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Design of Mesh-Signal Readout Electronics for PandaX-III prototype TPC

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The Particle And Astrophysical Xenon Experiment III (PandaX-III) is an experiment to search for the Neutrino-less Double Beta Decay (NLDBD) using high-pressure gaseous xenon TPC with Micromegas detectors at both ends and cathode in the middle. At the first phase of the experiment, there are 41 Micromegas detectors at each TPC end-plate. A small-scale TPC equipped with 7 Micromegas detectors is developed as the prototype detector. There are 128 strip signals and one mesh signals from the Micromegas module.

The Mesh Readout Card (MRC) is designed to readout all mesh signals from the end-cap on one side and generate individual 'Mesh-trigger' signals. These trigger signals can combine with the anode strip signals to help the track reconstruction. There are 41 input analog channels on one MRC, and 8 input channels with 2 ADCs has been welded for joint-test with the prototype TPC. Each channel uses discrete components containing a charge sensitive amplifier and a CR-RC2 shaper to readout the charge from mesh. The waveform of each shaper output is sampled by ADC channel, processed by an FPGA chip and sent to back-end electronics via an optical link. The integral nonlinearity of the MRC is less than 3% with 5.5 pC range. The noise (RMS) of each readout channel is less than 1.25 fC with 1 μ s peaking time and 5.5 pC range. The performance of the MRC meets the requirements of the PandaX-III prototype TPC.

Minioral

Yes

Description

TPC, micromega board

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