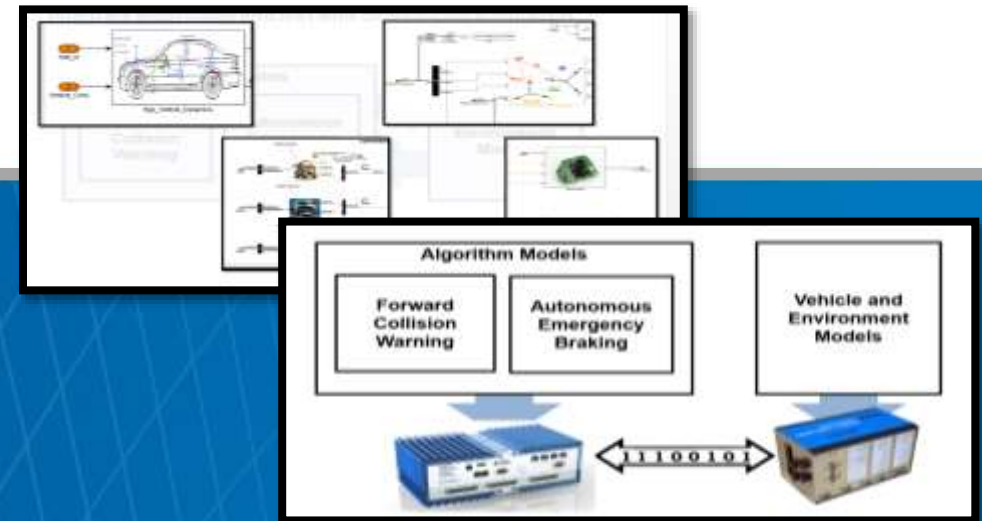


Test drive your ADAS algorithms: From desktop to real-time

Abhishek Bhat – Application Engineer, MathWorks
MathWorks Automotive Conference
12th May 2016



Introduction

MATLAB & Simulink are extensively used in automotive safety system development

ADAS introduce new engineering challenges

Vision algorithm design

Radar signal processing

Sensor fusion

Analyzing huge data

Ground truth labeling

Rapid re-simulation

Environmental modeling

Photo realistic display

...

MathWorks has Invested Heavily To Support ADAS Development

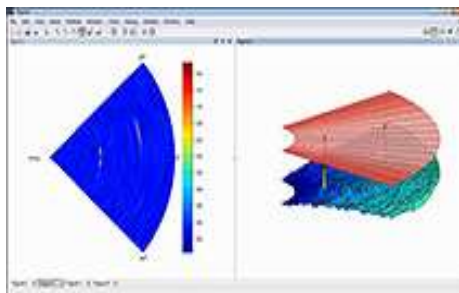
Sensor Data Streaming

Vision Algorithm Design



Camera Calibration

RADAR Signal Processing

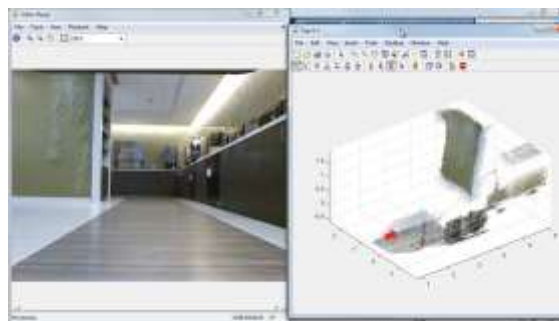


RADAR System Modeling

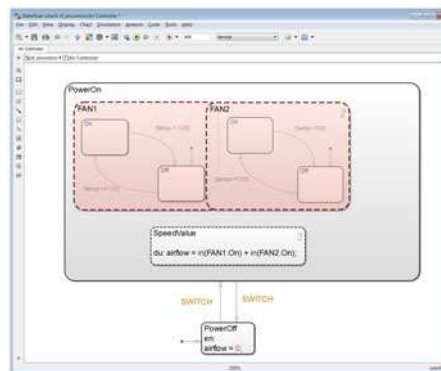
Large Scale Modeling

ROS Interface

Point Cloud Processing



Model Predictive Control



Machine Learning



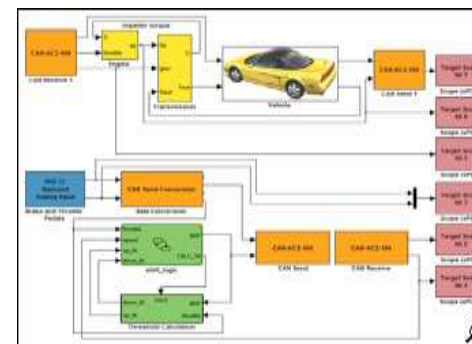
Deep Learning

Rapid Prototyping



C and HDL Code Generation

Simulation Integration



Gaming Engine Interface

MATLAB and Simulink Help Engineers Put ADAS and Autonomous Driving on the Road

Delphi Developing Pro Alignment Algo

Challenge
Deliver a prod
algorithm in fo

Solution
Use MATLAB
performance,
MATLAB Code

Results

- Generated
- for this algo
- Developm
- Algorithm



Mobileye Designing and Prototyping Control Algorithms

User Story – Mobileye
Connection with EyeQ chip, and vehicle buses

- ✓ Configure I/O and protocols settings through dialog fields
- ✓ *Automatically* create and run a real-time application from your Simulink model on the target machine



Eyal Bagon while not driving the car

“With the Speedgoat system, changing parameters and tuning the system is very easy and straightforward. It saves us a lot of time.”

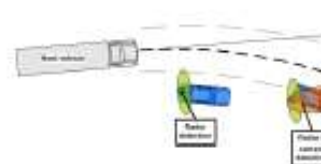
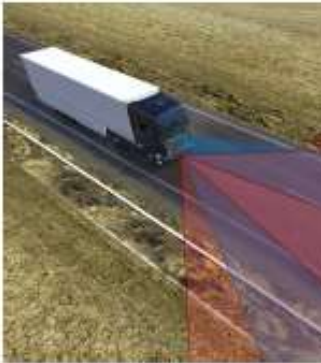
“There is no need to re-compile and burn each new version of the control algorithm.”

Eyal Bagon
Senior Director Autonomous Vehicle
Mobileye

MATLAB and Simulink Help Engineers Put ADAS and Autonomous Driving on the Road

Sensor fusion

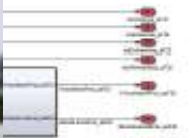
Tv



50 km/h - sudden brake



function blocks,
calculations.



tion Block

Code blocks, calculations, and other data.

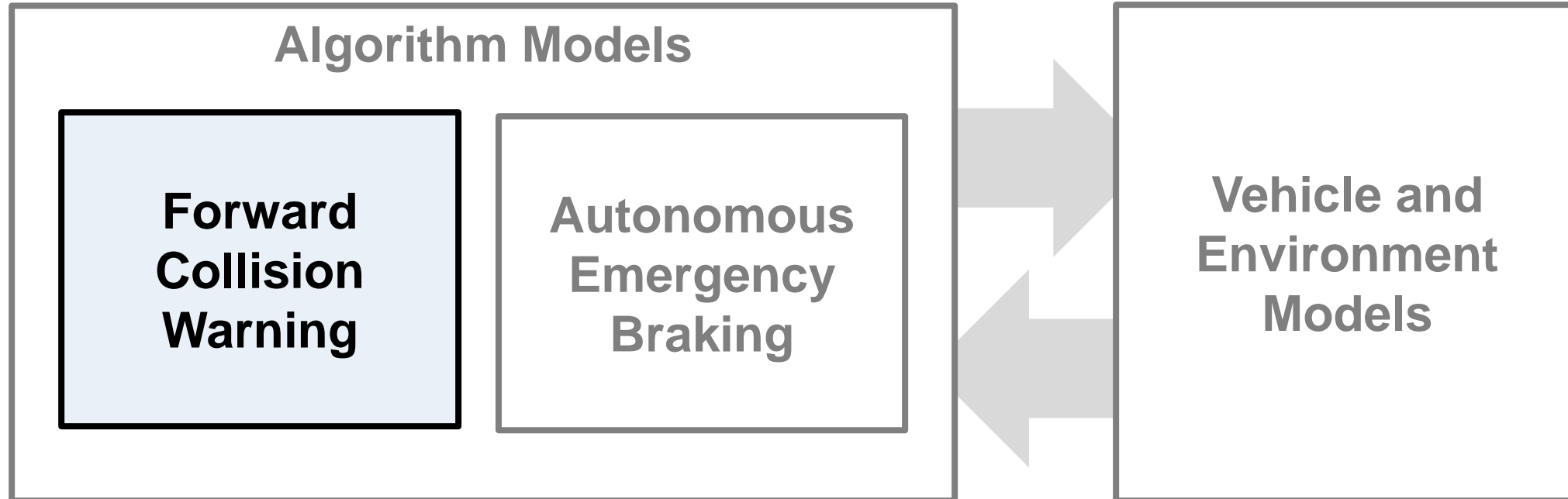
SCANIA

2015-08-24 Jonny Andersson

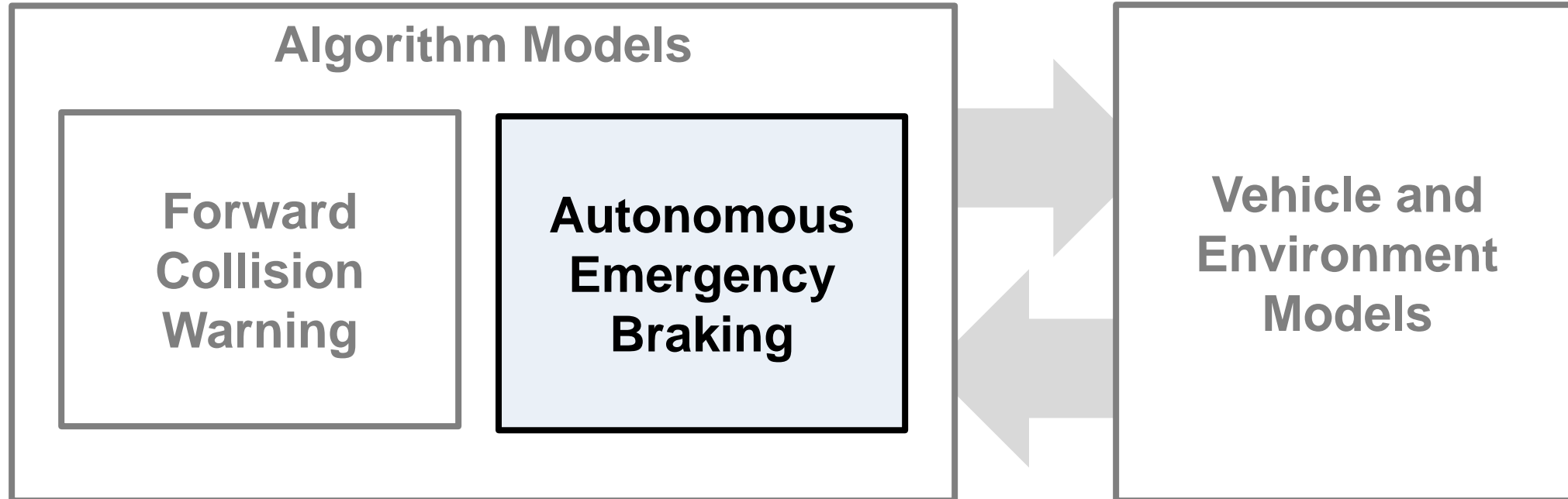
Test drive your ADAS algorithms

- Architect AEB algorithm in Simulink.
- Test drive the virtual car on the virtual track.
- Automate the testing and generate distributable test report.

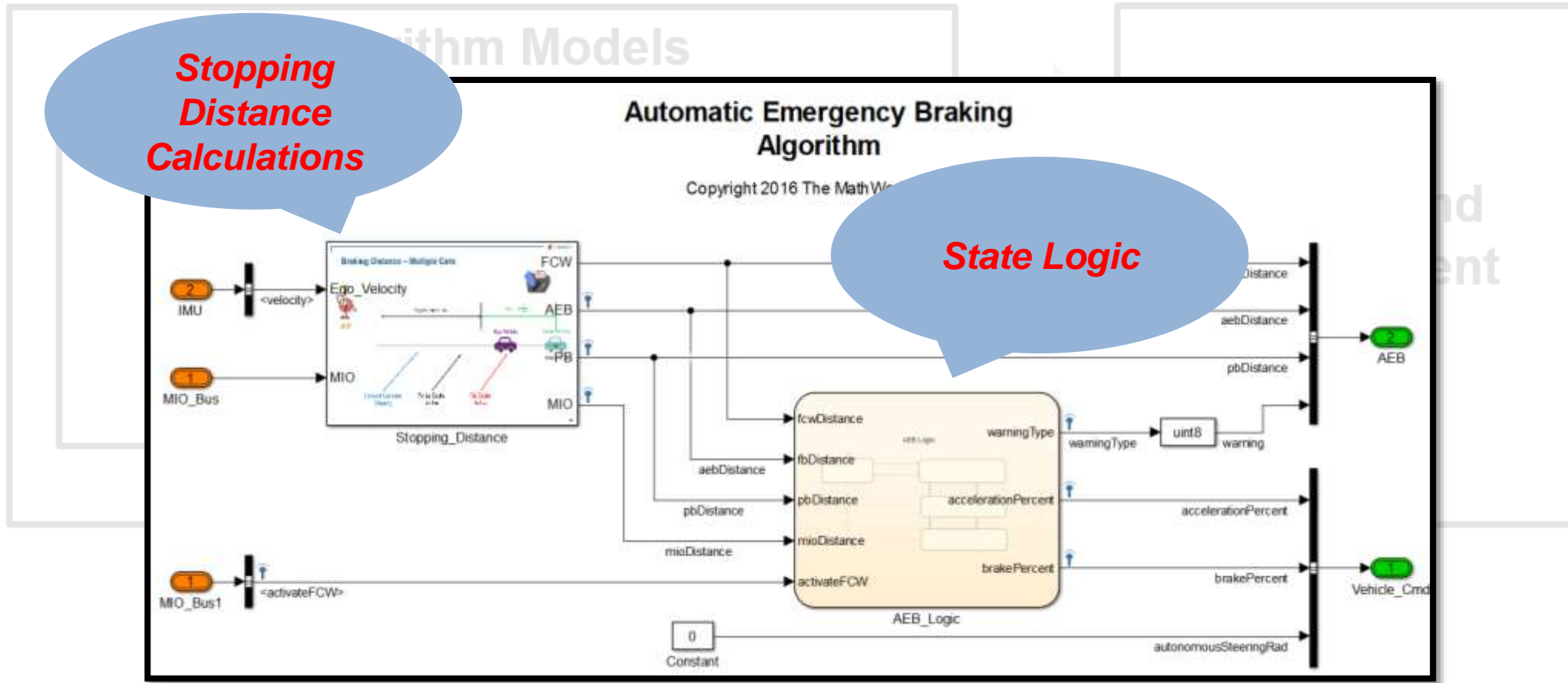
Develop FCW algorithm and test against logged vehicle data



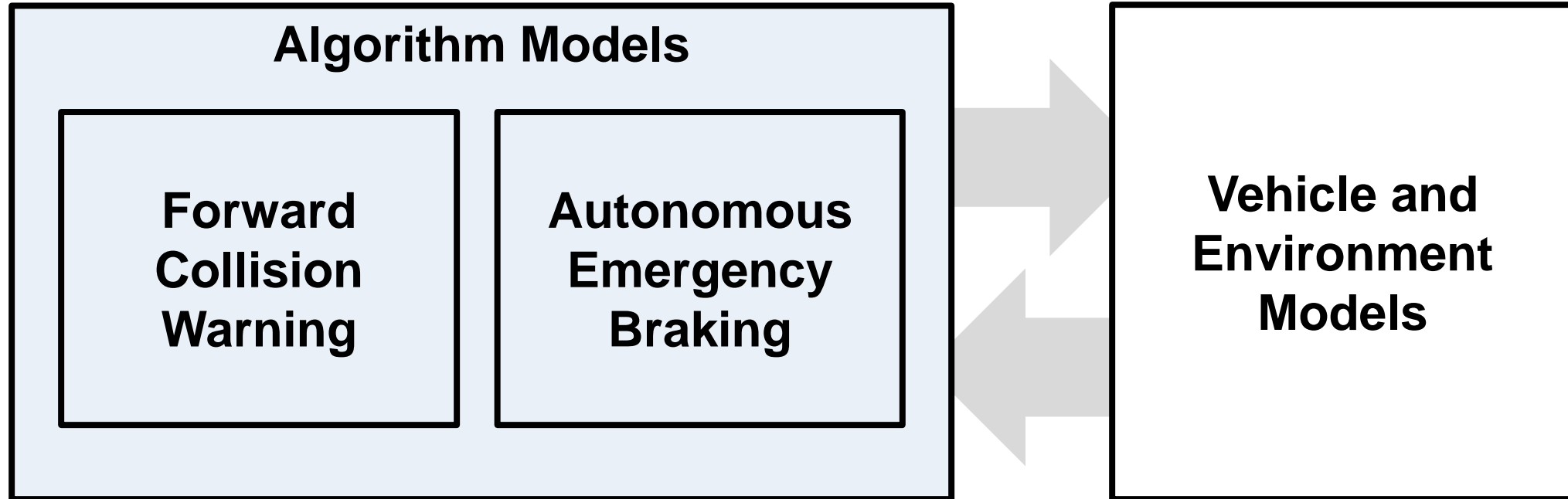
Develop AEB algorithm and test with event driven stimulus



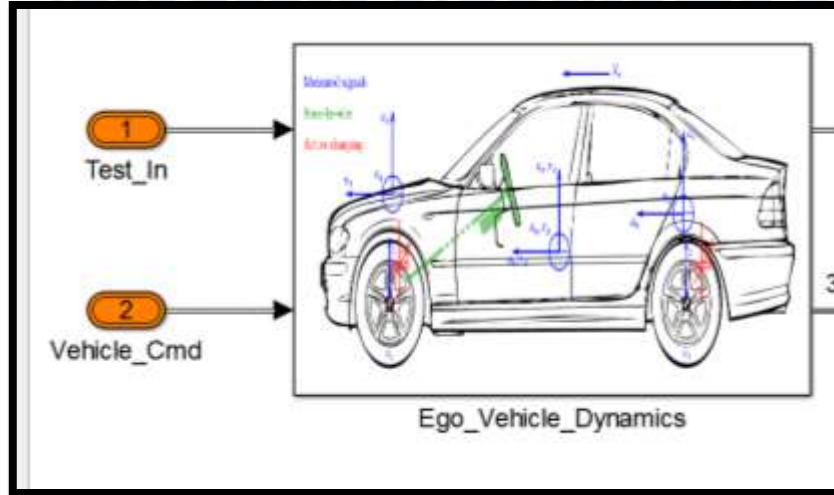
Develop AEB algorithm and test with event driven stimulus



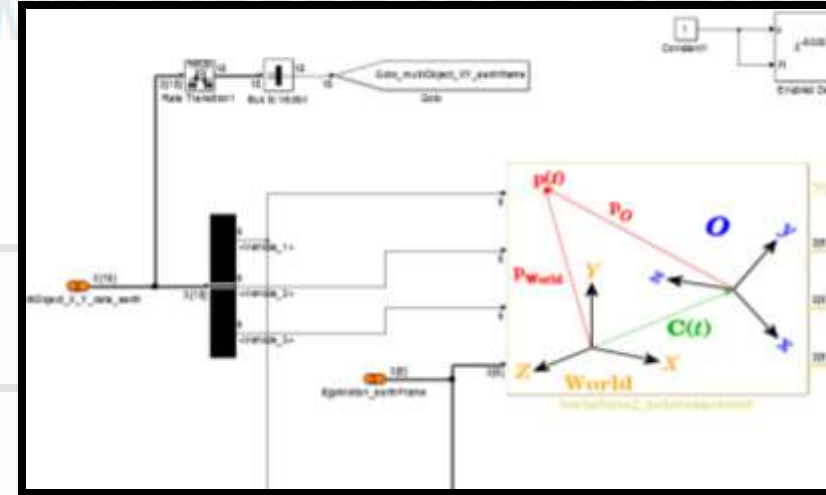
What next after open loop testing?



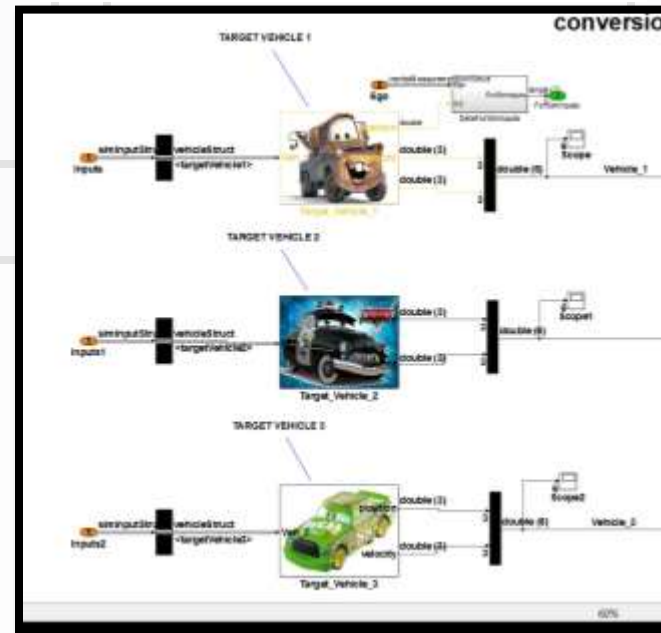
Ego Vehicle Dynamics



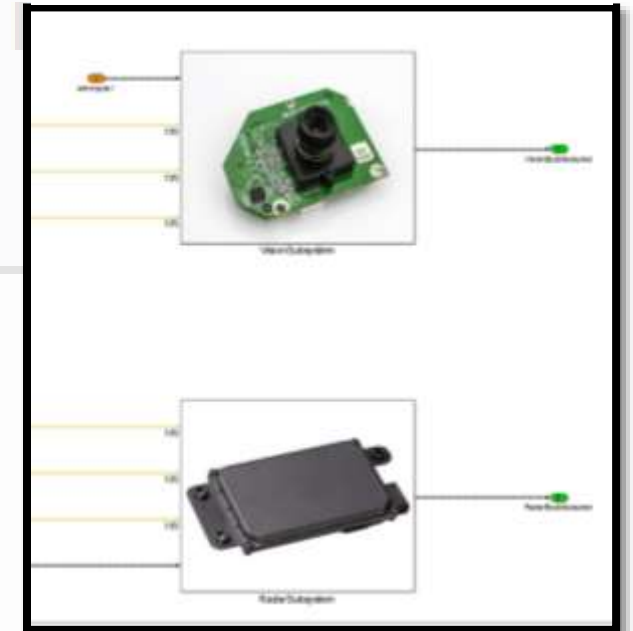
Coordinate Transforms



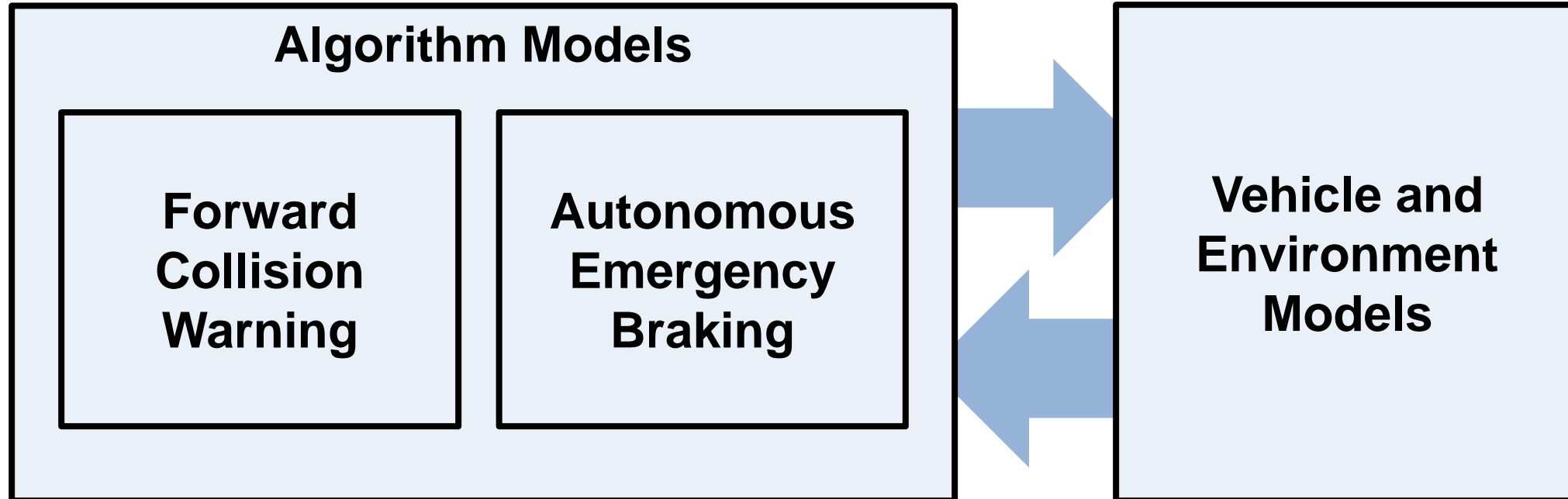
Target Vehicle Dynamics



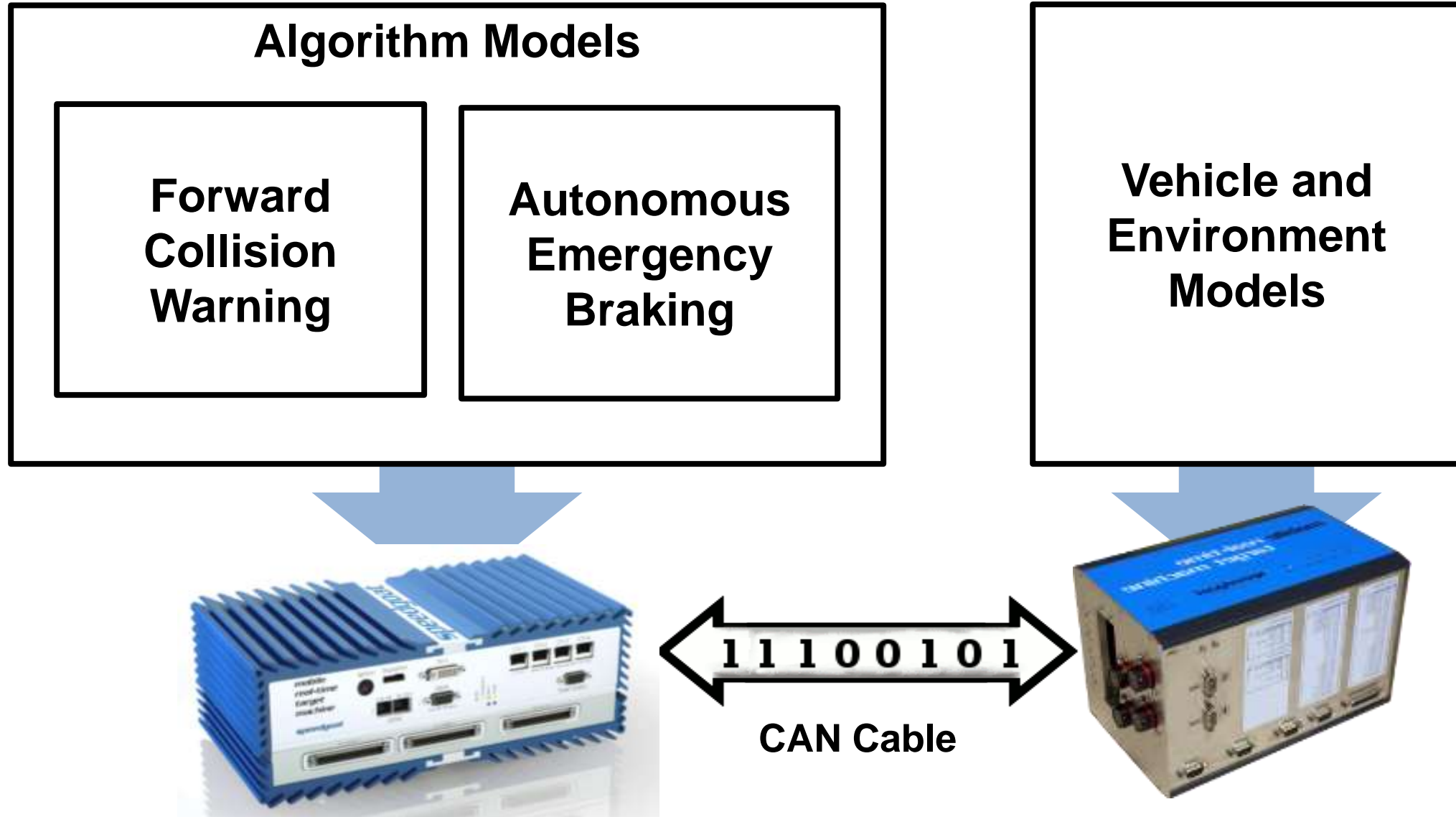
Sensor Models



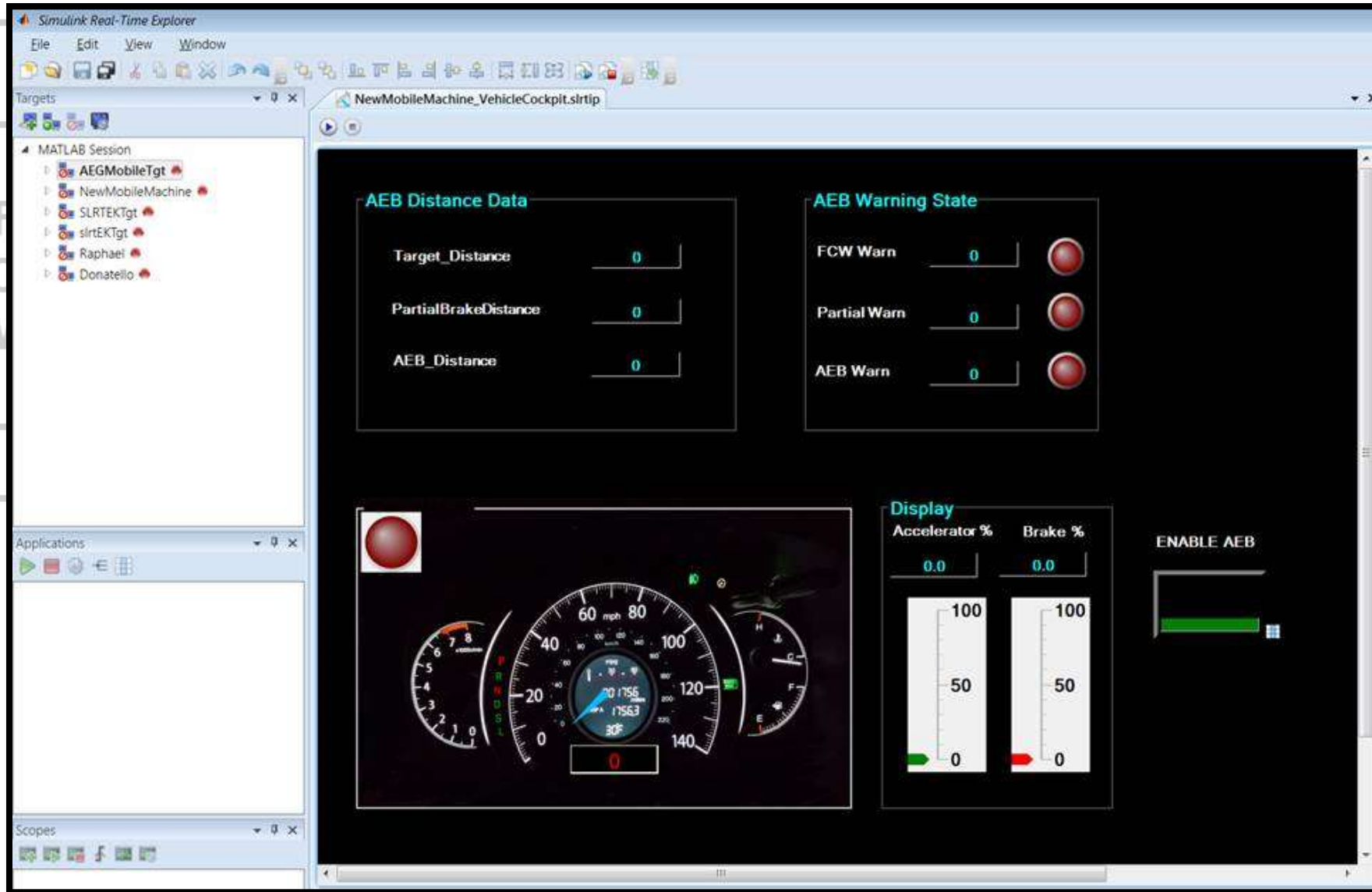
Integrate algorithms and test with closed-loop simulation



Real-Time Testing with Simulink Real-Time



Calibration and Rapid Prototyping with Speedgoat



Test Automation with Simulink Test

MATLAB R2016a

HOME PLOTS APPS SHORTCUTS EDITOR PUBLISH VIEW

Find Files Compare Go To Comment Indent Breakpoints Run Run and Advance Advance Run and Time

FILE NAVIGATE EDIT BREAKPOINTS RUN

Current Folder: C:\ADAS\SimulinkRealTime\Work

Editor: C:\ADAS\SimulinkRealTime\Work\RunTestCases.m

RunTestCases.m task_AnalyseSLTestData.m Untitled2* fcn_SLRTValidateResult.m

This file can be opened as a Live Script. For more information, see [Creating Live Scripts](#)

```

1
2 %% Run the realtime test cases in the test Manager
3
4 % In the SL Test Manager window:
5 % 1) Click Open Test FilePlay
6 % 2) Select the Test file: AEB_testing_scenarios_SLRT.mldatx
7 % 3) Click Run to run all the test cases
8
9 % Clear all the files in the
10 sltest.testmanager.clear
11 pause(0.5);
12
13 % Open the AEB_testing_scenarios_SLRT.mldatx file
14 sltest.testmanager.load('AEB_testing_scenarios_SLRT.mldatx');
15 sltest.testmanager.view;
16 pause(0.5);
17
18 % Run the test file
19 sltest.testmanager.run;
20
21 % Once the test gets done, analyse the test data and automatically generate the test report.
22 pause(5);
23 disp('Tests Complete. Generating Test Report');
24 run('task_AnalyseSLTestData.m');
25
26

```

Workspace: Simulink Project - demo

Name	Status	Classification	Git
References	-		-
SLRT	-		-
TestScenarioDescr..	-		-
Utilities	✓	None	-
Work	-		-
backup_work	-		-
fcwaebSLRT_INC..	-		-
fcwaebSLRT_slrt_..	-		-
INCA_stuff_folder	-		-
jetty-0.0.0-3141..	-		-
slprj	-		-
vehicleAndEnviro..	-		-
adasDemo_15b_2..	-		-
aeb_slx.r2015b	-		-
aeb_inca.slx	-		-
aeb_msf.mexw64	-		-
aeb_sfun.mexw64	-		-

Command Window

New to MATLAB? See resources for [Getting Started](#).

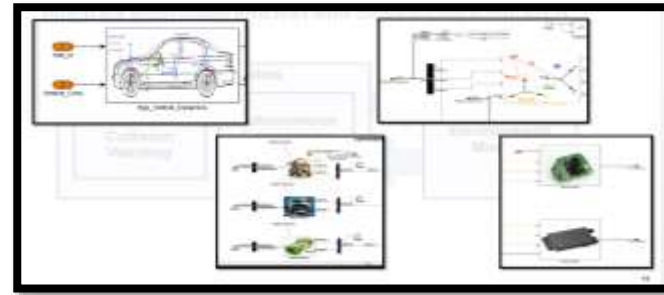
fx >>

script Ln 15 Col 25

100% 1:35 PM

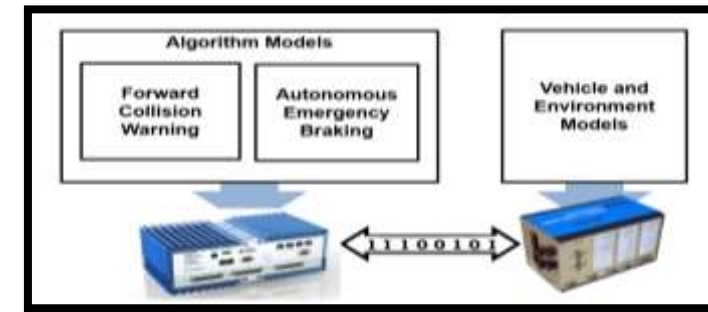
Test drive your ADAS algorithms

- Architect AEB algorithm in Simulink.



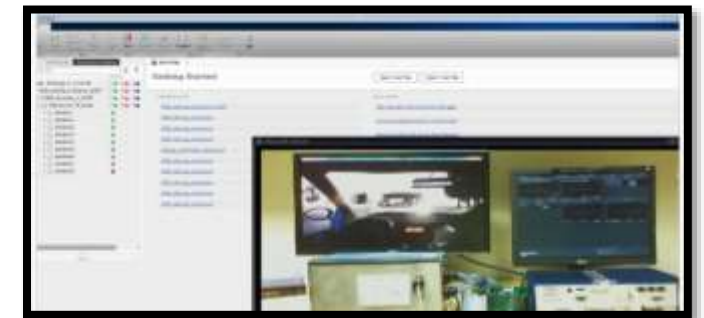
 **Simulink/Stateflow**

- Test drive the virtual car on the virtual track.



 **Simulink Real-Time/Speedgoat**

- Automate the testing and generate distributable test report.



 **Simulink Test**

Thank you