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Gamma-ray imaging applications of position-sensitive fast scintillators

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We are developing position-sensitive detectors based on Cerium doped Lanthanum Bromide(LaBr3:Ce), Gadolinium Aluminium Gallium Garnet ($Gd_3Al_2Ga_3O_{12}$:Ce, GAGG), and lutetium-yttrium oxyorthosilicate (Lu1.8Y.2SiO5:Ce, LYSO) crystals coupled with the position-sensitive photo-multipliers for the gamma-ray imaging application. Some of these detectors have been tested for energy, timing, and position resolutions for the interaction of the gamma-rays within the detector crystal. The measured results are explained by the GEANT4 simulation results. With a collimated source, the images of irradiation spots in different positions throughout the detector crystal have been obtained. The 2-d images of hexagonal Bismuth Germanate (BGO) crystal and a cylindrical LaBr3(Ce) crystal have been generated using the position sensitive scintillator detectors. The performance for imaging application of the detectors has been investigated by coincidence technique in GEANT4 simulation and compared with the experimental results. The 2-d images of objects with various geometrical shapes have been investigated by Compton back-scattered events of the gamma rays using these detectors in the simulation. These position-sensitive detectors can be used as an absorber of a Compton camera for the image reconstruction of an extended radioactive source. These detectors can have various applications in the fields of nuclear and high-energy physics for scanning of detectors, as well as for the purpose of imaging in the medical and defense sectors. Recent results from these detectors will be presented at the conference.

What is your experiment?

Gamma-ray imaging

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