System Acceptance Review - Bifrost

Bifrost – Instrument Components
=ESS.NSS.H01.BIFRO

PRESENTED BY LIAM WHITELEGG

Agenda

1 Instrument Overview

2 Systems Overview

3 Deferred Scope

4 EPL and As-Built Status

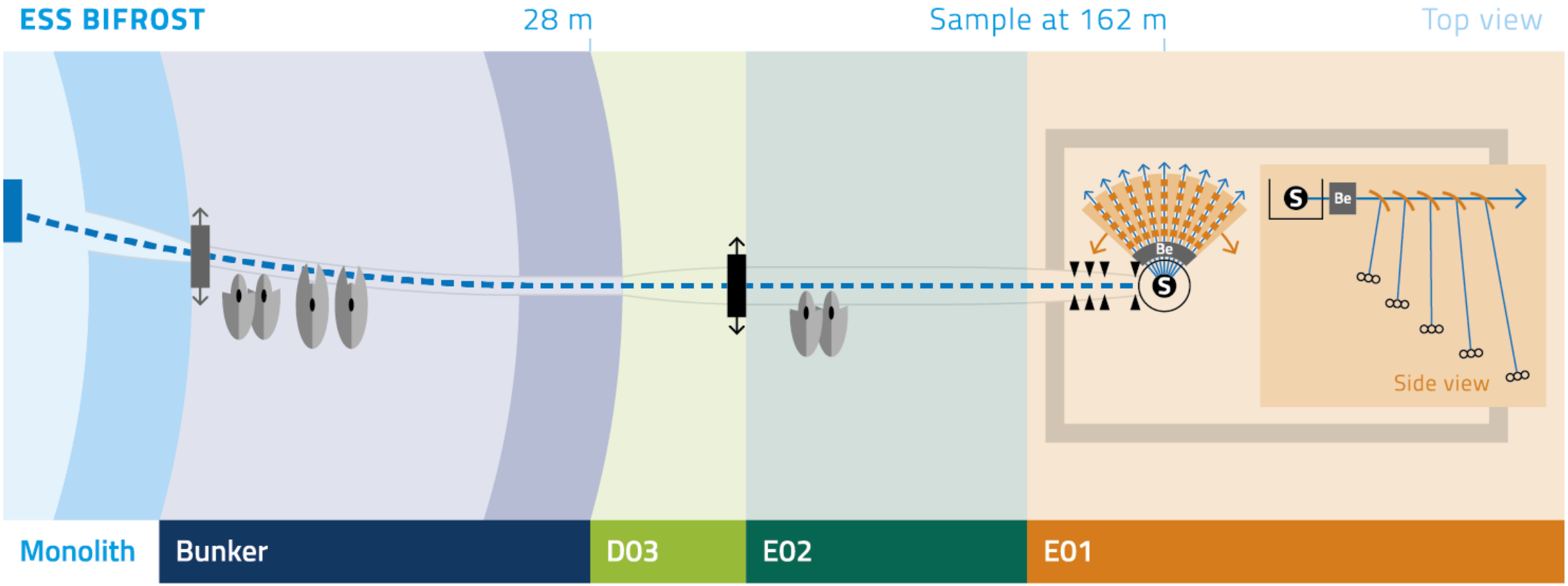
5 Summary

1

Instrument Overview

Instrument Overview

Overview



Instrument Overview

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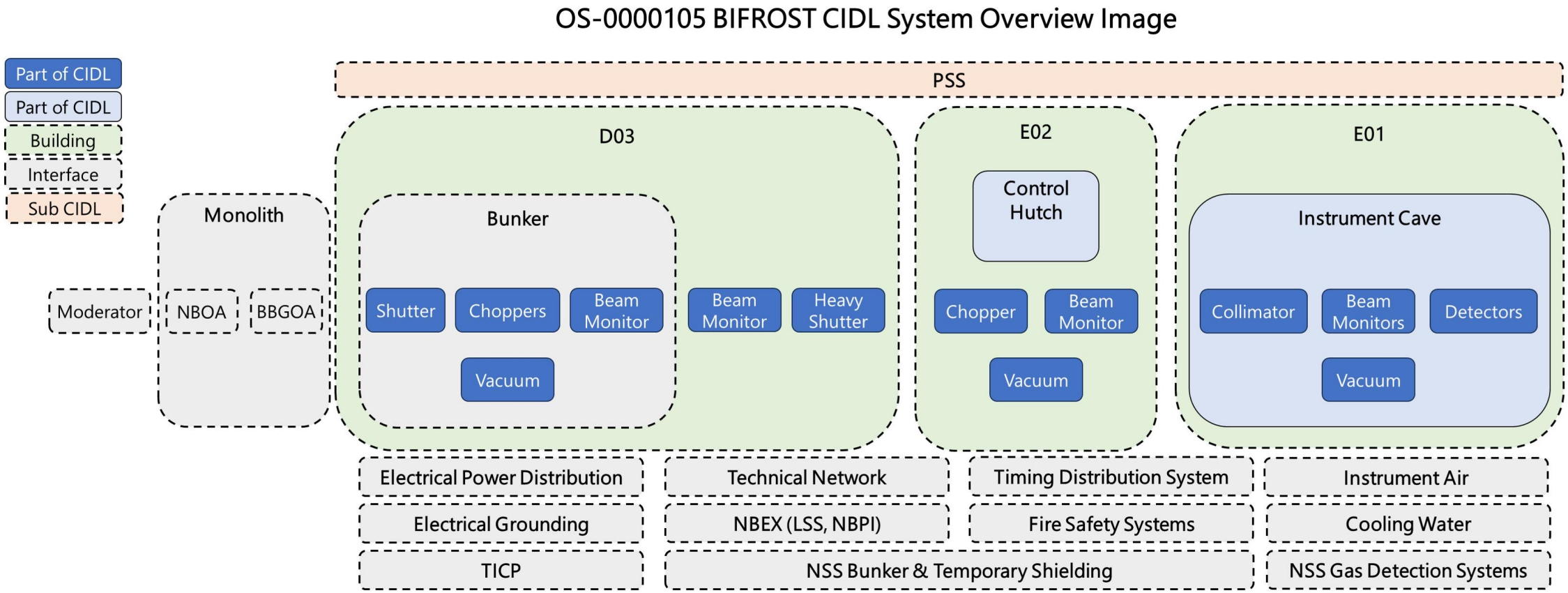

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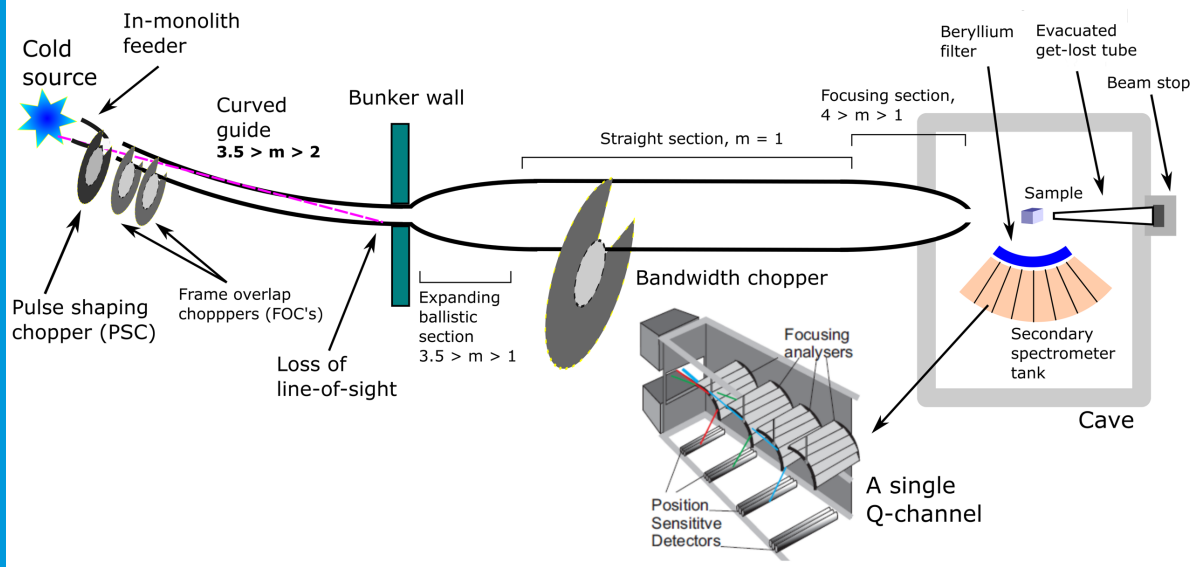
Systems Overview

ESS.NSS.H01.BIFRO.A01

Beam Transport & Conditioning



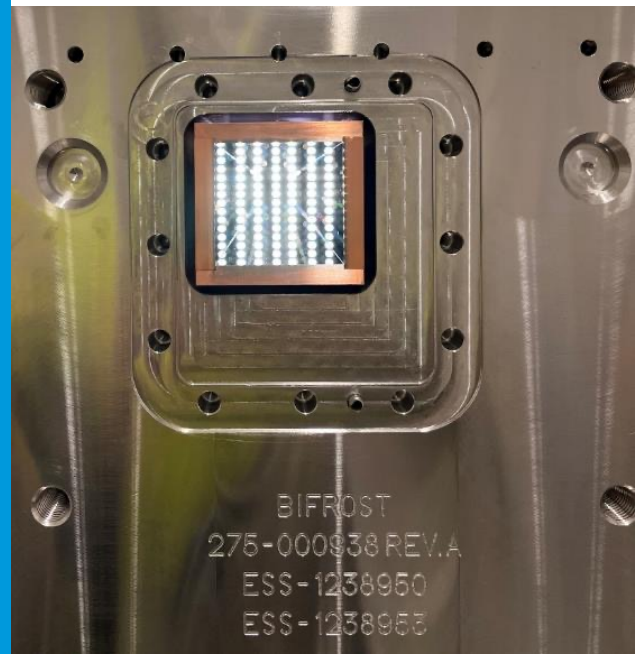
Tag	Description	Classification
=ESS.NSS.H01.BIFRO.A01	Beam Transport and Conditioning	Infrastructure System
=ESS.NSS.H01.BIFRO.A01.R02	Beam Geometry Conditioning	Beam Geometry Conditioning System
=ESS.NSS.H01.BIFRO.A01.W02	Beam Extraction System	Beam Transport System
=ESS.NSS.H01.BIFRO.A01.R03	Beam Cut off	Beam Cut Off System
=ESS.NSS.H01.BIFRO.A01.B01	Beam Validation	Beam Validation System
=ESS.NSS.H01.BIFRO.A01.R01	Neutron Chopper System	Chopper System
=ESS.NSS.H01.BIFRO.A01.F01	Shielding	Shielding System
=ESS.NSS.H01.BIFRO.A01.W01	Beam delivery system	Beam Transport System

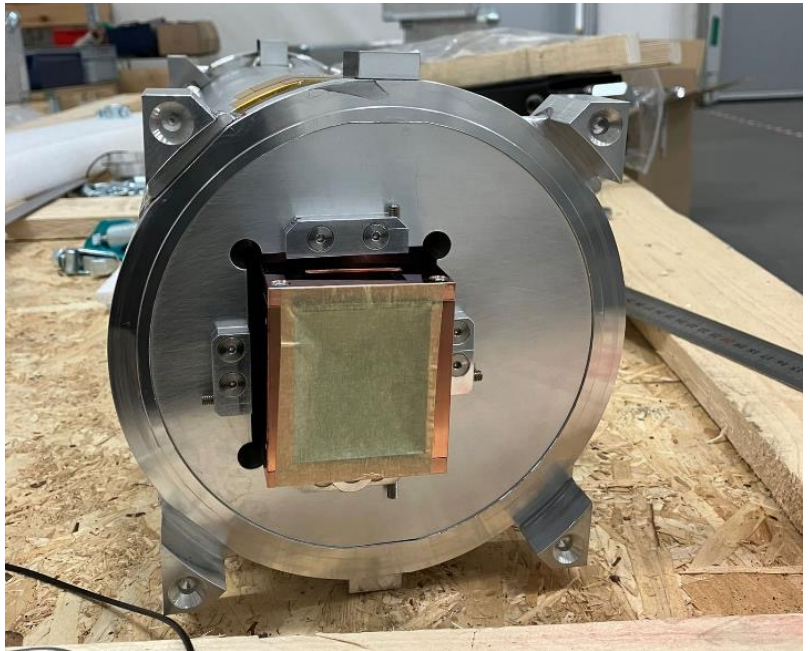
Beam Transport and Conditioning

Beam Extraction System BIFRO.A01.W02

System name	FBS	EPL	FAT	SAT
NBOA - Neutron Beam Optics Assembly	BIFRO.A01.W02.WH01	ESS-2820483	ESS-5580602	ESS-4019846
BBGOA - Bridge Beam Guide Optics assembly	BIFRO.A01.W02.WH02	ESS-4972085	ESS-5266473	ESS-5548730

- Copper guide pieces installed
- NBOA integrated within NBPI and installed within monolith
- BBG integrated within vacuum housing and installed with light shutter

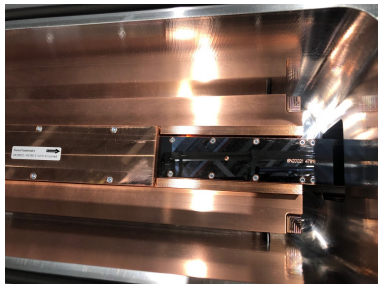




Beam Transport and Conditioning

Beam Delivery System BIFRO.A01.W01

System name	FBS	EPL	FAT	SAT
Feeder Guide	BIFRO.A01.W01.W03	ESS-4819304	ESS-5580562	ESS-5795899
Curved Guide	BIFRO.A01.W01.W01	ESS-4863513	ESS-5580562	ESS-4120293 & ESS-5694591
Opening Ellipse	BIFRO.A01.W01.R02	ESS-4863512	ESS-5580562	ESS-4120293 & ESS-5694591
Straight Guide	BIFRO.A01.W01.W02	ESS-4863514	ESS-5580562	ESS-4120293 & ESS-5694591
Focussing Ellipse	BIFRO.A01.W01.R01	ESS-4863511	ESS-5580562	ESS-4120293 & ESS-5694591



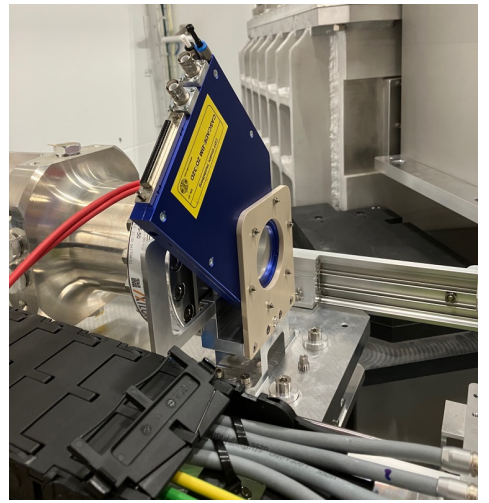
- Feeder – Elliptical copper guide piece within PSC housing
- Curved – Glass curved guide pieces with collimator section
  - Start in PSC housing. Sodium Float optics in aluminium vacuum housings
  - Copper collimator, with copper guide piece at roughly halfway point
- Opening ellipse – Expanding elliptical glass and copper guide pieces
  - Starts in bunker wall insert. Copper guide piece in stainless steel housing
  - Remaining elliptical pieces are Borkron optics in aluminium vacuum housings
- Straight – Borofloat optics in aluminium vacuum housings
- Focussing Ellipse – Borofloat and Borkron optics in aluminium vacuum housings

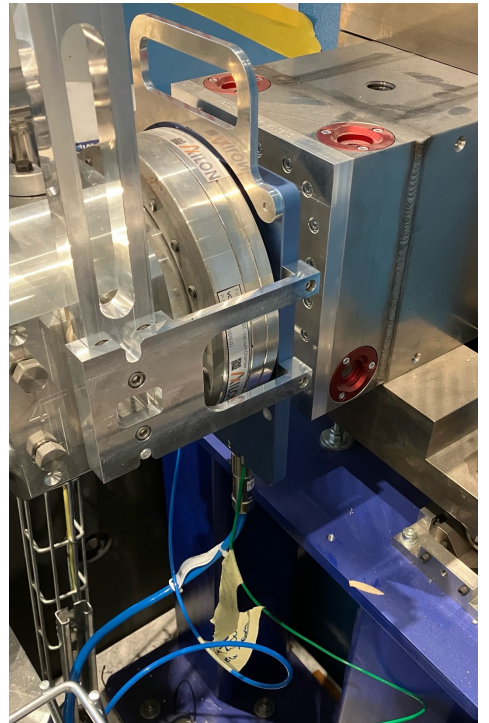
Beam Transport and Conditioning

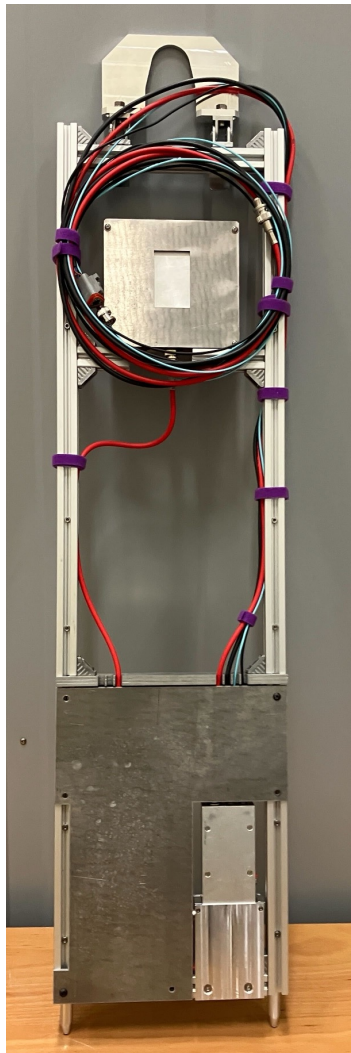
Beam Validation BIFRO.A01.B01

System name	FBS	EPL	FAT	SAT
Beam Monitor System M1 - PSC	BIFRO.A01.B01.B01	ESS-4003136	ESS-5485346	ESS-5774690
Beam Monitor System M2 - Bunker wall	BIFRO.A01.B01.B02	ESS-4049854	ESS-5472460	ESS-5774690
Beam Monitor System M3 - BWC	BIFRO.A01.B01.B03	ESS-4074337	ESS-5472460	ESS-5774690
Beam Monitor System M4 - Sample	BIFRO.A01.B01.B04	ESS-5474648	ESS-5546615	ESS-5774690

- Monitor 1
  - Extractable Fission Monitor in Bunker (0.065mg coating of U-235)
  - Contingency gas lines installed
- Monitors 2 & 3
  - I-BMs at Bunker Exit and E02 Chopper Pit
  - Small gas flow needed (Argon/CO2)
- Monitor 4
  - Cascade 2D-32-D at Sample Position
  - Small gas flow needed (Argon/CO2)





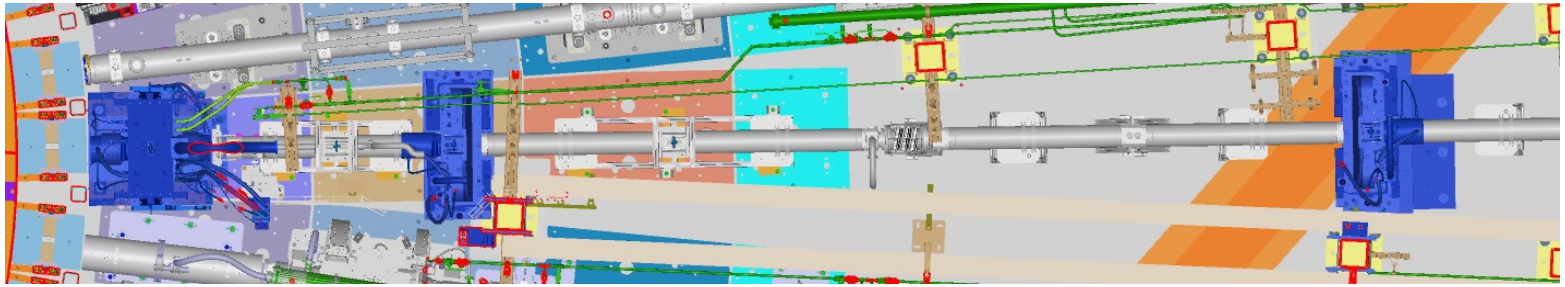


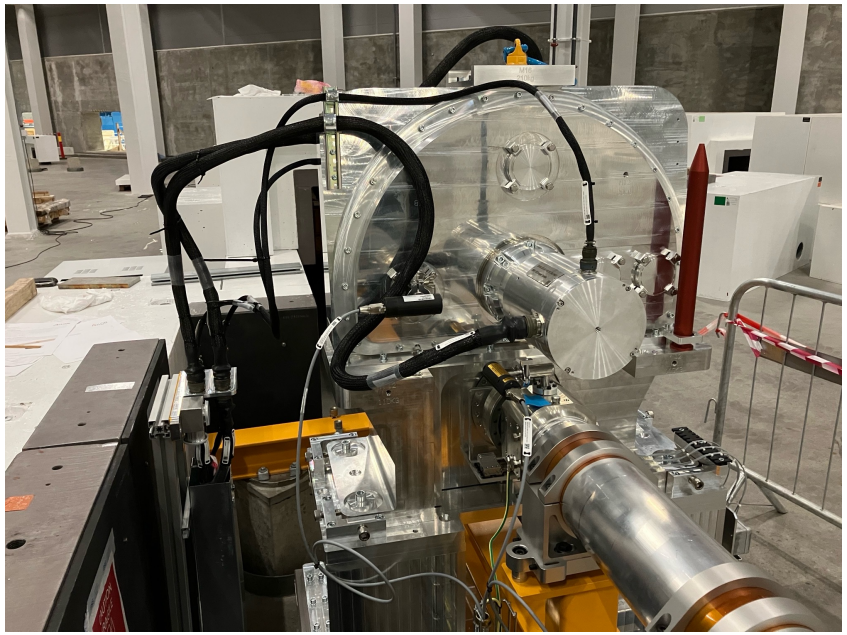
Beam Transport and Conditioning

Neutron Chopper System BIFRO.A01.R01

System name	FBS	EPL	FAT	SAT
BIFROST Bunker Chopper System	BIFRO.A01.R01.R01	ESS-3185457	ESS-4227821	ESS-4227822
BIFROST Band Width Chopper System	BIFRO.A01.R01.R02	ESS-3185459	ESS-4227826	ESS-4227827

- Bunker system contains;
  - Pulse Shaping Chopper – 126Hz double disc – Guides internal
    - Water cooling operational pressure of 3Bar
  - Frame Overlap Chopper 1 – 14Hz single disc – Windows
  - Frame Overlap Chopper 2 – 14Hz single disc – Windows
- Bandwidth system contains;
  - Bandwidth Chopper – 14Hz double disc – Common vacuum

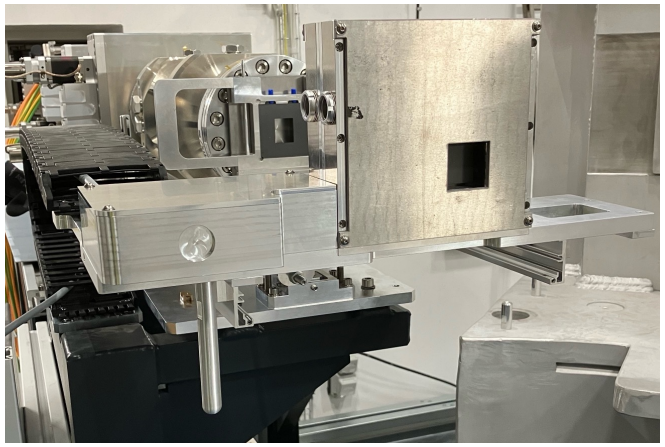


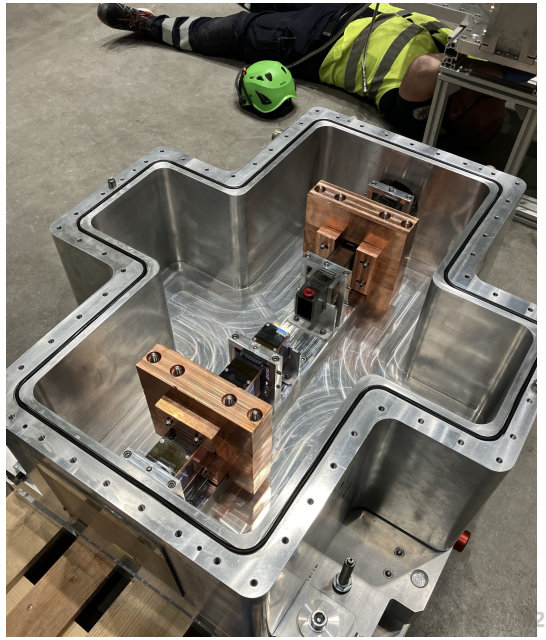


Beam Transport and Conditioning

Beam Geometry Conditioning BIFRO.A01.R02

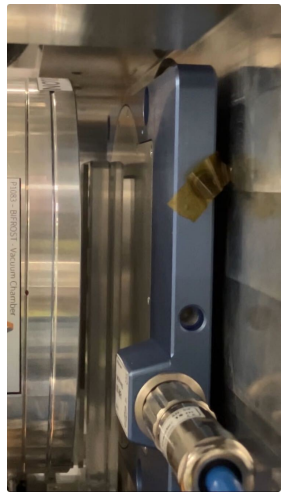
System name	FBS	EPL	FAT	SAT
Divergence Slit Set 1	BIFRO.A01.R02.R01.R01	ESS-4980076	ESS-5580603	ESS-5702798
Divergence Slit Set 2	BIFRO.A01.R02.R01.R02	ESS-4980077	ESS-5580603	ESS-5702798
Divergence Slit Set 3	BIFRO.A01.R02.R01.R03	ESS-4980078	ESS-5580603	ESS-5702798
Sample Slits	BIFRO.A01.R02.R01.R04	ESS-4979987	N/A	ESS-5770642
In-bunker copper apertures	BIFRO.A01.R02.R02	ESS-5633937	N/A	N/A





- Divergence Slits 1-3
  - Identical 2 axis slit systems
  - Integrated onto guide vacuum housings
  - Stepper motor with back axles resolver
- Sample Slits
  - 4 axis slit set with Piezo drives with redundant potentiometer readout
  - Slit system translates along the beamline with potentiometer readout
- Copper apertures are fixed, copper blocks housed in the PSC housing

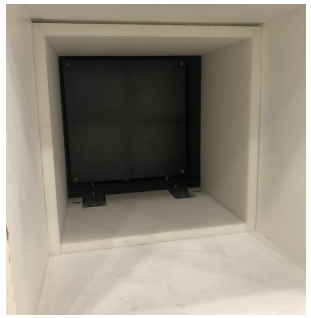
Beam Transport and Conditioning

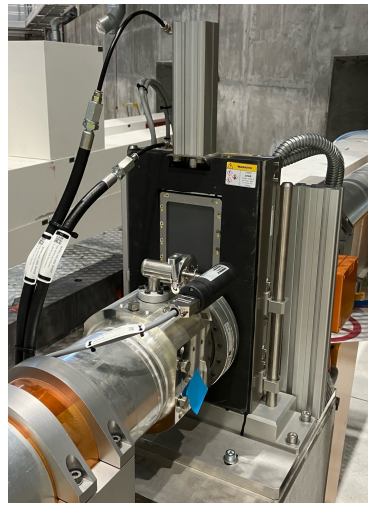


Beam Cut Off BIFRO.A01.R03

System name	FBS	EPL	FAT	SAT
Thermal Shutter	BIFRO.A01.R03.R01	ESS-4178157	ESS-4813462	ESS-5688808
Get Lost Tube	BIFRO.A01.R03.WP01	ESS-4000639	N/A	ESS-5702798
Beam-stop	BIFRO.A01.R03.R02	ESS-4000638	ESS-5603450	ESS-5774902
Attenuators	BIFRO.A01.R03.R03	ESS-4965635	ESS-5428669	ESS-5770642

- Thermal Shutter is situated in D03. Operator Panel mounted on hutch
  - Pneumatic actuated machine. Attenuator block consists of B4C/lead
  - No guide or vacuum housings associated with the design
- Get Lost Tube is situated in the cave
  - Pneumatic actuated machine. Translating vacuum pipe with B4C lining
- Beam Stop sits in Cave Wall. Static B4C box with borated poly sheets
- Attenuators are situated in E02 Chopper Pit
  - Pneumatic actuated machine with 3 axes
  - 2 PlexiGlass Blades and a Perforated B4C blade can attenuate the beam



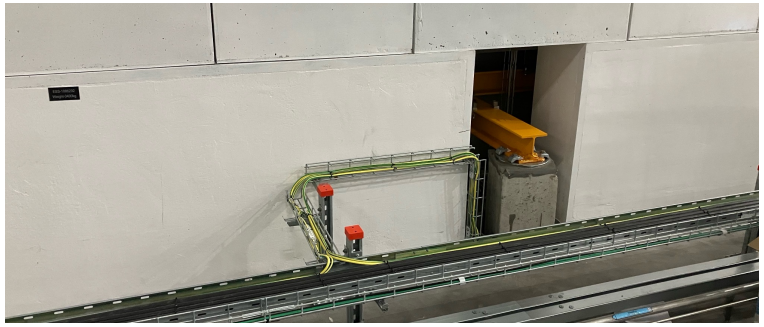


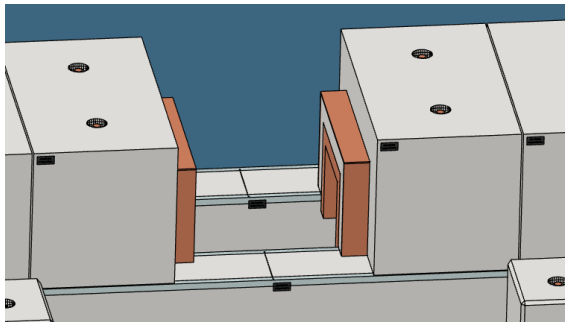
Beam Transport and Conditioning

Shielding BIFRO.A01.F01

System name	FBS	EPL	FAT	SAT
Beamline Shielding	BIFRO.A01.F01.F01	ESS-4000636	N/A	N/A
Neutron Guide Shielding	BIFRO.A01.F01.F02	ESS-5445979	ESS-3218932	ESS-5774942

- Beamline Shielding at interface between Cave and Guide Shielding
  - Combination of radiological (Stainless Steel) and background shielding (Borated Polyethylene)
- Neutron Guide Shielding runs from Bunker Wall to E01 Cave
  - D03 – Concrete, Steel and Lead
  - E02 – Concrete and Concrete/Steel mix at Chopper Pit
  - E01 – Concrete (with Stainless Steel rebar)
- Generic design uses alternating Pocket and Extrude Blocks

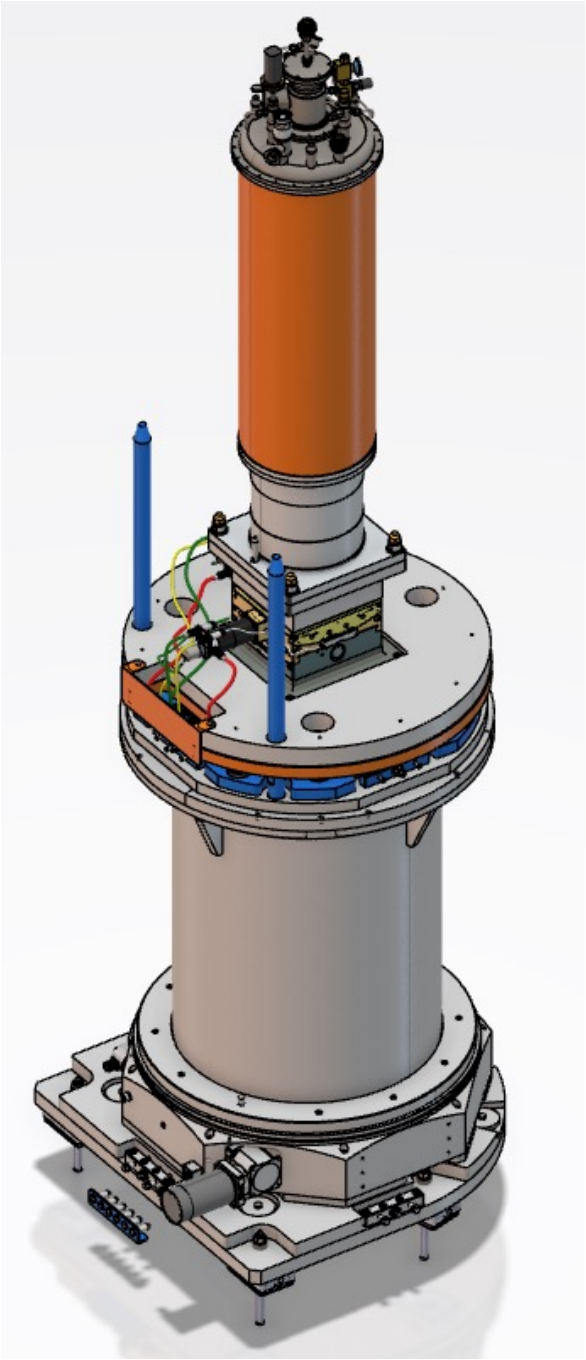




ESS.NSS.H01.BIFRO.A02

Sample Exposure System

Tag	Description	Classification
=ESS.NSS.H01.BIFRO.A02	Sample Exposure System (BIFROST)	Infrastructure System
=ESS.NSS.H01.BIFRO.A02.W01	Sample Positioning	Positioning System
=ESS.NSS.H01.BIFRO.A02.AS01	Sample Environment Equipment	Sample Environment System

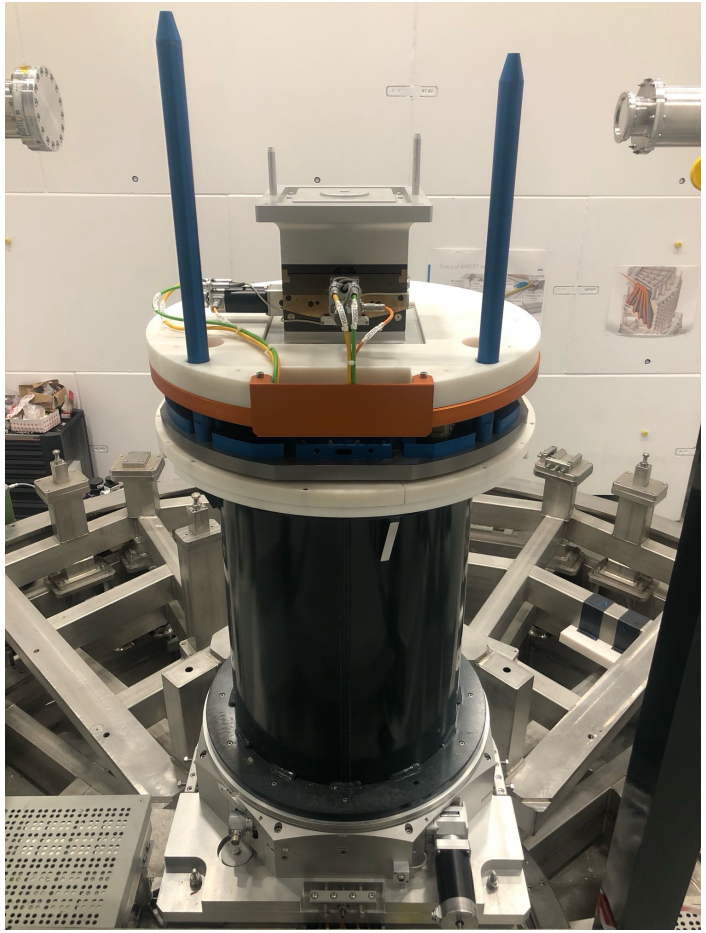


Sample Exposure System

Sample Positioning BIFRO.A02.W01

System name	FBS	EPL	FAT	SAT
Rotational Sample Stack	BIFRO.A02.W01.W02	ESS-3820316	ESS-5580637	ESS-5702798
2-Circle Goniometer	BIFRO.A02.W01.W01	ESS-3820316	N/A	ESS-5702798

- Rotational Sample Stack sits beneath sample position
  - Rotation stage with conventional ESS motion components
  - Spacer tube with alignable SE interface plate
  - Missing drum shielding
- 2-Circle Goniometer sits on removable SE plate
  - Conventional motion components
  - Gearbox added
  - KIPP inserts to allow quick installation
  - Provides interface for Orange Cryostat

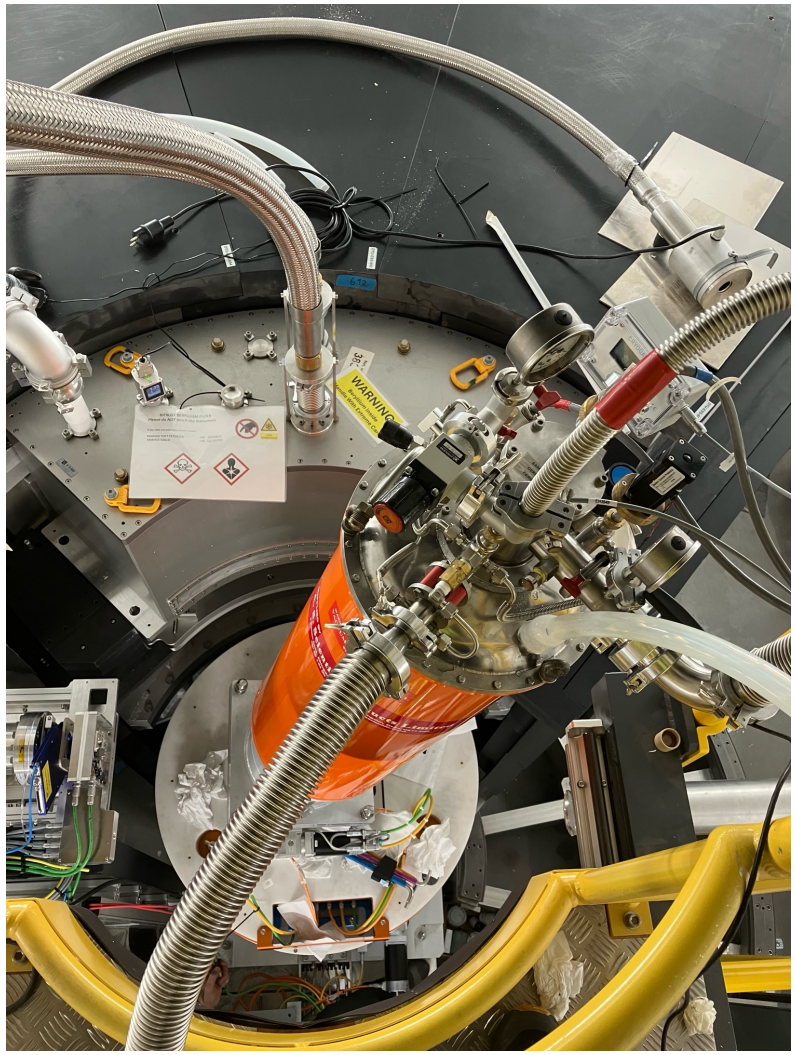


Sample Exposure System

Sample Environment Equipment BIFRO.A02.AS01

System name	FBS	EPL	FAT	SAT
Orange Cryostat	BIFRO.A02.AS01.EQ01	ESS-3820316	ESS-5592070:	ESS-4217032

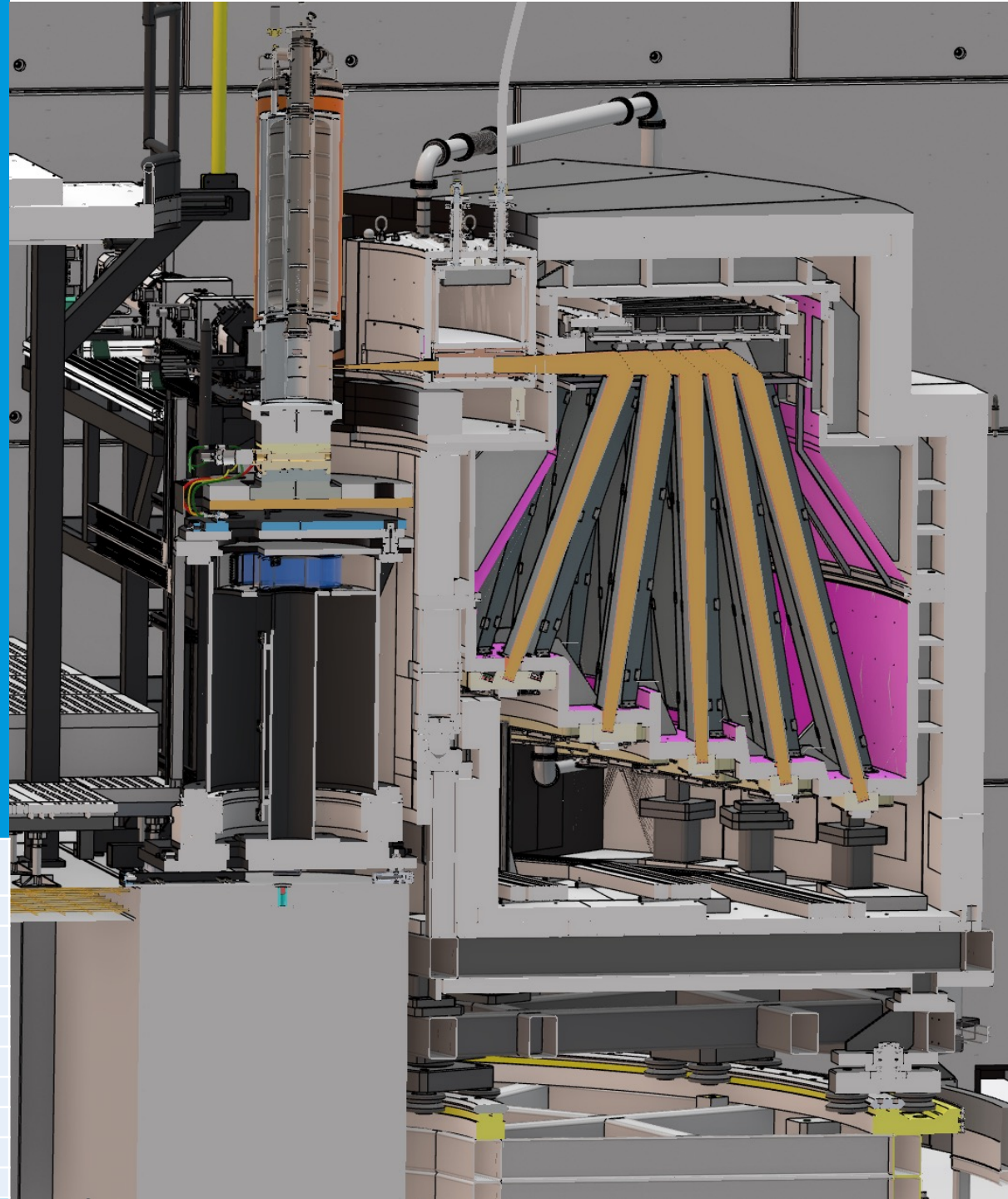
- Orange Cryostat procured from licensed supplier
- Cools samples down to 1.5K with cryogens
- 70mm VTI
- Secured with RH bolts
- Procurement of hardware is instrument scope
- Integration part of SE scope



ESS.NSS.H01.BIFRO.B01

Scattering Characterization System

Tag	Description	Classification
=ESS.NSS.H01.BIFRO.B01	Scattering Characterization System	Neutron Detector System
=ESS.NSS.H01.BIFRO.B01.C01	Neutron Detector Electronics	Data Acquisition System
=ESS.NSS.H01.BIFRO.B01.F02	Background Shielding	Shielding System
=ESS.NSS.H01.BIFRO.B01.W01	Detector Tank Motion Carriage	Positioning System
=ESS.NSS.H01.BIFRO.B01.B01	Neutron Detector System	Detector System
=ESS.NSS.H01.BIFRO.B01.V01	Beryllium Filter System	Neutron Filter
=ESS.NSS.H01.BIFRO.B01.C02	Detector Vacuum Tank	Tank
=ESS.NSS.H01.BIFRO.B01.B02	Neutron Analysers	Neutron Analyser System
=ESS.NSS.H01.BIFRO.B01.U01	Tank Support	Mechanical Support
=ESS.NSS.H01.BIFRO.B01.F01	Cross Talk Shielding	Shielding System



Scattering Characterization System

- Detector Vacuum Tank BIFRO.B01.C02
- Tank Support BIFRO.B01.U01
- Detector Tank Motion Carriage BIFRO.B01.F02

System name	FBS	EPL	FAT	SAT
Detector Vacuum Tank	BIFRO.B01.C02	ESS-4003132	ESS-5580768	ESS-5581181
Detector Tank Motion Carriage	BIFRO.B01.W01	ESS-4979990	ESS-5580768	ESS-5581181
Tank Support	BIFRO.B01.U01	ESS-4000642	ESS-5580768	ESS-5581181

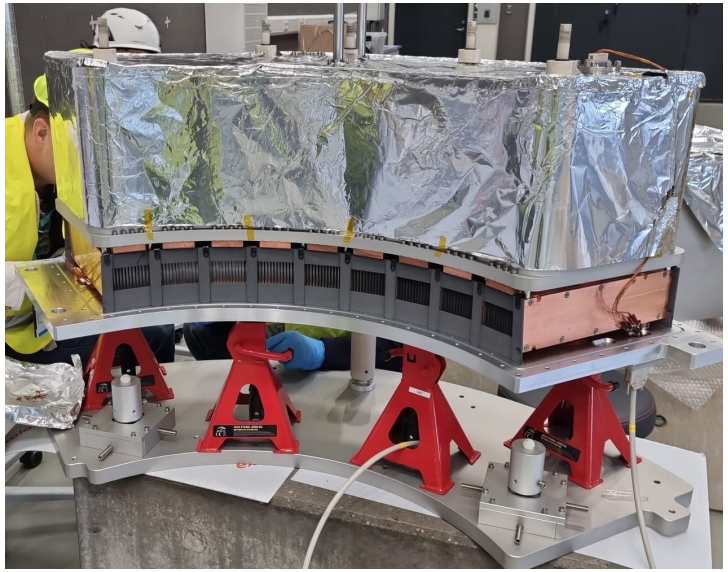
- Procured as one integrated package
- Aluminium vacuum vessel with multiple interface points
- Stainless steel support and alignment system beneath
- Rotational motion system mounted upon E01 floor
  - Conventional ESS motion components
  - Steel curved rail with chain rack and pinion
  - Limit switch as input to prevent clashes with Get Lost Tube

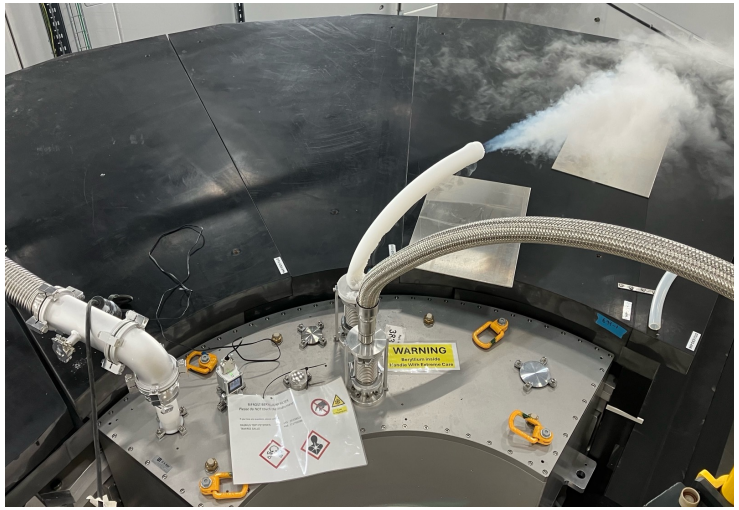
Scattering Characterization System

Beryllium Filter System BIFRO.B01.V01

System name	FBS	EPL	FAT	SAT
Beryllium Filter System	BIFRO.B01.V01	ESS-4983487	ESS-5580770	ESS-5775125

- Beryllium wedges with absorbing borated glass lamellas to make up one unit
- Each unit contained within a copper housing
- 9 units thermally coupled to a liquid nitrogen tank
- Liquid nitrogen tank sits within an insulating vacuum jacket





Scattering Characterization System

Neutron Analysers BIFRO.B01.B02

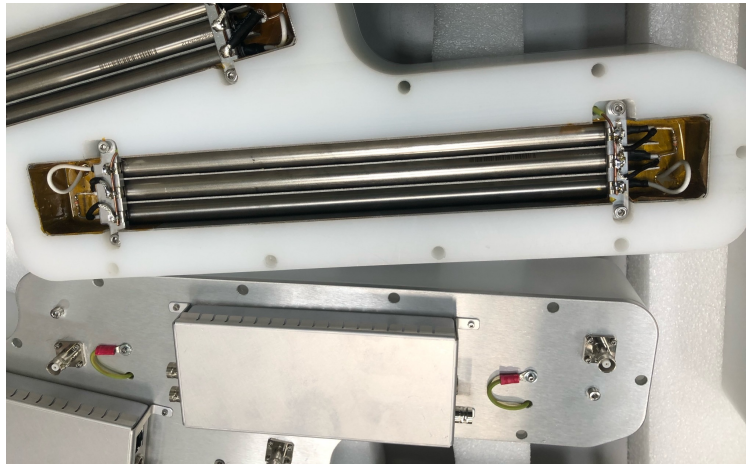
System name	FBS	EPL	FAT	SAT
Neutron Analysers	BIFRO.B01.B02	ESS-4159660	ESS-5580769	ESS-5761865

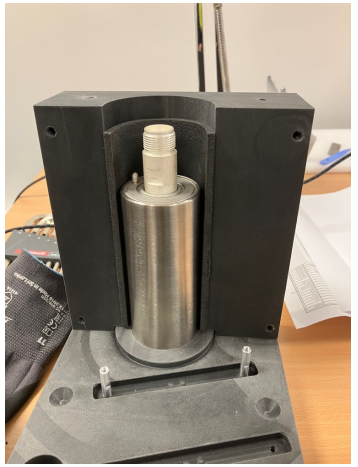
- Pyrolytic graphite (PG) crystals mounted on silicon wafers
- Silicon assemblies mounted onto aluminium holders
- 5 holders selecting differing energies in each channel
- Nine angular channels in total on analyser plate
- Analyser plate aligned within tank and re-checked upon tank install

Scattering Characterization System

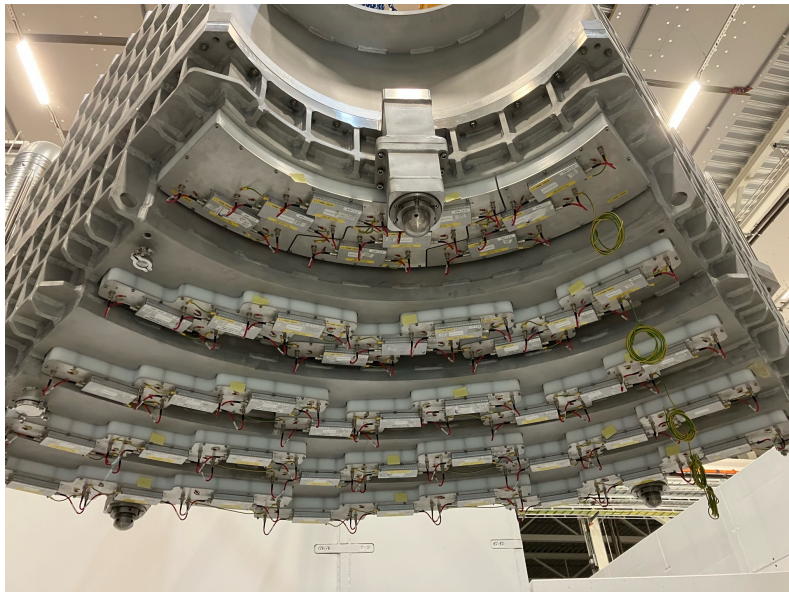
Neutron Detector System BIFRO.B01.B01

System name	FBS	EPL	FAT	SAT
Neutron Detector Bank 1	BIFRO.B01.B01.B01	ESS-5587956	ESS-5201462	ESS-5592068
Neutron Detector Bank 2	BIFRO.B01.B01.B02	ESS-5587957	ESS-5201462	ESS-5592068
Neutron Detector Bank 3	BIFRO.B01.B01.B03	ESS-5587958	ESS-5201462	ESS-5592068
Neutron Detector Bank 4	BIFRO.B01.B01.B04	ESS-5587959	ESS-5201462	ESS-5592068
Neutron Detector Bank 5	BIFRO.B01.B01.B05	ESS-5587960	ESS-5201462	ESS-5592068
Bragg Peak Monitor System	BIFRO.B01.B01.B06	ESS-5587961	-	-
Detector PE Busbar	BIFRO.B01.B01.WE01	ESS-5634023	N/A	N/A





- Banks 2-5 are 3x 3He (8Bar) tubes to form a triplet shrouded in cadmium with pre-amplifier behind
  - 3 triplets per removable module formed from borated polyethylene
  - 3 modules per bank (energy)
- Bank 1 is a larger module with 9x triplets
- Bragg Peak Monitor is a standalone 2” 3He tube (1 Bar)
  - Procured with electronics and installed onto the beamline
  - Not yet tested as discussions on-going on how to extract data

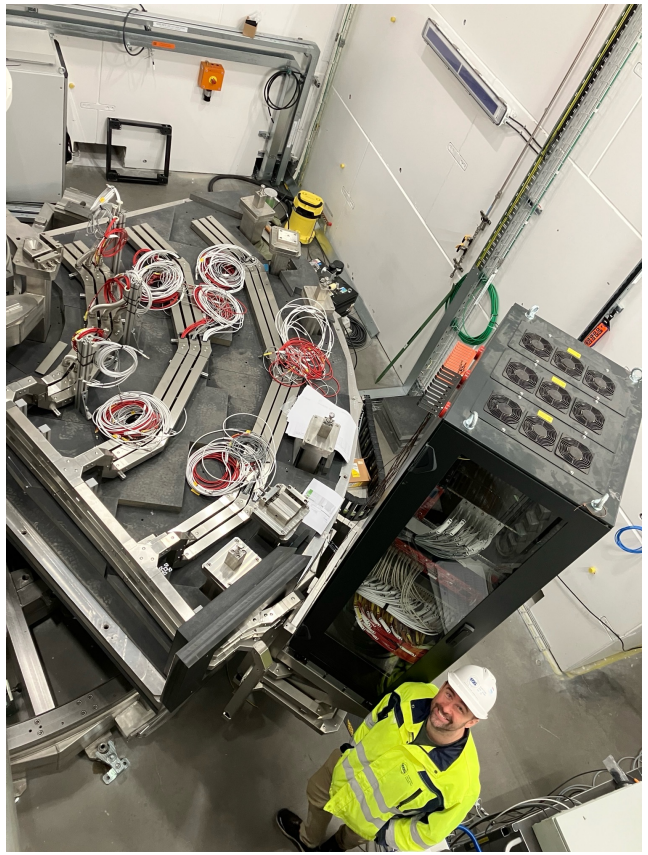


Scattering Characterization System

Neutron Detector Electronics BIFRO.B01.C01

System name	FBS	EPL	FAT	SAT
Neutron Detector Backend Electronics	BIFRO.B01.C01.C01	ESS-5293718	N/A	ESS-5592068
Neutron Detector Frontend Electronics	BIFRO.B01.C01.C02	ESS-5293719	ESS-5201462	ESS-5592068

- Front End Cabinet Contains;
  - HV power supplies and distribution board
  - LV power supplies to pre-amplifiers
  - Collector patch panel
  - Digitizer
  - Network switches
- Backend Cabinet Cabinet Contains;
  - UPS
  - Readout Master Module
  - Network Switches

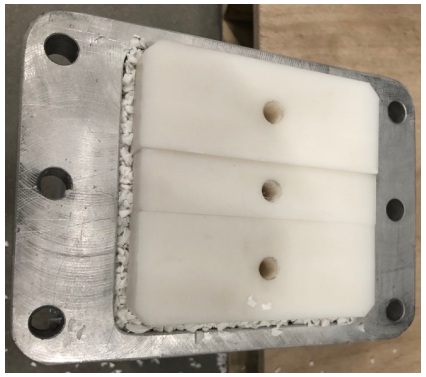


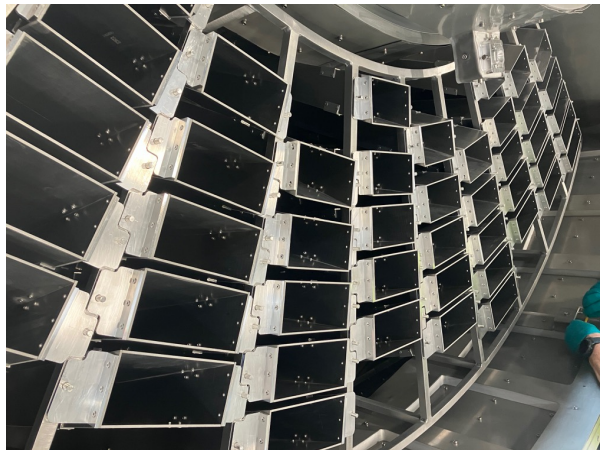
Scattering Characterization System

- Background Shielding BIFRO.B01.F02
- Cross Talk Shielding BIFRO.B01.F01

System name	FBS	EPL	FAT	SAT
Background Shielding	BIFRO.B01.F02	ESS-4159659	N/A	N/A
Cross Talk Shielding	BIFRO.B01.F01	ESS-5634024	ESS-5815701	N/A

- Background shielding consists of cadmium lining around the inside of the vacuum vessel
  - Borated Polyethylene lining around the outside of the tank. Small pieces missing.
  - Pulverised polyethylene and polyethylene sandbags in weak spots
- Crosstalk shielding constructed from borated aluminium sheets 3mm thick (25% vol.B4C)
  - 45 cones created restricting travel path to specific detectors and analysers mounted via frame





ESS.NSS.H01.BIFRO.U01

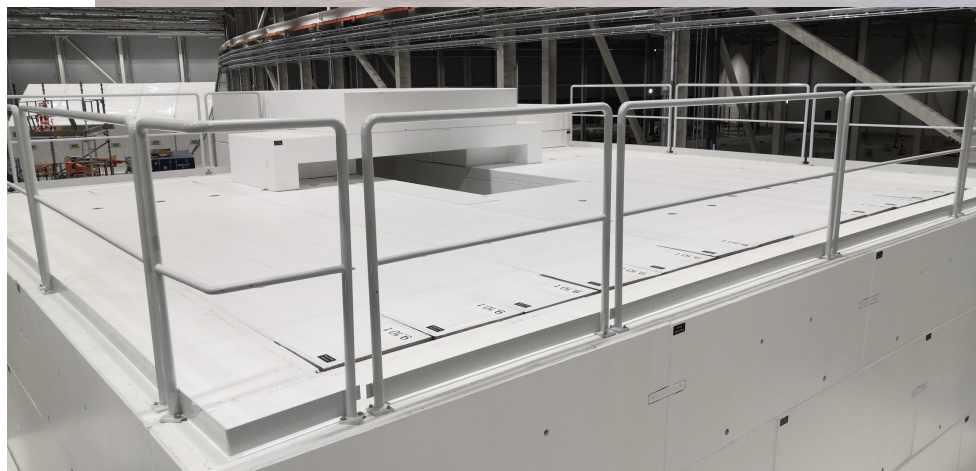
Experimental Cave

Tag	Description	Classification
=ESS.NSS.H01.BIFRO.U01	Experimental Cave	Structural System
=ESS.NSS.H01.BIFRO.U01.U01	Cave Structure	Structural System
=ESS.NSS.H01.BIFRO.U01.F01	Shielding on Cave	Shielding System
=ESS.NSS.H01.BIFRO.U01.A02	Roof Hatch	Shielding Door
=ESS.NSS.H01.BIFRO.U01.WS01	Access platform (movable)	Platform
=ESS.NSS.H01.BIFRO.U01.A01	Ground Sliding Door	Shielding Door
=ESS.NSS.H01.BIFRO.U01.A03	Elevated Sliding Door	Shielding Door

Experimental Cave

- Shielding on Cave BIFRO.U01.F01
- Cave Structure BIFRO.U01.U01

System name	FBS	EPL	FAT	SAT
Shielding on Cave	BIFRO.U01.F01	ESS-4019996	ESS-5580772	ESS-5774902
Cave Structure	BIFRO.U01.U01	ESS-4972511	N/A	ESS-5774902

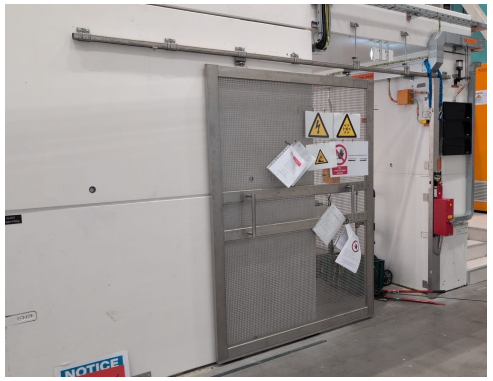


- Cave walls blocks are pre-assembled concrete containers
  - Concrete then cast within walls in-situ. No gaps
  - Pre cast panels have glass fibre re-enforcement
  - Internal structure stainless or steel depending on position
- Two personnel access points. One equipment access point
- Roof beams contain stainless steel re-enforcement
- Concrete beam stop on rear face with protrusion
- Concrete and lead used to cover service inlets – 3 incomplete
- All stairs and walkways are aluminium constructions
- False floors are aluminium inside, steel/tile outside the cave

Experimental Cave

- Ground Sliding Door BIFRO.U01.A01
- Elevated Sliding Door BIFRO.U01.A03
- Access Platform BIFRO.U01.WS01

System name	FBS	EPL	FAT	SAT
Ground Sliding Door	BIFRO.U01.A01	ESS-4019997	N/A	ESS-5774902
Elevated Sliding Door	BIFRO.U01.A03	ESS-5426764	N/A	ESS-5774902
Access Platform	BIFRO.U01.WS01	ESS-4019997	N/A	ESS-5774902



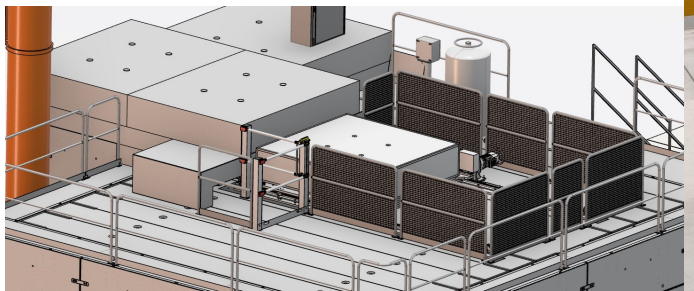
- Both access doors are manually operated with a door sitting on rails
- Doors provide no radiation shielding, only access control
- PSS positioning switches integrated into both
  - Tongue for PSS lock is being amended before re-integration
- Access Platform provides access to the top of sample environment
- Stainless steel and copper sheets
  - Provide shielding from both radiological and activated sources
- Ability to manually translate copper sheets towards sample environment

Experimental Cave

Roof Hatch BIFRO.U01.A02

System name	FBS	EPL	FAT	SAT
Roof Hatch	BIFRO.U01.A02	ESS-4019998	ESS-5580771	ESS-5774902

- Shielding, mechanism and control system procured as one package
- Allows craning of equipment onto the sample position
- Stainless steel (with MirrorBor lining) and concrete provide shielding
- Mounted onto carriages that run on linear rail
- Asynchronous motor drives standards rack and pinion application
- Control stand allows for full visibility of motion
- Dead man switch operation and emergency stop present
- Currently lacking full handrail coverage



ESS.NSS.H01.BIFRO.K01

Instrument Automation Control System

Tag	Description	Classification
=ESS.NSS.H01.BIFRO.K01	Instrument Automation Control System	Control System
=ESS.NSS.H01.BIFRO.K01.K03	BIFROST Motion Control 3 (Collimation+Sample+Detector)	Motion Control System
=ESS.NSS.H01.BIFRO.K01.K02	BIFROST Motion Control 2 (Attenuator + Sample-Slits)	Motion Control System
=ESS.NSS.H01.BIFRO.K01.K01	BIFROST Motion Control 1 (Shutter)	Motion Control System

Instrument Automation Control System

Instrument Automation Control System BIFRO.K01

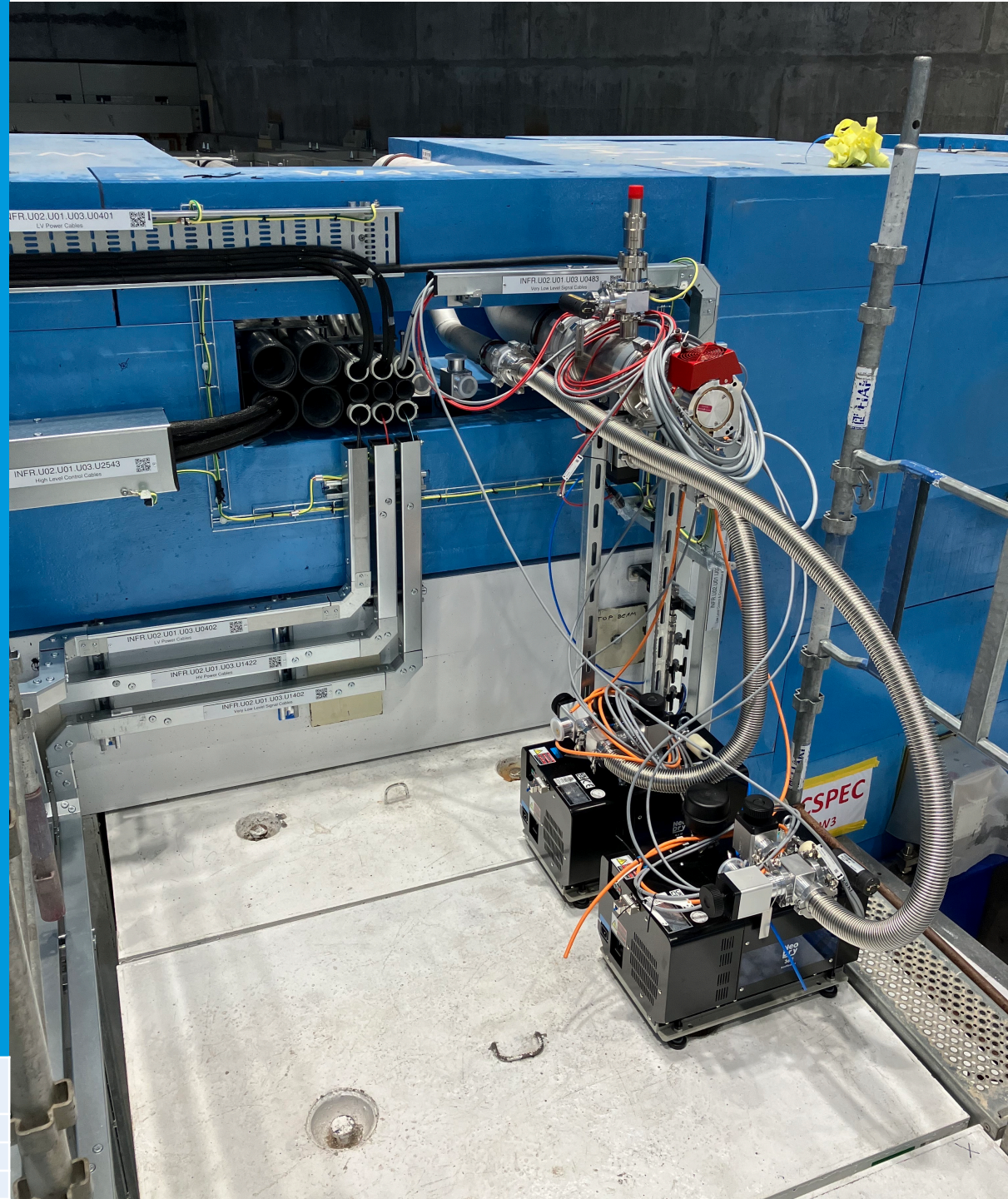
System name	FBS	EPL	FAT	SAT
BIFROST Motion Control 1 (Shutter)	BIFRO.K01.K01	ESS-4913372	ESS-5461184	ESS-5694447
BIFROST Motion Control 2 (Attenuator + Sample-Slits)	BIFRO.K01.K02	ESS-4969702	ESS-4813462	ESS-5770642
BIFROST Motion Control 3 (Collimation+Sample+Detector)	BIFRO.K01.K03	ESS-5105201	ESS-5293536	ESS-5702798

- Control System 1 – D03
  - 1 control cabinet, 1 pneumatic box and 1 operator panel
  - 1 pneumatic field device (Instrument Shutter)
- Control System 2 – E01
  - 1 control cabinet, 1 pneumatic box, 1 EtherCat box and 2 sensor modules
  - 3 pneumatic field devices (Attenuators), 4 piezo field devices and 5 potentiometers (Sample Jaws)
- Control System 3 – E01
  - 1 control cabinet and 1 pneumatic box
  - 1 pneumatic device (Get Lost Tube) and 1 limit switch indication (Sample Platform)
  - 10 conventional axes (Tank Rotation, Sample Rotation, Goniometers and Divergence Slits)

ESS.NSS.H01.BIFRO.G01

Bifrost Vacuum System

Tag	Description	Classification
=ESS.NSS.H01.BIFRO.G01	BIFROST Vacuum System	Vacuum System
=ESS.NSS.H01.BIFRO.G01.G01	BIFROST Vacuum System Bunker Zone	Vacuum System
=ESS.NSS.H01.BIFRO.G01.G02	BIFROST Vacuum System Instrument Zone	Vacuum System

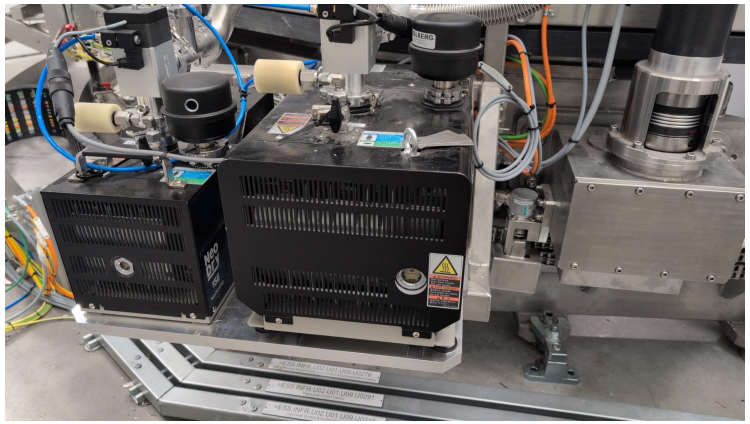


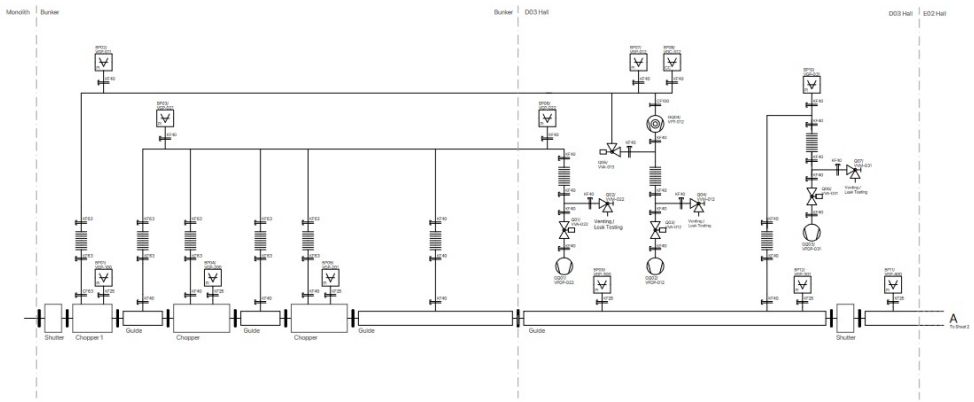
Instrument Automation Control System

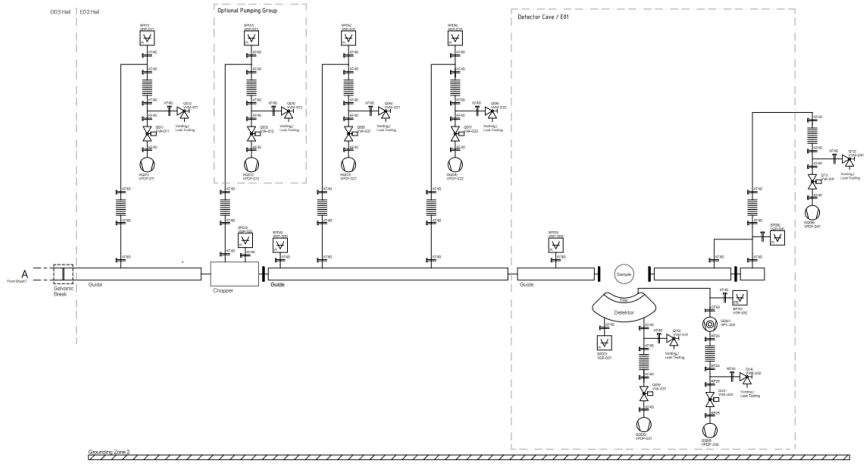
Bifrost Vacuum System BIFRO.G01

System name	FBS	EPL	FAT	SAT
BIFROST Vacuum System Bunker Zone	BIFRO.G01.G01	ESS-4049809	N/A	ESS-5628976
BIFROST Vacuum System Instrument Zone	BIFRO.G01.G02	ESS-4074329	N/A	ESS-5628976

- One control cabinet for each grounding zone
- Most vacuum sections are rough vacuum (0.1mBar)
- Two critical areas
  - PSC chopper inside bunker
  - Beryllium filter jacket in cave
- All gauges can be read and all valves controlled (exc. 1)

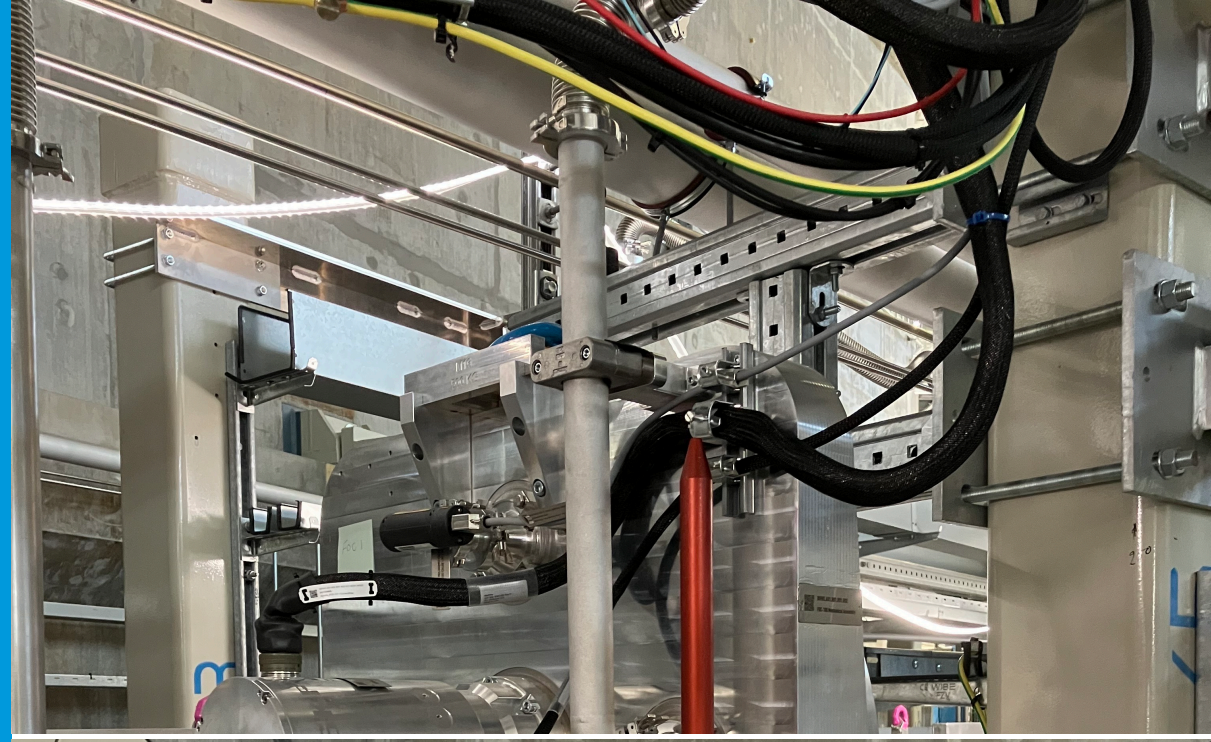






ESS.NSS.H01.BIFRO.A05

Supply System



Tag	Description	Classification
=ESS.NSS.H01.BIFRO.A05	Supply System (BIFROST)	Infrastructure System
=ESS.NSS.H01.BIFRO.A05.Q01	Gas Supply Systems	Gas Management System
=ESS.NSS.H01.BIFRO.A05.K01	Timing system	Timing System
=ESS.NSS.H01.BIFRO.A05.W01	Electrical Power & Grounding	Electrical Power Distribution System
=ESS.NSS.H01.BIFRO.A05.W02	Process Utilities	Piping System

Supply System

- Gas Supply Systems BIFRO.A05.Q01
- Process Utilities BIFRO.A05.W02

System name	FBS	EPL	FAT	SAT
Gas Supply Systems	BIFRO.A05.Q01	N/A	-	-
Process Utilities	BIFRO.A05.W02	N/A	ESS-5660574	ESS-5355623

- Cooling water system supplied for Bunker Chopper
- Compressed air supplied for;
  - Pneumatic motion devices
  - Vacuum valves
- Gas supply pipework supplied for BM2, BM3 and BM4
- Gas handling, ventilation and He recovery lines supplied to the Cave Roof

Supply System

- Electrical Power & Grounding BIFRO.A05.W01
- Timing system BIFRO.A05.K01

System name	FBS	EPL	FAT	SAT
Electrical Power & Grounding	BIFRO.A05.W01	N/A	N/A	ESS-3244602
Timing system	BIFRO.A05.K01	N/A	N/A	ESS-5551568

- 2 Electrical Distribution Boards installed – One in each grounding zone
- Provides power to all technology cabinets, as well as hutch, crane, etc.
- Lights and sockets within cave area energised
- All SAR scope now energised
  - ODH cabinet and REMS remaining
- Grounding bars provided for earthing along beamline and in cave
  - Some interconnections still missing in bunker and cave

ESS.NSS.H01.BIFRO.A04

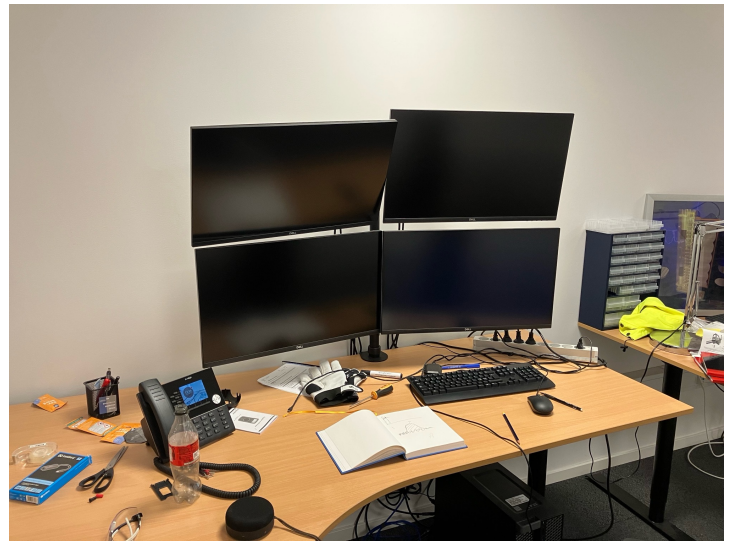
Support Systems

Tag	Description	Classification
=ESS.NSS.H01.BIFRO.A04	Support Systems (BIFROST)	Infrastructure System
=ESS.NSS.H01.BIFRO.A04.F01	Fire protection (SRR)	Fire Fighting System
=ESS.NSS.H01.BIFRO.A04.A02	Permanent Pre-assembly & Maintenance Area	Infrastructure System
=ESS.NSS.H01.BIFRO.A04.P01	Remote Area Serveillance	Video Surveillance System
=ESS.NSS.H01.BIFRO.A04.A01	Control Hutch	Control Hutch
=ESS.NSS.H01.BIFRO.A04.GM01	Local Crane	Crane

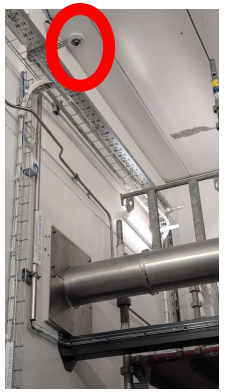
Support Systems

- Control Hutch BIFRO.A04.A01
- Local Crane BIFRO.A04.GM01
- Permanent Pre-assembly & Maintenance Area BIFRO.A04.A02
- Remote Area Surveillance BIFRO.A04.P01

System name	FBS	EPL	FAT	SAT
Control Hutch	BIFRO.A04.A01	ESS-3820228	N/A	ESS-5580670
Local Crane	BIFRO.A04.GM01	ESS-5815465	N/A	ESS-5592071
Permanent Pre-assembly & Maintenance Area	BIFRO.A04.A02	ESS-3820229	N/A	N/A
Remote Area Surveillance	BIFRO.A04.P01	N/A	-	-



- Control hutch built, energised and furnished in E02
- Videoconferencing and DMSC equipment installed
- Local crane installed and 3rd party certified
- Maintenance area built up and stocked in E02 besides control hutch
- 2 webcams positioned in cave – no access to them



3

Deferred Scope

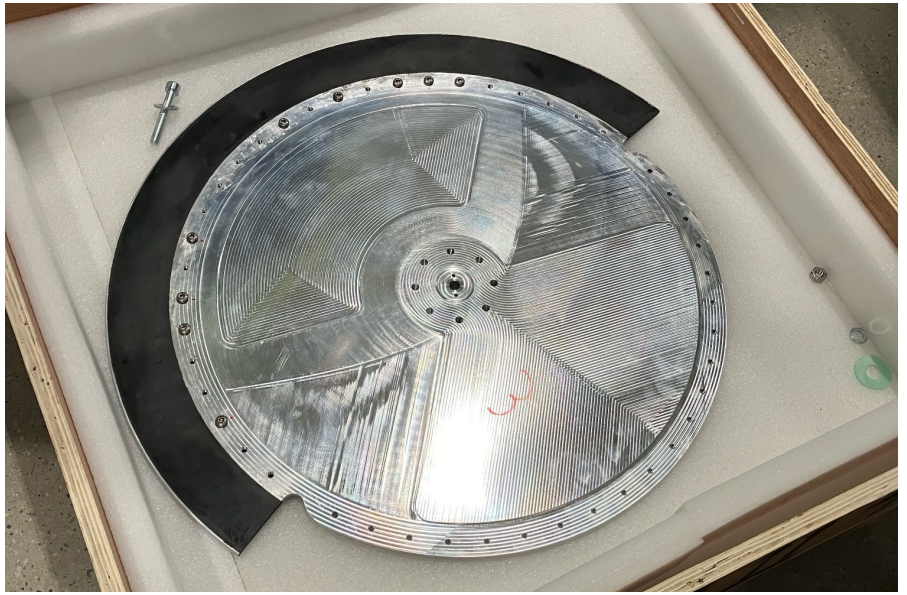
Deferred Scope

Bifrost Deferred Scope - PSC

- Initial scope for the PSC discs were 210Hz
- During the FAT, both discs failed catastrophically
- Decision made in 2023 to proceed to BoT with slower aluminium discs (126Hz)
- System fully integrated, installed and tested with 126Hz discs
- Procurement of new 210Hz discs commenced in 2024
- Discs due for FAT in Q3 and possible delivery in Q4

NSS Change Request for "TG5/SAR scope deferral"

CHANGE DATA			
CR ID	CR0612 NSS SS CR 13.189	**Date created**	2025-07-07
Title of the CR	TG5/SAR Scope Deferral of the BIFROST CFRP chopper discs		
Name of Change Originator :	Niko Tsapatsaris		
Agreed by NSS PM:	☒ YES NAME: Sofie Ossowski		



4

EPL and As-Built Status

Drawing Release Status

EPL & Chess Drawings

Tag	Description	Revision	Comments	
=ESS.NSS.H01.BIFRO	BIFROST	2		
=ESS.NSS.H01.BIFRO.F01	Personnel Safety System (BIFROST PSS)	1		
=ESS.NSS.H01.BIFRO.K02	Data Management & Experiment Control System BIFROST	1		
=ESS.NSS.H01.BIFRO.G01	BIFROST Vacuum System	1	Needs Checking	
=ESS.NSS.H01.BIFRO.G01.G01	BIFROST Vacuum System Bunker Zone	1	Needs Checking	
=ESS.NSS.H01.BIFRO.G01.G02	BIFROST Vacuum System Instrument Zone	1	Needs Checking	
=ESS.NSS.H01.BIFRO.G01.G02.K01	Vacuum Control System Instrument Zone	1	Needs Checking	
=ESS.NSS.H01.BIFRO.G01.G02.UH01	BIFROST Vacuum Control Rack Instrument Zone	1	Needs Checking	
=ESS.NSS.H01.BIFRO.A01	Beam Transport and Conditioning (BIFROST)	2	New Revision	
=ESS.NSS.H01.BIFRO.A01.R02	Beam Geometry Conditioning	1	As Built - P	
=ESS.NSS.H01.BIFRO.A01.W02	Beam Extraction System	1	As Built - P	
=ESS.NSS.H01.BIFRO.A01.R03	Beam Cut off	1	New Revision	
=ESS.NSS.H01.BIFRO.A01.R03.R01	1.5.1 Thermal shutter	2	As Built - P	
=ESS.NSS.H01.BIFRO.A01.R03.R04	1.5.4 Attenuators	2	As Built - P	
=ESS.NSS.H01.BIFRO.A01.R03.R02	1.5.3 Beam-stop	2	As Built - P	
=ESS.NSS.H01.BIFRO.A01.R03.WP01	1.5.2 Get lost Tube	2	New Revision	+ Chess drawings
=ESS.NSS.H01.BIFRO.A01.B01	Beam Validation	1	As Built - P	
=ESS.NSS.H01.BIFRO.A01.R01	Neutron Chopper System	2	As Built - P	
=ESS.NSS.H01.BIFRO.A01.F01	Shielding	2	Awaiting installation b4 as built	
=ESS.NSS.H01.BIFRO.A01.W01	Beam delivery system	2	As Built - P	
=ESS.NSS.H01.BIFRO.A04	Support Systems (BIFROST)	2	Needs Checking	
=ESS.NSS.H01.BIFRO.A04.A02	permanent pre-assembly and maintenance area	1	Needs Checking	
=ESS.NSS.H01.BIFRO.A04.P01	Remote Area Serveillance	2	Needs Checking	
=ESS.NSS.H01.BIFRO.A04.A01	Control Hutch	2	As Built - P	
=ESS.NSS.H01.BIFRO.A04.GM01	Local Crane	2	As Built - P	

Drawing Release Status

EPL & Chess Drawings

Tag	Description	Revision	Comments	
=ESS.NSS.H01.BIFRO.B01	Scattering Characterization System	2	New Revision	
=ESS.NSS.H01.BIFRO.B01.C01	Neutron Detector Electronics	1	As Built - P	
=ESS.NSS.H01.BIFRO.B01.C01.C01	Neutron Detector Backend Electronics	1	As Built - P	
=ESS.NSS.H01.BIFRO.B01.C01.C02	Neutron Detector Frontend Electronics	1	As Built - P	
=ESS.NSS.H01.BIFRO.B01.F02	Background Shielding	1	Awaiting installation b4 as built	Needs poly
=ESS.NSS.H01.BIFRO.B01.W01	Detector Tank Motion Carriage	2	Awaiting installation b4 as built	Needs hard stop
=ESS.NSS.H01.BIFRO.B01.W01.X01	Detector Tank Motion Connection Panel	1	Needs Checking	
=ESS.NSS.H01.BIFRO.B01.B01	Neutron Detector System	2	New Revision	
=ESS.NSS.H01.BIFRO.B01.B01.B04	Neutron Detector Bank 4	1	New Revision	Peek screws
=ESS.NSS.H01.BIFRO.B01.B01.B01	Neutron Detector Bank 1	1	New Revision	Peek screws
=ESS.NSS.H01.BIFRO.B01.B01.B02	Neutron Detector Bank 2	1	New Revision	Peek screws
=ESS.NSS.H01.BIFRO.B01.B01.WE01	Detector PE Busbar	1	Needs Checking	
=ESS.NSS.H01.BIFRO.B01.B01.B05	Neutron Detector Bank 5	1	New Revision	Peek screws
=ESS.NSS.H01.BIFRO.B01.B01.B03	Neutron Detector Bank 3	1	New Revision	Peek screws
=ESS.NSS.H01.BIFRO.B01.B01.B06	Bragg Peak Monitor System	1	Awaiting installation b4 as built	Poly
=ESS.NSS.H01.BIFRO.B01.V01	Beryllium Filter System	2	Awaiting installation b4 as built	Poly & Feedthrough
=ESS.NSS.H01.BIFRO.B01.V01.V01	Beryllium Filter + Collimator	1	Awaiting installation b4 as built	Poly & Feedthrough
=ESS.NSS.H01.BIFRO.B01.V01.C01	Temp-Acquisition System	1	Needs Checking	
=ESS.NSS.H01.BIFRO.B01.C02	Detector Vacuum Tank	2	As Built - P	
=ESS.NSS.H01.BIFRO.B01.B02	Neutron Analysers	2	As Built - P	
=ESS.NSS.H01.BIFRO.B01.U01	Tank Support	2	Needs Checking	Isolation details in there?
=ESS.NSS.H01.BIFRO.B01.F01	Cross Talk Shielding	2	As Built - P	

Drawing Release Status

EPL & Chess Drawings

Tag	Description	Revision	Comments	
=ESS.NSS.H01.BIFRO.K01	Instrument Automation Control System	2	Awaiting installation b4 as built	
=ESS.NSS.H01.BIFRO.K01.K03	BIFROST Motion Control 3 (Collimation+Sample+Detector)	1	Awaiting installation b4 as built	
=ESS.NSS.H01.BIFRO.K01.K02	BIFROST Motion Control 2 (Attenuator + Sample-Slits)	1	As Built - P	
=ESS.NSS.H01.BIFRO.K01.K01	BIFROST Motion Control 1 (Shutter)	1	As Built - P	
=ESS.NSS.H01.BIFRO.A02	Sample Exposure System (BIFROST)	2	New Revision	Plant item collaboration
=ESS.NSS.H01.BIFRO.A02.W01	Sample Positioning	2	New Revision	
=ESS.NSS.H01.BIFRO.A02.W01.W02	Rotational Sample Stack	1	New Revision	Drums + CHESS
=ESS.NSS.H01.BIFRO.A02.W01.W01	2-circle Goniometer	1	New Revision	New motors
=ESS.NSS.H01.BIFRO.A02.AS01	Sample Environment Equipment	2	Needs Checking	
=ESS.NSS.H01.BIFRO.A02.AS01.EQ01	Orange Cryostat	1	Needs Checking	
=ESS.NSS.H01.BIFRO.U01	Experimental Cave	2	New Revision	
=ESS.NSS.H01.BIFRO.U01.U01	Cave Structure	1	As Built - P	
=ESS.NSS.H01.BIFRO.U01.F01	Shielding on Cave	1	Awaiting installation b4 as built	Poly lining?? Wider Lead
=ESS.NSS.H01.BIFRO.U01.A02	Roof Hatch	2	Awaiting installation b4 as built	
=ESS.NSS.H01.BIFRO.U01.WS01	Access platform (movable)	2	As Built - P	
=ESS.NSS.H01.BIFRO.U01.A01	Ground Sliding Door	2	As Built - P	
=ESS.NSS.H01.BIFRO.U01.A03	Elevated Sliding Door	2	As Built - P	

5

Summary

Summary

Status at SAR

- All major systems tested and no showstoppers encountered
  - Further development of monitor and detector system required
  - Further testing of Beryllium Filter required
- Small sections of shielding still to install
  - E02 shielding block being installed today and service cover work continues next week
  - Background shielding blocks arrive throughout September
- Little technical risk due to rigorous testing. Detector ground is the highest risk
- Further aspects to get through SRR and beyond
  - PSS, REMS and fire suppression systems installations and tests
  - Motion Safety implementation
  - Sample Environment integration
- Instrument team confident that the design and implementation will deliver a leading instrument