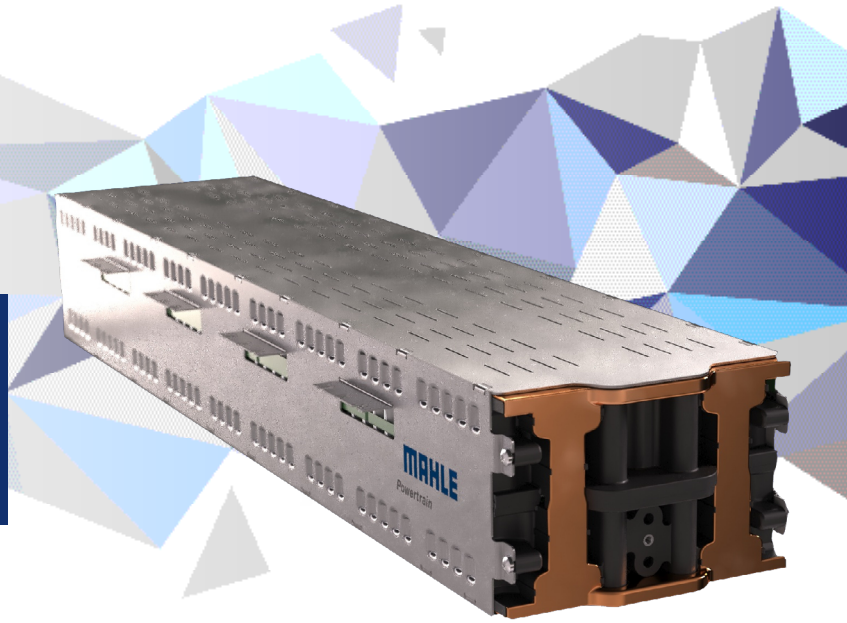
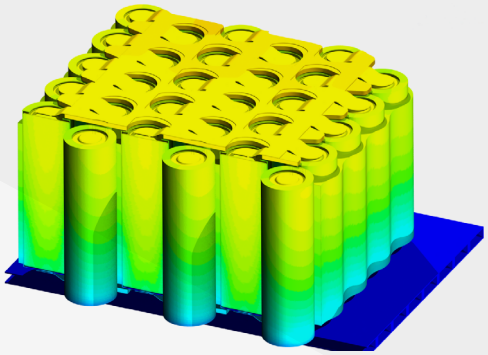
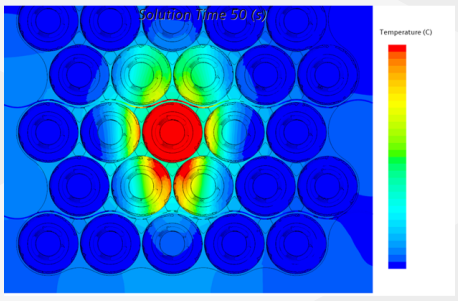
MAHLE Powertrain Battery Simulation



- Battery pack modelling and simulation
- 1D and 3D analysis techniques
- Critical first step in battery development





>> Detailed thermal simulation

Battery Simulation

The analysis and simulation of battery systems is a vital process at the early stages of all electric and hybrid vehicle development projects. MAHLE Powertrain has extensive experience and capabilities in a wide spectrum of 1D and 3D analysis techniques which are backed up by accurate correlation with data from the testing of physical hardware.

We have developed a coupled 1D - 3D modelling approach which enables high fidelity thermal simulations to be undertaken within a full representation of the complete vehicle thermal system.

Our approach provides valuable insights into the behaviour and performance of key vehicle systems during the initial concept phase of a vehicle program and helps to establish design confidence whilst reducing the total costs and timescales significantly.

MAHLE Powertrain provides a turnkey battery development process from initial concept and cell selection through detailed design and simulation to prototyping, validation and vehicle integration. Our high performance battery packs are designed and developed to allow sustained, de-rate free operation at extreme levels of performance.

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MAHLE Powertrain Approach

We adopt our proprietary advanced thermal management philosophy, in conjunction with cutting-edge cells to break the commonly accepted trade-off between maximising energy density and performance.

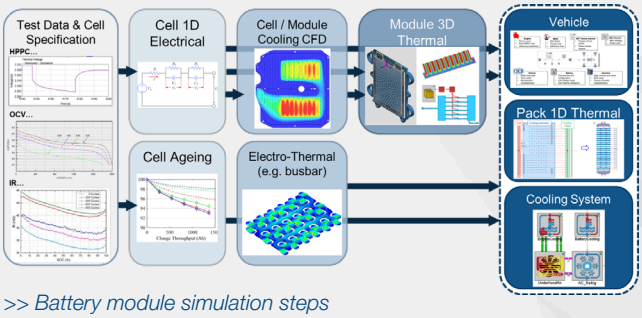
Modularity is also a key feature of our battery packs, allowing us to easily customise the physical and electrical layout of a battery pack to meet any customer requirement.

What We Offer

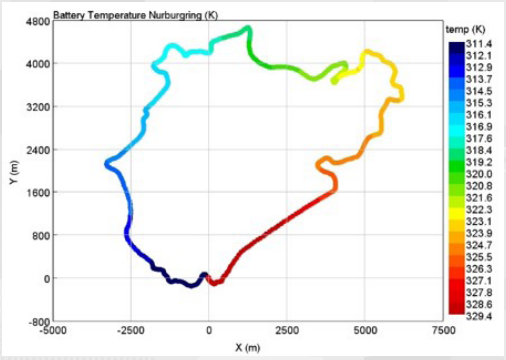
- Sustained, de-rate free operation at extreme levels of performance
- Unique in-house developed cooling systems using conventional coolants
- Coupled 1D-3D simulations for complete system modelling
- Break the commonly accepted trade-off between maximising energy density and performance
- Flexible battery pack design philosophy allows unlimited battery packaging options
- Testing capability for battery packs of extreme performance levels
- Close ties with suppliers that offer cutting-edge cell performance
- Production support for modules and packs
- Complete turnkey battery development service

1D Analysis

- Drive cycle simulation
  - › Vehicle modelling
  - › Hybrid strategy optimisation
- Electrical simulation
  - › Battery module & pack simulation
- Thermal simulation
  - › Full vehicle system
  - › Cooling system performance
  - › Warm up optimisation



>> Battery module simulation steps



>> Battery thermal profile lap of Nürburgring

3D Analysis

- Thermofluids
  - › Battery cooling
  - › Electro-thermal simulation
  - › Vent gas management
  - › Battery cell chemistry
- Structural, modal & shock analysis

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MAHLE product information 05/2022

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