Study of threshold for noise rejection of detector at sPHENIX

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The sPHENIX experiment studies the quark-gluon plasma (QGP) at the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory. According to the Big Bang theory, the early universe was filled with QGP before the creation of ordinary matter.

The Intermediate Silicon Tracker (INTT) is one of the tracking detectors in sPHENIX. The INTT system consists of eight servers (intt0–intt7), each connected to a FELIX board.[1] Each FELIX server operates half-ladders through two types of readout cards. Along the readout chain, several data selection steps are implemented, such as noise rejection, in order to collect higher-quality beam-beam collision data. It is important to optimize the noise-rejection threshold for stable DAQ performance. However, the optimization must be performed carefully because the threshold setting directly affects the recorded data.

A dedicated threshold scan was carried out with Au+Au collisions at a center-of-mass energy of $\sqrt{s_{\rm NN}}$ = 200 GeV. The energy deposited by charged particles was measured by the readout chip FPHX,[2] and the ADC output was divided into eight ranges and recorded.

Figure 1 shows the average number of hits per event for all ladders of each FELIX server. Some half-ladders were excluded from the analysis due to poor detector conditions. From this analysis, it was found that the average number of hits becomes almost constant once the threshold is higher than 20. Therefore, a threshold value above 20 is considered appropriate.

A more detailed analysis, decomposed into each half-ladder or even smaller units, was also performed. The ADC threshold can in principle be optimized per ladder or even per FPHX chip. A higher average number of hits is observed for FELIX servers intt4-7 compared with intt0-3. These correspond to the north and south sides of the INTT, respectively. Because the two sides

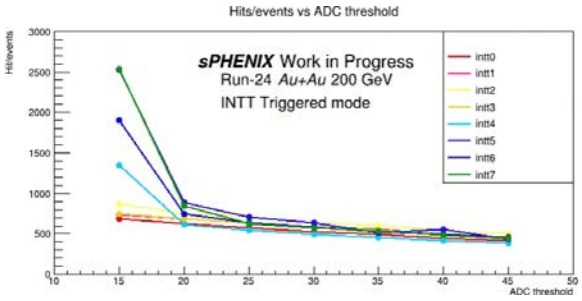

Fig. 1. Number of hits in an event for each FELIX server as a function of the ADC threshold.

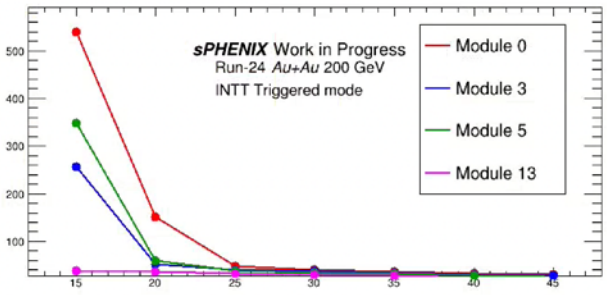

Fig. 2. Number of hits in an event for FELIX server intt7 as a function of the ADC threshold.

are connected to different ground (GND) ports, external noise coupling is different between them. Figure.2 shows the average number of hits for some half-ladders of intt7. By applying these bad-channel masking to the INTT before calculating the hit rate and the threshold setting can be improve hit rate. This is way we can improve our data taking. I wound like to search the best threshold to cut noise without signal.

References

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