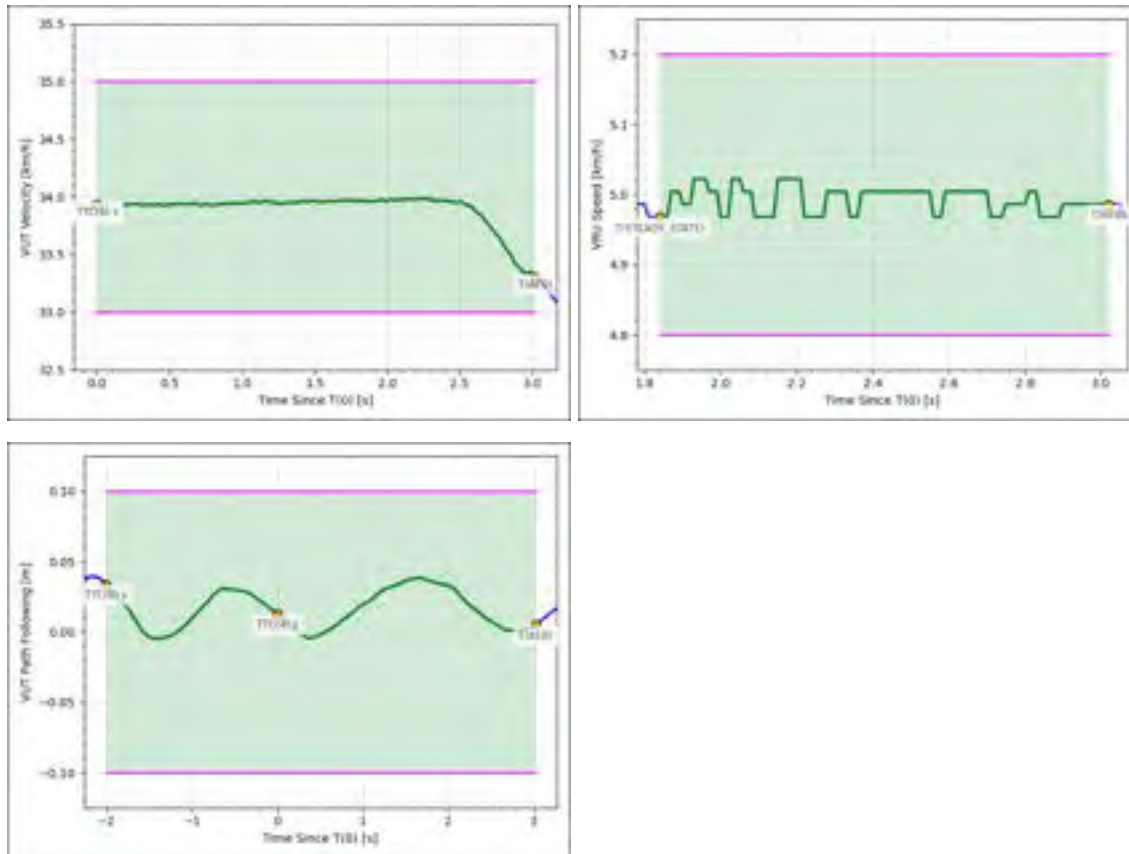
CPNC-50 5 kph (Day) | 35 km/h | Run 5

Run Date / Time 14-Mar-2023 11:05



CPNC-50 5 kph (Day) | 35 km/h | Run 6

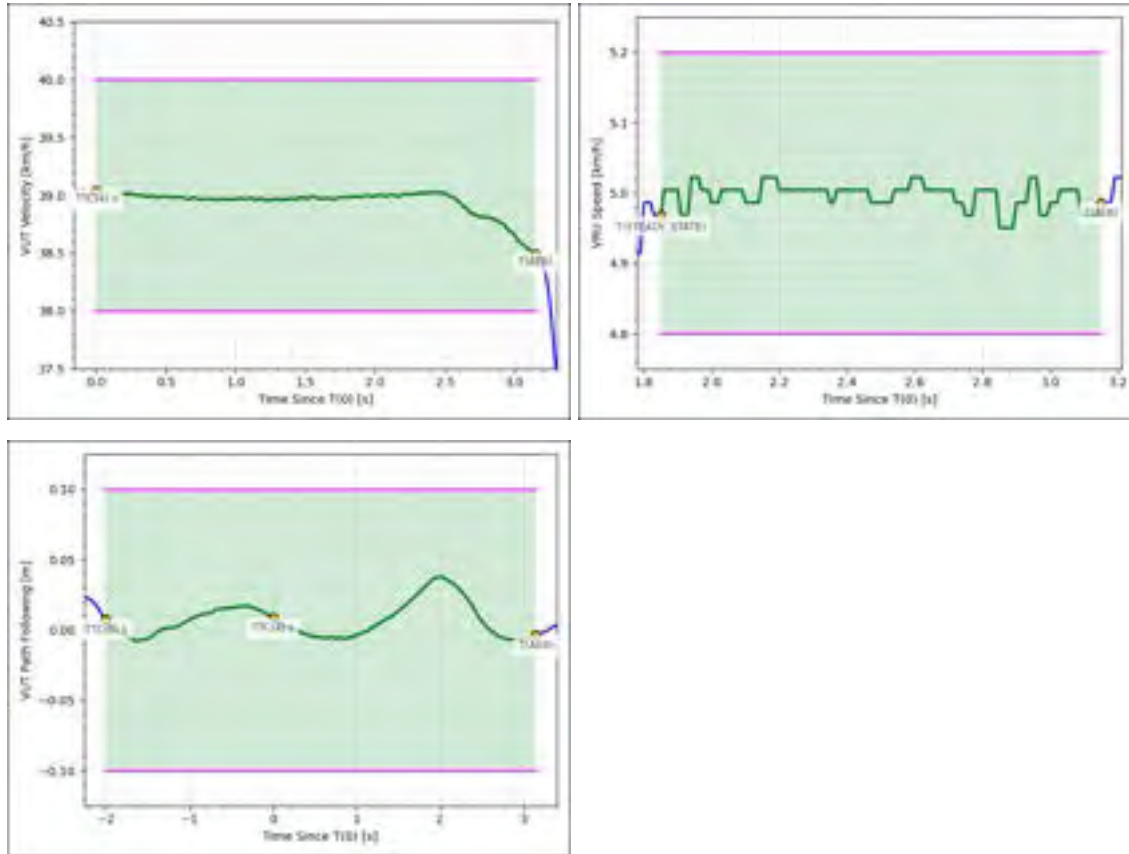
Run Date / Time 14-Mar-2023 11:08



J.2.1.6. CPNC-50 VUT 40kph EPT 5kph (Day)

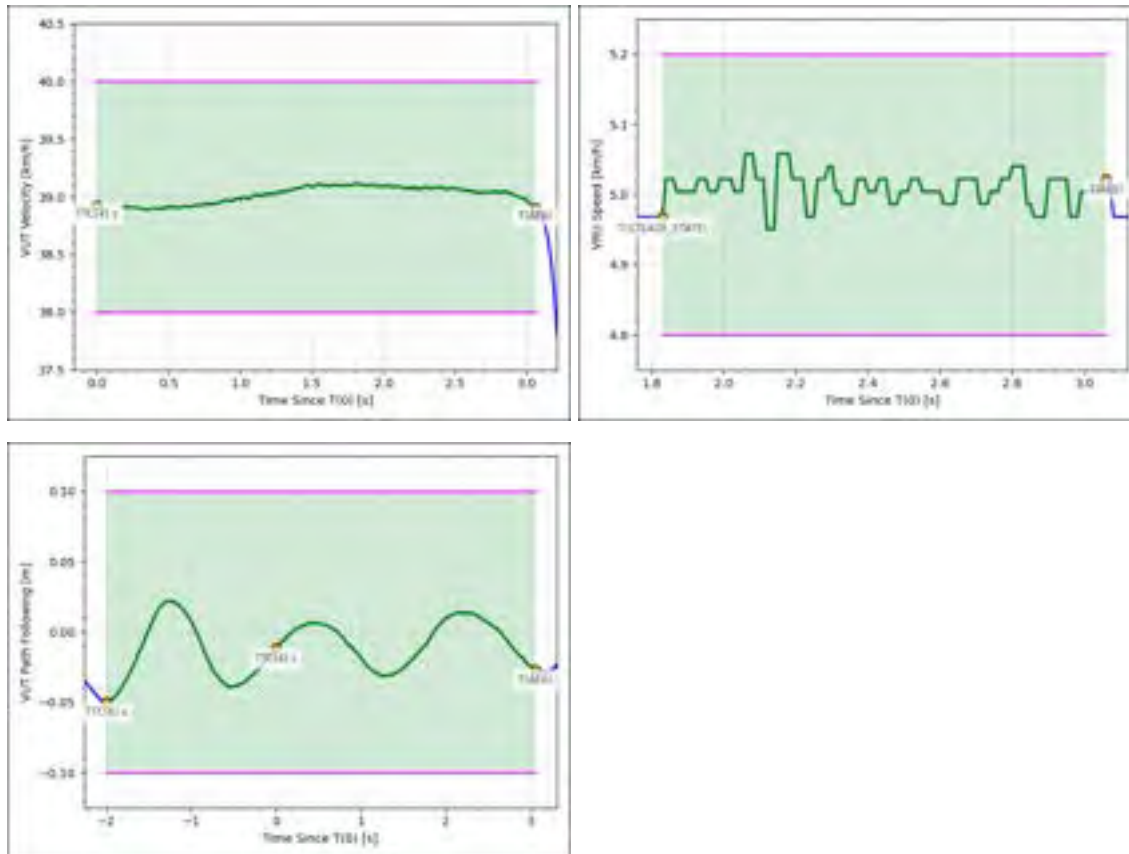
CPNC-50 5 kph (Day) | 40 km/h | Run 15

Run Date / Time 14-Mar-2023 10:25



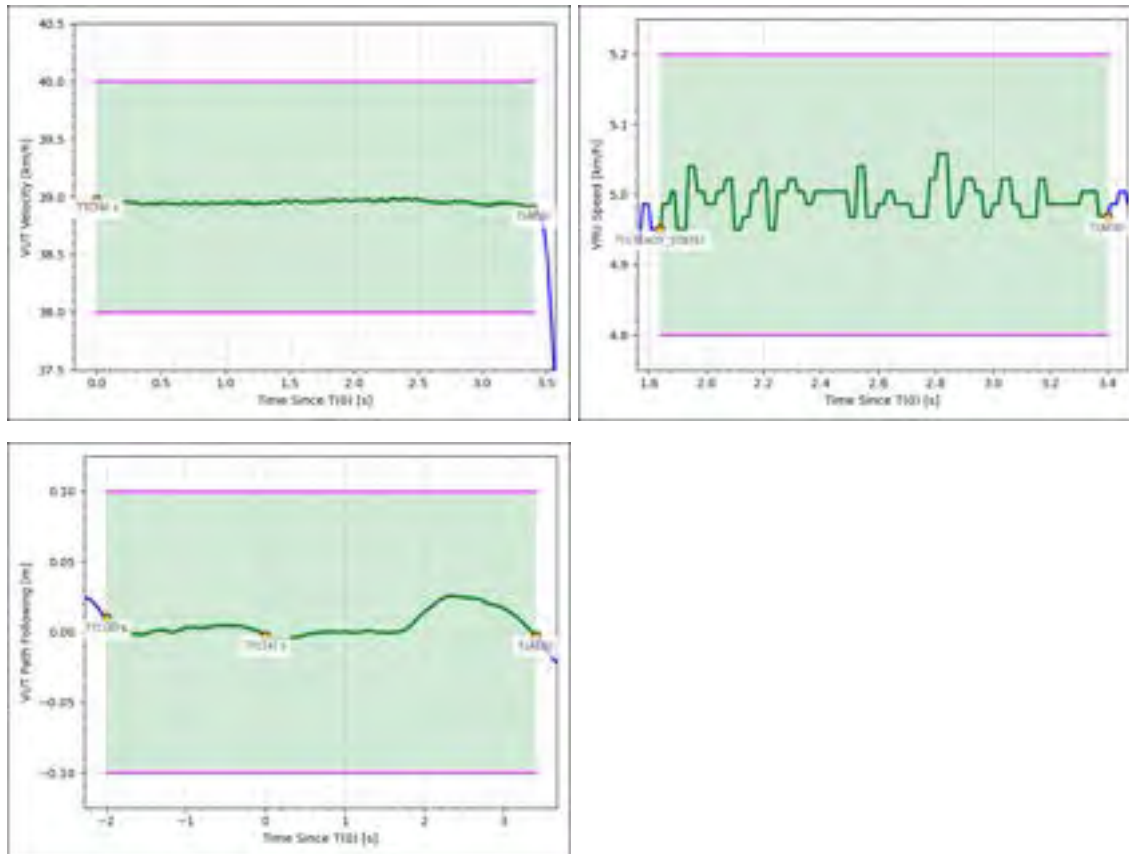
CPNC-50 5 kph (Day) | 40 km/h | Run 16

Run Date / Time 14-Mar-2023 10:30



CPNC-50 5 kph (Day) | 40 km/h | Run 17

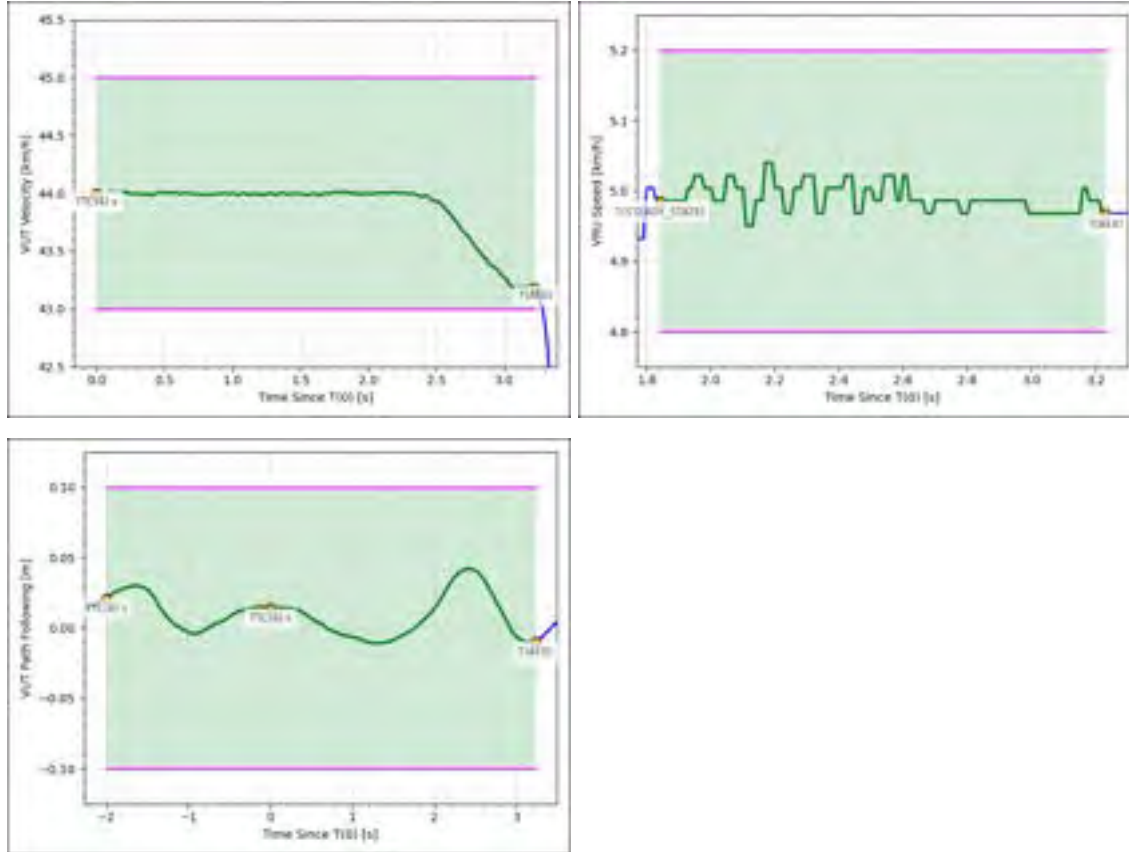
Run Date / Time 14-Mar-2023 10:34



J.2.1.7. CPNC-50 VUT 45kph EPT 5kph (Day)

CPNC-50 5 kph (Day) | 45 km/h | Run 4

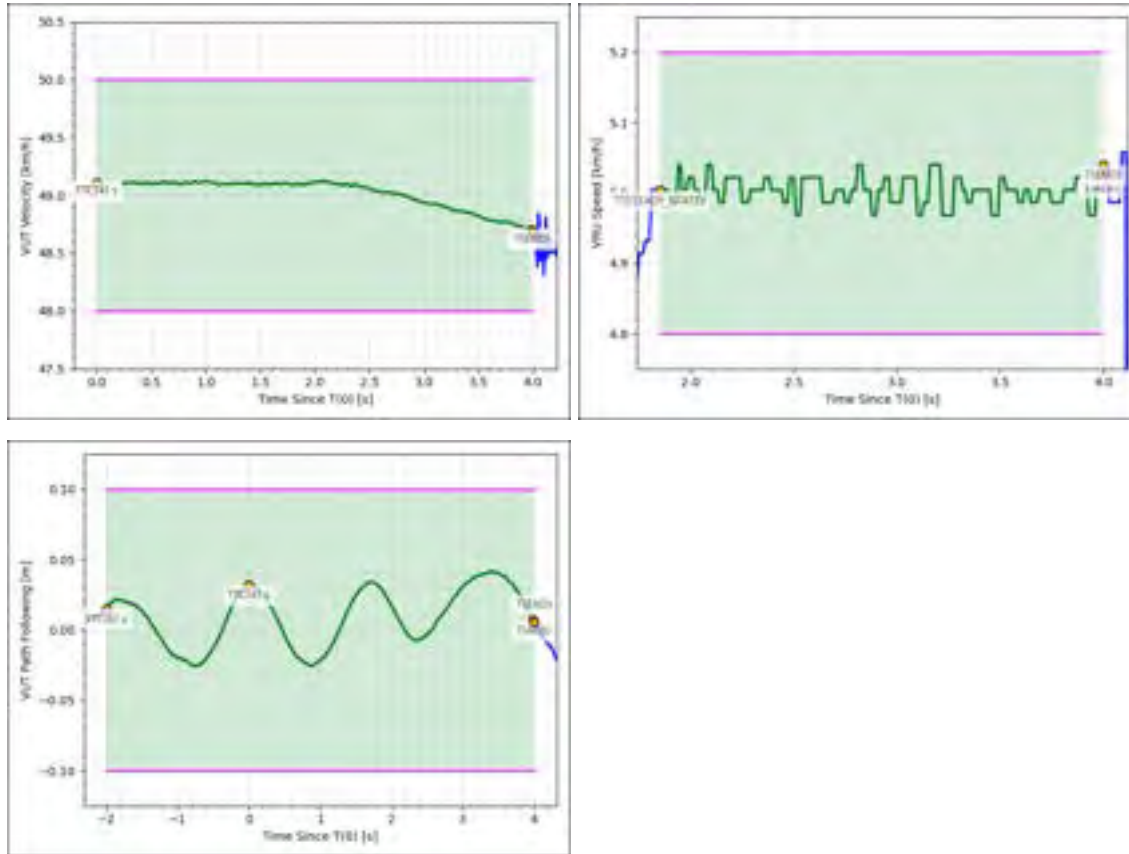
Run Date / Time 14-Mar-2023 11:14



J.2.1.8. CPNC-50 VUT 50kph EPT 5kph (Day)

CPNC-50 5 kph (Day) | 50 km/h | Run 6

Run Date / Time 14-Mar-2023 10:12

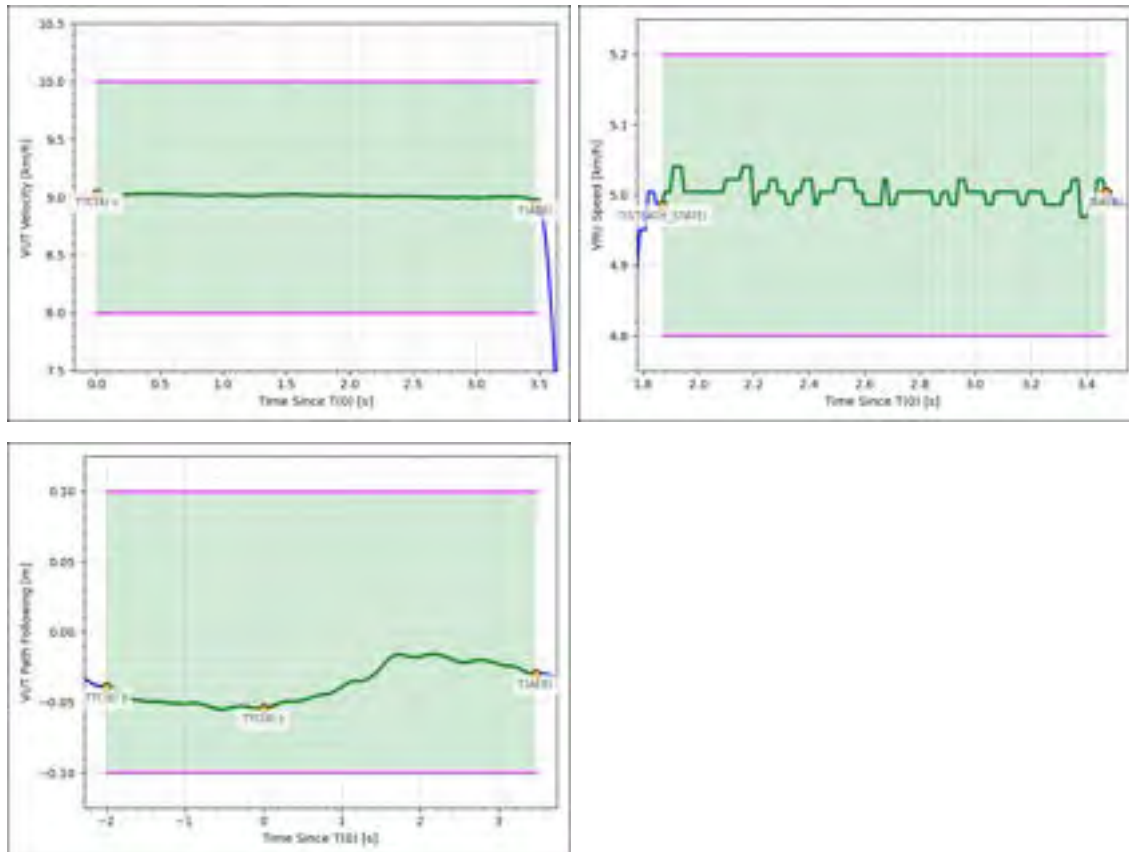


J.2.1. Lift Kit + Bullbar

J.2.1.1. CPNC-50 VUT 10kph EPT 5kph (Day)

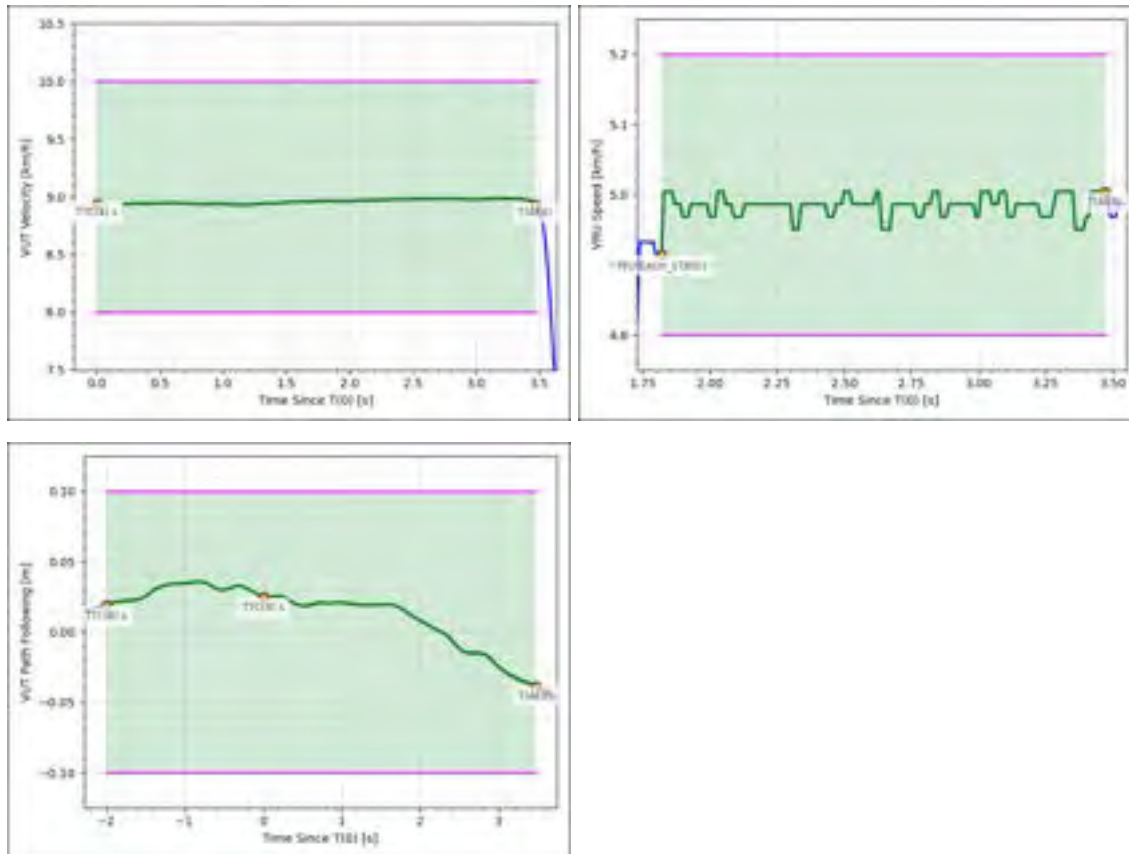
CPNC-50 5 kph (Day) | 10 km/h | Run 1

Run Date / Time 30-Mar-2023 11:05



CPNC-50 5 kph (Day) | 10 km/h | Run 2

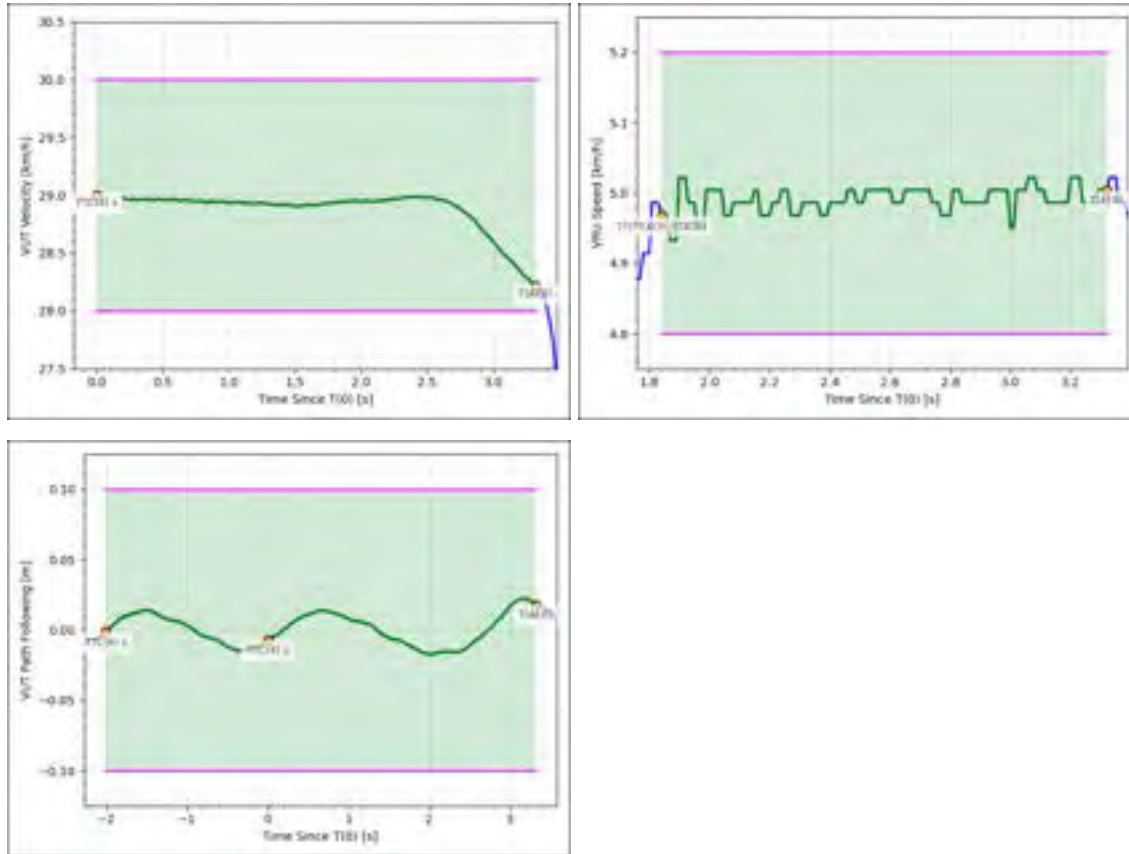
Run Date / Time 30-Mar-2023 11:09



J.2.1.2. CPNC-50 VUT 30kph EPT 5kph (Day)

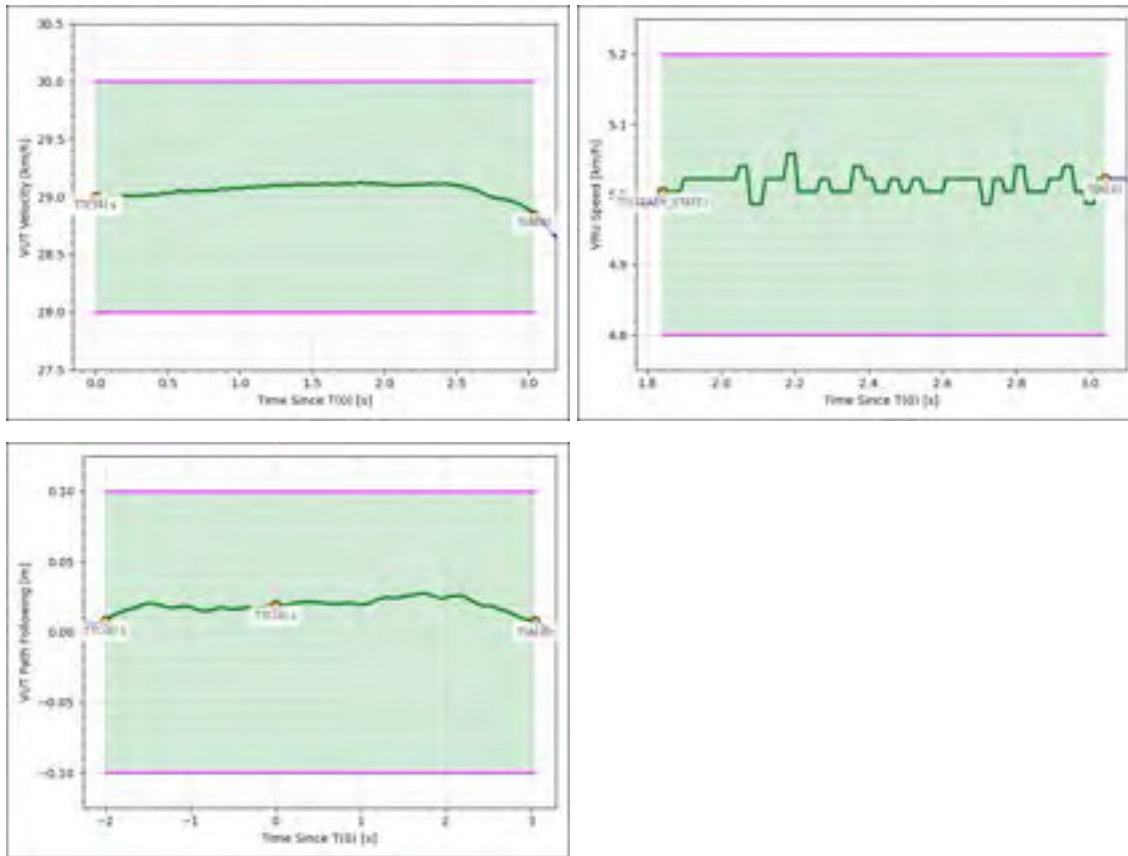
CPNC-50 5 kph (Day) | 30 km/h | Run 1

Run Date / Time 30-Mar-2023 11:12



CPNC-50 5 kph (Day) | 30 km/h | Run 2

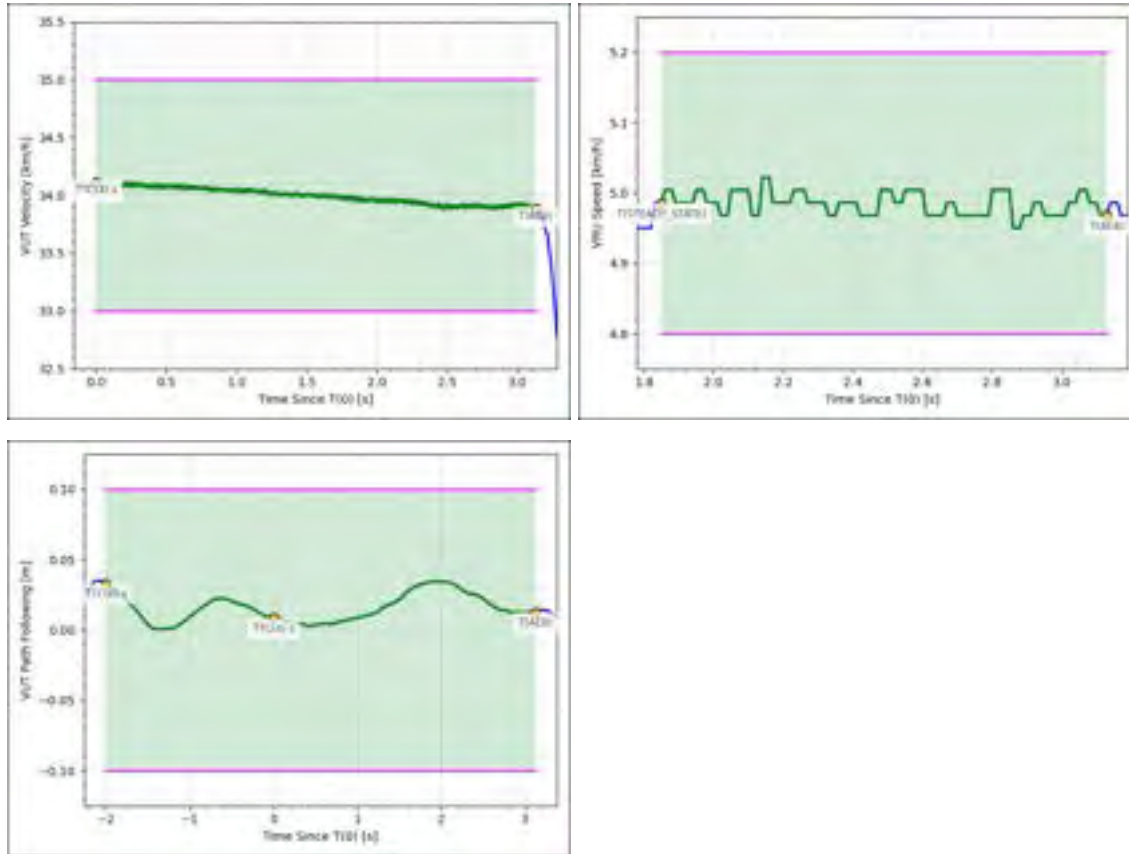
Run Date / Time 30-Mar-2023 11:16



J.2.1.3. CPNC-50 VUT 35kph EPT 5kph (Day)

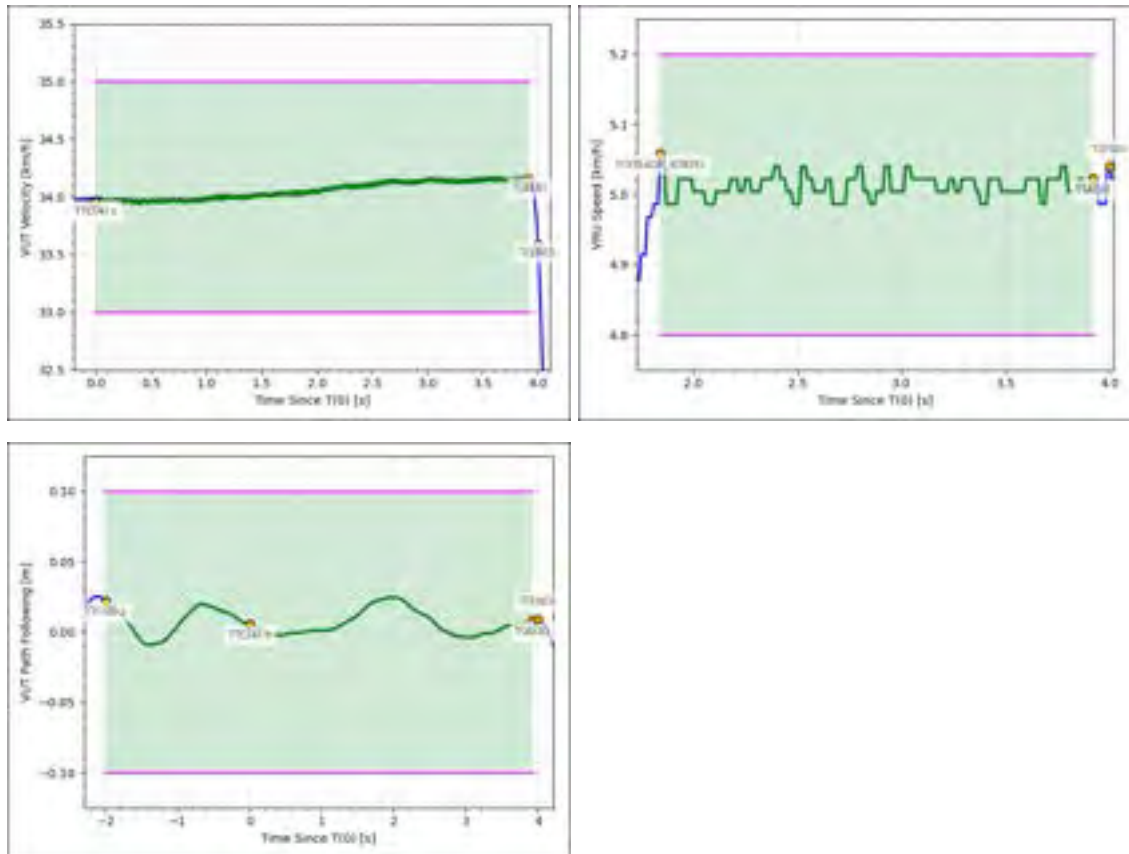
CPNC-50 5 kph (Day) | 35 km/h | Run 1

Run Date / Time 30-Mar-2023 11:59



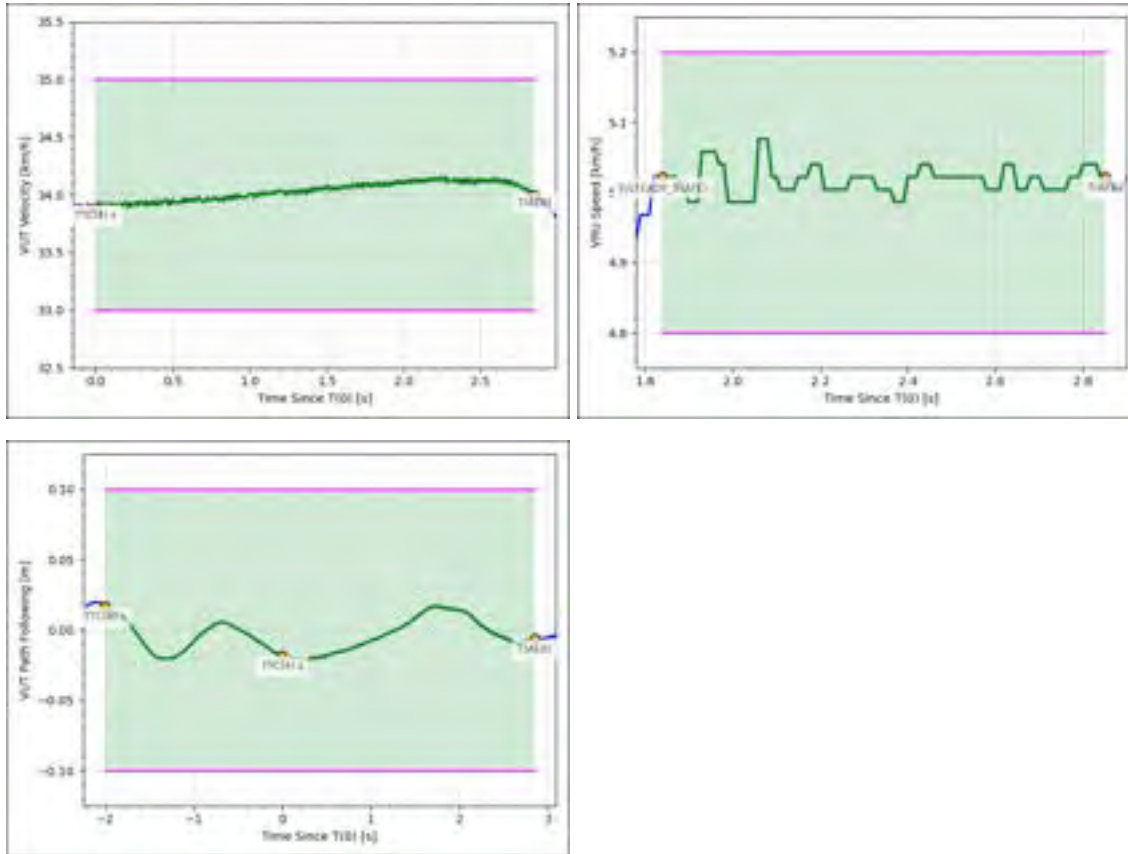
CPNC-50 5 kph (Day) | 35 km/h | Run 2

Run Date / Time 30-Mar-2023 12:04



CPNC-50 5 kph (Day) | 35 km/h | Run 3

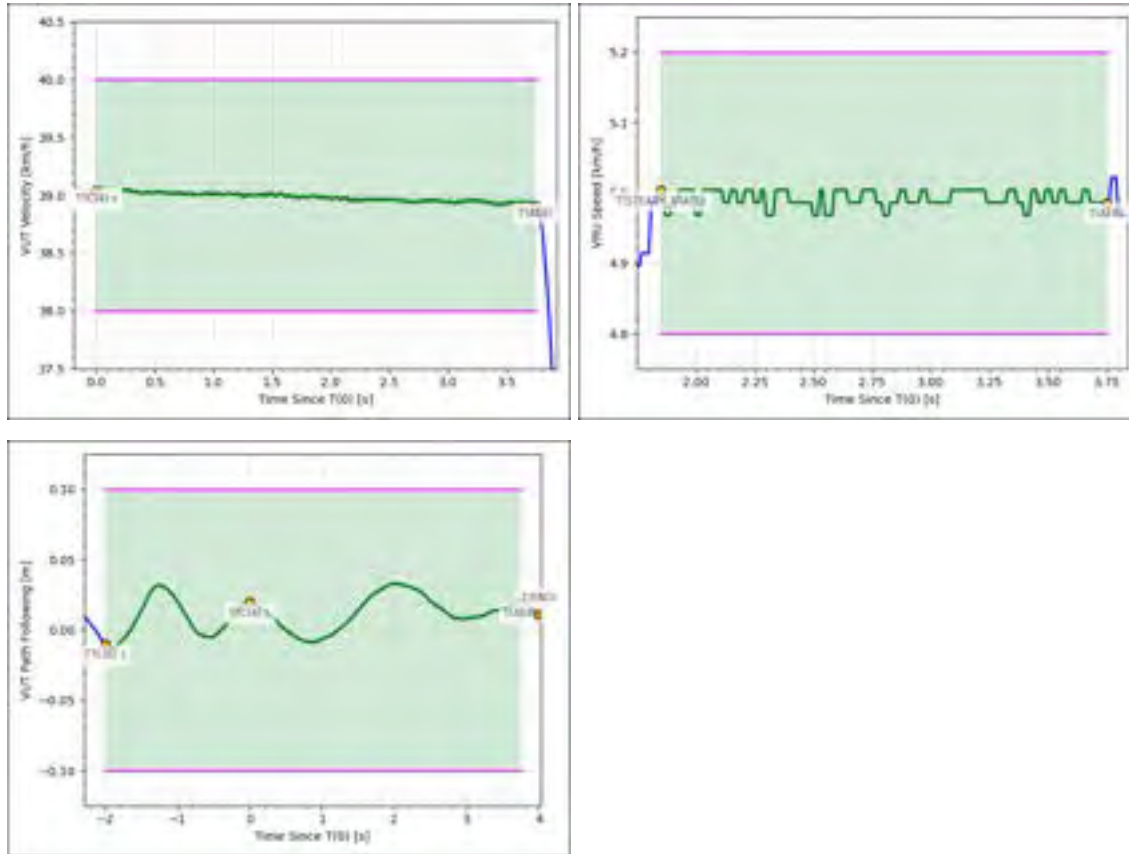
Run Date / Time 30-Mar-2023 12:16



J.2.1.4. CPNC-50 VUT 40kph EPT 5kph (Day)

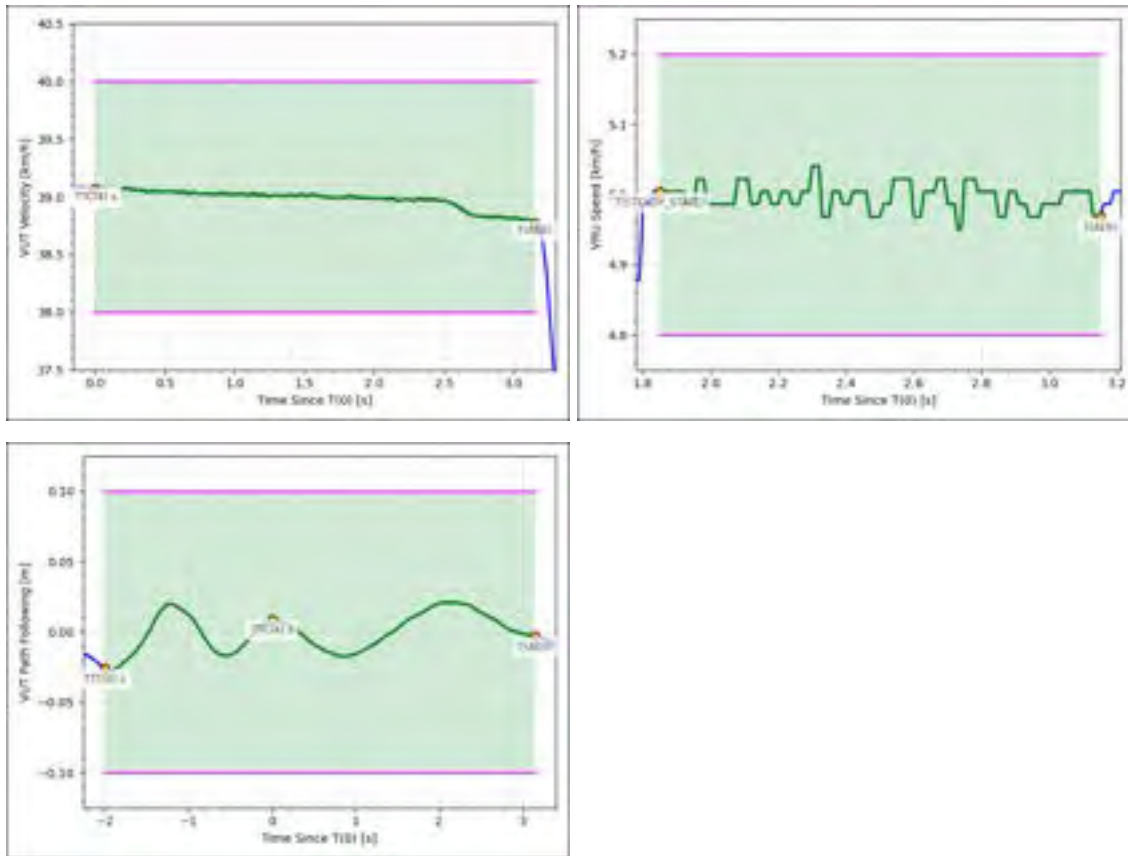
CPNC-50 5 kph (Day) | 40 km/h | Run 1

Run Date / Time 30-Mar-2023 11:20



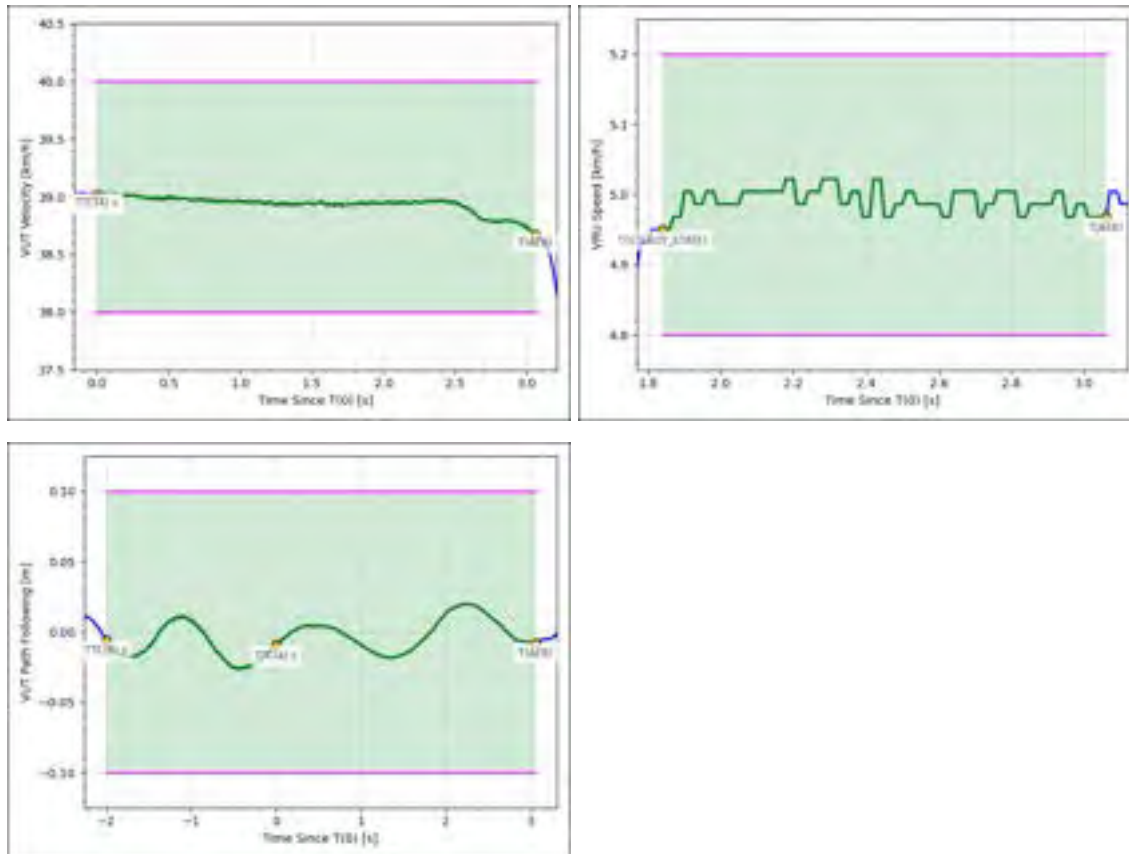
CPNC-50 5 kph (Day) | 40 km/h | Run 2

Run Date / Time 30-Mar-2023 11:30



CPNC-50 5 kph (Day) | 40 km/h | Run 3

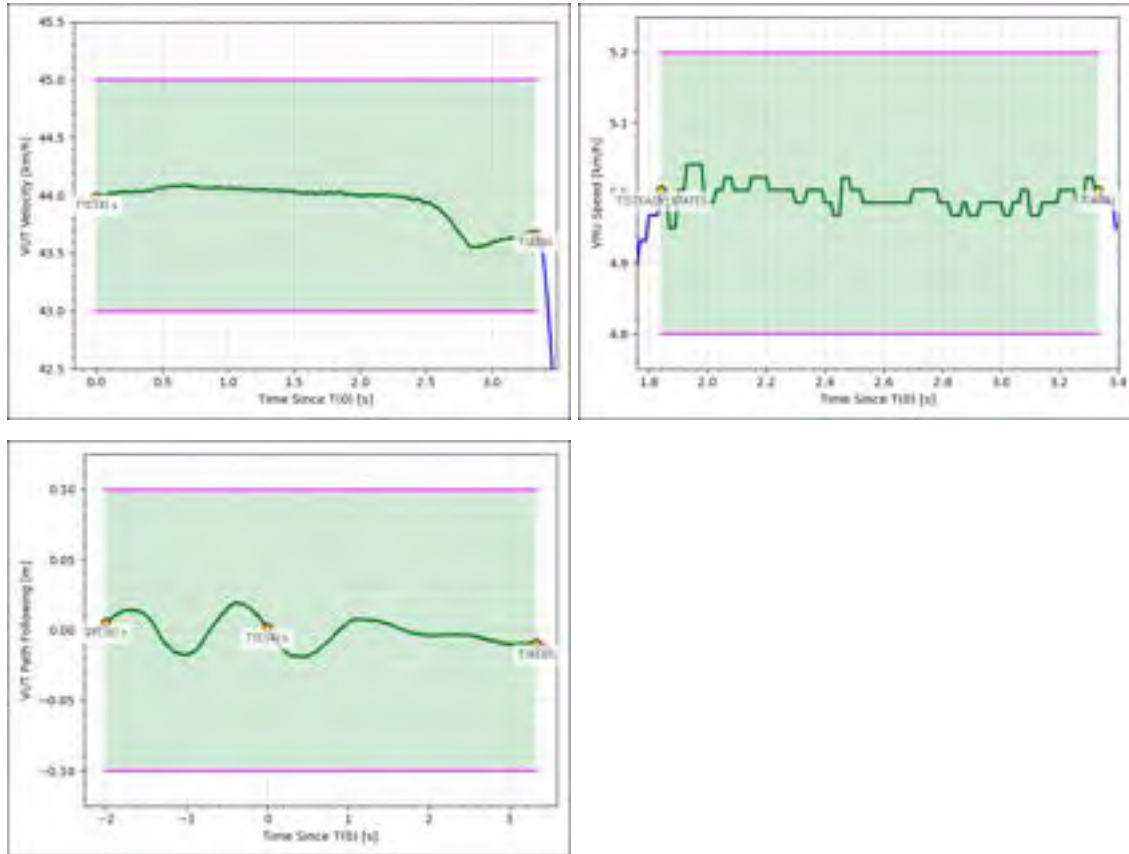
Run Date / Time 30-Mar-2023 11:33



J.2.1.5. CPNC-50 VUT 45kph EPT 5kph (Day)

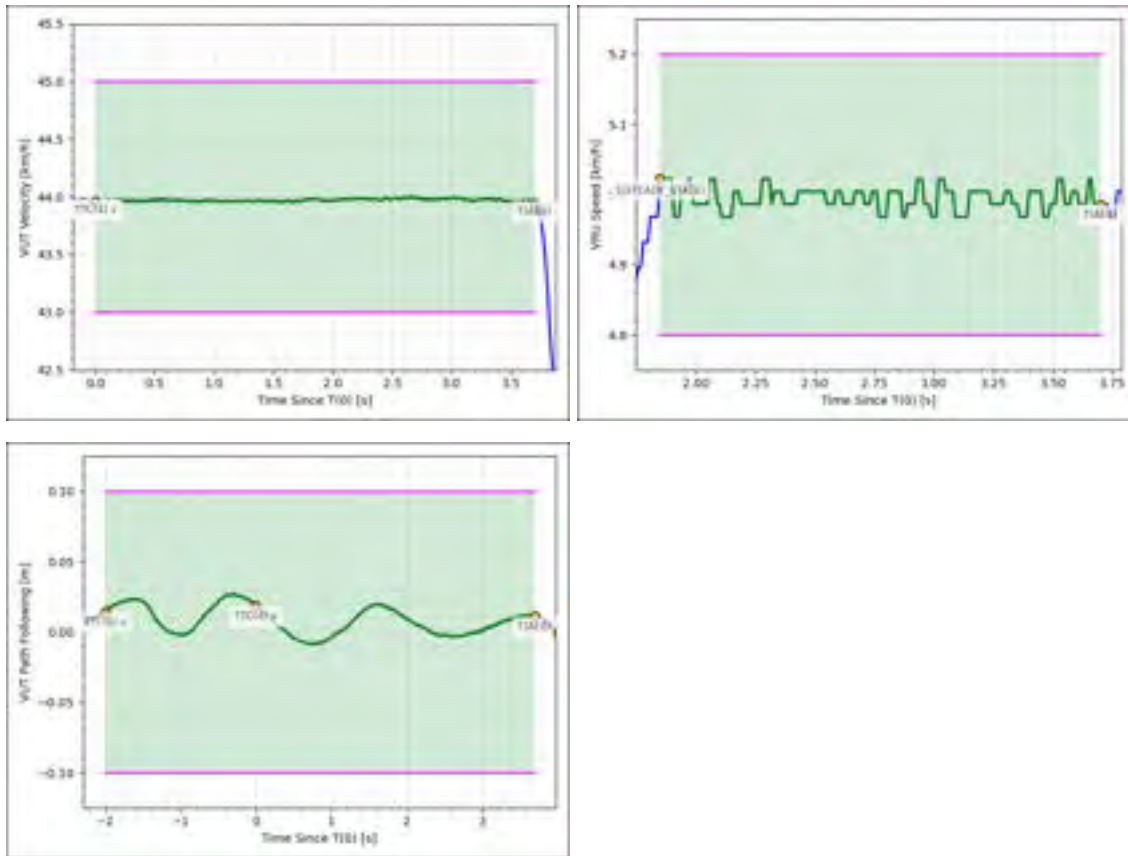
CPNC-50 5 kph (Day) | 45 km/h | Run 1

Run Date / Time 30-Mar-2023 12:23



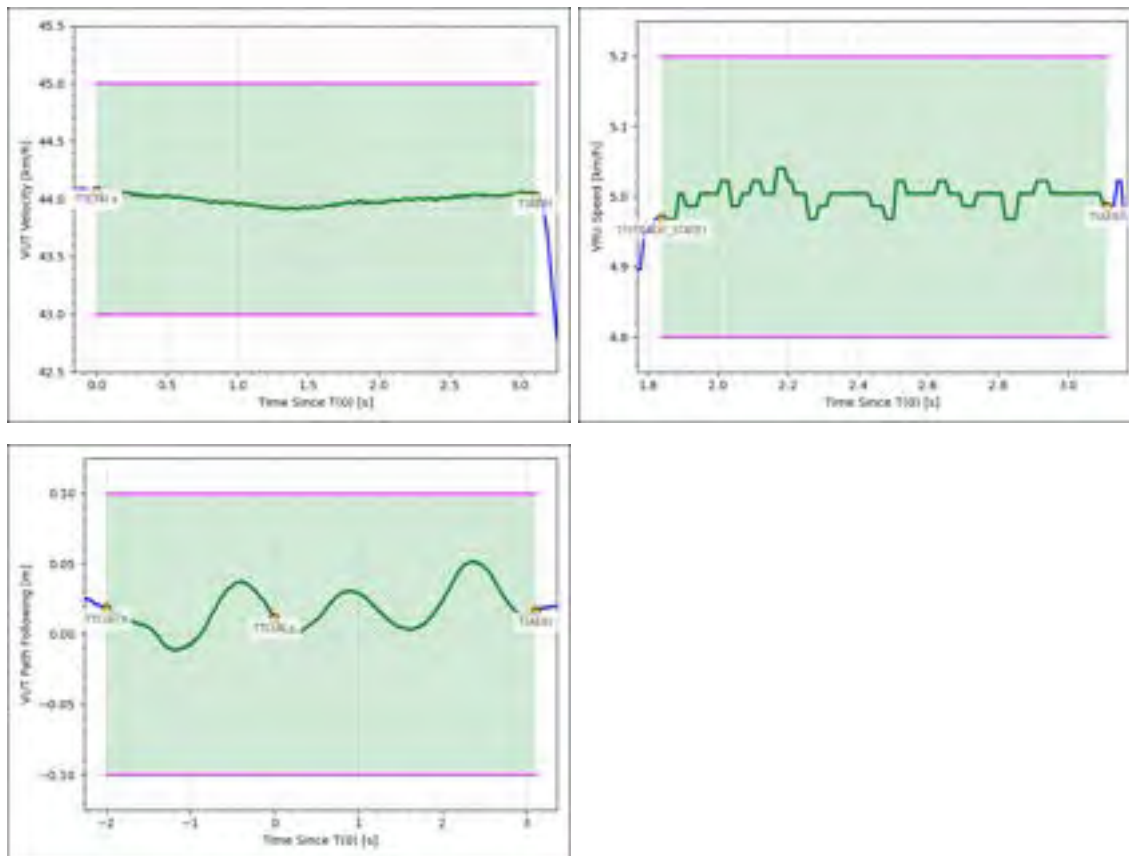
CPNC-50 5 kph (Day) | 45 km/h | Run 2

Run Date / Time 30-Mar-2023 12:35



CPNC-50 5 kph (Day) | 45 km/h | Run 3

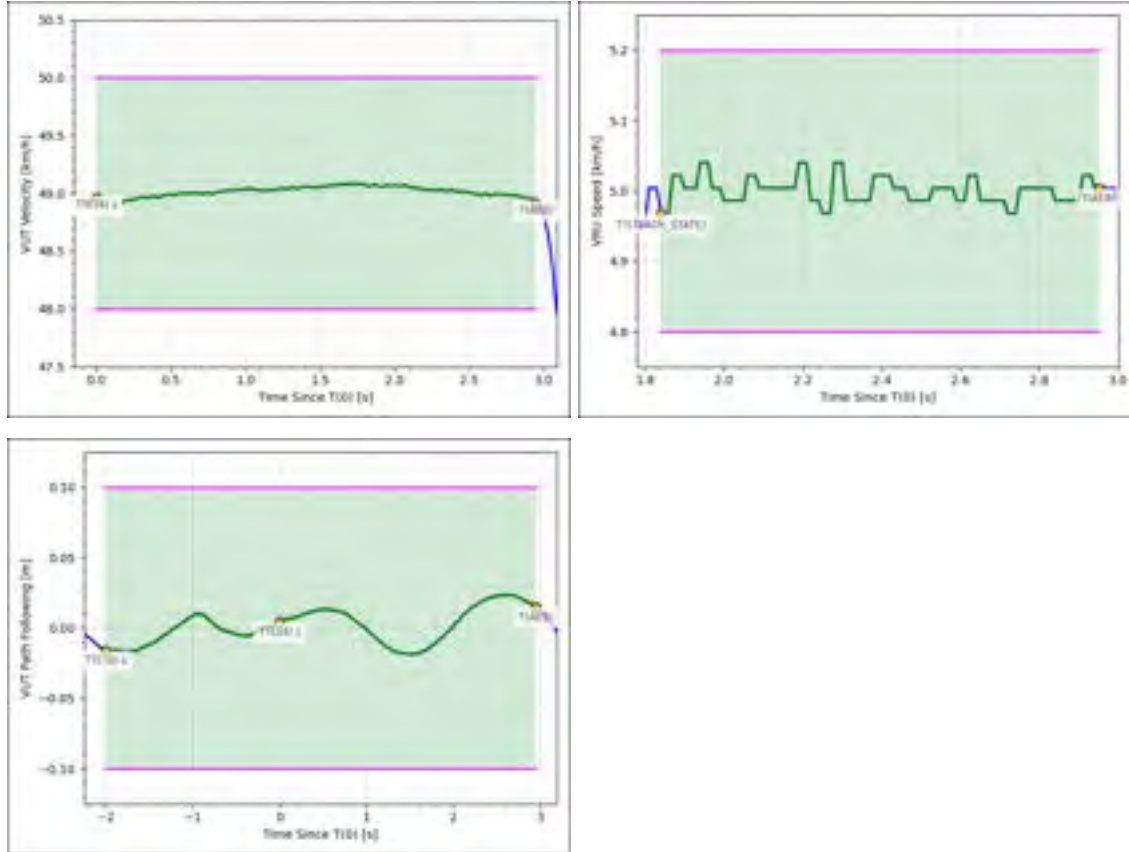
Run Date / Time 30-Mar-2023 12:49



J.2.1.6. CPNC-50 VUT 50kph EPT 5kph (Day)

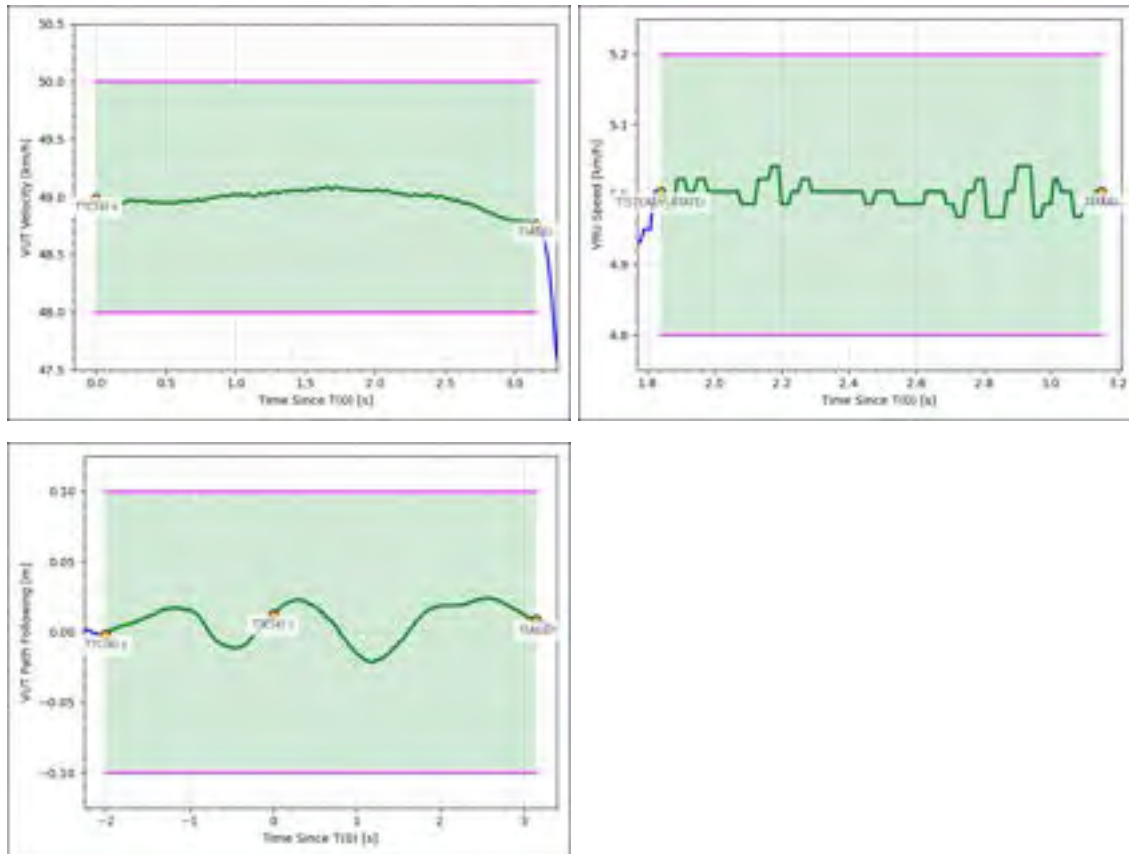
CPNC-50 5 kph (Day) | 50 km/h | Run 1

Run Date / Time 30-Mar-2023 13:05



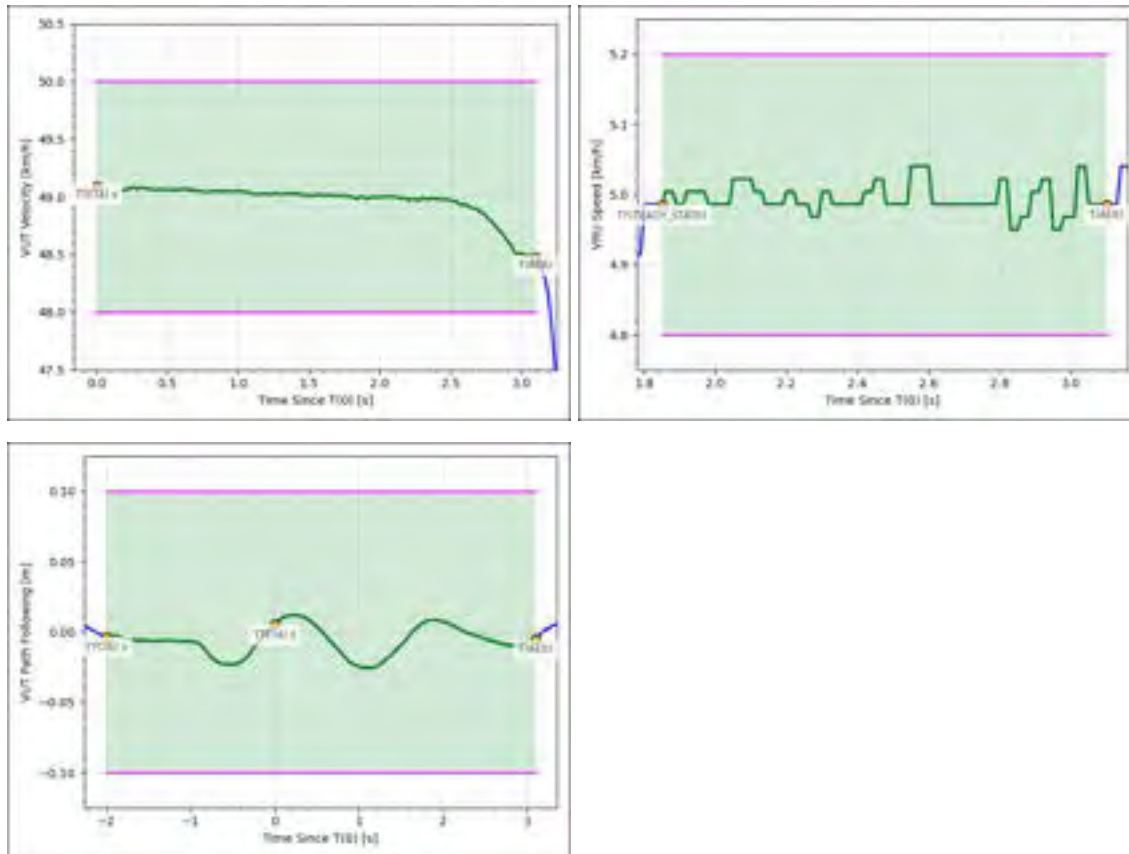
CPNC-50 5 kph (Day) | 50 km/h | Run 2

Run Date / Time 30-Mar-2023 13:53



CPNC-50 5 kph (Day) | 50 km/h | Run 3

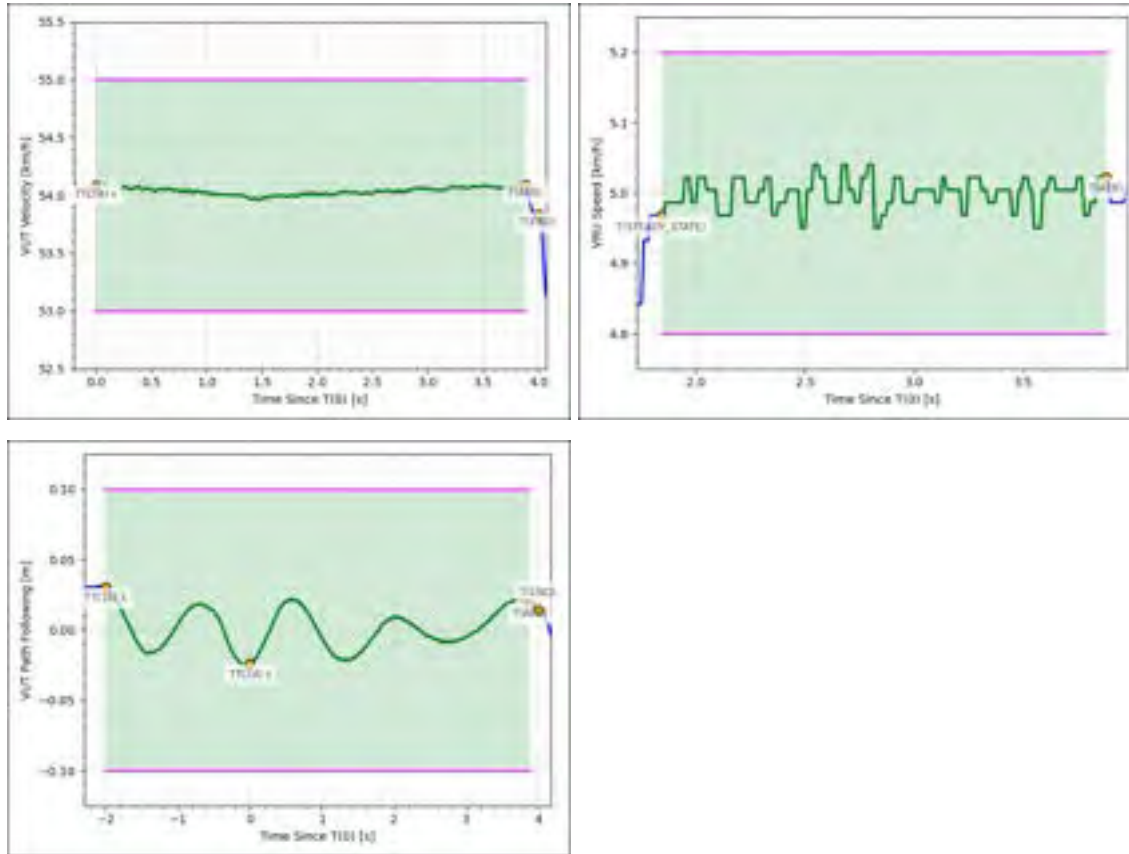
Run Date / Time 30-Mar-2023 13:57



J.2.1.7. CPNC-50 VUT 55kph EPT 5kph (Day)

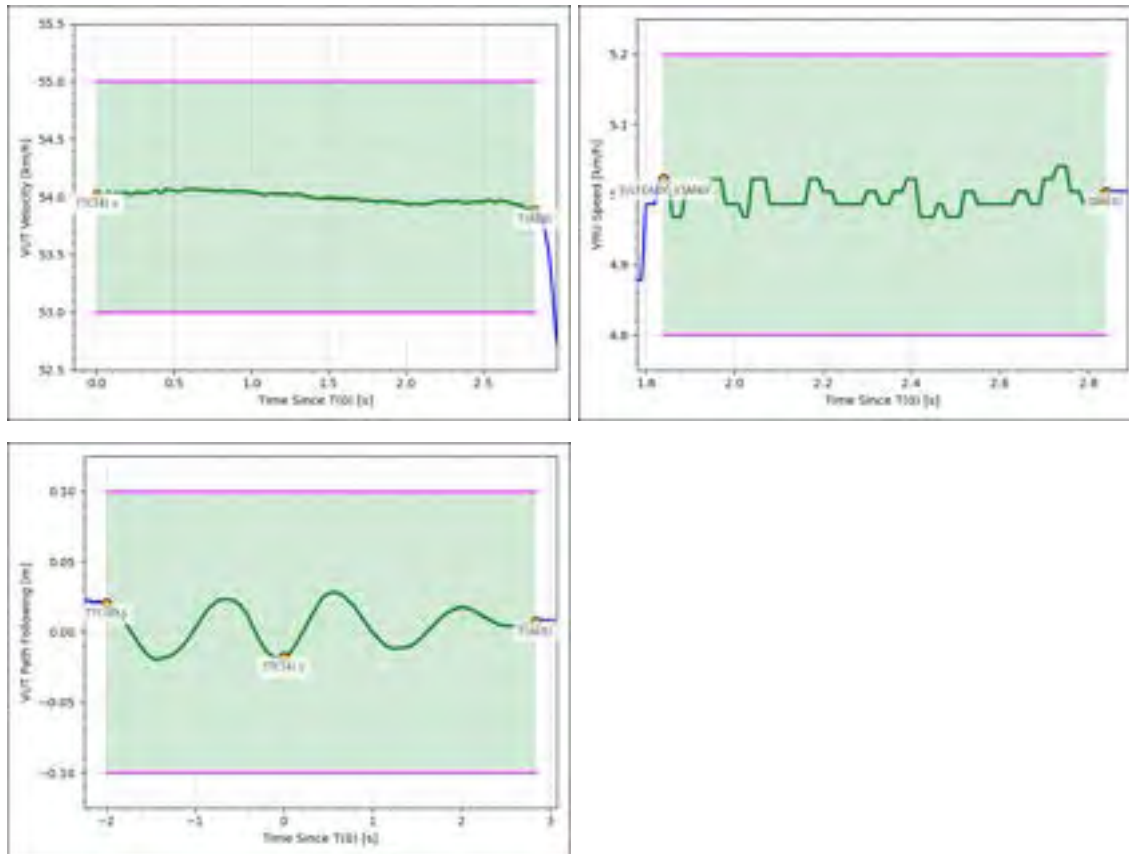
CPNC-50 5 kph (Day) | 55 km/h | Run 1

Run Date / Time 30-Mar-2023 14:08



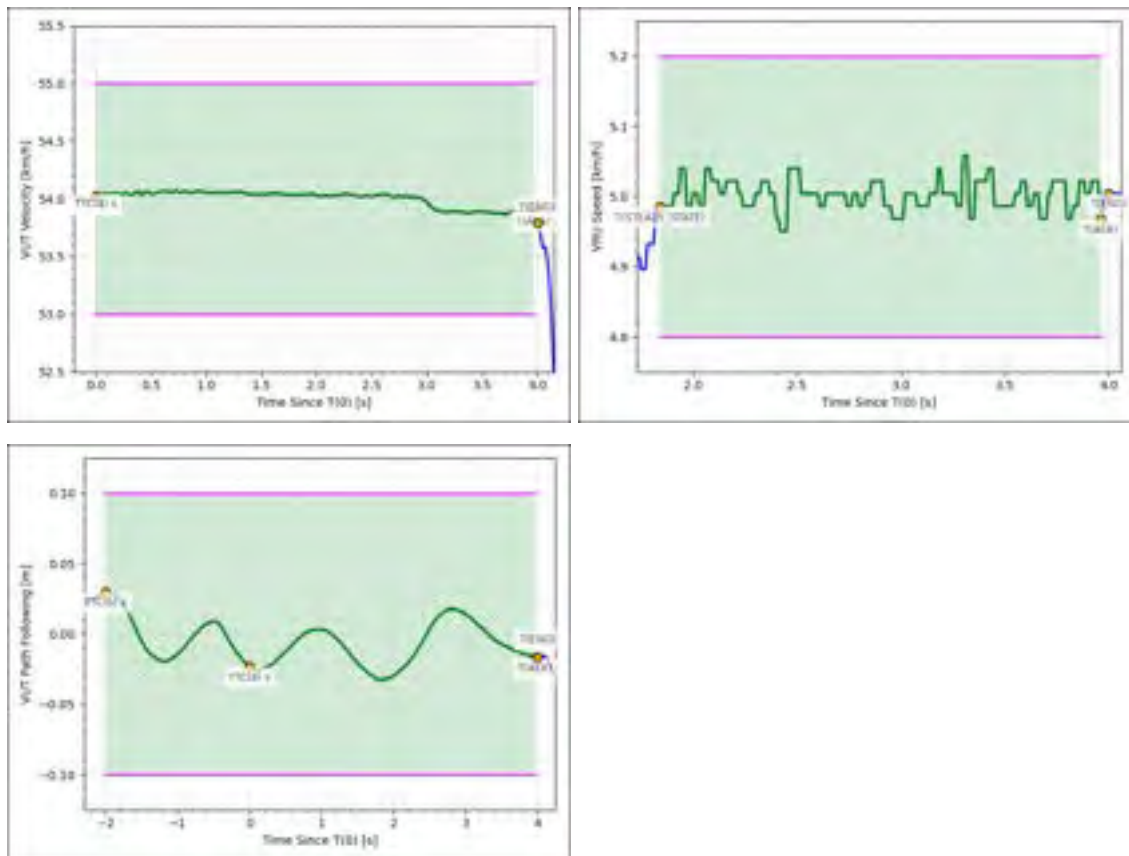
CPNC-50 5 kph (Day) | 55 km/h | Run 2

Run Date / Time 30-Mar-2023 14:20



CPNC-50 5 kph (Day) | 55 km/h | Run 3

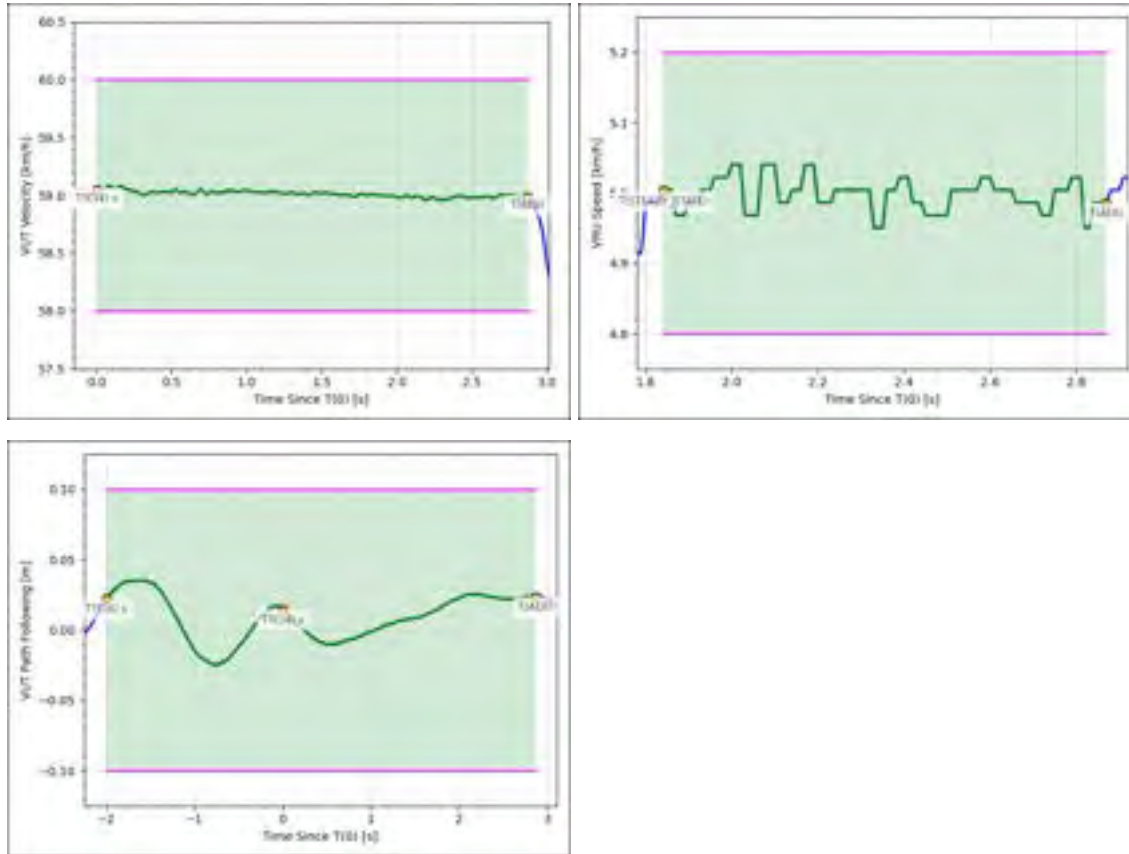
Run Date / Time 30-Mar-2023 14:24



J.2.1.8. CPNC-50 VUT 60kph EPT 5kph (Day)

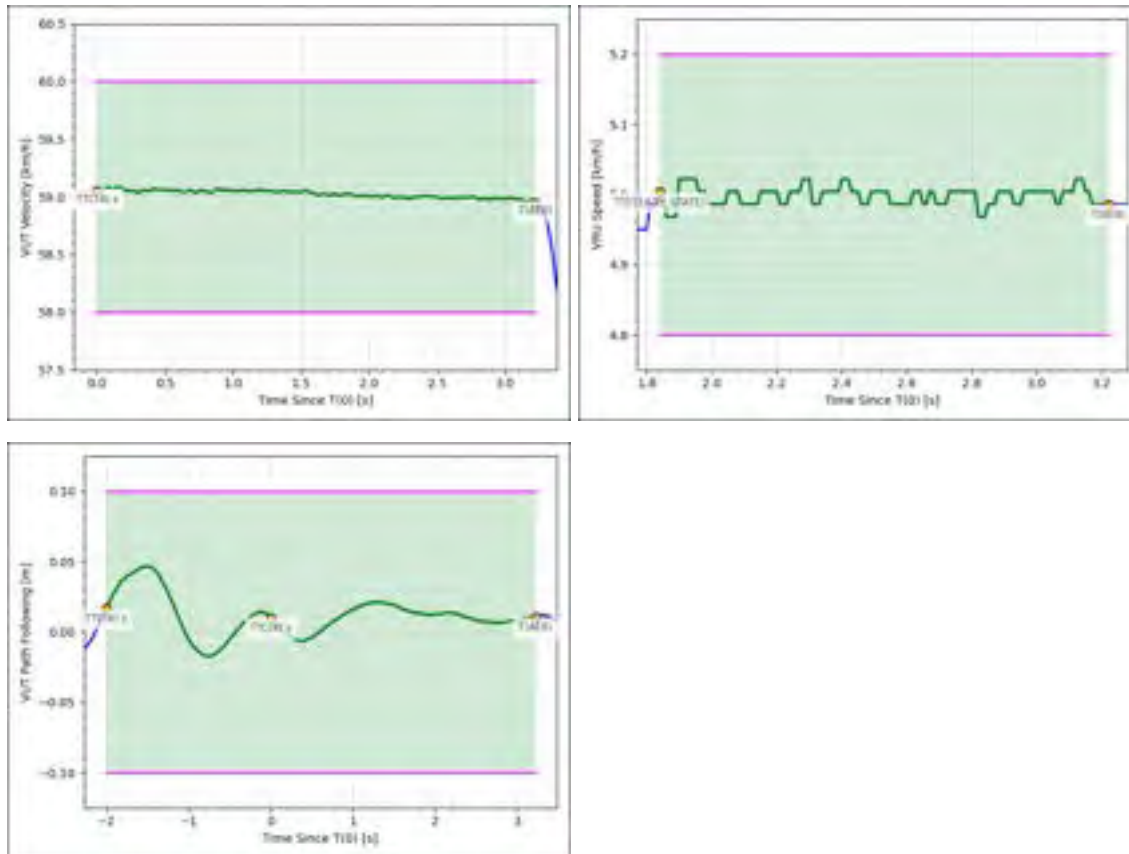
CPNC-50 5 kph (Day) | 60 km/h | Run 1

Run Date / Time 30-Mar-2023 14:36



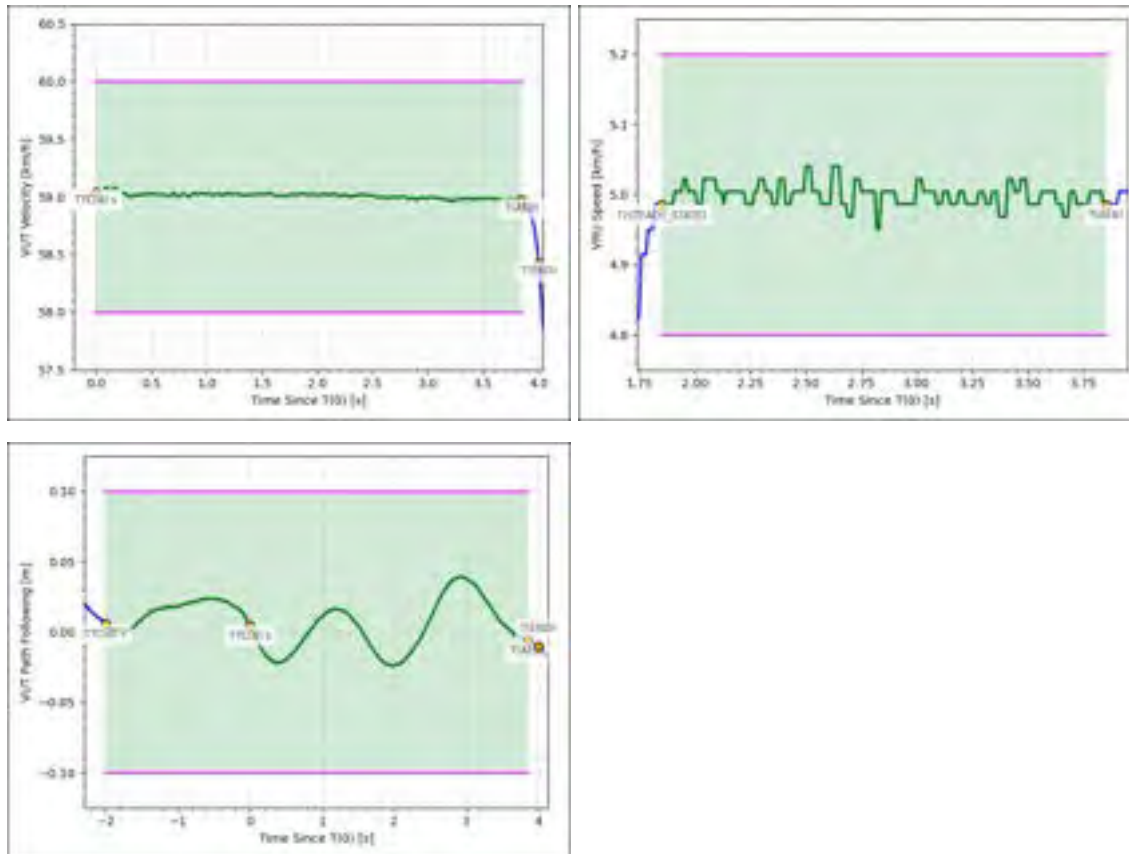
CPNC-50 5 kph (Day) | 60 km/h | Run 2

Run Date / Time 30-Mar-2023 14:43



CPNC-50 5 kph (Day) | 60 km/h | Run 3

Run Date / Time 30-Mar-2023 14:51

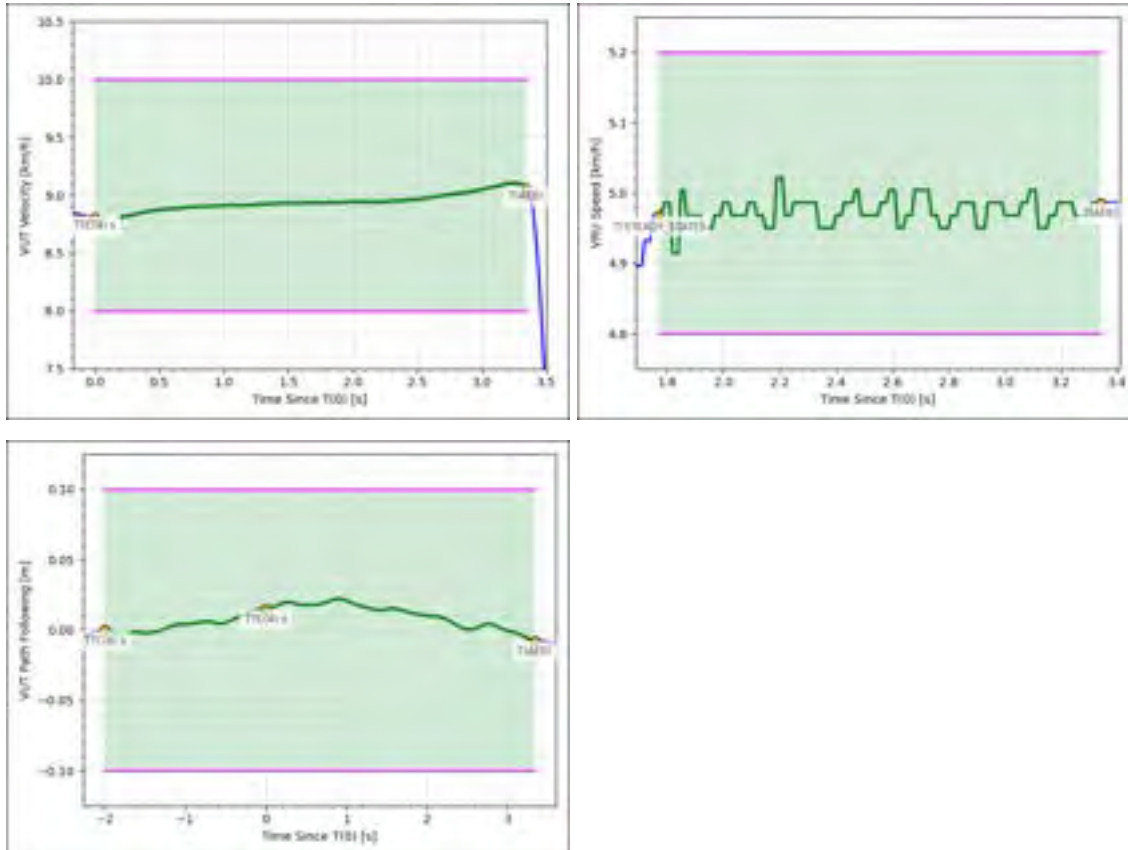


J.2.1. Bullbar

J.2.1.1. CPNC-50 VUT 10kph EPT 5kph (Day)

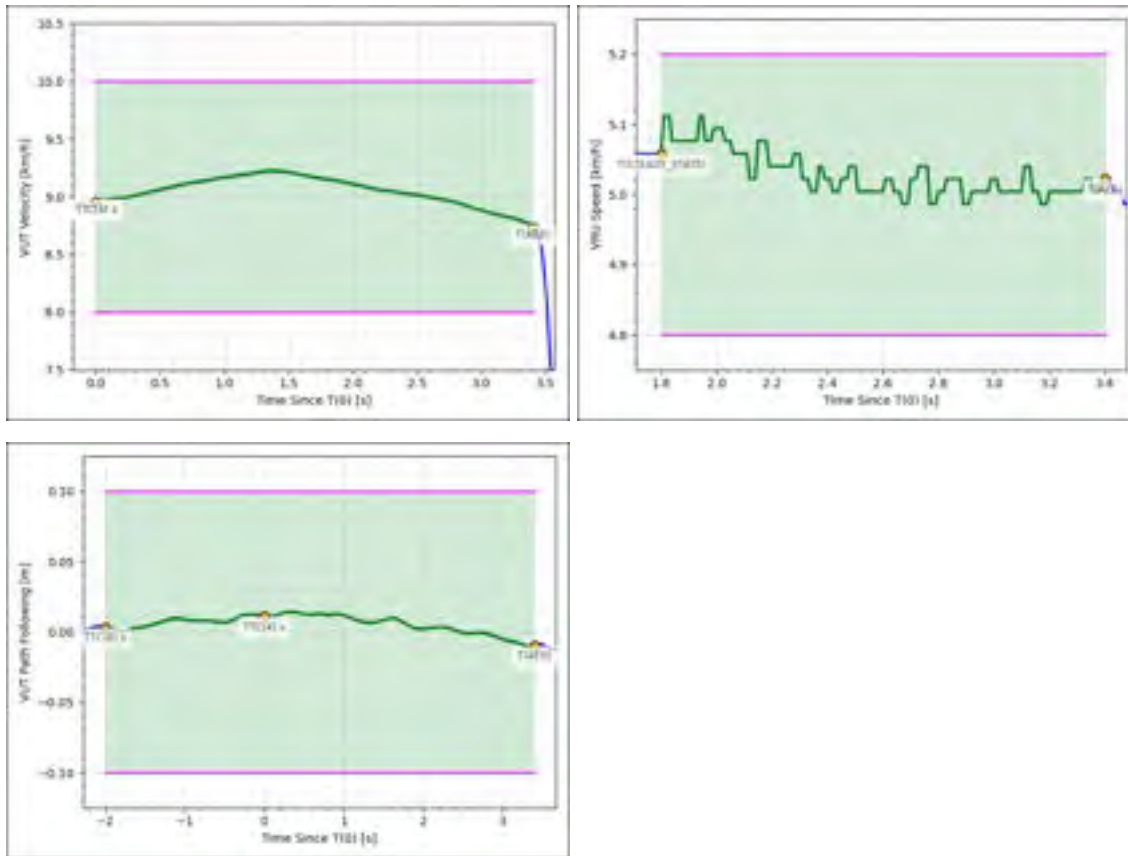
CPNC-50 5 kph (Day) | 10 km/h | Run 3

Run Date / Time 6-Apr-2023 10:24



CPNC-50 5 kph (Day) | 10 km/h | Run 4

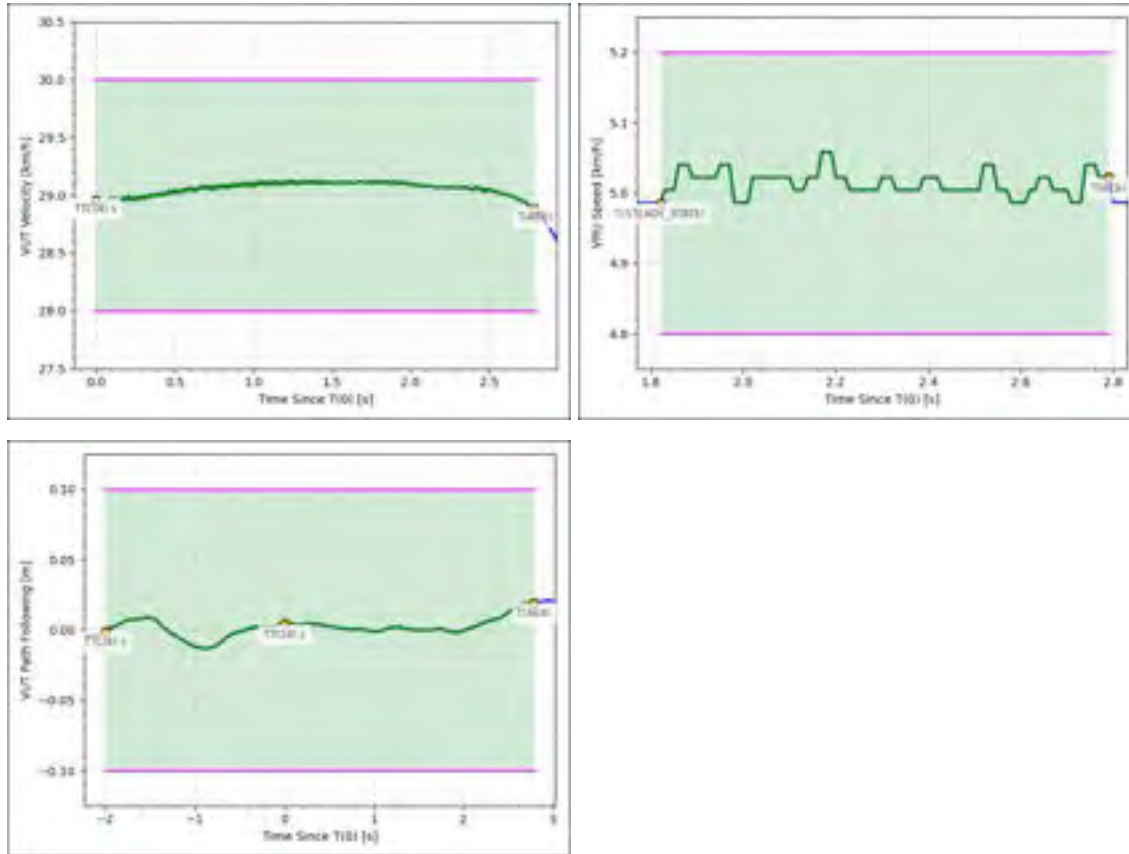
Run Date / Time 6-Apr-2023 10:28



J.2.1.2. CPNC-50 VUT 30kph EPT 5kph (Day)

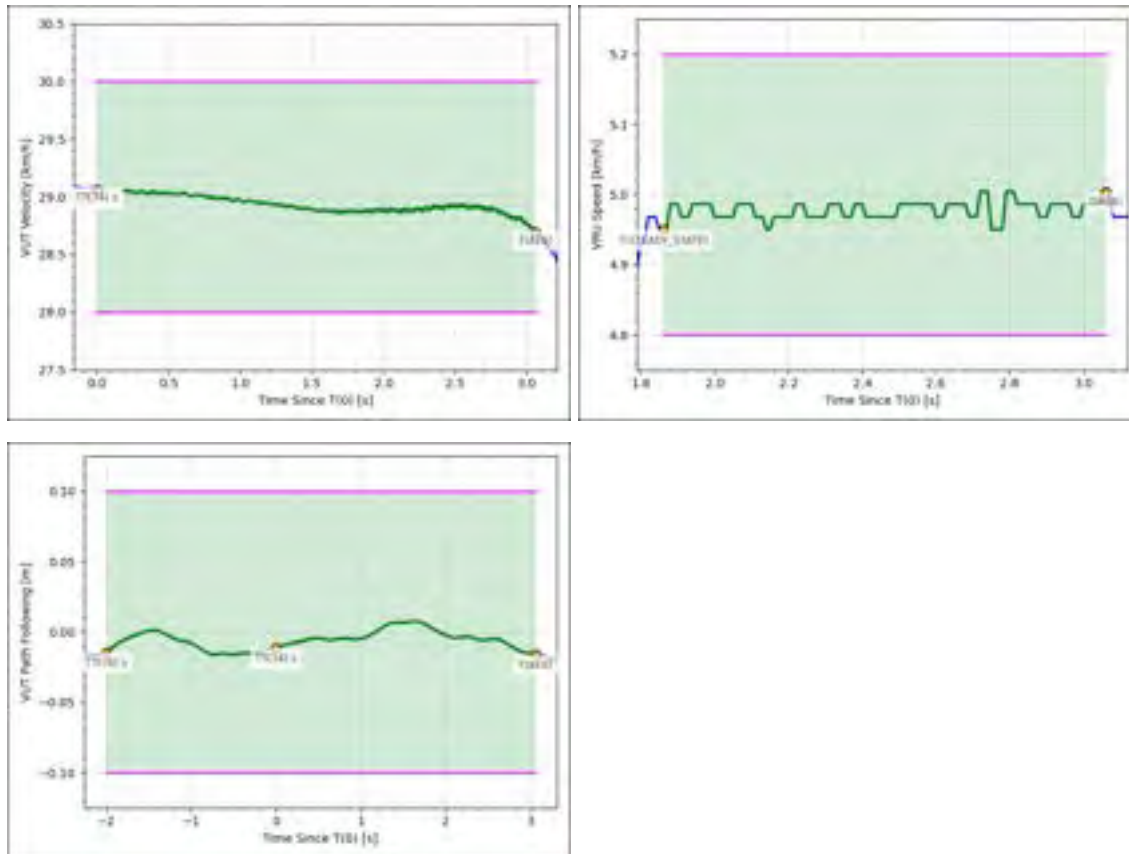
CPNC-50 5 kph (Day) | 30 km/h | Run 4

Run Date / Time 6-Apr-2023 10:37



CPNC-50 5 kph (Day) | 30 km/h | Run 5

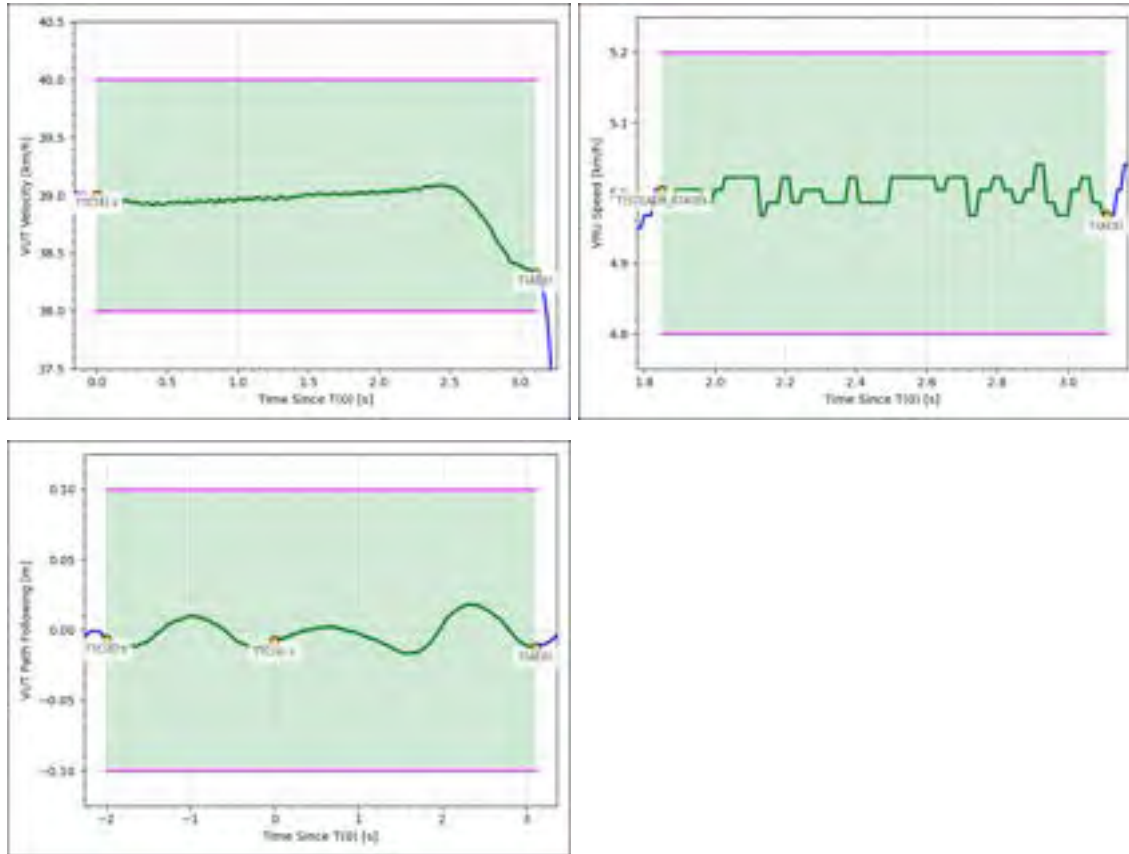
Run Date / Time 6-Apr-2023 10:45



J.2.1.3. CPNC-50 VUT 40kph EPT 5kph (Day)

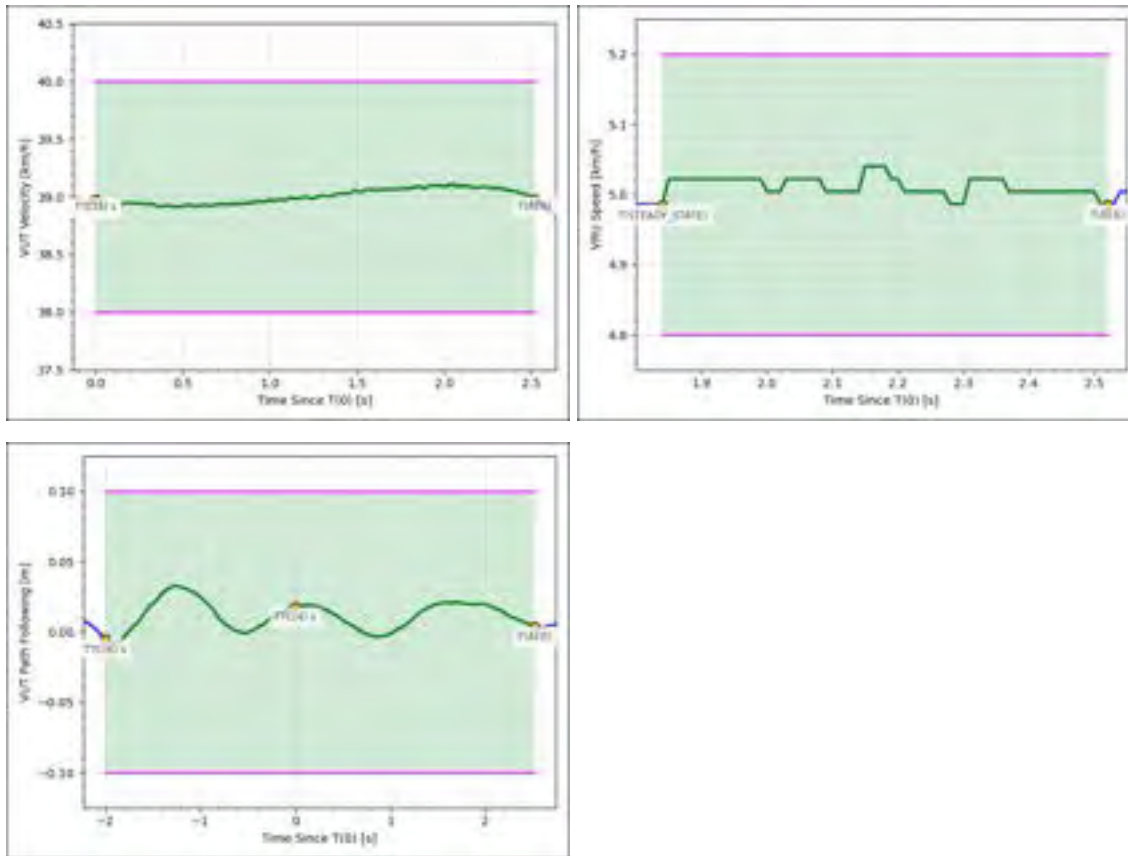
CPNC-50 5 kph (Day) | 40 km/h | Run 4

Run Date / Time 6-Apr-2023 10:49



CPNC-50 5 kph (Day) | 40 km/h | Run 6

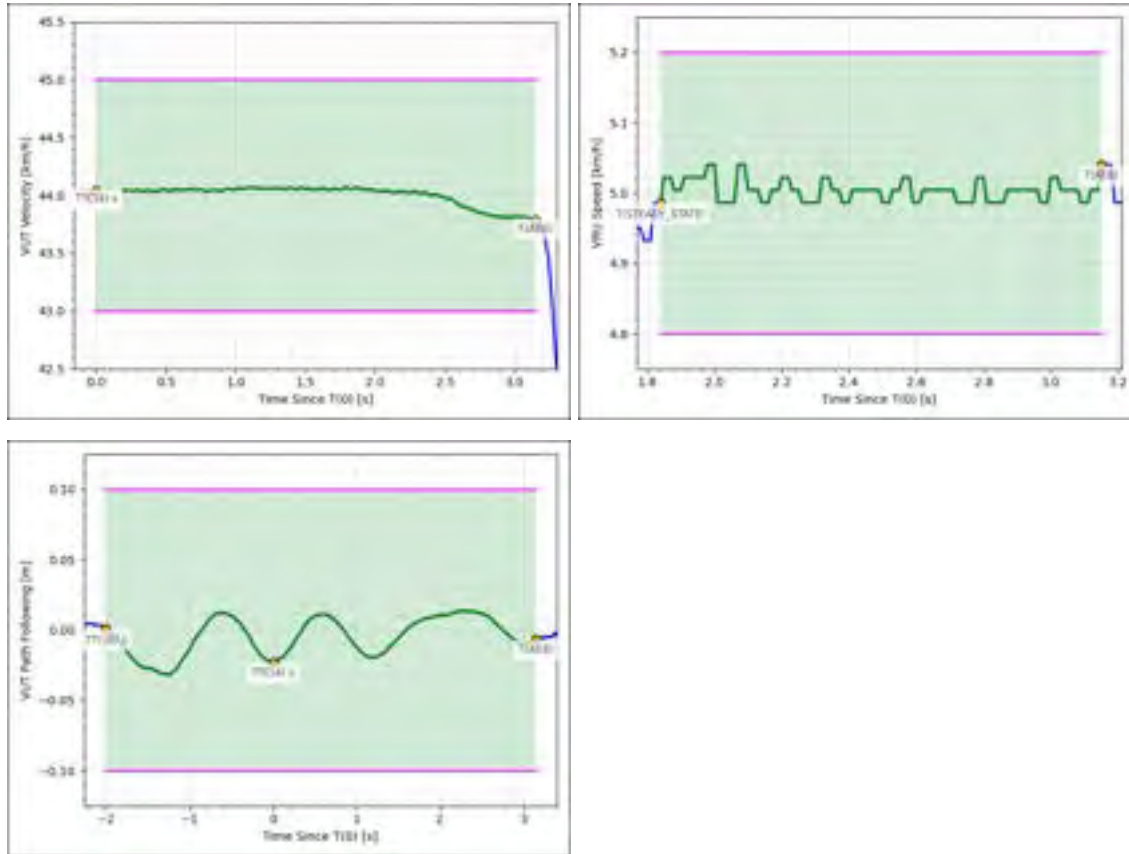
Run Date / Time 6-Apr-2023 11:13



J.2.1.4. CPNC-50 VUT 45kph EPT 5kph (Day)

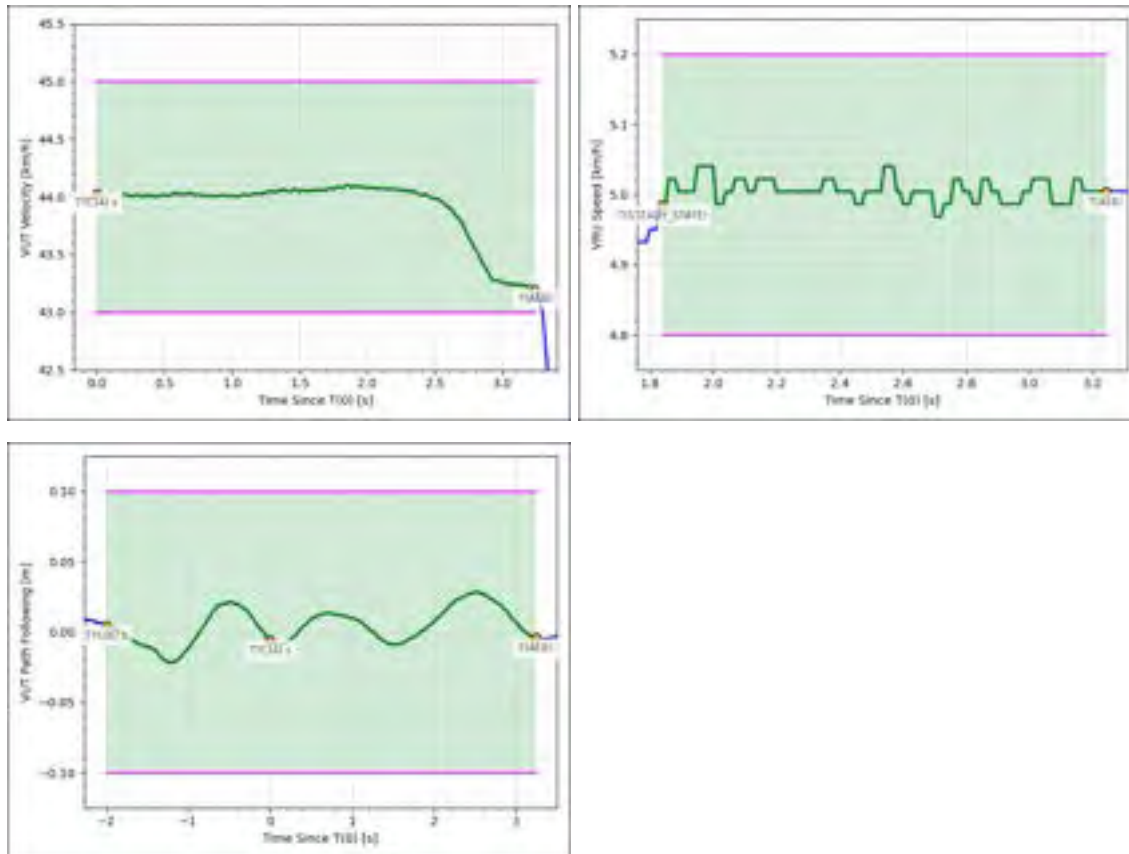
CPNC-50 5 kph (Day) | 45 km/h | Run 4

Run Date / Time 6-Apr-2023 11:36



CPNC-50 5 kph (Day) | 45 km/h | Run 5

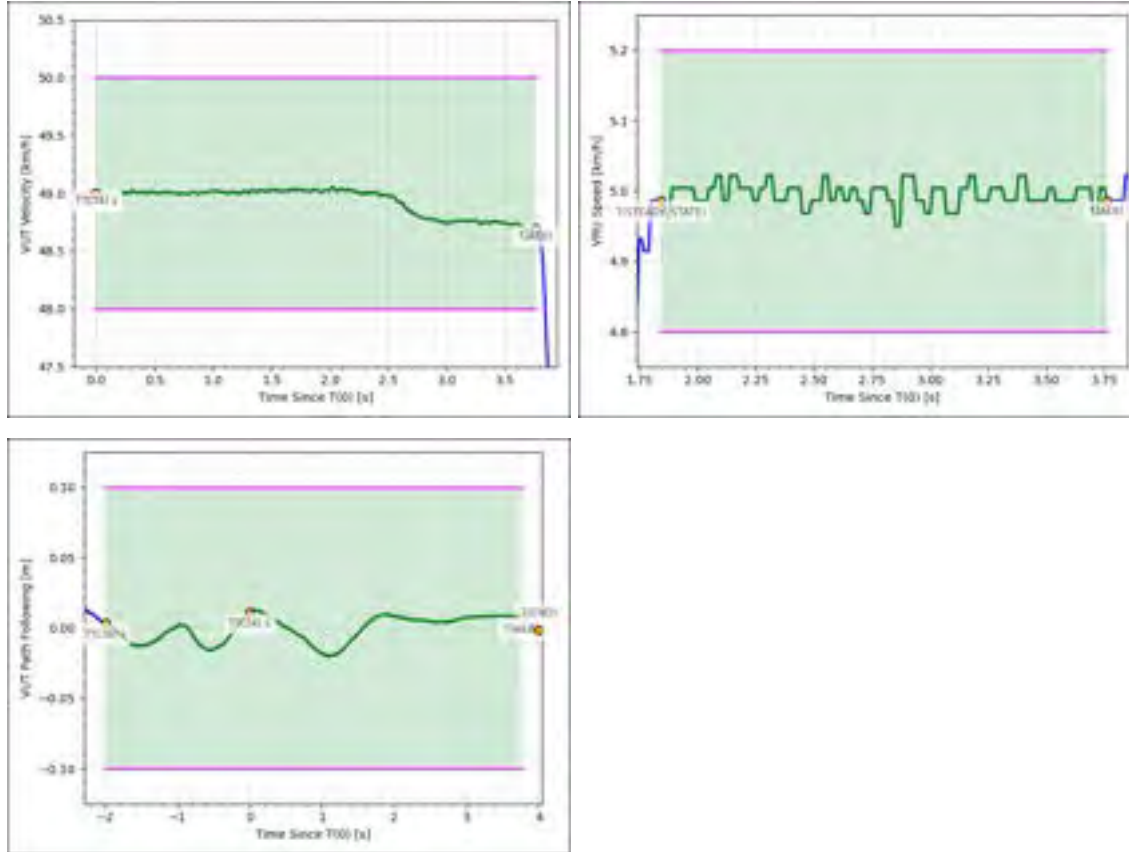
Run Date / Time 6-Apr-2023 11:40



J.2.1.5. CPNC-50 VUT 50kph EPT 5kph (Day)

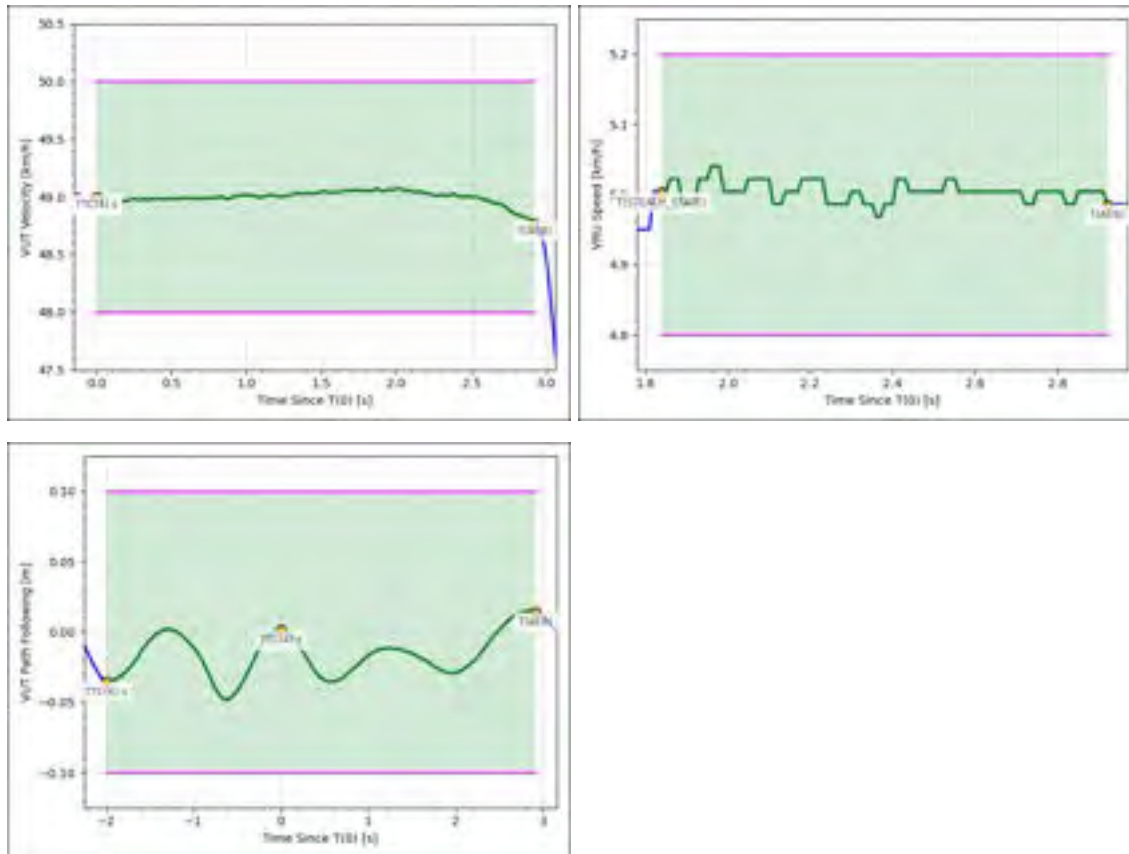
CPNC-50 5 kph (Day) | 50 km/h | Run 4

Run Date / Time 6-Apr-2023 11:19



CPNC-50 5 kph (Day) | 50 km/h | Run 5

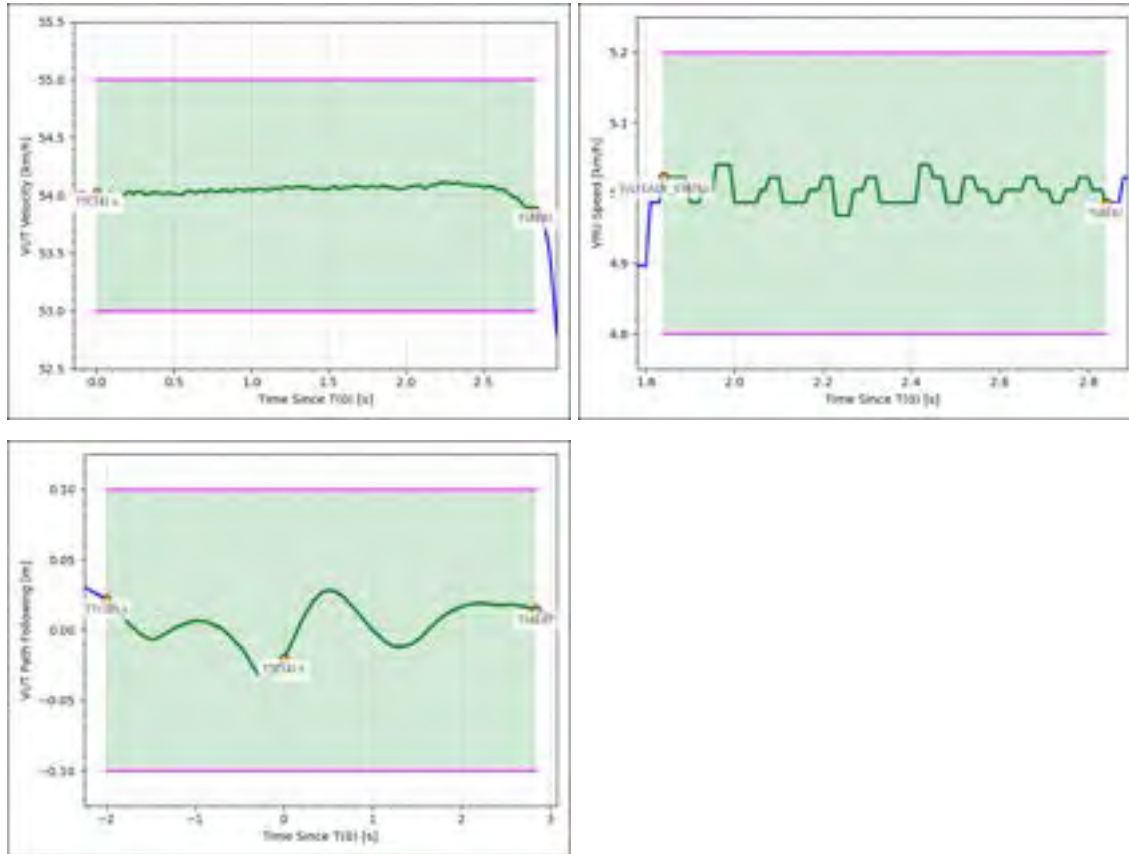
Run Date / Time 6-Apr-2023 11:31



J.2.1.6. CPNC-50 VUT 55kph EPT 5kph (Day)

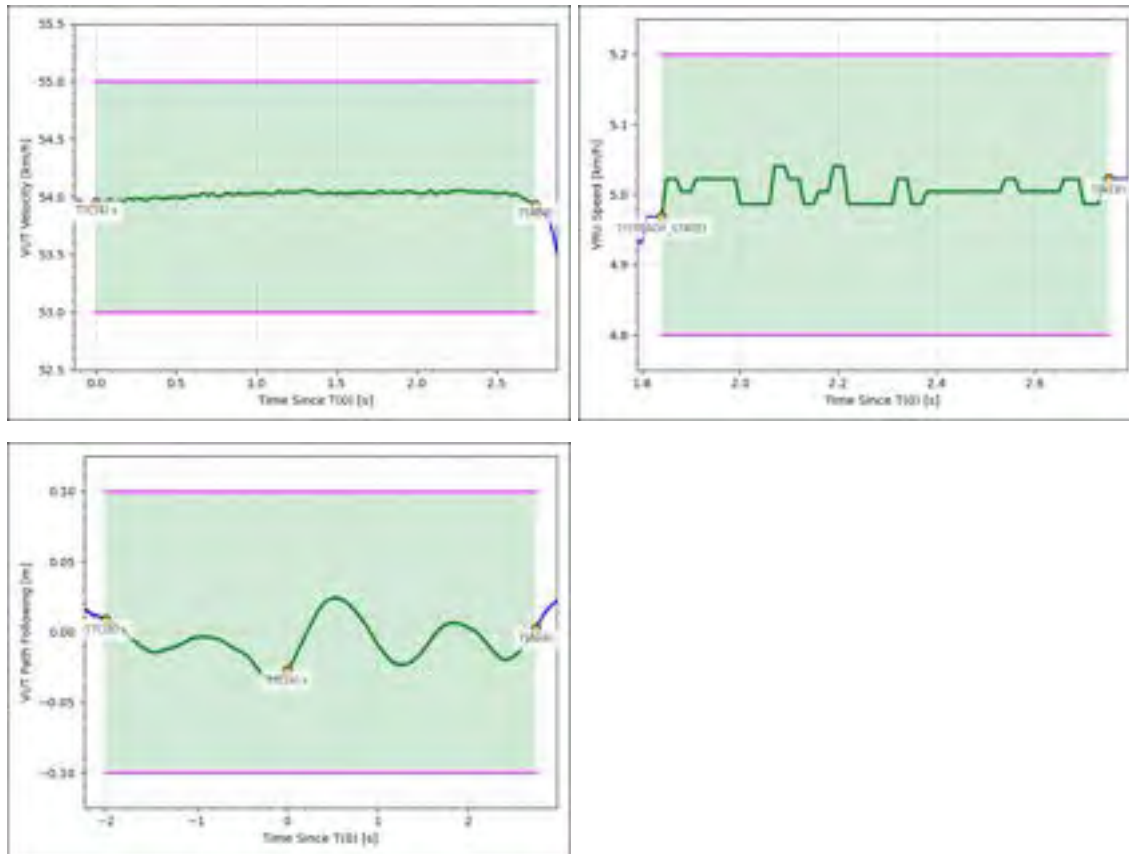
CPNC-50 5 kph (Day) | 55 km/h | Run 5

Run Date / Time 6-Apr-2023 11:52



CPNC-50 5 kph (Day) | 55 km/h | Run 6

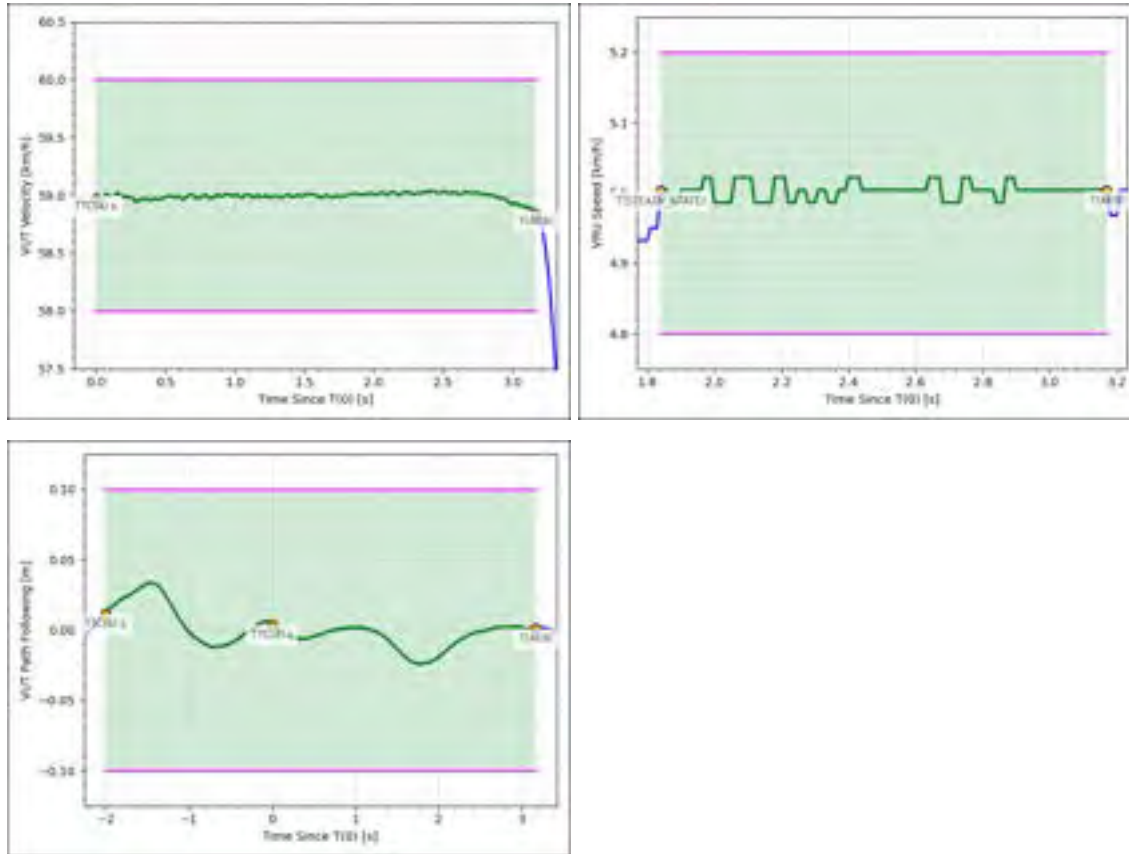
Run Date / Time 6-Apr-2023 11:56



J.2.1.7. CPNC-50 VUT 60kph EPT 5kph (Day)

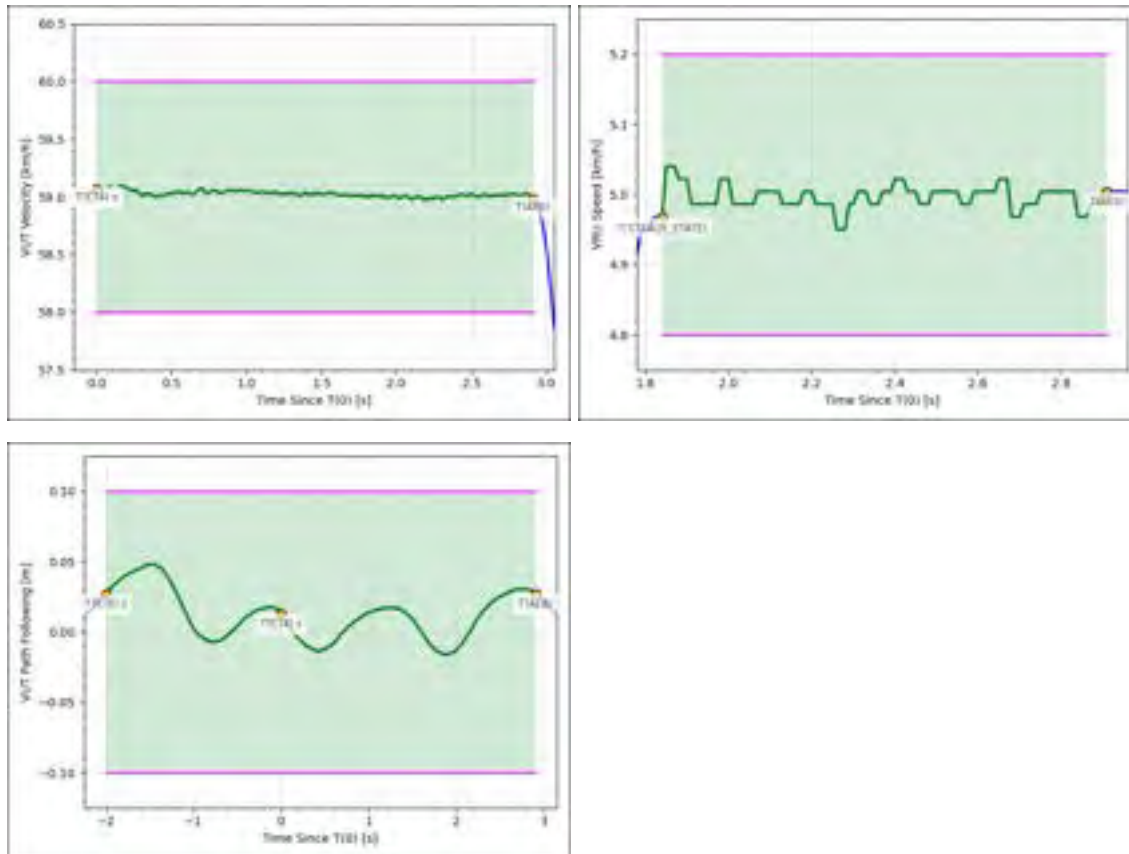
CPNC-50 5 kph (Day) | 60 km/h | Run 4

Run Date / Time 6-Apr-2023 12:01



CPNC-50 5 kph (Day) | 60 km/h | Run 7

Run Date / Time 6-Apr-2023 12:23

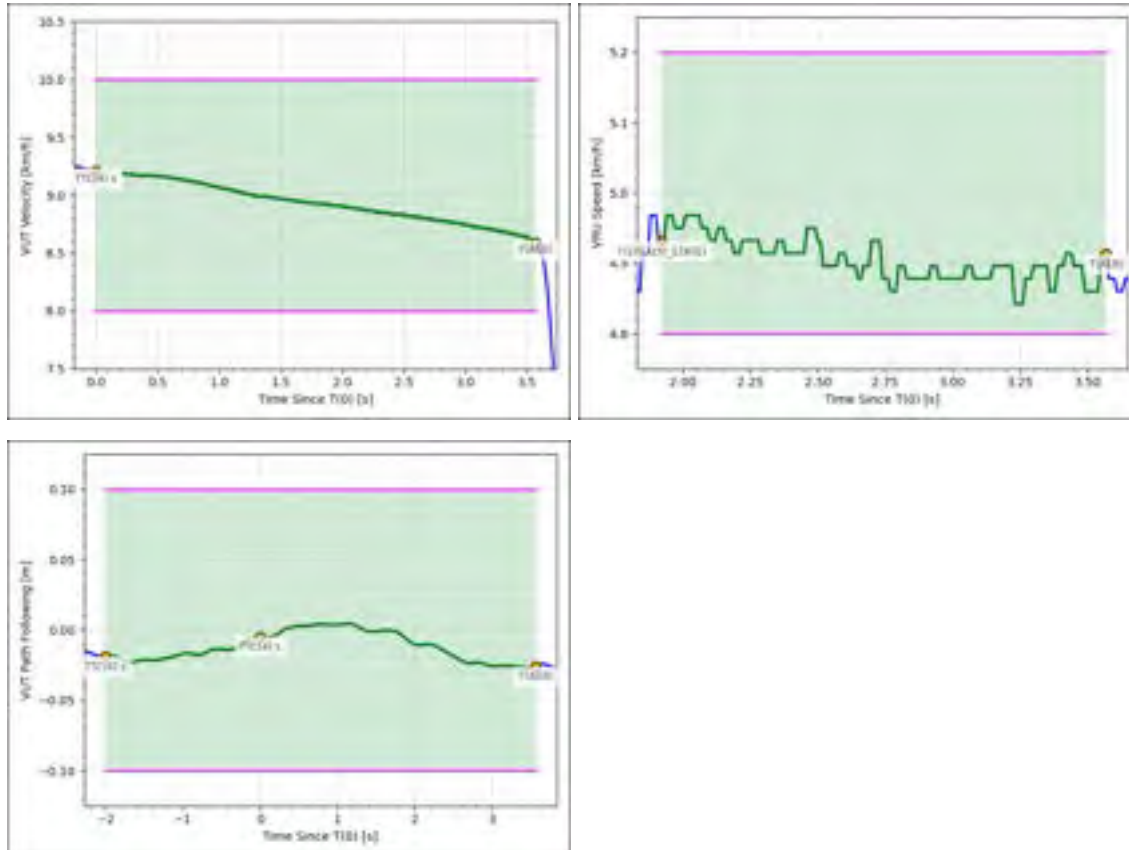


J.2.1. Bullbar (OEM Height)

J.2.1.1. CPNC-50 VUT 10kph EPT 5kph (Day)

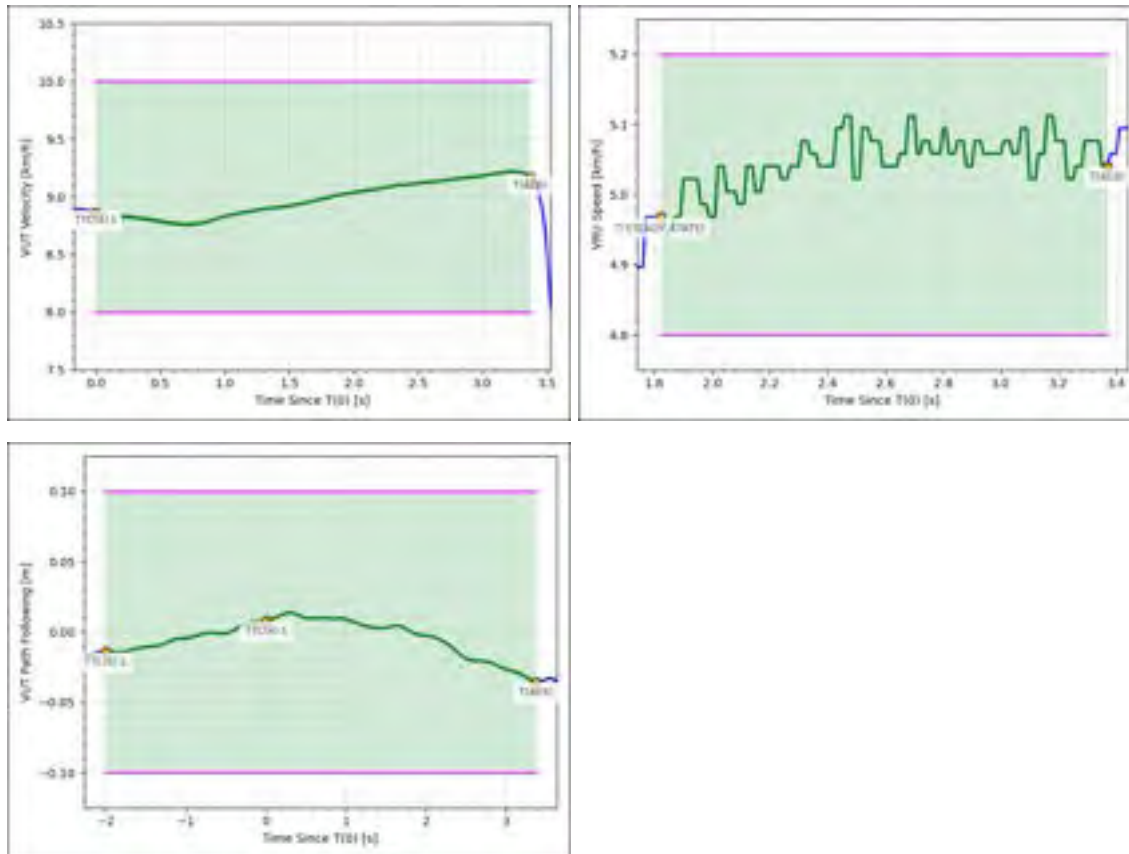
CPNC-50 5 kph (Day) | 10 km/h | Run 9

Run Date / Time 19-Jul-2023 11:45



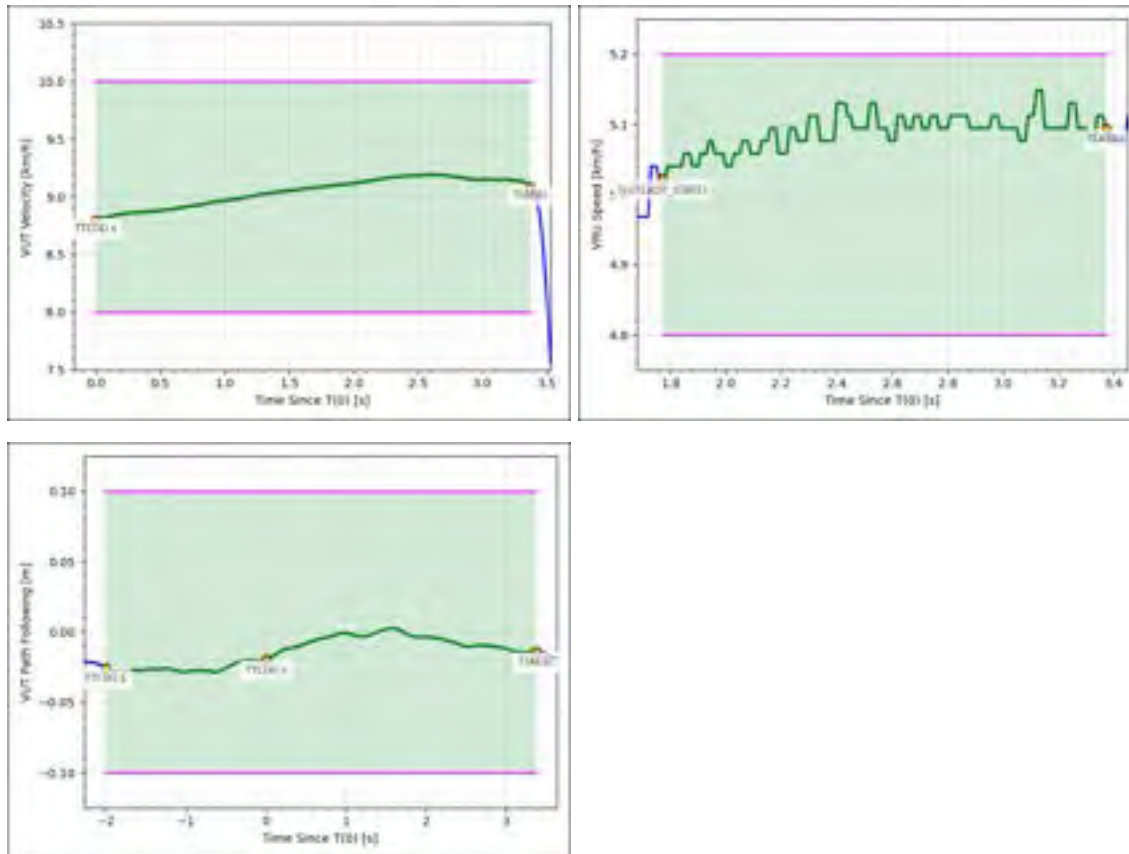
CPNC-50 5 kph (Day) | 10 km/h | Run 10

Run Date / Time 19-Jul-2023 11:48



CPNC-50 5 kph (Day) | 10 km/h | Run 11

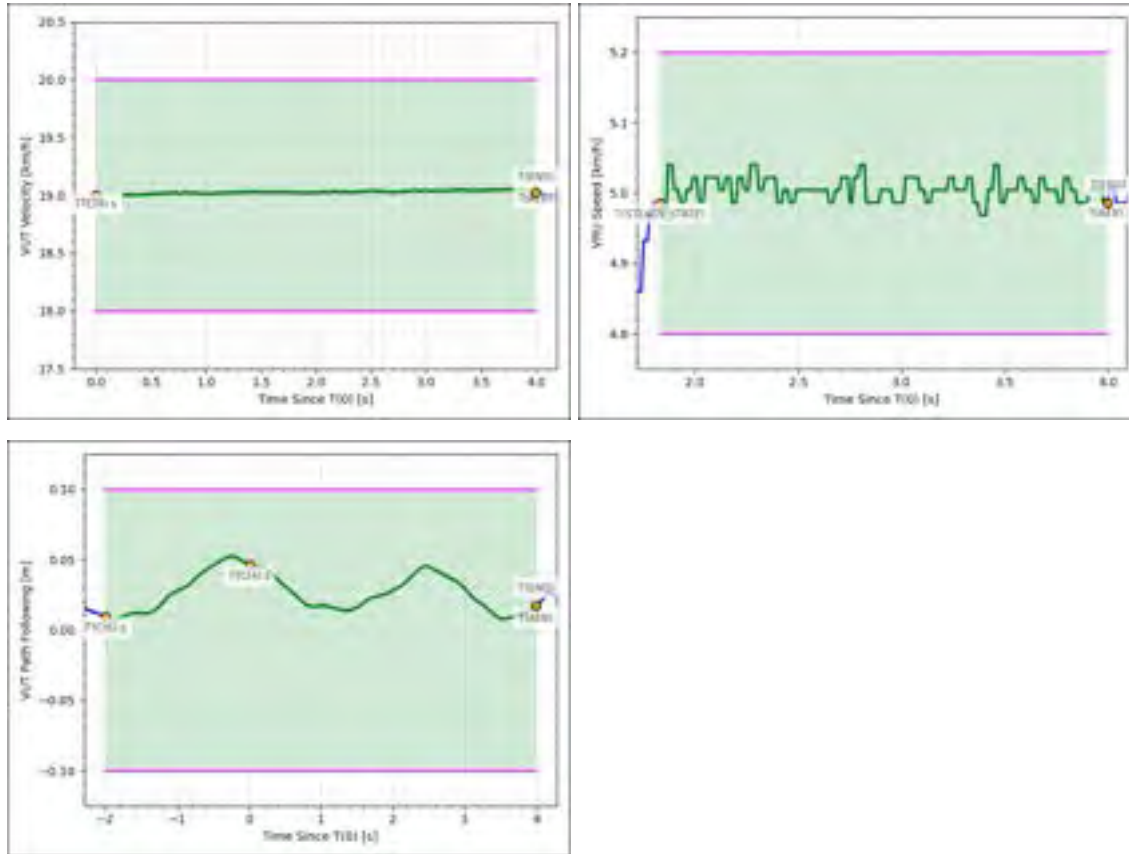
Run Date / Time 19-Jul-2023 11:53



J.2.1.2. CPNC-50 VUT 20kph EPT 5kph (Day)

CPNC-50 5 kph (Day) | 20 km/h | Run 1

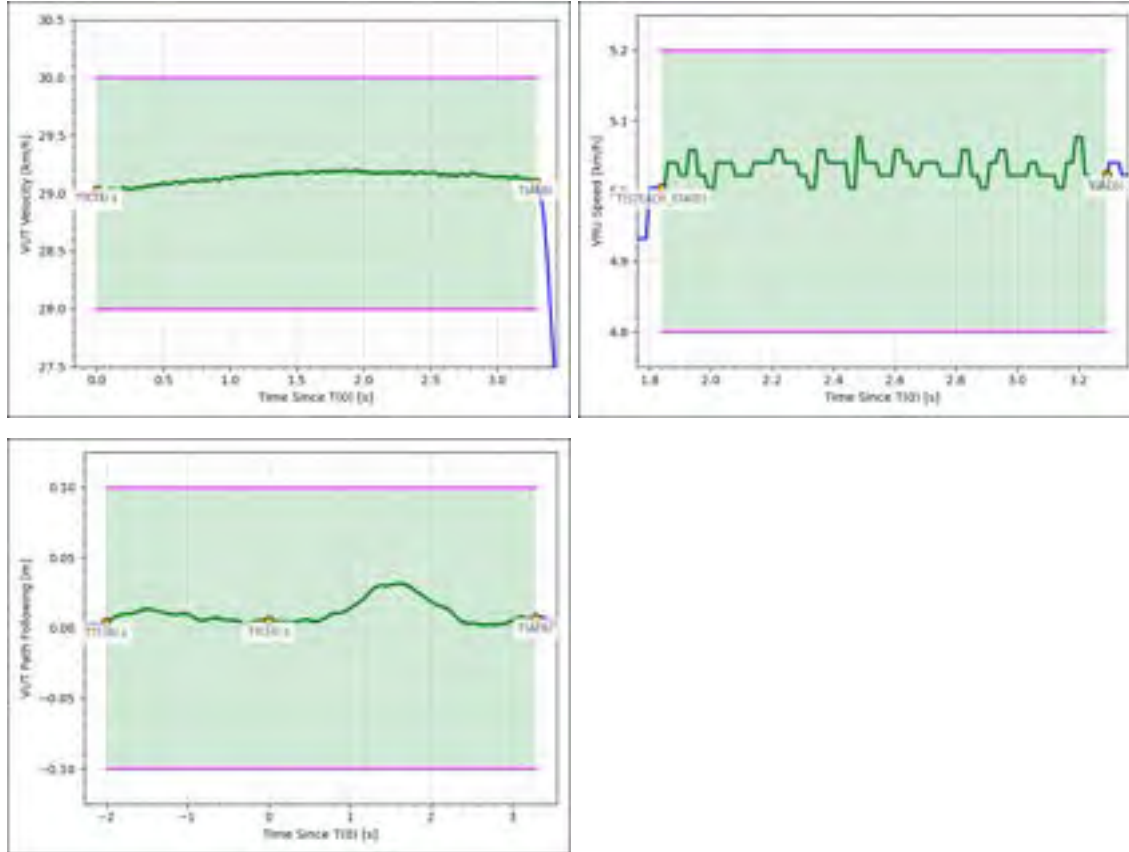
Run Date / Time 19-Jul-2023 14:30



J.2.1.3. CPNC-50 VUT 30kph EPT 5kph (Day)

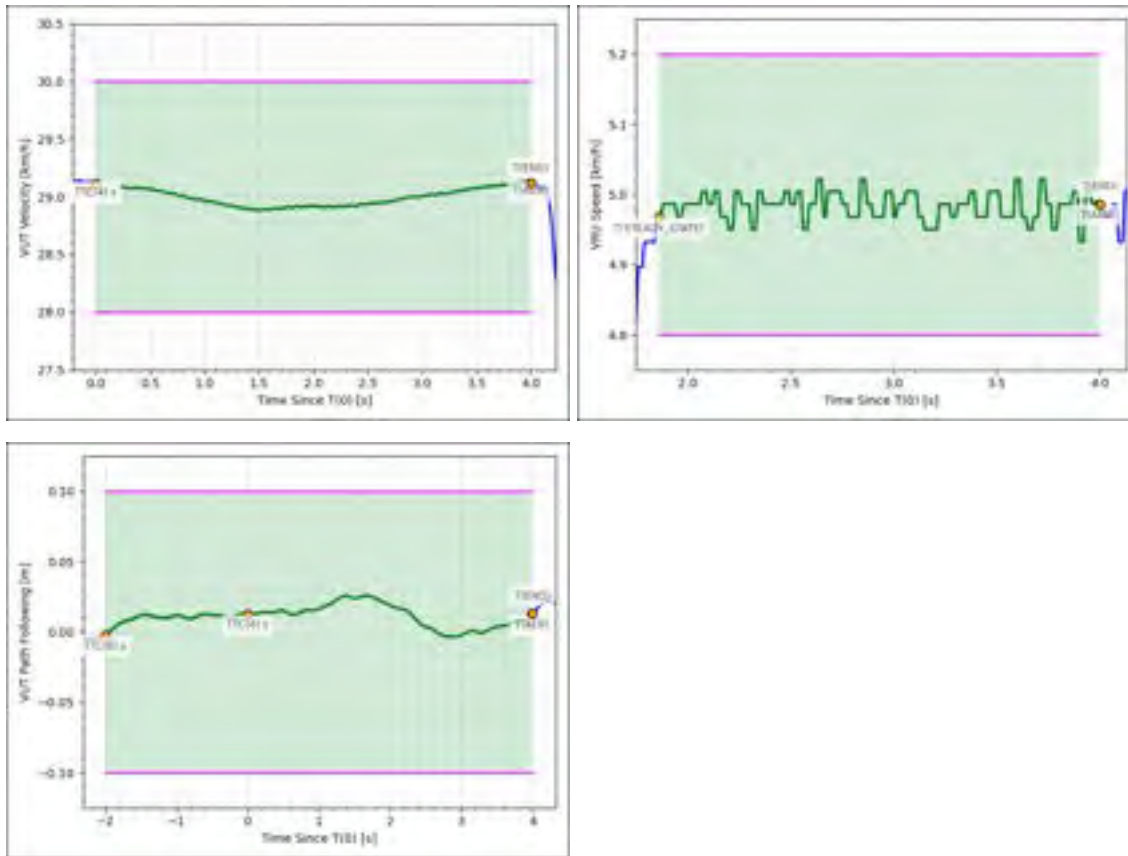
CPNC-50 5 kph (Day) | 30 km/h | Run 6

Run Date / Time 19-Jul-2023 11:58



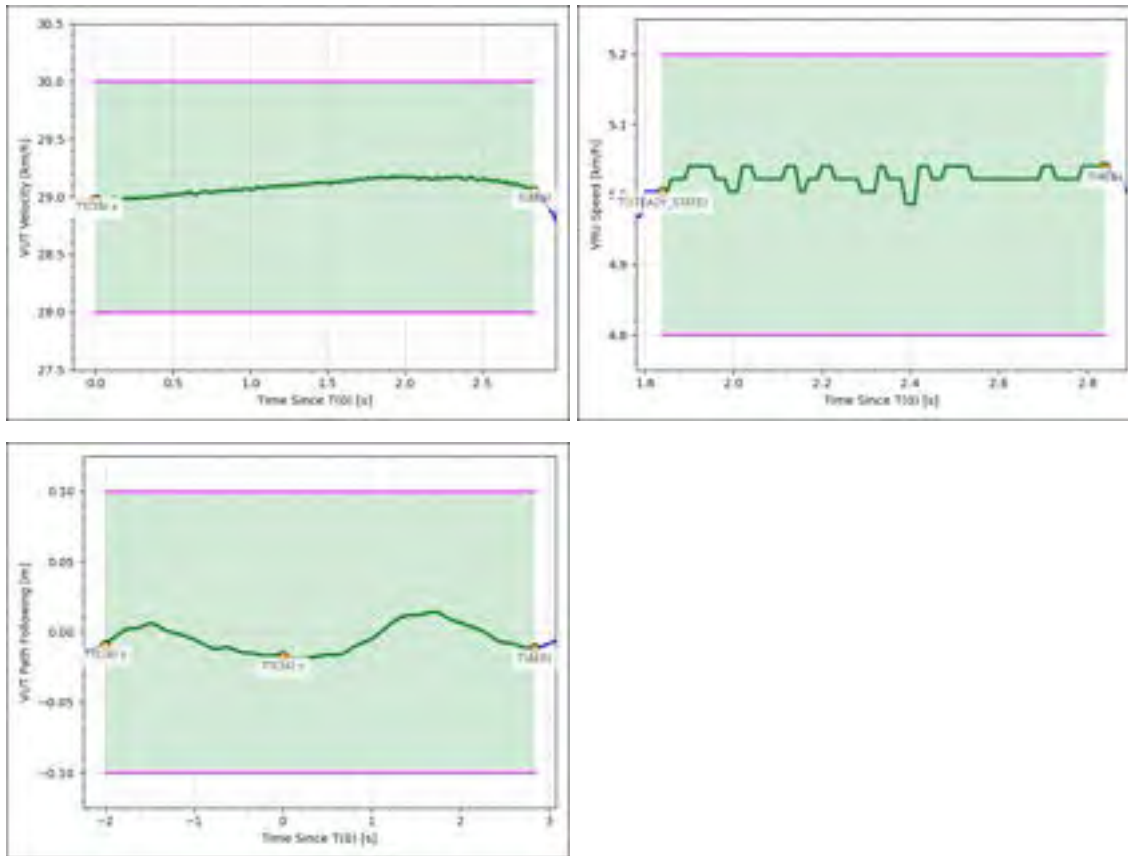
CPNC-50 5 kph (Day) | 30 km/h | Run 7

Run Date / Time 19-Jul-2023 12:01



CPNC-50 5 kph (Day) | 30 km/h | Run 8

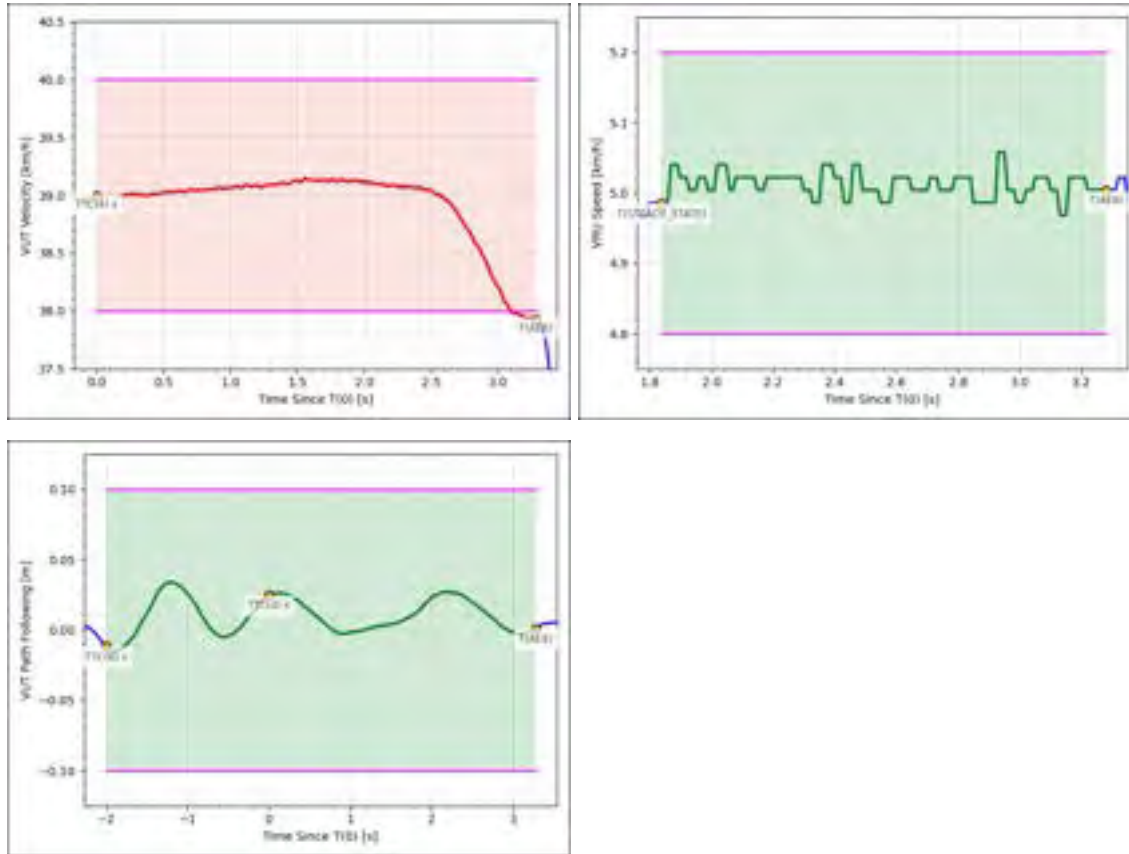
Run Date / Time 19-Jul-2023 12:11



J.2.1.4. CPNC-50 VUT 40kph EPT 5kph (Day)

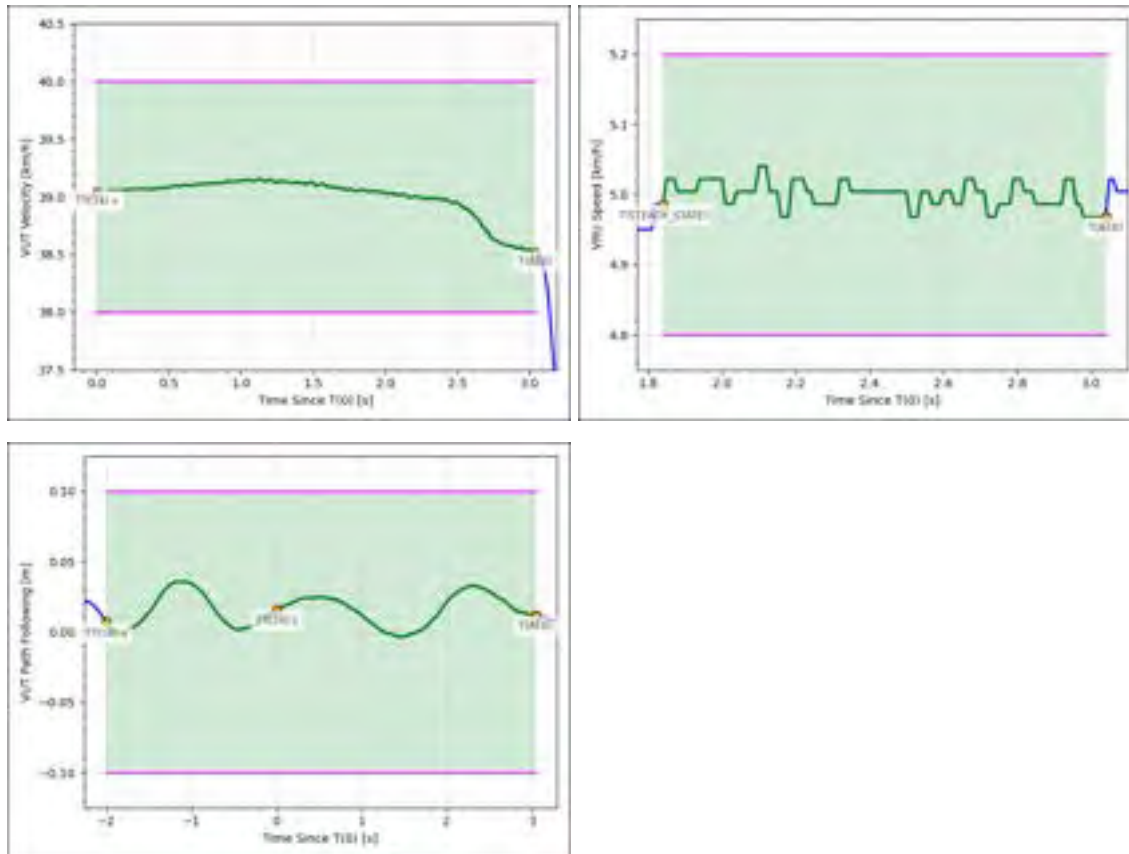
CPNC-50 5 kph (Day) | 40 km/h | Run 7

Run Date / Time 19-Jul-2023 12:15



CPNC-50 5 kph (Day) | 40 km/h | Run 8

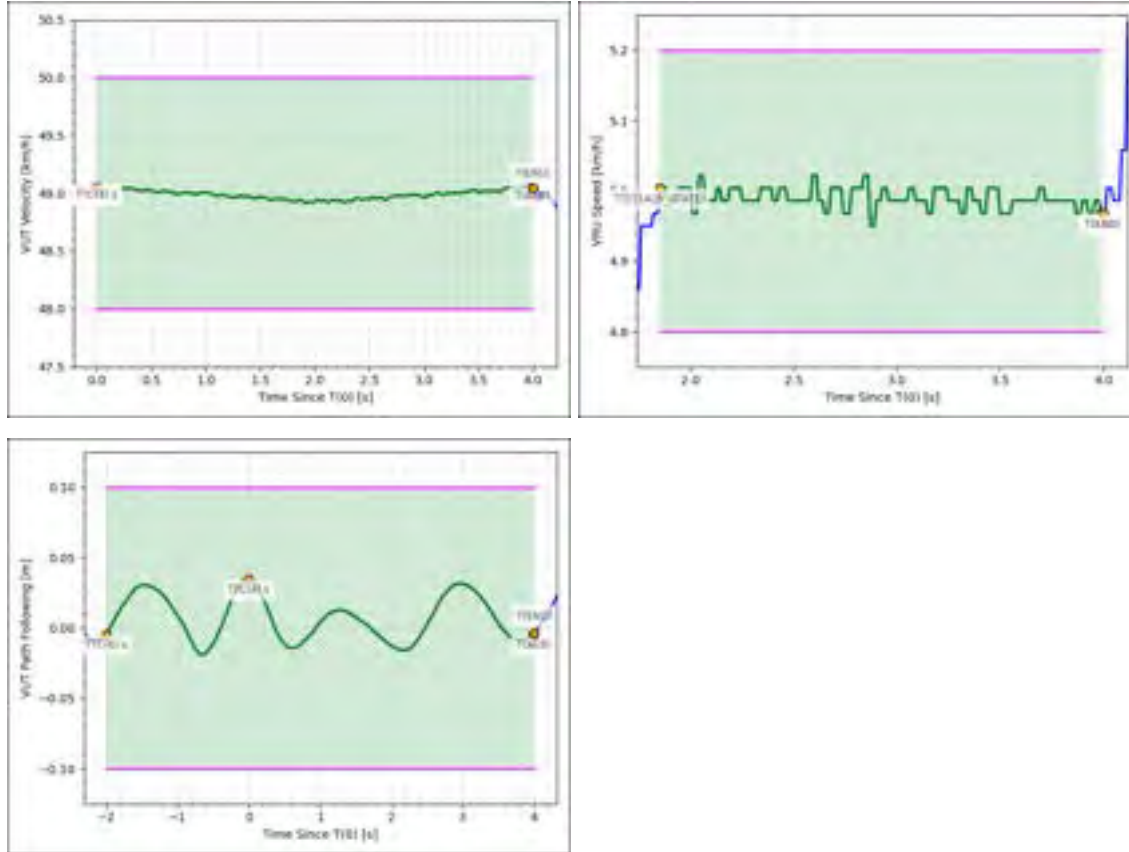
Run Date / Time 19-Jul-2023 12:22



J.2.1.5. CPNC-50 VUT 50kph EPT 5kph (Day)

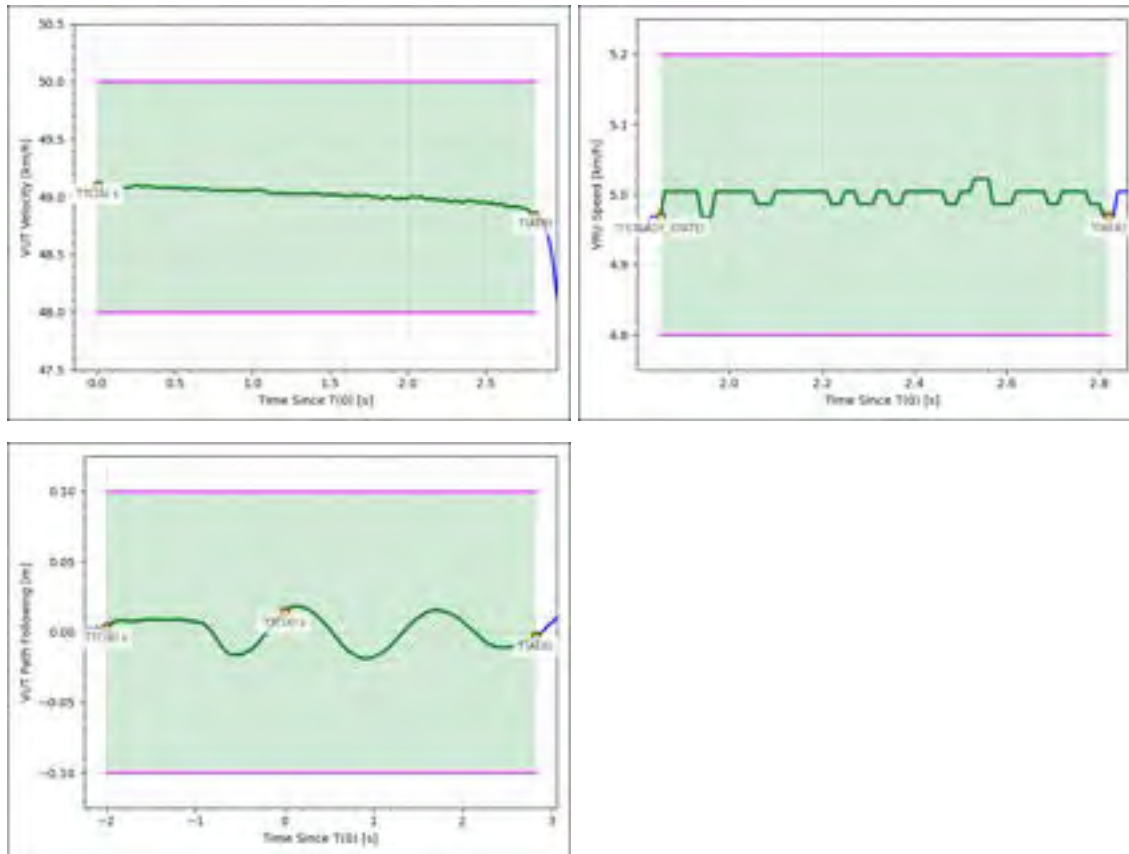
CPNC-50 5 kph (Day) | 50 km/h | Run 6

Run Date / Time 19-Jul-2023 13:28



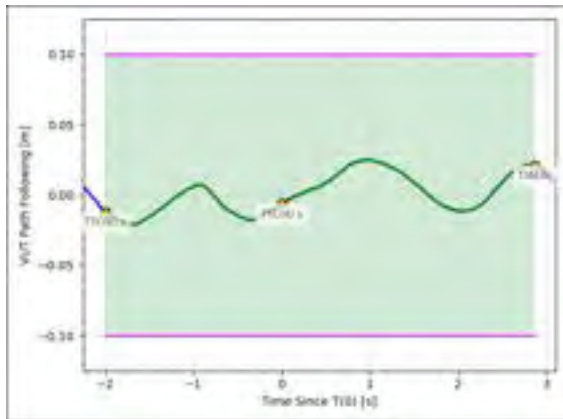
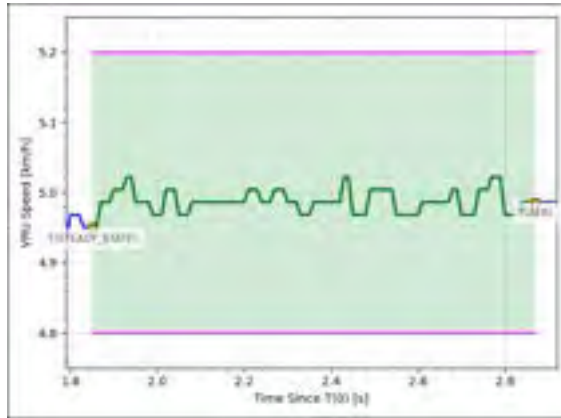
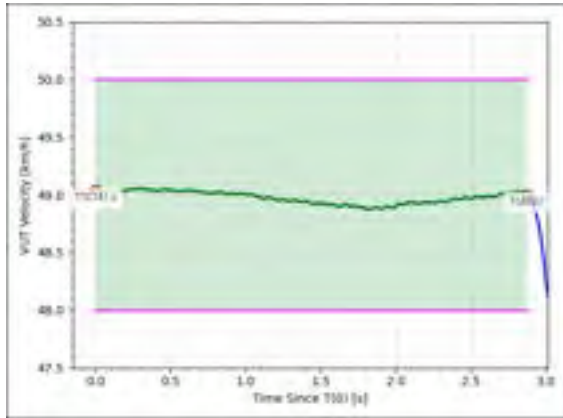
CPNC-50 5 kph (Day) | 50 km/h | Run 7

Run Date / Time 19-Jul-2023 13:49



CPNC-50 5 kph (Day) | 50 km/h | Run 8

Run Date / Time 19-Jul-2023 13:54



APPENDIX K

Toyota Hilux Lane Keeping Results Validity

K. Hilux Lane Keeping Results Validity

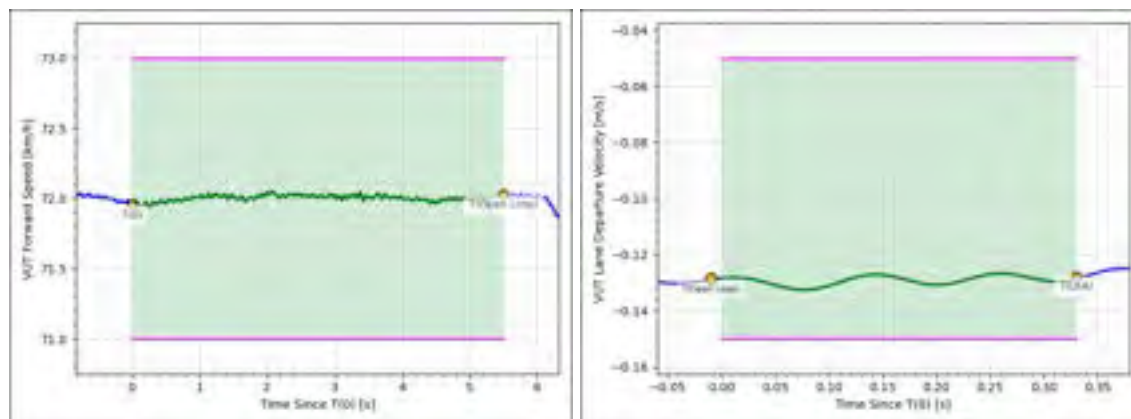
K.1. GVM

K.1.1. SLN-D

K.1.1.1. 0.1 m/s

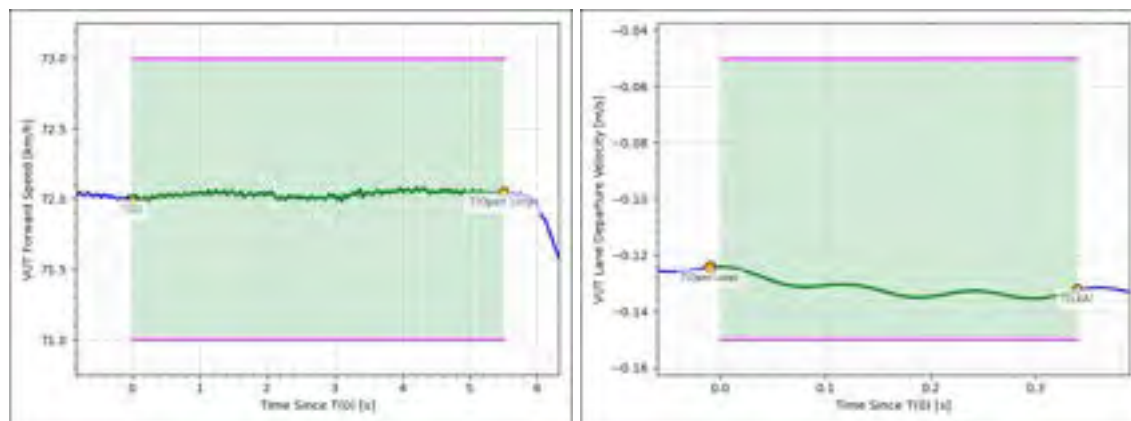
LKA SLN-D 0.1 mps Main | 0.1 m/s | Run 3

Run Date / Time 21-Feb-2023 11:06



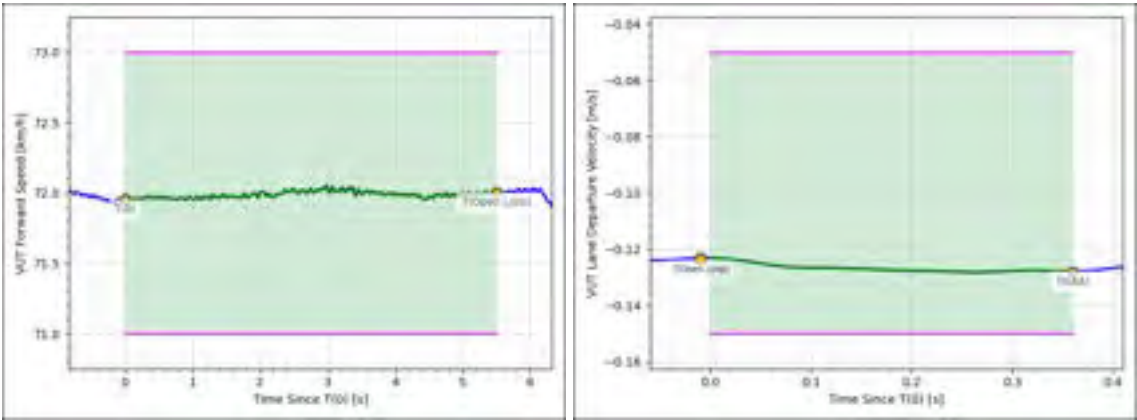
LKA SLN-D 0.1 mps Main | 0.1 m/s | Run 4

Run Date / Time 21-Feb-2023 11:09



LKA SLN-D 0.1 mps Main | 0.1 m/s | Run 6

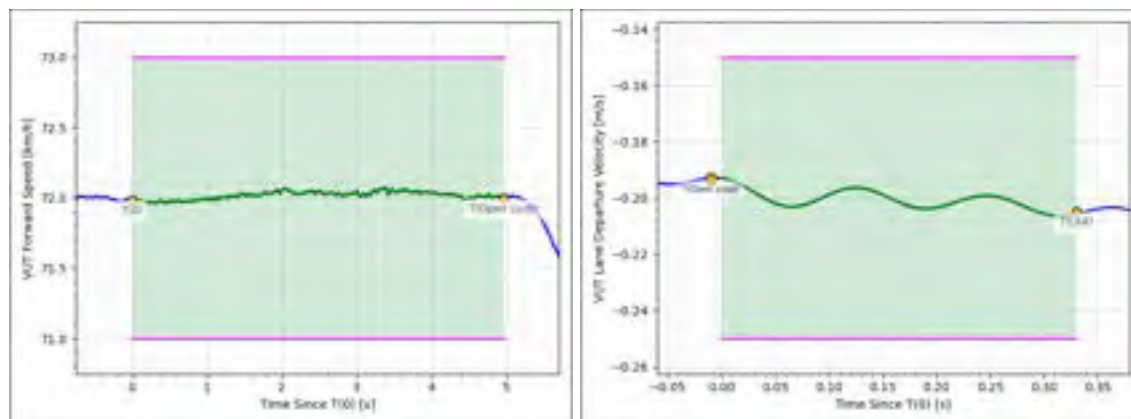
Run Date / Time 21-Feb-2023 11:15



K.1.1.2. 0.2 m/s

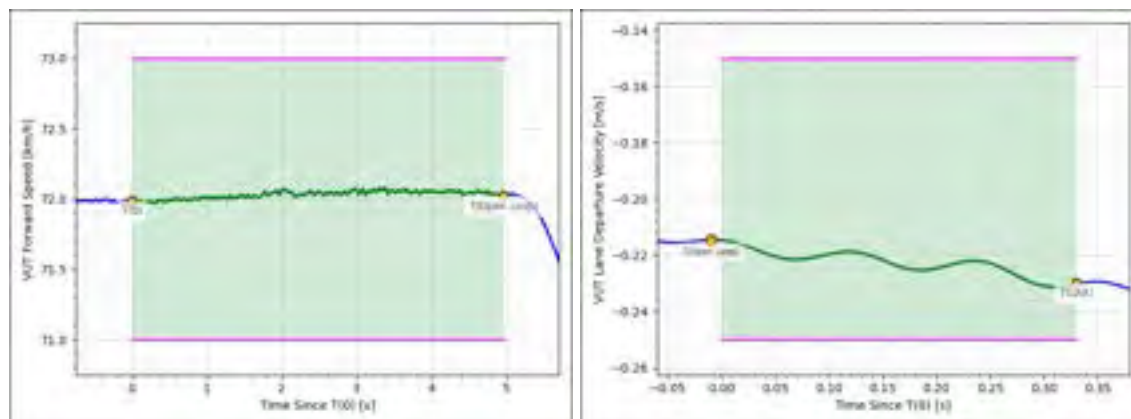
LKA SLN-D 0.2 mps Main | 0.2 m/s | Run 2

Run Date / Time 21-Feb-2023 10:55



LKA SLN-D 0.2 mps Main | 0.2 m/s | Run 3

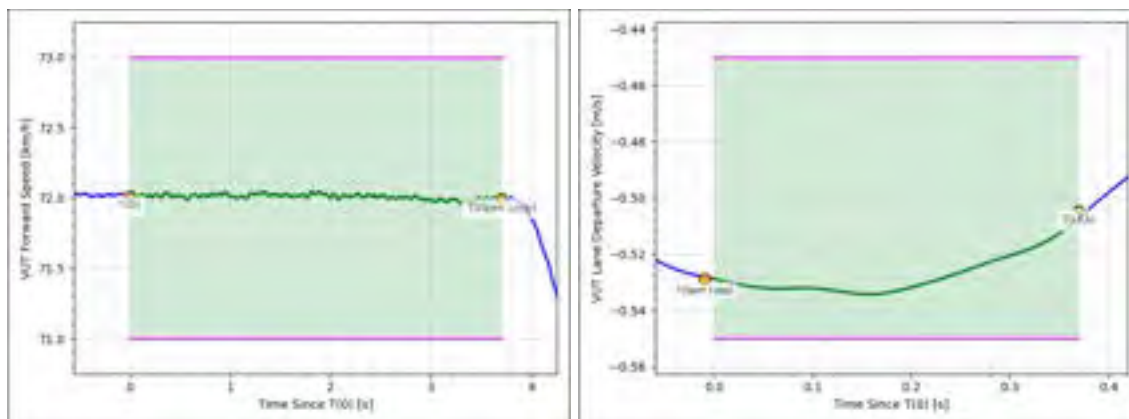
Run Date / Time 21-Feb-2023 10:57



K.1.1.3. 0.5 m/s

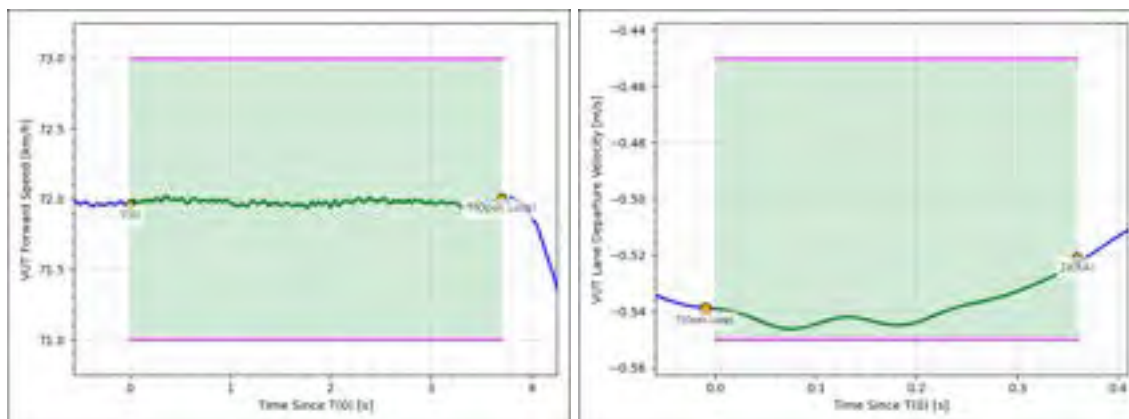
LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 4

Run Date / Time 21-Feb-2023 11:33



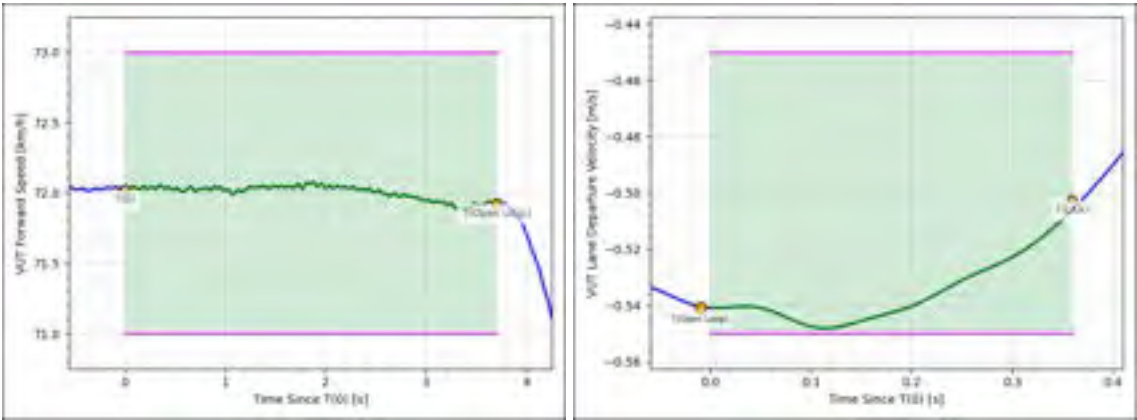
LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 6

Run Date / Time 21-Feb-2023 11:42



LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 7

Run Date / Time 21-Feb-2023 11:44

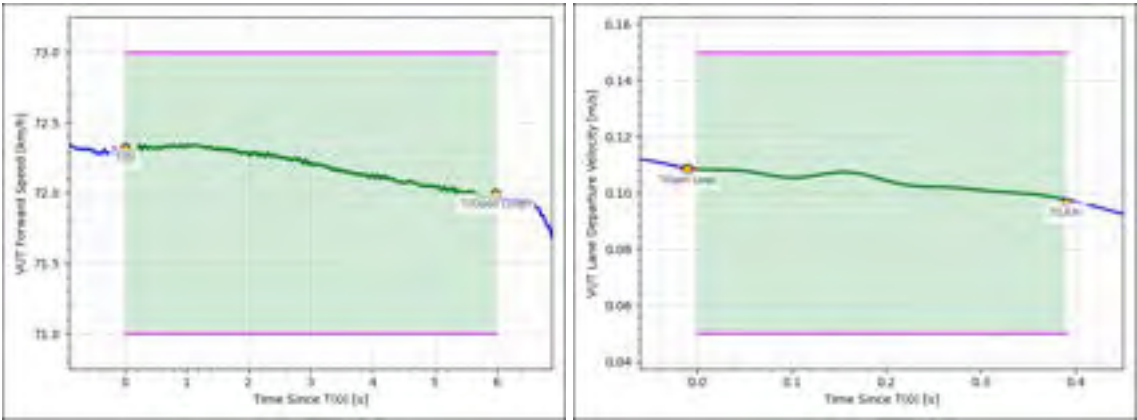


K.1.2. SLN-P

K.1.2.1. 0.1 m/s

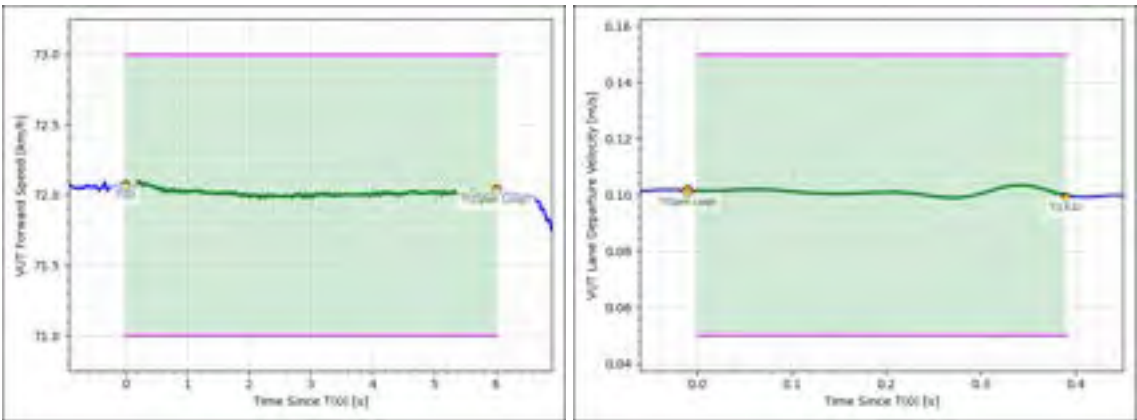
LKA SLN-P 0.1 mps Main | 0.1 m/s | Run 1

Run Date / Time 20-Feb-2023 15:28



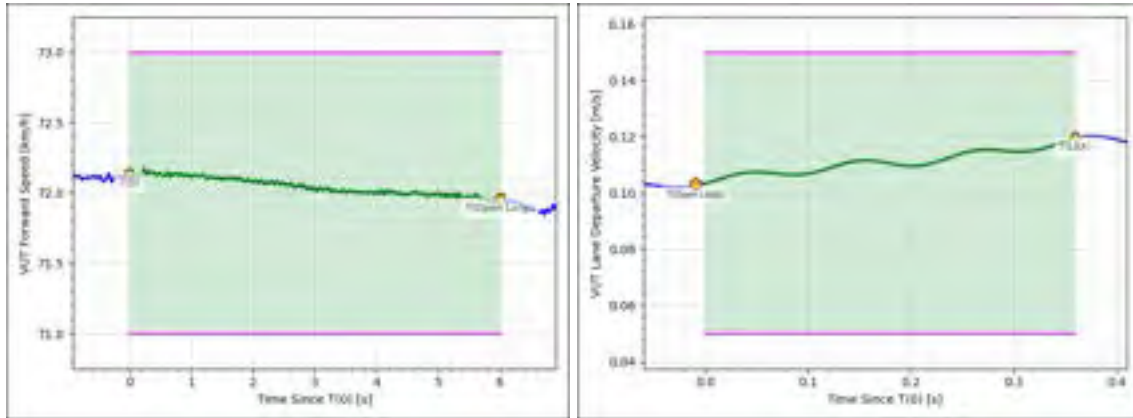
LKA SLN-P 0.1 mps Main | 0.1 m/s | Run 2

Run Date / Time 20-Feb-2023 15:31



LKA SLN-P 0.1 mps Main | 0.1 m/s | Run 5

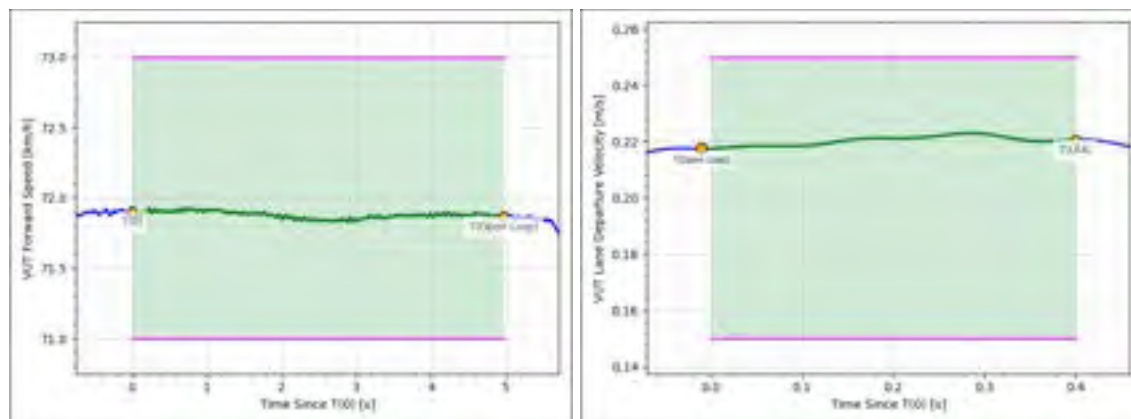
Run Date / Time 20-Feb-2023 15:36



K.1.2.2. 0.2 m/s

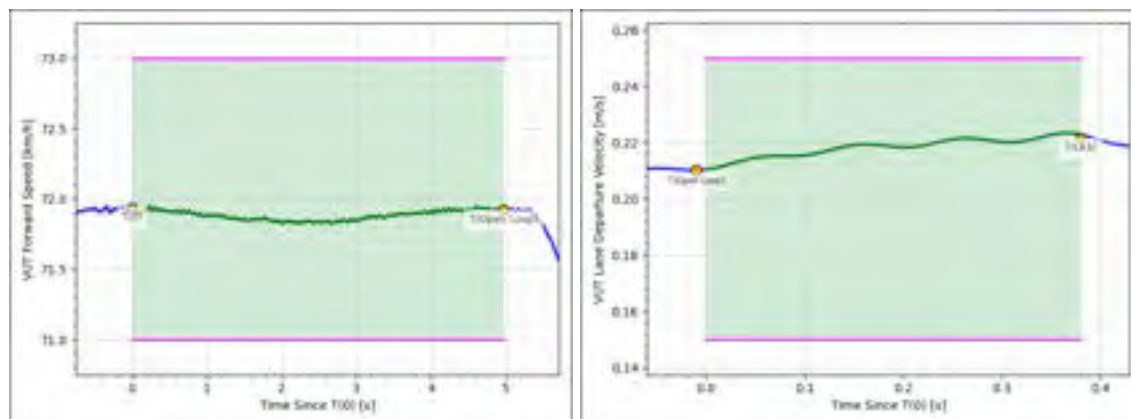
LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 20

Run Date / Time 20-Feb-2023 12:56



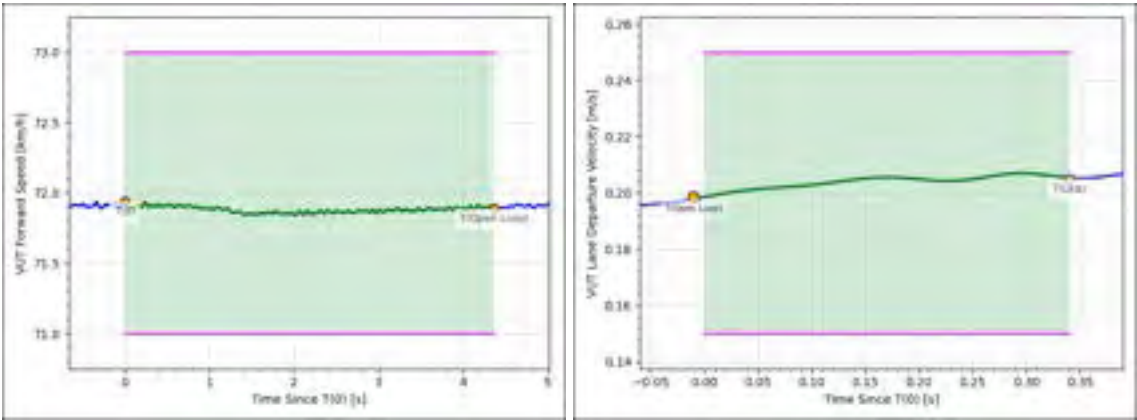
LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 21

Run Date / Time 20-Feb-2023 12:58



LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 25

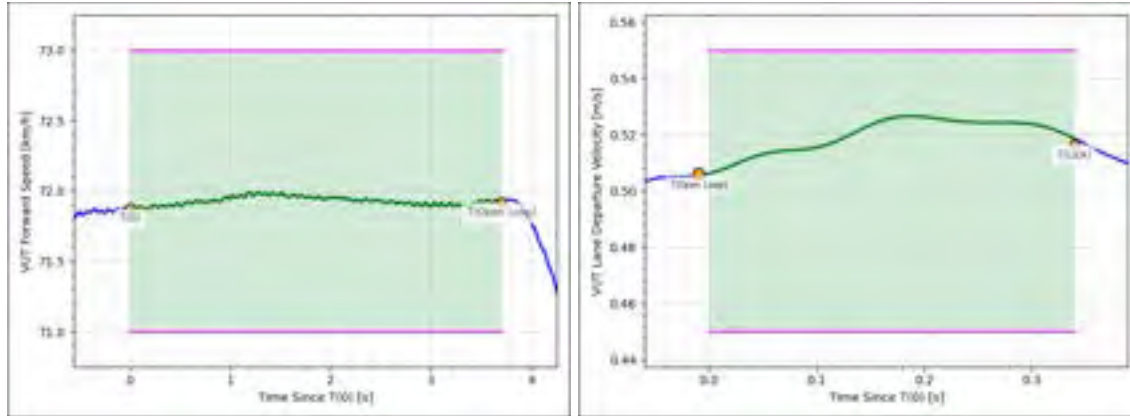
Run Date / Time 20-Feb-2023 13:10



K.1.2.3. 0.5 m/s

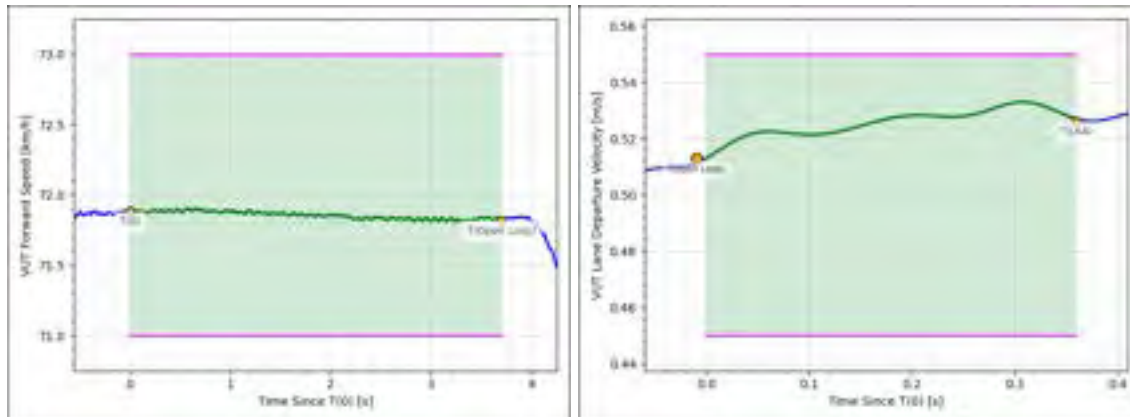
LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 6

Run Date / Time 20-Feb-2023 13:24



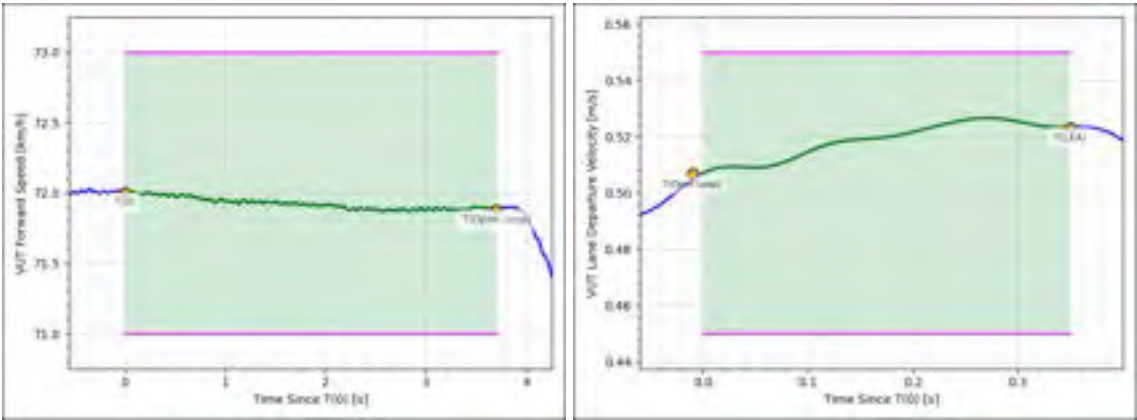
LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 11

Run Date / Time 20-Feb-2023 13:52



LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 12

Run Date / Time 20-Feb-2023 13:55

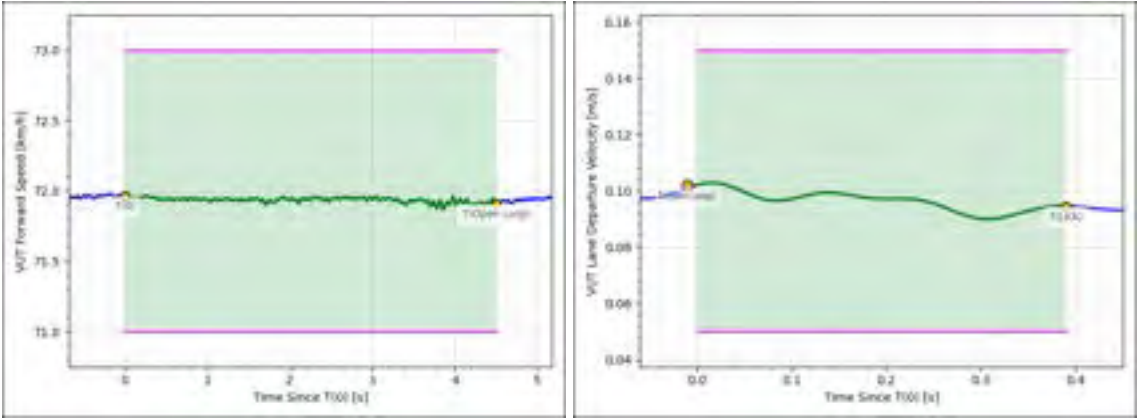


K.1.3. DLN-P

K.1.3.1. 0.1 m/s

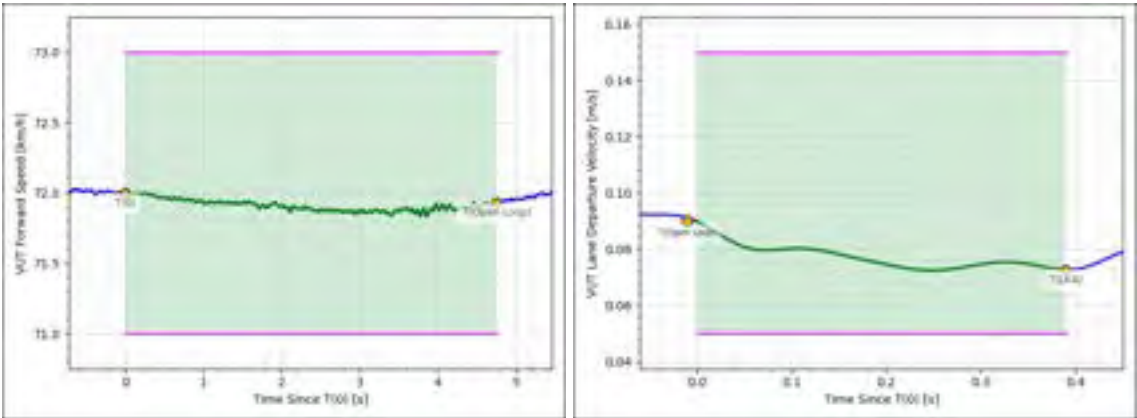
LKA DLN-P 0.1 mps Main | 0.1 m/s | Run 1

Run Date / Time 20-Feb-2023 15:03



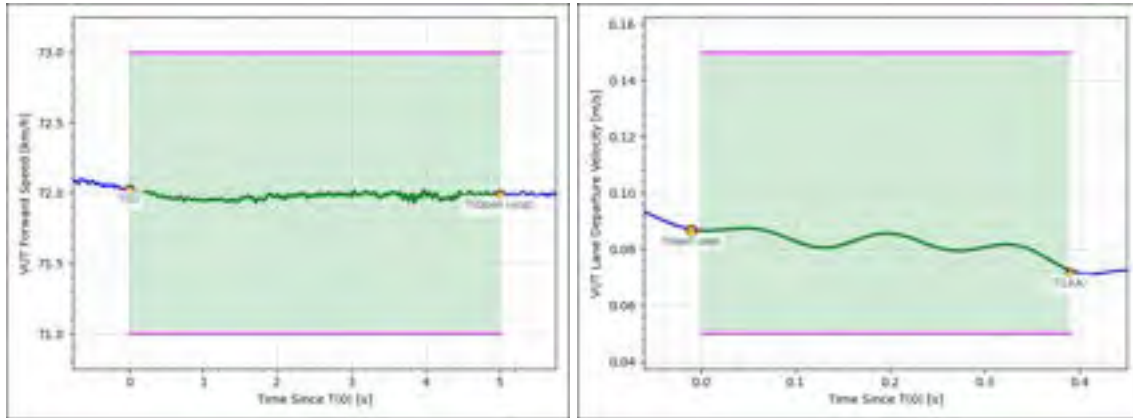
LKA DLN-P 0.1 mps Main | 0.1 m/s | Run 2

Run Date / Time 20-Feb-2023 15:07



LKA DLN-P 0.1 mps Main | 0.1 m/s | Run 3

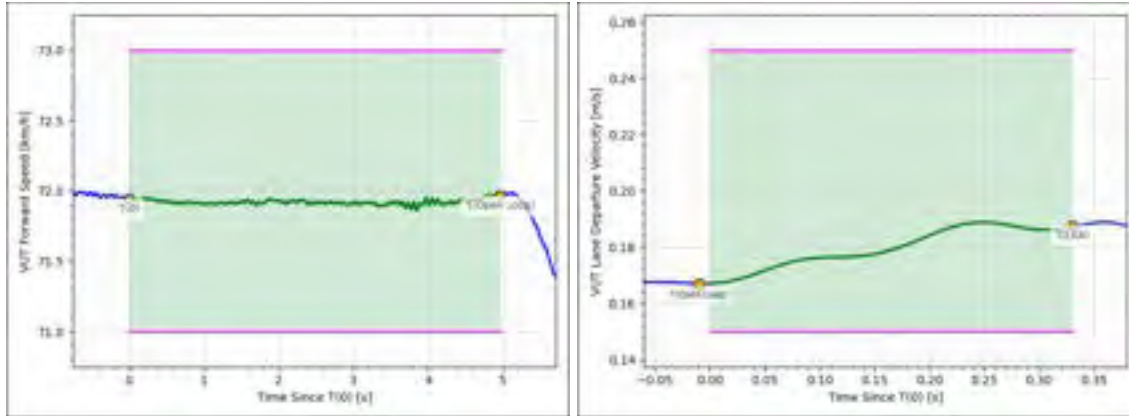
Run Date / Time 20-Feb-2023 15:10



K.1.3.2. 0.2 m/s

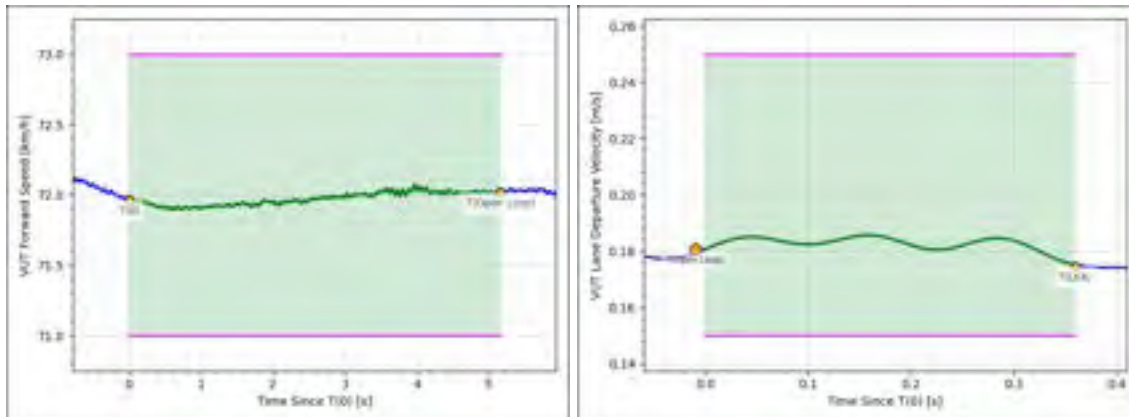
LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 5

Run Date / Time 20-Feb-2023 14:27



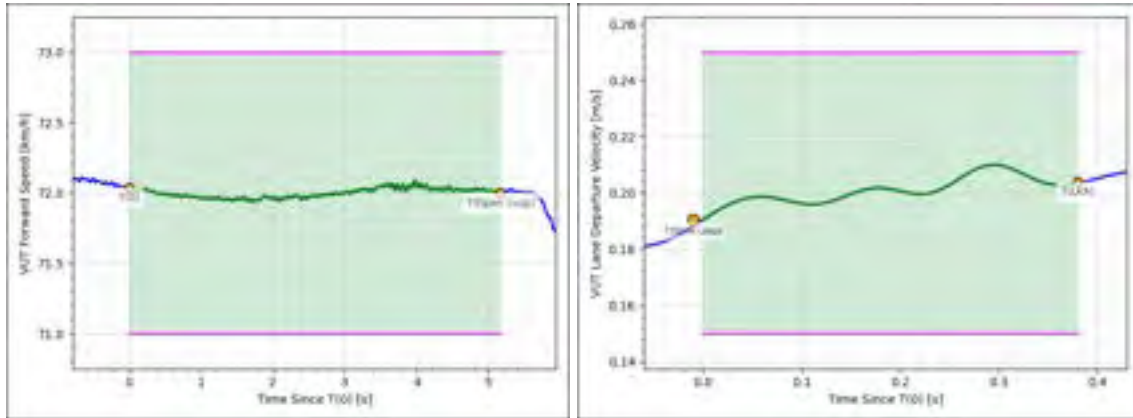
LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 8

Run Date / Time 22-Feb-2023 21:41



LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 9

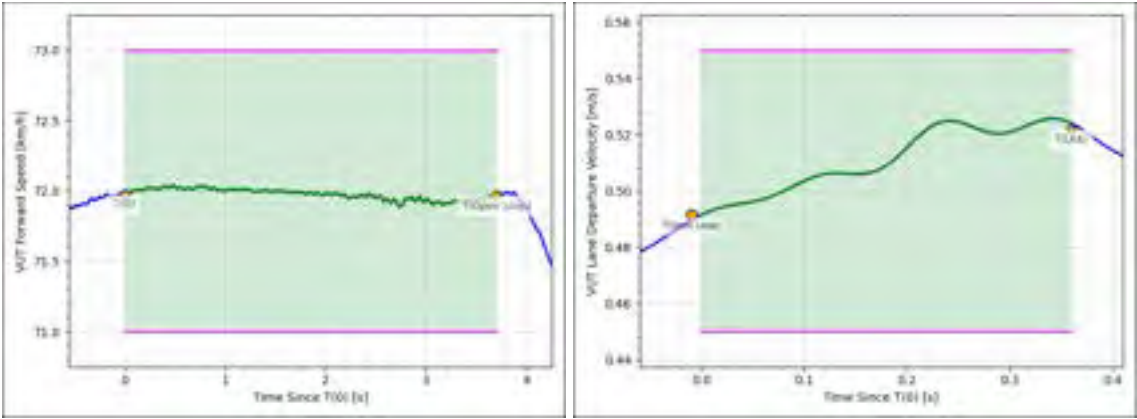
Run Date / Time 22-Feb-2023 21:44



K.1.3.3. 0.5 m/s

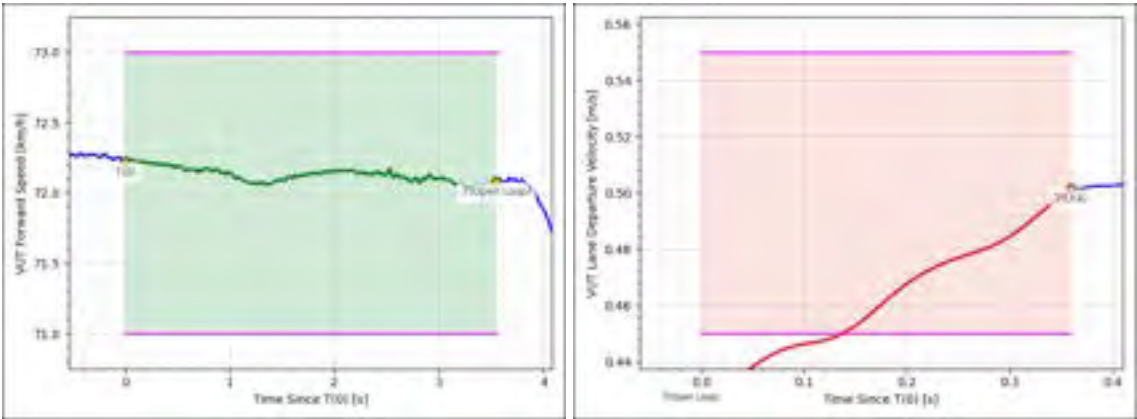
LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 1

Run Date / Time 20-Feb-2023 14:05



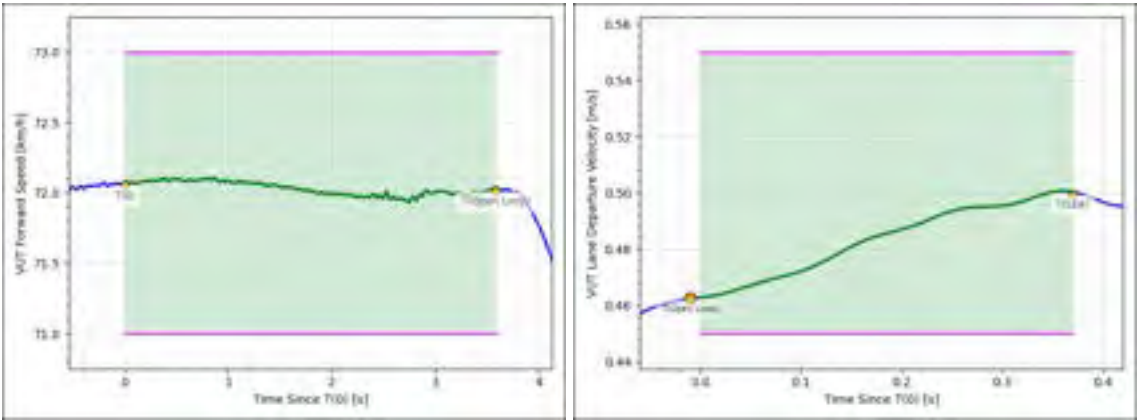
LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 4

Run Date / Time 28-Feb-2023 12:02



LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 6

Run Date / Time 28-Feb-2023 12:07

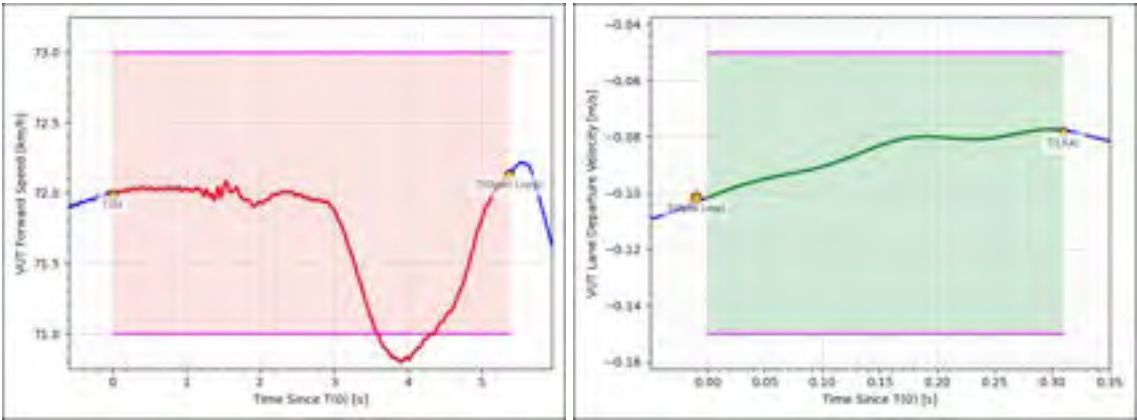


K.1.4. DLN-D

K.1.4.1. 0.1 m/s

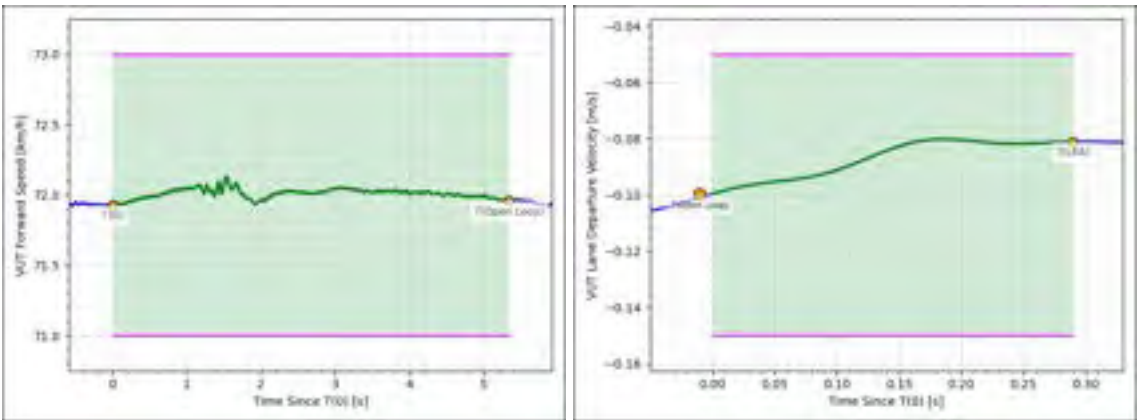
LKA DLN-D 0.1 mps Main | 0.1 m/s | Run 6

Run Date / Time 24-Feb-2023 14:49



LKA DLN-D 0.1 mps Main | 0.1 m/s | Run 8

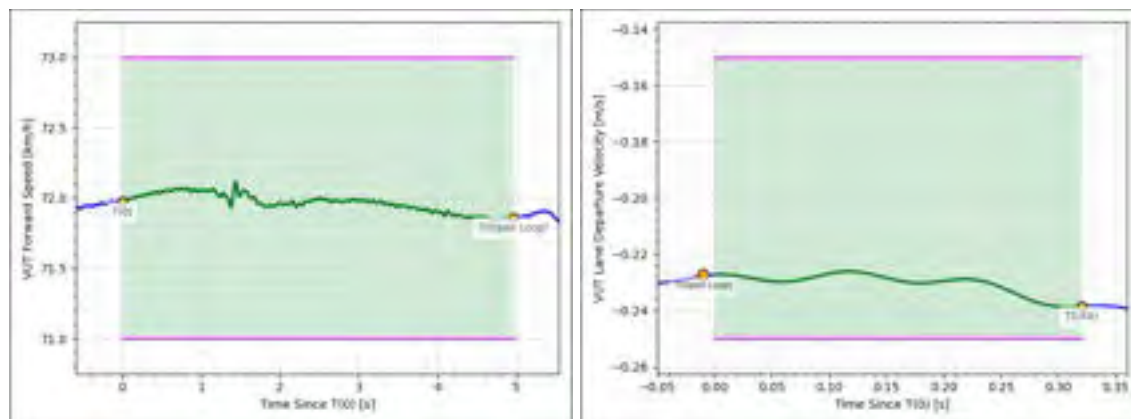
Run Date / Time 24-Feb-2023 14:54



K.1.4.2. 0.2 m/s

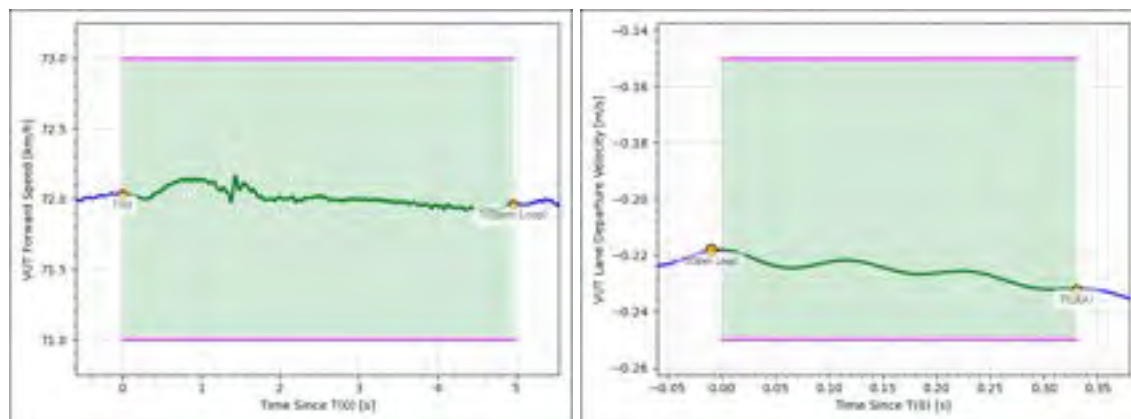
LKA DLN-D 0.2 mps Main | 0.2 m/s | Run 3

Run Date / Time 21-Feb-2023 12:51



LKA DLN-D 0.2 mps Main | 0.2 m/s | Run 4

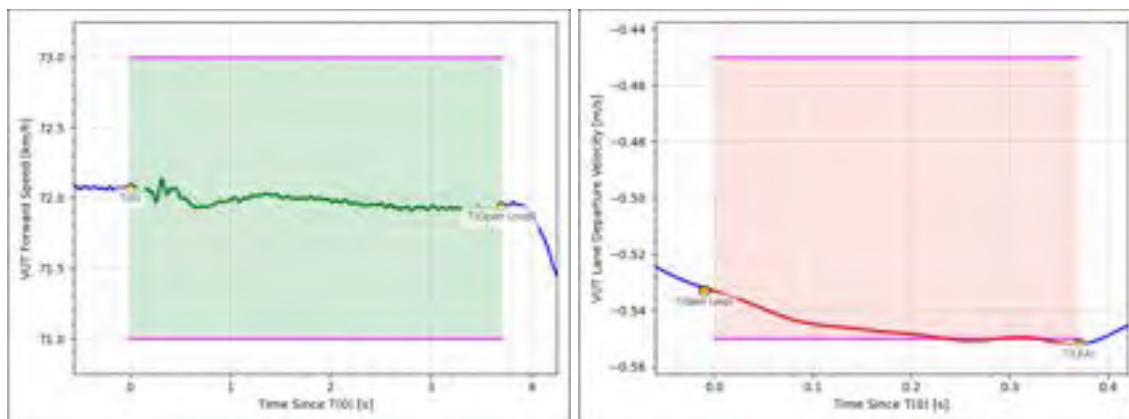
Run Date / Time 21-Feb-2023 12:54



K.1.4.3. 0.5 m/s

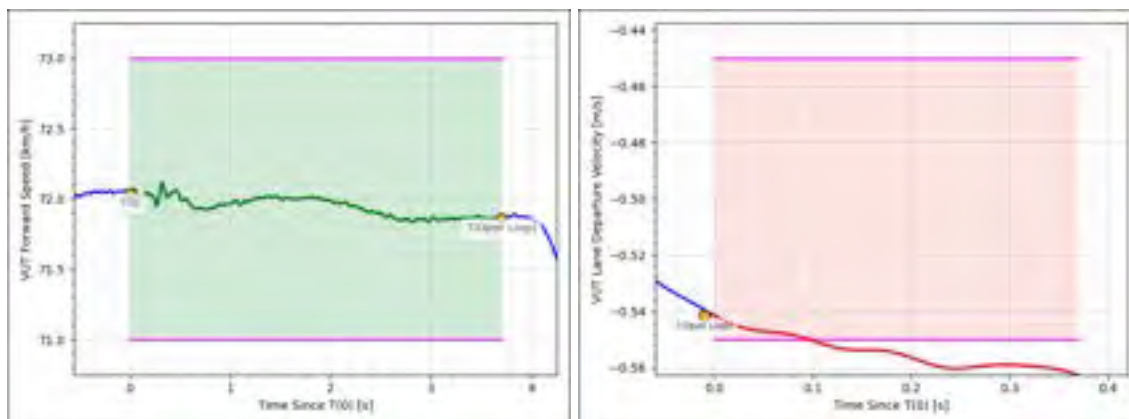
LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 1

Run Date / Time 21-Feb-2023 11:53



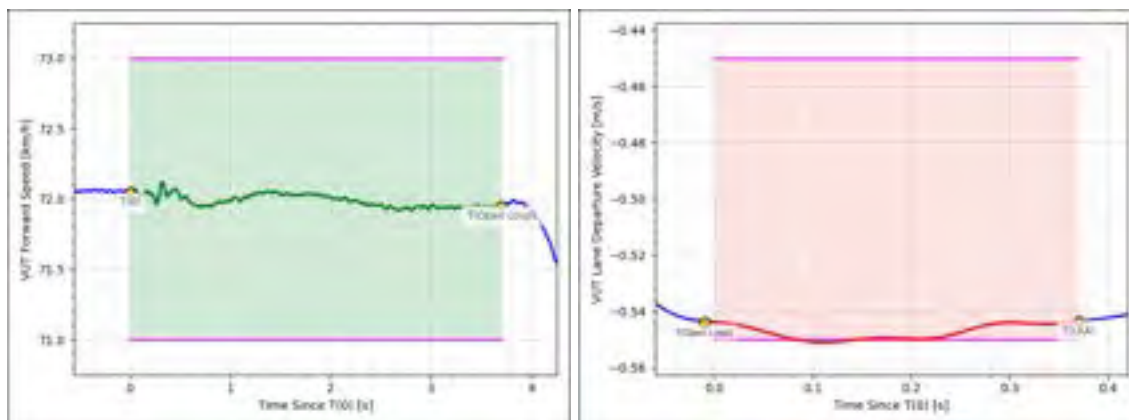
LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 2

Run Date / Time 21-Feb-2023 11:56



LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 3

Run Date / Time 21-Feb-2023 11:58



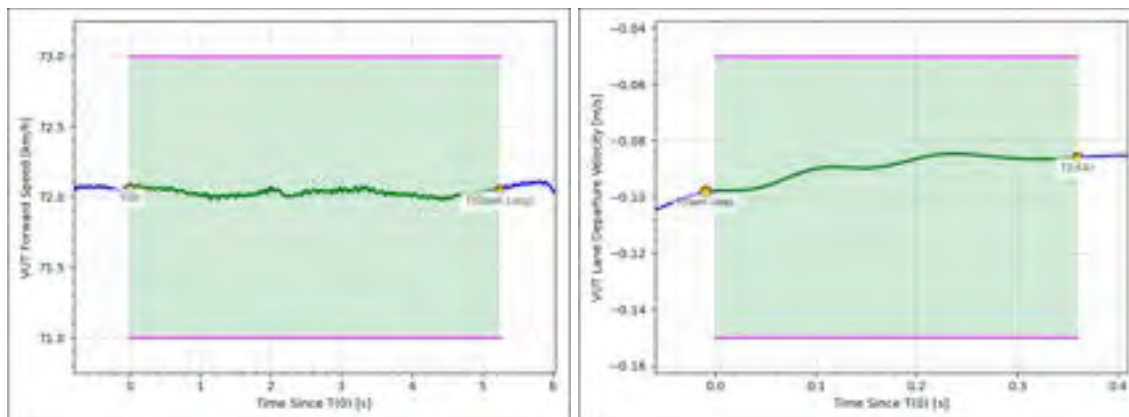
K.2. Rear Pitch

K.2.1. SLN-D

K.2.1.1. 0.1 m/s

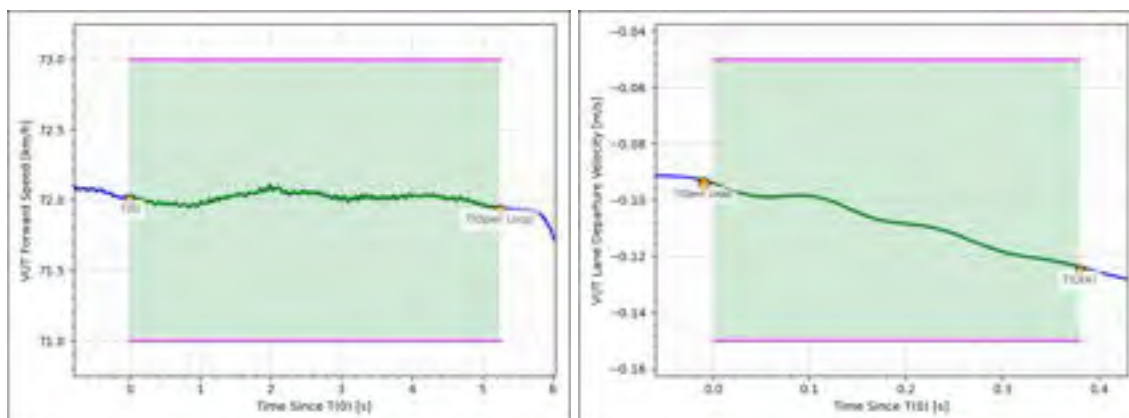
LKA SLN-D 0.1 mps Main | 0.1 m/s | Run 8

Run Date / Time 24-Feb-2023 11:14



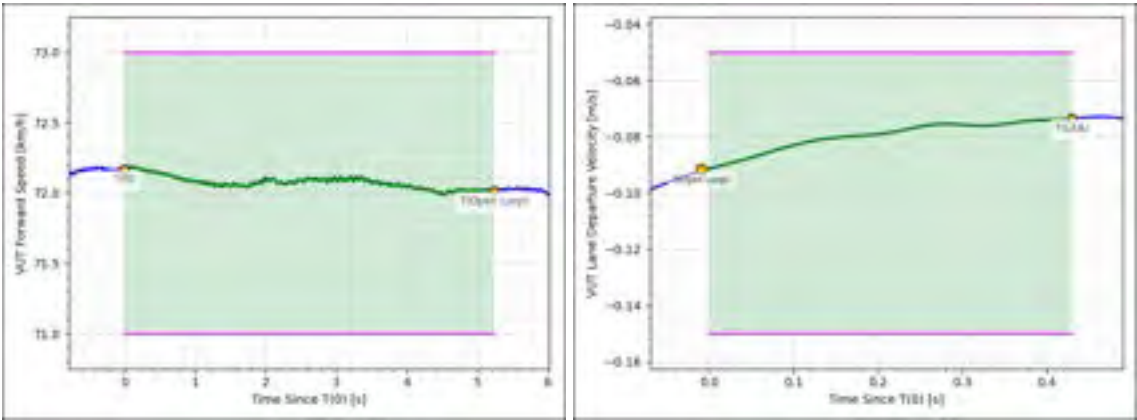
LKA SLN-D 0.1 mps Main | 0.1 m/s | Run 10

Run Date / Time 24-Feb-2023 11:18



LKA SLN-D 0.1 mps Main | 0.1 m/s | Run 11

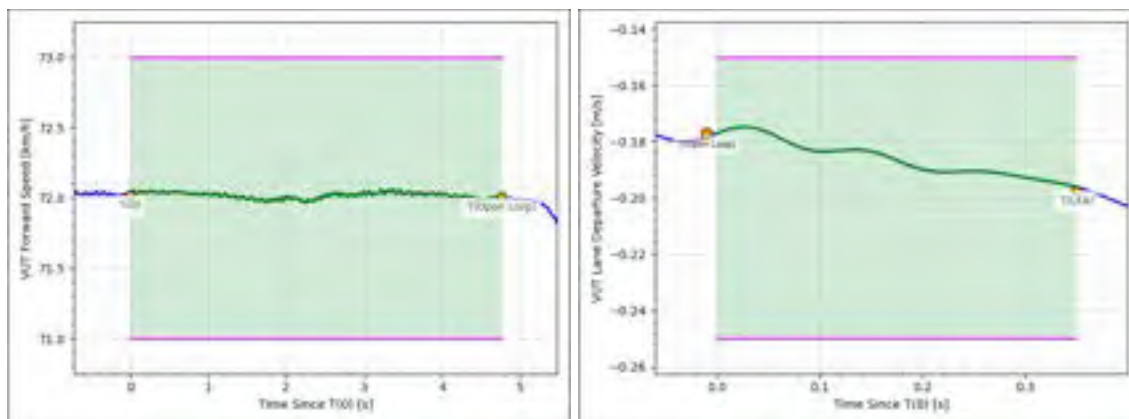
Run Date / Time 24-Feb-2023 11:20



K.2.1.2. 0.2 m/s

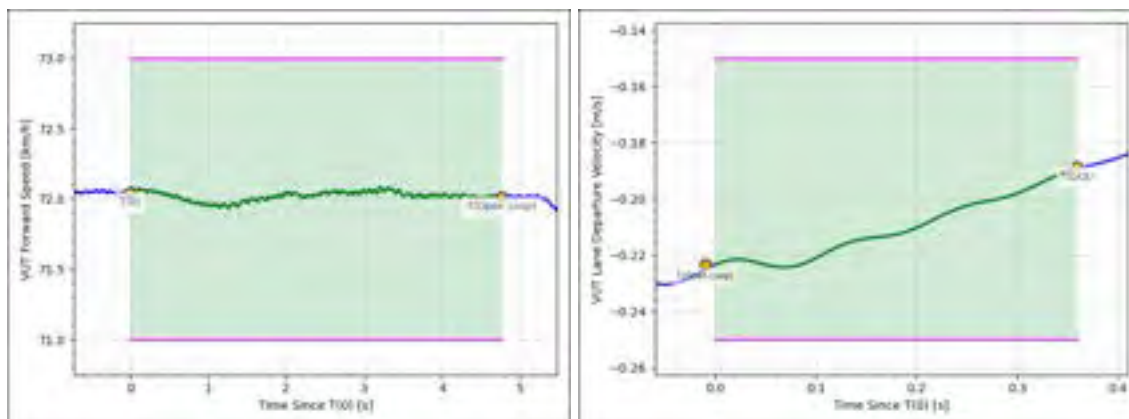
LKA SLN-D 0.2 mps Main | 0.2 m/s | Run 12

Run Date / Time 24-Feb-2023 11:00



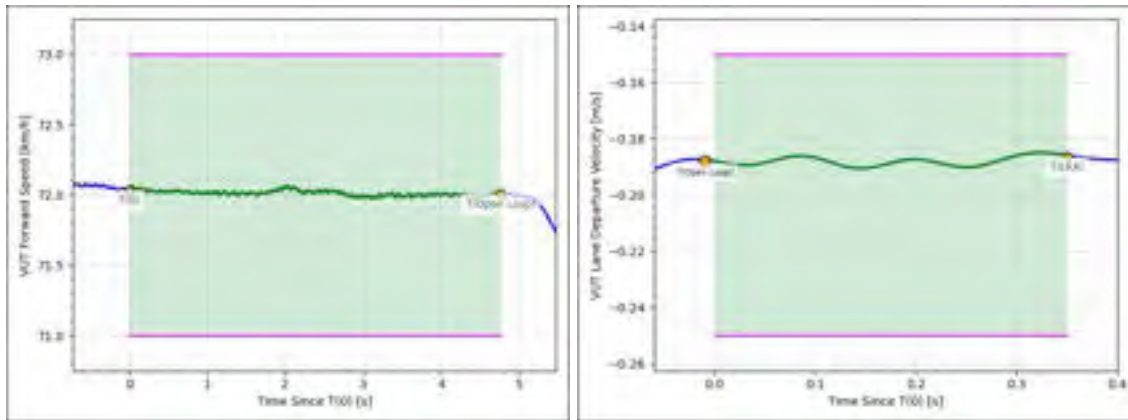
LKA SLN-D 0.2 mps Main | 0.2 m/s | Run 13

Run Date / Time 24-Feb-2023 11:02



LKA SLN-D 0.2 mps Main | 0.2 m/s | Run 14

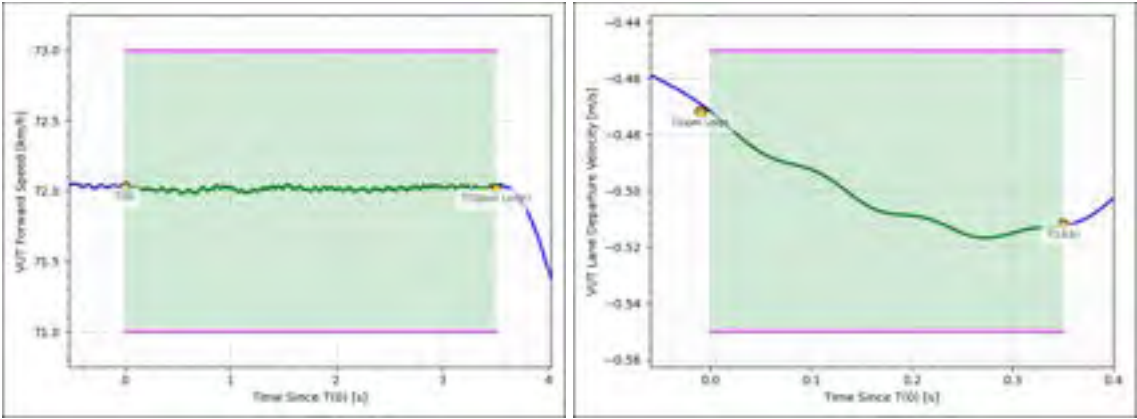
Run Date / Time 24-Feb-2023 11:04



K.2.1.3. 0.5 m/s

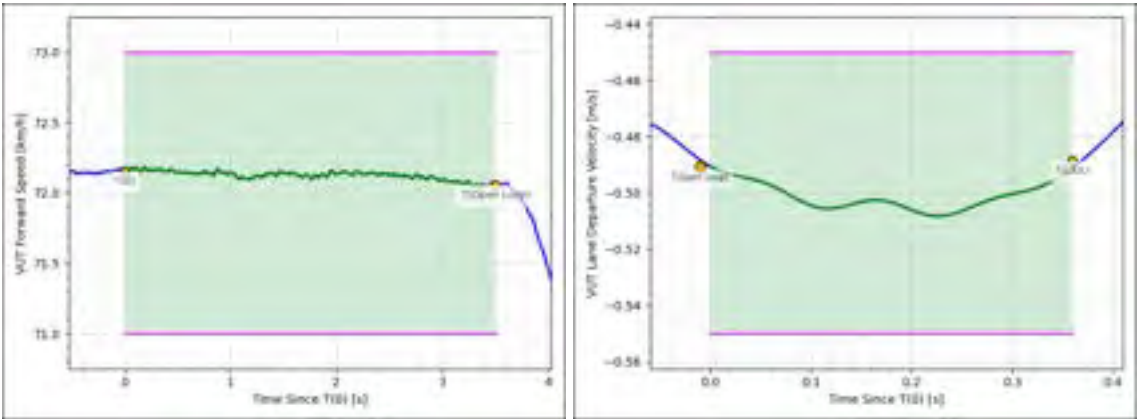
LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 13

Run Date / Time 28-Feb-2023 11:28



LKA SLN-D 0.5 mps Main | 0.5 m/s | Run 14

Run Date / Time 28-Feb-2023 11:32

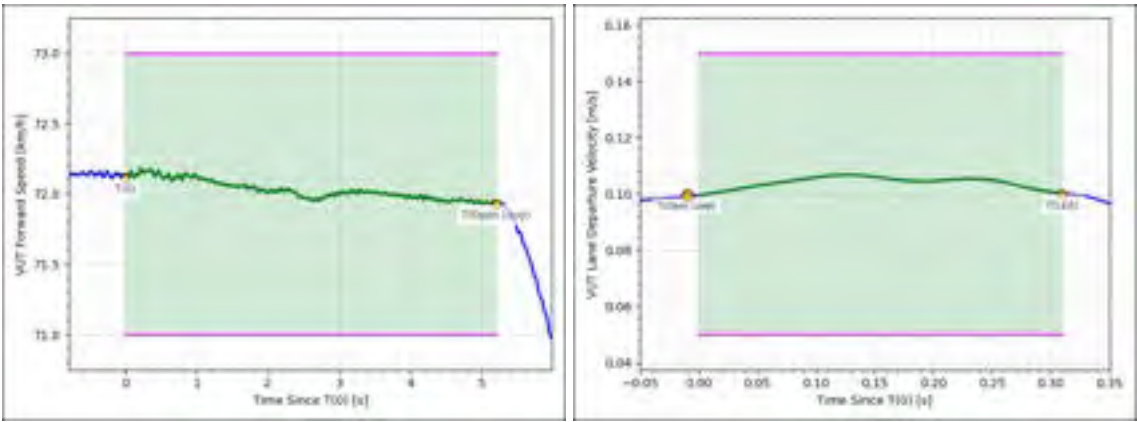


K.2.2. SLN-P

K.2.2.1. 0.1 m/s

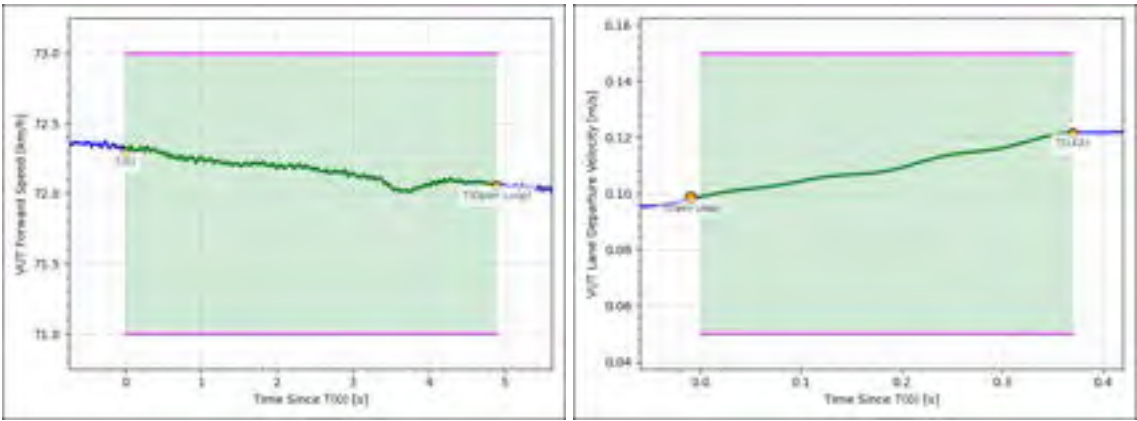
LKA SLN-P 0.1 mps Main | 0.1 m/s | Run 11

Run Date / Time 24-Feb-2023 13:24



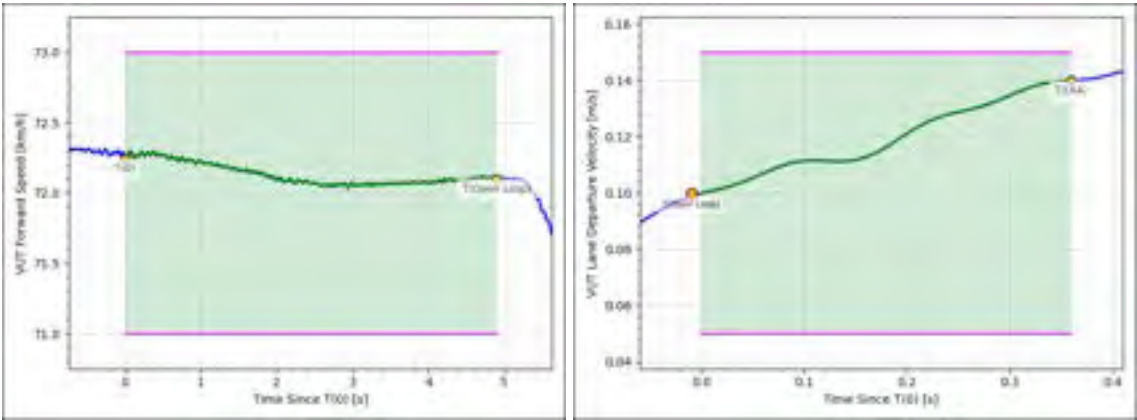
LKA SLN-P 0.1 mps Main | 0.1 m/s | Run 17

Run Date / Time 24-Feb-2023 13:42



LKA SLN-P 0.1 mps Main | 0.1 m/s | Run 18

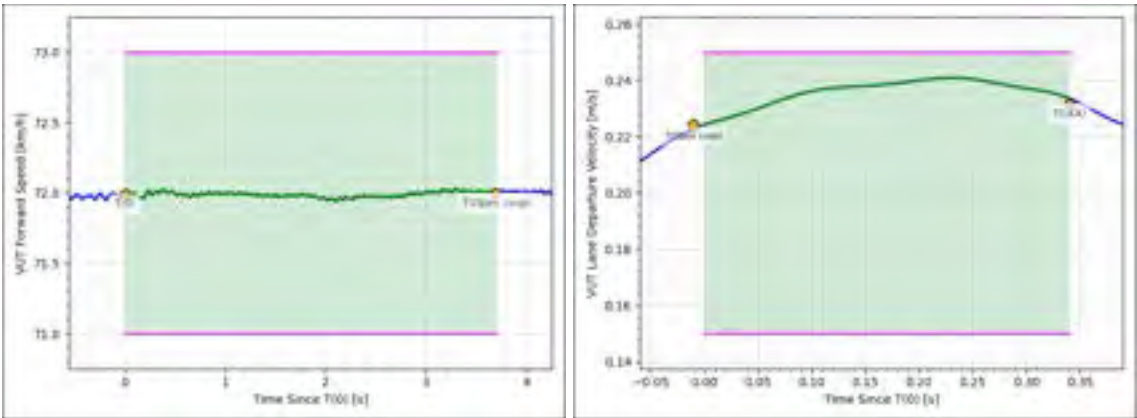
Run Date / Time 24-Feb-2023 13:44



K.2.2.2. 0.2 m/s

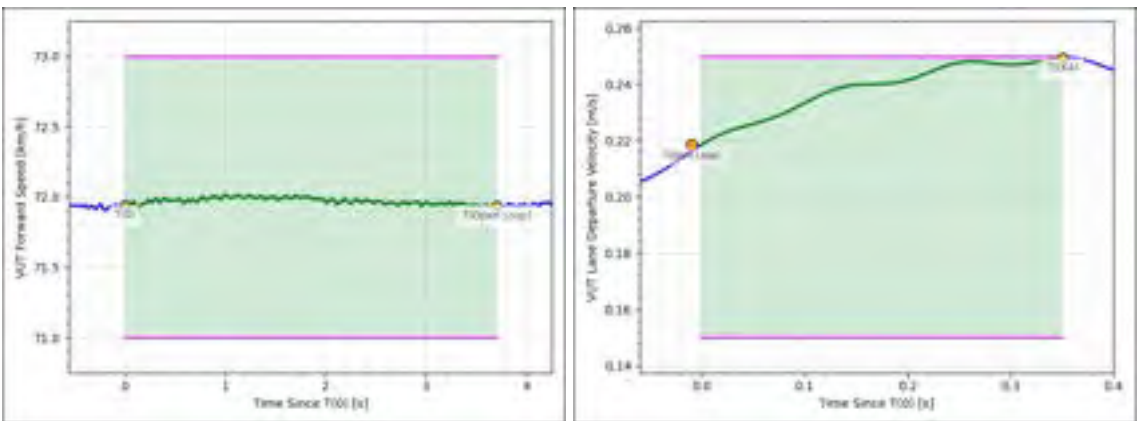
LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 40

Run Date / Time 24-Feb-2023 13:00



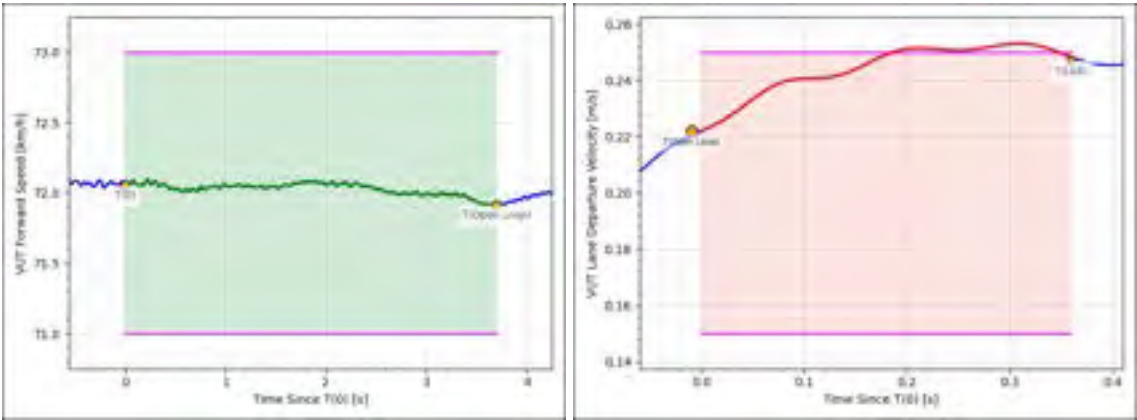
LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 41

Run Date / Time 24-Feb-2023 13:04



LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 42

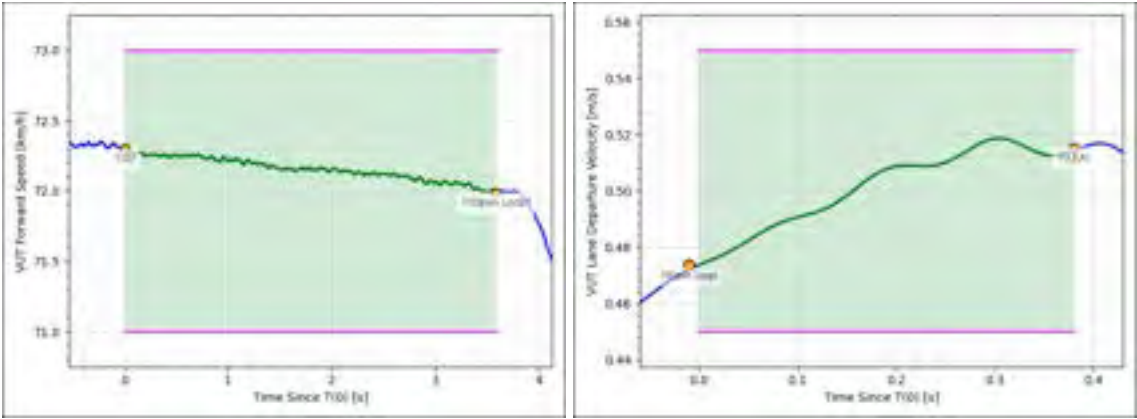
Run Date / Time 24-Feb-2023 13:06



K.2.2.3. 0.5 m/s

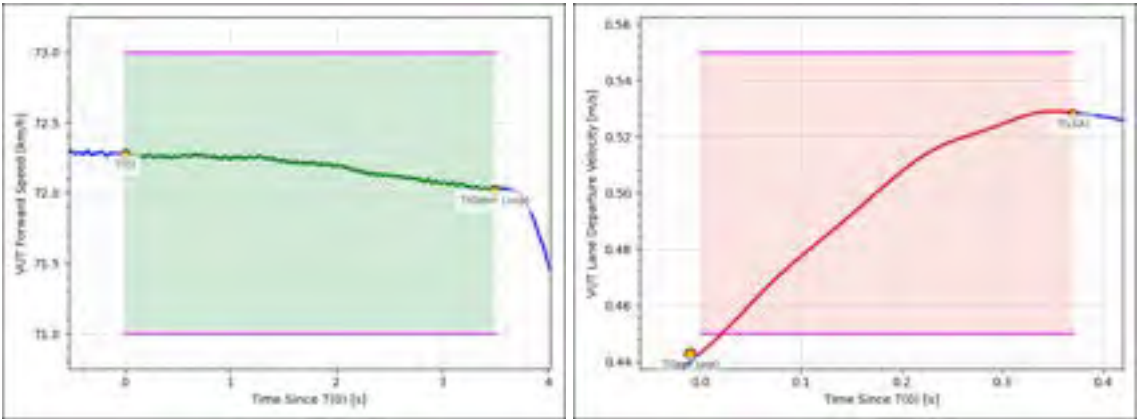
LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 13

Run Date / Time 28-Feb-2023 12:15



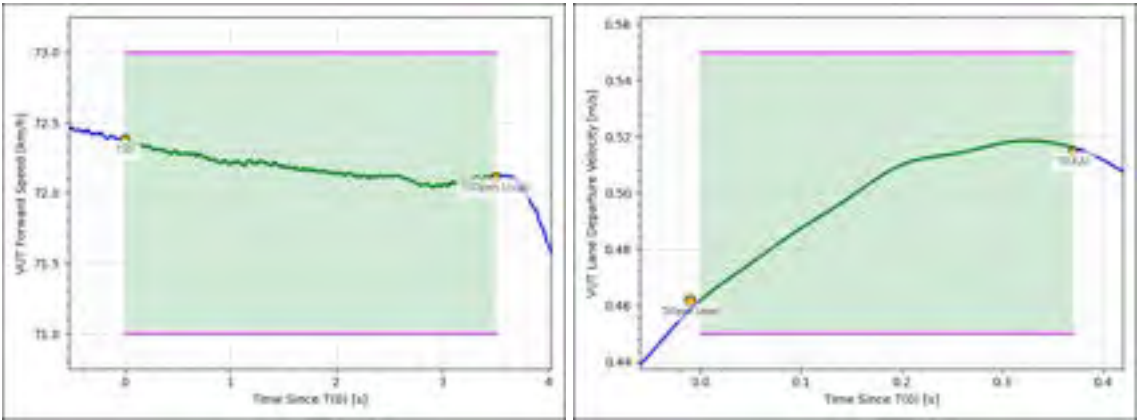
LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 16

Run Date / Time 28-Feb-2023 12:23



LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 17

Run Date / Time 28-Feb-2023 12:25

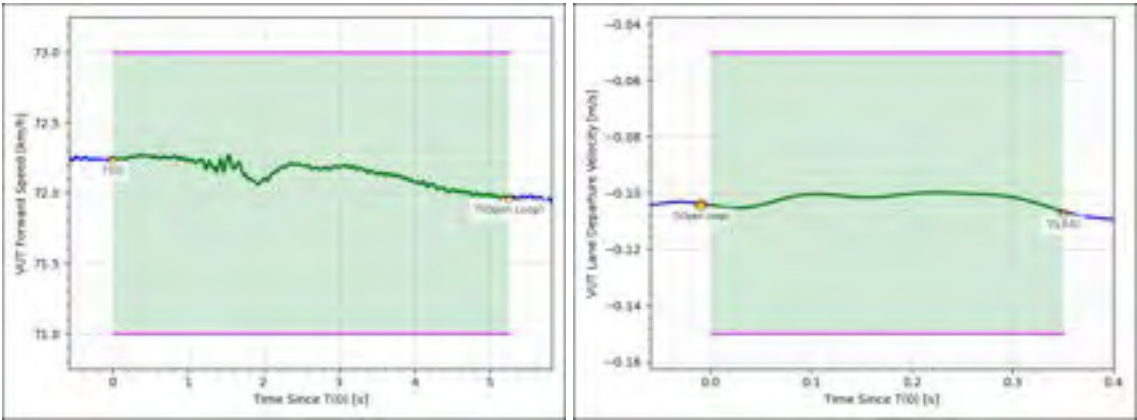


K.2.3. DLN-D

K.2.3.1. 0.1 m/s

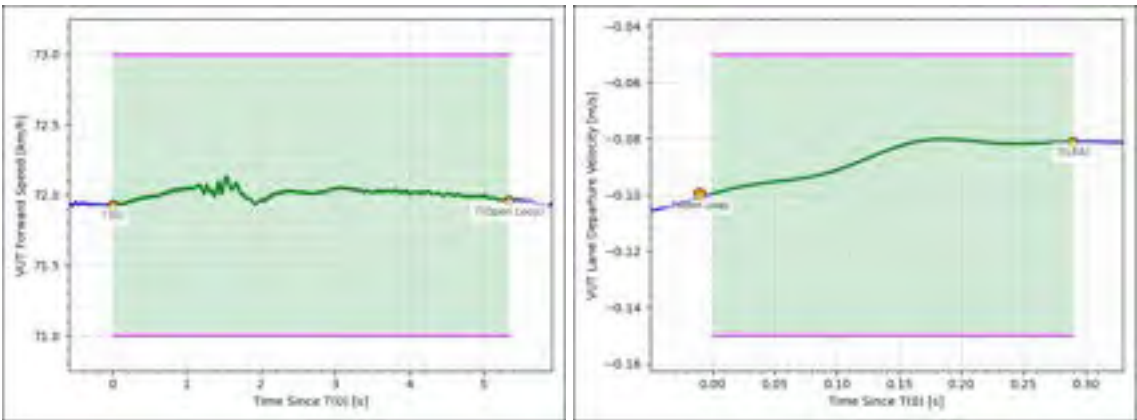
LKA DLN-D 0.1 mps Main | 0.1 m/s | Run 5

Run Date / Time 24-Feb-2023 14:46



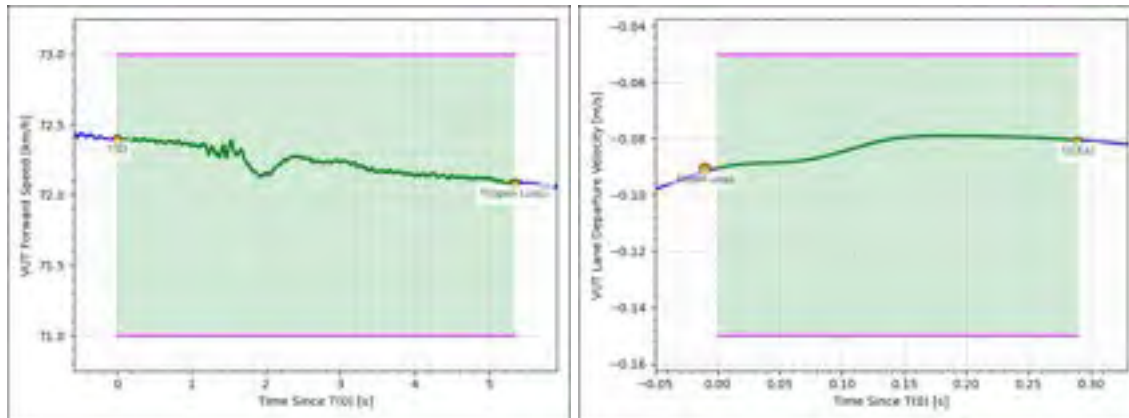
LKA DLN-D 0.1 mps Main | 0.1 m/s | Run 8

Run Date / Time 24-Feb-2023 14:54



LKA DLN-D 0.1 mps Main | 0.1 m/s | Run 9

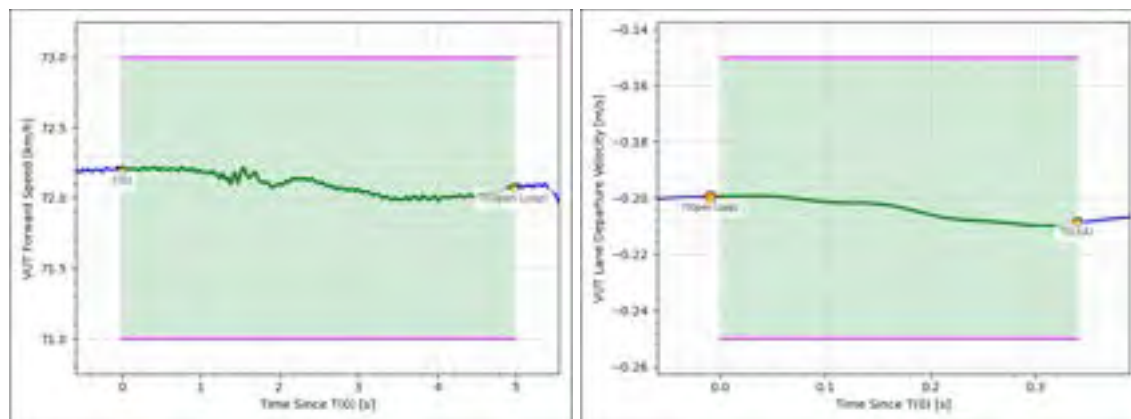
Run Date / Time 24-Feb-2023 14:56



K.2.3.2. 0.2 m/s

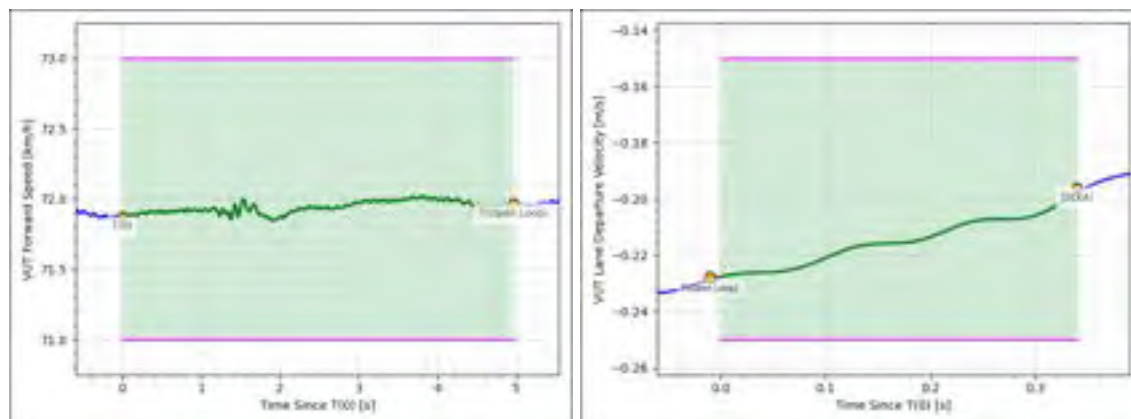
LKA DLN-D 0.2 mps Main | 0.2 m/s | Run 23

Run Date / Time 24-Feb-2023 14:37



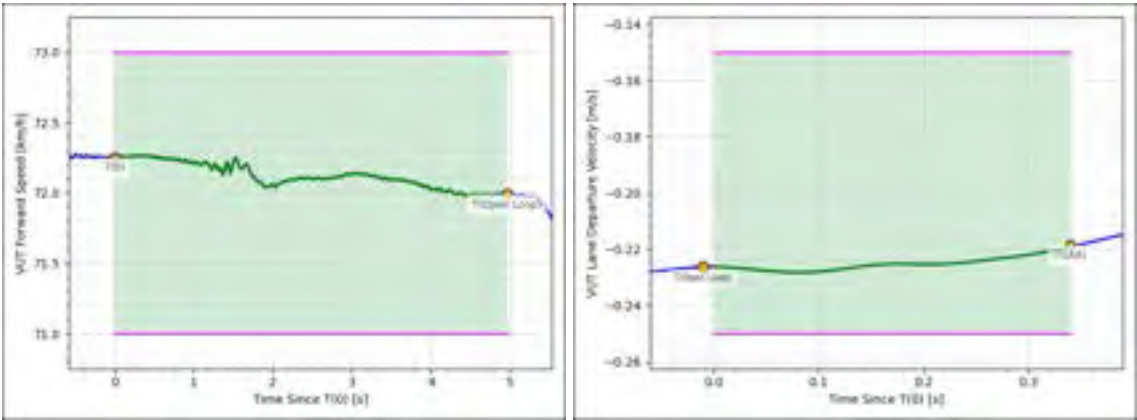
LKA DLN-D 0.2 mps Main | 0.2 m/s | Run 24

Run Date / Time 24-Feb-2023 14:39



LKA DLN-D 0.2 mps Main | 0.2 m/s | Run 25

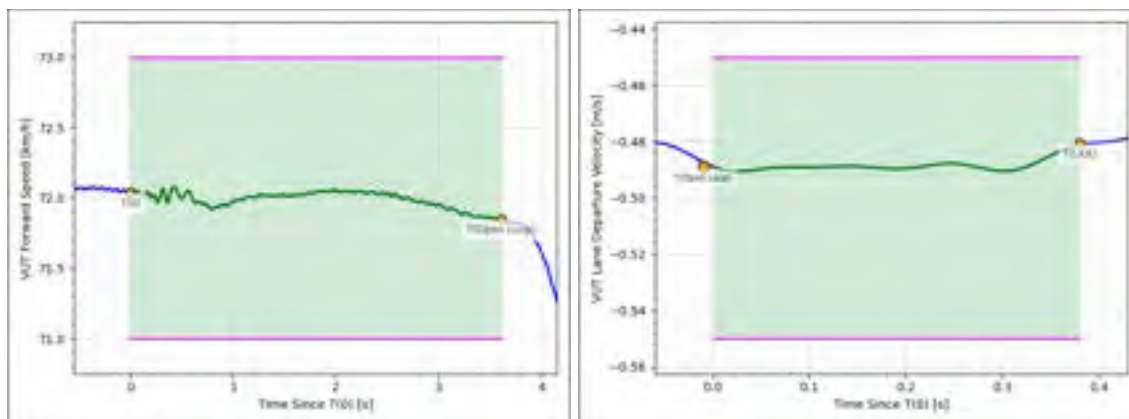
Run Date / Time 24-Feb-2023 14:41



K.2.3.3. 0.5 m/s

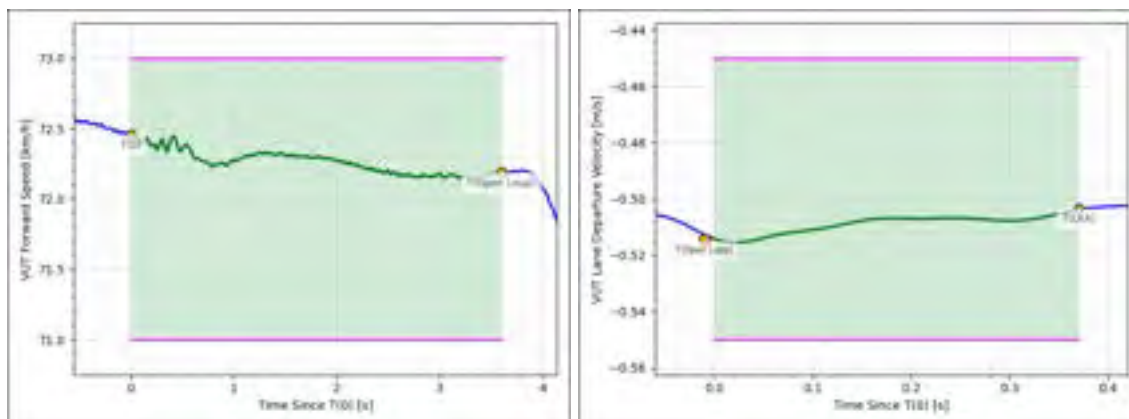
LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 7

Run Date / Time 28-Feb-2023 11:49



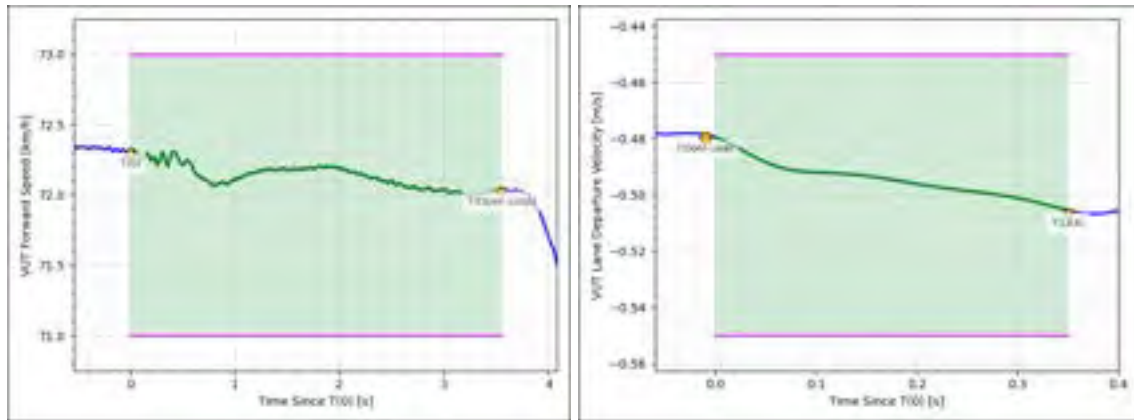
LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 8

Run Date / Time 28-Feb-2023 11:52



LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 10

Run Date / Time 28-Feb-2023 11:57

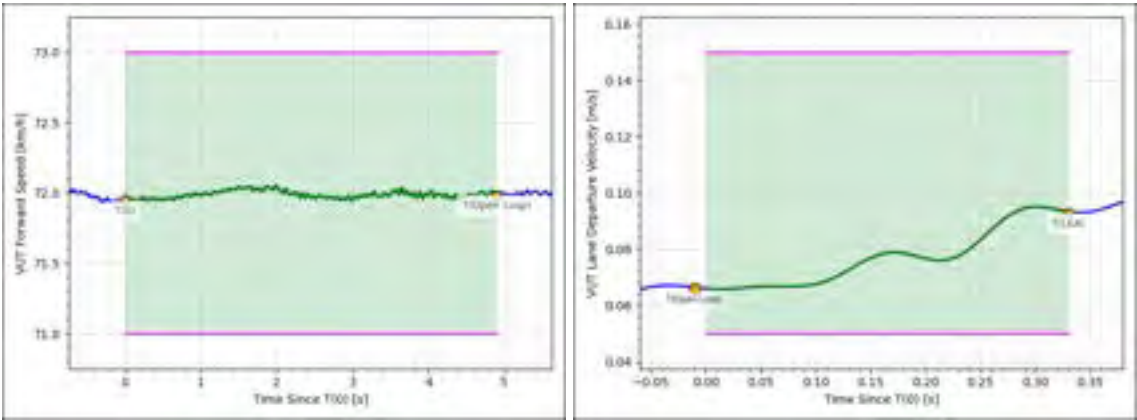


K.2.4. DLN-P

K.2.4.1. 0.1 m/s

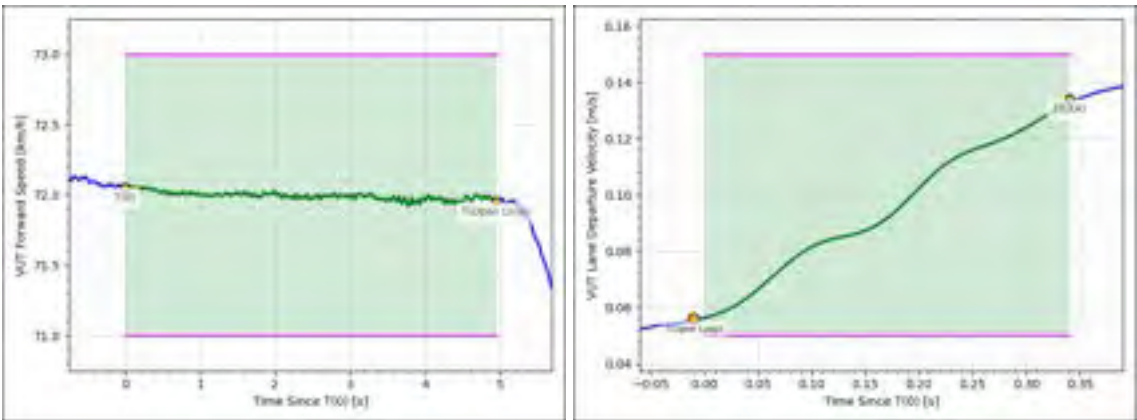
LKA DLN-P 0.1 mps Main | 0.1 m/s | Run 9

Run Date / Time 24-Feb-2023 14:01



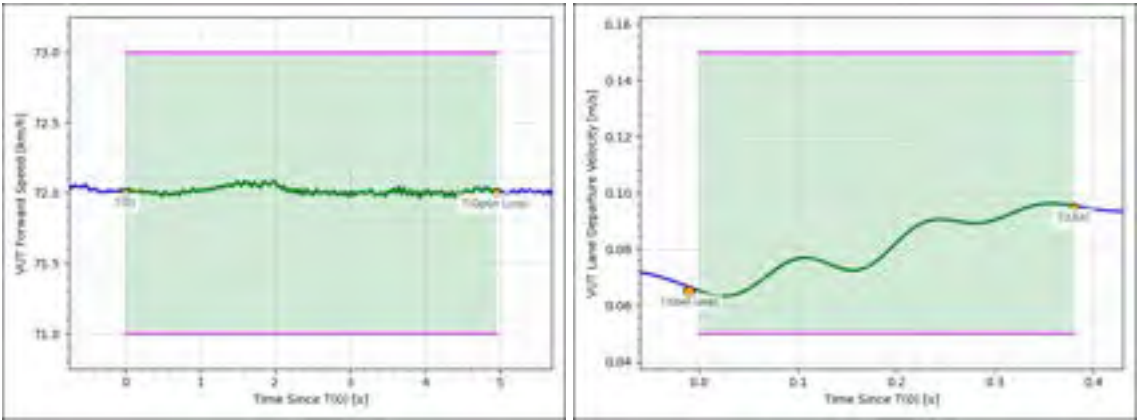
LKA DLN-P 0.1 mps Main | 0.1 m/s | Run 12

Run Date / Time 24-Feb-2023 14:09



LKA DLN-P 0.1 mps Main | 0.1 m/s | Run 13

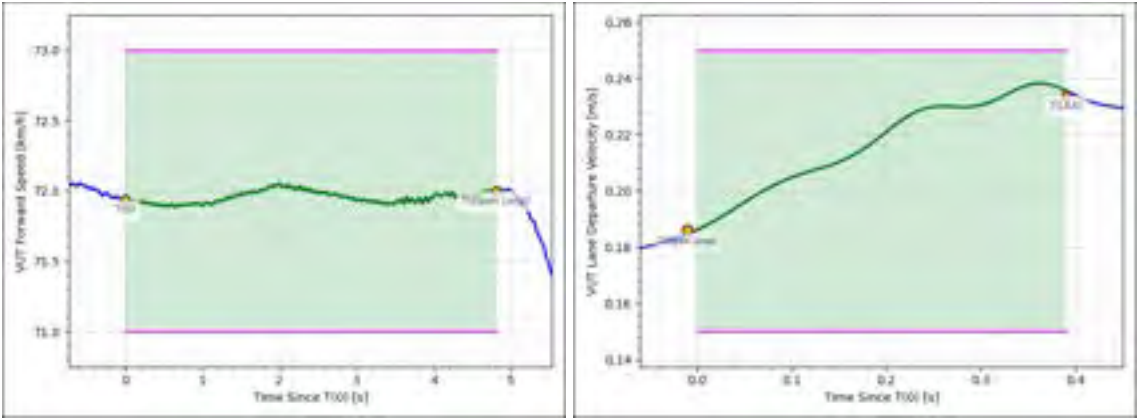
Run Date / Time 24-Feb-2023 14:11



K.2.4.2. 0.2 m/s

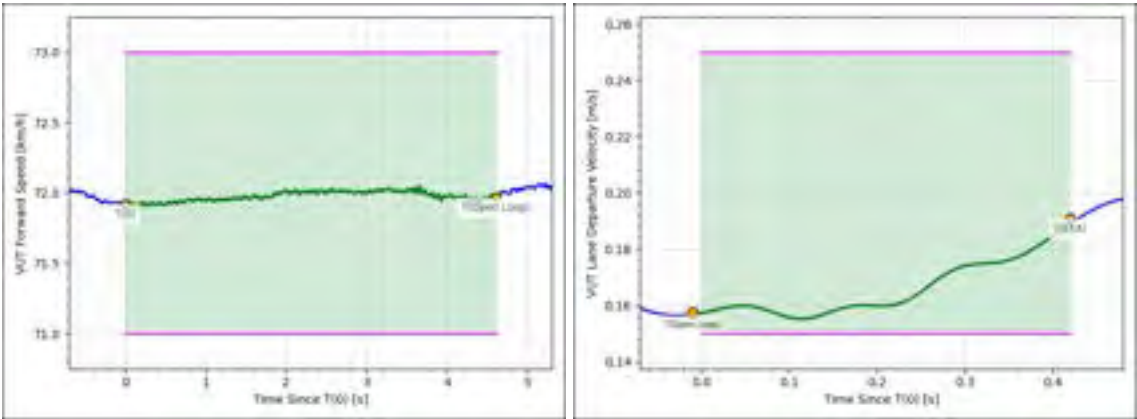
LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 14

Run Date / Time 24-Feb-2023 10:22



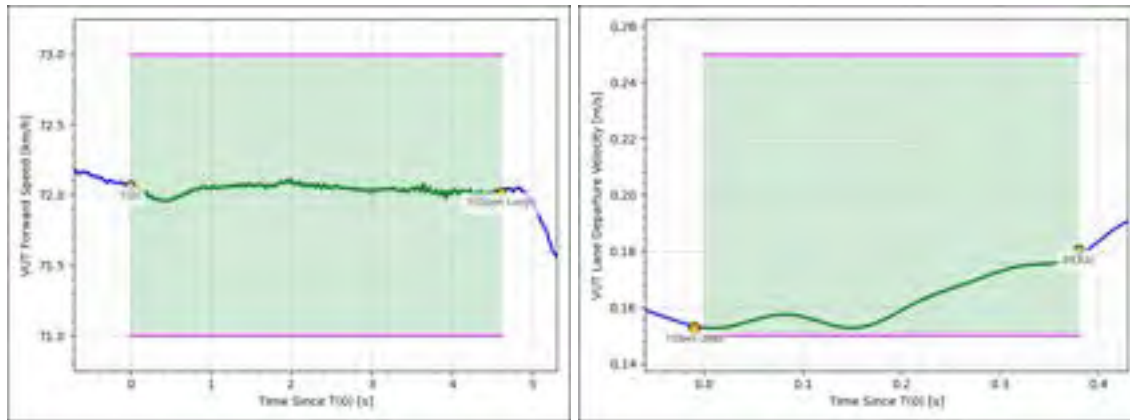
LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 19

Run Date / Time 24-Feb-2023 10:40



LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 22

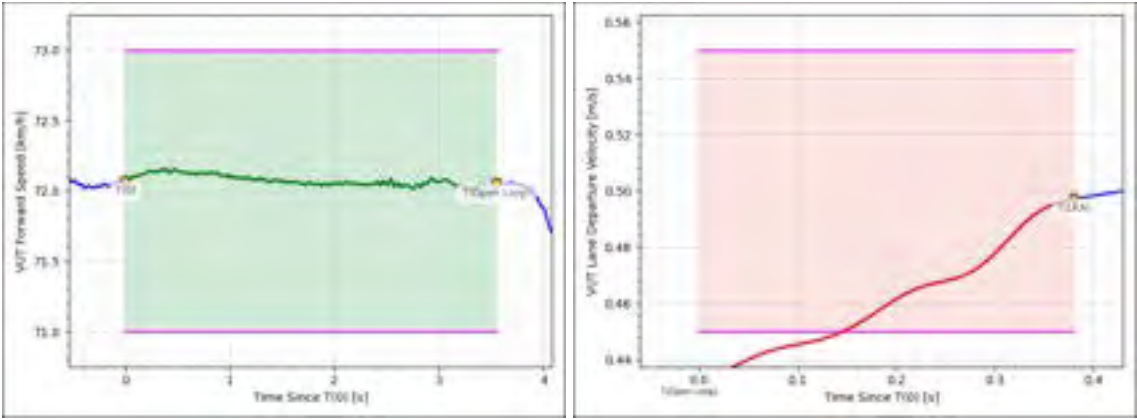
Run Date / Time 24-Feb-2023 13:51



K.2.4.3. 0.5 m/s

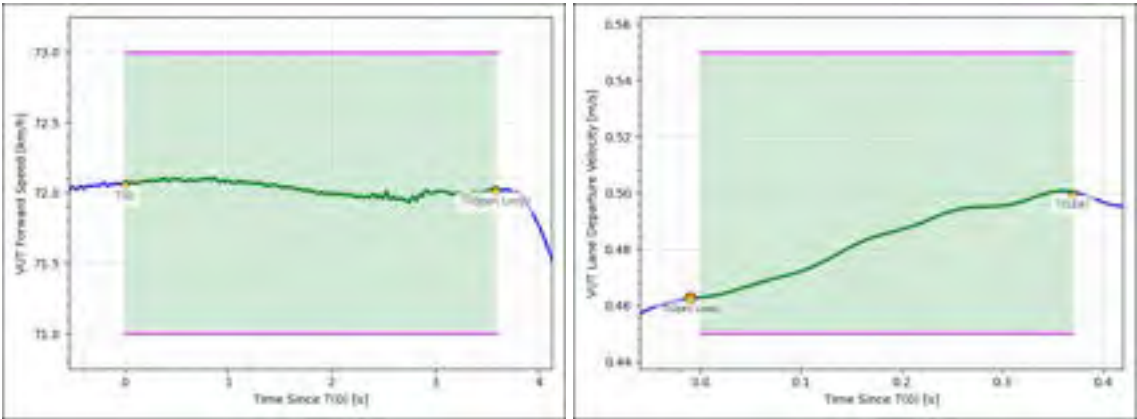
LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 5

Run Date / Time 28-Feb-2023 12:04



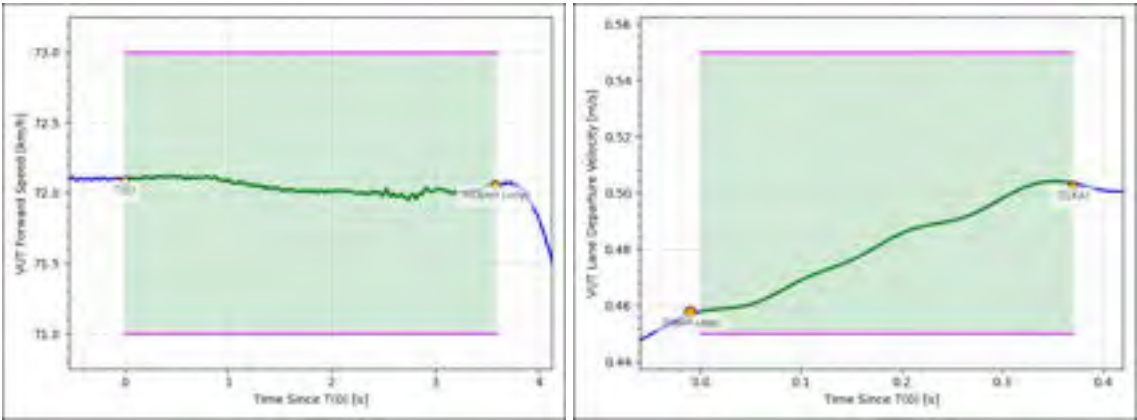
LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 6

Run Date / Time 28-Feb-2023 12:07



LKA DLN-P 0.5 mps Main | 0.5 m/s | Run 8

Run Date / Time 28-Feb-2023 12:11



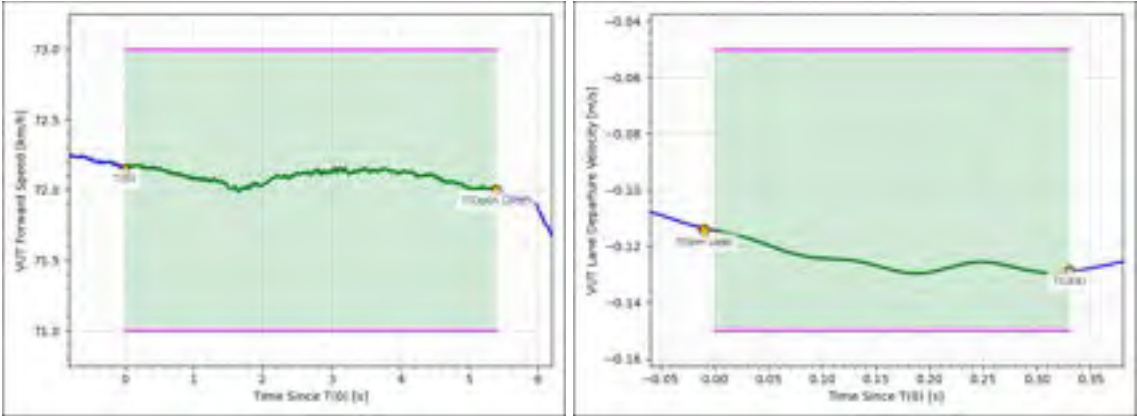
K.3. Lift Kit

K.3.1. SLN-D

K.3.1.1. 0.1 m/s

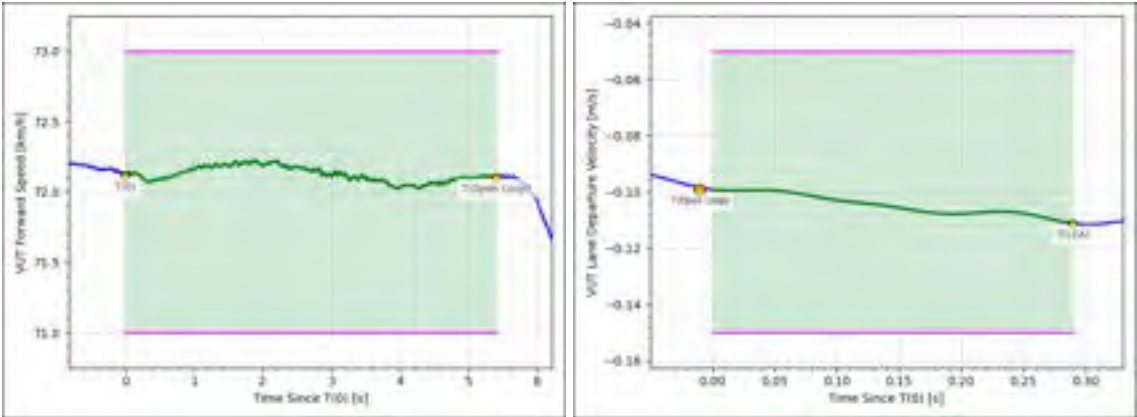
LKA SLN-D 0.1 mps Main | 0.1 m/s | Run 13

Run Date / Time 16-Mar-2023 10:39



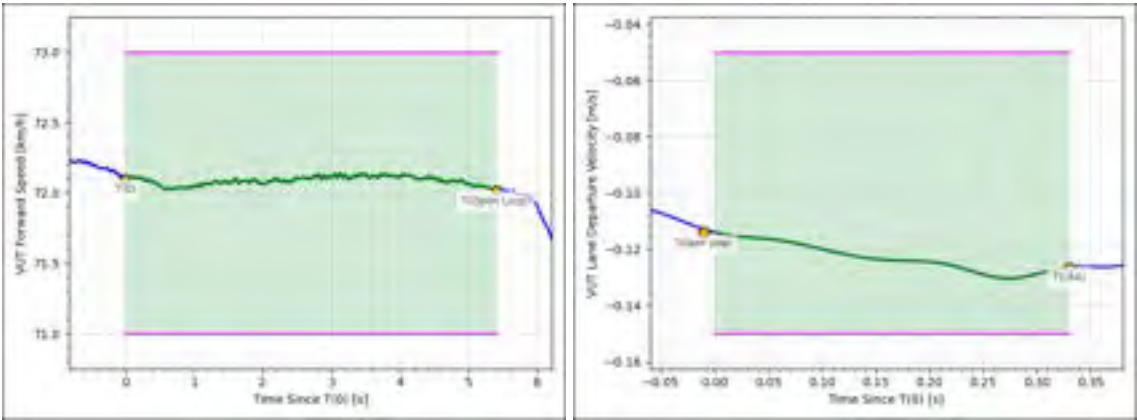
LKA SLN-D 0.1 mps Main | 0.1 m/s | Run 14

Run Date / Time 16-Mar-2023 10:41



LKA SLN-D 0.1 mps Main | 0.1 m/s | Run 15

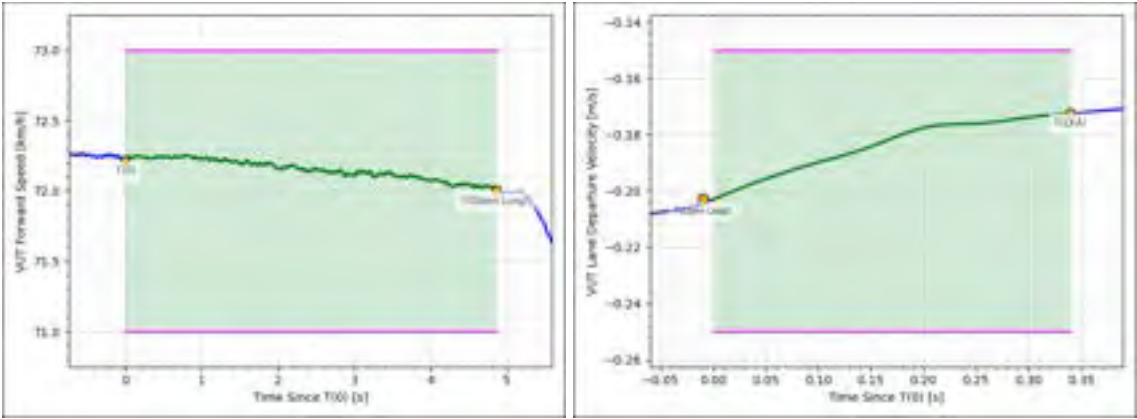
Run Date / Time 16-Mar-2023 10:44



K.3.1.2. 0.2 m/s

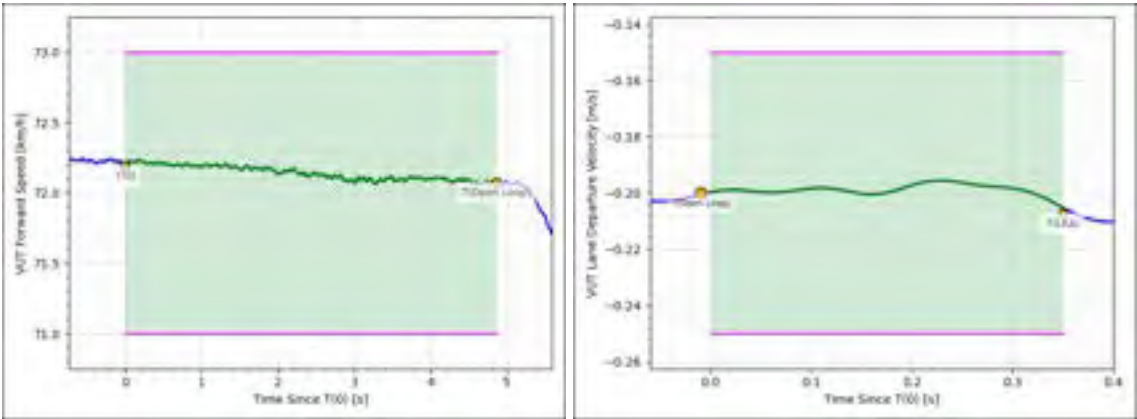
LKA SLN-D 0.2 mps Main | 0.2 m/s | Run 15

Run Date / Time 16-Mar-2023 10:27



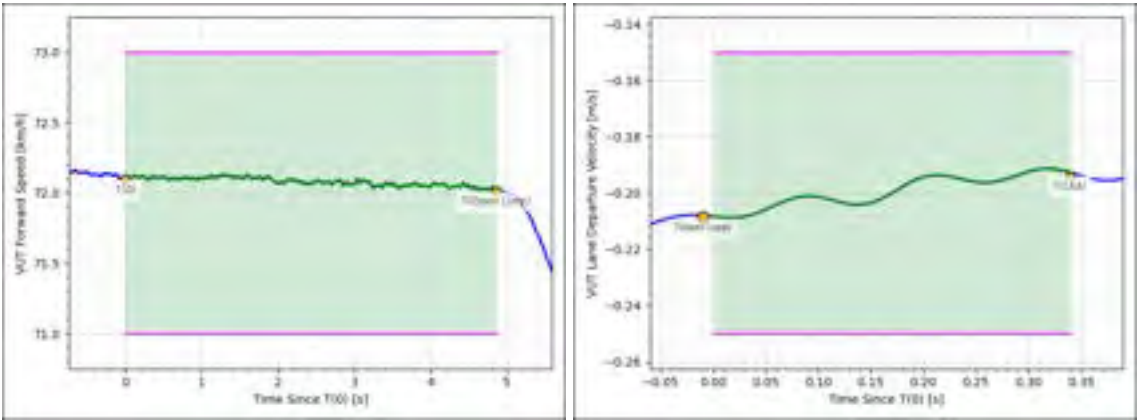
LKA SLN-D 0.2 mps Main | 0.2 m/s | Run 16

Run Date / Time 16-Mar-2023 10:29



LKA SLN-D 0.2 mps Main | 0.2 m/s | Run 17

Run Date / Time 16-Mar-2023 10:32

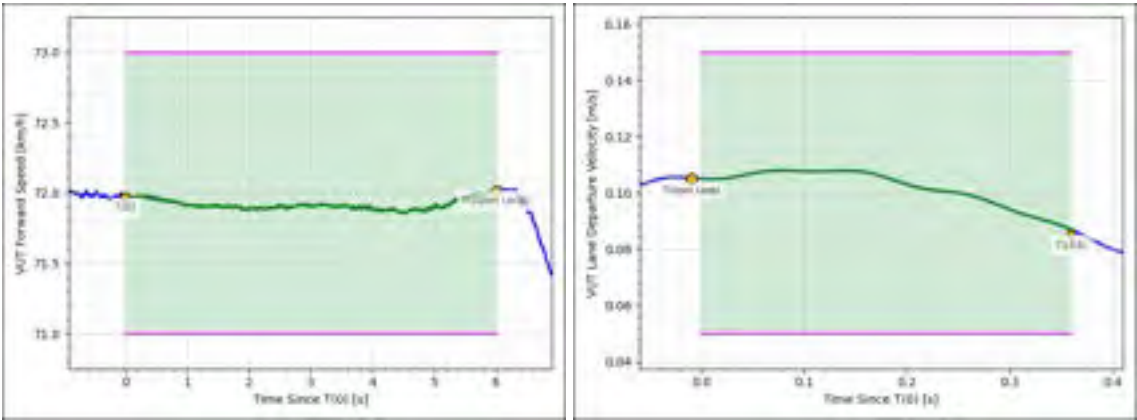


K.3.2. SLN-P

K.3.2.1. 0.1 m/s

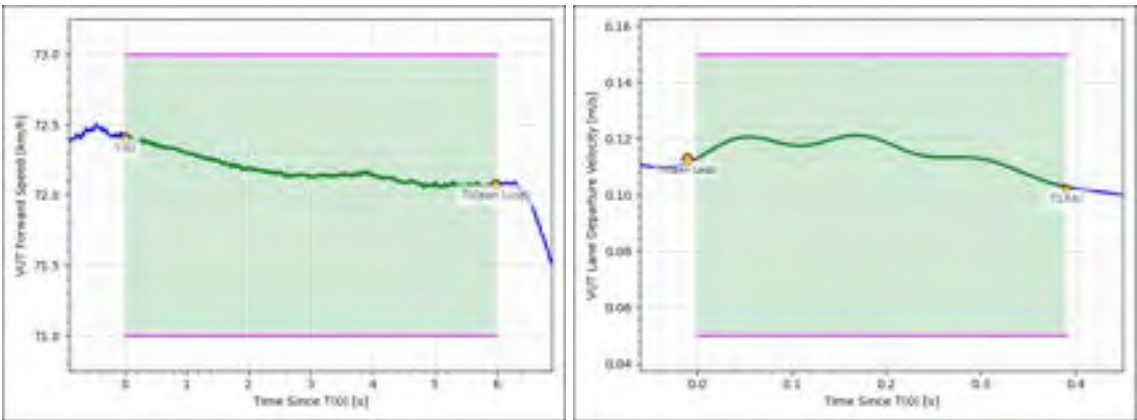
LKA SLN-P 0.1 mps Main | 0.1 m/s | Run 19

Run Date / Time 16-Mar-2023 09:45



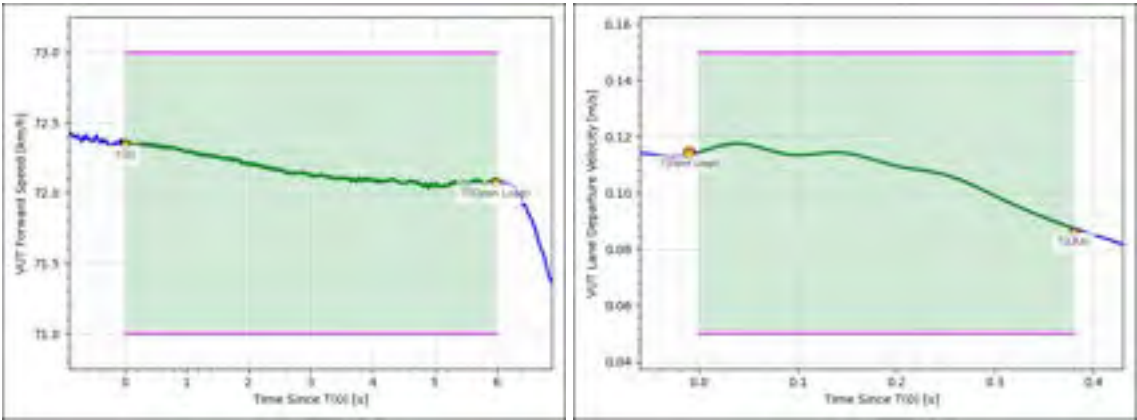
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Run Date / Time 16-Mar-2023 09:47



LKA SLN-P 0.1 mps Main | 0.1 m/s | Run 21

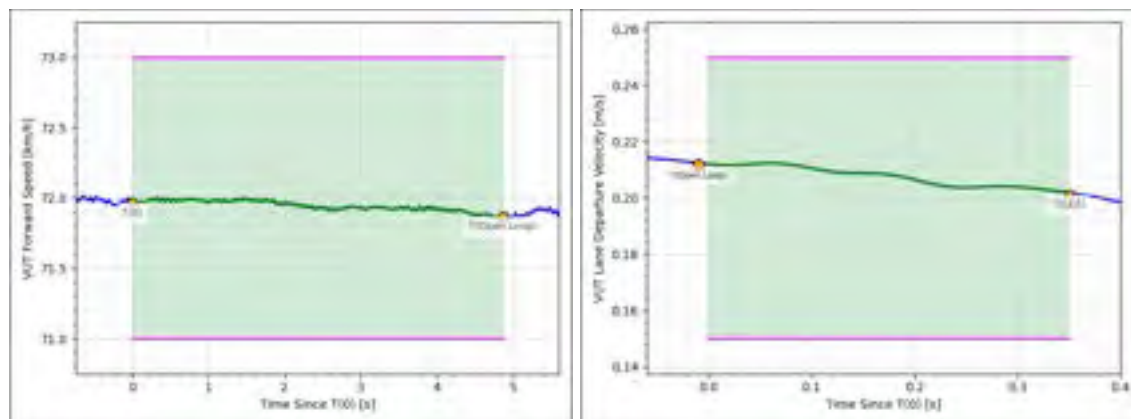
Run Date / Time 16-Mar-2023 09:50



K.3.2.2. 0.2 m/s

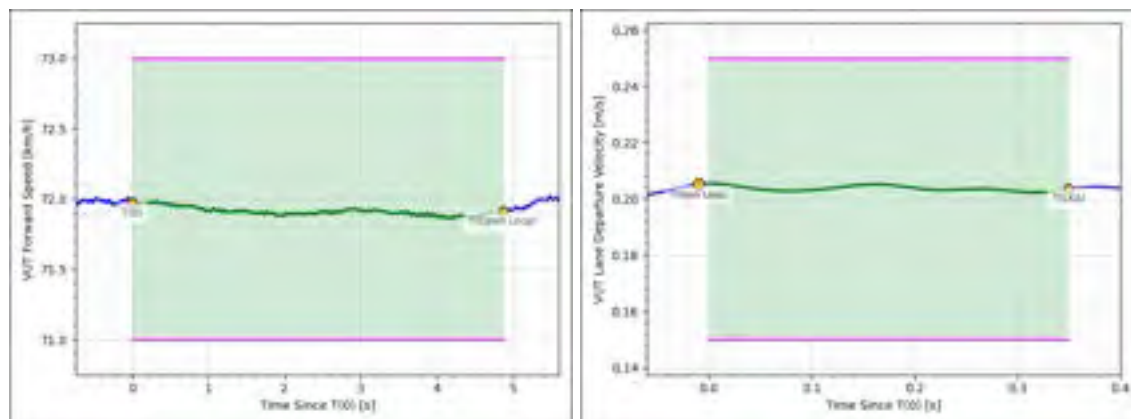
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Run Date / Time 16-Mar-2023 09:36



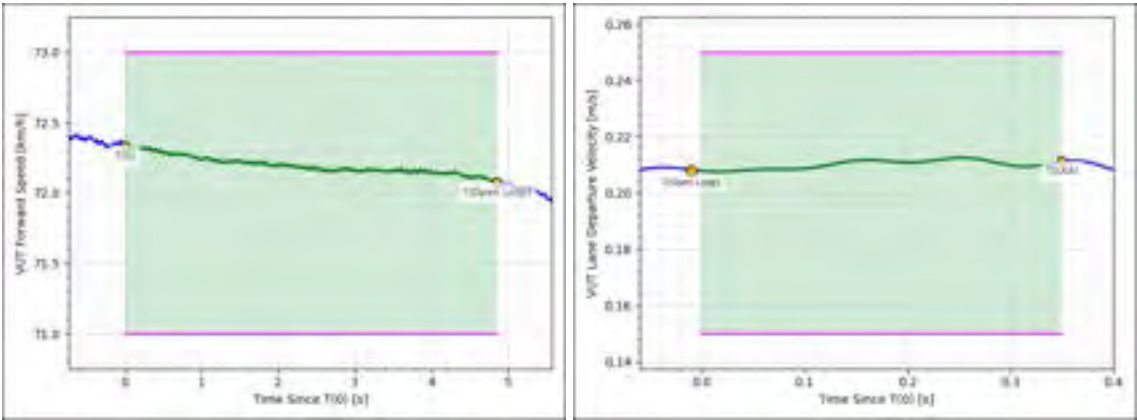
LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 44

Run Date / Time 16-Mar-2023 09:39



LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 45

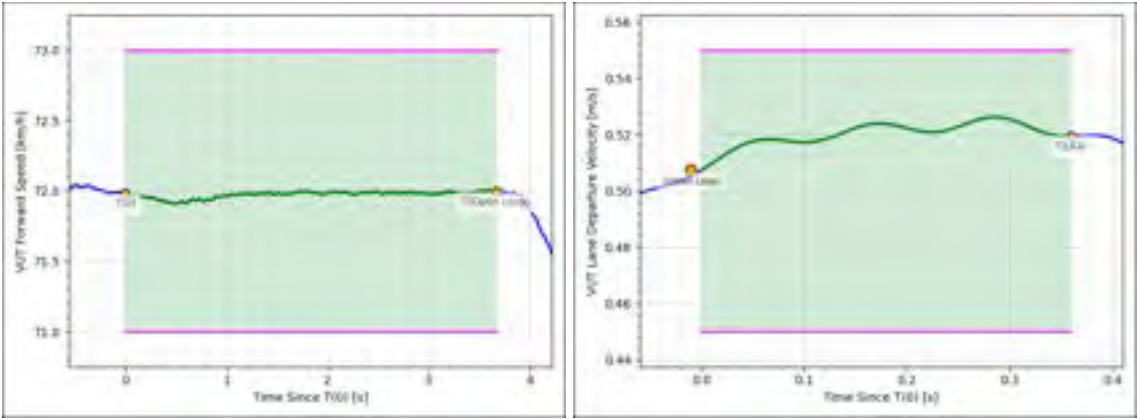
Run Date / Time 16-Mar-2023 09:41



K.3.2.3. 0.5 m/s

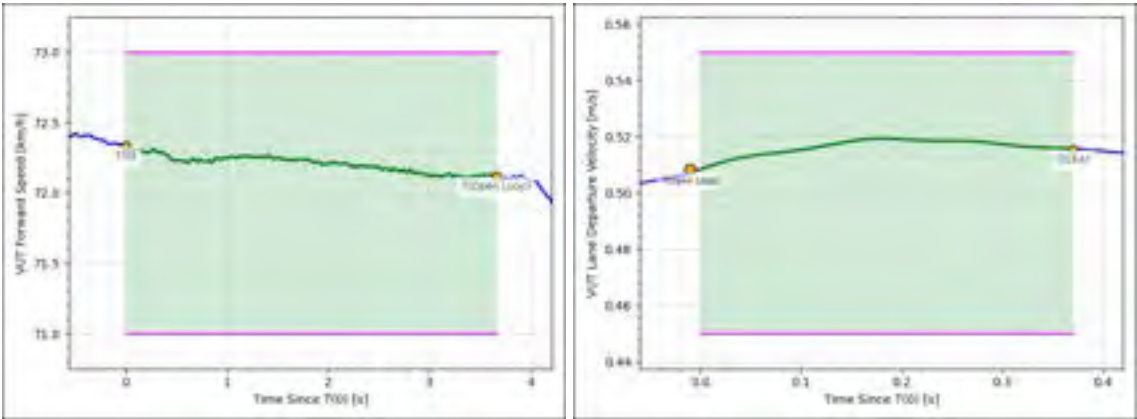
LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 18

Run Date / Time 16-Mar-2023 11:08



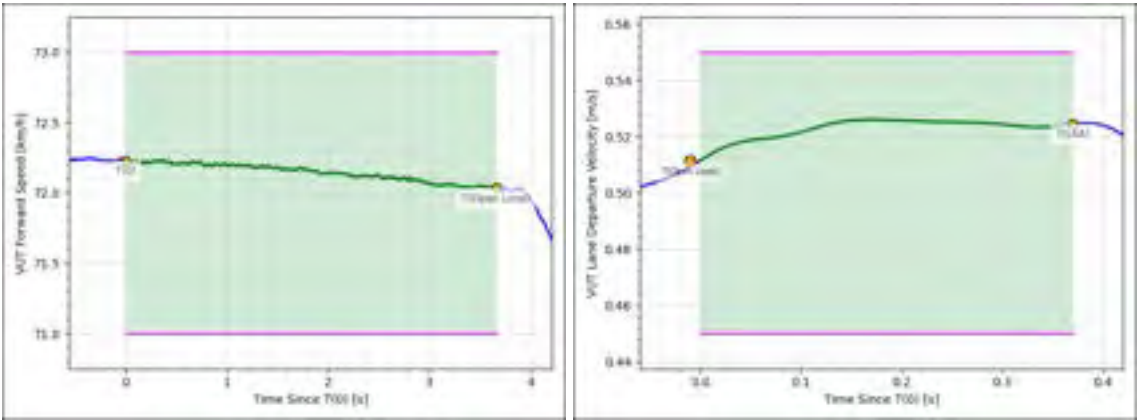
LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 19

Run Date / Time 16-Mar-2023 11:10



LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 20

Run Date / Time 16-Mar-2023 11:13

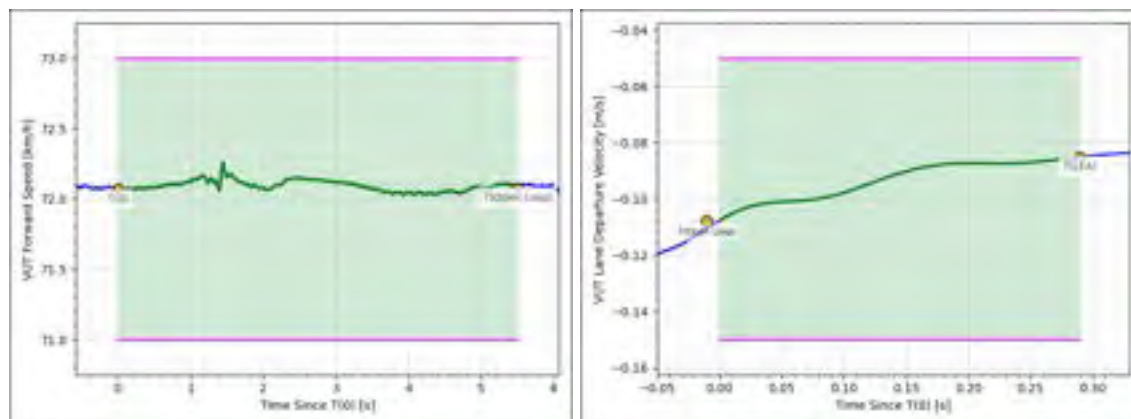


K.3.3. DLN-D

K.3.3.1. 0.1 m/s

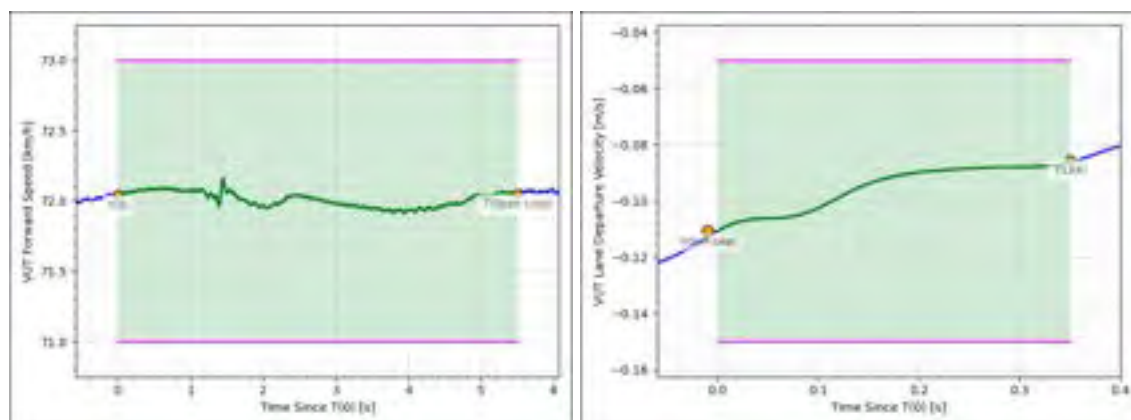
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Run Date / Time 16-Mar-2023 10:15



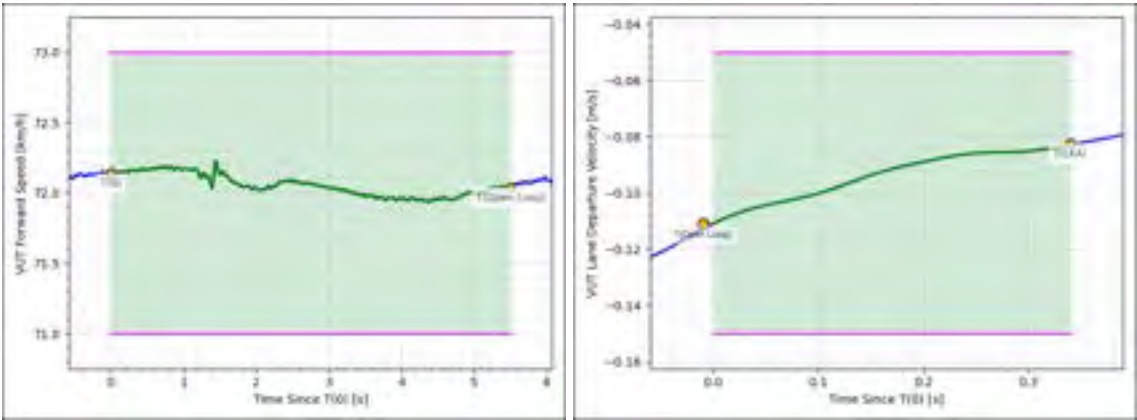
LKA DLN-D 0.1 mps Main | 0.1 m/s | Run 11

Run Date / Time 16-Mar-2023 10:18



LKA DLN-D 0.1 mps Main | 0.1 m/s | Run 12

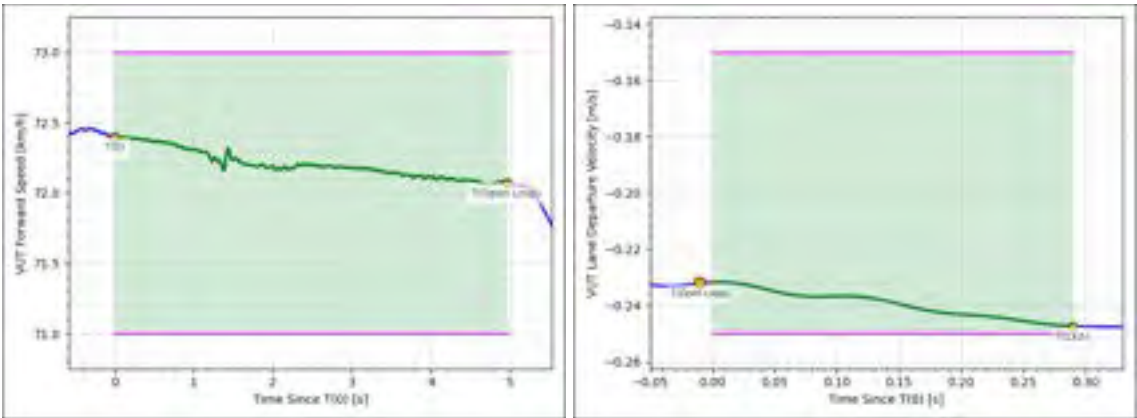
Run Date / Time 16-Mar-2023 10:21



K.3.3.2. 0.2 m/s

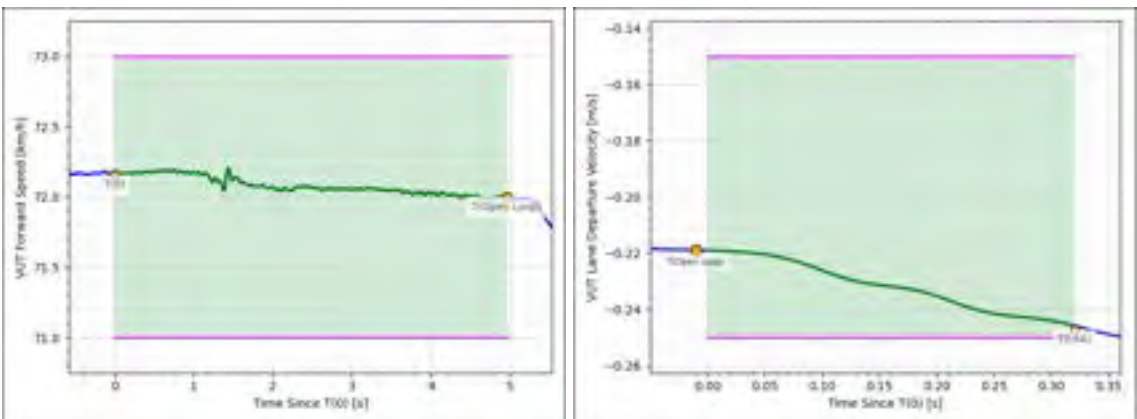
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Run Date / Time 16-Mar-2023 10:04



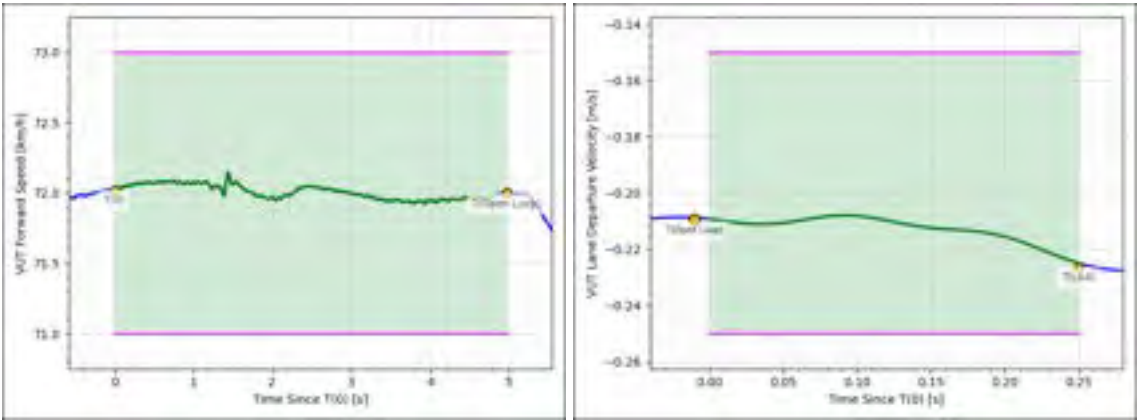
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Run Date / Time 16-Mar-2023 10:07



LKA DLN-D 0.2 mps Main | 0.2 m/s | Run 29

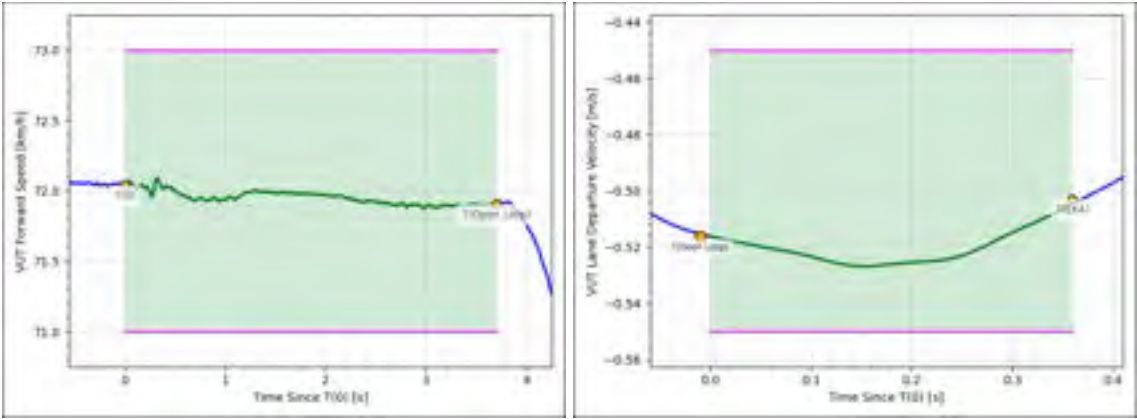
Run Date / Time 16-Mar-2023 10:10



K.3.3.3. 0.5 m/s

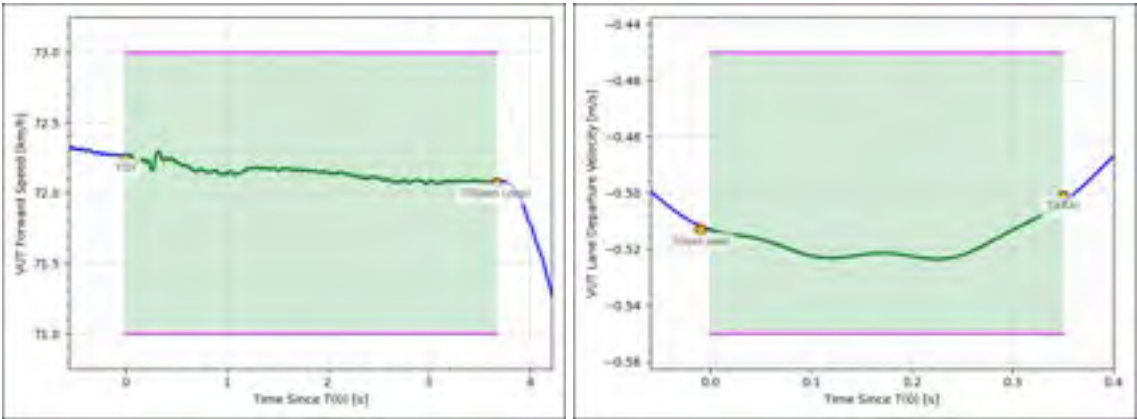
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Run Date / Time 16-Mar-2023 10:50



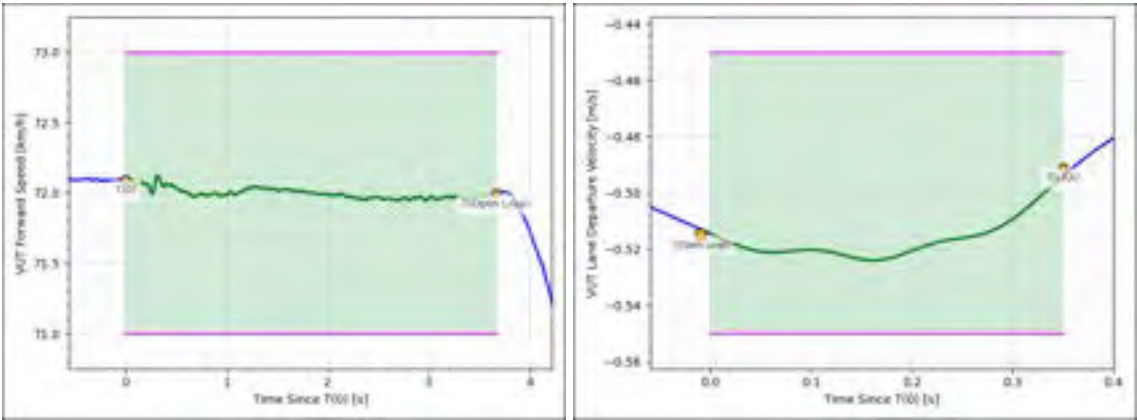
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Run Date / Time 16-Mar-2023 10:55



LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 13

Run Date / Time 16-Mar-2023 10:58

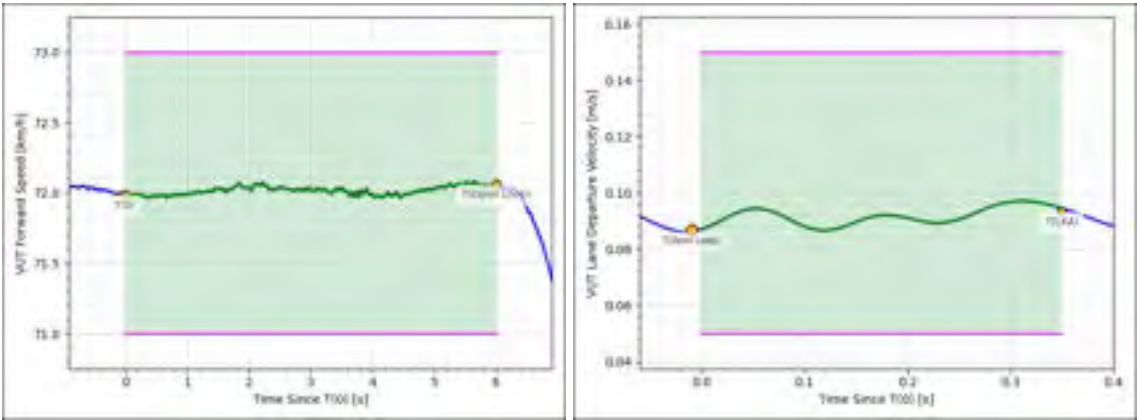


K.3.4. DLN-P

K.3.4.1. 0.1 m/s

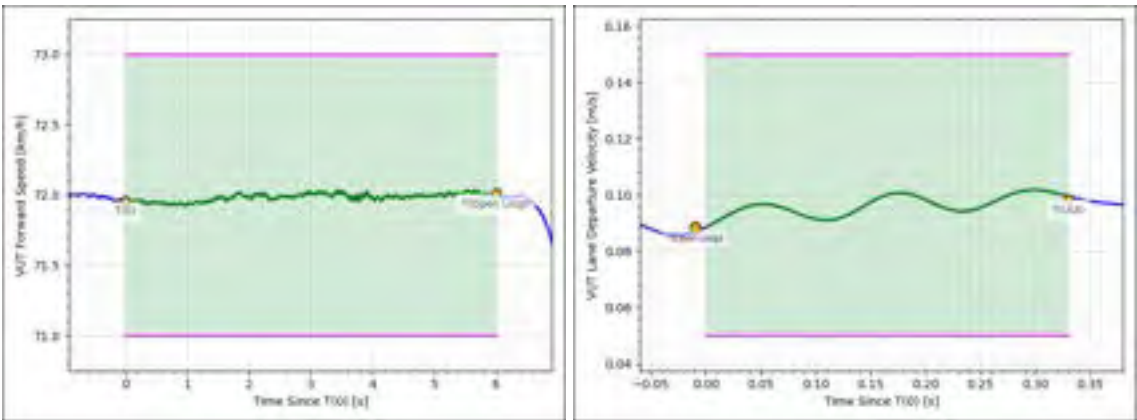
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Run Date / Time 16-Mar-2023 09:25



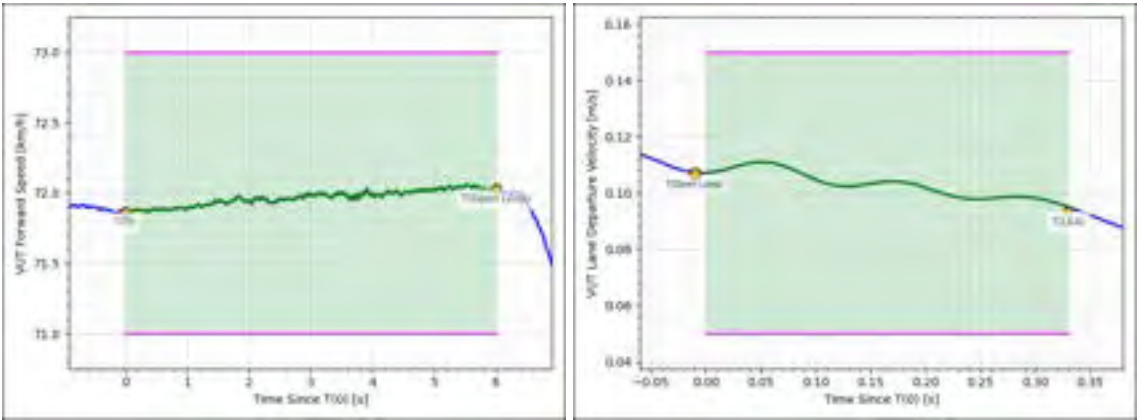
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Run Date / Time 16-Mar-2023 09:28



LKA DLN-P 0.1 mps Main | 0.1 m/s | Run 16

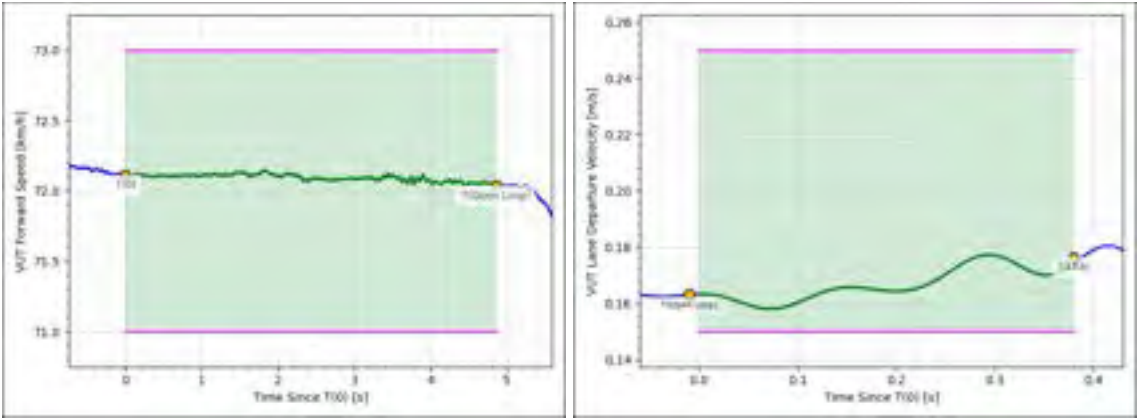
Run Date / Time 16-Mar-2023 09:30



K.3.4.2. 0.2 m/s

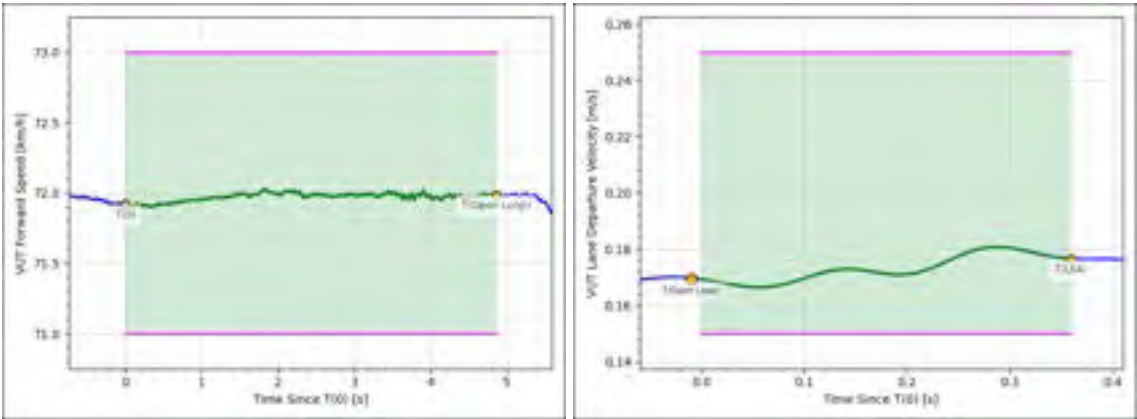
LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 27

Run Date / Time 16-Mar-2023 09:01



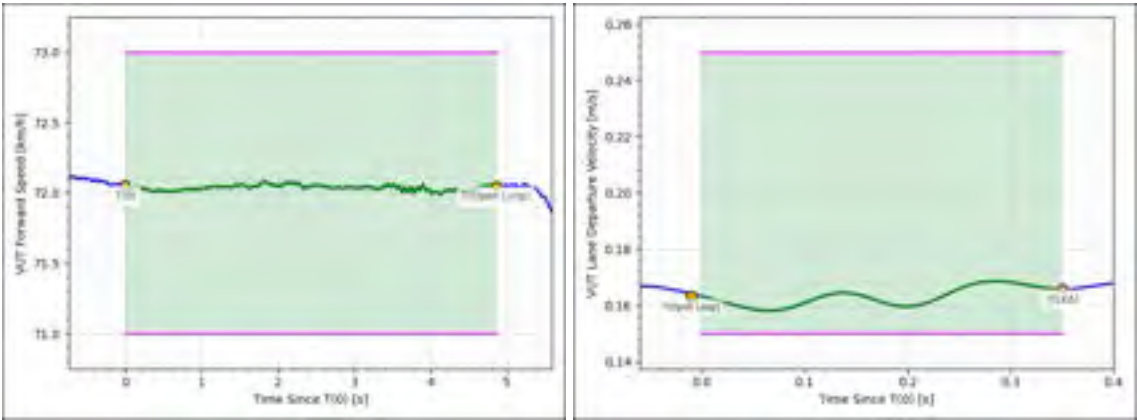
LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 28

Run Date / Time 16-Mar-2023 09:18



LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 29

Run Date / Time 16-Mar-2023 09:20



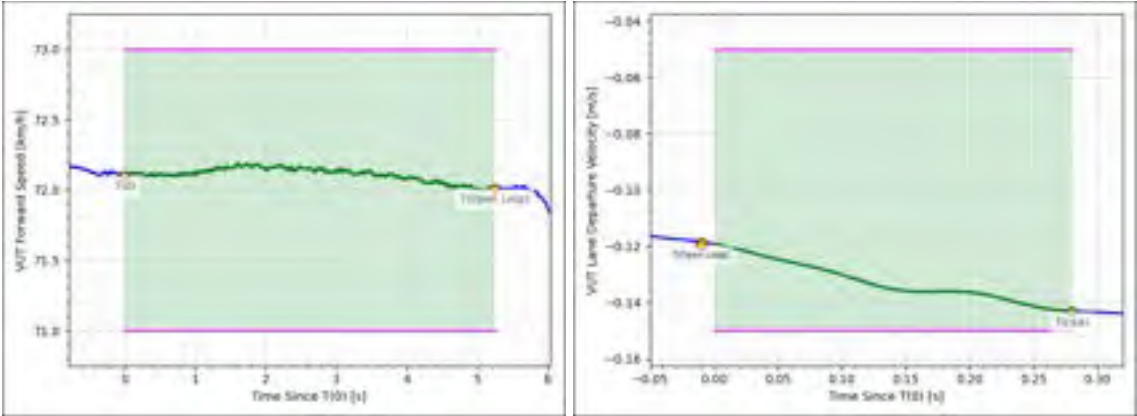
K.4. Lift Kit+ Bullbar

K.4.1. SLN-D

K.4.1.1. 0.1 m/s

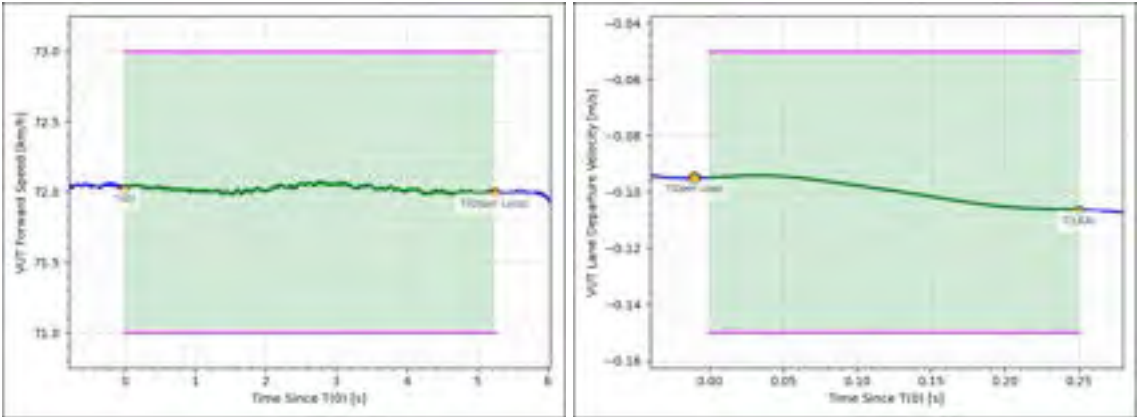
LKA SLN-D 0.1 mps Main | 0.1 m/s | Run 1

Run Date / Time 31-Mar-2023 11:58



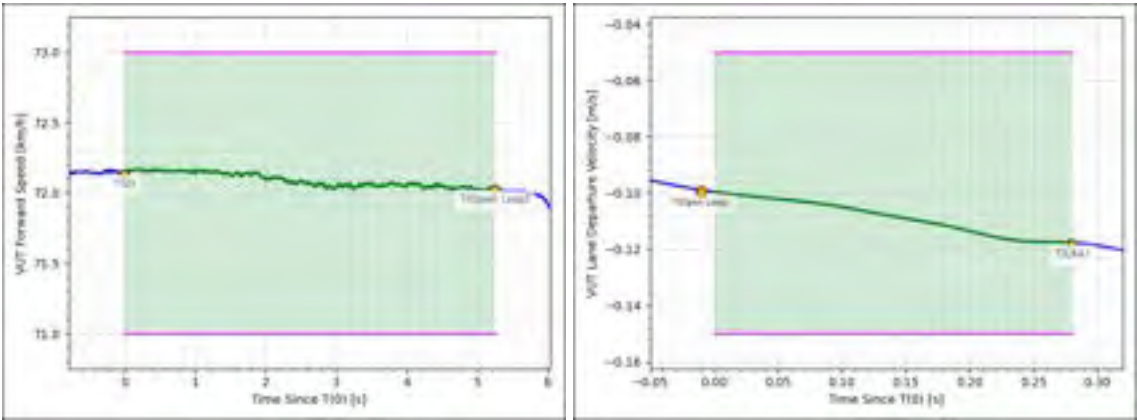
LKA SLN-D 0.1 mps Main | 0.1 m/s | Run 2

Run Date / Time 31-Mar-2023 12:01



LKA SLN-D 0.1 mps Main | 0.1 m/s | Run 3

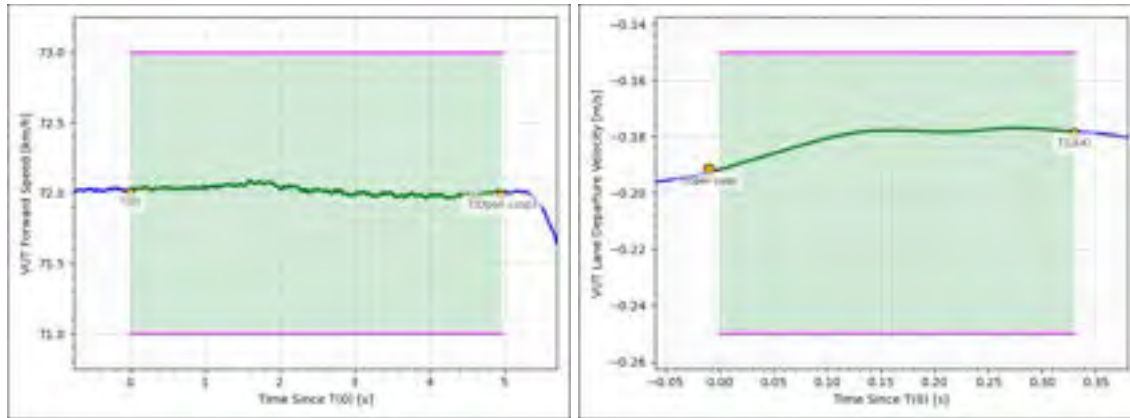
Run Date / Time 31-Mar-2023 12:02



K.4.1.2. 0.2 m/s

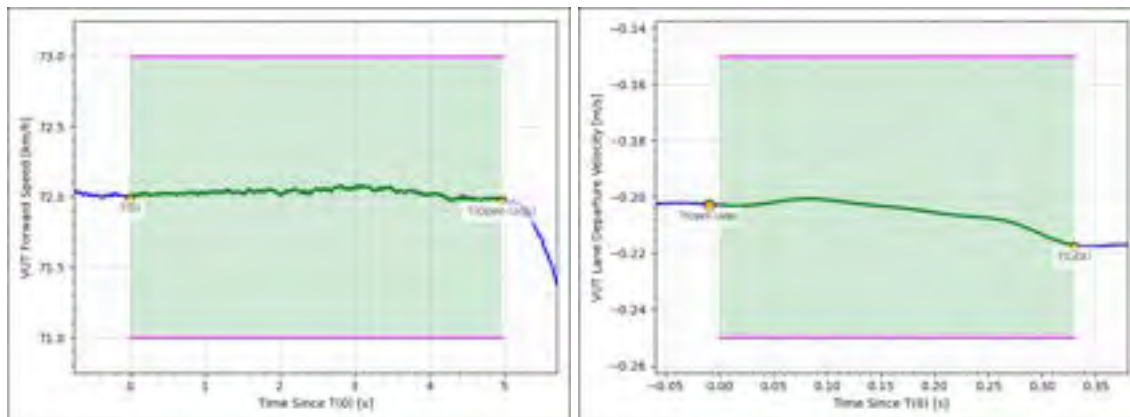
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Run Date / Time 31-Mar-2023 11:52



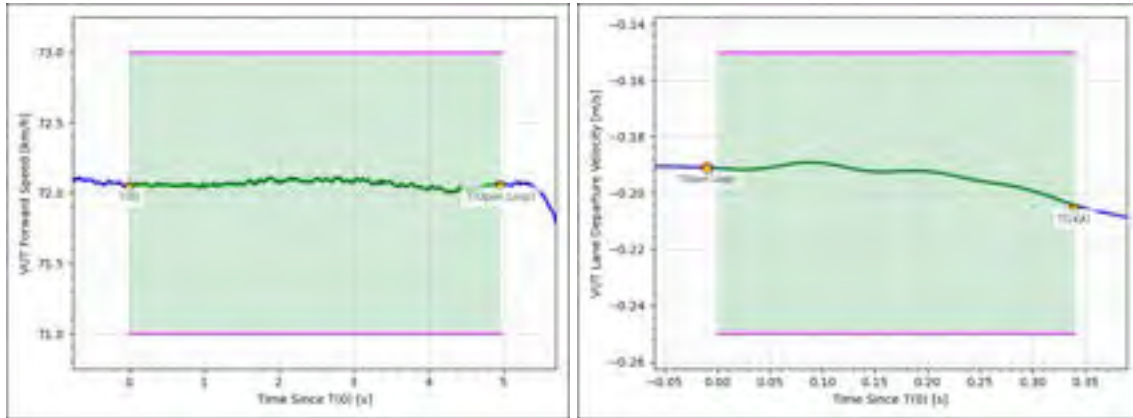
LKA SLN-D 0.2 mps Main | 0.2 m/s | Run 2

Run Date / Time 31-Mar-2023 11:54



LKA SLN-D 0.2 mps Main | 0.2 m/s | Run 3

Run Date / Time 31-Mar-2023 11:56

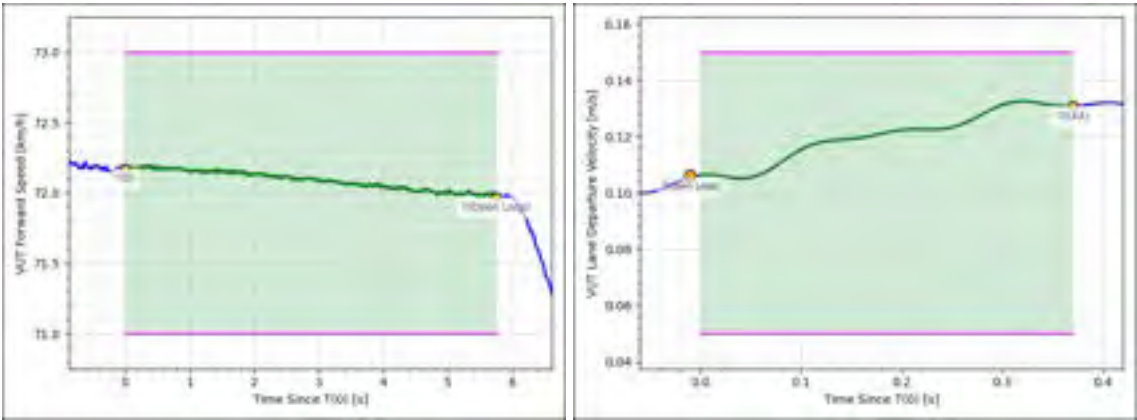


K.4.2. SLN-P

K.4.2.1. 0.1 m/s

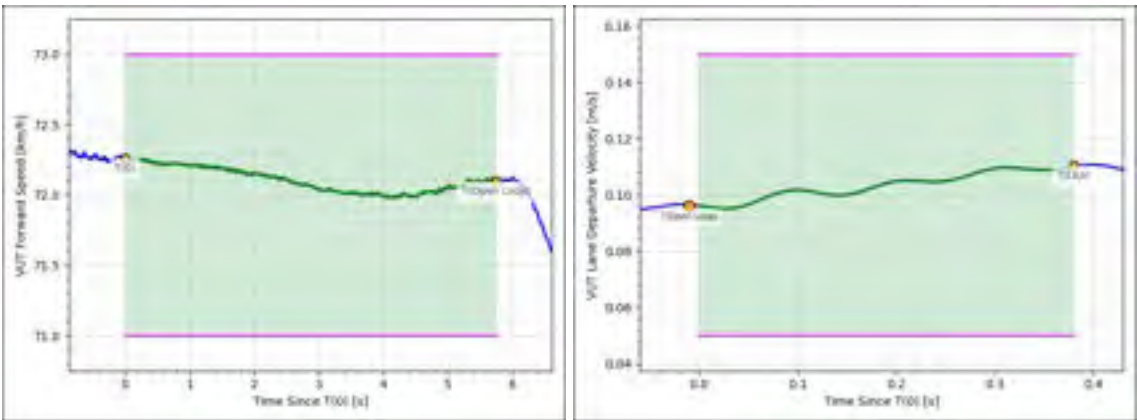
LKA SLN-P 0.1 mps Main | 0.1 m/s | Run 2

Run Date / Time 31-Mar-2023 10:43



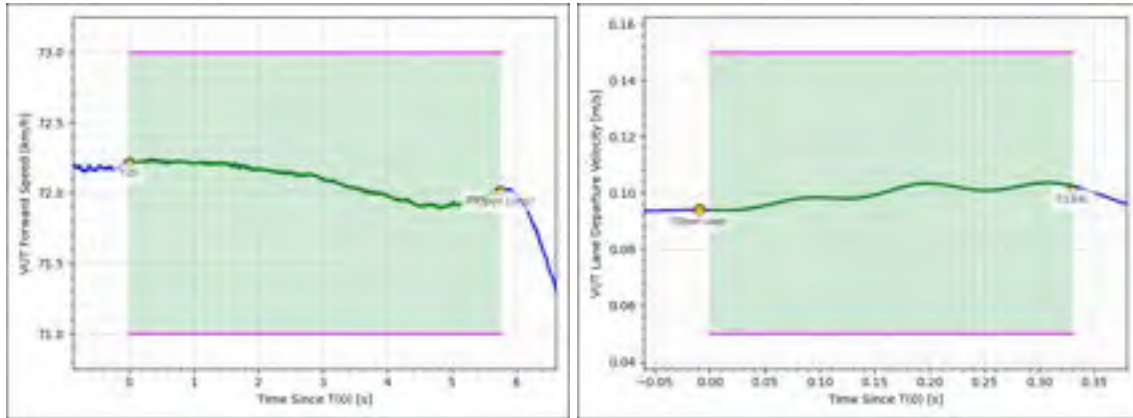
LKA SLN-P 0.1 mps Main | 0.1 m/s | Run 3

Run Date / Time 31-Mar-2023 10:45



LKA SLN-P 0.1 mps Main | 0.1 m/s | Run 4

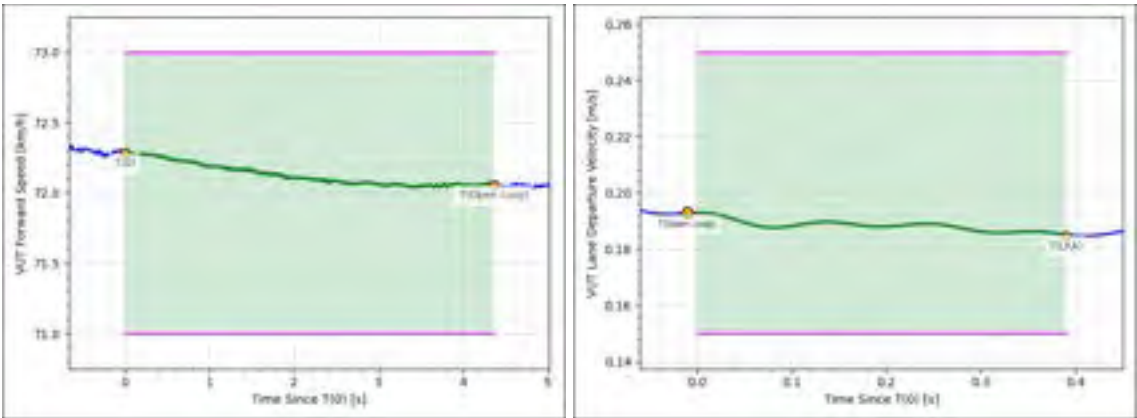
Run Date / Time 31-Mar-2023 10:48



K.4.2.2. 0.2 m/s

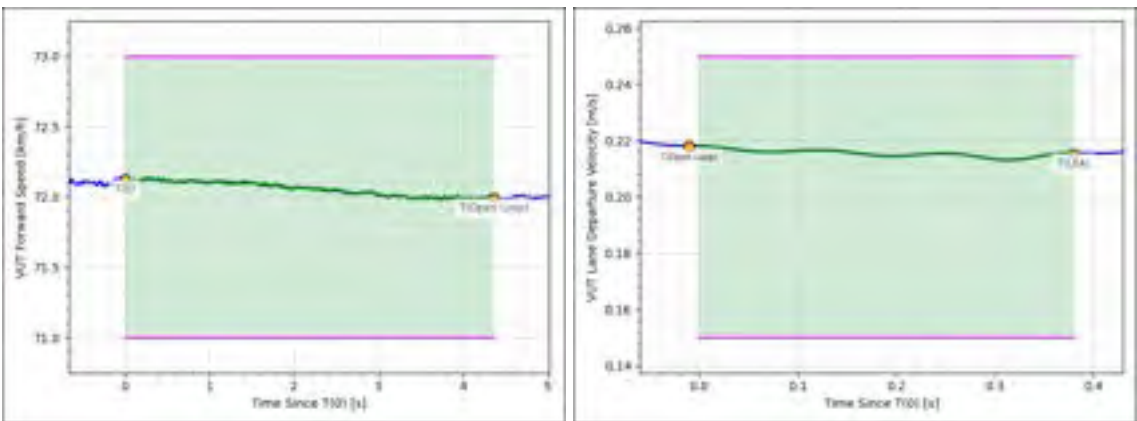
LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 1

Run Date / Time 31-Mar-2023 10:21



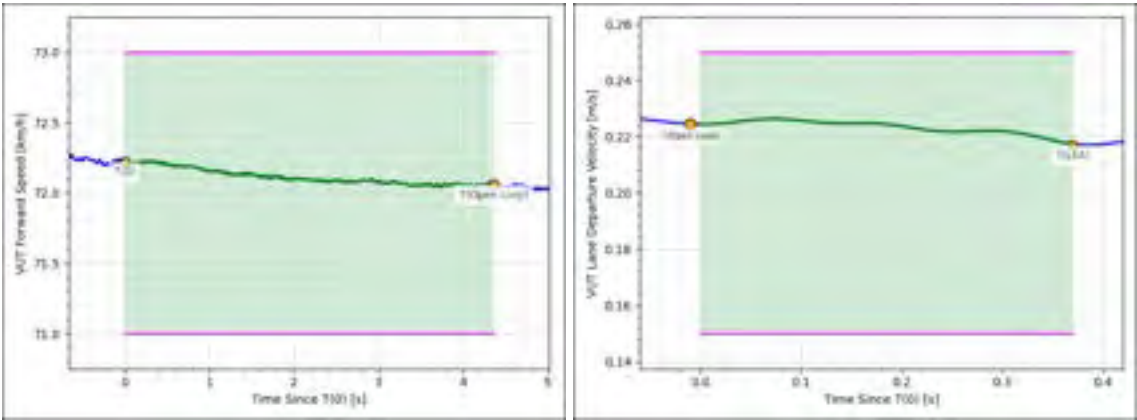
LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 2

Run Date / Time 31-Mar-2023 10:24



LKA SLN-P 0.2 mps Main | 0.2 m/s | Run 3

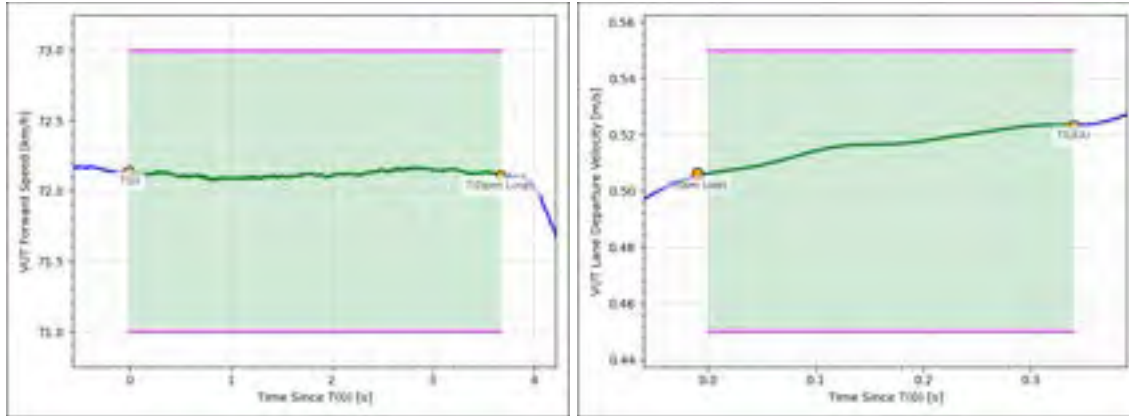
Run Date / Time 31-Mar-2023 10:27



K.4.2.3. 0.5 m/s

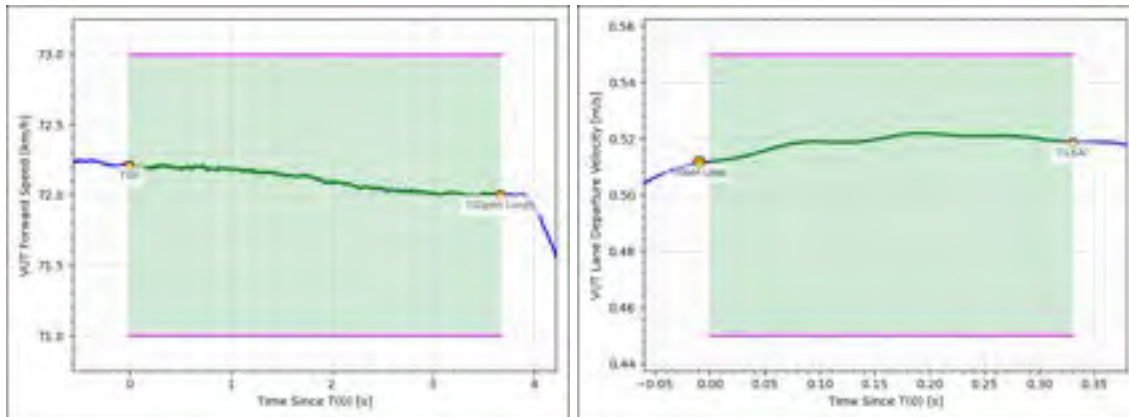
LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 1

Run Date / Time 31-Mar-2023 10:53



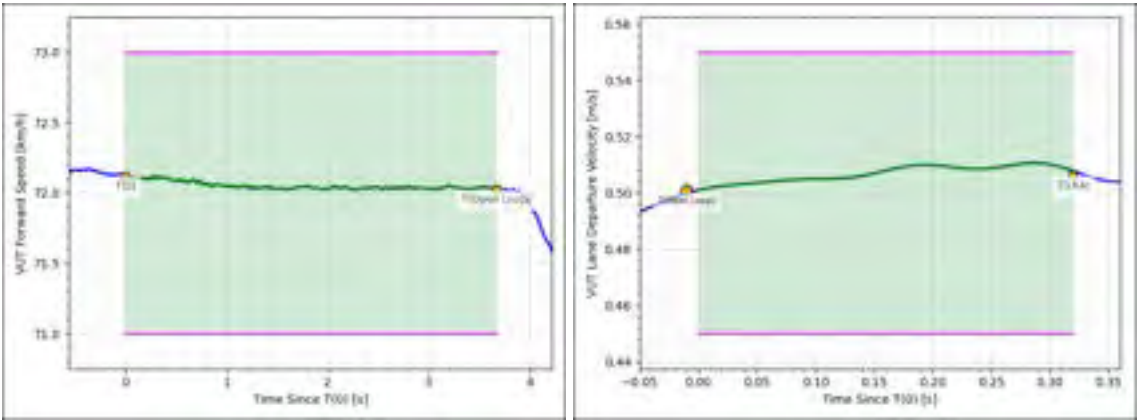
LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 2

Run Date / Time 31-Mar-2023 10:55



LKA SLN-P 0.5 mps Main | 0.5 m/s | Run 3

Run Date / Time 31-Mar-2023 10:58

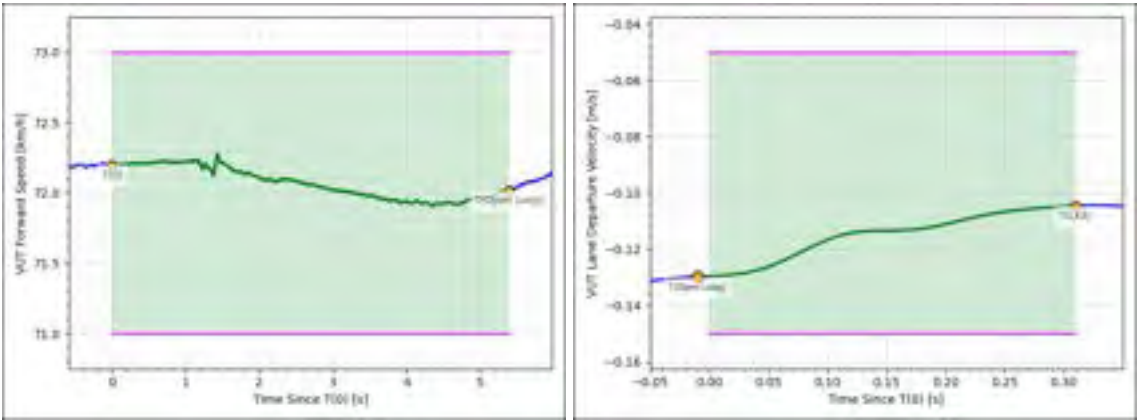


K.4.3. DLN-D

K.4.3.1. 0.1 m/s

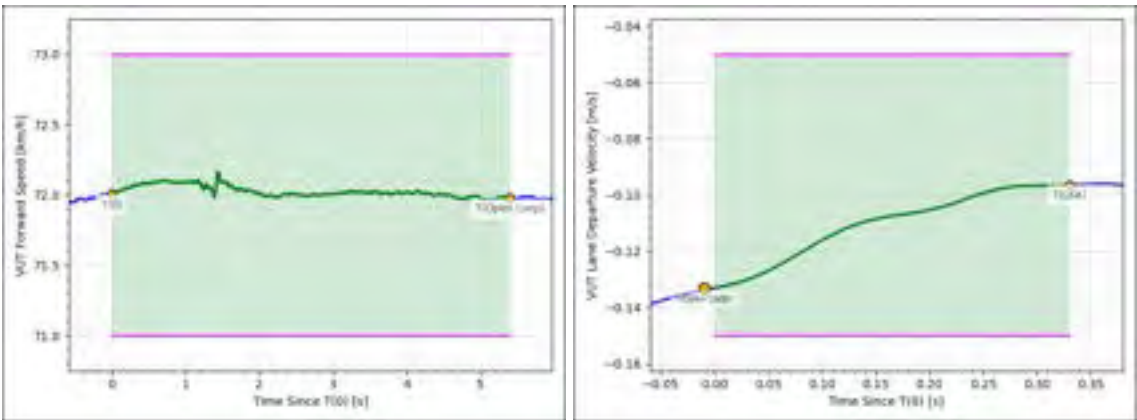
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Run Date / Time 31-Mar-2023 11:14



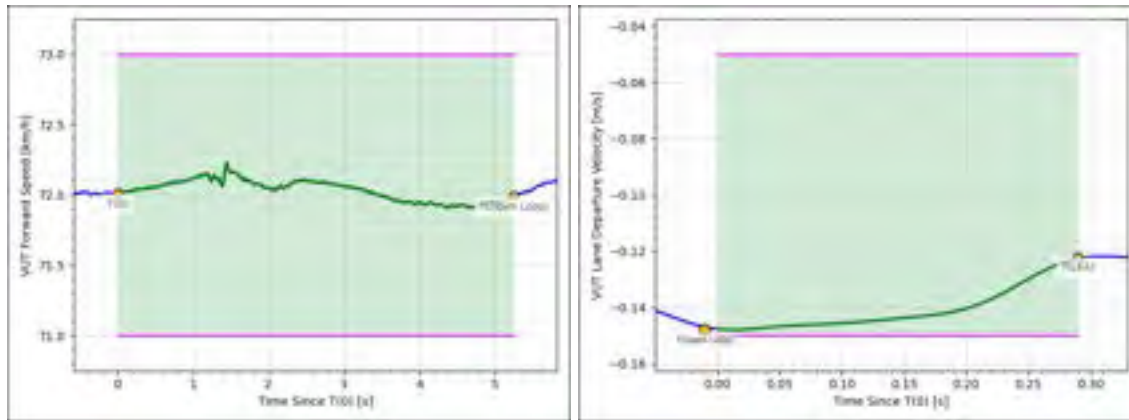
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Run Date / Time 31-Mar-2023 11:16



LKA DLN-D 0.1 mps Main | 0.1 m/s | Run 5

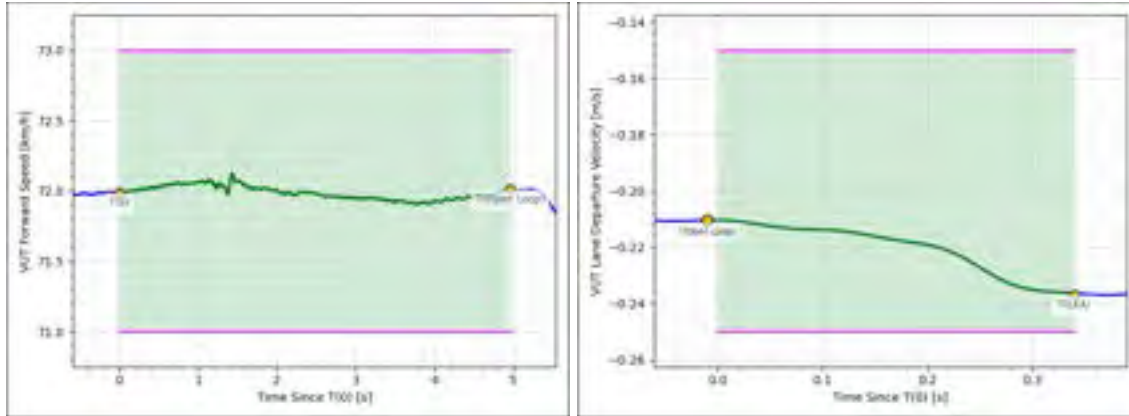
Run Date / Time 31-Mar-2023 11:26



K.4.3.2. 0.2 m/s

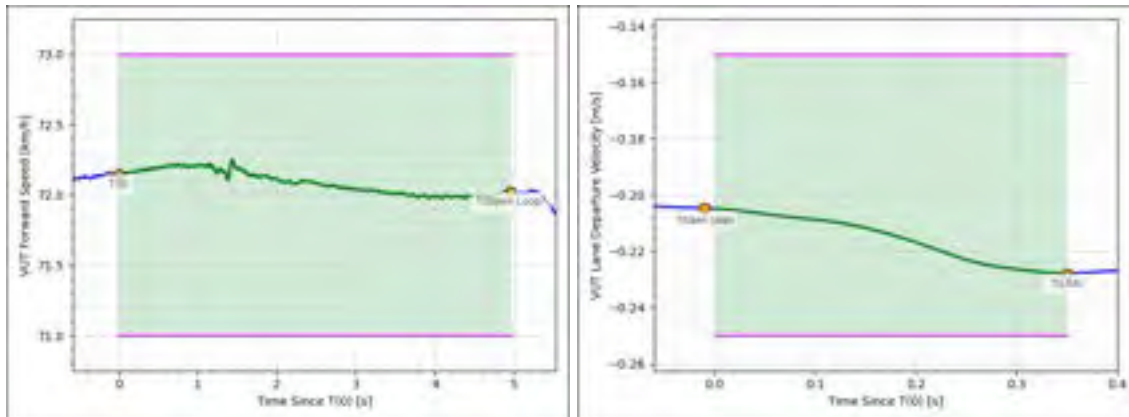
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Run Date / Time 31-Mar-2023 11:06



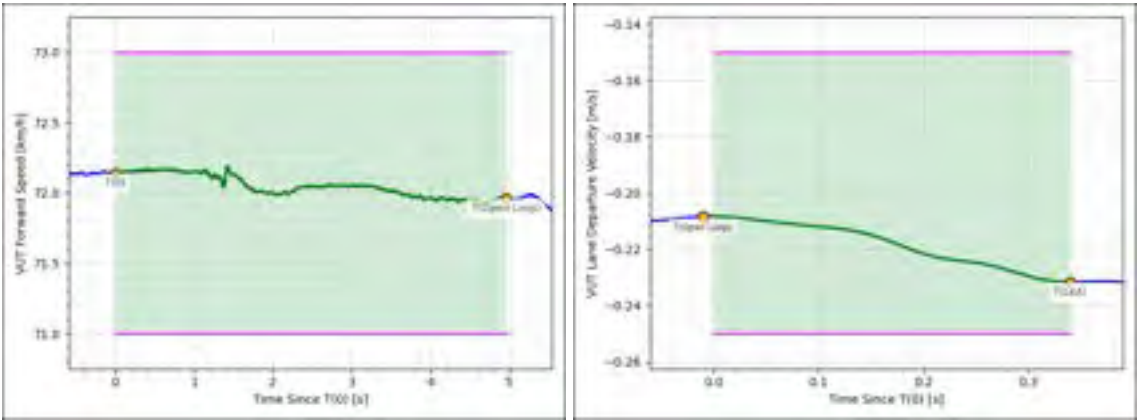
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Run Date / Time 31-Mar-2023 11:08



LKA DLN-D 0.2 mps Main | 0.2 m/s | Run 3

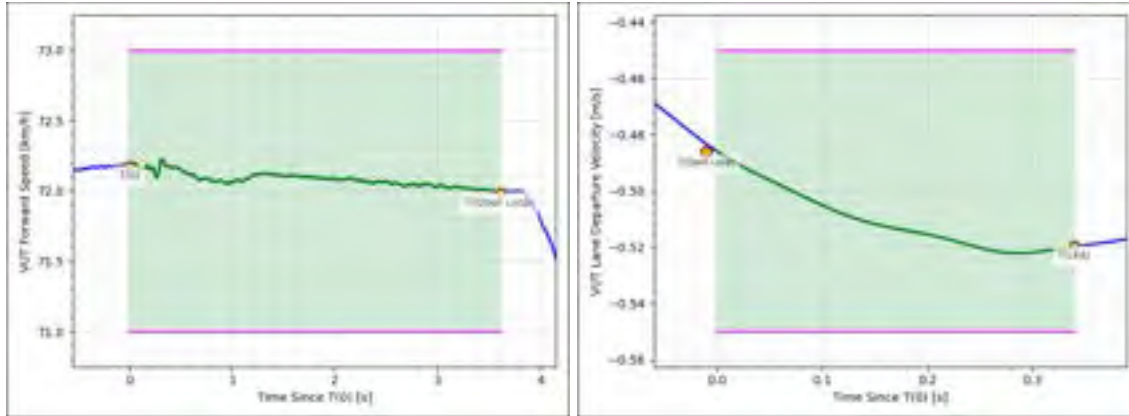
Run Date / Time 31-Mar-2023 11:11



K.4.3.3. 0.5 m/s

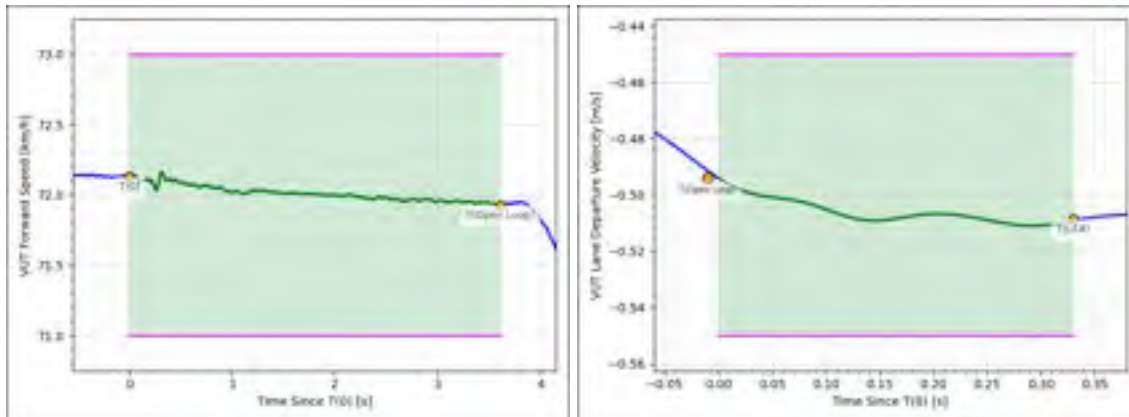
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Run Date / Time 31-Mar-2023 11:38



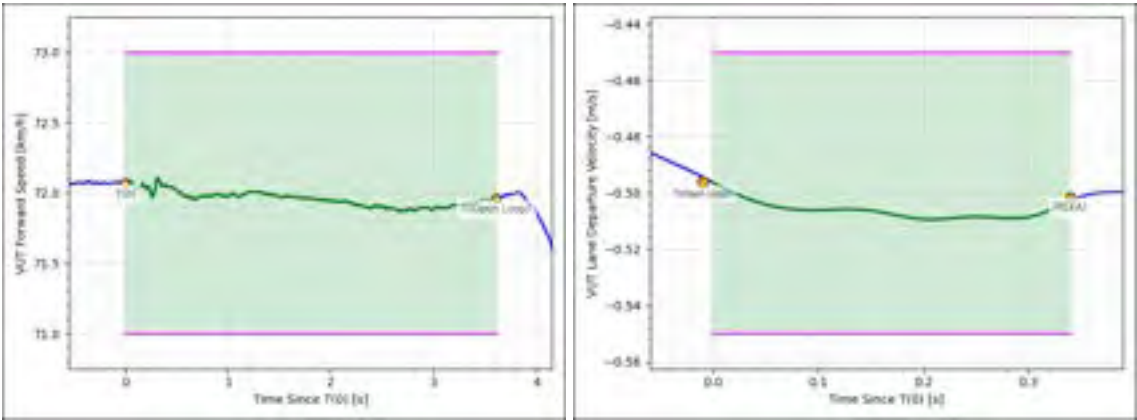
LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 6

Run Date / Time 31-Mar-2023 11:42



LKA DLN-D 0.5 mps Main | 0.5 m/s | Run 7

Run Date / Time 31-Mar-2023 11:44

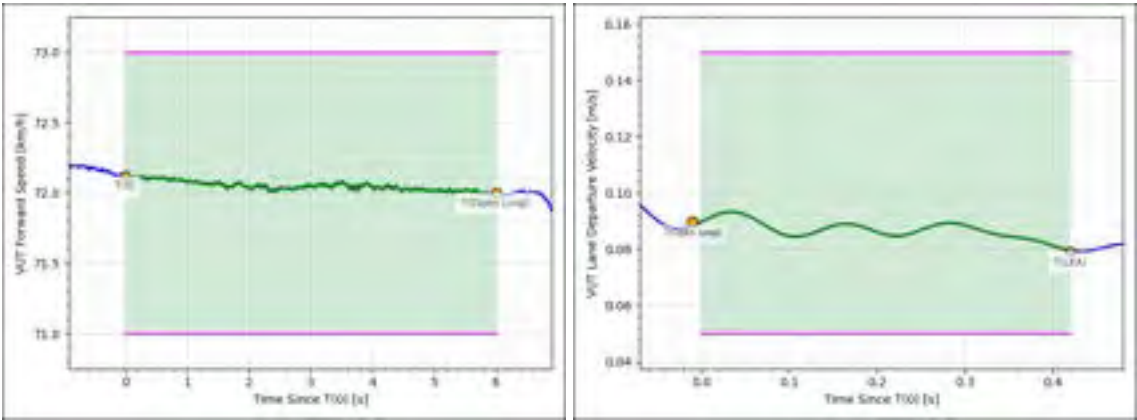


K.4.4. DLN-P

K.4.4.1. 0.1 m/s

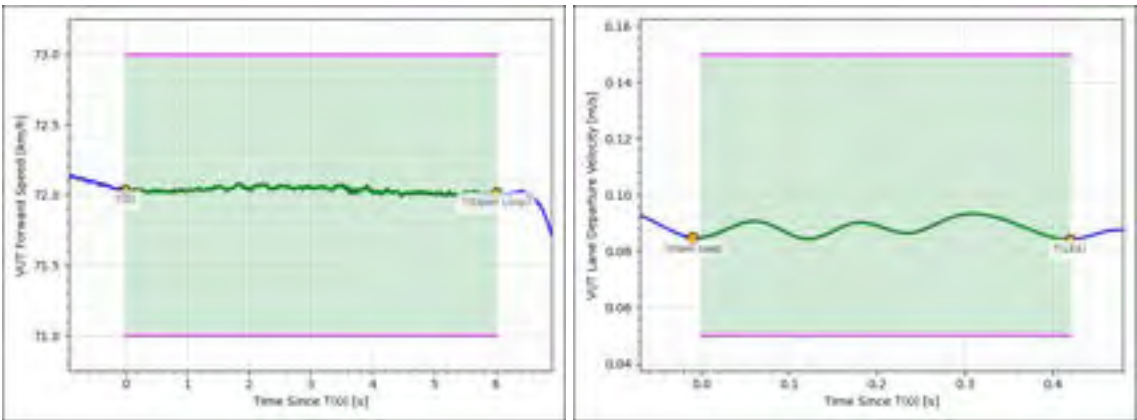
LKA DLN-P 0.1 mps Main | 0.1 m/s | Run 1

Run Date / Time 31-Mar-2023 10:08



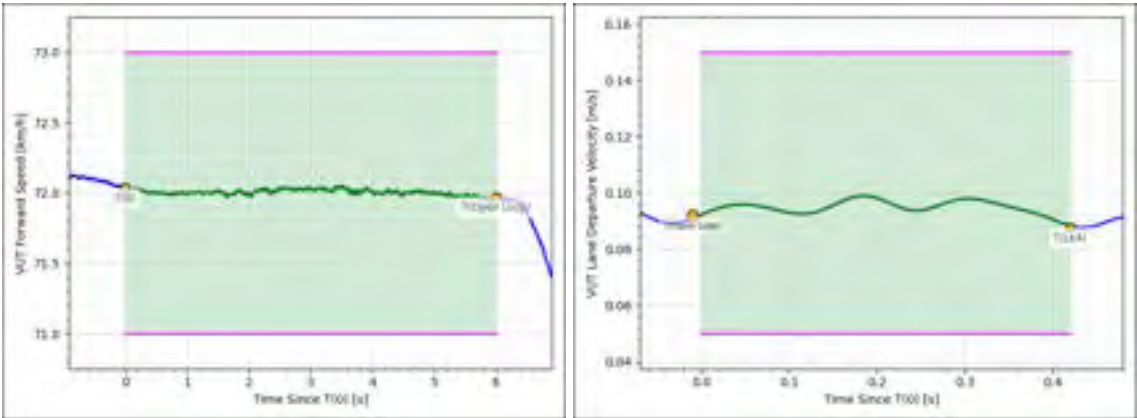
LKA DLN-P 0.1 mps Main | 0.1 m/s | Run 2

Run Date / Time 31-Mar-2023 10:10



LKA DLN-P 0.1 mps Main | 0.1 m/s | Run 3

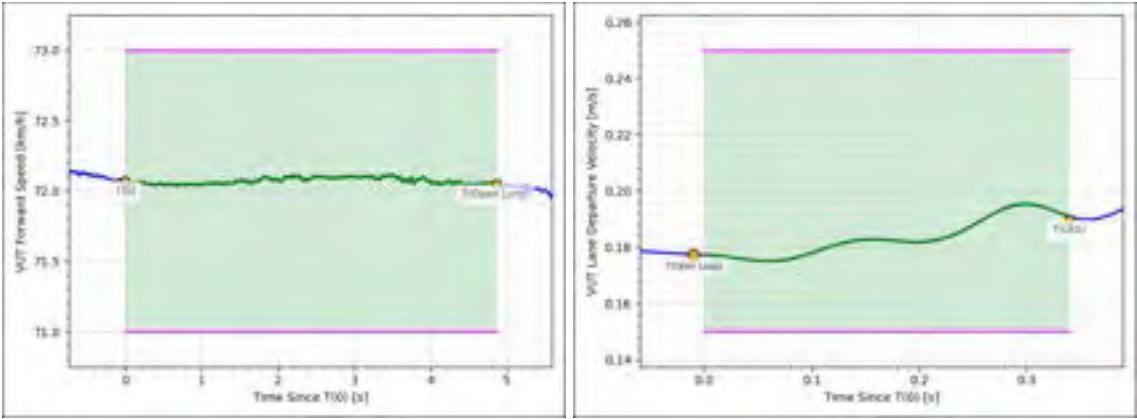
Run Date / Time 31-Mar-2023 10:12



K.4.4.2. 0.2 m/s

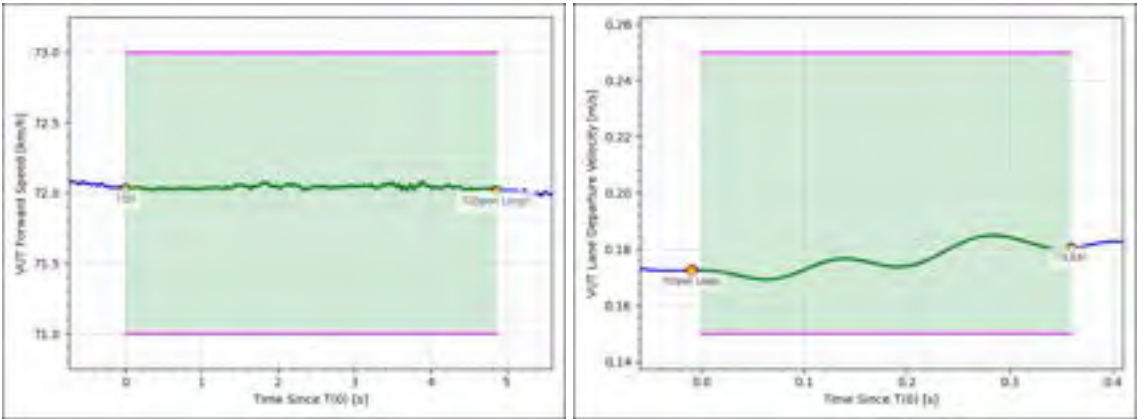
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Run Date / Time 31-Mar-2023 09:58



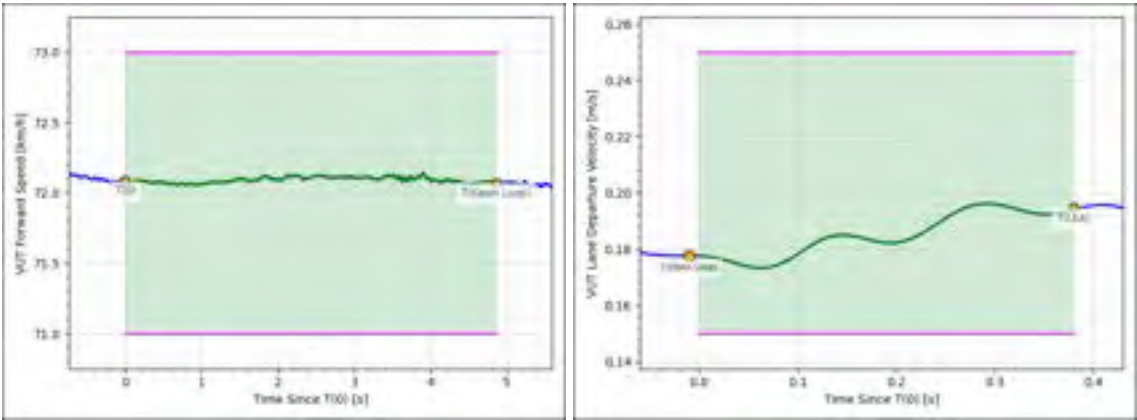
LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 3

Run Date / Time 31-Mar-2023 10:01



LKA DLN-P 0.2 mps Main | 0.2 m/s | Run 4

Run Date / Time 31-Mar-2023 10:04



APPENDIX L

Draft ADR 107/00



National Road Vehicle Standard (Australian Design Rule 107/00 – Lane Keeping Systems) 2022

I, KEVIN HOGAN, Assistant Minister to the Deputy Prime Minister, determine this National Road Vehicle Standard under section 12 of the *Road Vehicle Standards Act 2018*.

Dated

[NOT FOR SIGNING]

Kevin Hogan

Assistant Minister to the Deputy Prime Minister

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1. LEGISLATIVE PROVISIONS

1.1. Name of instrument

1.1.1. This Instrument is the National Road Vehicle Standard (Australian Design Rule 107/00 – Lane Keeping Systems) 2022.

1.1.2. This Instrument may also be cited as Australian Design Rule 107/00 – Lane Keeping Systems.

1.2. Commencement

1.2.1. This Instrument commences on the day after it is registered.

2. FUNCTION

2.1. The function of this National Road Vehicle Standard is to require vehicles to be fitted with systems that provide warning to the driver and correct the vehicle trajectory when the driver is unintentionally leaving the lane. This standard includes technical requirements intended to ensure lane keeping systems function appropriately.

3. APPLICABILITY

3.1. This National Road Vehicle Standard applies to vehicles in MA, MB, MC and NA categories as defined in Vehicle Standard (Australian Design Rule – Definitions and Vehicle Categories) 2005 from the dates set out in clause 3.1.1 and clause 3.1.2 and in the applicability table under clause 3.3 below.

3.1.1. [1 March 2024] for all new model vehicles.

3.1.2. [1 March 2026] for all vehicles.

3.2. For the purposes of clause 3.1.1, a “new model” is a vehicle model first produced with a ‘*Date of manufacture*’ on or after the agreed date in that clause.

3.3. Applicability Table

Vehicle Category	ADR Category Code	UN Category Code*	Manufactured on or After**	Acceptable Prior Rules
Moped 2 wheels	LA	L1	N/A	
Moped 3 wheels	LB	L2	N/A	
Motor cycle	LC	L3	N/A	
Motor cycle and sidecar	LD	L4	N/A	
Motor tricycle	LE	L5		
	LEM		N/A	
	LEP		N/A	
	LEG		N/A	
Passenger car	MA	M1	[1 March 2024]	
Forward-control passenger vehicle	MB	M1	[1 March 2024]	
Off-road passenger vehicle	MC	M1	[1 March 2024]	
Light omnibus	MD	M2		
up to 3.5 tonnes 'GVM' and up to 12 seats	MD1		N/A	
up to 3.5 tonnes 'GVM' and more than 12 seats	MD2		N/A	
over 3.5 tonnes and up to 4.5 tonnes 'GVM'	MD3		N/A	
over 4.5 tonnes and up to 5 tonnes 'GVM'	MD4		N/A	
Heavy omnibus	ME	M3	N/A	
Light goods vehicle	NA	N1	[1 March 2024]	
Medium goods vehicle	NB	N2		
over 3.5 tonnes up to 4.5 tonnes 'GVM'	NB1		N/A	
over 4.5 tonnes up to 12 tonnes 'GVM'	NB2		N/A	
Heavy goods vehicle	NC	N3	N/A	
Very light trailer	TA	O1	N/A	
Light trailer	TB	O2	N/A	
Medium trailer	TC	O3	N/A	
Heavy trailer	TD	O4	N/A	

* Note: The Australian Design Rule Vehicle Category Codes are broadly aligned with the category codes used by the United Nations – This column sets out the relationship between category codes.

** See clause 3.1.

4. REQUIREMENTS

- 4.1. Applicable vehicles must be fitted with a Lane keeping System (LKS) in accordance with this National Road Vehicle Standard.

Note: The requirements in this National Road Vehicle Standard have been adapted from EU Regulation EU 2021/646 Emergency Lane Keeping Systems (ELKS).

5. DEFINITIONS

- 5.1. For vehicle categories, definitions and meanings used in this National Road Vehicle Standard, refer to Vehicle Standard (Australian Design Rule Definitions and Vehicle Categories) 2005.
- 5.2. “AS 1742.2-2009” means the Australian Standard AS 1742.2-2009 Manual of uniform traffic control devices - Part 2: Traffic control devices for general use.
- 5.3. “*Corrective Directional Control Function (CDCF)*” means a control function within an *electronic control system* whereby, for a limited duration, changes to the steering angle of one or more wheels and/or braking of individual wheels may result from the automatic evaluation of signals initiated on-board the vehicle optionally enriched by data provided off-board the vehicle, in order to correct lane departure, e.g. to avoid crossing lane markings, leaving the road.
- 5.4. “*subject vehicle*” means the vehicle being tested;
- 5.5. “*Distance To Lane Marking (DTLM)*” means the remaining lateral distance (perpendicular to the lane marking) between the inner side of the lane marking and most outer edge of the tyre before the *subject vehicle* crosses the inner side of the lane marking.
- 5.6. “*flat road*” means a road with a slope less than 1 % in the longitudinal direction and for the lateral direction, less than 3 % for the lane width.
- 5.7. “*the system*” means the *electronic control system* and complex *electronic control systems* that provide or form part of the control transmission of the LKS, including the *transmission links* to or from other vehicle systems that act on the LKS.
- 5.8. “*units*” means the smallest divisions of system components which will be considered, since these combinations of components will be treated as single entities for purposes of identification, analysis or replacement.
- 5.9. “*transmission links*” means any electric, mechanic, pneumatic or hydraulic equipment used for inter-connecting distributed *units* for the purpose of conveying signals, operating data or energy supply.
- 5.10. “*electronic control system*” means a combination of *units*, designed to cooperate in the production of a vehicle control function by electronic data processing.
- 5.11. “*control strategy*” means a strategy to ensure robust and safe operation of the function(s) of an *electronic control system* in response to a specific set of ambient and/or operating conditions (such as road surface condition, traffic intensity and other road users, adverse weather conditions, etc.), which may include the automatic deactivation of a function or temporary performance restrictions (e.g. a reduction in the maximum operating speed, etc.).
- 5.12. “*safety concept*” means a description of the measures designed into *the system*, for instance within the electronic *units*, so as to address system integrity and ensure safe operation under fault and non-fault conditions, including in the event of an electrical

failure. The possibility of a fallback to partial operation or even to a back-up system for vital vehicle functions may be a part of the *safety concept*.

6. GENERAL REQUIREMENTS

6.1. A LKS must comprise a Lane Departure Warning System (LDWS) and a CDCF.

6.1.1. The LDWS must meet the requirements of subsections 7.1, 7.2, 7.3 and 7.4.

6.1.2. The CDCF must meet the requirements of subsections 7.1, 7.2, 7.3 and 7.5.

6.2. LKS lane departure warnings and interventions

Subject to specific requirements below *the system* must be designed to minimise warnings and interventions for driver intended manoeuvres.

7. SPECIFIC REQUIREMENTS

7.1. LKS failure warning

A warning must be provided when there is a failure in the LKS that prevents the requirements of this National Road Vehicle Standard being met.

7.1.1. The failure warning must be a constant visual warning signal.

7.1.1.1. There must not be an appreciable time interval between each LKS self-check (an integrated function that checks for a system failure on a continuous basis at least while *the system* is active), and subsequently there must not be a delay in illuminating the warning signal, in the case of an electrically detectable failure.

7.1.1.2. Upon detection of any non-electrical failure condition (e.g. sensor misalignment), the warning signal as defined in clause 7.1.1 must be activated.

7.1.2. If the vehicle is equipped with a means to deactivate the LKS a warning must be given when *the system* is deactivated according to subsection 7.2. This must be a constant visual warning signal. The failure warning signal specified in clause 7.1.1. may be used for this purpose.

7.2. LKS deactivation

7.2.1. Manual deactivation

When a vehicle is equipped with a means to manually deactivate the LKS function, either partially or fully, the following conditions must apply as appropriate:

7.2.1.1. The full LKS function must be automatically and fully reinstated upon each activation of the vehicle master control switch.

7.2.1.2. The manual deactivation of the full LKS must not be possible with less than two deliberate actions, e.g. press and hold on a button, or select and confirm on menu option. It must be possible to easily suppress acoustic warnings of the LDWS, but such action must not at the same time deactivate the LDWS or the CDCF.

7.2.1.3. The manual deactivation capability must be tested in accordance with the relevant vehicle test(s) specified in section 8.

7.2.2. Automatic deactivation

If the vehicle is equipped with a means to automatically deactivate the LKS function, either partially or fully, for instance in situations such as off-road use, being towed, a trailer being hitched to the vehicle or the electronic stability control (ESC) being deactivated, the following conditions must apply as appropriate:

- 7.2.2.1. For testing, the vehicle manufacturer must provide a list of situations and corresponding criteria where the LKS function is automatically deactivated which must be annexed to the test report.
- 7.2.2.2. The LKS function must be automatically and fully reactivated as soon as the conditions that led to the automatic deactivation are not present anymore.
- 7.2.3. A constant visual warning signal must inform the driver that the LKS function has been deactivated. The failure warning signal specified in clause 7.1.1 above may be used for this purpose.

7.3. Automatic suppression

7.3.1. For driver intended manoeuvres

For testing, the manufacturer must provide a documentation package which gives access to the basic design and logic of *the system* for detection of likely driver intended manoeuvres and automatic suppression of the LKS. This package must include a list of parameters detected and a basic description of the method used to decide that *the system* should be suppressed, including limit values where possible. For both the CDCF and LDWS, the Testing Facility must assess the documentation package to show that driver unintentional manoeuvres, within the scope of the lane keep test parameters (in particular lateral departure velocity), will not result in automatic suppression of *the system*.

- 7.3.2. Automatic suppression of the LKS is also permitted in situations when other driver assist or automated steering functions, (i.e. Automatically commanded steering function, emergency steering function or automated lane keeping), are controlling the lateral movement of the vehicle or other safety related functions (i.e. that is capable of changing the dynamic behaviour of the vehicle such as AEBS, ESC, etc.) are intervening. These situations must be declared by the manufacturer.

7.4. LDWS requirements

7.4.1. Speed range

The LDWS must be active at least within the vehicle speed range between 65 km/h and 130 km/h (or the maximum vehicle speed if it is lower than 130 km/h) and at all vehicle load conditions, unless deactivated as per clause 7.2.

7.4.2. Lane departure warning

When activated and operated within the prescribed speed range, the LDWS must be able to warn the driver at the latest if the vehicle crosses over a visible lane marking for the lane in which it is running by more than a DTLM of – 0,3 m:

- (a) for lateral departure velocities in the range of the 0,1 m/s to 0,5 m/s;
- (b) on straight, flat and dry roads;

- (c) for solid line and dashed lane markings in line with one of those described in AS 1742.2-2009;
- (d) with the markings being in good condition;
- (e) in all illumination conditions without blinding of the sensors (e.g. direct blinding due to sunlight) and with activated passing-beam (dipped-beam) headlamps if necessary;
- (f) in absence of weather conditions affecting the visibility of lane markings (e.g. no fog).

It is recognised that the performance required may not be fully achieved in other conditions than those listed above. However, *the system* must not unreasonably switch the *control strategy* in these other conditions.

The lane departure warning capability must be tested in accordance with the relevant vehicle test(s) specified in section 8.

7.4.3. LDWS warning indication

7.4.3.1. The lane departure warning referred to in clause 7.4.2 must be noticeable by the driver and be provided by:

- (a) at least two warning means out of visual, acoustic and haptic; or
- (b) one warning means out of haptic and acoustic, with spatial indication about the direction of unintended drift of the vehicle.

The warning mentioned above may be suppressed when there is a driver action which indicates an intention to depart from the lane;

7.4.3.1.1. Where a visual signal is used for the lane departure warning, it may use the failure warning signal as specified in clause 7.1.1 above in a flashing mode.

7.4.3.1.2. When there is a lane keep intervention by the CDCF, this must be considered a haptic warning according to clause 7.4.3.1.

7.4.3.2. The LDWS visual warning signal must be activated following a vehicle master control switch 'power-ON'. This requirement does not apply to warning signals shown in a common space.

7.4.3.3. The LDWS visual warning signals must be visible even by daylight; the satisfactory condition of the signals must be easily verifiable by the driver from the driver's seat.

7.4.4. The visual warning signal must be tested in accordance with the relevant vehicle test(s) specified in section 8.

7.5. CDCF performance requirements

7.5.1. Speed range

The CDCF must be active at least between 70 km/h and 130 km/h (or the maximum vehicle speed if it is below 130 km/h) and at all vehicle load conditions, unless deactivated as per subsection 7.2. However, in the case that the vehicle reduces its speed from above 70 km/h to below 70 km/h, *the system* must be active at least until the vehicle speed reduces below 65 km/h.

7.5.2. Lane keep

In the absence of conditions leading to deactivation or suppression of *the system*, the CDCF must be able to prevent lane departure by crossing of visible lane markings in the scenarios shown in the following table by more than a DTLM of – 0,3 m:

- (a) for lateral departure velocities in the range of the 0,2 m/s to 0,5 m/s for vehicle speeds up to 100 km/h and for lateral departure velocities in the range of 0,2 m/s to 0,3 m/s for vehicle speeds greater than 100 km/h and up to 130 km/h (or the maximum vehicle speed if it is below 130 km/h);
- (b) on straight, flat and dry roads;
- (c) for solid line and dashed lane markings in line with one of those described in AS 1742.2-2009;
- (d) with the markings being in good condition;
- (e) in all illumination conditions without blinding of the sensors (e.g. direct blinding sunlight) and with activated passing-beam (dipped-beam) headlamps if necessary;
- (f) in absence of weather conditions affecting the dynamic performance of the vehicle (e.g. no storm, not below 5 °C) or the visibility of lane markings (e.g. no fog).

No.	Scenario description
1.	Solid line – departure to right side of vehicle 
2.	Solid Line – Departure to left of vehicle 

It is recognised that the performances required for the scenarios in this table may not be fully achieved in other conditions than those listed above. However, *the system* must not unreasonably switch the *control strategy* in these other conditions. This must be demonstrated in accordance with the testing requirements.

The lane keep capability must be tested in accordance with the relevant vehicle test(s) specified in section 9.

7.5.3. Steering override

- 7.5.3.1. The steering control effort necessary to override the directional control provided by *the system* must not exceed 50 N. Significant loss of steering support once overridden must not happen suddenly.
- 7.5.3.2. For CDCF systems which do not act on the steering itself (e.g. differential braking type CDCF), the steering input must not exceed 25 degrees.
- 7.5.3.3. The steering override control effort must be tested in accordance with the relevant vehicle test(s) specified in section 9.

7.5.4. CDCF warning indication

- 7.5.4.1. Every CDCF intervention must immediately be indicated to the driver by a visual warning signal which is displayed for at least 1 second or as long as the intervention exists, whichever is longer. The visual signal may be the flashing of the failure warning signal specified in clause 7.1.1.
- 7.5.4.1.1. In the case of an intervention longer than 10 seconds, an acoustic warning signal must be provided until the end of the intervention unless there is a driver action which indicates an intention to depart from the lane.
- 7.5.4.1.2. In the case of two or more consecutive interventions within a rolling interval of 180 seconds and in the absence of a steering input by the driver during this intervention, an acoustic warning signal must be provided by *the system* during the second and any further intervention within a rolling interval of 180 seconds. Starting with the third intervention (and subsequent interventions) the acoustic warning signal must continue for at least 10 seconds longer than the previous warning signal.
- 7.5.4.2. The requirements in clauses 7.5.4.1.1 and 7.5.4.1.2 must be tested in accordance with the relevant vehicle test(s) specified in section 9.

8. TEST REQUIREMENTS FOR LDWS

8.1. General provisions

Vehicles fitted with LDWS must fulfil the appropriate tests requirements of this section

8.2. Testing conditions

The tests must be performed:

- (a) On a flat and dry asphalt or concrete road type surface, which may not contain any irregularities (e.g. large dips or cracks, manhole covers or reflective studs) within a lateral distance of 3,0 m to either side of the centre of the test lane and with a longitudinal distance of 30 m ahead of the *subject vehicle* from the point after the test is complete.
- (b) In ambient illumination conditions of at least 2 000 lux without blinding of the sensors (e.g. direct blinding sunlight) and with activated low beam head lamps if necessary.
- (c) In ambient air temperatures between 5 °C and 45 °C.
- (d) In the absence of weather conditions affecting the visibility of lane markings, e.g. fog.

8.2.1. Lane markings

The solid line and dashed lane markings on the road used for the tests must be in line with one of those described in AS 1742.2-2009. The markings must be in good condition. The lane-marking layout used for the tests must be recorded in the test report.

The width of the lane (measured between the lane markings) must be a minimum of 3.5 m for the purpose of the tests of this section. The vehicle manufacturer must demonstrate, through the use of documentation, compliance with all other lane markings identified in AS 1742.2-2009. Any of such documentation must be appended to the test report.

8.2.2. *Subject vehicle* conditions

8.2.2.1. Test mass

The *subject vehicle* must be tested at its GVM. The vehicle manufacturer must demonstrate, through the use of documentation, that *the system* works at all load conditions.

8.2.2.2. The *subject vehicle* must be tested at the tyre pressures recommended by the vehicle manufacturer.

8.2.2.3. Where the LDWS is equipped with a user-adjustable warning threshold, the tests specified in subsection 8.3 must be performed with the warning threshold set at its maximum lane departure setting. No alteration must be made once the test procedure has begun.

8.2.2.4. Pre-test conditioning

If requested by the vehicle manufacturer the vehicle can be driven to calibrate the sensor system up to a maximum of 100 km on a mixture of urban and rural roads with other traffic and roadside furniture.

8.3. Test procedures

8.3.1. Visual warning signal verification test

With the vehicle stationary, check that the visual warning signal(s) comply with the requirements of clause 7.4.3.2.

8.3.2. Lane departure warning test

8.3.2.1. Drive the vehicle at a speed of 70 km/h $\pm$ 3 km/h into the centre of the test lane in a smooth manner so that the attitude of the vehicle is stable.

Maintaining the prescribed speed, gently drift the vehicle, either to the left or the right, with a lateral departure velocity of between 0,1 and 0,5 m/s so that the vehicle crosses the lane marking.

Repeat the test at a different rate of departure within the range 0,1 and 0,5 m/s. Repeat the above tests drifting in the opposite direction.

8.3.2.2. The test requirements are fulfilled if the LDWS provides the lane departure warning indication mentioned in subsection 7.4.3.1 above at the latest when the DLTM is – 0,3 m.

8.3.2.3. In addition, the vehicle manufacturer must demonstrate to the satisfaction of the Testing Facility that the requirements for the whole speed range and lateral departure velocity range are fulfilled. This may be achieved on the basis of appropriate documentation appended to the test report.

8.3.3. Manual deactivation test

8.3.3.1. If the vehicle is equipped with means to manually deactivate the LDWS, turn the vehicle master control switch to the 'Power ON' position and deactivate the LDWS. The warning signal specified in clause 7.2.3 must be activated.

Turn the master control switch to the 'Power OFF' position. Turn the vehicle master control switch to the 'Power ON' position and verify that the previously activated warning signal is not reactivated, thereby indicating that the LDWS has been reinstated as specified in clause 7.2.1.1.

9. TEST REQUIREMENTS FOR CDCF

9.1. General provisions

Vehicles fitted with CDCF must fulfil the appropriate tests requirements of this section.

9.2. Testing conditions

The tests must be performed:

- (a) On a flat and dry asphalt or concrete road type surface, which may not contain any irregularities (e.g. large dips or cracks, manhole covers or reflective studs) within a lateral distance of 3,0 m to either side of the centre of the test lane and with a longitudinal distance of 30 m ahead of the *subject vehicle* from the point after the test is complete.
- (b) In ambient illumination conditions of at least 2 000 lux without blinding of the sensors (e.g. direct blinding sunlight) and with activated low beam head lamps if necessary.
- (c) In ambient air temperatures between 5 °C and 45 °C.
- (d) In the absence of weather conditions affecting the dynamic performance of the vehicle (e.g. no storm, not below 5 °C) or the visibility of lane markings (e.g. fog).

9.2.1. Lane markings

The solid line and dashed lane markings on the road used for the tests must be in line with one of those described in AS 1742.2-2009. The marking must be in good condition. The lane-marking used for the tests must be recorded in the test report.

The solid lane marking must be a minimum of 3,5 m distance from any other lane markings, for the purpose of the tests of this section. The vehicle manufacturer must demonstrate, through the use of documentation, compliance with all other solid lane markings identified in AS 1742.2-2009. Any of such documentation must be appended to the test report.

9.2.2. *Subject vehicle* conditions

9.2.2.1. Test mass

The *subject vehicle* must be tested at its GVM. The vehicle manufacturer must demonstrate, through the use of documentation, that *the system* works at all load conditions.

9.2.2.2. The *subject vehicle* must be tested at the tyre pressures recommended by the vehicle manufacturer.

9.2.2.3. Where the CDCF is equipped with a user-adjustable timing threshold, the test specified in subsection 9.3.3 must be performed with the timing threshold set at its latest setting for system intervention. No alteration must be made once the test procedure has begun.

9.2.2.4. Pre-test conditioning

If requested by the vehicle manufacturer the vehicle can be driven to calibrate the sensor system up to a maximum of 100 km on a mixture of urban and rural roads with other traffic and roadside furniture.

9.3. Tests procedures

9.3.1. Warning Indication test

9.3.1.1. The *subject vehicle* must be driven with an activated CDCF on a road with solid lane markings on at least one side of the lane.

The test conditions and the *subject vehicle* test speed must be within the operating range of *the system*.

During the test, the duration of the CDCF interventions and of the visual and acoustic warning signals must be recorded.

In the case referred to in clause 7.5.4.1.1, the *subject vehicle* must be driven such that it attempts to leave the lane and causes CDCF intervention to be maintained for a period longer than 10 seconds.

The test requirements are fulfilled if the acoustic warning is provided no later than 10 seconds after the beginning of the intervention.

In the case referred to in clause 7.5.4.1.2, the *subject vehicle* must be driven in such a way that it attempts to leave the lane and causes at least three interventions of *the system* within a rolling interval of 180 seconds.

The test requirements are fulfilled if all the following conditions are met:

- (a) a visual warning signal is provided for each intervention, as long as the intervention exists;
- (b) an acoustic warning signal is provided at the second and third intervention;
- (c) the acoustic warning signal at the third intervention is at least 10 s longer than the one at the second intervention.

9.3.1.2. In addition, the manufacturer must demonstrate to the satisfaction of the Testing Facility that the requirements defined in clauses 7.5.4.1.1 and 7.5.4.1.2 are fulfilled in the whole range of CDCF operation. This may be achieved on the basis of appropriate documentation appended to the test report.

9.3.2. Steering override test

9.3.2.1. The *subject vehicle* must be driven with an activated CDCF on a road with solid lane markings on each side of the lane.

The test conditions and the *subject vehicle* test speed must be within the operating range of *the system*.

The vehicle must be driven such that it attempts to leave the lane and causes CDCF intervention. During the intervention, the driver must apply the steering control effort necessary to override the intervention.

The force and steering input applied by the driver on the steering control to override the intervention must be recorded.

The test requirements are fulfilled if:

- (a) The force applied by the driver on the steering control to override the intervention does not exceed 50 N.
- (b) There is no sudden loss of significant steering support once CDCF is overridden.
- (c) For LKS that do not act on the steering itself (e.g. differential braking type CDCF), the steering input does not exceed 25 degrees.

9.3.2.2. In addition, the manufacturer must demonstrate to the satisfaction of the Testing Facility that the requirements defined in subsection 7.5.4 are fulfilled in the whole range of CDCF operation. This may be achieved on the basis of appropriate documentation appended to the test report.

9.3.3. Lane keep test

9.3.3.1. The CDCF must be tested for test scenarios No 1 and No 2 described in clause 7.5.2.

9.3.3.1.1. Tests for all scenarios must be performed with lateral velocities of 0,2 m/s and 0,5 m/s.

9.3.3.1.2. A test path must be driven which consists of an initial straight path parallel to the solid lane marking being tested, followed by a fixed radius curve to apply a known lateral velocity and yaw to the *subject vehicle*, followed again by a straight path without any force applied on the steering control (e.g. by removing the hands from the steering control).



9.3.3.1.3. The *subject vehicle* speed during the test up to the point of system intervention must be 72 km/h $\pm$ 1 km/h.

The curve of fixed radius driven to apply the lateral velocity required must have a radius 1 200 m or more.

The lateral velocity required must be achieved to a tolerance of $\pm$ 0,05 m/s.

The vehicle manufacturer must provide information describing the radius of the curve to be driven and the location when the closed loop path and/or speed control must be ended so as to ensure a free drifting in order not to interfere an automatic suppression according to clause 7.3.1.

9.3.3.2. The test requirements are fulfilled if the *subject vehicle* does not cross the lane marking by a DTLM of more than $-$ 0,3 m.

9.3.3.3. In addition, the vehicle manufacturer must demonstrate to the satisfaction of the Testing Facility that the requirements for the whole speed range and lateral departure velocity range are fulfilled. This may be achieved on the basis of appropriate documentation appended to the test report.

10. DOCUMENTATION

10.1. Requirements

The manufacturer must provide a documentation package which gives access to the basic design of *the system* and the means by which it is linked to other vehicle systems or by which it directly controls output variables. The function(s) of *the system*, including the control strategies, and the *safety concept*, as laid down by the manufacturer, must be explained. Documentation must be brief, yet provide evidence that the design and development has had the benefit of expertise from all *the system* fields which are involved.

The Testing Facility must assess the documentation package to show that *the system*:

- (a) is designed to operate, under non-fault and fault conditions, in such a way that it does not induce safety critical risks;

- (b) respects, under non-fault and fault conditions, all the appropriate performance requirements specified elsewhere in this Regulation; and
 - (c) was developed according to the development process/method declared by the manufacturer and that this includes at least the steps listed in subsection 10.4.4.
- 10.1.1. Documentation of testing and technical documents required to support the approval of this National Road Vehicle Standard must be maintained in such a manner that allows traceability.
- 10.2. A description must be provided which gives a simple explanation of all the functions including control strategies of *the system* and the methods employed to achieve the objectives, including a statement of the mechanism(s) by which control is exercised.
Any described function that can be over-ridden must be identified and a further description of the changed rationale of the function's operation provided.
- 10.2.1. A list of all input and sensed variables must be provided and the working range of these defined, along with a description of how each variable affects system behaviour.
- 10.2.2. A list of all output variables which are controlled by *the system* must be provided and an indication given, in each case, of whether the control is direct or via another vehicle system. The range over which *the system* is likely to exercise control on each output variable must be defined.
- 10.2.3. Limits defining the boundaries of functional operation (i.e. the external physical limits within which *the system* is able to maintain control) must be stated where appropriate to system performance.
- 10.3. System layout and schematics.
- 10.3.1. Inventory of components.
A list must be provided, collating all the *units* of *the system* and mentioning the other vehicle systems which are needed to achieve the control function in question.
An outline schematic showing these *units* in combination, must be provided with both the equipment distribution and the interconnections made clear.
- 10.3.2. Functions of the *units*
The function of each unit of *the system* must be outlined and the signals linking it with other *units* or with other vehicle systems must be shown. This may be provided by a labelled block diagram or other schematic, or by a description aided by such a diagram.
- 10.3.3. Interconnections within *the system* must be shown by a circuit diagram for the electric *transmission links*, by a piping diagram for pneumatic or hydraulic transmission equipment and by a simplified diagrammatic layout for mechanical linkages. The *transmission links* both to and from other systems must also be shown.
- 10.3.4. There must be a clear correspondence between *transmission links* and the signals carried between *units*. Priorities of signals on multiplexed data paths must be stated wherever priority may be an issue affecting performance or safety.
- 10.3.5. Identification of *units*

Each unit must be clearly and unambiguously identifiable (e.g. by marking for hardware and marking or software output for software content) to provide corresponding hardware and documentation association.

Where functions are combined within a single unit or within a single computer, but shown in multiple blocks in the block diagram for clarity and ease of explanation, only a single hardware identification marking must be used. The manufacturer must, by the use of this identification, affirm that the equipment supplied conforms to the corresponding document.

- 10.3.5.1. The identification defines the hardware and software version and, where the latter changes such as to alter the function of the Unit as far as this National Road Vehicle Standard is concerned, this identification must also be changed.
- 10.4. *Safety concept* of the manufacturer
- 10.4.1. The manufacturer must provide a statement which affirms that the strategy chosen to achieve *the system* objectives will not, under non-fault conditions, prejudice the safe operation of the vehicle.
- 10.4.2. In respect of software employed in *the system*, the outline architecture must be explained and the design methods and tools used must be identified. The manufacturer must show evidence of the means by which they determined the realisation of *the system* logic, during the design and development process.
- 10.4.3. The manufacturer must provide the Testing Facility with an explanation of the design provisions built into *the system* so as to generate safe operation under fault conditions. Possible design provisions for failure in *the system* are for example:
- (a) fall-back to operation using a partial system;
 - (b) change-over to a separate back-up system;
 - (c) removal of the high level function.
- In case of a failure, the driver must be warned for example by warning signal or message display. When *the system* is not deactivated by the driver, e.g. by turning the ignition (run) switch to 'off', or by switching off that particular function if a special switch is provided for that purpose, the warning must be present as long as the fault condition persists.
- 10.4.3.1. If the chosen provision selects a partial performance mode of operation under certain fault conditions, then these conditions must be stated and the resulting limits of effectiveness defined.
- 10.4.3.2. If the chosen provision selects a second (back-up) means to realise the vehicle control system objective, the principles of the change-over mechanism, the logic and level of redundancy and any built in back-up checking features must be explained and the resulting limits of back-up effectiveness defined.
- 10.4.3.3. If the chosen provision selects the removal of the higher level electronic control function, all the corresponding output control signals associated with this function must be inhibited, and in such a manner as to limit the transition disturbance.
- 10.4.4. The documentation must be supported, by an analysis which shows, in overall terms, how *the system* will behave on the occurrence of any of those hazards or faults which will have a bearing on vehicle control performance or safety.
- The chosen analytical approach(es) must be established and maintained by the Manufacturer and must be inspected by the Testing Facility.

The Testing Facility must perform an assessment of the application of the analytical approach(es). The assessment must include:

- (a) Inspection of the safety approach at the concept (vehicle) level with confirmation that it includes consideration of:
 - (i) interactions with other vehicle systems;
 - (ii) malfunctions of *the system*, within the scope of this Regulation;
 - (iii) for the functions referred to in subsection 10.2:
 - situations when a system free from faults may create safety critical risks (e.g. due to a lack of or wrong comprehension of the vehicle environment),
 - reasonably foreseeable misuse by the driver,
 - intentional modification of *the system*.

This approach must be based on a hazard/risk analysis appropriate to system safety.

- (b) Inspection of the safety approach at *the system* level. This may be based on a Failure Mode and Effect Analysis (FMEA), a Fault Tree Analysis (FTA) or any similar process appropriate to system safety.
- (c) Inspection of the validation plans and results. This must include validation testing appropriate for validation, for example, Hardware in the Loop (HIL) testing, vehicle on-road operational testing, or any other testing appropriate for validation.

The assessment must consist of spot checks of selected hazards and faults to establish that argumentation supporting the *safety concept* is understandable and logical and validation plans are suitable and have been completed.

The Testing Facility may perform or may require to perform tests as specified in section 11 to verify the *safety concept*.

- 10.4.4.1. This documentation must itemise the parameters being monitored and must set out, for each fault condition of the type defined in subsection 10.4.4, the warning signal to be given to the driver and/or to service/technical inspection personnel.
- 10.4.4.2. This documentation must describe the measures in place to ensure *the system* does not prejudice the safe operation of the vehicle when the performance of *the system* is affected by environmental conditions e.g. climatic, temperature, dust ingress, water ingress, ice packing.

11. VERIFICATION AND TEST

- 11.1. The functional operation of *the system*, as laid out in the documents required in section 10, must be tested as follows:
 - 11.1.1. Verification of the function of *the system*.

The Testing Facility must verify *the system* under non-fault conditions by testing a number of selected functions from those described by the manufacturer in subsection 10.2.

For complex electronic systems, these tests must include scenarios whereby a declared function is overridden.

 - 11.1.1.1. The verification results must correspond with the description, including the control strategies, provided by the manufacturer in subsection 10.2.

11.1.2. Verification of the *safety concept* of subsection 10.4

The reaction of *the system* must be checked under the influence of a failure in any individual unit by applying corresponding output signals to electrical *units* or mechanical elements in order to simulate the effects of internal faults within the unit. The Testing Facility must conduct this check for at least one individual unit, but must not check the reaction of *the system* to multiple simultaneous failures of individual *units*.

The Testing Facility must verify that these tests include aspects that may have an impact on vehicle controllability and user information (HMI aspects).