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P2.185 Nuclear analysis of the HCLL “advanced-plus” breeding blanket with single module segment structure

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In the framework of the Horizon H2020 program, the European consortium EUROfusion develops a conceptual design of a fusion power demonstrator (DEMO) with the capability of generating several hundred MW of net electricity and operating with a closed fuel-cycle by 2050. The breeding blanket is one of the key components of DEMO. It must ensure tritium self-sufficiency and heat removal functions. In this framework CEA, with the support of Wigner-CR and IPP-CR, is in charge for the design of the Helium Cooled Lithium Lead (HCLL) blanket. It uses the liquid lithium lead eutectic as tritium breeder and neutron multiplier and helium gas as coolant for both the Eurofer structure and the breeder. This paper presents the nuclear analysis carried out with the TRIPOLI-4® Monte-Carlo code for the HCLL “Advanced-Plus” breeding blanket design using the Single Module Segment (SMS) option in the European DEMO 2017 baseline. This baseline is characterised by a reduced outboard thickness for a better plasma stability. Compared to the former baseline outboard thickness is reduced by 30 cm. Previous study has quantified its impact on Tritium Breeding Ratio (TBR reduction up to -0.08). This major constraint lead to the need of SMS solution development with HCLL “Advanced-Plus” design to reduce the amount of steel in the breeding blanket for TBR improvement. HCLL “Advanced-Plus” design is the last HCLL reference design currently developed with the aim to improve the TBR. The main nuclear quantities: TBR, nuclear heating, neutron flux, displacement damage and helium production will be reported and discussed.

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