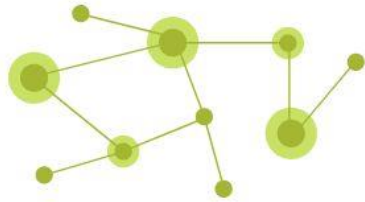


Driver-In-the-Loop Applications for New e-vehicles

ÉNERGIE
ÉLECTRIQUE 4.0



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(L2EP, TVES)

Comité de suivi EE4.0 – axe 3
15 février 2024



Le projet s'inscrit dans l'axe 3 intégration système, gestion de l'énergie et stockage

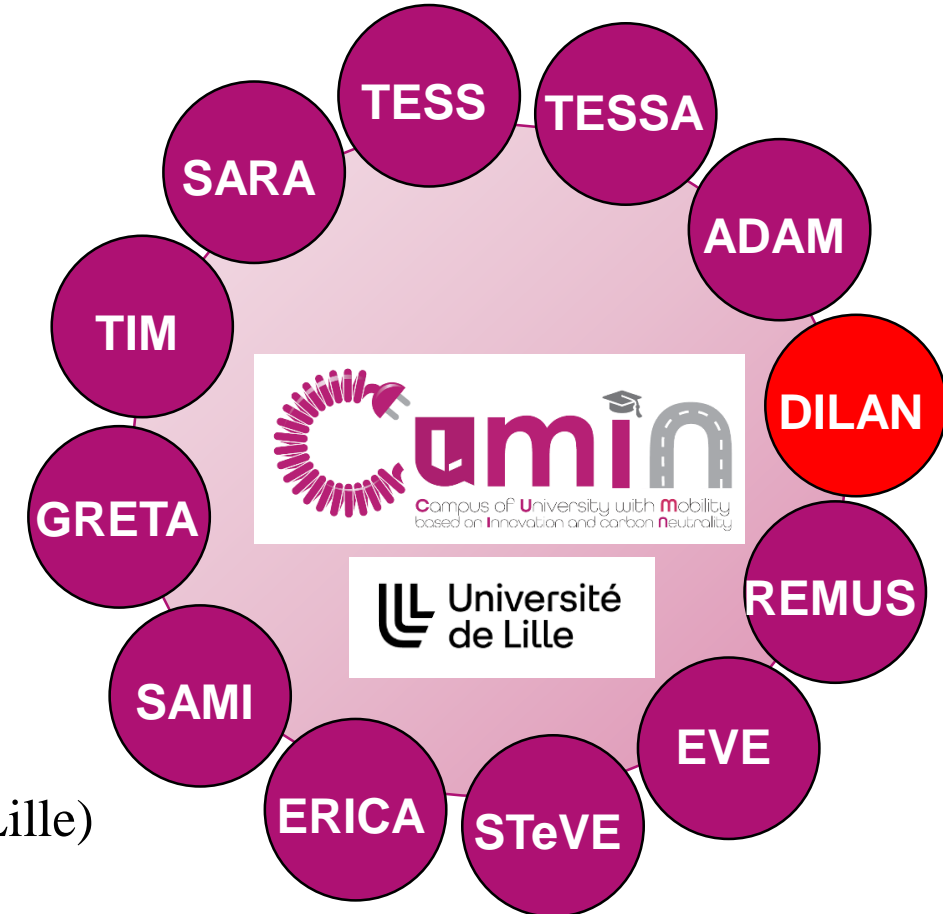
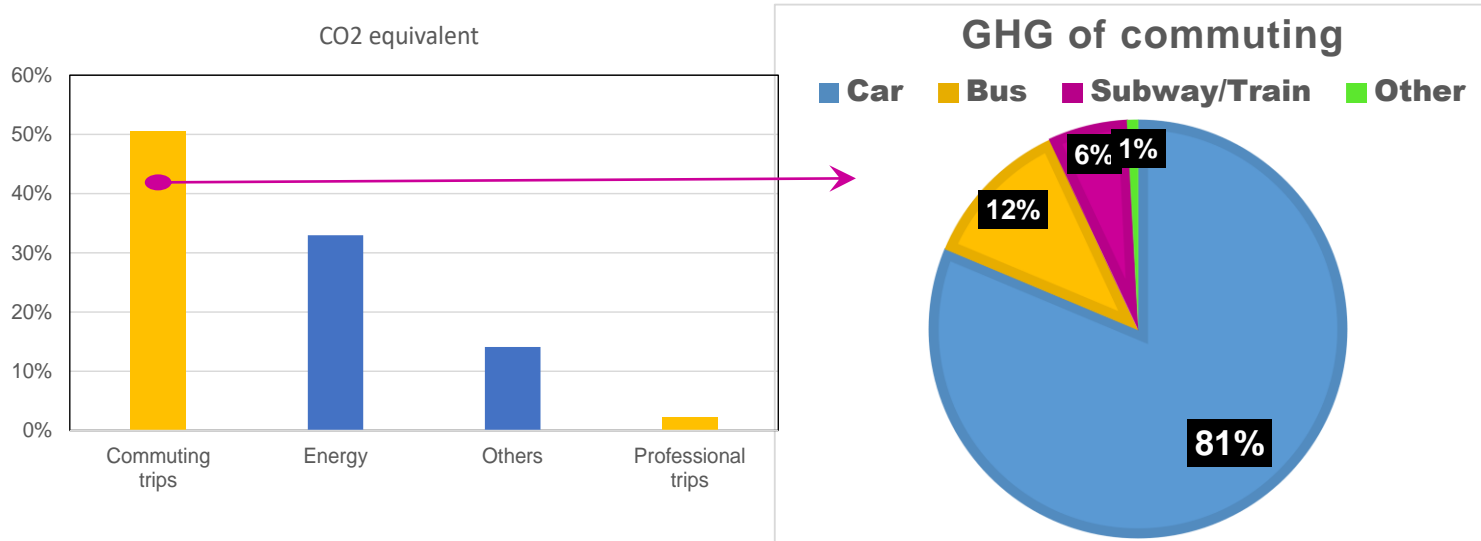
- **Ouverture thématique vers:**

- ~~les nouvelles technologies (Matériaux, Procédés, IA, Objets Connectés...)~~
- les sciences humaines et sociales (Economie, acceptabilité de nouveaux usages...)

- **~~Poursuite du transfert technologique :~~**

- ~~Partenariat fort vers les industriels et les collectivités~~

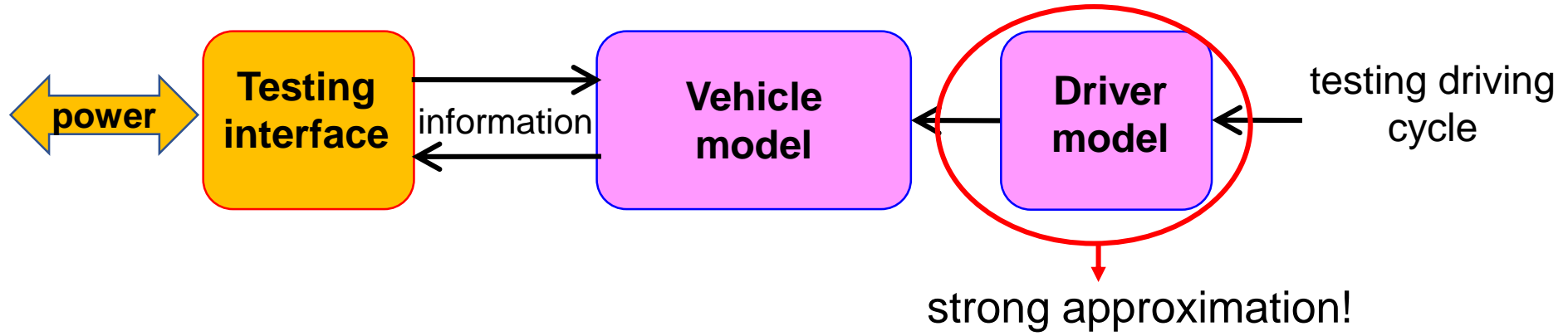
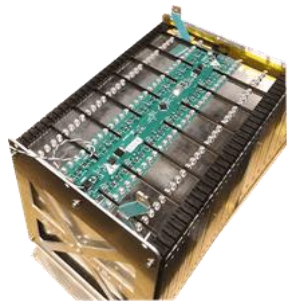
GHG of University of Lille in 2020



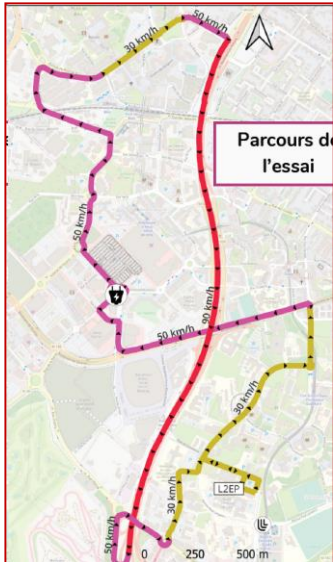
CUMIN: Campus of University with Mobility based on Innovation and carbon Neutrality (interdisciplinary program of Univ. Lille)

- EVE (Electric Vehicle – energy consumption Estimation)
- SARA (Social Acceptance of electric vehicles in Restricted Areas)
- **DILAN** (Drive-In-the-Loop applications for New electrified vehicles)
- Etc.

CUMIN-EVE: including testing of new component for e-vehicles (Power Hardware-In-the-Loop)



CUMIN-SARA/DILAN: including survey on e-mobility and try of Nissan Leaf



72 drivers
same vehicle
same trip
same period
(2 months)

Long time!



Socio-behavioural aspects (...)

Technical aspects

Variation in terms of energy consumption of 21%

Not presented today!

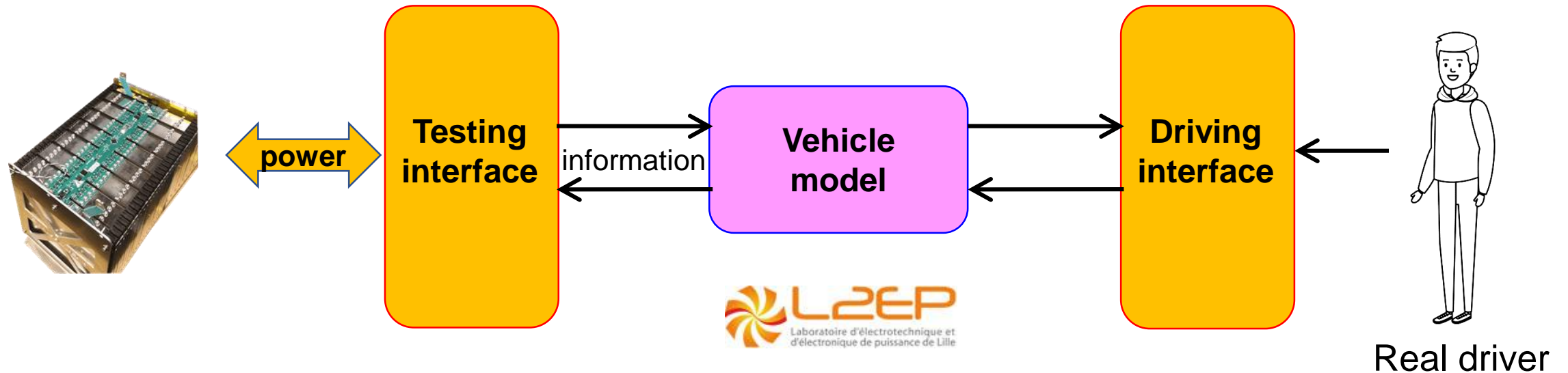


Impact of the traffic?
Impact of drivers?

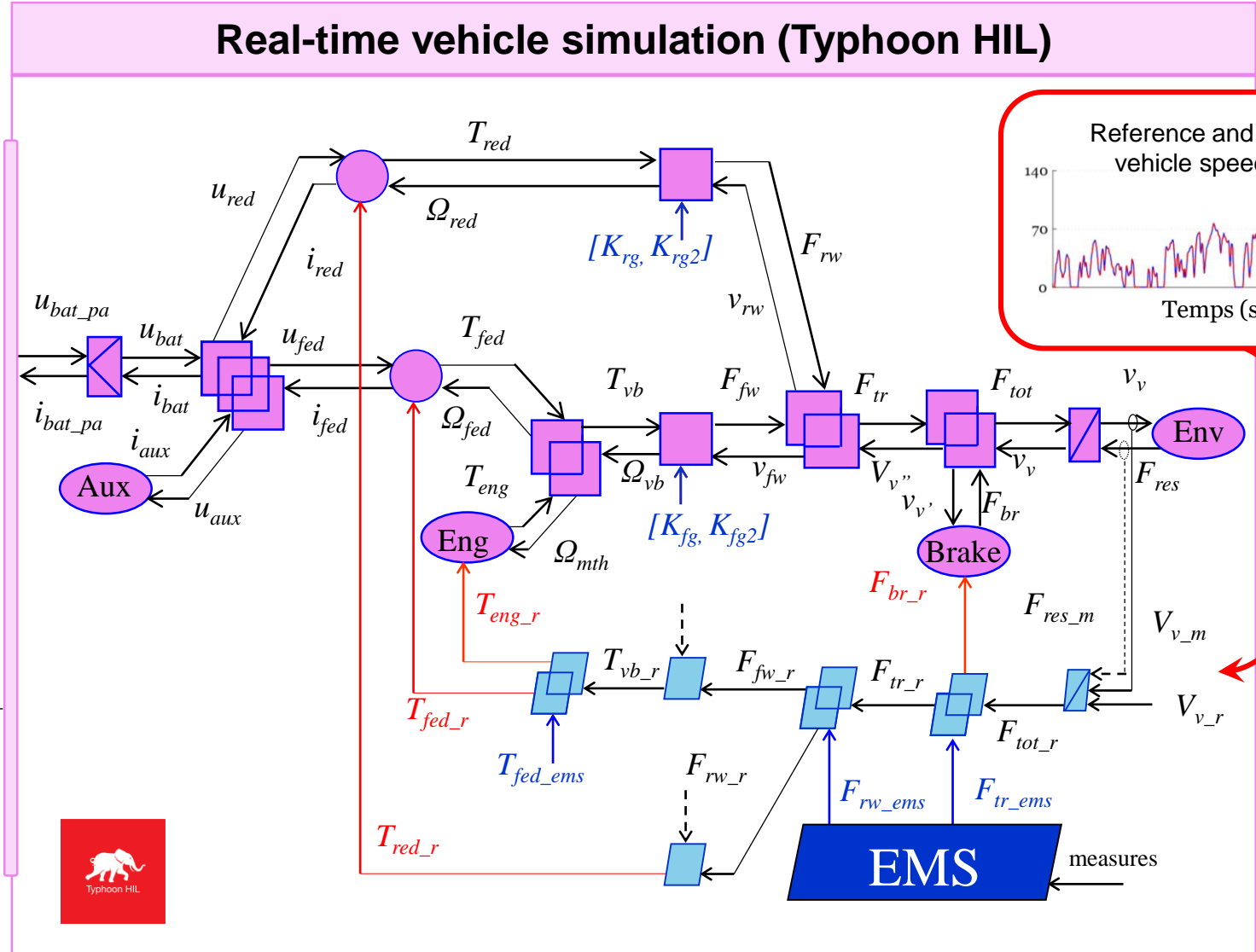
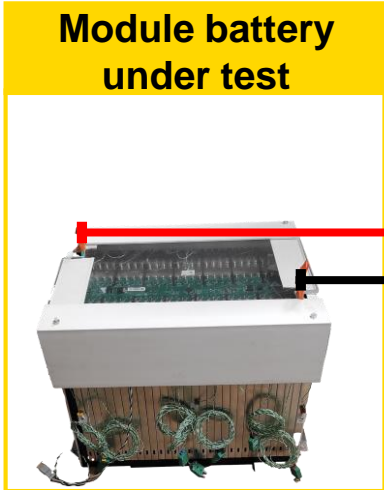
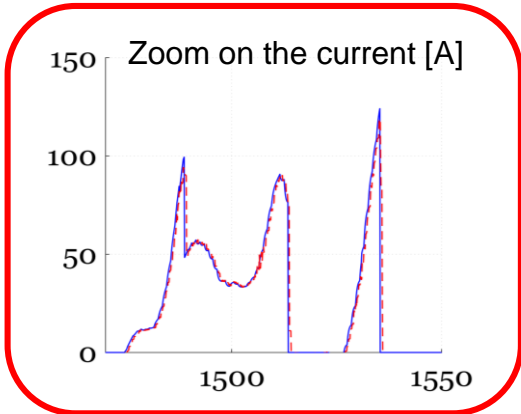
difficult to identify

Include the Driver in the testing Loop?

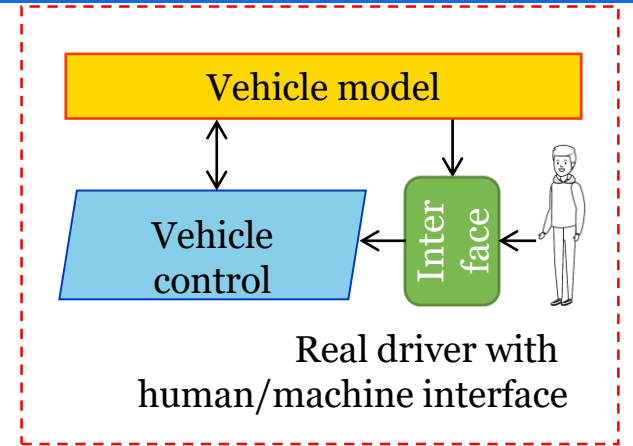
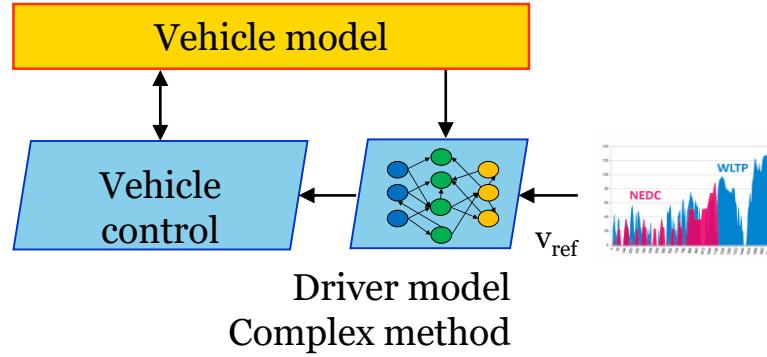
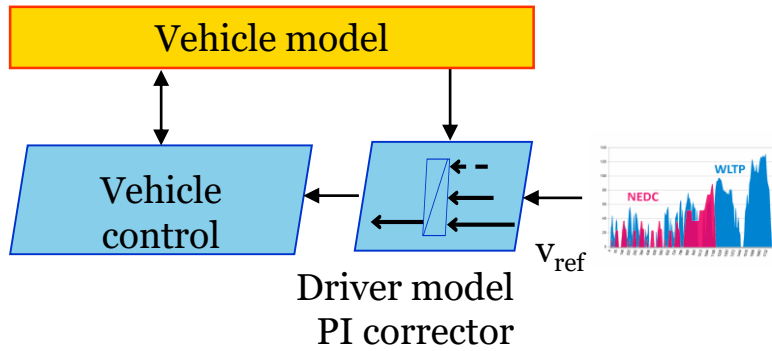
- Interest for multiply the driving tests?
- Interest for separate impacts of traffic and driver?
- Interest for testing components with the drivers' variations?



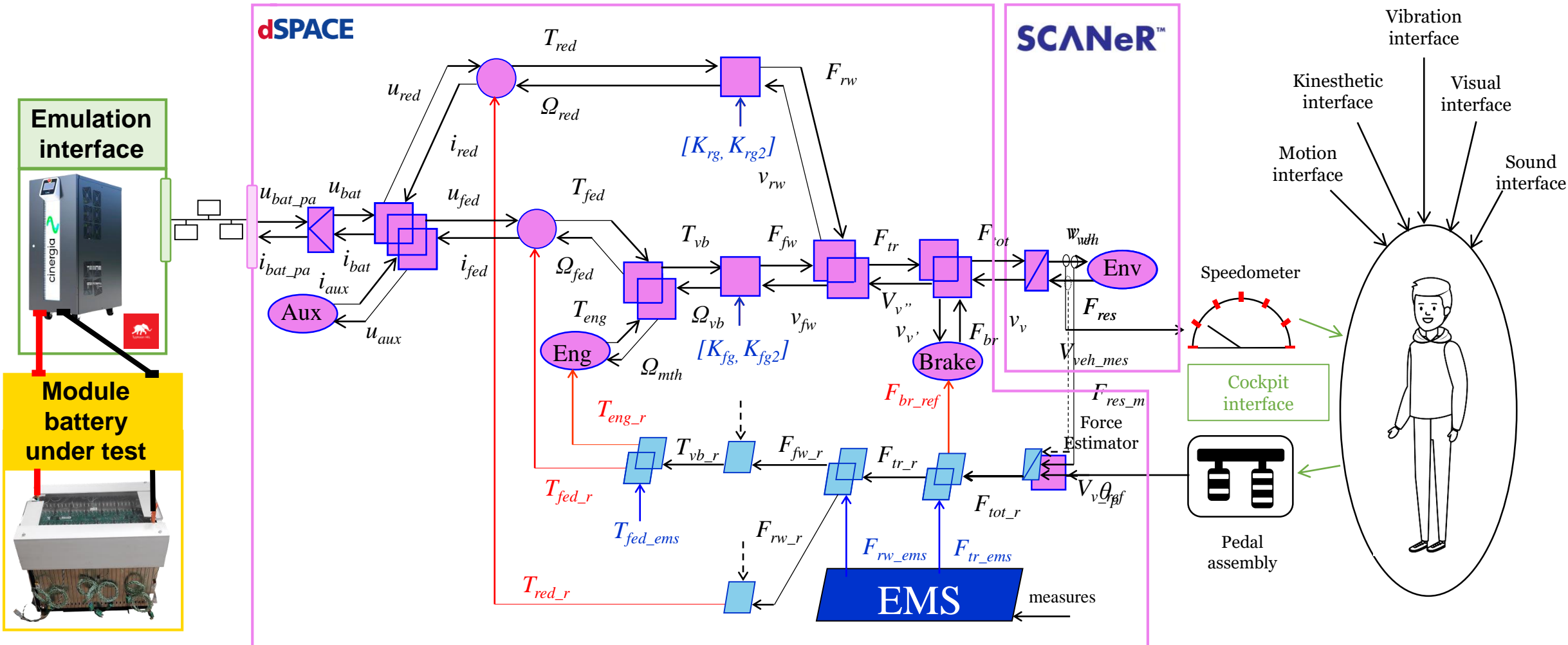
How to develop such a complex multi-objective testing facility?
How to select drivers and driving cycles ?



Driver-In-the-Loop



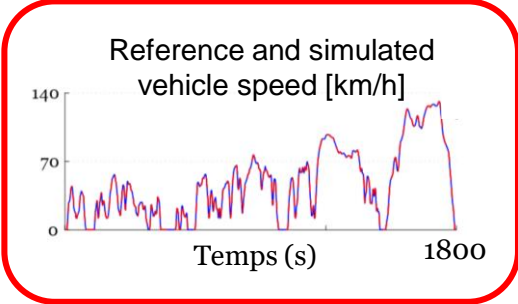
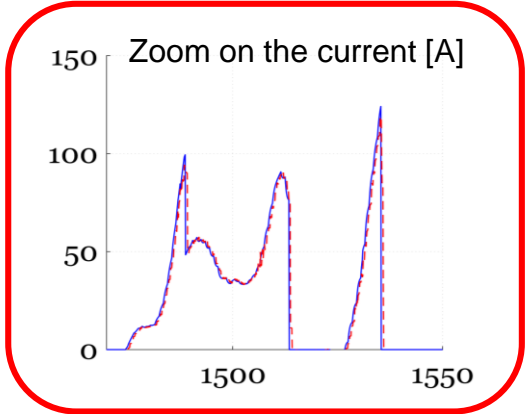
Coupling DIL & P-HIL



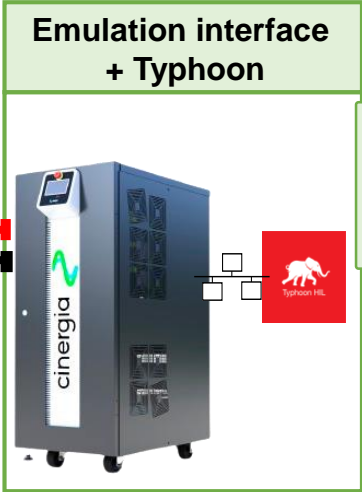
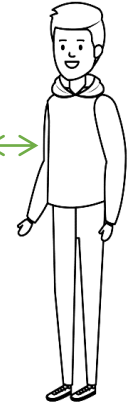
First results

Coupling:

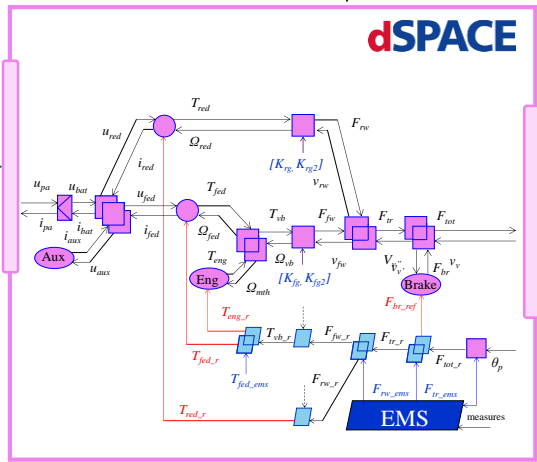
1. Power interface (Cinergia)
2. Typhoon ECU (safety management)
3. dSPACE ECU (real-time simulation of the vehicle)
4. SCANer (real-time visual interface)
5. Driving simulator



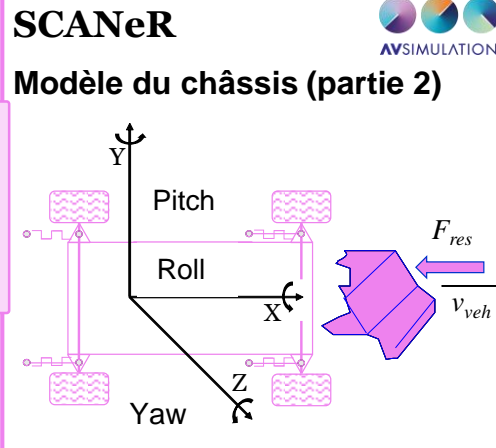
Driver



Vehicle model
Simulink version



Supervisor PC
+ Vehicle Settings
+ C++ Plugin
+ Python Script
+ MICE Script



➤ Development of the Driver-in-the-Loop set-up

- coupling with a Power HIL testing
- coupling different software and hardware parts (thanks to EMR formalism)
- Standard field bus to exchange data (CAN/modbus)
- First validations

➤ Perspectives

- validation of the other interfaces of the driving simulator
- Validation of the user perception compared to the real vehicle
- Testing new components with various drivers
- Recording more driving tests for CUMIN (CUMIN-SARA)
- Comparison with other HIL method (CRITT-M2A)
- Extension to meteorologic conditions (batterie conditioning)



Merci !

QUESTIONS ?