

IGNITOR PLASMA CHAMBER, FIRST WALL AND REMOTE HANDLING MAINTENANCE

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Ignitor is a high field compact machine conceived to achieve ignition conditions in D-T plasmas. The new designs of the Plasma Chamber (PC) and of the First Wall (FW) system are based on updated scenarios for vertical plasma disruption (VDE) as well as estimates for the maximum thermal wall loading at ignition. The simulation of the worst disruption event has been performed using the MAXFEA code. The PC wall thickness has been optimized to reduce the deformation during the worst operating condition without sacrificing the dimensions of the plasma column. A non linear dynamic analysis of the PC has been performed on a 360° model of it. The toroidal asymmetry of the halo current has been taken into account. Lateral EM loads obtained by scaling JET measurements have been also considered. The low-cycle fatigue analysis confirms that the PC is able to meet a lifetime of few thousand cycles.

The first wall protection is made of TZM (Molybdenum) tiles mounted on Inconel tile carriers that cover the entire PC and can be replaced by a remote handling system. A maximum thermal peak load of 1.8 MW/m² is calculated taking into account a displacement of ± 1 cm of the plasma column around its equilibrium position. The accuracy of the position of the tiles is prescribed to be better than ± 1 mm all around the torus. No active cooling for the FW is provided. The FW has been designed to withstand thermal and EM loads, both under normal operating conditions and in case of disruption (eddy and halo currents). Detailed elasto-plastic structural analyses of the most EM loaded tile carriers show that these are compatible with the design and fabrication requirements.

The restricted access and activation of the vessel requires the use of Remote Handling (RH) technology in any in-vessel intervention. The design of the in-vessel RH, which utilizes two of the six large horizontal ports, and of the boom and its enclosure has been completed. The tile carrier end-effectors have been designed to carry out the installation and removal of the tile carriers.