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Measurements of Position and Depth of Interaction using Silicon Photostrip Sensors with a CsI(Tl) Crystal Scintillator

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As a scintillation detector, silicon photo sensors have been widely used in variety of fields such as medical imaging system, high-energy/nuclear, astro-physics experiments and so on [1-2]. We developed AC-coupled single-sided photostrip sensors fabricated on 380 ㎛-thick n-type silicon wafers with high resistivity, and an anti-reflection coating process was applied to light entrance window of the sensors. They have a size of 3.8×2.8 cm2 and 128 strip channels. For an optical property, quantum efficiency was measured to be > 90% at the wavelength of visible light (450 –700 nm) [3]. We optically combined the sensors with a CsI(Tl) crystal scintillator to detect passing particles especially for gamma rays. Two photostrip sensors were orthogonally placed on the top and bottom sides of the crystal, so that 2-dimensional information of interaction position can be obtained by the two perpendicular sensors. In addition, depth of interaction inside the crystal can be also obtained from a signal ratio of the sensors. Analog signals from every second strips are serially read-out by a VATA ASIC chip and are converted to digitized signals by passing a flash analog-to-digital converter (FADC) on a data acquisition (DAQ) board, then all signals are stored in a PC as histograms of pulse height distributions. At first, the sensor with the crystal, exposed to an Am-241 radioactive source, was tested as the positions of the crystal and the radioactive source were varied together. Then different pulse height distributions were taken along the strip channels. The pulse height distribution appeared over about 10 readout channels which corresponded to a contact surface's area of the crystal to the sensor. Two sensors were also tested to get 2-dimensional position. The position was measured to be strip channel number of (55.7±1.4, 35.8±1.0) in range of 64 channels for each coordinate, and the signal ratio between two perpendicular sensors was obtained to be 0.46±0.05. Finally, a test of the detector consisting of two sensors combined with the crystal for gamma-ray detection is ongoing using the same experimental setup in the LED test, but a radioactive source instead of the LED. Besides, we are studying detector simulation using GEANT4 in order to compare experimental results and to give complementary information while changing the depth of interaction in the crystal with a size of 2.8 × 2.8 × 10 cm3. In preliminary results, the signal ratios as a function of distance from the sensor show 1.23×sigma discrepancy between the nearest and the farther interaction positions, 1.7 cm and 10.0 cm, respectively. We present measurement results of the energy resolution, 2-dimensional position and the depth of interaction from two perpendicular photostrip sensors with the CsI(Tl) crystal scintillator, and GEANT4 simulation result for the depth of interaction in the scintillator.

REFERENCE
[1] IEEE Trans. Nucl. Sci. NS-41 (1992) 1441.
[2] H.J. Hyun, et al., Nucl. Instr. And Meth. A787 (2015) 134.
[3] D.H. Kah, et al., Nucl. Instr. And Meth. A628 (2011) 256.

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