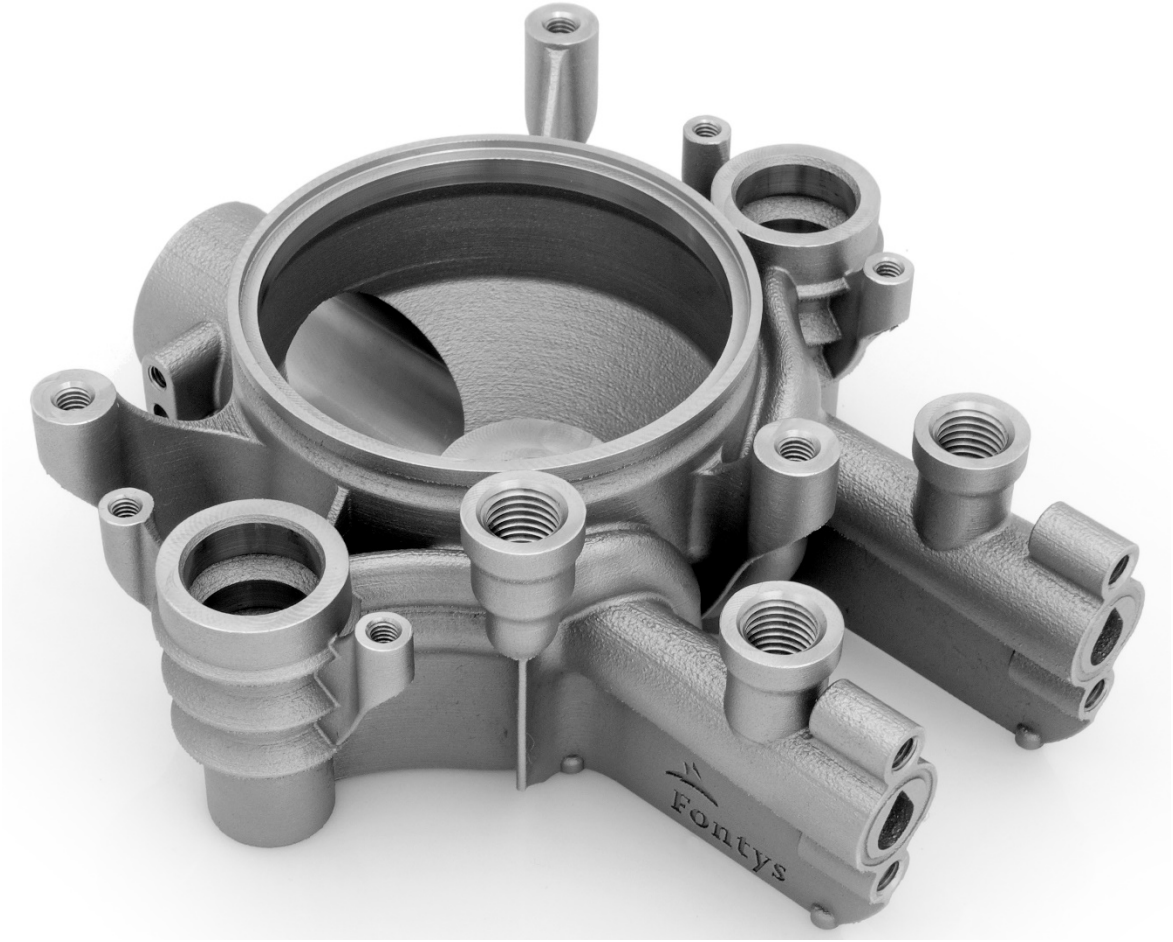
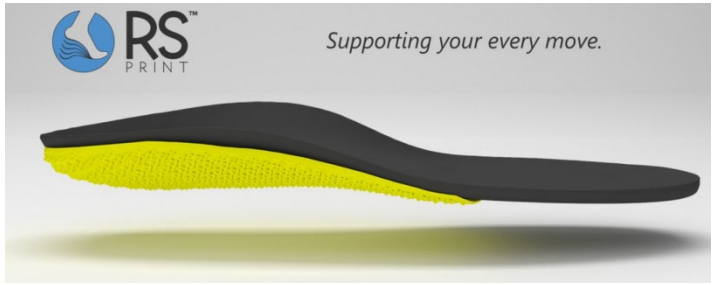
Fontys

University of Applied Sciences

THINK BIGGER

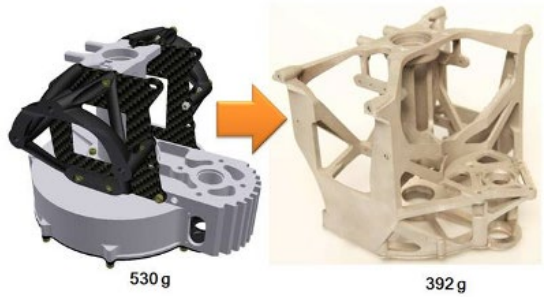
# Minor Smart Product Development with Additive Manufacturing (SPDAM)





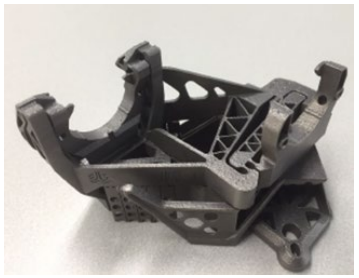

Mass customization

Freeform parts

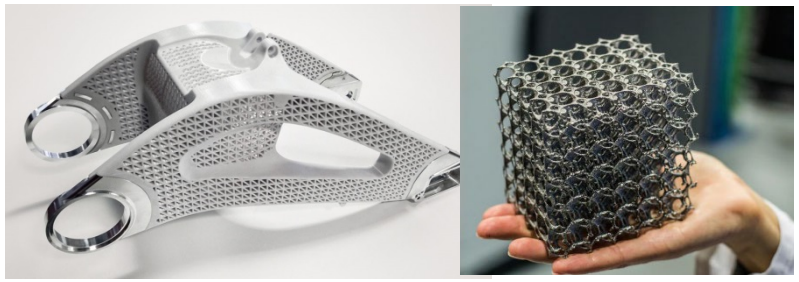



Topology optimization

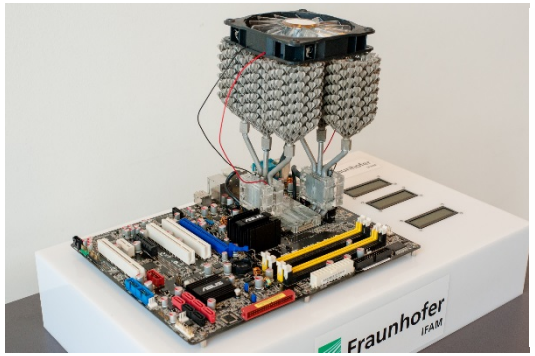
Flow optimization



Monolithic adjustments



Mass reduction (lattices)



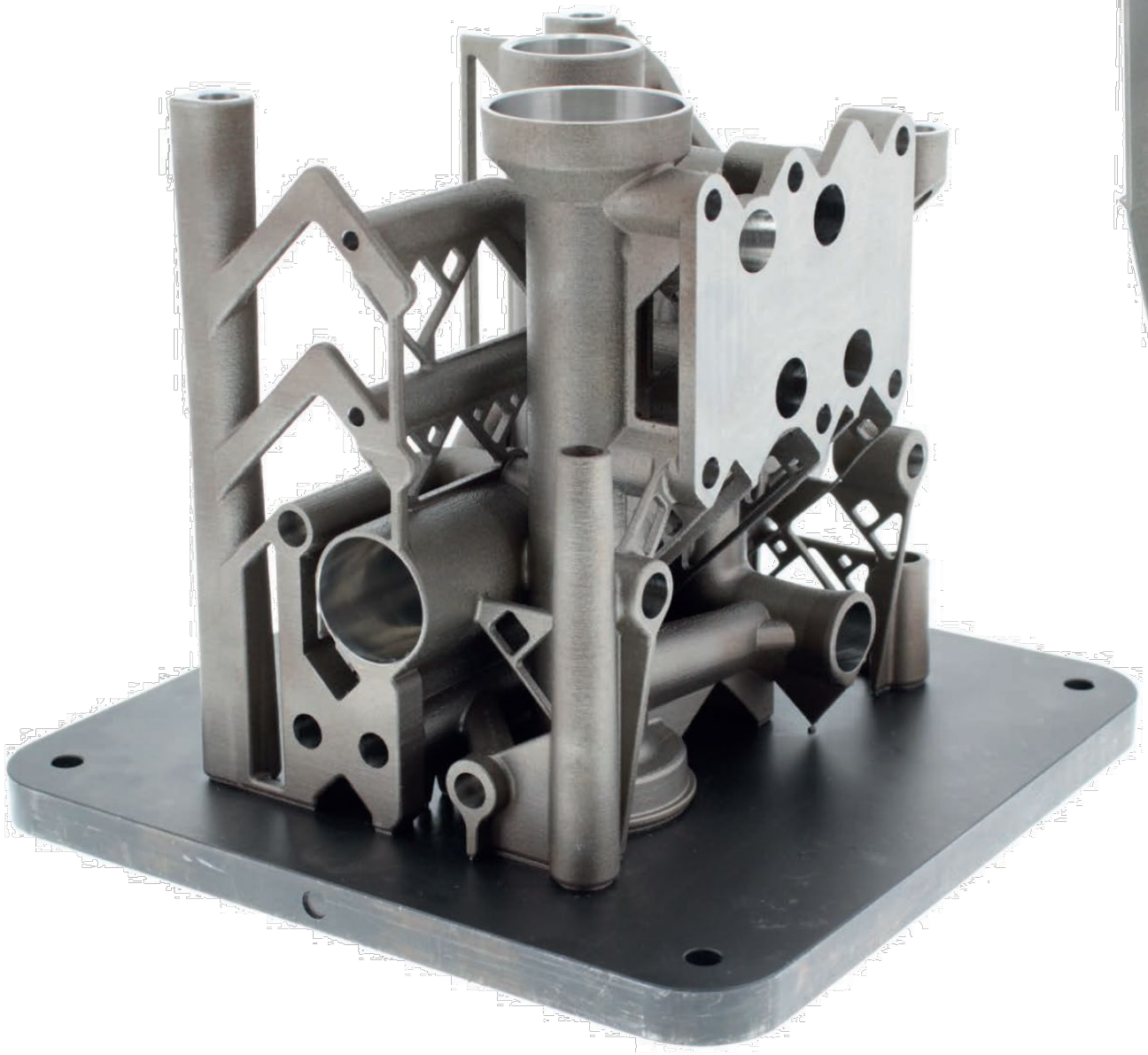

Heat optimization

Conformal cooling

# Brainport Industries Campus (BIC)


RENISHAW
RenAM 500M


RENISHAW
RenAM 500M



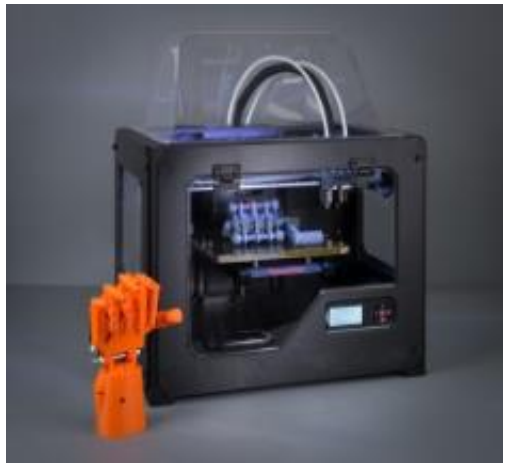

Ultimaker

Stratasys
Fortus 400

Stratasys
F370

Stratasys
Objet30 Prime

Formlabs
Form 1



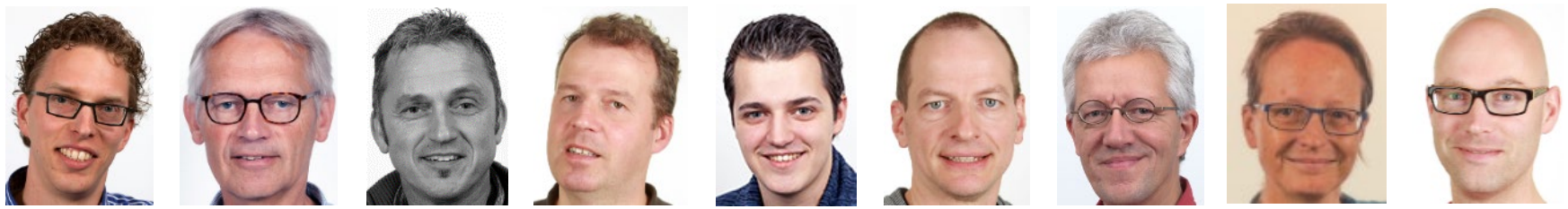
Makerbot
Replicator

DDDrop

Uprint
SE Plus

Solutionix
Rexscan

Cubify
Sense



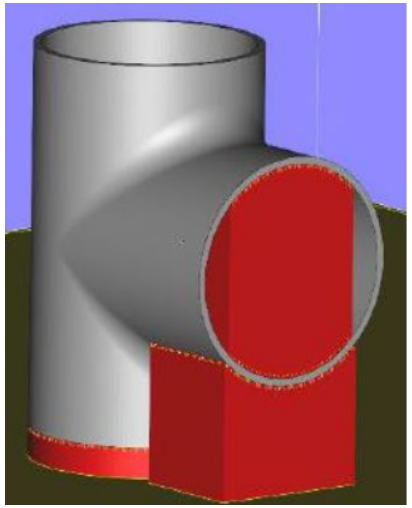
| | |
|---|---|
| Academic term: | Once a year in spring semester (February - July) |
| Admission: | Entry requirements based on an engineering/technical bachelor study, such as Mechanical engineering, Mechatronics, Automotive, Applied Physics, or comparable study. |
| Credits: | 30 EC (European Credit Transfer and Accumulation System)<br>840 study load hours, 20 educational weeks, 42 hours per week |
| Language: | English study materials, and in case of participating international students the lectures will also be in English. |
| Limitation: | Min–Max = 12–32 students |

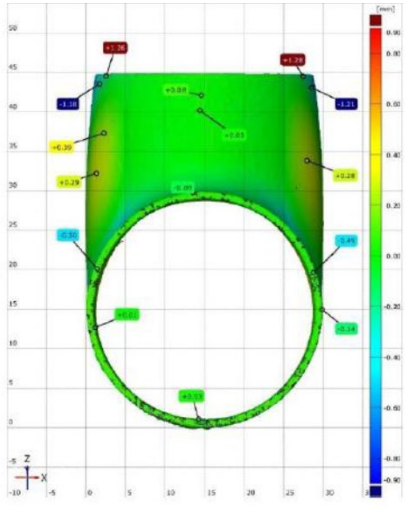
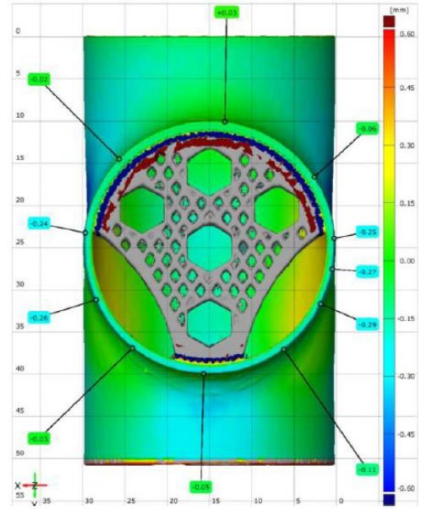
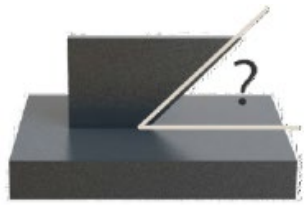
| | Study load [hr/week] | Contact time [hr/week] |
|---|---|---|
| Design for Additive Manufacturing (DFAM) | 5.6 | 2 |
| Practical Skills for Additive Manufacturing (PSAM) | 5.6 | 2 |
| Production technology and Materials (PM11) | 5.6 | 2 |
| Stress analysis and Optimization (CM11) | 5.6 | 4 |
| Heat and Flow analysis (EP11) | 5.6 | 2 |
| Project (IPDAM) | 14.0 | 1 |
| **Total** | **42.0** | **13** |

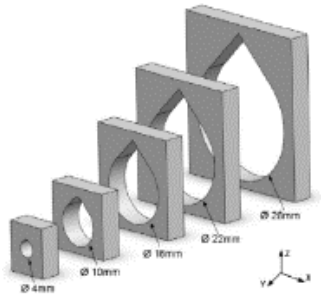
- Lessons at BIC are scheduled on two whole days a week.
- Project is scheduled on one whole day a week.
- Examination: 3 written exams (DFAM1, PM11T1, PM11T2), for the rest there are practical assignments and projects.
- Study materials: presentations, articles, lecture notes, hand-outs, etc.
  No mandatory books.

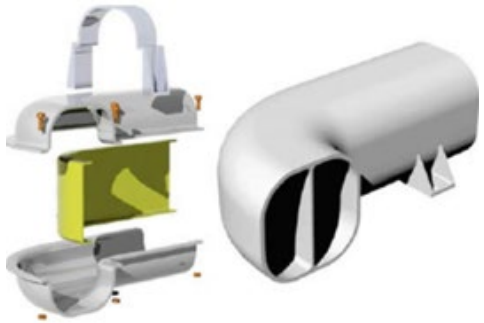
## Design for Additive Manufacturing

- Design guidelines
- Economic aspects
- Killer application identification





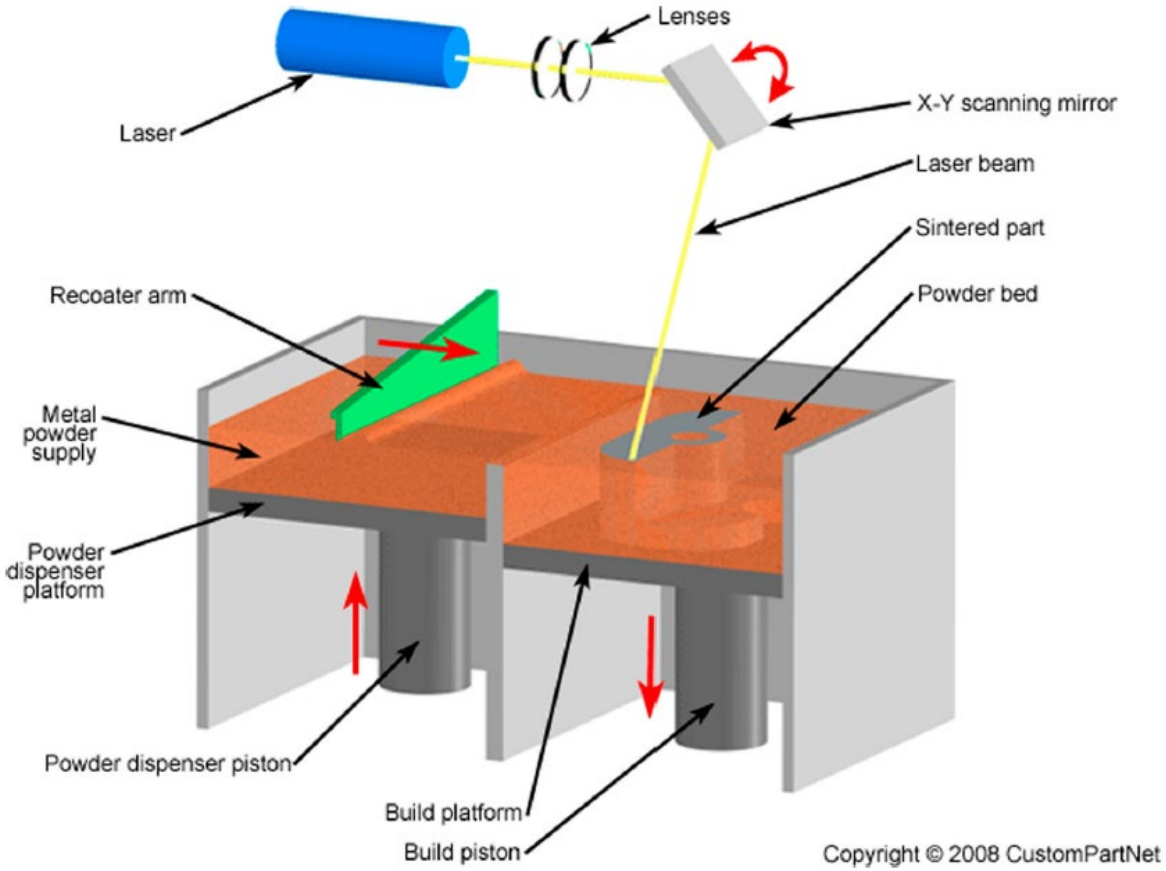


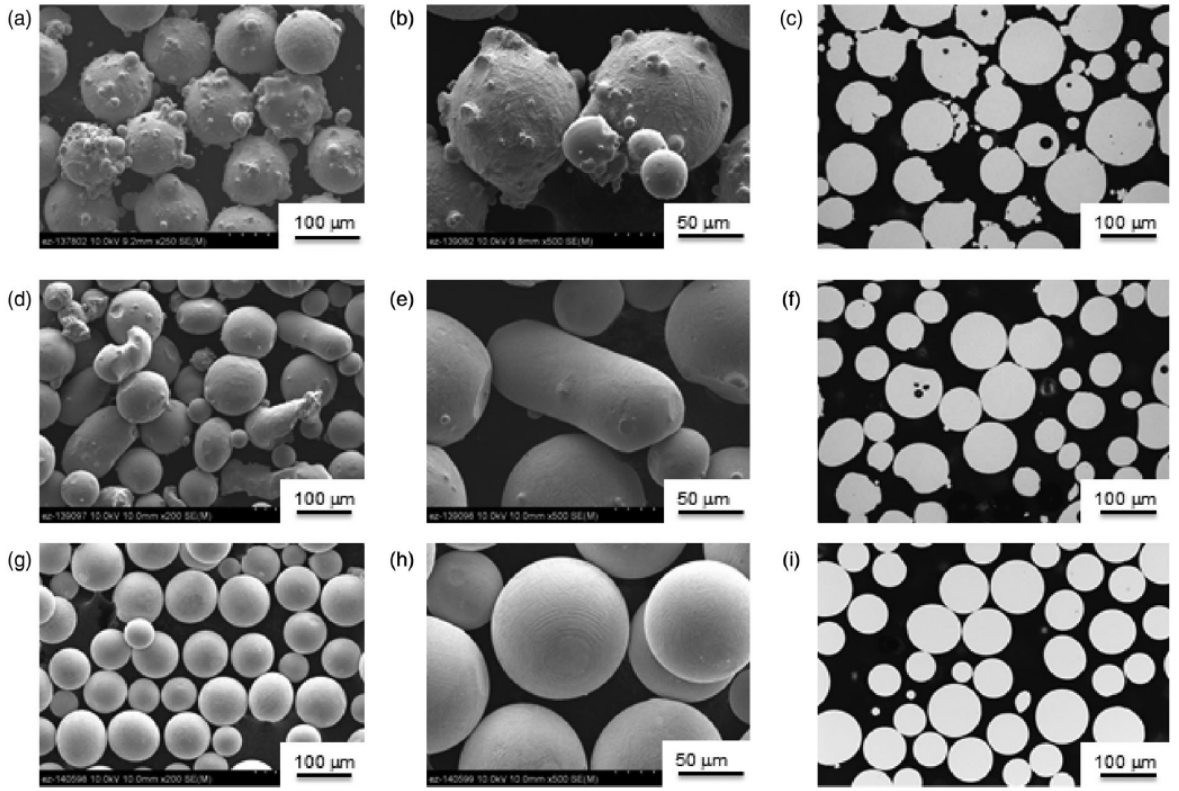
## Practical Skills for Additive Manufacturing

- Production preparation
- Safety
- 3D-printing
- Post processing
- Test and measurement

# Production technology and Materials

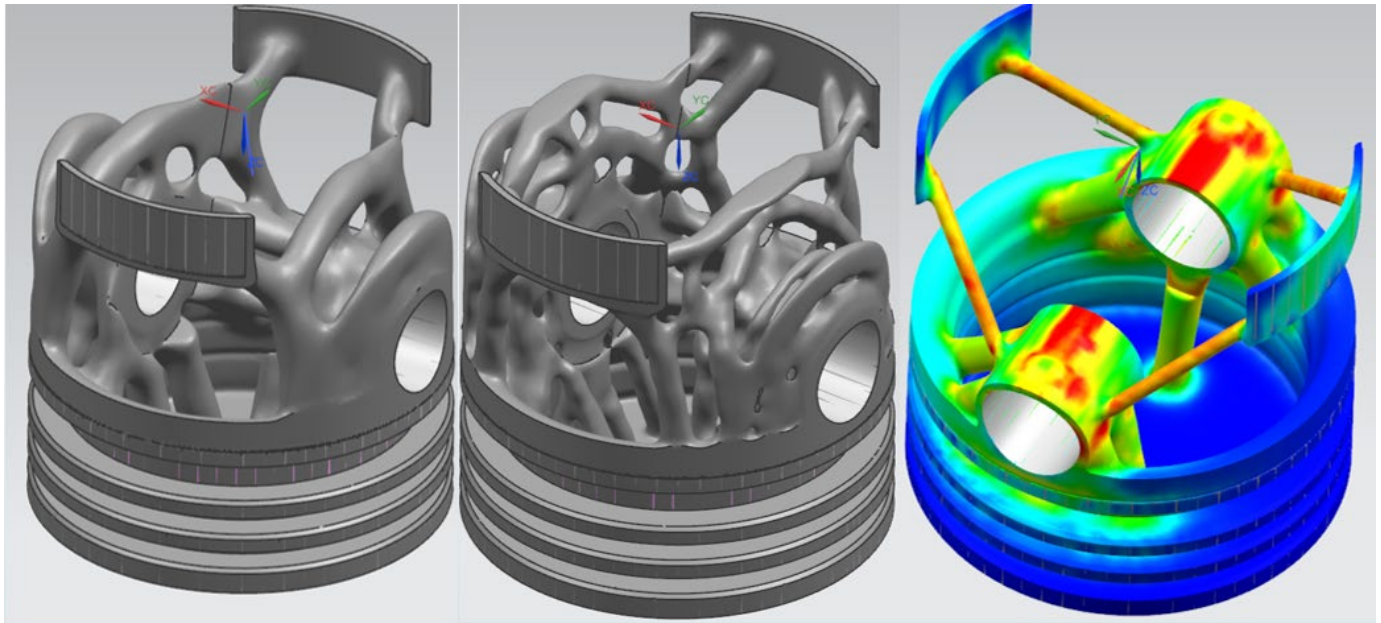
- Conventional versus additive processing
- Properties of materials for AM
- Heat treatment
- Testing of materials



## Stress analysis and Optimization

- FEM theory and background
- FEM analysis
- Topology optimization assignment



Geoptimaliseerd 90% Material spreading

Geoptimaliseerd 100% Material spreading

Geoptimaliseerd naar 1,5 safety factor, Material 60%

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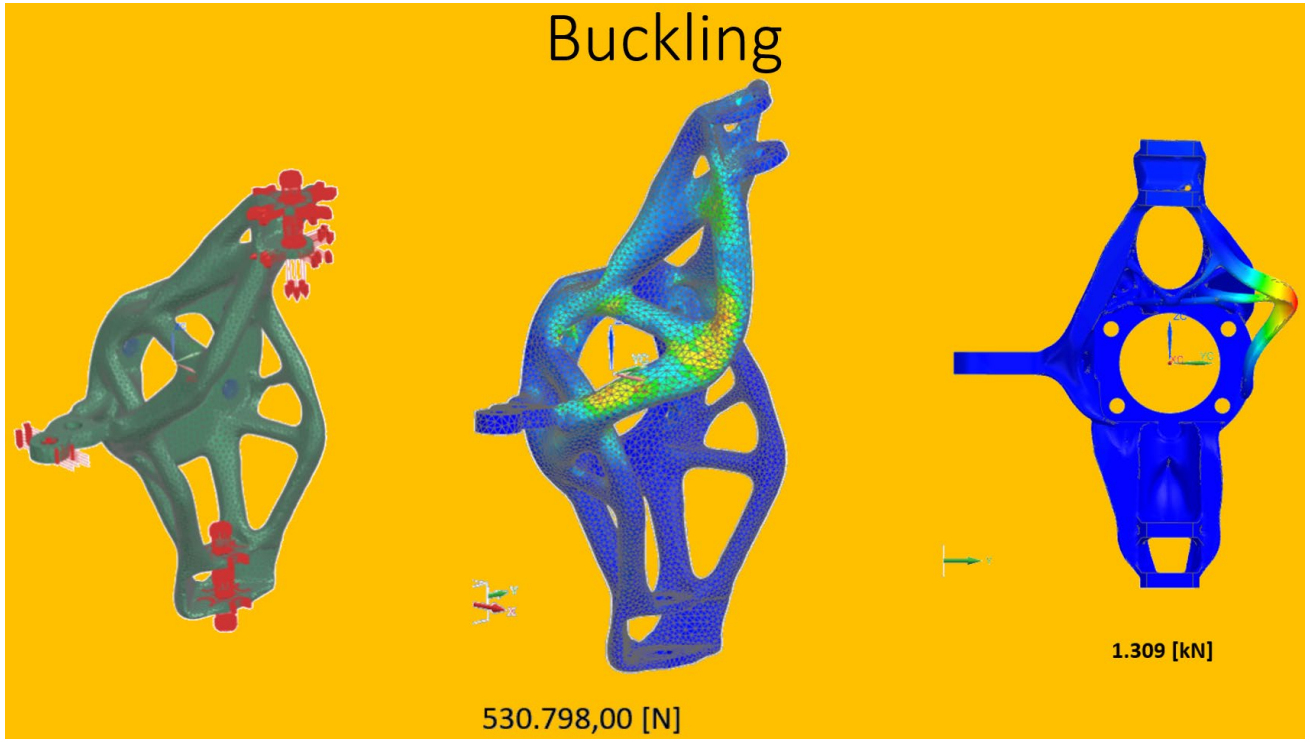
This cool looking part is the result of a colaboration with the minor Smart Product Development which is part of Fontys Mechanical Engineering. A group of students implemented 'topology optimisation' to one of the more complex mechanical parts of a lightweight vehicle, the steering knuckle.

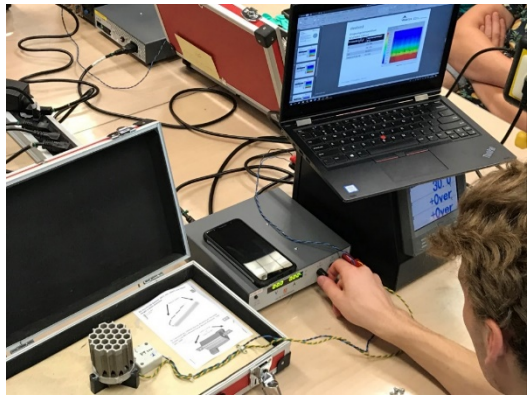
This part is still a PLA mockup and intentions are to print this part using a metal aloy printer in the future. For now it's a cool part which we can testfit in our coming prototype vehicle. Thanks to Auke Visser, Diederik van Iersel, Maikel van Grootel, Jarno Hermans, Rik Hanssen and the rest of the team for adding value to our cause.

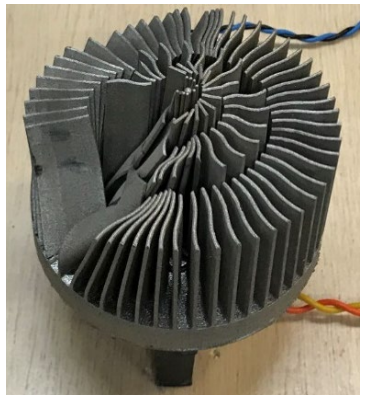
#coolparts #suspension #topologyoptimisation #automotive #solarchallenge #studentteam #student #university #fontys #fontysuniversity # fontysuniversityofappliedsciences #eindhoven #helmond #automotive

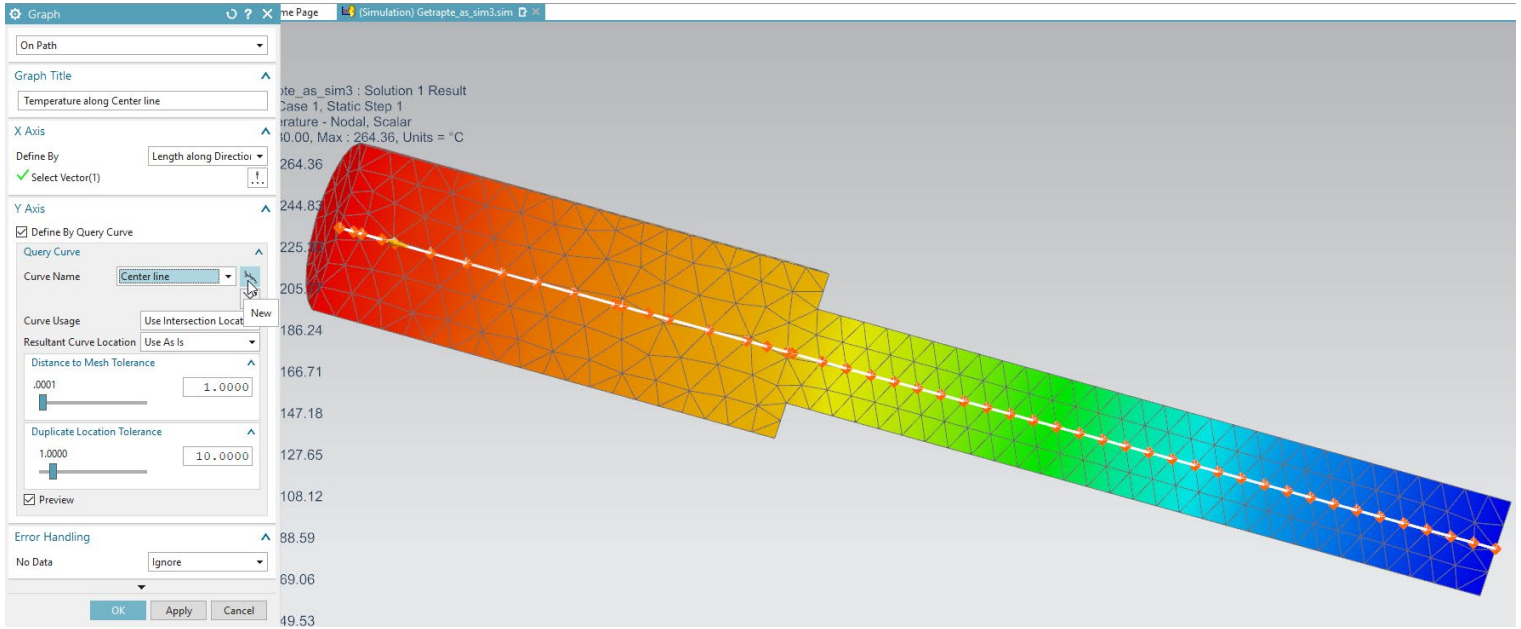


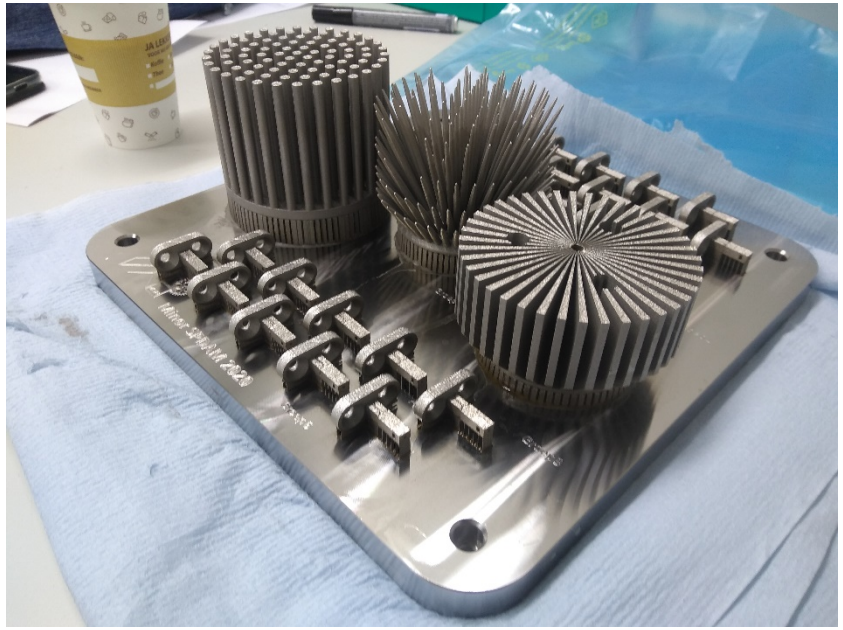
# Heat and Flow analysis

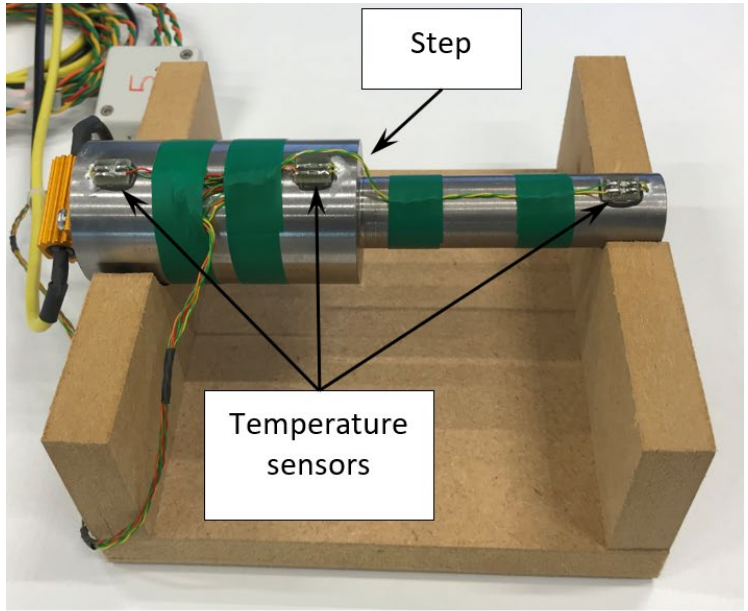
- Basic theoretical principles
- Computer simulations
- Validation by physical experiments



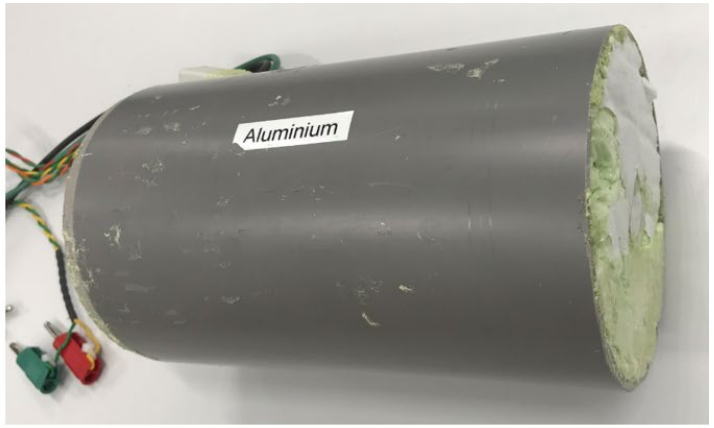




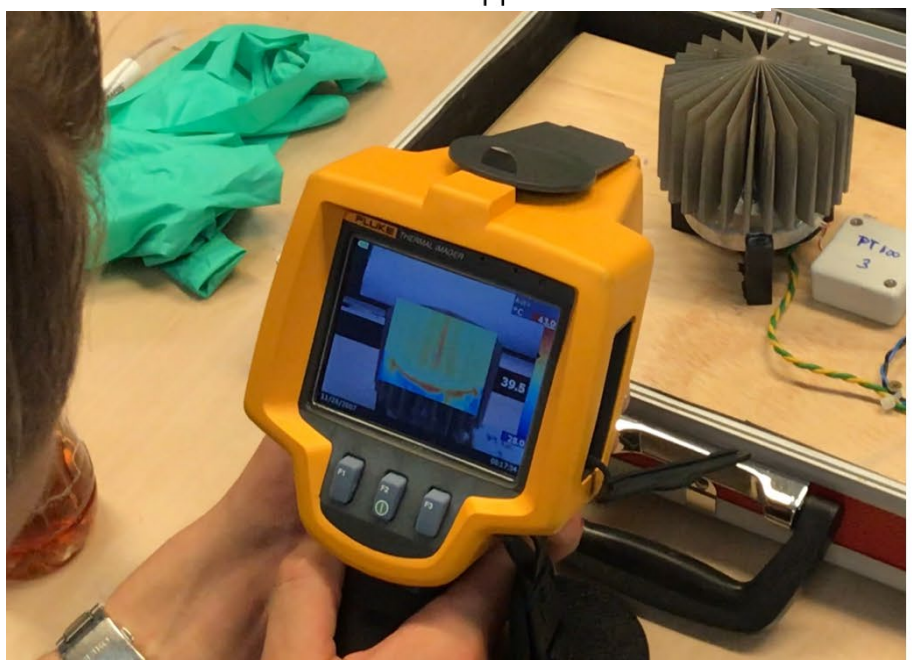



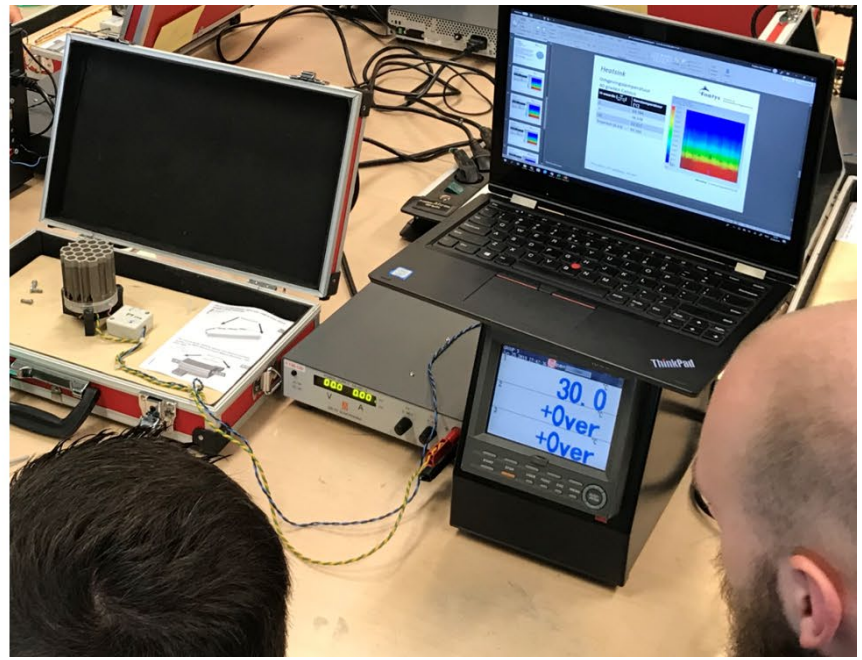



Non-insulated stepped bar



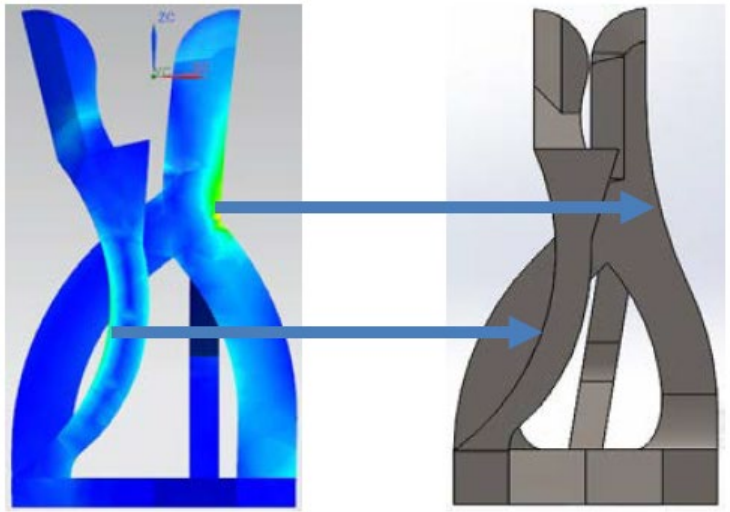

Insulated stepped bar

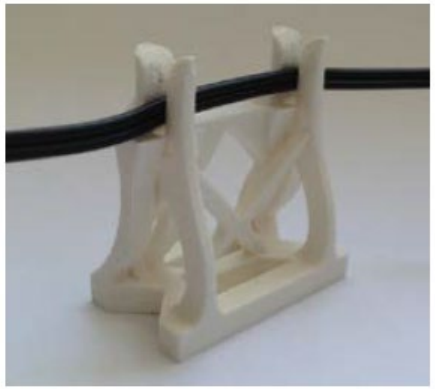




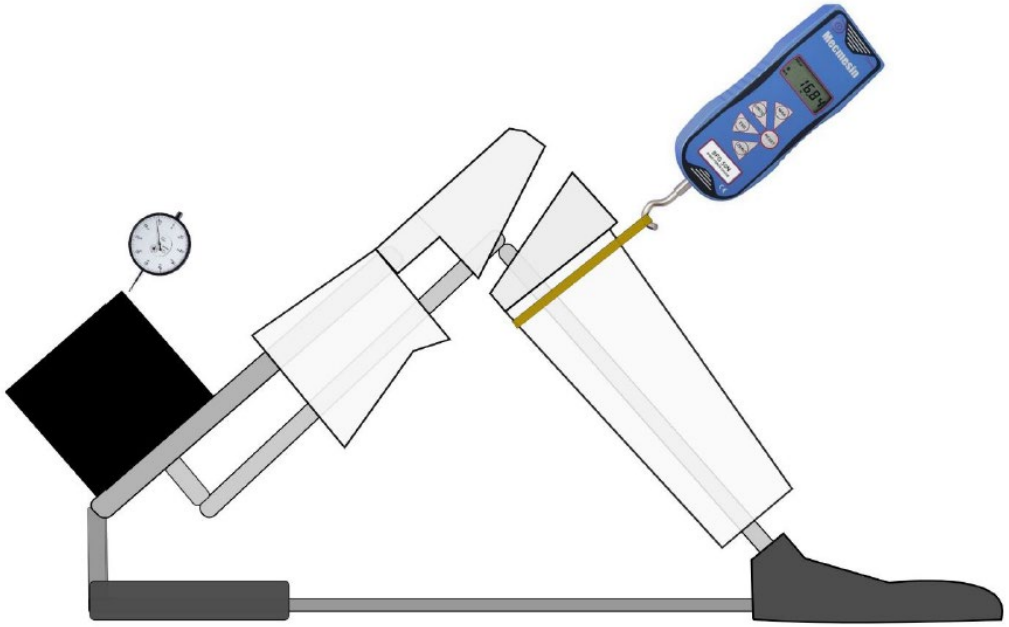
## Project

- Projectgroup and Company
- Analyzing
- (Re)designing
- Build
- Test and measure

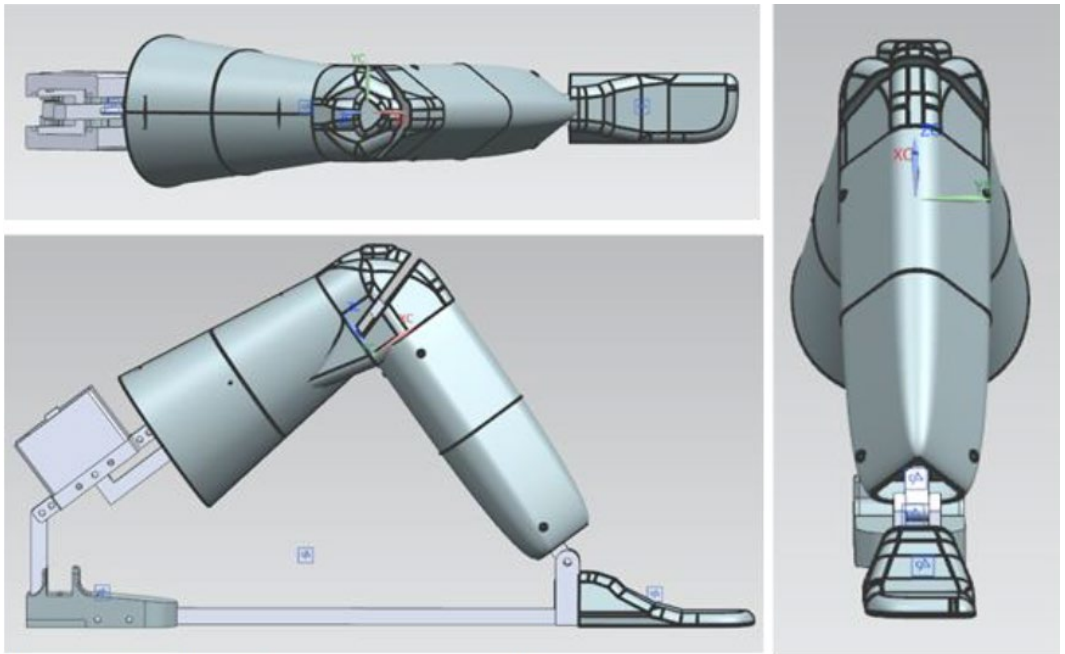





SUPERDRY
Modules

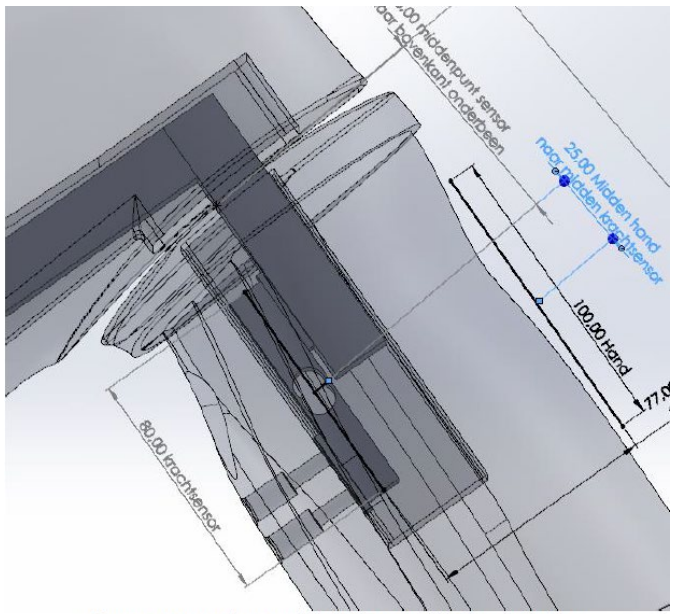


*Figuur 7: Schematische tekening van de opstelling.*

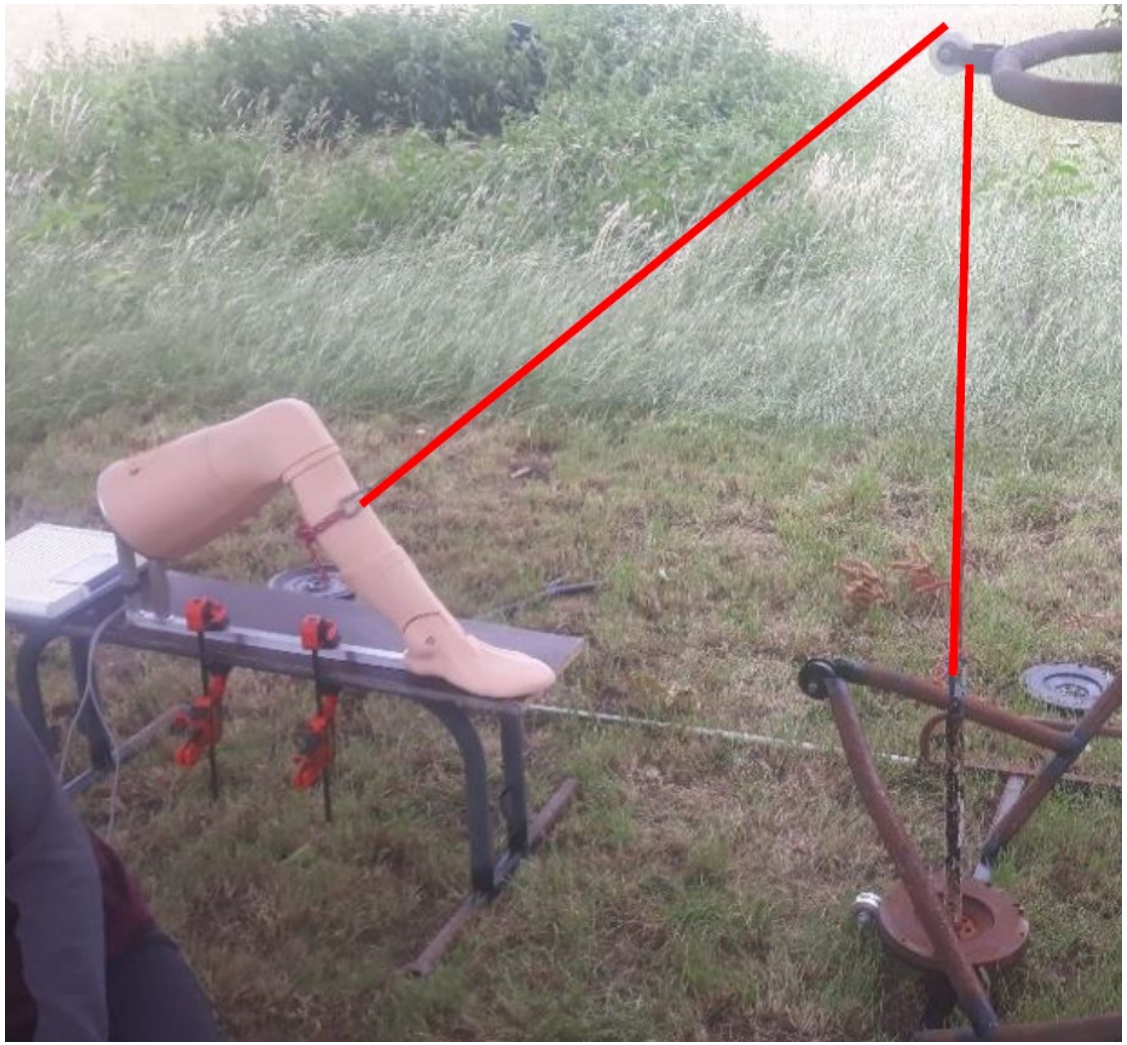


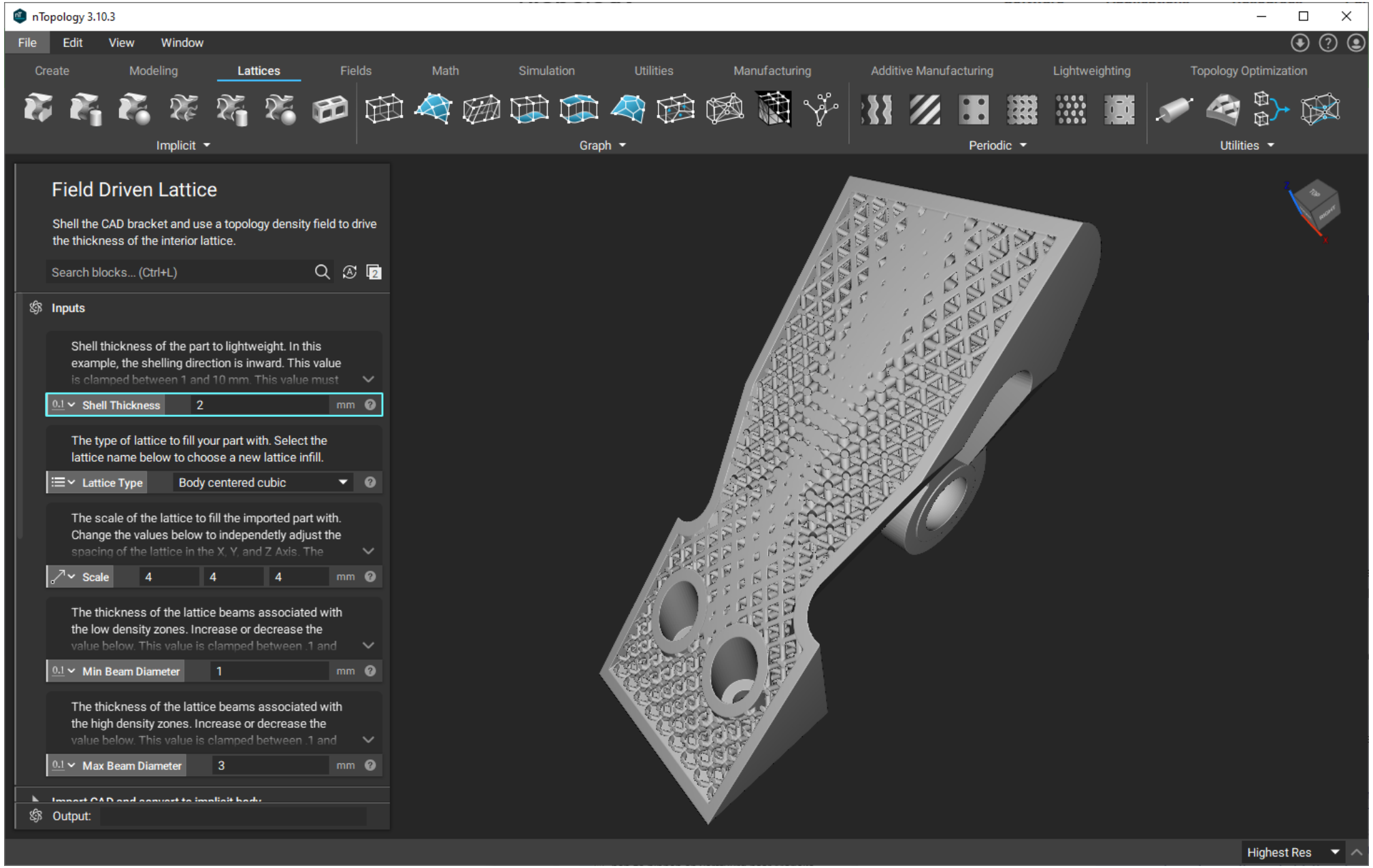
*Figuur 6: CAD tekeningen knieleermodel prototypen 3.*[6]

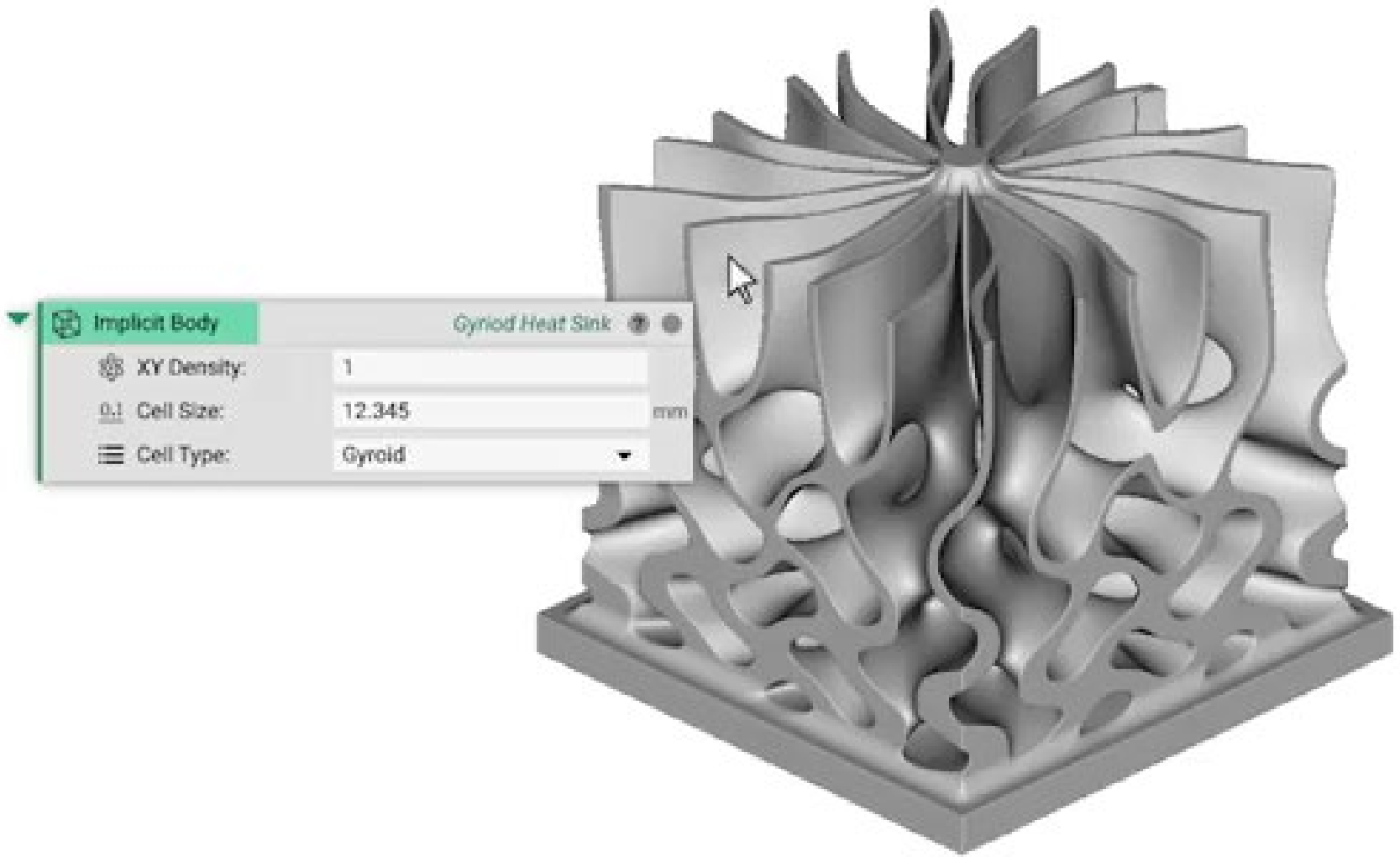
*Figuur 10: 3D-scan van het menselijk been.* [5]



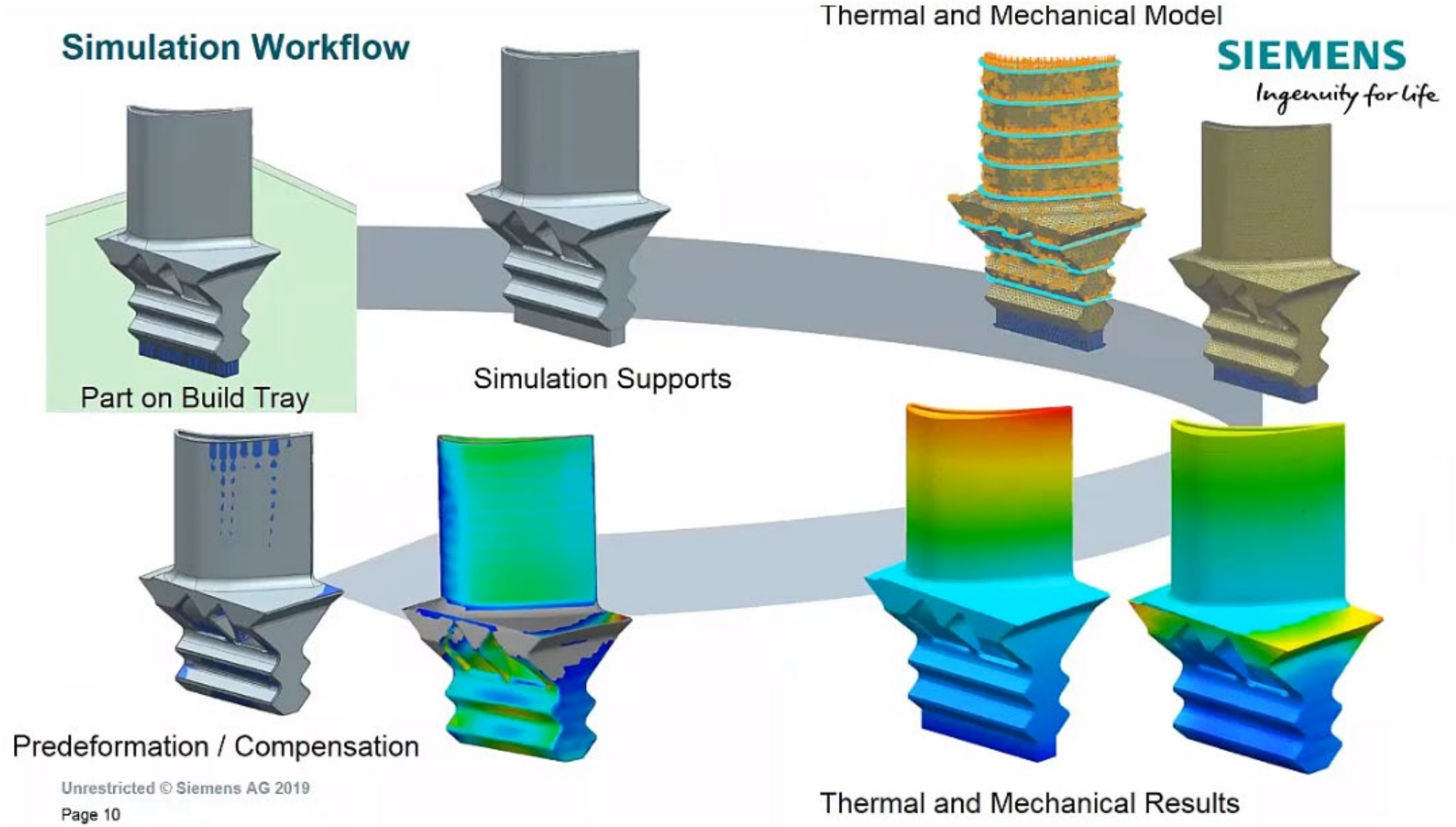

*Figuur 13: Locatie van de krachtsensor in het onderbeen.*




nTopology 3.10.3
File
Edit
View
Window
Create
Modeling
Lattices
Fields
Math
Simulation
Utilities
Manufacturing
Additive Manufacturing
Lightweighting
Topology Optimization
Implicit
Graph
Periodic
Utilities
Field Driven Lattice
Shell the CAD bracket and use a topology density field to drive the thickness of the interior lattice.
Search blocks... (Ctrl+L)
Inputs
Shell thickness of the part to lightweight. In this example, the shelling direction is inward. This value is clamped between 1 and 10 mm. This value must
Shell Thickness
2
mm
The type of lattice to fill your part with. Select the lattice name below to choose a new lattice infill.
Lattice Type
Body centered cubic
The scale of the lattice to fill the imported part with. Change the values below to independetly adjust the spacing of the lattice in the X, Y, and Z Axis. The
Scale
4
4
4
mm
The thickness of the lattice beams associated with the low density zones. Increase or decrease the value below. This value is clamped between .1 and
Min Beam Diameter
1
mm
The thickness of the lattice beams associated with the high density zones. Increase or decrease the value below. This value is clamped between .1 and
Max Beam Diameter
3
mm
Output:
Highest Res


Implicit Body
Gyriod Heat Sink
XY Density:
1
Cell Size:
12.345
mm
Cell Type:
Gyroid

# PBF process simulation



# Minor Smart Product Development with Additive Manufacturing (SPDAM)

Enrollment Fontys students ProgRESS and for external students KiesOpMaat

**Contact and coordination**
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08850-85844
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De Rondom 1, 5612 AP Eindhoven, 08850-77333,
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