Investigation of Different Analysis Methods for the Nuclear Heating of the Electron Cyclotron-Heating Upper Launcher Blanket Shield Module

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The electron cyclotron-heating upper launcher (ECHUL) will be installed in four upper ports of the ITER tokamak thermonuclear fusion reactor. Each ECHUL is able to deposit 8 MW power into the plasma for plasma mode stabilization via microwave beam lines. These beam lines and other components needed for the guidance of the microwaves are mounted into the upper port plug. In order to protect these components and to mitigate radiation leaving the reactor, several shield blocks are also included in the port plugs design. The ECHUL components which are closest to the fusion plasma are heated by the gamma and neutron radiation and therefore will need to be actively cooled. This paper reports the neutronic analyses performed for the cooling system of the ECHUL blanket shield module (BSM). From the distribution of the nuclear heating in the BSM the validity of its design is confirmed. Additionally, different analysis methods were applied investigating on the one hand the influence of homogenizing the materials of the BSM by removing pipes and cooling circuits for the neutronic analyses. On the other hand the influence of non-identical meshes used for the calculation of the nuclear heating and the heat deposition in the thermodynamic analyses is reported.

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