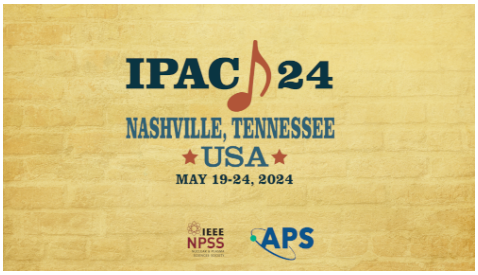

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Comparative study of decay heat calculations with FLUKA and MCNP

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In designing a high-power solid spallation target, decay heat driven temperature rise in the spallation volume is a safety concern during maintenance and in loss of coolant accidents. As tungsten above 800℃ hydrates and becomes volatile in steam, it is important to keep the target temperature below this threshold when active cooling is unavailable. Decay heat in a target is calculated with particle transport simulation codes combined with transmutation codes. The calculated decay heat usually differs depending on the nuclear cross sections and the decay particle transport models built in the code architecture. In this paper, we present the results of a decay heat calculation benchmark study using two popular particle transport codes, FLUKA and MCNP6 Version 6.2.0, coupled with the built-in transmutation solver within FLUKA and CINDER2008 paired with MCNP6. The effect of decay particle transport options on calculated decay heat values is included. The calculation is based on a simple water-cooled solid tungsten target model with water premoderators, liquid hydrogen cold moderators and beryllium reflectors. Heavy stainless-steel shielding is modeled around this target-moderator-reflector system. The tungsten volume is clad with a thin layer of erosion/corrosion resistant material. This study also informs uncertainty estimation in decay heat values in high-power spallation targets used in hazard analysis.

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