EUROPEAN
SPALLATION
SOURCE

Update Science Directorate

Mission: Preparing for ESS scientific success

By overseeing the transition from a construction project to a user facility

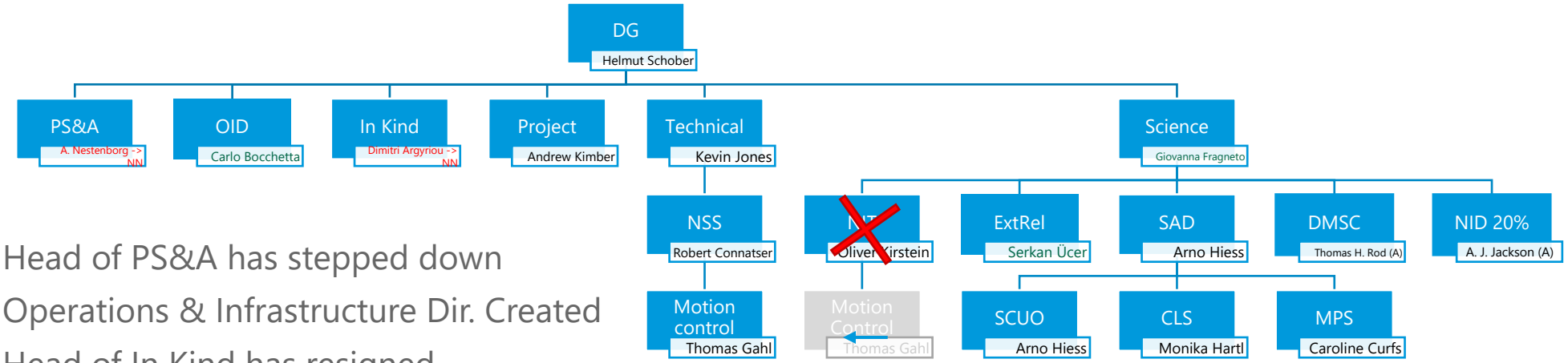
By making sure that scientific activities gain a central role in the ESS agenda

GIOVANNA FRAGNETO

2023-04-25

Organisational changes

Science strengthened with communication and external relations



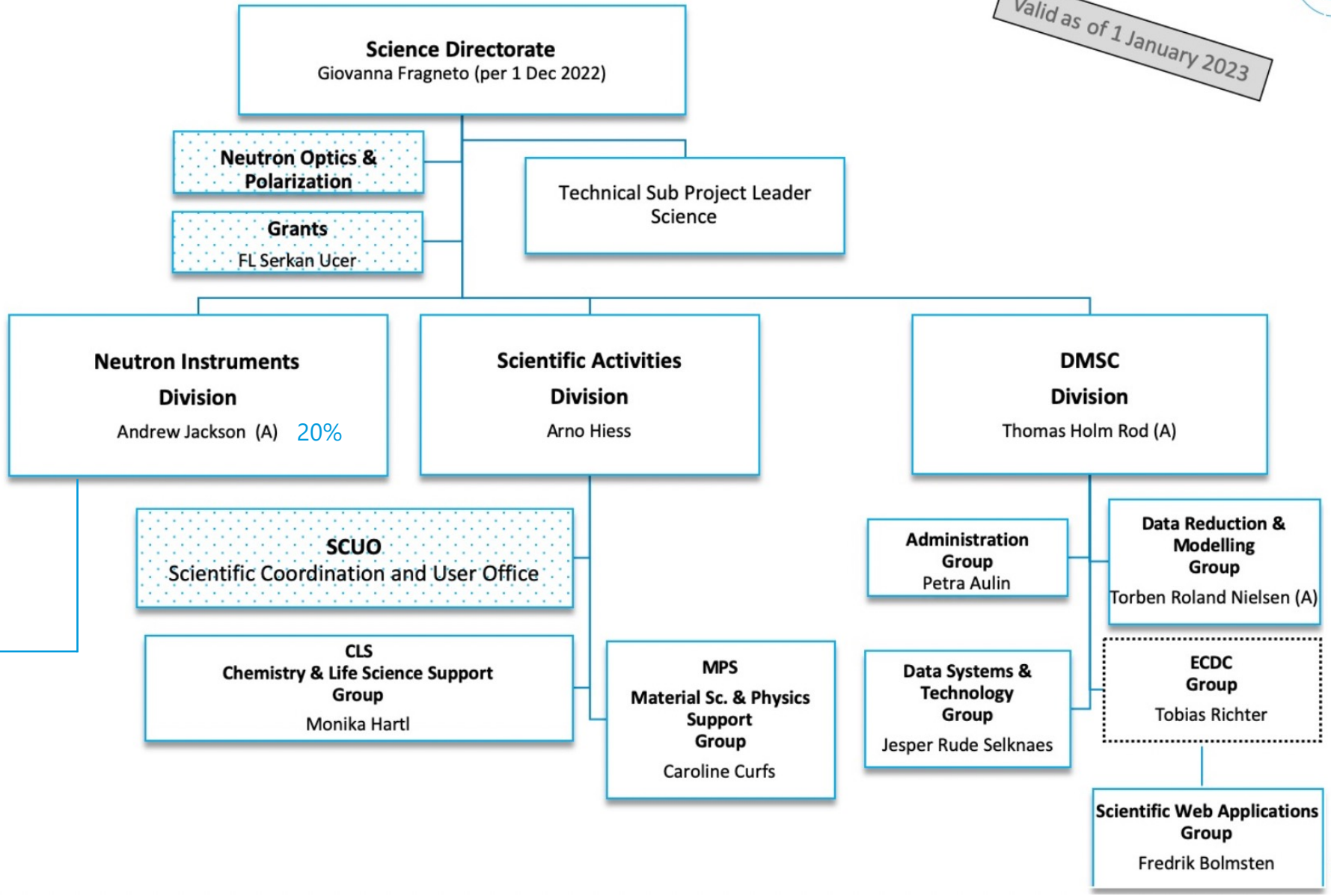
- Head of PS&A has stepped down
- Operations & Infrastructure Dir. Created
- Head of In Kind has resigned
- Motion Control moved from NIT to NSS
- External Relations now part of Science. New Head onboarded
- *Sample Handling & User Labs* and *Sample Environment* reorganized into *Chemistry & Life-science Support* and *Material & Physics Support*

- OK appointed sub-project leader for Science matrixed between Science & Project
- TK moved from Detector Group to DRAM
- PB moved from NIT to DMSC
- JL moved from Communication to SCUO
- DMSC new location under discussion (controversial)

Science Directorate

Dotted box = task based groups
FL = Functional Leader

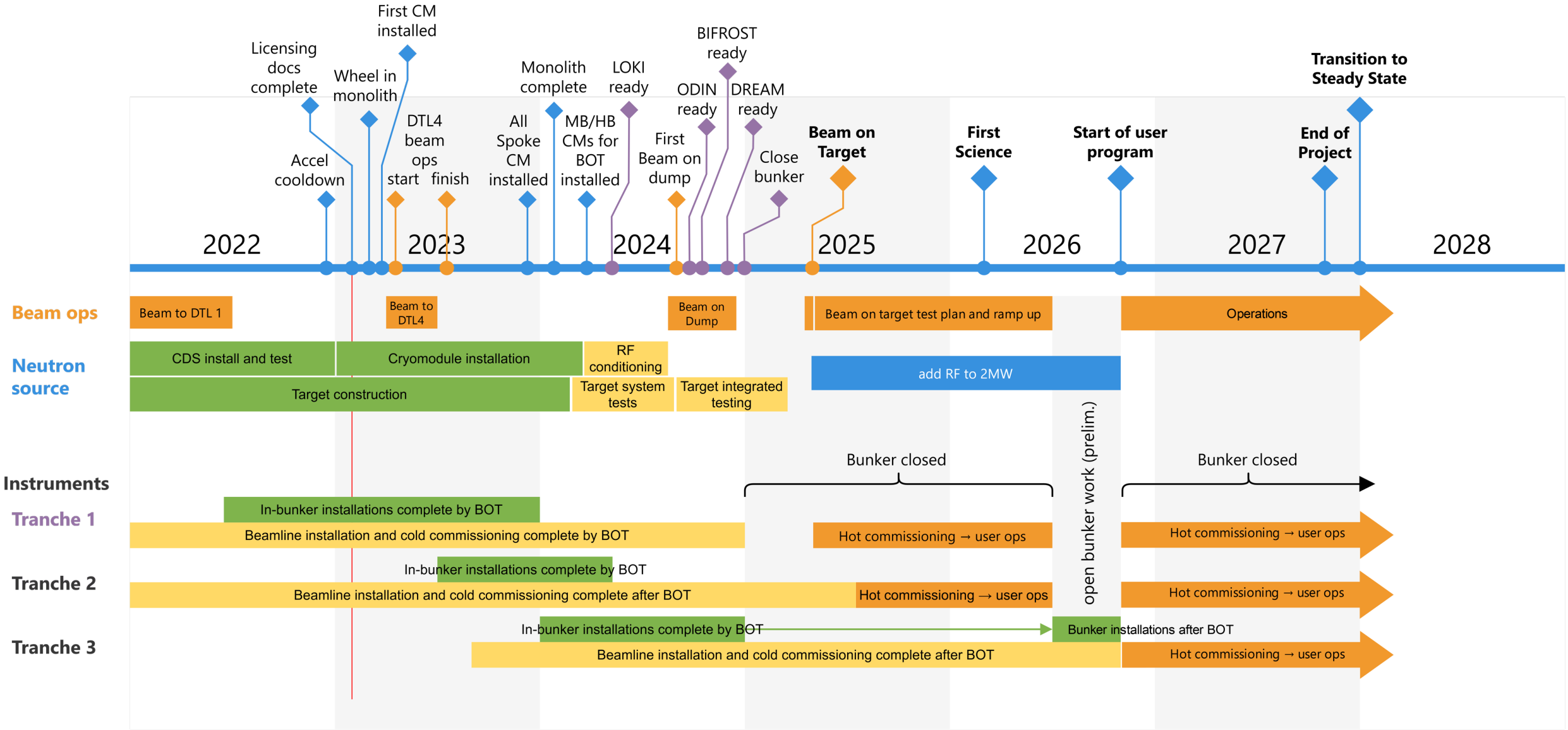
Valid as of 1 January 2023

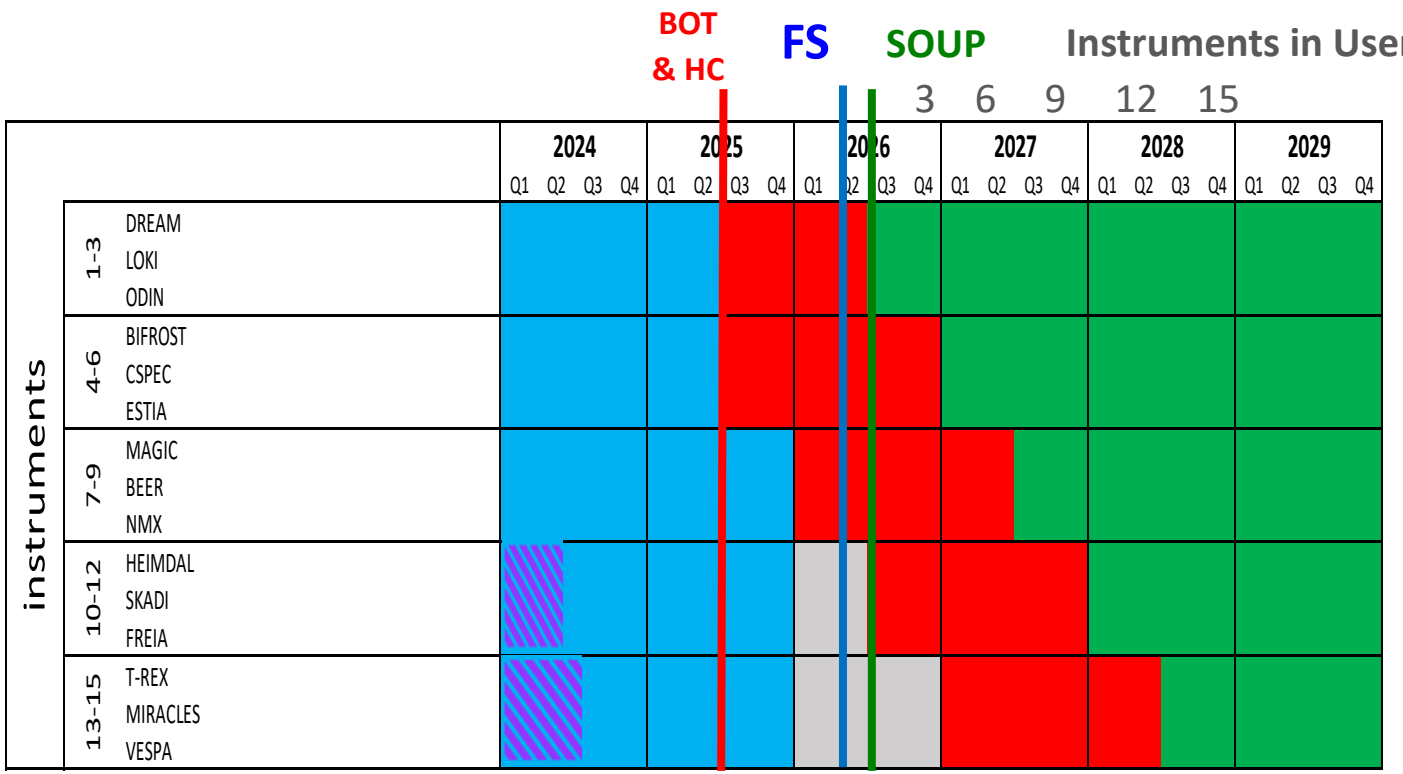


Technical Directorate

Dan Mannix - HEIMDAL
Daria Noferini - CSPEC
Esko Oksanen - NMX
Judith Houston - LOKI
Manuel Morgano - ODIN
Mikhail Fegenson - DREAM
Pascale Deen – Spectro/CSPEC
Premek Beran - BEER
Rasmus Toft Petersen - BIFROST
Robin Woracek - Test Beamline & Eng.
Thomas Arnold – LSS/FREIA
Werner Schweika – Diff/
Thawatchart Culapakorn - Post Doc

European Spallation Source: Roadmap to Science





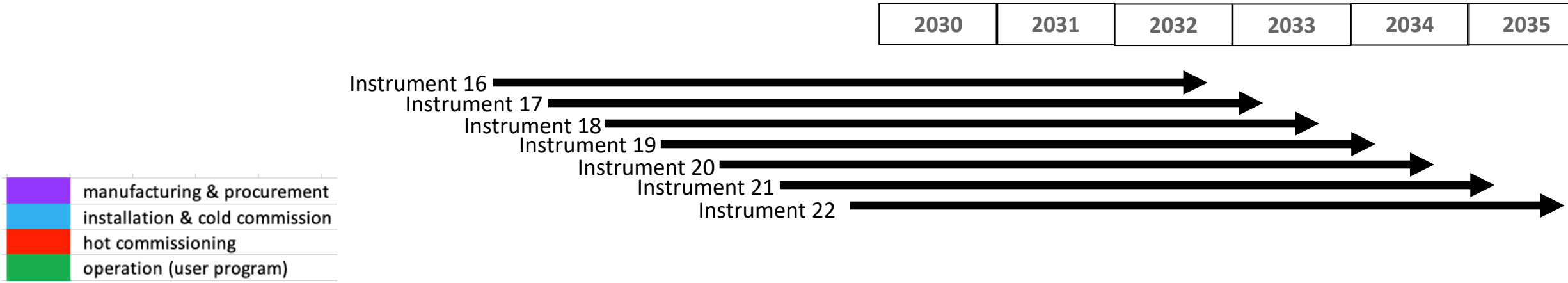
Adding 2 instruments per year
22 instrument suite completed in 2034/2035
Call in 2024 at the latest

Possible financially limited Scenario

Main variables:

- Start: 2028 (steady state ops) Earlier: Initial ops

- Build out rate

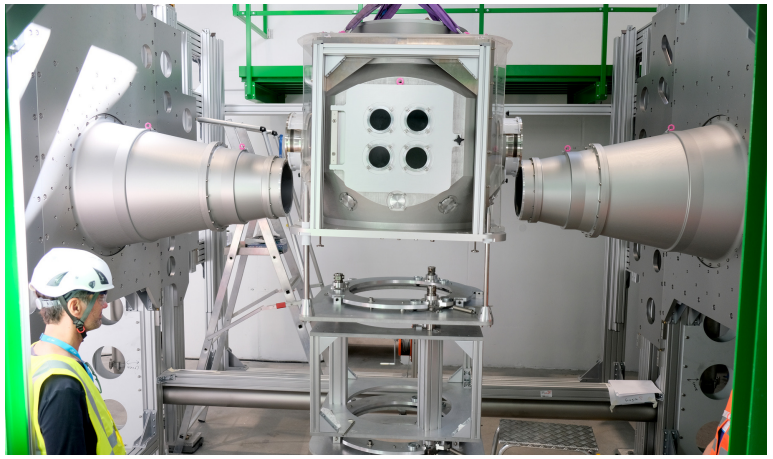


Courtesy O. Kirstein

Instruments

LoKI (SANS) experimental cave

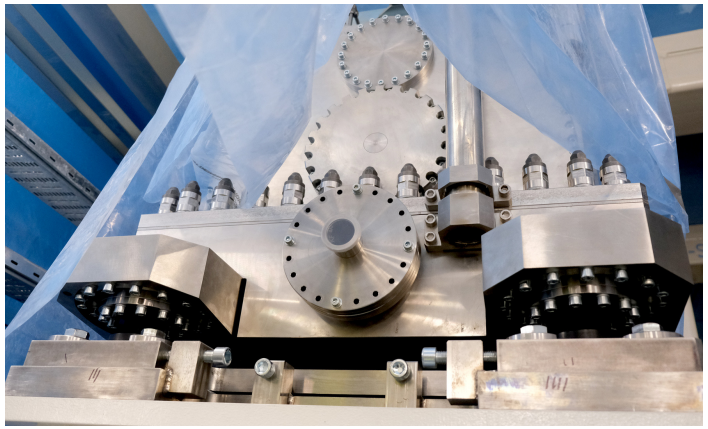
LoKI crane and TBL cave



DREAM Sample Vessel

ODIN (Imaging) experimental cave

ODIN in-bunker installations



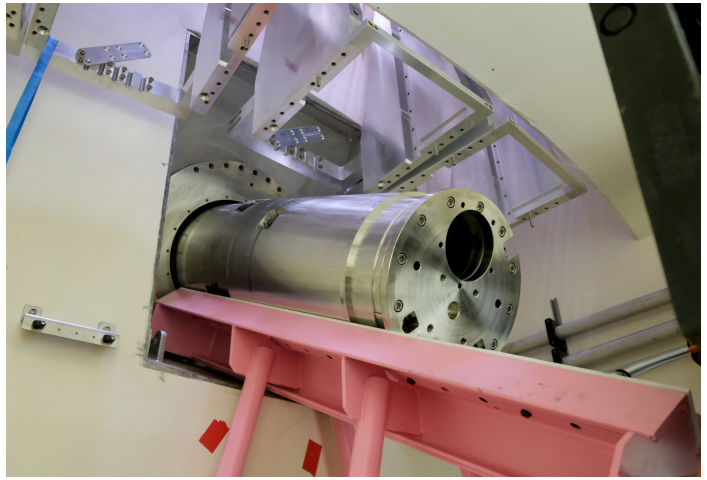
DREAM T0 Chopper

Instruments

BEER guide

BIFROST guide

BIFROST detector vessel



EHCIR (CHIPIR-like future instrument) revolver in Target Basement

NMX guide

NMX cave

Sample environment and 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.
- Provide SES control integration of complex systems and mechanical integration

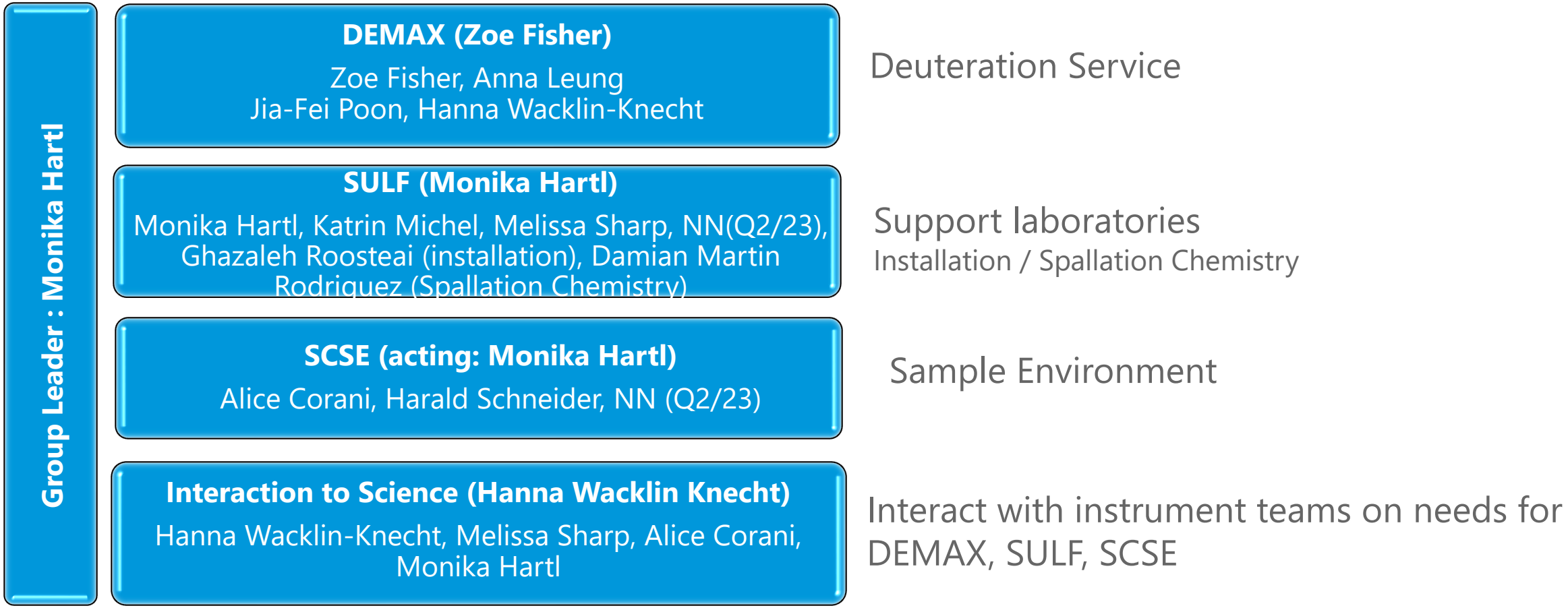
Chemistry and Life Science Support

The CLS scope:

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

Chemistry and Life Science Support - CLS

Structure of CLS with functional leads



ESS project support

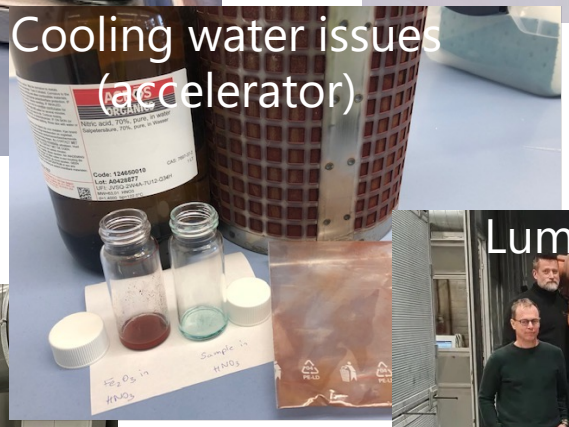
…frequently turns into science

O/p-H2 research for moderator (collab. ESS/JPARC/SNS)

BrightnESS – development reflector materials

Shielding material analysis

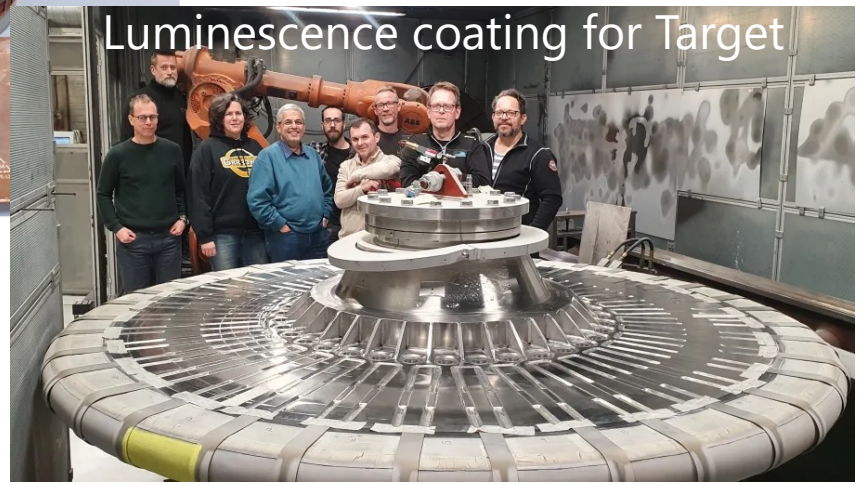
Waste water analysis



Cooling water issues (accelerator)

Radiation Hardness of Grease (LoQ, ISIS)

"goo" on the CW blocks



Luminescence coating for Target

Materials and Physics Support - MPS

The people of MPS and their scope

Group Leader : Caroline Curfs

Project leads for sample environment systems (SES)

A. Holmes (Low temp. and magnets)

C. Curfs (High temp., high pressure and mechanical processing)

- Define, design and procure SES
- Manage projects within time and budgets
- Test SES and lead the integration

Control electronics and control integration

N. Ekström & A. Hagelberg

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

Mechanical integration and technical support

R. Ammer & L. Saxtrup

- Provide mechanical alignment and integration of SES
- Mechanical workshop
- Technical work

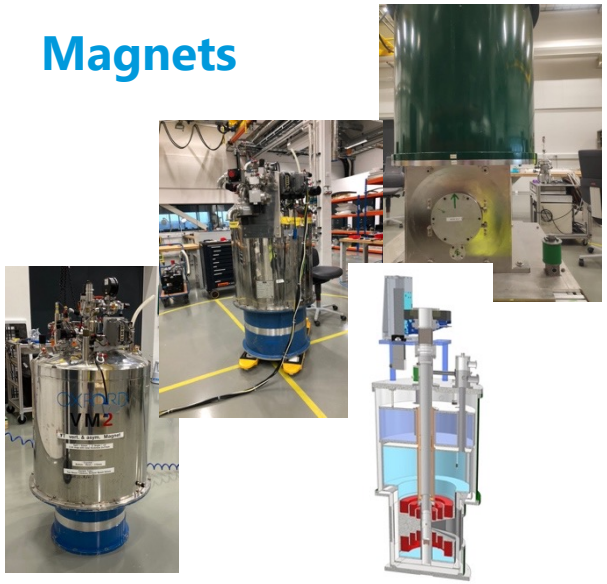
Polarization

W. T. Lee & J. Hagman

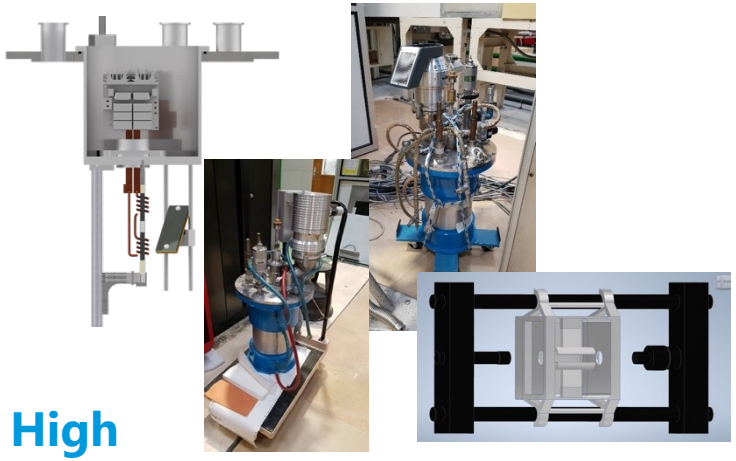
- Design, develop and provide hardware for polarization
- Provide software for control of hardware
- Scientific support

Sample environment systems

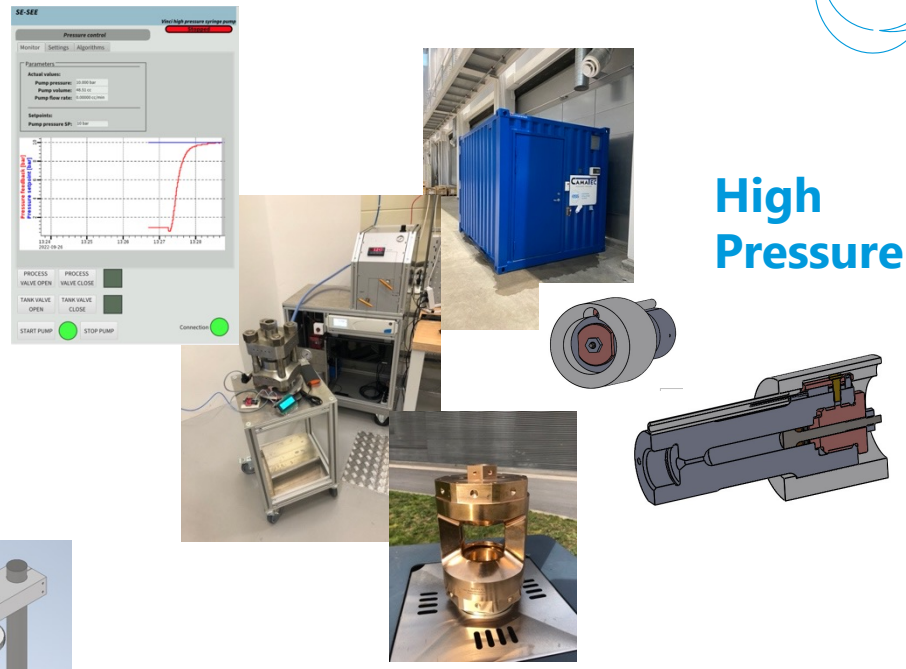
Magnets



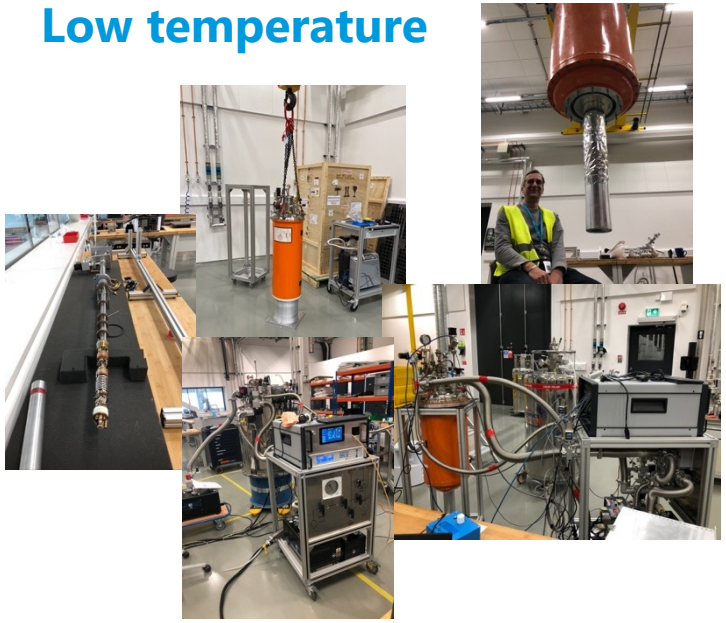
High temperature



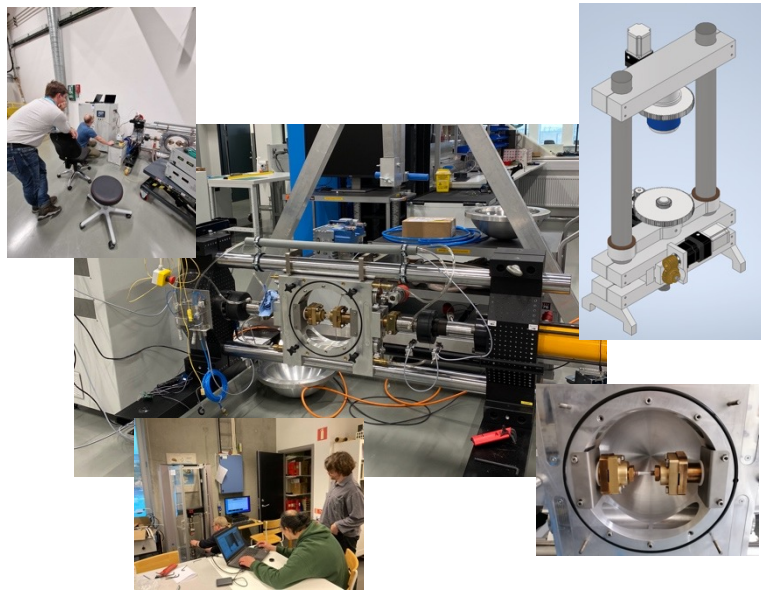
High Pressure



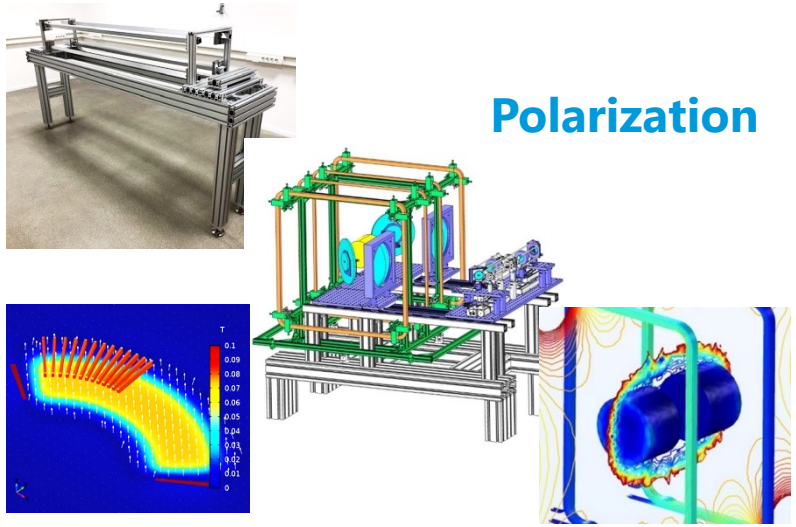
Low temperature



Mechanical processing

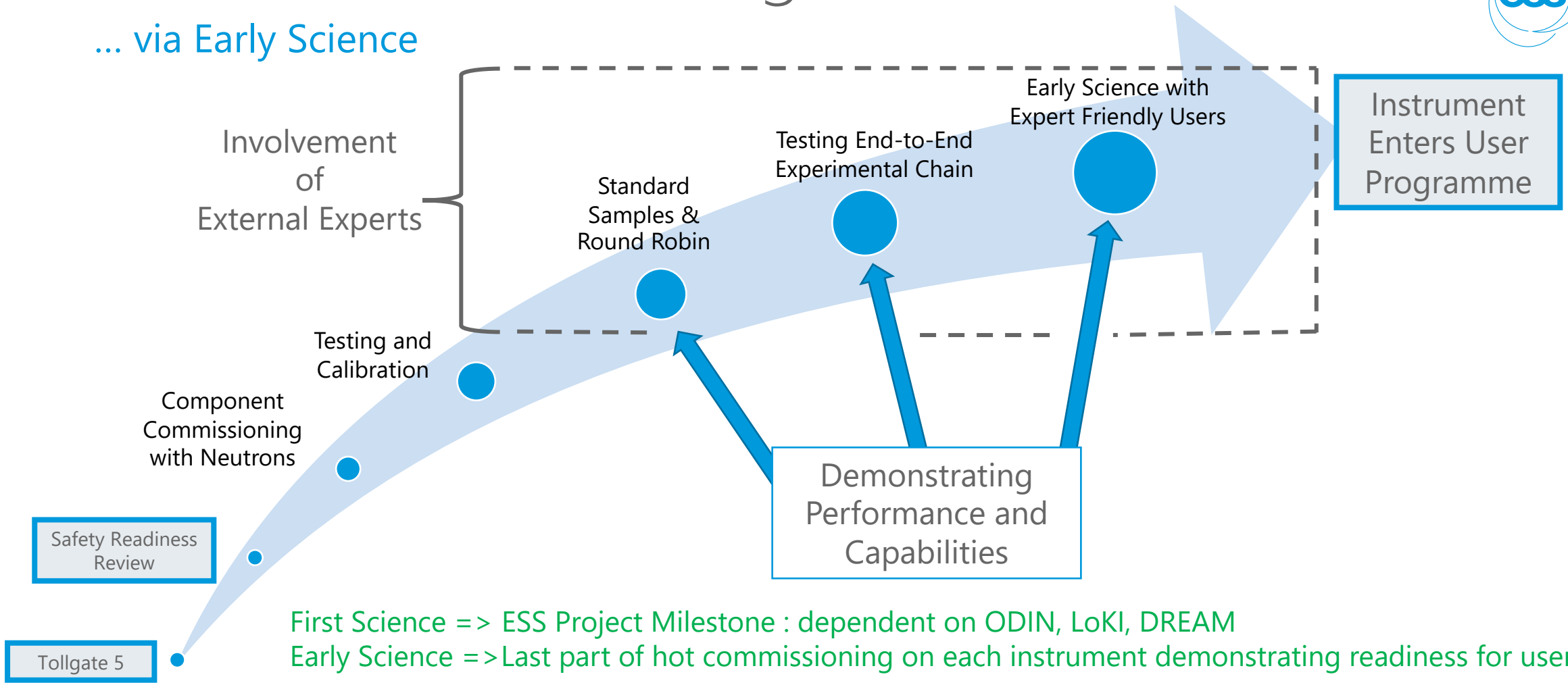


Polarization



Towards the User Programme …

… via Early Science



Adapted from A. J. Jackson

Mission: getting ready for first (and user) science

What do we need

- Instruments ready and properly staffed
- Select experimental projects not overly ambitious but in impactful areas for good publicity of facility potential
- Relevant fully functional sample environment, support facilities, software
- Standard samples/methods to check instrument capabilities
- Engaged friendly users with interesting scientific projects for early science
- Engaged users to carry out new science
- Getting ready for *round the clock* work

How do we proceed

- Commissioning plan for instruments (NSS)
- Hire scientists based at ESS, priority for instruments ready for BOT
- Enhance attractivity of scientific environment and make it interesting for scientists to join
- Get SAC and STAPs involved in first science definition
- Organise brainstorming workshops (2023-2024) with user community
- Revisit TDR (Technical Design Report 2013) chapter on science
- Start planning student and post-doc schemes

The motivation and interest of the facility's scientists/engineers/technicians is of paramount importance for successful user science:

the base of our scientific success will include attracting good scientists, keeping them here, nurturing their curiosity, maintaining high their motivation

Short term:
Enhance scientific environment to attract experienced scientists

- Organisation of internal seminars and scientists' meetings – science days

- Maximimise impact of co-location: common activities with local research facilities and university (ESS/MAX-IV Colloquia; LINX seminars; Lund university common seminars; …)

- Enhance interactions with Swedish, Danish and other European laboratories and companies

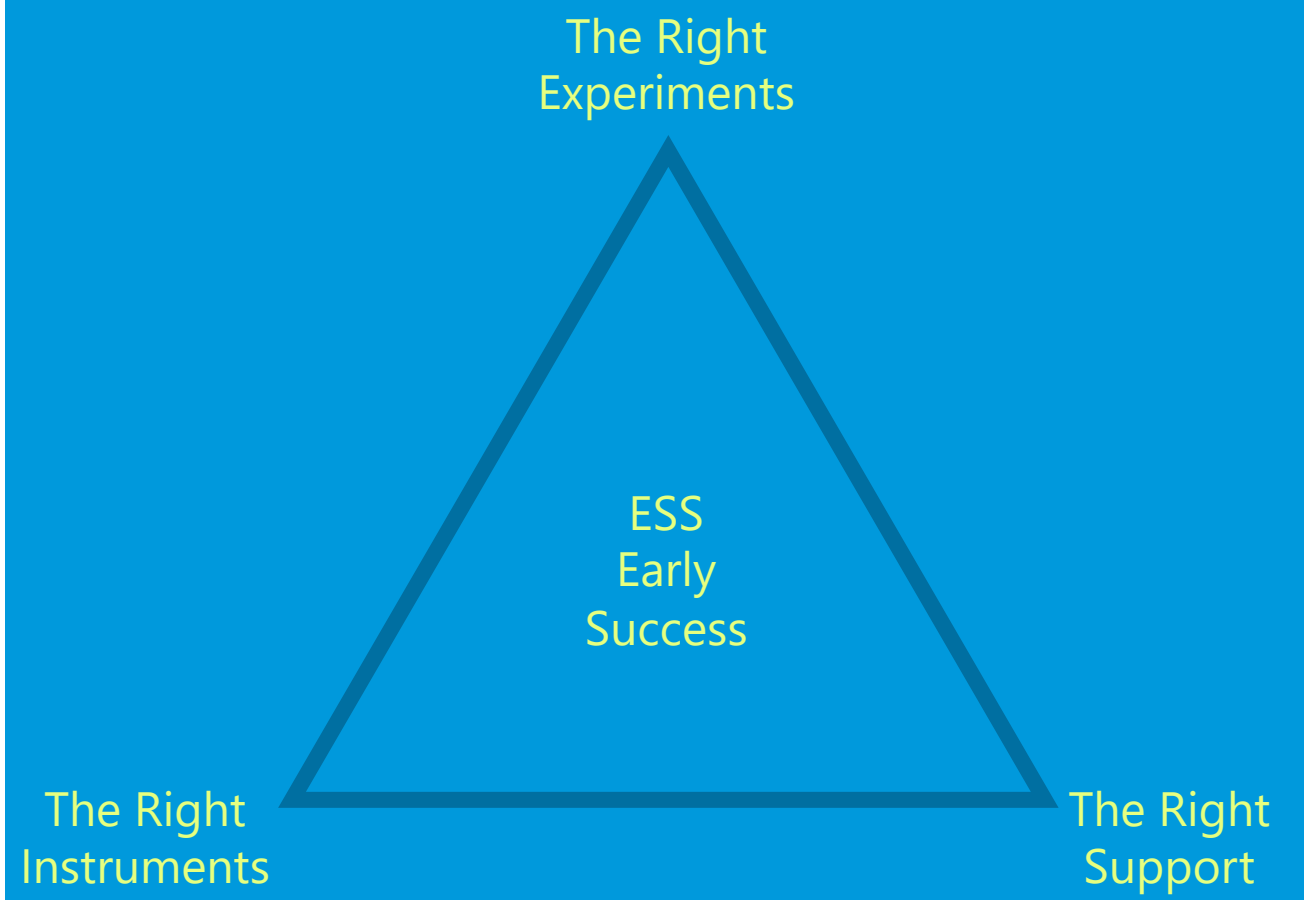
- Reorganisation of support laboratories and sample environment groups – science oriented – grant applications for students/post-docs to work in the labs

- Encourage scientists to maintain scientific activities and visits to other facilities/start new collaborations

- Have a realistic communication on performances at early stages both internally and with user community

- Work scientific outreach, science web pages, internal communication

Plans for First Science



Purpose of ESS scientists' Meetings

Instruments 20th January

Software/sample environment and labs 6th march

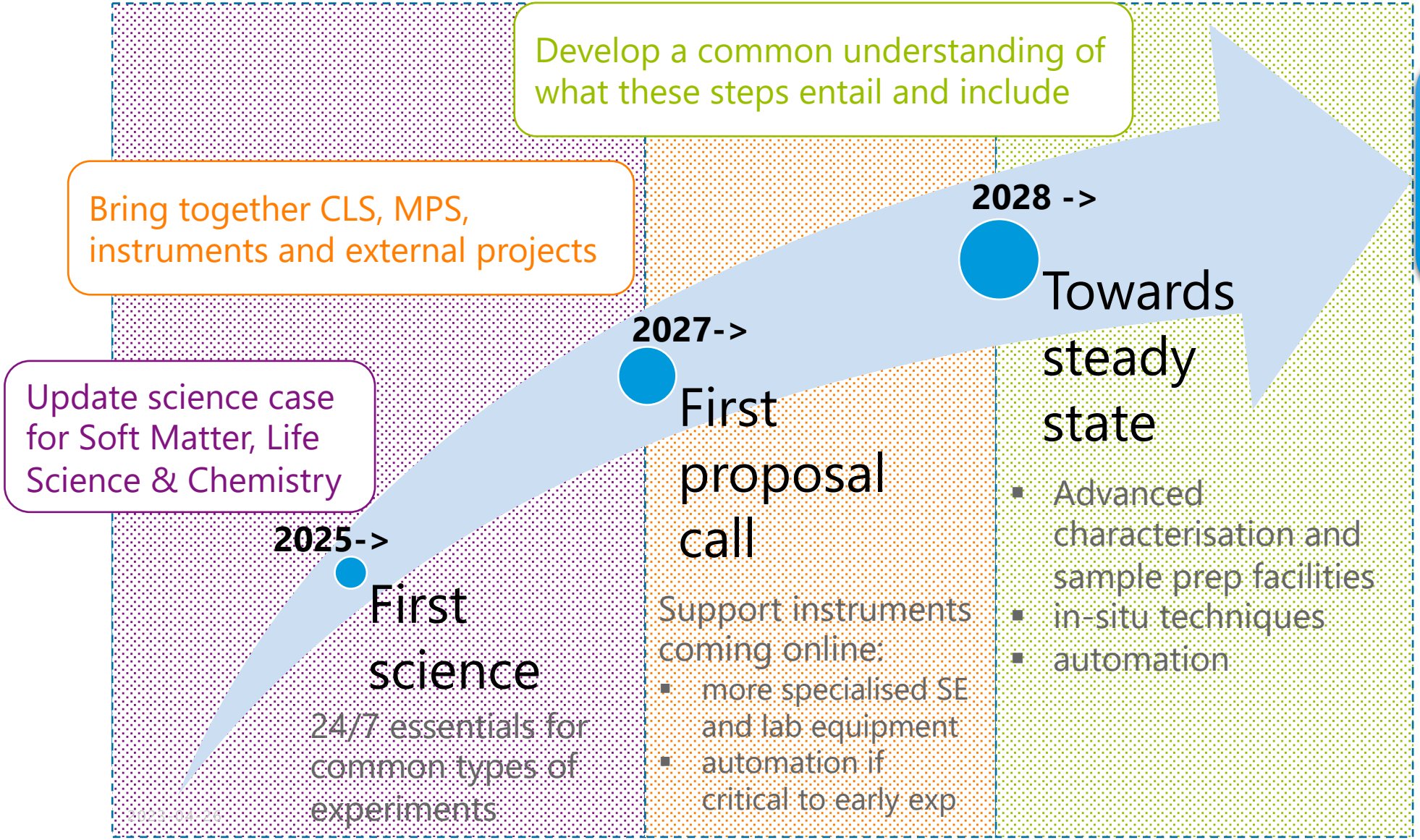
- Kick-off discussions of First Science
- Neutron Science focussed – we need to deliver neutron experiments
- Develop common knowledge of science cases
- Identify needs – SE, labs, software, collaborations – to deliver success

Notes from discussion at instruments' meeting:

- Several of the ideas for first science are already possible at current facilities
- Strong involvement of in-kind scientists existing and desirable
- Important to check capabilities with well studied samples
- Collect broad science cases involving STAPS and organising workshops
- Timing is important, do not do it too early
- Early use of laboratories excellent way to train the users
- Overwhelming need of data reduction and analysis optimisation
- Need to pre-commission sample environment
- Need to be complementary to steady state sources
- Need to revisit ESS scientific case (TDR)

The way to First Science and steady state ops

Strategy for supporting soft matter, life science and chemistry



Support for:
World leading science
Partnerships
Science Village
Industry

Courtesy M. Härtl

Instruments 16-22

Process to be started

GAP analysis to be revisited following update of instrument benchmarking

2018 CAPABILITY GAP ANALYSIS

The identified two most important missing capabilities in the current instrument suite are:

- **Particle Physics**
- **High-Resolution Neutron Spin-Echo**

An analysis of the remaining capability gaps resulted in the following highlight areas:

- High-Pressure Diffraction
- Grazing-Incidence SANS
- Very Fast Spectroscopy
- Wide Bandwidth Spectroscopy
- High Magnetic Fields

where the first four are new instruments, specialised in areas not adequately covered by the current 15 instruments, and the fifth capability need is for sample environment equipment.

Activities are going on in Sweden for NPP and GISANS instrumentation

Provision of a beam port for HIBEAM under consideration

Current goals:

Optimise directorate to have an efficient tool to carry out the work

Enhance scientific environment and put science at the center of ESS agenda: revisit scientific case

Enhance interactions of instrument teams with support infrastructure (sample & software) – move scientists into SD

Get ready for scientific exploitation of facility (user welcome, involvement of in-kind partners, support laboratories usage, sample environment developments)

Your input is essential to help us facing the challenges ahead

12th September – satellite of ICB meeting to discuss in-kind partners contribution to first science

EUROPEAN SPALLATION SOURCE

ACTIONS IN 2023

- Enhance scientific environment at ESS (seminars, common activities with LU and Max-IV, increase contacts among scientists in different divisions, …)
- Set-up an Internal Science Advisory board and revisit TDR chapter on science case
- Organise move and update scope of DMSC
- Organise move of Instrument Scientists group within the Neutron Instrument division in the Science Directorate – reorganise directorate
- Organise brainstorming workshops to define early science, involve STAPs, SACs, in-kind partners, scientists from facilities and academia
  - By the end of the year start call for instrument 16-22 (stepwise – keep capability to build two instruments per year) – update gap analysis
  - Consolidate HIBEAM
- Strengthen interactions with ILL (collaborative agreements in progress for technical and scientific exchange), maintain strong interactions with other facilities (ISIS, PSI, SNS, …)
- Rules for user access

...and beyond

- Have a honest communication with user community with realistic expectations for performances (at the start and for some time ESS will not outperform ILL or ISIS, this should not be underestimated)

- Engage with user community (closure of LLB and HZB has demonstrated that users do not automatically transfer to other facilities)

- Promote ESS science at conferences and user meeting (involved in organisation of **ICNS2025**)

- Strategically targeted post-doc and PhD positions (contribute to grant applications)

- Identify "friendly user" for experiments during commissioning and shortly afterwards – build user interest

- Pro-activity towards potential member countries, participate to initiatives carried out by ILL & ISIS (Portugal, Israel, etc.)