RECENT TECHNICAL ADVANCEMENTS OF THE ITER EQUATORIAL VISIBLE/INFRARED DIAGNOSTIC

Sophie Salasca, Hugo Arnichand, Gilles Belhabib, Miguel Dapena, Sarah Dastrevigne, Christian Dechelle, Vivien Legrand

Association Euratom-CEA, IRFM, Cadarache, 13108 Saint-Paul-lez-Durance, France

Corresponding author : sophie.salasca@cea.fr

The Equatorial Visible/InfraRed Diagnostic, which is under the responsibility of the European Domestic Agency, is one of the key diagnostics of ITER, due to its crucial role for the machine protection, through the determination of plasma facing components temperatures (IR range) and the first wall survey (visible range). It is distributed in four equatorial port plugs with three wide angle lines of sight per port plug (looking at the left and right sides of the vacuum chamber and at the divertor region). With the contribution of six similar diagnostics located in upper port plugs (under the responsibility of the American Domestic Agency), this diagnostic should provide a near full coverage of the inner machine.

Due to its location (the first mirrors are in the close vicinity of the plasma) and its complexity (two types of wavelength must be transferred from the plasma to the detectors by a series of optical components), the development of this diagnostic needs to address a lot of non trivial issues, ranging from technology (high level of neutron and gamma radiation on materials and coatings, erosion and deposition phenomena on the first mirrors…) to data processing (difficulty of quantitative temperature measurement in a reflective and variable emissivity environment, real time data analysis to fulfill the function of machine protection…).

Significant technical advancements have been performed on this diagnostic since a few years, from optical and mechanical designs to data acquisition and processing, including thermal and neutronic analyses as well as performances assessment.

This paper will focus on the recent progress made on the mechanical design of the diagnostic. This progress regards : a) the box facing the plasma which contains the first mirrors and is subject to high thermal and mechanical constraints ; b) the dog leg mirrors which are located in the port plug and transfer the light along channels embedded in the shielding blocks, while limiting the neutron flux at the exit of the port plug ; and c) the relay optics made of lenses which transport separately the visible and infrared lights (after a beamsplitter) along two parallel optical beams from the interspace area to the port cell.

After describing the severe environment of the diagnostic and its integration issues, the paper will give the results of the thermomechanical and neutronic analyses performed on one hand on the first mirrors, and on the other hand on the dog leg mirrors. A preliminary analysis of the possibility to install a shutter to protect the first mirrors will also be presented. Finally a rationalization of the diagnostic layout will be shown, which consists in inserting the diagnostic in the port plug via a retractable box, with the aim to simplify the assembly, integration, test and maintenance operations.