

ITER Ion Cyclotron System Design Options and Choices

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The ITER ion cyclotron system is required to deliver 20 MW of power to the plasma for ion heating and for current drive over the 40- to 55-MHz frequency range. It will use one antenna module mounted in an equatorial port. The design has evolved from the baseline design that was done in 2001, which had eight current straps in a 4 (toroidal) x 2 (poloidal) array, with eight rf sources each delivering 2.5 MW. Two antenna concepts are being evaluated at present by the ITER team and members of the international rf community. Both designs have 24 current straps in a 4 (toroidal) x 6 (poloidal) array. Both are designed to use the load-tolerant conjugate-T matching concept that should permit full delivery of power to the plasma even in the presence of ELMy H-mode operation.

The external-match design [1] still requires eight 2.5-MW rf sources. These are combined in pairs to deliver 5 MW to six conjugate-T circuits for load resilience. The matching components are external to but near the antenna. An alternate design does not use a conjugate-T system, but instead uses a series of combiner-splitters (ELM dumps) to protect the rf sources from reflected power. The internal-match design [2] connects two straps poloidally into 12 conjugate-T circuits, and so requires a change in the source requirements to twelve 1.7-MW sources. The matching components are located in a private vacuum region at the rear of the antenna and uses a compact tuning arrangement in series with the transmission lines.

This talk will describe in some detail the design options and the evolution of the different designs, and will discuss the pros and cons of the concepts. Future design work and R&D will be needed and will be described. More details of the antenna designs and transmission line and matching system options [3] will be found in the references.

[1] P. U. Lamalle, “Status of the ITER ICRF system design - ‘Externally Matched’ option”, this conference.

[2] G. Agarici et al., “Mechanical design proposal of an Ion Cyclotron Resonant Heating antenna for ITER”, this conference.

[3] D. A. Rasmussen, “ITER ICH Transmission Line Tuning and Matching System”, this conference.