# Thesis proposal:

*Development of a multi-physical model for the quench analysis in the DTT Toroidal Field Coil Cold Test Facility*

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# Motivation and framework

- This thesis work is inserted in the international research effort towards the production of fusion electricity
- DTT will be a fundamental experiment to test specific components of a fusion reactors in support to the EU DEMO design.
- DTT is a fully superconducting tokamak and reliable analysis on the magnet behavior in normal and off-normal condition is of key importance
- To verify the coil performances a cold test facility will be soon built in Frascati
- In this thesis work the analysis of a quench of the TF coil within the cold test facility will be implemented and in perspective results will be validated against the experimental data.
- To obtain reliable results several physical aspects must be considered including Thermal-Hydraulics (TH), Electrics (EL) and Electro-Magnetism (EM)

**COLLABORATIONS** → ENEA

# Thesis structure

- **EL modeling:**
  - Develop a suitable object oriented model of the DTT TF coil power supply system including fast discharge units (FDUs) to properly evaluate the coil current
- **EM modeling:**
  - Compute detailed eddy current power deposition in the coil casing during the transient using the open source finite element tool developed @ PoliTo 3D-FOX
  - Optional → estimate the importance of considering the eddy current power deposition in the conductor jacket as well
- TH modeling:
  - Using the input coming from previous steps run a TH simulation using the 4C code (developed @ PoliTo) of the coil quench and assess the coil maximum pressurization and hot spot temperature