Contribution ID: **117** Type: **not specified**

Neutronic effects of the ITER Upper Port environment update in C-Model

Monday, 17 September 2018 11:00 (2 hours)

The goals of this work are the neutronic modeling of the ITER Upper Port (UP) environment according to the updates of ITER CAD model, the assessment of neutronic effects caused by that update and proposing improvements of the radiation conditions. The update has been applied to the ITER-reference neutronics simulation model called "C-Model" which includes the standard components and generic port plugs. The modifications of UP environment are related to the Vacuum Vessel (VV) UP extension and the port duct. The particular components of the UP environment are the following: VV double and single walls around the Diagnostic Generic Upper Port Plug (DGUPP), UP stub and blanket manifolds, In-Vessel coils (IVC) including Edge Localized Mode (ELM) coils and feeders, and vacuum sealing flange. The neutronics analysis of the newly developed model identified the components which influence predominantly the radiation field at the UP Inter-Space Structure (ISS) where personnel access is anticipated after shutdown. The radiation environment was analyzed in terms of neutron fluxes and Shut-Down Dose Rates (SDDR). High-resolution distributions of the SDDR have been obtained with the R2Smesh method of KIT coupling MCNP radiation transport simulations with isotope inventory calculations using the FISPACT activation code. The material specifications of the model are based on the approved material compositions taking into account the radiological impurity requirements. It improves the reliability of the radiation transport simulations for the assessment of the radiation conditions in the UP area and for the implementation of the ALARA principle for SDDR analysis. In conclusion, several design solutions are proposed to reduce radiation streaming in the direction of the ISS maintenance area.
Disclaimer: This work has been funded by the ITER Organization (IO) service contract IO/17/CT/4300001478. This paper does not commit the IO as a nuclear operator. The model qualification is provided independently of this paper.

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Session Classification: P1

Track Classification: Diagnostics