

Design, simulation, and testing of microwave interferometer to measure line integrated plasma density in low aspect ratio machine assembly (STARMA)

Abstract

To characterize ECR-produced plasma in a simple tight aspect ratio machine assembly (STARMA), electrostatic probes are routinely employed to measure plasma density. The plasma density measurement employing microwave interferometry is required to support the probe measurement in the STARMA device. Microwave interferometry is a non-invasive tool to measure plasma density accurately in a hostile plasma environment. Microwave interferometer utilizes microwave source, isolator, power divider, mixer amplifier, waveguide, transmitting and receiving antenna, etc. As the microwave passes through the plasma column, there is a phase change of the probing signal with respect to the reference signal. The plasma density is proportional to the phase difference acquired by the probing signal with respect to the reference signal. Finally, the plasma density is extracted from the phase information.

Objectives:

- Design development of the interferometer diagnostics based on the microwave component available in the lab.
- Functional testing and characterization of each individual diagnostic component.
- Assembly of hardware components and combined testing of the diagnostics.
- Data analysis, measurement of the plasma density from phase information

Scope of the work:

- Student needs to learn basic concepts of microwave hardware components like VCO, low noise amplifier, frequency multiplier, mixer, horn antenna etc.
- Student needs to learn fundamentals and working principle of the interferometer diagnostic system by reading reports/research-papers
- Student will be required to perform functionality test and characterization of the above-mentioned components in laboratory.
- Student required to learn Simulink Matlab /CST/COMSOL to simulate the performance of the hardware components.
- Student will be involved in experiments and measurements of plasma density from phase information.
- Writing of the project report.

Expected outcome:

- A new diagnostics to measure line integrated pla

Academic Project Requirements:

1) Required No. of student(s) for academic project: 1

2) Name of course with branch/discipline: B.E./B.Tech. Other

3) Academic Project duration:

(a) Total academic project duration: 26 Weeks

(b) Student's presence at IPR for academic project work: 3 Full working Days per week

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