POLY-VERIFICATION USER GUIDE

Welcome to PolyVerif

This user guide provides a detailed walkthrough for seamlessly conducting simulations with the Poly-Verification Suite utilizing the powerful PolyVerif framework. Before diving into the simulation process, make sure to refer to the comprehensive "polyverif_setup_and_installation_doc" for successful installation and configuration of the PolyVerif framework.

Refer detail video link for below demo: - https://drive.google.com/file/d/1OXu2N8o5gXu-Sf2-2bSnIMfjqhGh_Omb/view?usp=drive_link

Configuration and Metric Defaults

Key configuration parameters are defined in the "config.ini" file, offering a glimpse into the default settings that govern the behaviour of the PolyVerif framework during simulations. These settings, ranging from detection thresholds to collision counts, play a vital role in the validation metrics that determine the success or failure of the simulation.

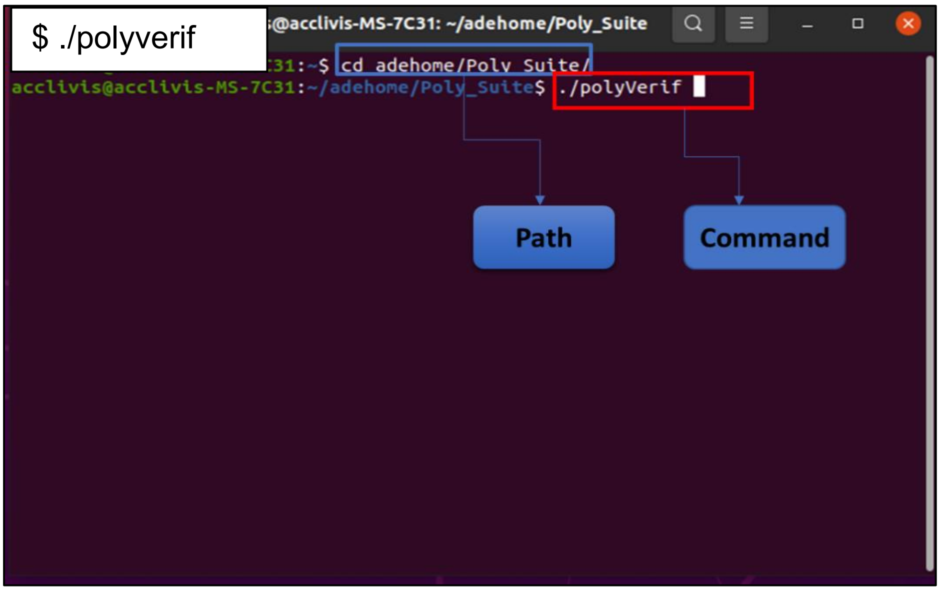
config.ini

```
Autonomous_stack_config]

Detection_max_threshold = 40

Detection_min_threshold = 30

Control_collision_count = 0

Localize_max_threshold = 0

Localize_min_threshold = 1

Planner_goalpose_max_threshold = 10

Planner_goalpose_min_threshold = 2
```

Navigating the Simulation Landscape

Navigate to Poly_Suite Directory:

Go to the Poly_Suite directory located at adehome/Poly_Suite and execute the following command:



```
$ ./polyverif
```

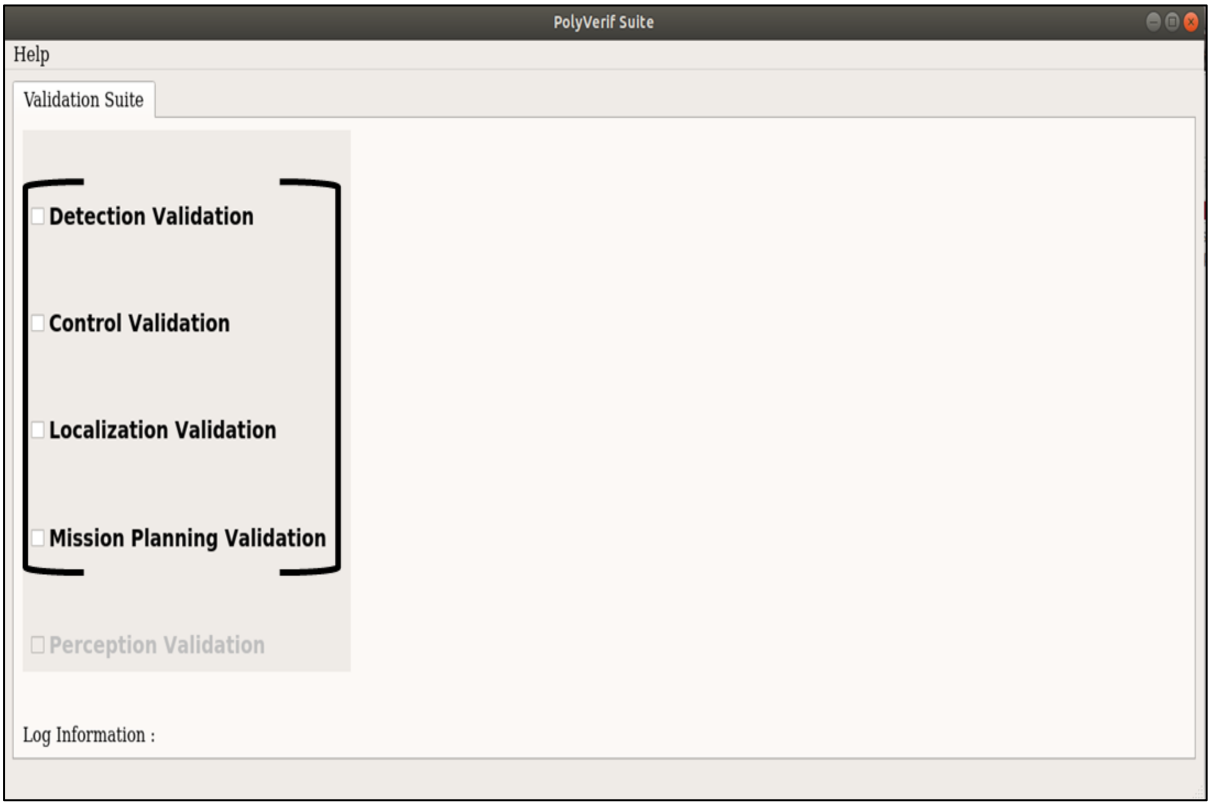
```
:31:~$ cd adehome/Poly_Suite/
acclivis@acclivis-MS-7C31:~/adehome/Poly_Suite$ ./polyVerif
```

This command will initiate the PolyVerif framework for further configuration and execution

Select Validation Types for Detection and Control

Four validation options await your exploration:

- **Detection Validation**
- **Control Validation**
- **Localization Validation**
- **Mission Planning Validation**



□ Detection Validation

□ Control Validation

□ Localization Validation

□ Mission Planning Validation

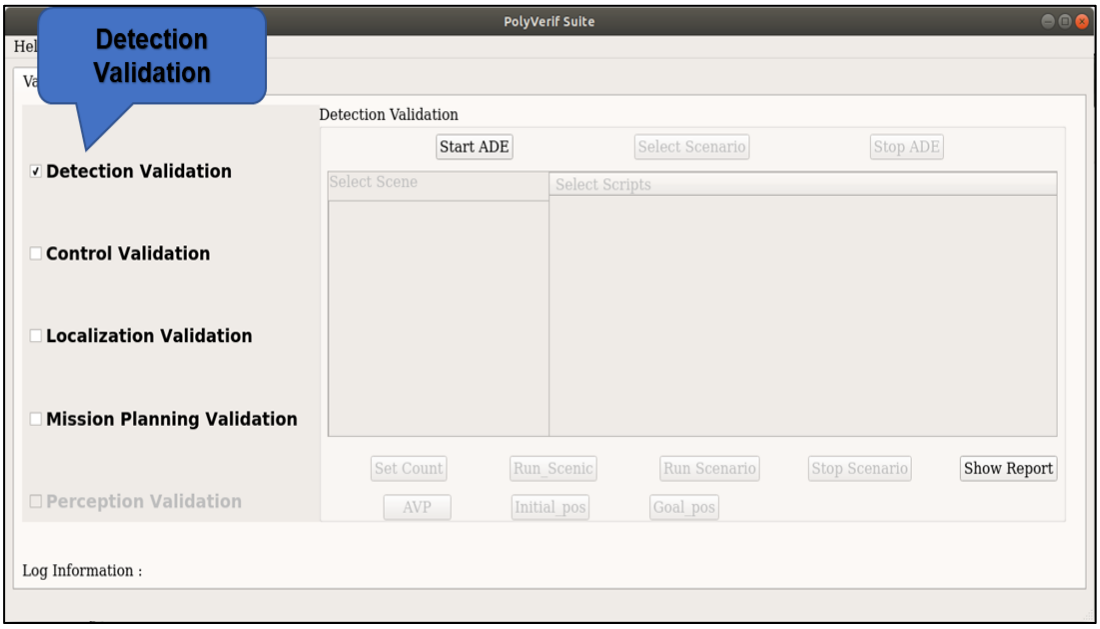
□ Perception Validation

Log Information :

For the purpose of this guide, direct your focus towards Detection and Control Validation.

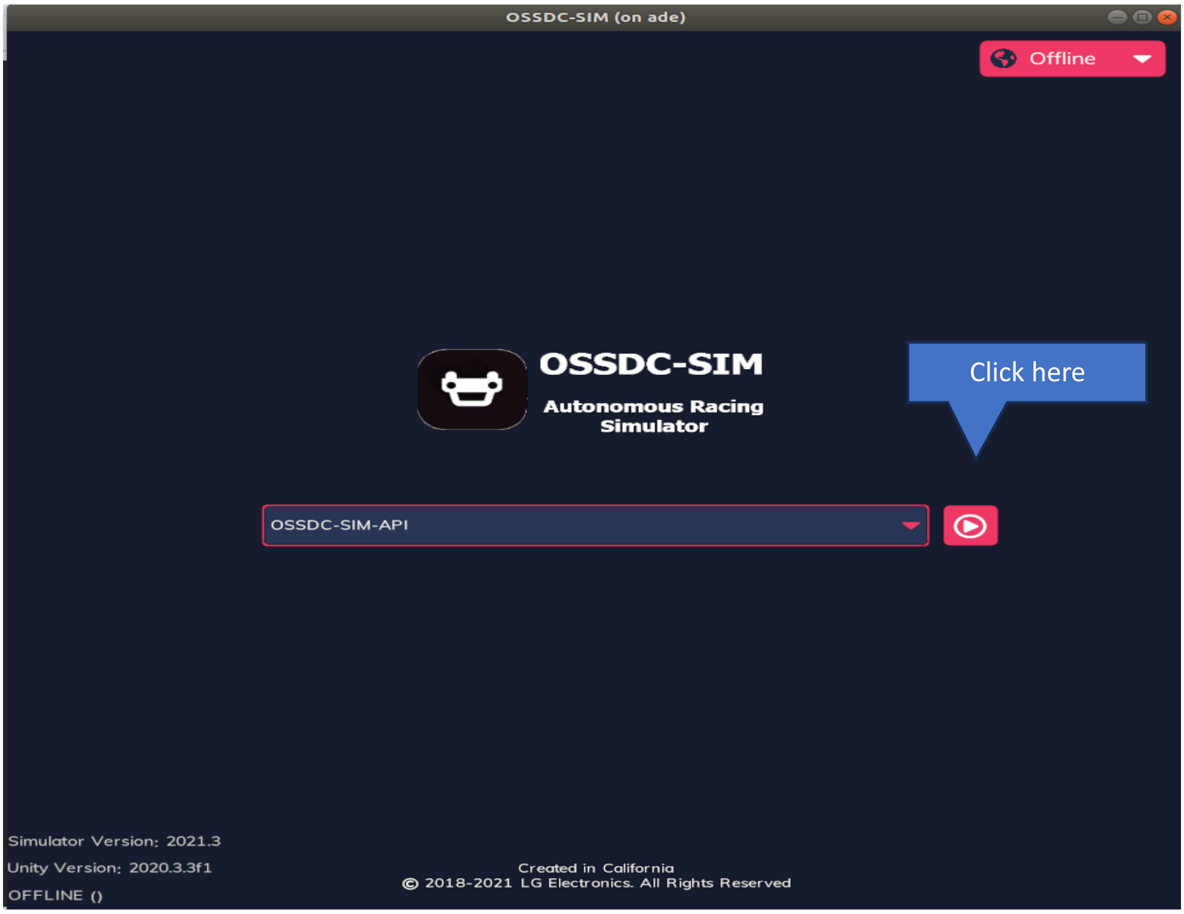
Detection Validation:

Begin by clicking "Start ADE" to initialize modules, which includes AutowareAuto, the Perception Stack, OSSDC simulator, Rviz, and Ros2-lgsvl-bridge. Allow some time for the ADE Docker and components to start.



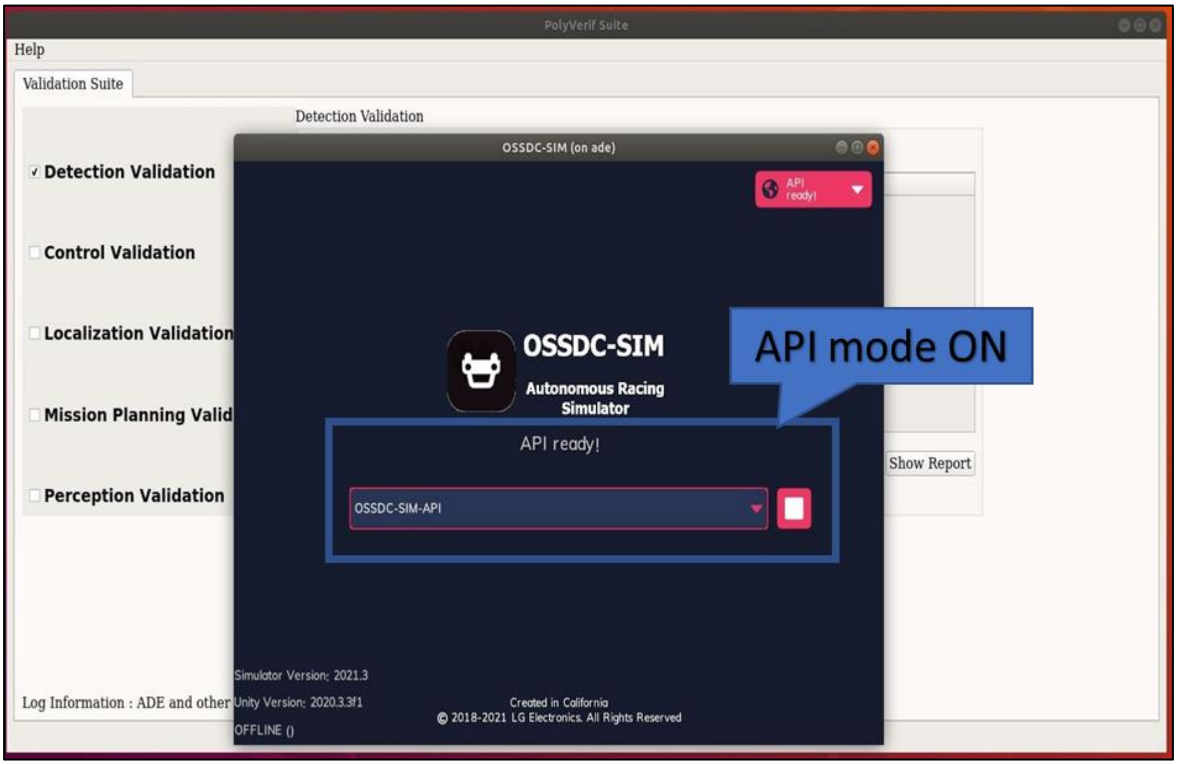
Scenario Setup:

Click on API_Mode button


OSSDC-SIM (on ade)
Offline
OSSDC-SIM
Autonomous Racing Simulator
Click here
OSSDC-SIM-API
Simulator Version: 2021.3
Unity Version: 2020.3.3f1
OFFLINE ()
Created in California
© 2018-2021 LG Electronics. All Rights Reserved

In API_Mode, select a scenario:

- Choose the Maps or Scenes like BorregasAve, Cubetown, JTA_R2 etc.
- Pick a scenario from the list.
- Click "Run Scenario" to execute the Python script.



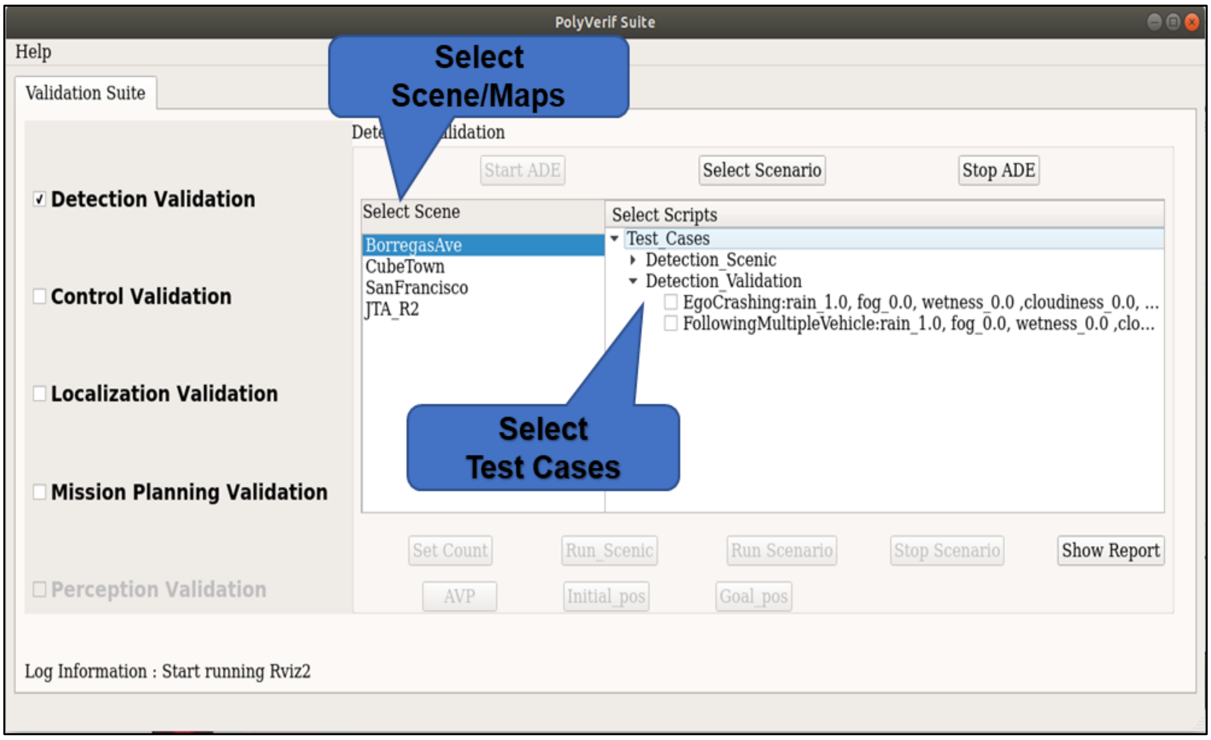
API mode ON

API ready!

Simulator Version: 2021.3
Unity Version: 2020.3.3f1
OFFLINE ()

Created in California
© 2018-2021 LG Electronics. All Rights Reserved

Log Information : ADE and other

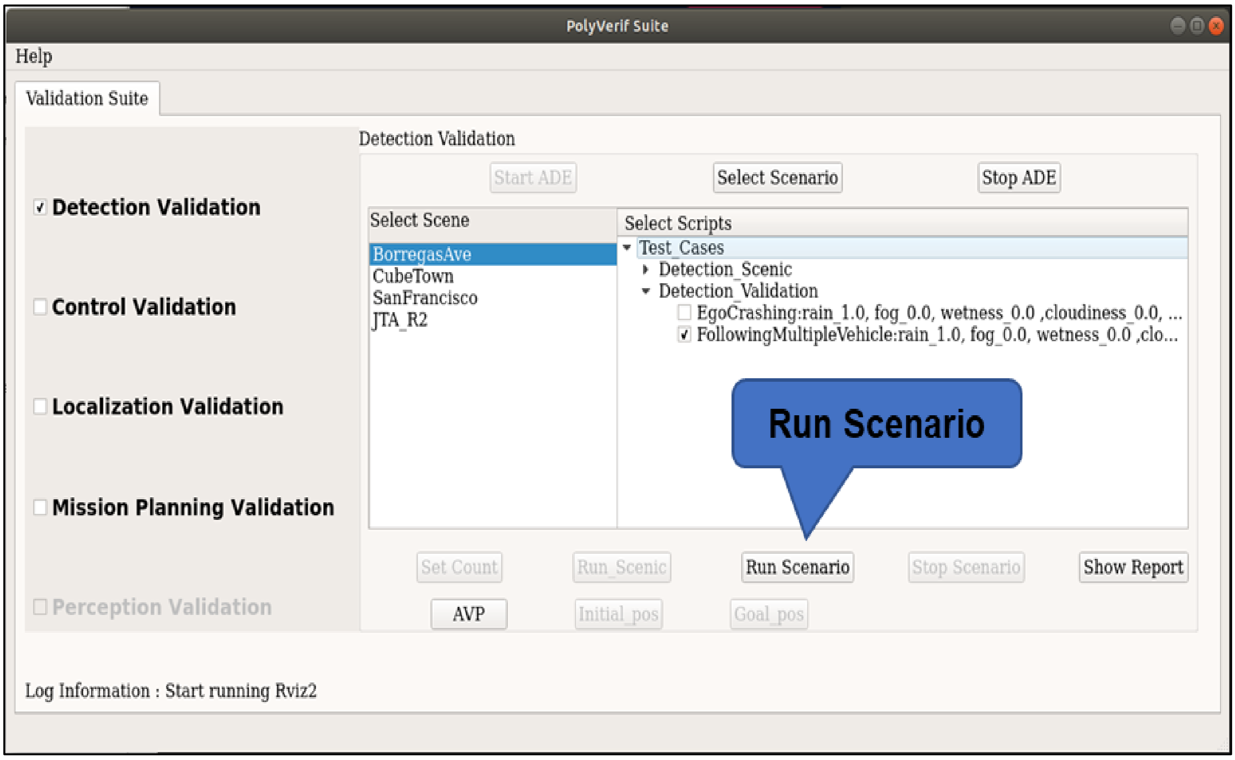


Select Scene/Maps

Select Test Cases

□ EgoCrashing:rain_1.0, fog_0.0, wetness_0.0 ,cloudiness_0.0, ...
□ FollowingMultipleVehicle:rain_1.0, fog_0.0, wetness_0.0 ,clo...

Log Information : Start running Rviz2



☑ Detection Validation

□ Control Validation

□ Localization Validation

□ Mission Planning Validation

□ Perception Validation

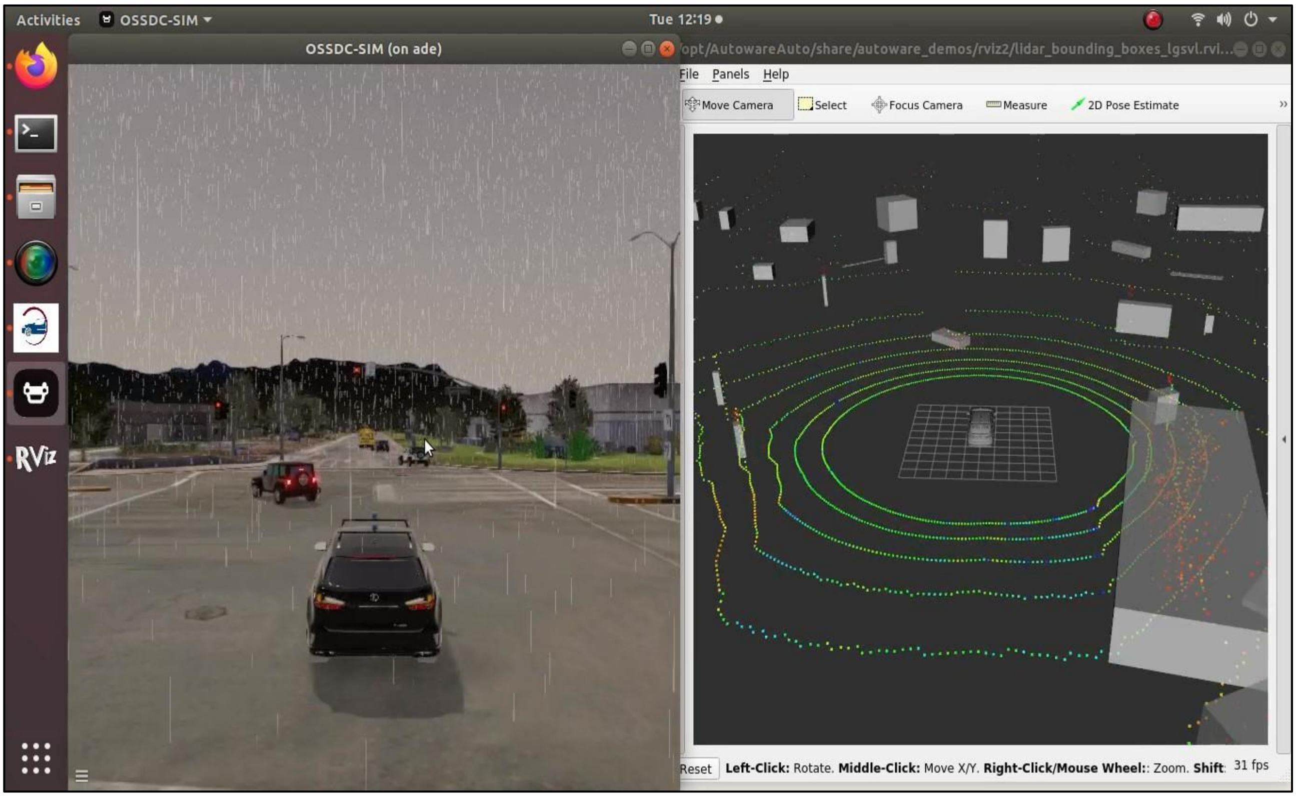
Select Scene

- BorregasAve
- CubeTown
- SanFrancisco
- JTA_R2

Select Scripts

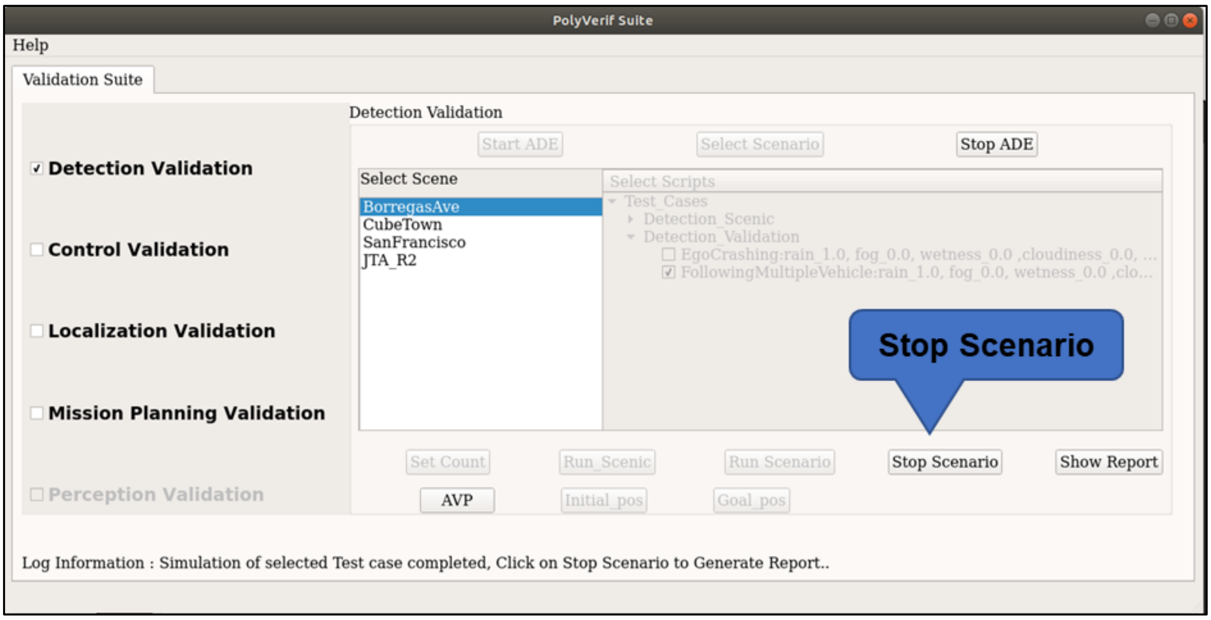
```
▾ Test_Cases
  ▸ Detection_Scenic
  ▾ Detection_Validation
      □ EgoCrashing:rain_1.0, fog_0.0, wetness_0.0 ,cloudiness_0.0, ...
      ☑ FollowingMultipleVehicle:rain_1.0, fog_0.0, wetness_0.0 ,clo...
```

Log Information : Start running Rviz2


Activities
OSSDC-SIM
Tue 12:19
OSSDC-SIM (on ade)
/opt/AutowareAuto/share/autoware_demos/rviz2/lidar_bounding_boxes_lgsvl.rvi...
File
Panels
Help
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
RViz
Reset
Left-Click: Rotate. Middle-Click: Move X/Y. Right-Click/Mouse Wheel:: Zoom. Shift
31 fps

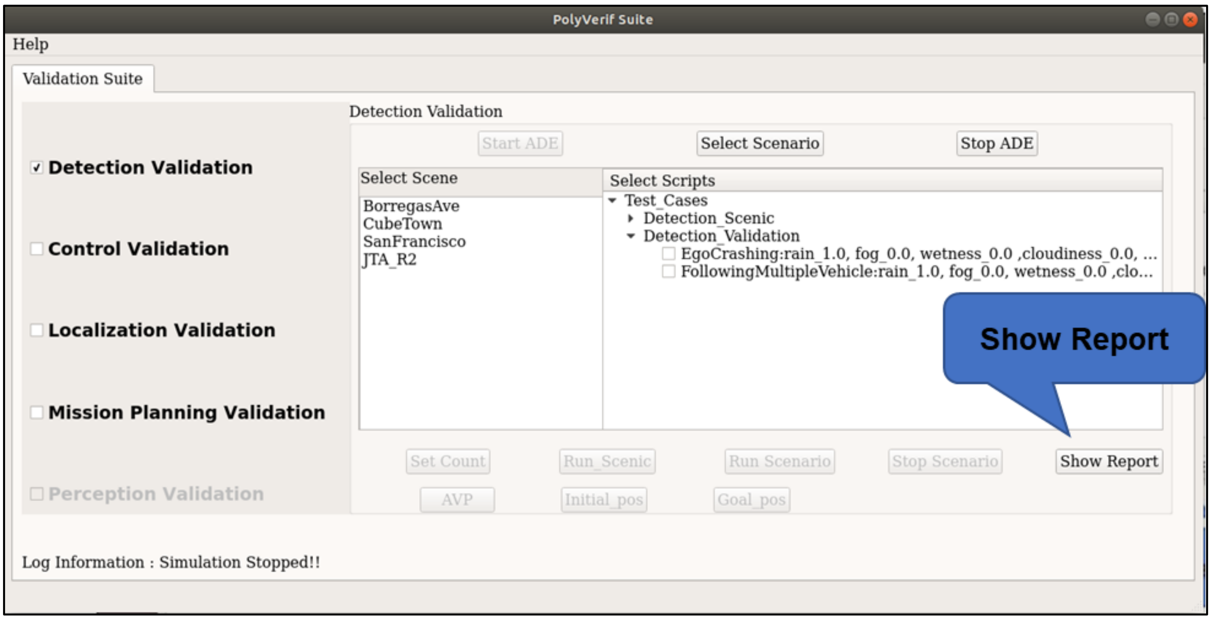
Simulation Management:

Utilize "Stop Scenario" to conclude the simulation.



Log Information : Simulation of selected Test case completed, Click on Stop Scenario to Generate Report..

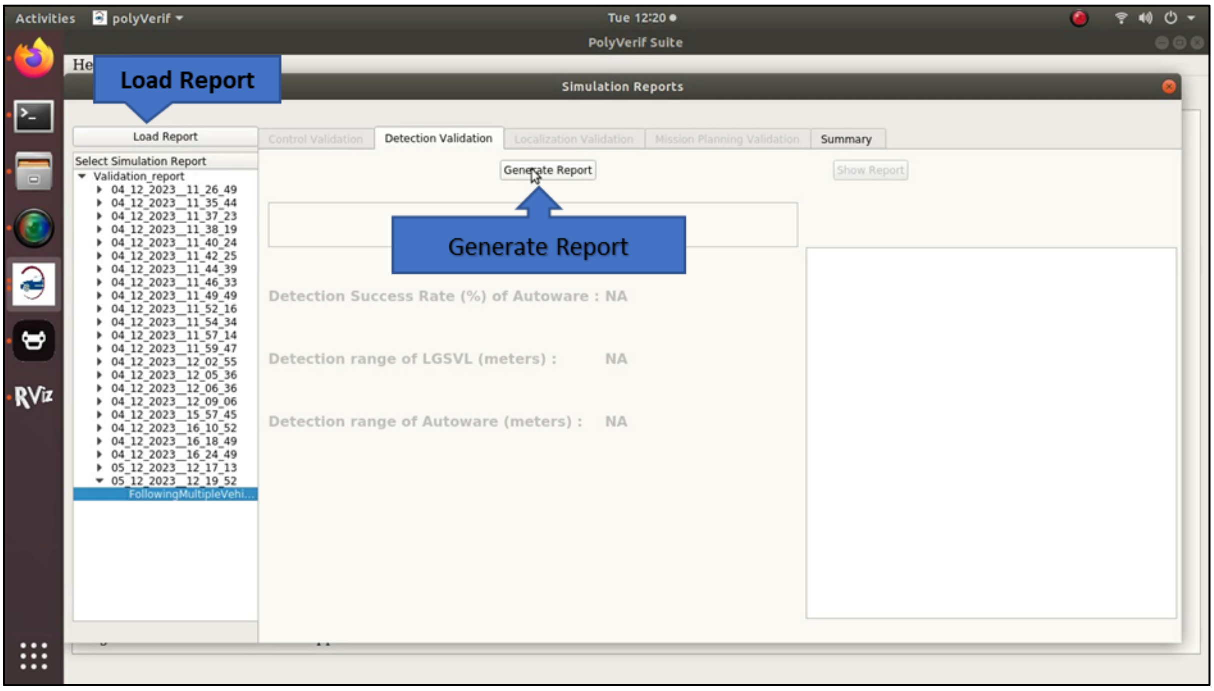
Access the detailed report through "Show Report."



Log Information : Simulation Stopped!!

Report Insights:

Explore simulation reports with the "Load Report" and "Generate Report" buttons.



```
Select Simulation Report
▾ Validation_report
  ▸ 04_12_2023__11_26_49
  ▸ 04_12_2023__11_35_44
  ▸ 04_12_2023__11_37_23
  ▸ 04_12_2023__11_38_19
  ▸ 04_12_2023__11_40_24
  ▸ 04_12_2023__11_42_25
  ▸ 04_12_2023__11_44_39
  ▸ 04_12_2023__11_46_33
  ▸ 04_12_2023__11_49_49
  ▸ 04_12_2023__11_52_16
  ▸ 04_12_2023__11_54_34
  ▸ 04_12_2023__11_57_14
  ▸ 04_12_2023__11_59_47
  ▸ 04_12_2023__12_02_55
  ▸ 04_12_2023__12_05_36
  ▸ 04_12_2023__12_06_36
  ▸ 04_12_2023__12_09_06
  ▸ 04_12_2023__15_57_45
  ▸ 04_12_2023__16_10_52
  ▸ 04_12_2023__16_18_49
  ▸ 04_12_2023__16_24_49
  ▸ 05_12_2023__12_17_13
  ▾ 05_12_2023__12_19_52
      FollowingMultipleVehi...
```

Detection Success Rate (%) of Autoware : NA

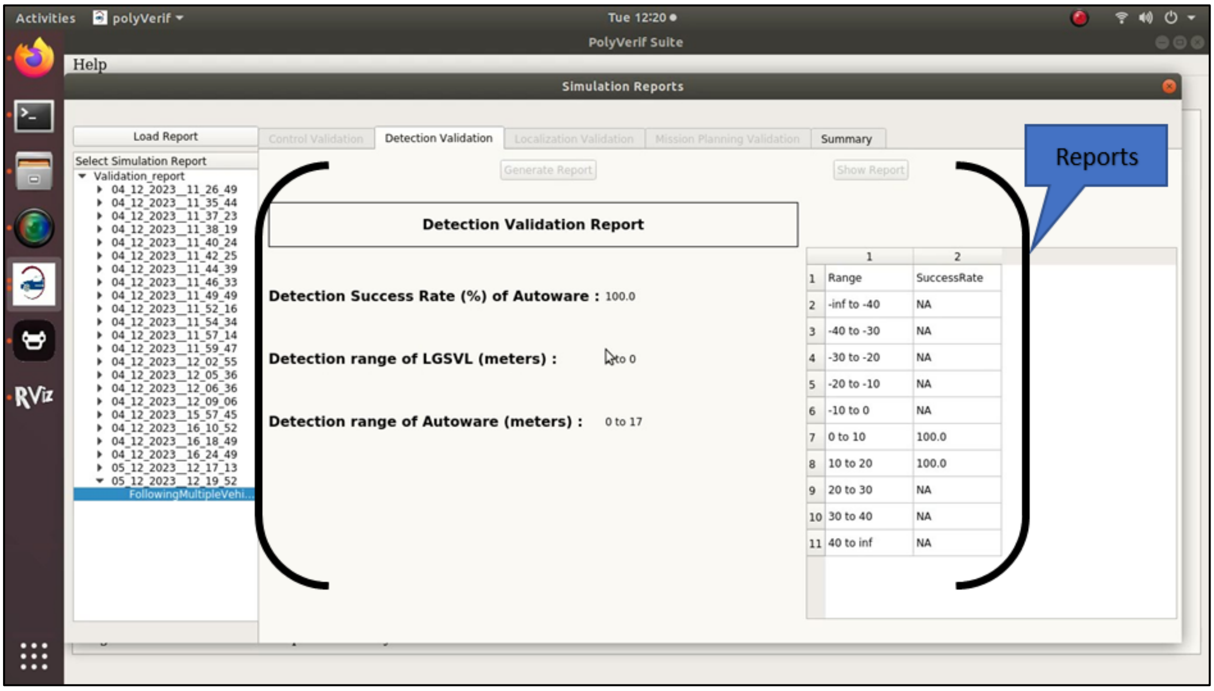
Detection range of LGSVL (meters) : NA

Detection range of Autoware (meters) : NA

Note: It will take 2-3min to generate report

Report Management:

Explore simulation reports



```
Select Simulation Report
▾ Validation_report
  ▸ 04_12_2023__11_26_49
  ▸ 04_12_2023__11_35_44
  ▸ 04_12_2023__11_37_23
  ▸ 04_12_2023__11_38_19
  ▸ 04_12_2023__11_40_24
  ▸ 04_12_2023__11_42_25
  ▸ 04_12_2023__11_44_39
  ▸ 04_12_2023__11_46_33
  ▸ 04_12_2023__11_49_49
  ▸ 04_12_2023__11_52_16
  ▸ 04_12_2023__11_54_34
  ▸ 04_12_2023__11_57_14
  ▸ 04_12_2023__11_59_47
  ▸ 04_12_2023__12_02_55
  ▸ 04_12_2023__12_05_36
  ▸ 04_12_2023__12_06_36
  ▸ 04_12_2023__12_09_06
  ▸ 04_12_2023__15_57_45
  ▸ 04_12_2023__16_10_52
  ▸ 04_12_2023__16_18_49
  ▸ 04_12_2023__16_24_49
  ▸ 05_12_2023__12_17_13
  ▾ 05_12_2023__12_19_52
      FollowingMultipleVehi...
```

Detection Validation Report

Detection Success Rate (%) of Autoware : 100.0

Detection range of LGSVL (meters) : 0 to 0

Detection range of Autoware (meters) : 0 to 17

	1	2
1	Range	SuccessRate
2	-inf to -40	NA
3	-40 to -30	NA
4	-30 to -20	NA
5	-20 to -10	NA
6	-10 to 0	NA
7	0 to 10	100.0
8	10 to 20	100.0
9	20 to 30	NA
10	30 to 40	NA
11	40 to inf	NA

Detection Success Rate of Autoware:

Refers to Autoware's accuracy in identifying objects. Evaluation involves comparing Autoware's detections with those from LGSVL.

Detection Range of LGSVL:

Defines the spatial area where LGSVL can identify objects. Autoware aims to match and detect objects within this specified LGSVL range.

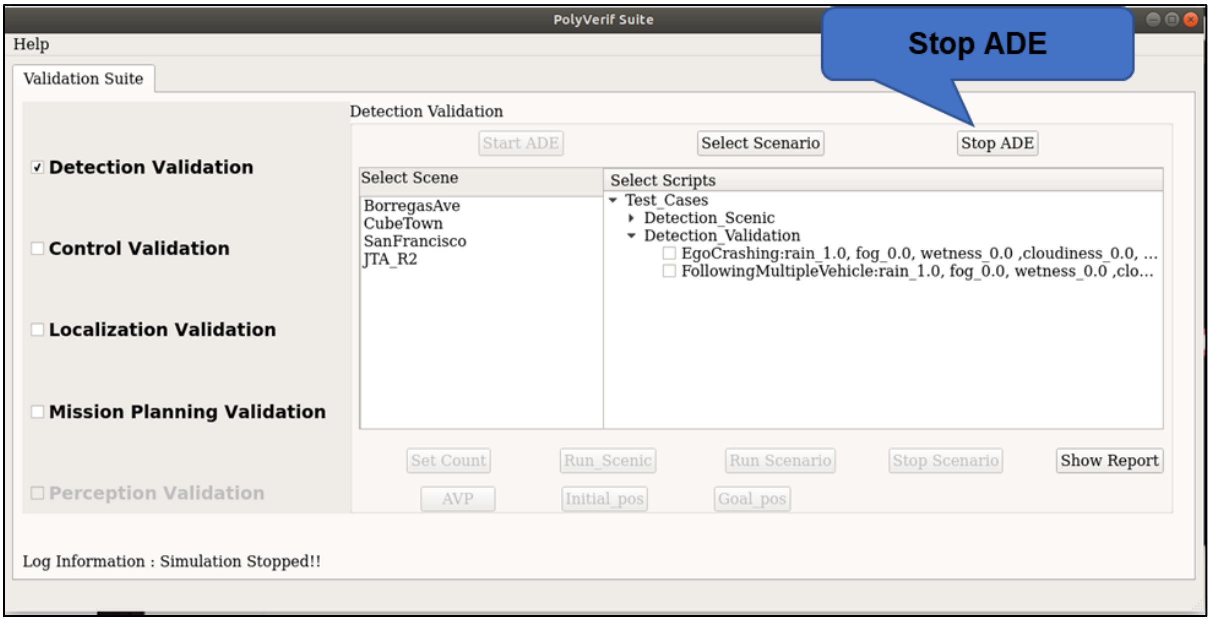
Detection Range of Autoware:

Indicates Autoware's spatial area for object identification. Success is measured by Autoware's ability to detect objects within its specified range.

For a thorough understanding of the reports, watch the explanatory video for detailed insights. ClickHere!

Stopping ADE:

After completing the test case runs, click on "Stop ADE" to halt the PolyVerif framework and then close the terminal.



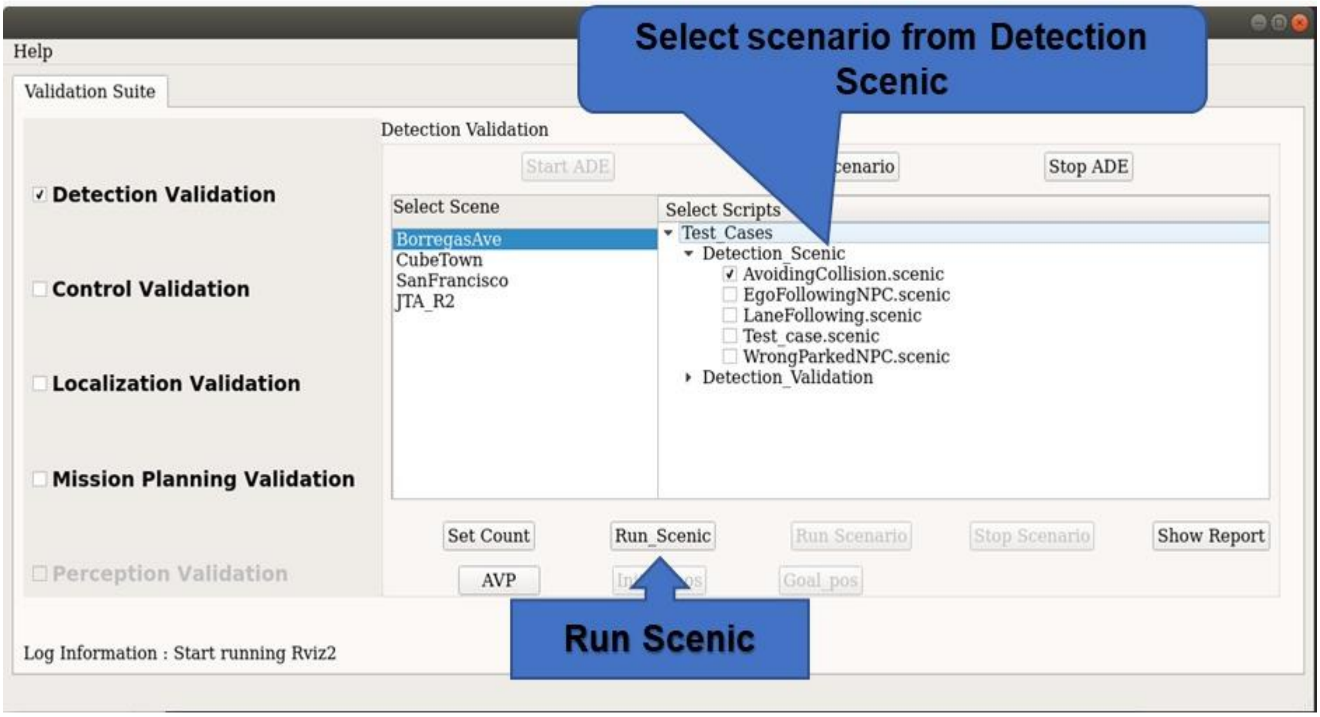
Select Scene:
BorregasAve
CubeTown
SanFrancisco
JTA_R2

Select Scripts:
- Test_Cases
  - Detection_Scenic
  - Detection_Validation
    - □ EgoCrashing:rain_1.0, fog_0.0, wetness_0.0 ,cloudiness_0.0, ...
    - □ FollowingMultipleVehicle:rain_1.0, fog_0.0, wetness_0.0 ,clo...

Log Information : Simulation Stopped!!

Scenic Scenarios:

For scenic scenario above steps are same. To run a scenario in Scenic mode, choose a map, select a detection scenic scenario, and click the "Run Scenic" button for seamless execution.

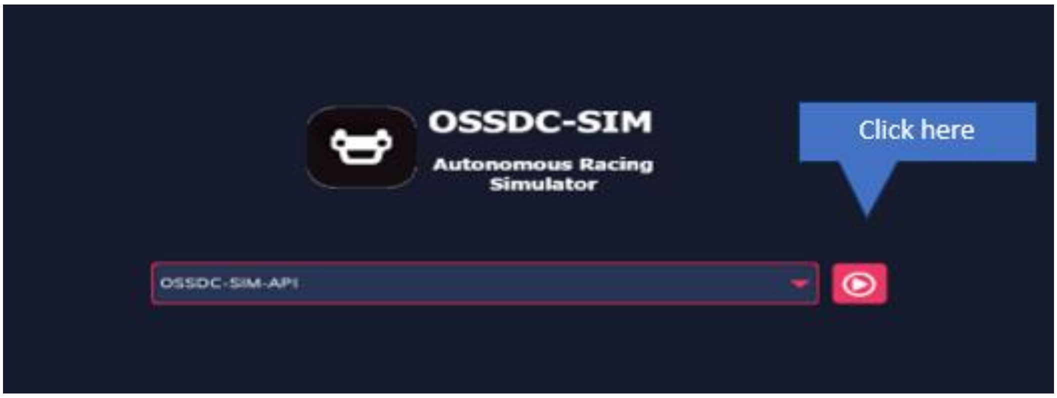


Select scenario from Detection Scenic

Run Scenic

Log Information : Start running Rviz2

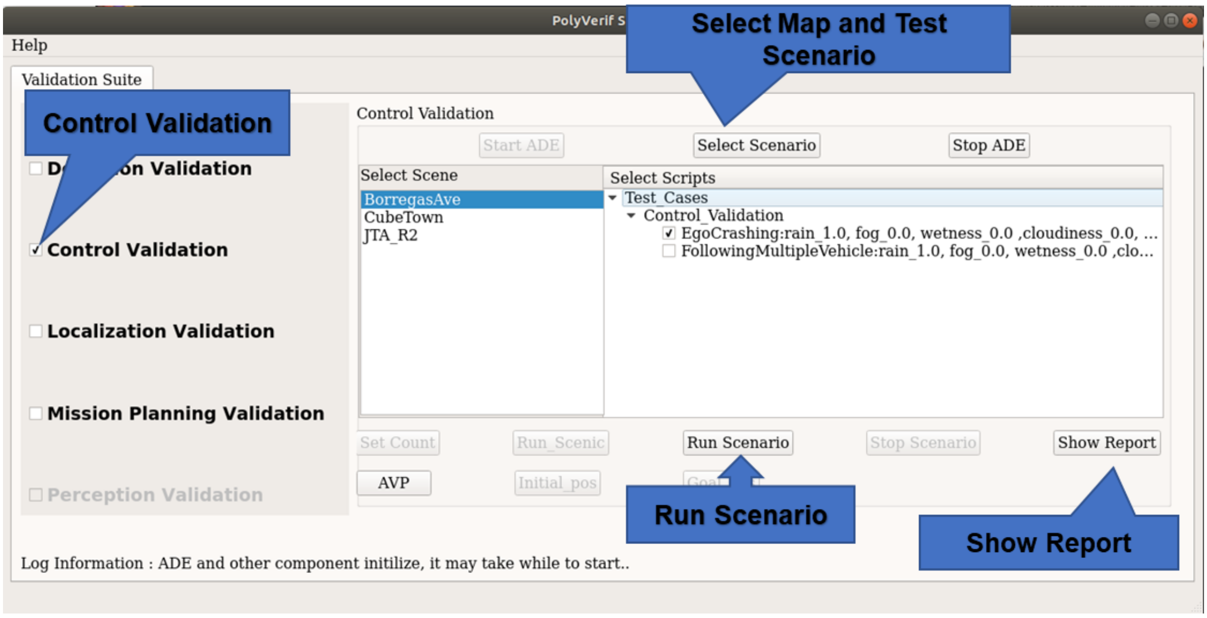
Note: In scenic make sure to stop and start api mode while running scenarios. Scenic generates real time environment while running scenarios so need to stop and start **play button** of simulator for effective environment generation.



Click here

Proceeding with Control Validation

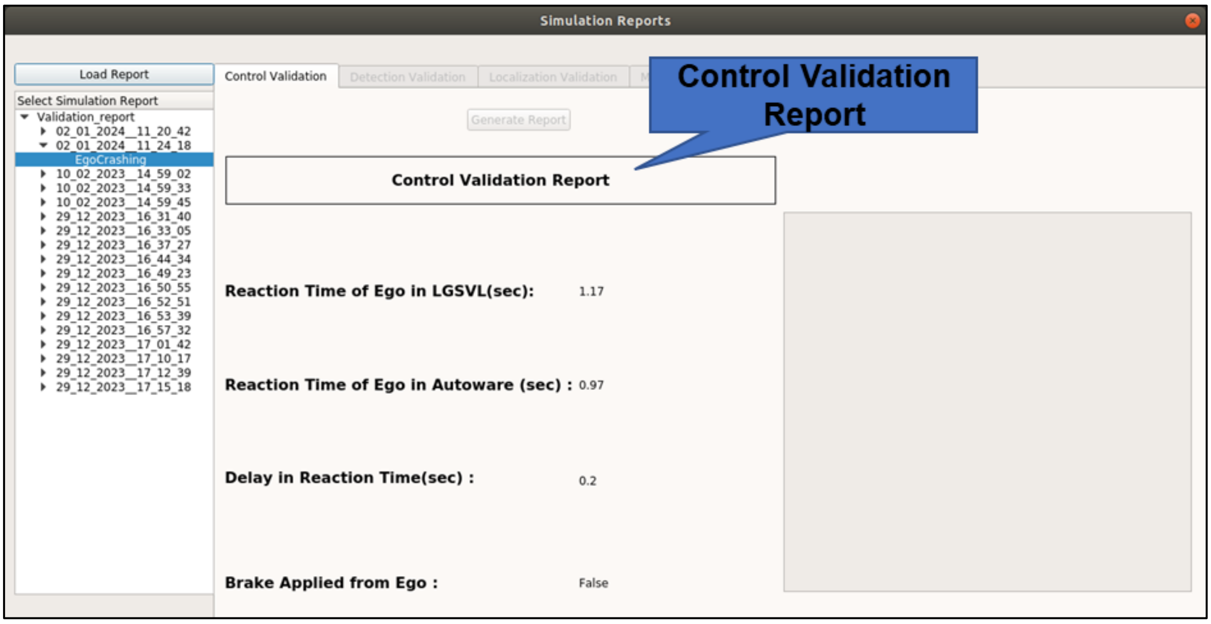
Follow the previously detailed steps, making sure to specifically choose "Control Validation" when integrating it into your simulation. Keep applying this standardized approach consistently across different maps for an organized and uniform method of managing simulations.



Log Information : ADE and other component initilize, it may take while to start..

Report Management:

Explore simulation reports



Control Validation Report

Reaction Time of Ego in LGSVL(sec): 1.17

Reaction Time of Ego in Autoware (sec) : 0.97

Delay in Reaction Time(sec) : 0.2

Brake Applied from Ego : False

- **Reaction Time of Ego in LGSVL:**

  Represents the time available for the Ego vehicle to react after object detection in the LGSVL simulation environment.

- **Reaction Time of Ego in Autoware:**

  Denotes the time available for the Ego vehicle to react after object detection within the Autoware system.

- **Delay in Reaction Time of Ego in Autoware:**

  Describes the delay in the Ego vehicle's reaction time within Autoware, attributed to perception processes.

- **Brake Applied from Ego:**

  Indicates whether the Ego vehicle has applied the brakes or not.

For a thorough understanding of the reports, watch the explanatory video for detailed insights. ClickHere!

Assumptions and Challenges

- **Rviz Dynamics:**

  Occasional crashes may happen, but rest assured, the perception stack persists.

- **Scenario Hurdles:**

  Some scenarios may experience hang-ups while connecting to the Ros2 Bridge, necessitating a restart.

- **System Configurations:**

  System hangs may occur based on machine specifications.

- **Network Issues:**

  If the network is not functioning properly, you may encounter issues such as scenarios not running or reports not generating. To resolve this, simply restart ADE or the PolyVerif Framework.

Learn More

For further insights and references, explore the provided links:

OSSDC Simulator

PythonAPI

Scenic

Now, let's embark on a journey of seamless simulations with PolyVerif!!