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Session 1: Metallischer 3D Druck

Industrielle AM Prozesskette für PBF in der Anwendung bei Siemens

Martin Gehringer | 11.09.2019 | 3DWEEK, Lübeck

Das Unternehmen Siemens
Neuaufstellung zum 1. April 2019

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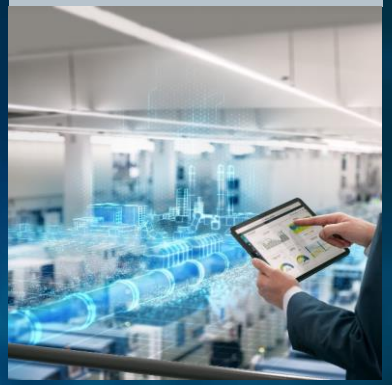
Operating Companies

Gas and Power*

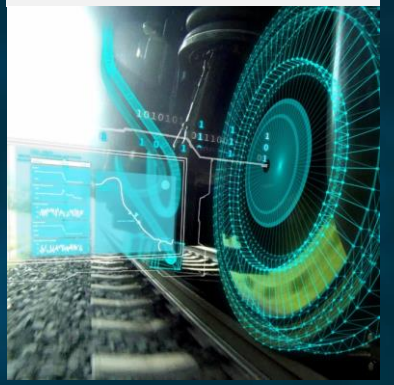
Smart Infrastructure

Digital Industries

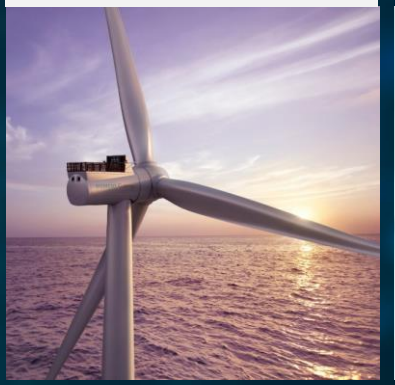


Strategic Companies

Siemens Mobility



SIEMENS Gamesa RENEWABLE ENERGY *



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Service Companies (Financial Services, Global Business Services, Real Estate Services)

Corporate Development (u.a. IoT Services, Corporate Technology, Next47, Portfolio Companies)

Governance Einheiten

* Geplanter partieller Spin-off von Gas and Power; geplanter Transfer des Mehrheitsanteils (59 Prozent) an SGRE zur neuen Gesellschaft.

Die Schwerpunkte unserer Forschung und Entwicklung
AM ist einer der 16 Schwerpunkte im Unternehmen

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Additive Fertigung	Autonome Robotik	Blockchain-Anwendungen	Vernetzte (e)Mobilität	Konnektivität und intelligente Geräte
Cybersecurity	Datenanalytik, Künstliche Intelligenz	Verteilte Energiesysteme	Energiespeicher	Zukunft der Automatisierung
Materialien	Leistungs-elektronik	Simulation und digitaler Zwilling	Softwaresysteme und Prozesse	

From Lab to Fab: Additive Manufacturing relevant in a wide range of industrial applications

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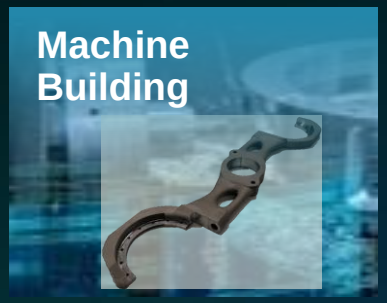

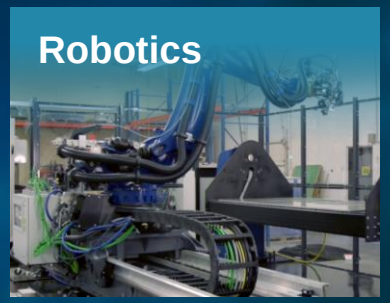

Drivers for industries are different …

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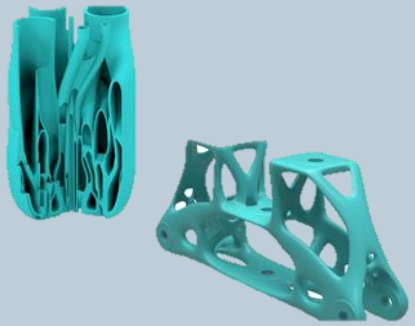
Product transformation
Shift from conventional design to innovative DFAM

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.
- Accelerate innovation

Reinvent manufacturing

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

STATUS QUO

Manufacturing transformation

“If you can print a turbine blade, you can print pretty much anything”

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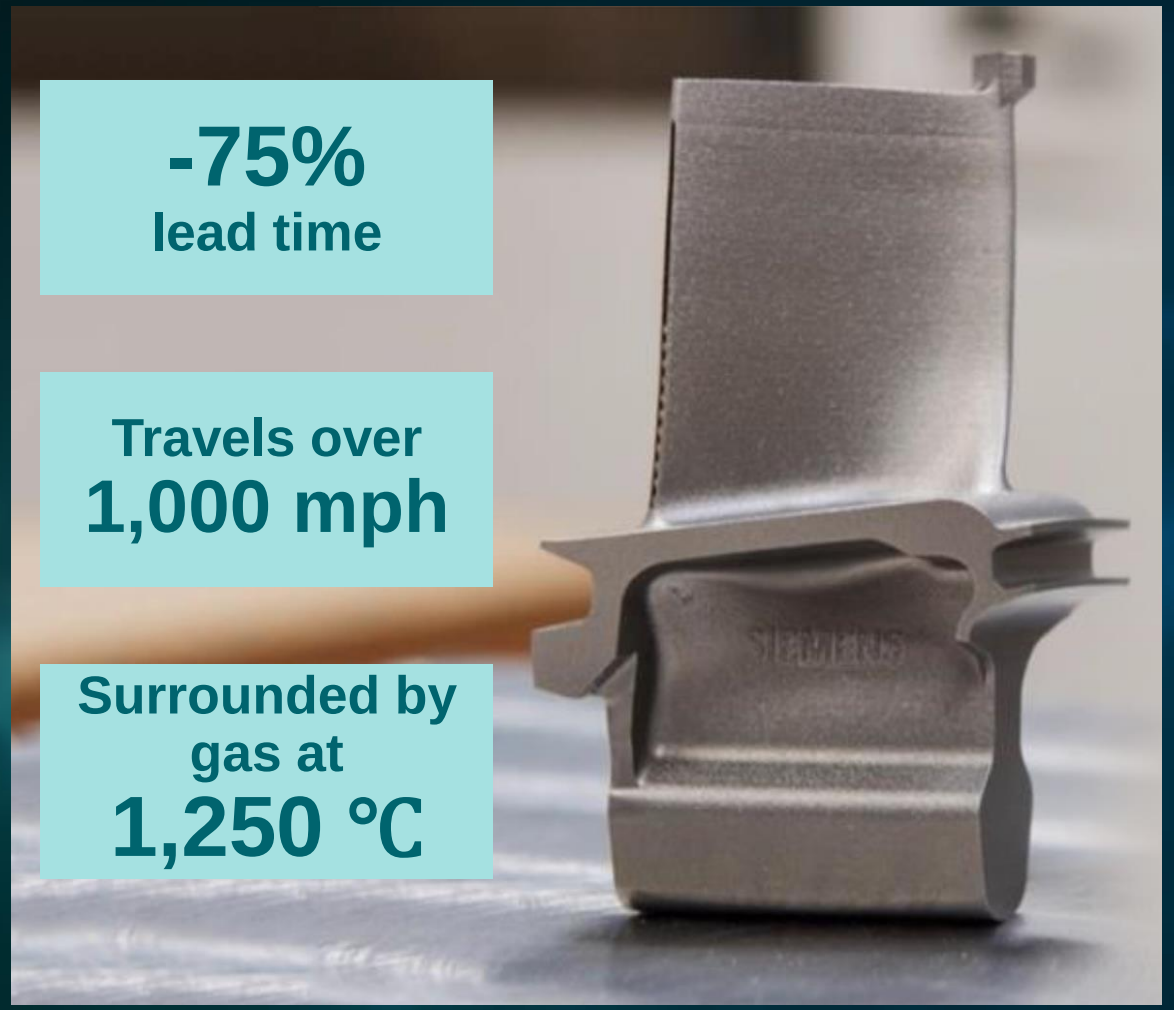

Siemens awarded by ASME
for 3D-printed gas turbine blades

Siemens, Superalloy gas turbine blades – winner

3D-printing use case or application

ASME
SETTING THE STANDARD

3D PRINTING INDUSTRY
THE AUTHORITY ON 3D PRINTING

From 1st machine invest to Design for AM serial parts in less than a decade

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First SGT-800
Repair Application

SGT-1000F
Spare part on demand

Turbine blade
printed & tested in engine (SGT-400)

SGT-700
DfAM Serial parts

Serial Production
of Gas Turbine core components

2006 — **Materials Solutions** founded in the UK

2009 — Installation of the **1st EOS M270 SLM** machine in FSP

2013

2014

2015

2016 — **Materials Solutions** acquisition

Materials Solutions
A Siemens Business

Finspång
Industrial workshop inaugurated

2017

2018 — **Materials Solutions** move into new facility

“Tipping Point” towards Design for AM serial production parts

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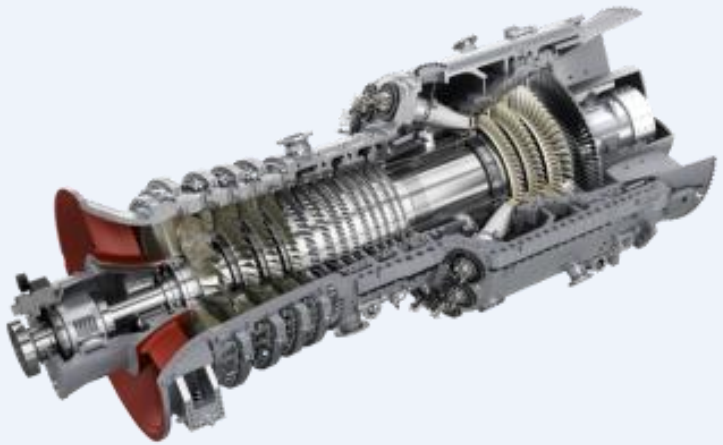
SGT-9000HL combustion system



NO_X

reduction

Lifetime

increase

SGT-700/800 DfAM burner

more than

8,000

operating hours
on E.ON engine

Design for AM
als Schlüsselelement

Function-driven Design for AM enabled by top-class domain expertise

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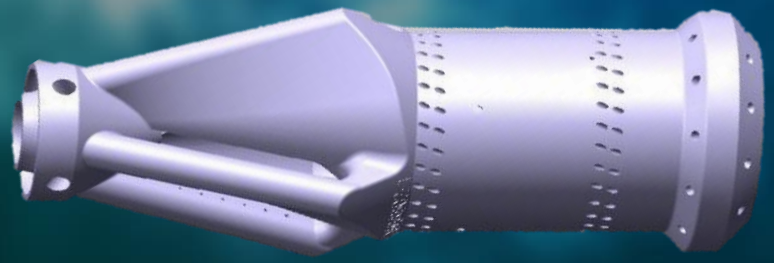
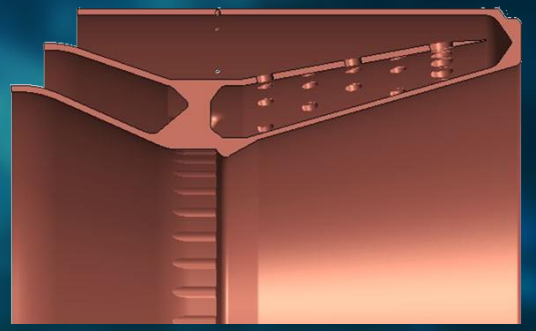
Functional Integration

13
parts



1
part

Design for AM only



conventional
Copy

DfAM
only

Herausforderungen für den industriellen AM Einsatz

Additive Manufacturing Industrialisation Challenges

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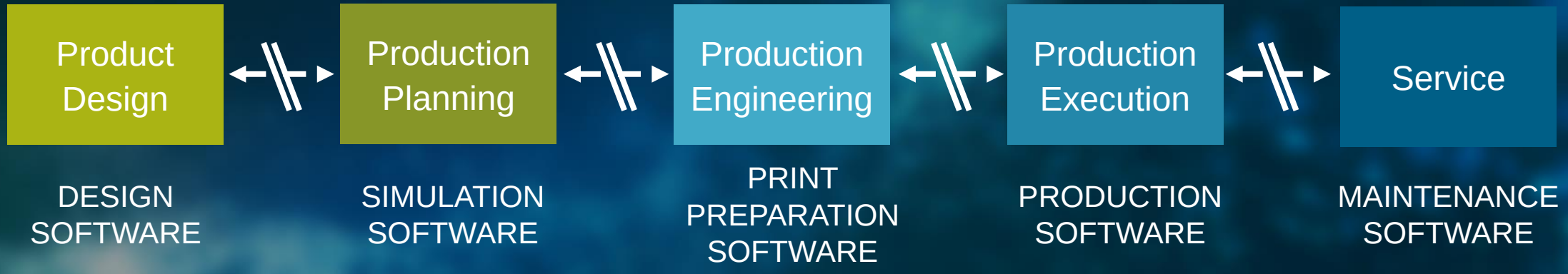
What are the limitations today?



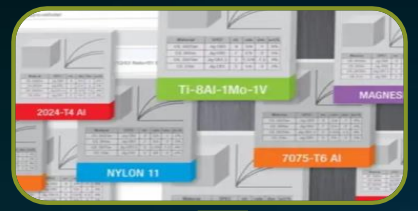
Conventional thinking

Disconnected software

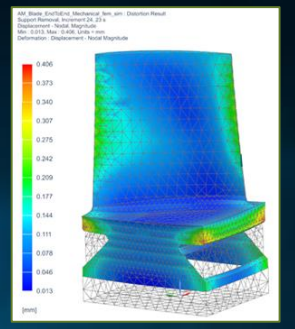
Multiple file conversions

Out of control workflow

Design for AM and end-2-end digital chain



SIEMENS AM Material Database



AM process simulation

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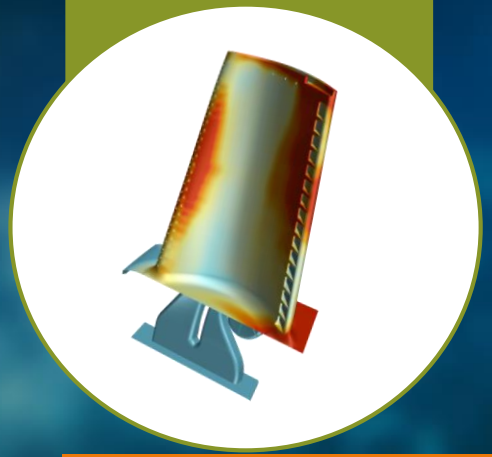
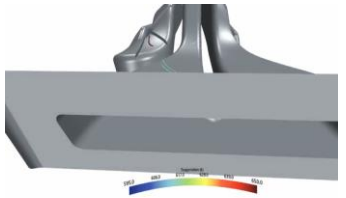
Design for AM in NX

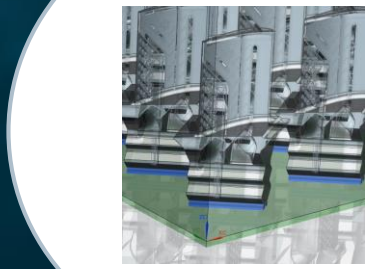
Structural FE Analysis in Simcenter 3D

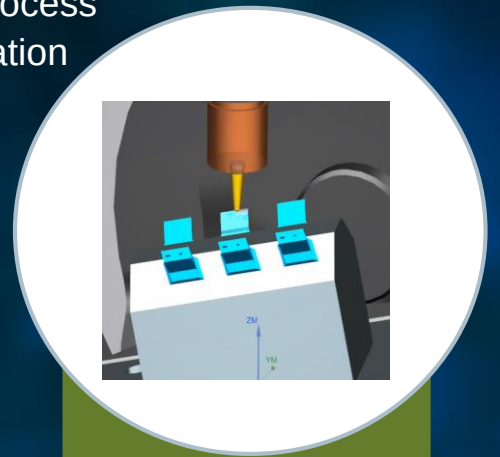




- **CFD / Heat Transfer Analysis**
- **Multi-Physics Topology Optimization**

AM build preparation & support structure optimization





Integrated post-processing & quality analysis in NX CAM

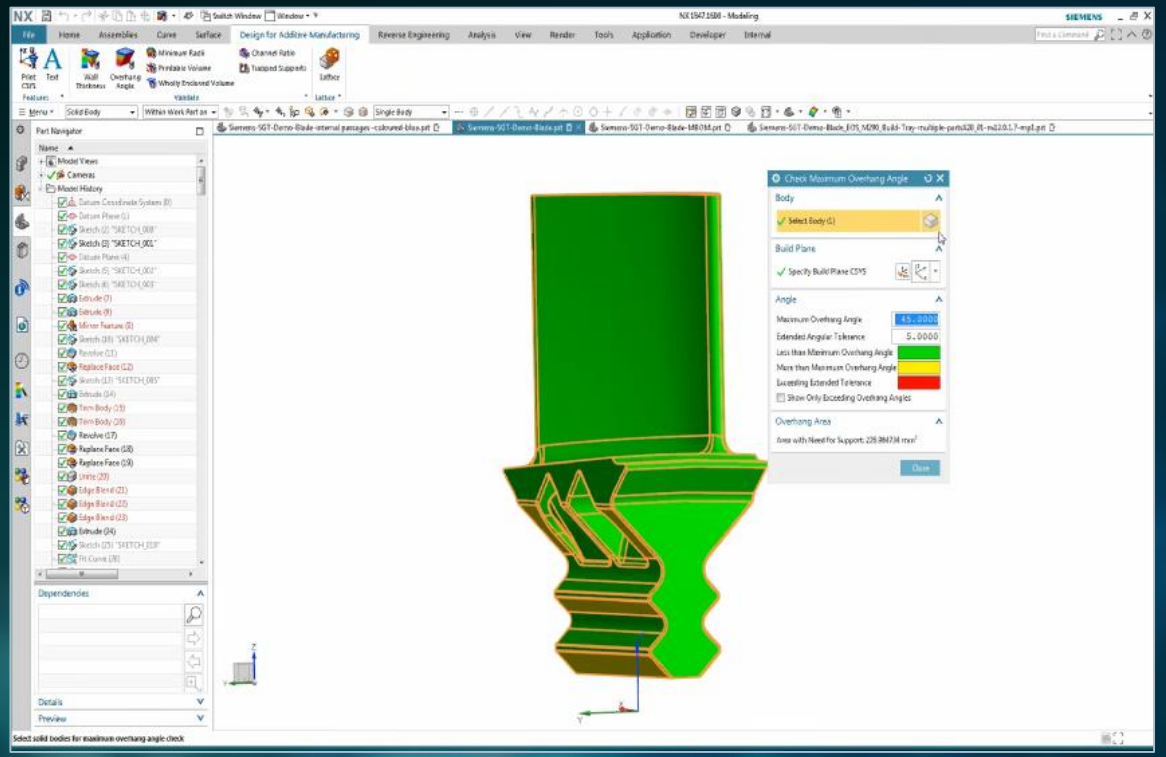
Simcenter 3D: Simulationsumgebung

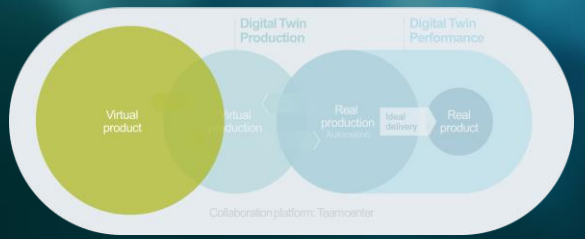
Siemens **NX** : Integrierte CAD CAM CAE Lösung

Teamcenter : Product Lifecycle Management (PLM) System

Siemens NX und Simcenter 3D für AM

One integrated Additive Manufacturing Solution
Validate customer design for manufacturability using NX





Digital Twin
Product

Overview:

- Using the powerful DfAM (Design for Additive Manufactruing) tools within NX, users can evaluate the ‘Manufacturability’ of designs and assess if features are likely to be problematic

Benefits:

- DfAM tools directly in the CAD software (intuitive for designers)
- Widest range of checkers availiable in the industry
- Immediate visual feedback of geometry based build issues

One integrated Additive Manufacturing Solution
Simulate & suggest changes using NX & Simcenter

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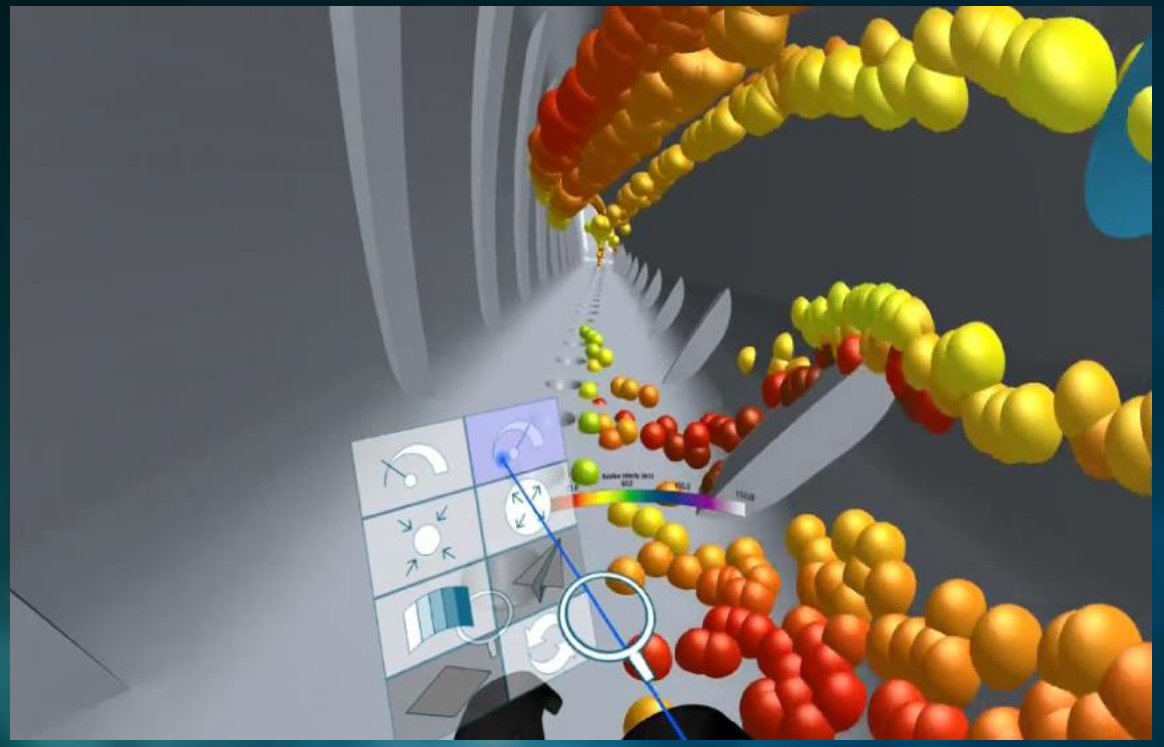
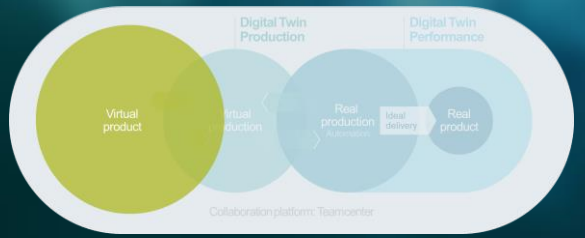




Digital Twin
Product

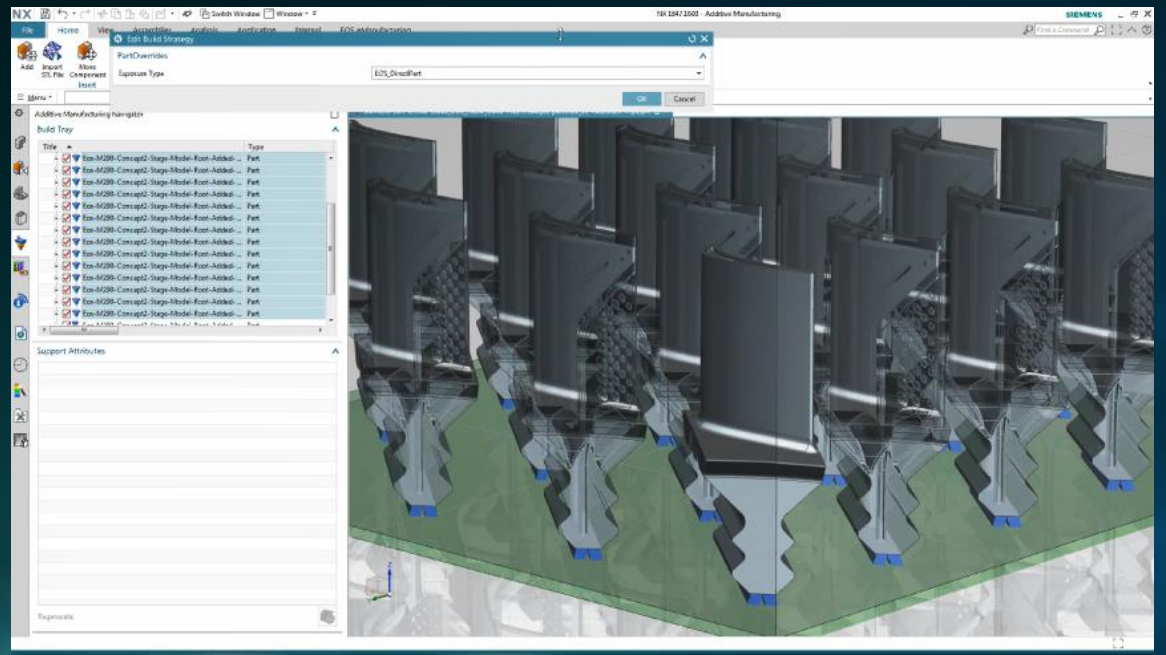
Overview:

- Utilise Siemens Simcenter 3D CAE & VR tools to assess product performance.
- Having understood the products characteristics, suggest design changes that improve manufacturability.

Benefits:

- Increase confidence in Manufacturability.
- Ensure Right First Time printing and Reduce Costs.
- Easily identify potential improvement areas for customers.

One integrated Additive Manufacturing Solution
Prepare parts for right first time printing using NX and Simcenter

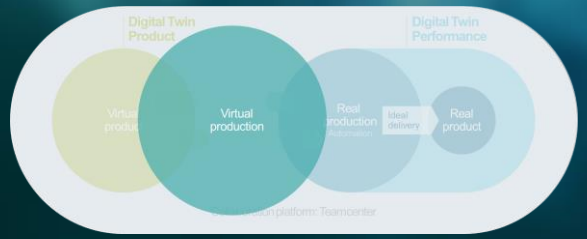


Overview:

- Connect to digital twin of the 3D printer, allowing 3D models to be added.
- Position parts in virtual build tray and allocate build strategies

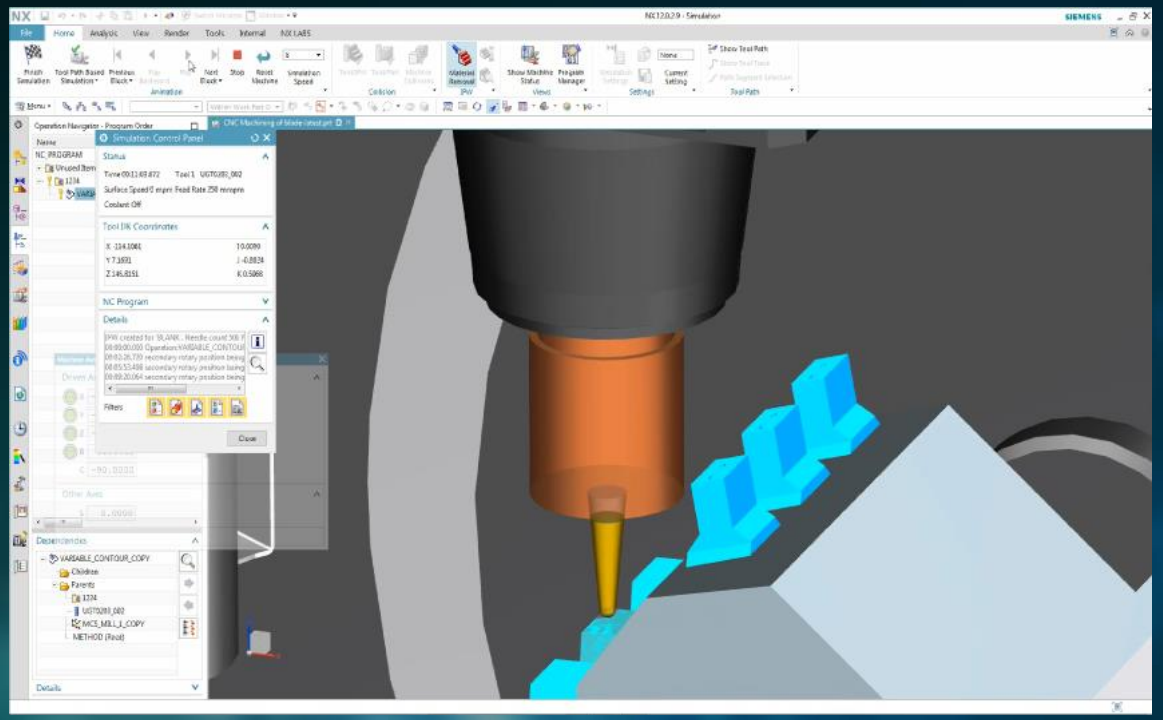
Benefits:

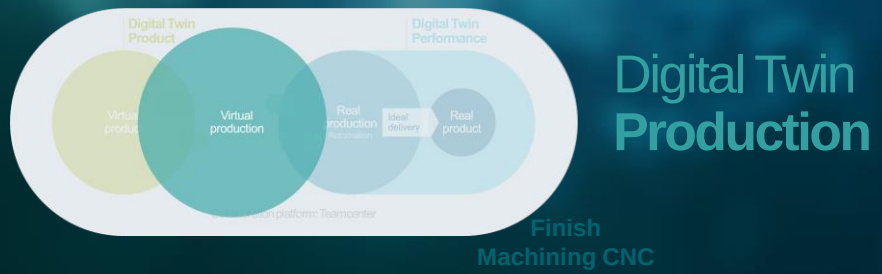
- Seamless and associate process from design through to production planning



Digital Twin
Production

One integrated Additive Manufacturing Solution
Remove supports & machine finished features using NX CAM





Overview:

- From the same environment engineers can set-up CNC machining steps to finish detailed features and remove excess printed materials, utilising digital twin of the machine tool.

Benefits:

- Simple intuative template based process
- Accurate and repeatable removal of excess materials.

Siemens Holistic Digital Twin enabling ‘Digital Transformation’ for Additive Manufacturing?

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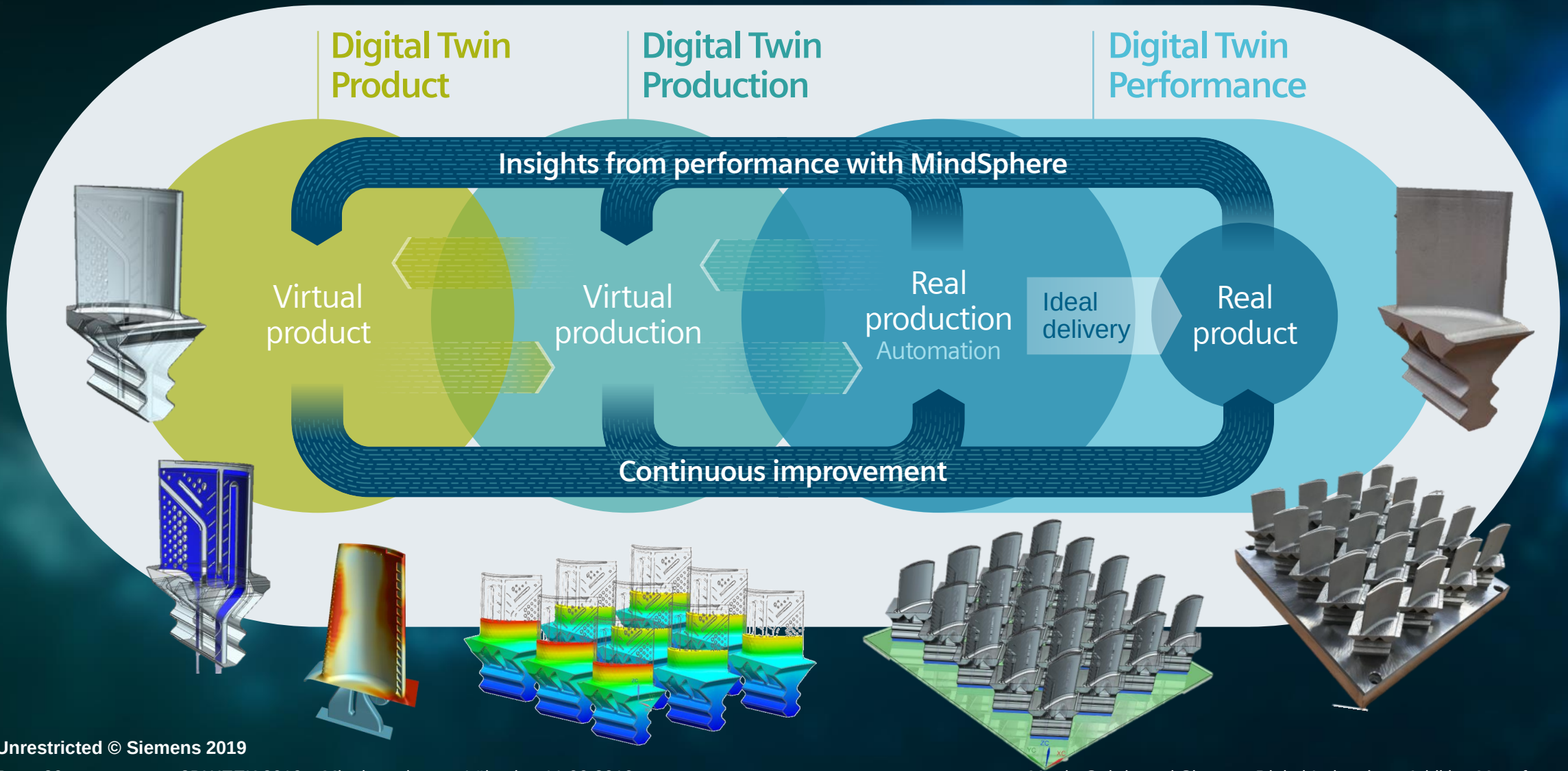

New Siemens Materials Solutions AM Factory opened in December 2018

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Manufacturing & Engineering Services for…

- Power
- Aviation & Space
- Automotive & Motorsports
- Tooling & Processing



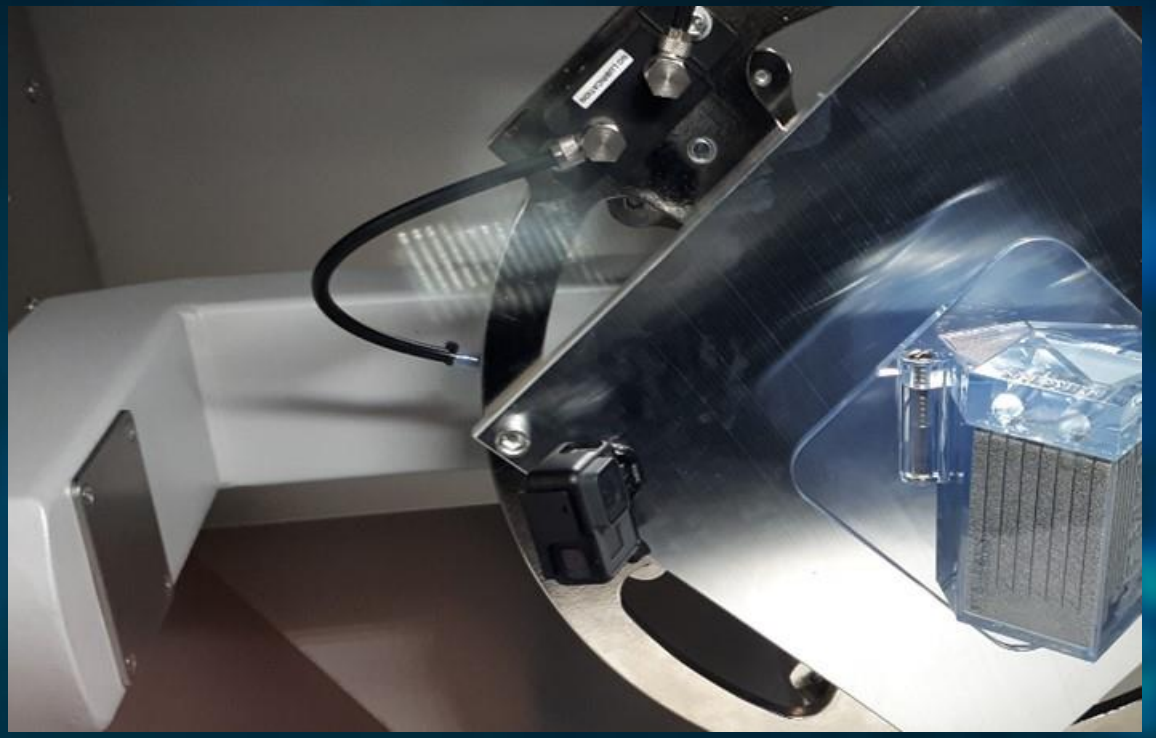
In total	more than	up to
€30 mn	4,500 m²	50
Investment	Factory space	Metal AM printers capacity

- Digitalized production facility to support serial production
- Production and post-processing under one roof

Maschinentechnologie

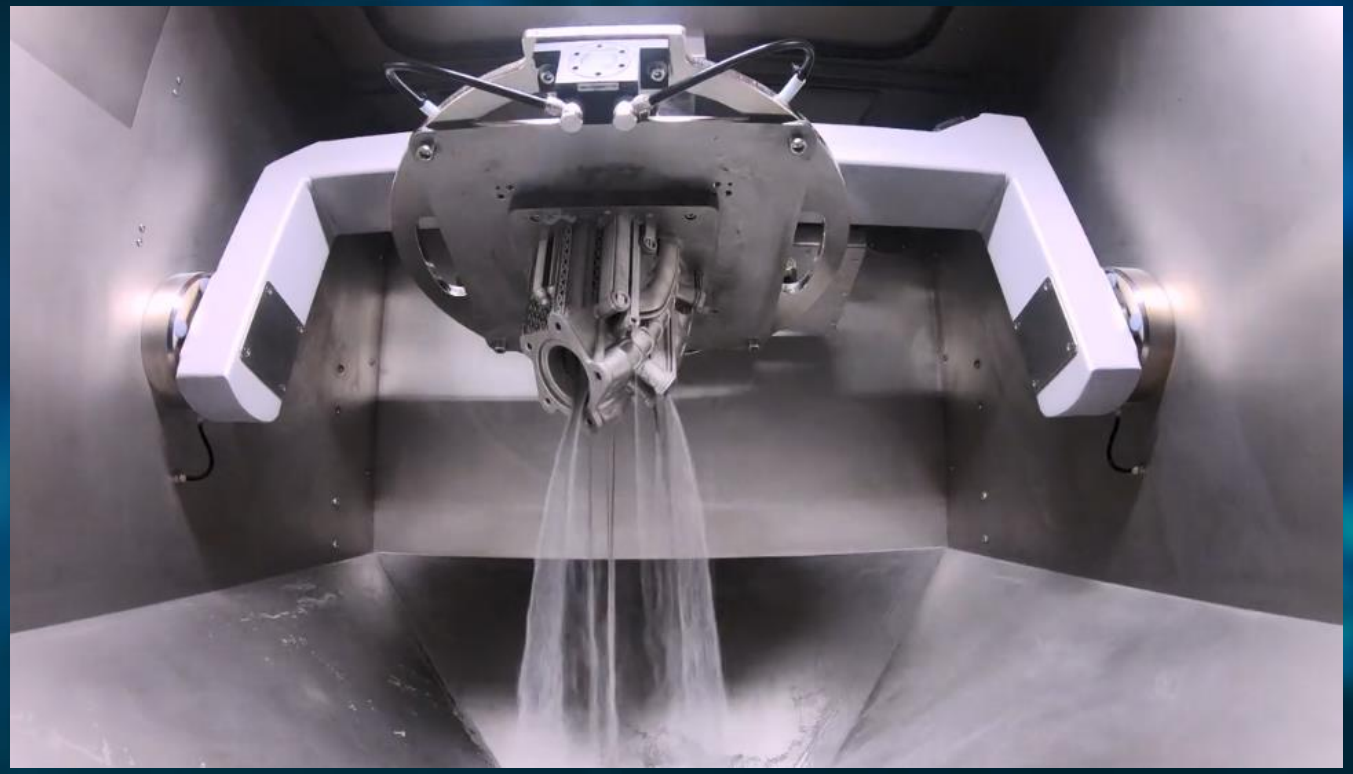
Industrialization critical by leveraging innovations in AM printers and automation of post-processing

- Co-develop printing machines with suppliers
- Flexible printer machines for industrial manufacturing with high productivity



- Partnering with Solukon on advanced depowdering system
- Effective removal of metal powder from complex internal channels

Solukon SFM-AT800S machine overview
De-powdering machine



Solukon and Siemens developed an advanced de-powdering system for metal 3D printed parts. The new system builds on the company's standard SFM-AT800, which can move parts into any three-dimensional position.

Siemens AM Experience Center
Opening of expanded area May 9, 2019

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Experience seamlessly integrated Industrial Additive Manufacturing

Power

Aviation & Space

Automotive & Motorsports

Machine tool Industry

more than
50
Portfolio elements of Digital Enterprise in action

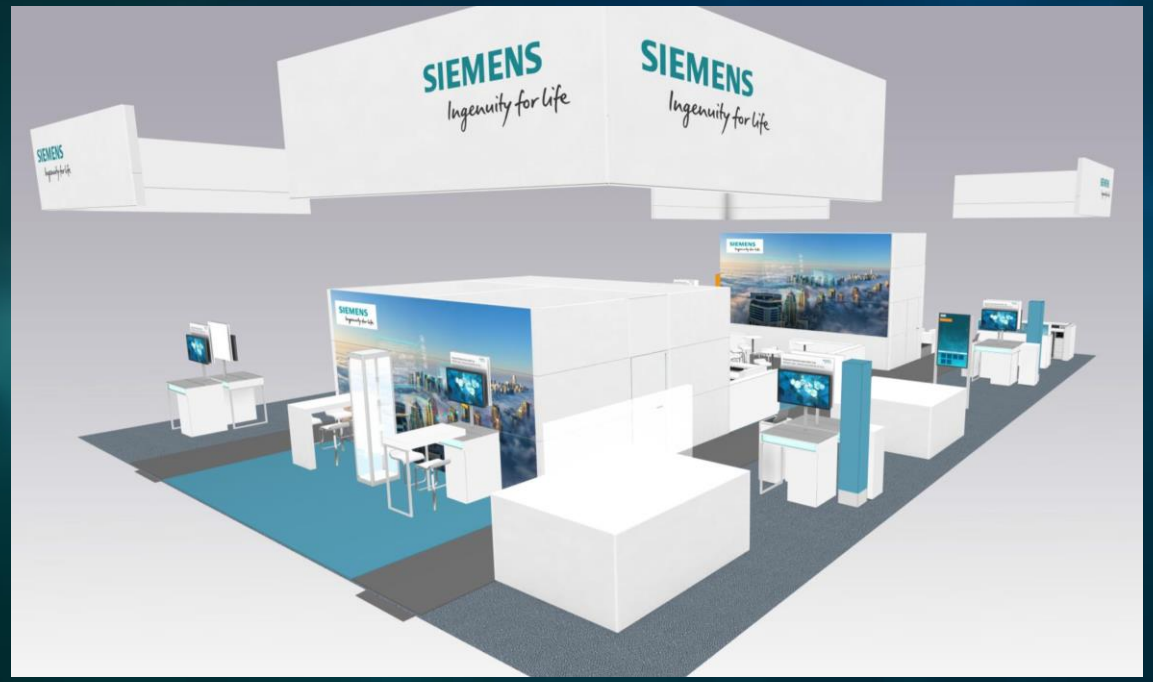
more than
350 m²
workshop space

more than
2700
visitors in first year

- Live use-cases from design to deliver for all industrial AM applications
- Broad coverage of materials and leading machine technologies
- Experience the power of the Digital Twins and automation

Besuchen Sie uns auf formnext 2019
Messe Frankfurt, 19.11. bis 22.11.2019

Halle 12.1 Stand **D81**



- Lösungen von Siemens Digital Industries zu den Technologiefeldern Powder Bed Fusion, Jetting, Laser Metal Deposition und Material Extrusion

- Dienstleistungs- und Fertigungsangebot von Materials Solutions

Vielen Dank für die Aufmerksamkeit

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