Accessibility and performance studies for the ITER ECRH launchers

E. Poli[1], *D. Farina*[2], *M. A. Henderson*[3], *G. Ramponi*[2], *G. Saibene*[4], *H. Zohm*[1]

[1]Max-Planck-Institut für Plasmaphysik, 85748 Garching bei München, Germany
[2]Istituto di Fisica del Plasma, EURATOM-ENEA-CNR Association, 20125 Milano, Italy
[3]CRPP, EURATOM-Confédération Suisse, EPFL, CH-1015 Lausanne, Switzerland
[4]EFDA Close Support Unit, Boltzmannstr. 2, 85748 Garching bei München, Germany

First Author e-mail: Emanuele.Poli@ipp.mpg.de

The ITER ECRH/ECCD system is designed to deliver to the plasma 20 MW of RF power through an upper (UL) and an equatorial launcher (EL). The former is intended for stabilisation of the Neoclassical Tearing Mode (NTM), whilst the latter should mainly provide current drive for core heating and control of the plasma current profile. The synergy between the two launchers, however, should be considered in order to establish the possible physical applications of the whole ECRH system [1]. Extended-physics issues include e.g. sawtooth and ELM control, the access of the FIR-NTM regime and counter current drive in the centre of the plasma. An accurate calculation of propagation and absorption of the EC beams is essential to evaluate the design performance. The paraxial WKB method for beam tracing [2] implemented in the TORBEAM code [3] is used to this aim.

The accessibility requirements change depending on the distribution of the physical tasks mentioned previously between and within the launchers (the two rows of the upper launcher can be dedicated for instance to different radial locations in the plasma). They result in different steering requirements, which are in turn connected with the focusing capabilities of the system. Moreover, the accessibility of the plasma edge to second-harmonic absorption is investigated. Another important point is the performance of the system, which can be quantified in terms of the total driven current I_{cd}, the current density j_{cd} and the current profile width w_{cd}. The total width of the current profile can be optimised in terms of proper positioning of the beam waist and of the respective alignement of the beams within a row (UL) or between different rows (EL). The performance of different options for driving counter current drive in the bulk plasma are also discussed.

References

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