

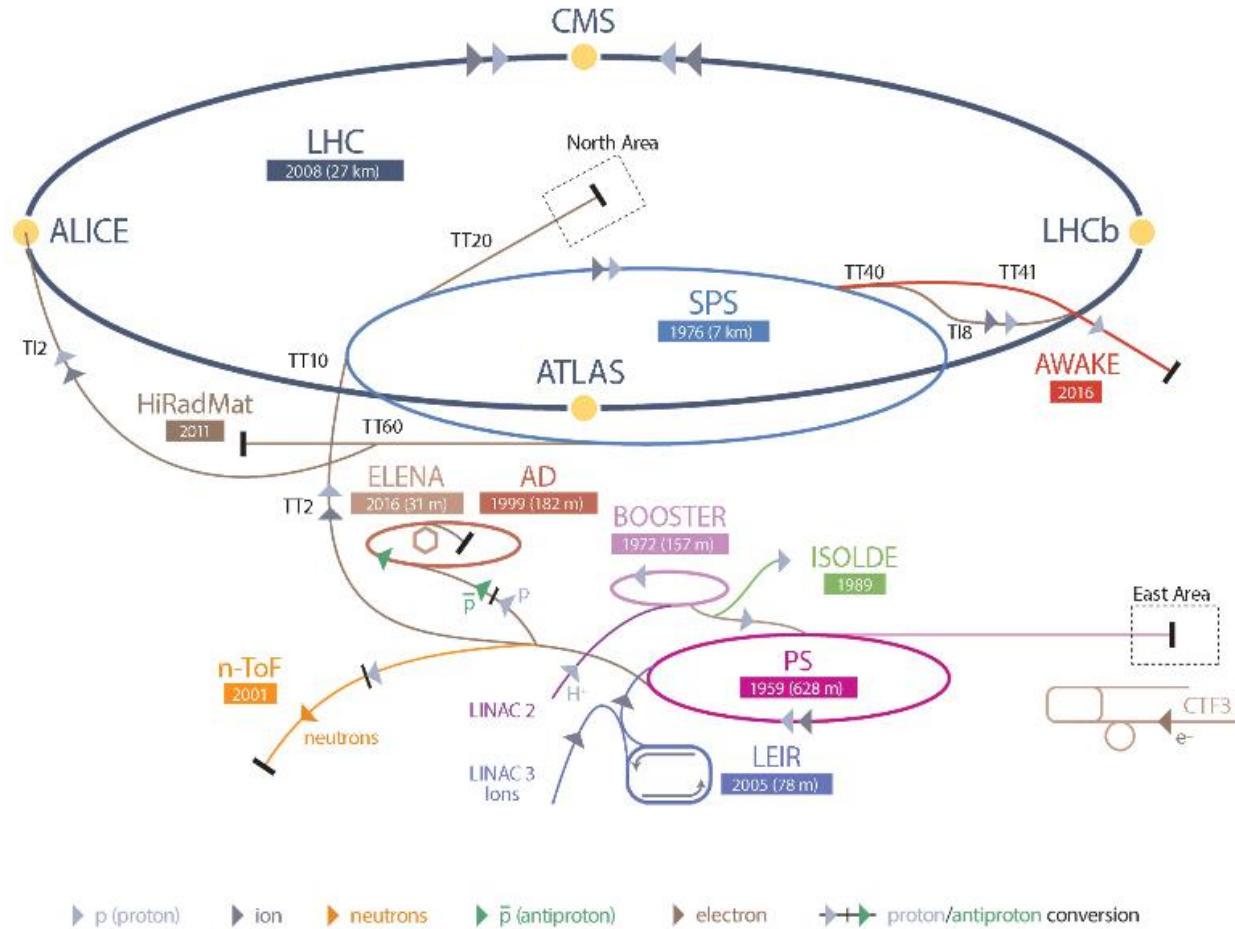
TECHNICAL CHALLENGES OF ACCELERATOR COMPONENTS FOR MECHANICAL DESIGN

Tommi Mikkola on behalf of CERN EN/MME



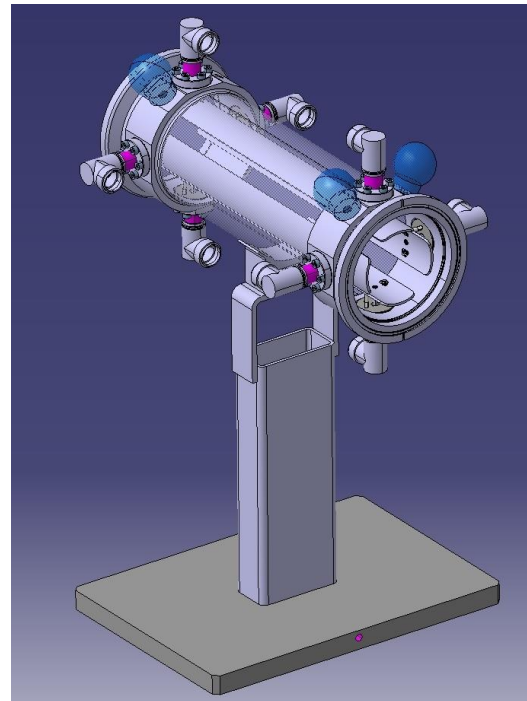
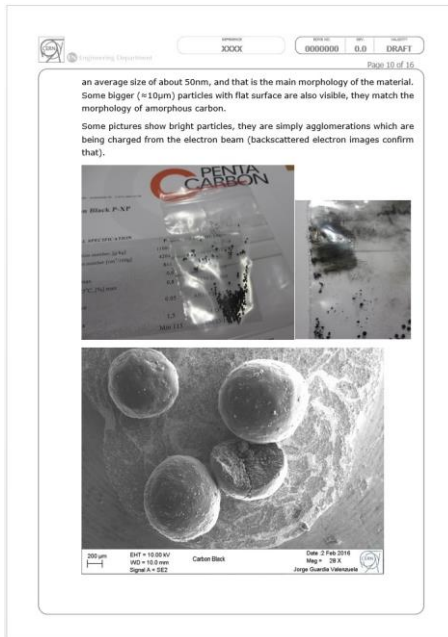
ENGINEERING
DEPARTMENT

CERN's Accelerator Complex



CERN EN-MME

- “The mandate of the MME group is to provide to the CERN community specific engineering solutions combining mechanical design, fabrication and material sciences.”



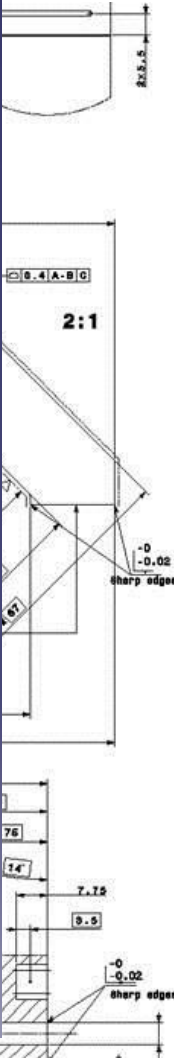
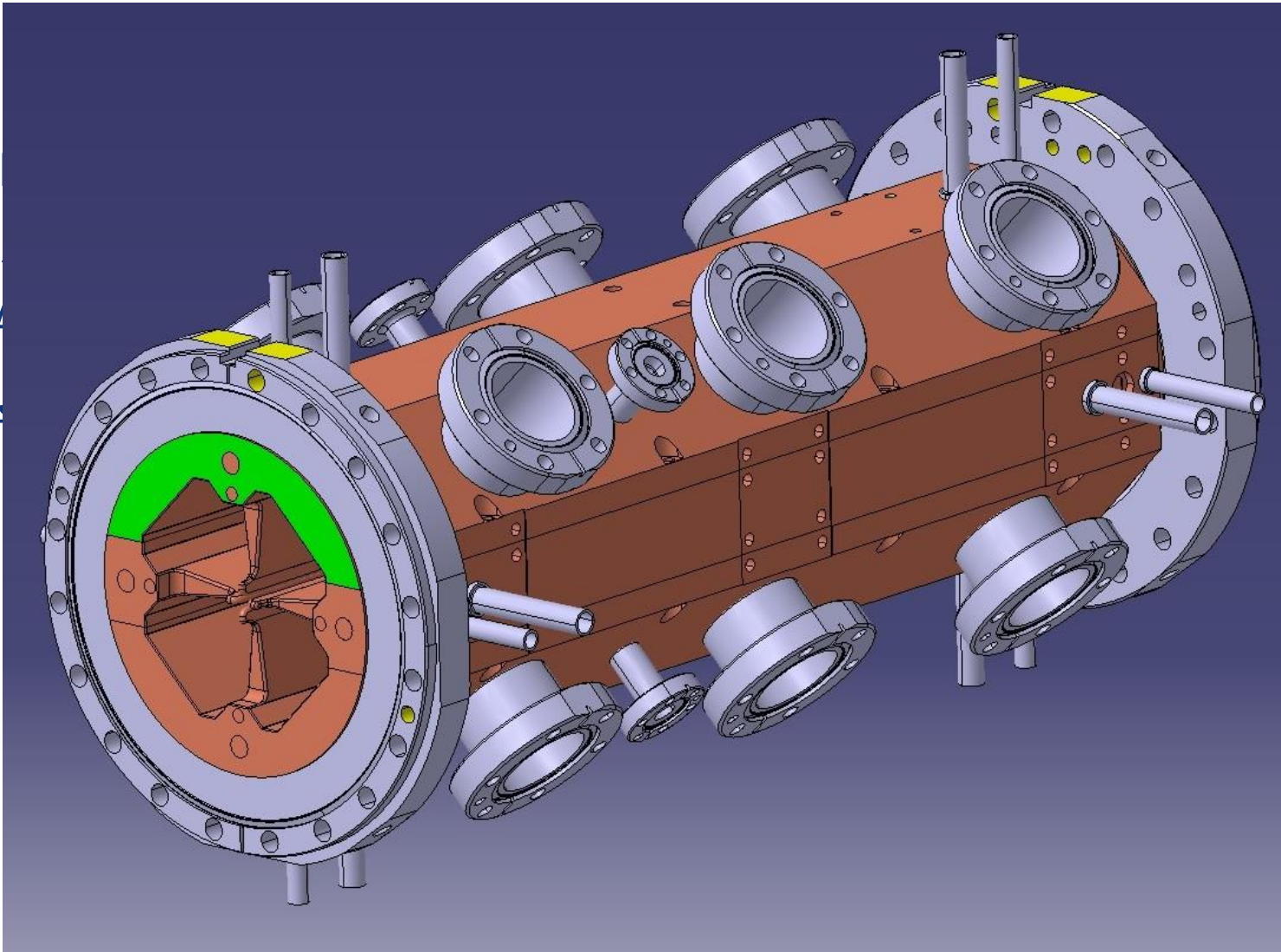
ANALYSIS



- MACHINE TO WIND SUPERCONDUCTING WIRES INTO CABLES
- PROCESS CAUSES HIGH DEFORMATIONS TO WIRES LEADING TO DECREASED ELECTRICAL PERFORMANCE
- FEA MODEL CREATED TO IMPROVE THE PROCESS

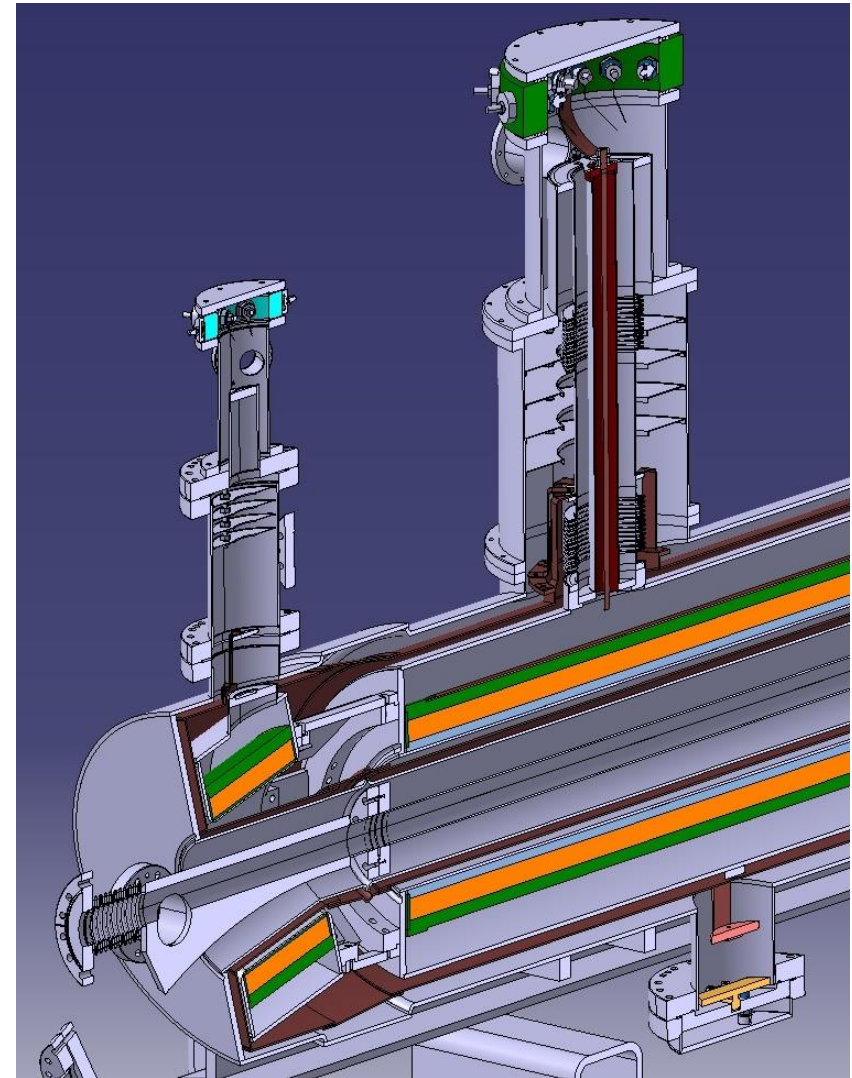
COMPLEX GEOMETRIES

- CR
- DE
- CH
- STA
- AD



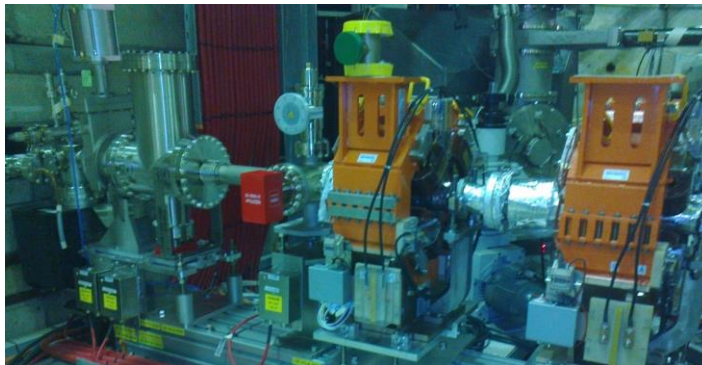
SUPERCONDUCTING MAGNETS

- COMBINES THREE TECHNOLOGIES:
 - SUPERCONDUCTIVITY
 - CRYOGENICS
 - VACUUM
- HEAT LOAD – 1 W inside = 1000 W outside
- STORED ENERGY
 - Beam = High speed train
 - Magnets = Air craft carrier @ 20 km/h
- THERMAL CONTRACTION/
EXPANSION
 - $\Delta T 250^{\circ}\text{C} \Rightarrow \sim 4 \text{ mm}$ expansion in stainless steel 316LN
- MAGNETIC FORCES BETWEEN COILS



VACUUM

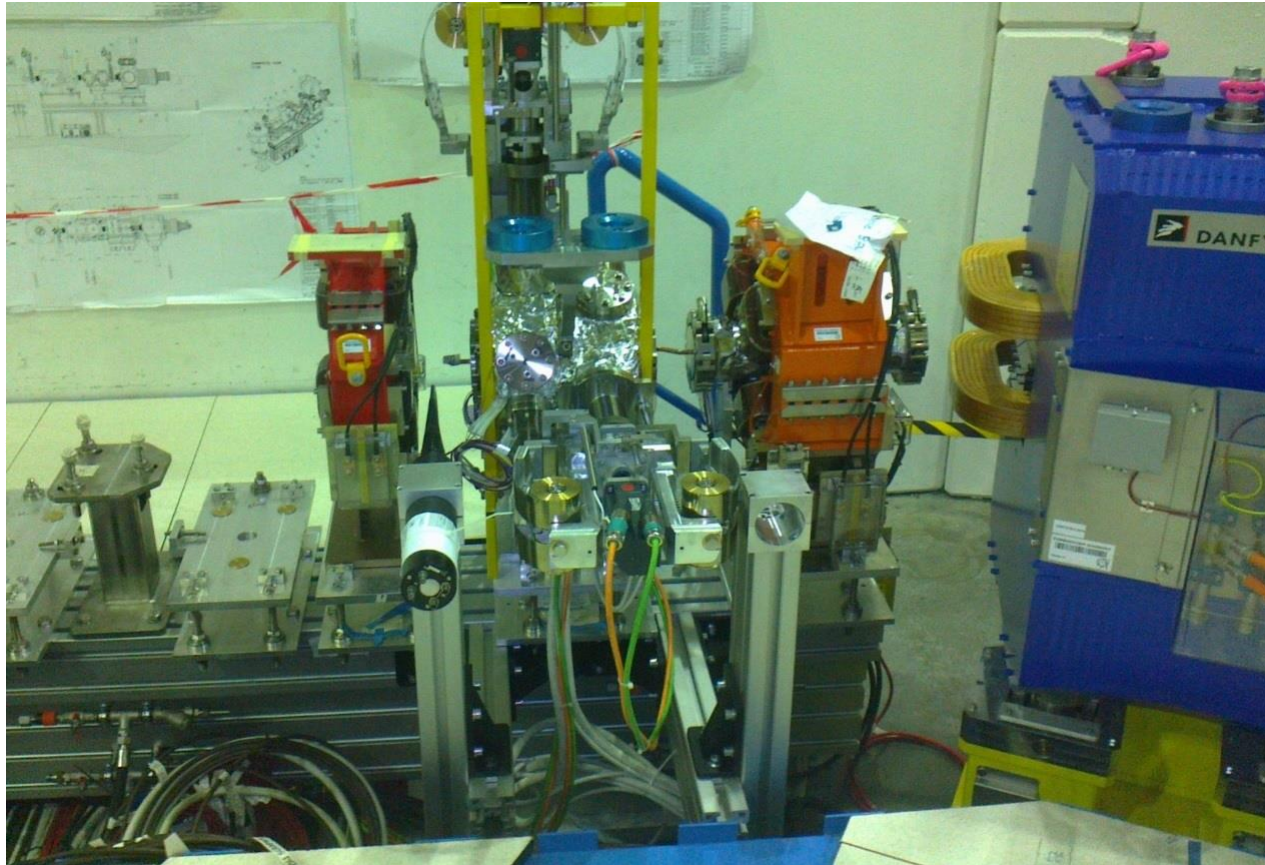
- UHV UP TO 10^{-10} mbar ~ MOON PRESSURE
- OUTGASSING & RESIDUAL GAS & LEAKAGES
 - MATERIAL SELECTION
 - RAW MATERIAL PRECONDITIONING
 - AVOID TRAPPED VOLUMES
 - JOINT DESIGN & QUALITY
 - CLEANING & VACUUM FIRING
 - NEG COATING
 - CRYOGENIC PUMPING



Courtesy of Antonios Sapountzis CERN TE/VSC

INTEGRATION

- LAY-OUT → DETAILED DESIGN → INSTALLED ACCELERATOR



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QUESTIONS / THANK YOU FOR YOUR ATTENTION



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