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Investigating the performance of a Low Energy Germanium (LEGe) detector in a strong 5.5 T magnetic field (student talk)

In certain cases of nuclear gamma-ray and x-ray spectroscopy, it is desirable to operate high resolution germanium semiconductor detectors in a strong magnetic field. Operation of these detectors in strong magnetic fields has been shown to affect the charge collection process and lead to a loss in detector resolution. This is exhibited in skewing, broadening and shifting of peaks in the photon spectrum. However, the phenomena that contribute to the loss in performance depend heavily upon detector crystal characteristics and are not well studied in very strong (up to 5.5 T) magnetic fields. We present an ongoing investigation into the performance of a Canberra LEGe detector being operated in the TITAN Electron Beam Ion Trap (EBIT) at TRIUMF. The goal of this work is to determine if the effects are primarily due to a loss in detection efficiency or to an interplay between charge collection and shaping electronics. In the former case, we would not be able to recover the lost resolution, but in the latter case we hope to apply a correction method to recover some of the lost resolution. In the course of performing this systematic study, we are analyzing the transfer functions of our electronics using curve fitting in conjunction with finite element simulations of signal generation in the detector crystal.

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