Traceable placement of metal stringers through direct scanning

Project LuFo VI.3: GREATER WP 3.2

Alexander Schönberg	alexander.schoenberg@fft.de
Jan Phillip Schmidt	jan.philipp.schmidt@fft.de
Philipp Schwanemann (GREATER)	philipp.schwanemann@fft.de

3DMC 2025, Aachen

September 17, 2025

3DMC 3D METROLOGY CONFERENCE

one step ahead in **INTELLIGENT** production systems

FFT Produktionssysteme GmbH & Co.KG

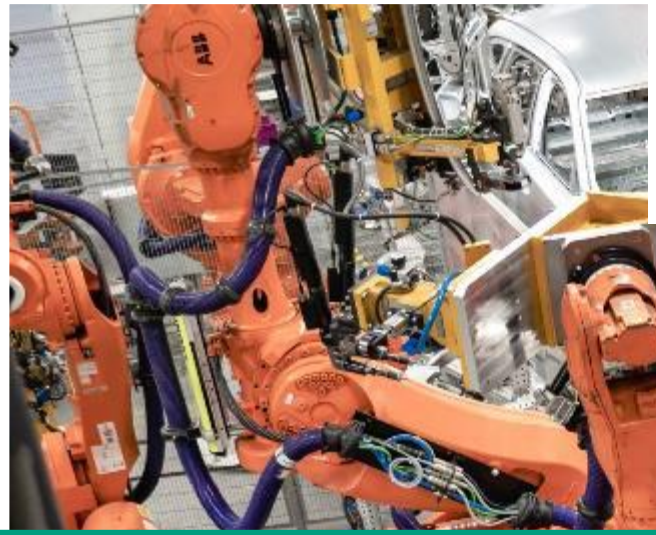
Traceable placement of metal stringers through direct scanning

1974
gegründet in Mücke

24
Standorte weltweit

710,6
Gesamtleistung in Mio € 2024

2808
Mitarbeiter in 2024

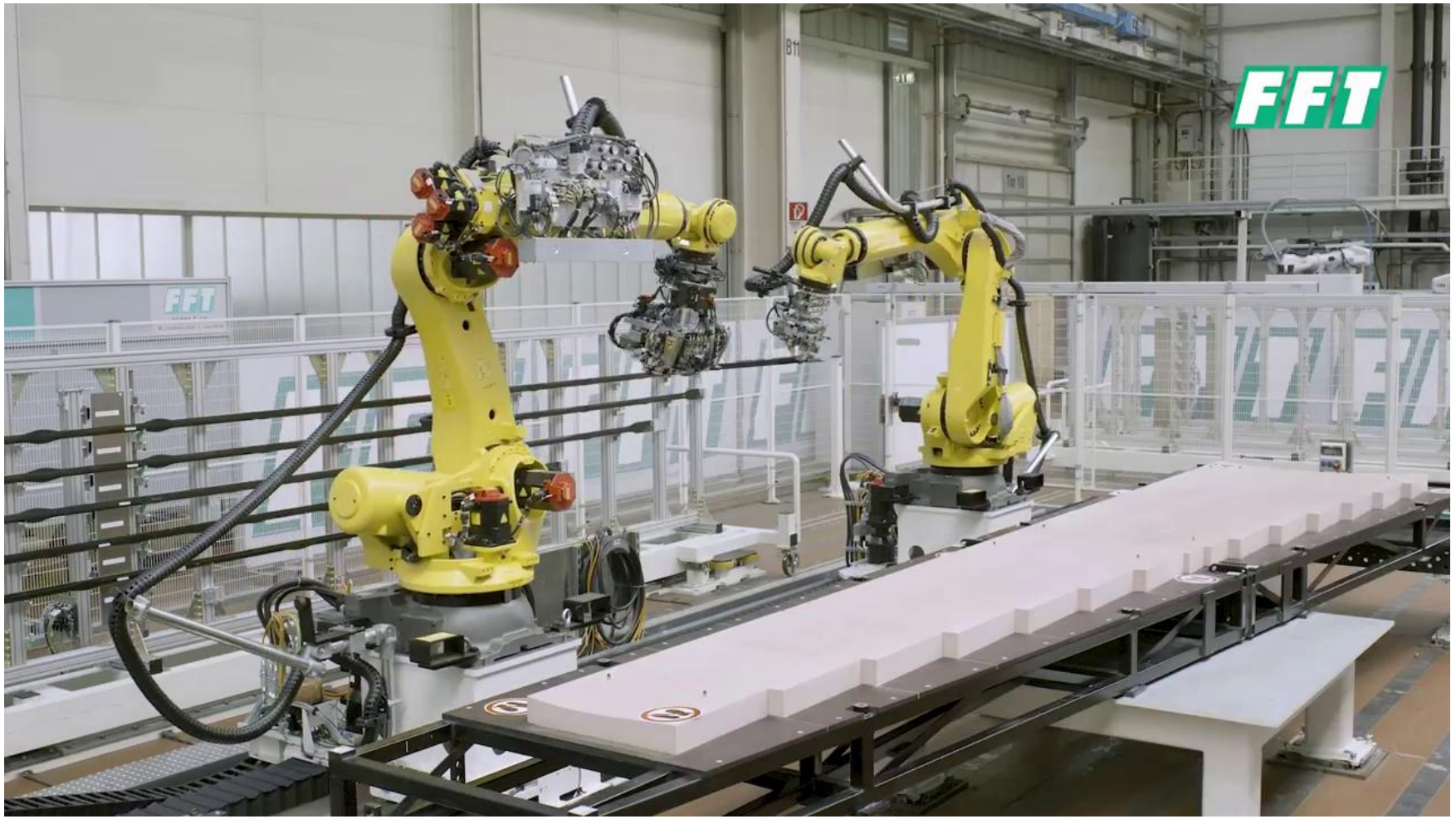


one step ahead in INTELLIGENT production systems

www.fft.de/en/

Metrology-assisted Placement of Stringers

Traceable placement of metal stringers through direct scanning



https://youtu.be/V1BuNR2KR2Y

Traceable placement of metal stringers through direct scanning

3DMC Aachen, 2025

1 **Placement of metal stringers**

LuFo VI.3: GREATER WP 3.2 Concept

2 Direct scanning

Measurement

3 Traceability

Results

LuFo VI.3: GREATER WP3.2

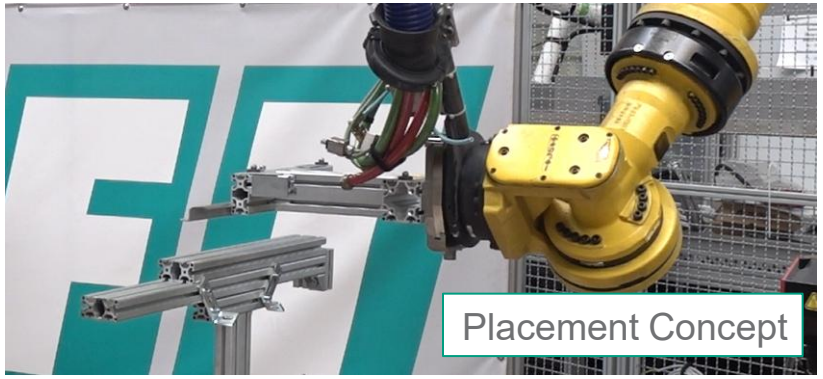
Placement of Metal Stringers

Gefördert durch:

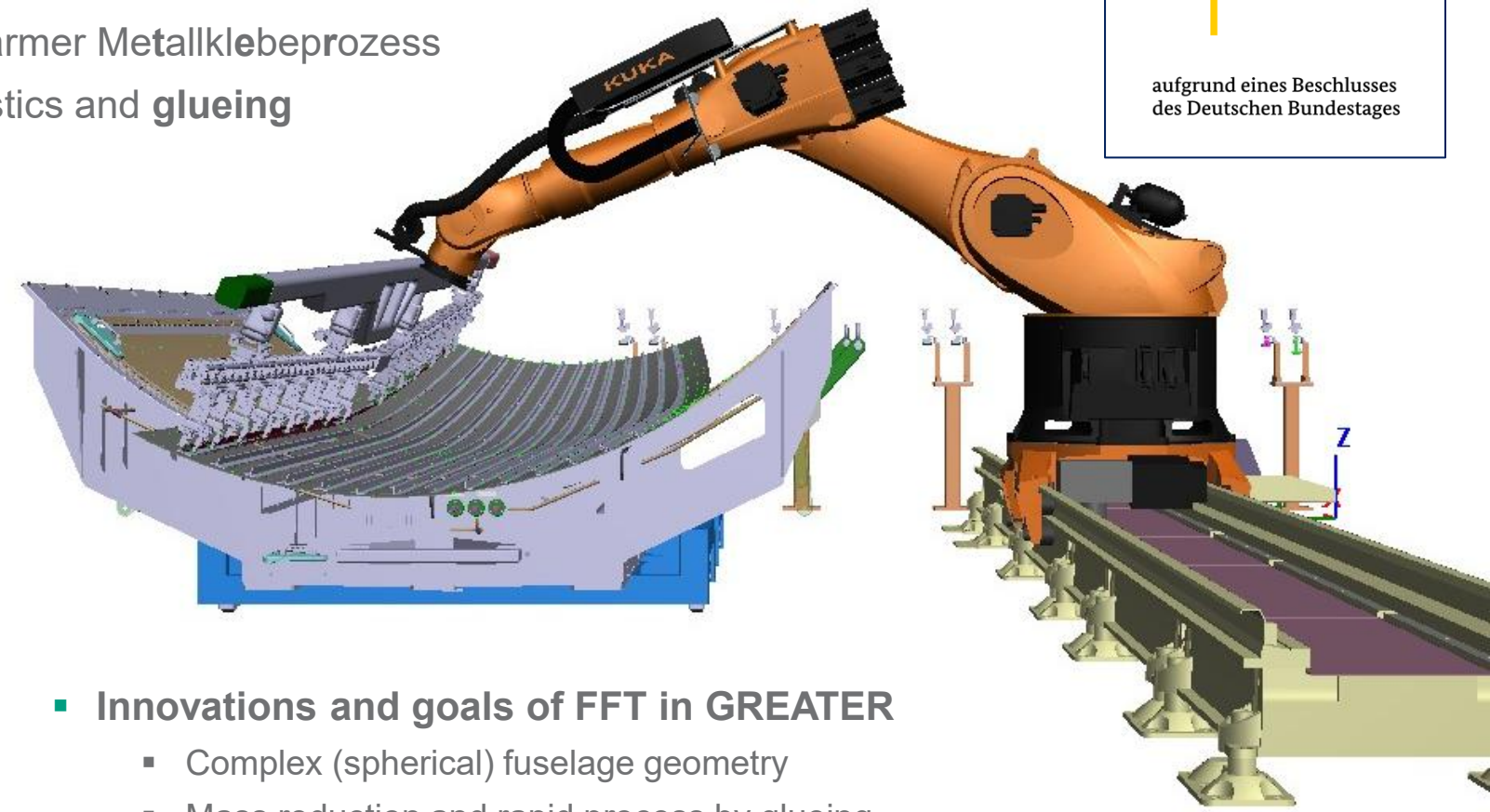
Bundesministerium für Wirtschaft und Klimaschutz

aufgrund eines Beschlusses des Deutschen Bundestages

- **Gr**üne **E**ntwicklung schl**a**nker emissionsarmer Me**t**allkl**e**bep**r**ozess
- **WP3.2: Innovation for** efficient intralogistics and **glueing**
  - 3.2.1 Definition of application
  - 3.2.2 **Innovative concepts** and solutions
  - 3.2.3 Proof of concept
- WP3.3: Validation and Integration
  - 3.3.1 Concept development
  - 3.3.2 Automation cell
  - 3.3.3 Spherical construction share



Placement Concept

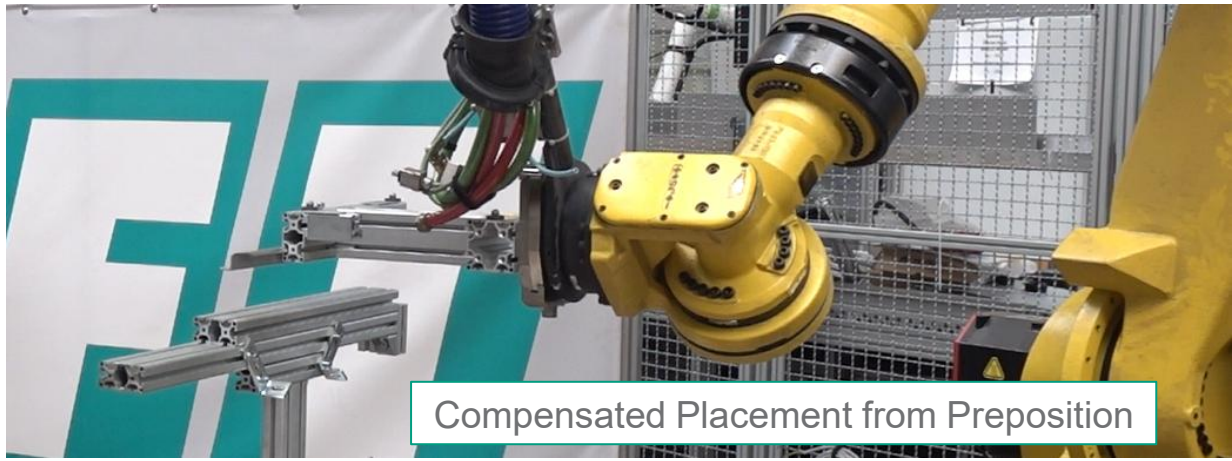


- **Innovations and goals of FFT in GREATER**
  - Complex (spherical) fuselage geometry
  - Mass reduction and rapid process by glueing
  - Digitizing of processes / data collection

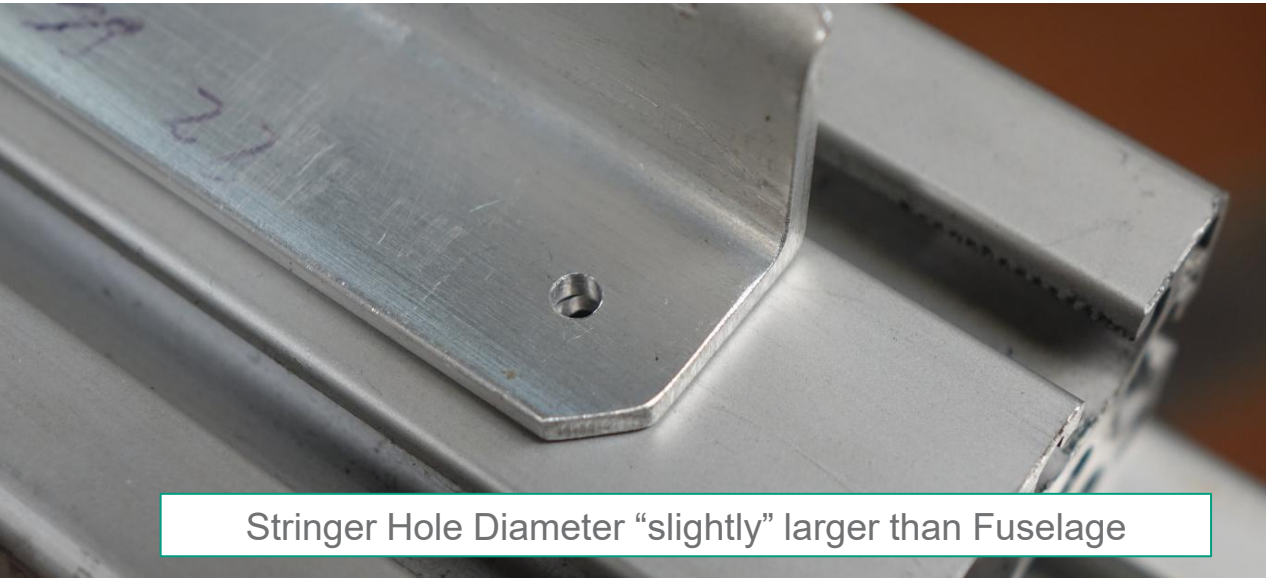
Placement Concept

Placement of Metal Stringers

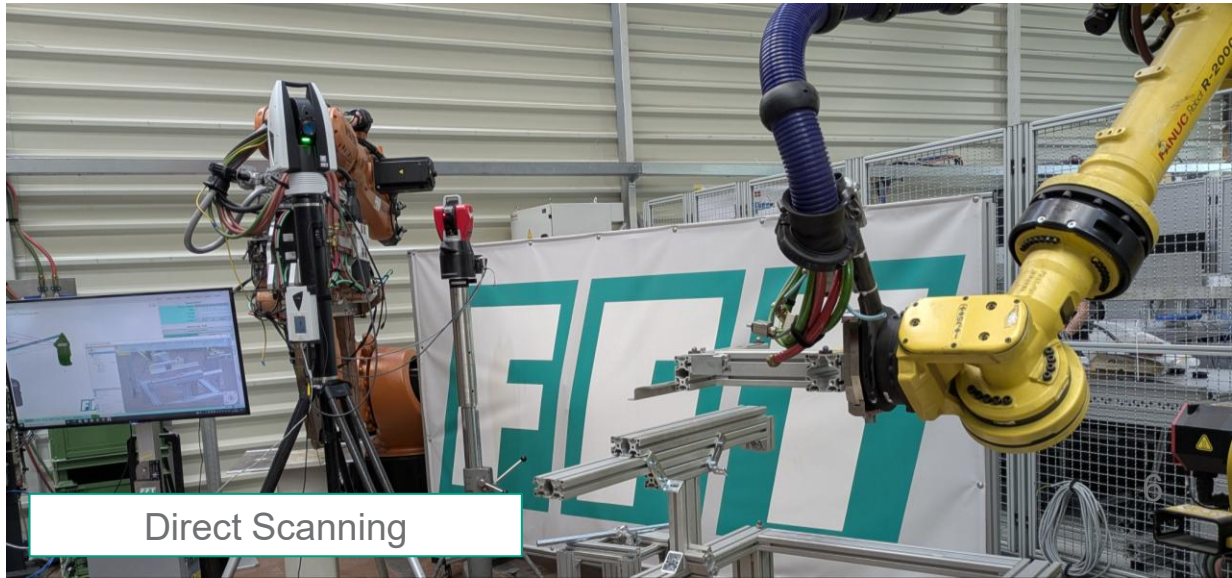
Cutout Metal Stringer on Preliminary Aluminium Profile



Compensated Placement from Preposition



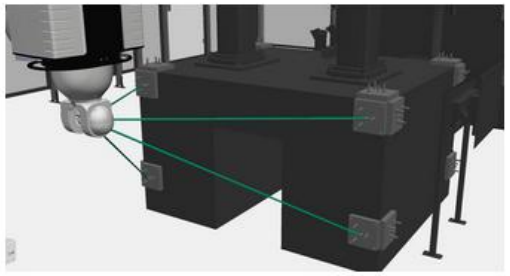
Stringer Hole Diameter “slightly” larger than Fuselage

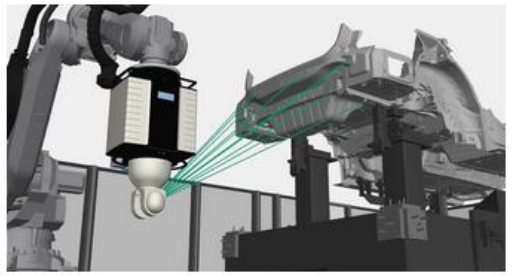


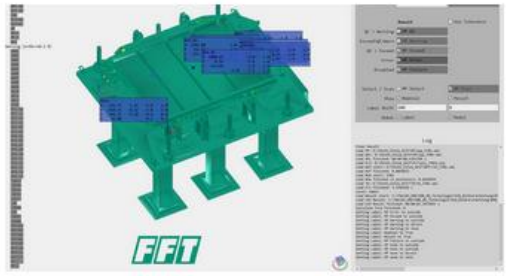
Direct Scanning

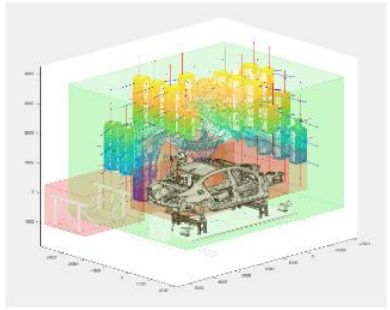
FFT VisionView

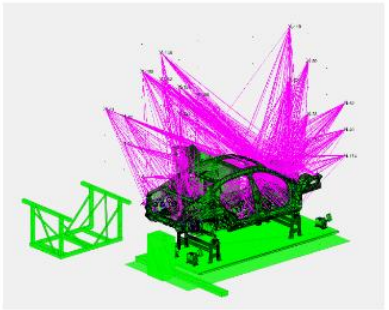
Placement of Metal Stringers

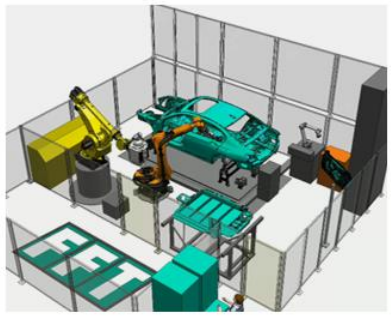












https://www.fft.de/produkte/visionview

Traceable placement of metal stringers through direct scanning

3DMC Aachen, 2025

1 Placement of metal stringers

LuFo VI.3: GREATER WP 3.2

2 **Direct scanning**

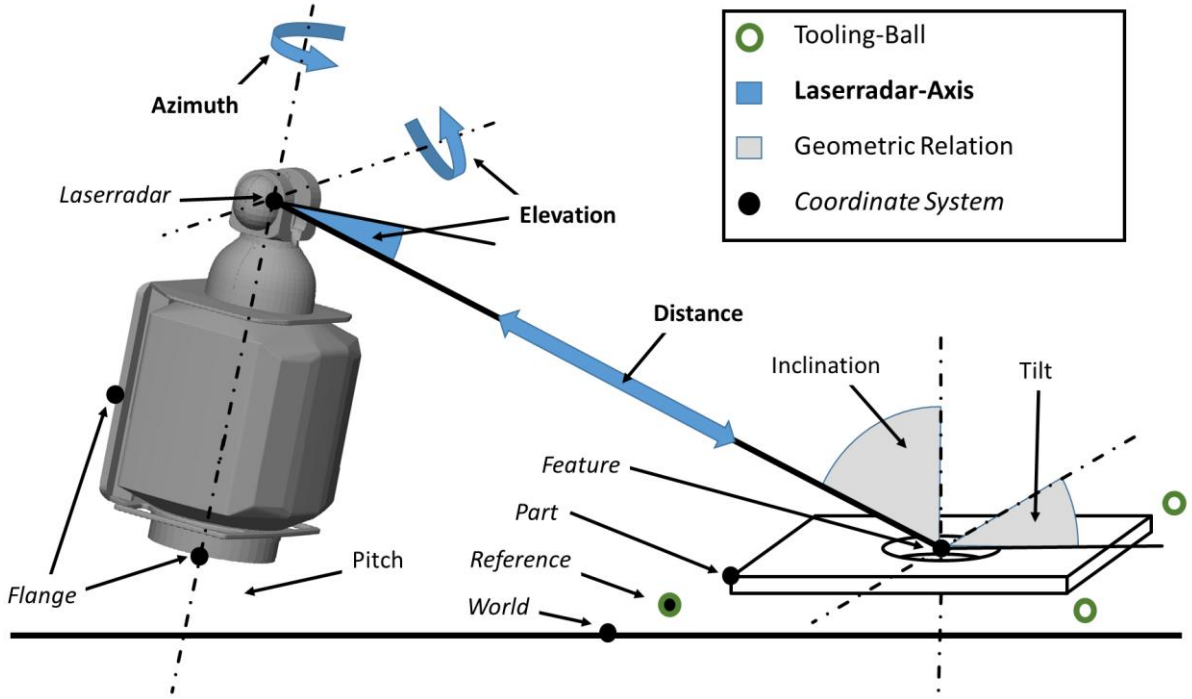
Measurement

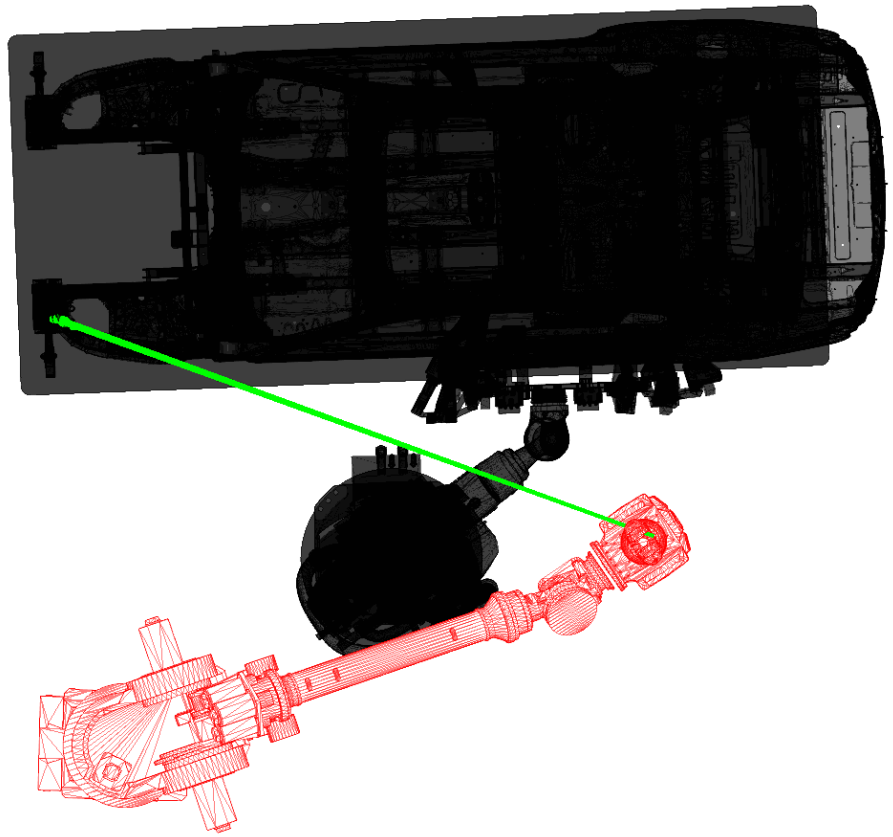
3 Traceability

Results

Measurement Principle

Direct scanning





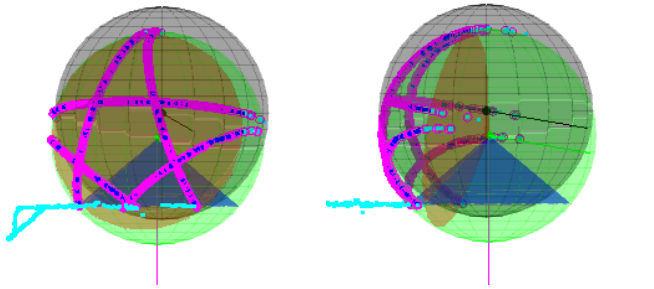
- Nikon MV331HS in G12-Demo cell

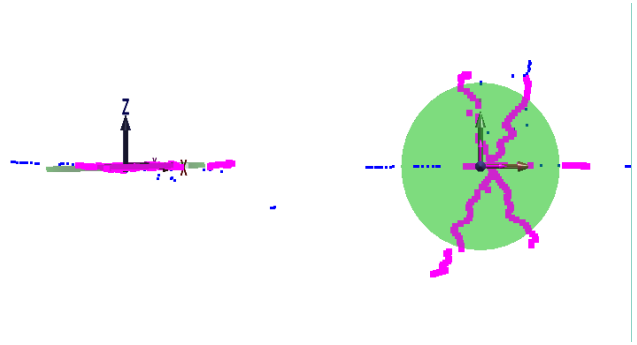
https://www.3dmc.events/modules/static/archive/media/vid/2022/talk_s6_t2.mp4
https://www.3dmc.events/modules/static/archive/media/vid/2020/schoenberg.mp4

Nikon APDIS MV430E Laser Radar

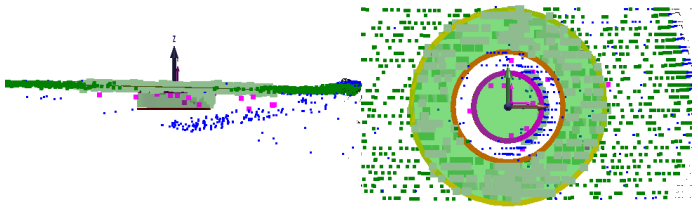
Direct scanning

- Referencing
  - Nest verification with reflector supported
  - Matte sphere 0.5“ 862 inliers / 1466 points ~1.4 s
- Features
  - Hardware surface points typical ~0.4 s
  - Surface point 175 inliers / 252 points ~0.5 s
  - Small hole 655 inliers / 3296 points ~2.2 s





Scan Rate	4.000 Pt/s
Weight	39 kg
Max. Distance	30 / 50 m
3D Accuracy (2σ)	20 µm + 13,6 µm/m
Strength	Fast surface inspection

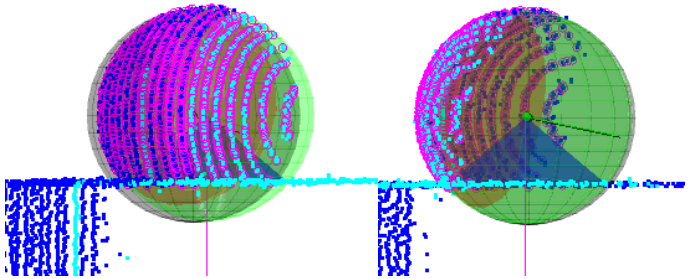


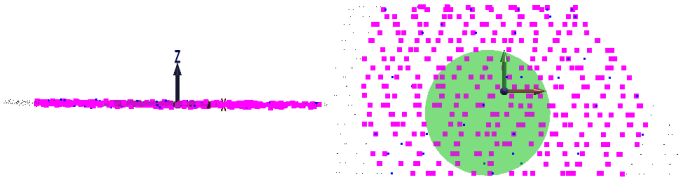
https://industry.nikon.com/en-aom/products/laser-radar/apdis-mv4x0/

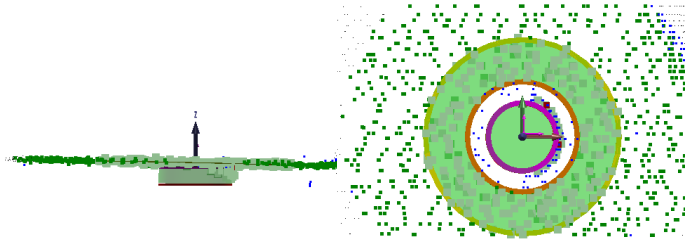
API Dynamic 9D LADAR

Direct scanning

- Referencing
  - Nest verification with reflector supported
  - Matte sphere 0.5“ 1164 inliers / 12416 points ~1.8 s
- Features
  - Batch surface points typical ~1.1 s
  - Surface point 397 inliers / 10563 points ~1.5 s
  - Small hole 302 inliers / 18331 points ~2.2 s







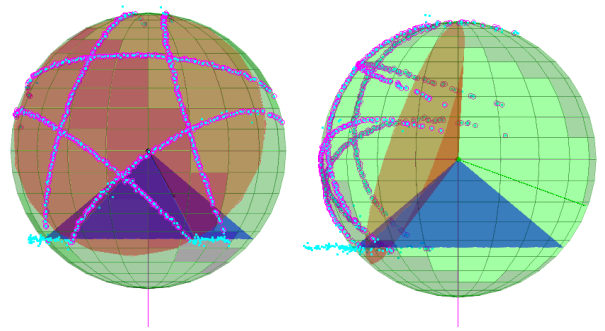
Scan Rate	20.000 Pt/s
Weight	10 kg
Max. Distance	8 / 15 / 25 m
3D Accuracy (2σ)	25 µm + 6 µm/m
Strength	High-sample rate

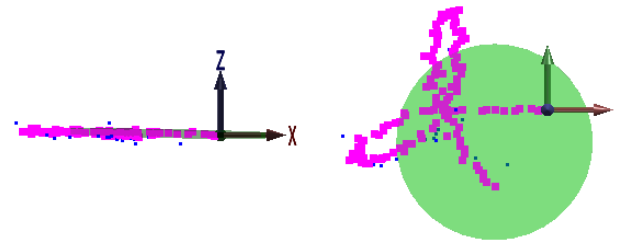
https://apimetrology.com/ladar/

Leica Absolute Tracker ATS800

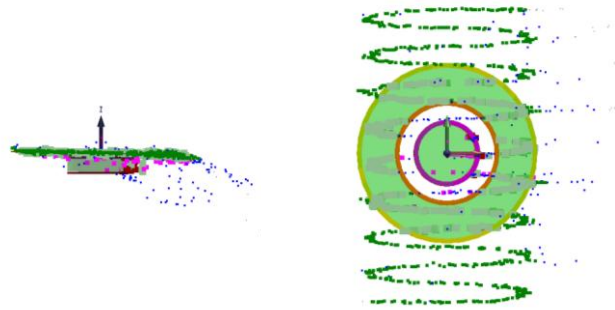
Direct scanning

- Referencing
  - Reflector tracking with PowerLock possible
  - Matte sphere 0.5“ 694 inliers / 4291 points ~2.5 s
- Features (non-optimized, available only 3 days for testing)
  - Batch surface planned
  - Surface point 129 inliers / 138 points ~1.7 s
  - Small hole 334 inliers / 1274 points ~6.0 s





Scan Rate	2.000 Pt/s
Weight	14 kg
Max. Distance	40 m
3D Accuracy (2σ)	15 µm + 6 µm/m
Strength	Reflector tracking



https://hexagon.com/products/leica-absolute-tracker-ats800

Traceable placement of metal stringers through direct scanning

3DMC Aachen, 2025

1 Placement of metal stringers

LuFo VI.3: GREATER WP 3.2

2 Direct scanning

Measurement

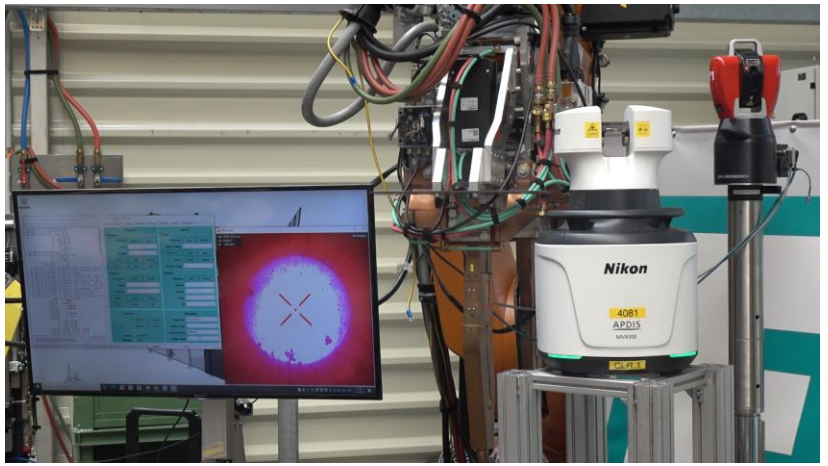
3 **Traceability**

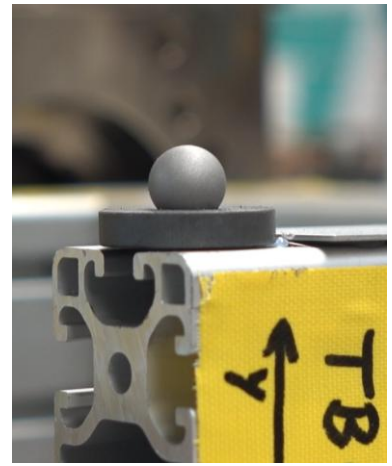
Results

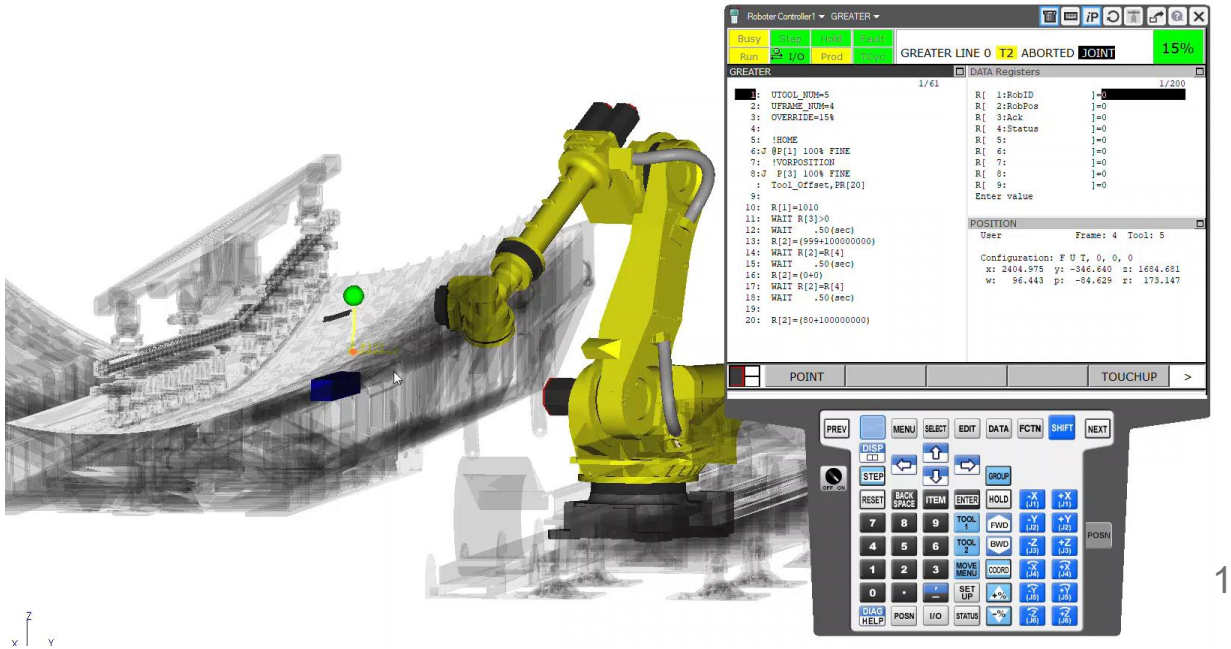
Placement Process

Direct scanning

- Pre-position at Z+80 mm
  - Reference stringer and fuselage
  - Calculate Tool_Offset to Z+10 mm
  - Save LPOS and apply Tool_Offset
- Re-measure at Z+10 mm
- Apply final Tool_Offset
  - A) Position Hole-to-Hole
  - B) Position gixed gripper + PLC-signal
- Check glueing conditions
  - Position / pins
  - Force
  - Heating







Questions and what's next?

Traceable placement of metal stringers through direct scanning

- **Traceable**
  - How to measure stringers correctly?
  - Will it be reliable in production setting?
- **Placement** of metal stringers
  - How does the glueing process imply?
  - How do the stringers fit the fuselage?
- through **Direct Scanning**
  - What are the shop-floor requirements?
  - **Systems qualification for aviation?**