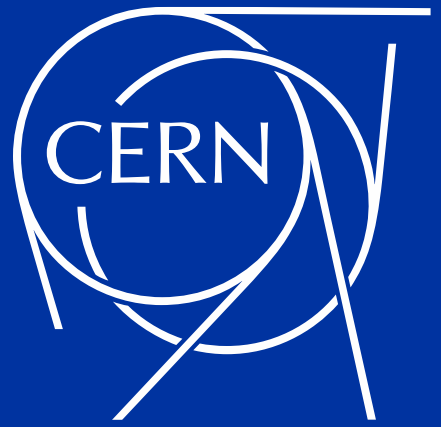


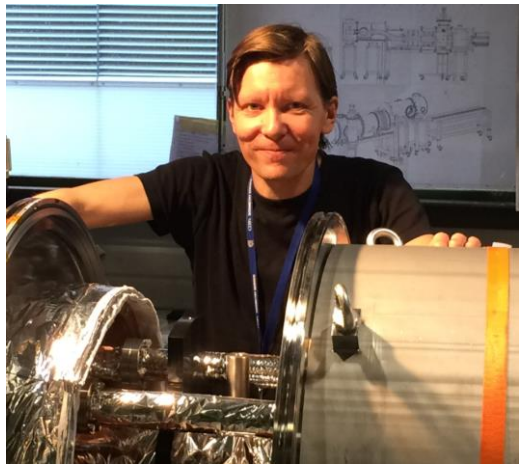
Mechanical engineering of accelerator components

Antti Kolehmainen EN-MME
Mikko Barinoff EP-DT
Taneli Mutanen TE-MSC

Finnish High-School Students visits program

WHO WE ARE

Antti

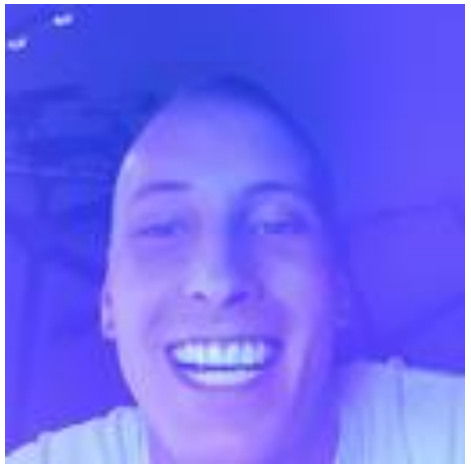


- Mechanical designer in Engineering Department
- BSc in engineering 2004, Jyväskylä
- CERN since 2012
- 10 years in industry prior to CERN

Mikko

- Mechanical engineer in the Experimental Physics department
- MSc in mechanical engineering 2021, Aalto university
- At CERN since 2019

Taneli

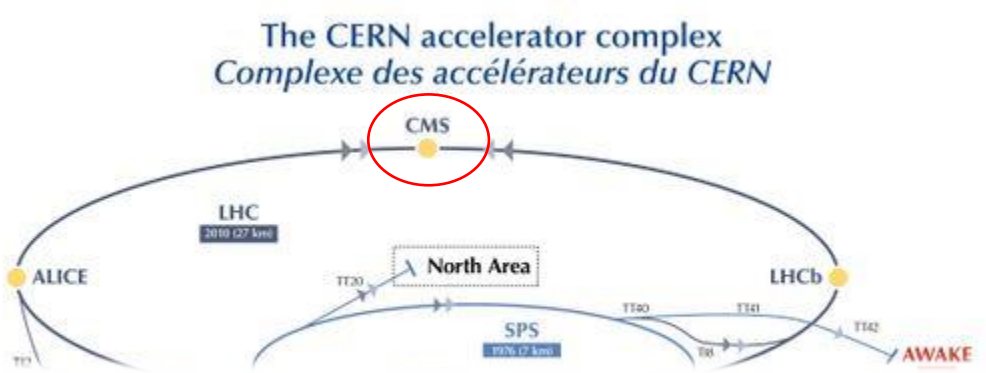


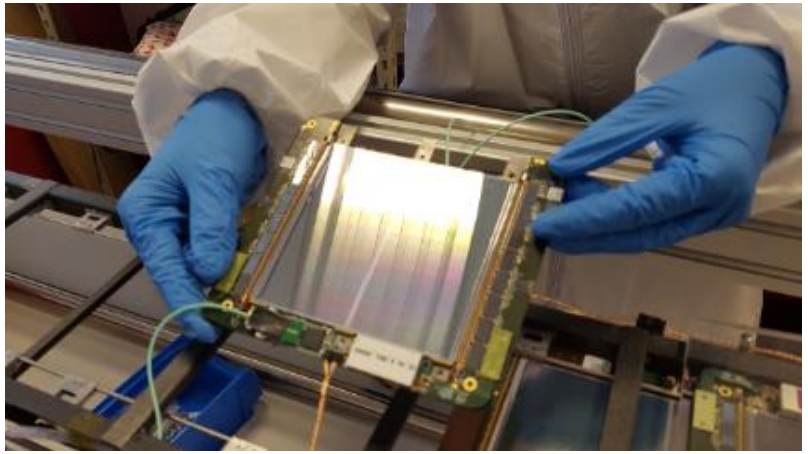
- Micromechanic in the Technology Department
- Micromechanics 2021, Finnish School Of Watchmaking
- At CERN since 2022

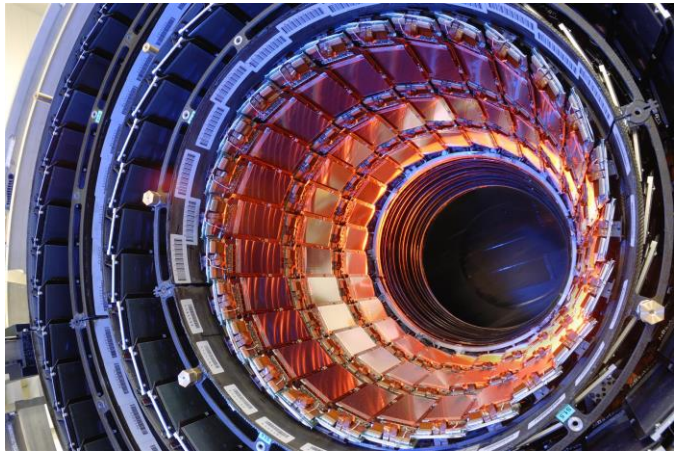
WHAT WE DO?

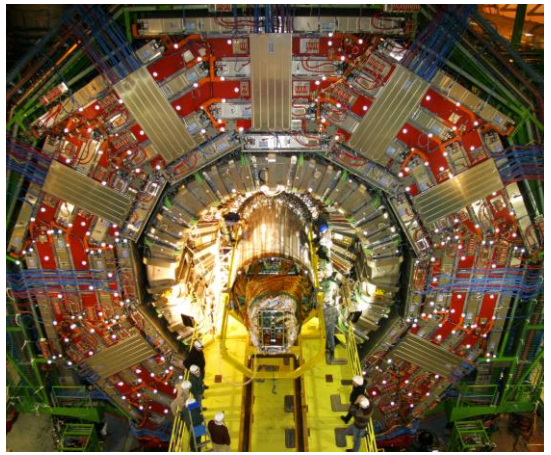
Mikko

- Mechanical design & construction work for the Phase-2 upgrade of the CMS Tracker
- Tasks vary from high precision micromechanics to heavy handling equipment





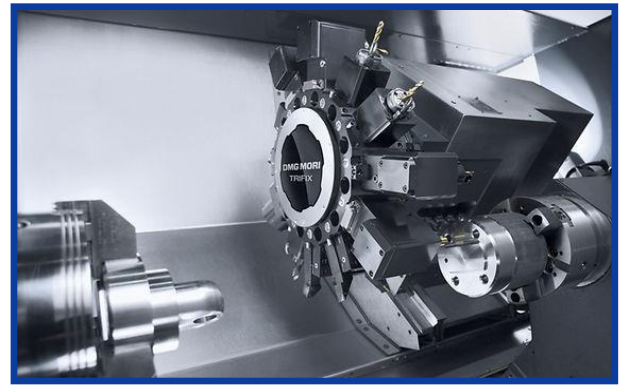


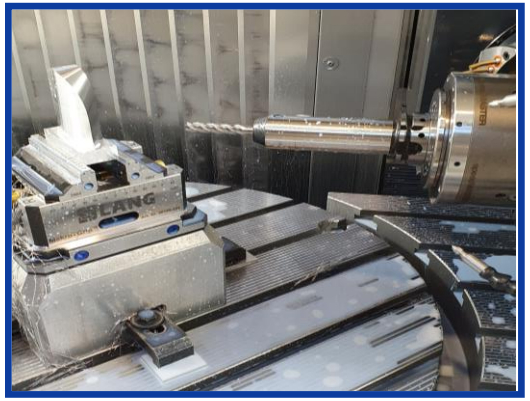


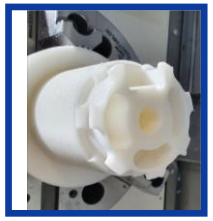
WHAT WE DO?

Taneli

- Manufacturing of prototype components for superconductive accelerator magnets and other projects
- TE-MSC-specialist in machining
- Programming and operating computer programmable manufacturing robots
- Manufacturing related consultation to help engineers and designers
- 2D&3D Mechanical design of components



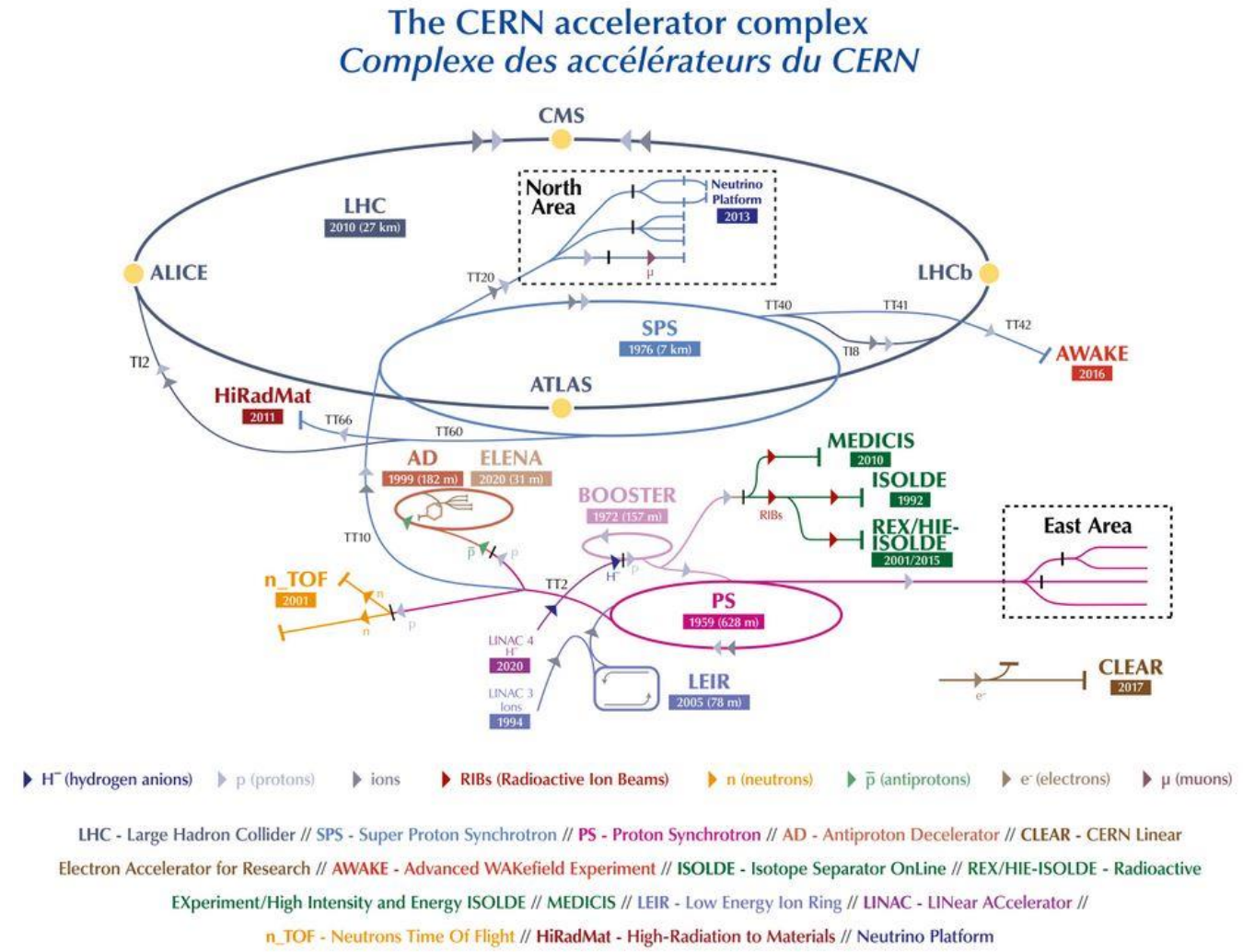




WHAT WE DO?

Antti

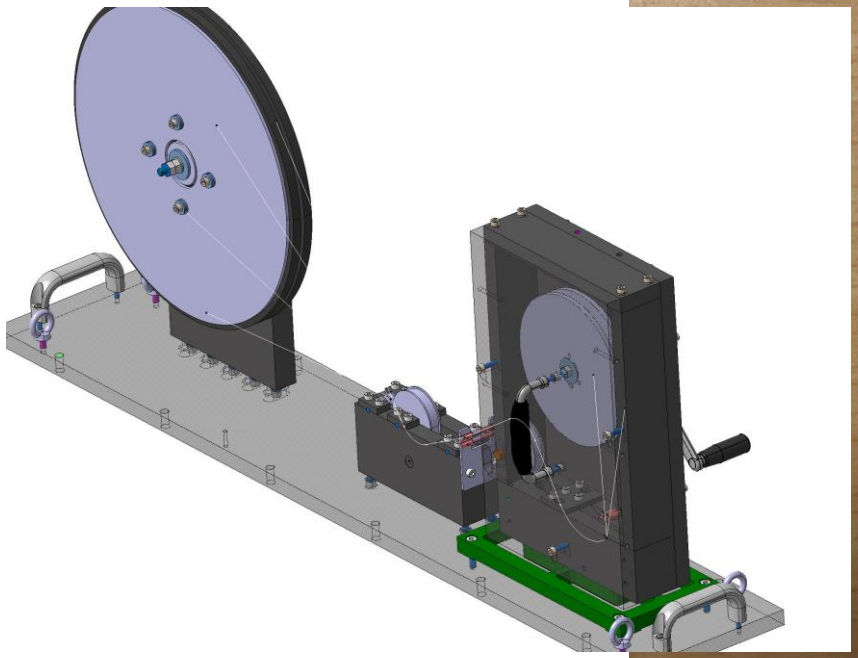
- Mechanical design of components <u>for the accelerator complex</u>
- EN-MME – specialist in mechanical engineering supporting other groups
- Small tasks
- Larger design projects
- <u>3D & 2D</u>
- <u>Calculations</u>
- Fabrication follow-up
- Installation
- Pre-studies for future accelerators

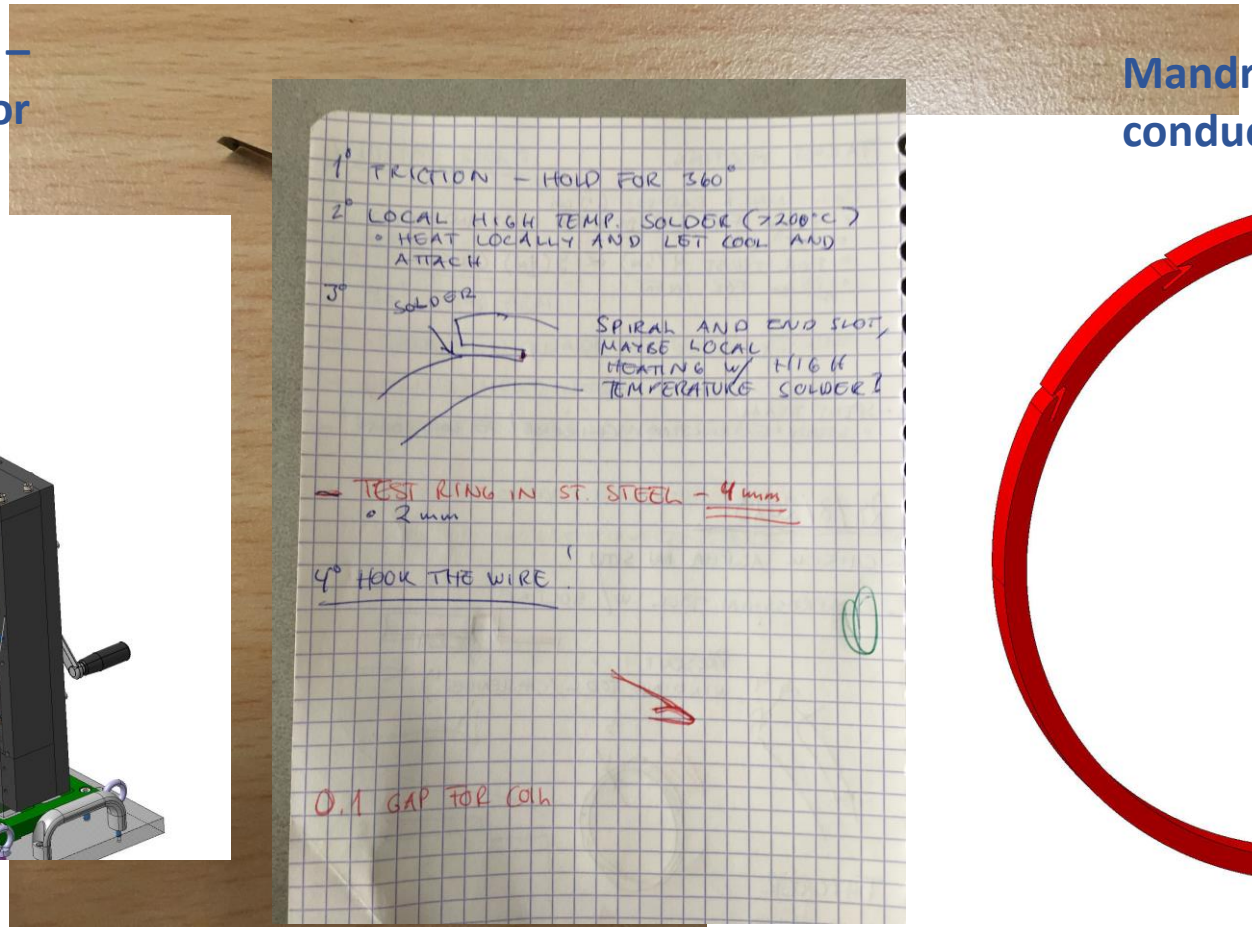


DESIGN ENGINEERING

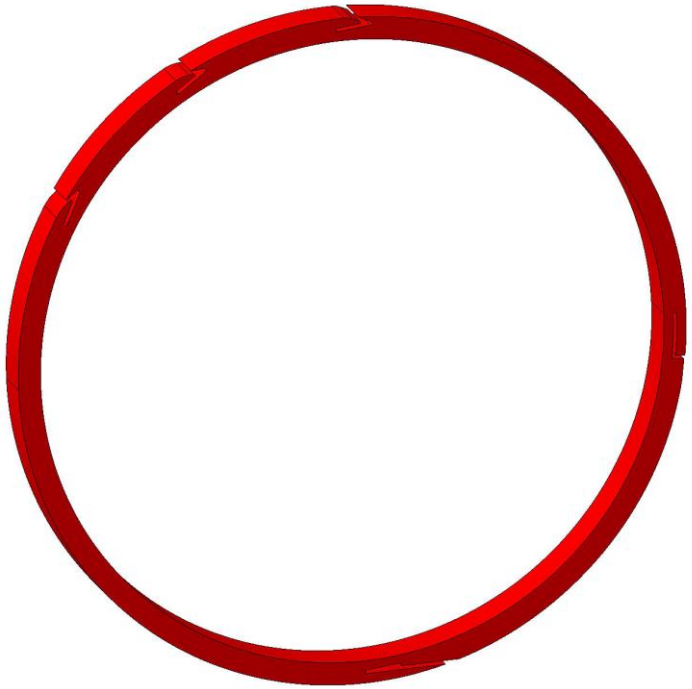
Small tasks

Pancake coil winding tool – how to attached conductor rapidly?





Mandrel to test coil conductor attaching



Context

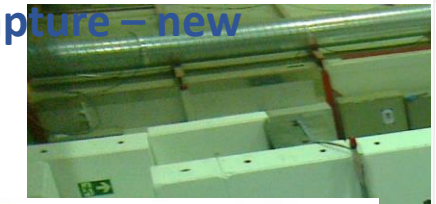
Discussion -> notes

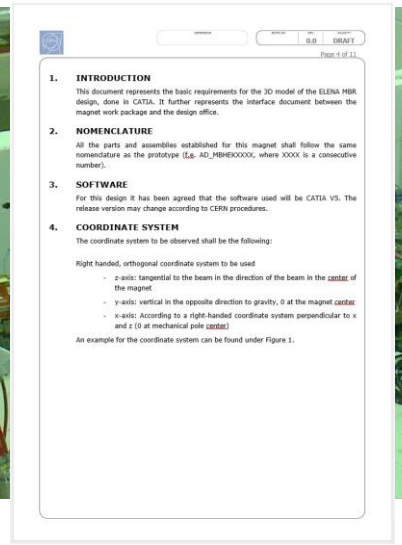
Two hours to release for production

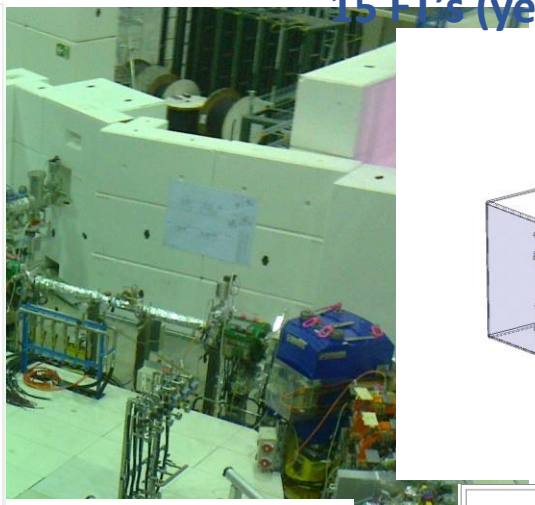
DESIGN ENGINEERING

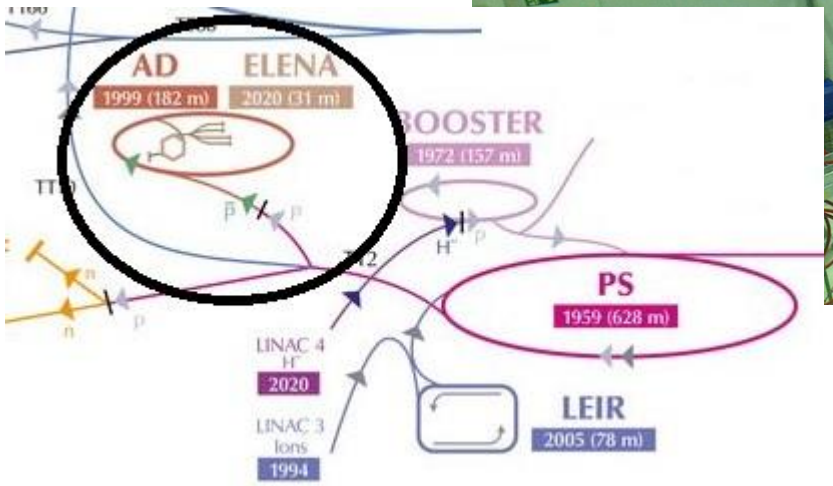
Large projects

Improve antimatter research by better antiproton capture – new decelerator ELENA

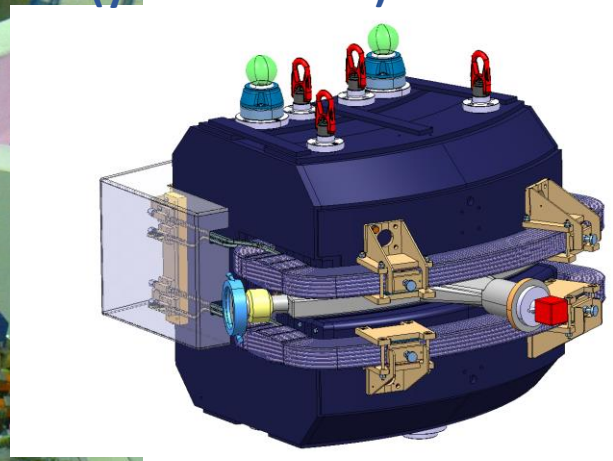




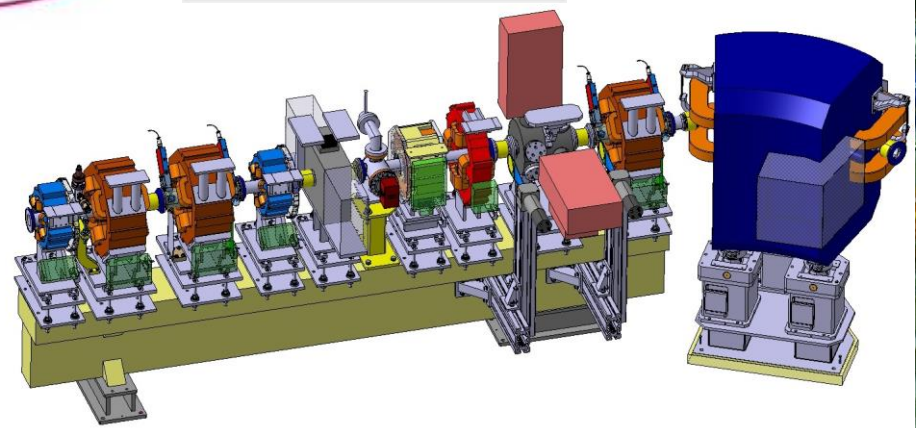


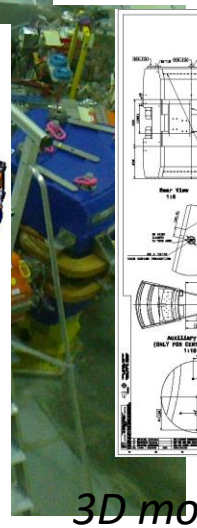


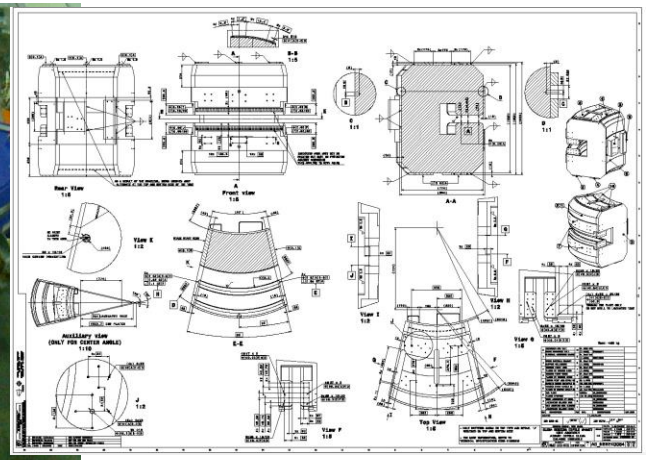
Design of ELENA machine components
15 FT's (years of work)



500h





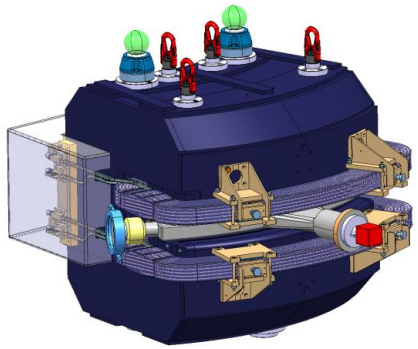


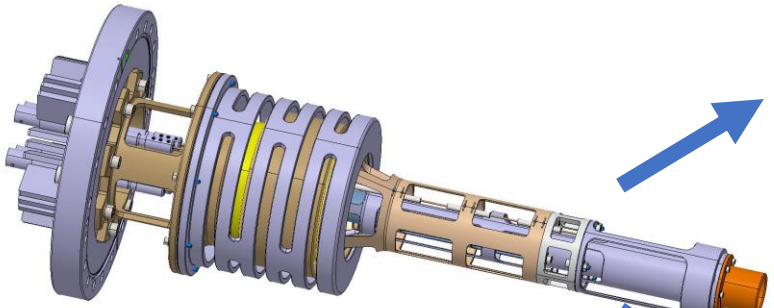
Context

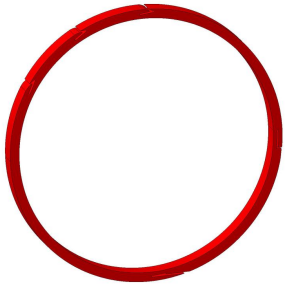
Specifications, simplified models, schedules

3D models, manufacturing drawings, calculations, instructions...

PRODUCTION







Production outside CERN

- Specialist manufacturing
- Capacity
- Specific technologies

- Specifications
- Tendering
- Committees
- Signed contract

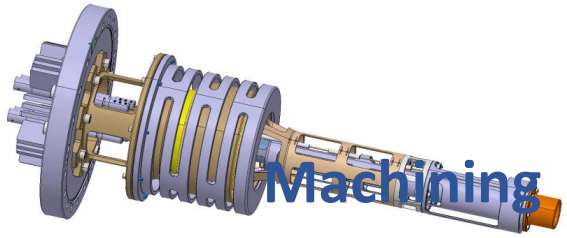
Production at CERN workshop

- Follow-up of all steps
- Technology mastered by CERN
- Available capacity
- Rapid delivery

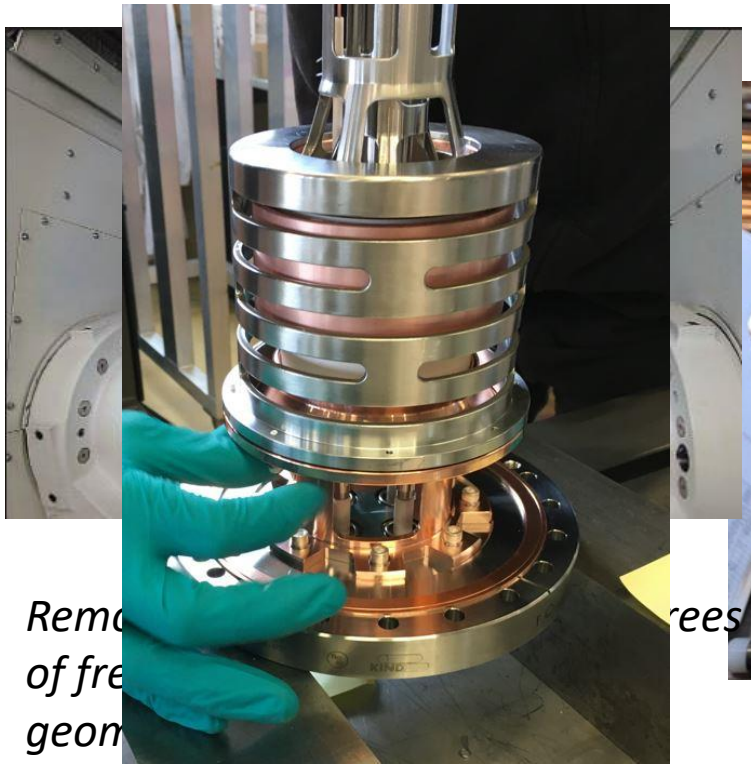
- Job request
- Documents(drawing)
- Budget

Electron gun to produce electron beam

PRODUCTION



Machining



Remo… …rees of fre… geom…

Joining

Welding – melt pieces locally to join them
Brazing – melt material between pieces to join them
Bonding – addhesive for different materials

Forming

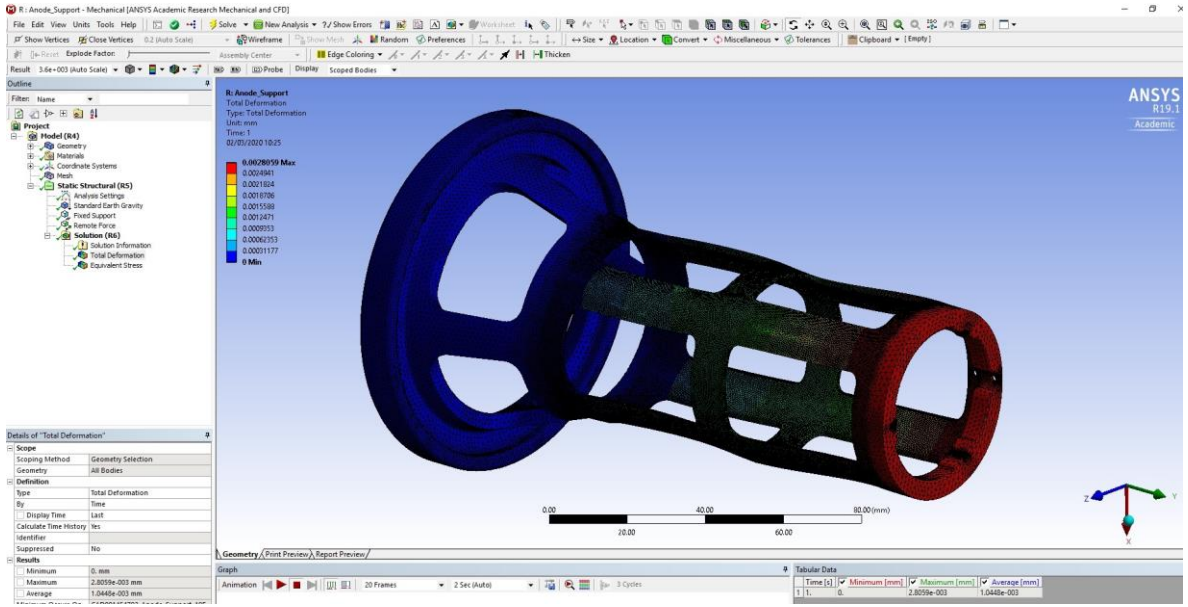
Roll, bend, stamp, draw sheets

Also subcontracting and assembly in clean room!

SERVICES
EN-MME Group

Calculations

To guarantee safe operations over the component lifetime



- *Safe (working)environment*
- *Material loss*
- *<u>Calculation confirmed requirements must be followed in practice!</u>*

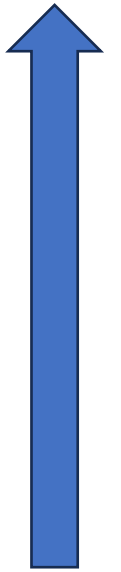
Measurements

To proof required quality

- *Geometry*
- *Raw material*
- *Mechanical measurements of produced components*

EDUCATION & PR

CERN – Lapin AMK collaboration



Until 2025 for now

2023: Timo

2019: Henrik, Jussi

2018: Katariina, Martti

2017: Jani, Eero

2016: Jani, Jari

2015: Ville, Jarkko

Established 

2014: Samuel

Finnish High School Student Presentations

Engineering presentations since 2014

Experimental physics requires engineering!

An internation organisation requires people from many domains!

Finns are involved in all CERN activities!

PHYSICS vs ENGINEERING

The challenge

Physics(Formula) ≠ Engineering(Real object)

→ Results in agreed compromise

THANK YOU FOR YOUR ATTENTION!
YOUR QUESTIONS?