

Development of GAGG Array at RIKEN for Next-generation Detection

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The DALI2⁺ array has well served at RIBF, RIKEN for many years with fruitful research outcomes. However, the energy resolution of DALI2⁺ array is far from adequate due to the intrinsic energy resolution of NaI crystal and the absence of interaction position reconstruction ability. Furthermore, the hygroscopic NaI crystal decays over time if the encapsulation is not good enough, which further affects the energy resolution and requires extra protection material that reduces detection efficiency. The next generation scintillator array needs to solve this problem by introducing crystal made of new scintillation material, ceramic GAGG ($\text{Gd}_3(\text{Ga}, \text{Al})_5\text{O}_{12}(\text{Ce})$), coupled with segmented photomultiplier, to take the gamma-ray detection ability to another level.

Performance of several GAGG array geometry configuration was simulated, which shows promising overall improvement from DALI2⁺ array, with halved energy resolution and doubled detection efficiency. By simulating the scintillation and light propagation process from the incident of gamma photon into GAGG crystal, correlation of interaction position and distribution of scintillation photons over detector surface were investigated. Preliminary result shows the reconstruction of first interaction can be achieved within about 2cm's range from actual incident position, with the help of segmented photomultiplier. More details will be given in the poster presentation.

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