

DATA ACQUISITION SYSTEM OF THE POGOLITE BALLOON EXPERIMENT

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Abstract

We present concept and an experimental result of SpaceWire-based data acquisition (DAQ) system of the Polarized Gamma-ray Observer, PoGOLite. PoGOLite is a balloon experiment with the capability of detecting 10% polarization from a 200 mCrab celestial object in 25–80 keV for the first time. To measure polarization, it captures a pair of Compton scattering and photoabsorption for one X/gamma-ray event with an array of 217 well-type phoswich detector cells (PDCs) made of fast plastic scintillator (detection part), slow plastic scintillator collimator and BGO crystals (shield) all viewed by one photo-multiplier tube. The 217 PDCs are surrounded by a side anti-coincidence shield (SAS) made of 54 segments of BGO crystals. In a balloon flight, intensity of backgrounds due to cosmic-rays and atmospheric gamma-rays is extremely high, typically a few hundred Hz of each unit, while signals from astrophysical objects are weak (200mCrab, 0.2-0.4 c/s). In the beam test at KEK-PF in 2008 February, 19 PDCs and 1 SAS were assembled, and 50 keV X-ray beam with the polarization of ~90% was irradiated at the center PDC unit. The signals from all the 20 units were fed to the flight electronics consisting of 6 circuit boards (4 waveform digitizer boards, 1 digital I/O board and 1 router board) and 1 microprocessor, where SpaceWire interface is adopted for the communication among them. One digitizer board, which can associate up to 8 PDCs, outputs a trigger signal. The digital I/O board handles the trigger and returns a data acquisition request when there is no veto (upper or pulse-shape discriminators) signal from any PDC. This DAQ system worked well as planned, and we have successfully measured the modulation factor of ~33%.