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14 MeV neutron streaming calculations for JET-like maze entrance using TRIPOLI-4 Monte Carlo code

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The International Thermonuclear Experimental Reactor (ITER) is currently under construction at Cadarache in southern France. The Joint European Torus (JET) is presently the largest tokamak in the world and the only one capable of using tritium. At JET, D-T fusion experiments will be conducted in 2019 (DTE2) on addressing the future ITER needs and reducing the risks of ITER operations. During the DTE2 operations, 14 MeV fusion neutrons will be generated. One of the aims of the DTE2 neutronics experiments is to investigate the D-T neutron streaming along the penetrations of biological shield of the JET Torus Hall. Continuous-energy Monte Carlo (MC) neutron transport calculations and TLDs measurements were already performed by different teams for the previous D-D neutron streaming benchmark experiments around the JET maze entrance. Using two-step simulation approach, two different calculation ways were performed to decrease the variances of calculated neutron fluence and ambient dose equivalent. Both the MC-MC approach using a midway surface source and the Deterministic-MC one using deterministic improved weight windows produced overestimated C/E results. The TRIPOLI-4 Monte-Carlo transport code has been extensively used on fission neutron radiation shielding analyses. To develop the TRIPOLI-4 application in ITER fusion neutronics, both experimental and computational benchmarks are being performed. In this study, using single-step approach combined with variance reduction (VR) techniques, TRIPOLI-4 shielding calculations were performed for a JET-like maze entrance in order to investigate the D-T neutron streaming from a Torus Hall of 40 m x 40 m x 4.2 m model. The calculation results including dose rate maps, the VR performance, and the user-friendly VR input of TRIPOLI-4 code will be reported in the final paper.

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