

Nuclear Diagnostics and the Search for Fusion

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The search for fusion continues at the National Ignition Facility at Lawrence Livermore National Laboratory. Nuclear physics is used to help understand the components of indirect-drive fusion and diagnosis problems through various tools. The $^{12}\text{C}(n, n'\gamma)$ signature gives scientists at LLNL a view into the neutron output through a Cerenkov radiation detector, called the Gamma-Ray History (GRH) detector. A comprehensive simulation of the capsule and generation of the 4.45 MeV gammas to the signature from the GRH was performed in various steps. MCNP was used to create a simplistic model of the NIF capsule. The gammas created as neutrons travel through the CH-ablator shell of the capsule were tracked and analyzed. The gamma output from these capsule cases was used as the source in a Geant4 simulation of the GRH detector and the data analyzed. Additionally, the GRH simulations allowed for a comparison of actual shot data to that of the best models, thereby progressing the NIF models to be more physically accurate. Results from the MCNP case study will be presented along with an update of the current status of the Geant4 GRH simulations.