Contribution ID: **836** Type: **Poster Presentation of 1h45m**

Quench simulation of a DEMO TF coil using a quasi-3D coupling tool

Tuesday, 29 August 2017 13:15 (1h 45m)

In the framework of the EUROfusion DEMO project, studies are conducted in several European institutions for designing the tokamak magnet systems. In order to generate the high magnetic fields required for the plasma confinement and control, the reactor should be equipped with superconducting magnets, the reference design being based on Cable-In-Conduit Conductors (CICC) cooled at cryogenic temperatures by forced circulation of supercritical helium.
In order to be compatible with DEMO requirements, a proposed toroidal field (TF) winding pack (WP) design should satisfy the criteria in operation and off-normal conditions. Quenches are studied to ensure that the proposed conductor design and associated quench protection system guarantee the integrity of the magnet; it is of most importance since it is a matter of safety and protection of the device.
Quench propagation in a coil is a 3-dimensional problem. For this reason, a transient pseudo-3D modelling tool was developed for coupled thermal and thermo-hydraulic calculation in a tokamak superconducting coil. The coupling tool is based on a set of 1D models of the cable using the THEA code, considering the helium flow, thermal conduction in the strands and propagation of the quench along the conductor; the 2D transverse thermal diffusion across turns and pancakes is modelled using the Cast3M code, considering the conductor jacket and insulation, and eventually casing structures, on a selected set of cross-sections along the D-shape coil.
The aim of the analysis is to assess the quench behaviour of the CEA proposal for DEMO TF coil. The hotspot temperature, as well as the maximal pressure and normal length evolution are evaluated on a realistic quench scenario, emphasizing the impact of transverse heat diffusion.

Submitters Country

FRANCE

Primary author: Mr LE COZ, Quentin (CEA/IRFM)

Co-authors: Mr CIAZYNSKI, Daniel (CEA/IRFM); Mr COLEMAN, Matti (EUROfusion); Mrs CORATO, Valentina (ENEA); Mr LACROIX, Benoit (CEA/IRFM); Mrs NICOLLET, Sylvie (CEA/IRFM); Mr NUNIO, François (CEA/IRFU); Mrs VALLCORBA, Roser (CEA/IRFU); Mr ZANI, Louis (CEA/IRFM)

Presenter: Mr LE COZ, Quentin (CEA/IRFM)

Session Classification: Tue-Af-Po2.03

Track Classification: B1 - Superconducting Magnets for Fusion