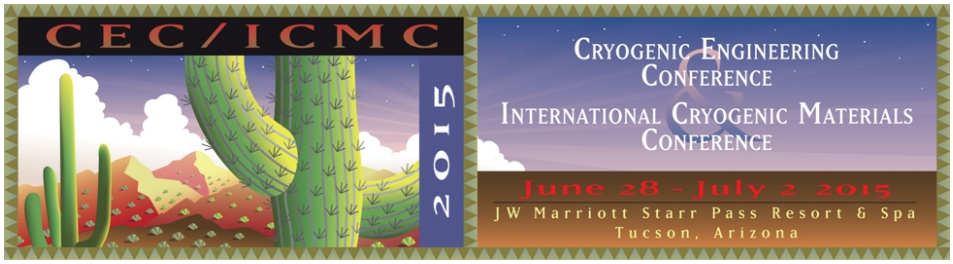

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Thermal-hydraulic analysis of transients in the HELIOS loop including a CICC section

Wednesday, 1 July 2015 09:00 (2 hours)

The HELIOS facility at CEA Grenoble is a supercritical helium (SHe) loop for the study of pulsed heat loads effects on the cryogenic cooling system as typical of superconducting tokamak operation. In order to avoid instabilities in the refrigerator, mitigation strategies with a thermal buffer have been investigated to smooth the pulsed heat loads.
In the standard HELIOS configuration no cable-in-conduit conductors (CICC) are present and the pulsed heat loads are generated through electrical heaters wrapped around a section of the cryolines. In such configurations the 4C code was shown in the recent past [R. Zanino et al, CEC 2013] to be able to accurately reproduce and even predict the thermal-hydraulic behaviour of the HELIOS loop in different configurations.
In the present work, the heated pipes are substituted in the 4C HELIOS model by an equivalent multi-channel volume made of JT-60SA CICC. The model is then used to highlight the differences between simple heated pipes and an actual magnet wound with CICCs, checking the representativity of the present HELIOS configuration. New drivers are used such as the non-homogeneous distribution of the heat loads on the multi-channels. Their effects on the dynamic behaviour of the SHe loop (pressure, temperature, mass flow) are studied with the new model. The results of the present work will highlight new features which do not arise in the present HELIOS configuration: redistribution and additional smoothing of the pulsed heat loads, distribution of the flow in multi-channels (bundles and central channels) in parallel, local acceleration/deceleration of the flow when pulsed loads are applied on the CICC strands and jacket.

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