



Large Scale Structures Division

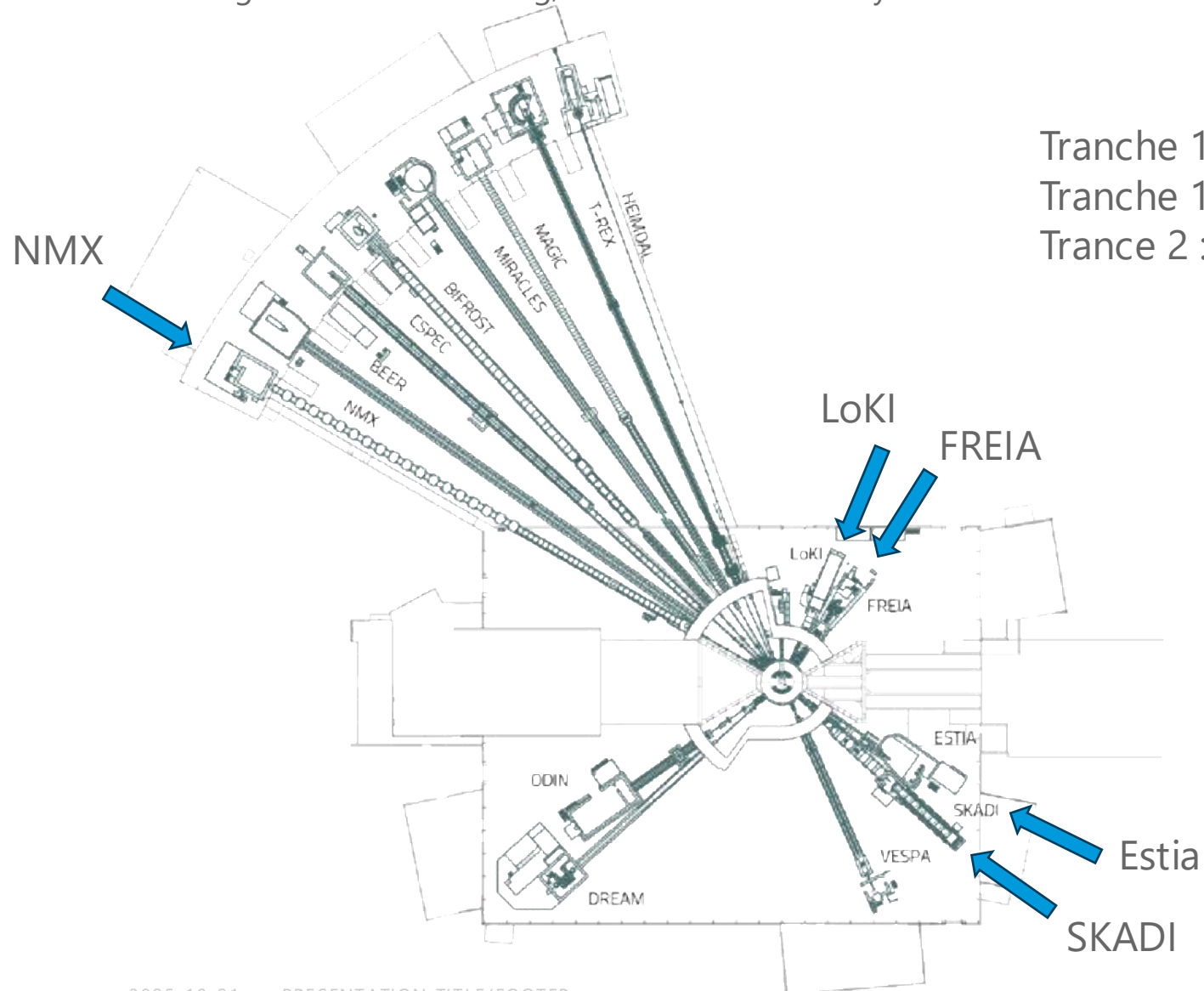
Common STAP Meeting – October 2025

ANDREW JACKSON
HEAD OF LARGE SCALE STRUCTURES DIVISION

2025-10-21

Large Scale Structures Instruments

Small Angle Neutron Scattering, Neutron Reflectometry & Neutron Macromolecular Crystallography



Tranche 1 : LoKI, NMX
Tranche 1-2 : Estia
Tranche 2 : SKADI, FREIA

Deuteration and Crystallisation

Previously ...



Science Support Division



Chemical Deuteration At ESS

- Small organic molecules, monomers
- Lipids (e.g. POPC, SOPC, POPE)
- Surfactants (e.g. sugar-based)
- Novel organic molecules for various applications



Biological Deuteration At Lund University (Biol. Dept)

- Deuterated biomass from *E. coli*, *B. braunii*, *P. pastoris*
- Recombinant soluble proteins, plasmid DNA, "other"
- Yeast-derived lipids (total, p-lipid)



Protein Crystallization At ESS & Lund University

- High- and low-throughput screening
- Fine screening in large volumes
- Support for room temperature crystal mounting & data collection
- X-ray testing (LU BAG at MAX lab)



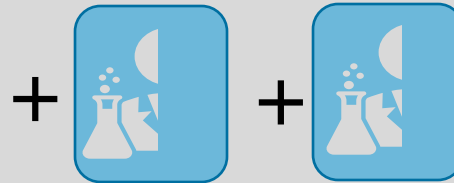
New
Deuteration
Chemist starting
soon



Hanna



Jia-Fei



0.75 RE @ LU 0.2 analysis @ ILL



Zoë

Deuteration and Crystallisation

Now



Science Support Division



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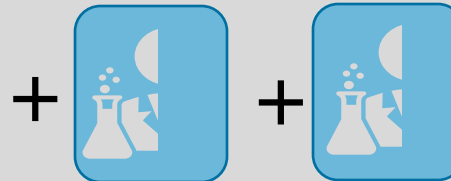
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LSS Division



Protein Crystallization NMX team at ESS & Lund University

- High- and low-throughput screening
- Fine screening in large volumes
- Support for room temperature crystal mounting & data collection
- X-ray testing (LU BAG at MAX lab)



Zoë



Swati

Teams on site

Judith & Ellen are on parental leave.
Andrew is filling in for Judith on LoKI



LoKI (Partner : STFC)

Judith Houston (ESS, Instrument Scientist)

Santiago Bordin (ESS, Instrument Scientist – Jan 2026)

Hannah Burrall (ESS, Instrument Ops Engineer)

Clara Lopez (ESS, Engineer - NSS)

SKADI (Partners : LLB & FZJ)

Sebastian Jaksch (ESS/FZJ, Instrument Scientist)

Annika Stellhorn (ESS, Instrument Scientist Polarized SANS)

Tamires Gallo (ESS, Instrument Operations Engineer)

Milan Klausz (HUN-REN, Postdoc Detector Simulations)

Sylvain Desert (LLB, Engineer – NSS)

Instrument Data Scientists (DMSC)

SANS : Oliver Hammond

Reflectometry : Nicolo Paracini

NMX : Aaron Finke

Estia (Partner : PSI)

Jos Cooper (ESS, Instrument Scientist)

Grace Causer (ESS, Instrument Scientist)

Felipe Lopes (ESS, Instrument Ops Engineer)

Nicolae Popescu (ESS, Engineer – NSS)

FREIA (Partner : STFC)

Tom Arnold (ESS, Instrument Scientist)

Ellen Wilson (LU/ESS, Postdoc XRR + FREIA)

Instrument Operations Engineer (Position advertised)

Clara Lopez (ESS, Engineer – NSS)

NMX

Esko Oksanen (LU/ESS, Instrument Scientist)

Justin Bergmann (ESS, Instrument Scientist)

Swati Aggarwal (LU/ESS, Support Scientist)

Zoë Fisher (ESS, Crystallisation and Biodeuteration Scientist)

Daniel Lundström (ESS, Engineer – NSS)

LoKI Progress

Installation Complete – June 2025


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LoKI instrument installed and ready for commissioning at ESS: A testament to the power of collaboration

SEPTEMBER 2, 2025



LoKI is getting ready for neutrons. Image: Ulrika Hammarlund/ESS

The installation phase of the LoKI instrument at ESS is now complete, and the instrument is set to begin its cold commissioning phase – a major milestone for ESS as it progresses toward full operations. LoKI, an advanced Small Angle Neutron Scattering (SANS) instrument, has been developed and delivered through a close collaboration between ESS and its UK In-Kind Partner, ISIS Neutron and Muon Source. This shared effort exemplifies the power of partnerships between scientific institutions.


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LoKI instrument installed and ready for commissioning at ESS: A testament to the power of collaboration 02 Sep 2025

As part of the UK contributions to the European Spallation Source (ESS) in Sweden, ISIS is taking the lead in designing and delivering two key instruments: LoKI and FREIA. The installation phase of the LoKI instrument at ESS is now complete.

The instrument is set to begin its cold commissioning phase – a major milestone for ESS as it progresses toward full operations. LoKI is an advanced small angle neutron scattering instrument and will be one of the first to receive neutrons when the ESS enters operations. The beamline was designed and built at ISIS and then installed at the ESS. This shared effort exemplifies the power of partnerships between scientific institutions.

"This milestone celebrates more than just engineering achievement - it's a testament to the strength of the partnership between ISIS and ESS," says Andrew Jackson, Head of the Large Scale Structures Division at ESS. "At ESS, we've learned an enormous amount working closely with the ISIS team, who have delivered exceptional equipment and documentation. Their commitment and support at all levels have been vital to the success of this project."



LoKI detector installation

LoKI is an instrument that will support soft-matter, materials, and life-science researchers that need to make advanced nanoscale measurements. Areas of research that will benefit from LoKI include: understanding the flow behaviour of complex fluids such as personal care products and pharmaceutical formulations; examining the formation and stability of lipid nanoparticles used for drug delivery; understanding the interactions and structure of proteins in solution; and studies of polymer composites and smart materials under strain.

Related Sections

- News

Related Content

- News Articles
- News in 2025
- Technical Highlights

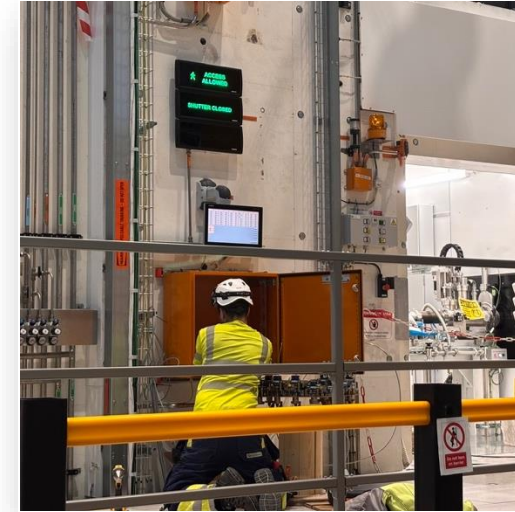
https://www.isis.stfc.ac.uk/Pages/News25_LoKI.aspx

LoKI Progress

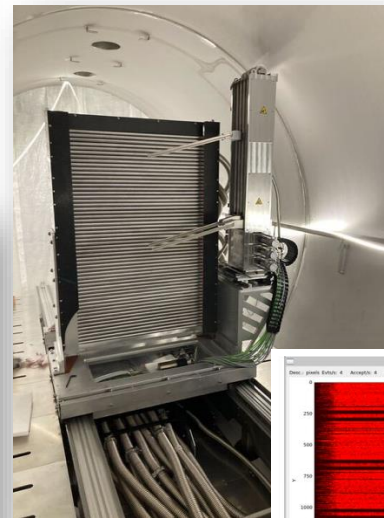
Installation Complete



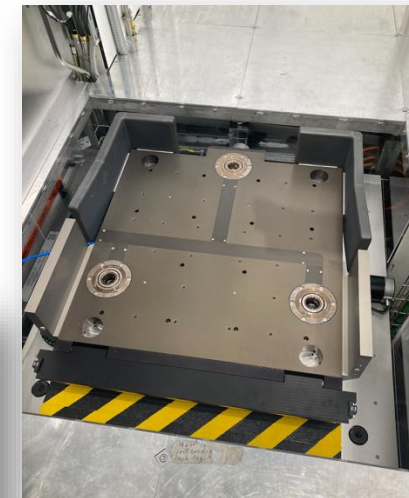
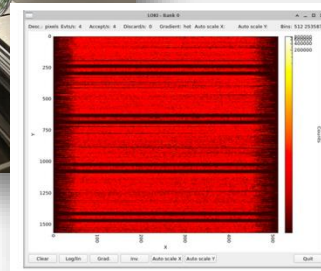
Hannah and Clara inspecting slit system cabling before closing shielding



PSS Installed



Long runs counting cosmics have allowed us to identify cabling and connectivity issues on the detectors. All now resolved



Sample stack in place



Andrew pretending to be useful by fixing 4 bolts

*Rear wall will be last thing we do, but it has been test fitted



LoKI Progress

Getting ready for Hot Commissioning

Integrated Testing Completed – June to September

System Acceptance Review held – 19th September

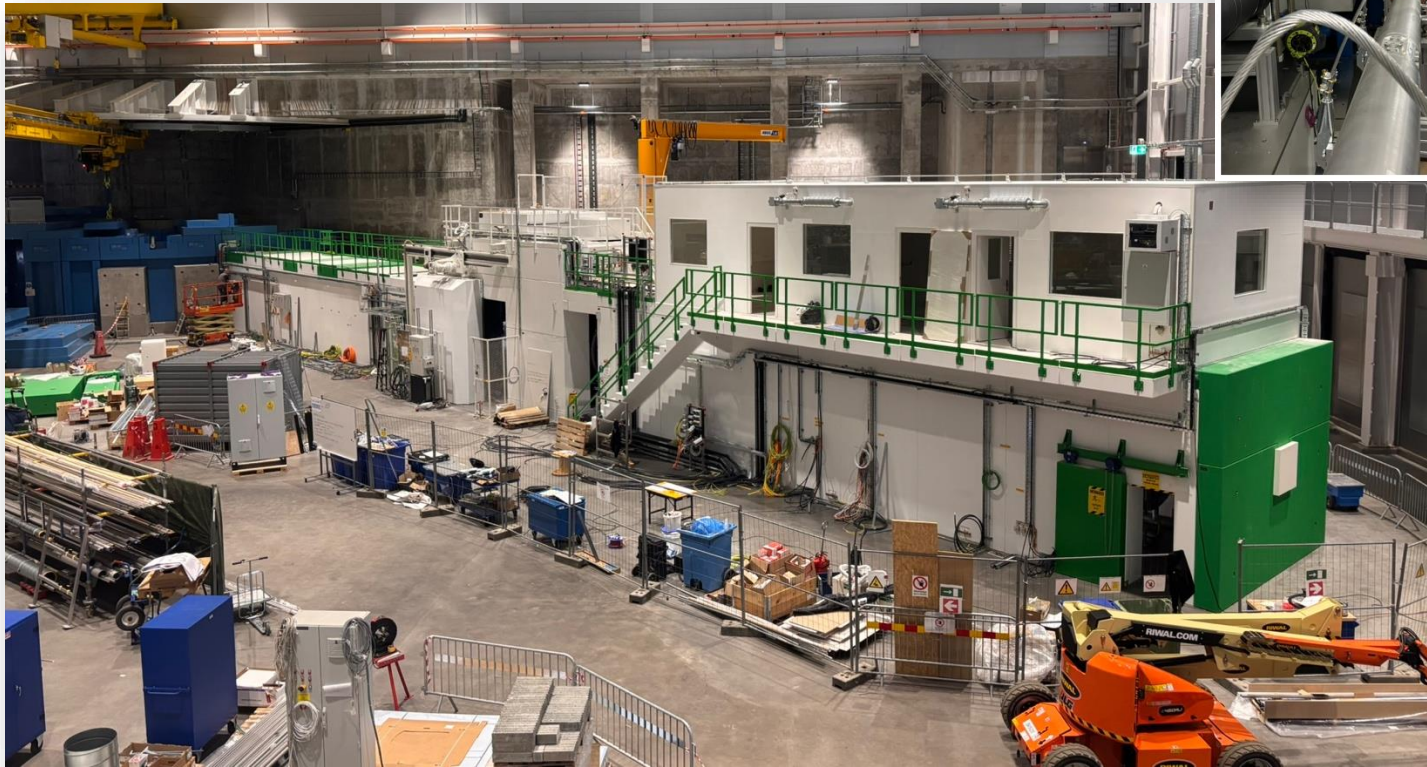
- Not approved due to outstanding issues arising from testing
 - Mostly controls issues
 - Detector module failure that has now been diagnosed and determined to be “expected” failure mode and the module is removed and awaiting maintenance.
- Review of completion of issues to be held by early December

Safety Readiness Review to be held – 3rd or 4th December

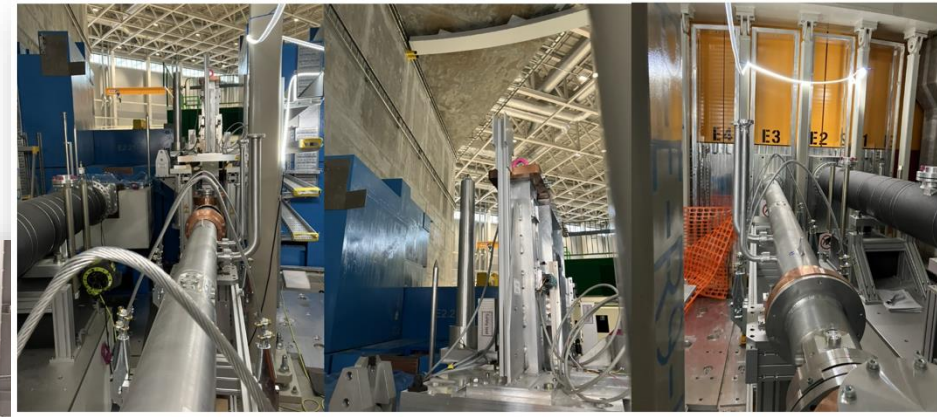
- PSS integration test completed
- Motion safety installation and integration to be done
- Quality and compliance process ongoing

SKADI Progress

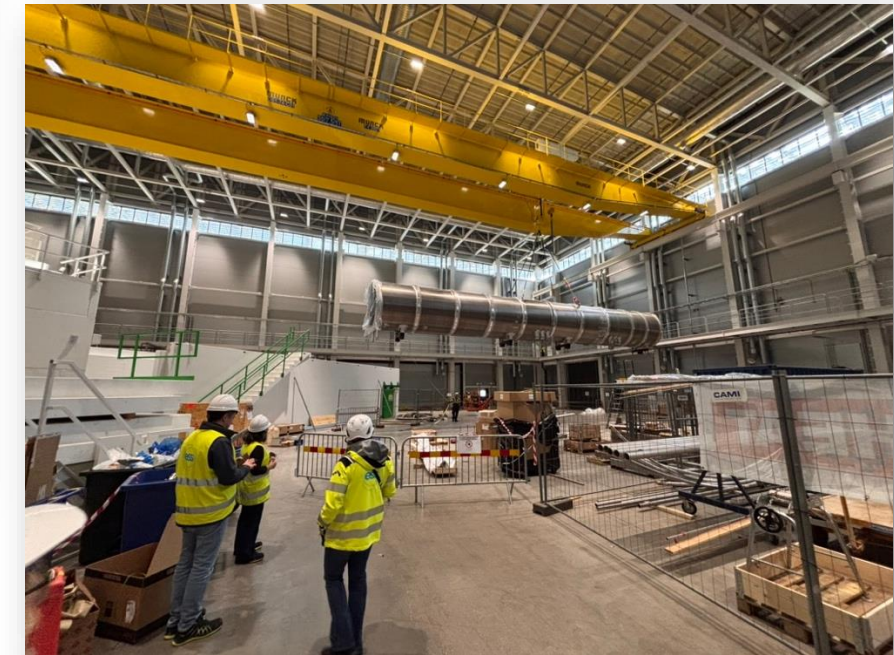
Installation well under way



Cave, Collimator Shielding, and Hutch Installed
Electrical and Utility installation started



In bunker components installed



Detector vessel delivered and installed,
undergoing mechanical integration,
alignment, and testing.

TG3 before end of 2025
TG5/SAR before end of 2026

Estia Status

Installation almost complete



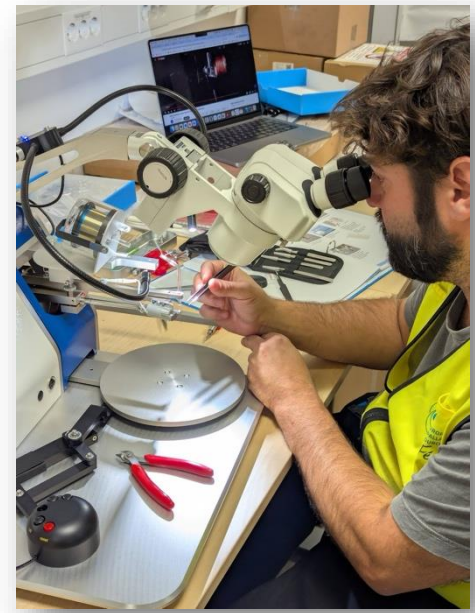
Estia team after completion of testing of detector arm



Detector complete, installed, and initial testing with cosemics done



Hexapod installed



Felipe testing the microscope and wire-bonder in the sample prep area



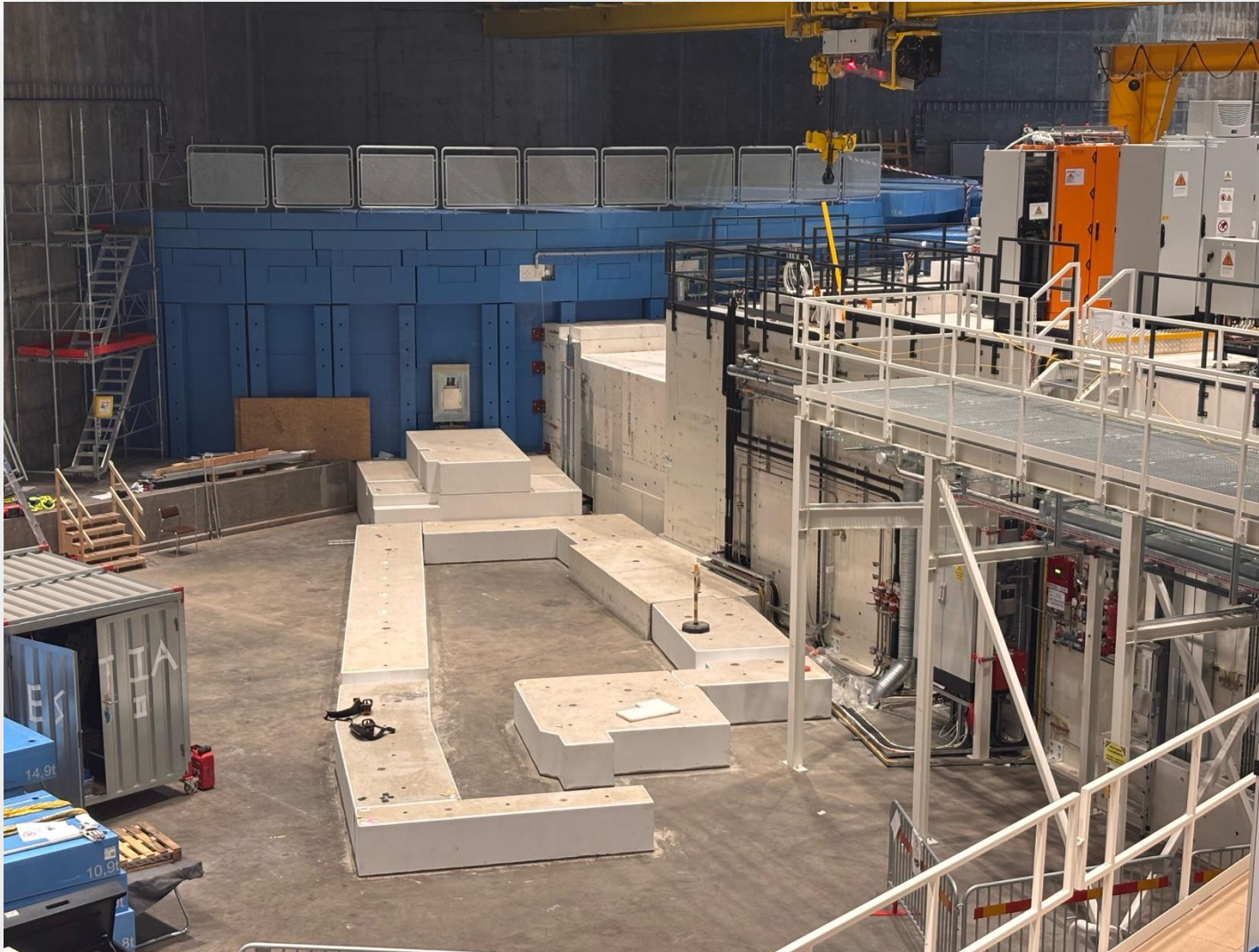
Control Hutch fitted out



TG3 completed 3rd October 2025
TG5/SAR due in Q1 2026

FREIA Progress

Installation started



Base for cave installed

Installation of cave ongoing

Delivery of components from
ISIS/STFC ongoing

NMX Status

Installation almost complete



Sample and detector robots installed and undergoing inspection for energisation



Sample prep lab fitted out and operational



Control Hutch fitted out and awaiting IT equipment

Sample Environment

Sample Changers

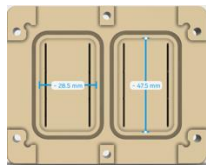
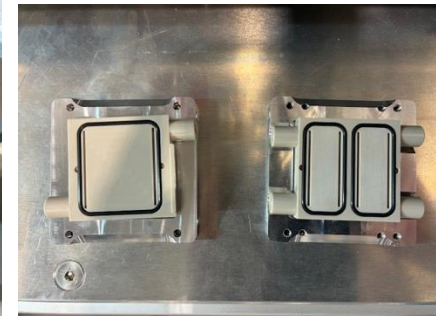
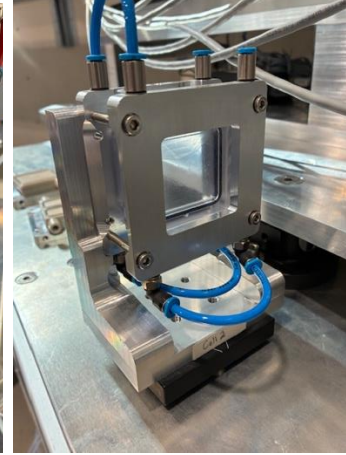
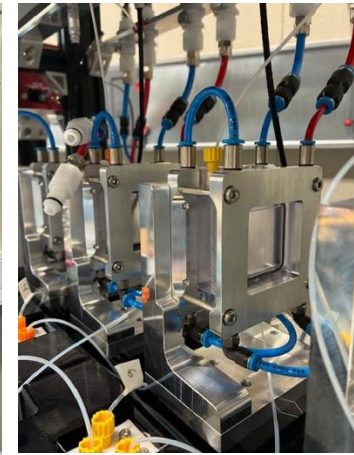
LoKI/SKADI

- Up to 48 narrow rectangular cuvettes
- Various options for different sizes/styles of cuvette
- Independent top and bottom temperatures
- Optional rotating sample holder for sedimenting samples
- *Future* : Peltier augmented sample racks for precise temperature control



Estia

- 7 position solid-liquid cell changer
- Small footprint / low volume solid-liquid cells



Large Scale Structures

Sample environment priorities



LOKI

- **HC (May 2026)**
 - Sample Changer
 - Circulating baths (Julabo)
 - Temperature readout box
- **First/Early Science (April 2027)**
 - Rheometer
 - NURF set up
 - HPLC Pumps and Switches
 - Syringe Pumps
 - Stopped Flow cell
- **SOUP (November 2027)**
 - SEC-SANS
 - AF4 (grant?)
 - Electromagnet
 - Humidity chamber (?? Which one)
 - Microfluidics
- **Later**
 - Liquid/gas mixing supercritical
 - EC cell
 - Humidity cell extreme condition
 - Vapor sorption (liquids)
 - In-situ reaction corrosive
 - Hydrostatic pressure cell
 - Soft matter stress rig
 - User/Grant led SEE

SKADI

- **HC (Jan 2027)**
 - Sample Changer
 - Circulating baths (Julabo)
 - Temperature readout box
- **First/Early Science (December 2027)**
 - Warm bore magnet
 - Flow cryostat
 - Electromagnet
 - Rotation stick
 - Rheometer
 - Stopped Flow cell
 - Syringe pump
 - HPLC pump
 - Flexiprob : DLS
 - Flexiprob : Foam Column
- **SOUP (March 2028):**
 - SANS Magnet
 - Cryostat or CCR
 - Humidity chamber
- **Later:**
 - SANS Magnet with PA
 - Dilution insert
 - He insert
 - EC cell
 - Vacuum furnace Niobium
 - DAC high P cells
 - Soft matter stress rig
 - UHT furnace
 - User/Grant led SEE

ESTIA

- **HC (June 2026)**
 - Warm bore magnet
 - Flow cryostat
 - Ambient sample changer (Estia)
 - Solid-Liquid cells + changer (manual cell loading)
 - Electromagnet (maybe)
- **First/Early Science (May 2027)**
 - HPLC/syringe pumps
 - 6.5T magnet
- **SOUP (December 2027)**
 - in-situ ellipsometry/ATR-FTIR
 - EC cell (batteries, potentiostat)
 - Environmental cell (humidity/temperature)
- **Later**
 - User/Grant led SEE

FREIA

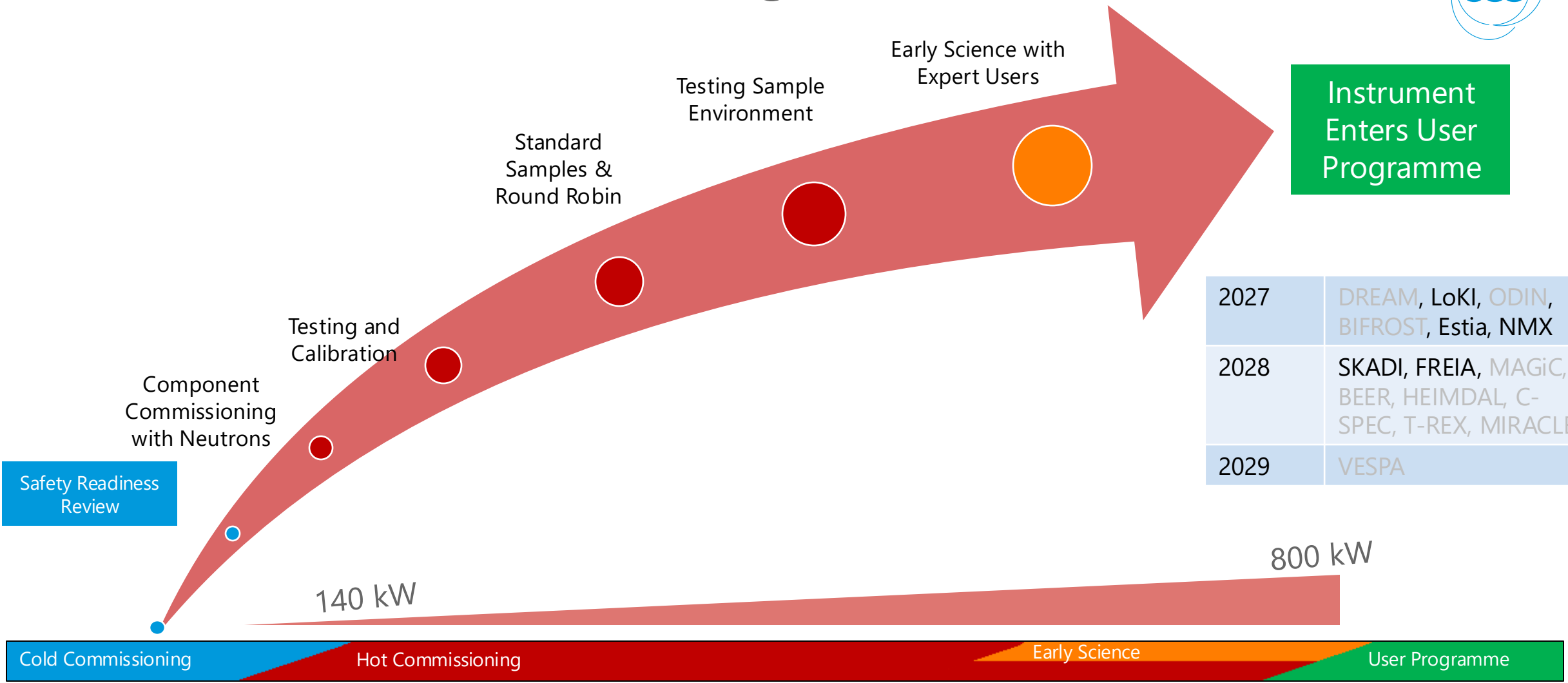
- **HC (May 2027)**
 - Langmuir trough
 - Air-liquid troughs
 - Solid-Liquid cells + changer
- **First/Early Science (March 2028)**
 - Temperature controller
 - HPLC/syringe pumps
- **SOUP (May 2028)**
 - Additional solid-liquid cells and Langmuir troughs
 - in-situ ellipsometry/ATR-FTIR
 - multiwell troughs
 - small volume/cooled troughs
- **Later**
 - Sample changing robot
 - Shear/confinement cells
 - Rheometer
 - Environmental chamber (humidity/temperature)
 - User led SE including Liquid-liquid cells, Electrochemical cells + potentiostat, Overflowing cylinder, Humidity cell, WLS, GISANS (Flexiprobe).

NMX

- Provided by NMX



Towards the User Programme



LoKI, Estia, NMX :
Hot Commissioning Start : mid-2026
User Programme : late-2027

SKADI, FREIA :
Hot Commissioning Start : 2027
User Programme : late-2028

ESS Early Science Postdocs



Estia and LoKI

Estia

In-operando Studies of Lithium-Ion Batteries

ESS: Jos Cooper, Grace Causer

Collaborators : Robert Weatherup (Oxford)

Using the unique capabilities of Estia to enable new studies of the solid-electrolyte-interphase in lithium-ion batteries.

Development of small-footprint battery cell for use with neutrons and comparison of this cell with existing coin cells used for x-ray studies.

Postdoc to start in mid 2026

LoKI

Rheology of microgels

ESS: Judith Houston

Collaborators: Emanuela Zaccarelli (La Sapienza) and Marco Laurati (Florence)

Using the capabilities of LoKI to understand the rheology of concentrated microgel suspensions.

(Project proposal in preparation and subject to review and approval)

Postdoc will start in late 2026/early 2027 if approved

Swedish Science Initiatives at ESS

VR Funded Early Science Consortia (2026-2029) – proposals under evaluation



Lifecycle of a Lipid Nanoparticle (PI: Margaret Holme, Chalmers)

- Examining the production, delivery, and biological interactions of lipid nanoparticles used as drug delivery agents
 - LoKI and Estia
 - Three postdocs based at ESS:
 - Lipid particles under flow (working with Judith Houston and Andrew Jackson)
 - Biological interactions of LNPs (working with Tom Arnold and Sebastian Jaksch)
 - Modelling of data from LNPs (working with Oliver Hammond and Andrew Jackson)

Quantum Horizons at ESS: From Synthesis to Scattering (PI: Elizabeth Blackburn, LU)

- Looking for skyrmion-vortex coupling and altermagnetism driven by interfaces
 - Estia (and possibly GISANS on SKADI)
 - One postdoc based at KTH (working at ESS with Jos Cooper and Grace Causer)



Questions?