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A multi-disciplinary approach for the electrical and thermal characterization of battery packs – case study for an electric race car

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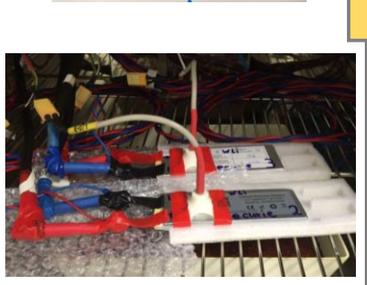
Objective

- Electro-thermal modelling of the battery pack of a race car.
- Using 1D and 3D simulation tools (*Simcenter Amesim and STAR-CCM+*).

Workflow

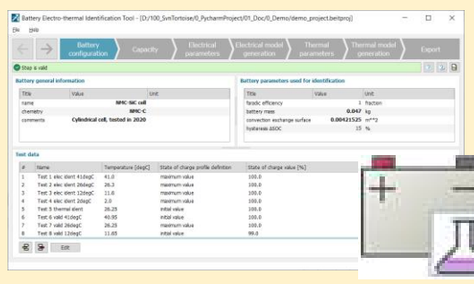
- Step 1: cell characterization

Battery test bench



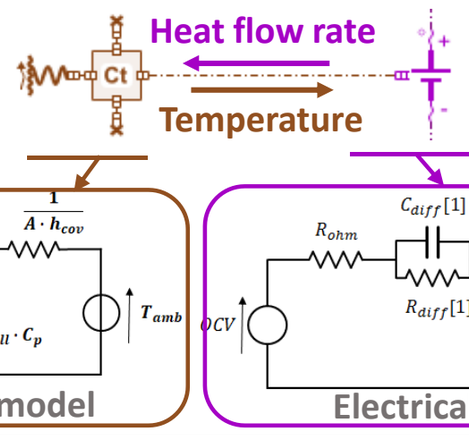
Test data

Battery Electro-thermal Identification Tool in *Simcenter Amesim*

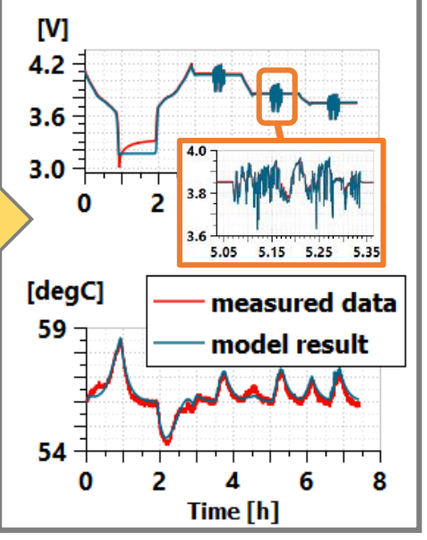


Step-by-step identification process

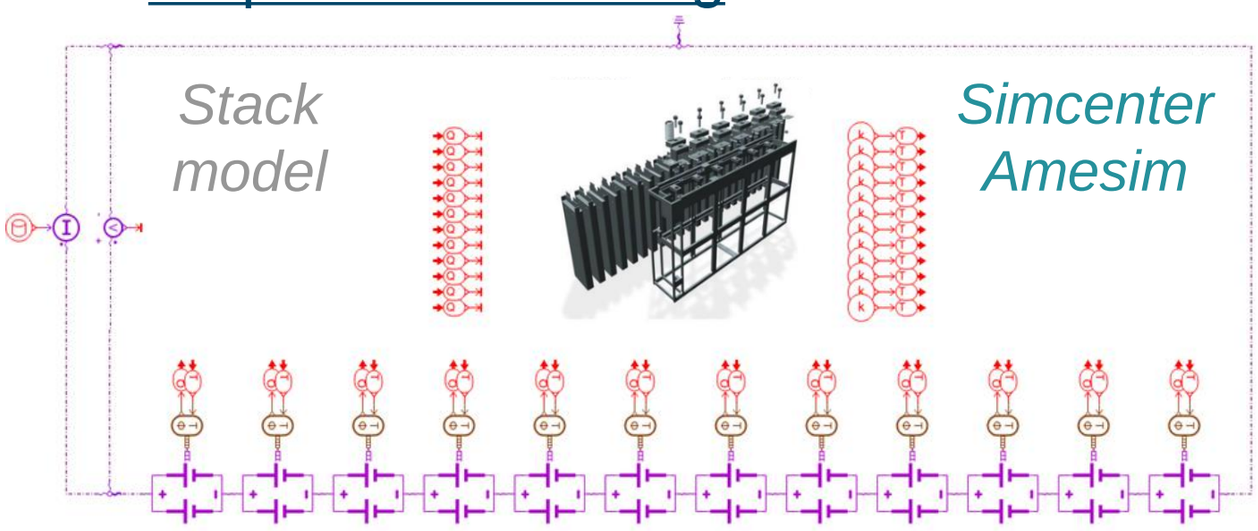
Battery electrical and thermal models in *Simcenter Amesim*



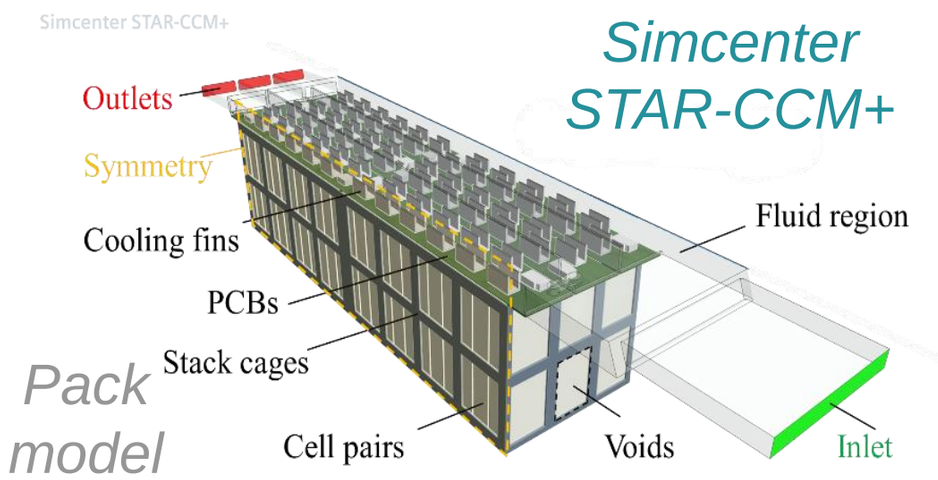
Model validation



- Step 2: 1D modelling



- Step 3: 3D modelling



- Step 4: co-simulation of 1D and 3D models

Battery **electrical model** in ***Simcenter Amesim***

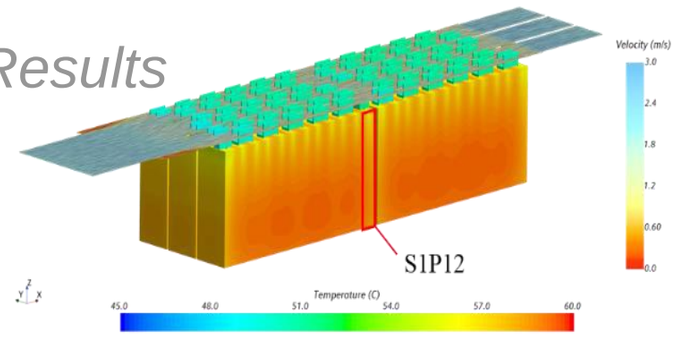
Temperatures

FUNCTIONAL MOCK-UP INTERFACE

Heat flow rates

Battery **thermal model** in ***Simcenter STAR-CCM+***

Results



Conclusion

- 1D and 3D battery models ready for future pack design.
- Approach applicable for different cooling strategies (e.g., air, liquid, immersion).