Dr. Gerald Sammer

Performance Optimization of Battery Cell, Module and Pack Testing

Public

ITM

Scaling battery testing – but the smart way!

Performance optimization of battery cell, module and pack testing

Today’s Presenter

Dr. Gerald Sammer

Principal Business Field Manager, Battery & Cell.

M.Sc. in computer science and a Ph.D. in economics.

32 years professional experience in computer science.

24 years experience in automotive technologies.

AVL representative in the technical steering committee of the ASAM standardization group for automotive standards.

AGENDA

AVL Company

Key Aspects of Optimized Testing & Validation

Lab Process Efficiency

Intelligent Test Optimization

Facts and Figures

Global Footprint

Represented in 26 countries

45 Affiliates at over 92 locations

45 Global Tech and Engineering Centers (including Resident Offices)

1948

Founded

10,700

Employees Worldwide

12%

Of Turnover Invested in Inhouse R&D

70+

Years of Experience

68%

Engineers and Scientists

2,500

Granted Patents in Force

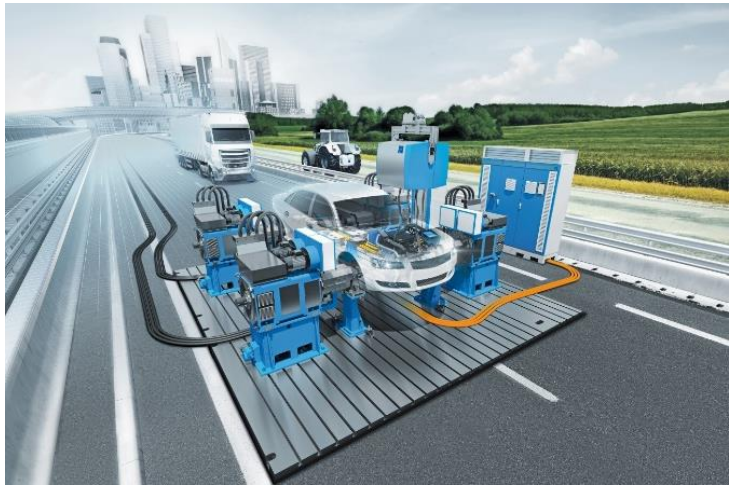
97%

Export Quota

Three Disciplines Under One Roof

ENGINEERING SERVICES

- Design and development services for all elements of ICE, HEV, BEV and FCEV powertrain systems
- System integration into vehicle, stationary or marine applications
- Supporting future technologies in areas such as ADAS and Autonomous Driving
- Technical and engineering centers around the globe



INSTRUMENTATION AND TEST SYSTEMS

- Advanced and accurate simulation and testing solutions for every aspect of the powertrain development process
- Seamless integration of the latest simulation, automation and testing technologies
- Pushing key tasks to the start of development

ADVANCED SIMULATION TECHNOLOGIES

- We are a proven partner in delivering efficiency gains with the help of virtualization
- Simulation solutions for all phases of the powertrain and vehicle development process
- High-definition insights into the behavior and interactions of components, systems and entire vehicles

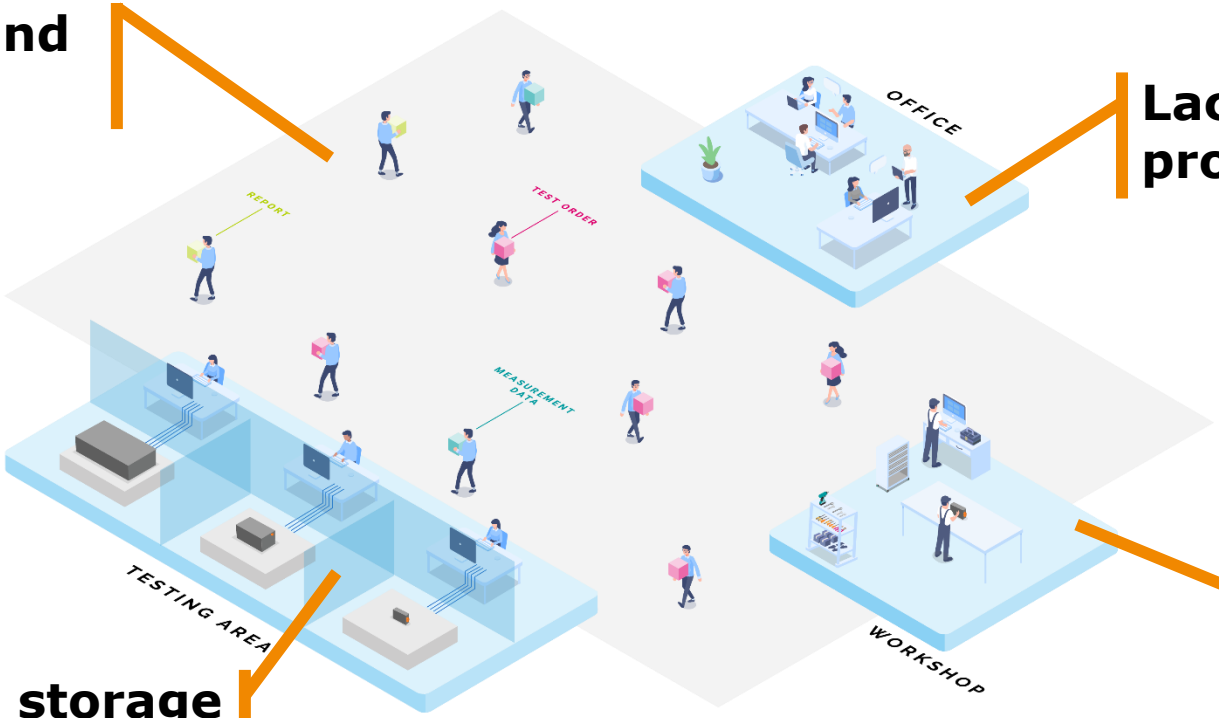
Key Aspects of Optimized Testing & Validation

Lab Process Efficiency

Test Methodology

Battery Lab with Low Maturity

KPIs not defined and measured



Lack of digitalization and process automation

Disconnected data storage in different locations

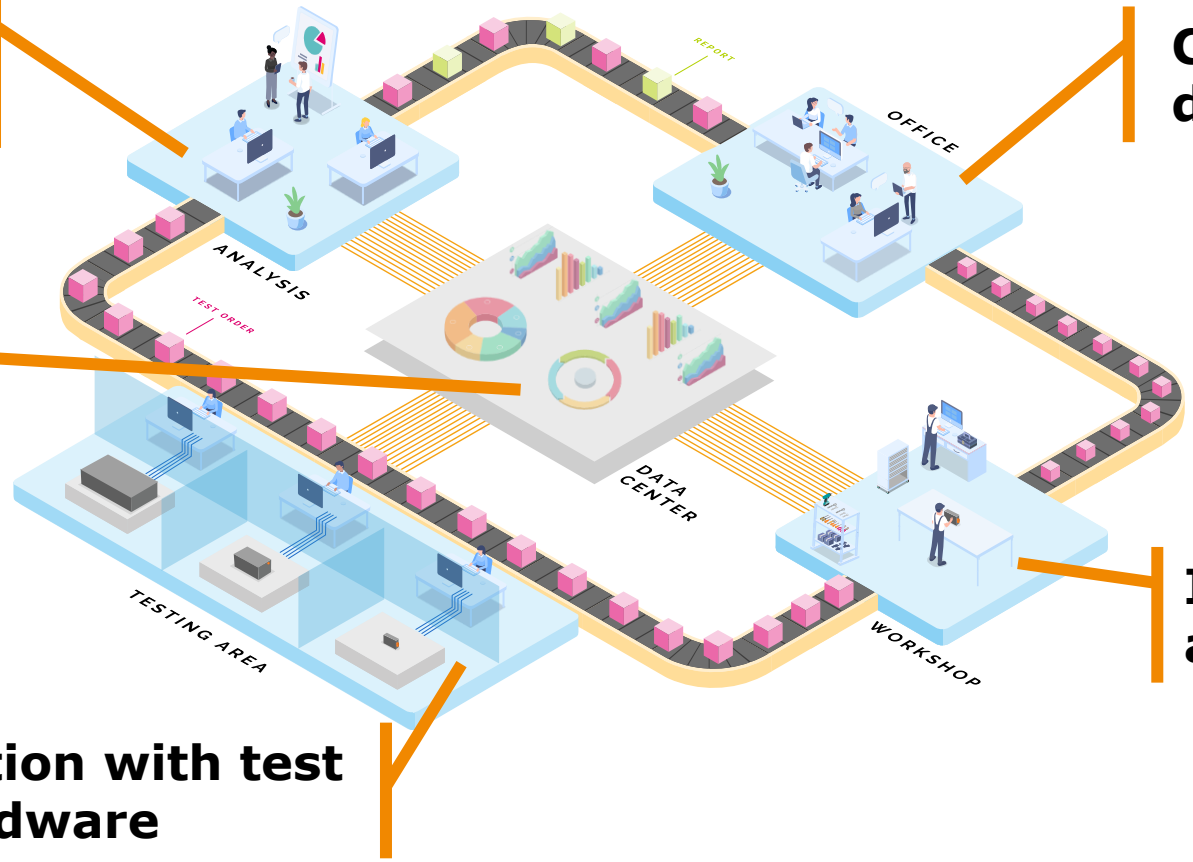
Manual planning processes

Optimize The Lab Process

Automated data analysis and processing

KPI driven lab performance monitoring

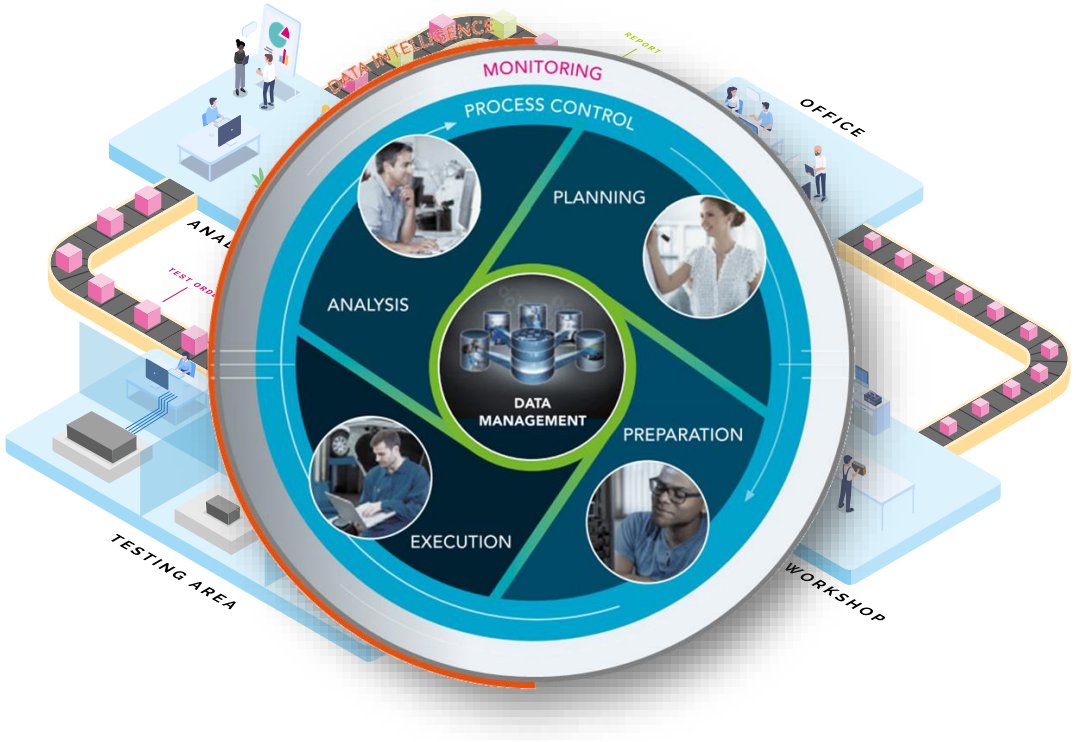
Seamless integration with test automation & hardware



Clear test requests and defined processes

Intelligent scheduling and task management

AVL Lab Management™



Asset Management
- ✓ Equipment & UUT Management
- ✓ Maintenance & Calibration

Process Control
- ✓ Work Order Management
- ✓ Planning & Scheduling

Data Management
- ✓ Data Integration (AVL & 3rd Party)
- ✓ Data Harmonization & Lifecycle
- ✓ Automated Data Processing

Monitoring
- ✓ Online Status View of all Testbeds
- ✓ Dashboarding of KPIs

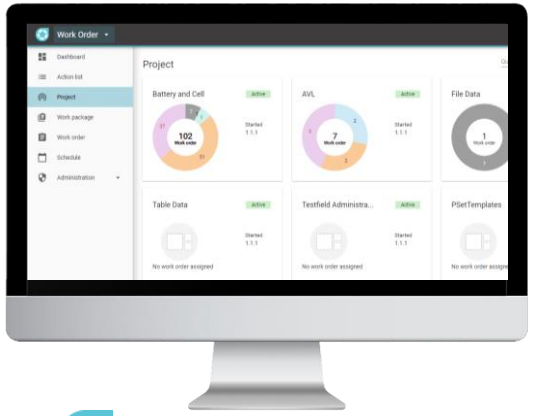
Energy Management
- ✓ Energy Monitoring
- ✓ Energy Control
- ✓ Energy Planning & Prediction

Data Intelligence
- ✓ Analyse & Visualize Results
- ✓ Reports & Statistical Evaluations
- ✓ Explorative Data Analysis

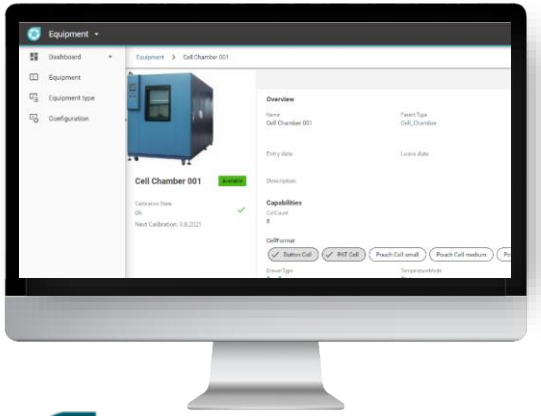
Reference Processes
- ✓ Battery Cell Test
- ✓ Battery Module/Pack
- ✓ Propulsion Test
- ✓ Vehicle Test

Modern Look & Feel, Scalable IT Technology & Deployment

Data Management



Process Control



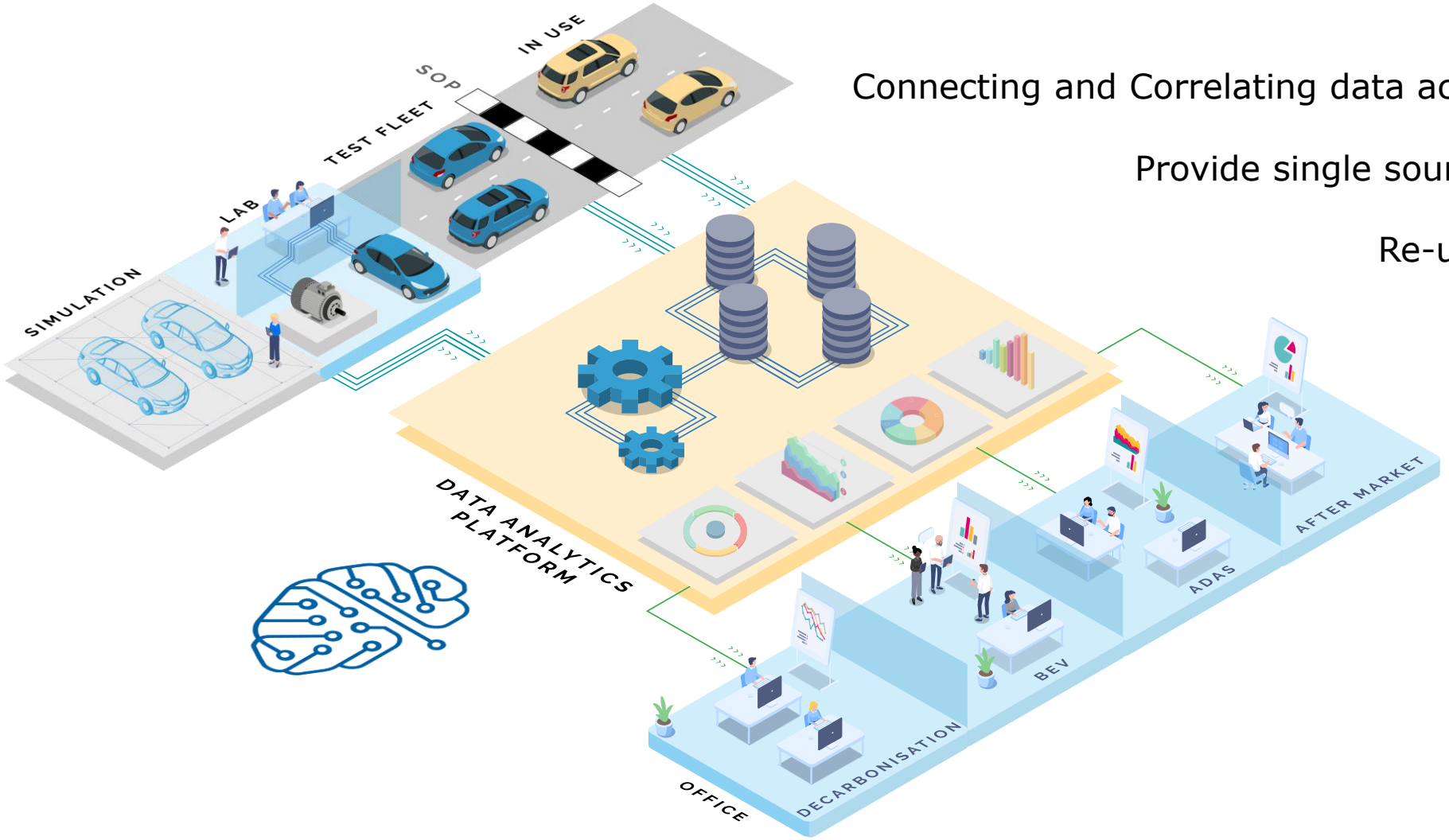
Asset Management

Energy Management

Data Intelligence

Lab Monitoring

AVL Data Analytics Platform

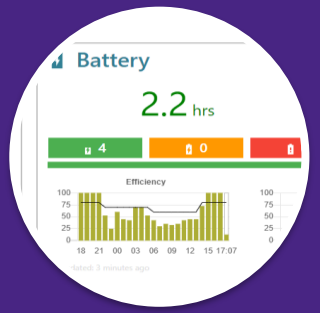


Connecting and Correlating data across development phases

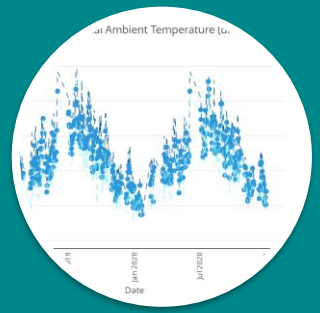
Provide single source of truth to all domains

Re-use data instead of re-test

AVL Lab Management for Battery Benefits



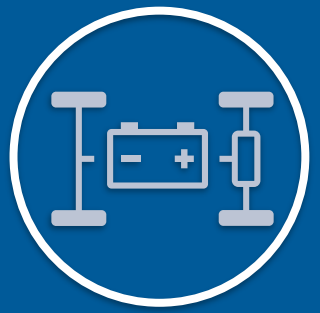
Maximize utilization of test resources



30-60% increase in value added data

Optimize energy consumption

Minimize human induced errors

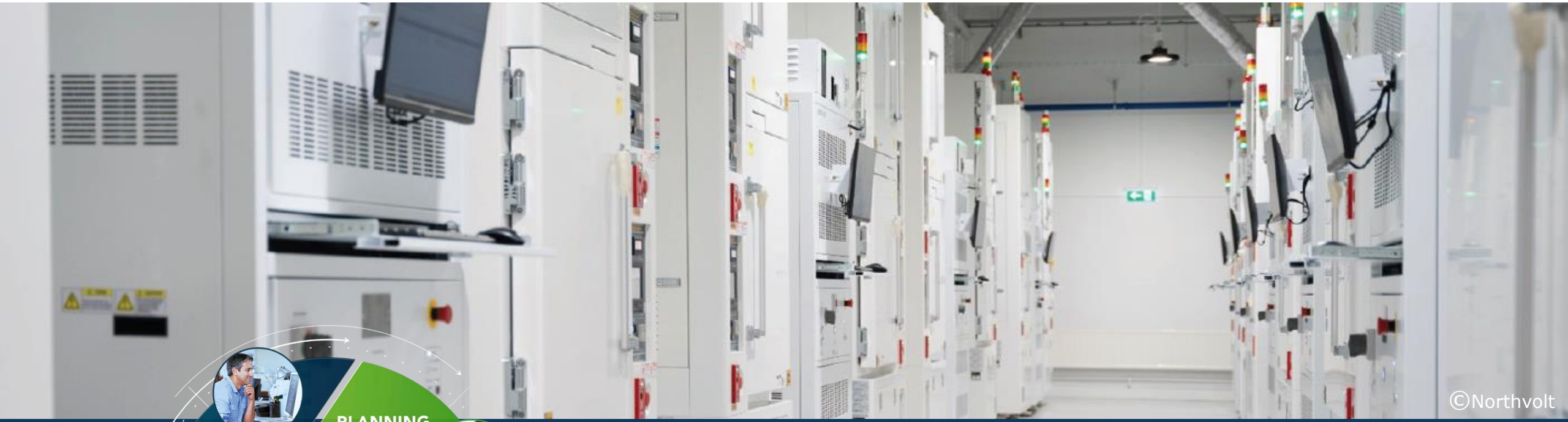


AVL battery expertise on board

Reference: Volkswagen Germany Battery Cell Lab in Salzgitter

- ✓ Optimized planning of tests and resources
- ✓ Short reaction times and reduced downtimes
- ✓ Full traceability of data
- ✓ Faster and solid product decisions

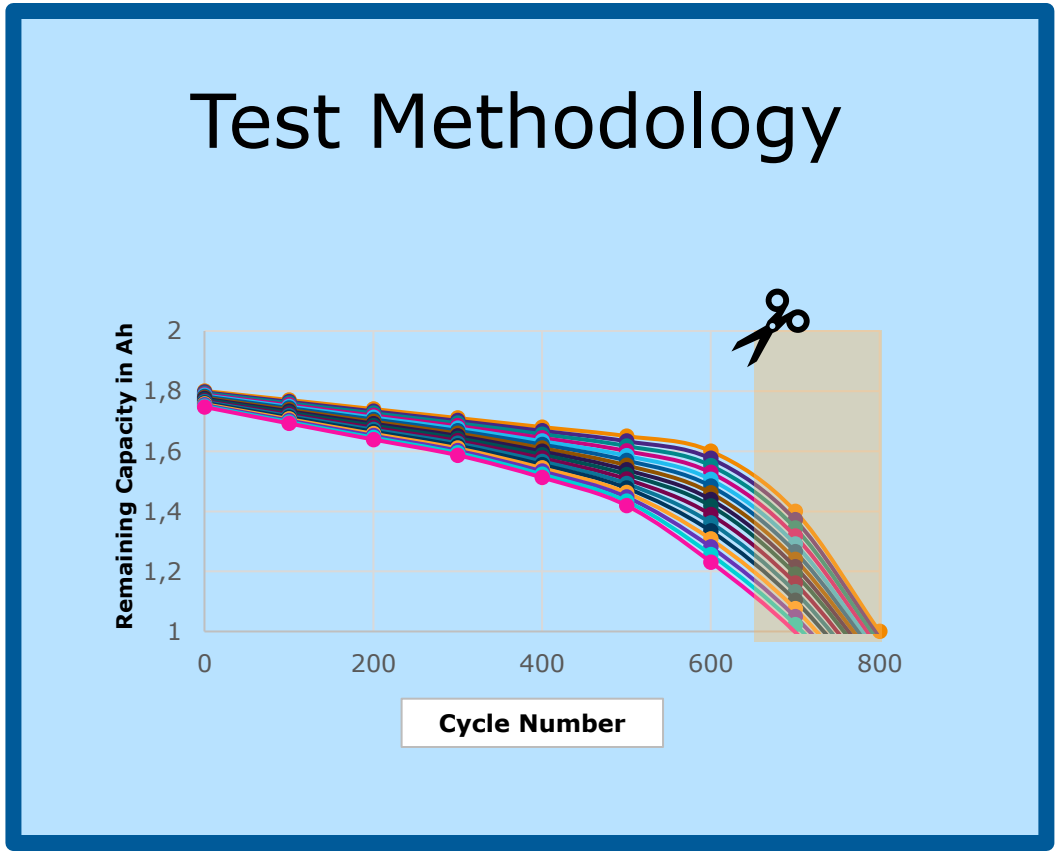
Reference: Northvolt AB
Performance & Life (P&L) Laboratory



Improve the productivity of battery P&L lab

- ✓ Flexible scaling according to future test demands
- ✓ Integration of cycler systems from different vendors
- ✓ Process automation starting from the test request
- ✓ Intelligent scheduling procedures
- ✓ Traceability throughout the process

Key Aspects of Optimized Testing & Validation

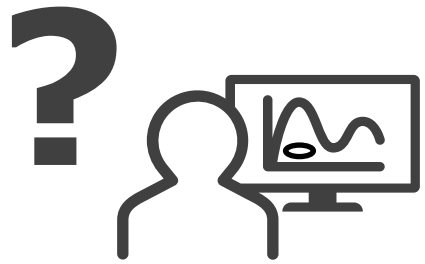


Challenges in Battery Development & Test

What is the influence of production tolerances on Battery KPI's?

How to reduce the time to measure a cell ageing model?

How can I efficiently adjust my BMS calibration after frequently changed cell chemistry, sensors, pack details



Fastest way to get/update the SOC RC model?

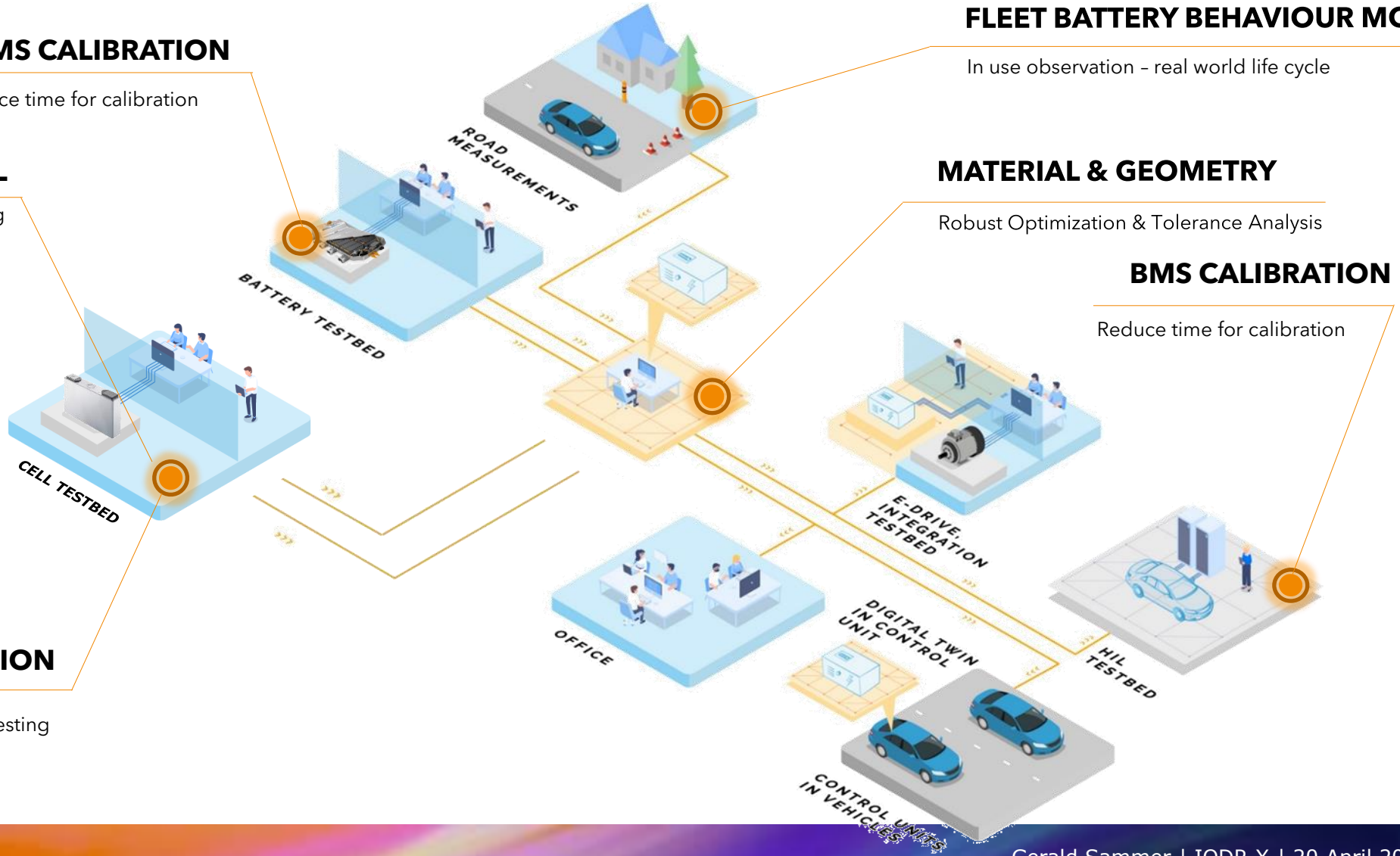
What are the influencing factors on delta SOC/km in my BEV fleet in a certain market?

Battery Development Environments
Where can AVL help?

BMS CALIBRATION
Reduce time for calibration

CELL AGEING MODEL
Reduce time for testing

CELL CHARACTERIZATION
Reduce time for testing



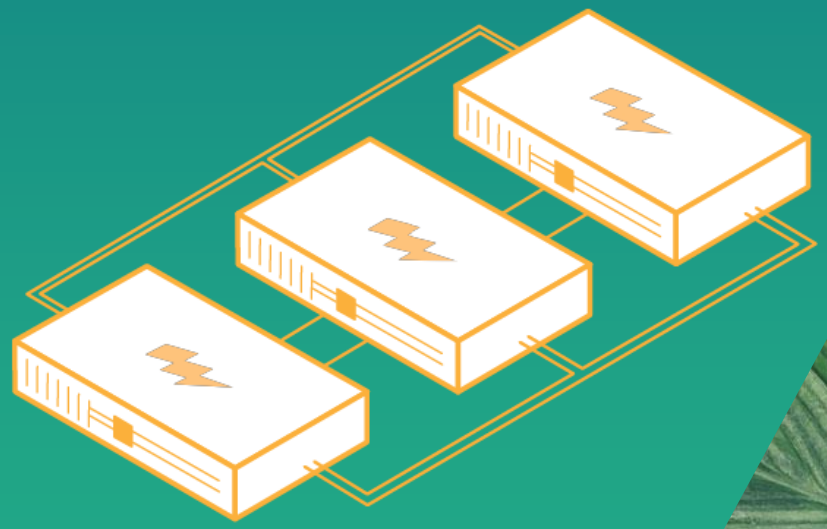
FLEET BATTERY BEHAVIOUR MODELING
In use observation – real world life cycle

MATERIAL & GEOMETRY
Robust Optimization & Tolerance Analysis

BMS CALIBRATION
Reduce time for calibration

AVL CAMEO 5™

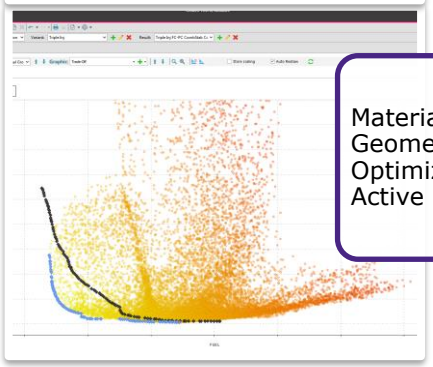
Enter the Cosmos of Smart Cell Development



AI driven Test Optimization

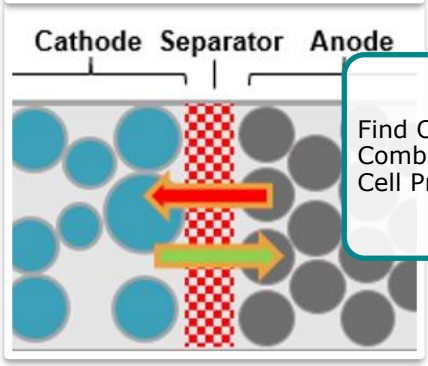
CAMEO 5™ Use Cases for Battery

Material / Geometry



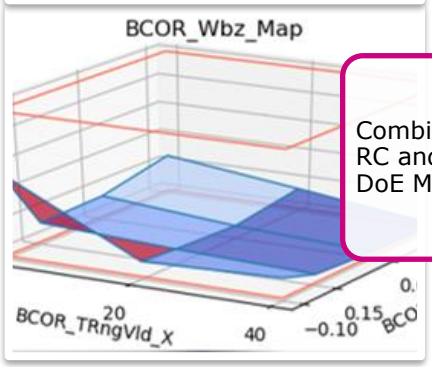
Material & Geometry Optimization using Active DoE

Cell Properties



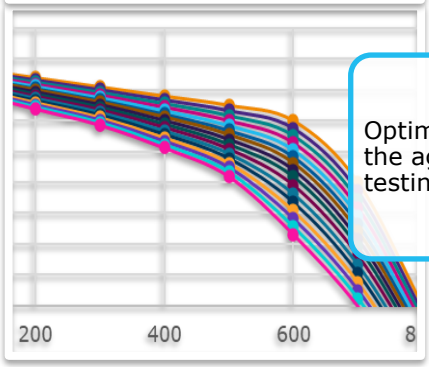
Find Optimum Combination of Cell Properties

Cell Characterization



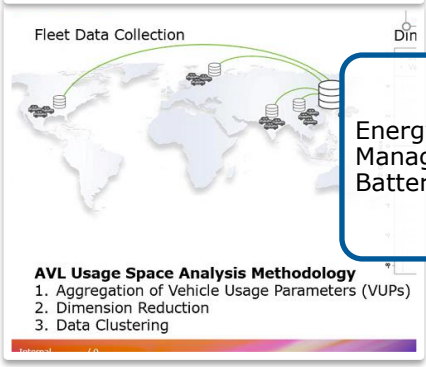
Combination of RC and Active DoE Model

Ageing



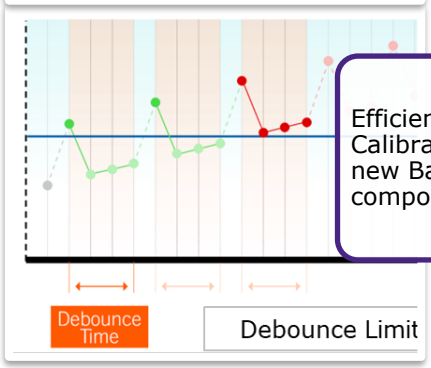
Optimization of the ageing testing process

Fleet Battery Modeling



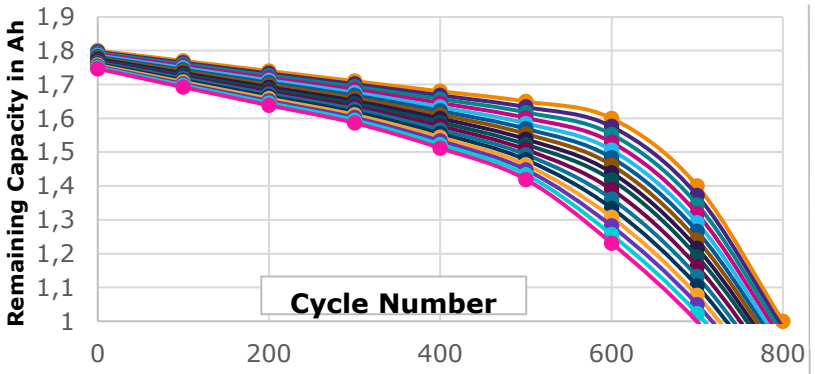
Energy Management & Battery KPIs

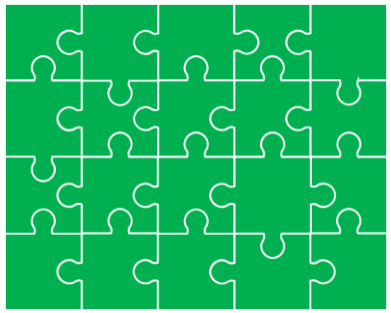
BMS Calibration



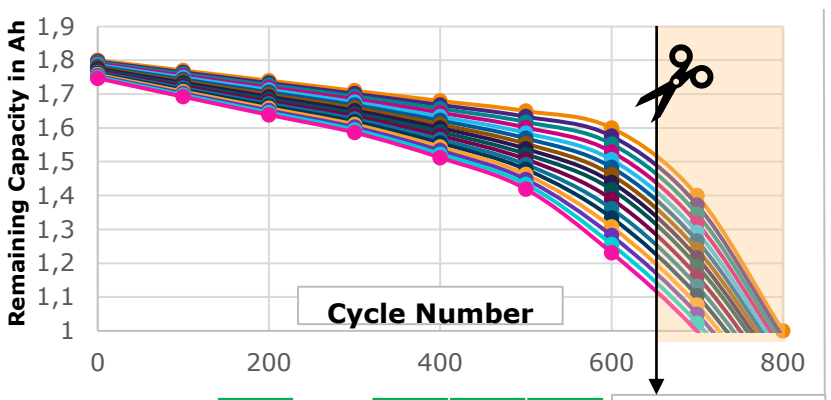
Efficient Calibration for new Battery components

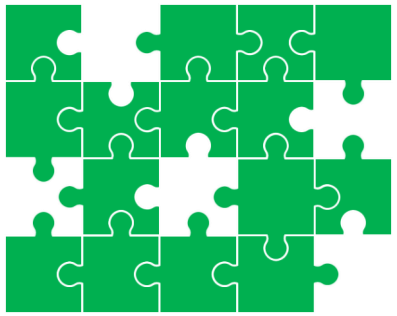
Reduction of Ageing Measurement Time
Use Ageing Information from Faster Ageing Cells for Extrapolation





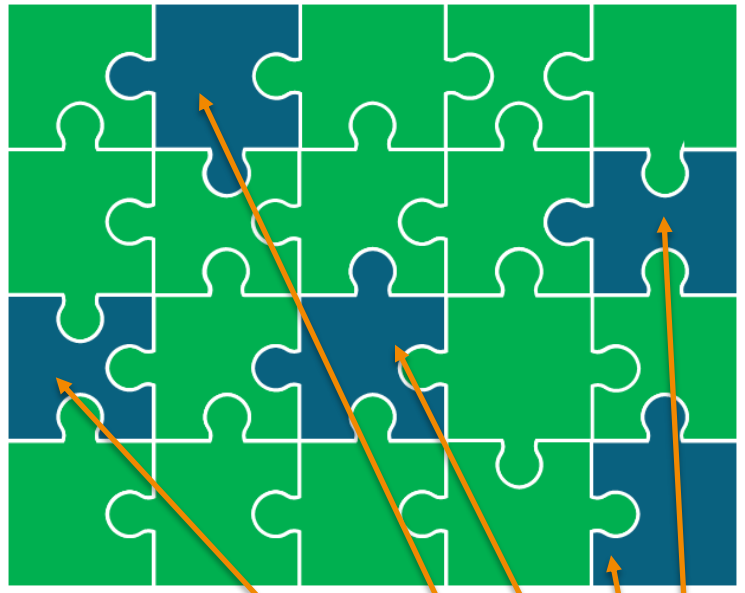
Ageing Model



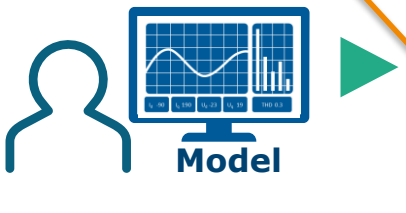


Reduce testing time by trimming the design points which need longer ageing time

Model uses the data from faster ageing cells to predict the EoL characteristics of the slower ageing cells



Test Plan



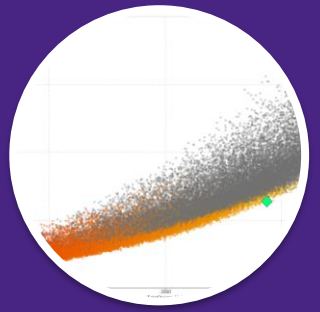
Model

BENEFIT: Reduction of test time by 20%

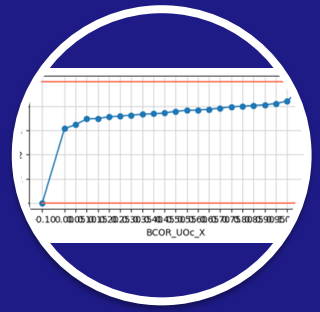
CAMEO for Battery Benefits

AVL CAMEO 5™

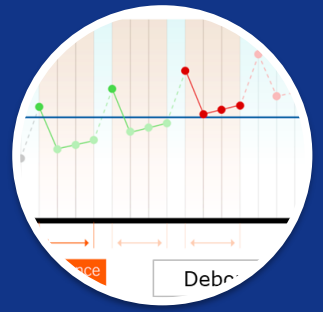
Create a new Continuum



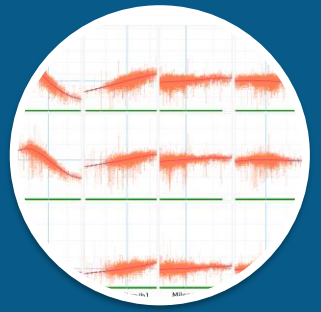
Workflow for Material & Geometry **Optimization and Tolerance** consideration



Active DoE to **speed up** cell characterization & **ageing** measurements



Proven and off the shelf intelligent automation to generate or adapt your **BMS calibration**



AI based **Battery Fleet data modelling**

Well established with **worldwide support and AVL Battery expertise** on board

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Thank You!

Contact me for further information: gerald.sammer@avl.com

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