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Upgrade Plan for Spallation and Transmutation Reaction Models in ADS Studies

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In accelerator-driven subcritical nuclear system (ADS) simulations, spallation and transmutation reaction models are typically employed due to the lack of the database in medium-to-high energy range. However, some model deviations have been identified, particularly in high-energy neutron-induced reactions on actinide nuclides. This paper presents a comprehensive verification of the current intranuclear cascade model and de-excitation models in terms of the differential cross-section data. Furthermore, we propose an upgrade plan for the spallation and transmutation reaction models by incorporating nuclear medium effects and nucleon-nucleon short-range correlations, which are currently missing in the existing Monte Carlo simulation framework. These model improvements are expected to enhance the accuracy of full-energy range and multi-particle Monte Carlo transport simulations, thereby advancing the ADS research and design and many other simulation studies in medium-to-high energy region.

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