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Numerical Design of RF Antennas for Ion Cyclotron Resonance Heating in ECRIS

In this paper we present the numerical design and simulation of RF antennas to be employed in Ion Cyclotron Resonance Heating (ICRH) systems working in an ECRIS setup. A 3D full-wave numerical model, based on the coupling between COMSOL FEM solution of Maxwell equations and the MATLAB-computed non-homogeneous plasma dielectric tensor, has been employed in order to study the performance of several ICRH antennas. The full-wave plasma model includes both collision frequency and Landau damping. Results in terms of S-parameters, on-axis electric field and RF absorbed power inside the plasma chamber have been obtained and compared between the chosen antenna geometries. The present study is the base towards future design of a proper matching network between the RF amplifier and the antenna, necessary to cope with the plasma properties' fast variations. Further ion kinetic simulations are ongoing, which study will permit to better investigate fundamental aspects of ion dynamics in ECRISs (e.g., ion confinement and diffusion processes).

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