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## BEER - System Validation Plan

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## 1. SCOPE

System Validation Plan for the shielding structures and safety shutter of the BEER instrument.

**This document is an early draft which is to be further developed and refined during the Phases 3 and 4 to culminate in a final version for TG5.**

## 2. ISSUING ORGANISATION

Nuclear Physics Institute (NPI).

## 3. CONTEXT

The BEER instrument is the engineering instrument dedicated for the in-situ and in-operando studies in the field of material science under real conditions. The novel technique of the pulse modulation will allow the fast strain scanning of even real shape engineering samples.

The sub TG3.1 phase includes shielding structures and devices that will be validated during the Hot Commissioning phase.

These shielding structures and devices are:

- Experimental Cave Shielding (PBS 13.6.6.5.4)
- Beamline Shielding (PBS 13.6.6.1.8.3)
- Safety Shutter (PBS 13.6.6.1.8.3)

The design of these structures is described in documents [1] and [2].

## 4. VALIDATION STRATEGY AND TESTS

### 4.1. Validation of shielding structures

Validation of shielding structures will be carried out in the initial period, when the power level of the spallation neutron source will be gradually increasing. For example, validation measurements could be performed at the power levels 0,1%, 0,2%, 0,5%, 1%, 2%, 5%, 10%, 20%, 50% a 100% of the nominal power of the source.

## **Test and measurement plan for validation of shielding structures**

Detectors for gamma and thermal neutrons will be deployed at reference points. Thermal neutron detectors shall be selected so that they can detect energies at least in range from 1e-4 eV to 1eV. The position of the reference points will be agreed in advance of the measurement. The reference points will preferably be selected near the gap under the heavy sliding door, near the personal access and close to connection of individual structures (shielding tunnel connection to the experimental cave, chopper pit, shutter pit and to the walls between E02 and D03, shutter pit connection to the outer bunker wall). Fast neutron detectors for energies in range from 10 keV up to the highest measurable level of available detectors will be placed in front of and behind the rear wall of the shutter pit. At the same time, portable detectors will be prepared to measure the dose rates close to joints between the individual shielding blocks and close to other selected critical points.

### **4.1.1. Measurement to test the safety shutter and shutter pit**

- Safety shutter is closed.

The radiation situation inside and around the shutter pit and inside the shielding tunnel behind the shutter pit wall is measured.

### **4.1.2. Measurement to test the chopper pit**

- Safety shutter is open.
- Chopper at 80 m is operated in various operation modes.

The radiation situation around the chopper pit is measured.

### **4.1.3. Measurement to test the shielding tunnel in front of the cave (reinforced part of the tunnel in hall E02)**

- Safety shutter is open.
- Chopper at 80 m is stopped.
- Slit at 152m is closed.
- Other slits are open.

The radiation situation around the reinforced part of the tunnel in hall E02 is measured.

#### **4.1.4. Measurement to test the cave shielding, beamstop and beamline shielding**

- Safety shutter is open.
- Chopper at 80 m is stopped.
- All slits are open.

The radiation situation around the experimental cave is measured.

#### **4.1.5. Measurement to test the cave shielding in operation mode**

- Safety shutter is open.
- Chopper at 80 m is operated.
- All slits are open.
- Large nickel/chrome sample covering the whole thermal neutron beam is in sample position.
- Flask with water or plastic sample is in sample position.

The radiation situation around the experimental cave is measured.

### **4.2. Validation of the safety shutter**

#### **4.2.1. Validation of the safety shutter before connecting to PSS**

The safety shutter moves from the open position to the closed position and it is checked whether the sensor on the shutter has sent an electrical signal.

#### **4.2.2. Validation of the safety shutter after connecting to PSS**

The safety shutter is moved from the open position to the closed position and it is checked whether both doors on the access to the experimental cave are blocked.

## **5. VALIDATION DOCUMENTATION**

Comprehensive testing program for shielding structures.

Protocols on validation of shielding structures.

Comprehensive testing program for shielding structures.

Protocols on validation of shielding structures.

## 6. ANNEXES

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## 7. GLOSSARY

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Term	Definition
NPI	Nuclear Physics Institute
PBS	Product Breakdown Structure
PSS	Personal Safety System

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## 8. REFERENCES

- [1] BEER – Sub-System Design Description – Experimental Cave (ESS-0432351)
- [2] BEER – Sub-System Design Description – Beam Transport (ESS-0432123)

## DOCUMENT REVISION HISTORY

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Revision	Reason for and description of change	Author	Date
1	First issue	R. Svejda	2019-08-22
2	Updated due to new template functionality in CHESS	H Björkman	2016-07-18

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