

## THE ITER EC H&CD UPPER LAUNCHER: STRUCTURAL DESIGN

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Four ITER EC H&CD (Electron Cyclotron Heating and Current Drive) Upper Launchers will be installed in the ITER Tokamak to counteract plasma instabilities by injection of up to 20 MW of millimeter-wave power at 170 GHz. Each Launcher features a structural system which is equipped with eight beam lines in a Front-Steering arrangement. The Launcher development has reached the status of a preliminary design, since the corresponding review meeting was held in November 2009 at the ITER site in Cadarache. All design work is performed by several EU associations being contracted by Fusion for Energy (F4E).

The structural design of the Upper Launcher consists of three sub-components: First of all the Blanket Shield Module (BSM), which fills the gap between the regular blankets. The BSM dissipates about 80% of the nuclear heating and envelopes the front mirrors of the mm-wave system. Second of all the Launcher Mainframe, which provides a rigid structure for precise and secure integration of the mm-wave system to guarantee reliable operation under all potential scenarios. Third of all the internals, such as dedicated support structures for the mm-wave system, shielding elements and components for gas and coolant supply.

The most challenging design aspects are proper dissipation of nuclear heating in zones of high heat flux, the mechanical integrity during plasma disruptions, the integration of sufficient shielding material and the precise alignment of the mm-wave system under tight space conditions. Furthermore the definition of efficient manufacturing routes with respect to tolerance compliance requires substantial investigation and, though the Launcher is designed for ITER lifetime, potential repair by adequate remote handling procedures must be considered.

This paper presents the recent status of the preliminary structural design and outlines future design approaches with the main focus on manufacturing methods, remote handling capability of the sub-components and optimum integration of the internals to bring the EC Launcher towards the final design.