

Advancements in the HELIAS 5-B breeding blanket structural analysis

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Within the framework of EUROfusion consortium, the Work Package S2 aims at developing the HELical-axis Advanced Stellarator (HELIAS) as a possible long-term alternative to a tokamak DEMO. From the plasma physics standpoint the most promising concept is the HELIAS 5-B machine, a large 5 field period stellarator reactor directly extrapolated from Wendelstein 7-X. An intense research campaign has been launched at KIT in order to attain a preliminary design of the HELIAS 5-B breeding blanket (BB), taking into account as initial input the design experience acquired in the pre-conceptual design phase of the tokamak DEMO BB. To this end, the Helium-Cooled Pebble Bed (HCPB) breeding blanket concept has been considered, focusing on the investigation of the suitability of its main structural features to the stellarator geometry. Design requirements coming from the Remote Maintenance have been taken into account in order to orient the blanket segmentation and a more sophisticated assessment of the BB modules structural behavior has been performed. Attention has been also paid to the refinement of the numerical models so far adopted, investigating the impact of some assumptions on the obtained results. The achieved advancements in this HELIAS 5-B BB design are herewith presented and critically discussed, indicating a possible way for the follow up of this activity.

Keywords: HELIAS, stellarator, breeding blanket, thermomechanics, FEM analysis

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