



**EUROPEAN  
SPALLATION  
SOURCE**



# The Bunker Project

Update

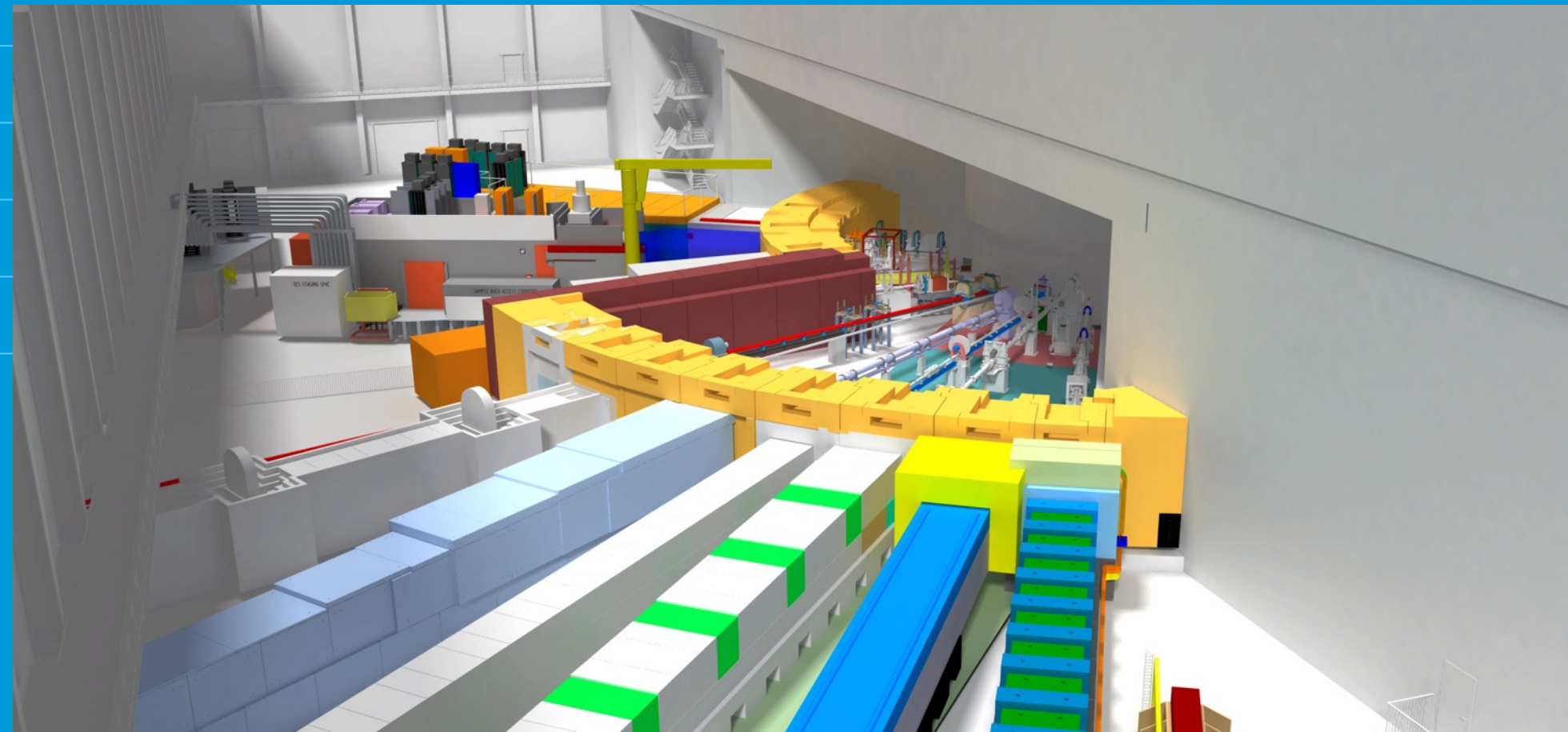
PRESENTED BY: ZVONKO LAZIĆ

2020-02-24



# Agenda

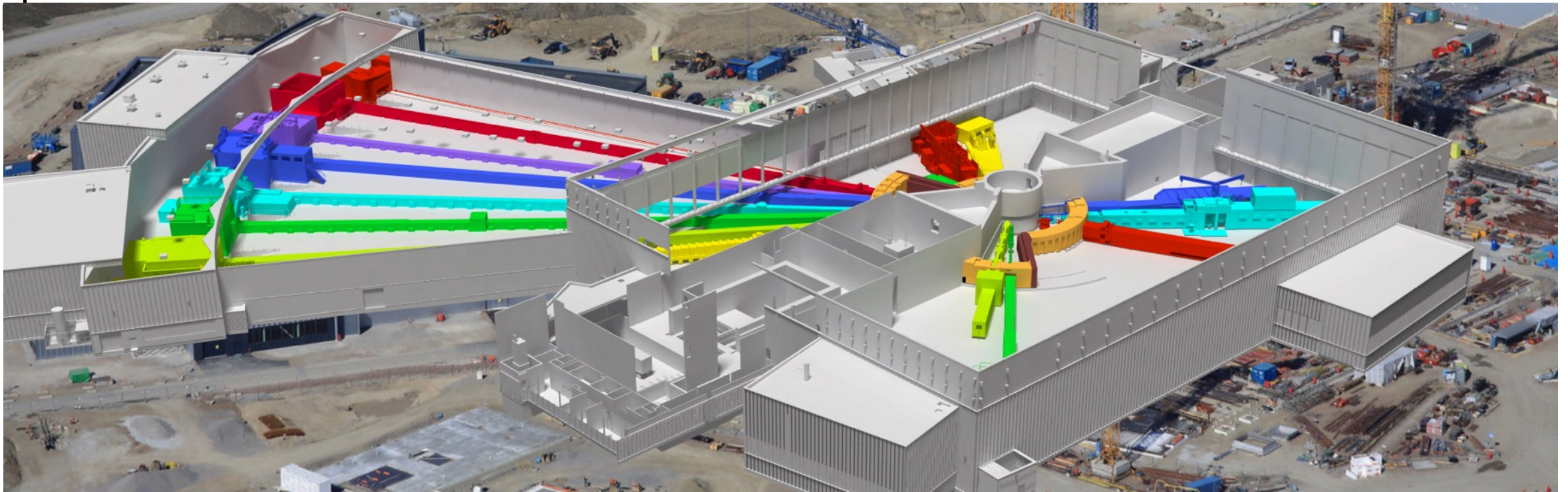
- 1 Project overview
- 2 Schedule
- 3 Production/installation status





# The Bunker – Overview I

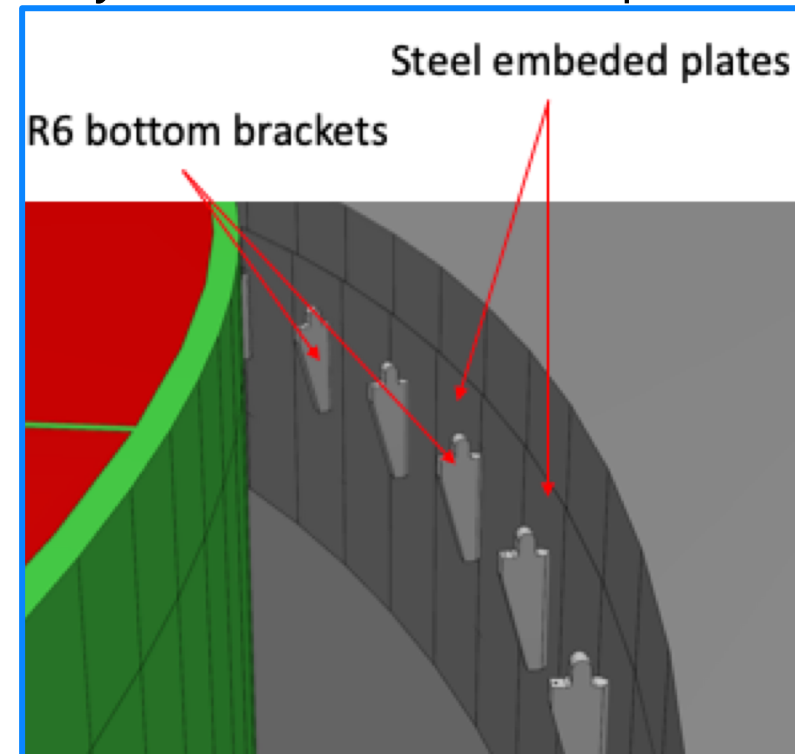
- Design for production phase ended 30.June. '19
- All CAD data delivered, checked and integrated into the EPL (Jan. 2020)
- First components delivered. (R6 brackets)
- First installation package actioning this week. (R6 brackets)
- Delivery schedule aligned with the latest ESS integrated installation



# The Bunker – Overview II

(or, what is going on now..)

- The first installation package is the R6 brackets.
- Installation Readiness Review (IRR) finalised with a list of actions to be completed before commencement of the work (this week).
- The actions are underway, all to do with Quality Assurance (QA) requirements, and ensuring collaboration of all parties involved is at a good level (everyone knows what is expected of them, and what the others are doing).
- Next in line is the R6 pillars and box beam, followed by the baseplates.
- The west wall production is starting now, it will be pre-assembled at Ferrobeton' production plant in Hungary (we are going to inspect the work late April). The West wall installation in Oct. '20.



# Schedule highlights



- Manufacturing start
- First IRR completed & Installation started (R6 brackets)
- West wall production start
- West wall installation start
- Bunker ready for BOT

October 2019

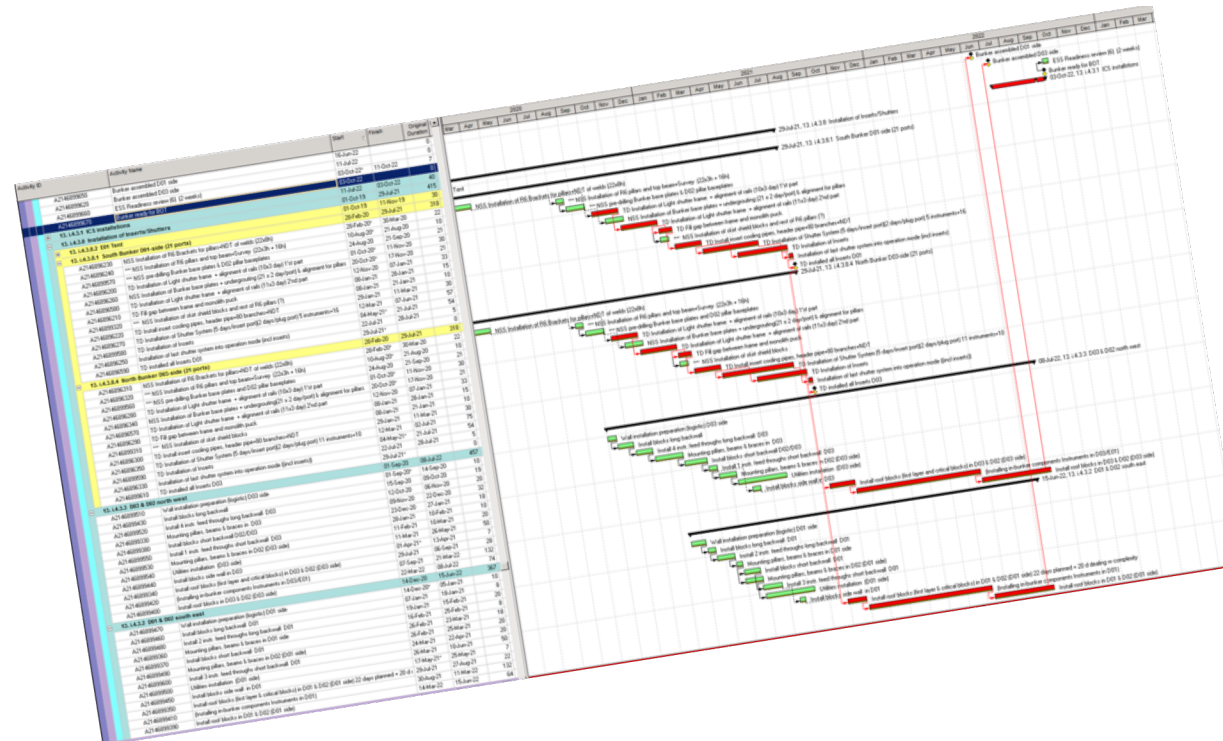
February 2020

March 2020

~~December 2020~~ shifted to October 2020

July 2022 -> 2 months negative float and is currently in Sep 2022

Mitigations ongoing ESS wide to bring it back.



# Bunker Installation Schedule – updates



- Current delay in port block manufacturing (Target) is causing delays to Bunker installations
  - Workshops held between NSS, TD, SEC/CF and rigging team to address the issue

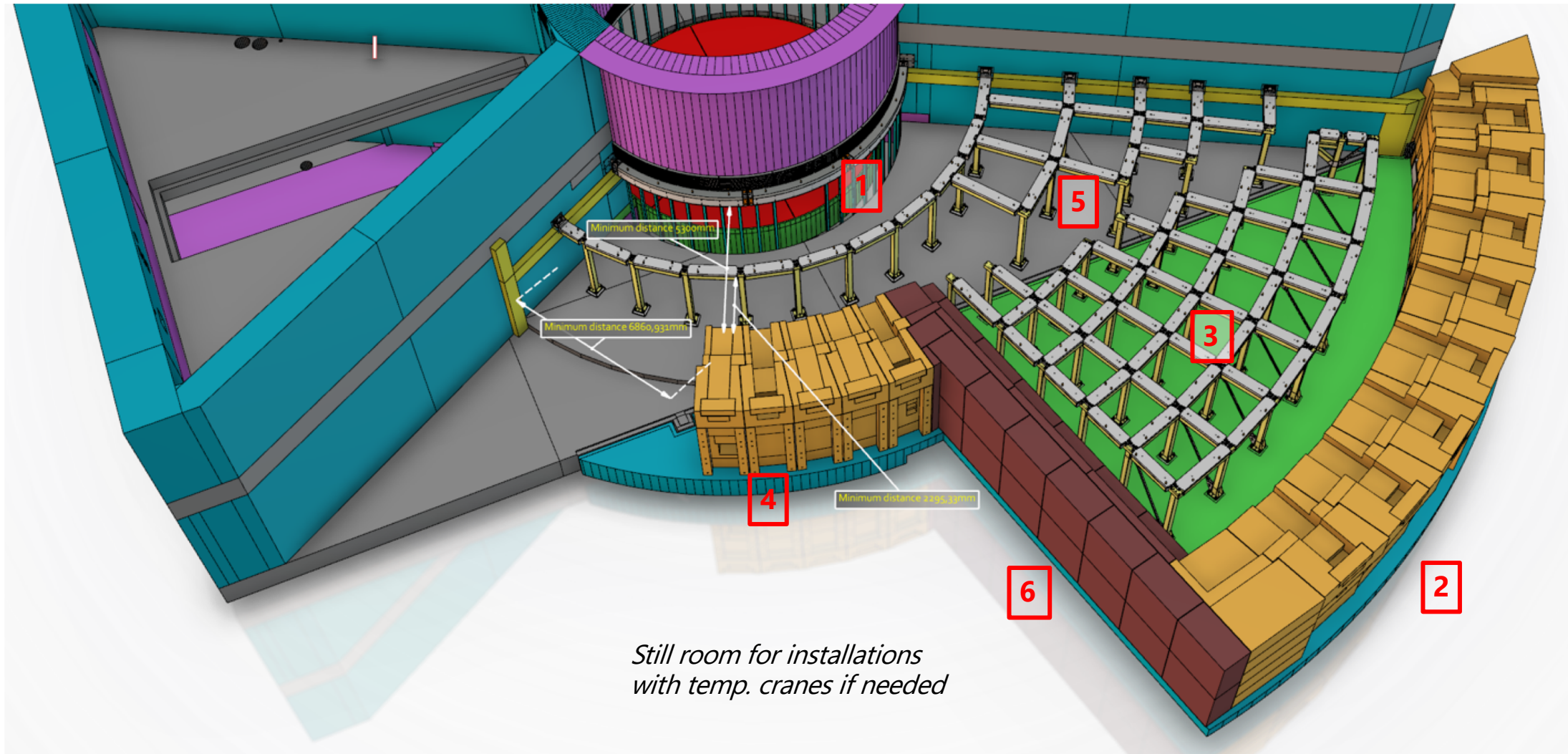
## Result:

- Optimized installation sequence with MINIMUM links between LS system and Bunker installation
    - Gives a schedule that can deal with potential delays in the future better, since it is almost “disconnected”
  - Optimized Bunker installation (also with minimum links to TD)
    - Start install walls earlier (earlier access and earlier deliveries)
    - Continue to build rest of Bunker (except roof) BEFORE insert installations
- Looking at additional mitigations with Target to bring it back further.  
Assume baseline dates for Instrument In-bunker access holds. More info tomorrow Tuesday in schedule session.*

Building Bunker  
“without TD” -  
NSS dates hold !

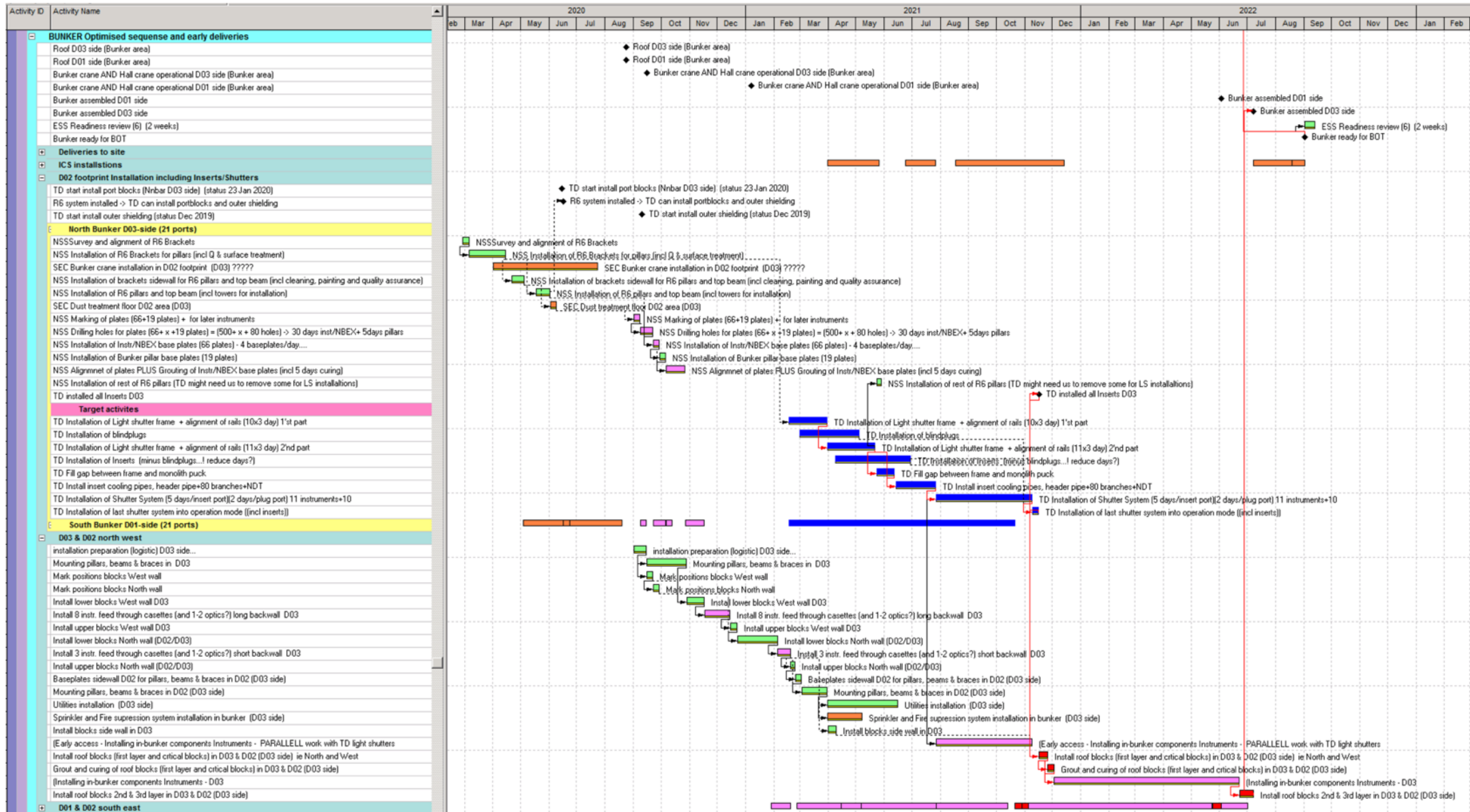
A green oval callout box is positioned on the right side of the slide, containing text that highlights a key result of the schedule optimization.

# Majority of Bunker installed before Insert installation (ex D03 side)

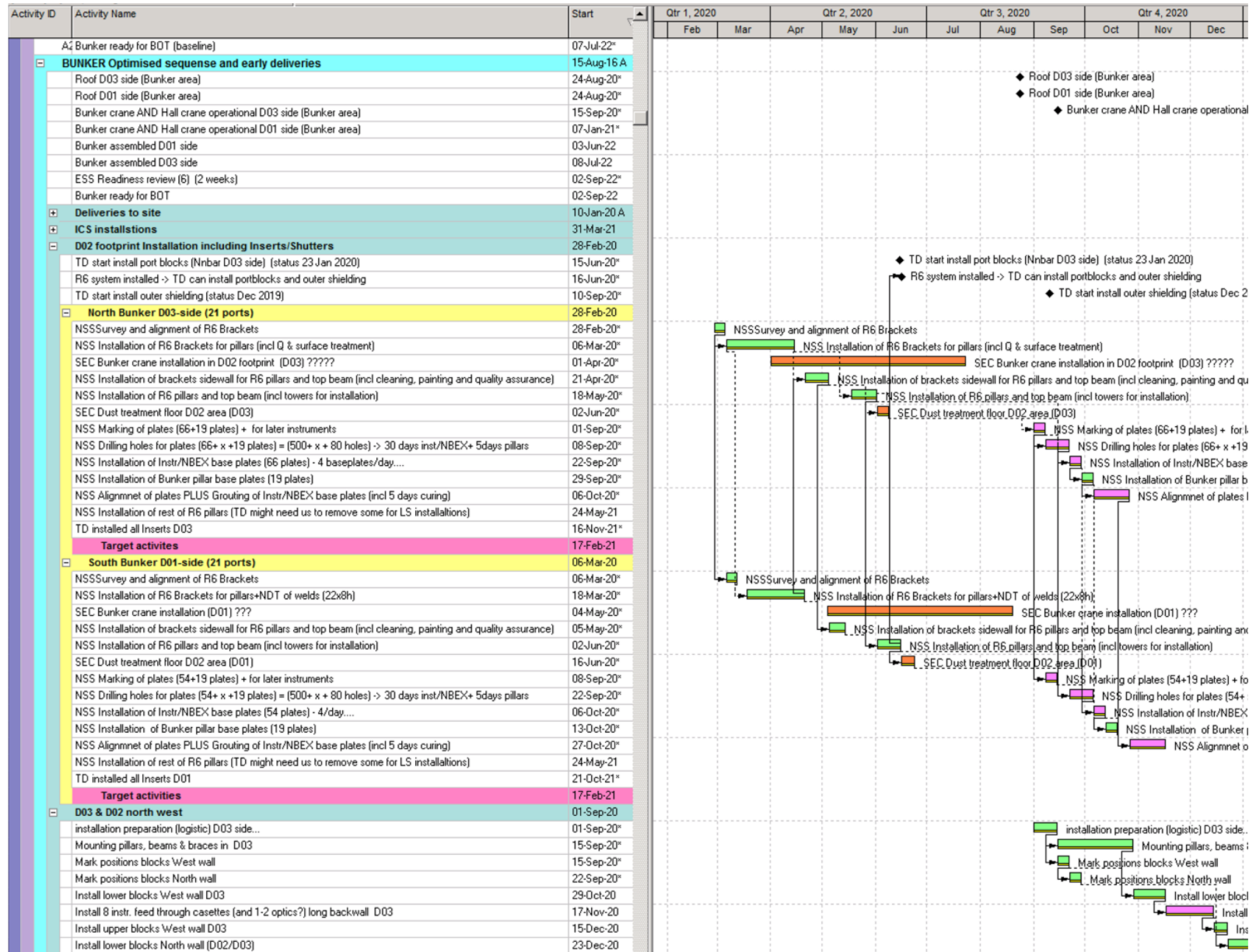




# Detailed (unreadable) installation schedule



# Detailed installation schedule for 2020



## Installation Bunker items in 2020:

- R6 brackets
- R6 pillars
- R6 beams

## Bunker cranes (CF)

- Baseplates NBEX tool
- Baseplates Instruments
- Baseplates bunker pillars in D02

- Pillars West area / D03 long
- Wall West area / D03 long
- & Bunker wall feed throughs

# First Bunker installations & Instruments



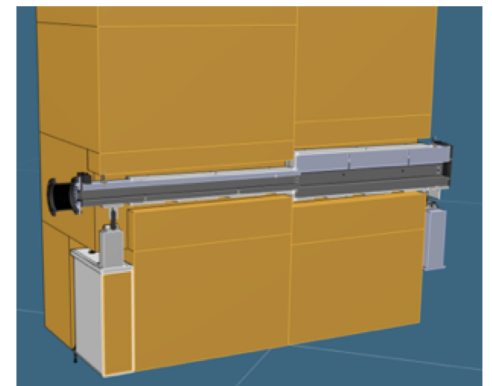
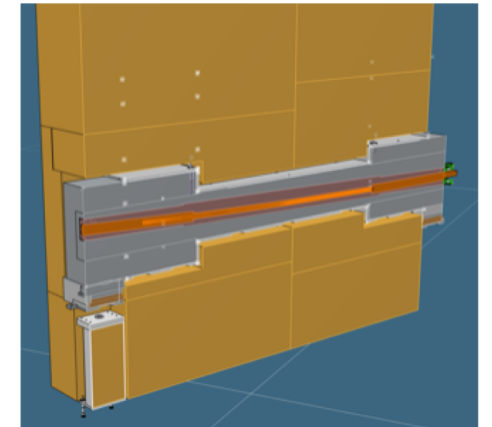
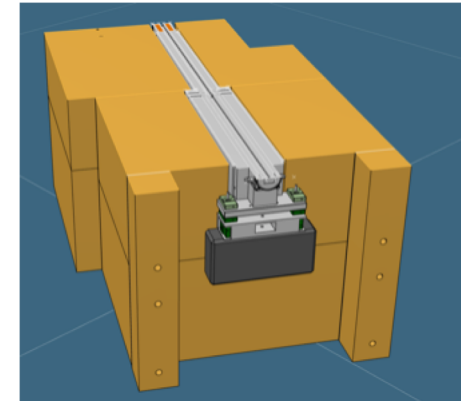
The walls are going up first!

*If possible, install Bunker wall insert with the wall for the FIRST 8, please have them Ready for Installation (ie optics aligned in wall insert):*

West Wall (D03, 28m):	1 Nov 2020	BEER, BIFROST, MAGIC, C-SPEC
North Wall (D03, 15m):	15 Jan 2021	LOKi, TBL
South Wall (D01, 28m):	15 Jan 2021	ODIN, DREAM
East Wall (D01, 15m):	15 March 2021	ESTIA

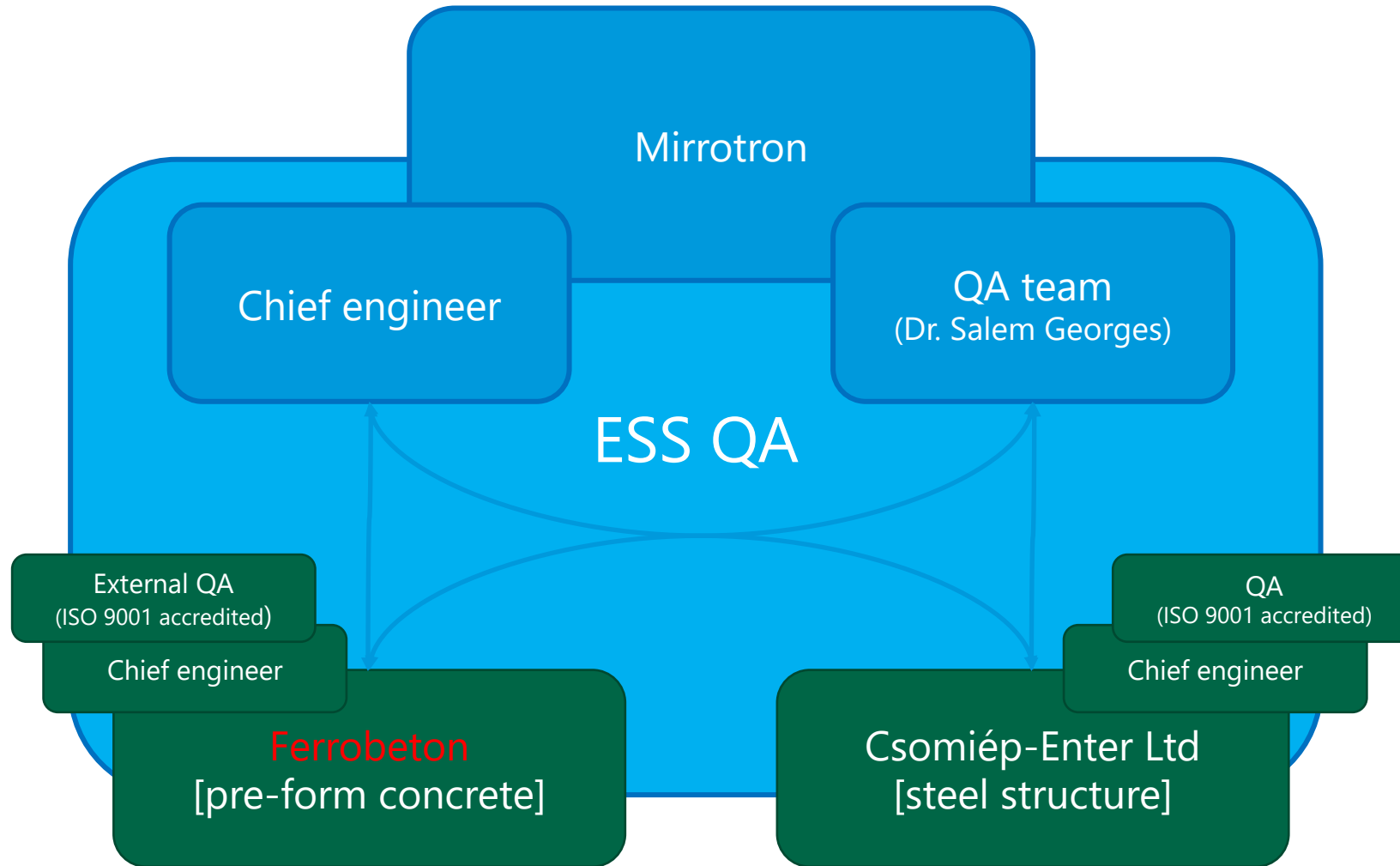
Bunker Wall insert envelope frozen and confirmed by supplier 1 June 2020.

Wall feed-through cases procured and manufactured by ESS.



More info here: <https://confluence.ess.lu.se/pages/viewpage.action?pageId=311642808>

# Production and QA



# The bunker – Production (summary)



- Detailed design completed and handed over.
- First deliverable supplied, remainder of production continuing in parallel (steel structure and blocks production).
- Production of the western wall starting now.
- ESS inspection of produced material scheduled for late April 2020.
- The next deliverables are the remainder of the R6 structure, the rest of the frame, and the first wall section (West).



# Installation – binder (R6 brackets)

D02

Binder name Installation of R6 brackets  
 Binder ID Ib 232  
 Created 27.11.2019

No.	Activity (A)	Hazard (B)	Who might be harmed and how? (C)	Initial Risk Rating (D)	Action to Mitigate Risk-Controls (E)		Residual Risk Rating (F)
					L	S	
1	Marking the center of the WCS plate. Drilling and setting the W3 anchor; installation of the first plate with the support of the ESS metrology group.	Drilling concrete/dust	Installation workers/lose PPE	3	5	15	3
2	Aligning and fixing the plates; drilling and installation of all the other plates, by using an optical level level that will allow a tolerance +/- 2 mm from the target level provided from the ESS metrology group; Final adjustment of the plates with the adjustment screws, later on the final level verification from Metrology.	Manual work	Installation workers/lose PPE	5	3	15	2
3	Removal of the plates.	Slips, trips & falls	All Personnel	3	2	6	2

**R.A.M.S. & SAFETY CERT**

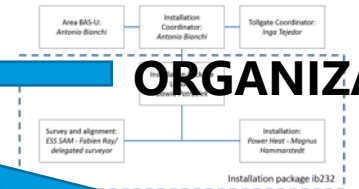
**INST. PLAN**

Task No	Task Name	Duration	Start	Finish	Predecessors	Owner	Res. Package
1	Installation Readiness review	2 days	Thu 08/08/19	Thu 08/08/19			
2	ESS access plan	2 days	Thu 13/08/19	Thu 15/08/19			
3	Installation of interface plates on top of the W3 beamline plate (EPL) in the ESS.1 guide hall	12 days	Mon 26/08/19	Tue 12/09/19			
3.1	On site delivery of material in the W3 beamline	1 day					
3.2	Mechanical installation of the first steel plate	1 day					
3.3	Surveying marking, support and validation of the first plate to install	1 day	Mon 22/08/19	Mon 22/08/19			
3.4	MS mechanical quality control of the first plate to install	1 day	Mon 22/08/19	Mon 22/08/19			
3.5	Mechanical installation and alignment of the remaining 11 steel plates in accordance to the first one	5 days	Tue 23/08/19	Thu 29/08/19			
3.6	Final surveying verification and mechanical adjustment of steel	1 day	Fri 06/09/19	Fri 06/09/19			
3.7	Final grinding of the steel plates	2 days	Mon 26/08/19	Tue 27/08/19			



**IB 232**

ib232 – Organisation structure  
 Bunker's R6 brackets installation



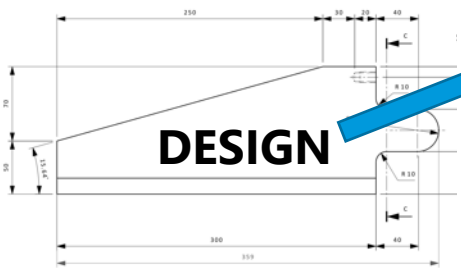
## ORGANIZATION

Document Type: Installation Report  
 Document Number: ESS-036617  
 Date: 06/09/2019  
 Revision: 3.00  
 Status: Approved  
 Confidentiality: Internal  
 Page: 3/5

Installation Readiness Review minute of meeting  
 Installation Binder 147 – Installation of interface plates on top of the W3 beamline (ESS.1 building)



Inspection at ESS (F03 building)



**WELDING PROCEDURES SPECIFICATION**

Run	Process	Material (d) (mm)	Current (A)	Voltage (V)	Speed (mm/min)	Travel (mm/min)	
1	TIG	3.2	623-100	90-90	100-120	0.76-1.15	
2	TIG	5.0	623-100	90-90	100-120	0.60-0.75	
3-6	TIG	3.25	78.6-154	23-28	DC+	340-220	0.61-0.90

**Marking position of brackets**

In order to mark theoretical position of brackets, support from ESS Survey and Alignment team is required.

For easier installation, theoretical position of brackets, with theoretical TCS shall be projected on embedded steel plates, which are cast in the Bunker floor, at R=6 m. Three marks per bracket are wanted:

- Horizontal mark of the top surface of the bracket
- Horizontal mark of the bottom surface of the bracket
- Vertical mark of the center of the bracket

Theoretical position of the brackets to be retrieved directly from the EPL model during marking process.

## INSTALLATION PROCEDURES

**I.R.R. MoM**

Credit: Antonio Bianchi

2020-02-24

# The bunker – Installation



- *Installation Package Leader (IPL) for the bunker project – Dawid P.*
- The IPL is responsible the binder is properly prepared before the IRR can take place
- *Installation Co-ordinator (IC) – Antonio B.*
- The IC is responsible for the approval/disapproval of the Installation Readiness Review



## ESS Installation Binder Library

- ▼ ESS Installation Binder Library
  - > ACCSYS BINDERS
  - > ICS BINDERS
  - ▼ NSS BINDERS
    - > Specific Instruments - Installation binders
      - ▼ Bunker Project - Installation binders
        - ▼ ib232 - Bunker's R6 brackets
          - ib232 - 01 List of Documents
          - ib232 - 02 Scope of Work
          - ib232 - 03 Organisation
          - ib232 - 04 Time Schedule
          - ib232 - 05 Risk Assessment Method Statement (RAMS)
          - ib232 - 06 Temporary Services
          - ib232 - 07 Drawings
          - ib232 - 08 Installation Procedures
          - ib232 - 09 Work Permits
          - ib232 - 10 Daily Diary
          - ib232 - 11 Non-Conformity Report (NCR)
          - ib232 - 12 QC - Installation & Test Documentation
          - ib232 - 13 List of Components & Material
          - ib232 - 14 Reference Documents
          - ib232 - 15 Installation Finalization
          - ib232 - Binder Versions
        - > Common Shielding - Installation binders
        - > General NSS - Installation binders
        - > Laboratories - Installation binders
      - > TARGET BINDERS
      - > TRASH
      - > Closed and Archived Binders



# Installation – easy, right?

- IF processes are set and followed correctly...
- The installation process is well set and is being 'robusted up' as we are gaining practical experiences and the first packages are being installed.
- Ensuring close collaboration of all parties involved (SKANSKA, ESS QA, installation subcontractors, project/package personnel,...) is one of the most complex tasks, however, the track record so far shows we are achieving good results.
- We are ensuring all installation work is done following appropriate standards and procedures.
- The above point stipulates all required documentation is in order (WO, RAMS, Certificates, Procedures, Coordination and planning docs...).



# Feedthroughs redesign change request



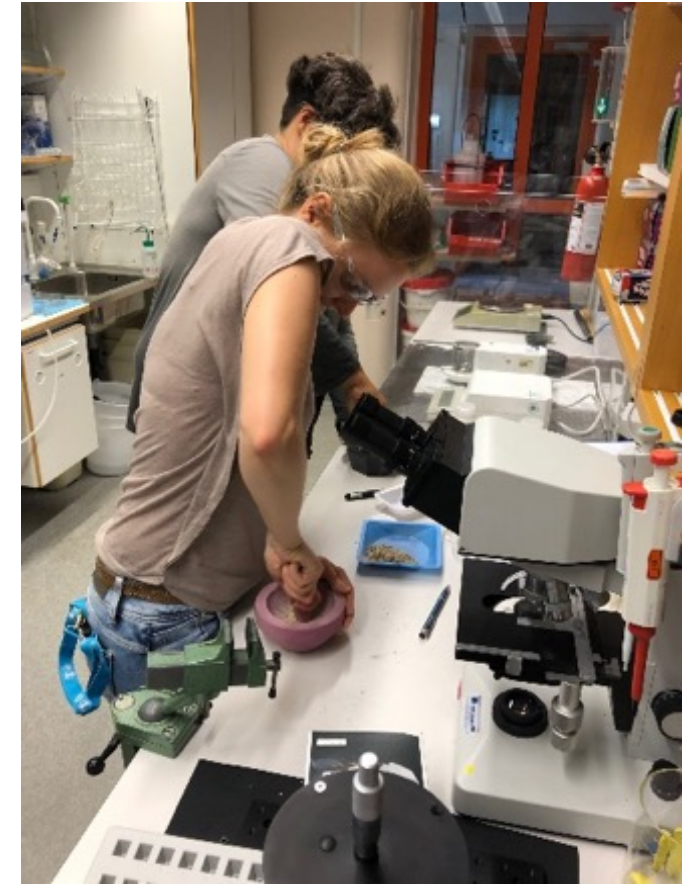
## Change requests created by ESS

- Many instrument teams requested minor redesign changes. Cost and deadlines were not affected.
- Manufacturing of concrete blocks has started, thus if additional changes will be requested, it might have potentially high risk (cost and time-wise) for the project. The supplier has a right to reject a CR (e.g. if delivery deadlines would be affected).
- The latest request for changes of the feed-through geometries (TBL, SCADI, FREIA) are currently being evaluated by the manufacturer for schedule and cost impact. Once the cost impact is communicated to us, we will pass this to respective instruments for approval.

# Why do we test the bunker construction material?



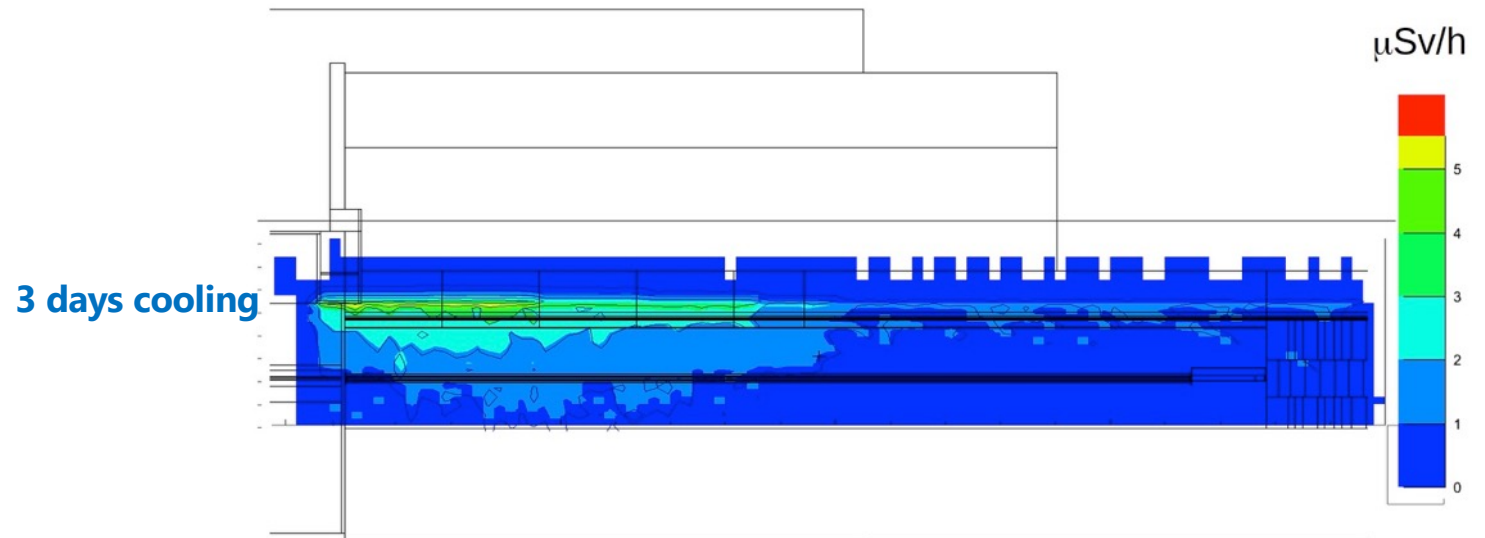
- To determine quantitatively which elements are present in the material.
- The more of the strongly activating, long half-life elements are present, the stronger the lasting activation of the bunker wall will be.
- This activation affects how we work in the bunker and how much time after beam shutdown passes before we can enter the bunker.
- **The tests are currently performed under strong support of the SULF (Sample and User Lab Facilities) team and use of the ESS user laboratories.**
- Examples for elements that are undesired even on the %-level:
  - Na, K, Sc, Cr, Fe, Co, Eu, Zn, Rb, W...



# Activation and dose rates from bunker walls and roof are needed for bunker access and operation



- Dose rates from the roof are at the level of 10s mSv/h after 3 days decay.
- Dose rate from a roof block removed and placed on the bunker floor are at the level of 1 mSv/h or less at 1 m from the block, 1 day after shutdown
- Dose rates from a realistic irradiation condition of the wall, i.e., with a beamline in place, going through the bunker, are comparable to the dose rates for the roof, for the short sector wall, and lower for the long sector wall.
- Results are in **ESS-0416081**



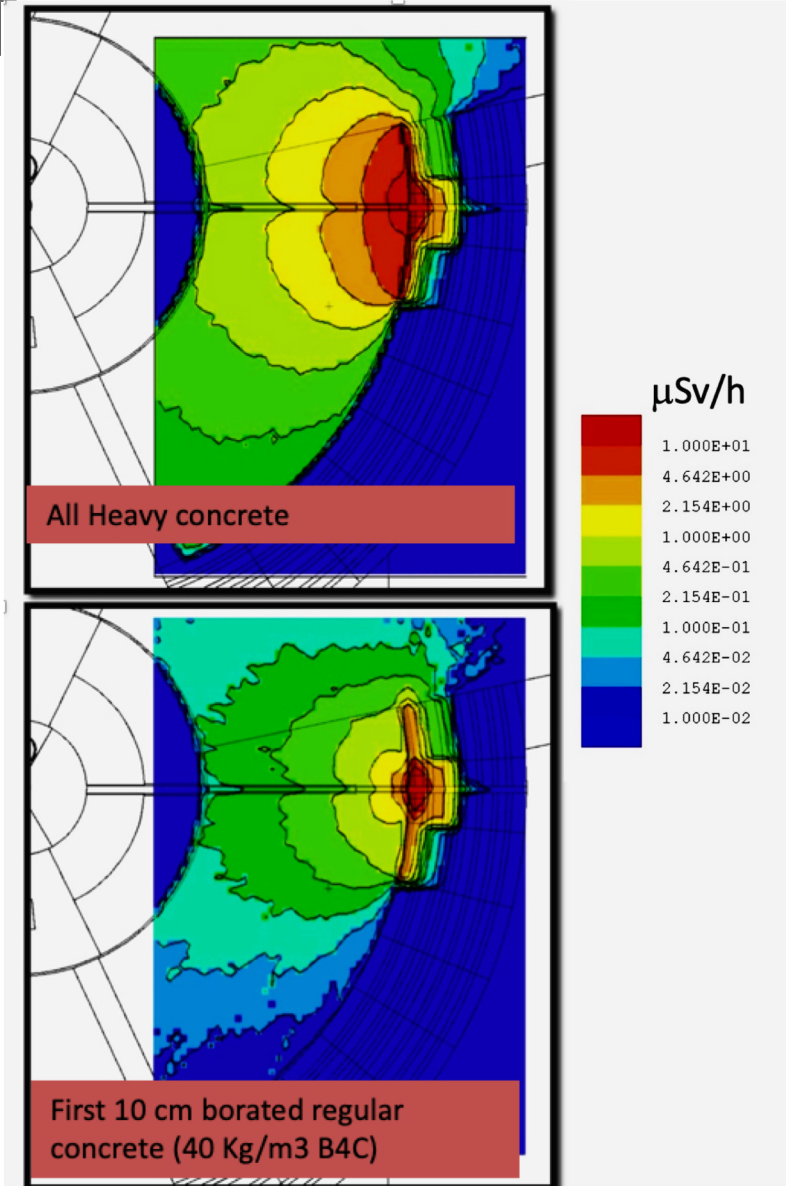
# Updated calculations for materials selection for Wall and Roof

Several options studied to reduce in bunker activation

1. All Heavy concrete
2. Like 1, with 1 cm of B4C in front
3. First 100 cm of borated Heavy concrete (10 Kg/m<sup>3</sup> B4C)
4. First 10 cm borated regular concrete (40 Kg/m<sup>3</sup> B4C)
5. First 10 cm regular concrete (no boron)

Roof and curved walls will be of heavy concrete with the first 10 cm of borated regular concrete (option 4).

Bunker straight walls will be of regular concrete, with the first block (1 m thick) containing B4C

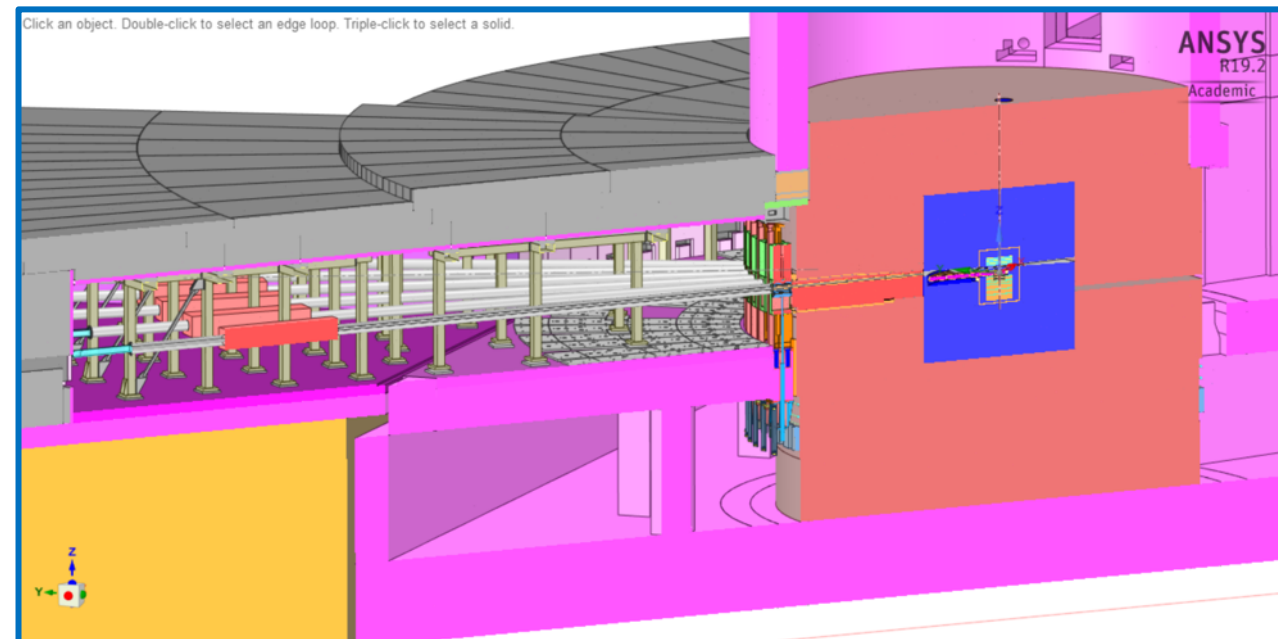


# Started comprehensive radiation work in bunker

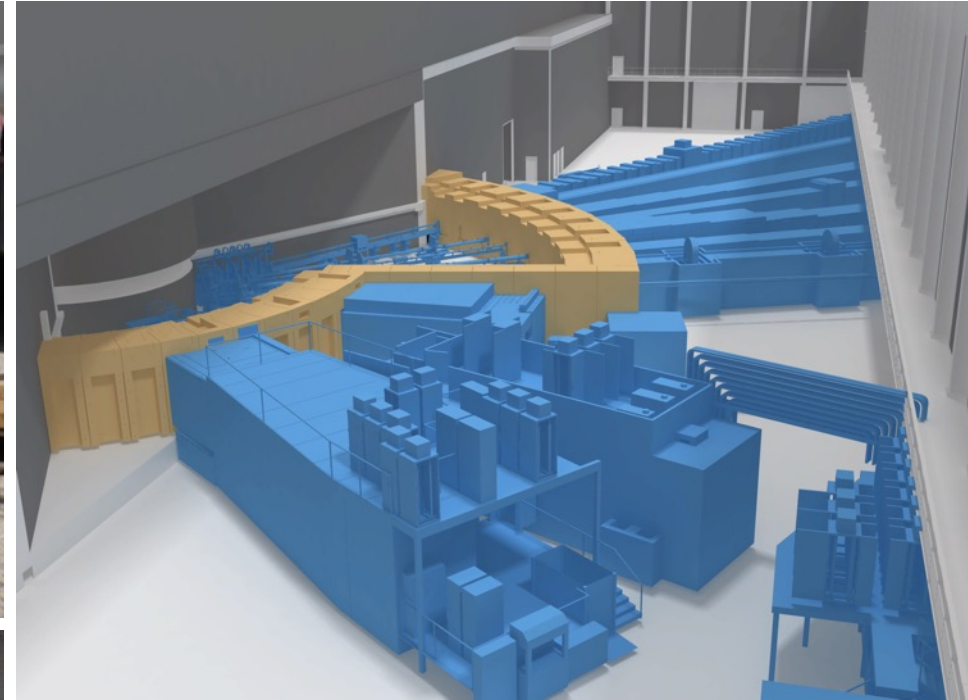


- Work started in January 2020 by UKAEA
- Detailed modeling of bunker area from CAD and converted to MCNP
- Results delivered by June 2020:
  - Calculations for Light Shutter System operation and maintenance
  - Accident scenarios during NBEX extraction
  - Prompt dose rates in bunker basement for irradiation of electronic components
  - Shutdown dose rates inside bunker for bunker access
  - Updated activation and dose rates of reference beamline
  - Updated design of temporary beam stops (DTU)

MCNP Model prepared from CAD

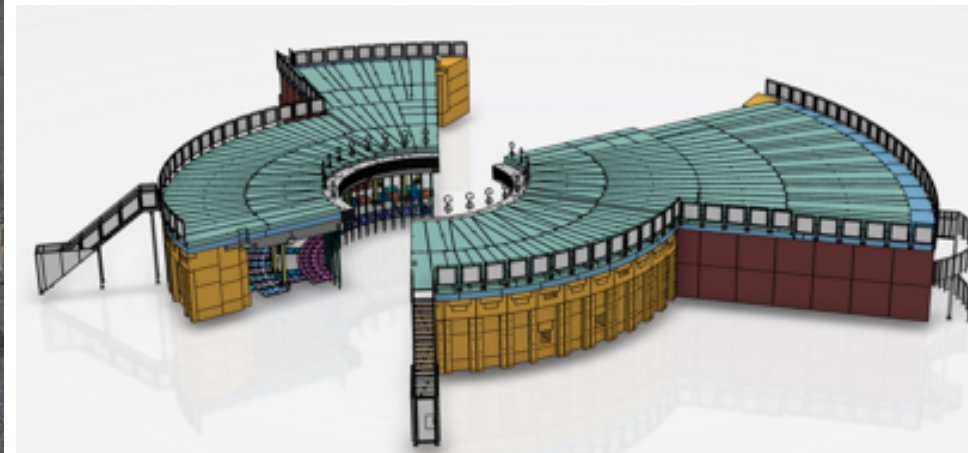


# The bunker – Production (summary)



## Outlook

- Production process is progressing well.
- QA systems are in place, at manufacturers' site, as well as at ESS.
- Production schedule, delivery schedule, are being updated following updates of the NSS

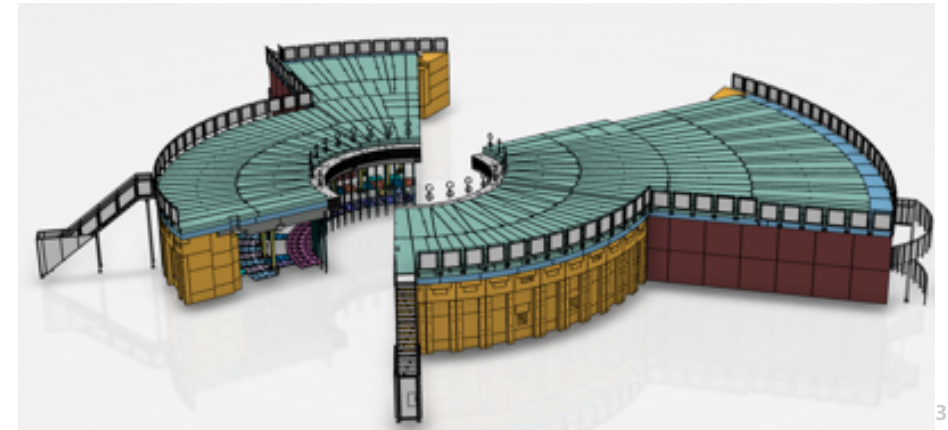
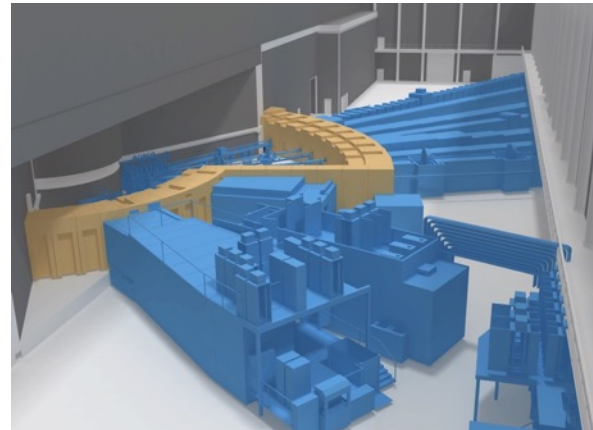
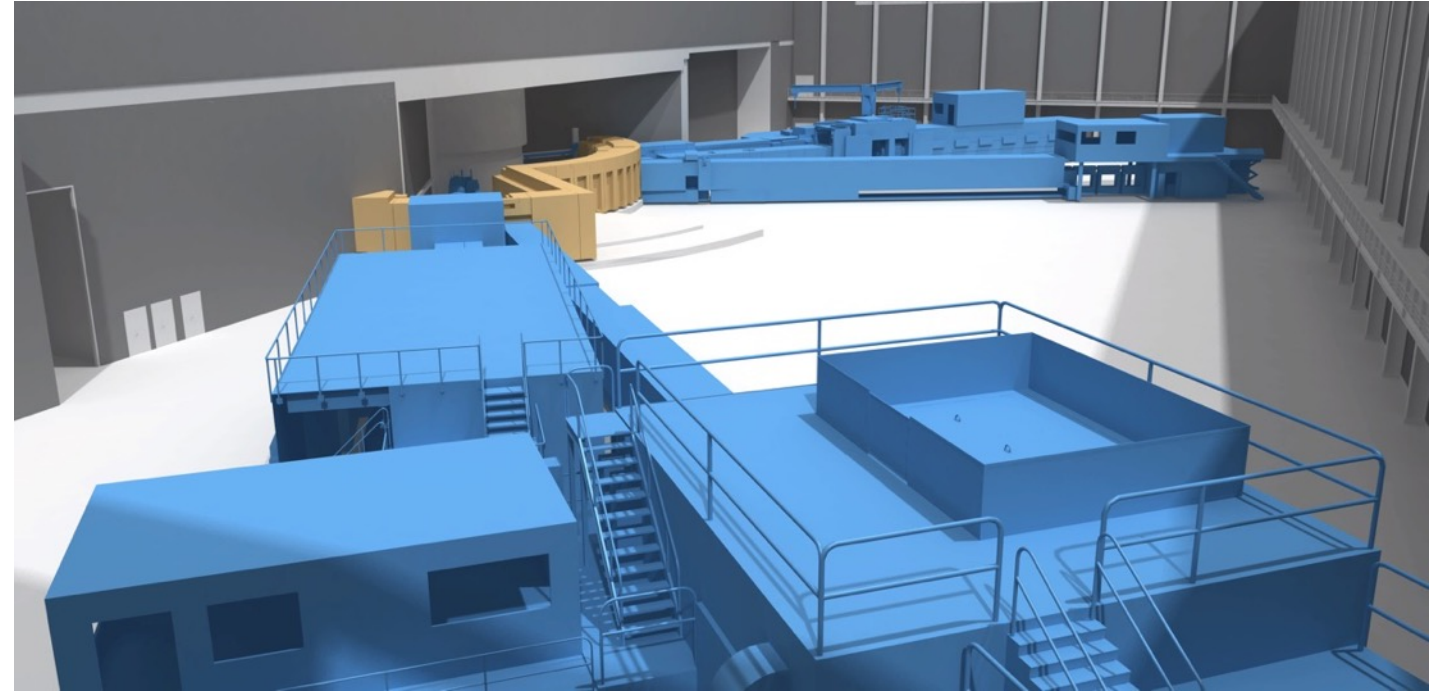


# The Bunker – take\_away

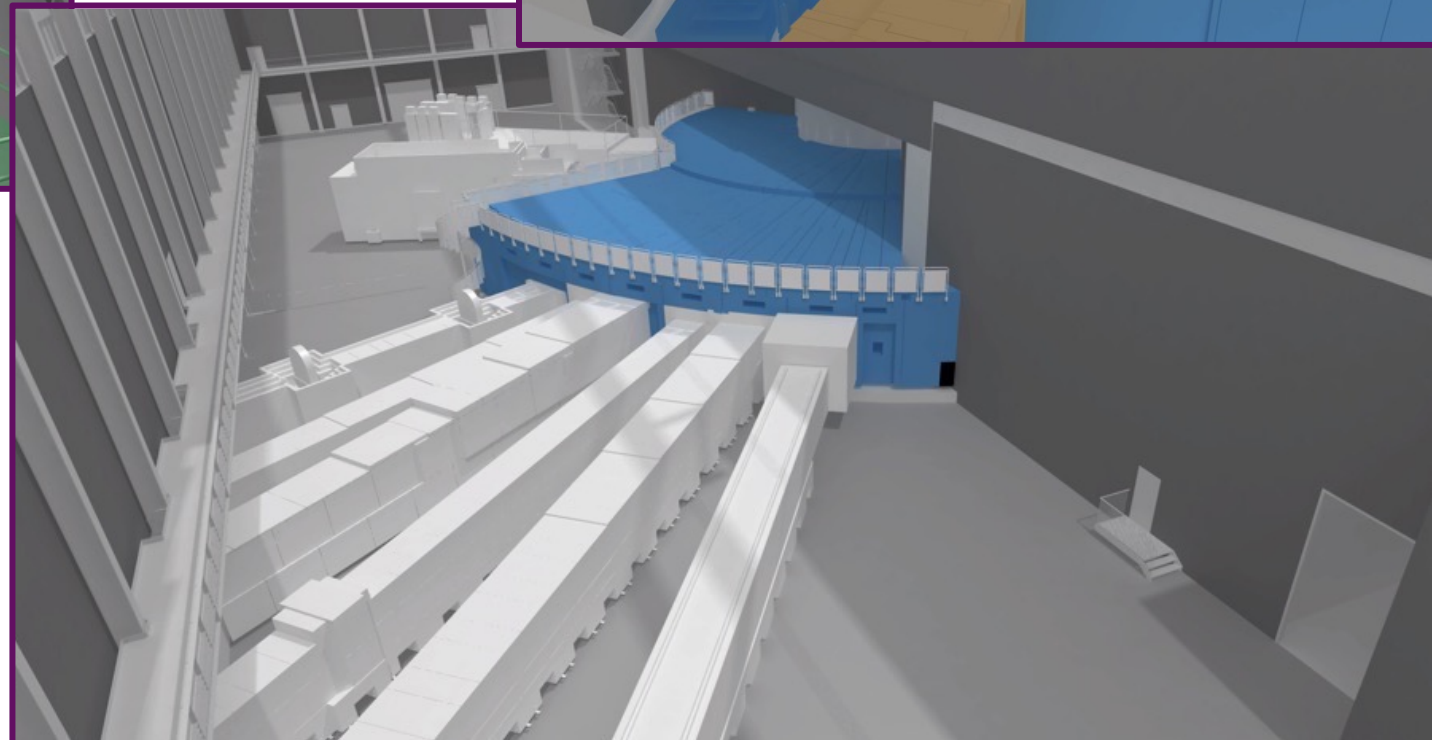
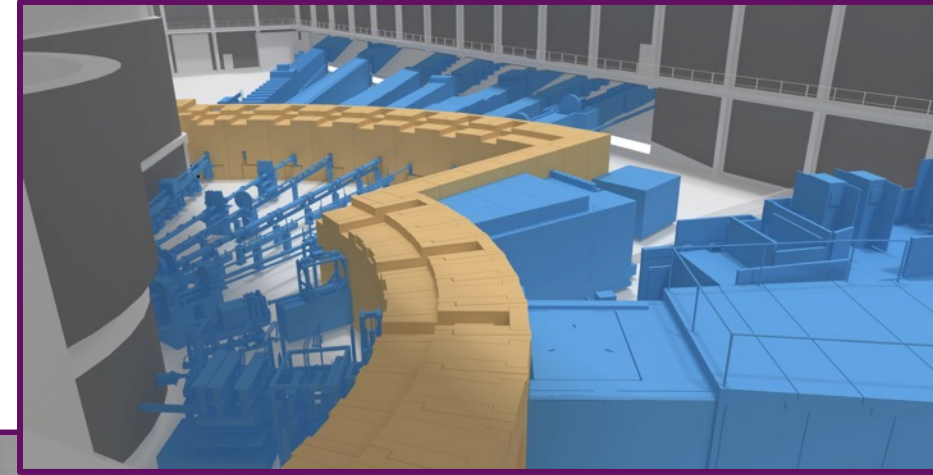
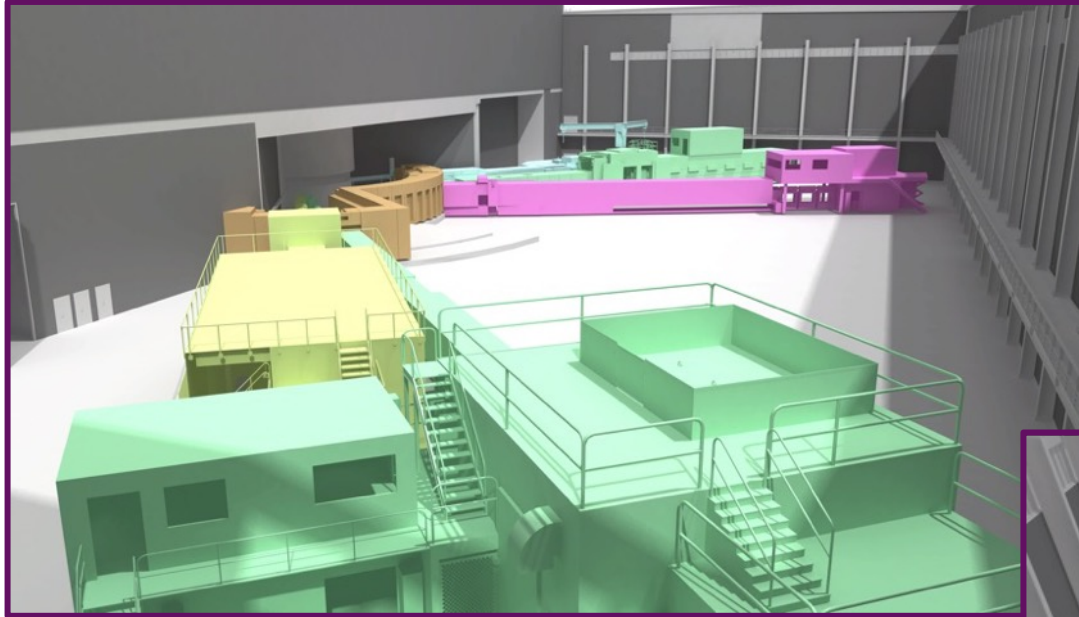


## Take away...

- Bunker wall FEED-THROUGHS
- CAD data
- Quality of the above
- Notify in time
- KEEP TALKING ...



# The Bunker Overview – q/a



**End of presentation**

**Q/A**

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- 
-





# Finish presentation