In this paper we present the Inverted-Conical light guide designed for optical crosstalk reduction in the scintillator-MAPMT assemblies. The research was motivated by the 30% crosstalk observed in UFFO X-ray telescope, UBAT, during the preliminary calibration with MAPMTs of 64 2.88 × 2.88 mm2 pixels and identically gridded YSO crystal matrices. We began the study with the energy and crosstalk calibrations of the detector, then we constructed a GEANT4 simulation with the customized metallic film model as the MAPMT photocathode. The simulation reproduced more than 70% of the crosstalk and explained it as a consequence of the total reflection produced by the photocathode. The result indicated that the crosstalk mechanism could be a common case in most of the contact-assembled scintillation detectors. The concept of the Inverted-Conical light guide was to suppress the total reflection by contracting the incident angle of the scintillation. We optimized the design in the simulation and fabricated a test sample. The test sample reduced 52% crosstalk with a loss of 6% signal yield. The idea of the Inverted-Conical light guide can be adapted by scintillation detectors multi-pixel, imaging-purpose scintillation detectors such as the ultra-fast GRB observatory UFFO-UBAT, whose performances are sensitive to responding time, image resolution, and geometrical modifications.
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