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P2.009 Design and implementation of quasi-optical components for the upgrade of the TCV EC-system

Tuesday, 18 September 2018 11:00 (2 hours)

The EC-system of the TCV tokamak is progressively being upgraded with the addition of two MW-class dual-frequency gyrotrons (84 and 126GHz/2s/1MW) being manufactured by Thales Electron Devices with the first gyrotron delivered to SPC at the end of 2017. In order to connect the two gyrotrons to the existing low field side and top launchers, new waveguide routing from gyrotron hall to TCV tokamak was designed and dedicated Matching Optics Units (MOU) have been developed. The internal optics of the system have been determined aiming at optimal coupling to the HE11 waveguides. The laws of quasioptics were used to find quadratic surfaces to shape an incoming Gaussian beam representative of the gyrotron output into a beam matching the proper field distribution at the waveguide entrance and with HE11 content compatible with the system requirements. A solution with one flat (movable) mirror and two shaping mirrors was found and characterized with the physical optics code GRASP. The resulting field distribution is then truncated and projected onto the HE11 component to evaluate the design solution (coupled power at the waveguide entrance >98.4% and HE11 content >96.8% for both frequencies). The model and the results of this analysis will be presented and compared to a model based on the Rayleigh-Sommerfeld scalar diffraction integral. GRASP was also used to evaluate preliminary misalignment effects in terms of coupled power to the waveguide and the first MOU design moved to the manufacturing phase. In parallel to the gyrotron integration and to extend the level of flexibility of the TCV EC-system, a modular closed divertor chamber is developed, requiring the X3 top-launcher to be redesigned. Preliminary antenna conceptual design studies including new curvature to cope with the requirements of modularity and flexibility will be presented.

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