IFERC Newsletter

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Status of DEMO Design Activity

Highlights on BB design and T extraction and removal

Concerning the development of conceptual Breeding Blanket (BB) design, the definition of the requirements (e.g., Tritium Breeding Ratio, safety, reliability, maintenance, dimension, and position) continued, as well as the definition of the load specification document for both EU and JA. A cylindrical concept with a Beryllide ($Be_{12}Ti$) block was further explored as the JA DEMO BB design. The thermo-structural integrity was evaluated, and it was found that the primary and secondary stress values for the enclosure structure were below the allowable stresses in all evaluation lines, and the stress values for the beryllide blocks were found to be below the high-temperature compressive failure stress values of beryllide block. Regarding the evaluation of JA DEMO load specifications, issues related to electromagnetic force analysis codes have been assessed by reviewing and validating the past work on a ferromagnetic structure deformation under a uniform magnetic field. FEM analysis was performed on the 9Cr-1Mo thin beam plate in order to validate the conclusions reported in findings before 2000. FEM analysis under various magnetic field conditions was conducted, and more extensive deformation was observed under the stronger magnetic field with higher penetration angle and magnetic field gradient, as shown in Fig-1. Thus, it was concluded that the conclusion derived from the previous 2-degree gradient uniform field calculation is incorrect.

On the EU side, studies on the integration of Electron Cyclotron Heating (ECH) system within the Central Outboard Blanket (COB) segment have been performed. In the current configuration, the ECH is assumed to be positioned in the equatorial port of DEMO, so a purposely designed cut-out has been realized to host the ECH system, as reported in Fig-2. Results obtained show that the modified segment is still able to fulfil RCC-MRx criteria with the exception of that considering thermal stresses, mostly due to the BB attachment layout, currently under re-design. These results indicate that the conceived geometric layout is still able to safely withstand the pressure loads and the self-weight, even though the structure has been heavily modified to allow the ECH system integration. The second remarkable activity carried out concerns the adoption of a different Double Walled Tube (DWT) layout, with the aim of assure the BZ cooling while reducing both the number of tubes (and then weldings) as well as the water content in the BZ in view of a TBR maximization. It consists of 6 couples of helical-shaped DWTs, each one positioned between two vertical stiffening plates or between the side wall and a vertical stiffening plate.

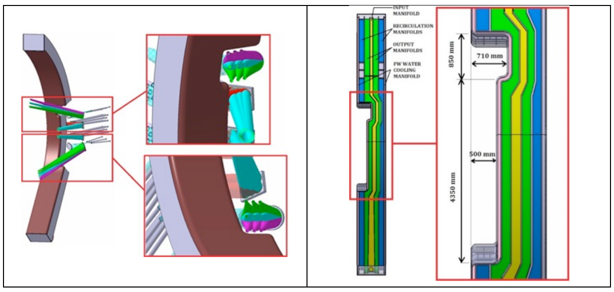

Fig-2: View of the BB COB segment with the integration of the ECH system.

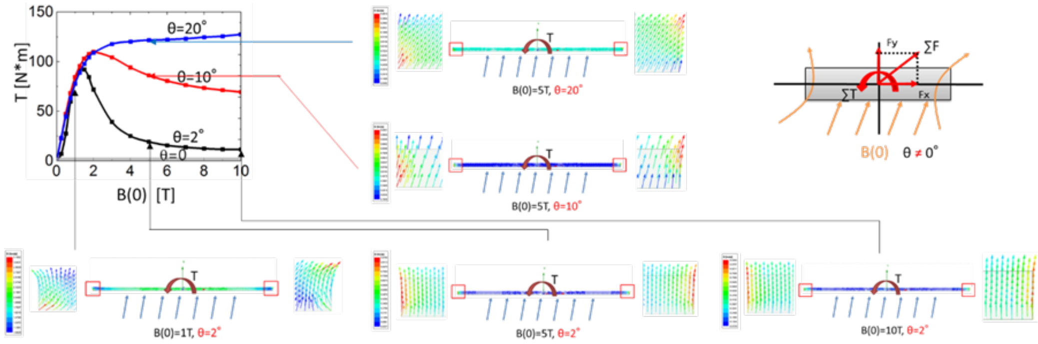

Fig-1: Torque on beam plate by FEM analysis

(DEMO Design Task-3 TROs)