Simulating Self Absorption Due to Neutron Inelastic Scattering in Xenon 134

Michael Potts

TTU Physics and Mathematics

An important aspect of rare event nuclear physics research such as neutrinoless double beta ($0\nu\beta\beta$) decay is filtering out background events that can lower data resolution. The search for $0\nu\beta\beta$ decay of 136Xe utilizes enriched 136Xe but still contains significant amounts of 134Xe. This poses a problem because, despite many experiments taking place in underground facilities, neutron-induced reactions can still occur in the sample and interfere with the data collected. Two background processes of interest are neutron inelastic scattering and neutron capture in 134Xe. The resultant de-excitation gamma rays from neutron inelastic scattering of 134Xe can scatter into the region of interest for 136Xe neutrinoless double beta decay. At Triangle Universities Nuclear Laboratory, we have measured neutron inelastic scattering and neutron capture on 134Xe. To fully understand the results of this experiment, we need to know the self absorption (a measure of the percentage of gamma rays that deposit energy in a sample) of the 134Xe sample. We simulated the absorption in a sample of 134Xe using Gears and Geant 4 along with the Root data analysis package to directly get the absorption number for use in data analysis.