Contribution ID: **689** Type: **not specified**

P2.117 Coupled fluid-structure thermofluid-dynamic analysis of the DEMO divertor cassette body equipped with a liner

Tuesday, 18 September 2018 11:00 (2 hours)

Within the framework of the Work Package DIV 1 - "Divertor Cassette Design and Integration" of the EUROfusion action, a research campaign has been jointly carried out by University of Palermo and ENEA to investigate the thermal-hydraulic performances of the DEMO divertor cassette cooling system. The research activity has been focussed onto the most recent design of the Cassette Body (CB) cooling circuit equipped with a Liner, whose main function is to protect the underlying vacuum pump hole from the radiation arising from the plasma. The research campaign has been carried out following a theoretical-computational approach based on the Finite Volume Method and adopting the commercial Computational Fluid-Dynamic code ANSYS-CFX.

The CB thermal-hydraulic performances have been assessed in terms of coolant and structure temperature, coolant overall pressure drop, flow velocity distribution and mass flow rate fed to the Liner cooling circuit, mainly in order to check coolant aptitude to provide a uniform and effective cooling to both CB and Liner structures.

The outcomes of the study have shown some major criticalities, mainly in terms of water coolant vaporization as well as of non-symmetric coolant distribution between the two Liner inlets. As a consequence, the following potential solutions have been successfully explored in order to allow the CB to safely operate complying with its design constraints:

• revising the CB design layout in order to increase the coolant mass flow rate fed to Liner;

• increasing coolant inlet pressure to rise water saturation temperature and, hence, its margin against vaporization;

• increasing coolant mass flow rate to reduce its overall thermal rise.

The main results and the achieved optimized model are herewith described and critically discussed.

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Session Classification: P2