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Upgrade of the Front-End Electronics of the C217 RPC Detector Stack at TIFR

Abstract: A 12 layered $1\text{ m} \times 1\text{ m}$ Cosmic Muon tracker, based on gaseous detector, Resistive Plate Chamber (RPC) [1] has been operational since 2007 in C217, TIFR. This detector has an in-house developed Data Acquisition (DAQ) [2] chain. Hybrid Micro-Circuits (HMC) based pre-amplifiers, Emitter Coupled Logic (ECL) based analog front end and Complex Programmable Logic Device (CPLD) based Digital front end have been configured to collect data using a VME backend.

During the long-term operation of the detector, we have observed sudden electronic noise pick-up in the stack and instability of the front-end amplifiers. Many measures were implemented to reduce the noise. Though they helped, but a permanent solution was needed to improve the data quality with new age technology. One way is to design and mount amplifier cum discriminator boards as close as possible to the detector and transmit the differential logic signals to the digital front-end. Upgradation was also needed to improve the power consumptions of the electronics.

Compact 8-in-1 NINO-ultrafast low power amplifier cum discriminator boards [3] have been specially developed as front-end which gives discriminated LVDS output. To incorporate the NINO boards in existing DAQ chain, we have developed new adapter boards in place of the Analog Front-end. A scheme of modified DAQ system and integration and RPC performance in terms of efficiency and noise rate will be discussed.

References:

1. Development of glass resistive plate chambers for INO experiment, N.K.Mondal, et. al, NIM A, Volume 602, May 2009, Pages 744-748.
2. Electronics and data acquisition system for the ICAL prototype detector of India-based neutrino observatory, S. Dasgupta, et. al, NIM A, Volume 701, February 2013, Pages 153-163.
3. Development of Fast, Low Power 8-Channel Amplifier-Discriminator Board for the RPCs, P.K. Kaur, et. al, XXII DAE High Energy Physics Symposium. Springer Proceedings in Physics, vol 203. Springer, Cham. https://doi.org/10.1007/978-3-319-73171-1_134

Field of contribution

Experiment

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Track Classification: Future experiments and detector development