1.1 – Overview of the Hot Cell Facility

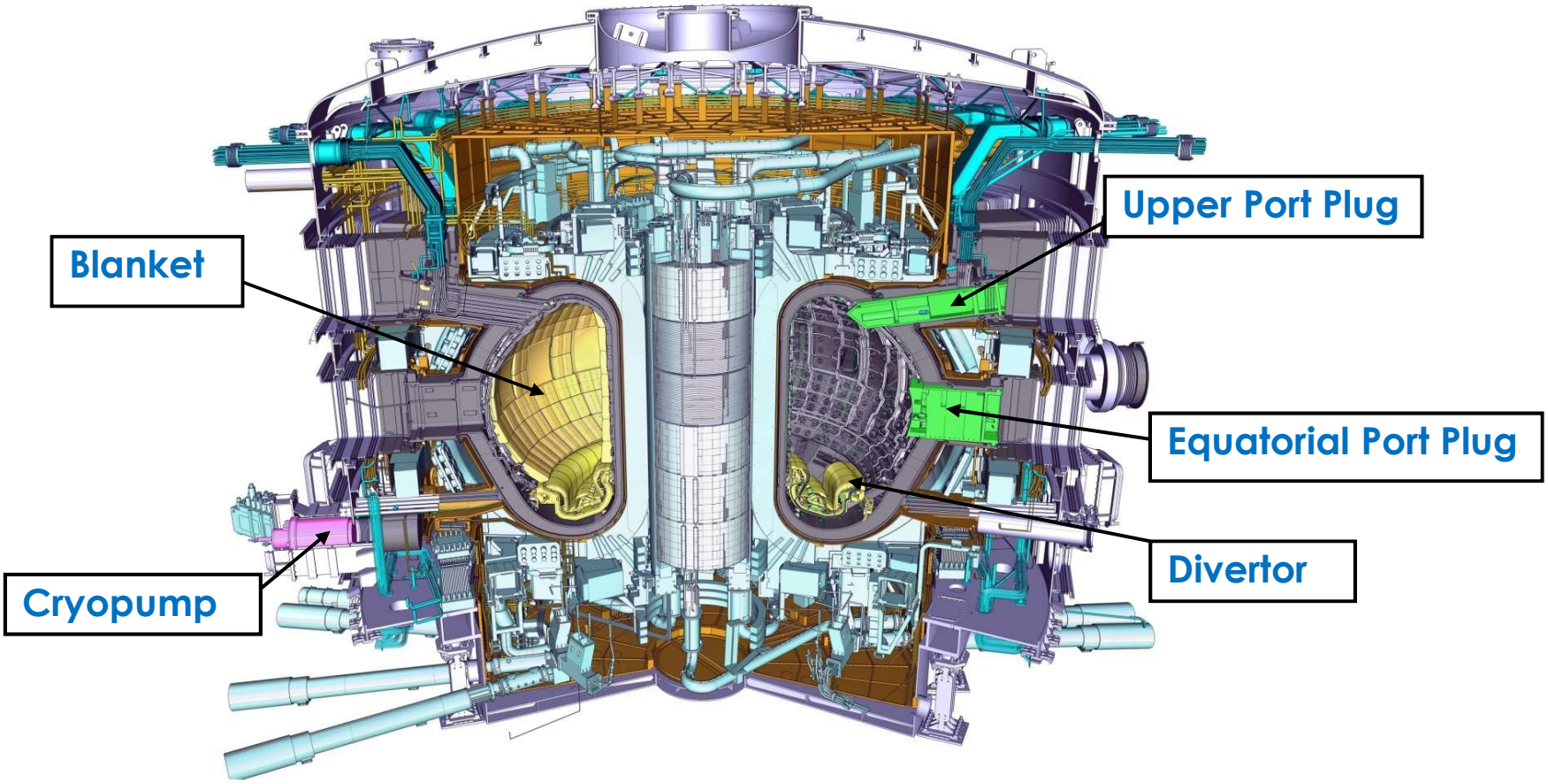
Alexis Dammann / Hot Cell and Radwaste Section Leader

Disclaimer: No information provided in the current slides is binding

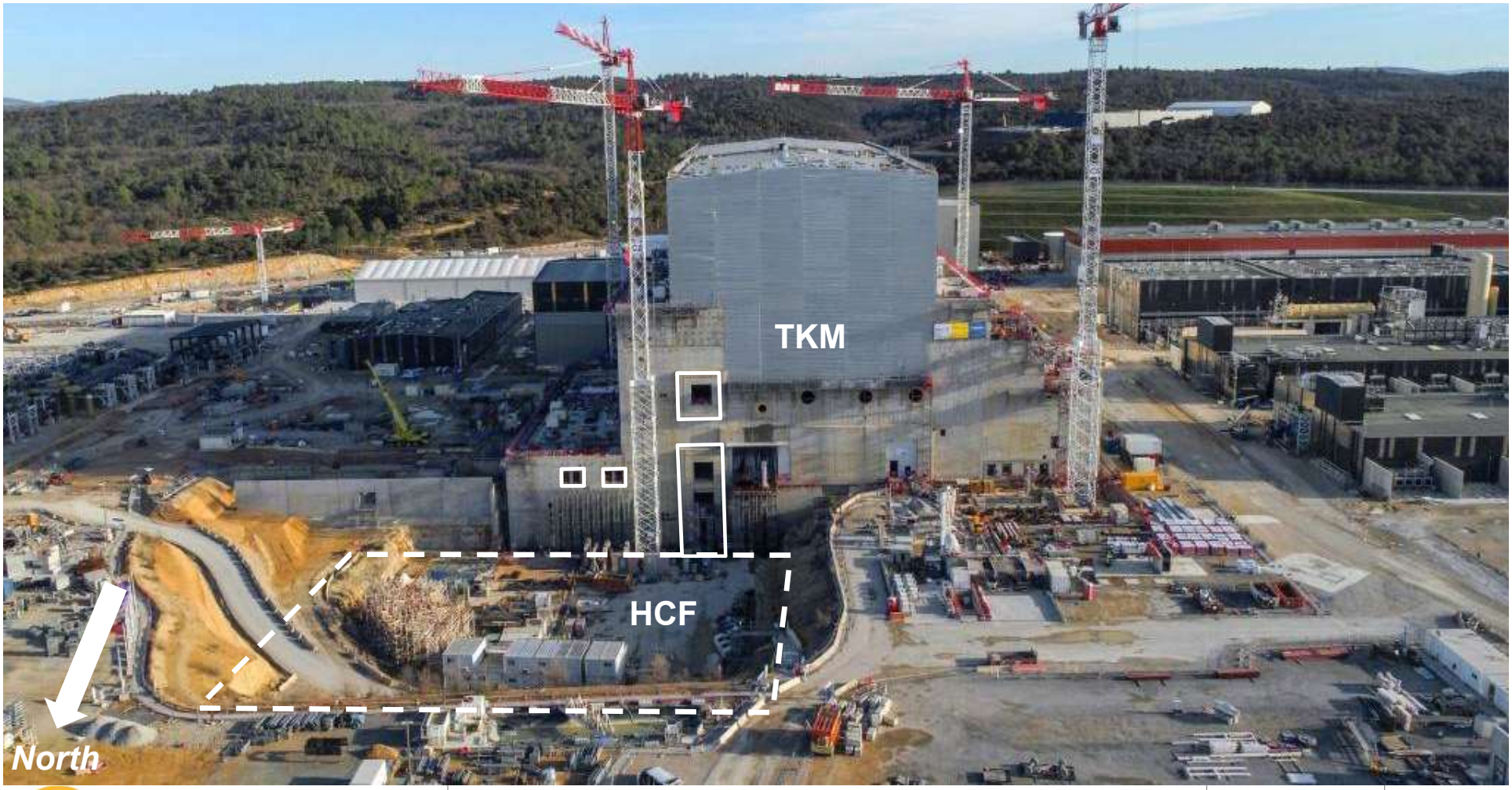
1. **Hot Cell Functions**
2. Hot Cell Complex layout
3. Maturity level

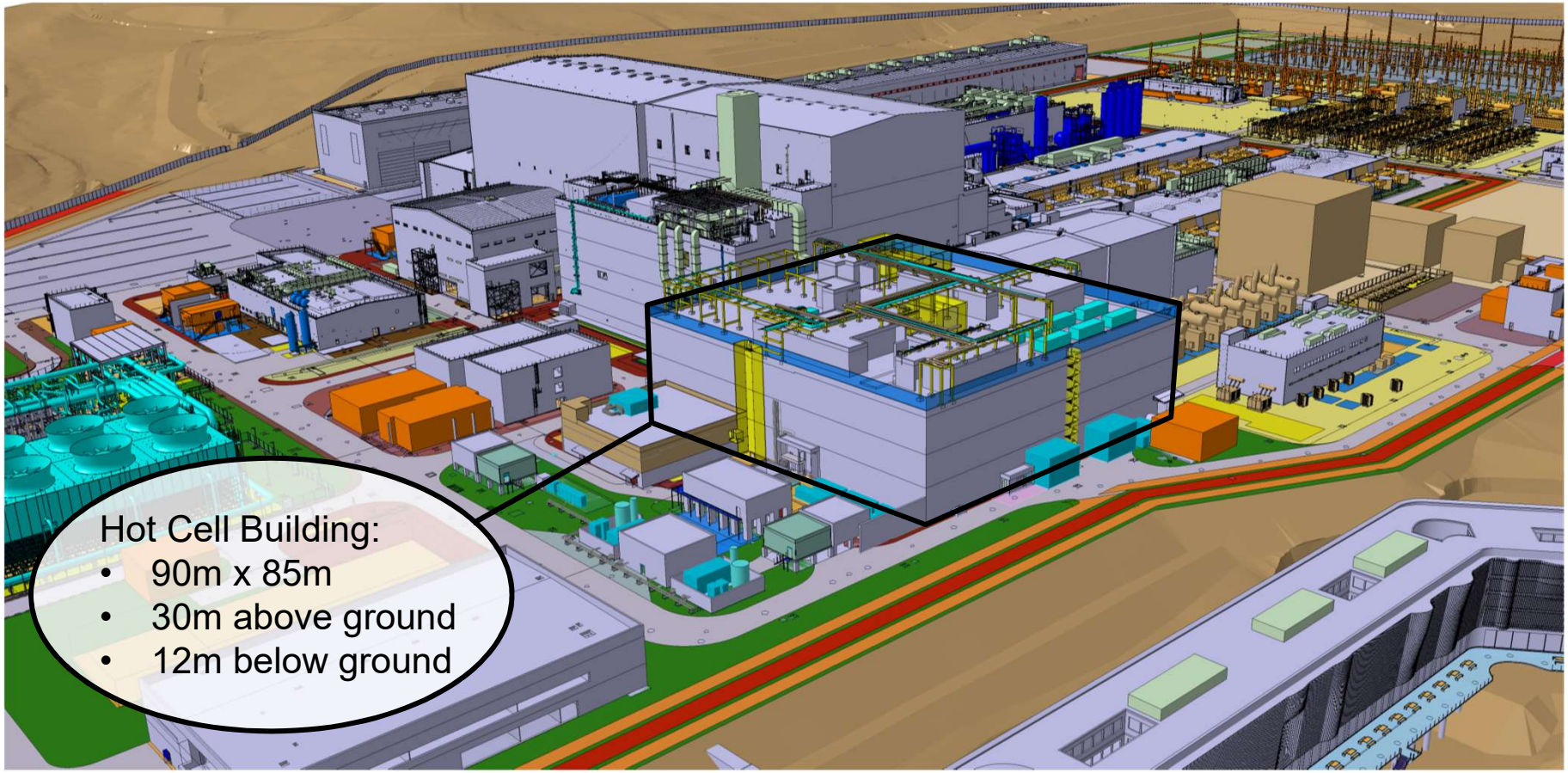
Functions of the Hot Cell Facility:

- the maintenance of activated and/or contaminated equipment:
  - In Vessel Components,
  - Port Cell Equipment,
  - TKM Remote Handling equipment,
- the treatment of radioactive waste,
- the import / export and specific nuclear functions.



Tokamak Complex





Functions of the Hot Cell Facility:

- **the maintenance of activated and/or contaminated equipment:**
  - **In Vessel Components,**
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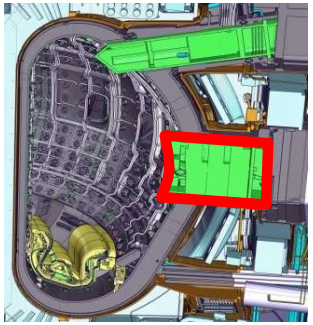
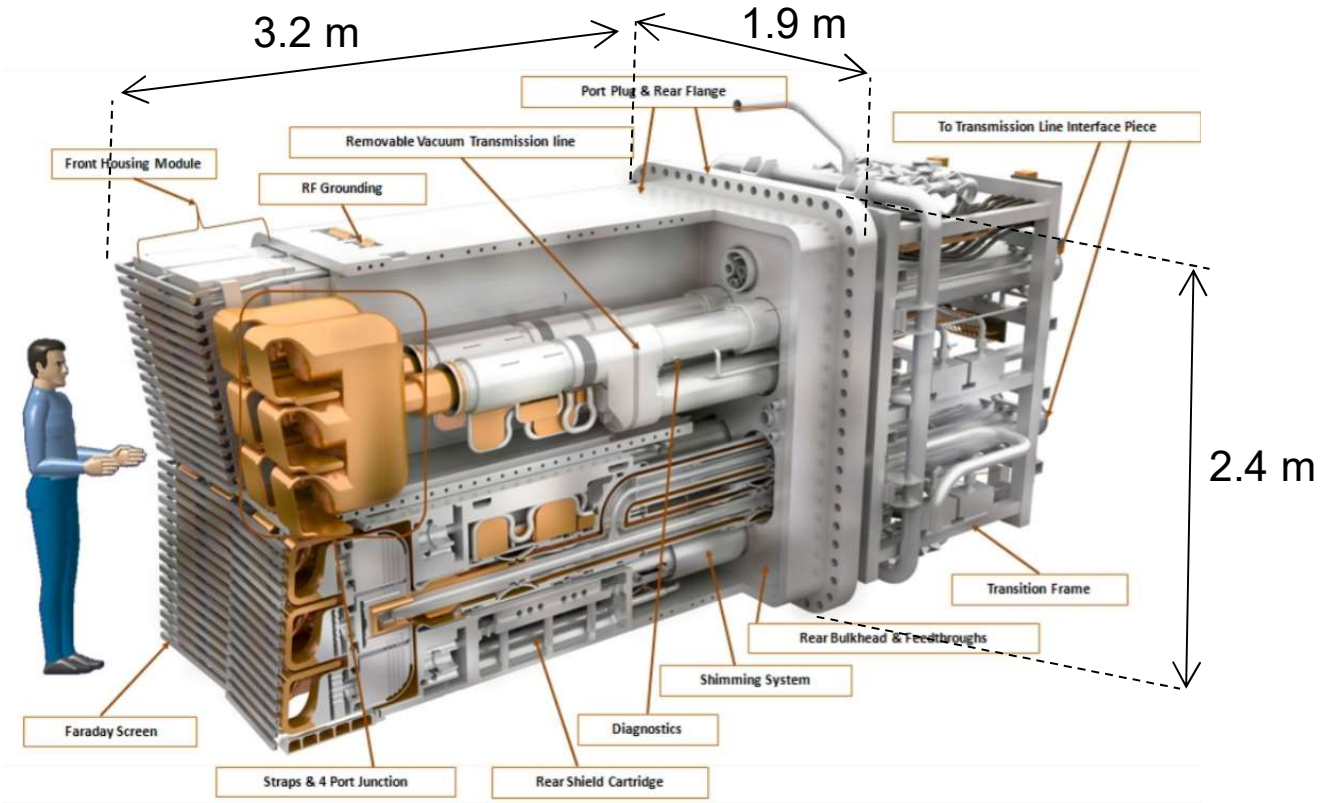
- the import / export and specific nuclear functions.

Illustration of Equatorial Port Plug (ICH)

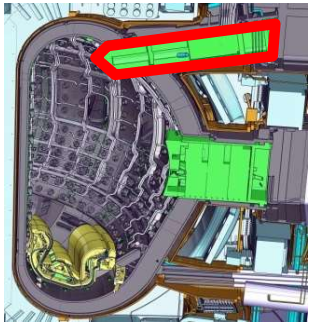


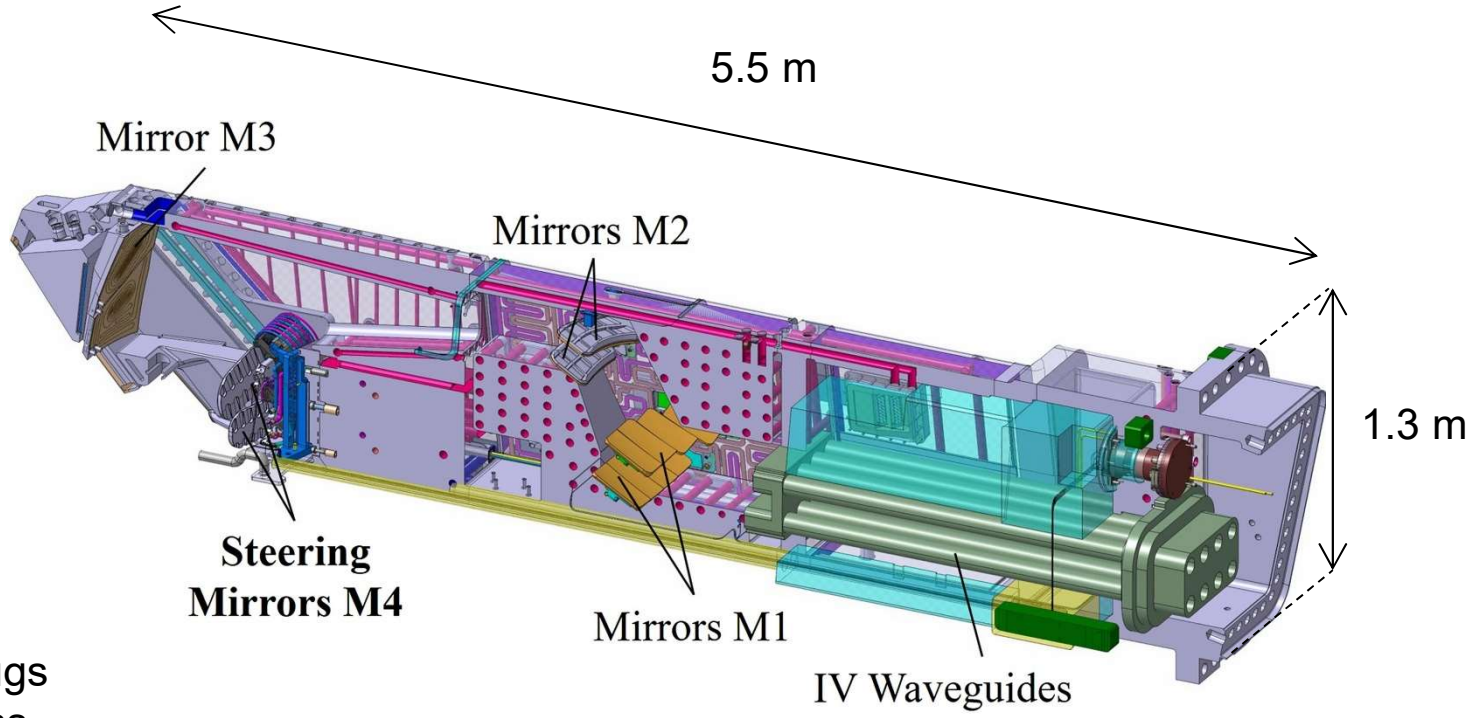


ICH Equatorial Port Plug

Max weight Port Plugs (EPP)
~ 50 tons

Illustration of Upper Port Plug (Electron Cyclotron)

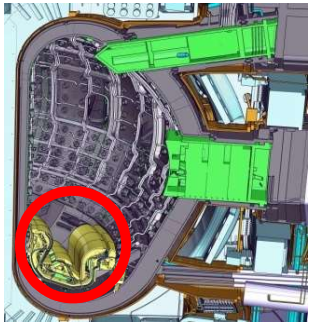


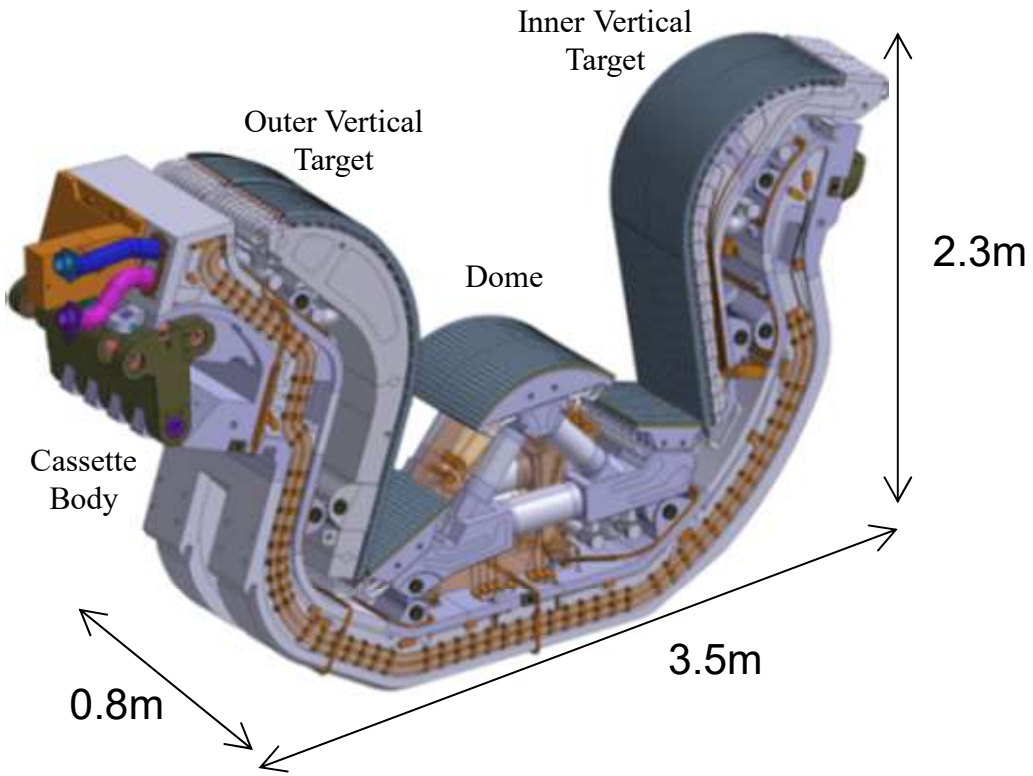


Upper Port Plugs
(UPP) ~ 25 tons

ITER Electron Cyclotron Upper Launcher
(Fusion Engineering and Design)

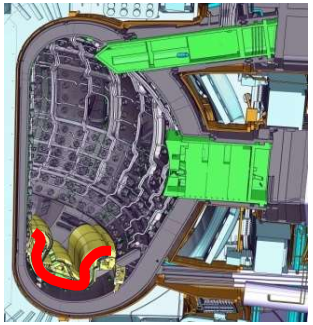
Illustration of Divertor





Divertor
~ 8 tons

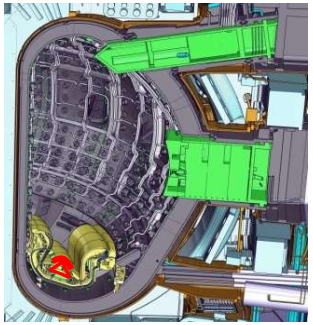
Illustration of Divertor (cassette body)



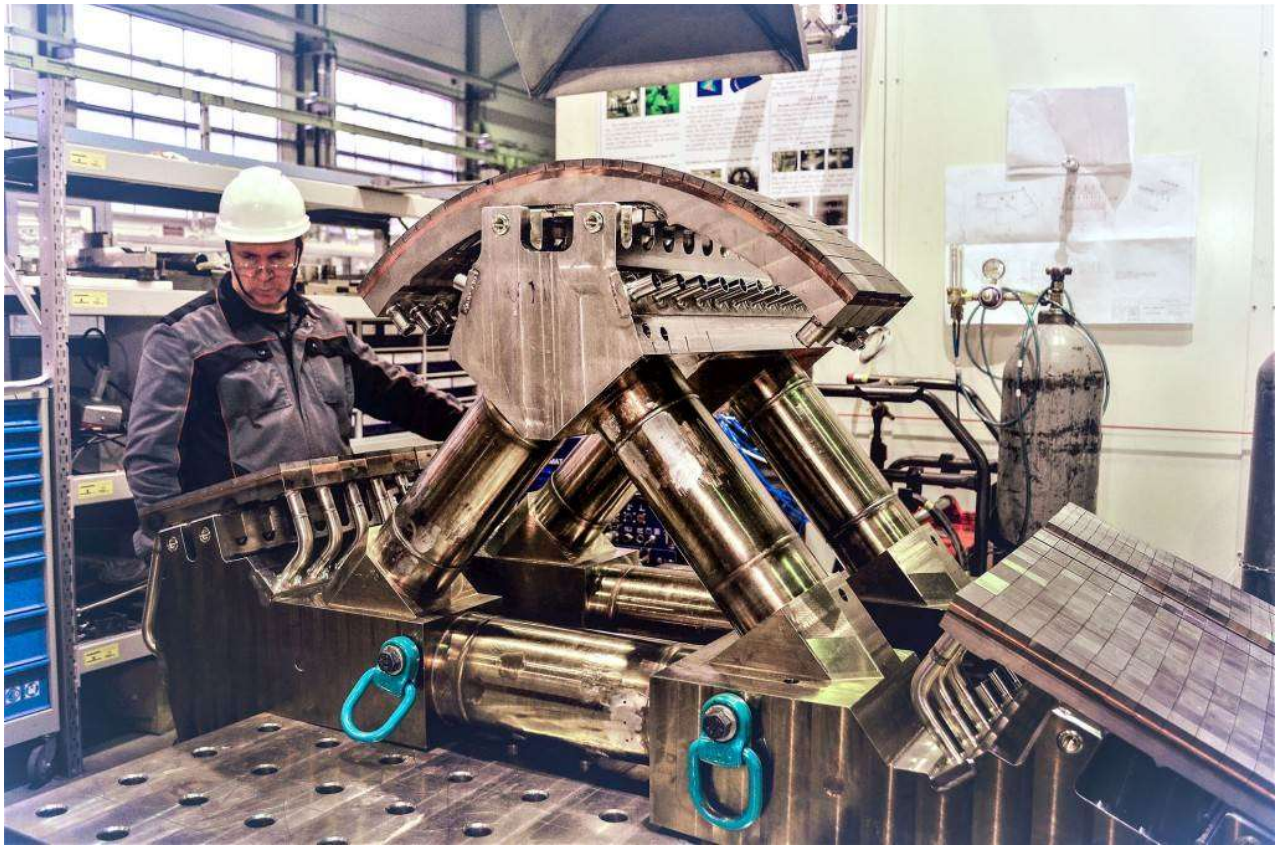
Cassette Body
~ 4.6 tons

Walter Tosto prototype

Illustration of Divertor (Dome)

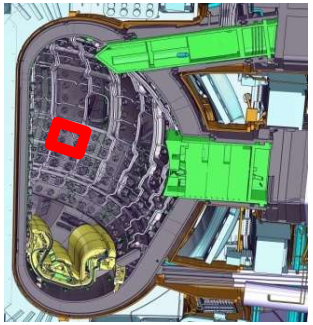


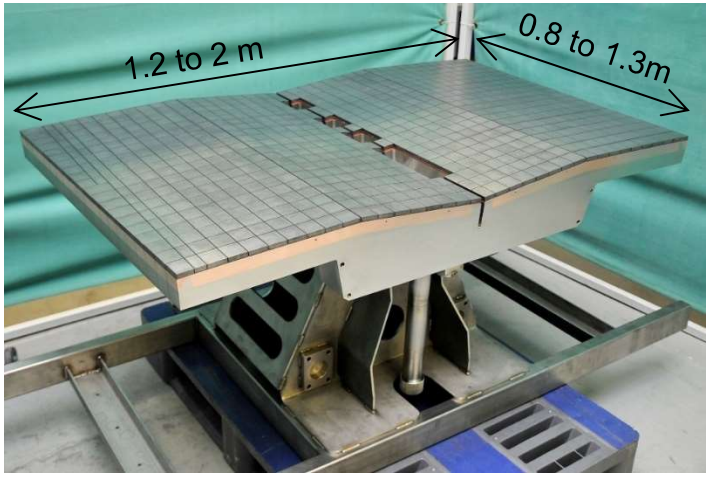
Dome
~ 800 kg



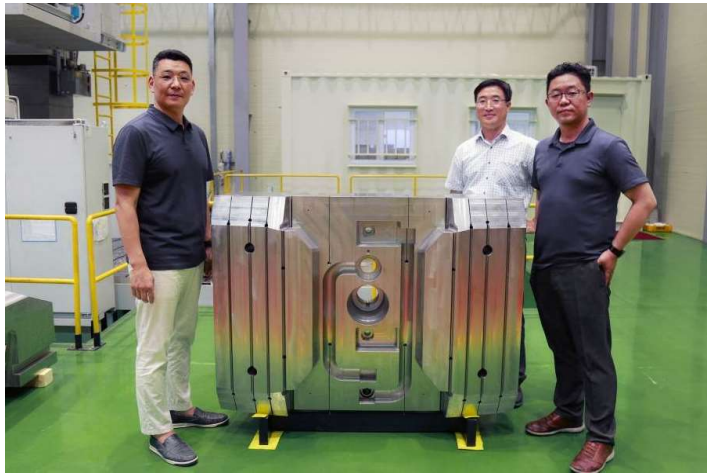
Divertor Dome – Full scale prototype - RF

Blanket Module: First Wall and Shield Block





First Wall *- Full size prototype – Atmostat-Alsyom for F4E*



Shield Block *– full size prototype*

Blanket First Wall Panel (FW)
between 600 and 800 kg

Blanket Shield Block (SB)
between 2 and 3 tons

Fusion plasma

⇩

Neutron flux

→ **Activation**

✚

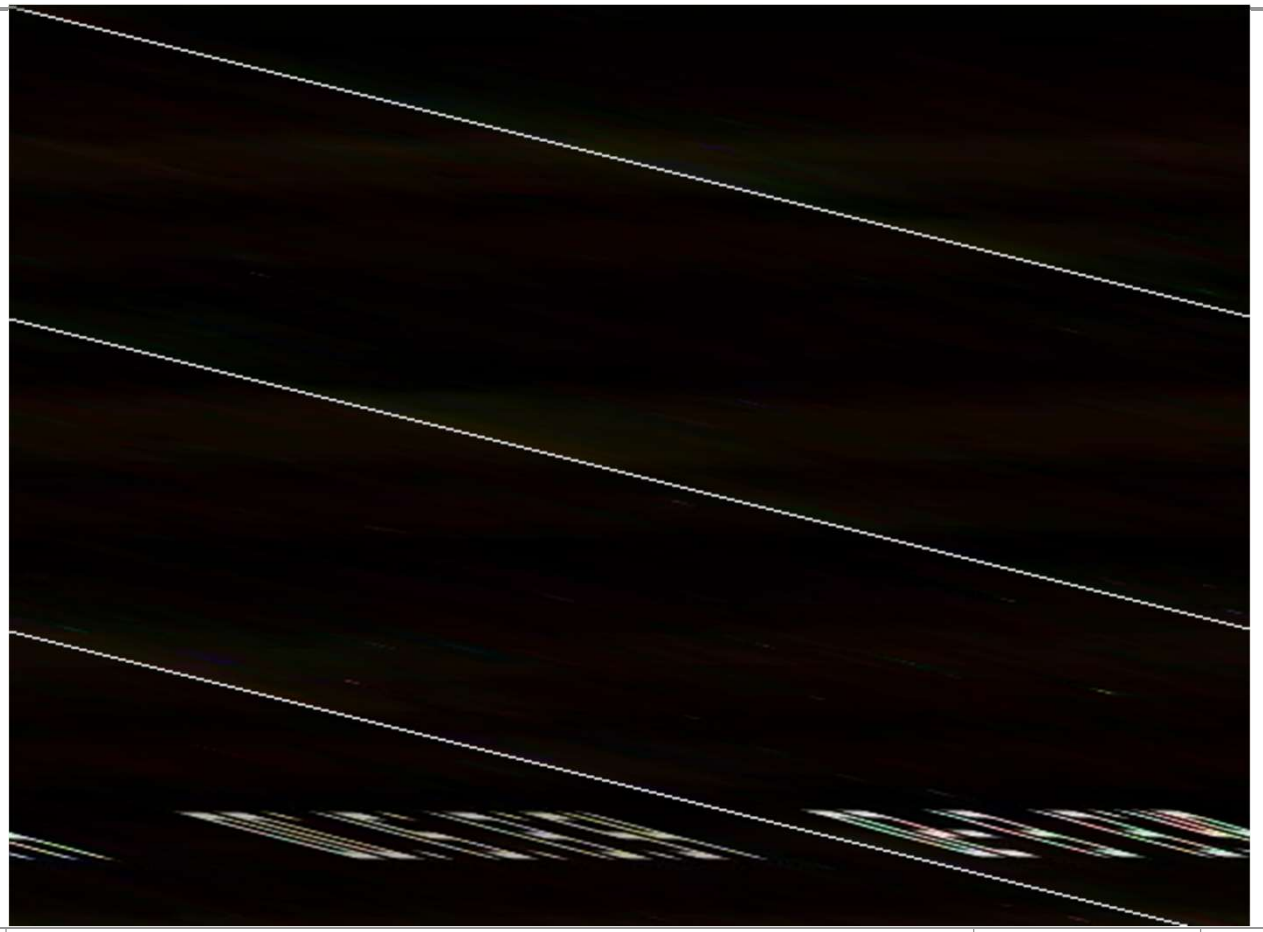
Tritium

→ **T Contamination**

✚

Erosion

→ **Contamination activated dust with Be**



Plasma in West Tokamak - CEA

Remote operations (illustration of hot Cells)

Copyright CEA

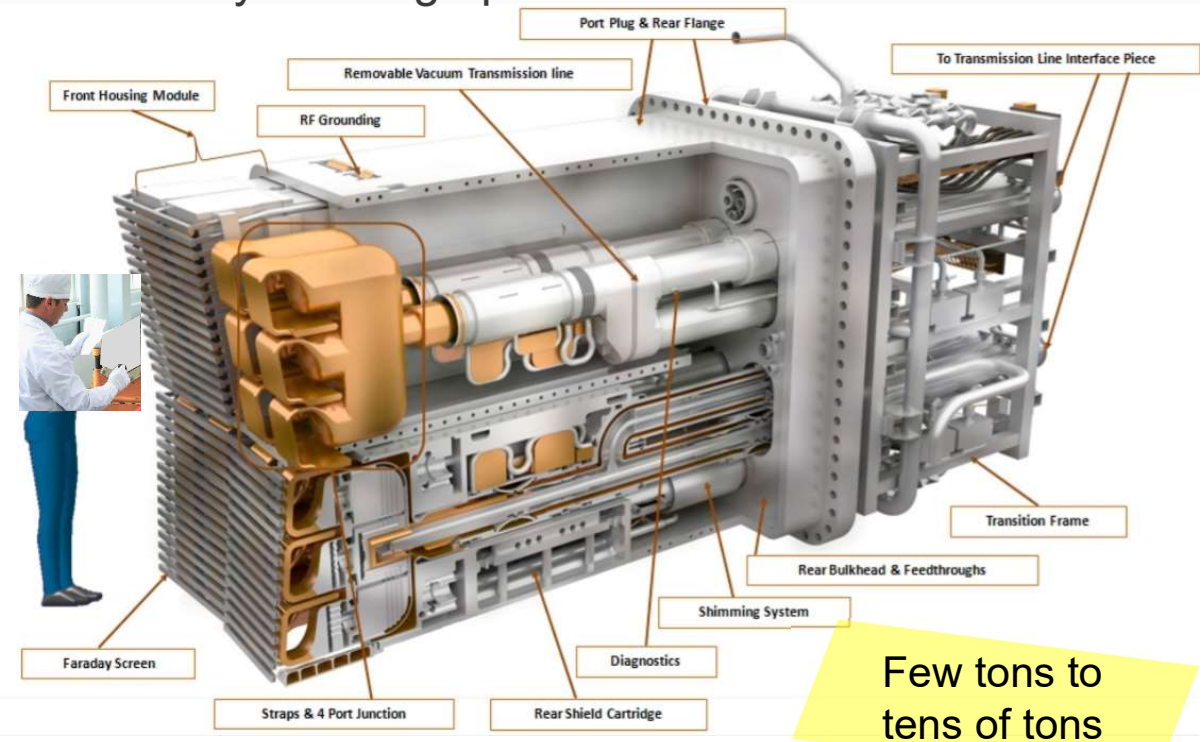
Heavy Handling in the ITER Hot Cell

Fission Power Plant

Typical fuel rod, has a length of few meters, with a diameter of around 1 cm

Few kg to tens of kg

ITER Hot Cell shall manage large size and heavy handing operations

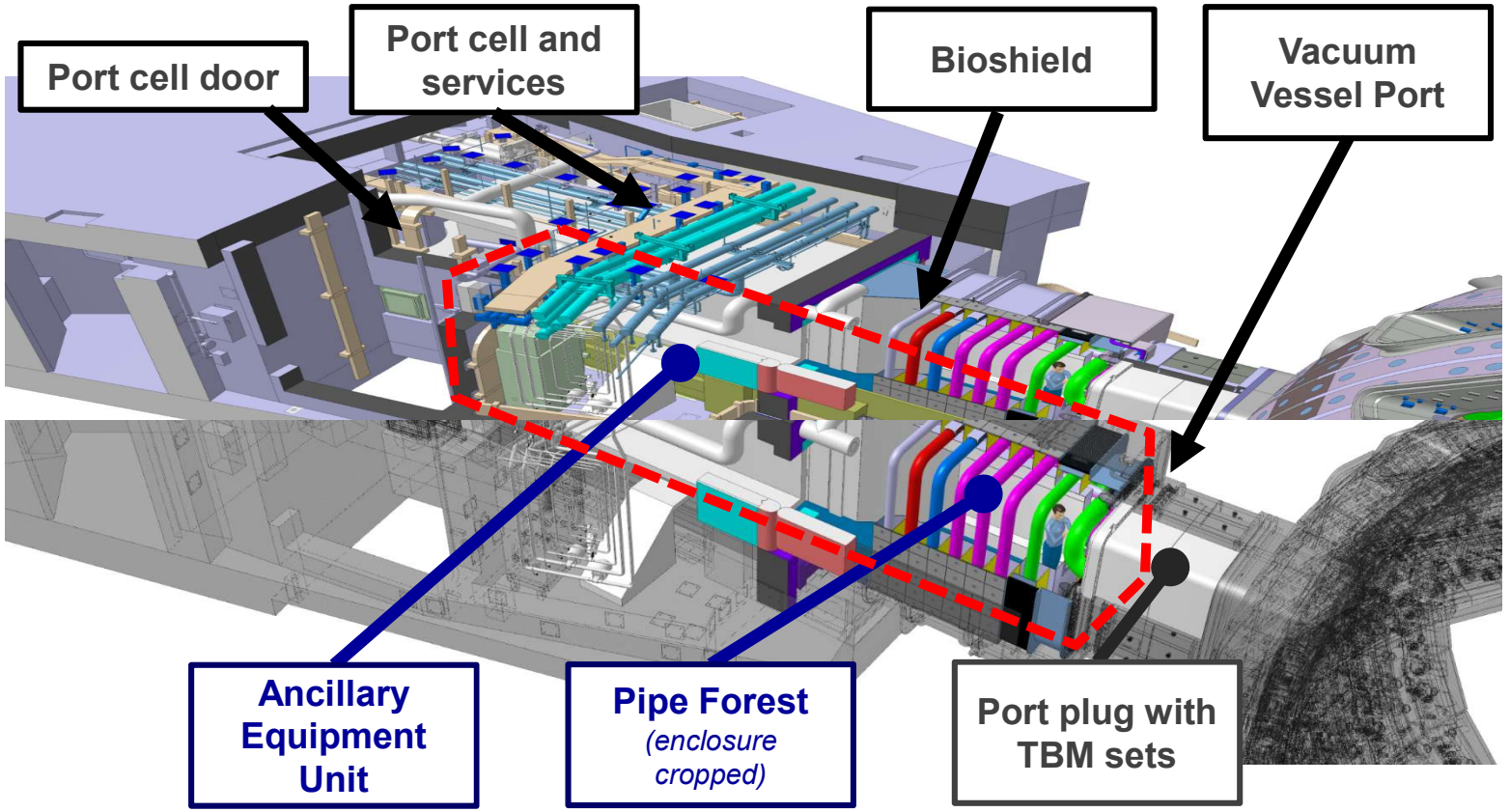


Few tons to tens of tons

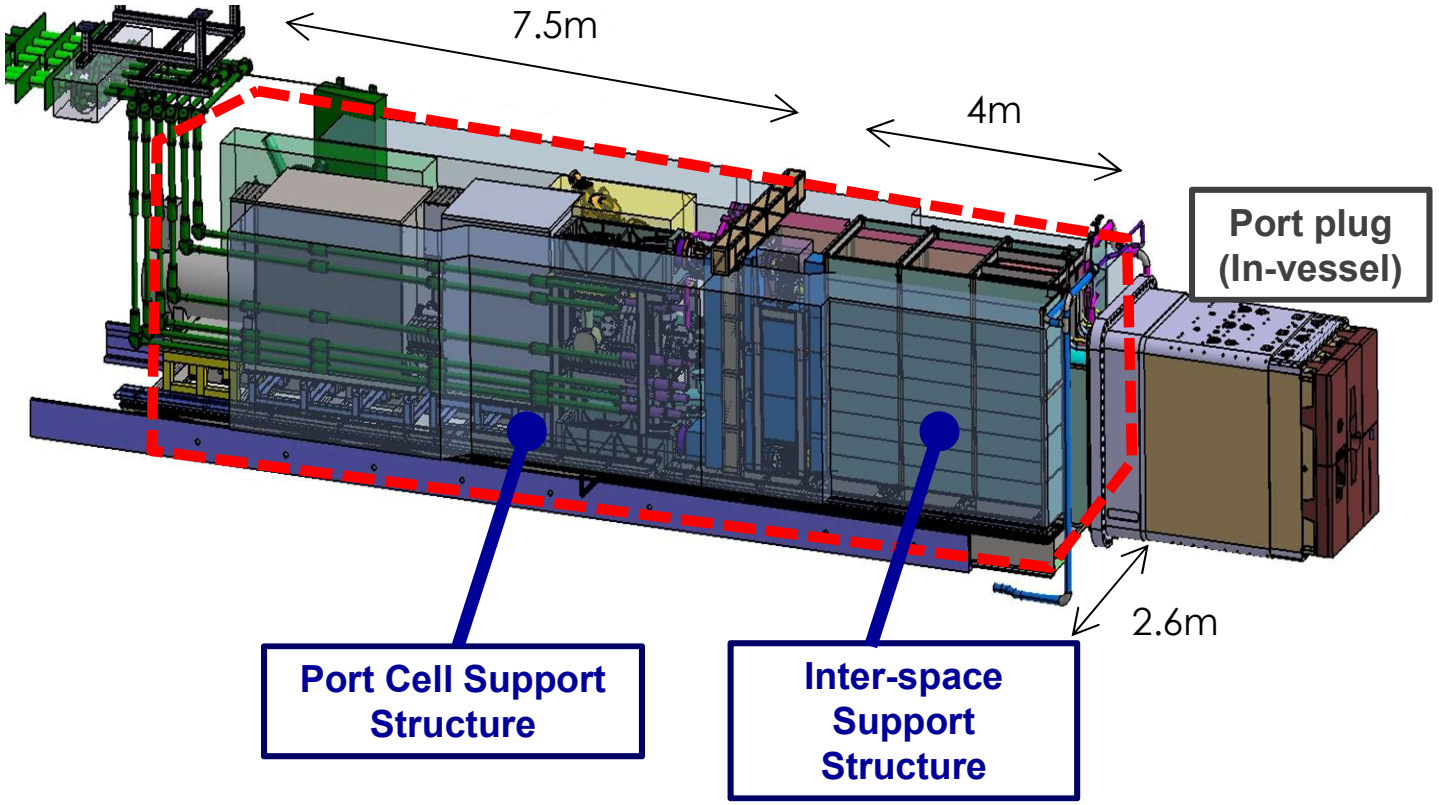
Functions of the Hot Cell Facility:

- **the maintenance of activated and/or contaminated equipment:**
  - In Vessel Components,
  - **Port Cell Equipment,**
  - TKM Remote Handling equipment,
- the treatment of radioactive waste,
- the import / export and specific nuclear functions.

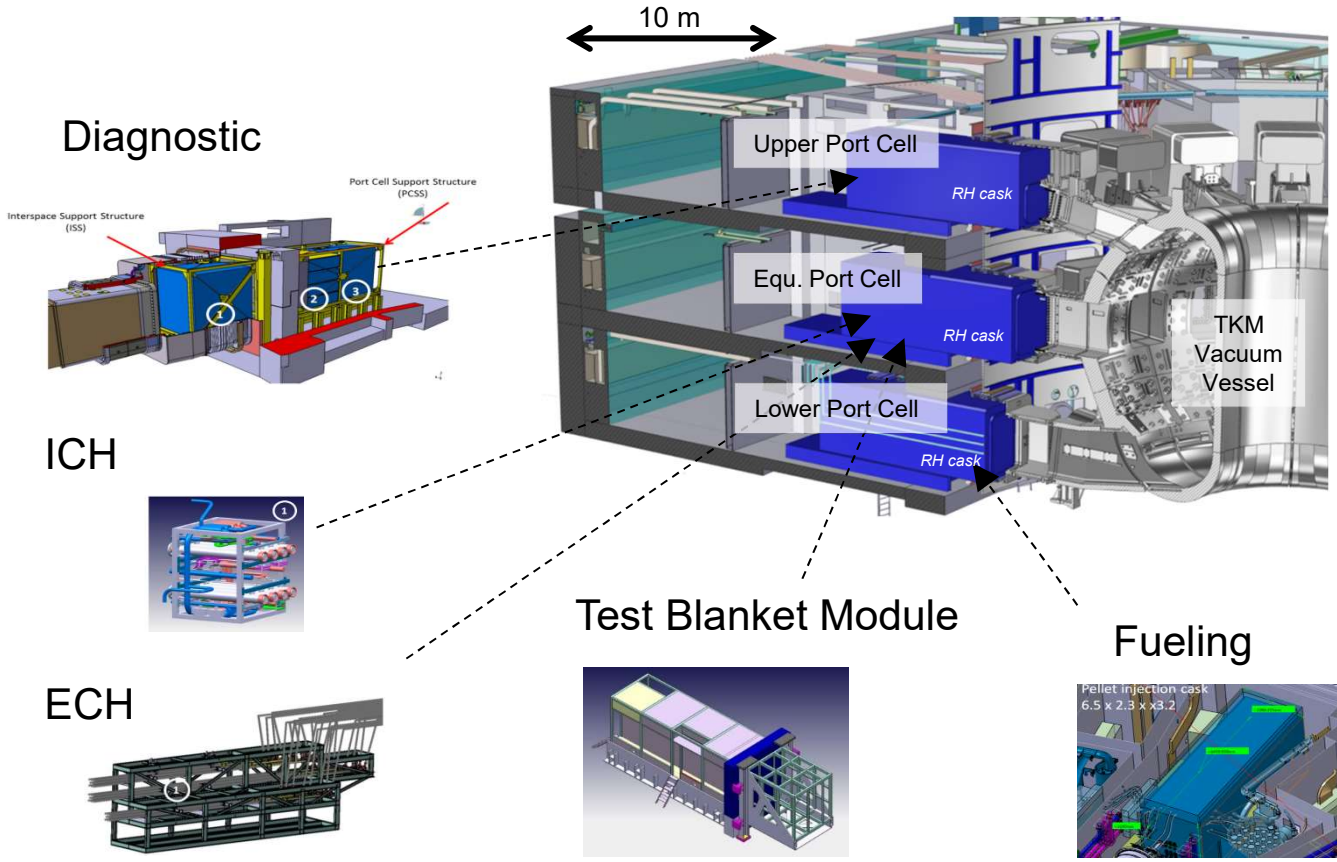
Illustrations of Port Cell Equipment 1/3



Illustrations of Port Cell Equipment 2/3



Illustrations of Port Cell Equipment



Port Cell Equipment ~ size of a bus
~ 100 tons (cask +PP)

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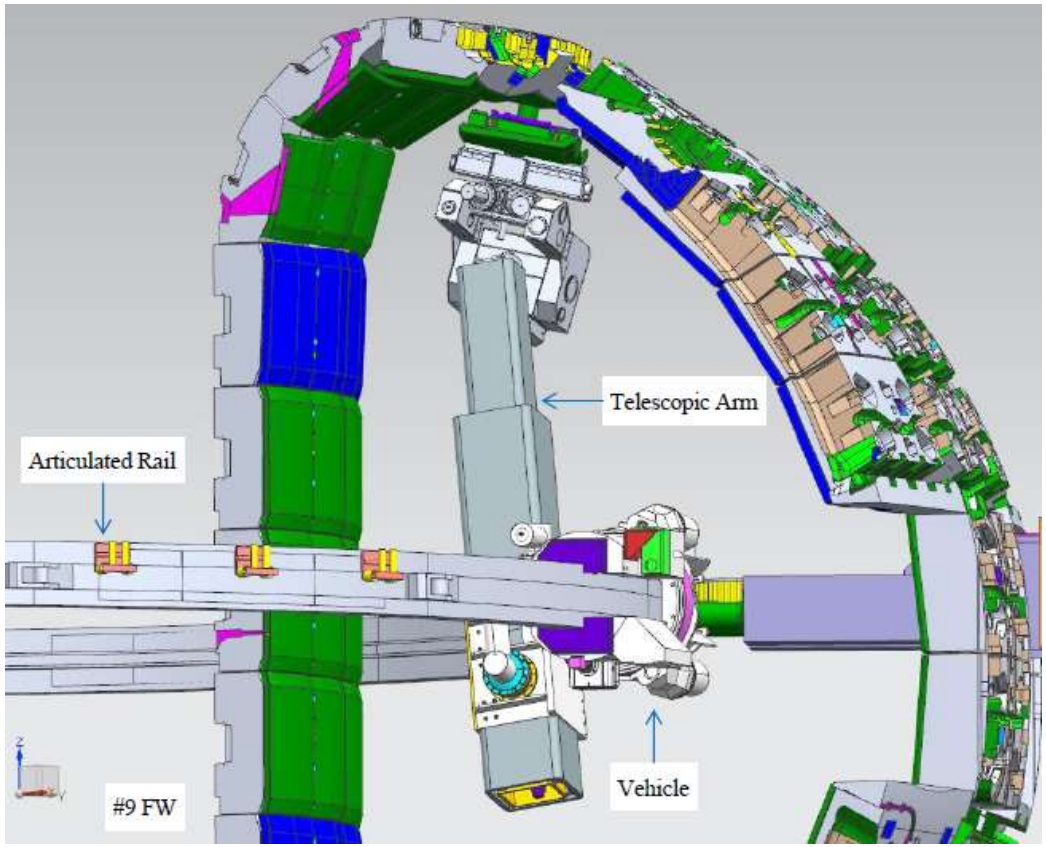
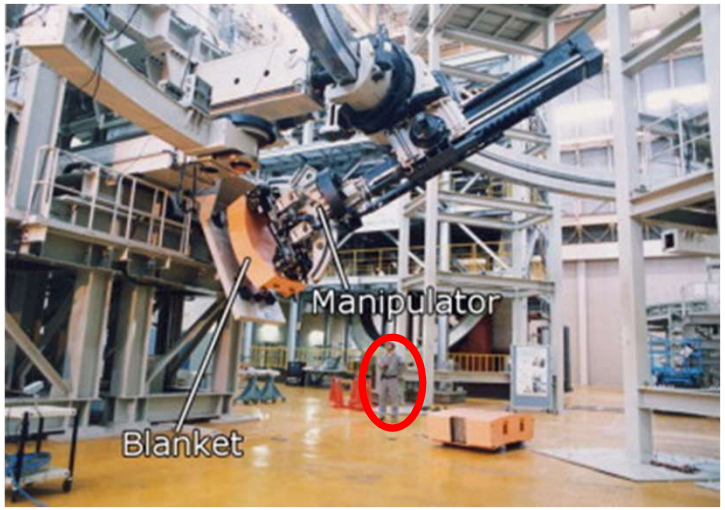
Illustration of TKM Remote Handling System 1/2

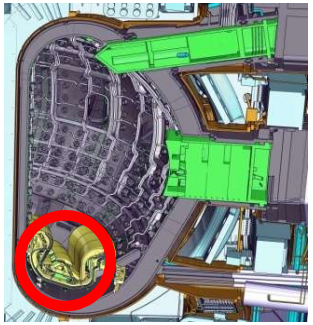




Mock-up Blanket RH System – IVT – JA DA

First Wall Panel (FW) ~ 0.8 ton

Illustration of TKM Remote Handling System 2/2



Divertor (DIV)
~ 8 tons

DTP2 – VTT - Finland

Functions of the Hot Cell Facility:

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Radwaste management

Housekeeping TFA waste - ANDRA

TFA waste at ANDRA CIRES (repository)

Type A waste – ANDRA

Transfer of Radioactive Liquid waste

Functions of the Hot Cell Facility:

- the maintenance of activated and/or contaminated equipment:
  - In Vessel Components,
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- **the import / export and specific nuclear functions.**

Import / Export and nuclear services

Import

Laboratories

Change room

Mantrap

Export shipping Flask

Rad Monitoring

1. Hot Cell Functions

2. **Hot Cell Complex layout**

3. Maturity level

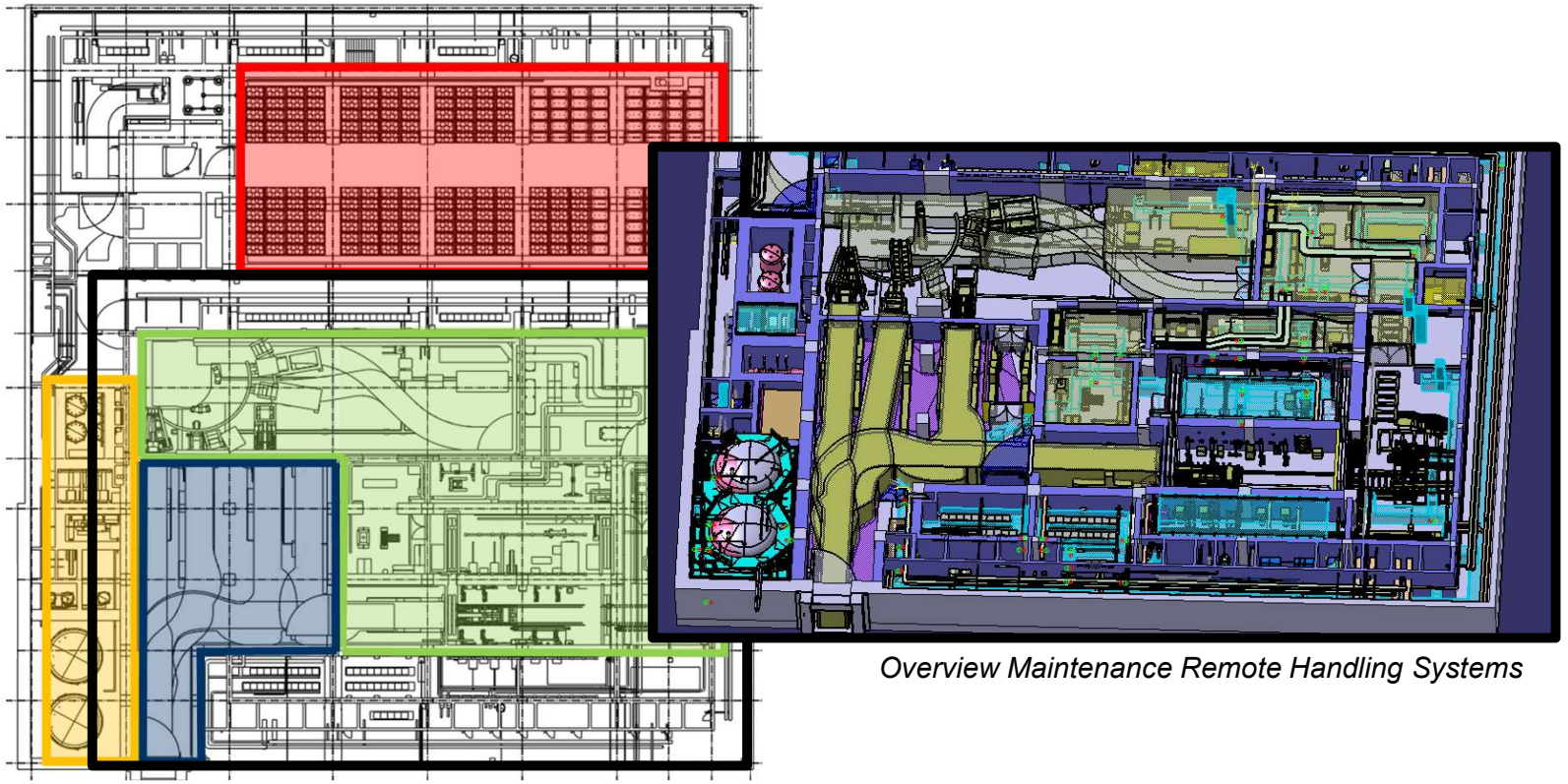
Hot Cell Layout – Basement B2

Type B Waste containers

Remote Handling Decontamination, maint. & test

Treatment & Storage Liquid Waste

Cask transfer / cask docking



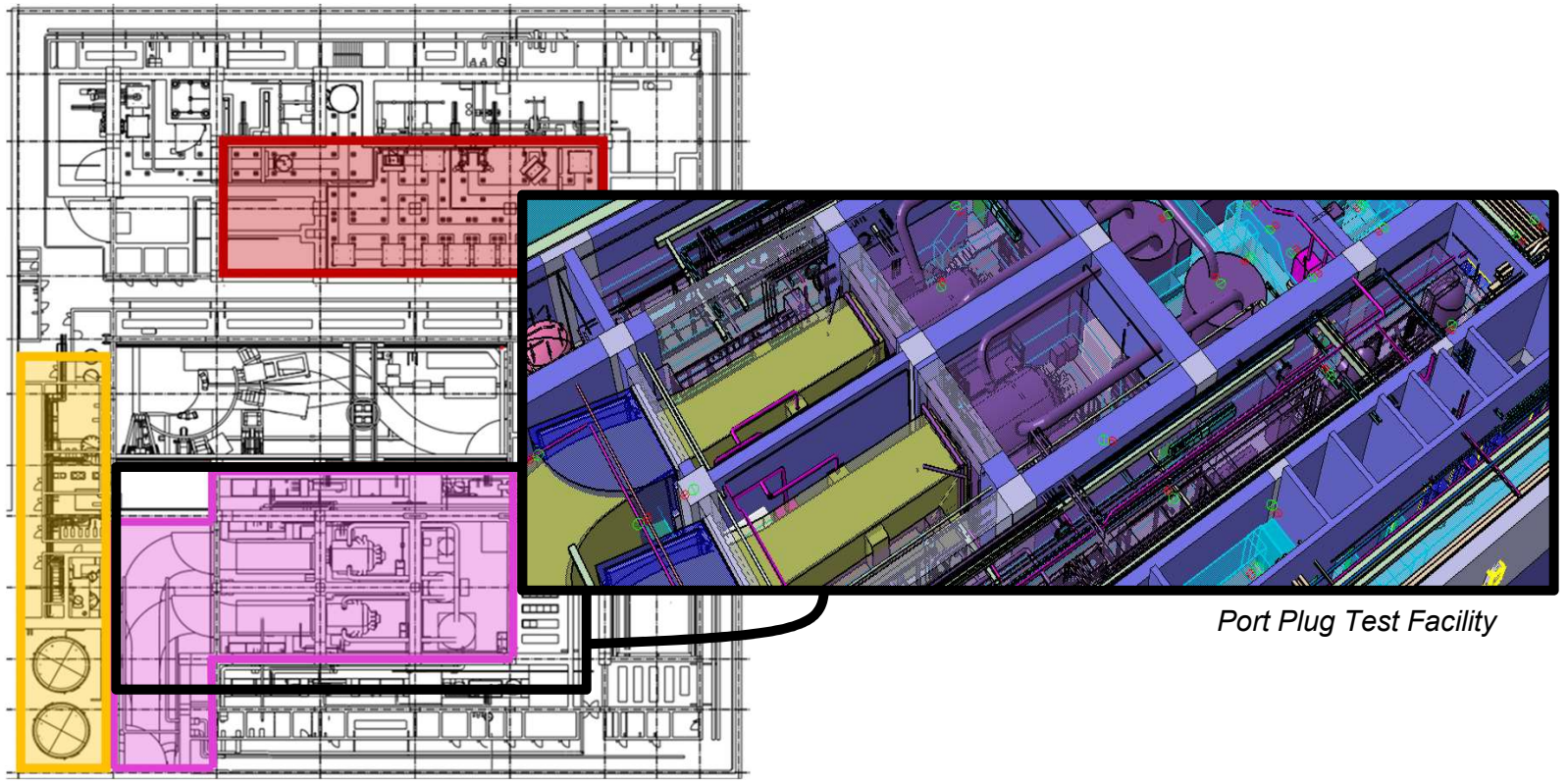
Overview Maintenance Remote Handling Systems

Hot Cell Layout – Basement B1

Treatment of Radwaste Type B

Treatment & Storage Liquid Waste

Port Plug Test Facility



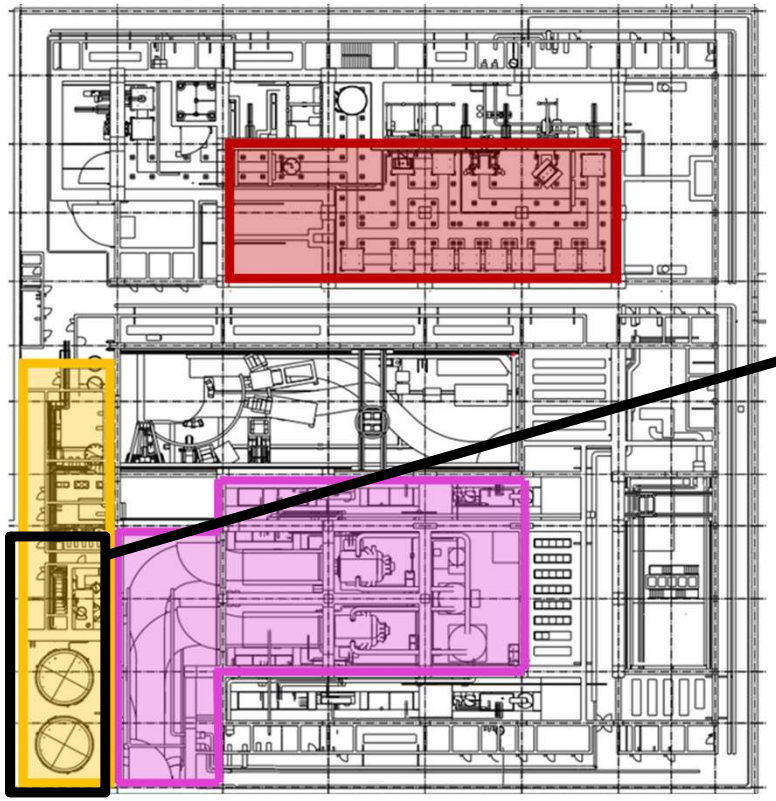
Port Plug Test Facility

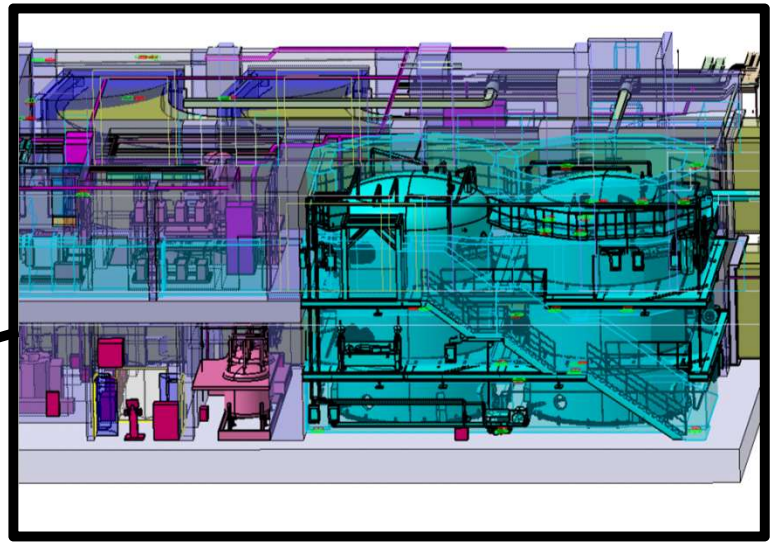
Hot Cell Layout – Basement B1

Treatment of Radwaste Type B

Treatment & Storage Liquid Waste

Port Plug Test Facility





Storage tanks and Liquid Waste Treatment

Hot Cell Layout – Ground Floor L1

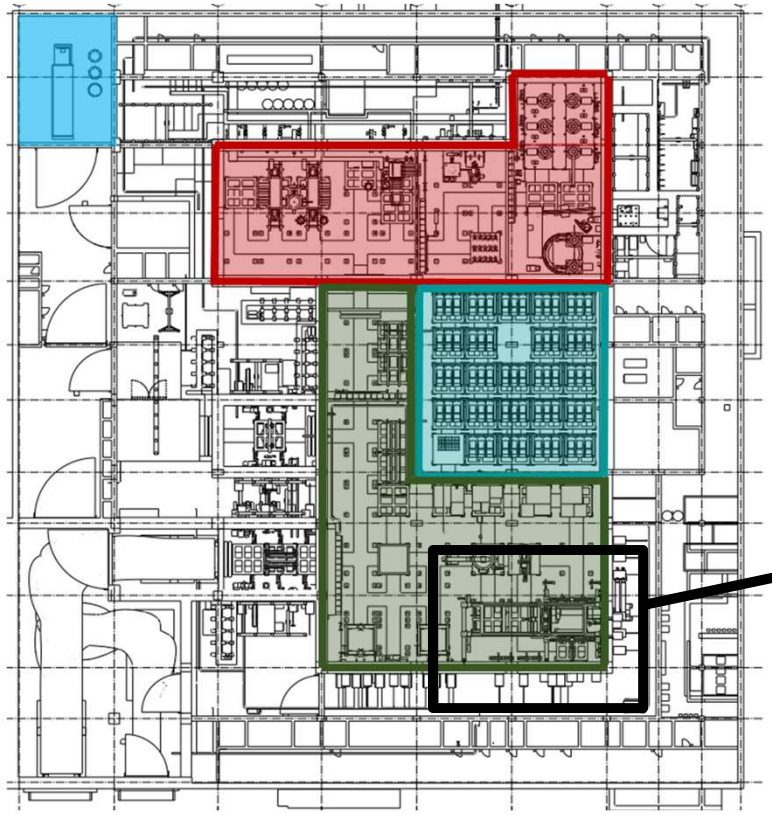
Truck Bay

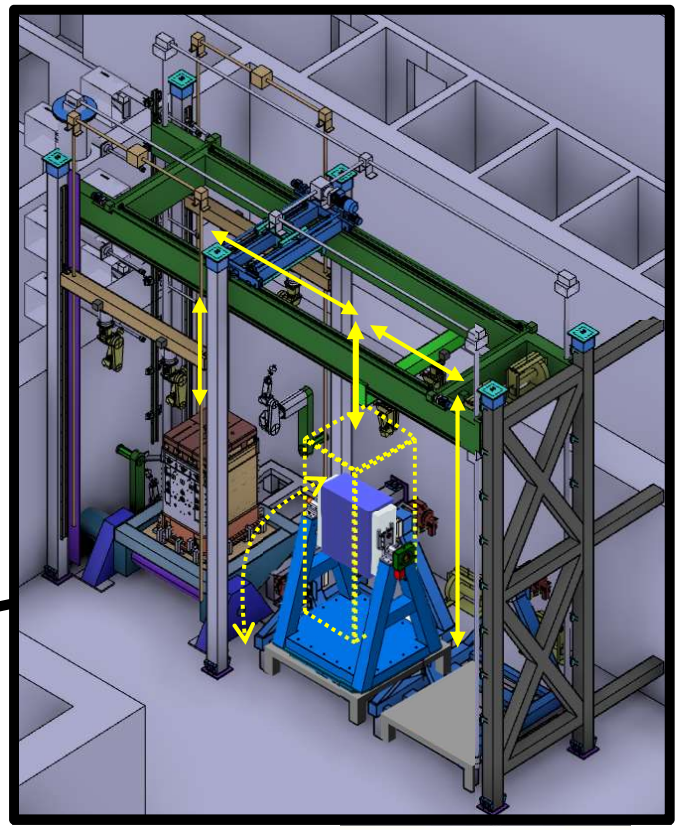
Treatment of Radwaste Type B

Buffer storage

Refurbishment area

Port Plug Test Facility





Tilting and Lifting Tower

Hot Cell Layout – Ground Floor L1

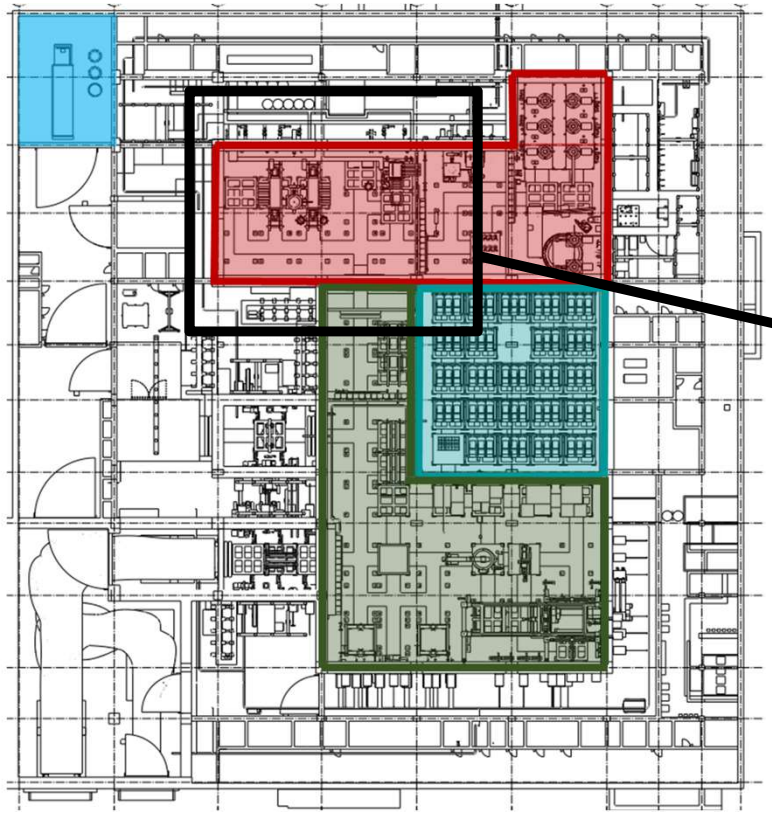
Truck Bay

Treatment of Radwaste Type B

Buffer storage

Refurbishment

Port Plug Test Facility



Radwaste Type B treatment

Hot Cell Layout – Upper Floor L2

RW Type A process

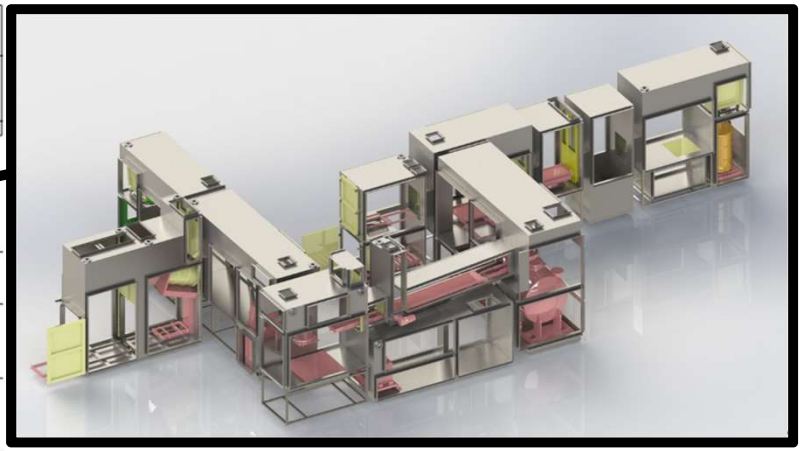
Detritiation System

Milling services

Detritiation System

RW Type A and PT process / buffer storage

Refurbishment



Detritiation of Radwaste Type A

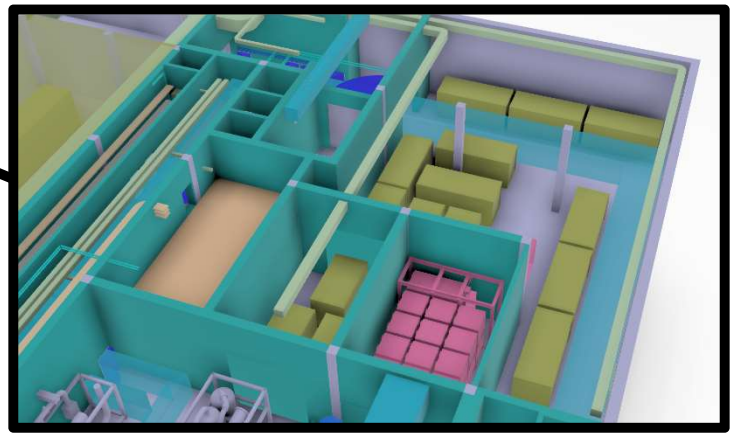
Hot Cell Layout – Upper Floor L3

Detritiation System

Port Cell Maintenance and storage

Detritiation System

Tilting Tower Services



Maintenance Port Cell Equipment and Purely Tritiated waste storage

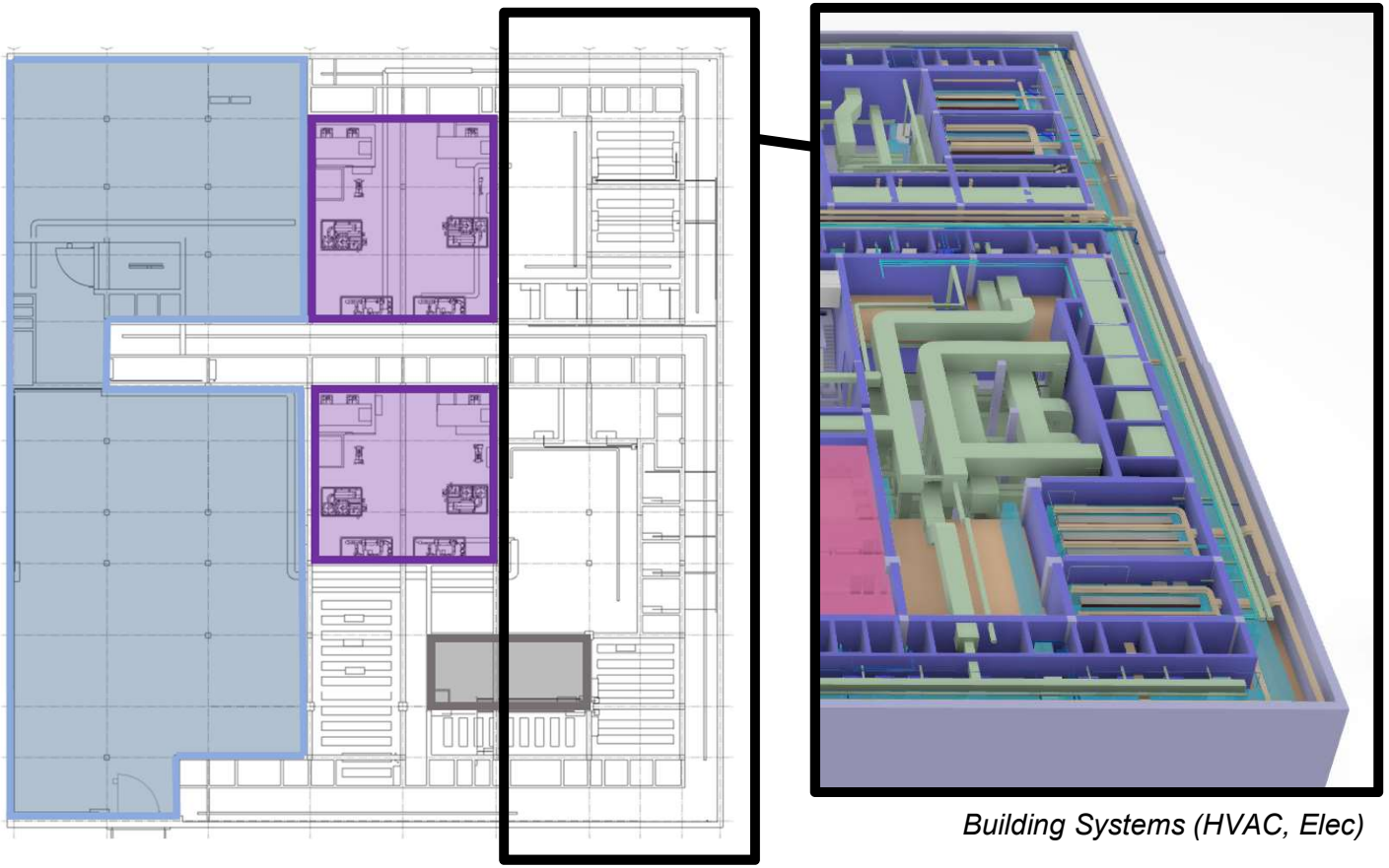
Hot Cell Layout – Upper Floor L3

Detritiation System

Port Cell Maintenance and storage

Detritiation System

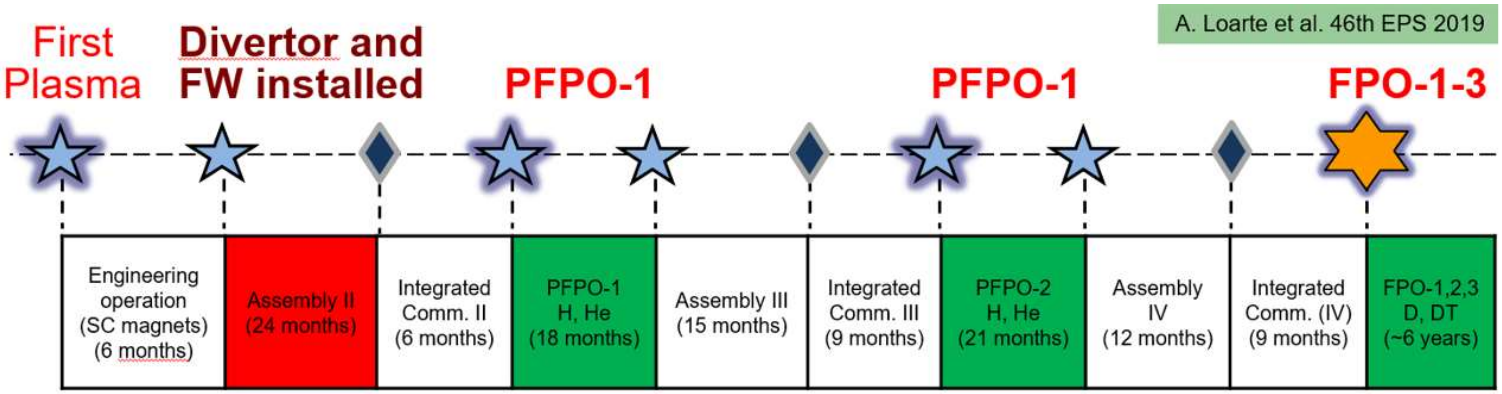
Tilting Tower Services



Building Systems (HVAC, Elec)

Staged Approach

The Hot Cell Facility shall accommodate the maintenance functions, including radwaste, in line with the staged approach and the ITER lifecycle (operation, decommissioning)



Staged Approach

The Hot Cell Facility shall fulfill the maintenance functions **Just In Time**

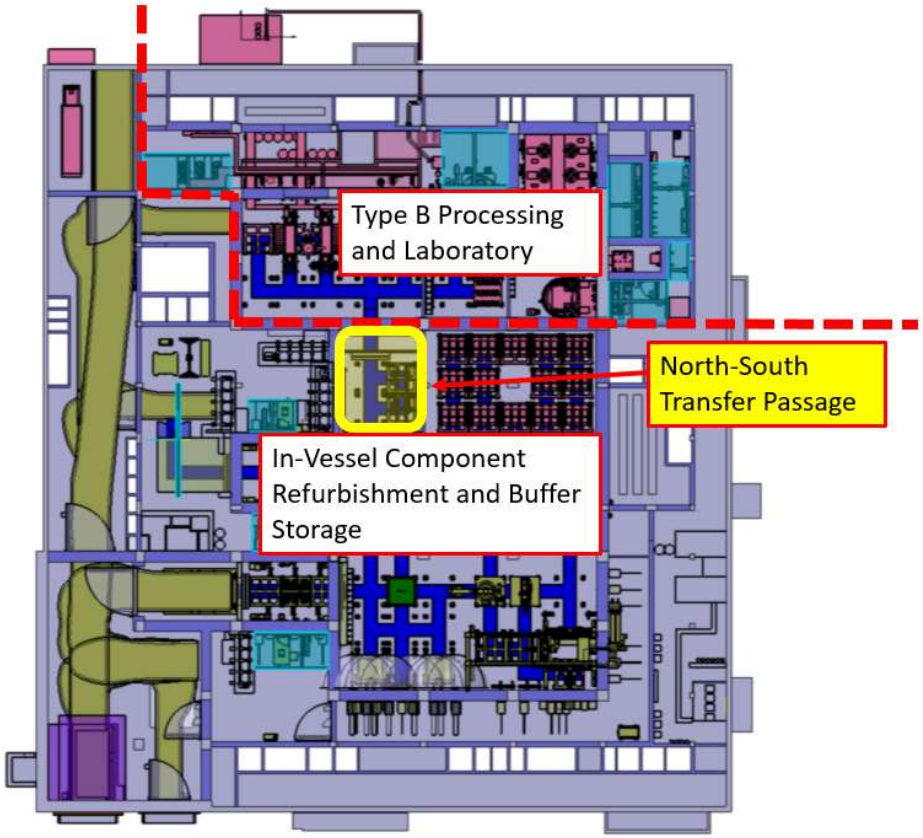


Illustration: Radwaste Type B not needed before D-T phase

1. Hot Cell Functions

2. Hot Cell Complex layout

3. **Maturity level**

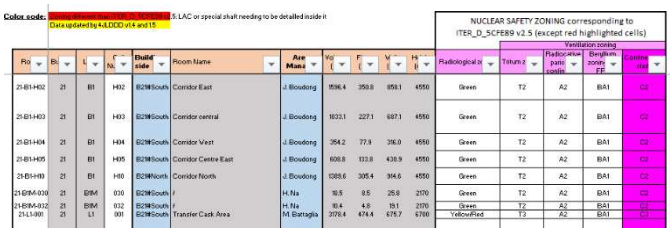
Main Systems in the Hot Cell Facility – Scope Share IO vs DA's

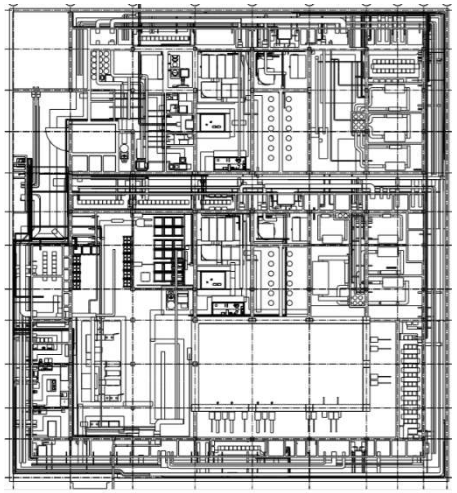
Main system involved in the Hot Cell Facility	Procurement Responsibility	Current Status
Maintenance of In Vessel Components	iter	Conceptual Design
Maintenance of TKM Remote Handling systems	iter	Conceptual Design
Radwaste type B, Purely tritiated waste and TFA	iter	Conceptual Design
Radwaste type A	EU → iter Transfer discussed	Conceptual Design
Hot Cell Detritiation System	JA iter	Preliminary Design
Port Plug Test Facility	RU	Final Design
Hot Cell Complex Building	EU	Conceptual Design

Integration activities
Facility Review at concept level

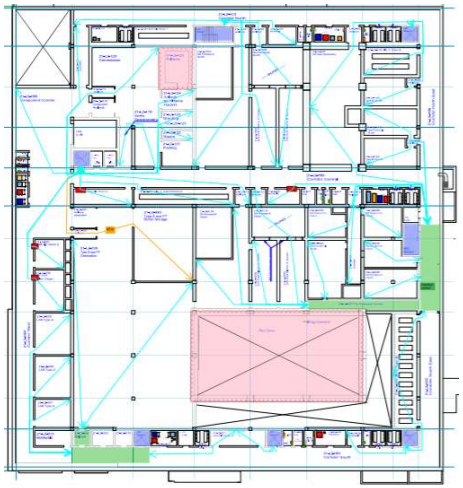
General Arrangement

Roomlist





General Arrangements



Emergency Exit

Personnel circulation

Time allocation (flow analysis)

Time allocation is as important as the space allocation

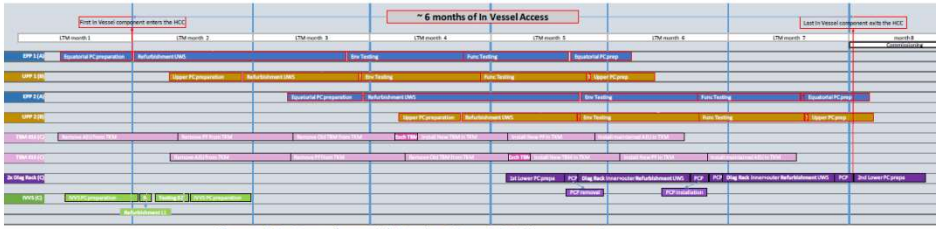


Figure 14: Gantt chart with Pools A, B and C sizing scenarios

"Static" analysis

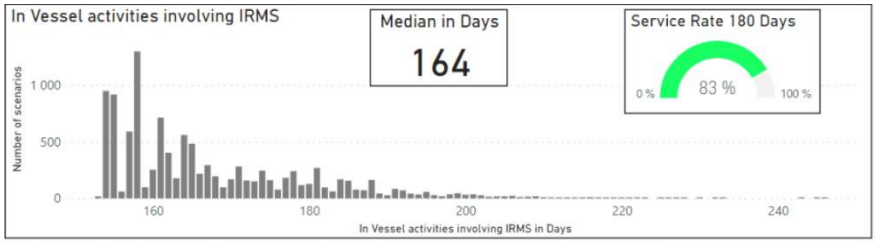
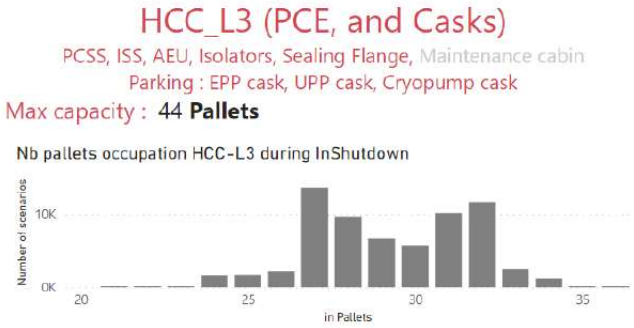


Figure 31: Duration of 'In-Vessel Activities involving remote handling' for Pools A, B, C and E

"Monte Carlo" analysis



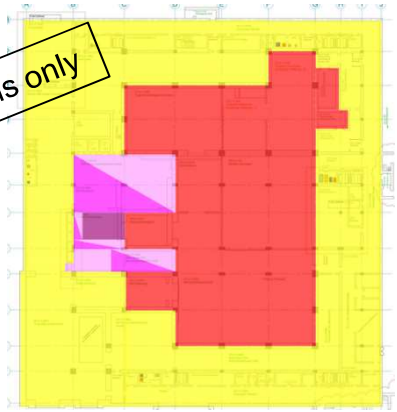
Space booked in buffer storage areas

Nuclear Safety

Safety = key design driver

Radiological zoning

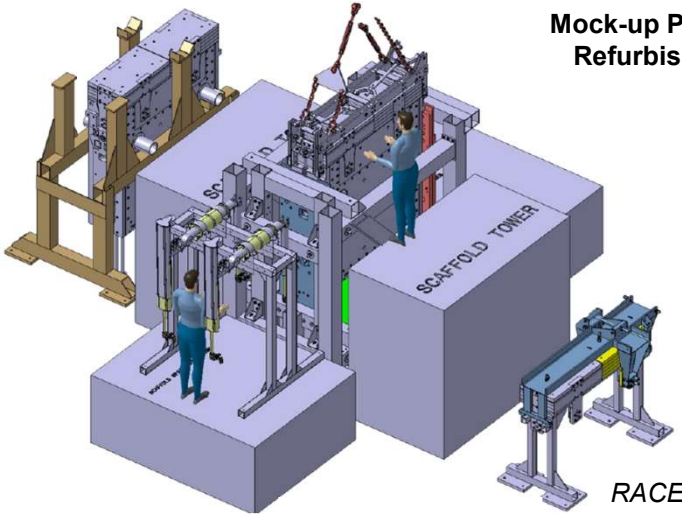
Ventilation zoning



Beryllium zoning

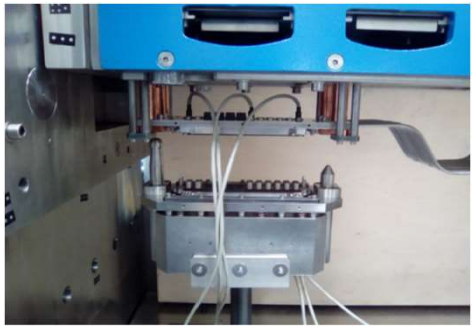
Fire zoning

Mock-up activities



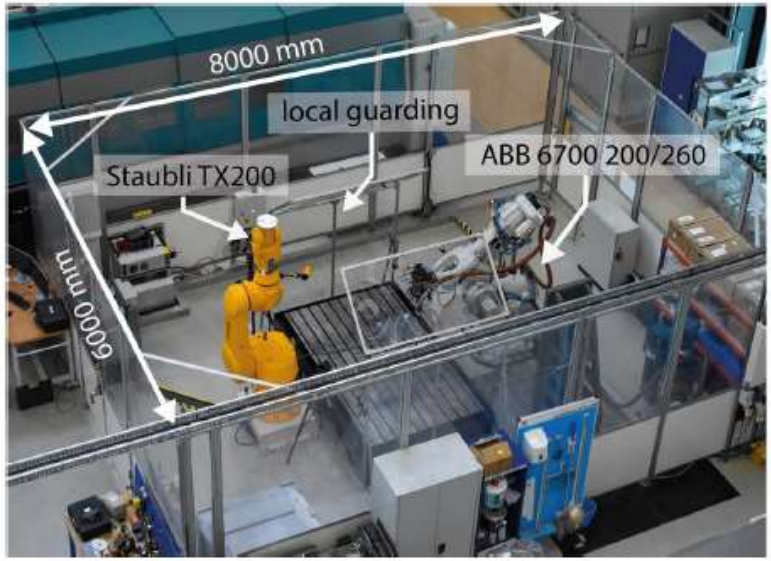
Mock-up Port Plug Refurbishment

RACE - UKAEA

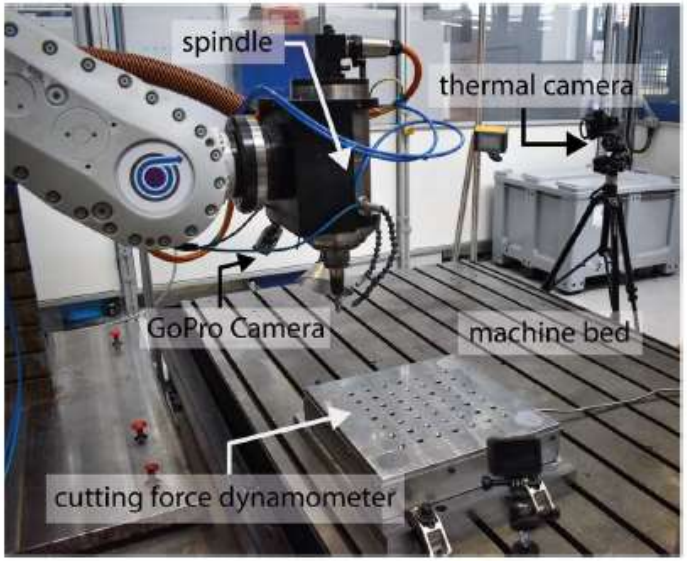


Mock-up activities

Trials cell set-up

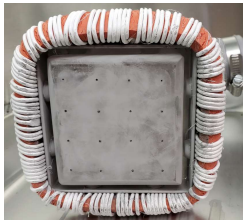


Milling tool set-up



Divertor mock-up

NAMRC



Prototype Air-jet cleaning

University of Cincinnati

Hot Cell Facility review

Design Review held end of 2021: Building and overall Facility

- 8 days total review meeting time
- 120-130 Panels/Observers/Design Team attending every day of the review
- 60 Presentations
- 120 Documents for the Facility Review
- 80 Documents for the Conceptual Design Review
- +100 written questions answered prior to the start of meetings
- +800 questions answered during the review through the Skype meeting chat

Strong and thorough documentation of the process, the building and the overall facility

Thank you for your attention