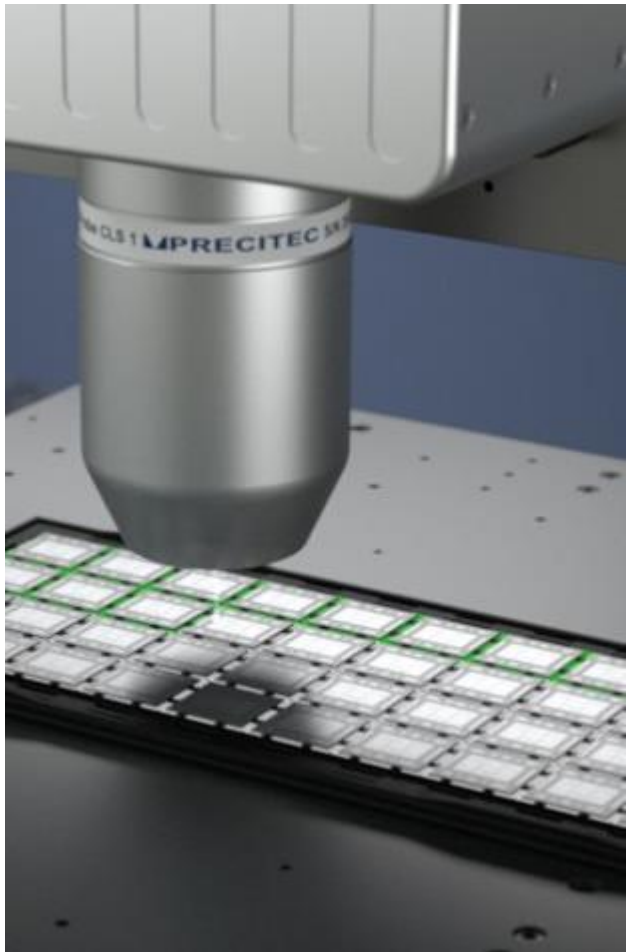




PRECITEC

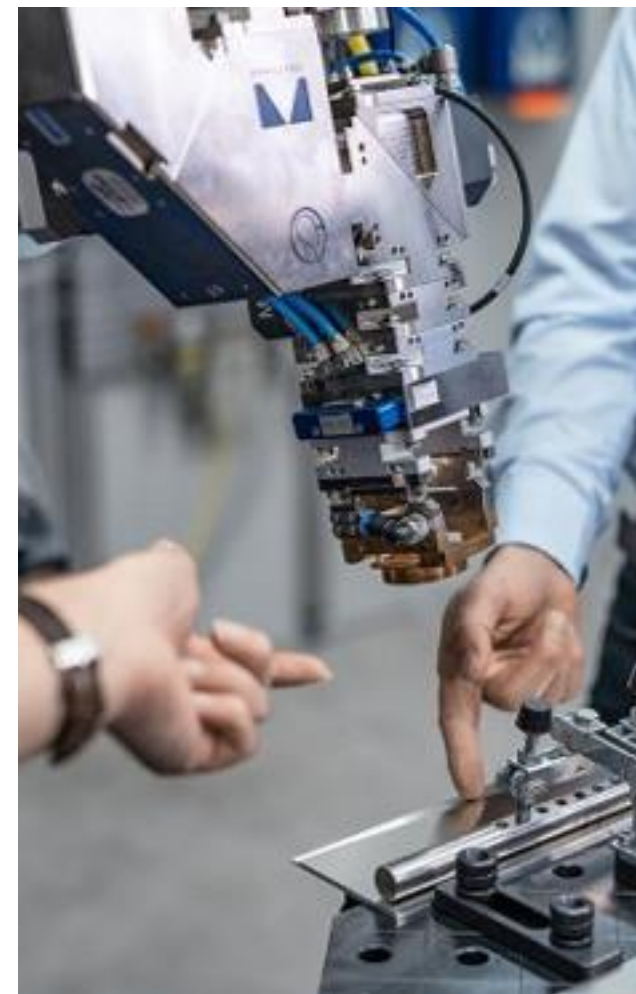
**THE FUTURE OF MOBILITY IS AUTOMATED,
NETWORKED AND ELECTRIC.**

22. November 2021 | Dr. Markus Kogel-Hollacher



M PRECITEC

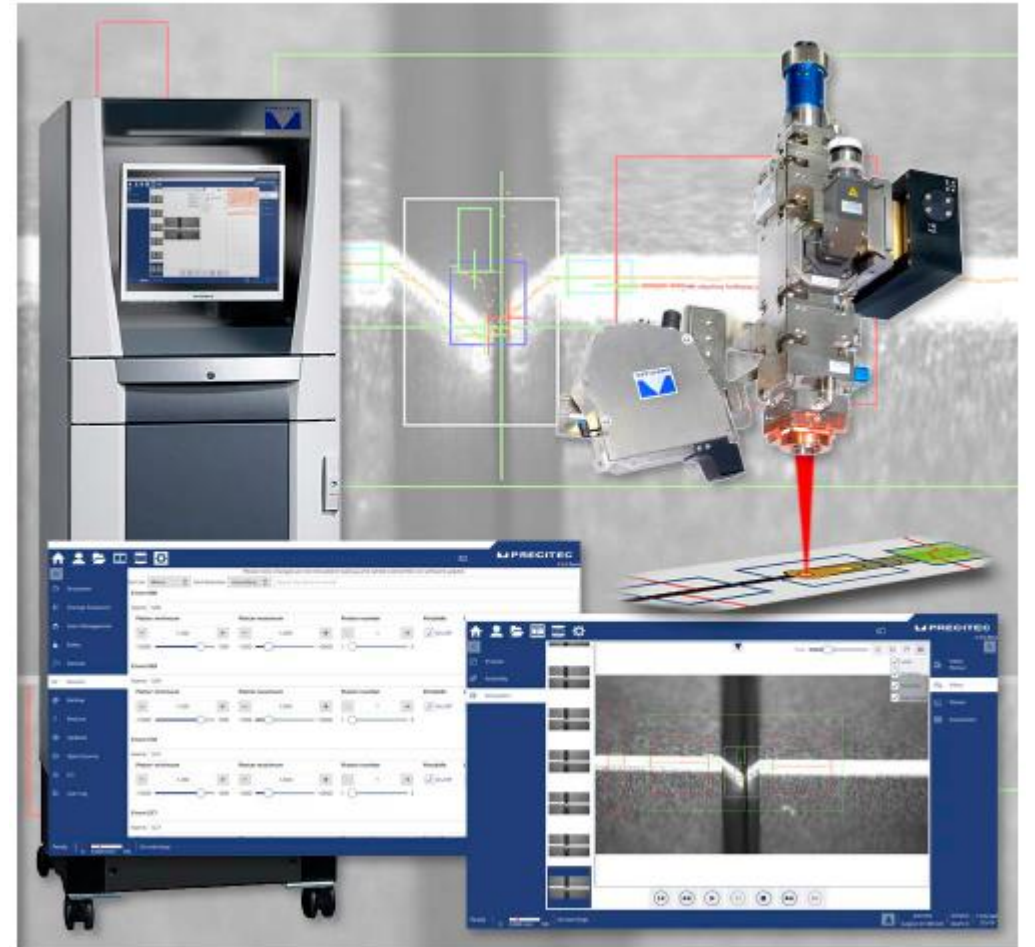
Your worldwide leading partner in the development of system solutions and components for laser material processing as well as in the field of 3D metrology.



BODY-IN-WHITE LASER WELDING STATE-OF-THE-ART

WeldMaster 4.0

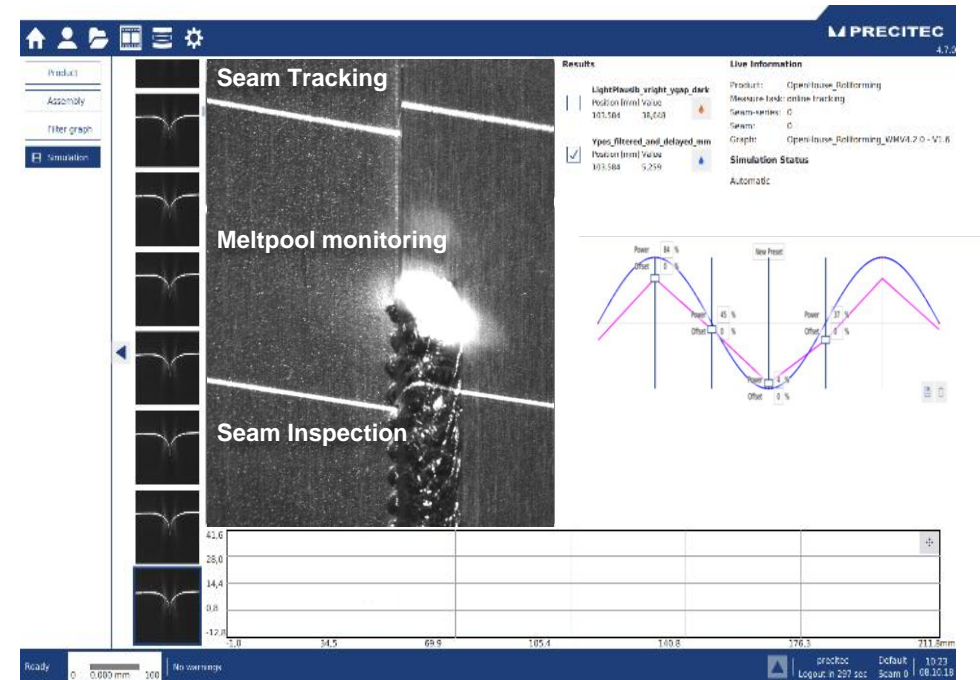
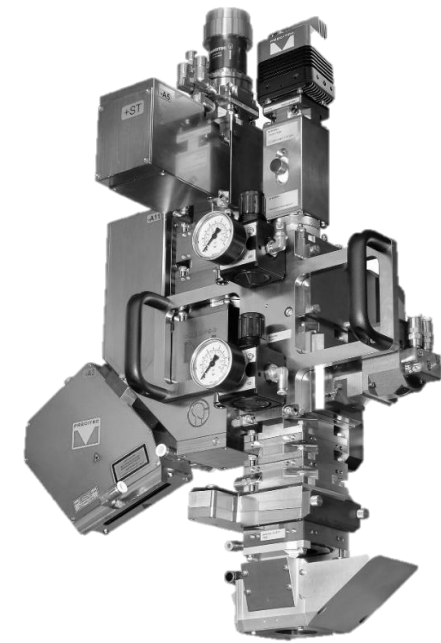
Your solution for an intelligent seam tracking / inspect system designed for laser welding application



WELDMASTER 4.0 SCANTRACK & INSPECT 1D 2.0

Customer Benefits

- Reduced investment costs
 - Attractive System Price for the new all-in-one solution depending on the configuration
- No Additional Station for Quality Check
 - Reduce foot print in your production line
- Faster processing speed up to 10 m/min
 - New camera technology
 - Improved signal processing
 - Detection of pores / defects > 0,6mm at 10m/min feed rate
- Shorter cycle times by moving forward and reversing
- System simplification by new graphical user interface (GUI)



APPLICATION EXAMPLE – AUDI A8 DOORS

LASER REMOTE WELDING OF ALUMINIUM DOORS



Source: www.audi.de

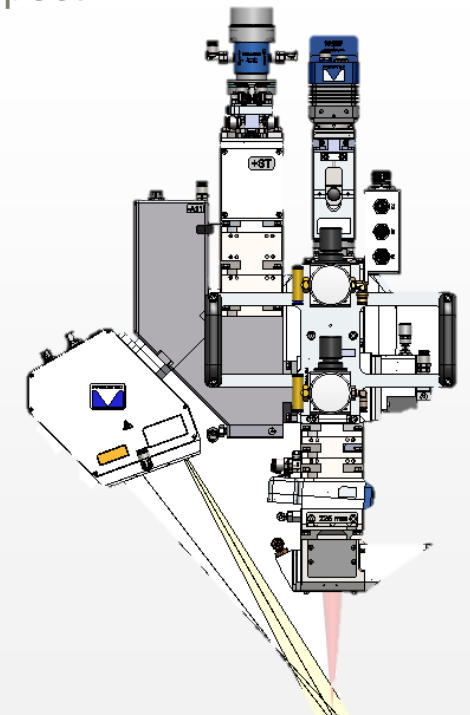
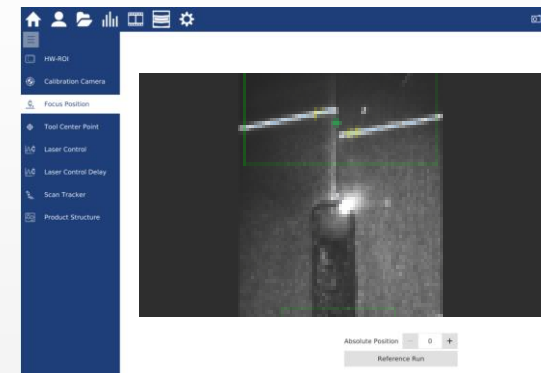
Application

- Audi A8 door
- Production reliably running since 2014



Precitec Product

- WeldMaster ScanTrack & Inspect



APPLICATION EXAMPLE – E-MOBILITY

WELDMASTER SCANTRACK & INSPECT



Source: www.audi.de

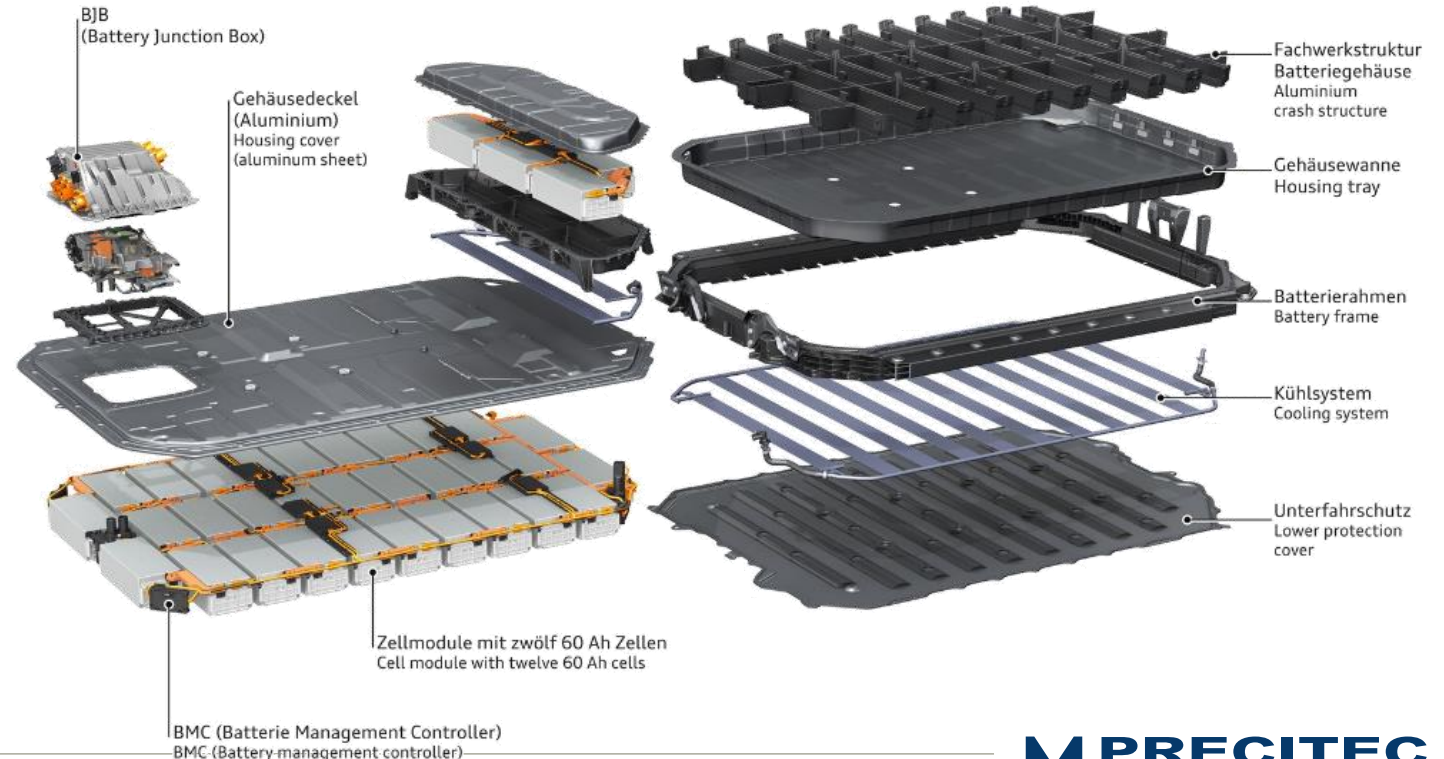


Application

- Welding of lower protection plate
- Production reliably running since 2017
- 260 step seams
- Exact placement of 10 reinforcement rails
- High material thickness of the upper sheet
- Low failure rate of single seams
- Fillet weld good connection cross section

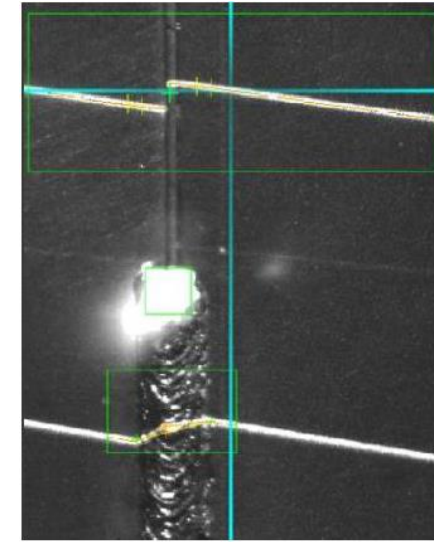
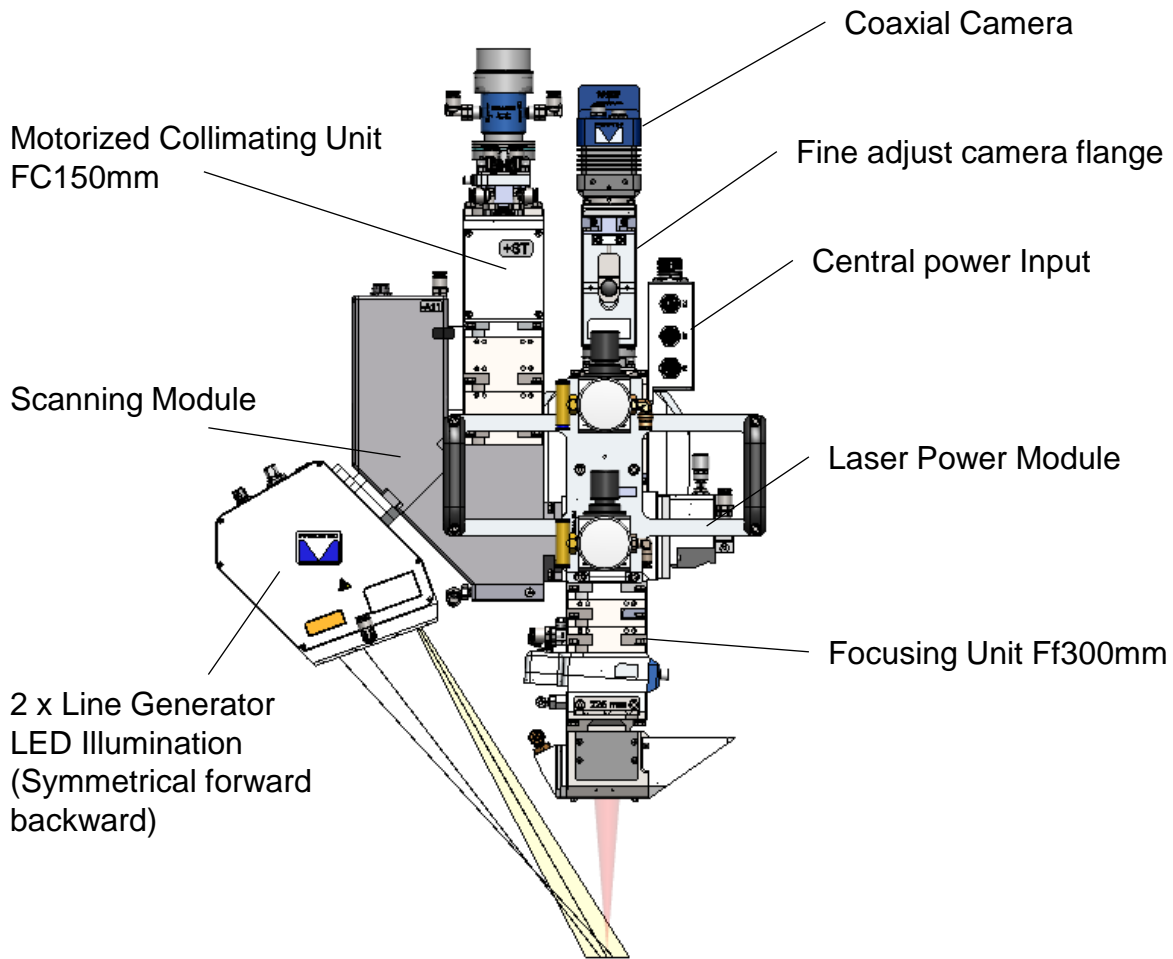
Audi e-tron Prototyp

Audi e-tron Prototyp
Flüssigkeitsgekühlte Lithium-Ionen-Batterie
Liquid cooled lithium-ion battery
04/18



WELDMASTER 4.0 SCANTRACK & INSPECT 1D 2.0

SYSTEM CONFIGURATION

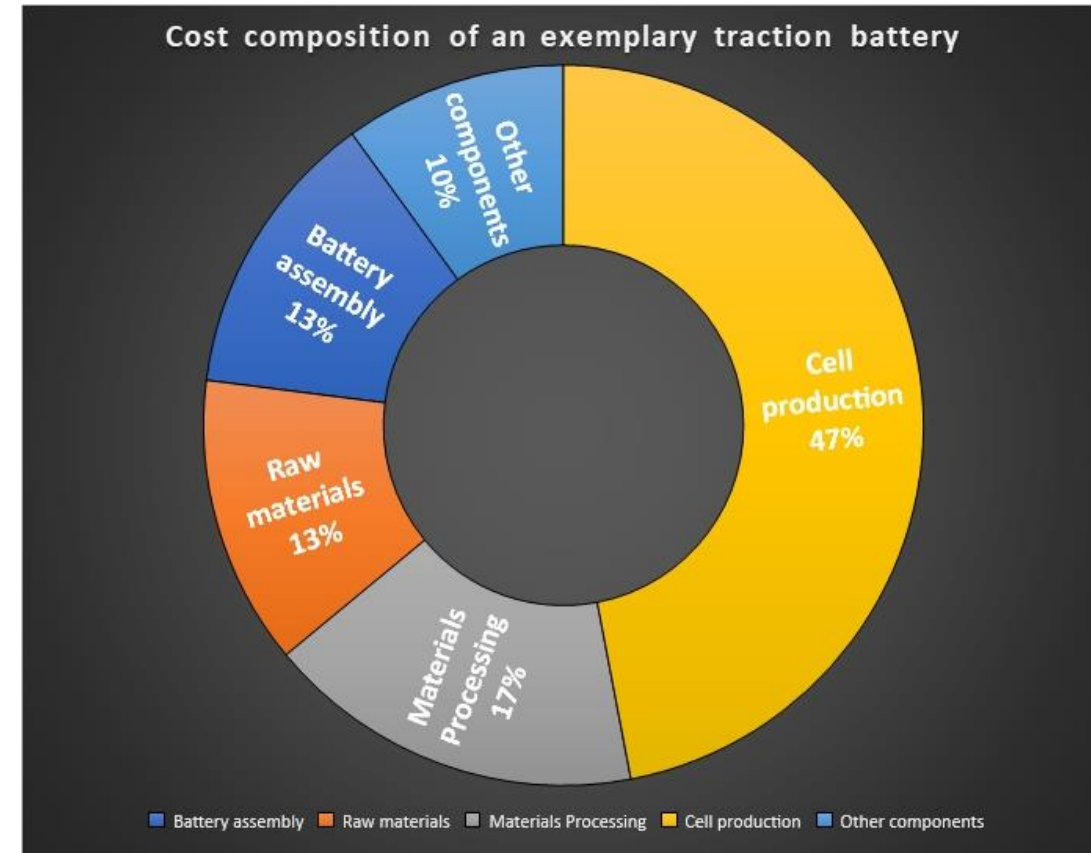


WeldMaster 4.0 ScanTrack & Inspect 1D 2.0

- Seam tracking with automatic correction of beam position
- Beam oscillation with synchronized laser power modulation to control the heat and the strength of the joint
- Adaptive scan-width and laser-power modulation bridges gaps up to 50% of top sheet thickness
- Online seam inspection

ELECTRIFICATION CONTINUES TO GROW

- E-mobility is a megatrend which - together with the networking of vehicles, autonomous driving and digitalized production - will significantly change the automobile, its use and its production in the coming years.
- The electrification of the powertrain in particular is changing the existing value-added and employment structures in the automotive industry, whereby classic components such as the combustion engine will ultimately lose importance, while at the same time new components of electric mobility will become more important.
- While for 100 km Range only 6 to 7 kg conventional fuel (incl. storage system) are required in the vehicle, this value increases to over 130 kg with today's battery systems. Achieving higher energy densities is accordingly the focus of the R&D on battery systems.



Strukturstudie BWe mobil 2019 - Landesagentur für neue Mobilitätslösungen und Automotive Baden-Württemberg

ELECTRIFICATION CONTINUES TO GROW

Whether we talk about e-mobility or hydrogen drive, laser and photonics industry take the chance to transform manufacturing processes, convince decision makers on the undoubted advantages of photonic tools in the relevant production chains.

ELECTRIFICATION CONTINUES TO GROW

As COVID-19 hammers the auto industry, electric cars remain a bright spot

According to IEA EV's are set to take a record share of overall market in 2020 and government policy responses to the crisis could accelerate the transition to electric cars

Figure 1: Global annual passenger vehicle sales by drivetrain

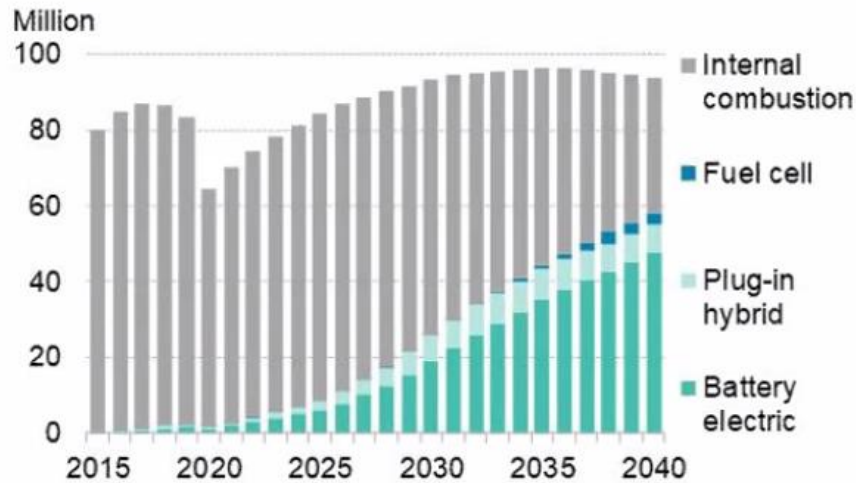
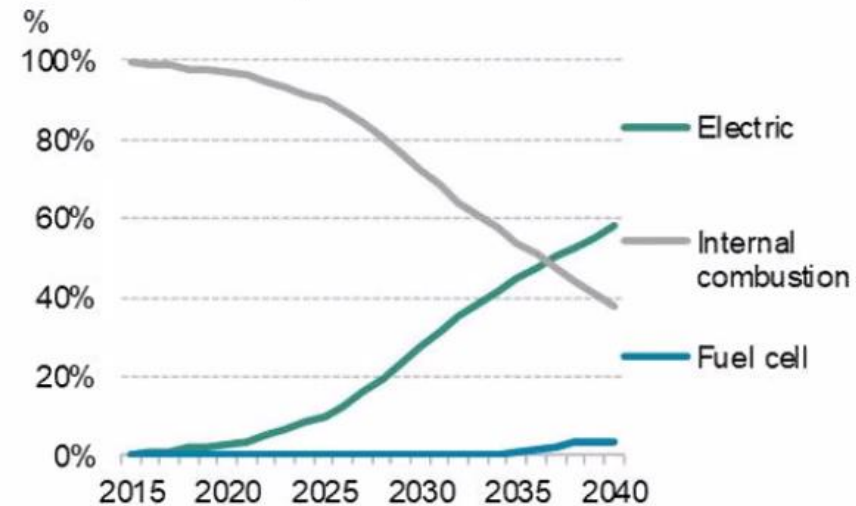


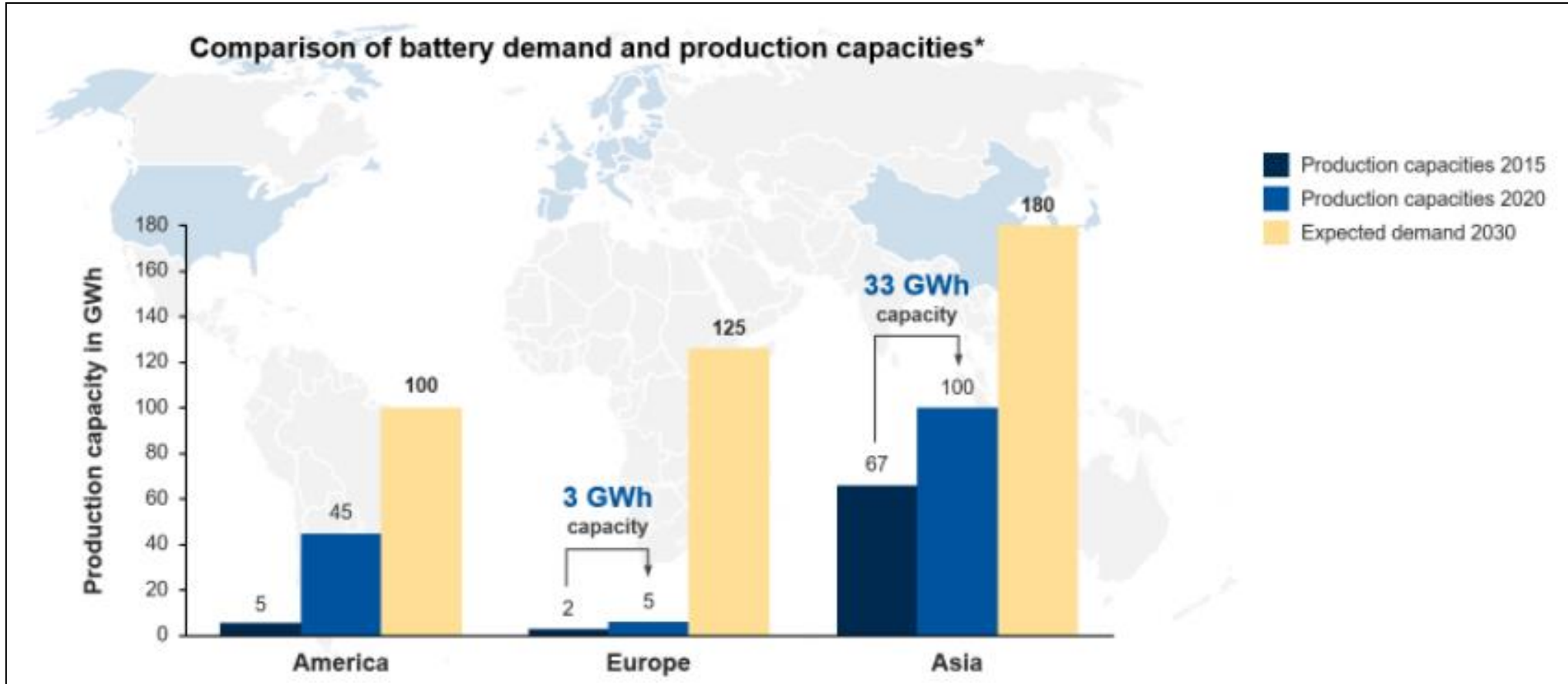
Figure 2: Global share of total annual passenger vehicle sales by drivetrain



Source: BNEF. Note: Electric share of annual sales includes battery electric and plug-in hybrid. June 2020

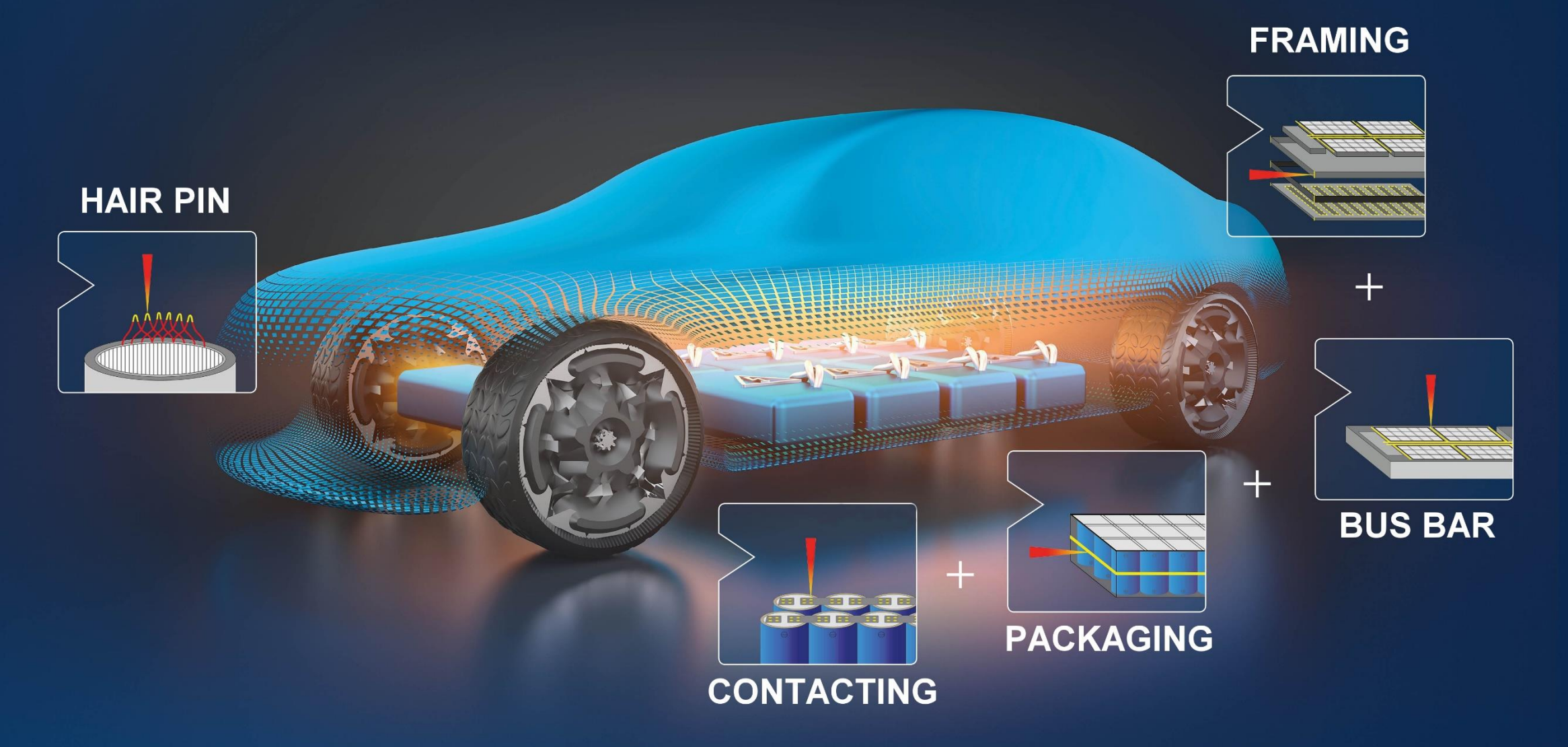
ELECTRIFICATION CONTINUES TO GROW

Global competition - Growing Gap in Europe



Source: RWTH-Aachen 2020

LASER WELDING SOLUTIONS FOR E-MOBILITY



LASER WELDING SOLUTIONS FOR E-MOBILITY

Batteries

- Pouch cells
- Cylindric cells
- Prismatic cells



Figure: A123

Modules

- Contacting
- Bus bar welding



Battery box

- Cooling parts, gas tight
- Lightweight



Figure: BMWi3

Hair pins

- Power train
- Stator

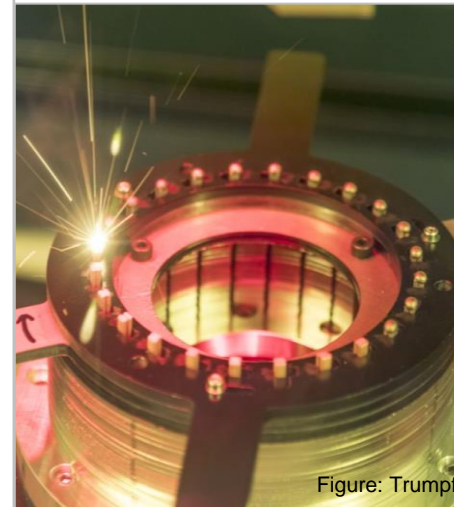


Figure: Trumpf

Fuel cells

- Welding of bipolar plates
- > 400m, leak-tight

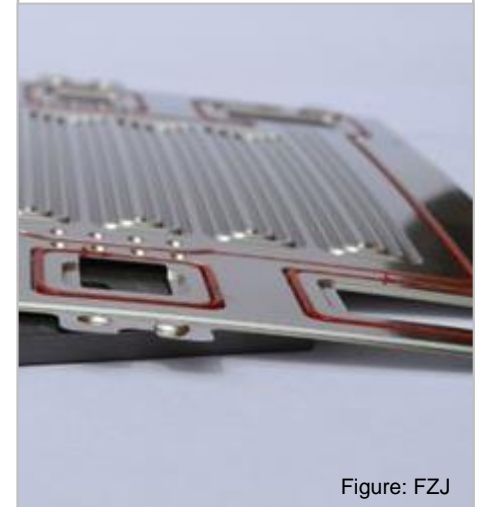


Figure: FZJ

SCANMASTER – ALL EXPERIENCE CONNECTED

ALL-IN-ONE SOLUTION FOR YOUR LASER WELDING PROCESS

- Autofocus collimation
- OCT sensor
- High speed image processing
- Integrated quality control

Perfectly suited for the challenging applications in e-mobility

Motorized collimation for highly accurate control of the distance

2D scanner for highly dynamic processing

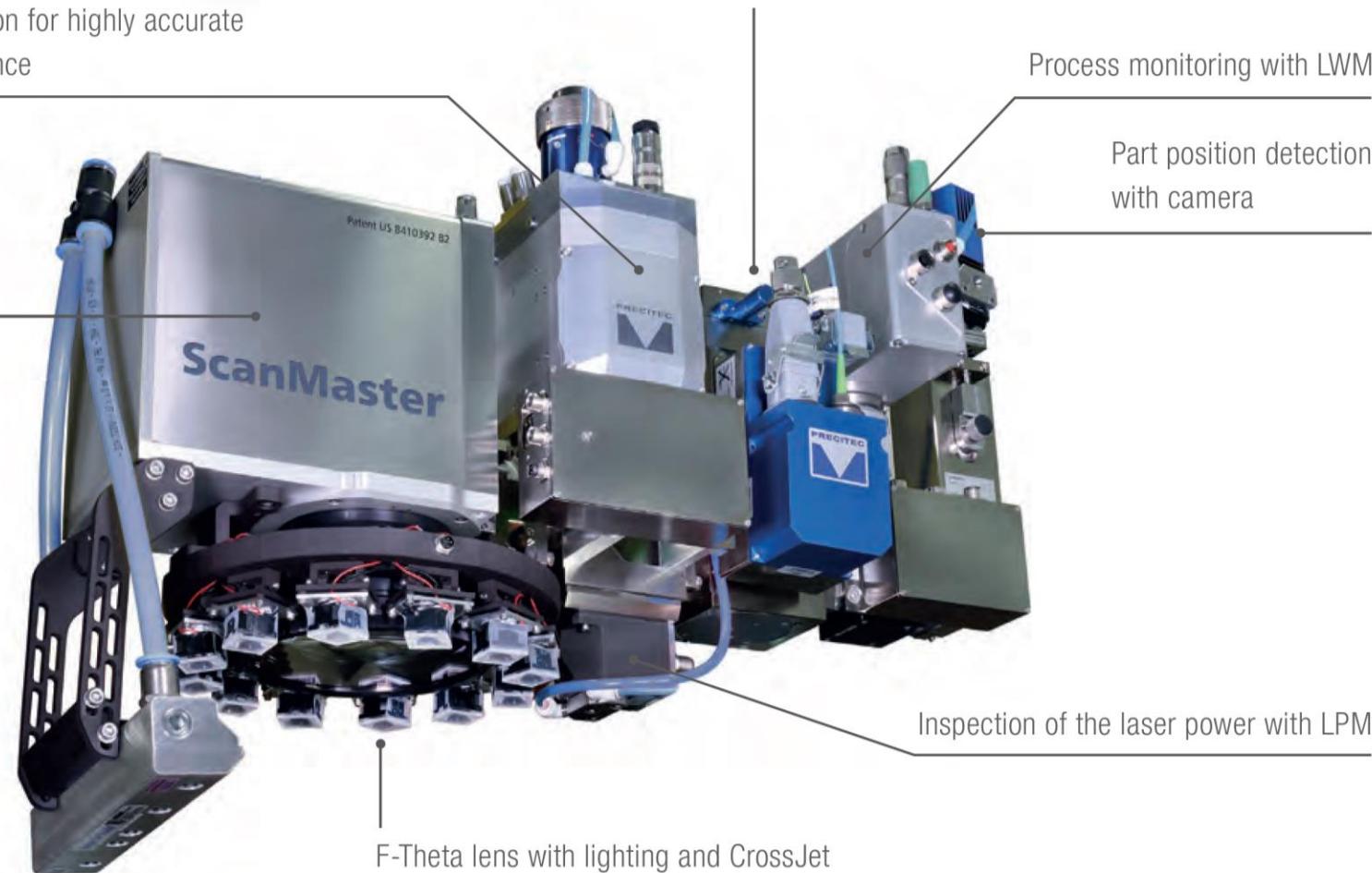
High-precision distance measurement with OCT

Process monitoring with LWM

Part position detection with camera

Inspection of the laser power with LPM

F-Theta lens with lighting and CrossJet



PRECITEC SCANMASTER – SUPER RELIABLE TECHNOLOGY

Scanlab Intelliscan 30

- > 3.500 units in operation



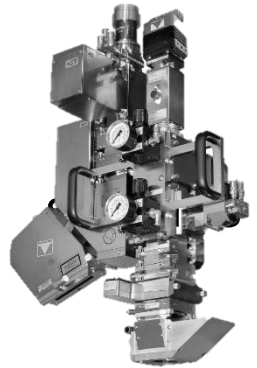
Motorized collimator

- ProCutter technology
- > 10.000 units in operation



All-In-One Packages

- Experienced based on WeldMaster
- > 300 WeldMaster in operation



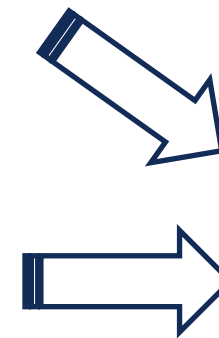
Quality Monitoring

- Photo diode based
- > 5.000 units in operation

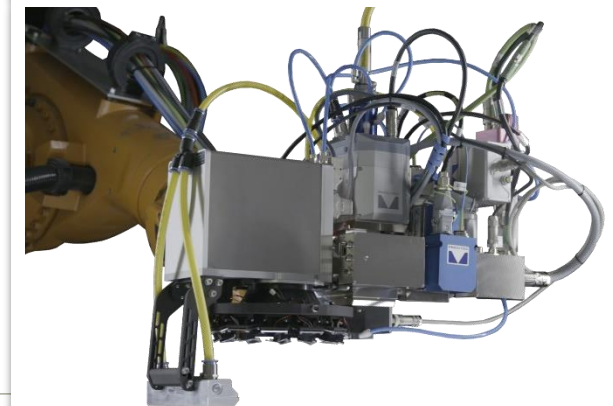


Vision System

- Camera based
- > 1.000 units in operation



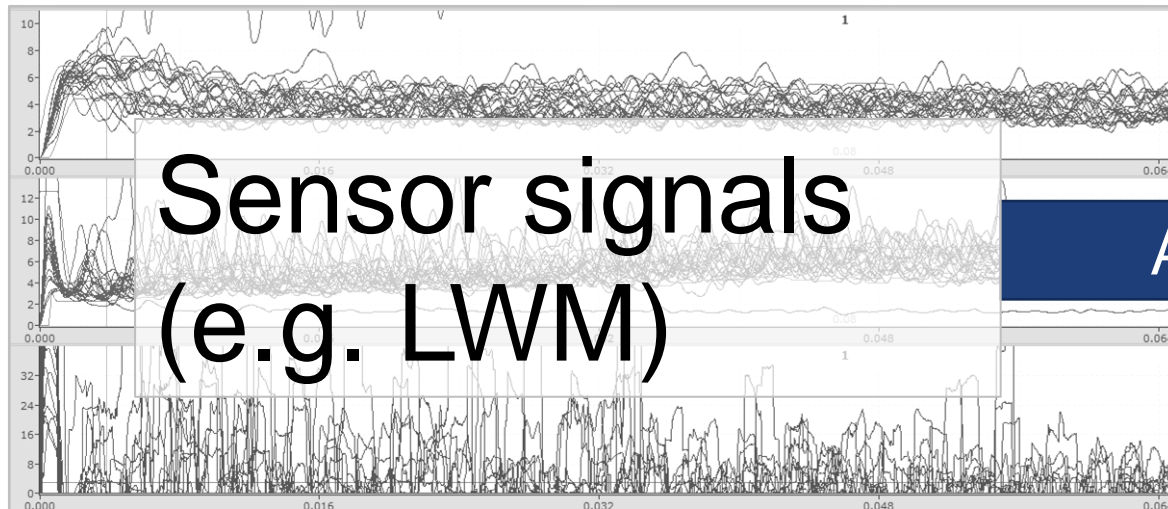
ScanMaster



ARTIFICIAL INTELLIGENCE (AI)

- Main question: Can we extract **absolute physical values** from the sensor signals?
- Approach: Acquisition of data → physical property (labelling) → AI model (structured data, supervised learning, neural network)

→ This approach is a vision. We may fail. But we are ready to give it a try.

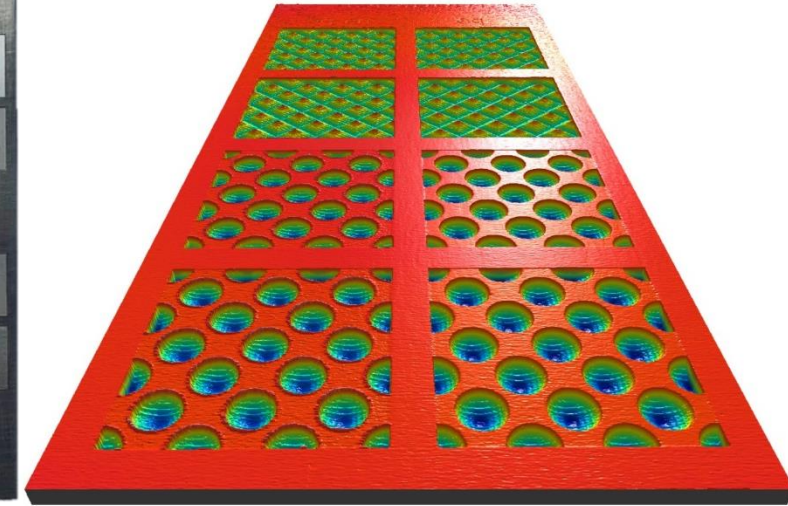
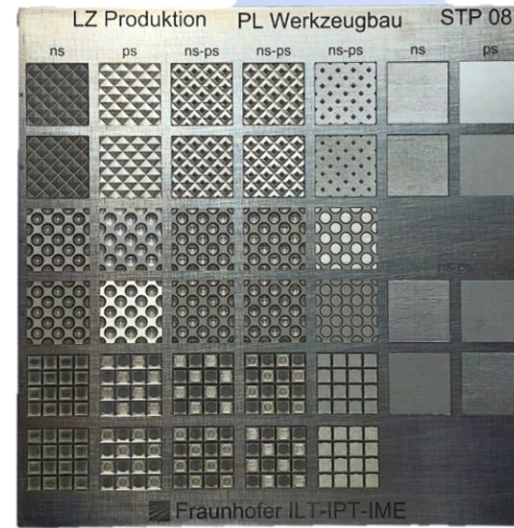


AI

e.g. $\sigma = 50 \text{ MPa}$

FLYING SPOT SCANNER

MEASURING WITH ACTIVE MOVING LIGHT

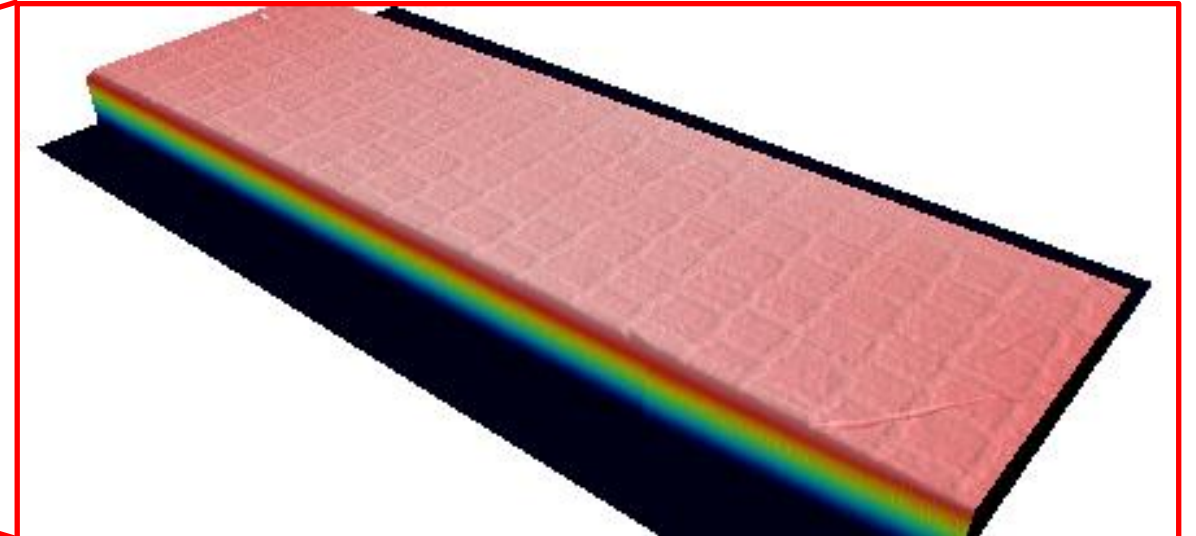
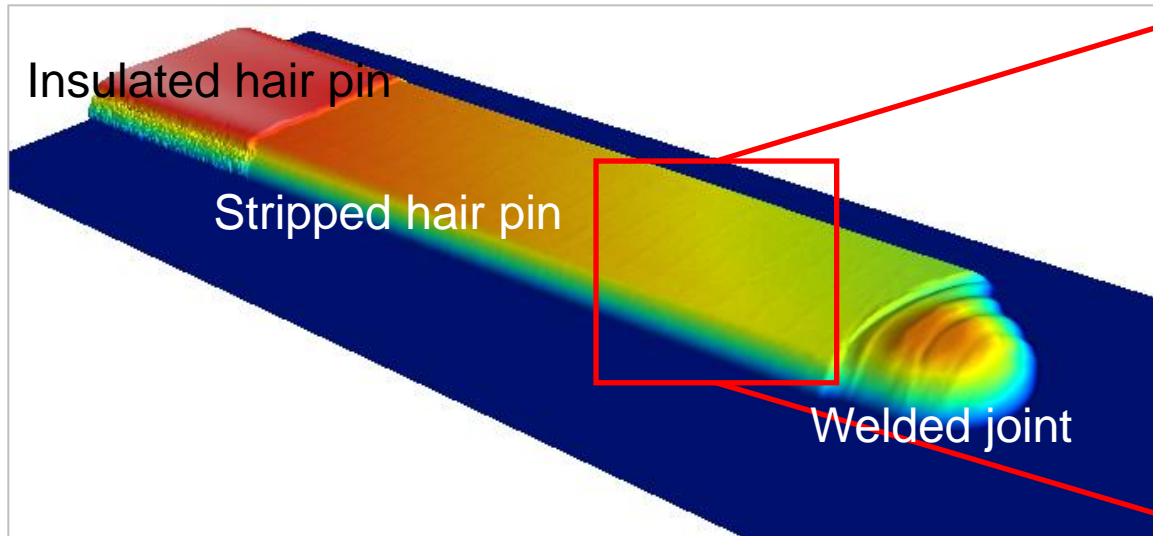
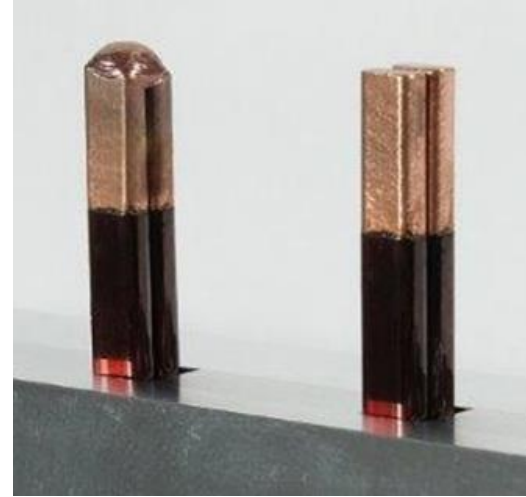


Flying Spot Scanner

Application	thickness and distance	
Measurement / second	70.000	
Working distance	200 mm	125 mm
Scan area	Ø 80 mm	Ø 40 mm
Lateral resolution	21 µm	6.5 µm
Measuring range	depends on CHRcodile IT sensor	

HAIRPIN – PROCESSING AND QUALITY

- Quality criteria “Pre-Process”
 - Geometrical shape after bending
 - Minor pores, scratches on the insulation of the pins
 - No residues after stripping
 - Good quality of the cut edge of the pins
 - Distances and position of the pins

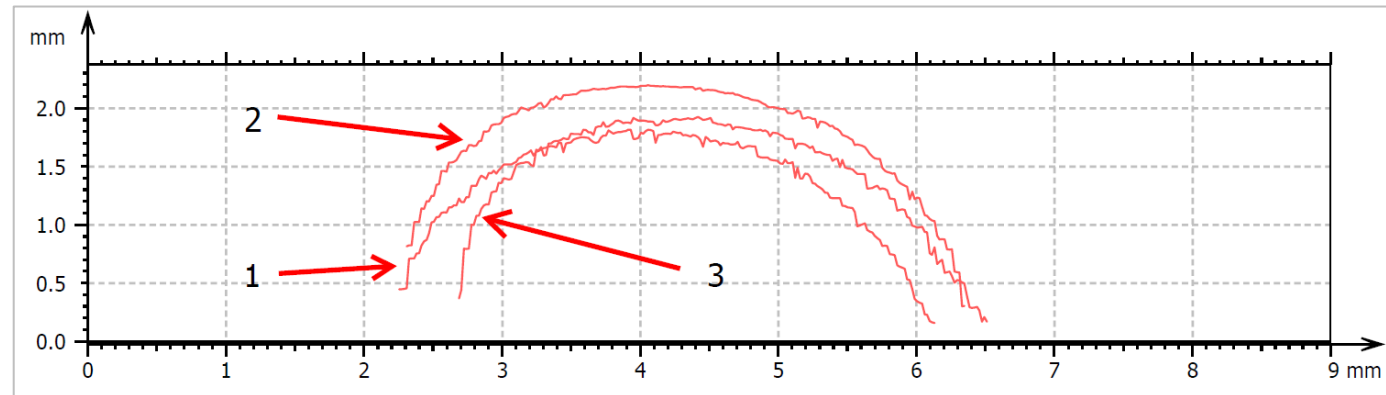
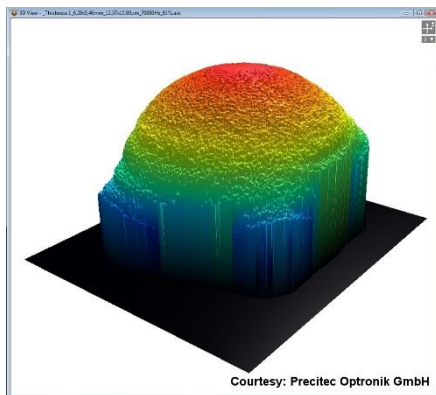
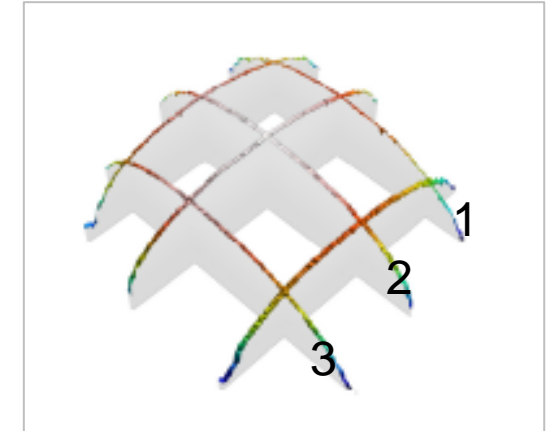
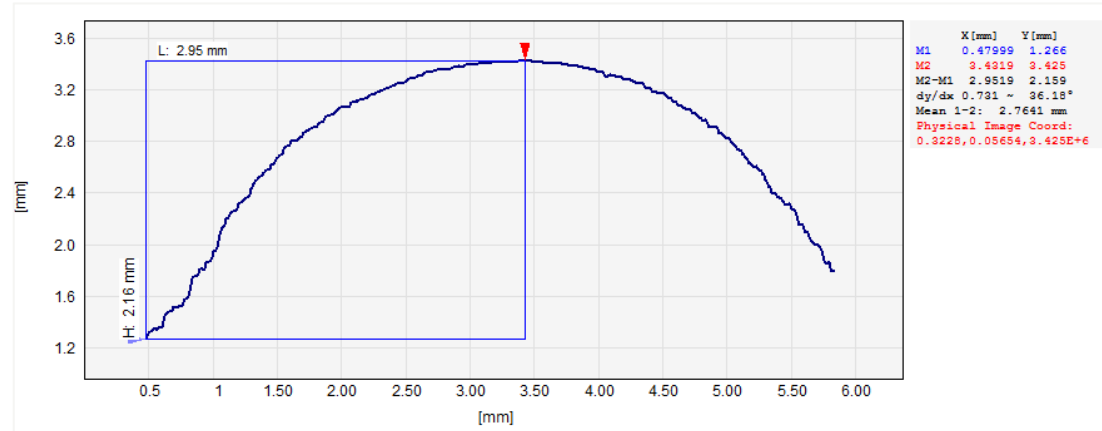


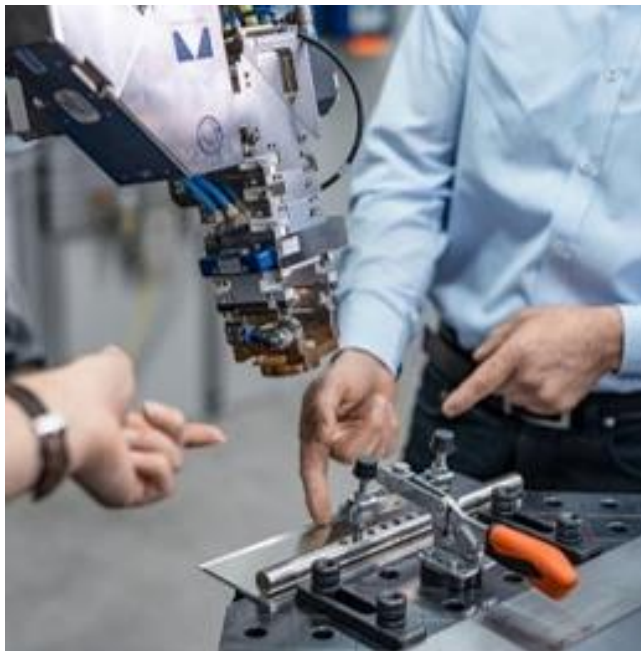
HAIRPIN – PROCESSING AND QUALITY

- Quality criteria “Post-Process”
 - Topology measurement by OCT

6 profiles sufficient for topology information

- Measurement time max. 100 ms





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22. November 2021 | Dr. Markus Kogel-Hollacher

