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P3.153 Nuclear analysis for the Preliminary Design Review of the ITER Equatorial Port #12

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The ITER Equatorial Port #12 is a first plasma port, which has undergone the Preliminary Design Review (PDR) in November 2017. In support of the PDR, the following nuclear analyses have been conducted: i) the nuclear heat has been calculated in the port plug, as one of the principal thermal loads considered in the design, and ii) the shutdown dose rates (SDDR) have been estimated in the port interspace, in relation to the SDDR requirement of 100 μSv/h (after 106 s of cooling time) to host planned in-situ maintenance activities.
The nuclear heat was determined in a high spatial resolution mesh of 2x2x2 cm3, covering the complete EP#12 port plug and diagnostic systems. In relation to the SDDR, the role played by each system, both in terms of neutron flux leakage and activation, was quantified in matrices of responsibilities. This study was then complemented in the next step, where the neighbor ports were explicitly modelled and the radiation transport and activation were considered in the complete neighborhood of EP#12.
As a result, the thermal loads due to radiation were quantified for the main elements of the EP#12, to be considered in further thermo-mechanical analyses. The calculations have shown that the SDDR in the maintenance corridors of the EP#12 is 189 μSv/h and 182 μSv/h, which is well outside the requirement to host the planned maintenance activities. The role of each system was quantified, indicating that the integration of the Visible – Infrared camera could be optimized. Two radiation cross-talks have been identified: i) a cross-talk from the In-Vessel Viewing System (IVVS) port through the cryostat and giving rise to the SDDR in the right corridor of EP#12, and ii) a cross-talk from both EC-UL ports towards the EP#12 interspace. Conceptual shielding proposals to mitigate the situation were analyzed.

Presenter: KOLSEK, Aljaz (Universidad Nacional de Educaci—n a Distancia)

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