Seminar

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Institute for Plasma Research

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Title: Design and Simulation of matching network for Ion cyclotron wall conditioning (ICWC)

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Date: 02nd September 2024 (Monday)

Time: 03.30 PM

Venue: Seminar Hall, IPR

Abstract

Ion Cyclotron Wall Conditioning (ICWC) is a vital technique employed in superconducting tokamaks to prepare and maintain plasma-facing components, ensuring efficient and stable plasma operations. This method harnesses radiofrequency (RF) waves at the ion cyclotron frequency to enhance plasma-wall interactions, effectively facilitating the removal of impurities such as oxygen and carbon from the tokamak walls. The conditioning process involves generating a low-density plasma within the tokamak, which, under the influence of ion cyclotron resonance (ICR) heating, increases the energy of ions in resonance with the RF waves. These energized ions bombard the walls, sputtering impurities and thereby reducing the contamination of the main plasma.

ICWC is included in the functional requirements of the ion cyclotron resonance heating and current drive (ICRH&CD) system, which is composed of several sub-components that contribute to the efficient generation, control, and application of RF waves for wall conditioning. In this study, we focus on the design and simulation of an ICRH matching network, which includes elements such as stub tuners, phase shifters, and antennas. This network is designed to ensure that RF power is efficiently transferred from the transmission lines to the antenna system by minimizing reflections and maximizing power coupling. It adjusts the impedance of the system to match the varying conditions within the plasma, a critical requirement for maintaining the stability and effectiveness of the ICRH system in the variable environment of a tokamak. Additionally, we have designed and fabricated a two-way coaxial RF switch that can be utilized in SST-1 and Aditya-U tokamaks for various applications.