Sample Environment for reflectometry instruments

Materials Science and Physics Support group MSPS

PRESENTED BY CAROLINE CURFS & ALEXANDER T. HOLMES

MSPS Scope

- Provide and maintain **sample environment systems** in the fields of:
  - **Low and ultra low temperatures**
  - **High temperature**
  - **Electrical and magnetic fields**
  - **High pressure**
  - **Mechanical processing**
- Provide **users services** for **materials engineering, quantum materials and physics**
- Provide **mechanical integration** for all SES
- Provide **control integration** for complex SES and **electronics**
- Coordinate the **He management**
- Provide hardware and scientific support for **polarization**

MSPS Team

Group leader : Caroline Curfs

Project leads for sample environment systems

- **Magnetic field:** Alexander Holmes
- **Low & Ultra low temp:** Oleksiy Zadorozhko
- **High Pressure:** Damian Paliwoda
- **High Temp & Mech. Processing:** Caroline Curfs

- **Scientific support** and **interaction** with Instruments and users
- Define, design and procure **SES**
- Manage **projects** within time and budgets
- **Test** SES and lead the **integration**

Control electronics and integration

Niklas Ekström & Andreas Hagelberg

- Design and fabrication of **control electronics**
- **Control integration** of systems, which cannot use EPICS directly

Mechanical integration and technical support

Richard Ammer & Lauritz Saxtrup

- **Mechanical alignment** and **integration** of SES
- Mechanical **workshop** and **technical work**

Polarisation

Wai Tung Lee, Joel Hagman & Johan Ranstad

- Design, develop and provide **hardware for polarisation**
- **Scientific support**

Wishlist for Reflectometry

Magnets:
- Pulsed magnet
- 2.5T Warm bore cryomagnet (x2)
- 5T Warm bore cryomagnet
- 1T electromagnet
- Vertical 8T cryomagnet
- 3D Helmholtz electromagnet
- Horizontal 11T magnet

Low and Ultra low temperature
- Flow cryostat + HT add-on
- Dilution fridge
- 3He sorption insert
- Cryostream and linear stage
- Cryofurnace with sample changer

High Temperature
- Vacuum furnace ILL-type
- IR furnace

Others :
- Portable stress rig
- High Voltage power supplies
- Pressure cell at low temperature
- robot

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- 6.5 T HZB magnet

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Warm bore magnet

A 2.1 T passively shielded asymmetric HTSC magnet from HTS110.

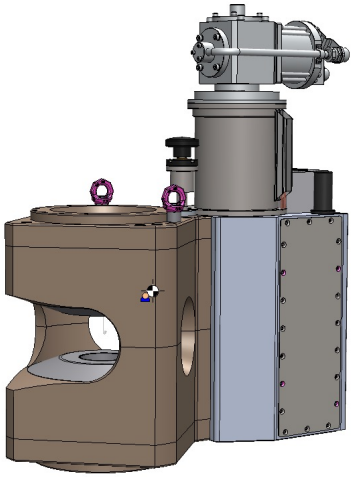
Design based on TOFTOF magnet at MLZ.

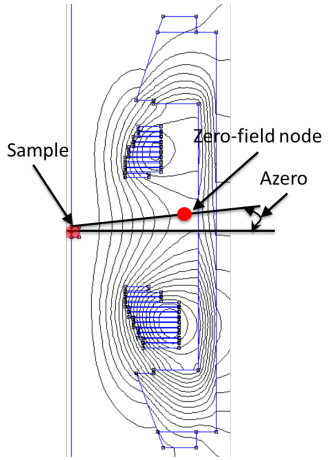
Assymmetric coils for polarised neturons, design study completed Feb ‘23

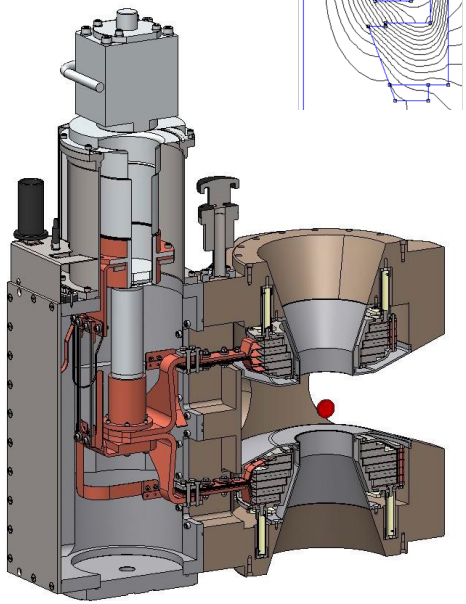
Full procurement completed, kick-off July ‘23. PDR passed, currently in detailed design stage.

Delivery planned July ‘24.

Description	
Peak Central Field	> 2.1 T
Magnet mode	Asymmetric
Field orientation	Vertical and horizontal
Sample volume	Φ25 mm
Field homogeneity over 15 mm DSV	±2% (< ±2.5%)
Vertical room temperature bore	2 X Ø80 mm with an opening angle of 40°
Horizontal room temperature bore	2 X Ø80 mm with an opening angle of 40° 1 X Ø80 mm with a horizontal opening angle of 150° and a vertical opening angle of 40°
Fringe field at distance of 1.0 m from centre of magnetic field (axial/radial)	1.5 /1.0 mT
Vertical scattering angle for polarized neutron scattering (sample height: 10 mm)	±2°







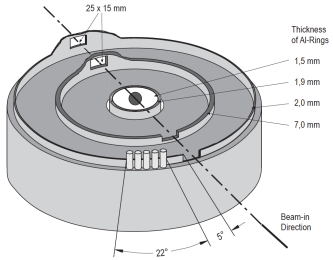
HTS-110

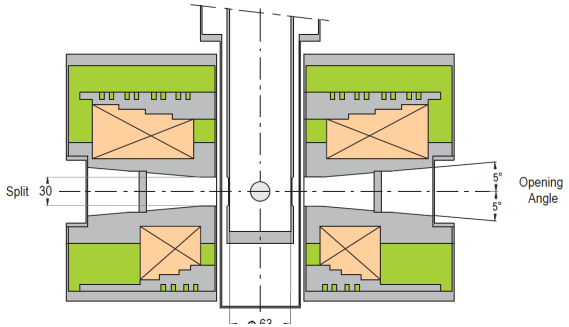
Other pool magnets

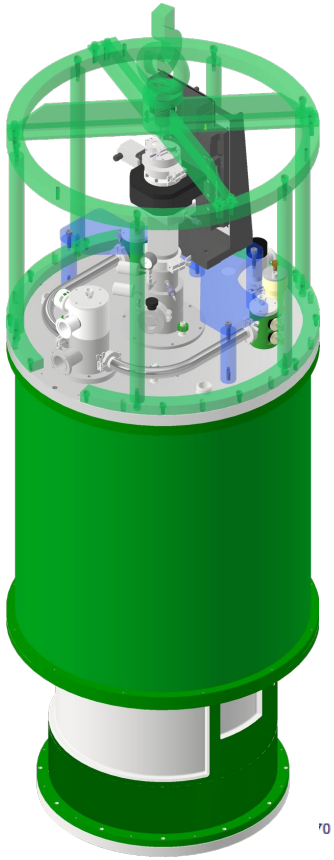
6.5T and 8T asymmetric cryomagnets

6.5T asymmetric magnet from HZB.
50mm bore, Al rings.

To be tested to full field this year (enabled by installation of He recovery).

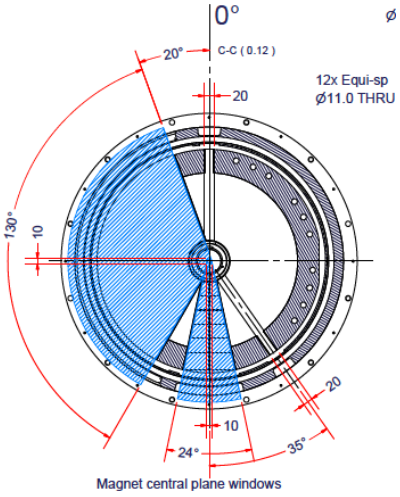






8T asymmetric magnet.
optimised for MAGiC.
In manufacturing by Cryogenic Ltd.
Delivery expected Q3 24

Floor mounted -
could be used on ESTIA?

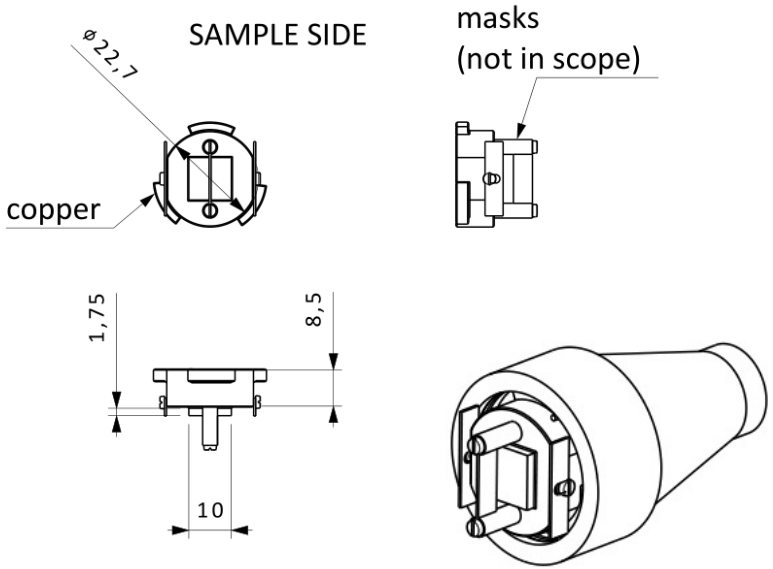


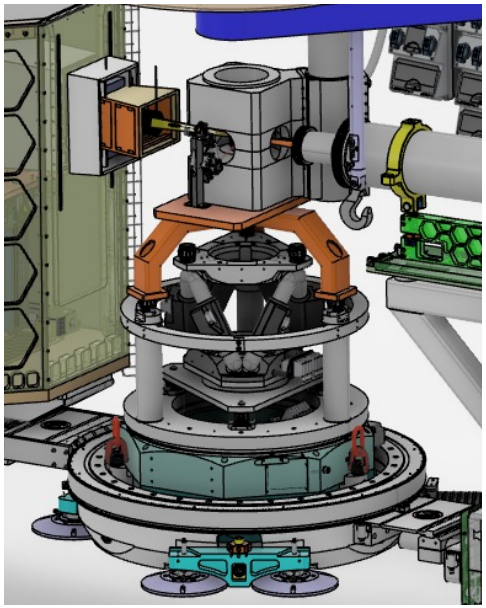
Magnet central plane windows

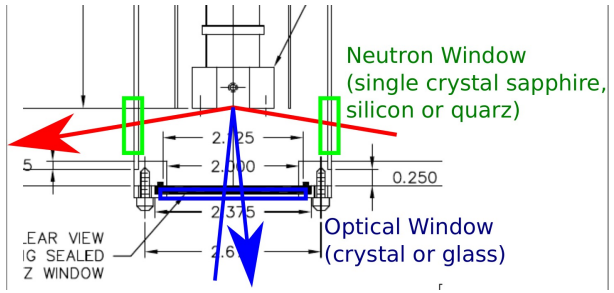
ESTIA LHe flow cryostat

- Instrument scope – PSI SE group in charge in consultation with ESS (Oleksiy Z.)
- Specifications sent to and discussed with vendors
- Waiting for updated quotation including detailed design of sample holder mechanism
- To be ordered until Q4 2023

Copper sample holder with quick-release mechanism:







Low background windows and front access (e.g. pump laser)