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P3.231 Neutronics study for DTT tokamak building

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The Divertor Tokamak Test (DTT) facility is a project proposed by the Italian Consortium aimed to test the physics and technology of various alternative divertor concepts in order to design a heat and power exhaust system able to withstand the large loads expected in the divertor of a DEMO fusion power plant.
Even though DTT is a machine operating without tritium, a significant 2.5 MeV neutron yield by deuterium-deuterium (DD) reactions is foreseen. During high performance scenarios a maximum DD neutron yield rate of 1.5⊠1017 n/s is expected and according to the present operation plan, 3.7x1022 neutron will be produced during its lifetime with an annual budget ranging between 9x 1018n and 1.53x1021 n. Furthermore, due to triton burn-up a significant 14 MeV neutron production is also expected (1-2% of the total yield).
Therefore neutronics and activation analyses are fundamental for the design of the machine as well as for licensing, maintenance, decommissioning and waste management.
This work is devoted to preliminary three-dimensional shielding study optimize the DTT building for licensing purposes. Neutron and gamma transport simulations were carried-out with MCNP5 Monte Carlo coupled with FENDL nuclear data libraries code and the ADVANTG tool has been used for the implementation of specific variance reduction techniques. 360° model of DTT machine and building have been developed to assess the spatial distributions of the neutron and gamma fluxes, spectra and effective doses inside and outside the tokamak hall. The results of the shielding study and the impact of building design on radiological protection issues are presented and discussed.

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