ODIN:

Optical and **D**iffraction **I**maging with **N**eutrons at the ESS

ODIN STAP - April 22nd 2020

Aureliano Tartaglione (TUM-Lead Scientist)
Manuel Morgano (PSI-Instrument Scientist)
Elbio Calzada (TUM-Lead Engineer)
Robin Woracek (ESS-ICC)

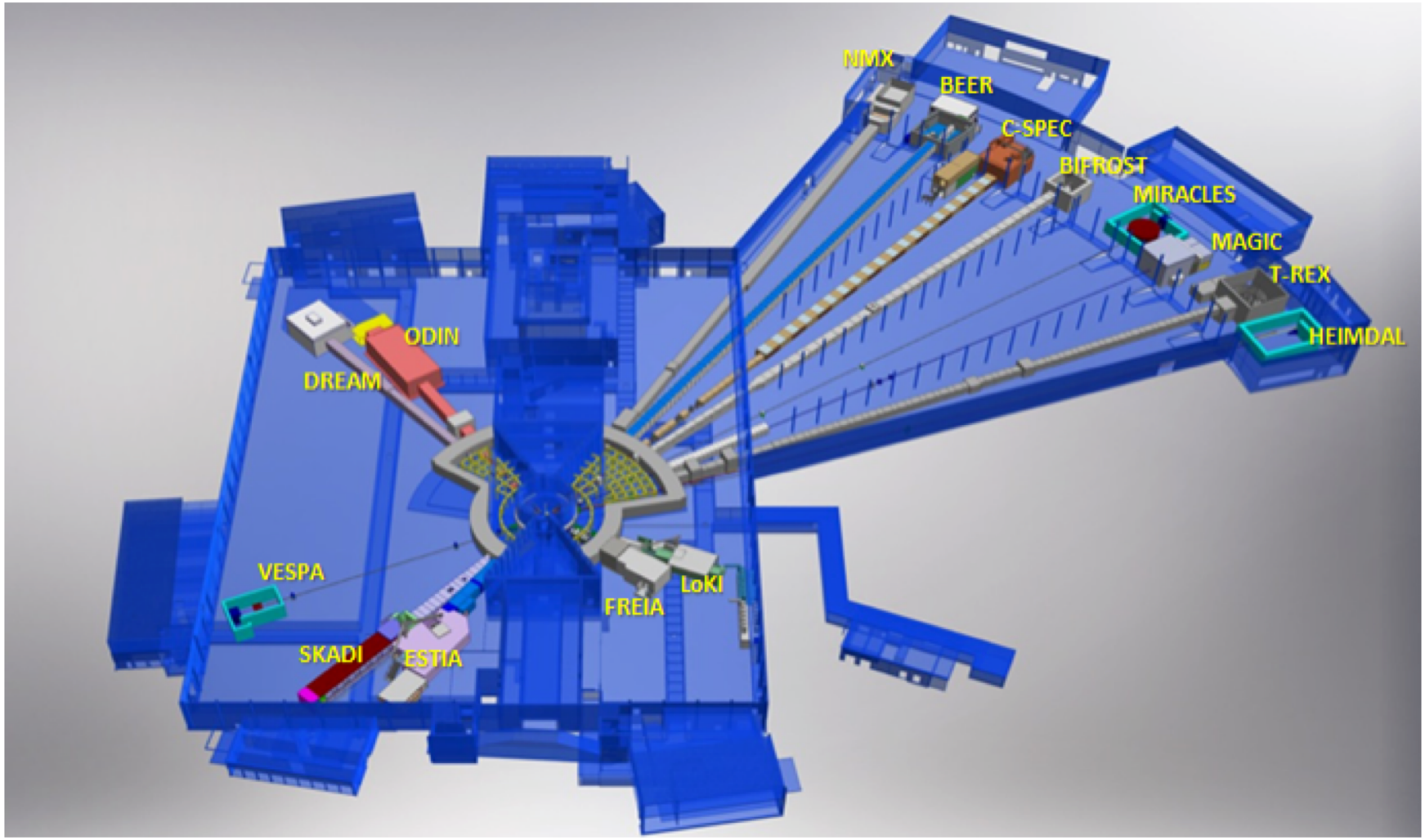
ODIN Status update

AGENDA

- ODIN overview
  - General overview
  - High level schedule
  - ODIN people
- Project Status
  - MOU, IKAs and TAs
  - ODIN Work Units Overview
  - Installation plan
- Project risks and Issues

ODIN: Background and Science case

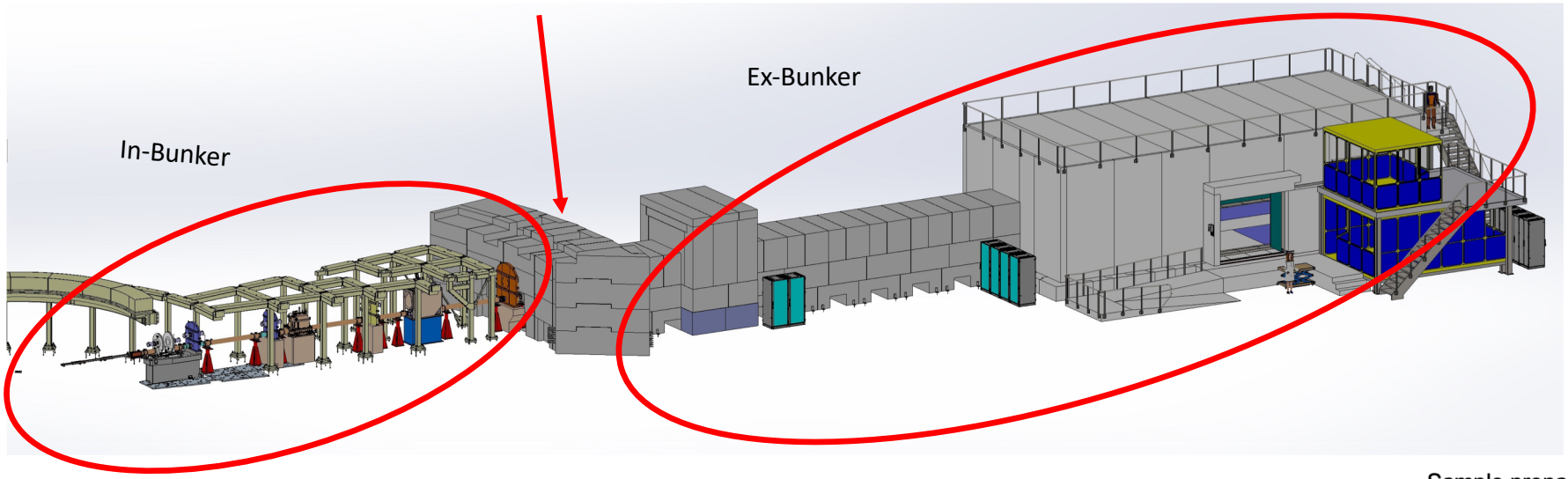
General Overview

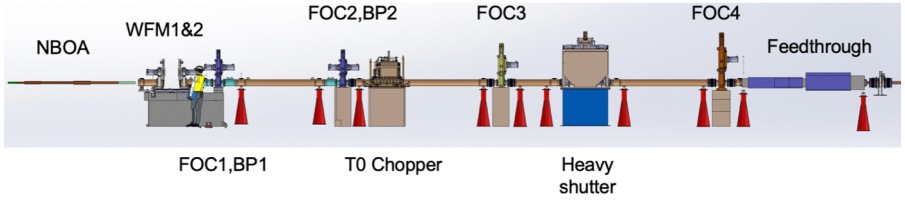


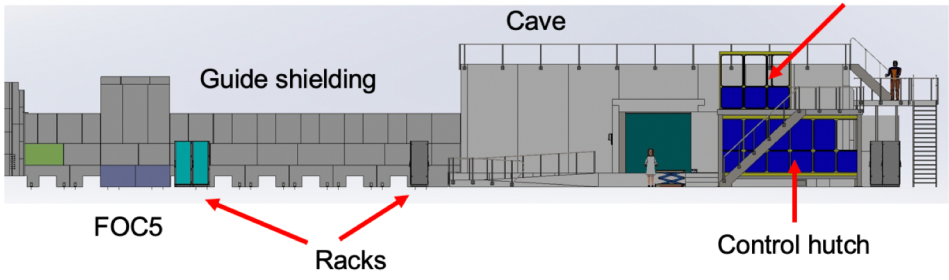
ODIN: Background and Science case

General Overview

- In-Kind partners TUM (lead institution) & PSI
- Total Budget 11.6M€
- Multi purpose imaging instrument in D01 with flexible operation modes

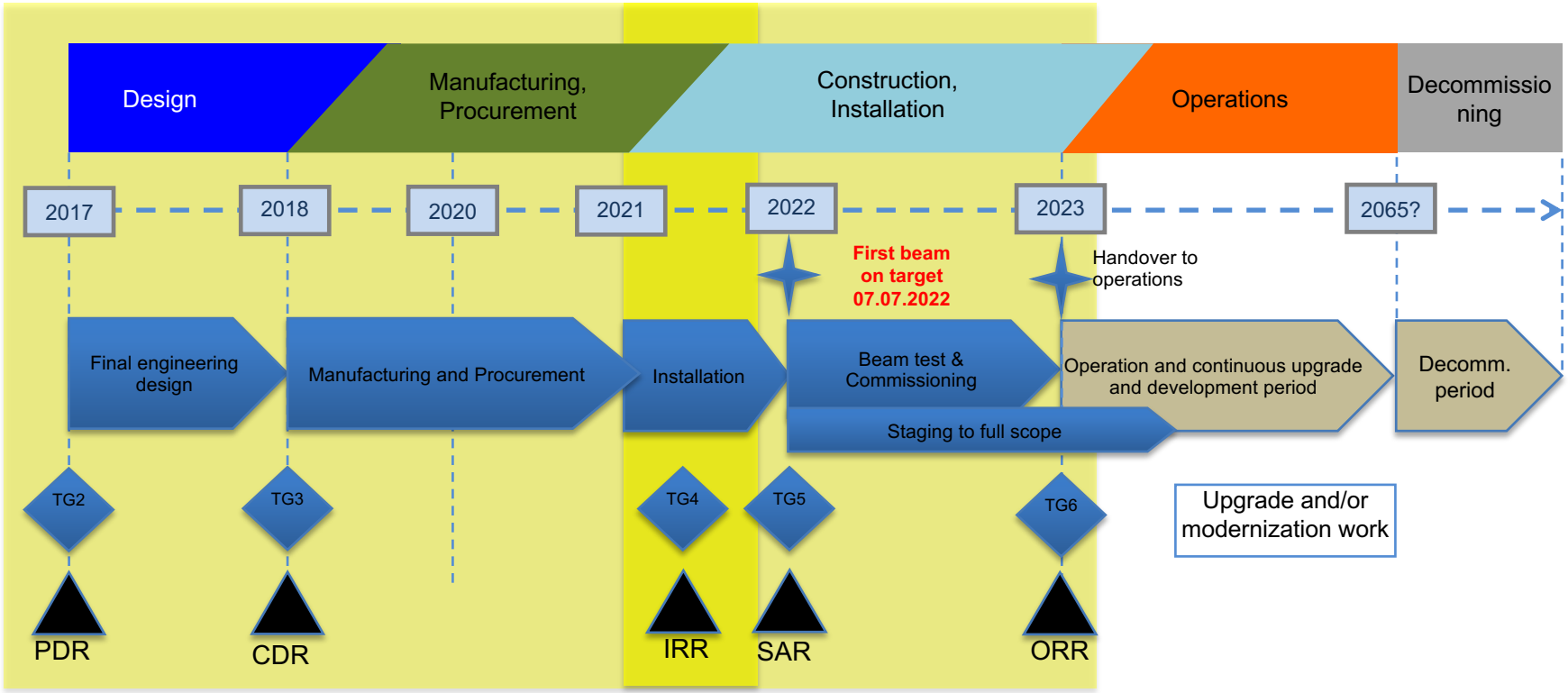






ODIN: Background and Science case

High level schedule



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)	User Programme
03-Mar-17	31-Jun-18	24-Jan-19	15-Nov-20	03-Jun-21	11-Aug-21	22-Feb-22	06-Jul-22	31-Dec-23

Project completion: 23/12/2022

How we work

Collaboration Structure

TUM:

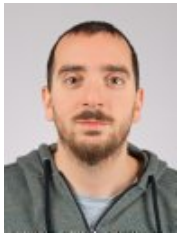
Aureliano Tartaglione
ODIN Lead Scientist

Elbio Calzada
Lead Engineer

Michael Schulz
Head of Imaging group

PSI:

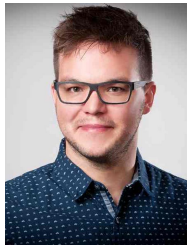
Manuel Morgano
ODIN Scientist



Markus Strobl
Head of Imaging group

Jan Hovind
Technician of Imaging Group

ESS:



Robin Woracek
Instrument Class Coordinator

Formal meetings and interactions: STAP, IKON, ICEB, monthly reports to ESS

ODIN Status update

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Project Status

Status MOU, IKAs and TAs

TUM and PSI contractual issues:

- TUM IKA/TA signed
- PSI-VAT issue solved
- PSI IKA/TA ready for sign

Memorandum of Understanding for
ESS Instrument Consortium

[*ODIN, Multi Purpose Imaging Instrument*]

In-kind Contribution Agreement

relating to Schedule NIK x.x #x Instrument ODIN

Project Status

From TA's: WUs and Budget

	Task no.	TA ID	Deliverables – Project Results	CBV	Date	Status
TUM	WU 03	2-8	Heavy Shutter*	383,000 €	Oct 2021	Tech. Spec. ongoing (ID2)
TUM	WU 04	9-15	T0 Chopper*	313,000 €	Dec 2021	CDR ESS Prototype done CTV approved March 2020
TUM	WU 05	16-25	Choppers*	2,272,000 €	Mar 2022	CDR meeting done (21/4)
TUM	WU 08	26-32	Motion Control and Electric Engineering	405,000 €	Sept 2021	Waiting for ESS offer
TUM	WU 11		Shielding*	2,887,000 €	N/A	
TUM	WU 11.1	33-38	Guide Shielding (common shielding project)	…500,000 €	Jul 2021	Final design June 2020
TUM	WU 11.2	39-50	Cave Shielding	…2,387,000 €	Aug 2021	Tender started (25/3)
TUM	WU 12		Instrument Infrastructure	306,000 €	Feb 2022	
TUM		51-56	Control Hutch (TUM) *			CTV done (15/11/19)
TUM			Sample preparation area & storage (TUM) *			CTV done (15/11/19)
TUM		59	FINAL Tollgate 3		Re-Scheduled November 2020	Ongoing
PSI	02.1	1-4	NBOA	429,000 €	Sept 2019	TG3 passed
PSI	02.2	5-16	Neutron transport system (Guides)	1,699,000 €	Mar 2022	KOM done
PSI	06	17-32	Cave interior	1,250,000 €	June 2022	CTV done March 2020
PSI	09	33-43	White beam detectors	402,000 €	Dec. 2021	Off-the-shelf
PSI	10	44-48	ToF detector	364,000 €	Dec. 2021	Readout pending

* Item agreed to be procured by ESS for TUM

Project status

Heavy Shutter

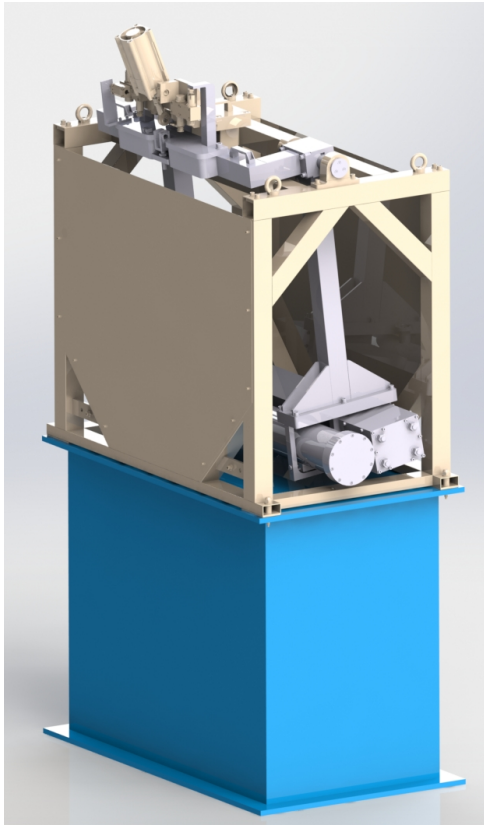
	Task no.	TA ID	Deliverables – Project Results	Cost Book Value	Delivery Date	Status	
TUM	WU 03	2-8	Heavy Shutter*	383,000 €	Oct 2021	Tech. Spec. ongoing (ID2)	Delayed ~8months, but enough float

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)
  - Preliminary MC simulations ready (F. Grünauer)
  - Technical specification ongoing
  - Must be delivered before June 2021
  - Delivery time: 6 months after contract signed

  - Status OK



* Item agreed to be procured by ESS for TUM

Project status

Heavy Shutter

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TUM	WU 03	2-8	Heavy Shutter*	383,000 €	Oct 2021	Tech. Spec. ongoing (ID2)	Delayed ~8months, but enough float

In-Bunke

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We had an action item here:

- Reliability requirement was taken from original design: 98%

- The STAP pointed out these requirement might imply a failure every 10 days which is of course not acceptable for a safety component.

<u>Strategy to reduce risks/improve reliability:</u>

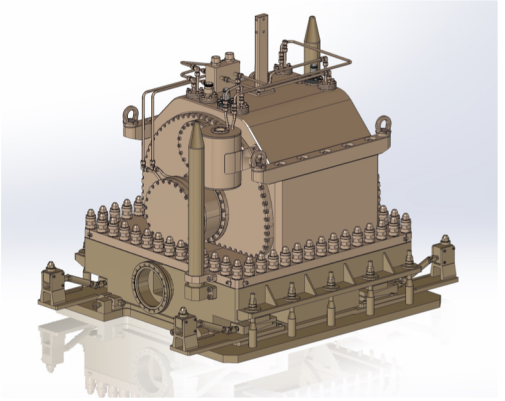
- We will specify an overestimated pneumatic cylinder
- Redundancies in sensitive control electronics
- Guaranteed fail safe design

* Item agreed to be procured by ESS for TUM

Project status

T0 Chopper

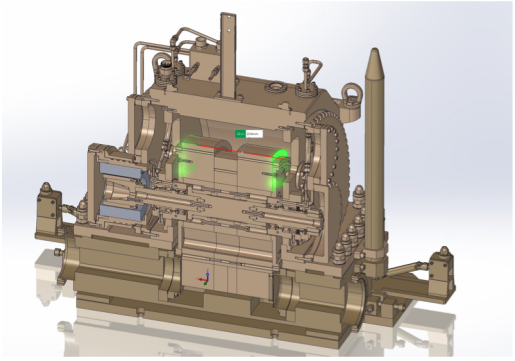
	Task no.	TA ID	Deliverables – Project Results	Cost Book Value	Delivery Date	Status	
TUM	WU 04	9-15	T0 Chopper*	313,000 €	Dec 2021	CDR ESS Prototype done CTV approved March 2020	On track



In-Bunker main components:

- Installation window: 11.8.21 – 25.2.22

- T0 Chopper (TUM-ESS)
  - Design based on DREAM T0 chopper (CDR approved 2019)
  - ODIN and HEIMDAL same design
  - FAT for prototype on schedule (June2020)
  - CTV for ODIN T0 chopper approved (March 2020)
  - ESS waiting for costing estimates update
  - Maximum expected delivery time: 18 months
  - Status OK



* Item agreed to be procured by ESS for TUM

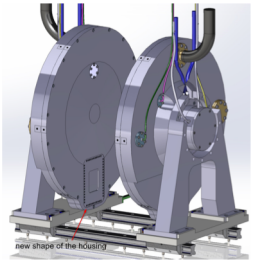
Project status

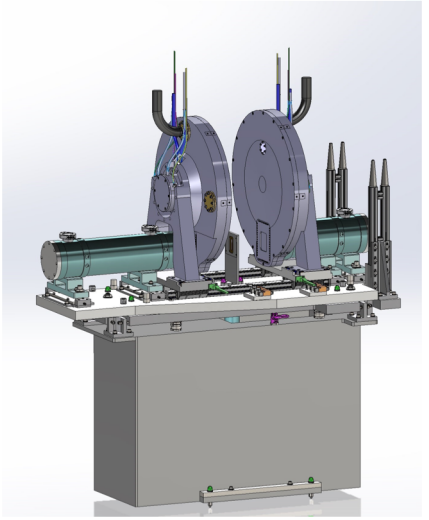
Choppers

	Task no.	TA ID	Deliverables – Project Results	Cost Book Value	Delivery Date	Status	
TUM	WU 05	16-25	Choppers*	2,272,000 €	Mar 2022	CDR meeting done (21/4)	ok

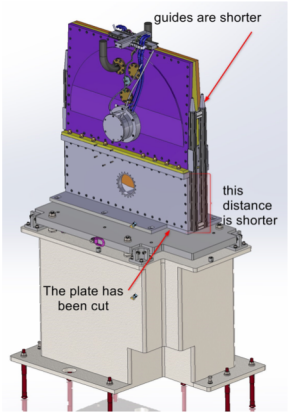
In-Bunker main components:

- Installation window: 11.8.21 – 25.2.22





- Choppers (TUM)
  - Contract signed with AIRBUS in June 2019
  - IDR (ESS) held in Dec 11th 2019
  - PDR closed Feb 2020. All Collisions solved.
  - CDR meeting held 21/4
  - Pedestals, WFMC Motion Table and Alignment Interfaces designed and procured by TUM. CTV May 2020
  - WP on schedule
  - Status OK



* Item agreed to be procured by ESS for TUM

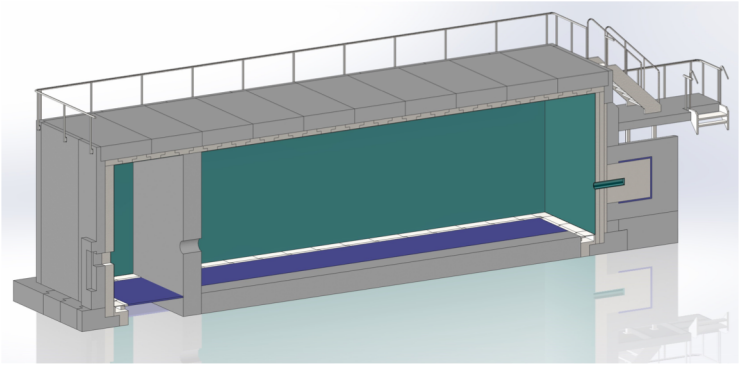
Project status

Cave shielding

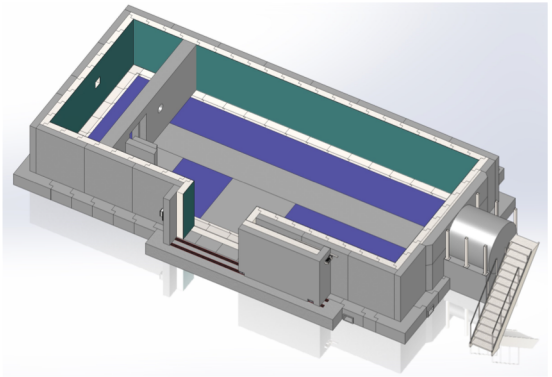
	Task no.	TA ID	Deliverables – Project Results	Cost Book Value	Delivery Date	Status	
TUM	WU 11.2	39-50	Cave Shielding*	2,387,000 €	Aug 2021	Pre Tender	On track

Ex-Bunker main components:

Installation window: 3.6.21 – 25.2.22



- Shielding (TUM)
  - Cave shielding
    - Floor loading issues solved increasing footprint (elephant foot)
    - CTV was held in Nov 15th, 2019
    - H1/H2 Scenarios and Shielding verification documents reviewed with minor changes.
    - Documents now ander formal review at ESS
    - Tender published in March 25th, 2020
    - Status OK



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Project status

Cave shielding

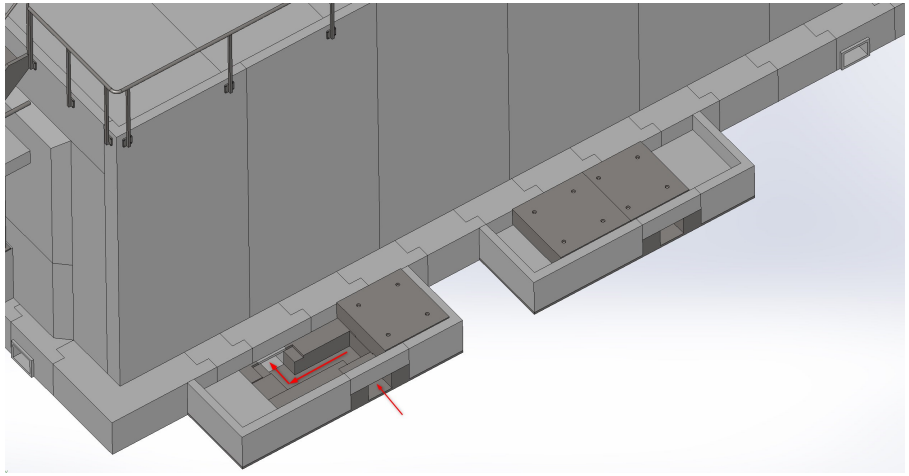
	Task no.	TA ID	Deliverables – Project Results	Cost Book Value	Delivery Date	Status	
TUM	WU 11.2	39-50	Cave Shielding*	2,387,000 €	Aug 2021	Pre Tender	On track

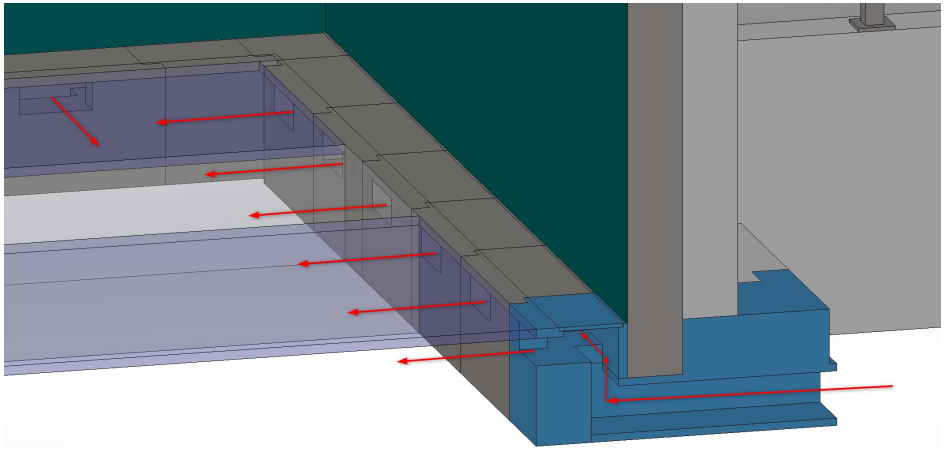
Ex-Bunker main components:

Installation window: 3.6.21 – 25.2.22

Shielding (TUM) – Design&Engineering Solutions

- Introduction of cables, pipes and hoses into the cave
  - Proposal: put a chicane outside the wall.
- The design of the wall pedestal (elephant foot) allows the cables with their connectors to be routed anywhere in the cave





Project status

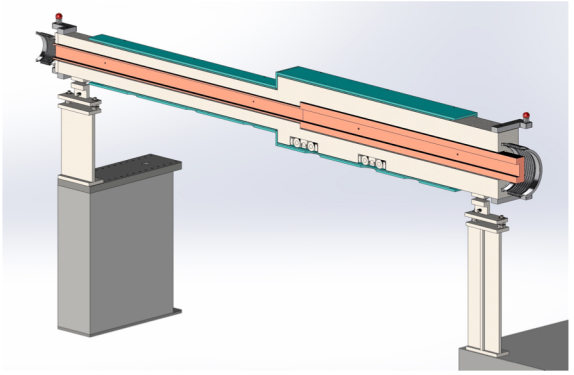
Guide shielding

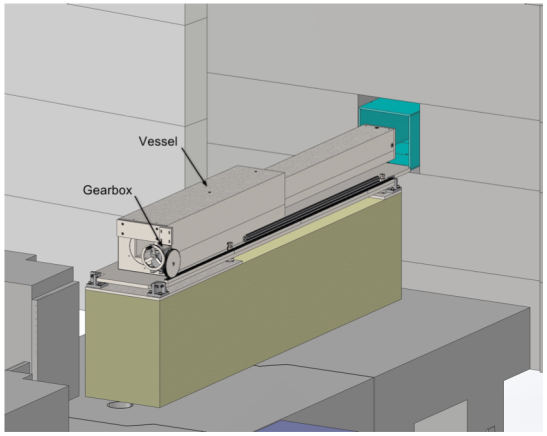
	Task no.	TA ID	Deliverables – Project Results	Cost Book Value	Delivery Date	Status	
TUM			Bunker wall feedthrough	35,000€	Jan 2021	Detailed design scheduled June 2020	On track

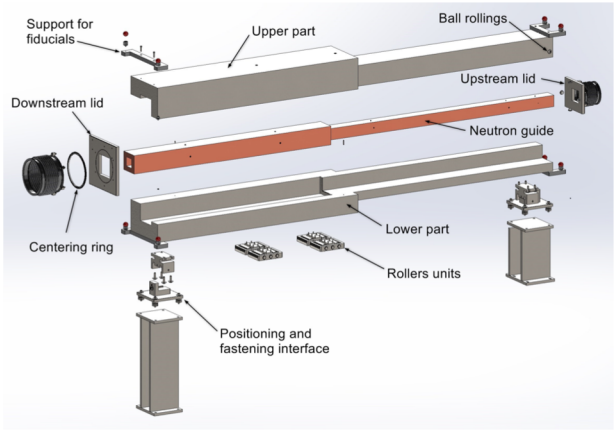
Ex-Bunker main components:

Installation window: 3.6.21 – 25.2.22

- Bunker wall Feedthrough
  - <u>This item not included in TA, but is guide shielding</u>
  - Conceptual design by TUM.
  - Installation tooling and procedure included in the design
  - Vertical or horizontal installation possible
  - CTV held in March 2020
  - Revised Tech Spec ready
  - Status OK







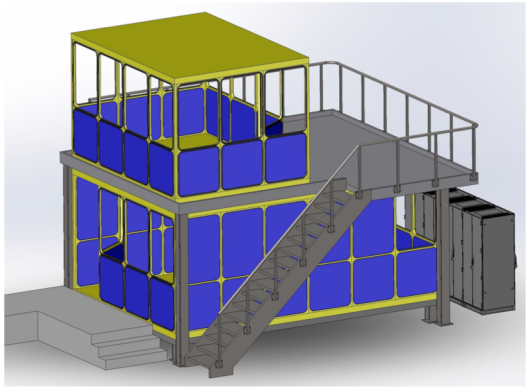
Project status

Instrument infrastructure

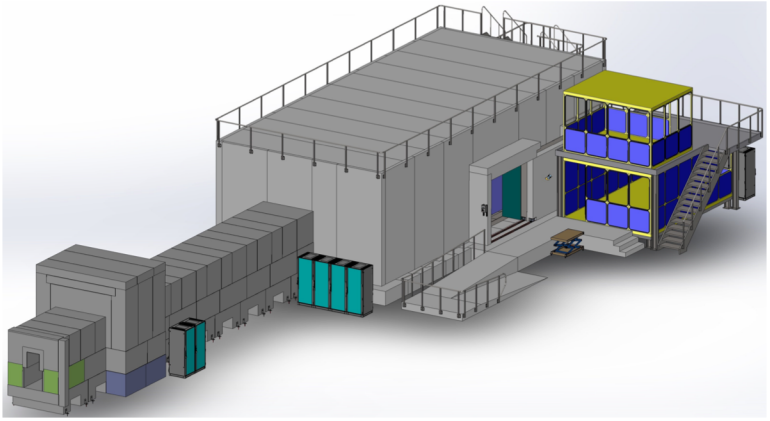
	Task no.	TA ID	Deliverables – Project Results	Cost Book Value	Delivery Date	Status	
TUM	WU 12		Instrument Infrastructure	306,000 €	Feb 2022	CTV done	On track

Ex-Bunker main components:

Installation window: 3.6.21 – 25.2.22



- Instrument infrastructure (TUM)
  - Control Hutch (TUM)
  - Sample preparation Area & Storage (TUM)
  - CTV for both systems was held on Dec. 15th, 2019
  - ODIN team waiting for ESS tender process definitions
  - Status OK



* Item agreed to be procured by ESS for TUM

Project status

Guide system (including NBOA)

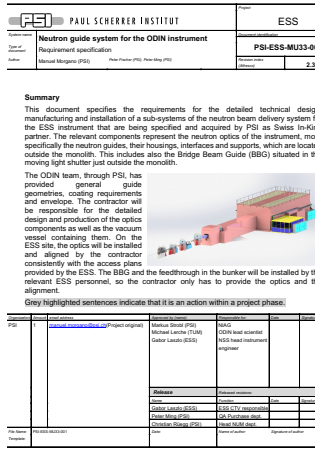
	Task no.	TA ID	Deliverables – Project Results	Cost Book Value	Delivery Date	Status	
PSI	02.2	5-16	Neutron transport system	1,760,000 €	Mar 2022	Contract signed	Ok (using contingency)

In-Bunker main components:

- Installation window: 11.8.21 – 25.2.22

Ex-Bunker main components:

- Installation window: 3.6.21 – 25.2.22


PAUL SCHERRER INSTITUT

ESS

Neutron guide system for the ODIN instrument

Requirement specification

PSI-ESS-MU33-0

Summary

This document specifies the requirements for the detailed technical desig manufacturing and installation of a sub-systems of the neutron beam delivery system f the ESS instrument that are being specified and acquired by PSI as Swiss In-Ki partner. The relevant components represent the neutron optics of the instrument, mo specifically the neutron guides, their housings, interfaces and supports, which are locate outside the monolith. This includes also the Bridge Beam Guide (BBG) situated in th moving light shutter just outside the monolith.

The ODIN team, through PSI, has provided general guide geometries, coating requirements and envelope. The contractor will be responsible for the detailed design and production of the optics components as well as the vacuum vessel containing them. On the ESS site, the optics will be installed and aligned by the contractor consistently with the access plans provided by the ESS. The BBG and the feedthrough in the bunker will be installed by t relevant ESS personnel, so the contractor only has to provide the optics and t alignment.

Grey highlighted sentences indicate that it is an action within a project phase.

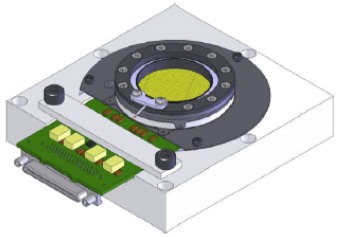
- Guides
  - NBOA TG3 passed in November
  - Guide contract signed (Dec 20/2019) with Axilon+SNAG
  - Budget: 1.76 MEUR (including NBOA and contingency, hardware only)
  - Total price for the entire guide system: 1.751 MEUR
  - KOM held by Feb 10th 2020
  - Guide system is on budget (when using all the contingency for this item)
  - Bi-weekly ODIN guide meeting with PSI - Axilon+SNAG - TUM
  - Timeline is feasible, even with COVID-19
  - Status OK

Project status

Detectors

	Task no.	TA ID	Deliverables – Project Results	Cost Book Value	Delivery Date	Status	
PSI	09	33-43	White beam detectors (WB)	402,000 €	Dec. 2021	prototype	ok
PSI	10	44-48	ToF detector	364,000 €	Dec. 2021	Readout pending	ok

- WB detector
  - WB detectors: existing well probed technology, not critical
  - DMSC and Andor are in contact and collaborating



- ToF detector
  - TOF Detector from UC Berkeley acquired at PSI, GP2 (ISIS) and uNID (JPARC) detector tested
  - New tests to happen at BOA this year
  - Common project between PSI and UC Berkeley for next gen. MCP detector development and corresponding integration to be kicked-off
  - Milestone definitions concerning readout, data reduction, instrument control and detector integration alignment projects crucial and needs to happen soon (DMSC/ICS deliverables)
  - ODIN is interested on ESS Beam Monitor Project. We should receive an offer from Detector Group any days now.
  - Status OK

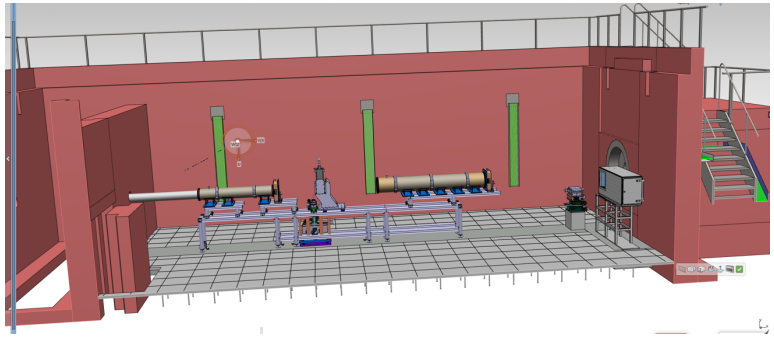
Project status

Cave interior

	Task no.	TA ID	Deliverables – Project Results	Cost Book Value	Delivery Date	Status	
PSI	06	17-32	Cave interior	1,250,000 €	June 2022	In prep.	On track

Ex-Bunker main components:

Installation window: 3.6.21 – 25.2.22



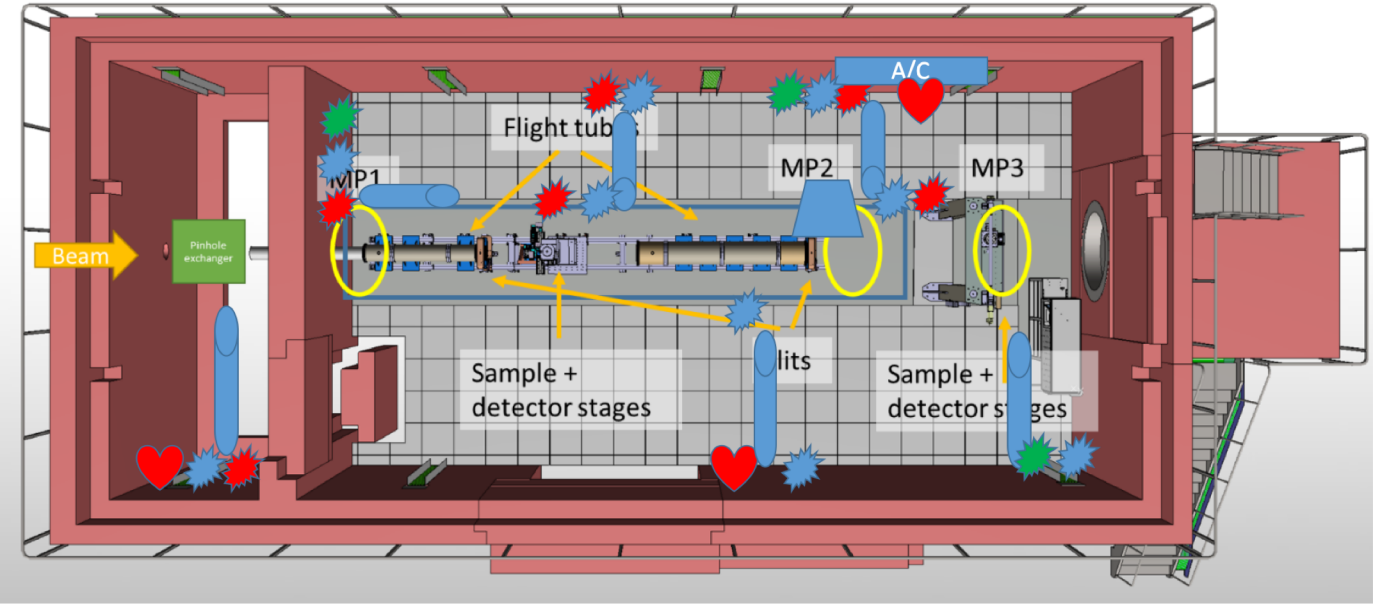
- Cave Interior (PSI)
  - Procurement contract and final specifications almost done (see later)
  - Jan Hovind (PSI) is currently working on the design of some of the components
  - Current concept with a false floor to accommodate for the “elephant foot”
    - Advantages: cabling and piping hidden under the floor
  - (half) CTV in March 2020 passed
  - Strong interest in joining/kick-starting centralized efforts for power and utilities distribution design, procurement and installation. First contacts with corresponding technical groups happened and are encouraging.
  - Status OK

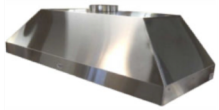
Project status

Cave interior

	Task no.	TA ID	Deliverables – Project Results	Cost Book Value	Delivery Date	Status	
PSI	06	17-32	Cave interior	1,250,000 €	June 2022	In prep.	On track

- Power and utilities distribution: proposed layout





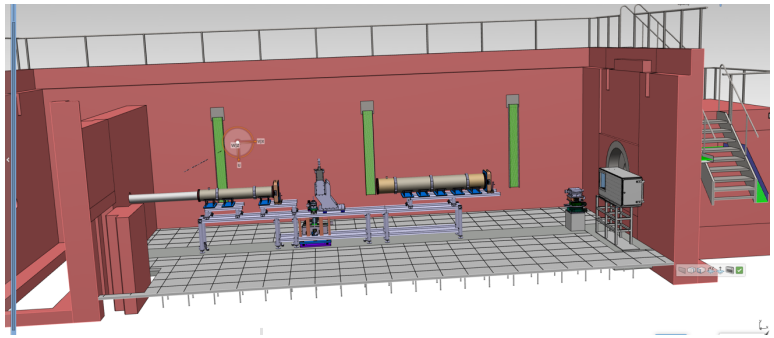
Also safety tour button

Project status

Cave interior

	Task no.	TA ID	Deliverables – Project Results	Cost Book Value	Delivery Date	Status	
PSI	06	17-32	Cave interior	1,250,000 €	June 2022	In prep.	On track

- False floor
  - Procurement contract needs measurables. Any ideas?



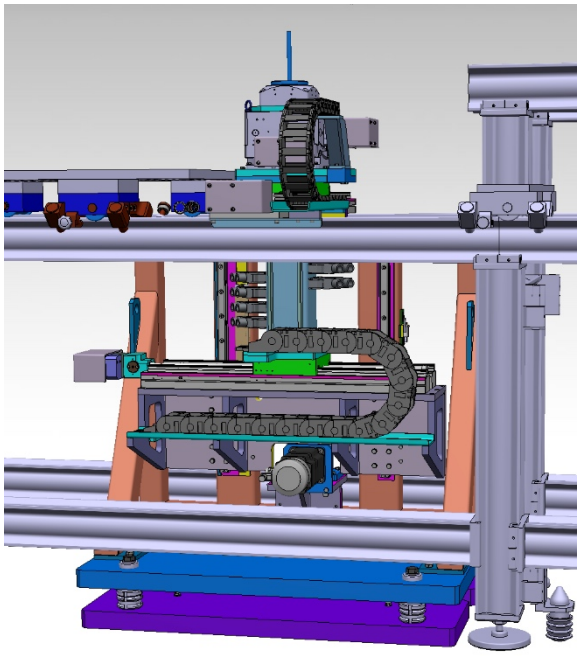
I would focus here on the ease of access and section-wise removal.
For example:
3 points: each section can be removed by a single person of average strength without using tools
2 points: each section can be removed by 2 persons and/or using tools
1 point: each section needs the use of the crane for its removal
0 points: sections needs external help for removal
Or something like that.
Other proposals?

Project status

Cave interior

	Task no.	TA ID	Deliverables – Project Results	Cost Book Value	Delivery Date	Status	
PSI	06	17-32	Cave interior	1,250,000 €	June 2022	In prep.	On track

- Sample table
  - Procurement contract needs measurables. Any ideas?



Problem: can a company have an idea abut the stability of the system at the offer stage?

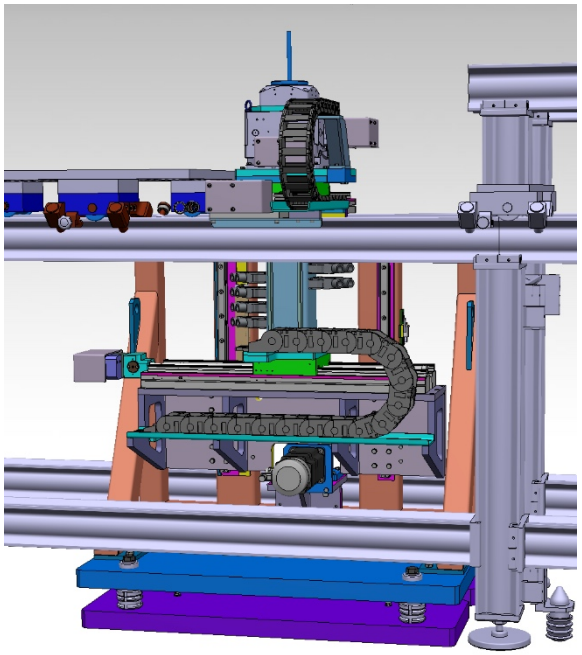
I would focus here on a more holistic approach:
3 points: the complete stacks shall retain >90% of the required precision and capacity if a sample of *200kg* and of size *30x30x30 cm3* is placed off-center by *10cm*. This simulates i.e. a fuel cell experiment which is bulky, heavy and with some connections that apply force off-axis.
2 points: the complete stacks shall retain 75% of the required precision and capacity if a sample of *200kg* and of size *30x30x30 cm3* is placed off-center by *10cm*.
1 point: the complete stacks shall retain 50% of the required precision and capacity if a sample of *200kg* and of size *30x30x30 cm3* is placed off-center by *10cm*.
0 points: the complete stacks retains less than 50% of the required precision and capacity if a sample of *200kg* and of size *30x30x30 cm3* is placed off-center by *10cm*.
Or something like that.
Other proposals?

Project status

Cave interior

	Task no.	TA ID	Deliverables – Project Results	Cost Book Value	Delivery Date	Status	
PSI	06	17-32	Cave interior	1,250,000 €	June 2022	In prep.	On track

- Sample table
  - Procurement contract needs measurables. Any ideas?



Problem: can a company have an idea abut the stability of the system at the offer stage?

Another/an additional approach is to evaluate the space that is left unoccupied by the motor stack around it. Here we could define a benchmark sample (*5x5x100 cm3* for instance) that requires scanning and see if it fits. For example:

3 points: the benchmark sample, placed horizontally, can rotate by > ± *45degrees* with one end of the rod as pivot point.

2 points: the benchmark sample, placed horizontally, can rotate by ±*30degrees* with one end of the rod as pivot point.

1 point: the benchmark sample, placed horizontally, can rotate by ±*10degrees* with one end of the rod as pivot point.

0 points: the benchmark sample, placed horizontally, can rotate by < ±*10degrees* with one end of the rod as pivot point.

Project status

Cave interior

	Task no.	TA ID	Deliverables – Project Results	Cost Book Value	Delivery Date	Status	
PSI	06	17-32	Cave interior	1,250,000 €	June 2022	In prep.	On track

- Cave Interior (PSI)
  - Another approach: references

	Proof (indicated by underlined deliverable)	Single weight W_S [%]
6.	Description of at least one already realized project with similar complexity	5

We should give more weight to this (and less to the rest) and ask for international references. I suggest at least 20. For example:

3 points: Description of at least two international realized projects with similar complexity and corresponding reference letters from the instrument responsible.

2 points: Description of at least one international realized project with similar complexity and corresponding reference letter from the instrument responsible.

1 point: Description of one realized projects with similar complexity and corresponding reference letters from the instrument responsible.

0 points: No similar project ever realized before.

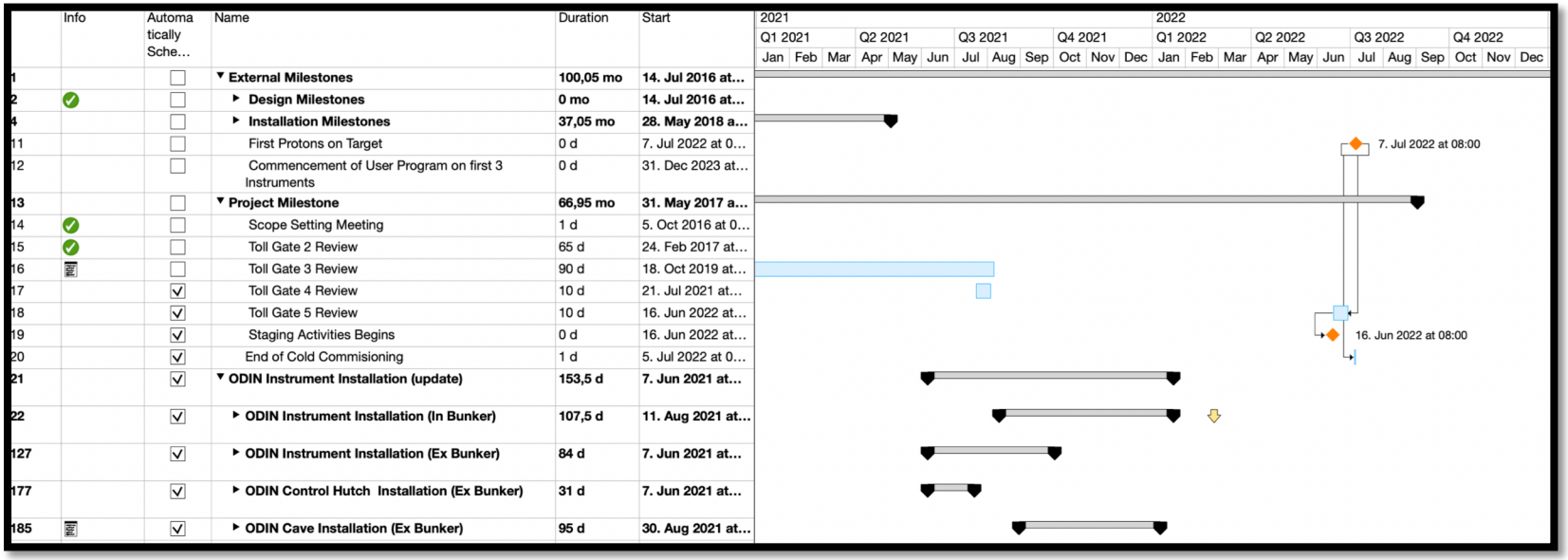
Project status

Installation plan

Project status

Installation plan

- Global installation schedule exists (Feb 2019) and shared with ESS (Antonio Bianchi)
- Now being updated with new installation information from contractors and ESS experience from first installations
- Revising strategy to mitigate installation risks:
  - R1: something fails during FRH tests. M1: Full remote handling tests at the beginning
  - R2: BTCS misalignment due to floor deformation. M2: Final alignment after bunker roof is completely in place
- Starting with definition and preparation of installation binders
- **Risk/Problem: ODIN doesn´t have at the moment an Installation Package Leader assigned (IPL)**

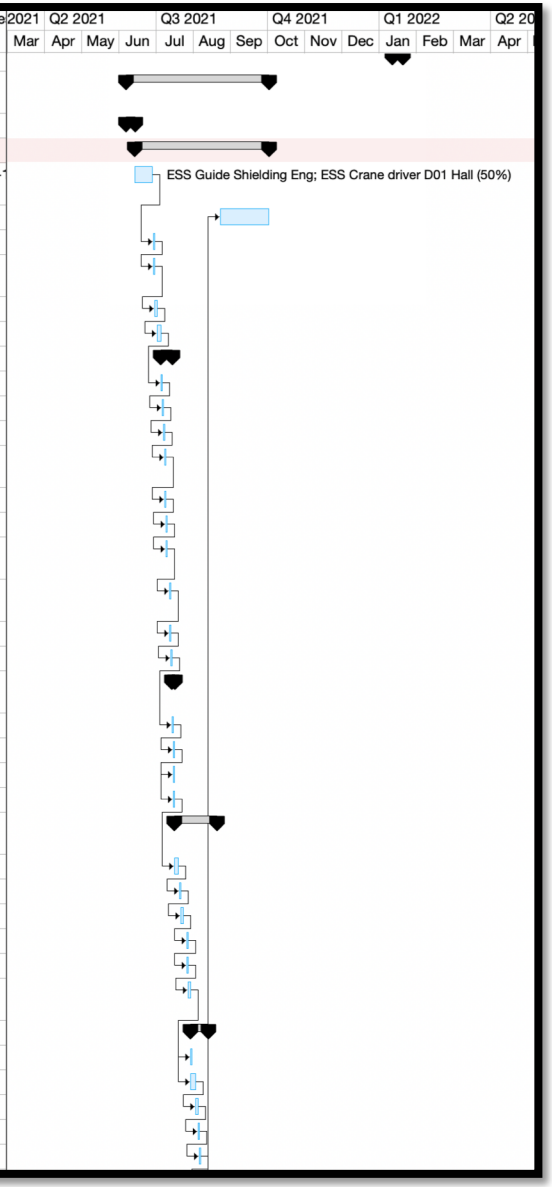


	Info	Automatically Sche…	Name	Duration	Start
1		☐	**External Milestones**	**100,05 mo**	**14. Jul 2016 at…**
2	✓	☐	**Design Milestones**	**0 mo**	**14. Jul 2016 at…**
4		☐	**Installation Milestones**	**37,05 mo**	**28. May 2018 a…**
11		☐	First Protons on Target	0 d	7. Jul 2022 at 0…
12		☐	Commencement of User Program on first 3 Instruments	0 d	31. Dec 2023 at…
13		☐	**Project Milestone**	**66,95 mo**	**31. May 2017 a…**
14	✓	☐	Scope Setting Meeting	1 d	5. Oct 2016 at 0…
15	✓	☐	Toll Gate 2 Review	65 d	24. Feb 2017 at…
16		☐	Toll Gate 3 Review	90 d	18. Oct 2019 at…
17		☑	Toll Gate 4 Review	10 d	21. Jul 2021 at…
18		☑	Toll Gate 5 Review	10 d	16. Jun 2022 at…
19		☑	Staging Activities Begins	0 d	16. Jun 2022 at…
20		☑	End of Cold Commisioning	1 d	5. Jul 2022 at 0…
21		☑	**ODIN Instrument Installation (update)**	**153,5 d**	**7. Jun 2021 at…**
22		☑	**ODIN Instrument Installation (In Bunker)**	**107,5 d**	**11. Aug 2021 at…**
127		☑	**ODIN Instrument Installation (Ex Bunker)**	**84 d**	**7. Jun 2021 at…**
177		☑	**ODIN Control Hutch Installation (Ex Bunker)**	**31 d**	**7. Jun 2021 at…**
185		☑	**ODIN Cave Installation (Ex Bunker)**	**95 d**	**30. Aug 2021 at…**

Project status

Installation plan

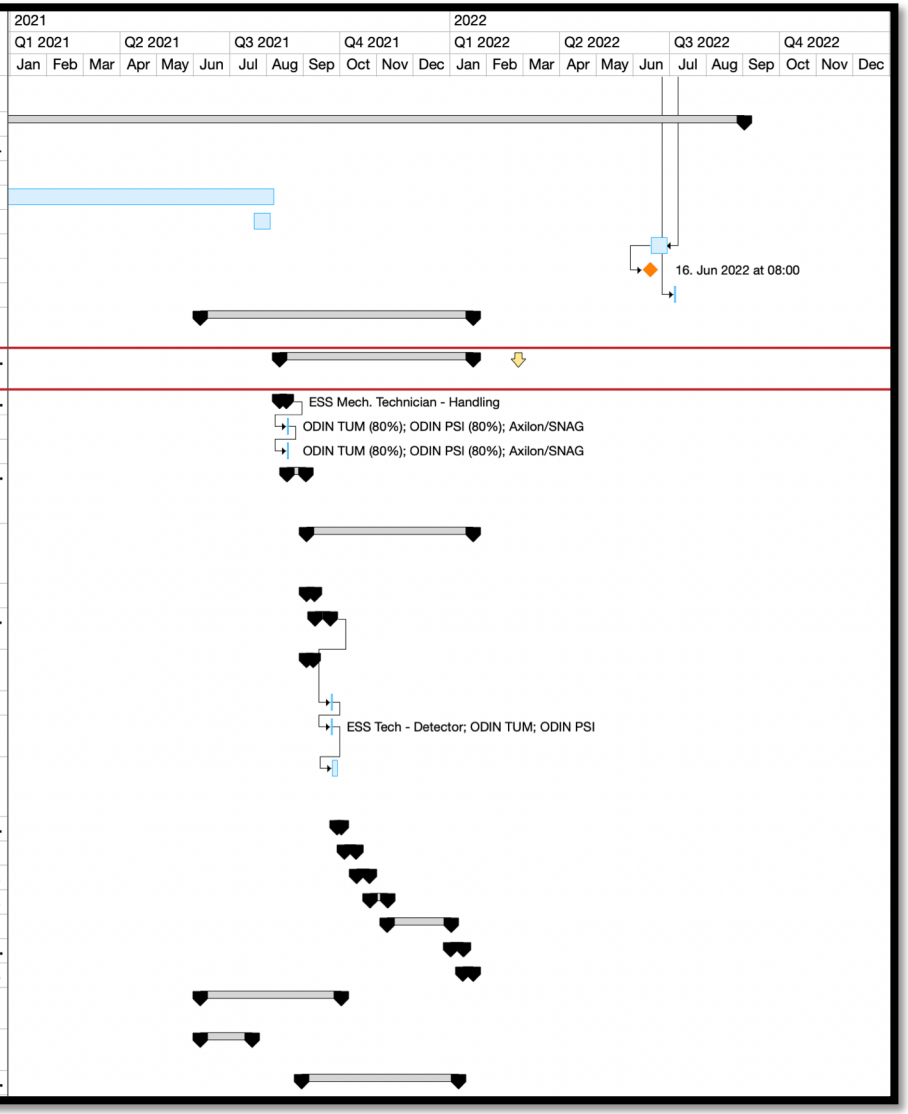
	PB S…	PMS Ax…	Info	(%) Com…	A u…	Name	Duration	Start	Finish	Predece
227				**0 %**	☑	▸ **Connectivity test**	**6 d**	**11. Jan 2022 at…**	**19. Jan 2022 at…**	
240		**W**		**0 %**	☑	▾ **ODIN Instrument Installation (Ex Bunker)**	**84 d**	**7. Jun 2021 at…**	**1. Oct 2021 at…**	
241				**0 %**	☑	▸ **Preparation tasks**	**6 d**	**7. Jun 2021 at…**	**14. Jun 2021 at…**	
248				**0 %**	☑	▾ **Installation of guide shielding**	**80 d**	**14. Jun 2021 at…**	**1. Oct 2021 at…**	
249			👤	0 %	☑	Mounting of bottom guide shielding w/ Verification	11 d	14. Jun 2021 at…	28. Jun 2021 at…	245FS+1
250				0 %	☑	Mounting upper side of guide shieldi…	30 d	23. Aug 2021 at…	1. Oct 2021 at 1…	290
251				0 %	☑	Marking beam axis in the guide shiel…	0,5 d	29. Jun 2021 at…	29. Jun 2021 at…	249
252				0 %	☑	Marking pedestal holes in guide shielding	1 d	29. Jun 2021 at…	30. Jun 2021 at…	251
253				0 %	☑	Drilling pedestal holes in guide shiel…	2 d	30. Jun 2021 at…	2. Jul 2021 at 1…	252
254				0 %	☑	Cleaning	1 d	2. Jul 2021 at 1…	5. Jul 2021 at 1…	253
255				**0 %**	☑	▾ **Installation of Feedthrough**	**7 d**	**5. Jul 2021 at 1…**	**14. Jul 2021 at…**	
256				0 %	☑	Mounting Feedthrough support	0,5 d	5. Jul 2021 at 1…	5. Jul 2021 at 1…	254
257				0 %	☑	Mounting installation tools	1 d	6. Jul 2021 at 0…	6. Jul 2021 at 1…	256
258				0 %	☑	Adjust and fix the tools	1 d	7. Jul 2021 at 0…	7. Jul 2021 at 1…	257
259				0 %	☑	Bringing the Feedthrough vessel w/ vacuum cup in the bunker side	0,5 d	8. Jul 2021 at 0…	8. Jul 2021 at 1…	258
260				0 %	☑	Place the Feedthrough in the wall	0,5 d	8. Jul 2021 at 1…	8. Jul 2021 at 1…	259
261				0 %	☑	Fix the Feedthrough in the support	0,5 d	9. Jul 2021 at 0…	9. Jul 2021 at 1…	260
262				0 %	☑	Bring the neutron guide (side ex bunker)	0,5 d	9. Jul 2021 at 1…	9. Jul 2021 at 1…	261
263				0 %	☑	Place the neutron guide (side ex bunker)	0,5 d	12. Jul 2021 at…	12. Jul 2021 at…	262
264				0 %	☑	Remove the tools	1 d	12. Jul 2021 at…	13. Jul 2021 at…	263
265				0 %	☑	Preliminary adjustment of the vessel	1 d	13. Jul 2021 at…	14. Jul 2021 at…	264
266				**0 %**	☑	▾ **Installation of pedestals (Guides and FOC5)**	**2 d**	**14. Jul 2021 at…**	**16. Jul 2021 at…**	
267				0 %	☑	Mount FOC5 pedestal	0,5 d	14. Jul 2021 at…	14. Jul 2021 at…	265
268				0 %	☑	Grouting under FOC5 pedestal	0,5 d	15. Jul 2021 at…	15. Jul 2021 at…	267
269				0 %	☑	Mount pedestals neutron guides	1 d	15. Jul 2021 at…	16. Jul 2021 at…	268
270				0 %	☑	Mount pedestal of vacuum valve	0,5 d	15. Jul 2021 at…	15. Jul 2021 at…	268
271				**0 %**	☑	▾ **Installation of Beam Transport and Conditioning System**	**26 d**	**16. Jul 2021 at…**	**20. Aug 2021 at…**	
272				0 %	☑	Mounting alignment interfaces	2 d	16. Jul 2021 at…	19. Jul 2021 at…	270
273				0 %	☑	Mounting FOC lower vessel	1 d	20. Jul 2021 at…	20. Jul 2021 at…	272
274				0 %	☑	Mounting neutron guide vessels	3 d	21. Jul 2021 at…	23. Jul 2021 at…	273
275				0 %	☑	Mounting of vacuum valve	0,5 d	26. Jul 2021 at…	26. Jul 2021 at…	274
276				0 %	☑	Preliminary alignment of components	1 d	26. Jul 2021 at…	27. Jul 2021 at…	275
277				0 %	☑	Connect and seal components (Vacuum flanges and windows)	2 d	27. Jul 2021 at…	29. Jul 2021 at…	276
278				**0 %**	☑	▾ **Vacuum connections and test**	**11 d**	**29. Jul 2021 at…**	**13. Aug 2021 at…**	
279				0 %	☑	Installation of Vacuum Rack	1 d	29. Jul 2021 at…	30. Jul 2021 at…	277
280				0 %	☑	Installation of Vacuum pipes	2 d	29. Jul 2021 at…	2. Aug 2021 at…	277
281				0 %	☑	Installation of vacuum sensors	2 d	2. Aug 2021 at…	4. Aug 2021 at…	280
282				0 %	☑	Connect vacuum valve to MCA	0,5 d	4. Aug 2021 at…	4. Aug 2021 at…	281
283				0 %	☑	Proceed vacuum test	2 d	5. Aug 2021 at…	6. Aug 2021 at…	282



Project status

Installation plan

	Info	Automatically Sche…	Name	Duration	Start
12		☐	Commencement of User Program on first 3 Instruments	0 d	31. Dec 2023 at…
13		☐	**▼ Project Milestone**	**66,95 mo**	**31. May 2017 a…**
14	✓	☐	Scope Setting Meeting	1 d	5. Oct 2016 at 0…
15	✓	☐	Toll Gate 2 Review	65 d	24. Feb 2017 at…
16		☐	Toll Gate 3 Review	90 d	18. Oct 2019 at…
17		☑	Toll Gate 4 Review	10 d	21. Jul 2021 at…
18		☑	Toll Gate 5 Review	10 d	16. Jun 2022 at…
19		☑	Staging Activities Begins	0 d	16. Jun 2022 at…
20		☑	End of Cold Commisioning	1 d	5. Jul 2022 at 0…
21		☑	**▼ ODIN Instrument Installation (update)**	**153,5 d**	**7. Jun 2021 at…**
22		☑	**▼ ODIN Instrument Installation (In Bunker)**	**107,5 d**	**11. Aug 2021 at…**
23		☑	**▸ Prepatory Tasks**	**5 d**	**11. Aug 2021 at…**
27		☑	Adjust Feedthrough Vessel	0,62 d	18. Aug 2021 at…
28		☑	Adjust Neutron Guide	0,5 d	18. Aug 2021 at…
29		☑	**▸ Installation of pedestals (Choppers, WFMC, T0, HS, Guide vessels)**	**12 d**	**18. Aug 2021 at…**
39		☑	**▼ Beam Transport and Conditioning System Installation**	**90,5 d**	**3. Sep 2021 at…**
40		☑	**▸ Mounting interfaces**	**5 d**	**3. Sep 2021 at…**
45		☑	**▸ Neutron Guide Installation**	**9 d**	**10. Sep 2021 at…**
51		☑	**▸ Heavy Shutter Installation**	**4 d**	**3. Sep 2021 at…**
54		☑	Mounting Cd filter	0,5 d	23. Sep 2021 at…
55		☑	Beam Monitor Installation	1 d	23. Sep 2021 at…
56		☑	Preliminary raw alignment (guide vessel, choppers, T0 chopper and heavy shutter)	2 d	24. Sep 2021 at…
57		☑	**▸ Vacuum system first test**	**3,5 d**	**28. Sep 2021 at…**
63		☑	**▸ Chopper Installation**	**8 d**	**4. Oct 2021 at…**
67		☑	**▸ Connections 1**	**8 d**	**14. Oct 2021 at…**
76		☑	**▸ Installation tests**	**10,5 d**	**26. Oct 2021 at…**
92		☑	**▸ Final alignment In Bunker**	**38 d**	**9. Nov 2021 at…**
104		☑	**▸ Connections 2**	**7 d**	**31. Dec 2021 at…**
114		☑	**▸ Connectivity test**	**6 d**	**11. Jan 2022 at…**
127		☑	**▸ ODIN Instrument Installation (Ex Bunker)**	**84 d**	**7. Jun 2021 at…**
177		☑	**▸ ODIN Control Hutch Installation (Ex Bunker)**	**31 d**	**7. Jun 2021 at…**
185		☑	**▸ ODIN Cave Installation (Ex Bunker)**	**95 d**	**30. Aug 2021 at…**



ODIN Status update

AGENDA

- ODIN overview
  - General overview
  - High level schedule
  - ODIN people
- Project Status
  - MOU, IKAs and TAs
  - ODIN Work Units Overview
  - Installation plan
- Project risks and Issues

Project status

Project major risks and mitigation actions

- Risk on schedule and long term delivery/critical components: Cave, T0 chopper, Feedthrough
  - Mitigation: priorization in the preliminary design and preparation of CTVs
    - Cave: CTV done. Tender published.
    - T0 chopper: CTV approved March 2020.
    - Feedthrough: CTV done March 2020. Tech. Specs. revised and ready.
- Installation
  - Feedthrough originally to be installed vertically January 2021 (Schedule risk).
    - Mitigation: Redesigned for horizontal installation option. More flexibility with schedule.
  - FRH tests and final alignment risks
    - Mitigation: 1) Anticipate FRH tests. 2)Final alignment after bunker roof is in place
  - ODIN has no Installation Package Leader (IPL) envisaged so far, and this may represent a major risk
    - Strategies to explore:
      - Looking for the resource: May be provided by ESS?
        - We are looking for a candidate as well
      - Mitigation: ODIN Team to get more involved into the whole installation documentation process

Summary

- IKA/TA issues solved
- ODIN choppers system (CDR done), NBOA (TG3 approved) and neutron guides (KoM done) are within schedule envelope and on budget
- T0 chopper (CTV approved), Feedthrough (CTV done) and Heavy shutter Tech. Spec. ongoing
- Shielding
  - CTV Cave and Hutch achieved. Cave´s Tender started
  - Guide shielding on ESS Common Shielding Project. TG3 scheduled in June. The project status is OK.
- Installation schedule exist and is being revised and updated with more information available from ESS and contractors.
- Major risks on IPL

- General ODIN status is on track

EUROPEAN SPALLATION SOURCE

Thank you!

Aureliano. Tartaglione@frm2.tum.de

Project status

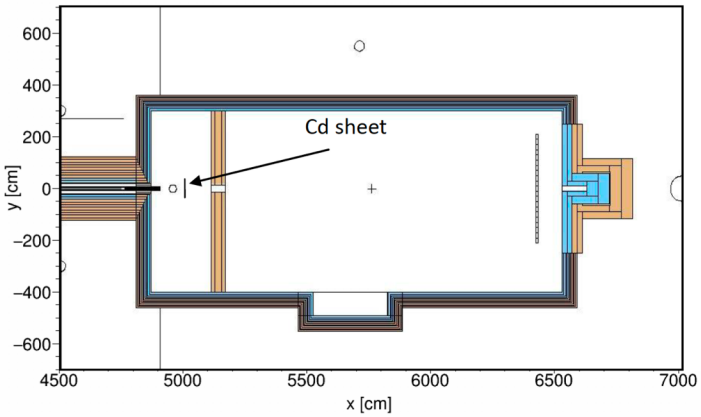
Cave shielding

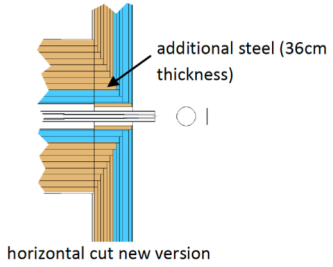
	Task no.	TA ID	Deliverables – Project Results	Cost Book Value	Delivery Date	Status	
TUM	WU 11.2	39-50	Cave Shielding*	2,387,000 €	Aug 2021	Pre Tender	On track

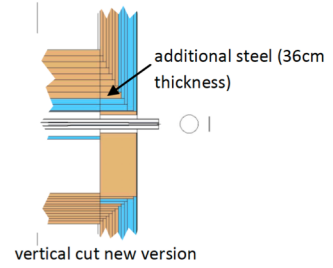
Ex-Bunker main components:

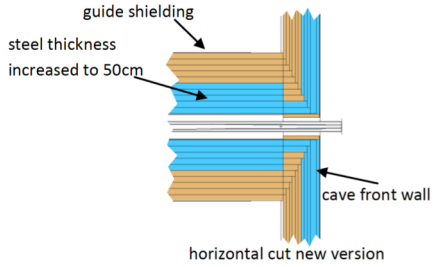
Installation window: 3.6.21 – 25.2.22

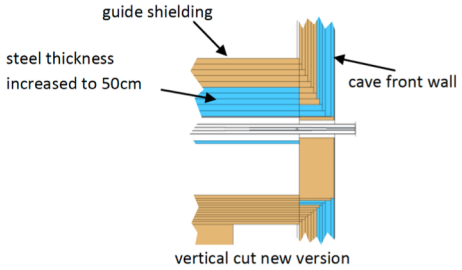
- Shielding (TUM)
  - Cave shielding
    - H1/H2 Scenarios and Shielding verification documents reviewed at CTV with minor changes.
    - Cd sheet in optical cave: **Average** dose in front wall of Cave exceeds limit (0.57µSv/h)
    - Solution: add steel at the entrance of the cave and the last section of guide shielding











* Item agreed to be procured by ESS for TUM

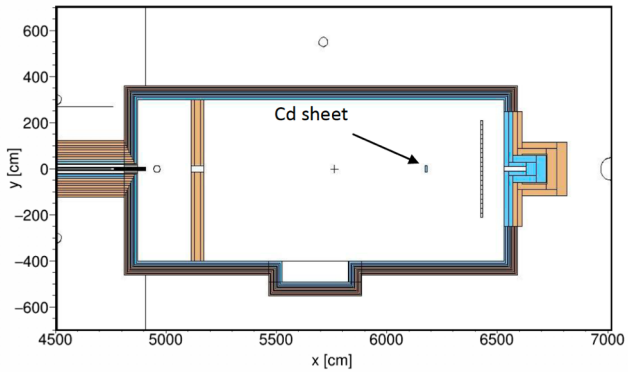
Cave shielding

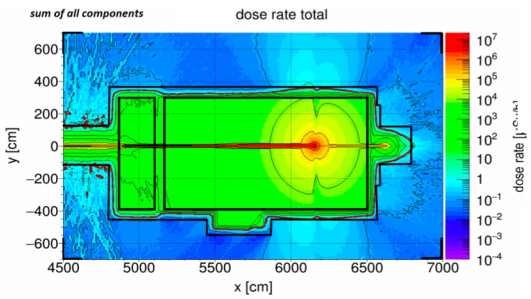
	Task no.	TA ID	Deliverables – Project Results	Cost Book Value	Delivery Date	Status	
TUM	WU 11.2	39-50	Cave Shielding*	2,387,000 €	Aug 2021	Pre Tender	On track

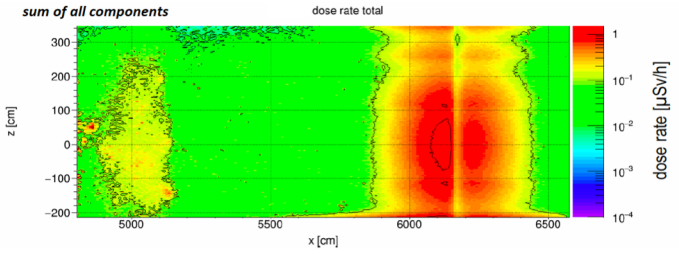
Ex-Bunker main components:

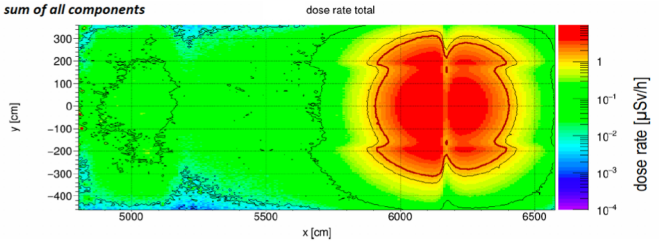
Installation window: 3.6.21 – 25.2.22

- Shielding (TUM)
  - Cave shielding
    - H1/H2 Scenarios and Shielding Verification documents reviewed at CTV with minor changes.
    - Cd sheet is the worst case
    - Documents now under formal review process by ESS









* Item agreed to be procured by ESS for TUM

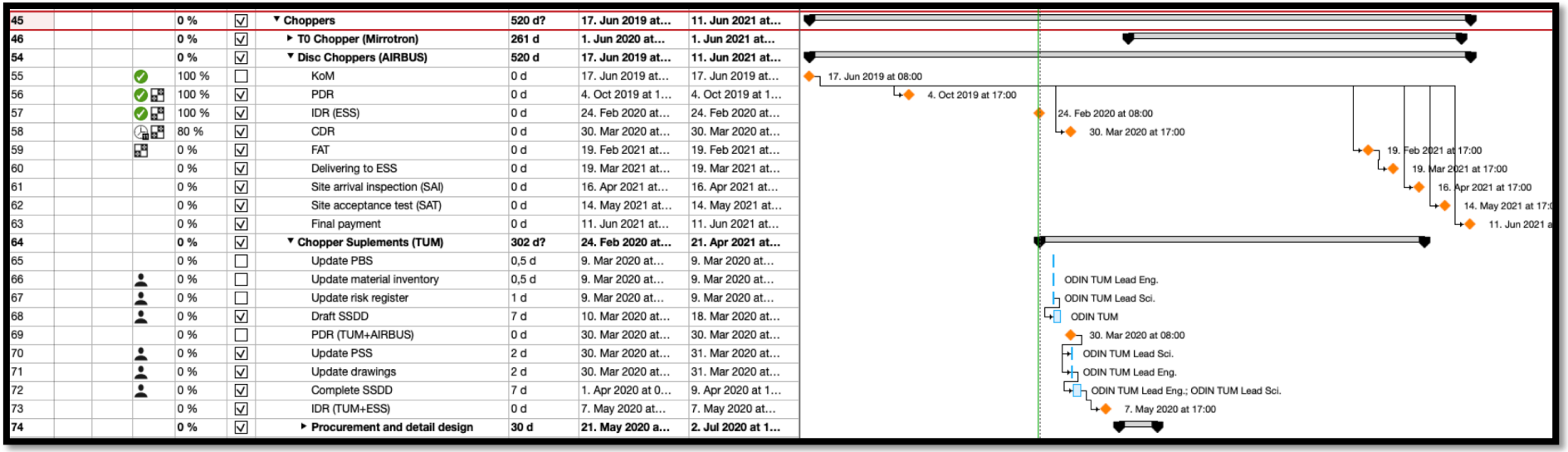
Project status

Choppers

	Task no.	TA ID	Deliverables – Project Results	Cost Book Value	Delivery Date	Status	
TUM	WU 05	16-25	Choppers*	2,272,000 €	Mar 2022	PDR closed Feb 2020	ok

In-Bunker main components:

- Installation window: 11.8.21 – 25.2.22
- Choppers (TUM)
  - Pedestals, WFMC Motion Table and Alignment Interfaces designed and procured by TUM. CTV May 2020
  - Preparation for IDR: 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 frecuency verification



45		0 %	☑	**Choppers**	520 d?	17. Jun 2019 at…	11. Jun 2021 at…
46		0 %	☑	**T0 Chopper (Mirrotron)**	261 d	1. Jun 2020 at…	1. Jun 2021 at…
54		0 %	☑	**Disc Choppers (AIRBUS)**	520 d	17. Jun 2019 at…	11. Jun 2021 at…
55		100 %	☐	KoM	0 d	17. Jun 2019 at…	17. Jun 2019 at…
56		100 %	☑	PDR	0 d	4. Oct 2019 at 1…	4. Oct 2019 at 1…
57		100 %	☑	IDR (ESS)	0 d	24. Feb 2020 at…	24. Feb 2020 at…
58		80 %	☑	CDR	0 d	30. Mar 2020 at…	30. Mar 2020 at…
59		0 %	☑	FAT	0 d	19. Feb 2021 at…	19. Feb 2021 at…
60		0 %	☑	Delivering to ESS	0 d	19. Mar 2021 at…	19. Mar 2021 at…
61		0 %	☑	Site arrival inspection (SAI)	0 d	16. Apr 2021 at…	16. Apr 2021 at…
62		0 %	☑	Site acceptance test (SAT)	0 d	14. May 2021 at…	14. May 2021 at…
63		0 %	☑	Final payment	0 d	11. Jun 2021 at…	11. Jun 2021 at…
64		0 %	☑	**Chopper Suplements (TUM)**	302 d?	24. Feb 2020 at…	21. Apr 2021 at…
65		0 %	☐	Update PBS	0,5 d	9. Mar 2020 at…	9. Mar 2020 at…
66		0 %	☐	Update material inventory	0,5 d	9. Mar 2020 at…	9. Mar 2020 at…
67		0 %	☐	Update risk register	1 d	9. Mar 2020 at…	9. Mar 2020 at…
68		0 %	☑	Draft SSDD	7 d	10. Mar 2020 at…	18. Mar 2020 at…
69		0 %	☐	PDR (TUM+AIRBUS)	0 d	30. Mar 2020 at…	30. Mar 2020 at…
70		0 %	☑	Update PSS	2 d	30. Mar 2020 at…	31. Mar 2020 at…
71		0 %	☑	Update drawings	2 d	30. Mar 2020 at…	31. Mar 2020 at…
72		0 %	☑	Complete SSDD	7 d	1. Apr 2020 at 0…	9. Apr 2020 at 1…
73		0 %	☑	IDR (TUM+ESS)	0 d	7. May 2020 at…	7. May 2020 at…
74		0 %	☑	**Procurement and detail design**	30 d	21. May 2020 a…	2. Jul 2020 at 1…

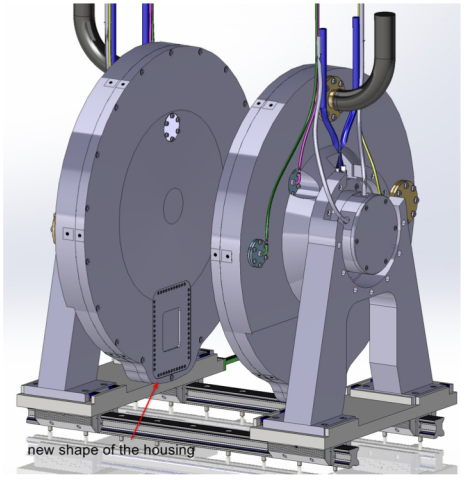
Project status

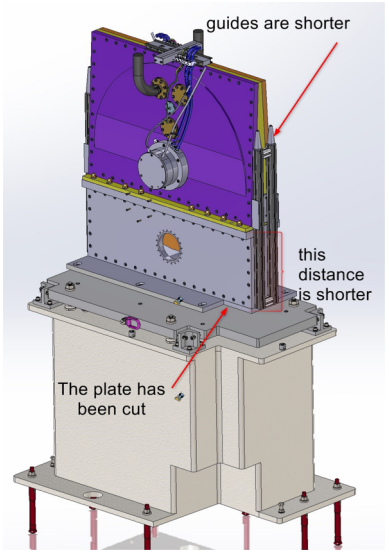
Choppers

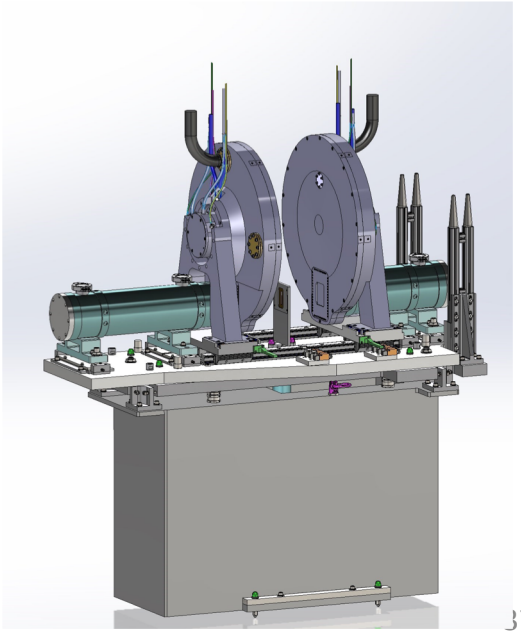
	Task no.	TA ID	Deliverables – Project Results	Cost Book Value	Delivery Date	Status	
TUM	WU 05	16-25	Choppers*	2,272,000 €	Mar 2022	PDR closed Feb 2020	ok

In-Bunker main components:

- Installation window: 11.8.21 – 25.2.22
- Choppers (TUM)
  - Pedestals, WFMC Motion Table and Alignment Interfaces designed and procured by TUM. CTV May 2020
  - Chopper additionals: Est. book value: 40,000€





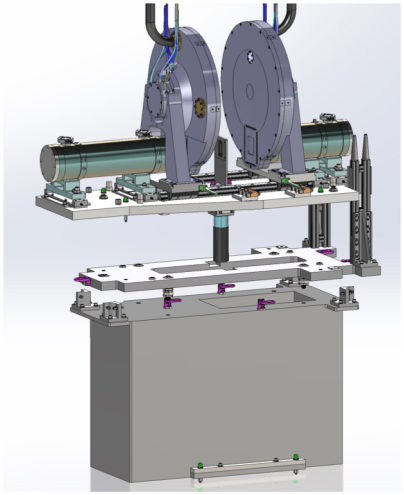


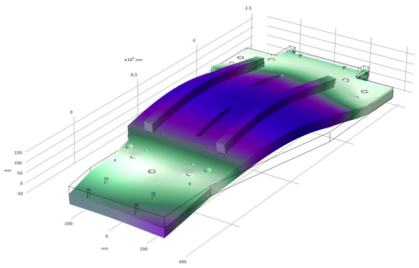
Choppers

	Task no.	TA ID	Deliverables – Project Results	Cost Book Value	Delivery Date	Status	
TUM	WU 05	16-25	Choppers*	2,272,000 €	Mar 2022	PDR closed Feb 2020	ok

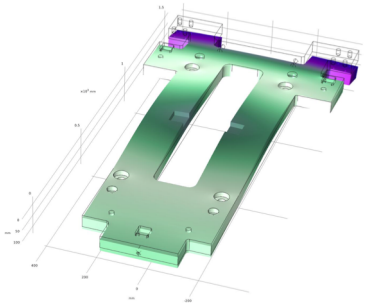
In-Bunker main components:

- Installation window: 11.8.21 – 25.2.22
- Choppers (TUM)
  - Pedestals, WFMC Motion Table and Alignment Interfaces designed and procured by TUM. CTV May 2020
  - 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 frecuency verification

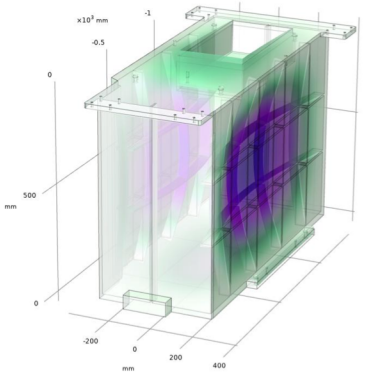




Lowest freq: 162.52Hz
Max deformation: 3µm



Lowest freq: 260.63Hz
Max deformation: 6µm



Lowest freq: 155.52Hz
Max deformation: 5µm

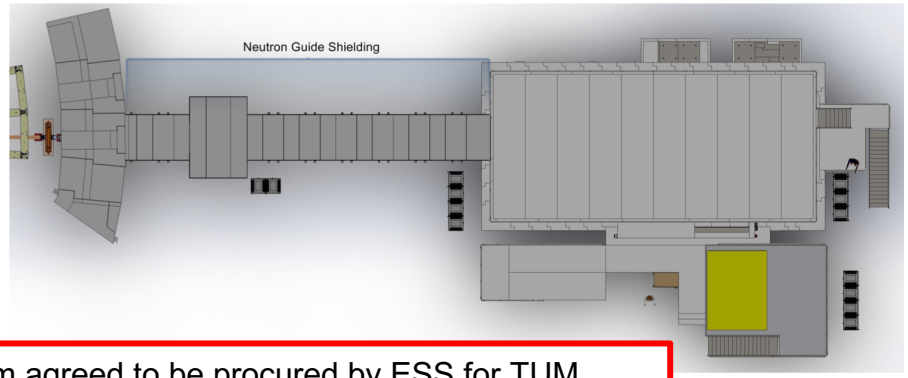
Guide shielding

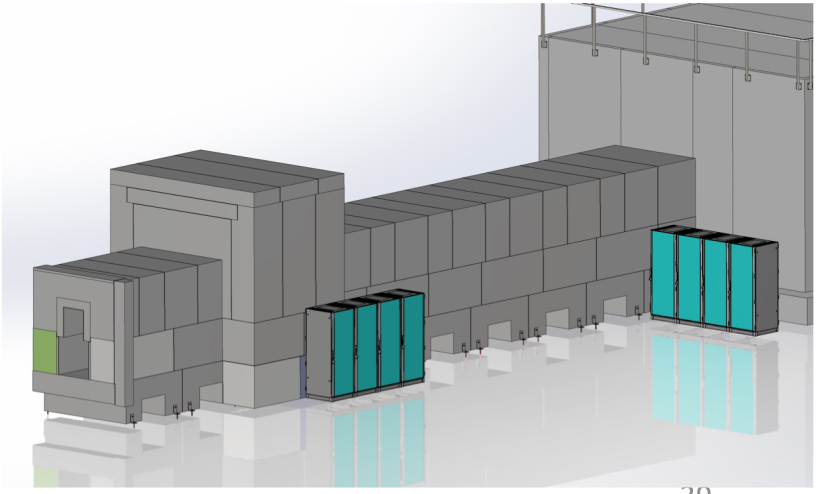
	Task no.	TA ID	Deliverables – Project Results	Cost Book Value	Delivery Date	Status	
TUM	WU 11.1	33-38	Guide Shielding* (common shielding project)	500,000 €	Jul 2021	Detailed design scheduled June 2020	On track

Ex-Bunker main components:

Installation window: 3.6.21 – 25.2.22

- Guide shielding (TUM)
  - ODIN guide shielding belongs to Common shielding project ESS
  - Interface with ODIN Cave solved
  - Detail design: last verification MC simulations ongoing
    - TG3 (ESS) scheduled by June 2020
  - Status OK





* Item agreed to be procured by ESS for TUM

Motion control and electric engineering

	Task no.	TA ID	Deliverables – Project Results	Cost Book Value	Delivery Date	Status	
TUM	WU 08	26-32	Motion Control and Electric Engineering	405,000 €	Sept 2021	ESS to provide offer	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
  - ESS-MCA Group will send an offer. May?
  - TA Milestone: Contract signed in September 2020. On-schedule
  - Status OK

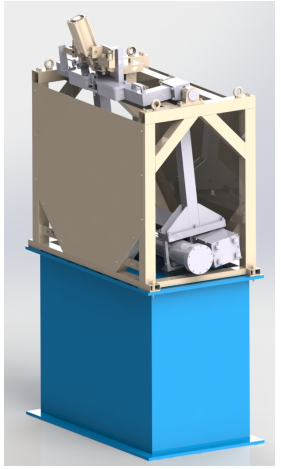
Project status

Heavy Shutter

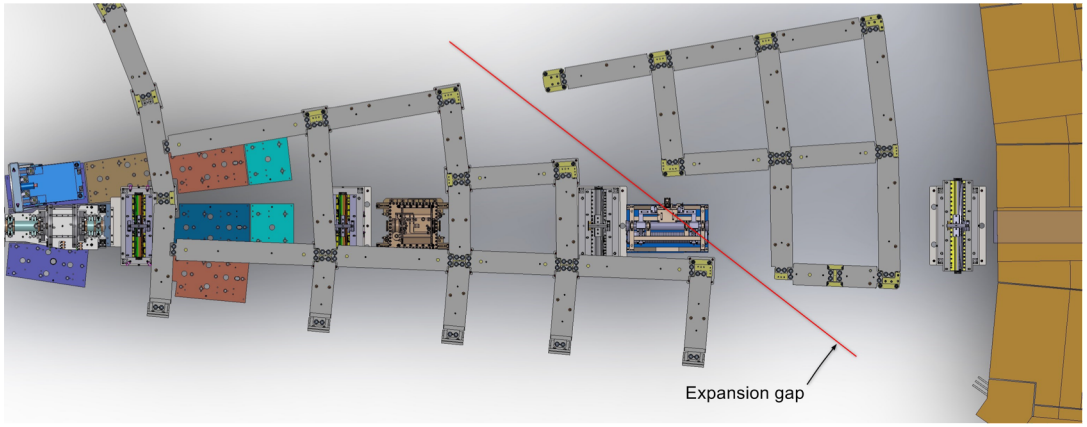
	Task no.	TA ID	Deliverables – Project Results	Cost Book Value	Delivery Date	Status	
TUM	WU 03	2-8	Heavy Shutter*	383,000 €	Oct 2021	Tech. Spec. ongoing (ID2)	Delayed ~8months, but enough float

In-Bunker main components:

- Installation window: 11.8.21 – 25.2.22



- Heavy shutter (TUM):
  - Design constraints
    - Pillars + Roof beams + Expansion gap (floor)
    - Max lenght required: 1.6m
    - Dose requirement: max 3μSv/h in Cave, and 25μSv/h in FOC5 pit
    - Safety factor: 2



* Item agreed to be procured by ESS for TUM

Project status

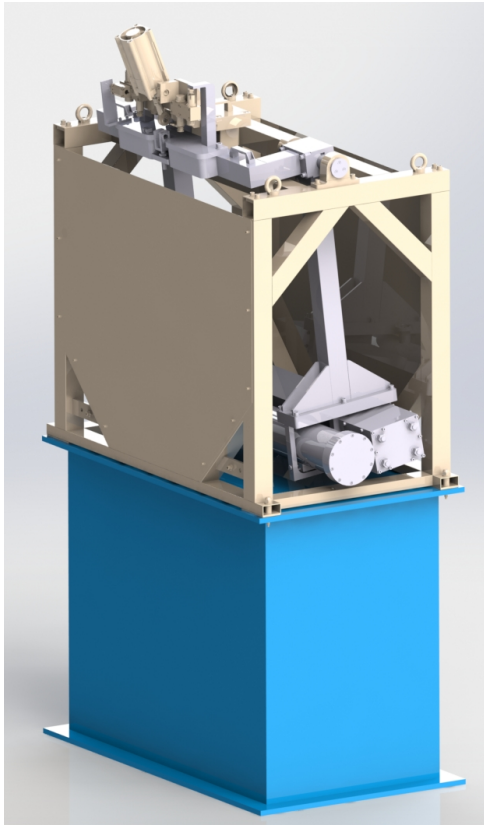
Heavy Shutter

	Task no.	TA ID	Deliverables – Project Results	Cost Book Value	Delivery Date	Status	
TUM	WU 03	2-8	Heavy Shutter*	383,000 €	Oct 2021	Tech. Spec. ongoing (ID2)	Delayed ~8months, but enough float

In-Bunker main components:

- Installation window: 11.8.21 – 25.2.22

- Heavy shutter (TUM):
  - Design constraints
    - Pillars + Roof beams + Expansion gap (floor)
    - Max lenght required: 1.6m
    - Dose requirement: max 3μSv/h in Cave, and 25μSv/h in FOC5 pit
    - Safety factor: 2
  - Stopper preliminary design ready: 1.6m
    - Maximum attenuation: 1cm B4C + 32cm Steel + 127cm Copper
    - Neutron Dose: 1.1E-2μSv/h (Cave) and 3.7E-2μSv/h (Pit)
    - Still it is necessary to consider gamma contribution in the simulations
    - Final optimization ongoing



* Item agreed to be procured by ESS for TUM

Project status

Heavy Shutter

	Task no.	TA ID	Deliverables – Project Results	Cost Book Value	Delivery Date	Status	
TUM	WU 03	2-8	Heavy Shutter*	383,000 €	Oct 2021	Tech. Spec. ongoing (ID2)	Delayed ~8months, but enough float

In-Bunker main components:

- Installa

- Heavy sh
  - Desig
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    - M
    - D
    - Sa
  - Stopp
    - M
    - N
    - St
    - Fi

We had an action item here:

- Reliability requirement was taken from original design: 98%

- The STAP pointed out these requirement might imply a failure every 10 days which is of course not acceptable for a safety component.

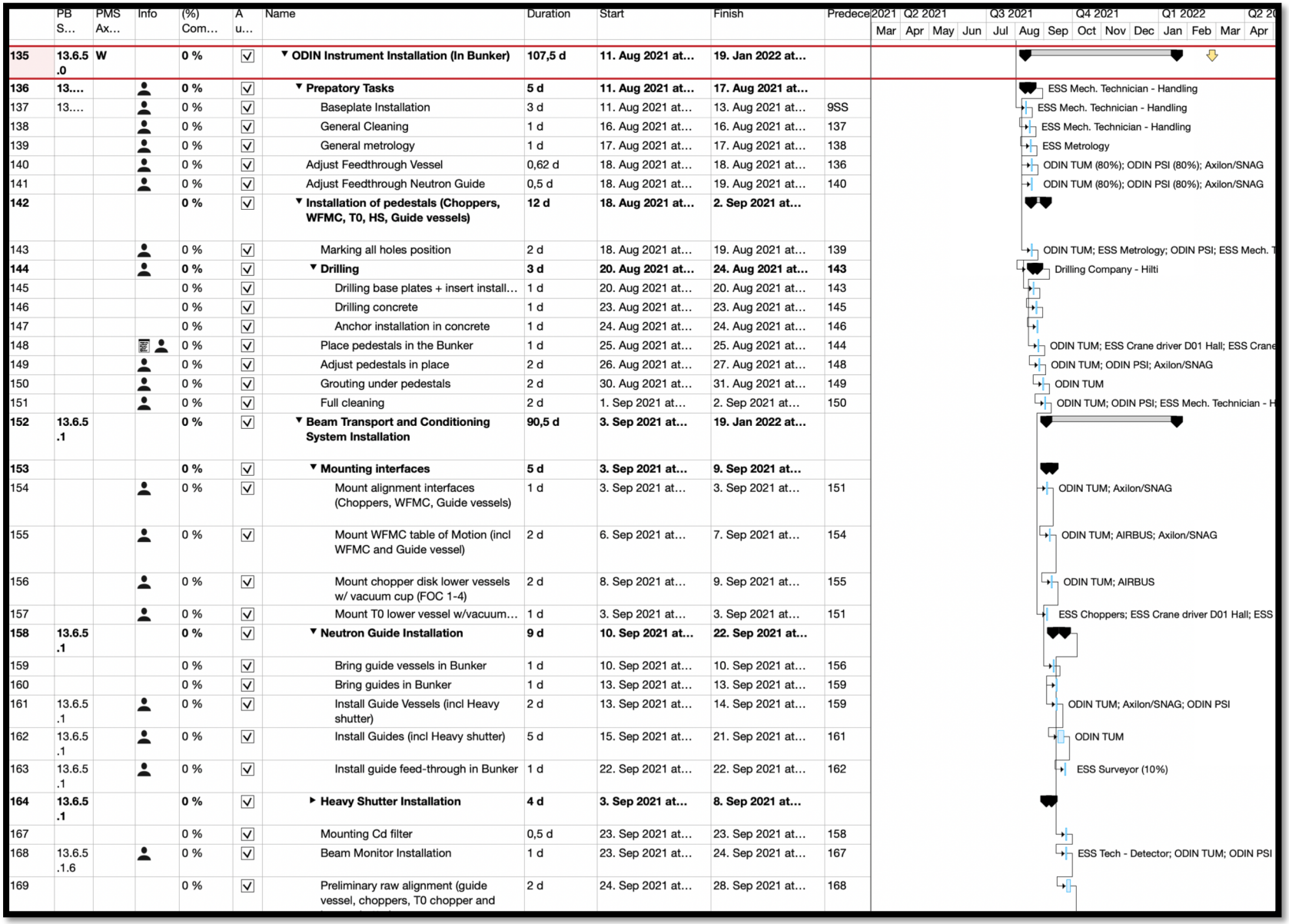
<u>Strategy to reduce risks/improve reliability:</u>

- We will specify an overestimated pneumatic cylinder
- Redundancies in sensitive control electronics
- Guaranteed fail safe design

* Item agreed to be procured by ESS for TUM

Project status

Installation plan



	PBS...	PMS Ax...	Info	(%) Com...	Au...	Name	Duration	Start	Finish	Predece...
135	**13.6.5.0**	**W**		**0 %**	☑	**▼ ODIN Instrument Installation (In Bunker)**	**107,5 d**	**11. Aug 2021 at...**	**19. Jan 2022 at...**	
136	**13....**		👤	**0 %**	☑	**▼ Prepatory Tasks**	**5 d**	**11. Aug 2021 at...**	**17. Aug 2021 at...**	
137	13....		👤	0 %	☑	Baseplate Installation	3 d	11. Aug 2021 at...	13. Aug 2021 at...	9SS
138			👤	0 %	☑	General Cleaning	1 d	16. Aug 2021 at...	16. Aug 2021 at...	137
139			👤	0 %	☑	General metrology	1 d	17. Aug 2021 at...	17. Aug 2021 at...	138
140			👤	0 %	☑	Adjust Feedthrough Vessel	0,62 d	18. Aug 2021 at...	18. Aug 2021 at...	136
141			👤	0 %	☑	Adjust Feedthrough Neutron Guide	0,5 d	18. Aug 2021 at...	19. Aug 2021 at...	140
142				**0 %**	☑	**▼ Installation of pedestals (Choppers, WFMC, T0, HS, Guide vessels)**	**12 d**	**18. Aug 2021 at...**	**2. Sep 2021 at...**	
143			👤	0 %	☑	Marking all holes position	2 d	18. Aug 2021 at...	19. Aug 2021 at...	139
144			👤	**0 %**	☑	**▼ Drilling**	**3 d**	**20. Aug 2021 at...**	**24. Aug 2021 at...**	**143**
145				0 %	☑	Drilling base plates + insert install...	1 d	20. Aug 2021 at...	20. Aug 2021 at...	143
146				0 %	☑	Drilling concrete	1 d	23. Aug 2021 at...	23. Aug 2021 at...	145
147				0 %	☑	Anchor installation in concrete	1 d	24. Aug 2021 at...	24. Aug 2021 at...	146
148			🏗 👤	0 %	☑	Place pedestals in the Bunker	1 d	25. Aug 2021 at...	25. Aug 2021 at...	144
149			👤	0 %	☑	Adjust pedestals in place	2 d	26. Aug 2021 at...	27. Aug 2021 at...	148
150			👤	0 %	☑	Grouting under pedestals	2 d	30. Aug 2021 at...	31. Aug 2021 at...	149
151			👤	0 %	☑	Full cleaning	2 d	1. Sep 2021 at...	2. Sep 2021 at...	150
152	**13.6.5.1**			**0 %**	☑	**▼ Beam Transport and Conditioning System Installation**	**90,5 d**	**3. Sep 2021 at...**	**19. Jan 2022 at...**	
153				**0 %**	☑	**▼ Mounting interfaces**	**5 d**	**3. Sep 2021 at...**	**9. Sep 2021 at...**	
154			👤	0 %	☑	Mount alignment interfaces (Choppers, WFMC, Guide vessels)	1 d	3. Sep 2021 at...	3. Sep 2021 at...	151
155			👤	0 %	☑	Mount WFMC table of Motion (incl WFMC and Guide vessel)	2 d	6. Sep 2021 at...	7. Sep 2021 at...	154
156			👤	0 %	☑	Mount chopper disk lower vessels w/ vacuum cup (FOC 1-4)	2 d	8. Sep 2021 at...	9. Sep 2021 at...	155
157			👤	0 %	☑	Mount T0 lower vessel w/vacuum...	1 d	3. Sep 2021 at...	3. Sep 2021 at...	151
158	**13.6.5.1**			**0 %**	☑	**▼ Neutron Guide Installation**	**9 d**	**10. Sep 2021 at...**	**22. Sep 2021 at...**	
159				0 %	☑	Bring guide vessels in Bunker	1 d	10. Sep 2021 at...	10. Sep 2021 at...	156
160				0 %	☑	Bring guides in Bunker	1 d	13. Sep 2021 at...	13. Sep 2021 at...	159
161	13.6.5.1		👤	0 %	☑	Install Guide Vessels (incl Heavy shutter)	2 d	13. Sep 2021 at...	14. Sep 2021 at...	159
162	13.6.5.1		👤	0 %	☑	Install Guides (incl Heavy shutter)	5 d	15. Sep 2021 at...	21. Sep 2021 at...	161
163	13.6.5.1		👤	0 %	☑	Install guide feed-through in Bunker	1 d	22. Sep 2021 at...	22. Sep 2021 at...	162
164	**13.6.5.1**			**0 %**	☑	**▶ Heavy Shutter Installation**	**4 d**	**3. Sep 2021 at...**	**8. Sep 2021 at...**	
167				0 %	☑	Mounting Cd filter	0,5 d	23. Sep 2021 at...	23. Sep 2021 at...	158
168	13.6.5.1.6		👤	0 %	☑	Beam Monitor Installation	1 d	23. Sep 2021 at...	24. Sep 2021 at...	167
169				0 %	☑	Preliminary raw alignment (guide vessel, choppers, T0 chopper and	2 d	24. Sep 2021 at...	28. Sep 2021 at...	168

Project status

Installation plan

	PB S…	PMS Ax…	Info	(%) Com…	A u…	Name	Duration	Start	Finish	Predece
164	**13.6.5 .1**			**0 %**	☑	**Heavy Shutter Installation**	**4 d**	**3. Sep 2021 at…**	**8. Sep 2021 at…**	
167				0 %	☑	Mounting Cd filter	0,5 d	23. Sep 2021 at…	23. Sep 2021 at…	158
168	13.6.5 .1.6		👤	0 %	☑	Beam Monitor Installation	1 d	23. Sep 2021 at…	24. Sep 2021 at…	167
169				0 %	☑	Preliminary raw alignment (guide vessel, choppers, T0 chopper and heavy shutter)	2 d	24. Sep 2021 at…	28. Sep 2021 at…	168
170				**0 %**	☑	**Vacuum system first test**	**3,5 d**	**28. Sep 2021 at…**	**1. Oct 2021 at…**	
171				0 %	☑	Connect guide vessel and chopp…	0,5 d	28. Sep 2021 at…	28. Sep 2021 at…	169
172				0 %	☑	Connect and seal vacuum connections (guides, choppers an…	0,5 d	29. Sep 2021 at…	29. Sep 2021 at…	171
173				**0 %**	☑	**Proceed w/ vacuum test**	**2,5 d**	**29. Sep 2021 at…**	**1. Oct 2021 at…**	**172**
174				0 %	☑	Start vacuum. Verify level. Verif…	2 d	29. Sep 2021 at…	1. Oct 2021 at 1…	172
175				0 %	☑	Vent system	0,5 d	1. Oct 2021 at 1…	1. Oct 2021 at 1…	174
176	**13.6.5 .1**			**0 %**	☑	**Chopper Installation**	**8 d**	**4. Oct 2021 at…**	**13. Oct 2021 at…**	
177	13.…		👤	0 %	☑	Mount and fix Chopper Top (FOC…	5 d	4. Oct 2021 at 0…	8. Oct 2021 at 1…	175
178	13.…		👤	0 %	☑	Mount and fix T0 chopper Top (T0)	2 d	11. Oct 2021 at…	12. Oct 2021 at…	177
179	13.6.5 .1.9		👤	0 %	☑	Vacuum System Connection	1 d	13. Oct 2021 at…	13. Oct 2021 at…	178
180				**0 %**	☑	**Connections 1**	**8 d**	**14. Oct 2021 at…**	**25. Oct 2021 at…**	
181				0 %	☑	Connect choppers to cooling syst…	0,5 d	14. Oct 2021 at…	14. Oct 2021 at…	179
182				0 %	☑	Connect power (choppers, motion table, T0, heavy shutter, Cd filter)	0,5 d	14. Oct 2021 at…	14. Oct 2021 at…	181
183				0 %	☑	Connect PSS Heavy Shutter	1 d	15. Oct 2021 at…	15. Oct 2021 at…	182
184				0 %	☑	Connect choppers to CHIC	1 d	18. Oct 2021 at…	18. Oct 2021 at…	183
185				0 %	☑	Connect sensors (vacuum, tempe…	0,5 d	19. Oct 2021 at…	19. Oct 2021 at…	184
186				0 %	☑	Connect beam monitors (power and DAQ)	0,5 d	19. Oct 2021 at…	19. Oct 2021 at…	185
187				0 %	☑	Connect MCA	1 d	20. Oct 2021 at…	20. Oct 2021 at…	186
188				0 %	☑	Verify all connections	3 d	21. Oct 2021 at…	25. Oct 2021 at…	187
189				**0 %**	☑	**Installation tests**	**10,5 d**	**26. Oct 2021 at…**	**9. Nov 2021 at…**	
190				**0 %**	☑	**Full remote handling test (11.5m)**	**8 d**	**26. Oct 2021 at…**	**4. Nov 2021 at…**	
197				**0 %**	☑	**Test of Maintenance manoeuvr…**	**4,5 d**	**3. Nov 2021 at…**	**9. Nov 2021 at…**	
205				**0 %**	☑	**Final alignment In Bunker**	**38 d**	**9. Nov 2021 at…**	**31. Dec 2021 at…**	
206				**0 %**	☑	**Preparation tasks**	**24 d**	**9. Nov 2021 at…**	**13. Dec 2021 at…**	
207				0 %	☑	Mounting of bunker roof	20 d	9. Nov 2021 at…	7. Dec 2021 at…	204
208				0 %	☑	Prepare access for personnel t…	4 d	7. Dec 2021 at…	13. Dec 2021 at…	207
209				0 %	☑	Installation of lighting system	4 d	7. Dec 2021 at…	13. Dec 2021 at…	207
210				**0 %**	☑	**Alignment BTCS**	**14 d**	**13. Dec 2021 at…**	**31. Dec 2021 at…**	
217				**0 %**	☑	**Connections 2**	**7 d**	**31. Dec 2021 at…**	**11. Jan 2022 at…**	
227				**0 %**	☑	**Connectivity test**	**6 d**	**11. Jan 2022 at…**	**19. Jan 2022 at…**