



ODIN: Optical and Diffraction Imaging with Neutrons at the ESS

STAP – October 2020

Aureliano Tartaglione (TUM-Lead Instrument Scientist)

Manuel Morgano (PSI-Instrument Scientist)

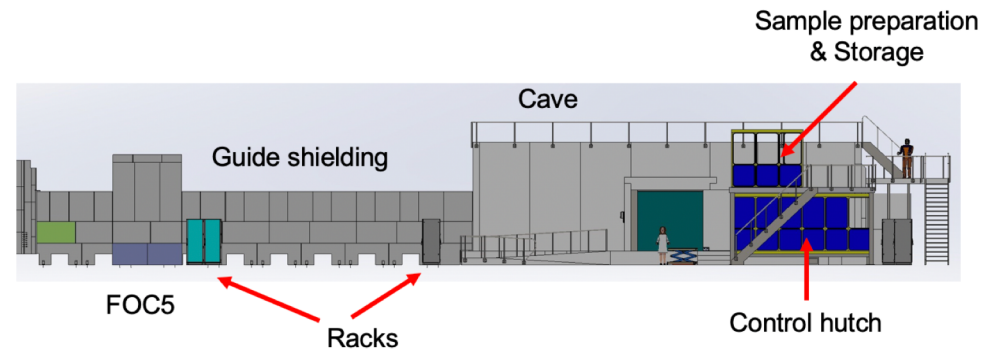
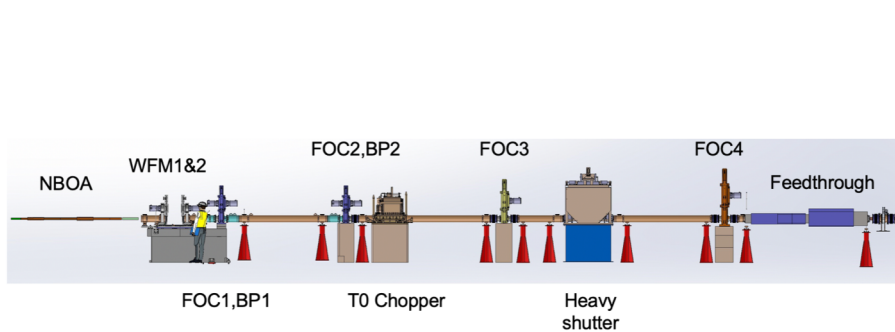
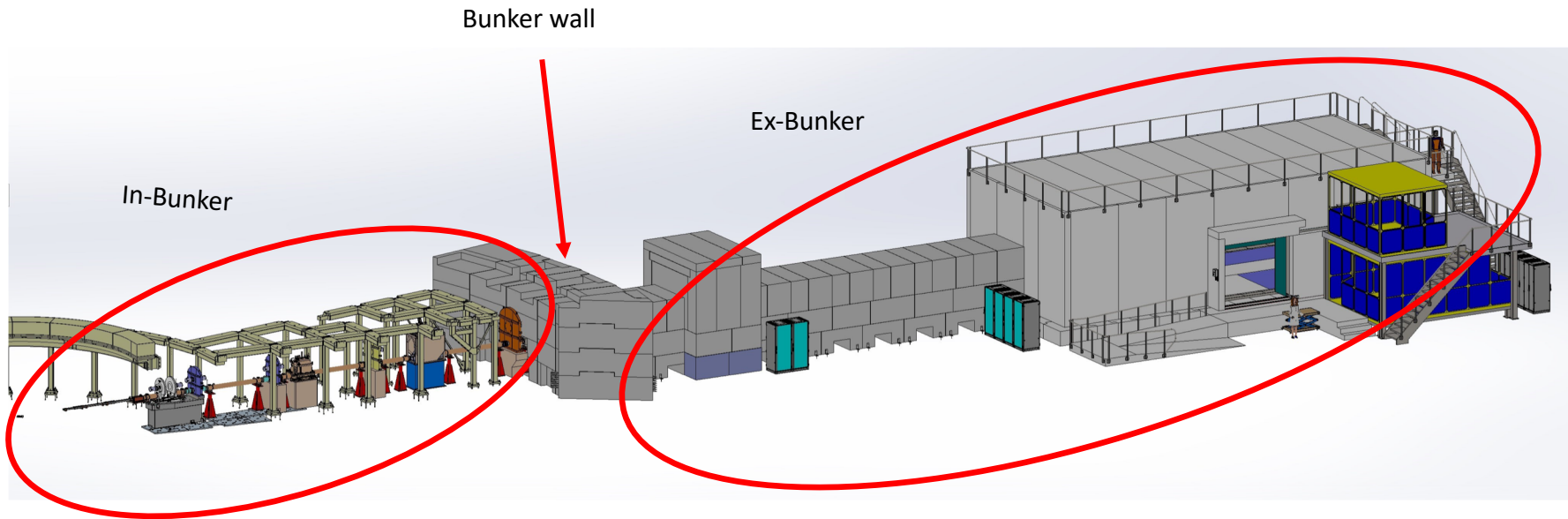
Elbio Calzada (TUM-Lead Engineer)

Virginia Martinez Monge (TUM-Installation Engineer)

- ODIN overview
 - Quick overview
 - High level schedule
- How we work
- Project Status
 - ODIN Work Units Overview
 - Installation plan
- Summary

ODIN Overview

Quick Overview: terminology

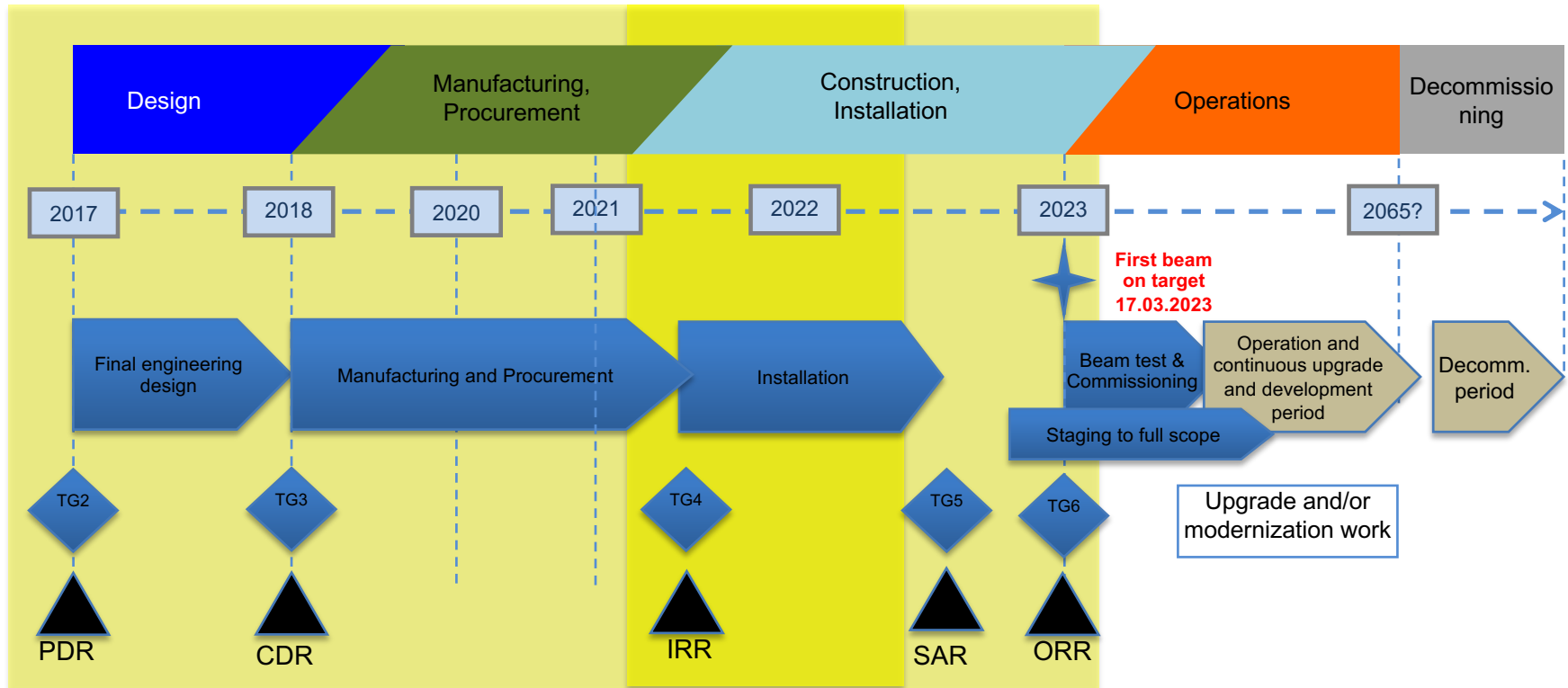


ODIN Overview

High level schedule



EUROPEAN
SPALLATION
SOURCE



Bunker wall penetration design	Design monolith insert envelop	Arrival in-monolith optics to ESS site	Bunker wall insert delivered to ESS	Partial Access D01	Start In-bunker installation	End In-bunker installation	Hot Commissioning (TG5)	BOT	User Programme
03-Mar-17	31-Jun-18	24-Jan-19	15-Nov-20	06-Jun-21	Oct-21	May-22	Oct-22	17-Mar-23	31-Dec-23

Project completion: 23/12/2022

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ODIN construction core team

TUM:

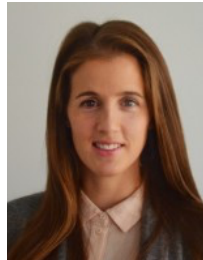
Aureliano Tartaglione
ODIN Lead Scientist



Elbio Calzada
ODIN Lead Engineer



Virginia Martinez Monge
*ODIN Installation Engineer
(since Sep 2020)*



Michael Schulz
Head of Imaging group



PSI:

Manuel Morgano
ODIN Scientist



Markus Strobl
*Head of Imaging
group*



Jan Hovind
*Technician of
Imaging Group*



ESS counterparts



Robin Woracek
*Instrument Class
Coordinator*



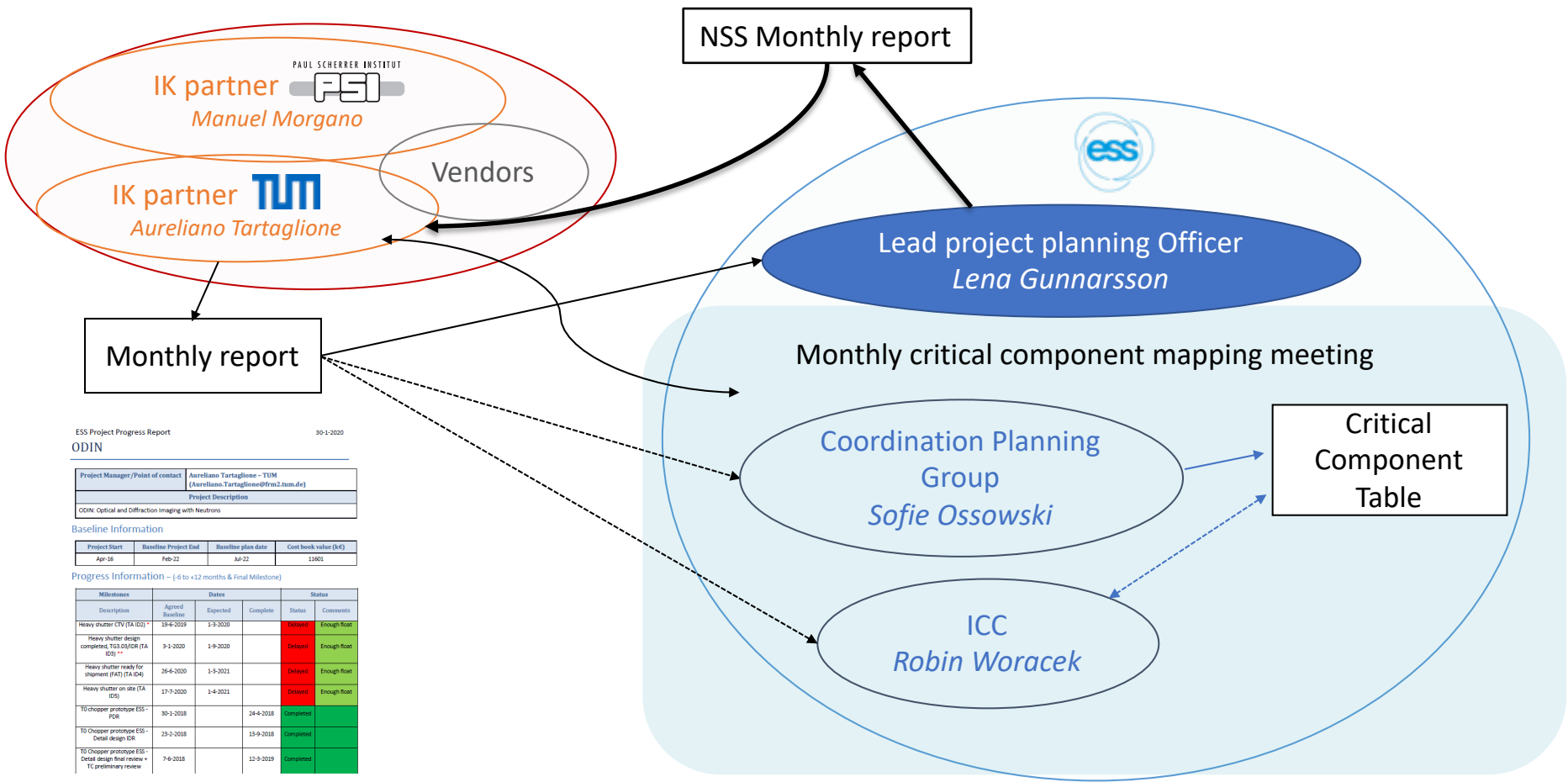
Søren Schmidt
*Instrument Data
Scientist for ODIN
& BEER*

Day to day: PSI-TUM-ESS

- We always have phone, Vidyo, Zoom, WhatsApp, or Skype communications on demand
- TUM-PSI closely collaborates on documentation (e.g. mutually cross-review of documents required by ESS)
- On demand Skype or Vidyo meeting with ICC
- Positive: We usually reach agreement on working strategies and design criteria
- Regular participation on Instrument Scientist, and Engineering monthly meetings
- Very constructive collaboration and meetings on demand with ESS Chopper Group (Niko/Erik), ESS-NI Lead Engineer (Gabor), TG Coordination (Inga), Vacuum (Lawrence), Installation (Antonio), PSS (Morteza), Shielding (Valentina and Riccardo), Procurement (Mirko) and a lot of help from Zvonko.
- Well embedded in the broader imaging community
- Strong ties with the data analysis efforts (Anders, Chiara, Matteo, Søren...)

How we work

Collaboration Structure



ESS Project Progress Report 30-3-2020

ODIN

Project Manager/Point of contact	Aureliano Tartaglione - TUM (Aureliano.Tartaglione@frm2.tum.de)
Project Description	ODIN: Optical and Diffraction Imaging with Neutrons

Baseline Information

Project Start	Baseline Project End	Baseline plan date	Cost book value (k€)
Apr-16	Feb-22	Jul-22	11801

Progress Information - (-6 to +12 months & Final Milestone)

Milestone	Dates			Status	Comments
	Agreed Baseline	Expected	Complete		
Heavy shutter CTV (TA ID2) *	19-6-2019	1-9-2020		Delayed	Enough float
Heavy shutter design completed, top coil/CR (TA ID2) **	3-1-2020	1-9-2020		Delayed	Enough float
Heavy shutter ready for shipment (TA1, TA ID4)	26-6-2020	1-9-2021		Delayed	Enough float
Heavy shutter on site (TA ID2)	17-9-2020	1-4-2021		Delayed	Enough float
TO Chopper prototype ESS - FOR	30-1-2018		24-4-2018	Completed	
TO Chopper prototype ESS - Detail design (DR)	29-3-2018		13-9-2018	Completed	
TO Chopper prototype ESS - Detail design final review + TC preliminary review	7-9-2018		12-9-2019	Completed	

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	Task no.	TA ID	Deliverables – Project Results	Delivery date	Status (milestones)
TUM	WU 03	2-8	Heavy Shutter*	Jun 2021	KoM done
TUM	WU 04	9-15	T0 Chopper*	May 2022	Tender ongoing
TUM	WU 05	16-25	Choppers*	Jun 2021	CDR closed. Sub-TG3 done. Now manufacturing.
TUM	WU 08	26-32	Motion Control and Electric Engineering*	Mar 2021 (subTG3)	About to sign provision by MCAG (ESS): Design begins
TUM	WU 11		Shielding*	-	-
TUM	WU 11.1	33-38	Guide Shielding (common shielding project)	Jun 2021	Sub-TG3 Dec 2020
TUM	WU 11.2	39-50	Cave Shielding	Jun 2021	PDR done
TUM	WU 12		Instrument Infrastructure	-	-
TUM		51-56	Control Hutch (TUM) *	Oct 2021	SoC Dec2020
TUM			Sample preparation area & storage (TUM) *	Oct 2021	SoC Dec2020
TUM	AO01	-	Bunker Wall Feedthrough	Jun2021	PDR done
TUM	AO02	-	Chopper supplements	Jun2021	IDR done
TUM		59	FINAL Tollgate 3	Re-Scheduled March 2021	Ongoing
PSI	02.1	1-4	NBOA	Q1 2021	Delivery ESS
PSI	02.2	5-16	Neutron transport system (Guides)	Mar 2022	IDR done
PSI	06	17-32	Cave interior #	Jun 2022	Tender done
PSI	09	33-43	White beam detectors	Dec 2021	Off-the-shelf
PSI	10	44-48	ToF detector	Dec 2021	Readout pending

* Item agreed to be procured by ESS for TUM

* Item procured by TUM (forgotten in the TA)

Parts of this item agreed to be delivered by ESS for PSI

Project Status

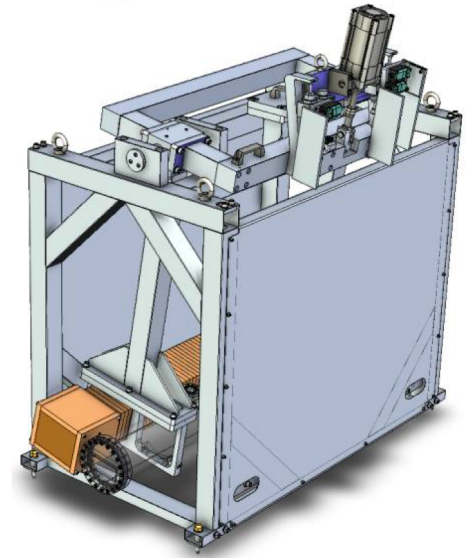
Work Units Overview



	Task no.	TA ID	Deliverables – Project Results	Delivery Date	Status	
TUM	WU 03	2-8	Heavy Shutter*	Jun 2021	KoM done	

In-Bunker main components:

- Installation window: 11.8.21 – 25.2.22
- Heavy shutter (TUM):
 - It is a concept proposed by ESS for TBL (G. Lászlo)
 - MC simulations completed July 2020
 - CTV completed July 2020
 - Delivery time: 6 months after contract signed
 - Tender done: Sept 2020
 - KoM done: October 2020
 - Status **OK**

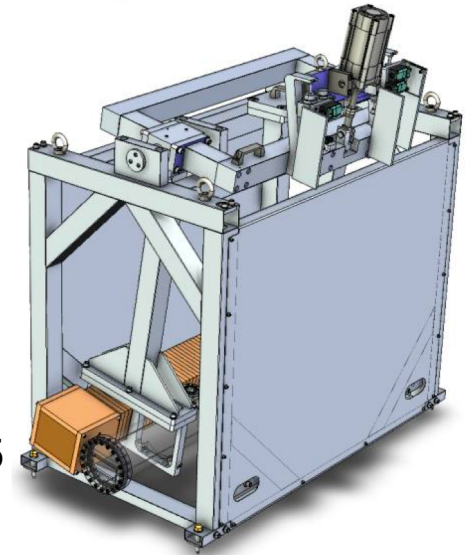


* Item agreed to be procured by ESS for TUM

	Task no.	TA ID	Deliverables – Project Results	Delivery Date	Status	
TUM	WU 03	2-8	Heavy Shutter*	Jun 2021	KoM done	

In-Bunker main components:

- Installation window: 11.8.21 – 25.2.22
- Heavy shutter (TUM):
- Design constraints
 - Pillars + Roof beams + Expansion gap (floor)
 - Max length required: 1.6m
 - Dose requirement: max $3\mu\text{Sv/h}$ in Cave, and $25\mu\text{Sv/h}$ in FOC5 pit
 - Safety factor: 2
- Stopper preliminary design ready:
 - Total thickness 1.2m ✓
 - Maximum attenuation: 1cm B4C + 24cm Steel + 96cm Copper
 - Total Dose: $0.5\mu\text{Sv/h}$ (Cave) and $1.4\mu\text{Sv/h}$ (FOC5 Pit) ✓
 - Guide vacuum vessel: scope of Axilon/SNAG ✓



* Item agreed to be procured by ESS for TUM

	Task no.	TA ID	Deliverables – Project Results	Delivery Date	Status	
TUM	WU 03	2-8	Heavy Shutter*	Jun 2021	KoM done	

First prototype delivered to ESS for the TBL

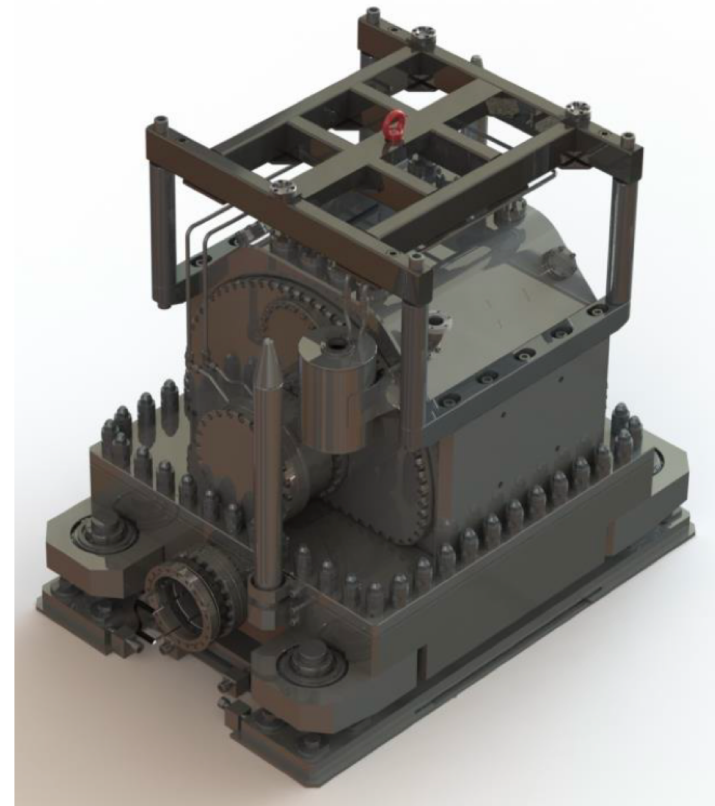


* Item agreed to be procured by ESS for TUM

	Task no.	TA ID	Deliverables – Project Results	Delivery Date	Status	
TUM	WU 04	9-15	T0 Chopper*	May 2022	Tender ongoing	

In-Bunker main components:

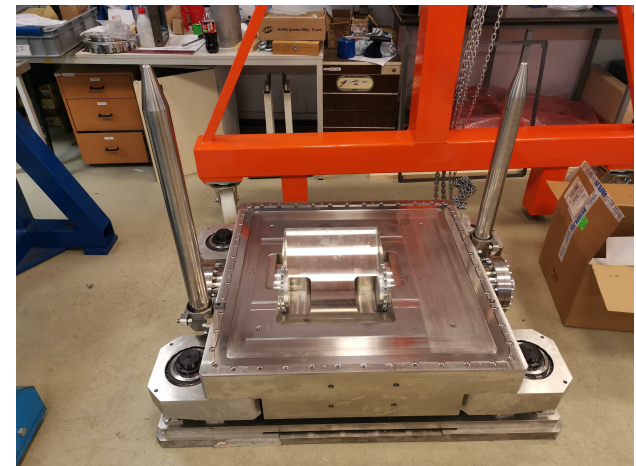
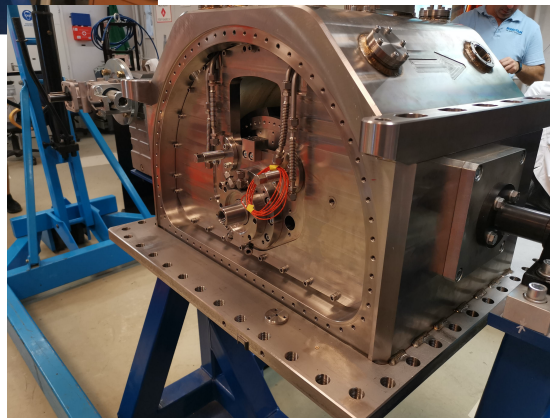
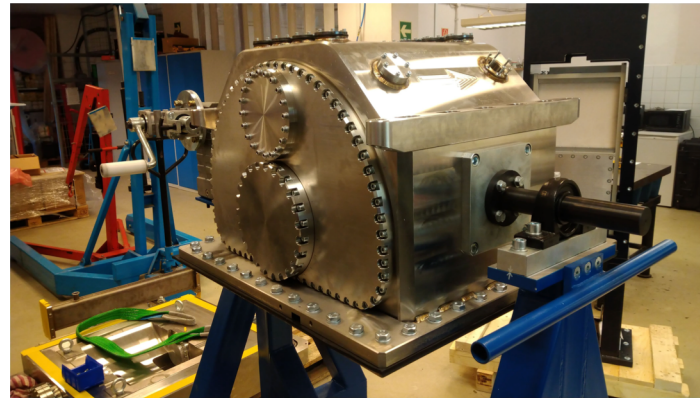
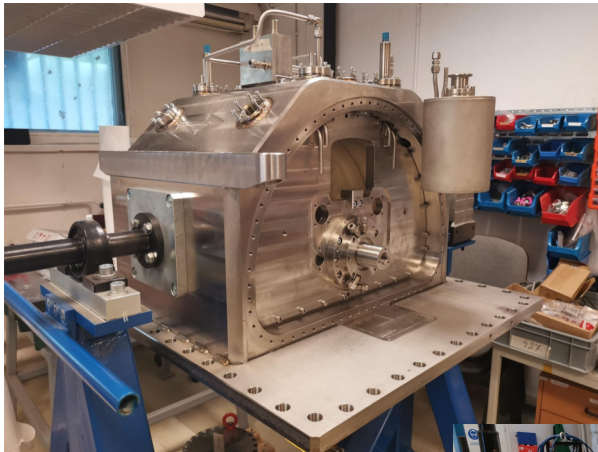
- Installation window: Oct 2021 – May 2022
- T0 Chopper (TUM)
 - CTV ODIN T0 chopper approved Mar 2020
 - Design based on DREAM´ s T0 chopper but:
 - Larger diameter: 64cm
 - A re-design is needed
 - 48% higher cost than TA book value ✘
 - SoC expected Nov 2020
 - Delivery time: 18 months after SoC
 - Impacts In-bunker installation plan ✘
 - Status OK



* Item agreed to be procured by ESS for TUM

	Task no.	TA ID	Deliverables – Project Results	Delivery Date	Status	
TUM	WU 04	9-15	T0 Chopper*	May 2022	Tender ongoing	

First prototype (DREAM´ s) ready for FAT by Mirrotron

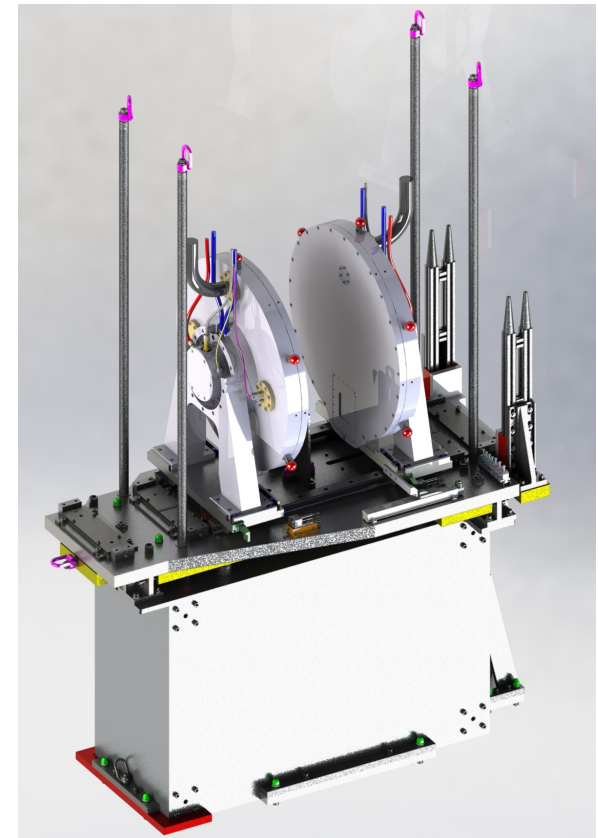


* Item agreed to be procured by ESS for TUM

	Task no.	TA ID	Deliverables – Project Results	Delivery Date	Status	
TUM	WU 05	16-25	Choppers*	Jun 2021	subTG3 done	

In-Bunker main components:

- Installation window: Jun 21 – Feb 22
- Choppers (TUM)
 - Contract signed with AIRBUS in June 2019
 - subTG3 done Aug 2020 ✓
 - FAT scheduled in March 2021
 - SAT: July 2021
 - Pedestals, WFMC Motion Table and Alignment Interfaces designed and procured by TUM
 - Choppers on schedule ✓
 - Status OK

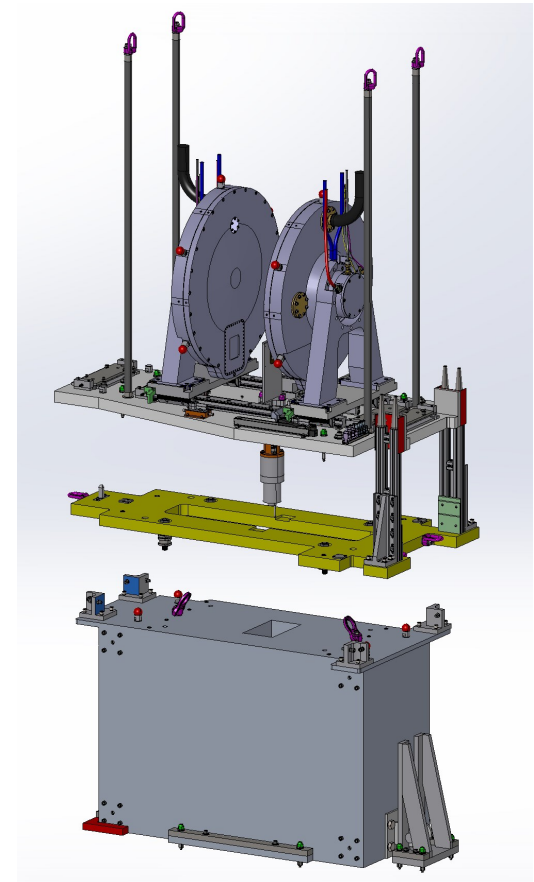
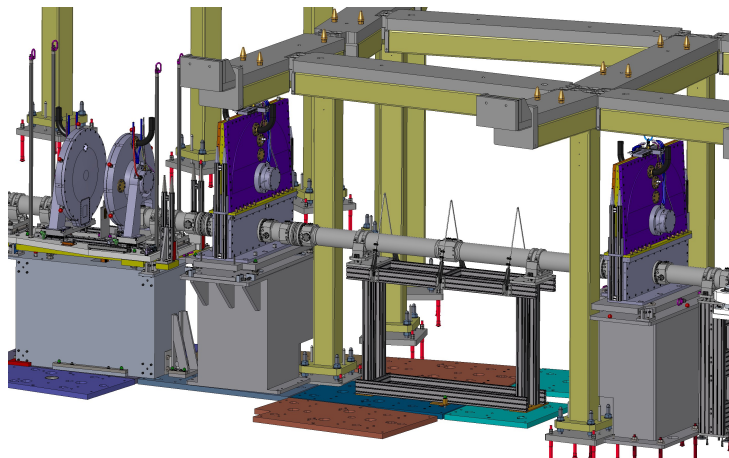


* Item agreed to be procured by ESS for TUM

	Task no.	TA ID	Deliverables – Project Results	Delivery Date	Status	
TUM	A001	-	Choppers supplements	Jun 2021	IDR done	

In-Bunker main components:

- Installation window: Jun 21 – Feb 22
- Choppers **Supplements** (TUM)
 - Pedestals, WFMC Motion Table and Alignment Interfaces designed and procured by TUM
 - IDR done May 2020 ✓
 - Detail (& Manufacturing) design for subTG3 **ongoing**

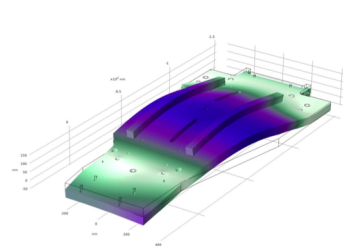
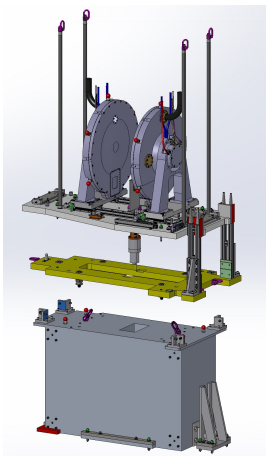


* Item procured by TUM

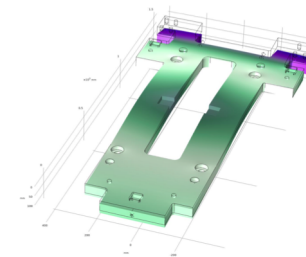
	Task no.	TA ID	Deliverables – Project Results	Delivery Date	Status	
TUM	A001	-	Choppers supplements	Jun 2021	IDR done	

In-Bunker main components:

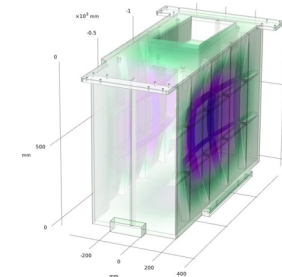
- Installation window: Jun 21 – Feb 22
- Choppers **Supplements** (TUM)
 - Pedestals, WFMC Motion Table and Alignment Interfaces designed and procured by TUM
 - IDR done May 2020 ✓
 - Done for IDR by TUM: detail mechanical design of interfaces, WFMC motion table and pedestals
 - Use of COMSOL (Elbio) and ANSI (Kaltrina Shehu and Christian Reiter – FRM2 Hochdichte Kernbrennstoffe Gruppe) for resonance frequency verification. ✓



Lowest freq: 162.52Hz
Max deformation:
3 μ m



Lowest freq: 260.63Hz
Max deformation: 6 μ m



Lowest freq: 155.52Hz
Max deformation: 5 μ m

* Item procured by TUM

	Task no.	TA ID	Deliverables – Project Results	Delivery Date	Status	
TUM	WU 08	26-32	Motion Control and Electric Engineering*	subTG3: Mar 2021	Design begins Oct 2020	On track

Ex-Bunker main components:

Installation window: 3.6.21 – 25.2.22

- Motion control and Electric Engineering
 - Agreed to be provided by ESS for TUM (TA)
 - Updated SoW and offer presented by ESS-MCA Sep 2020 ✓
 - SoC scheduled Oct 2020

 - Status OK

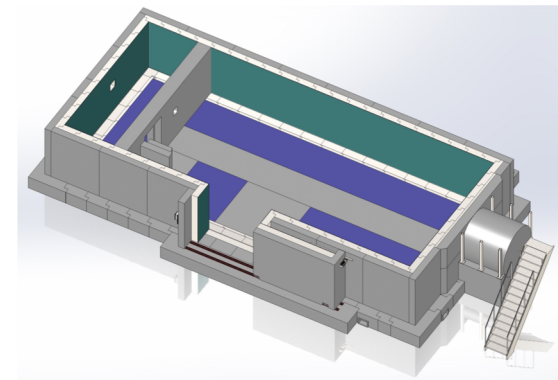
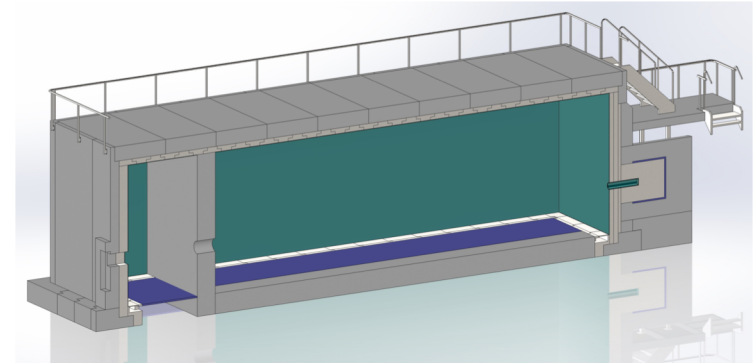
* Item agreed to be procured by ESS for TUM

	Task no.	TA ID	Deliverables – Project Results	Delivery Date	Status	
TUM	WU 11.2	39-50	Cave Shielding*	Jun 2021	PDR done	On track

Ex-Bunker main components:

Installation window: Jun 21 – Feb 22

- Shielding (TUM)
 - Cave shielding
 - SoC w/Mirrotron: Jul 2020 ✓
 - New material solution proposed by Mirrotron is about 35% cheaper than TA estimated book value ✓
 - PDR meeting done: 18 Sep 2020 ✓
 - Goal: subTG3 in December 2020
 - Status OK



* Item agreed to be procured by ESS for TUM

	Task no.	TA ID	Deliverables – Project Results	Delivery Date	Status	
TUM	WU 11.2	39-50	Cave Shielding*	Jun 2021	PDR done	On track

Ex-Bunker main components:

Installation window: Jun 21 – Feb 22

Shielding (TUM)

- Cave shielding
 - Preliminary design (CTV) considered three layers: B4C, steel and normal concrete
 - Dose rate and floor loading requirements passed ✓
 - Mirrotron proposed same solution used for the bunker (~35% cheaper) ✓
 - Precasted heavy concrete (HC) stones
 - Includes 10cm borated HC layer
 - Preliminary MC using new material looking very good ✓
 - Detail design MC including chicanes and ventilation ongoing
 - Preliminary results are promising ✓
 - Floor loading above the limit
 - Looking for a suitable solution: Joint work with Mirrotron, NSS (Gabor) and CF (ESS) now ongoing. Risk of delay in the next design milestones ✗

* Item agreed to be procured by ESS for TUM

	Task no.	TA ID	Deliverables – Project Results	Delivery Date	Status	
TUM	WU 11.2	39-50	Cave Shielding*	Jun 2021	PDR done	On track

Ex-Bunker main components:

Installation window: Jun 21 – Feb 22

Shielding (TUM)

- Cave shielding

fast and epithermal neutrons

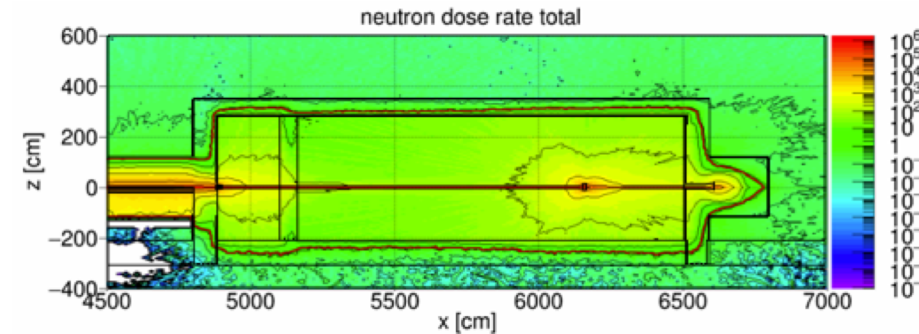
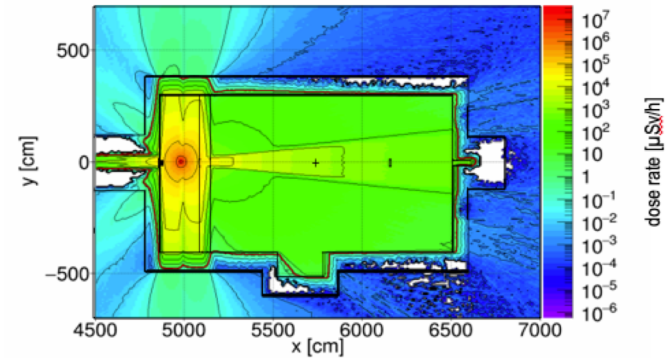


Figure 14: Neutron dose rate $E > 1\text{eV}$. The red line is the $1.5\mu\text{Sv/h}$ border. The maximum of the scale is the maximum that appears in the diagram.



re 61: Gamma dose rate produced by thermal neutrons ($E < 1\text{eV}$). The red line is the $1.5\mu\text{Sv/h}$ border. The maximum of the scale is the maximum that appears in the diagram.

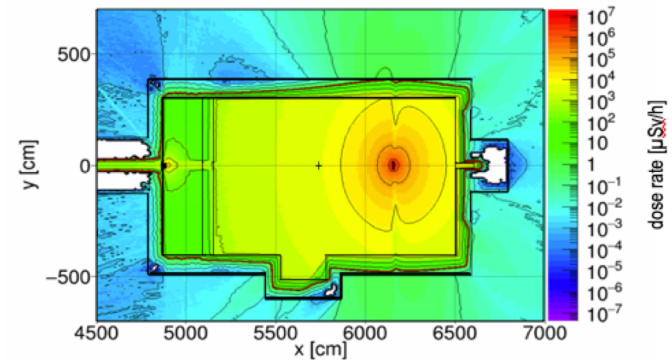


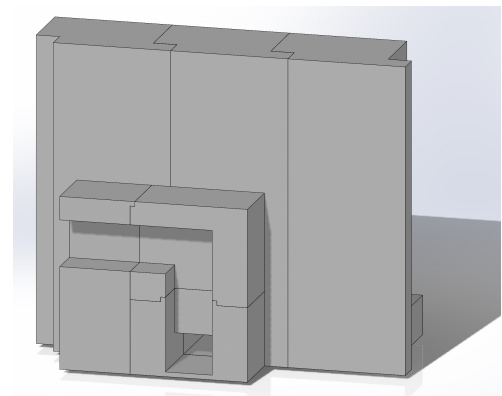
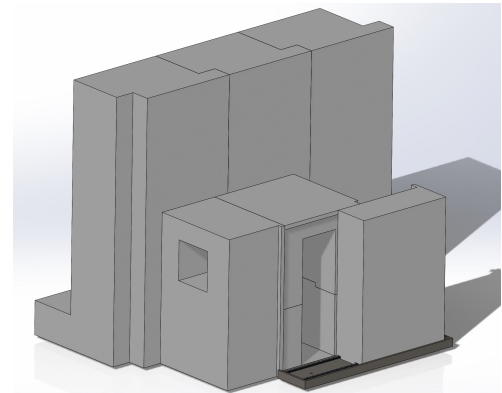
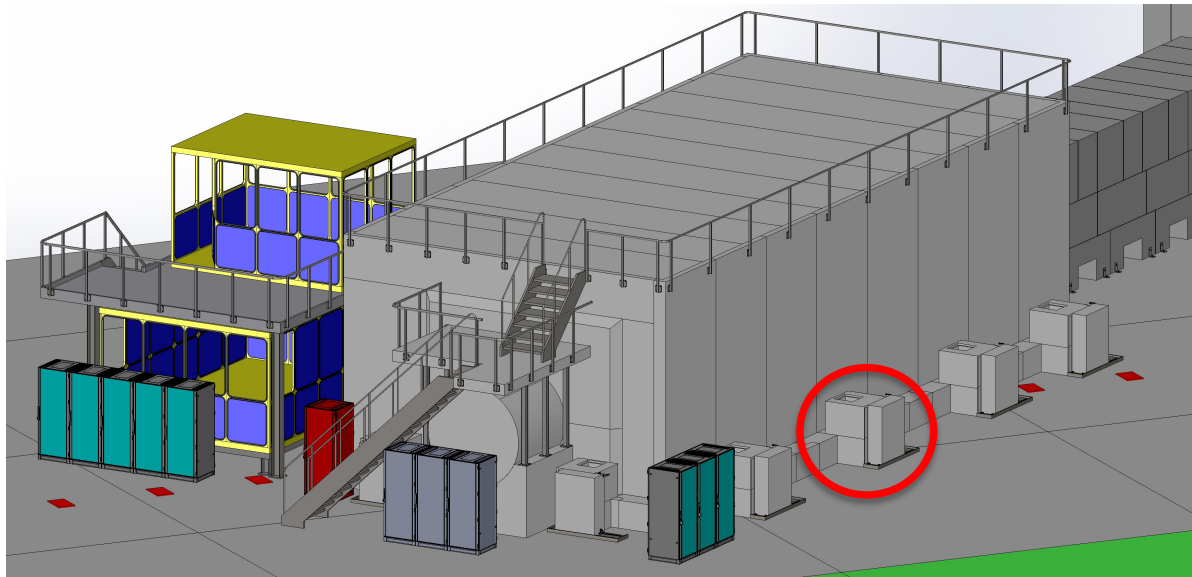
Figure 40: Gamma dose rate produced by thermal neutrons ($E < 1\text{eV}$). The red line is the $1.5\mu\text{Sv/h}$ border. The maximum of the scale is the maximum that appears in the diagram.

* Item agreed to be procured by ESS for TUM

	Task no.	TA ID	Deliverables – Project Results	Delivery Date	Status	
TUM	WU 11.2	39-50	Cave Shielding*	Jun 2021	PDR done	On track

Ex-Bunker main components:

Installation window: Jun 21 – Feb 22

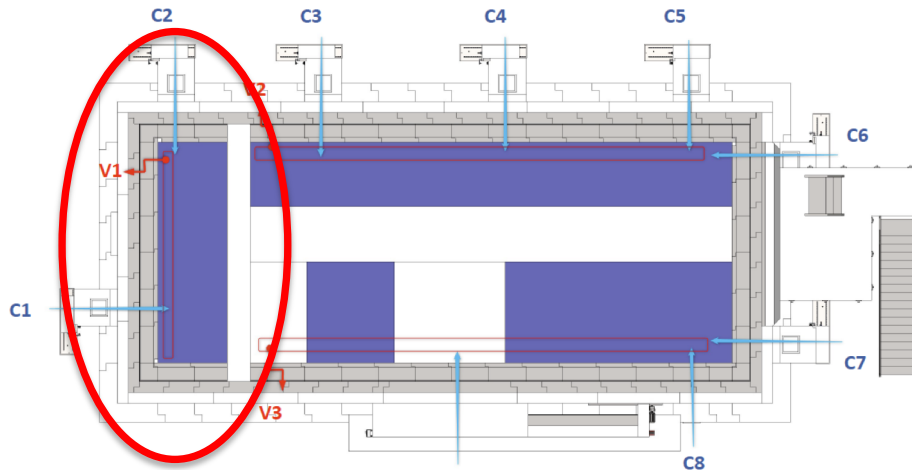


* Item agreed to be procured by ESS for TUM

	Task no.	TA ID	Deliverables – Project Results	Delivery Date	Status	
TUM	WU 11.2	39-50	Cave Shielding*	Jun 2021	PDR done	On track

Ex-Bunker main components:

Installation window: Jun 21 – Feb 22



C1-C8: Chicanes for piping and cabling

V1-V3: Ventilation feedthrough

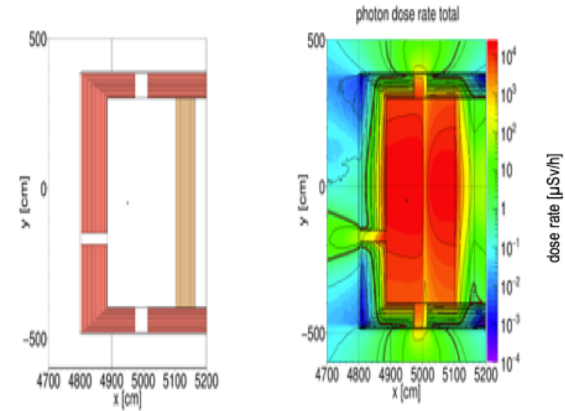


Fig. 4. Generated gamma dose rate due to thermal neutron capture (2mm Cd sheet in optical chamber). The red line is the 1.5μSv/h border.

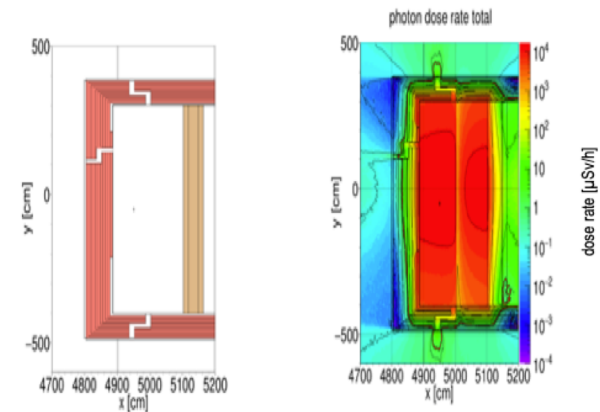


Fig. 6. Generated gamma dose rate due to thermal neutron capture (2mm Cd sheet in optical chamber). The red line is the 1.5μSv/h border.

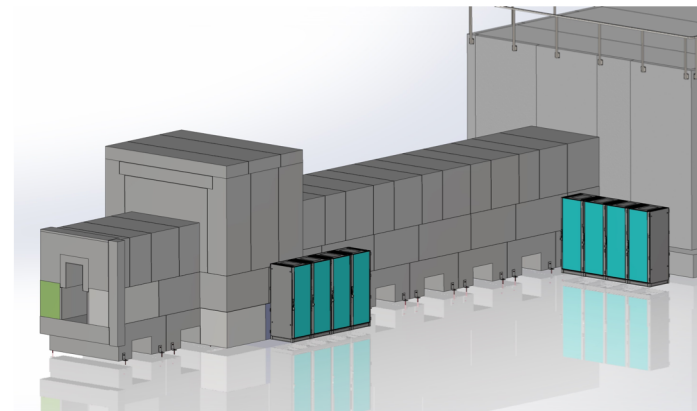
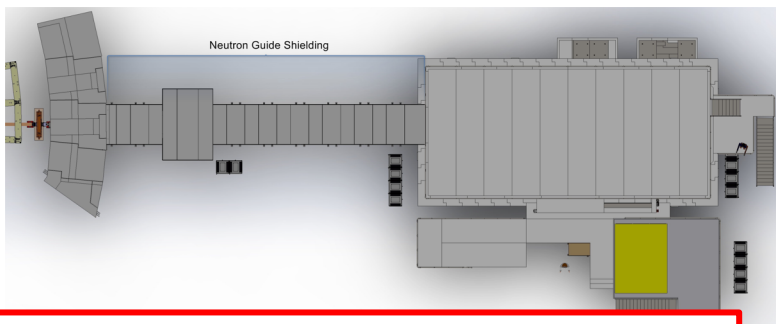
* Item agreed to be procured by ESS for TUM

	Task no.	TA ID	Deliverables – Project Results	Delivery Date	Status	
TUM	WU 11.1	33-38	Guide Shielding* (common shielding project)	Jun 2021	subTG3 ongoing	On track

Ex-Bunker main components:

Installation window: Jun 2021 – Mar 2022

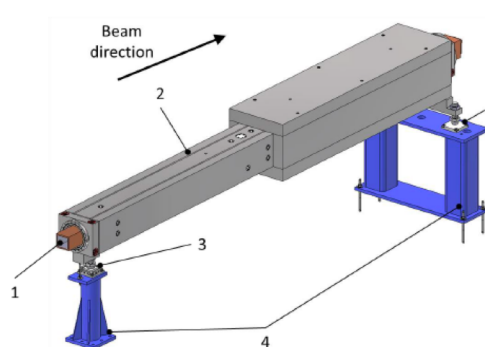
- Guide shielding (TUM)
 - ODIN guide shielding belongs to Common shielding project ESS
 - Detail design: Last verification MC simulations ongoing
 - subTG3 re-scheduled Dec 2020
 - Status **OK**



* Item agreed to be procured by ESS for TUM

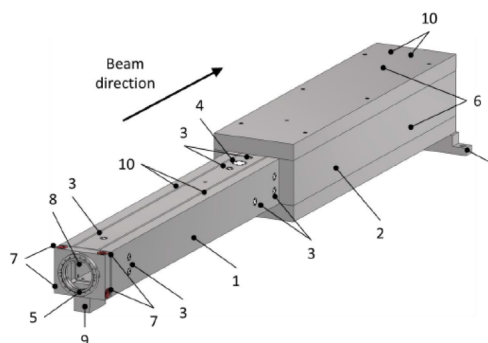
	Task no.	TA ID	Deliverables – Project Results	Delivery Date	Status	
TUM	AO02		Bunker wall feedthrough	Jun 2021	PDR done	On track

Scope of supply by SwissNeutronics



Pos.	Component	Function / Description
1	Neutron guide	Channel with neutron reflecting coating at the interior wall to transport neutrons
2	Vacuum vessel	Casing to provide vacuum to the neutron guide
3	Kinematic mount	3-point support of the vacuum vessel providing a kinematic mount with provision for precise alignment of the vacuum vessel (neutron guide) in xyz and fixation against vertical lift-off
4	Support pillars	Pillars to support the guide system at the appropriate level above the floor

Design of BWF vacuum vessel



Pos.	Part/feature	Function/Description
1	Vacuum vessel	Massive steel enclosure made from four plates (stainless steel, certified Co content <0.2%), which are welded together. Dedicated frames are attached (welded) at either end providing vacuum flanges to the respective attachments.
2	Shielding jacket	Shielding jacket screwed to the vacuum vessel, providing a stepped outer profile of the assembly.
3	Vacuum ports for alignment screws	Integrated provisions to support and align the two neutron guide units. Those have the standard arrangement of set screws and spring-loaded plungers (6-point support) per guide unit. Caps with aluminum gaskets seal these ports.
4	Metrology access port	Opening which provides access to the alignment references of the guide units for the 3d measurement arm. A cap with aluminum gaskets seals the port.
5	Vacuum flange adapter	Vacuum flange CF DN150 at upstream and CF DN200 at downstream end to provide connection to vacuum bellows (provided by Axilon); welded onto the vacuum vessel.
6	Shielding jacket openings	Openings to reach the guide alignment provisions, which are integrated in the vacuum vessel
7	Fiducial	Fiducials to locate the ball probes with size 1 1/2" of the laser tracker and the 3d measurement arm. All fiducials are strictly referenced to the guide axis.
8	Axial locking/adjustment module	Attachment providing provision to align and lock the axial position of the guide units.
9	Kinematic mount interface	Provisions to screw the parts of the kinematic mount into.
10	Lifting provisions	For eye bolts M16

Ex-Bunker main components:

Installation window: Jun 2021 – Feb 2022

■ Bunker wall Feedthrough

- CTV Approved Mar 2020
- SoC Sep 2020 ✓
- Manufactured by SNAG
- KoM done ✓
- PDR done ✓
- subTG3 scheduled Dec 2020
- Status OK

* Item procured by TUM

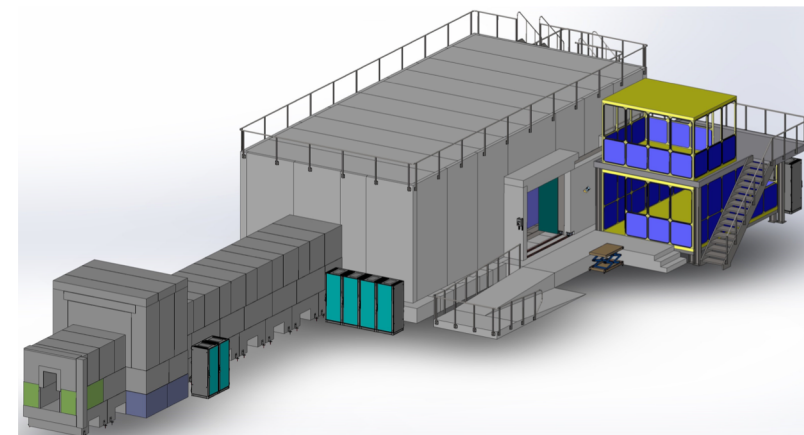
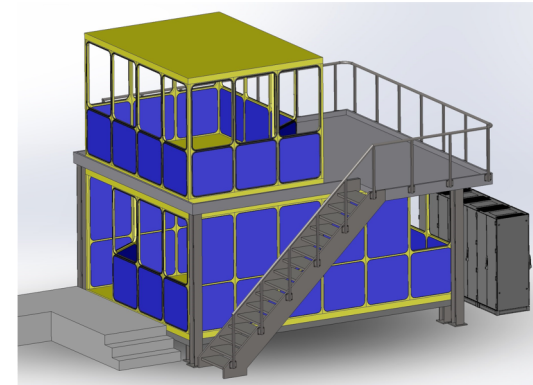
	Task no.	TA ID	Deliverables – Project Results	Delivery Date	Status	
TUM	WU 12		Instrument Infrastructure	Feb 2022	RFQ	

Ex-Bunker main components:

Installation window: Jun 2021 – Oct 2021

- Instrument infrastructure (TUM)
 - Control Hutch (TUM)
 - Sample preparation Area & Storage (TUM)
 - CTV approved Mar 2020
 - RFQ October 2020 ✓
 - SoC Jan 2021 the latest

- Status OK

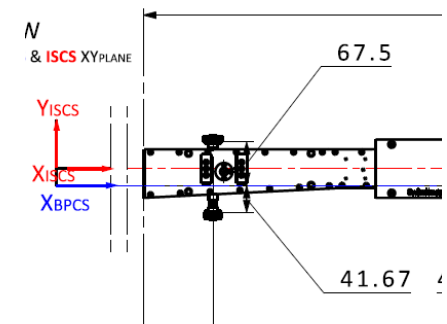
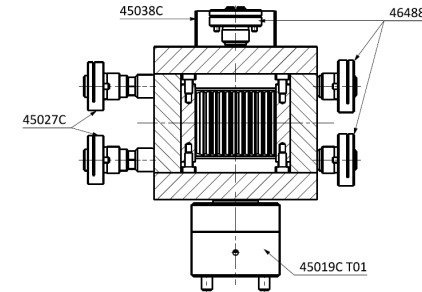


* Item agreed to be procured by ESS for TUM

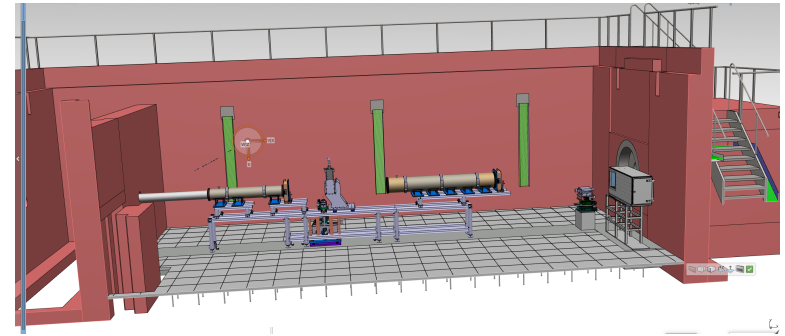
	Task no.	TA ID	Deliverables – Project Results	Delivery Date	Status	
PSI	02.1	1-4	NBOA	Q12021	Delivery ESS	On track

In-Bunker main components:

- Installation window: 11.8.21 – 25.2.22
- NBOA
 - NBOA manufacturing contract was signed in 2019
 - Simplification of the design was requested from SNAG
 - PDR was held in August 2019
 - Detailed design is now ready
 - Manufacturability check from FZJ done
 - TG3 passed in November 2019
 - Manufactured, assembled and (50%) tested ✓
 - Ready for delivery in December 2020
 - Status OK



	Task no.	TA ID	Deliverables – Project Results	Delivery Date	Status	
PSI	06	17-32	Cave interior	June 2022	In prep.	On track



Ex-Bunker main components:

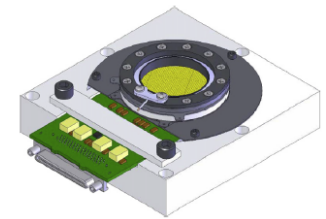
Installation window: 3.6.21 – 25.2.22

- Cave Interior (PSI)
 - Tender published (May 2020) and offers received (September 2020)
 - Received offers are more expensive than the budget → discussion ongoing to de-scope and to save budget somewhere else
 - Some of the components will be designed internally by PSI (J. Hovind)
 - Current concept with a false floor to accommodate for the “elephant foot”
 - Advantages: cabling and piping hidden under the floor
 - ODIN wants to participate in the common power distribution project: price estimate received, discussion ongoing.
 - Strong interest in the utilities distribution common project. First price estimate received ✓
 - Status OK

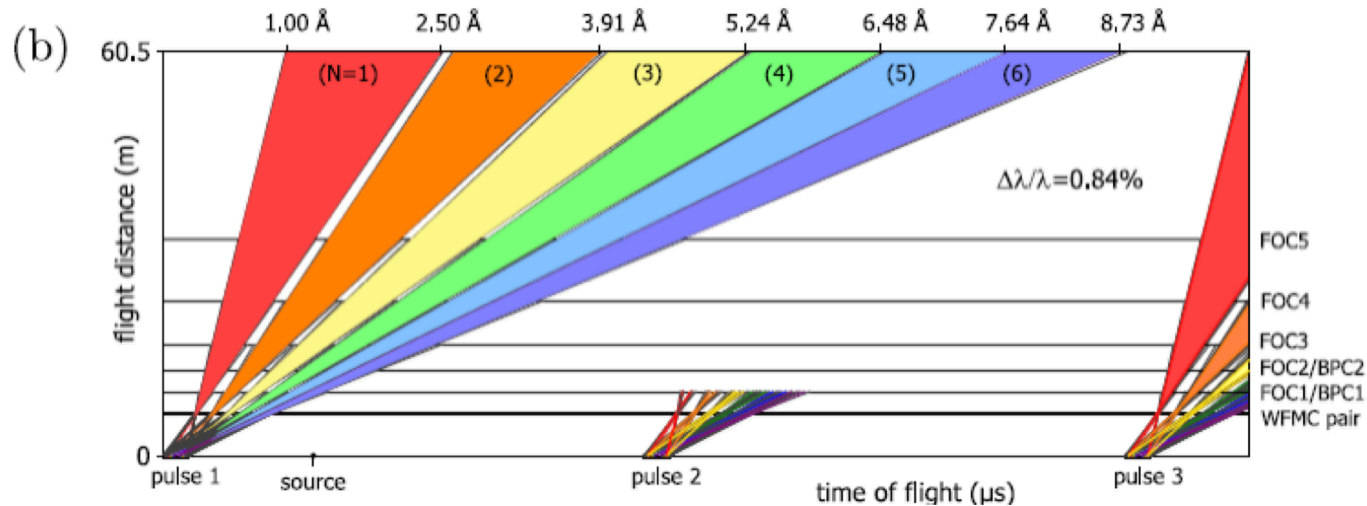
	Task no.	TA ID	Deliverables – Project Results	Delivery Date	Status	
PSI	09	33-43	White beam detectors (WB)	Dec. 2021	commercial	ok
PSI	10	44-48	ToF detector	Dec. 2021	Readout pending	ok

In-Bunker main components:

- Installation window: not critical
- WB+TOF detector
 - WB detectors: existing well probed technology, partly already integrated at ESS, not critical ✓
 - TOF Detector from UC Berkeley acquired at PSI, GP2 (ISIS) and uNID (JPARC) detector tested ✓
 - New event-based detector technology tested in August 2020 and October 2020: definition of the best technology for ODIN will happen early next year ✓
 - Milestone definitions concerning readout, data reduction, instrument control and detector integration alignment projects crucial and needs to happen soon (DMSC/ICS deliverables)
 - ODIN participates in the ESS Beam Monitor Project ✓
 - Status OK

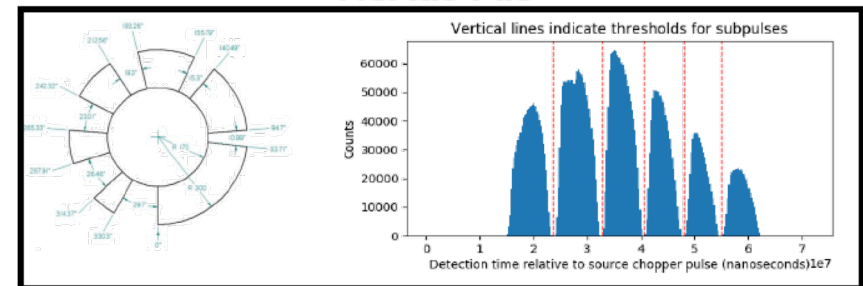


- ODIN employs Wavelength Frame Multiplication (WFM) to enable high wavelength resolutions
- Paper on ODIN chopper system published: Schmakat, P., et al. NIMA 979 (2020)

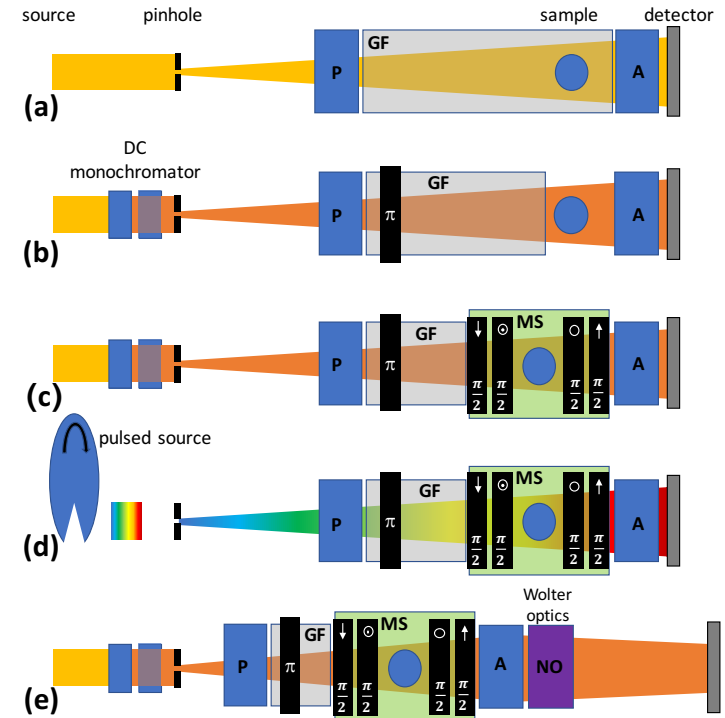


- WFM requires specialized data reduction and development work started based on data acquired on V20.
- Activities will now be focused with the start of the Instrument Data Scientist and regular meetings (16th of October first meeting).

NeXus File



- ODIN participates on the common polarization initiative kicked-off by ESS recently
- Presentations at the past workshop both from instrument team and from “external” users
- Plan: design and build a all-purpose polarization setup ready for the user program
 - Setup includes:
 - Polarizer
 - Analyzer (suitable for imaging)
 - Spin flipper
 - Guiding field
 - (spin manipulators?)
 - Participation on the design of a common He cell to ensure it is suitable for imaging
- Outside the instrument budget and maintained centrally
- More resources and no disruption to the construction project
- More detailed information (budget, schedule, exact scope) to come in the next months



Polarization measurements in neutron imaging Journal of Physics D: Applied Physics, Volume 52, Number 12

Project Status

Installation plan



EUROPEAN
SPALLATION
SOURCE

- Installation plan evolving and shared with ESS (Antonio Bianchi)
 - Plan continuously updated with new installation information from contractors
- Starting soon with definition and preparation of binders (Virginia) ✓
- Installation in-bunker is a challenge
 - Timing: T0 Chopper, guides and bunker roof
 - Synchronization with DREAM (sharing resources for common tasks)
 - Full Remote Handling and other testing must be done (PSS? MCA?)
 - Early scheduled for risk mitigation
 - Power supply and utilities
 - Availability in-bunker
 - More coordination with power and utilities supply needed in the following months
 - ESS In Bunker interfaces: Piping, Cable trays and connection panels. Checking for collisions in the 3D model with ESS Ongoing.
- ODIN installation timeline is very tight
 - Many suppliers coordination: deliveries prioritization shall be necessary (i.e. guides shielding and feedthrough)
 - Early preparation of installation binders and IRR of “simpler” items (i.e. feedthrough, hutch)

Open items (ongoing)

- PSS and IHA
 - Very productive collaboration with PSS (Morteza) ✓
 - ODIN will update operational and maintenance IHA
 - Preliminary review Nov 2020
 - Workshop with ESS scheduled for Dec 2020 ✓

- Power distribution and Utilities supply
 - ODIN has joined both common projects ✓
 - Waiting an offer for Power distribution project ✗
 - Many definitions of scope and interfaces still missing for Utilities supply project ✗

- **Major risks**
 - COVID19 and installation
 - What if in 2021...
 - Travelling restrictions?
 - Major lockdown?
 - T0 chopper delivery and installation delays
 - New installation strategies under study

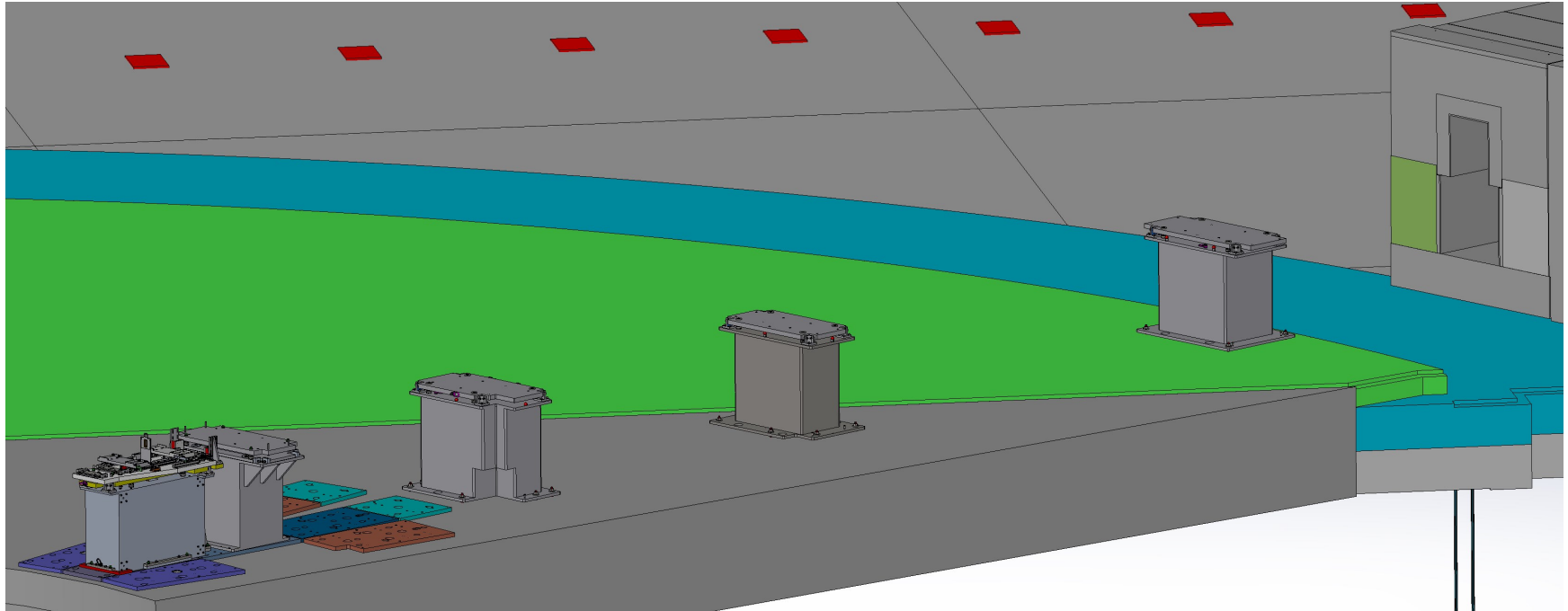
Project Status

ODIN design today... timelapse



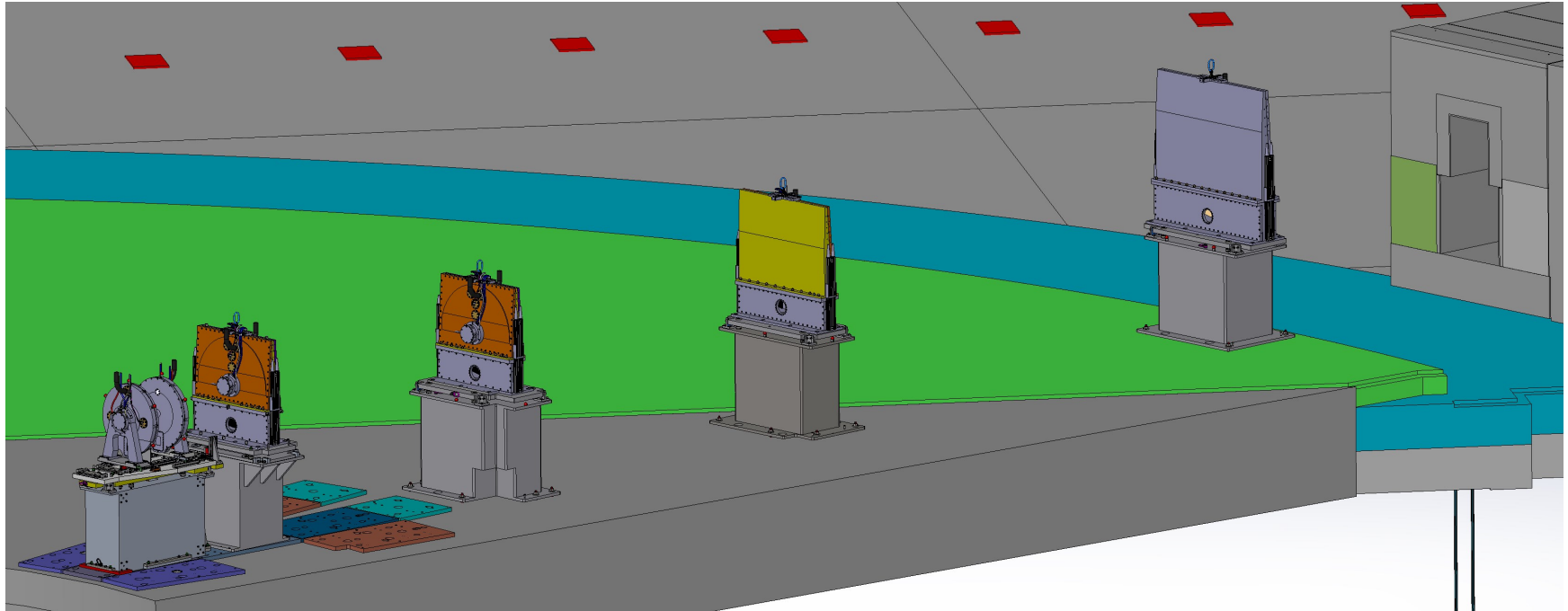
Project Status

ODIN design today... timelapse



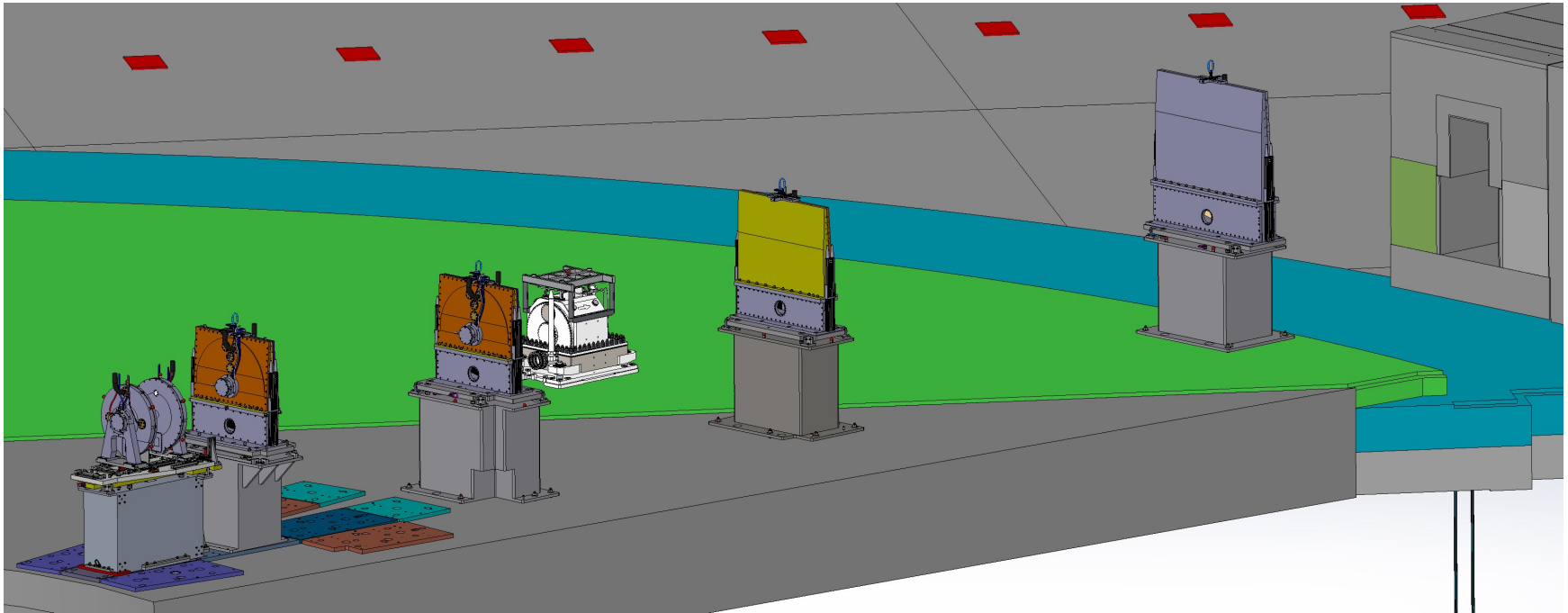
Project Status

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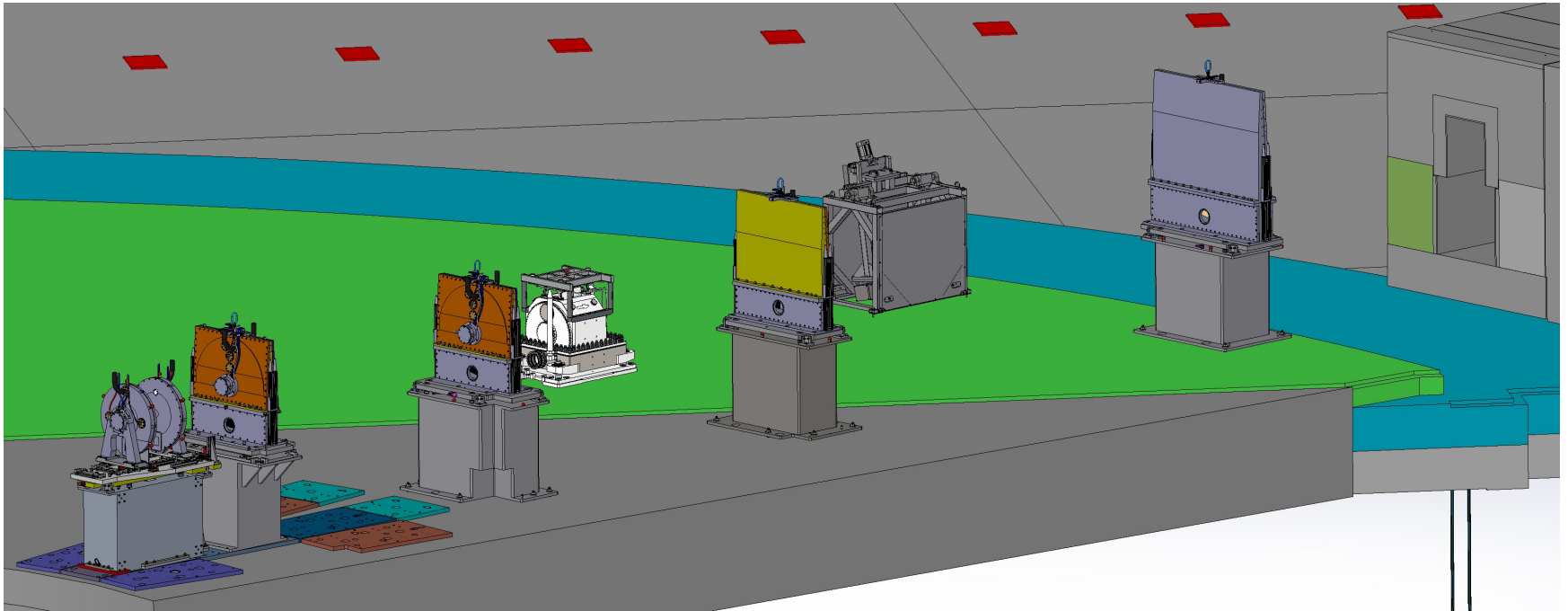
Project Status

ODIN design today... timelapse



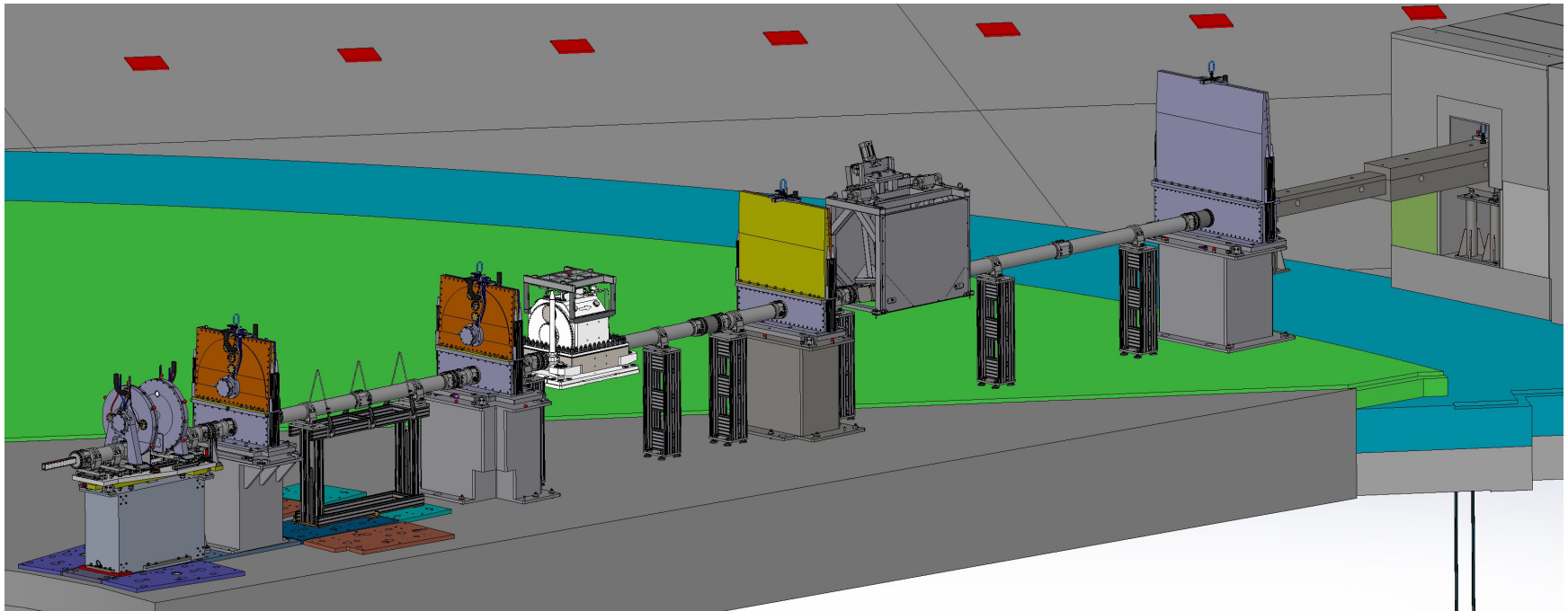
Project Status

ODIN design today... timelapse



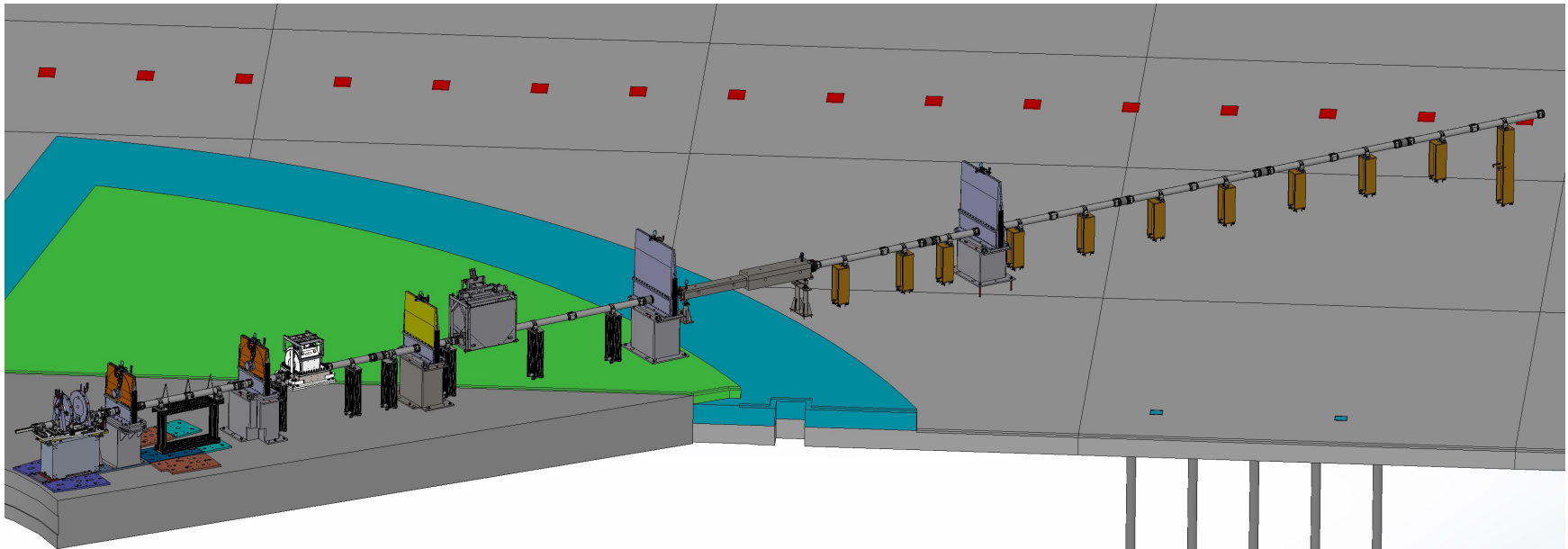
Project Status

ODIN design today... timelapse



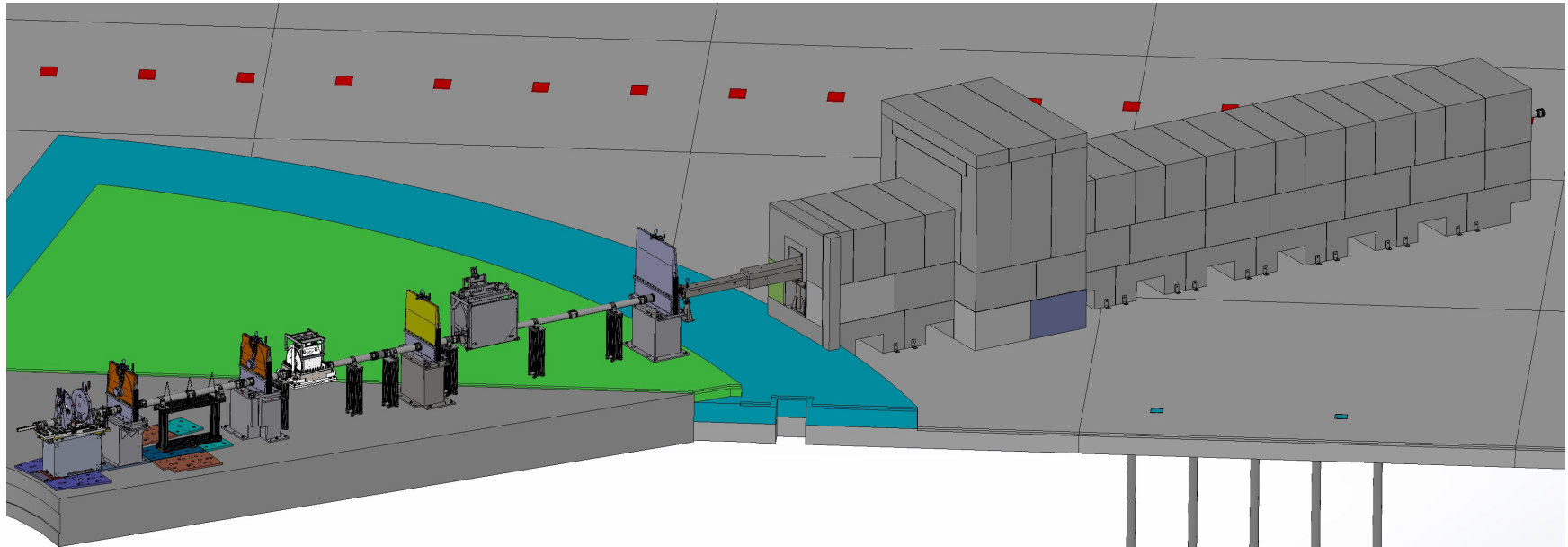
Project Status

ODIN design today... timelapse



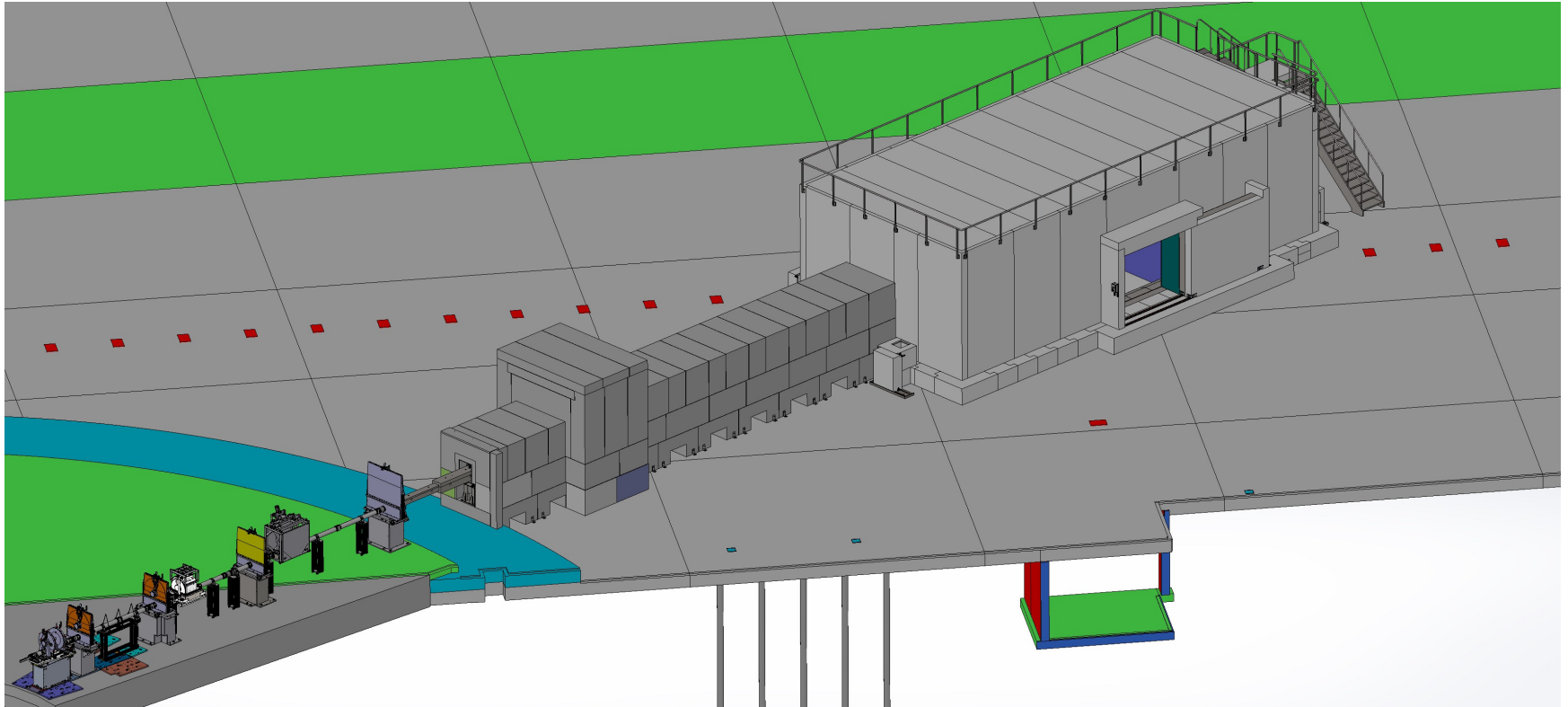
Project Status

ODIN design today... timelapse



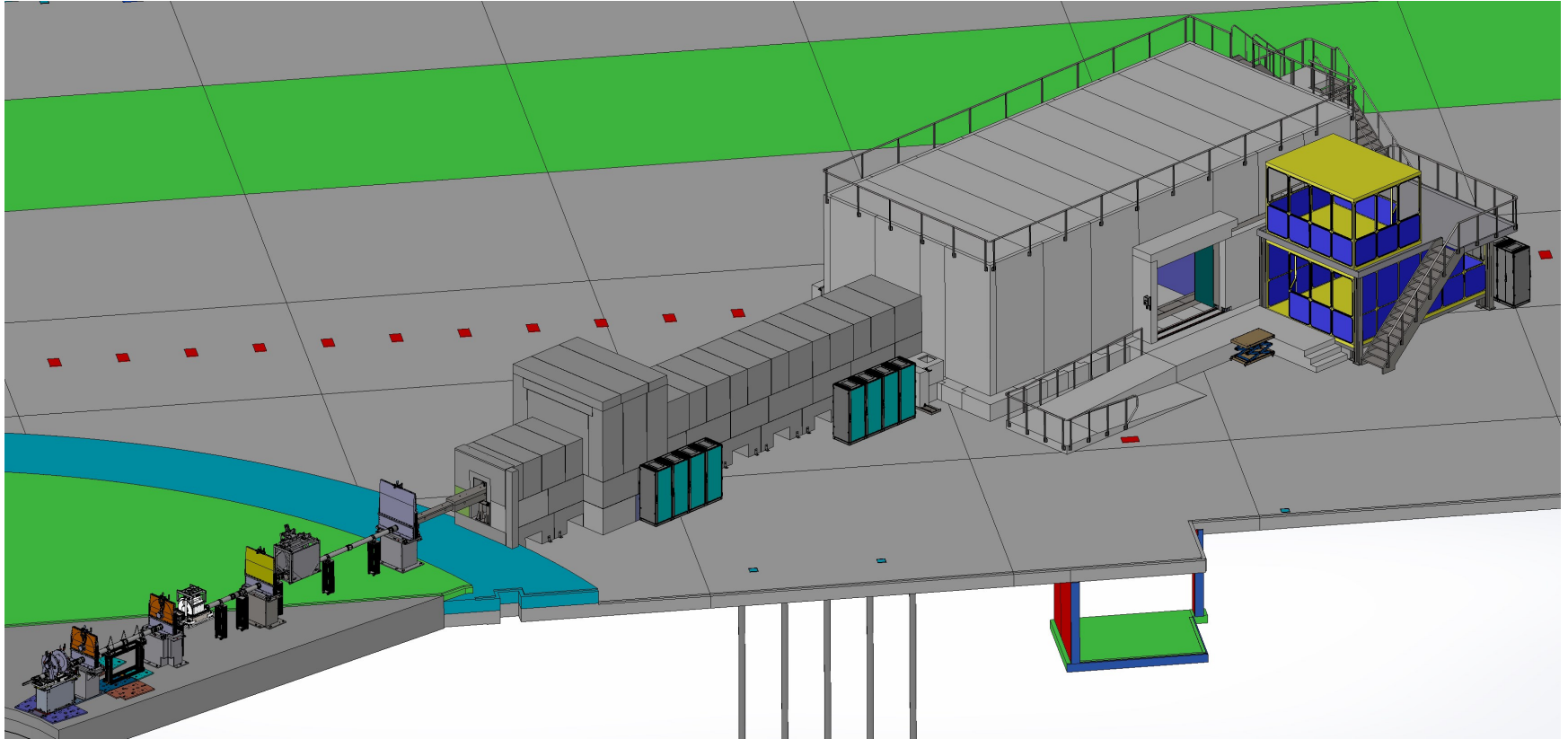
Project Status

ODIN design today... timelapse



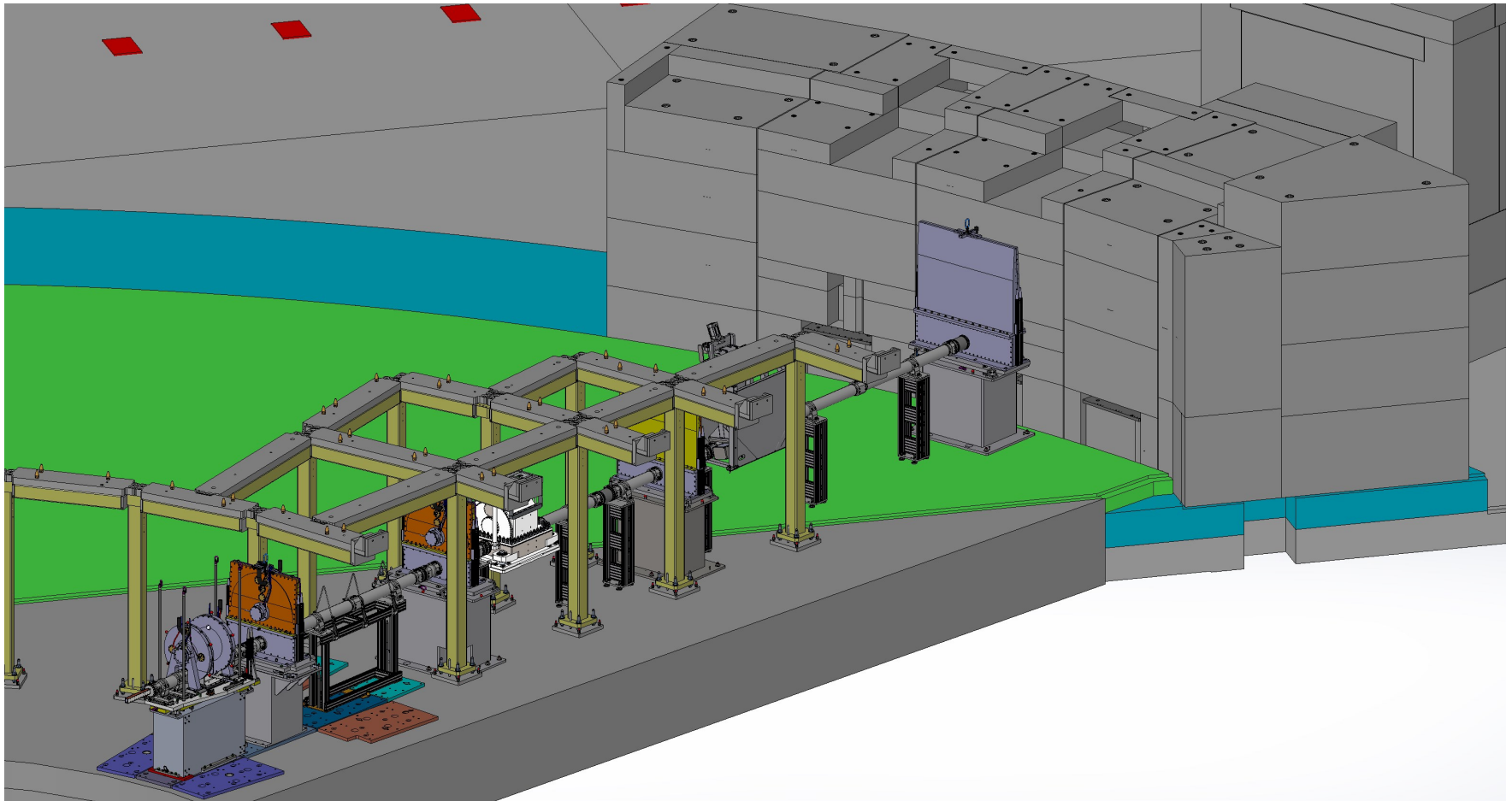
Project Status

ODIN design today... timelapse



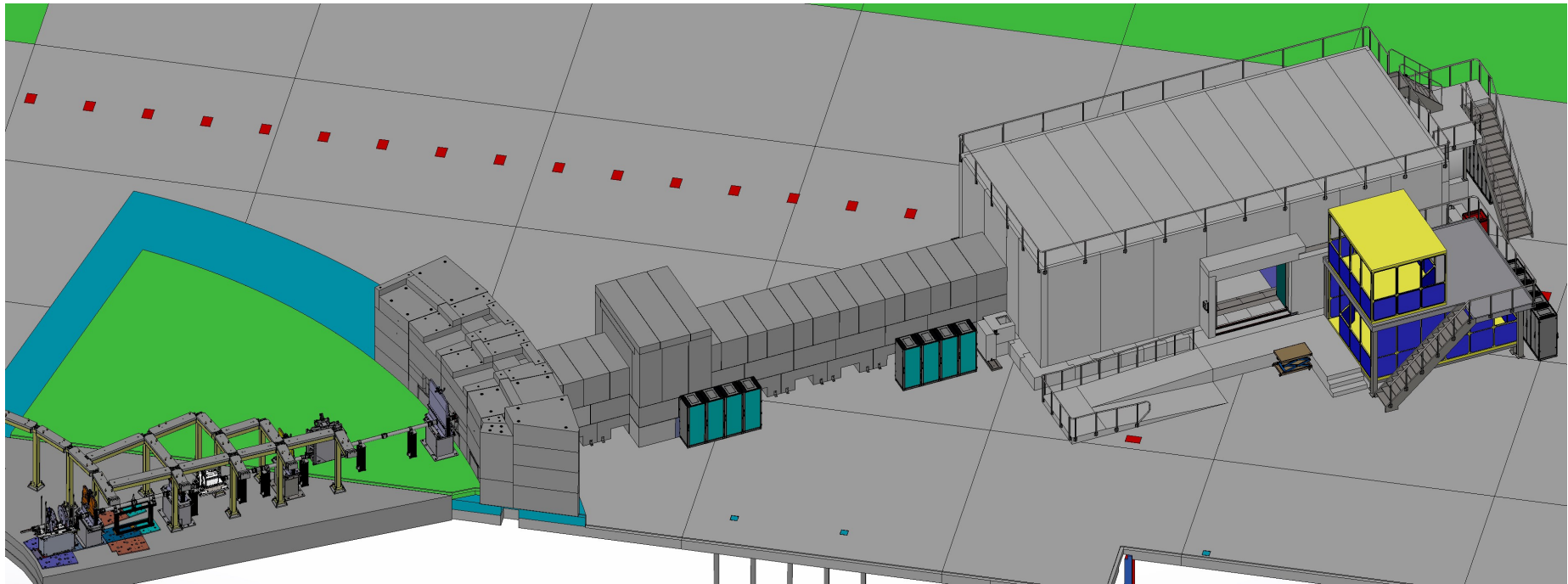
Project Status

ODIN design today... timelapse



Project Status

ODIN design today... timelapse



- ODIN overview
 - Quick overview
 - High level schedule
- How we work
- Project Status
 - ODIN Work Units Overview
 - Installation plan
- Summary

Summary

- ODIN choppers system (Manufacturing), NBOA (Manufacturing) and Neutron guides (IDR Done). **On Track**
- Chopper supplements (IDR done): Longer delivery time parts being procured. Preparing detail design for subTG3. **On Track**
- BW-Feedthrough (PDR) and Heavy shutter (KoM). **On track**
- Shielding
 - Cave shielding: PDR done. **On track**
 - Guide shielding (ESS Common Shielding Project): subTG3 scheduled in Dec2020. **The project status is OK**
- ODIN Cave interior: Tender done. **On track, attention required on the budget**
- T0 chopper: Tender ongoing. **Critical path.**
- MCA: Statement of Work and schedule ready. **Waiting signature of agreement**
- PSS, Power distribution and Utilities supply: **Ongoing**
- ODIN Final TG3 scheduled in March2021. **Ongoing**

- Installation
 - Master plan and schedule exists. **New installation strategies (mitigations) ongoing**
 - ODIN has now a dedicated installation engineer. **✓**

- General ODIN status is: **On track ✓**



Thank you!

Aureliano.Tartaglione@frm2.tum.de

Field of View up to $20 \times 20 \text{cm}^2$ with a homogeneity of more than 75%

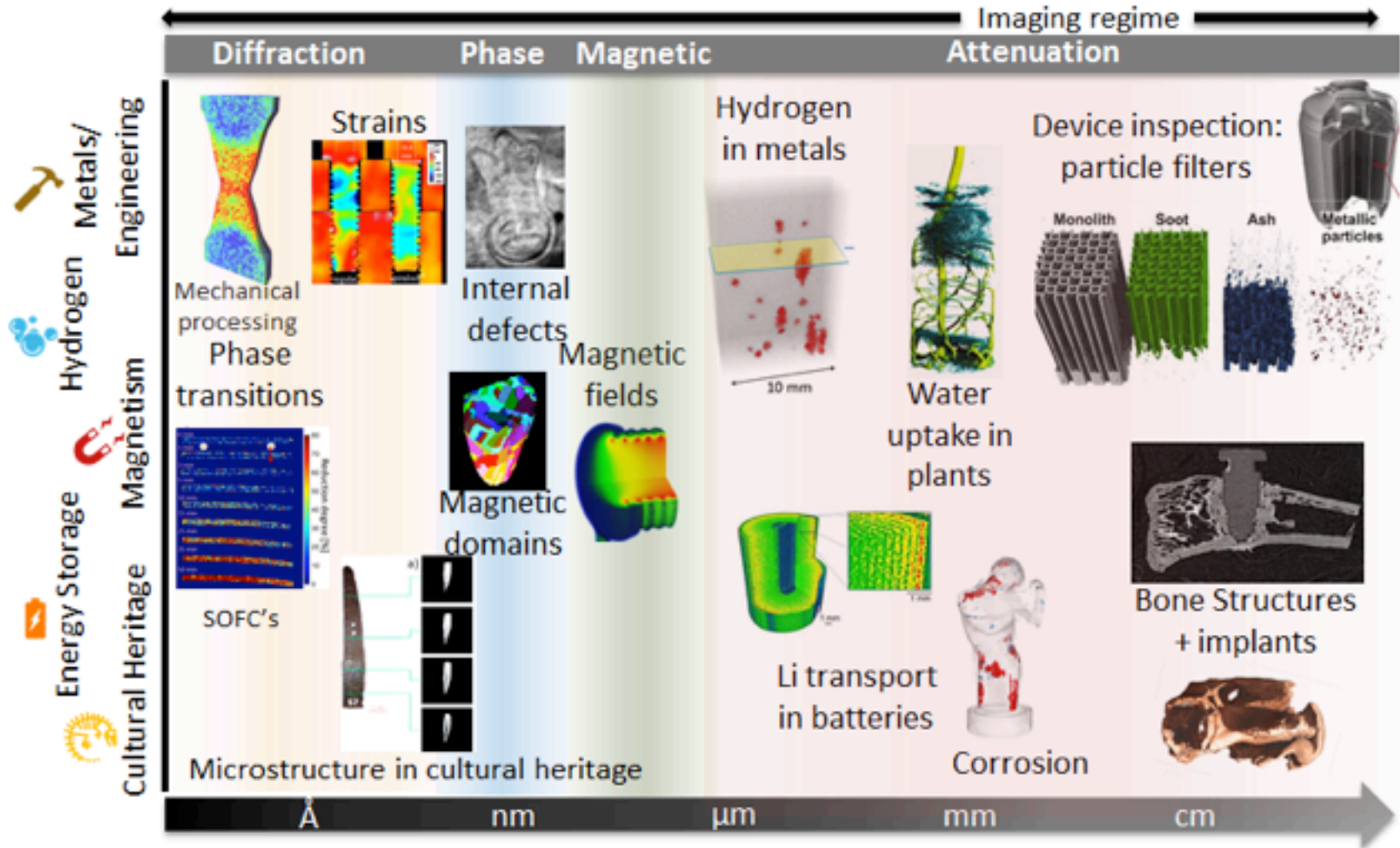
High resolution: Real space resolution of $10 \mu\text{m}$ (smaller FOV)

ODIN shall cover a wavelength range from 1 to 20Å to make optimal use of ESS's spectrum.

Wavelength resolutions of 10%, 1% and down to below 0.5% for spectra from 1Å to 10Å and 1Å to 5.5Å shall be available.

Bandwidths of about 4.5Å and 9Å in every pulse and single pulse suppression modes shall be freely selectable between $1\text{-}20 \text{Å}$.

Applications

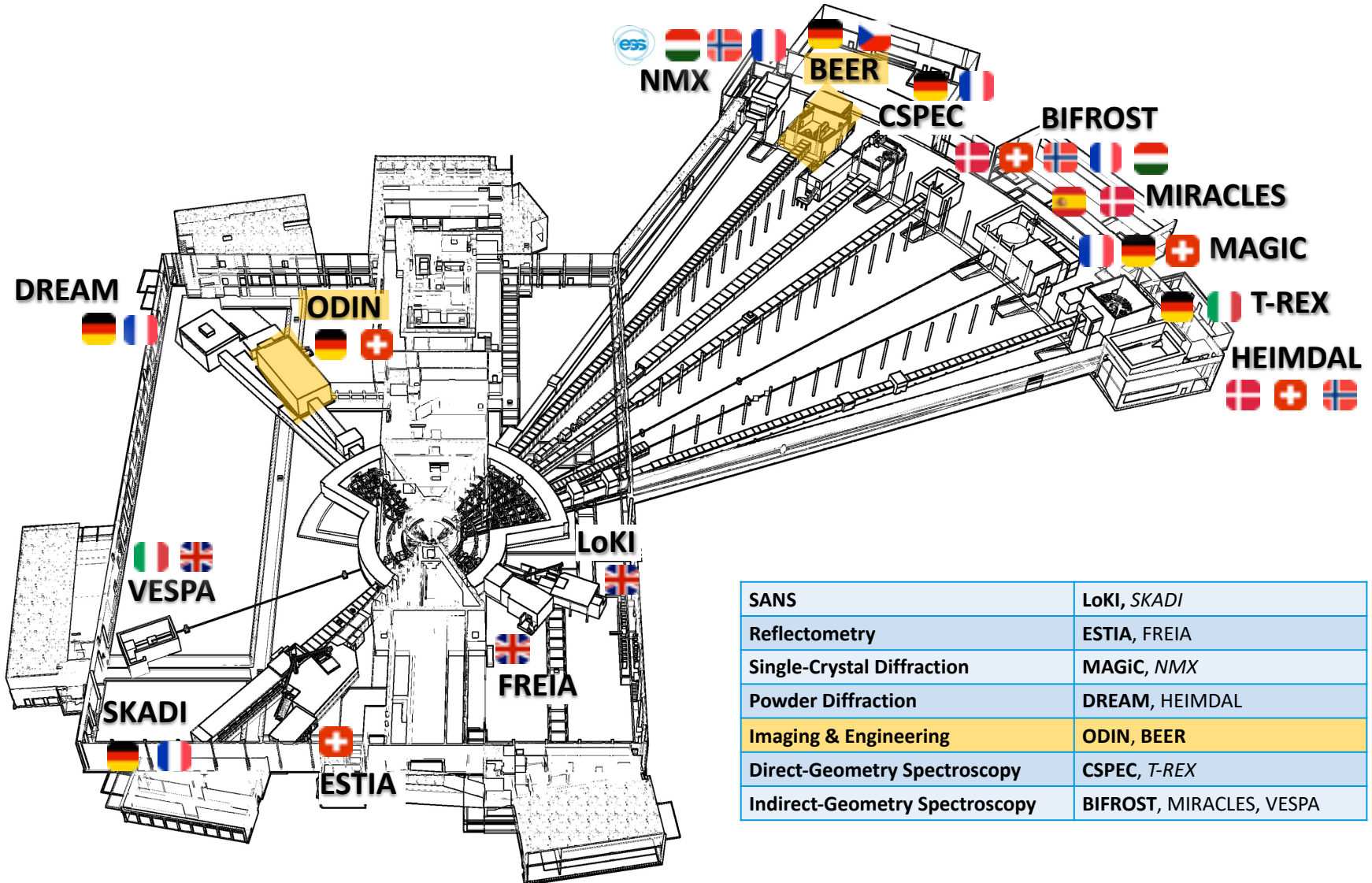


ODIN Overview

General Overview



EUROPEAN
SPALLATION
SOURCE



SANS	LoKI, SKADI
Reflectometry	ESTIA, FREIA
Single-Crystal Diffraction	MAGiC, NMX
Powder Diffraction	DREAM, HEIMDAL
Imaging & Engineering	ODIN, BEER
Direct-Geometry Spectroscopy	CSPEC, T-REX
Indirect-Geometry Spectroscopy	BIFROST, MIRACLES, VESPA

K.H. Andersen, D.N. Argyriou, A.J. Jackson et al.

Nuclear Inst. and Methods in Physics Research, A 957 (2020) 163402

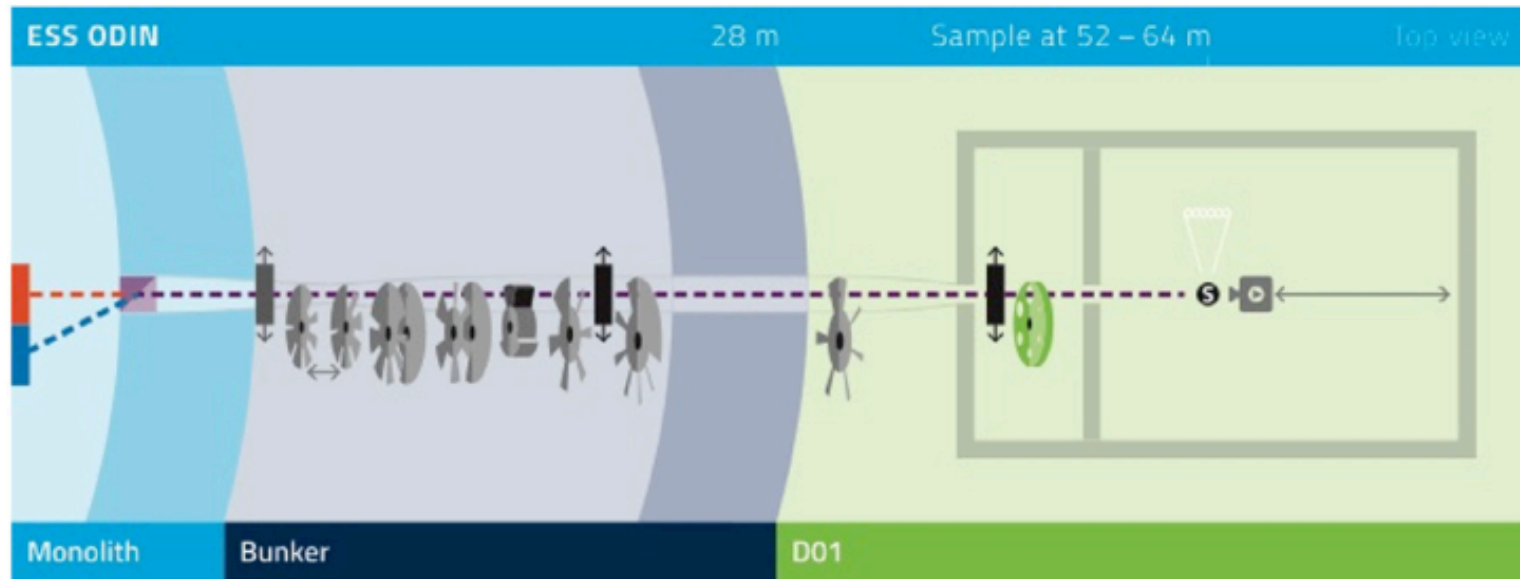
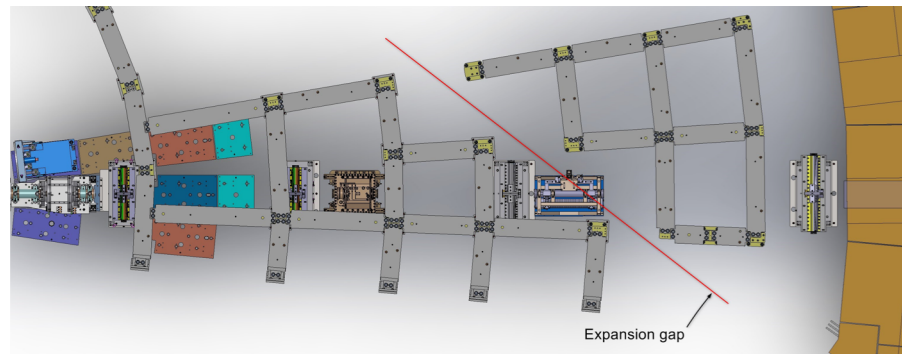
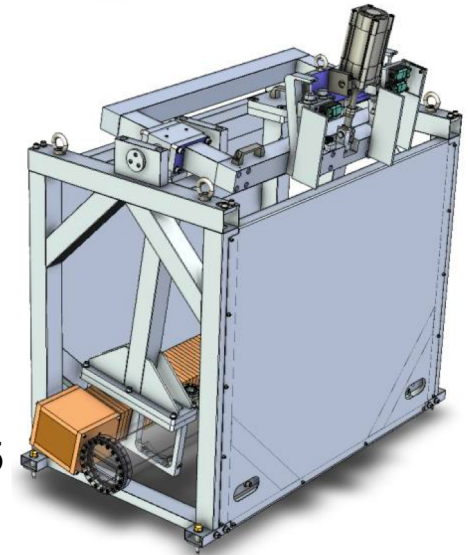


Fig. 19. ODIN instrument layout. Components shown in white are foreseen upgrades.

	Task no.	TA ID	Deliverables – Project Results	Delivery Date	Status	
TUM	WU 03	2-8	Heavy Shutter*	Jun 2021	KoM done	

In-Bunker main components:

- Installation window: 11.8.21 – 25.2.22
- Heavy shutter (TUM):
- Design constraints
 - Pillars + Roof beams + Expansion gap (floor)
 - Max length required: 1.6m
 - Dose requirement: max $3\mu\text{Sv/h}$ in Cave, and $25\mu\text{Sv/h}$ in FOC5 pit
 - Safety factor: 2



* Item agreed to be procured by ESS for TUM

Meetings with focus on scientific scope of the instrument

- STAP (1 video + 1 physical per year)
- ODIN team actively participates scientific workshops, conferences, proposal reviews for existing facilities, advisory panels for new beamlines (benchmarks known)

Project related meetings

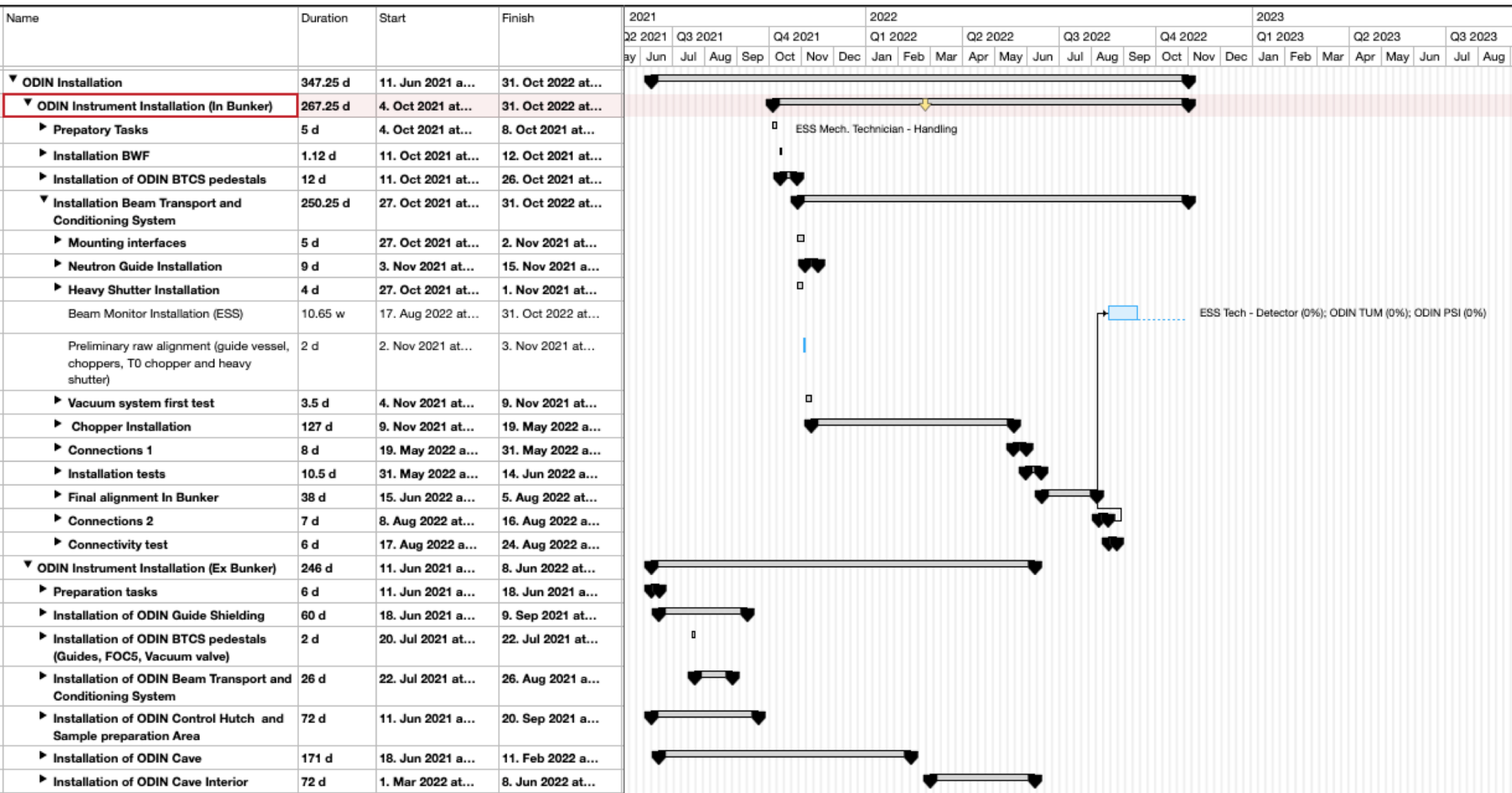
- ICEB meeting (2 per year)

Monthly reports

- Always received on time. Checked and discussed at ESS.

Project Status

Installation plan



WU	Topic	Non-Labor (TA)	Budget (TA)	Current estimate	Comments
WU02	NeutronTransport	- €	34,000.00 €	34,000.00 €	
WU03	Heavy shutter	206,000.00 €	347,000.00 €	40,000.00 €	Heavy shutter + Pedestal
WU04	TO chopper	227,000.00 €	283,000.00 €	463,000.00 €	TO chopper larger hammer
WU05	Chopper	1,778,000.00 €	2,066,000.00 €	1,887,528.00 €	Disk Chopper
WU05.1	Chopper supplements		- €	100,000.00 €	Forgotten in the TA
WU06	Cave interior	- €	39,000.00 €	39,000.00 €	
WU07	Add ons	- €	-	-	
WU08	Motion control	102,000.00 €	368,000.00 €	413,000.00 €	
WU09	White beam detectors	- €	16,000.00 €	16,000.00 €	
WU10	TOF detectors	- €	9,000.00 €	9,000.00 €	
WU11	Shielding	2,395,000.00 €	-	-	
WU11.1	Cave Shielding		2,126,000.00 €	1,614,200.00 €	New offer with heavy concrete
WU11.2	Guide Shielding		500,000.00 €	500,000.00 €	
WU11.3	Bunker Wall Feedthrough		- €	118,134.00 €	Forgotten in the TA
WU12	Infrastructure	123,000.00 €	278,000.00 €	278,000.00 €	Control hutch + sample prep area + Power distribution + Utilities supply
WU14	PSS	118,000.00 €	150,000.00 €	150,000.00 €	
WU15	Travel	- €	61,000.00 €	61,000.00 €	
	TUM labor: 5 years 1.8 FTEs + 1 FTE			872,000.00 €	
	Contingency	495,000.00 €	628,000.00 €		
	Total without contingency	4,949,000.00 €	6,277,000.00 €		
	Total TA TUM	5,444,000.00 €	6,905,000.00 €		
	Toptal current estimate			6,594,862.00 €	
	Total saldo			310,138.00 €	

Budget is under control

WU	Topic	Budget (TA)	Current estimate	Difference	Comment
WU02	Guide system	CHF 2'110'101.43	CHF 1'895'972.65	CHF 214'128.78	NBOA+rest
WU06	Cave interior	CHF 1'257'081.70	CHF 1'801'440.00	CHF -544'358.30	Includes power distribution and utilities
WU09	White beam detector	CHF 448'957.75	CHF 189'000.00	CHF 259'957.75	2 cameras + scintillators
WU10	ToF detector	CHF 448'957.75	CHF 417'200.00	CHF 31'757.75	Includes beam monitors
TG5	TG5	CHF 224'478.88	CHF 224'478.88	CHF -	
	Manpower	CHF 989'236.23	CHF 989'236.23	CHF -	8 FTE
			Total saldo	CHF -38'514.02	

Listed estimates are based on as-received offers and generous, but realistic, assumptions. The price of the cave interior is also as-received, further negotiations and already identified saving potentials are not reflected in the table (yet).

Expected further >100'000 CHF savings from WU06 (will be communicated during the next ICEB)

Budget is under control

Bonus....

WU	Topic	Non-Labor (TA)	Labor (TA)	Budget (TA)	Current estimate	Difference	Comments	
WU02	NeutronTransport	- €	34,000.00 €	34,000.00 €	34,000.00 €	- €		
WU03	Heavy shutter	206,000.00 €	141,000.00 €	347,000.00 €	40,000.00 €	307,000.00 €	Heavy shutter + Pedestal	
WU04	TO chopper	227,000.00 €	56,000.00 €	283,000.00 €	463,000.00 €	- 180,000.00 €	TO chopper larger hammer	
WU05	Chopper	1,778,000.00 €	288,000.00 €	2,066,000.00 €	1,887,528.00 €	178,472.00 €	Disk Chopper	
WU05.1	Chopper supplements			- €	100,000.00 €	- 100,000.00 €	Forgotten in the TA	
WU06	Cave interior	- €	39,000.00 €	39,000.00 €	39,000.00 €	- €		
WU07	Add ons	- €	- €	-	-			
WU08	Motion control	102,000.00 €	266,000.00 €	368,000.00 €	413,000.00 €	- 45,000.00 €		
WU09	White beam detectors	- €	16,000.00 €	16,000.00 €	16,000.00 €	- €		
WU10	TOF detectors	- €	9,000.00 €	9,000.00 €	9,000.00 €	- €		
WU11	Shielding	2,395,000.00 €	231,000.00 €	-	-			
WU11.1	Cave Shielding			2,126,000.00 €	1,614,200.00 €	511,800.00 €	New offer with heavy concrete	
WU11.2	Guide Shielding			500,000.00 €	500,000.00 €	- €		
WU11.3	Bunker Wall Feedthrough			- €	118,134.00 €	- 118,134.00 €	Forgotten in the TA	
WU12	Infrastructure	123,000.00 €	155,000.00 €	278,000.00 €	278,000.00 €	- €	Control hutch + sample prep area + Power distribution + Utilities supply	
WU14	PSS	118,000.00 €	32,000.00 €	150,000.00 €	150,000.00 €	- €		
WU15	Travel	- €	61,000.00 €	61,000.00 €	61,000.00 €	- €		
TUM labor: 5 years 1.8 FTEs + 1 FTE					872,000.00 €			
Contingency		495,000.00 €	133,000.00 €	628,000.00 €				
						554,138.00 €	Caution: it compares values with (Current estimate) and without contingency (TA)	
Total without contingency		4,949,000.00 €	1,328,000.00 €	6,277,000.00 €				
Total TA TUM		5,444,000.00 €	1,461,000.00 €	6,905,000.00 €				
Toptal current estimate					6,594,862.00 €			
Total saldo					310,138.00 €			