

Finnish High-School Students Internship Programme
2019



Mechanical engineering

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18.10.

The manufacturing process



1. Designing

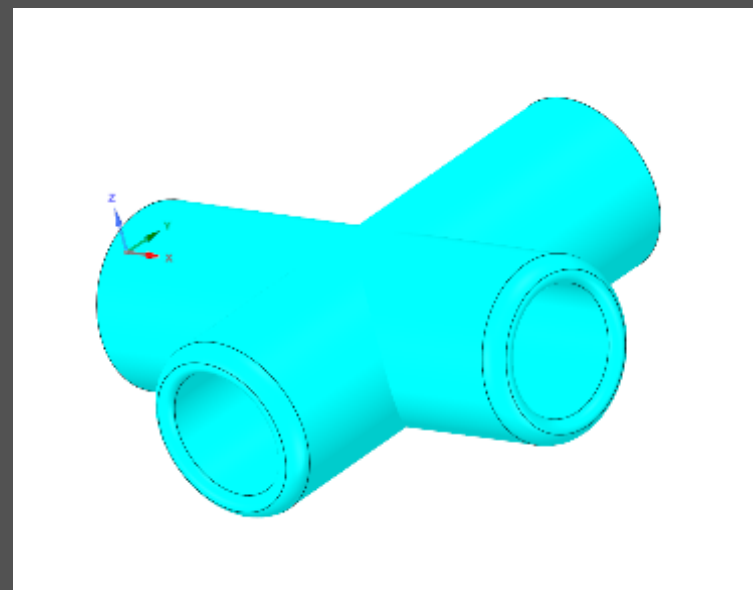
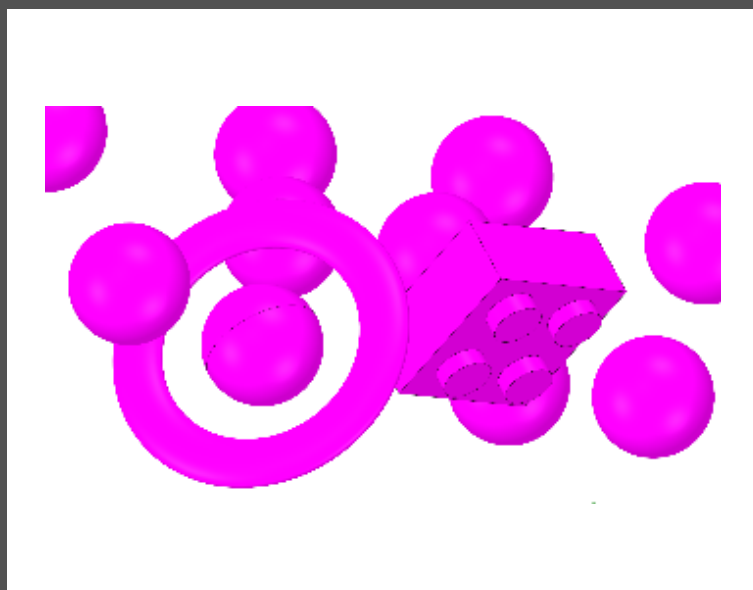
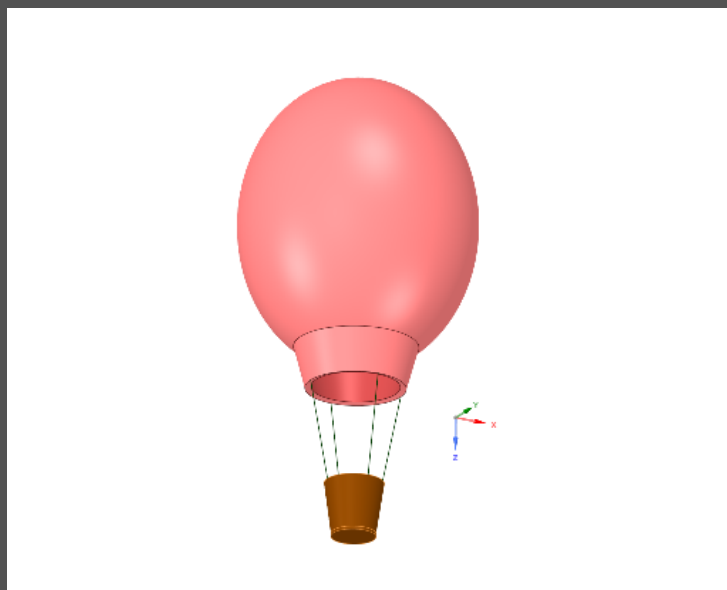
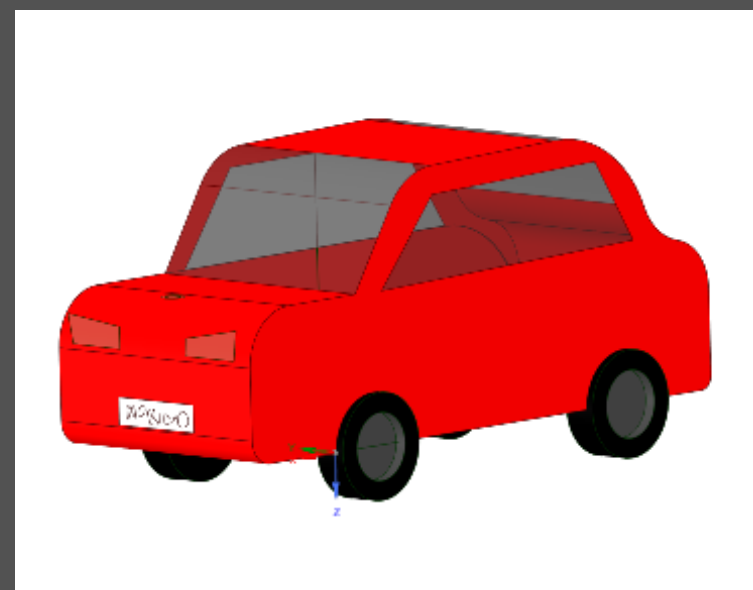
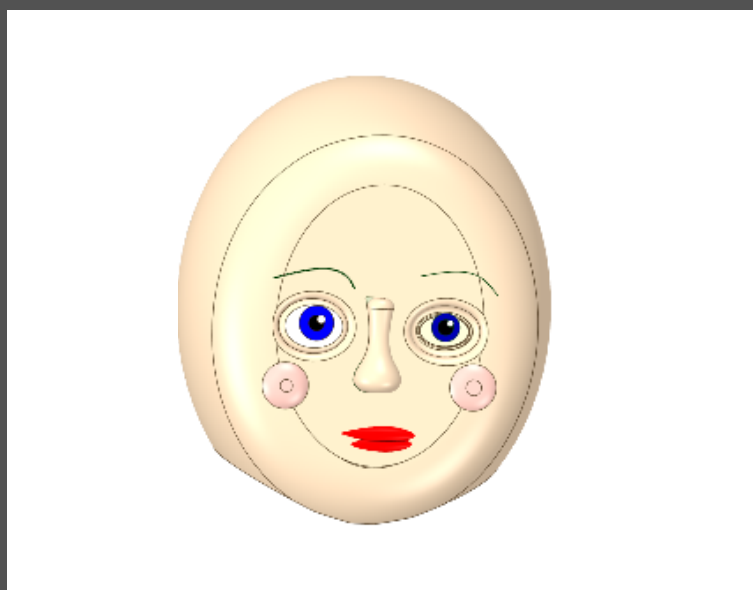
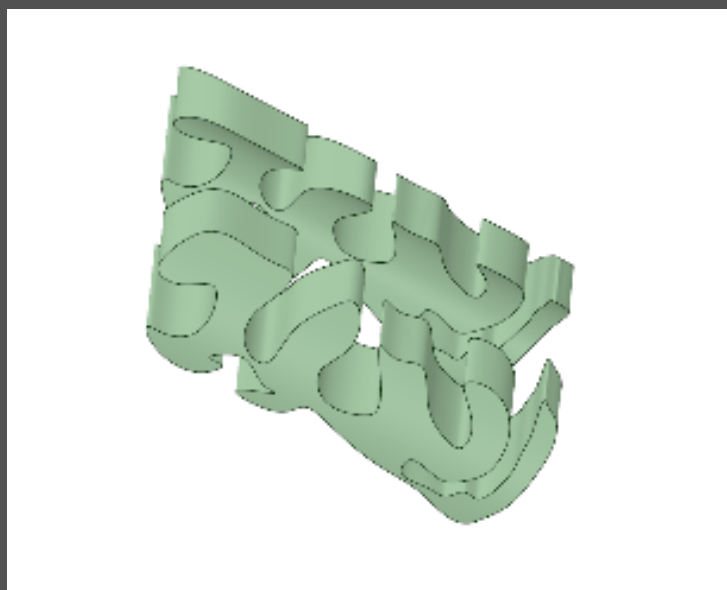
2. Simulations



3. Realization

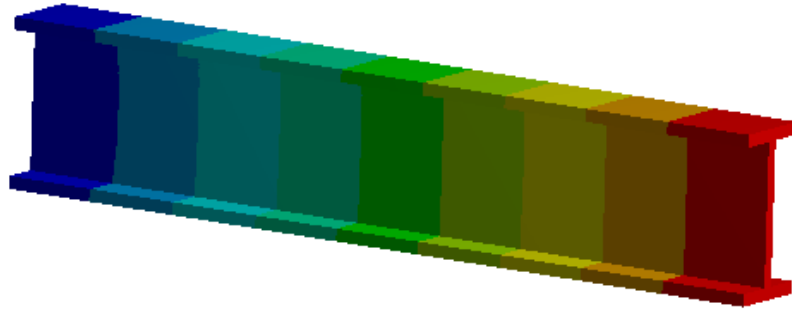
4. Measurements





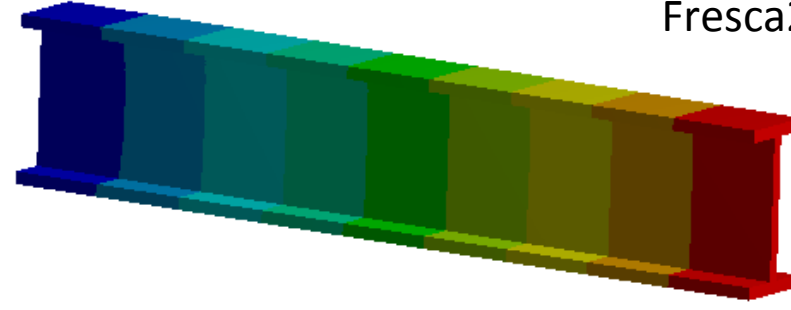
A: Static Structural
 Total Deformation
 type: total Deformation
 Unit: mm
 Time: 1
 15/10/2019 10:06

Bear pulling



A: Static Structural
 Total Deformation
 type: total Deformation
 Unit: mm
 Time: 1
 15/10/2019 10:07

Elephant pulling

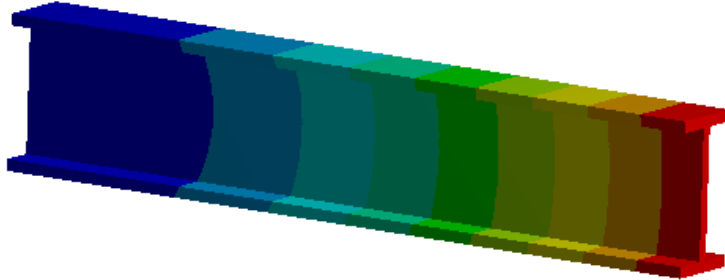


Elephant 65 000 N
 Bear 2 300 N
 Fresca2 torque 5 000 N*m

$$\frac{F * L_0}{A * E} = L$$

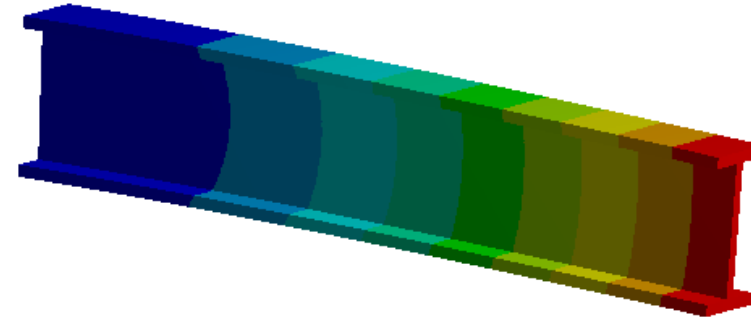
A: Static Structural
 Total Deformation
 type: total Deformation
 Unit: mm
 Time: 1
 15/10/2019 10:04

Bear bending



A: Static Structural
 Total Deformation
 type: total Deformation
 Unit: mm
 Time: 1
 15/10/2019 10:02

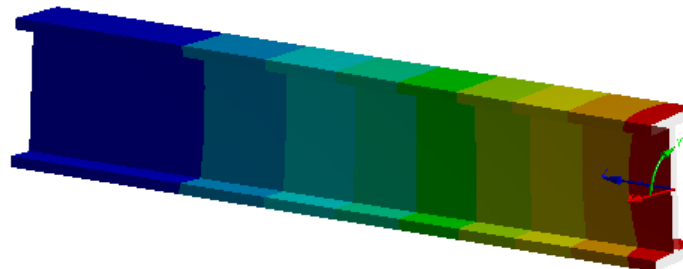
Elephant bending



$$\frac{F * L^3}{3 * E * I} = \delta$$

A: Static Structural
 User Defined Result 2
 expression: a95/uy/lockx
 Unit: °
 Time: 1
 15/10/2019 10:10

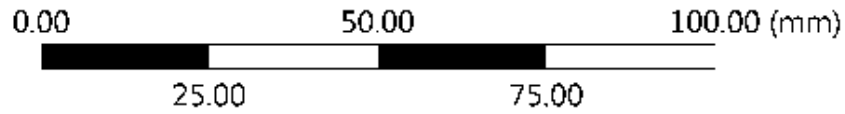
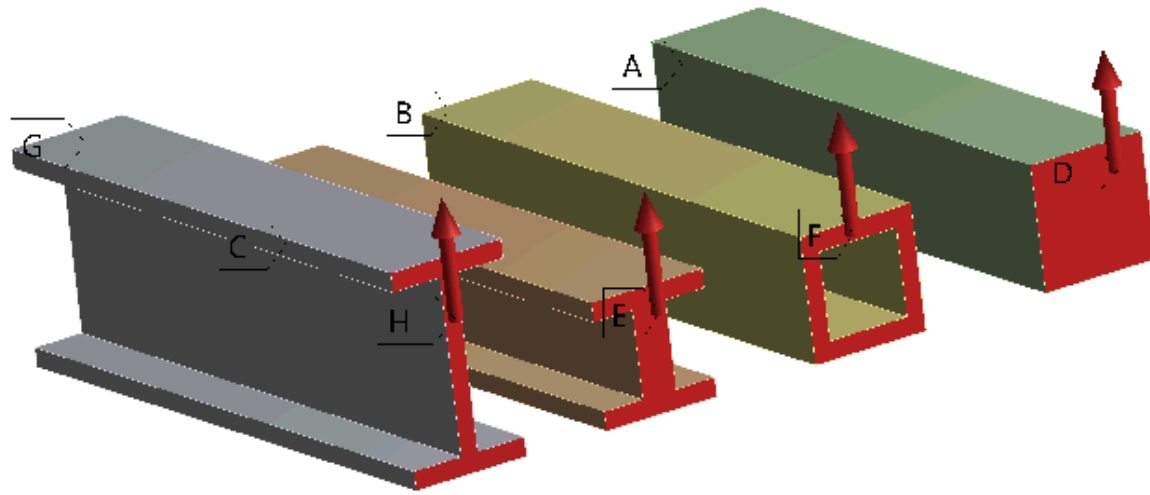
Fresca 2 experiment maximum load



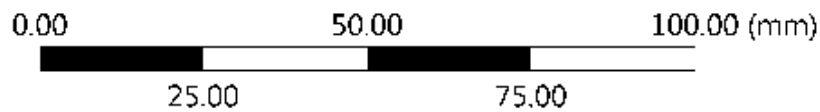
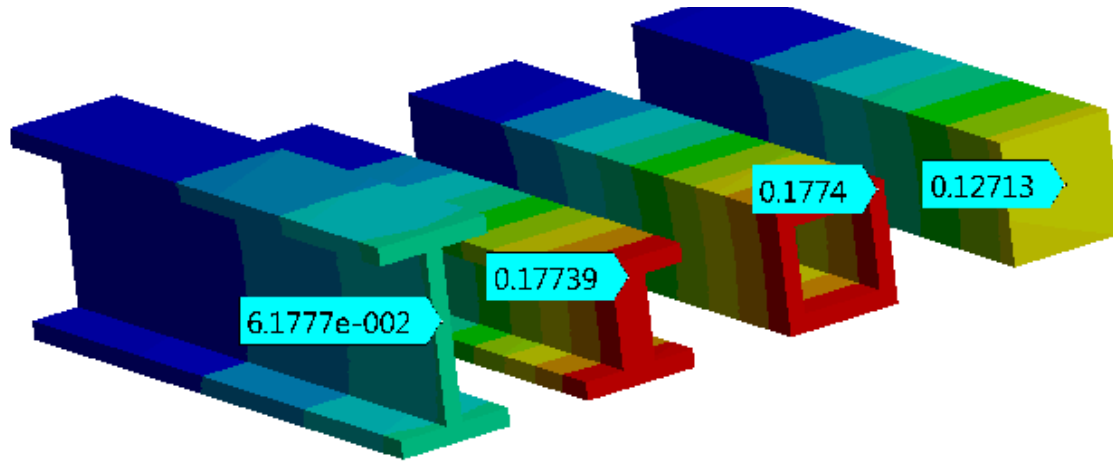
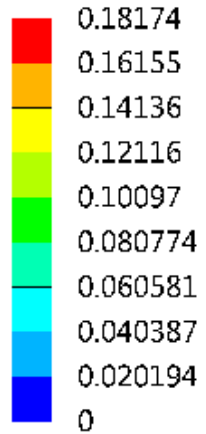
$$\theta = \frac{M_T * L}{G * J}$$

Values for I, G, J, E were taken from SpaceClaim or Ansys Engineering data

- A** Fixed Support
- B** Fixed Support 2
- C** Fixed Support 3
- D** Force: 1000. N
- E** Force 2: 1000. N
- F** Force 3: 1000. N
- G** Fixed Support 6
- H** Force 6: 1000. N



$$\frac{F * L^3}{3 * E * I} = \delta$$



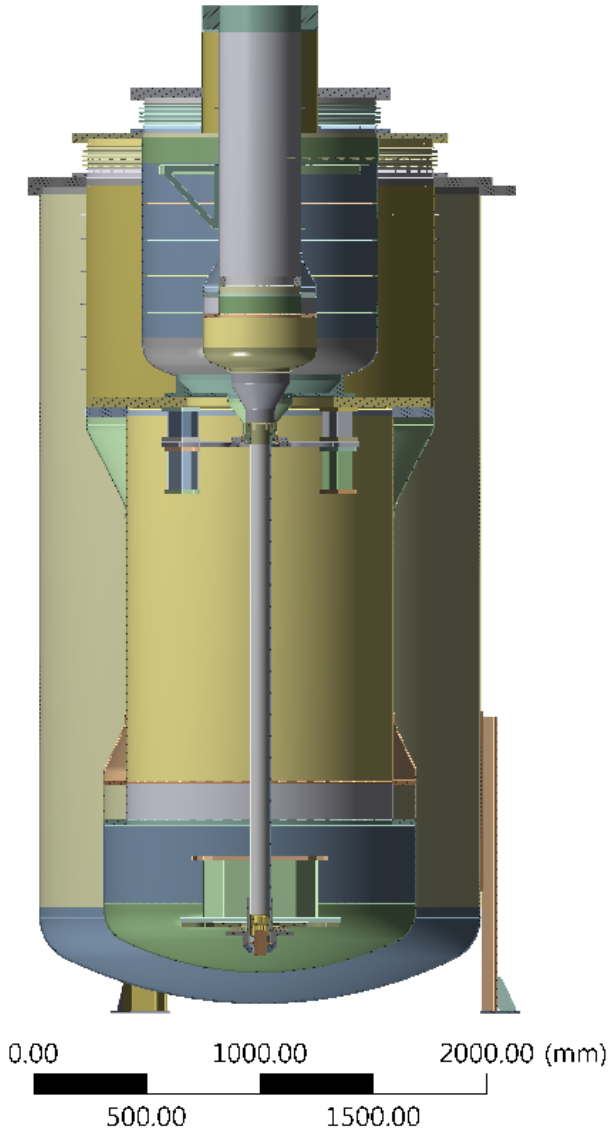
Deformation = change in the shape



Vessel = säiliö

Next level simulation (Fresca 2)

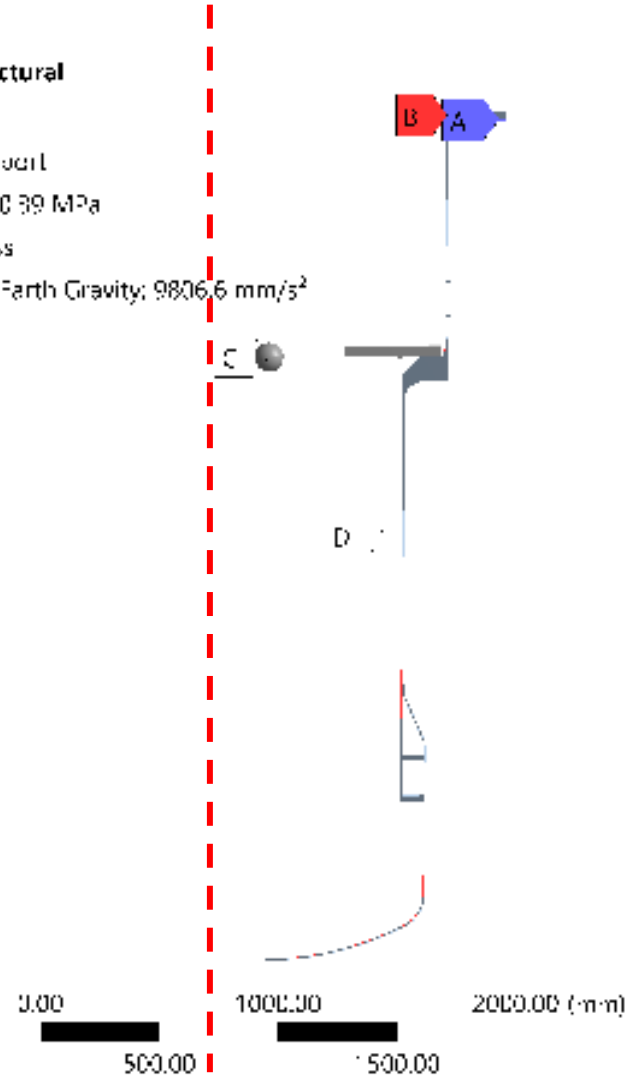
Full model



Boundary conditions and axial symmetric simplification

B: Static Structural

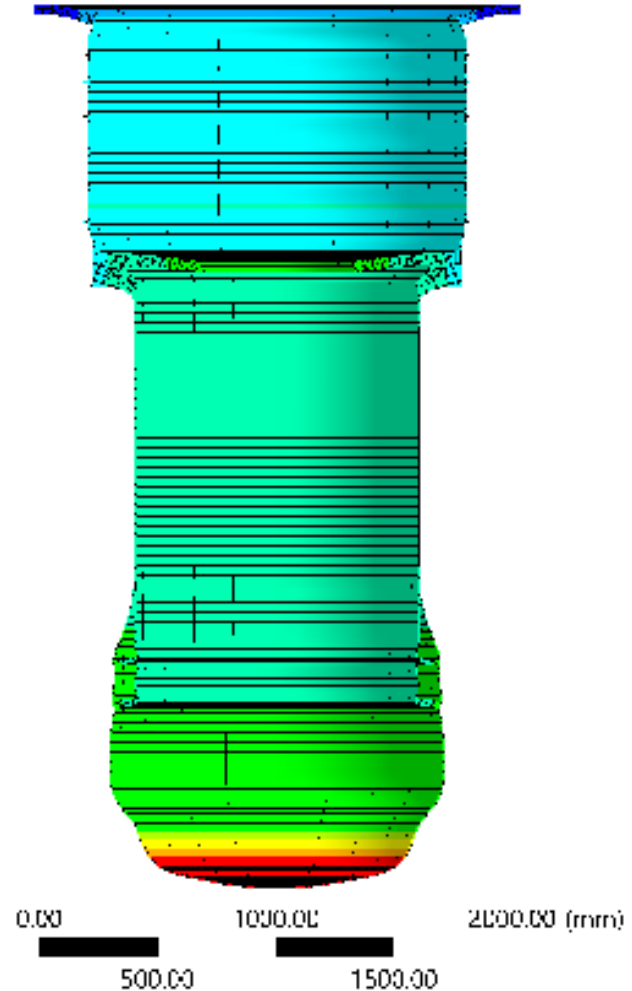
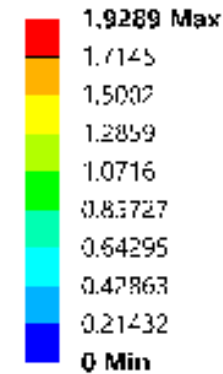
- A Fixed Support
- B Pressure: 0.39 MPa
- C Point Mass
- D Standard Earth Gravity: 9806.6 mm/s²

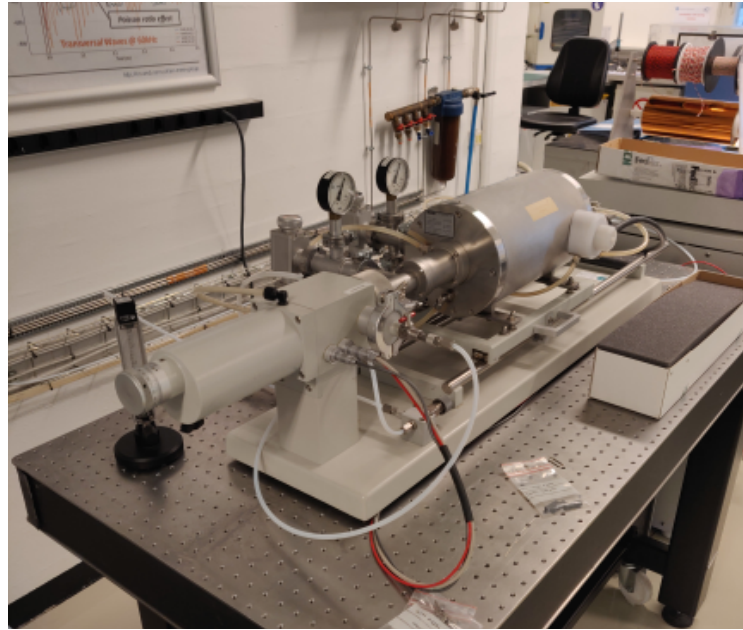


Results

B: Static Structural

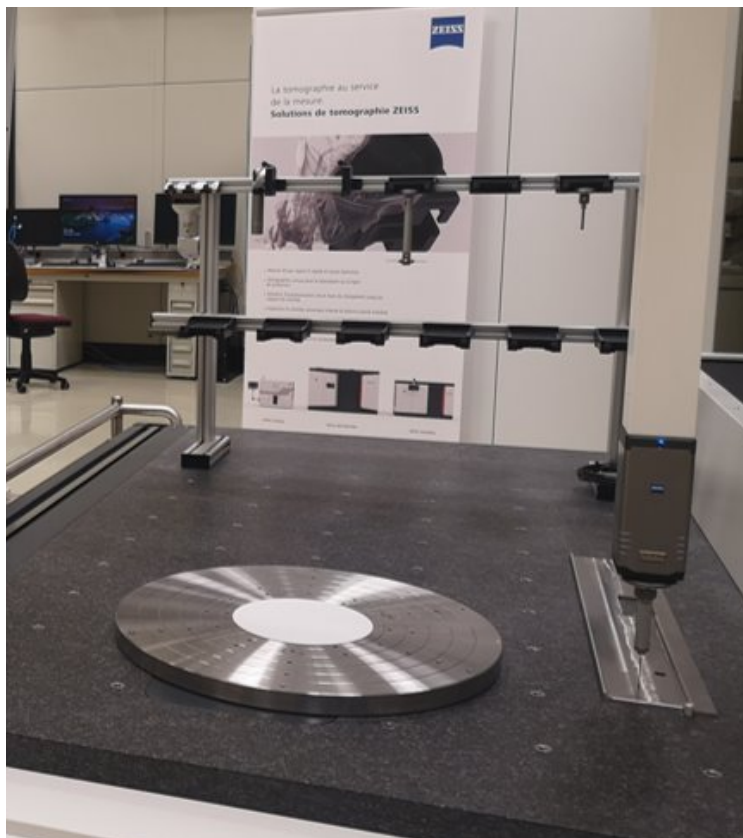
Total Deformation
Type: Total Deformation
Unit: mm
Time: 1





Measurement laboratory

Picture: Vilhelmiina Hännikäinen

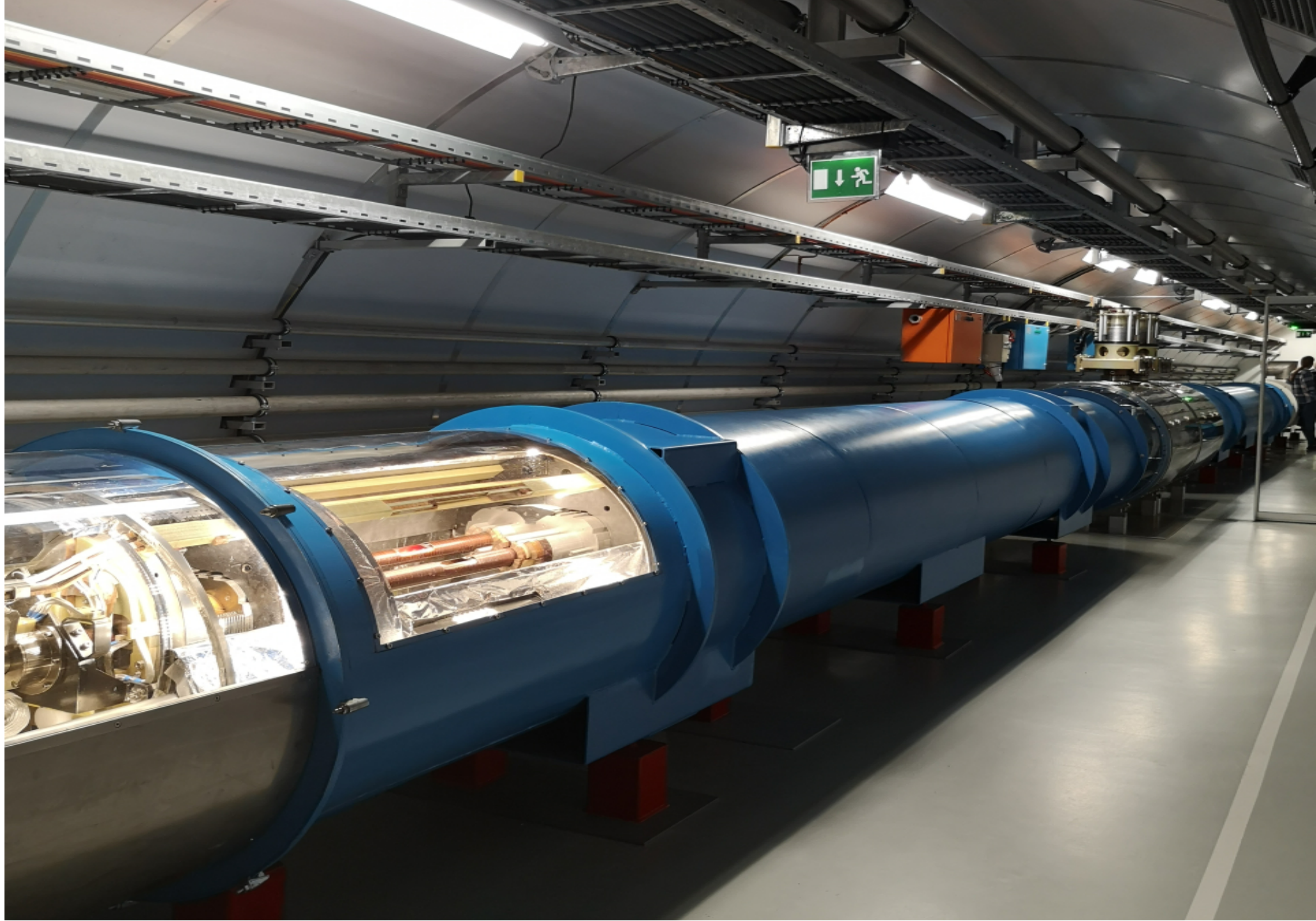


Workshop

Virtual reality



SM18





THANK YOU!