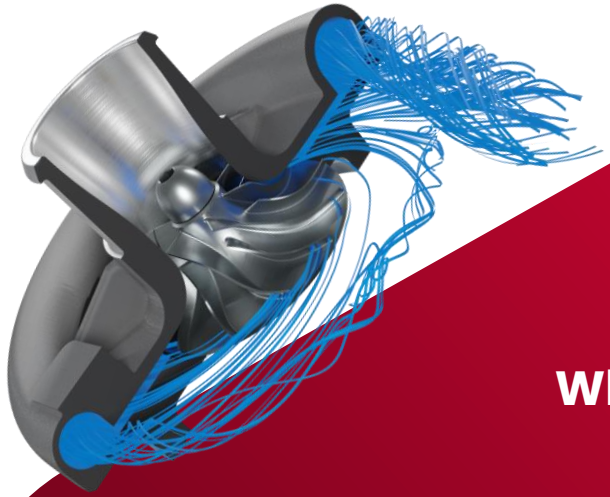
# Turbocharger thermodynamic & mechanical testing

FEV SIGNATURE SOLUTIONS

**Find the right solution for your powertrain with our turbocharger testing approach, from concept to series maturity**

## FEV offers

- Comprehensive testing and engineering services, including simulation & development, from a single source
- Performance & mapping tests
  - Compressor and turbine maps, efficiency and mass-flow characterization
  - Benchmarking against FEV's scatter bands (350+ data points)
- Thermal & mechanical validation
  - Endurance/durability testing → e.g. Low-Cycle-Fatigue (LCF) or thermoshock testing
  - Inhouse method for early evaluation of component robustness to mitigate extensive vehicle & engine testing
- NVH analysis
- Customized test bench solutions
  - Customer-specific test methods and automation concepts, including HV capabilities for e-turbochargers
- Everything you need - challenge us!



## Why FEV

- 45+ years of automotive engineering excellence, trusted by global OEMs and Tier-X suppliers
- Holistic powertrain understanding with turbochargers considered as an integral part of the system
- Unique combination of testing, simulation and development expertise with over 25+ years in turbocharger development
- Independent engineering partner: OEM- and supplier-neutral assessment

# Benefit from our experience due to our long term cooperations with turbocharger manufacturers and OEMs developing future boosting systems

## TC Matching & Simulation

**› 100 Projects**

Understanding the TC in detail and optimizing the interaction of engine & turbocharger

## TC Testing

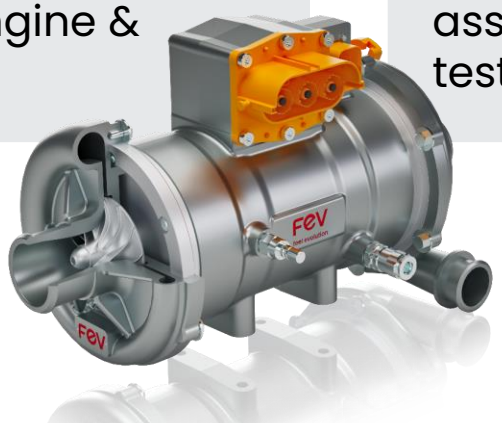
**› 370 TCs tested**

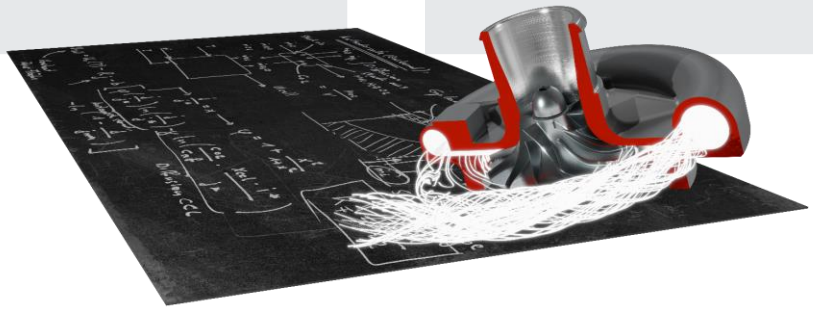
Benchmarking, mechanical development & prototype assessment in FEVs boosting testing center

## Consultancy & Development

**› 30 Customers**

FEV is a trusted partner working together you to boost future mobility solutions





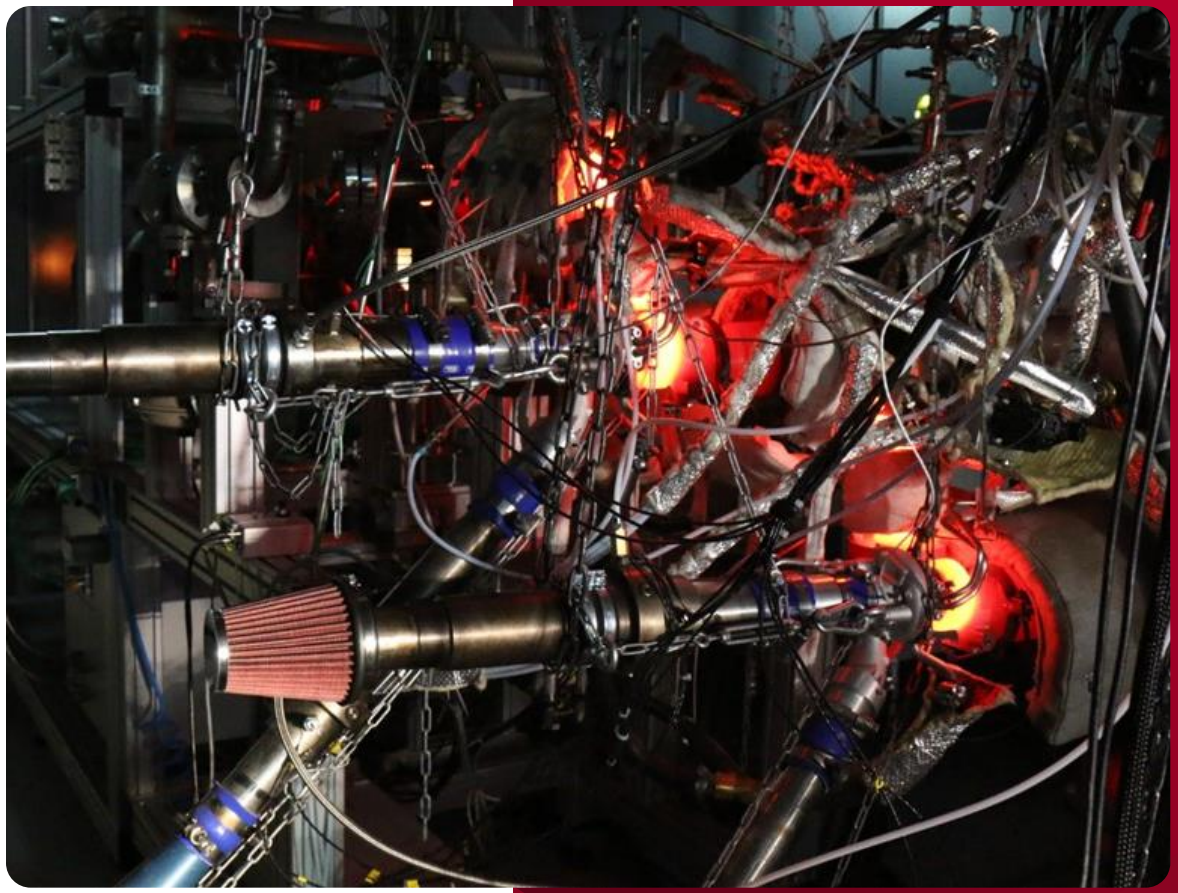
# Reference project FEV propulsion
# Courtesy of Volkswagen AG

## LOW CYCLE FATIGUE (LCF) TESTING

Volkswagen approached FEV in 2018 to conduct LCF investigations on their turbochargers to reduce internal effort for vehicle endurance testing. This request turned into a 6-year frame contract and good partnership.

### FEV involvement

- Finetuning of FEV's test bench setup and routines to accommodate VW's requirements (speed limits min and max, pressure ratio, temperatures)
- Incorporate safety features to allow fully automatized testing of two turbochargers simultaneously (see picture) incl. shut down procedures to safe the non-damaged turbocharger after a provoked LCF failure
- Back-to-back testing of different turbo suppliers, production facilities/locations and engine applications
- Quick turnaround time due to established setup and evaluation routines



**+10 Million cycles throughout the project**
The DUT were pushed through over 10 million speed cycles.

# E-Compressor and e-Turbocharger testing for HV and LV application
# Investigation of different architectures as benchmark

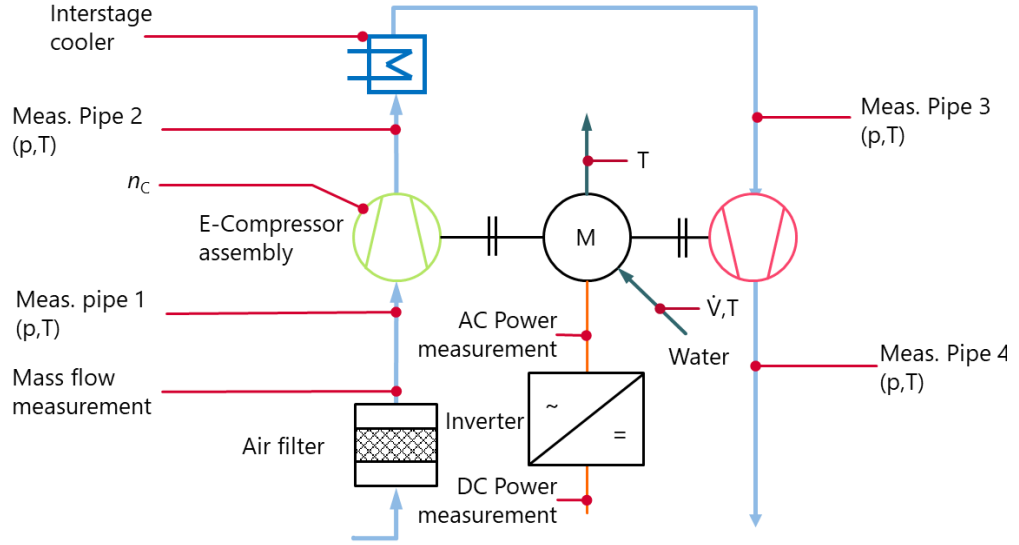
CLIENT: OEM AND TIER 1

**BACKGROUND:** The customers wanted to gain detailed insides into the performance and design highlights of available fuel cell charging systems and their inverters.

## Deliverables

- Preparation of charging unit
  - LV (≤48V) and HV (≥300V) power sources available
  - setup of CAN communication
  - Special measurement equipment (thermocouples and accelerometer)
- Measurement of aerodynamic, electrical and acoustic performance of available charging systems
- Documentation of results (e.g. maps and acoustic plots), test bench setup (instrumentation) and tear down
- Results:
  - Turbocharger performance maps
  - Inverter performance/efficiency
  - Data post-processing and setup of turbocharger model to be used in system simulations (e.g. heat transfer model, map extrapolation)
  - Benchmarking of results in FEV scatter bands

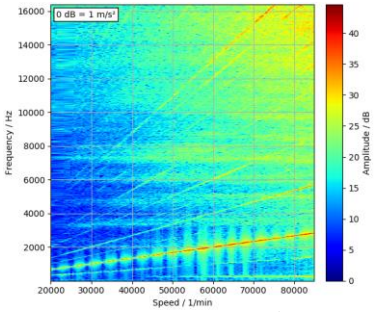
- two stage setup for singe stage performance assessment




- Documentation and special instrumentation

**Pressure Sensor**

**Thermocouple**



**NVH Analysis**

# Get in touch with us for further information

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