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Swedish collaboration – FREIA orbit corrector magnets testing plans and DFH components production status

Maja Olvegård
On behalf of the FREIA team

Special thanks to:

Rocio Santiago Kern, Johan Eriksson, Kevin Pepitone, Akira Miyazaki and Tord Ekelöf

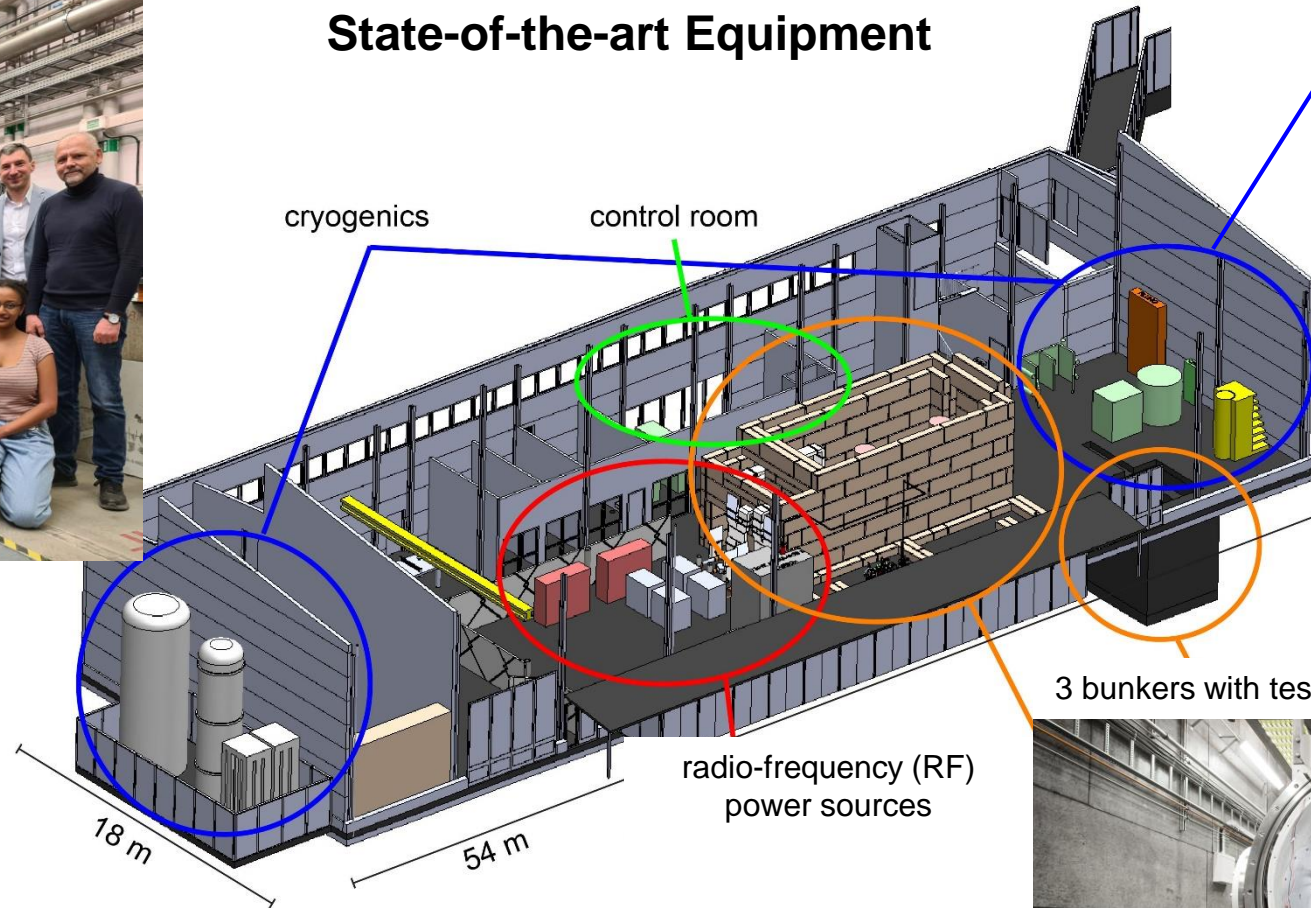


FREIA

Facility for Research Instrumentation and Accelerator Development



State-of-the-art Equipment



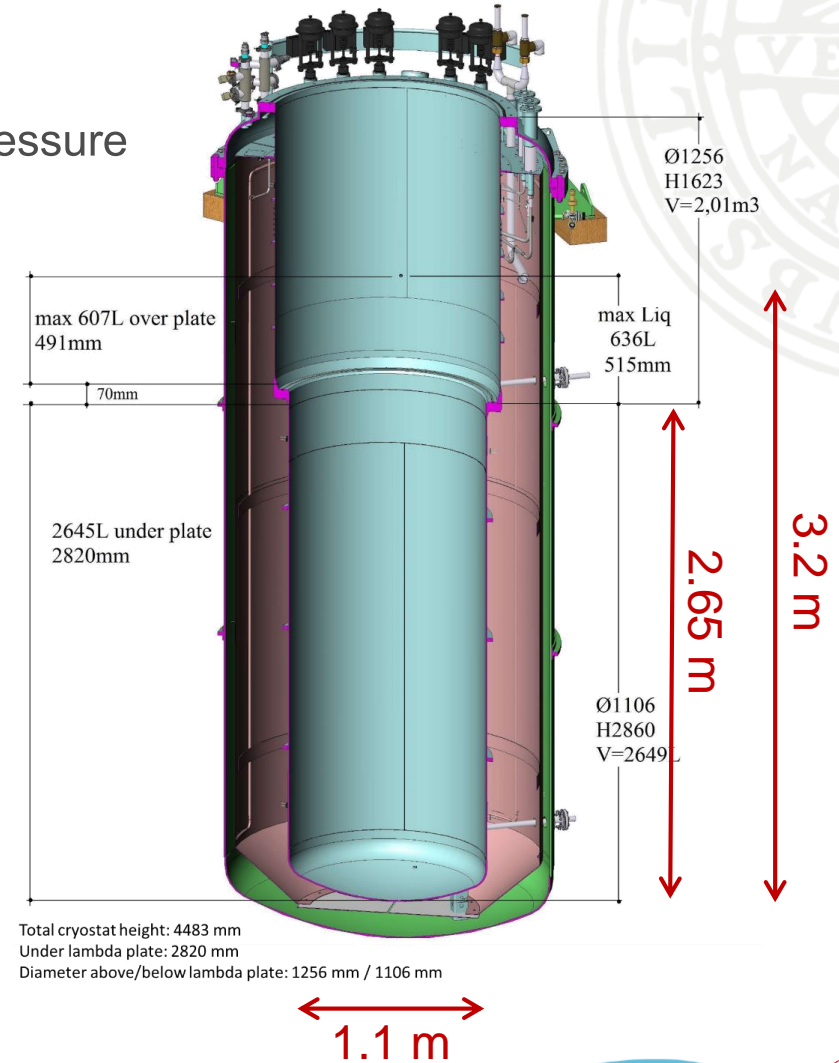
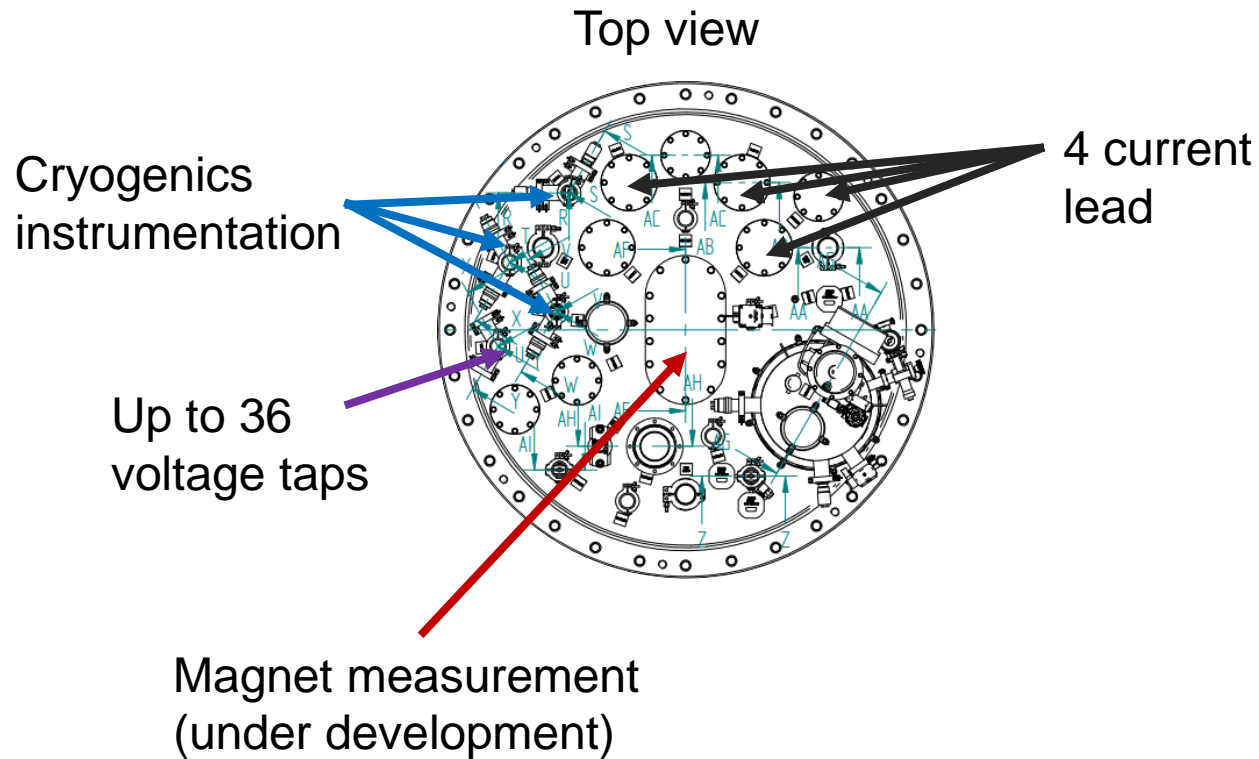
Delivery of cryogenics to the whole university

3 bunkers with test stands & a horizontal cryostat



GERSEMI

- Superconducting magnets at 4.3 K and 1.9 K, at atmospheric pressure
 - Up to 350 kJ
- Two inserts, with and without lambda plate

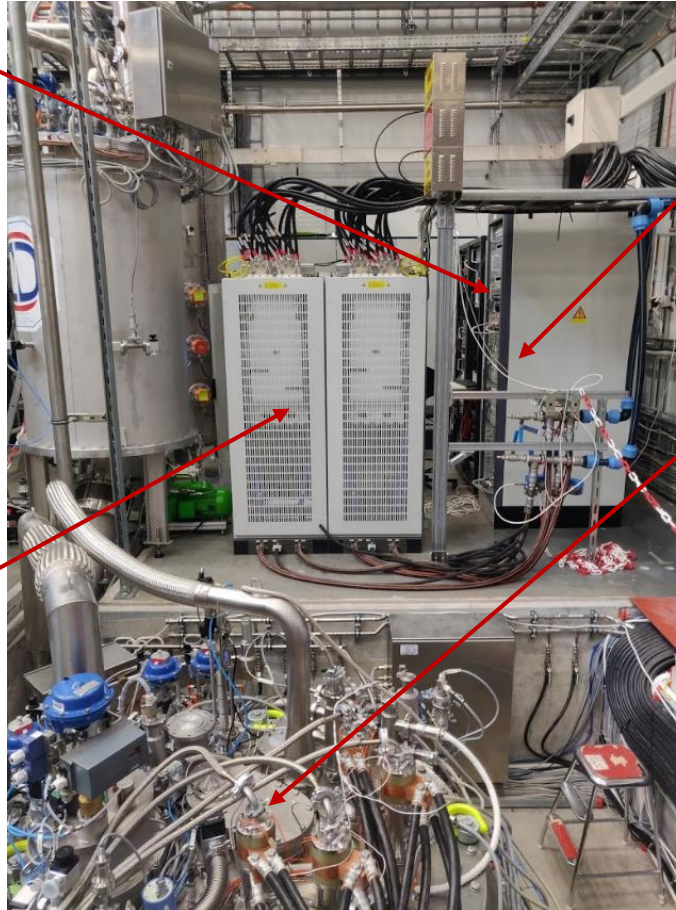


Satellite equipment

Data acquisition and PLC

- 48 high frequency channels
- 72 low frequency channels
- 1 uQDS, universal quench detection system for symmetric quenches
- Polarity switch

Two energy extraction units

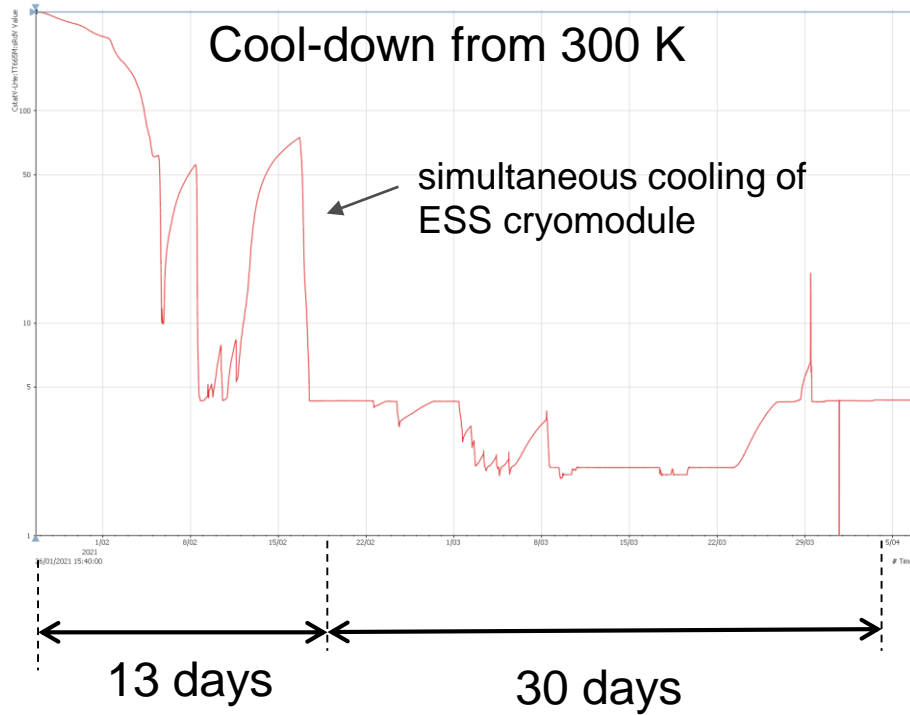


Power converters 2x2 kA

Magnet insert, fully equipped

Software for the DAQ system provided by CERN

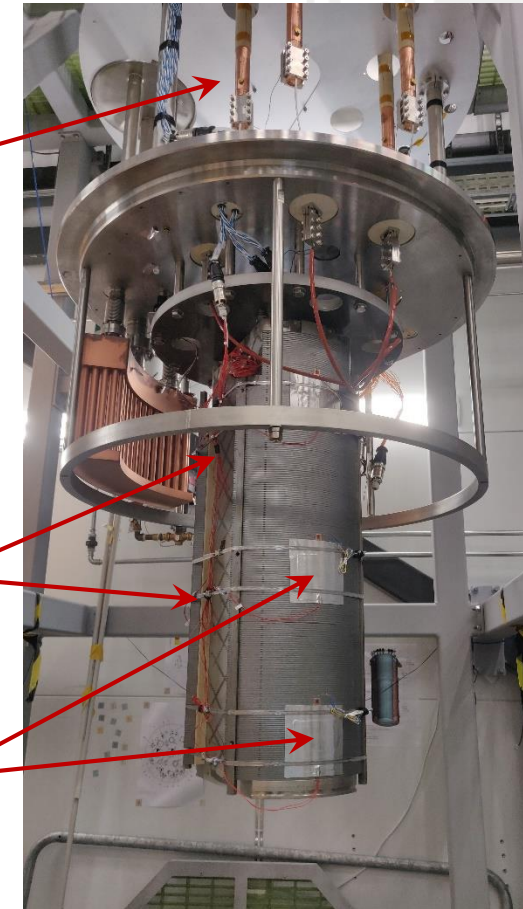
Commissioning: MCBC Cool-down



Level probe,
voltage taps,
temperature
sensors...

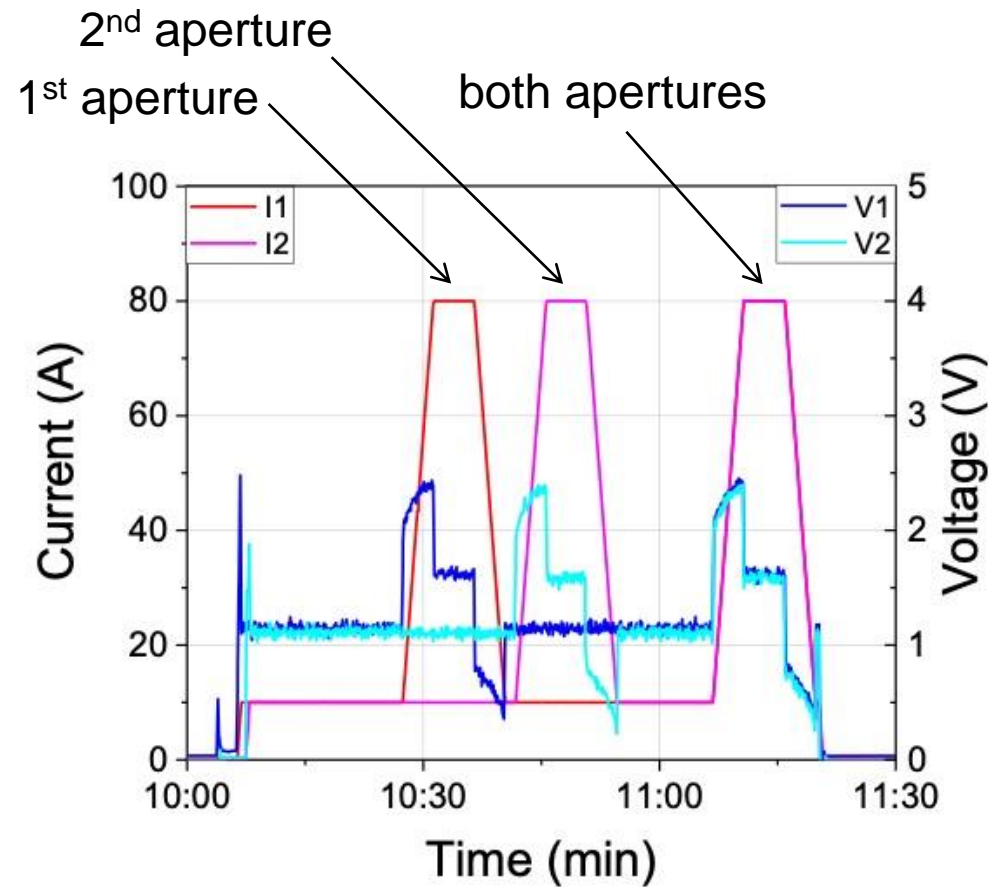
temperature
sensors

heaters





Commissioning: MCBC Powering at 1.9 K



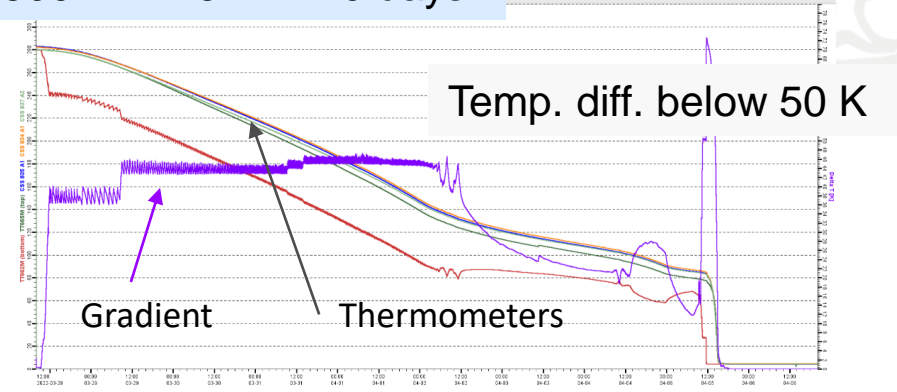
We reached the nominal current of 80 A, corresponding to a peak field of 2.5 T.



Thermal cycle of a 2.2 m CCT magnet (MCBRD)

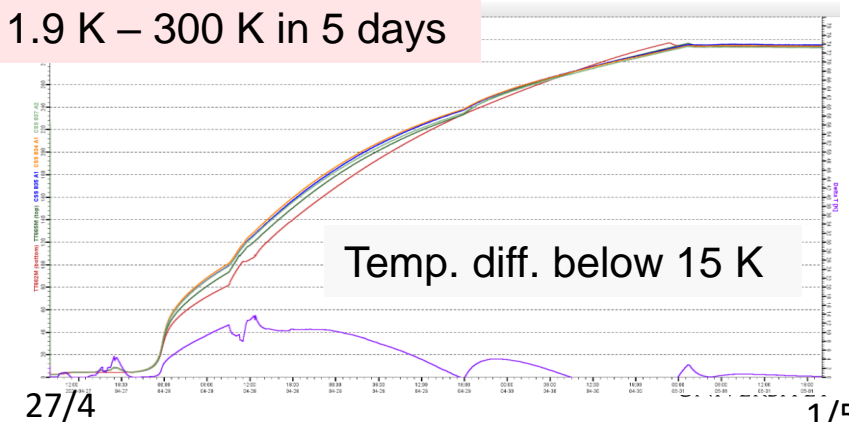
- Gradient fully controlled during cooldown and warmup.
- Quench detection system, data acquisition and all the auxiliary equipment are fully functional.
- **One thermal cycle takes 17 days.**

300 K – 4.5 K in 10 days



06/4

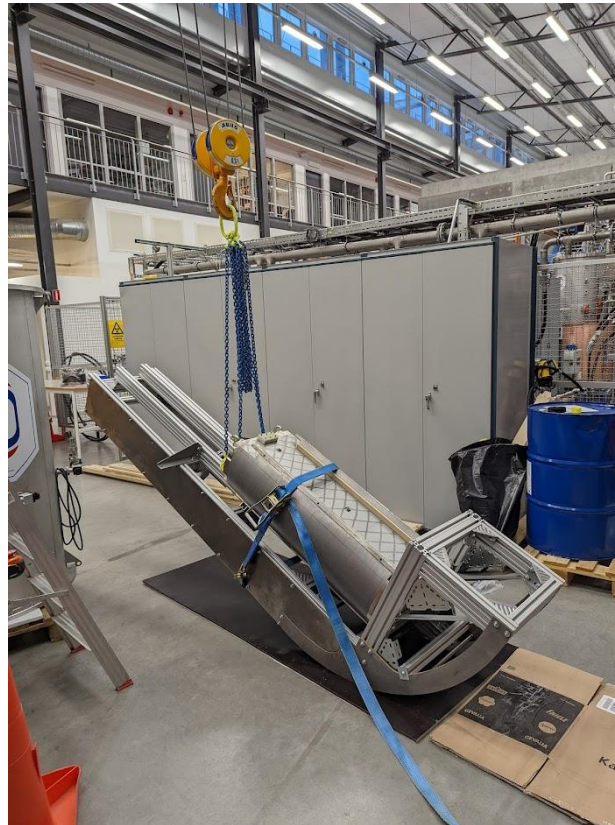
1.9 K – 300 K in 5 days



1/5

Test plan at FREIA

- Contract signed between Uppsala and CERN summer 2022
- Test five magnets
 - MCBXF
 - single-aperture
 - nested corrector dipole
 - 1.5 m long.
 - MCBRD
 - Double-aperture
 - 2.2 m long



<https://espace.cern.ch/HiLumi/MP3/SitePages/MCBXF.aspx>

12th HL-LHC Collaboration Meeting

UPPSALA - Sweden

19 - 22 September 2022

The 12th HL-LHC Collaboration Meeting will take place in Uppsala, Sweden, from 19th to 22nd September 2022, as an in-person meeting.

Based on the traditional programme with plenary and work package parallel sessions, this meeting will serve as a technical update forum for the 6th Cost and Schedule Review, planned at CERN in November 2022, and provides the framework for additional collaborative meetings between the project partners.

This year, the main objectives will be to update all HiLumi collaborators on the results of key HL-LHC prototypes tests, to highlight the progress made in the transition from prototype validation to series production, and to update all collaborators on the latest schedule changes.



CERN - Organizing Committee

Oliver Brüning *Project Leader*
 Markus Zerlauth *Deputy Project Leader*
 Cécile Noels *Project Office*
 Irene Garcia Obrero *Project Office*

Uppsala - Organizing Committee

Tord Ekelöf *Chairperson*
 Richard Brenner *Head of Physics Department*
 Maja Olvegård *Head of FREIA Department*
 Rocio Santiago Kern *Technical Leader (DHF project)*

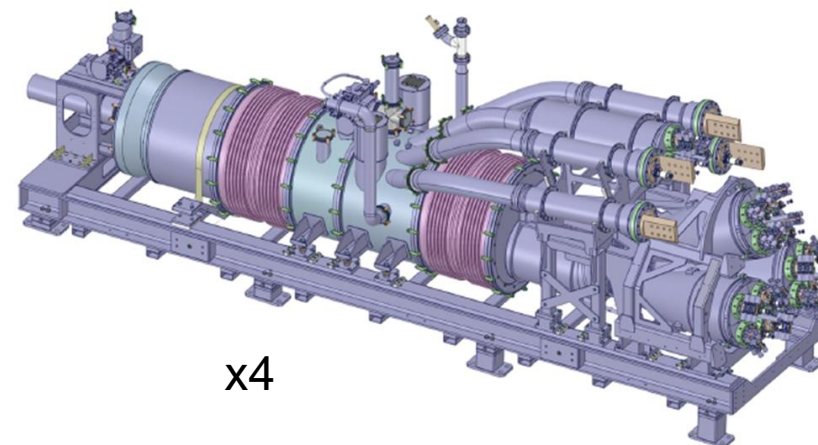
For more details and registration

cecile.noels@cern.ch
www.hilumilhc.web.cern.ch

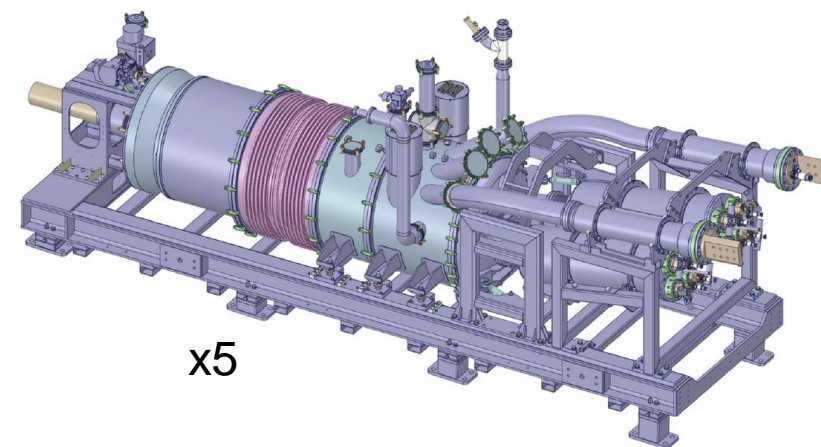


DFH delivery

- Uppsala to supply parts for
 - DFHX (4)
 - DFHM (5)
- Design and drawings made by CERN
- Manufacturing at
 - Uppsala University Workshop
 - RFR Solutions
 - CERN
- Uppsala supplies parts to CERN
 - Quality assurance
- Inspection, acceptance, assembly made at CERN



x4



x5

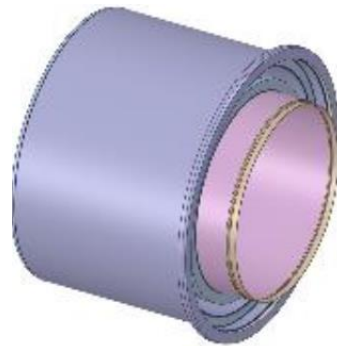
One cryostat every two months. First delivery November 2022.

Knowledge transfer

- Three particularly complex pieces
 - Welds, leak checking, etc.
- CERN will produce these pieces for the first two sets
- RFR Solutions and Uppsala learn from these and produce the remaining seven sets.



Vacuum chamber central
LHCDFHX_0024



Vacuum chamber for thermal
dissipation
LHCDFHX_0042



Envelope Cryogenic Box
LHCDFHX_0049



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Current Status

- **UU workshop**
 - 95% of parts ready
- **RFR**
 - Procurement of all material complete.
 - Manufacturing ongoing for parts approved by CERN.
 - Documentation for remaining parts almost finished.
- **CERN**
 - Currently working on vacuum barrier
 - Next phase for knowledge transfer in 1-2 weeks



Rocío Santiago Kern, Johan Eriksson

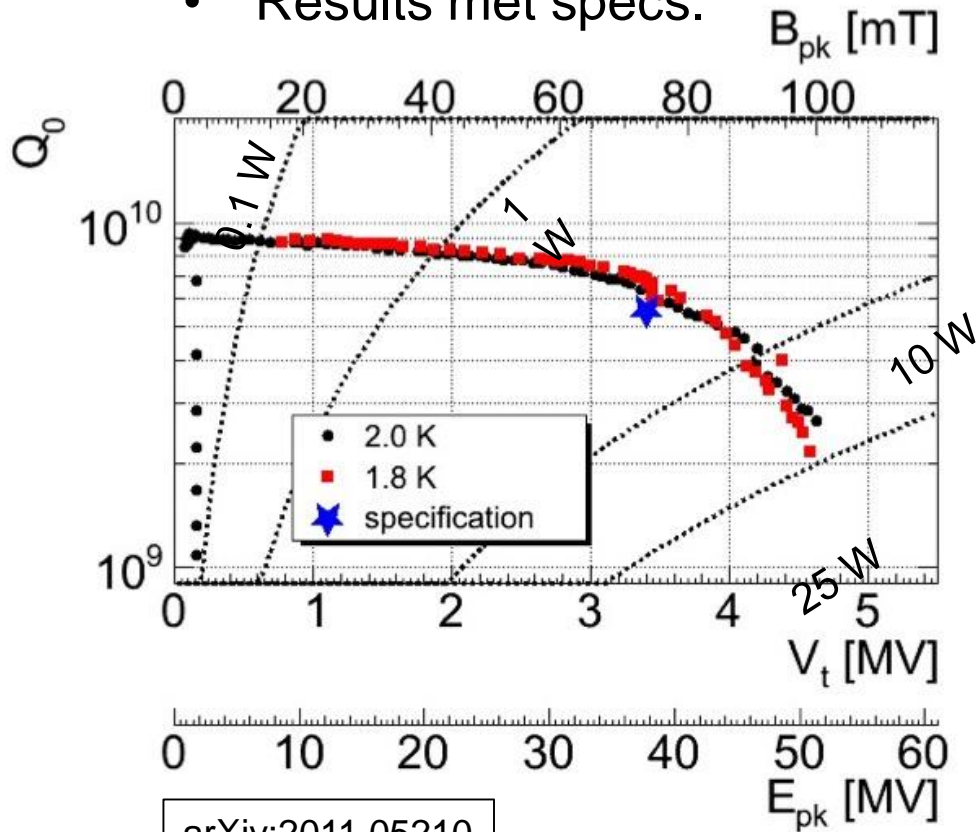
Welcome to FREIA!



Test of Prototype Double Quarter-Wave crab cavity

First test in 2020

- Results met specs.



Akira Miyazaki

Second try in 2021

- The pick-up antenna fell off during transportation to Uppsala

Demonstration of UU's clean room



diva2:1599675



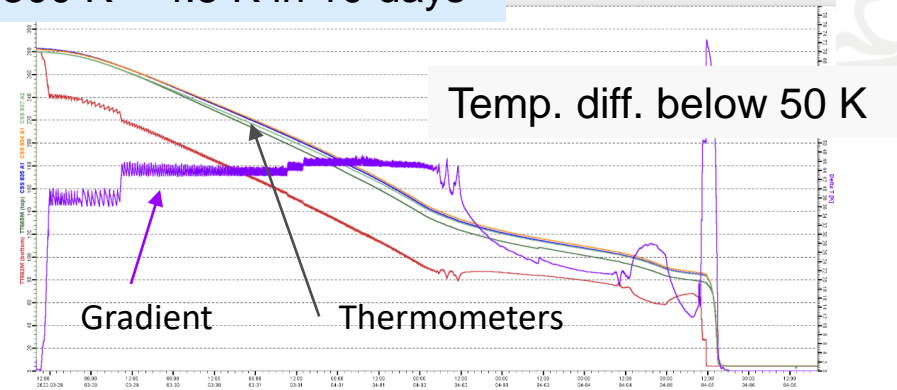
Thermal cycle of a 2.2 m CCT magnet

- Cooldown 300 K – 4.5 K: 10 days
- Cooldown 4.5 K – 1.9 K: 36 hours
- Warmup 1.9 K – 300 K: 5 days

➔ **One thermal cycle takes 17 days.**

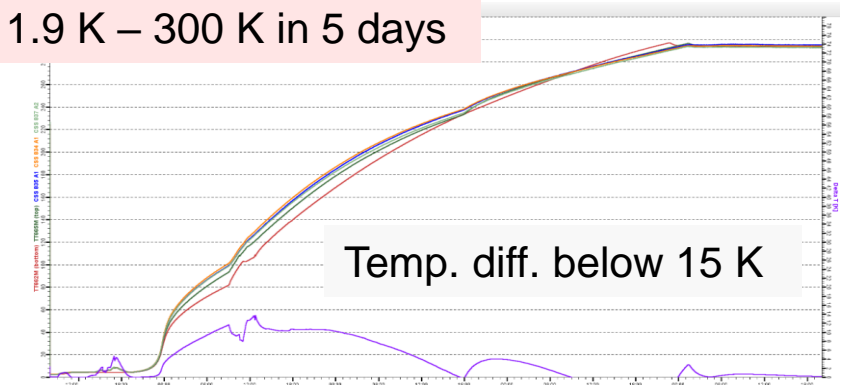
- Gradient fully controlled during cooldown and warmup (<50 K).
- Quench detection system, acquisition system and all the auxiliary equipment are fully functional.

300 K – 4.5 K in 10 days



06/4

1.9 K – 300 K in 5 days



27/4

1/5



First test of MCBC: Cool-down

