

Developing a Feasible Solution for Controlling the Initial Phase of VF Current Profile for ADITYA-U

Abstract

Background:

The vertical field (VF) current profile plays a pivotal role in tokamak plasma operations, as it governs the plasma current profile throughout the pulse. During the initial phase of plasma evolution, particularly the plasma current ramp-up stage, maintaining equilibrium and achieving a stable plasma column is crucial for ensuring high plasma performance.

To match the high ramp rate of plasma current during this phase, the VF current must also be ramped up at a corresponding rate. Currently, the VF power supply utilizes a 12-pulse converter and a pre-charged capacitor bank. While the present setup supports a pre-defined discharge profile, it falls short in achieving the desired increase in the initial current slope, which is essential for higher plasma current. Preliminary efforts, such as connecting a combination of series pre-charged capacitors, have been explored but require further refinement.

Objective:

This project aims to identify a practical and feasible solution to enhance the initial ramp-up phase of the VF current. The solution will involve detailed simulations using real experimental data and, if successful, may extend to practical implementation.

Scope of Work:

1. Analyse the limitations of the existing VF power supply system.
2. Conduct simulations using tools like MATLAB/PSIM/Multisim to model the VF current ramp-up phase.
3. Propose and validate a solution to increase the initial ramp-up phase while keeping the source voltage constant.
4. Assist in implementing the solution if the simulations yield satisfactory results.

Expected Outcomes:

- A validated, practical solution for improving plasma operation during the initial VF current ramp-up phase.
- Simulation results based on real experimental data.

This project offers students an excellent opportunity to gain practical experience in electrical systems, simulation tools, and plasma operation, contributing to the tokamak plasma research.

Academic Project Requirements:

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

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

3) Academic Project duration:

(a) Total academic project duration: 25 Weeks

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

**Email to: shivam.gupta@ipr.res.in[Guide's e-mail address] and
project_ee@ipr.res.in [Academic Project Coordinator's e-mail address]**

Phone Number: 079 -07923962270 [Guide's phone number]