

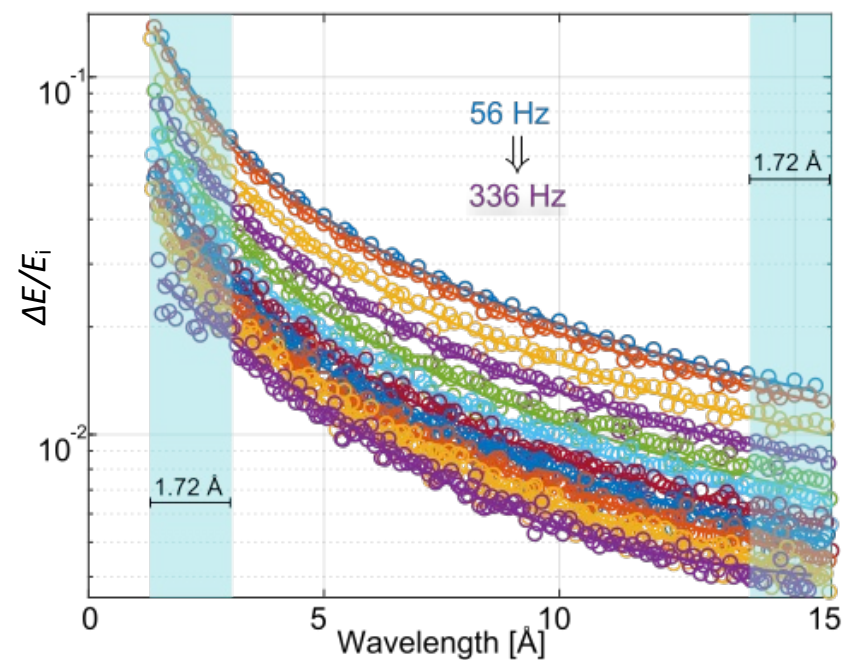
CSPEC update

Daria Noferini, Lead Scientist for CSPEC

Spectroscopy STAP meeting 21.10.2025

Specifications

λ range	2-20 Å
Energy resolution	1-5% of E_i
Detector coverage	-30°-140° [H] $\pm$ 26.5° [V] (full scope)
Beam dimension	4x2 cm ² or 1x1 cm ² (focussed)
Polarisation analysis	(foreseen)
Flux gain factor (@5MW, no RRM, 1 pulse)	2-6 with respect to current leading cold chopper spectrometers
Repetition Rate Multiplication	Wavelength band = 1.7 Å (approx. 6 pulses)
Signal-to-noise ratio	10 ⁵ (@5 Å, vanadium standard sample)



Kinetic measurements, combined characterisations,
small samples, *in situ*, *operando*...

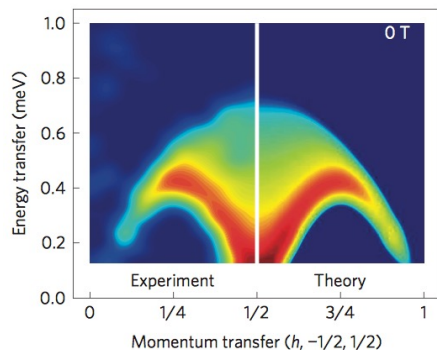
Science cases

INS and QENS (translations, rotations, quantum effects, spin dynamics, phase transitions, collective excitations, relaxation phenomena...)

Energy materials: fuel cells membranes and electrolytes, thermoelectric materials, battery electrolytes, H-storage, organic photovoltaics...

Soft matter: polymers, nanocomposites, gels, surfactants...

Materials: clays, crystal growth, catalysis, quasi crystals...



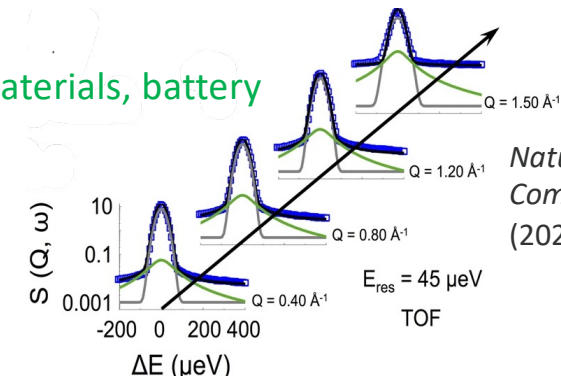
Nature Physics, 9, (2013)

Magnetism: spin glasses and fluids, quantum materials, frustrated compounds, magnetothermal, multiferroic materials, superconductors...

Liquids & glasses: monoatomic and molecular liquids, ionic liquids, glass forming liquids, liquid metals and alloys, glasses, confined fluids...

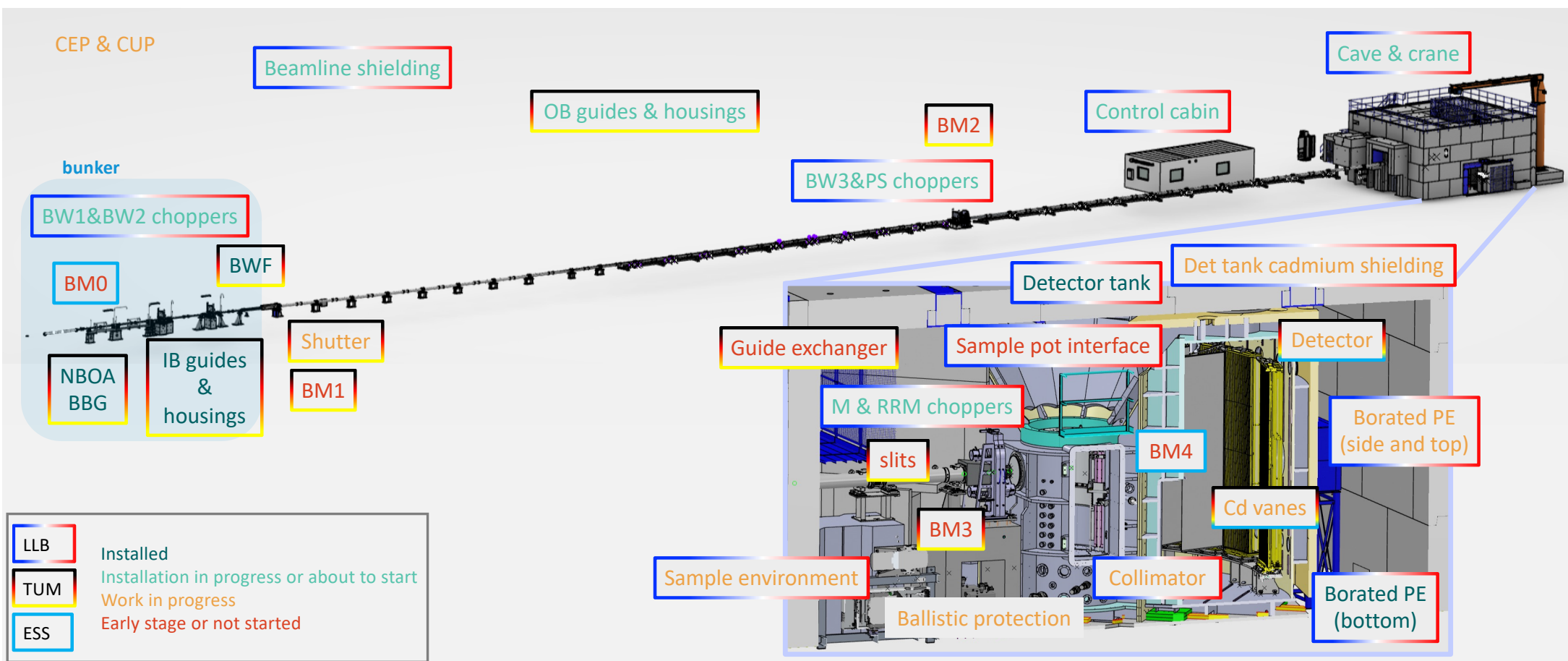
Biological systems: proteins, DNA, lipid membranes, pharmaceuticals & drug delivery...

Focus on small samples, in situ/operando, kinetics etc

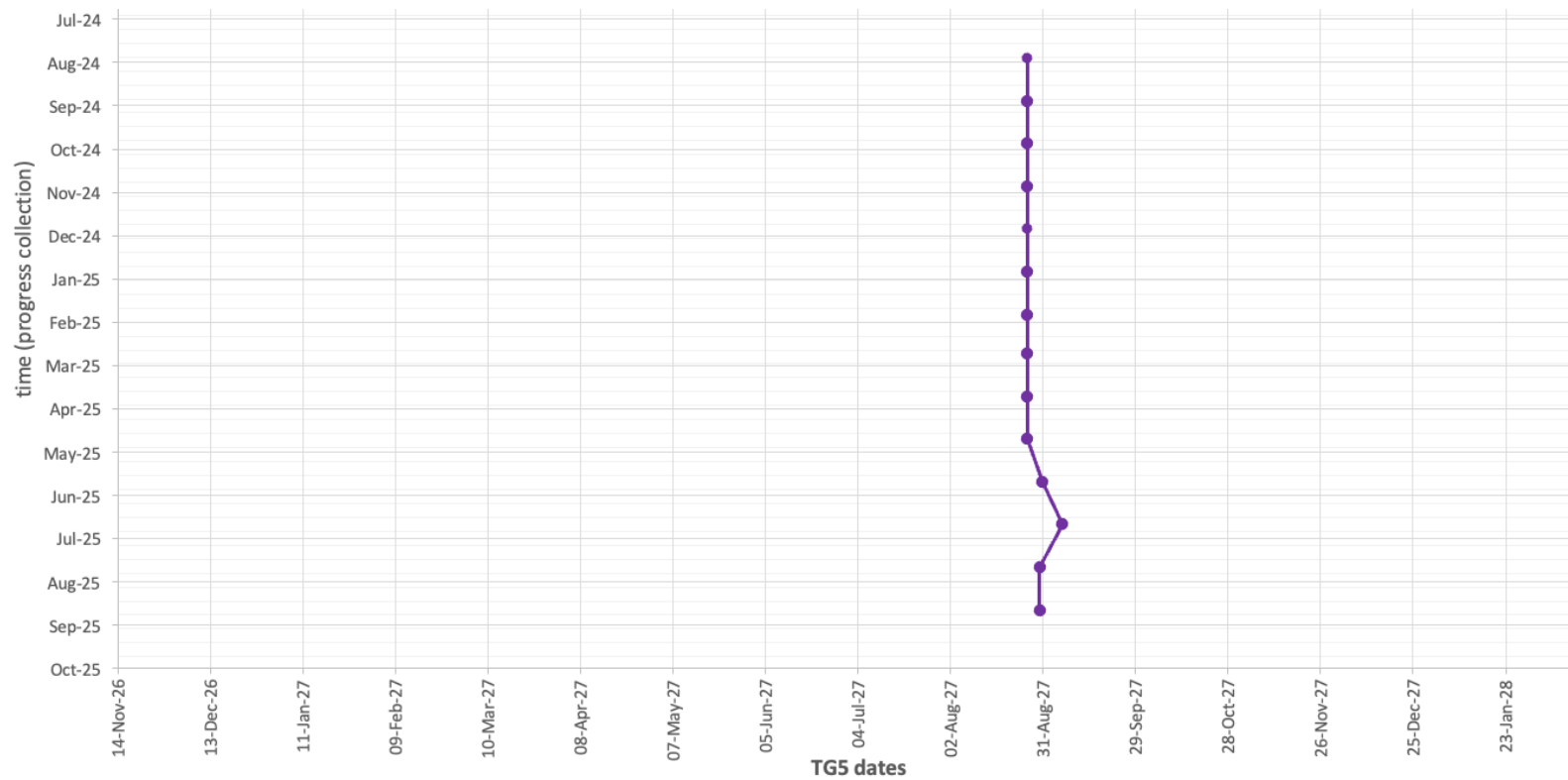


Nature Communications, 13 (2022)

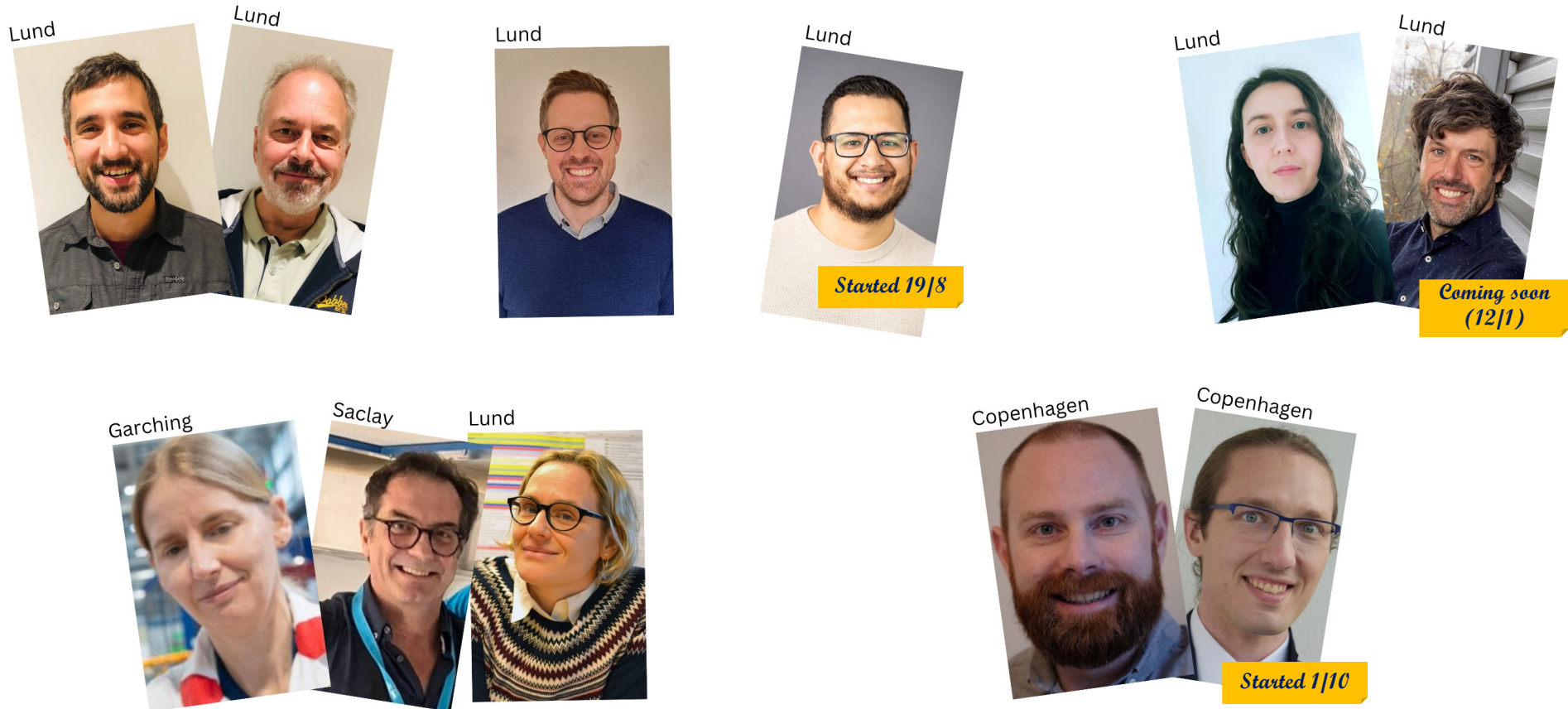
Overview & summary of the current status



TG5 slip chart



Team



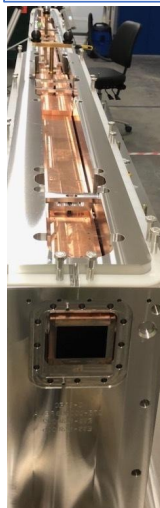
Guides & housings



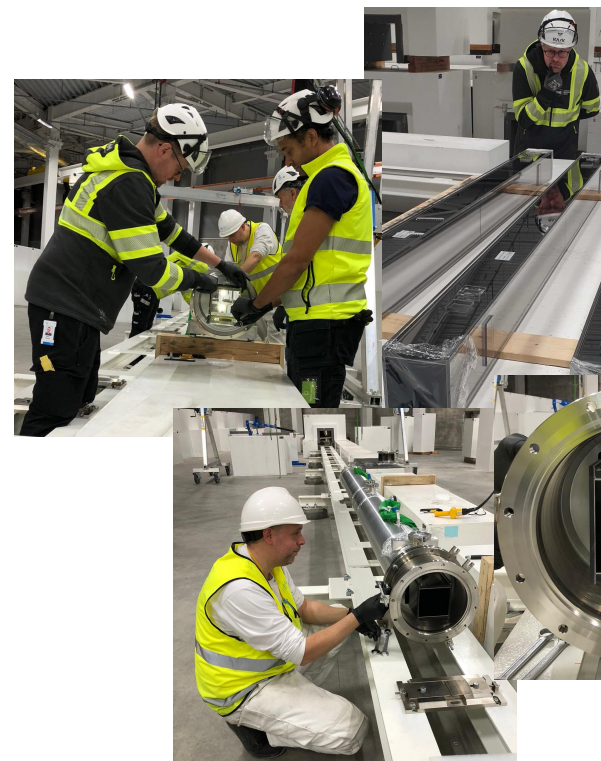
TUM in-bunker guides: installation completed



NBOA: installation completed
BBG: Installation completed
BWF: installation completed



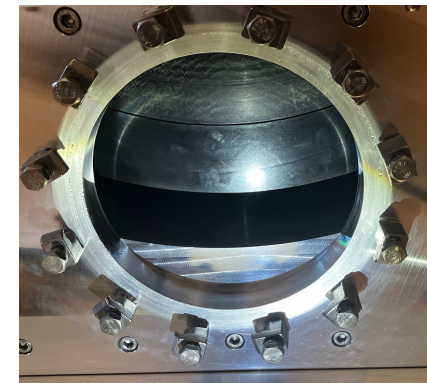
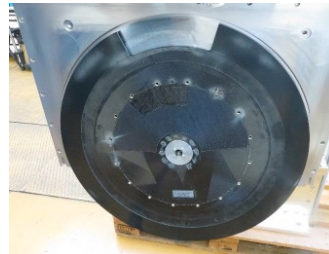
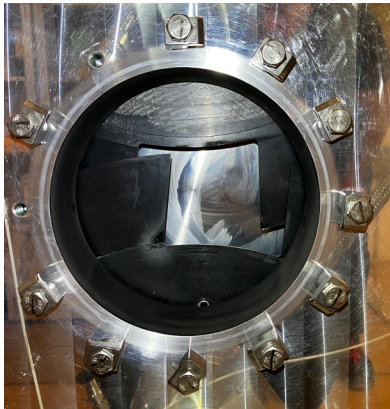
**TUM outside bunker guides:
installation → November 25**



Choppers

In-bunker: installed

Out of bunker installation: Dec 25 – March 26



Detector tank

31 March 2025



Detector tank

31 March 2025

*The first part of the
detector tank enters
through the door of E01!*



An iconic moment for CSPEC!

Detector tank

Installation, 7-11 April 2025



Detector tank

Installation, 7-11 April 2025



Detector tank

Installation, 7-11 April 2025



Detector tank



Detector tank



Detector tank shielding

Inside tank: Cd sheets (procured, to be installed in summer; sample pot shielding need more design) + borated sheets behind the detector modules (concept)

60 mm borated PE installed under the tank;

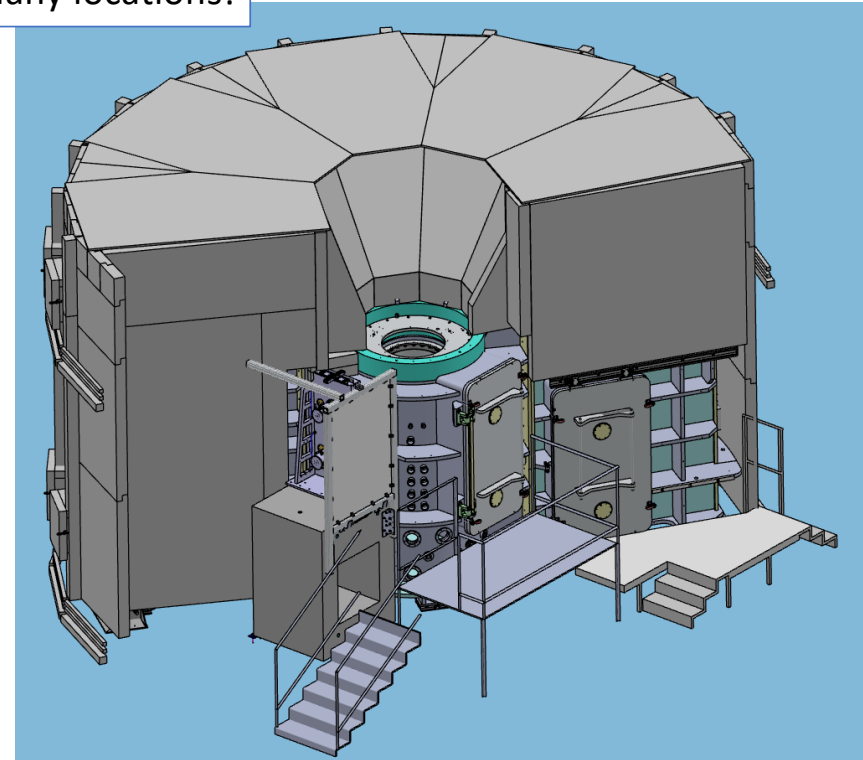
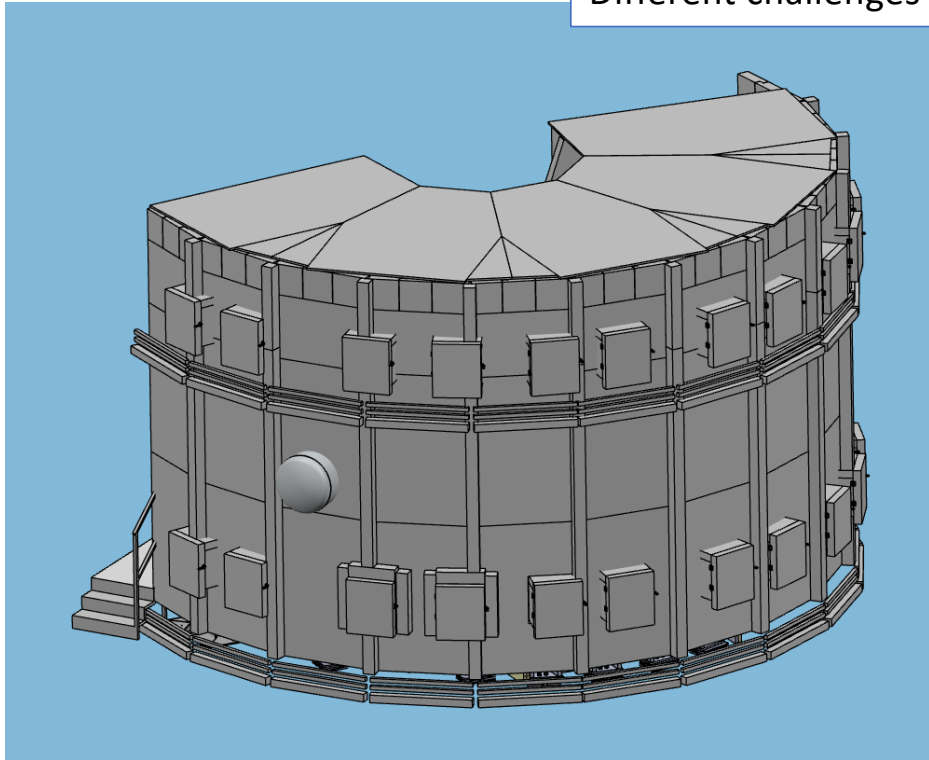
(Preliminary) Design is ongoing for side and top outside shielding (150 mm PE + B, with caveats) to request a quote. The price for the material might end up being (much?) less convenient than for the bottom part. Regular PE + borated sheet (initially discarded because of the cutting cost and relatively cheap material)? ESS stepping in?



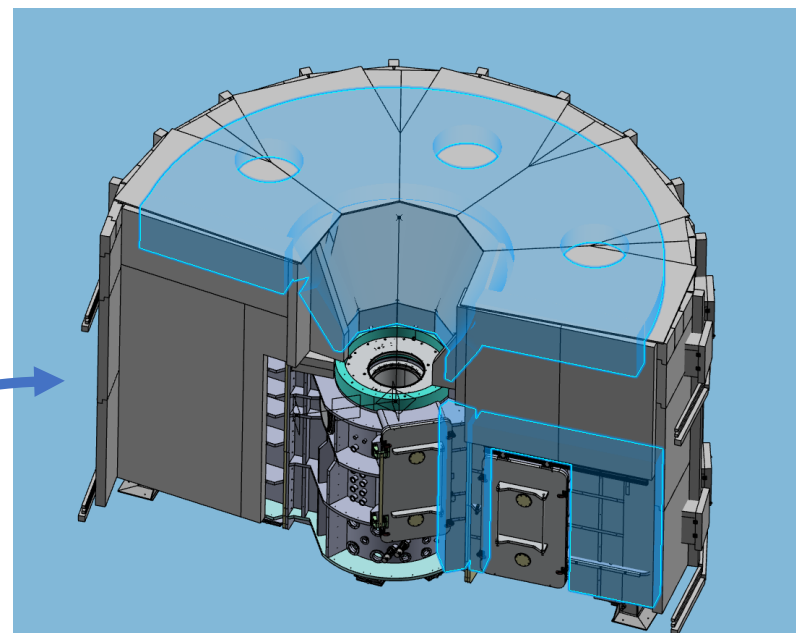
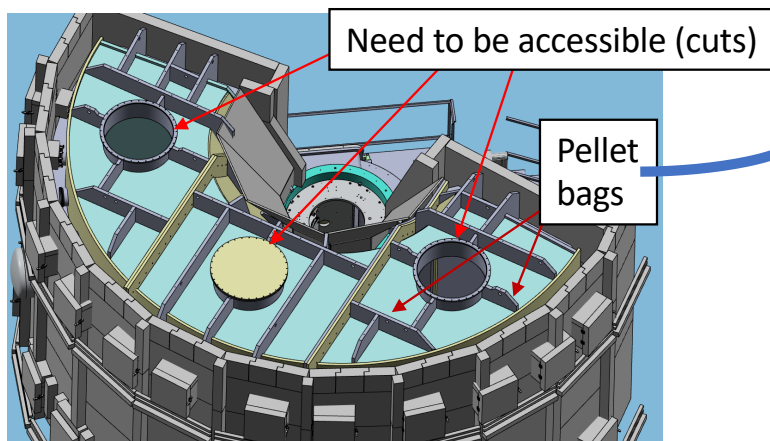
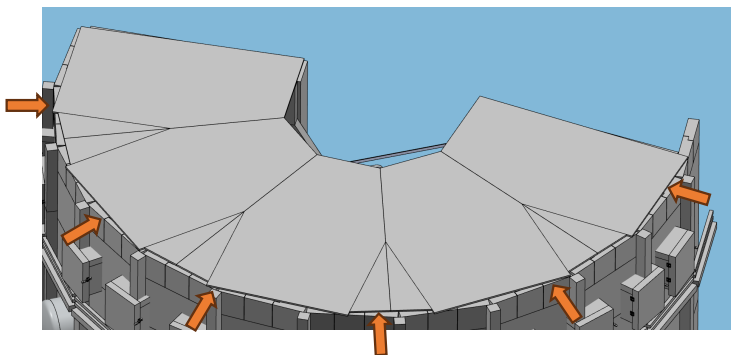
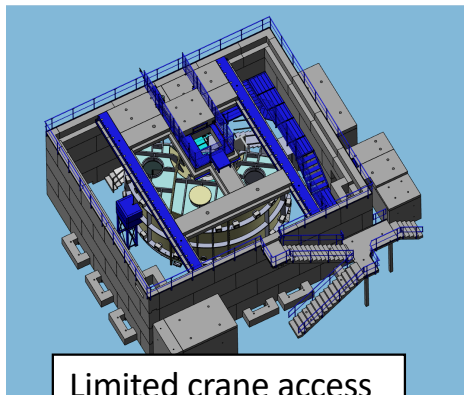
Detector tank shielding

Preliminary design side and top

Different challenges at many locations!



Detector tank shielding



Detector

MT modules delivery schedule (ILL):

- 1(2?) MT module → April 2026 (tests@ILL, next reactor cycle)
- Nov 2026: MT modules 2-4
- May 2027: MT modules 5-8
- Nov 2027: MT modules 9-13

Electronics (ESS & ILL):

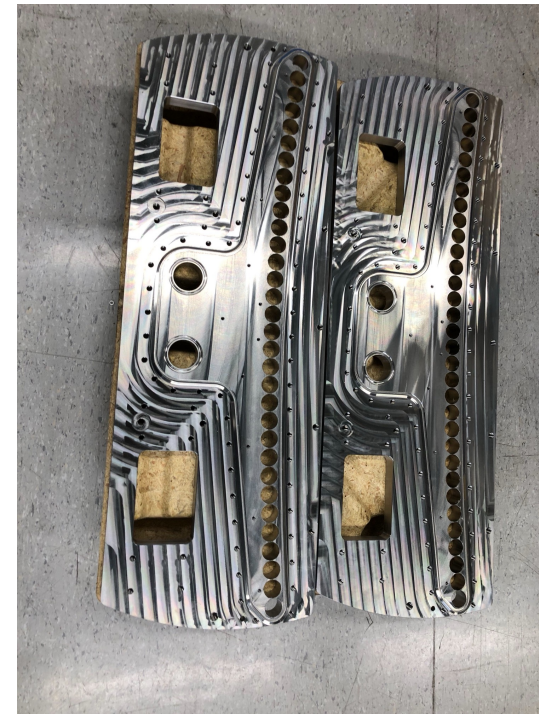
back-end electronics (ESS): data acquisition (DAQ) system, Readout Master Module, and high voltage are ready.
Low voltage for preamplifiers (ILL): March 2026.

Integration (CSPEC team)

Ongoing work to be ready for the first module on site

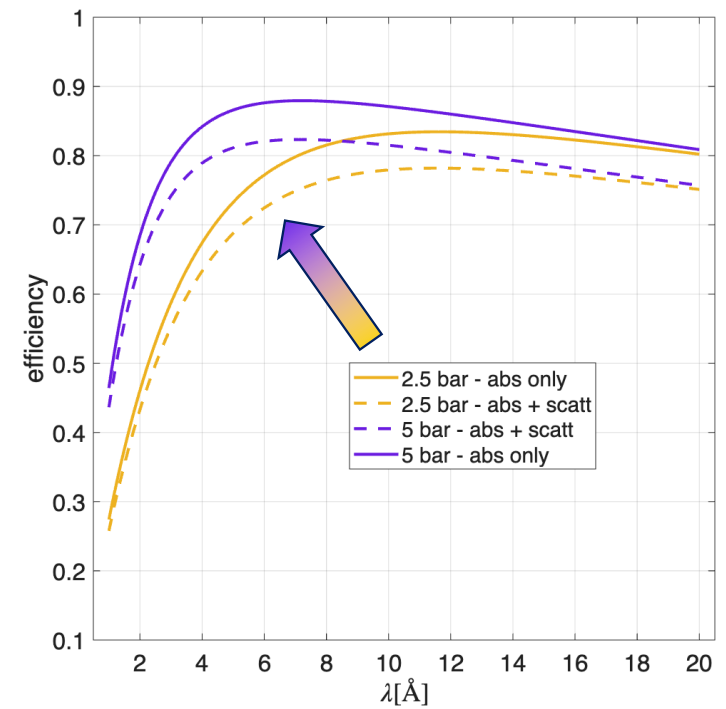
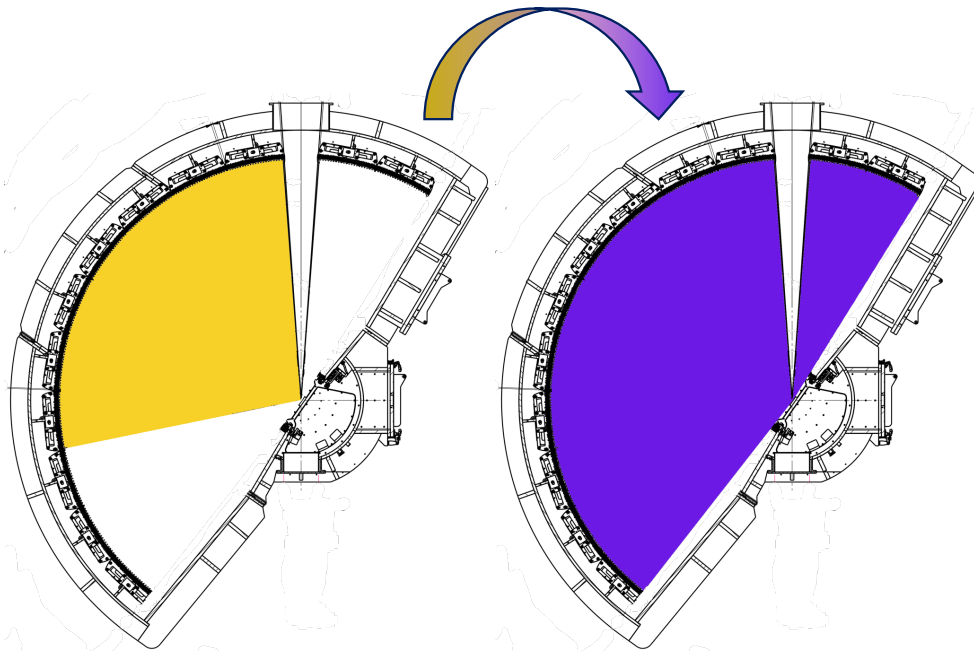
Gas handling system (ESS)

Expected in February 2026 (Siga GmbH)



Detector

Air Liquide will provide 3600 l of ^3He ($\sim 6.7 \text{ M€}$) $\rightarrow$ 5 bar of $^3\text{He}+\text{Ar}/\text{CO}_2$ for full detector coverage



Detector

Ourania Sidiropoulou (^3He -detector responsible)
left the ESS. Replacement on-going.

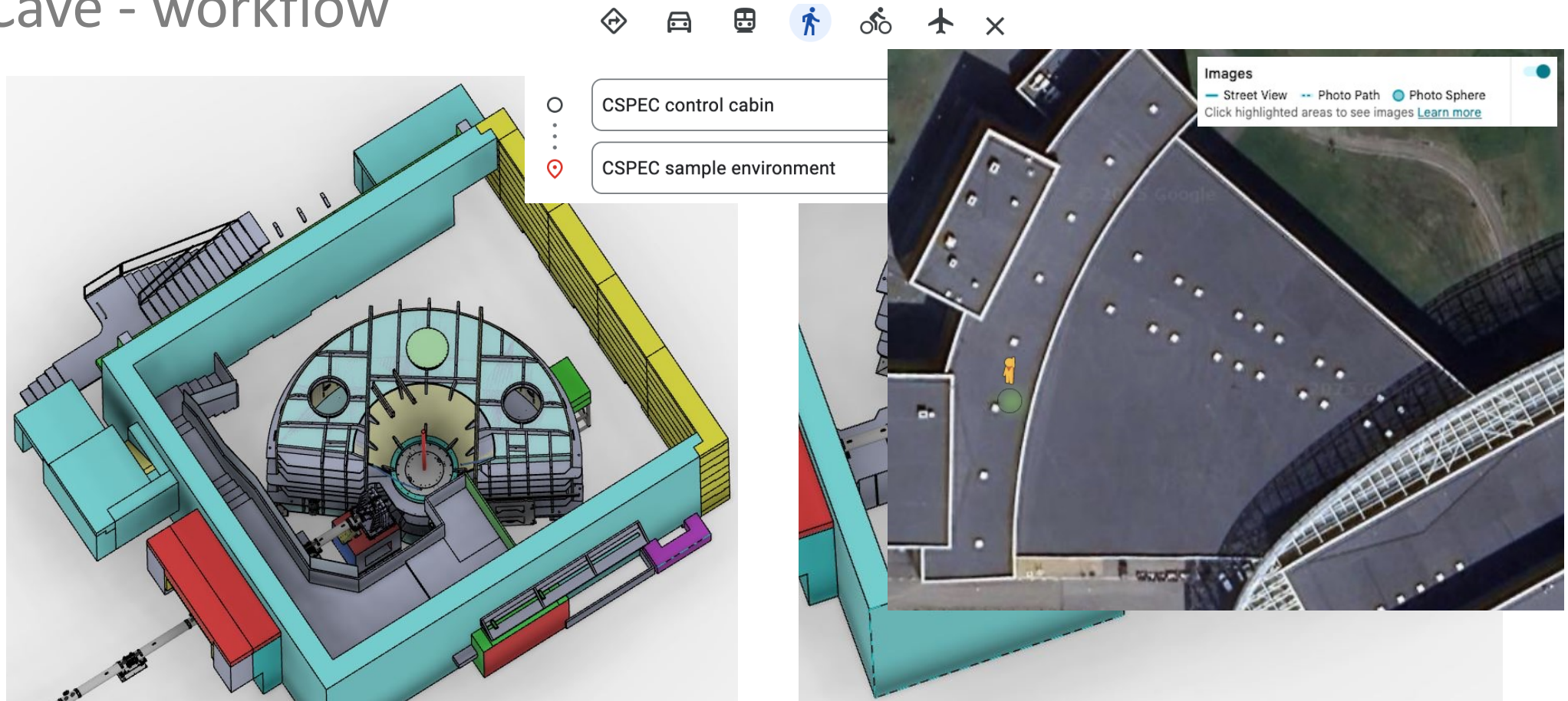


Cave and control cabin



Installation almost completed

Cave - workflow



Cave - workflow

Top access

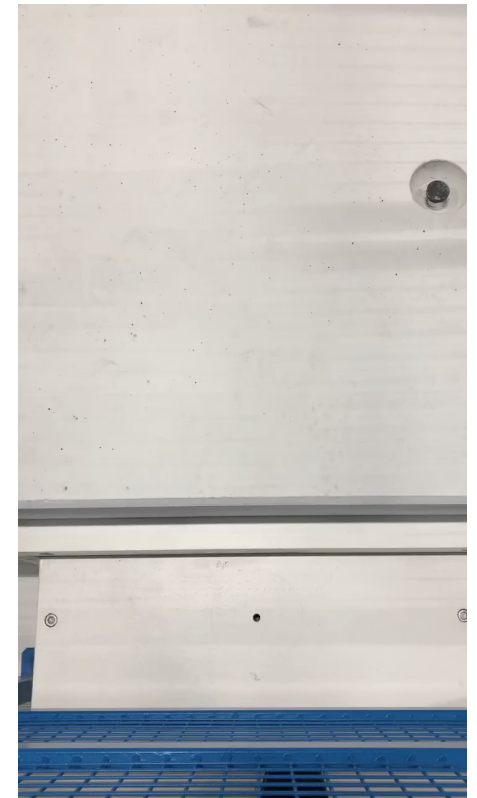
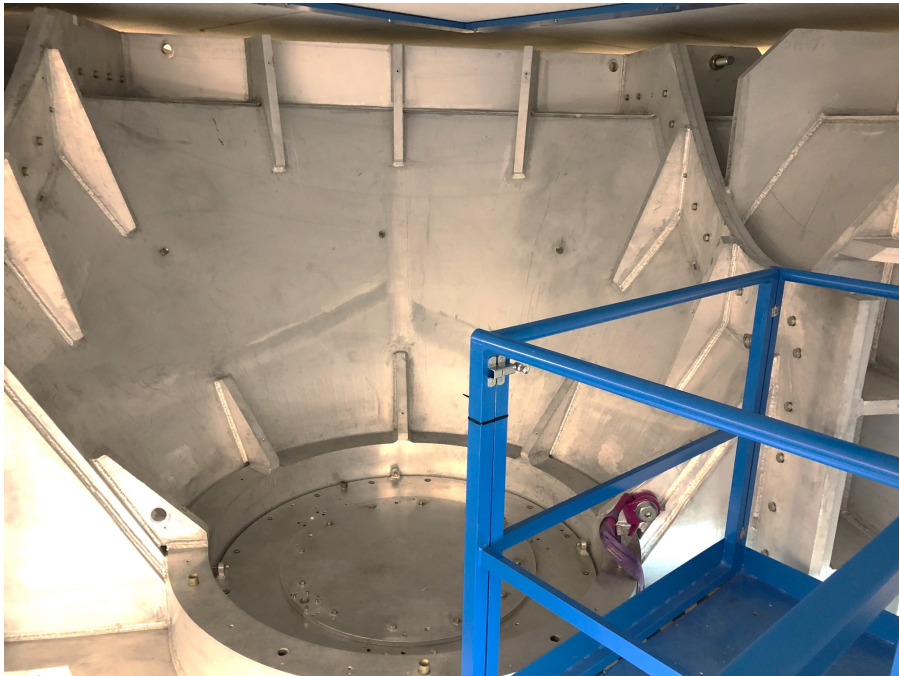


Separated searching zone



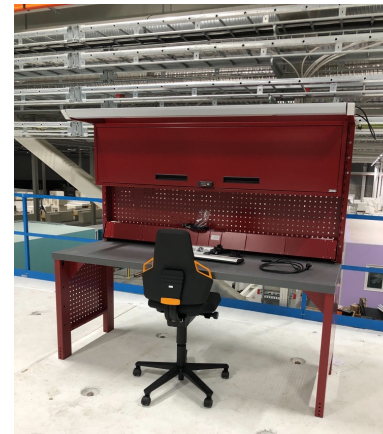
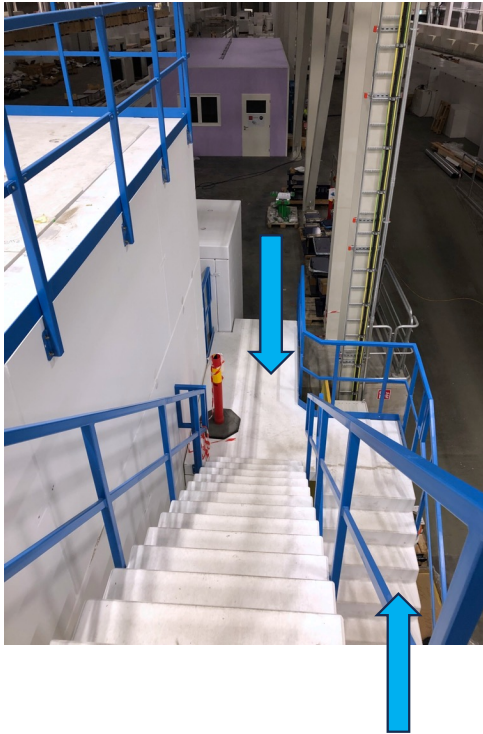
Cave - workflow

Top access



Cave - workflow

Access to the roof



Cave - workflow

Side access



Cave - workflow

Side access – shortcut



The overpass would also make easier sharing workshop spaces between the two instruments.

Cave - workflow

Side access



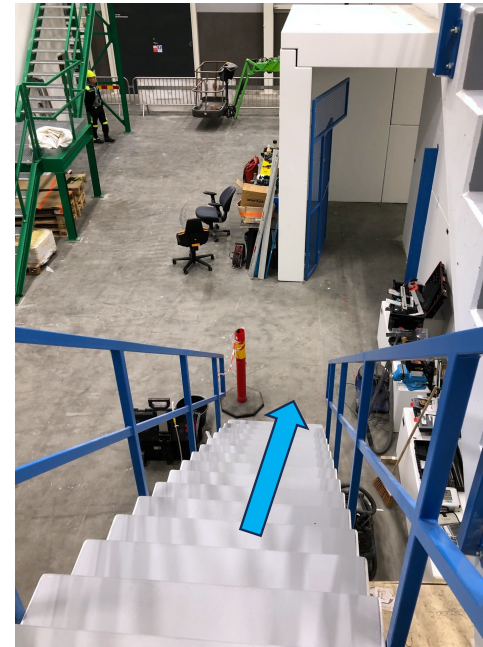
Sample pot, detector modules,
choppers, guides...

Separated searching zone



Cave - workflow

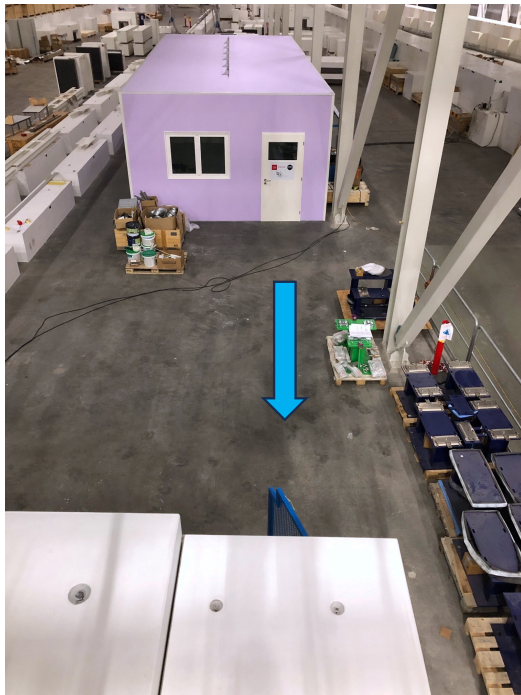
Back access via chicane



Separated
searching zone

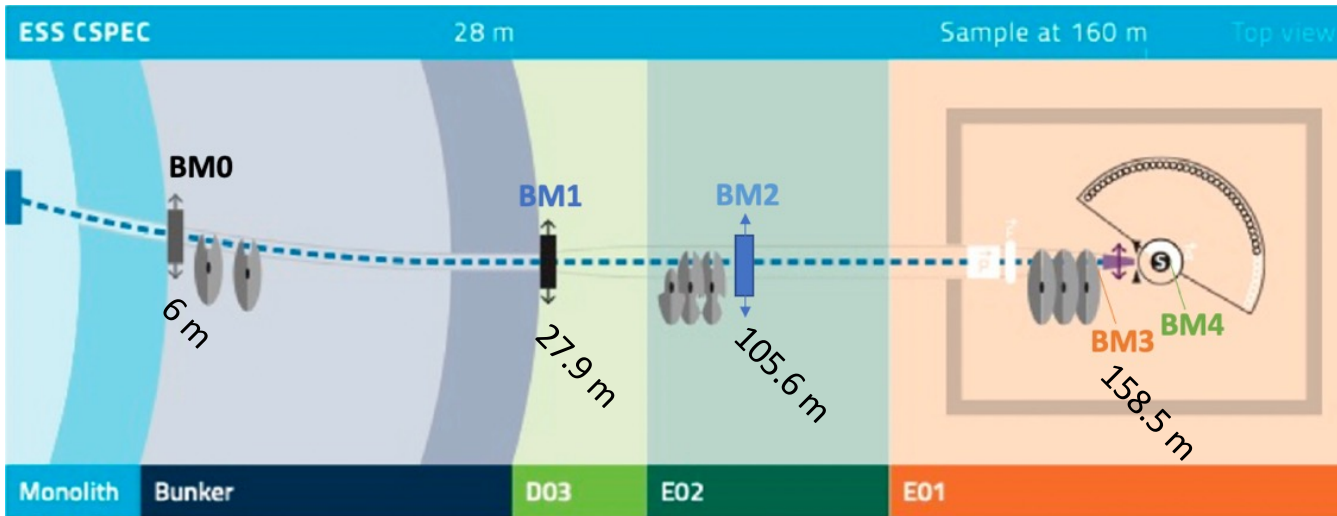
Cave - workflow

Back access from E02



Search on the top part too

Monitors (common project)



Advanced requirements defined with BM scientist; good communication with detector scientist (Ioannis) and engineer (Antoine).

Waiting for official offer (priority on earlier instruments).

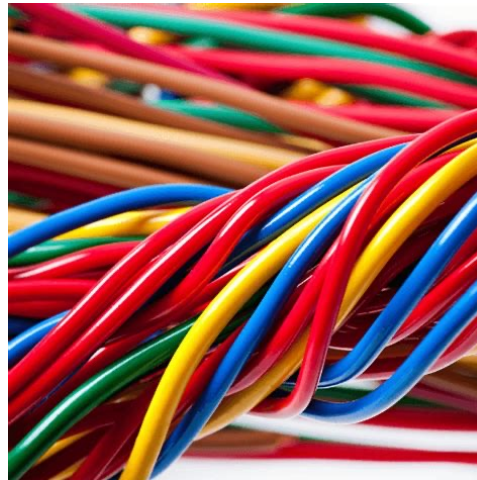
Integration work ongoing for shutter (BM1). Lifting mechanism for BM2 not prioritised.

- BM0 (in-bunker, fixed): ionisation beam monitor (IBM), CDT Germany. ESS scope.
- BM1 (removable, with shutter): IBM
- BM2 (removable, own lifting system) and BM3 (fixed): MicroMegas (MM), CEA, France.
- BM4 (after sample): neutron camera, shared within spectroscopy + pool BM for commissioning and maintenance. Plans for a fixed transmission monitor for polarisation analysis (not day 1).

CEP, CUP & MCA (common projects)

Preliminary meetings with requirements done. Offer received from Common Electrical Project, working towards preliminary design review. Awaiting offers from Motion Control and Automation and Common Utilities Project.

Priority on earlier instruments → possible delays.



Sample environment

For hot commissioning:

- Cryofurnace*
- Rotation stage*

For first science/start of the user program:

- 14 T magnet (shared with TREX)
- ^3He insert*
- High pressure cells (pool)
- High temperature furnaces (pool)
- Optical pump and probe setup (pool)
- Automatic sample changer* (likely later)

* CSPEC scope

Engagement with the community to expand our sample environment suite. **RÅC call proposals:**

- **TIMENESS** (LU, KTH, TU Darmstadt, University of Tübingen, ESS + ILL) → **Flow trough & microfluidic** (CSPEC, MIRACLES, LOKI)
- **TRESS** (FZJ, UMu, ESS + ILL & Tartu University) → **Upgrade and expansion of the optical pump and probe setup** (CSPEC, MIRACLES, LOKI)
- **AquaScatt** (TUM, UU, KTH, ESS) → **Temperature and humidity control + in situ IR/Raman** (CSPEC)

Other components

- **Shutter:** prototype produced and tested; working on some corrections.
- **Radial oscillating collimator:** at the ESS (installation planned: May 2026). Collimator drive is in preliminary design stage; detailed/manufacturing design will be outsourced to an external company.
- **Guide exchanger:** assigned to Jackson
- **Focussing nose:** on hold
- **Collimation slits:** on hold
- **Fast chopper ballistic protection:** on hold
- **Sample environment support stack:** on hold
- **Primary spectrometer shielding:** installation in November; in cave shielding of the guides on hold (possible clash with PA requirements)

Possible post TG5 components

- Focussing nose
- Side and top PE
- Detector modules 2-13
- Collimator drive
- “Later” SE (cfr SE slide)



By unlinking these components from TG5 date **and if** we manage to anticipate some activities from common projects, we could start hot commissioning at least 1-2 months earlier.



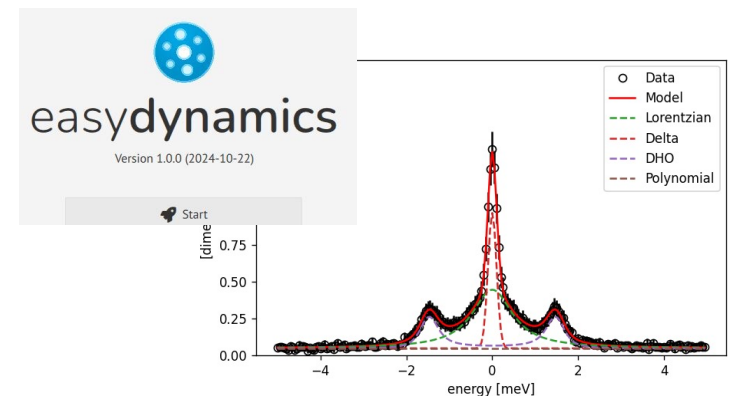
To ensure first science/user program with a complete instrument, resources need to be available after TG5.

Data acquisition and analysis

Different fronts: data acquisition, reduction, analysis, complementary simulations, user-friendly McStas model...

Avoid reinventing the wheel: building from work on other instruments, “stealing” from different sources, updating and adapting to specific needs and wishes, trying to be flexible.

Working together with DMSC and other spectroscopy instruments, but also external collaborations (ILL, RUC, LU, FZJ...).





Thanks!

