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Report on Space-Qualified Readout Electronics for the BGO Calorimeter of DAMPE Mission

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A satellite-borne high energy cosmic ray detector to be launched in the near future, named Dark Matter Particle Explorer (DAMPE), is now being developed in China. The major scientific objectives of DAMPE mission are primary cosmic ray, gamma ray astronomy and dark matter particles, by observing cosmic rays with an energy range from 5 GeV to 10 TeV. An electromagnetic calorimeter, which contains 308 BGO (Bismuth Germanate) crystal logs and 616 PMTs (photomultiplier tubes), is a critical sub-detector, for measuring the energy of cosmic particles, distinguishing positrons/electrons and gamma rays from hadron background, and providing trigger information. In order to achieve a maximum dynamic range to 1.8×10^5 for the BGO detector unit, each PMT base incorporates a three dynode (2, 5, 8) pick off, which results in 1848 signal channels and a complex readout system with 16 front-end electronic (FEE) boards.

From year 2013 to 2014, a Qualification Model for the BGO Calorimeter, together with its readout electronics, was successfully developed and pass ground-based cosmic ray tests and a serial of qualification level environmental tests. Later several test beam experiments for the DAMPE Qualification Model were carried out with the CERN PS and SPS facilities, which proved the major specifications of the BGO Calorimeter, such as energy range and resolution, and the capability of its readout electronics. Right now we have finished the construction of the Flight Model of BGO Calorimeter and doing environmental tests. The progress and some details related to the high reliability design and quality control for the readout electronics, will be introduced in this paper.

Collaboration

– not specified –

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