Virtual Development and Validation Environment for ADAS and RDE

Connect simulation and test

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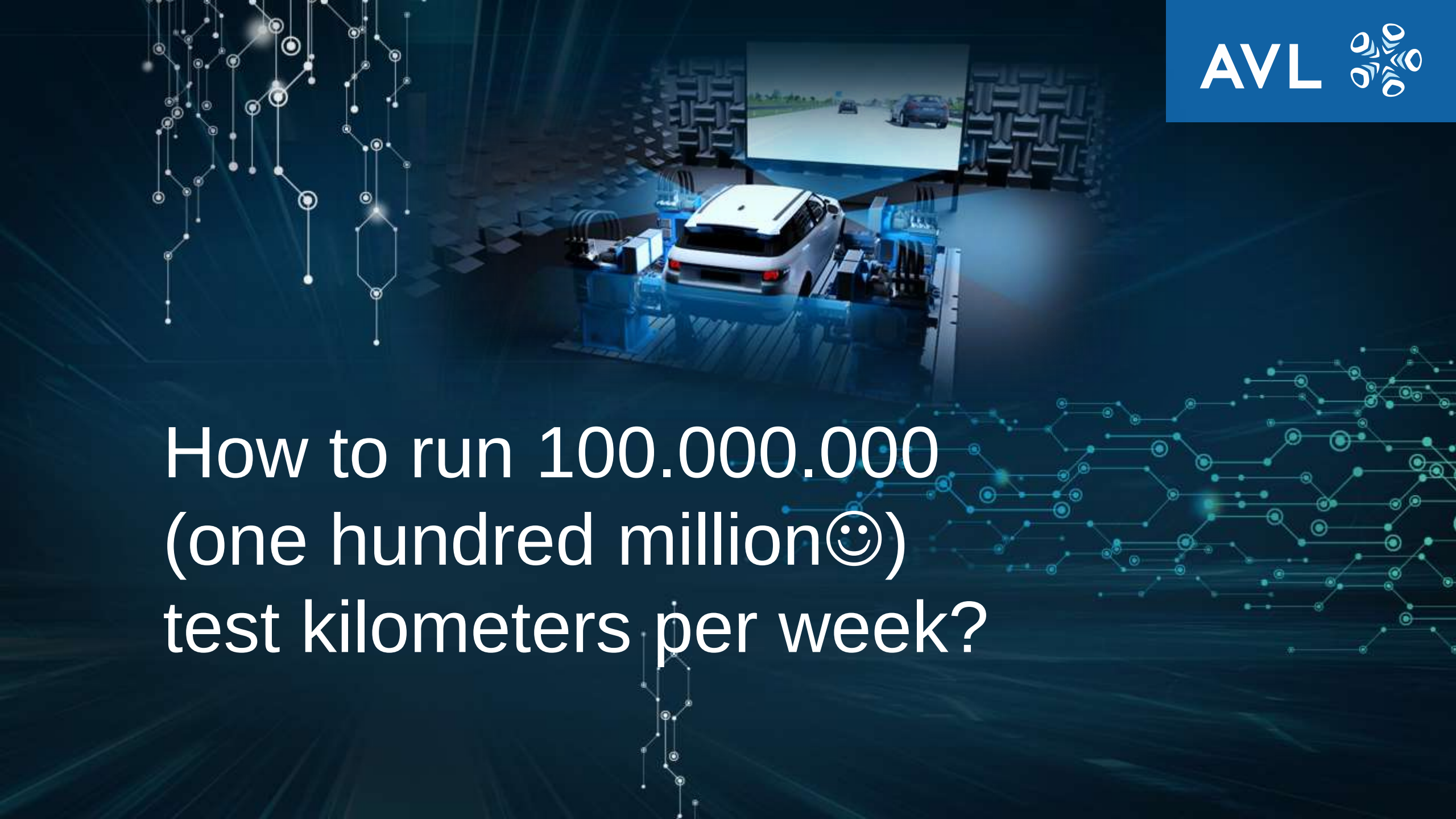


How to run 100.000.000 (one hundred million☺) test kilometers per week?

Integrated & Open Development Platform

Connect simulation & test

TESTBEDS

PROCESSES

DATA

MODELS

...

Connect existing elements within
the vehicle development process...

Model.CONNECT™

Testbed.CONNECT™

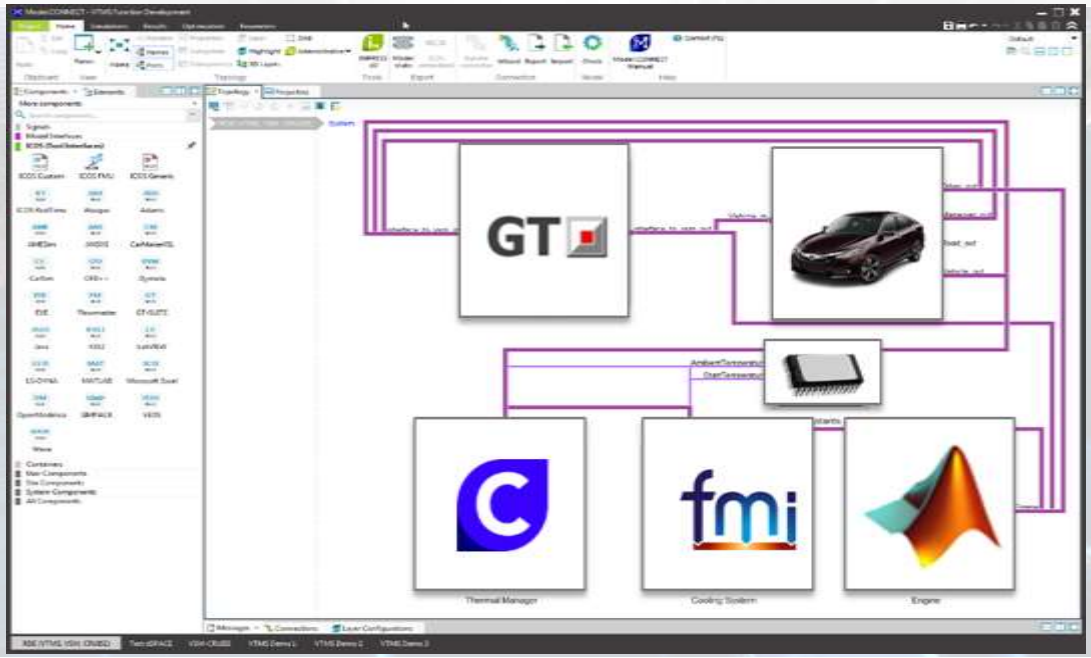
Data.CONNECT

...

... for early, fast and sound decisions.

Model.CONNECT™

AVL



- Neutral, Open, Tool-Free
- Coupling Error Compensation
- Local and Distributed Co-Simulation
- Connecting RT and non-RT Systems

Neutral and open model integration and co-simulation platform, opening the door from simulation to testbed.

Tools specific interfaces (25+ software vendors) and interface standards (FMI)

Model.CONNECT™

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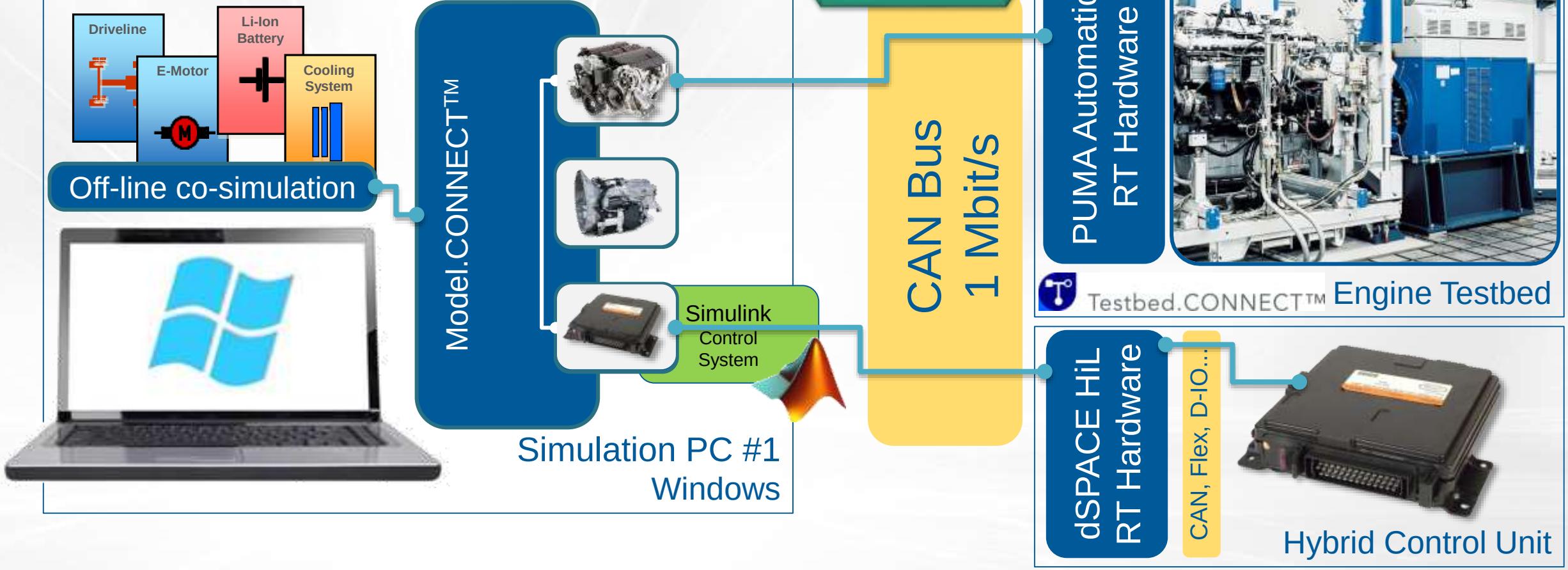


REAL-TIME: Connecting RT and non-RT Systems

ACORTA - Synchronizing off-line co-simulation with hardware components

Testbed.CONNECT™

ADAS ENGINEERING SERVICES AT A GLANCE

Functional integration & calibration services
incl. controls & function development for add-on features

Methods & tools
for simulation, testing & validation from lab to road

New predictive/adaptive functions
improving vehicle attributes e.g. fuel efficiency

For new levels of vehicle comfort, safety and efficiency

TRANSFER REAL WORLD SCENARIOS INTO SIMULATED WORD

SIMULATION CHALANGES FOR ADAS FUNCTION DEVELOPMENT

REQUIREMENTS ON MODELS:

- Fast, accurate and extendable
- Real-time capability for control function development
- Integration with vehicle dynamics and traffic simulation
- Virtual driving quality assessment
- Execution in a distributed cluster/cloud environment
- Integration environment for HiL and testing applications

SIMULATION CHALANGES FOR ADAS FUNCTION DEVELOPMENT

IT IS NOT SO IMPORTANT HOW WELL
THE TOOLS WORK FOR THEMSELVES,

IT IS IMPORTANT HOW WELL THE TOOLS WORK TOGETHER!

DEVELOPMENT, TESTING AND VALIDATION OF ACTIVE AND PREVENTIVE SYSTEMS

Model.CONNECT™

VSM
CarMaker
CarSim
...
Custom

Components

FMI
Matlab
AMESim
CRUISE
ADAMS
SIMPACK
LS-Dyna
...
Test bed

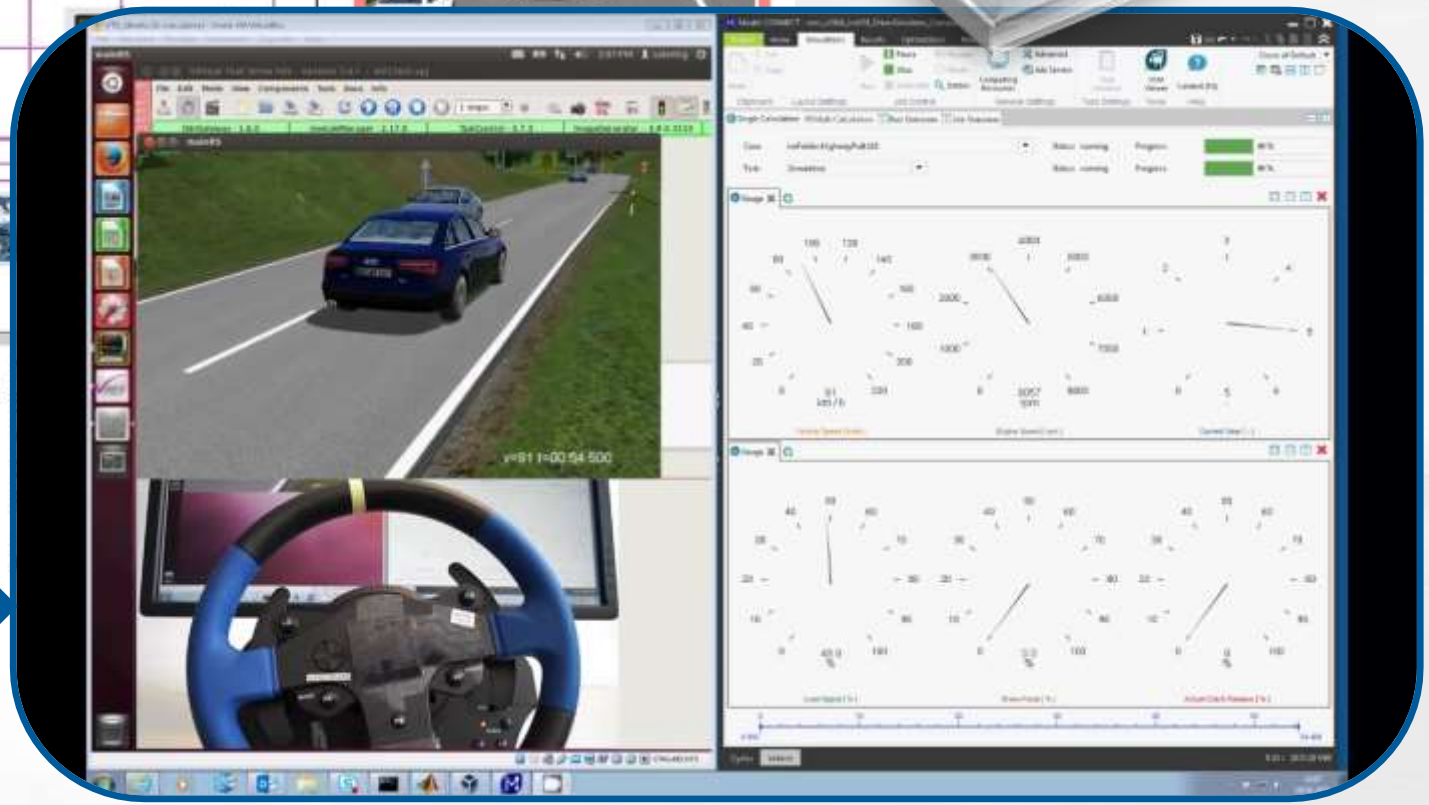
Scenario

V-ECUs

Matlab
VEOS
EVE*

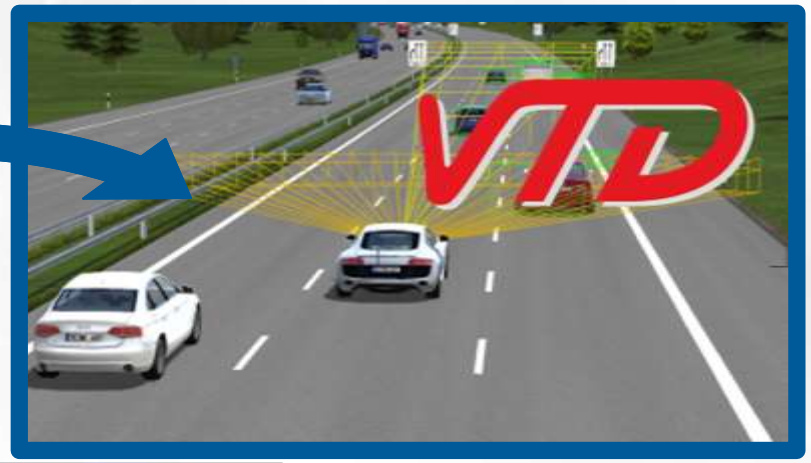
Driver

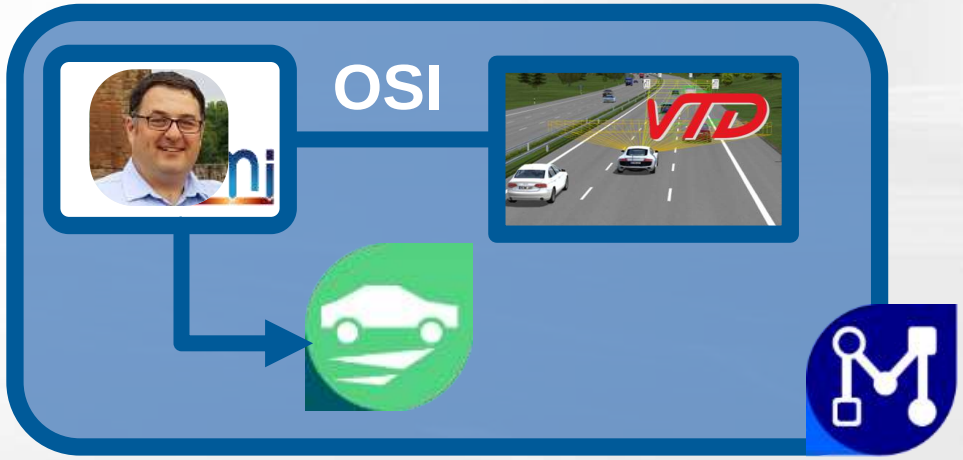
USE CASE: lane keeping assistant with PlayStation2 steering wheel



VTD VIRES AUTOMATIC PARAMETRIZATION

Model.CONNECT automatic parametrization

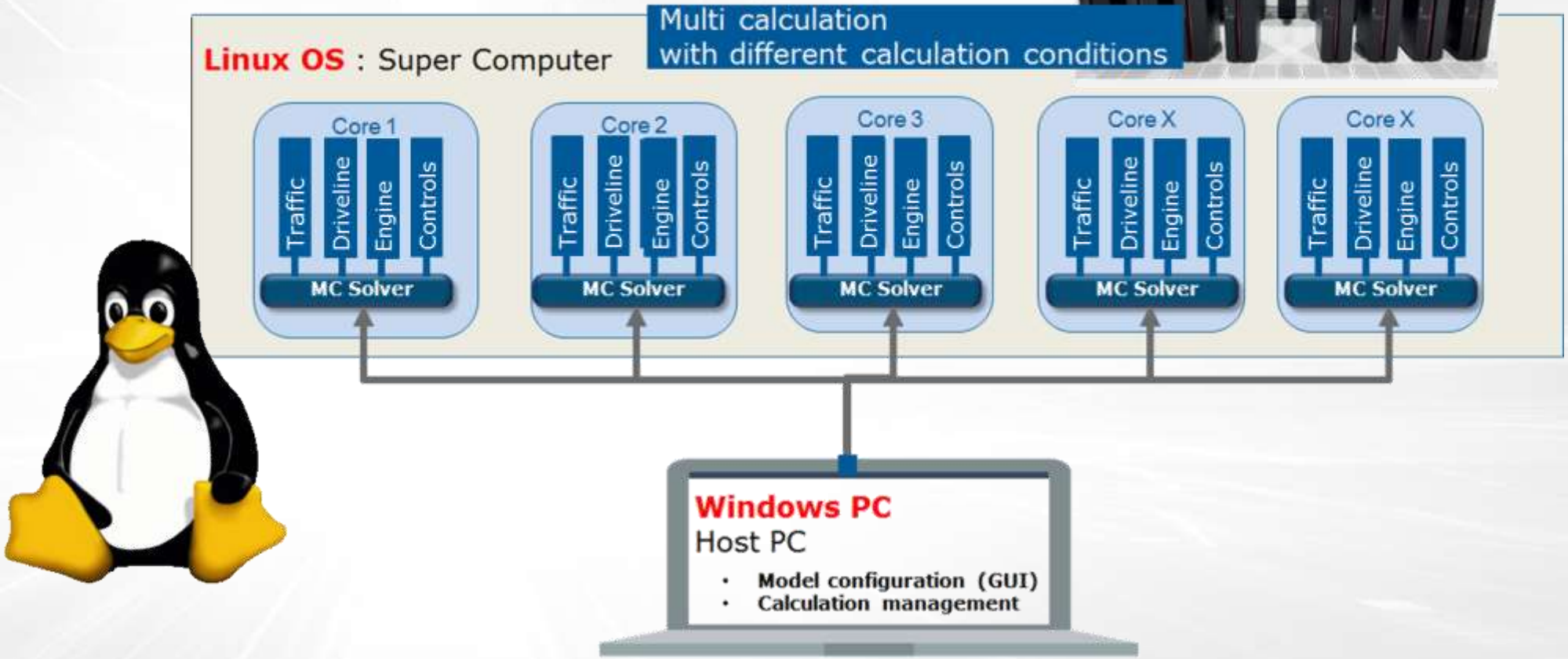




OPEN SIMULATION INTERFACE

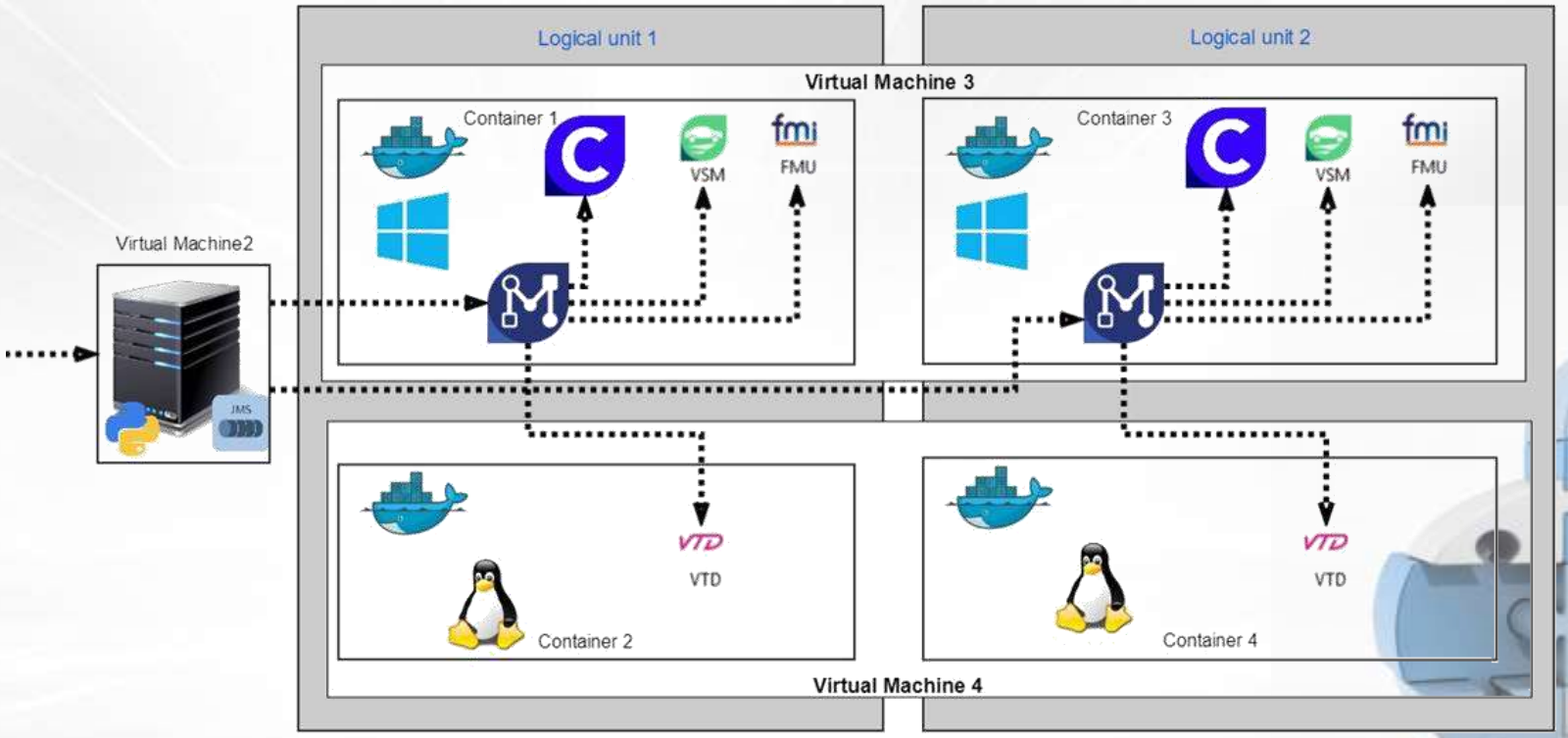
LARGE SCALE VALIDATION AND OPTIMIZATION
Model.CONNECT @ LINUX

USE CASE: ADAS DRIVING CASE STUDIES WITH OPTIMIZATION TOOL

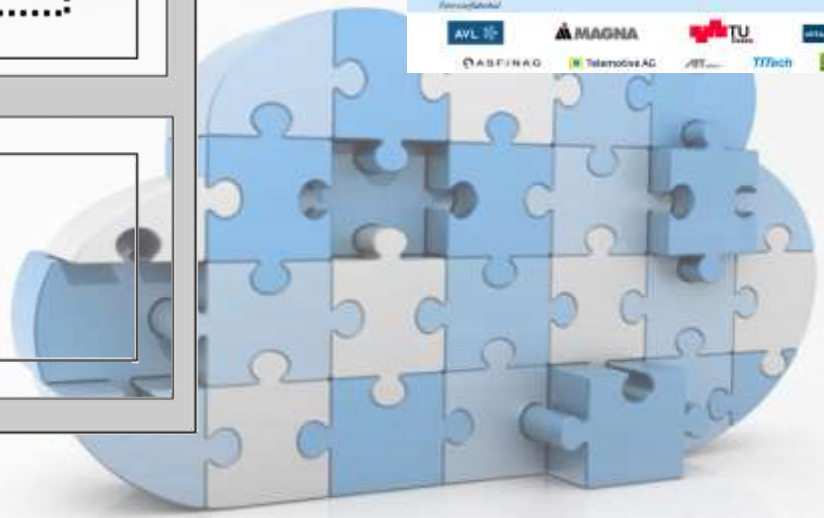


MODEL.CONNECT IN THE CLOUD + ALP.Lab

Model.CONNECT Docker Containers Demonstrator in the Azure Cloud



Use case: ALP.Lab



ADVANCED OPEN VALIDATION ENVIRONMENT

Validation Simulation Environment

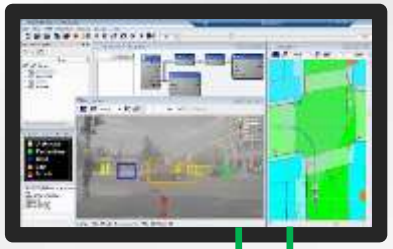
Environment Simulation

Model, SW, Testing Integration Platform

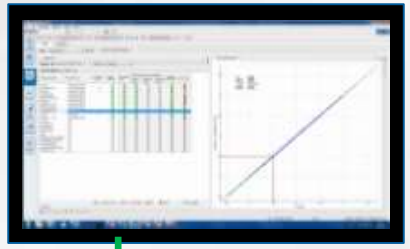
Tool Environment

Online & Post-Processing

Tool Extension Image Processing



Model Based Validation



Model.CONNECT™

Signals (closed loop, information)

Object lists

Streams (videos, 3D data…)

MIL in cloud

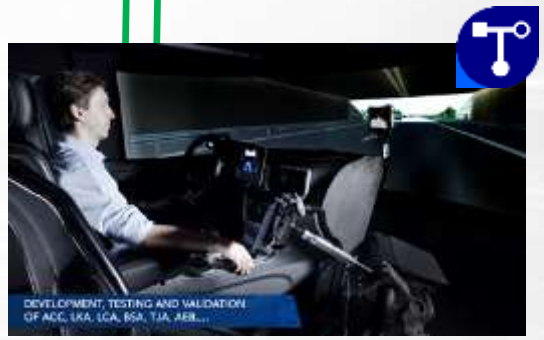
MIL

Inverter

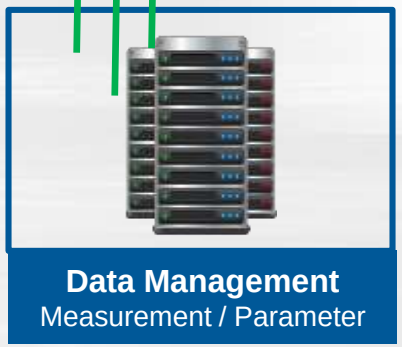
ADAS ECU

HIL

(Mini-)DrivingCube



Driving Simulator

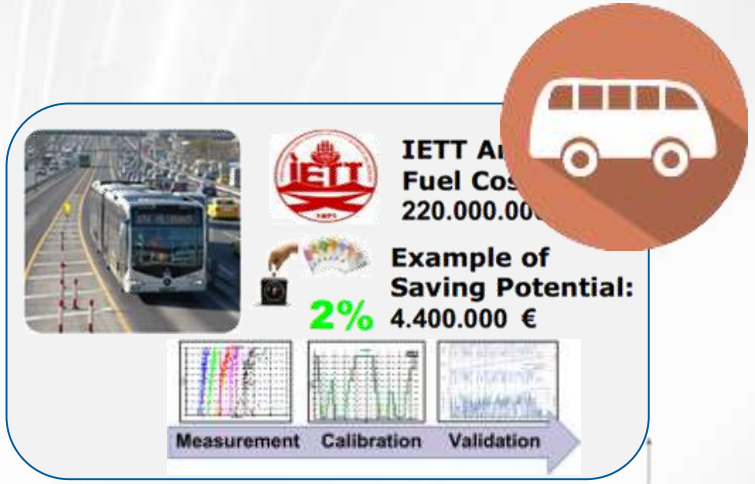


Data Management

Measurement / Parameter

Development Environments

LET'S START A RIDE OF 100.000.000 KM

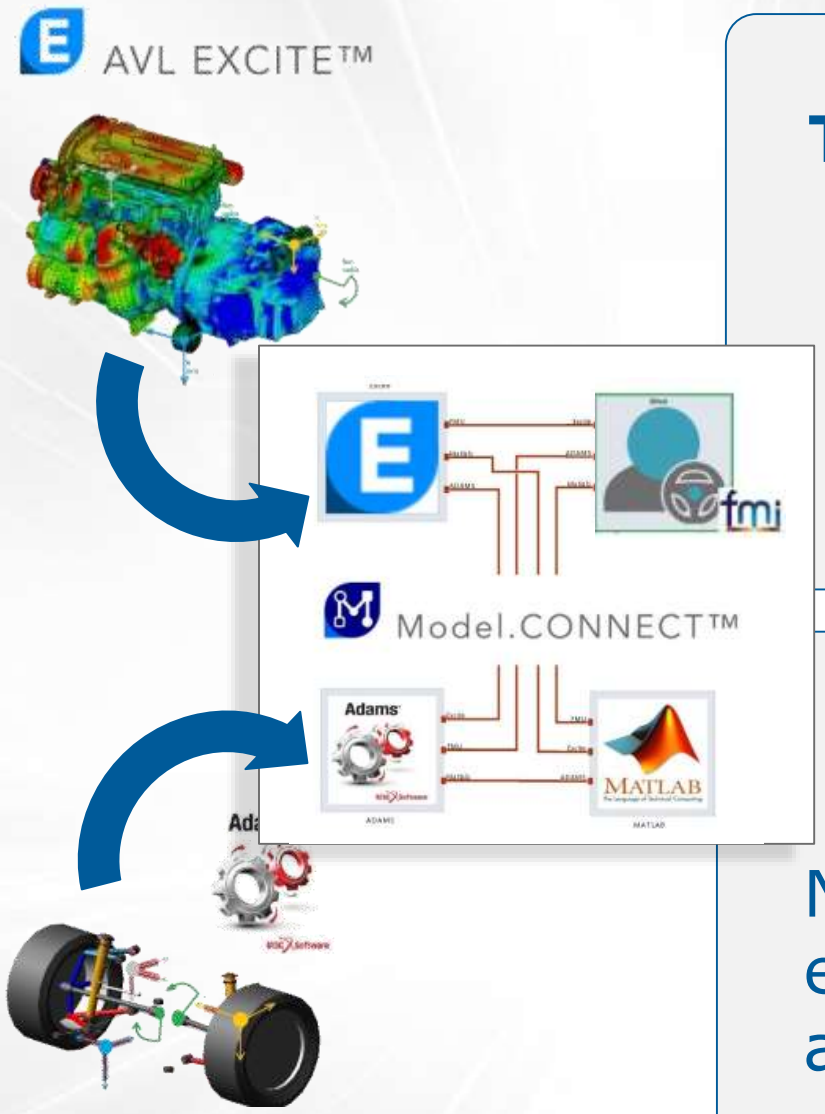


PCC active events	Fuel reduction in %
Only Coasting	2.14
Only Hill cresting	5.00
Only Dip crossing	2.20
Coasting and Hill cresting	5.90
Coasting and Dip crossing	4.33
Hill cresting and Dip crossing	6.56

Simulation engine for fuel economy, emission and performance aspects of ADAS function development (ACC/PCC, acceleration, VTMS, drivability etc.)

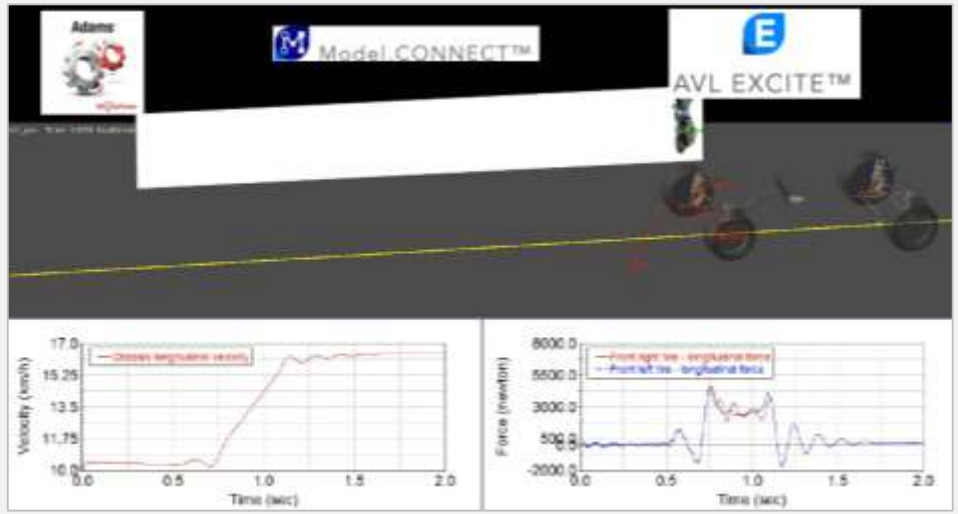
Preferred integration platform for ADAS functions development and validation.

HOLISTIC APPROACH IN NVH ANALYSIS



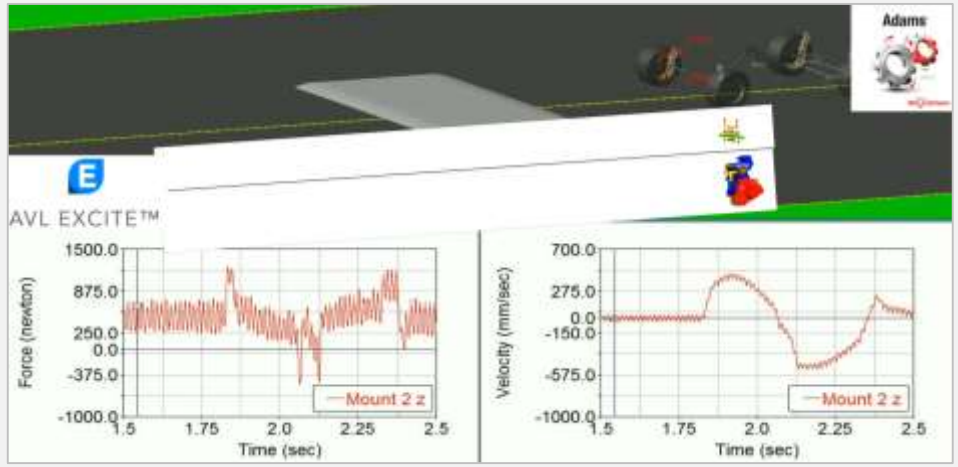
Tip-In-Back-Out:

Clunk and shuffle noise prediction in the driveline.



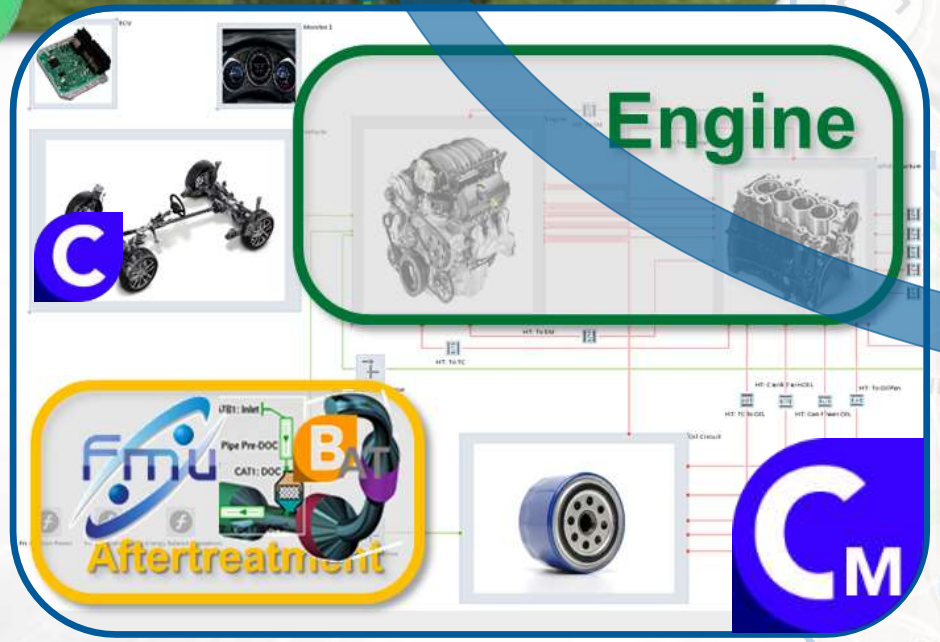
Road Bumper:

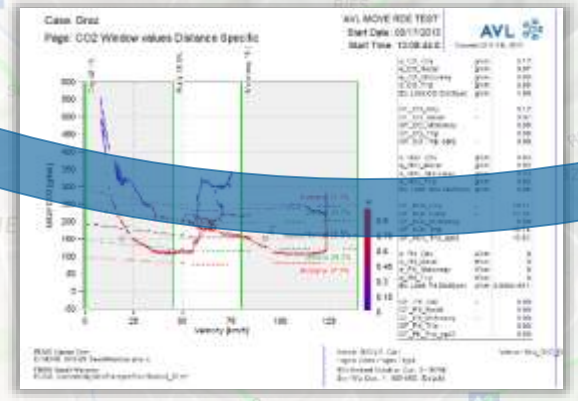
NVH impact on the engine mounts, tires and suspension.



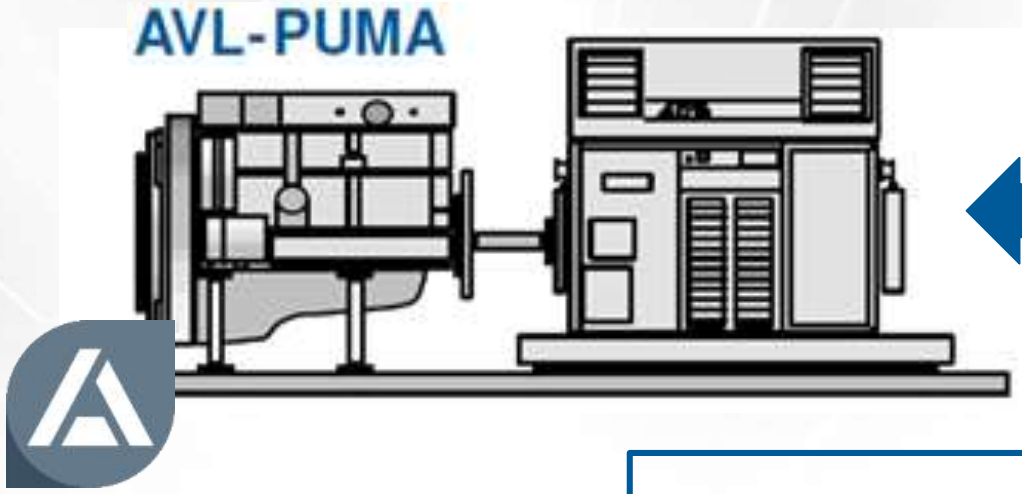
FRONTLOADING REAL DRIVING EMISSION TESTS FROM ROAD TO THE OFFICE

Office → LAB/HiL → Rig → Road





REAL DRIVING EMISSION TESTING ON THE ENGINE TESTBED



Testbed.CONNECT
RT-Workstation

Real Driving
Emission Routes

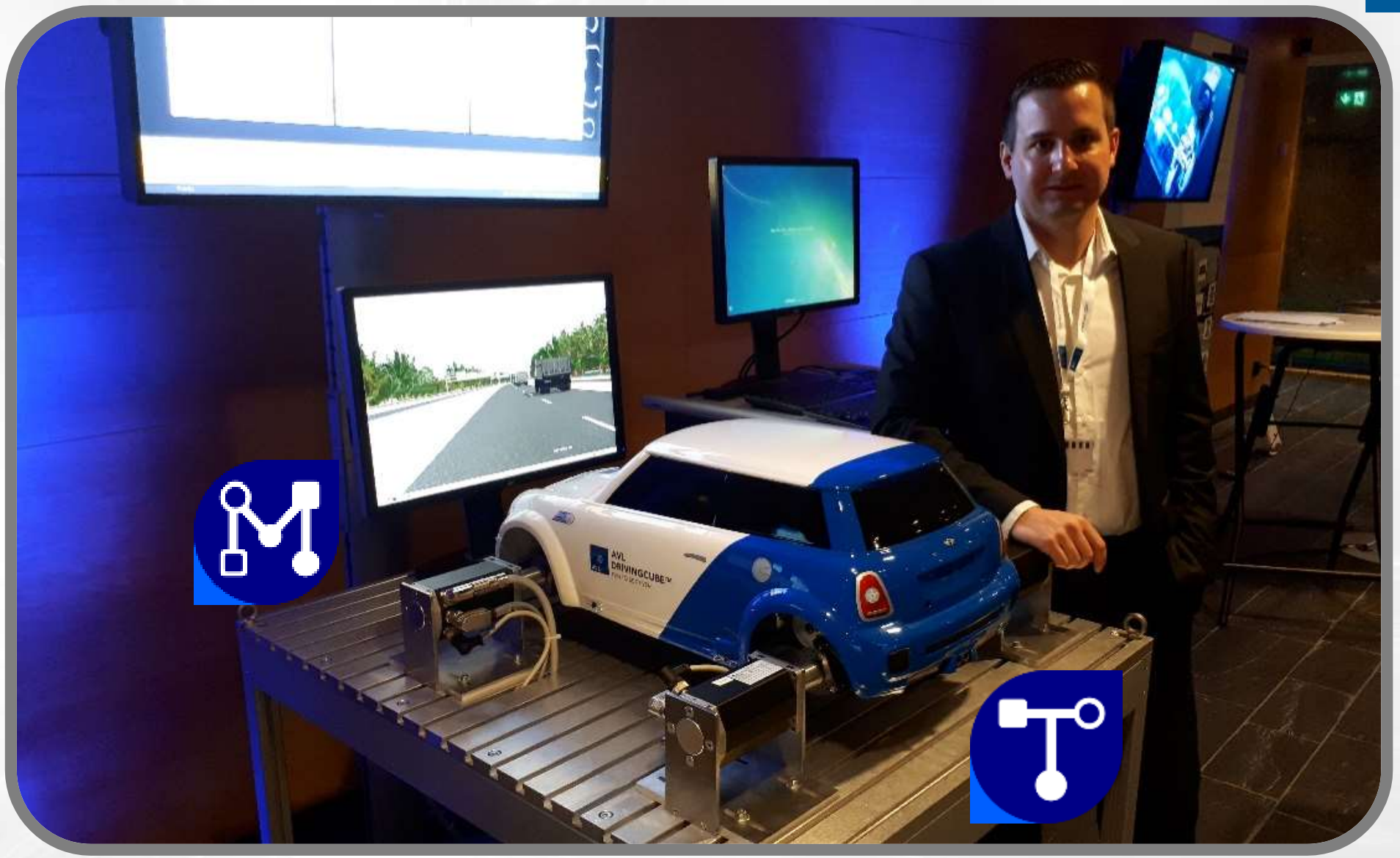
Vehicle:
CarMaker

Driveline:
GT

Controls:
Simulink

Model.CONNECT co-simulation vehicle prototype

AVL Mini-DrivingCube DEMONSTRATOR AT PDiM 2017 IN GOTHENBURG



INTEGRATED AND OPEN DEVELOPMENT PLATFORM

AVL

SIMULATION

TESTING