POLY-VERIFICATION USER GUIDE

This document contains the information on how to run the simulation through the Poly-Verification Suite. Once the installation and setup is completed you are ready to use the PolyVerif framework.

If you have not setup and installed the pre-requisites, then for reference please follow the **Setup_And_Installation** document.

This framework uses predefined metrics for the validation of the stacks which will be calculated after running the test cases. On the basis of the metrics threshold the success/failure of the stack is validated. Any user can set their own values by modifying the config.ini file in **adehome/Poly_Suite/config.ini**.

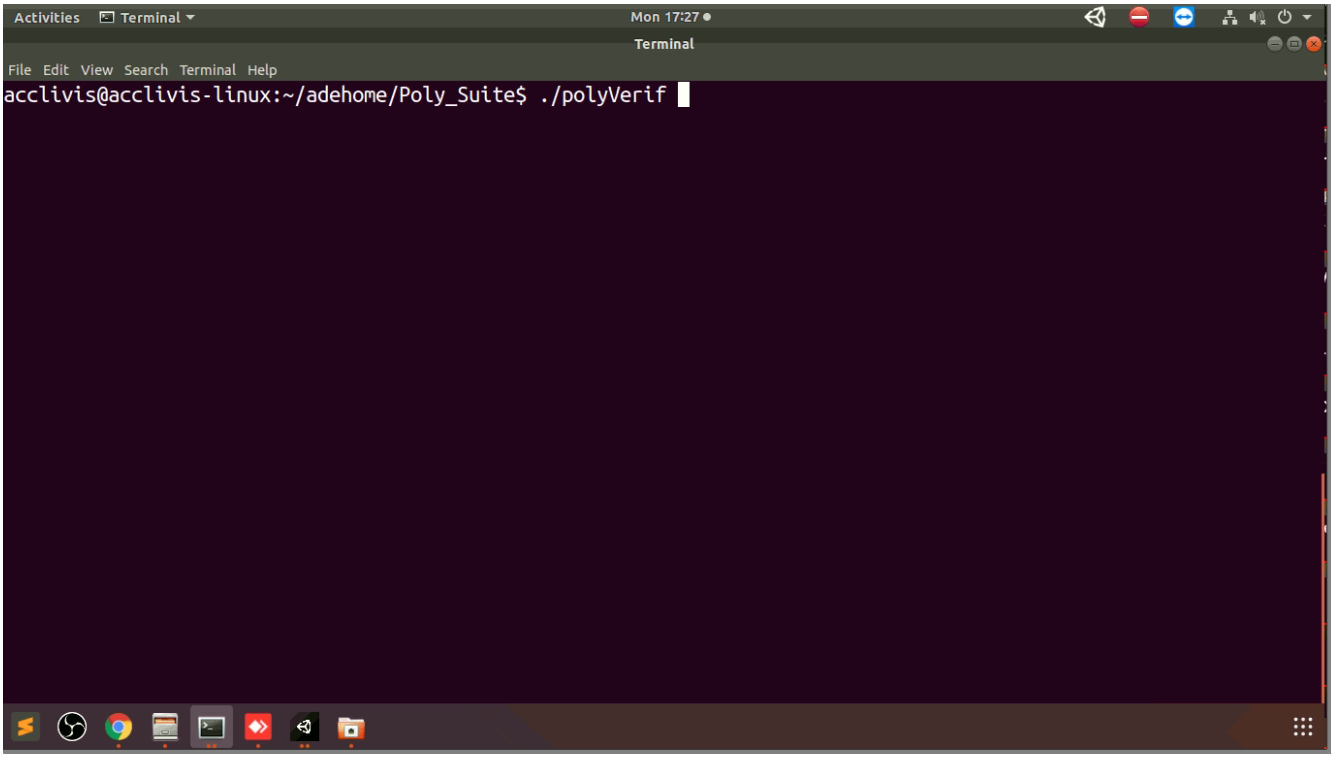
Below is the config.ini file parameters-

```
[autonomous_stack_config]
  detection_max_threshold=40        #MAX value for detection validation
  detection_min_threshold=30        #MIN value for detection validation
  control_collion_count=0           #Collision count
  localize_max_threshold=5          #MAX value for localization validation
  localize_min_threshold=1          #MAX value for localization validation
  planner_goalpose_max_deviation=5 #MAX value of goal position deviation
  planner_goalpose_min_deviation=2 #MIN value of goal position deviation
```

Follow the steps given below-

1. Go to the Poly_Suite directory and run

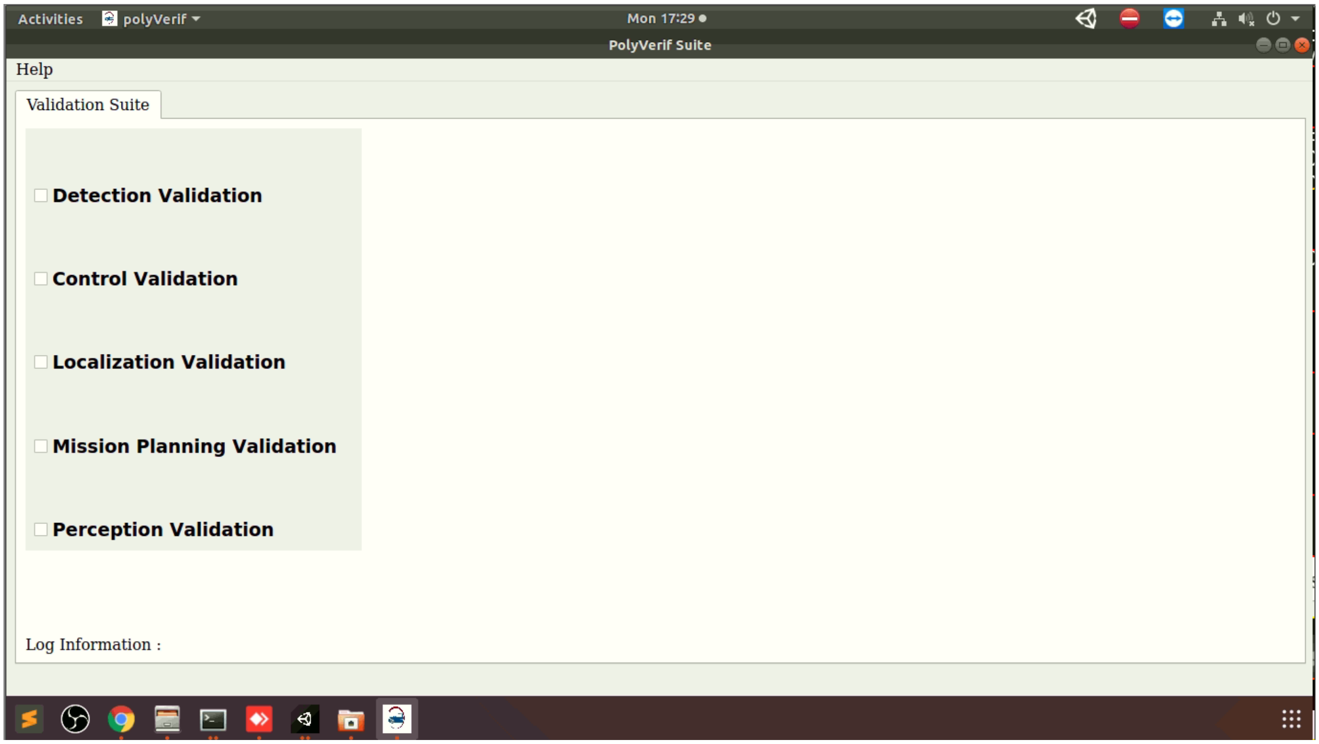
   $ ./polyVerif



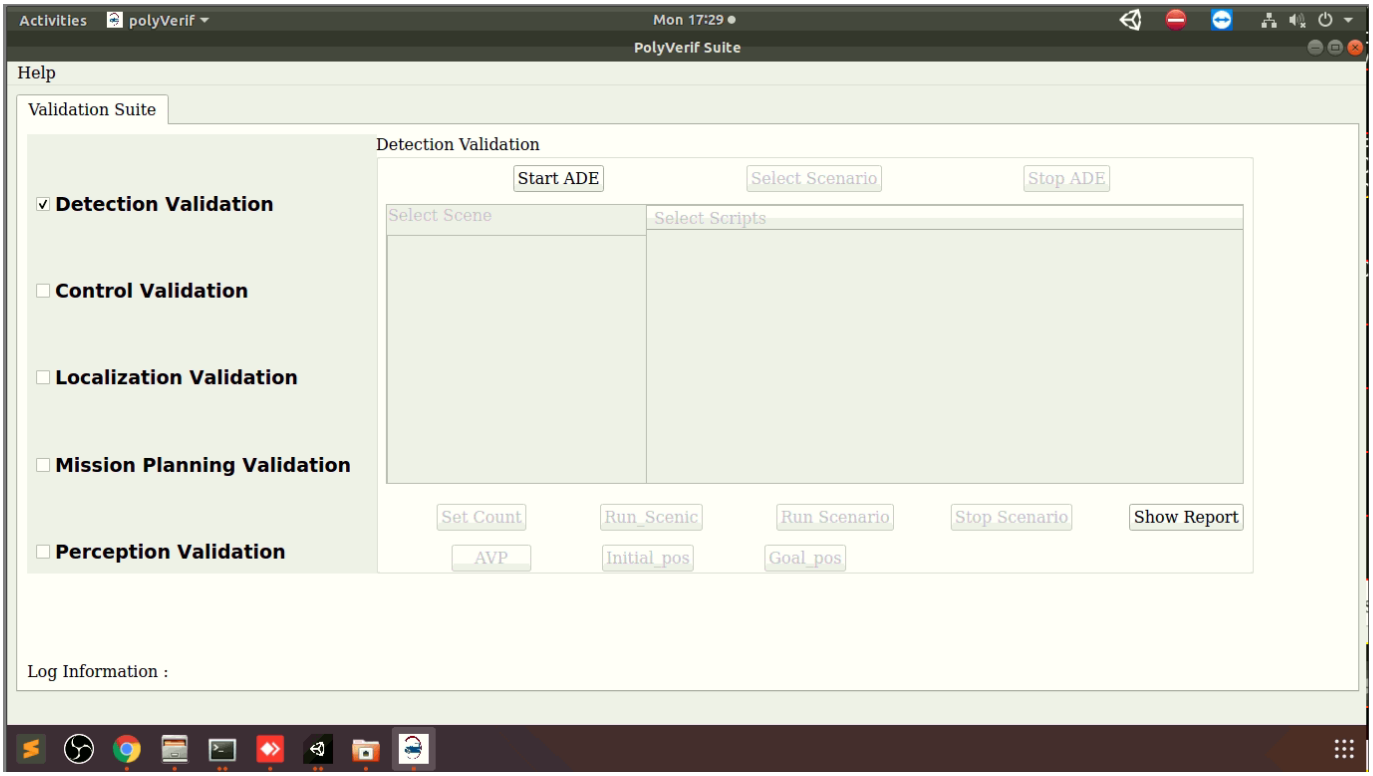
```
acclivis@acclivis-linux:~/adehome/Poly_Suite$ ./polyVerif
```

2. It will start the polyVerif framework
   a. As of now four validations are working-
      - Detection Validation
      - Control Validation
      - Localization Validation
      - Mission Planning Validation

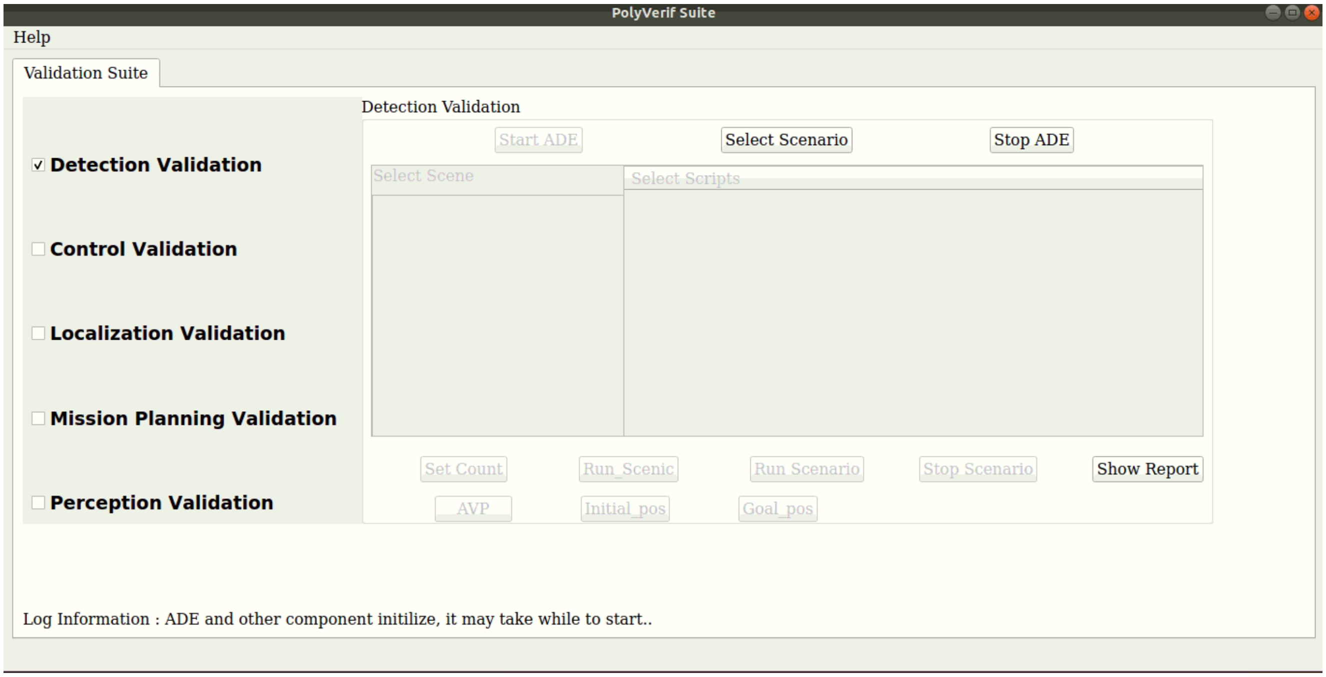
Click any of them (Screenshot is provided below for reference)-



3. Detection Validation is for detecting the vehicle from perception stack.
   a. Click on the Start ADE button, it will start all the required modules for example-
      - AutowareAuto
      - Perception Stack
      - Lgsvl simulator
      - Rviz
      - Ros2-lgsvl-bridge

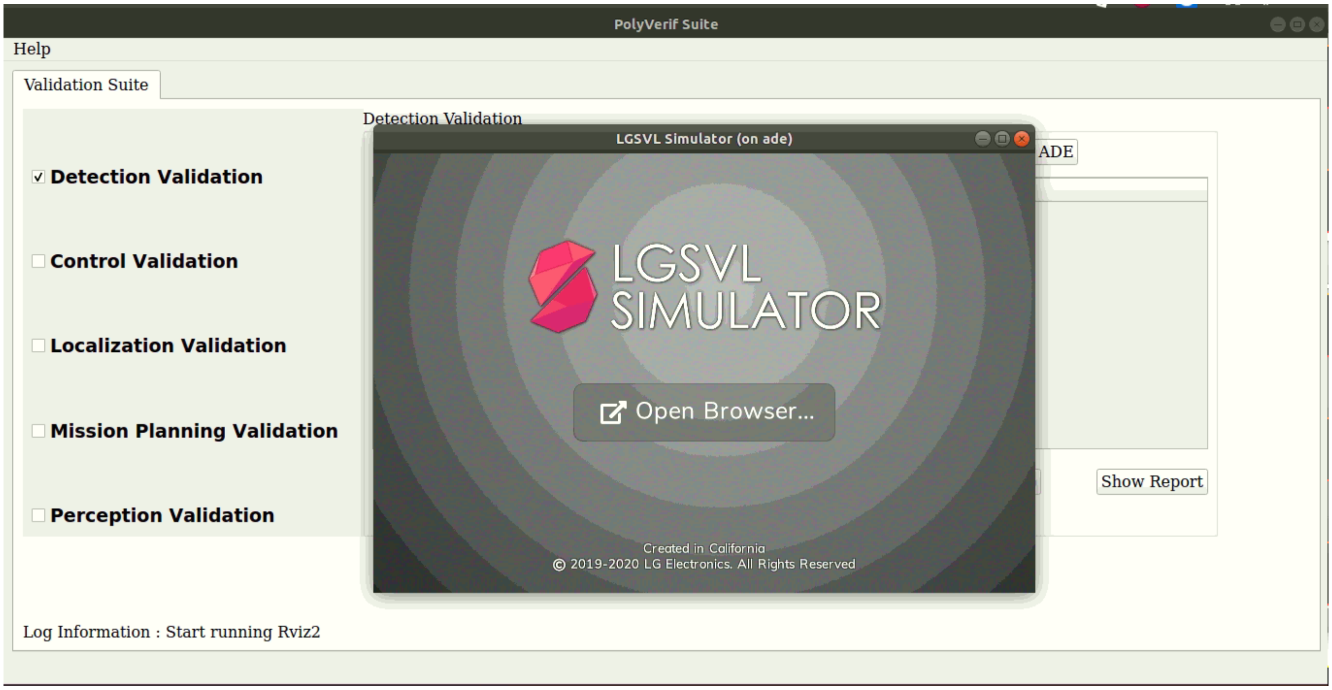


4. It will take some time to start the ADE docker and other components please wait for a while.



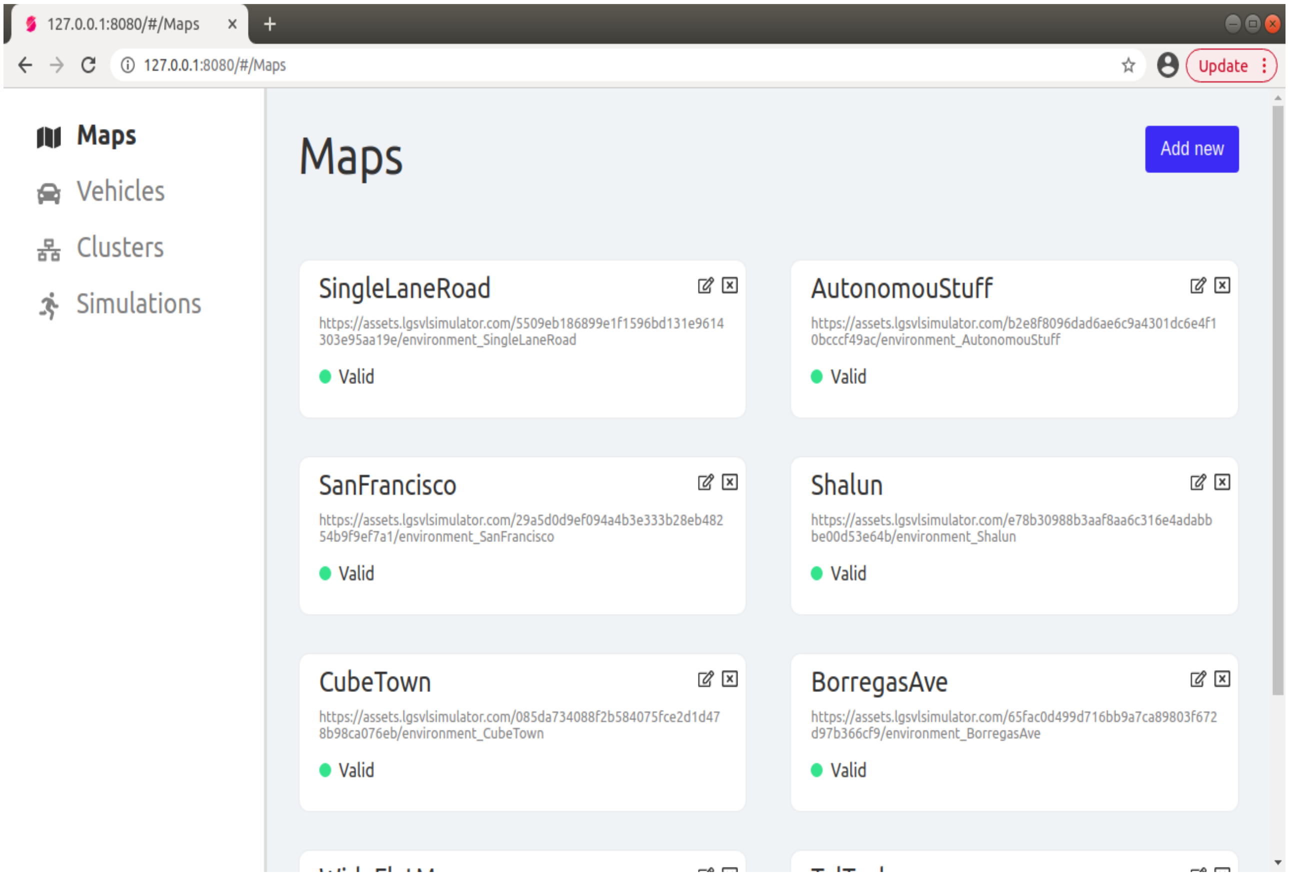
Log Information : ADE and other component initilize, it may take while to start..

5. Once lgsvl simulator and rviz has started, Open any web browser



Log Information : Start running Rviz2

6. Enter localhost:8080 on address bar and hit enter.



Maps

SingleLaneRoad
https://assets.lgsvlsimulator.com/5509eb186899e1f1596bd131e9614303e95aa19e/environment_SingleLaneRoad
● Valid

AutonomouStuff
https://assets.lgsvlsimulator.com/b2e8f8096dad6ae6c9a4301dc6e4f10bcccf49ac/environment_AutonomouStuff
● Valid

SanFrancisco
https://assets.lgsvlsimulator.com/29a5d0d9ef094a4b3e333b28eb48254b9f9ef7a1/environment_SanFrancisco
● Valid

Shalun
https://assets.lgsvlsimulator.com/e78b30988b3aaf8aa6c316e4adabbbe00d53e64b/environment_Shalun
● Valid

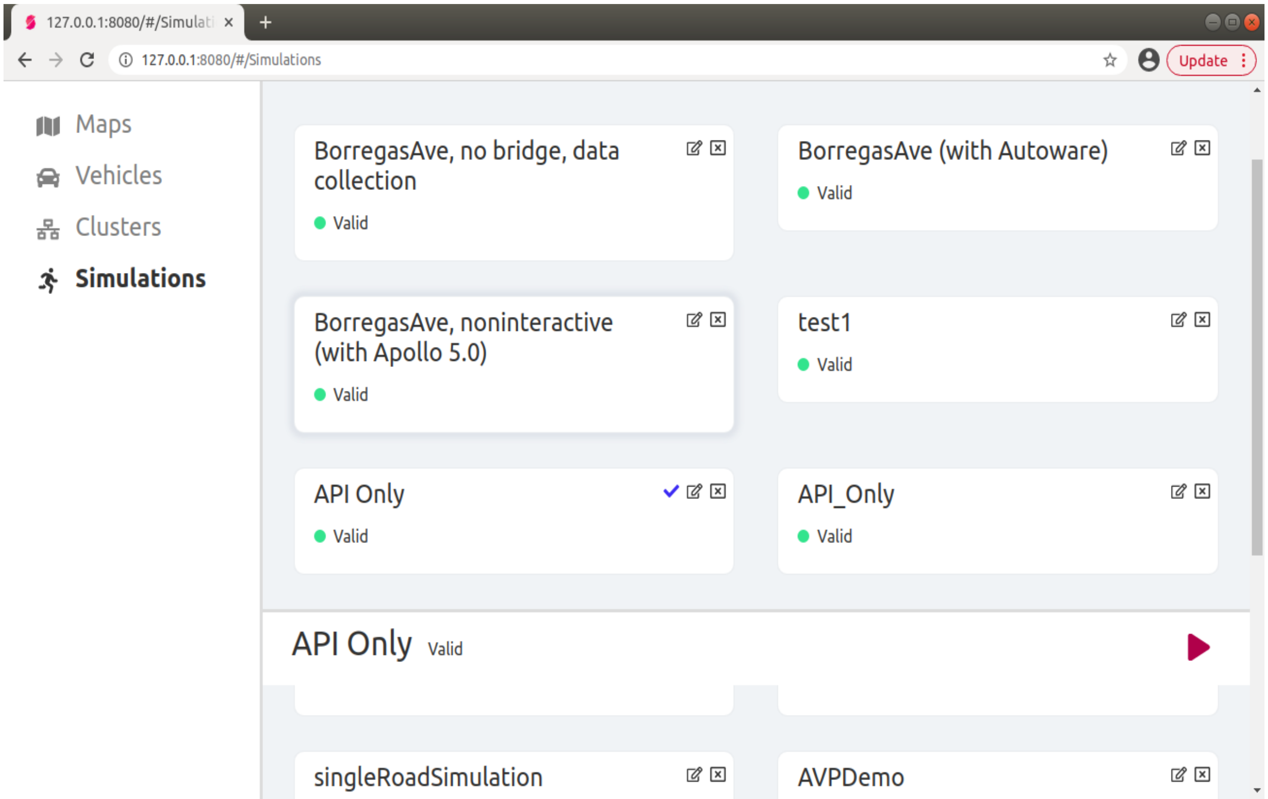
CubeTown
https://assets.lgsvlsimulator.com/085da734088f2b584075fce2d1d478b98ca076eb/environment_CubeTown
● Valid

BorregasAve
https://assets.lgsvlsimulator.com/65fac0d499d716bb9a7ca89803f672d97b366cf9/environment_BorregasAve
● Valid

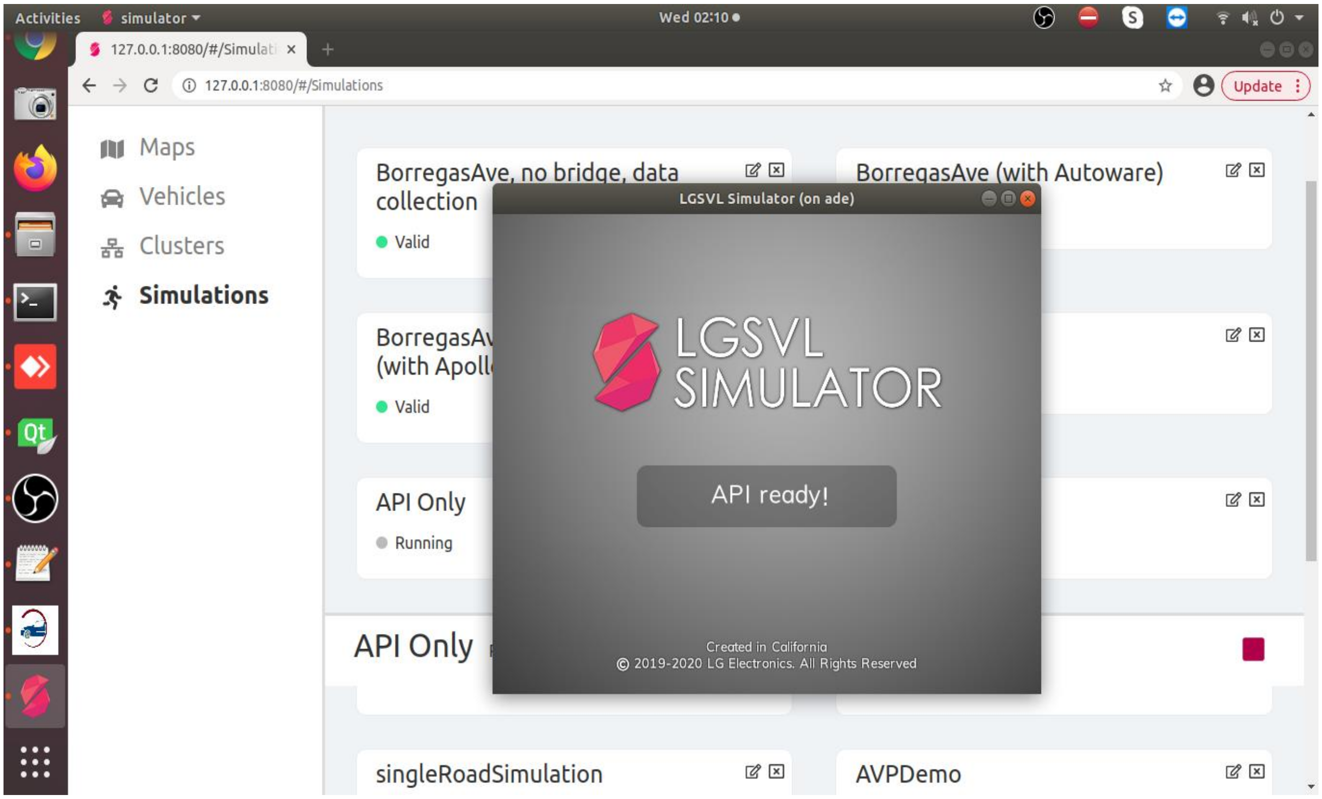
Note: - If the LG Simulator web page does not open then try entering the below address-

127.0.0.1:8080

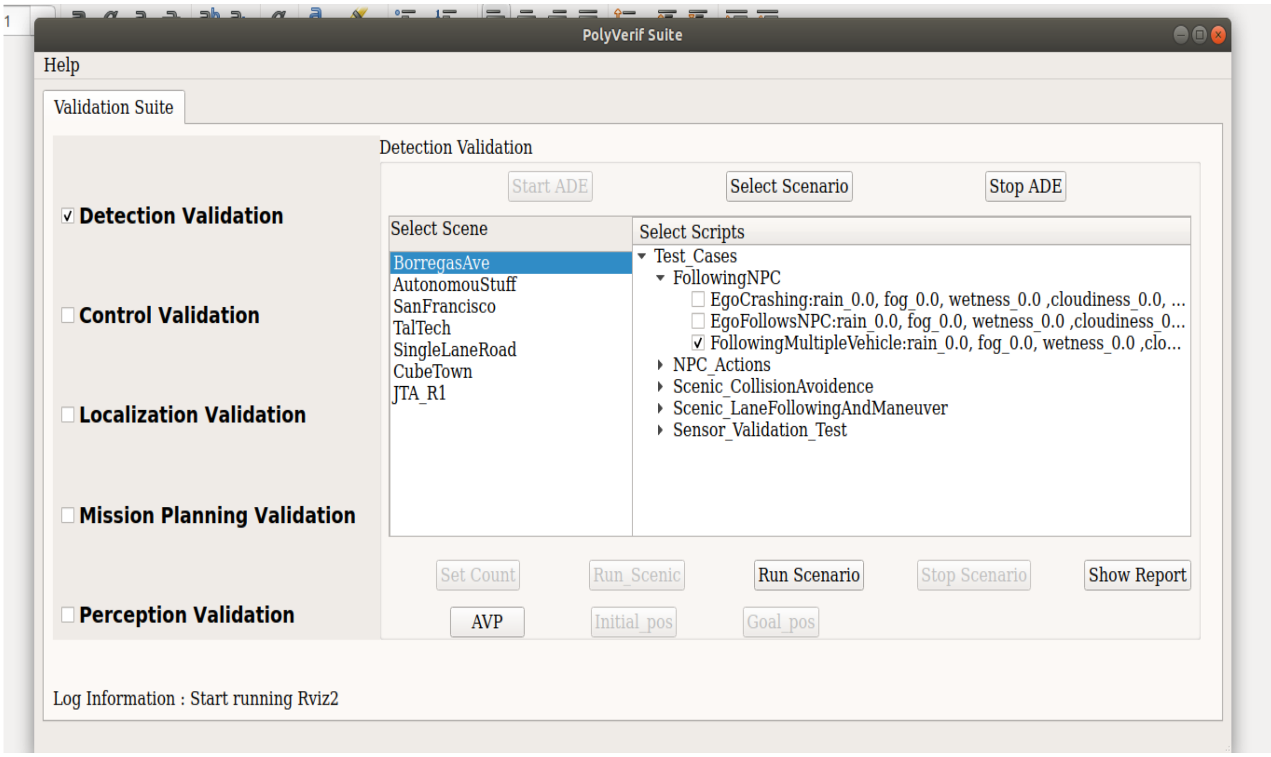
7. Click on the Simulations tab and select the ‘**API_Only’ option**.
    a. Click on the **Play** button


127.0.0.1:8080/#/Simulati
127.0.0.1:8080/#/Simulations
Update
Maps
Vehicles
Clusters
Simulations
BorregasAve, no bridge, data collection
Valid
BorregasAve (with Autoware)
Valid
BorregasAve, noninteractive (with Apollo 5.0)
Valid
test1
Valid
API Only
Valid
API_Only
Valid
API Only
Valid
singleRoadSimulation
AVPDemo

8. Now the simulator is in the **API_Mode** as shown.



9. Now click on the **Select Scenario** button
    - Select **BorregasAve** map from the **Select Scene**
    - Select any scenario from the **Select Scripts** list
    - The selected script in the below screenshot is written in python which will add an ego vehicle in the BorregasAve map which will controlled by the AutowareAuto.

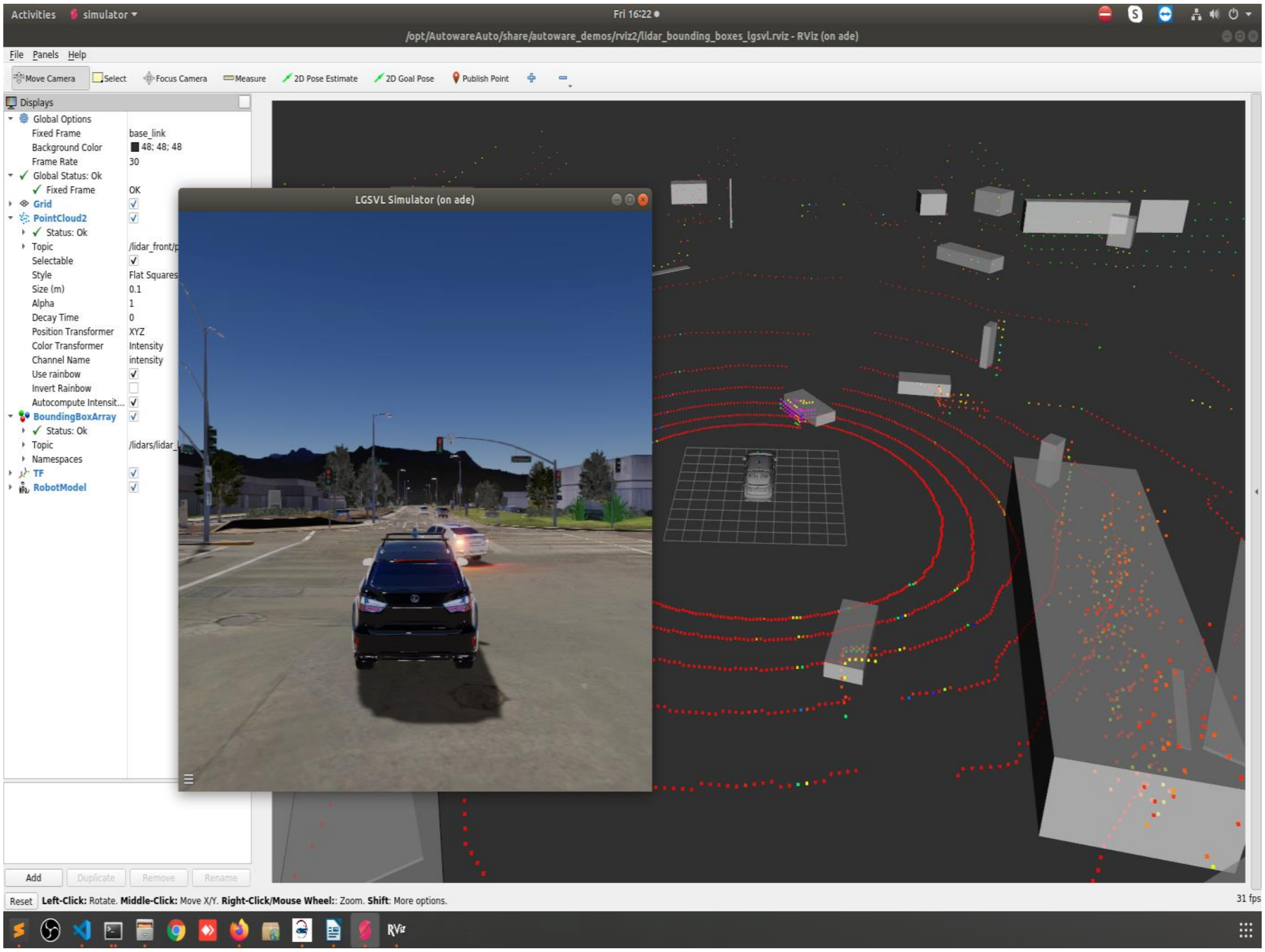


Log Information : Start running Rviz2

10. Once you select any script from the list it enables the respective button to run the script as there are two ways to run the script -
    - Using Scenic
    - Using PythonAPI

    Since in the above example we have selected the python script to run thus the **Run Scenario** button is enabled.

    While running scenic script you can also set the number of random iterations for simulation through scenic using the **Set Count** button.



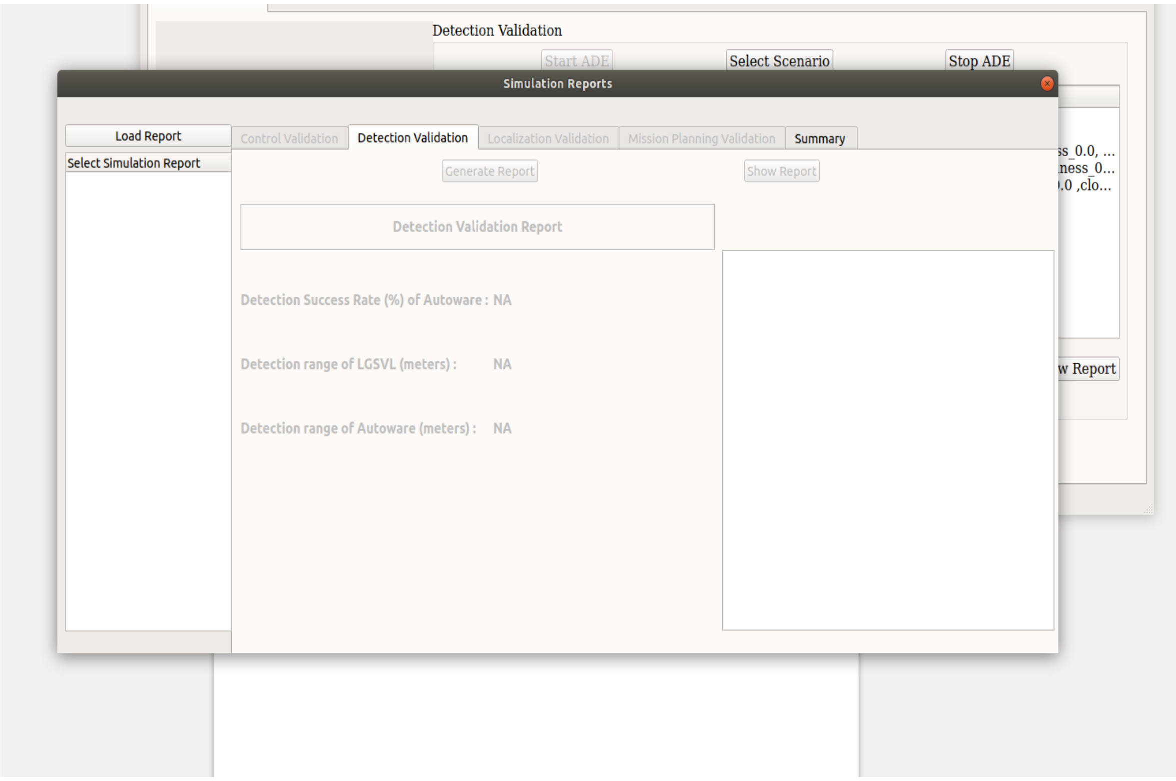
/opt/AutowareAuto/share/autoware_demos/rviz2/lidar_bounding_boxes_lgsvl.rviz - RViz (on ade)

Displays

Global Options	
Fixed Frame	base_link
Background Color	■ 48; 48; 48
Frame Rate	30
✓ Global Status: Ok	
✓ Fixed Frame	OK
Grid	☑
PointCloud2	☑
✓ Status: Ok	
Topic	/lidar_front/p
Selectable	☑
Style	Flat Squares
Size (m)	0.1
Alpha	1
Decay Time	0
Position Transformer	XYZ
Color Transformer	Intensity
Channel Name	intensity
Use rainbow	☑
Invert Rainbow	□
Autocompute Intensit...	☑
BoundingBoxArray	☑
✓ Status: Ok	
Topic	/lidars/lidar_
Namespaces	
TF	☑
RobotModel	☑

Left-Click: Rotate. **Middle-Click:** Move X/Y. **Right-Click/Mouse Wheel:**: Zoom. **Shift**: More options.

11. Once the simulation is completed or if you want to stop the simulation then Click on the **Stop Scenario** button and click on the **Show Report** button. It will redirect to another form where you can see the respective simulation reports.

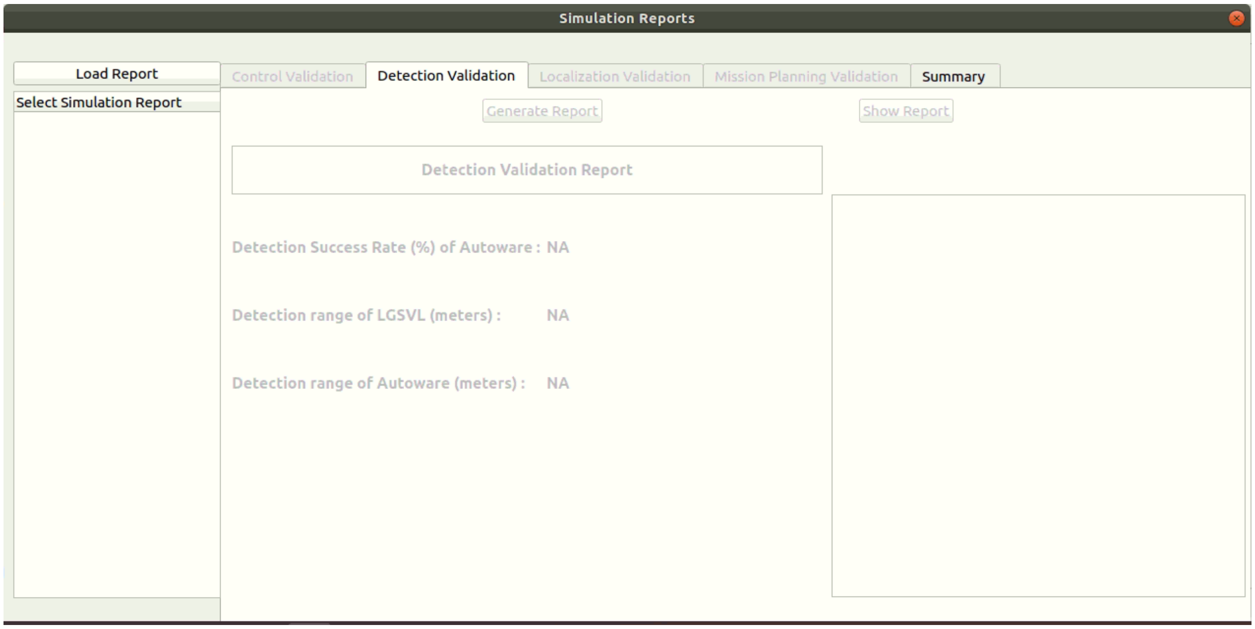


Detection Success Rate (%) of Autoware : NA

Detection range of LGSVL (meters) : NA

Detection range of Autoware (meters) : NA

12. This form contains reports of the respective simulation. As we ran the simulation for Perception Validation so it will generate and show the perception report.
13. Click on the **Load Report** button, it will list all the simulation reports with date and time.



Detection Success Rate (%) of Autoware : NA

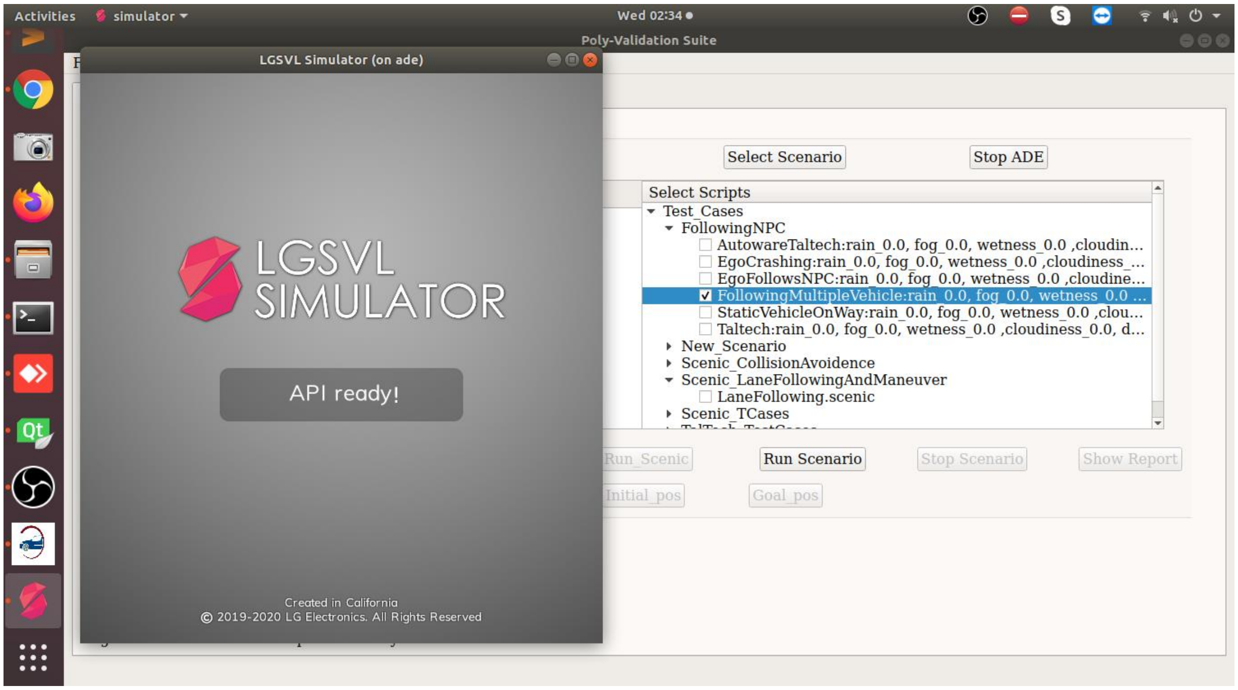
Detection range of LGSVL (meters) : NA

Detection range of Autoware (meters) : NA

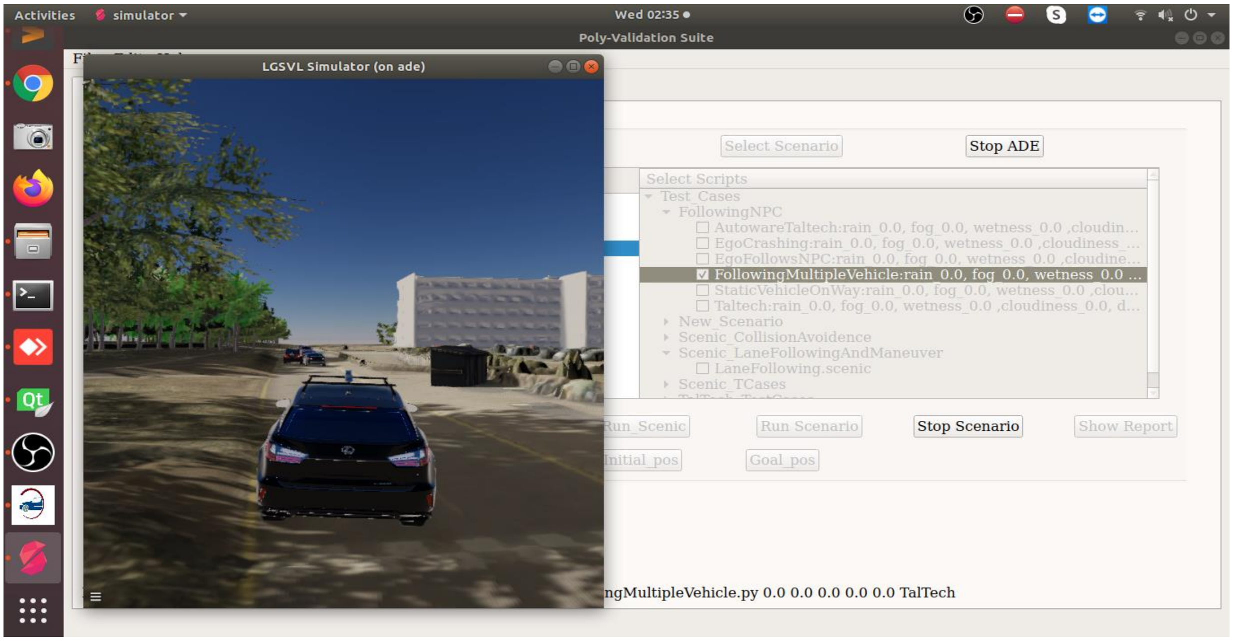
14. The last completed simulation report is set at the end of the list. Select and click on the **Generate Report** button. It will take some time to generate the report. Once report is generated it will enable the **Show Report** button. By clicking on the **Show Report** button you will see few respective parameters on the UI.

Steps to execute Python scenario –

1. Select any **map** and any python scenario from the list.

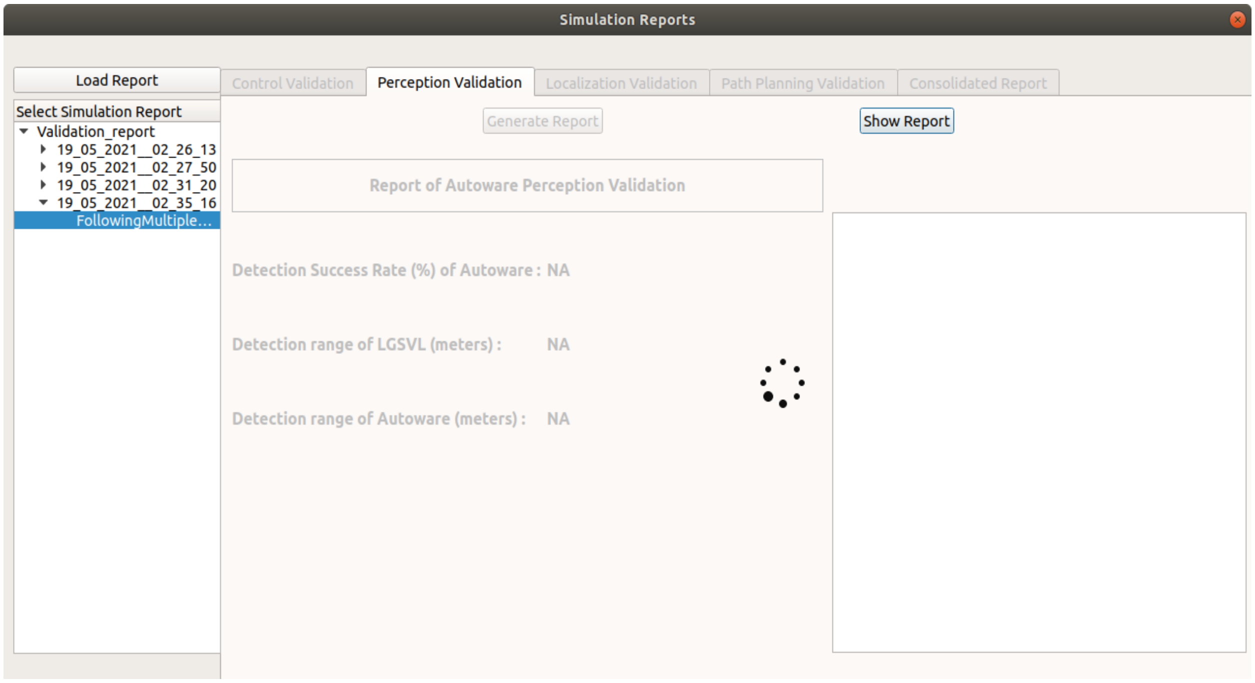

Activities
simulator
Wed 02:34
Poly-Validation Suite
LGSVL Simulator (on ade)
LGSVL SIMULATOR
API ready!
Created in California
© 2019-2020 LG Electronics. All Rights Reserved
Select Scenario
Stop ADE
Select Scripts
Test_Cases
FollowingNPC
☐ AutowareTaltech:rain_0.0, fog_0.0, wetness_0.0 ,cloudin...
☐ EgoCrashing:rain_0.0, fog_0.0, wetness_0.0 ,cloudiness_...
☐ EgoFollowsNPC:rain_0.0, fog_0.0, wetness_0.0 ,cloudine...
☑ FollowingMultipleVehicle:rain_0.0, fog_0.0, wetness_0.0 ...
☐ StaticVehicleOnWay:rain_0.0, fog_0.0, wetness_0.0 ,clou...
☐ Taltech:rain_0.0, fog_0.0, wetness_0.0 ,cloudiness_0.0, d...
New_Scenario
Scenic_CollisionAvoidence
Scenic_LaneFollowingAndManeuver
☐ LaneFollowing.scenic
Scenic_TCases
Run_Scenic
Run Scenario
Stop Scenario
Show Report
Initial_pos
Goal_pos

2. Now click on the **Run Scenario** button to run the selected scenario.


Activities
simulator
Wed 02:35
Poly-Validation Suite
LGSVL Simulator (on ade)
Select Scenario
Stop ADE
Select Scripts
Test_Cases
FollowingNPC
☐ AutowareTaltech:rain_0.0, fog_0.0, wetness_0.0 ,cloudin...
☐ EgoCrashing:rain_0.0, fog_0.0, wetness_0.0 ,cloudiness_...
☐ EgoFollowsNPC:rain_0.0, fog_0.0, wetness_0.0 ,cloudine...
☑ FollowingMultipleVehicle:rain_0.0, fog_0.0, wetness_0.0 ...
☐ StaticVehicleOnWay:rain_0.0, fog_0.0, wetness_0.0 ,clou...
☐ Taltech:rain_0.0, fog_0.0, wetness_0.0 ,cloudiness_0.0, d...
New_Scenario
Scenic_CollisionAvoidence
Scenic_LaneFollowingAndManeuver
☐ LaneFollowing.scenic
Scenic_TCases
Run_Scenic
Run Scenario
Stop Scenario
Show Report
Initial_pos
Goal_pos

```
ngMultipleVehicle.py 0.0 0.0 0.0 0.0 0.0 TalTech
```

3. Once the simulation is completed, Click on the **Stop scenario** button and then Click on the **Show Report**.
4. Now click on the **Load Report** button and select the respective scenario in the list.
5. Now click on the **Generate Report** button, it will take some time to process the report.

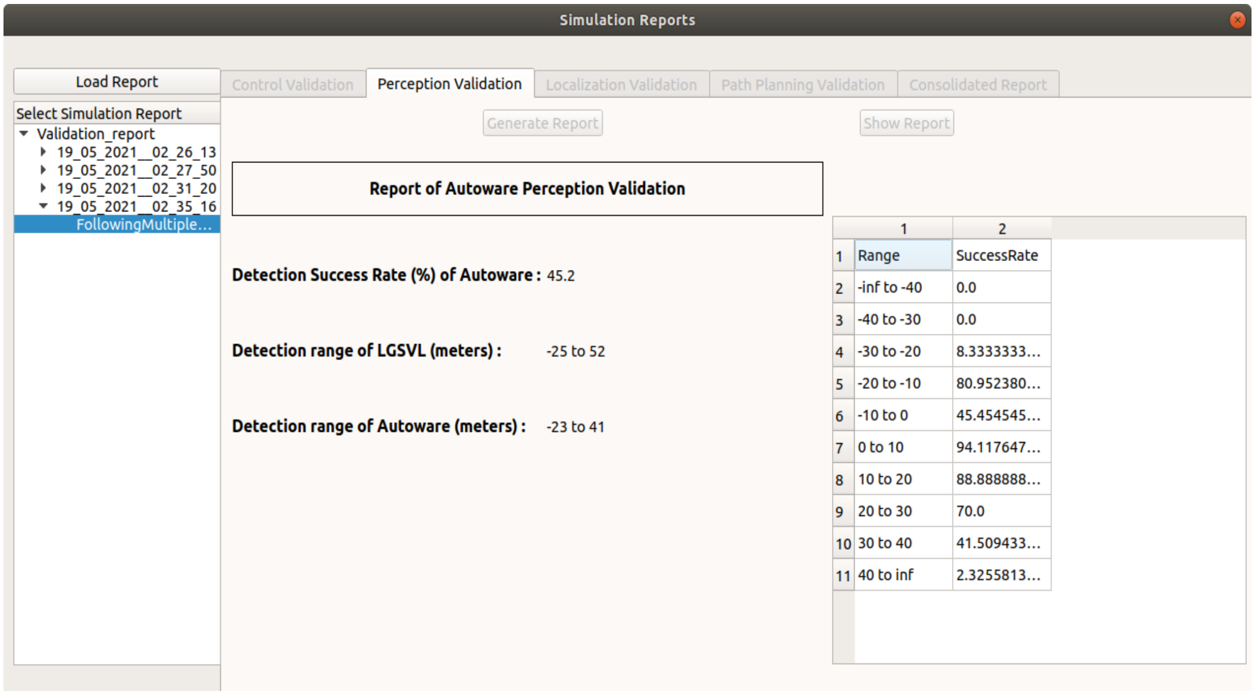


Detection Success Rate (%) of Autoware : NA

Detection range of LGSVL (meters) : NA

Detection range of Autoware (meters) : NA

6. Once generated data is processed, click on the **Show Report** button to see the final results.



Report of Autoware Perception Validation

Detection Success Rate (%) of Autoware : 45.2

Detection range of LGSVL (meters) : -25 to 52

Detection range of Autoware (meters) : -23 to 41

	1	2
1	Range	SuccessRate
2	-inf to -40	0.0
3	-40 to -30	0.0
4	-30 to -20	8.3333333...
5	-20 to -10	80.952380...
6	-10 to 0	45.454545...
7	0 to 10	94.117647...
8	10 to 20	88.888888...
9	20 to 30	70.0
10	30 to 40	41.509433...
11	40 to inf	2.3255813...

Note: - You can run Control Test suite using the same steps as mentioned above. Firstly, you will need to stop the ADE by clicking the Stop ADE button and Select the Control Test Suite**.**

Assumptions/Issues:

- If there is only ego vehicle in the simulation then data will not compute.
- Sometimes rviz crashes but the perception stack is running in the back ground
- While running scenario using scenic, it gets stuck or hangs while connecting to Ros2 Bridge. So we need to forcefully terminate using Ctrl+C and start again.
- Sometimes the machine might hang based on its system configuration

References:

- **Lgsvl Simulator - https://github.com/lgsvl/simulator/releases/tag/2020.06**
- **Scenic - https://scenic-lang.readthedocs.io/en/latest/syntax_guide.html?highlight=facing#specifiers**
- **PythonAPI - https://www.svlsimulator.com/docs/python-api/python-api/**
- **AutowareAuto avp demo - https://autowarefoundation.gitlab.io/autoware.auto/AutowareAuto/avpdemo.html**