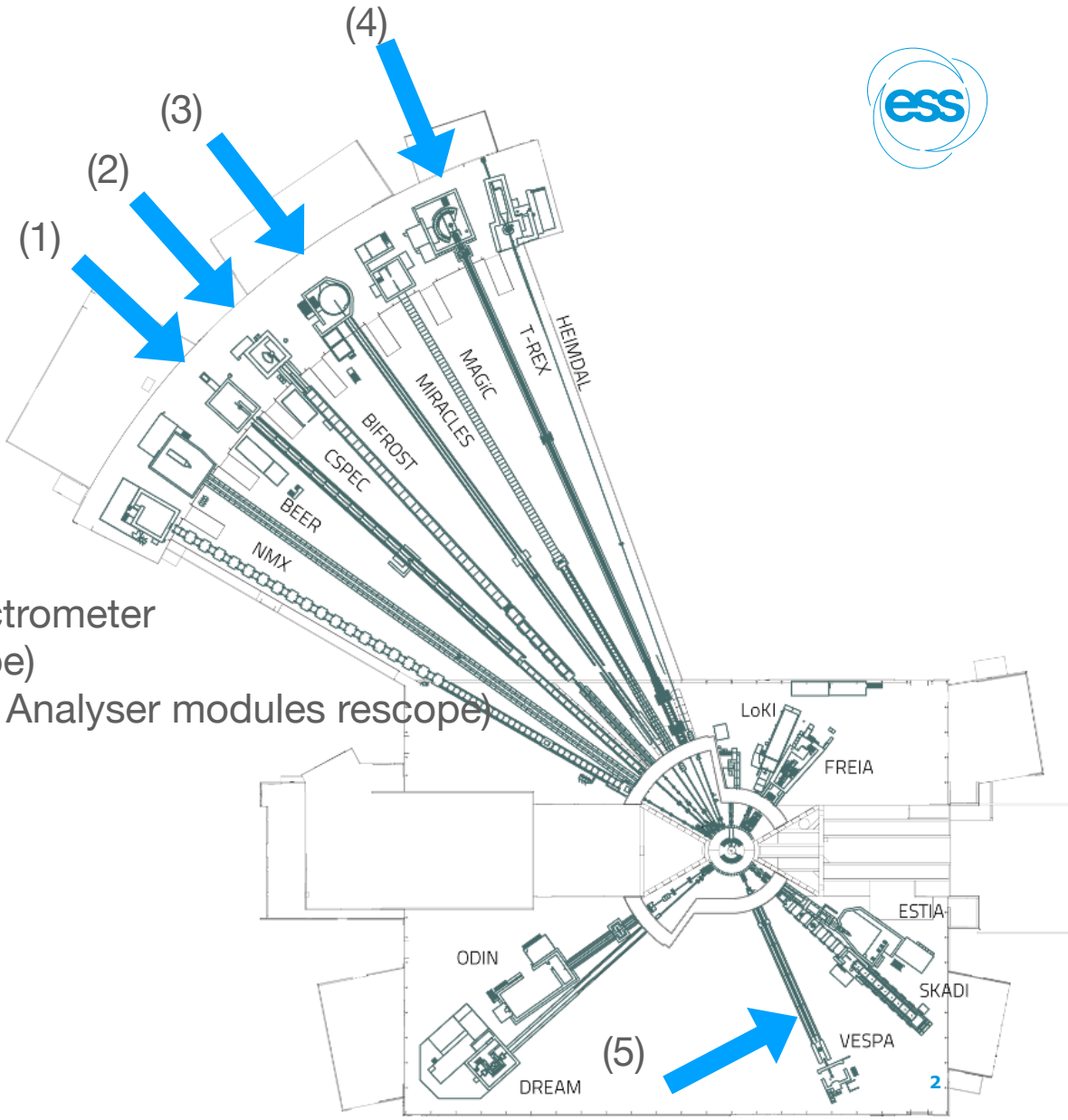
STAP Spectroscopy overview

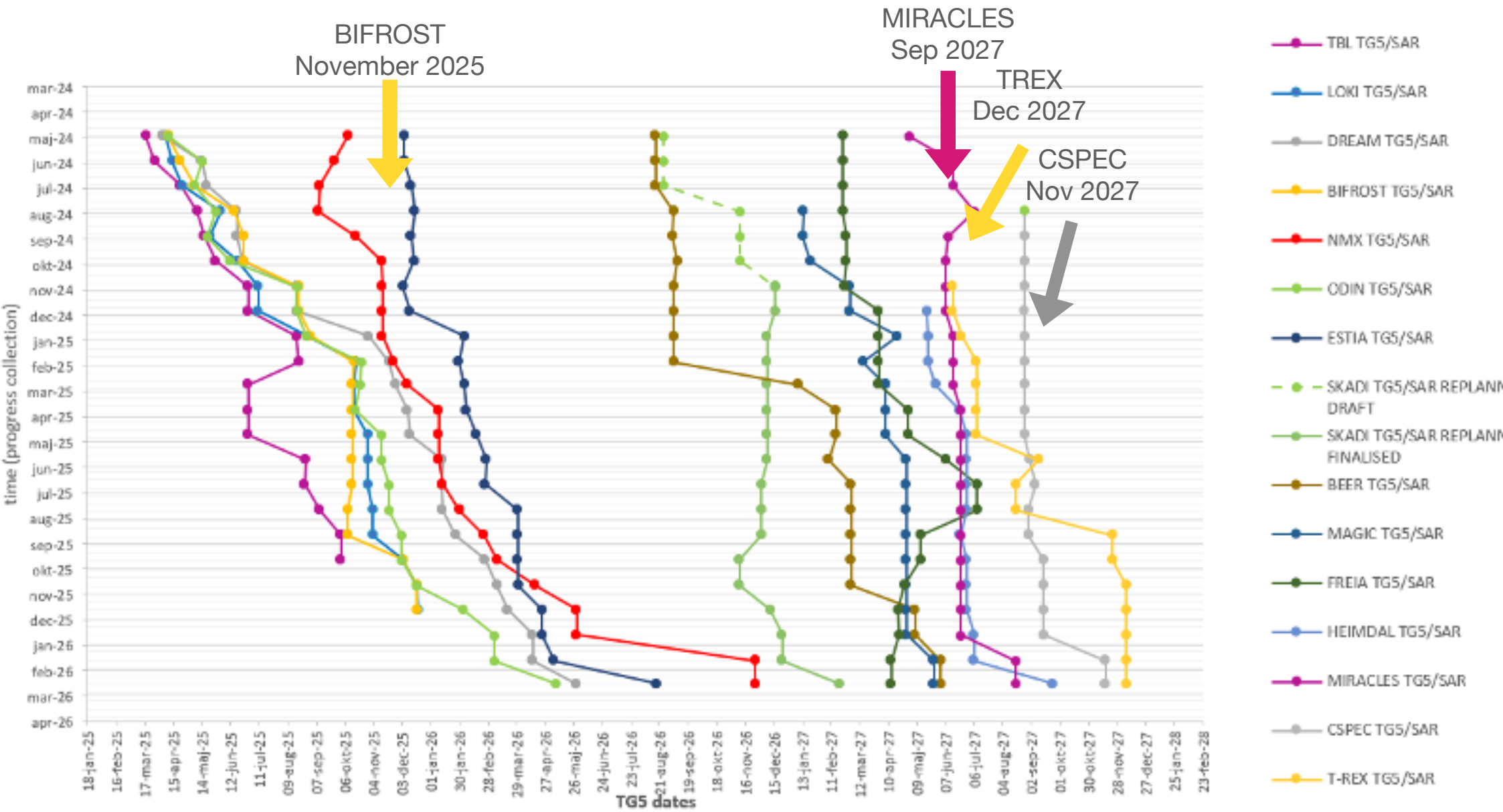
April 2026: Heading towards BOT

PASCALE DEEN

Spectroscopy division

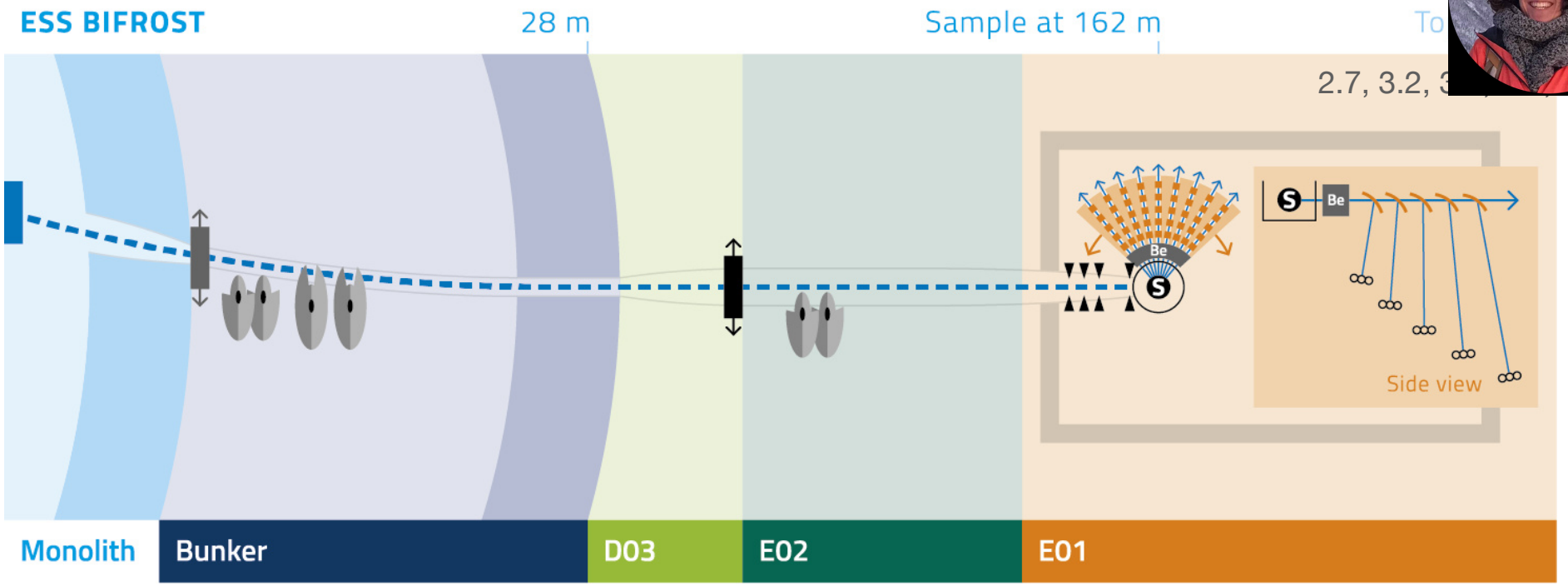
1) CSPEC Cold chopper spectrometer (Rescoped)
2) BIFROST Extreme Environment Spectrometer
3) MIRACLES High resolution Backscattering spectrometer
4) TREX Bispectral chopper spectrometer (Rescope)
5) VESPA Vibrational Spectrometer (Rescoped T0, Analyser modules rescope)




BIFROST
November 2025
MIRACLES
Sep 2027
TREX
Dec 2027
CSPEC
Nov 2027
time (progress collection)
mar-24
apr-24
maj-24
jun-24
jul-24
aug-24
sep-24
okt-24
nov-24
dec-24
jan-25
feb-25
mar-25
apr-25
maj-25
jun-25
jul-25
aug-25
sep-25
okt-25
nov-25
dec-25
jan-26
feb-26
mar-26
apr-26
18-jan-25
16-feb-25
17-mar-25
15-apr-25
14-maj-25
12-jun-25
11-jul-25
09-aug-25
07-sep-25
06-okt-25
04-nov-25
03-dec-25
01-jan-26
30-jan-26
28-feb-26
29-mar-26
27-apr-26
26-maj-26
24-jun-26
23-jul-26
21-aug-26
19-sep-26
18-okt-26
16-nov-26
15-dec-26
13-jan-27
11-feb-27
12-mar-27
10-apr-27
09-maj-27
07-jun-27
06-jul-27
04-aug-27
02-sep-27
01-okt-27
30-okt-27
28-nov-27
27-dec-27
25-jan-28
23-feb-28
TG5 dates
TBL TG5/SAR
LOKI TG5/SAR
DREAM TG5/SAR
BIFROST TG5/SAR
NMX TG5/SAR
ODIN TG5/SAR
ESTIA TG5/SAR
SKADI TG5/SAR REPLANN DRAFT
SKADI TG5/SAR REPLANN FINALISED
BEER TG5/SAR
MAGIC TG5/SAR
FREIA TG5/SAR
HEIMDAL TG5/SAR
MIRACLES TG5/SAR
CSPEC TG5/SAR
T-REX TG5/SAR

BIFROST: Extreme environment spectrometer

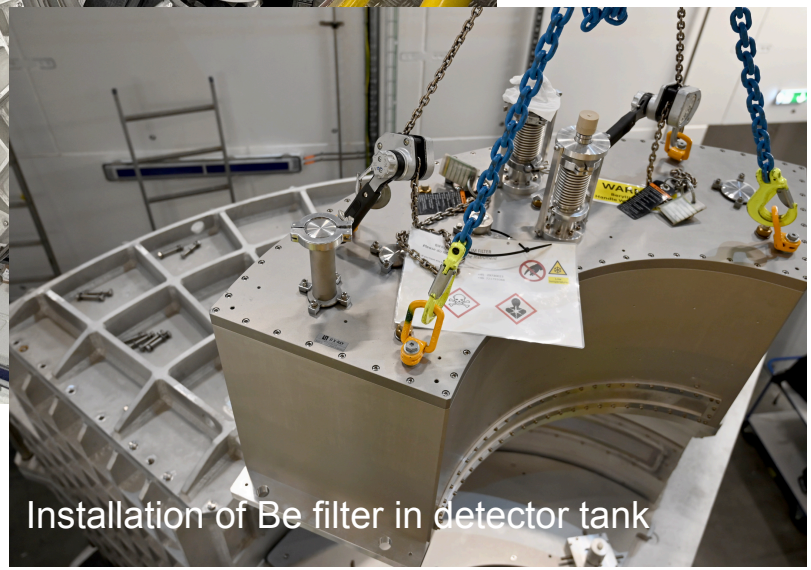
Scientists: Rasmus Toft-Peterson (ESS/DTU), Lukas Beddrich, Data Scientist: Greg Tucker
IOE: Manon Chesneau



λi = 1.5-6 Å
Radius of curvature = 1500 m: 1 x out of line of sight (Prior to bunker wall)
Bandwidth = 1.7 Å
Sample = 1 x 1 cm^2 - 0.1 x 0.1 cm^2
Horizontal 7 - 135°, Vertical angular coverage = ±1.4°

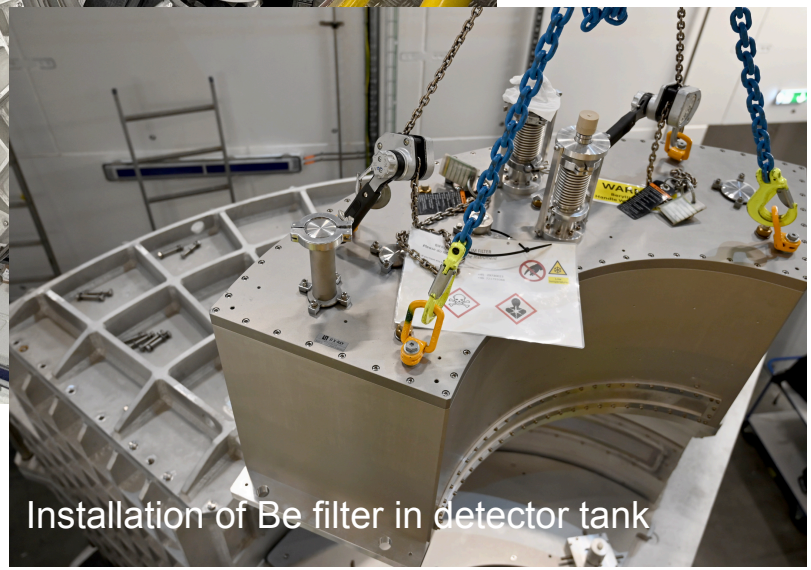
BIFROST: Extreme environment spectrometer
Progress April 2025:


Installation of detector tank in final position


Installation of Be filter in detector tank

BIFROST: Extreme environment spectrometer
Progress April 2025:


Installation of detector tank in final position

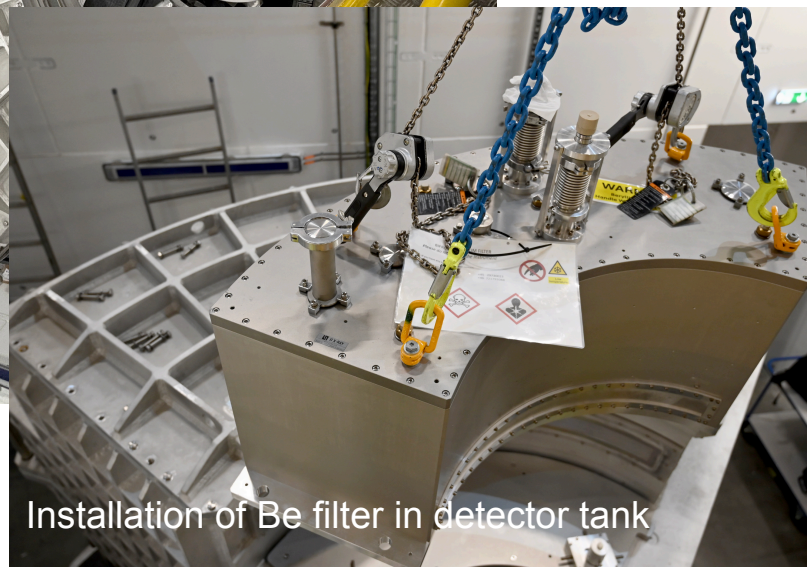

Installation of Be filter in detector tank

- Bifrost is fully energised (except 1 Vacuum rack)
- Local motion testing started
- Integrated testing completed June 2025:
  - Beam attenuation, divergence jaws and sample slits
  - Tank and sample stack motion, filter temp. readout
  - Monitors
  - Choppers
  - Miscellaneous (pressure gauges, pump control etc)
  - Sample environment

- Shutter, hatch and PSS testing: technology groups & PSS.
- Prepare documentation for TG5

BIFROST: Extreme environment spectrometer
Progress April 2025:


Installation of detector tank in final position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- Shutter, hatch and PSS testing: technology groups & PSS.
- Prepare documentation for TG5

Installation to do:

- Polyethylene installation
- Cave roof completed
- Installation of cryogenic lines & workstation for sample mountin
- Fire suppression installation (some concern).

Completed TG5 - from construction to ready for hot commissioning

TG5 December 2025:

Internal ESS review of instrument components.

Conventional safety and radiation safety.

NSS instrument tracker of remaining issues.

Completed TG5 - from construction to ready for hot commissioning TG5 December 2025:

ESS neutron rainbow instrument BIFROST ready to receive neutrons

FEBRUARY 4, 2026

BIFROST spectrometer tank and sample position seen from above. Image: Ulrika han

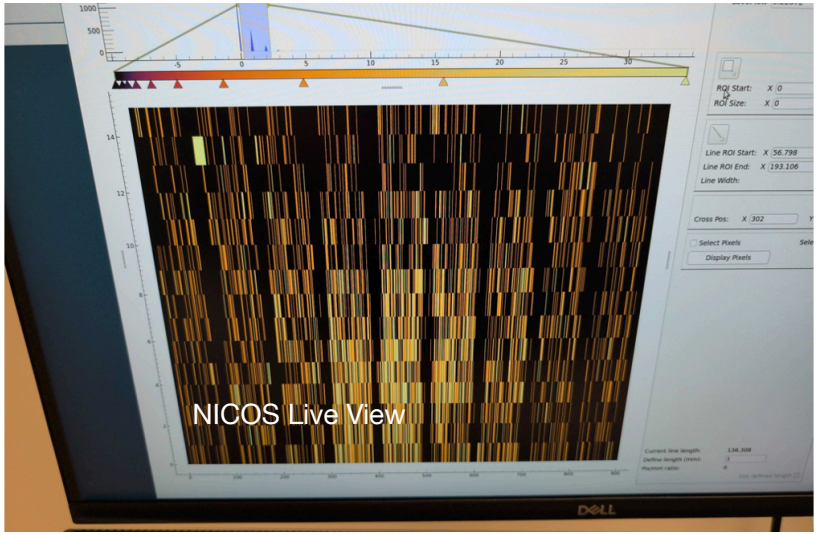
Ready for hot commissioning but …

General tasks for both IOE and scientists prior to BOT (not exhaustive):

1. Implement grounding solution on detector system + associated test report documentation
2. Documentation that remains to be released post TG5: Shielding report, SAT, TRA, shutdown sequence
3. Finalize monitor system SAT tests
4. Integrated testing of monitor system
5. Final test of the entire detector system, long term stability
6. Resolve sample handling strategy, implement shielding and handling solutions
7. Create a synoptic monitoring page in EPICS or NICOS
8. Write a user manual for BIFROST (a useful one for users)
9. Magnet force testing with sample environment
10. Work with sample environment to facilitate EPICS integration and redo integrated test of sample environment
11. Cable management for sample environment & cave roof space management
12. Establish access to local crane
13. Design and build a detector extraction system for the detector modules under the BIFROST tank
14. Work with Hall managers and IOEs to establish user support procedures
15. Clarify the use of EAM in operation + SSCI2S registration in EAM
16. Define a full system ownership of the different subsystems on the instrument and the responsibilities
17. Help facilitate remote access
18. Learn how to use NICOS
19. Facilitate local printing via IT
20. Clarify how to deal with configuration control management
21. Help sort out the messy workspace around the BIFROST guide + manage the storage of surplus (inventory)
22. Finalize establishing our local workshop/ Establish a work bench for sample handling
23. Get access to and learn how to use the chemical labs (sonicators, solvents, fume hoods, gloveboxes)
24. Learn how to use the Laue camera, and help facilitate a user access strategy
25. Help onboard Lukas Beddrich (second scientist on Bifrost)
26. And likely many more things that will come up

Data pipeline (April 2025): end to end with AmBe source

Detector group, FPGA, NITIS, ECDC, IDS, IS.
Data acquisition from all ^{3}He detectors
Live screened in Nicos and recorded on Nexus file (DMSC)



First End-to-End Neutron Data Flow Test Successfully Conducted

DECEMBER 17, 2024

ESS has successfully completed its first integration test of the entire neutron data acquisition system, connecting a BIFROST neutron detector module to the ESS timing system and control network.

Thermalised neutron events were detected, processed, and stored, marking a significant milestone in ESS commissioning efforts.

Data pipeline (April 2025): end to end with AmBe source

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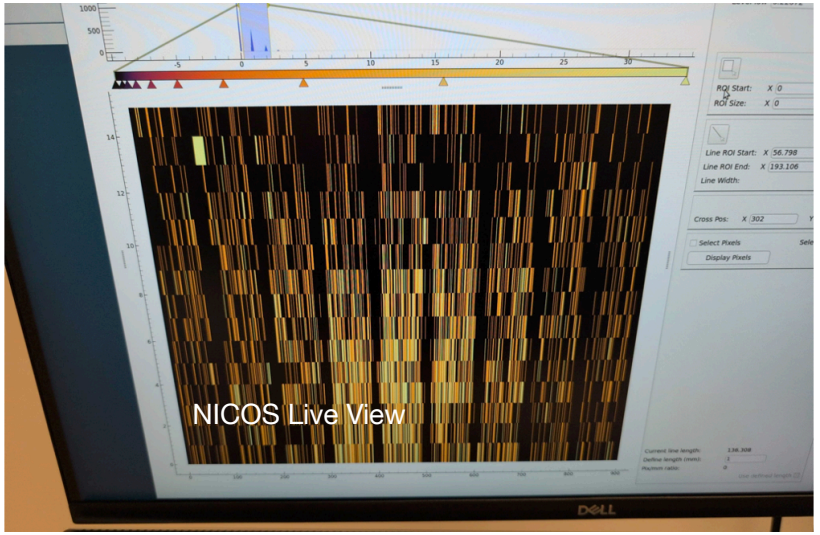

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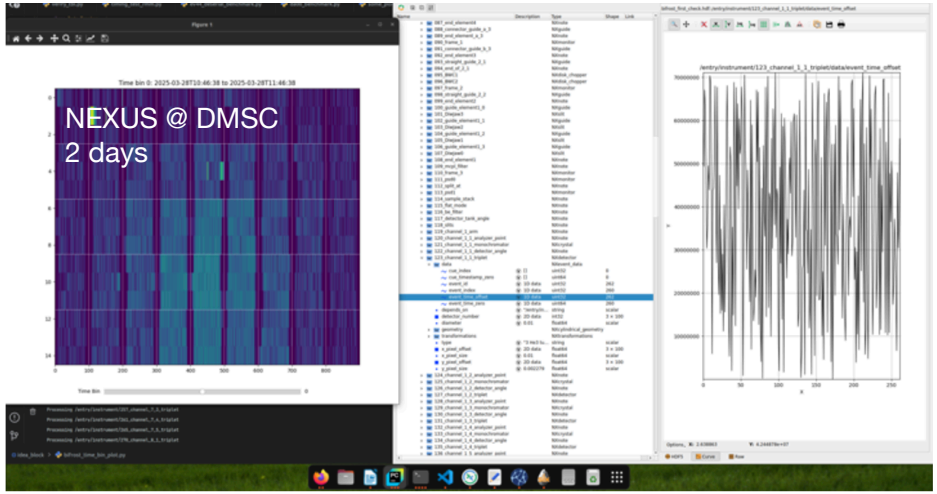
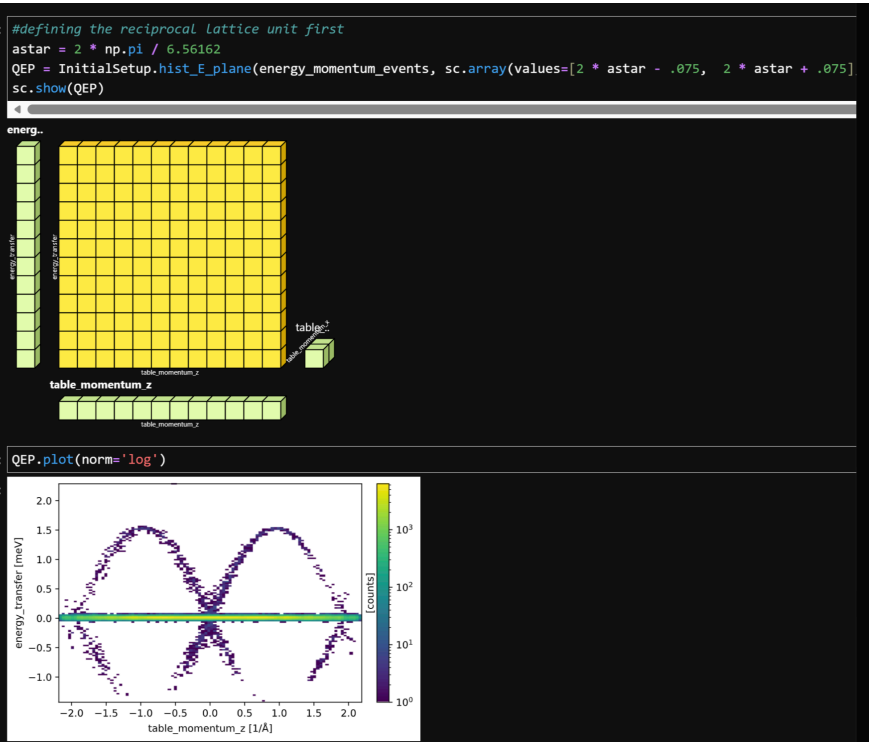


- BIFROST detector tests at ESS
  - data through to NeXus files at DMSC
  - (un)expected artifacts highlight need for flexible tools

HERCULES: Focus on data acquisition & analysis

HERCULES
European School

```
[57]: #defining the reciprocal lattice unit first
      astar = 2 * np.pi / 6.56162
      QEP = InitialSetup.hist_E_plane(energy_momentum_events, sc.array(values=[2 * astar - .075,  2 * astar + .075]
      sc.show(QEP)
```



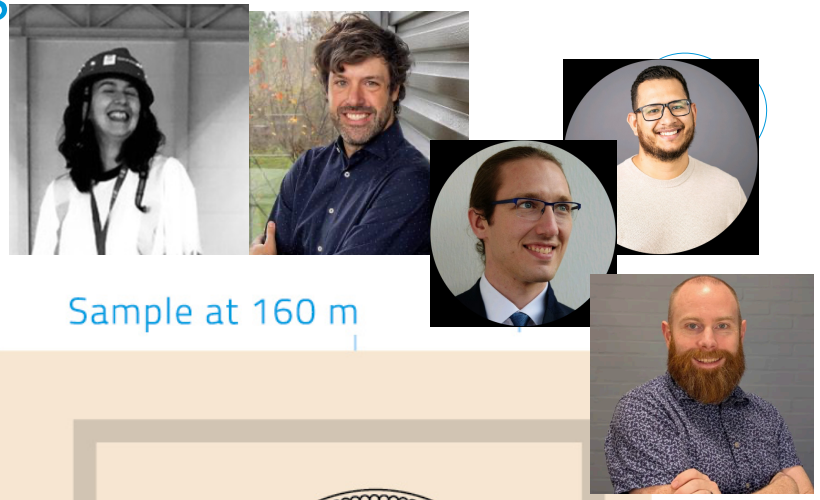

```
[58]: QEP.plot(norm='log')
```


BIFROST: Use DMSC/ECDC infrastructure on instrument to ‘measure’ a phonon and determine lifetime broadening.

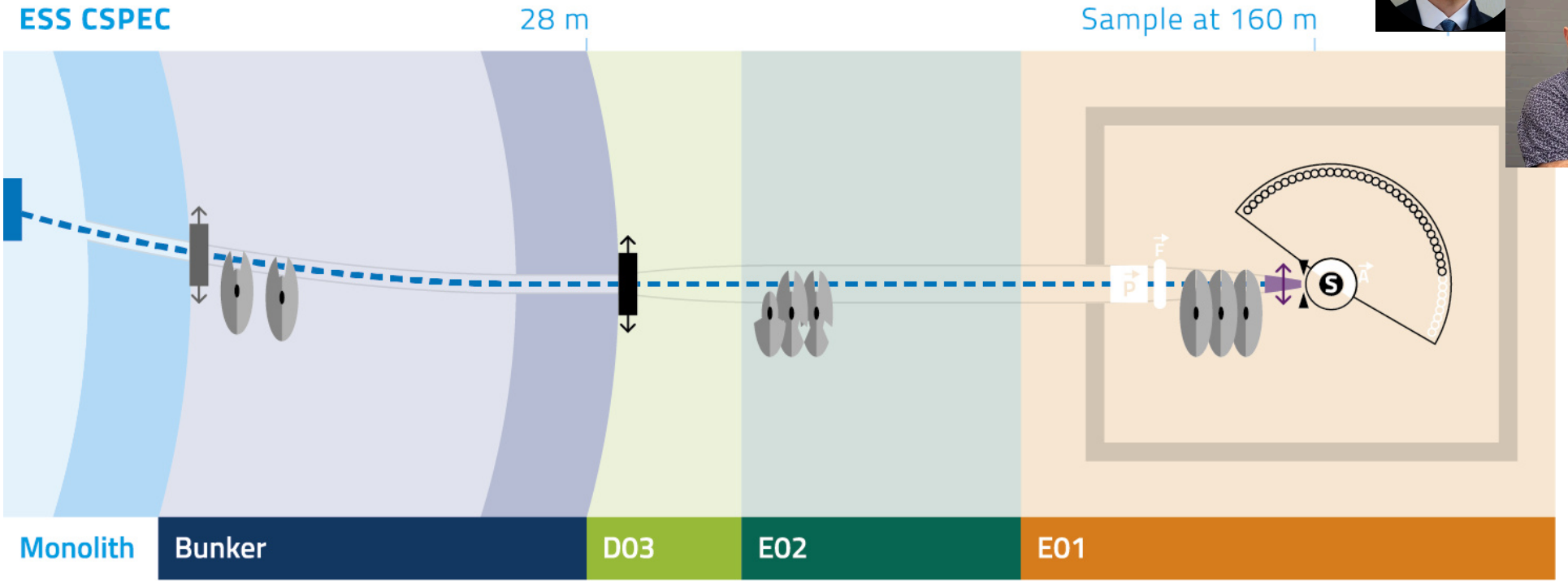
NICOS, VISA, Jupyter notebook, SCIPP

CSPEC: The cold chopper spectrometer of the ESS

Lead scientists: Daria Noferini (ESS), ScientistL Christian Balz (magnetism),
Data Scientists: Greg Tucker & Christian Beck
IOE: Jackson Da Silva
Lead instrument engineer: Fernando Moreira (ESS)



TG5: August 2027→December 2027



- Cold neutrons (2-20 Å), ΔE/E = 1.5 % @ 4 Å.
- Focus flux on range of sample areas 4 x 2 cm^2 → 1 x 1 cm^2.
- Signal to noise = 10^5 (@5 Å, Vanadium).

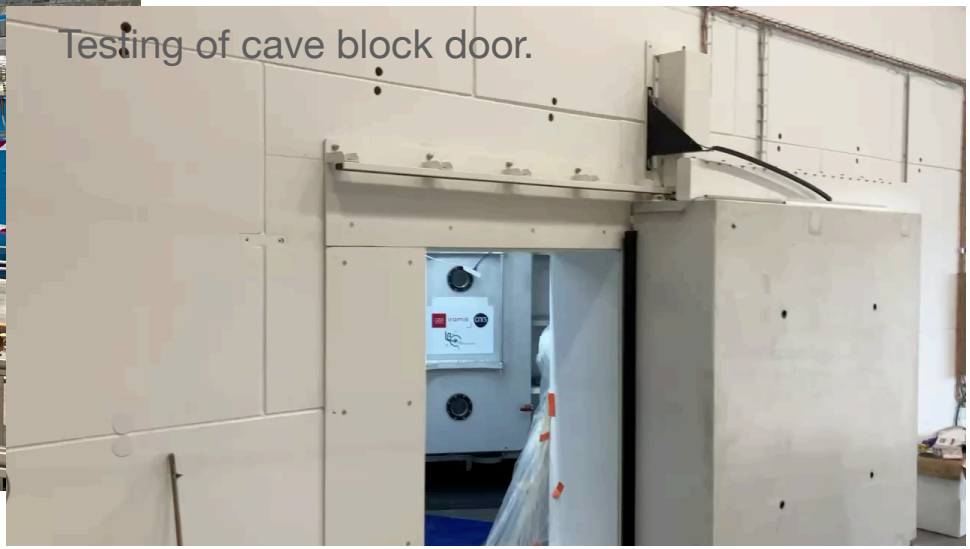
CSPEC: Cold Chopper Spectrometer of ESS (October 2025)

Completion of cave and crane installation

Installation of BW choppers in bunker.
All choppers tested and accepted

Motion control units

Testing of cave block door.



14 T magnet tendered.
Cryofurnace tendered.

RESCOPING: Full detector coverage with 5 bar ^{3}He (procured). ILL detectors under manufacturing.

CSPEC: Cold Chopper Spectrometer of ESS (April 2026)

CSPEC: Cold Chopper Spectrometer of ESS (April 2026)

CSPEC: Cold Chopper Spectrometer of ESS (April 2026)

Detector testing at ILL

Guide installation & vacuum testing.

Updating and finalising safety features on cave

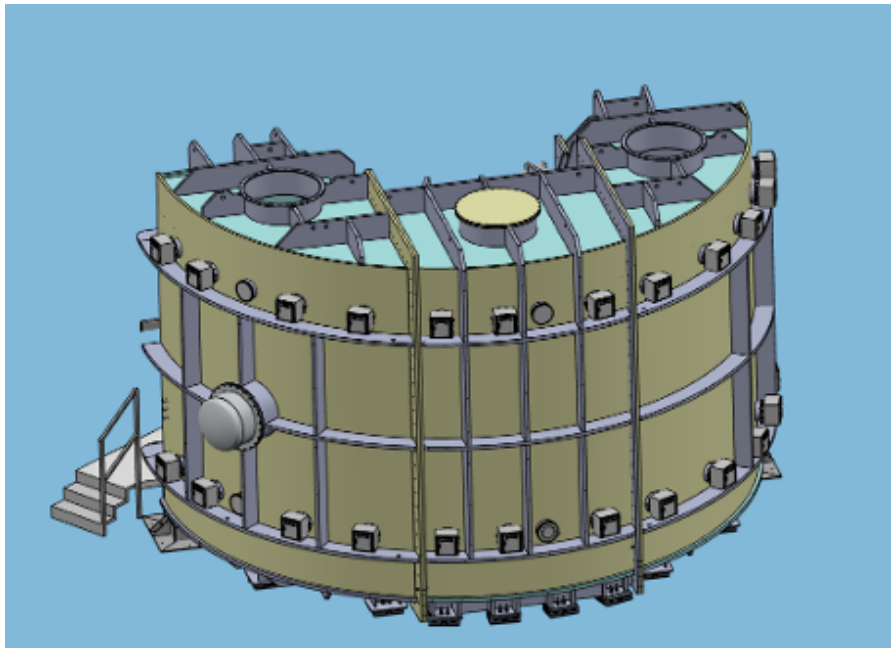
CSPEC: Cold Chopper Spectrometer of ESS (April 2026)

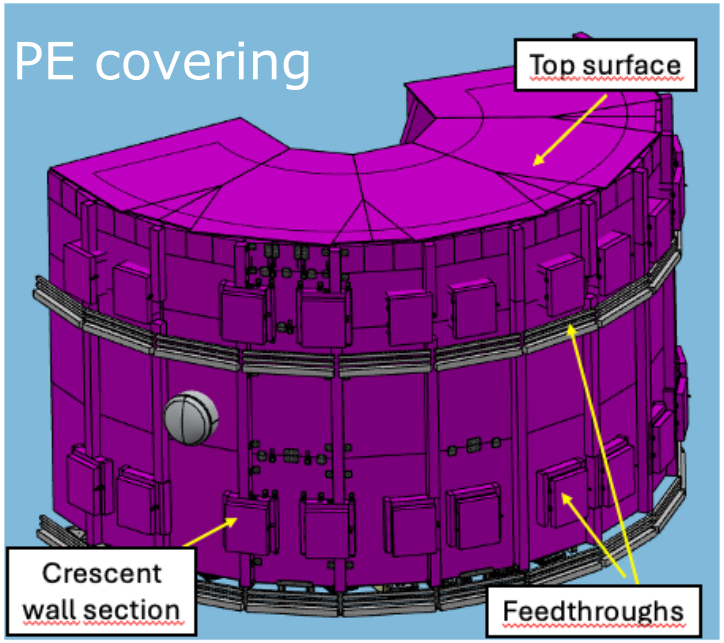
Cadmium design for installation is almost complete.
Conceptional design for guide exchanger.
PDR of electrical design approved.
Instrument Shutter updated.
Choppers (Quality gate), …

Optimise signal to noise
Borated polyethylene:

ESS approved procurement of Borated PE for CSPEC, T-REX, MIRACLES & VESPA.
Preliminary designs completed for CSPEC & MIRACLES.

CSPEC Detector Tank

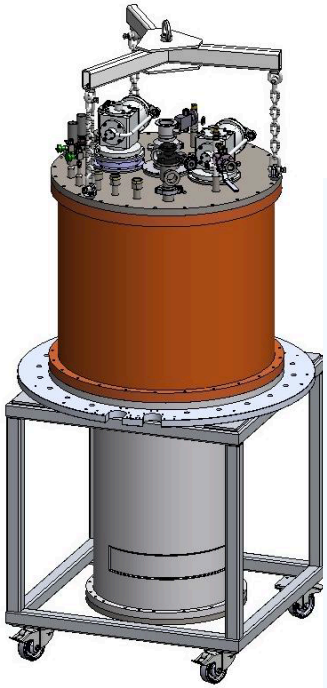




14 T magnet for CSPEC & T-REX

Second-generation high-temperature superconducting (HTS) wire.

Future opportunities B → 20+ T



Preliminary design

Based on:
12 T magnet © ILL.

Maximized Detector Coverage:
Split-pair geometry features $-36° < \theta_H < +144°$ and $-7° < \theta v < 7°$

Low Background Interference

Operational Efficiency: The system features a recondensing helium tank feeding the dual-heat-exchanger VTI ensuring one-week autonomy in liquid helium, fast sample cooling/heating and a ramp time to full field of less than one hour.

DMSC: Focus on data acquisition & data analysis

easy dynamics 0.4.0

Search

- Introduction
- Installation & Setup
- User Guide
- Tutorials
- API Reference

Introduction

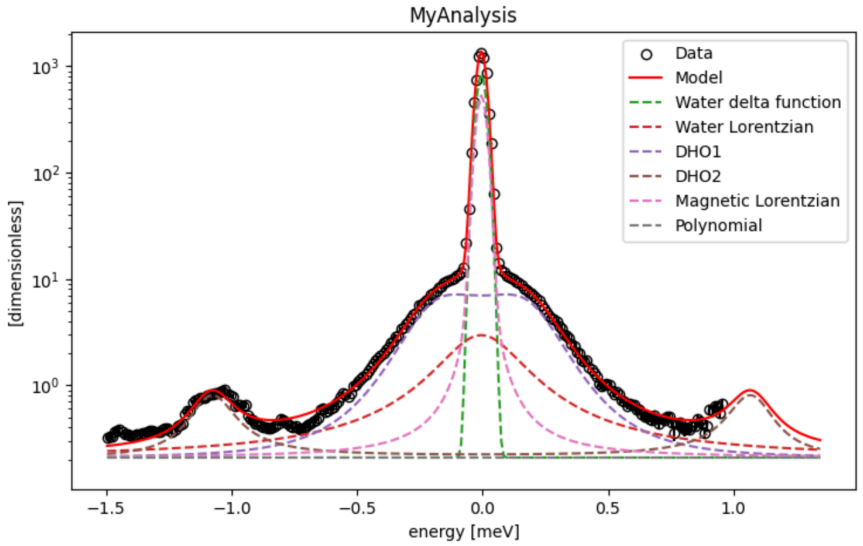
Description

EasyDynamics is a software package for plotting and fitting neutron spectroscopy data (QENS and INS), mainly dedicated to amorphous materials and crystalline powders

EasyDynamics is developed both as a Python library and as a cross-platform desktop application.

Table of contents

- Description
- License
- Releases
- Citation
- Contributing
- Get in Touch



CSPEC: The cold chopper spectrometer of the ESS

Lead scientists: Daria Noferini (ESS), ScientistL Christian Balz (magnetism),
Data Scientists: Greg Tucker & Christian Beck
IOE: Jackson Da Silva
Lead instrument engineer: Fernando Moreira (ESS)

TG5: August 2027→December 2027

Situation:

Stable staffing configuration - we know what we have to deliver - confident we can (not so far).

Project was understaffed (from start).

Complex instrument which requires detailed consideration.

Acceleration is possible with more staff to follow procurement closely (can only be a knowledgeable/ experienced engineer).

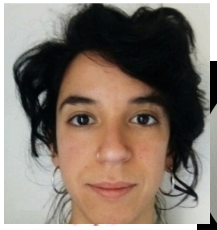
CSPEC = Tranche 3 instruments - technical groups do not have time.

Further acceleration measures considered but not much available.

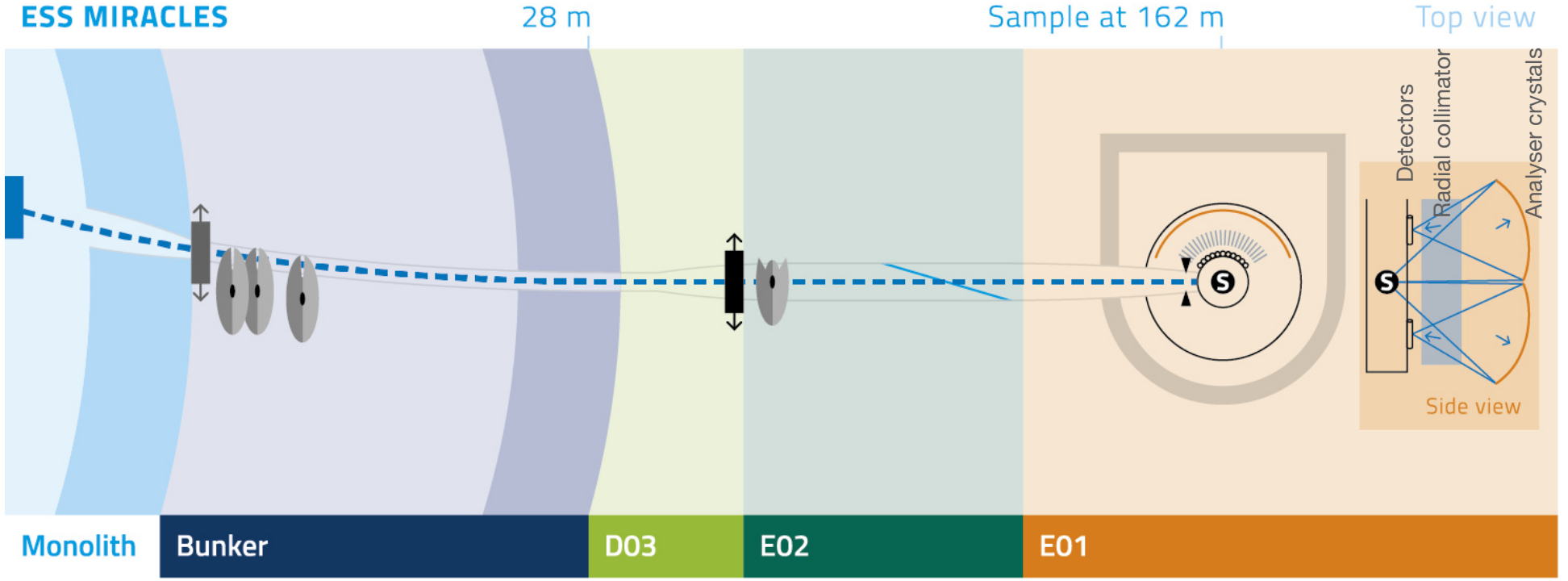
MIRACLES: High resolution backscattering spectrometer

Lead scientist: Felix Villacorta (Bilbao), Jose Pereira (Bilbao), Benedetta Rosi (ESS)
Lead instrument engineer: Alex Conde Estebanez (Bilbao)

Antoni Simelio, Integration Engineer (ESS Bilbao, in Lund).

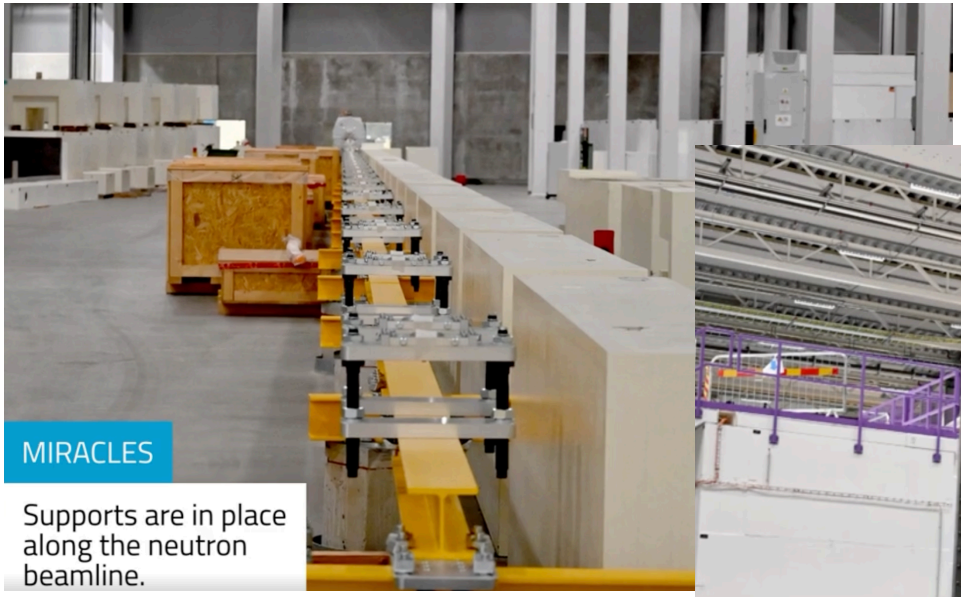


TG5: June 2027 - September 2027



GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA E INNOVACIÓN
Financiado por la Unión Europea NextGenerationEU
EUSKO JAURLARITZA GOBIERNO VASCO

MIRACLES: October 2025



MIRACLES

Supports are in place along the neutron beamline.

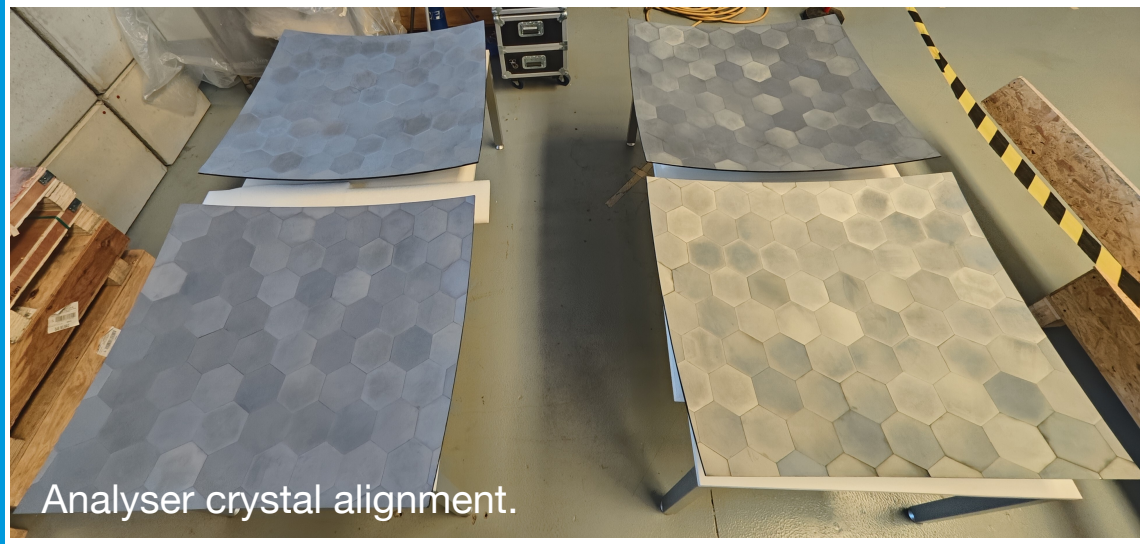
MIRACLES

The vacuum vessel is awaiting cave construction in the long instrument hall.

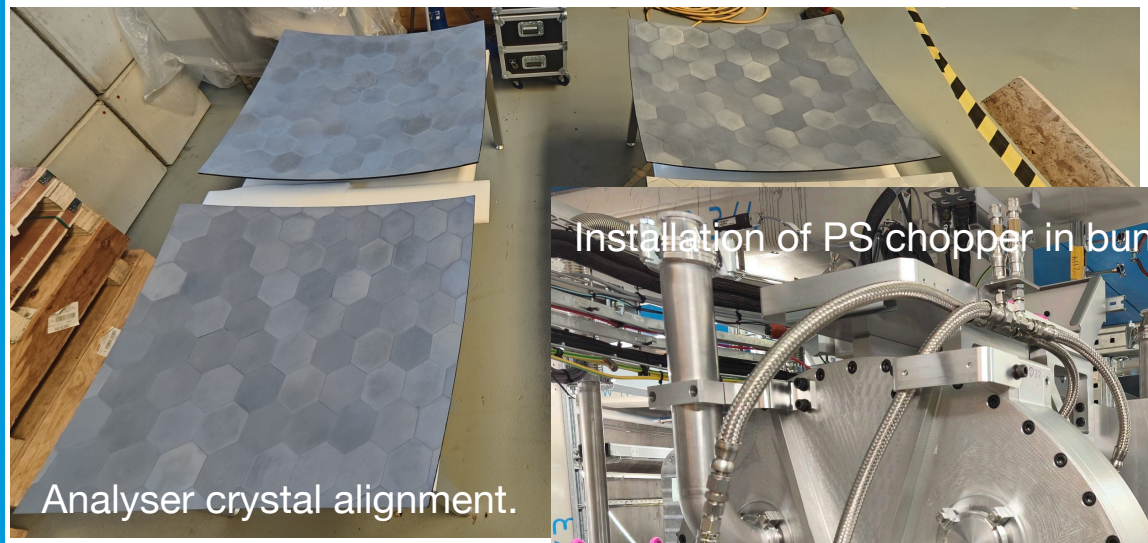
MIRACLES

Additional shielding blocks have been placed outside the bunker.

MIRACLES: April 2026



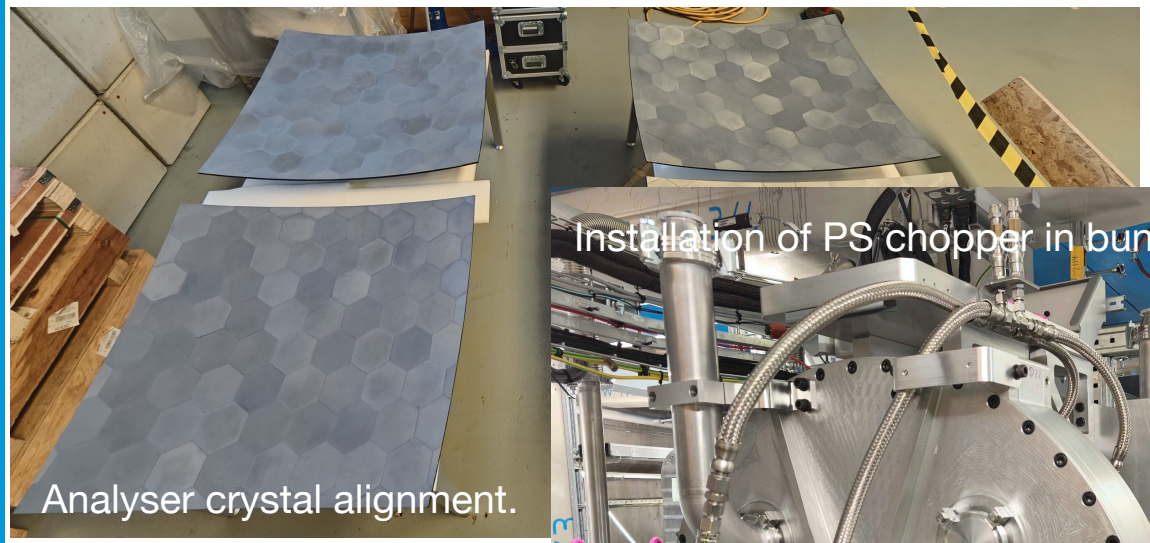
MIRACLES: April 2026



Analyser crystal alignment.

Installation of PS chopper in bunker

MIRACLES: April 2026



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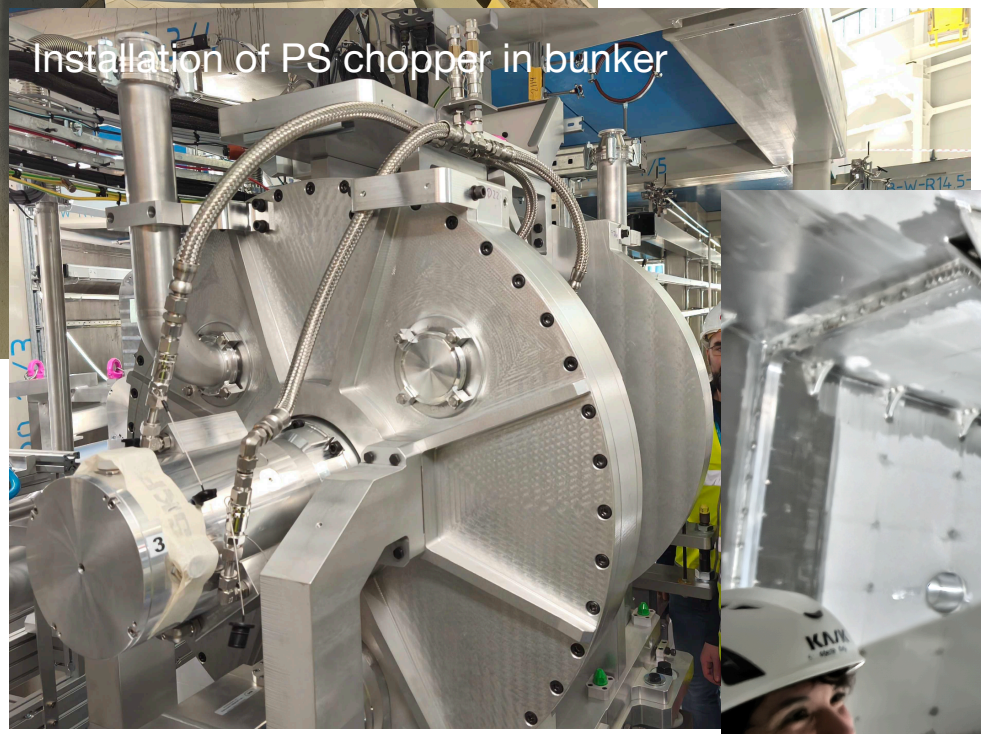
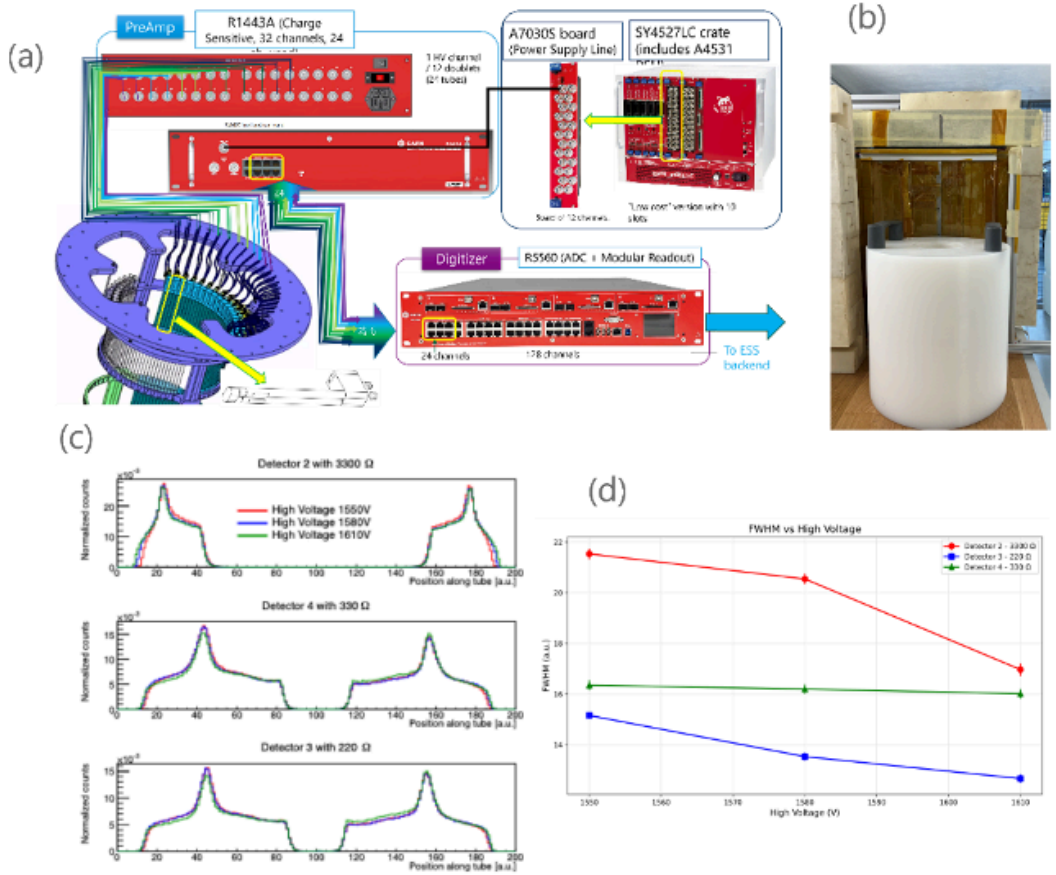


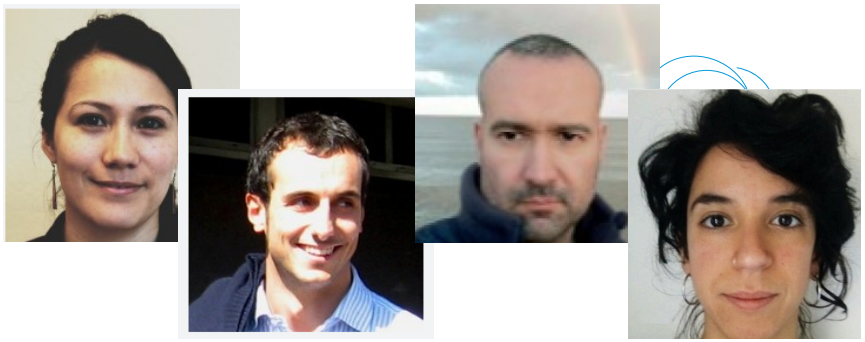
Installation of PS chopper in bunker

Inside detector tank (Cd shielding)

Continued testing of detectors (@ILL)
Integration of detectors

Nathalie de la Rosa, Francesco Piscatelli, Bernhard Meirose, Benedetta Rosi

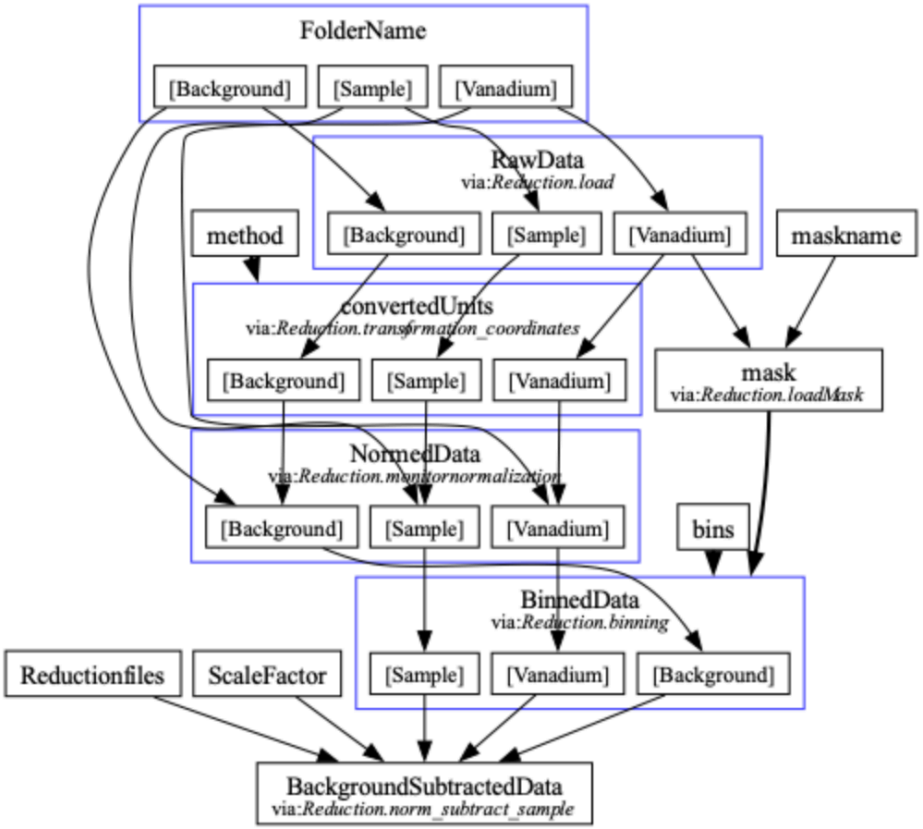


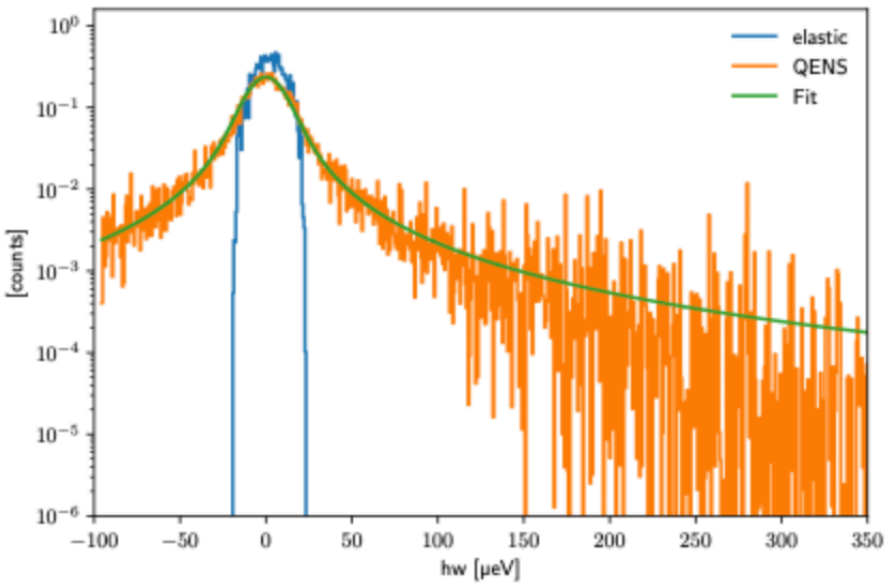


- ^{3}He doublets, preamplifiers and front-end acquisition electronics.
- Tested by using an Am/Be source to check parameters including position sensitivity and dynamic range.
- Tests are currently ongoing to determine position sensitivity at the edges of the tubes.
- Further tests to check stability under vacuum are planned in the next future.

SCIPP data analysis

Updated MIRACLES Mcstas case.
Data reduction in scipp converted to S(Q,ω)





MIRACLES: High resolution backscattering spectrometer

Lead scientist: Felix Villacorta (Bilbao), Jose Pereira (Bilbao), Benedetta Rosi (ESS)
Lead instrument engineer: Alex Conde Estebanez (Bilbao)

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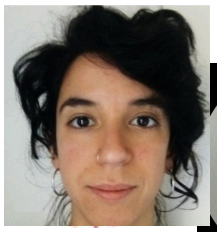
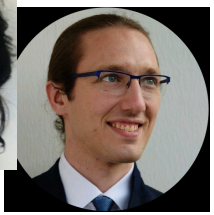




TG5: June 2027 - September 2027

Situation:

Confident that we can deliver the instrument (Technically and scientifically).

Timeline held (despite delays on components) but concern that a lot is left to do.

Staffing configuration at ESS can be improved. Need experienced engineer at ESS (neutron scattering).

Complex instrument which requires detailed consideration.

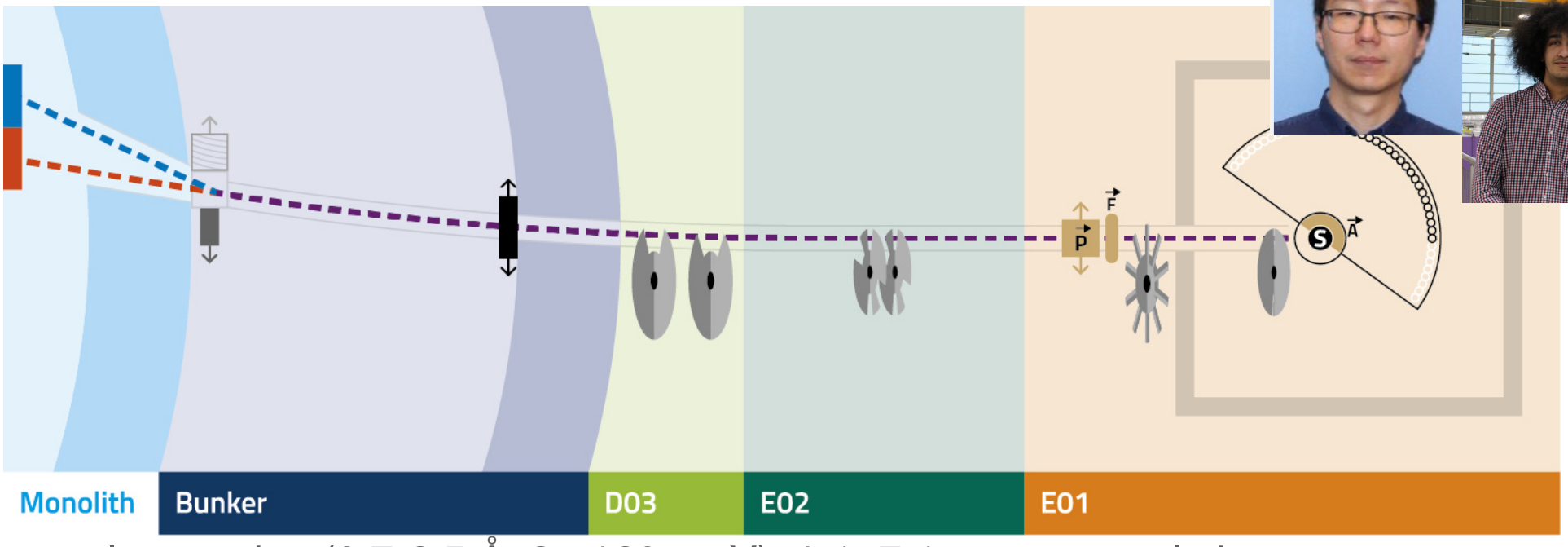
MIRACLES = Tranche 3 instruments - technical groups do not have time.

Further acceleration measures considered but not much available.

T-REX: Bispectral chopper spectrometer with PA

Lead scientist: Christian Franz (Julich), Mohamed Aouane (ESS)
Lead instrument engineer: Marcel Serwe (Julich),
Local engineer Sylvain Desert.
Instrument Data Scientist: Bing Li.

TG5: December 2027



- Bispectral extraction (0.7-6.5 Å, 2 - 160 meV), 1%–7% energy resolution.
- Focus flux on sample area 3 x 1 cm^2 (Div: ±0.25^o in the thermal band to ±1^o in the cold regime).
- Polarisation using PASTIS XYZ set-up.
- Novel B10 detector technology

TREX: The bispectral chopper spectrometer with PA. Concerns & actions (October 2025)

Common projects not prioritised for Tranche 2/3 instruments: electrical and conventional utilities, monitors, detector scope.

Focus remains on T1 but solutions are being found (e.g. CEP/CUP contracts, detector solutions)

ESS documentation criteria and requirements are difficult for many of our partner companies and laboratories to fulfil - leads to delays. Working actively to readjust.

No staff member on site:
Recruitment completed for instrument scientist & will start 7th January 2025.
Concomitant recruitment of engineering resources.

Still no on-site engineering resources. Recruitment on-going

Critical path is detector delivery.

Critical path is Cave & MCA

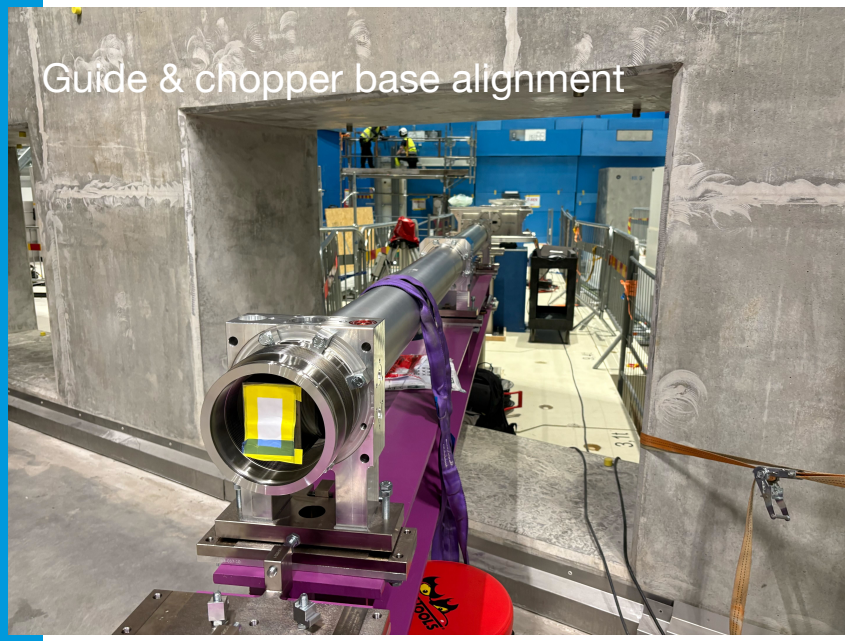
Data chain & workflow: no current focus.

Recruitment for INS Data Scientist on-going, Interviews in May.

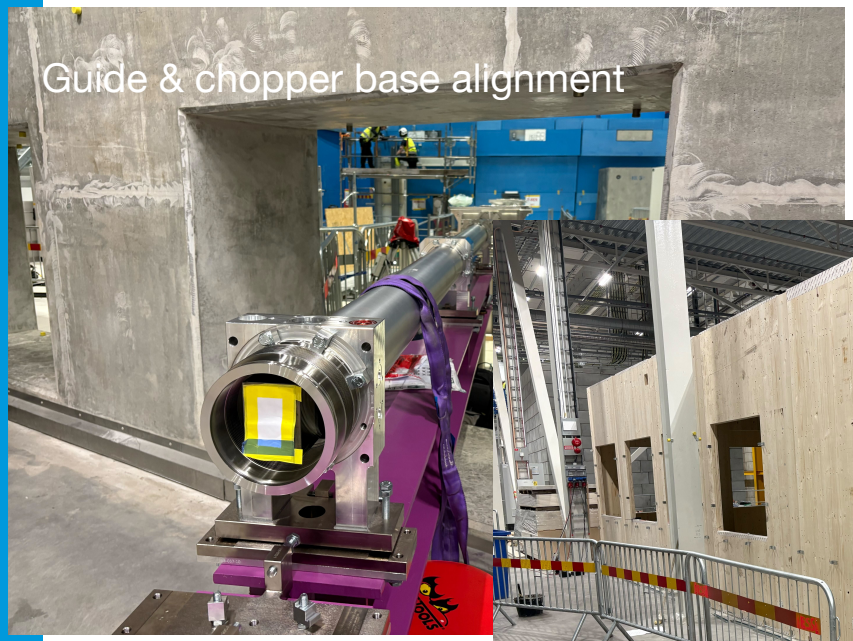
Further concerns

Late component delivery (Cave)
Integration of PA (ESS requirements)
Sample environment

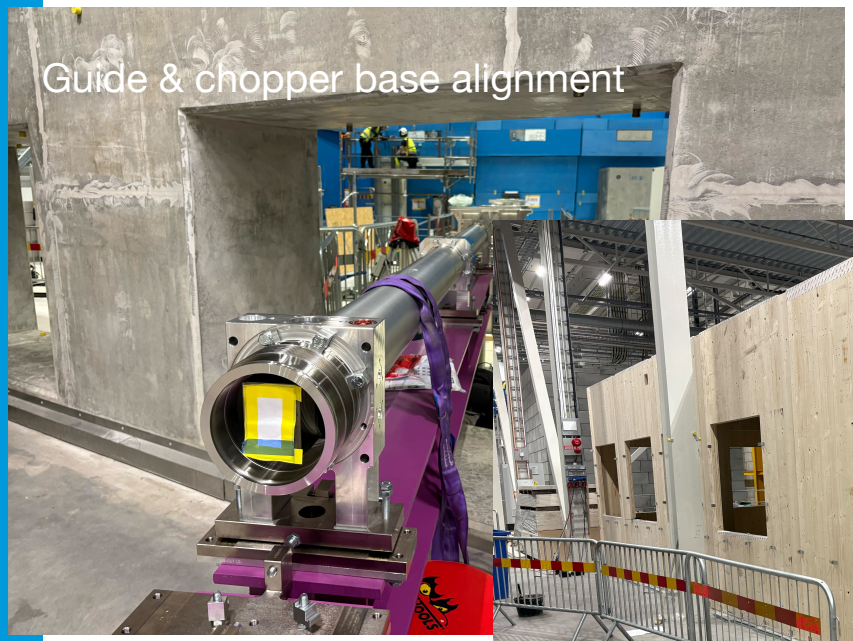
TREX: The bispectral chopper spectrometer with PA. (April 2026)

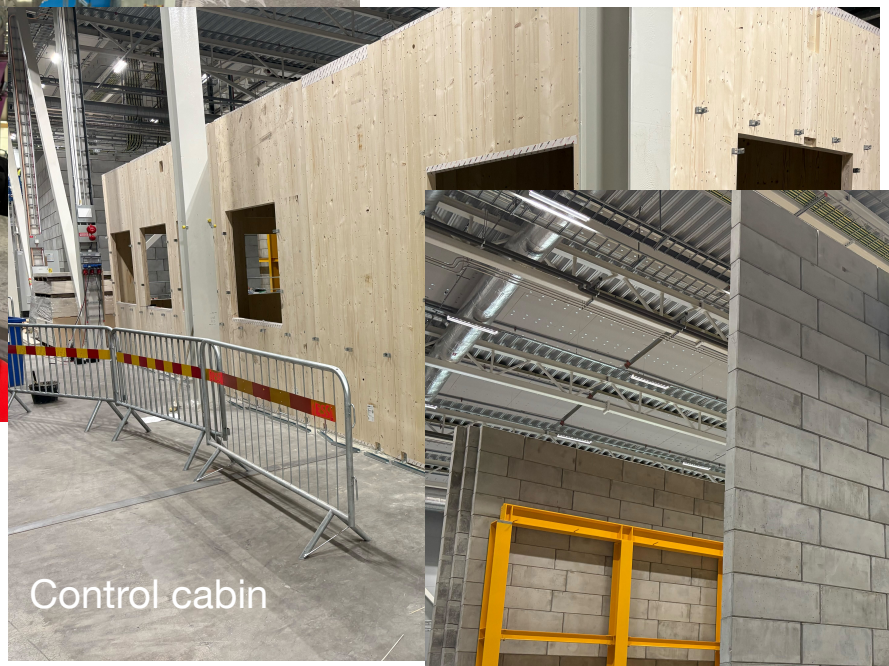


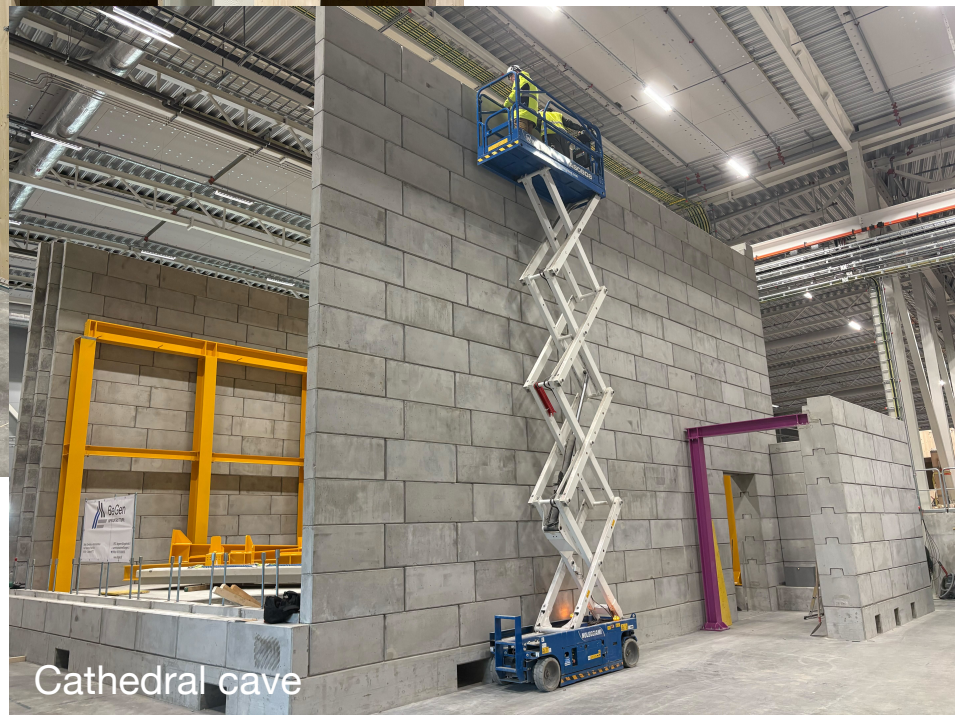
TREX: The bispectral chopper spectrometer with PA. (April 2026)



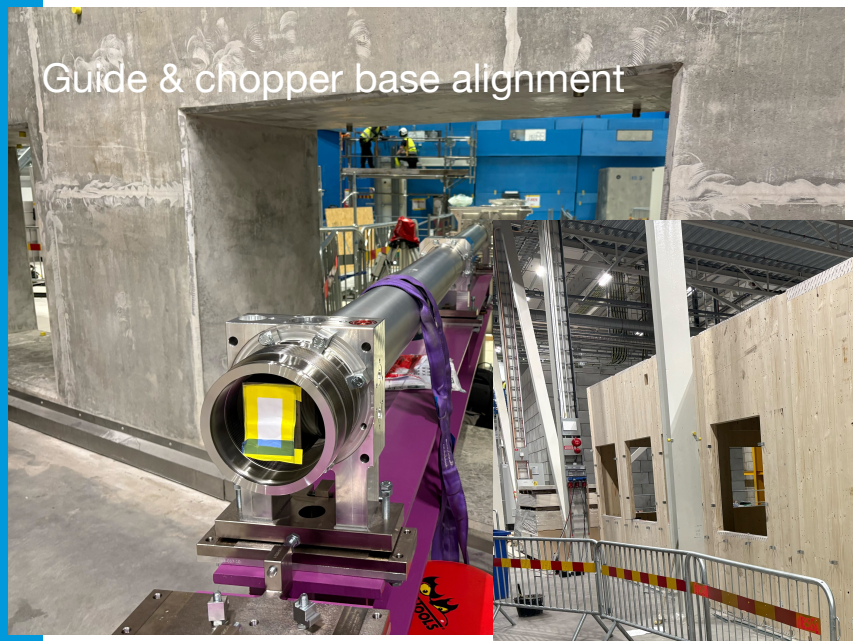
TREX: The bispectral chopper spectrometer with PA. (April 2026)



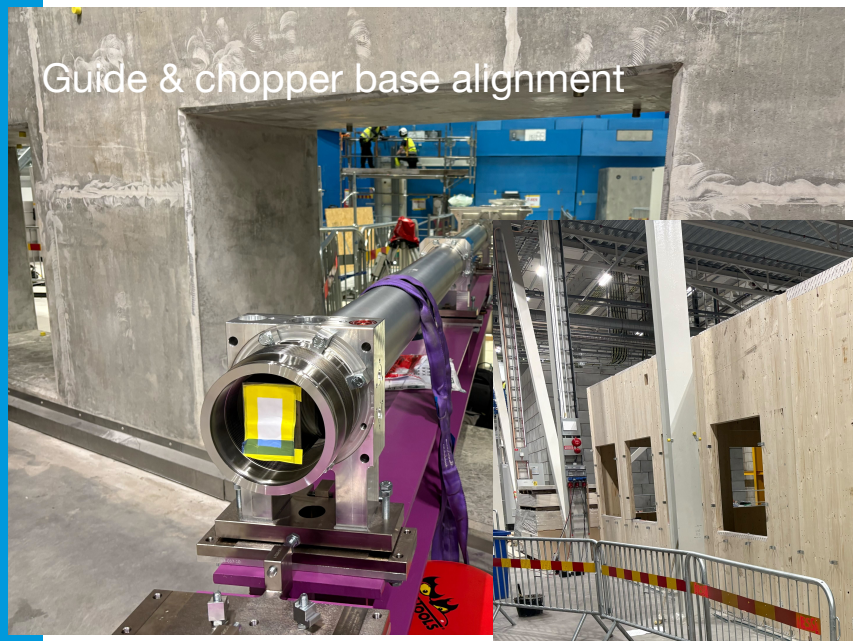




TREX: The bispectral chopper spectrometer wit

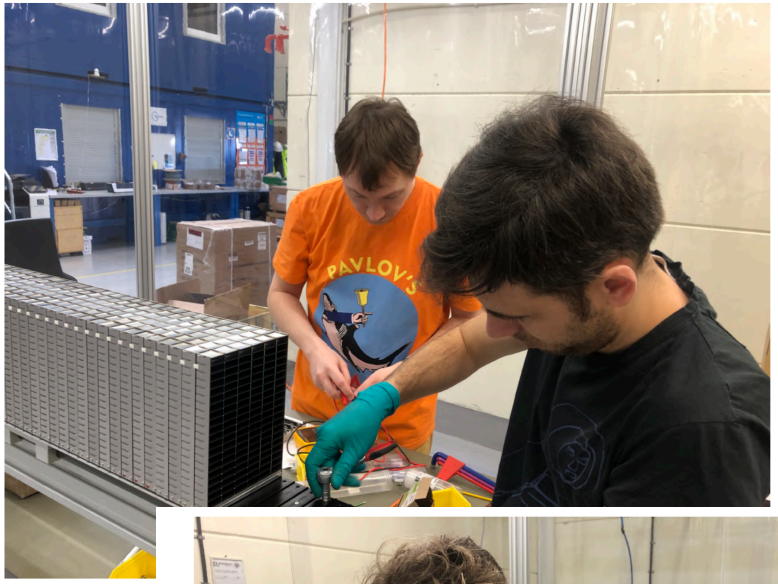


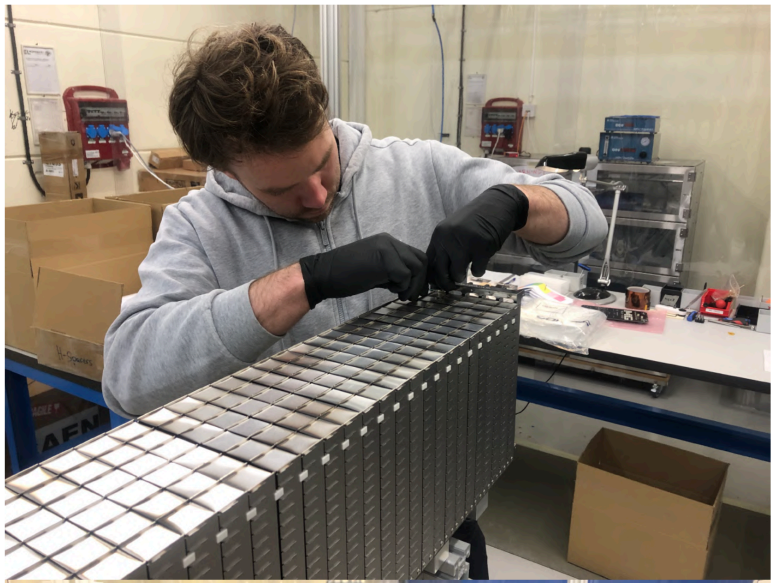
TREX: The bispectral chopper spectrometer wit

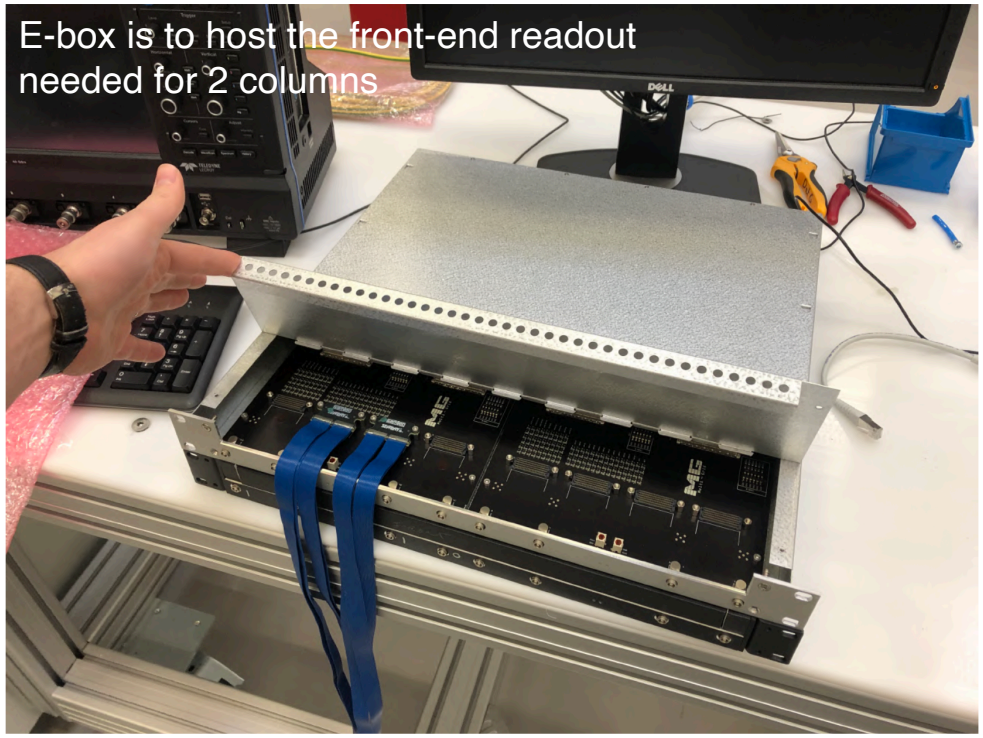


MG Detector: towards full scale delivery

- This week, the MG.T-REX column assembly started

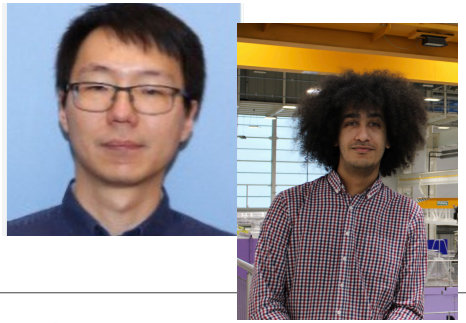


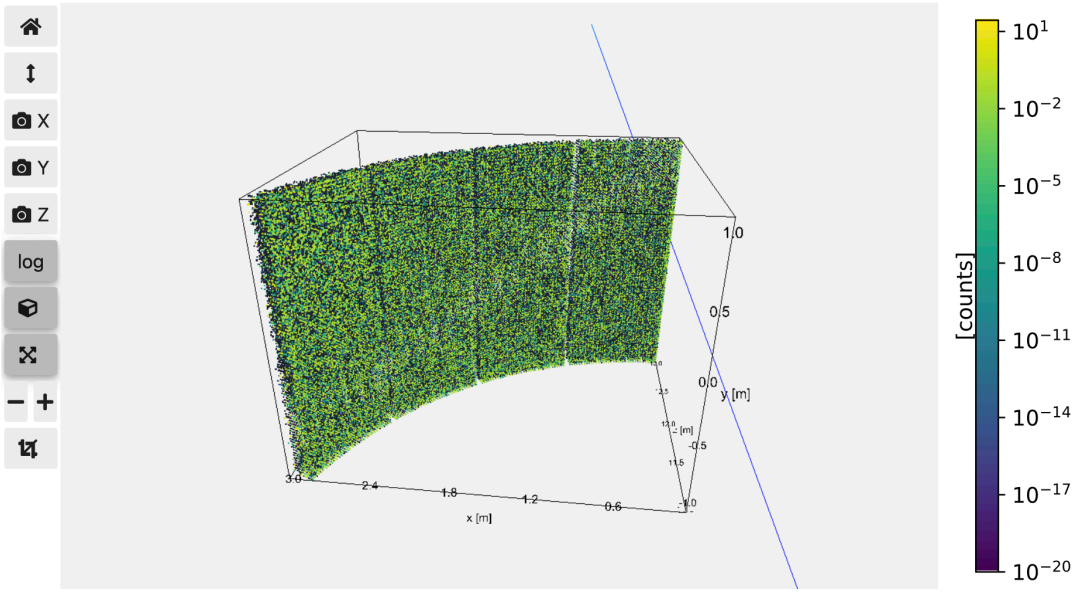


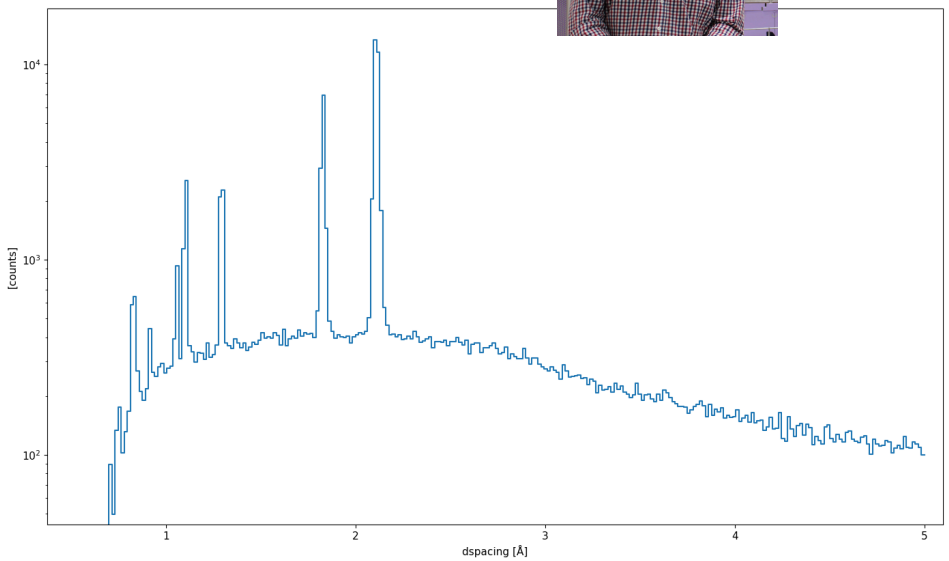


DMSC: Prototype of full MG detector. NCrystal (Fe).

253,440 voxels.







T-REX: Bispectral chopper spectrometer with PA

Lead scientist: Christian Franz (Julich), Mohamed Aouane (ESS)
Lead instrument engineer: Marcel Serwe (Julich),
Local engineer Sylvain Desert.
Instrument Data Scientist: Bing Li.

TG5: December 2027

Situation:

Lots of positive developments.

- MG detectors, concern reduced.
- Chopper cascade re-optimised - technical risk limited.
- Fast speed choppers - remanufactured - path forward.

Issues:

- Polarisation analysis cell (in-house) - what is the timeline?
- Polariser & lasers are in-kind - unclear what the path to delivery and installation is (Quality gate)

Acceleration measures

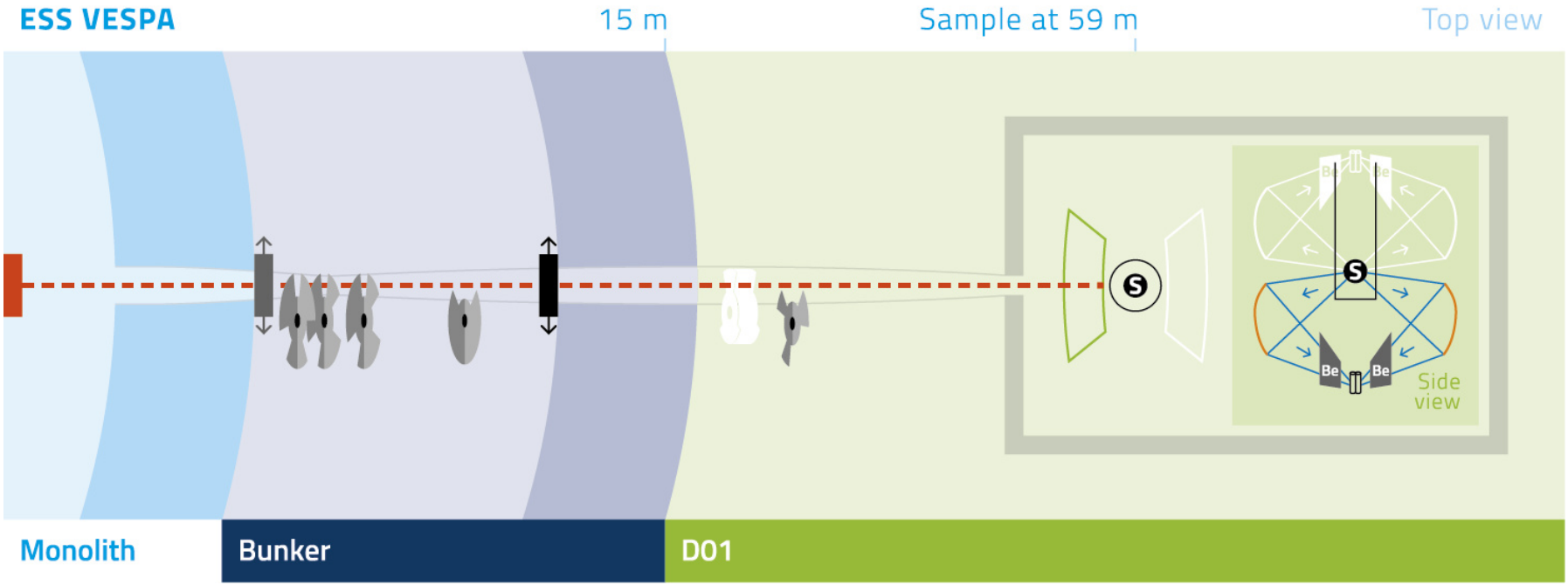
- Considered but few.

VESPA: The vibrational spectrometer of the ESS

Lead scientist: Adrien Perrichon (ESS), Monika Hartl (ESS)

Lead instrument engineer: Liam Whitelegg (ESS), Rosa Camilleri Lledó (ESS)

TG5: November 2029



Direct view of the thermal moderator (Ei = 3 - 1000 meV)

Complex chopper cascade to achieve 3 subframes and variable resolution

Indirect-geometry crystal-analyser

Complex and compact secondary spectrometer:

280 ^{3}He tubes, 8500 HOPG crystals, 200 kg of cryo-cooled Be, in <2 m^{3} vacuum vessel

VESPA: The vibrational spectrometer of the ESS

Lead scientist: Adrien Perrichon (ESS), Monika Hartl (ESS)
Lead instrument engineer: Liam Whitelegg (ESS), Rosa Camilleri Lledó (ESS),

TG5: November 2029 ⟹ March 2029

And acknowledging the continuous & extensive support from:

- NSS & NSS groups
- ISIS Neutron & Muon Source

Any questions?

- adrien.perrichon@ess.eu
- monika.hartl@ess.eu
- vespa@ess.eu

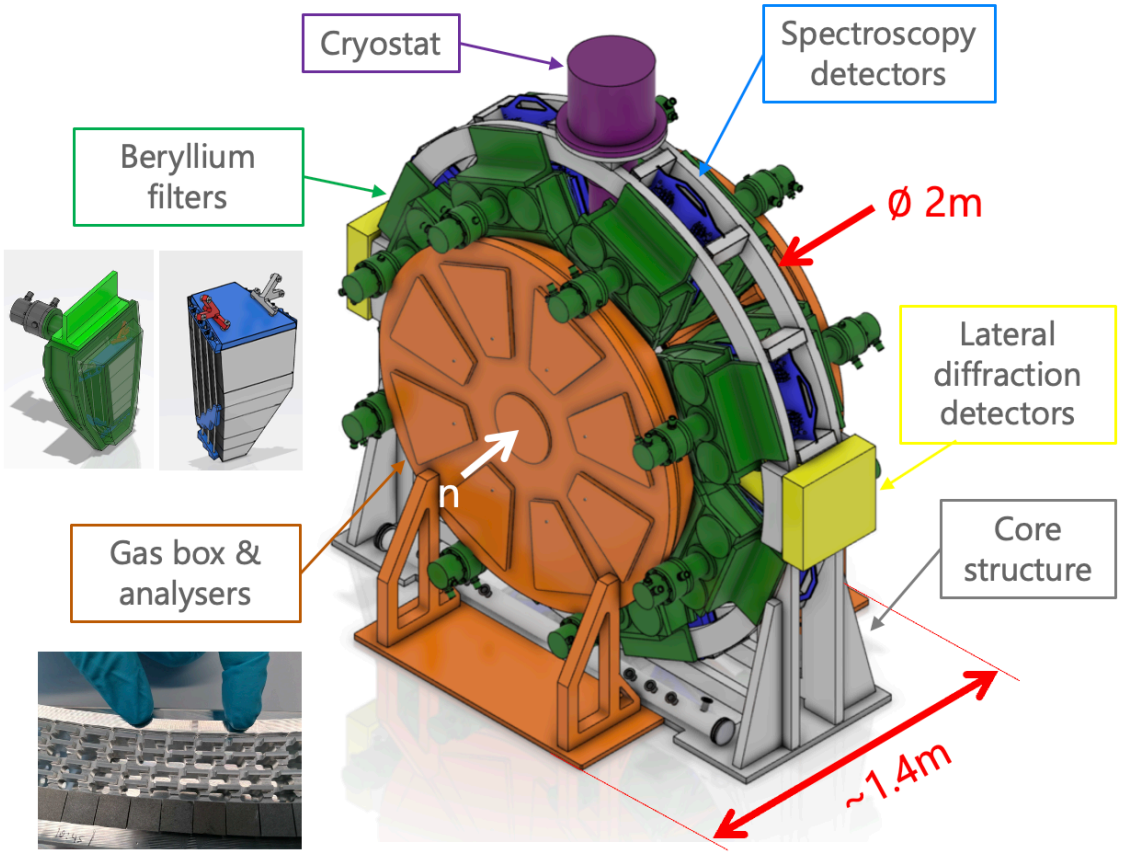
Status update on VESPA

VESPA, the Neutron Vibrational Spectrometer at the ESS

Rapid progress over the past 6 months, with major achievements of completing the preliminary design of the secondary spectrometer and of the cave, hutch and sample prep. area

- All preliminary designs completed except detector electronics and diffraction banks
- Well-progressed prototyping of all critical components of the secondary: analyser backplate machining & coating, HOPG crystal performance, HOPG crystal assembly, etc
- All large procurements have started (guide, cave, beryllium filter) or will start at ESS shortly (HOPG crystals, ^{3}He tubes, cryostat)

TG5 in March 2029 (delay till May resolved)



13,000 HOPG crystals, 280 kg of cryo-cooled Be, 600 ^{3}He tubes, in <2 m^3 footprint

Spectroscopy @ ESS

Focus 2026

Close collaboration with technical teams of NSS, DMSC & sample environment group.

- Ensure that the instrument components deliver the scientific requirements of the instrument.
- Data acquisition, analysis tools to be delivered.
- Sample environment delivery, testing on instruments.

Recruitments: IOE (MIRACLES/T-REX) , Scientists (MIRACLES/T-REX)

Plan and start execution of the rescoping of TREX detectors and additional VESPA analyzer arms in conjunction with the NSS division.

Engage proactively with the neutron user community and further develop the proposed scientific programme for the spectroscopy instruments. Participate in national user meetings when relevant.

Engage with the future instrument opportunities through collaboration with the community.

STAP Spectroscopy overview

April 2026: Heading towards BOT

PASCALE DEEN

New ESS spectroscopy instruments

GERSEMI **L_{ms} = 30 m, N1**

A high-resolution neutron spin echo instrument for the ESS

Proposers: D. Noferini (ESS); F. Roosen-Runge (LU, Sweden); *et al.*

KVASIR **L_{ms} = 160 m.**

A backscattering instrument optimised for hard condensed matter

Proposers: S. Petit (LLB, France); K. Lefmann (KU, Denmark); P. Deen (ESS)

Additional documents available, see list at the bottom of the page.

NERTHUS **L_{ms} = 70 m, E8**

NEutRon THermal time-focUssing spectrometer

Proposers: M. Zanatta (University of Trento, Italy); *et al.*

NJORD AND REMORA **L_{ms} = 160 m, 70 m**

Spectrometers in symbiosis

Proposers: E. Fogh (TUM, Germany); *et al.*

STAP Spectroscopy overview

April 2026: Heading towards BOT

PASCALE DEEN