

New digital twin capabilities to accelerate the certification process for aerospace components

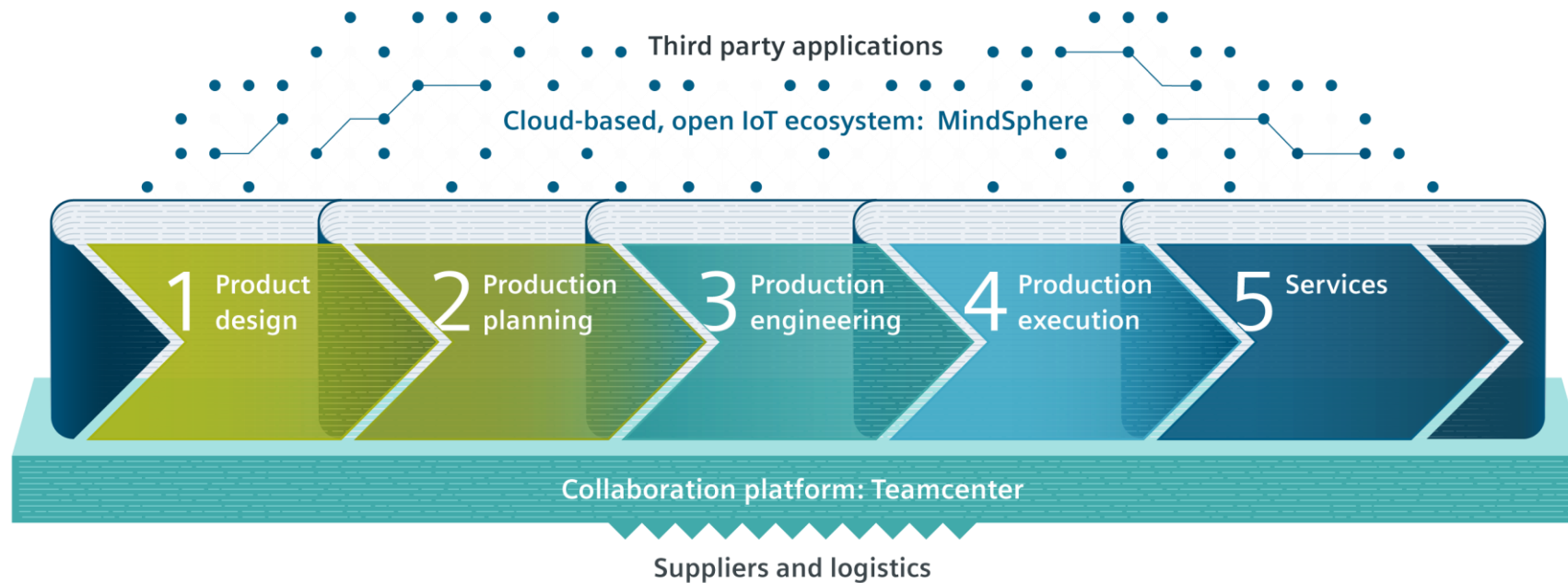
2019 EASA-FAA Workshop on Additive Manufacturing
Köln, 6 Nov 2019

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Zach Dyer (Siemens Energy)

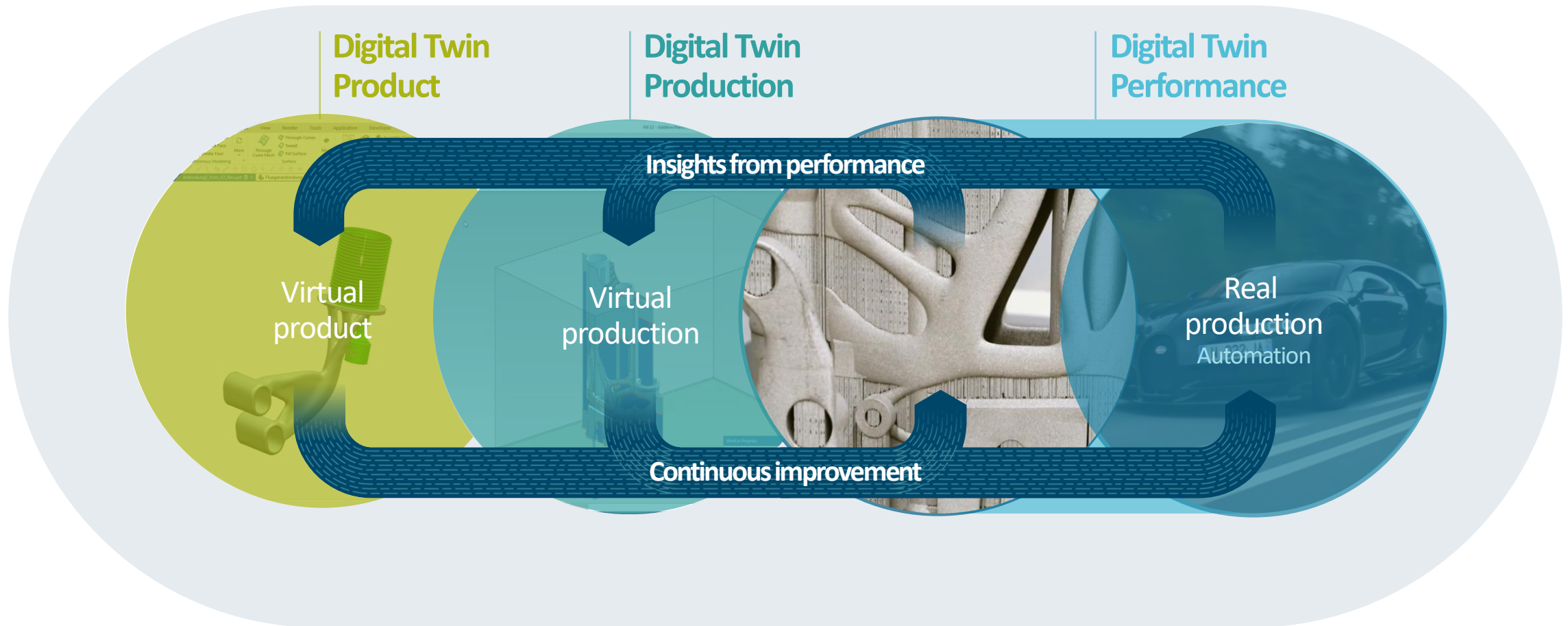
Siemens Digitalization Strategy



Holistic approach for an Integrated Product and Production Lifecycle



Industrialize Additive Manufacturing: Design and produce useful parts at scale



One integrated CAD/CAM/CAE AM Solution

From requirement driven Generative Design to 3D Printing



NX for Additive Manufacturing – One integrated Solution

Digital Product Twin

Digital Production Twin

Simcenter 3D

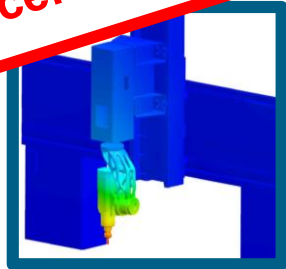


Generative Design

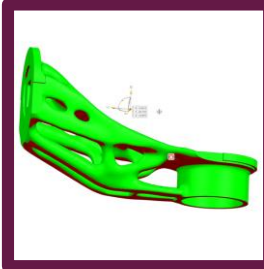
Simcenter 3D



Adaption

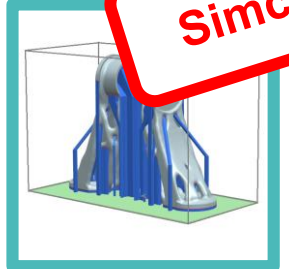


Product Validation

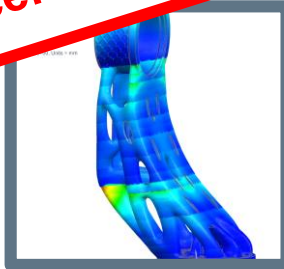


Additive Manufacturing Checkers

Simcenter 3D



Build Preparation



Build Process Simulation



Part Finishing, Quality & Security

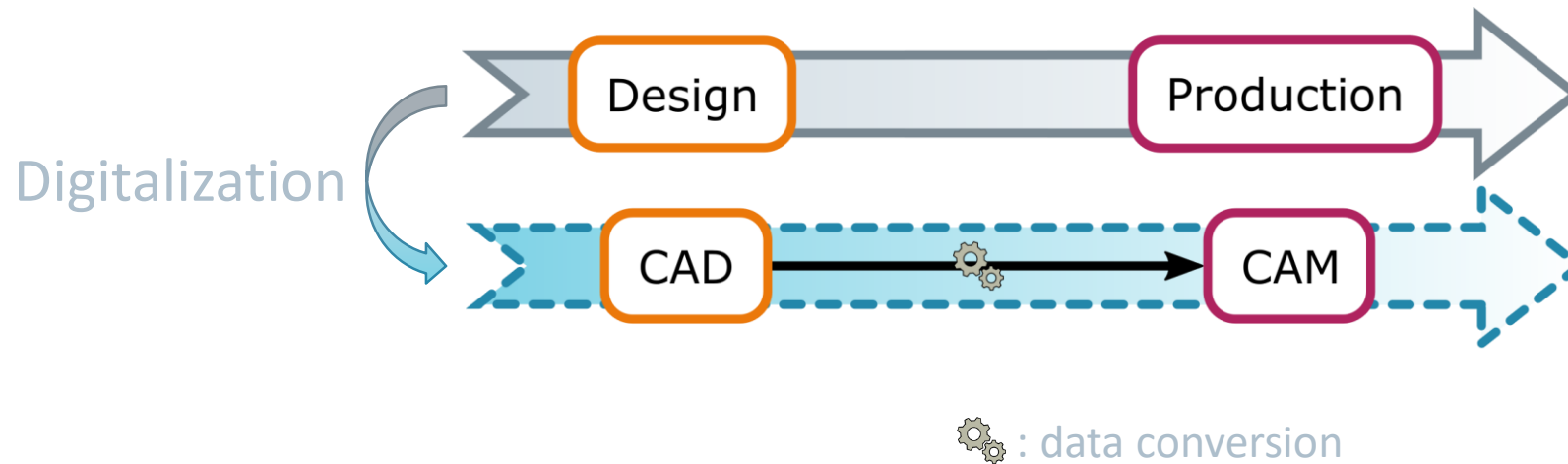


Manufacturing Execution

Data and Process Management in Teamcenter

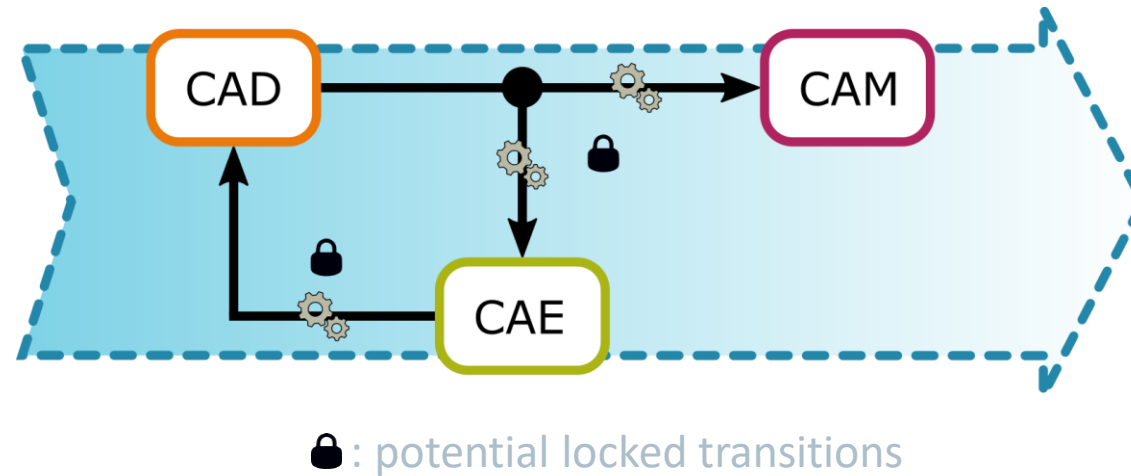
Enhance the digital workflow to handle AM industrialization

- ▶ State-of-the-art analysis in end-to-end AM engineering software



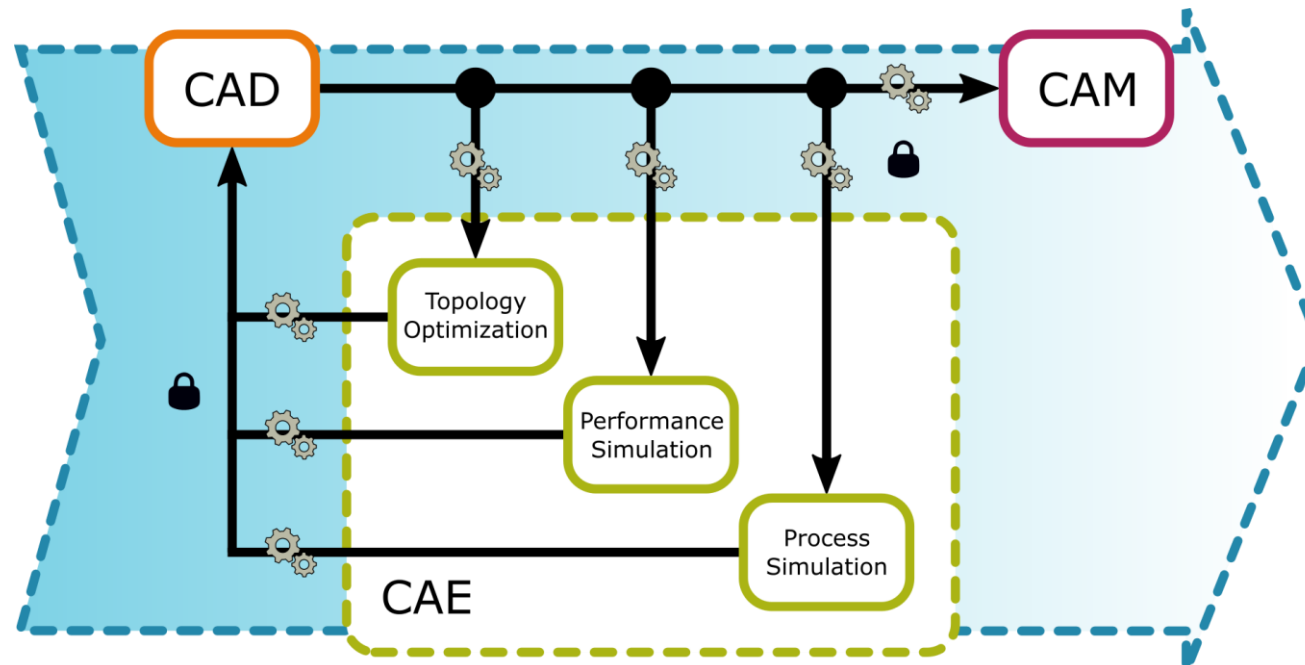
Enhance the digital workflow to handle AM industrialization

- ▶ State-of-the-art analysis in end-to-end AM engineering software



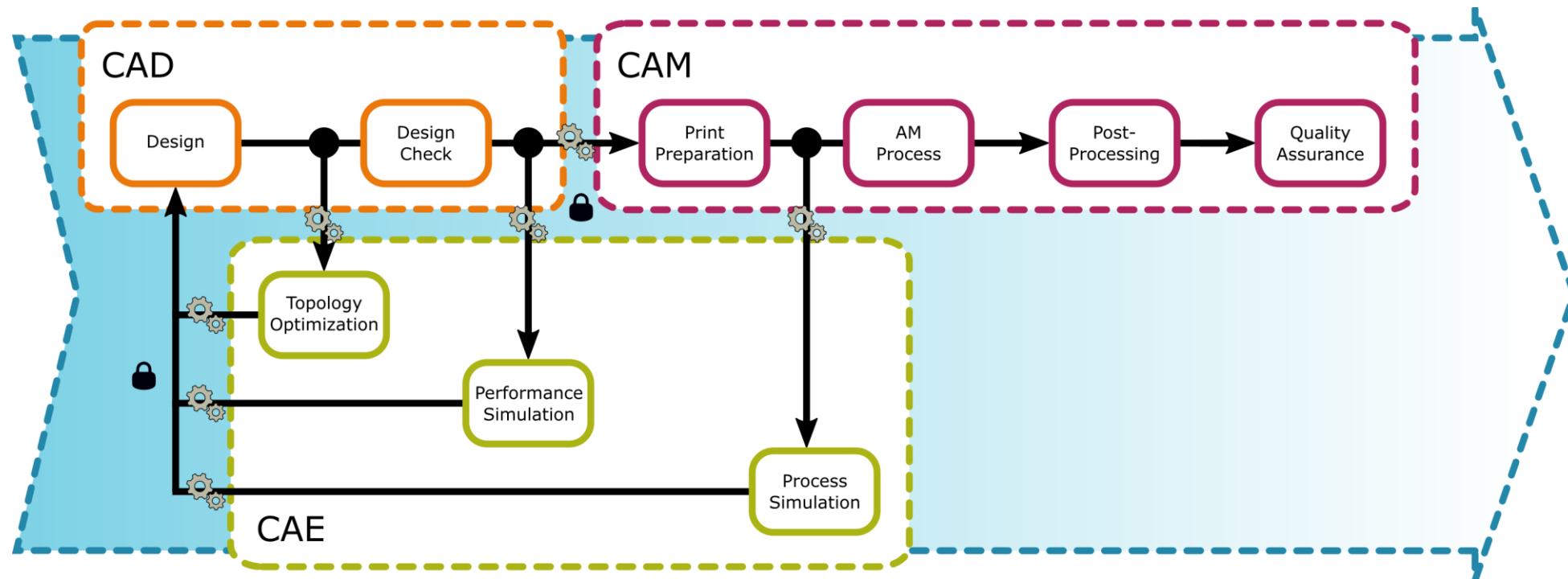
Enhance the digital workflow to handle AM industrialization

- ▶ State-of-the-art analysis in end-to-end AM engineering software



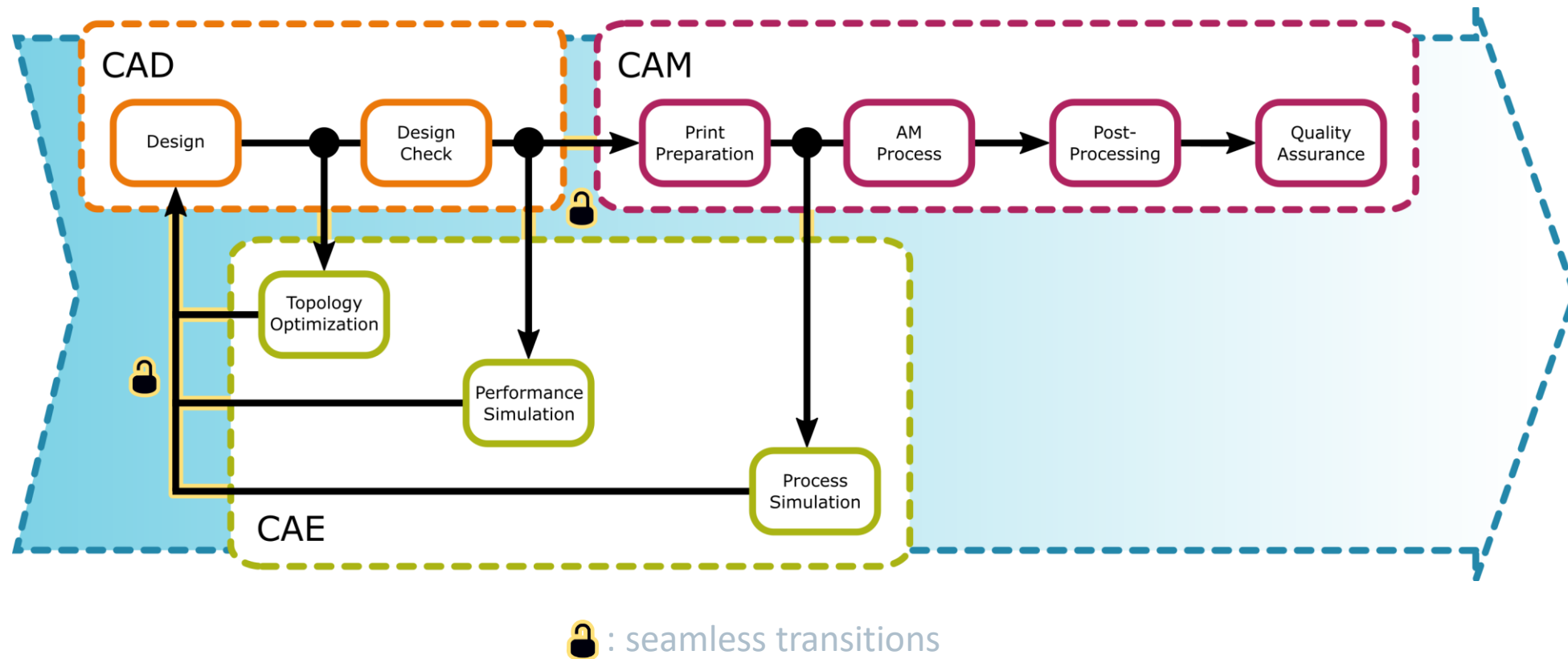
Enhance the digital workflow to handle AM industrialization

► State-of-the-art analysis in end-to-end AM engineering software



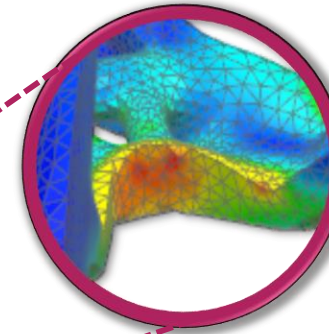
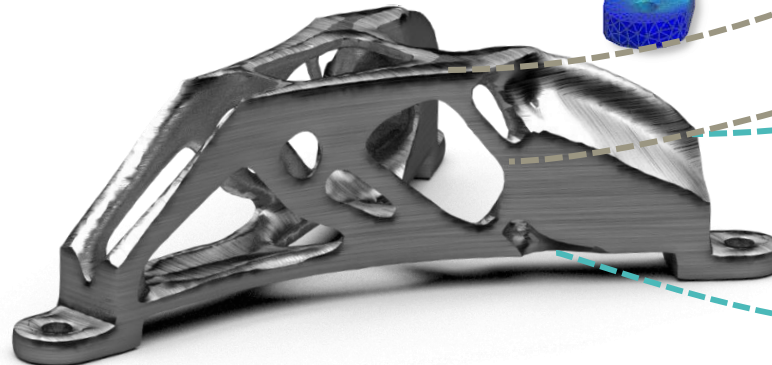
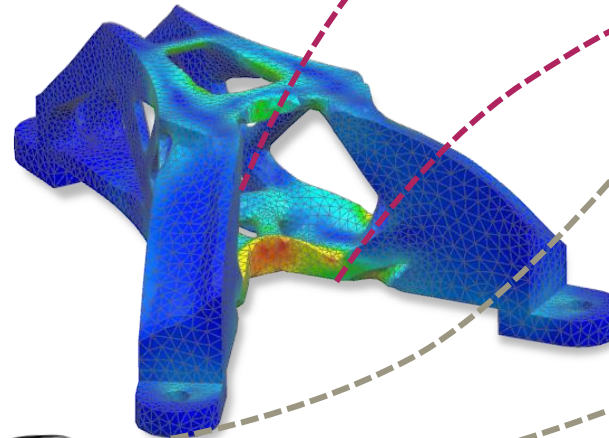
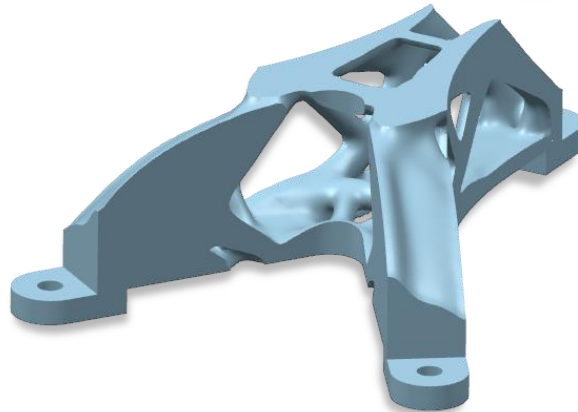
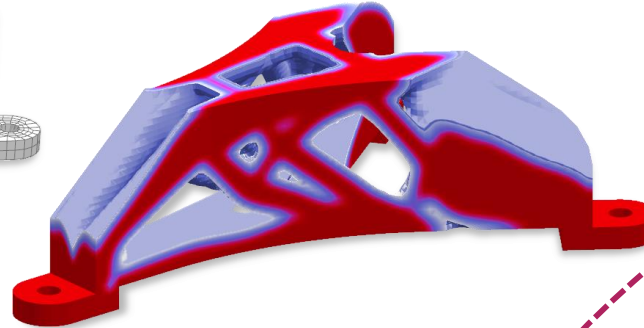
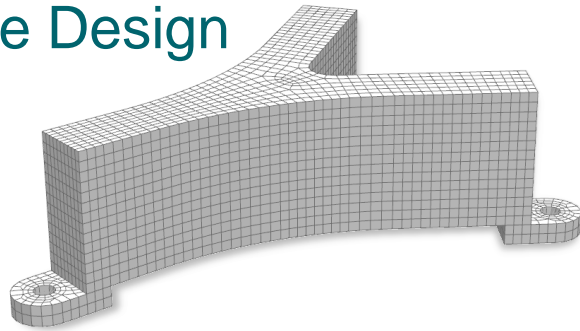
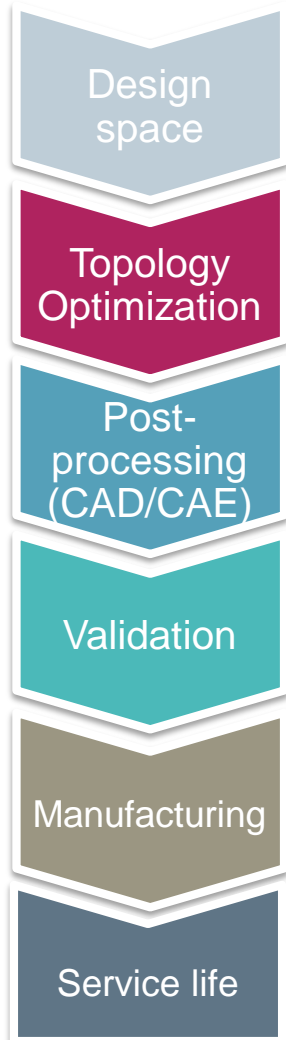
Enhance the digital workflow to handle AM industrialization

► State-of-the-art analysis in end-to-end AM engineering software



Simcenter 3D Topology Optimization Generative Design

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Prevent failure by considering **maximum stress control**

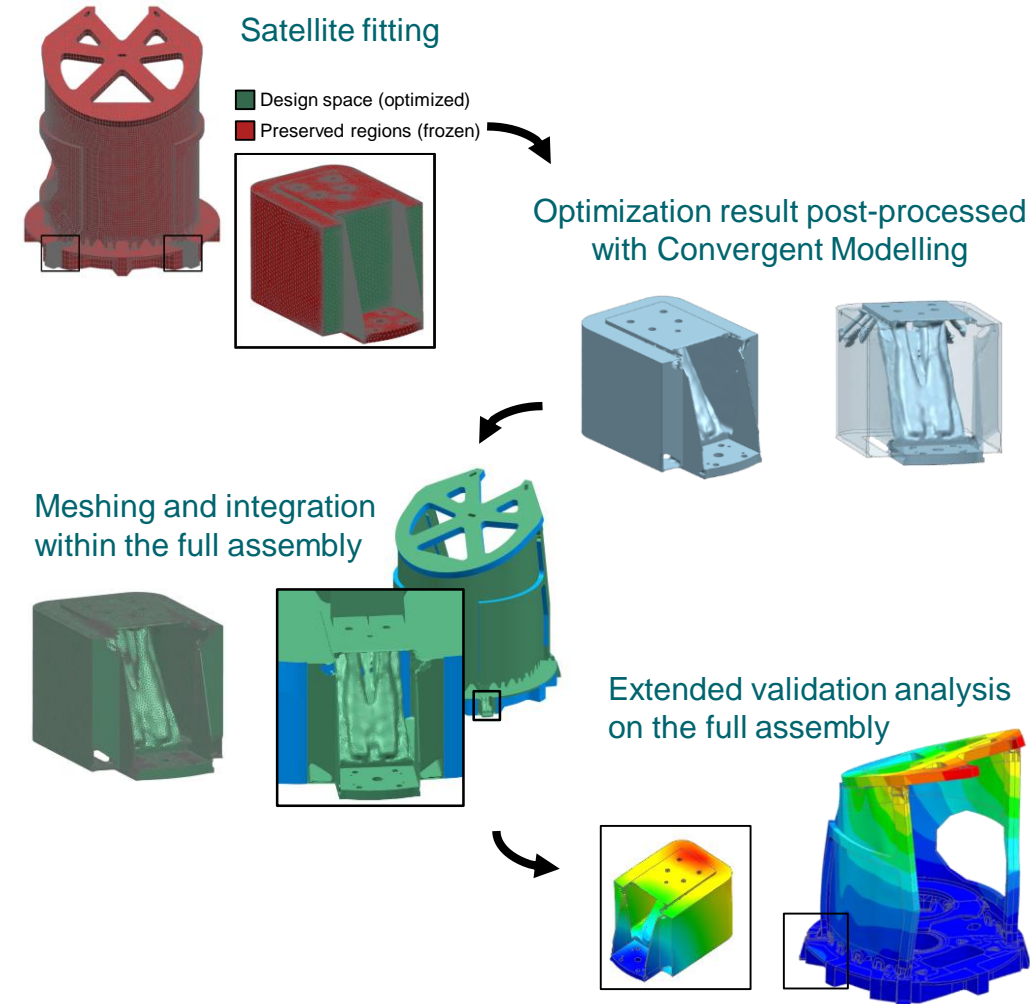


Limit small details with a **minimum length scale**

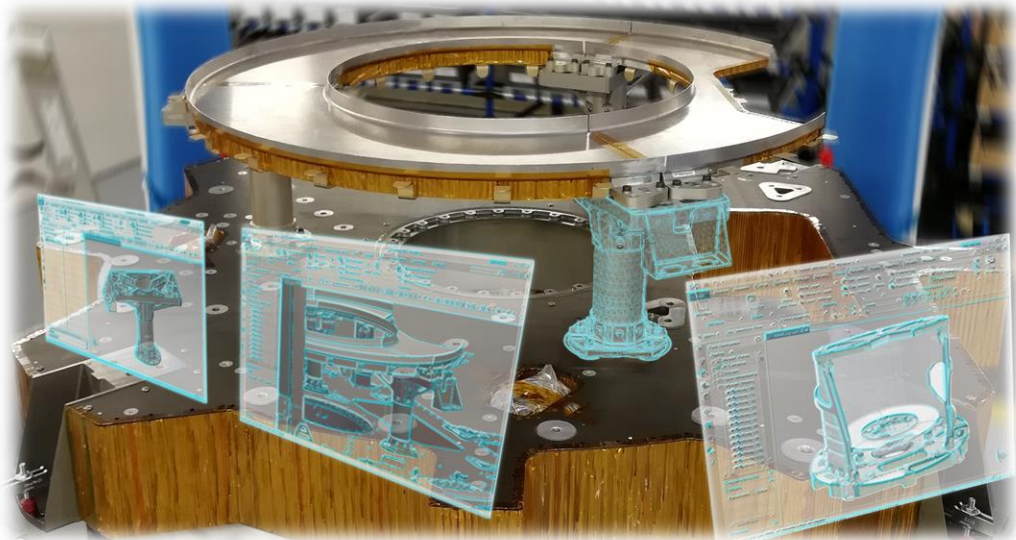
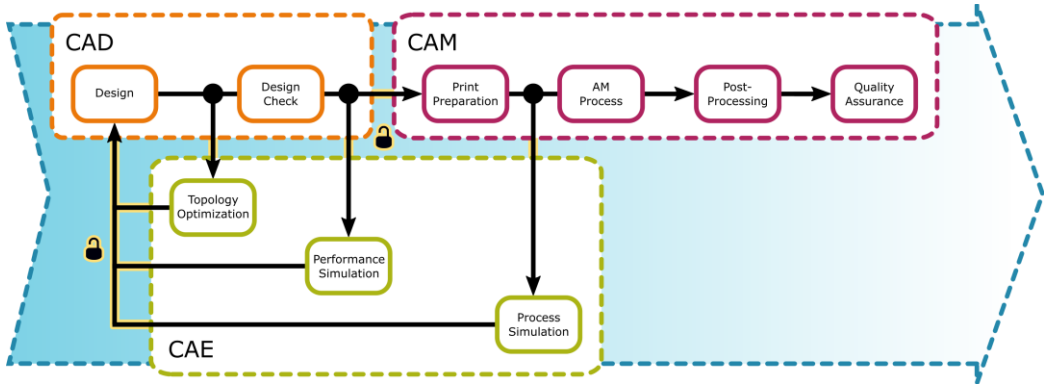


Control bulk region with a **maximum length scale**

End-to-end Additive Manufacturing engineering software, including Topology Optimization and Process simulation



Originates from project
“FASAMA”, “ANY-SHAPE4.0”



Originates from project
“Design4AM”



Siemens Digital Industries Software

Predict and prevent AM failures with process simulation

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Simcenter 3D Additive Manufacturing

Build Process Simulation for Powder Bed Fusion Applications

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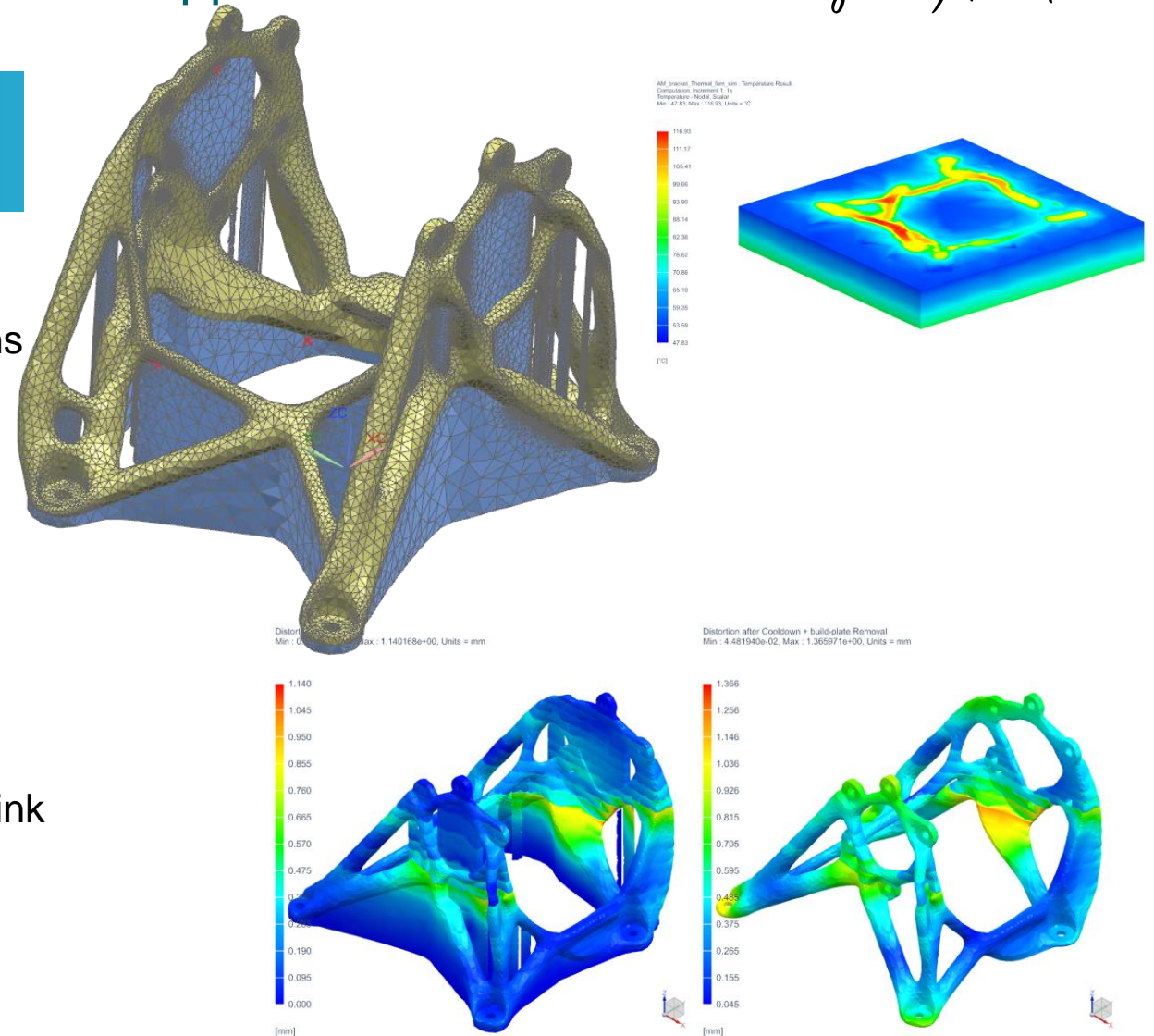
Predict Distortions and Compensate to
“Print first time right”

Challenge:

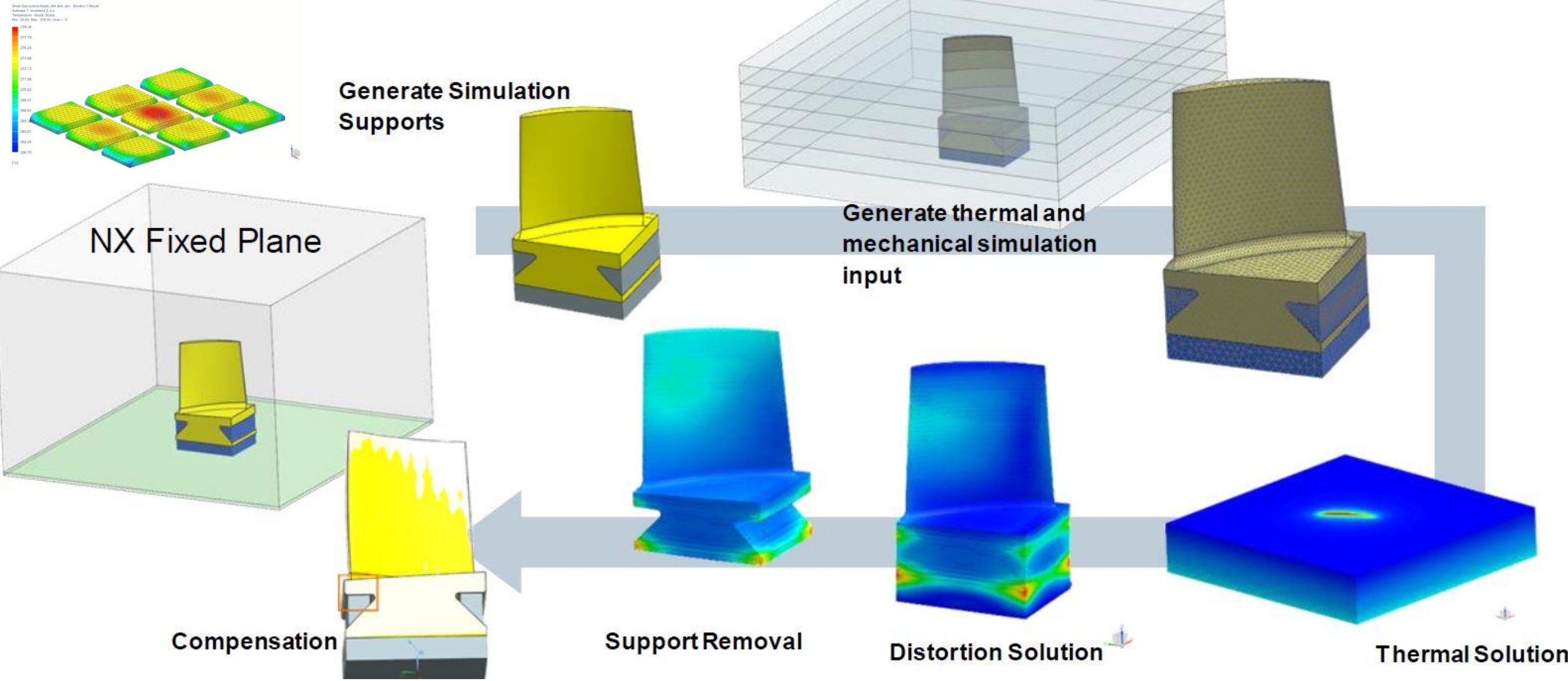
- Complex Thermo-Mechanical processes lead to distortions while 3D printing
- Many test prints have to be performed to find the right components orientation, correct support structures, good print setup.

Solution:

- Predict distortions using Simcenter 3D Additive Manufacturing
- Get information about thermal profile, part distortions, shrink lines and support failure.
- Fully Integrated into the Additive Manufacturing workflow.



Simcenter 3D Additive Manufacturing Simulation Workflow

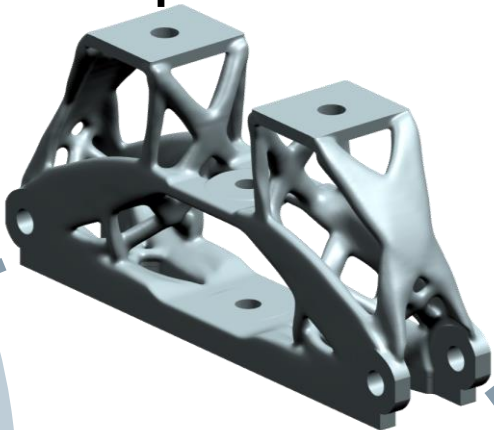


ML-enhanced Fatigue Analysis for AM components in Simcenter 3D

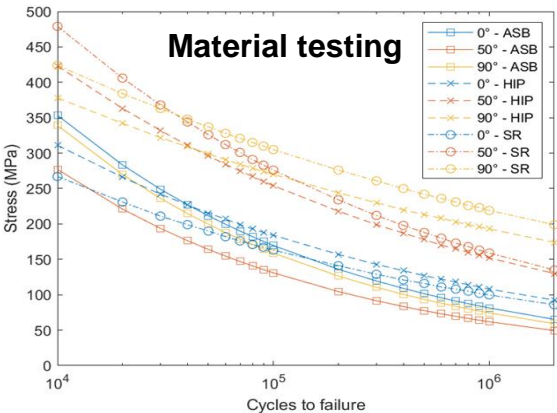
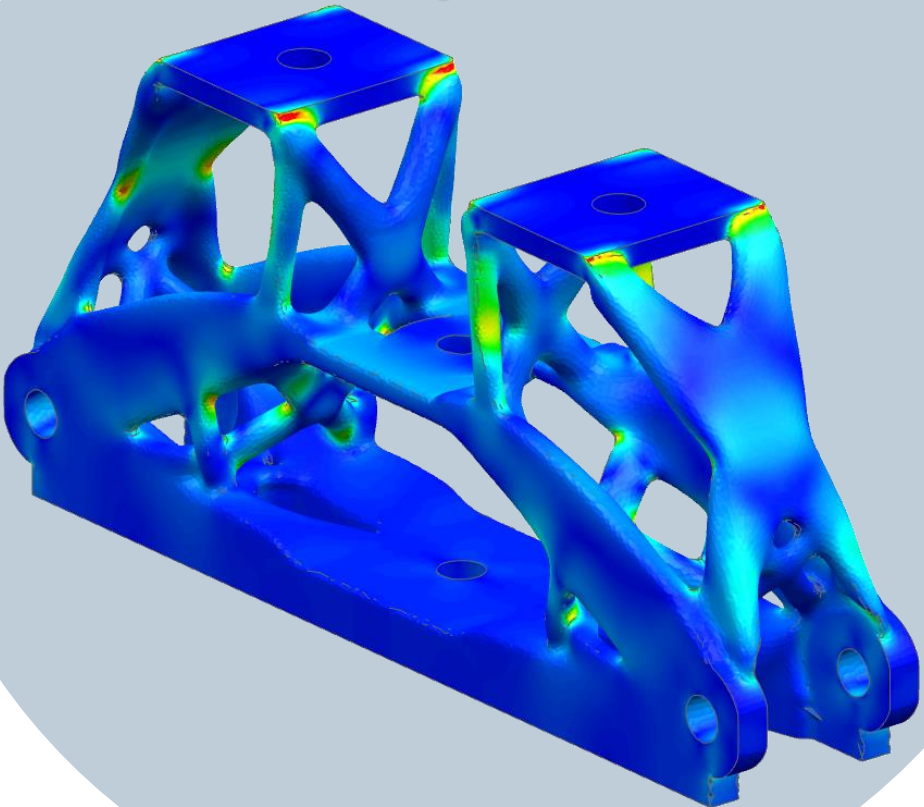
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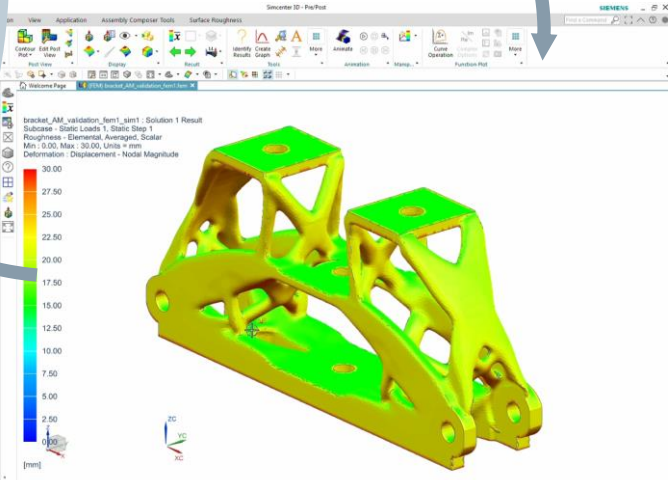
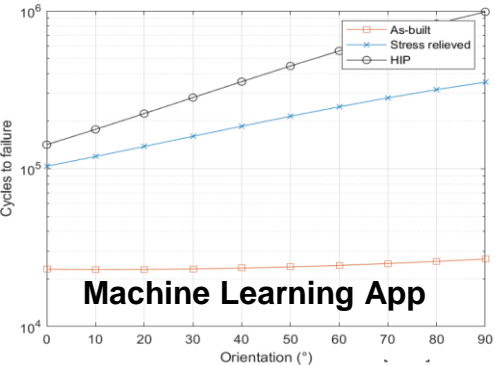
Component CAD model



**AM-enhanced
Durability simulation**



Material database



Automated feature extraction

Siemens Digital Industries Software

Conclusion

Siemens digital thread via the digital product definition provides a comprehensive tool to support aerospace in accelerating the complex qualification & certification process.

How?



- Design and redesign tools
- Simulation (both part and scan strategy)
- Optimization
- Fatigue AM
- Teamcenter to insure traceability & conformance between design and manufacturing

Thank you for your attention

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