Update NSS activities

Common STAP mtg
16 April, 2024

ROB CONNATSER - NSS SUBPROJECT LEADER

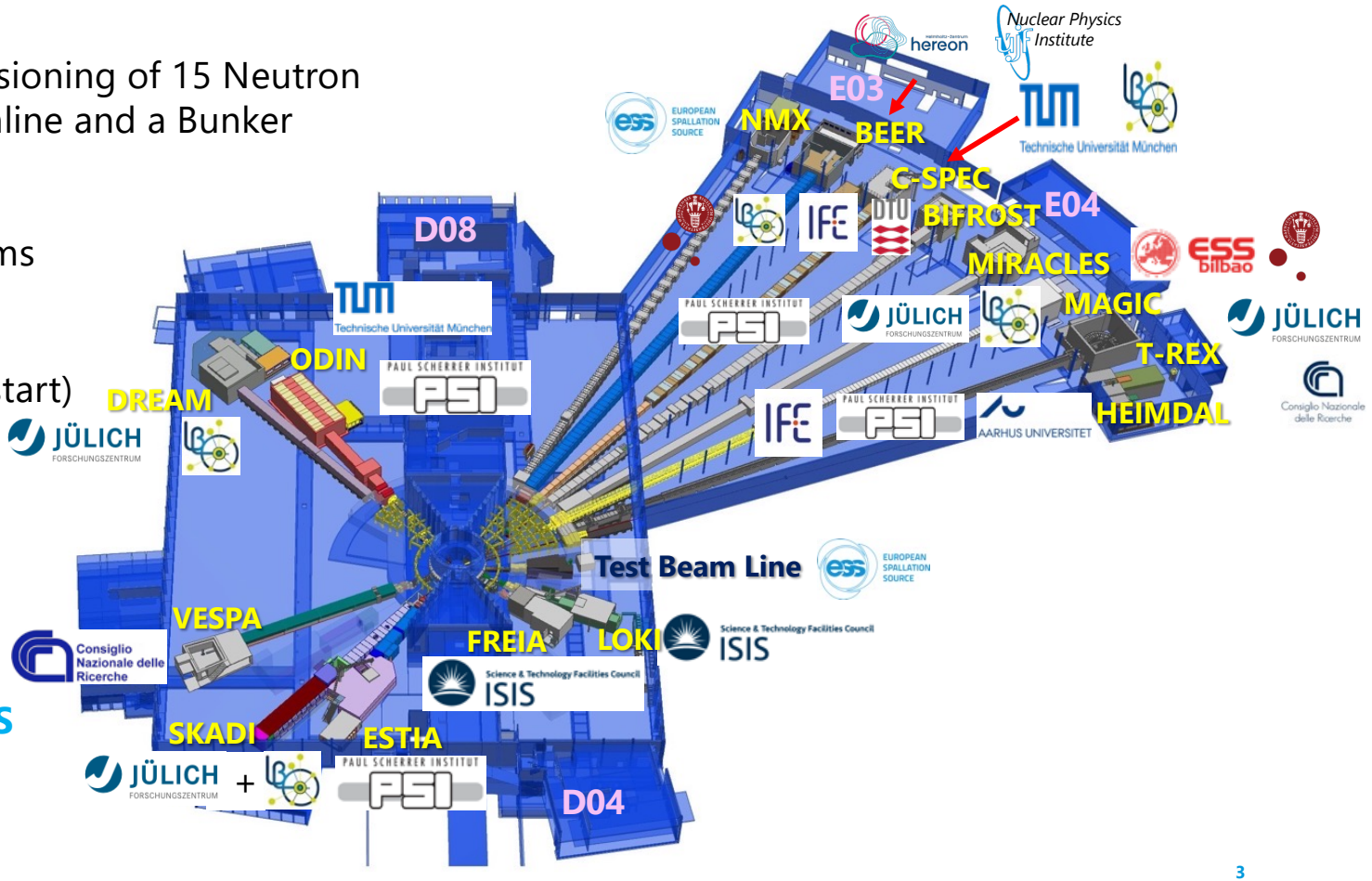
Agenda

1. Overview of NSS Project Scope and Tranche 1 instruments
2. Organizational Update
3. Project Progress Update

The Neutron Scattering Systems Project

Scope
Construction and cold commissioning of 15 Neutron Beam Instruments, a Test Beamline and a Bunker

Includes
- Experimental Control Systems
- Data Readout
- Data chain
- Polarization capacity (post start)
- Engineering Integration
- Installation Management

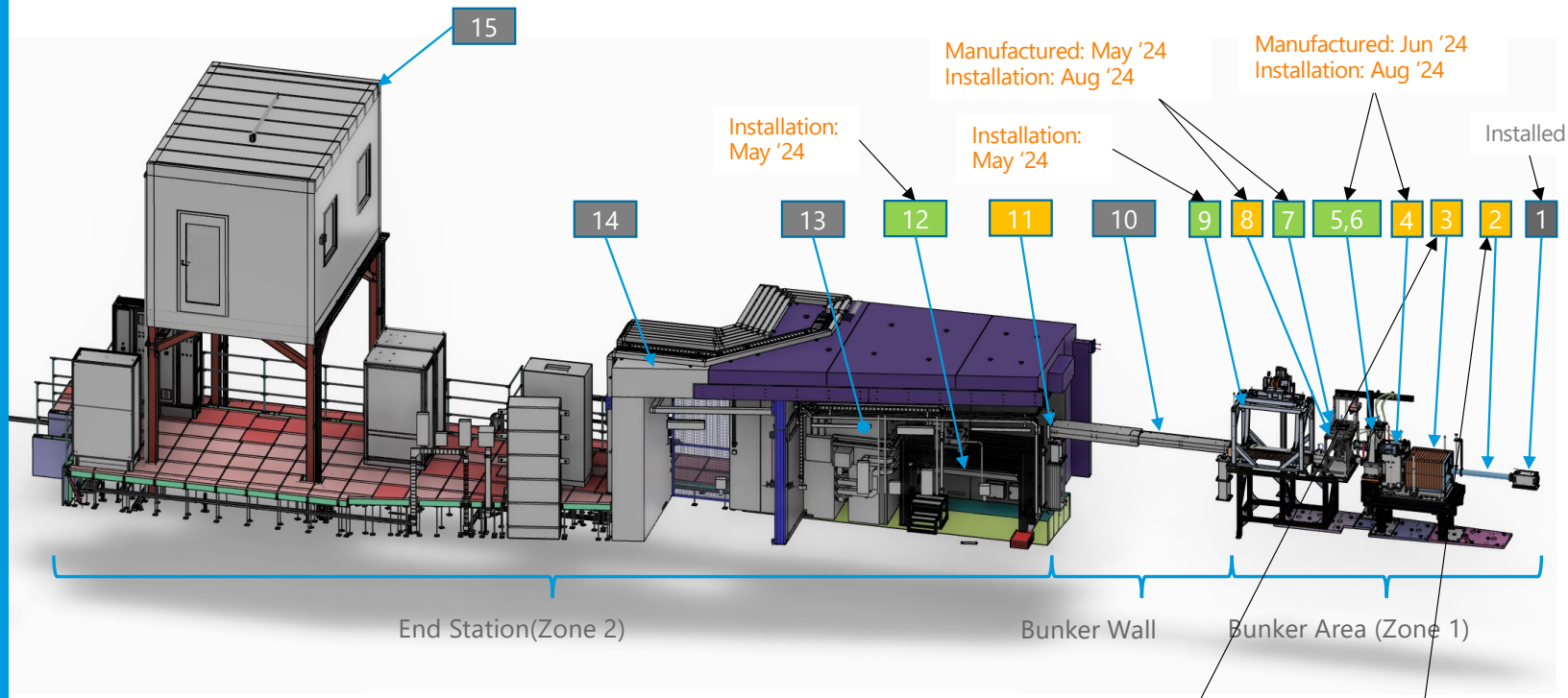


Instrument layout and ESS Partners for instrument construction

TBL

Start Int. CC:	Oct 2024
TG5/SAR mtg:	Jan 2025
iSRR mtg:	Mar 2025

Main concerns:
- Documentation for TG5/SAR
- ESS workshop delivery times
- Lack of work and testing areas

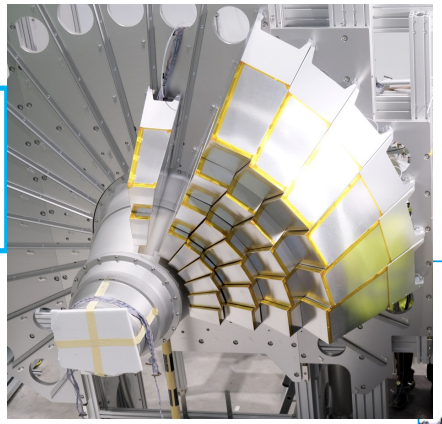


Ref.	Component
1	BBGOA (delivered)
2	Flight Tube 1
3	Fixed Collimator
4	adjustable Collimator
5,6	Chopper, Flight tube 2
7	Beam Monitor 1 (delivered)
8	Filter stage
9	Heavy Shutter (delivered)
10	Bunker Wall Feedthrough
11	Beam Monitor 2
12	Detector Table (delivered)
13	Beam Stop
14	Experimental Cave
15	Control Hutch

Slide updated mid April.

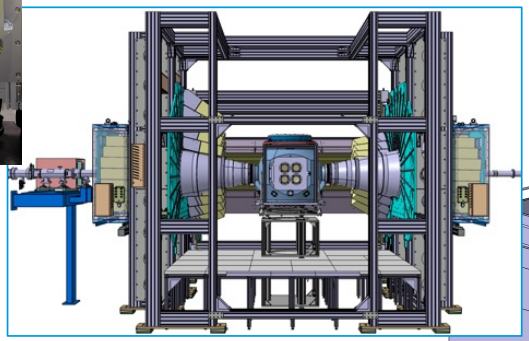
DREAM

Start Int. CC:	Oct 2024
TG5/SAR mtg:	Jan 2025
iSRR mtg:	Mar 2025



Detectors (FZJ)
- Endcap Installed
- HR: May 2024
- Mantle: June 2024

CEP: 95 % installed (rack termination)
CUP: 95 % installed
PSS: Q2 2024
Racks: Detector & monitor delivery Q2-24



Detector frame (FZJ)
- Installed

Experimental cave (LLB)
- Installed

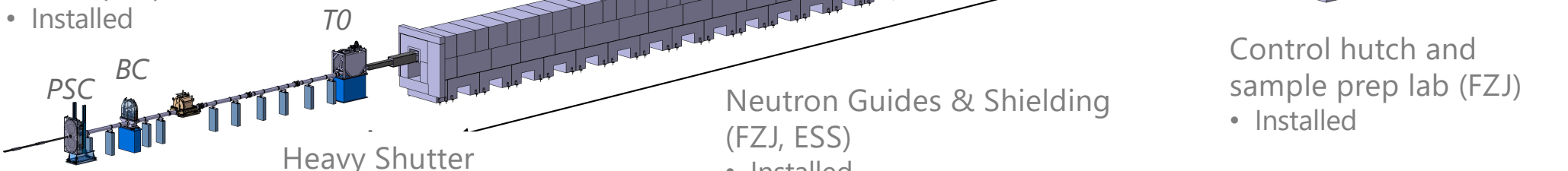
Disc choppers (FZJ)
(PSC & BC)
Installation: Q2 2024

T0 Chopper (ESS)
- Installed

Sample vessel (FZJ)
- Installed

Vessel support (LLB)
- Installed

NBOA (FZJ)
- Installed



Heavy Shutter
- Installed

Neutron Guides & Shielding (FZJ, ESS)
- Installed

Control hutch and sample prep lab (FZJ)
- Installed

Inside the bunker

In-bunker components re-installation is done

Main concerns: Documentation requirements for TG5/SAR

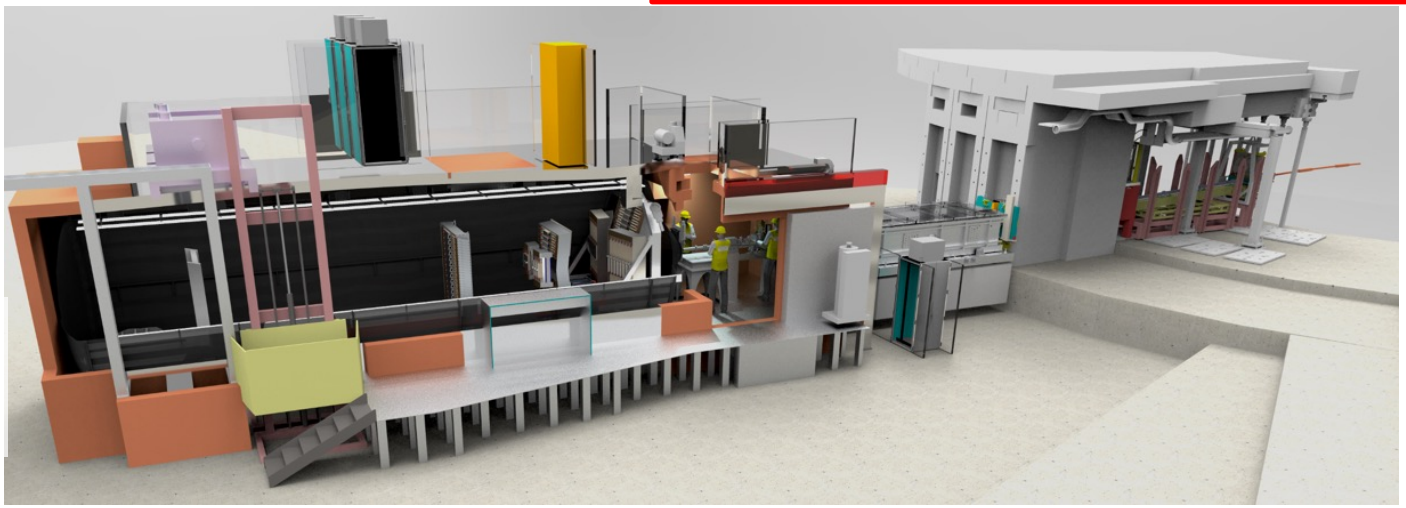
Slide updated mid April.

LoKI

Start Int. CC:	Oct 2024
TG5/SAR mtg:	Jan 2025
iSRR mtg:	April 2025

Main concern:

- More waiting times in having access to support teams like Survey and Riggings, as well Technicians, because of the high demand
- Simultaneous activities around the instrument, more complexity on planning and coordination of resources;
- MCA/ICS/ECDC commissioning timeline not fully understood



Hutch
- Installed

Detector vessel
- Installed

Detectors & Cabling
- Ongoing Installation
- Cabling to complete June 2024

Beamstop mechanism
- Undergoing testing and installed mid April

Jaw sets
- Awaiting installation: April 2024

Collimator vessel
- Installed June 2023

Collimator selector
- Installation of selector tables complete, now continuing with guide and shielding components

Door & Hatch
- Undergoing installation: to complete beginning May

Fast shutter, Pre-sample Snout, Sample stage
- Awaiting installation: June 2024

Neutron Guides
- In-bunker sections installed
- Out of bunker sections installed (12th April)

Cave shielding
- Installed

In-bunker Heavy Shutter, Guides & Disc Chopper #1
- *Awaiting bunker crane to put in position*

NBOA & BWI
installed

BBGOA
installed

Disc chopper #2
- Installed

Electrical:
- Awaiting energisation of the CEP rack to start partial energisation.

Utilities:
- 90% installed

Network:
- Started installation

PSS:
- Started installation

Slide updated mid April.

ODIN

Start Int. CC:	Oct 2024
TG5/SAR mtg:	Jan 2025
iSRR mtg:	Apr 2025

Main concerns:
- Loss of staff
- Cave completion
- Documentation and instrument control in view of TG5

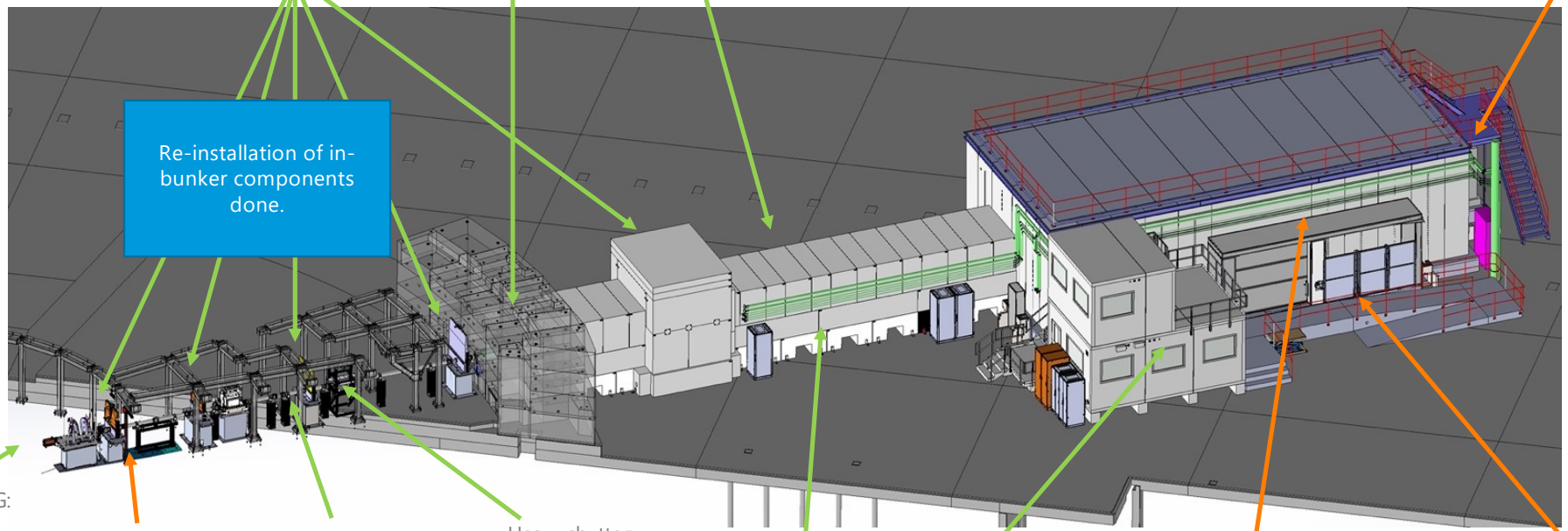
Other components/activities:
- T0 chopper (ESS): in design (not critical for operation, mitigation already in place)
- CUP (ESS): Installation ongoing
- CEP (ESS): installation ongoing
- MCA (ESS): manufacturing ongoing. Machine safety considerations starting
- PSS (ESS): in design

Choppers:
Bottom housings: installed Jun ´22
Disks delivery in progress (FAT done)

Bunker wall feedthrough: Installed

Common shielding: Partly installed

Cave roof, beamstop and stairs: Manufacturing contract under discussion



Cave walls: Installed August

NBOA and BBG: installed

Remote handling area guides: At ESS, awaiting T0 support installation

In bunker guides: Installed

Heavy shutter: Installed

Out-of-bunker guides: Installed

Control hutch: Installed

Cave interior components: SAT passed, awaiting cave completion for installation

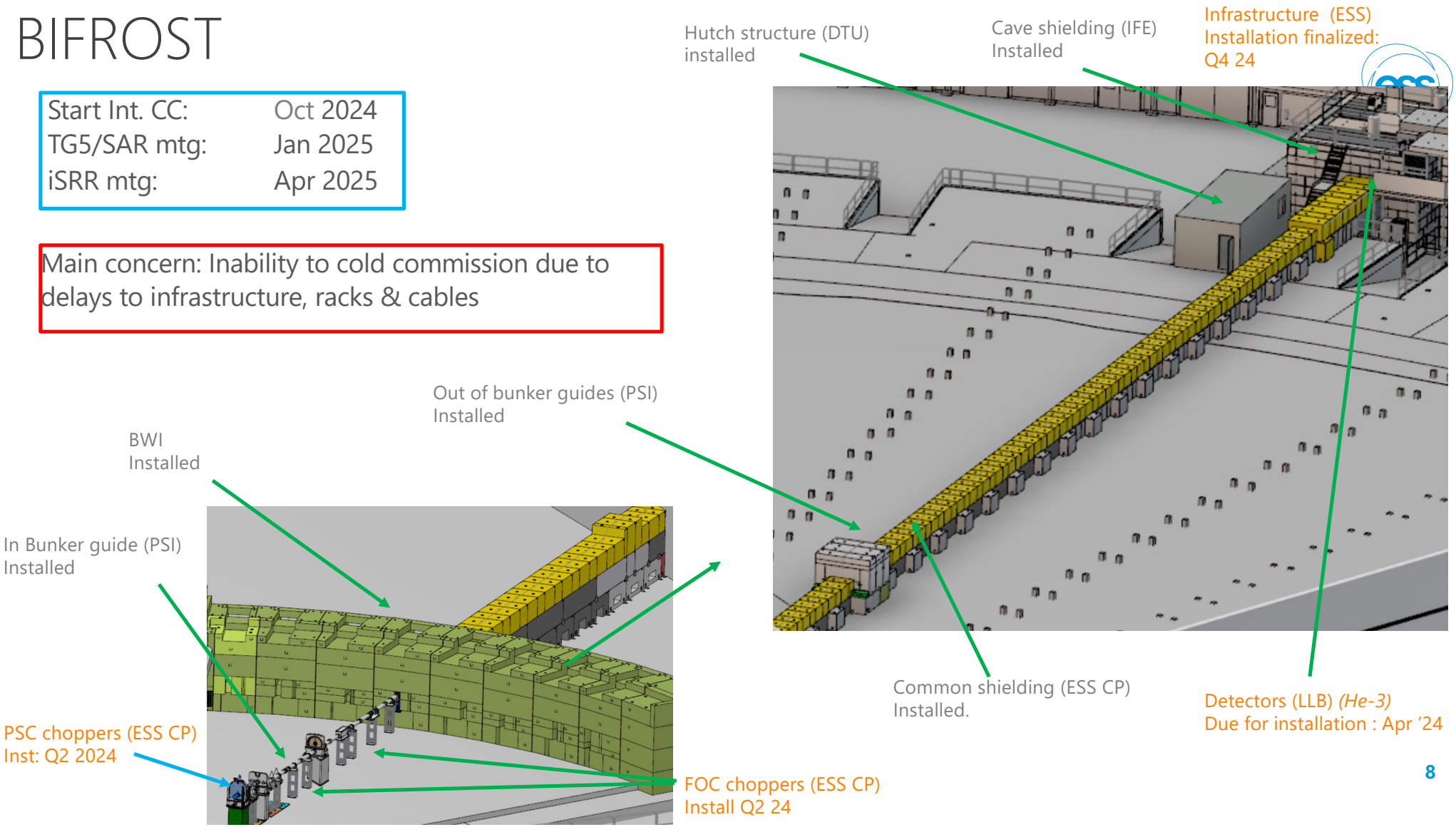
Cave door: Installation planned for May

Slide updated mid Apr.

BIFROST

Start Int. CC:	Oct 2024
TG5/SAR mtg:	Jan 2025
iSRR mtg:	Apr 2025

Main concern: Inability to cold commission due to delays to infrastructure, racks & cables



Slide updated mid Apr.

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NMX

Start Int. CC:	Feb 2025
TG5/SAR mtg:	May 2025
iSRR mtg:	Aug 2025

Main concern:
- Electrical infrastructure installation
- Detector delivery
- Beam monitor delivery

CUP & CEP Infrastructure, CDR May '24

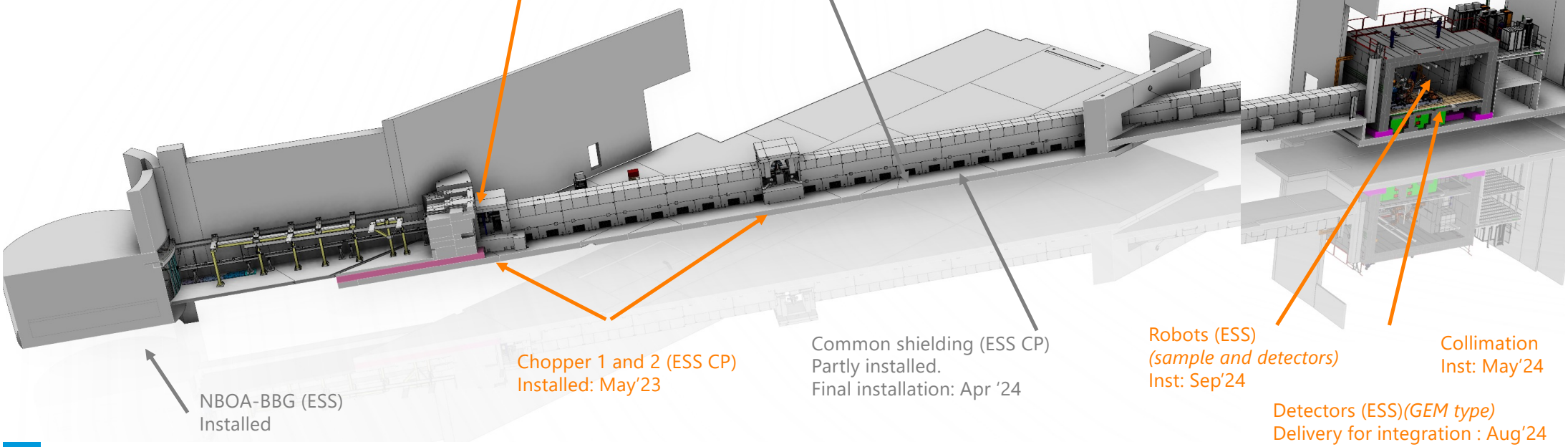
In Bunker guide
Installed

BWI
Installed

Thermal shutter (ESS)
Installation: Apr '24

Out of bunker guides
Ongoing Installation: Done Feb '24

Cave shielding
Sample Prep, hutch structure installed



NBOA-BBG (ESS)
Installed

Chopper 1 and 2 (ESS CP)
Installed: May'23

Common shielding (ESS CP)
Partly installed.
Final installation: Apr '24

Robots (ESS)
(sample and detectors)
Inst: Sep'24

Collimation
Inst: May'24

Detectors (ESS)*(GEM type)*
Delivery for integration : Aug'24

Slide updated mid Apr.

Installation Progress

MAGIC Cave

FREIA Bunker Wall Insert

SKADI cave, ESTIA cave and Hutch

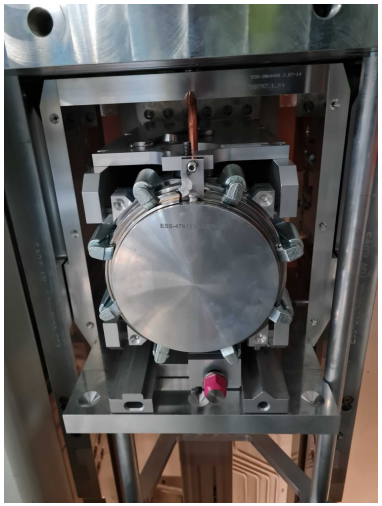
Installation Progress

Bridge beam guides

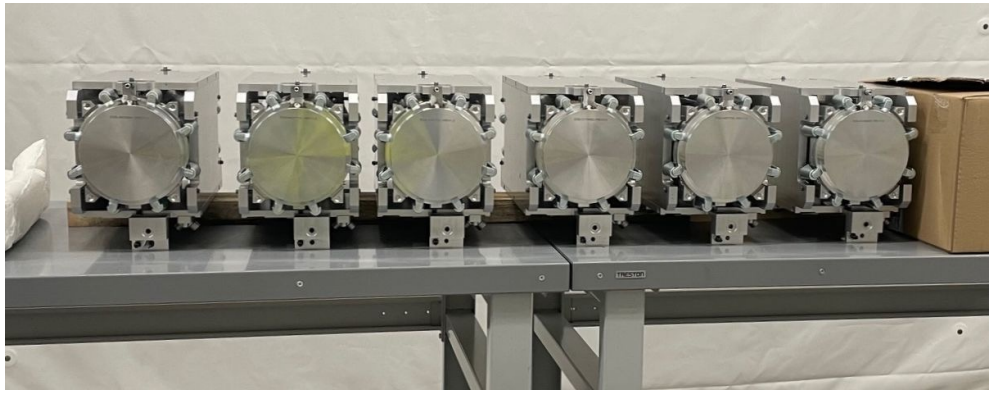
Vacuum issues have caused delays in the installations. Root cause has been identified and addressed.

Several BBGOA have been already installed

no	Instrument	Assembly	Installation
1	E2 ESTIA	Complete	Complete
2	E3 SKADI	Complete	Ongoing
3	S2 ODIN	Complete	Complete
4	S3 DREAM	Complete	Complete
5	N5 FREIA	Complete	Ongoing
6	N7 LOKI	Complete	Complete
7	W11 TBL	Complete	Complete
8	W1 NMX	Complete	Complete
9	W3 C-SPEC	Not Started	Not Started
10	W4 BIFROST	Complete	Ongoing
11	W5 MIRACLES	Not Started	Not Started



NMX BBGOA installed and aligned



Common electrical project

- Activities to close the bunker and start commissioning of T1 instruments are prioritized.
- Focus on critical paths activities,
- LOKI, DREAM, ODIN TBL and BIFROST installations are ongoing.
- NMX and ESTIA, Design started
- Completing the T2 requirements collection is urgent

Odin

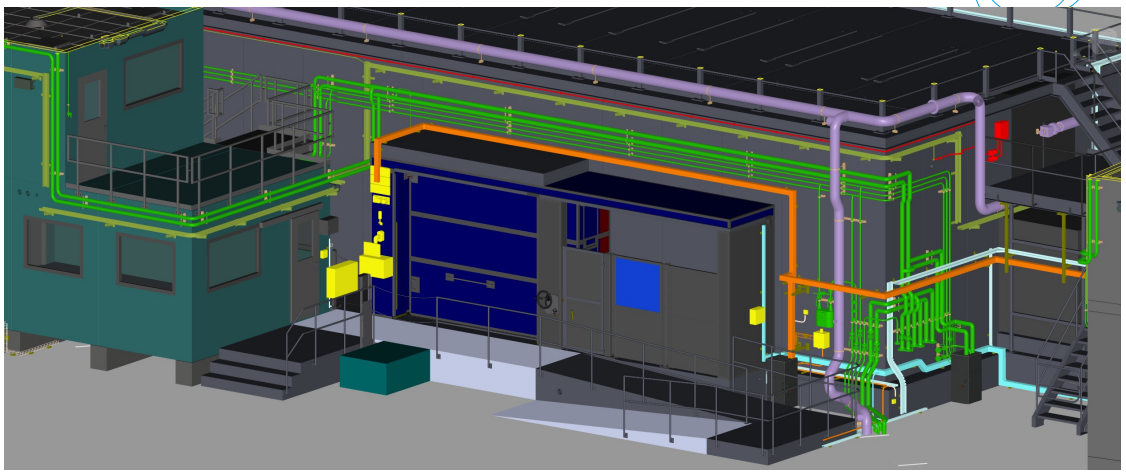
LOKI

Bifrost

Dream

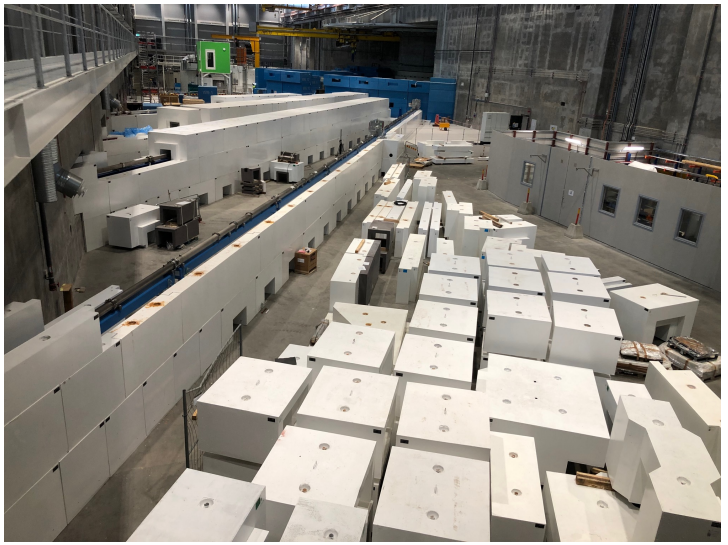
Common utilities project

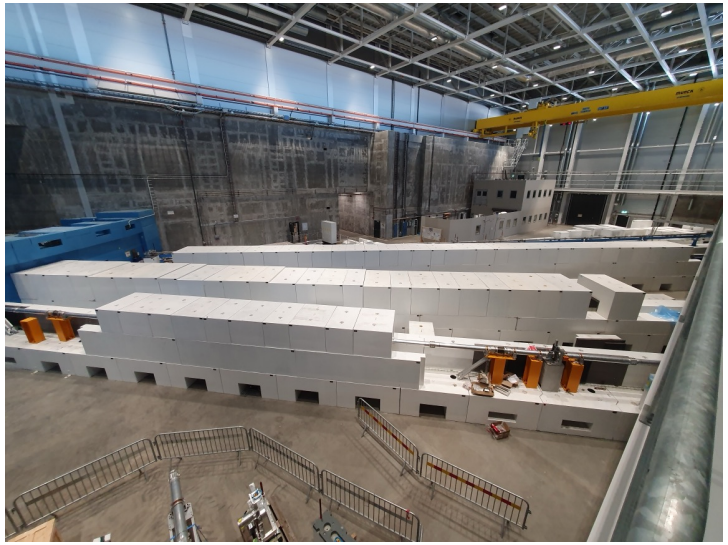
- Common Utilities installations have started for Loki, Bifrost, Odin, Dream, in bunker cooling water distribution.
- Design is ongoing on TBL, NMX and Estia.
- Successful FAT in April for Bunker skids



Common Shielding

- Installed over 500 blocks of LOT1 beamline shielding
- Finished conceptual design of LOT2 beamline shielding
- Finalized tender of the LOT2
- Started detailed cooperation with the supplier on the LOT2





Bunker

- Issues with paint of blocks being addressed
- Installed power sockets inside the Bunker
- Four out of six false floors for in-Bunker components designed, purchased and installed
- Hazard Analysis of the Bunker completed

NW raised floor

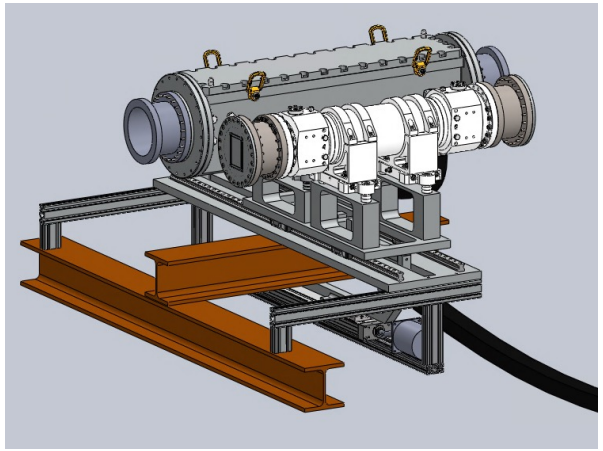
Freia feedthrough installation

Heimdal Feedthrough installation

Special thanks to **Gustav, Helena, Jesper, Nicolas and Stefan**

Polarization

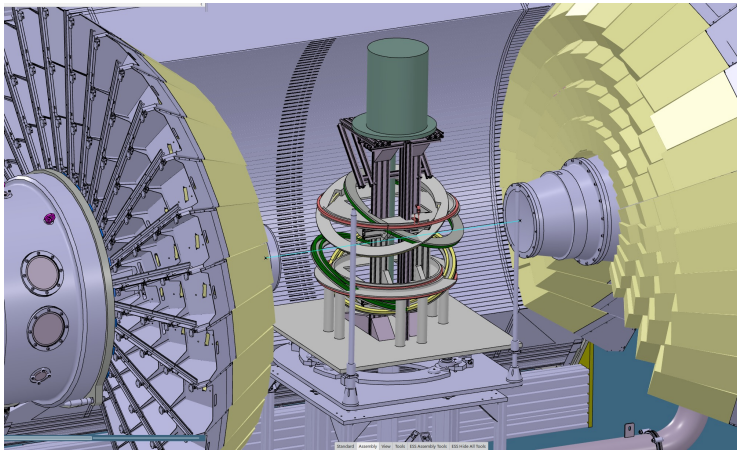
Progress ongoing with for polarization projects



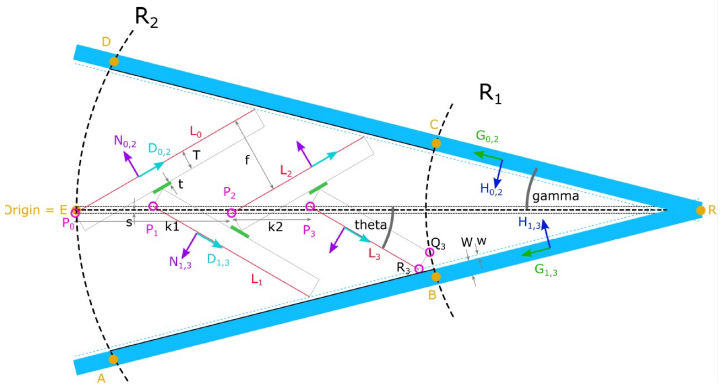
BIFROST Polariser, optics exchanger design. (Joel with BIFROST team input)

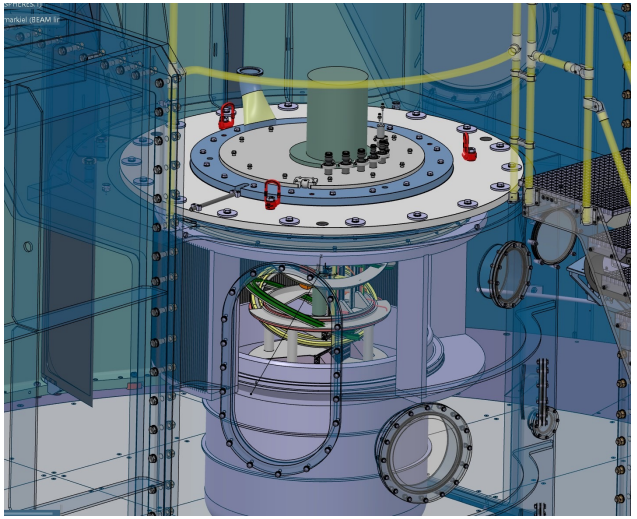
Gathering input from potential suppliers for polariser.

We are exploring different mechanisms for the optics exchanger.



DREAM Analyser design. (Bartek with DREAM team input)





Interface to T-REX analyser design (Bartek with T-REX team input)

ODIN polariser computational design – showing geometry for McStas simulation (Alex, Siddhay with ODIN team input)

NSS high level schedule

With T2T3 replanning

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

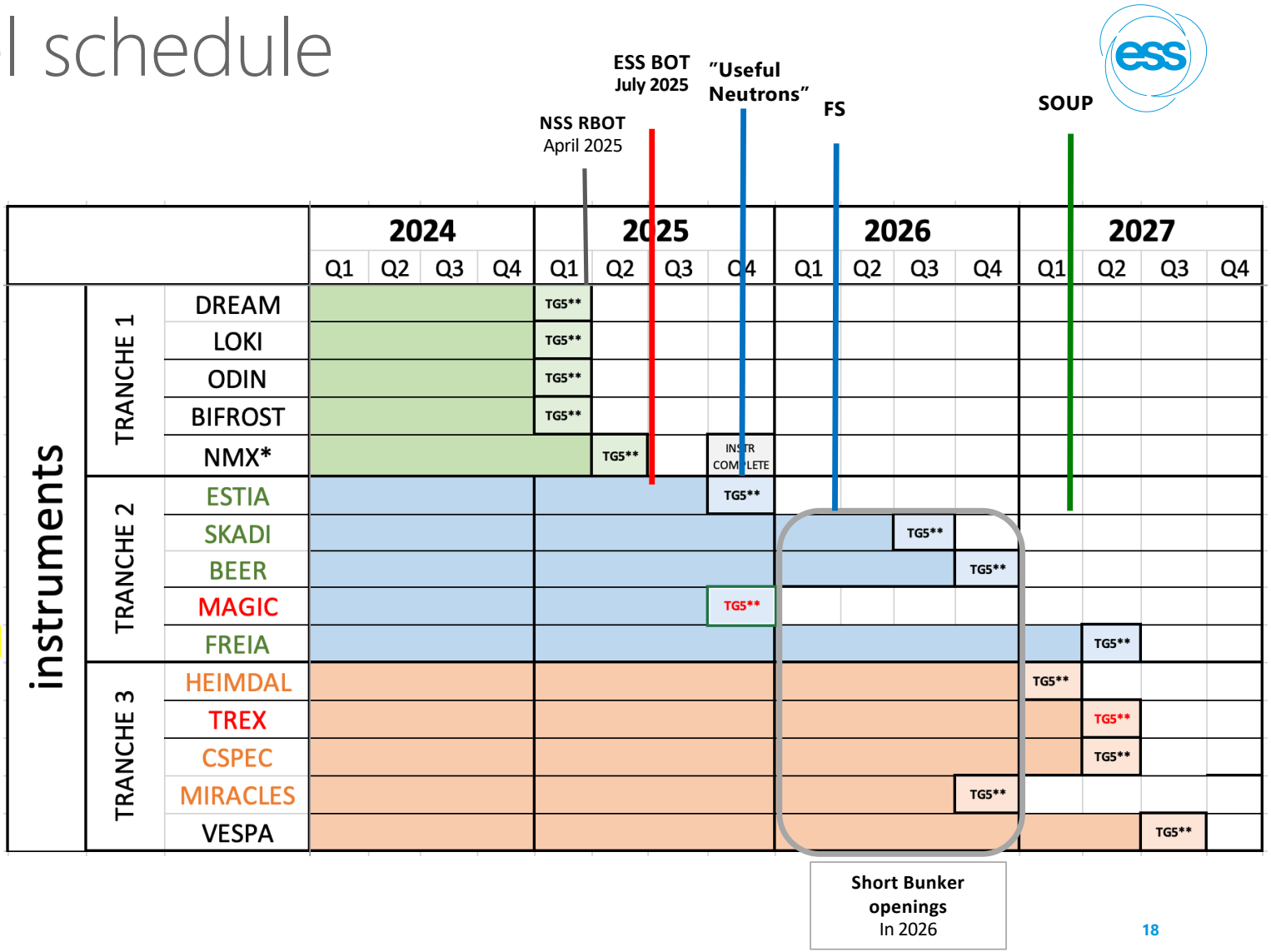
TG5 milestone (IK partner) is followed by Instrument SRR (NSS responsibility), which triggers Hot Commissioning (Science).

NSS is currently tracking **4-5 instruments passed Safety Readiness Review (SRR)** at the point of **BOT.**

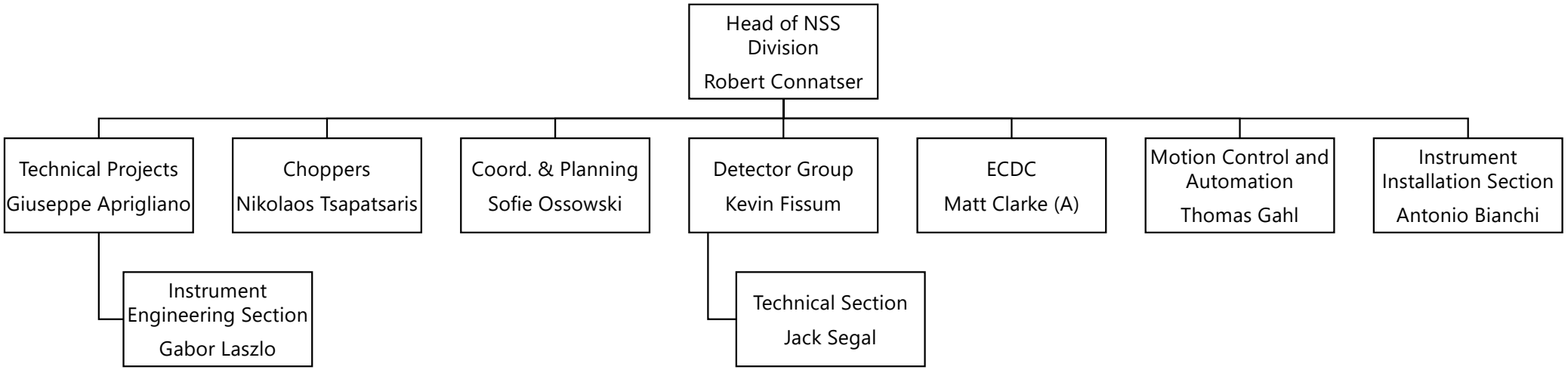
NMX might not be ready for SAR5, but will be ready for Useful Neutrons…..

T2T3 replanning ongoing:

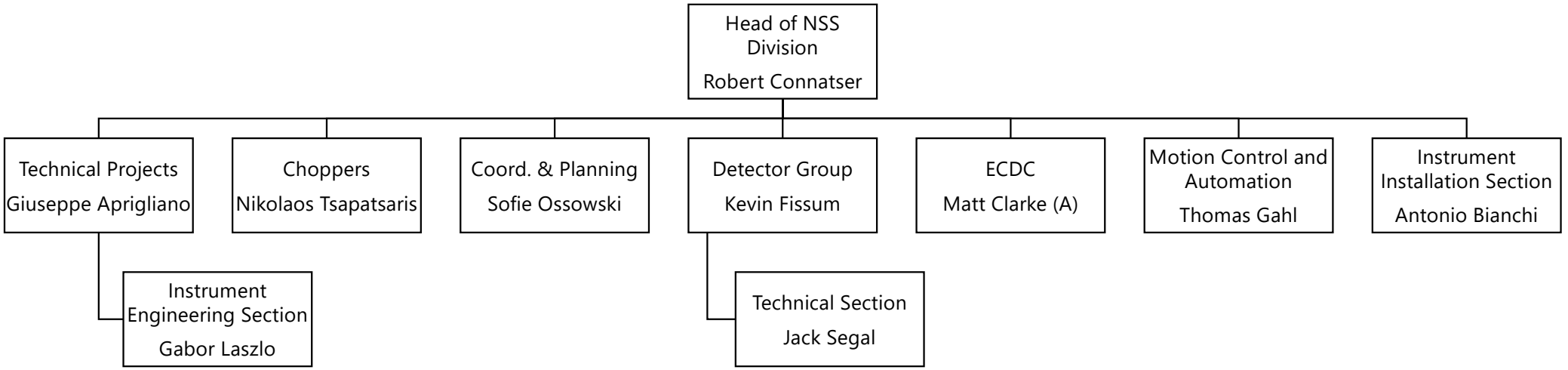
Green = almost ready
Orange = ongoing (draft dates)
Red = not started (draft dates)



NSS Organization



NSS Line Organization



- Technical Projects Group has added 8 engineers and technical writers plus the polarization team in order to support instrument projects and has 7 more openings to fill
- Chopper Group has added 2 staff – one engineer and one technician
- Detector Group has added 5 staff – engineers, technicians, and a technical writer
- Coordination and Planning has added 3 staff – project manager, coordinator for detectors, and planner
- ECDC has added one staff and has one (loan from ICS) starting soon, with 4 recruitments starting
- MCA has added BLANK
- Instrument Installation has added 2 Instrument Package Leaders and is recruiting one more and 2 technicians

Project Roles for Science Heads

3 “Technique” Leaders – LSS, Diffraction and Imaging, and Spectroscopy

Responsibilities:

- Provide scientific advice on <*technique*> instrument construction work packages within the NSS sub-project, including close collaboration with relevant IK partners
- Oversight of scientific scope for <*technique*> instruments
- Support execution of <*technique*> project scope within budget and to schedule, including reviewing Change Requests and partner Scope transfers / TA amendments.
- Ensure safe operations and radiological safety of the <*technique*> neutron instruments
- Provide advice to the NSS Subproject leader and Science Director on individual <*technique*> project scopes

Authorities:

- Propose and rank upgrades or scope completions for instrument in the <*technique*> domain
- Chair TG5/System Acceptance Reviews for instruments in the <*technique*> domain
- Concurrence on change requests that have an impact on meeting scientific requirements for instruments in the <*technique*> domain

General Update

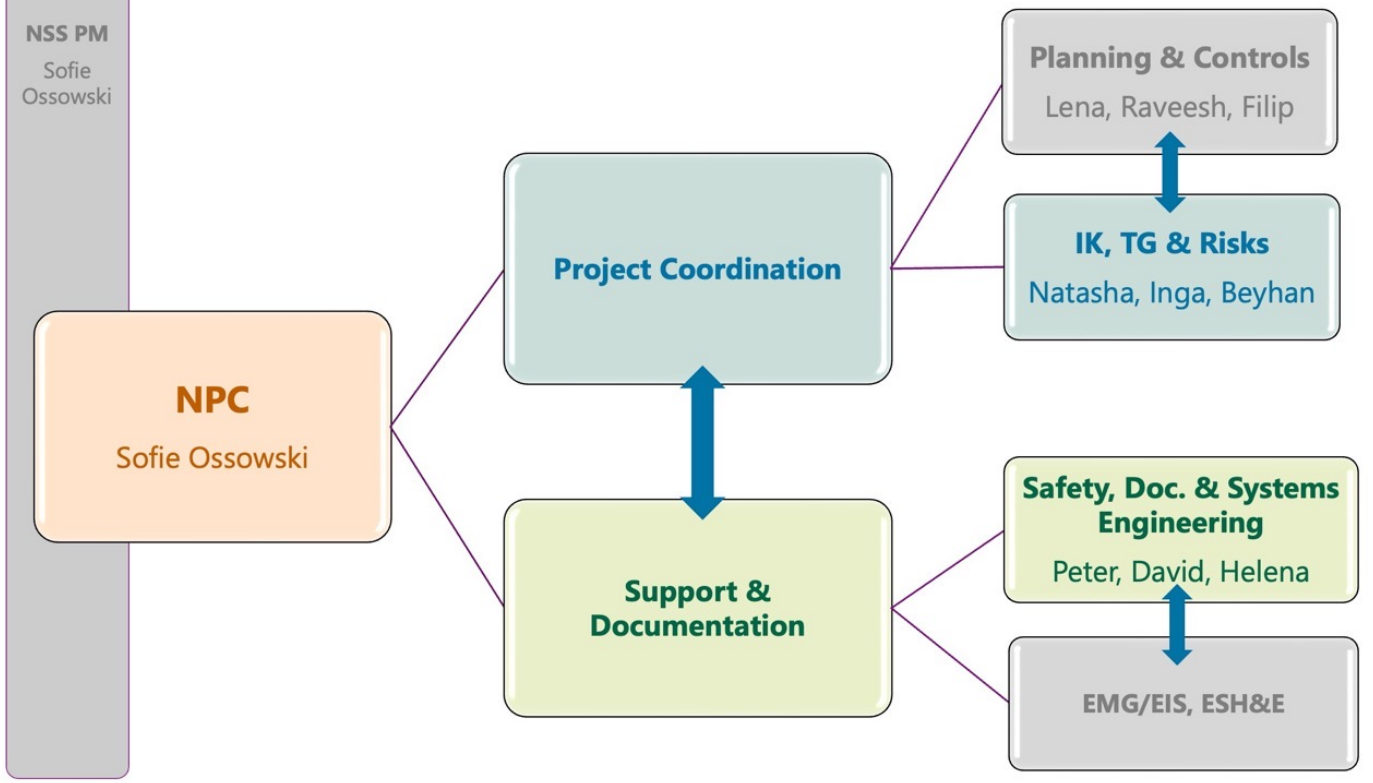
Planning & Quality

- Q-gate implementation
  - Backlog continues to grow – as more teams add items to the list
  - Mixed success on adding resources to the team
    - Beyhan Alkan added in February
    - Helena Ramsing added in March
    - Consultant Jimmy Svensson started in April
    - Still looking for second consultant

Recent achievements

EUROPEAN SPALLATION SOURCE

NSS Planning & Coordination group



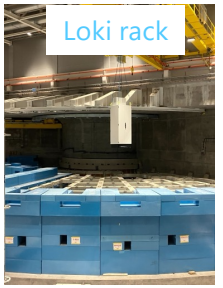
- Good progress on T1 for **Integrated schedule**, and started some T2.
- **Detector replanning** ongoing
- **Critical Path reviews** improving, sent to T1
- Several **CRs** implemented, in particular PSS (almost done for all). **EAC** updates.
- **IKRC** Oct (several amendments)
- Increased work on **Risks**, more attention

- Updating **key NSS Documents** (Sys Eng)
- **Final TG3** reviews
- Progressing on **Instrument HA**
- Dedicated work for **INP submission**

Neutron Chopper Systems Highlights

Highlights

- Reinstallation of DREAM T0, Epoxy grout rectified
- First LOKI Chopper Rack installed
- New Coating process for disc coating qualified at 133 Hz
- Finalisation of TBL Double Chopper Assembly & discs
- HEIMDAL CDR done, BEER CDR in 7 days
- BIFROST Chopper PSC System fully assembled, In FAT testing currently at 70Hz
- BIFROST FOC1 and 2 FAT passed awaiting reinstallation
- BIFROST BWC Chopper ready for energisation
- Full Chopper SAT documentation in place, v1
- CE marking of CHIC v1/2


Loki rack

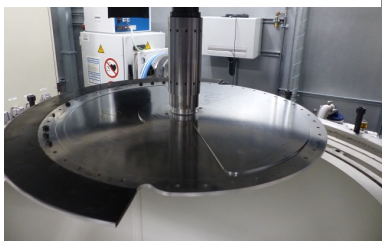

DREAM T0

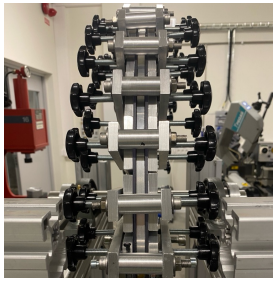

TBL Dbl Chopper


BIFROST PSC Chopper

BIFROST Fast

BIFROST Fast disc Spin test

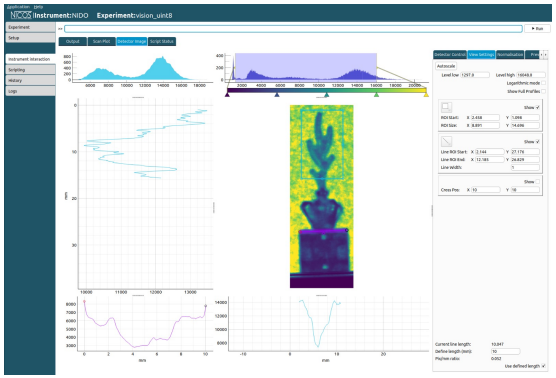



New disc coating process

Experiment Control

Recent highlights

- VIP demo from Instrument Data Scientists
- Integrated into NICOS:
  - Freia solid liquid cell sample changer
  - Anton-Paar rheometer
  - Octopy cryomagnet
- Improved camera/data viewer



Readout and Data Streaming Achievements (ECDC)

Consolidating readout system

- Data formats (Beam Monitors)
- Instrument Debug and Monitoring inferface
- Network compliance

Event Formation Unit development

- Timepix3
- Beam Monitors
- DREAM data generator
- Streaming solution for readout monitor/debug

Measurement campaigns

- Multi-blade detector commissioning at PSI, Switzerland
- NMX Detector test at BNC, Budapest
- Utgaard test setups

Streaming architecture

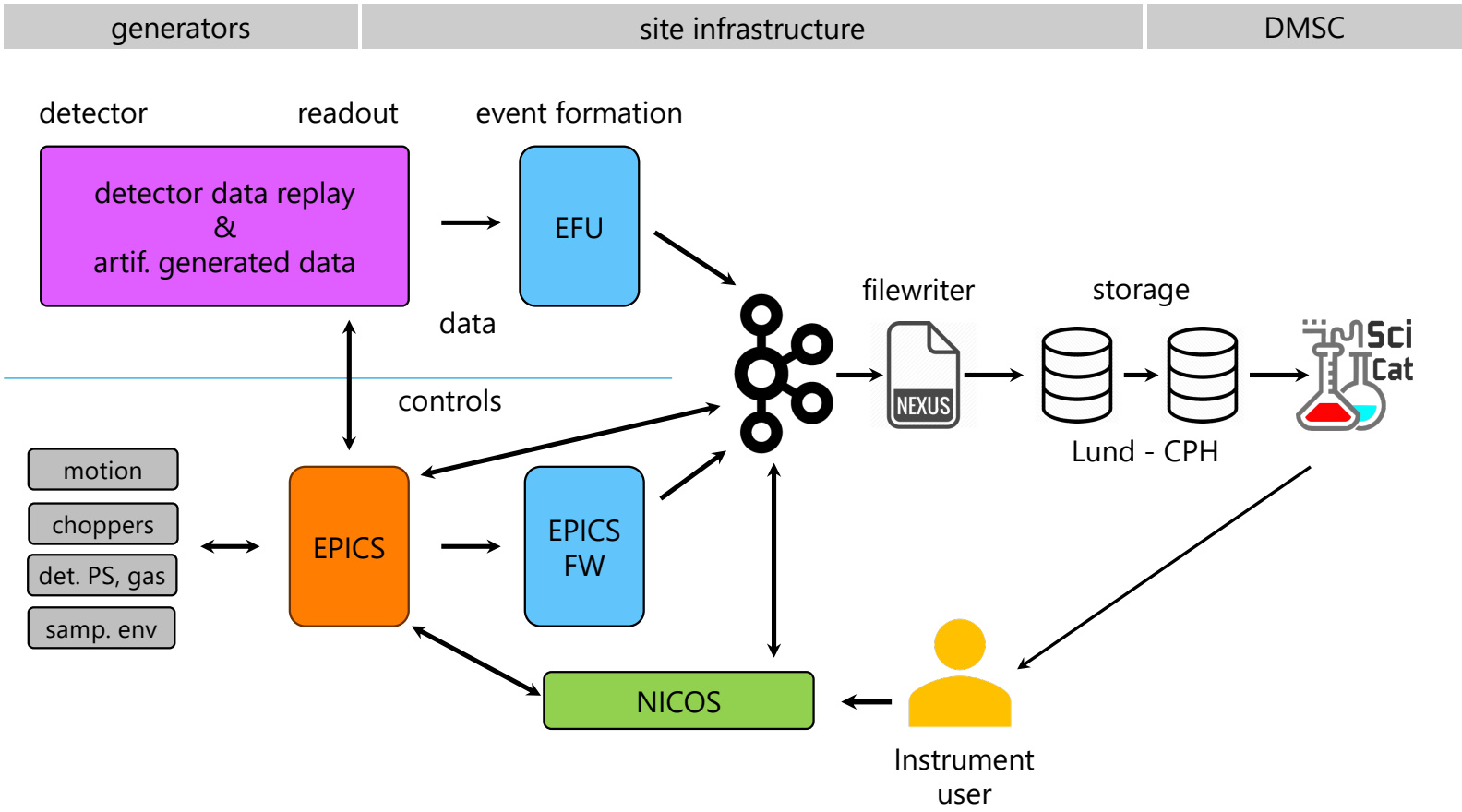
- Performance measurements
- System parameter optimisation

File writing

- COntinuous DAta (coda)

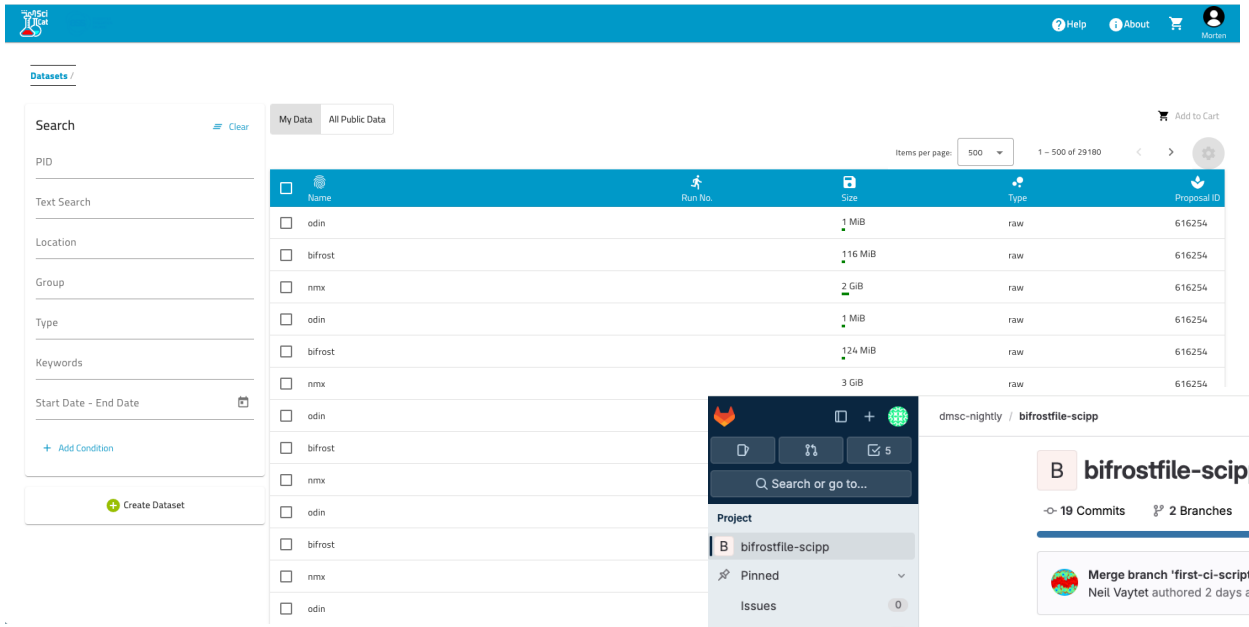
Continuous Virtual Experiments

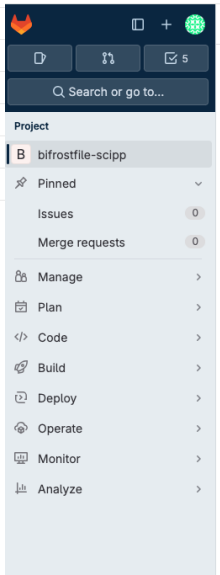
NMX, BIFROST, ODIN, TBL(FREIA)

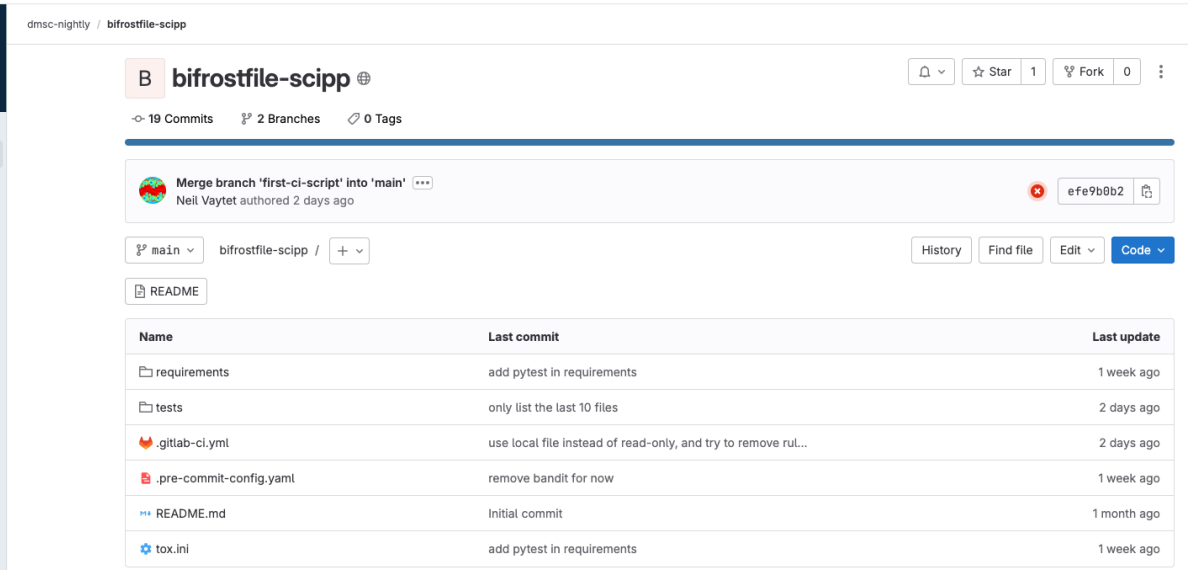


Continuous Virtual Experiments

Data ingested in SciCat, integrity tests with SCIPP







Files written	6700+
Storage	3.1 TB

Since Feb 27 2024

MAJOR ISSUES

- ECDC and the move of the DMSC office
  - Group Leader/WPM (Tobias Richter) and another scientist have additionally resigned
  - Causing delays in replacing other holes in the organization

  Interim Solution:

  - Anders Pettersson has accepted assignment as Work Package Manager with objective to identify the remaining work, create a plan for executing it, and prioritizing current effort.
  - Matt Clarke and Morten Jagd Christensen are technical leads, working closely with ICS interface Nicklas Holmberg

MAJOR ISSUES – Bunker roof blocks

Over the last few months, four major issues with Bunker's concrete blocks were identified:

1. Insufficient paint thickness
2. Flaking of the outermost layer of concrete
3. Air gaps under steel corners
4. Internal reinforcement of blocks (rebar) casted too close to outer surfaces

ESS has decided to repair the flaking and air gaps. This is technically a warranty issue with Mirrotron, the supplier.

MAJOR ISSUES – Mirrotron

Mirrotron has approached ESS stating that they are in financial distress and requesting advanced payment on milestones regarding the ODIN cave contract. Similar request made last fall on NMX guide installation to Hungarian partner.

What	Who	Notes
Common Shielding	ESS	Seeing delays in information
Bunker shielding	ESS	Completed, but warranty issue
NMX guides	MTA (HU)	Installation nearly complete
Heimdal cave	ESS for partner (IFE)	Still in design phase – design delayed
ODIN cave	ESS for partner (TUM)	Changed contract due to inability to complete full scope in reasonable timeframe
MAGIC guides	LLB (FR)	

Summary

Significant progress in the experimental halls building, constructing, and installing!

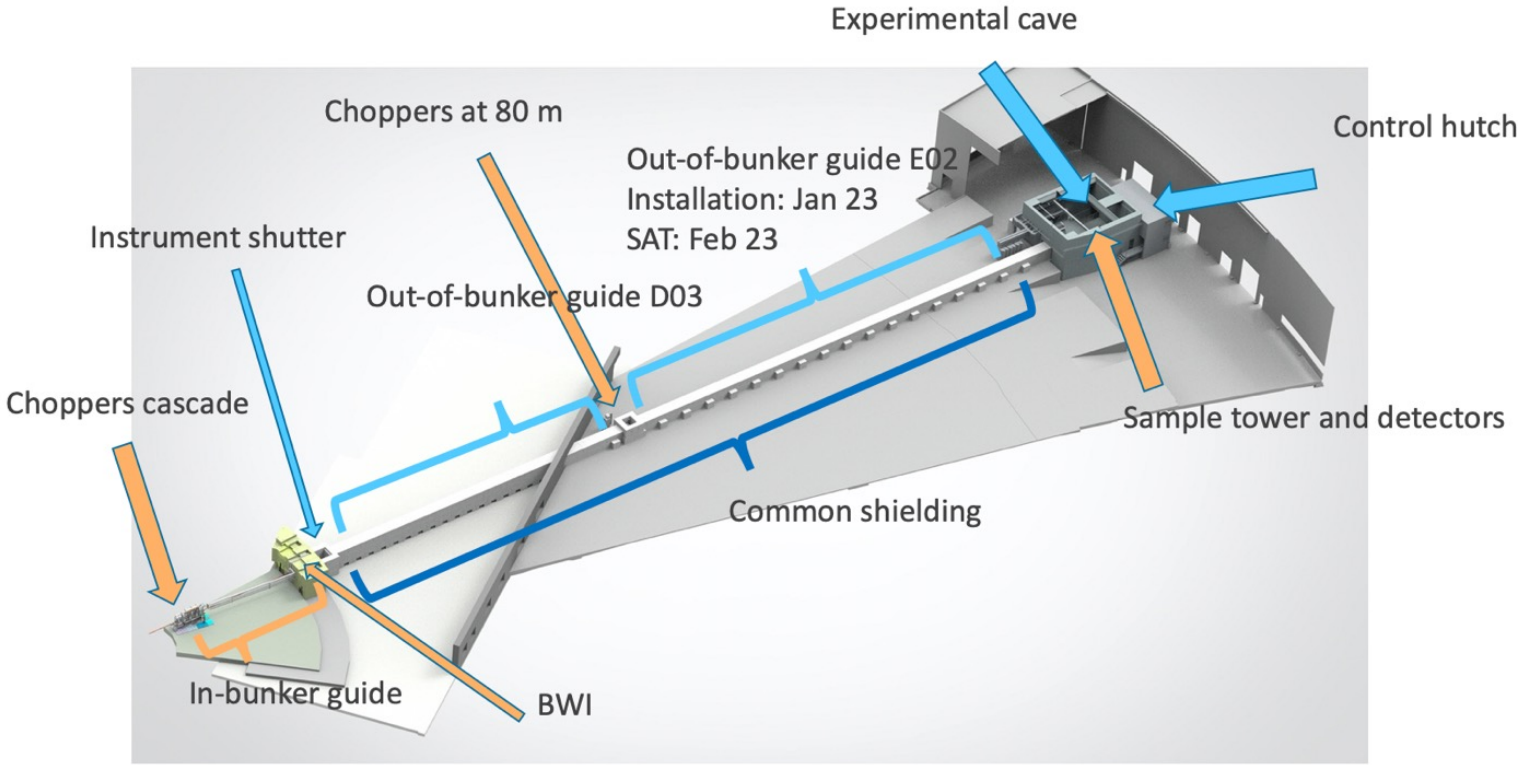
We are facing some significant hurdles on delivery with some vendors and partners, but we are trying to work togther to find solutions.

Looking forward to starting cold commissioning with the Tranche 1 instruments, but this will be a new phase for NSS and ESS. Anticipating new lessons!

Questions?

BEER

Material engineering diffractometer

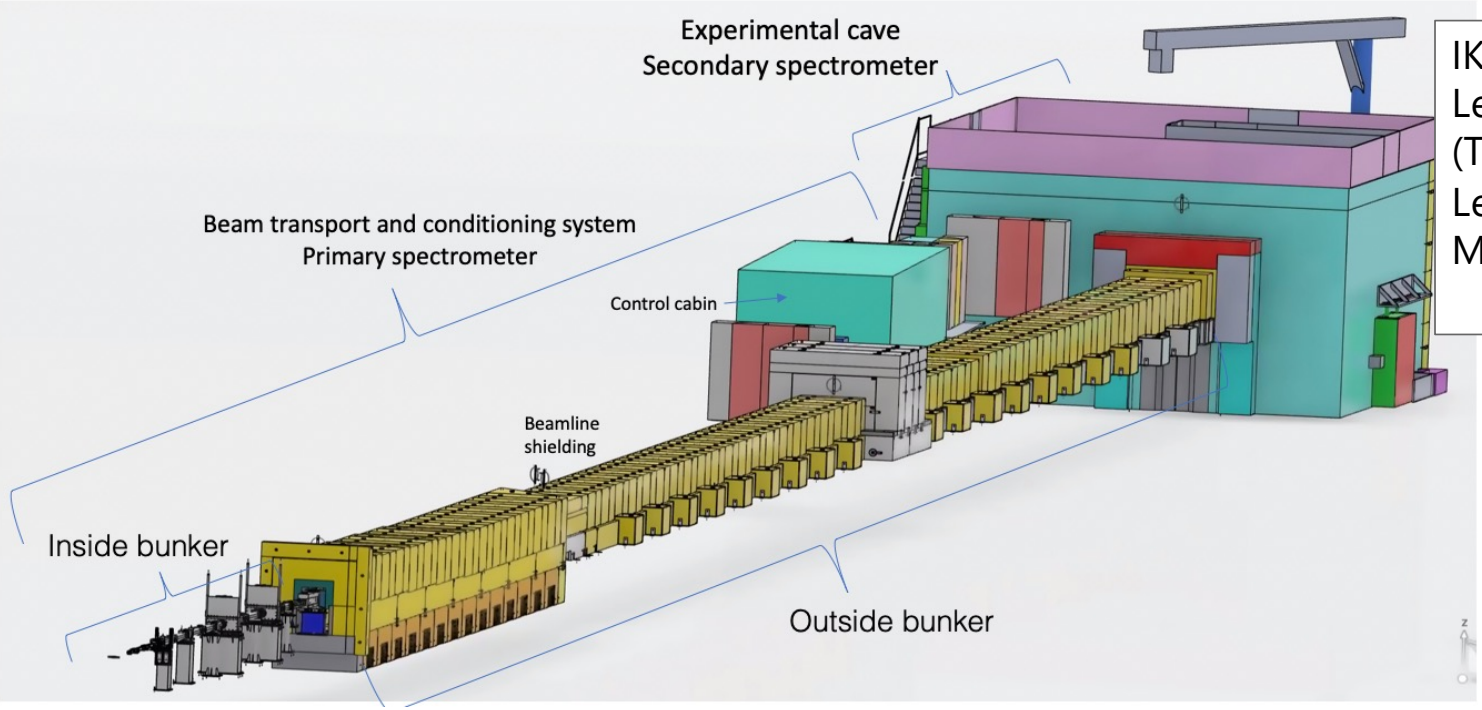


In-kind partners: **NPI** and Hereon
Lead scientists:
P. Beran (NPI)
J. Fenske (Hereon)
Lead Engineer:
Bojan Peric (NPI->ESS)

BEER: in-situ and in-operando experiments, strain scanning, texture measurements, phase analysis, long term experiments;
Day 1 Performance (2MW): world-leading in medium and high-resolution strain-scanning, unique flexibility

CSPEC

Cold chopper spectrometer



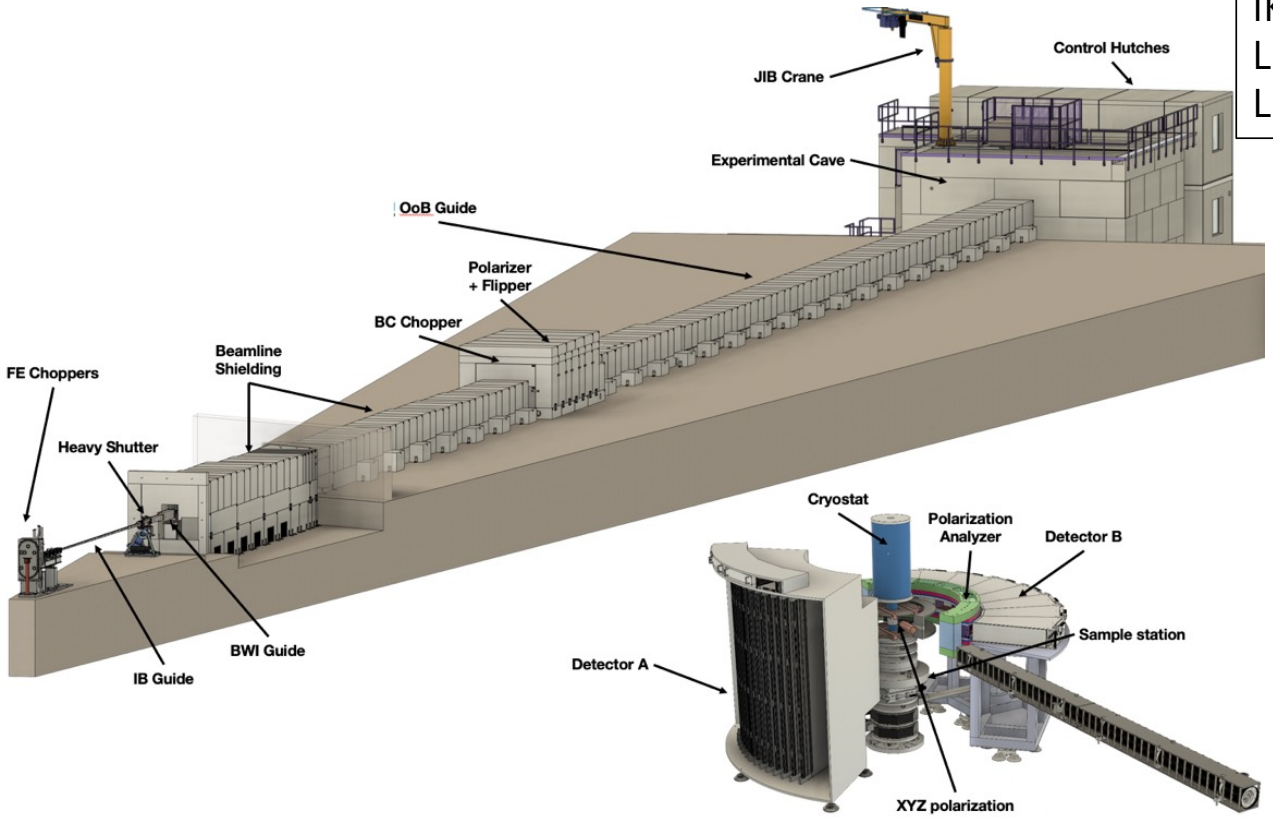
IK partners: **TUM** and LLB
Lead scientist: Daria Noferini (TUM->ESS)
Lead engineer: Fernando Yamil Moreira (LLB->ESS)

CSPEC: energy (solar cells, batteries, hydrogen storage, thermoelectric materials), climate (carbon nanotubes, steel and chemi industries), health (drug delivery, protein dynamics, hydrogen bonding, quantum effects in the origin of life), digital society (magnetic storage and reading, spin liquids, novel magnetic behaviour, topology)

MAGIC

Polarized single-crystal diffractometer for magnetism

IK partners: **LLB**, FZJ, PSI
Lead scientist: Xavier Fabrèges (LLB)
Lead Engineer: Sergey Klimko (LLB)



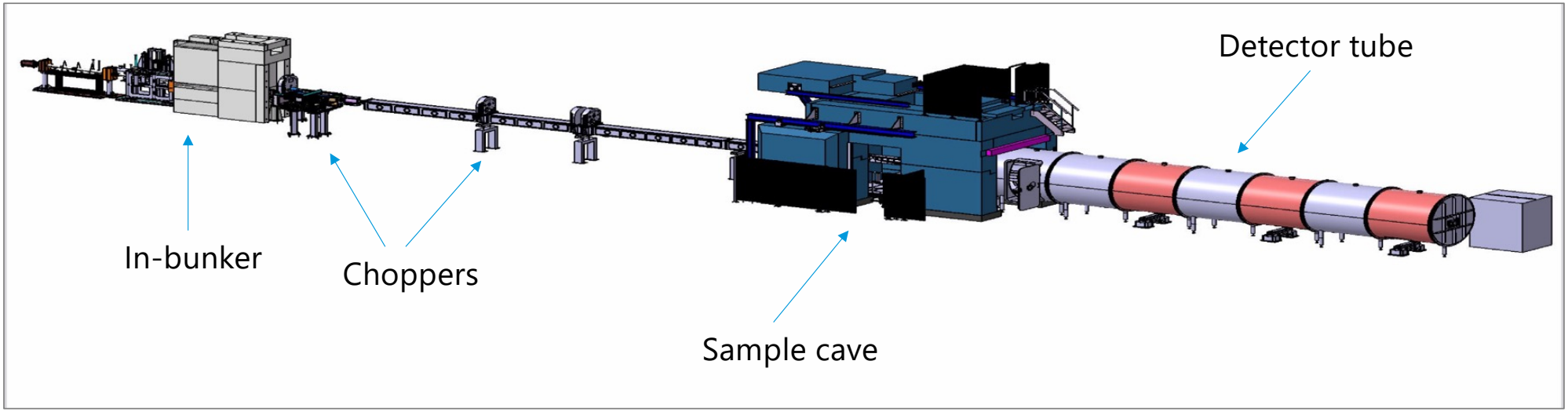
MAGIC: multi-functional materials, magnetism at interfaces, thin film, superconductivity and magnetism,
long range magnetic states (skyrmions, multiferroics), molecular magnetism, fundamental magnetism, spin-orbit coupling

SKADI

High-resolution versatile SANS

In-kind partners: **FZJ** and LLB

Lead Scientist: Sebastian Jaksch (FZJ -> ESS)
Lead Engineers: Romuald Hanslik (FZJ)

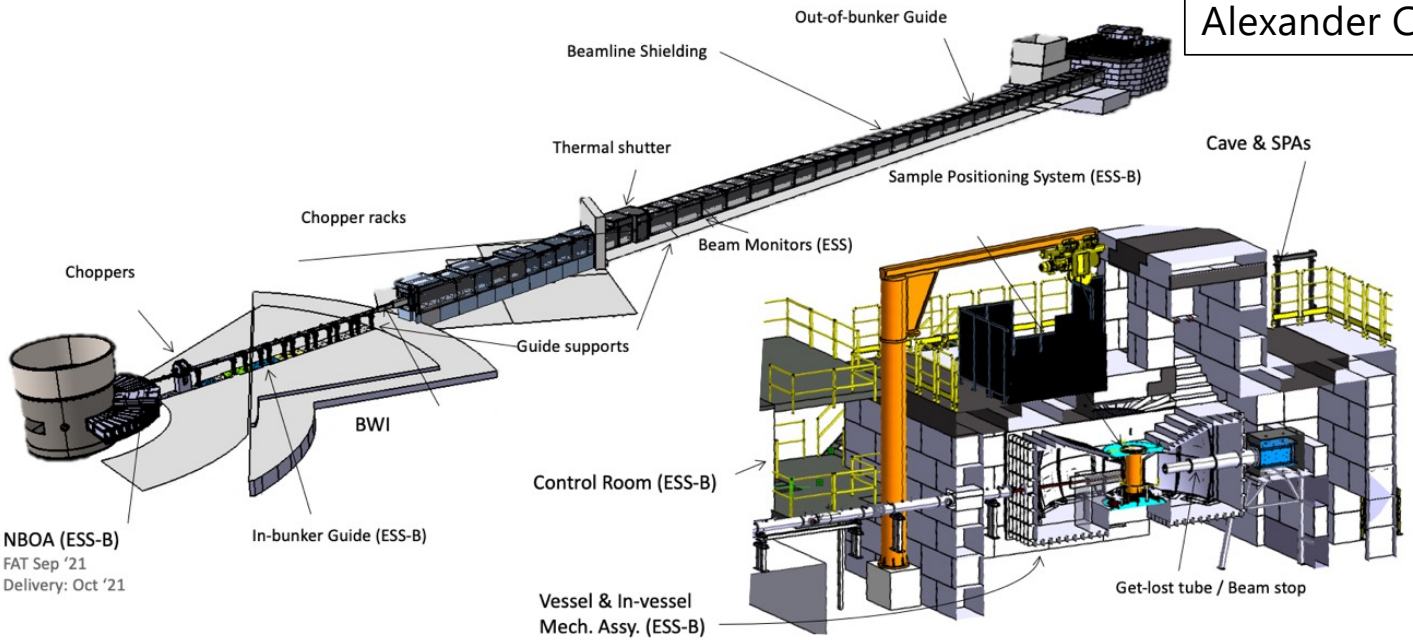


SKADI: world leading flux: ~5x10^8 neutrons/s cm^2 at sample position; Day 1 Performance (2MW) - world-leading: approximately 2x compared to D22

MIRACLES

The TOF-backscattering spectrometer

IK partners: **ESS-Bilbao** and KU
Lead scientist: Felix Villacorta (ESS-B)
Lead engineer:
Alexander Conde Estebanez (ESS-B)

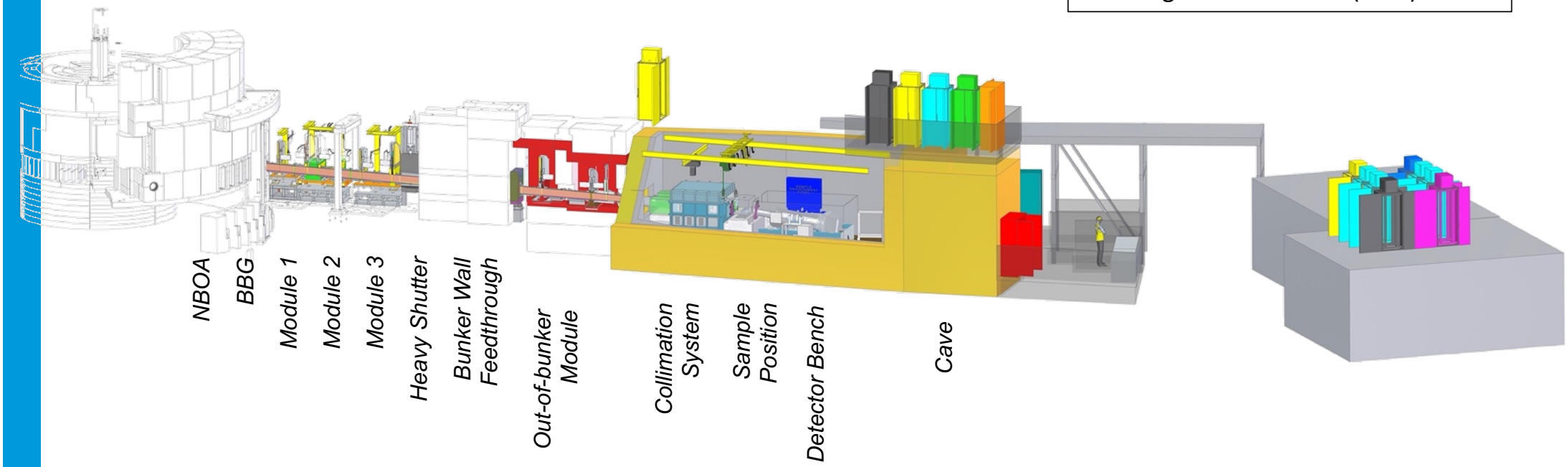


MIRACLES: dynamics of proteins and water, drug delivery, morphology-performance connections, hydrogen storage, quantum information processing, greener building materials

FREIA

Kinetics reflectometer liquid surfaces and soft matter

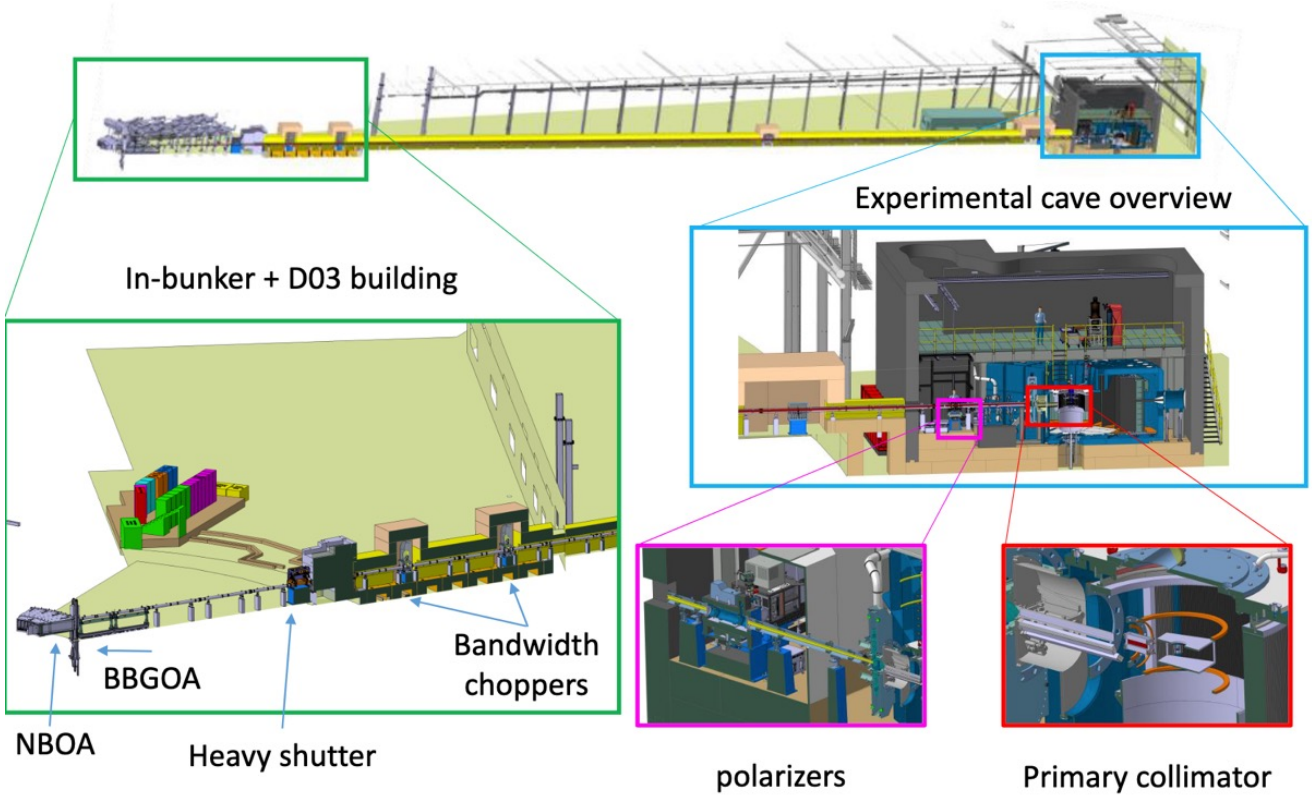
IK partner: **STFC**
Lead Scientist: Tom Arnold (STFC->ESS)
Lead Engineer: Jon Elmer (STFC)



FREIA: surfactants and polymers, membranes and proteins, biosensors, organic protovoltaics, drug delivery systems, lubrication/trib
in-situ and in-operando, complex sample environments; deposition, structure and phase behaviour, adsorption,
self-assembly and reactions, gas/liquid/solid interfaces

T-REX

Bi-spectral chopper spectrometer



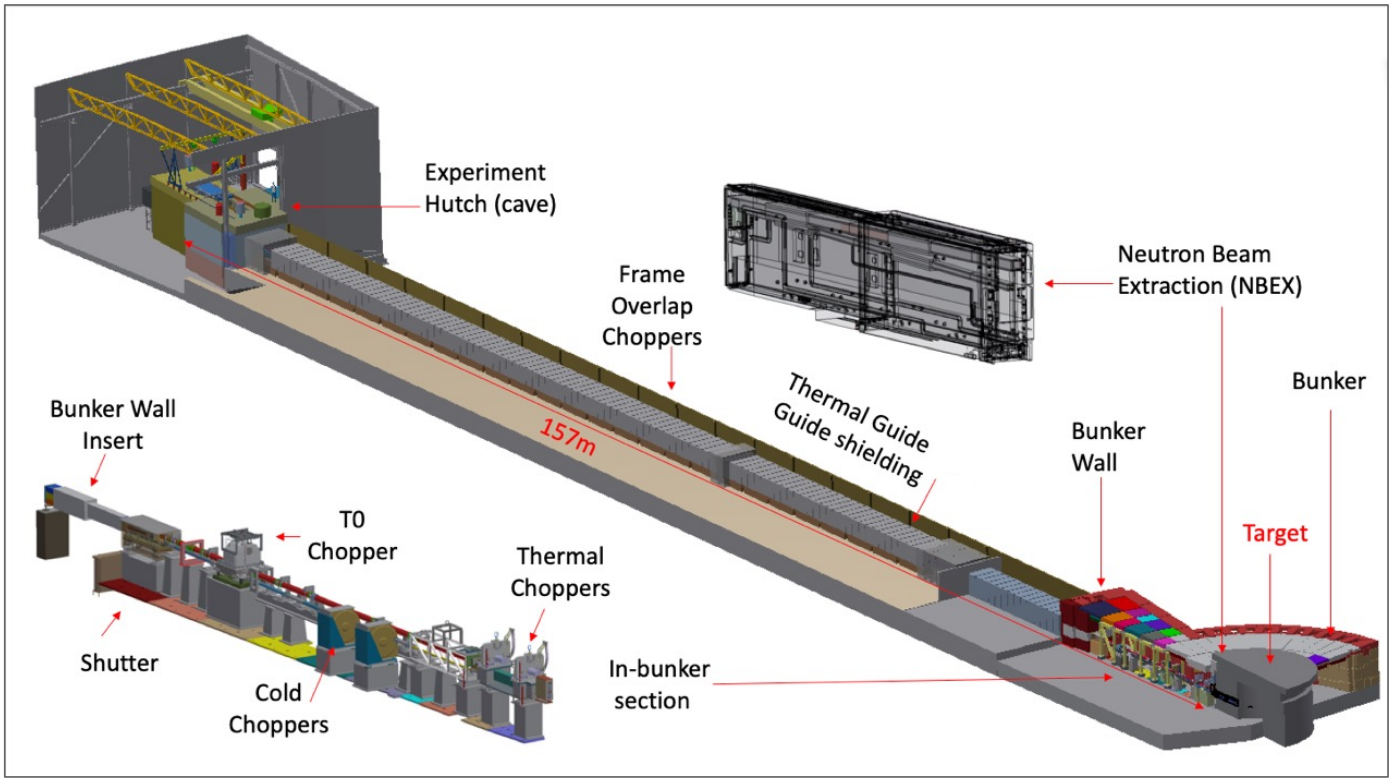
IK partners: **FZJ** and CNR/INFN

Lead scientist: Nicolò Violini (FZJ)
Lead engineer: Marcel Serwe (FZJ)

T-REX: inelastic neturon scattering for a broad community; excitations in quantum condensed matter, coupling mechanism between phonon dynamics and spin waves, spin correlations, spinwaves of polycrystans or phonons in disordered systems

HEIMDAL

Thermal powder diffractometer



IK partners: **AU**, PSI, IFE

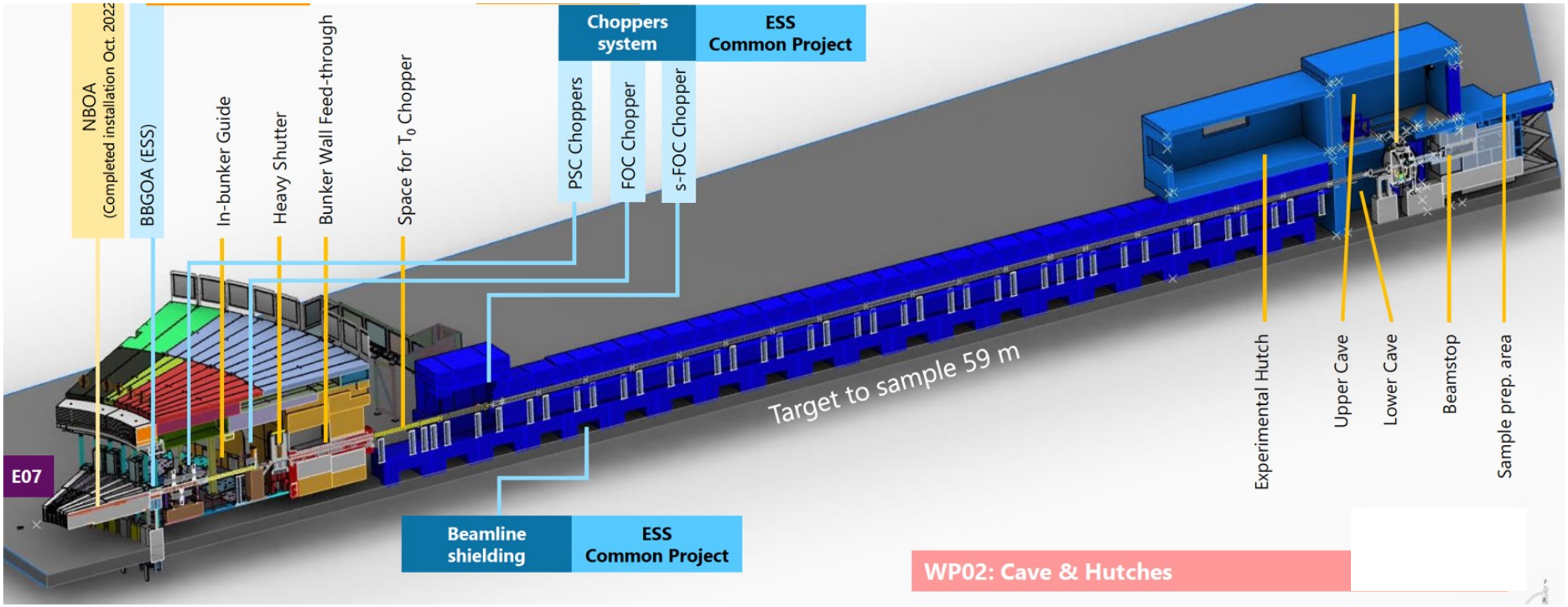
Lead scientist: Dan Mannix (AU)
Lead engineer: Kåre Iversen (AU)

HEIMDAL: next generation powder diffractometer for in-situ/in-operandi studies. Energy materials, catalysts, hierarchical systems, biominerals, structure of functional materials, crystallization/growth, magnetic phases, nanomaterials

VESPA

Vibrational excitation spectrometer with pyrolytic-graphite analysers

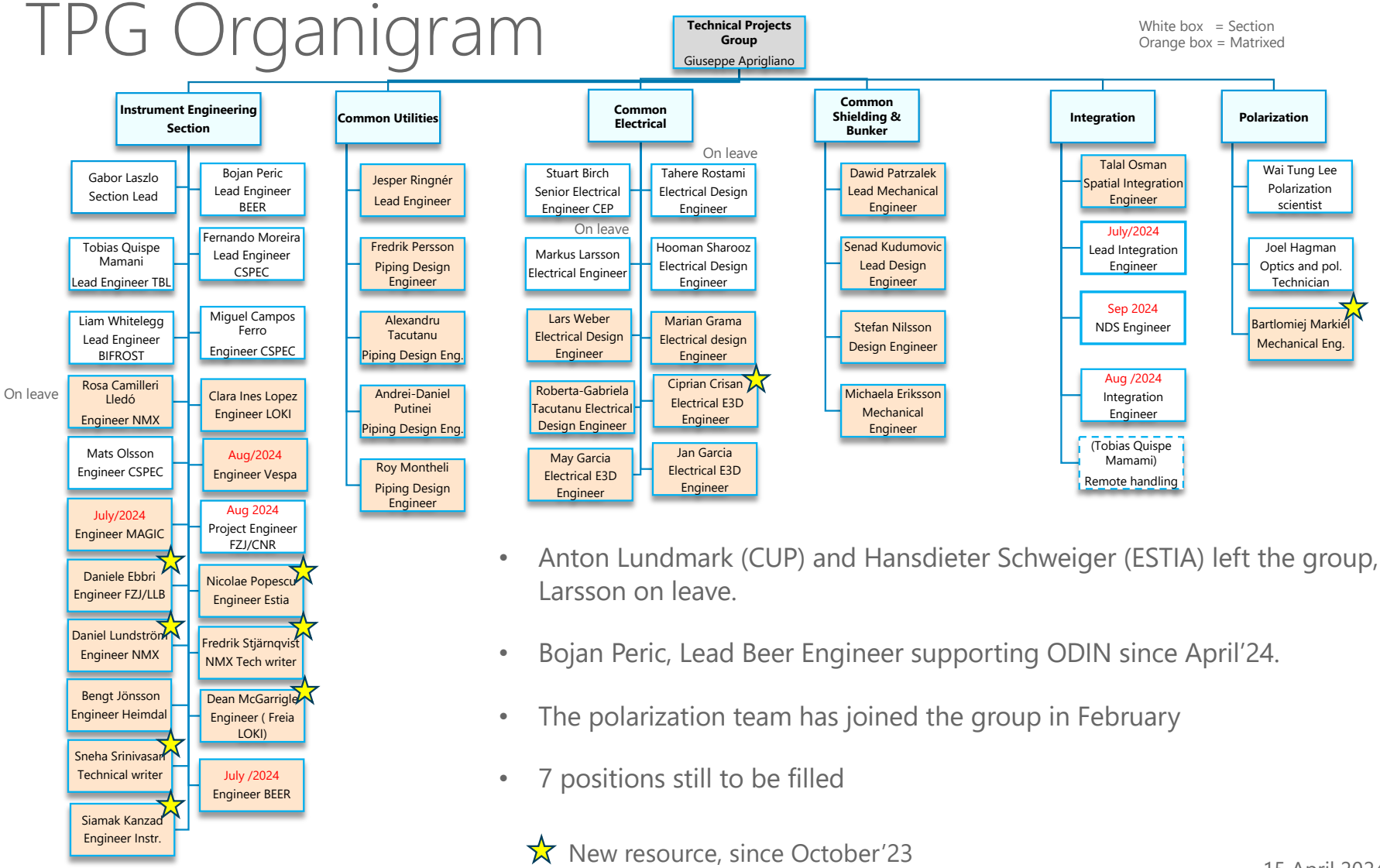
IK partners: **CNR & INFN**



VESPA: polymers, pharmacueticals, earth science, renewvable energies, catalysis

Lead scientist: Adrien Perrichon
Lead engineer: Liam Whitelegg

TPG Organigram



- Anton Lundmark (CUP) and Hansdieter Schweiger (ESTIA) left the group, Marcus Larsson on leave.
- Bojan Peric, Lead Beer Engineer supporting ODIN since April'24.
- The polarization team has joined the group in February
- 7 positions still to be filled

★ New resource, since October'23