

AN ICRH ARC PREVENTION SYSTEM

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The problem of the of voltage breakdown occurrences in Ion Cyclotron Heating (ICH) systems is important in long pulse, in-vessel, water cooled launching structures, where the energy dissipated in undetected arcs may cause coolant spillage and severe hardware damage.

Several automatic arc detection/suppression systems have been proposed. All of them rely on the fast detection of a developed arc and a RF power suppression for a period thought sufficient for the arc to clear [1].

In this paper we propose a launching structure and a monitoring system which, on one hand, could in principle provide a reliable arc detection signal, essentially independent of the arc position and, on the other one, the measurement of the current flowing in the arc, which could be used for a controlled power reduction at a level sufficiently low for the arc to clear at an early stage, before full development.

The launching structure integrates a tuning system featuring one single adjustable element per radiating strap, and a set of vectorial detectors from which the real-time resistive and reactive impedance of each strap can be deduced when in normal operation, or arc parameters and position computed in the case of voltage breakdown.

The structure features a constant power transfer efficiency over a wide frequency range, phased operation for heating and current drive operation in the usual four straps array configuration, low on-strap and maximum in-vessel electric field, and a topology favourable for water cooling.

In the paper a general analysis of the proposed structure is provided and its performances compared with a more usual array of short circuited straps connected in parallel.

[1] G. Berger-By, B.Beaumont, G.Lombard, L.Millon, P.Mollard, D. Volpe: Arc security system based on harmonic detection for the Tore Supra ICRH transmitter, Fusion & Engineering Design Vol 82 - 716, (2007)