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Performance Study of Large CsI(Tl) Scintillator with MPPC Readout

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Short duration gamma-ray bursts (short GRBs, SGRBs) are one of the most promising candidates of electromagnetic radiation from gravitational wave sources.One of the possible methods to localize these GRB events is to launch several small satellites and determine the position of GRBs by using the difference in detection time in each satellite.For accurate determination of these GRB positions, we need accurate time information and sufficient photon statistics.Therefore, we synchronize time information of each satellite by using global positioning system (GPS), and use detectors which have a large area and low energy threshold.Currently, we are designing and developing a fleet of small satellites, coined "GRBCube" for detection and position determination of SGRBs.We plan to use CsI scintillator which has high light output and a large area and multi-pixel photon counter (MPPC) which has a small size and low electricity consumption as well as high quantum efficiency.

As a part of the feasibility study of this project, we report the investigation of performance of a system combining CsI scintillator and MPPC.We compared the performance of two scintillators of different sizes ($150 \times 75 \times 5$ mm^3, $100 \times 75 \times 5$ mm^3),where the bigger one is the maximum size that can be mounted on a 3-unit satellite, corresponding to the CubeSat standards. We used the one of the latest models of MPPC by Hamamatsu Photonics, S13360-6050CS, which has an effective size of 6×6 mm^2.We examined the irradiation position dependence of light output using ^{241}Am (59.5 keV), and confirmed that the threshold level of $\sim$10 keV is achieved by using ^{55}Fe (5.9 keV).We also plan to test two channels readout in order to further increase the light output and reduce MPPC noise.

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