

HTPD 2018



Contribution ID : 385

Type : not specified

6.8 Polycapillary optics for Soft X-Ray transmission in ITER

Tuesday, 17 April 2018 10:30 (120)

Tokamak plasmas emit as a volumetric Soft X-Ray (SXR) source and the emitted radiation contains very useful information about plasma stability, shape and impurity content. In the deuterium-tritium phase of ITER, the high neutron fluxes, gamma and hard X-ray emission will constitute too harsh an environment to permit the use of classical semiconductor detectors in a close vicinity of the machine. The first issue is thus to consider new SXR detector technologies more robust to such environments. The GEM (Gas Electron Multiplier) and LVIC (Low Voltage Ionization Chamber) are foreseen as the two most promising solutions so far. The second issue is then to investigate the possibility of moving these detectors at a sufficient distance from the plasma to protect them from heat fluxes and radiation. We have thus investigated the possibility of using polycapillary lenses in ITER, to transport the SXR information several meters away from the plasma in the complex port-plug geometry. Different polycapillary lenses configurations have been tested thanks to a polycapillary transmission model and synthetic diagnostics (mimicking GEM and LVIC response) which have been recently developed. Results confirm the great potential of polycapillary lenses for SXR transmission in tokamak plasmas.

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Session Classification : Session #6, Tuesday Morning Poster Session