

# The Heimdal Instrument ESS: Update

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Lead Scientist Heimdal Instrument ESS

IKON Diffraction Class Meeting - February 2020

# Heimdal News in Brief



- (1) July - Heimdal Change Request for installation of more cold guide day-1 rejected
- (2) STAP 10/19 - Noted Excellent Progress of Instrument, Recommends real costings (tenders)
- (3) ICEB 11/19 - Recommended provide real costing of instrument (from tender offers)
- (4) 12/19 CTV For Chopper Systems (approved 02/20)
- (5) 12/19 CTV For T0 Chopper
- (6) 12/19 CTV for Cave
- (7) 12/19 CTV for Slits & X,Y,Z table
- (8) 01/20 Meeting with Swiss Neutronics to discuss NBOA in Switzerland.
- (9) 01/20 TG3 Workshop held in Aarhus University (3 Days)
- (10) 01/20 H1H2 Scenarios submitted
- (11) Discussion of Polarized Neutrons - Meeting 26-27 March.
- (12) Next TG3 Workshop in IFE Norway March 2020 - Cave Structure & Neutronics
- (13) Next TG3 meetings Scheduled for May 2020
- (14) Next ICEB meeting June 2020
- (15) Instruments 9-15 Procurement start July 2020

# Rebaseline schedule for Neutron Beam Instruments (V4.1, 29<sup>th</sup> November 2018)

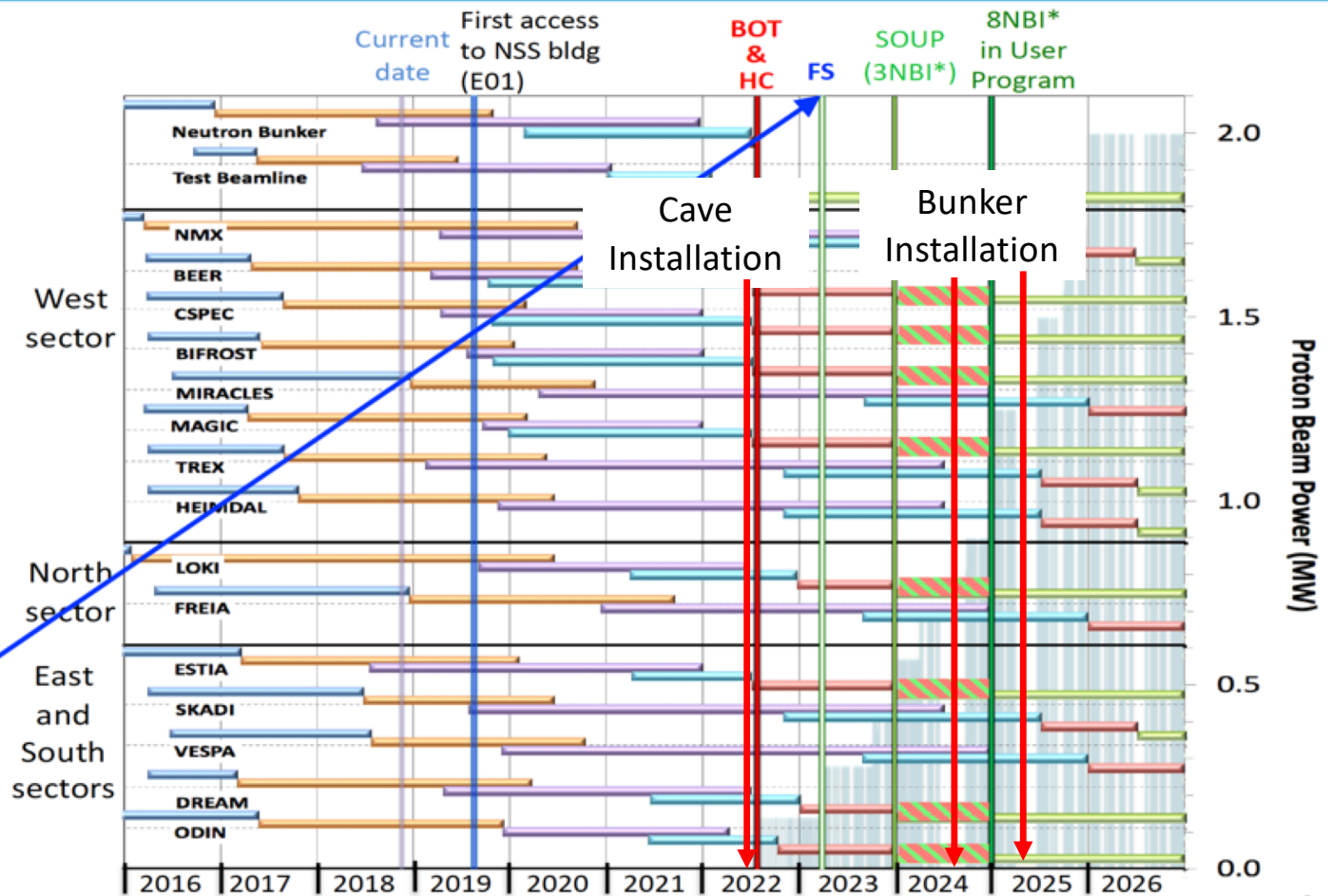
*aligned with accelerator ramp up (ESS-0420218)*



- **First 3 NBI selected for SOUP: DREAM, LOKI & ODIN** (best chance for early impact, as agreed by NSS, SAC and Council)
- **Back-up instruments** (for risk of late access to D01 & D03) BEER, CSPEC, MAGIC or BIFROST, ESTIA

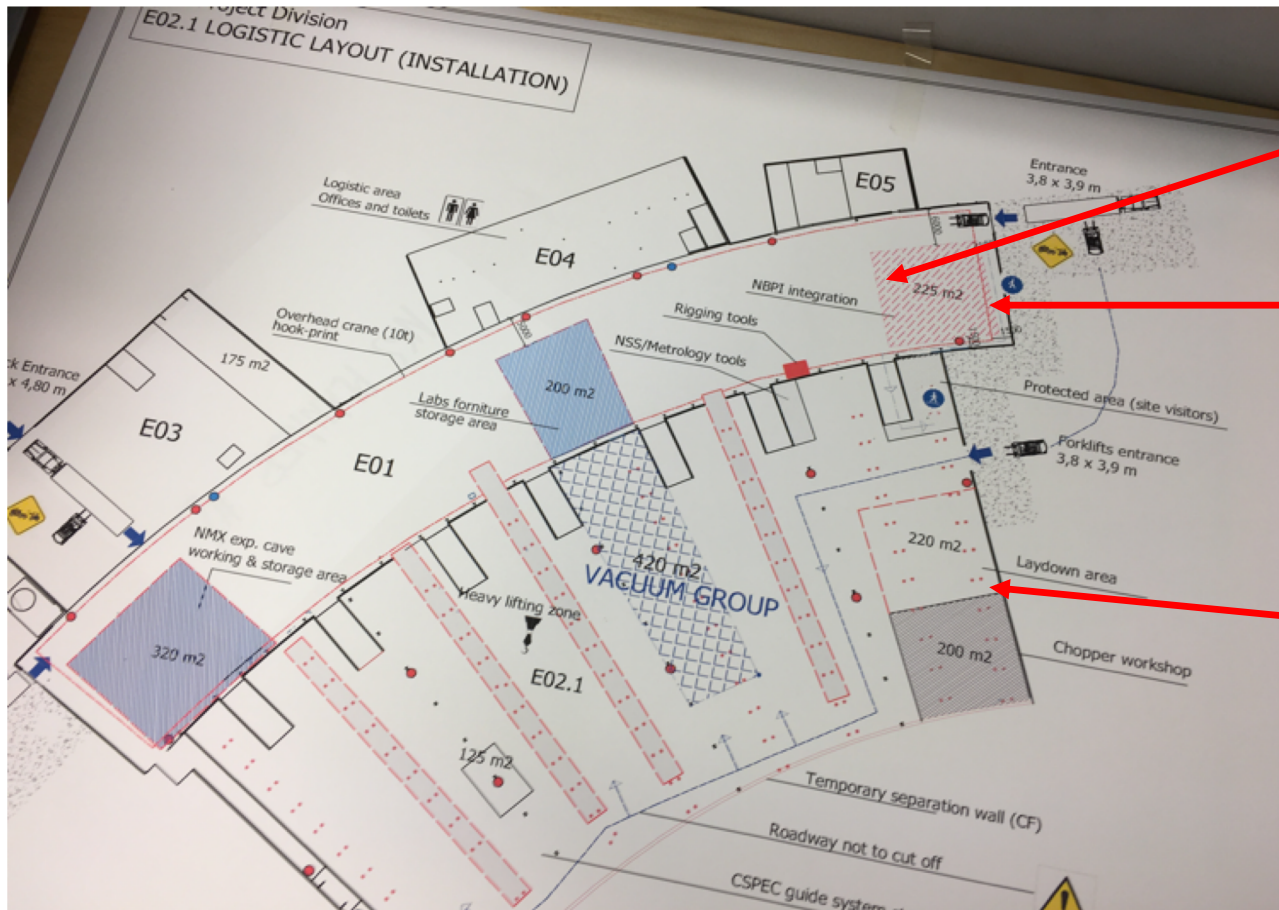
*March 2023:*

- **First Science (FS) with expert teams on any instrument above**
- **Review progress of first 3 NBI for SOUP, implement backup plan if needed.**



\* NBI = Neutron Beam Instrument

# ESS Installation & Storage



Heimdal Instrument

NBOA Storage – 2020  
NBOA Installation 6/20 – 6/21  
Storage Zone until June 2022

June 2022 Start of Heimdal Cave Installation

Storage and Chopper Workshop

Moved to permanent Chopper Workshop  
in mid 2021 in D01



# Heimdal TG3 Schedule



Dec'19	Jan'20	May'20	October '20	Mar'21
<p>Sub-TG3.1 [Handled remotly. Deliverables 26Nov19. Reviewers 16Dec19]</p> <ul style="list-style-type: none"> <li>- Bunker wall insert (SSDD Dan/Kåre)</li> </ul> <p><b>IDR</b> [In-person mtg 16Dec19 . 26Nov19 deliverables]</p> <ul style="list-style-type: none"> <li>(1) Detector Ancillaries</li> <li>- Detector Collimators (SSDD: Mogens)</li> <li>- Detector Support (SSDD: Mogens)</li> <li>(2) Shielding / Shutters</li> <li>- Light Shutter (SSDD: Kåre)</li> <li>(3) Motion Control</li> <li>- Slits1 - Divergence Slits (SSDD: Mogens)</li> <li>- Slits2 - Collimating Slits (SSDD: Mogens)</li> <li>- XYZ Table (SSDD: Mogens)</li> <li>(4) Experimental Area</li> <li>- Hutch - (SSDD: Kåre)</li> </ul> <p>CTV [Handled remotely. Deliverables 26Nov19. Reviewers 16Dec19]</p> <ul style="list-style-type: none"> <li>- T0 Chopper</li> <li>- Cave Structure, Beam Stop, Staircase</li> </ul>		<p>Sub-TG3.2 [Hanged Remotely] Deliverables 7 May'20 Reviewers 30May'20</p> <ul style="list-style-type: none"> <li>(2) Detector Ancillaries</li> <li>- Detector Collimators (SSDD: Mogens)</li> <li>- Detector Support (SSDD: Mogens)</li> <li>(3) Shielding / Shutters</li> <li>- Cave Shielding (SSDD: Dan/Rodion)</li> <li>- Cave Staircase (SSDD: Kåre)</li> <li><b>ESS Safety by May'20 ???</b></li> <li>- Beam Stop (SSDD: Dan/Rodion)</li> <li>- Light Shutter (SSDD: Kåre)</li> <li>(4) Motion Control</li> <li>- XYZ table (SSDD: Mogens)</li> <li>- Slits1 - Divergence Slits (SSDD: Mogens)</li> <li>- Slits2 - Collimating Slits (SSDD: Mogens)</li> <li>(5) Experimental Area</li> <li>- Hutch cabin</li> <li>(6) Choppers Systems</li> <li>T0 Chopper (SSDD: Isabel)</li> <li><b>Detailed Design from Mirtron by May'20 ??</b></li> <li>Choppers (SSDD: Isabel) (ESS Common)</li> </ul>	<p><b>IDR</b> [In-person mtg 7Oct20. 30Oct20 deliverables]</p> <ul style="list-style-type: none"> <li>(1) Shielding and Shutters</li> <li>- Heavy Shutter (SSDD: Kåre/Dan)</li> </ul> <p>Sub-TG3 [In-Person meeting]</p> <ul style="list-style-type: none"> <li>(1) Optics</li> <li>- Guides and Support Structure (SSDD: Dan)</li> </ul>	<p><u>Sub-TG3.4</u> [In-person mtg]</p> <ul style="list-style-type: none"> <li>- Monitors: (ESS Common?) (SSDD: Uwe)</li> <li>- Detector (SSDD: Uwe)</li> <li>- Heavy Shutter (SSDD: Kåre/Dan)</li> <li>- Instrument Control and Automation [ESS MCA] (SSDD Kåre/Engineer)</li> <li>- PSS [ESS PSS] (SSDD: Dan)</li> <li>- DMSC [ESS DMSC] (SSDD: Mogens/Dan)</li> <li>- Vacuum system [ESS Vacuum Team] (SSDD: Kåre/Engineer)</li> <li>- Drawing package of complete system (Kåre/Engineer)</li> </ul> <p><u>Final TG3</u></p>

# HEIMDAL – TAs

*Many Thanks to AU, IFE, PSI & ESS!*



European Spallation Source ERIC

2020.02.11

Date

*Kevin W. Jones*

Signature

KEVIN W. JONES

Name (in block letters)

TECHNICAL DIRECTOR

Position

Aarhus University

22-11-2019

Date

*Lars H. Andersen*

Signature

LARS H. ANDERSEN

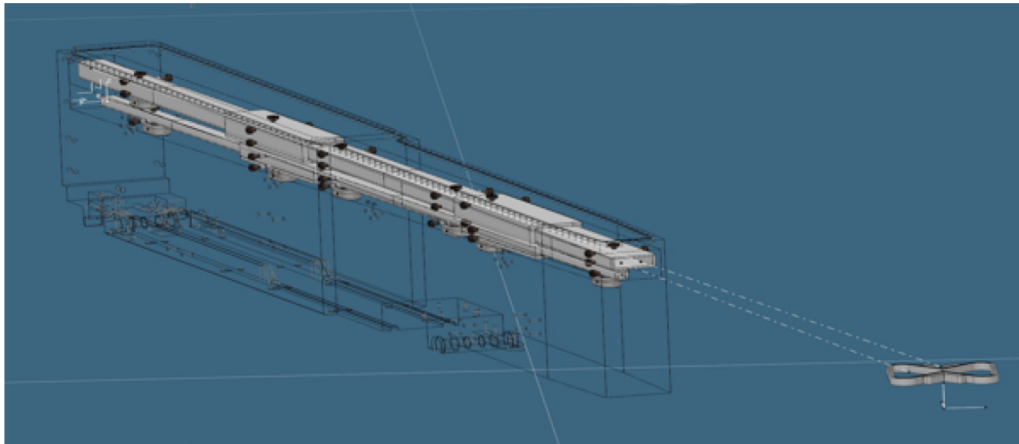
Name (in block letters)

DEKAN

Position

**Heimdal Supply & Service Agreements**

# NBOA Detailed Design & Manufacture PSI - Procurement

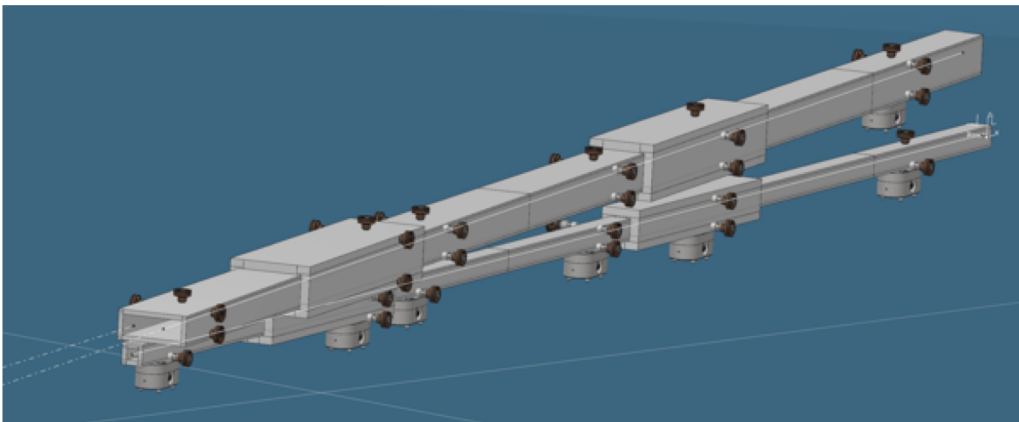


We have had some delay on our NBOA. Conceptual design -> Detailed Design

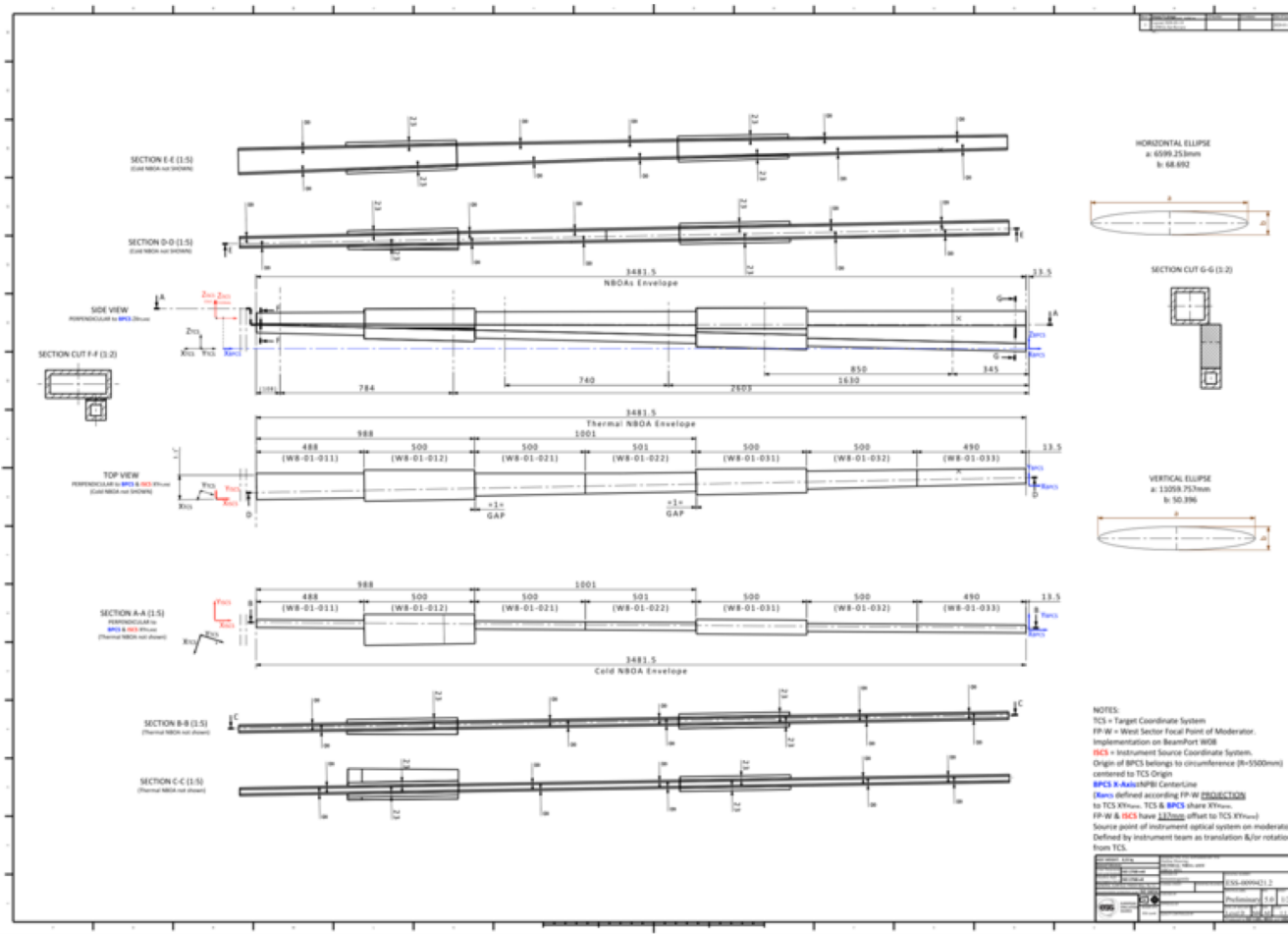
Meeting with Swiss neutronics in January 2020

Issues should now be resolved

New Design with Swiss Neutronics

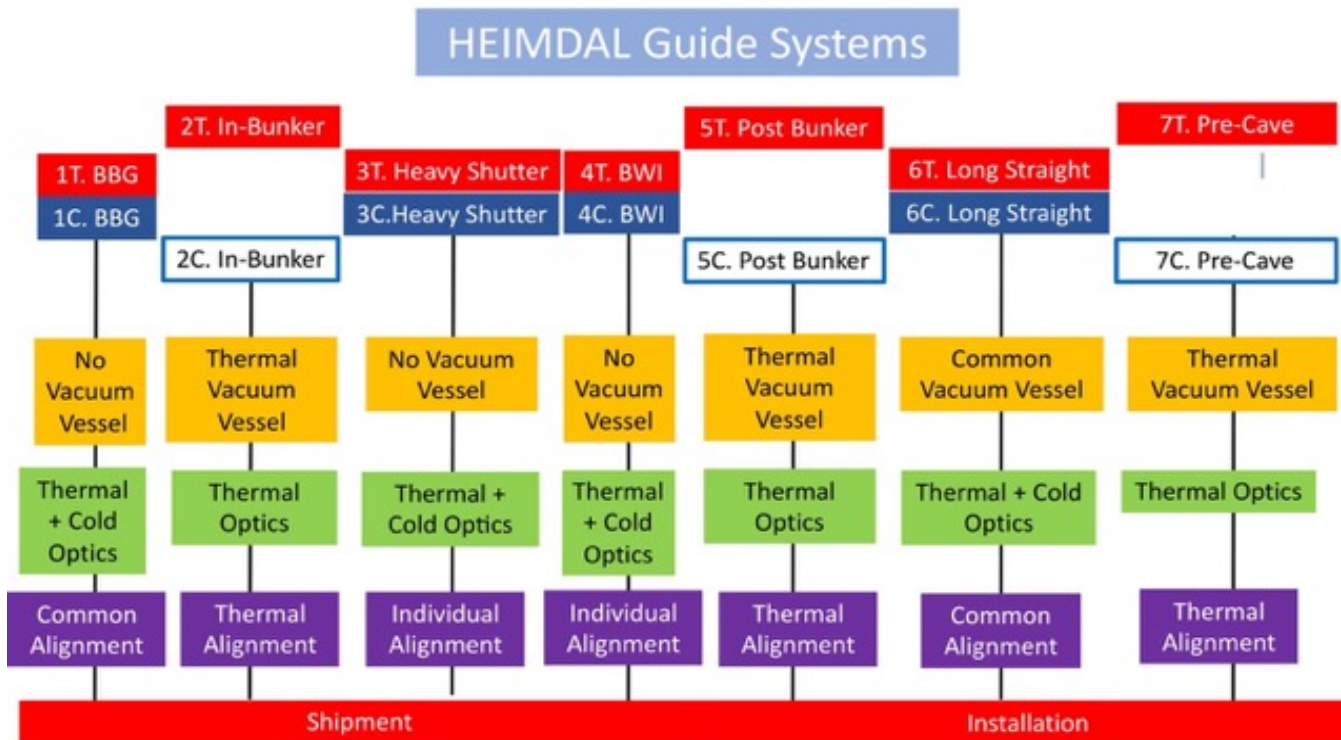


# NBOA Detailed Design & Manufacture PSI - Procurement



NBOA Detailed Design

# Guide System - Procurement Status



PSI Procurement:  
Zeljka Budrovic + Uwe Stuhr

Guide Costing and Design:  
Coherent Detailed Design of  
Thermal & Cold guide (must).

Cost & Design:  
(1) Thermal Only (must)  
(2) Thermal + Cold Guide (must)

Winner is bidder for best score for  
Thermal + Cold

\* PSI reserves the right to order all  
or part of the Guide

Reduce risk of not receiving a bid – keep it simple  
Reduce risk of tender being challenged – winner should be unambiguous

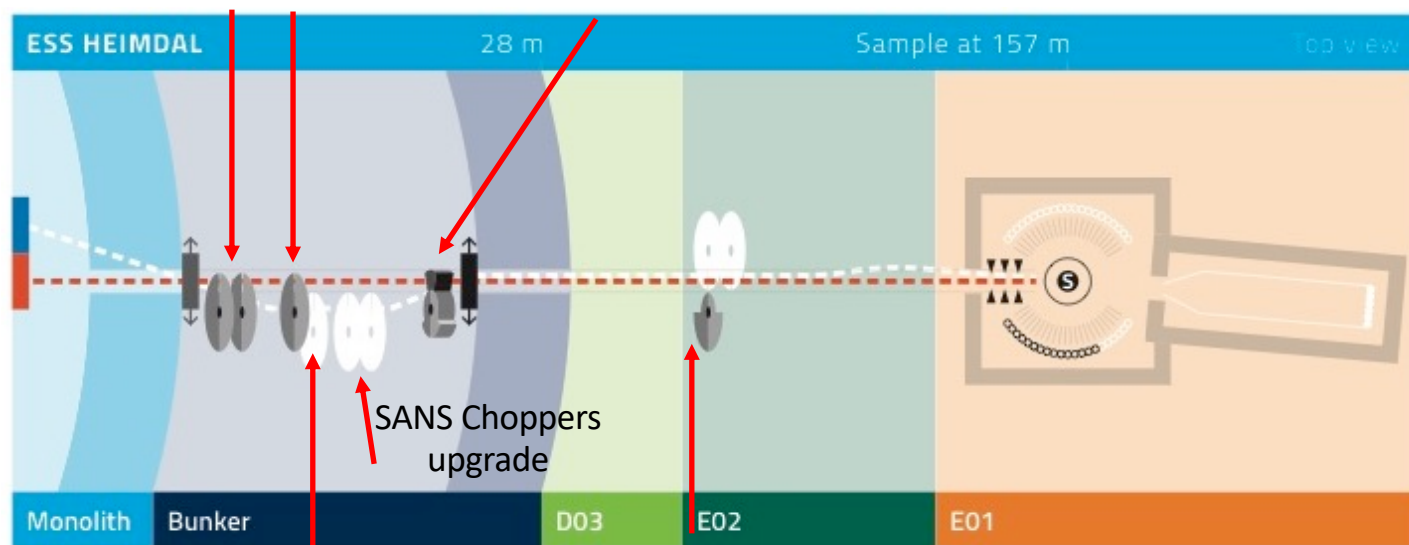


# TG3 - Chopper Systems

- 1.1 Thermal Pulse Shaping Chopper Double Disc 168Hz @6.5m
- 1.2 Thermal Wavelength Sorting Chopper 14Hz @8m
- 1.3 Thermal T0 Chopper 28Hz@21.6m

CTV Choppers Systems May 2019

CTV approved February 2020



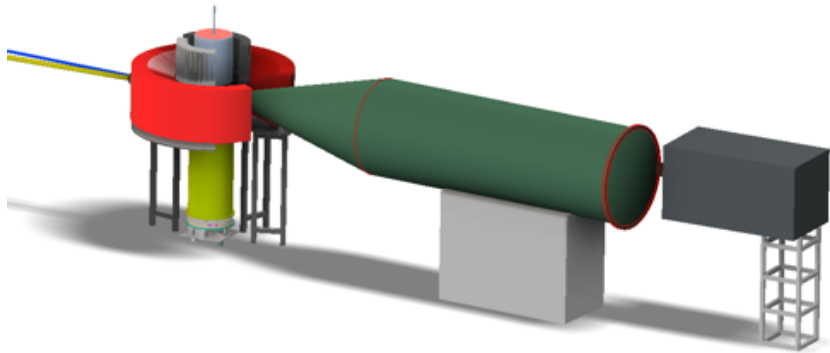
Chopper Sub-TG3 May 2020

Moving forward with full costing.

- 1.5 Thermal Frame Selection Chopper 14Hz @8m Upgrade

- 1.4 Thermal (& Cold) Frame Overlap Chopper 14Hz @78m

# 2D Detector CTV - Project Schedule



B<sup>10</sup> 2D Neutron Detectors CDT Heidelberg

(1) Dream

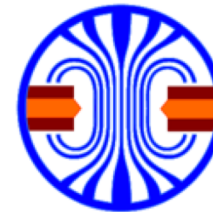
(2) Magic

(3) Heimdal

Contract Phase	Description	Date Due
A	Call for Tender Verification (CTV)	May 2019
A	Publish Call for Tender (PT)	February 2020
A	End Call for Tender (ET)	March 2020
A	KO Kick-Off Contract signing (KO)	April 2020
A	Conceptual Design Review (CDR)	May 2020
A	Detailed Design Review (DDR)	January 2021
B	Start of Manufacture (SM)	February 2021
B	End of Manufacture (EM)	November 2022
B	Factory Acceptance Tests (FAT)	December 2022
C	Delivery to Aarhus University for Assembly and Integration	February 2023
C	Site Acceptance Test (SAT)	March 2023
D	Delivery to ESS (DESS)	September 2024
D	Installation at ESS (IESS)	October 2024

# Monitors

## ESS - Common Project



**CDT**  
**CASCADE Detector**  
**Technologies**  
**GmbH**

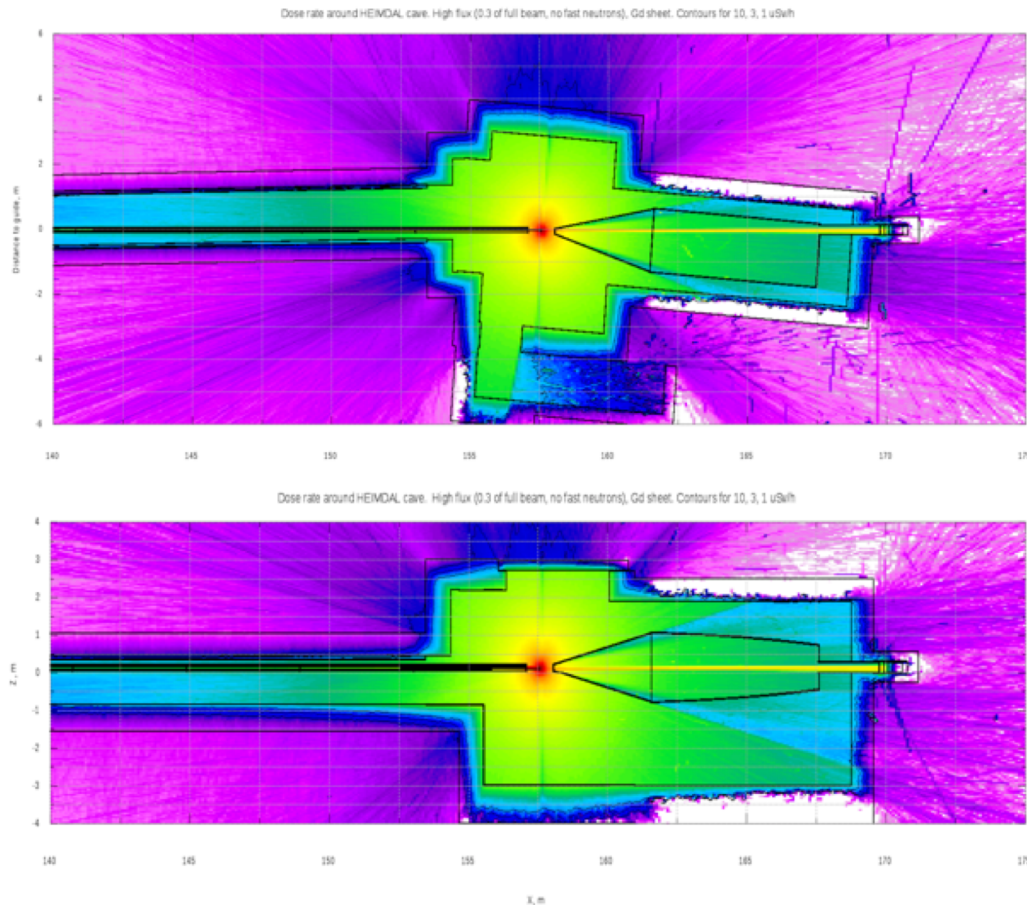
#14 HEIMDAL	Position	Use
BM1	8.1m	Mod flux
BM2	20m T0 chopper	Chopper diagnostics
BM3	78m (TBD)	Chopper diagnostics
BM4	Pre-sample	

So far we are not part of ESS monitor project.

Waiting to see how that develops (ICEB discussion)

Pos.	Quantity	Part-No.	Description	Unit Price [EUR]	Amount [EUR]
1	1	pc. 1022	CASCADE-BM 2D-32 beam monitor detector of 32mm x 32mm sensitive area, structured in 32 x 32 pixels (including one 64-ch. ASIC preamplifier board AS20xx). Detection efficiency customized from 0.01% to 1%.	6.925,00	6.925,00
2	1	pc. 2140	CASCADE DAQBox (USB) as stand-alone solution (including software license for "CDT Detector Control" and "CASCADE Hardware Library")	5.800,00	5.800,00
3	1	pc. 2151	Dedicated CDRE based DAQ-System for readout of up to six AS20BS-boards, i.e. up to six beam monitors, which again interfaces to ESS defined electronics and integrates via Gbit optical link into the HEIMDAL system (scalable solution).	7.560,00	7.560,00

# TG3 -Cave Shielding



## Neutronics Calculations – Optimising costs

- 90cm concrete walls (Diffraction).
- 40cm concrete walls (SANS)
- 70cm concrete roof (Diffraction)
- 30cm Concrete roof (SANS)
- Beam stop Steel Bar inside heavy concrete

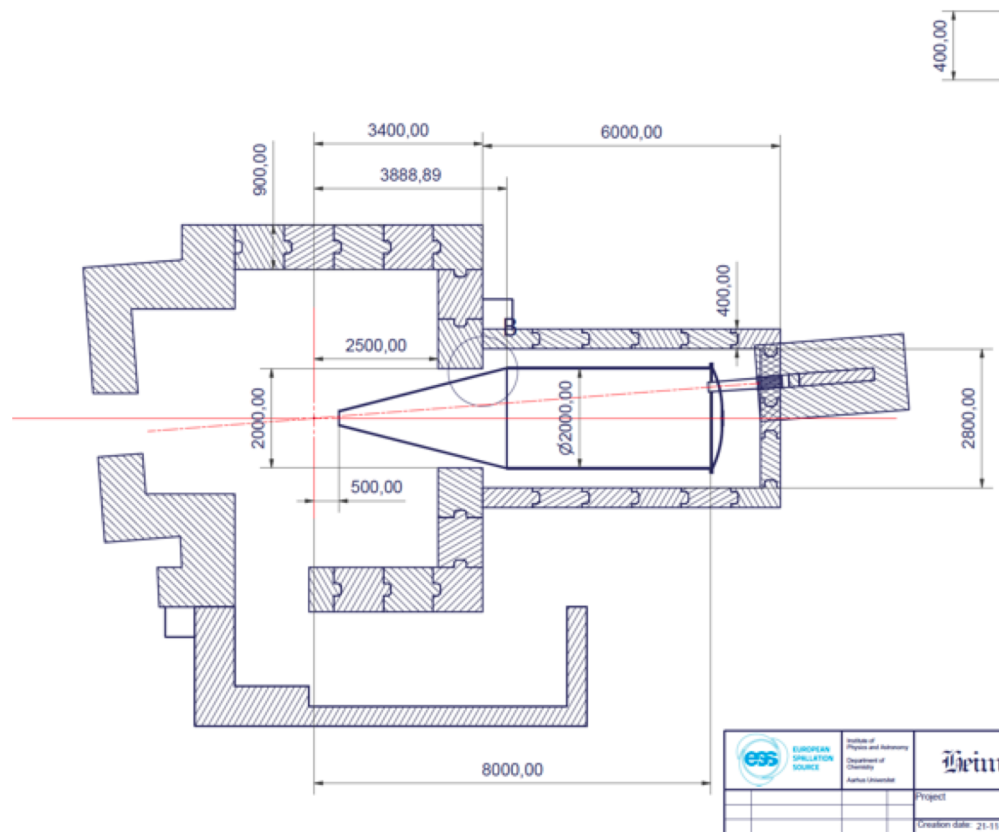
- Slightly shorter SANS cave
- Slightly thicker SANS cave back wall

H1H2 Scenarios submitted (Feb. 2020)

Cave Workshop March 2020 IFE  
Complete neutronics for Heimdal cave  
for TG3 May 2020 ?

# TG3 -Cave Shielding

A-A (1 : 70)



Cave Shielding Conceptual Design

Costing Requested –

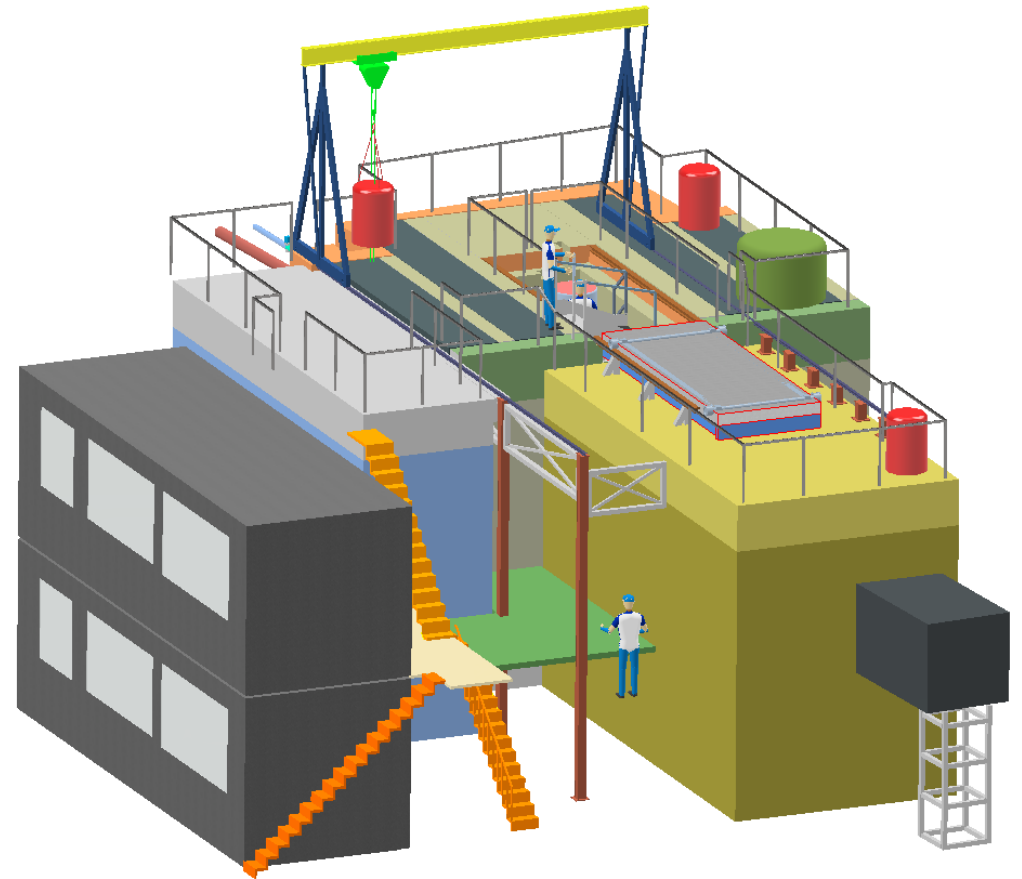
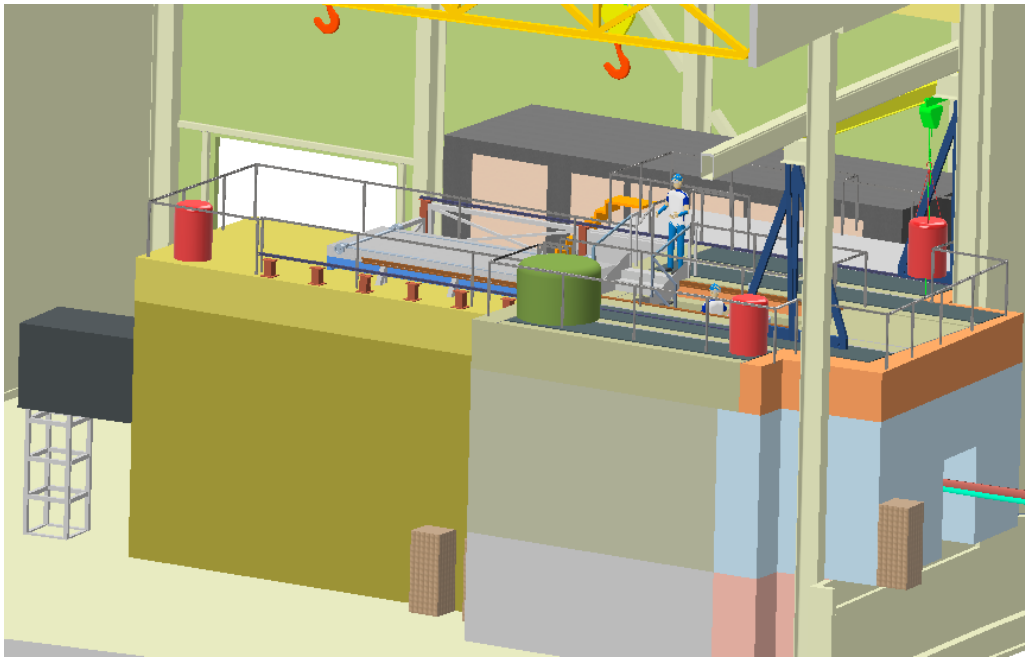


Awarded Contract for NMX cave

Need to define penetrations for services:

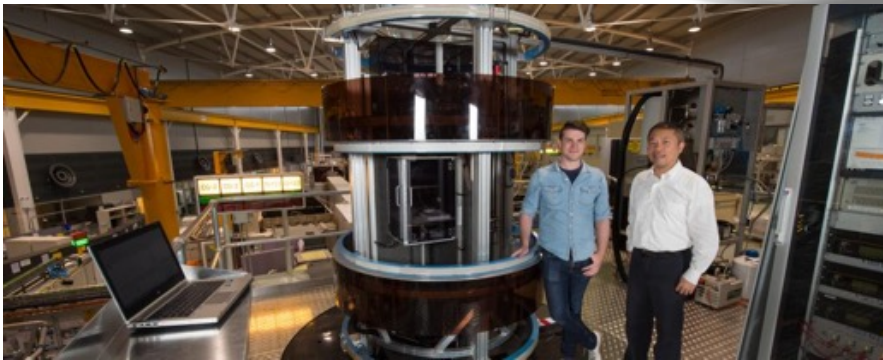


# TG3 -Cave Shielding

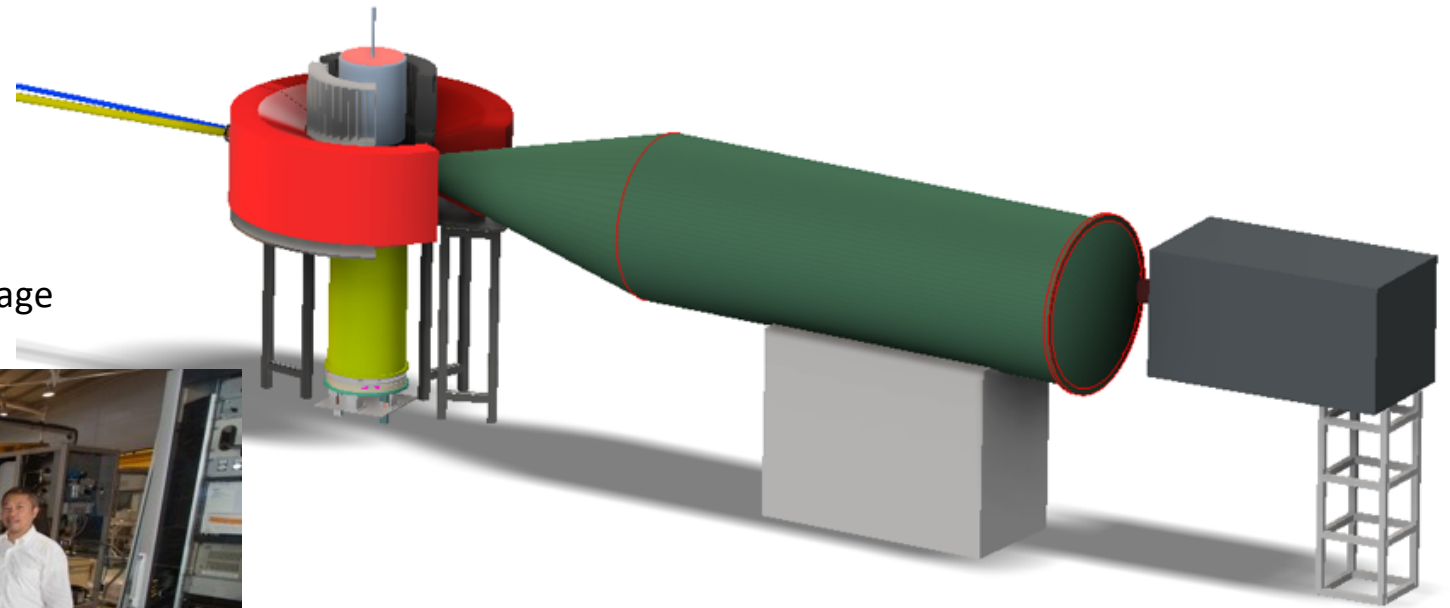


# Polarised Neutrons at Heimdal ?

'Hal' – Wai Tung Lee:  
ESS Polarised Neutron workpackage



Long term development for  $^3\text{He}$  neutron polarisers  
Funding possibility in operations program

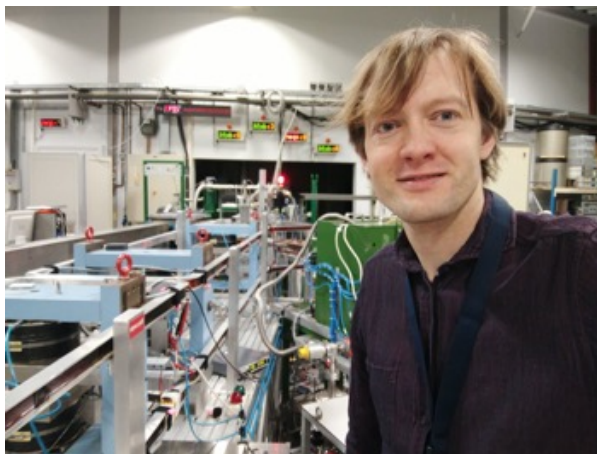


Heimdal could also employ supermirror on cold guide  
For polarised neutrons: Upgrade possibility ?

# Polarised Neutrons Workshop 26-27 March



Prof. Cathrine Frandsen  
DTU Physics  
Polarised Neutron Powder Diffraction



Dr Erik Brok  
Niels Bohr Institute  
Polarised Neutron Powder Diffraction  
Polarised Neutron SANS



Prof. Dr. Catherine 'Katia' Poppas  
Delft University of Technology  
Polarised Neutron SANS & Imaging