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Simulating Detector Efficiency for Experimental Constraint of 56-Ni(n,p)56-Co

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Computer simulations are valuable in predicting, verifying, and constraining experimental results. The simulation that this poster describes was a project for a collaboration between Central Michigan University, Michigan State University, and North Carolina State University that is studying the mysterious νp-process and its role in nucleosynthesis within core-collapse supernovae. The reaction that signals the beginning of this process is the neutron-induced 56-Ni(n,p)56-Co reaction. To study this reaction rate, inverse kinematics and the time-of-flight technique will be used at the National Superconducting Cyclotron Laboratory's (NSCL) Low Energy Neutron Detector Array (LENDA), which is an array of 24 plastic scintillating bars located at the NSCL, to study the 56-Co(p,n)56-Ni reaction. To aid in the reduction of the uncertainty in these measurements, my simulation, which I developed using GEANT4, constructs the LENDA configuration to be used in this experiment (e.g. geometry of bars, location of bars with respect to beamline, bar material) and tracks neutron events in such a way that allows for estimation of detection efficiency equal to that of the physical LENDA at relevant threshold energies (200 keV, 300 keV, and 400 keV recoiling proton energy). This poster describes the development of this simulation, including how the geometry was constructed, how the efficiency is estimated, and its use in reducing the uncertainty in the cross section measurement of 56-Ni(n,p)56-Co at the NSCL.

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