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Driving the digital enterprise with digital twins

Achieving the next frontier of speed, quality and agility

Dr. Pieter Dejonghe | November 21st 2018

“We are on the verge of transforming one of society’s most fundamental build blocks: manufacturing.”

Peter Diamandis, founder and chairman of the X Prize Foundation
Cofounder and executive chairman of Singularity University

Initiatives
We're all saying essentially the same thing

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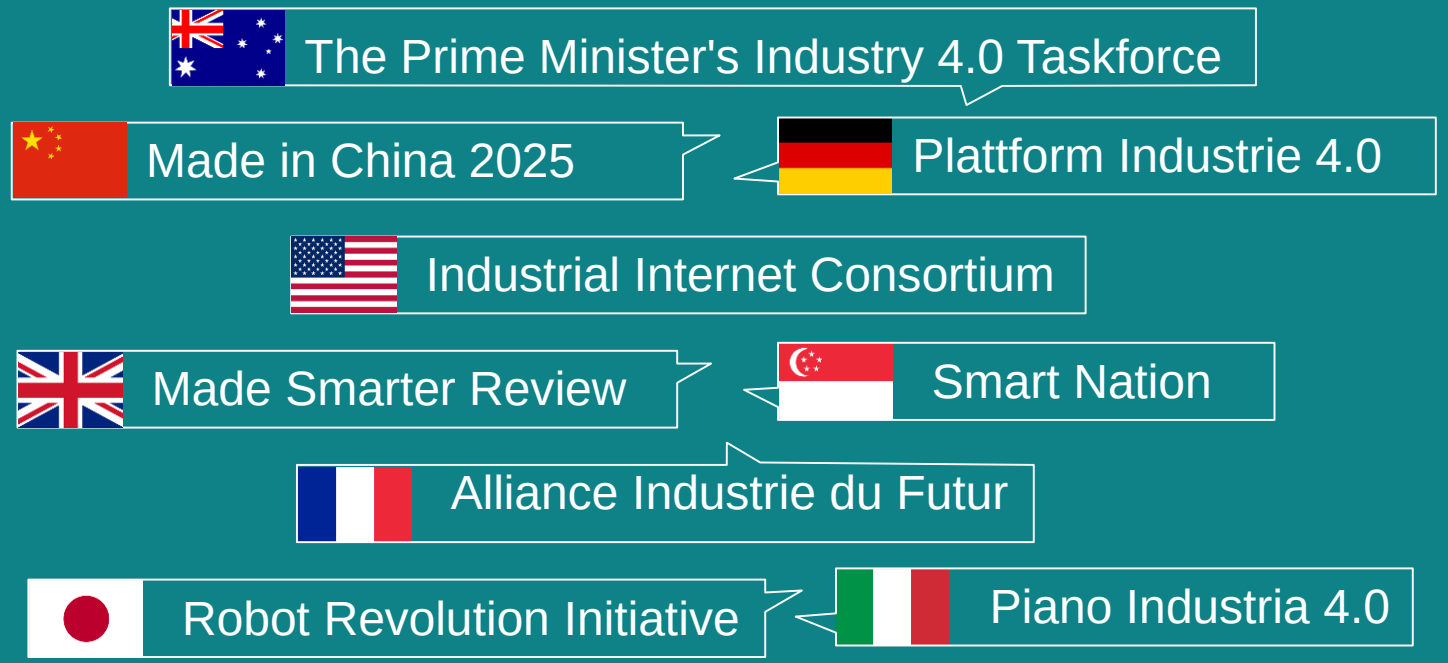

Manufacturing
The widening gap in digital productivity

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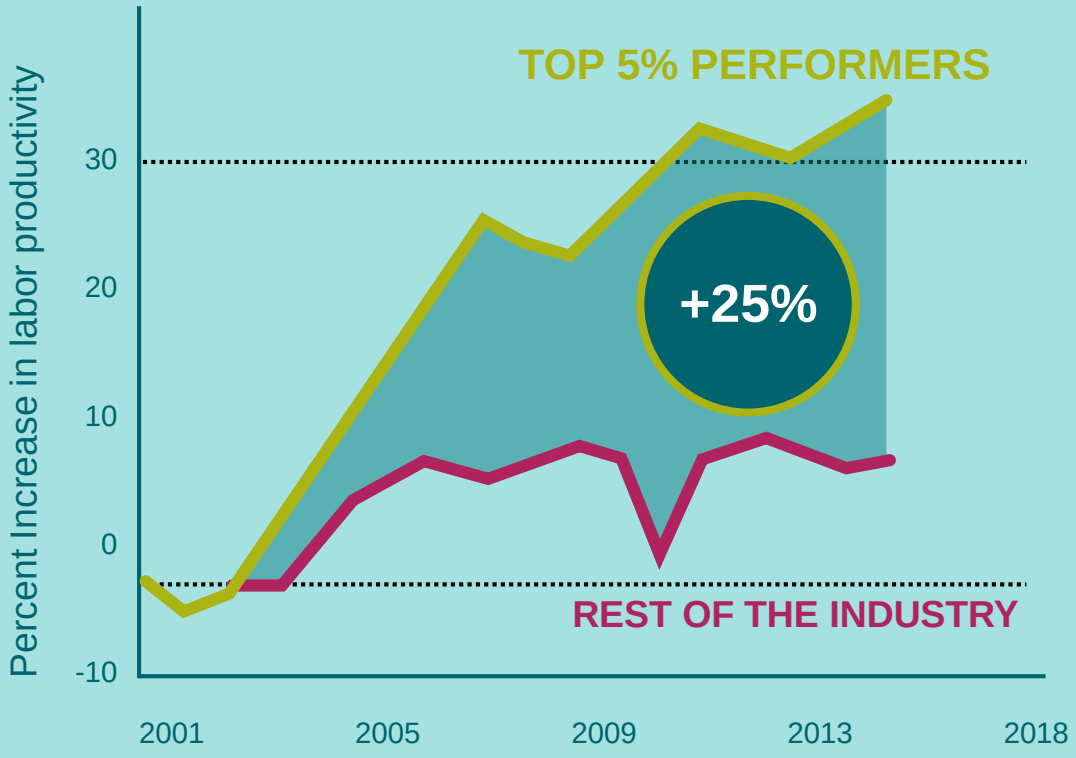

Data is from 24 OECD countries.

The top 5% of companies are dominating the economy by exploiting digital competencies.

The Best Versus the Rest: The Global Productivity Slowdown, Divergence Across Firms And The Role of Public Policy, OECD Productivity Working Papers

The Digital Factory transforms business models

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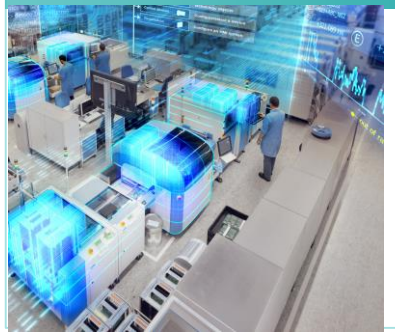
KUKA SYSTEMS do BRASIL

GREATER
competitiveness
and improved
margins

IMPROVED
CYCLE-TIME
PRODUCTIVITY

98%
READINESS DONE
VIRTUALLY

SIEMENS AMBERG



FLEXIBLE
production
>1200 product variants
configured-to-order and
shipped within 24 hours

1 PART
PRODUCED
EVERY SECOND

QUALITY
LESS THAN
11 DPM (99.9989%)

FIREWIRE

IMPROVED
SUSTAINABILITY

FASTER
PRODUCTION

INDIVIDUAL
-IZED
product
performance

UNITI

DATA-
DRIVEN
continuous
improvement

REDUCED
RISK

FASTER
TIME-TO-MARKET

Digitalize manufacturing. Democratize innovation.

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Achieving the next frontier with configurable, flexible and personalized production.

The barriers to next frontier manufacturing

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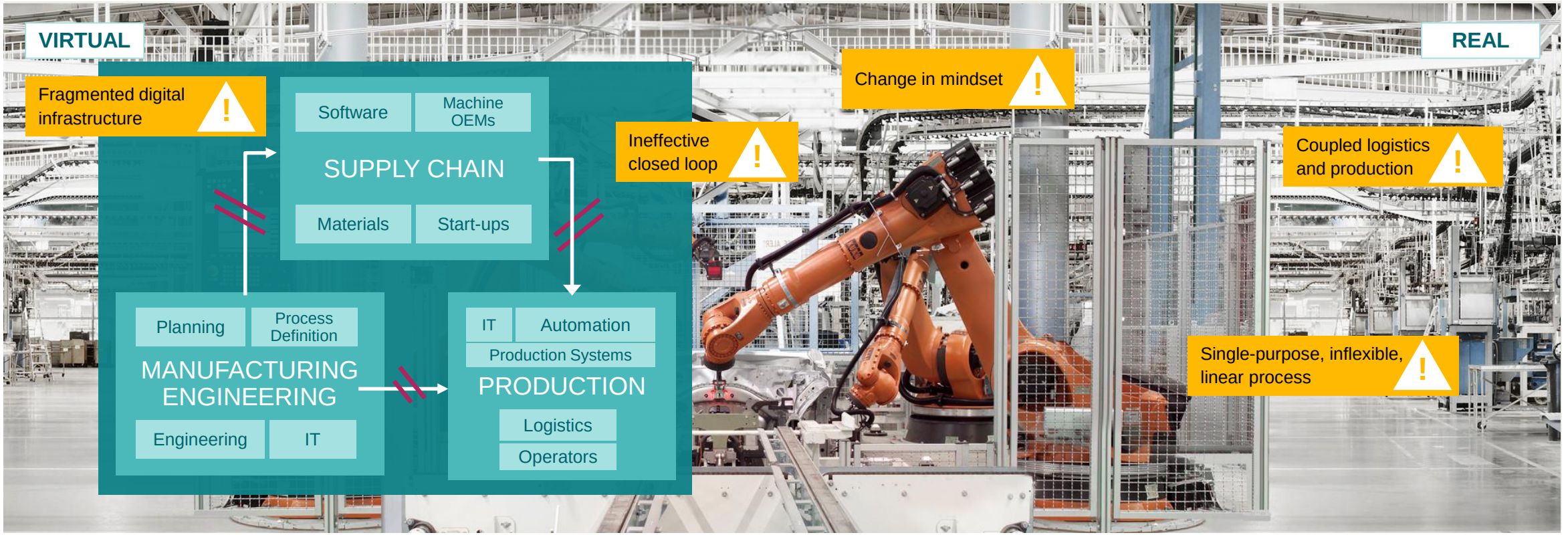
Customer Desire → Design and Engineering → Manufacturing Engineering → Production → Service



What if….

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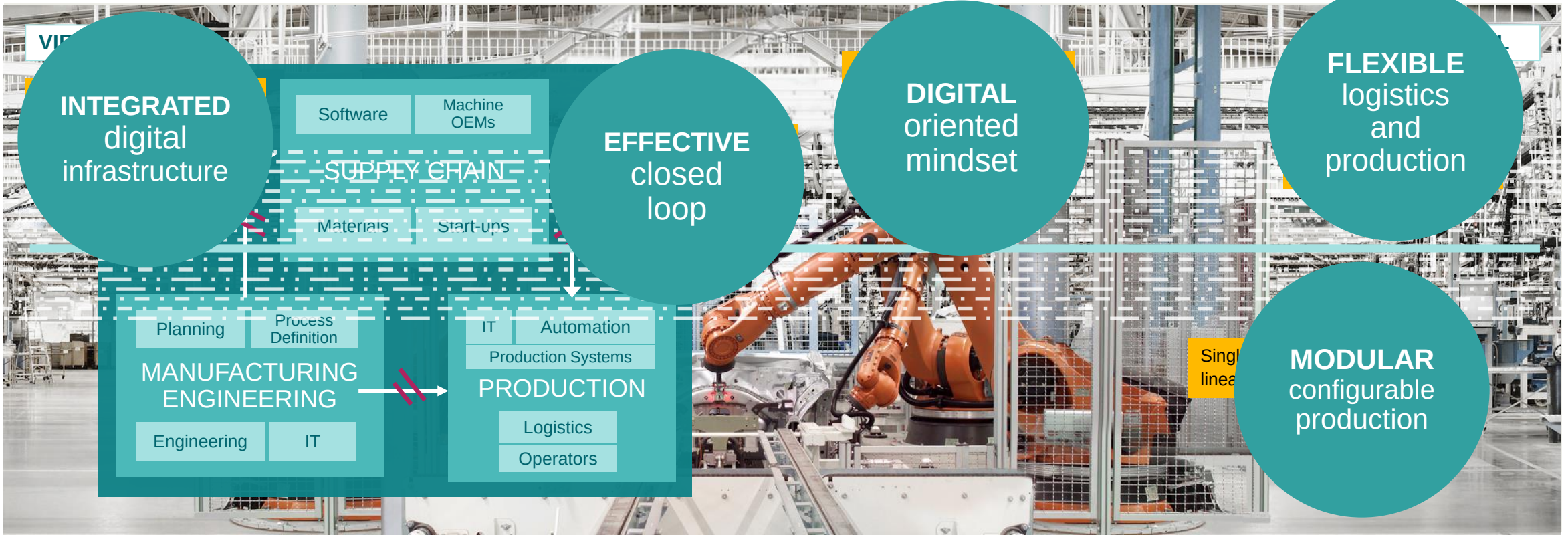
Customer Desire ⟷ Design and Engineering ⟷ Manufacturing Engineering ⟷ Production ⟷ Service



Realize the full value of digitalization

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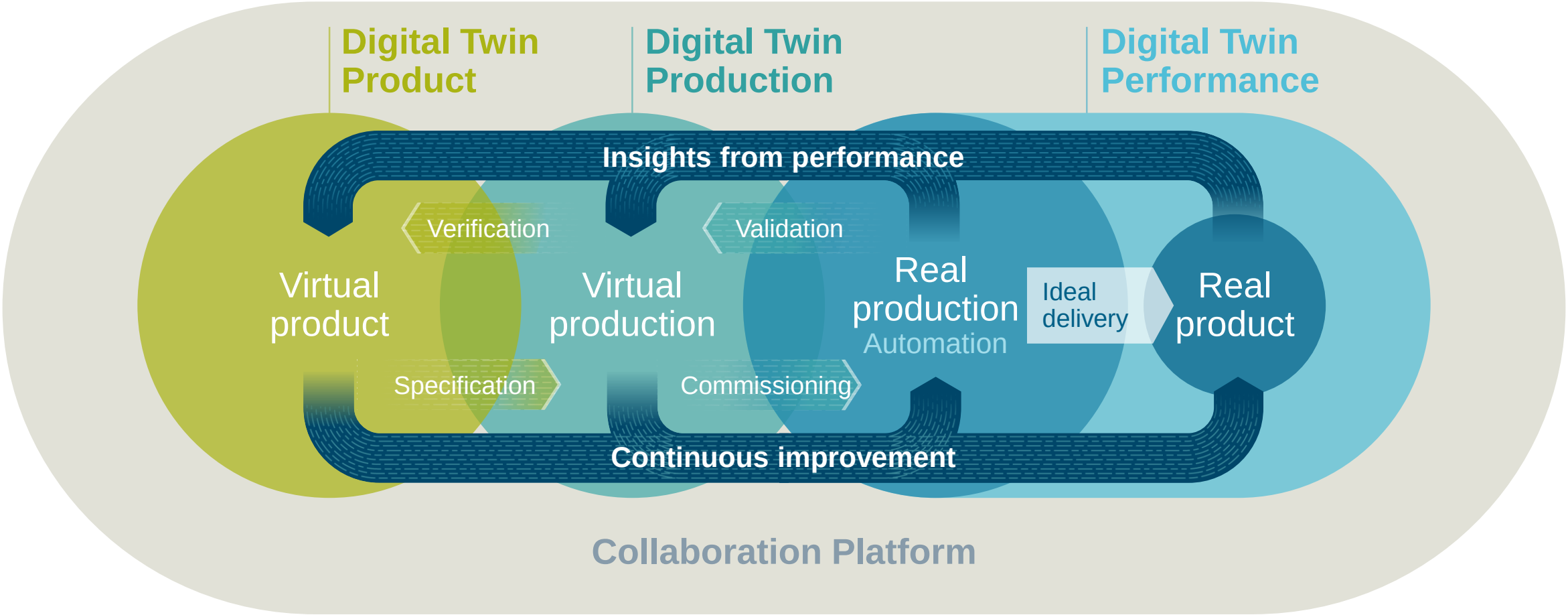

Digitalize manufacturing to unify virtual and real production

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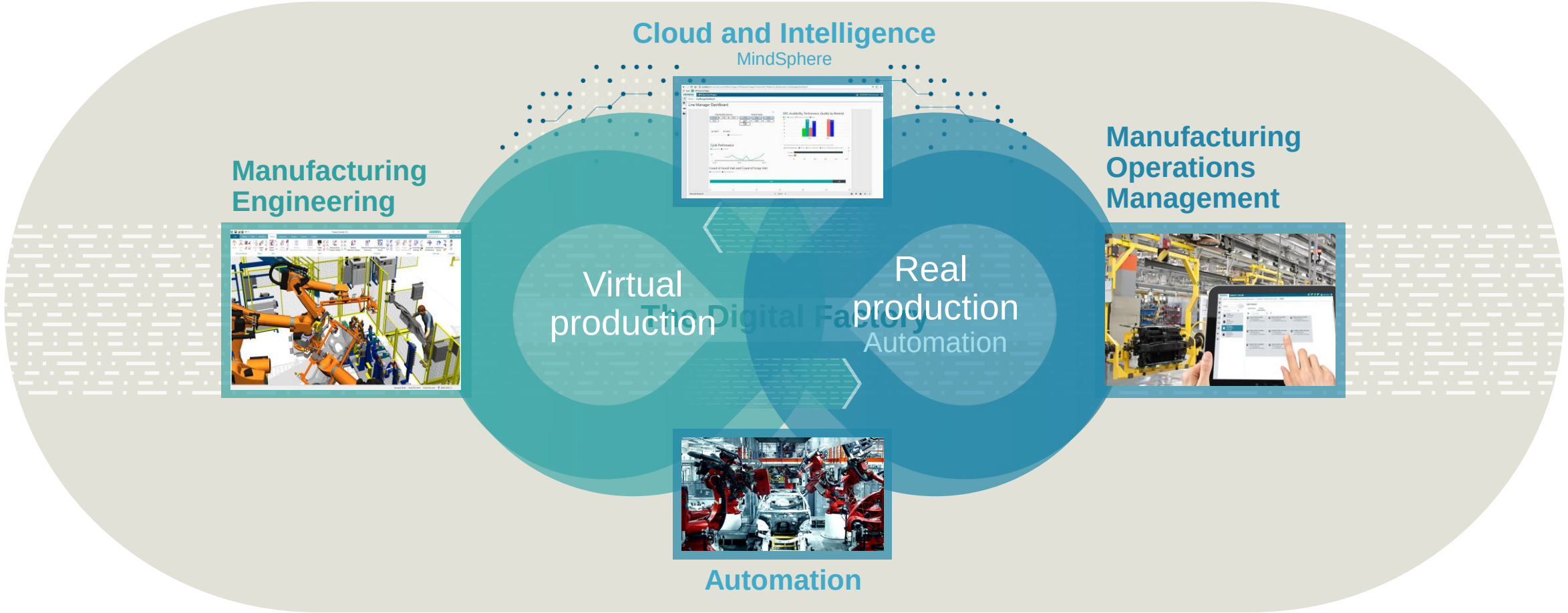

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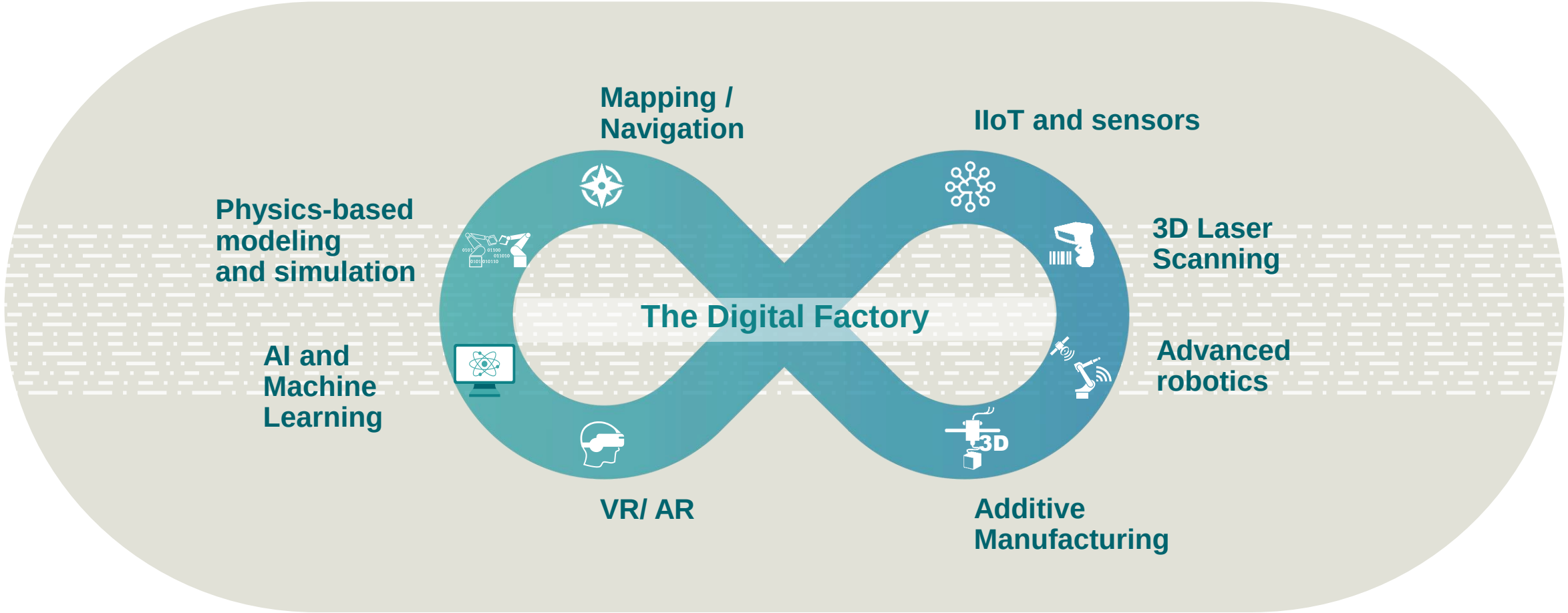
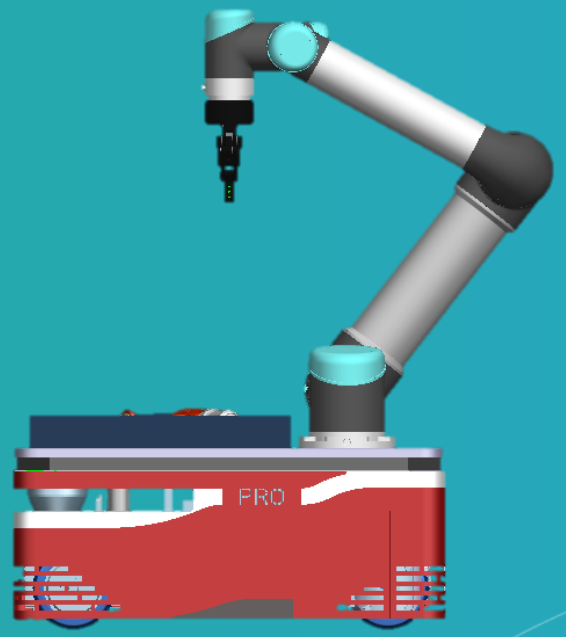


It’s time to rethink manufacturing.



Inventing new application fields with robots on demand

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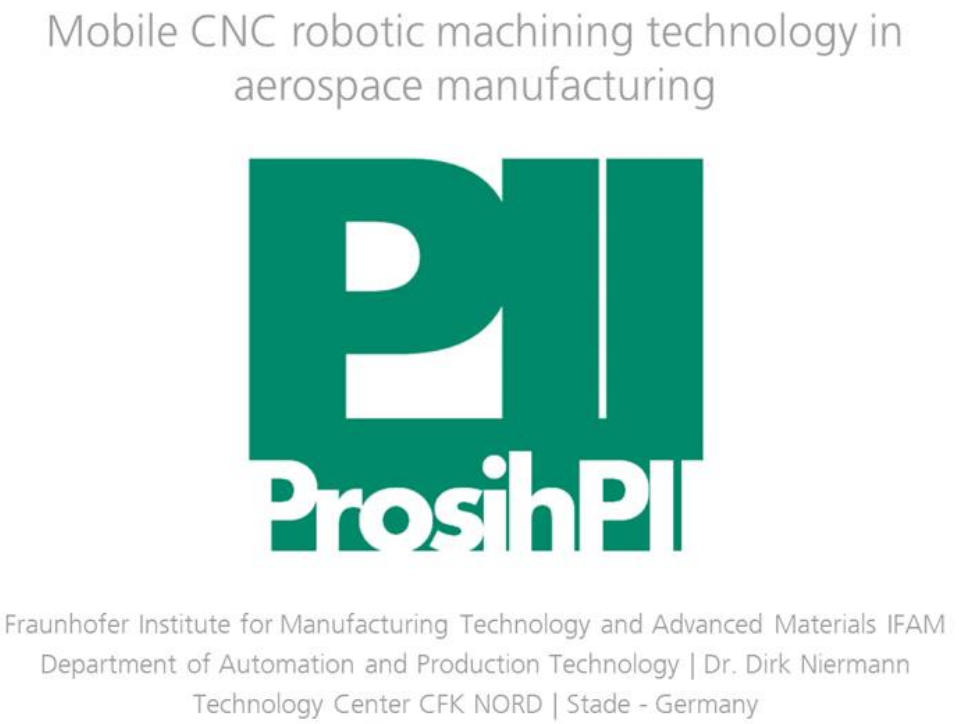
Integrate the digital twin and physical automation to mobilize robots equipped for performing precision jobs at any scale.



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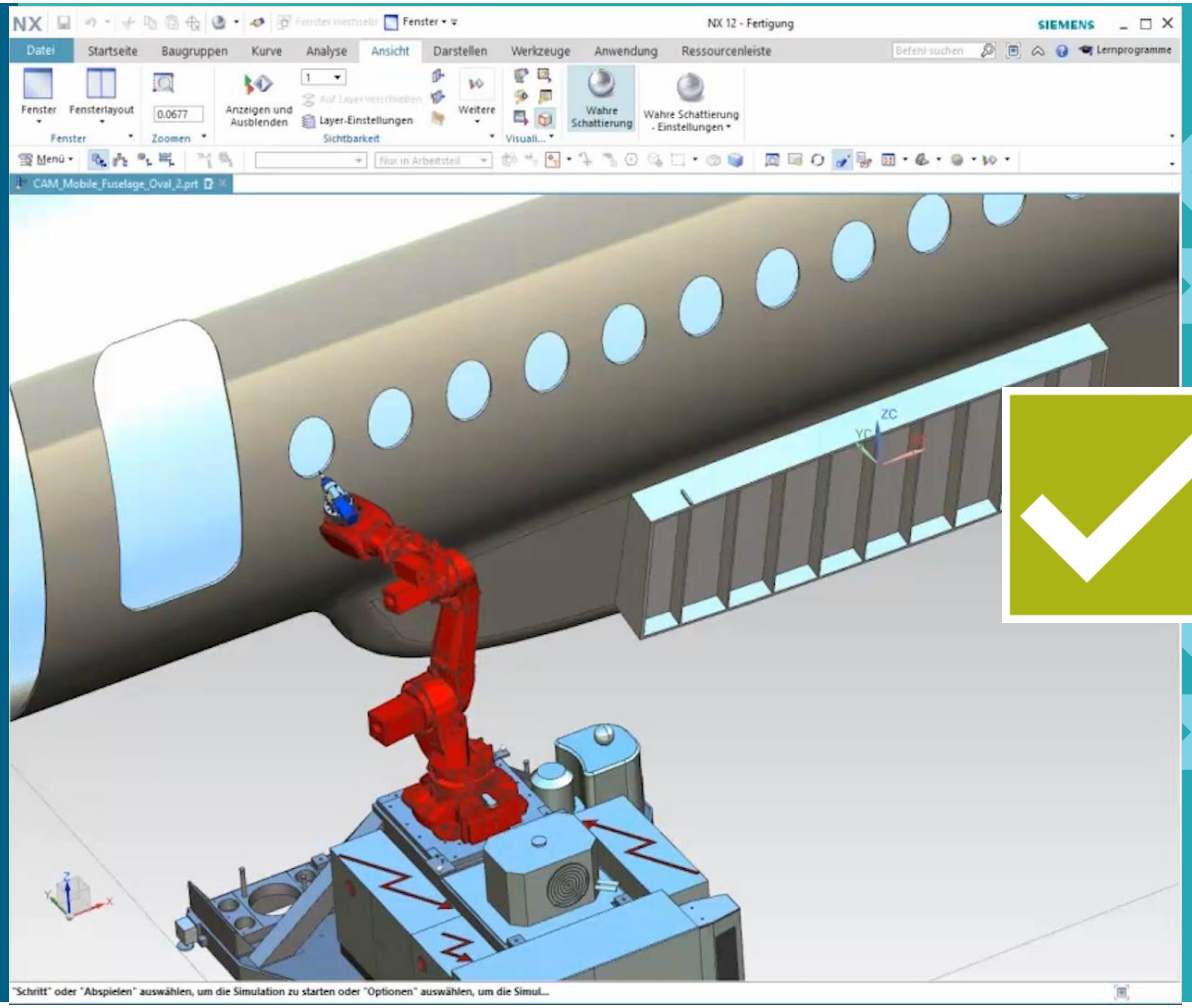
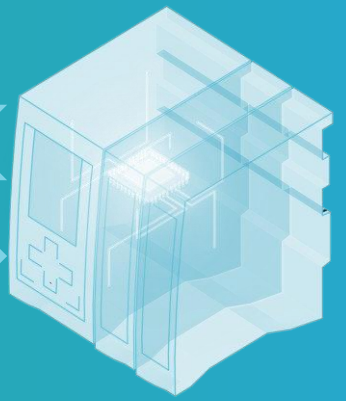


SINUMERIK 840D sl



Digital Twin of SIMATIC S7-1500

Inventing new application fields with robots on demand

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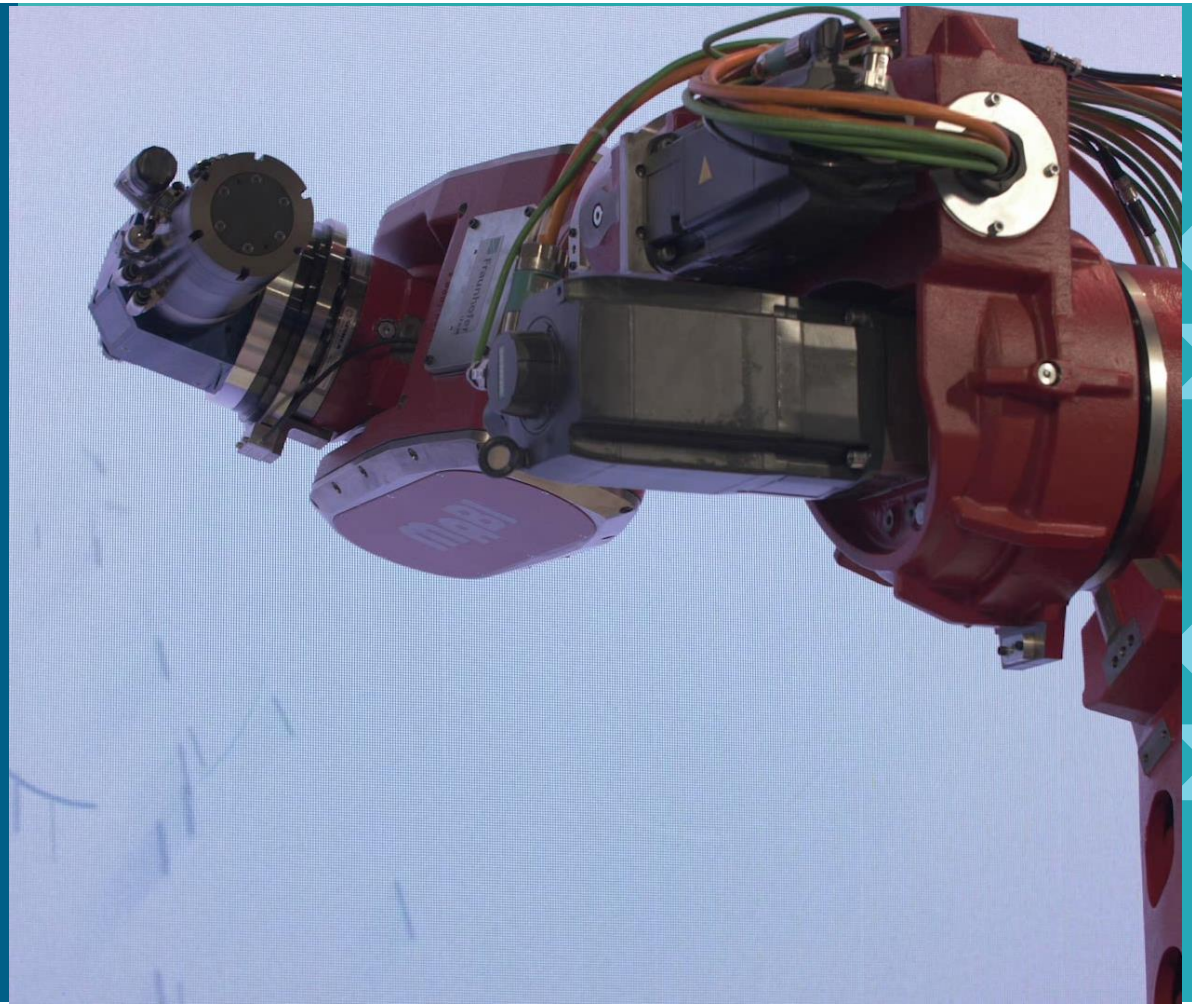

SINUMERIK 840D sl

SIMATIC S7-1500

Transforming assembly quality and throughput

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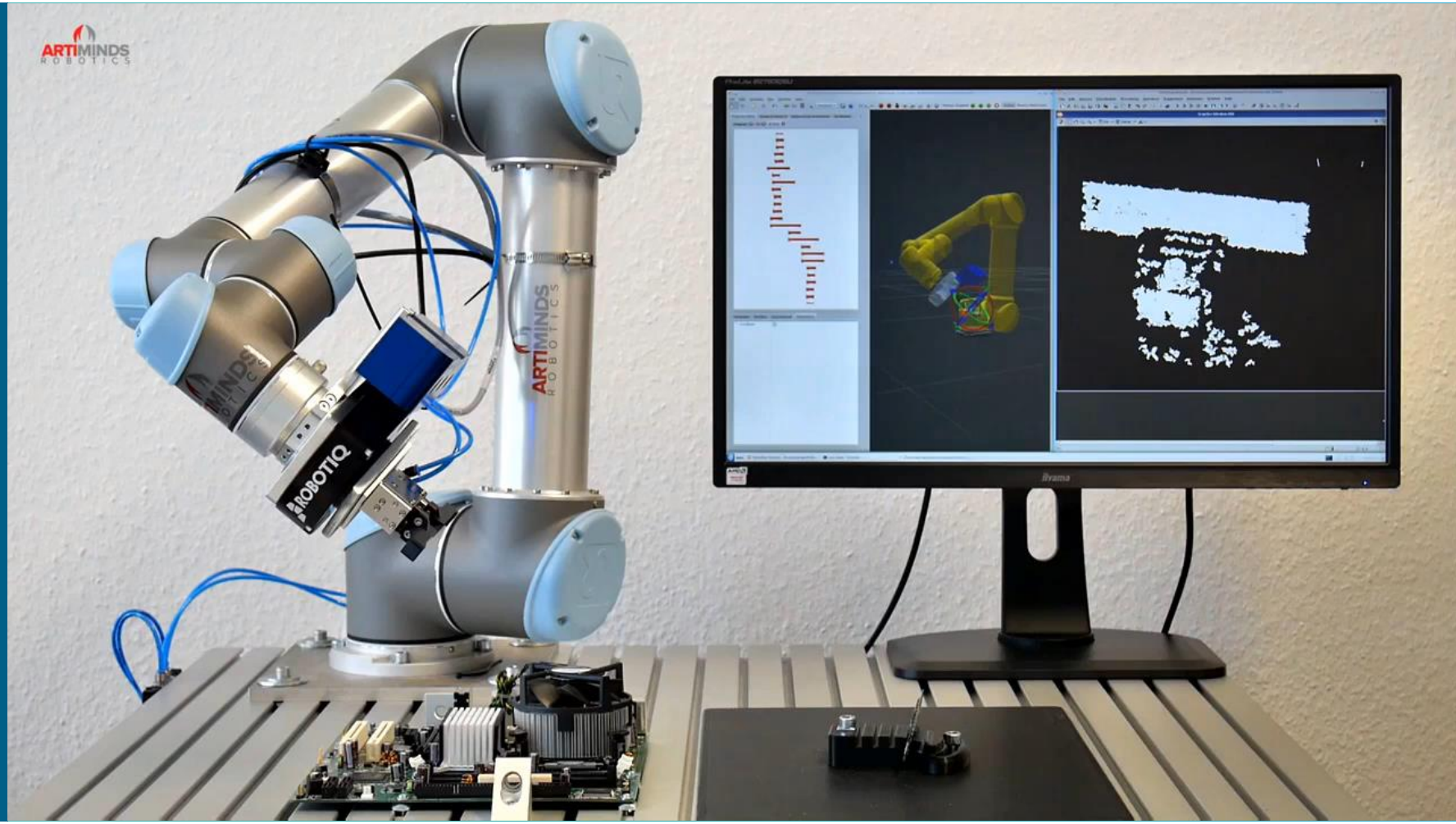
Integrate advanced robotics, sensors, programming and production system simulation to automate complex smart product assembly.



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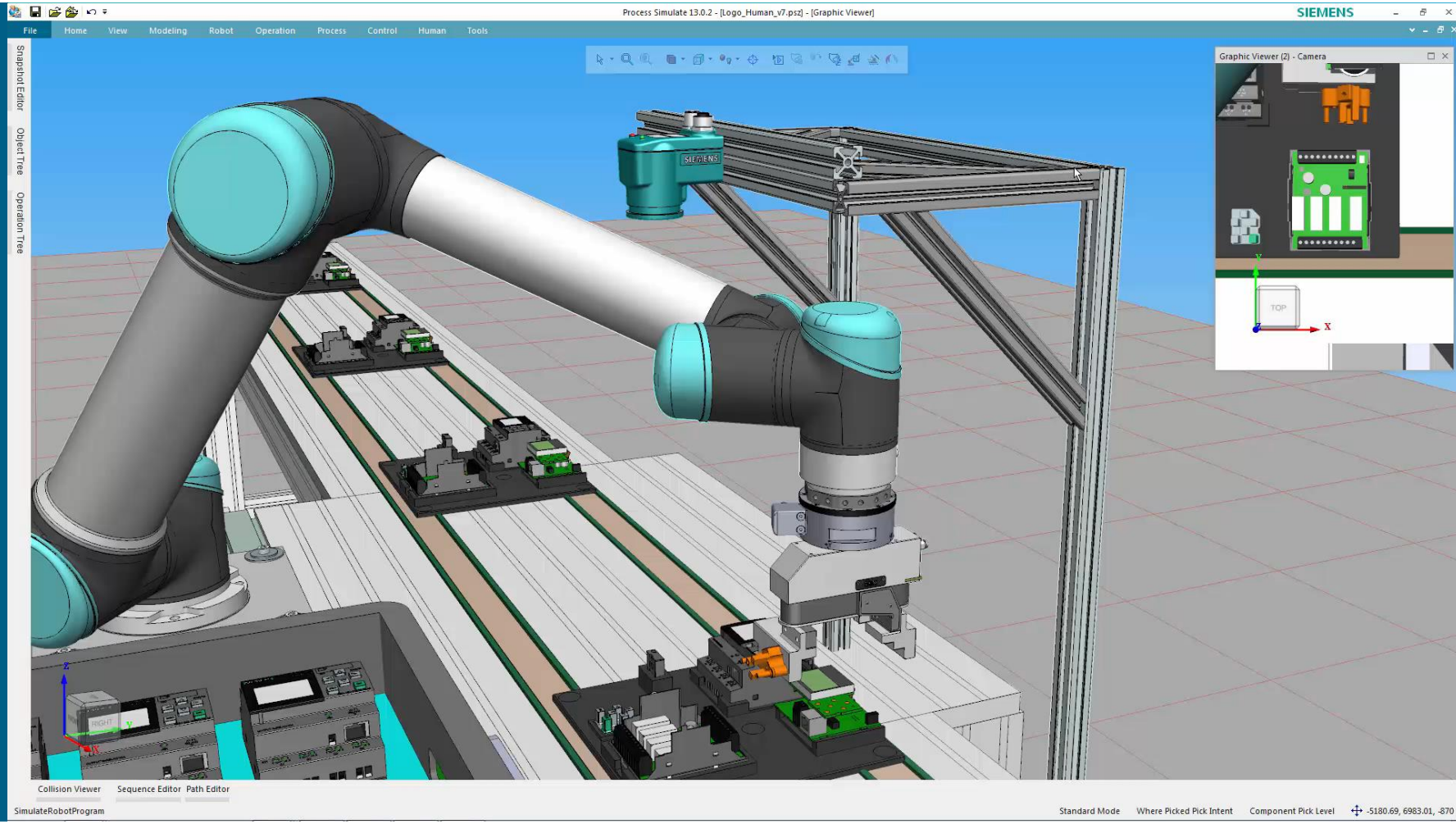

Additive Manufacturing is driving Innovation: Incremental progress isn't competitive enough

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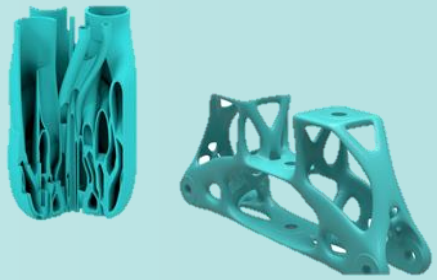
Product transformation
Shift from conventional design to innovative DFAM

Reimagine products

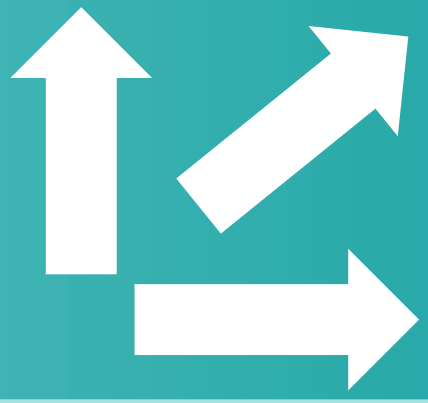
- Reduce weight, material
- Scan-to-product
- Expand performance
- Accelerate innovation cycles



Rethink business

- Individualization, personalization
- Zero inventory – on demand printing
- Design anywhere. Print anywhere.
- Increase competitiveness

STATUS QUO



Reinvent manufacturing

- Eliminate molding/castings/tooling
- Eliminate/simplify assembly process
- Reduce supply chains
- Affordable low volume production

Manufacturing transformation
Shift from prototyping / experimentation to mainstream industrial production

Barriers to industrializing additive manufacturing

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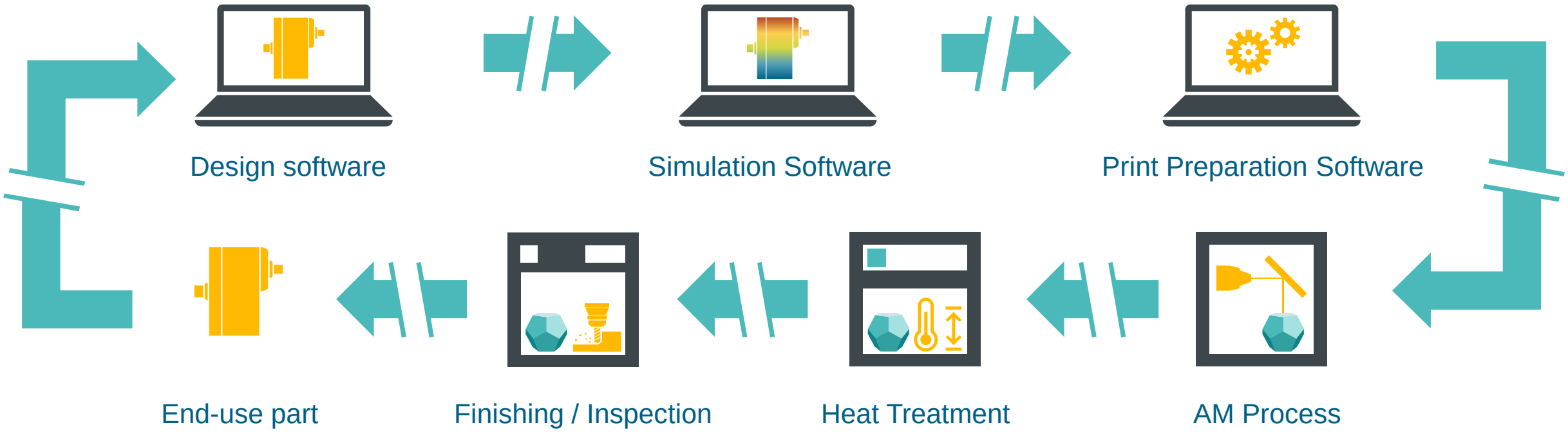

Conventional thinking

Disconnected process chain

Multiple file conversions

Uncontrolled workflow

Reimagining design, production and service for greater business value

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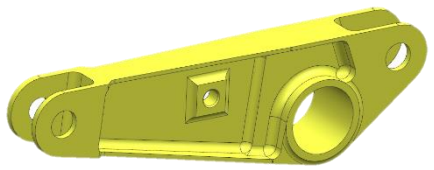
Original design



Final part

Connecting a digital thread across the complete product lifecycle

15% reduction in weight

Equal or greater strength

Less material waste

On-demand availability

Generative design

Topology optimization

Light weighting*

Adapt design
Convergent Modeling™

Validate
Inc. process simulation

Post processing and inspection

Slicing, hatching printing*

Prepare for printing*

* Powered by Materialise

Reinvent Manufacturing
Major 3D printing technologies supported in one system

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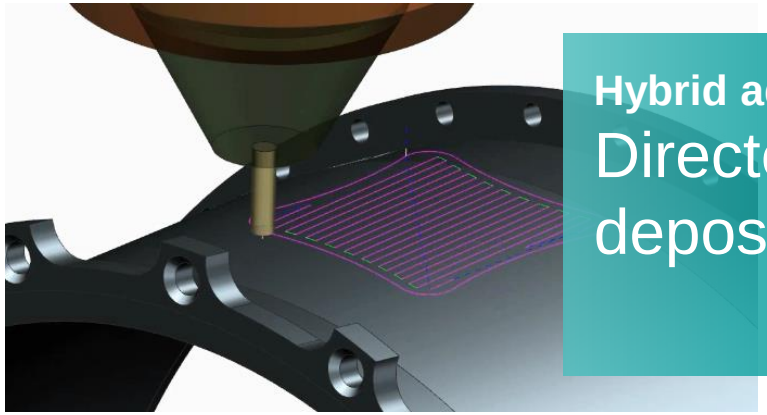
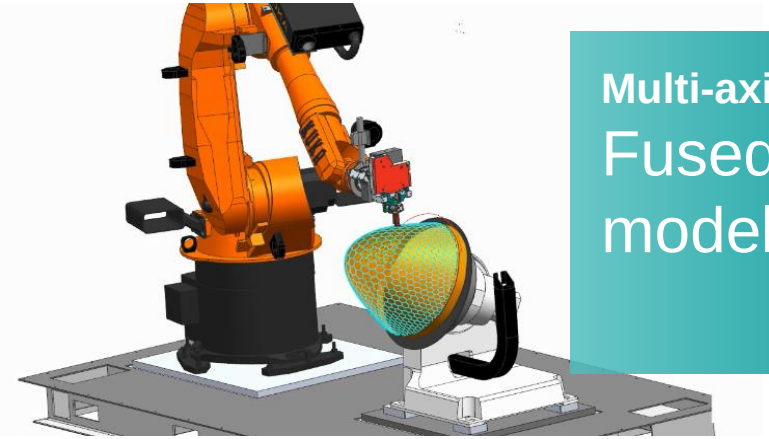
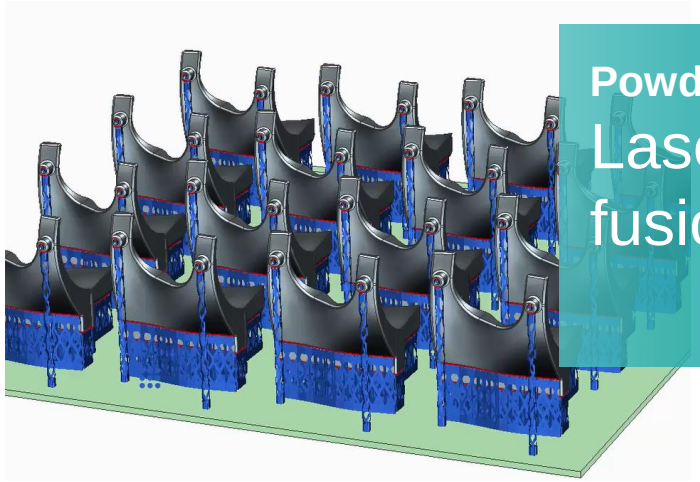


Hybrid additive
Directed energy deposition



Multi-axis
Fused deposition modeling



Powder bed fusion
Laser material fusion

Multi jet fusion
Agent jetting/ inkjet technology

Siemens PG Finspång:
Reimagining designs for greater performance

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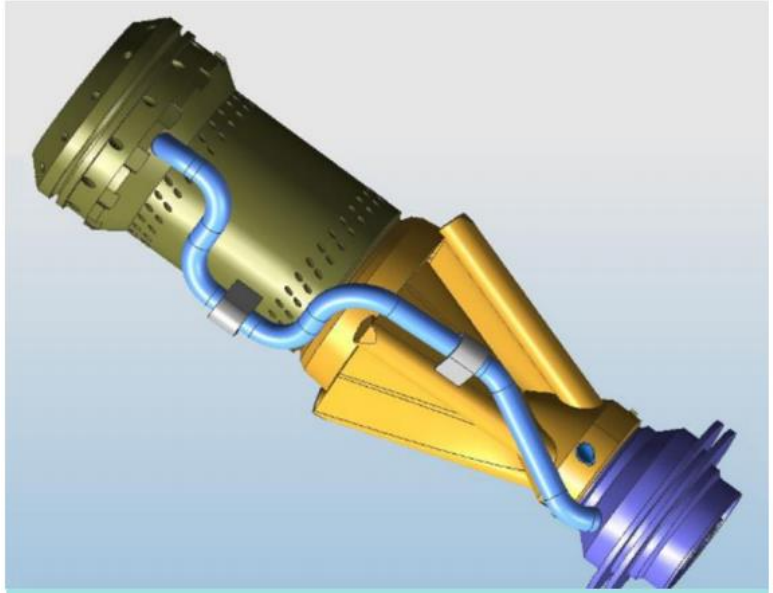
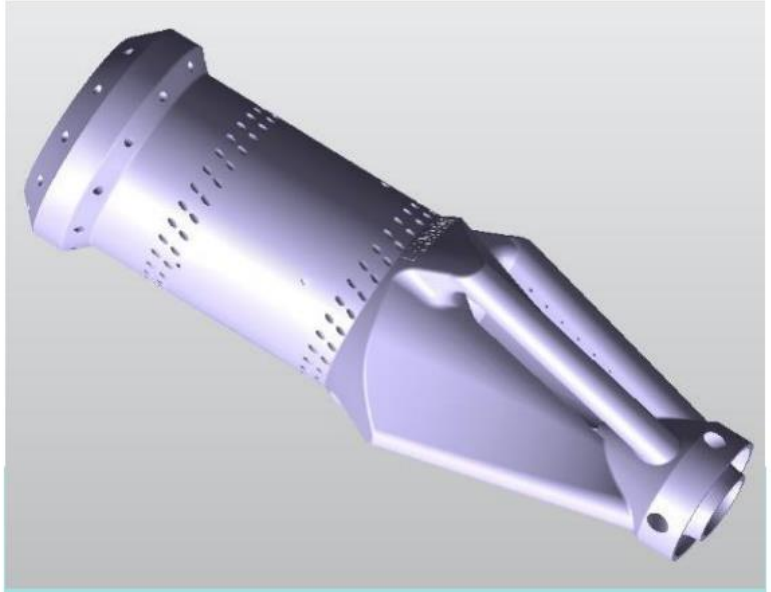
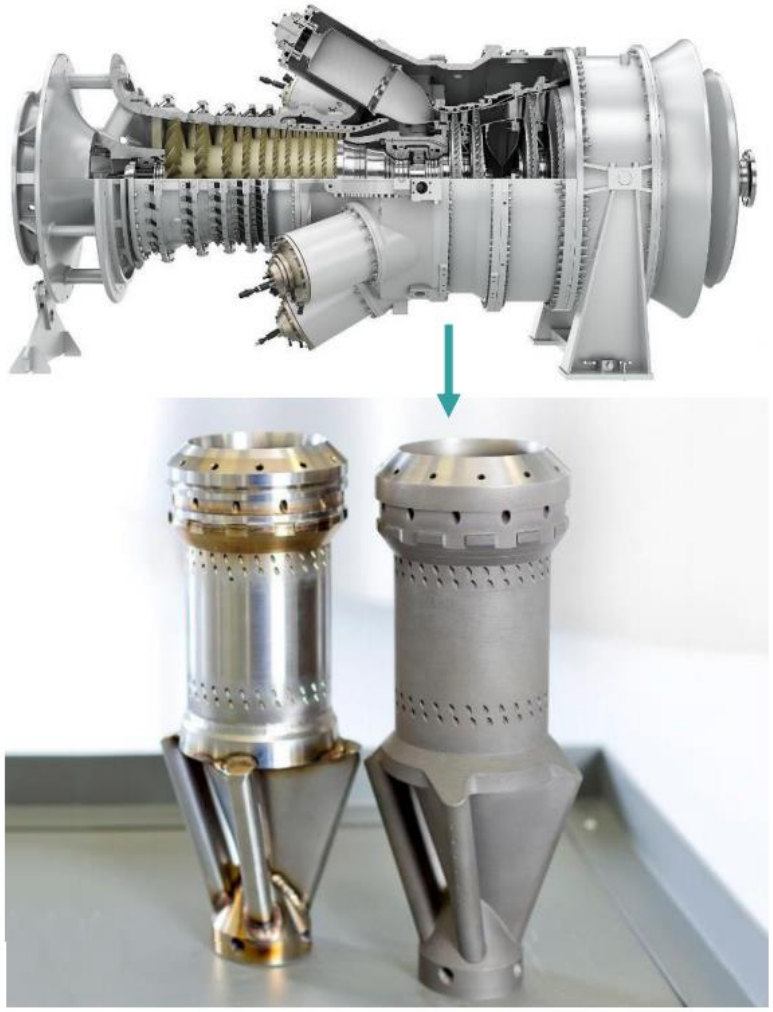
Conventionally manufactured burner	Additive manufacturing adapted burner
	
13 machined parts, joined by 18 welds Thermal Barrier Coating (TBC) on front surface External pilot gas feed Standard lead time 26 weeks (excl. TBC) Weight: 4,5 kg	1 single part Pilot gas feed integrated in structure Optimized cooling, possible to remove TBC Standard lead time 3 weeks (excl. TBC) Weight: 3,5 kg



Accelerating introduction of next gen production concepts

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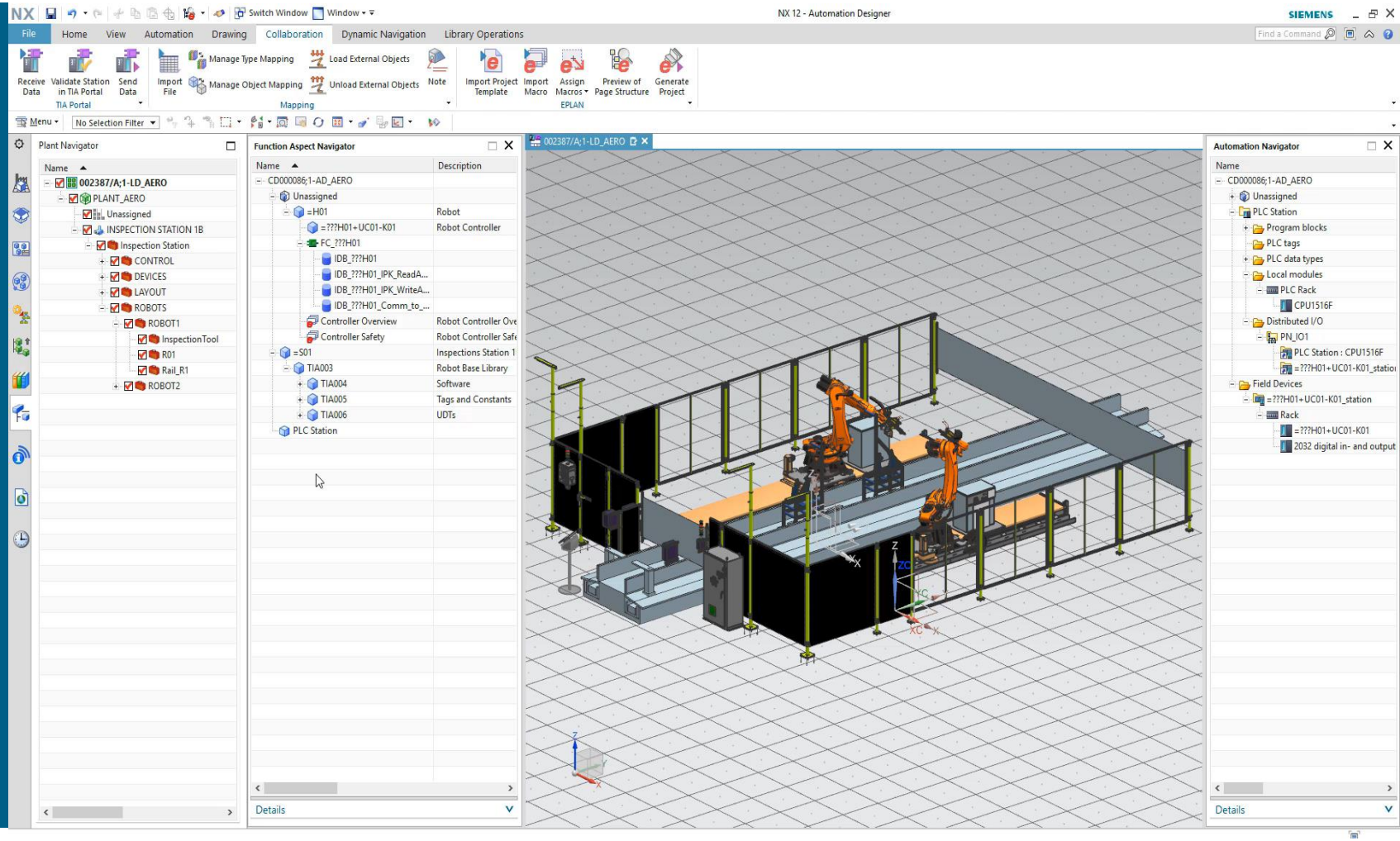
Integrate mechanical and electrical design to generate PLC code automatically - and integrate automation hardware for the design and virtual commissioning of production systems.



Breaking through the screen barrier in production planning

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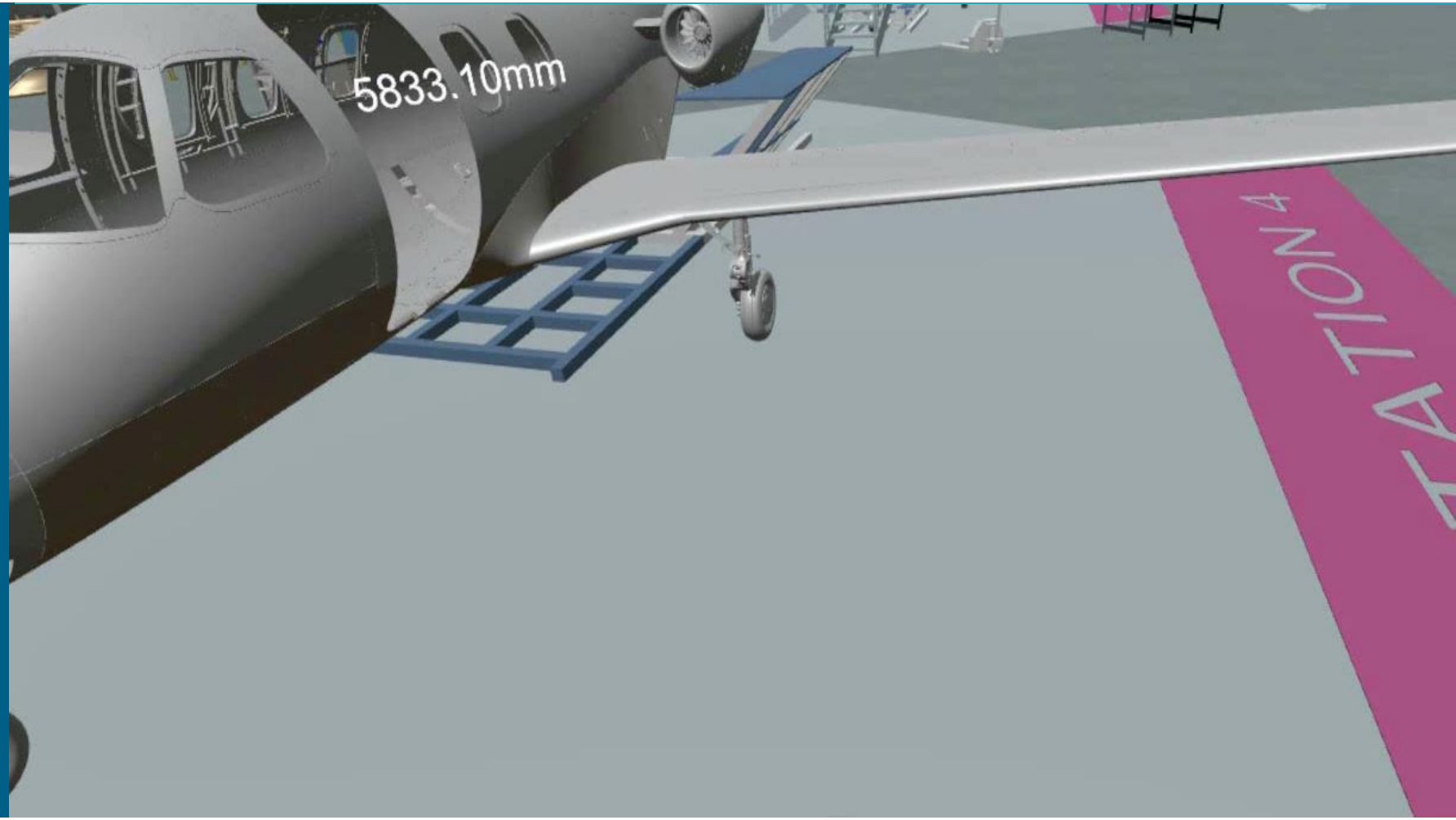
Bring virtual simulation closer to reality with immersive and interactive VR experiences for work training.



Introducing AR in manufacturing operations for improved worker guidance and quality inspection

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Overlay virtual and real data for augmented EWI and real-time 3D views of as-design and as-build products.

Gaining global visibility into production data and insights via manufacturing intelligence technologies on MindSphere

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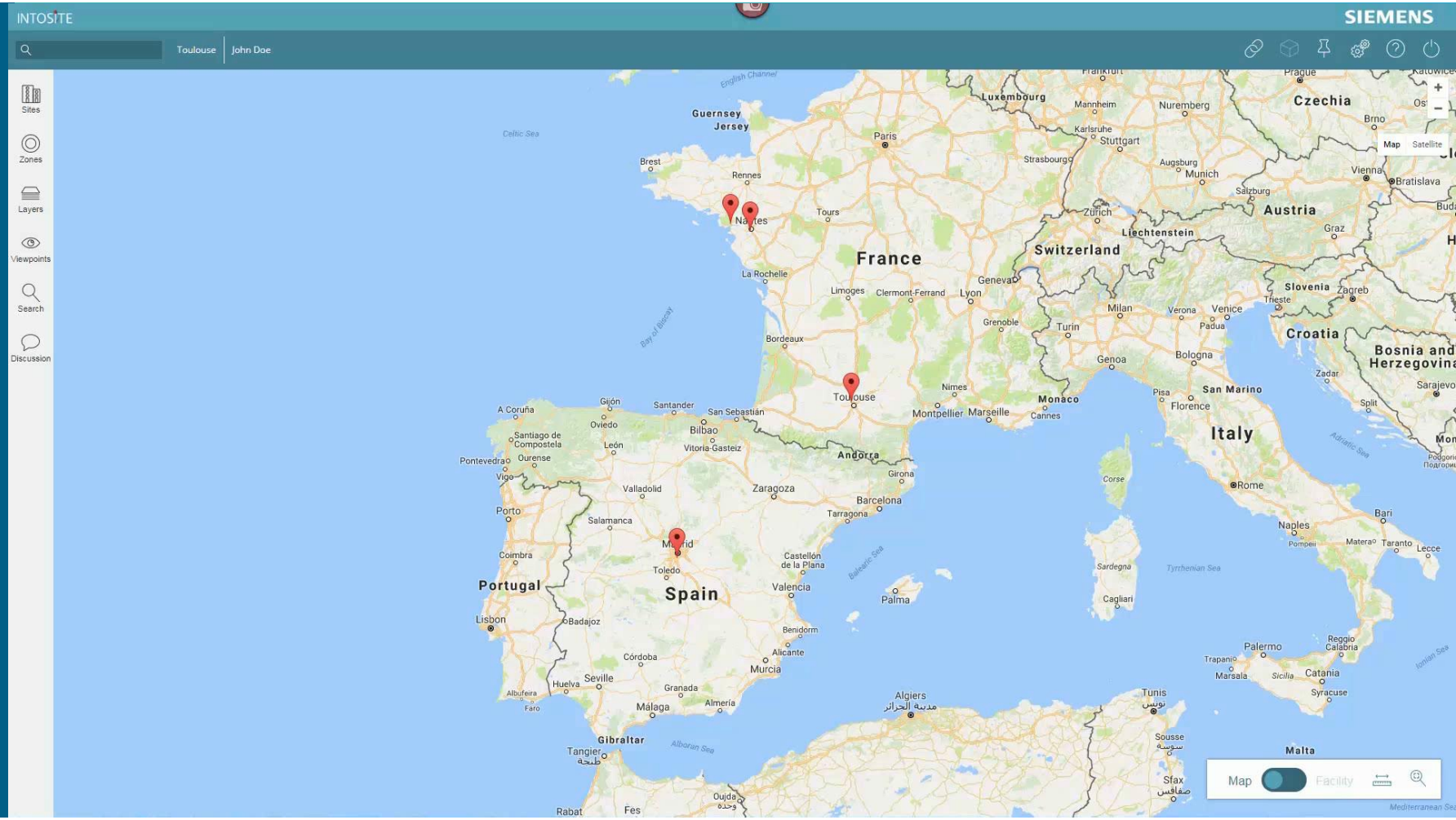
Impact production KPIs with actionable insights gained from analyses of real time global operation data.



Combining Digital Twins and IIoT to optimize logistic flows

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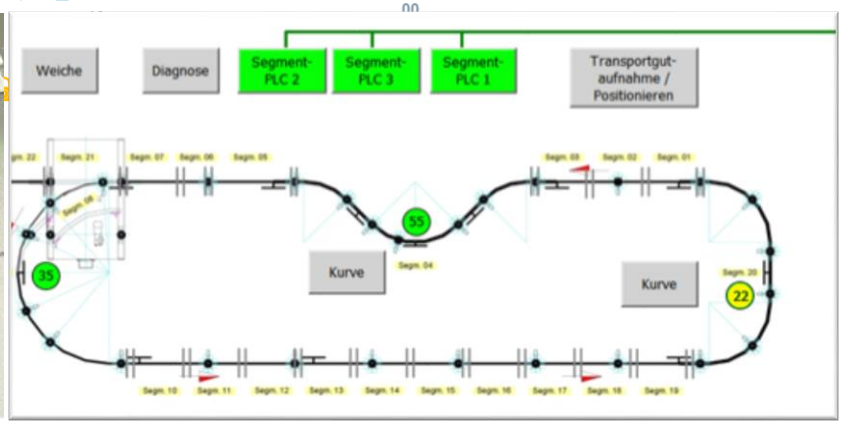
Using an up-to-date digital twin of production to re-plan optimal solutions to incidents through multivariate simulations.



Model-based performance analytics

Realize the full value of digitalization

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