



Model.CONNECT: Case Studies of Virtual Testing for RDE, Electrification and ADAS

Connect simulation and test

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The challenge

Speeding-up development process by re-using simulation models from different tools from the office concept phase to the hardware testing and validation.

- Mastering new applications: ADAS, RDE, VTMS, calibration etc.
- Connecting existing co-simulation models in an optimal way.
- Using simulation models in HiL and testbed environments.



Integrated & Open Development Platform

Connect simulation & test

Connect existing elements within the vehicle development process for early, cost-saving decisions.

 TESTBEDS

PROCESSES

 MODELS

...

 DATA

USE CASES



SIMULATION MODELS

COMPARABLE RESULTS

 Model.CONNECT™

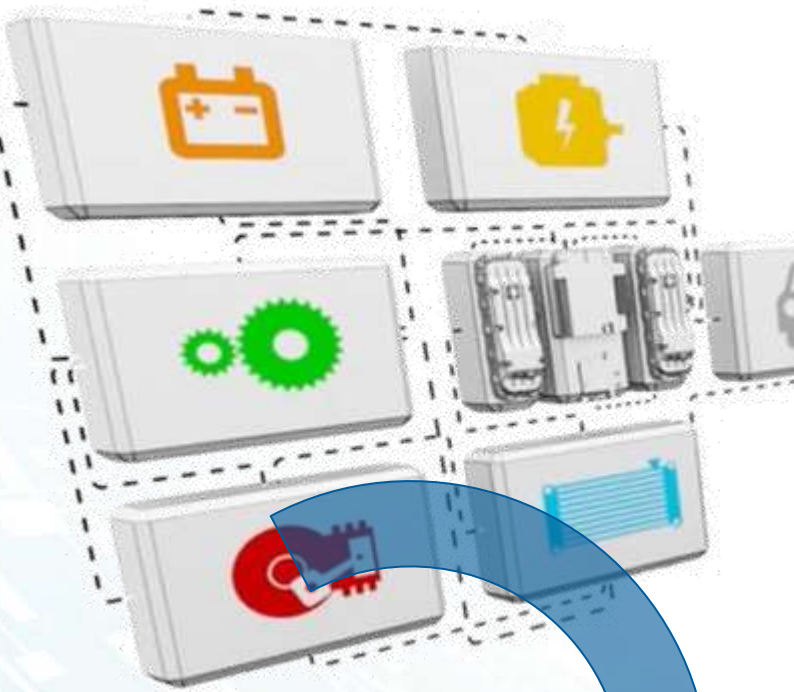
 Testbed.CONNECT™

 Data.CONNECT

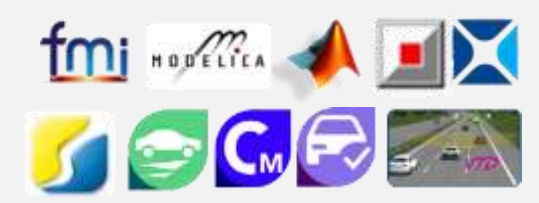




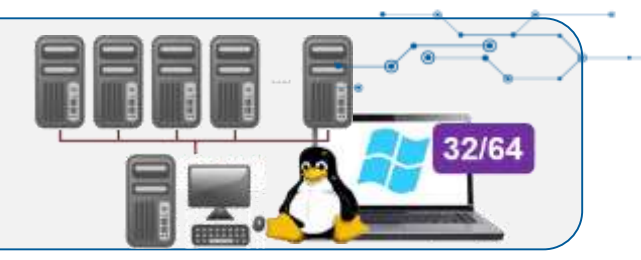
Model.CONNECT™



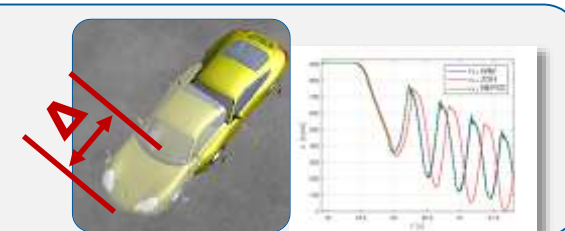
1. 30+ ready to use standard interfaces and tool wrappers



2. Maximum performance due to distributed computing

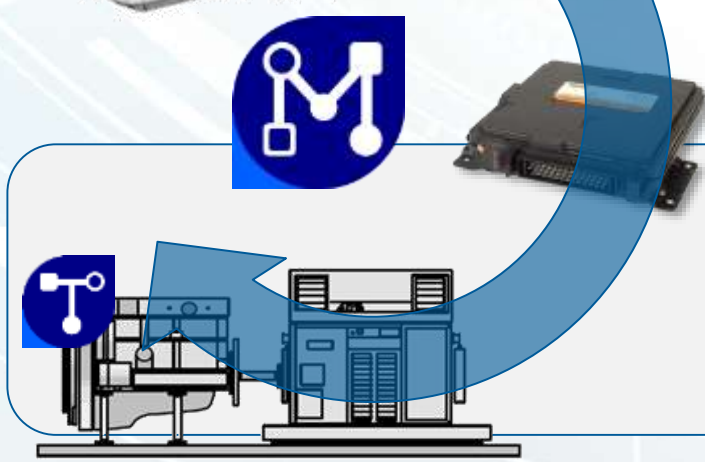


3. Error correction using patented coupling technique

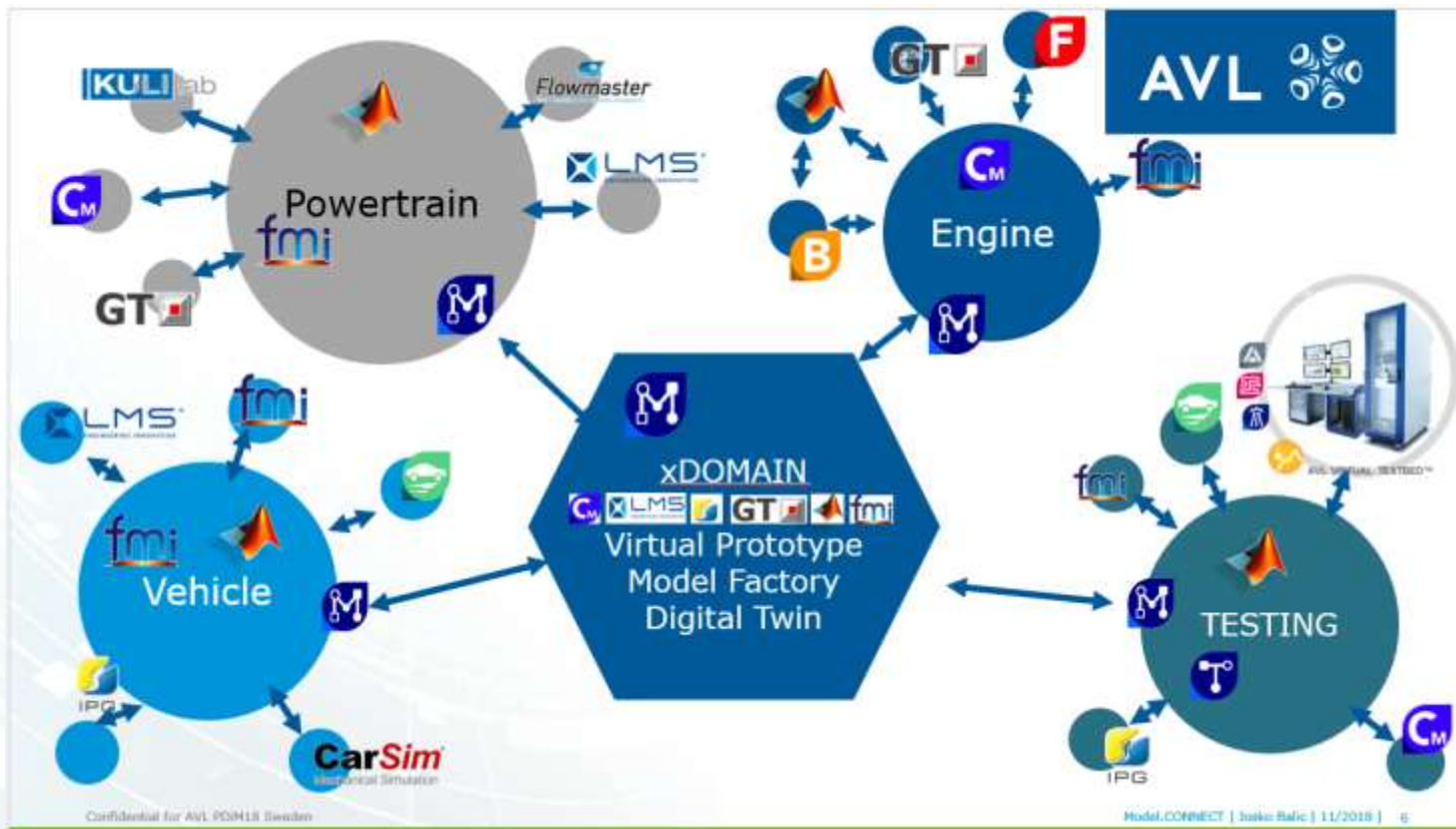


4. Patented RT/non-RT synchronization technology

5. Solution stability in all simulation environments

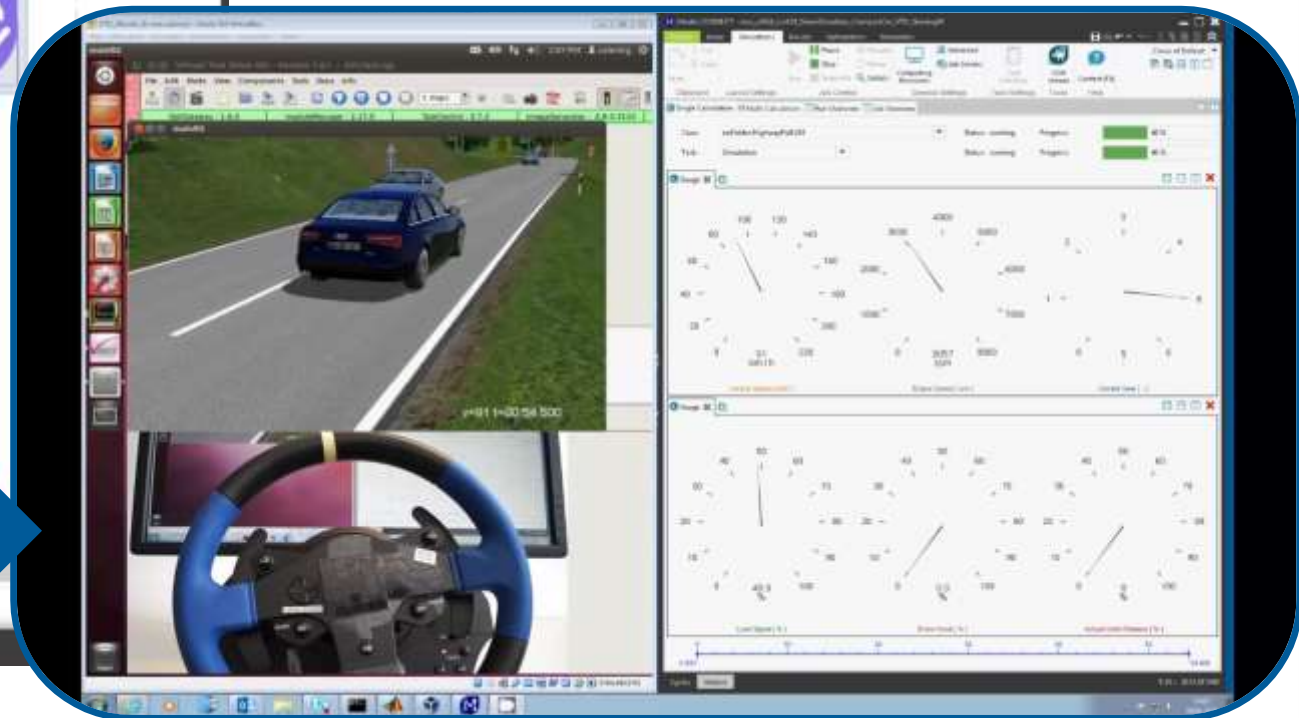
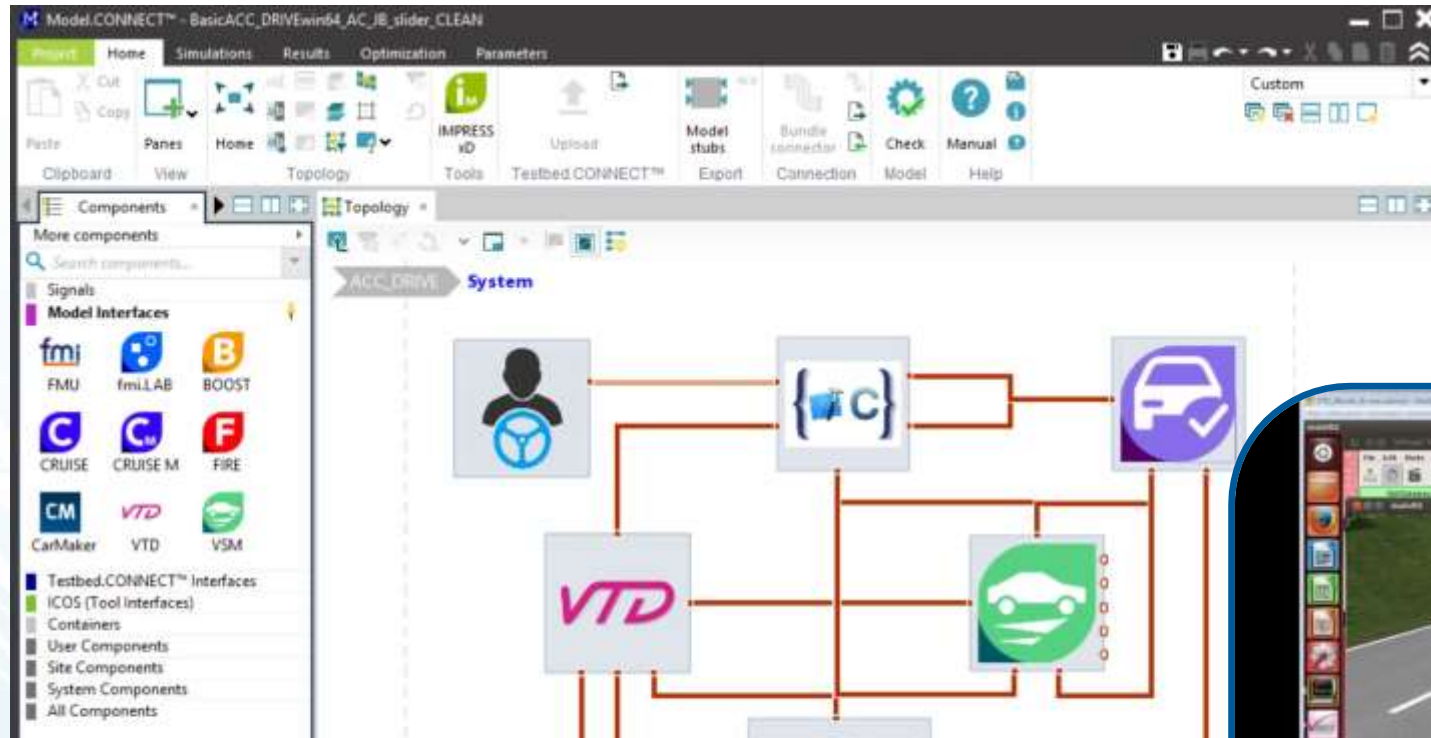


Model.CONNECT: aligning model exchange and integration process within organization



ADAS/HAD

ADAS/AD: Development, Testing and Validation of Active and Preventive Systems



**USE CASE:
Adaptive Cruise Control
w. Lane Keeping Assist**

Project Reference: Platooning



3-10% fuel cost saving!

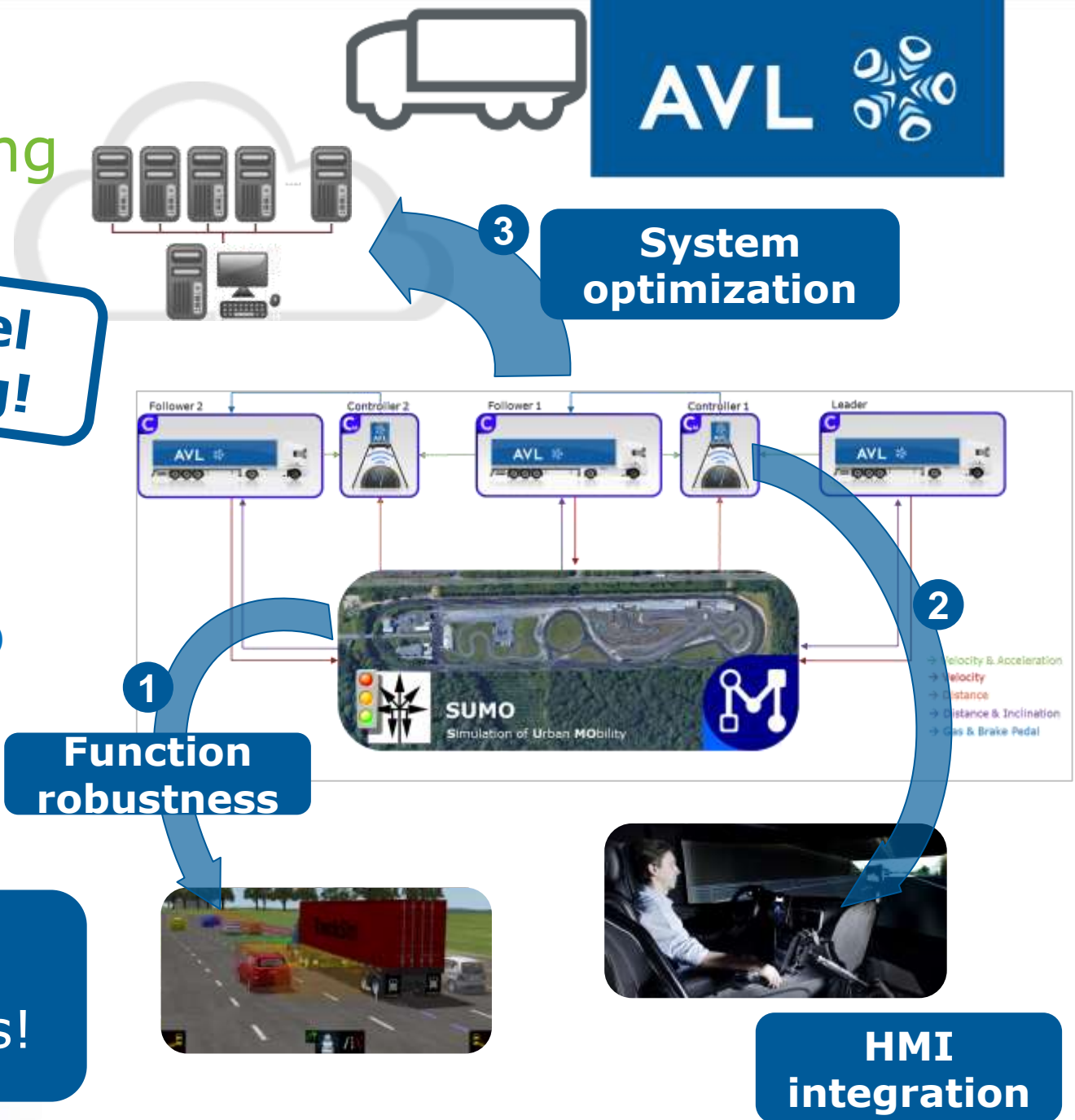
Design objectives:

- Variable safety distance
- Fuel consumption reduction
- Interaction between various ADAS functions

Simulation toolchain:

- Road and traffic simulator (**SUMO/VTD/PreScan etc.**)
- Truck models (**AVL CRUISE**)
- Control functions (**Matlab or actual hardware**)
- Integration platform (**Model.CONNECT**)

Road test cases performed in a virtual environment after 2 weeks!



Project Reference: Park Assist



AVL Scenario Database

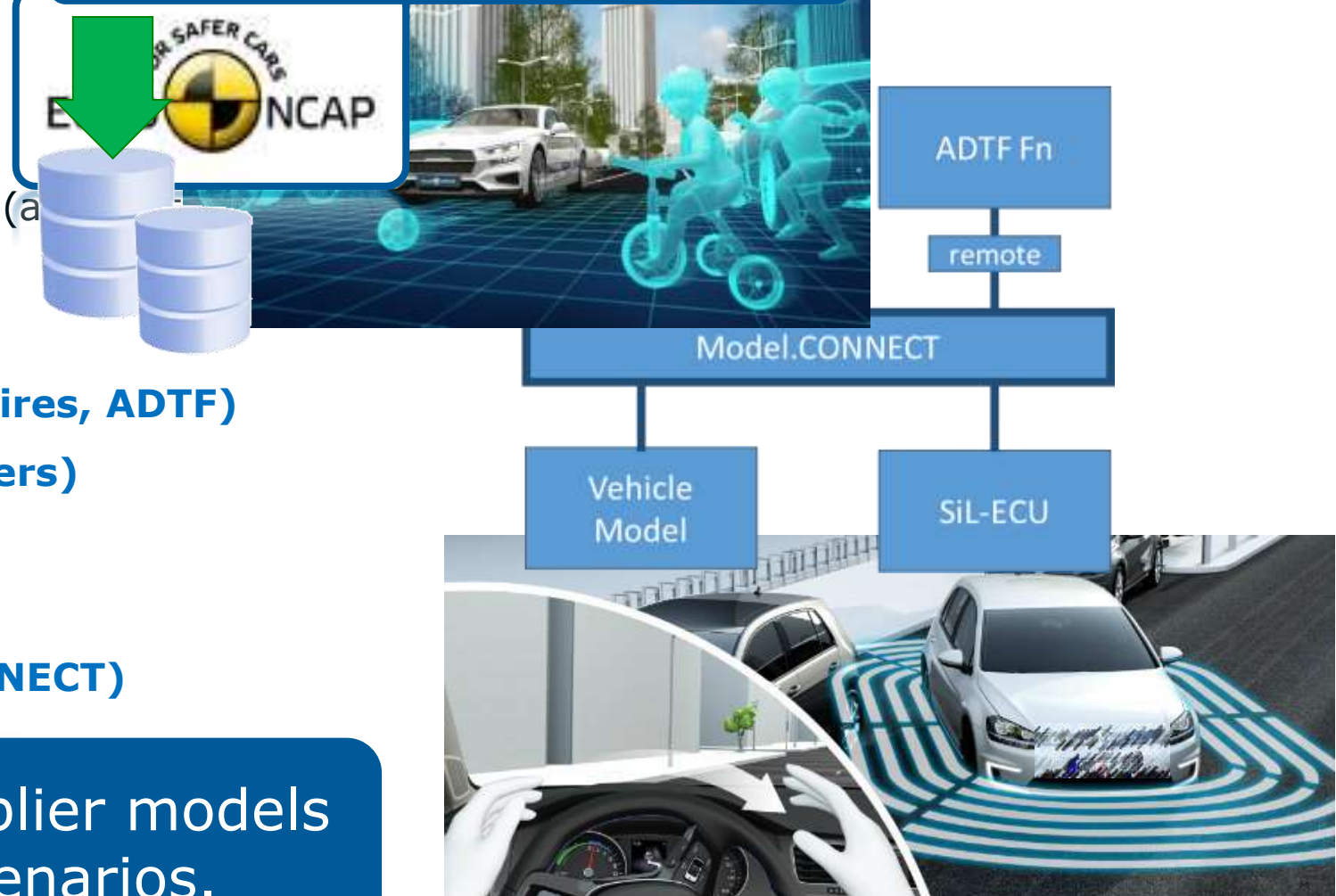
Design objectives:

- Safe and fast autonomous parking
- Options for different vehicle types (a

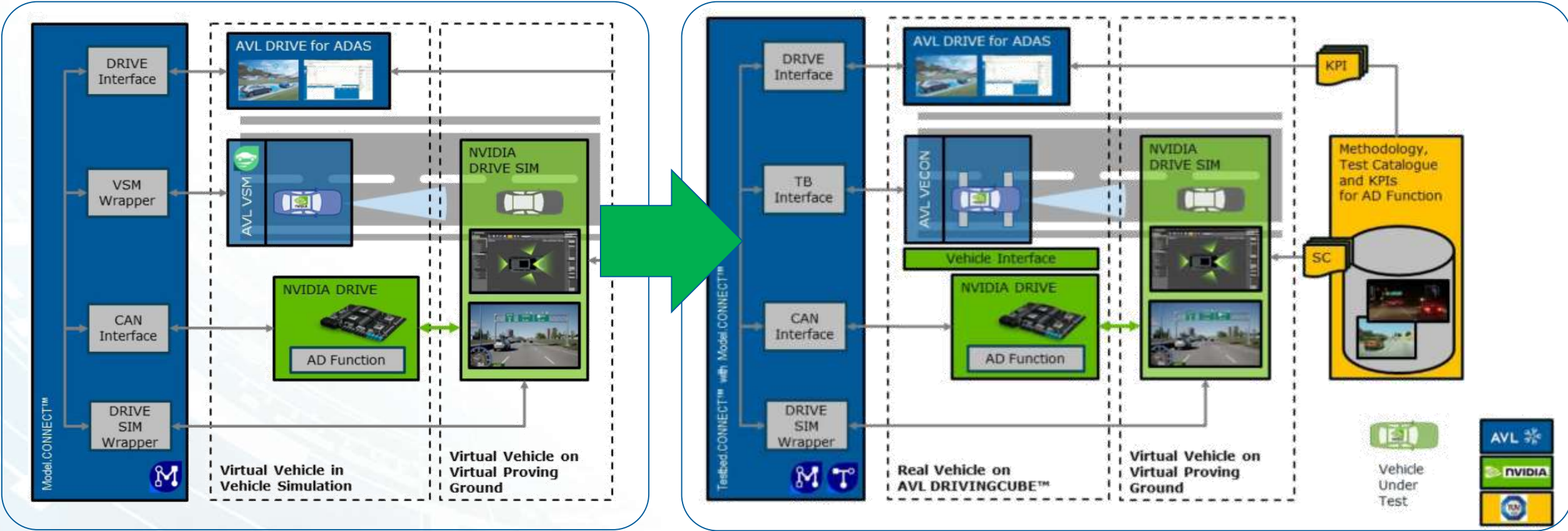
Simulation toolchain:

- Road and traffic simulator (**VTD Vires, ADTF**)
- Sensor models (**different providers**)
- Vehicle models (**In-house tools**)
- Control functions (**C-code**)
- Integration platform (**Model.CONNECT**)

Easy integration of supplier models and open format scenarios.



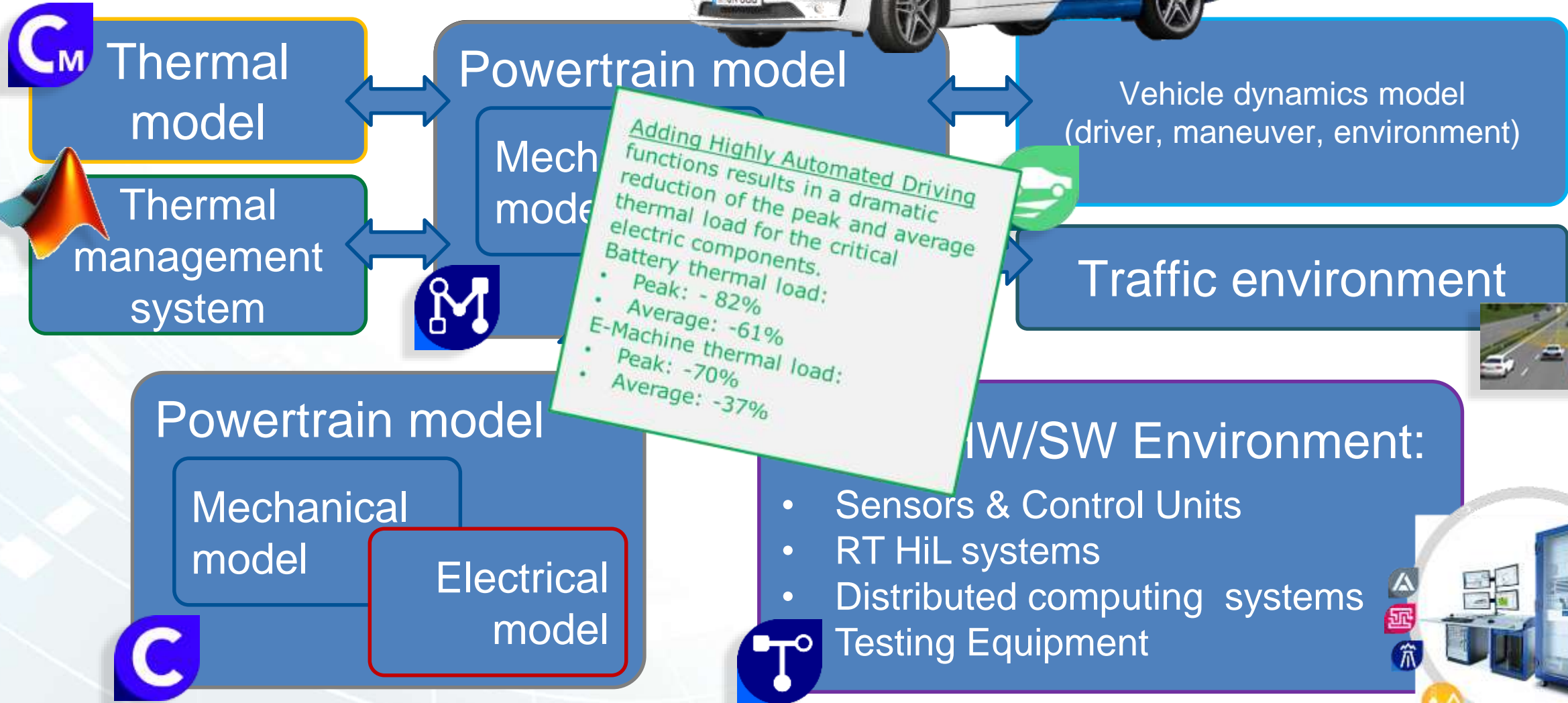
"AVL, TÜV SÜD AND NVIDIA TEAM UP FOR ADAS/AD"



The most efficient validation will be done by those who use the smartest combination!

ELECTRIFICATION

Project Reference: Energy Efficiency Optimization for 800V BEV



Adding Highly Automated Driving functions results in a dramatic reduction of the peak and average thermal load for the critical electric components.

Battery thermal load:

- Peak: - 82%
- Average: -61%

E-Machine thermal load:

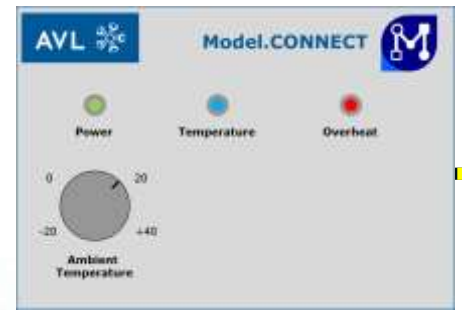
- Peak: -70%
- Average: -37%



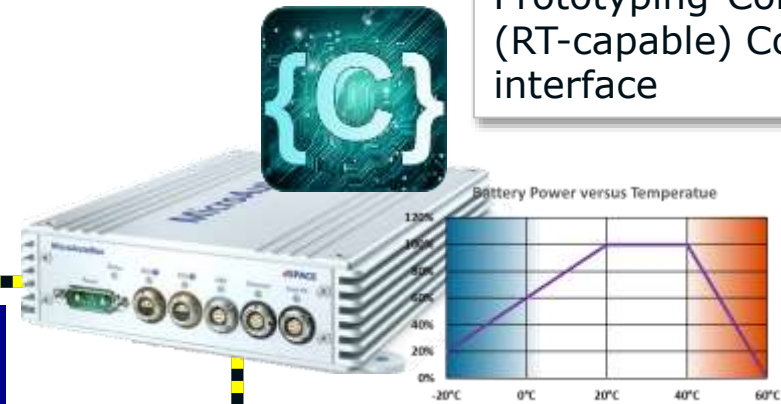
Energy Efficiency Optimization for 800V BEV Thermal Management In The Loop



HMI
Change model parameters while simulation is running



Thermal Management Controller
Prototyping-Controller linked to (RT-capable) Co-Simulation via CAN interface



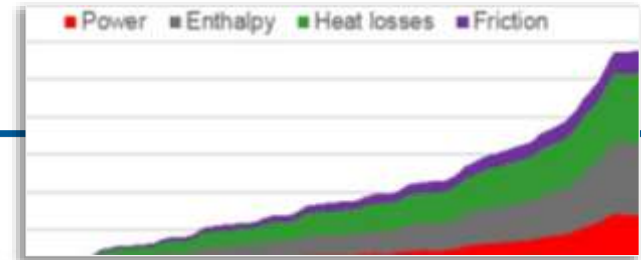
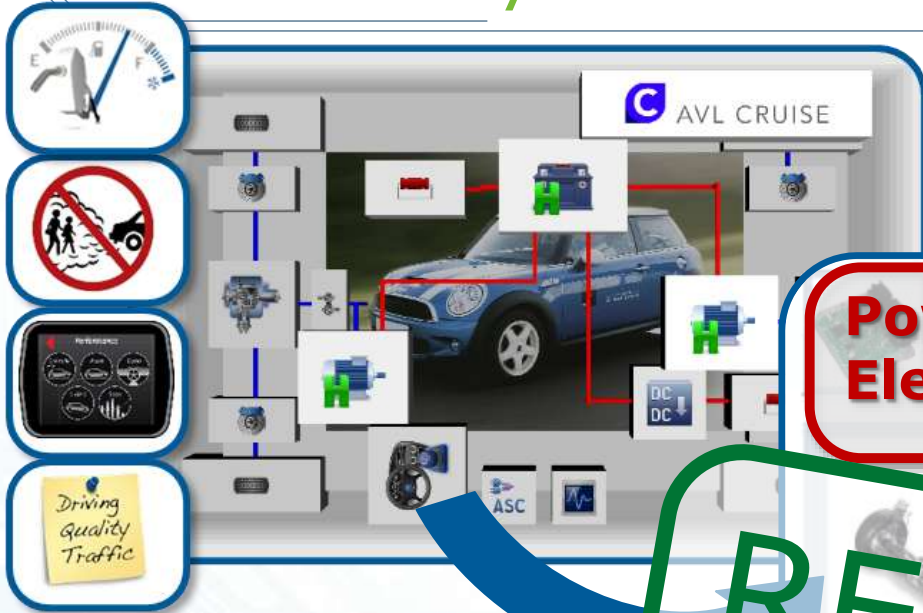
Vehicle/Powertrain
Mechanical and electrical model of vehicle



Cooling System
Passive or active battery cooling

RDE

AVL CRUISE M: The Factory of Premium Real-Time Models



Power-Electronics

Engine

Cooling

Aftertreatment

Lubrication

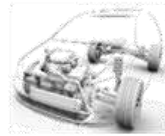
Hydraulics

REAL-TIME CAPABLE

- Applications:**
- Fuel Efficiency & Emissions
 - Performance & Drivability
 - EV/HEV
 - Control function development
 - Thermal Management
 - Aftertreatment etc.



Project Reference: RDE test frontloading in the office



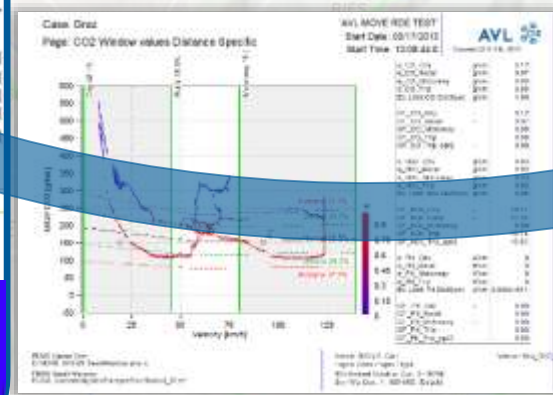
Office

LAB/HiL

Rig

Road

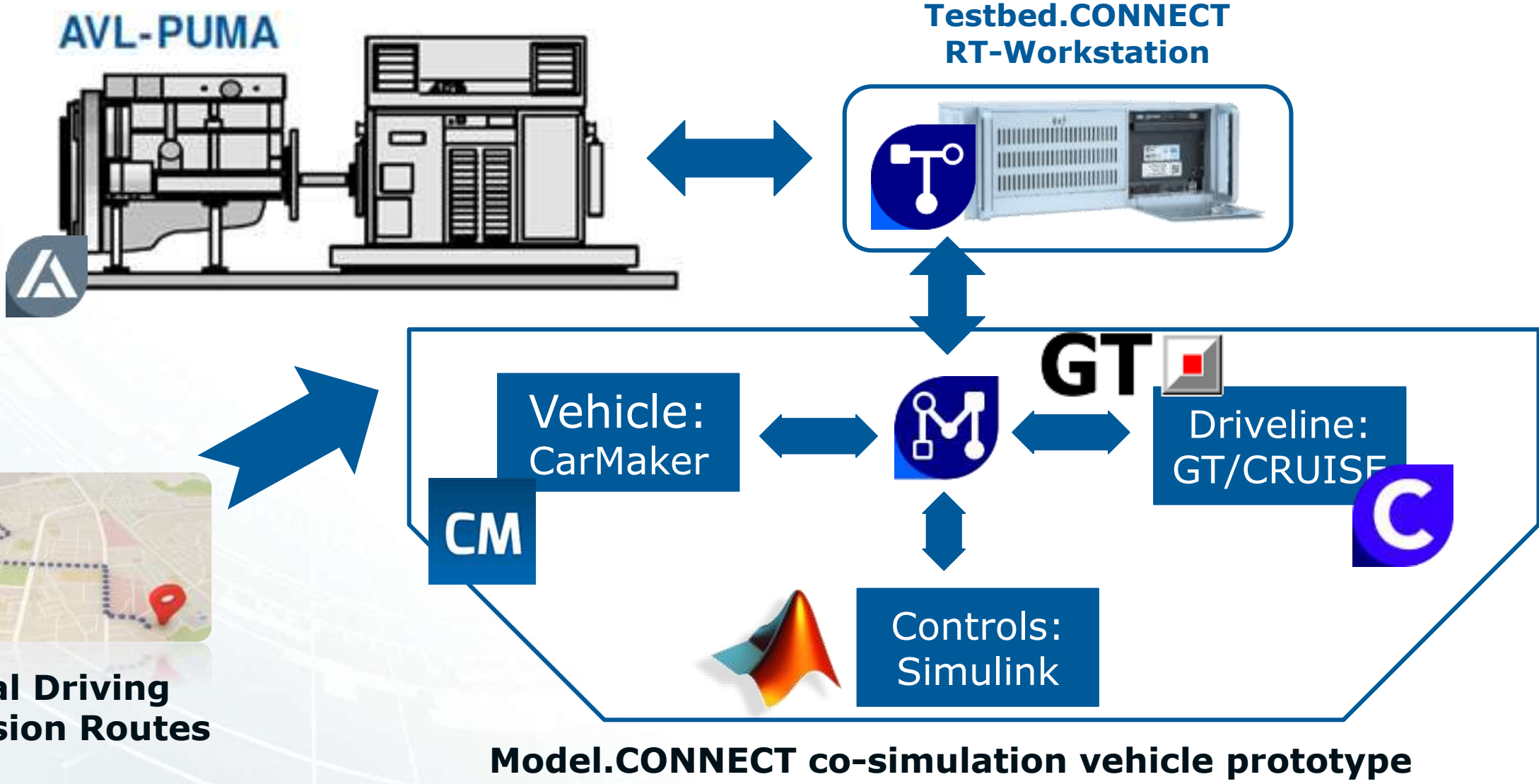
Engine



FMU
Aftertreatment

CM

Customer Reference: Real Driving Emission Testing Environment on Engine Testbed



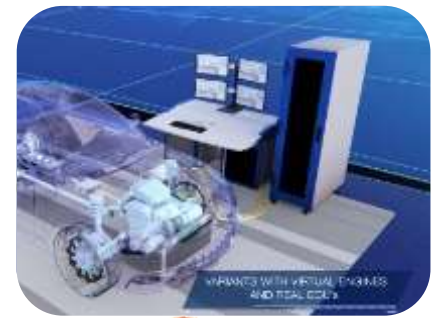
Real Driving Emission Routes

Model.CONNECT co-simulation vehicle prototype

INTEGRATED AND OPEN DEVELOPMENT PLATFORM



SIMULATION



TESTING

