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Simulation of Photonuclear Neutron Yield on the CSNS Spallation Target and Reflector

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The tantalum cladded solid tungsten is applied as the CSNS spallation targets. A large amount of high-energy gamma rays will be generated by the interaction between incident protons, secondary neutrons and the target materials. Furthermore, the radioactive spallation reaction fragments will also release decay gamma rays. These gamma rays could further produce neutrons through (γ, n) reactions on the target and reflector components. The photonuclear neutrons might affect the safe operation, and pose a risk to personnel radiation safety during the devices maintenance, so it is necessary to simulate and evaluate the photonuclear neutron yield as well as the resulting dose rate. Simulated results show that the tungsten and tantalum, with relatively high photonuclear reaction cross sections but a high reaction threshold energy, will dominate the photoneutrons production during the CSNS operation. The yield and the spectra of the photoneutrons on beryllium reflector are also analyzed for the maintenance period.

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