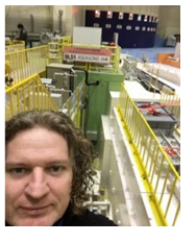
The HEIMDAL Instrument at ESS
Diffraction STAP Meeting October 2024
Update Summary

(1) Heimdal Team update:

We have recruited another new lead engineer Siamak Kianzad to add to the engineer team of Bengt Jönsson Bengt and Kåre Iversen. Siamak is a systems engineer and will be based at ESS and is focused 100% time on Heimdal. Siamak's role will include, overseeing the project management schedule, organizing the TG3 documentation, engineering resources. He will be permanently be based at ESS working full time of Heimdal on a one year contract initially funded by NSS. It is likely we will recruit more engineering support or outsource engineering work in the near future, in order for Heimdal to meet the desired TG5 timeline.

Isabel Llamas
Scientist (IFE)

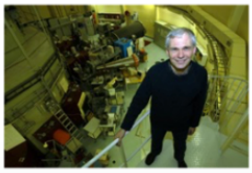


Dan Mannix
Lead Scientist
(ESS/AU)

Siamak Kianzad
Lead Engineer
(ESS/NSS)

Kåre Iversen
Engineer
(AU scope)

Bengt Jönsson
Engineer
(ESS/AU)



Bjørn Hauback
In-kind Partner IFE

sen
In-Kin Partner AU

Autur Glavic
In-kind Partner PSI

(2) Instrument Schedule

Heimdal has this year undergone a new rescheduling review along with other T2&T3 instruments, as the last timeline was seen as being outdated (Fig. 2.1). The new schedule is much more resource loaded and an overview is shown in Fig. 2.2 below..

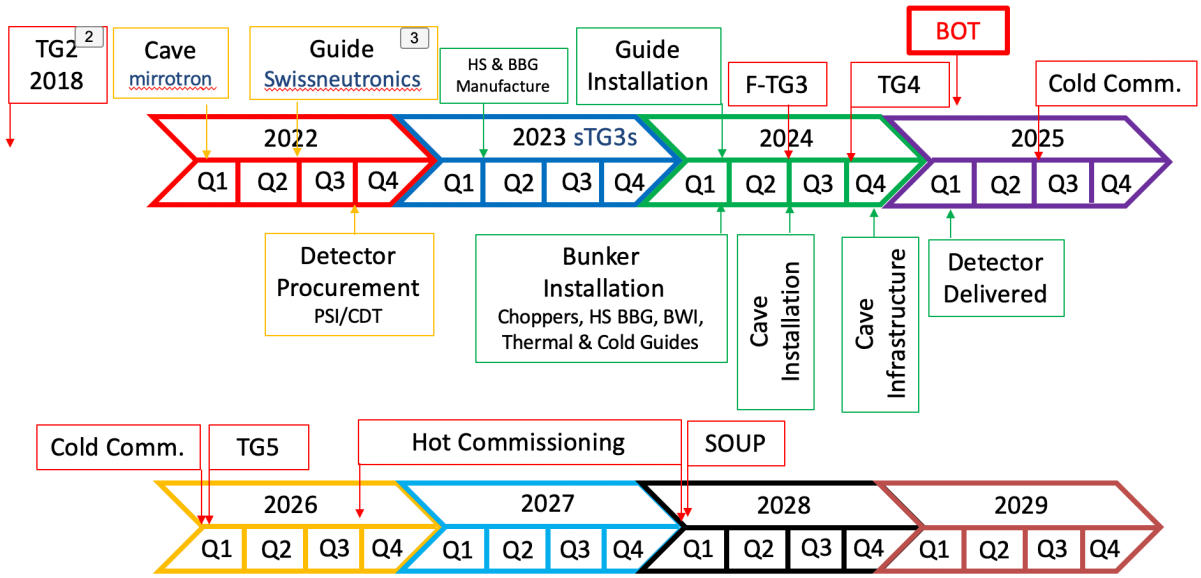


Fig 2.1. The older timeline for the instrument, with major milestones Final TG3 Q2 2024, BOT Q1 2025, TG5 Q1 2025, Hot Commissioning 2027 and SOUP 2028.

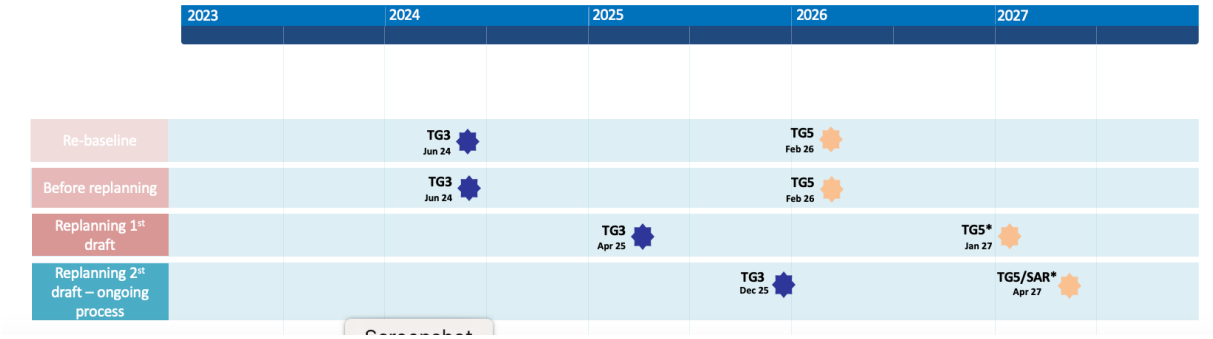


Fig. 2.2 The current (in-progress) schedule for Heimdal. Final TG3 is now estimated to be Q4 2025, BOT is Q4 2025 and TG5 Q3 2027. ESS management would like to push for all instruments finished by end 2027, which is before Steady state operations of ESS. This will require a further injection of engineering resources.

(3) Update on instrument rescoping

Rescope of Diffraction Detector installation:

There is currently a drive and opportunity at ESS to rescope instruments to ensure the ESS is scientifically competitive during initial user operations. The Heimdal instrument was heavily descoped from its original science case of multi-length scale analysis by combining Diffraction, SANS and imaging. It is therefore important for the Heimdal instrument to be able to take advantage of any rescoping opportunities provided by ESS so that the instrument can maximize its science impact from day-1 of user operations. The detector coverage for thermal neutron diffraction was reduced to just 1.0sr as shown in fig. 3.1, which provides only 80° coverage of the scattered beam angles. This fixed detector coverage also reduces the science scope of Heimdal. The price for rescoping the diffraction detectors are accurate, being purchased recently in 2023 for a cost of 1.8M€. A staged rescoping of the neutron diffraction

detectors doubling and tripling the coverage to around 2.0sr and 3.0sr (fig 3.1) is expected to cost an additional 1.8-3.6M€, respectively.

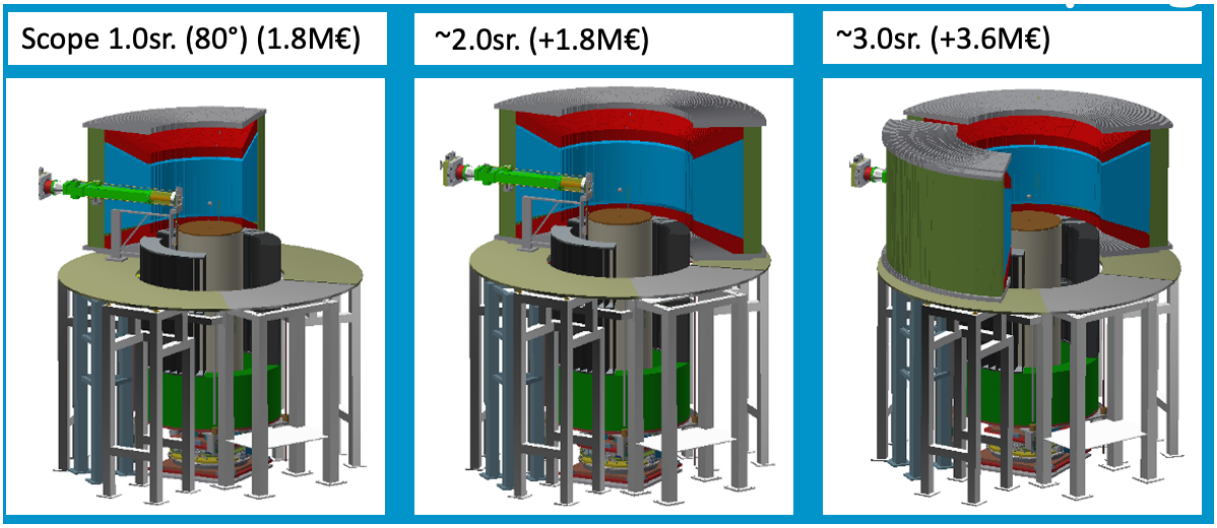


Fig 3.1. (left) The 1.0sr day-1 scope of the Heimdal diffraction detectors limited to a coverage of 80°. (middle) Doubling the detector coverage to provide 160° (~2.0sr) and (right) tripling the detector coverage to ~3.0sr.

Rescope of Heimdal SANS installation.

The Heimdal guide project is contracted to swissneutronics and delivered in-kind by PSI. We have been able to buy 75% of the cold guide within the budget of the project. The remaining guide will be supplied during a future rescoping phase of the instrument. Rescope of the SANS scope is estimated to be around 2.5M€,.

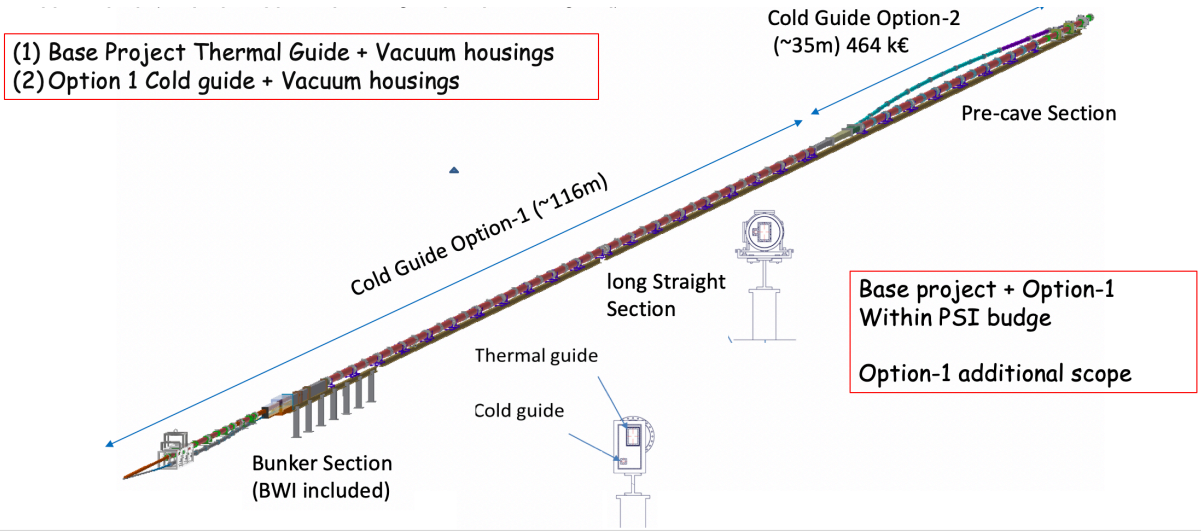


Fig.3.2. The Heimdal guide system is contracted to swissneutronics and delivered in-kind by PSI. The project has been able to buy up to 75% of the cold guide. The final 35m is still remaining for the rescoping phase of the instrument.

(4) Optimisation of the cold guide project including SANS design.
Part of the guide project is the delivery of a coherent design for the thermal and cold guide systems together to ensure the straightforward rescope to include SANS in the future. The SANS section was reoptimised in collaboration with Artur Glavic at PSI. The new design include a straight collimating section up to 10m and uses reflector instead of s-bends in the original design and could produce gains in flux up to 3.5.

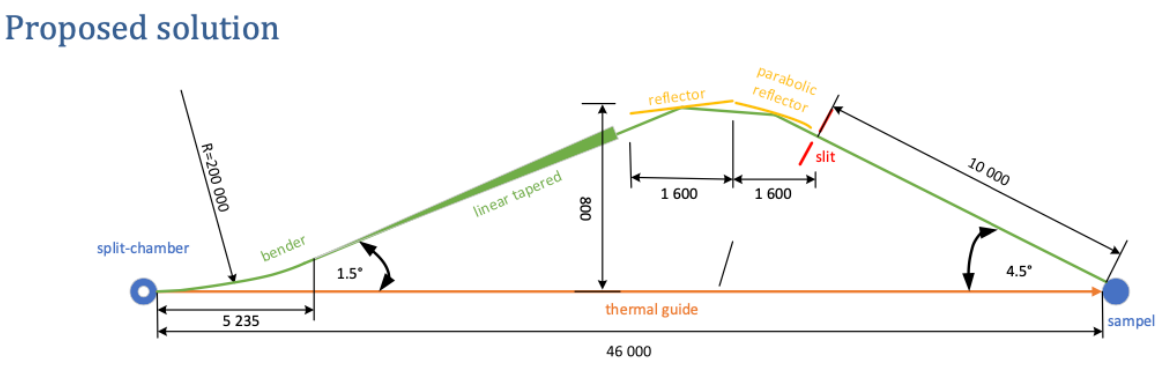


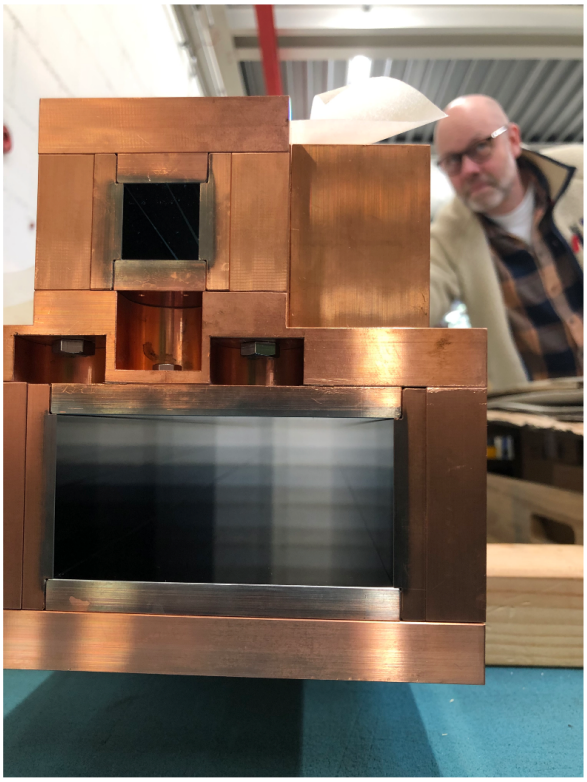
Fig 4.1. A new opimisation of the SANS optics layout.

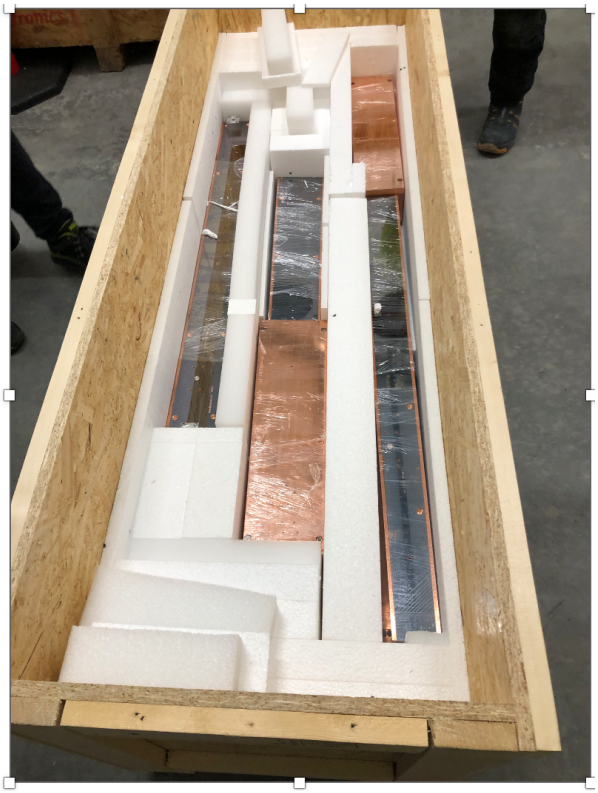
(5) ICEB meetings: The last Heimdal ICEB took place in September 2024.

(6) Instrumentation

6.1 NBOA & Bunker wall insert Devibered and installed.

The NBOA has been manufactured by swissneutronics and was installed at ESS in May 2023. This represents the first installation milestone for Heimdal.

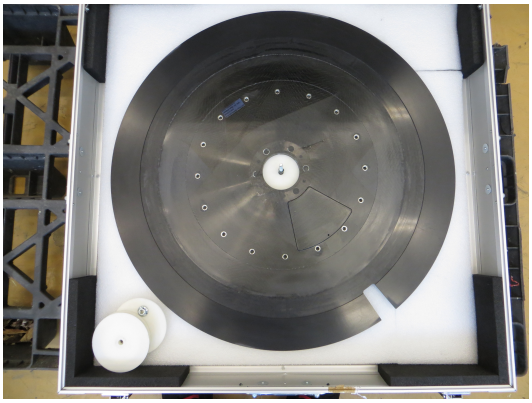




Heimdal Bunker wall Insert installation.

6.2. Choppers

The choppers are being procured via the common chopper project. We have had the detailed design for the chopper systems in March 24, which has been approved. The chopper disks have been manufactured.



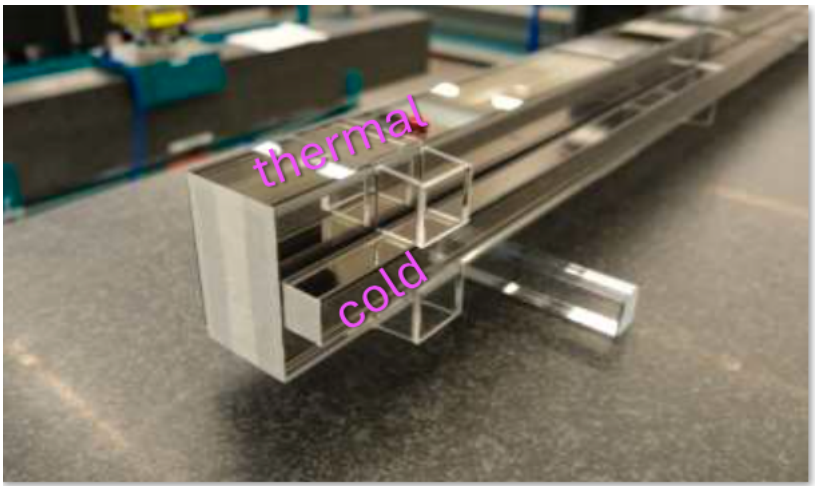
Chopper Disk Heimdal.

The T0 chopper: The T0 chopper based on the prototype developed by Mirrotron is being developed by ESS with some slight modifications. The technical specifications have now been finalised and reviewed. Scope will be transferred to ESS. The T0 Chopper project is currently with-in budget. It is not certain that the T0 will arrive before BOT. If not at piece of vacuum tube will be temporally installed until Bunker access in mid 2026.

6.3 Guides

The guide project continues with swissneutronics and optimisation of the cold guide design work with PSI. The detailed design for the long straight sections 1&2 have been approved so than manufacturing has started. The recent developments are as follows:

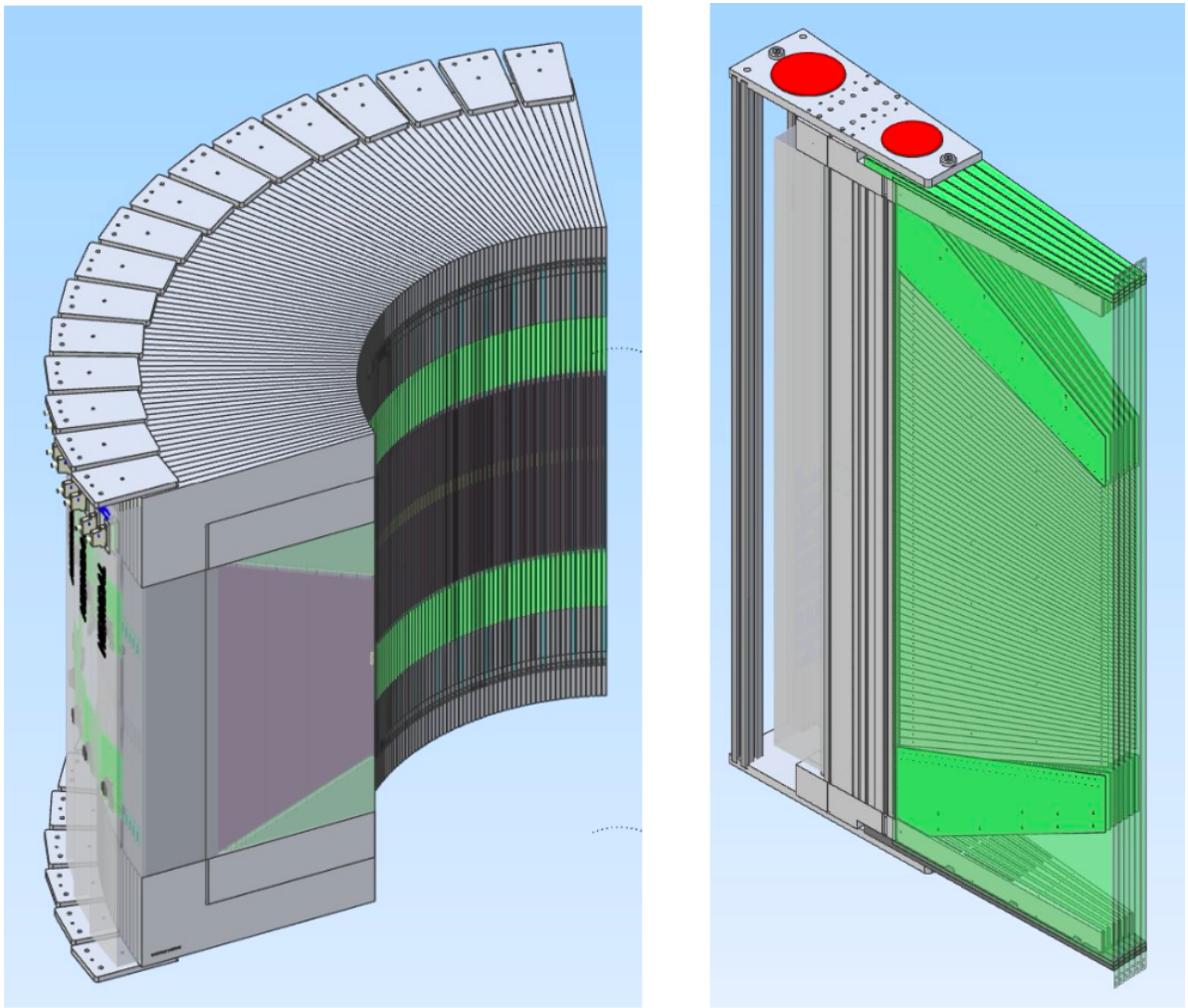
1. In-Bunker : SubTG3 planned 24/10, documentation @ESS for review
2. BWI: Installed installed 24/06
3. Merge Chamber: Detail design ongoing
4. Long Straight 1: FAT documentation for review @ESS
5. Long Straight 2: SubTG3 240322
6. Split Chamber: Detail design ongoing



Heimdal Thermal and Cold neutron guides manufactured for the long straight section by swissneutronics.

6.4 Detector:

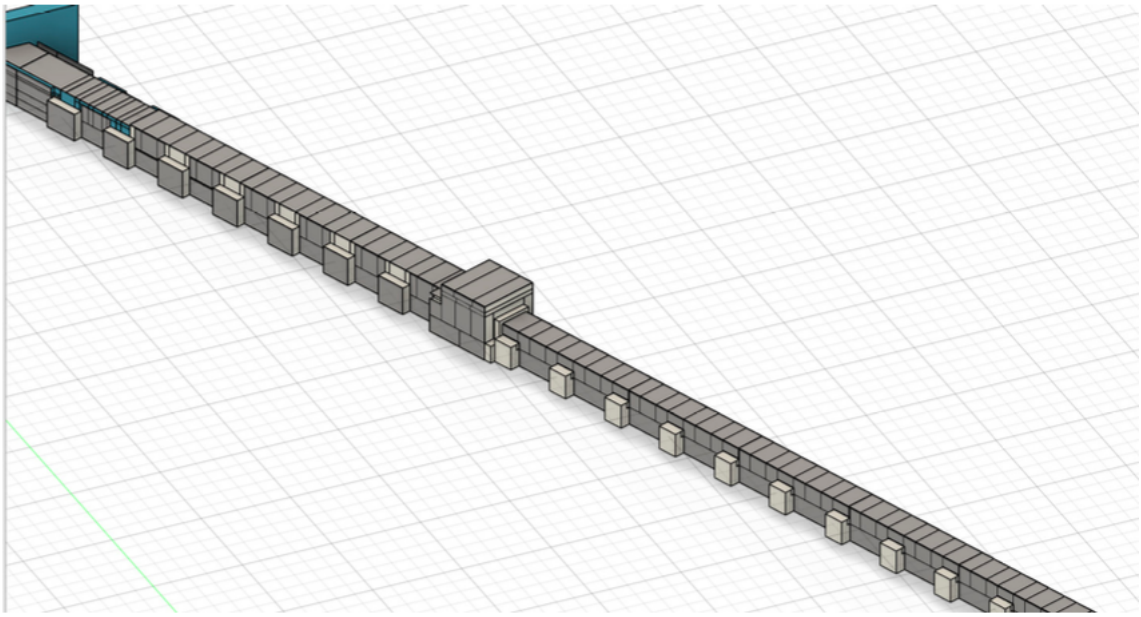
The 2D project was awarded to CDT, like Dream and Magic. The offer from CDT falls within budget and scope of the technical specification of 1.0sr or around 80-degree coverage. The 2D detector is proceeding towards detailed design and is expected to be delivered in mid-2026.



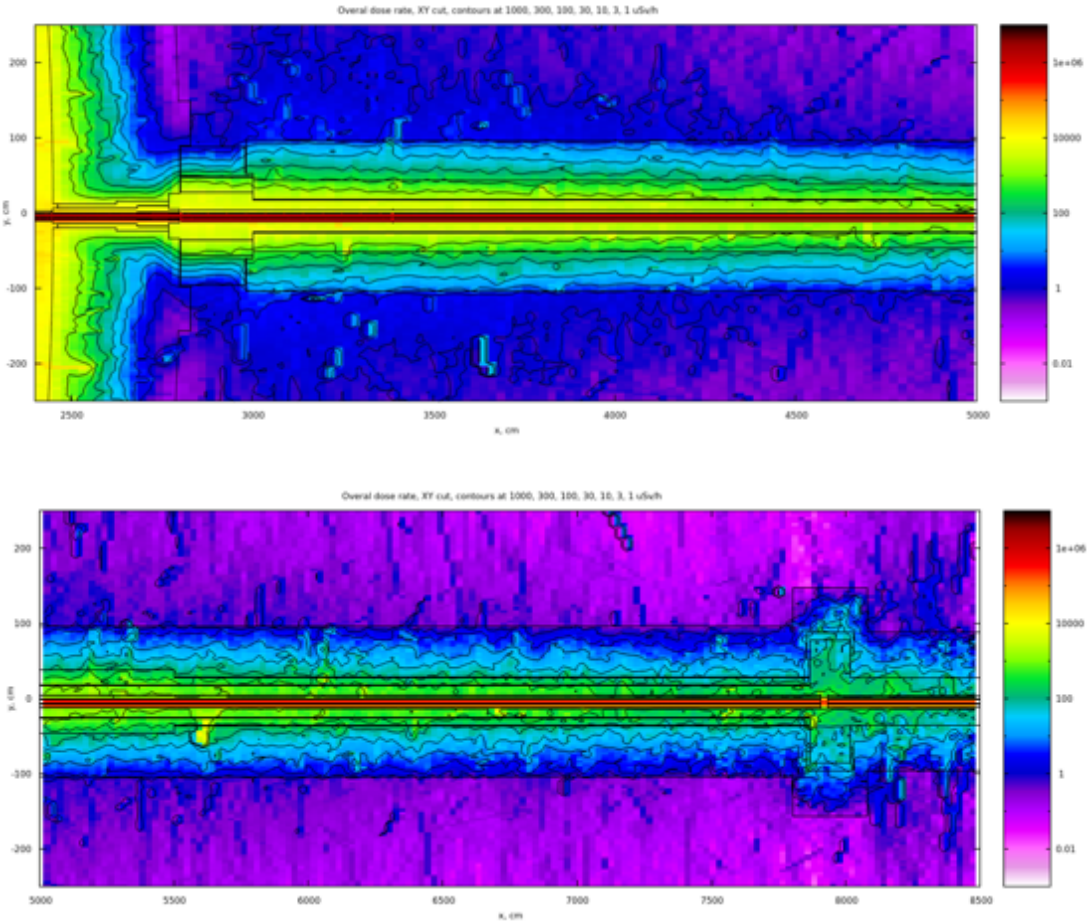
The Heimdal 2D detector design from CDT.

6.5 Guide Shielding

The guide shielding will be provided by the common guide shielding project. The last round of the tender for the guide shielding was awarded to Mirrotron, who will also fabricate the Heimdal cave shielding.



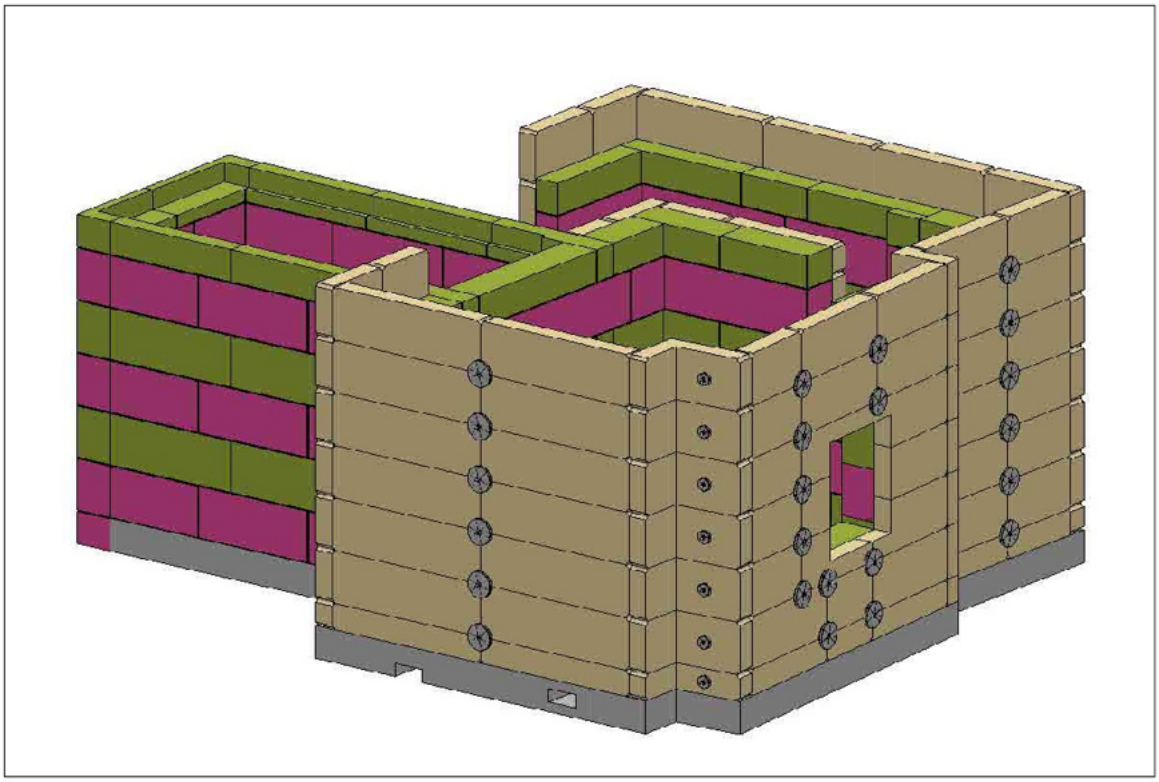
Heimdal Guide Shielding design



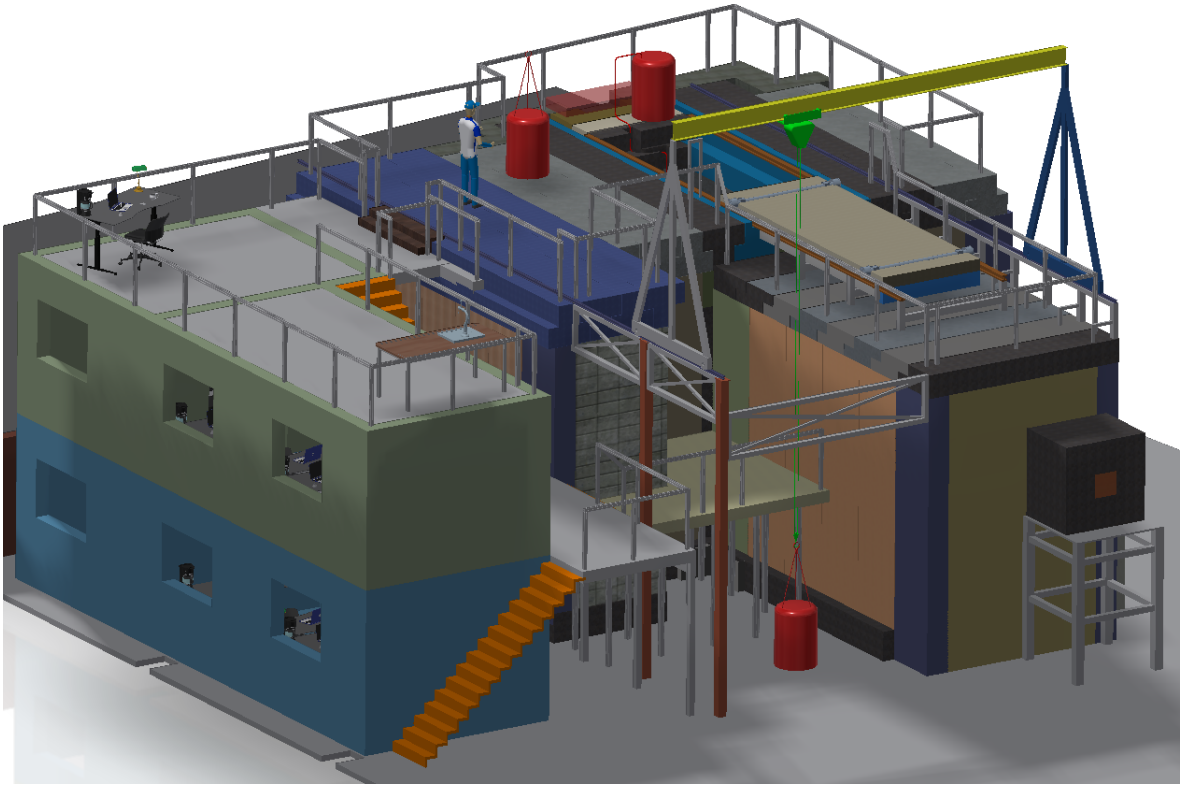
Heimdal Guide shielding calculations for Heimdal guides.

6.6 Cave Shielding:

The Call for Tender for the cave was awarded to Mirrotron with a bid including cave shielding and beamstop which was within budget. Due to quality issues in the Odin cave project delivered by Mirrotron, ESS advised us to look into a new design solution using smaller lego-type concrete blocks, that can be reused later by ESS. We visited Mirrotron this year to try to improve the communication and spped of development of the cave project. This seems to have improved and we are now close to a new preliminary design review.



Heimdal Cave shielding new design using small lego block concept. with walls of 40-90cm thick concrete.

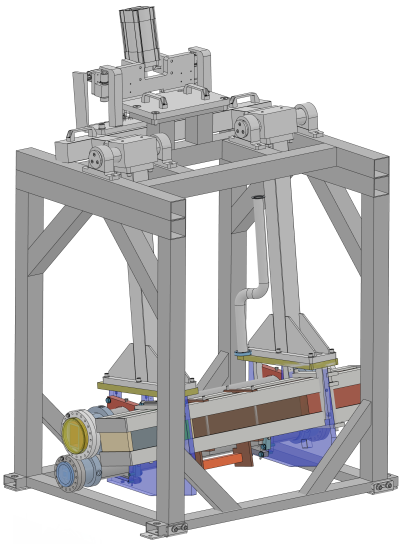


Design of the Heimdal Cave & Cabin.

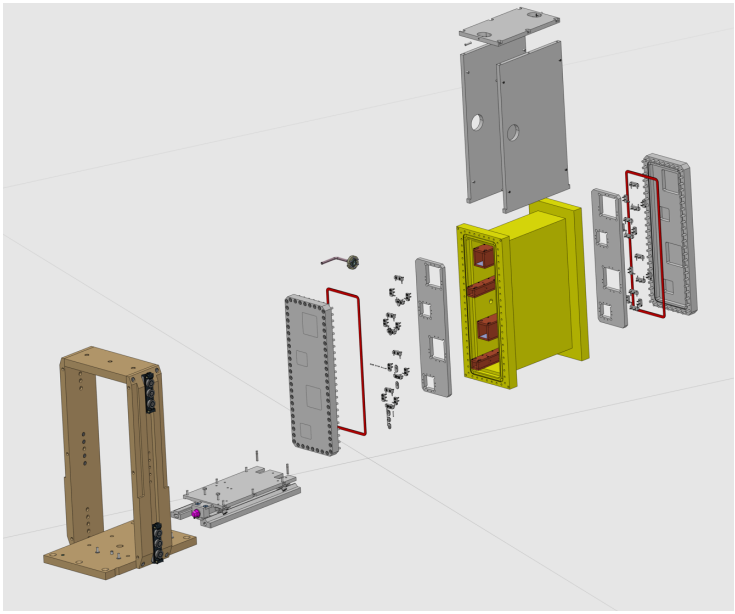
6.7 Heavy Shutter and Light Shutter:

The heavy shutter design is based on the ESS test beamline design and is being constructed by Kenetic. We are awaiting of approval of the final design before going to manufacture.

The heimdal light shutter final design design has been submitted for review.



Heimdal Heavy shutter design



Heimdal light shutter design.