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Investigation of Optimal Compton-Suppression Schemes for the TIGRESS HPGe Detector Array

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The TRIUMF-ISAC Gamma-Ray Escape-Suppressed Spectrometer (TIGRESS) is a new gamma-ray detector array being developed in order to take advantage of the radioactive ion beams to be delivered by the new ISAC-II facility at TRIUMPH. When complete, TIGRESS will consist of twelve large-volume 32-fold segmented HPGe clover detectors, fitted with 20-fold segmented Compton-suppression shields. The high efficiency of TIGRESS, predicted to be ˜18% in the “high-efficiency” and ˜10% in the “optimized peak-to-total” configurations for 1MeV gamma rays, will make it ideal for experiments with low-intensity radioactive ion beams. However, the photopeak efficiency and the peak-to-total response degrade as the multiplicity of the emitted gamma ray increases, due in part to an increase in the probability of false suppression. In order to counteract this problem, the high segmentation of the Compton suppression shield will be utilized. Suppression schemes, in which the suppression of events is based on analysis of which crystals and suppressor segments are hit have been developed. In order to accomplish this, data taken from a prototype TIGRESS detector were used to validate the results of a GEANT4 simulation of the full TIGRESS array. This simulation was used to examine the changes in peak-to-total and efficiency that result from the use of different suppression schemes. The results of this search, and the methodology behind it, will be presented

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