NSS
Shielding and Safety systems
SAR

an introduction to
the system of interest

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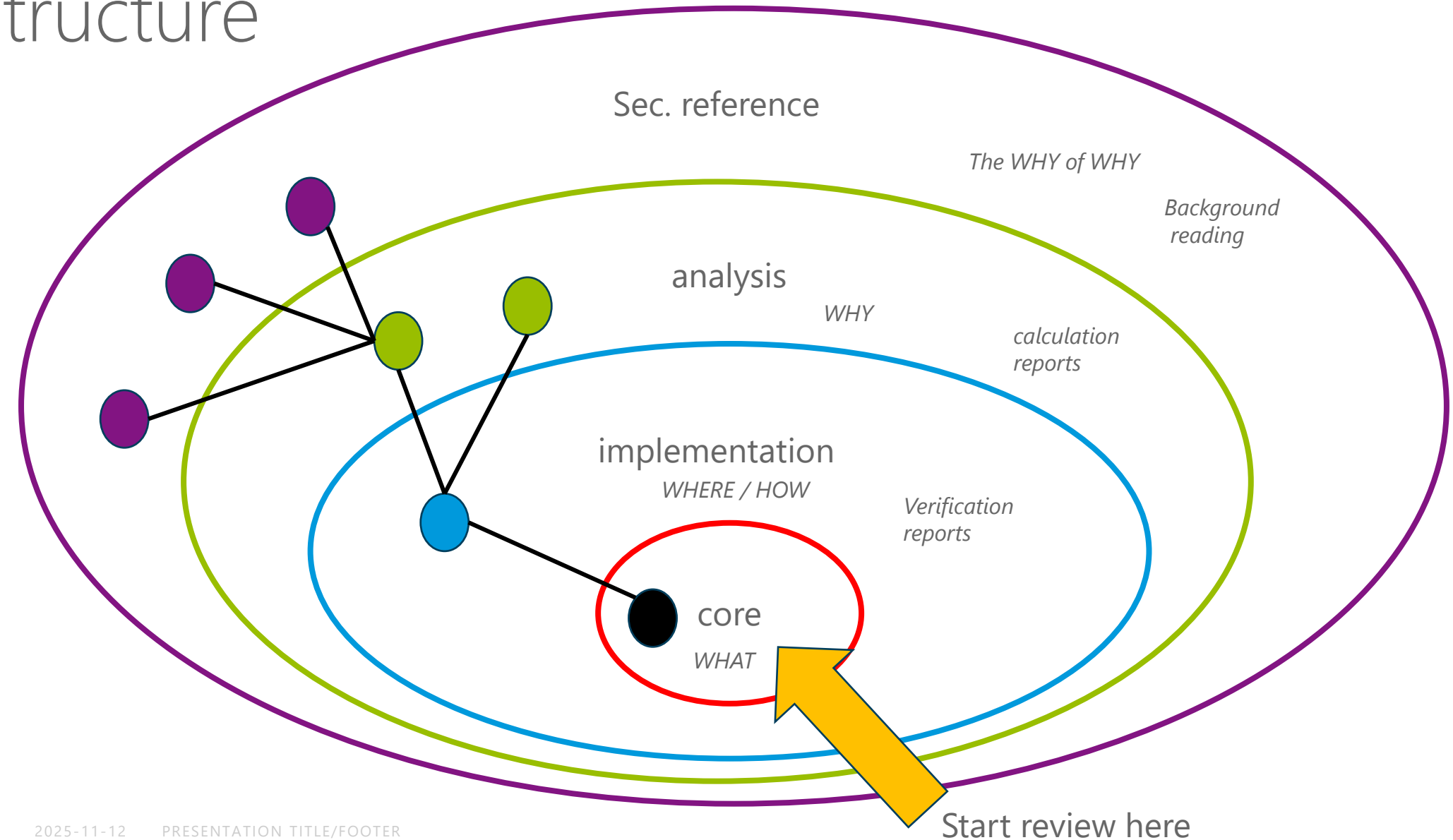
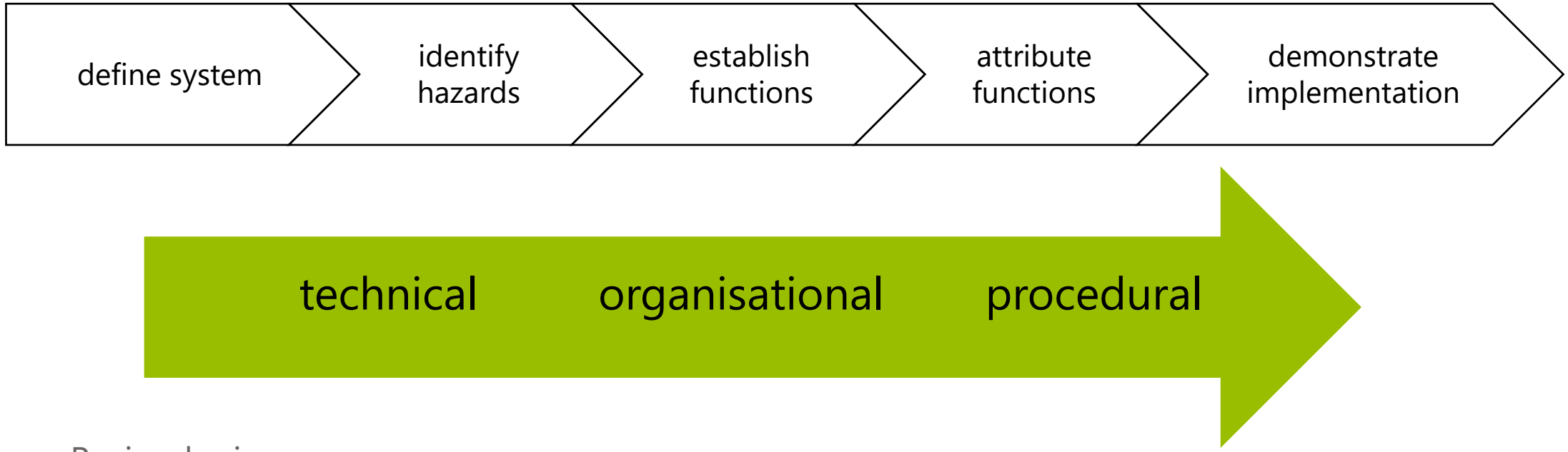
2025-11-12

Documentation structure



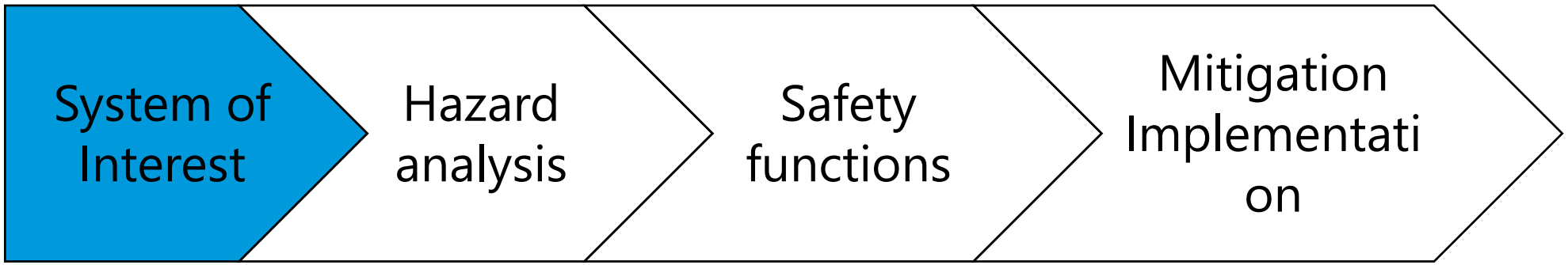
logos

Safety inspired approach



Review logic

System of interest



What is it ?

The Shielding and Safety Systems (S&SS, SaSS) is a system of interest composed of of systems and components which perform safety function relevant to to the neutron source operation.*

- Principally radiation Safety functions
- But also, conventional safety functions associated to the Bunker(s)

An intermediate level system

Level ABOVE	The whole	NSS, Target
This level	Groups & SoI	Shielding & Safety, Instrument suite
Level BELOW	The parts	Bunker, TBS,

It is composed of parts of (but not all) than individual 20 systems delivered by >30 partners

What is it

Though SoI and the function will remain the hardware implementing it will evolve over time as new instruments come on-line and functions are reassigned.

For example

the function of stopping a neutron beam currently assigned to a temporary beamstop while an instrument is under construction

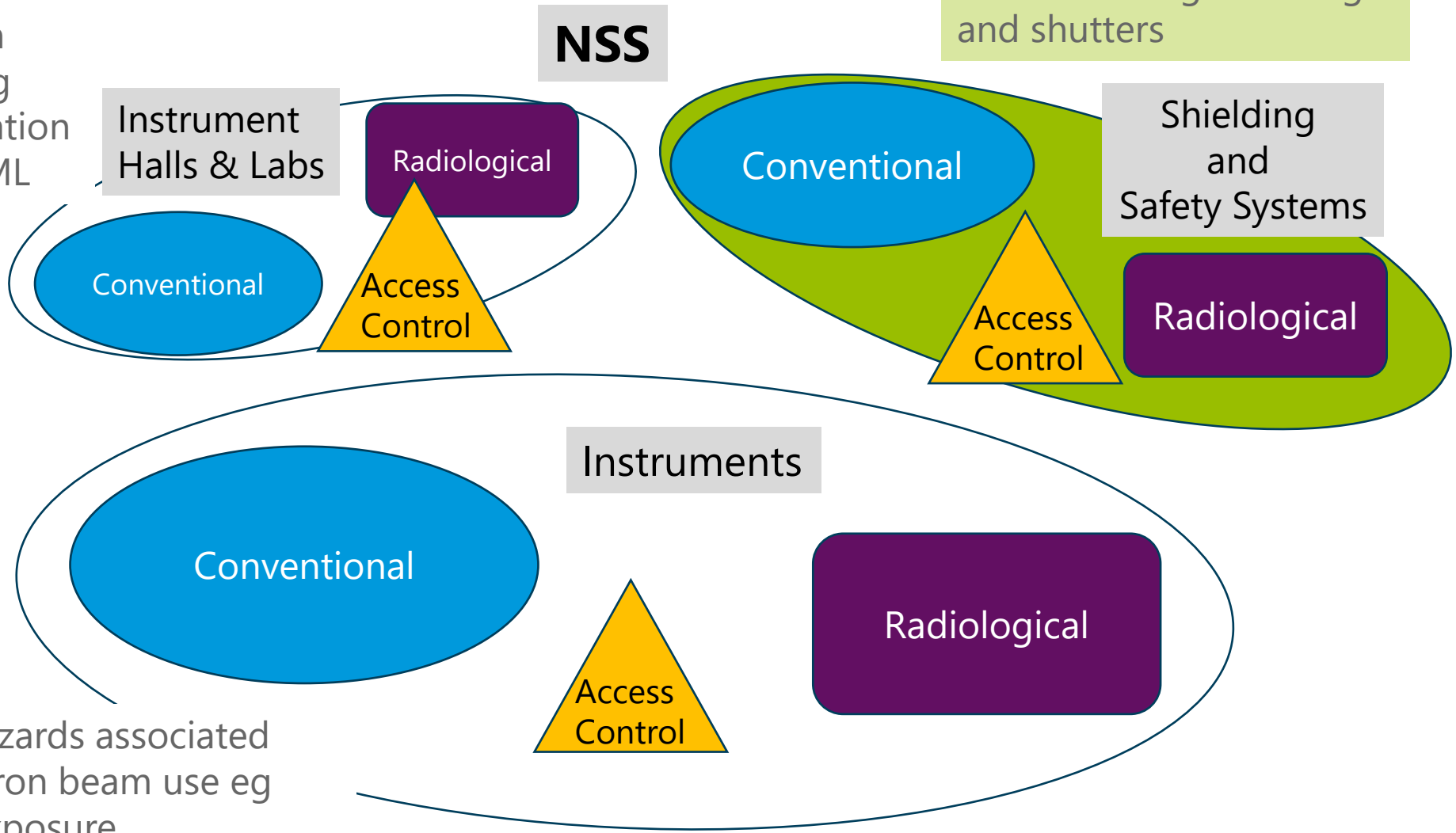
On completion will be fulfilled by the instruments own beamstop.

The system will continue to compliment the instrument suite through the life of the facility

Safety functions in NSS

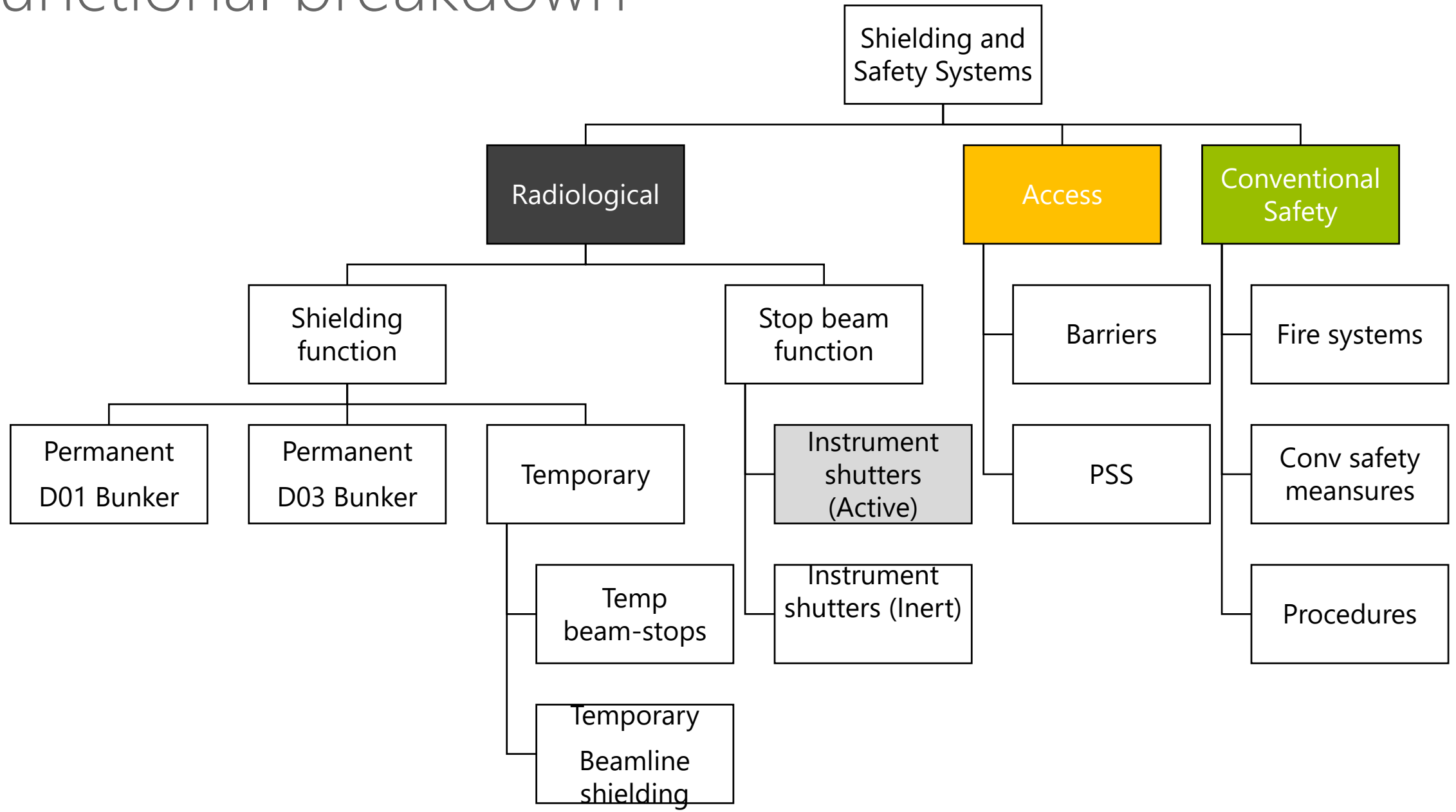
Mainly hazards associated with area hazards eg REM and activation eg samples, RML

Mainly hazards associated with neutron beam extraction and distribution eg shielding and shutters

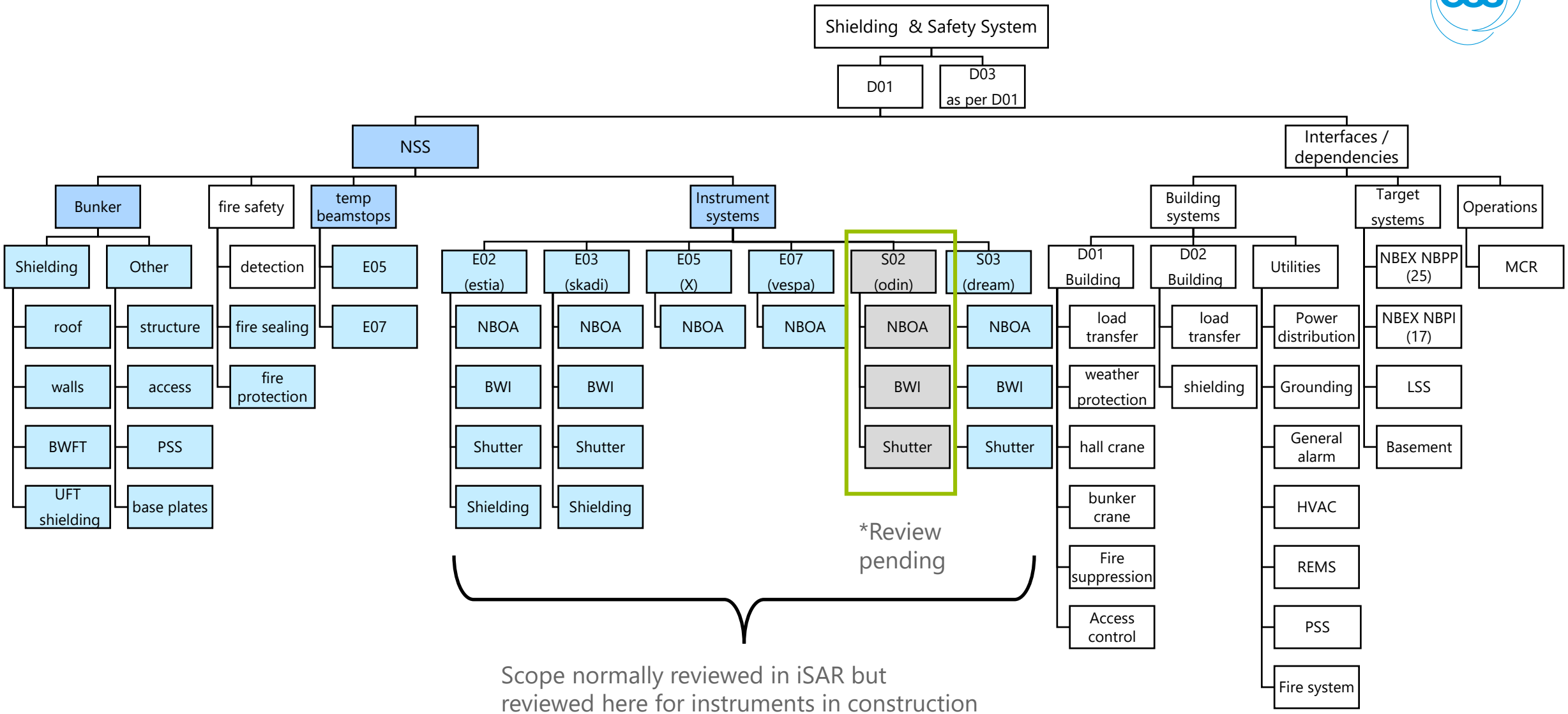


Mainly hazards associated with neutron beam use eg sample exposure

Functional breakdown



hardware break down

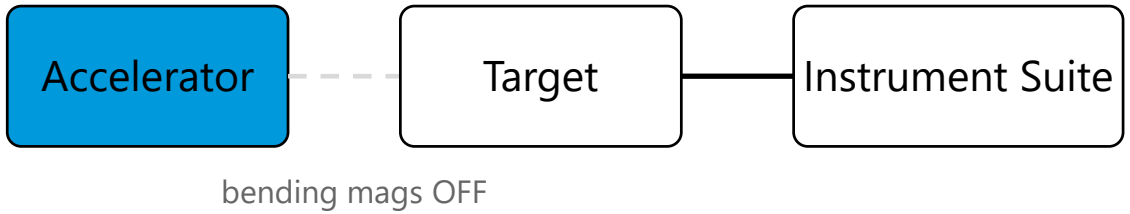


Part of a bigger system

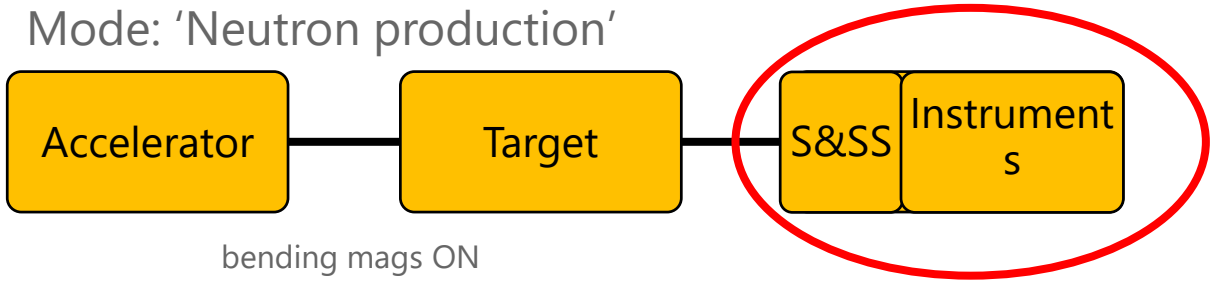
ESS-0038264 ESS beam operational modes

Simplified interaction model

Mode: Accelerator tests (beam to a dump)

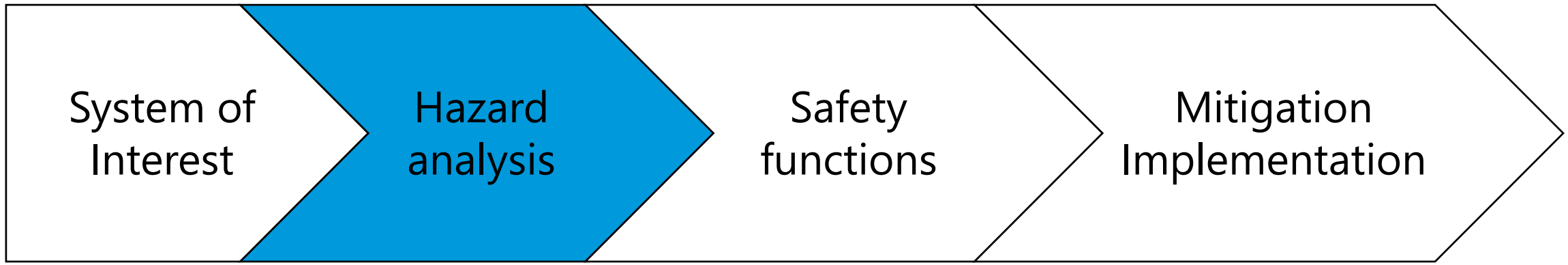


Mode: 'Neutron production'



		Beam Operational Modes				
		Off-line	Accelerator Tests	Target Tests	Pre-production	Production
Accelerator Modes	Maintenance	INTENDED	NOT ALLOWED	NOT ALLOWED	NOT ALLOWED	NOT ALLOWED
	Ion	INTENDED	ALLOWED	ALLOWED	NOT ALLOWED	NOT ALLOWED
	RF	NOT ALLOWED	INTENDED	ALLOWED	NOT ALLOWED	NOT ALLOWED
	Dump	NOT ALLOWED	INTENDED	ALLOWED	NOT ALLOWED	NOT ALLOWED
	Target	NOT ALLOWED	NOT ALLOWED	INTENDED	NOT ALLOWED	NOT ALLOWED
	Pre-production	NOT ALLOWED	NOT ALLOWED	NOT ALLOWED	INTENDED	NOT ALLOWED
	Production	NOT ALLOWED	NOT ALLOWED	NOT ALLOWED	NOT ALLOWED	INTENDED
Target Modes	Maintenance	INTENDED	ALLOWED	NOT ALLOWED	NOT ALLOWED	NOT ALLOWED
	Startup	ALLOWED	INTENDED	NOT ALLOWED	NOT ALLOWED	NOT ALLOWED
	Cooling down	ALLOWED	ALLOWED	NOT ALLOWED	NOT ALLOWED	NOT ALLOWED
	Production	ALLOWED	ALLOWED	INTENDED	INTENDED	INTENDED
Instrument Suite Modes	Maintenance	INTENDED	ALLOWED	NOT ALLOWED	NOT ALLOWED	NOT ALLOWED
	Production	ALLOWED	ALLOWED	INTENDED	INTENDED	INTENDED

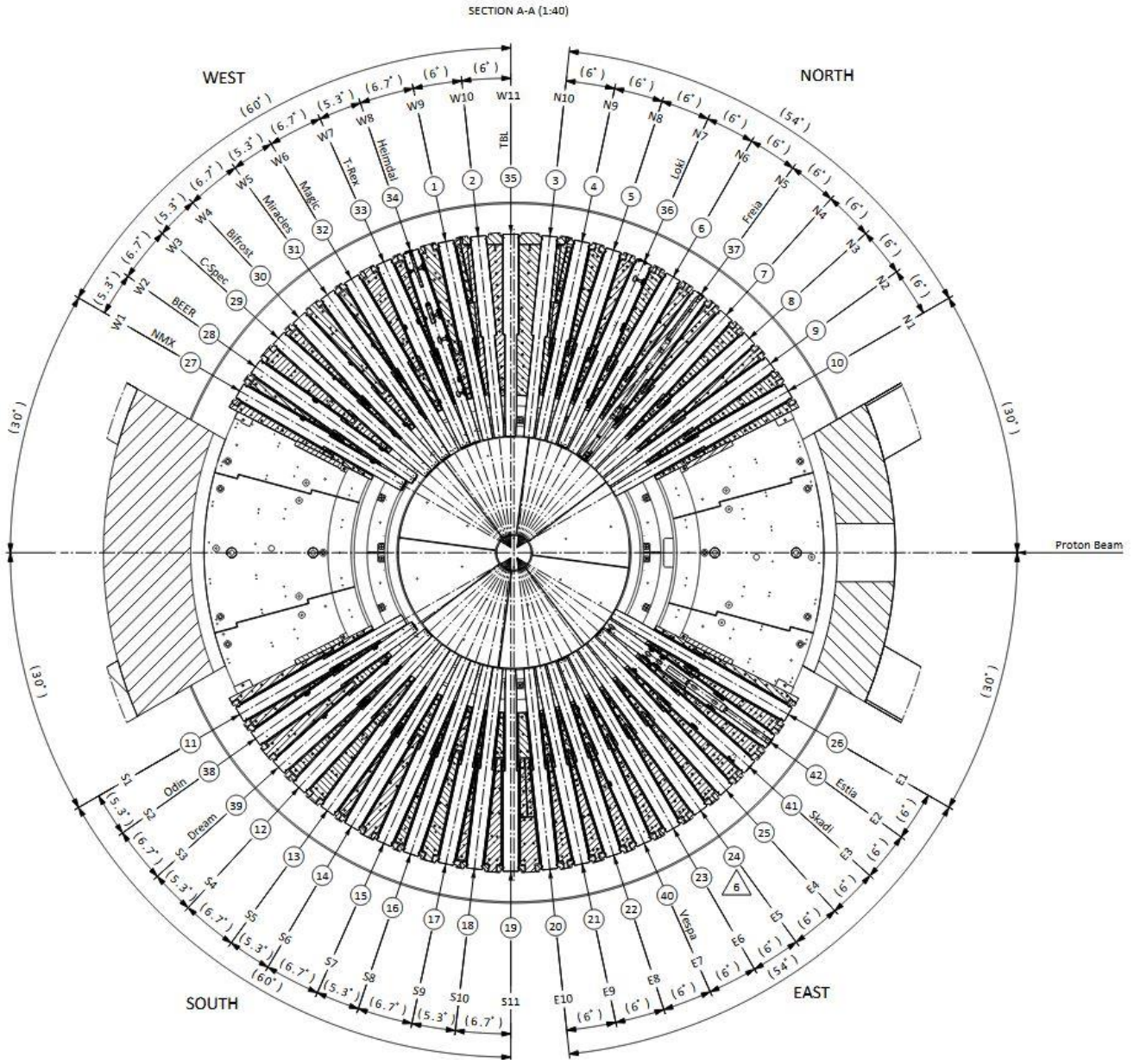
process


System of Interest
Hazard analysis
Safety functions
Mitigation Implementation

all beamports

42 Neutron beams ports

"with great flux comes great responsibility"

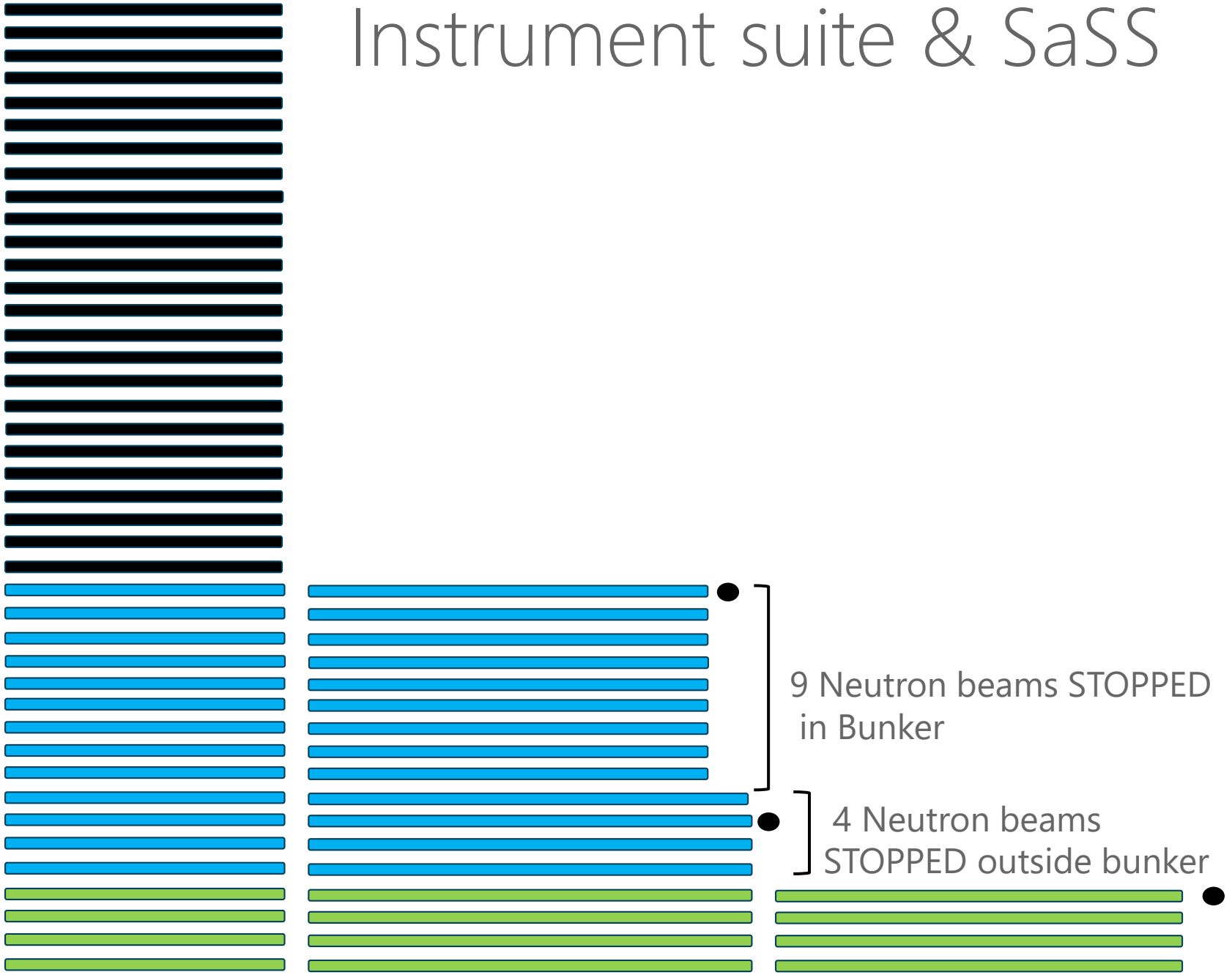


active beamports

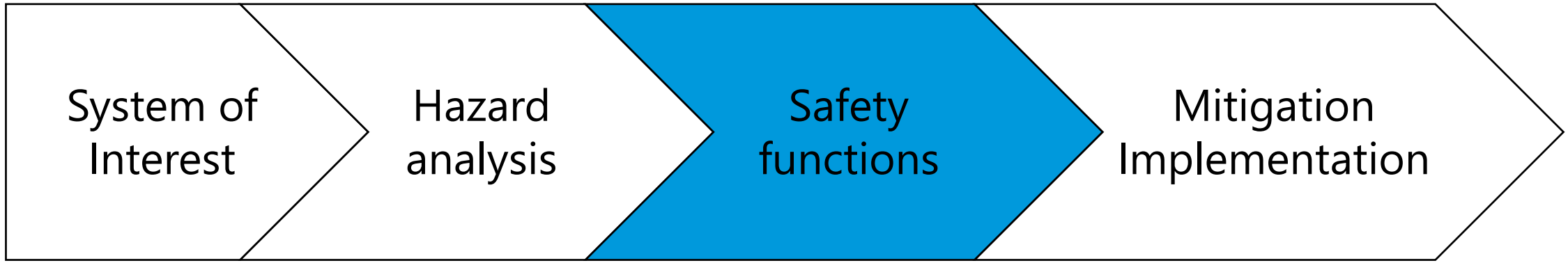
25 Neutron beams
STOPPED within Target by NBPP

17 Neutron beams
DISTRUBUTED to Instruments
through NBPIs

Instrument suite & SaSS



System of interest



Rad Safety Functions

Systems in RS for Public

S&SS SSCs – Functional requirements

- Monolith Shielding:
  - RSF-P-TUB-L1-003_Shield_: Shield monolith sources
  - RSF-R-TUB-L1-012_Shield_: Shield mo
- Bunker Wall/Roof:
  - RSF-P-NSB-L1-001_Shield_: Shielding
  - RSF-P-NSB-L1-002_Shield_: Shield by
- NBPP/NBPI:
  - RSF-P-NSB-L1-024_Shield_: Shield m
- BWI/Collimator/NBOA:
  - RSF-P-NSB-L1-002_Shield_: Shielding
  - RSF-P-NSI-L1-003_Shield_: Shield by

Systems in RS for Workers

S&SS SSCs – Functional requirements

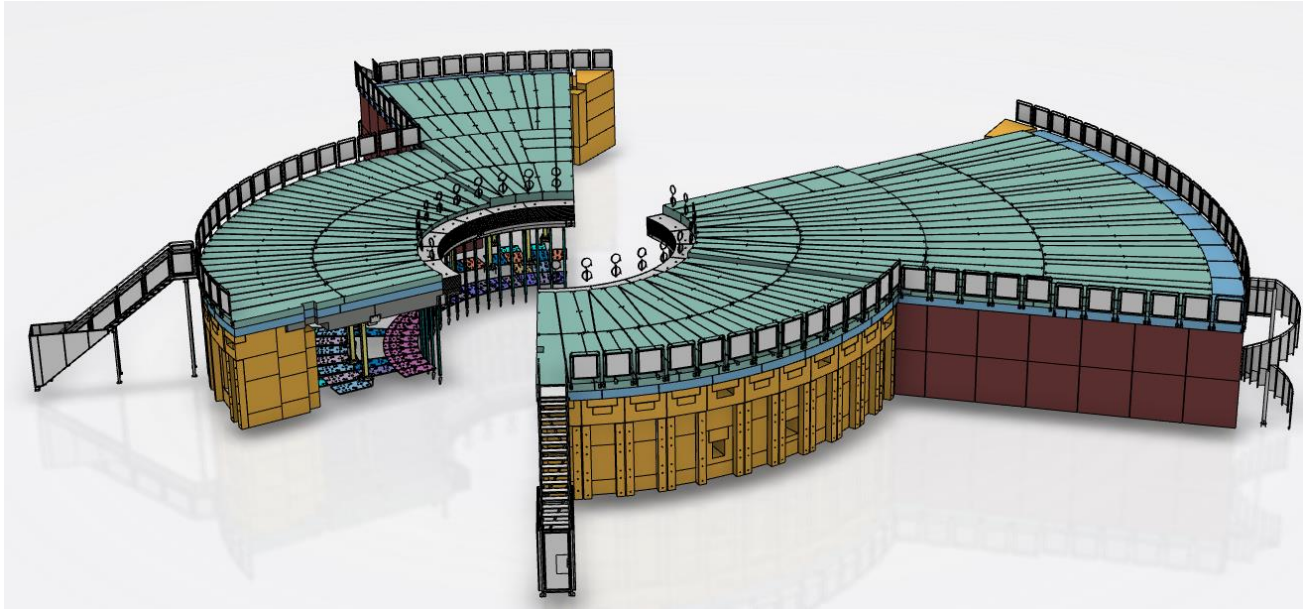
- LSS:
  - WRSF-R-NSB-L1-007_Stop flux_: Stop gamma flux by LSS
- BWI/Collimator/NBOA:
  - WRSF-R-NSB-L1-004_Limit irradiation flux_: Limit number of particles
  - WRSF-R-NSI-L1-007_Limit irradiation flux_ : Stop gamma flux by LSS
- Instrument shutter (active):
  - WRSF-P-NSI-L1-002_Shield_: Shield by movable shielding and manage shielding configuration
- PSS (Bunker):
  - WRSF-R-NSB-L2-020_Stop flux_: Interlock LSS to ensure that gamma flux is stopped
  - WRSF-P-NSB-L2-021_Grant/prevent human presence_: Prevent access to Bunker
  - WRSF-P-NSB-L2-022_Prevent flux_: Interlock accelerator bending magnets

Shielding function

Typical functions

- RSF-P-……Shield_: Shielding of monolith/prompt gamma radiation/scattered radiation
- RSF-P-…._Shield_: Shield by movable shielding and manage shielding configuration

Temp beamstop



Beam line shielding

Shielding function

Typical functions
WRSF-P- …. Shield_: Shield by movable shielding and manage shielding configuration

See rad safety presentation for details

Inert shutter

NBOA & BWI

Typical functions

RSF-P-.....Shield_: Shielding of monolith/prompt gamma radiation/scattered radiation

WRSF-R-....._Limit irradiation flux_: Limit number of particles

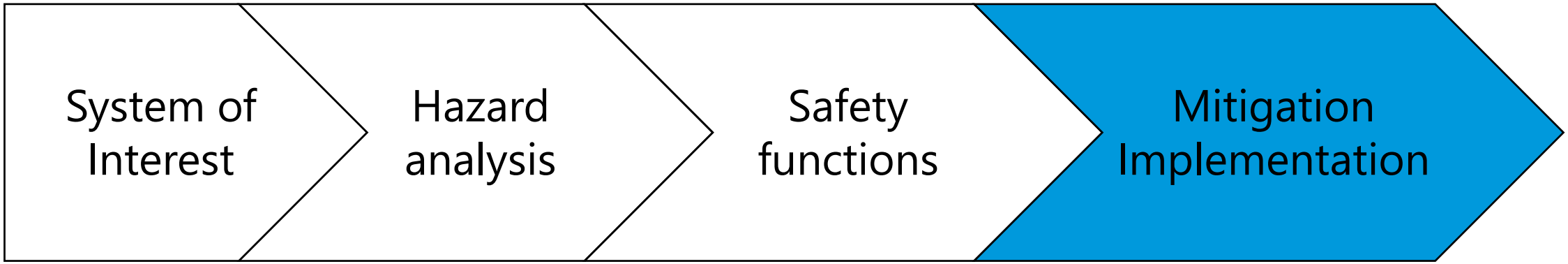
See Rad Safety presentation for details

Access control

Typical functions
WRSF-R-……Stop flux_: Interlock LSS to ensure that gamma flux is stopped
WRSF-P-……Grant/prevent human presence_: Prevent access to Bunker
WRSF-P-……_Prevent flux_: Interlock accelerator bending magnets

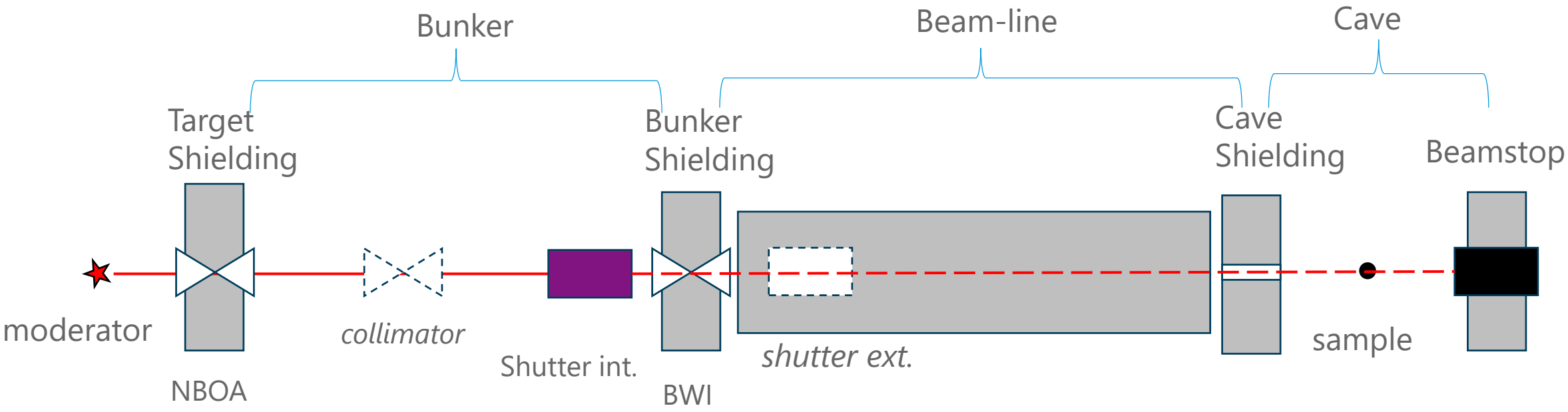
See Rad Safety Presentation

System of interest

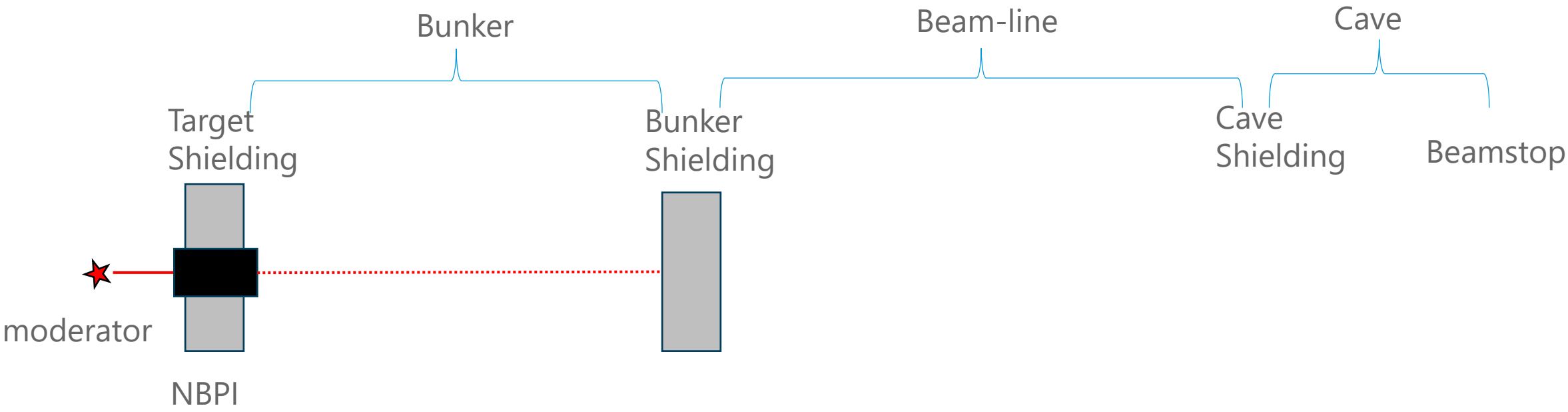


instrument

schematic

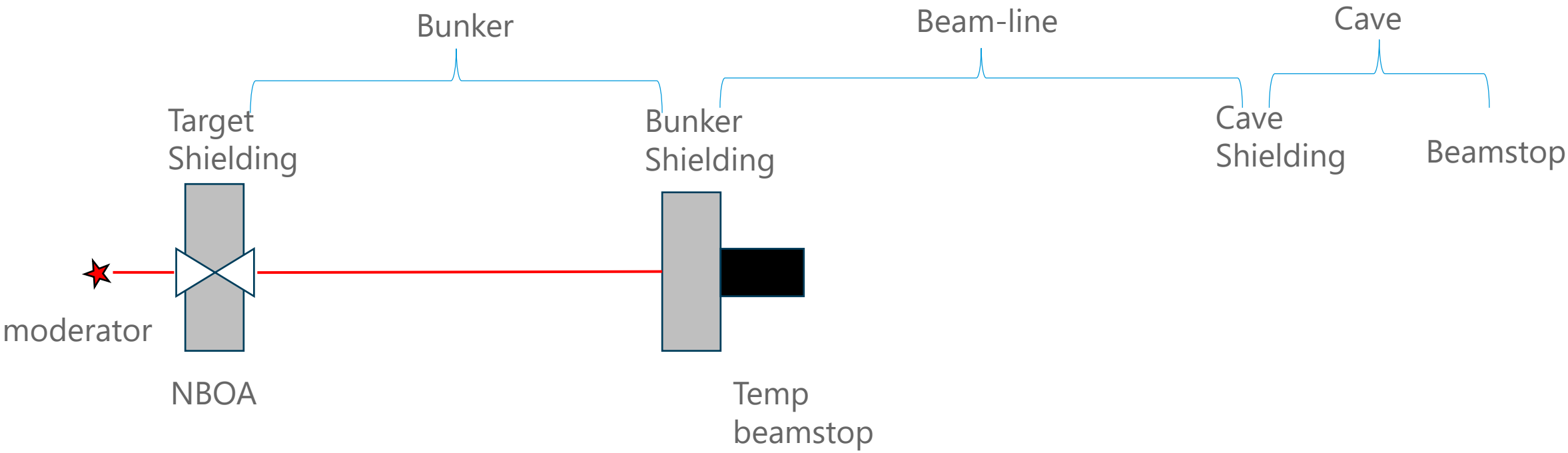


Variant I



Examples
All unused beamports

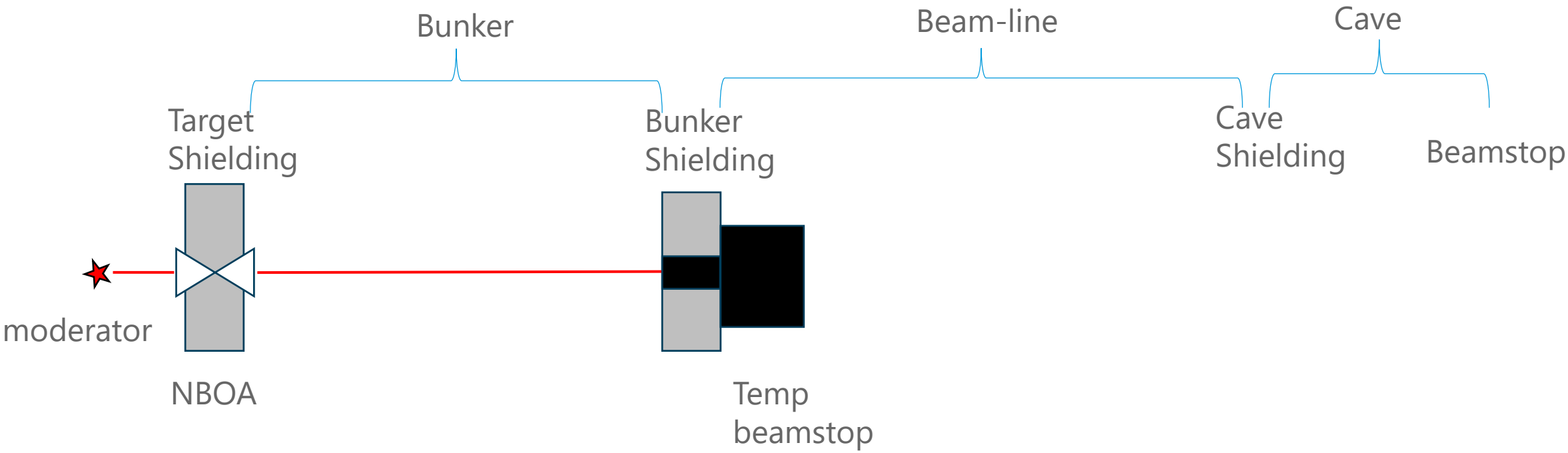
Variant 2



Examples

- E5

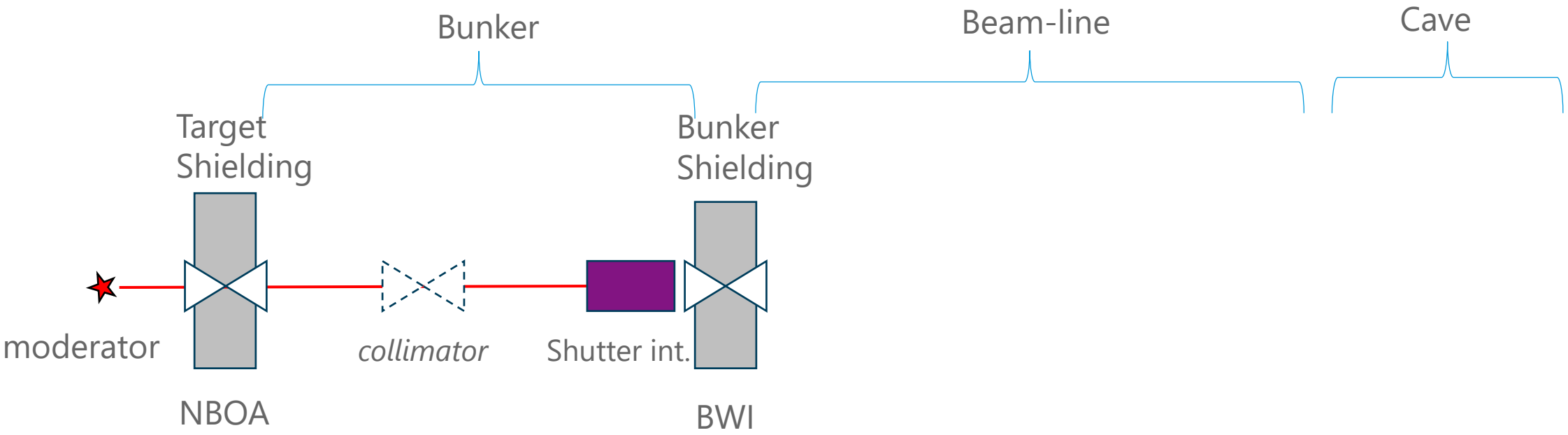
Varient 3



Examples

- MIRACLES
- VESPA

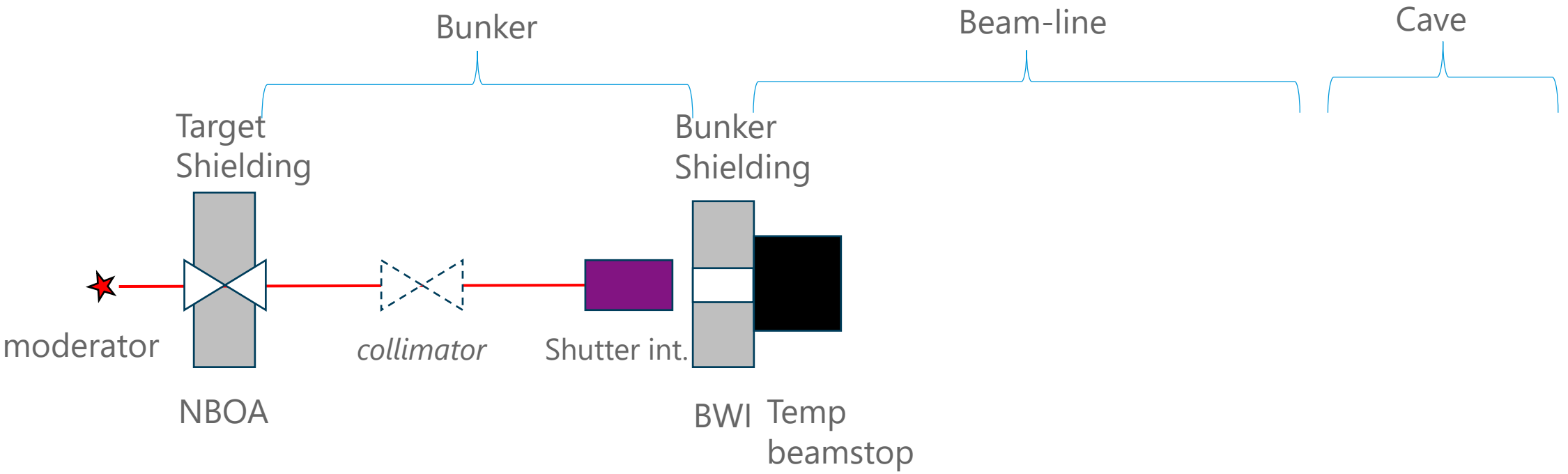
Varient 4



Examples

- FREIA
- SKADI
- TREX
- DREAM

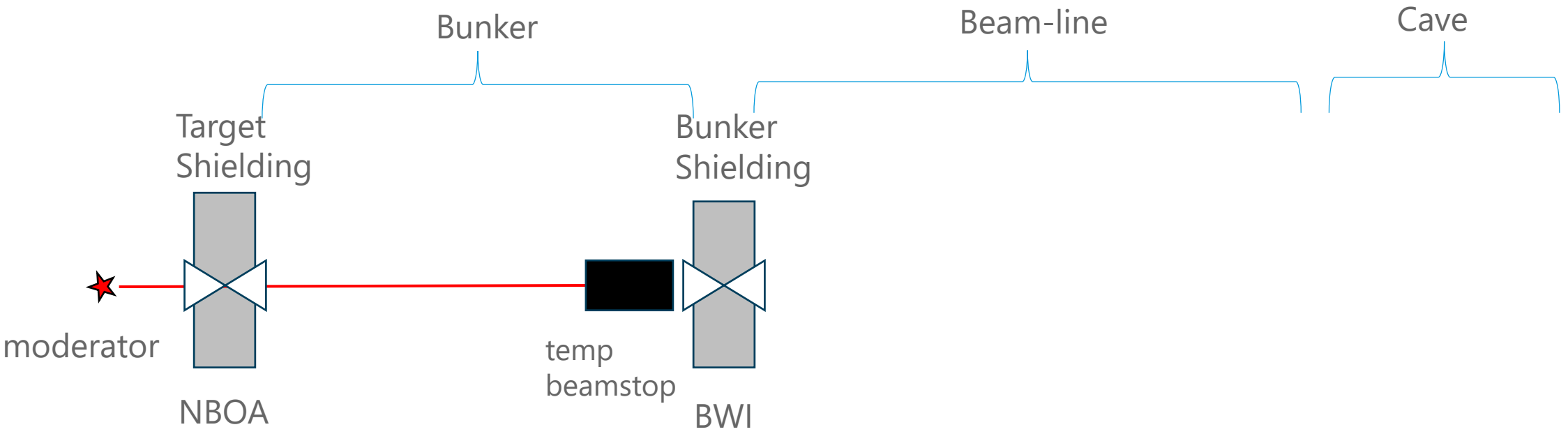
Varient 5



Examples

- MAGIC

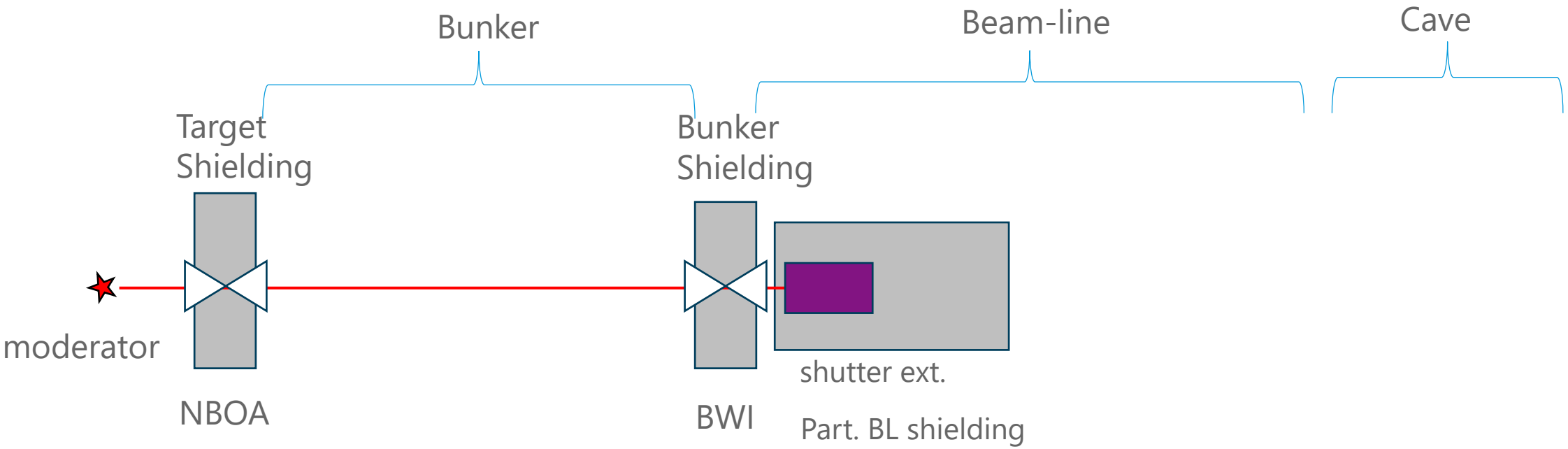
Varient 6



Examples

- HEIMDAL

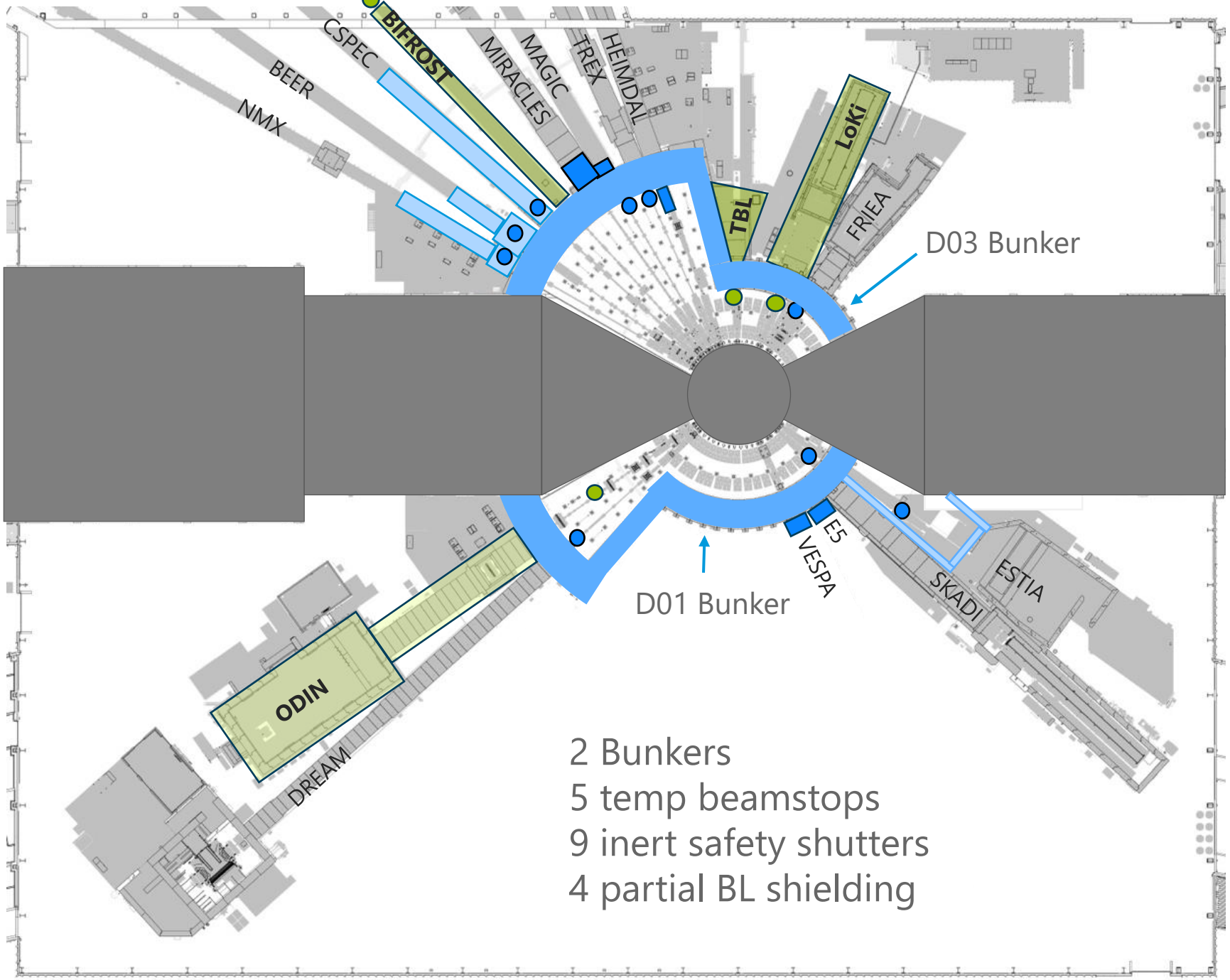
Varient 7



Examples

- NMX
- BEER
- CSPEC
- ESTIA

SSCs for 1st BoT



- Instrument Shutter Active
- Instrument Shutter Inert
- Temp beam stop
- Beamline shielding
- Commissioned instrument
- Instrument in construction

Conventional Safety

Conventional Hazards

Bunker (+beamlines) in operation will comprise 3 work areas

With a full range of conventional and Radiological Hazards

inc Confined Space & Work at heights

Contains (few) flammables

And radiation!

Fire safety system

Finish presentation