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**Monte Carlo simulations for analysis and design of nuclear isomer experiments** TRISTAN WINICK, BRIAN GODDARD, Drexel University, JAMES CARROLL, U.S. Army Research Laboratory — The well-established GEANT4 Monte Carlo code was used to analyze the results from a test of bremsstrahlung-induced nuclear isomer switching and to guide development of an experiment to test nuclear excitation by electron capture (NEEC). Bremsstrahlung-induced experiments have historically been analyzed with the assumption that the photon flux of the bremsstrahlung spectrum at a given energy varies linearly with the spectrum's endpoint. The results obtained with GEANT4 suggest that this assumption is not justified; the revised function differs enough to warrant a re-analysis of the experimental data. This re-analysis has been applied to the switching of the unusually long-lived isomer of $^{180}$Ta ($T_{1/2} > 10^{16}$ yr.), showing that the energies of its switching states differ by about 30 keV compared to those previously identified. GEANT4 was also employed in the design of a NEEC experiment to test the isomer switching of $^{93}$Mo via coupled atomic-nuclear processes. Initial work involved modeling a beam of $^{93}$Mo ions incident on a volume of $^{4}$He gas and observing the charge exchange process and associated emitted fluorescence. The beam and $^{4}$He volume, the ionization trails of the electrons liberated from the $^{4}$He atoms, and the subsequent fluorescence were successfully simulated; however, it was found that GEANT4 does not currently support ion charge exchange. Future work will entail either the development of the requisite code for GEANT4, or the use of a different model that can accurately simulate ion charge exchange.

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