TG5/SAR Meeting

ODIN: Hot commissioning plan

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+ support groups

LUND
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ODIN - System Validation and verification Plan

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LED COPY. ESS-1075656, Rev. 2, Released, 2025-11-13, Internal. 1 file. , page (1/25)
ps://chess.esss.lu.se/enovia/link/ESS-1075656.2/21308.51166.47581.13552

3.1 FBS and Test Reports

FBS	System name	Integrated Test Report	Integrated test Plan	SAT report
=ESS.NSS.H01.ODIN	ODIN	NA	NA	NA
=ESS.NSS.H01.ODIN.F01	Personnel Safety System (PSS)	NA	NA	NA
=ESS.NSS.H01.ODIN.A02	Sample Exposure System	NA	NA	NA
=ESS.NSS.H01.ODIN.A02.W01	Sample Positioning	ESS-5849575	ESS-5820454	ESS-5765134
=ESS.NSS.H01.ODIN.A02.W02	Support & Rail System	NA	NA	ESS-5841787
=ESS.NSS.H01.ODIN.A04	Support Systems	NA	NA	NA
=ESS.NSS.H01.ODIN.A04.A01	Control Hutch	NA	NA	ESS-4812810 ESS-5510167 ESS-5572438
=ESS.NSS.H01.ODIN.A04.A02	Sample Preparation Facility	NA	NA	ESS-4812810 ESS-5510167 ESS-5572438

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ESS Ramp Up

Assuming BOT Feb 2026

Beam parameters are indicative only, actual beam will depend on progress of commissioning

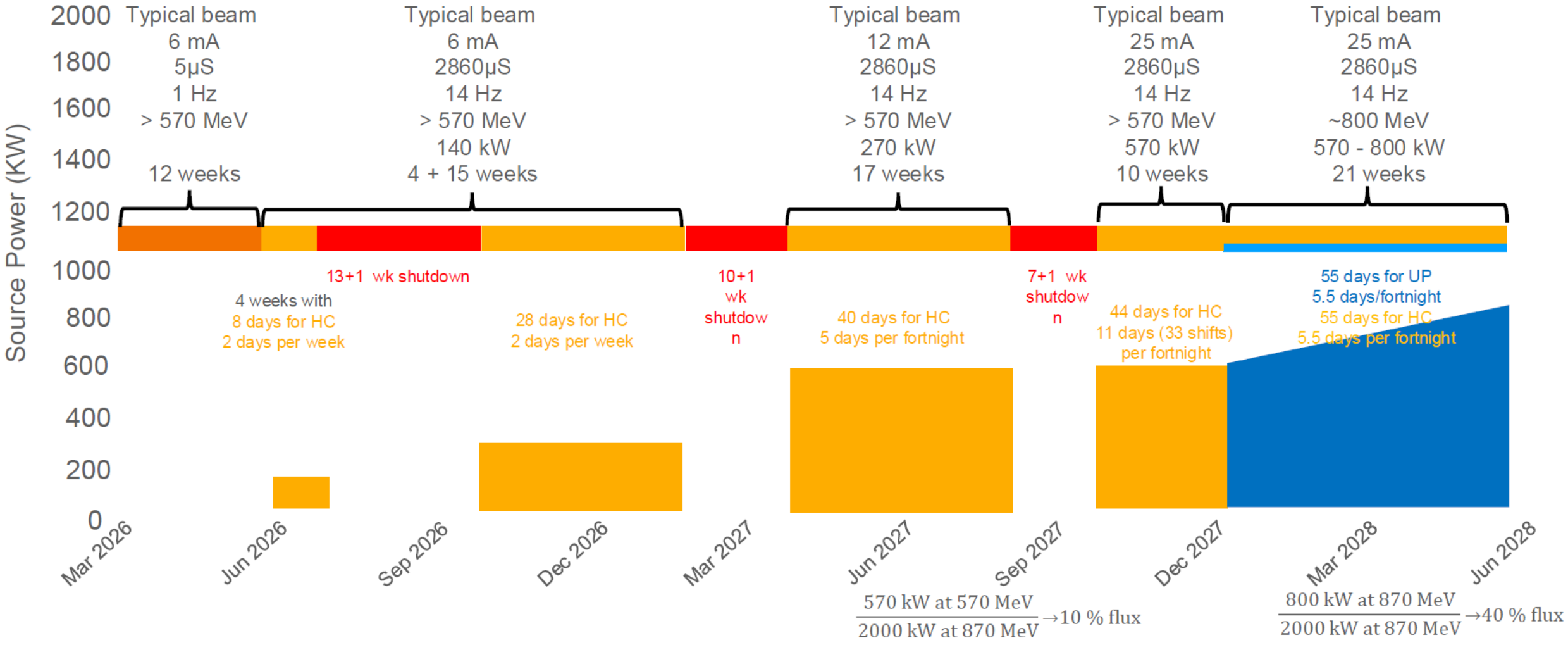
Accelerator commissioning & TBL

Hot commissioning

Shutdown

Users

First users



See ESS-0420218 “Early operations of ESS and prerequisites for first scientific results” for more details

Phase	Main focus
Accelerator, Target & TBL (12 weeks)	First beam on target. Establish nominal (3ms) pulse length at low current (6mA or lower). Validation of moderator performance using TBL. (stable beam likely available overnight for instruments)
Hot commissioning #1	Power ramp up and availability improvements Target transient tests First dedicated neutron beam for instruments 2 days per week dedicated for instrument hot commissioninig
Hot Commissioning #2	Power ramp up and availability improvements Target transient tests 5 days per fortnight dedicated for instrument hot commissioninig
Hot Commissioning #3	Power ramp up and availability improvements 11 days per fortnight dedicated for instrument hot commissioninig
First User Period	Power ramp up and availability improvements 11 days per fortnight above 500kW for instruments HC Half of the instrument time with users, rest for continued HC

Hot commissioning - overview

1. Shielding (steered by RP)
2. Hot commissioning of beam monitors
3. White beam profile with an imaging detector
4. Flight path calibration
5. Beam spectrum
6. Gold foil measurement
7. Choppers phases verification
8. Beam limiters and pinhole
9. WFM
10. Characterization of background (incl. T0 chopper)
11. Gamma strikes
12. Characterization of position and tilt of detectors
13. Resolution (TOF and spatial), including potential spatial dependencies.
14. Tomography and Bragg edge (first science).
15. Commissioning of SE

1. Shielding (steered by RP)

Demonstrate the performance of the shielding to the licensing authority

Procedure

- Bridge beam guide and heavy shutter closed, check the radiation level at various points of the instrument
- Bridge beam guide open and heavy shutter closed, check radiation level in various points of the instrument (to be repeated every time the accelerator changes some setting) (ESS-1571051) (ESS-3394509) (ESS-2711154).
- Radiation around the beam stop area and around the door of the cave
- Verify the cave shielding according to the procedure defined in the H1/H2 document (ESS-0135303)
- See also the Generic ESS Instrument Commissioning Plan (ESS-5146219)

Checkpoint

The measured dose outside any points of the bunker, guide shielding and cave is below the threshold of 3 uSv/h, and <25 uSv/h on the roof of the cave (ESS-3394509)[6](ESS-1571051)

2. HC of beam monitors

Demonstrate the performance of the shielding to the licensing authority

Assumptions

- Monitors successfully cold commissioned and calibrated
- Sufficient accelerator power

Procedure

- Test signal in the first monitor when bridge beam guide is open (in parallel with Shielding)
- Test signal in last two monitors when the heavy shutter is open

3. White beam profile with an imaging detector

Assumptions

- The imaging detector is fully integrated
- Basic functionality of the data reduction software available. Refer to documents derived from the Black Forest Software Workshop held in 2017 (ESS-5162255).
- Cold commissioning of the relevant motors (pinhole, beam limiters, camera box)

Successful

Procedure

- With all choppers parked open, plot the white beam profile vs. position for different pinhole openings

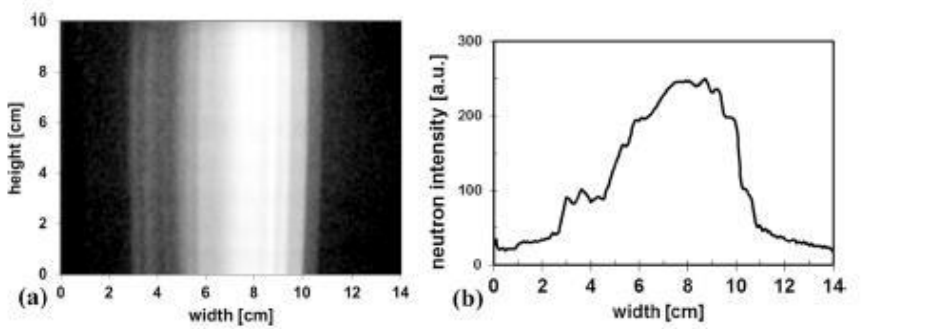
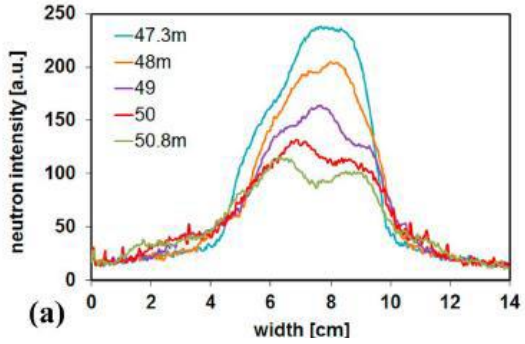


Fig. 5. (a) The beam profile at 47.3 m (about 1.1 m after the end of the guide, without any additional slit), recorded with a scintillator-CCD camera. (b) Intensity distribution across the beam profile.

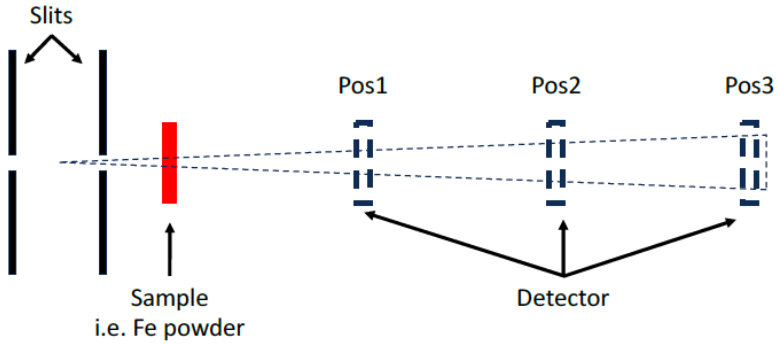


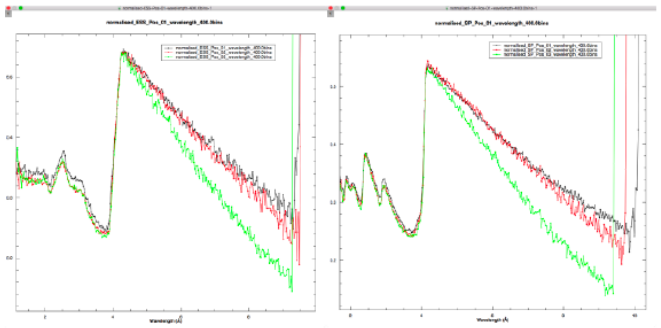
4. Flight path calibration

Calibrate the effective flight path as a function of position (and eventually wavelength resolution according to high level requirements) (ESS-0129656)

- Some ToF functionality of the data reduction software are available
- Well calibrated reference sample is available (Fe powder, Ce203)
- ToF detector available and fully integrated
- A mobile beam monitor is available for cross-checking the results

- Use standard Fe sample for wavelength calibration (Bragg edge) in the filter bank (sample shall be measured at other neutron sources first).
- Be-filter can also be used to verify
- Check for detector pile-ups
- Check for position dependency
- This step will be repeated after the commissioning of the chopper cascade for all the instrument's modalities (ESS-0129656)





5. Beam spectrum

Assumptions

- Beam monitors working
- ToF detector integrated
- Sufficiently powerful and stable beam
- Moderator pulse shape measured and according to expectation (ODIN can also serve as a test bench if needed, with a monochromator or a diffraction setup)

Procedure

- With all choppers parked open, plot the white beam profile vs. position for different pinhole openings

6. Gold foil measurement

Assumptions

- Sufficiently powerful and stable beam
- Au-foil and corresponding equipment in working condition
- Au-foil procedure measurement established
- Radiation protection group available to perform the measurements

Procedure

- Refer to RP group procedure
- Repeat for various chopper configurations (after the chopper verification is complete)

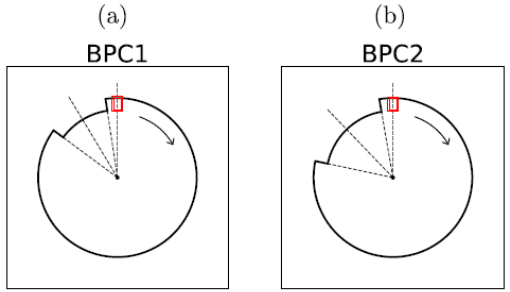
7. Chopper phases verification

Assumptions

- Sufficiently powerful and stable beam
- Pulse length as by design

Procedure

a. From downstream and go upstream. Use monitors
b. Park all choppers open. Step BPC1 through (parked) in 1deg (or finer) steps



c. Park all choppers open. Step BPC2 through (parked) in 1deg (or finer) steps
d. Spin both BPCs and record ToF spectra with different wavelength ranges (include table here with phases)
e. Same for FOC, and WFM
f. BPC: use Bragg edges to test wavelength ranges
g. Repeat steps a-f with the chopper spinning at the source frequency (not parked)

8. Beam limiters and pinhole

Assumptions

- Sufficiently powerful and stable beam

Procedure

a. Park all the choppers open
b. Verify centring w.r.t. the beam axis
c. Verify opaqueness
d. Measure spectra/effects of the filters

9.1 WFM

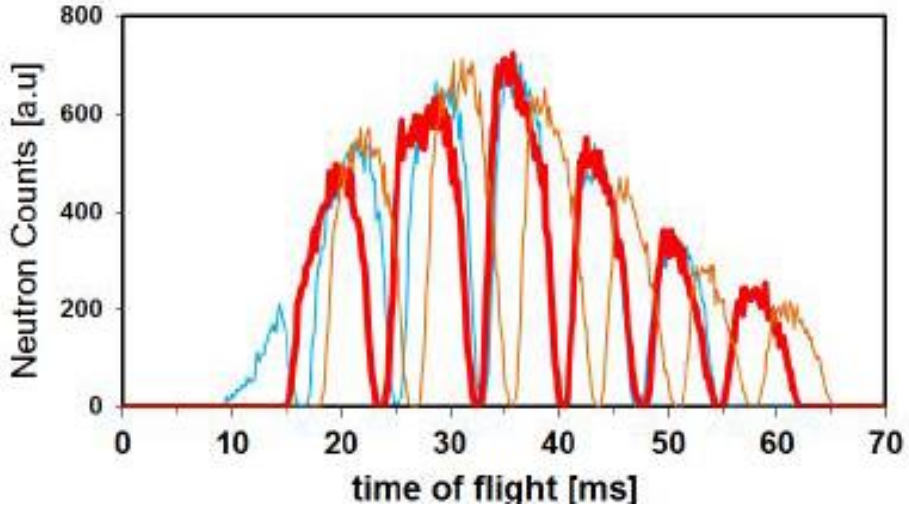
Wavelength Frame Multiplication

Assumptions

- Sufficiently powerful and stable beam
- Data reduction is fully functional (at least in “expert mode”)
- All detectors are fully integrated
- The data acquisition chain is fully established

Procedure

a. Park all the choppers open



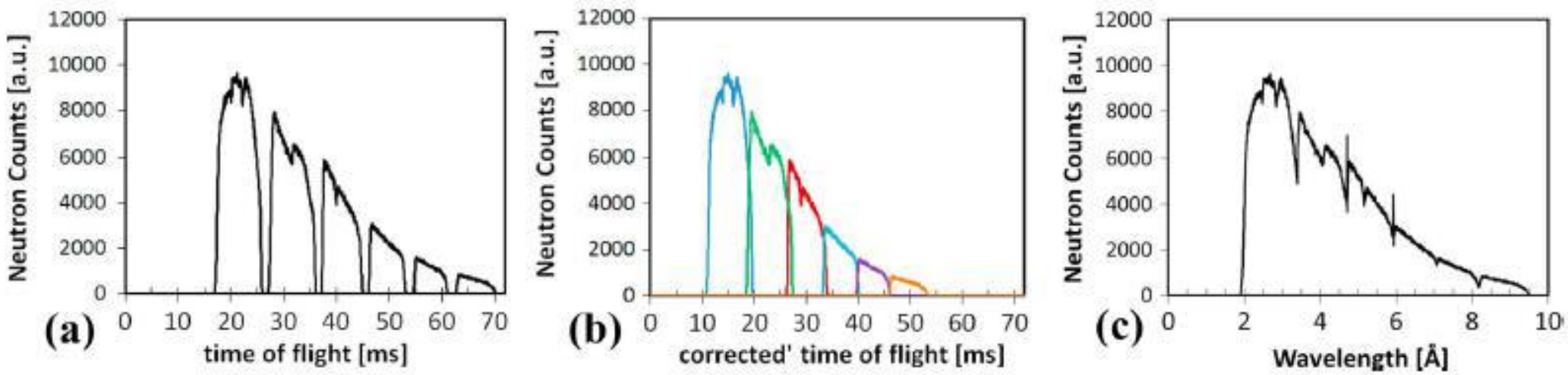
Time of flight spectrum at the detector at TBL of V20 at HZB, with three different phase settings

9.2 WFM

Wavelength Frame Multiplication

Procedure

b. Test the data reduction algorithm (frame stitching) with 3 and 6 frames

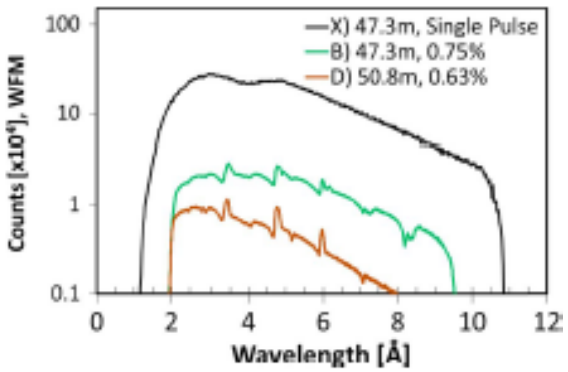


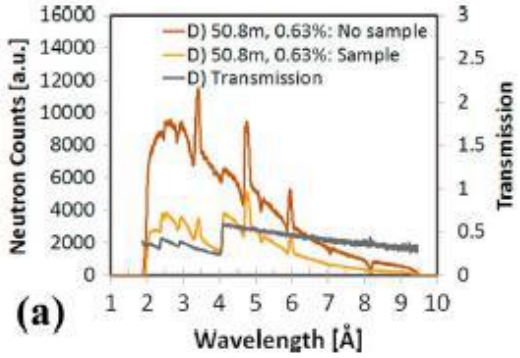
The time-of-flight spectrum corrected with the frame stitching algorithm. The corrected spectrum converting time of flight into neutron wavelength

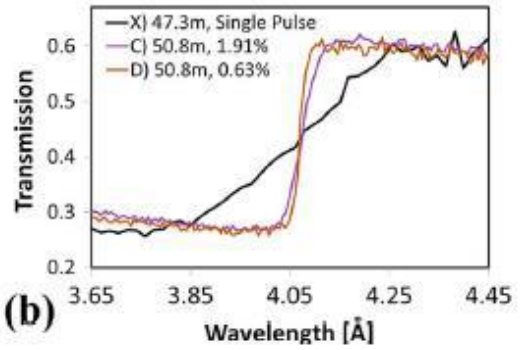
9.3 WFM

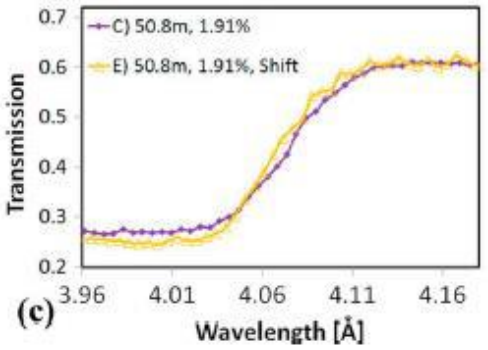
Wavelength Frame Multiplication

c. *Verify the obtained resolution with known samples*
d. *Test for local variation of the stitching performance*
e. *Repeat for higher and higher resolution*
f. *Refer to WFMC stitching software package (ToF)*
g. *Check the effect of global phase delay*









Examples of wavelength spectra with sample, and without sample playing with the resolution adjusting theseparation between the WFM choppers at TBL of V20 in HZB.

10. Characterization of background (incl. T0 Chopper)

Assumptions

- Sufficiently powerful and stable beam

Procedure

a. Spin all the choppers for a given instrument modality
b. Park WFMC2 closed
c. Measure the corresponding signal
d. Spin the T0 chopper
e. Measure the corresponding signal
f. Spin the WFMC2 as desired (or park it open for WB)
g. Measure the corresponding signal
h. Stop the T0 chopper
i. Measure the corresponding signal
j. Compare the results both in spatial distribution and in ToF

11. Gamma strikes

Assumptions

- Sufficiently powerful and stable beam

Procedure

a. See before, use a Gamma sensitive scintillator

12. Characterization of position and tilt of detectors

This is for use with grain mapping, which is not part of the initial scope

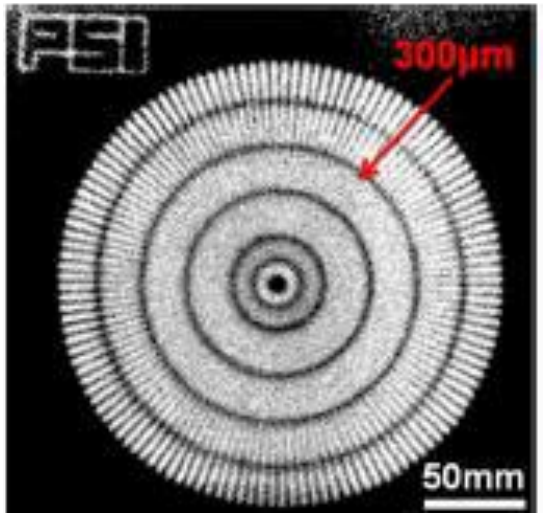
13. Resolution (ToF and Spatial), including spatial dependencies

Assumptions

- Sufficiently powerful and stable beam
- Samples for spatial resolution are available
- Stress rig for ToF/strain resolution available and integrated

Procedure

a. Measure the spatial resolution for all the various instrument modalities
b. Measure the wavelength resolution for all the various instrument modalities using an appropriate sample

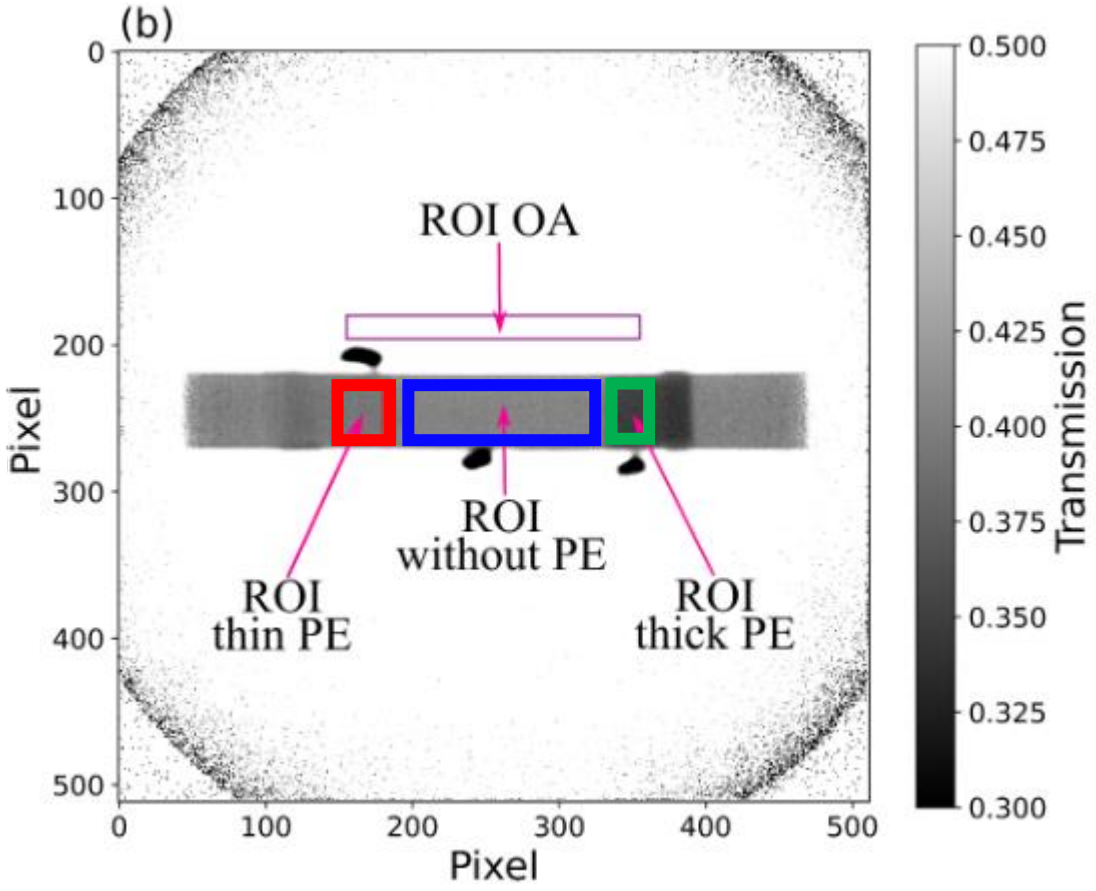


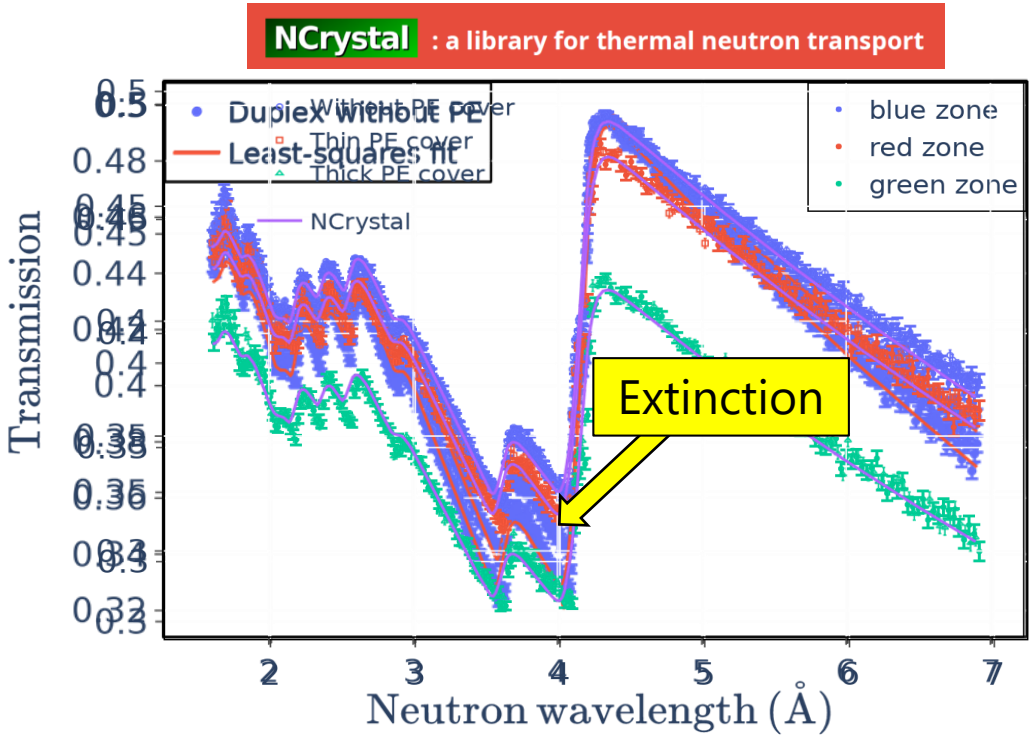
Neutron radiography of PSI spatial resolution Siemens star, a standard tool to evaluate the spatial resolution in a neutron imaging instrument

14. Tomography and Bragg edge (first science)

Shuqi Xu

1) Establish Fit for **Sample Composition**
2) Mimic H with **PE sheets**
3) Derive PE thickness from Fit





Fitted thickness:
thin PE: 44±2 μm
thick PE: 230±2 μm

≈98 wt.ppm H
≈ 495 wt.ppm H

15. Commissioning of SE

Assumptions

- Sufficiently powerful and stable beam
- Sample environments available and integrated

Procedure

- TBD depending on the specific SE

Time planning

#	Activity	Expected duration (days)	Resources needed
1	Shielding (steered by RP)	5	see text
2	Hot Commissioning of beam monitors	3	
3	White beam profile with an imaging detector	3	
4	Flight path calibration	3	
5	Beam spectrum	3	
6	Gold foil measurement	1	
7	Choppers phases verification	10	
8	Beam limiters and pinhole	2	
9	WFM	20	
10	Characterization of background (incl. T0 chopper)	5	
11	Gamma strikes	2	
12	Characterization of position and tilt of detectors	2	
13	Resolution (ToF and spatial), including potential spatial dependencies.	10	
14	Tomography and Bragg edge (First science).	10	
15	Commissioning of SE	5	
	Total	84	

THANK YOU!