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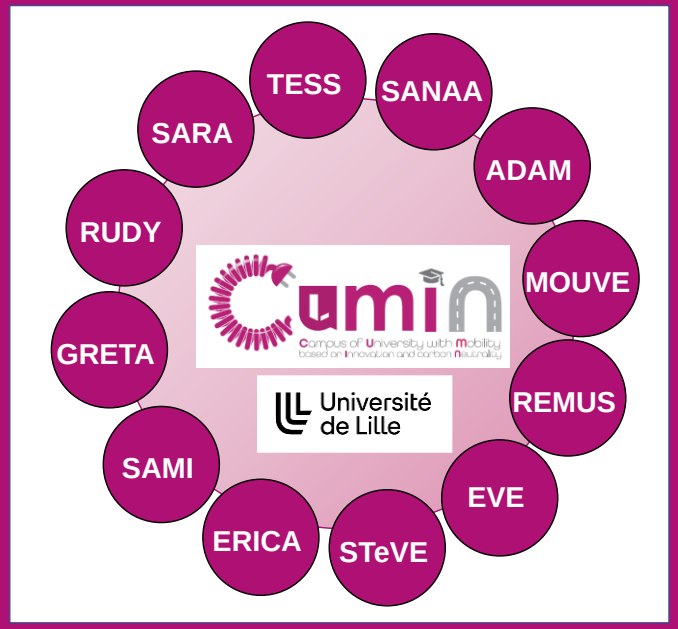

CUMIN - DILAN

Driver-In-the-Loop Applications for New electrified vehicles

Tournez Florian
Lhomme Walter, Bouscayrol Alain
Castex Elodie, Fraisse Amel

L2EP / TVES / GERRiiCO
University of Lille

ÉNERGIE ÉLECTRIQUE 4.0

Ce programme reçoit le soutien du Pôle MEDEE

Outline

1. Context
2. Vehicle model
3. Driver-In-the-Loop

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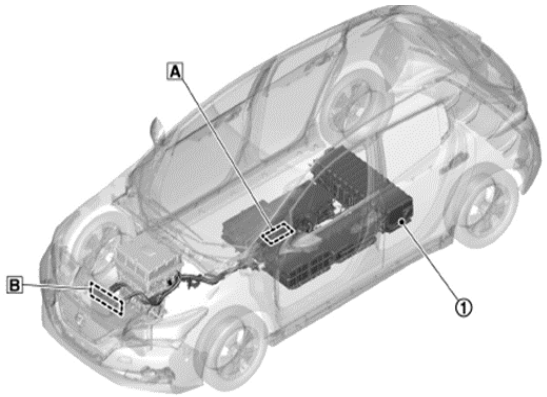
Context

Context: trip acquisition

- GPS information (latitude, longitude, altitude)
- Weather data
- Battery data
- Electrical machine data
- HVDC
- Etc.

MABX



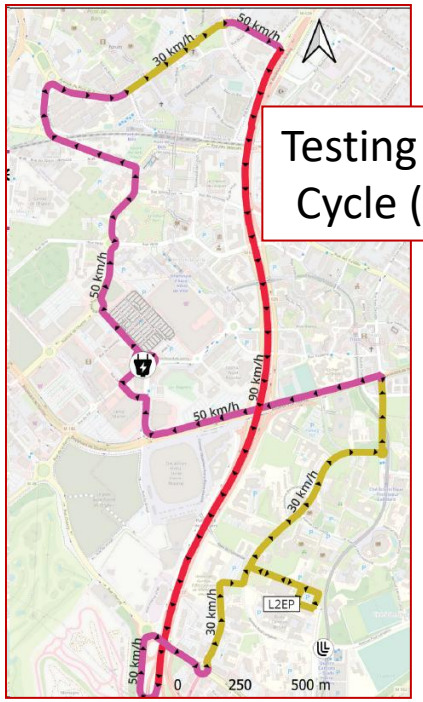
L2EP
Laboratoire d'électrotechnique et d'électronique de puissance de Lille

GPS

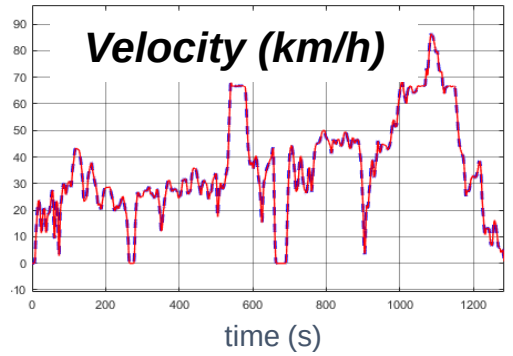
Data base

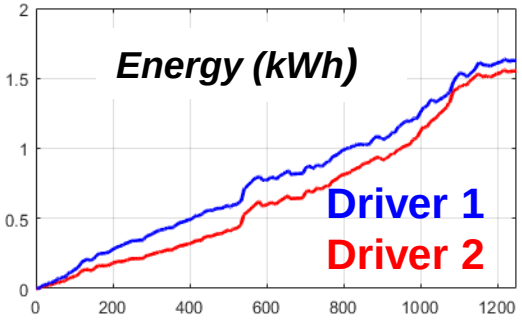
Gériico

Context: CUMIN-SARA



Testing driving Cycle (11 km)





Technical aspects

- Same trip for more than 120 drivers
- Variation of energy consumption of **21%**

[Junker 2024]

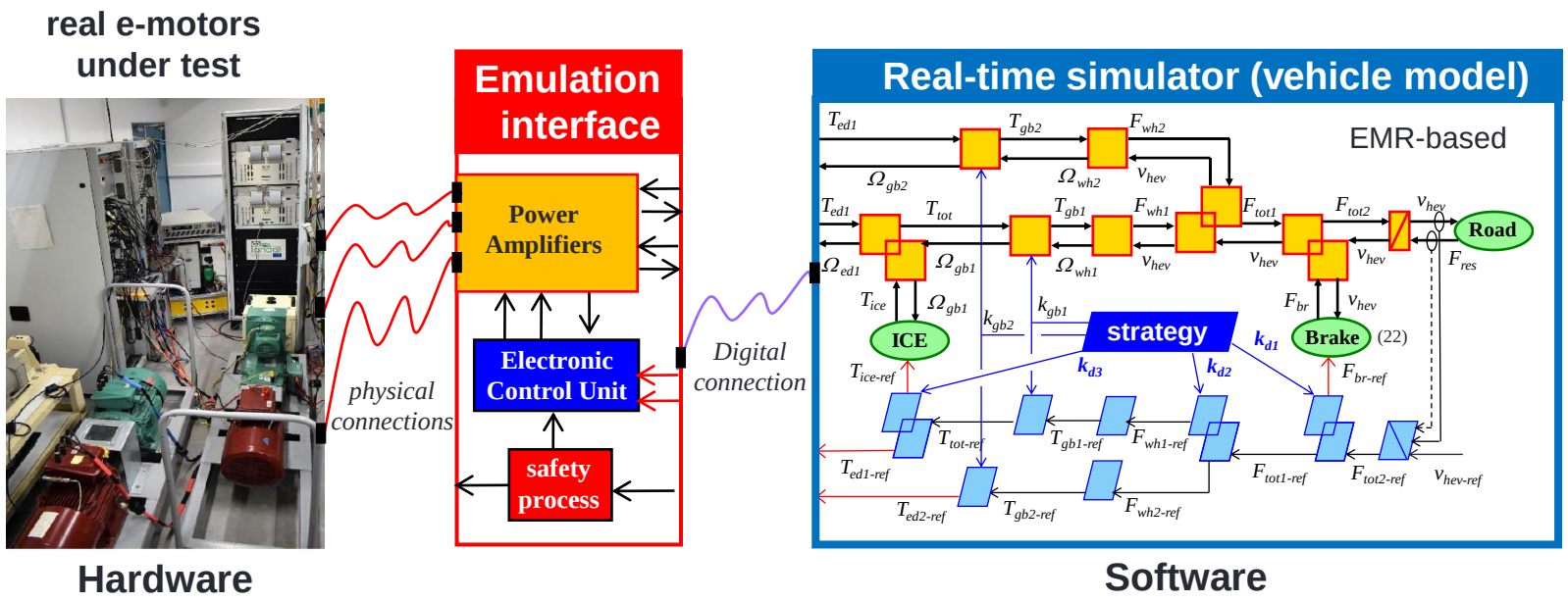
Impact of traffic?
Impact of driver?
Impact of weather?

→ programmable traffic and weather ? →

CUMIN DILAN
(Driver-In-the-Loop) using a driving simulator

Context: HIL @ L2EP

Hardware-In-the-Loop expertise: coupling Hardware under test and digital model



[Tournez 2024]

Example from H2020 PANDA

Plug-in Hybrid demo car

How to extend this concept to Driver-In-the-Loop for CUMIN-DILAN ?

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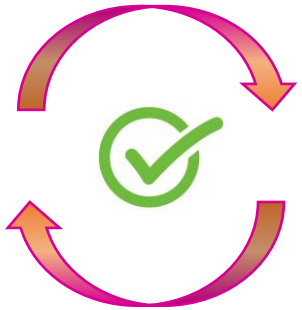
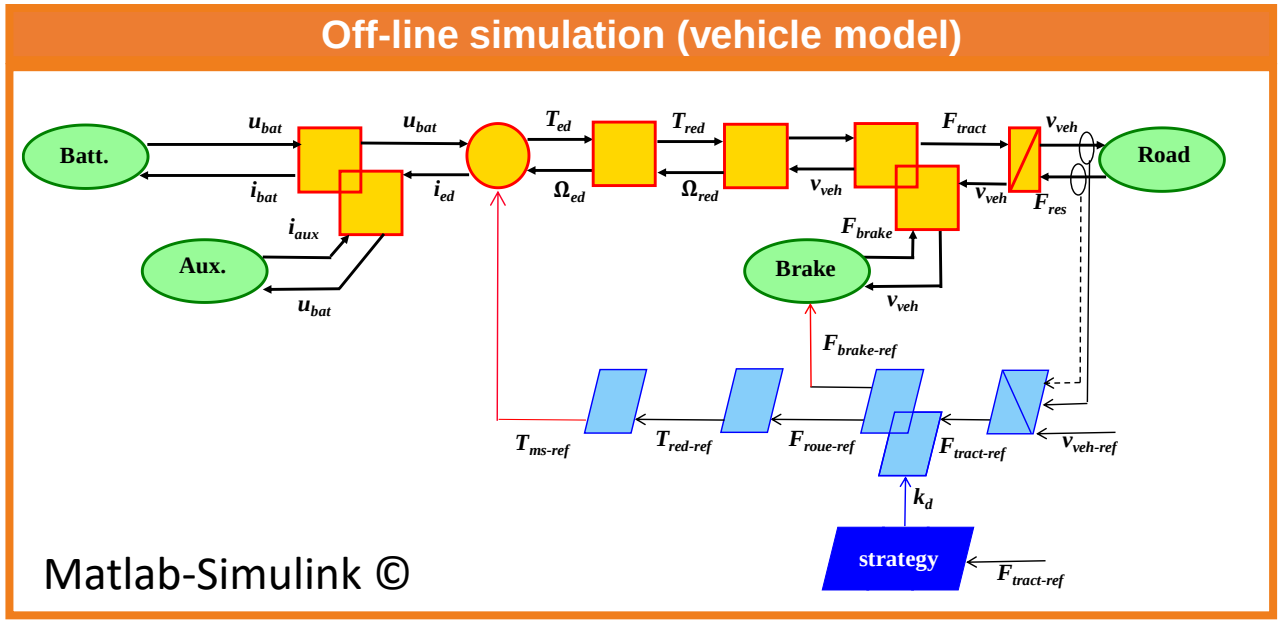
Vehicle model

Model of Nissan Leaf (reference vehicle)

Development of a simulation model based on the real vehicle using Energetic Macroscopic Representation formalism





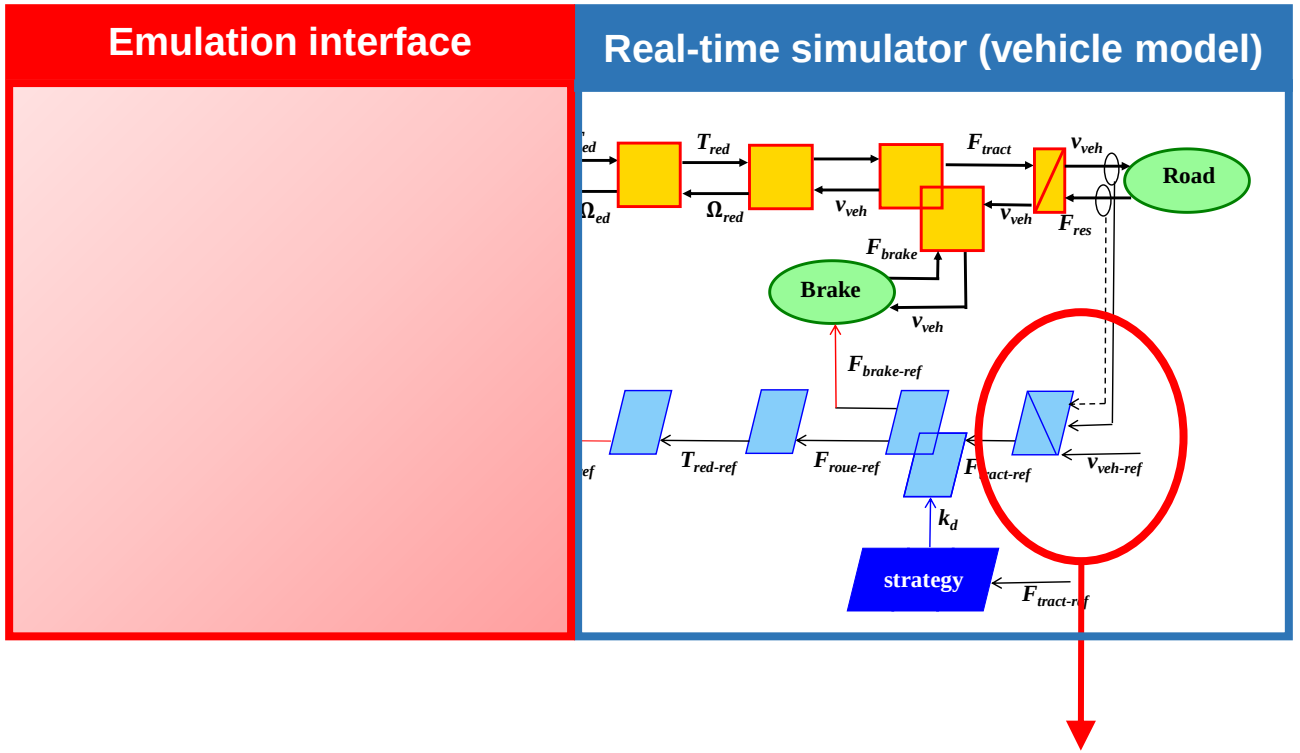
only 2% of error on energy consumption

Power-HIL of the Nissan Leaf

Test of the real battery and the real e-motor using a simulation model

Nissan e-motor

Nissan Battery



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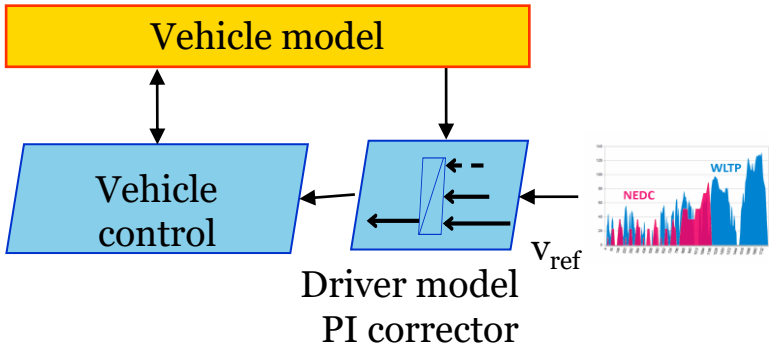
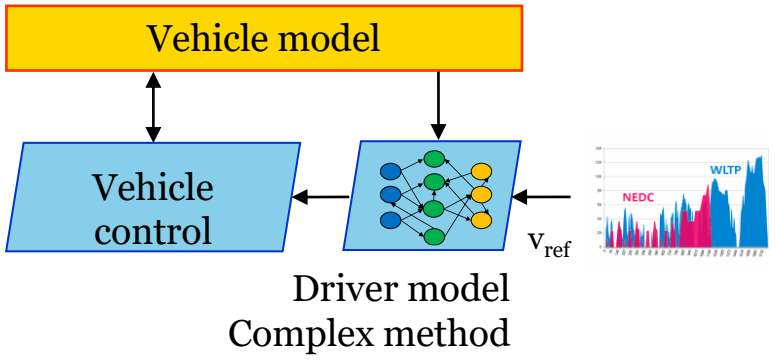
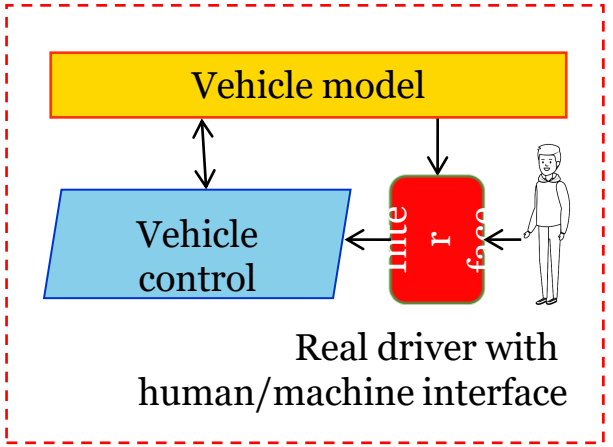
Driver-In-the-Loop

Driver-in-the-Loop (DIL)







powertrain simulation

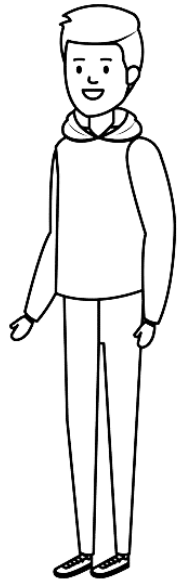
Driving simulator

Scanner Software

Driving simulator

vision
sound
vibration
etc.

dashboard
driving wheel
pedals
etc.

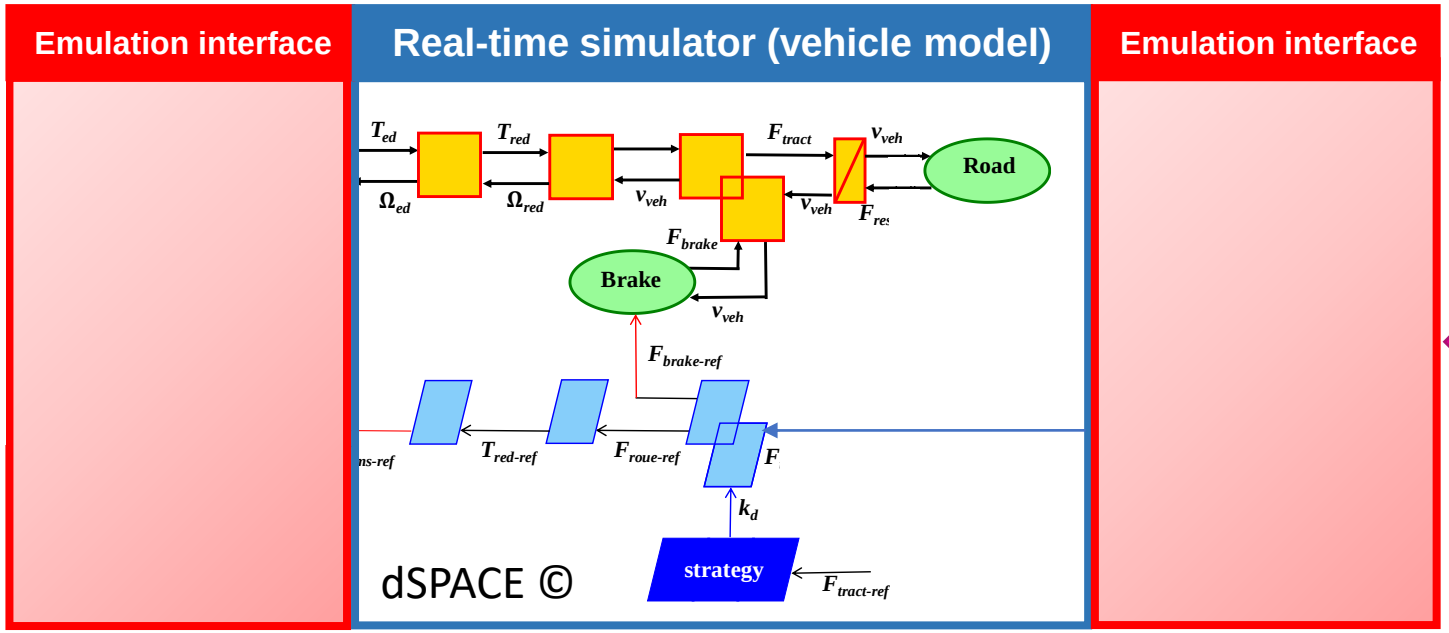


Driver-In-the-Loop of the Nissan Leaf

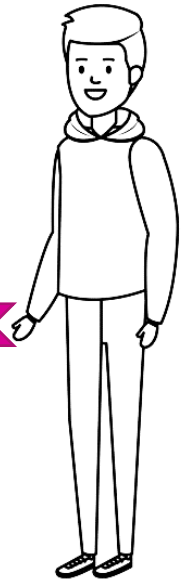
Integration of the Driver in the testing loop

Nissan e-motor

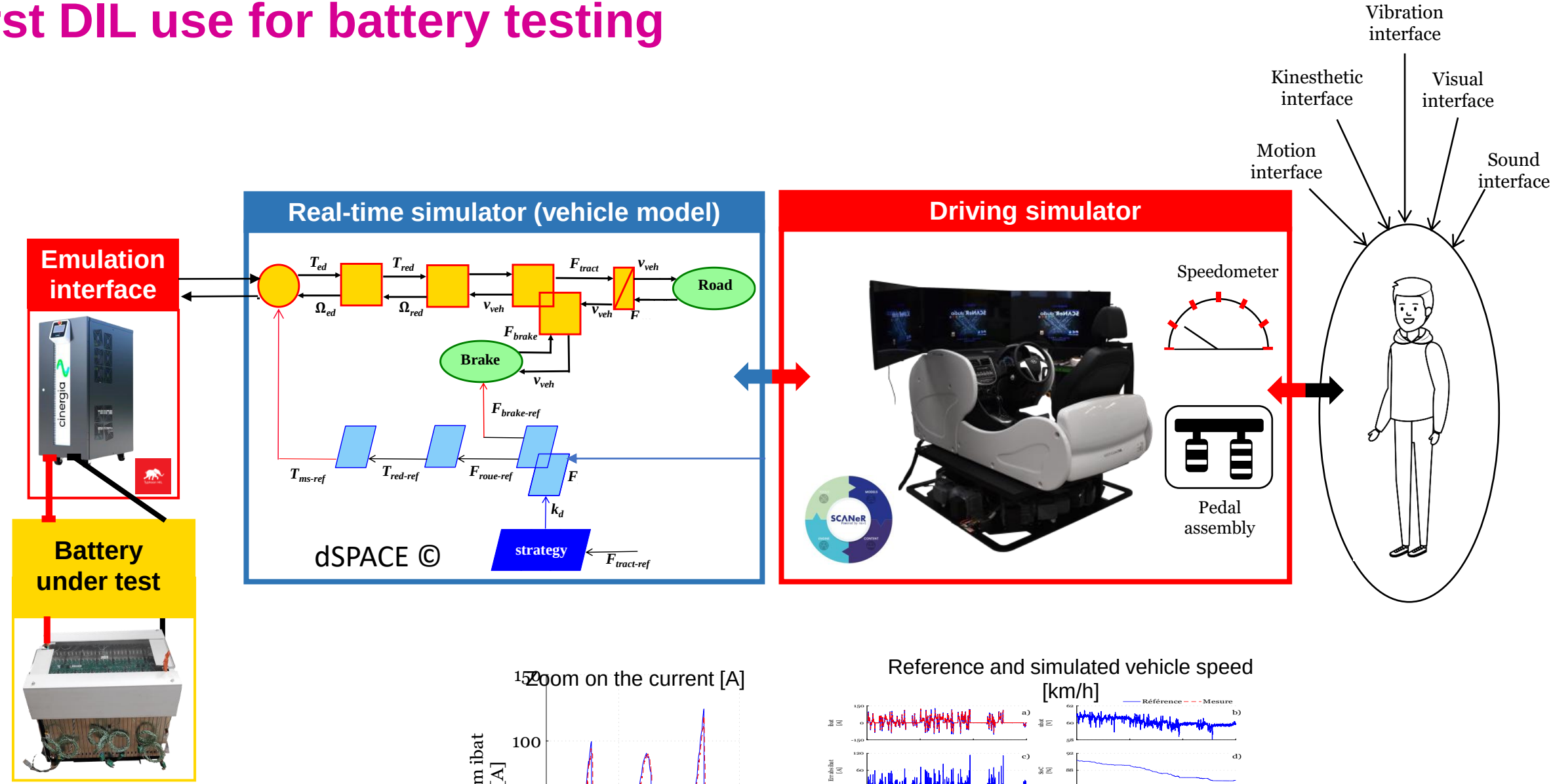
Nissan Battery

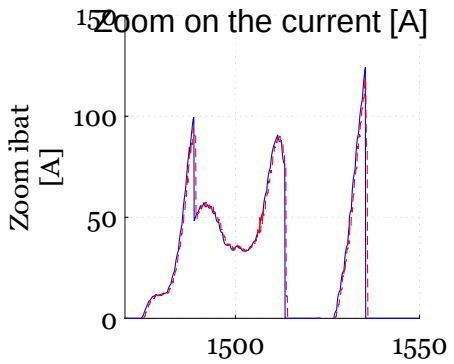


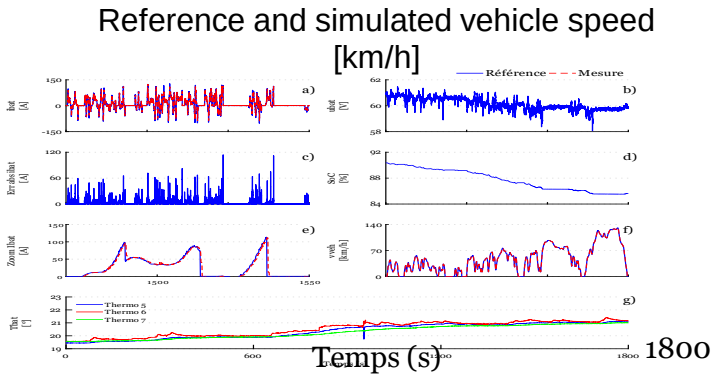
Driver



First DIL use for battery testing

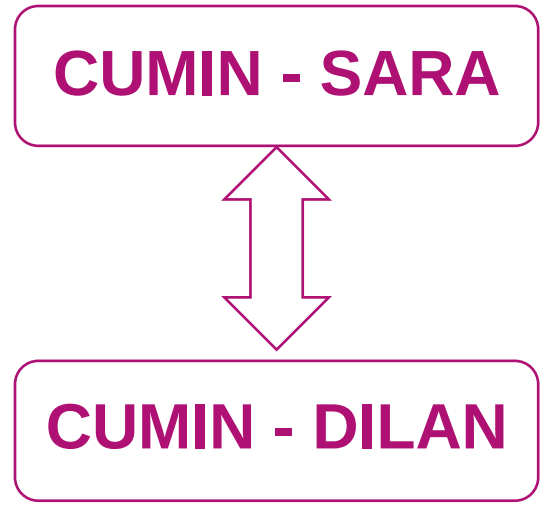






Conclusion

- ✓ Extension of the Power-HIL to the DIL
- ✓ Strong work for Hardware and Sotfware interfaces
- ✓ Cockpit interface validation



Perspective

- Selection of relevant driving cycles (TVES / L2EP)
- Validation of the human perception (TVES)
- Validation of the energy behavior (L2EP)
- Management of the data flow for CUMIN (GERiiCO)
- Comparison DIL with other testing methods (L2EP/CRITT-M2A)

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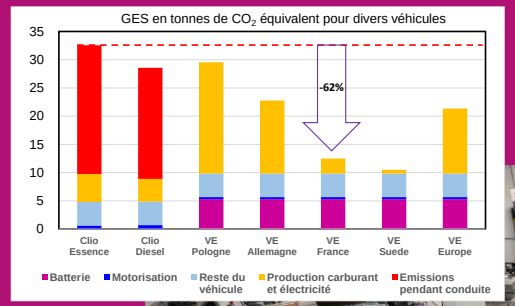

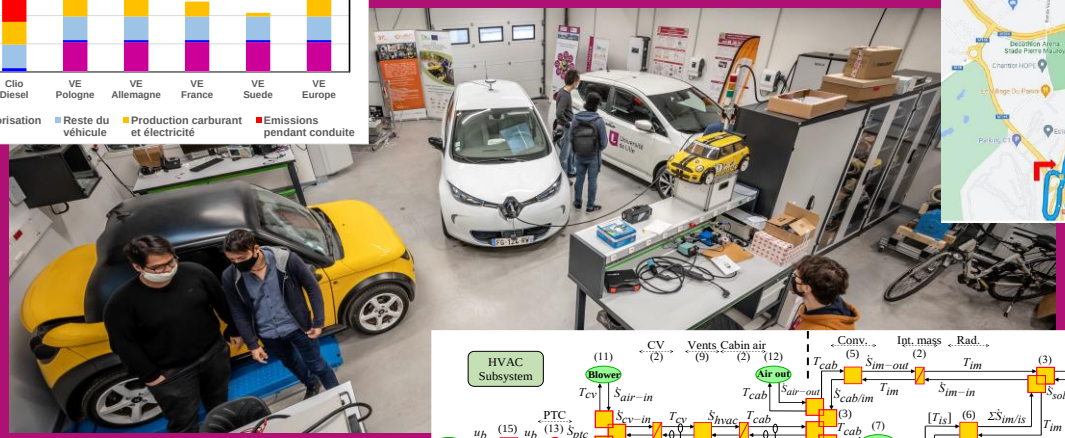

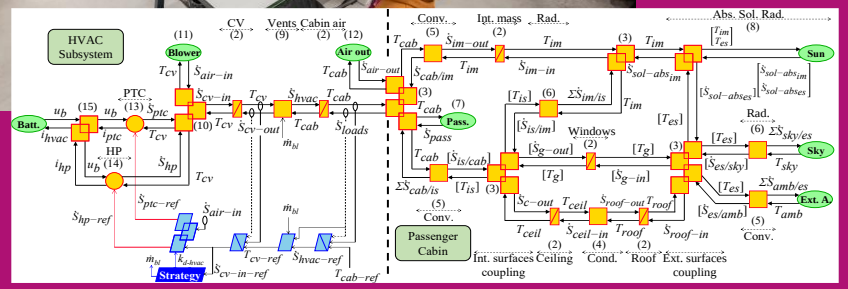

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