Current Monitoring System for ITER Like ICRH Antenna (P3-B-196)

Arnaud Argouarch

Association Euratom CEA, CEA/DSM/DRFC Cadarache 13108 St Paul Lez Durance France

On TS antennas, the power transfer optimization from ICRH antenna to Plasma load is performed using feedback internal matching system [1] [2]. Experimental handling is required to mach the reactive impedance accordingly to the fluctuant plasma loading. As part of the development of the new ICRH prototype antenna, an additional measurement system based on Rogowski coils was developed to monitor the current distribution in antenna straps. The objective is to control module and phase of the antenna current straps with measurement provided by the coil system. Matching capacitors values, generators power and phase can also be controlled using the output of the devices, improving the real time matching control of the array.

This paper details the new measurement layout, the Rogowski coil, and the whole system connected on each strap design for RF currents measurement between 40 MHz – 60 MHz for maximum amplitude of 1 kA. On the new ICRH prototype antenna [3], the measurement coils are coupled to the point where the strap currents are short circuited to the frame. The module and phase measurements are performed with the coils by direct magnetic induction in a vacuum and high temperature environment.
Also, the Rogowski coils were characterized at low level power with vector network analyzer and the design adapted in order to obtain a controlled and reproducible gain in the desire bandwidth. The transconductive function is established with an experimental gain near -80 dB between primary circuit and inductive signal generated by the Rogowski coil. In a second step, the system with its associated electronic was qualified under high RF power.

First results with high RF current (closed to 500 A at 57 MHz) match the desire Rogowski coil response. Compromises with electrical response at low power level and the coil under thermal/RF stresses were the most challenging part of the development.
The overall response of the system and the current module/phase measurements are promising. A proper use of this new instrumentation improve significantly the antenna matching capability by allowing a direct RF current monitoring.