Vertical anti-cryostat and magnetic measurement systems

MSC-TM - 23 September 2021

C. Petrone

Context

Magnetic **measurement:** <u>room</u> temperature **rotating coils**

<u>ADVANTAGES</u>:

- Reduced **complication** for the measurement shaft

- No **moving** mechanical parts at cryogenic temperature

- Easy **adjustable** measurement head

  - both measurement and quench revealing

- Easy access for **debugging**

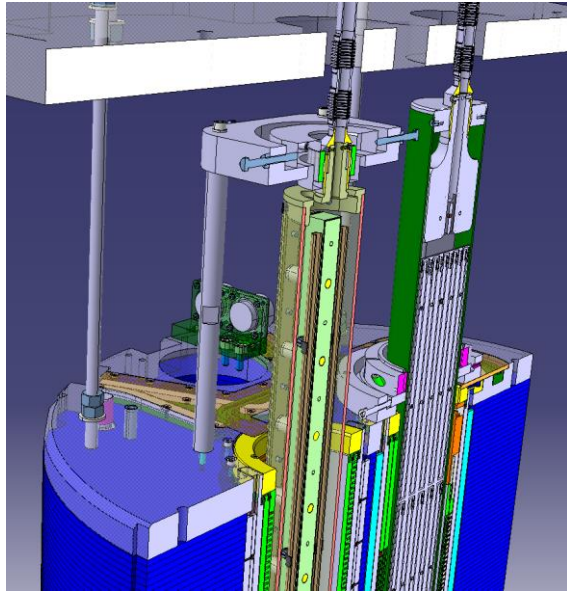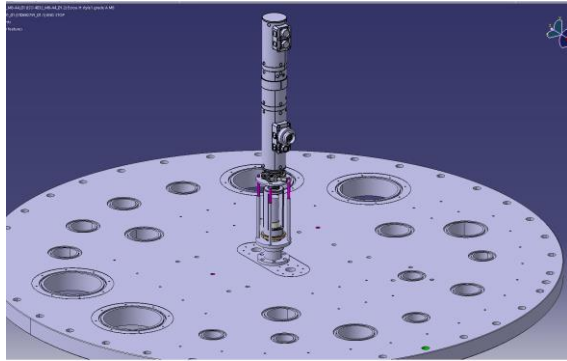- No dimensions shrinkage -> consistent **calibration** factors
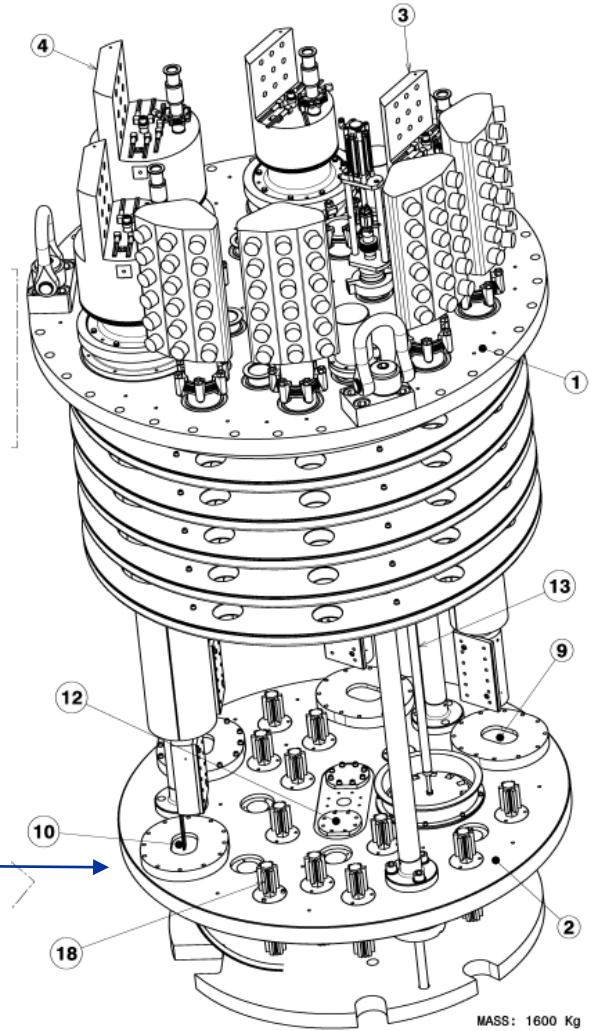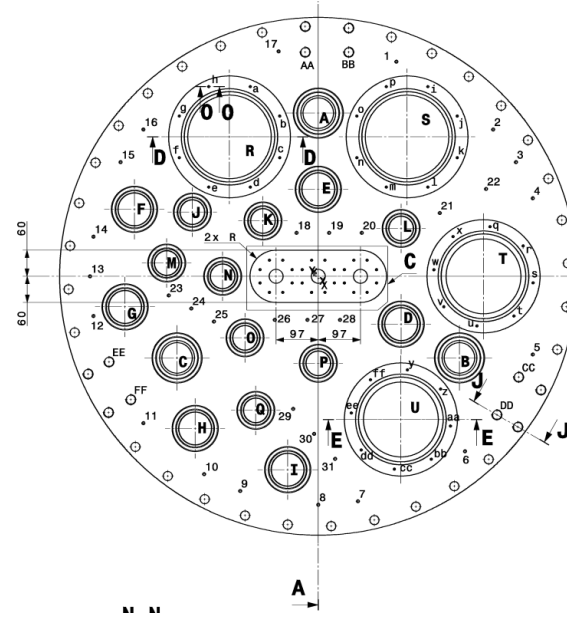
Anti-cryostat

Anti-cryostat

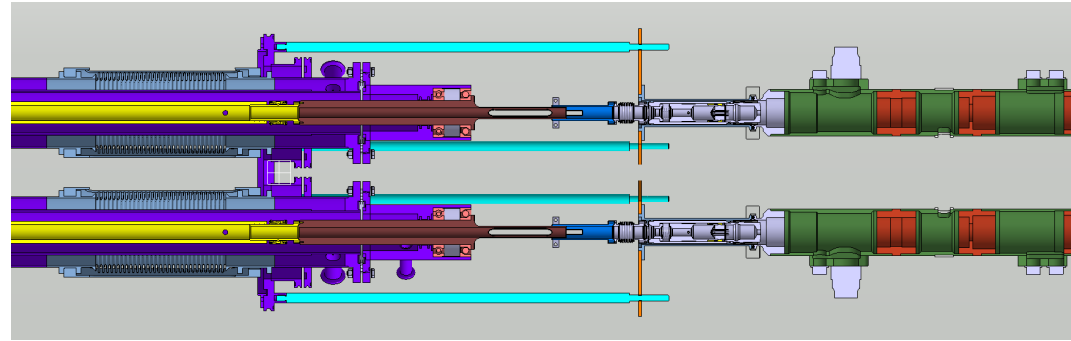@SM18 Top plate: not presenting the anti-cryostat access yet

Measurement method used today

4.5 K above the Lambda plate and superfluid helium at 1.9 K below the Lambda plate.

Anti-cryostat

Example: anti-cryostat characteristics:

Bellows to give flexibility, compensate thermal contraction, and compensate tube concentricity

Between the two inner and outer tubes (vacuum) spacers are required

Heaters and temperature sensors are required between the 2 tubes and distributed along the length of the anti-cryostat.

For example: according to power consumption analysis, **heaters** can be glued to the exterior of the internal tube and **temperature sensors** can be installed on the exterior surface of the internal tube to measure its temperature. Once heaters and the temperature sensors are installed, **MLI** (multi-layer insulation) can be wrapped around the exterior of the internal tube to thermally insulate the internal tube at room temperature.

Gap in vacuum between the 2 concentric cylinders used for passing the **wires** for the heaters and the temperature sensors plus the **pipe** for blowing hilum to the bottom of the measurement system to distribute potential temperature differences.
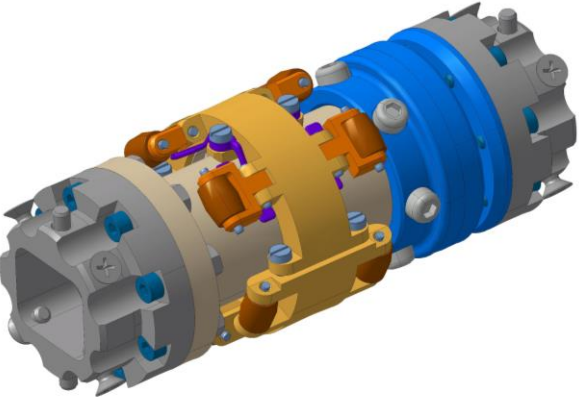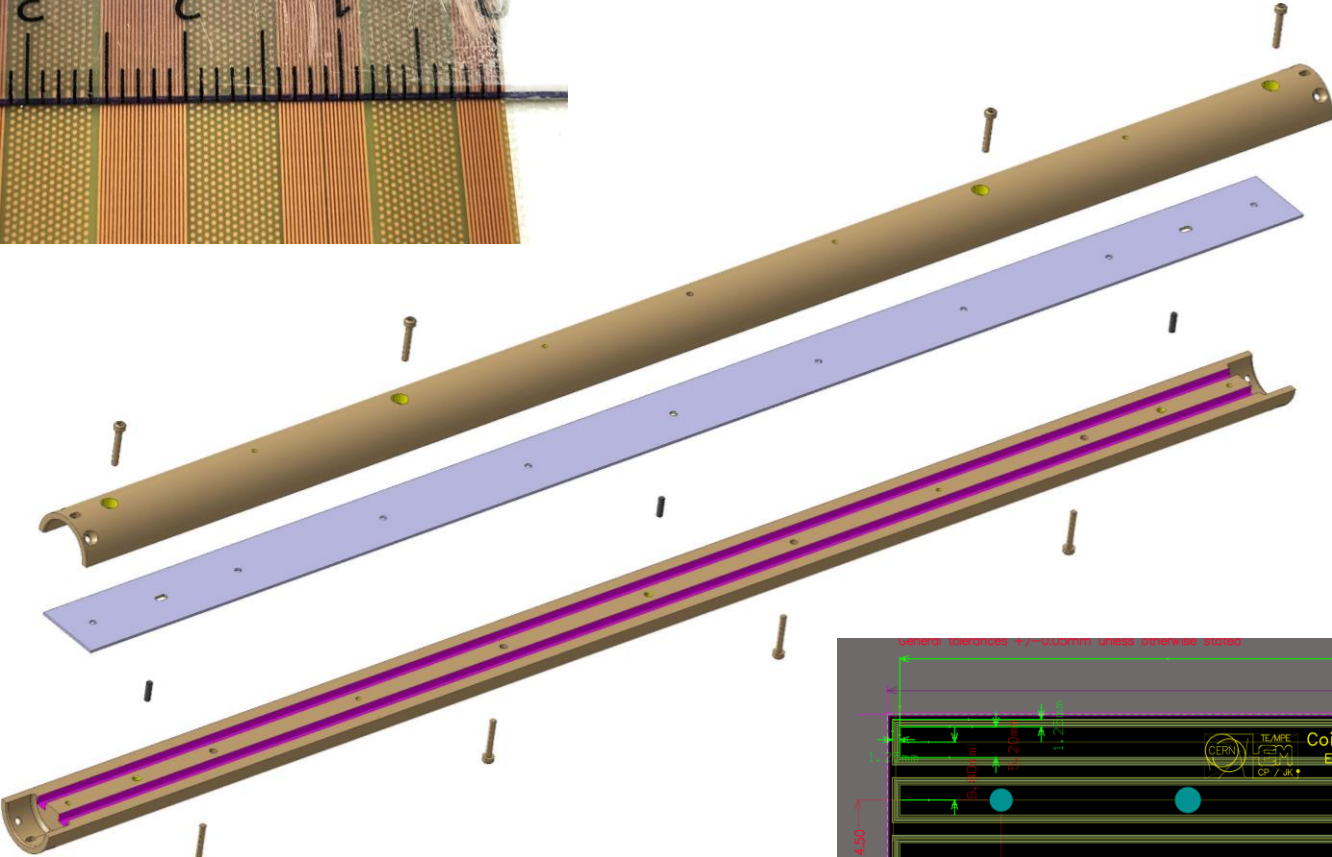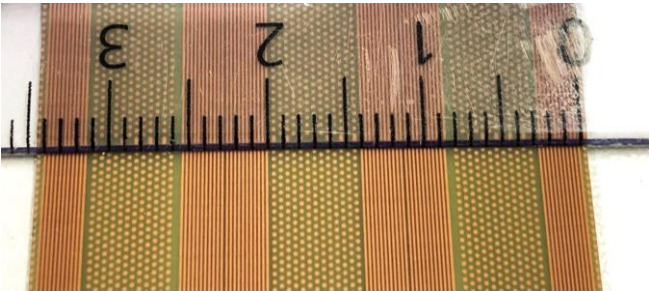
Tubes with no longitudinal welds (to avoid magnetic field inhomogeneities)

For example: material 316 LN with suitable inner tolerances (rectitude) to insert the measurement system
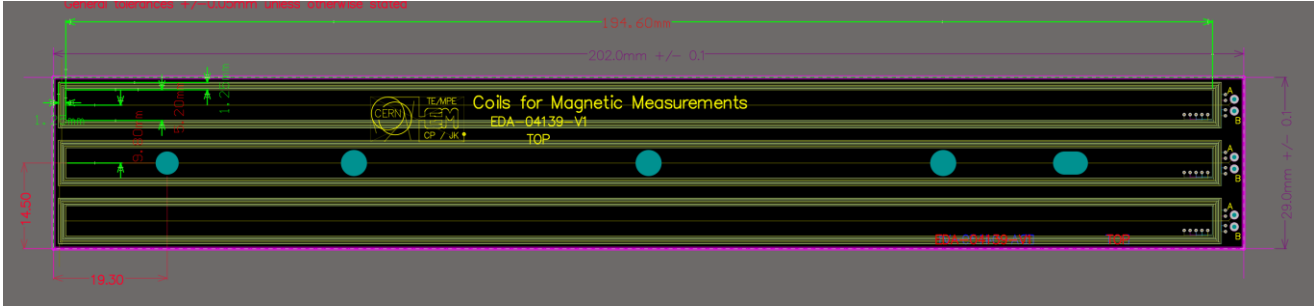
Measurement method: rotating induction coils

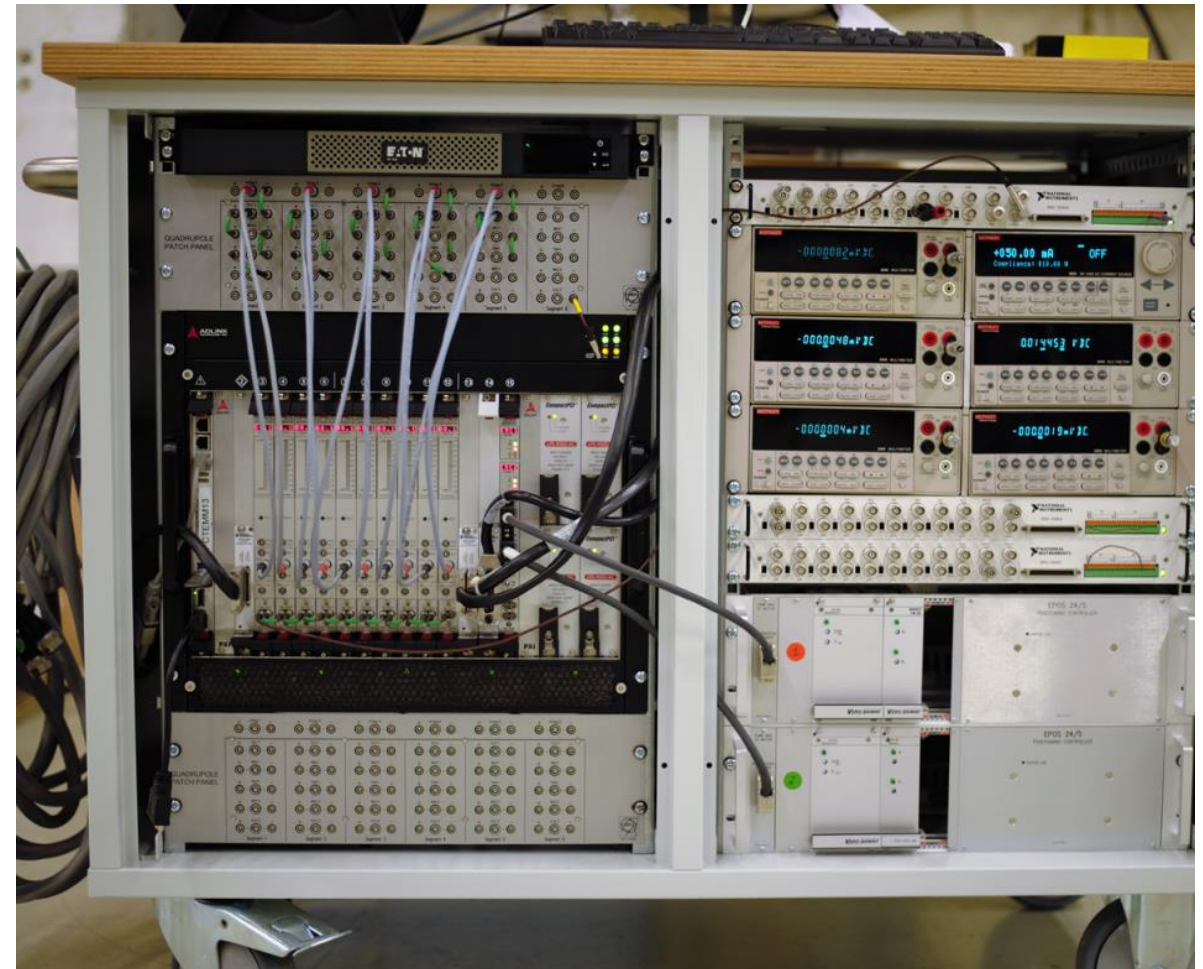# Measurement system: rotating coil

Short rotating-coil magnetometers that can be moved along the magnet axis
Proposal: PCB technology

Measurement system: electronic

FAME for cryogenic temperature in SM18

- Flexible Framework Magnetic Measurements (FFMM) software

- Fast Digital Integrators (FDI)

- Motor controller

- Patch panel for compensation scheme

- GPS time synchronization

- Encoder cards for triggering acquisition cards

- PXI computer with windows OS (License?)

Rotating coil

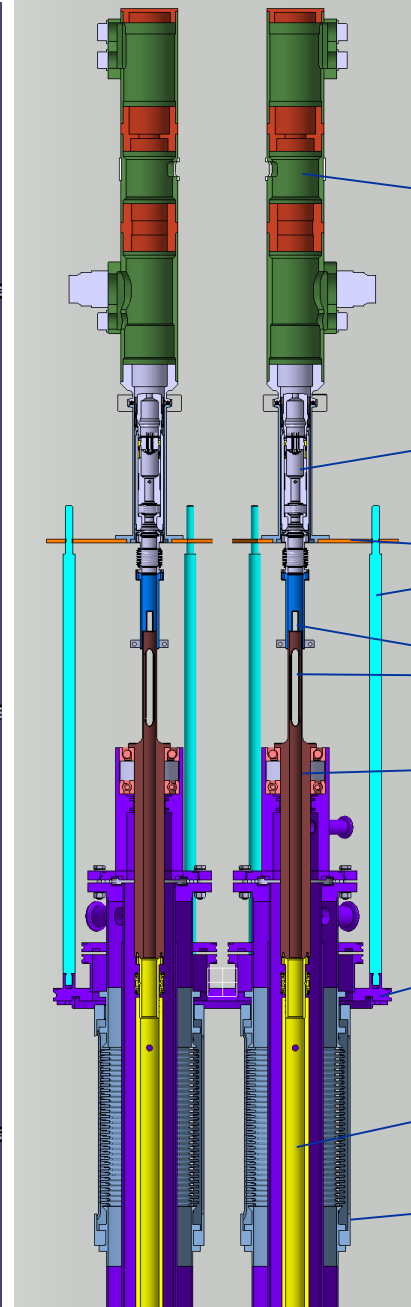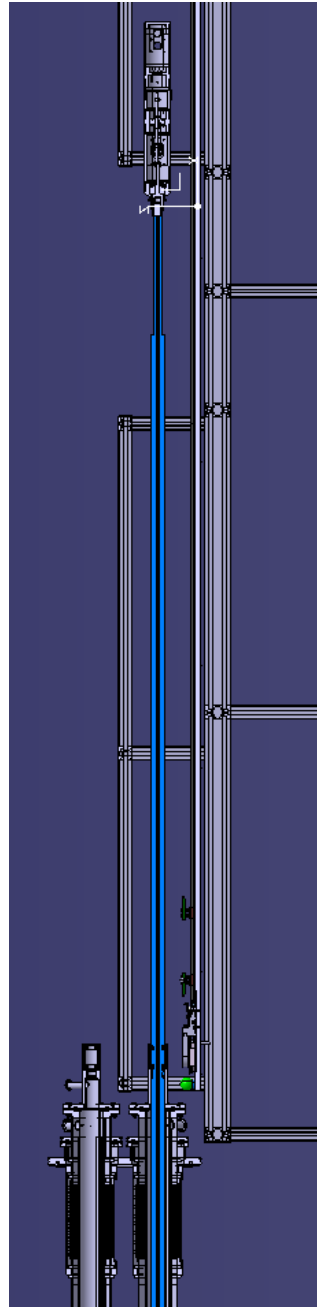**Coil displacement system**

Preferable **automatized** system:

- Additional motor controller

- Software development

Manual movement -> evaluate safety

Manual translation intervention time

Test Facility **integration**

Data post processing

Motor Unit

MRU connection

Supporting structure
Can be mobile

Intermediate connection

Shaft holder

Top flange

Extension with coils

Anti-cryostat

Open points

- Anti-cryostat diameter

- Anti-cryostat length

- Scanning mechanical design

- Test Facility integration

- Software and related rule

- Deadlines and time scale

- Spare parts

Safety design requirements

- The supply shall comply with **CERN safety rules** (available at the link: http://cern.ch/safety-rules) and the Swiss and/or French and European legislation.

All documents produced shall be submit in electronic format:

- Drawings in **CATIA**®, AUTOCAD® and/or HP-GL® format