

ITER Port tolerancing study for remote handling compliance

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In the framework of ITER, CEA has contributed to several design and integration tasks regarding the Equatorial Port Plug engineering. Depending on the location of the components inside ITER, some components close to the plasma will be highly activated and will need to be manipulated by Remote Handling means. Thus, their maintenance has to be studied since the early design to insure their manipulability.

The Transfer Cask System (TCS) is the Remote Handling equipment dedicated to the Ports. It is used to mount and remove the Port Plugs from the Ports. This operation takes place in the Port Cell, where the TCS lies on the concrete floor. It has to dock on the Vacuum Vessel. The docking is a crucial issue, because it must guarantee the confinement and provide the alignment of interfaces between the handling equipment and the Plug.

During design phase the assembly tolerance between the concrete floor and the Vacuum Vessel has to be studied, therefore the relative position between the Vacuum Vessel and the Port Cell can't be exactly known. In order to correct its possible misalignments, the TCS has 6 degrees of mobility: 3 translations and 3 rotations.

The goal is to study the bilateral relation between the Port misalignments and the actuators strokes of the TCS. A better knowledge of this interface enables to evaluate acceptable tolerances regarding the actuators, and vice versa.

The first step was to establish a methodology to reduce the number of independent displacement parameters. Then an inverse geometrical model has been created, in order to calculate the actuators displacement regarding the Port misalignments. These tools embedded in a spreadsheet permit to validate the position of the Port that the TCS can reach, and consequently to quantify the acceptable misalignments. As the mechanisms are parallel mechanisms, each movement impacts the others. The main difficulty was to build an appropriate model of the mechanism and to find a methodology to analyse the results and identify the most critical case studies.

Alongside a CAD model has been built to help and validate the analytic results.