



Update on LoKI

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2025-10-21



LoKI Progress

Installation Complete – June 2025

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LoKI instrument installed and ready for commissioning at ESS: A testament to the power of collaboration

SEPTEMBER 2, 2025



LoKI is getting ready for neutrons. Image: Ulrika Hammarlund/ESS

The installation phase of the LoKI instrument at ESS is now complete, and the instrument is set to begin its cold commissioning phase – a major milestone for ESS as it progresses toward full operations. LoKI, an advanced Small Angle Neutron Scattering (SANS) instrument, has been developed and delivered through a close collaboration between ESS and its UK In-Kind Partner, ISIS Neutron and Muon Source. This shared effort exemplifies the power of partnerships between scientific institutions.

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LoKI instrument installed and ready for commissioning at ESS: A testament to the power of collaboration 02 Sep 2025

As part of the UK contributions to the European Spallation Source (ESS) in Sweden, ISIS is taking the lead in designing and delivering two key instruments: LoKI and FREIA. The installation phase of the LoKI instrument at ESS is now complete.

The instrument is set to begin its cold commissioning phase – a major milestone for ESS as it progresses toward full operations. LoKI is an advanced small angle neutron scattering instrument and will be one of the first to receive neutrons when the ESS enters operations. The beamline was designed and built at ISIS and then installed at the ESS. This shared effort exemplifies the power of partnerships between scientific institutions.

"This milestone celebrates more than just engineering achievement - it's a testament to the strength of the partnership between ISIS and ESS," says Andrew Jackson, Head of the Large Scale Structures Division at ESS. "At ESS, we've learned an enormous amount working closely with the ISIS team, who have delivered exceptional equipment and documentation. Their commitment and support at all levels have been vital to the success of this project."



LoKI detector installation

LoKI is an instrument that will support soft-matter, materials, and life-science researchers that need to make advanced nanoscale measurements. Areas of research that will benefit from LoKI include: understanding the flow behaviour of complex fluids such as personal care products and pharmaceutical formulations; examining the formation and stability of lipid nanoparticles used for drug delivery; understanding the interactions and structure of proteins in solution; and studies of polymer composites and smart materials under strain.

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https://www.isis.stfc.ac.uk/Pages/News25_LoKI.aspx

<https://ess.eu/article/2025/09/02/loki-instrument-installed-and-ready-commissioning-ess-testament-power>

LoKI Progress

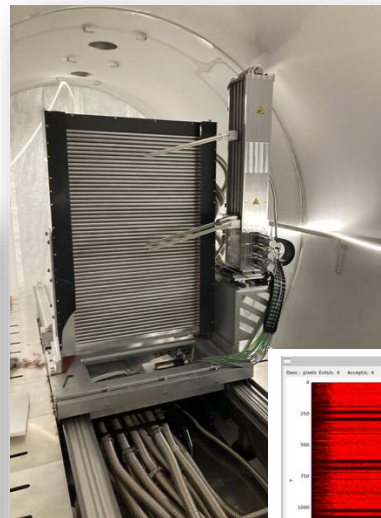
Installation Complete



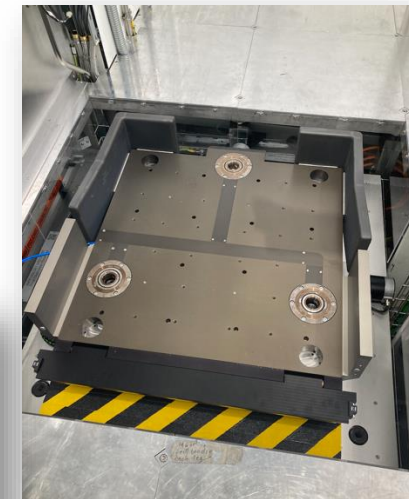
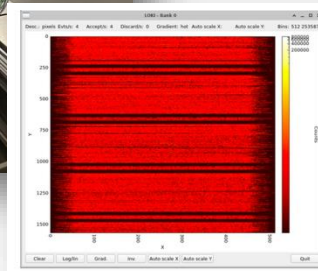
Hannah and Clara inspecting slit system cabling before closing shielding



PSS Installed



Long runs counting cosmics have allowed us to identify cabling and connectivity issues on the detectors. All now resolved



Sample stack in place



Andrew pretending to be useful by fixing 4 bolts

*Rear wall will be last thing we do, but it has been test fitted



LoKI Progress

Getting ready for Hot Commissioning

Integrated Testing Completed – June to September

System Acceptance Review held – 19th September

- Not approved due to outstanding issues arising from testing
 - Mostly controls issues
 - Detector module failure that has now been diagnosed and determined to be “expected” failure mode and the module is removed and awaiting maintenance.
- Review of completion of issues to be held by early December

Safety Readiness Review to be held – 3rd or 4th December

- PSS integration test completed
- Motion safety installation and integration to be done
- Quality and compliance process ongoing



Integrated Tests

- From SAT tests, we knew the components worked in isolation. Minor issues were known
- The aim was to test the interfaces and the “end user” facing operation of the instrument
- Tests were developed and executed in close collaboration with ECDC, ICS, MCA, Detector Group, Chopper Group and DMSC staff. Excellent support was provided by all.

ESS-5601100	Integrated Test Plan for the LOKI Chopper System	Released: 4 June 2025	Test complete: 23 June 2025	ESS-5759105	Integrated Test Report for the LoKI Chopper System	Released: 29 August 2025
ESS-5601101	Integrated Test Plan for the LoKI Collimation System	Released: 19 May 2025	Test complete: 26 June 2025	ESS-5769855	Integrated Test Report for the LoKI Collimation System	Released: 5 Sept 2025
ESS-5601102	Cold commissioning plan for the LOKI detector motion system	Released: 19 June 2025	Test complete: 3 July 2025	ESS-5767051	Integrated Test Report for the LoKI Detector Motion System	Released: 5 Sept 2025
ESS-5758315	Integrated Test Plan for the LOKI detector & beam monitor system	Released: 2 Sept 2025	Test complete : 3 Sept 2025	ESS-5818477	Integrated Test Report for the LoKI Detector and Beam Monitor Systems	Released: 5 Sept 2025
ESS-5758591	Integrated Test Plan for the LOKI Sample Area	Released: 16 July 2025	Test complete: 17-18 July & 4 Aug 2025	ESS-5769853	Integrated Test Report for the LoKI Sample Area	Released: 5 Sept 2025
ESS-5758586	Integrated Test Plan for the LoKI Instrument	Released: 8 Sept 2025	Test complete : 3 Sept 2025	ESS-5773511	Integrated Test Report for the LoKI Instrument	Released: 11 Sept 2025

Test Statistics



Test Report		Test Cases	Executed	Passed	Sub-cases	Executed	Passed
ESS-5759105	Integrated Test Report for the LoKI Chopper System	3	3	3	29	29	29
ESS-5769855	Integrated Test Report for the LoKI Collimation System	6	6	3	40	40	28
ESS-5767051	Integrated Test Report for the LoKI Detector Motion System	3	3	1	127	127	107
ESS-5818477	Integrated Test Report for the LoKI Detector and Beam Monitor Systems	6	6	4	24	16	12
ESS-5769853	Integrated Test Report for the LoKI Sample Area	7	7	2	52	52	34
ESS-5773511	Integrated Test Report for the LoKI Instrument	9	3	1	36	8	6

Detector Failure(s)



Failure on Bank0, Module 9 that looks like a vacuum leak issue.

- Replaced module with “spare” from upgrade set
- Module 9 to be inspected with support from ISIS and repaired.

Failure on Bank0, Module 6.

Troubleshooting indicated that this is a wire failure in one tube, and not the same issue as Module 9.

- Module removed and hose capped
- Tube to be replaced with support from ISIS
- Wire failures are to be expected, and tube replacement will likely be a regular maintenance task

2025-09-30 Plan for Addressing M6 Failure

Created by Hannah Burrall, last updated by Andrew Jackson on Sept 30, 2025 • 2 minute read

Date

Sept 30, 2025

Attendees

- @Hannah Burrall
- @Andrew Jackson
- @Laurence Page
- @Clara Lopez
- @Irina Stefanescu
- @Mikhail Feygenso
- @Oliver Hammond

Agenda

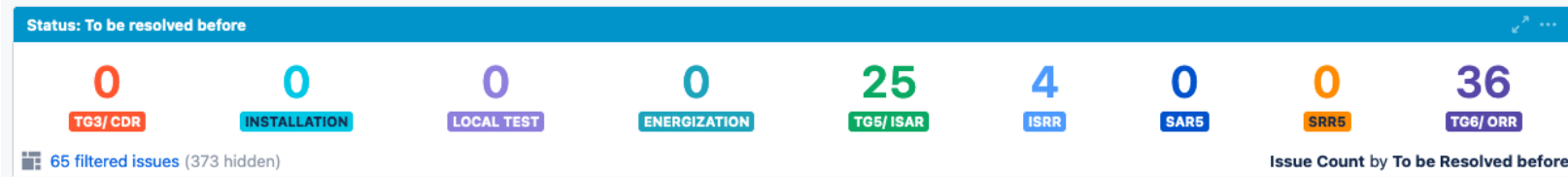
As per the feedback form the SAR, let's meet to address the action plan for addressing the M6 failure ([NIT-309](#)).

Action Plan (as per email from @Andrew Jackson 23rd September 2025:

1. Tank let up to air
 - a. DONE 2025-09-23
2. Check HV/LV on module 6 to see if there has been gas loss in the tubes / damage to boards
 - a. DONE - 2025-09-23 : see comment in [NIT-309](#). Conclusion of test is that the issue is a broken wire in tube 3 of module 6.
3. Externally inspect the modules and hoses to see if there are issues
 - a. DONE - no obvious visual issues
4. Do an in-situ vacuum check / leak test on module 6
 - a. Not needed as failure cause identified as broken detector wire
5. Along with the vacuum check, inspect the cables in the ends of the hose to see if they are strained/damaged.
 - a. Perform this check when module is removed (item 6), since no vacuum check in-situ is needed
6. Remove the module and transport to detector lab for further investigation with Davide in October
7. Cap hose to module 6 (will need a short stub of pipe and blanking plate), do not replace module



Status of Issues from Testing/SAR



NSS Issue Tracker Tickets / Rich Filter Results							
Key	Status	Summary	Instrument	Issue source	To be resolved before	Assignee	Reporter
NIT-366	TO DO	LOKI EPL - Issues in Vacuum system	LOKI	CDR/TG3	TG5/iSAR	Clara Lopez	Alejandro Tobias Quispe Mamani
NIT-363	TO DO	LOKI EPL - Issue in Sample Exposure system	LOKI	CDR/TG3	TG5/iSAR	Clara Lopez	Alejandro Tobias Quispe Mamani
NIT-362	TO DO	LOKI EPL - Issue in Chopper system	LOKI	CDR/TG3	TG5/iSAR	Clara Lopez	Alejandro Tobias Quispe Mamani
NIT-367	IN REVIEW	LOKI EPL - Issues in Instrument Automation Control System	LOKI	CDR/TG3	TG5/iSAR	Clara Lopez	Alejandro Tobias Quispe Mamani
NIT-365	IN REVIEW	LOKI EPL - Issues in Scattering Characterization system	LOKI	CDR/TG3	TG5/iSAR	Clara Lopez	Alejandro Tobias Quispe Mamani
NIT-361	IN REVIEW	LOKI EPL - Issue in Beam Validation System	LOKI	CDR/TG3	TG5/iSAR	Clara Lopez	Alejandro Tobias Quispe Mamani
NIT-327	IN REVIEW	Availability of Accelerator and Target PVs/data to instruments	LOKI	Cold commissioning	TG5/iSAR	George Kontogiorgos	Andrew Jackson
NIT-202	IN REVIEW	LoKi: Update beamstop_selector park position logic	LOKI	Cold commissioning	TG5/iSAR	Line Møller	Hannah Burrall
NIT-201	IN REVIEW	LoKi: NICOS routine for selecting and positioning the beamstop arm	LOKI	Cold commissioning	TG5/iSAR	Line Møller	Hannah Burrall
NIT-199	IN REVIEW	LoKi: Add "park" position for beamstop_x at 1.0	LOKI	Cold commissioning	TG5/iSAR	Line Møller	Hannah Burrall
NIT-197	IN REVIEW	LoKi: Ensure Automatic Sync of beamstop_x User and Absolute Limits	LOKI	Cold commissioning	TG5/iSAR	Line Møller	Hannah Burrall
NIT-196	IN REVIEW	LoKi: Implement NICOS Beam Center Position for beamstop_y motor	LOKI	Cold commissioning	TG5/iSAR	Line Møller	Hannah Burrall
NIT-195	IN REVIEW	LoKi: Default Beamstop Arm Limits to Match MCA/TwinCAT	LOKI	Cold commissioning	TG5/iSAR	Line Møller	Hannah Burrall
NIT-179	IN REVIEW	LoKi: Display chopper alarm, error, or warning messages in NICOS	LOKI	Cold commissioning	TG5/iSAR	Jonas Petersson	Hannah Burrall
NIT-178	IN REVIEW	LoKi: Limit Chopper Set Speed	LOKI	Cold commissioning	TG5/iSAR	Jonas Petersson	Hannah Burrall
NIT-52	IN REVIEW	LOKI: Beam Monitors (M0, M1) electrical compliance	LOKI	Q-gate/FAT	TG5/iSAR	Hannah Burrall	Philip Ohlin
NIT-422	IN PROGRESS	LoKi: Integration of two Julabo water circulators into NAVIS	LOKI	TG5/SAR	TG5/iSAR	Clara Lopez	Hannah Burrall
NIT-368	IN PROGRESS	Cable management: Bonding cable LOKI Shutter	LOKI	Installation/SAT	TG5/iSAR	Unassigned	Giuseppe Aprigliano
NIT-218	IN PROGRESS	LoKi: Resolve inconsistent display of error/warning messages in NICOS	LOKI	Cold commissioning	TG5/iSAR	Line Møller	Hannah Burrall
NIT-215	IN PROGRESS	LoKi: Replace encoder reading scale on sample stack Z-axis	LOKI	Cold commissioning	TG5/iSAR	Kristina Jurisic	Hannah Burrall

1 - 20 of 25 filtered issues (413 hidden)



Between now and HC

- Fixing of issues from Cold Commissioning
- Repeating of Integrated Tests
- Robustness/repeatability testing:
 - Leaving chopper systems running
 - Leaving detectors powered and counting
 - Performing repeat movements of motion axes (long running scripts)

Overview of HC Tasks

ESS-1108651

- Fulfil radiation protection requirements
- Hot Commissioning of beam monitors
- ToF Calibration
- Gold foil measurement
- Choppers phases verification
- Characterize beam profile
- Flight path calibration
- Characterization of position and tilt of detectors
- Calibration of detector efficiency and resolution
- Commissioning of sample environment

The test descriptions in ESS-1108651 will be converted to test plans similar to the integrated tests.

HC plan in ESS-1108651 needs to be updated with experience/new information when Judith returns from parental leave

Note : many of these steps will be repeated multiple times during beam ramp-up

ESS plan: using the accelerator commissioning time



Non-experimental commissioning tasks could be:

- Detector uniformity (put e.g. PTFE or acrylic slab in beam and count)
- Detector firmware tweaking
- If we get short pulses – initial ToF and flight path calibration from moderator to sample

Experimental commissioning tasks are described in the following but are defined by

- The need for the full pulse to populate the wavelength band
- The need for high flux to generate statistics in low efficiency monitors
- The need for 14 Hz operation to test the work flow for data reduction, initial analysis and calibration

Key Issues/NITs to be solved for HC

Before HC can start:

- Availability of Acc/Target PVs/data to instruments (NIT-327)
- Beamstop system logic (NIT-202,NIT-201, NIT-200, NIT-198, NIT-197,NIT-196)
- Detector failure issues need to be understood

Before collimation commissioning measurements can be made

- Slit precision settings (NIT-344)

Before detector calibration measurements can be made:

- Detector distance recording (NIT-209)
- T0 offset definition (NIT-314)

Before experimental measurements can be made

- Sample environment integration (NIT-182, NIT-181)

Fulfil radiation protection requirements



Key personnel: RP, PSS, and the instrument team

Requirements/assumptions: Successful cold commissioning, accelerator stable enough for the duration of each test measurement

- **Instrument heavy shutter**

Hot commissioning of the heavy shutter is the responsibility of the instrument team, in collaboration with the RP and PSS teams. Hot commissioning of the heavy shutter is expected to simply confirm the cold commissioning process using neutrons, therefore we will check open/close.

- **Cave structure**

The functionality of the doors, roof and PSS systems are assumed cold commissioned when hot commissioning commences. The possibility to test the shielding properties of the cave strongly depends on the proton beam power. Radiation will be measured at several points around the instrument, including, but not limited to, external door, roof door, and sample environment chicanes. Also, if allowed, with the roof door open. Here RP will confirm compliance with the 3uSv/h requirement in green zones and with appropriate levels in other zones.

It should be noted that the instrument shielding is designed for 5 MW worst case scenarios, and it is unlikely that a useful measurement of radiation emerging from the cave can be performed at 500 kW (*initial operations*). Therefore, radiation surveys will need to be repeated at key stages as the source is ramped up, as well as when flux is increased as a result of improved alignment. Samples in the beam during the radiation surveys will progress increase in severity of radiation danger, e.g. empty beam, water, steel, Cd. Firstly, using the longest collimation distance, $L1 = 8$ m, and then the shortest, $L1 = 3$ m, all with maximum beam sizes and choppers parked open. Then add full beam scattering samples. Then close down apertures, close fast shutter, or close safety shutter to see what scatters off them into shielding.

Beam Monitor Commissioning



In order to check stability, time-of-flight spectra and ratios between monitors will be compared at ~15 min intervals and compared to the proton beam current.

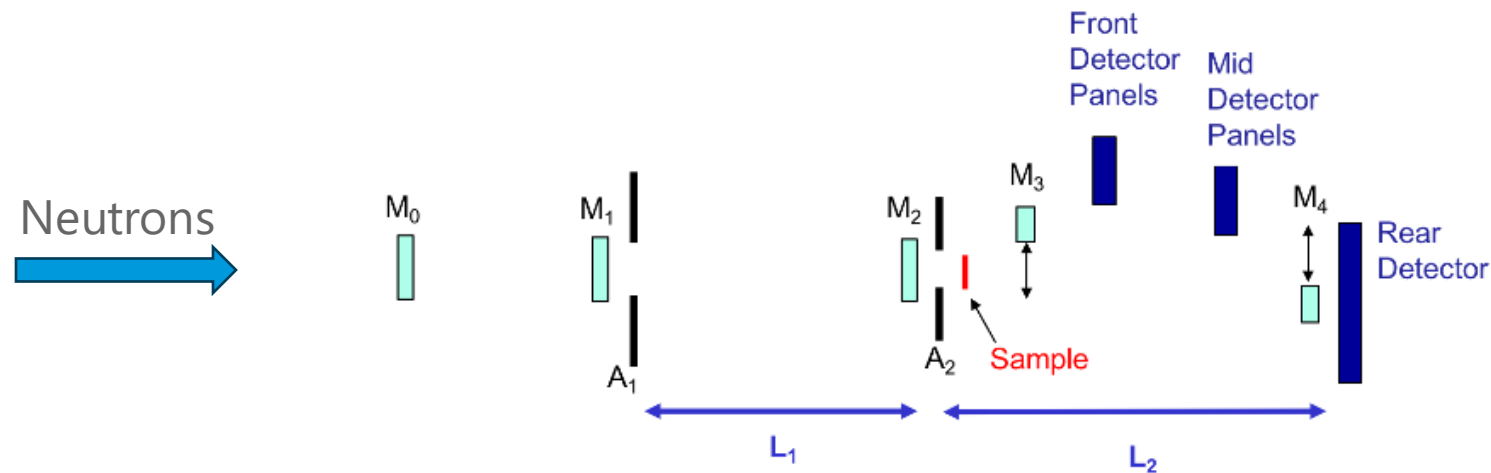


Figure 2.1 Instrument configuration of the monitors and detectors: M_n refers to monitors 0-4, L_1 = collimation length, L_2 = sample-to-detector distance, A_1 = the first collimation aperture 8, 5 or 3 m before the final aperture, A_2 .

Flux and beam profiles

Beam Monitors

Key personnel: instrument team, detector group, ECDC, DMSC, Spallation Physics (Gold Foil)

Requirements/assumptions: Access to a portable neutron camera. Data chain pipeline from monitors and detectors to data reduction software will be tested. Sufficiently powerful and stable beam.

3.2.1 Monitors

Before proceeding with most of the instrument HC

Measure pulse height spectra, count rates, discriminator levels and testing the data chain.

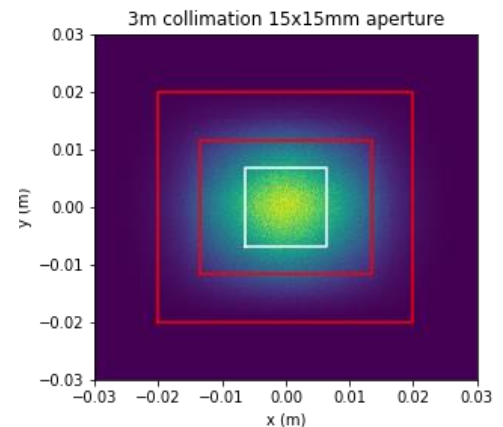
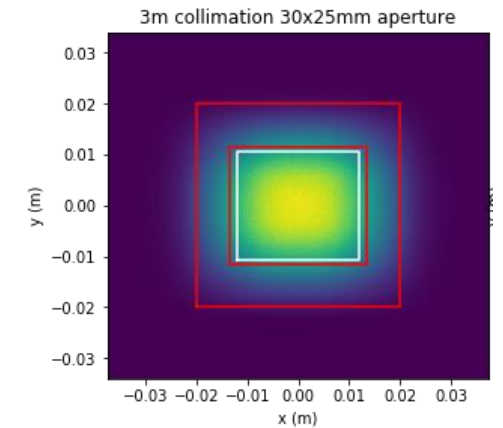
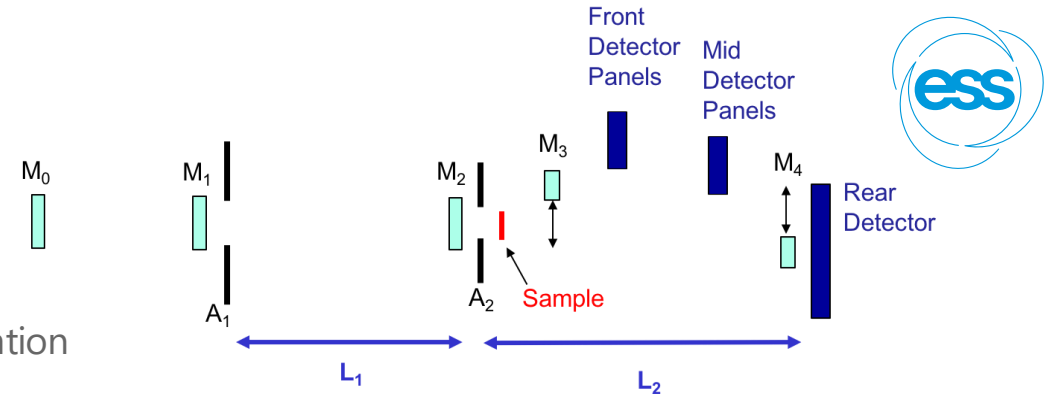
NOTE: The main transmission monitor directly after the sample position may be used for commissioning of the earlier beamline components, e.g. heavy shutter, choppers, collimation slits.

3.2.2 Flux measurements

Calibrate the flux measured by M2, M3, and at the sample position in using gold foils. Compare to McStas data.

3.2.3 Beam profile

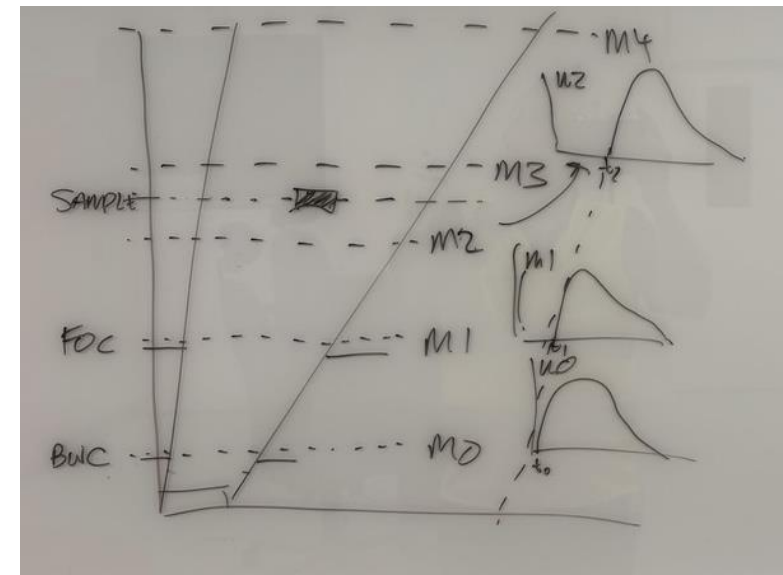
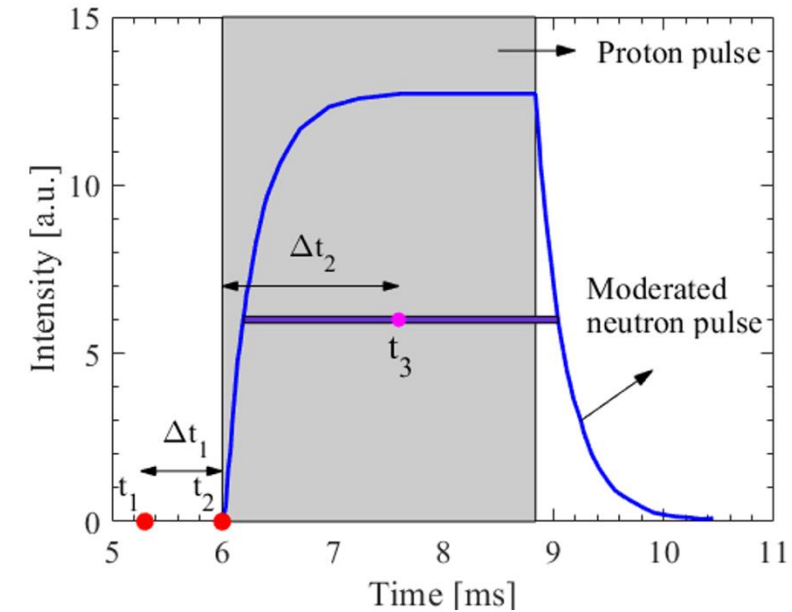
Using an imaging detector, we will characterise the beam profile at the sample position, across a range of instrument configurations, and then compared with McStas simulations.



ToF & Distance Calibration

Making use of short pulses

- Choppers running as for 2.86ms 14Hz
- Measure ToA spectrum on 3 beam monitors
- Project back in time to find T0 offset needed for ToA to ToF conversion.
- Assumes we know the distance to each monitor with sufficient accuracy
- Need a diffraction rig/setup to do ToF/wavelength cross-check, or could use bragg edges with short pulses



Choppers



The hot commissioning of the choppers will be supported by the chopper group, with the instrument team participating.

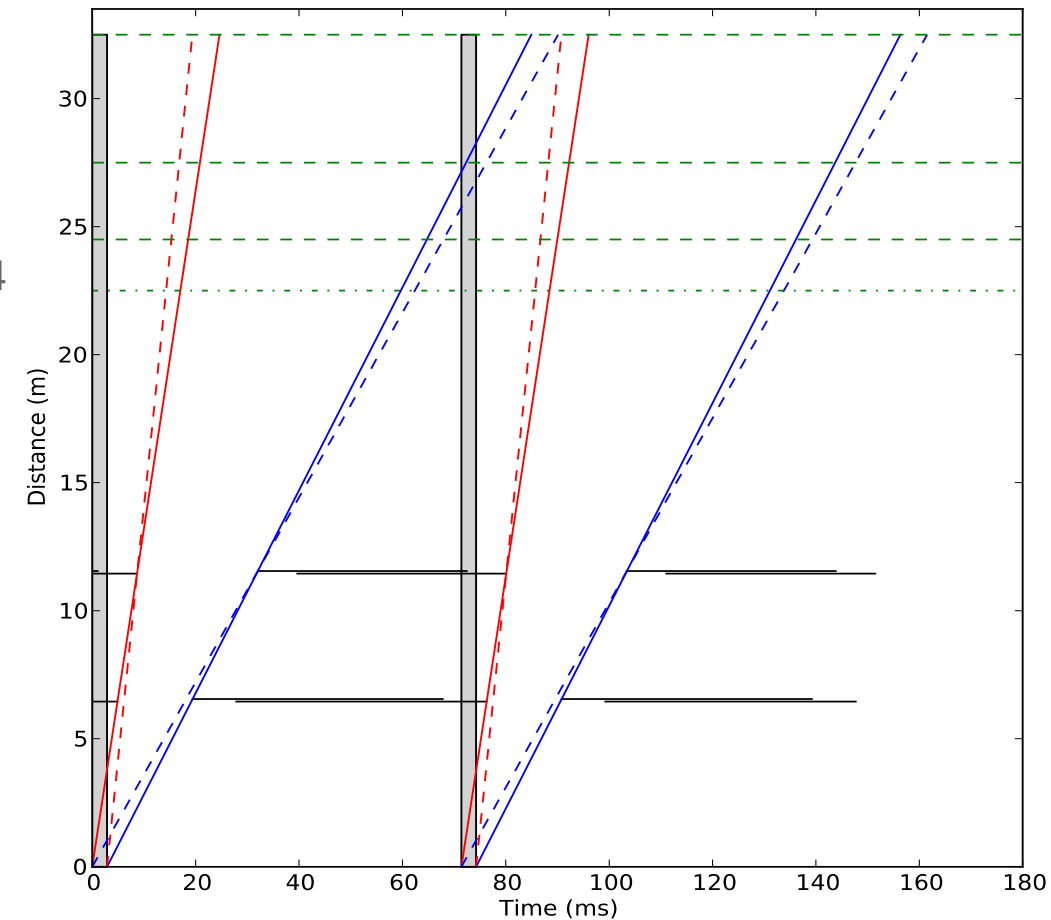
During hot commissioning we will check park open, phasing of the co-rotating discs, and opening angles of all 4 discs at 7 and 14 Hz, with "monochromatic" and "full beam" openings.

This will be a repeat of the integrated tests, but using the timing system as the reference for phasing to the proton pulse.

Firstly, we will feed in the phases for the expected wavelength ranges and compare with the collected monitor detector data.

This would then be cross-checked with the results using the calculation.

Compare with McStas simulations.



Detectors



Maximising the neutrons we count – make the most of the source

Various different options were considered : 3He tubes, Boron blades (BandGEM) and Boron Straw Tubes. On balance of performance, cost and complexity Boron Straw Tubes were chosen

Efficiency: ~50%-60% at LoKI wavelength

Position resolution: FWHM is ~6 mm up to 350 kHz

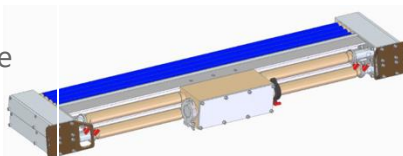
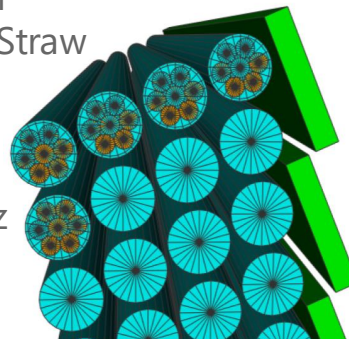
Rate capability: 15% rate lost at 2.3 MHz

4 layers of 1" Al tubes, each containing 7 x 8mm boron-coated straws

Signal is read out via 4 wires per tube with multiplexing resistance chain.

Detectors assembled as modules of 16 tubes.

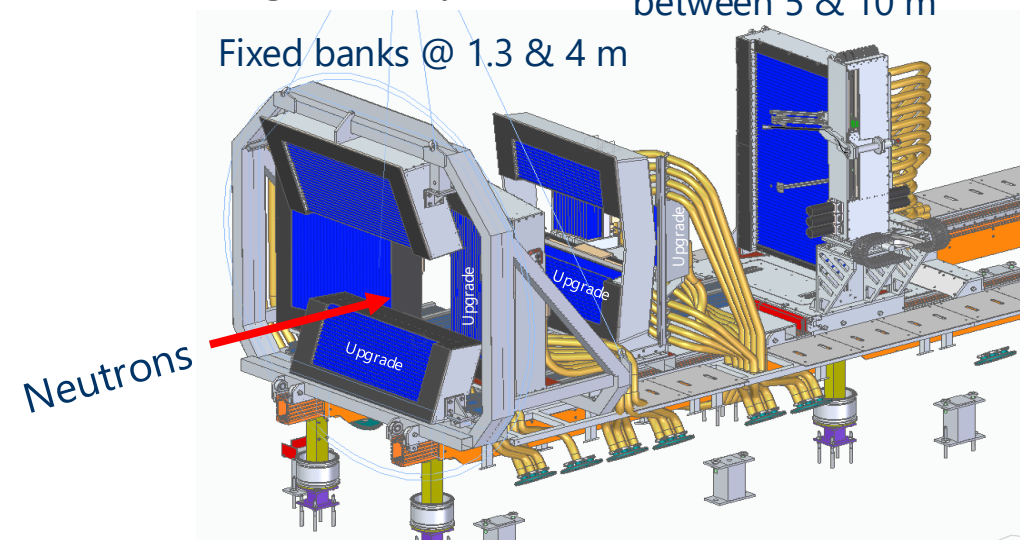
Preamp and power board in airbox on ends of tube assemblies



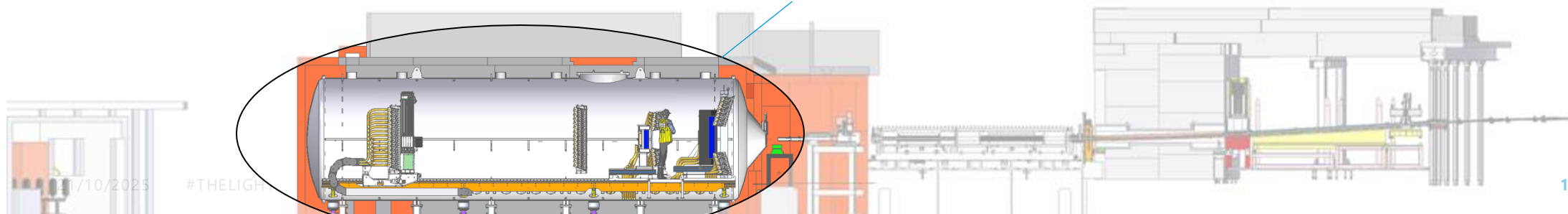
Covering 0° to 45° in scattering angle and 360° in azimuthal angle (180° Day 1).

Rear detector moveable between 5 & 10 m

Fixed banks @ 1.3 & 4 m



Day 1 scope : 576 tubes x 7 straws x 256 pixels Full scope : 880 tubes x 7 straws x 256 pixels
= **1,032,192 pixels** = **1,576,960 pixels**

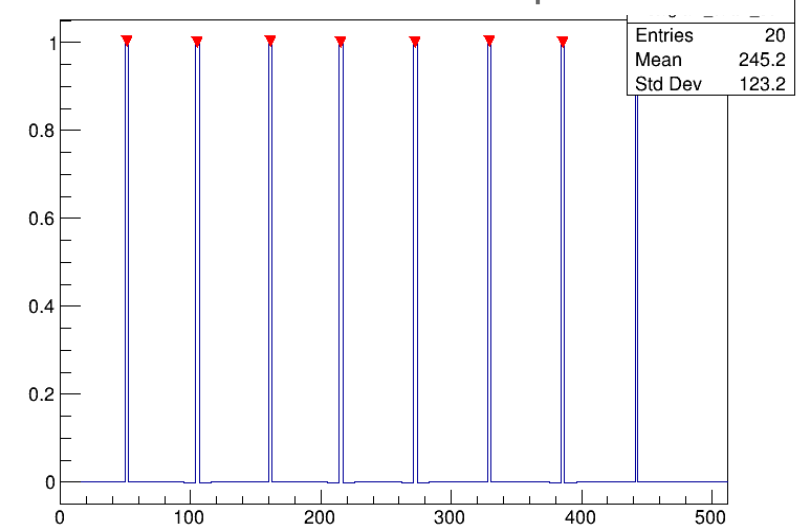


Detector calibration

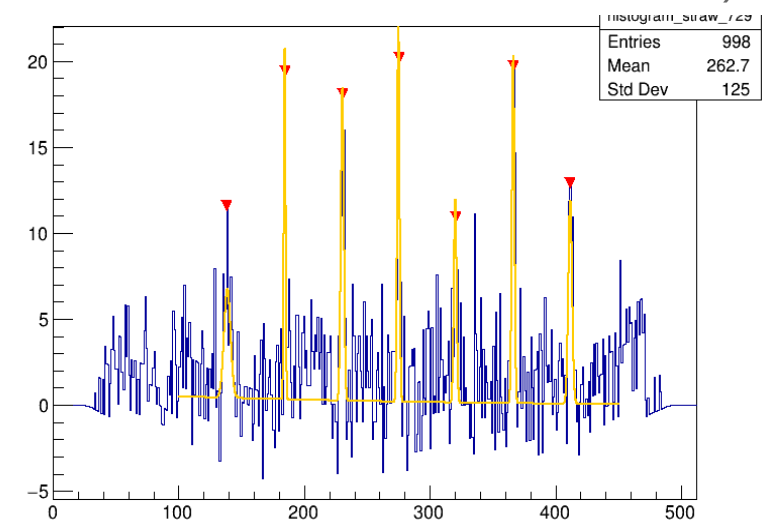
Position

- Position calibration data is generated by place a mask with narrow slits
- For challenging noisy peaks algorithmically approximated
- The difference between simulated and measured peaks is calculated, and a polynomial relationship is fitted.
- The result is used by Event Formation Unit in order to generate position-corrected NeXus files.
- For the LoKI detector tests, the demultiplexing and position correction was originally performed at ISIS by Davide Raspino, but is now replicated by code written by ECDC in preparation for hot commissioning.

Geant4 simulated peaks



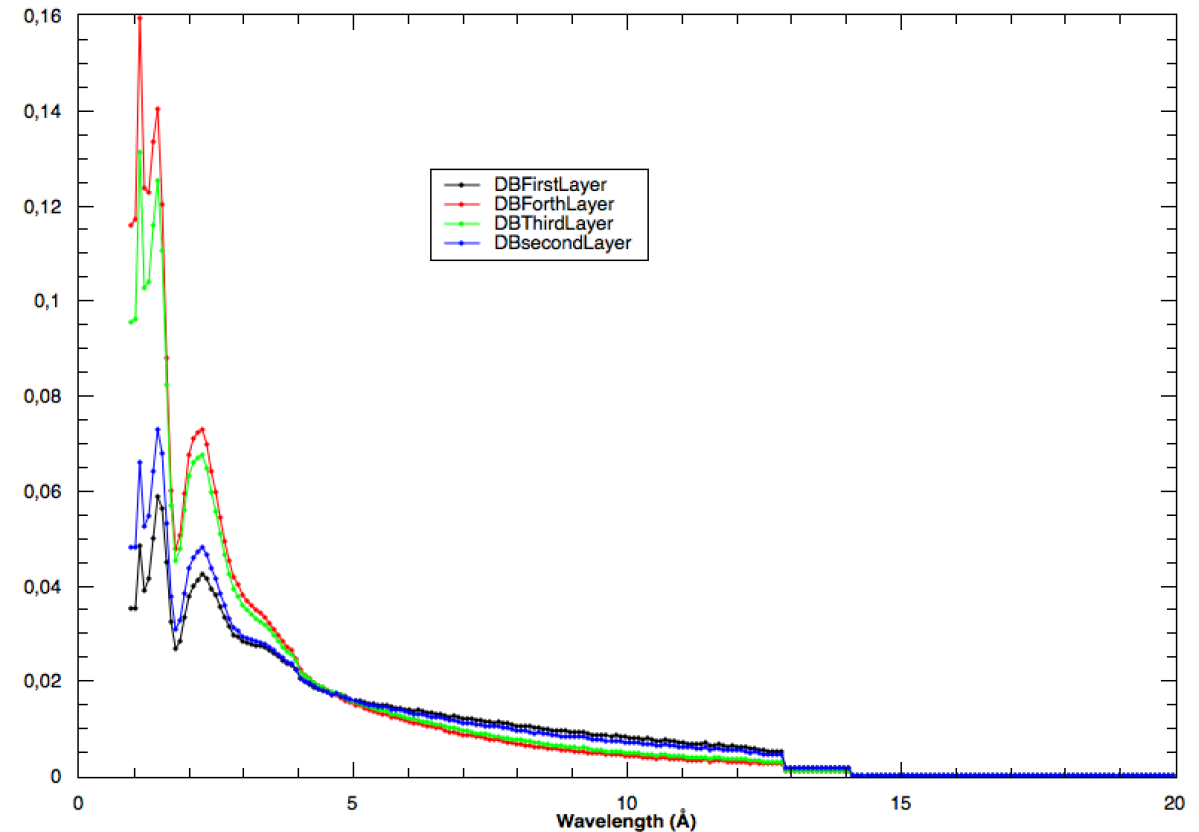
Measured peaks (naturally worse towards the back of the detector)



Detector Calibration

Data reduction of the LoKI test data

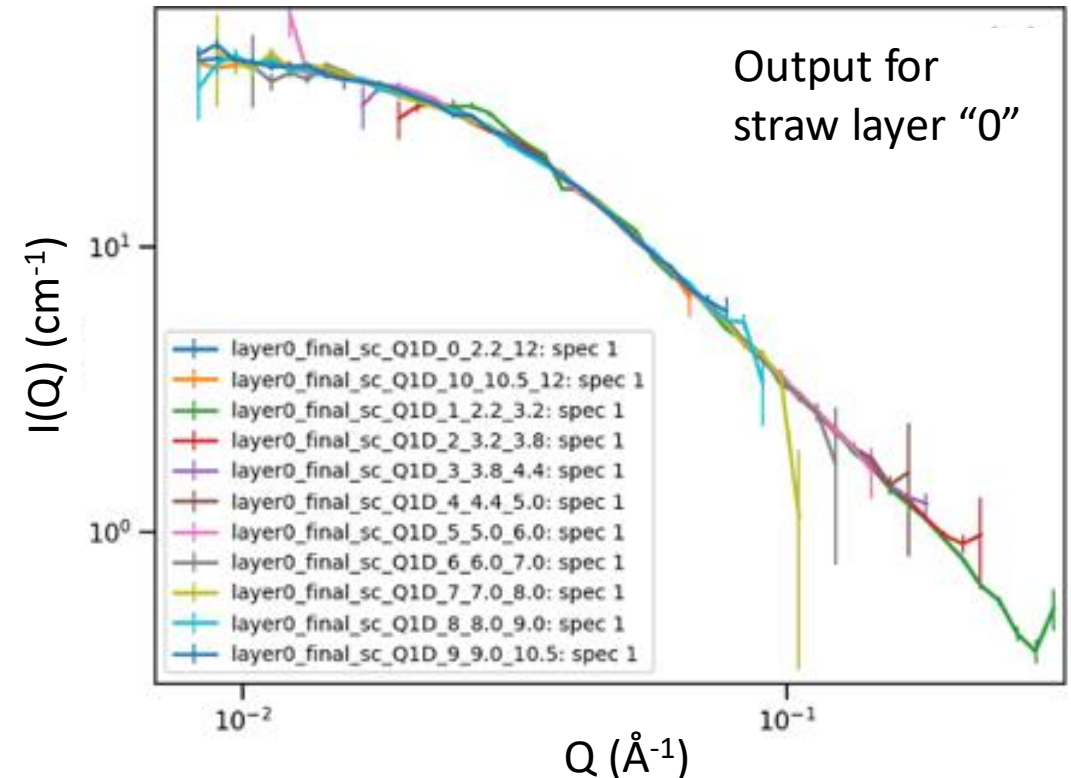
- As expected we observed: a hardening of the direct neutron beam as we go through the panel of detector straws, due to self-screening from one layer of straws to another.
- To account for this effect, we need to create a “direct-beam function” ($D(\lambda)$) that changes through the depth of the detector
- $D(\lambda)$ is the **relative efficiency of the main detector (or detector straws) compared to the incident beam monitor as a function of wavelength**. $D(\lambda)$ allows us to cross-normalise the incident spectrum to that of the empty beam (without sample) is seen on the main detector.



Detector Calibrations

Direct Beam Function

- $I(Q)$ is generated by the reduction of 6 to 12 wavelength bands which are then compared to $I(Q)$ from the full wavelength range. The process is iterated until the correction converges to a nearly flat polynomial.
- We then iterate and correct the wavelength adjustment profile, until the wavelength sufficiently overlaps. The final step simply scales the $D(\lambda)$ to correct for the overall absolute intensity.
- Start with a simulation of a flat scattering from Geant4. This simulation helpfully picks up any straw-to-straw variability and provides a “master” file in which we can save the new $D(\lambda)$ functions.
- The generated $D(\lambda)$ for each layer is then applied to all the straws in the relevant layer of the master file (i.e. original flat simulation).



After many iterations we are considering 28 layers (so all straw number 0 in Tube layer 1 are one “layer”)

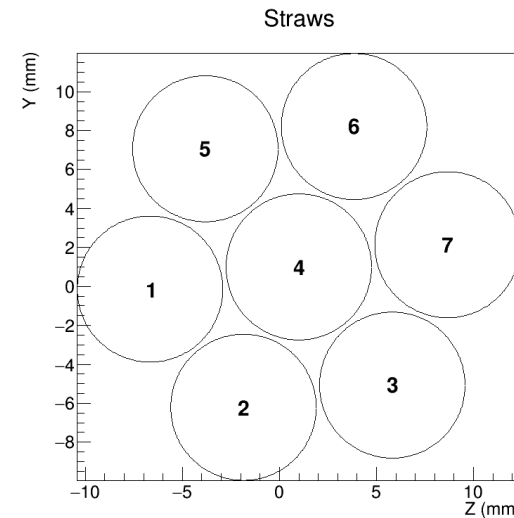
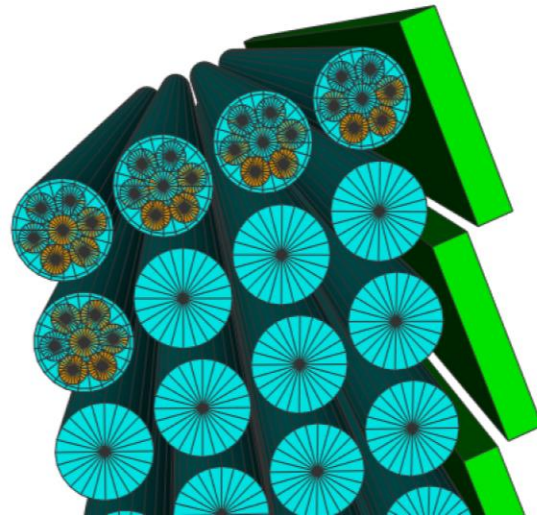
Detector Calibration



Possible $D(\lambda)$ simplifications ... to be determined in HC

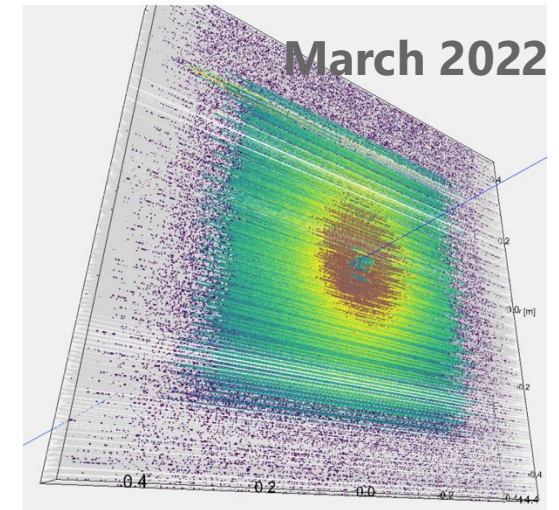
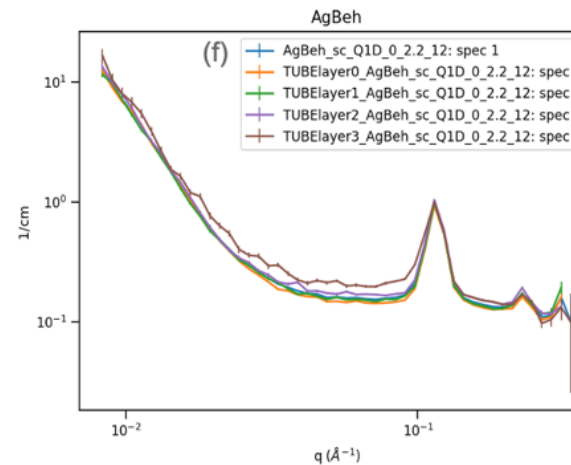
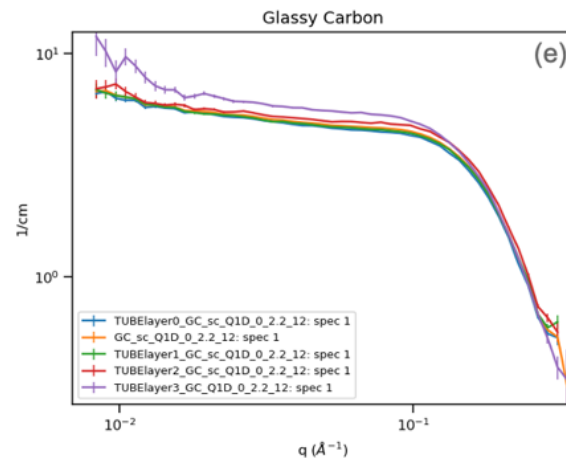
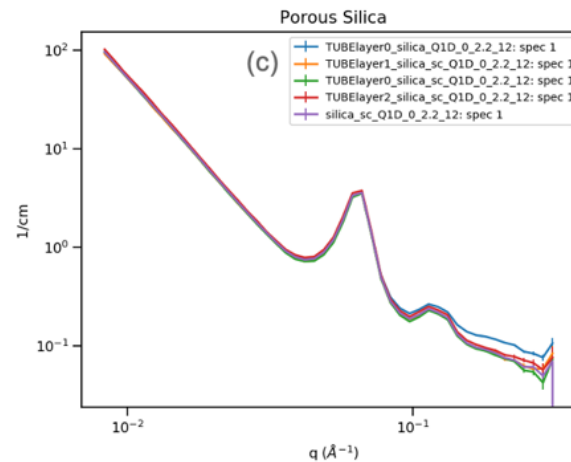
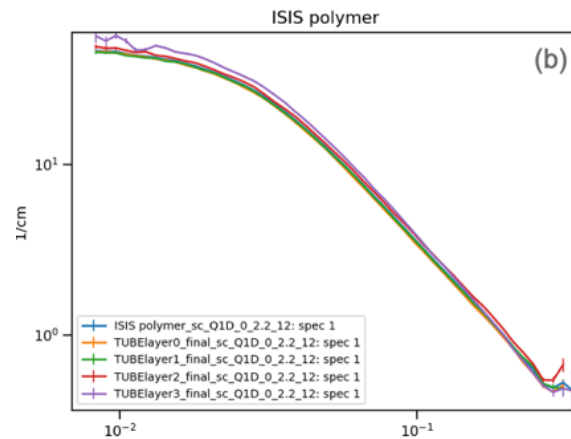
One challenge for us has been to decide to what resolution we should be generating the $D(\lambda)$, e.g. per each straw (difficult with poor statistics), per each “straw layer” (consider 7 straws in each of 4 tube layers = 28 layers), grouping the straw layers in logical geometrical layers (= 11/12 layers), or per each tube layer (= 4 layers).

Currently, we are still working with the **28 layers approach** (so all straw number 0 in Tube layer 1 are one “layer”).



Detector Calibration

Repeat of Detector Tests from 2022 at Larmor (ISIS, UK)



NeXus file displayed in scipp

Sample measured:

1. Cd stripped masks (GdO to be used on LoKI)
2. Silver behenate
3. SDS powder
4. empty beam
5. blocked beam
6. ISIS standard polymer
7. Silica particles
8. Vanadium

Beam time requirements



Task	Beam days required	Comments
Fulfil radiation protection requirements	5 days in (~0.5 day increments?)	Hold point before any further step can begin. Need to repeat if neutronic alignment and commissioning increases flux.
Gold foil measurements	1	
Check monitor detectors M0 to M4 electronics with neutrons	5 days	Detector group support
Check neutron beam profile	5 days	
Chopper phasing verification	5 days	Chopper group support
Optimise collimation tube, guide and jaw set positions	10 days	Reliant on availability of portable neutron cameras
Check neutron beam through all components in sample area	5 days	Reliant on availability of portable neutron cameras
Collection of detector calibration mask data and silver behenate powder	15 days	Perhaps collect data at night time during some other tasks.
Processing of calibration mask data, integration with survey results, check against reduced behenate powder data.	(~10 days)	Can be during "beam off".
Collection of data from standard samples for detector efficiency iterations.	15 days	
Processing of detector efficiency data.	(~10 days)	Can be during "beam off".
Commissioning of SE	10 days	
Demonstration experiments, interspersed with frequent standards.	25 days	Maybe with friendly users in person.
TOTAL	100 beam days	This total is probably rather optimistic

Commissioning phases



Phase	Main focus	Nominal Beam Power	LoKI Neutron Flux (n/s/cm ²)	LoKI Activities
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)	N/A	1x10 ⁴ to 1x10 ⁶	"Parasitic" usage (no dedicated HC days) ToF testing and calibration Detector "flood" tests
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 commissioning	> 100 kW (570 MeV)	> 1.5x10 ⁷	Beam monitor commissioning Flux and Beam Profiles Chopper commissioning
Hot Commissioning #2	Power ramp up and availability improvements Target transient tests 5 days per fortnight dedicated for instrument hot commissioning	> 200 kW (570 MeV)	> 3x10 ⁷	Detector calibration Flux and Beam Profiles Standards measurements
Hot Commissioning #3	Power ramp up and availability improvements 11 days per fortnight dedicated for instrument hot commissioning	> 300 kW (570 MeV)	> 4.5x10 ⁷	Detector calibration Flux and beam profiles Standards measurements Test experiments with sample changer
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	> 500 kW (800 MeV)	> 8x10 ⁷	User experiments Sample Environment Commissioning (beyond sample changer)

Power level for instruments will be agreed based on commissioning status to provide good availability and beam stability

Resources



All testing : IOE + 2 IS + IDS will be involved

- This will be full time work during beam production

All testing : support from ECDC and ICS will be needed

- Not full time, but will be needed 1-2 days at start of any testing period.

Tech group support for specific sub-system tests, but many tests will be cross-functional and need to have support available as needed e.g. we find a problem with choppers during a detector calibration test.

- Hard to predict level of effort needed, but more detailed HC plan will enable some predictability/planning

- We expect only the core team to be available 24/7 during beam days – clear plan for non-standard work hours required
- During work hours, it seems crucial to have manpower to resolve issues quickly and move on to the next test and the next problem.
- Prefer to have people ready, at the same time, during the day to fix things, rather than have people ready to restate a problem at 2:00 AM.

First LoKI Early Science Workshop



25-30 scientists mostly expert users or international neutron facility scientists, as well as contributors from the ESS Science Directorate

1. Provide an overview of the instrument capabilities, expected performance as a function of facility start-up, keys dates, and currently planned sample environment and data analysis abilities.
2. Brainstorm early science experiments within the instrument's target themes: soft matter, materials and bioscience.
3. Ensure we have identified the necessary infrastructure (sample environments, utilities, data analysis, etc) in order to take best advantage of the early beam at the ESS.



ECIS 1-6 SEPTEMBER 2024

38th Conference of European Colloid & Interface Society

SCANDIC FALKONER, COPENHAGEN, DENMARK

LOKI Early Science (0.5 MW)



Taking advantage of the wide simultaneous q-range & moderate flux

Performance @~0.5 MW:

➤ Comparable to SANS2D

Performance @2 MW:

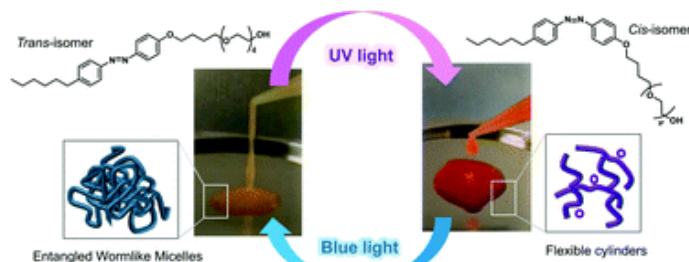
➤ ~5x compared to D22 (LoKI@14 Hz)

➤ ~20x SANS2D (LoKI@7 Hz)

Some current ideas...

Photoswitchable worm-like micelles

R. Evans in Cambridge, UK



Nanoscale,
2020,**12**, 6300

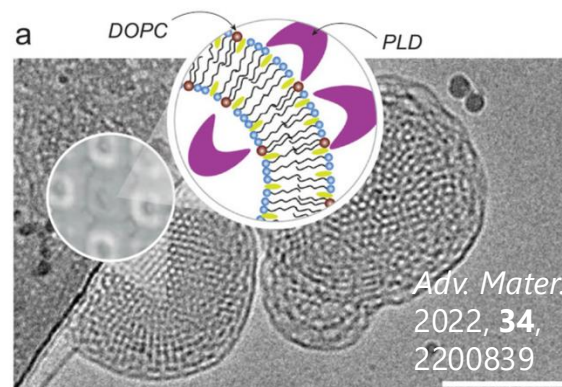
System under flow ✓

Multiple length-scales ✓

In situ sample irradiation (adaptive sample environment) ✓

Lipid nanoparticles

H. Barriga & M. Holme



Potential to involve ESS DEMAX ✓

Multiple length-scales ✓

Work-horse SANS experiments ✓

Dissolved Organic Matter

U. Olsson in Lund



JCIS Open, 2023, 11, 100091

Multiple length-scales ✓

Workhorse SANS experiments ✓

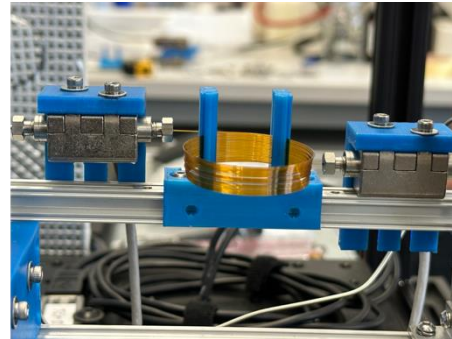
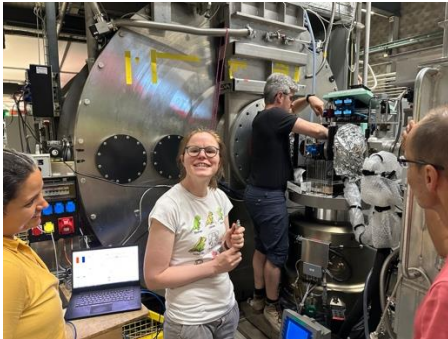
Potential to involve ESS DEMAX ✓

LOKI Future Science (full detector coverage & 2 MW)

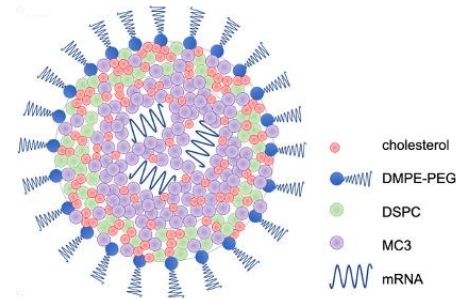


Taking advantage of the wide simultaneous q-range & great flux

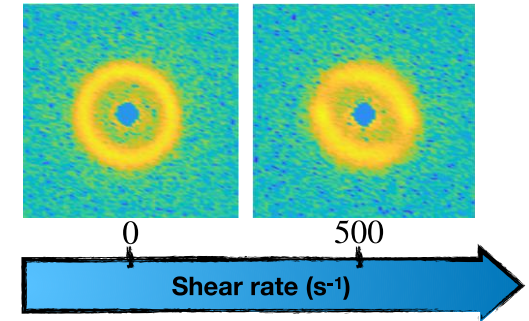
Systems under shear



Faster timescales and smaller beam sizes ✓
Multiple length-scales ✓

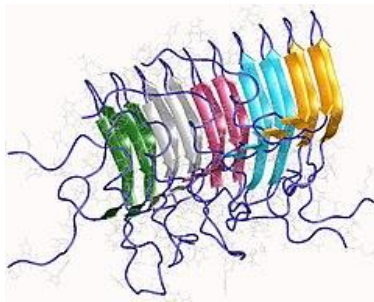


Structural effects due to the shear stress upon intravenous administration



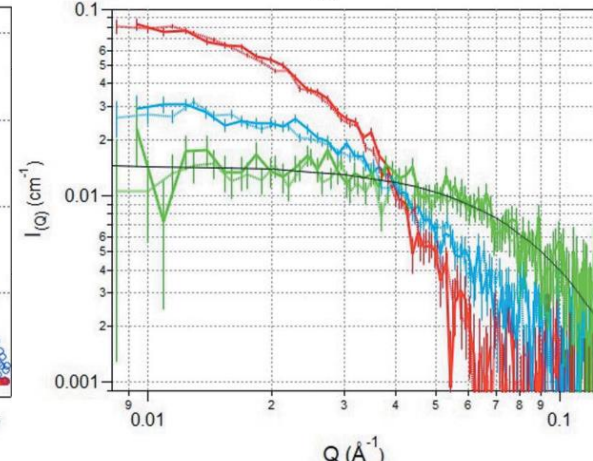
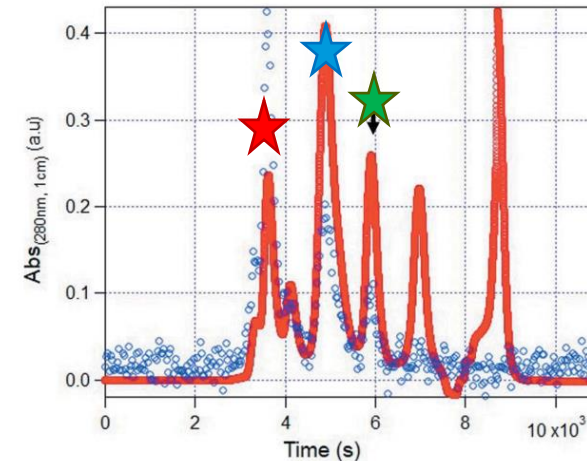
How different parameters affect the flow behavior of soft colloidal systems, e.g. microgels

BioSANS with a size-exclusion chromatography



Studying the suppression of Amyloid β -protein formation into fibrils with molecular chaperone proteins

Better resolution due to smaller cell size ✓
Potential to involve ESS DEMAX ✓



A. Martel et al., *J. Appl. Cryst.* (2023). 56, 994–1001

Early Science Projects

Funding proposals currently under evaluation



Lifecycle of a Lipid Nanoparticle

PI: Margaret Holme, Chalmers

Examining the production, delivery, and biological interactions of lipid nanoparticles used as drug delivery agents

- LoKI and Estia
- Three VR funded postdocs based at ESS (2026-2029):
 - Lipid particles under flow (working with Judith Houston and Andrew Jackson)
 - Biological interactions of LNPs (working with Tom Arnold and Sebastian Jaksch)
 - Modelling of data from LNPs (working with Oliver Hammond and Andrew Jackson)

Rheology of microgels

ESS: Judith Houston

Collaborators: Emanuela Zaccarelli (La Sapienza) and Marco Laurati (Florence)

Using the capabilities of LoKI to understand the rheology of concentrated microgel suspensions.

(Project proposal in preparation and pending review and approval)

Postdoc will start in late 2026/early 2027 if approved



Questions?