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Integration of the Neutral Beam Injector System into the DCLL breeding blanket for the EU DEMO

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The integration of plant systems involving penetrations into the in-vessel components, like H&CD, fuel cycle and diagnostics, is a complex task constrained by top level requirements of remote maintainability and high reliability. Within the EUROfusion PPPT Program, some activities are ongoing to assess the integration of different systems into the breeding blanket, specifically NBI, ECRH launchers, diagnostics sightlines, fueling lines and specific protections for the FW (like start-up limiters).
This work describes the integration of the Neutral Beam Injector (NBI) system into the Dual Coolant Lithium-Lead (DCLL) breeding blanket for the EU DEMO. After identifying the major issues impacting the mechanical, thermal-hydraulic and neutronic behavior of the blanket, the integration efforts have been focused on minimizing the invasiveness of the NBI system and exploring different NBI options for the best compromise between plasma heating and breeding blanket performance. This paper describes the adaptation of the DCLL breeding blanket design to allocate the neutral beam duct. A particular attention is devoted to the redistribution of breeding and shielding functions, the new path of fluid circuits and the additional cooling needs.
The consequences of design modifications on key neutronic aspects like Tritium Breeding Ratio (TBR) and shielding capability are addressed. Besides, after a brief discussion regarding the thermal loads transferred to the breeding blanket walls from the neutral beam and the plasma, a preliminary thermal assessment of the proposed integration solution is presented.

Eligible for student paper award?

No

Authors: Dr FERNÁNDEZ-BERCERUELO, Iván (CIEMAT); Dr RAPISARDA, David (CIEMAT); Dr PALERMO, Iole (CIEMAT); Mr R. URGORRI, Fernando (CIEMAT); Mr AGOSTINETTI, Piero (Consorzio RFX (CNR, ENEA, INFN, Università di Padova, Acciaierie Venete SpA)); Dr CISMONDI, Fabio (PPPT Department, EUROfusion Consortium); Dr DE ESCH, Hubert P.L. (CEA-Cadarache); Dr IBARRA, Angel (CIEMAT)

Presenter: Dr FERNÁNDEZ-BERCERUELO, Iván (CIEMAT)

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