Abstract: We assembled an 8 × 8 array of 6 × 6 × 15 mm³ LaBr₃(Ce) pixels by our own technique for an absorber of a Compton camera. The energy resolution (FWHM) of one pixel was 5.8 ± 0.9 % at 356 keV by measurement with a single anode PMT. When the array was coupled to a 64ch multi-anode PMT and read out from 4-channels with a resistor chain, it had energy resolutions (FWHM) of 7.6 ± 0.5 % and 5.8 ± 0.4 % at 356 keV and 662 keV, respectively, except outer pixels.

1. Introduction —our Compton camera—

We have developed a gamma-ray imaging detector with GSO arrays as an absorber of a Compton camera (ref. [2],[5],[6],[7],[8],[9]).

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Our experiments using the Compton camera:

- Gamma-ray astronomy (SMILE project)
- Bellonix was launched in 2006 Sep. in Japan for observation of cosmic and atmospheric gamma rays.
- Our final goal is to survey all sky with more than ten times as higher sensitivity as COMPTEL (ref. [8]).

- Nuclear medicine
- Injection of 100 MBq ¹³⁷Cs (peak: 662 keV) and 57Co (122 keV) source.

2. LaBr₃

- Characteristic of our array:
  - Specific structure for the PMT
  - Pitch of crystal pixel is the same as PMT (Hitachi type) anode.

- Energy resolution measured with collimated gamma rays from a ¹³⁷Cs source to one pixel.

3. LaBr₃ array

- Assembly of our LaBr₃ array
- We tried to assemble a LaBr₃ array for the Compton camera.
- Previous researches on position sensitive detectors with LaBr₃.

- Energy resolution of arrays
- We assembled an 8 × 8 GSO array coupled to a multi-anode PMT (HPK R6231).

4. Readout of multi-anode PMT

- Characteristics of our array:
  - Specific structure for the PMT
  - Pitch of crystal pixel is the same as PMT (Hitachi type) anode.

- Energy resolution measured with collimated gamma rays from a ¹³⁷Cs source to one pixel.

- Solution of a leakage of scintillation light
  - Leakage of scintillation light from the outer pixels tends to reduce the energy resolution.

- Readout of all anodes using ASIC
  - It is expected to improve the energy resolution by readout of all PMT anode channels with ASIC (IDEAS V32 HDRI11) than 4-channels with resistor chain, because of a variety of PMT anode gases by a factor of 2.4.

- Assembly of 4 LaBr₃ arrays
  - To expand the effective area in the Compton camera from 5×5 cm² to 10×10 cm².

5. Performance

- Improvement of angular resolution (ARM) of the Compton camera
- Setup for the measurement of ARM (the array in the center of TPC).