HITRI plus
Heavy Ion Therapy Research Integration

1862
RIGA TECHNICAL UNIVERSITY

CERN

Design of support structure for nozzle components in heavy ion therapy gantry

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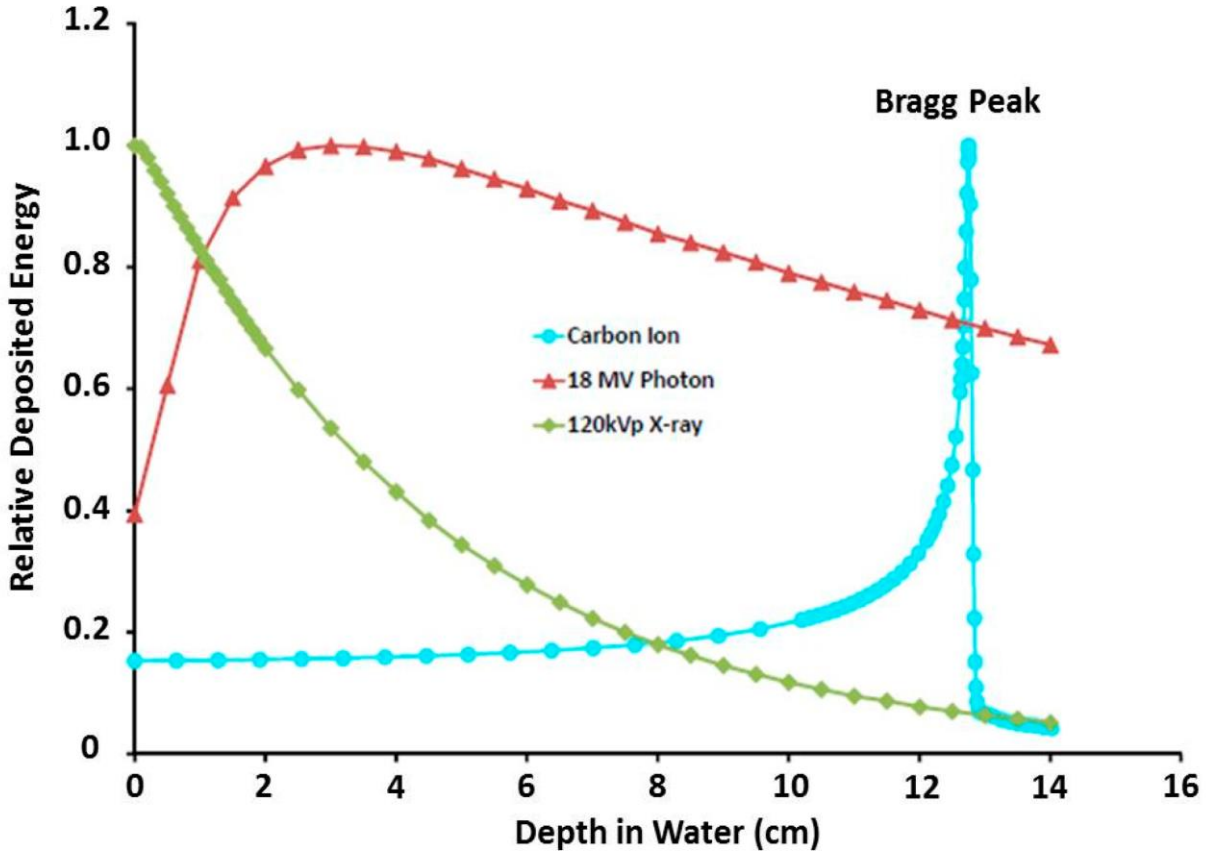
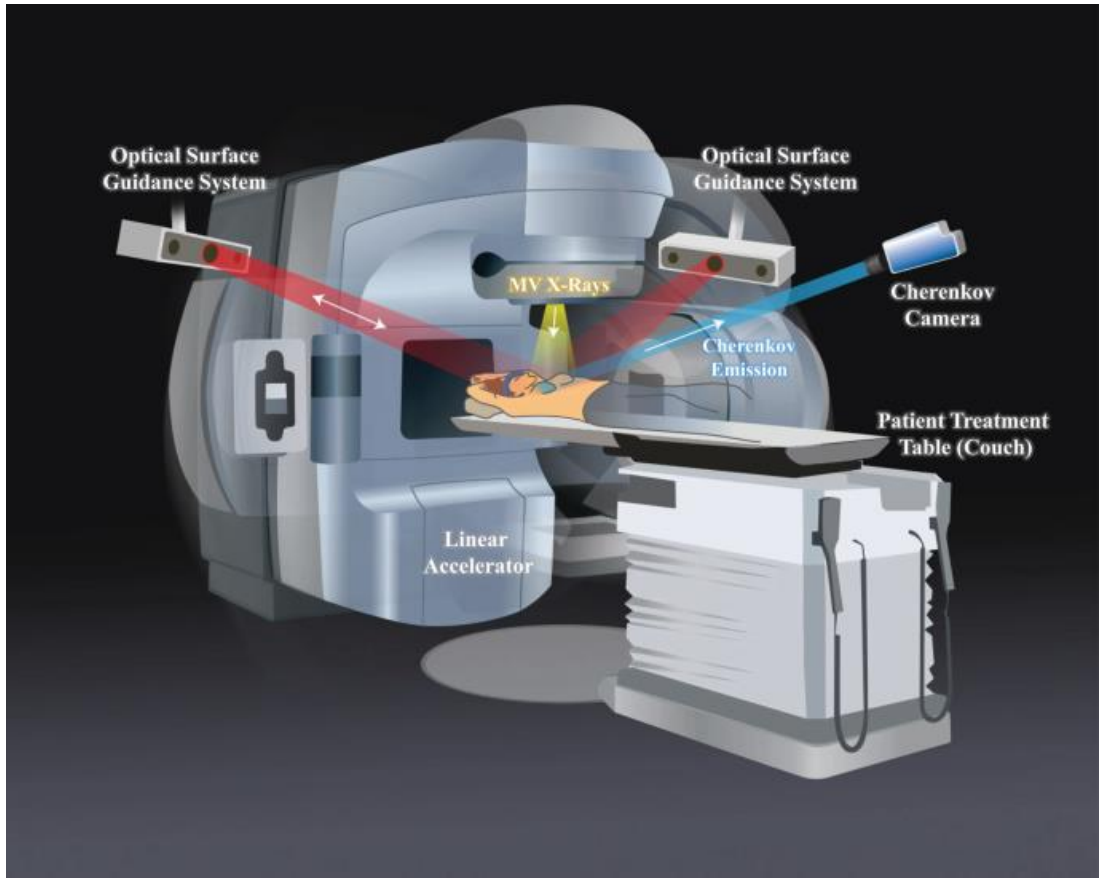
About me

Heavy ion therapy

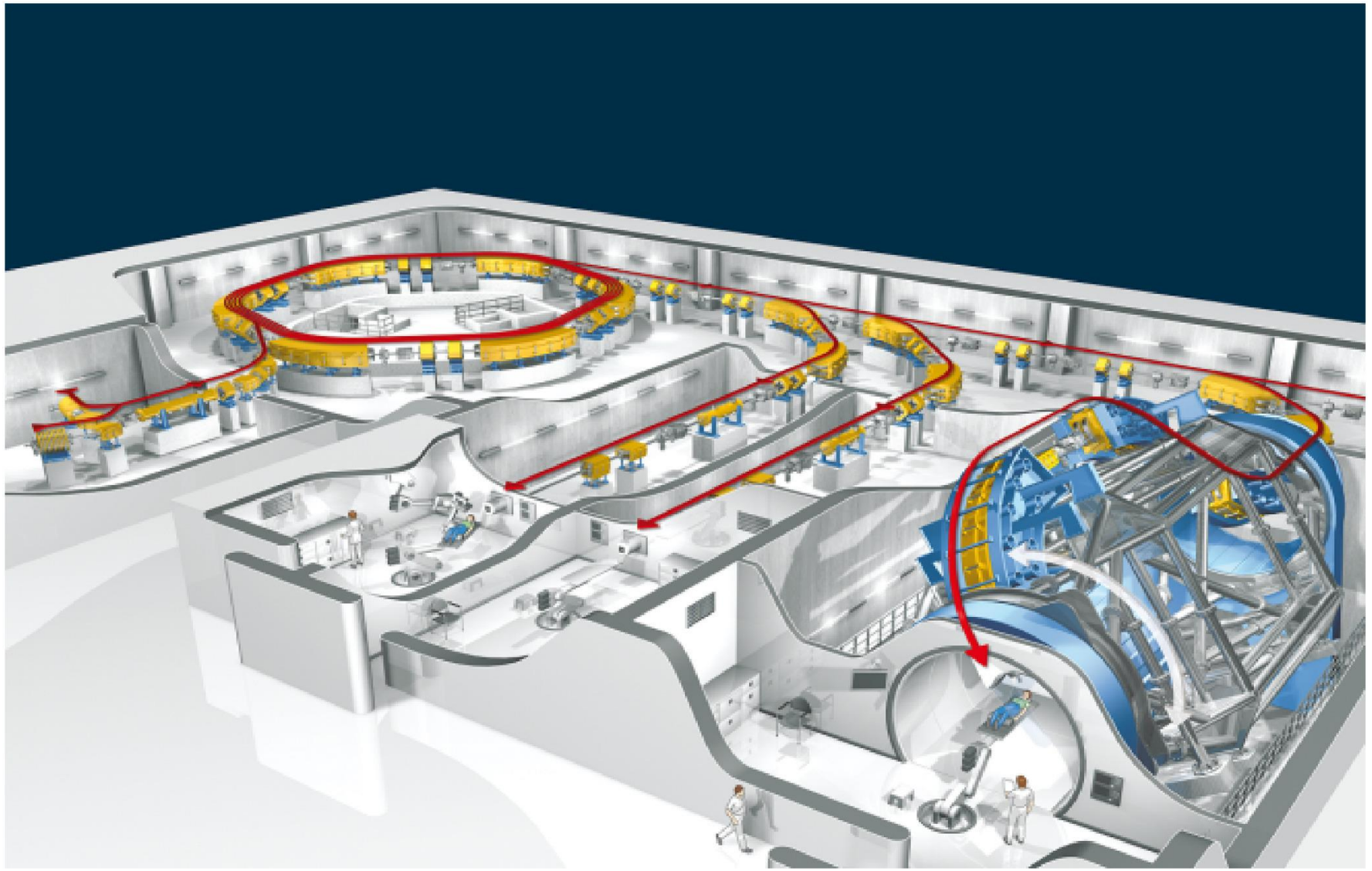


M. Osama, et al. 2017

Radiation therapy with X-Rays



R. L. Hachadorian, et al. 2020

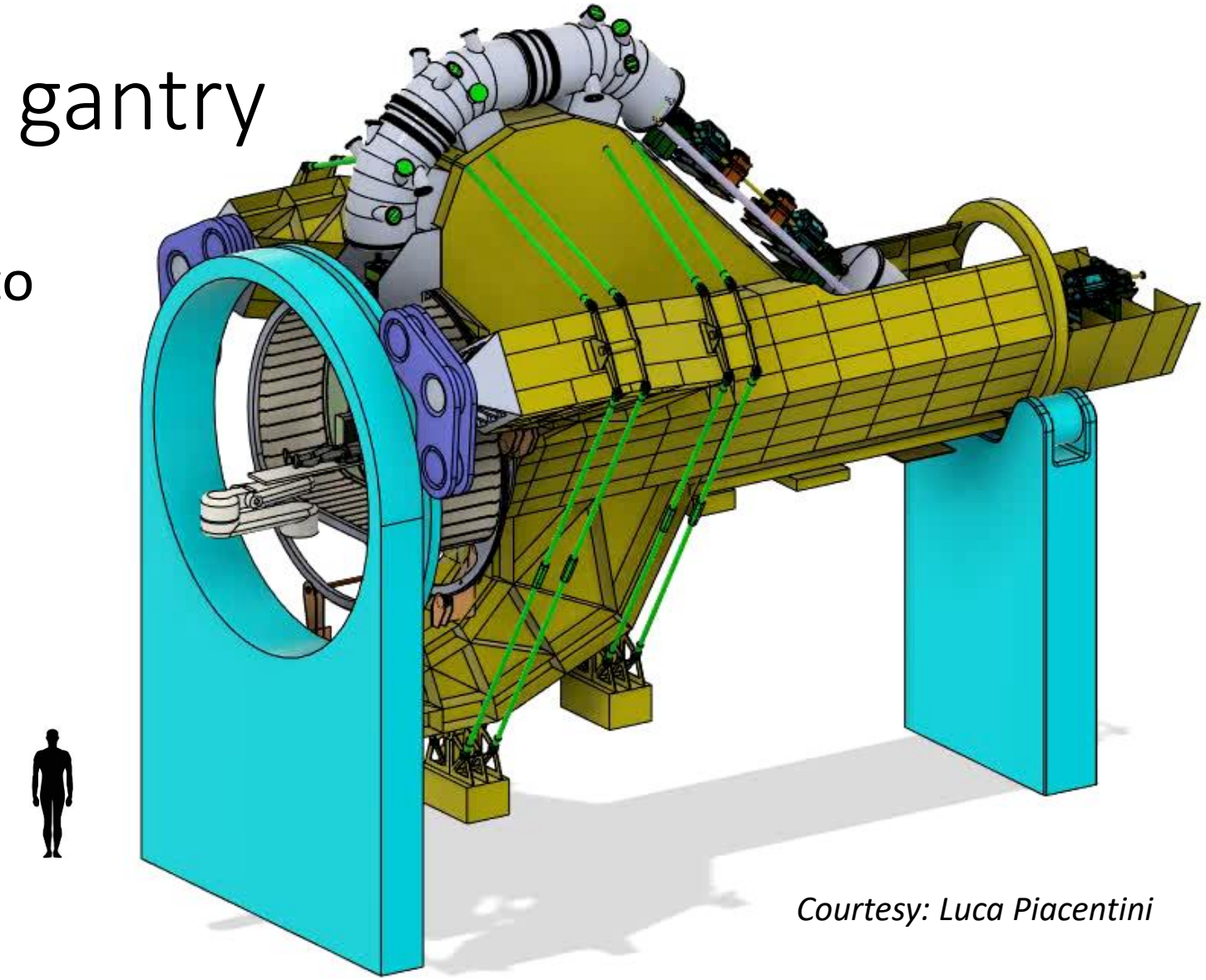


Mass: 600 t

O. Jäkel, et al. 2022

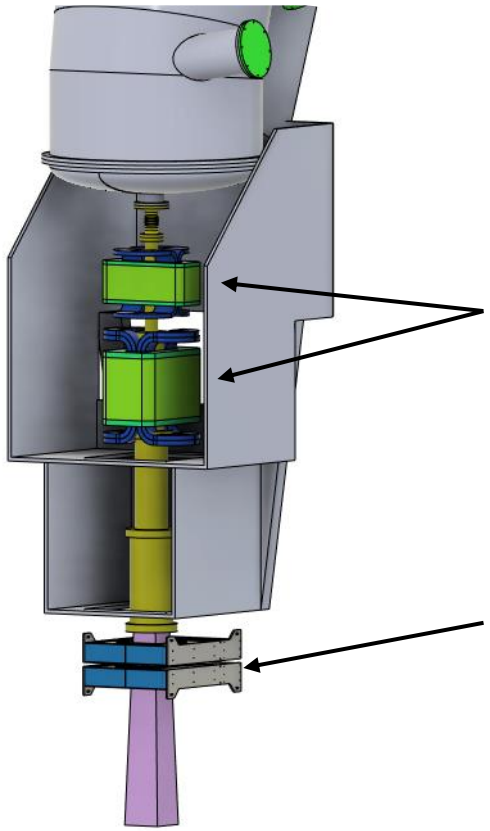
Heavy ion therapy gantry

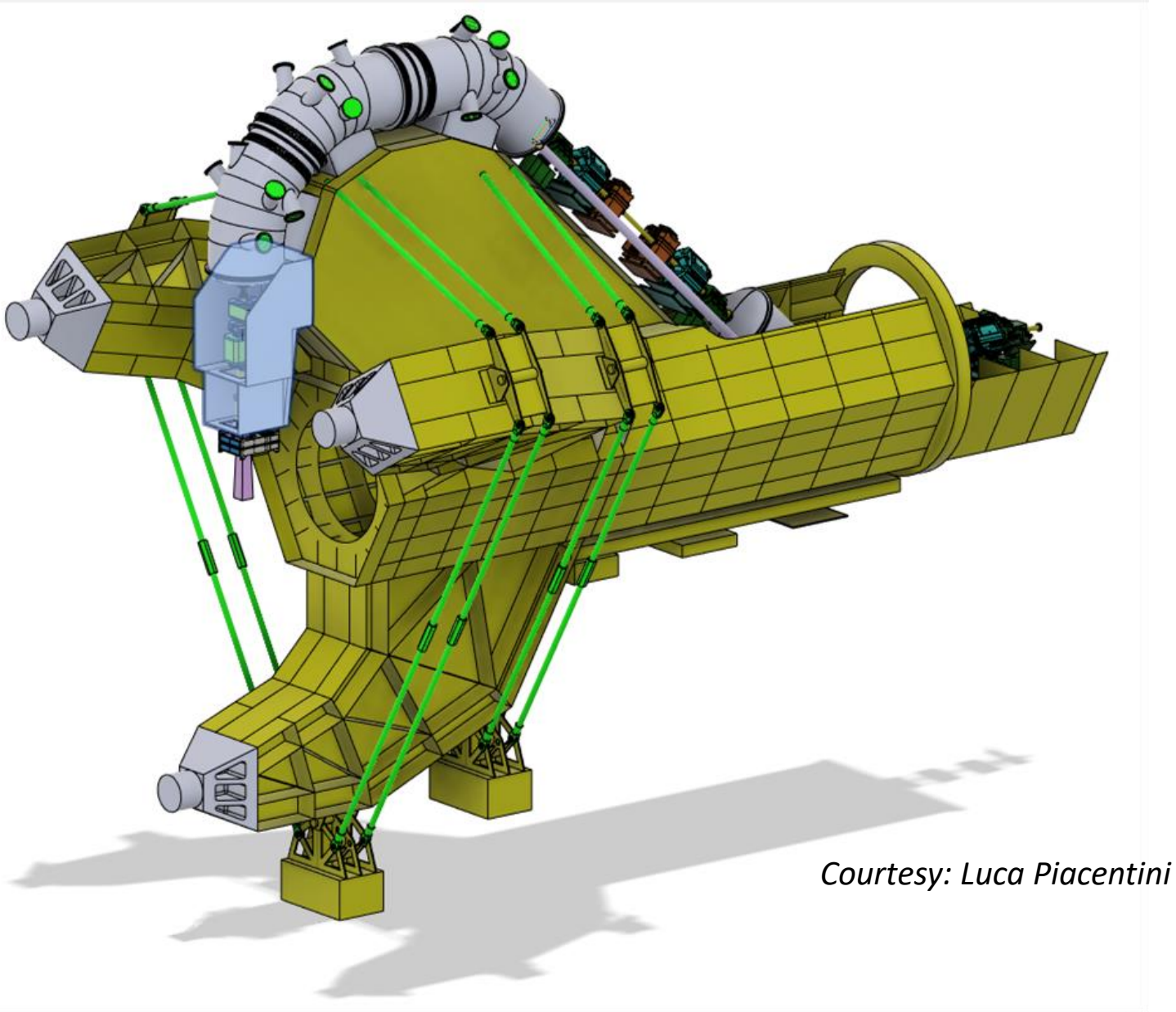
- Holds all the components to direct the beam.
- Allows irradiation from different directions



Courtesy: Luca Piacentini

Gantry nozzle





Courtesy: Luca Piacentini

Design requirements of nozzle structure

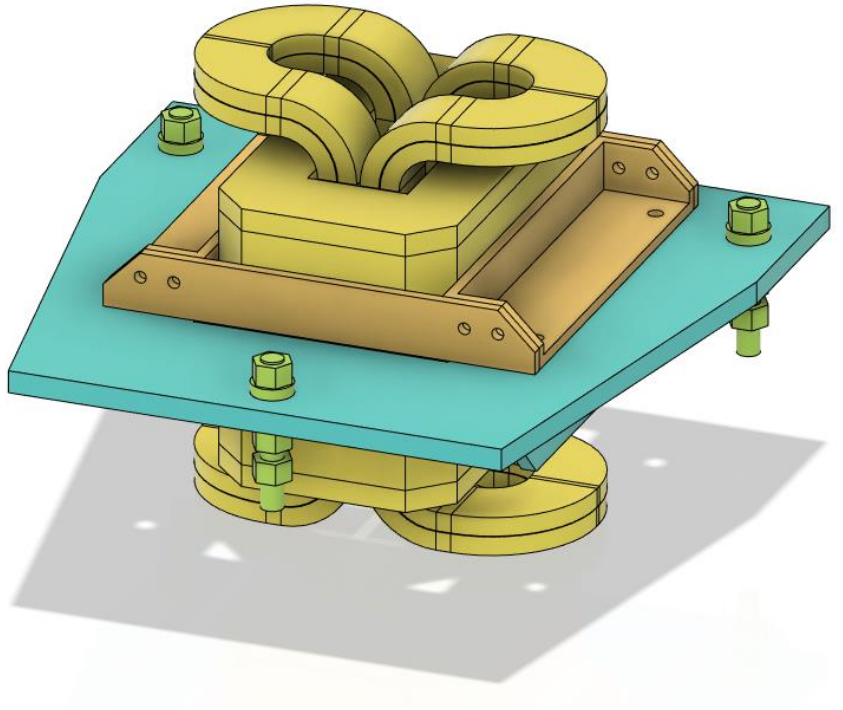
1) Component displacements
2) Mass
3) Volumetric constraints
4) Component alignment
5) Assembly
6) Manufacturability

Design workflow

Mounting of components

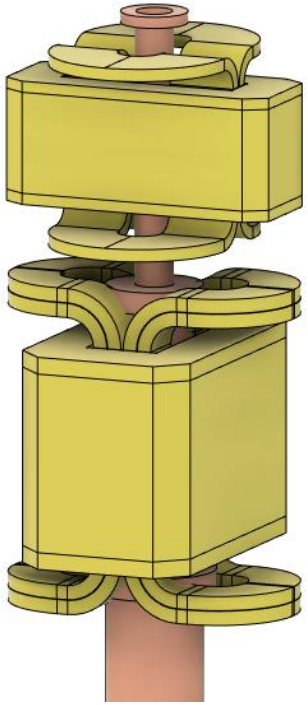
Requirements

- Possibility of 6DOF adjustability
- Simplicity
- Minimal displacements

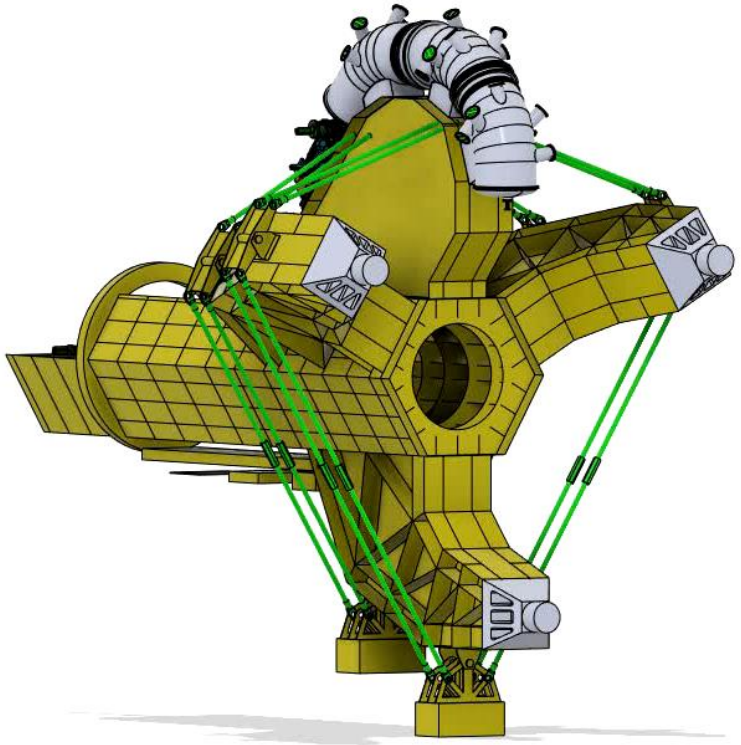


Assembly constraints

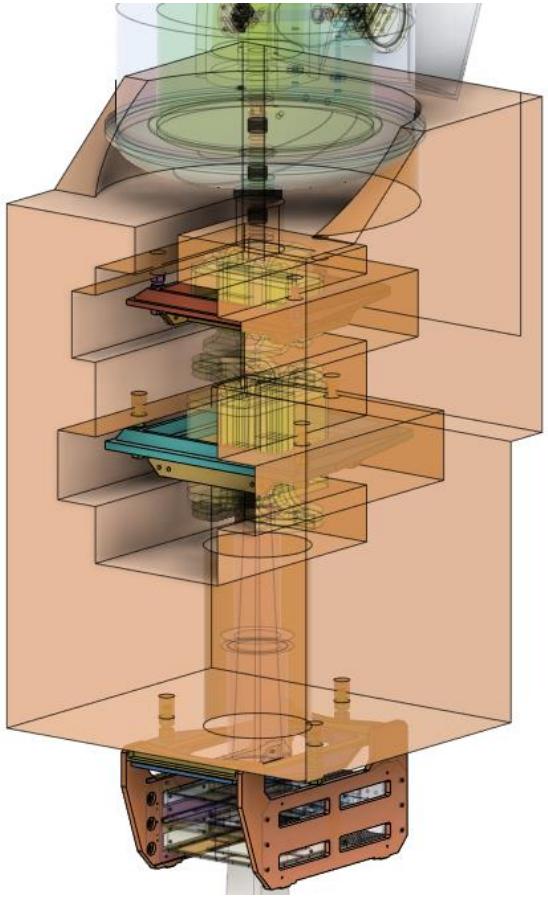
Scanning magnets as one peace

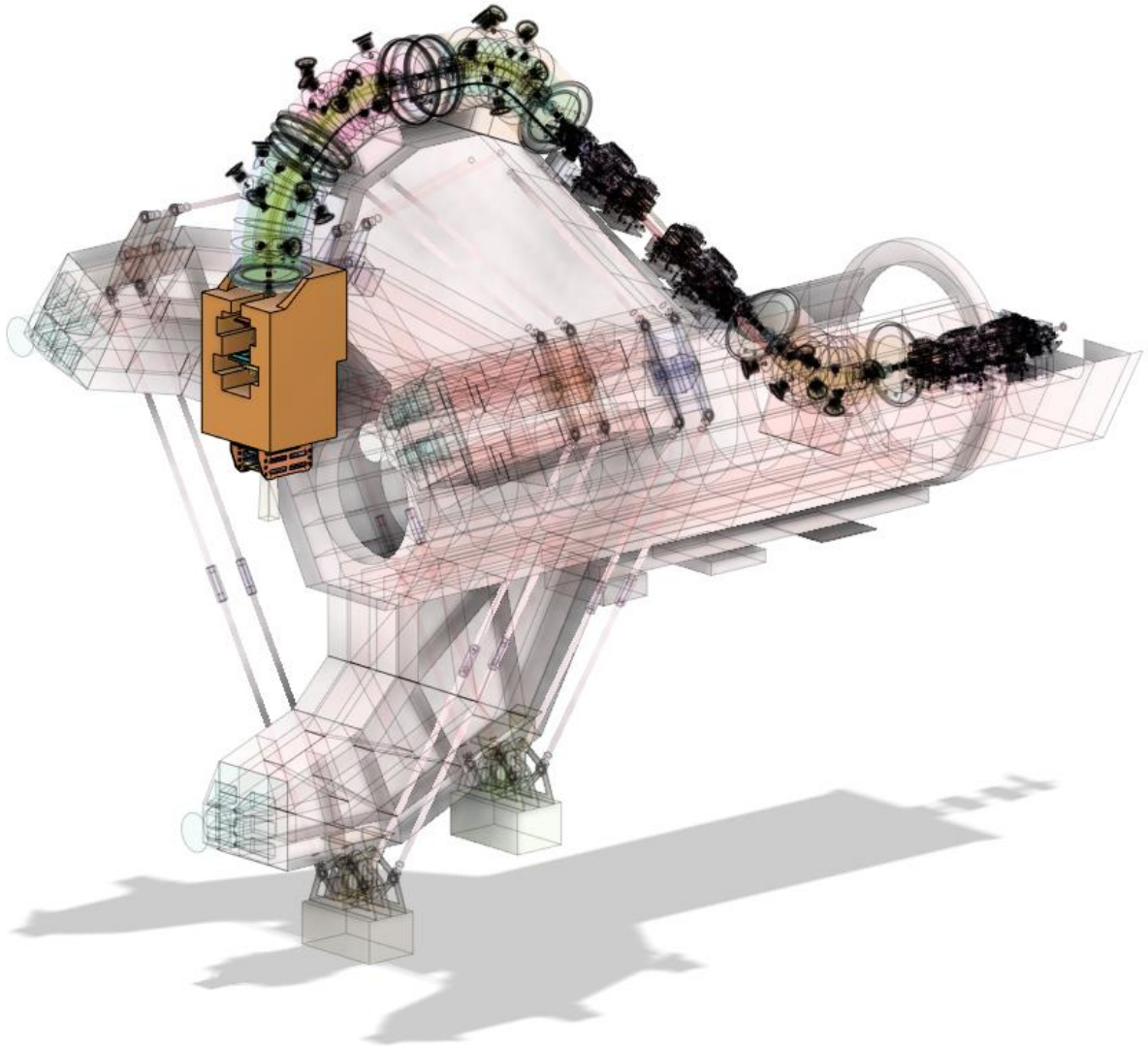


Maintenance



Volumetric limitations



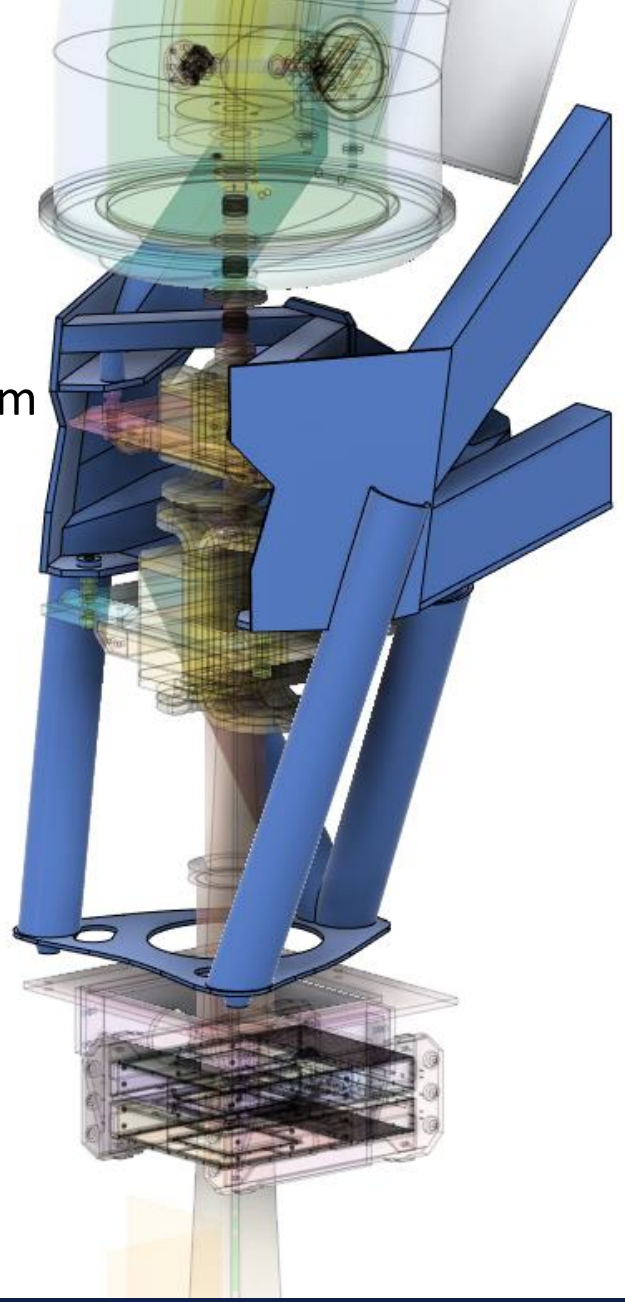


Topology optimisation

1st

1.3t

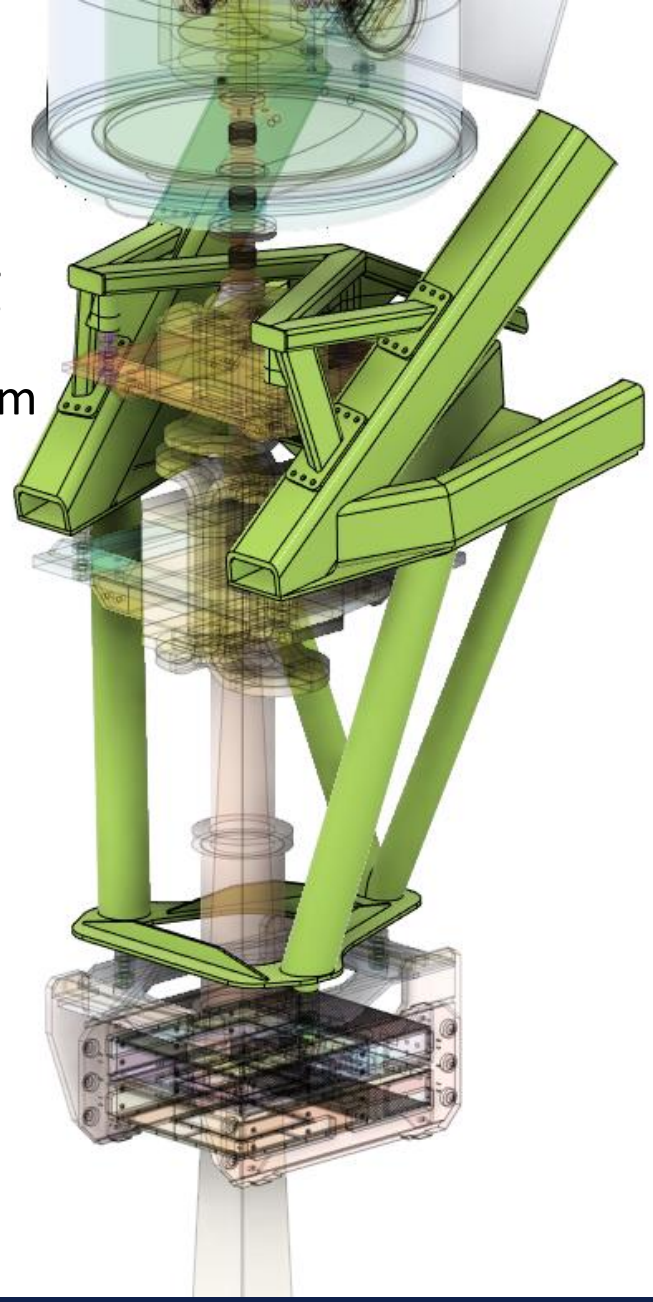
0.02mm



2nd

730kg

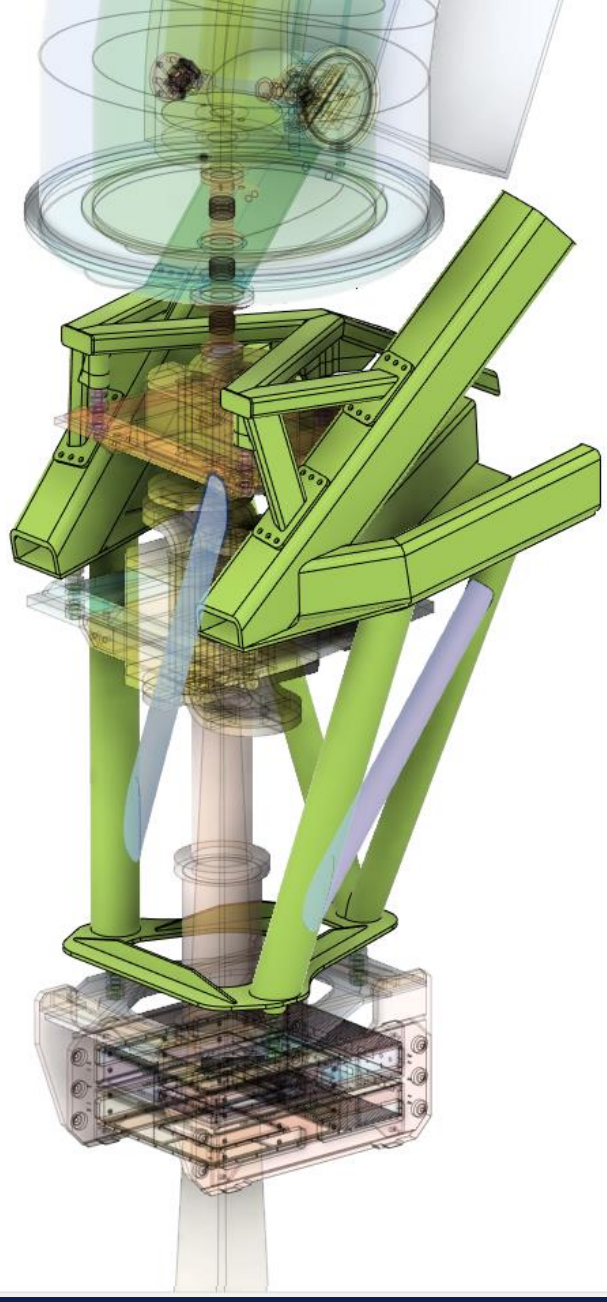
0.06mm



3rd

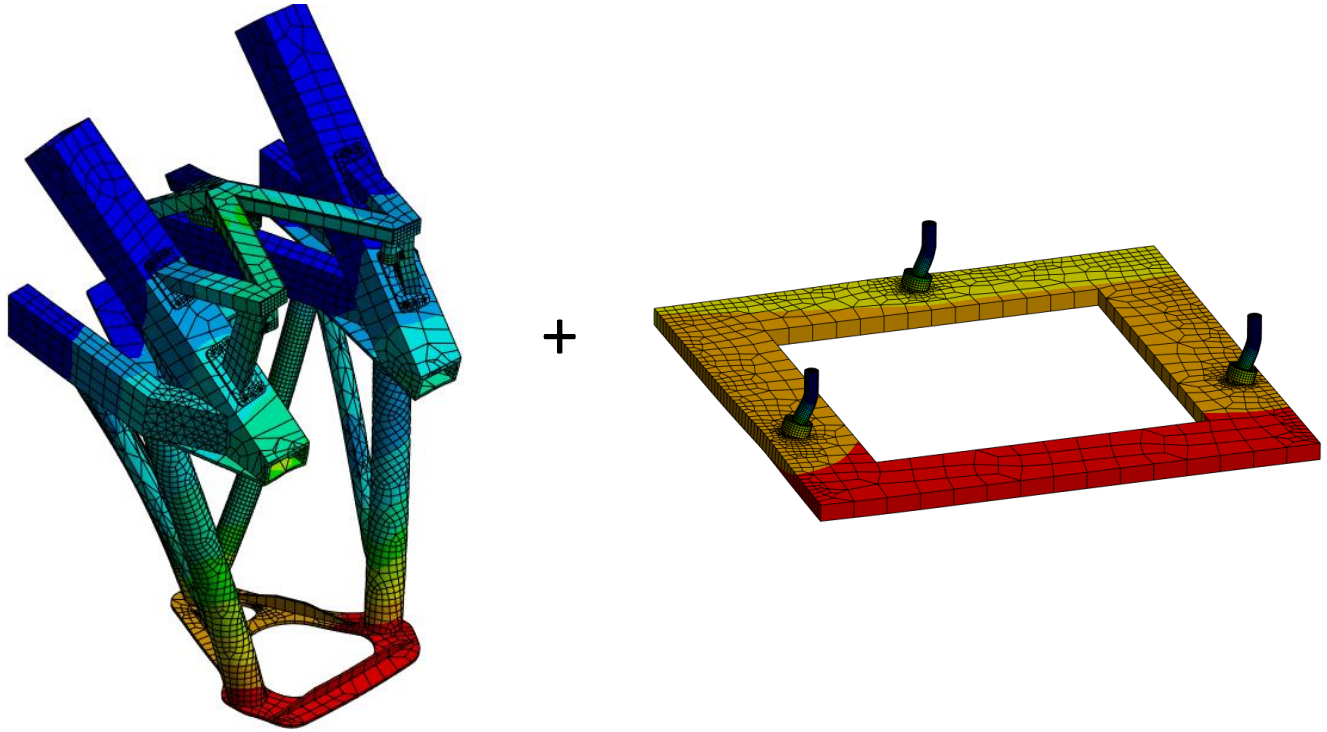
620kg

0.06mm



Ongoing work

- Calculations of component displacements
- Precision of calculation
- 4th iteration



Questions

Thank you!