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Development of an 8 x 8 array of LaBr3(Ce) pixels for a gaseous Compton gamma-ray camera

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Summary

For Mev and sub-MeV gamma-ray astronomy or medical imaging, we have developed an electron-tracking Compton camera (ETCC) consisting of a gaseous Time Projection Chamber (TPC) and a scintillator. The TPC measures the three-dimensional track and energy of a Compton recoil-electron, while the scintillator measures the energy and position of the scattered gamma ray. Therefore, the ETCC is able to reconstruct Compton scattering event-by-event.
Since the angular resolution of the camera depends on an energy resolution of the scintillator, we have adopted a LaBr3(Ce) that has an excellent energy resolution. We have developed an 8 x 8 array of the LaBr3(Ce) pixels with a pixel size of 5.8 mm x 5.8 mm x 15.0 mm (or 20.0 mm) in order to have position sensitivity for gamma rays. The array was coupled to an 8 x 8 multi-anode PMT (Hamamatsu H8500), and the pixel size was as the same as the anode size. The energy resolution of the array reached 5.2±0.6% (FWHM) at 662 keV. Using the LaBr3(Ce) arrays, the ETCC had an angular resolution of 4.2±0.3 degrees (FWHM) at 662 keV.

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