



Developing mobility for the future

# HISTORY

## Company history

1904

Foundation of August Horch Motorwagenwerke AG



1932

Fusion of HORCH, AUDI, DKW and Wanderer to AUTO UNION AG



From 1957

Foundation of Sachsenring Automobilwerke Zwickau

Development and production of the passenger car "Trabant"



1997

Foundation of Auto-Entwicklungsring Sachsen GmbH



2004

Opening of our site in Munich



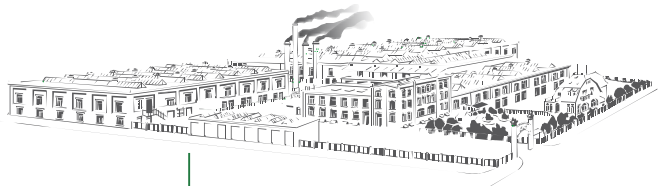
2014

Extension of the company premises in Zwickau to a total of approx. 23 ha and opening of the Ingolstadt site



2023

Increase of the production capacity



Foundation of AUDI Automobilwerke GmbH

1910

Foundation of **FES GmbH**  
Fahrzeug-Entwicklung Sachsen  
*(with 120 employees - core of the previous development department of Sachsenring GmbH)*

1992

Opening of our site in Gaimersheim near Ingolstadt

1998

Relocation of the Gaimersheim site to Steinheilstrasse

2015

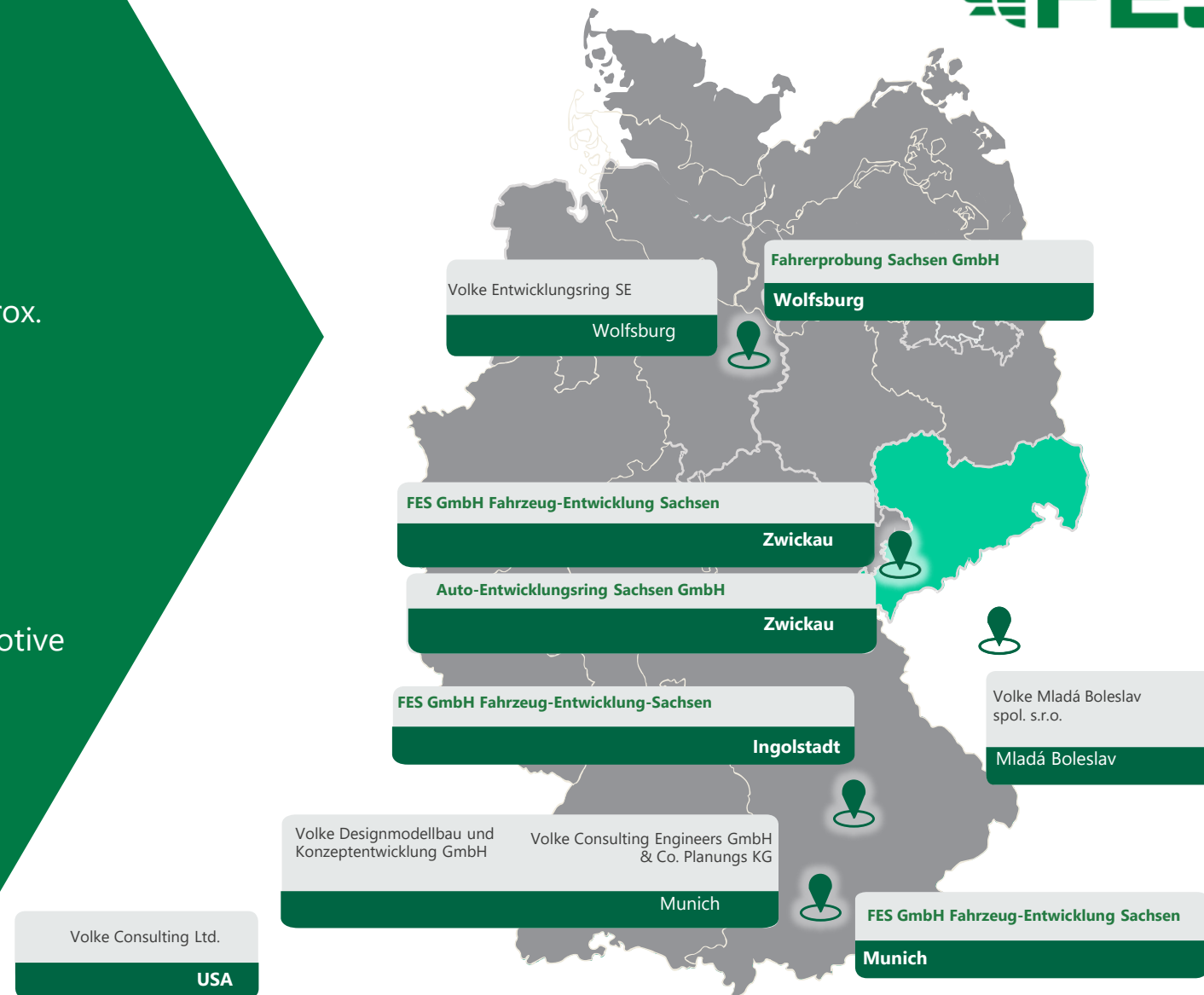
Opening of the electromobility test field

2020

## COMPANY

### Partner in the complete process of vehicle development

- 850 employees
- Part of the Volke group of companies (approx. 2,500 employees)
- Headquarters in Zwickau
- Sites in Ingolstadt, Munich and Wolfsburg
- More than 30 years of experience in automotive development



## CAPACITIES

23 ha company premises and 90 ha of driving test space

### Site MÜNCHEN:

BMW project office and workshop surface as required

### Site INGOLSTADT:

3,000 m<sup>2</sup> premises, 1,400 m<sup>2</sup> of workshop, 35 office working places

### Capacities per year (Zwickau):

Vehicle construction: up to 1,000 vehicles

Body construction: approx. 1,000 car bodies

230 CAD workplaces

15,000 m<sup>2</sup> of office space

5,500 m<sup>2</sup> of component production

4,500 m<sup>2</sup> of car body construction - several bodyshell assembly lines

8,500 m<sup>2</sup> with 85 lifting platforms in vehicle assembly



Site Zwickau

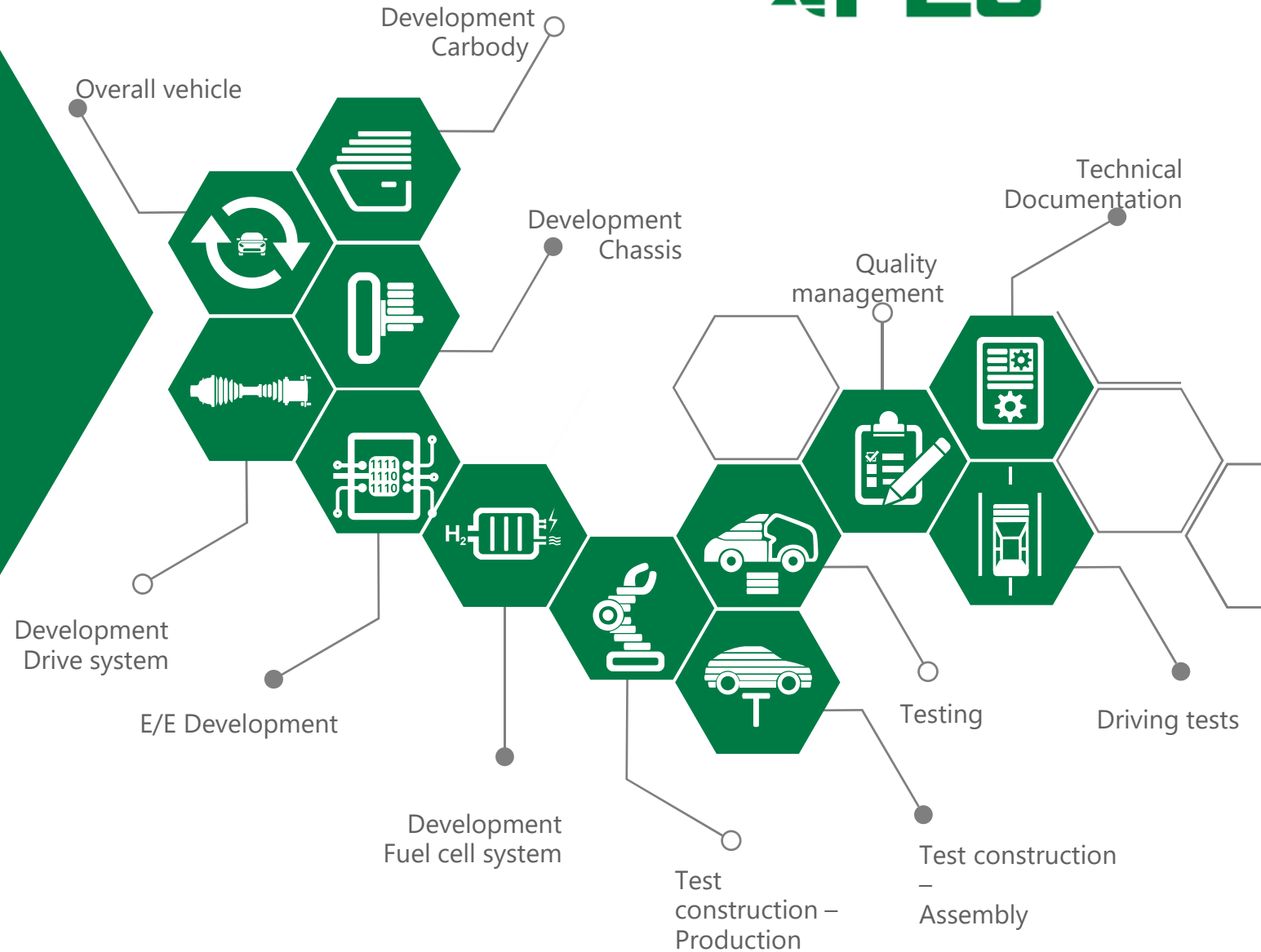
## COMPANY STRUCTURE / SPECIALIST DEPARTMENTS

### Cross-process complete vehicle competence

#### From the concept to series maturity.

We offer efficient and cost-effective automotive development services, complying with time schedules. We support you throughout the entire process, from concept and prototype construction to vehicle testing and technical documentation. In doing so, we rely on state-of-the-art development tools and facilities to provide the best possible quality.

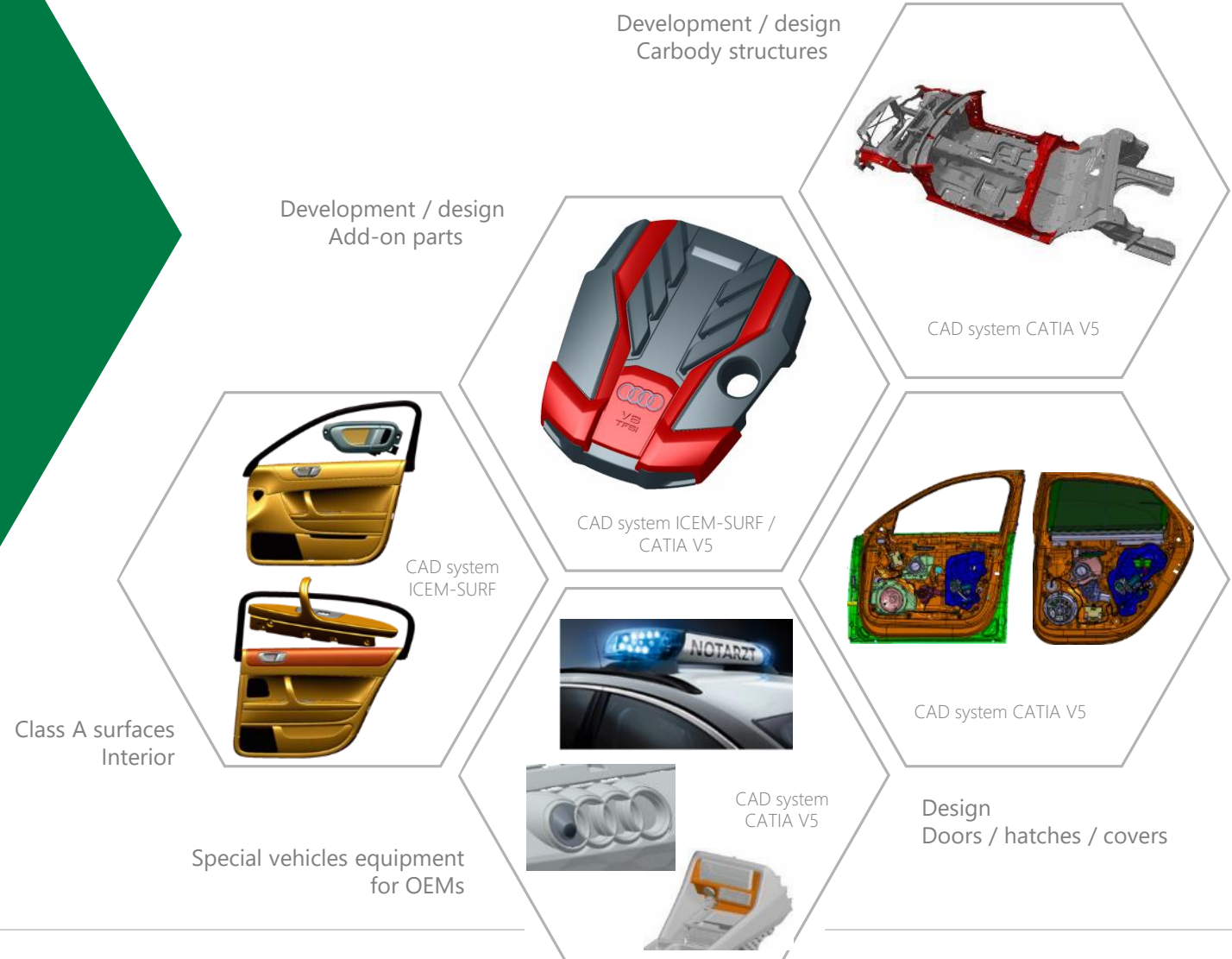
FES/AES possesses over 30 years of experience as a development service provider in vehicle development. Our customers have confirmed that we are a true leader in terms of price-performance ratio.





## Carbody development services Shell structures / doors, hatches / interior

- Visualization of complete body shell structures incl. manufacturing feasibility studies and connectivity
- Complete development of doors, hatches, covers
- Layout and design of add-on parts
- Creation of Class A surfaces during the design finding process by using ICEM-Surf
- Development and integration of accessories such as special signalling systems and camera systems

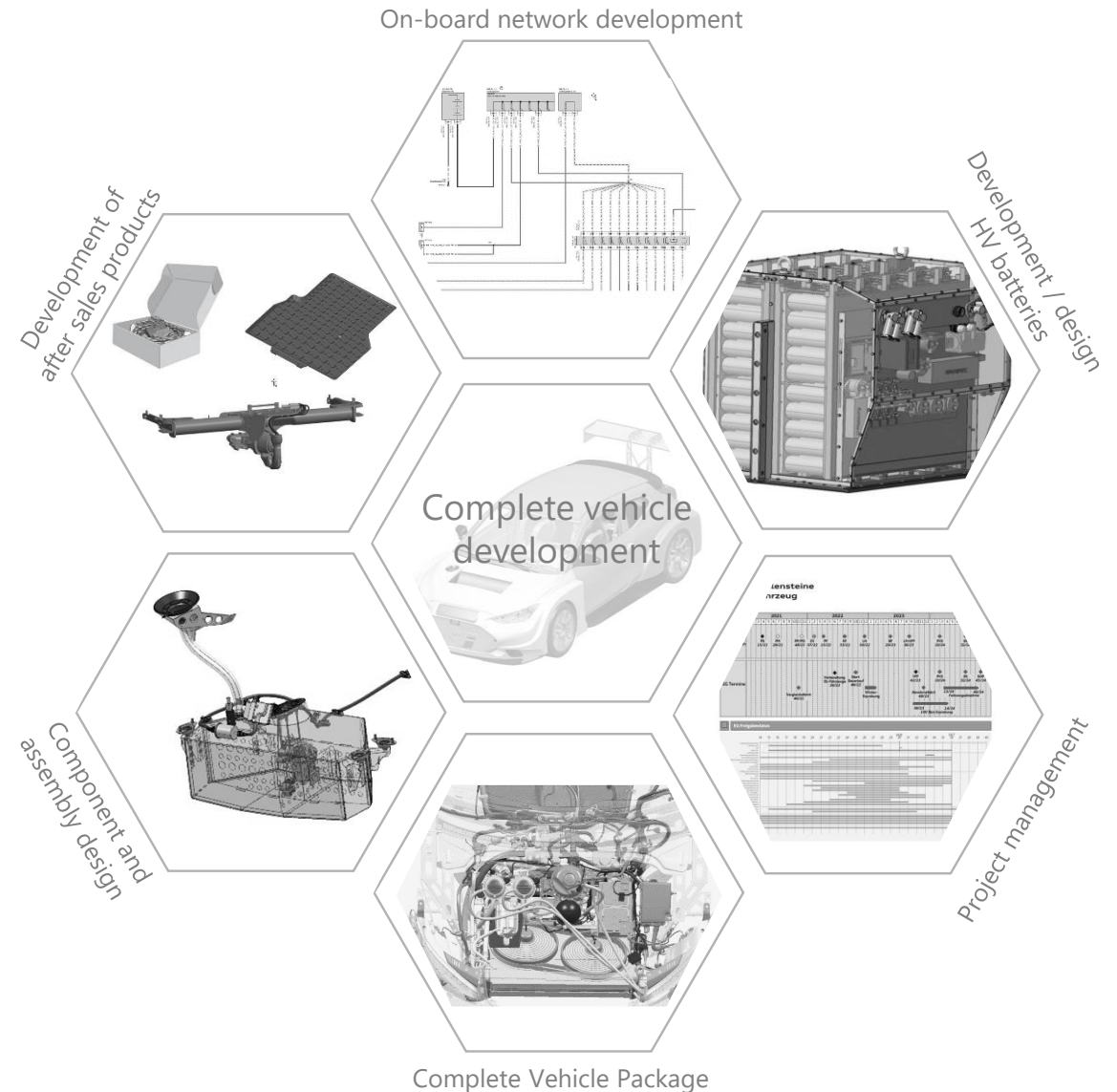




## COMPLETE VEHICLE DEVELOPMENT

### Development of complete vehicles, we coordinate all domains

- Project management for components, subsystem and complete vehicle projects
- Creation of complete vehicle package
- Concept development/ integration of e-drives in the complete vehicle package
- Conceptual design and development of HV batteries
- (package, cooling, interconnection and wiring)
- Component and assembly design
- Development of special vehicles
- Development of after sales products
- On-board network development

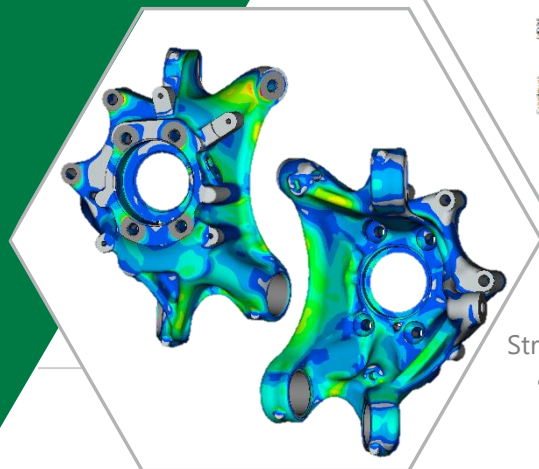




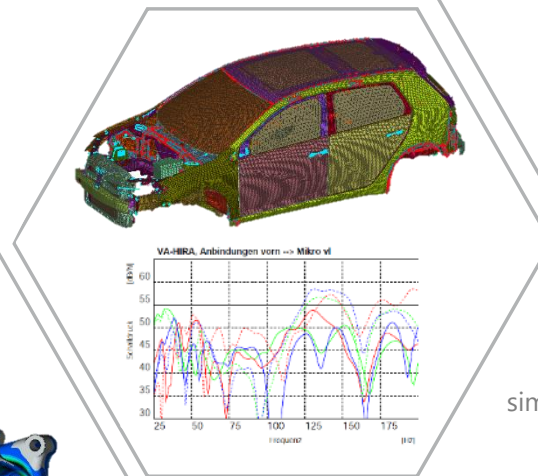
# COMPLETE VEHICLE TECHNICAL CALCULATION

## Efficient development based on technical calculation

- Design of calculation models for the evaluation of mechanical components and assemblies
- Stress and stiffness analyses
- Durability analyses by means of FEMFAT
- Topology and topography optimisation as well as sensitivity analyses
- NVH - Acoustic analysis of the vibration behaviour of components up to complete vehicle models
- CFD - Numerical flow simulation of components and assemblies
- Crash simulation of complete vehicles and components
- Mapping of nonlinear material behaviour, geometric nonlinearities and contact behaviour

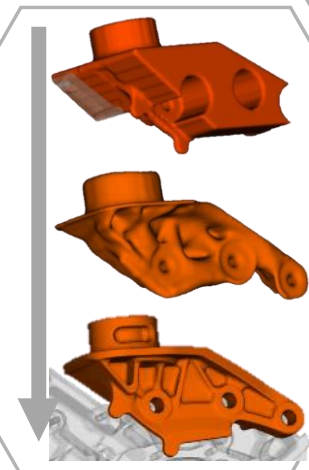


Strength analysis of a wheel carrier

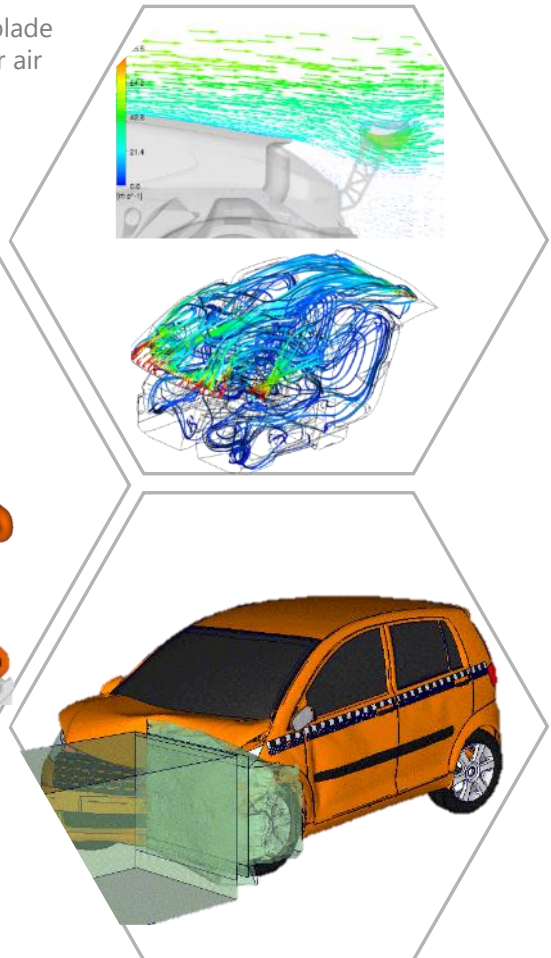


NVH - Comfort simulation in the vehicle interior

Topology optimisation



CFD simulation of blade airflow and interior air conditioning



Front crash calculation by means of PAMCRASH

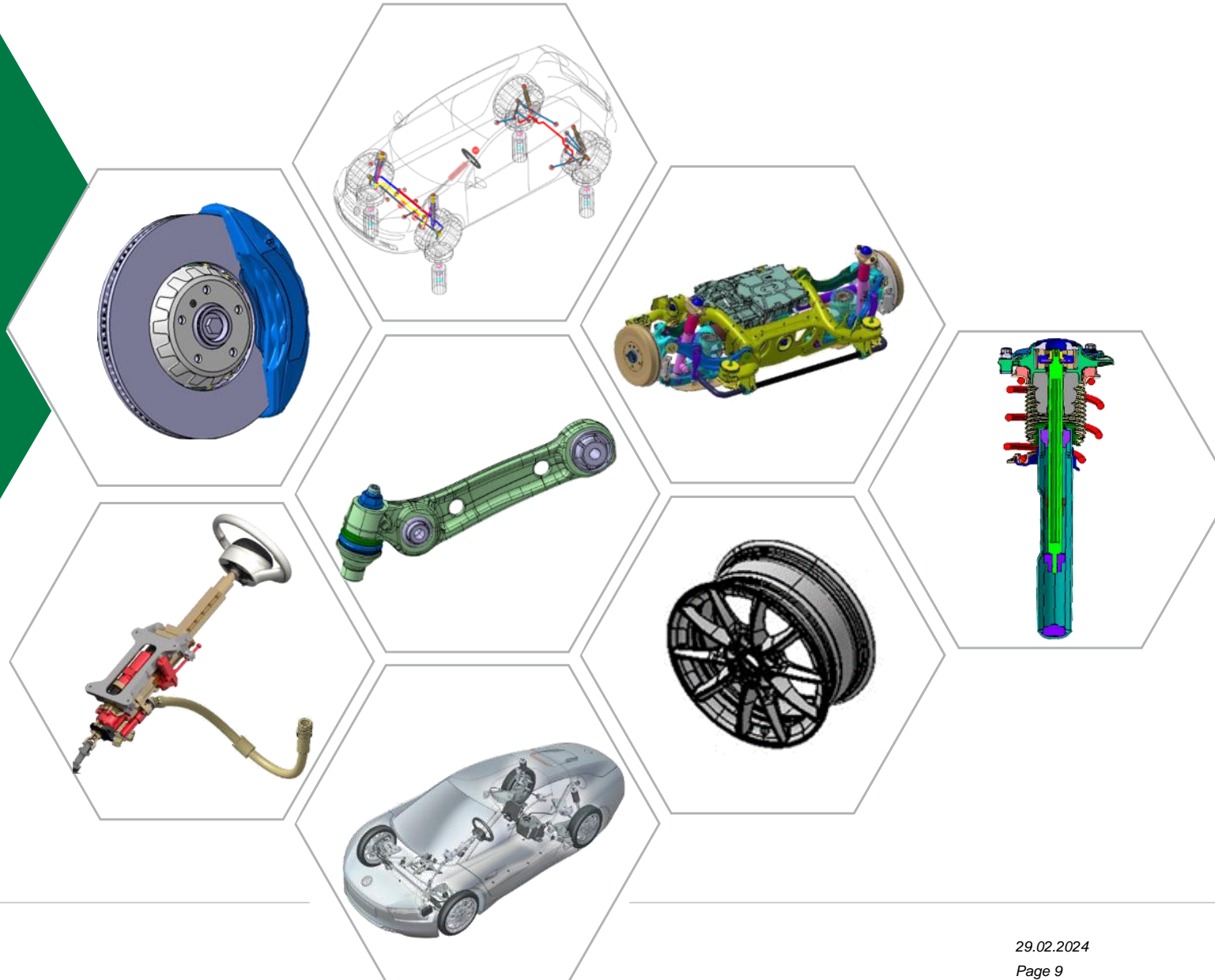




## CHASSIS DEVELOPMENT

We develop chassis from concept to components through to complete chassis

- Axle kinematics, vehicle dynamics
- Control arms
- Spring, damper, anti-roll bar
- Steering/braking systems
- Wheels, tires
- System testing
- Concept
- Component responsibility
- Project management /  
SE team management
- Release

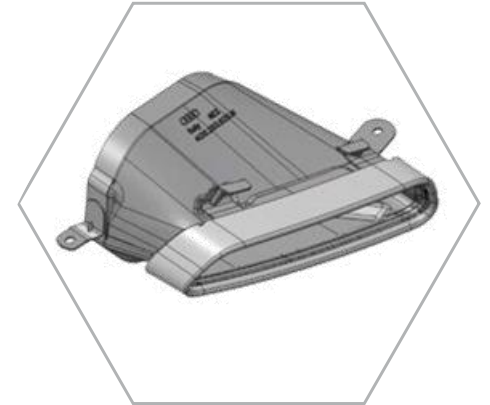
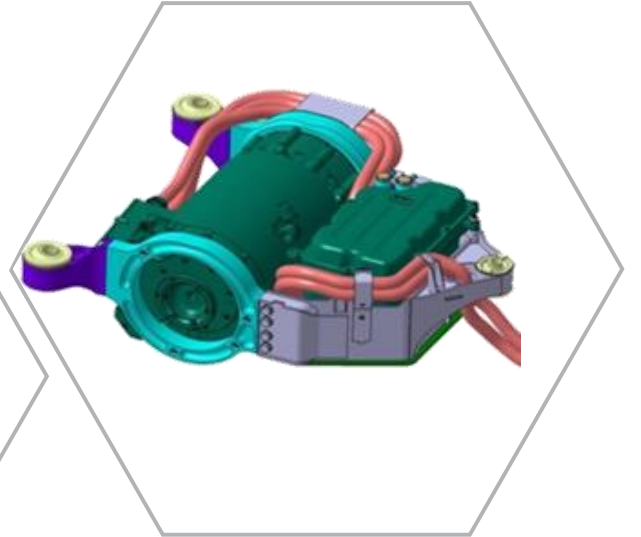
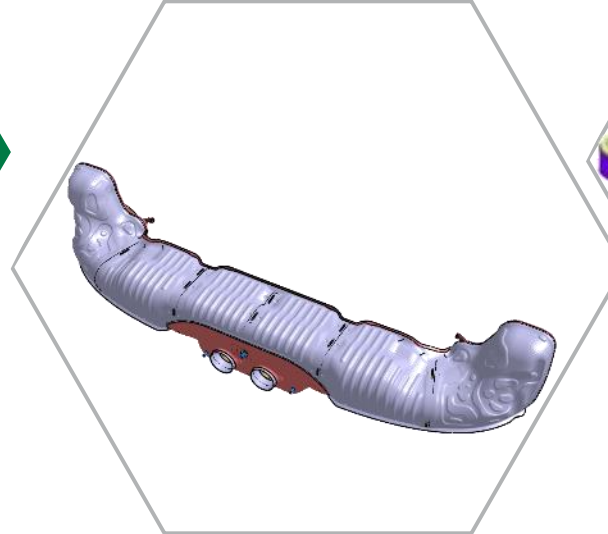
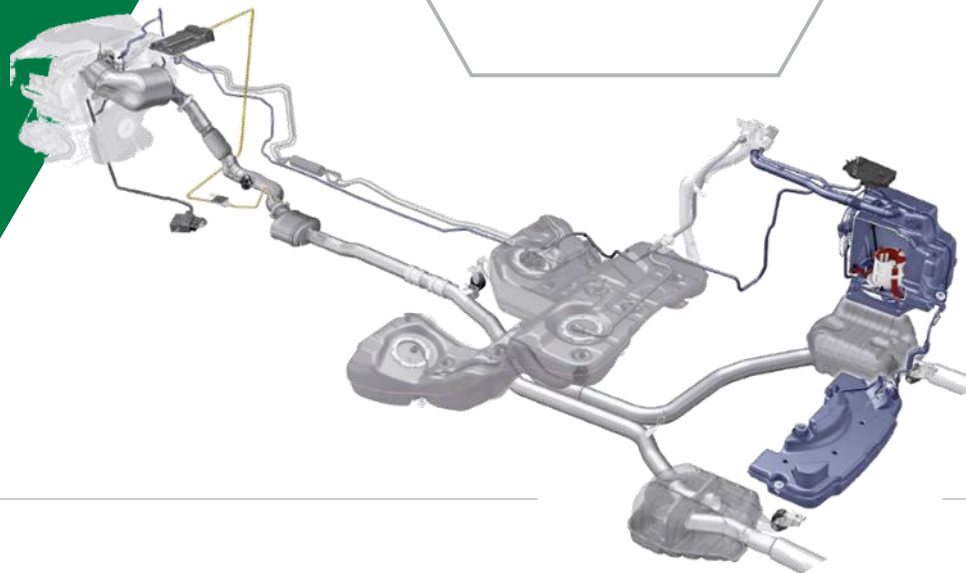




## DRIVE SYSTEM DEVELOPMENT

### We develop the evolution of the powertrain

- Electrical drivetrain integration
- Engine brackets, drive shafts
- Exhaust system and exhaust emission control
- Sensor technology in the powertrain
- Tank systems: AdBlue and hydrogen
- Water injection

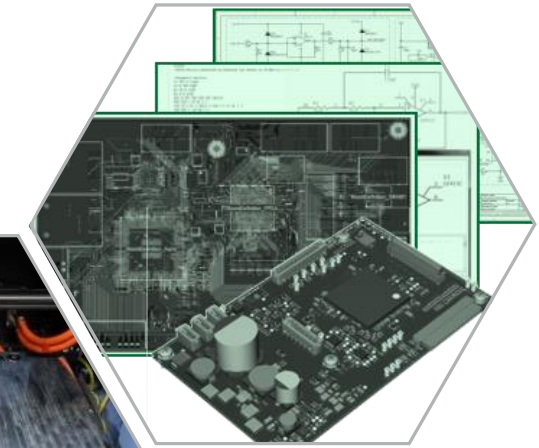




## We develop electronics

- Hardware
  - Power electronics
  - Embedded hardware
  - Hardware for test systems
- Software
  - Basic software
  - Application software
  - Software for test systems
  - Development of SW tools
- Integration
  - EE architecture, networking
  - LV/HV systems
  - On-board networks
  - Requirements engineering
  - Functional safety

Software engineering



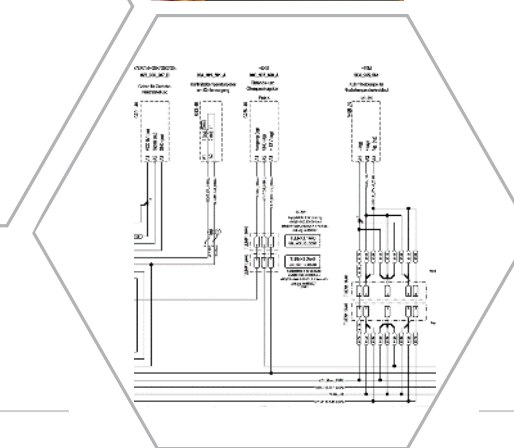
Hardware development



HV system integration



Test systems

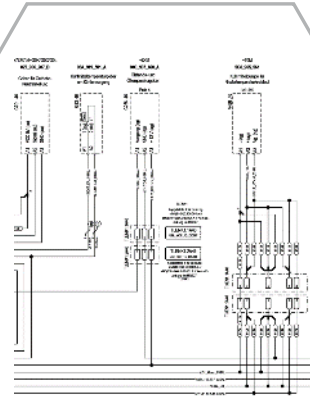


System plan using EBCA

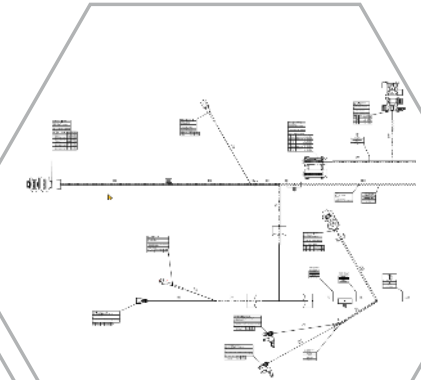


## Development services in the field of on-board networks

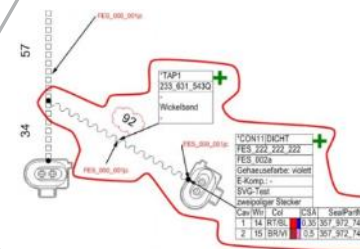
- On-board network development according to VOBES
- Collaboration in the further development of the VOBES tool chain
- 1st and 2nd level support
- Superordinate testing of on-board network data
- Creation of digital customer service circuit diagrams
- Conduct of SW trainings



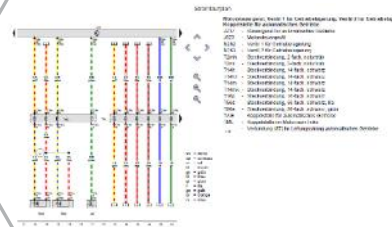
System plan using EBCA



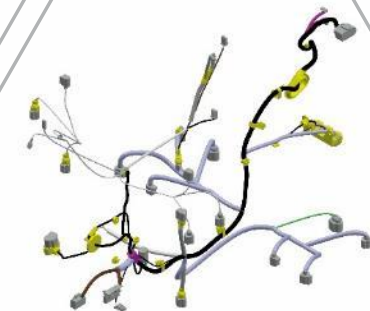
Wire harness drawing by means of Capital LD



Change documentation by means of Capital LD



Customer service circuit diagram by means of GOLE SP



CATIA V5 wiring

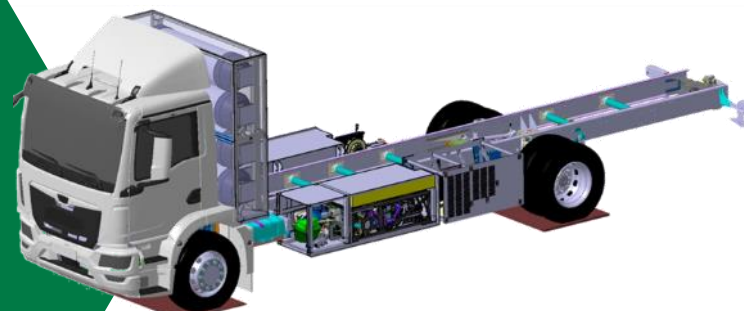




## DEVELOPMENT FUEL CELL SYSTEM

### System integration of components for fuel cell drive

- Development
  - Concept, system simulation
  - Air and hydrogen supply
  - Cooling system
  - Tank system
  - Control system
- Test bench operation
  - Start-up
  - Component characterisation
  - Endurance test
- Products
  - FEScell: Fuel cell-based plug & play battery replacement for industrial trucks
  - 18t truck with fuel cell drive



18t truck



Test bench



FEScell 24/7



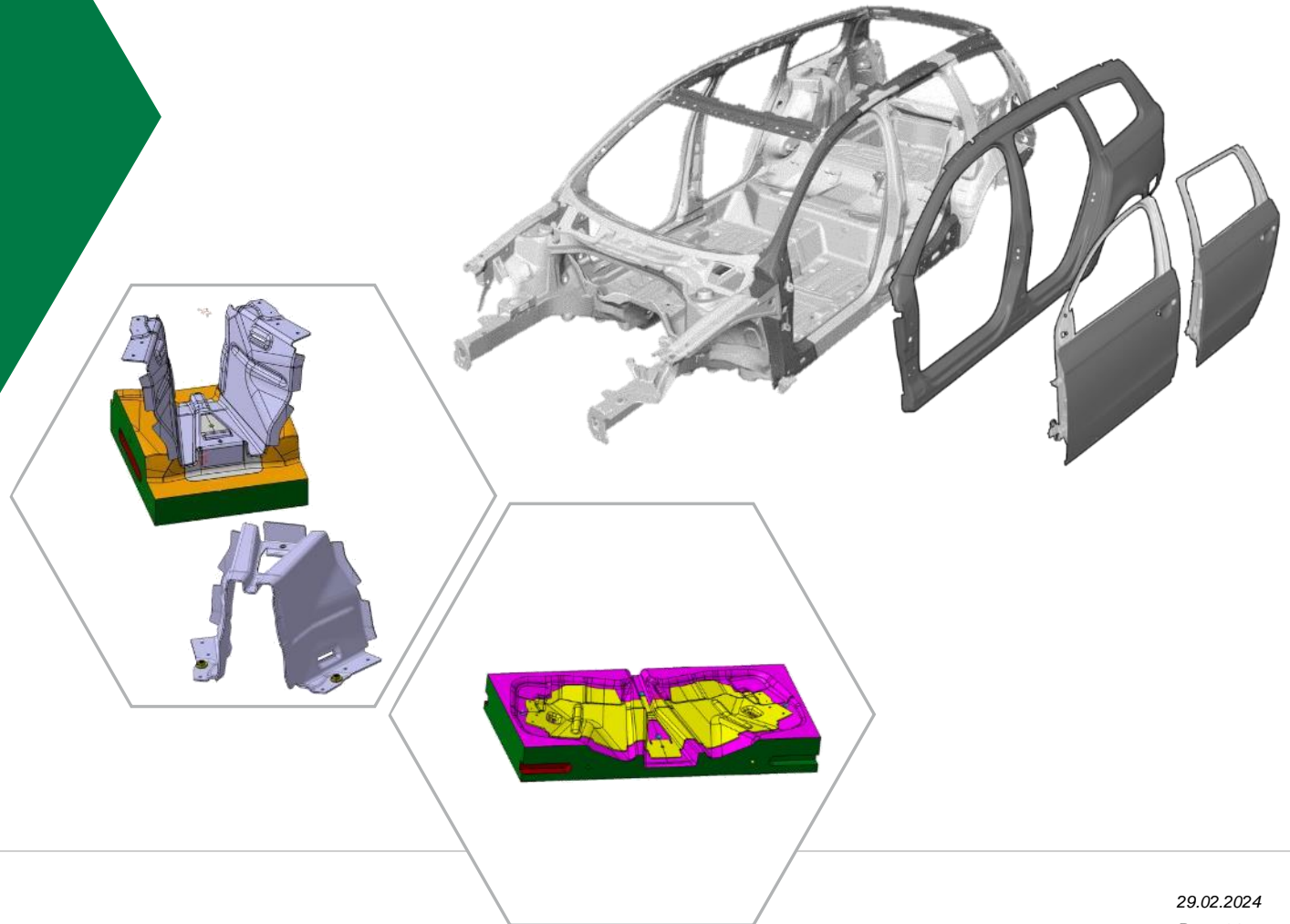
HyFFCC





### From the forming tool to the complete carbody assembly

- Work preparation and project management incl. design and simulation
- Manufacturing of single parts and small series
- CNC machining, milling, turning, bending
- Component forming by pressing, drawing, stamping
- Laser processing 2D & 3D laser cutting/laser welding according to CAD data in laser cell
- Joining by punching and welding
- Body construction from the small assembly up to the complete body-in-white
- Tactile measuring systems, mobile measuring systems, optical measuring systems
- Model making





**TESTING  
VEHICLES & COMPONENTS  
FIELDS OF WORK**

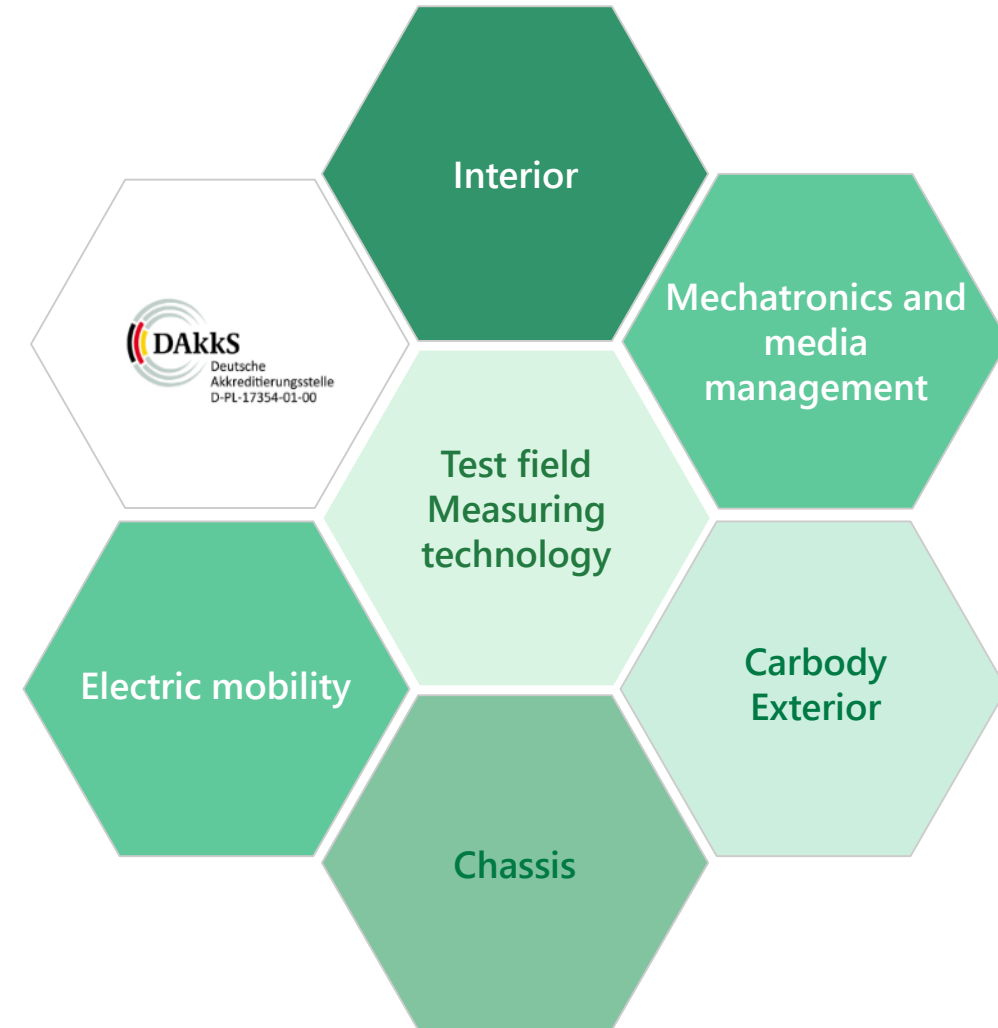
**Uncompromised testing**

**We are your partner for highest product quality**

System and component testing - test laboratory  
accredited according to DIN EN ISO/IEC 17025:2018

- Project work and control
  - Requirement definition
  - Load data determination
  - Trial planning
  - Test parts management
- Implementation of tests in the accredited test laboratory
- Evaluation, documentation, analysis, report generation
- Failure/damage analysis / optimisation process
- Monitoring of release process

→ Individual testing and **complete validation from a single source**





## PROTOTYPING - ASSEMBLY

Our competencies are the key to success.

### A one-stop service:

- Project management/ process control
  - Setup support, order processes, missing parts tracking in the system environment of the customer
- Wiring harness manufacturing
  - Setup and modification of on-board networks
  - Modules, adapter wires, customized wiring harnesses
- Vehicle construction
  - Complete assembly of unit carriers and prototypes
  - Special vehicle construction, vehicle conversions
- Commissioning
  - Components / complete vehicles
  - Updating
  - Pre-commissioning





# QUALITY MANAGEMENT



This is what we guarantee: Proven quality throughout the entire development process.

- Quality Management
  - Process analysis / process optimisation
  - Auditing (system, process, product)
  - Supplier Management / SQA
  - Supplier qualification / supplier development
  - Start-up management
  - FMEA (design, product, process)
- Quality assurance
  - Advance quality planning / quality concepts
  - Production process and product release
  - Complaint processing
  - Task force
- Training / coaching
  - Quality management consulting
  - Compilation of quality management documentation
  - Preparation and monitoring of certification audits
  - Conduct of trainings

**Produktionsprozess- und Produktfreigabe - Deckblatt - PPF Bericht - Neuteil**

**Absender (Absender):** FES GmbH Fahrzeug-Entwicklung, FMB, Crammischauer Str. 59, 08058 Zwickau, Deutschland

**Kunde (Empfänger):** 28 Volkswagen W. Dummy

Angaben zum Lieferanten		Angaben zum Kunden	
Produktionsstandort	Dunsnummer: 331031369	Werknummer:	28
Lokale Lieferantennummer:	00096302 / 00	Werk:	Volkswagen Werk Zwickau
Lieferantenname:	FES GmbH Fahrzeug-Entwicklung	BTW/VWSG:	28 B NT
Lief.PB-Nr.:	FES_08_18	PPF Berichts-Nr.:	28 18 50172
Version / Index:	BY 631	Benennung:	TRAVERSE
Teil-Nr.:	Z38 Dachquerträger han ND	Teil-Nr.:	SSE 817 433 B
Zeichnungsnummer:	SSE 817 433 B	OmBA Kunde:	Ja
Stand/Datum:	/	OmBA Lieferant:	Nein
Änderungsnummer:	/	Zeichnungsnummer:	/
Bestelllauf-Nr./Datum:	/	Stand/Datum:	/
Lieferscheinnummer:	VL18F3452 / 2018-06-21	Änderungsnummer:	Ja
Liefermenge:	3	Asprachestand/Datum:	TM01 / 2018-02-28
Chargennummer:	/	Werkzeug-/Investmentnummer:	/
Eintrittsdatum:	/	Stand Hardware/Software:	/
Umsatzgewicht:	1120 Gramm / Stück	Form / Nest:	/
Umsatzgewicht:	Akzeptiert(!)	Generationsstand/Werkzeug:	02 / S

**Freigabe Lieferant:** wird bestätigt, dass das PPF-Verfahren entsprechend den Vereinbarungen der Abstimmung zum PPF-Vorgaben gemäß VDA Band 2 durchgeführt wurde.

**Abgestimmt durch:** Dannemann, Ute (FES GmbH Fahrzeug-Entwicklung)

**Kommentar Änderungsbeschreibung:**

**FMEA Fehlermöglichkeits- und Einflussanalyse**

Produkt  Prozess  System  Konstruktion  Design

Mögliche Fehler	Mögliche Fehlerfolge	B	K	Mögliche Fehlerursache	Gegenwärtige Maßnahmen zur Vorbeugung	Gegenwärtige Maßnahmen zur Entdeckung	R	P	E	RPZ	Erfolgreiche Maßnahmen	Verbleibende Risiken	Ergreifene Maßnahmen
Pflicht Montagegeometrie	keine Sachfehler bei spezialisierten	C	1	Produktionsprozess bei Lieferanten problem d. produktion ist kritisch	keine Maßnahme	keine Maßnahme	4	10	10	40	APR	Heute 07.10.19	keine
Wahlweise	keine Sachfehler bei spezialisierten	C	1	Produktionsprozess bei Lieferanten problem d. produktion ist kritisch	keine Maßnahme	keine Maßnahme	4	10	10	40	APR	07.10.19	keine
Wahlweise	keine Sachfehler bei spezialisierten	C	1	Produktionsprozess bei Lieferanten problem d. produktion ist kritisch	keine Maßnahme	keine Maßnahme	4	10	10	40	APR	07.10.19	keine
Wahlweise	keine Sachfehler bei spezialisierten	C	1	Produktionsprozess bei Lieferanten problem d. produktion ist kritisch	keine Maßnahme	keine Maßnahme	4	10	10	40	APR	07.10.19	keine

D = Dokumentationspflichtig

**Auditbericht VDA 6.3 Beurteilung der Qualitätstauglichkeit**

Urf.Nr.: 10-346577 D-U.Nr. N: 122214676

Auftraggeber: 10-2221131 Abteilung: 04\_05\_HON Auto

Auftraggrund: Neuteil Artikel: ET-4000 / 1 / Inkret

Standort	Standort-Code	Einl.	Einl.	Einl.
1	F <sub>1</sub>	n.b.	n.b.	n.b.
2	F <sub>2</sub>	n.b.	n.b.	n.b.
3	F <sub>3</sub>	n.b.	n.b.	n.b.
4	F <sub>4</sub>	n.b.	n.b.	n.b.

**Beurteilung:** In Rahmen der Audierung wurden folgende wertvolle Feststellungen erlangt: Die Prozessleistung ist zufrieden.

**Maßnahmen:** Die Prozessleistung überarbeiten und durch eine Reibschleife steigern.

**Termin Maßnahmenplan:** 11.12.2019

**Auditor:**







## TECHNICAL DOCUMENTATION

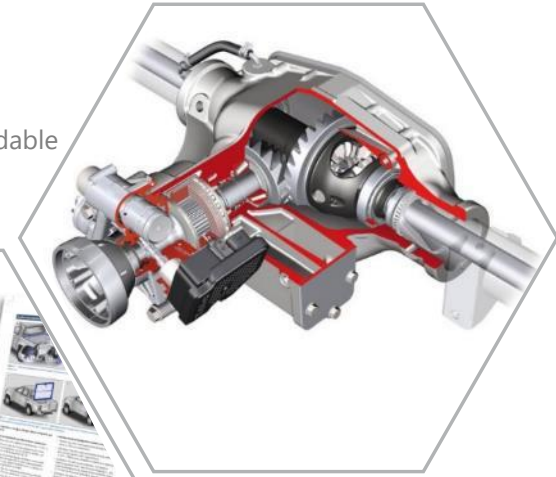
**We are your competent service provider for illustration, documentation, digitization and translation.**

- Preparation of installation and repair manuals
- Development of training programs
- Preparation of operating manuals
- Preparation and implementation of troubleshooting strategies
- Programming of guided troubleshooting
- Conduct of diagnosis - intensive trials
- Visualisation/animation of technical topics
- Editing of international technical vehicle standards

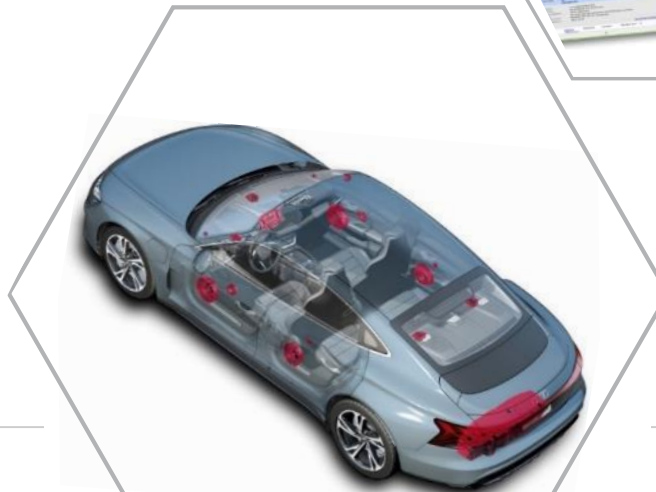
Augmented reality - computer-aided applications



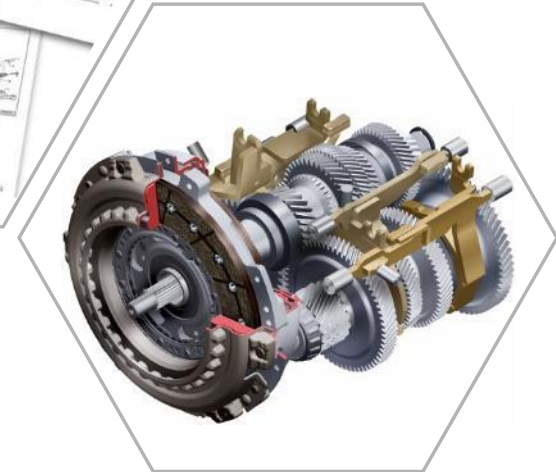
Making technical processes visible and understandable



Creation of workshop literature



Graphic editing:  
Based on design data







## DRIVING TESTS

With the drive of over 33 million km of experience...

- Vehicle endurance tests on testing ground (according to customer requirements)
- Vehicle endurance tests on road (3S / 24h)
- Off-road and racetrack trials
- Special tests on national/international territories
- Preparation, support and organisation of acceptance drives
- Support/maintenance of company car fleets



**We would be happy  
to support you  
with your projects.**



**Address:**

Crimmitschauer Straße 59,  
D-08058 Zwickau



**E-mail:**

info@fes-aes.de



**Telephone:**

+49 375 5660 0



[www.fes-aes.de](http://www.fes-aes.de)

