

Title

The DAQ and trigger of the High Energy Particle Detector (HEPD-02) for the CSES-02 space satellite

Speaker

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Abstract

The High Energy Particle Detector (HEPD-02) onboard the second China Seismo-Electromagnetic Satellite (CSES-02) is designed to measure cosmic rays, i.e., electrons and protons, along with light nuclei, in the energy range between a few MeV and a few hundreds of MeV. This high-precision instrument is composed of different subdetectors: a tracking system, a trigger system, a calorimeter made by a tower of plastic scintillators and an array of LYSO crystals, and a veto system.

The data acquisition system is constituted of three boards: one is dedicated to the tracker, a second one acquires all the scintillating detectors and manages the trigger signals for the whole apparatus, and finally, the DPCU board controls the whole detector, synchronizes the data acquisition, and interfaces the detector with the Satellite.

Since particle fluxes span several orders of magnitude along the orbit of CSES-02, the data acquisition must guarantee the measurement of energy spectra with a high duty cycle, and the trigger generation system must be extremely adaptable.

The HEPD-02 trigger system features concurrent trigger configurations and prescaling capability to adjust the data acquisition scheme depending on the orbital zone and on the presence of impulsive events. Each trigger configuration is optimized to meet scientific requirements about the field of view and the type of particles, with prescaling settings suitably adjusted.

While still monitoring particle bursts, trigger configurations dedicated to gamma rays will be tracked on a time basis of 5 milliseconds, to measure photon fluxes in the MeV-tens of MeV energy range and provide sensitivity for rare events, such as Gamma Ray Bursts (GRB).

This contribution describes the design criteria of the DAQ and the architectural choices for the use in space. The performance of the system, including results from laboratory and beam tests performed on the flight model of the HEPD-02, is also presented.