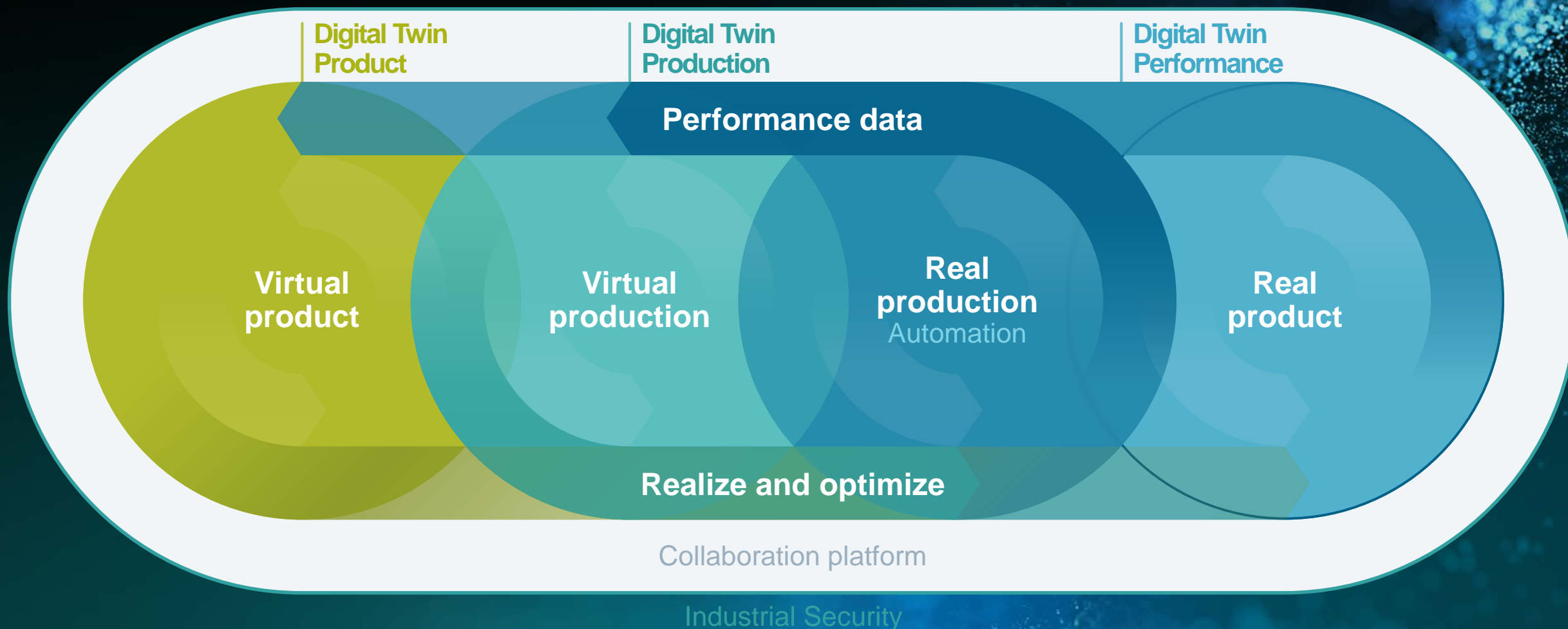


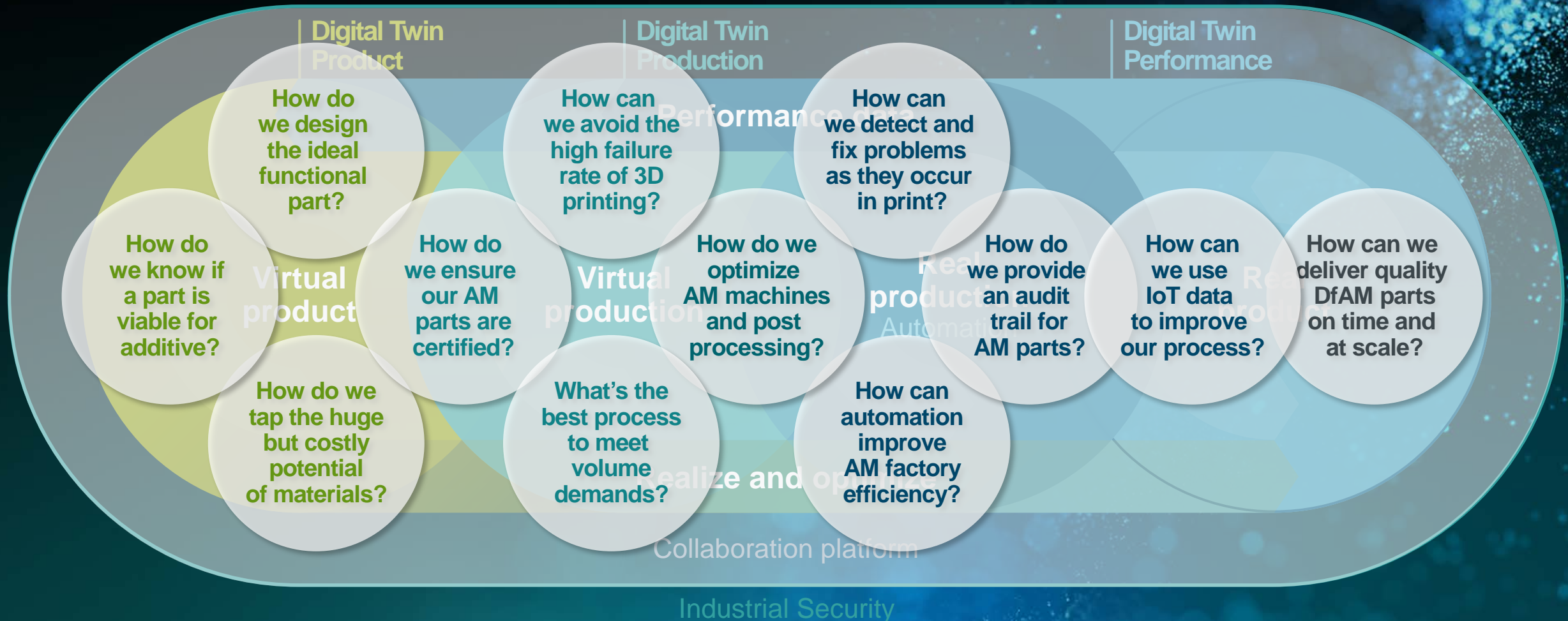
Thinking Industrialized Additive Manufacturing Further

K. Heuser, O. Fergani, M. Seibold, R. Meshel
Press Conference, November 19, 2019

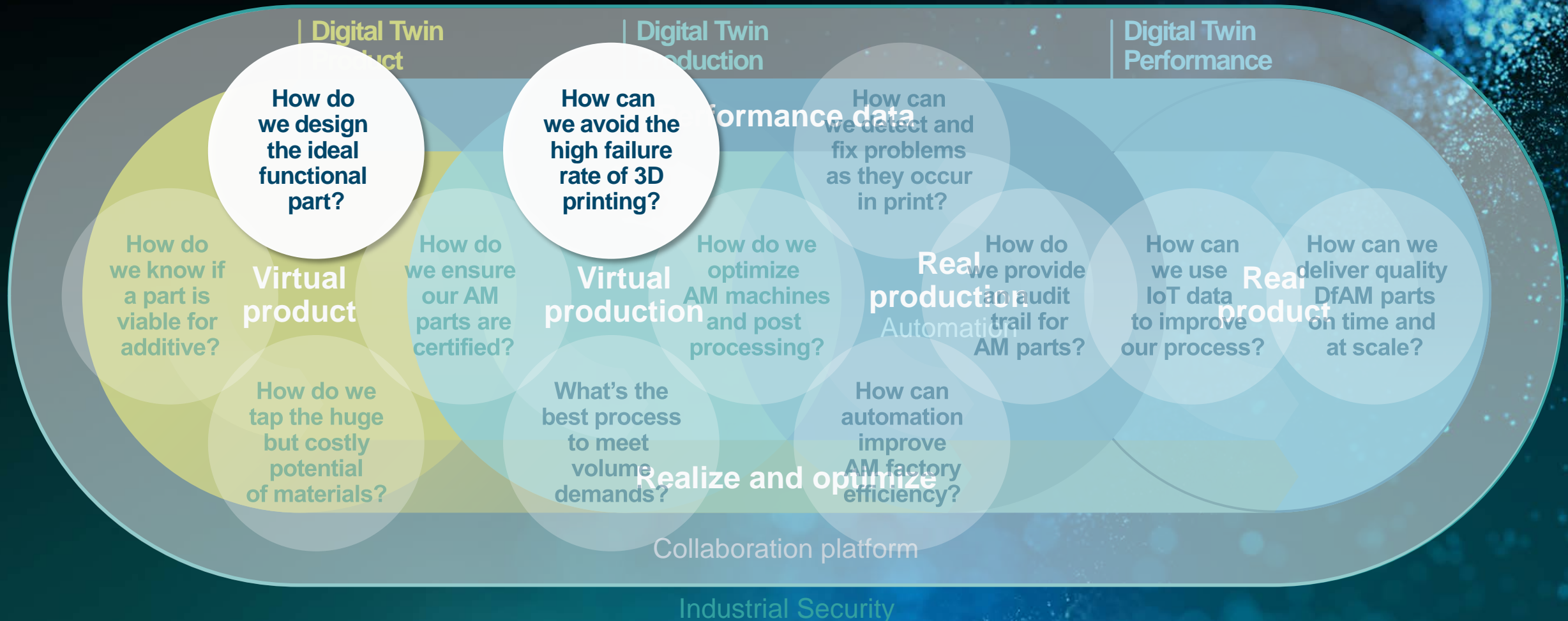
Industrialize Additive Manufacturing with seamlessly integrated digital twins for machine builder and user



Typical customer challenges of machine builder and user on the journey of crossing the chasm towards serial production



Typical customer challenges of machine builder and user on the journey of crossing the chasm towards serial production



**Automate discovery of
optimal design performance
and build orientations**

Strategic acquisition: ATLAS 3D



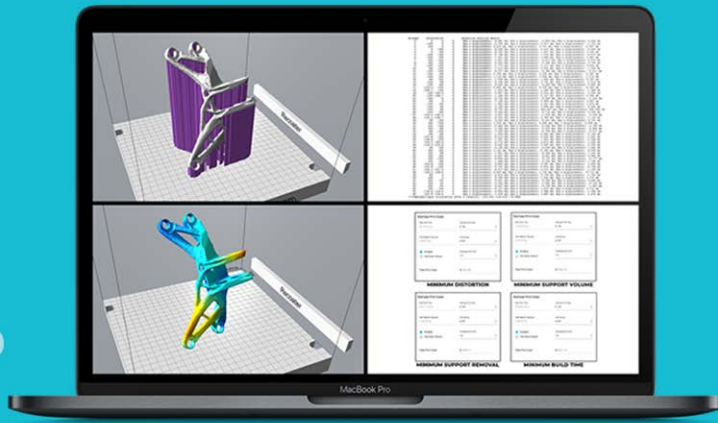
ATLAS 3D

ADDITIVE MANUFACTURING MADE EASY

**WE BUILT AN "EASY BUTTON"
FOR 3D PRINT DESIGNERS**



**SUNATA
BY ATLAS 3D**



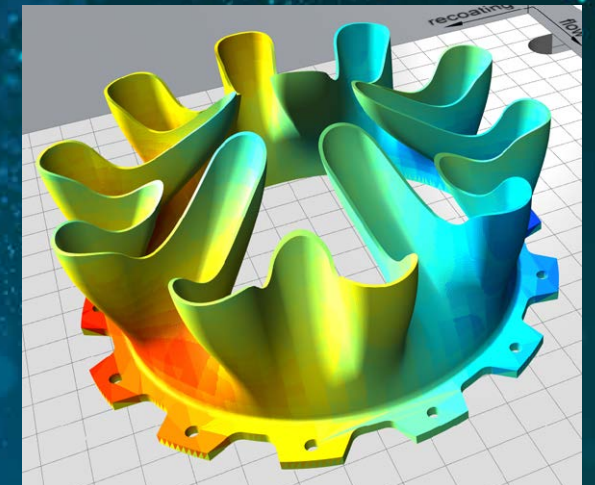
**Simple, cloud-based solution
for identifying build orientations**

**Quickly positions parts for
minimum time, material, distortion**

Can be linked to AM Network

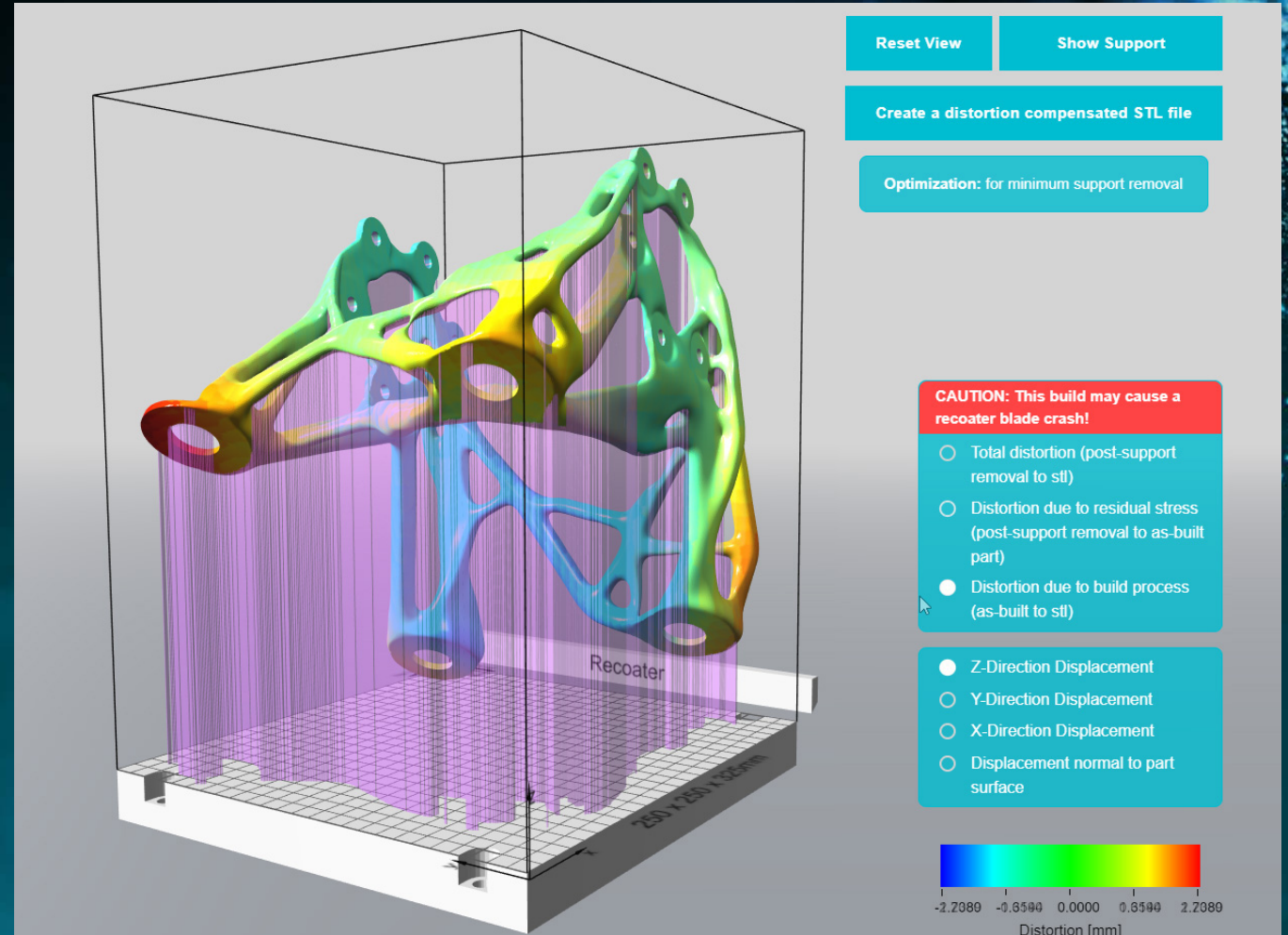
-95%

**Reduction in
simulation
processing time**



Strategic acquisition: ATLAS 3D

With ATLAS 3D, designers and manufacturing engineers can quickly gain insights into the optimal part build orientation in order to minimize supports, distortion, effort to remove supports, part material, and printing time.

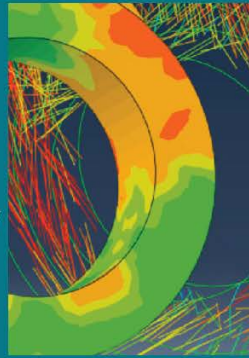


Siemens adds material modeling to Simcenter through acquisition of MultiMechanics



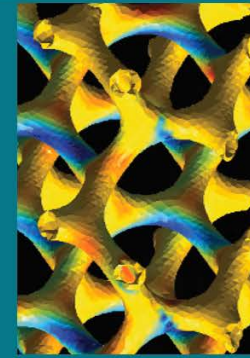
Predict

Account for manufacturing variability and imperfections to maximize product reliability



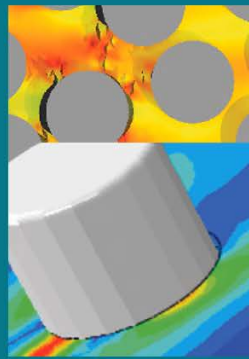
Optimize

Optimize the material microstructure for the most cost-efficient performance



Zoom

Zoom into the material microstructure to identify the root cause of failure and see how damage mechanisms affect structural performance



Innovate

Create and test new and existing materials (composites, ceramics, metals)



Introducing the digital twin of materials

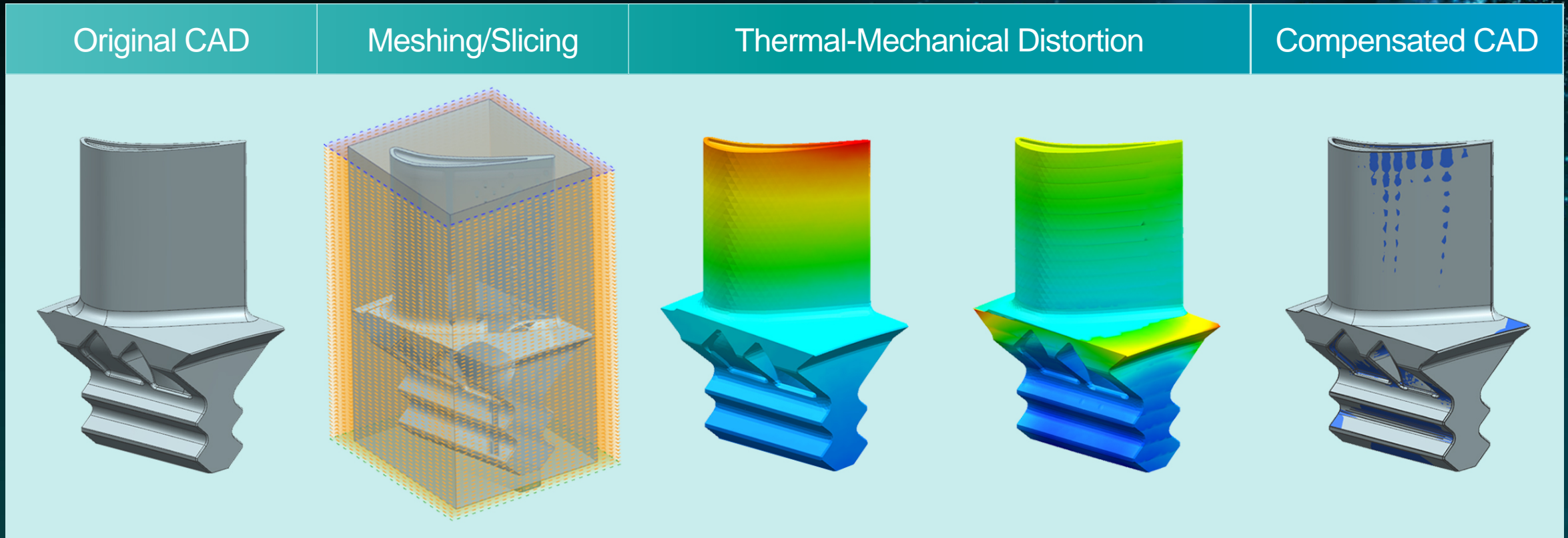
TRUE Multiscale™ technology to predict the effect of any material microstructure on part performance

- ✓ 1000 times faster than FE²
- ✓ 500 times less memory usage
- ✓ Best accuracy

Save up to 40% in time and cost to develop and certify new materials

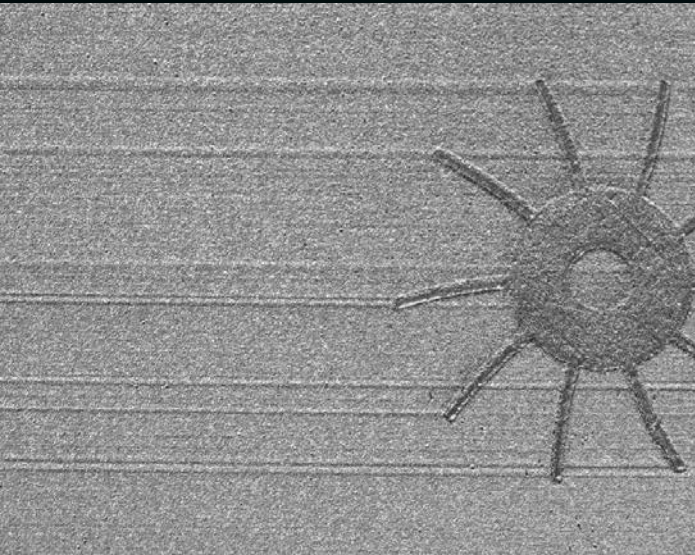
**Simulation predicts and
compensates for macro-
and meso-level defects**

Process digital twin to predict thermo-mechanical distortion and generate compensated geometry for first-time-right 3D printing.

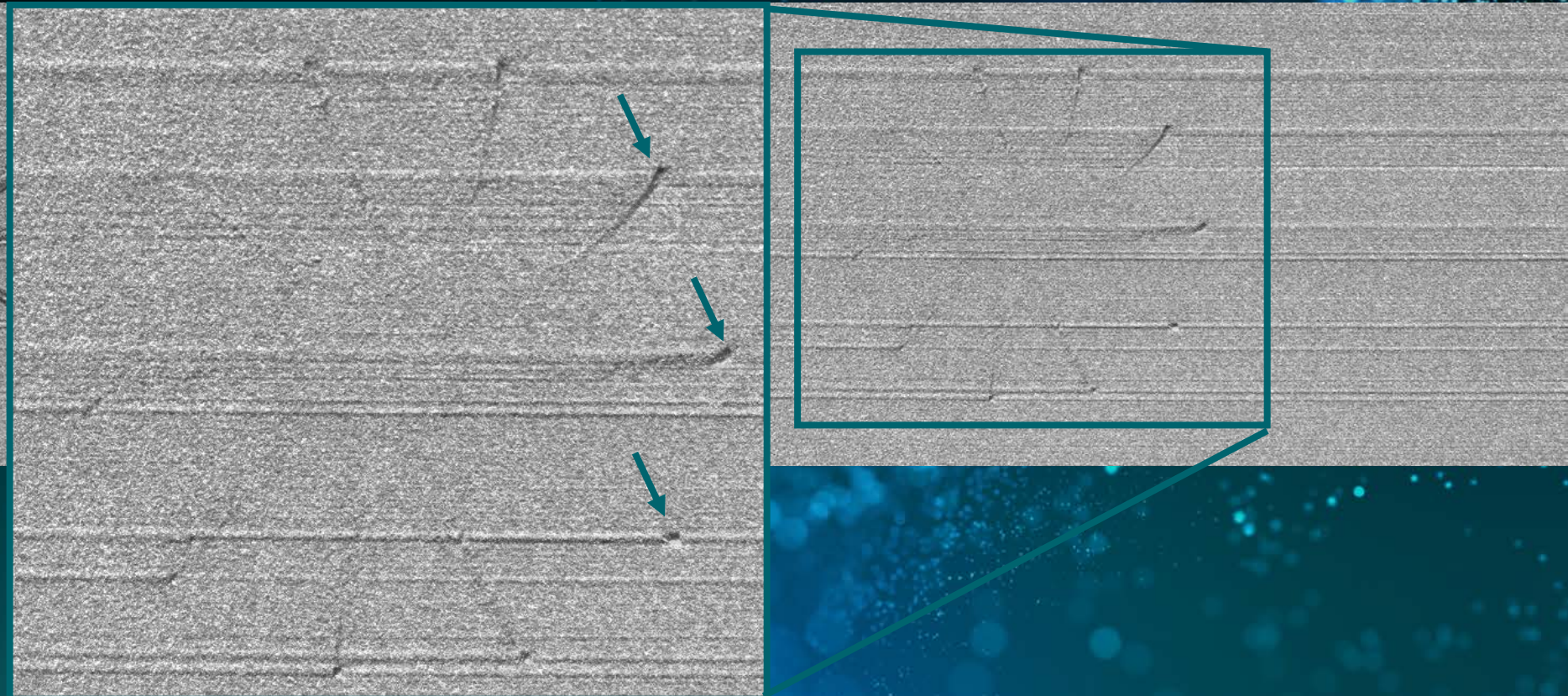


Overheating is a severe challenge in current AM production generating recoater crashes and generating waste

Layer X after laser melting



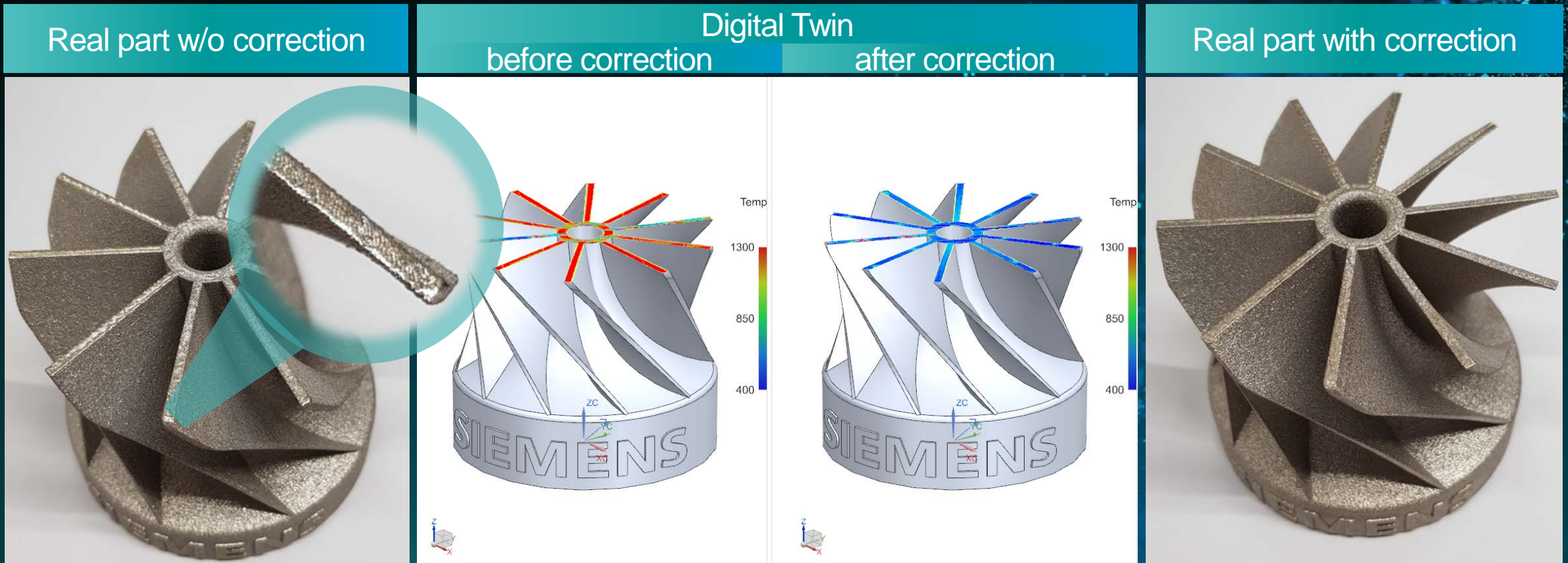
Layer X+1 after recoating & before laser melting



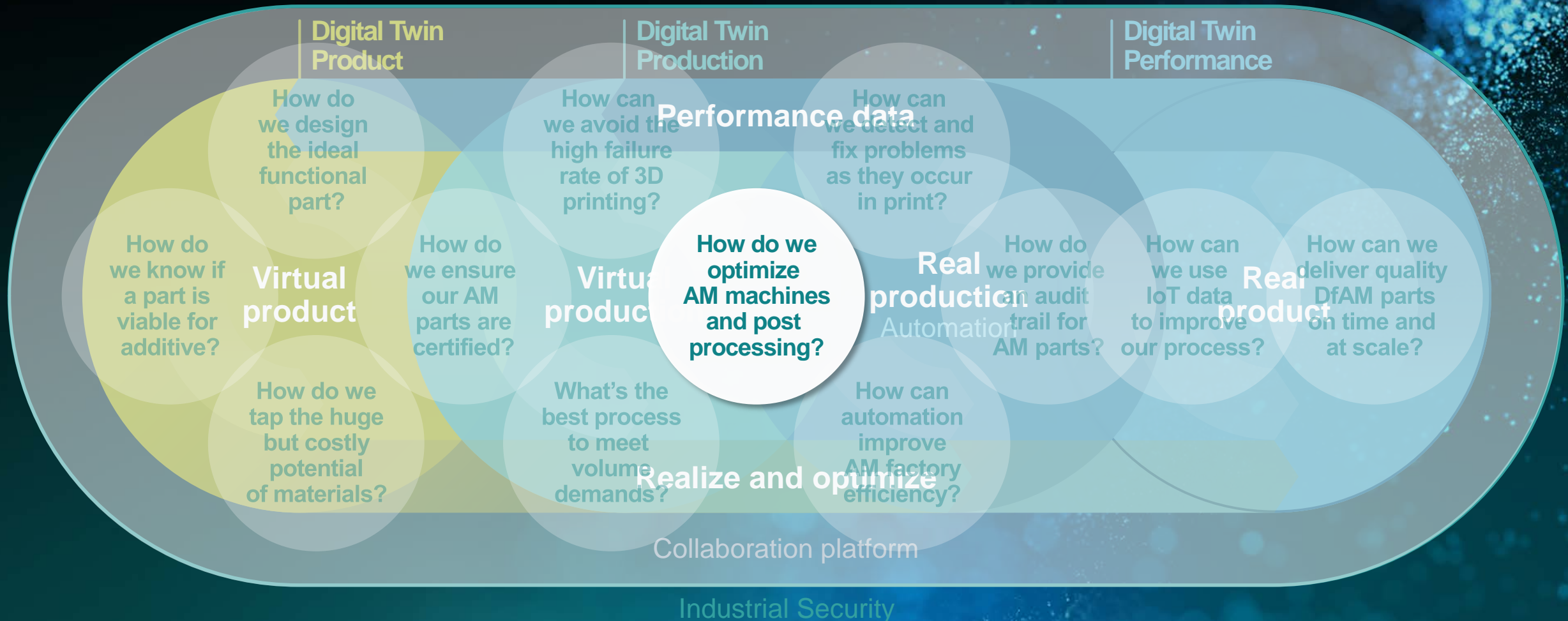
Additive Manufacturing NX Path Optimizer



Predict meso-level defects from overheating and automatically adjust 3D print toolpath, proven in partnership with TRUMPF



Typical customer challenges of machine builder and user on the journey of crossing the chasm towards serial production

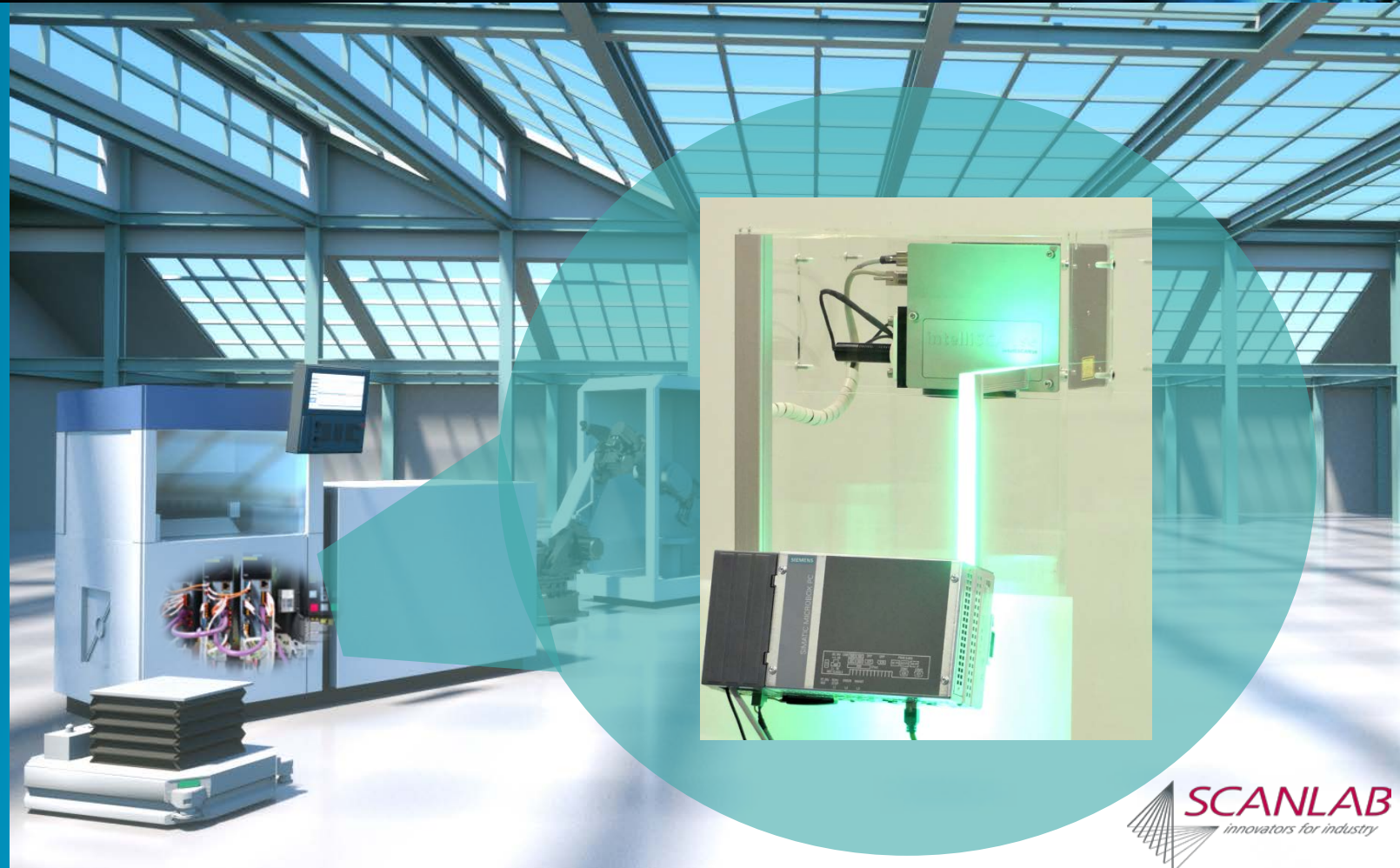


**Siemens
automation technology
industrializes AM machines
of > 50 machine builder**

SCANLAB and Siemens support machine builder to deliver faster and built better AM machines



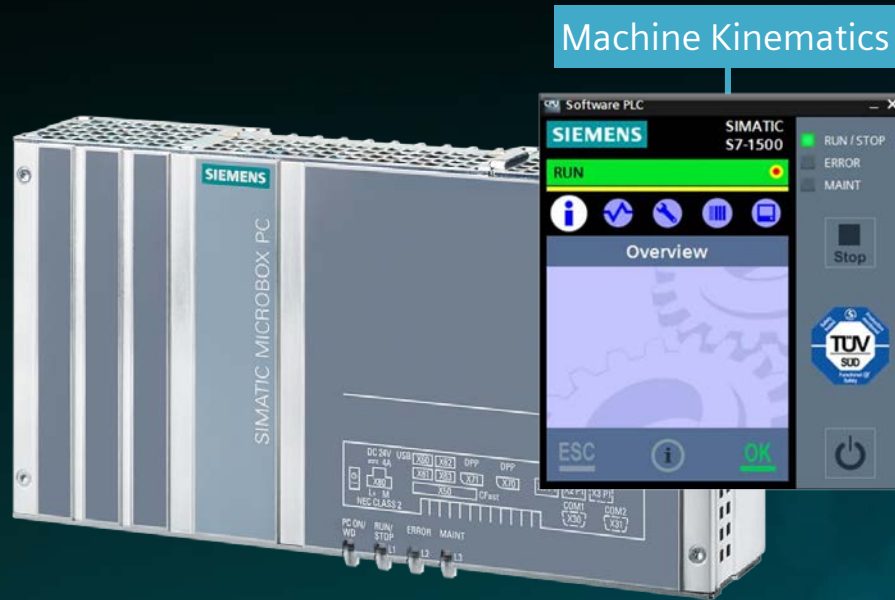
ONE integrated automation platform that offers machine builders in Additive Manufacturing a pre-configured starter kit to simplify the machine-specific development of their Machine Control System (MCS)



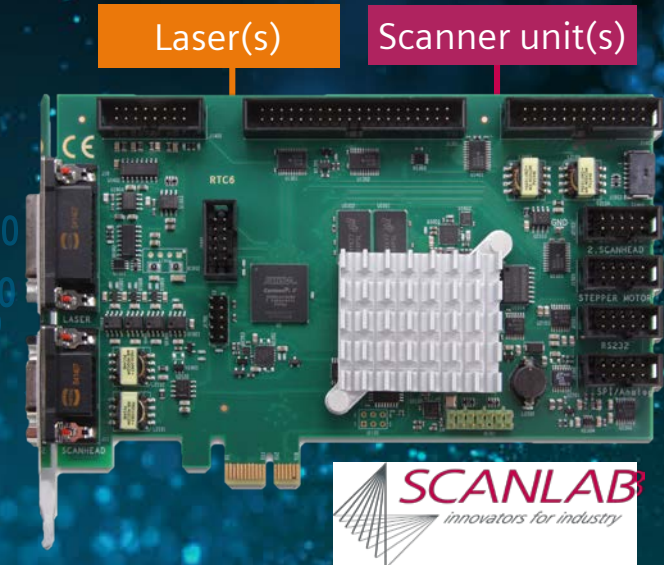
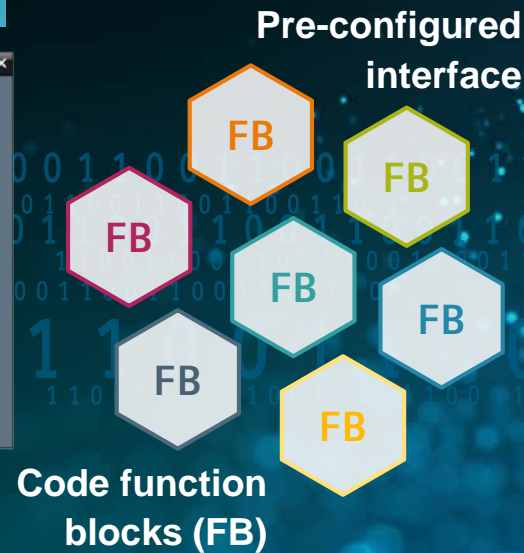
ONE Integrated Automation Platform = Industrial PC + Software PLC + Scanhead Control Board



ONE Automation platform



SIMATIC IPC427E
and SIMATIC S7-1500 Software Controller



SCANLAB RTC 6 Scanhead
Control Board

CEAD and Siemens intensify collaboration for industrial 3D printing of large fiber reinforced polymer parts



Gantry and robot extrusion systems enabled by Siemens Sinumerik Run MyRobot /Direct Control for precise printing with COMAU robot and CEAD extruder



CEAD
Composite Additive manufacturing

FARSOON industrializes its machines in partnership with Siemens for automation and software integration



First machine FS301 M with Siemens automation solution realized

Integrated workflow with Siemens NX demonstrated

Showcased at Formnext Hall 11.1 C68



We collaborate with leading machine builders along the complete process chain to industrialize machines further



>50 machine builder are working with Siemens industrial automation solutions

Examples...



DMG MORI



GEFERJET

solukon



HAGE3D

EVOLVE
ADDITIVE SOLUTIONS



Typical customer challenges of machine builder and user on the journey of crossing the chasm towards serial production



The Siemens' AM Factory planning kit optimizes the investment in large scale industrial AM factories



EOS system integration for >200,000 parts p.a.



HP Polymer technology for >300,000 parts p.a.

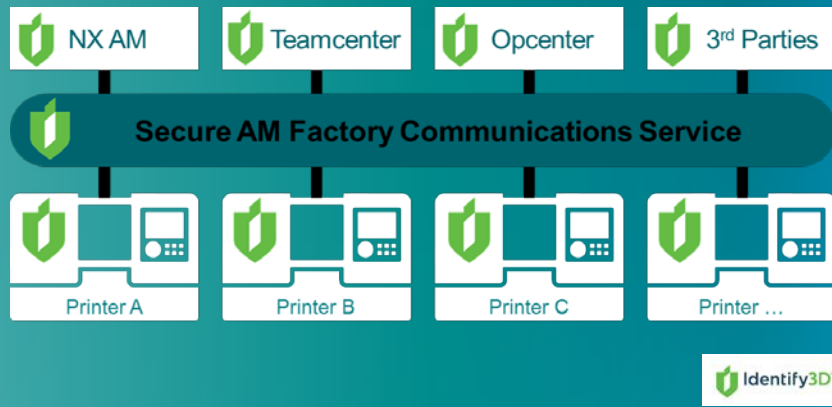


Scenario planning of AM factories in close cooperation with equipment suppliers
offered by IOT Services Consulting

AND securely connects and coordinates the entire Additive Manufacturing operation

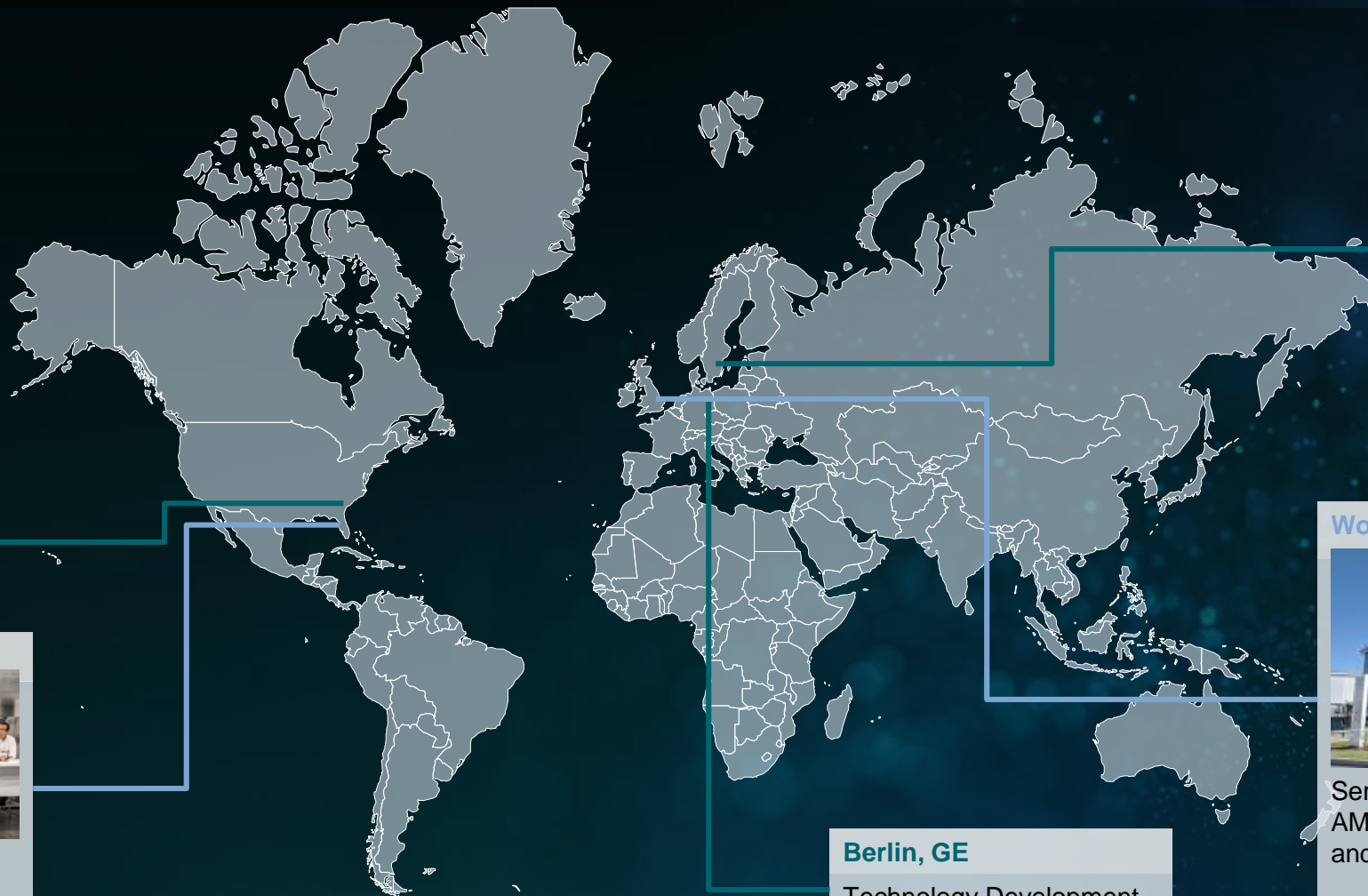


Securely connect and coordinate the entire 3D print operation via MES and real-time monitoring to improve OEE



**Siemens Gas and Power
and Materials Solutions
are expanding
their portfolio**

We are expanding our global footprint 45 printers – growing fleet



Charlotte, U.S.
R&D and Prototypes

Orlando, U.S.



Innovation Center and
AM Application Center
Opened in October 19


Berlin, GE
Technology Development
and Industrialization

Finnspong, SE



Serial Production for Oil & Gas and
Industrial Power Generation

Worcester, UK



Serial Production for Power Generation,
AM Services for Aerospace, Automotive
and others

We are in serial production



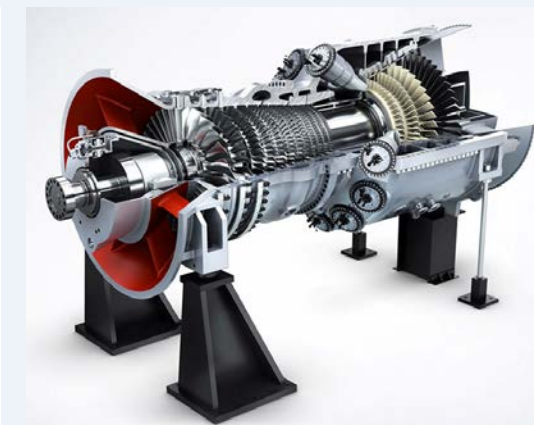
SGT5/6-8000H DfAM swirler



1,000 p.a.

Serial production

SGT-9000HL combustion system



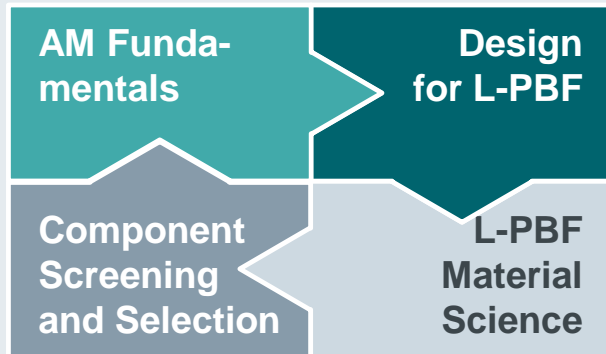
NO_x

reduction

Lifetime

increase

We are inspiring novel thinking in part production and educate on the usage and design of AM-parts



Advanced Additive Manufacturing Training

- Up to four-day training courses
- Holistic overview on Laser Powder Bed Fusion technology from ideation to costing and production
- Special focus on engineering
- Conducted by Siemens and Materials Solutions



Joint ASME and Siemens Digital Training

- Combining Siemens' industry leading AM application expertise with ASME's agile course development methodology
- Integration of the training solutions on the ASME digital learning platform
- Access to ASME Applied Learning Courses for Siemens customers

**Siemens
Additive Manufacturing
Network is now
globally available**

**A COLLABORATION
PLATFORM
DESIGNED TO
STREAMLINE AND
DIGITALIZE THE
END-TO-END
“ORDER TO DELIVERY”
BUSINESS PROCESSES**

SIEMENS
Ingenuity for life



Siemens' AM Network Launch

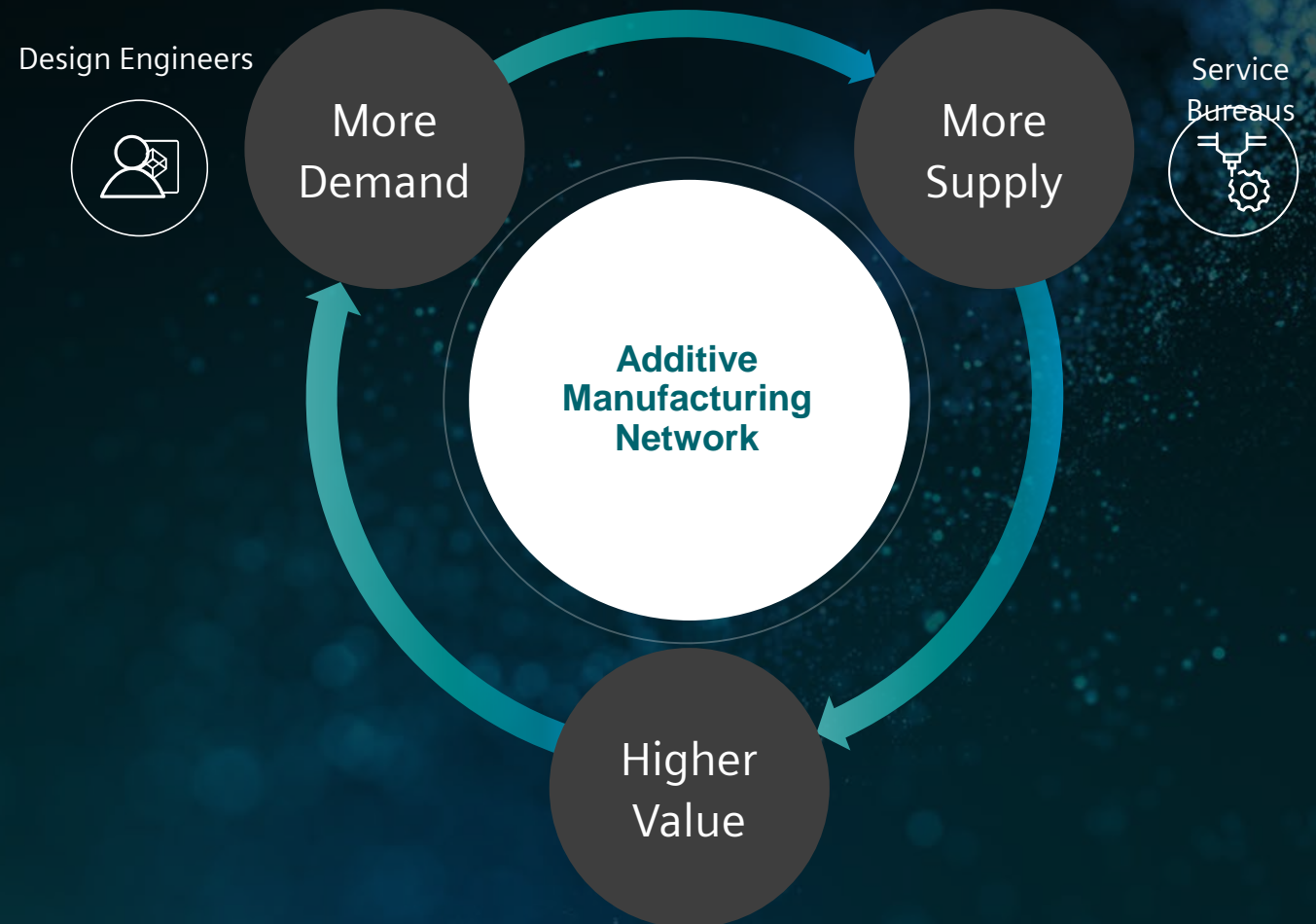
Join us at Formnext on November 19th for our official Additive Manufacturing launch event.

[Join Us](#)

Siemens Additive Manufacturing Network

Additive manufacturing demand synergy

- ➔ Meet the demands of AM efficiently and at lower operational costs
- ➔ Generate new demand by engaging with untapped markets and potential customers



**Siemens presents
Additive Manufacturing Network**

Maximize your business potential with Additive Manufacturing



Enterprises

- Digital inventory
- Collaboration
- RFQ/ Bidding
- Suppliers network
- Order management

"We are using the AM Network to scale additive manufacturing globally and ramp up production, all while maintaining a high standard of quality."



Suppliers

- Order management
- Cost analysis
- Planning & Scheduling
- Production tracking
- Dashboards and reports

"We have full confidence in the AM Network to help us facilitate the a smooth flow of information among the various functions within the organization". "It will also allow us to effectively connect to our external customers, while providing a detailed outlook on costs and production time from beginning to end."



Plug in to the AM Ecosystem

- ➔ Connects buyers with a global supplier network
- ➔ Streamlines the process
- ➔ Fosters collaboration
- ➔ Orchestrates the workflow



Venturing into the future of AM – together



"We are now expanding our successful partnership with Siemens to include the AM Network in order to form an integrated and streamlined solution to meet the needs of the market."



"Siemens' AM Network facilitates that connection with HP's highly qualified Digital Manufacturing Network Partner."



Thinking Industrialized Additive Manufacturing Further

Formnext 2019, Hall 12.1 | Booth D81