

# **ESS Update**

# A coalition of 13 European countries

# ess

### Host countries

Sweden, Denmark



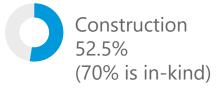
Operations 15%

### When in operation:

2-3000 users per year Open 24-7 (200 d/y) ~600 members of staff ~260M€ operation budget

## Non host member countries

Czech Republic, Estonia, France, Germany, Hungary, Italy, Norway, Poland, Spain, Switzerland, United Kingdom

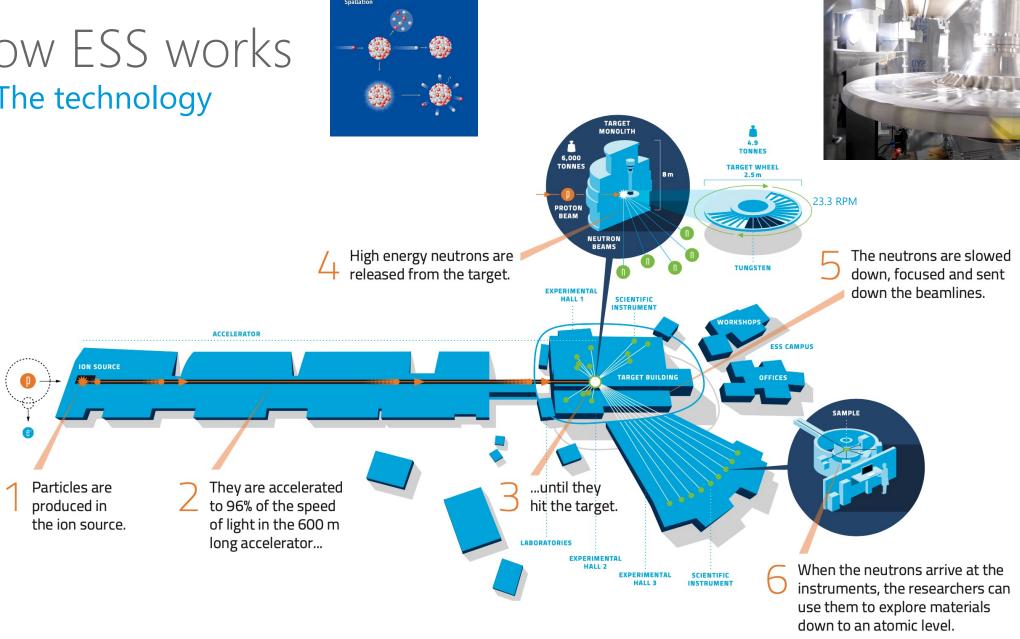




In-kind contribution of Denmark for building and commissioning instruments + **DMSC** 



# How ESS works The technology

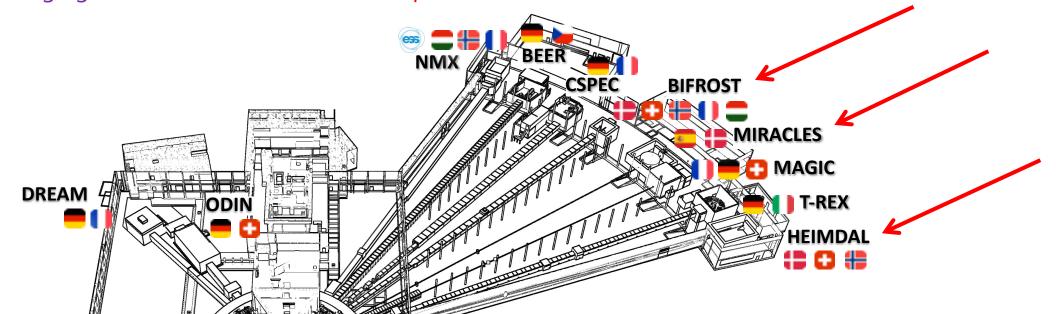


# Neutron Science Instruments at ESS

**VESPA** 

ess

1 Imaging, 2 SANS, 2 Reflectometers, 5 Spectrometers, 5 Diffractometers, 1 Test Beamline



- Expertise from all around Europe
- Instrument components designed, built, and tested at partner institutes
- Instruments assembled and integrated at ESS
- ESS provides core labs, data acquisition, processing and management, engineering support, electrical, utilities, safety systems,

# HEIMDAL



## Hybrid Diffractometer: Combined Diffraction and SANS and Imaging

ESS HEIMDAL	28 m	Samp	ole at 157 m Top view
	<b>1</b>	V	
Monolith Bunker	D03	E02	E01

- Real time chemical synthesis
- Fast chemical reactions and kinetics
- 2D Rietveld Neutron Powder Diffraction
- In operando fuel cells and batteries
- Texture studies
- Magnetic Materials
- Superconductor Materials
- In situ catalysis
- Single crystal diffraction of small samples
- Nano-particles and core-shell structures



### HEIMDAL Quick Facts.

HEIMDAL Quick Facts		
Instrument Class	Diffraction	
Moderator	Thermal (Bispectral and Colda)	
Primary Flightpath	157 m	
Secondary Flightpath	Diffraction: 0.8 m	
	(SANS: 10 m, Imaging: 4 m <sup>a</sup> )	
Wavelength Range	0.5–4 Å	
Bandwidth	1.7 Å	
Flux at Sample at 2 MW	$10^6 - 10^8 - 10^9 \text{ n s}^{-1} \text{ cm}^{-2}$	
	(High-resolution – Medium-res. – High-flux)	
Q-Range	$0.5-25 \text{ Å}^{-1}$	
d-spacing Resolution ∆d/d	Adjustable 0.04%–1%	
SANS and Imaging modes <sup>a</sup>		
Moderator	Cold	
Wavelength Range	3–20 Å	
Q-Range (SANS)	$10^{-3}$ –4 Å <sup>-1</sup>	
Wavelength Resolution	1.5% at $\lambda = 4$ Å	
$\Delta \lambda / \lambda$ (SANS)	0.6% at $\lambda = 11 \text{ Å}$	
Field of View (Imaging)	$50 \times 50 \text{ mm}^2$	
Spatial Resolution (Imaging)	50 μm	

### **Full Technical Scope**

- Bispectral Instrument
- Thermal + Cold Neutron Guides
- Optimised Diffraction & SANS
- 3D Neutron Imaging





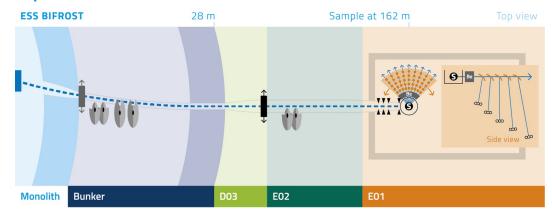


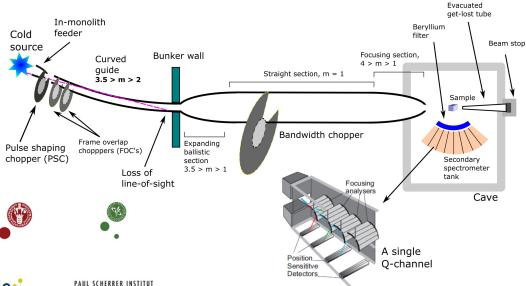
# BIFROST

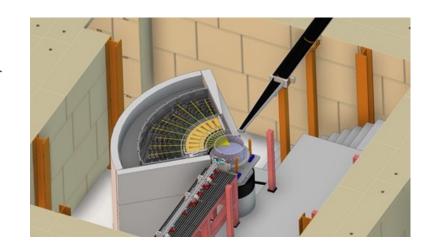
An innovative indirect time-of-flight spectrometer with multi-energy analysis

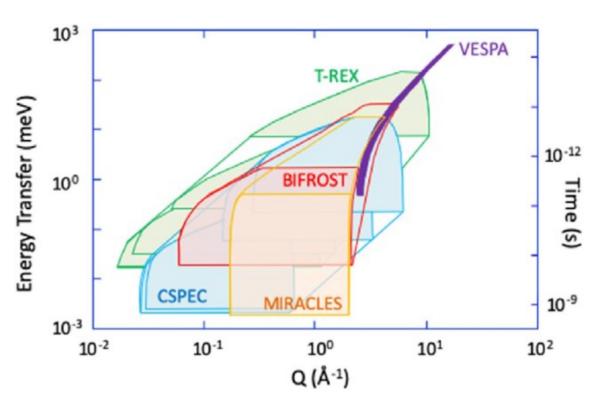
### Resolving complexity of unconventional modes

Small samples – extreme environments

















# MIRACLES

### **Backscattering Spectrometer**

Revealing dynamic processes over a wide energy range, it will serve life science, polymer science, energy materials, magnetism studies and much more.

### Life sciences, molecular dynamics and water dynamics

- •Degenerative diseases: Alzheimer, Parkinson, Cancer
- Protein dynamics and enzyme catalysis
- •Pharmaceutical studies: drug implementation/delivery

### **Energy sciences:**

- •Fuel cells and H2 storage (hydrides)
- Proton diffusion in MOFs
- Catalysis

### **Polymer sciences:**

- Viscoelasticity
- •Morphology-performance connections in e.g. organic electronic devices

### **Climate change:**

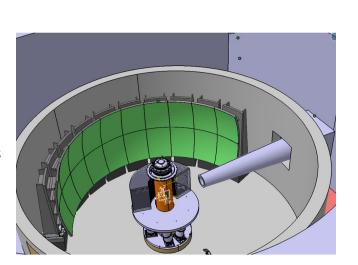
- •Ice formation
- Portland-alternative cements (water dynamics)

### **Next-generation magnetic materials:**

- Molecular nanomagnets
- •Spin dynamics in novel magnetic materials (spin ice, large SOC)



E02

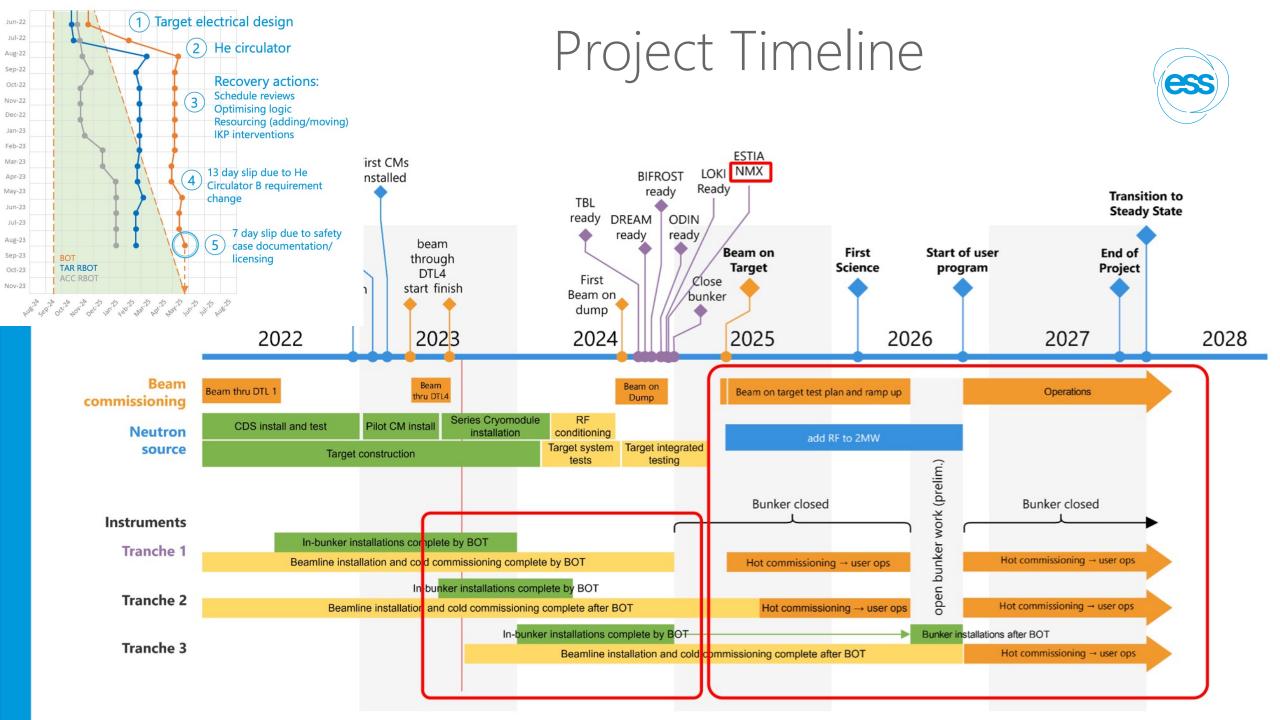


Monolith Bunker









# Instrument overview

**Short Bunker** openings In 2026

FS

Bunker needs to be ready for ESS BOT

NSS R-BOT has 3-4 months float to ESS BOT (end April 2025)

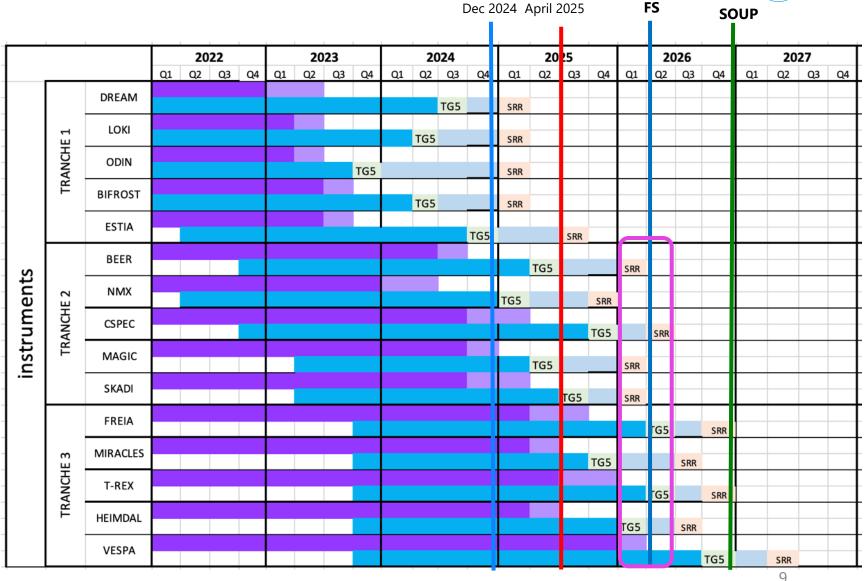
NSS "end of project" defined as TG5 for instrument 15

TG5 milestone (IK partner) is followed by Instrument SRR (NSS responsibility), which triggers Hot Commissioning.

NSS is currently tracking to **4 instruments** passed Safety Readiness Review (SRR) at the point of **BOT.** 

The forward-looking schedule is ambitious!





**NSS RBOT BOT** 

# Recent achievements



Key activities supported by the whole of ESS





# CDS Cooldown + CM Series Installation

5 SPK + 1 ELL CMs now in the tunnel







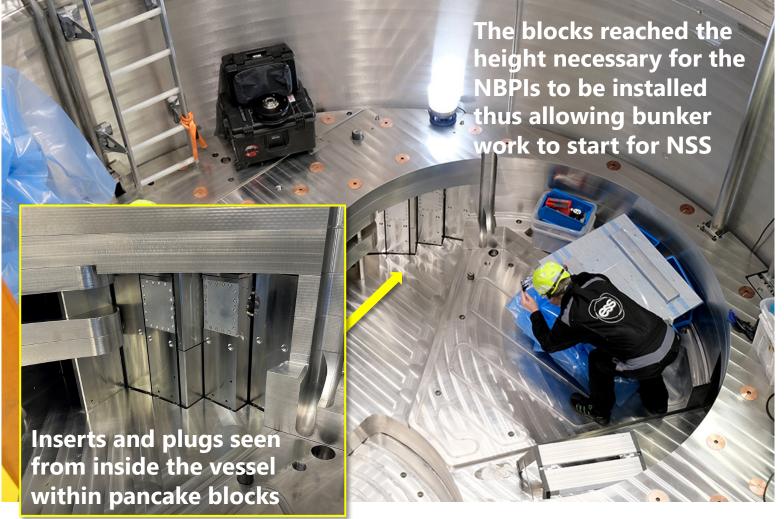


# Recent achievements

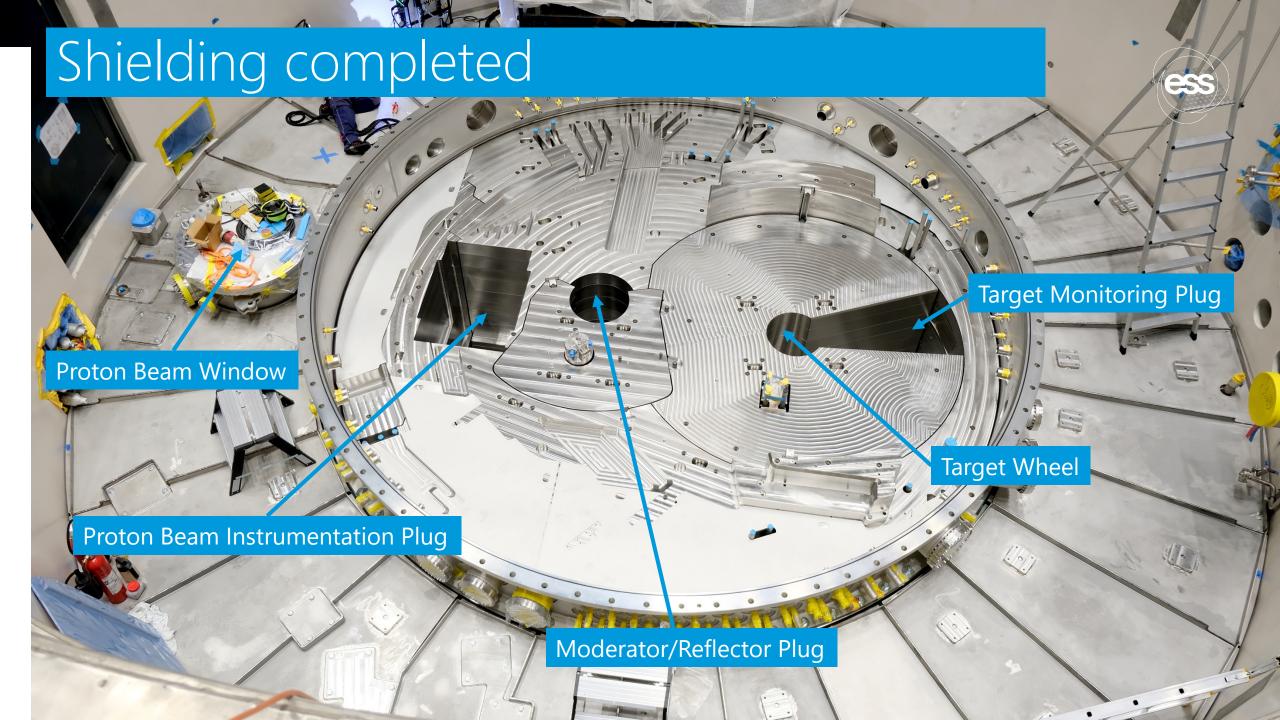
### Key activities and progress







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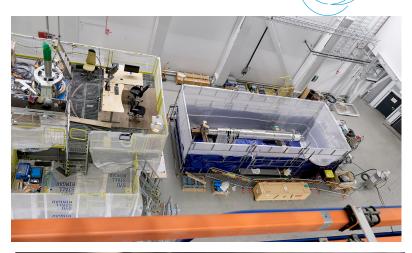


# Recent achievements

Key activities and progress









Moderator installation in the MUTS and subsequent cleaning of the external and internal surfaces.

Now it is inside a temporary cleanroom next to the MUTS, pending further cleaning/quality improvements.













# Some news from the directorate...

# Implementing changes to get ready for delivering neutron science:

- structure of directorate
- benchmarking instruments
- plans for user involvement

# Scientific Coordination and User Office



### Ensuring administrative support for science division activities

ESS successfully hosted a booth with the ILL at ECNS 2023







A collaboration between ESS and our neighbouring universities have won the bid to host ICNS 2025 in Copenhagen and Lund

SCUO are working with IT to implement an e-library to provide journal access for ESS scientists

A recently hired librarian will drive this work

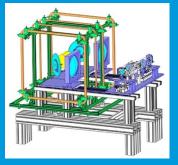


User access policy to be validated at next Council

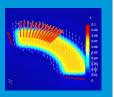




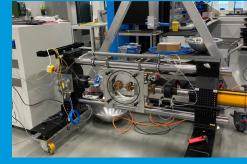








# Sample environment & support laboratories





# Materials and Physics Support

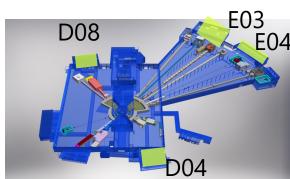
### The MPS scope:

- Provide sample environment systems and users support for low and high temperatures, magnetic and electrical fields, high-pressure and mechanical constraints, **polarisation**.
- Provide SES control integration of complex systems and mechanical integration

# Chemistry and Life Science Support

### The CLS scope:

- Support laboratories (Installation/Spallation Chemistry)
- Sample environment for chemistry and soft matter
- Deuteration service
- Interaction Science



# Science Directorate

### Testing & commissioning of equipment



SPOTLIGHT ON:

### "Plug and Play" Integration of Sample Environment Equipment Successfully Demonstrated

Created by Ulrika Hammarlund, last modified on Sep 08, 2023



Above: Team members from ICS, NSS and IT (Remy Mudingay, Jim Larsson, Johan Christensson, Nicklas Holmberg, Jonas Petersson, Tobias Richter, Anders Pettersson, Matt Carke) celebrating successful completion of the Plug and Play demo for Sample Environment equipment, using the YMIR testbed. Not in picture: Stephane Armamet and Alessio Curri, Controls Infrastructure.

Image: Ulrika Hammarlund/ESS

Through collaboration across teams, the Plug and Play functionality of ESS sample environment equipment was demonstrated for the first time. This system, provided by the Integrated Control System (ICS) division, will enable the streamlining neutron experiment setups, enhancing the efficiency of ESS' shared pool of sample environment devices.

SPOTLIGHT ON:

### Successful 15 Tesla magnet testing

Created by Joanna Lewis, last modified on Aug 18, 2023

The Materials and Physics Support team has been using the new helium recovery system to test their 15 T superconducting magnet.

This week the Materials and Physics Support team has been making the most of the newly functional helium recovery system to test their 15 T superconducting magnet.

A The magnet, bought from HZB after their reactor shutdown, will enable users to impose a very high magnetic field onto their samples at a range of low and ultra-low temperatures, in particular on the BIFROST instrument.











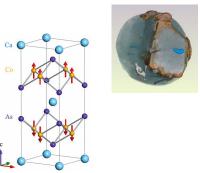


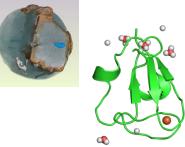
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# Data Management and Software Center

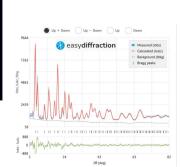


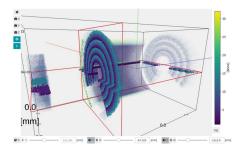
Support user from proposal to publication with scientific computing tools & services



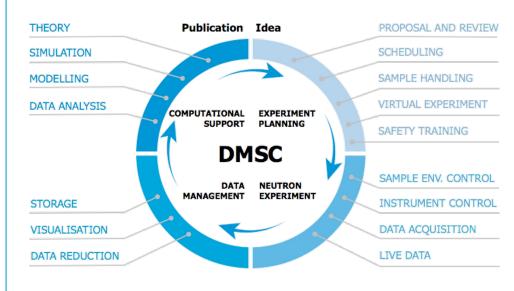


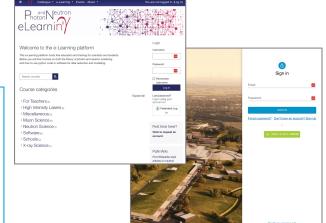


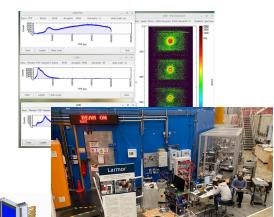














2023-10-05 PRESENTATION TITLE/FOOT

