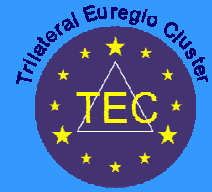**FOM-Institute for Plasma Physics Rijnhuizen**
Association Euratom-FOM

On-site test bed for ITER port plugs

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Introduction

- The EU is preparing the design of four ECRH Upper Port Launchers (UPLs)

- UPLs will be fully assembled and acceptance tested at external test sites (of the manufacturing Party)

  - Anything that can be tested off-site (from ITER) should not be done on-site

- On-site testing is, however, mandatory before UPLs can be inserted into ITER

- The test bed that needs to be developed for this purpose, should be versatile to also accommodate testing of diagnostic PPs

How do UPPs arrive at ITER?

- As far as possible assembled and tested
  - However, sensitive components (mirrors, windows, actuators) will be secured during transport.
  - Special transport fixtures need to be attached to keep everything in position and avoid damage during transport

Main functionalities of test bed

- **After reassembly on-site:**
  - Preparation of all UPPs after transportation and before installation into ITER
  - Leak testing of cooling circuit
  - Vacuum testing of in-vessel section
  - Final check of electrical connections and interfaces for port plug auxiliaries;
  - Final adjustments and check of alignment of the system by optical means and/or by low-power mm-wave testing
  - Test and validation of tools and procedures developed for the cask, and for insertion of port plugs into the ports

- **Test bed preferably separate from hot cell**

- See also C.Walker – Diagnostic Hot Cell Test Area – ITER_D_254VSW

Auxiliary functions of the test bed

- Can be used for maintenance of UPPs during the non-active phase of ITER
  - Provided Be front end can be sealed
  - This relieves pressure on the Hot Cell
- Continued use for testing of new (spare or replacement UPPs) during active phase, without need of doing this in hot cell
- Can be used for testing of primary vacuum components as diamond window and isolation valves as part of ITER test programme
- Test and validation of tools and procedures developed for hot-cell Remote Handling, in an environment that is also accessible for direct handling by operators;
- Training of operators for hot-cell Remote Handling. In the test bed environment, operator errors have much less adverse consequences than in the hot cell.
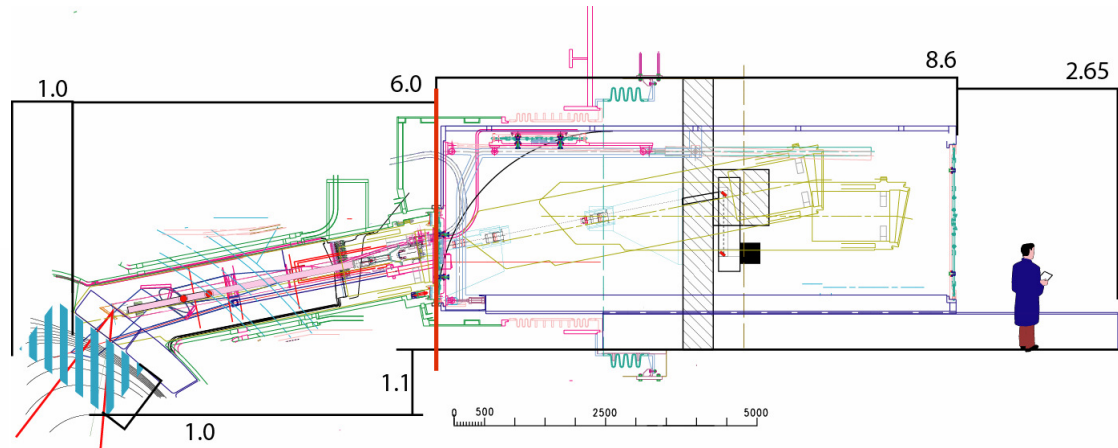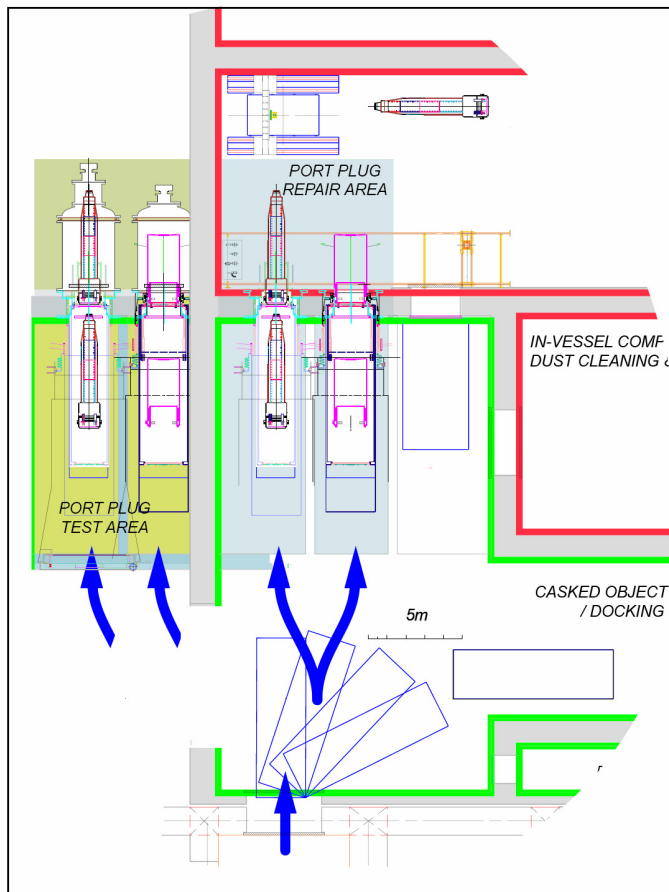
Optional functionality

- Use of the test bed for high power mm-wave test of ECRH launcher

  – This is not proposed by the ECRH team, but could become a requirement from ITER side.
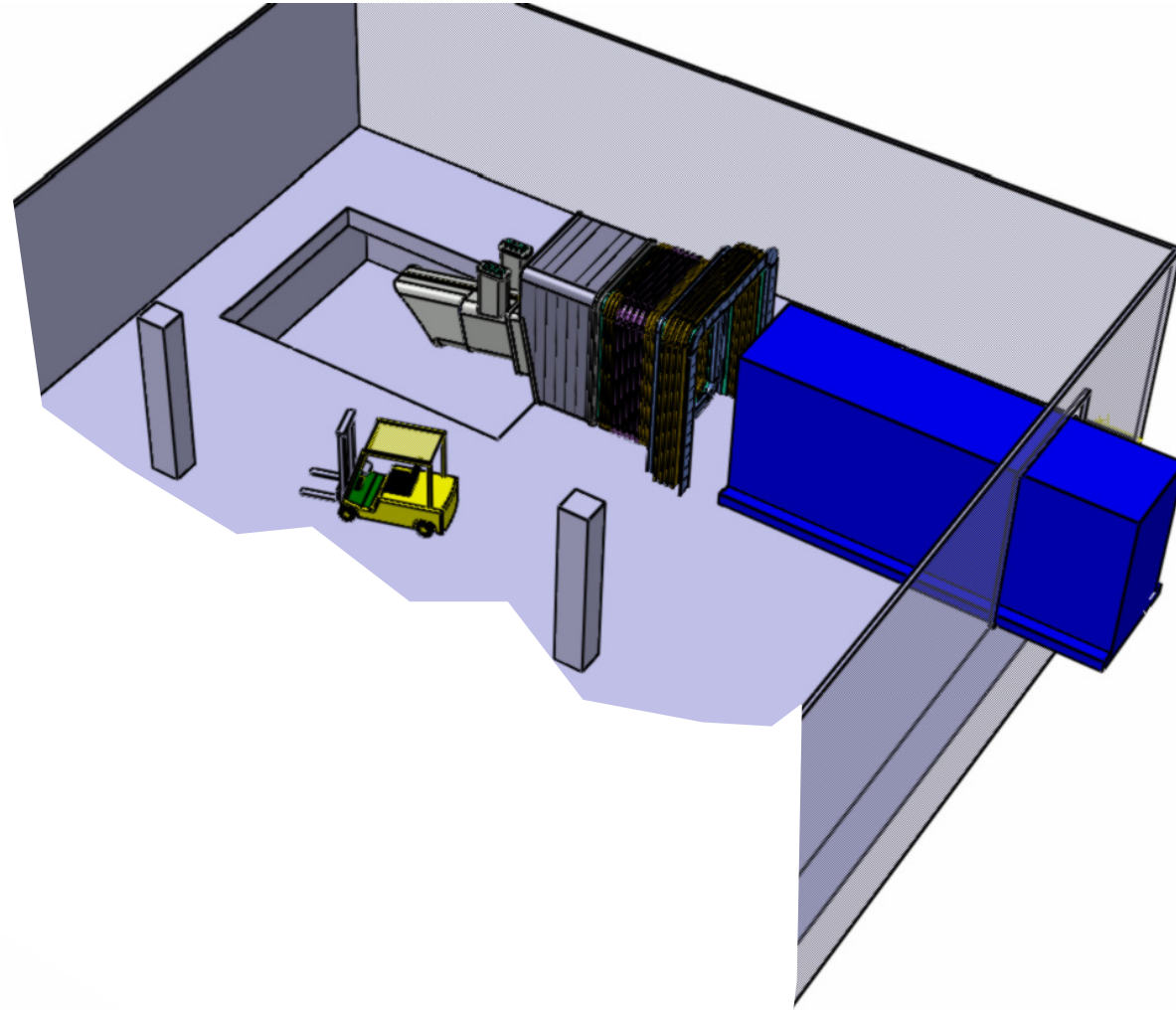
Location in the building

- ## Near casks transfer system with transport cask docking position

  - ### Or more remote location with test cask

- ## No nuclear radiation

  - ### But needs Be encapsulation

PORT PLUG
REPAIR AREA

IN-VESSEL COMP
DUST CLEANING

PORT PLUG
TEST AREA

CASKED OBJECT
/ DOCKING

5m

From C. Walker, ITER_D_254VSW

Artists impression

Testing time

- Typically 6 weeks per UPP
  - With exceptional extensions to 10 weeks
- This enables testing of all UPPs within a period of 2 years.

High priority tasks

- The work required with high priority (next three months) is the identification of:
  - the main/essential functionalities of the test bed
  - the main services and equipment
  - possible location of the test bed

Elements of workplan

Evaluation of testing/checking needs of all Upper Port Plugs.

– Study which tests can be done off-site (location tbd) and which have to be done at the on-site test bed

– Functional requirements for the test bed for the ECRH and Diagnostic Port Plugs

– This can serve as input for a document on ITER acceptance procedure for port plugs

– Especially for the auxiliary functionalities (repair, maintenance and training during the non-active phase), it is important to set up Beryllium component handling procedures and facility requirement

– Option for: Potential study to describe a preliminary design for the test bed (including visualization) called by ITER to specify detailed test bed features such as:
  - Configuration
  - Auxiliary systems
  - Supply systems

For the diagnostics UPP manufacturers

- Under the assumption that on-site high power ECRH tests by ECRH are not required by ITER:

  - A universal Upper Port test bed could be set up to test all UPPs for ITER

  - Are there any very specific functional requirements related to testing of specific diagnostic port plugs?