

Title : [Advanced physics for Tokamaks](#)

Acronym : C1

EU Coordinator : Rémy GUIRLET, Yanick SARAZIN (CEA/IRFM)

Teaching staff : Rémy GUIRLET, Julien HILLAIRET, Pierre MANAS, Jorge MORALES, Eric NARDON, Rémy NOUAILLETAS, Bernard PEGOURIE, Cédric REUX, Yanick SARAZIN, Alexandre TORRE

Pre-requisites : First year of MSc in Physics or Engineering Schools.

Credits : 3 ECTS

Language : French/English

Keywords : Thermonuclear magnetic fusion -Tokamak - Reactor sizing - Energy efficiency – Hot plasmas.

The ambition of this module is to give students an integrated vision of the tokamak, to make tangible the interdependence of plasma physics, plasma-wall interaction, materials and superconductors in the definition of the characteristics of a fusion reactor.

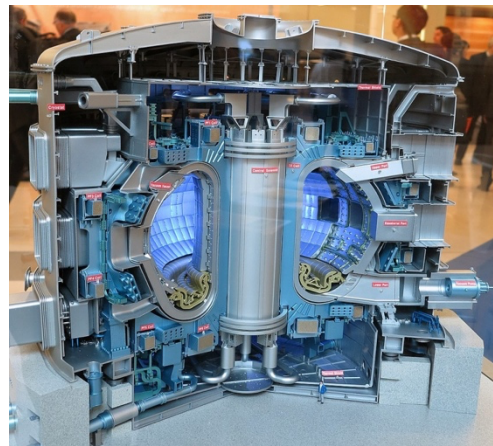
The method consists in answering the following question: how to "size a tokamak" given the objectives assigned to it, mainly in terms of fusion power and energy efficiency? The work is done in small groups supervised by CEA/IRFM researchers.

The first two days are devoted to lectures that explain the topics studied during the following stages and the working methods (in particular the scaling laws, the operational regimes and the plasma-wall interaction).

In the first step of the group work, fusion performance goals and some constraints are given to all groups. Each group determines the best "engineering" parameters of the tokamak (torus radius, plasma current, magnetic field...) that allows to reach the objectives. For this, we use the scaling laws that relate the performance of a tokamak (for example the energy confinement time in the plasma) to the "engineering" parameters of the tokamak.

In the second stage, each group is tasked with examining a question of particular engineering or physical importance: the means of heating the plasma, magnetohydrodynamic equilibrium and turbulence, impurities and radiation, particle and heat fluxes on the enclosure components, sizing of the superconducting coils, etc. Each group is supervised by a subject expert.

During all the group work, the supervisors are present and available. During the two weeks, the students are encouraged to interact with the other groups and to interview all the CEA/IRFM researchers who can help them in their work.



Vue interne d'un Tokamak