Parametric Study of One Triplet of the ITER ICRH Antenna by Numerical Modelling

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Each of two ITER ICRF antennas consists of a close-packed array of 24 straps arranged in a 6 poloidal by 4 toroidal array. Three poloidally adjacent straps (a "triplet" of straps) are fed together through a 4-port junction from one 20Ω feeding line. The array has to radiate 20MW of RF power over a frequency range of 40MHz to 55MHz and for different toroidal phasings.

The RF optimization of the antenna has been performed numerically on one triplet of straps ($1/8^{th}$ of the antenna) [1,2]. In parallel a reduced-scale mock-up of one triplet of the ITER ICRH antenna was constructed in order to validate the results of the numerical optimization [3].

In the present work a comprehensive parametric study of one triplet of straps of the ITER ICRH antenna was performed by CST MWS numerical modelling. The aim of this parametric study is:

- Better understanding and consolidation of the optimization done in the past
- Analysis of the fields and currents of the triplet of straps in order to localise the peaks of the electric field and check the balance of current between the straps
- Extend the parameters space in order to explore other optimization possibilities

The considered parameters are: strap width, antenna box depth, vertical septum recess with respect to the front of the current strap and antenna recess with respect to the first wall. The impact of the presence of the Faraday screen is also analysed.

Comparisons of the numerical modelling with experimental measurements on the reduced-scale RF mock-up show good agreement. Qualitative interpretation of the numerical results is given in the frame of the transmission line analytical description.

[1] P. Dumortier et al., Fusion Engineering and Design 84 (2009) 707–711
[2] V. Kyrytsya et al., AIP Conf. Proc. 1187 (2009) 281-284
[3] P. Dumortier et al., AIP Conf. Proc. 1187 (2009) 277-280