

Final Event
24-25th of May 2022

Industrial feedback

Feedback from TÜV Süd Battery Testing



Powerful **A**dvanced **N**-Level **D**igital **A**rchitecture
for models of electrified vehicles and their components



Battery Testing

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TÜV Süd Battery Testing



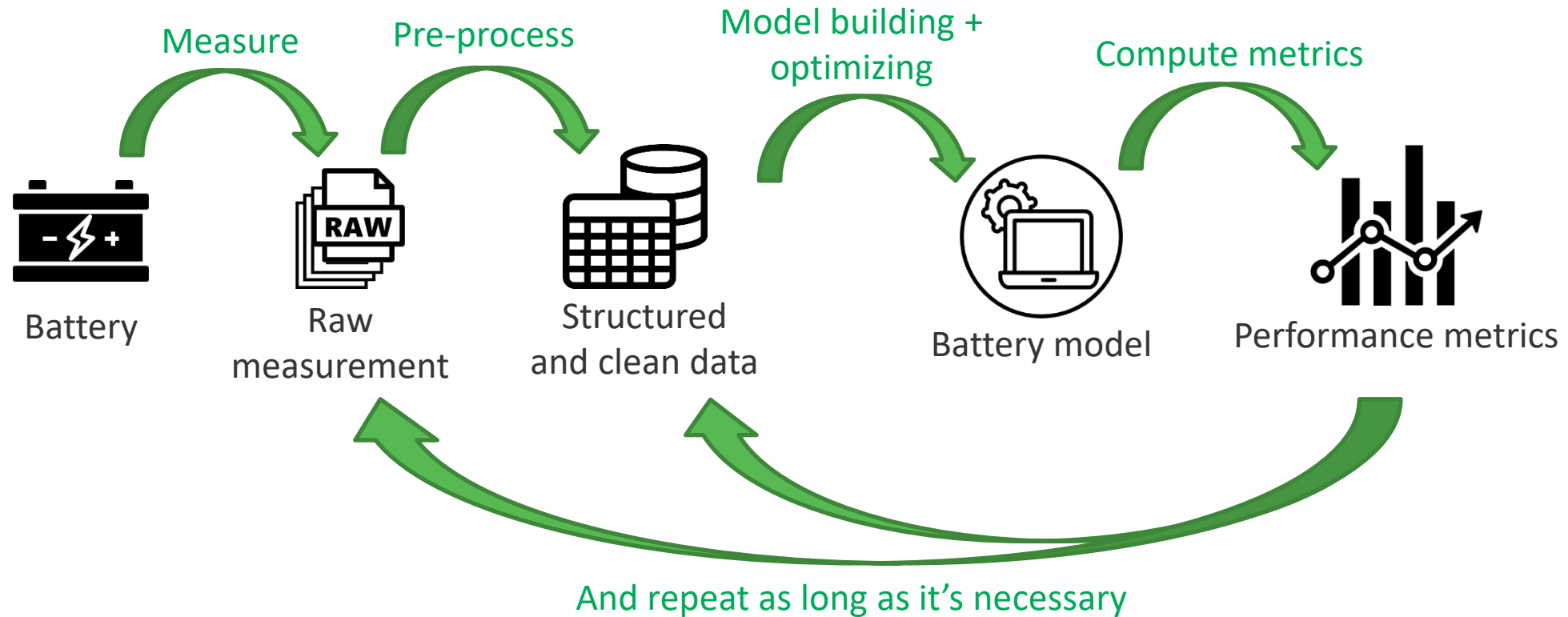
| | Performance / Lifecycle | Environment / Durability | Safety / Abuse |
|--------|---|--|--|
| System | <ul style="list-style-type: none"> 🐼 Cycle testing under different climatic conditions (temperature, humidity) | <ul style="list-style-type: none"> 🐼 Vibration/shock testing under different climatic conditions | <ul style="list-style-type: none"> 🐼 External short circuit |
| Module | <ul style="list-style-type: none"> 🐼 Parameter determination | <ul style="list-style-type: none"> 🐼 Dust and salt fog testing 🐼 Humidity, dew & thermal shock testing | <ul style="list-style-type: none"> 🐼 Overcharge 🐼 Overdischarge 🐼 Nail penetration 🐼 Static crush 🐼 Roll-over |
| Cell | <ul style="list-style-type: none"> 🐼 High Performance cycling 🐼 Life cycle simulation | <ul style="list-style-type: none"> 🐼 Altitude simulation 🐼 IPX, Immersion & splash water testing 🐼 Electromagnetic compatibility testing 🐼 Chemical influence analysis | <ul style="list-style-type: none"> 🐼 Drop 🐼 Leakage-tests (water intrusion) 🐼 Fire resistance 🐼 ECE R100 Rev. 2 & GB 🐼 Crash (60g) / mechanical shock |



General Approach



- 🐼 Purely data-driven approach using measurement data (Machine learning)
- 🐼 Only measured data necessary, no physical understanding of the battery (black box)



Results



- 🐼 It is possible to generate a model based on battery measurement data to reproduce the electric and thermal behavior!
- 🐼 Proof of concept using real measurement data using Machine Learning (ML)

Advantages

- + Generation of a digital twin possible “at the test bench”
- + Low computational cost of ML approach
- + Easy to build up ML model without specific knowledge of the battery
- + Black box

Drawbacks

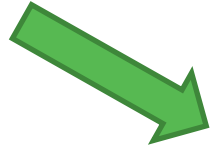
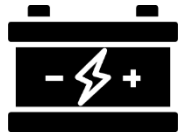
- Generalizability?
- Missing literature / Knowledge
- Missing physical details of battery



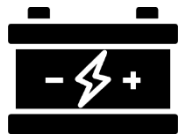
Future Outlook



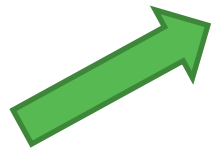
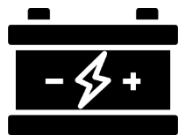
Battery details as input
from manufacturer



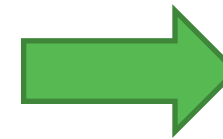
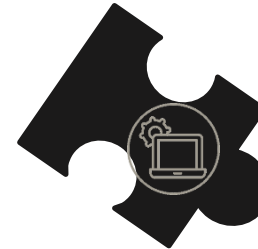
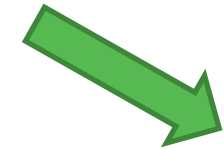
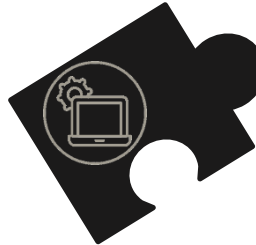
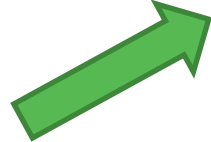
Simulate T-I-U
relation



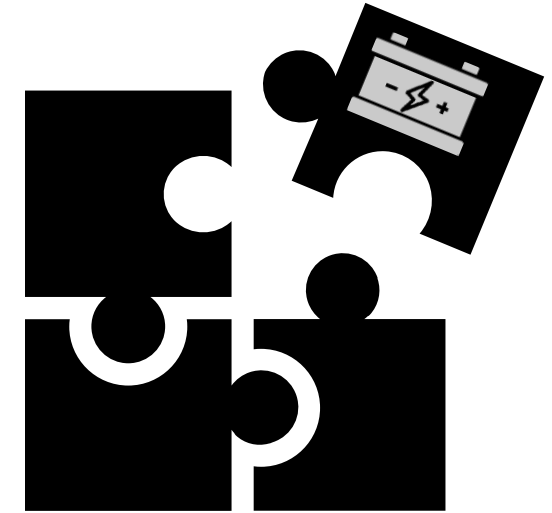
Black Box
Model



(possible during
development)



Tailor-made battery



Power train



Thanks for your attention!

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