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Design of the data acquisition system for the transition radiation detector prototype

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The Transition Radiation Detector (TRD) of the High Energy Cosmic Radiation Detection facility (HERD) utilizes the relationship between high-energy charged particle transition radiation and the Lorentz factor to calibrate the energy of TeV-band protons in HERD calorimeters. It can also independently conduct X-ray observation and monitor Gamma-Ray Bursts. The TRD mainly consists of detector units, front-end electronics, and data acquisition system. The data acquisition system is responsible for the overall power management of the TRD, communication and triggering between the TRD and HERD, data processing of the detector units, control of multiple modules within the TRD, and in-orbit operation of the whole TRD. Here we report a prototype of the TRD data acquisition system, which connects six front-end circuit boards, six high-voltage circuit boards, a turntable device, HERD triggering subsystem, and HERD electronics. It adopts a structure with separate data and electrical components, with the power sections of the front-end electronics, high-voltage, turntable device, and data acquisition system designed as power circuit boards, and the FEE data transmission and telemetry, triggering, main control, storage, and communication designed as data circuit boards. We tested our data acquisition system prototype at the European Organization for Nuclear Research, and the results show that the system can meet the requirements of the TRD prototype in terms of power, communication, data processing, and overall control. We also demonstrate that the data acquisition system has been redundantly designed to enhance adaptability.

Minioral

No

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