CS-LABCAR
High Performance HiL Testing for Chassis Systems

Automotive Test and Validation
Key Market & Technology Trends

Market Trends

- Requirements have shifted from "new features" to availability (24/7), stability, intuitive operation
- Automotive electronics test departments becoming increasingly price sensitive
- Wide variety of different ECUs in chassis market (ABS, ESP, DCU, Driver assistance systems)
- Tier-1 and OEMs invest in commercial test automation solutions

ETAS Solution: CS-LABCAR

- Modular system architecture
- Easy to integrate third party models
- Process integration in automotive industry
- Good long term price/performance ratio

CS LABCAR
Benefits

Usability ...
ensures time and cost efficiency as well as safe set-up and operation

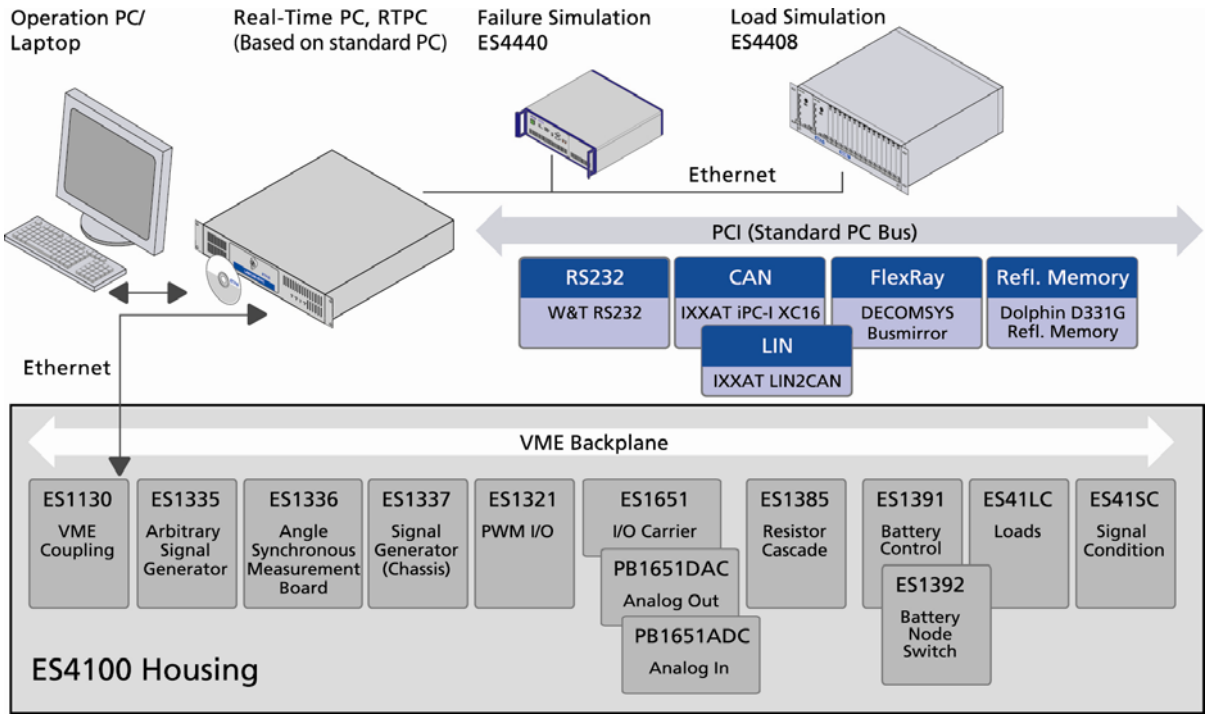
Investment Protection ...
reduces total cost of ownership

Scalability ...
allows modular and cost efficient extensions and upgrades

Adaptability ...
provides easy reuse across test projects and ECU variants

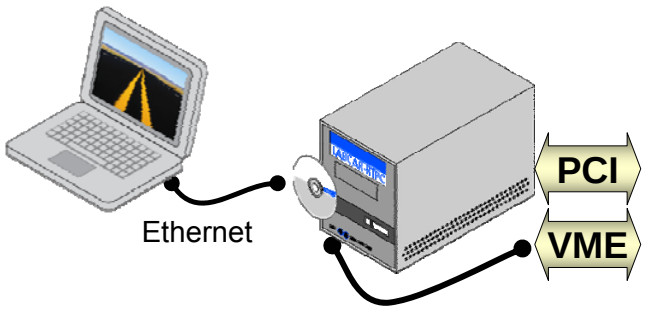
LABCAR
System Architecture Overview

- Open architecture guaranties:
  - Easy enhancements for future requirements
  - Efficient updates

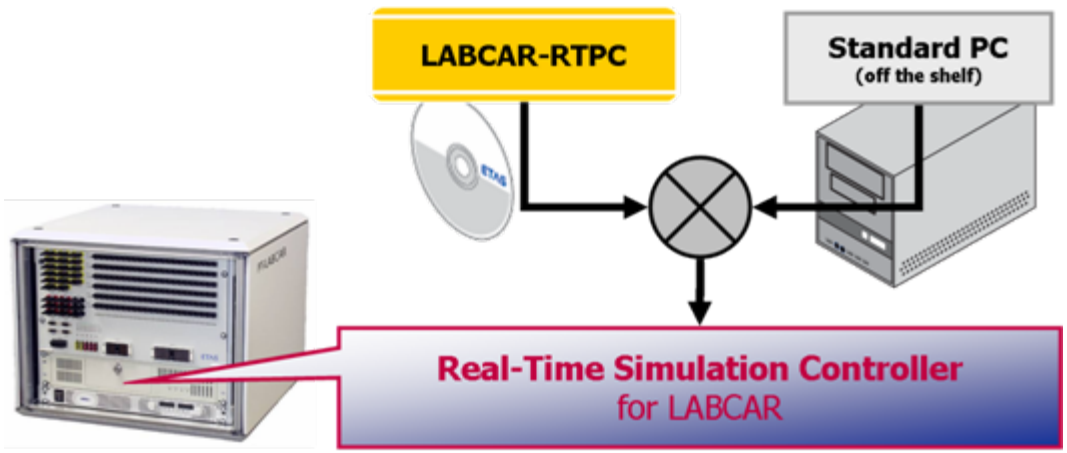


LABCAR-RTPC (Real-Time PC)
Standard PCs for Real-Time Calculations

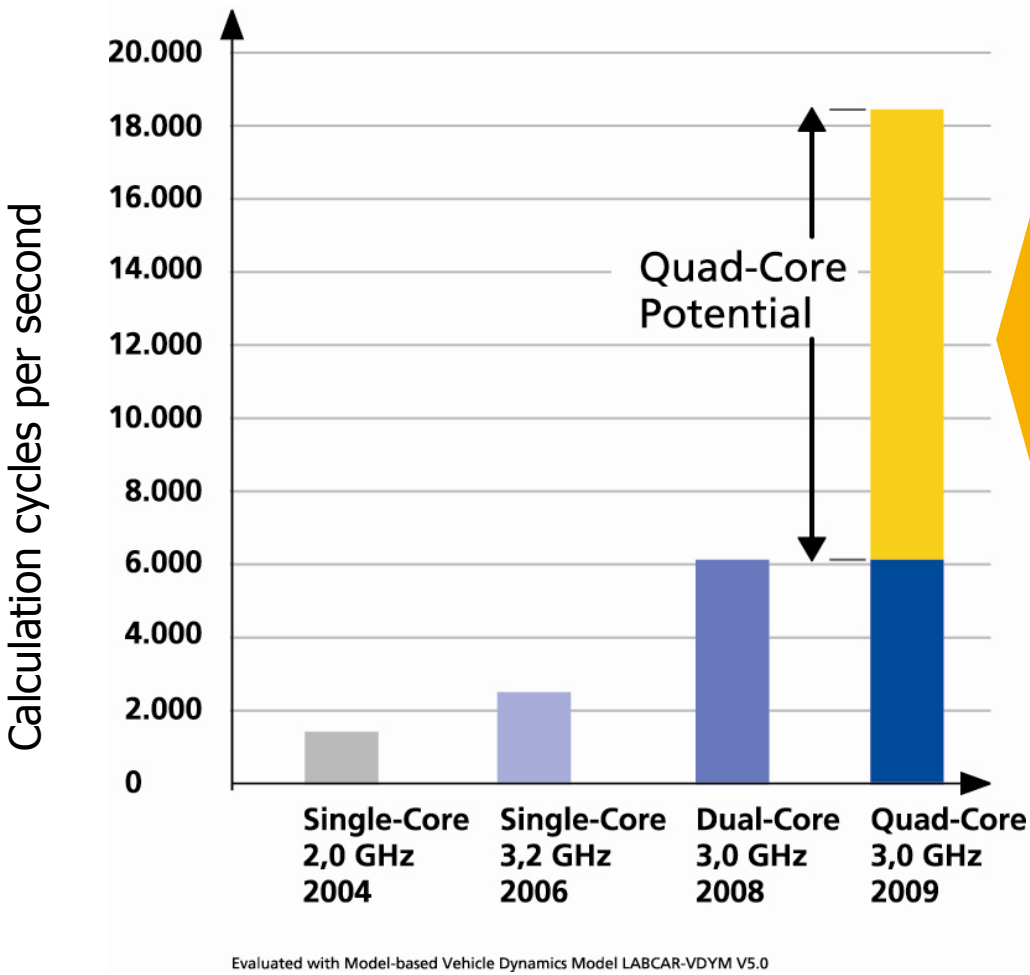
LABCAR-RTPC V3



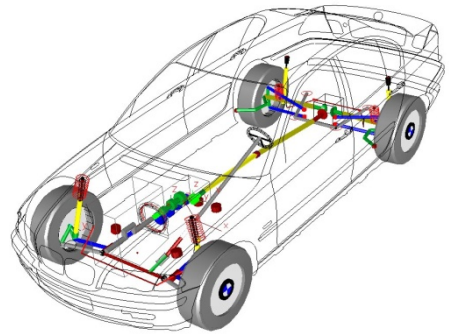
✓	Commercial standard PCs can be used as high-performance simulation target
✓	Leverages continued increase in PC computing power
✓	Provides access to standard HW bus systems (PCI, PCIe)



LABCAR Innovations
Verifiably Faster



- Soaring increase of calculation speed with the use of RTPC multi-core CPU



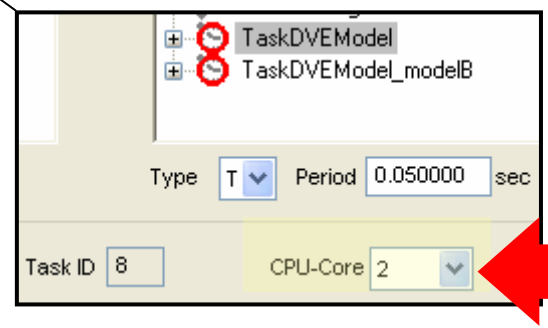
Verified with the vehicle dynamics model LABCAR-VDYM V5.0 (using Euler method)

LABCAR-RTPC
Quad-Core Support

High-performance real-time simulation for LABCAR

- Support of standard-PC quad-core processors
- Allows assigning tasks to cores in LCO
- Parallel simulation of complex models increases performance

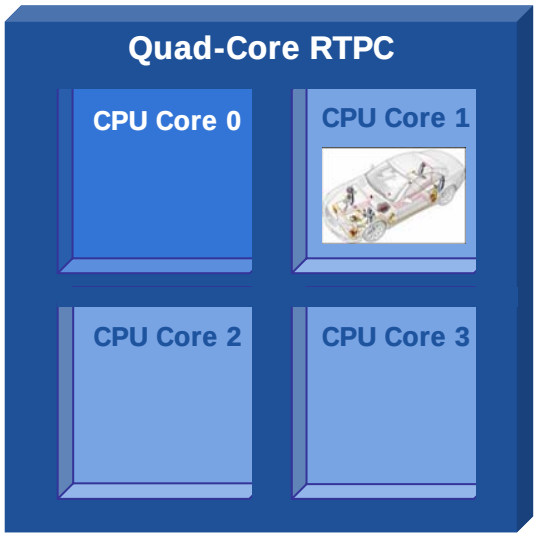
- Multi-Core support is bound to a specific number of cores.
- Today: Quad Core
- 2008: Dunnington 6-Core
- 2009: Nehalem EX 8-Core



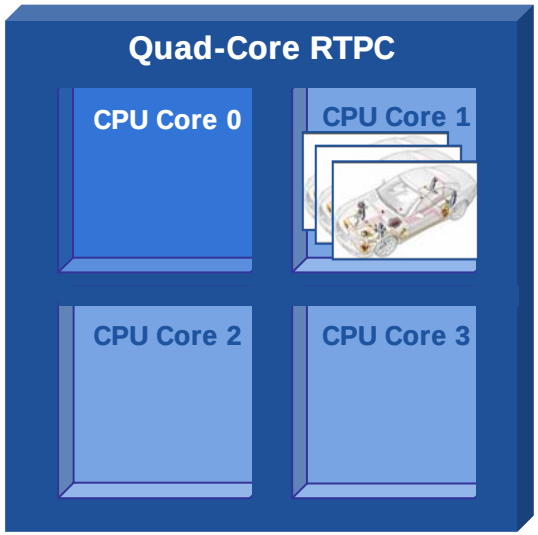
OS-Settings

LABCAR-RTPC
Performance – Runtime

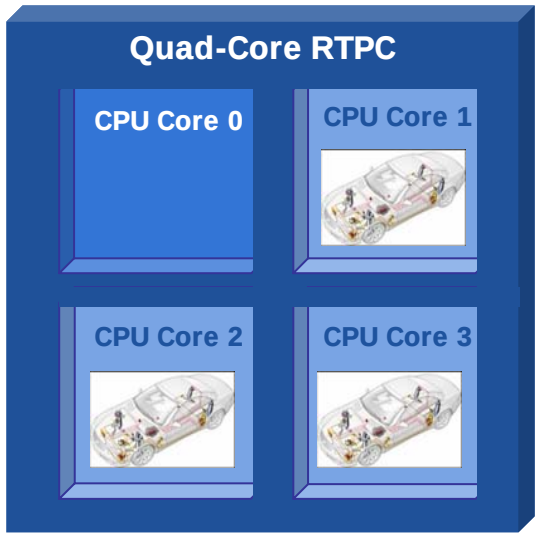
1 Model on 1 Core



3 Models on 1 Core



3 Models on 3 Cores



Core 0	-	Core 0	-	Core 0	-
Core 1	15 µs	Core 1	45 µs	Core 1	16 µs
Core 2	-	Core 2	-	Core 2	16 µs
Core 3	-	Core 3	-	Core 3	16 µs

CS-LABCAR
Summary

LIVE DEMO
Stand 1642
Hall 1

- HiL System for closed-loop testing of cassis system ECUs
- System oriented product data model
- Excellent price/performance ratio
- Open and scalable architecture
- Reduced efforts for operation by standardization
- Reliable, proven technology
- Compact size

LABCAR Innovations Worldwide!

Muchas gracias

Thank you

谢谢

Tack så mycket

Děkuji

धन्यवाद

Mille Grazie

Hvala

Merci

sağ olun

감사합니다.

有難うございました

Спасибо!

Vielen Dank

Kiitos

Д‘якую

TESIS DYNAware

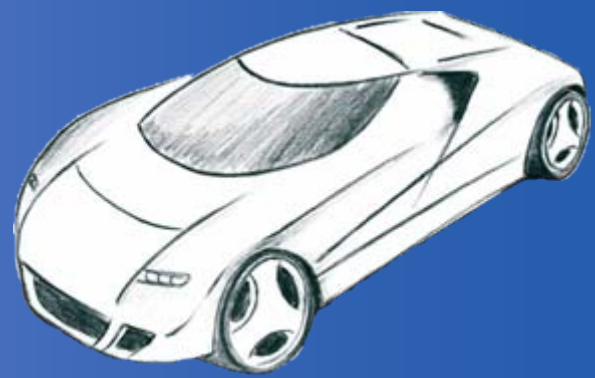
- CS LABCAR Interface
- veDYNA Applications

Karl-Eric Köstlin, TESIS DYNAware GmbH, 17 June 2009

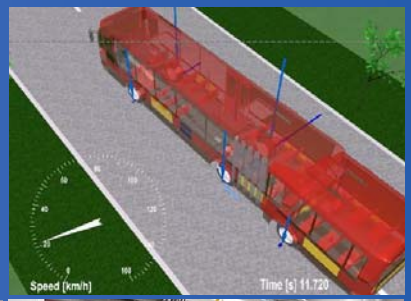
CS-LABCAR & veDYNA
Product Overview

- **veDYNA** - Vehicle dynamics simulation
- **enDYNA** - Combustion engine simulation
- **Realtime BrakeHydraulics** –Brake hydraulics simulation
- **Traffic Environment**, **Driver Model**, **3D-Road Model**
- **DYNAanimation** - 3D online animation tool
- **Suspension Toolbox** – Automated analysis of axle models
- **Hybrib Toolbox** – Hybrid Electric Vehicle Solutions

- **Common to all Products**
  - Real-Time capable
  - Matlab/Simulink based
  - Modular structure, open, scalable



CS-Labcar



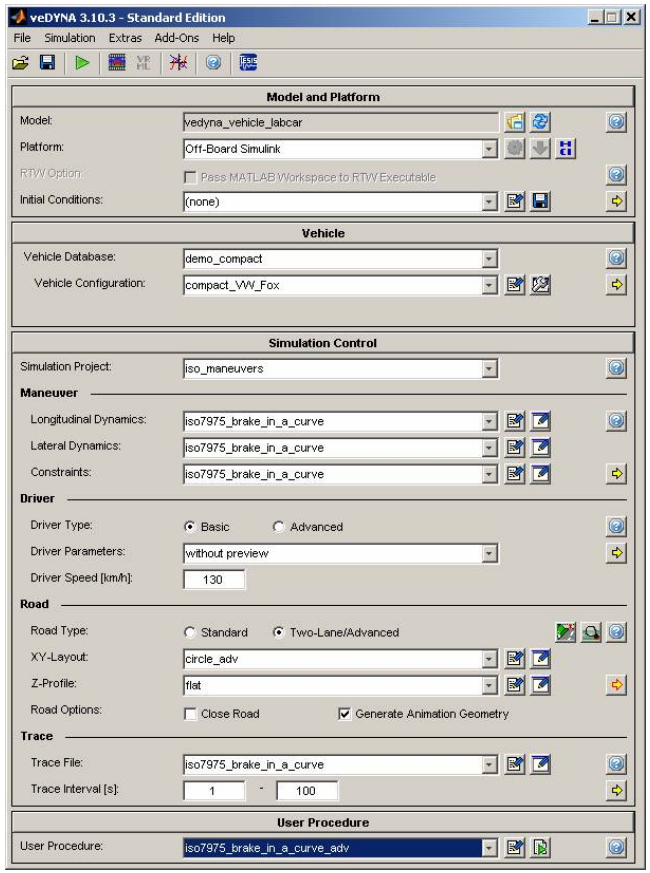
CS-LABCAR & veDYNA
CS-LABCAR Concept

- **“Chassis System” HiL Simulator**
- Based on ETAS **extendable** hardware
- Integrated **TESIS DYNAware** simulation software
- Support for **Controller Function Development:**
  - **Brake**: ESP, EPB, Trailer stabilisation
  - **Driveline**: 4WD, Torque vectoring, E-diff, Haldex
  - **Steering**: EPS, AFS, RWS
  - **Comfort**: Air suspension, Active damper, Roll control
  - **Driver assistance systems**: ACC, LDW
- Can be merged with **PT-LABCAR** & other HiL systems to create a Virtual Vehicle HiL for GCC

CS-LABCAR & veDYNA

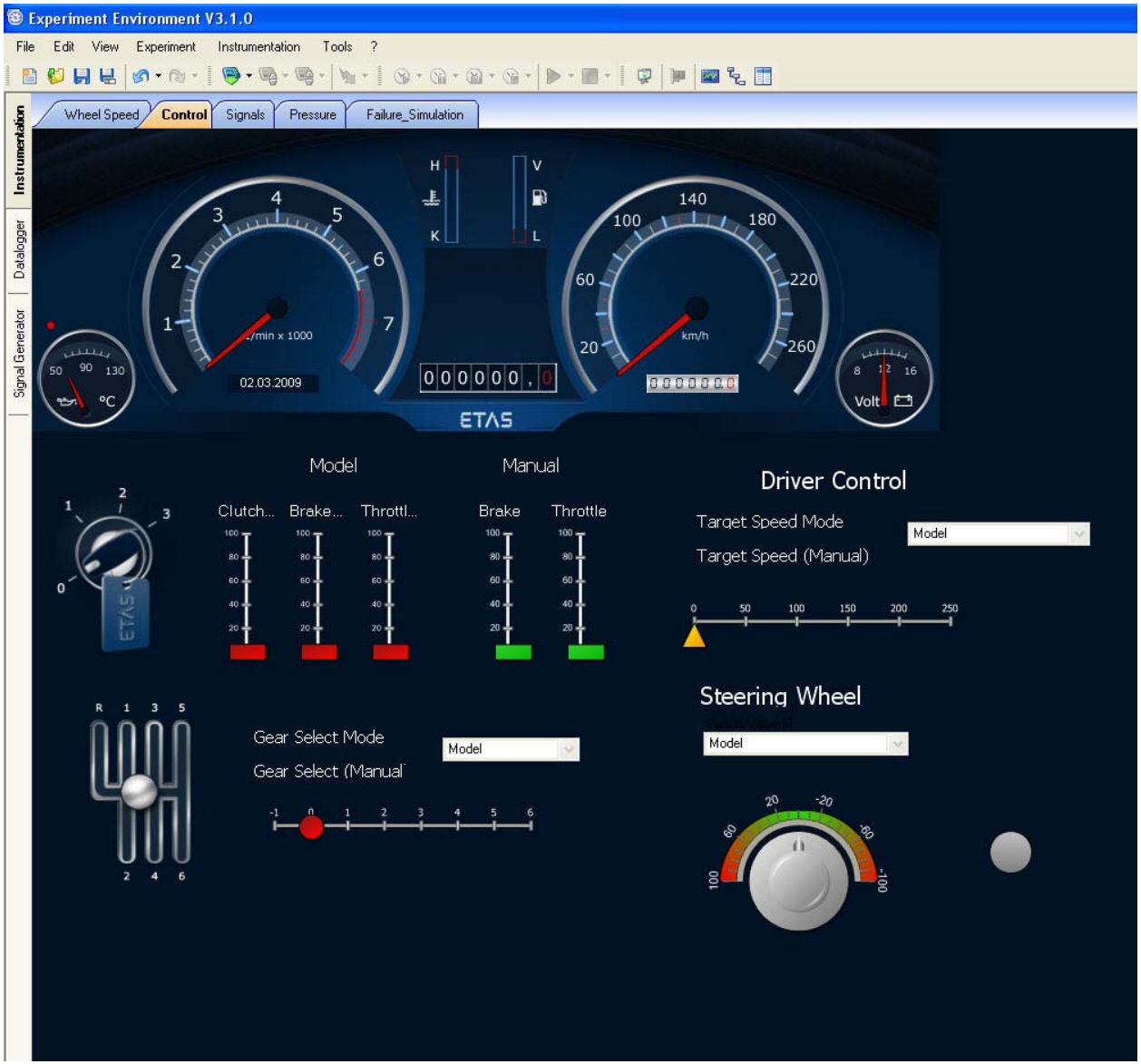
CS-LABCAR: ESP Reference System

- **Bosch ESP ECU + RTPC + LCO + veDYNA + BrkHyd**
- **Standardised** Simulink **interface** for ESP/ABS ECUs
- Clear Simulink **signal flow** which is easily **extendible by user**
- Direct loading of veDYNA Maneuvers and Vehicle **Parameters** to RealTime Application
- Direct **Plot** visualisation
- Online **animation (DYNAanimation)**
- Same look and feel for **offline or RealTime** applications



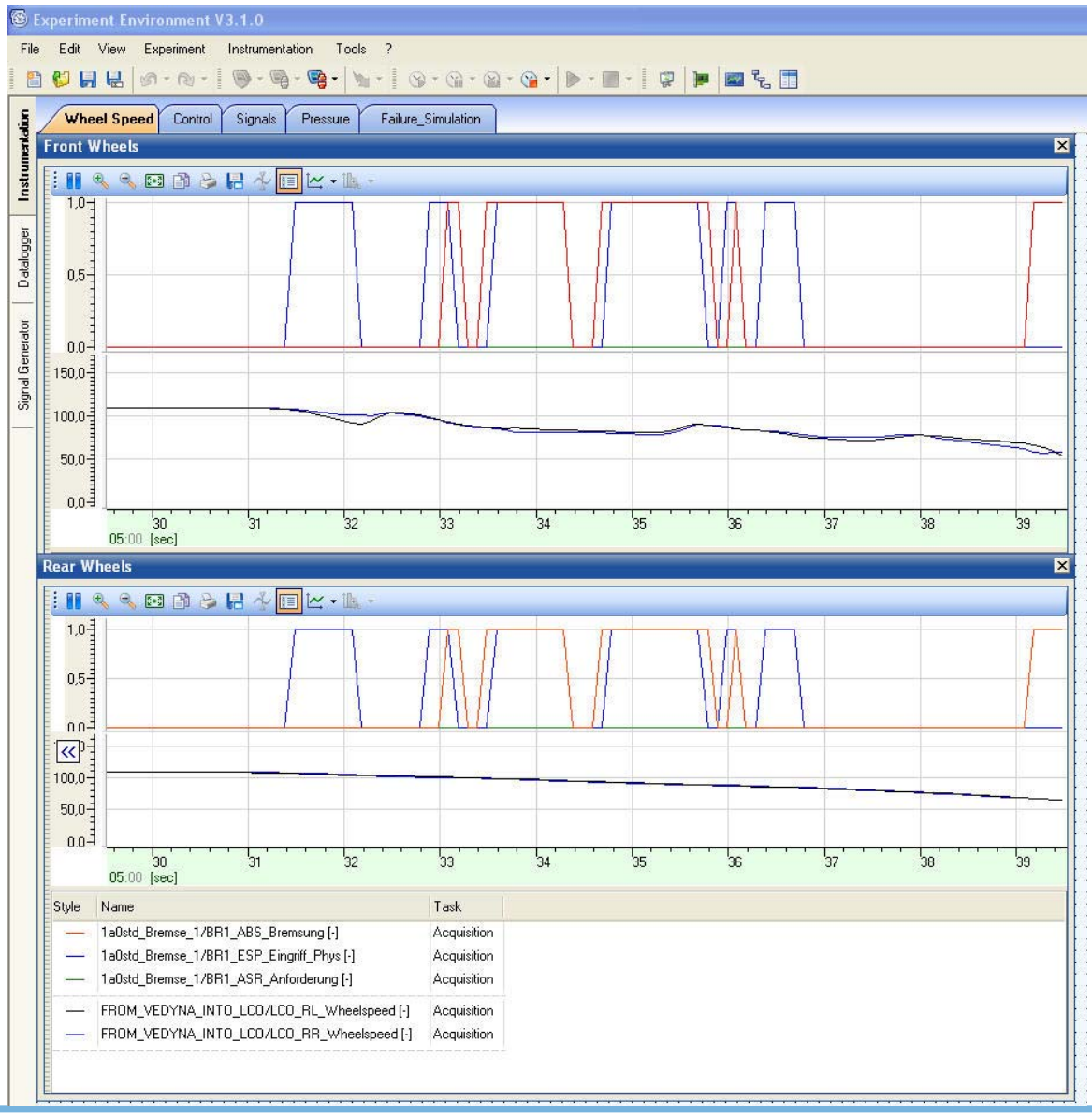
CS-LABCAR & veDYNA

LABCAR Experiment Environment



CS-LABCAR & veDYNA

Results: Double lane change at 110km/h



ABS/ESP/ASR Flags

Wheel speeds

CS-LABCAR & veDYNA

veDYNA – I/O Interface

veDYNA Simulation Model
+ Realtime BrakeHydraulics

Feedback

- Hydraulic valves current
- ASR / MSR intervention

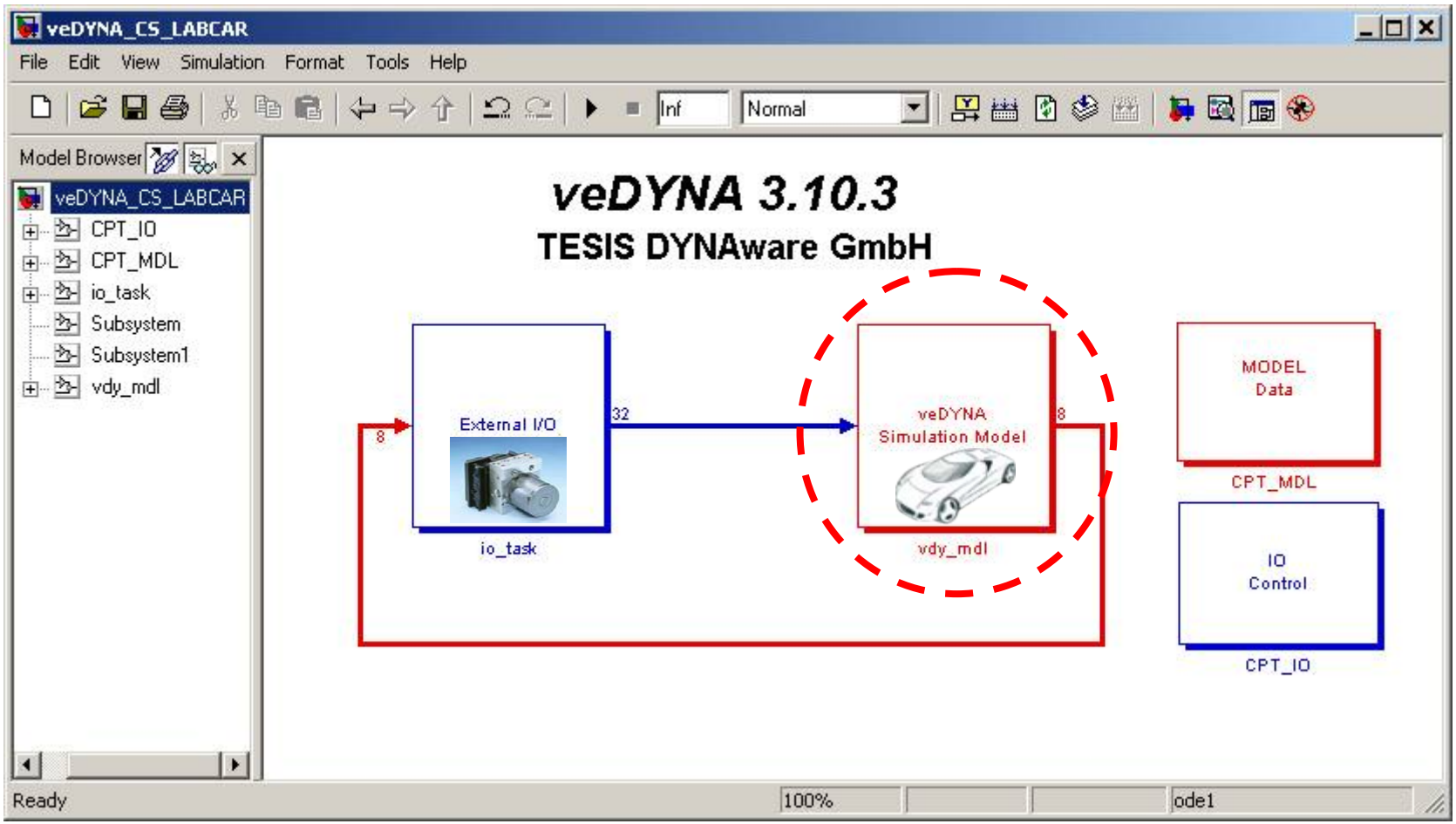
Simulated Data

- Yaw rate
- Steering wheel angle
- Longitudinal and lateral acceleration
- Wheel speeds
- Brake pressure

ABS / ESP Control Unit

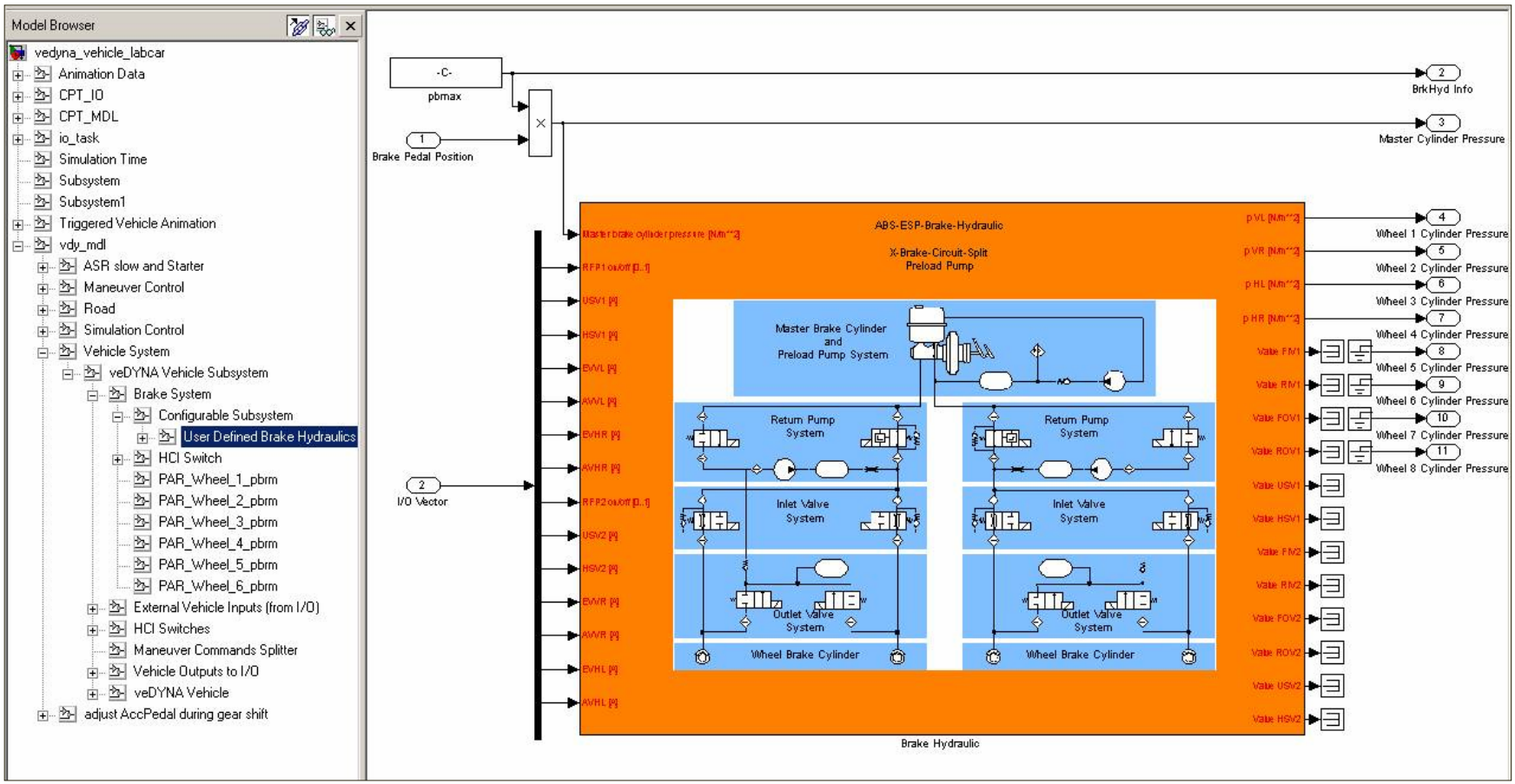
CS-LABCAR & veDYNA

veDYNA Simulink Interface

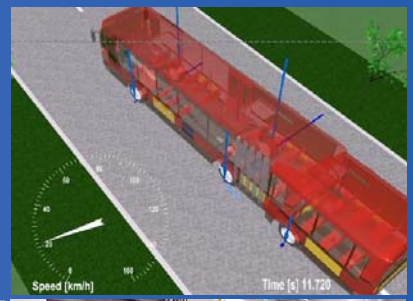


CS-LABCAR & veDYNA

veDYNA Simulink Interface: Brake Hydraulics

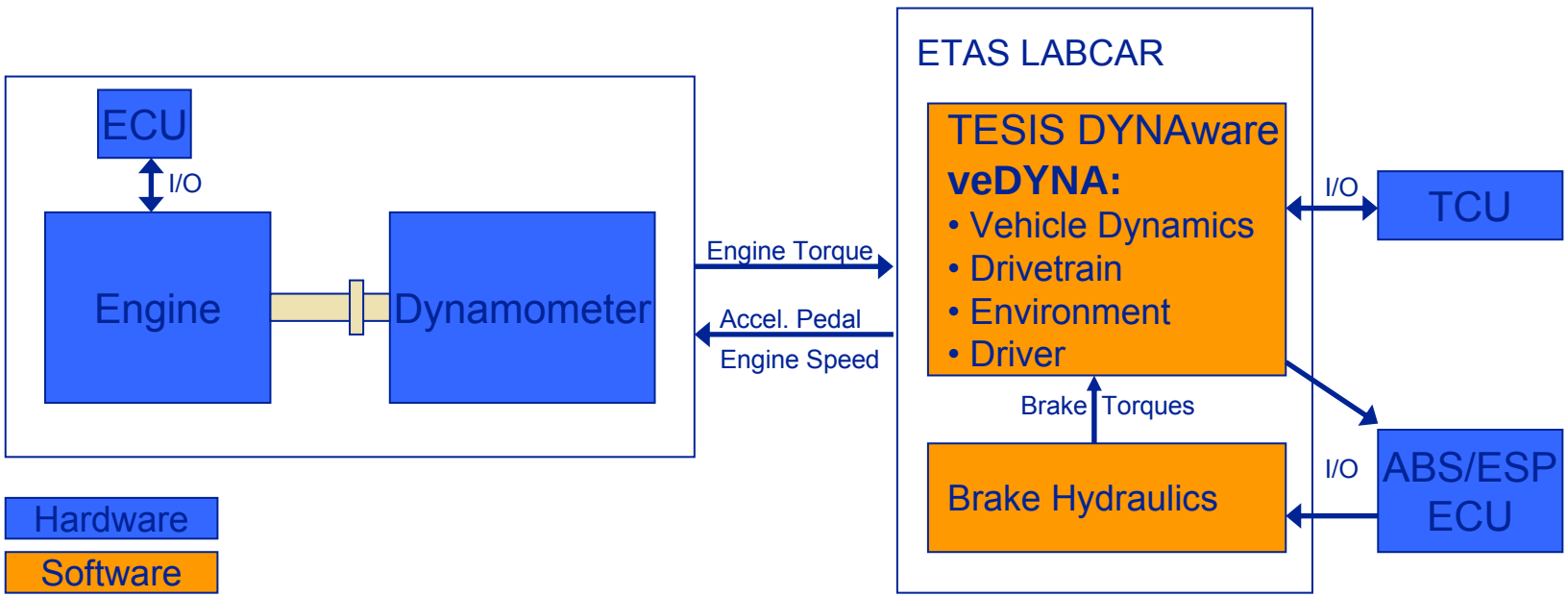


veDYNA Applications



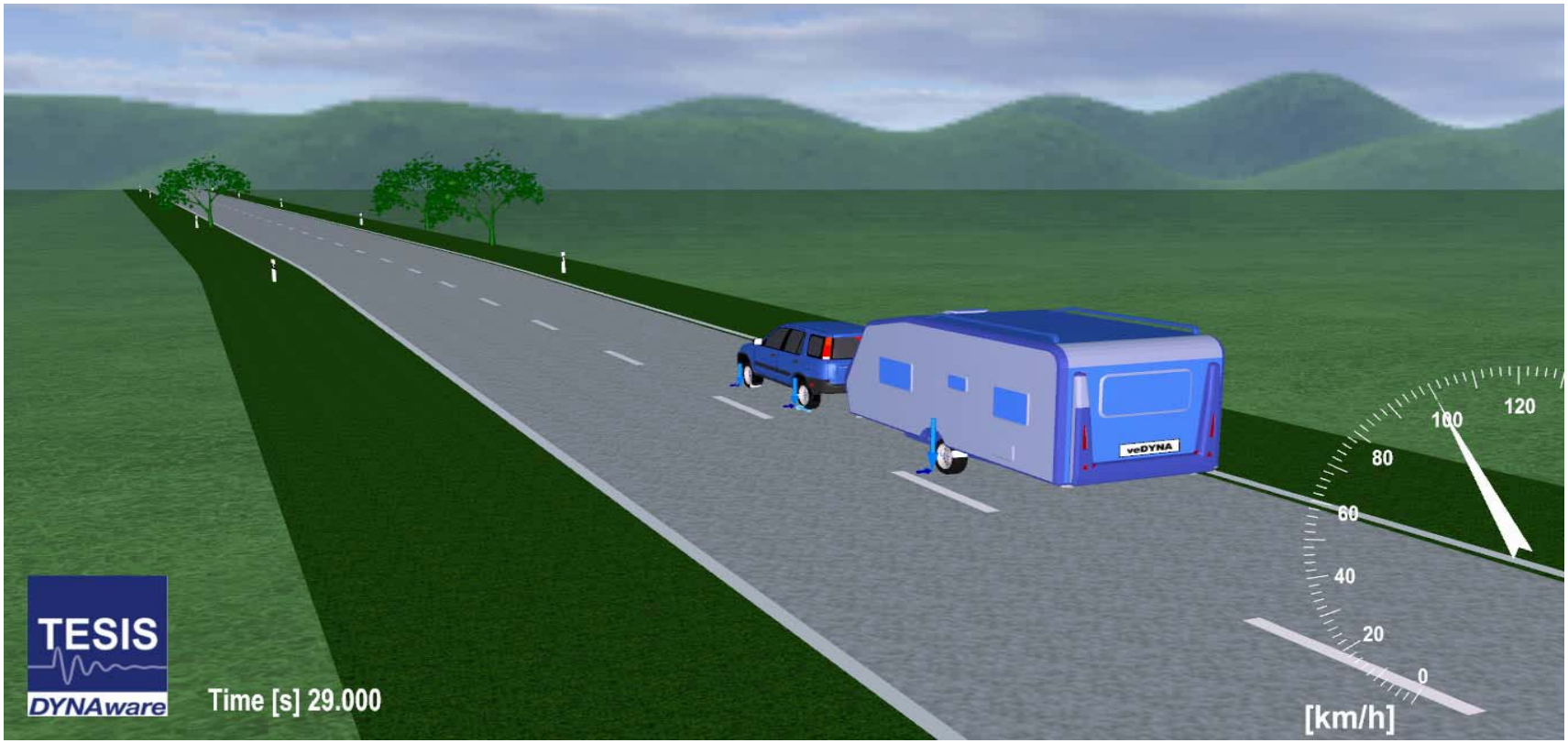
Engine-in-the-Loop (Hyundai, S. Korea)

- Investigate **fuel consumption** and **exhaust gas** of real engine
- Test automation for **controllers**: Engine ECU, TCU (AT), ESP ECU



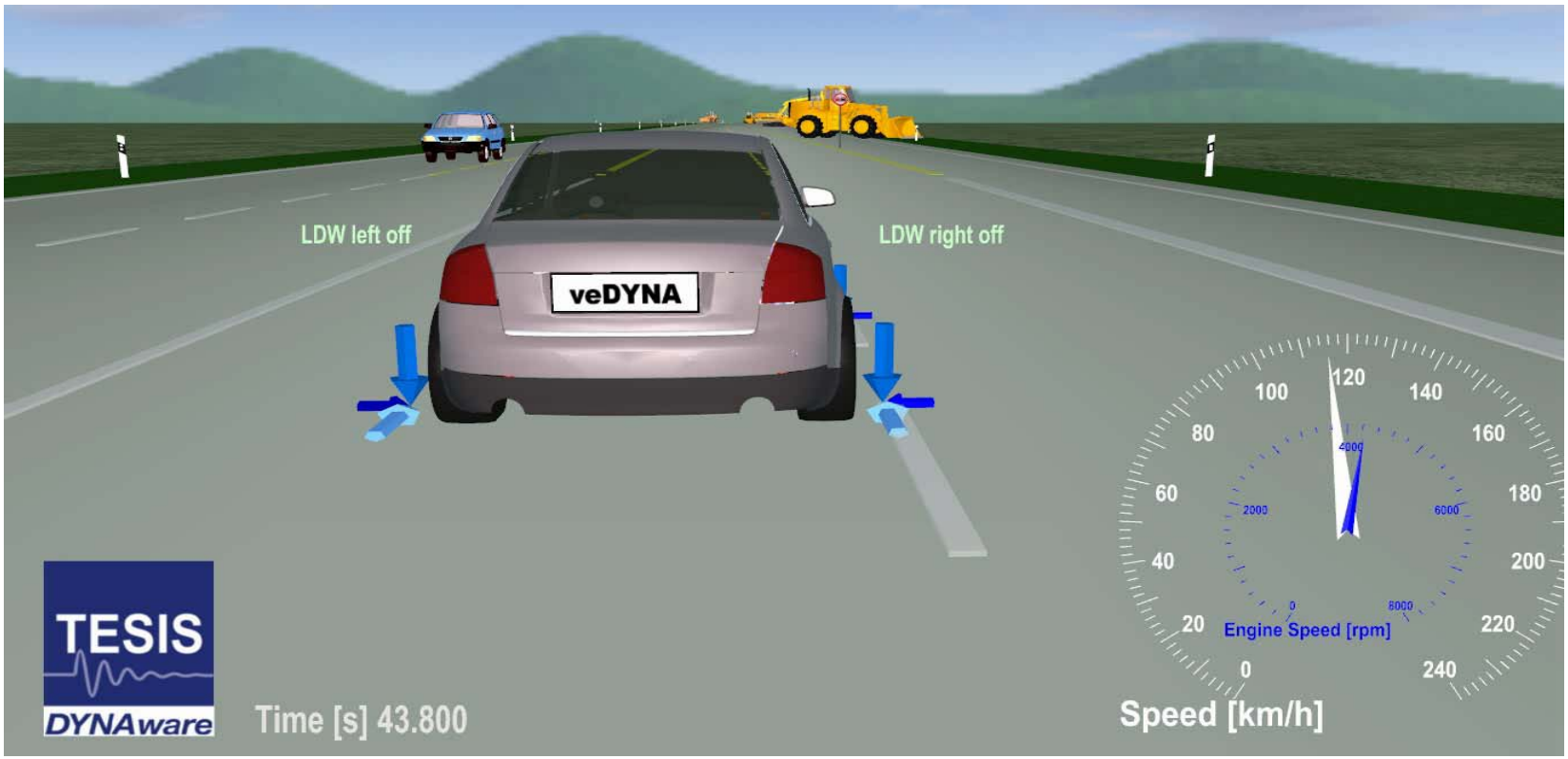
Trailer Stabilisation (Knott, Germany)

- Development and test of trailer stabilisation algorithms



Driver Assistance Systems (Various OEMs)

- Lane marks for LDW application



CS-LABCAR & veDYNA

Thank you

for your attention

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