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P4.183 Steam Generator mock-up design and testing suitable for Pb-Li technology demonstration and code assessment

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One of the main challenges for DEMO is to overcome the Power Conversion System (PCS) issues for a pulsed reactor. PCS is a complex system where the secondary circuits, connected to the Primary Heat Transport Systems (PHTS), should be integrated into an industrial and reliable system based, as much as possible, on proven technology. PCS should be designed to remove heat from PHTSs, during pulse phase and during the Dwell time, for a thermal power conversion to electricity, possibly with high efficiency.
Dual Coolant Lithium Lead (DCLL) concept is based on two coolant fluids flowing into two independent circuits: a helium circuit which oversees cooling the FW and some BB structural materials and a PbLi circuit removing the heat generated in the BZ. The heat from PbLi is used to produce steam by means of an innovative steam generator, that requires experimental tests to demonstrate the technological feasibility and performance evaluation.
The objective of the activity is to support the design of a LiPb steam generator and an experimental campaign defining the test matrix and the expected outcomes. Two configurations are analysed: the Steam Generator Bayonet Tube (SGBT) and the Helical Coil Steam Generator (HCSG). The first phase of the activity was dedicated to the evaluation of the steam generators performance, using a modified version of RELAP5/MOD3.3 (R5), which allows to identify the reference configuration for each typology. R5 has been modified to evaluate a correct two-phase heat transfer in helical coils.
After that, the CIRCE facility at ENEA Brasimone RC was selected to investigate the steam generators capability, carrying out the experimental campaign for the mock-ups of the two configurations.
HERO (Heavy liquid mEtal – pRessurized water cOoled tube) was identified as mock-up for the SGBT and conceptual design of the HEX mock-up was carried out using R5.

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