GRPE / HDH Meeting
Presentation of research institute:
IFA, TU Vienna

IFA
Institut für Fahrzeugantriebe
& Automobiltechnik

TU Graz

TU WIEN
TECHNISCHE UNIVERSITÄT WIEN
Vienna University of Technology

Dipl.-Ing. Bernhard Schneeweiss

Institut für Fahrzeugantriebe & Automobiltechnik

Development of an exhaust emissions and CO_2 measurement test procedure for heavy duty hybrids (HDH)

Tasks and research institutes

Task	TU Vienna	TU Graz	TRL	Chalmers
#1: Investigation and modification, if applicable, of the HILS model and interface	+++	++	++	+
#2: Investigation and modification, if applicable, of the HILS component testing	+++			
#3: Extension of HILS to non-electrical hybrids				+++
#4: Inclusion of PTO operation, which normally takes place outside the test cycle		+++	+++	+
#5: Development of WHVC weighting/scaling factors to represent real world vehicle operation		+++	+++	+

+++ main work; ++ single work package; + consulting and dialogue

Presentation
Institute for Powertrains & Automotive Engineering (IFA), TU Vienna

Researchers:

1 Univ.-Professor	B. Geringer (Head of Institute)
1 Ao. Univ.-Professor	E. Pucher
1 Assoc.-Professor	P. Hofmann

27 Scientific employees (Assistants)

26 Non-Scientific employees

Infrastructure:

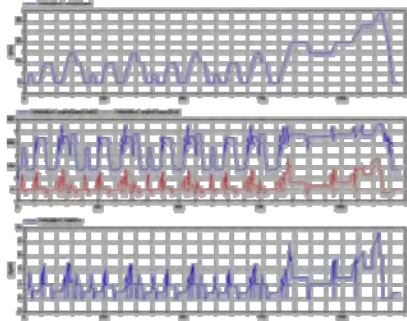| 13	Engine test beds
6	Air conditioned (down to -32°C)
2	highly dynamic
1	HiL test bed
1	4-wheel-Chassis dynanometer /w A/C (-32°C)

- Manufacturing of components and prototypes
- in-house Linux-Cluster

Core Competences
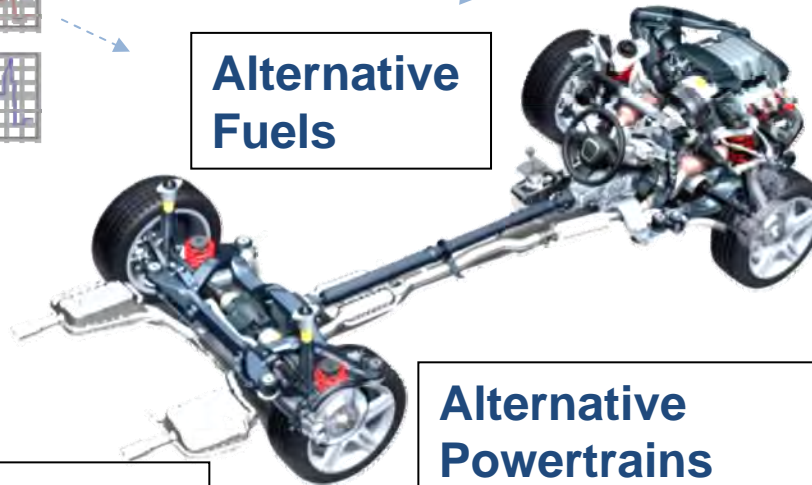## Institute for Powertrains & Automotive Engineering (IFA), TU Vienna

Numerical Simulation

Combustion and flame propagation

Alternative Fuels
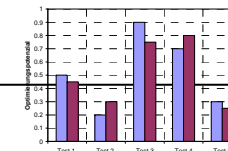
Component development

Electromobility

Alternative Powertrains

Exhaust gas aftertreatment

Trendanalysis & Technology assesments

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# Presentation
The HDH-HILS-Team at the IFA, TU Vienna

☐ Scientific guidance: Prof. Bernhard Geringer

☐ Key researcher, Project coordination:
Associate Prof. Dipl.-Ing. Dr.techn. Peter Hofmann

☐ Key researcher, Coordination of Simulation tasks:
Assistant Prof. Dipl.-Ing. Dr.techn. Thomas Lauer

☐ Research Assistant:
Dipl.-Ing. Bernhard Schneeweiss

IFA – Competences
## Simulation of vehicle's longitudinal dynamics (I)

- ☐ In-house development of a longitudinal dynamics simulation model programmed in *Dymola/Modelica*

- ☐ Simulation of conventional and hybrid vehicles

- ☐ modular design

- ☐ library of components
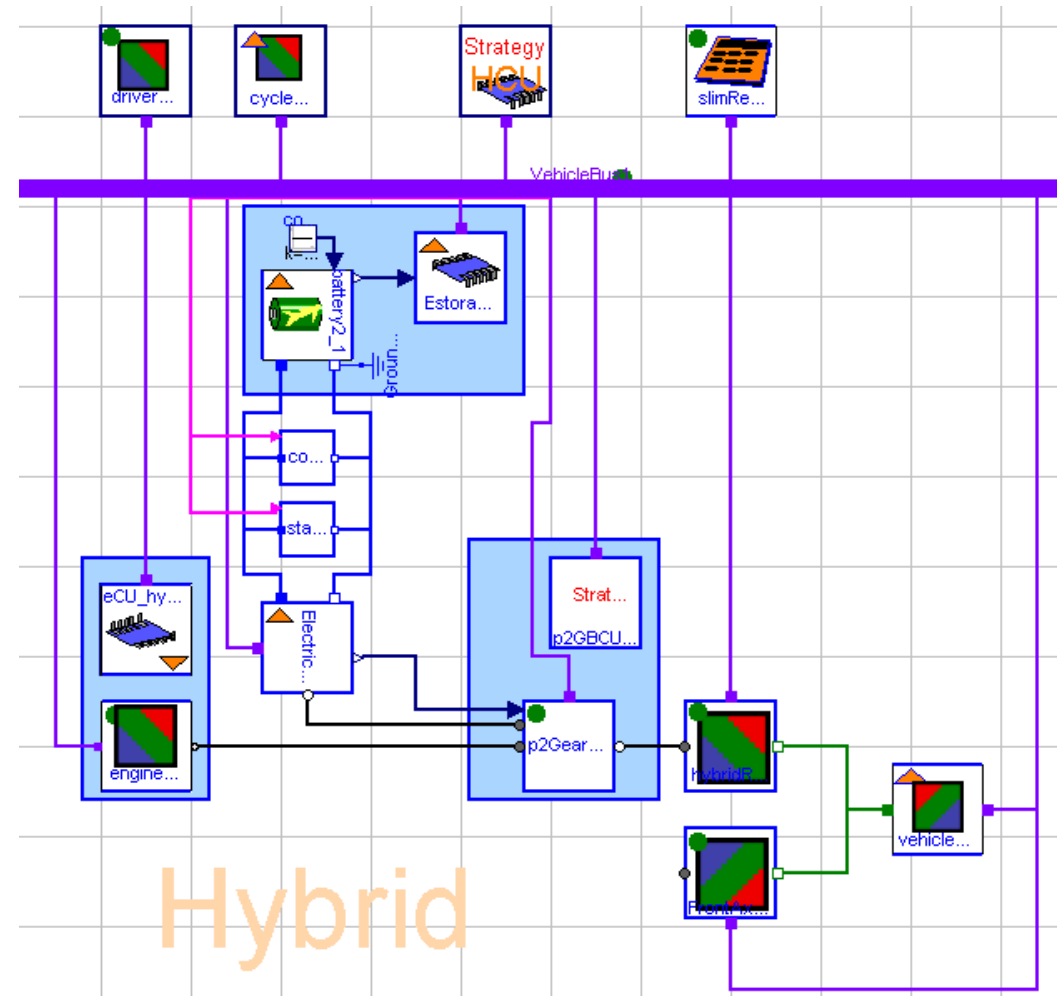
IFA – Competences
Simulation of vehicle's longitudinal dynamics (II)

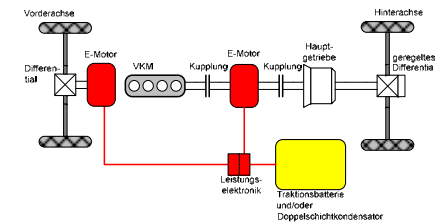☐ Longitudinal dynamics simulation model using commercial Software „GT Drive"
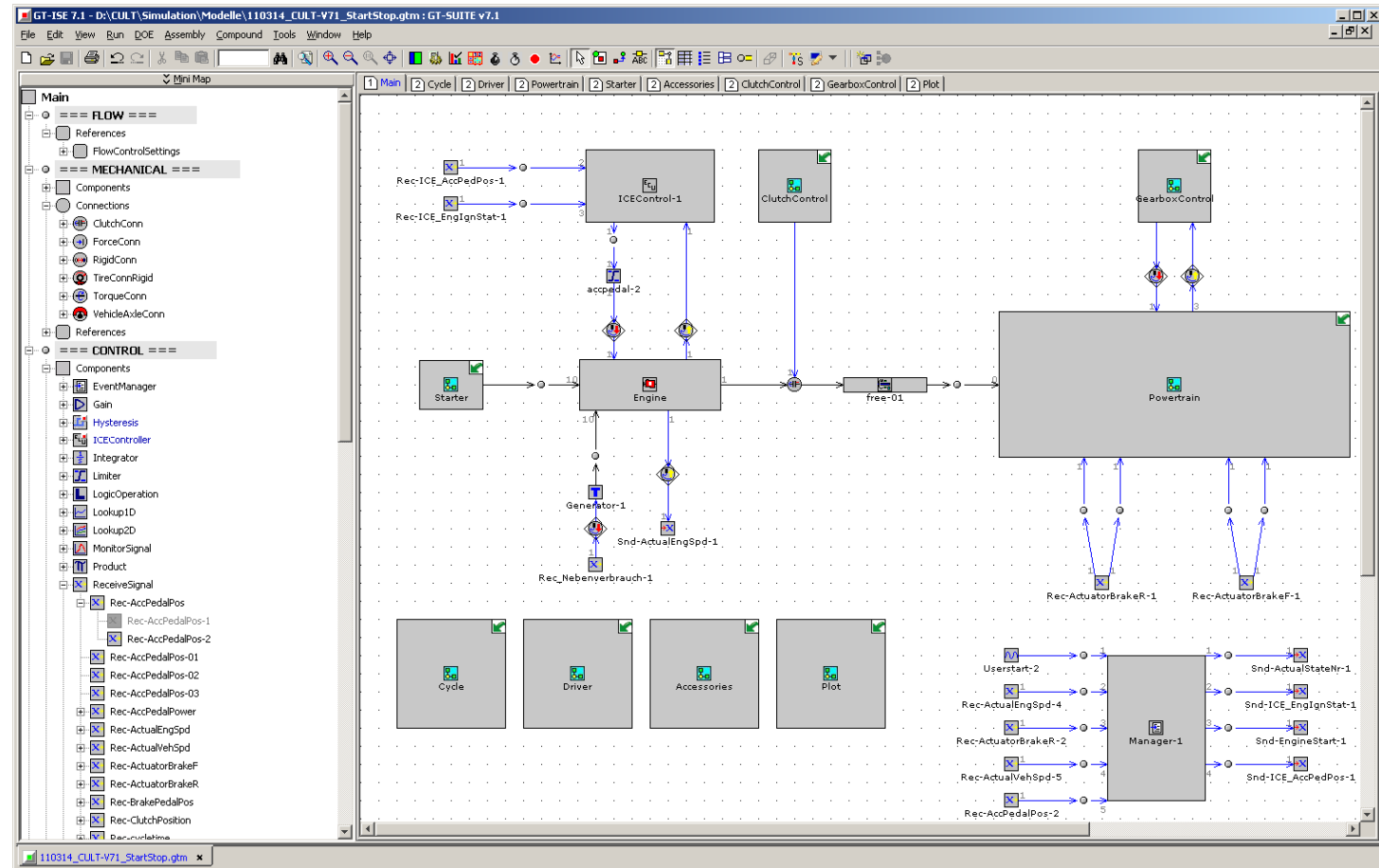
IFA – Competences
Project: „K-Net"

☐ Phase 1: Analysis of alternative Powertrain Concepts

☐ Phase 2: Development of a innovative Powertrain Concept

☐ Phase 3: Development of the new subsystems and technologies

☐ Phase 4: composition of subsystems on test beds and in vehicles

☐ 5. Phase: Scenarios of realisation

IFA
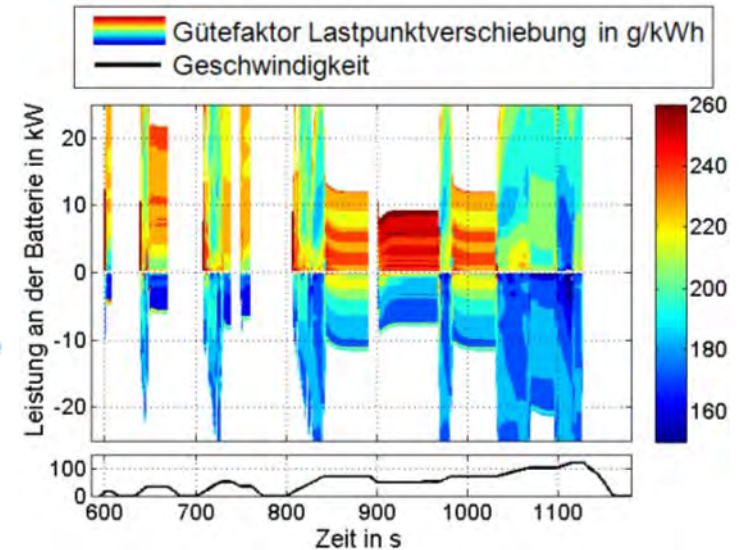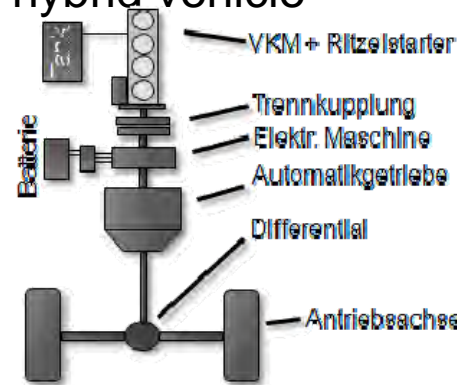Institut für Fahrzeugantriebe
& Automobiltechnik

IFA – Competences
Project: „Mild Hybrid"

☐ Longitudinal dynamics simulation, Development of optimized control strategies for a Parallel hybrid vehicle

☐ Research on the engine test bed:

– Determination of engine maps

– Open-loop-control of speed and torque of the ICE

☐ Research on the Engine-in-the-Loop test bed

– measurement of fuel consumption and pollutants using CVS-Method (official method for vehicle certification)

– ICE: Hardware; vehicle including powertrain+hybrid components: simulation (closed-loop-control of ICE)

IFA – Competences
Engine-in-the-Loop-Simulation (I)

☐ Functional principle of Engine-in-the-Loop operation
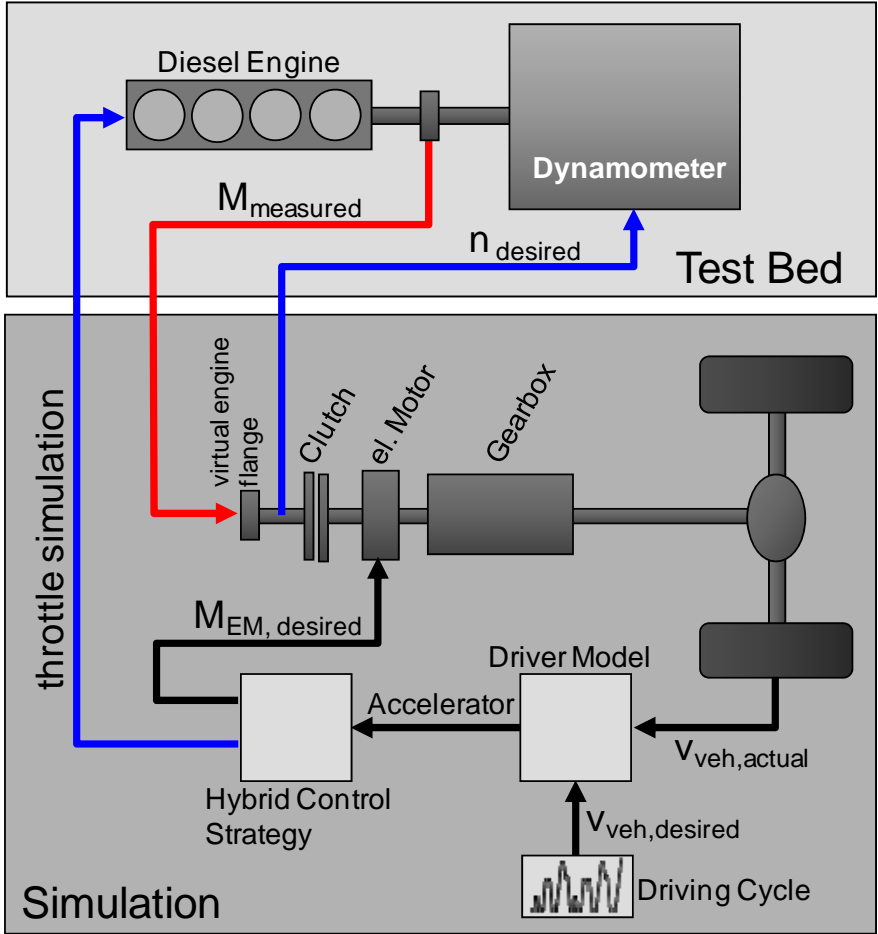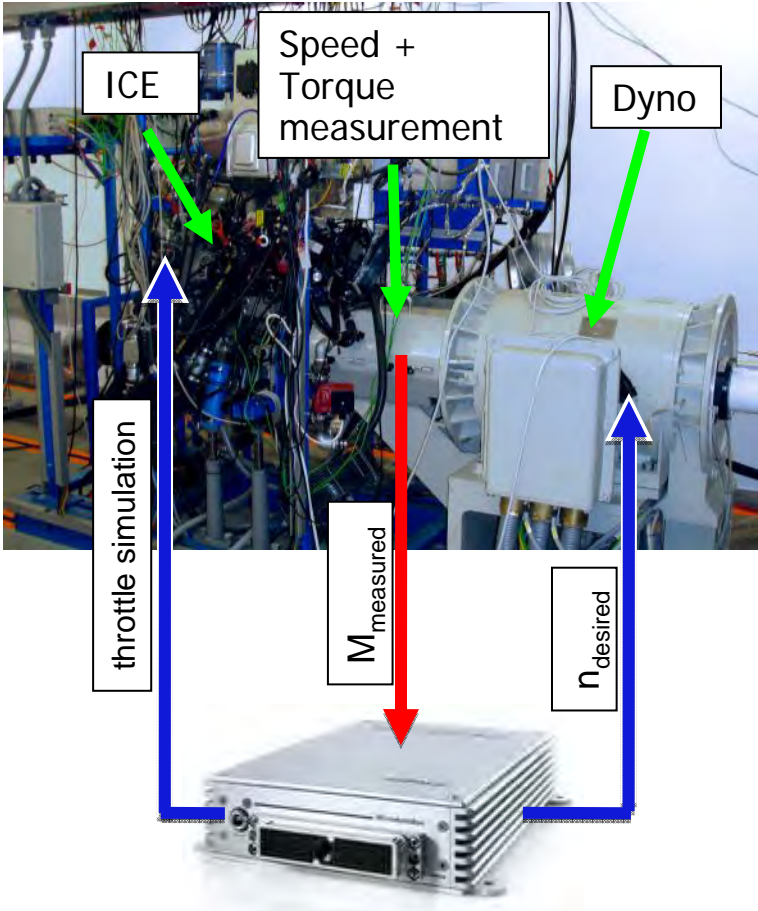
IFA – Competences
Engine-in-the-Loop-Simulation (II)

☐ Engine-in-the-Loop test bed at IFA

IFA – PROJECT APPROACH

WP 1: Investigation and modification, if applicable, of the HILS model and interface; this should include a proposal for a verification method w/o vehicle testing
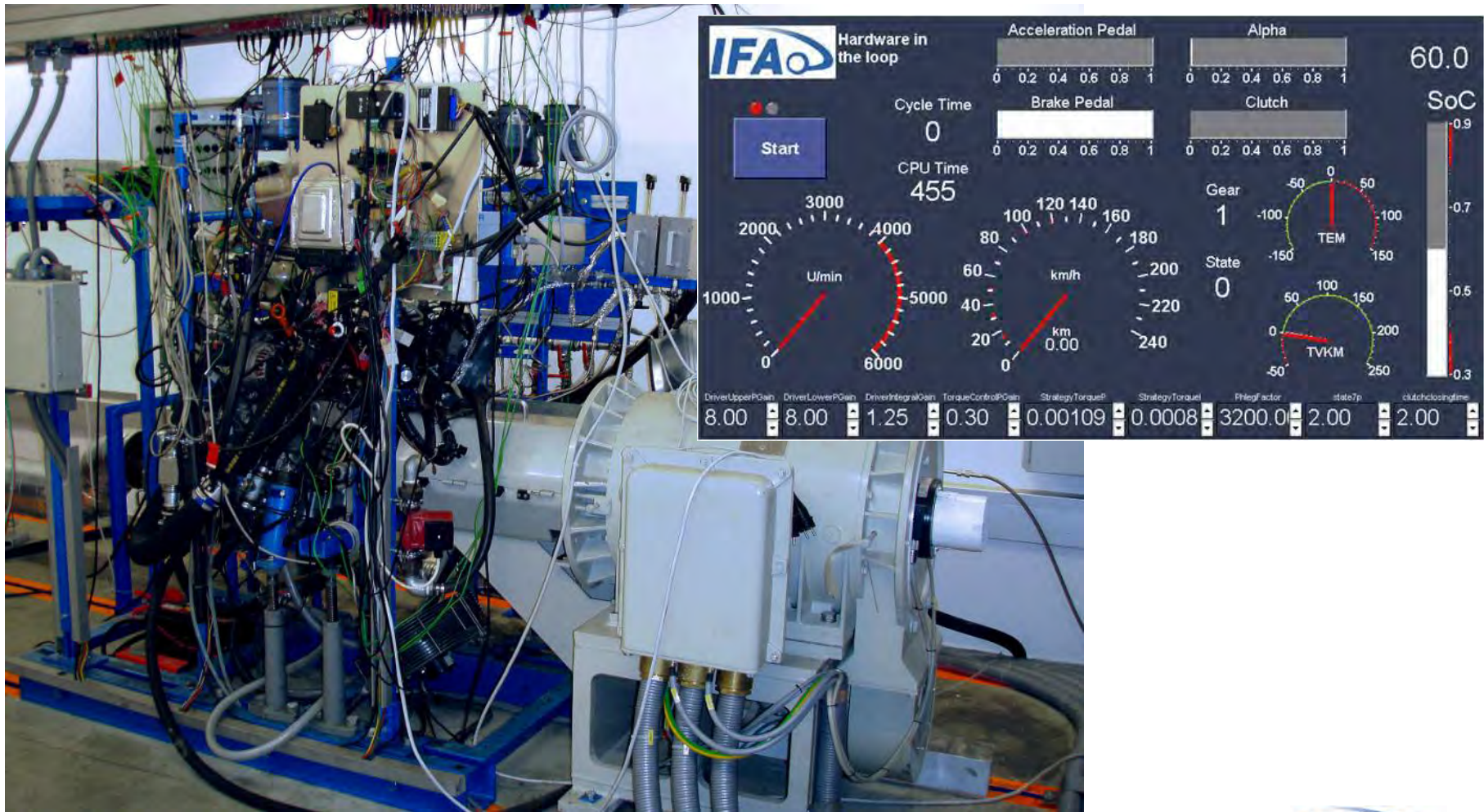
☐ Review of interface and software setup

- − Interface is used to connect real Hardware-Hybrid-ECU and simulated engine+powertrain.

- − Interface also provides vehicle-specific signals necessary for proper vehicle operation, which are not considered by the HW-ECU or SW-vehicle model (e.g. outputs of a Gearbox-conrol unit).

- − Investigations on different existing Interface models.

- − Goal 1: List of signals created/transmitted by interfaces under investigation.

- − Goal 2: List of conversions done by interfaces under investigation.

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HILS Interface
connecting the simulation model and the Hardware ECU

Software
Hardware
Software Interface

"interface"

time-series data

environment signal generation (e.g. GBCU,…) → Bus simulation

Hardware ECU

Interface: signal processing

vehicle model
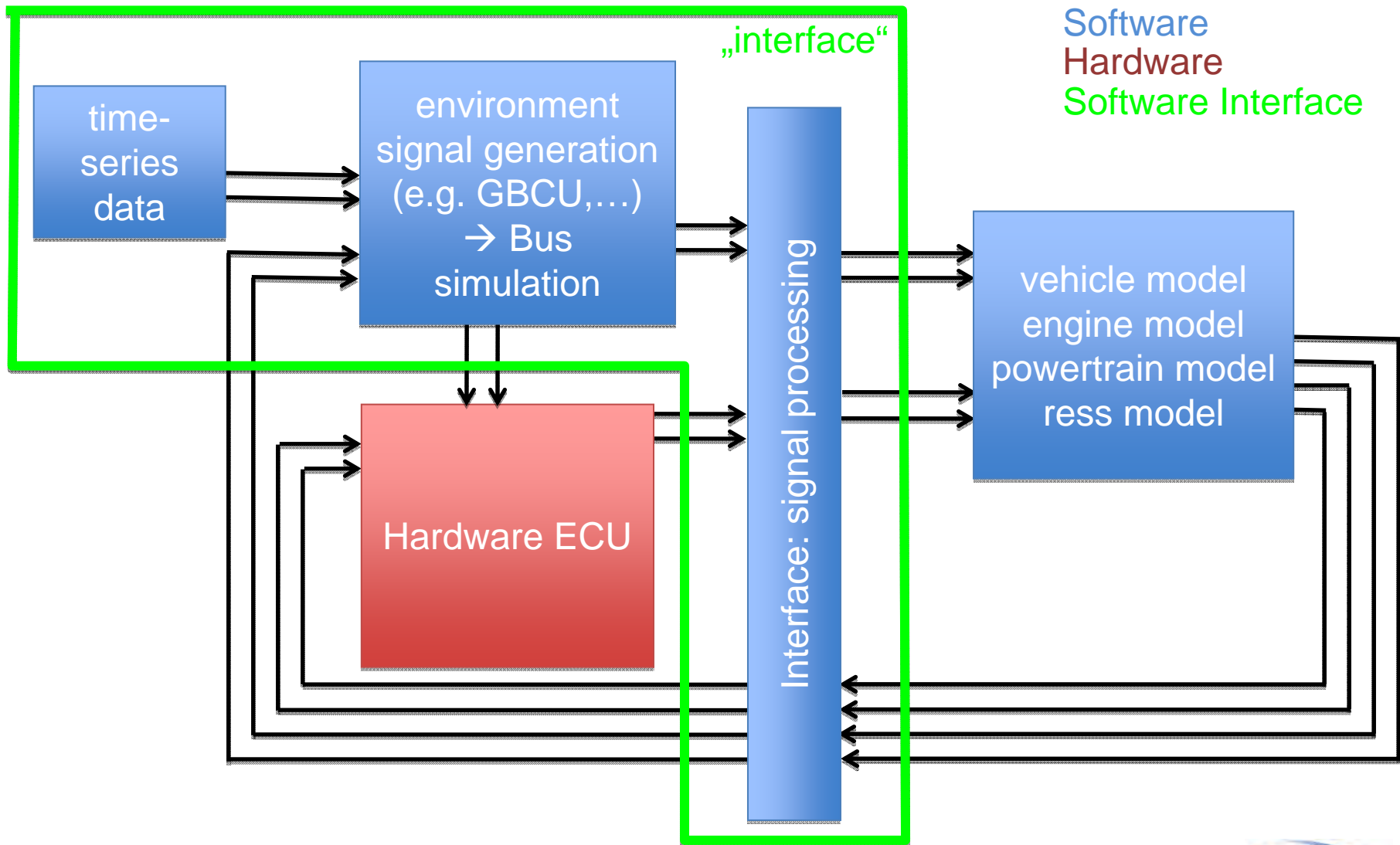engine model
powertrain model
ress model

IFA – PROJECT APPROACH

WP 1: Investigation and modification, if applicable, of the HILS model and interface; this should include a proposal for a verification method w/o vehicle testing

☐ Analysis of improvements and relevant gaps for a global regulation

– Meetings with HDV manufacturers to determine the spectrum of current and future HDH powertrain configurations.

– Meetings with HDV manufacturers to investigate which additional interface I/Os are needed.

– Determination of the powertrains' necessary level of detail.

– A requirement profile for the powertrain model and interface models will be created and compared to the japanese HIL models.

– Necessary changes to the japanese HILS will be outlined.

☐ Analysis of the necessary preparation work to run a HIL system

– Identification of requirements for test bed Hardware and Software, Laboratory infrastructure

– Workflow for implementing the HIL System

– Workflow for interface design (Hardware and Software)

– Development of a common HILS test bed setup concept

IFA – PROJECT APPROACH

WP 2: Investigation and modification, if applicable, of the HILS component testing

☐ Detailed review of the japanese test procedure for obtaining HIL input parameters

– Determination of map characteristics (ICE, Motor/Generator, Battery, Gearbox,…)

– Evaluation of the required effort.

☐ Analysis of improvements and relevant gaps concerning component testing

– Assessment of the potential to minimize measuring effort.

– Identification of additional necessary measurements following a more detailed level of the simulation model (according to the suggestions made in WP1).

☐ Improvements for future technological development

– Assessment of possible future hybrid powertrain components and methods to obtain their characteristics for simulation purpose.

Time Schedule IFA - TU Vienna

WP	Subject	KW	2011																										
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1	Review of interface and software setup		■	■	■	■	■	■	■	■	■	■	■																
	Review completed													▮															
1	Analysis of improvements and relevant gaps for a global regulation								■	■	■	■	■	■	■	■	■	■	■	■	■							
1	Meetings with OEM's and stakeholders		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■					
1	Analysis of the necessary preparation work to run a HILS system																												
2	Detailed review of the test procedure for obtaining HIL input parameter		■	■	■	■																							
2	Analysis of improvements and relevant gaps concerning component testing										■	■	■	■	■	■	■	■	■									
2	Improvements for future technological development																				■	■	■						
	Final Report																							■	■	■			
	Final Report finished 1.Nov																												▮

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Herzlichen Dank für Ihre Aufmerksamkeit!

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