Seminar

Institute for Plasma Research

Title : Assembly of Michelson Interferometer Diagnostics with Acquisition & Signal Processing of Calibration Data

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Time : 11:30 AM

Venue : Committee Room 3, (New Building), IPR

Abstract :

The installation of Michelson interferometer diagnostics has been carried out at IPR. The diagnostics will measure the ECE spectrum in the spectral range 70–500 GHz and determine broadband plasma temperature profile in SST-1 tokamak. Various aspects of diagnostics installation and basic operation principle have been explained. A Wave Collection and Transport System (WCTS) to transport the electromagnetic waves from SST-1 tokamak to Michelson interferometer (MI) diagnostic has been designed and simulated using the CST Microwave Studio. Operating frequency range of the MI diagnostic is 70-500 GHz. To reduce propagation losses oversized waveguides (WR-284) were selected over the fundamental waveguides. The overall losses of the system reduce significantly on using oversized waveguides while introduction of higher order modes is a major drawback in using oversized waveguides. The diagnostic is calibrated before measurements and this is done in two phases. The first phase of the calibration process is done in-lab using ambient source at room temperature and cold source at 77 K. The second phase of the calibration is done in the tokamak hall considering the losses of all the waveguides and transmission line components. A high temperature source is required for the second phase of calibration to improve the poor signal level and reduce the averaging time. The entire calibration process is done with Hot / Cold technique and two blackbody sources at two different temperatures are required. It is essential to characterize multiple black body target materials and identify suitable materials for developing the required sources for calibration. Also, due to limited availability of high temperature target materials, a new source has been developed which exhibits black body properties at high temperature. Characterization of the target materials has been done by measuring their monostatic transmission and reflection. To gain knowledge on the scattered power by the targets, characterization of black body materials has been performed. This work also presents the results of the characterization of different blackbody target materials and a comparative study has been carried out. In-lab calibration of the Michelson interferometer has been carried out successfully and validation measurements have been done with monochromatic source. The results of in-lab calibration and measurements with monochromatic source have been presented in the thesis.