DEVELOPMENT OF A SPACEWIRE-BASED DATA ACQUISITION SYSTEM FOR A SEMICONDUCTOR COMPTON CAMERA

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Short Paper

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ABSTRACT

We have developed semiconductor Compton cameras, which are promising detectors for next-generation gamma-ray astrophysics missions. Our Compton camera enables us to dramatically reduce background events and to measure polarization of soft gamma-ray photons (from several tens keV to a few MeV). We will carry out a balloon-borne experiment to observe cosmic hard X-ray by the Compton camera in 2008. The balloon mission called High Energy Focusing Telescope (HEFT) is aimed at hard X-ray imaging spectroscopy by using hard X-ray focusing mirror. The Compton camera consists of four layers of double-sided silicon strip detectors (DSSDs) and several cadmium telluride (CdTe) pixel detectors at the bottom and sides of the DSSD module. High energy and position resolution of these detectors provide the Compton camera with good angular resolution of ~2 degrees at 511 keV.

The data acquisition system we have developed of the Compton camera is compact and powerful. It utilizes our framework of multipurpose data acquisition systems based on SpaceWire network (Yuasa et al., this conference). The system is driven by a very small computer called SpaceCube and SpaceWire Digital IO boards which are connected to the detectors in the Compton camera. A field programable gate array (FPGA) on SpaceWire Digital IO board processes data from the detector and SpaceCube accesses the data by SpaceWire remote memory access protocol (RMAP). The system satisfies requirements of concurrent readout from ~2500 channels at event frequency of ~100 Hz. In this paper we demonstrate the architecture and performance of the data acquisition system for the Si/CdTe Compton camera of the HEFT mission.