



EUROPEAN
SPALLATION
SOURCE



European Spallation Source Big Science 2020

Remote handling and robotics session

Update on the Active Cells Facility in ESS

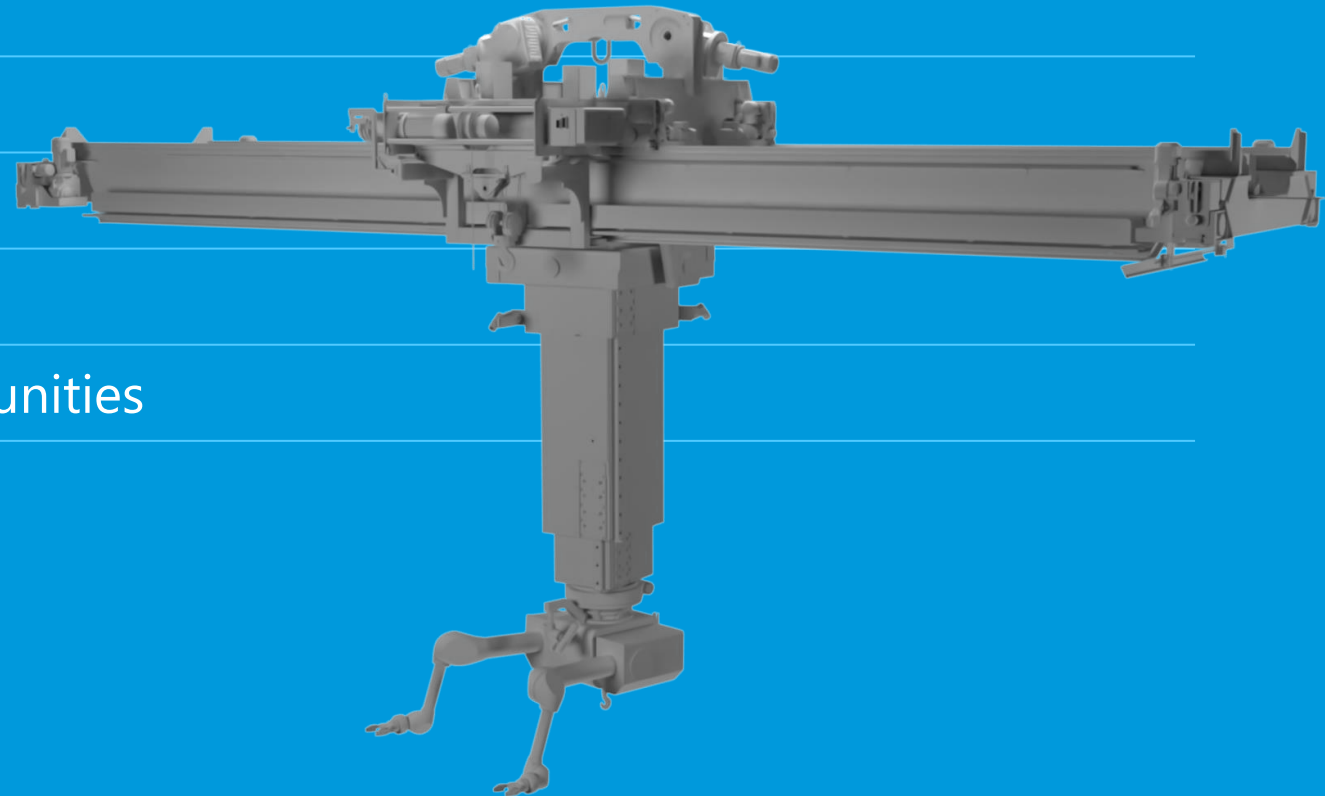
DR CARWYN JONES
WORK PACKAGE MANAGER-REMOTE HANDLING SYSTEMS
EUROPEAN SPALLATION SOURCE ERIC

2020-11-24

Agenda



- 1 Remote Handling System (RHS) Overview
- 2 Target Components
- 3 Mock Up and Test Stand (MUTS)
- 4 Cask Assembly
- 5 Active Cells Facility
- 6 Current Status on Site
- 7 Supplier competencies and opportunities



Target Station

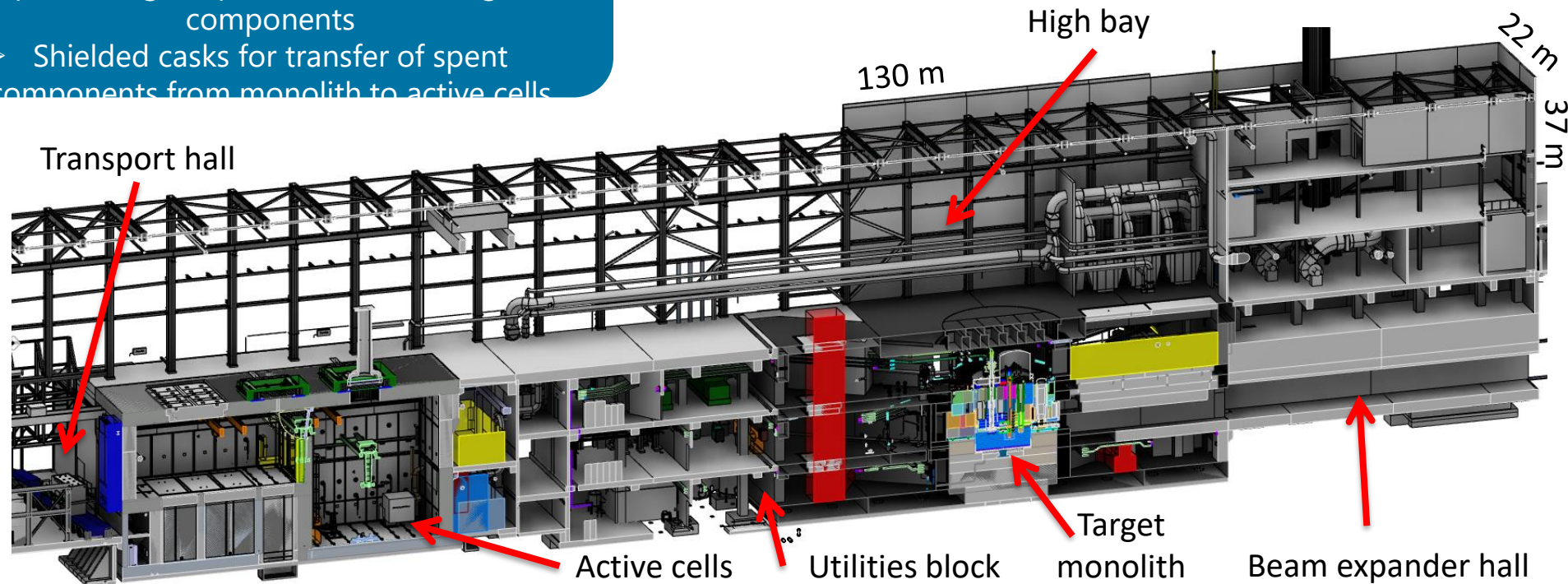
Cut section of the D02 building

Remote handling systems

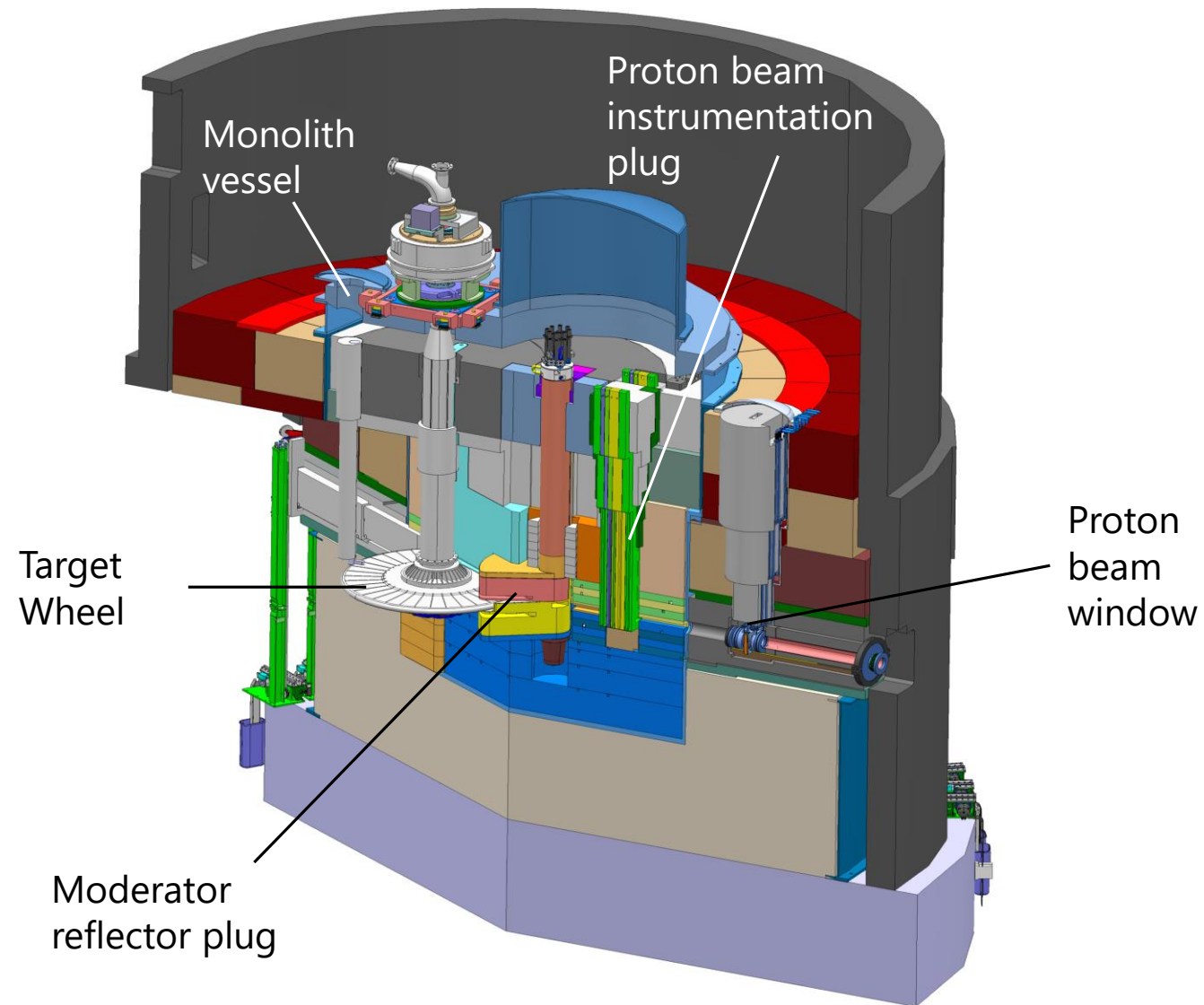
- Large active cells for safe storage and processing of spent radioactive target components
- Shielded casks for transfer of spent components from monolith to active cells

Target Monolith

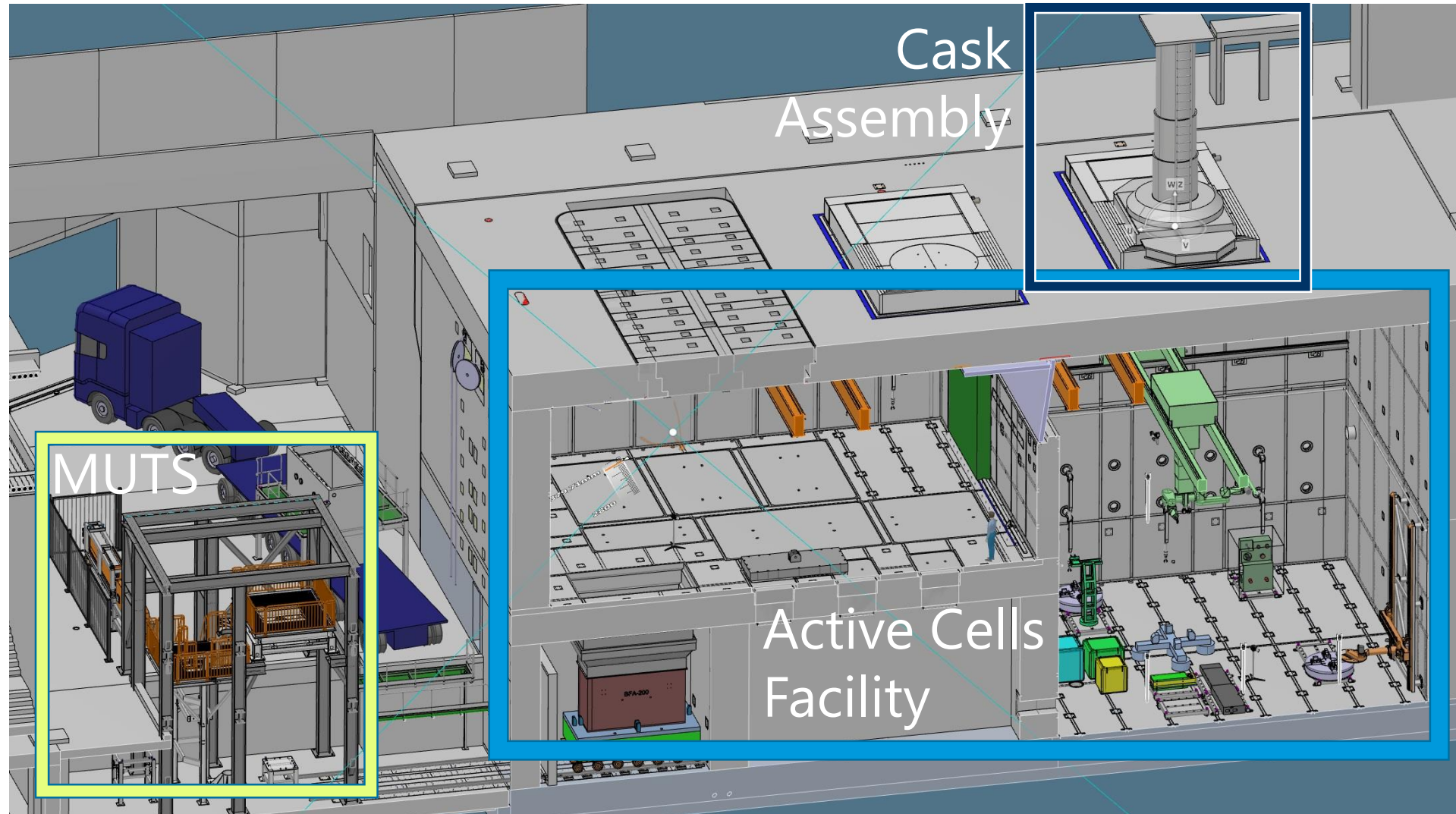
- 11 meter diameter cylinder with steel and concrete shielding
- Rotating Solid Tungsten Target – 36 sectors – Helium Cooled – 11 tons
- Moderators with liquid hydrogen @ 17K – and room temperature water – 18 tons
- Proton Beam Window and beam diagnostics



Target Monolith



Remote Handling Systems

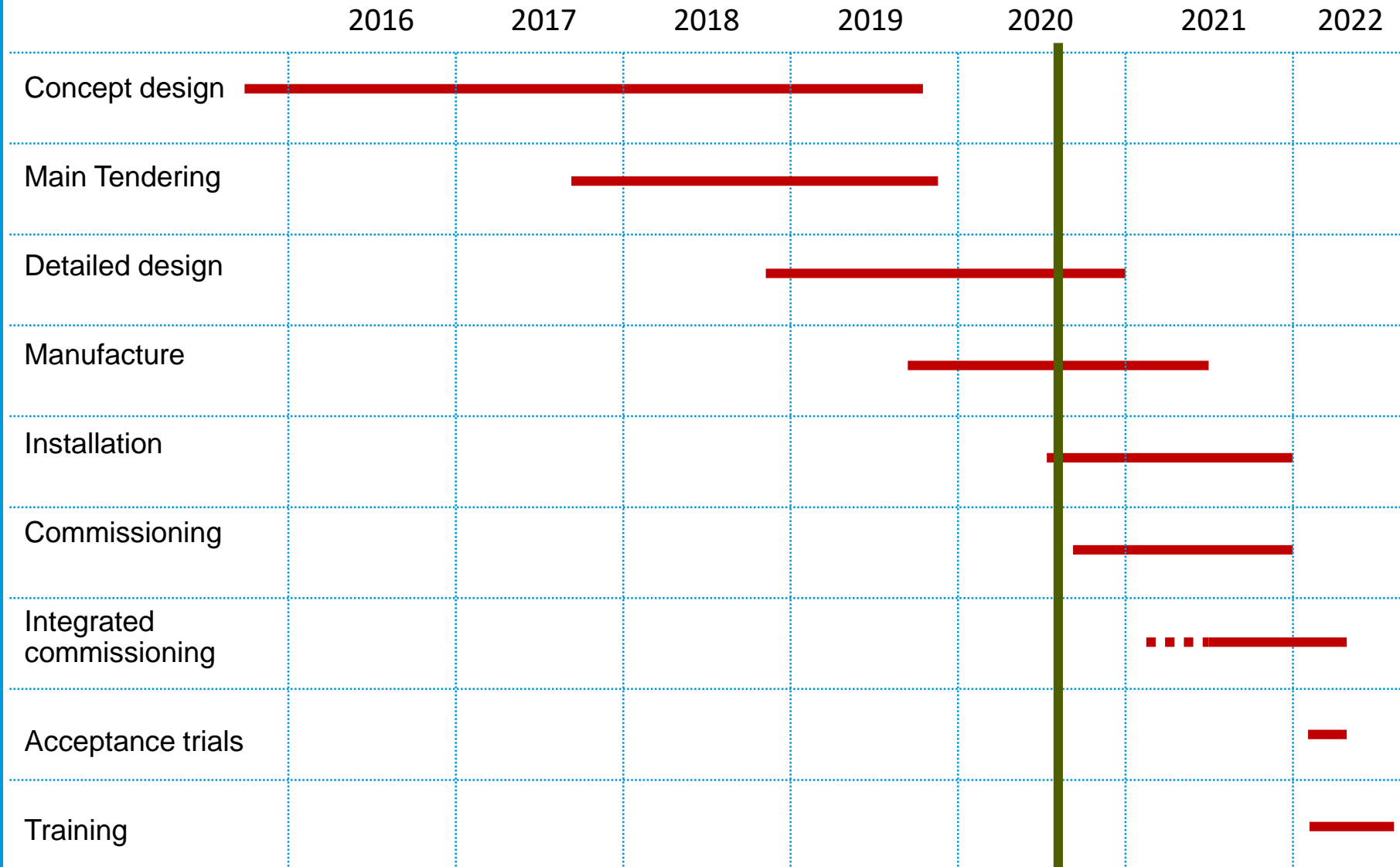




Active Cells Facility – High Level

UKAEA/RACE in-kind delivery to ESS

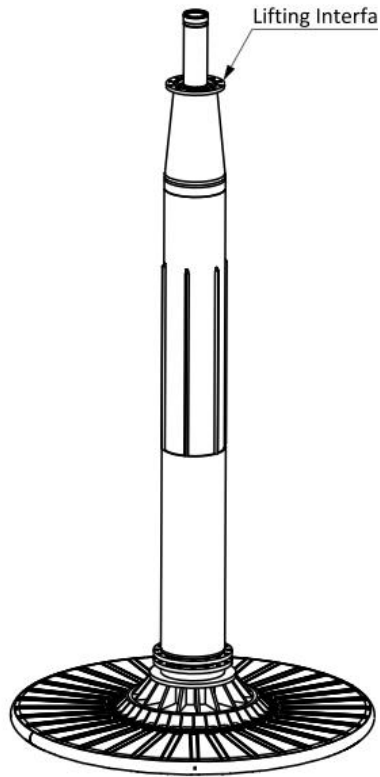
Schedule



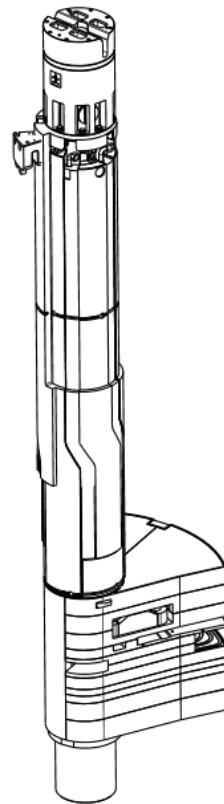
- Majority of the procurement is completed
- Entering into manufacturing phase

Components to be handled

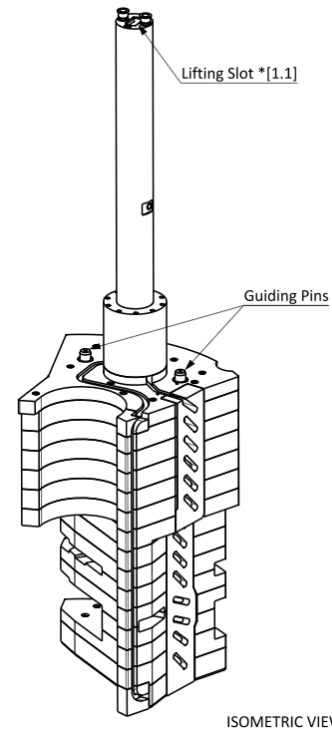
26 Lifts in total



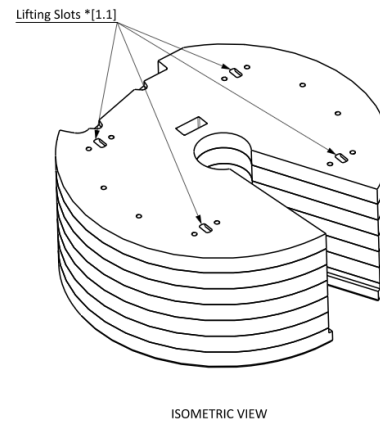
TARGET
WHEEL



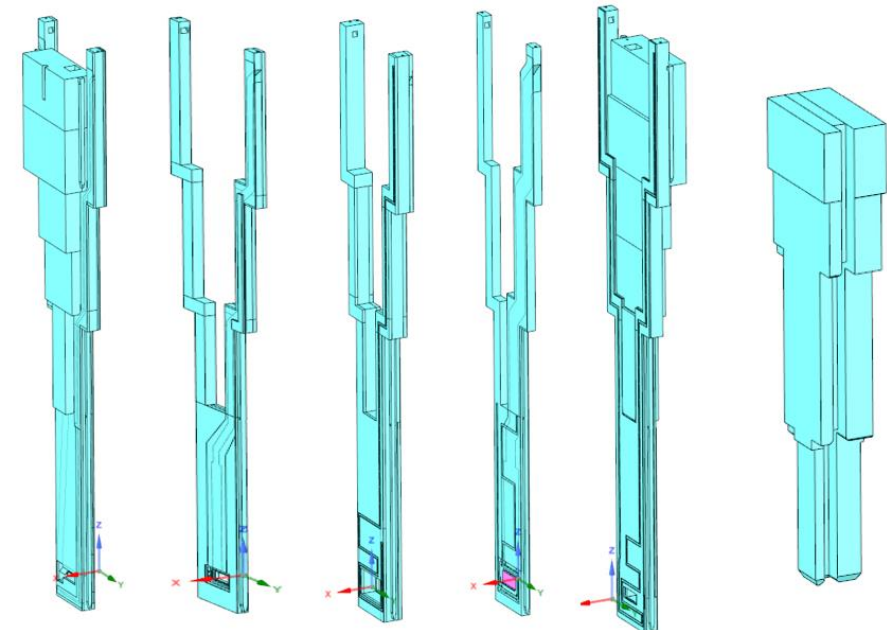
MODERATOR
REFLECTOR
PLUG



MODERATOR
COOLING
BLOCK



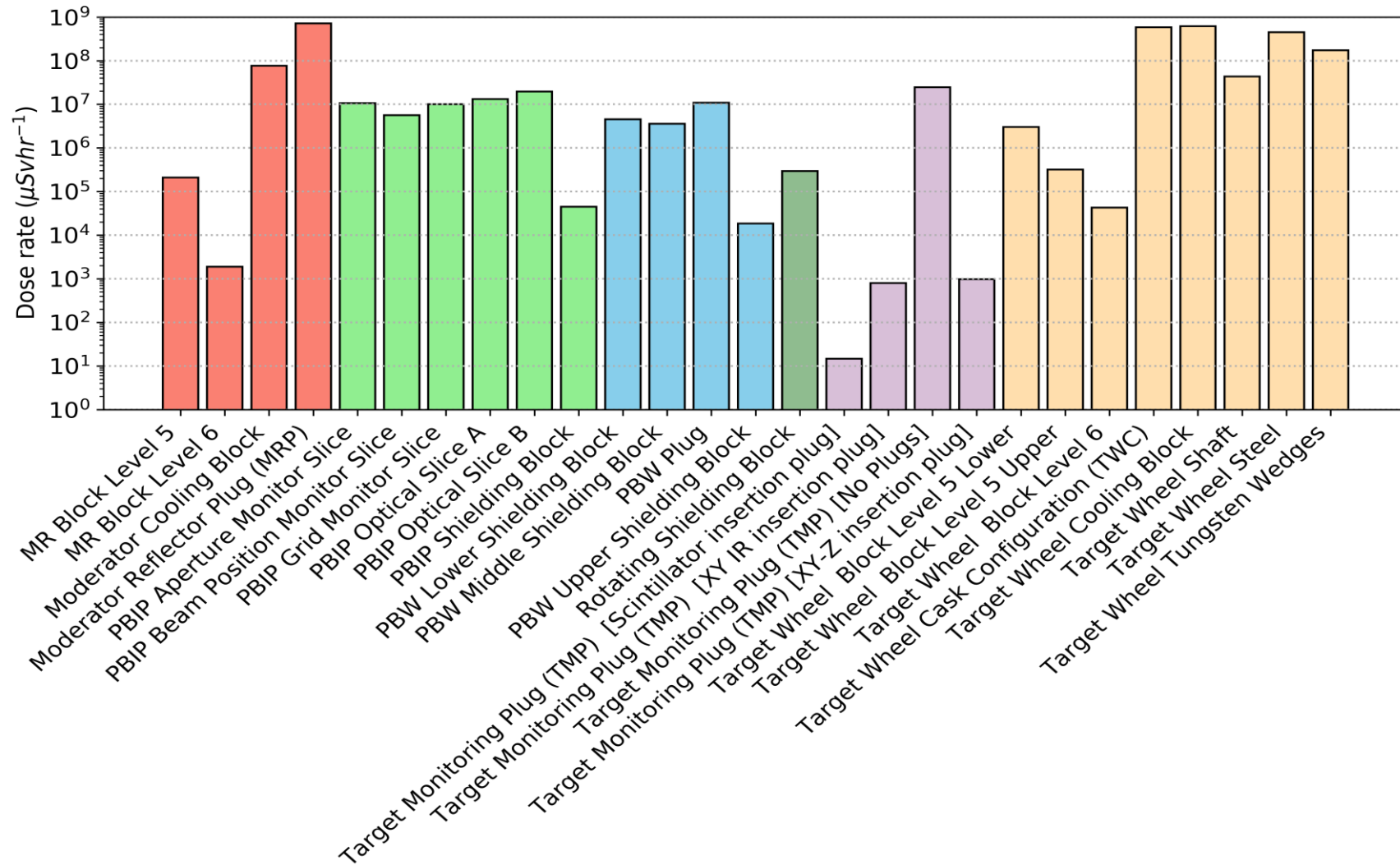
TARGET
WHEEL
BLOCK LEVEL
6



PROTON BEAM INSTRUMENTATION PLUG
SLICES

Source Terms

Developed by UKAEA



Components to be handled... detail

26 Lifts in total



Component handled by the Cask Assembly	Consumable? (Y/N)	Planned replacement interval (yrs)	Mass (T ± 10%)
Moderator Reflector Block Level 6	N	-	14
Moderator Reflector Block Level 5	N	-	12
Moderator Cooling Block	N	-	13
MRP	Y	1	14
TW Block Level 6	N	-	60
TW Block Level 5 Upper	N	-	30
TW Block Level 5 Lower	N	-	30
Rotating Shielding Block	N	-	1
Target Wheel Cooling Block Upper	N	-	24
Target Wheel Cooling Block Lower	N	-	20
TW	Y	5	9
PBIP Shielding Block	N	-	3
PBIP slices x5	Y	2	0.5-3
PBW Upper Shielding Block	N	-	6
PBW Middle Shielding Block	N	-	6
PBW Lower Shielding Block	N	-	2
PBW	Y	0.5	0.5
TMP	Y	5	11
TMP Inserts x3	Y	1	0.3

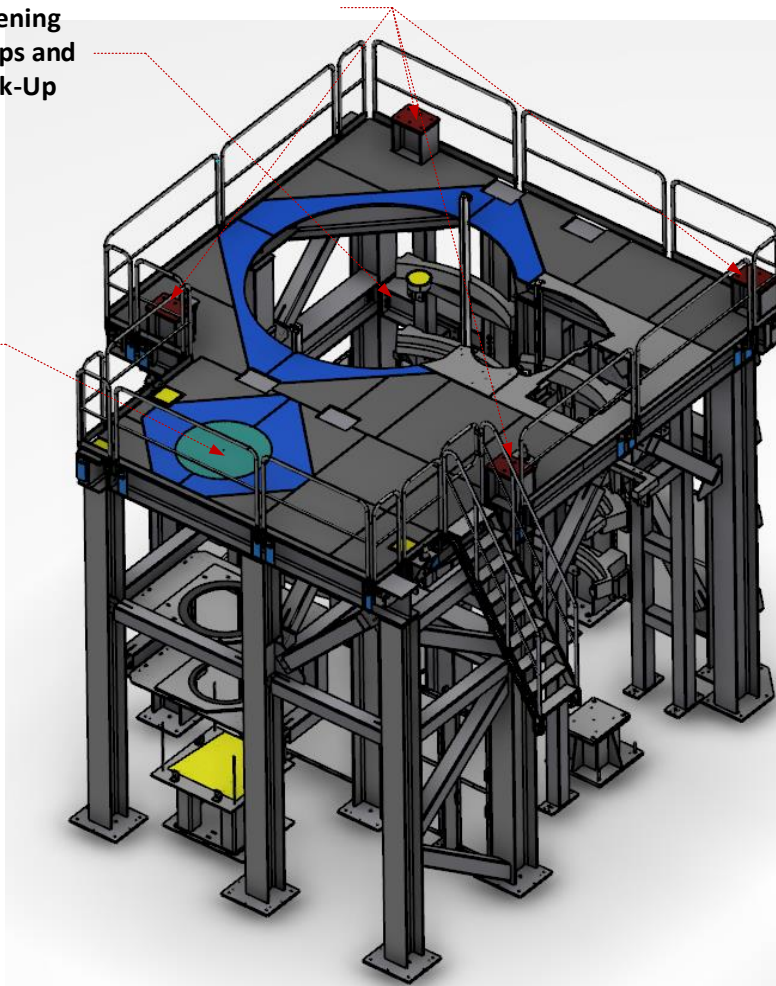
11 lifts to replace one
target wheel >220 T

* After two weeks cool down
following plant shutdown

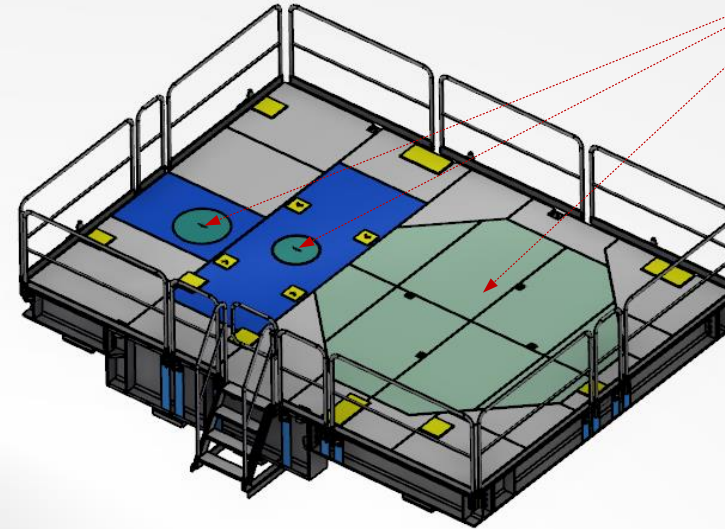
Mock-Up and Test Stand (MUTS)

Inner Shielding structure opening
(Covered by shielding mock-ups and
PBIP Support Structure Mock-Up)

PBW Vessel penetration
(Removable)



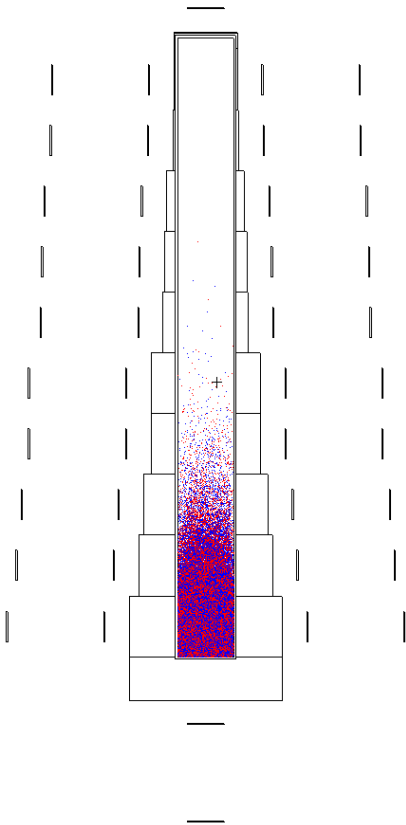
Monolith Vessel Head
Penetrations Mock-Ups
(Removable)



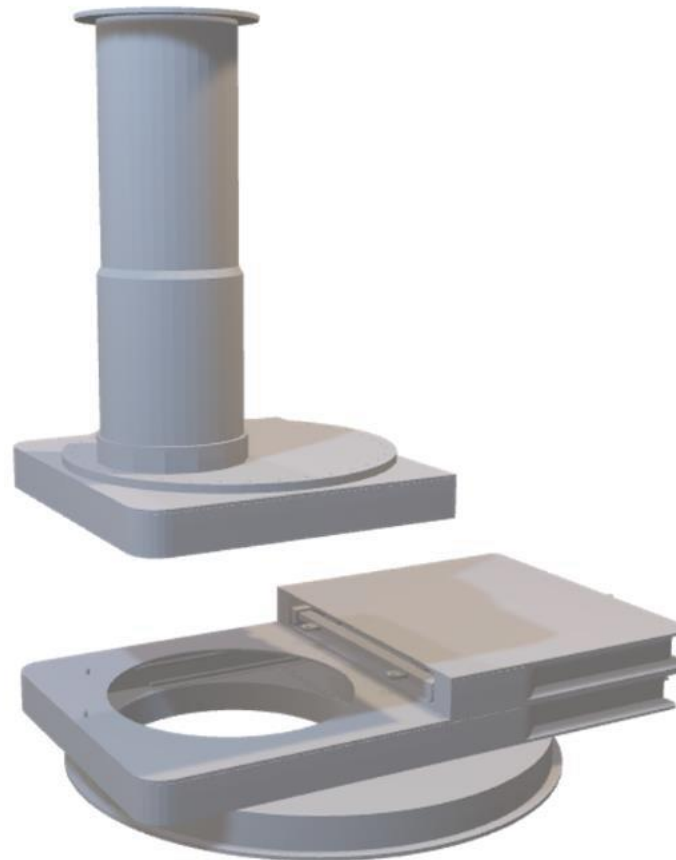
Cask Assembly proposed solution

Design Considerations

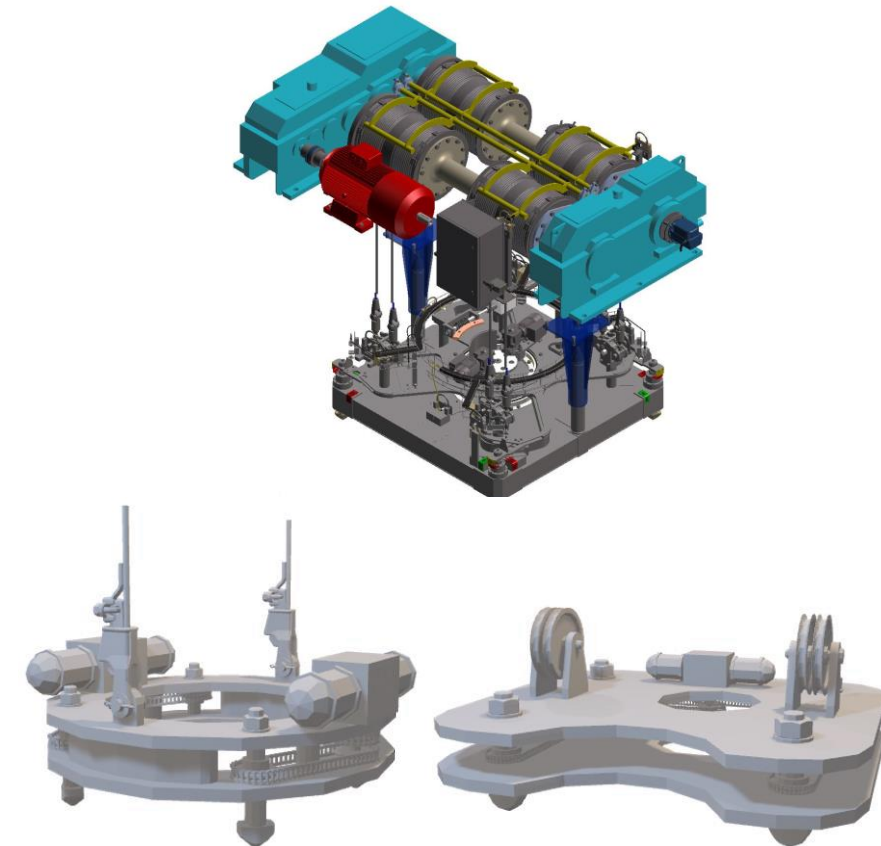
Specific shielding profiles



Double gamma gate



Internal lifting



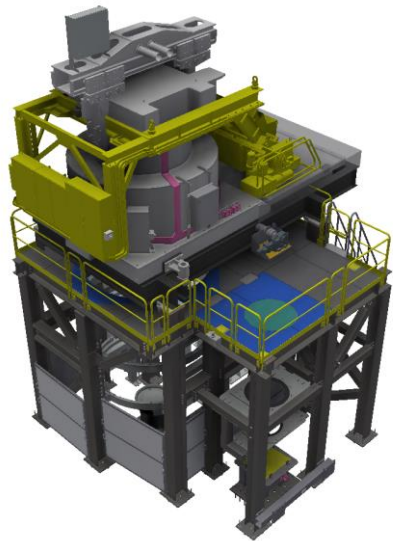
Cask Design

Seven casks and three monolith gamma gates



Cask Design

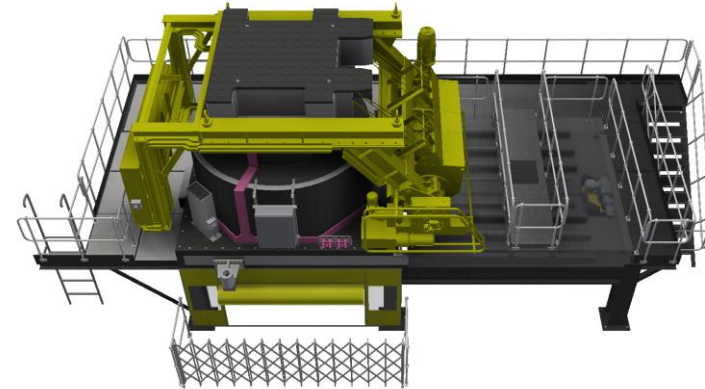
Interfaces and additional equipment



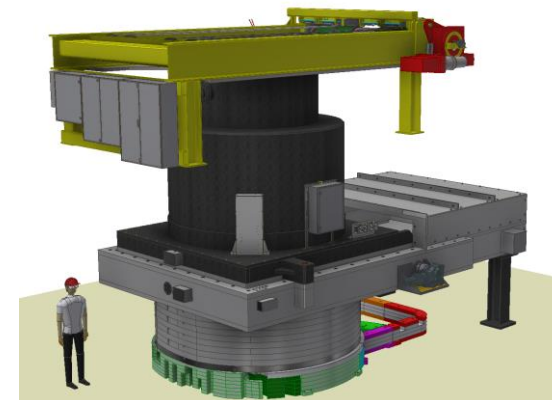
MUTS



Active Cells - Floor Valve



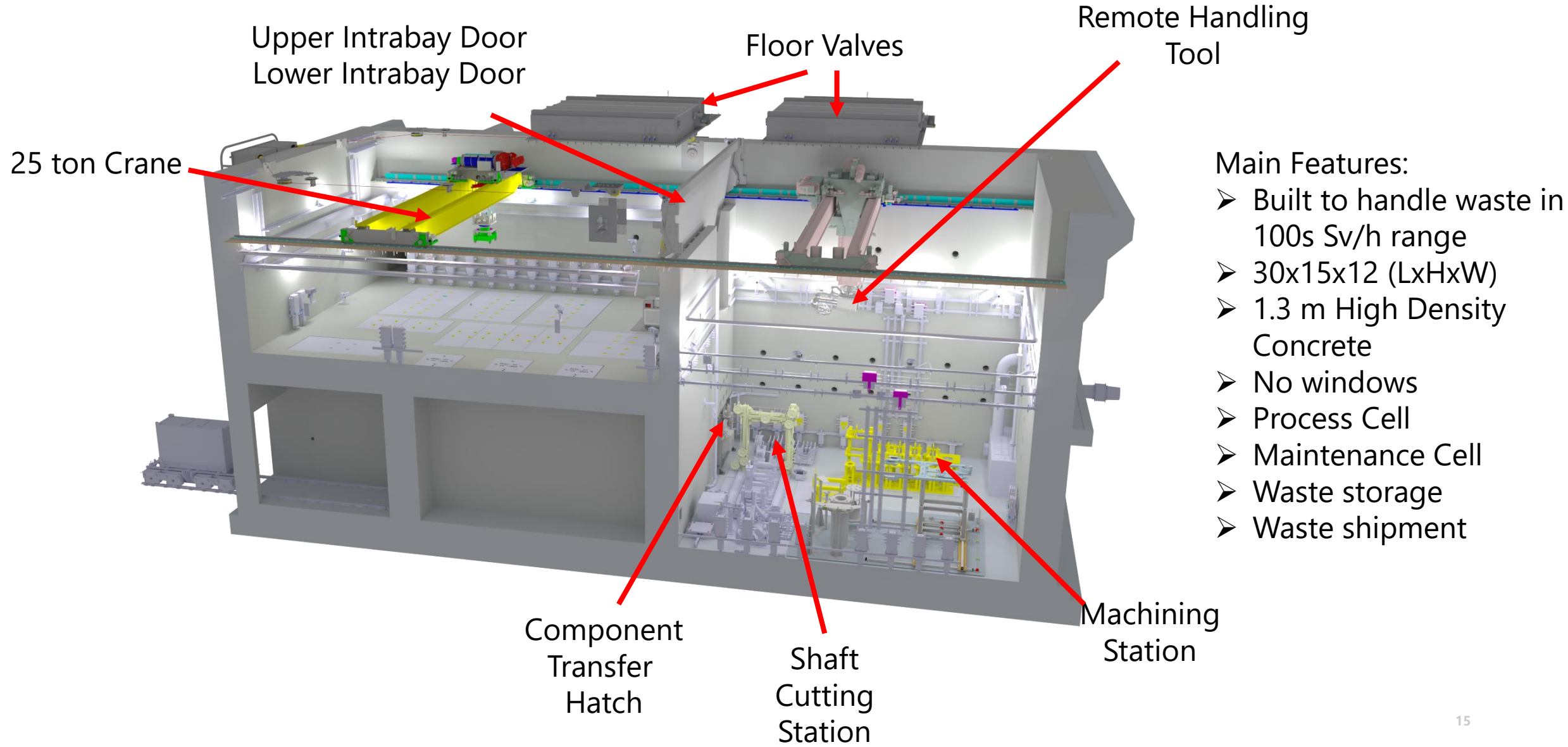
Maintenance and Decontamination Station



Monolith Target

The Active Cells Facility System

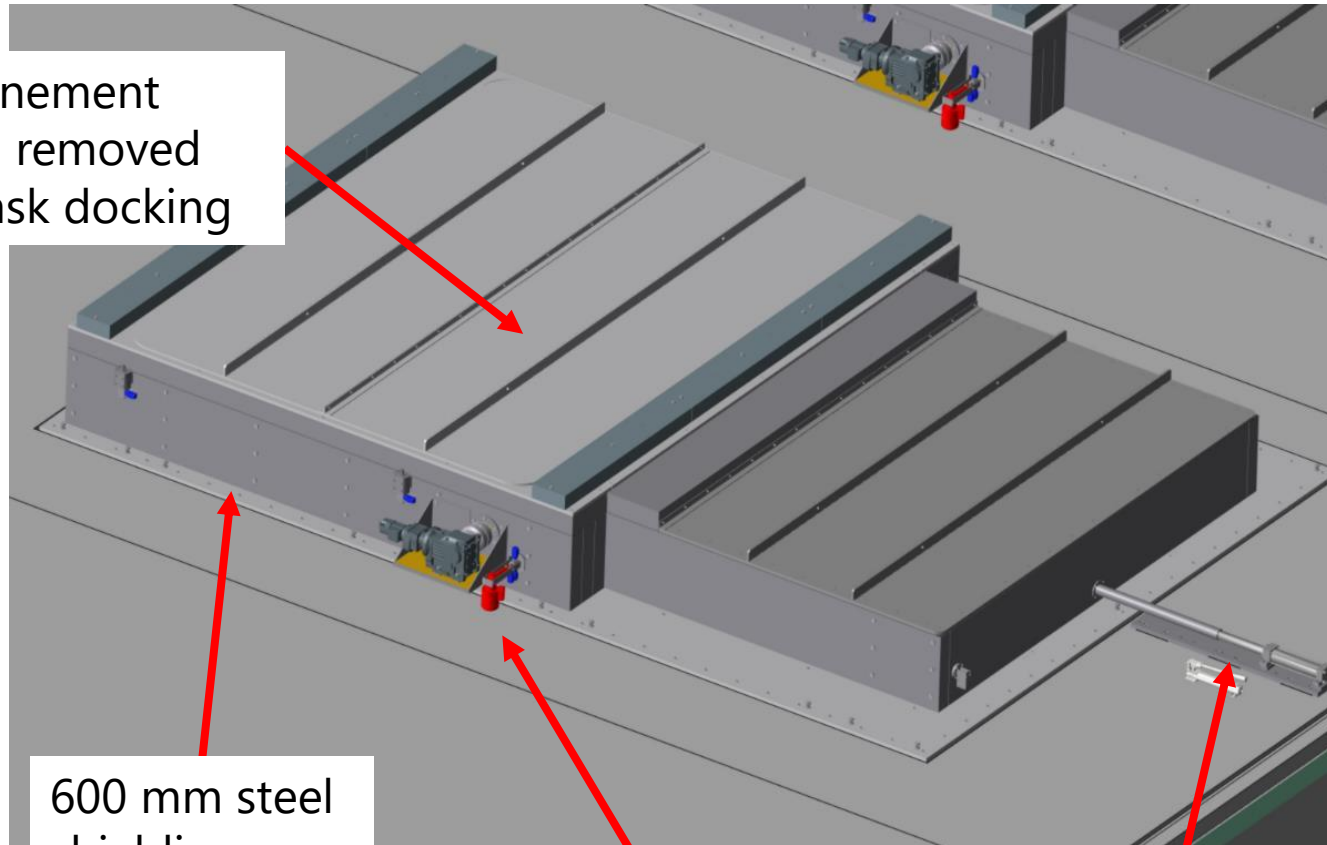
Current Procurement Status



Floor Valves

Current Status

Confinement plate, removed for cask docking



600 mm steel shielding

Electric Motor drives shield door

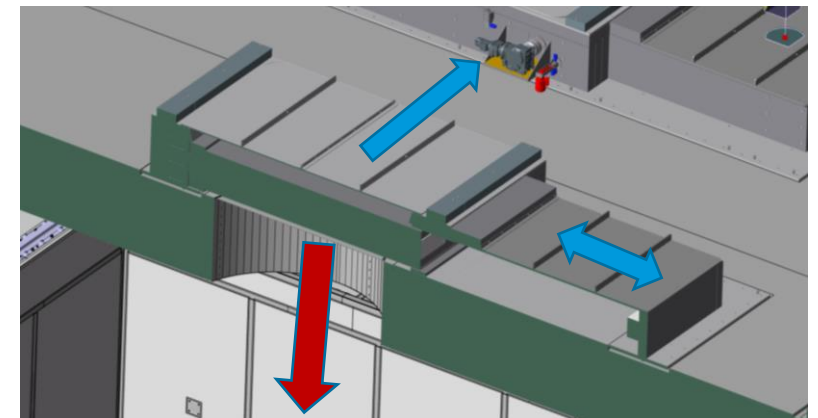
Hand Pump to close door for recovery

Contract: Ansaldo Nuclear Design, **build** and installation.

➤ Design: Dec 2019

➤ FAT: Q4 2020

➤ SAT: April 2021



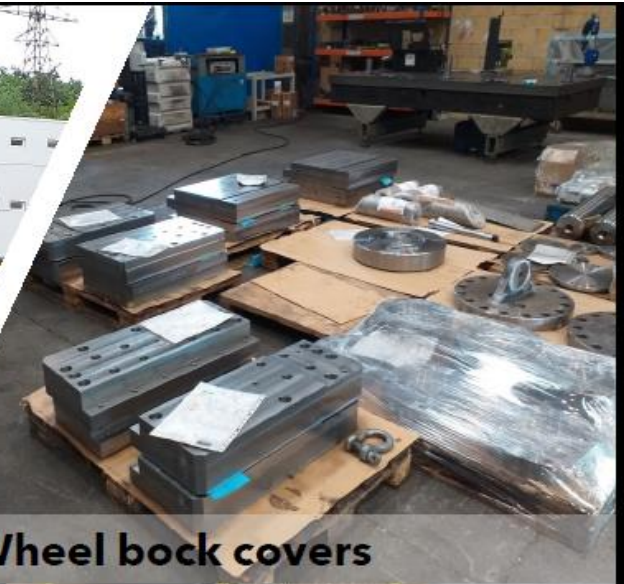
Floor Valve Manufacturing



FV machining of shield plates



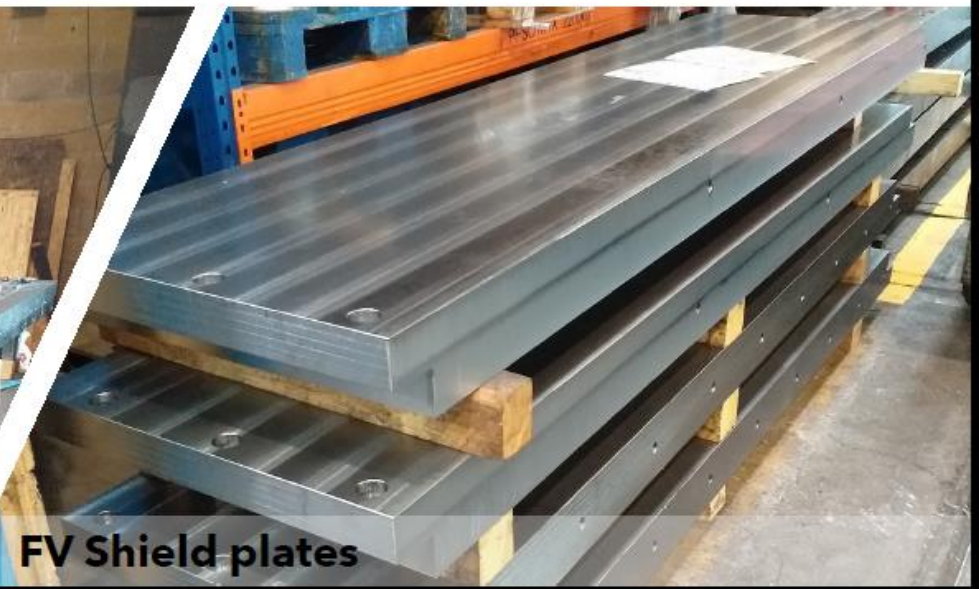
Raw plates waiting for machining



FV Wheel back covers



FV Shield plates threads checking



FV Shield plates



Intrabay doors (Upper and Lower)

Current Status

Contract: Ansaldo Nuclear
Design, **build** and installation.

- Design: Dec 2019
- FAT: Q4 2020
- SAT: April 2021

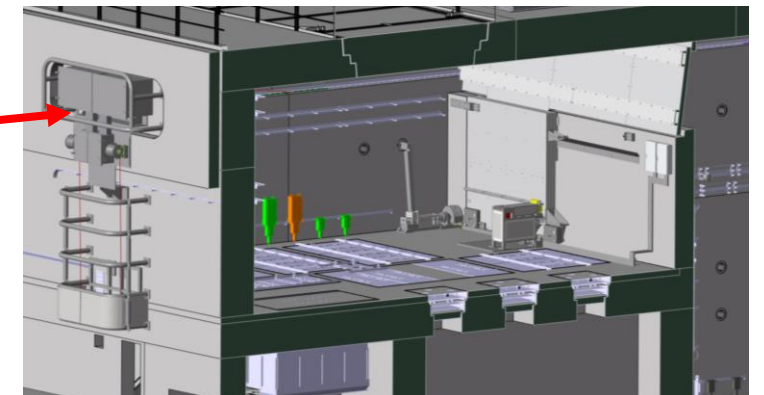
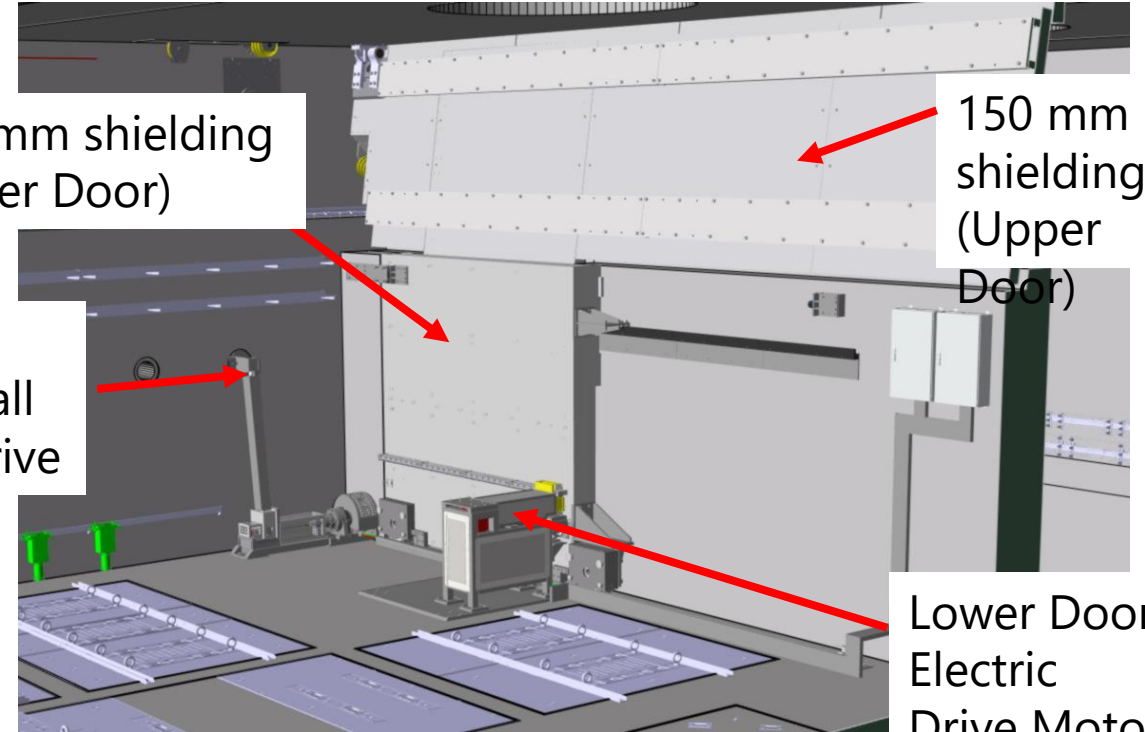
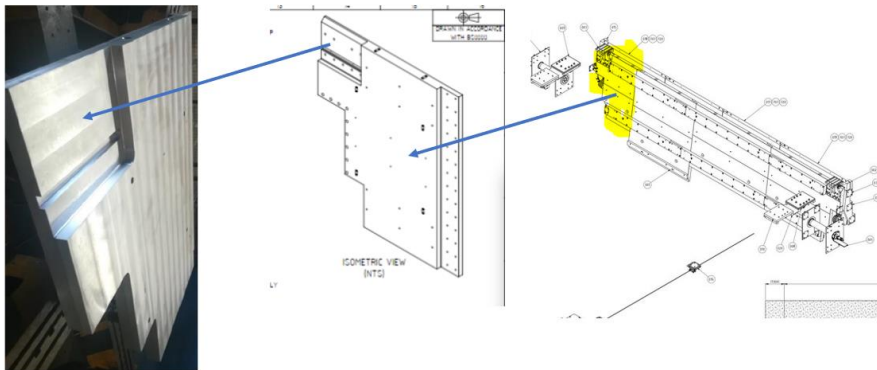
750 mm shielding
(Lower Door)

150 mm
shielding
(Upper
Door)

Manual
through-wall
recovery drive

Lower Door
Electric
Drive Motor

Upper Door
driven from
outside the
cell



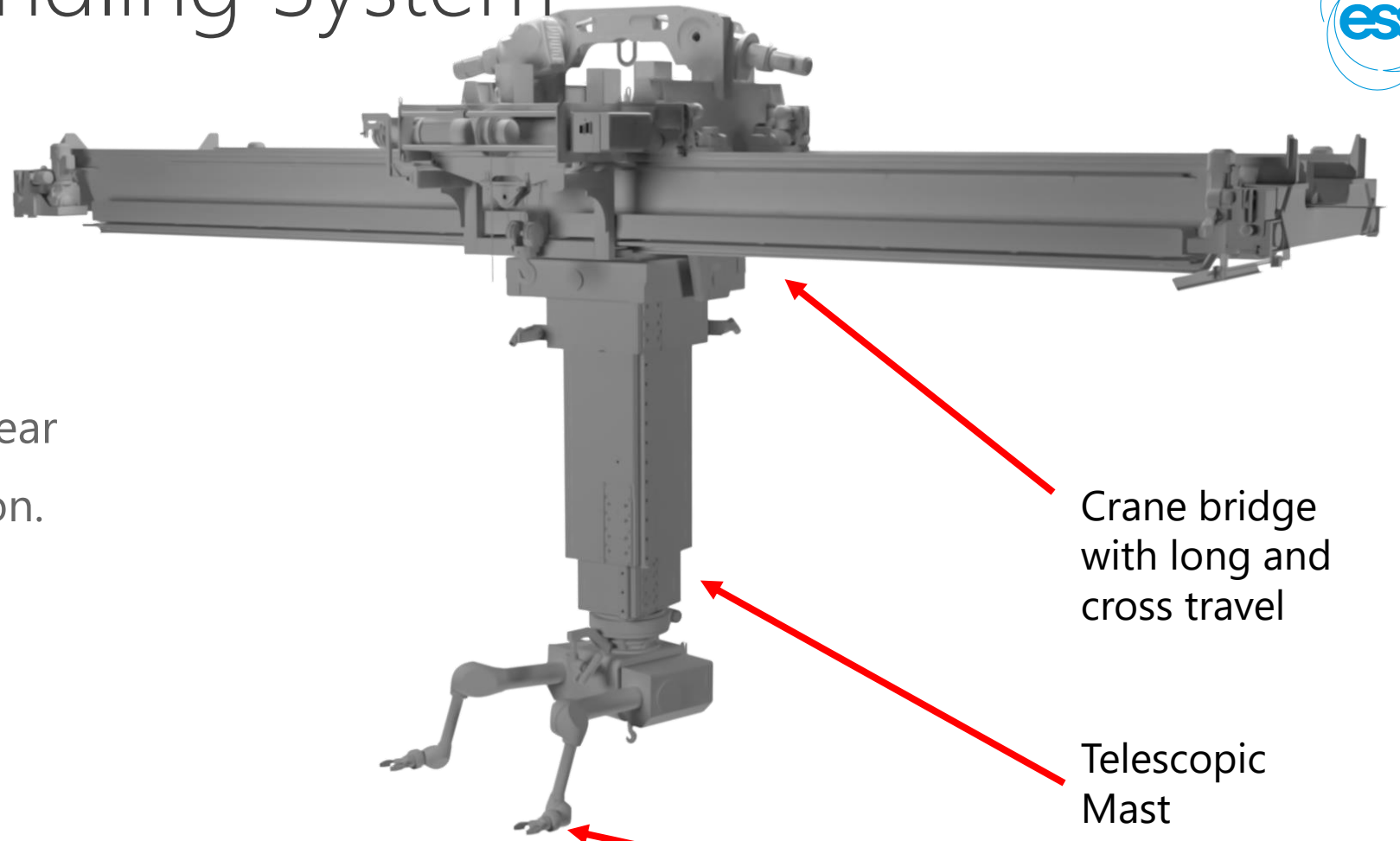
Robotic Handling System

Current Status



Contract: James Fisher Nuclear
Design, build and installation.

- Design: Q4 2020
- FAT: Q2 2021
- SAT: Q4 2021



Crane bridge
with long and
cross travel

Telescopic
Mast

2x Wälischmiller
manipulators

Robotic Handling System

Wälischmiller – 2x telbots



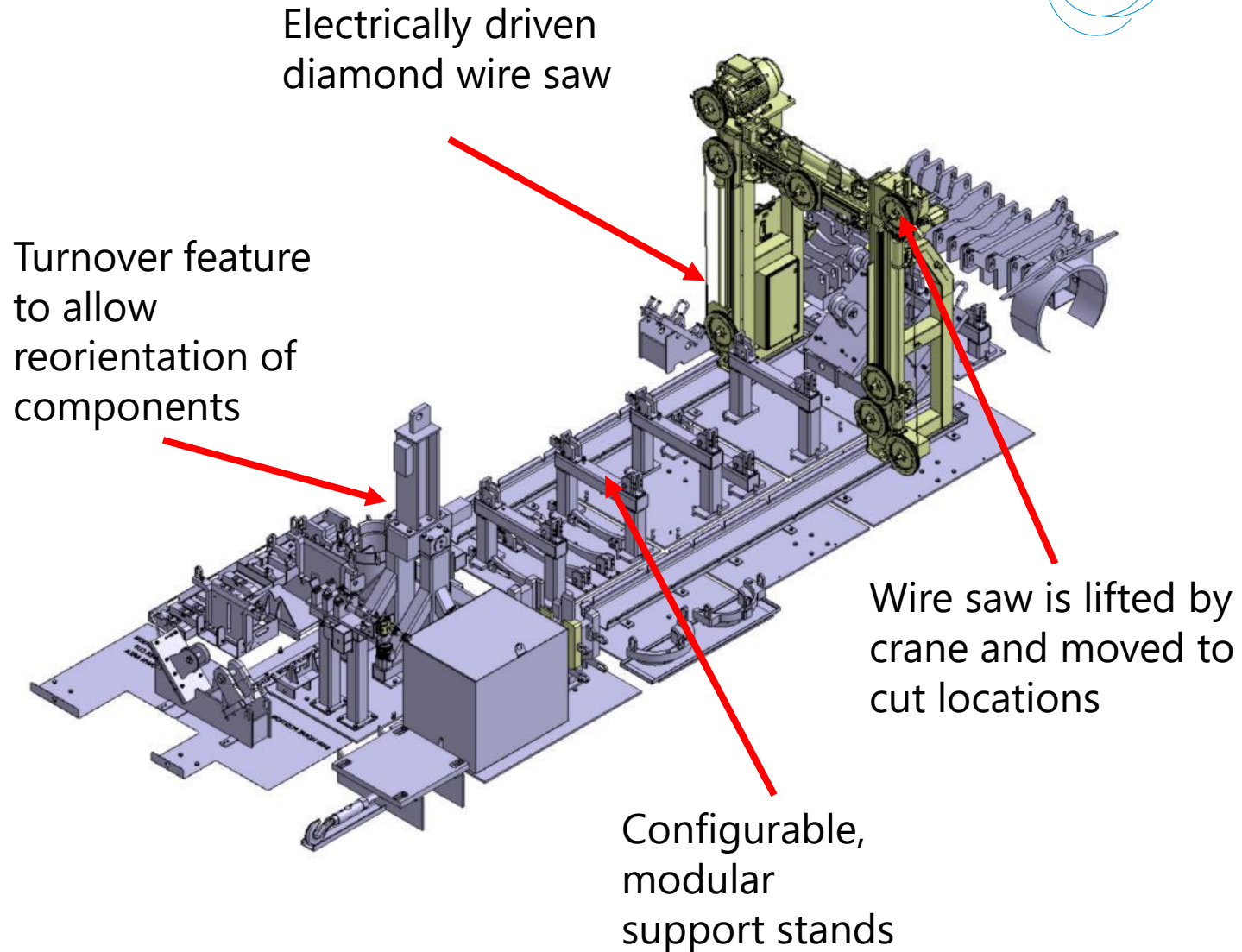
Shaft Cutting Station



Current Status

Contract: Aquila
Design, **build** and installation

- Design: August 2019
- FAT: Q4 2020
- SAT: Q2 2021

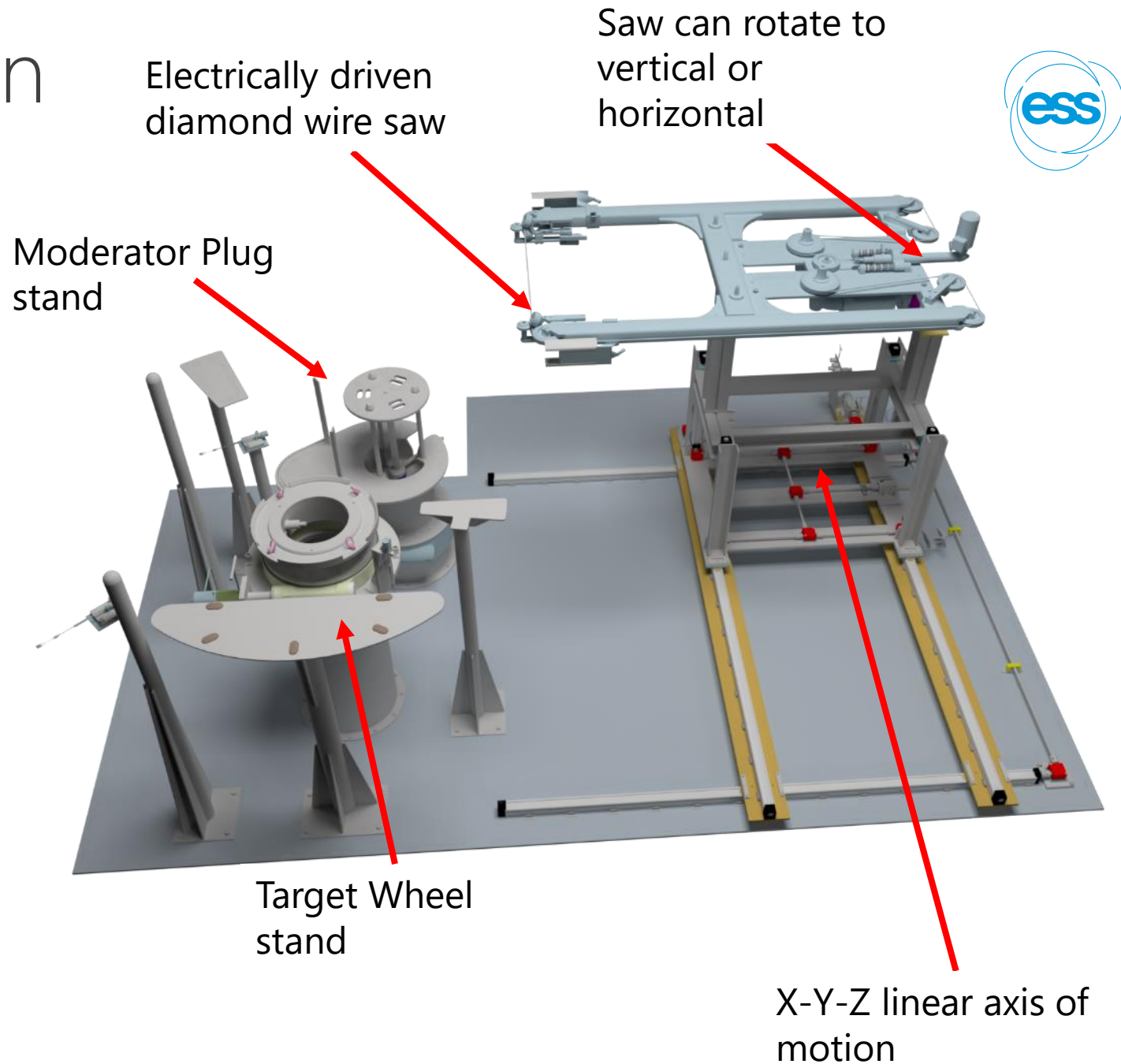


Machining Station

Current Status

Contract: James Fisher Nuclear
Design, build and installation.

- Design: Nov 2020
- FAT: Q2 2021
- SAT: Q4 2021



Component Transfer Hatch

Current Status

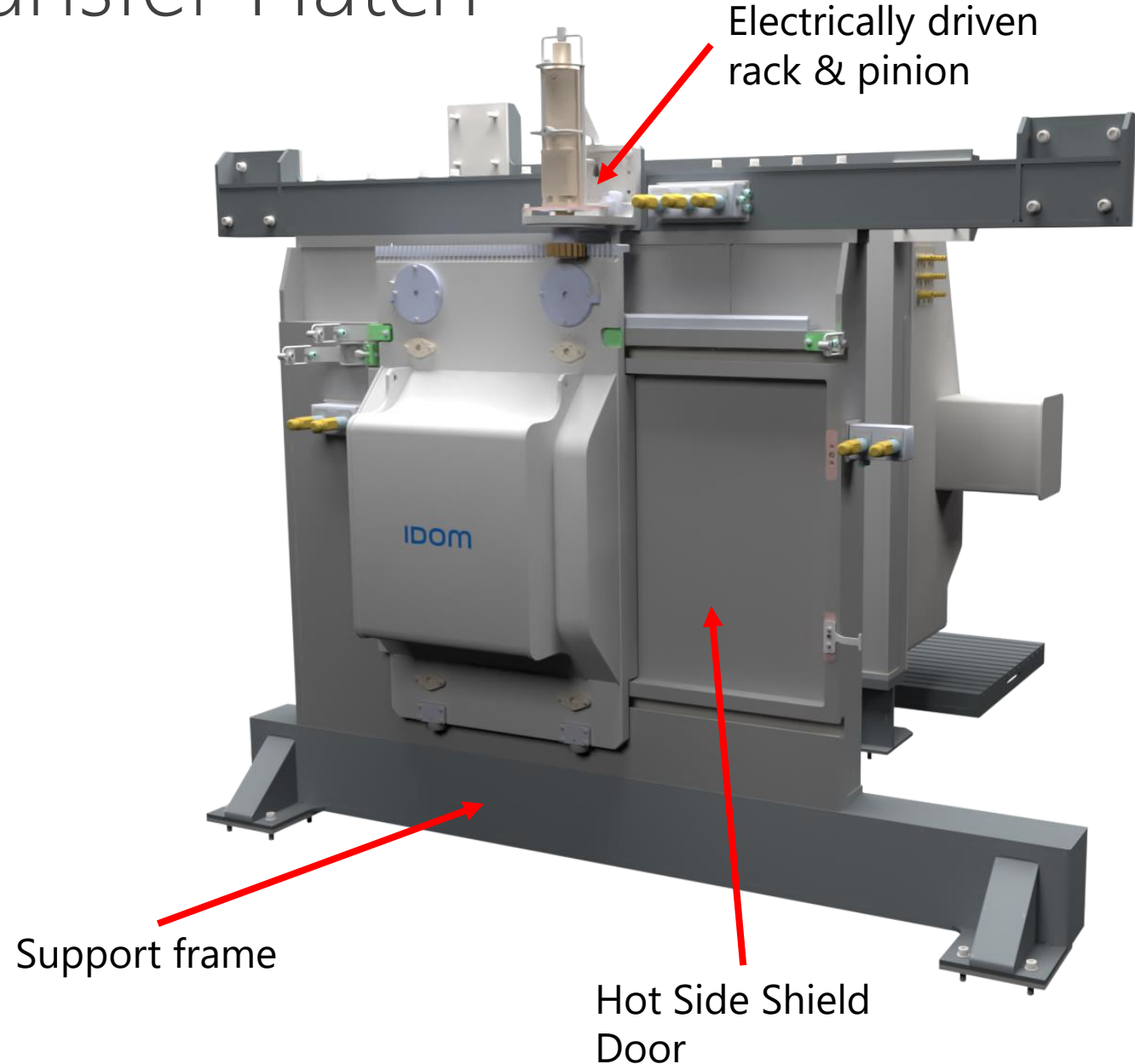
Contract: IDOM

Design, **build** and installation.

➤ Design: Nov 2019

➤ FAT: Dec 2020

➤ SAT: Q2 2021



Photos from site

Inside of the cell and angled penetration for the Upper Intrabay Door wire



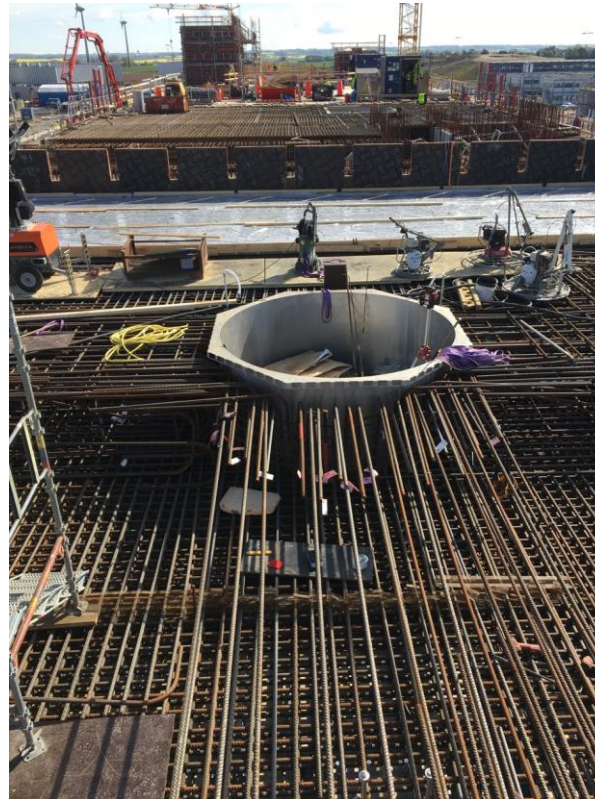
Photos from site

Floor Valve Penetration – Rebars and last concrete pour

Ceiling Floor Valve Penetration



Rebar & last concrete pour



Upper Intrabay Door Hinge Anchor Plate



Ceiling Stainless Steel beams and plates prior to casting



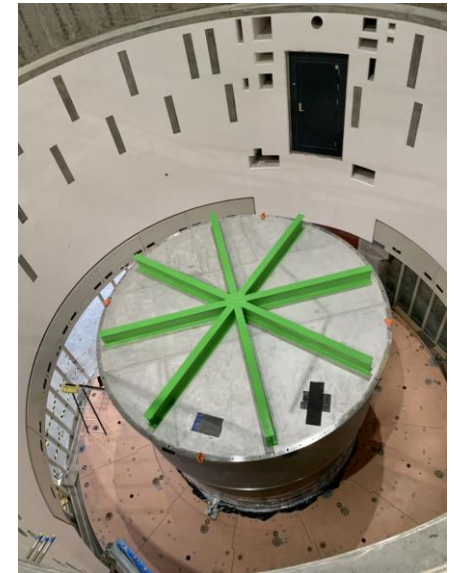
Photos from site

High bay crane – now commissioned



Photos from site

Vessel - installed



Photos from site

Maintenance and Process Cells liner beams and plates



Photos from site

Maintenance Cell – storage pit



Prototype
pit lid

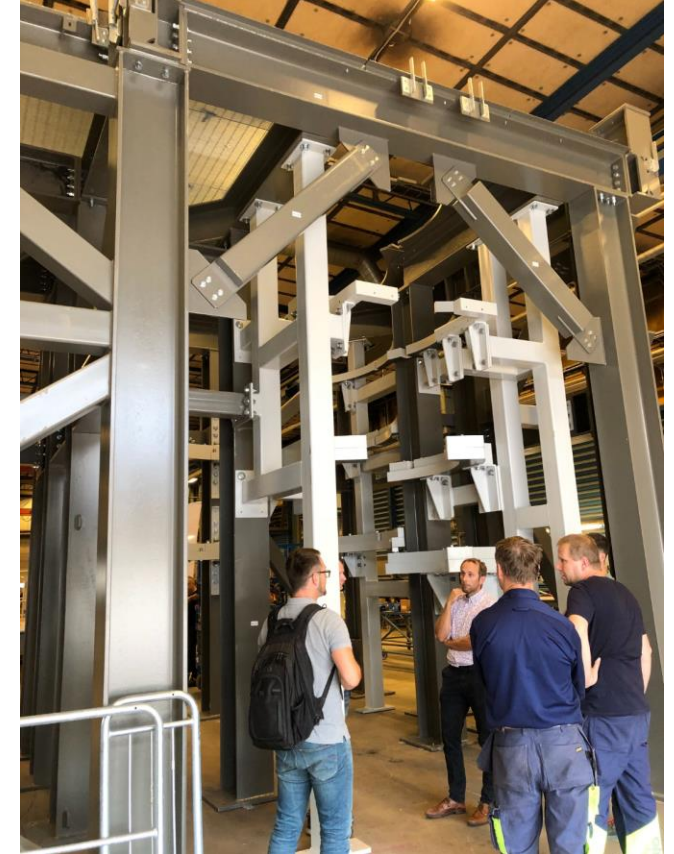
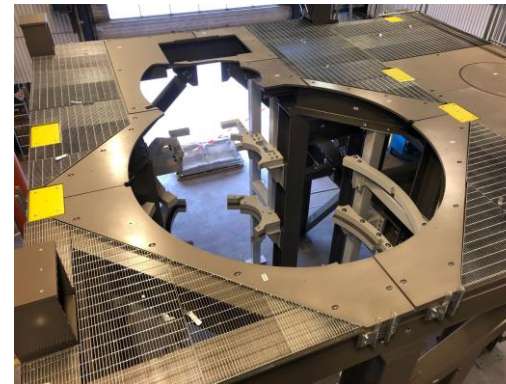
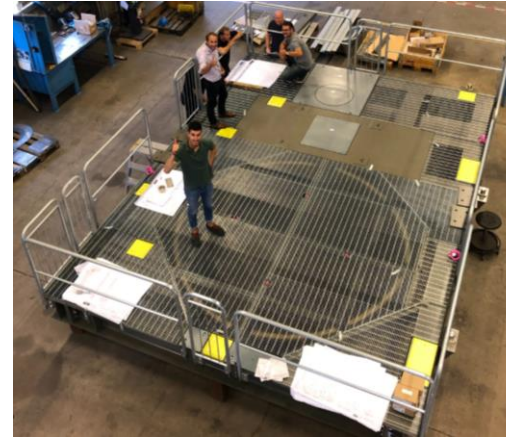


MUTS

Mock-up and Test Stand



Successful FAT at Elajo in Oskarshamn



Supplier competencies and opportunities



Near future:

- Cask Assembly manufacture – 7 casks and associated equipment.
- 4x4x8m body, steel and lead combination, hoisting system, control and safety systems, user interfaces
- Start in 2021 finish Q3 2022

Long term:

- Peak periods where we need to get skilled and trained personnel on site to do maintenance of highly radioactive systems
- Delivery of a variety of stainless steel waste packages
- Support in design and production of receiving fixtures and such like
- Control room VR/AR integration and development
- System development (Robotic handling, cameras, drones etc)

Even longer term:

- A suit of smaller hot cells to be able to run our own Post Irradiation Examination program

Photos from site

Site View 2020-09-07





Many thanks!

Any questions?

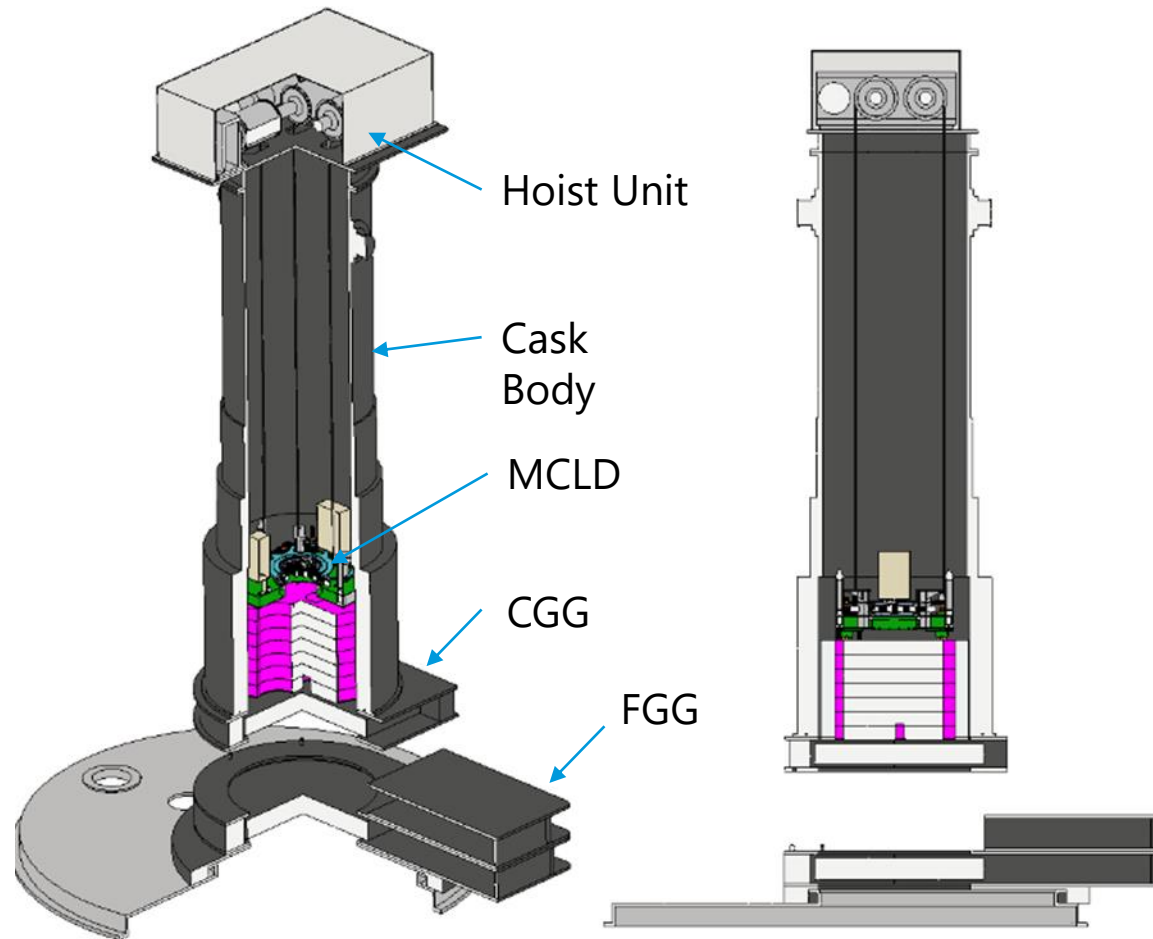


Cask 3 Operations

Removal of the Target Wheel Cooling Block Upper



Cask Assembly Breakdown



Cask Assembly on the High Bay

High Bay Layout

