ESS Test Beamline: Improvement prior to (delayed) BoT

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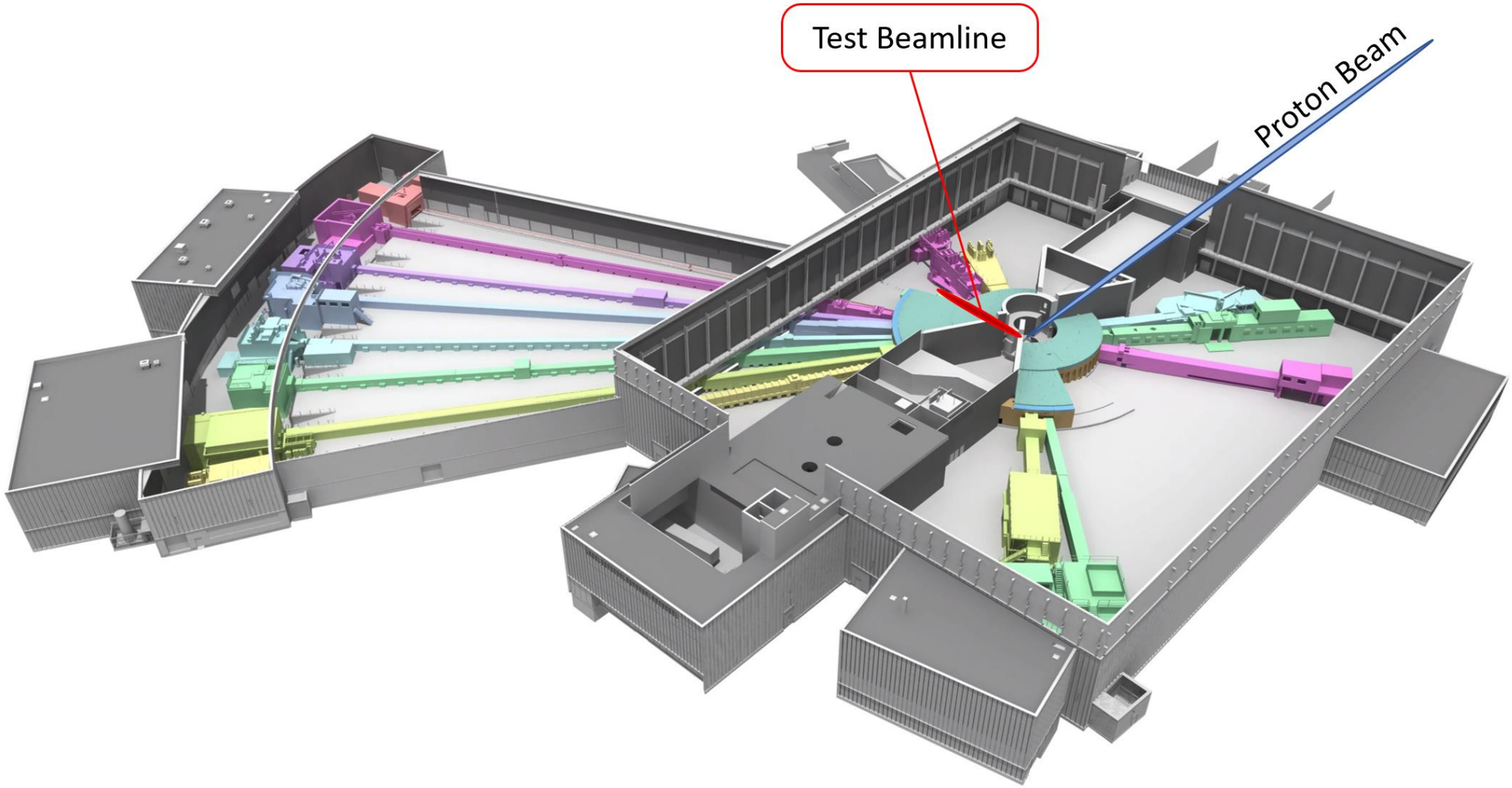
21 April 2026

Outline

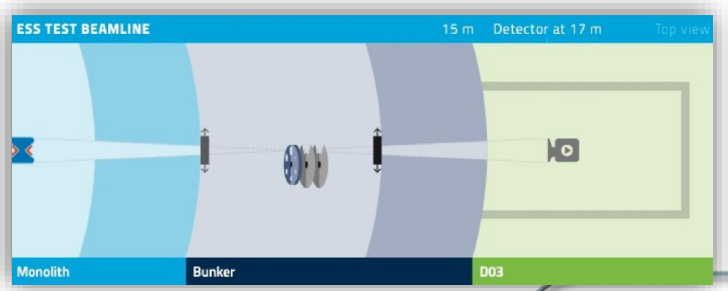
- ❑ Overview of TBL Layout
- ❑ Activities in the past 6 months
- ❑ BoT and Hot-commissioning
- ❑ Test cases to be discussed
- ❑ From previous comments

Overview

Location in Facility: W11 (North Sector)

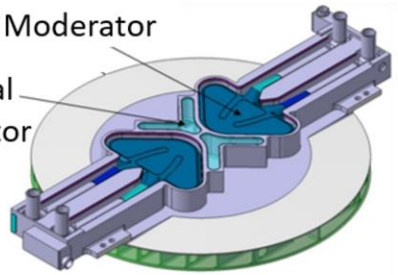


Overview



Cold Moderator

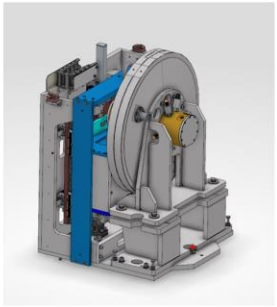
Thermal Moderator



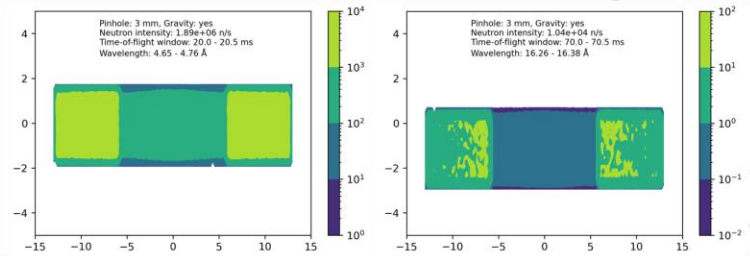
Upgrade from MARK-I (initial) to MARK-II (neutronically optimized) moderator

Blocks unwanted radiation

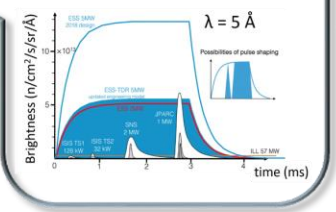
Wavelength Selection

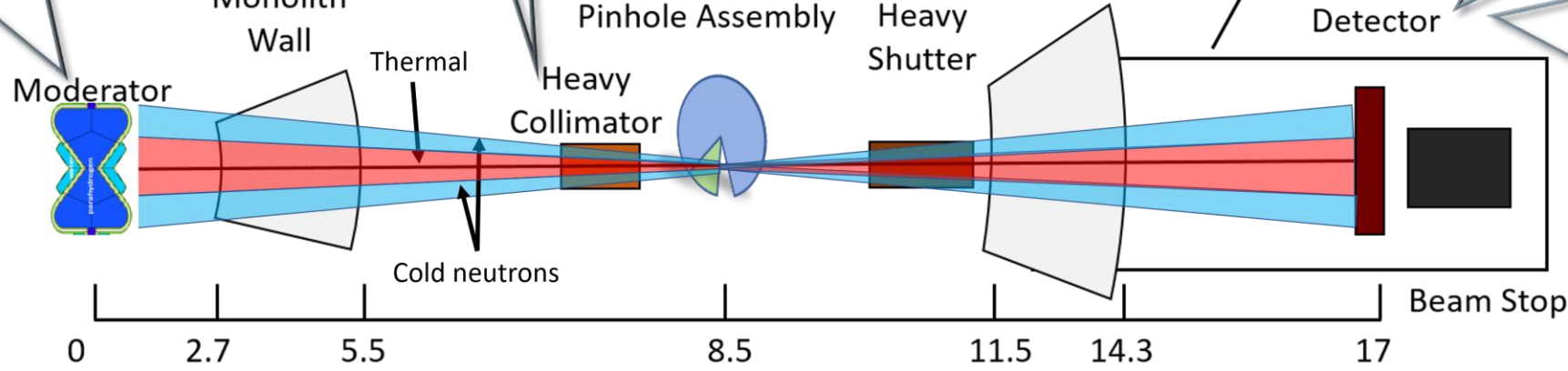


A 2D image of the moderator is obtained by "pinhole camera concept" and allows to study intensity distributions at different neutron energies.



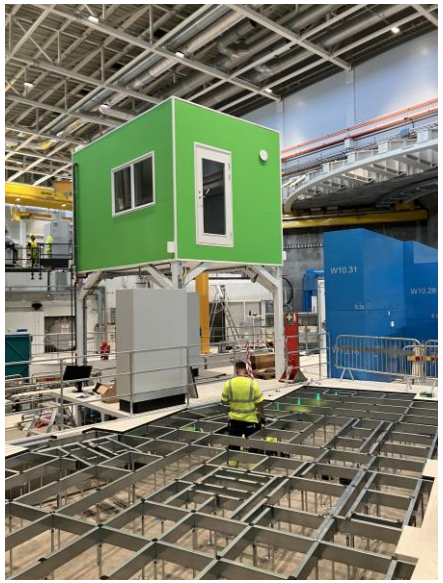
Measure the pulse shape

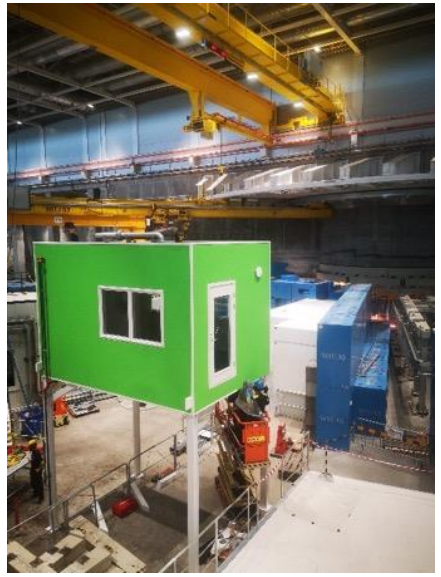




2022

2023





2024

2025

2026

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Quick Updates

TG5/SAR	Approved (Oct 2025)
iSRR	Approved (Mar 2026)

Jason Morin: Instrument Operations Engineer (IOE)

(Agreed but not finalized yet): Instrument Scientist (IS)

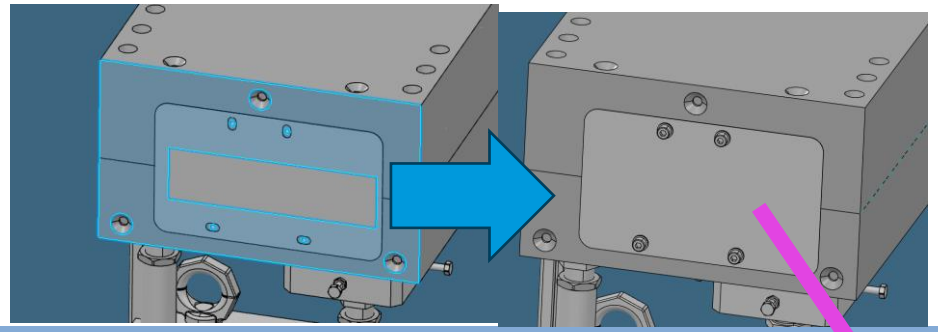
Irina Stefanescu: Detector Scientist

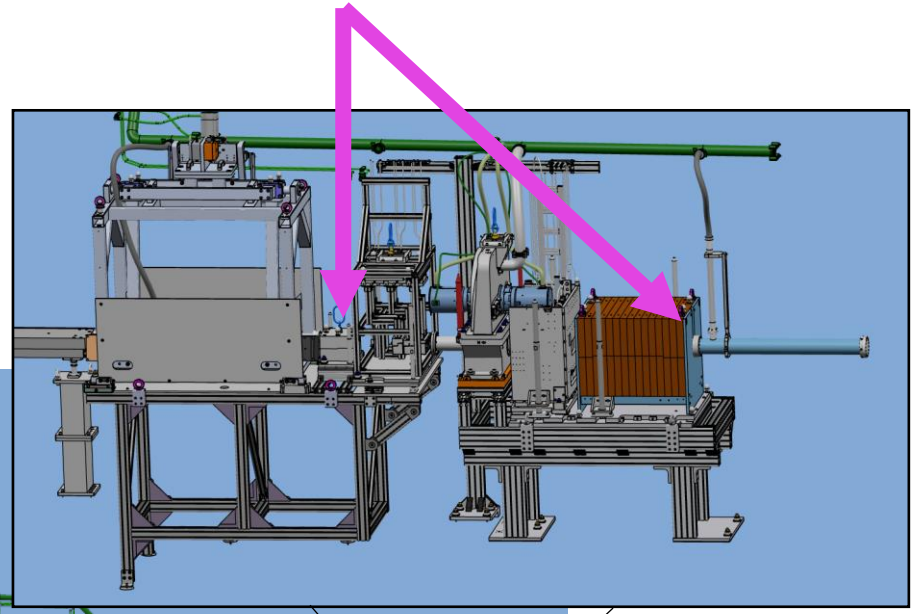
Farnaz Ghazi Moradi: Detector Scientist

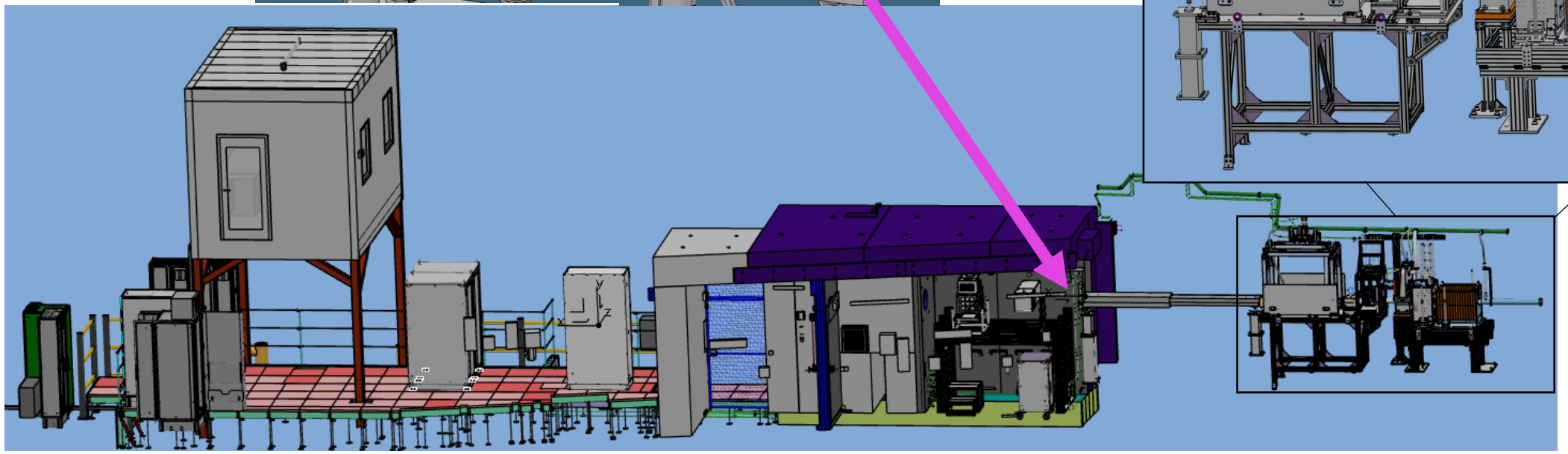
Douglas Di Julio: Spallation Physicist

Improvement on installed components

1) Put mirrobor in front of collimators (HC and FC), made from Cu, due to high activation potential
2) Bunker wall insert will be closed to protect dusts.





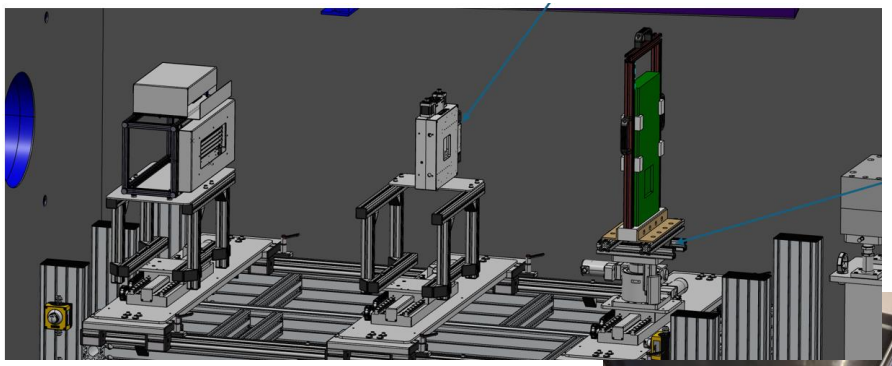


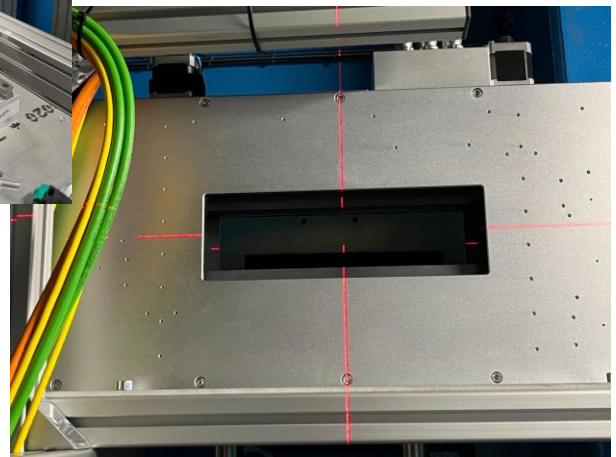
Beam direction

Hutch, false floor, cabinets | Cave, Detectors | Wall Feedthrough | Beam Transport & Conditioning

Inside the Cave

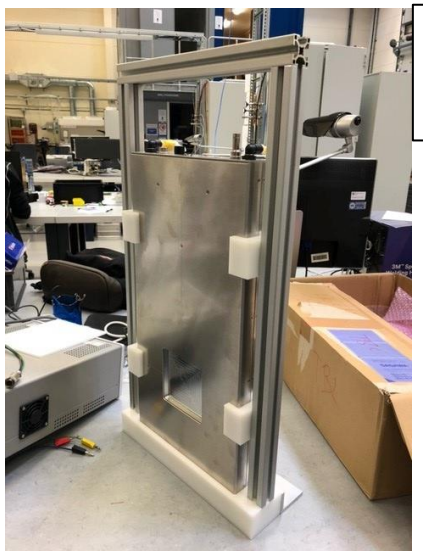
1) 3x Sliding platforms are installed to facilitate alignment and manually moving ***along*** the beam.
2) 3x motorized linear stages are mounted on the sliding plate to move ***across*** the beam.
3) Z-stage, goniometers, and tilt stages can be used altogether in different configurations.
4) Big slit (250mm x 80 mm HxV) is mounted at the entrance of the cave to shape the incoming beam.
6) 2x small slits (80mm x80 mm) are available for close-distance beam shaping, e.g., diffraction
7) Tabletop are removed which allow more space for experiments such as diffraction.





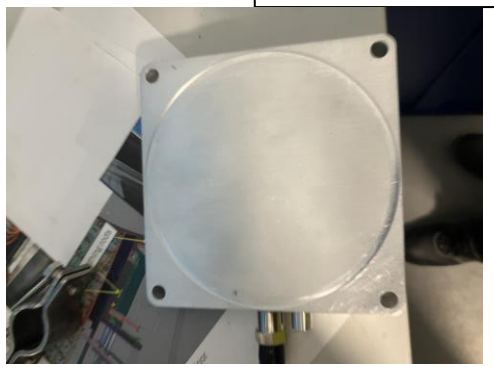
Detectors at TBL

2x He-3 tubes
1st use for BoT

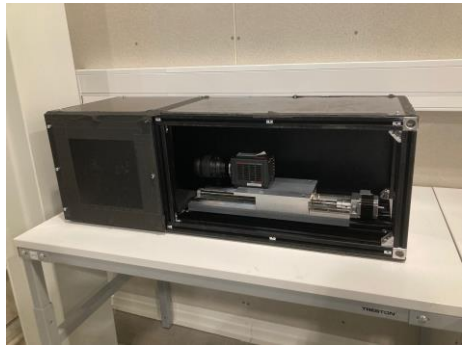


nGEM (ToF)
2nd use for BoT

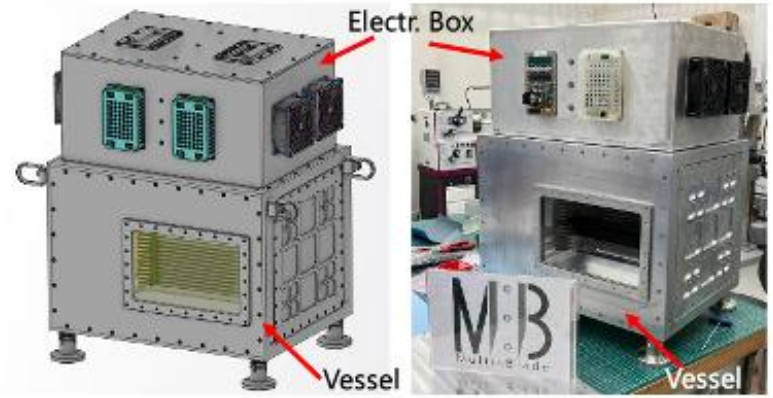
1 more detector, i.e., 10^{-3} efficiency fission chamber.



LumaCam
(ToF imaging/diffraction)



Camera (Gated-imaging)
Low-resolution ToF: Test onsite with lights

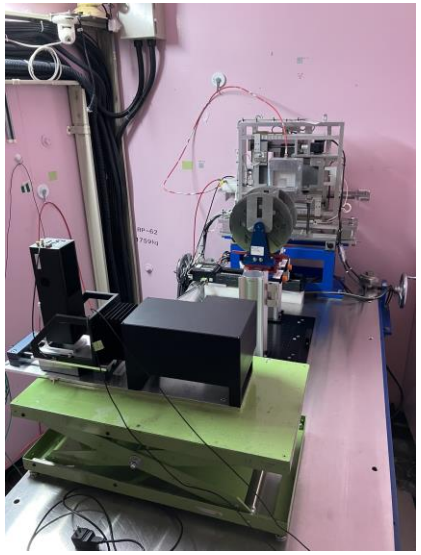


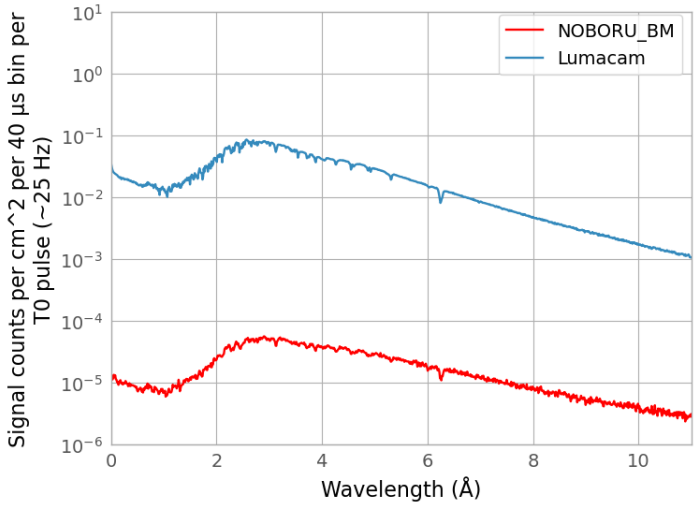
Multiblade
(imaging/diffraction)

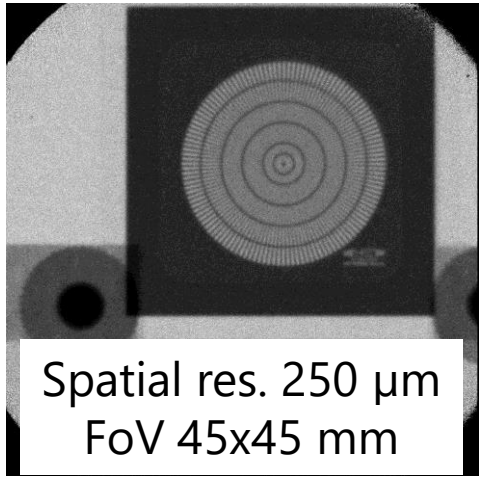
Difficult to use in direct beam
Planned for diffraction

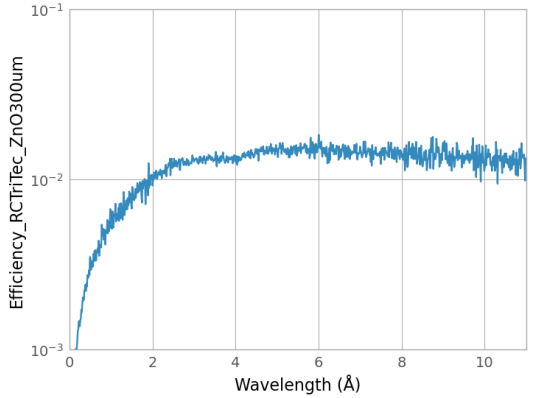
Test at other facilities: Efficiency

NOBORU: Lumacam

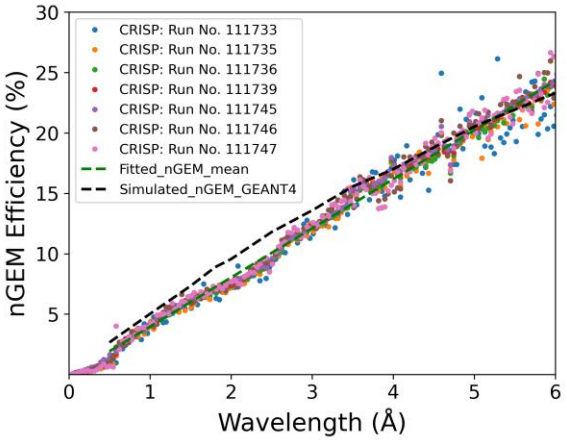




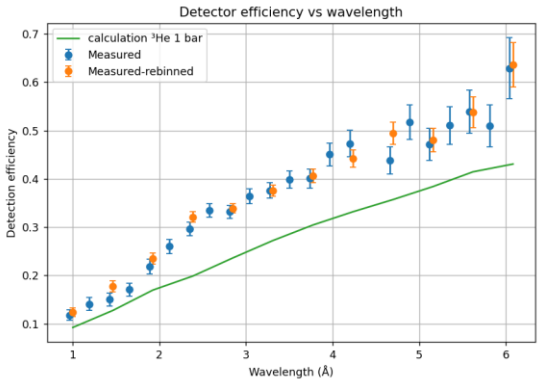




CRISP: He3 and nGEM

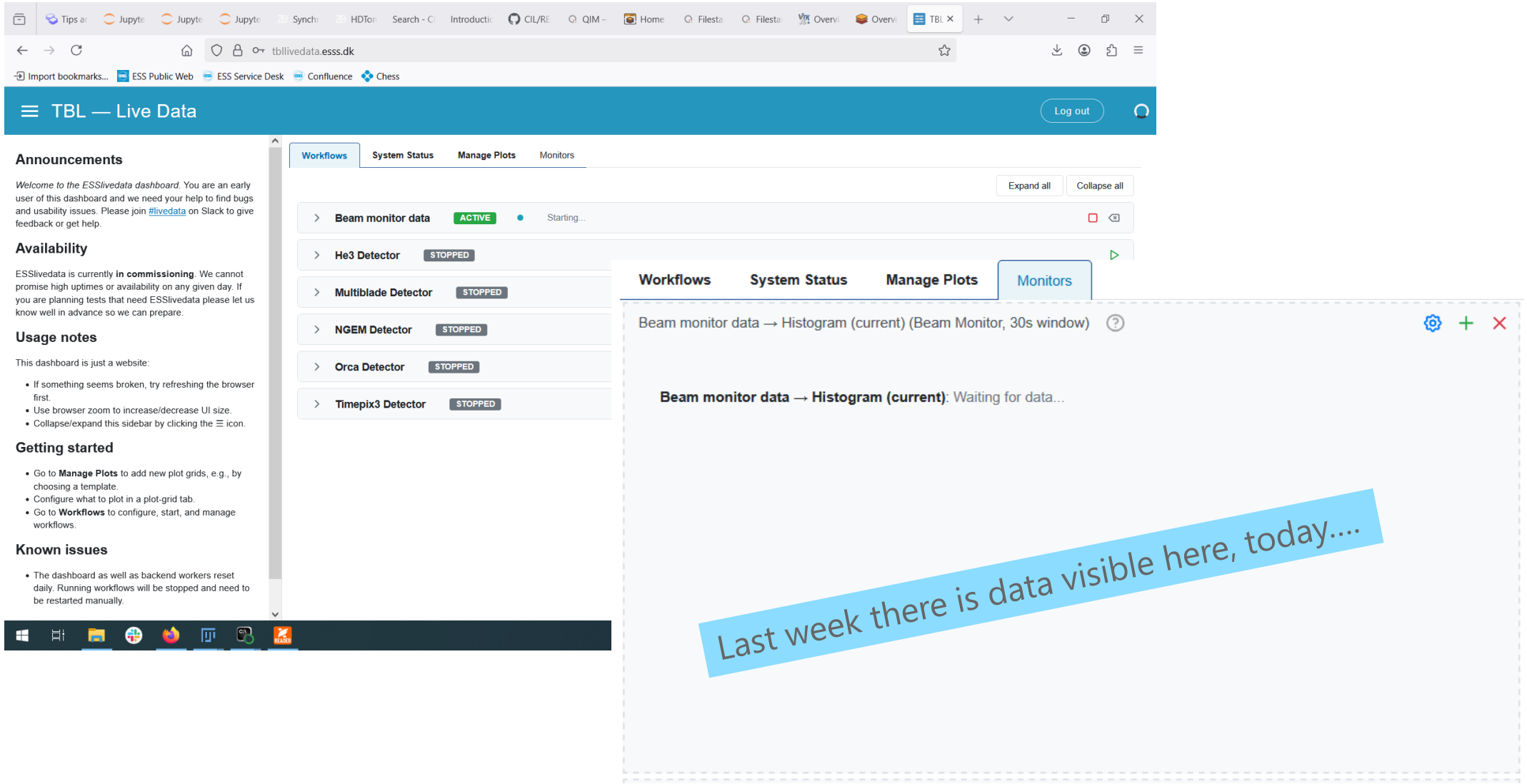


- Efficiency of nGEM is obtained.
- Results from JPARC in 2023 was from the back side of detector.

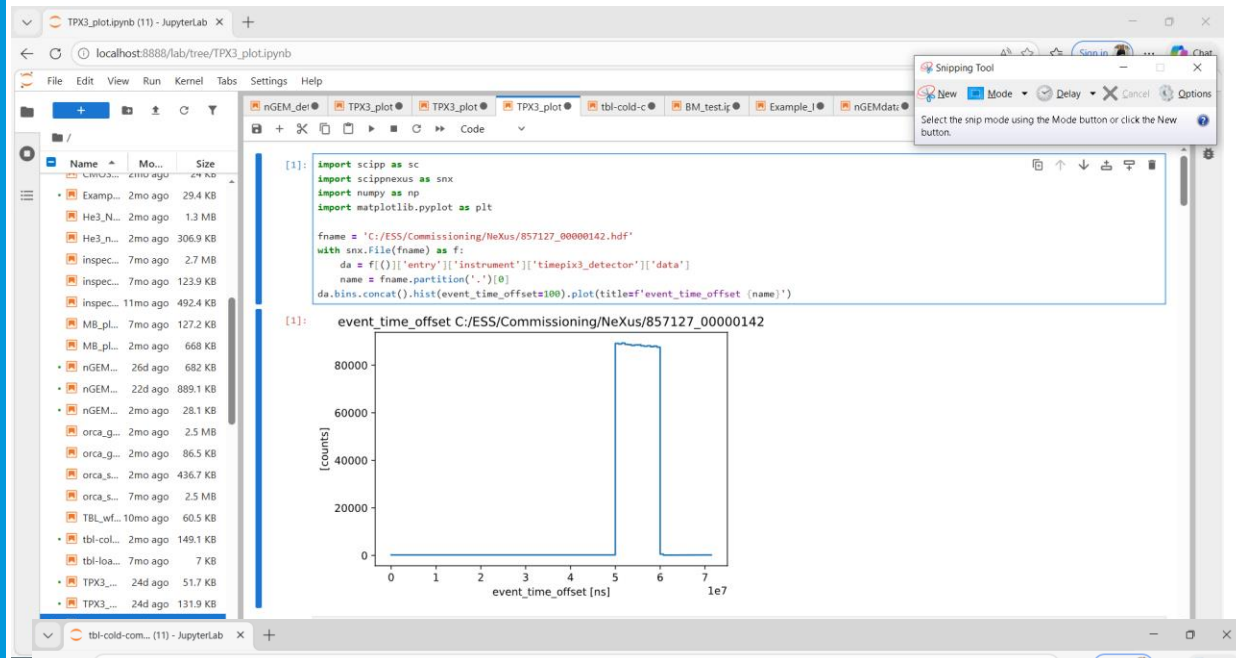


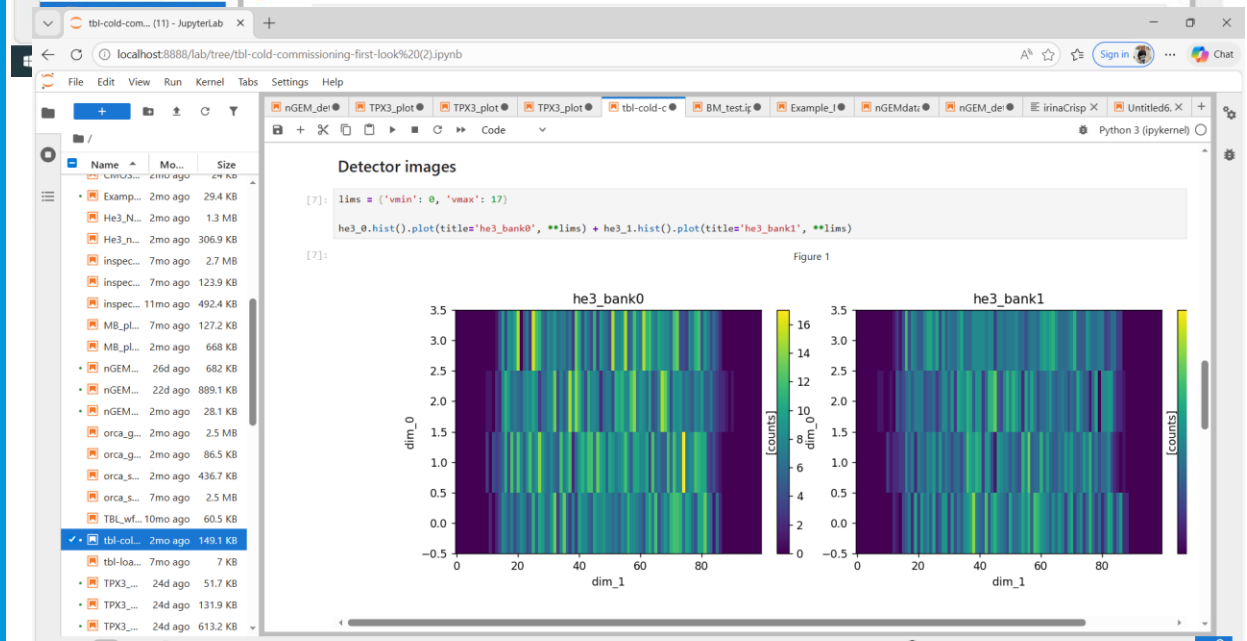
Only LP module is good.
HP needs better preAmp.

Live-view

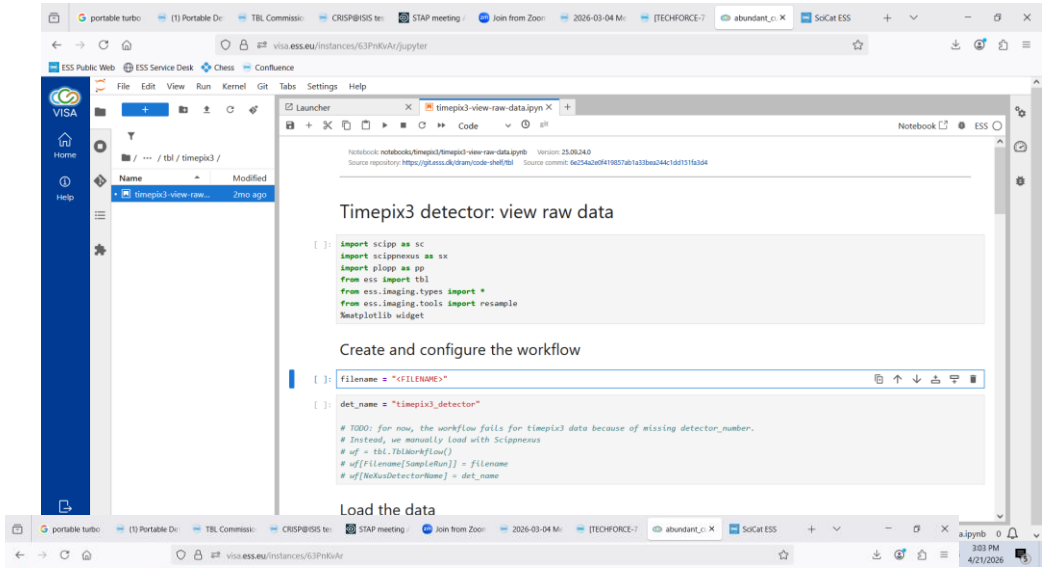

tbllivedata.esss.dk
Import bookmarks...
ESS Public Web
ESS Service Desk
Confluence
Chess
TBL — Live Data
Log out
Announcements
Welcome to the ESSlivedata dashboard. You are an early user of this dashboard and we need your help to find bugs and usability issues. Please join #livedata on Slack to give feedback or get help.
Availability
ESSlivedata is currently in commissioning. We cannot promise high uptimes or availability on any given day. If you are planning tests that need ESSlivedata please let us know well in advance so we can prepare.
Usage notes
This dashboard is just a website:
If something seems broken, try refreshing the browser first.
Use browser zoom to increase/decrease UI size.
Collapse/expand this sidebar by clicking the ☰ icon.
Getting started
Go to Manage Plots to add new plot grids, e.g., by choosing a template.
Configure what to plot in a plot-grid tab.
Go to Workflows to configure, start, and manage workflows.
Known issues
The dashboard as well as backend workers reset daily. Running workflows will be stopped and need to be restarted manually.
Workflows
System Status
Manage Plots
Monitors
Expand all
Collapse all
Beam monitor data ACTIVE Starting...
He3 Detector STOPPED
Multiblade Detector STOPPED
NGEM Detector STOPPED
Orca Detector STOPPED
Timepix3 Detector STOPPED
Workflows
System Status
Manage Plots
Monitors
Beam monitor data → Histogram (current) (Beam Monitor, 30s window)
Beam monitor data → Histogram (current): Waiting for data...
Last week there is data visible here, today....

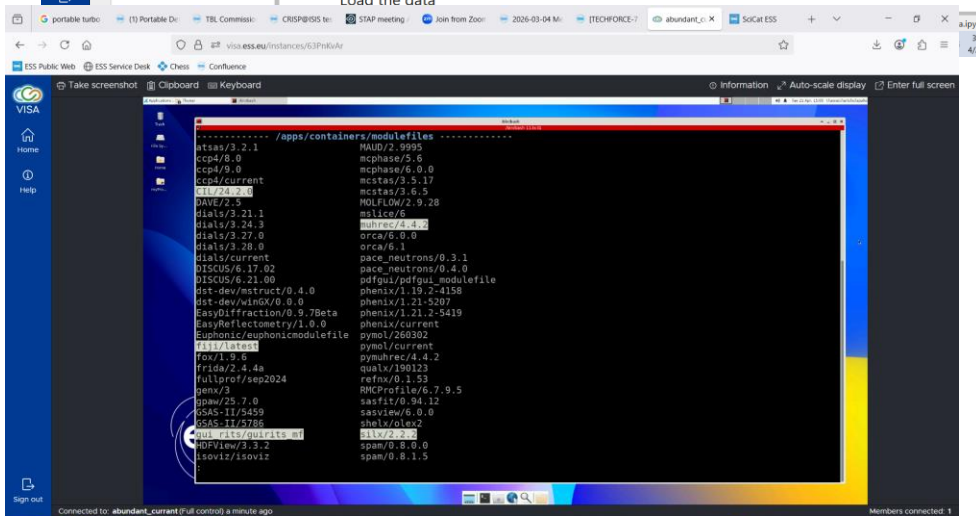
Data Reduction





Work locally via scipp commands
On VISA, “fixed” workflows are available.





Data Analysis Tools

Common imaging tools:

- VGStudioMax (Reconstruction and Visualization)
- IDVC
- SPAM (Available on VISA)
- CIL* (Available on VISA)
- Dragonfly (Not on VISA)
- Other common tools used locally, e.g., nbragg, rits, tofimaging

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Ramping-up phase

Neutron flux on TBL at BOT

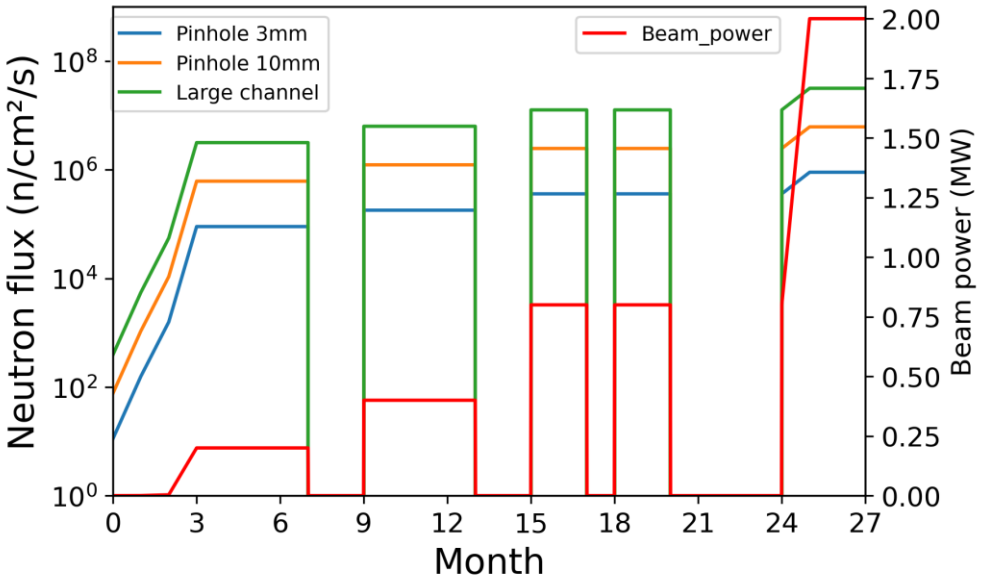
27 January 2027

Neutron flux (n/cm2/s) @5MW (2 GeV)

- 3mm pinhole: ~ 2.25x10^6 n/cm2/s
- 10mm pinhole: ~1.54x10^7 n/cm2/s
- 30mmX25mm channel: ~7.88x10^7 n/cm2/s

Thermal/cold flux (Up to Year)	**< 0.5**	**< 1**	**< 2**	**>2**
Beam energy	~800 MeV			
Power	0.2 MW	0.4 MW	0.8 MW	2 MW
Neutron Flux 3mm (n/cm2/sec)	8.98E+04	1.80E+05	3.60E+05	8.98E+05
Neutron Flux 10mm (n/cm2/sec)	6.15E+05	1.23E+06	2.46E+06	6.15E+06
Neutron Flux 30mm x 25mm (n/cm2/sec)	3.15E+06	6.31E+06	1.26E+07	3.15E+07

HC Plan: Facility ramp-up schedule

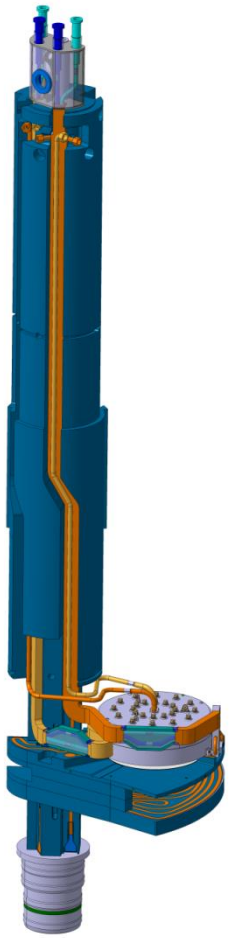


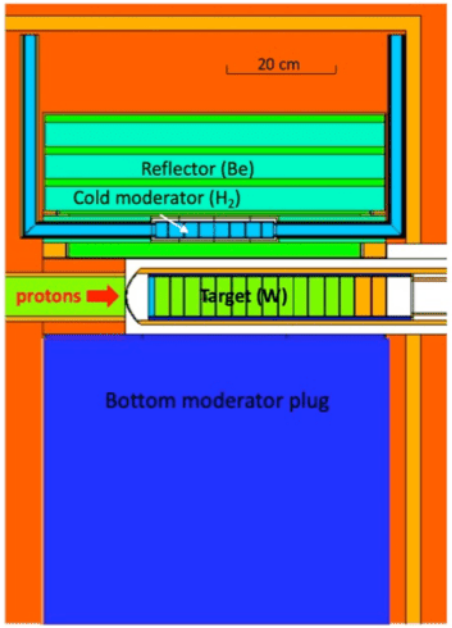
During 1st beam commissioning (short pulses)

- At BoT, 5µs at 6.25mA at 1Hz would be only **25 W**; which translates into a flux (very ROUGH estimate) ~**11 n/cm²/s** to ~ **394 n/cm²/s** at TBL in current configurations.
- Within 0.5 year, 2.86ms at 6.25mA at 14Hz would be **200kW**; which translates in a flux (very ROUGH estimate) of ~**9x10^4 n/cm²/s** to ~ **3x10^6 n/cm²/s** at TBL in current configurations.

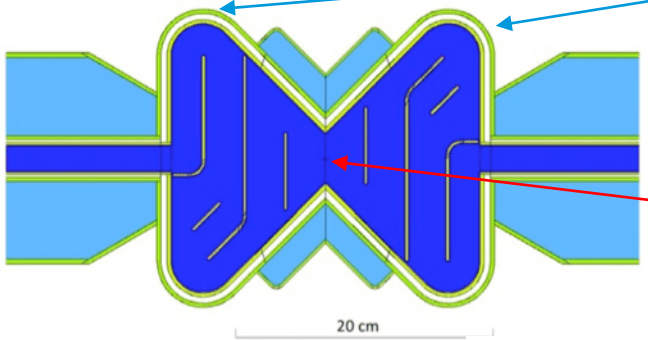
ESS moderator ~~(BF2/MARK-1)~~ ➔ (BF1/MARK-2)

The goal is to make an as-built model of the moderator for 800 MeV and 1.2 GeV protons.





Now we are working on the same moderator as used in McStas, but the spectrum and flux will differ from the simulation (5MW @2GeV).

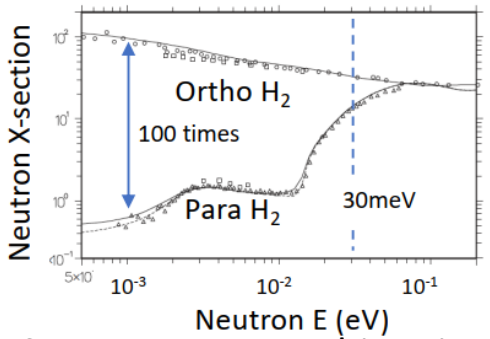


Cold Moderators

(para-Hydrogen <20K)

Thermal Moderator

(light water)



Courtesy: Masatoshi Arai

ESS moderator

Asymmetric and focusing effect

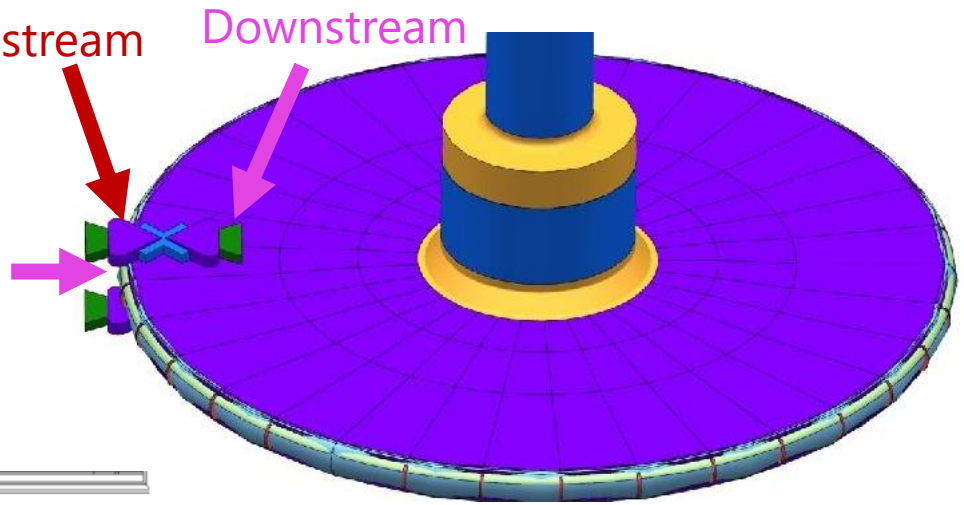
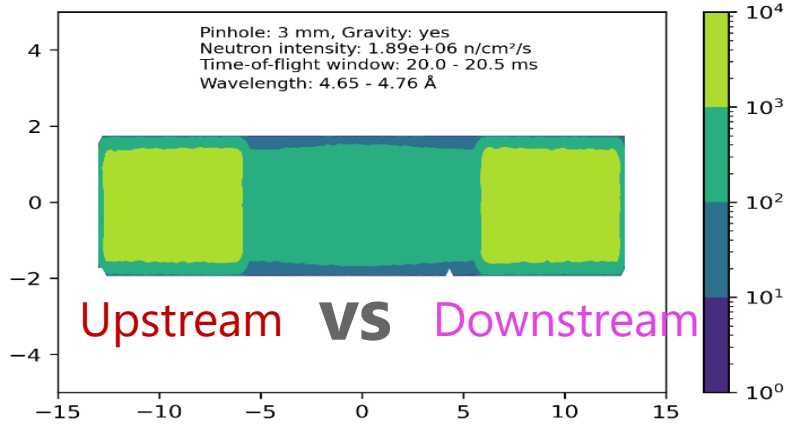
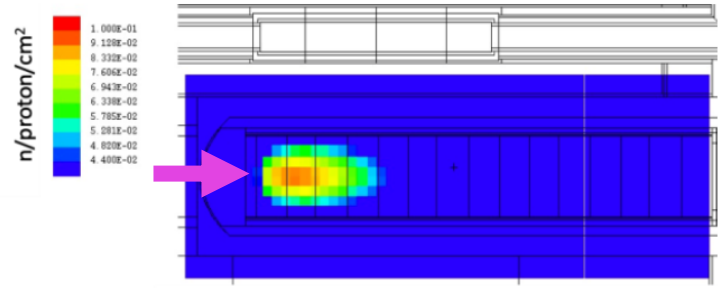


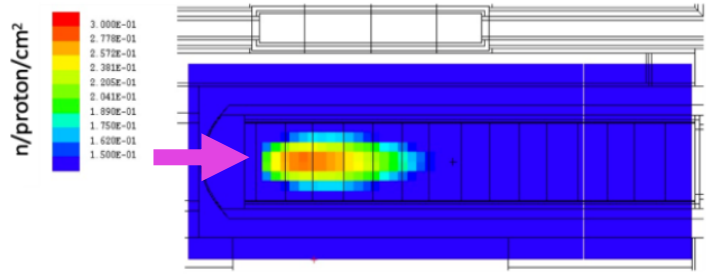
Image at TBL by ‘pinhole imaging’



Projected range

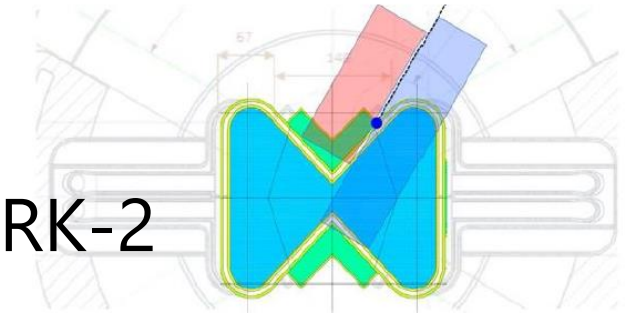


800 MeV



2 GeV

Moderator

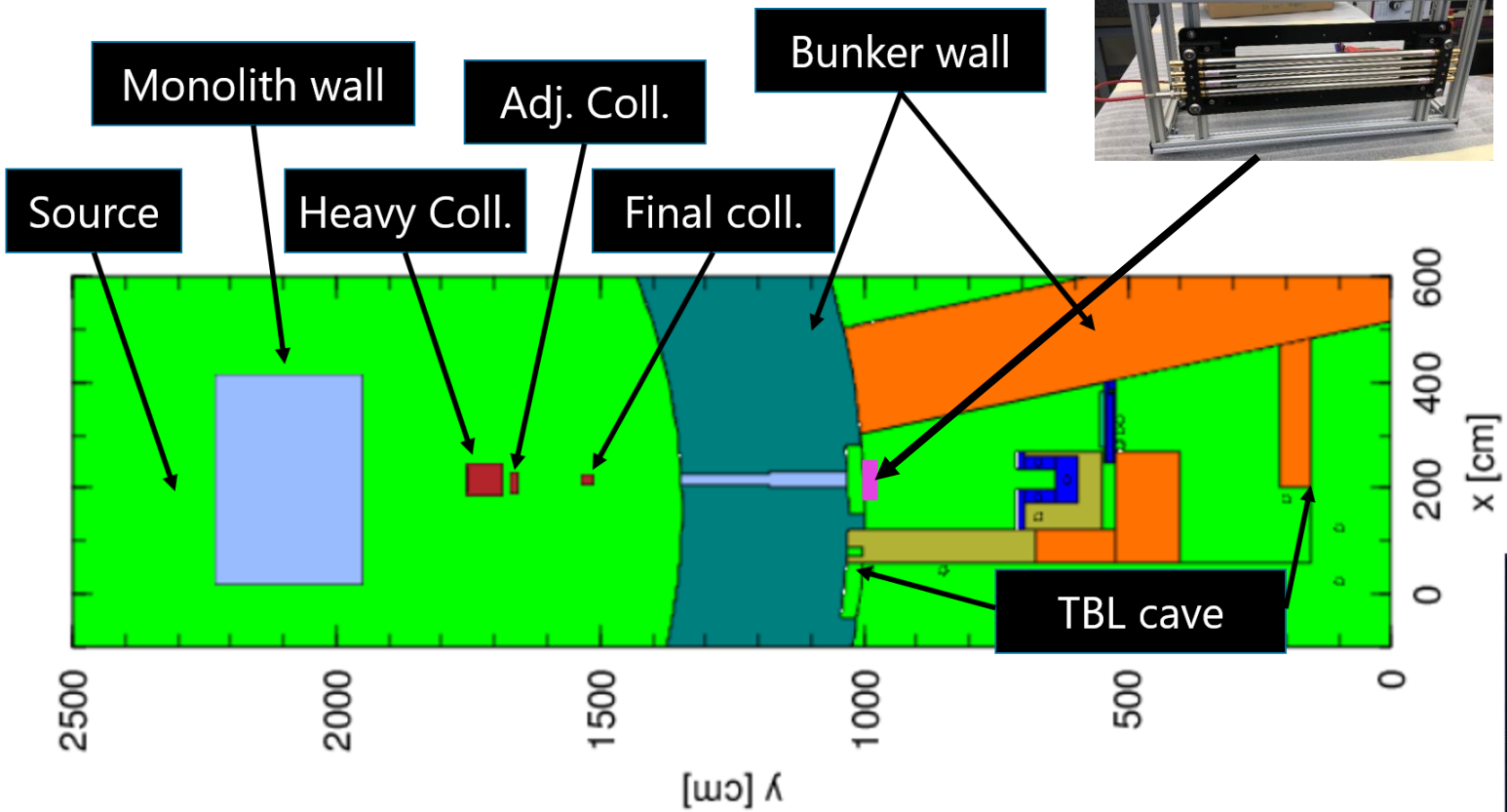


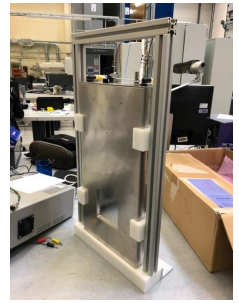
BF-1/MARK-2

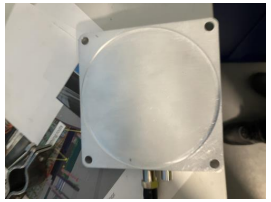
Test 1: Validation of Neutron Production

He-3 tubes (63.6% efficiency @1.6Å)

Located close to the bunker wall

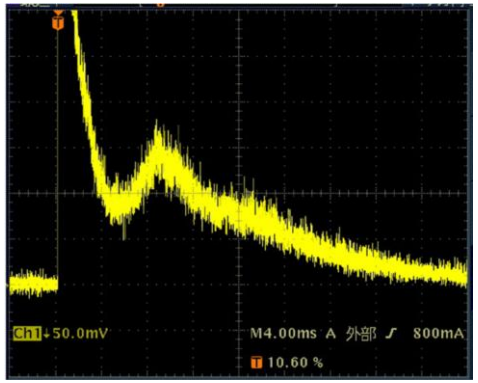






Expected result: 1D tof spectrum

Minimum result: 0D neutron counts



Proton beam 800 MeV, 5 μs pulse width @1Hz, 25 W
Neutron flux ~ 400 n/cm^2/s

F. Maekawa *et al.*, *NIMA*, **620** (2010) 159-65.

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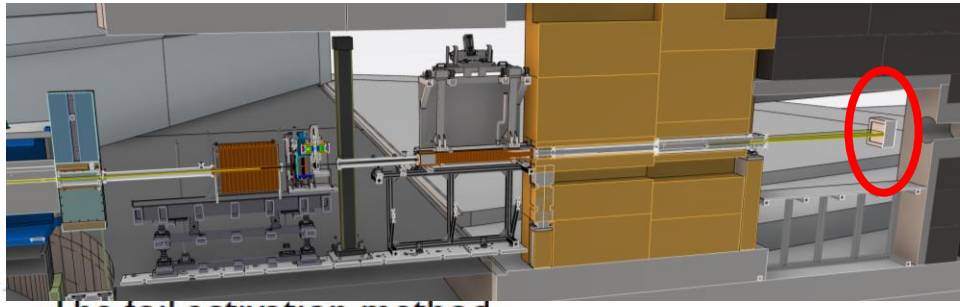
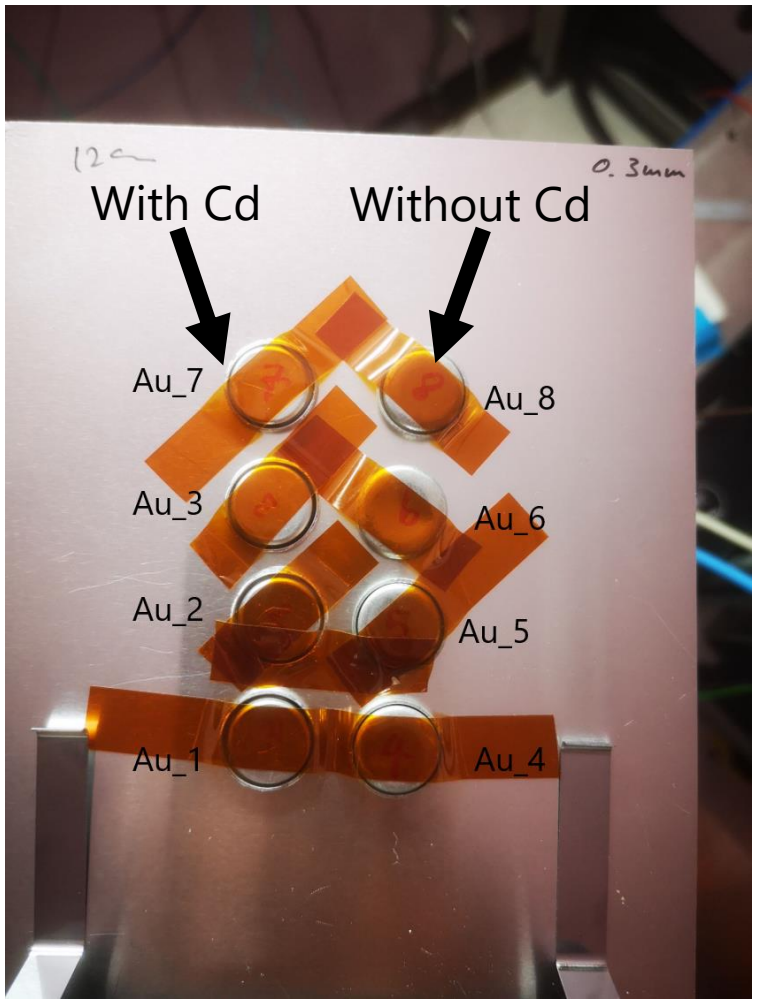
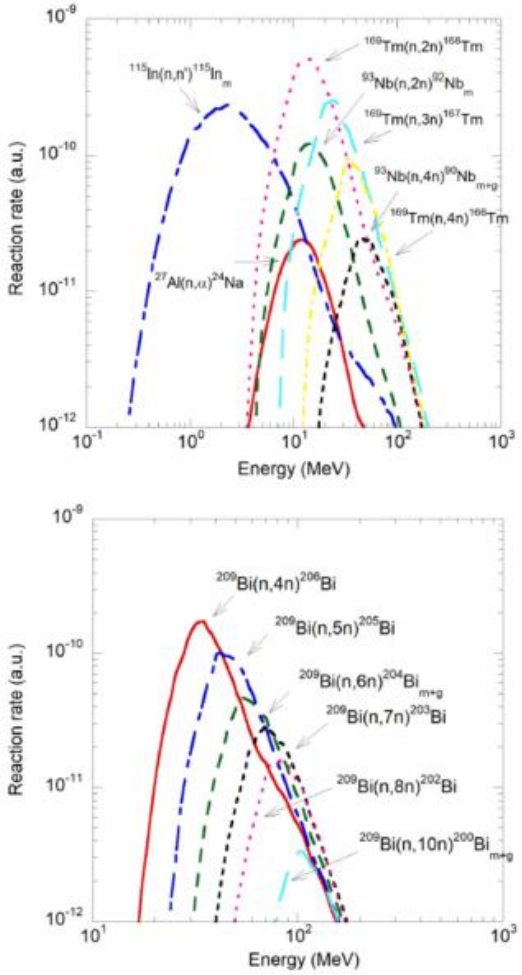
Test 7: Foil measurements

Beam power > kW

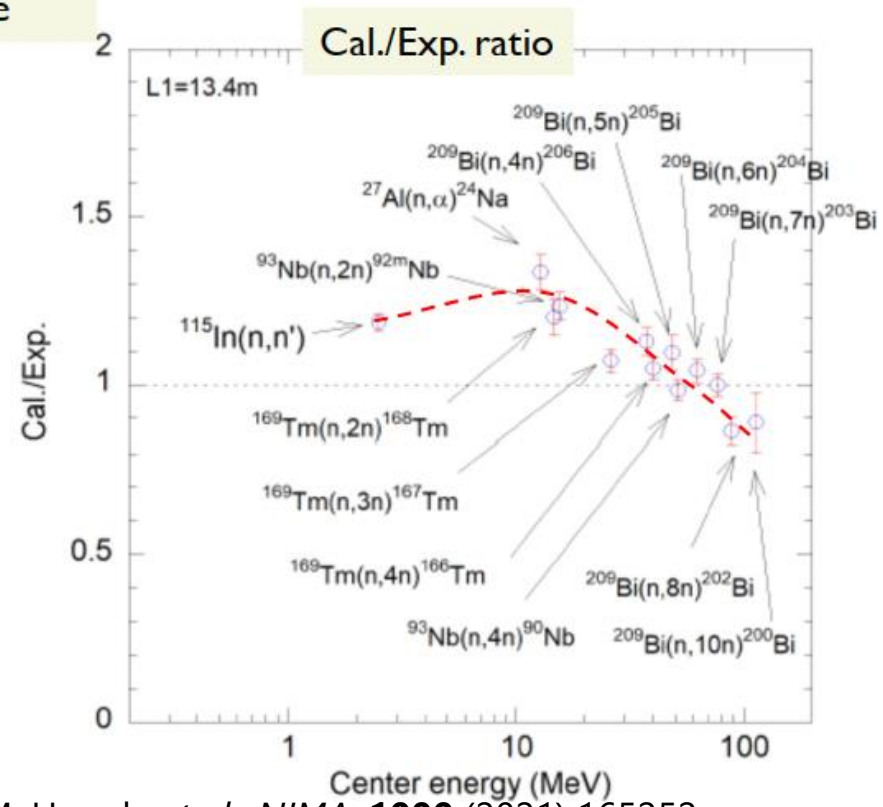






Reaction rate

The foil activation method with the threshold energy reactions was used.



M. Harada *et al.*, *NIMA*, **1000** (2021) 165252.

More foils for epithermal/fast
Al, Cu, Fe, In, Mg, Ni, Sc, Ti, V, Zr, Tm, Dy

Expected result: Flux - Whole range

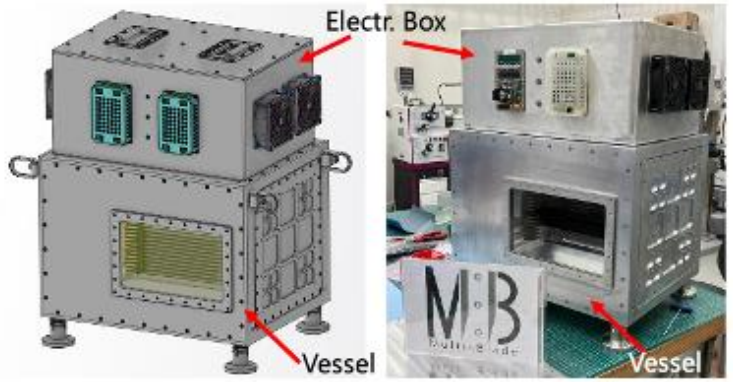
Minimum result: Thermal/cold flux (< Cd)

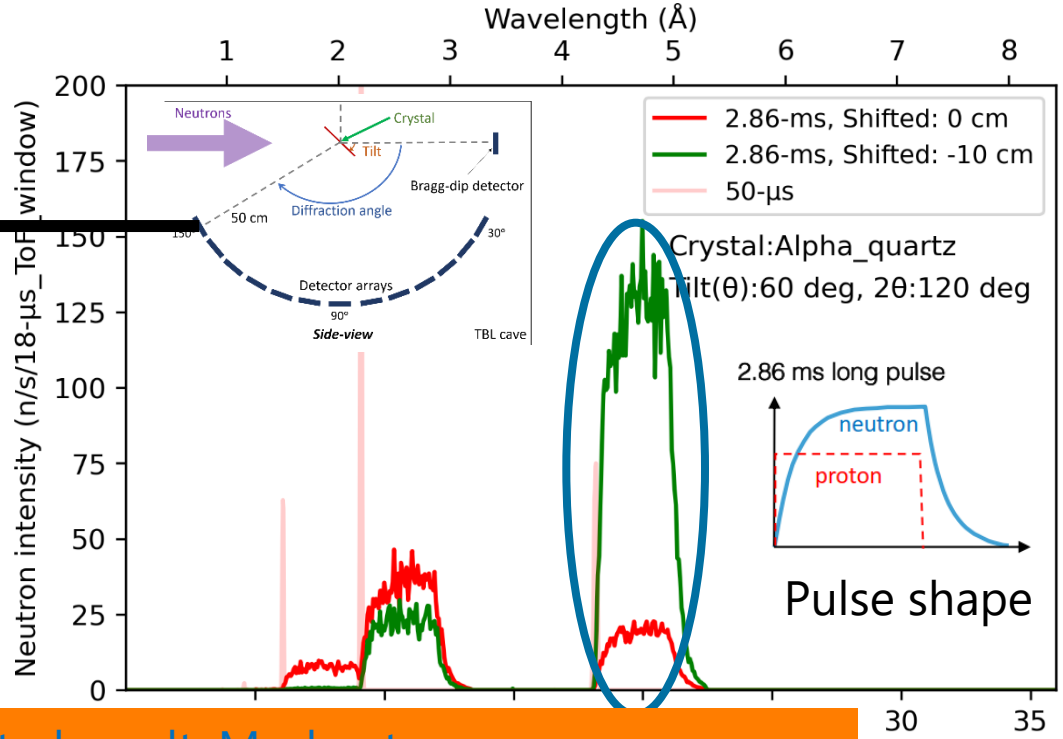
Test 4: Pulse-shape: Diffraction

Beam power > hundreds kW

This calibration is to ensure the pulse shape of ESS neutron production. A large lattice powder (e.g. mica) will be used to diffract beam at larger angles. The setup is under development.

Please suggest:
1) Detector config
2) Sample? Single crystal > Powder
3) Radial collimator?



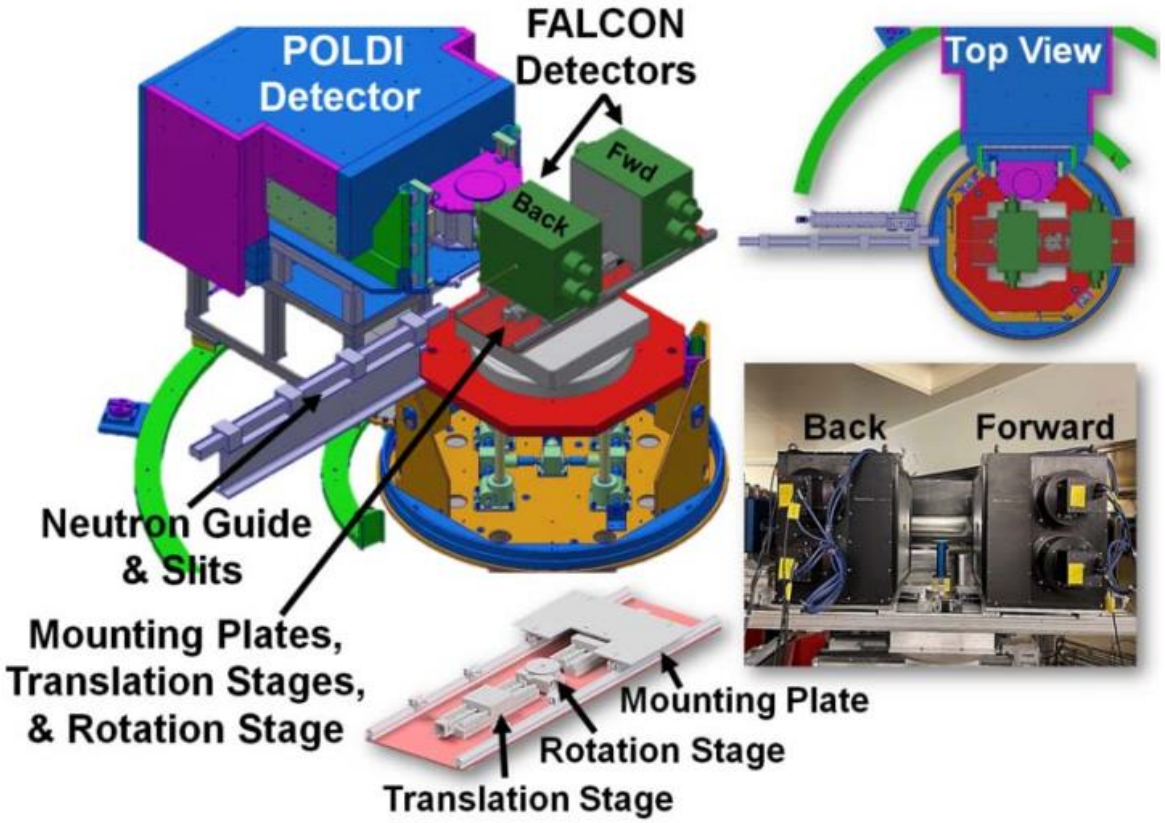


Setup will be employed like conventional *Bragg diffraction* using MB/nGEM at a fixed and tilt angle. This setup needs more space. Perhaps, the detector will be placed under the table and faced tilting to the sample?

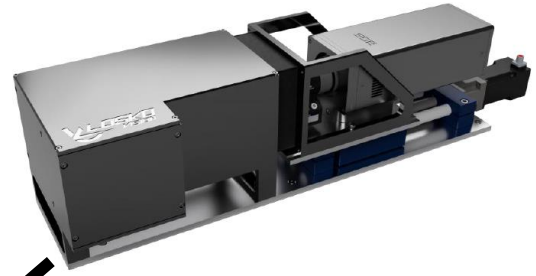
Expected result: Moderator response

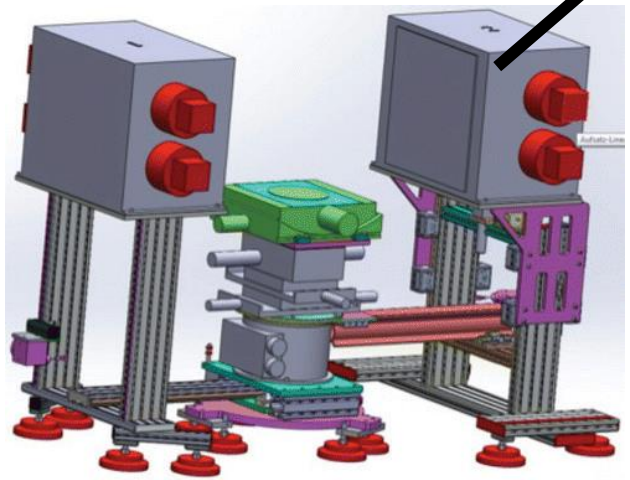
Minimum result: 2.86-ms pulse shapre

Test 4: Pulse-shape: Laue camera



We foresee *Laue diffraction*, using LumaCam detector, same as the flight path calibration (but larger FoV).





Setup similar to FALCON (HZB)

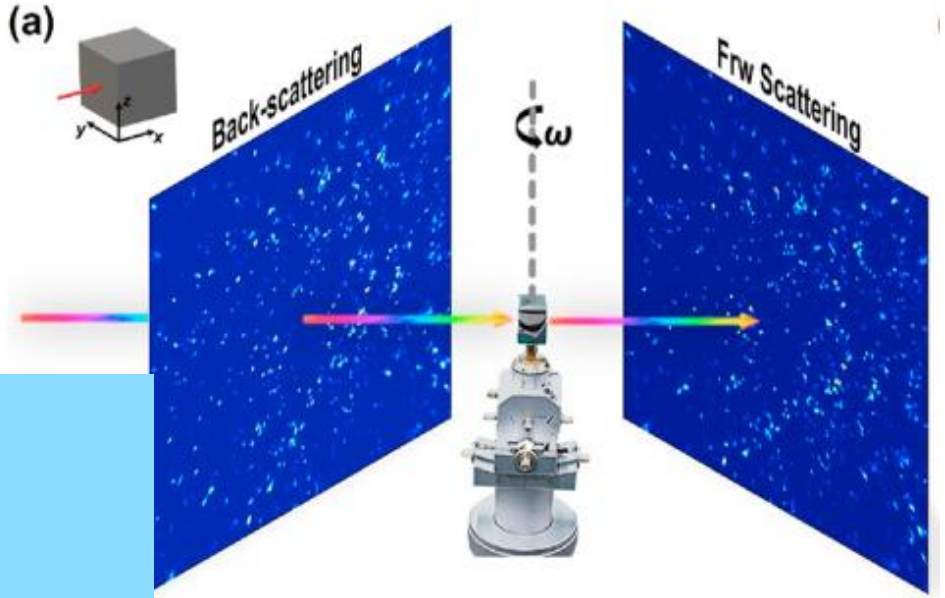
S. Samothrakitis *et al.*, *J. Appl. Cryst.*, **56** (2023) 1792–1801.
S. Samothrakitis *et al.*, *Mater. Today Adv.*, **15** (2022) 100258.

Please suggest:
1) Backward or Forward
2) FoV size and sample-to-detector distance
3) Stage configuration

Single crystal alignment/measurements?

This has been written in TBL scope, but lack of information or users' inputs.

Assume: we need goniometer head and alignment pin?



Please suggest:

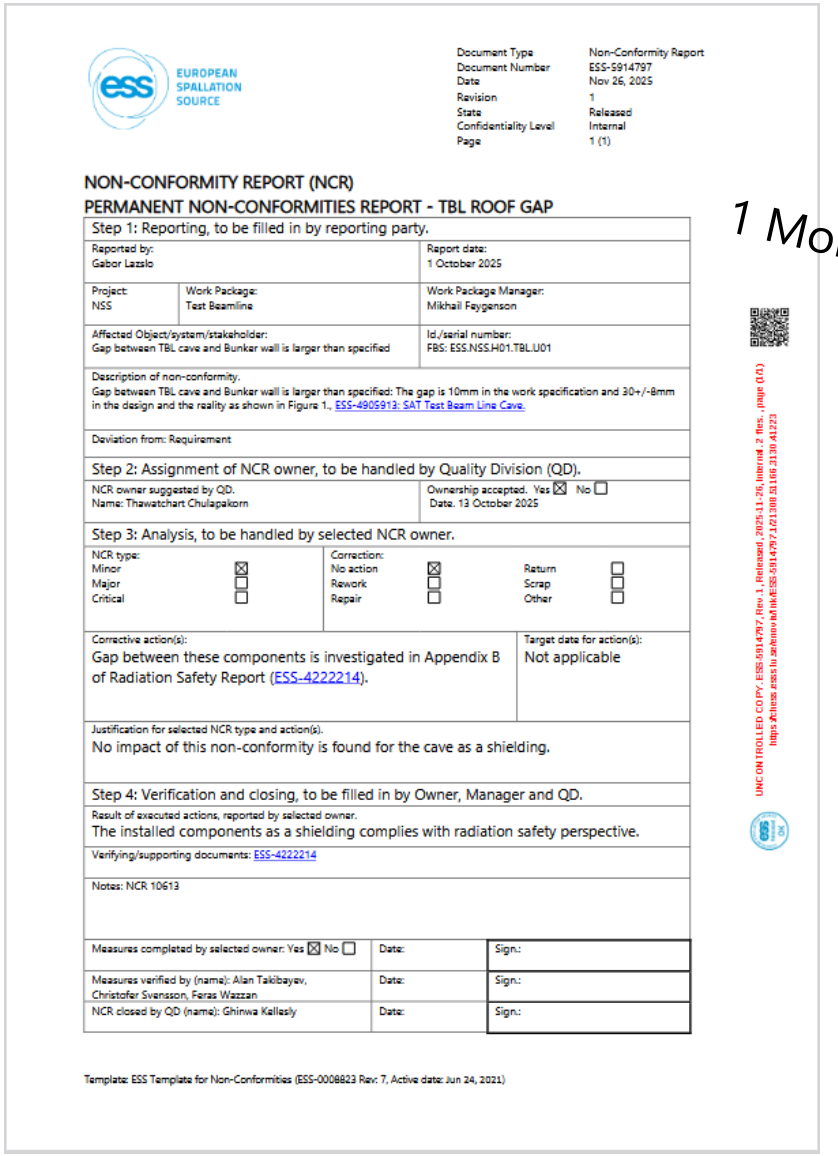
1) Alignment pin?
2) Transfer to other beamlines?
3) Stage setup compatible with previous Laue setup?

Outline

- ❑ Overview of TBL Layout
- ❑ Activities in the past 6 months
- ❑ BoT and Hot-commissioning
- ❑ Test cases to be discussed
- ❑ From previous comments

Updates from the latest STAP report (1)

1) Cave wall/roof gaps (> 10 mm) ➔ *Done*
- No radiation safety impact
- Need to file NCR reports (part of TG5)



EUROPEAN SPALLATION SOURCE

Document Type	Non-Conformity Report
Document Number	ESS-5914797
Date	Nov 26, 2025
Revision	1
State	Released
Confidentiality Level	Internal
Page	1 (1)

NON-CONFORMITY REPORT (NCR)
PERMANENT NON-CONFORMITIES REPORT - TBL ROOF GAP

Step 1: Reporting, to be filled in by reporting party.

Reported by: Gabor Laszlo		Report date: 1 October 2025
Project: NSS	Work Package: Test Beamline	Work Package Manager: Mikhail Feygenson
Affected Object/system/stakeholder: Gap between TBL cave and Bunker wall is larger than specified		Id./serial number: FBS: ESS.NSS.H01.TBL.U01

Description of non-conformity.
Gap between TBL cave and Bunker wall is larger than specified: The gap is 10mm in the work specification and 30+/-8mm in the design and the reality as shown in Figure 1., ESS-4905913: SAT Test Beam Line Cave.

Deviation from: Requirement

Step 2: Assignment of NCR owner, to be handled by Quality Division (QD).

NCR owner suggested by QD. Name: Thawatchart Chulapakorn	Ownership accepted. Yes ☒ No ☐ Date. 13 October 2025

Step 3: Analysis, to be handled by selected NCR owner.

NCR type:		Correction:			
Minor	☒	No action	☒	Return	☐
Major	☐	Rework	☐	Scrap	☐
Critical	☐	Repair	☐	Other	☐

Corrective action(s):	Target date for action(s):
Gap between these components is investigated in Appendix B of Radiation Safety Report (ESS-4222214).	Not applicable

Justification for selected NCR type and action(s).
No impact of this non-conformity is found for the cave as a shielding.

Step 4: Verification and closing, to be filled in by Owner, Manager and QD.

Result of executed actions, reported by selected owner.
The installed components as a shielding complies with radiation safety perspective.

Verifying/supporting documents: ESS-4222214

Notes: NCR 10613

Measures completed by selected owner: Yes ☒ No ☐	Date:	Sign.:
Measures verified by (name): Alan Takibayev, Christofer Svensson, Feras Wazzan	Date:	Sign.:
NCR closed by QD (name): Ghinwa Kallasly	Date:	Sign.:

Template: ESS Template for Non-Conformities (ESS-0008823 Rev: 7, Active date: Jun 24, 2021)

1 Month for this doc.

Updates from the latest STAP report (1)

2) *"The instrument and sample environment teams do not have procedures to bring user-supplied equipment or even samples to/from ESS."* ➔ No space for temporary storage of activated materials (samples, sample environment, activated foils, detectors) ➔ *still no conclusion*

- No procedure how to move activated foils to spectrometer located outside Supervised Area.

3) *"ESS must provide policies to receive and ship samples and equipment as well as how to integrate equipment."* Still no conclusion/guideline since then ➔ *still no conclusion*

- Not all samples/equipment need integration (ISIS 1 day, JPARC 1 hour, ILL right away?)

4) Motion Controls are fully handed over to Instrument team. ➔ *Done*

5) Reliability of software is *not mature*, constantly updates without discussion with Instrument Team. Long waiting time to resume the operation of all system.

6) Live data is just available last week for trial, but only for Beam Monitor ➔ *No live-view tools for other detectors* including ones used for BoT. We need a ready-to-use systems for BoT.

Updates from the latest STAP report (2)

7) Supports from collaborators outside ESS is valuable apart from limited resources from ESS staff. (Lumacam)

8) Dry-run experiments for TBL are planned to be after summer break after 5) has been rechecked this year. ➔ Planned: Neutron/Gamma source tests on all detectors.

10) *"The STAP suggests ESS pro-actively exploring the potential of utilizing the Lumacam detectors for diffraction and other neutron scattering modalities as a cost-effective and low Maintenance…"* ➔ The suggestions to get more Lumacams has not been granted by Division Head. (Comment 1)

11) *"TBL: No special software needs, mostly similar to ODIN. The software teams need to ensure that data can be displayed in 2D, TOF etc with flexible binning in space and time."(Comment 2)* – We move forward on standalone solution for Data Analysis. This is actually because of no progress in good-timing on ODIN software. Partial Data Reduction can be done via scipp tools (not all). Although Live-view cannot be used at all, using supplier's software or even Oscilloscope will be our last stop.

Updates from the latest STAP report (3)

12) “Readiness”:
- Tested at other facilities ➔ *Done and plan more*
- Tested with weak 370 MBq AmBe source ➔ Done but will redo with stronger source (37 GBq)
- Multiple detector technologies at BoT ➔ He3, nGEM, Lumacam (scintillator selection?)

13) Arc collimator for Brightness measurement:
- We only have parallel Soller collimator from V20.
- Arc collimator will be tested in simulation if the result improves.

14) Portable detectors should be available shortly (undocumented works): nGEM, CMOS, Lumacam. Can be used at any instruments as long as there is a space…

Still some issues…

1) **Motorized door** is not yet installed.
2) No allocated **space and guidance for activated materials** (sample/SE/detectors) storage.
3) No procedure how to **receive/send equipment** from/to external stakeholders.
4) Control hutch is still **shaking**.
5) **No direct passage** between TBL and E03 Optics Lab (storage and optics tests) without exiting the Supervised area.
6) DMSC mentioned that they are ready for BoT, but many issues on software and hardware are **not yet complete** such as Live-view.
7) More resource on computation hardware: VISA is not ready for **heavy-duty imaging analysis**, workstations for TBL are **mostly used for ODIN ➔ We need more workstations!**, Live-view tools. (Using hpc is not easy for non-expert linux users).
8) Imaging software: both open-source and proprietary will be implemented on our **local workstations** rather than VISA (Dragonfly has not been in used at all even we got the license).
9) Sample holders are being prepared and will be tested together with standard samples in autumn 2026.
10) Many small sub-levels to contacts for DMSC: E.g. if there is no data displayed, we have to identify the issue ourselves in order to contact to the 'right' person. Different groups "impose" different rules to us.

Prefer to have all issues resolved before October to allow practice with real system before BoT.

Thank you

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christofer.svensson@ess.eu (former engineer)
samuele.andreucci@ess.eu (former installation)