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Design of the readout electronics for the engineering model of the HERD-TRD

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The High Energy Radiation Detection Facility (HERD) is a flagship space astronomy and particle astrophysics experiment of the Chinese Cosmic Lighthouse Program, which will be installed at the China Space Station in 2027. HERD will plan a decade-long experiment in orbit for dark matter detection, cosmic ray energy measurement and high-energy gamma-ray detection. The high-energy cosmic ray energy detection in the HERD experiment will reach the PeV range for the first time. To fulfil the accuracy of the energy detection, the transition radiation detector (TRD), one of the critical HERD detectors, will be mounted on the windward side of the load to calibrate the TeV energy range of the electromagnetic calorimeter. The TRD system comprises six detector units, six front-end readout electronics (FEEs), one back-end electronics, and six high-voltage units. The TRD utilizes a sealed gas detector design. The FEE uses 4 SAMPA ASICs to read 128 anode signals. To improve the detection accuracy, the FEE will realize an on-orbit adjustable dynamic range of 0-500 fC. The FEE design has progressed to the engineering model stage, and the FEE has carried out a series of irradiation-resistant designs. Comprehensive tests have been performed on the readout electronics. The test results indicate that the readout electronics have reached good performance. We are preparing for joint tests with TRD using radioactive sources, cosmic rays, X-rays, etc. These will be demonstrated at the conference.

Primary experiment

HERD

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