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Gamma-Gamma Angular Correlation Measurements With GRIFFIN

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When a excited nuclear state emits successive γ-rays in a $\gamma-\gamma$ cascade, $X^{**} \rightarrow X^{*} + \gamma_1 \rightarrow X + \gamma_2$ an anisotropy is found in the spatial distribution of γ_2 with respect to γ_1. By defining the direction of γ_1 to be the z-axis, the intermediate level, X^{*}, in general will have an uneven distribution of m-states. This causes an anisotropy in the angular correlation of the second γ-ray with respect to the first. The correlations depend on the sequence of spin-parity values for the nuclear states involved as well as the multipolarities and mixing ratios of the emitted γ-rays. These angular correlations are expressed by the $W(\theta)$ function:
\begin{center}

$$W(\theta) = 1 + \sum_{k=even}^{2L} a_k P_k(cos\theta)$$

\end{center}
where L is the lowest multipole order of the emitted γ-rays and the a_k are coefficients\part{title} for all of the $P_k(cos\theta)$ Legendre polynomials.

Angular correlations can be used for the assignment of spins and parities to nuclear states and thus provide a powerful means to elucidate the structure of nuclei away from stability through $\beta-\gamma-\gamma$ coincidence measurements. In order to explore the sensitivity of the new 16 clover-detector GRIFFIN γ-ray spectrometer at TRIUMF-ISAC to such $\gamma-\gamma$ angular correlations, and to optimize its performance for these measurements, we have studied a well known $4^{+} \rightarrow 2^{+} \rightarrow 0^{+}$ $\gamma-\gamma$ cascade from ^{60}Co decay through both experimental measurements and Geant4 simulations. Results of these investigations will be presented in this talk.

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