# IMPLEMENTATION OF THE AUTOMATIC FEEDBACK CONTROLLED MATCHING OPTIONS OF THE ITER ICRH SYSTEM

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For ITER, each of the two ICRH antennas is designed to couple 20MW to the plasma in the 40-55MHz band via an array of 24 radiating shorted straps fed by four generators. The matching system must provide automatic matching control on the mean load provided by the plasma and be resilient ($|\Gamma| < 0.2$) to a wide range of fast antenna load excursions occurring in ELMy plasmas. Furthermore, good control of the current distribution in the strap array is required for the various heating and current drive scenarios. Two load resilient matching options have been considered for ITER: the 4 "Conjugate-T" (CT) and the 4 hybrids ones, the first being presently considered as a back-up option [1]. Automatic control for these two options is presently developed, and tested for optimization on a low-powered scaled mock-up.

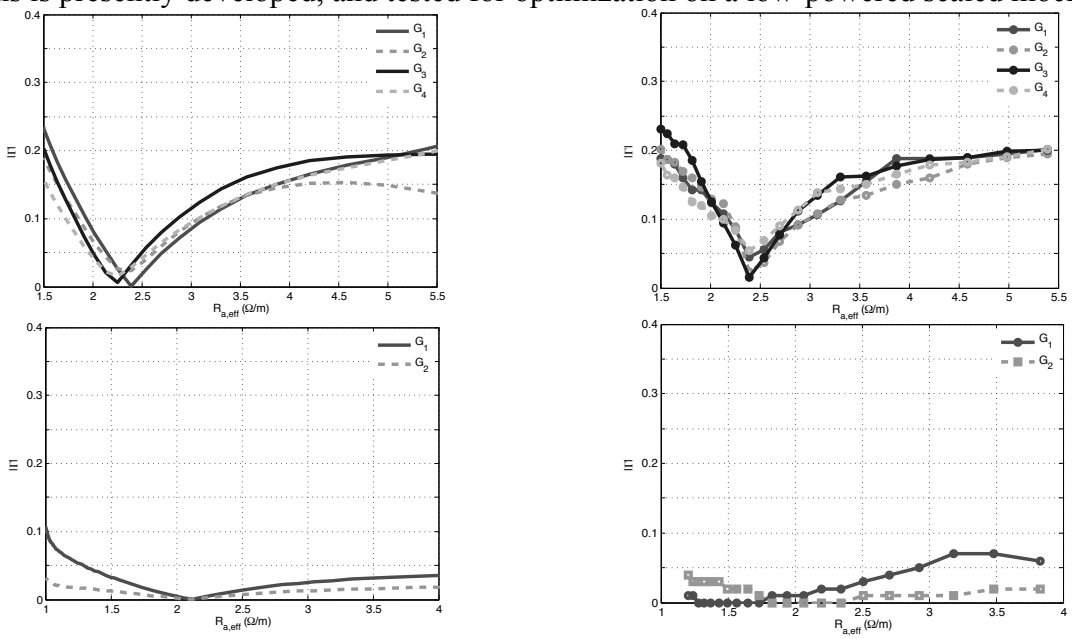


*Figure 1: Load-resilience at the generators ($G_i$): Conjugate-T (top) and 3dB hybrid schemes (bottom); simulations (left) and measurements (right). $|\Gamma|$ is the magnitude of the reflection coefficient at the generators.*

Successful implementation of the simultaneous feedback control of 11 actuators for the matching of the 4CT and for the control of the toroidal phasing has already been achieved [1,2]. The matching and array current control of the 3dB hybrid option is provided by simultaneous feedback control of the decouplers and double stub tuners (23 actuators in total) and is being progressively implemented. The latter has already been successfully tested on half of the array [3]. Fig. 1 displays the obtained magnitude of the reflection coefficient of both matching options for a reference effective antenna resistance $R_{a,eff}$ of approximately 2.5Ω/m using current drive phasing. The load variations with respect to this $R_{a,eff}$ represent the excursions and hence, the load-resilience of each matching scheme. The article goes into the details of the automatic feedback implementation and covers the developed control systems and employed algorithms.

[1] A. Messiaen et al., Nuclear Fusion, 29, 2009, 055004
[2] D. Grine, Thesis Ghent University; LPP-ERM/KMS lab. Report, 2008, no 134
[3] D. Grine et al., Proceedings of the 18th Topical Conference on Radio Frequency Power in Plasmas, 2009, 285