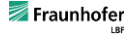




System Simulations of Battery Pack Thermal Management Using Flexible Cooling Technology

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Gefördert von der Europäischen Union. Die geäußerten Ansichten und Meinungen sind jedoch ausschließlich die der Autoren und spiegeln nicht notwendigerweise die der Europäischen Union oder von CINEA wider. Weder die Europäische Union noch die Förderbehörde übernehmen dafür die Verantwortung. Dieses Projekt trägt außerdem zu den Zielen der Batt4EU-Partnerschaft im Rahmen des Förderthemas HORIZON-CL5-2024-D2-02-03 bei: Reduzierung von Größe und Gewicht von Batteriezellen und -gehäusen durch die Integration von leichten und funktionalen Materialien, innovatives Wärmemanagement sowie ein sicherer und nachhaltiger Designansatz (Batt4EU-Partnerschaft)



Co-funded by
the European Union

Project Structure

Resilient / Economical / Silicon-rich

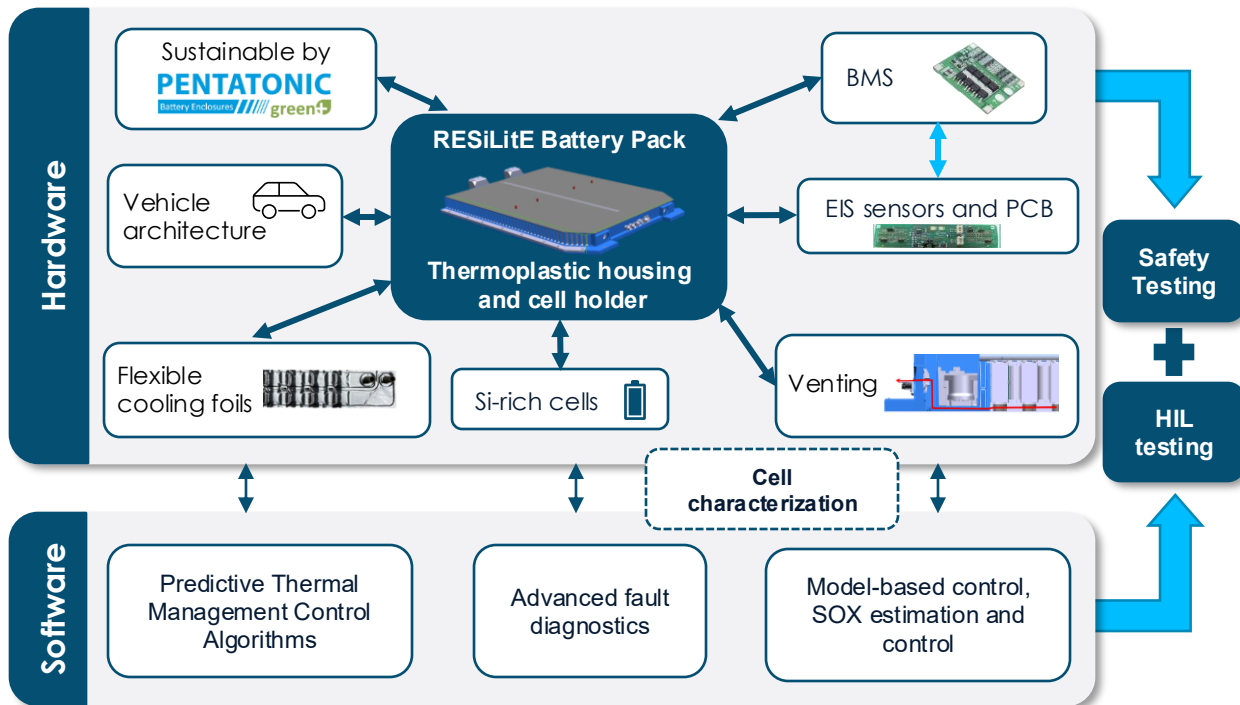
- Focus on safety
- No potting
- High energy density

Light

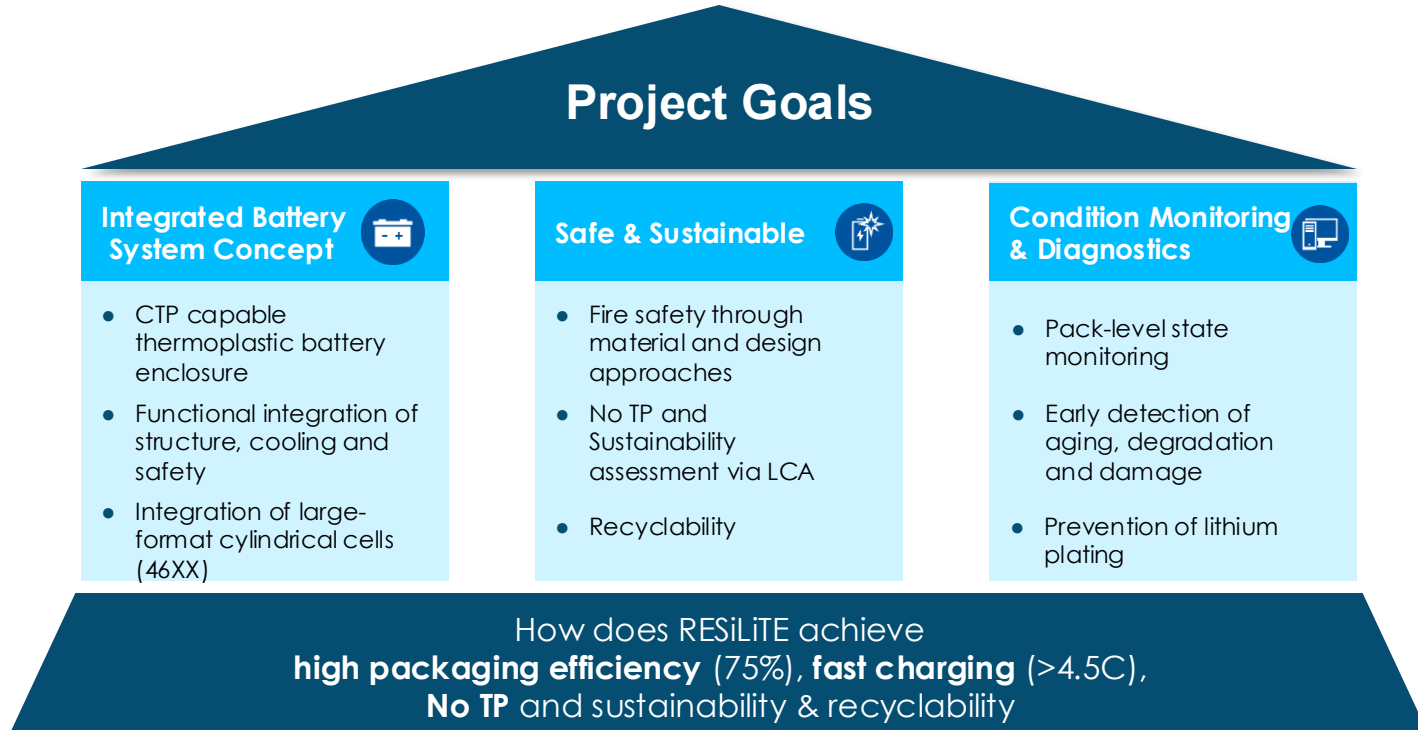
- Thermoplastic battery housing with fiber reinforcement
- Ultrasonic welded plastics joints

Thermally Efficient

- Extension of the temperature operating range with AI-supported BTMS



RESiLiTE: Fundamental basis of the project



RESiLiTE: Project Timeline



RESiLiTE: Thermal Management



Thermal Management System capability

- Designed for 4.7C fast-charging
- Features for the local improvement of thermal performance
- <5 K Temperature gradients at pack level

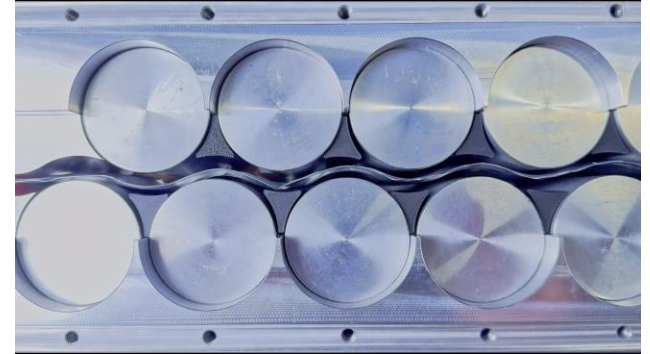


Thermal Management Control System

- Integration with Li-Plating detection during fast-charging
- High level of controllability for maximum energy efficiency
- Scenario-based Thermal Management design

Thermal+ Cooler

- Low-cost Flexible foil
- Removal of Thermal Interface Material
- Tolerance compensation
- High Wrap Angles
- Tailorable thermal performance



Thermal System Simulation Process @ Kautex

Funnel Process: From Requirements Specifications to a Validated Design

Design space Exploration

Boundaries &
Target dimensions

OEM Requirements

Installation Space · Cooling Capacity · Pressure Drop · ...

Speed-up of
simulation time

1D | ThermoSim

Extensive screening of many geometric variations

Ansys Discovery

Quick 3D Check of Favorites

Ansys Fluent

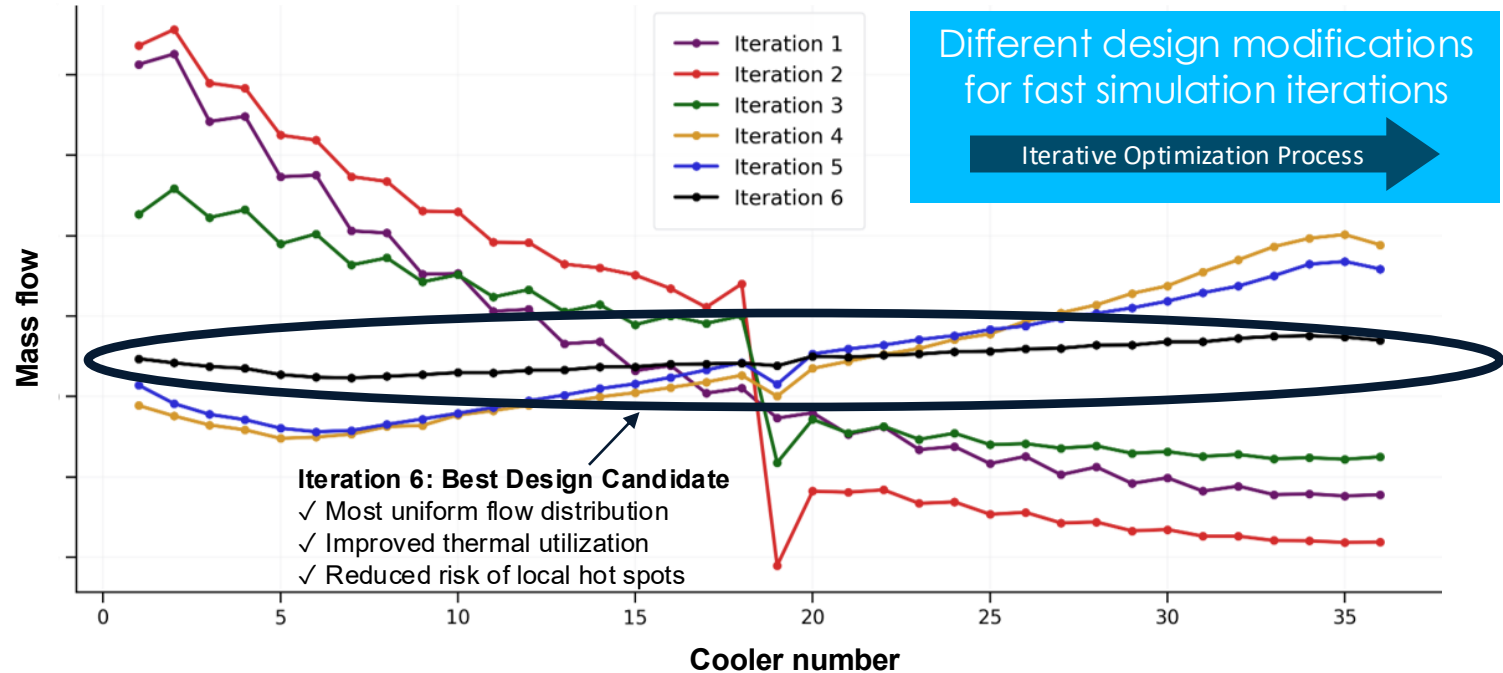
3D Conjugate Heat
Transfer

Validated Design

Number of variants ↓
Level of detail ↑
Computational effort ↓

Rapid screening of multiple design variants, focusing detailed CFD simulations on the most promising concepts to reduce development time, engineering effort, and computational cost.

Optimized Flow Distribution Identified Through Rapid Design Iterations



Fast simulation iterations enable identification of optimized flow distribution and improved thermal system performance.

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