Operation of GET system as main readout device for SπRIT experiment at 2016 spring campaign

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SπRIT Time Projection Chamber (TPC) is one of the main devices for SπRIT project at RIKEN-RIBF[1]. The SπRIT project aims to study the density dependent term of the symmetry energy using heavy RI collision. General Electronics for TPC (GET)[2], is the novel readout system employed for the SπRIT-TPC[3]. It is required to take the signal produced by charged particles passing through TPC. By using GET system, it is possible to realize high resolution, wide dynamic range and stable operation of data taking. GET system for SπRIT-TPC composed of 48 AsAd boards, 12 CoBo boards and 2 MuTANT boards. 12 CoBo boards and 2 MuTANT boards are mounted in 2 μ-TCA shelves so that the trigger signal and sampling clock are synchronized among different CoBo boards.

At the spring season of 2016, the first physics experimental campaign was performed as well as the commissioning of SπRIT system in SAMURAI magnet. The all of readout electronics on TPC worked under the magnetic field of 0.5 T without problem, and full operation of GET system was successfully performed for two weeks physics run. The analog part of the system was configured to be 120 fC dynamic range, 117 nsec shaping time, and 25 MHz sampling rate. The trigger rate was ∼60 Hz, and total beam rate was ∼10 kHz. The SπRIT-DAQ system sustained the data rate of 300 MByte/sec. The data were copied to RIKEN HPC storage through 10 Gbps network for 1st/offline data analysis. The trigger rate of 60 Hz was expected to be improved after the integration of partial readout mode, where the channel was digitized and can be selected event by event to reduce the conversion time. Since this functionality was not fully tested as of Spring 2016, only the full digitized readout mode was used.

Fig. 1 and Fig. 2 show the event display of heavy RI collision taken with SπRIT-TPC and the typical shape of electric signals detected with GET electronics, respectively.

As shown in Fig. 1, there are large number of charged particle tracks passing through TPC. There are several pads which seem to be dead. However, the positions of the dead pads vary from event to event. The pads above the beam trajectory become dead.

The drift electrons produced by beam is supposed to be blocked by gating grid wire plane of TPC. Too large amount of δ-ray electrons made by beam which can penetrate the gating grid is expected to affect the readout system.

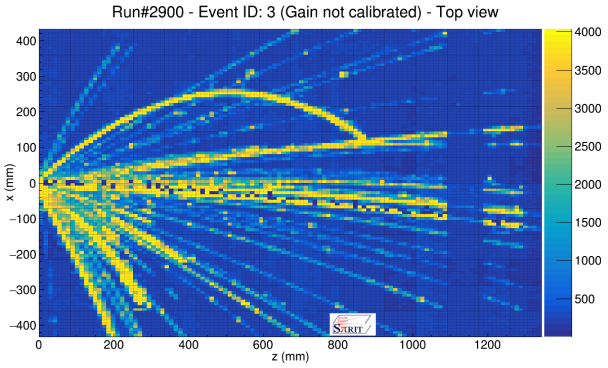

Fig. 1. Event display of heavy RI collision taken with SπRIT-TPC (top view). One dot corresponds to the one of the channels. Color of each pad shows the maximum value of the signal. The Sn target is located at the left hand side of this display.

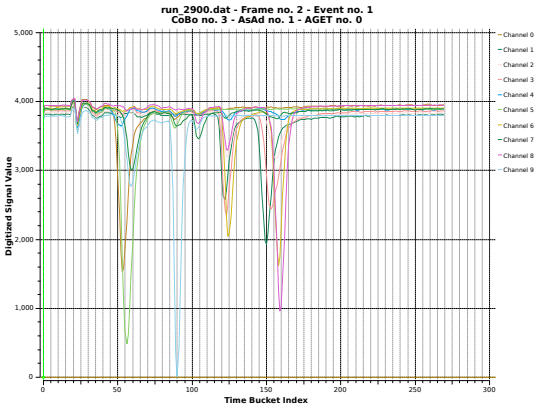

Fig. 2. Typical shape of electric signals made by charged particles passing through TPC. Each color corresponds to each pad. Signals on 10 pads out of 12k pads are shown.

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