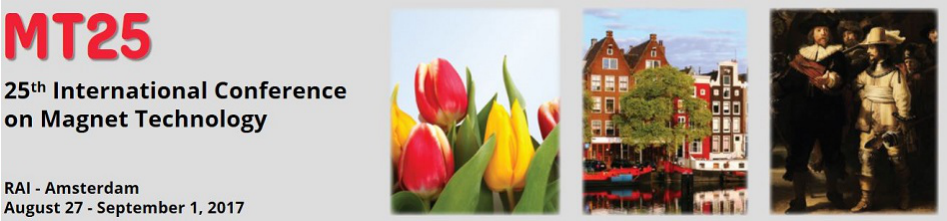

Contribution ID: **733** Type: **Poster Presentation of 1h45m**

Development of a 2D simplified tool for the analysis of the cooling of the ITER TF winding pack

Thursday, 31 August 2017 13:45 (1h 45m)

The cooling of the ITER Toroidal Field (TF) coils winding pack is guaranteed by the circulation of supercritical Helium (He) in 134 Nb3Sn Cable in Conduit Conductor (CICCs) and in 74 channels devoted to the cooling of the Stainless Steel (SS) case supporting the winding pack. A simplified tool aimed at computing the temperature distribution and the He temperature in the cooling channels of the TF winding pack has been developed. The advantage of this tool, which is based on 2D FE thermal analyses and has been entirely developed inside ANSYS with the APDL language, is that is able to provide in a relatively fast time the temperature reached by He during plasma operation. The heat load that has been considered is the volumetric nuclear heating computed with the MNCP code in 32 poloidal segments in which each TF coil has been divided. For each segment, a FE model has been built and a thermal analysis carried out by applying the corresponding heat load. The Heat Transfer coefficient (HTC) of the He flowing in the CICC and in the cooling pipes of the SS case is calculated with Dittus Boelter correlation, taking into account the pressure drop computed with the Katheder correlation. The He is assumed to enter the coil at 4.2 K in the lower terminal junction. Several steady state analyses have been done considering the baseline pancake wound configuration, and two ideal layer wound configurations. In these analyses the bulk temperature in all the CICCs in each of the 32 segments is calculated by means of enthalpy balance between segments, taking into account the actual direction of He circulation. In a second step, transient analyses of the pancake-wound and layer-wound configurations have been also carried out, considering the actual ramp up and ramp down of the nuclear heating.

Submitters Country

Spain

Primary authors: Dr CAU, Francesca (Fusion for Energy, F4E, Barcelona, Spain); FORTE, Ruggero (2Dipartimento di Energia, Ingegneria dell'Informazione e Modelli Matematici (DEIM), Università di Palermo)

Co-authors: Dr PORTONE, Alfredo (Fusion for Energy, F4E); DI MAIO, Pietro Alessandro (2Dipartimento di Energia, Ingegneria dell'Informazione e Modelli Matematici (DEIM), Università di Palermo)

Presenter: Dr CAU, Francesca (Fusion for Energy, F4E, Barcelona, Spain)

Session Classification: Thu-Af-Po4.02

Track Classification: B1 - Superconducting Magnets for Fusion