

# Automated Solutions for Production Control

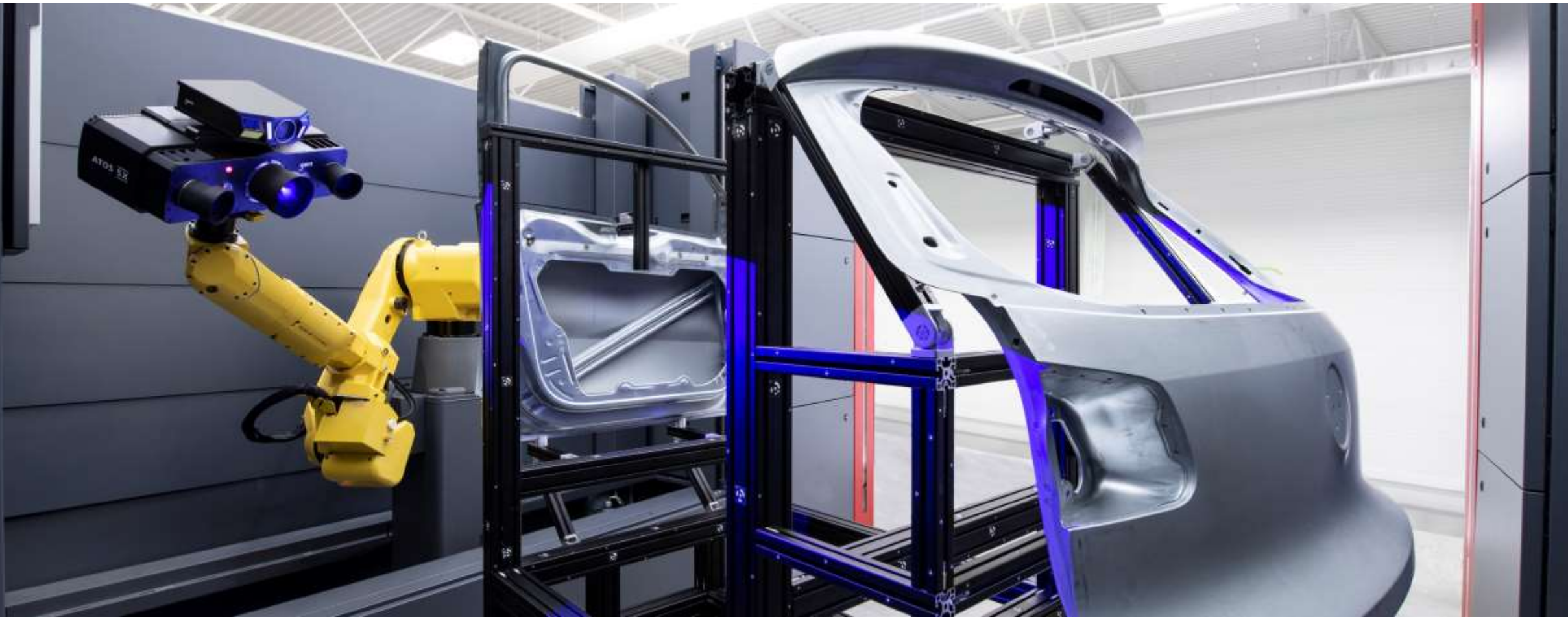
## Mastering quality with optical 3D metrology solutions



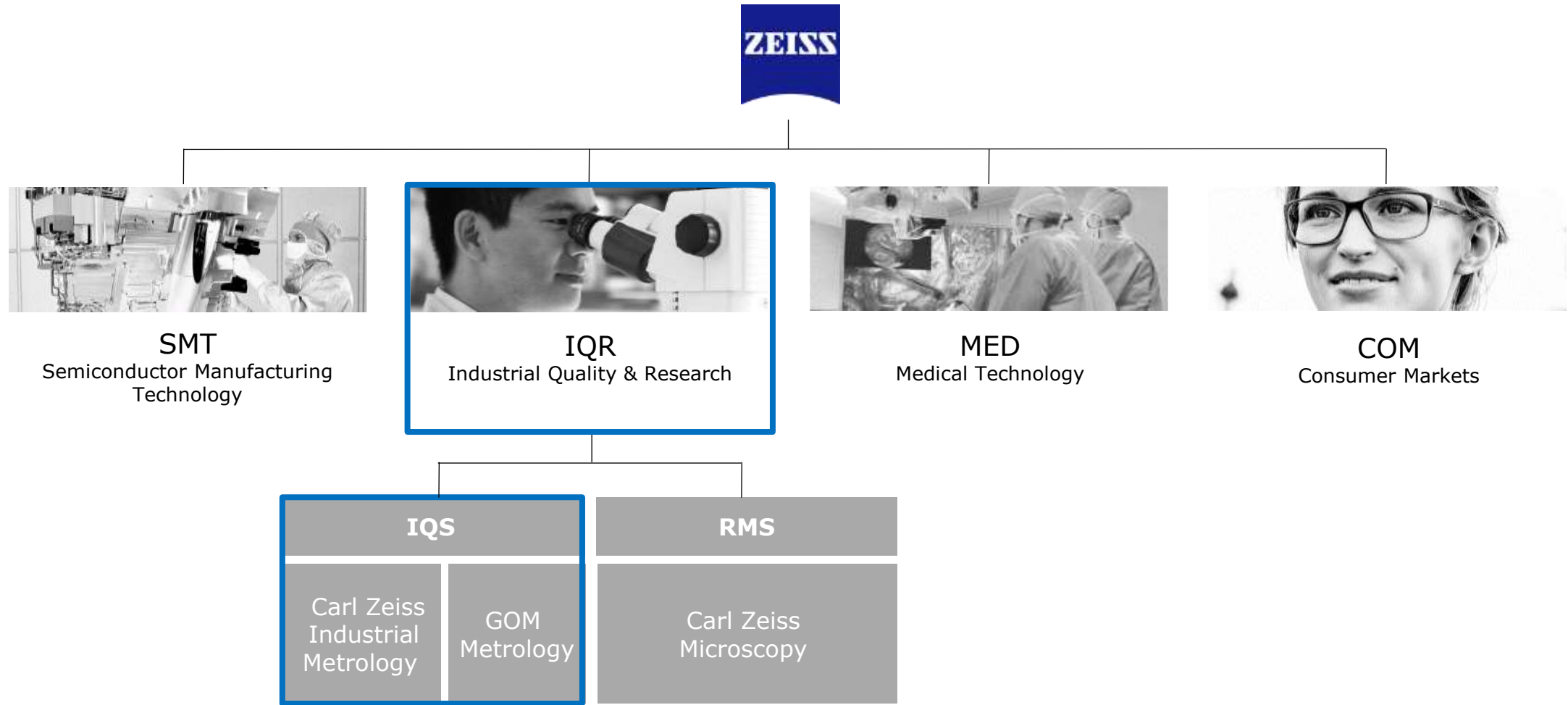
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November 16, 2022



# GOM Metrology – Part of ZEISS Industrial Quality Solutions



# Automated Solutions for Production Control

## Mastering quality with optical 3D metrology solutions

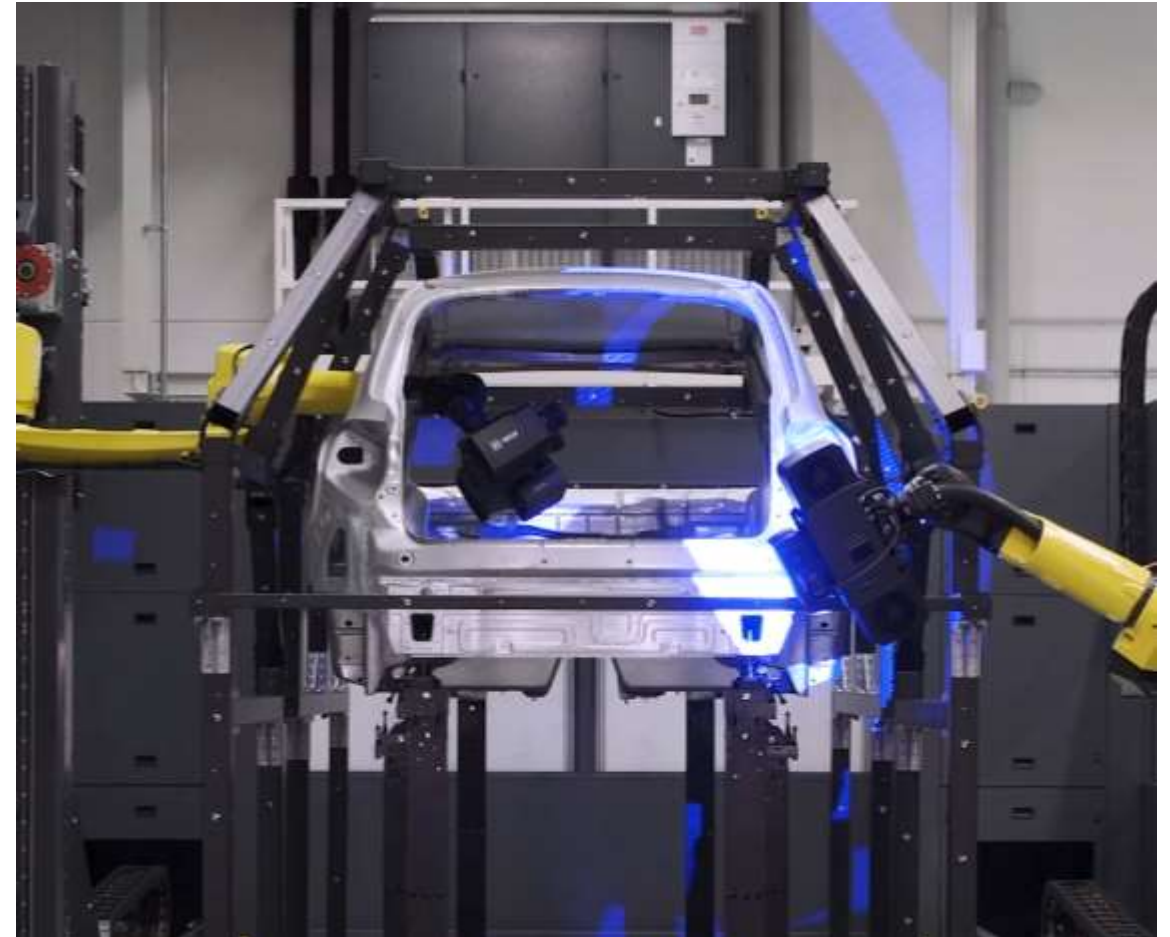


## 3D Scanning for Digitizing the part

- Using triangulation principle in conjunction with the fringe projection technique
- For Precise 3D coordinates captured by the stereo camera system
- Manual or automated measuring in production environment

## Sensor on Industrial Robot

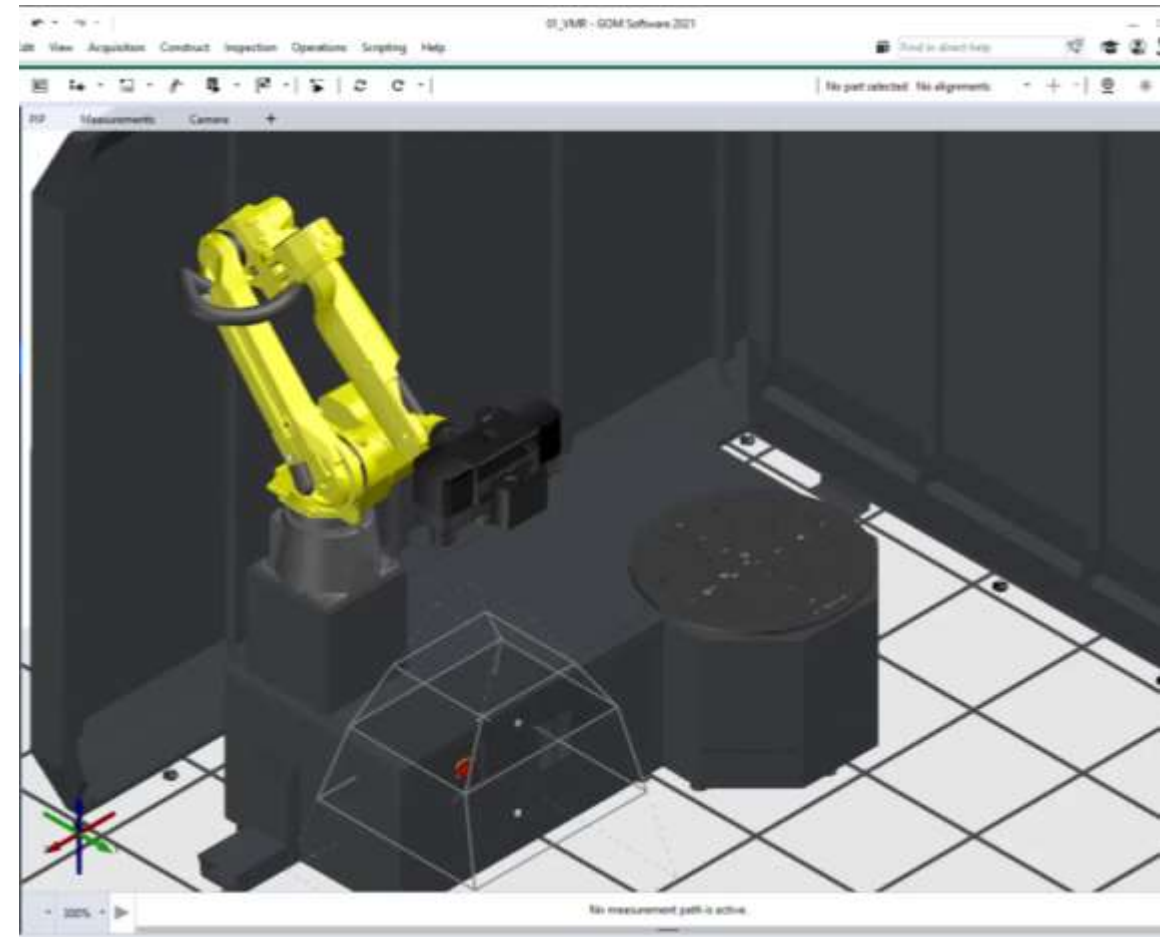
- Fast measurement and high throughput
- Flexibility with regard to measuring parts
- Automatic programming
- Use in production environment



# Smart Scanning Virtual Measuring Room (VMR)

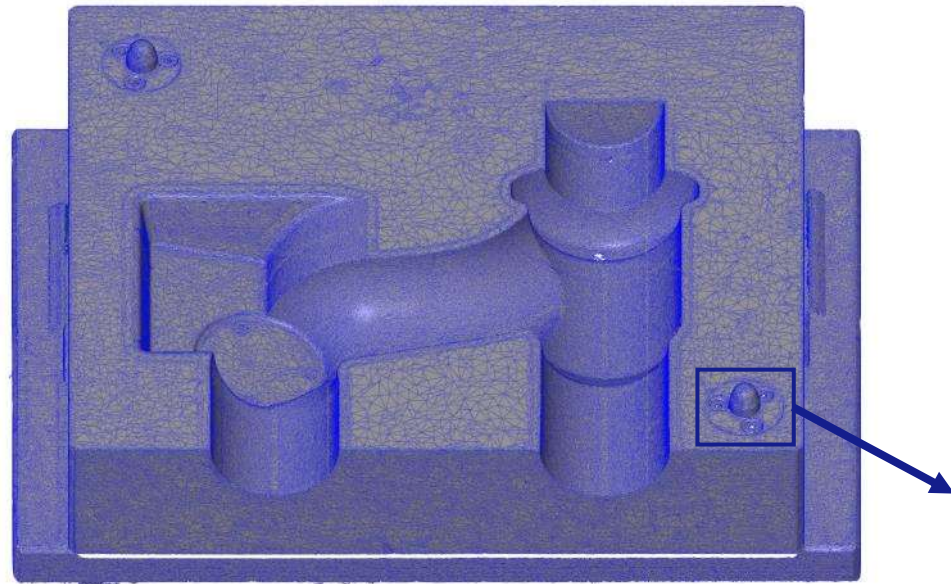
Reduced programming effort with Smart Scanning function:

- Robot programming without any prior knowledge
- Import of CAD and measurement plans
- Automatic programming
- Generation of sensor positions
- Simulation of 3D measurements
- Collision check
- Data acquisition
- Analysis and reporting
- Automatic updating programs when CAD or measurement plan changes

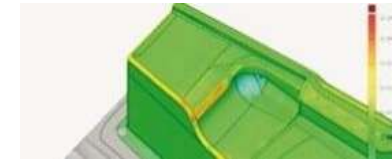
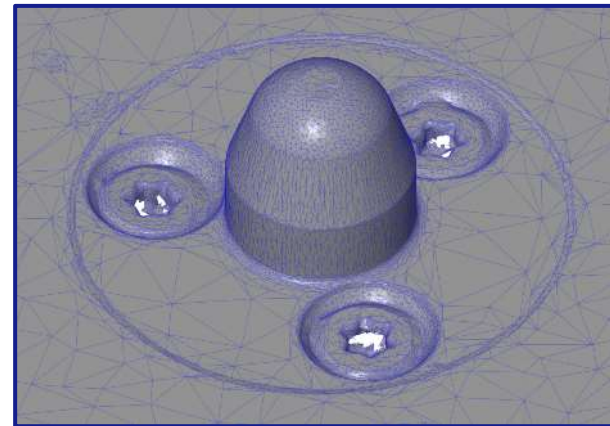


# Digital Twin

## Capturing the full dimensional information of the part



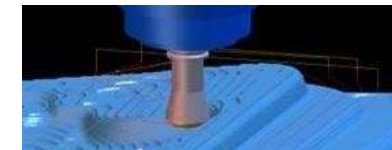
used for further processes



Quality Control



Additive Manufacturing



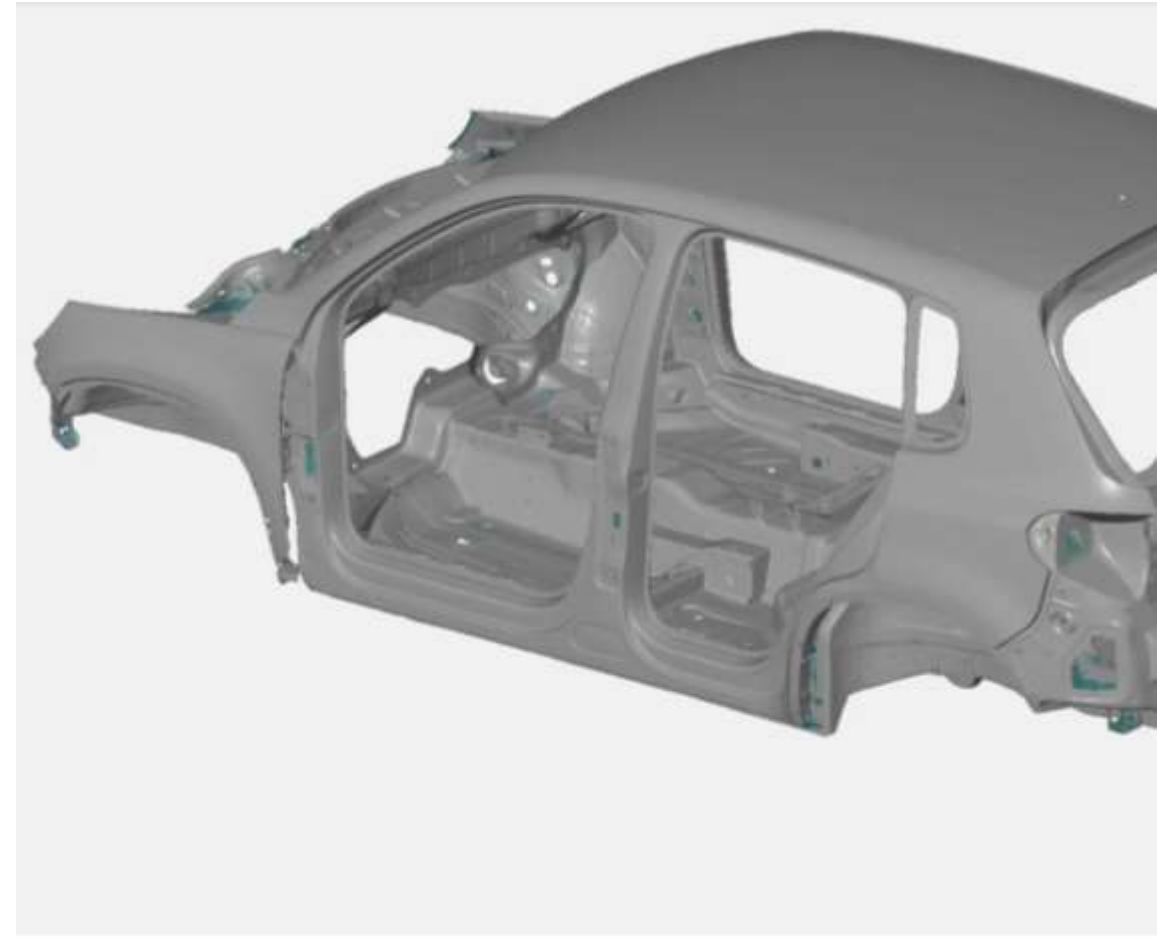
CNC-Machining



Reverse Engineering

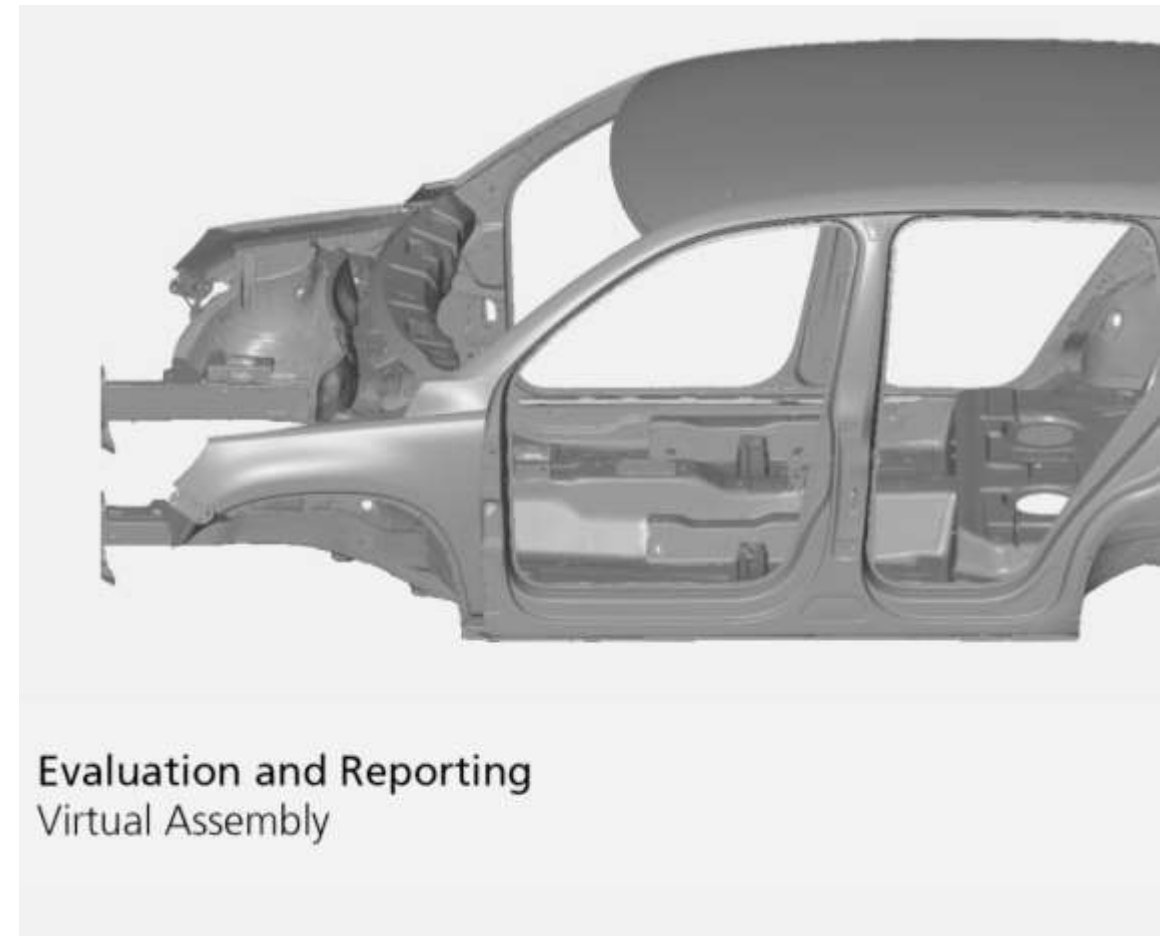
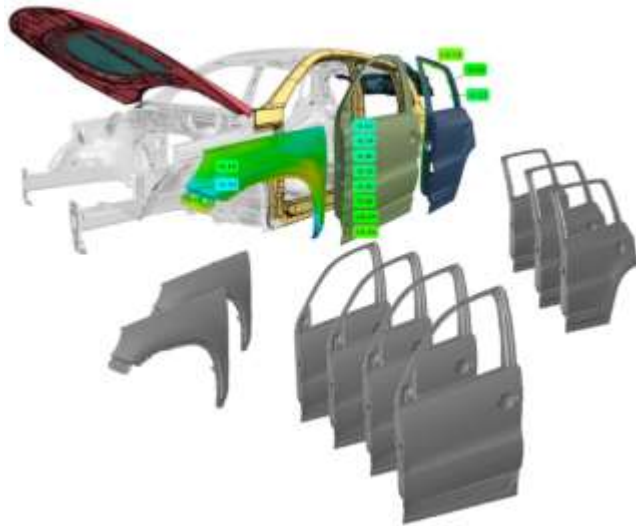
# Making Quality visible

- Full-field data
- Deviation to CAD
- Dynamic in 3D
- Making GD&T visible
- Easy to explain/understand
- Wall thickness analysis
- Feature based measurement reports
- Process monitoring



# Digital Assembly State of the Art

- Combine individual parts digitally, regardless of where the parts have been produced
- Comfortable and quick gap and flush inspection
- Inspection of different part combinations using “cross assembly”
- Digital “Meisterbock”

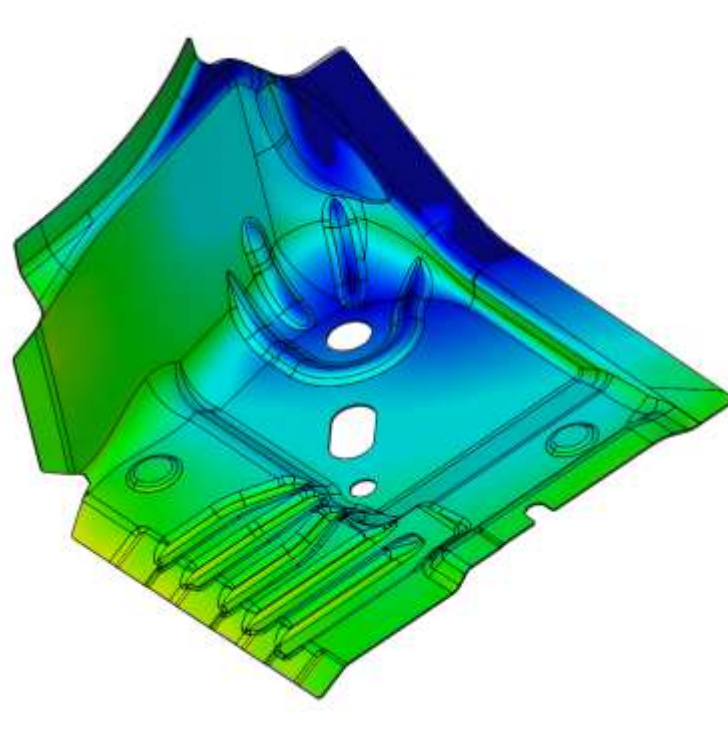


Evaluation and Reporting  
Virtual Assembly



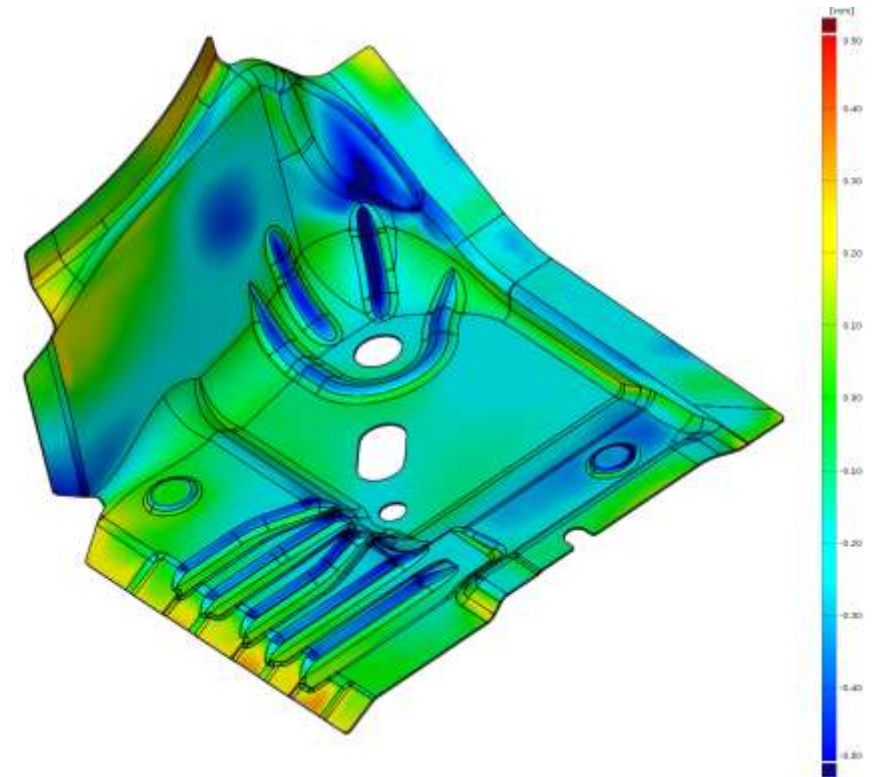
# Virtual Clamping

## Compensate warpage mathematically, not physically



Measurement in free state

GOM Inspect  
algorithm, using  
deformation model  
and FEM algorithms



Evaluation in constrained state

# Benefits of Virtual Clamping

## Virtual Clamping replaces fixtures and accelerates measuring workflows

- Cost reduction
  - No individual fixture needed
  - Less multiple measurements (i.e., clamped/unclamped)
  - Simple change management (i.e., without mechanical changes)
- High process capability
  - Early integration into process chain
  - Reduction of optimization loops
  - Perfect accessibility for optical measurements
  - Mathematically perfect boundary conditions
  - No undefined friction at the clamps
  - Reduced user influence



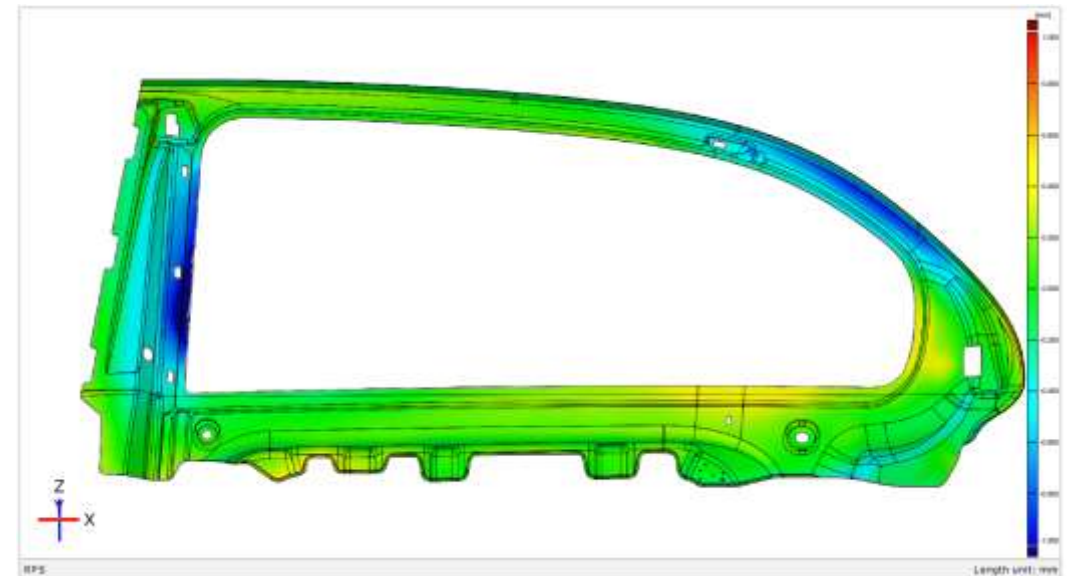
# Comparison

## Identical results within the scattering of the mechanical process

Mechanical fixture, physical clamping



Universal Pneumatic Device, virtual clamping



# Photorealistic Rendering of Scan Data



GAP (10)

J	Nominal	Actual	Dev.	Check
F	+0.00	+0.30	-0.30	
S	+0.51	+0.15	+0.35	

SPS 7 Fy

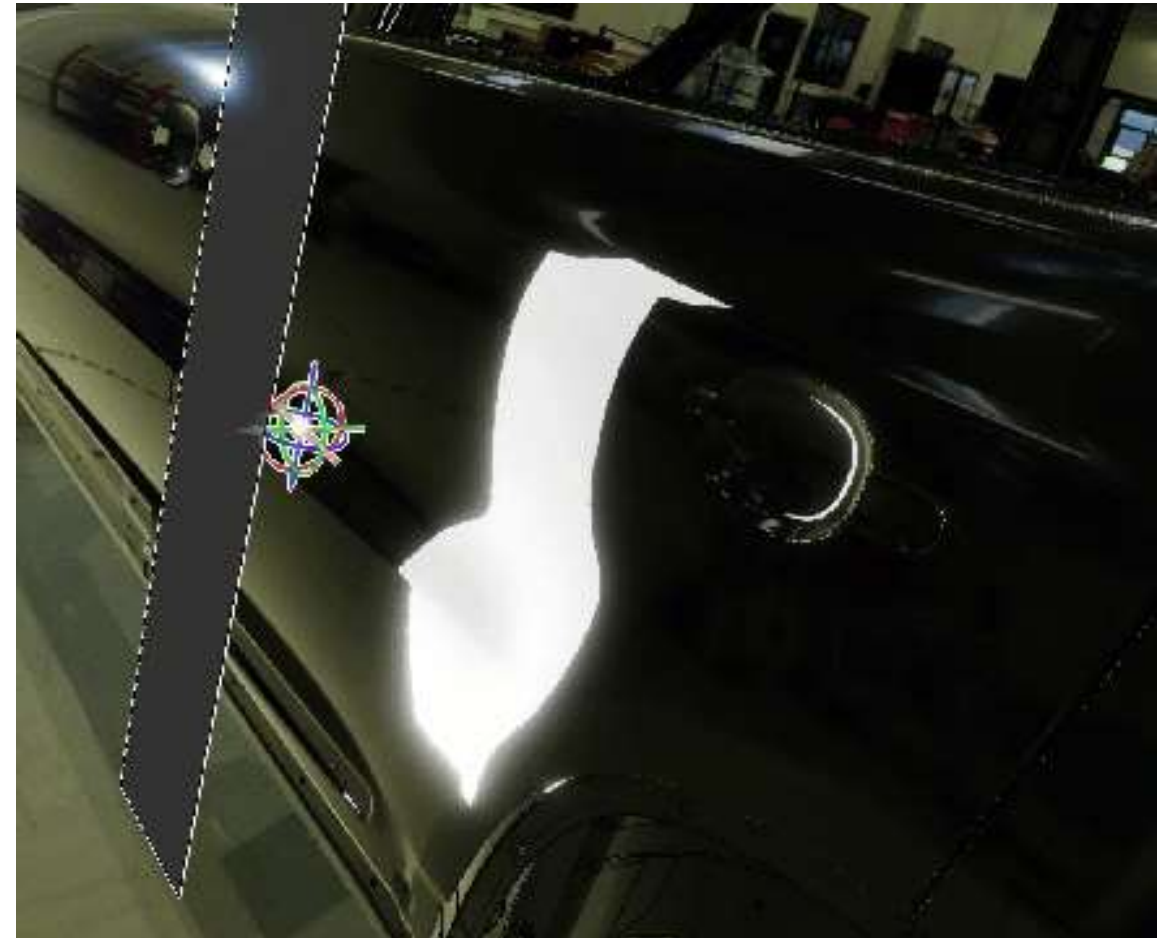
I	Nominal	Actual	Dev.	Check
X	+1450.09	+1456.09	-0.00	
Y	-905.61	-905.47	+0.14	HB
Z	+231.50	+230.53	+0.00	

## Current state

- All parts of hull are brought together as part of quality control
- The parts get measured and evaluated
- Inspect flush and gap in digital assembly
- Missing: virtual check for “visual fidelity”
- Auditors want to see “their car”

## Features of photorealistic rendering

- Realistic environments
- Surface materials
- Zebra light (color, intensity, geometry, ...)
- Light spots, realistic shadows
- Different perspectives and views
- Enable kind of virtual audit



# Photorealistic Rendering



# Photorealistic Rendering



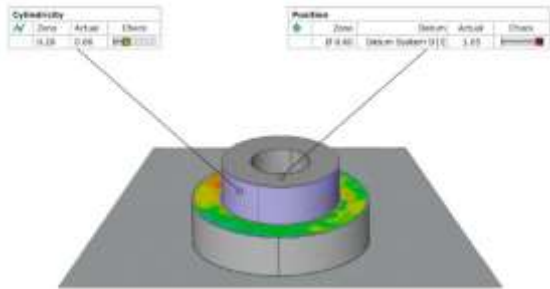
# Photorealistic Rendering





# Digital integration of quality processes

## Process steps integrated into ZEISS Quality Suite



### CAD/CAE Software

- Geometry
- Measuring plan/PMI
- Keywords / data formats



### ZEISS Quality Suite and ScanBox

Operate all aspects of the system in one Software interface

- All common import formats
- Full parametric inspection, also on GD&T
- Implemented packages for applying customer standards
- Template based parametric scanning
- Trend analysis
- Different levels of reporting definable
- All common export formats (.csv, .xml, .stl)



### Statistical databases + viewer

(e.g. ZEISS PiWeb + Free GOM Inspect)

- Advanced statistics
- Access to full-field 3D-data

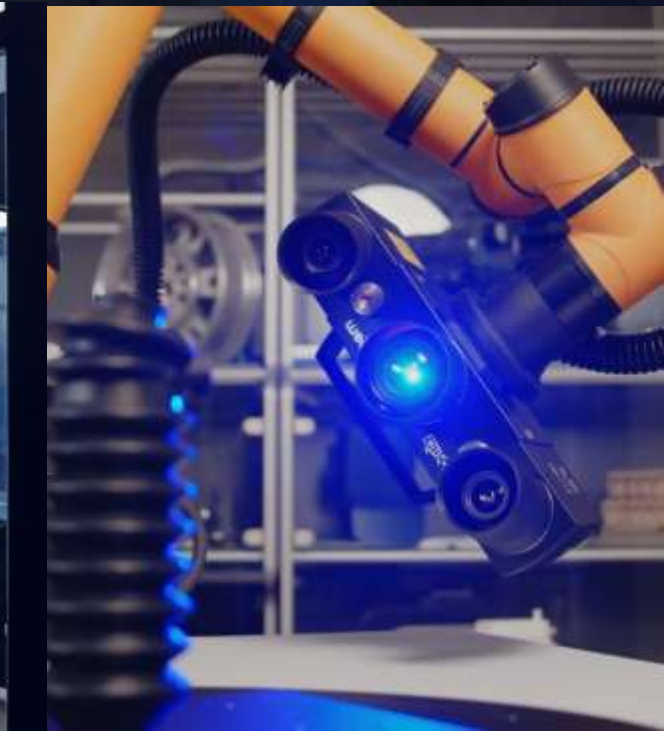
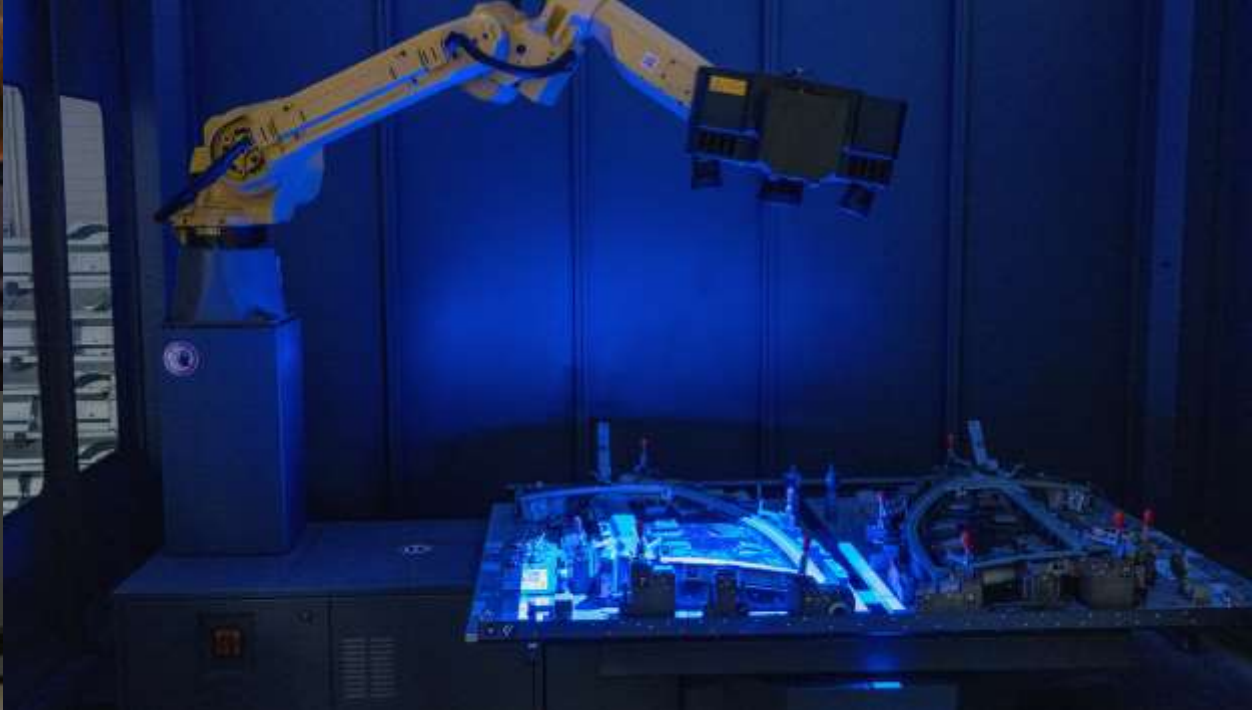
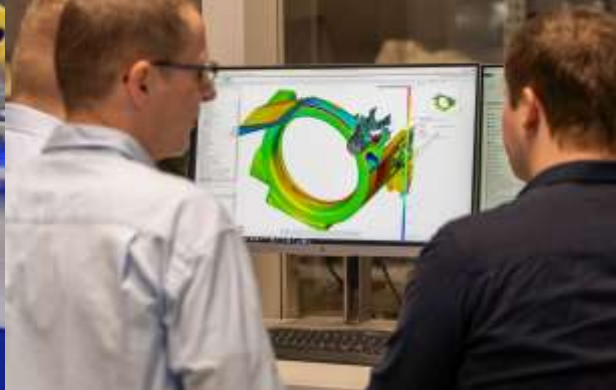
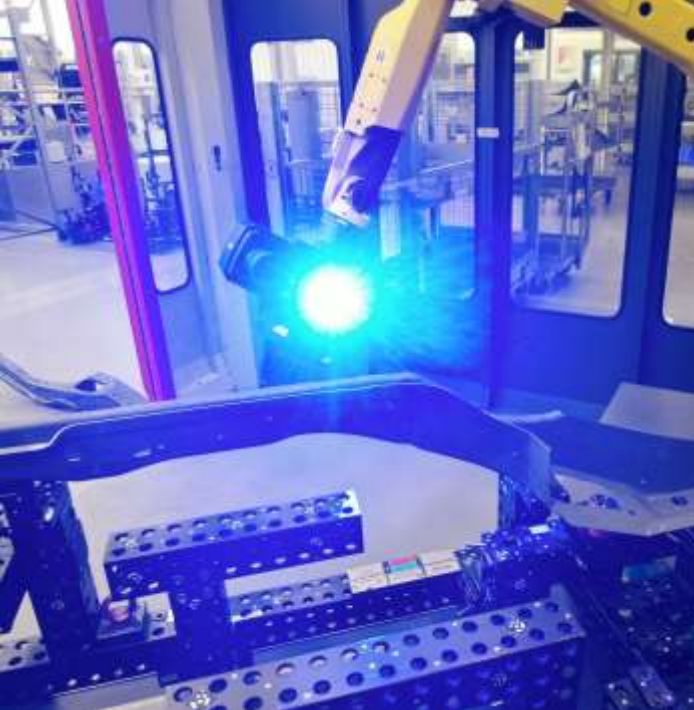
# ScanBox

The proven measuring machine to generate precise full-field 3D data



New release





# Q&A



Seeing beyond