
Preliminary Design Report - Common Shielding Project

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Review

1. SCOPE

This document describes conceptual standard shielding solutions for the following ESS instruments: CSPEC, BIFROST, MAGIC, HEIMDAL, ODIN, DREAM, T-REX.

2. CONTRIBUTORS

NSS team in collaboration with Instrument teams (CSPEC, BIFROST, MAGIC, HEIMDAL, ODIN, DREAM, VESPA and T-REX)

3. ISSUING ORGANISATION

This document is been created and issued by the Common Shielding Project office, belonging to the NSS division.

4. INTRODUCTION

Following the costings presented and agreed on at the instrument scope-setting meetings, the total cost of shielding across all 15 instruments amounts to about 35 M€ of which about 2/3 was for the shielding of the guides, i.e. between the bunker and the instrument caves.

Since many instruments have rather similar needs for guide shielding, the potential for cost savings through standardisation is thus significant. A preliminary study indicates that the scope for standardisation of cave shielding is more limited, for several reasons:

- *The total cost of caves shielding is only half that of the total cost of guides shielding.*
- *A cave shielding is highly integrated with an instrument operations which individual instrument teams are better equipped to deal with.*
- *The overall amount of engineering effort to produce caves detailed design is deemed not to be significantly reduced by the NSS central project team taking it over.*
- *The installation schedule of several of the caves in the West sector does not allow for the time needed for the centralised cave design to take place, further limiting the scope for standardisation.*

The basis for this project is the collaborative framework between ESS/NSS and participating instrument teams. The aim is to develop a shielding system for beamlines that can be easily reproduced and installed, thus, benefiting from an economy of scale. The project team will incorporate requirements associated with the instruments (case-specific neutronics, access requirements, space claims etc.), including interfacing systems, related to installation, safety, etc.

5. INSTRUMENT SHIELDING DESIGN DESCRIPTION

Instrument shielding was designed in a way that allows easy installation and maintenance.

Another benefit of this design is having a shielding close to the instrument guide, which significantly decrease amount of used material reducing the cost.

In order to use identical shielding blocks as much as possible but also to allow easy and fast installation/maintenance, shielding tunnel is made out of two levels in E02 building and three levels in D01/D03 building. Figure 1

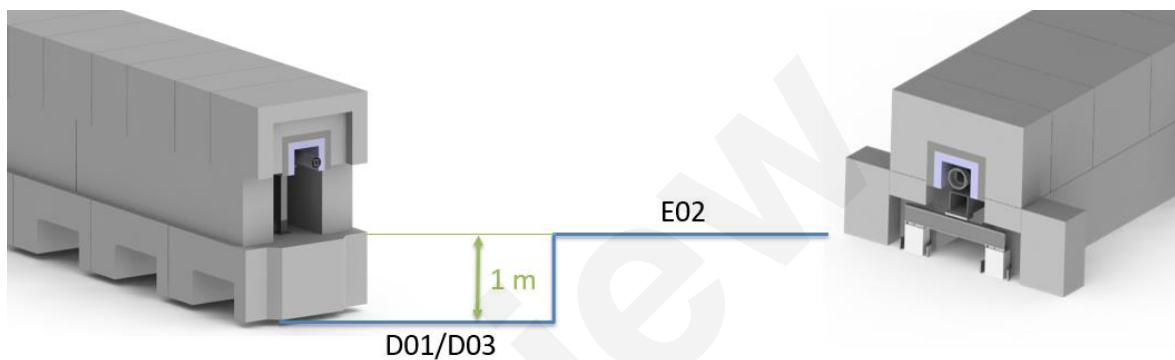


Figure 1 Height difference between D01/D03 and E02 buildings.

Benefit of this is also in load distribution. Lower shielding is static (not removed for maintenance), minimising load removal effect on miss/re/alignment. Figure 2

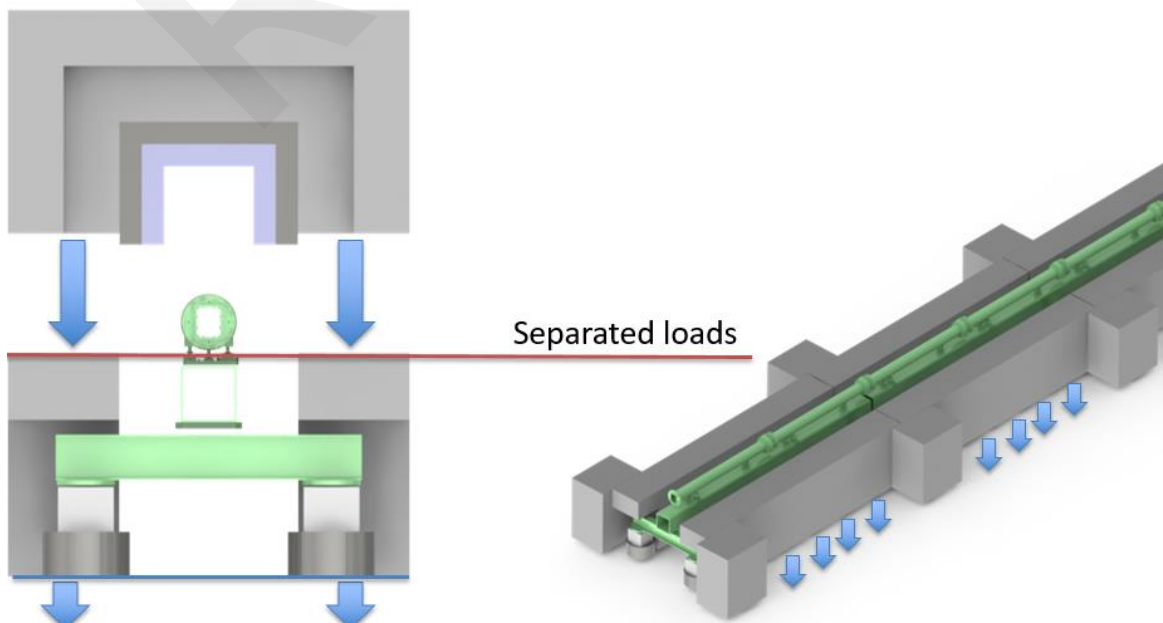


Figure 2 Load distribution

Survey and alignment will be easy to do, since most of the time only ONE lift is required for access to the alignment features. This was done designing the shielding in a way that every 4 meters (in line with piles at E02) there is a “pocket block”, which can be lifted independently.

Neighbouring “extrude blocks” were used also as the guides. Figure 3

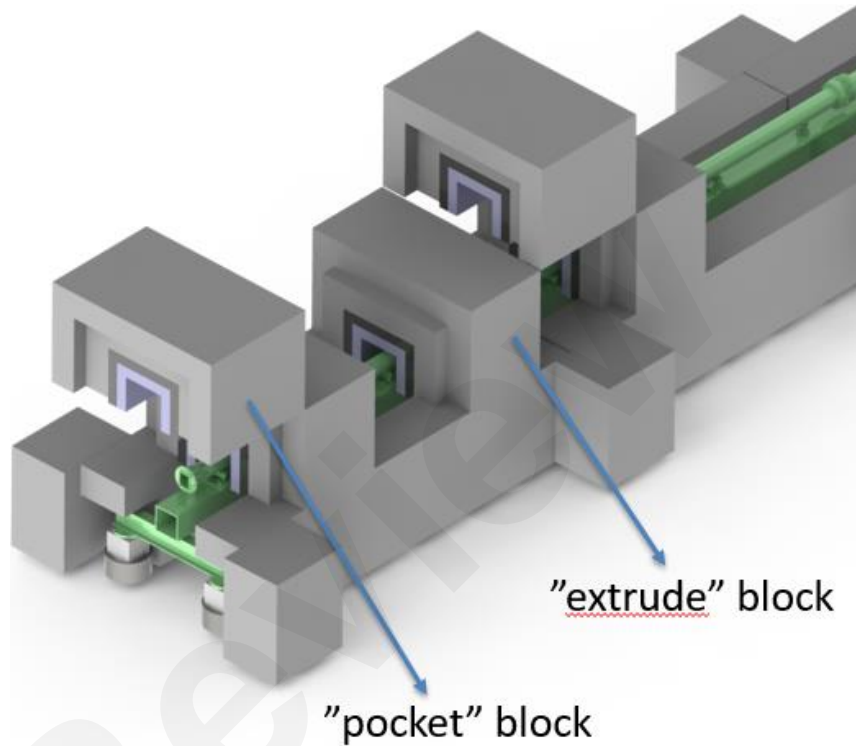


Figure 3 Lifting optimisation

Chopper pits are designed in a way that allow access from the top in two lifts and there is possibility to remove the side walls as well. Figure 4

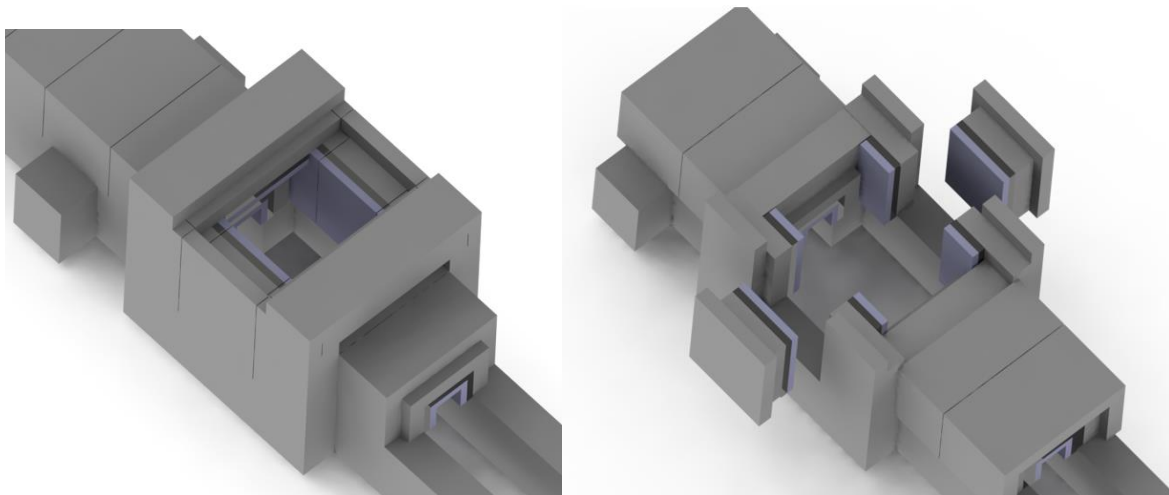


Figure 4 Chopper pit

Feedthroughs for vacuum pipes inside the E02 portion of the shielding are intended to be through the side blocks next to the piles. Current opening inside the side block is 150 x 150 mm. Figure 5 *(to be check and validated with Vacuum group)*

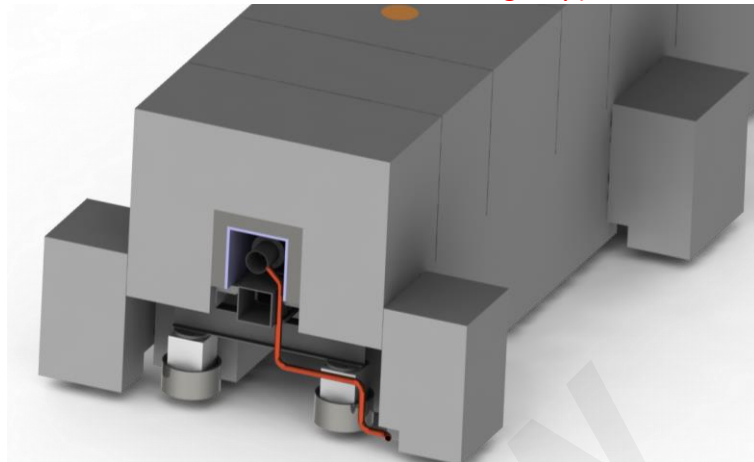


Figure 5 Vacuum pipe feedthrough E02

Inside D01/D03 building, a plastic pipe is cast into support block, as a feedthrough. Figure 6

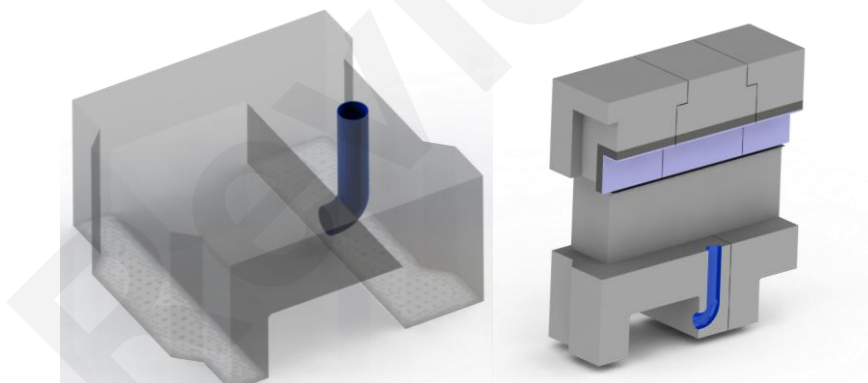


Figure 6 Vacuum pipe feedthrough D01/D03

Feedthroughs for a Chopper pits where done in a similar way as for vacuum pipes but only with bigger opening. At the moment it's 250 x 250 mm which allow to install feedthrough pipe $\varnothing 200$ mm with bending radius 110 deg. *(size to be checked and validated for each chopper with Chopper group).*

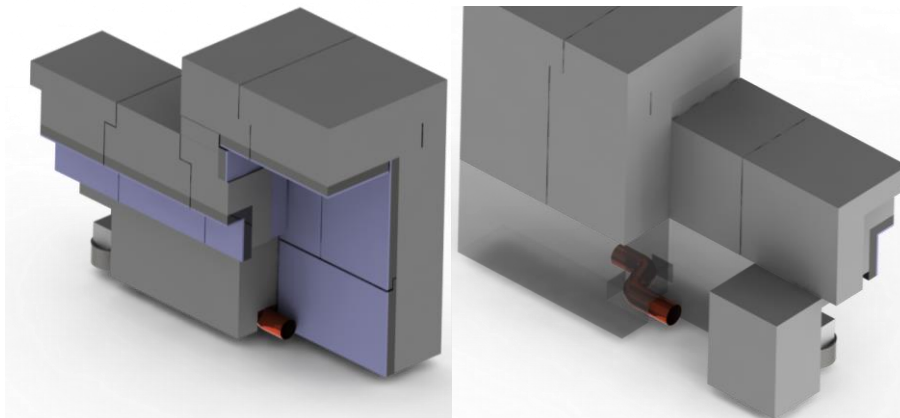


Figure 7 Chopper pit feedthrough

Guide shielding opening is 400 x 400 mm (sufficiency to be validated with all instrument teams) Figure 7

Some instrument will also have bottom shielding plate.

Inside D01/D03 building Figure 8, bottom plate have cut-outs 380 x 500 mm for guide supports (opening to be checked and validated with instrument teams)

Inside E02 building, bottom steel plates are extended up to the support beam. Support beam should be filled with concrete in order to reduce streaming. Figure 10 (to be discussed with instrument teams, design of the guides girder, and what deflection (of the girder) they can tolerate)

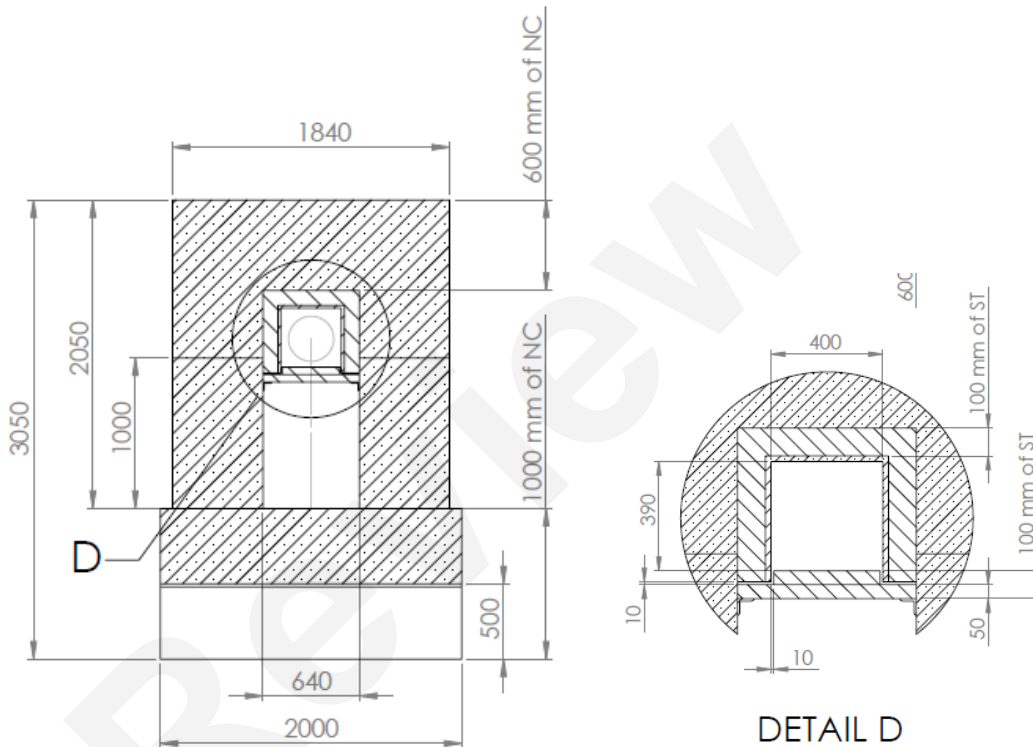


Figure 8 Guide shielding opening D01/D03

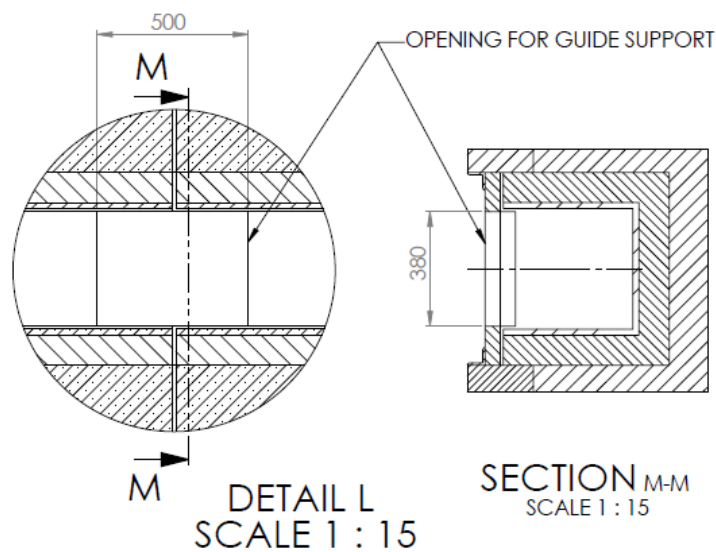


Figure 9 Opening for guide support at D01/D03

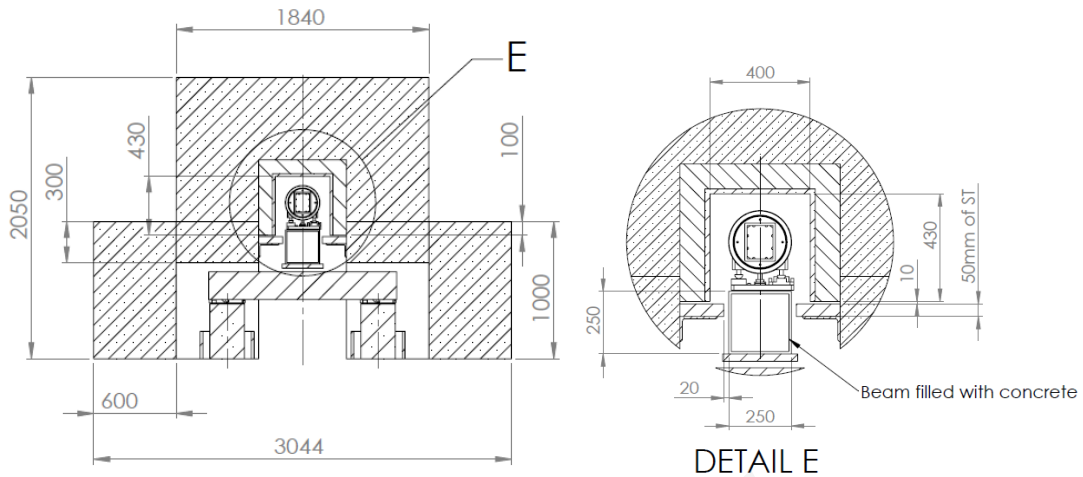


Figure 10 Guide shielding opening E02

Interfaces. In case of long instruments, there are three type of interfaces (with bunker wall, CF wall and instrument cave), while in case of short instruments we have only bunker wall and instrument cave interface.

Bunker wall interface. Our intention is to have customised heavy concrete panels around guide shielding connected to the bunker wall (Figure 11). Additionally, for some instruments, few guide shielding block will be made out of heavy concrete.

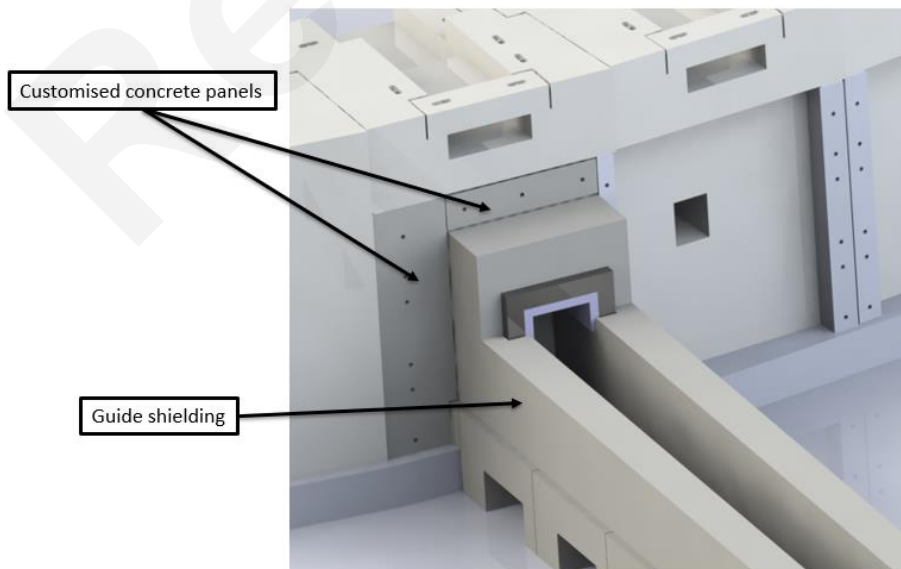


Figure 11 Bunker wall interface

CF Wall interface. Next to the CF Wall between D03 and E02 there is a “hook blind zone”. Hook coverage ends up approximately 1,8 m from both side of the wall. (Figure 12). Considering this limit, guide shielding through and next to the CF wall will be bricked. Driven by that, alignment guide features should be far as possible from the CF wall meaning less lifts during realignment. (to be discussed with instrument teams) Outside the bricked portion of the shielding, we will have two customized blocks. Those blocks we can reach and lift with cantilever spreader bar. Figure 12

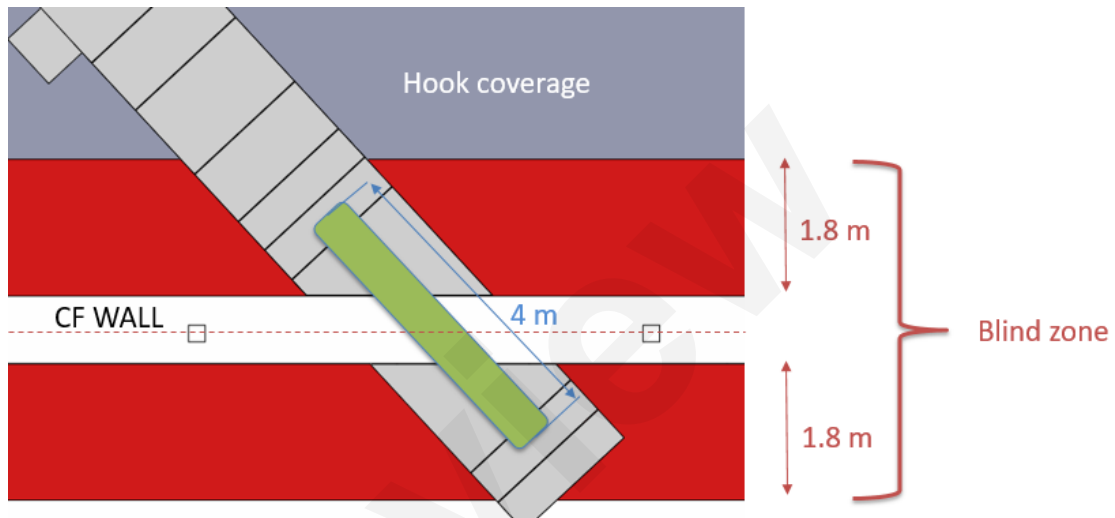


Figure 12 Hook coverage and 4m guide position

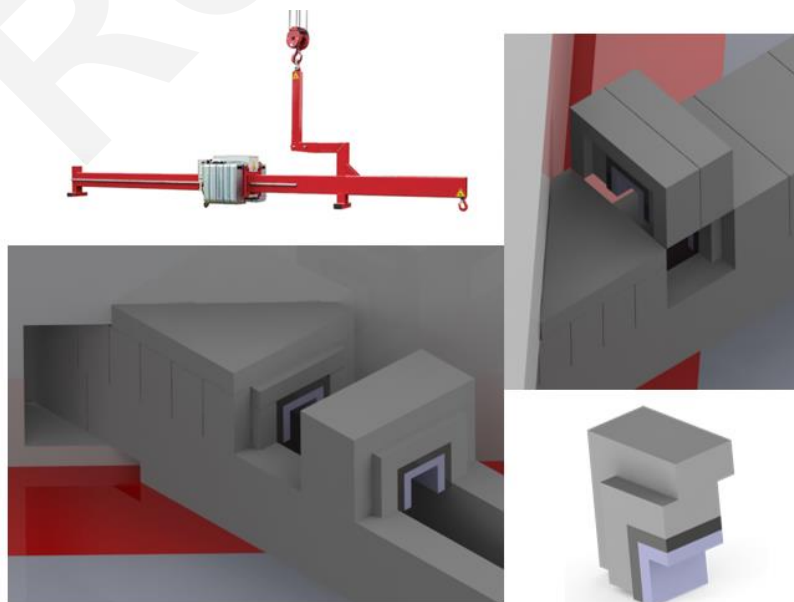


Figure 13 Bricked portion of the shielding and spreader bar

Cave interface to be defined in detailing phase in collaboration with cave designers. General plan is to have simple opening for guide shielding providing necessary chicanes.

6. GLOSSARY

Term	Definition
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7. REFERENCES

- [1] ESS-0510203 Guide Shielding Sketch D01/D03
- [2] ESS-0510213 Guide Shielding Sketch E02
- [3] ESS-0510203 Chopper Pit Sketch

DOCUMENT REVISION HISTORY

Revision	Reason for and description of change	Author	Date
1	First issue	Senad Kudumovic	2019-01-10