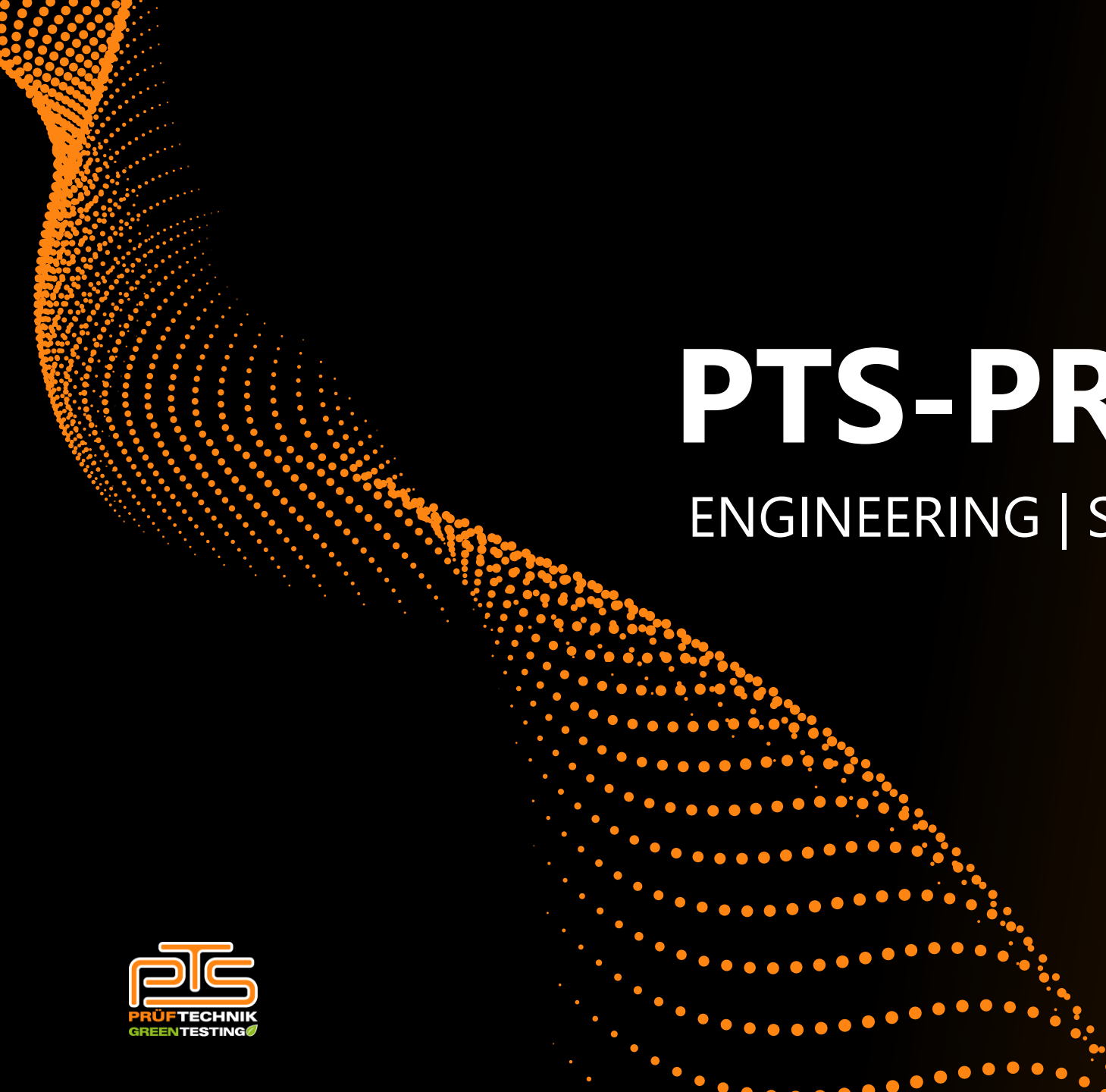


A decorative graphic on the left side of the slide, consisting of a series of orange dots arranged in a wavy, funnel-like shape that tapers towards the bottom right.

PTS-PRÜFTECHNIK

ENGINEERING | SIMULATION | TESTING

Solutions. Engineered to validate.

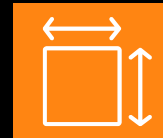
ABOUT US



Founding
2005



Experts
250



m² area
30,000



Locations
5



Test rigs
> 300



TISAX Label
DIN ISO 9001/14001/17025/50001

OVERVIEW COMPETENCES

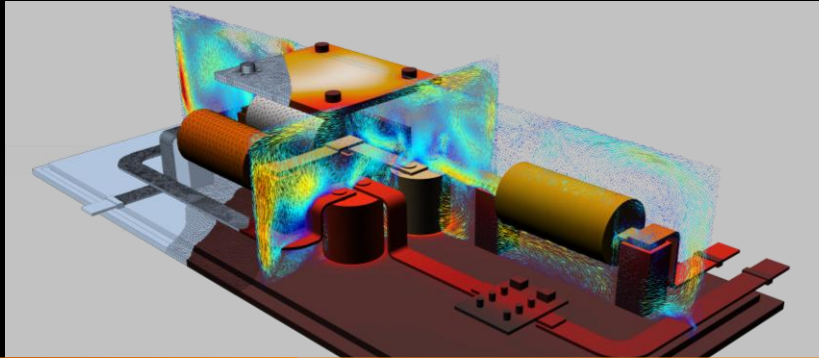
From the initial concept to a qualified system solution, we support our customers throughout the entire development process.



01

ENGINEERING

- DESIGN/ CONSTRUCTION
- THERMAL MANAGEMENT
- DATA ANALYSIS
- APPLICATION



02

SIMULATION

- 1D- & 3D-SIMULATION
- FEM-SIMULATION
- CASTING PROCESS SIMULATION
- MULTI-PHYSICS-MODELLING



03

TESTING

- ENVIRONMENTAL TESTING
- ENDURANCE TESTING & FUNCTIONAL TESTING ON TEST RIGS AND IN REAL OPERATION



ENVIRONMENTAL TESTING

ENVIRONMENTAL TESTING FOR TRANSPORT TECHNOLOGY

Reliable under extreme conditions - customized, flexible & everything done by a single source



TEST BENCH DEVELOPMENT IN-HOUSE

- ✓ Flexible & scalable



ELECTRICAL TESTING

- ✓ Low & High voltage
- ✓ DUT control
- ✓ Signal logging



COMBINED TESTS

- ✓ Realistic combined loads with the DUT in active operating mode

OUR SERVICES

In accordance with standards such as EN50155, EN61373 and EN50125



**Humidity/Climate
Testing**



**Shock & Vibration
Tests**



IP Testing (Water & Dust)



Corrosion Tests



Active cooling circuit



**High /Low Temperature &
Temperature Cycle**



BATTERY TESTING

BATTERY TESTING FOR TRANSPORT TECHNOLOGY

Reliable under extreme conditions - customized, flexible & everything done by a single source



TEST BENCH DEVELOPMENT IN-HOUSE

✓ Flexible & scalable



ELECTRICAL TESTING

✓ Functional and safety tests for cells, modules & battery systems



VALIDATION TESTING

✓ Customized & reliable

OUR SERVICES



**Humidity/Climate
Testing**



**Functional, Safety &
Service Life Tests**



**Analysis & disassembly
of battery systems**



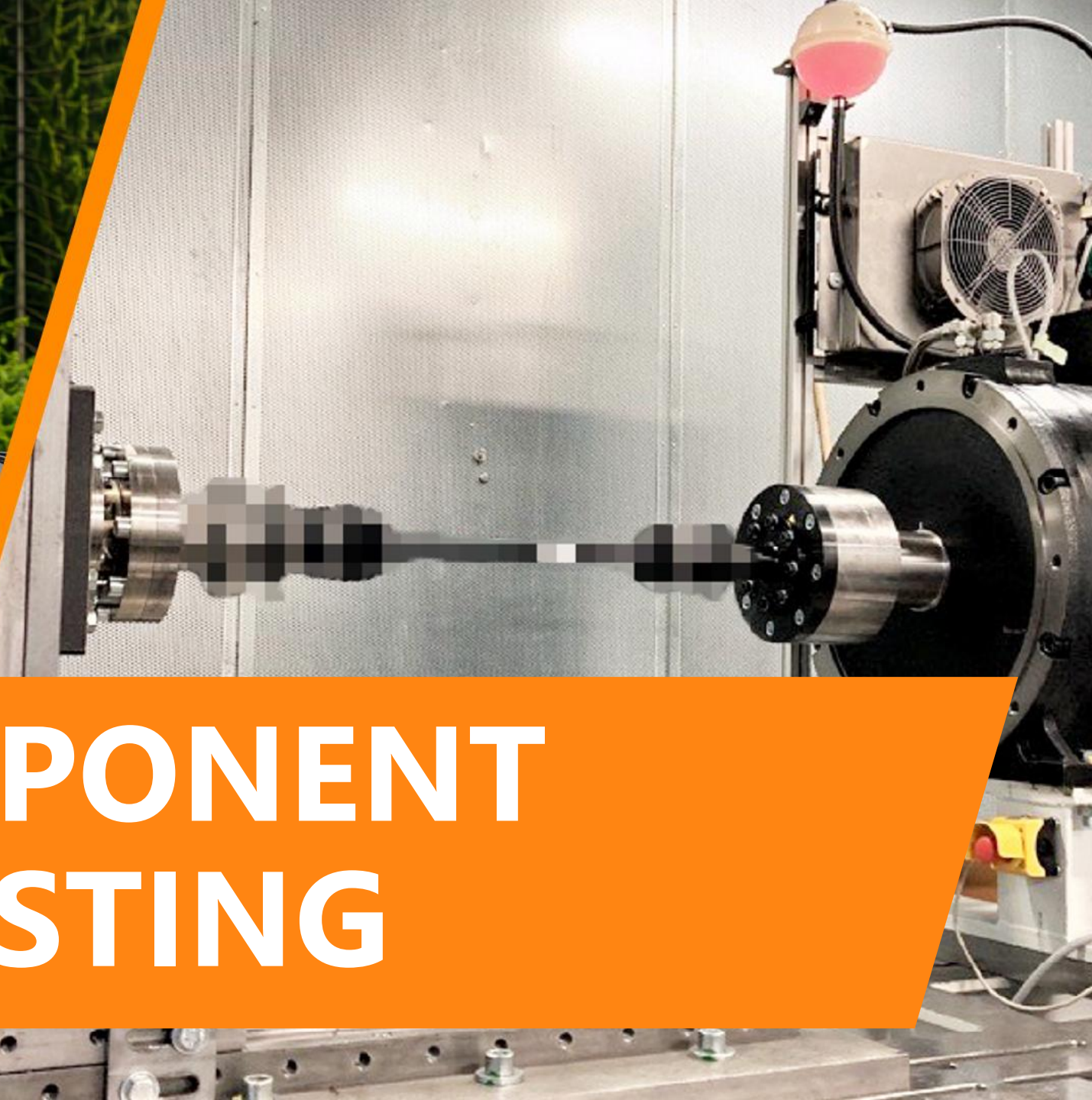
**Development
validation tests**



**Tab welding on battery
cells & modules**



**Module
Prototyping**



COMPONENT TESTING

COMPONENT TESTING FOR TRANSPORT TECHNOLOGY

Reach your destination with reliability, flexibility and speed.



TEST BENCH DEVELOPMENT IN-HOUSE

- ✓ Flexible & scalable



ELECTRICAL TESTING

- ✓ Low & High voltage
- ✓ DUT control
- ✓ Signal logging



ACTIVE COOLING CIRCUIT

- ✓ Customized & reliable

OUR SERVICES



**High-Speed-
Testing**



**High-Torque-
Testing**



**Endurance, fatigue, &
functional tests under
realistic load conditions**



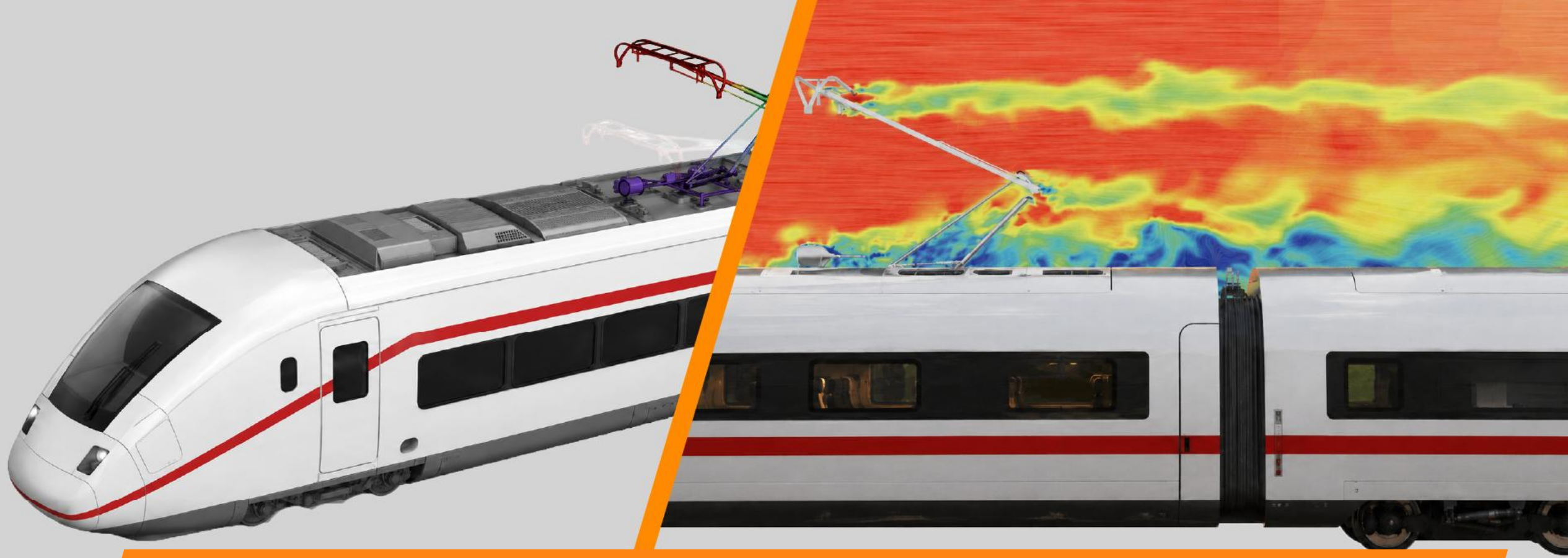
**Structural mechanics
tests**



Combined Tests



**Mechanical and electro-
mechanical components**
e.g. highly stressed structural & bearing



NUMERICAL SIMULATION

NUMERICAL SIMULATION FOR TRANSPORT TECHNOLOGY

Simulation meets reality – for better products and faster development from a single source



**FAST & RELIABLE
RESULTS**



**FROM INDIVIDUAL
COMPONENTS TO
COMPLETE SYSTEMS**



**SEAMLESS
CONNECTION BETWEEN
SIMULATION & TESTING**

OUR SERVICES

In accordance with standards such as VDI 2230 and FKM



**Structural Mechanics &
Strength Analysis (FEM)**



**Fluid Dynamics & Thermal
Management (CFD)**



**Combined simulation &
testing for high-precision &
reliable model development**



**System Simulation &
Functional Modeling (1D)**



**Coupled multiphysics
simulations for realistic
operating conditions**



THERMAL MANAGEMENT

THERMAL MANAGEMENT FOR TRANSPORT TECHNOLOGY

Reliable under extreme conditions - customized, flexible & everything done by a single source



TEST BENCH DEVELOPMENT IN-HOUSE

- ✓ Flexible & scalable



ELECTRICAL TESTING

- ✓ Low & High voltage
- ✓ DUT control
- ✓ Signal logging



CUSTOMIZED TEST ENVIRONMENTS

- ✓ Pressure, humidity, temperatures, etc.

OUR SERVICES



**Thermal Management
System Design**



Component Testing



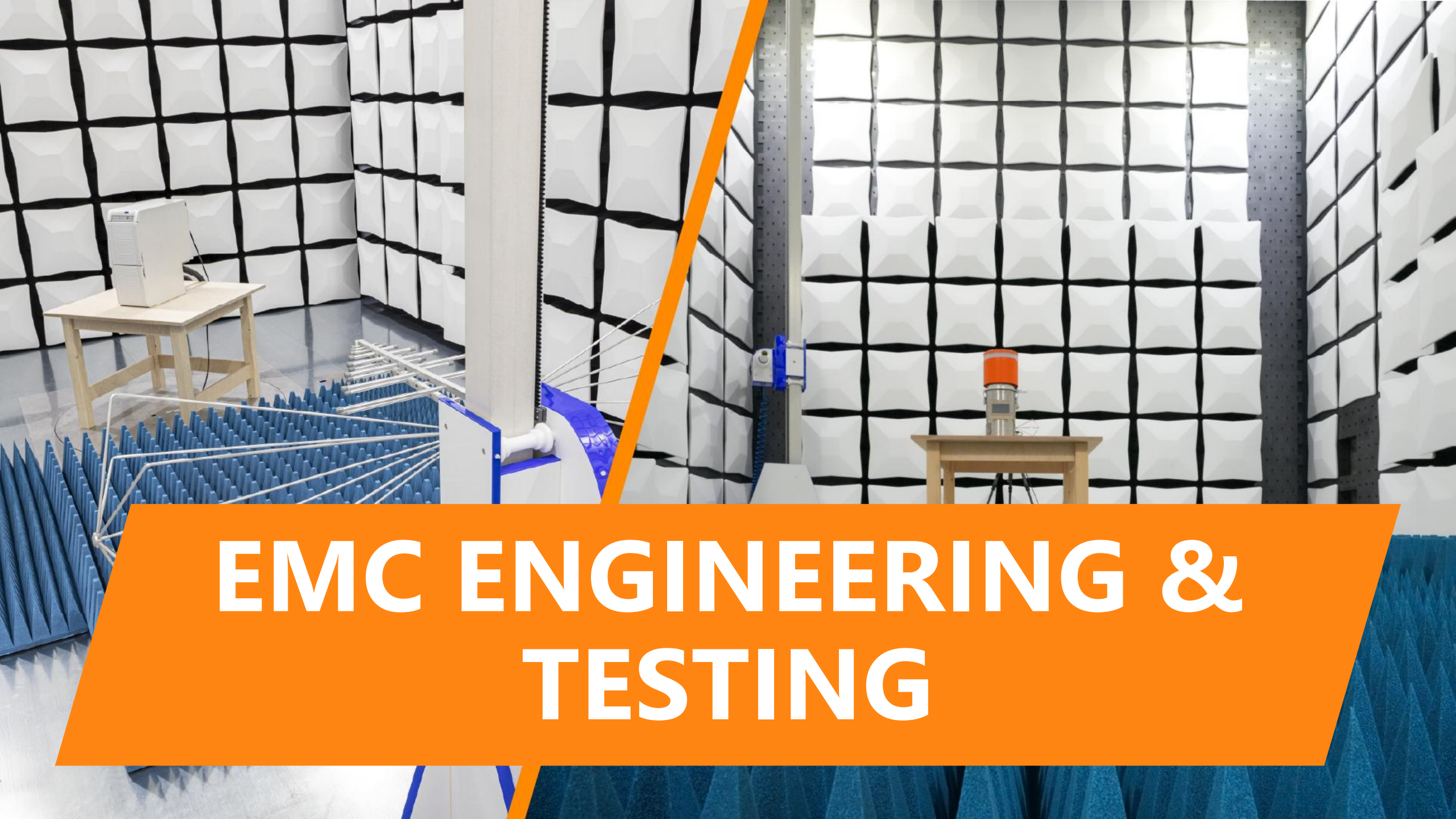
**High /Low Temperature &
Temperature Cycle**



**Thermal Management
Applications**



**Test Design &
Validation**



EMC ENGINEERING & TESTING

EMC ENGINEERING & TESTING FOR TRANSPORT TECHNOLOGY

Reach your destination with reliability, flexibility and speed.



TEST BENCH DEVELOPMENT IN-HOUSE

- ✓ Flexible & scalable



ACTIVE TESTING

- ✓ Low & High voltage
- ✓ DUT control
- ✓ Signal logging



ACTIVE COOLING CIRCUIT

- ✓ Customized & reliable

OUR SERVICES



High-Torque-Testing



Combined Tests



**EMC Pre-Compliance Tests
& Debugging**



EMC Concept



**Design Consulting & EMC
Mitigation Measures**



**EMC measurement
chamber**

YOUR PARTNER AT 5 LOCATIONS

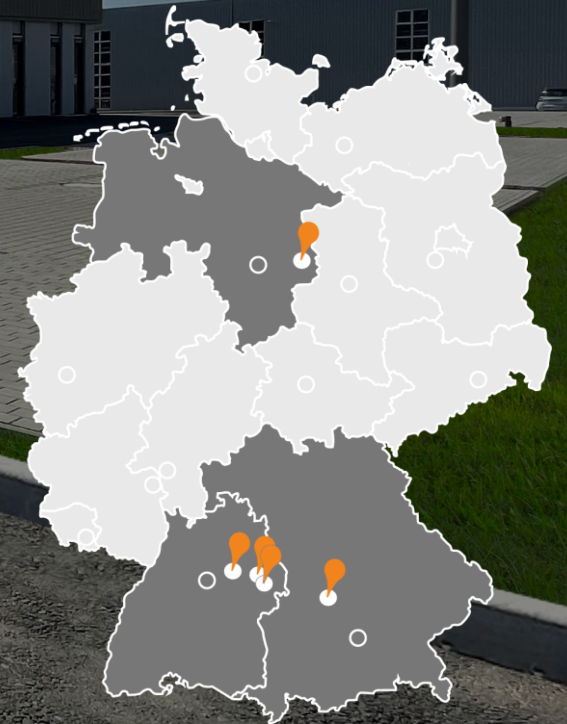
Waldstetten

Schwäbisch Gmünd

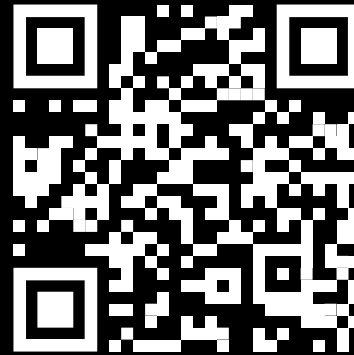
Remshalden

Ingolstadt

Wolfsburg



**TAKE THE PRESENTATION WITH YOU –
SCAN HERE:**



EMV ENGINEERING & TESTING

EMV-VALIDIERUNG ELEKTRISCHER ANTRIEBE UNTER MAXIMALER LAST

AUFGABENSTELLUNG

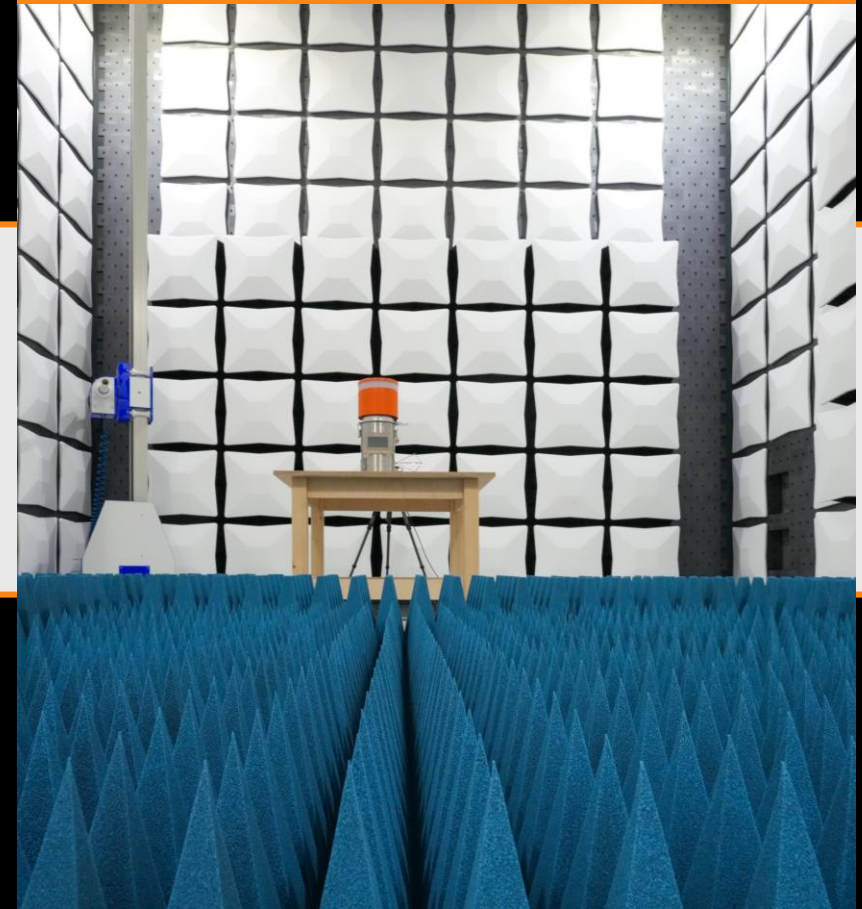
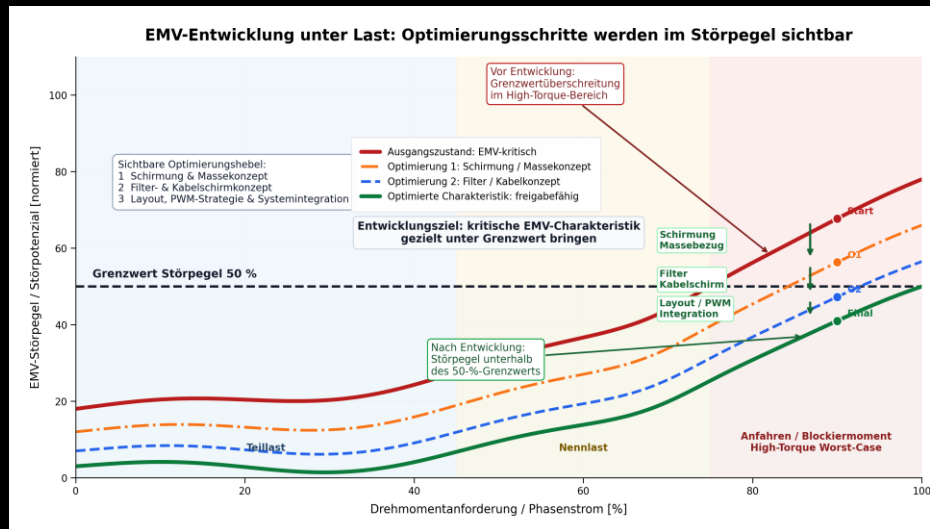
Elektrifizierte Antriebe, Inverter und Leistungselektronik erzeugen im Blockier- und Anfahrmoment höchste Phasenströme. Genau in diesen Betriebspunkten steigen Schirmströme, leitungsgebundene Emissionen und Common-Mode-Störungen. Klassische EMV-Tests ohne reale Last erkennen kritische Effekte oft zu spät. PTS bildet den Worst-Case auf Komponenten- und Systemebene unter Last ab

PROJEKTZIELE

EMV-Risiken bei hohen Strömen und hoher Taktung früh sichtbar machen und bereits beim Design zu minimieren. Den Störpegel durch Optimierung unter den Grenzwert bringen.

METHODISCHER ANSATZ PTS

- Ursachenanalyse: Betriebsprofile und EMV-Zielkorridor definieren
- Prüfstandsphase: High-Torque-Betrieb
- Messphase: Störungen, Schirmströme, HF-Strompfade und Ripple erfassen
- Optimierungsphase: Schirmung, Massebezug, Filter, Kabelkonzept, Layout und PWM-Strategie weiterentwickeln, Verbesserung der Symmetrie, Reduktion der Innenwiderstände



WICHTIGSTE ERKENNTNISSE

- Hohe Ströme sind der kritische EMV-Stressfall:** Beim Blockier- bzw. Anfahrmoment entstehen die größten Störpotenziale.
- EMV sollte mit Last geprüft werden:** Nur so werden Wechselwirkungen von Inverter, Motor und Verkabelung sichtbar.
- Entwicklungsziel erreicht:** Der Störpegel wird schrittweise unter den Zielkorridor gebracht.

ENTLÜFTUNGSOPTIMIERUNG STROMRICHTER-KÜHLKREISLAUF E-LOKOMOTIVE

AUFGABENSTELLUNG

Bei einer E-Lokomotive treten nach Wartungs- oder Inbetriebnahmevorgängen des Stromrichter-Kühlkreislaufes lokale Überhitzungen und kurzzeitige, schwer reproduzierbare Temperaturspitzen auf.

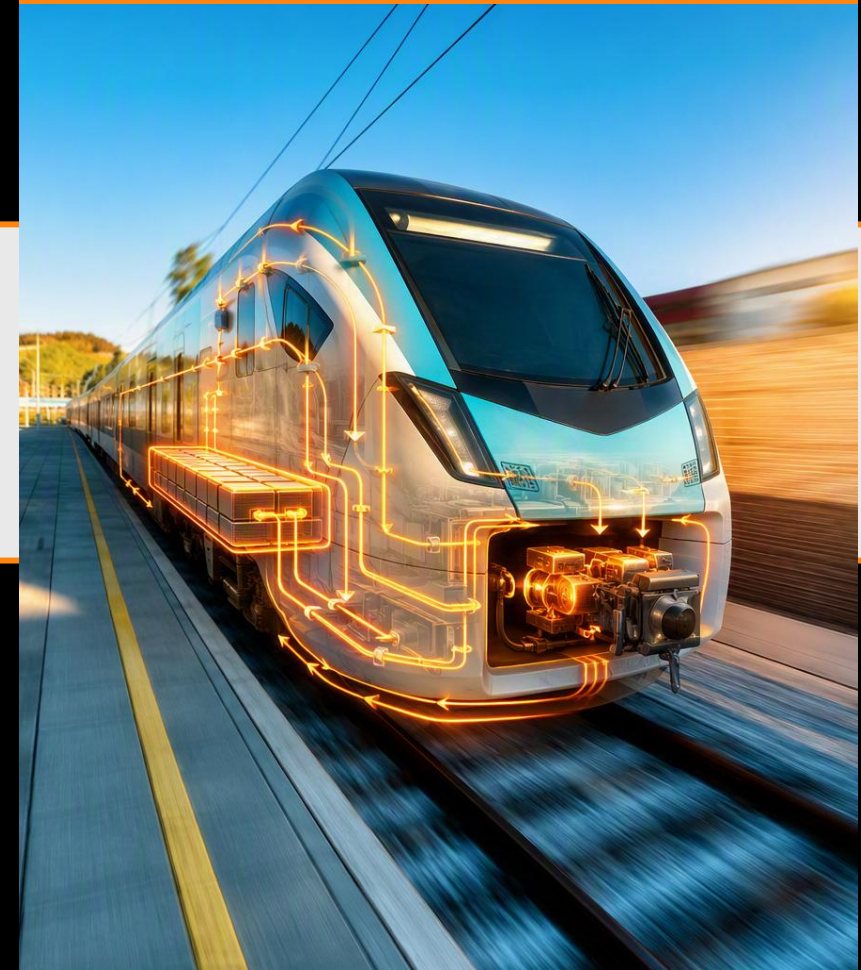
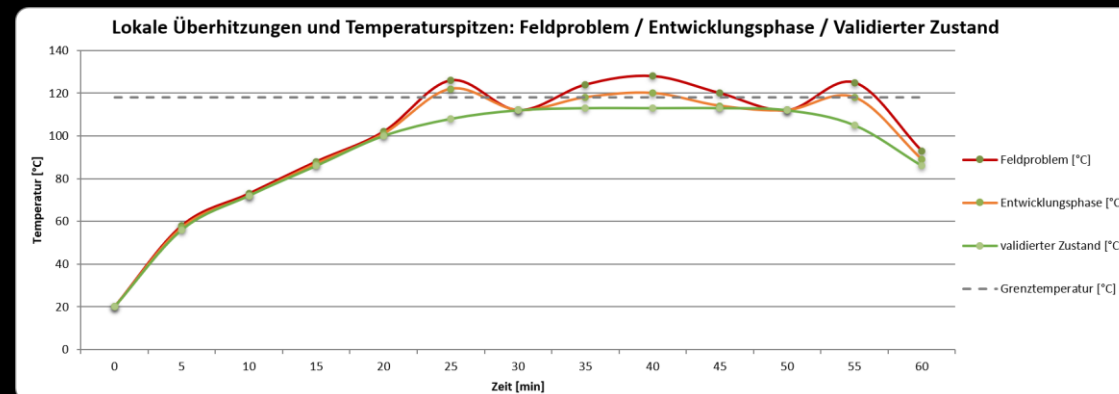
PROJEKTZIELE

- Probleme im Kühlkreis identifizieren
- Befüll- und Entlüftungsvorgang optimieren
- Komponenten hinsichtlich Volumenstrom und Druckverluste bewerten.

ANALYSEN & DIAGRAMME

Methodischer Ansatz PTS:

- **Analysephase** – Kreislaufanalyse
- **Simulationsphase** – Analyse der Befüllung / Entlüftung
- **Prüfstandsphase** – reale Validierung und Vermessung Kreislauf
- **Optimierungsphase** – Optimierung Befüll- und Entlüftungszyklus



WICHTIGSTE ERKENNTNISSE

Durch reproduzierbare Befüll- und Entlüftungsanalyse, Volumenstrom-/ Δp -Messungen und Validierung am Kühlkreislauf reduziert PTS lokale Hotspots systematisch und liefert dem OEM den Nachweis, dass die Grenztemperatur im optimierten Zustand unterschritten wird.