

**NXT
GEN**
hightech

The future is automated

Smart Advanced Composites Manufacturing

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8 October 2025



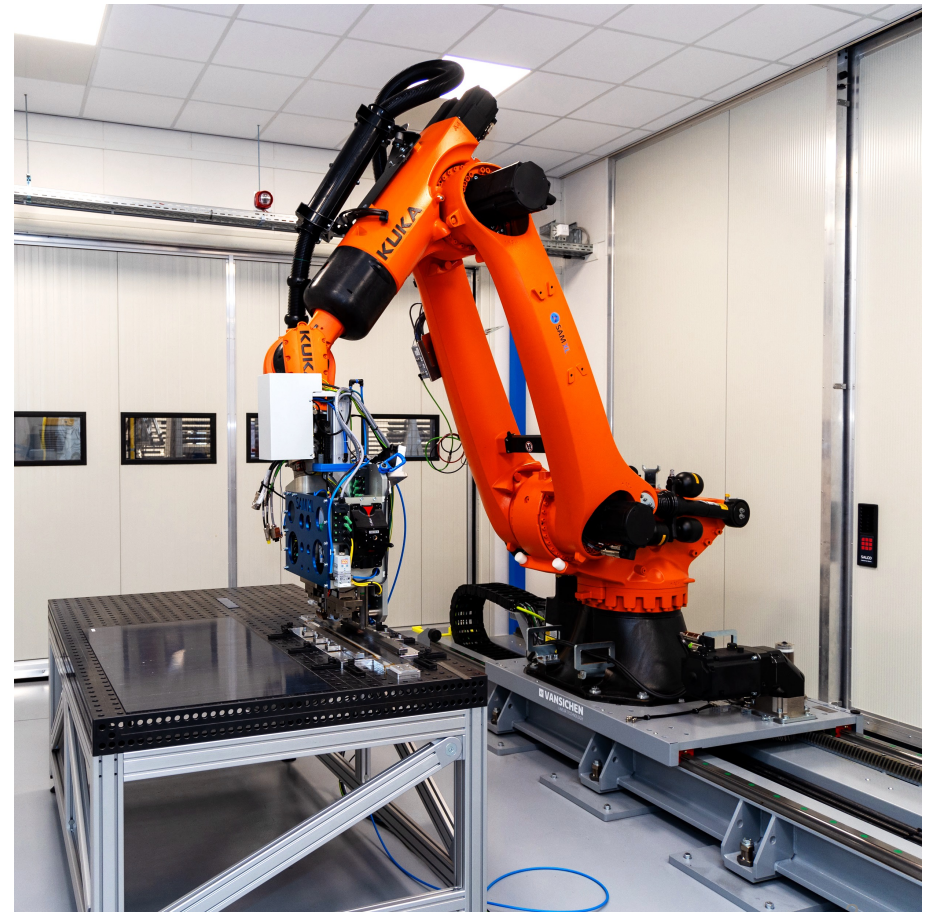
SAM XL - Smart Advanced Manufacturing XL

2 TUD robotic fieldlabs, Robohouse & SAM XL

SAM XL is a manufacturing automation development & expertise centre.

We bridge the gap between low TRL at the universities laboratory to higher TRL needed for industry.

By using industrial robots & AI



SAM XL - Smart Advanced Manufacturing XL



2,000 m² manufacturing automation Fieldlab

Collaborative (flexible) Space – Together with researchers (MBO-HBO-WO) and industry



Manufacturing
Process

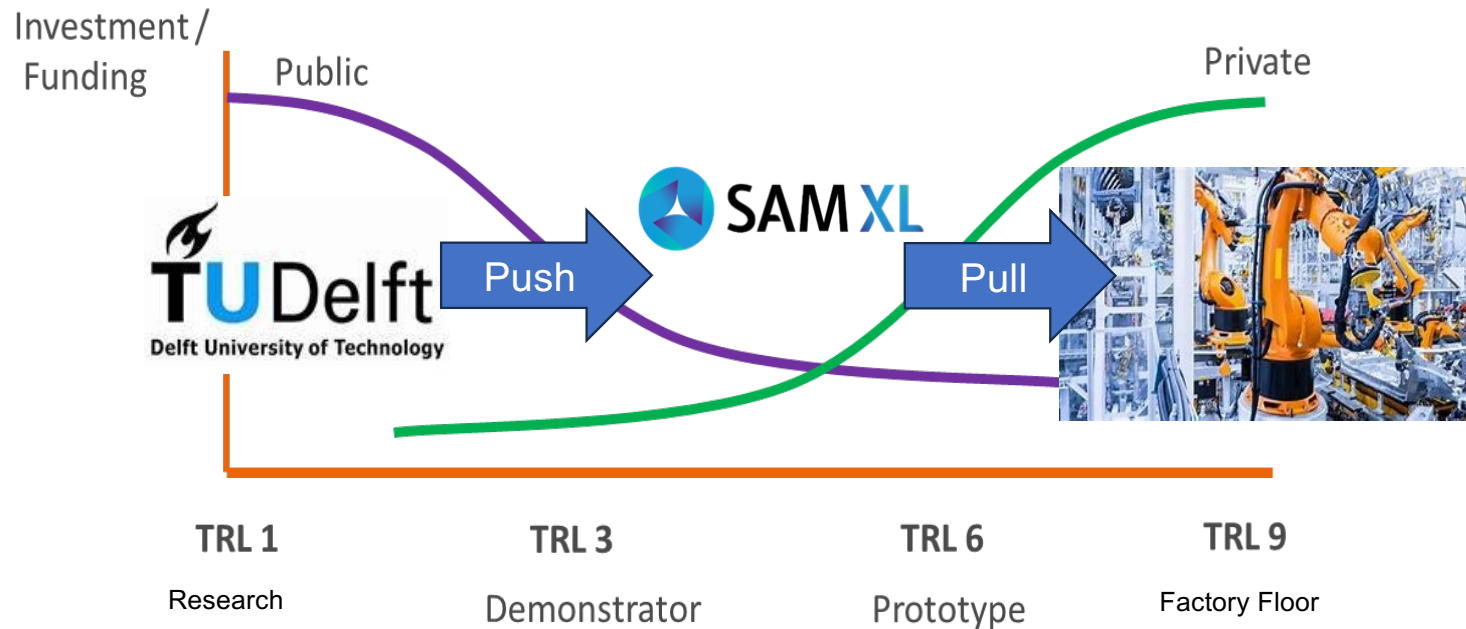
Mechatronics



Robotics
Software

Robotics
System

SAM XL : Mature Innovation towards Industry

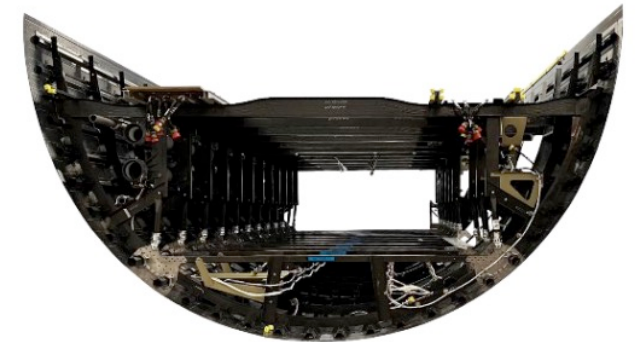
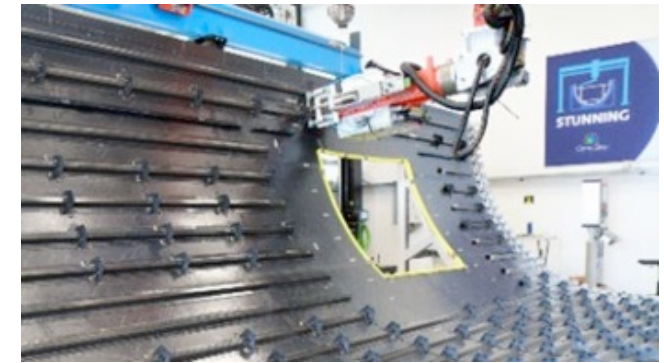


- Smart automation in manufacturing based on collaboration
- Knowledge **supply chain** in valley of death
- Funded by government + Industry + University
- Majority of projects: large government funded innovation programs eg. NXTGEN

Examples of Collaboration - STUNNING



Automated assembly of the lower half fuselage at SAM XL -
Show the aircraft industry that they **can** automate for faster
production.



Current composites manufacturing challenges



- Availability & cost of skilled (manual) labor
- Consistency, accuracy, traceability
- Scaling up to high rate manufacturing
- Not even touching the MRO field...

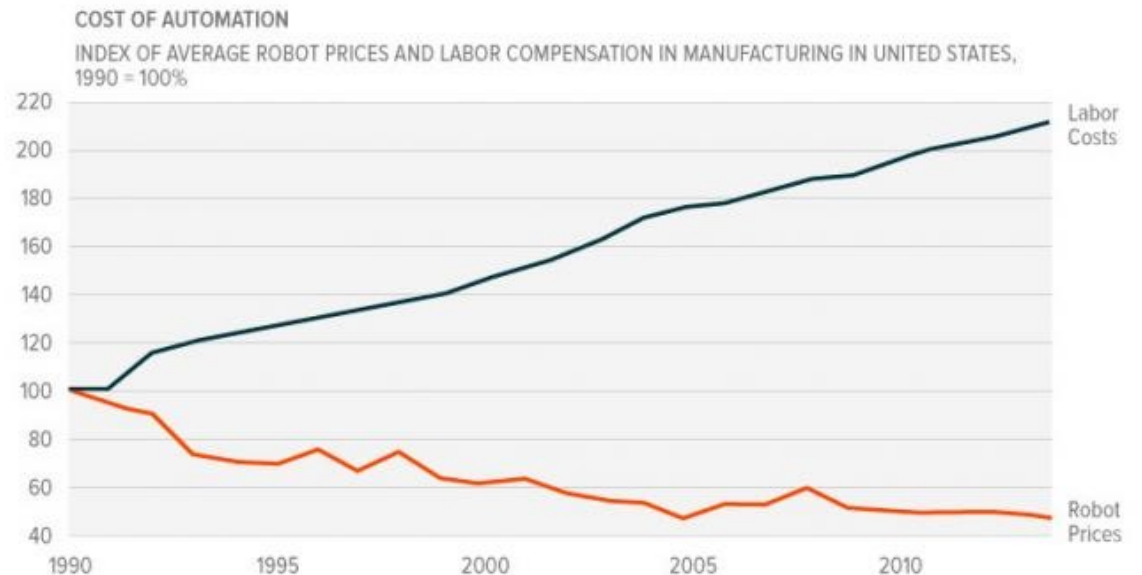
Current traditional automation approach

- Cost of manual labour 
- Cost of robotics hardware 

Traditional automation for
High volume – Low mix =

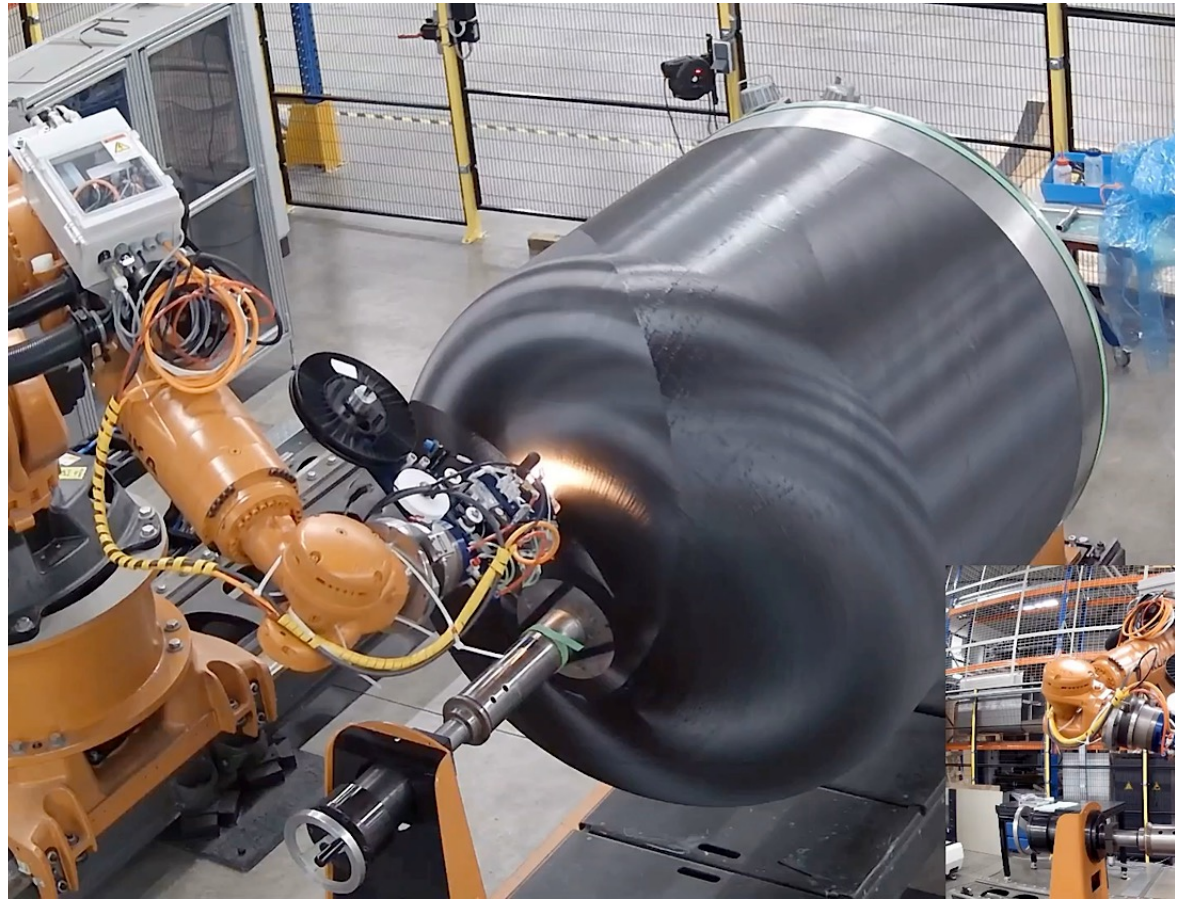
- Tooling -> REALITY = CAD
- Pick-n-Place motions
- Business case = positive

ROBOT PRICES VS. LABOR COSTS
Source: McKinsey&Co



Smart robotics needed in/for composites

- High mix, high spec, low volume
- Complex manufacturing process (Path & Motion Planning)
- Larger complex parts: Reality vs CAD
- High level of accuracy needed

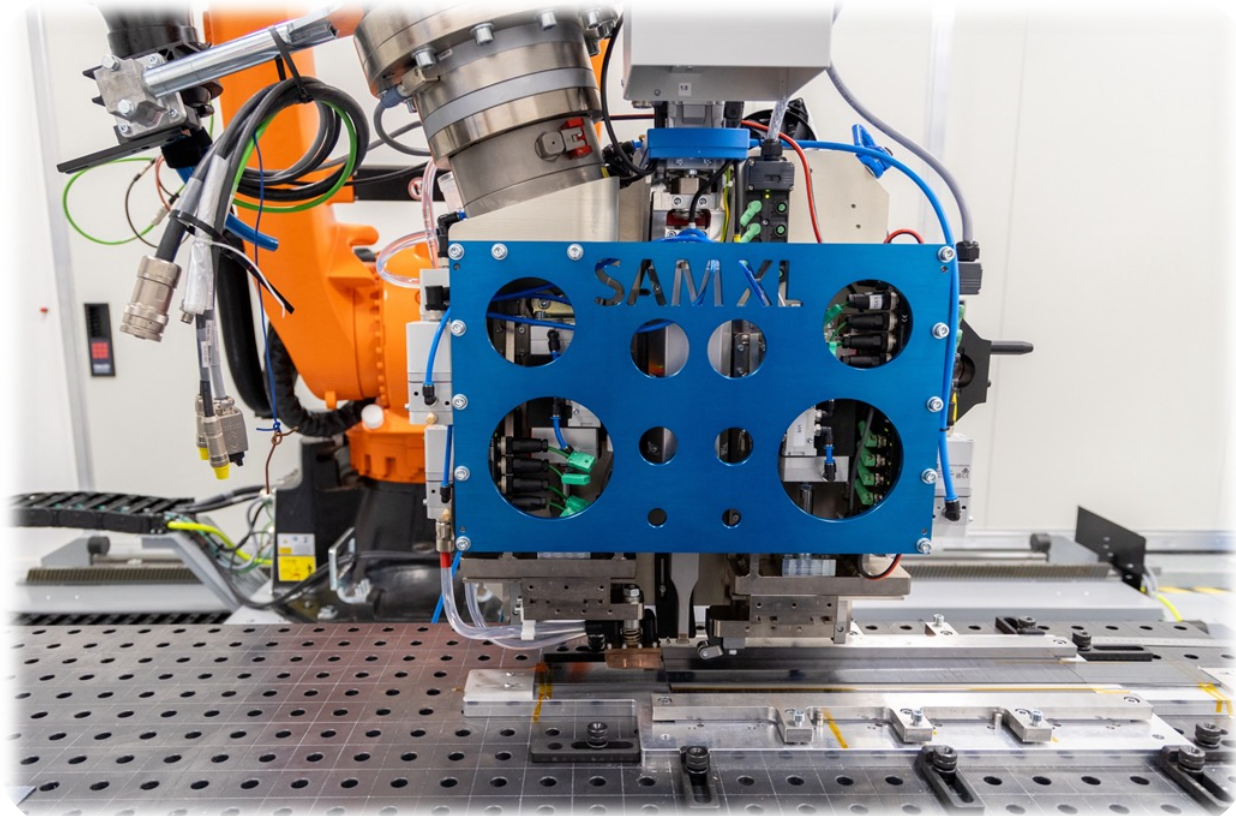


Smart Robotics in NXTGEN domain of Composites

We do;

- End effector design
- Motion planning
- Perception
- Mobile platforms

AI Integration at all levels



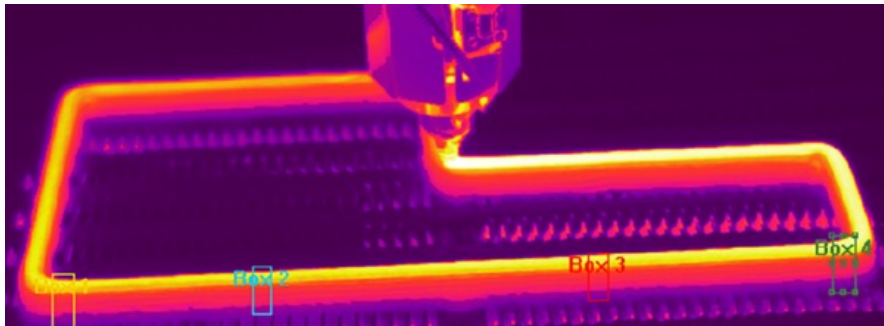
Example in NXTGEN:

- Mobile composites inspection
- NXTGEN Partners KLM & Suzlon
- Required: Scan - plan, navigate & accurate follow double curved surfaces with contact

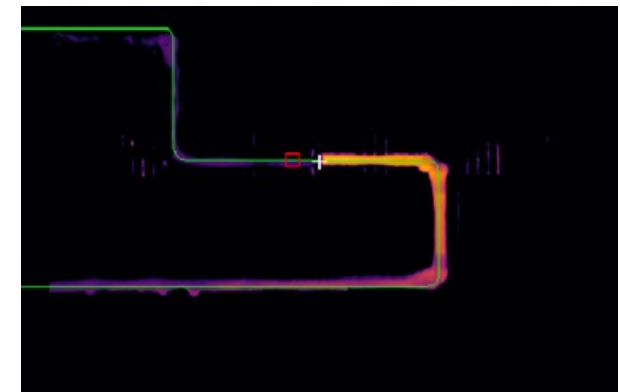
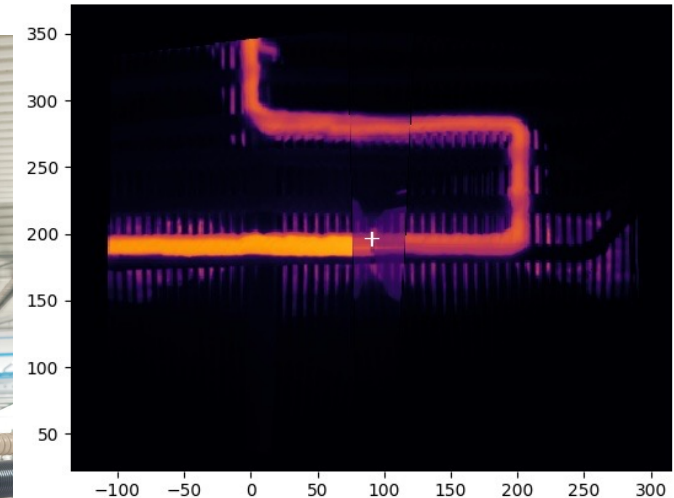


Example in NXTGEN:

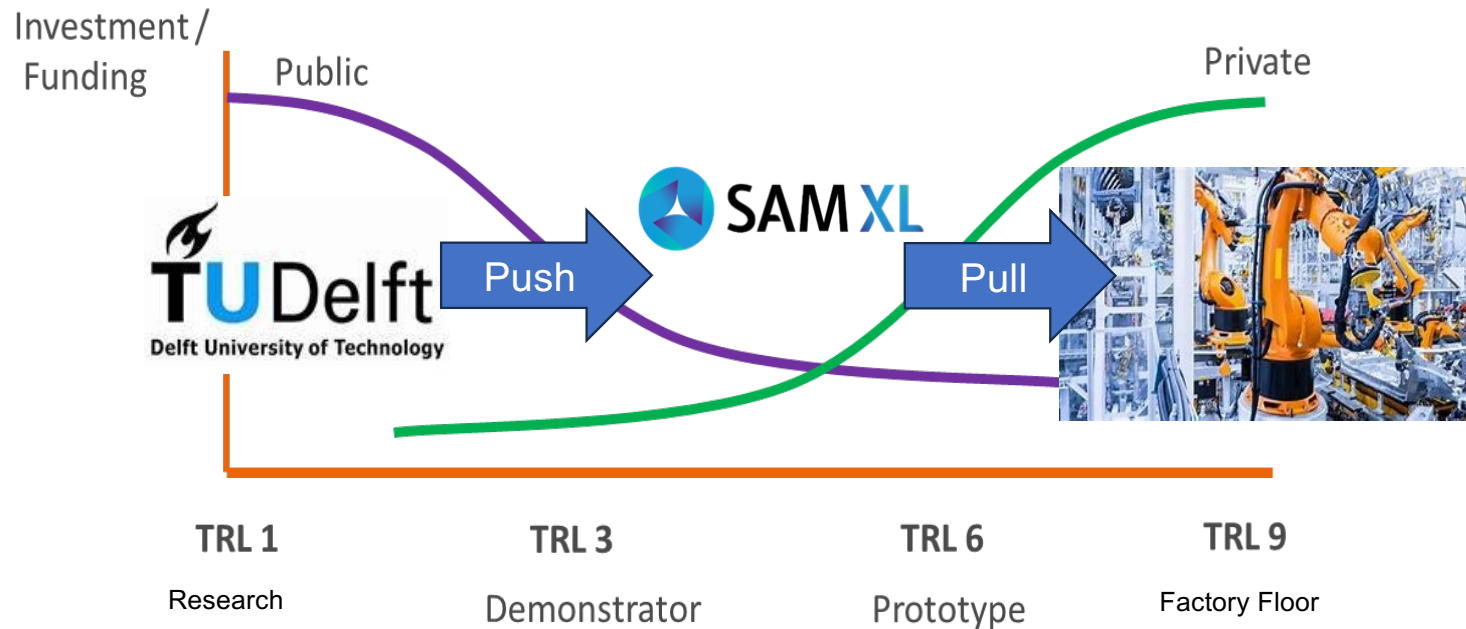
- Robotic large 3D composites printing
- NXTGEN partners CEAD (boat outside)
- Required: Inline temperature scanning of substrate to optimize robotic path/motion



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Industry need for new assembly methods

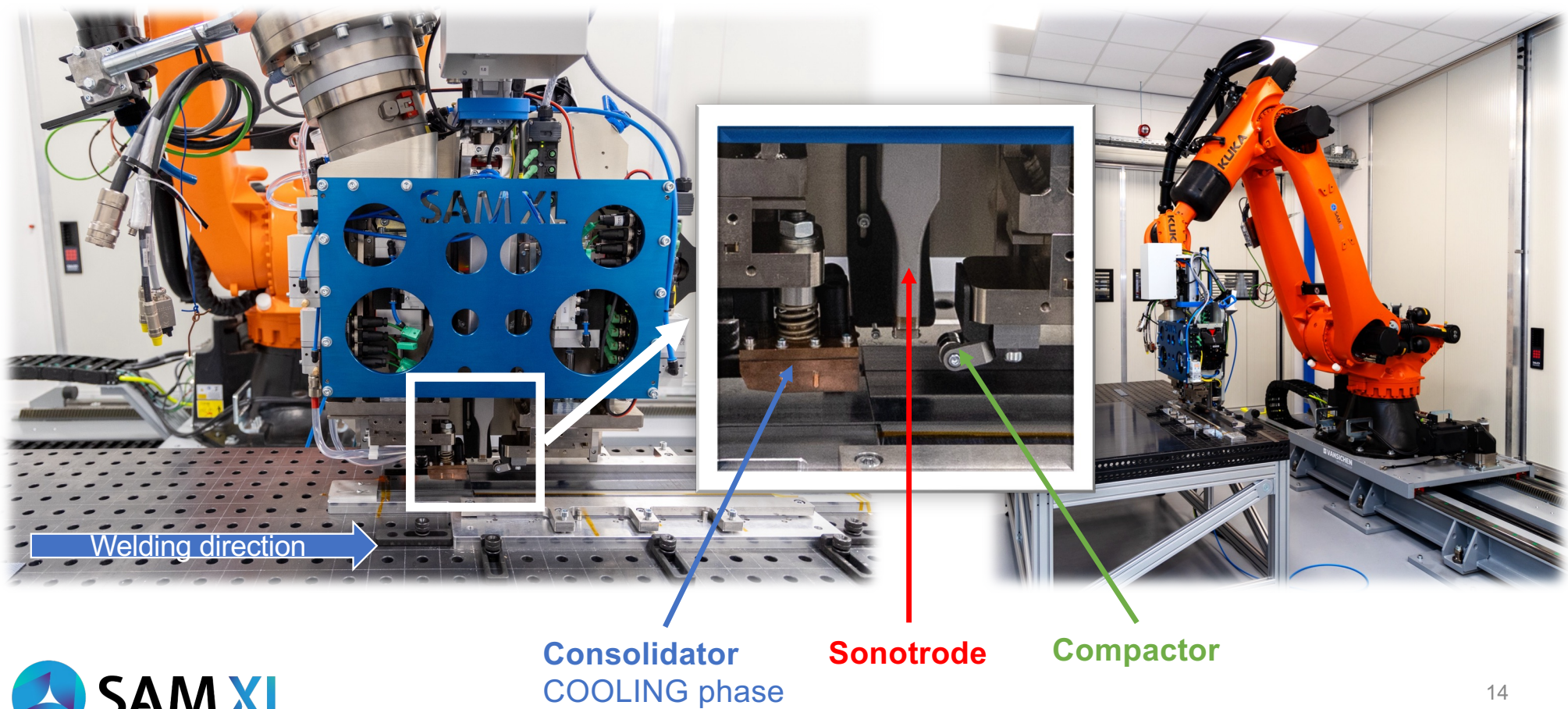
- Aircraft composite parts are often fastened
 - Mechanical fastening adds weight
 - Drilling holes for fasteners is problematic
- Faster production methods needed
 - Huge backlogs: Airbus (8700) and Boeing (6500)
- Thermoplastics composites
 - Re-processable (joining/forming/repairing)
 - Continuous Ultrasonic Welding is a fast joining method



Boeing 787 fuselage circumferential joint

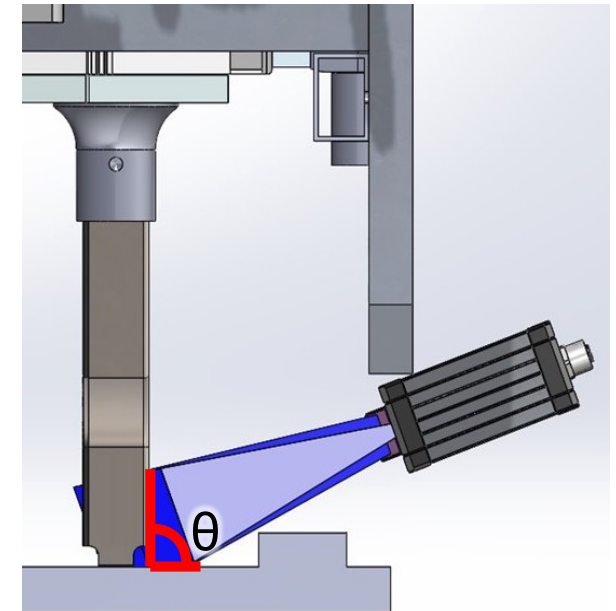
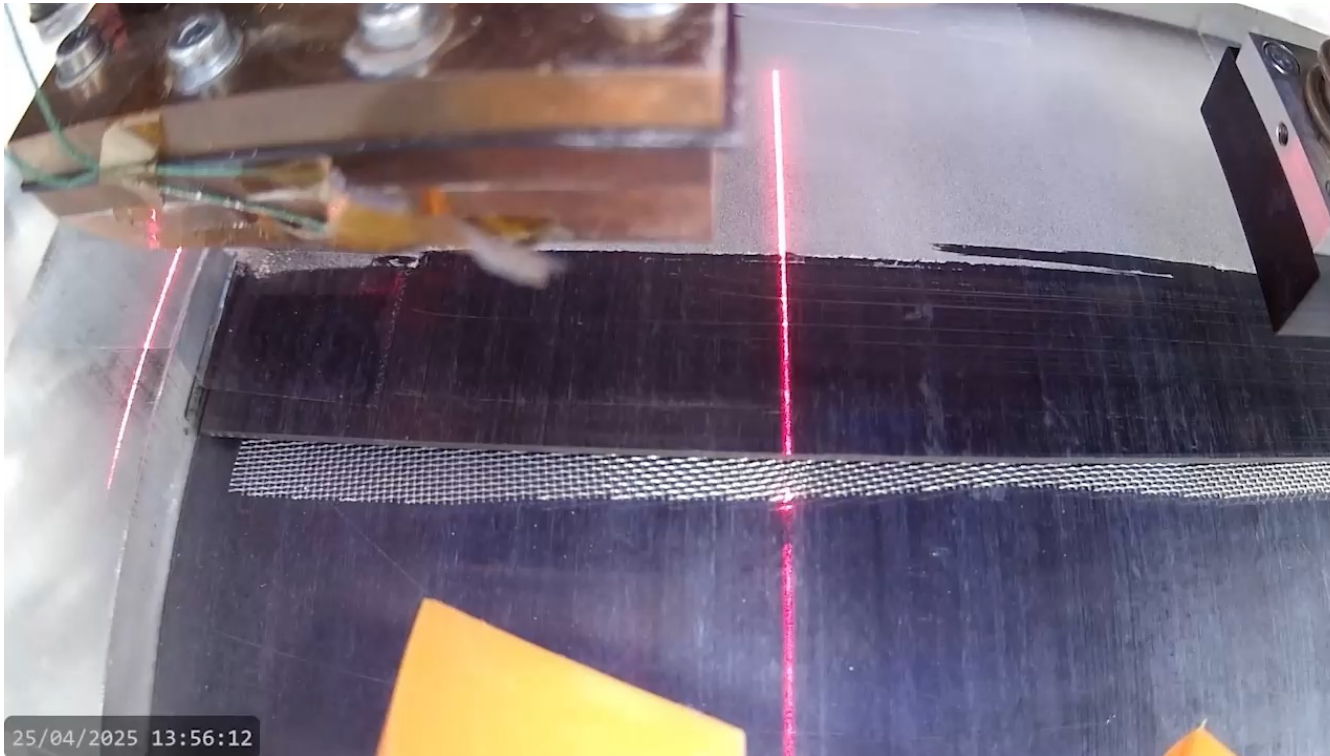
Inhouse development

Thermoplastic Composites Ultrasonic Welding



Thermoplastic Composites Welding

Challenge: Applied force leads to slippage & end effector rotation.
Need for Closed Loop Control



To wrap up

- SAM XL Fieldlab to Collaborate around robotics in manufacturing (Mid TRL) as an essential part(ner) of the ecosystem
- Developing building blocks & integration for smart robotics
- Transition of the composites manufacturing industry



Smart Advanced Manufacturing

“Robotics is essential for all the transitions Europe is facing”

“Bringing together fragmented initiatives into one powerful ecosystem”

Prof. David Abbink – TUD - Winner StevenPremie 2024

**Applies also to the EU Manufacturing industry transition
towards strategic autonomy**

