EUROPEAN
SPALLATION
SOURCE

System Acceptance Review - LoKI

Instrument FBS Tag: =ESS.NSS.H01.LOKI

PRESENTED BY CLARA LOPEZ

2025-09-18

Agenda

1 Instrument Overview

2 Systems Overview

3 Third thing to address

4 The fourth action point

5 The fifth matter

6 Discussion point six

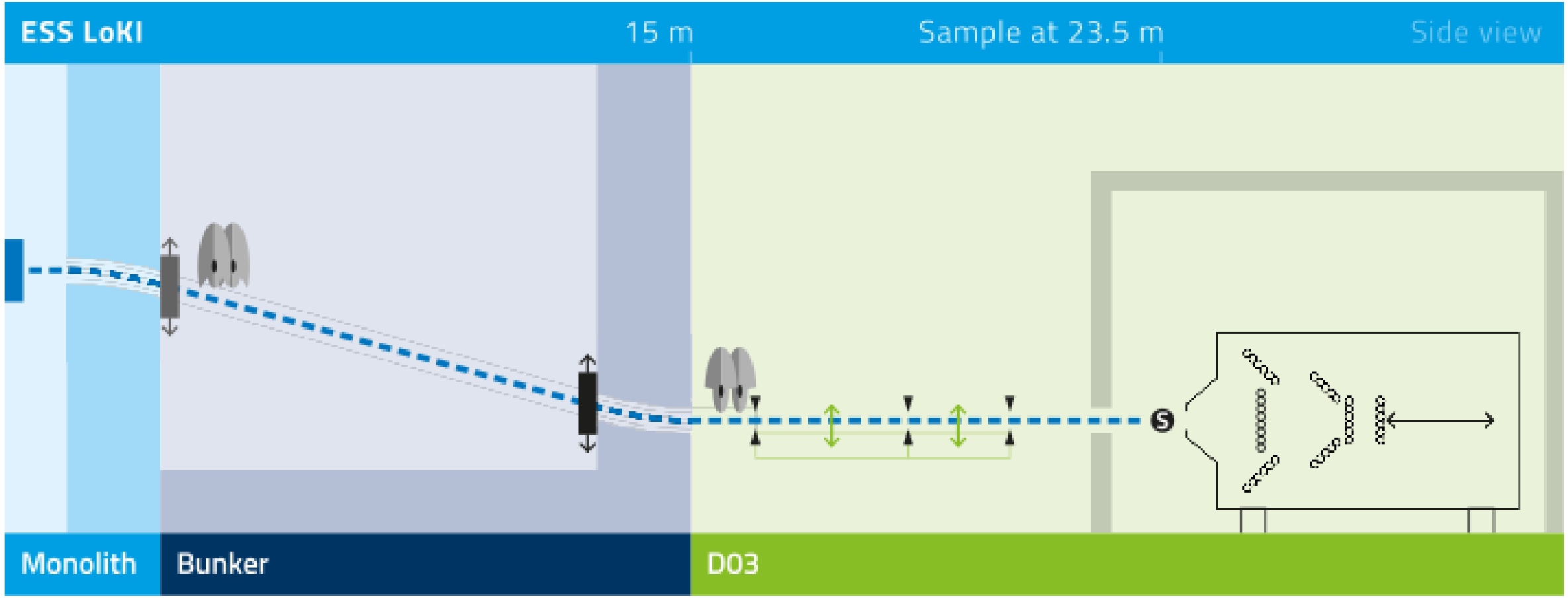
7 Topic number seven

1

Instrument Overview

Instrument Overview

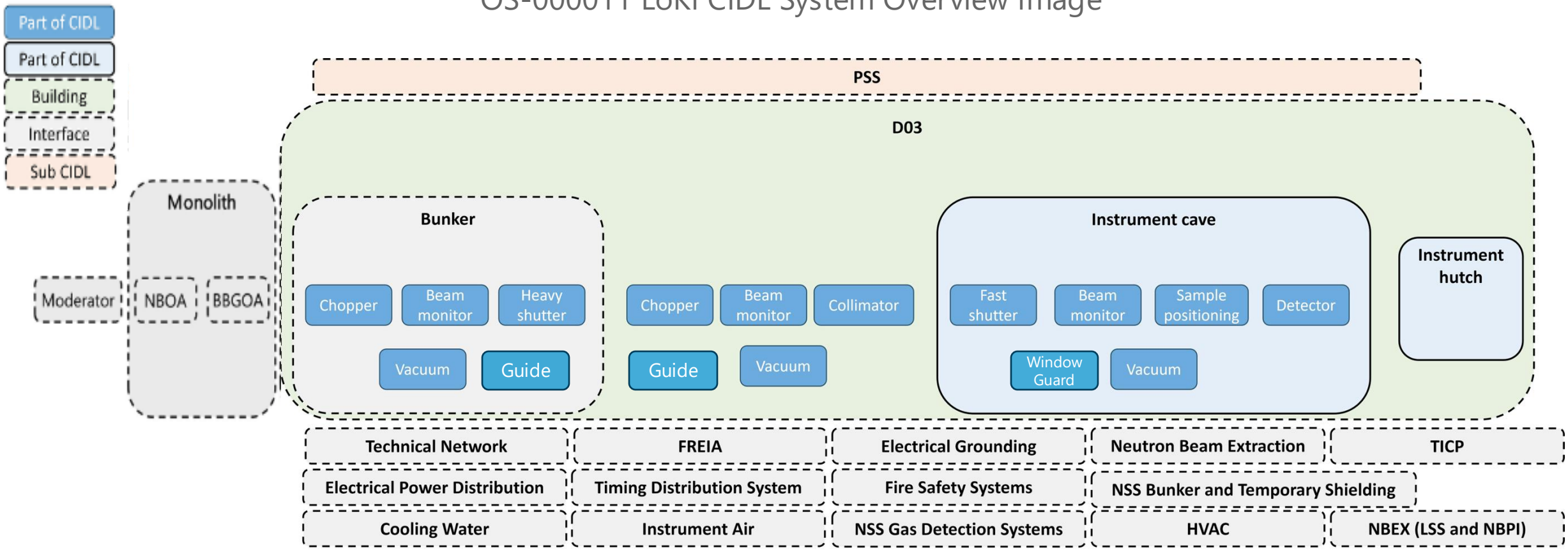
LoKI Schematics



Instrument Overview

CIDL

OS-000011 LoKI CIDL System Overview Image



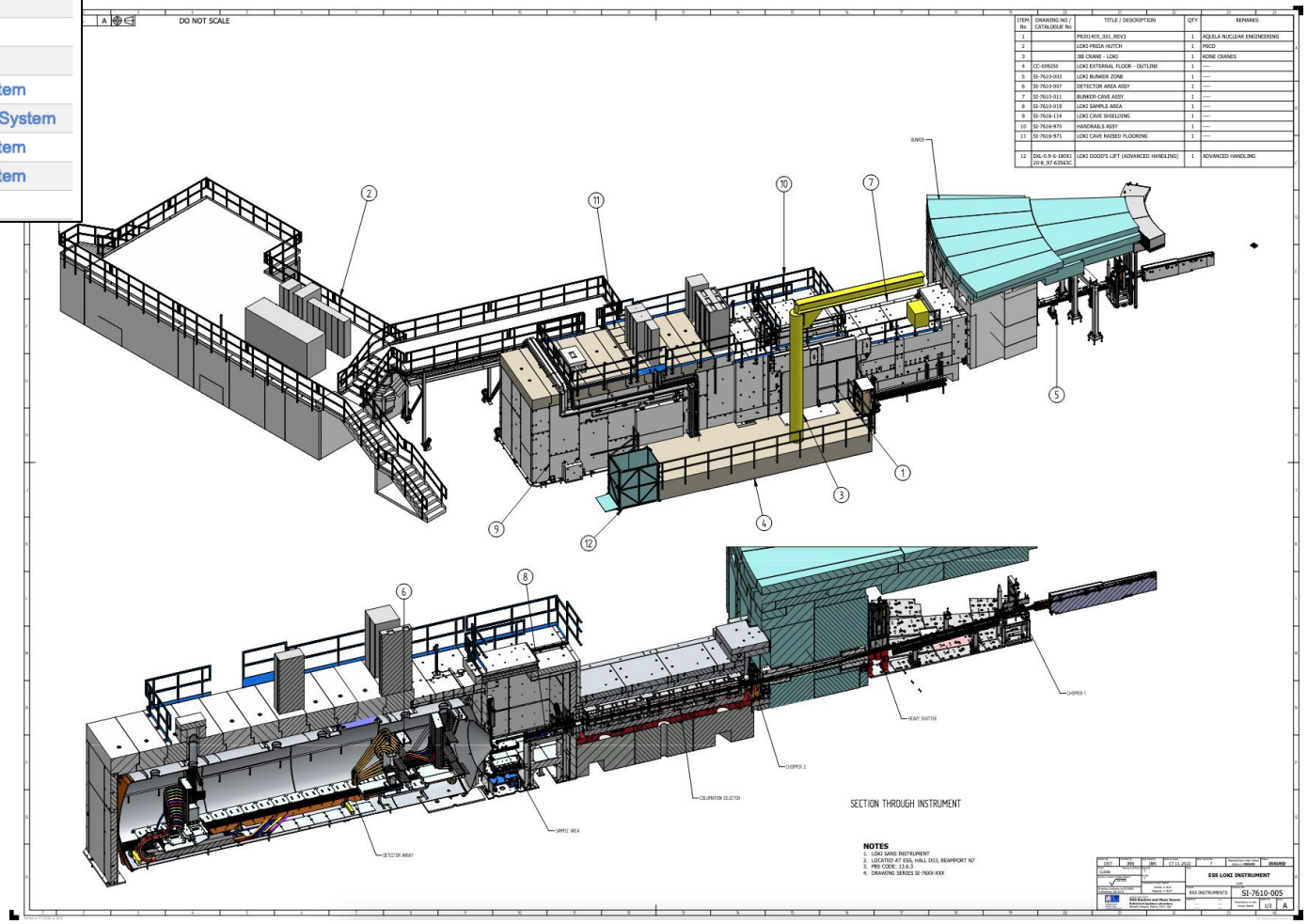
2

Instrument Overview

Instrument Overview

LoKI FBS

		Tag	M...	Description	Classification
1.	LOKI	=ESS.NSS.H01.LOKI		LoKI	LoKI
2.	A01	=ESS.NSS.H01.LOKI.A01		Beam Transport and Conditioning	Infrastructure System
3.	K02	=ESS.NSS.H01.LOKI.K02		Data Management & Experiment Control System	Data Management And Analysis System
4.	U01	=ESS.NSS.H01.LOKI.U01		Experimental Cave	Structural System
5.	K01	=ESS.NSS.H01.LOKI.K01		Instrument Automation Control System	Control System
6.	F01	=ESS.NSS.H01.LOKI.F01		Personnel Safety System (LoKI PSS)	Safety System
7.	A02	=ESS.NSS.H01.LOKI.A02		Sample Exposure System	Infrastructure System
8.	B01	=ESS.NSS.H01.LOKI.B01		Scattering Characterisation System	Neutron Detector System
9.	A05	=ESS.NSS.H01.LOKI.A05		Supply Systems	Infrastructure System
10.	A04	=ESS.NSS.H01.LOKI.A04		Support Systems	Infrastructure System
11.	G01	=ESS.NSS.H01.LOKI.G01		Vacuum System (LOKI)	Vacuum System



=ESS.NSS.H01.LOKI.A01

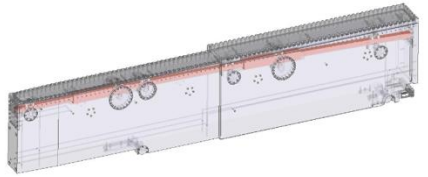
Beam Transport and Conditioning

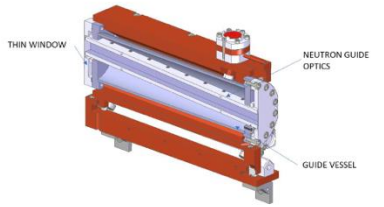
TAG	Description
=ESS.NSS.H01.LOKI.A01.W02	Beam Extraction System
=ESS.NSS.H01.LOKI.A01.W01	Beam Delivery System
=ESS.NSS.H01.LOKI.A01.R01	Neutron Chopper system
=ESS.NSS.H01.LOKI.A01.B01	Beam Validation System
=ESS.NSS.H01.LOKI.A01.R02	Beam Geometry Conditioning
=ESS.NSS.H01.LOKI.A01.R03	Beam Cut Off
=ESS.NSS.H01.LOKI.A01.F01	Shielding Bunker to cave

Beam Transport and Conditioning

=ESS.NSS.H01.LOKI.A01.W02 Beam Extraction system

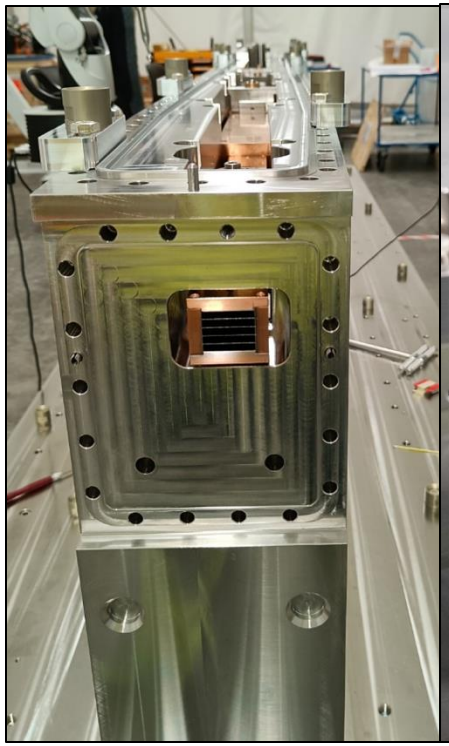
System Name	FBS	EPL	FAT	SAT
NBOA Neutron Beam Optics Assembly (section 1)	LOKI.A01.W02.WH01	ESS-2051804	ESS-3918171	ESS-5531562
BBGOA Bridge Beam Guide Optics Assembly (section 2)	LOKI.A01.W02.WH02	ESS-3819605	ESS-5176451	ESS-5548720

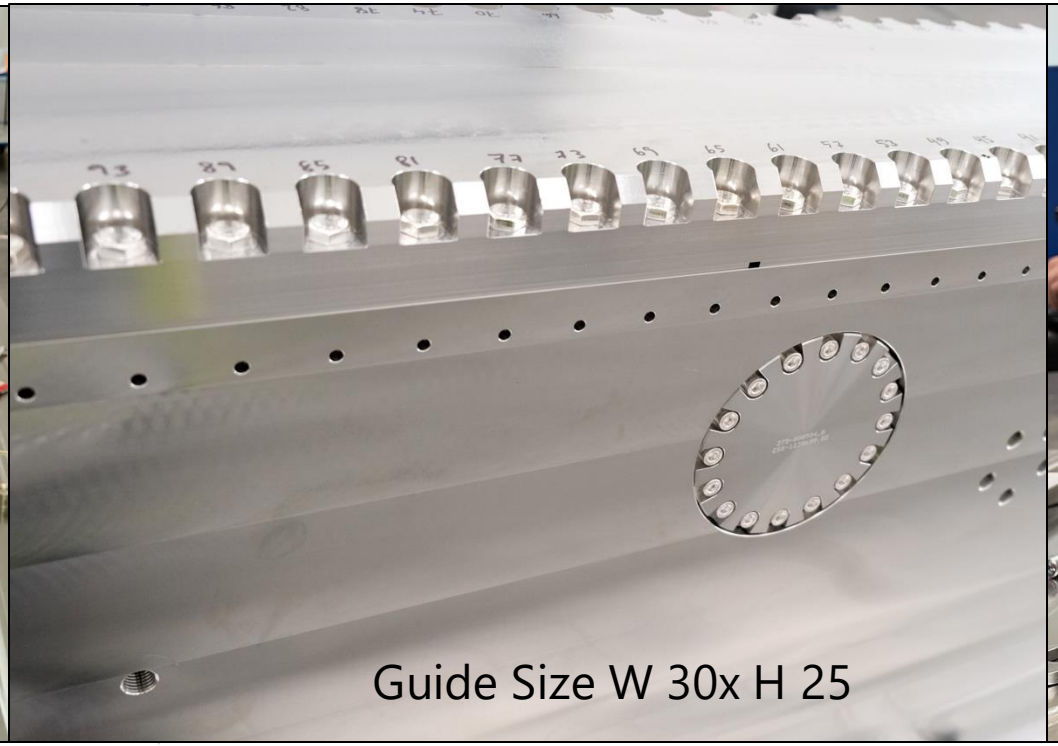


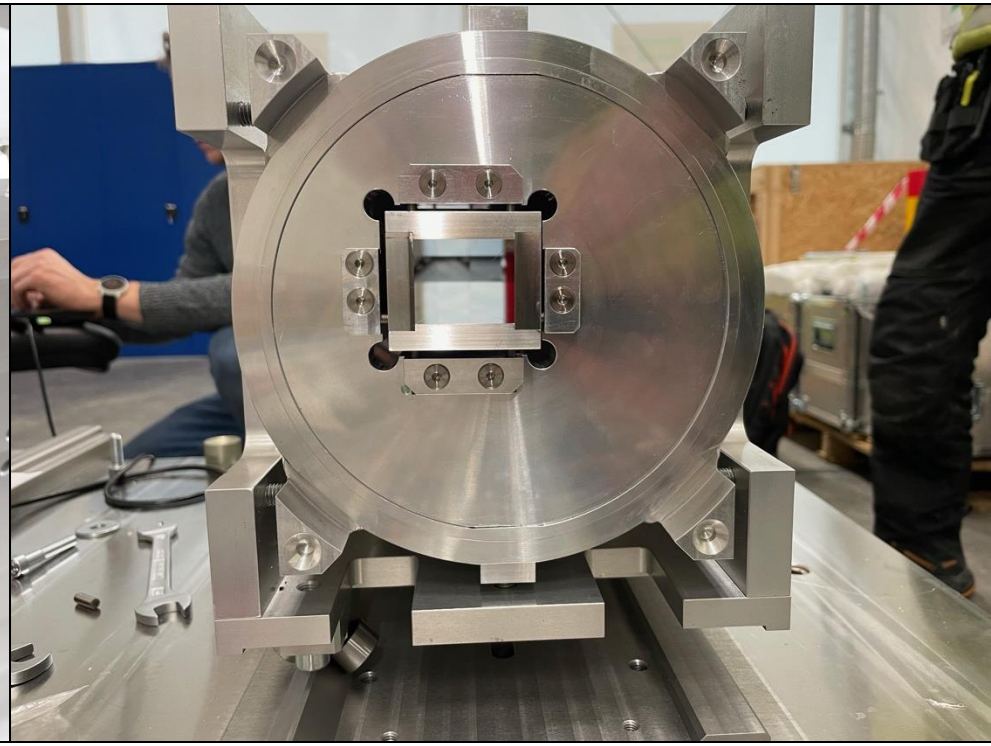


Instrument components integrated and aligned within Target systems: Copper substrate

- Neutron beam Optics Assembly (NBOA) installed within the Neutron Beam Port Insert (NBPI)
- Bridge Beam Guide + Vacuum vessel, Installed in the Light Shutter System (LSS)





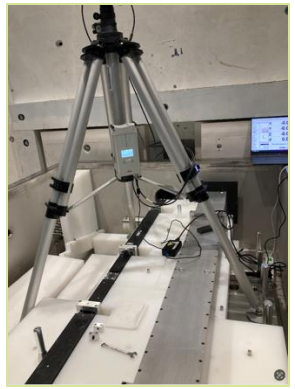


Beam Transport and Conditioning

=ESS.NSS.H01.LOKI.A01.W01 Beam Delivery System

System Name	FBS	EPL	FAT	SAT
In Bunker guide	LOKI.A01.W01.WH01.WH01	ESS-5362756	ESS-3918171	ESS-5304056
Bunker Wall insert	LOKI.A01.W01.WH01.WH02	ESS-5362758	ESS-3918171	ESS-3921194
Guide out of Bunker	LOKI.A01.W01.WH01.WH03	ESS-5362759	ESS-3918171	ESS-5661674

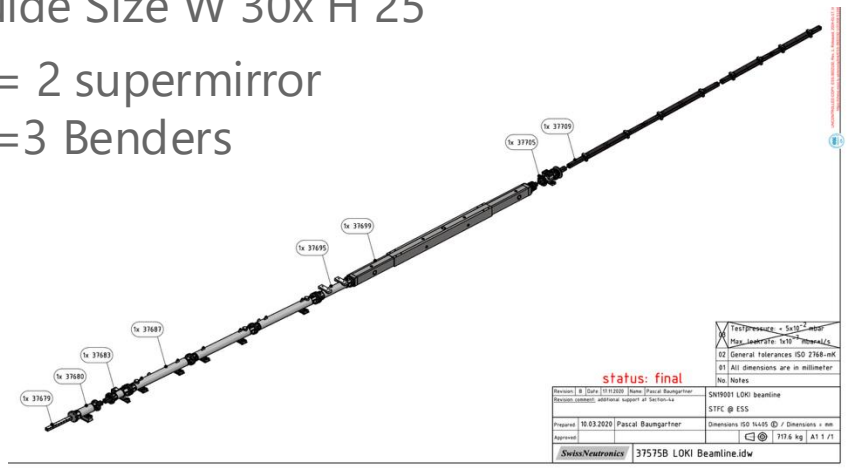
- Beamline Section 3 – Chopper Assembly 1 –
- Beamline Section 4 – In-Bunker section table -
- Beamline Section 5 – Heavy Shutter
- Beamline Section 6 – Bunker Wall Insert
- Beamline Section 7 – Chopper Assembly 2- beam monitor
- Beamline Section 8 – Collimation Selector

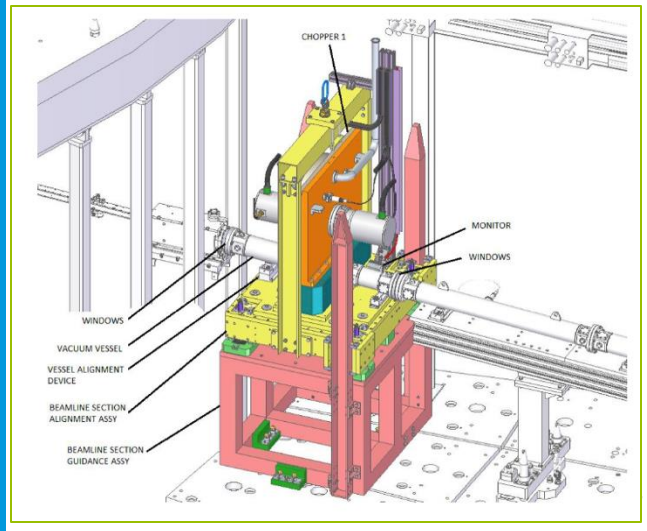


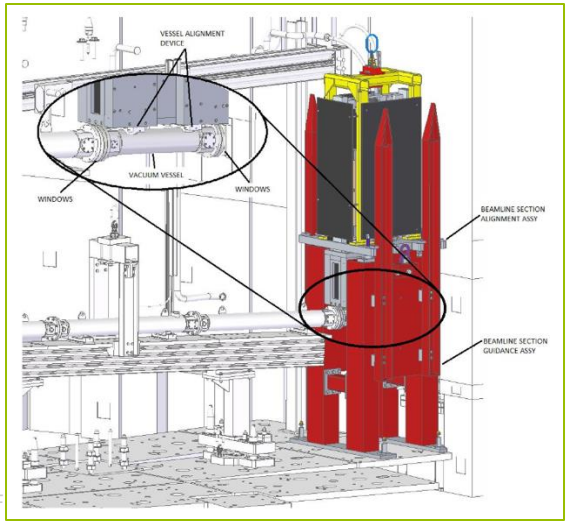
Guide Size W 30x H 25

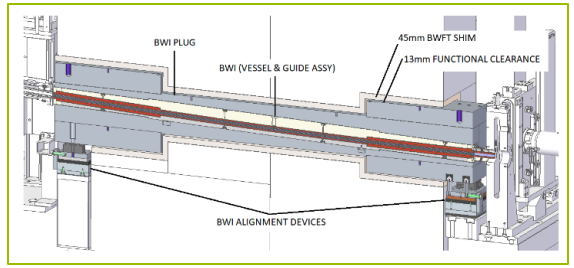
M= 2 supermirror

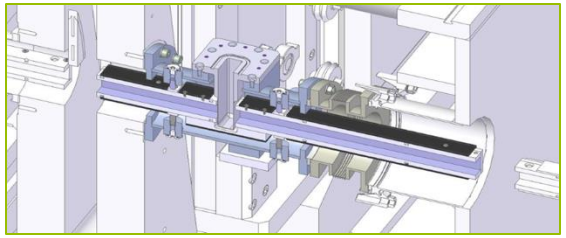
M=3 Benders

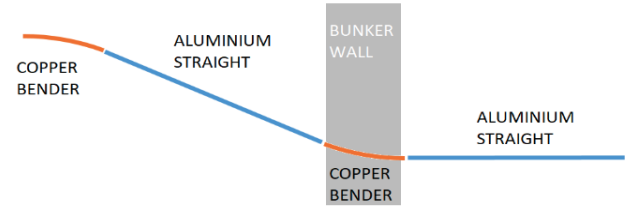


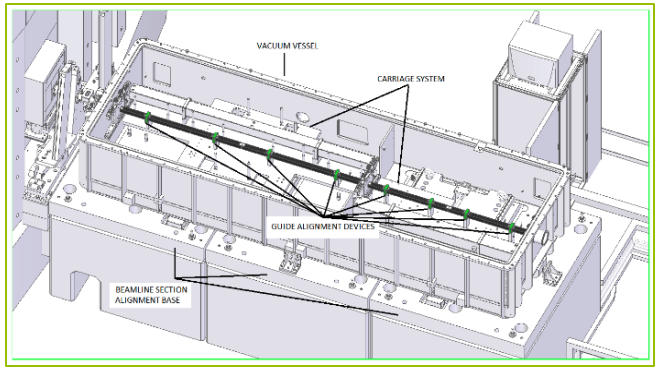








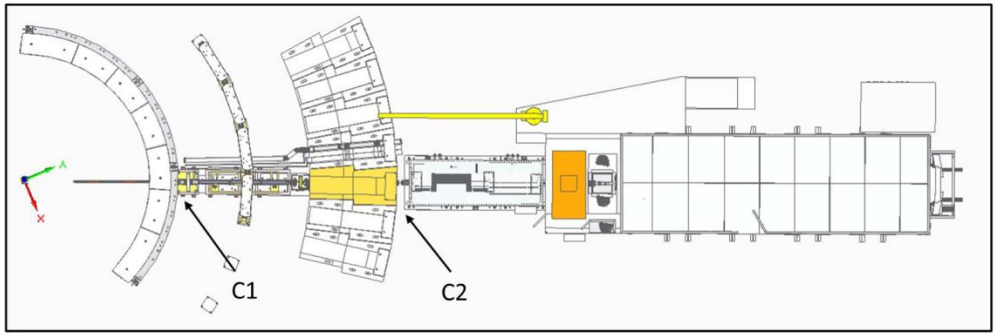


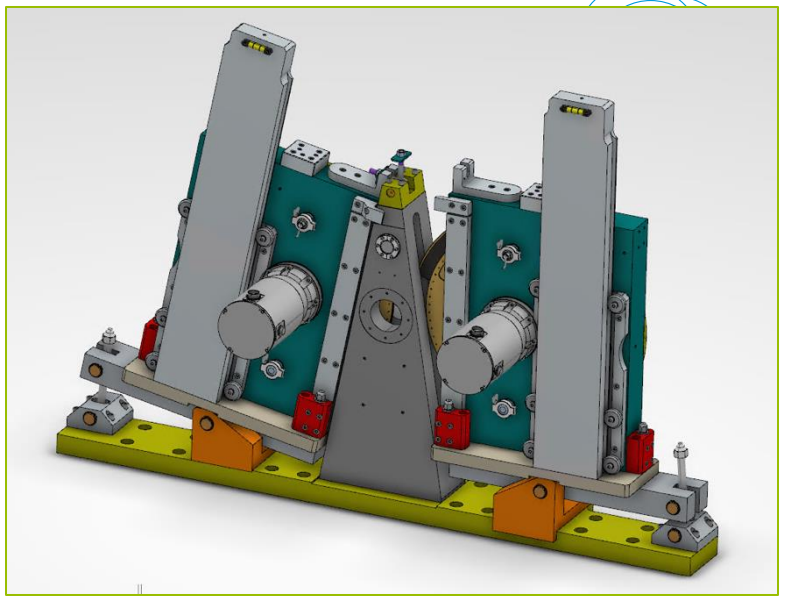


Beam Transport and Conditioning

=ESS.NSS.H01.LOKI.A01.R01 Neutron Chopper System

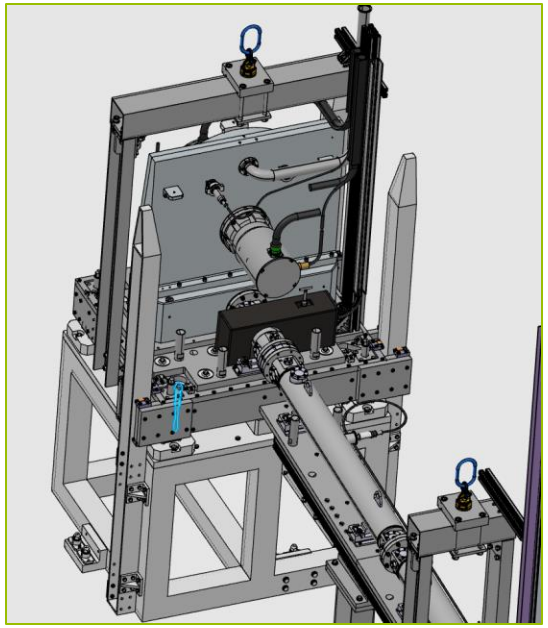
System Name	FBS	EPL	FAT	SAT
Band Width Chopper System	LOKI.A01.R01.R01	ESS-3819597	ESS-3832163	ESS-3805769
Frame Overlap Chopper System	LOKI.A01.R01.R03	ESS-3819599	ESS-3832163	ESS-3805769

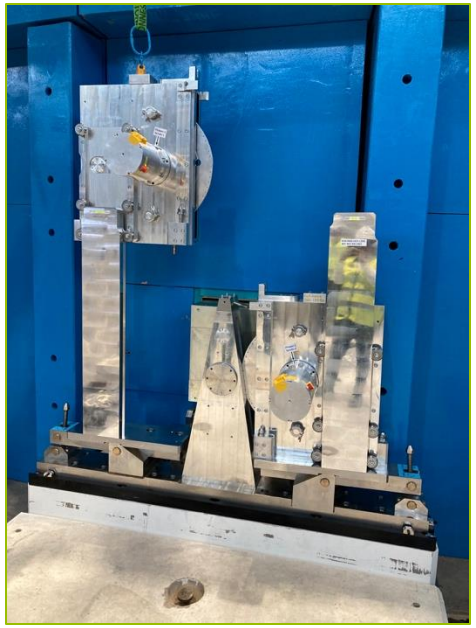




In Bunker:
Bandwith chopper system 6.5 m from TCS, 14 Hz- low speed, double disc – Remote handling
Guides section 3, Disc radio 349.5

Out of Bunker
Frame overlap Chopper 15.1 m from TCS, 14 Hz – low speed, double disc. Vertical extraction, Disc radio 349.5 mm





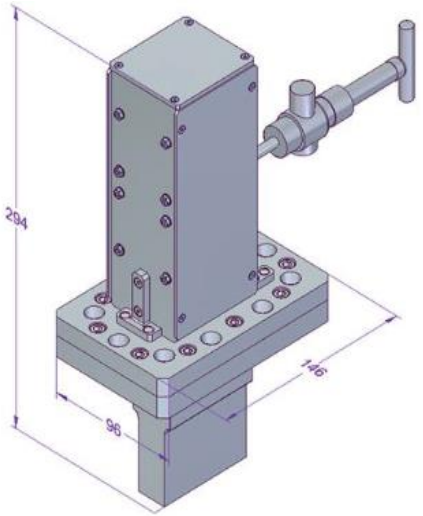
Beam Transport and Conditioning

Scope Deferral

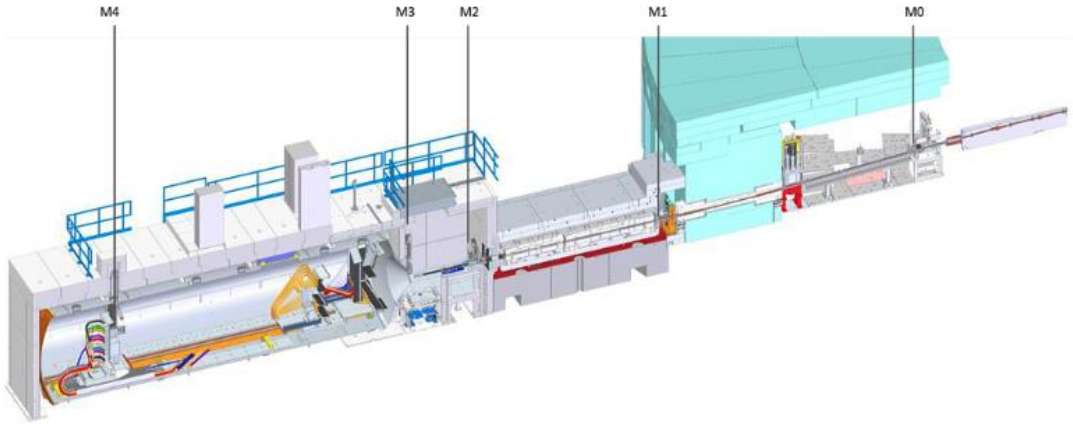
=ESS.NSS.H01.LOKI.A01.B01 Beam Validation System

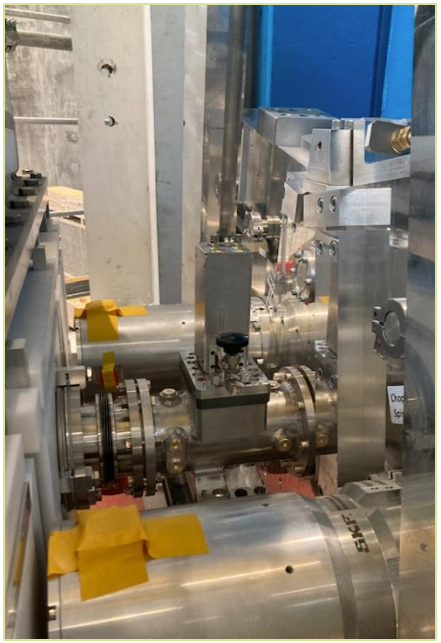
System Name	FBS	EPL	FAT	SAT
Beam monitor Chopper System 6.5 m in bunker - M0	LOKI.A01.B01.B01	ESS-4818008	ESS-5585107	ESS-5533260
Beam Monitor chopper System 15.1 m out of bunker- M1	LOKI.A01.B01.B02	ESS-4818009	ESS-5585107	ESS-5533260
Beam Halo monitor - Snout system-M2	LOKI.A01.B01.B03	ESS-4817918		
Beam Transmission monitor - Detector vessel nose - M3	LOKI.A01.B01.B04	ESS-4817921		
Beam monitor beam stop - Inside detector vessel- M4	LOKI.A01.B01.B05	ESS-4818008		

M0-M1 Monitor



- Active volume filled with a mixture of N and Ar+CO2 at 0.6 bar (absolute)
- Gas can be refilled
- M0 and M1 are in vacuum – diagnostic monitors located in bunker
- The monitors are electrically insulated from the rest of the beamline
- M2, M3, and M4 are motorized



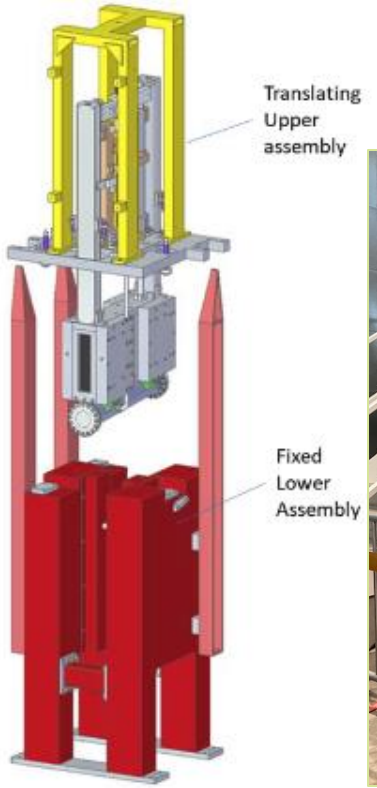


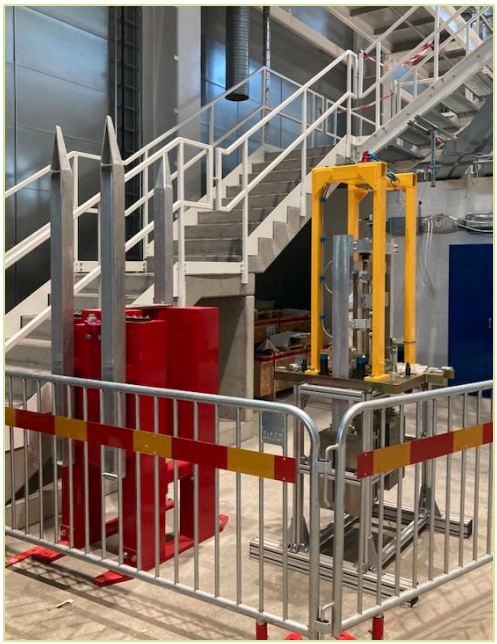
Beam Transport and Conditioning

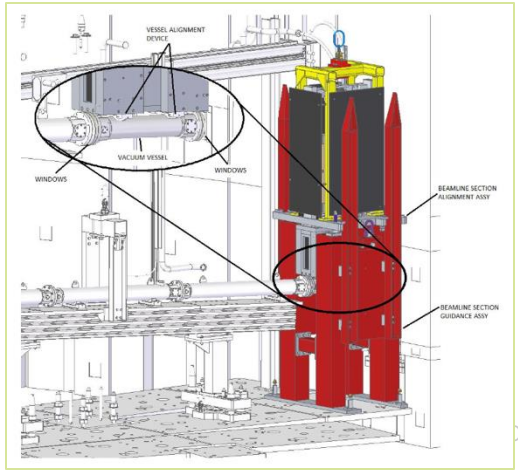
=ESS.NSS.H01.LOKI.A01.R03 Beam Cut Off

System Name	FBS	EPL	FAT	SAT
Pre-cast base assembly	LOKI.A01.F01.U01	ESS-4090315	ESS-4598037	ESS-4972411

- Heavy shutter is located in the bunker zone, inside the bunker wall in D03
- Shutter open – neutron beam is guided to sample position
- Shutter closed – neutron beam is blocked allowing safe access to sample area. Pneumatic actuated. In the case of air failure the HS will return to a closed safe state. PSS/Motion control interface
- Actuator panel is mounted next to the sample area access door.
- The section guide 5 is installed in amall vacuum vessel in this position
- Shielding assembly dump (B4C, aluminium, steel, borated poly layer, B4C) and heavy shielding walls located around







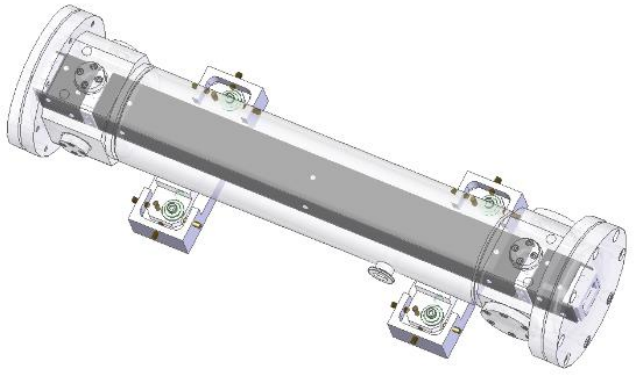
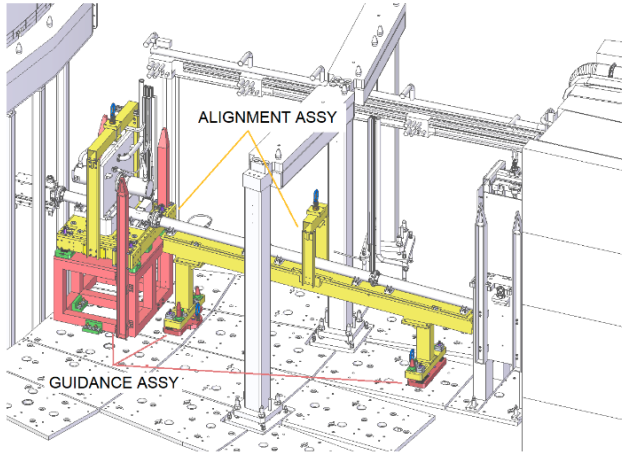


Figure 13: Heavy Shutter Guide Vessel

Beam Transport and Conditioning

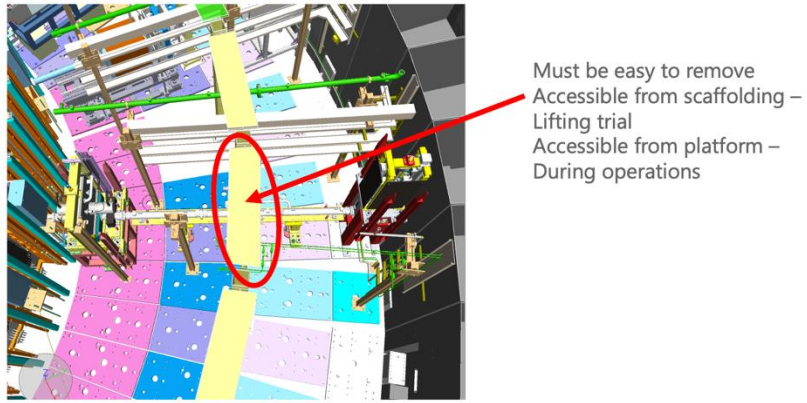
Remote handling for in bunker components

- Fully remote handling between radious 6m – 11.5 m
- Components can be extractable from the top of the bunker roof
- Lifting trial at STFC / ESS, and verification of access to remote bolts



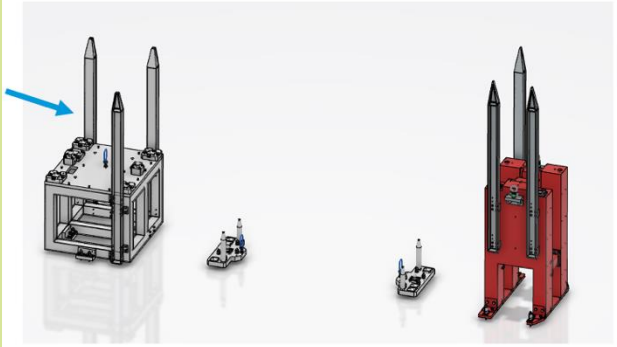
Stage 1: Preparation/Mechanical Installation/Lifting trial

2. Removal of crossbeam for extraction of components during lifting

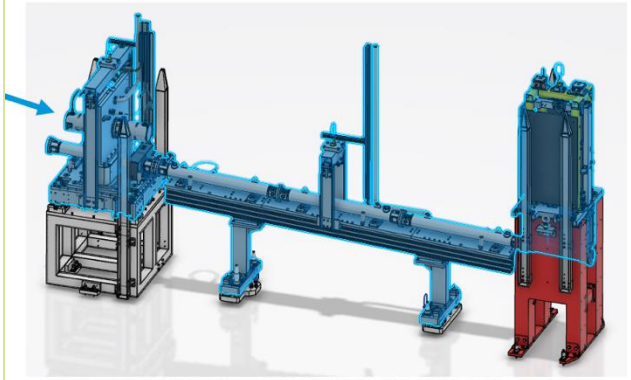


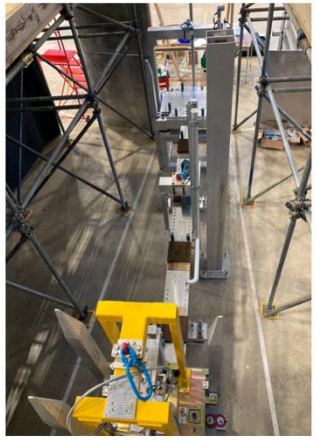
LoKI Instrument – In bunker components

Stage 1: Preparation/Mechanical Installation/Lifting trial



1. PREPARATION - OFLINE
   A. Preparation subassemblies
   B. SAT1 Heavy shutter
   C. Fiducialization of structures and assemblies
2. Installation of bases: bolting to the baseplates
3. Lifting trial

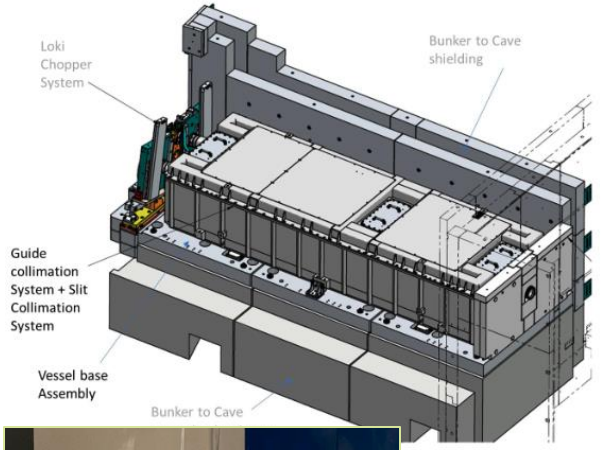




Beam Transport and Conditioning

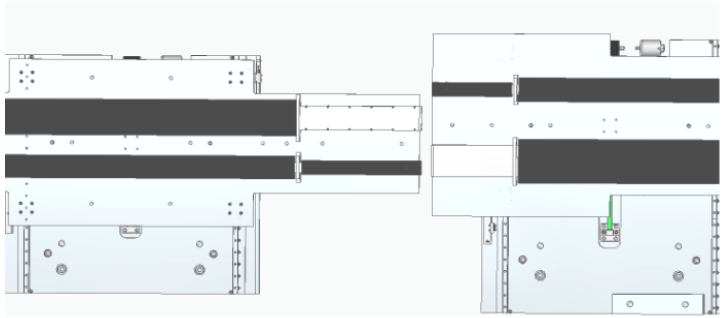
=ESS.NSS.H01.LOKI.A01.R02 Beam Geometry Conditioning

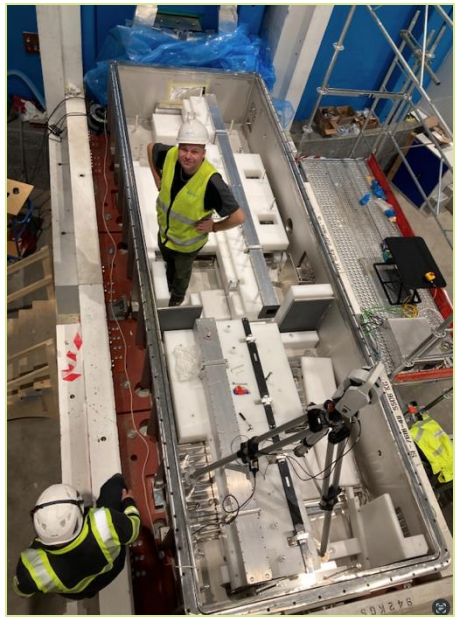
System Name	FBS	EPL	FAT	SAT
Collimation System	LOKI.A01.R02.R01	ESS-5015789	ESS-473306 –ESS-4752125	ESS-5762641



Collimation System: allows the user to switch between sections of super mirror guide and collimation channels to alter the beam profile and how it is focussed upon the sample. This system is located out of the bunker wall

- 2 linear tables driven to accurate position a select guide or channel
- 3 Slits systems with motorised XY boron carbide blades, to improve focus and minimise divergence
- Vacuum vessel where the above systems will be placed.





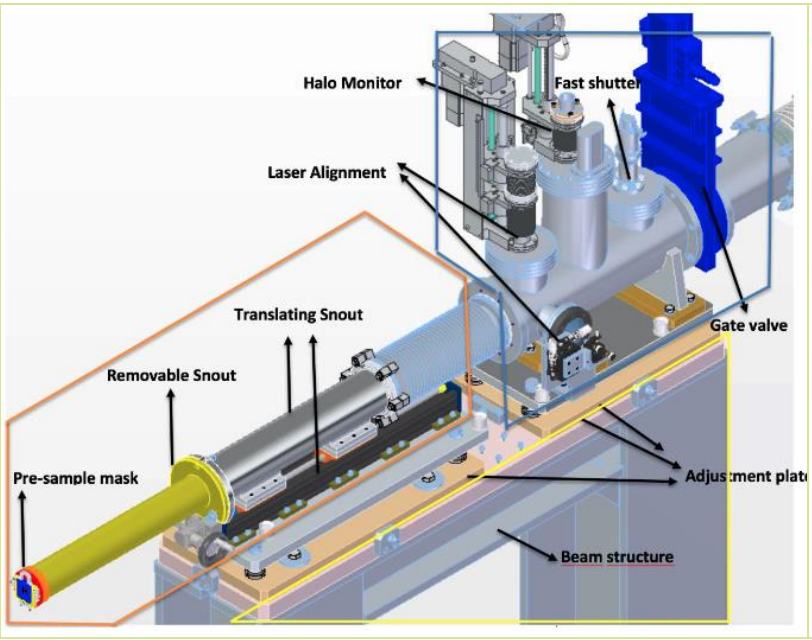
Beam Transport and Conditioning

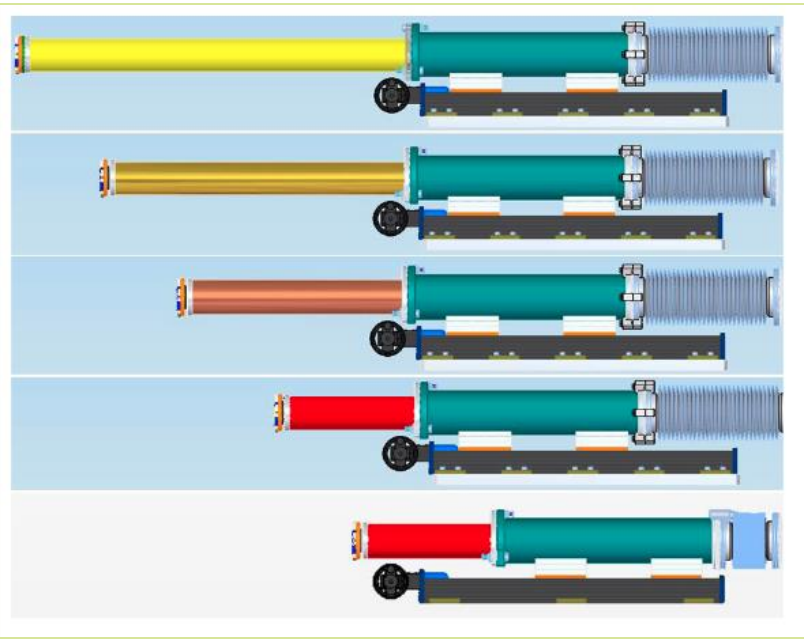
=ESS.NSS.H01.LOKI.A01.R02 Beam Geometry Conditioning

System Name	FBS	EPL	FAT	SAT
Pre- sample snout	LOKI.A01.R02.R02	ESS-5362859	ESS-5072421 – ESS-5649512	ESS-5765154

Pre-sample snout: Is located in the sample area and is constrained by the beam centre. Vessels work under vacuum.

- Support Frame: bolted in a D03 floor
- Vacuum chamber assembly: Alignment laser, (Beam monitor M2), experiment shutter, Gate valve
- Snout: Vacuum tube of adjustable length and allows the positinioning of the beam mask holder



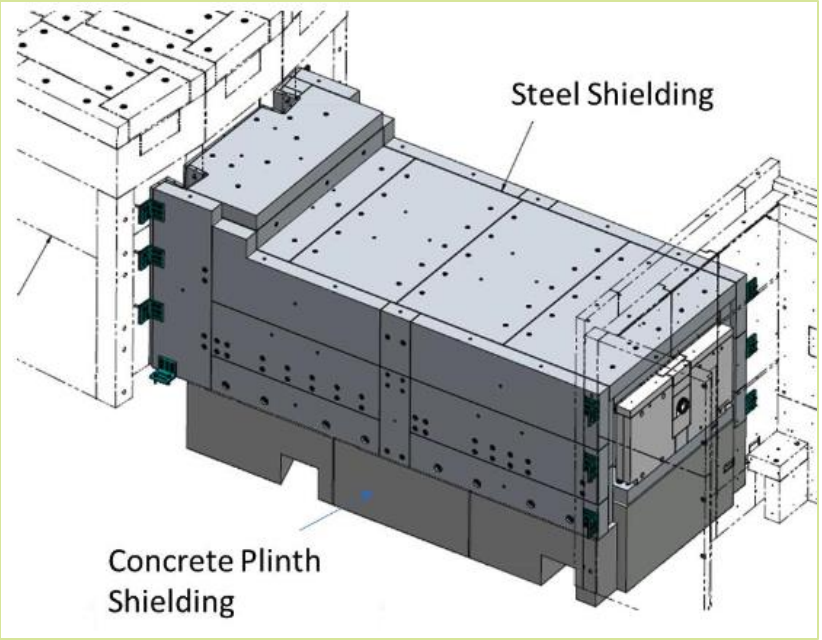


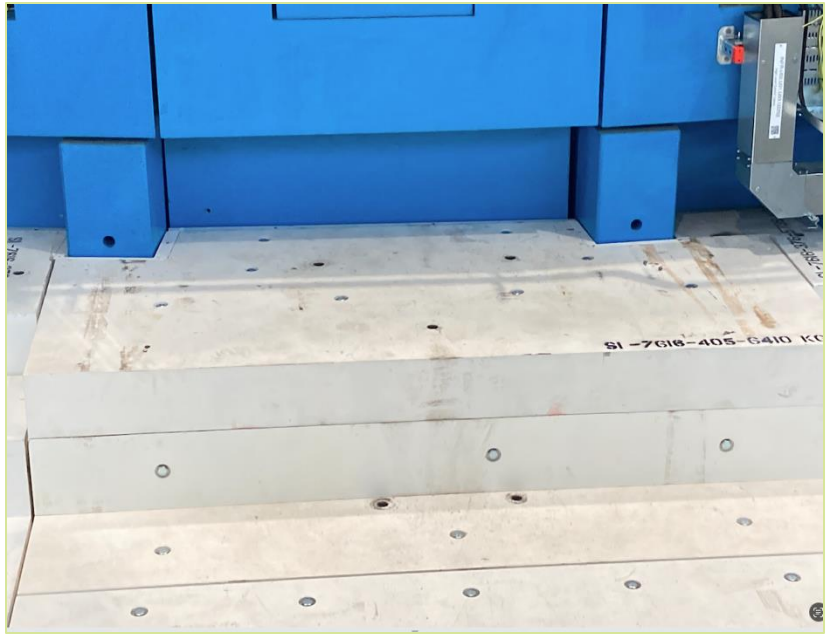
Beam Transport and Conditioning

=ESS.NSS.H01.LOKI.A01.F01 Shielding Bunker to cave

System Name	FBS	EPL	FAT	SAT
Shielding	LOKI.A01.F01.F01	ESS-3819595	N/A	ESS-5723871 – ESS-5806458
Pre-cast base assembly	LOKI.A01.F01.U01	ESS-5373243	N/A	ESS-5723871 – ESS-5806458

The system consists of concrete base structures and steel shielding blocks. Providing a rigid support for the equipment and shielding, helping the load distribution. Providing the biological shielding to achieve the dose rate no greater than 1.5uSv/h. Steel 210 mm thick wall, low cobalt content





=ESS.NSS.H01.LOKI.A02

Sample Exposure System

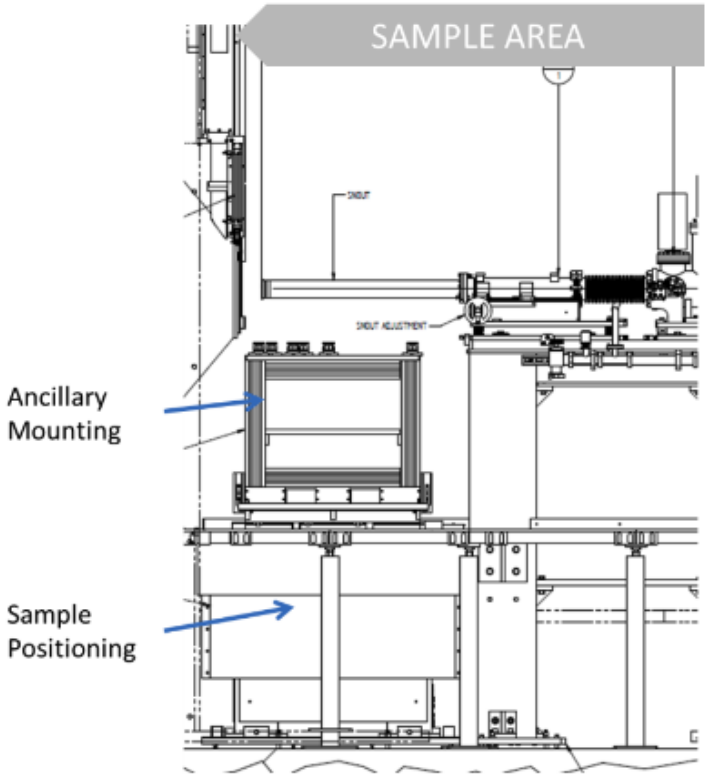
TAG	Description
=ESS.NSS.H01.LOKI.A02.AS01	Sample Conditioning
=ESS.NSS.H01.LOKI.A02.AS03	Sample Environment Equipment
=ESS.NSS.H01.LOKI.A02.W01	Sample Positioning

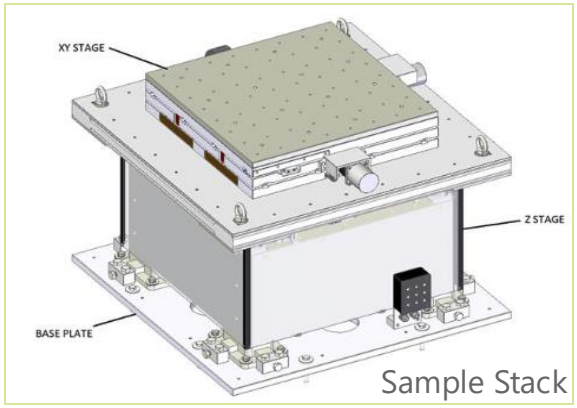
Sample Exposure System

=ESS.NSS.H01.LOKI.A02.W01 Sample Positioning

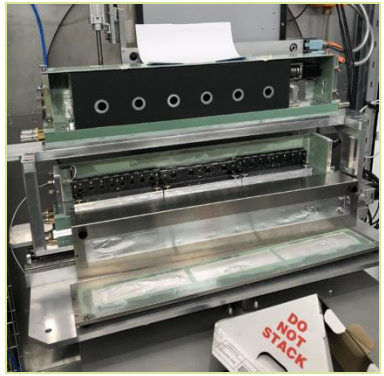
System Name	FBS	EPL	FAT	SAT
Linear Rotating Sample Cells Changer	LOKI.A02.W01.W05	ESS-5377115	N/A	Ongoing
Sample Rotation Stage	LOKI.A02.W01.W04	ESS-5377115	N/A	Ongoing
Sample stack	LOKI.A02.W01.W01	ESS-5377114	ESS-3970687	ESS-4760095

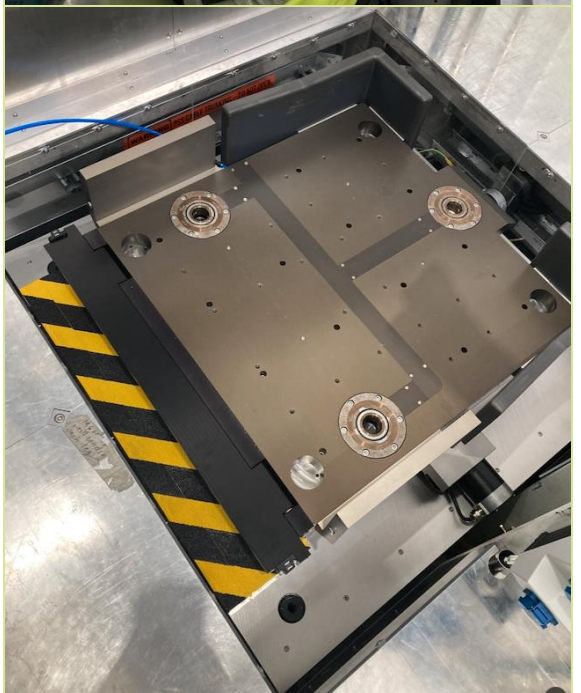
The purpose of the SES is to manipulate samples and accurately position them in the neutron beam.
The system has multiple stages of motion.





Sample Stack





=ESS.NSS.H01.LOKI.B01

Scattering Characterisation System

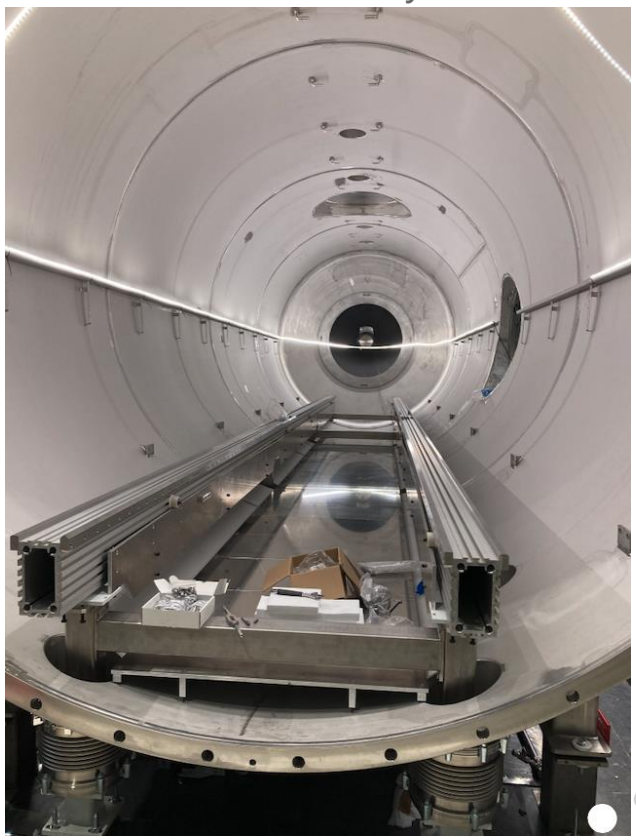
TAG	Description
=ESS.NSS.H01.LOKI.B01.C02	Neutron Detector Tank System
=ESS.NSS.H01.LOKI.B01.B01	Neutron Detector System
=ESS.NSS.H01.LOKI.B01.C01	Neutron Detector Electronics

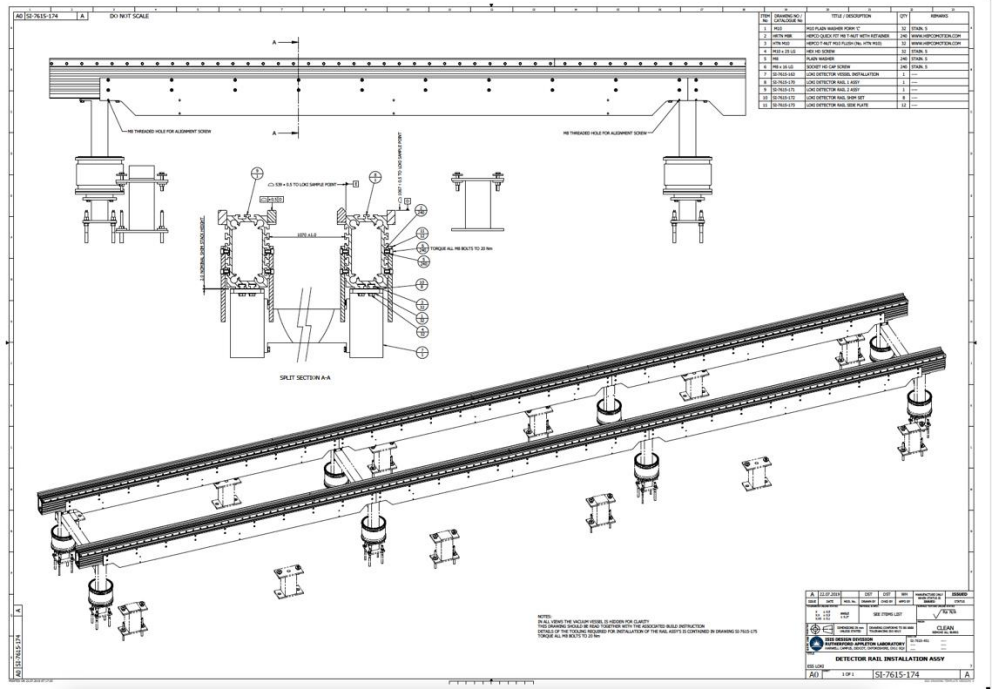
Scattering Characterisation System

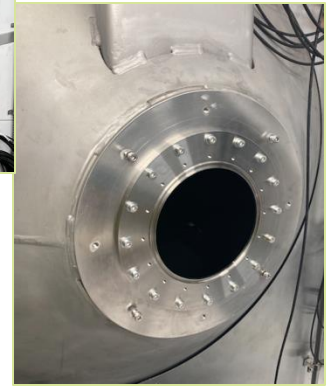
=ESS.NSS.H01.LOKI.B01.C02 Neutron Detector Tank System

System Name	FBS	EPL	FAT	SAT
Neutron Detector Tank	LOKI.B01.C02.C01	ESS-4803883	ESS-3475704	ESS-3481700
Rail system	LOKI.B01.C02.W01	ESS-4803884	N/A	N/A
Window Safety Guard	LLOKI.B01.C02.F01	ESS-4817915	ESS-5649270	ESS-5716246

- The vessel will allow the Vacuum System is to provide an evacuated environment that reduces unwanted scatter of neutrons between the sample and detector
- The Window Safety Guard is to protect persons from a potential hazard in case of failure of the sapphire window.





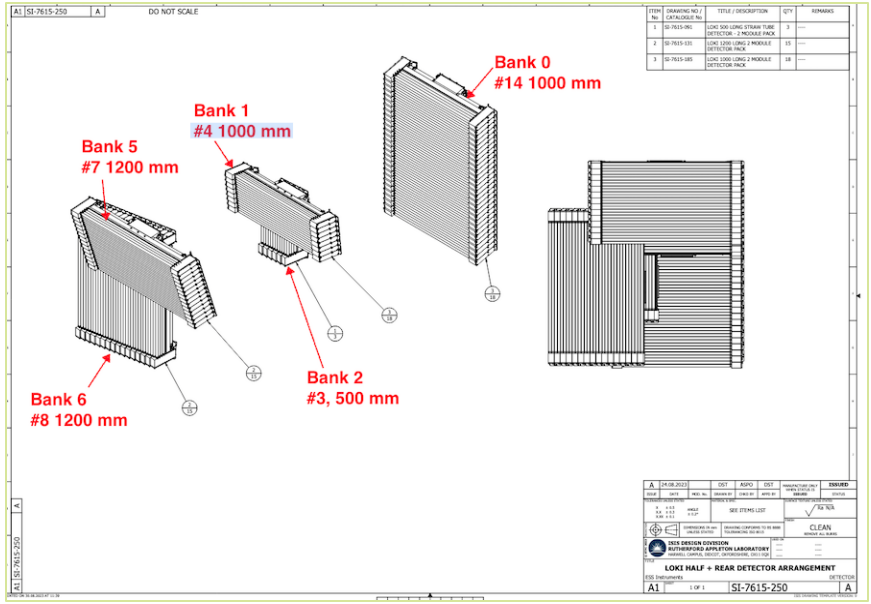


Scattering Characterisation System

=ESS.NSS.H01.LOKI.B01.B01 Neutron Detector System

System Name	FBS	EPL	FAT	SAT
Front Neutron Detector System	LOKI.B01.B01.B01	ESS-5428484	ESS-5716335	ESS-5716334
Middle Neutron Detector System	LOKI.B01.B01.B02	ESS-5428490	ESS-5716335	ESS-5716334
Rear Neutron Detector System	LOKI.B01.B01.B03	ESS-5428496	ESS-5716335 – ESS-1408217	ESS-5716334

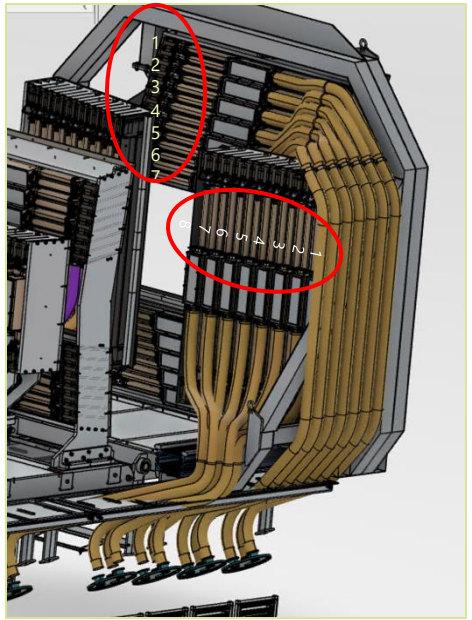
- The SCS is designed to detect neutrons scattered from the sample, providing scientific data.
- Technology used: Boron straw wire tube. It helps to maximise coverage and enable to collect data at higher facility source power without limiting sample sizes.
- The hight angle detector remain in fixed locations. The rear detector shall be able to move to control small angular coverage.
- For day 1 coverage, 5 banks will be installed. Total 18 modules L=1000 mm, 3 modules L= 500 mm, 15 modules L= 1200 mm



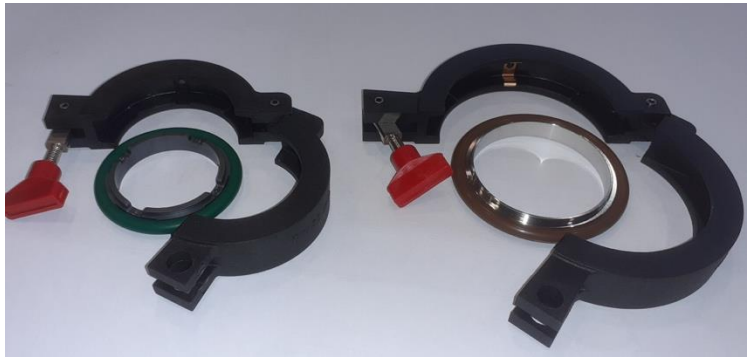
Scattering Characterisation System

=ESS.NSS.H01.LOKI.B01.C01 Neutron Detector Electronics

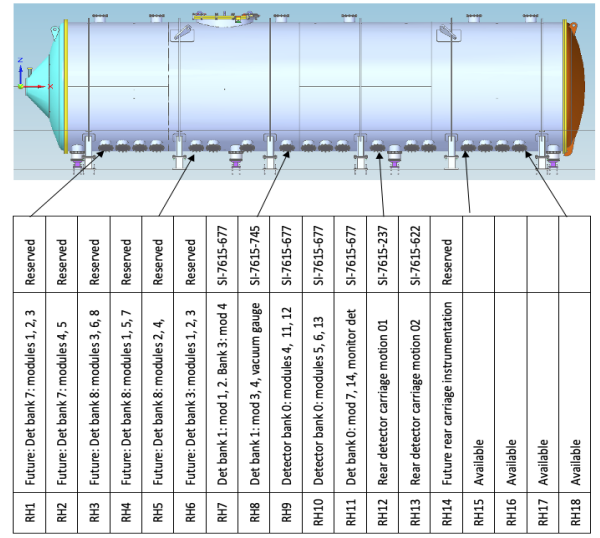
System Name	FBS	EPL	FAT	SAT
Detector DAQ System 1 - 5	LOKI.B01.C01.C01 to C05	ESS-3889928	ESS-5716335	ESS-5716334
Patch Panels 1 - 22	LOKI.B01.C01.X01 to X22	ESS-3889928	ESS-5716335	ESS-5716334



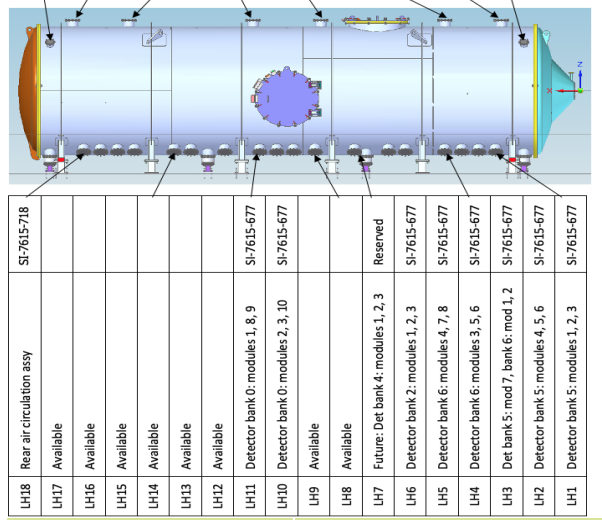
Each module has 18 cables plugged into the common connection plate. 1 LV, 1 HV, 16 ethernet cables, 1 spare



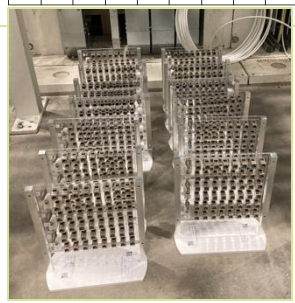
Detector Bank Ref: SI-7615-097		Detector Module Number	Vessel Port Ref: SI-7616-451
Bank 0	Rear bank	1	LH11B
Bank 0	Rear bank	2	LH10B
Bank 0	Rear bank	3	LH10C
Bank 0	Rear bank	4	RH9C
Bank 0	Rear bank	5	RH10B
Bank 0	Rear bank	6	RH10C
Bank 0	Rear bank	7	RH11C
Bank 0	Rear bank	8	LH11A
Bank 0	Rear bank	9	LH11C
Bank 0	Rear bank	10	LH10A
Bank 0	Rear bank	11	RH9B
Bank 0	Rear bank	12	RH9A
Bank 0	Rear bank	13	RH10A
Bank 0	Rear bank	14	RH11B



RH1	Future: Det bank 7: modules 1, 2, 3	Reserved															
RH2	Future: Det bank 7: modules 4, 5	Reserved															
RH3	Future: Det bank 8: modules 3, 6, 8	Reserved															
RH4	Future: Det bank 8: modules 1, 5, 7	Reserved															
RH5	Future: Det bank 8: modules 2, 4,	Reserved															
RH6	Future: Det bank 3: modules 1, 2, 3	Reserved															
RH7	Det bank 1: mod 1, 2. Bank 3: mod 4	SI-7615-677															
RH8	Det bank 1: mod 3, 4, vacuum gauge	SI-7615-745															
RH9	Detector bank 0: modules 4, 11, 12	SI-7615-677															
RH10	Detector bank 0: modules 5, 6, 13	SI-7615-677															
RH11	Det bank 0: mod 7, 14, monitor det	SI-7615-677															
RH12	Rear detector carriage motion 01	SI-7615-237															
RH13	Rear detector carriage motion 02	SI-7615-622															
RH14	Future rear carriage instrumentation	Reserved															
RH15	Available																
RH16	Available																
RH17	Available																
RH18	Available																



LH18	Rear air circulation assy	SI-7615-718															
LH17	Available																
LH16	Available																
LH15	Available																
LH14	Available																
LH13	Available																
LH12	Available																
LH11	Detector bank 0: modules 1, 8, 9	SI-7615-677															
LH10	Detector bank 0: modules 2, 3, 10	SI-7615-677															
LH9	Available																
LH8	Available																
LH7	Future: Det bank 4: modules 1, 2, 3	Reserved															
LH6	Detector bank 2: modules 1, 2, 3	SI-7615-677															
LH5	Detector bank 6: modules 4, 7, 8	SI-7615-677															
LH4	Detector bank 6: modules 3, 5, 6	SI-7615-677															
LH3	Det bank 5: mod 7, bank 6: mod 1, 2	SI-7615-677															
LH2	Detector bank 5: modules 4, 5, 6	SI-7615-677															
LH1	Detector bank 5: modules 1, 2, 3	SI-7615-677															



=ESS.NSS.H01.LOKI.B01

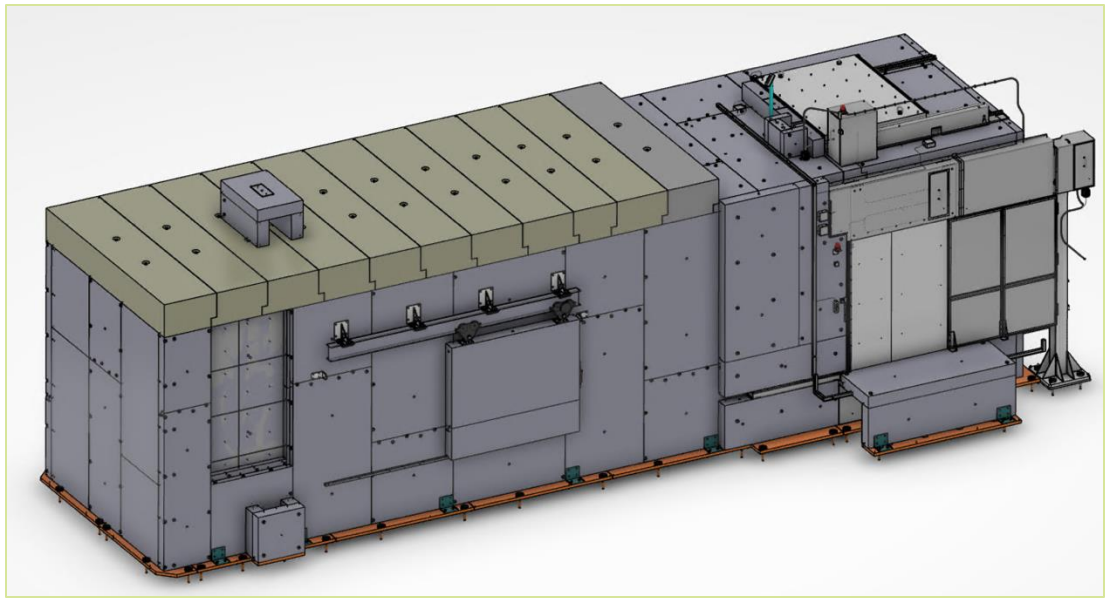
Experimental Cave

TAG	Description
=ESS.NSS.H01.LOKI.U01.U01	Cave Structure
=ESS.NSS.H01.LOKI.U01.A03	Detector Vessel Access Door
=ESS.NSS.H01.LOKI.U01.K01	Power door & roof control cabinet
=ESS.NSS.H01.LOKI.U01.A02	Roof hatch
=ESS.NSS.H01.LOKI.U01.A01	Sliding Door
=ESS.NSS.H01.LOKI.U01.ND01	Raised Floor to Sample Area
=ESS.NSS.H01.LOKI.U01.F01	Shielding on cave

Experimental Cave

=ESS.NSS.H01.LOKI.U01.ND01 Shielding on cave

System Name	FBS	EPL	FAT	SAT
LoKI Cave concrete Roof ASSY		ESS-4028016	N/A	ESS-5768841
Detector Vessel Shielding ASSY		ESS-4027721	N/A	ESS-5768841
Sample Area Steel wall		ESS-4028030	N/A	ESS-5768841
Vessel Side Access Door	LOKI.U01.A03	ESS-5335445	N/A	ESS-5768841
Sliding Power Door	LOKI.U01.A01	ESS-5110417	ESS-5156552	ESS-5486285
Roof Hatch	LOKI.U01.A02	ESS-5316218		
Power door & roof control cabinet	LOKI.U01.K01	ESS-5282166	ESS-5162143	



Materials:

- Cave, side access door and sample blocks are in steel T=210 mm
- Inner coverage of 10 mm B4C to prevent background radiation from outside the instrument
- Cave roof is precast blocks, 680 mm thick, with inner 100 mm mix of (B4C + concrete)
- Sample door is encapsulated lead

Personnel access:

- Access to sample area interfaced by PSS and motion control actuator panel.

Design constrains

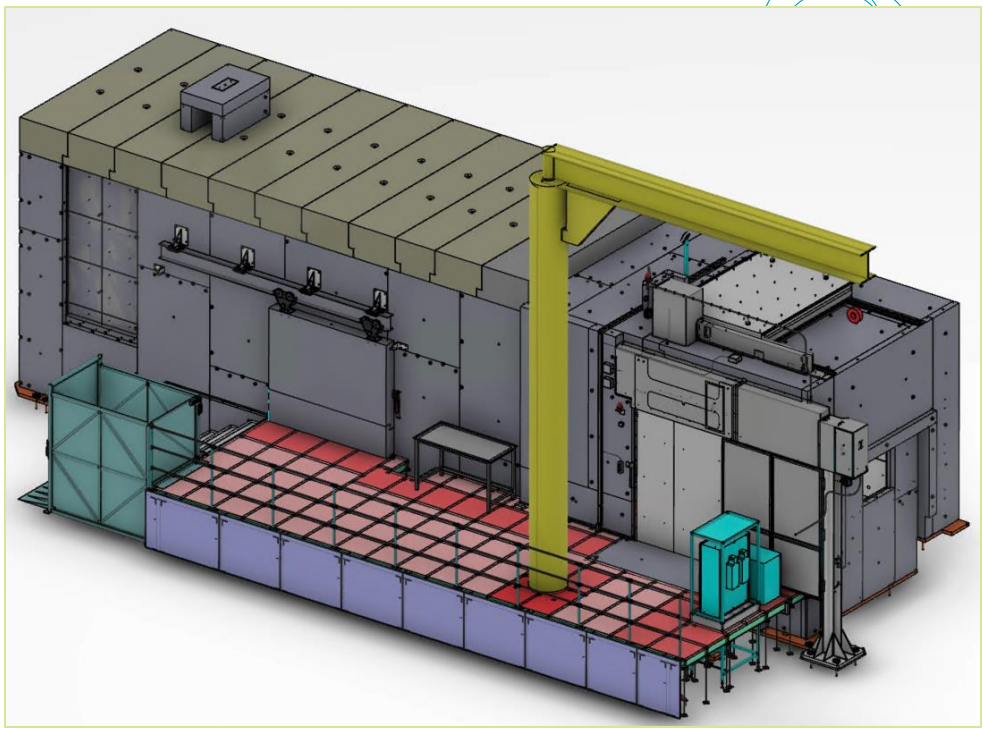
- Use of heavy walls due to gamma dominated shielding needed
- Space constrains to use concrete material
- Flexible design around vessel, removal of back blocks and partially roof block
- Allow crawling space to vessel ports
- Load distributed on D03 floor by baseplates
- Interfaces for cabling and sample area loading
- Access for maintenance to the vacuum vessel
- Gaps < 10 mm between blocks
- Crane capacity – assembly blocks <30 t

Experimental Cave

=ESS.NSS.H01.LOKI.U01.F01 Raised Floor to Sample Area

System Name	FBS	EPL	FAT	SAT
Raised Floor to Sample Area	LOKI.U01.F01	ESS-5065086	N/A	ESS-5166313

- Raised floor designed to be removable and integrated with the north floor
- Floor height 1 m, to be levelled with sample area floor to allow smooth rolling of wheeled equipment
- Interfaces towards goods lift, crane and door and roof cabinet
- Hand rails required and non slip floor
- Max load 300 kg

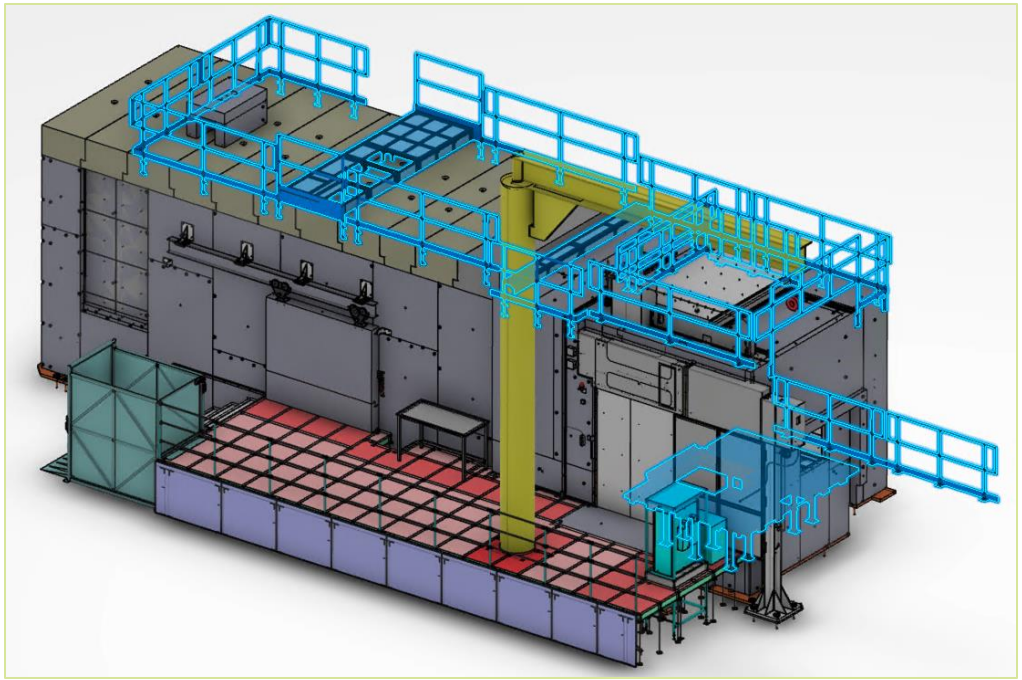


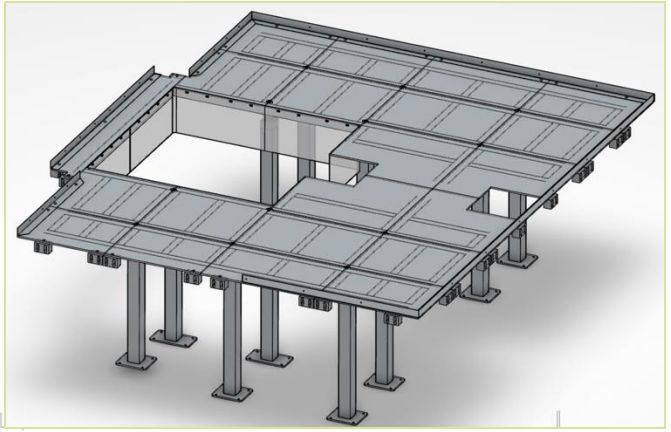
Experimental Cave

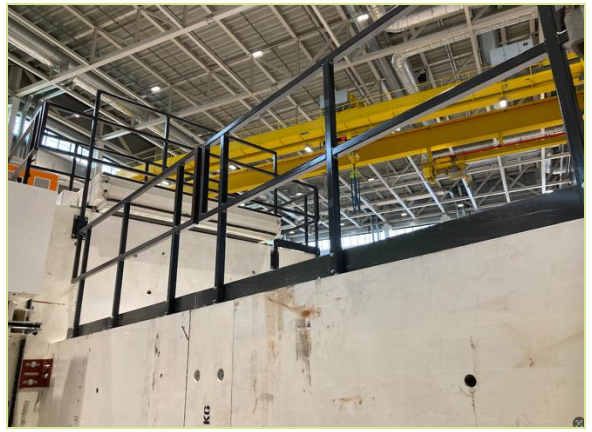
=ESS.NSS.H01.LOKI.U01.U01 Cave Structure

System Name	FBS	EPL	FAT	SAT
Cave Handrails	LOKI.U01.U01.FQ01	ESS-5065073	N/A	ESS-5768841
Raised Floor on Cave Roof	LOKI.U01.U01.ND01	ESS-5065074	N/A	ESS-5768841
Sample Area Floor	LOKI.U01.U01.ND02	ESS-5376501	N/A	ESS-5768841

- **Cave guard rails** designed to prevent falling hazards. Design assessment to check compliance and safety
- **Raised floor on top of the cave** used to allow Racks installation and to avoid cabling trays tripping
- **Sample area floor**: designed to allow users in sample area 1 m height. Complex interface







=ESS.NSS.H01.LOKI.K01

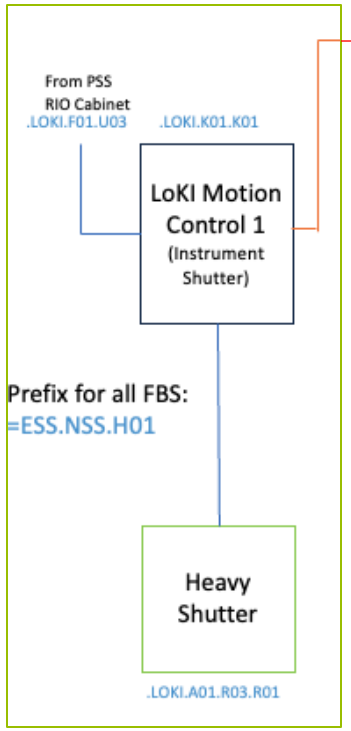
Instrument Automation Control System

TAG	Description
=ESS.NSS.H01.LOKI.K01.K01	LOKI Motion Control 1 (Instrument Shutter)
=ESS.NSS.H01.LOKI.K01.K02	LOKI Motion Control 2 (Collimation)
=ESS.NSS.H01.LOKI.K01.K03	LOKI Motion Control 3 (Sample Area)
=ESS.NSS.H01.LOKI.K01.K04	LOKI Motion Control 4 (Sample Stage)
=ESS.NSS.H01.LOKI.K01.K05	LOKI Motion Control 5 (Detector)

Instrument Automation Control System

Instrument Automation Control System

System Name	FBS	EPL	FAT	SAT
LOKI Motion Control 1 (Instrument Shutter)	LOKI.K01.K01	ESS-4219996	ESS-5461186	ESS-5694413
LOKI Motion Control 2 (Collimation)	LOKI.K01.K02	ESS-4126485	ESS-5423298	ESS-5694417



Shutter Operator Panel
Located next to sample door

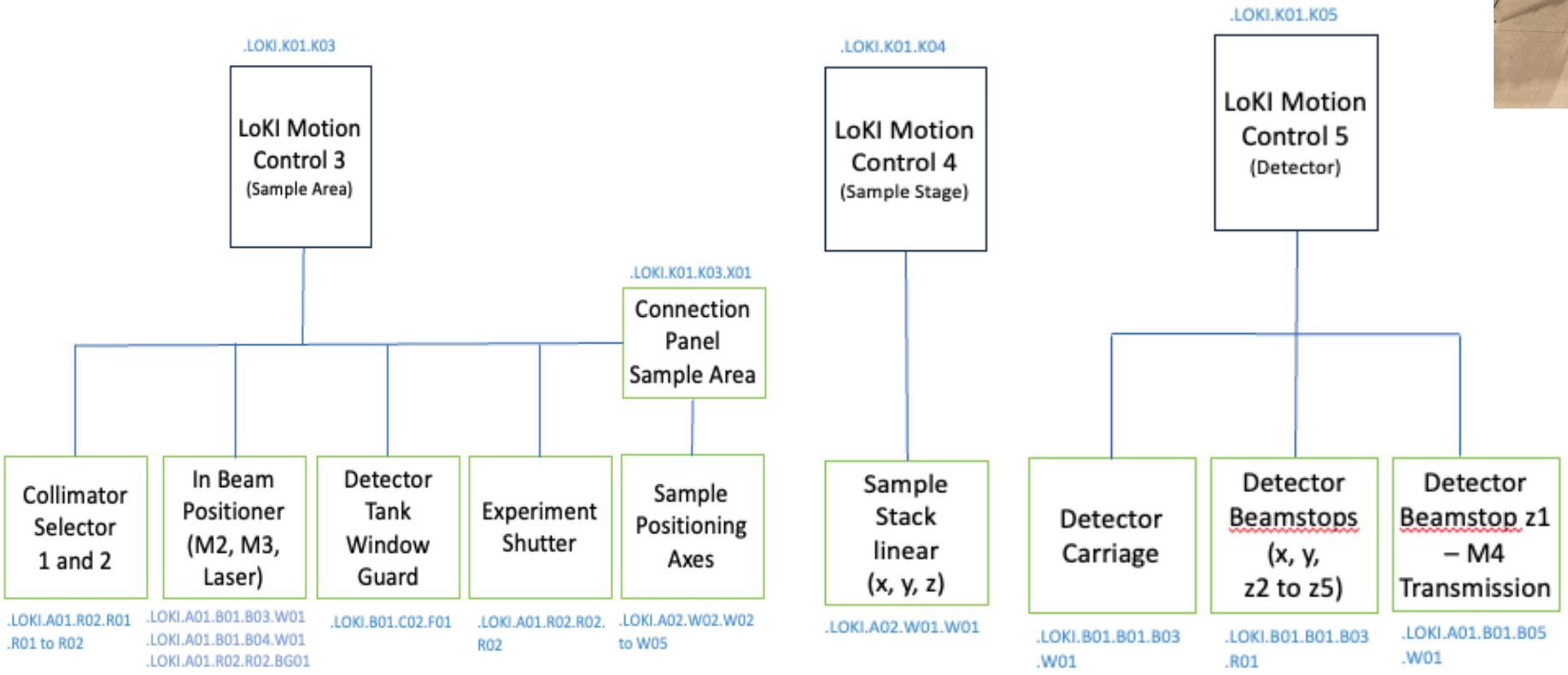
System: in bunker

System: Located in collimation area (out of bunker)

Instrument Automation Control System

Instrument Automation Control System

System Name	FBS	EPL	FAT	SAT
LOKI Motion Control 3 (Sample Area)	LOKI.K01.K03	ESS-4123486	ESS-5423300	ESS-5694420
LOLOKI Motion Control 4 (Sample Stage)	LOKI.K01.K04	ESS-4123487	ESS-5461187	ESS-5770634
LOKI Motion Control 5 (Detector)	LOKI.K01.K05	ESS-4123488	ESS-5423301	ESS-5699646



=ESS.NSS.H01.LOKI.G01

Vacuum System (LOKI)

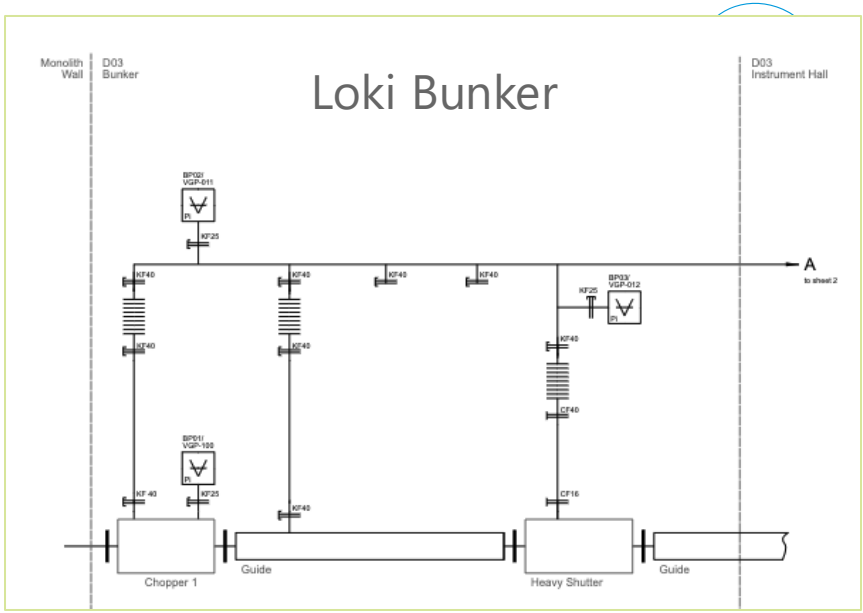
TAG	Description
=ESS.NSS.H01.LOKI.G01.G01	LOKI Vacuum System Bunker Zone
=ESS.NSS.H01.LOKI.G01.G02	LOKI Vacuum System Instrument Zone

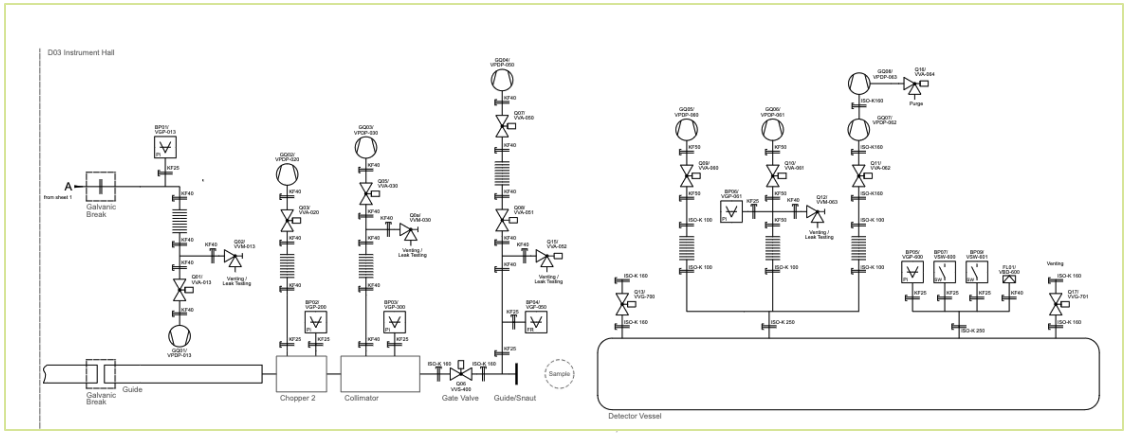
Vacuum System (LOKI)

=ESS.NSS.H01.LOKI.G01LoKI Vacuum systems

System Name	FBS	EPL	FAT	SAT
LOKI Vacuum System Bunker Zone	LOKI.G01.G01	ESS-3819618	N/A	ESS-5726991
LOKI Vacuum System Instrument Zone	.LOKI.G01.G02	ESS-3819619	N/A	

- One control cabinet for each grounding zone
- Vacuum values: 10-2mBar
- In bunker circuit – north floor
- Instrument zone:
  - Chopper out of bunker- north floor
  - Collimation vessel – north floor
  - Sample area – north floor
  - Detector vessel





=ESS.NSS.H01.LOKI.A05

Supply Systems

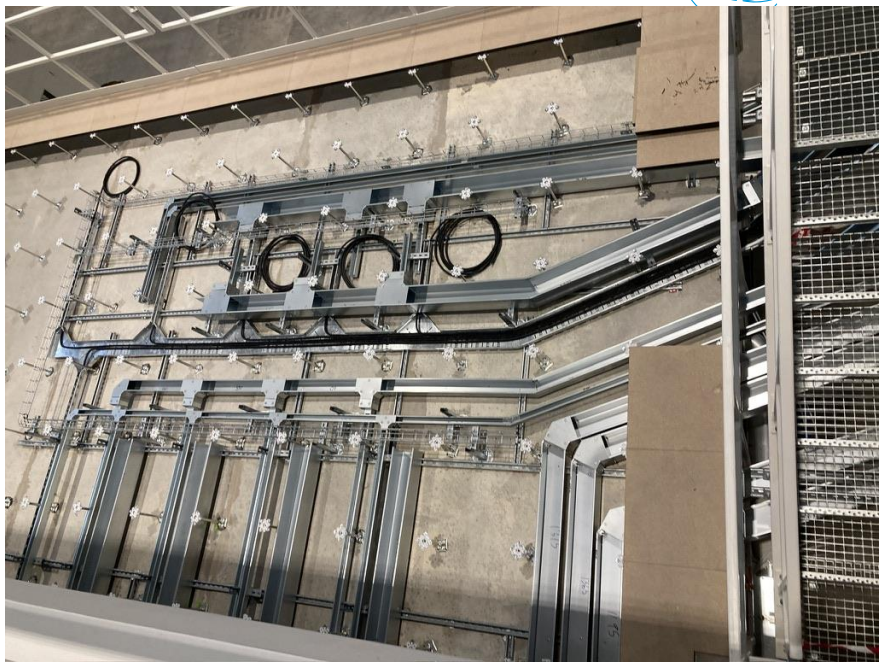
TAG	Description
=ESS.NSS.H01.LOKI.A05.W01	Electrical Power & Earthing
=ESS.NSS.H01.LOKI.A05.W02	Process Utilities
=ESS.NSS.H01.LOKI.A05.K01	Timing System

Supply Systems

=ESS.NSS.H01.LOKI.A05.W01 Electrical Power & Earthing

System Name	FBS	EPL	FAT	SAT
Electrical Power & Earthing	LOKI.A05.W01	ESS-5203717	N/A	ESS-4973023 – 5537145
Timing System	LOKI.A05.K01	N/A	N/A	ESS-5551582

- 2 Electrical Distribution Boards installed – One in each grounding zone: In bunker and Instrument zone
- Provides power to all technology cabinets, as well as hutch, crane, goods lift etc.
- Lights and sockets within cave area - energised
- All SAR scope now energised
- ODH cabinet and REMS remaining
- Grounding bars provided for earthing for in bunker and instrument zone out of the bunker
- Some bonding points still missing.
- Cable and containment installation

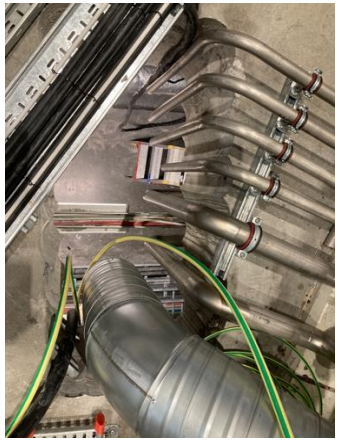


Supply Systems

=ESS.NSS.H01.LOKI.A05.W02 Process Utilities

System Name	FBS	EPL	FAT	SAT
Process Utilities	LOKI.A05.W02	ESS-3532907	N/A	ESS-5544008/ESS-5165508

- Compressed air supplied for;
  - Pneumatic motion devices
  - Vacuum valves
- Water supply for HVAC
- Gas handling, ventilation and He recovery lines supplied to the Cave Roof and sample preparation area



=ESS.NSS.H01.LOKI.A04

Support Systems

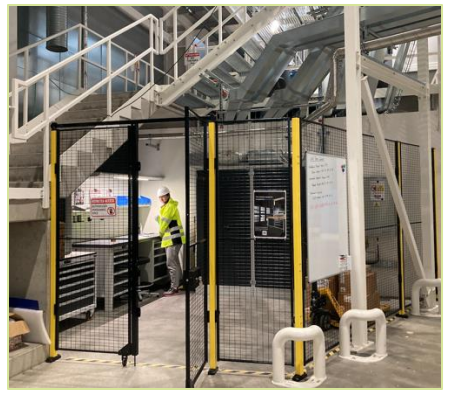
TAG	Description
=ESS.NSS.H01.LOKI.A04.A01	Control Hutch
=ESS.NSS.H01.LOKI.A04.F01	Fire protection
ESS.NSS.H01.LOKI.A04.GM01	Instrument Crane
=ESS.NSS.H01.LOKI.A04.G01	Instrument goods Lift
=ESS.NSS.H01.LOKI.A04.P01	Remote Area Surveillance

Support Systems

=ESS.NSS.H01.LOKI.A04

System Name	FBS	EPL	FAT	SAT
Control Hutch	LOKI.A04.A01	ESS-3819609	N/A	ESS-3895802
Instrument Crane	LOKI.A04.GM01	ESS-3819611	ESS-4220225	ESS-4956857
Instrument goods Lift	LOKI.A04.G01	ESS-3819613	ESS-5546617	ESS-5765138
Fire protection	LOKI.A04.F01	ESS3819610		
Remote Area Surveillance	LOKI.A04.P01	ESS-3819614		

- The control hutch in D03 has been built with access to the roof cave, fully energised, and furnished.
- Zoom screen installed
- PC Units and screens connected (DMSC equipment)
- Network connected
- Local crane Installed, energised and reviewed by 3rd party inspector
- Fenced area next to LoKI hutch built, equipped with proper workbenches and stocked with tools.
- Goods lift installed, energised and fully operational



Finish presentation