Assessment of Gamma Dose during Activated Divertor Moving in the ITER Building

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The divertor system in the ITER [1] exhausts the major parts of the plasma heat and helium ash from the plasma. It is highly activated by D-T neutrons with energy up to 14MeV during operation. When being removed to the hot cell for refurbishments, high intensity gamma will be emitted from the activated divertor, which will cause temporary increase of gamma dose along the pathway. Because of the personal access possibility to some parts of the ITER building and sensitive equipment (including control cubicles and distribution boards) installation in the tokomak hall, assessment of the gamma dose distribution is required for optimizing the design of shielding.

In this work, neutronic model of ITER building was created based on the latest CAD engineering drawings including the tokomak, diagnostic and tritium building by using the automatic CAD/MCNP convertor system MCAM[2]. In order to evaluate the activation of divertor more accurately, the “A-lite” model, which is the latest three-dimensional ITER tokomak neutronics model with 40 degree in toroidal direction, was used in this calculation.

In the calculation, the flux spectrum throughout the divertor was computed by MCNP[3] with FENDL2.1 data library, and the activation of the divertor during ITER operation was calculated by FISPACT with EAF-2007. Then the activated divertor was treated as a gamma source in the tokomak hall, and the gamma dose and heat deposition in electronics equipment was evaluated during the divertor moving in the tokomak hall. A comparison between the results and the regulation limitations has also been made. Further analysis of dose distribution will be performed for shielding design.

The views and opinions expressed herein do not necessarily reflect those of the ITER Organization.

[1] Vienna, Technical Basis for the ITER Final Design Report, Cost Review and Safety Analysis (FDR), ITEREDA Documentation Series No 16, 1998

[2] Y. Wu, CAD-based Interface Programs for Fusion Neutron Transport Simulation. Fusion Engineering and Design 84 (2009) 1987-1992.

[3] Monte Carlo Team, MCNP - A General Monte Carlo N-Particle Transport Code, Version 5,Los Alamos National Laboratory, Report LA-UR-03-1987. 2003.