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P4.225 Development and Validation of Shutdown Dose Rate Calculation in SuperMC

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Accurate calculation of the dose rate level around nuclear facilities after shutdown can provide important reference for the operation and maintenance of nuclear device, and also has important significance for the design of radiation shielding system and the disposal of nuclide waste. In this paper, based on the advanced neutron/photon transport calculation and activation calculation of SuperMC, an internal coupled rigorous 2-step (R2S) shutdown dose rate (SDR) calculation function was implemented.

The internal coupled method avoids tedious data transfer, which accelerated the whole calculation process. The capability to process complex models is enhanced through accuracy homogenization method for multi-material activation mesh based on CAD model. The materials for intersecting meshes which superimpose several cells are calculated by random sampling method using the bounding box data generated based on the CAD model before Monte Carlo particle transport calculation. The flexible sector cylinder activation mesh division method that supports direction angle sampling is implemented. It makes fine, accurate and convenient source specification automatically for any cylindrical mesh.

A validation assessment of internal coupled R2S SDR capability of SuperMC has been performed utilizing the FNG-ITER SDR experiment. The SDR calculation results of SuperMC were in good agreement with the measured values, the variation tendency of SDR along with cooling time calculated by SuperMC is consistent with experimental results. In summary, it preliminarily proved that the internal coupled SDR capability of SuperMC is correct, reliable and easy to use.

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