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A Total Monte Carlo study in the modelling of nuclear de-excitation

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In this study, we utilized the Total Monte Carlo (TMC) methodology to simulate the de-excitation process of primary fission fragments in GEF and TALYS. Our primary goal was to establish a framework for evaluating model deficiencies and parameter sensitivities in fission models. As a proof-of-principle we systematically varied the input fission fragment data in TALYS using the GEF code, generating 10,000 random files by altering the 94 model parameters that influence fission yields and excitation energy distributions. This parameter variation, amounting to a 3% change, resulted in significant deviations across various aspects of fission evaporation data, encompassing the multiplicities of γ rays, prompt neutrons, and their corresponding spectra. Furthermore, our study shed light into the impact of angular momentum population on the de-excitation data derived from both GEF and TALYS. Finally, we attempt to optimise the parameter files by benchmarking against evaluated nuclear data files, aiming to establish a parameterisation scheme for enhanced accuracy in future simulations.

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