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Title

Parametric Shielding Analysis of a Flexible Accelerator-Driven Subcritical System

Abstract

Applications of accelerator-driven sub-critical systems have garnered significant interest in the last few decades. Due to their ability to maintain net negative reactivity (i.e. $k_{eff} < 1$) under all operating conditions, these assemblies are proven to be inherently safe and hence prove to be fantastic testbeds for a variety of instrumentation, neutron field spectra analyses, shielding and criticality testing. In anticipation of such a facility being built at Ontario Tech University, this work mainly focuses on conducting a parametric analysis of current shielding strategies within a variable configuration subcritical assembly that can accommodate multiple neutron generator configurations or alternative accelerator-based neutron sources.

Using the proposed Ontario Tech subcritical assembly as a focus, simulations have been performed using the radiative transport code, GEANT4, that has capabilities to handle various particle interactions that are pertinent to radiation protection in both reactor and accelerator facilities. Small-scale neutron generators, when placed in a variable configuration within a subcritical assembly won't affect the effective multiplication factor (k_{eff}) that maintains subcritical conditions but will amplify the input neutron flux. The effects of this additional fluence can affect the total effective radiation dose. To assess the radiation protection implications, shielding curves are constructed for different assembly configurations to investigate whether all operations meet regulatory expectations and ALARA compliant throughout its lifetime.