Additive Fertigung mit Netfabb

Lukas Fuhrmann

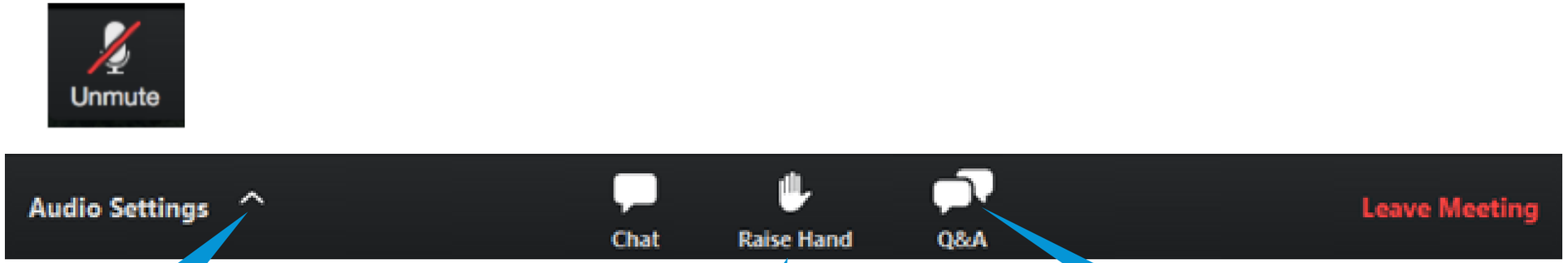
Product Owner Additive Manufacturing

Johannes Kaindl

Education Account Manager

AUTODESK.

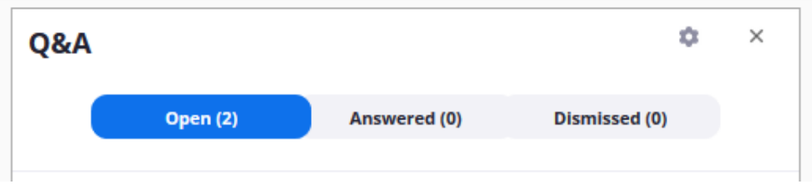
Das Zoom Webinar Panel



Stellen Sie hier Lautsprecher und Microfon ein

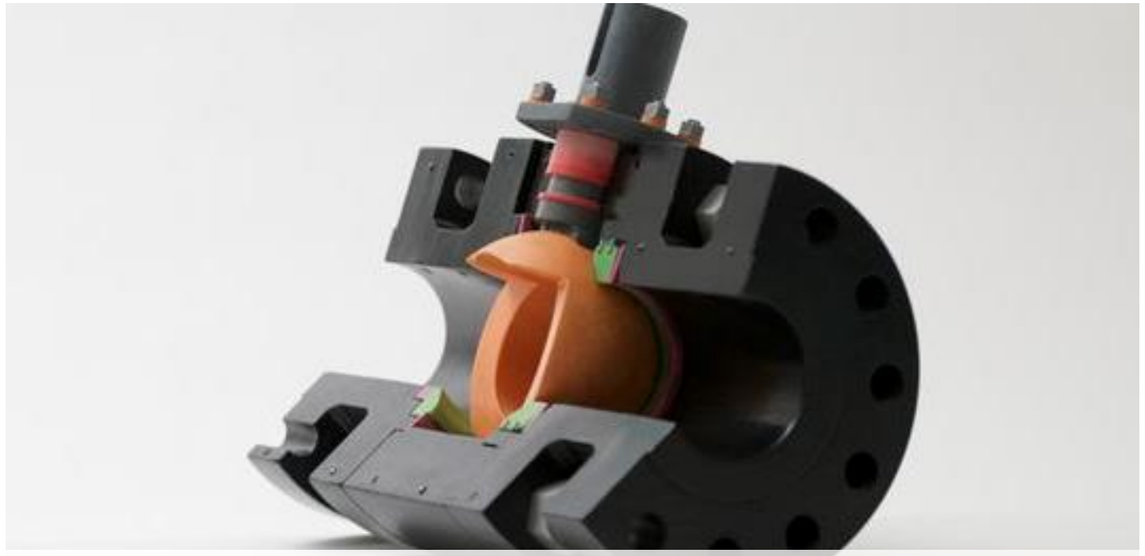
Hand heben für mündliche Fragen

F&A
Geben Sie hier Ihre Fragen ein

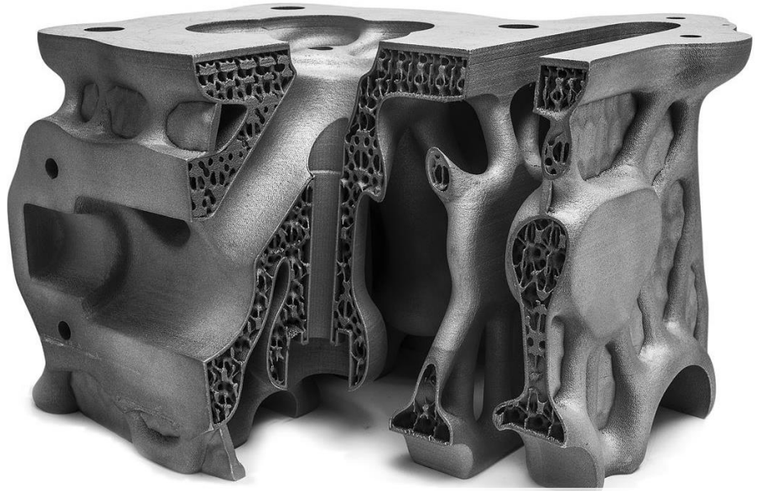


- Vorstellung
- **Generatives Design mit Fusion 360**
- Datenaufbereitung mit Netfabb
- Metall Prozessimulation mit Netfabb
- Latticestrukturoptimierung mit Netfabb
- Fragen und Antworten

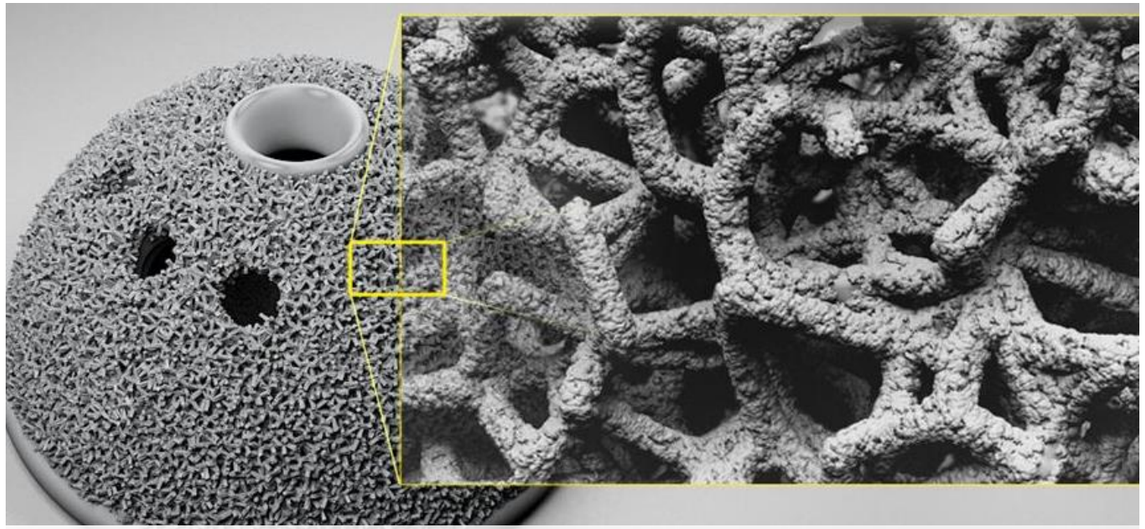
AUTODESK.



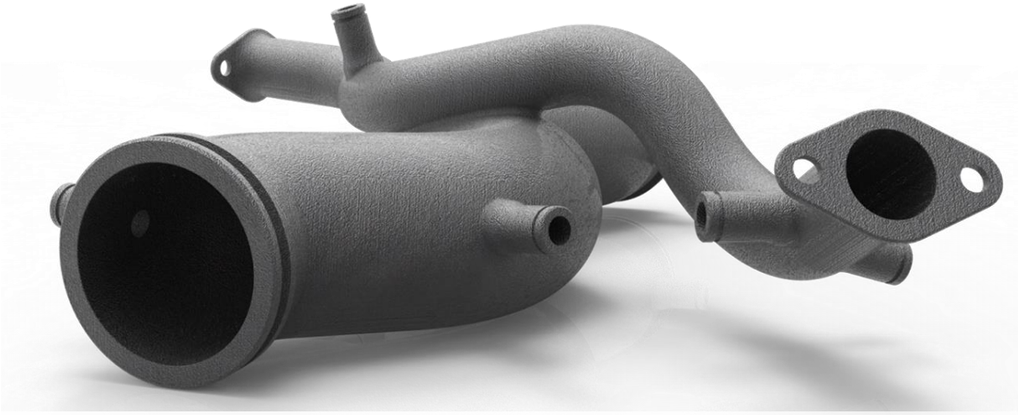
Prototypen & Produktionshilfen



Verbesserte Produktperformance



Mass Customization

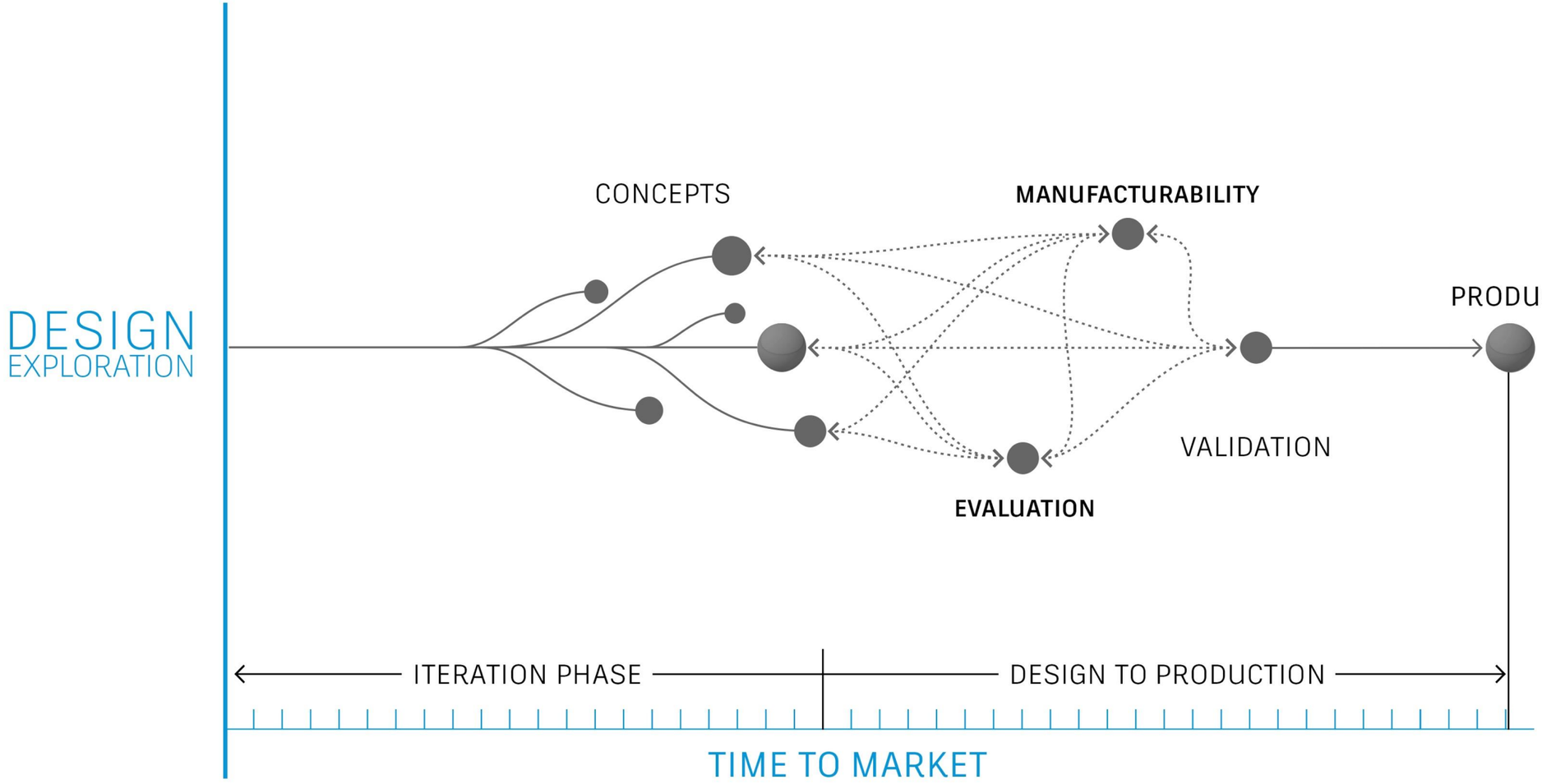


Bauteil Konsolidierung

HOW DOES AUTODESK GENERATIVE DESIGN HELP THE PRODUCT DEVELOPMENT PROCESS

AUTODESK® FUSION 360™

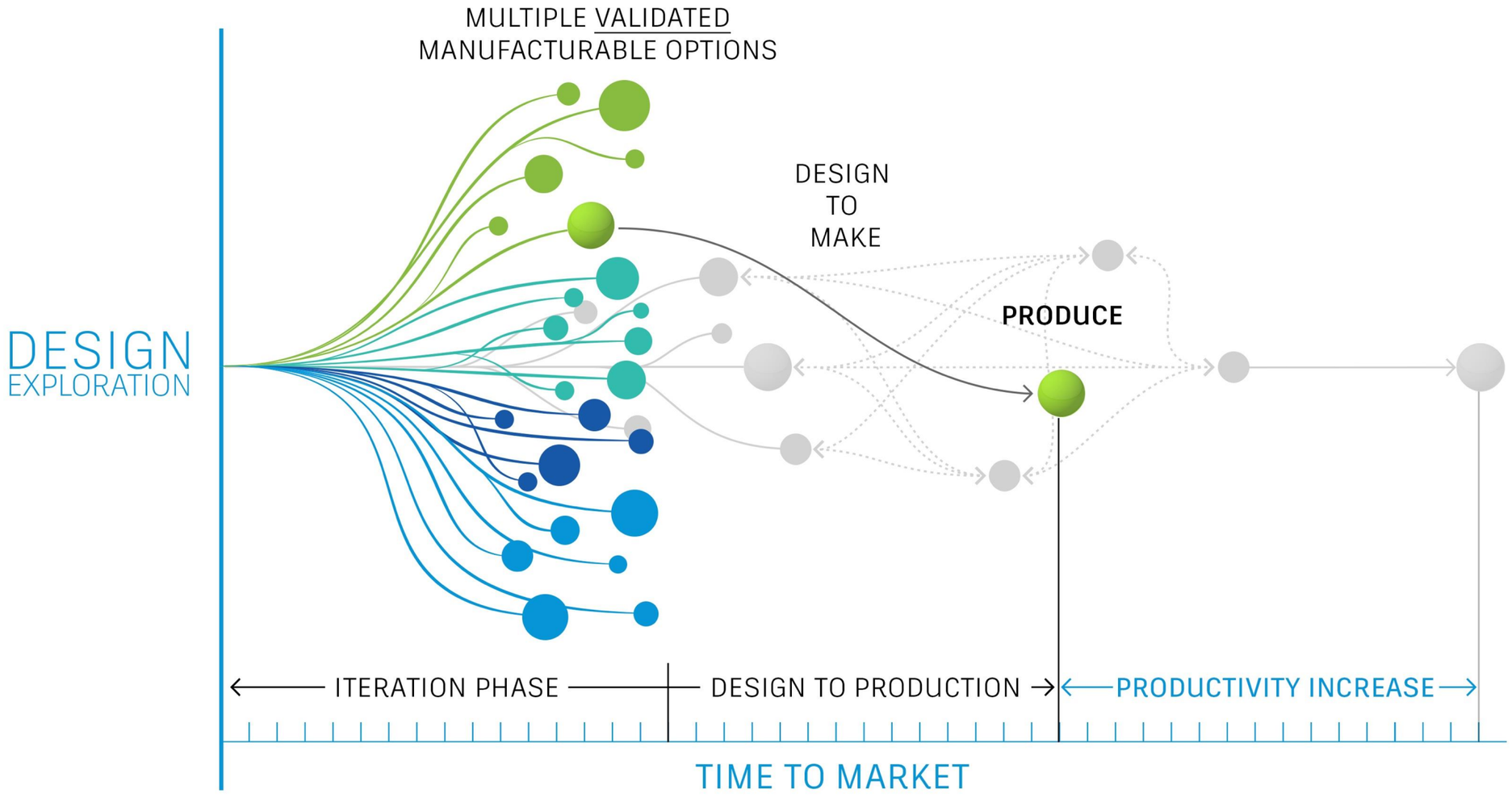
TRADITIONAL

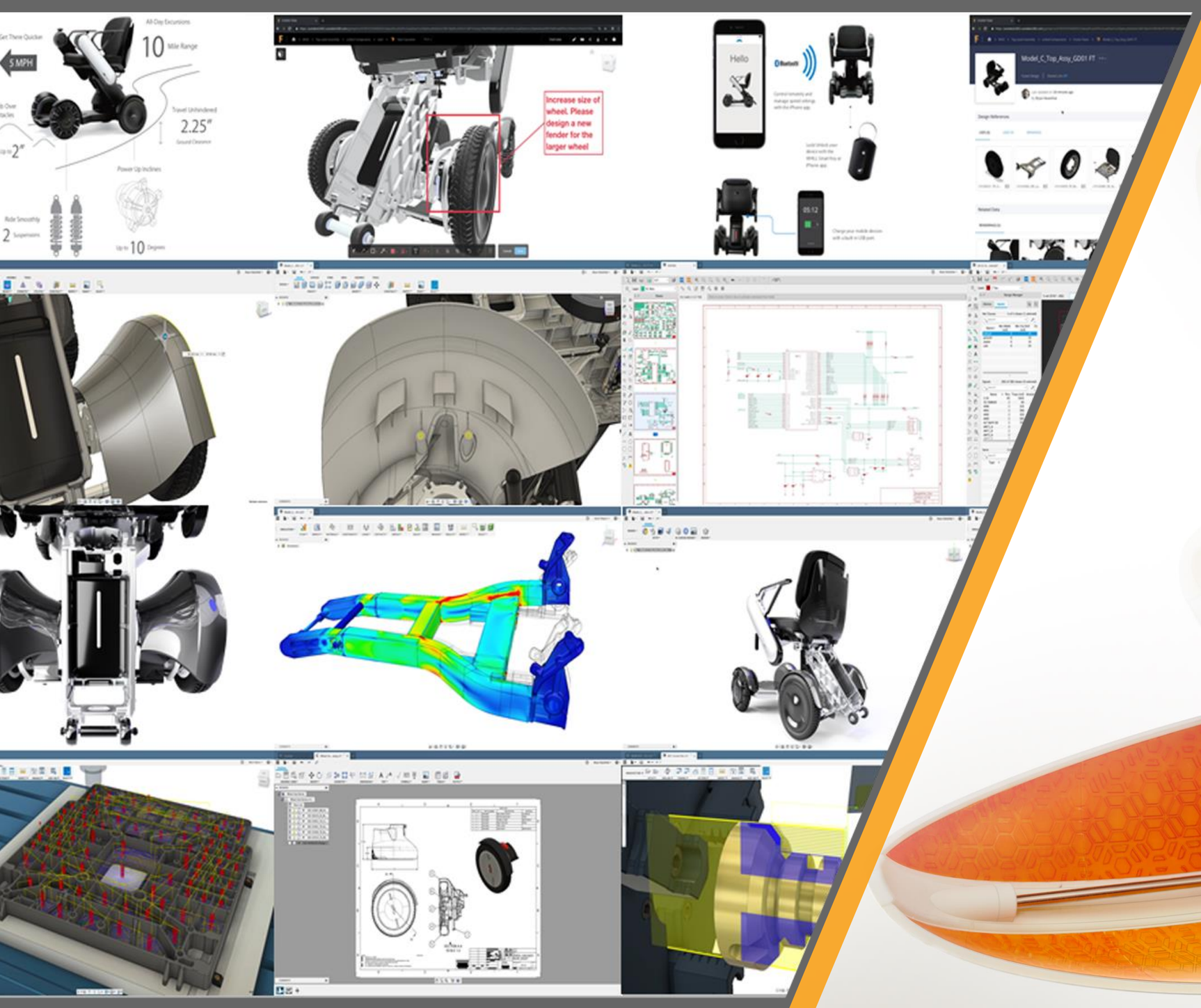


HOW DOES AUTODESK GENERATIVE DESIGN HELP THE PRODUCT DEVELOPMENT PROCESS

AUTODESK® FUSION 360™

GENERATIVE DESIGN





AUTODESK® **FUSION 360**™

- Vorstellung
- Generatives Design mit Fusion 360
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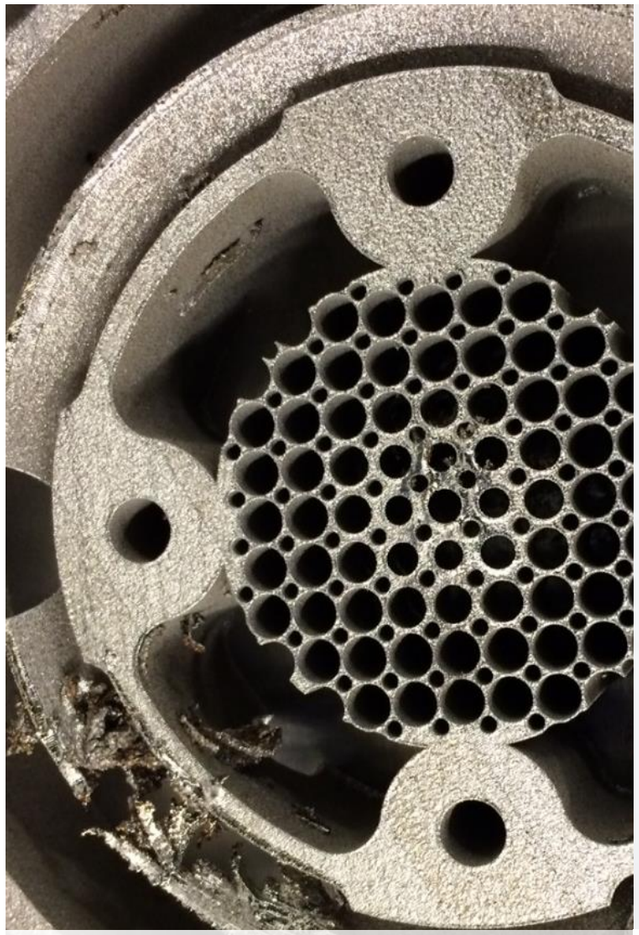
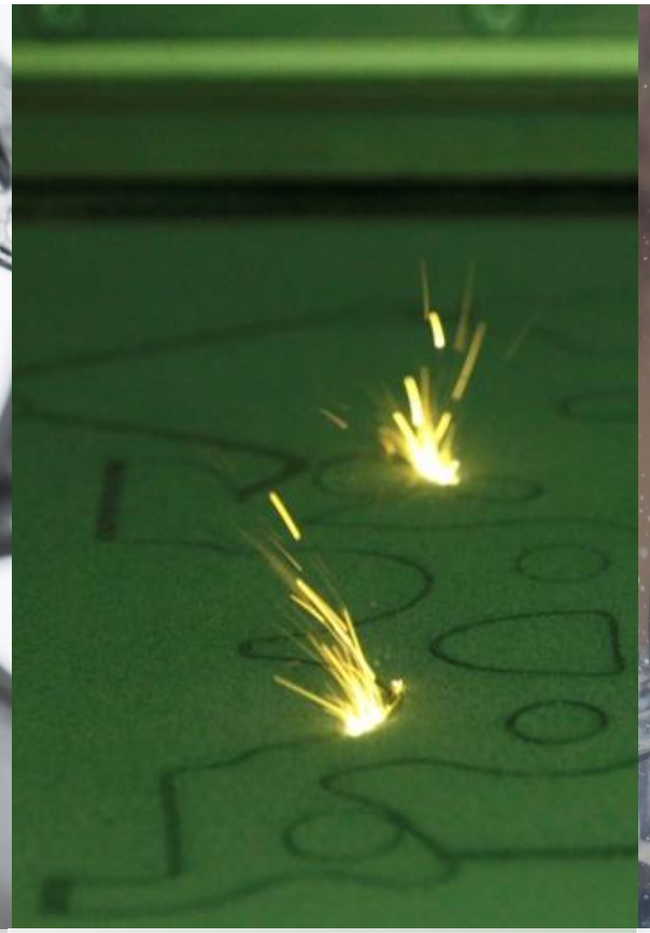
AUTODESK.

Herausforderungen in der Additiven Fertigung



VERZUG UND JOBABBRUCH

ERSCHAFFEN ORGANISCHER UND KOMPLEXER FORMEN

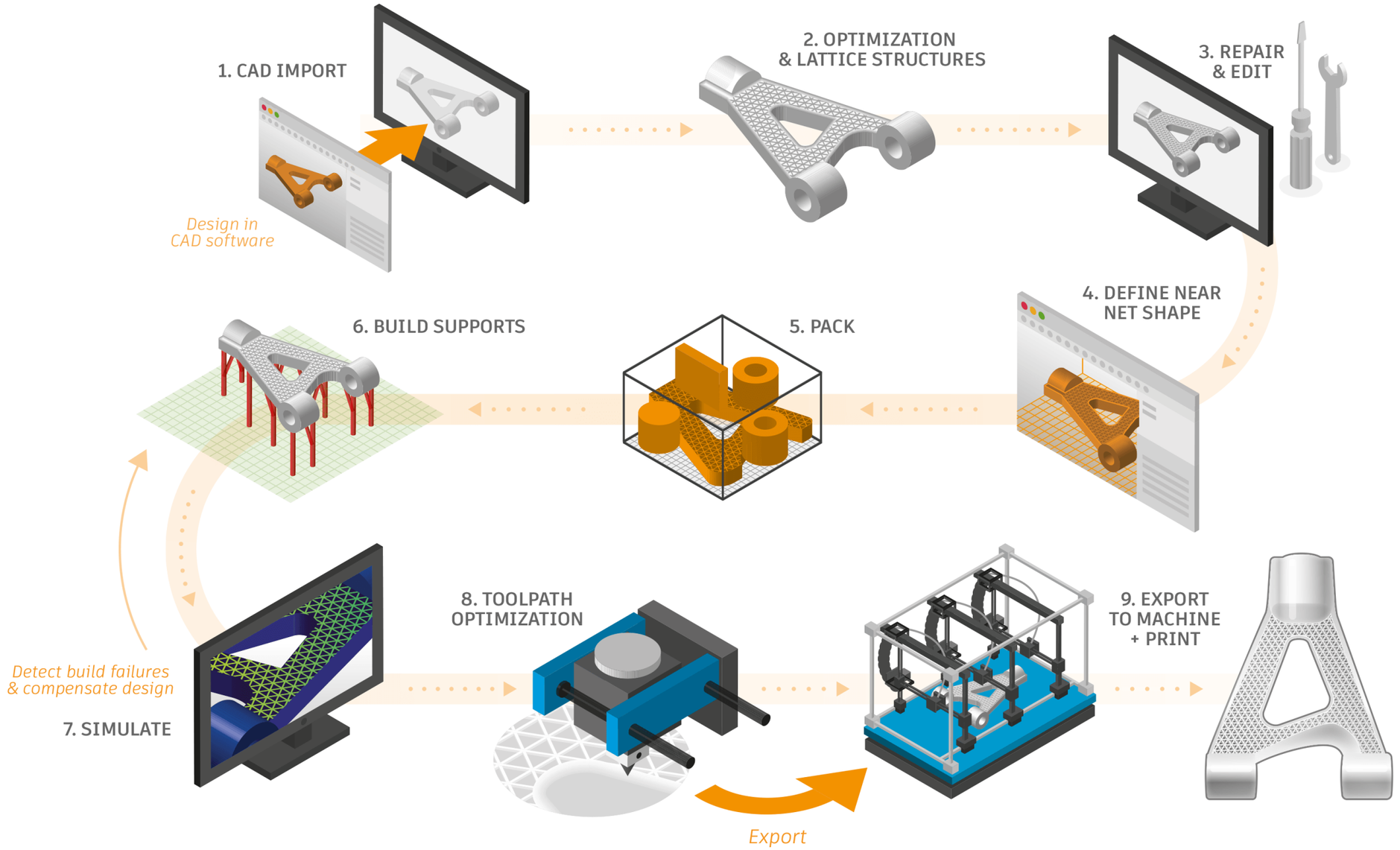


MASCHINENKONTROLLE UND -DURCHSATZ

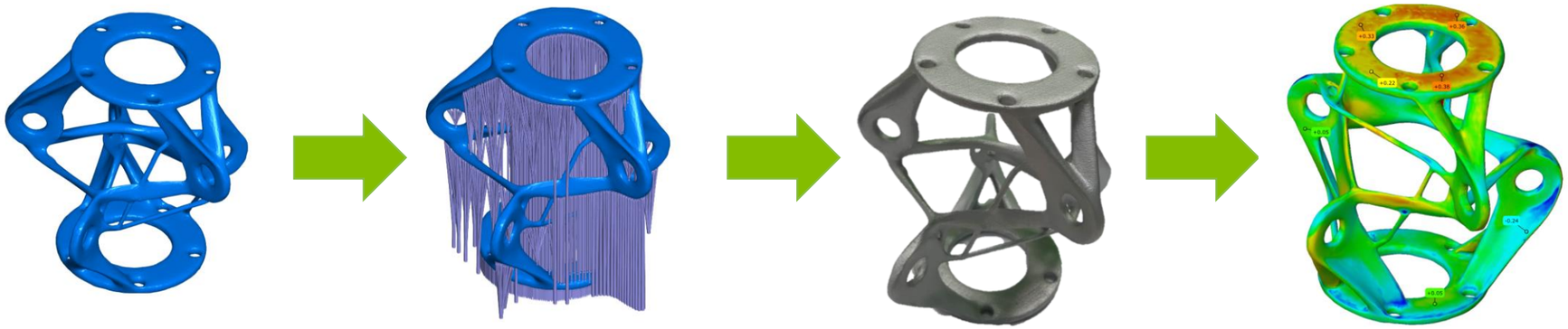
VORBEREITUNG SUBTRAKTIVER NACHBEARBEITUNG

AUTODESK®
NETFABB®

End-to-end additive manufacturing workflow

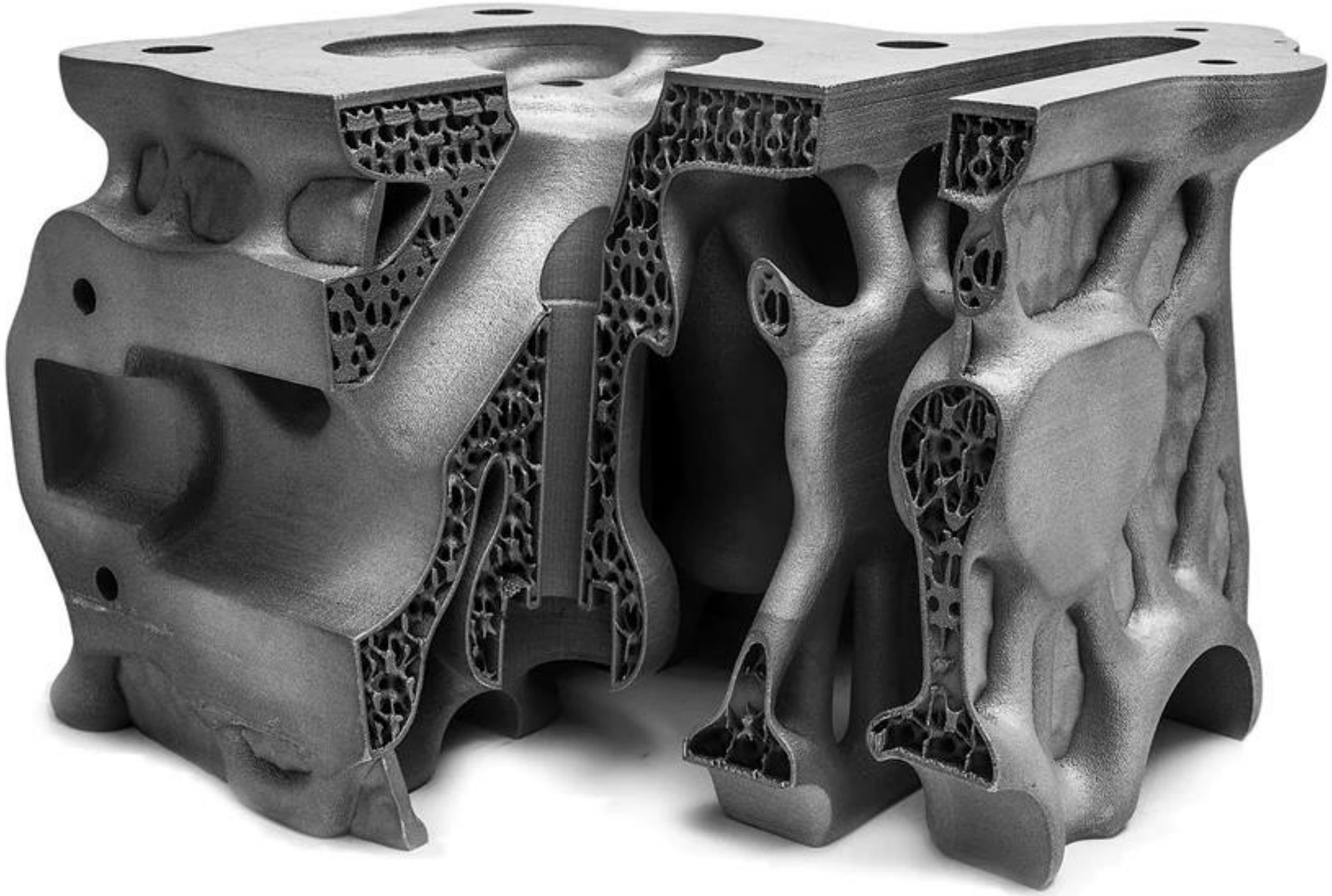


Fertigungsprozess

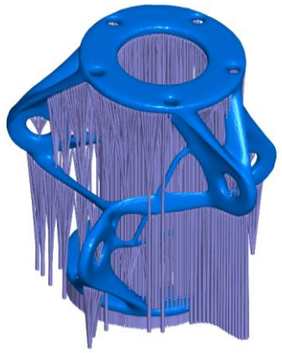


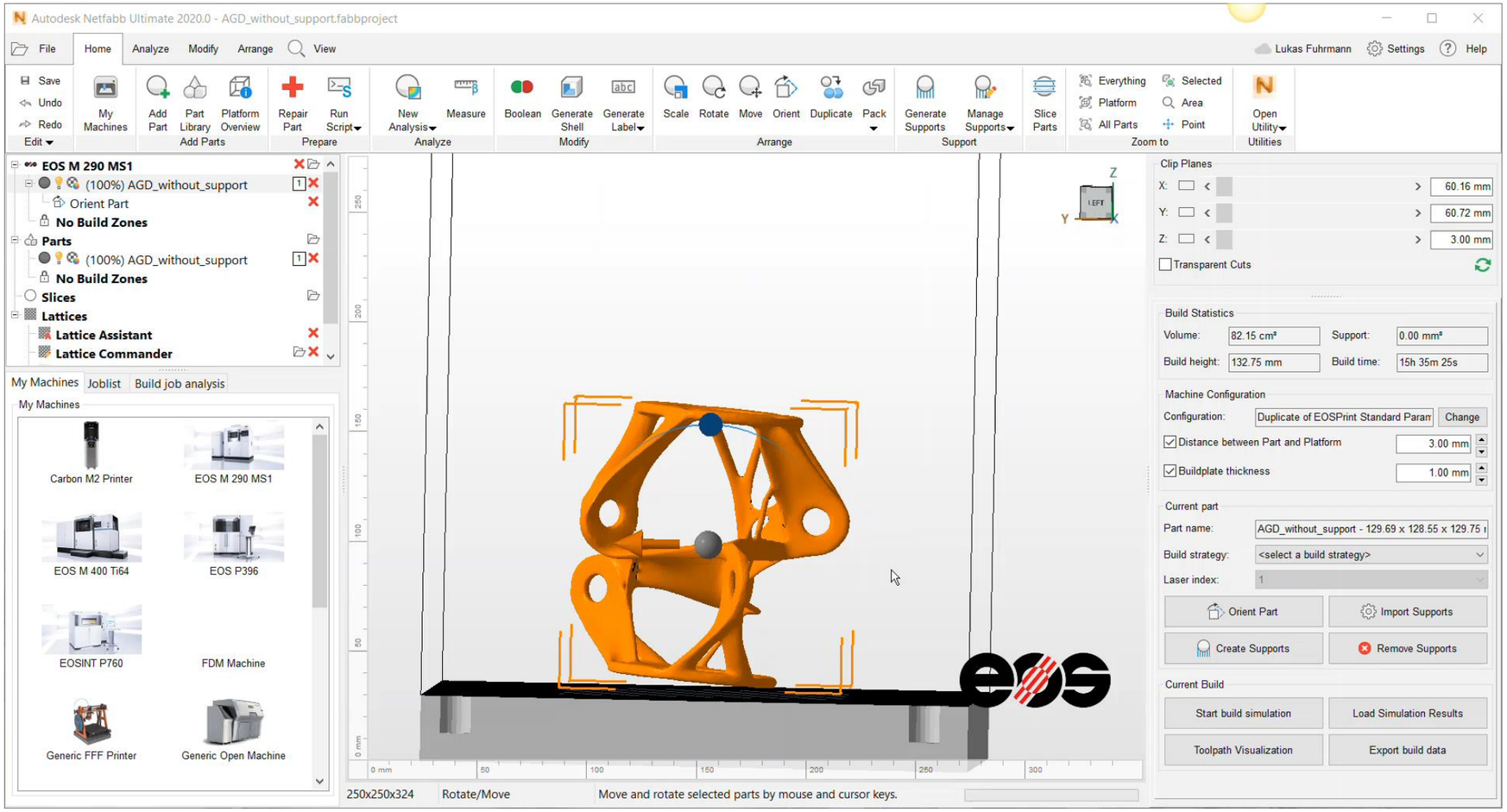
CAD Import → Orientation → Build Prep → Simulation → Compensation

Anforderungen



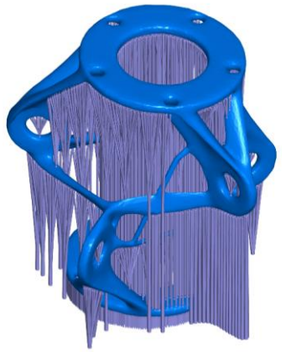
Aufbereitung

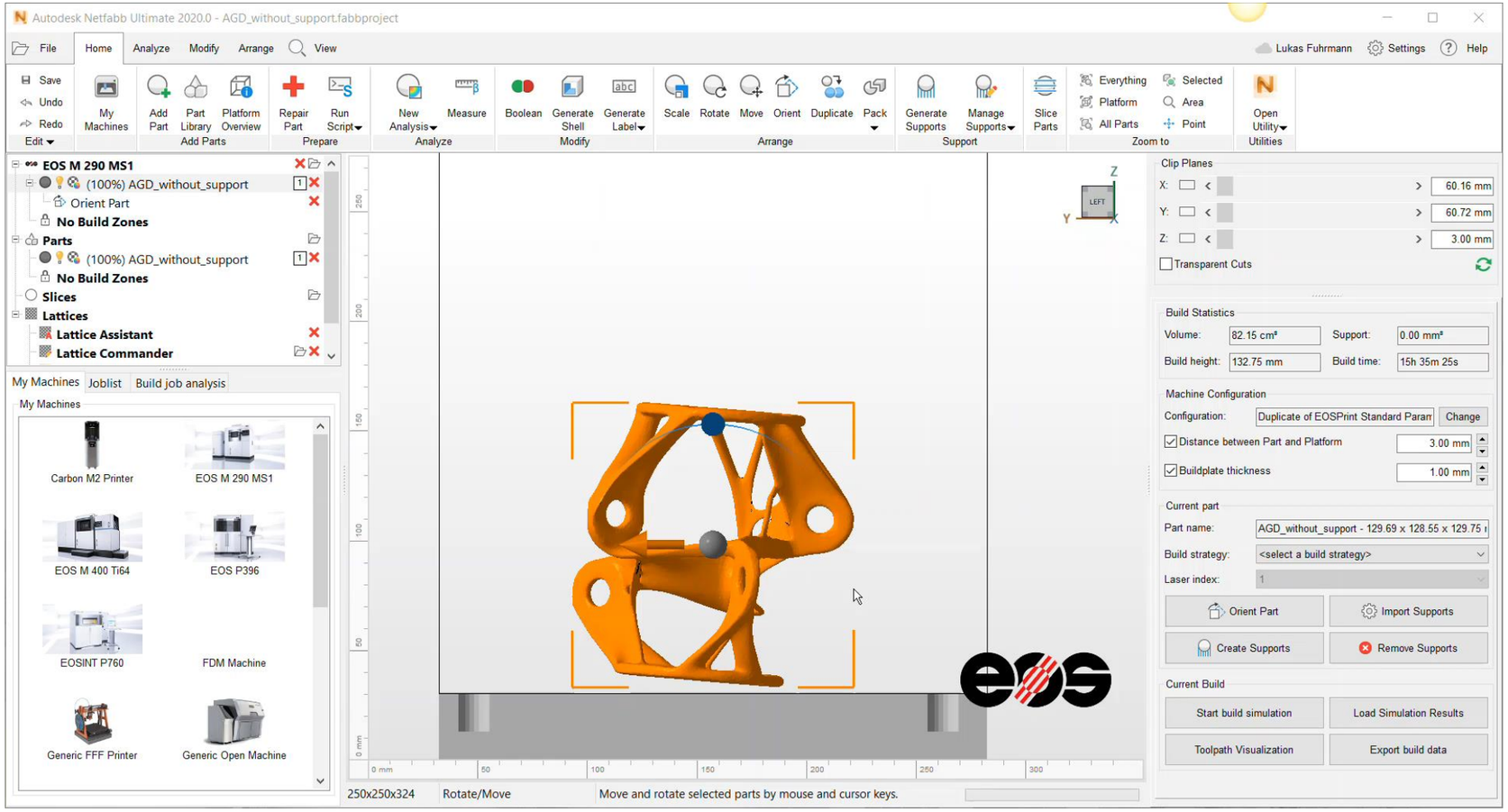




3D File → Build Prep → Simulation → Finishing → Inspection

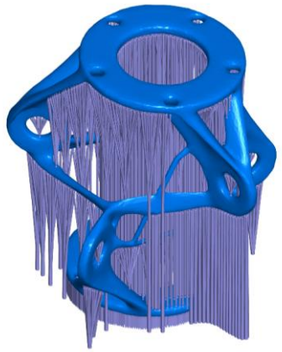
Aufbereitung

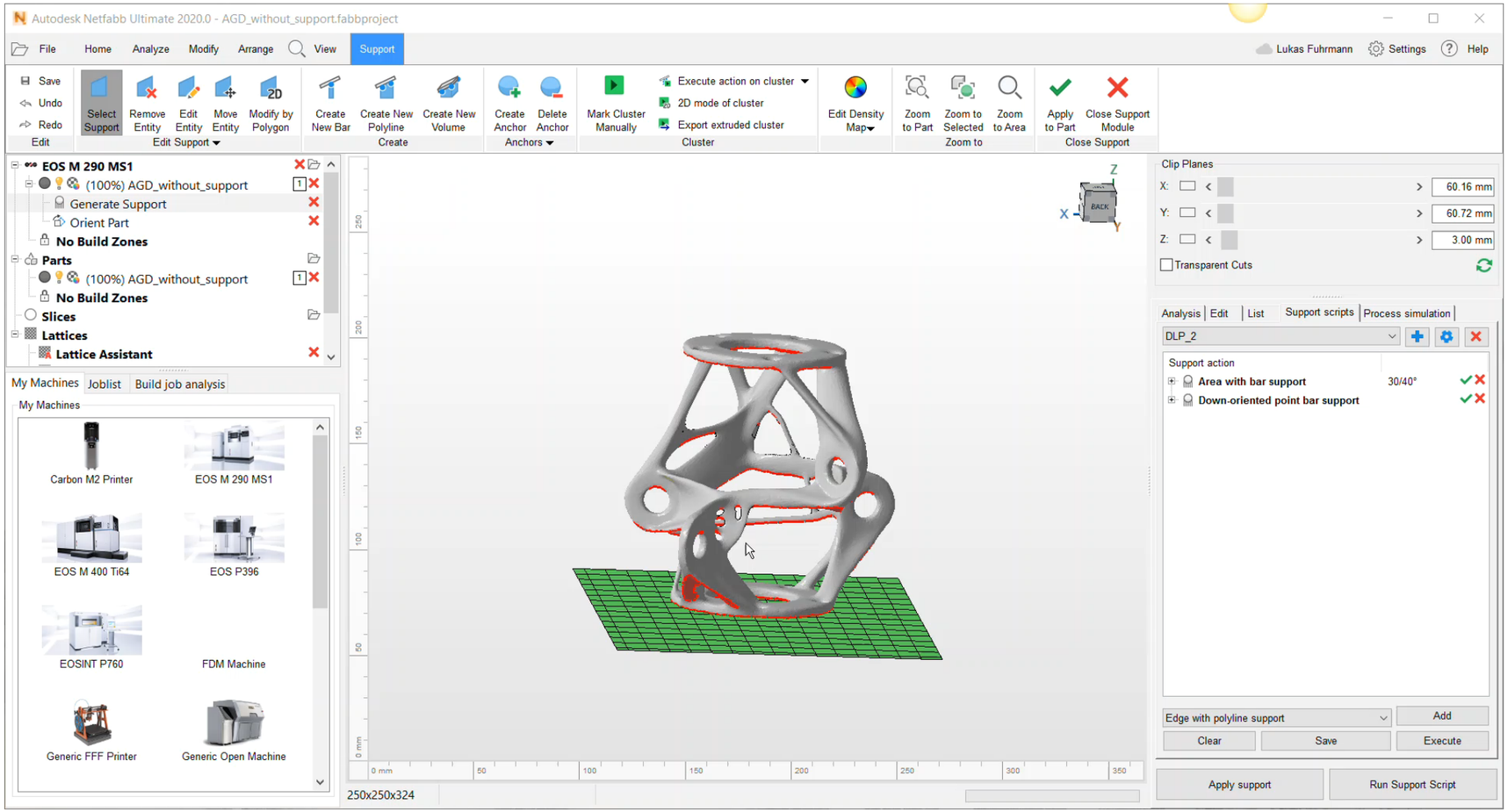




3D File → Build Prep → Simulation → Finishing → Inspection

Aufbereitung





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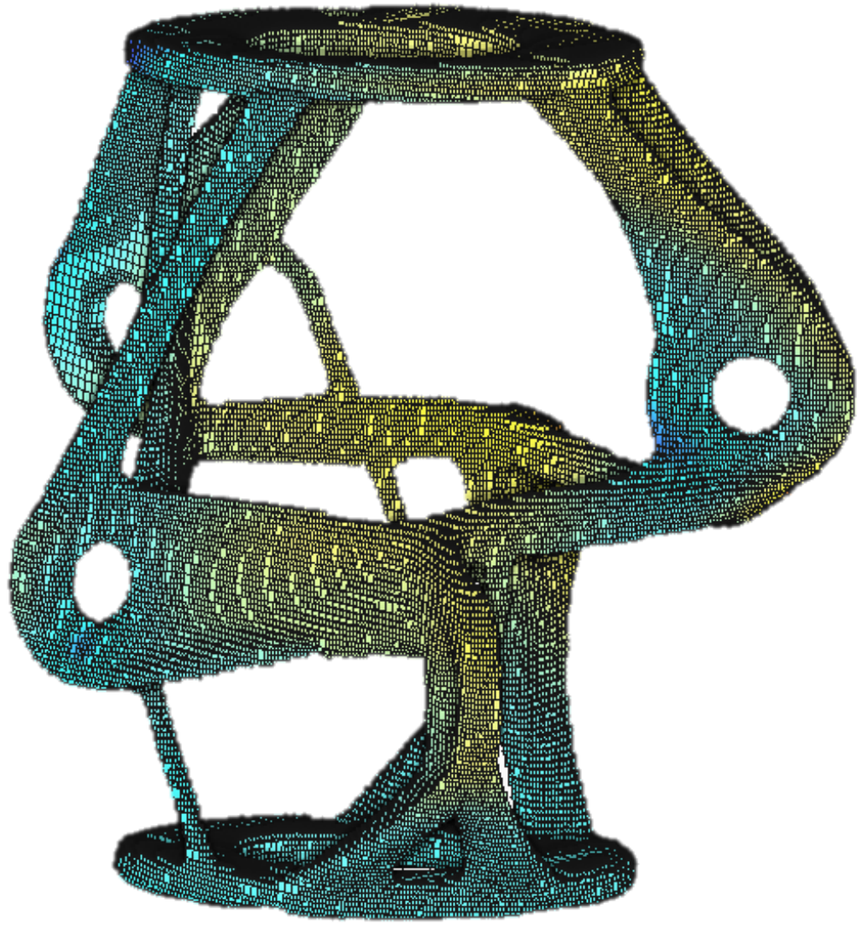
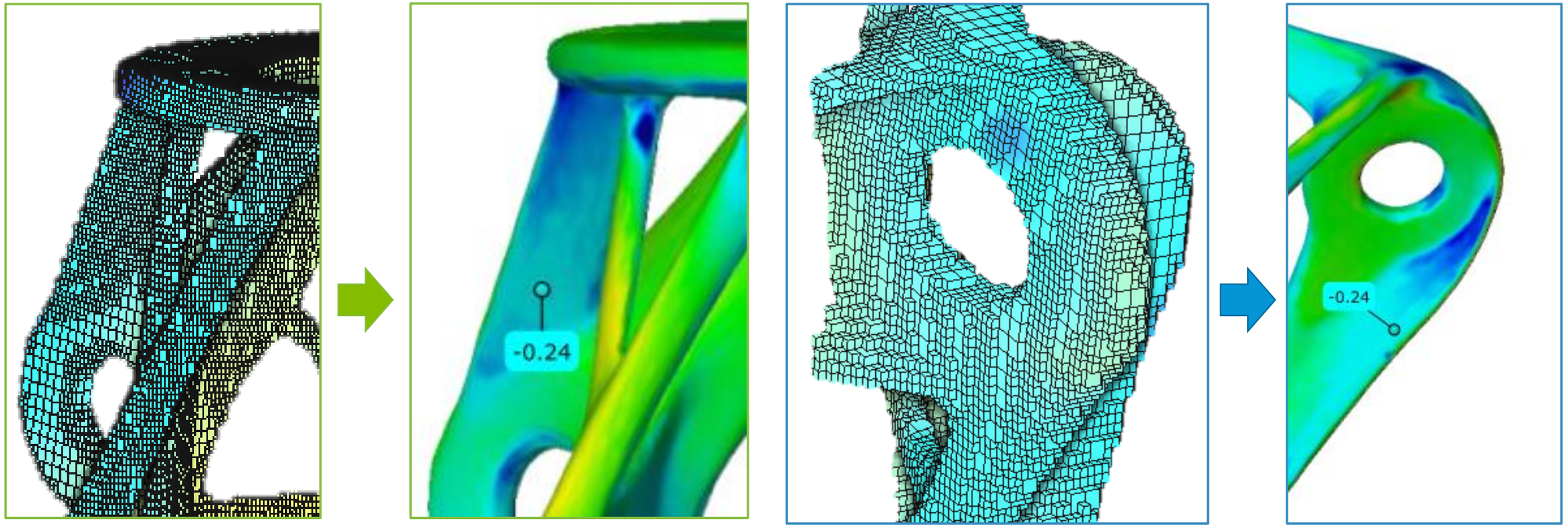
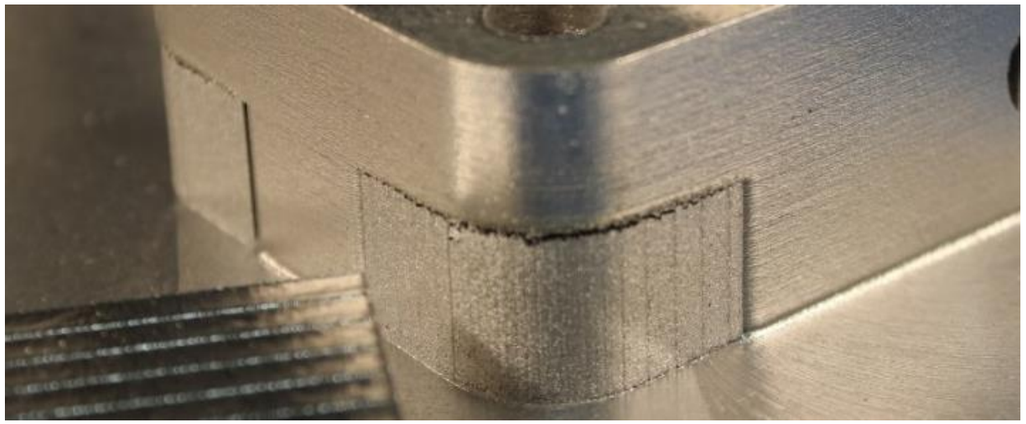
Prozess Simulation



Prozess Simulation



Support failures and recoater blade interference



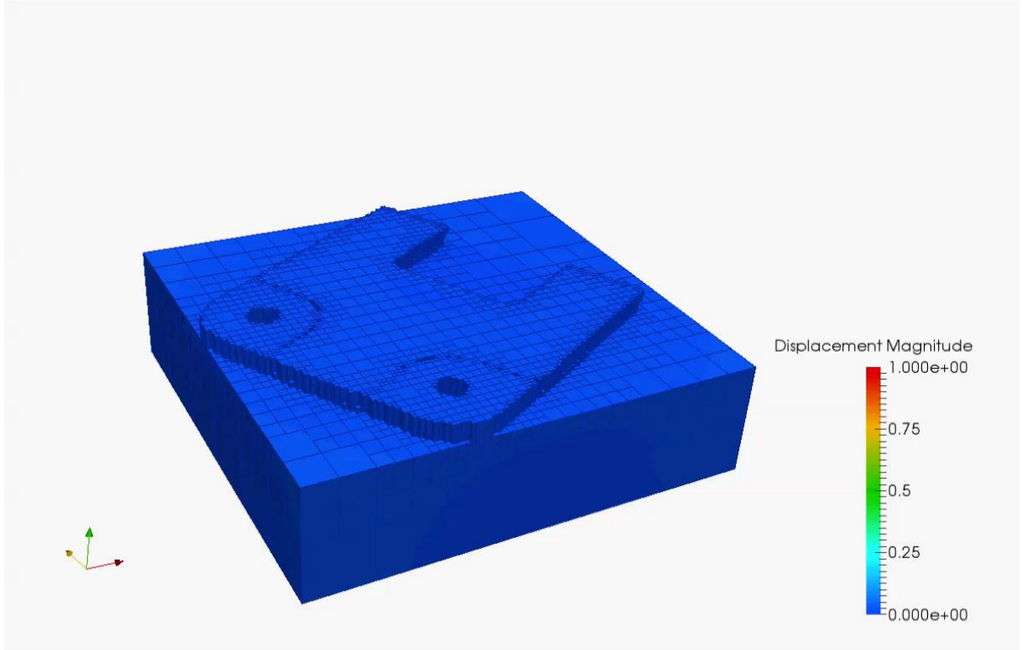


Figure courtesy of Dr. Tim Simpson (Penn State CIMP-3D)

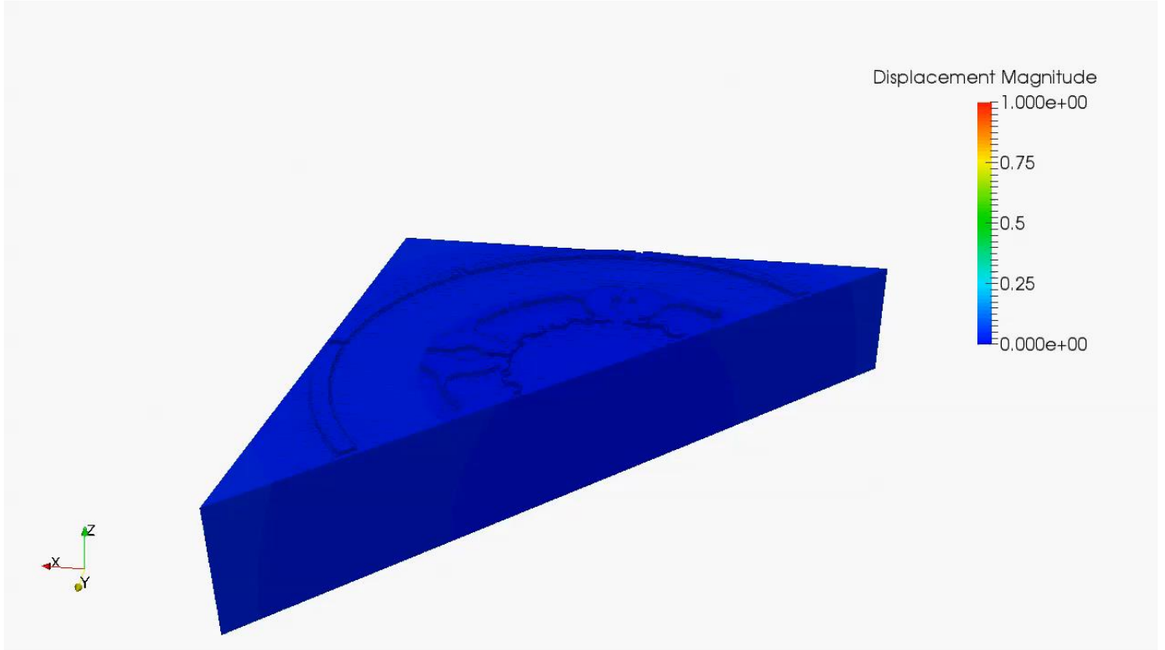


Figure courtesy of Dr. Ed Demeter (Penn State CIMP-3D)

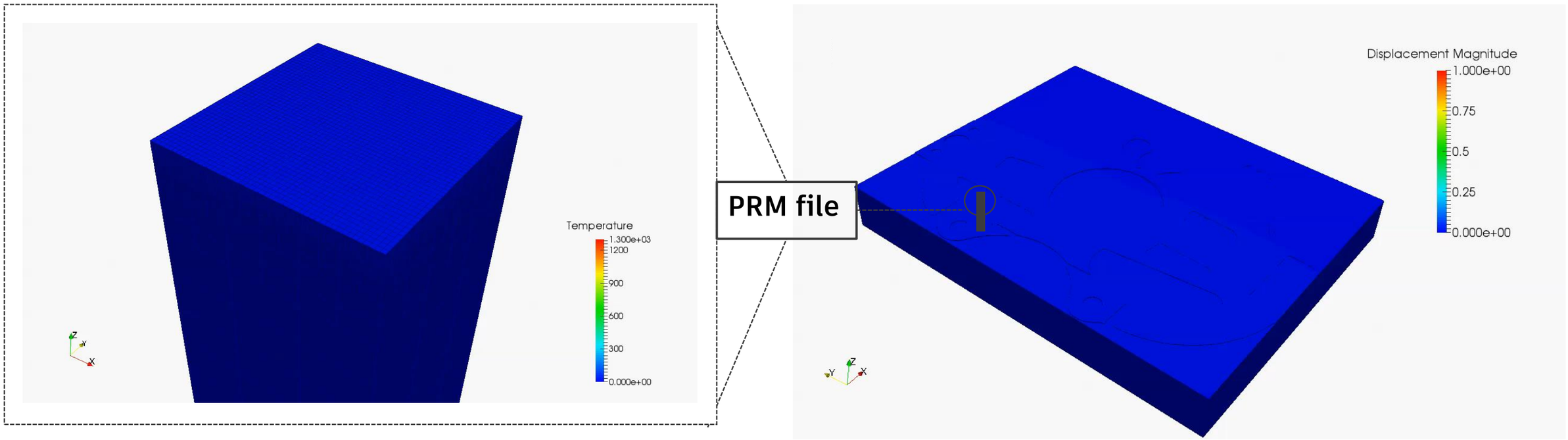
Multi-scale modeling allows for fast simulation of entire parts

Small-scale model

Input: Process parameters (Power, scan speed, layer thickness, etc.) and temperature dependent material properties

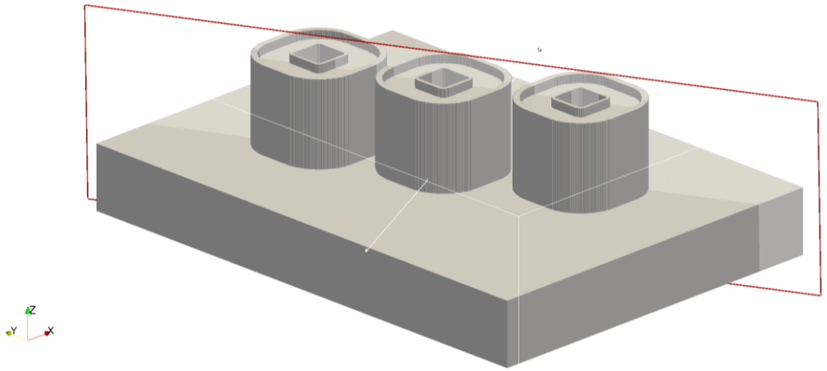
Part-scale model*

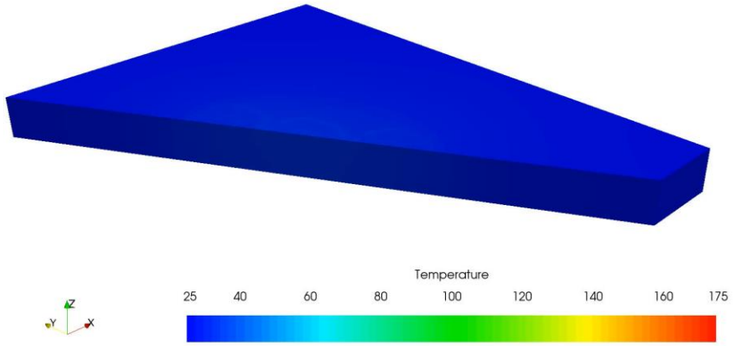
Input: Geometry + PRM file +Analysis settings

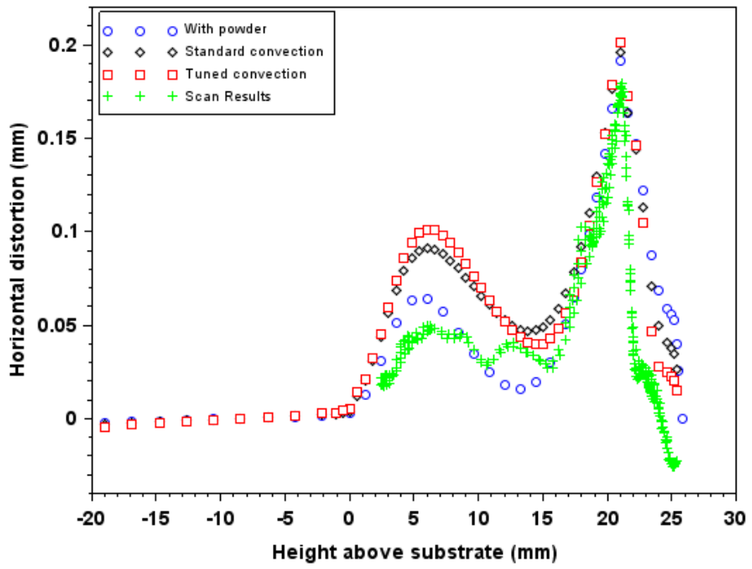


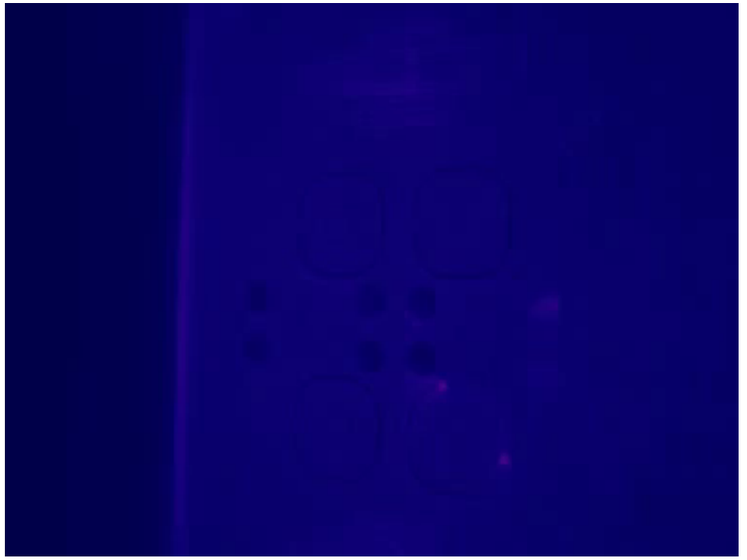
*2 hour runtime on a 14 core CPU

Direct modeling of powder losses improves the accuracy of distortion predictions

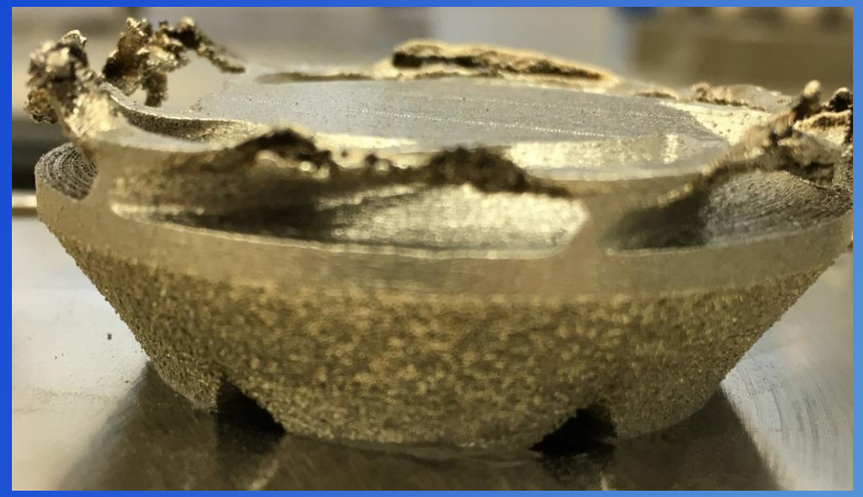


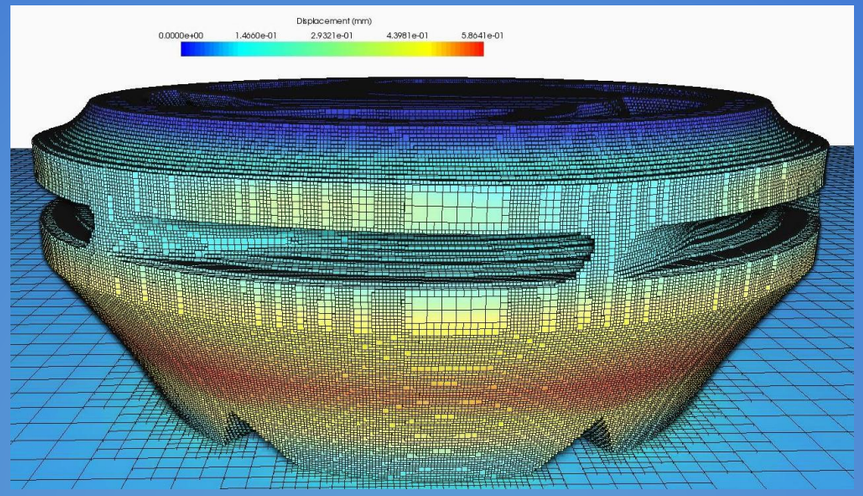


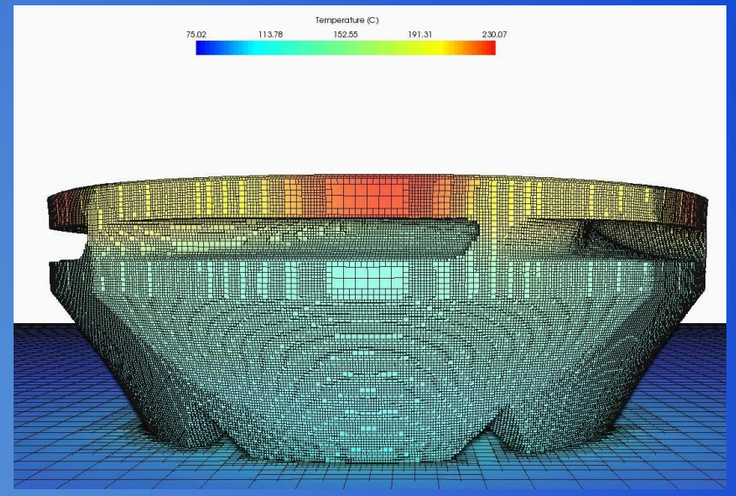




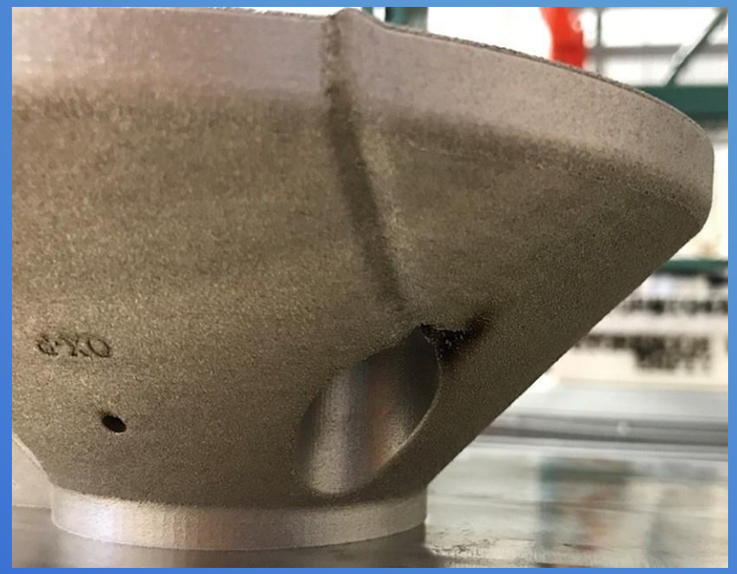
Build Simulation: Residual Stress & Distortion Failure Prediction

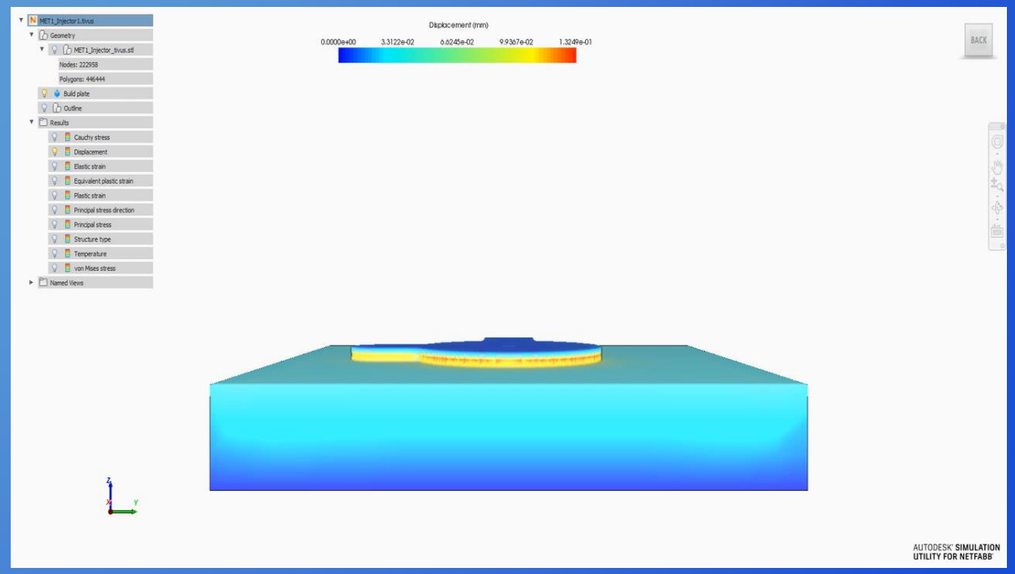






Impeller test. Build time - $0.3k, Powder - $ 0.01k (0.25 kg), Saw - $0.2k, Plate resurface - $0.2k, Total - $0.71k





Injector test. Build time - $5.5k, Powder - $ 0.32k (5.82 kg), Saw - $0.2k, Plate resurface - $0.2k, Unsuccessful total - $6.22k. Successful total $6.22k. Total Cost $12.44k. 15 minute long simulation.

Autodesk Netfabb Ultimate 2017.2 - M-SP-1004 v1 v1.fabbproject

Project Edit Part Extras View Window Settings Utilities Help

Parts
(100%) M-SP-1004 v1 v1
Slices
Structure Library
EOS M290
(100%) M-SP-1004 v1 v1

Clip planes
X: 102.13 mm
Y: 101.68 mm
Z: 2.8 mm
Transparent Cuts

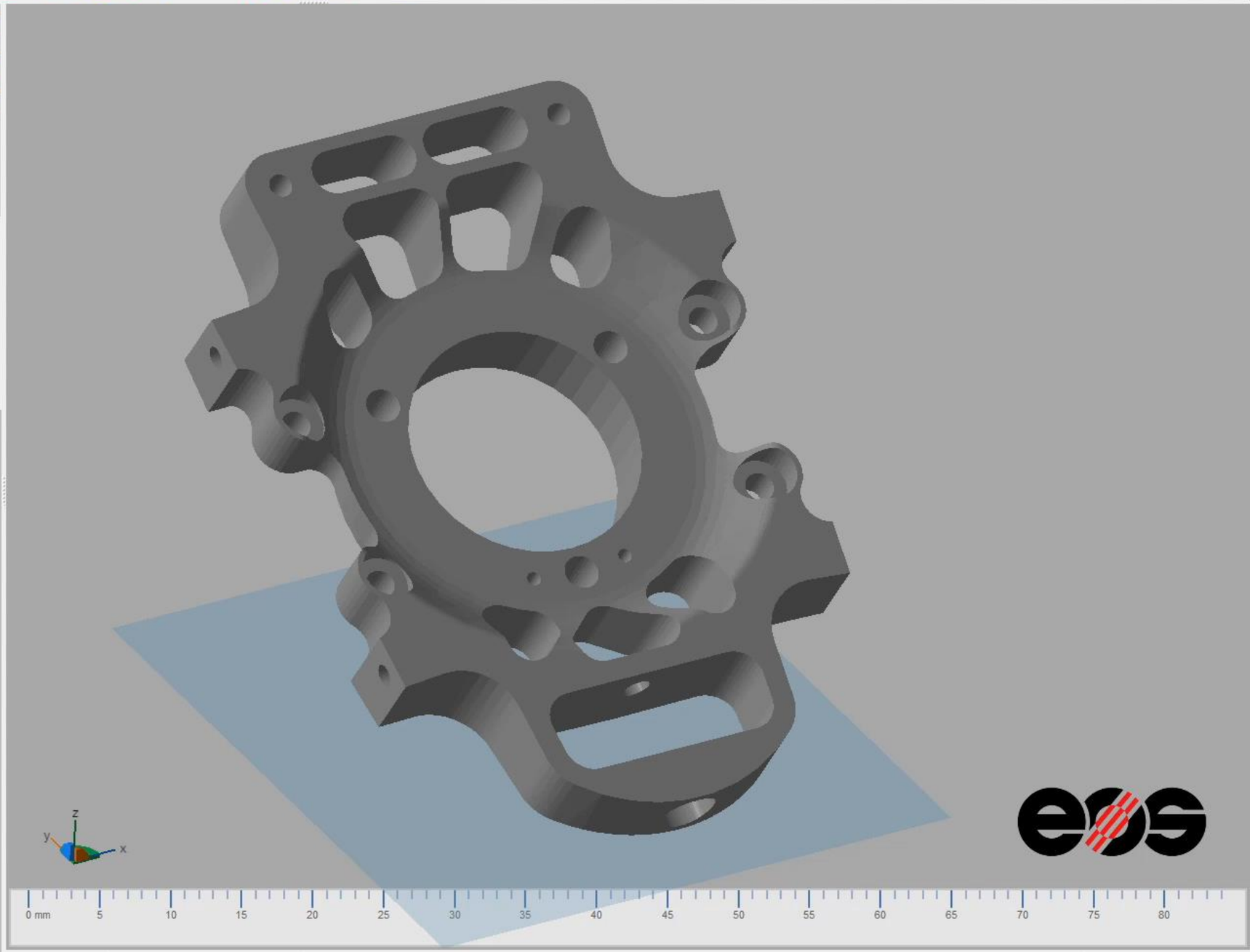
Parts Visualization Simulation

Build properties
Configuration: EOS Aluminium AlSi10Mg (preliminary) Change
Create Supports | Remove Supports | Import Supports

Current part
Part name: M-SP-1004 v1 v1
Build strategy: <select a build strategy>
Keep parts on platform 2.8 mm

Tray Properties
Volume (Support): 5.76 cm³ (0.00 mm³)
Buildheight: 38.54 mm
Build time estimate: 3h 17m 35s

Automatic placement | Collision detection
Generate preview | Export build data



250x250x325 | Rotate/Move | Move and rotate the selected parts by the mouse and the cursor keys

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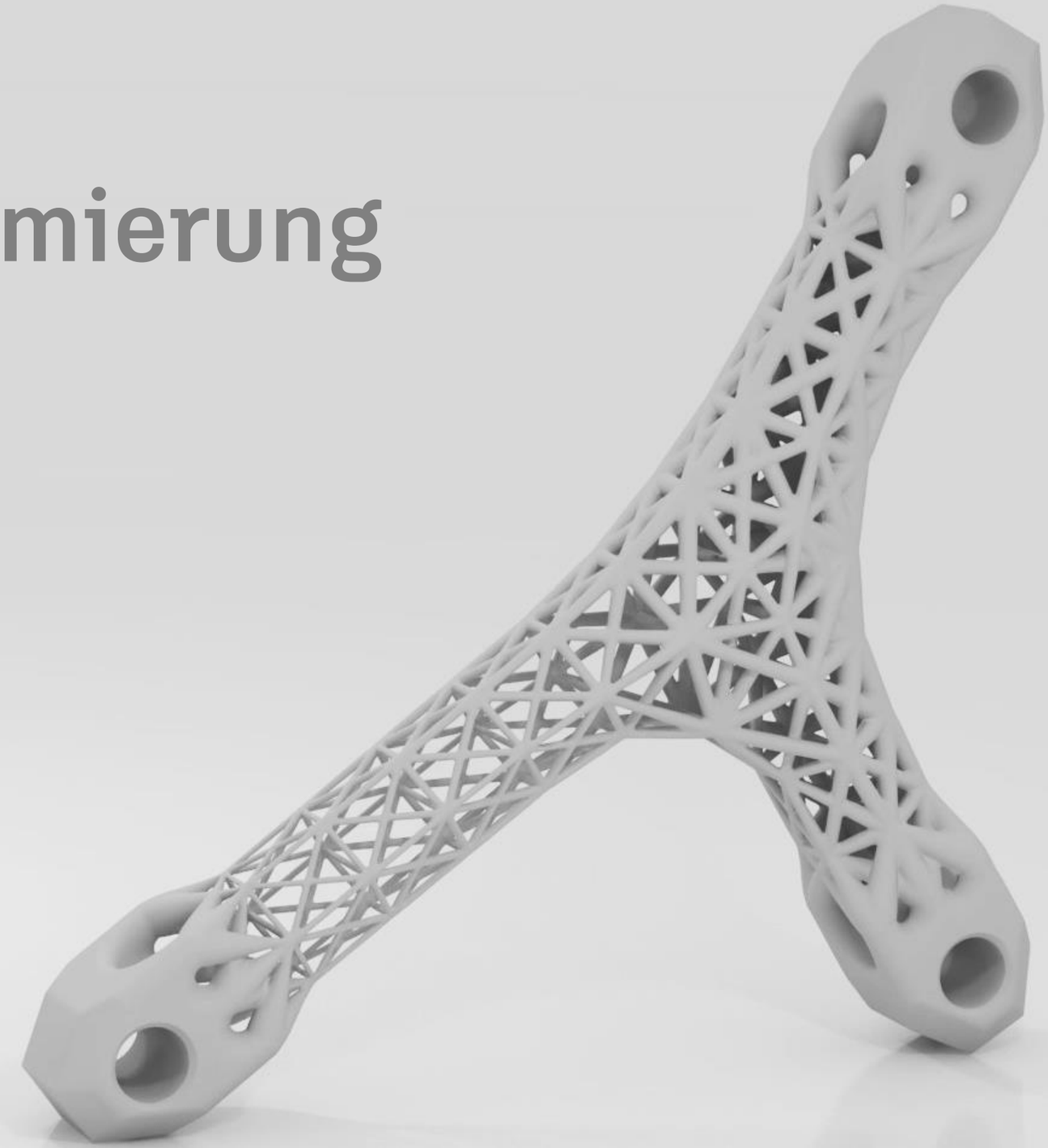
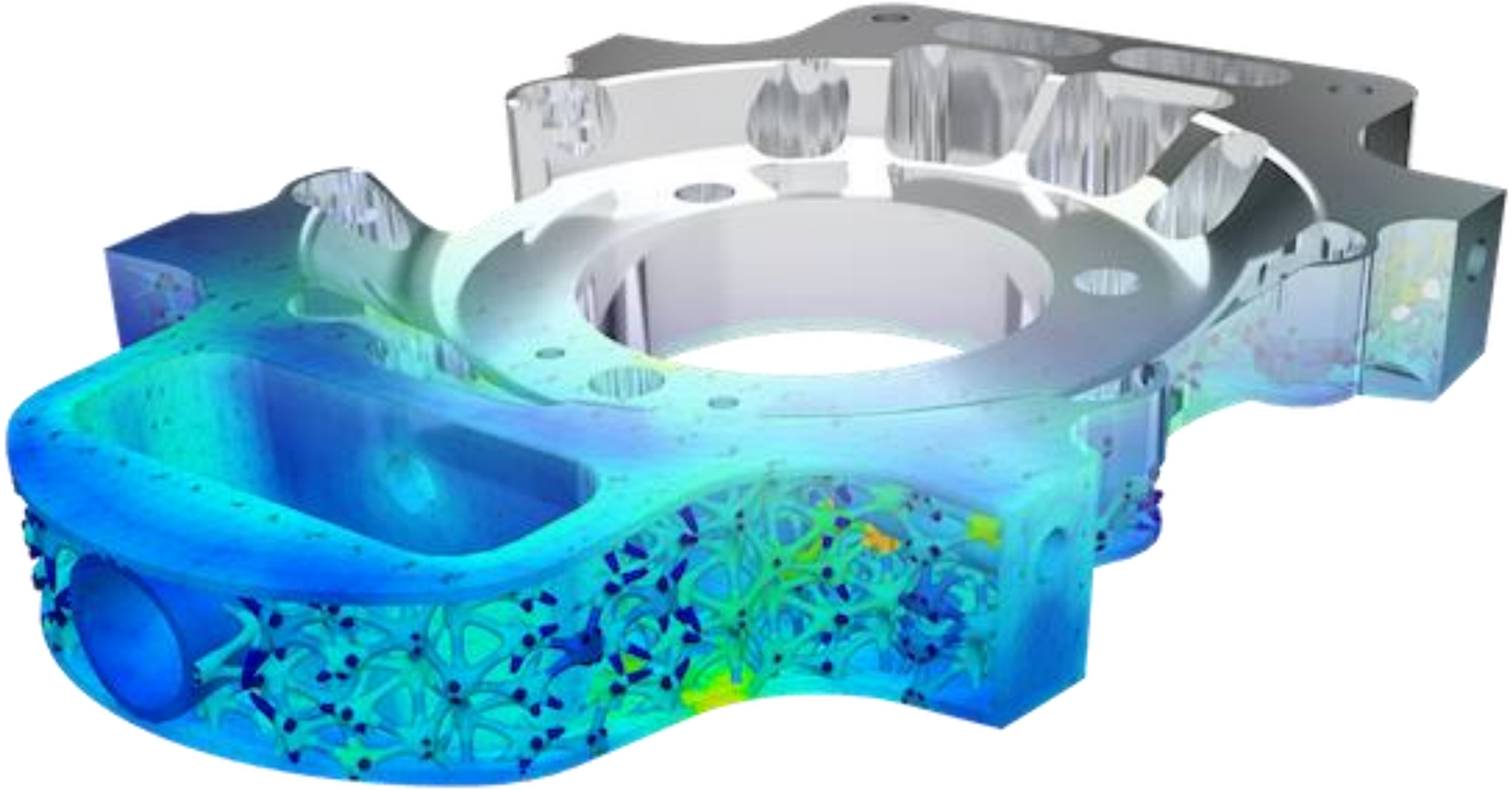
Komplexität ≠ Kosten

Lattice Optimierung

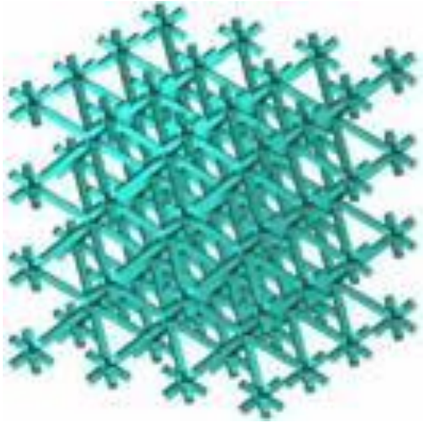


Optimierung

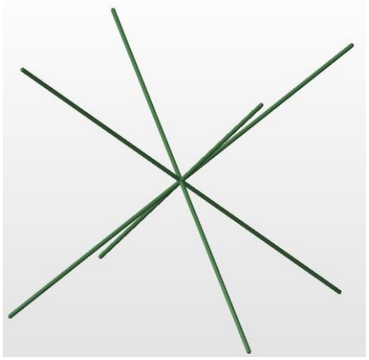
BAC Monopart

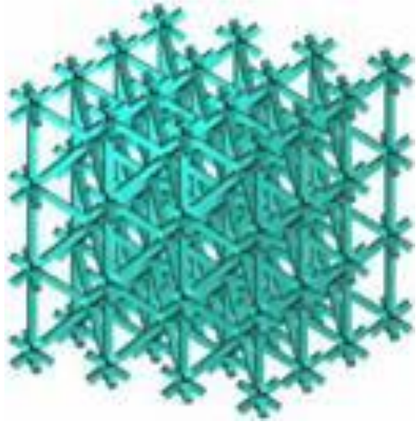


Verschiedene Lattice-Typen

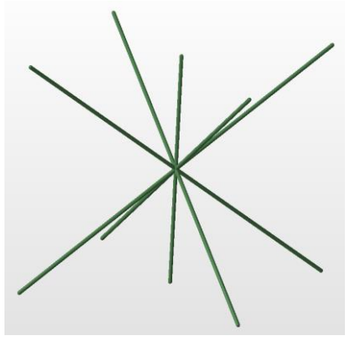


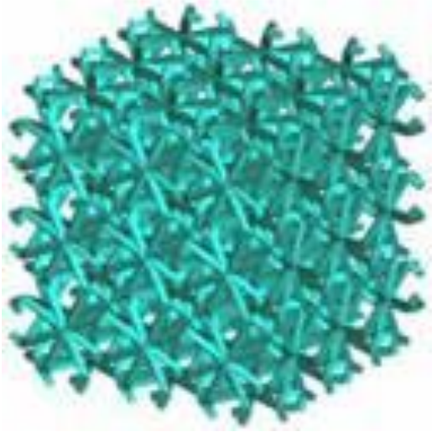
X



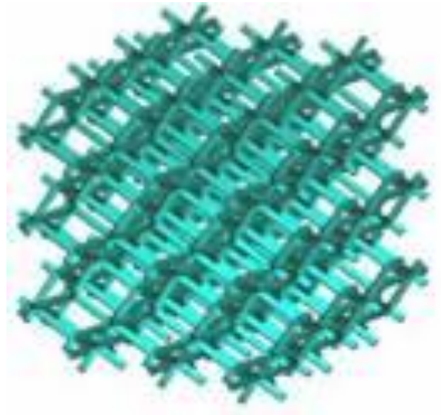


Stern

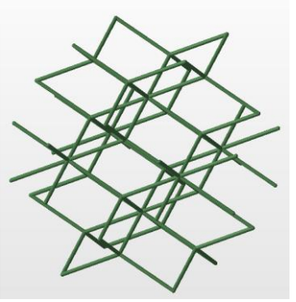




Kreuzförmig

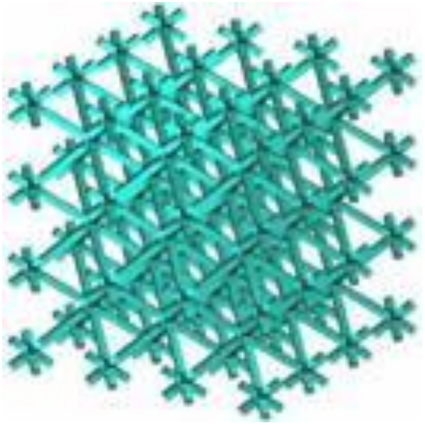


Rhombisches Dodecahedron



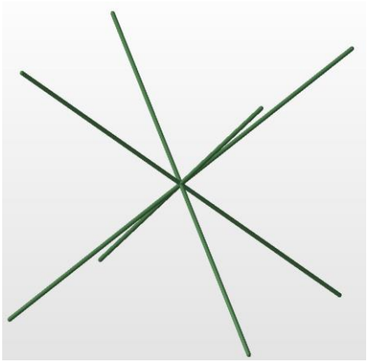
Verschiedene Lattice-Typen

- Beispiel X



- Gute Lastverteilung
- Geeignet für variable Strebendicke
- Selbsttragend für Metall (DMLS) durch 45 Grad Winkel

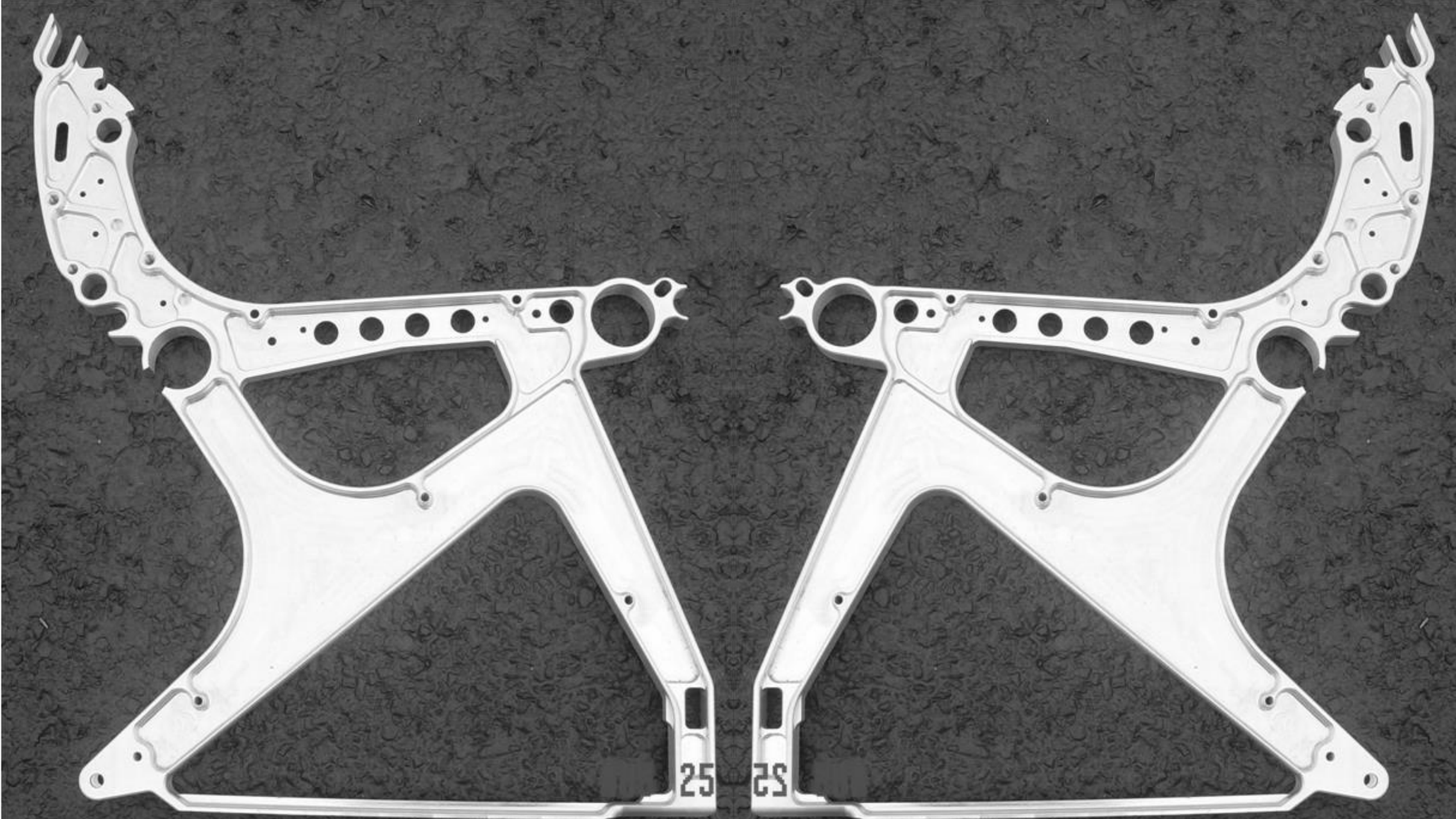
X



- Porengröße: 10mm x 10mm x 10mm (X,Y,Z)
- Variable Strebendicke: 2.5mm – 3.5mm

Image courtesy of Philipp Manger.

Vielflieger?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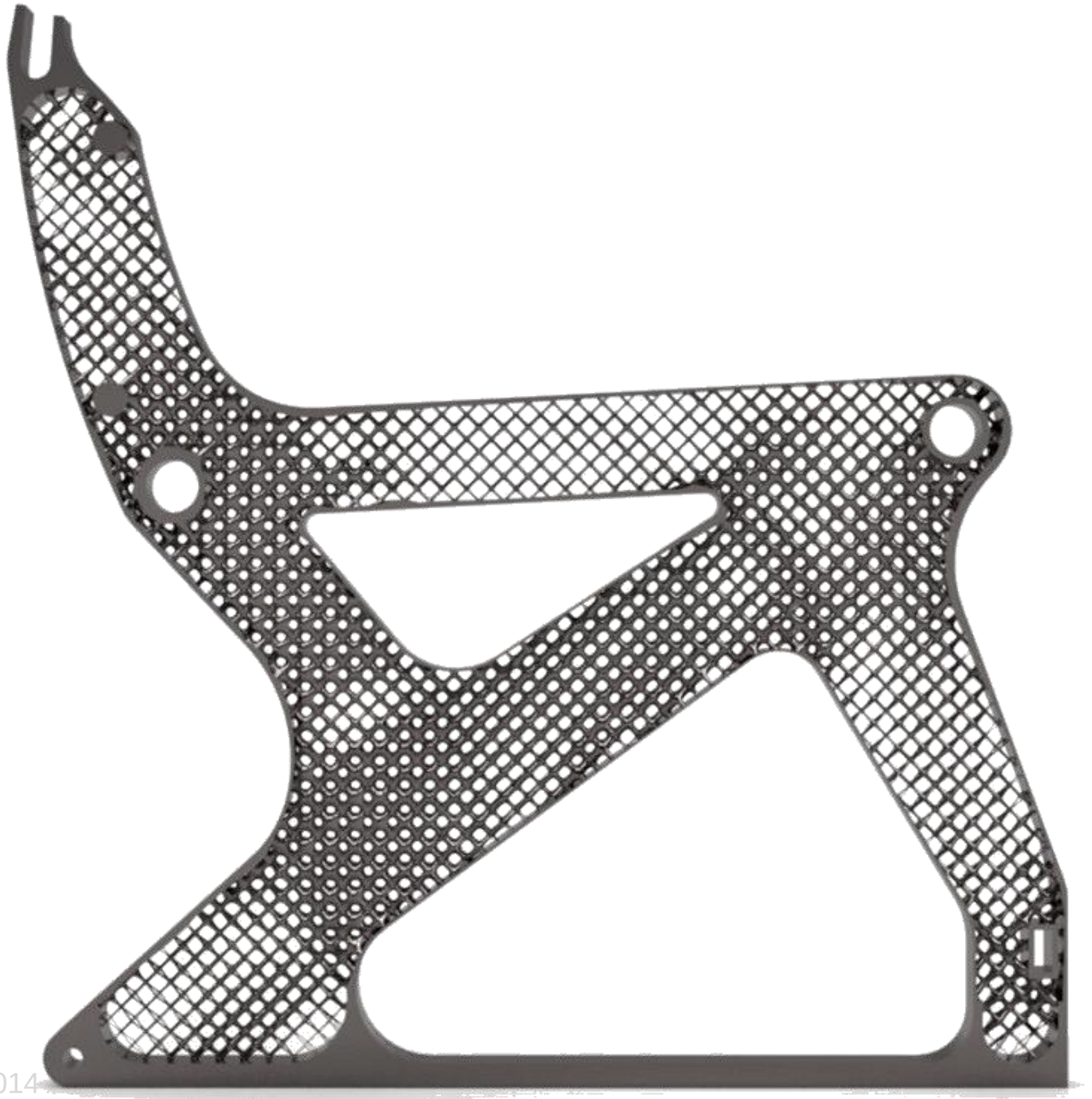
25

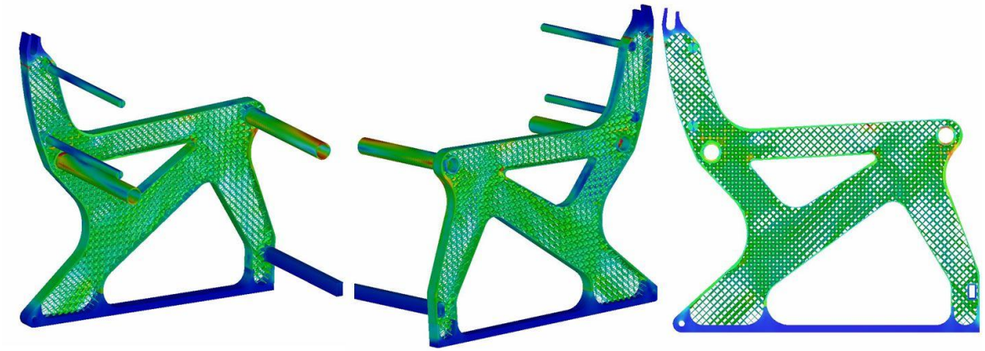


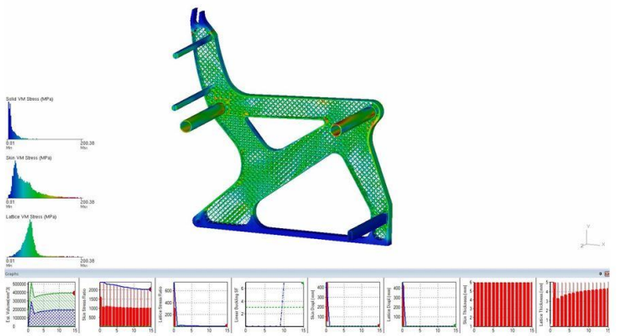
13
Al
Aluminum
26.982
2
8
3

Masse um **29.5%** reduziert
Gewicht finales Teil: **1,179g**

12
Mg
Magnesium
24.305
2
8
2

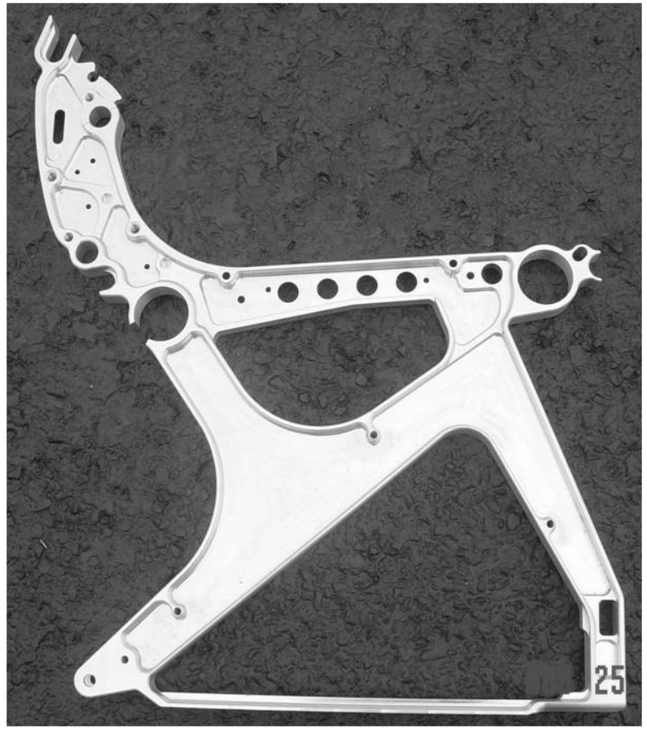
Masse um **56%** reduziert
Gewicht finales Teil: **766g**

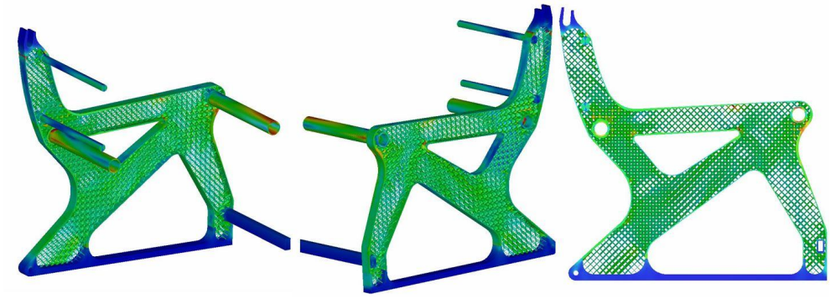


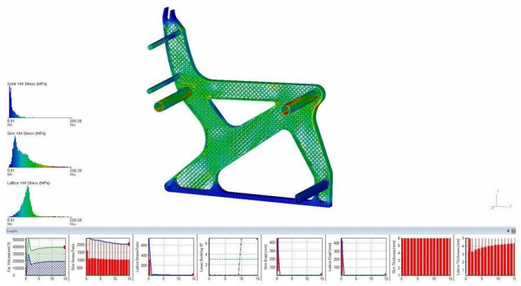


AUTODESK.

Lattice-Optimierung







13 Al Aluminum 26.982 — Masseeinsparung **29.5%**
Gewicht finales Teil: **1,179g**

12 Mg Magnesium 24.305 — Masseeinsparung **56%**
Gewicht finales Teil: **766g**

ORIGINALES DESIGN

LATTICE OPTIMIERUNG IN NETFABB

FINALES TEIL

Andere Strukturtypen

Fragen?