Tipo di tesi: Laurea Magistrale
Corso di Laurea: Fisica
Tipologia: Modellistica
Titolo della tesi: Peeling-ballooning stability of DTT plasmas with Resonant Magnetic Perturbations
Proponente: Leonardo Pigatto
Relatore Accademico: Tommaso Bolzonella
Capogruppo: David Terranova

Argomento della tesi:

The present thesis focuses on studying the optimization of the 3D magnetic boundary in perspective DTT plasmas by means of external magnetic fields from saddle coils. A set of non-axisymmetric coils is presently being developed for the I-DTT tokamak, with the main purpose of Edge Localized Modes (ELMs) mitigation and Error Field (EF) control.

ELMs are local Magneto-Hydro-Dynamic (MHD) instabilities that appear in fusion relevant plasmas during the so-called H-mode operation. This consists in an increased confinement regime triggered when a Tokamak plasma is operated with sufficient auxiliary heating, with respect to a purely ohmic plasma (examples of auxiliary heating can be neutral beam, electron cyclotron, ion cyclotron). The destabilization of ELMs is linked to the pressure (and pressure gradient) in the peripheral region of the plasma, where a transport barrier, responsible for the improved confinement, is formed.

Spurious magnetic fields, known as error fields (EFs), are inevitably present in fusion devices and can be associated with either stationary non-symmetric electromagnetic sources or with transient phenomena inducing eddy currents in asymmetric geometrical features of a specific machine. Correction of Error Fields (EF) is a task of primary importance for operating fusion devices, in order to maximize performance and avoid undesirable disruption events.

The thesis proposes a modeling activity on plasma scenarios foreseen for the operation of the DTT machine, which is being designed for construction in Frascati (Italy). The student will build experience in one of the most challenging topics for operating a modern Tokamak device, the study will be relevant to address design and operation issues for DTT in particular. The thesis will explore the effect of external magnetic perturbation recipes developed for the aforementioned purposes of ELM and EF control, on a selection of perspective DTT operational scenarios. The final goal is to provide useful insight on plasma stability for present integrated modeling and future plasma operations.

Competenze richieste (se necessarie):
Ambienti Python e Matlab
Conoscenza degli argomenti trattati nei seguenti corsi della Laurea Magistrale in Fisica:
- Physics of fluids and plasmas
- Physics of nuclear fusion and plasma applications

Data della proposta: 23/11/2021

Stato: non assegnata

Laureando/a: (quando sarà assegnata)