

AACHEN, AUGUST, 2020

FEV CONSULTING

BENCHMARK PEUGEOT E-208 GT-LINE

HV BATTERY 50 kWh

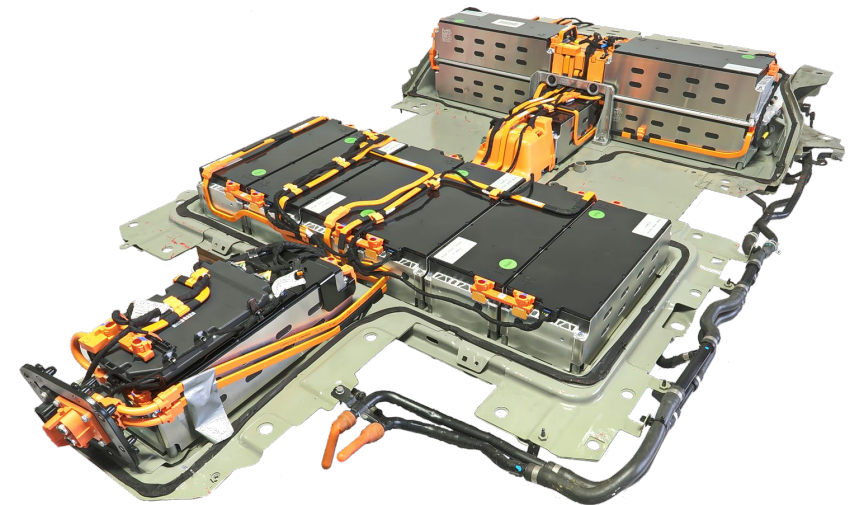


 BENCHMARKING

INTRODUCTION

PEUGEOT E-208 HV BATTERY

- BEV HV battery
 - Underfloor battery with 50 kWh / 125Ah
 - Modules are placed on two levels
 - 2P108S cell configuration
 - CATL prismatic battery cells
- Integrated cooling circuit
 - Water/glycol cooling circuit
 - 5 different cooling plates
 - Module cooling at second level
- Modularity approach
 - Same battery also used in Opel Corsa E
 - Only one battery configuration available
 - Vehicle platform shared with conventional powertrain architecture

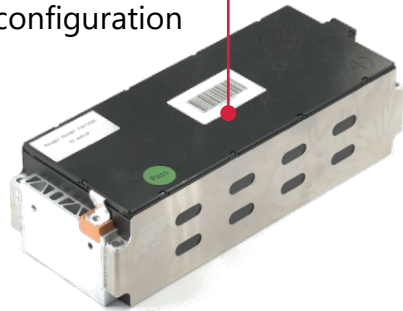


FEV benchmarking experts performed a detailed teardown study on the Peugeot e-208 battery pack; optionally cost analysis is available

HV BATTERY PACK

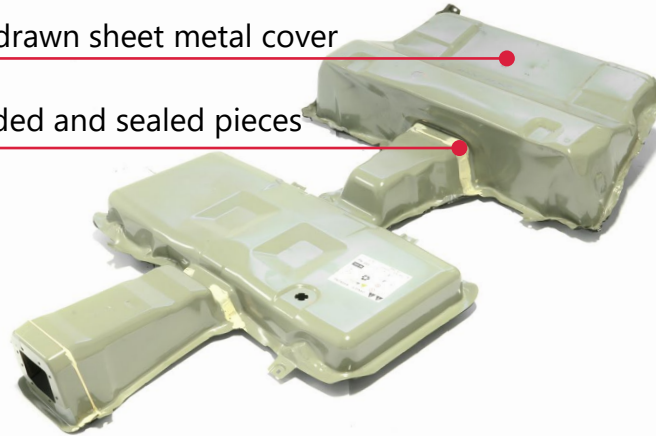
Module

- 12 prismatic cells
2P6S configuration



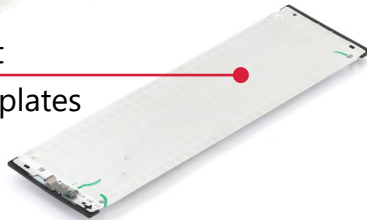
Deep drawn sheet metal cover

Consists of 5 welded and sealed pieces



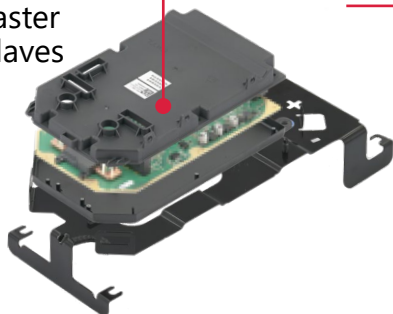
Thermal management

- 5 different cooling plates

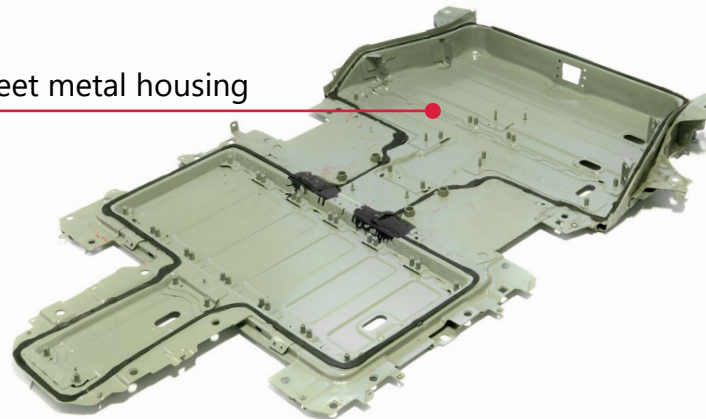


BMS

- 1 BMS master
- 18 BMS slaves



Deep drawn sheet metal housing



TEARDOWN

Photo documentation

- ~ 70 photos of teardown process
- ~ 5 component groups
- ~ 350 photos of main components

Bill of material

- Component name & number,
short description, mass & dimensions

Report

- Comprehensive reporting including system overview and description of e.g. battery architecture and cell configuration, BMD&BDU concept, connection concept, cooling concept

COST ANALYSIS

Should cost analysis

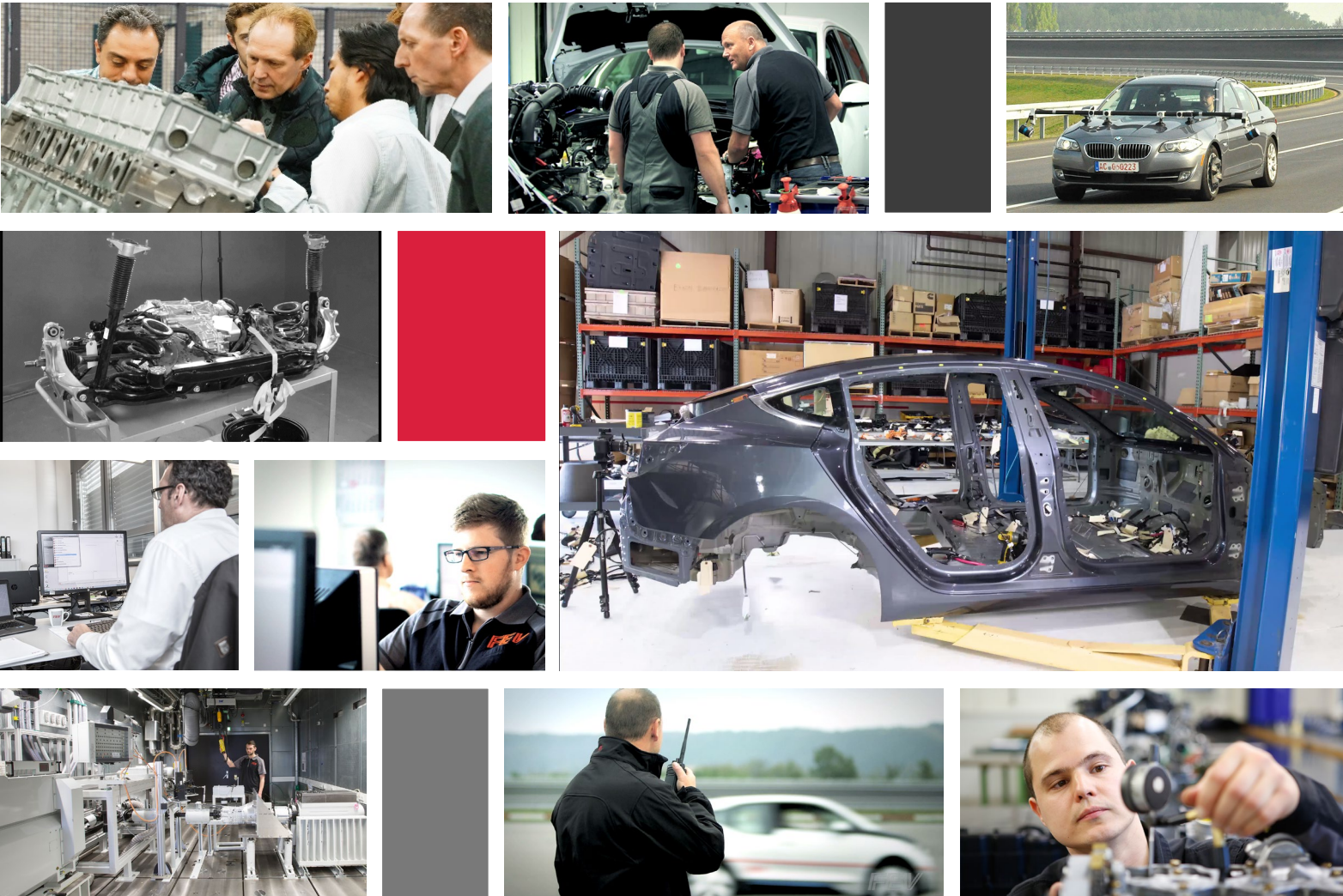
- Detailed calculation for main components
- Sub-BOM for subassemblies
- Estimation for standard parts

Deliverables are cost report and costed BOM to provide detailed cost insights and transparency

FEV
CONSULTING

**“We not only show you how it looks,
we explain why!”**

FEV Group is a global leading engineering and consulting service provider which turns technical and business innovation into reality

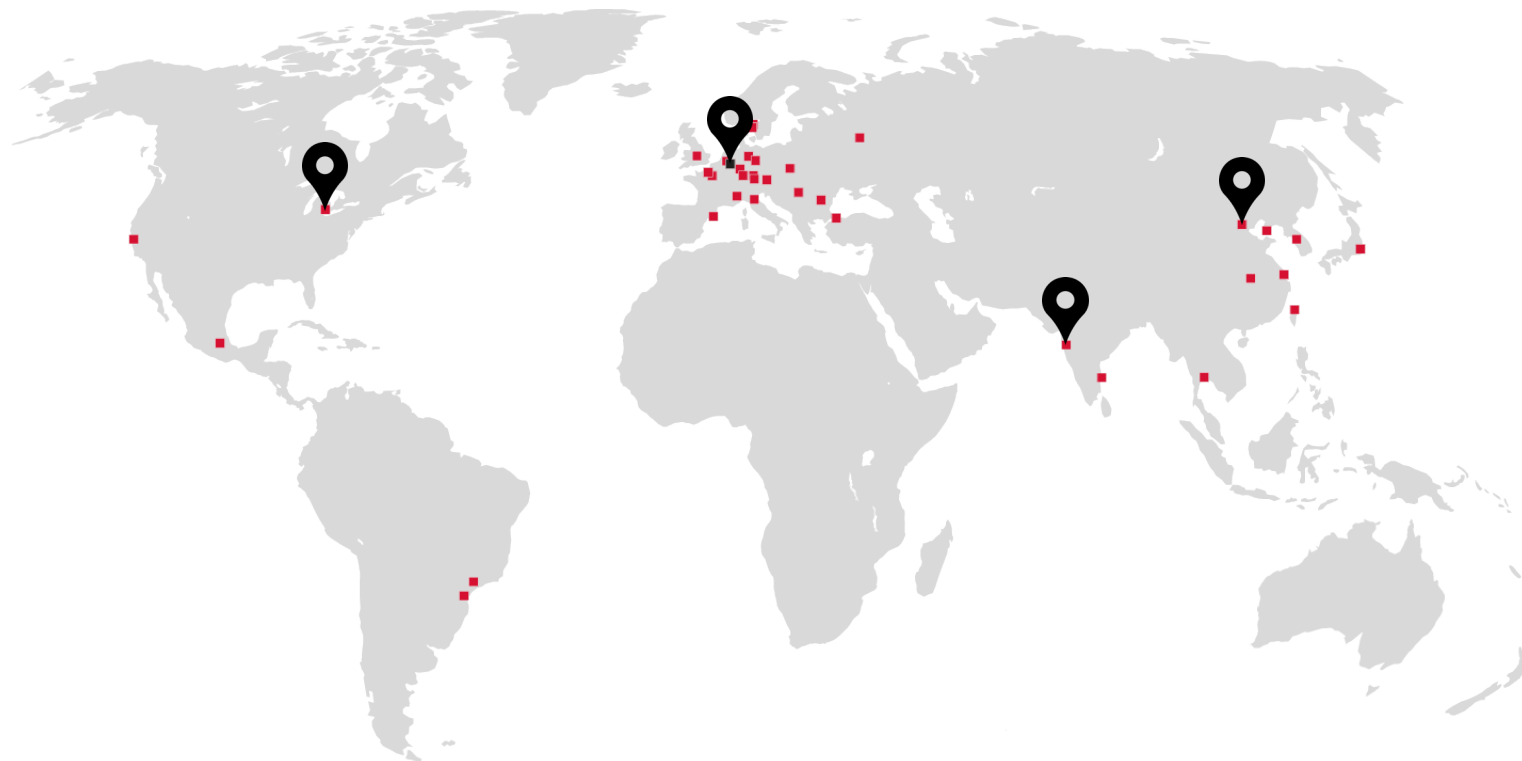


- Independent / Family owned since 1978
- Driving OEM and Tier 1/2 engineering programs to develop future mobility solutions and innovative products
- Unique combination of deep technical knowhow with consulting and cost engineering skills
- Highly involved in key industry sectors as automotive, commercial vehicle, agriculture & construction equipment and other highly engineered products

850 mn Euro revenue
expected in 2020

6700+ employees
globally

FEV offers engineering and consulting services worldwide with a global network of subsidiaries, technical and benchmark centers



4 main benchmark centers

12+ technology centers

42+ subsidiaries on four continents

300+ test benches for various vehicle and powertrain architectures

■ Headquarter ■ Subsidiary ● FEV Benchmark Centers

FEV offers a unique benchmarking service combining deep technical knowhow, comprehensive test facilities and cost engineering skills

BENCHMARKING

Do you want to ...

... have an insight view into latest technologies?

... understand functions and design of products in detail?

... receive measured performance data & comparisons?

... know about the cost structure of competitor products?



Technical Benchmarking



Teardown Analysis



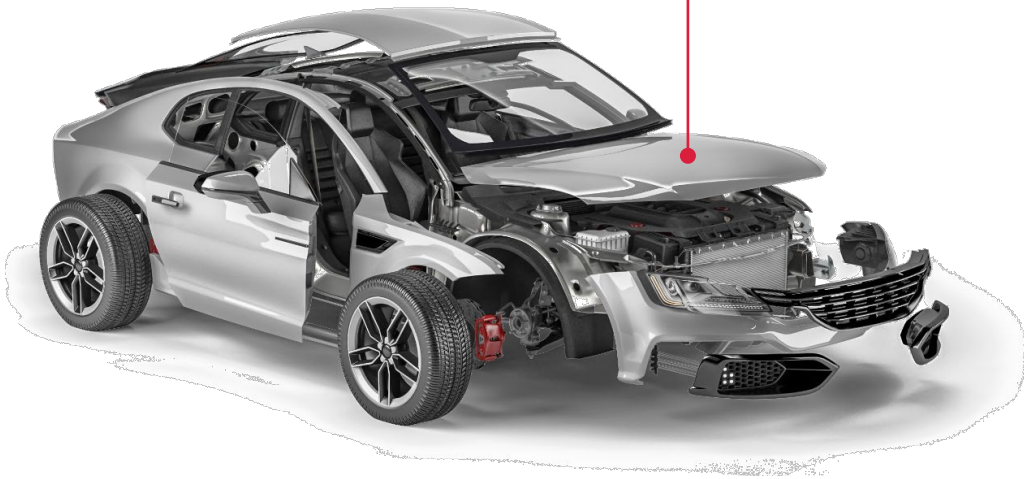
Cost Benchmarking



Benchmark Academy



Benchmark Database

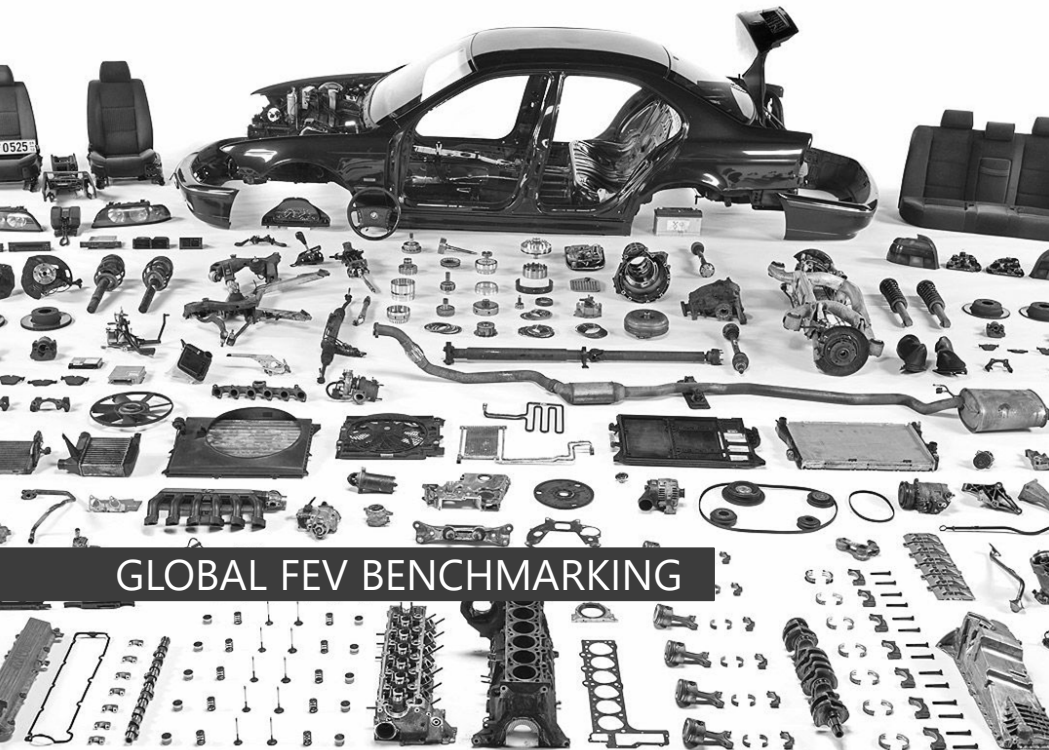


»Automotive »Commercial Vehicles »Agriculture &
Construction Machinery »Other Highly Engineered Products

Key Benefits

- Early analysis of new technologies
- Technical data & scatter bands
- Vehicle & power-train experts
- Conventional, hybrid & electric
- ADAS, AD & HMI
- Global footprint
- Wide range of test facilities
- Cost engineering
- Innovative methods & tools

FEV comprehensive benchmarking services include technical benchmarking, teardown studies, cost analysis and a benchmark academy



Technical Benchmarking

- Operating Strategy & Performance
- Efficiency & Emissions
- Vehicle Dynamics
- Noise, Vibration & Harshness
- Durability & Friction
- ADAS, Autonomous Driving, HMI



Teardown Analysis

- Hardware Research & Procurement
- Vehicles, Systems & Components
- Professional Pictures & Videos
- Bill of Material with Key Data
- Technical Component Analysis
- 3D Scanning, X-Ray & Virtual Reality



Cost Benchmarking

- Material & Manufacturing Analysis
- Should Cost Analysis
- Functional Cost Analysis
- Cost Breakdown & Comparison
- Design to Cost Ideas
- Cost Reduction Workshops



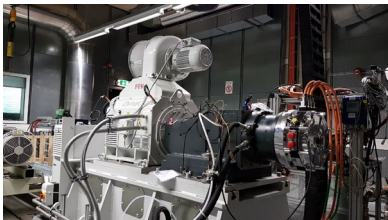
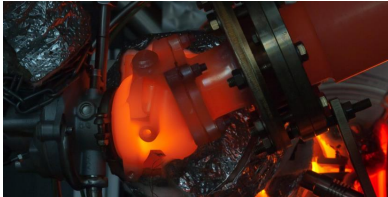
Benchmark Academy

- Driving & Technology Events
- Teardown Workshops
- Hardware Exhibitions
- Technical & Costing Expert Advisory
- Brainstorming & Idea Generation
- Benchmark Community & Network



Benchmark Database, Scatter Bands and Online Platform

FEV offers a wide range of advanced test facilities and brings the required knowhow to run highly specialized tests



ON-ROAD TESTING:

- Standardized duty cycles
- Portable emission measurement syst.

TEST TRACK:

- Multipurpose proving grounds
- 5G network
- City simulation

TEST BENCHES:

- Climate AWD chassis dyno
- Combustion engine & turbocharger
- Transmission
- Noise, vibration & harshness
- Electric motor & electric drive unit
- HV battery
- Power electronics

TEARDOWN WORKSHOPS:

- Professional photo & video equipment
- 3D scanning and virtual reality



FEV has performed numerous benchmarking studies on conventional, hybrid & electric vehicles and powertrains

SELECTED AVAILABLE BENCHMARK STUDIES

Internal Combustion Engine

- Mazda 3 Skyactiv-X
- Infiniti QX50 with VCR
- Mercedes E350 M264 48V BSG
- VW UP GTI EA211
- BMW Mini Cooper S B48 Tü1
- VW Golf 1.5 TSI EA211
- Audi G-tron CNG
- VW Polo TGI CNG
- Renault Grand Scenic dCi 48V
- BMW 730d B57

Plus a wide range of turbochargers:

- IHI, WG, Audi EA888 Gen3B
- Garrett, VTG, VW 1.5I TSI EA211
- BWTS, WG, JLR 2.0I high power 2018
- BWTS, WG, VW Polo 1.0 TGI 2019
- BorgWarner, DS, GM Silverado 2.7I 2019
- Garrett, TS, BMW B48 2.0I 2019

Transmission

- Porsche Panamera ZF 8DT80
- VW Tiguan R DQ381
- VW DQ 400e
- Audi DL382
- BMW 760li ZF 8HP90
- BMW X5 40e ZF 8HP electric
- Land Rover Evoque ZF 9HP
- Aisin 8F45
- Getrag 7DCT 300
- Getrag 6DCT 205
- Dodge Promaster MTA M40
- Ford 10R80
- Ford 8F35

Hybrid & Electric Powertrain

- Hyundai Nexo Fuel Cell
- Audi e-tron
- Tesla Model 3
- Tesla Model S
- Renault Zoe
- Mercedes E300de OM654 PHEV
- BMW 225xe PHEV
- Daimler 48V Battery Pack
- Kia Soul EV
- BYD T4 LCV
- Porsche Taycan
- VW ID.3
- Peugeot e208



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