

# GEANT4 SIMULATIONS OF THE *GRIFFIN* SPECTROMETER\*

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There is a need for a high-efficiency  $\gamma$ -ray spectrometer at the ISAC-I low energy radioactive beam facility at TRIUMF, Canada's national laboratory for nuclear and particle physics research. The proposed high-purity germanium detector, *GRIFFIN*, will meet this demand. The *GRIFFIN* spectrometer can be configured into two separate geometries which have different advantages. For the "maximum efficiency" mode the detectors are placed fully forward into a tightly compact arrangement. For the "optimized signal-to-background" mode the detectors are moved back and BGO shields are inserted into the front section which creates a full Compton suppression shield around each detector. As a benchmark, the *GRIFFIN* simulations were compared to simulations of the current  $8\pi$  spectrometer at ISAC-I. Both simulations were performed under the same experimental conditions, which allowed for a direct comparison of the results. Experimental data from the  $8\pi$  allowed us to refine our simulations for realistic experimental conditions. Our results illustrate that *GRIFFIN* when compared to the  $8\pi$  is approximately 11 times more efficient at low  $\gamma$ -ray energies ( $\sim 200$  keV) and up to 40 times more efficient at high  $\gamma$ -ray energies ( $\sim 10$  MeV). In the  $\gamma$ - $\gamma$  coincidence mode, used in many experiments at ISAC-I, the *GRIFFIN* spectrometer will be approximately 300 times more efficient than the  $8\pi$  array. The enormous advantages of *GRIFFIN* will be illustrated through comparison of *GRIFFIN* simulations to actual  $8\pi$  data for two recently completed ISAC experiments studying the superallowed Fermi  $\beta$ -decay of  $^{62}\text{Ga}$  and the evaluation of nuclear shell structure through the  $\beta$ -decay of  $^{32}\text{Na}$ , respectively.

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