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P21 Performance study of a large CsI(Tl) scintillator with an MPPC readout for nanosatellites used to localize gamma-ray bursts

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"We are developing a fleet of nano-satellites to perform the accurate position determination of short gamma-ray bursts (SGRBs) by measuring the arrival time differences for the proposing CAMELOT (Cubesats Applied for MEasuring and LOcalising Transients) mission. To measure the arrival time precisely and achieve sufficient photon statistics under the severe limitation of size, mass and power consumption, we synchronize time information of each satellite by using a global positioning system, and plan to use large-area CsI(Tl) scintillators which provide a high light output and readout by multi-pixel photon counters (MPPC). We plan to use one of the latest-model MPPCs provided by Hamamatsu Photonics, namely, S13360-6050CS, which have an active area of 6×6 mm^2.

We compared the performance of two scintillators of different sizes (150×75×5 mm^3, 100×75×5 mm^3); the bigger one is the maximum size that can be mounted on a three-unit satellite we are planning to apply. We found that the difference of light yield was only ~13 %. We also tested two-MPPC readout to improve the energy threshold and uniformity, and confirmed the almost same energy threshold as one-MPPC readout of ~10 keV at 25 ℃ and energy resolution got better by 7 % thanks to the improved uniformity. Then we investigated the optimum position of two-MPPCs on the scintitllator by using ray-tracing Monte Carlo simulator, and found that symmetrical configurations against to the center of the scintillator gives the best performance of light yield. In this contribution, we will present a detail of experimental and simulation studies about the detectors for our CAMELOT mission."

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