



Instrument Safety Readiness Review

Test beamline (TBL): Overview of Radiation Safety Assessment

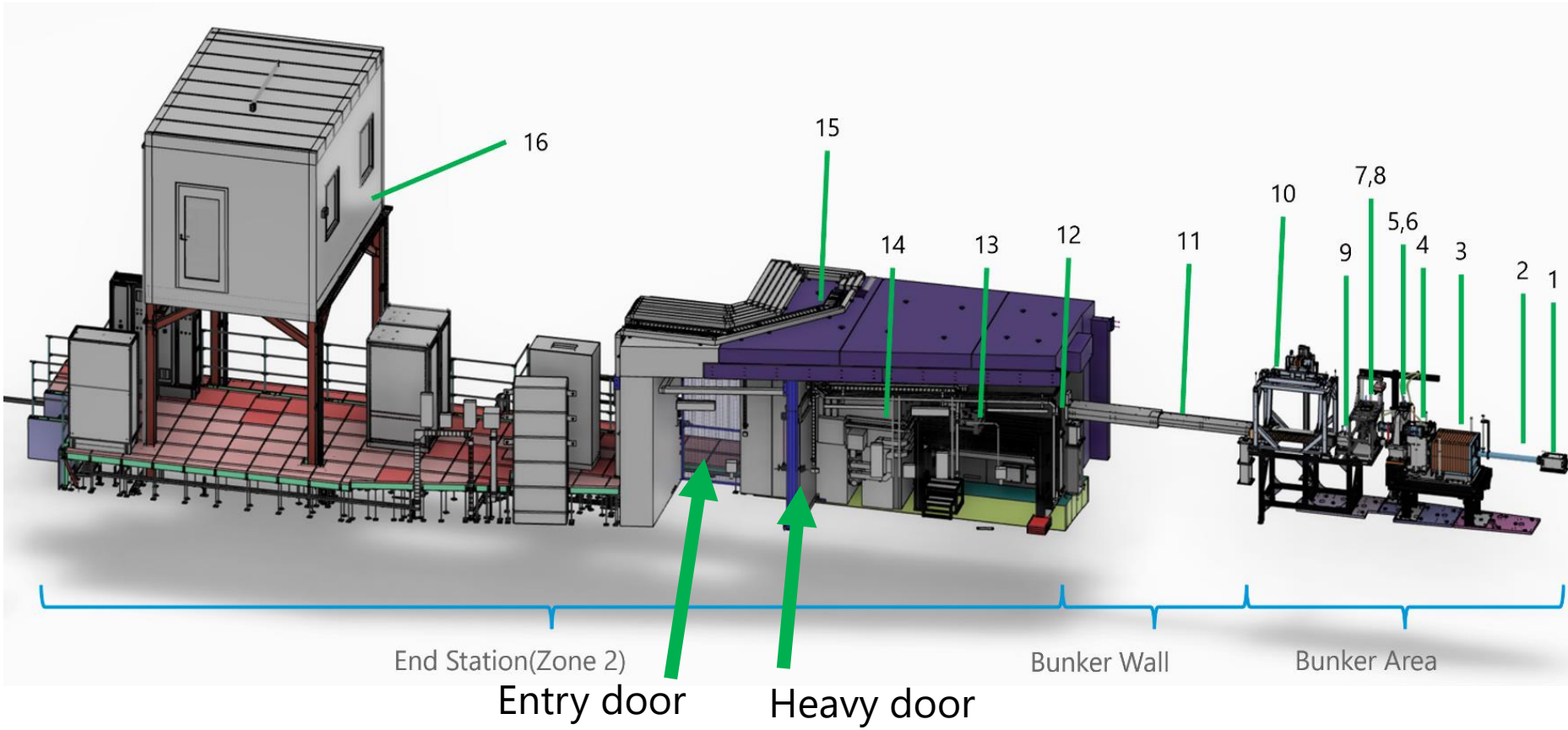
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Jason Morin, Samuele Andreucci

European Spallation Source (ERIC), Lund, Sweden

10 October 2025

Overview

TBL has 2 doors:
 Heavy door: This has shielding properties
 Entry door: This is just a gate to prevent access to the first section of the cave



No.	Component Name	Distance from target coordinate system
1	BBGOA and Light Shutter	5.5 m – 6 m
2	Flight Tube 1	6 m – 7.4 m
3	Heavy Collimator	7.4 m – 8.2 m
4	Adjustable Collimator	8.3 m – 8.5 m
5,6	Chopper, Flight Tube 2	8.5 – 8.7 m
7,8	Filter station, In-bunker Beam Monitor	8.7 – 9.3 m
9	Final Collimator	9.3 – 9.5 m
10	Heavy Shutter	9.5 m – 11.3 m
11	Bunker Wall Feedthrough	11.5 m – 15 m
12	In-cave Beam Monitor	15.1 – 15.2 m
13	Detector Table	15.2 – 17.5 m
14	Beam Stop	17.5 m
15	Experimental Cave	15 – 21 m
16	Control Hutch	25 m



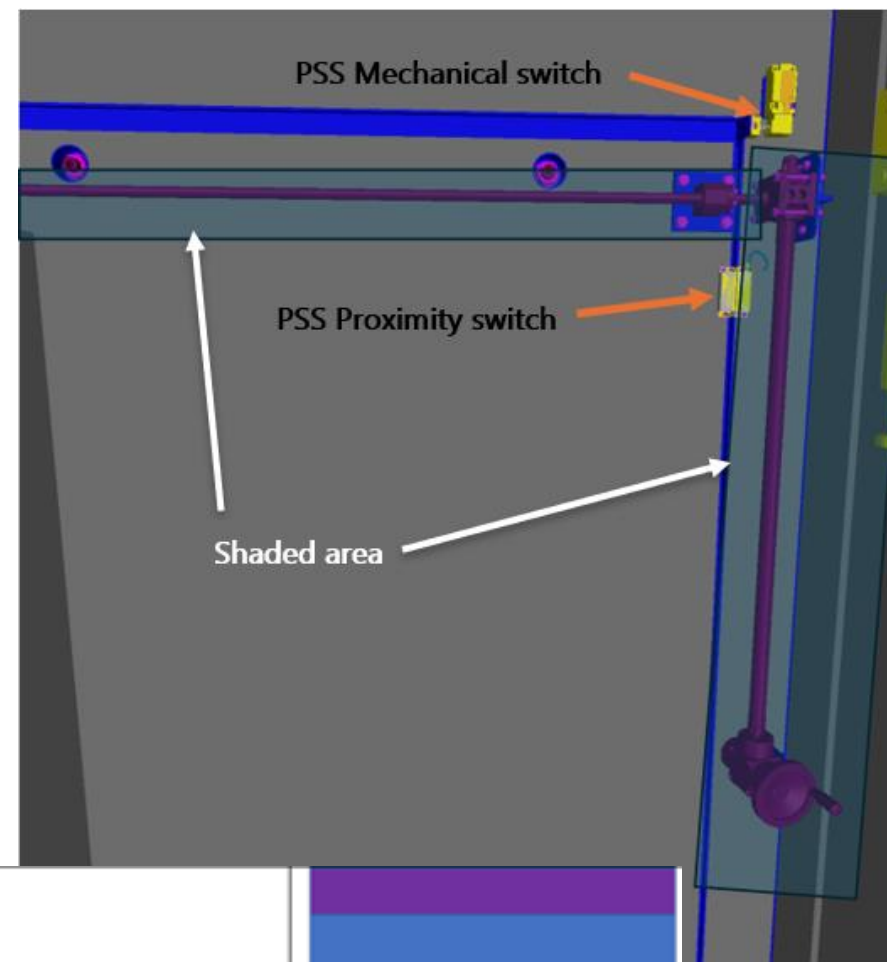
IHA: Radiation Hazard

Cause / Initiating Event	Actions to Mitigate Risk (Risk Controls)
Person outside the cave footprint /worst sample, or no sample	Cave shielding to achieve radiation levels equal or less than 3 microSv/hour on touch.
Access to the cave during operation	a) Shielding and barriers to prevent access to the cave. b) Doors to prevent access to the cave where access points are required. c) Signage.
Intrusion into entry area of cave during operation	a) Lock the entry door if the Heavy Shutter is open. B) Information about instrument status close to the entrance. C) Monitoring of entry door by safety interlock system and interlock with heavy shutter. D) PSS will interlock shutter in closed position when beam is on.
Intrusion into detector area of cave during operation	a) Lock the entry door if the Heavy Shutter is open. B) Information about instrument status close to the entrance. C) Monitoring of heavy door by safety interlock system and interlock with heavy shutter and proton beam. D) PSS will interlock shutter in closed position when beam is on.
Person in the cave during start of operation	a) Close heavy shutter b) Cave to be checked for people prior to operation.
Person in the cave and heavy shutter inadvertently opens	a) Warning lights and sound controlled by a safety interlock system inside cave to alert people that operation is imminent. b) Safety interlock system preventing inadvertent request for opening the instrument shutter. c) Formalised search in the cave prior to opening the instrument shutter, monitored by safety interlock system. d) Possibility to manually switch-off the neutron beam from inside the cave (safety interlock system). e) Means of escape from inside the cave through entry door and heavy door.
Instrument shutter opens while cave shielding blocks are not in place.	a) Shielding configuration controlled by RP and supported by safety interlock system. b) Signage
Person in cave and failure of heavy shutter	Radiation monitor downstream to instrument shutter linked to PSS.



Shielding door

- Heavy door attenuates radiation, but not as the controlled area perimeter.



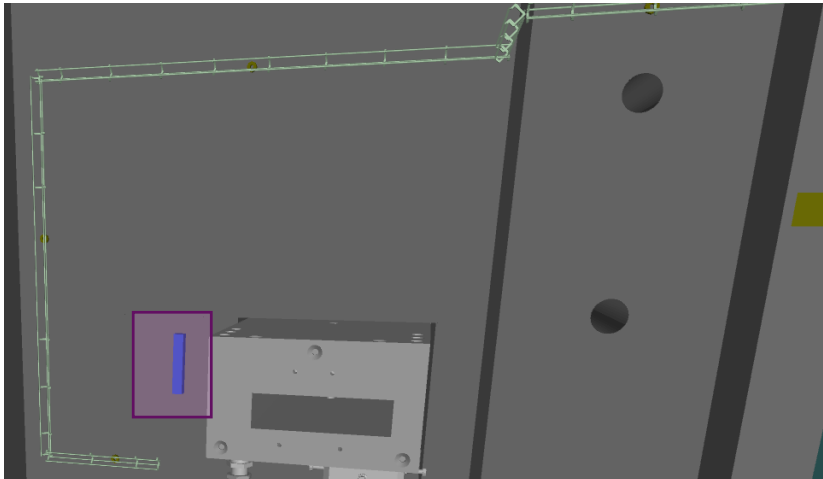
7

B4C_40mm_2layer

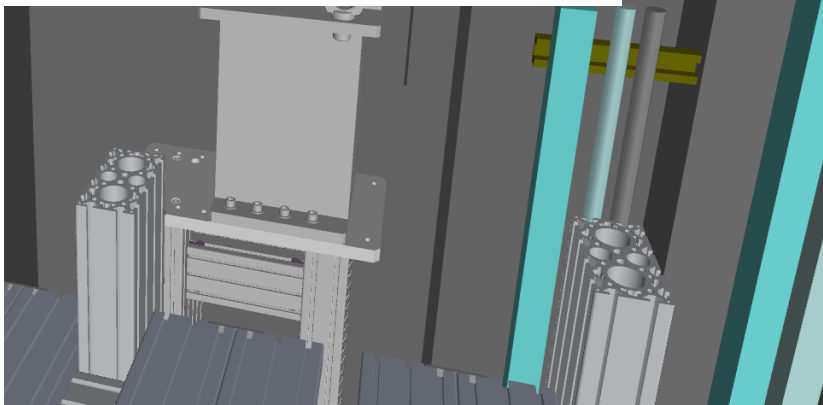


Radiological and Environmental Monitoring System (REMS)

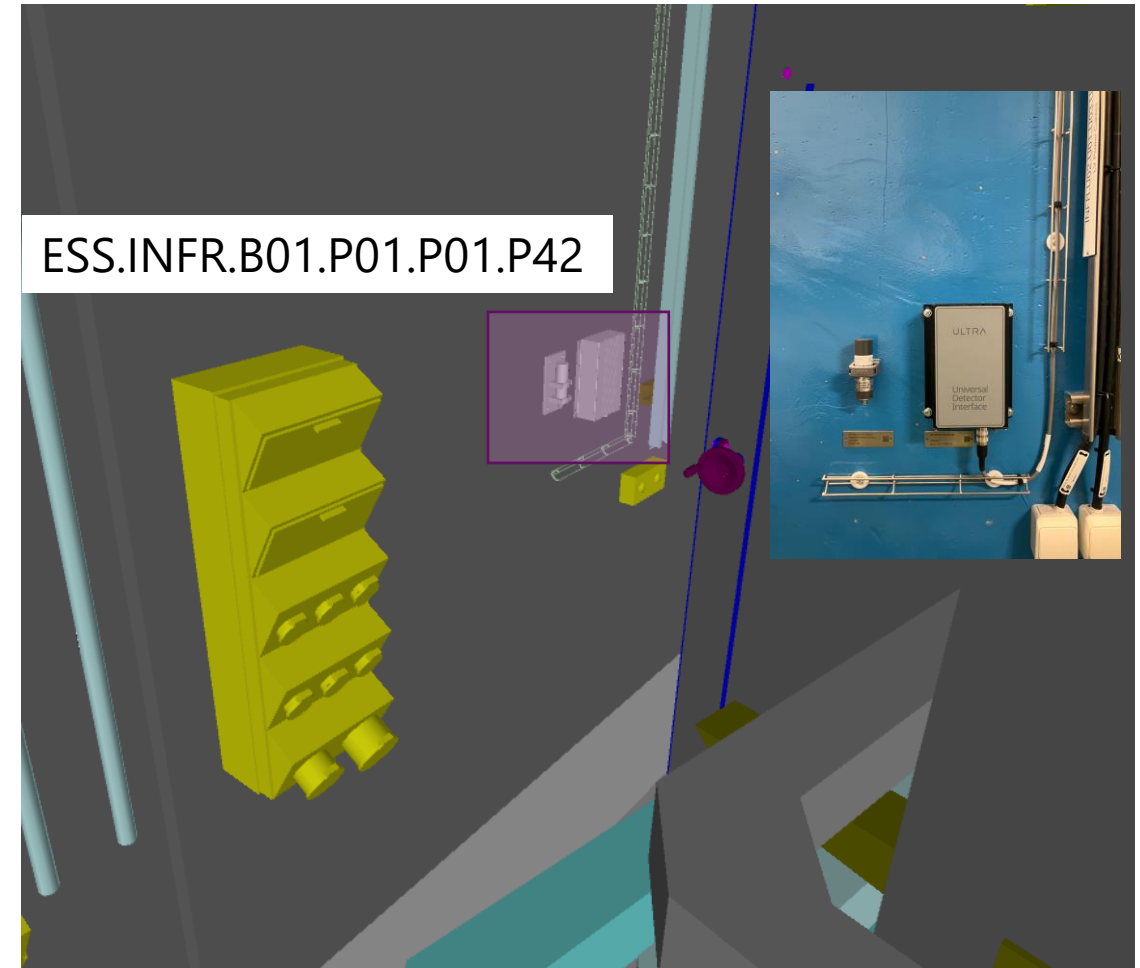
- Radiation monitors



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Area Neutron Monitor (ANM) – connected to PSS

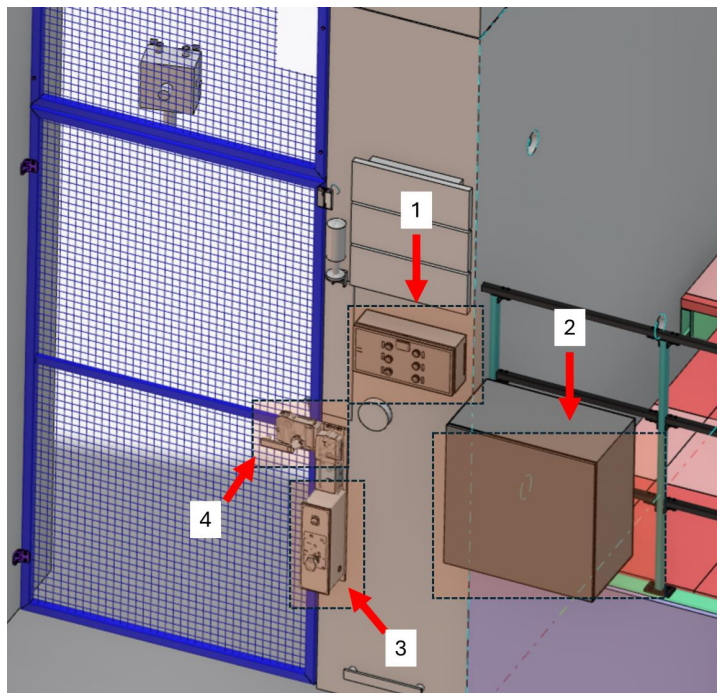


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Area Gamma Monitor (AGM)



Access the cave



Access to the cave

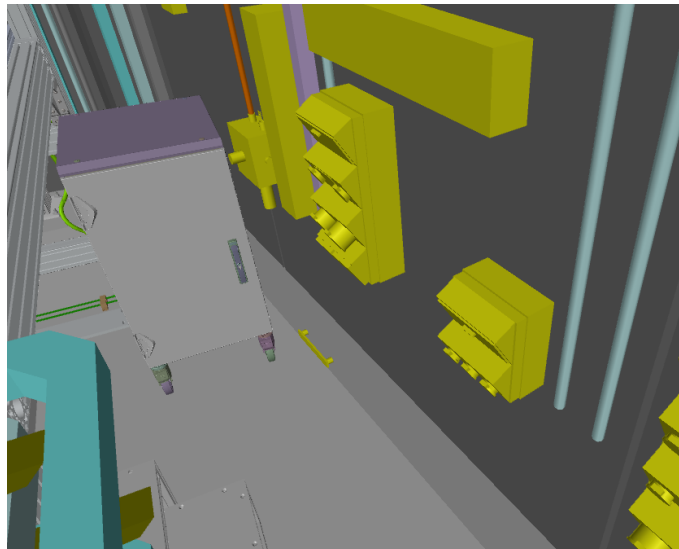
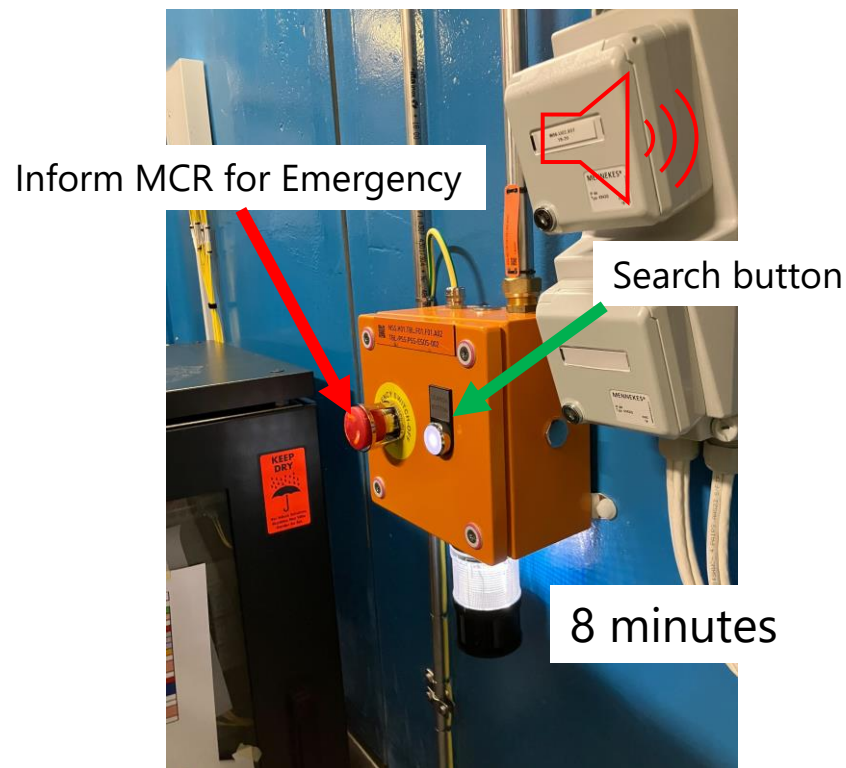
- 1) Assume the shutter is in Closed position (Check the Shutter Operation Panel (1)).
- 2) Open the PSS box (2) and take the key from Slot 8.
- 3) Insert the key to the Electromechanical Lock and unlock the lever.
- 4) After cool-down period passes and Access is allowed, open the Entry door.
- 5) Open the Heavy door via the handwheel.



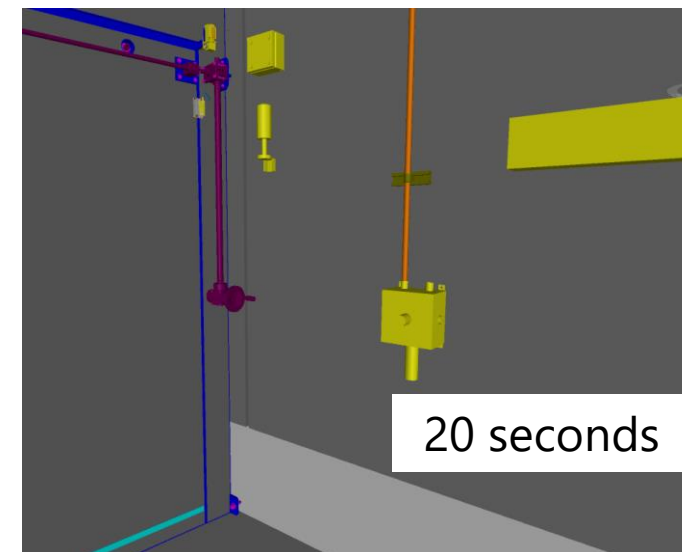


Search procedure

- Two sets of Search buttons and Emergency buttons are available inside the cave.



Inside the experimental area



Entry area

When the Emergency button is pressed:

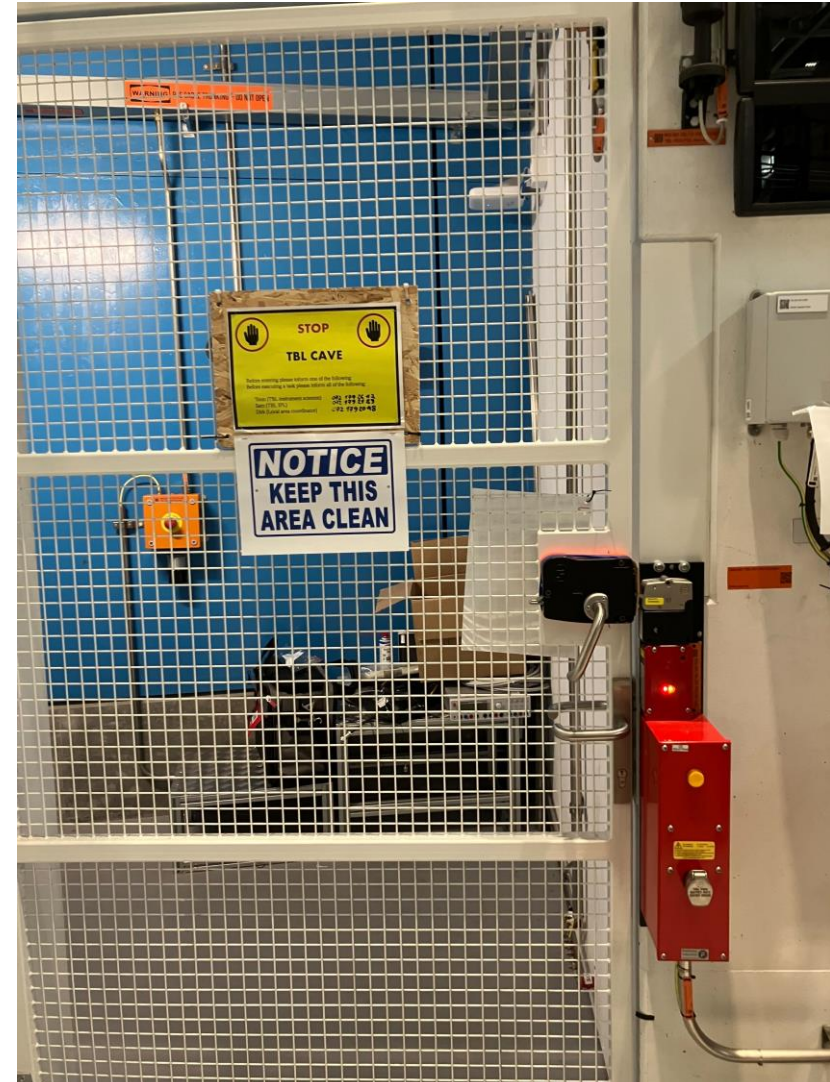
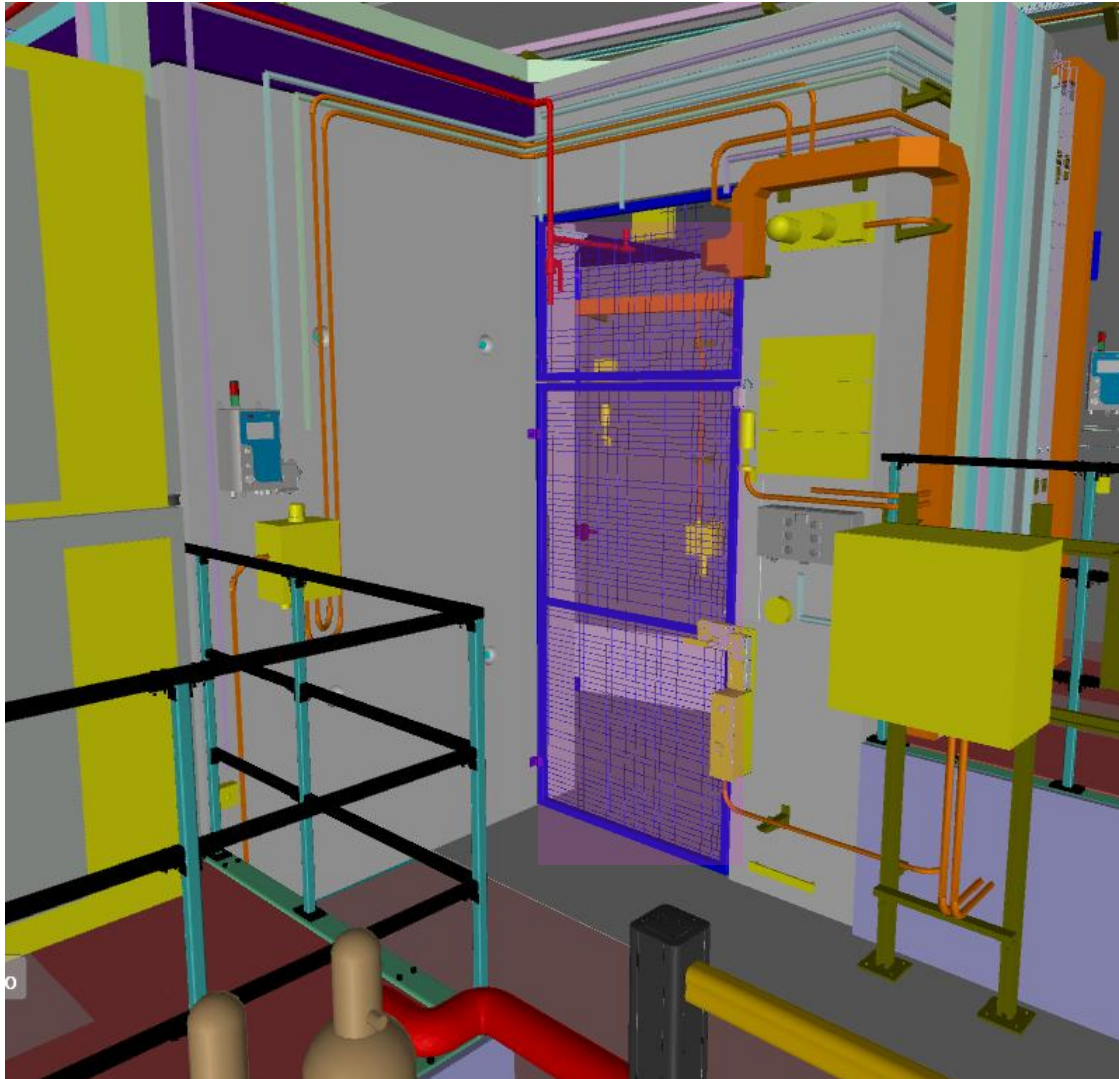
- 1) Shutter closed
- 2) If shutter is not closed in-time (PSS), accelerator is shut down.

Note, no actions while Access Allowed mode



Controlled perimeter

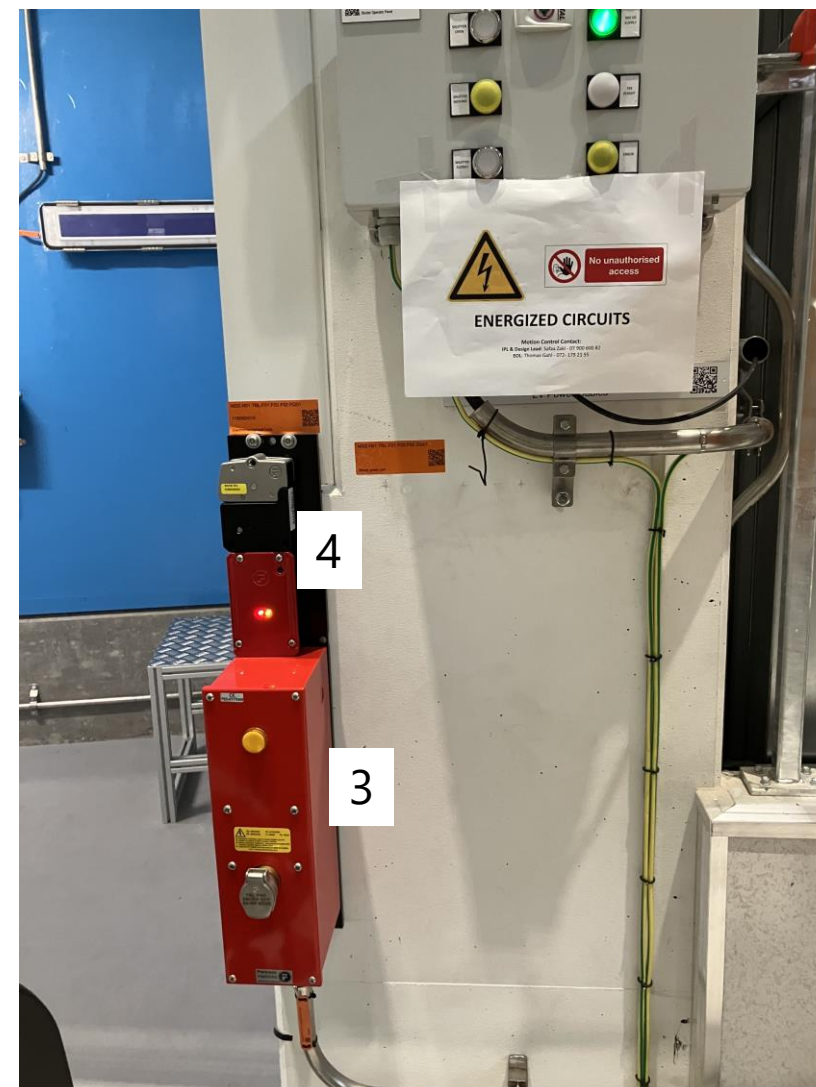
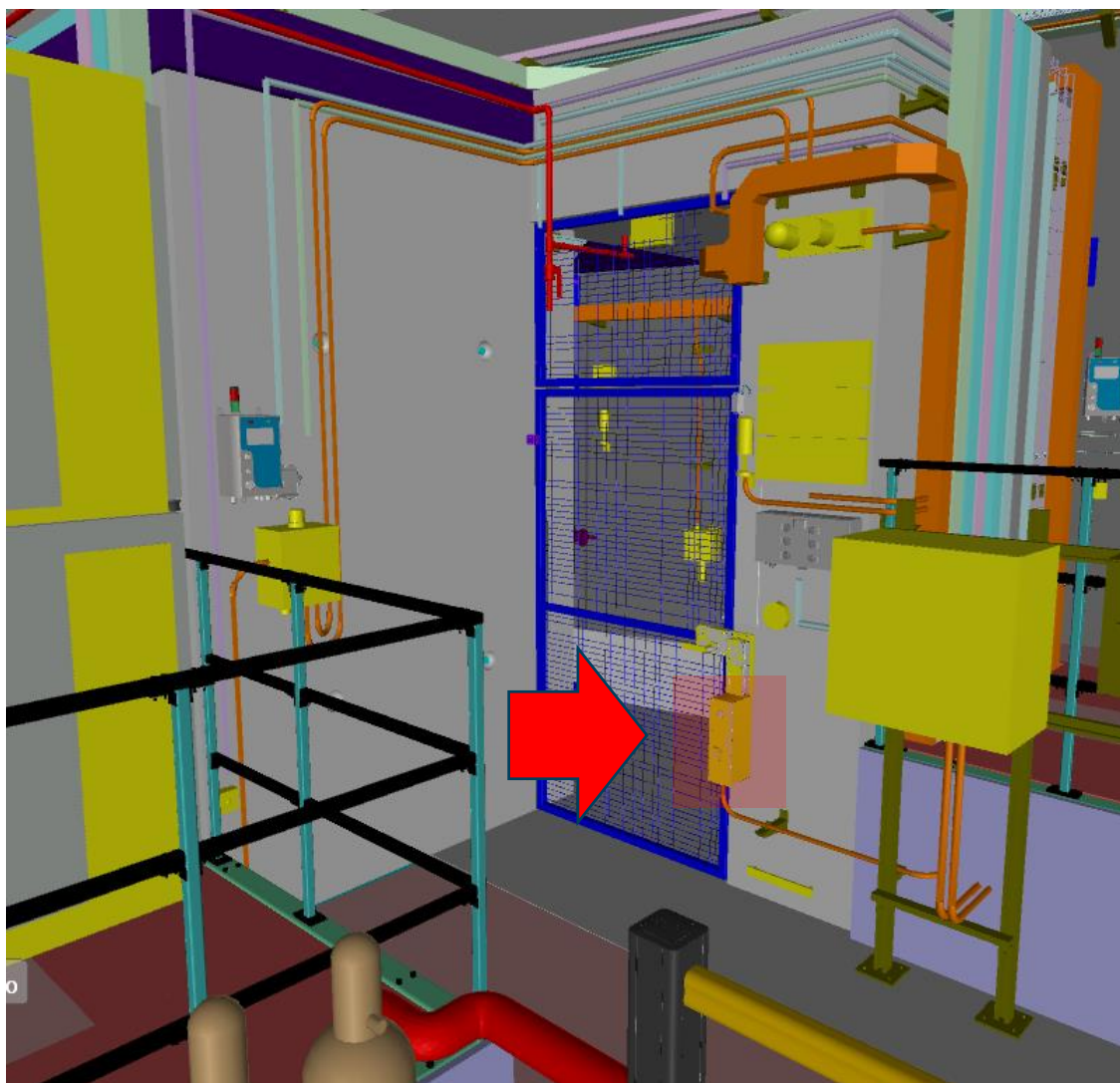
- Blue light is kept ON at the entrance, while it will be off inside the cave due to experiment compromised.





Electromechanical lock

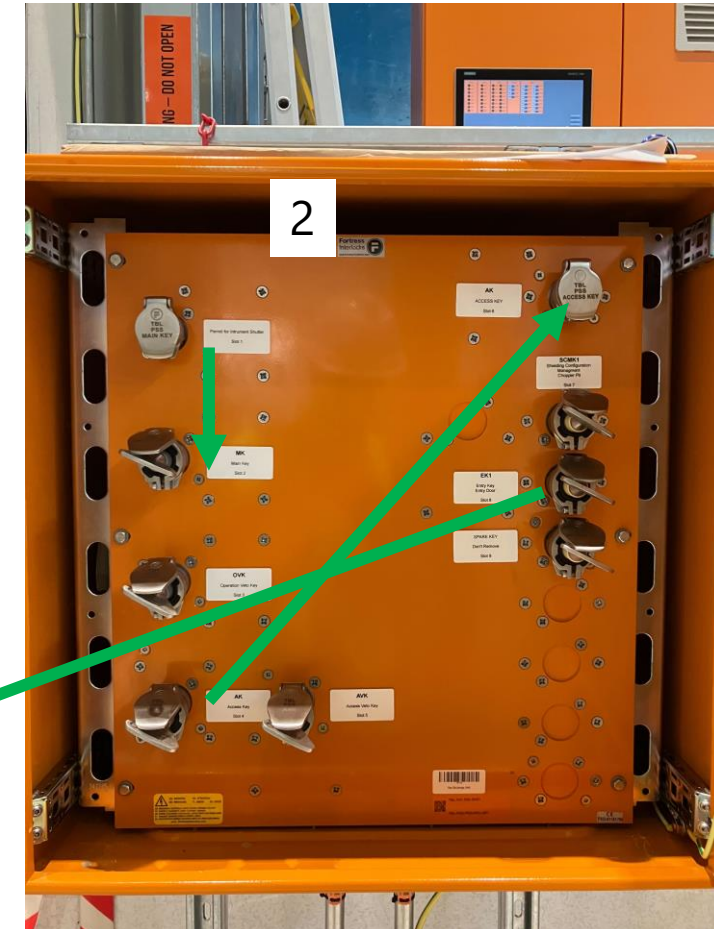
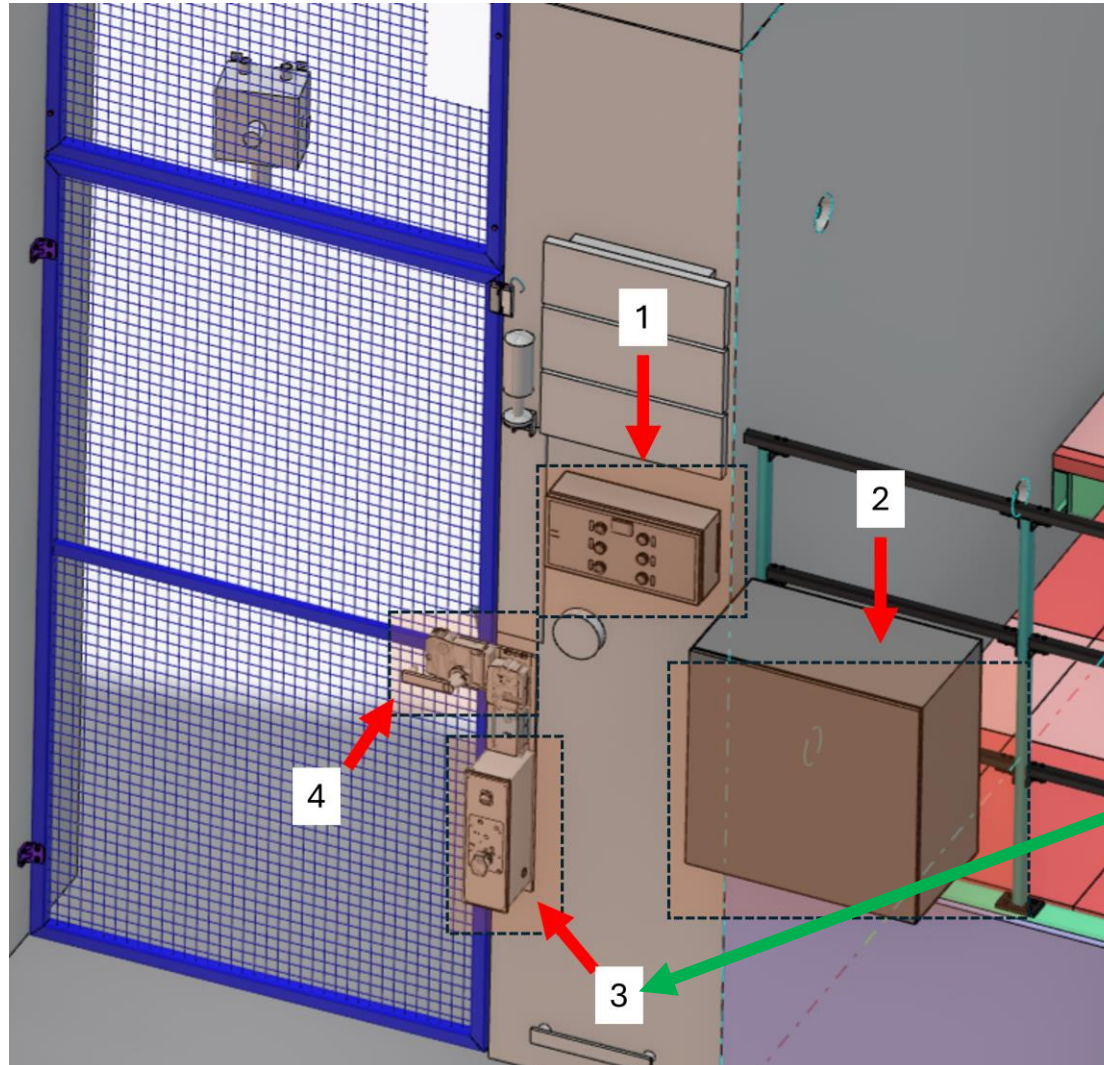
- Exchange key box is used to lock/access the cave.





Exchange key

- Entry door is the main entry controlled by PSS to access the cave.



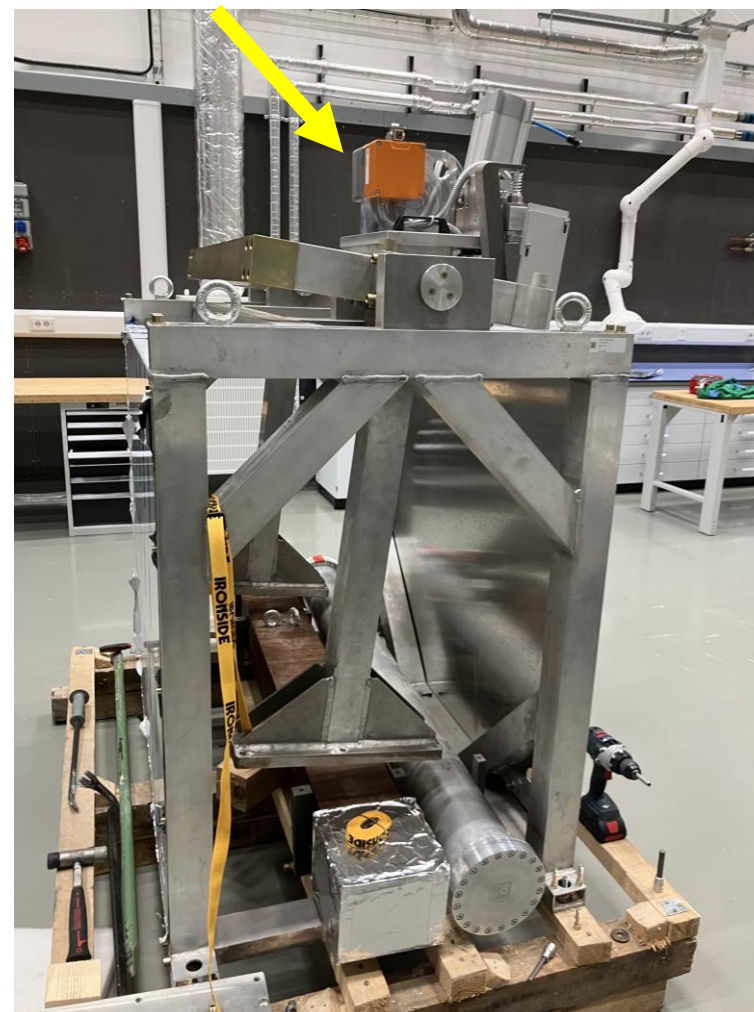
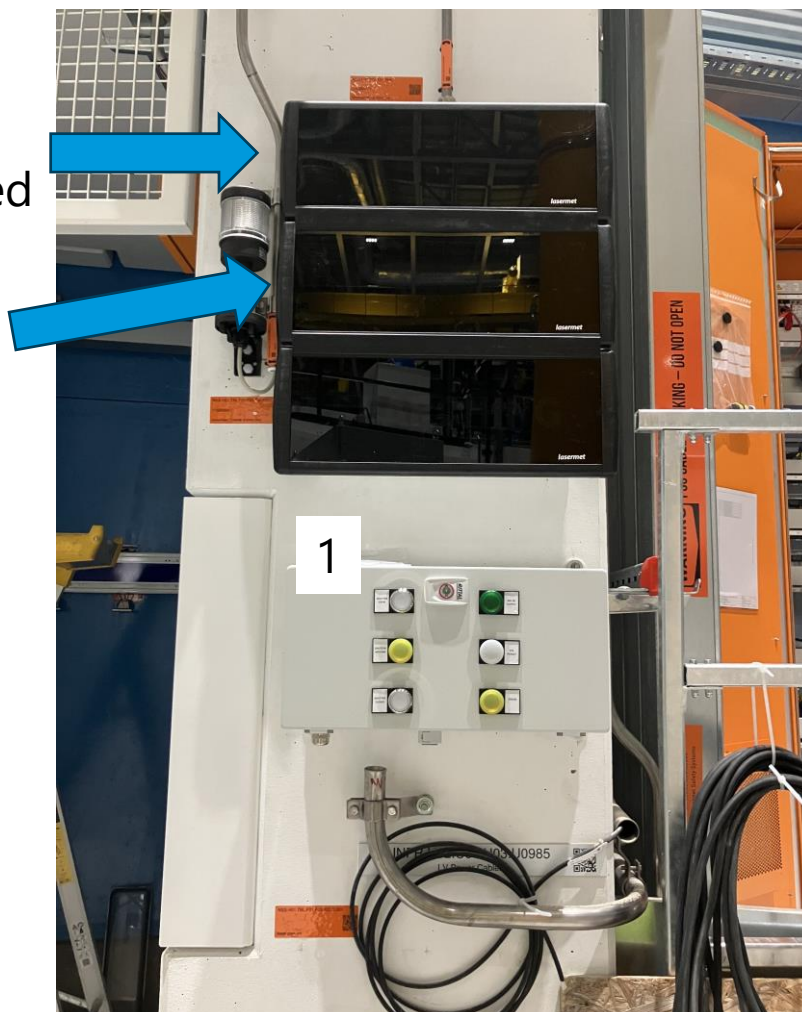


Access modes

- Heavy shutter has an interlock connected to PSS.

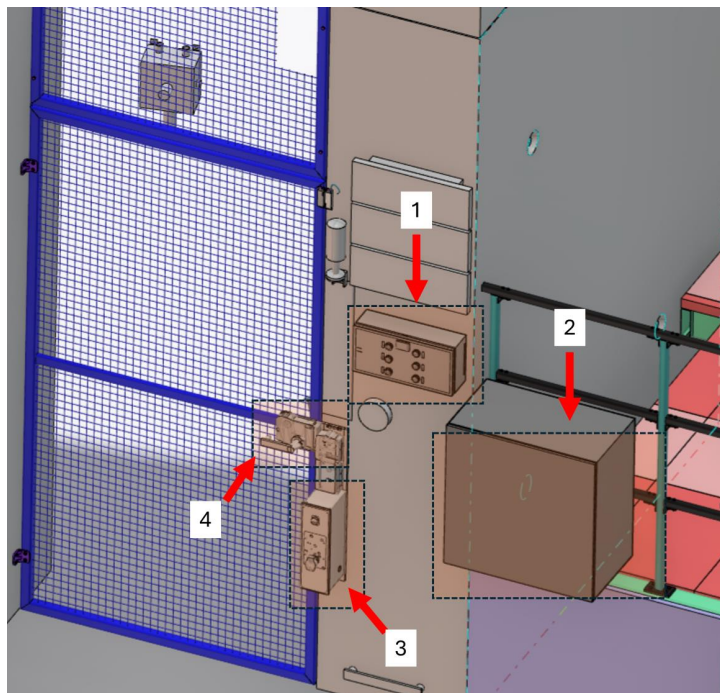
Access allowed
Access prohibited

Shutter closed
Shutter open





To open the shutter



Lock the cave

- 1) Take the key from the red box (3) to the orange box (2)
- 2) Exchange the key
- 3) Wait for 30 seconds(?)** before open the shutter
- 4) Blue light in the Entry zone should be lit)

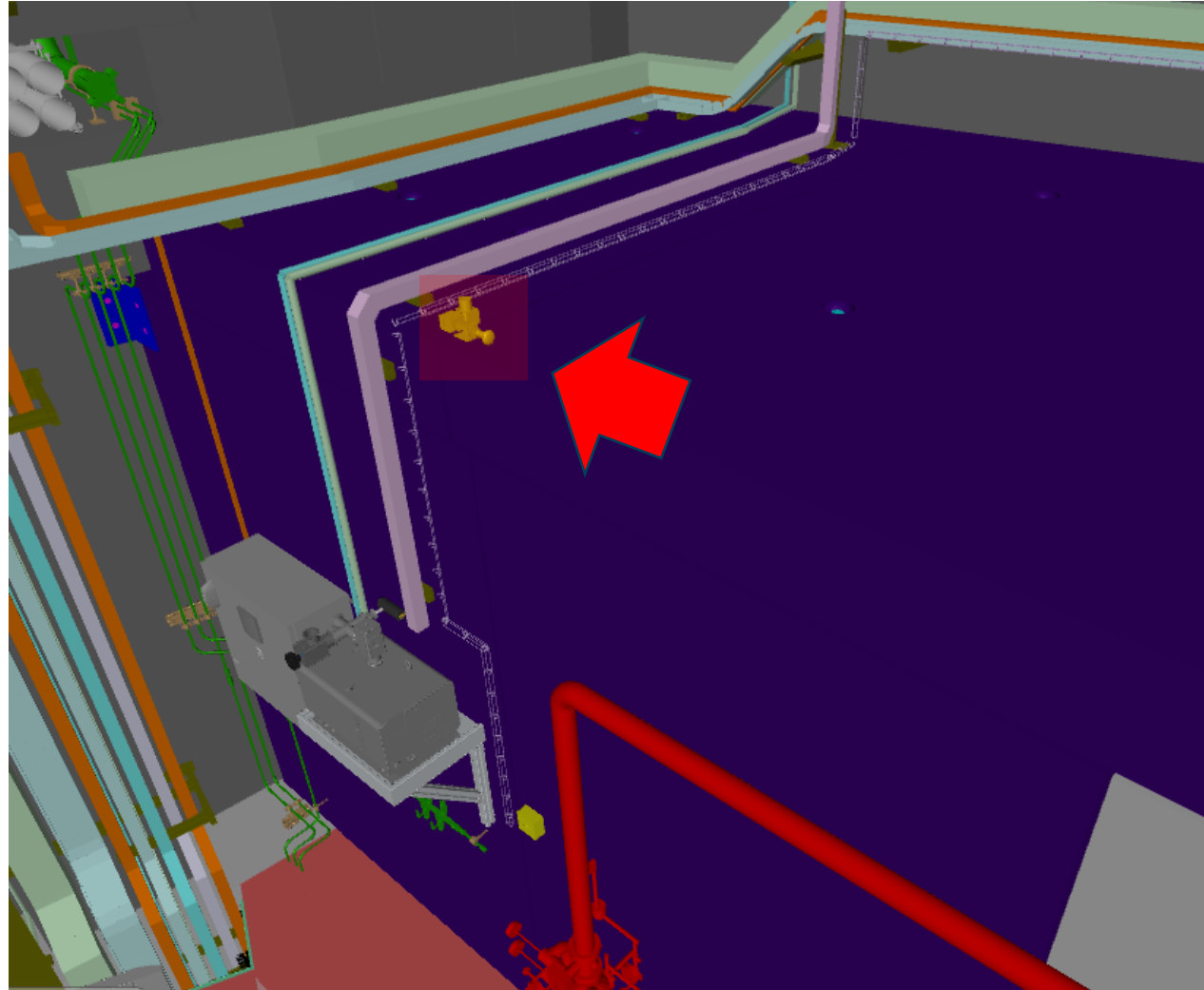




In case of opening the cave roof

- Middle roof block has a keystone to ensure the shielding performance.

Controlled by RP
(AVK)





Area Classification

- Radiation survey shall be used to monitor any activated component (gammas)
- Sample/component highly activated shall be fenced off and minimizing handling time.

Criteria/Area classification	White Non-designated area	Green Supervised Area	Blue Controlled Area	Yellow Controlled Area	Red Controlled Area	Magenta Prohibited Area
Potential annual effective dose	<1 mSv	<6 mSv	>6 mSv	>6 mSv	>6 mSv	-
Ambient equivalent dose rate	Permanent: 100 μ Sv/year Non-permanent: 0.5 μ Sv/h	<3 μ Sv/h	<25 μ Sv/h	<2.5 mSv/h	<100 mSv/h	>100 mSv/h
Operational implementation of ambient equivalent dose rate						
Integrated ambient equivalent dose	Permanent: 100 μ Sv/year Non-permanent: 0.5 μ Sv in one hour	<3 μ Sv in one hour	<25 μ Sv in one hour	<2.5 mSv in one hour	<100 mSv in one hour	N/A
Dose rate (measured every second)	Non-permanent: <2.5 μ Sv/h	<15 μ Sv/h	<125 μ Sv/h	<2.5 mSv/h	<100 mSv/h	N/A
Contam						
Air borne contamination	<0.005 DAC	<0.005 DAC	<2.5 DAC			
Surface contamination	β, γ < 4 Bq/cm ² α <0.4 Bq/cm ²	β, γ < 4 Bq/cm ² α <0.4 Bq/cm ²	β, γ < 40 Bq/cm ² α < 4 Bq/cm ²	β, γ ≤ 100 Bq/cm ² α ≤ 10 Bq/cm ²	β, γ > 100 Bq/cm ² α > 10 Bq/cm ²	
Controls						
Access control	N/A	Access control	Personal dose limits used for access, restricted access,	Personal dose limits used for access, restricted access	Personal dose limits used for access, restricted access	Access Prohibited
Radwork permit	N/A	Required	Required	Required	Required	Required

All workers in Controlled Area shall be categorised as Category B worker or as Category A worker if, after review by the ALARA committee [3], planning predicts that the individual dose limits for Category B could be exceeded.



Category B personnel occupationally exposed to radiation (< 6 mSv/year)

PPD, EPD?



Emergency Monitoring Plan for Ionising Radiation (EMPIR)

- Contact RP (Tel: +46 46 888 35 25), radiationprotection@ess.eu

ESS Emergency Preparedness Plan (English translation) ([ESS-0092951](#))

ESS Handbook for Emergency Response Team ([ESS-0087627](#))

ESS Handbook for Radiation Protection Chapter 2. General Radiation Protection Rules ([ESS-0239718](#))

Training



RP Supervised Areas Certification - Working in Supervised Areas

Certification | ID: 000005791

Expired

Expired on: 01/10/2025

REGISTER

Working in Supervised Areas v1

Certification | ID: 000005482 | V1

Acquired

100%

PRINT CERTIFICATE

Paths

Overview & Other Information

History

Certification path

100% Path Completed

Certification Module

Required (Complete 1 of 1)

0/1

Radiation Protection - Supervised Areas

Pending Registration

Course

VIEW

REGISTER

Overview

The training "Supervised Radiation Area" gives relevant information and instructions for work with ionising radiation in Supervised Areas as ESS. It is mandatory to take this course before commencing work and is not sufficient for work in Controlled radiation area.

Course Content

The course contains the following parts:

Show more

Progress History

Print

01/10/2025 (2:30 UTC)

Expired

26/09/2025 (20:41 UTC)

Acquired

Acquisition date: 31/01/2024
Expiry date: 30/01/2027

SHOW ACQUISITION HISTORY

26/09/2025 (20:41 UTC)

In Progress

26/09/2025 (20:41 UTC)

Assigned

Back

Radiation Protection - Supervised Areas

Course | ID: 00003405

Successful

Completed on: 31/01/2024

EXPORT CERTIFICATE

PRINT CERTIFICATE

Progress and Activities

Overview & Other Information

History

31/01/2024 - 31/01/2024 | English | Blended | Class ID: 000027463

ESS Campus | B01

Total duration: 02:00 Hrs

5 seats available | 0 Waitlist available

Class Instructors: Fredrik Tidholm, David Ferreira

Cancellation policy

Time Limit to Drop

This class cannot be dropped on and after date 29/01/2024

Activities

Radiation Protection Supervised Areas

Instructor(s): Fredrik Tidholm, David Ferreira

Room(s): Rosalind Franklin

31/01/2024 | 13:00-15:00 (CET)

Not evaluated

SESSION DETAILS

SHOW OTHER AVAILABLE CLASSES

Working in Controlled Areas Certification

Certification | ID: 0000006580

In Progress

33%

REGISTER

Radiation Protection Controlled Areas

Course | ID: 0000004480

Successful

Completed on: 01/10/2024

SEE CLASSES TO ENROL

Paths

Overview & Other Information

History

Certification path

33% Path Completed

Certification Module

Required (Complete 3 of 3)

0/3

Working in Supervised Areas - Employee and non Employee -

Acquired

Certification

VIEW

Radiation Protection Controlled Areas

Pending Registration

Course

VIEW

Introduction and Use of Electronic Personal Dosimeter

In Progress

Web-Based

LAUNCH

REGISTER

Overview

The nested certification selected at the time of registration will be assigned to the learner if it's not already assigned.

Assigned By: Thawatchart Chulapakorn (+1)

Assigned on: 01/10/2025

Valid for: 1295 day(s)

Show more

Progress History

Print

02/10/2025 (9:07 UTC)

In Progress

01/10/2025 (2:30 UTC)

Assigned

01/10/2025 (2:30 UTC)

Expired

31/03/2025 (22:57 UTC)

Acquired

Acquisition date: 31/03/2025
Expiry date: 30/03/2028

SHOW ACQUISITION HISTORY

31/03/2025 (22:57 UTC)

In Progress

31/03/2025 (22:57 UTC)

Assigned

Overview

This training addresses the theoretical and practical aspects of working in controlled areas such as rules, radiation protection principles and protection measures.

Course content

The course contains the following parts:

Show More

Other Classes

Available Completed Filters

1 Completed class(es).

01/10/2024 - 01/10/2024

Session Details: 01/10/2024 | 13:00 - 15:00 (CET)

English | Blended | Class ID: 000003925 | Successful

ESS Campus

Total duration: 02:00 Hrs | Check cancellation policy

4 seats available | 0 Waitlist available

Show More

VIEW DETAILS

Can't find a class that works for you? Show Interest

Other Information

Associated Certifications

Working in Controlled Areas Certification

Access to G01 ACC PSS - OPEN MODE

Attachments

Course Attachments (1)

Course Presentation

Controlled Areas + D02

Controlled Radiation Areas Training Acc + D02.pptx

Progress History

Print

01/10/2024 | Successful | VIEW SUMMARY



Thank you!

Contacts:

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samuele.andreucci@ess.eu (installation)