

## Design upgrading on Ignitor Machine (P1-A-67)

**Antonio Cucchiaro**(1), Aldo Bianchi(2), Alberto Coletti(1), Bruno Coppi(3), Paolo Frosi(1), Flavio Lucca(4), Anna Marin(4), Giuseppe Mazzone(1), Bruno Parodi(2), Aldo Pizzuto(1), Giuseppe Ramogida(1), Massimo Roccella(1)

1. Associazione EURATOM- ENEA sulla Fusione, Via Enrico Fermi 45, I-00044 Frascati (RM), Italy
2. Ansaldo Ricerche S.r.l. Corso Perrone 25 16152 Genova Italy
3. MIT 77 Massachusetts Avenue, NW16 02139 Cambridge USA, MA
4. L.T. Calcoli P. Prinetti 26/B 23807 Merate (LC) Italy

Ignitor is a high field compact machine conceived to achieve ignition in D-T plasma. The upgraded design of the Plasma Chamber (PC) and of the First Wall (FW) system consider the updated scenarios for IGNITOR vertical plasma disruption (VDE). The electromagnetic (EM) loads arising from halo currents and net horizontal force with the proper toroidal distribution have been envisaged. The dynamic elastic-plastic structural analysis of the PC has brought to a tailoring of the wall thickness such to reduce the displacements within the clearance with toroidal coil.

A detailed 3D finite elements model has been developed in order to evaluate the electromagnetic loads on FW. The thermal loads arisen from plasma heat loads (peak value 1.8 MW/m<sup>2</sup>) have been also considered. In any case the maximum calculated stresses are within the allowable limits.

The relevant 3D virtual mockup software simulates the inside of the PC including the entire boom with end-effector. This allowed for the analysis of the boom kinematics to cover all positions with the various end-effectors to assess the Remote Handling task operations.

The structural analysis of the IGNITOR machine Load Assembly has been performed taking into account the friction coefficients between the significant components. The non linear analysis takes into account for both the in-plane and the out-of-plane loads. The vertical plasma disruption conditions (VDE) result in bigger out-of-plane loads than the normal operating conditions.

Keys of proper dimensions between the 30° extension C-Clamps modules was adopted to assure structural stability. As far as the interlaminar shear stresses on toroidal field coils are concerned, the related safety factors are decreased respect to the normal operating conditions, but remaining around 2.