Coupling characterization of the ITER-relevant lower hybrid antenna in Tore Supra: experiments and modelling results

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The Passive Active Multijunction (PAM) launcher, a new concept of LH launcher at 3.7 GHz, presents a specific coupling behaviour compared to previous multijunction launchers operated on Tore Supra.
In this paper, the electromagnetic properties of the launcher are measured at a reduced power [0.2-1.0 MW] to allow a systematic comparison with the linear wave coupling theory and the associated modelling based on the linear code ALOHA [1]. Dedicated low power experiments are performed in a wide range of edge electron densities n_{e0} and several main peak $N_{//0}$ values of the launched power spectrum.
Low power reflection coefficients (RC) (1-5%) are measured at a low n_{e0}, close to the cut-off density n_c, i.e. in the range [0.5-3]*n_c. For higher n_{e0}, RC further increases with n_{e0} for this two-waveguide multijunction. Experimental coupling characteristics, such as the RC behaviour with n_{e0} variation and the spectrum directivity, are well reproduced by the ALOHA simulations [2]. Measurements and analysis of the antenna-plasma scattering matrices provide explanation of the good coupling properties of the PAM launcher close to n_c by highlighting the crucial role of the slow wave intercoupling between active and passive waveguides via the edge plasma.
[1] J. Hillairet et al., Nucl. Fusion **50** (2010) 125010.

[2] M. Preynas et al., Nucl. Fusion **51** 023001 (2011).