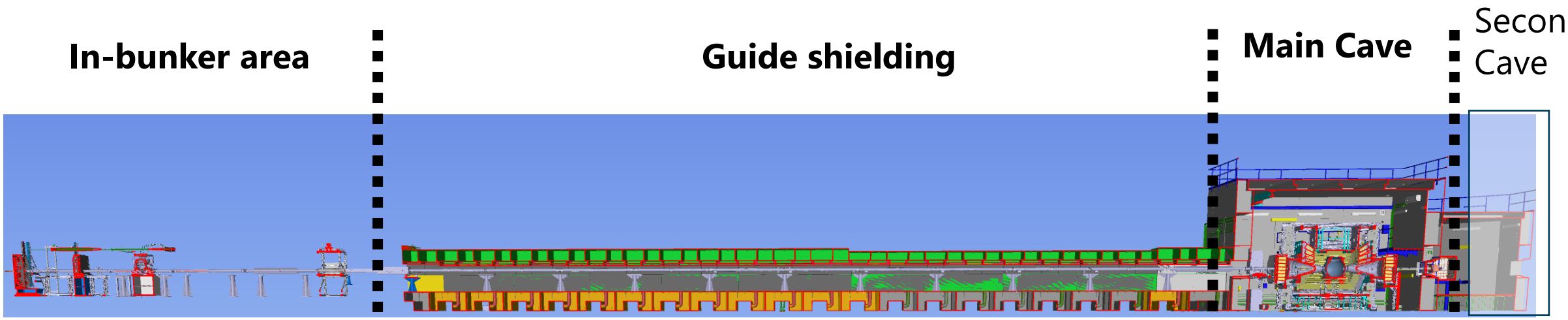
Instrument Safety Readiness Review

DREAM: Overview of Radiation Safety Assesment

DREAM team

Overview of DREAM beamline



Light shutter/NBOA
PSC-OC-BC choppers
T0 chopper
Heavy shutter

Straight, elliptic guide
Shielding

Collimation
Guide/Polarizer
Sample
Shielding

Beamstop

BIOLOGICAL SHIELDING COMPONENTS: Heavy shutter, Neutron guide shielding, Walls/roofs of the cave, beam stop
NEUTRON BEAM MODES: Chopper system, Collimation (boron nose)

FBS nodes

FBS Tag	Description	Classification
ESS.NSS.H01.DREAM.A01	**Beam Transport and Conditioning**	**Infrastructure System**
ESS.NSS.H01.DREAM.A01.F01	Neutron Guide Shielding	Shielding System
ESS.NSS.H01.DREAM.A01.R01	Chopper System	Chopper System
ESS.NSS.H01.DREAM.A01.R02	Beam Geometry Conditioning	Beam Geometry Conditioning System
ESS.NSS.H01.DREAM.A01.R02.R01	Collimation System	Beam Collimation System
ESS.NSS.H01.DREAM.A01.W01	Beam Delivery System	Beam Transport System
ESS.NSS.H01.DREAM.A01.W01.W01	Beam Delivery in Bunker	Beam Transport System
ESS.NSS.H01.DREAM.A01.W01.W02	Beam Delivery outside Bunker	Beam Transport System
ESS.NSS.H01.DREAM.A01.R03	Beam Cut off	Beam Cut Off System
ESS.NSS.H01.DREAM.A01.R03.R01	Instrument Safety Shutter	Neutron Shutter
ESS.NSS.H01.DREAM.A01.R03.R02	Beam Stop	Beam Dump
ESS.NSS.H01.DREAM.A01.W02	Beam Extraction System	Beam Transport System
ESS.NSS.H01.DREAM.A01.W02.WH01	NBOA - Neutron Beam Optics Assembly	Neutron Guide System
ESS.NSS.H01.DREAM.A01.W02.WH02	BBG- Bridge Beam Guide	Neutron Guide System
ESS.NSS.H01.DREAM.A02	**Sample Exposure System**	**Infrastructure System**
ESS.NSS.H01.DREAM.A02.W01	Sample Positioning	Positioning System
ESS.NSS.H01.DREAM.A02.C01	Sample Vessel	Vacuum Vessel
ESS.NSS.H01.DREAM.B01	**Scattering Characterization System**	**Neutron Detector System**
ESS.NSS.H01.DREAM.U01	**Experimental Cave**	**Structural System**
ESS.NSS.H01.DREAM.U01.F01	Cave Shielding	Shielding System

BIOLOGICAL SHIELDING COMPONENTS: Heavy shutter, Neutron guide shielding, Walls/roofs of the cave, beam stop
NEUTRON BEAM MODES: Chopper system, Collimation (boron nose)

Overview of documentation

Document	CHESS number – Type	Status
Shielding report	ESS-0454189 DREAM - Radiation Safety Report	CHESS RELEASED REV 2
Inventory/inventories (integrated to the shielding reports)	Covered as part of SDDs.	
H1/H2 document	ESS-3486225 DREAM: H1 and H2 scenarios for radiation shielding	CHESS RELEASED REV 1
Comprehensive Radiation safety report	ESS-5974655 Comprehensive radiation safety assessment of DREAM	CHESS RELEASED REV 1
Activation Analysis	Covered in ESS-0454189 DREAM - Radiation Safety Report	CHESS RELEASED REV 2
Shielding verification report	ESS-6017800 DREAM - Shielding Verification Report	CHESS RELEASED REV 1

Design criteria & Documentation

DREAM H1/H2 scenarios

Table 1. List of H1 scenarios for DREAM

#	Cause	Event	Effect
H1.1	Unspecified bulky sample environment	MOB hit on a bulky aluminium piece of sample environment	Aluminium prompt gamma generated at the sample position
H1.2	Empty sample	MOB dumped onto the beam stop	Prompt gammas generated at the beam stop and fast neutrons scattered back into the experimental cave
H1.3	Strong neutron scattered sample	Less than 10% of MOB isotropically scattered from the sample	High activation at the inner surface of the walls of experimental cave
H1.4	Neutron guide	MOB propagating in the last focusing section	Hard gammas generated from the beam guide coating and substrate

Table 2. List of H2 scenarios for DREAM

#	Cause	Event	Effect
H2.1	All choppers parked in open position	AOB dumped onto the heavy shutter	The radiation dose rate downstream beam to the heavy shutter is less than 3 mSv/h
H2.2	All choppers and heavy shutter parked in open position	AOB transported along the entire guide	Hard gammas generated along the entire guide, highest current of fast neutrons streaming outside the bunker area, highest prompt- gammas generated at the beam stop and largest amount of fast neutrons scattered back into the experimental cave
H2.3	Cadmium sheet at the sample position	The entire MOB neutrons converted into photons at the sample position	Highest radiation dose rate generated at the sample position

DREAM: H1 AND H2 SCENARIOS FOR RADIATION SHIELDING

	Name	Role/Title
Owner	Tsitohaina Randriamalala Mikhail Feygenson	Shielding Scientist (FZJ) DREAM Instrument Scientist (ESS)
Reviewer	Fredrik Tidholm Valentina Santoro Arno Hiess	Radiation Protection Officer (ESS) Neutron Beam and Shielding Scientist (ESS) Head of Scientific Activities Division (ESS)
Approver	Sigrid Kozielski Günter Muhrer Andrew Jackson	Group Leader for Radiation Protection (ESS) ESS Shield Design Coordinator (ESS) Group Leader for Instrument Scientists (ESS)

DREAM H1/H2 scenarios

H1.3	Strong neutron scattered sample	Less than 10% of MOB isotropically scattered from the sample	High activation at the inner surface of the walls of experimental cave

H2.1	All choppers parked in open position	AOB dumped onto the heavy shutter	The radiation dose rate downstream beam to the heavy shutter is less than 3 mSv/h
H2.2	All choppers and heavy shutter parked in open position	AOB transported along the entire guide	Hard gammas generated along the entire guide, highest current of fast neutrons streaming outside the bunker area, highest prompt- gammas generated at the beam stop and largest amount of fast neutrons scattered back into the experimental cave
H2.3	Cadmium sheet at the sample position	The entire MOB neutrons converted into photons at the sample position	Highest radiation dose rate generated at the sample position

DREAM: H1 AND H2 SCENARIOS FOR RADIATION SHIELDING

	Name	Role/Title
Owner	Tsitohaina Randriamalala Mikhail Feygenson	Shielding Scientist (FZJ) DREAM Instrument Scientist (ESS)
Reviewer	Fredrik Tidholm Valentina Santoro Arno Hiess	Radiation Protection Officer (ESS) Neutron Beam and Shielding Scientist (ESS) Head of Scientific Activities Division (ESS)
Approver	Sigrid Kozielski Günter Muhrer Andrew Jackson	Group Leader for Radiation Protection (ESS) ESS Shield Design Coordinator (ESS) Group Leader for Instrument Scientists (ESS)

Accidental Open Beam (AOB):

- All choppers parked open
- No boron nose

For ESS at 5MW, proton beam energy at 2 GeV

➔ Simulations: 10^{10} n/(cm^2.s) at Heavy shutter

➔ Simulations: $3x10^{10}$ n/s at sample position

Maximum flux Operation Beam (MOB)

Chopper operating with Highest Flux configuration

Boron nose 1.25x1.25 cm2 (widest)

For ESS at 5MW, proton beam energy at 2 GeV

➔ Simulations: $6x10^{9}$ n/s at sample position

DREAM Radiation Safety Report

Regions near or beyond the shielding structure:

- Controlled area. 3 μSv/h < dose limits < 25 μSv/h
- Supervised area: dose limits < 3 μSv/h

DREAM - Radiation Safety Report

Acceptance criteria

C1. For normal operations, classified as supervised area.
Contact dose rate < 3 μSv/h averaged over 20 cm x 20 cm area

C2. For a section of 10 m long on each surface side
Average dose rate < 0.5 μSv/h [5].

	Name	Role/Title
Owner	Mikhail Feygenson	DREAM Lead Scientist
Author	Tsitohaina H. Randriamalala	Shielding Scientist FZJ
Reviewers	Yvonne Hinrichsen	Scientist Radiation Protection ESS
	Alan Takibayev	Scientist Target Division ESS
Approvers	Günter Muhrer	Shield Design Coordinator ESS
	Per Roos	Group Leader for Radiation Protection ESS
	Pascale Dean	Head of Spectroscopy Division ESS

CONCLUSION OF NEUTRONIC CALCULATIONS:
Heavy shutter, Beam guide shielding, Experimental caves and Beam stop designs
FULFIL THE RADIATION DOSE LEVEL REQUIREMENTS FOR ESS.

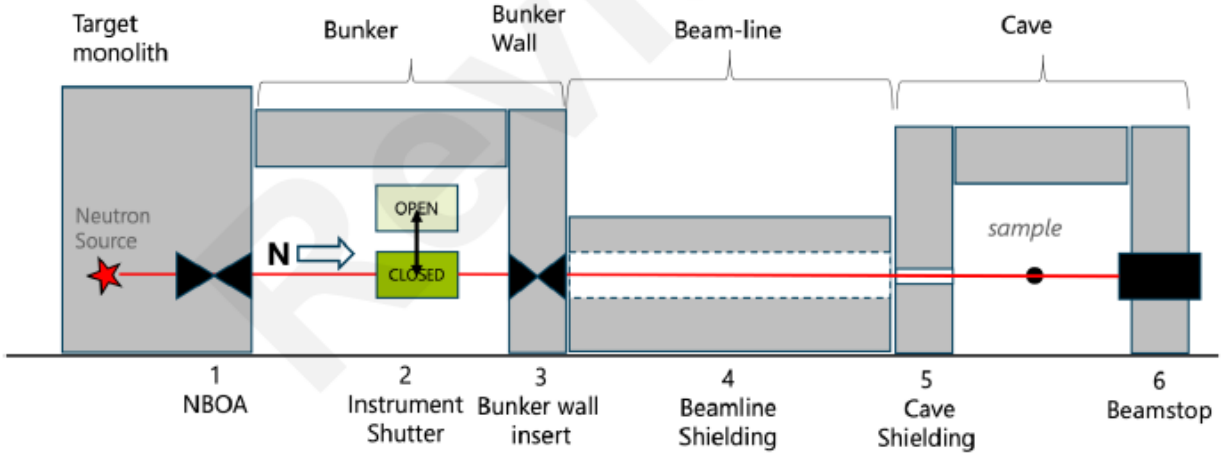
DREAM Shielding verification report

DREAM - SHIELDING VERIFICATION REPORT

	Name	Role/Title
Author	Florence Porcher	DREAM Lead Instrument Scientist
Owner	Anna Fornell	DREAM Operation Engineer
Reviewer	Ana Cintas	Radiation Protection Expert
Approver	Per Roos	Group Leader, Radiation Protection

1.1. Systems concerned

1. ESS.NSS.H01.DREAM.A01.W02.WH01 Neutron Beam Optics Assembly
2. ESS.NSS.H01.DREAM.A01.R03.R01 Heavy shutter
3. ESS.NSS.H01.DREAM.A01.W01.W01.WH02 Bunker wall insert
4. ESS.NSS.H01.DREAM.A01.F01 Neutron Guide shielding
5. ESS.NSS.H01.DREAM.U01.F01 Cave Shielding
6. ESS.NSS.H01.DREAM.A01.R03.R02 Beam dump



	Shielding system	FBS Tag	Calculation Report	Installation Inspection report
No	DREAM		ESS-5974655 Comprehensive Radiation Safety Report [11]	
1	Neutron Guide shielding	ESS.NSS. H01.DREAM.A01.F01	ESS-0454189 DREAM - Radiation Safety Report	ESS-3218932 QC and FAT information on the Guide Shielding blocks for BIFROST, CSPEC, DREAM, ODIN, BEER, NMX, MAGIC [12] ESS-5796751 SAT DREAM Guide Shielding [8]
2	Cave Shielding	ESS.NSS. H01.DREAM.U01.F01	ESS-0454189 DREAM - Radiation Safety Report	ESS-5878375 DREAM - Shielding SAT [9]
3	NBOA	ESS.NSS. H01.DREAM.A01.W02.WH01		ESS-3432645 FAT-documents DREAM NBOA and BBG [13] ESS-5808039 SAT for NBOA Dream [14] ESS-5765758 Local Test Report (SAT) DREAM Beam Extraction System [6]
4	Heavy shutter	ESS.NSS.H01.DREAM.A01.R03.R01	ESS-0454189 DREAM - Radiation Safety Report	ESS-3229916 Factory Acceptance Test DREAM Heavy Shutter [15] ESS-3888900 Site Acceptance Test DREAM Heavy Shutter [16] ESS-3072038 DREAM Heavy Shutter - Material inventory for activation analysis [17] ESS-5849425 DREAM safety shutter local test 1 [18] ESS-5688791 DREAM Safety shutter Local test 2 [10]
5	Bunker wall insert	ESS.NSS.H01.DREAM.A01.W01.W01. WH02	ESS-0454189 DREAM - Radiation Safety Report	ESS-5863788 SAT of DREAM neutron guide in bunker, BWI and out of bunker except in-cave section [7]
6	Beam stop	ESS.NSS.H01.DREAM.A01.R03.R02	ESS-0454189 DREAM - Radiation Safety Report	Included in ESS-5878375 DREAM - Shielding SAT [9] ESS-6015828 Drawings of DREAM beam stop [19] ESS-5990686 DREAM Cave BOM [20]

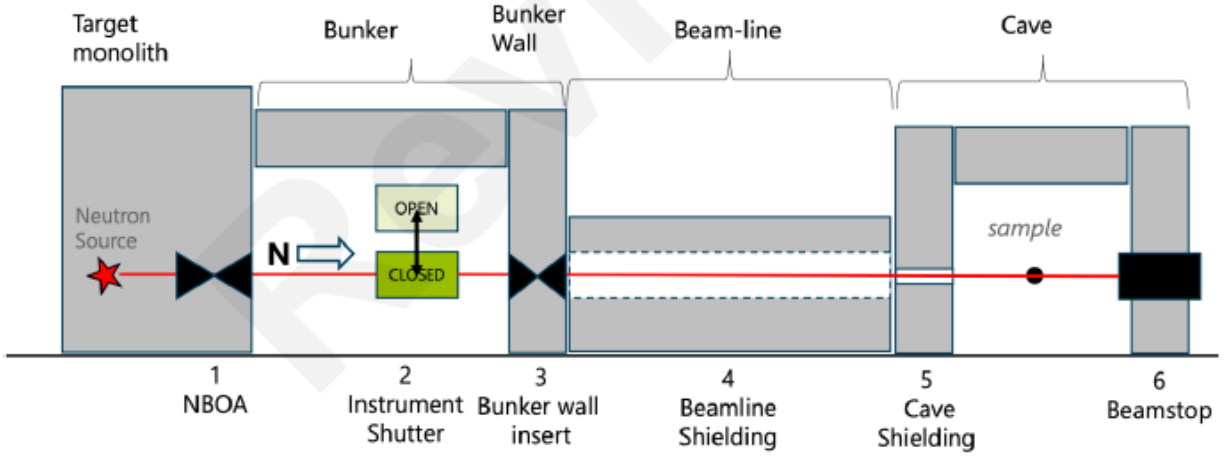
DREAM Shielding verification report

DREAM - SHIELDING VERIFICATION REPORT

	Name	Role/Title
Author	Florence Porcher	DREAM Lead Instrument Scientist
Owner	Anna Fornell	DREAM Operation Engineer
Reviewer	Ana Cintas	Radiation Protection Expert
Approver	Per Roos	Group Leader, Radiation Protection

1.1. Systems concerned

1. ESS.NSS.H01.DREAM.A01.W02.WH01 Neutron Beam Optics Assembly
2. ESS.NSS.H01.DREAM.A01.R03.R01 Heavy shutter
3. ESS.NSS.H01.DREAM.A01.W01.W01.WH02 Bunker wall insert
4. ESS.NSS.H01.DREAM.A01.F01 Neutron Guide shielding
5. ESS.NSS.H01.DREAM.U01.F01 Cave Shielding
6. ESS.NSS.H01.DREAM.A01.R03.R02 Beam dump



	Shielding system	FBS Tag	Calculation Report	Installation Inspection report
5	Bunker wall insert	ESS.NSS.H01.DREAM.A01.W01.W01.WH02	ESS-0454189 DREAM - Radiation Safety Report	ESS-5863788 SAT of DREAM neutron guide in bunker, BWI and out of bunker except in-cave section [7]
6	Beam stop	ESS.NSS.H01.DREAM.A01.R03.R02	ESS-0454189 DREAM - Radiation Safety Report	Included in ESS-5878375 DREAM - Shielding SAT [9] ESS-6015828 Drawings of DREAM beam stop [19] ESS-5990686 DREAM Cave BOM [20]

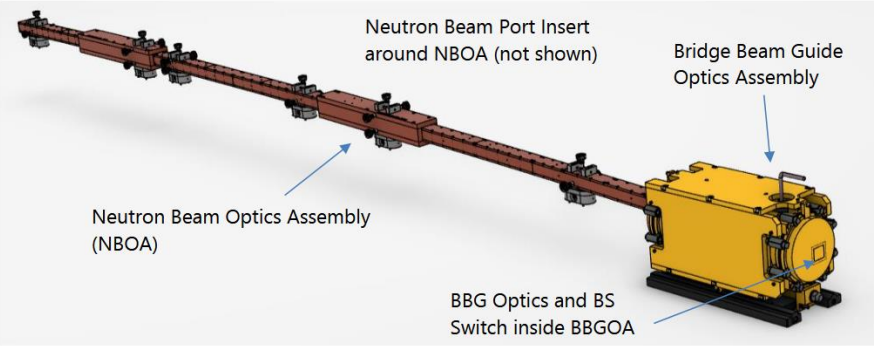
Design & Calculations from TG3

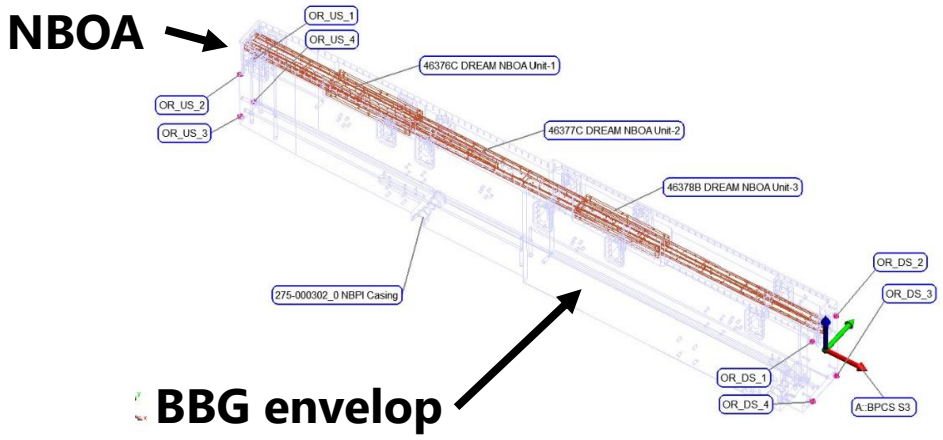
Installations SAT (shielding) BOM (activation) …

Installed components

Neutron Beam Optical Assembly

3	NBOA	ESS.NSS. H01.DREAM.A01.W02.WH01		ESS-3432645 FAT-documents DREAM NBOA and BBG [13] ESS-5808039 SAT for NBOA Dream [14] ESS-5765758 Local Test Report (SAT) DREAM Beam Extraction System [6]





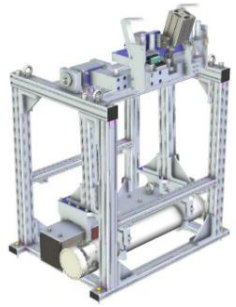
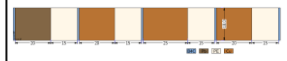
Punch lists for Certificates, FAT, SAT (ESS-5808039)

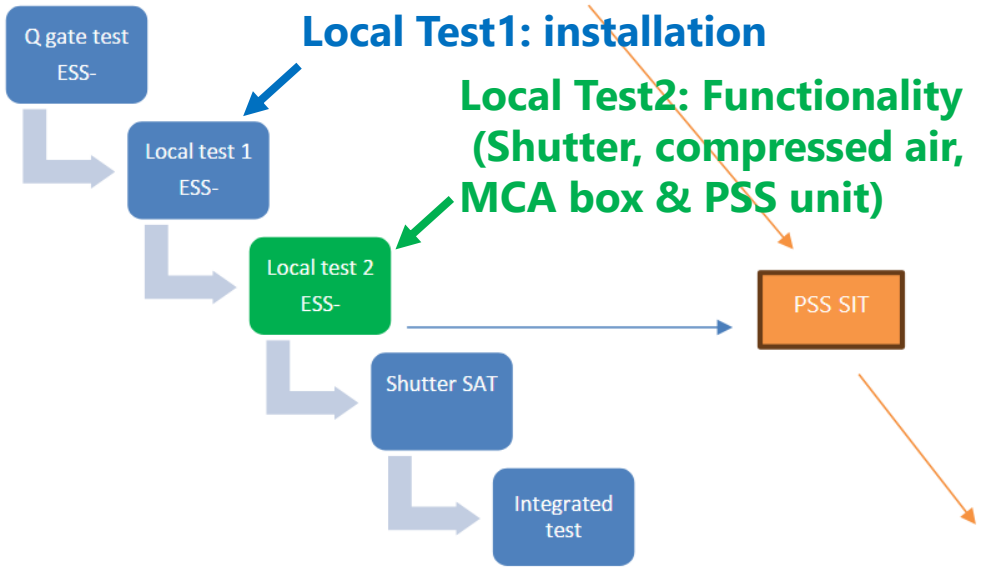
2.3 SAT

ESS.NSS.H01.DREAM.A01.W02.WH01:	NBOA	ESS-5808039	☒	☐	☐
ESS.NSS.H01.DREAM.A01.W02.WH02:	BBG Optics	ESS-5356461	☒	☐	☐
ESS.NSS.H01.DREAM.A01.W01.WH01.WH01:	BS Switch	ESS-5356461	☒	☐	☐
ESS.NSS.H01.A03.WH15:	BBGOA	ESS-5548727	☒	☐	☐
ESS.TS.SSS.W01.W013:	NBPI	ESS-5850666 ESS-5128707	☒	☐	☐

No anomaly from installation

Heavy shutter

4	Heavy shutter	ESS.NSS.H01.DREAM.A01.R03.R01 	ESS-0454189 DREAM - Radiation Safety Report Closed position  	ESS-3229916 Factory Acceptance Test DREAM Heavy Shutter [15] ESS-3888900 Site Acceptance Test DREAM Heavy Shutter [16] ESS-3072038 DREAM Heavy Shutter - Material inventory for activation analysis [17] ESS-5849425 DREAM safety shutter local test 1 [18] ESS-5688791 DREAM Safety shutter Local test 2 [10]



Local Test1 (ESS-5849425) Approved 2025-09-02

ITEM	DESCRIPTION	CATEGORY	RESPONSIBLE	COMPLETION DATE
1	Close NCR 10466 and 10467. Copy NIT:s NIT 380 and NIT 381.	D	Gabor Laszlo	
2	Release model and drawings, Error report: JIRA: ESD-71744	D	Gabor Laszlo	
3	Close NIT-60	D	Gabor Laszlo	
4				

Local Test2 (ESS-5688791) Approved 2025-11-03

ITEM	DESCRIPTION	CATEGORY	RESPONSIBLE	COMPLETION DATE
1	Report ESS-5849425 is approved, but still unsolved issues. This is traced in NIT-380, NIT-381 and NIT-60.	d	Gabor Laszlo	
2				

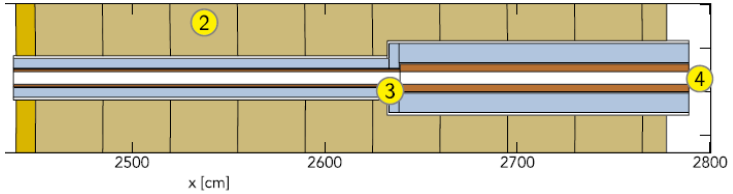
Anomalies detected during tests

NIT-381	CLOSED	Dream NCR 10467 Evaluate design fix done in situ.
NIT-380	CLOSED	Dream shutter NCR 10466 Absence of CE marking, or related documentation
NIT-75	IN PROGRESS	Replace the upstream interface plate for the shutter
NIT-60	IN PROGRESS	Remote handling accuracy out of range for the DREAM shutter.

Bunker Wall Insert (Bunker Wall Feedthrough Assembly)

5	Bunker wall insert	ESS.NSS.H01.DREAM.A01.W01.W01.WH02	ESS-0454189 DREAM - Radiation Safety Report	ESS-5863788 SAT of DREAM neutron guide in bunker, BWI and out of bunker except in-cave section [7]

dose rate in D01 hall.



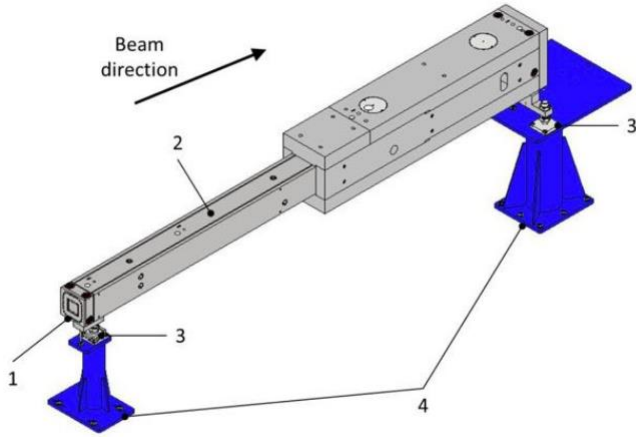
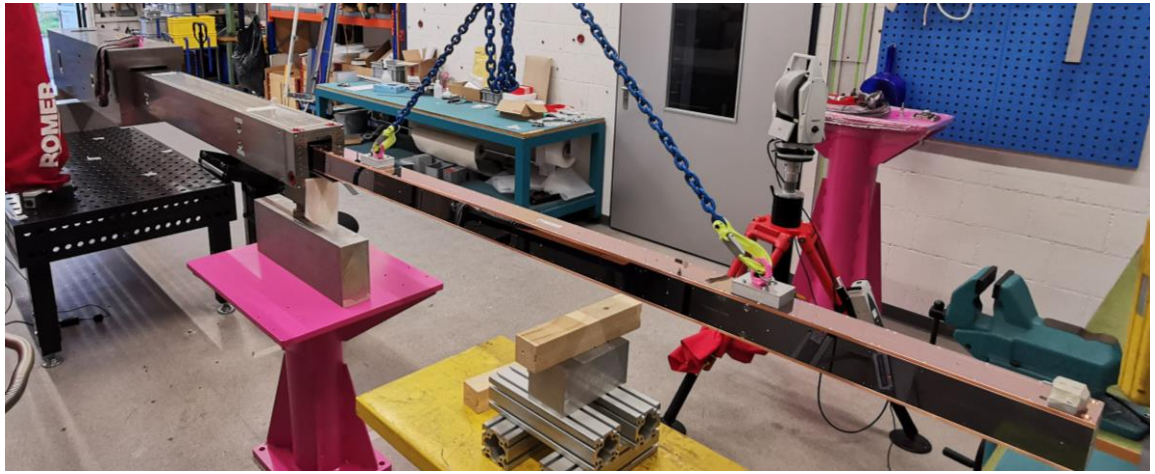


Figure 7 - Bunker Wall Feedthrough Assembly (BWFA)



ESS-5098788 SAT DREAM guide without in-cave section

1. final alignmnent of BWFA casing - points to points comparison

1.1 Vertical and lateral alignment (Y- & Z-axis)

All Vectors Summary: Vector Group
1000163 BWFA casing complete::fianl YZ

Statistic	dZ (mm)	MagZ (mm)
Min	-0.015	0.002
Max	0.004	0.015
Average	-0.007	0.008
StdDev from Avg	0.007	0.005
StdDev from Zero	0.010	0.010
RMS	0.009	0.009
Tol Range		-0.030
		0.030
In Tol		7 (100.000%)
Out Tol		0 (0.000%)
Count	7	

Projection mode: Surface to Offset Point

Vector Group
1000163 BWFA casing complete::fianl YZ

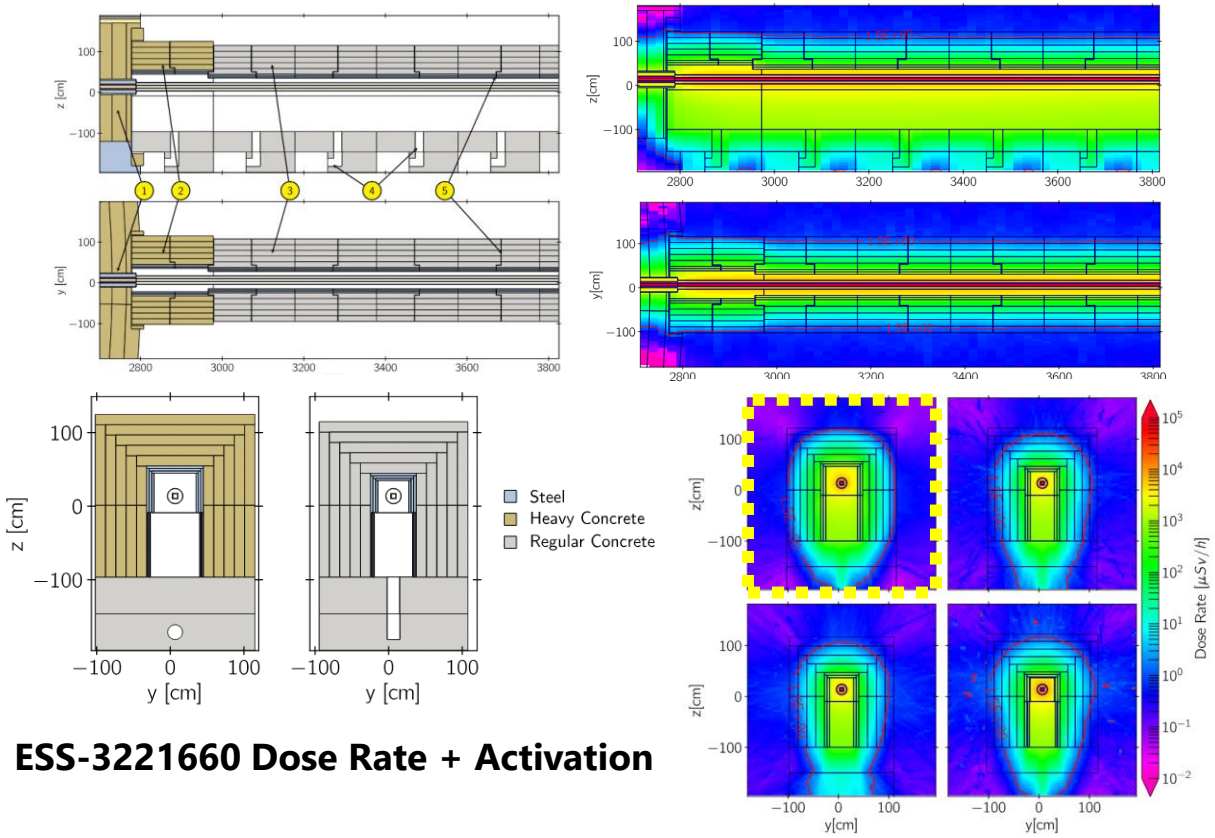
Name	Begin Z1 (mm)	End Z2 (mm)	Delta dZ (mm)	Delta MagZ (mm)
ORBWFA_6	101.652	101.656	0.004	0.004
ORBWFA_7	101.149	101.140	-0.009	0.009
ORBWFA_12	-53.651	-53.653	-0.002	0.002
ORBWFA_13	-63.136	-63.142	-0.006	0.006
ORBWFA_18	201.863	201.852	-0.011	0.011
ORBWFA_19	200.239	200.224	-0.015	0.015
ORBWFA_20	-55.953	-55.963	-0.011	0.011

No anomaly from installation

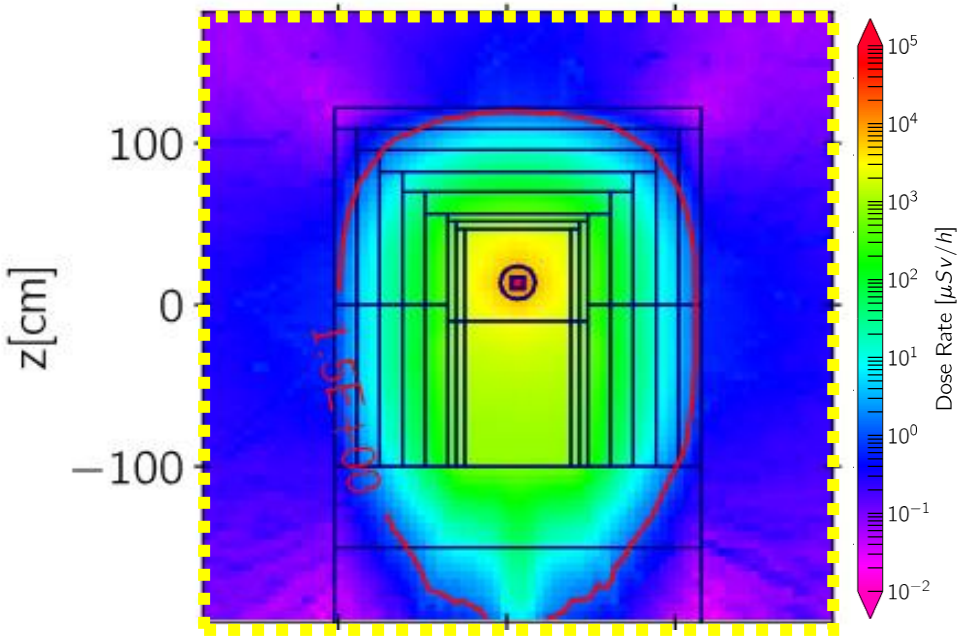
Neutron Guide shielding (Common Shielding Project)

1	Neutron Guide shielding	ESS.NSS. H01.DREAM.A01.F01	ESS-0454189 DREAM - Radiation Safety Report	ESS-3218932 QC and FAT information on the Guide Shielding blocks for BIFROST, CSPEC, DREAM, ODIN, BEER, NMX, MAGIC [12] ESS-5796751 SAT DREAM Guide Shielding [8]

ESS-2068227 - Common Shielding General Design Specification
ESS-3221660 - Neutronics calculations of the DREAM Guide Shielding
ESS-3221660 Beam Guide Shielding for the DREAM Instrument within the Common Shielding Project
ESS-5796752 – Gap measurement sheet



ESS-3221660 Dose Rate + Activation



Regions near or beyond the shielding structure:

- Supervised area: dose limits < 3 μSv/h
  (Safety factor of 2 for calculations)

Neutron Guide shielding (Common Shielding Project)

1	Neutron Guide shielding	ESS.NSS. H01.DREAM.A01.F01	ESS-0454189 DREAM - Radiation Safety Report	ESS-3218932 QC and FAT information on the Guide Shielding blocks for BIFROST, CSPEC, DREAM, ODIN, BEER, NMX, MAGIC [12] ESS-5796751 SAT DREAM Guide Shielding [8]

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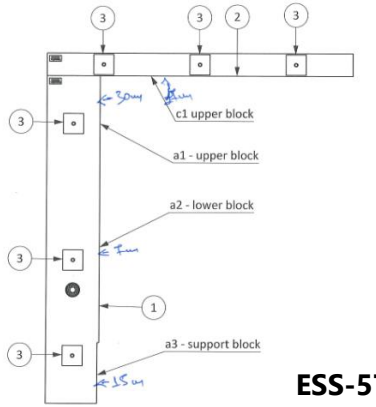
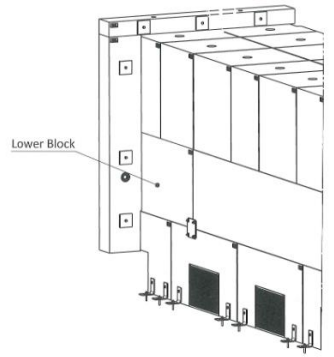
ESS-5796752 DREAM Guide Shielding - Gap Measurement sheet





ESS-5796751
SAT DREAM Guide shielding

Gap		Value (mm)	Average (mm)
a1	Top	15	15
	Bottom	15	
a2	Top	7	7
	Bottom	7	
a3	Top	30	30
	Bottom	30	

Gap		Value (mm)	Average (mm)

Gap		Value (mm)	Average (mm)
c1	Left	17	17
	Right	17	

CONCLUSION
Gaps in red, that are outside tolerance, are reported to the Radiation Protection Group (NC-10635) to include them in non-conformities for the instruments. Mapping of the gaps is presented in the ESS-5445979.1
RP will measure in the area once the instrument is operational and decide if more shielding is needed to cover the gap.

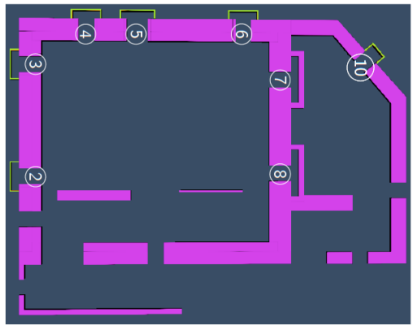
NIT-660 **TO DO** NCR 10635 Oversized gaps in the DREAM Guide Shielding

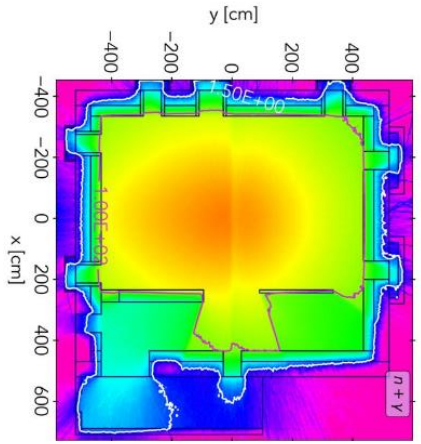
Cave shielding

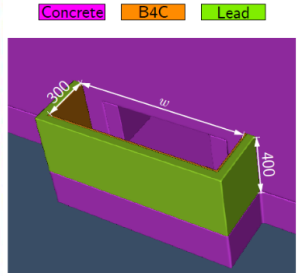
2	Cave Shielding	ESS.NSS. H01.DREAM.U01.F01	ESS-0454189 DREAM - Radiation Safety Report	ESS-5878375 DREAM - Shielding SAT [9]

DREAM - SHIELDING SAT

	Name	Role/Title
Owner	Sylvain Desert	Lead engineer for LLB
Reviewer	Ana Cintas	Radiation Protection Expert
	Feras Wazzan	Quality Engineer
	Tobias Quipse Mamani	Lead Integration Engineer
Approver	Michail Feygenson	Science Division Head







ESS-0454189 DREAM - Radiation Safety Report (Maximum flux Operation Beam (MOB))

SAT PUNCH LIST

Any incomplete work or non-conformities shall be recorded in the SAT punch list and categorized as follows:

a) To be cleared on the spot, SAT to be continued after rectification
b) Ongoing rectification during SAT; if the rectification requires a design modification, give a reference to the change request
c) SAT to be repeated (motivate why)
d) Modifications to be made after SAT, before the system is integrated with other systems on site; in this case give a reference to the change request

Non-conformities need to be registered in the Enterprise Asset Management (EAM) system.

ITEM	DESCRIPTION	CATEGORY	RESPONSIBLE	COMPLETION DATE
1	NA			

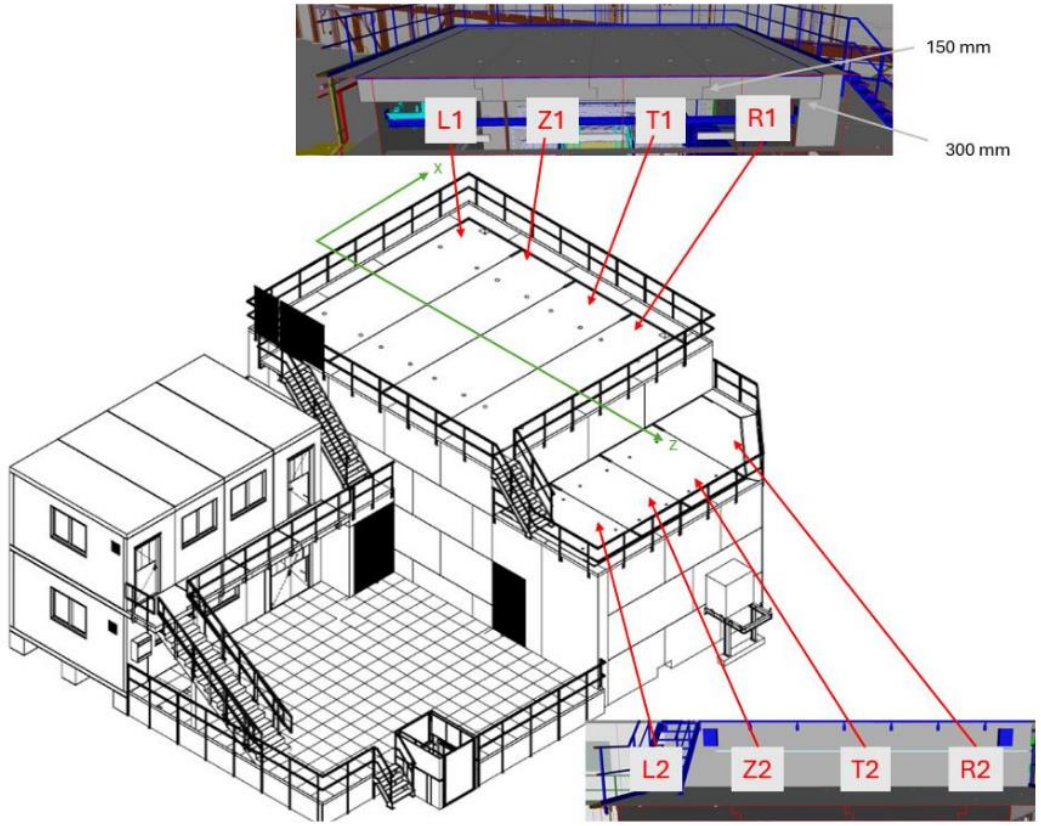
Normal operations:

- Supervised area: Sides of the walls + downstream to the beam stop
- Controlled area: Top of the roofs (barriers)

Cave shielding

2	Cave Shielding	ESS.NSS. H01.DREAM.U01.F01	ESS-0454189 DREAM - Radiation Safety Report	ESS-5878375 DREAM - Shielding SAT [9]

ESS-5993146 DREAM - Cave Shielding gaps
ESS-5796752 Gap measurement sheet
➔ Interface with Guide shielding



DREAM - SHIELDING GAPS

	Name	Role/Title
Owner	Sylvain Desert	Skadi lead engineer (ESS)
Reviewer	Ana Cintas	Radioprotection Officer
Approver	Mikhail Feygenson	Division head Diffraction

Interface	x (mm)	Z (mm)
Cave / L1	-	27
L1 / Z1	-	10
Z1 / T1	-	5
T1 / R1	-	17
R1 / Cave		25
Cave / L1	34 – 10 (22)	
Cave / Z1	33 – 4 (19)	
Cave / T1	33 – 27 (30)	-
Cave / R1	41 – 12 (27)	-

Interface	x (mm)	z (mm)
Cave / L2	-	10
L2 / Z2	-	15
Z2 / T2	-	16
T2 / R2	-	19
R2 / Cave	-	19
Cave / L2	14 - 10	-
Cave / Z2	10 - 7	-
Cave / T2	16 - 8	-
Cave / R2	19 - 5	-

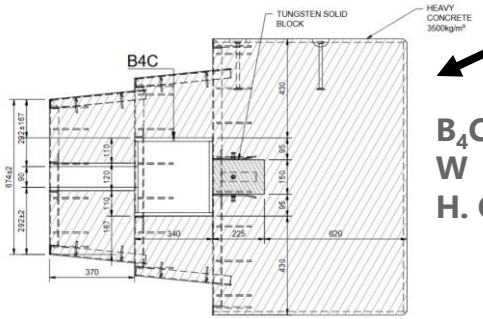
Gaps Cave / roof elements of main cave

Although all the worst gaps between the roof elements and the cave along x axis are greater than 30 mm, the average value with the opposite is always lower or equal to 30 mm.
This means it is possible to even the gaps to fulfil the requirement, if needed.

Problem can be mitigated (repositioning) ➔ No NIT

Beam stop

6	Beam stop	ESS.NSS.H01.DREAM.A01.R03.R02	ESS-0454189 DREAM - Radiation Safety Report	Included in ESS-5878375 DREAM - Shielding SAT [9] ESS-6015828 Drawings of DREAM beam stop [19] ESS-5990686 DREAM Cave BOM [20]



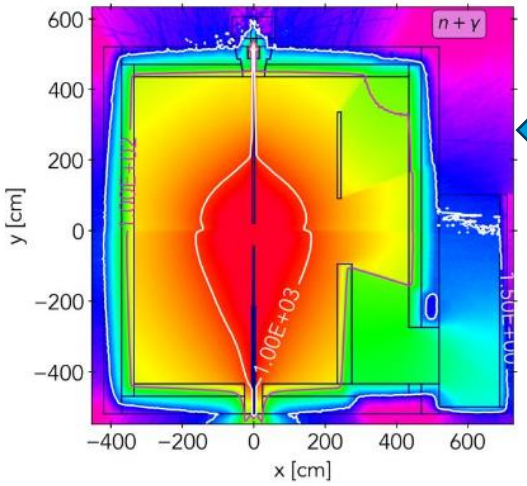
ESS DREAM experimental cave

Bill of Materials

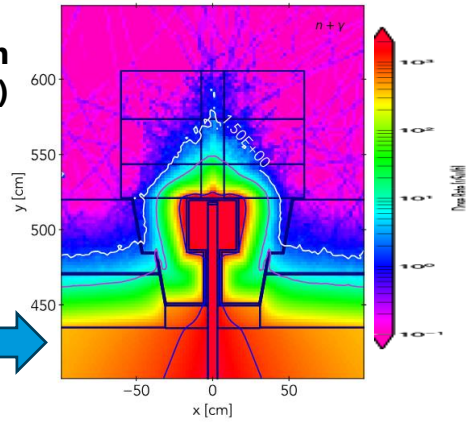
Item #	Description	Volume [m³]	Density [kg/m³]	Mass [kg]	Centre of gravity to sample X [mm]	Y [mm]	Z [mm]	Distance to beam d [mm]
A	**Near beam objects**							
1	beam entry							
1.1	Steel inserts	0.027	7850	213	1539	0	-613	613
2	beam stop							
2.1	B4C inserts	0.008	2520	19	4976	0	0	0
2.2	Thungsten bar	0.005	19250	94	4345	0	0	0
2.3	Concrete block	1.646	2400	3952	5439	0	0	0
2.4	Carbon steel stand	0.016	7850	124	6125	0	-916	916
3	Sample area tech. floor							
3.1	Aluminium structure and plate	0.141	2700	381	0	-274	-1461	1486
3.2	Calcium sulphate tiles	0.284	2320	659	0	-645	-1356	1502

B_4C
W
H. Concrete

DREAM - SHIELDING GAPS



Maximum flux Operation Beam (MOB)



Accidental Open Beam (AOB)

	Name	Role/Title
Owner	Sylvain Desert	Skadi lead engineer (ESS)
Reviewer	Ana Cintas	Radioprotection Officer
Approver	Mikhail Feygenson	Division head Diffraction

Interface	x (mm)	y (mm)
Cave / Beamstop	12 - 4	9 - 9

No anomaly at installation

Overview of Radiation Safety Assessment

Radiation Safety Assessment: Summary

Radiation Safety Functions (RSFs)
Worker Radiation Safety Functions (WRSFs).

DREAM is within the radiation safety envelope
of a generic instrument as defined in SSM submissions
All relevant RSFs and WRSFs are satisfied.

COMPREHENSIVE RADIATION SAFETY ASSESSMENT OF DREAM

	Name	Role/Title
Owner	Fabian Valenzuela Lundkvist	Safety Engineer, ESH&S Division
Reviewers	Florence Porcher	DREAM Instrument Scientist
	Alan Takibayev	Spallation Physics Scientist, Target Division
	Ana Cintas	Radiation Protection Expert, ESH&S Division
Approvers	Mikhail Feygenson	Head of Diffraction and Imaging Division
	Per Roos	Group Leader of Radiation Protection, ESH&S Division
	Günter Muhrer	Group Leader for ESS Spallation Physics, Target Division

8. CONCLUSIONS

From the conclusions in Section 7, the radiation safety requirements of DREAM are met. With respect to the shielding, [7] confirms that the design of the cave and guide meets the dose requirements. The calculations have been performed with a beam power of 5 M which is the maximum beam power possible. Thus, the shielding is valid and sufficient for phases with a lower beam power.

Thank you!