The DAQ System for a Beam Detection System Based on TPC-THGEM

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Abstract

A beam detection system has been developed for tracks, position and energy calibration of electron.

It consists of a TPC (thick gas electron multiplier detector), a PDD (particle distribution detector), a detector to be calibrated and a silicon-based energy detector.

The DAQ of this detection system is divided into readout system (ROS) and online data processing system (ODP).

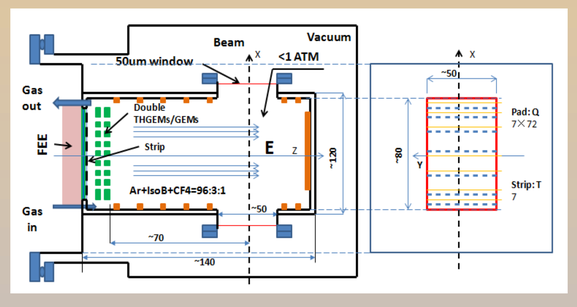
This paper will present the system and software architecture design, implement of the DAQ software and evaluation of its ROS performance.

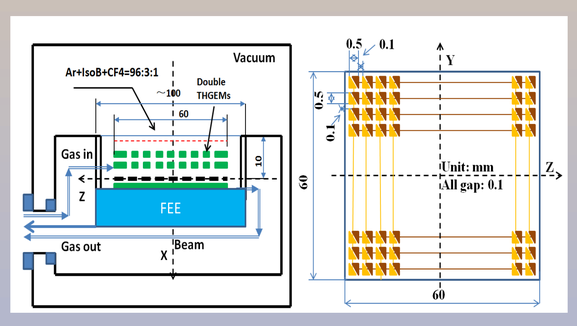
Introduction

THE beam detection system is aimed to study the effect of location, energy and direction factors of electron beam on the detector.

- The TPC detector is the main detector, it aims to measure tracks of electron online. It is designed with several pads, with which measure tracks of electron in sample.

- The PDD detector is a position detector, played the following effect in this system.



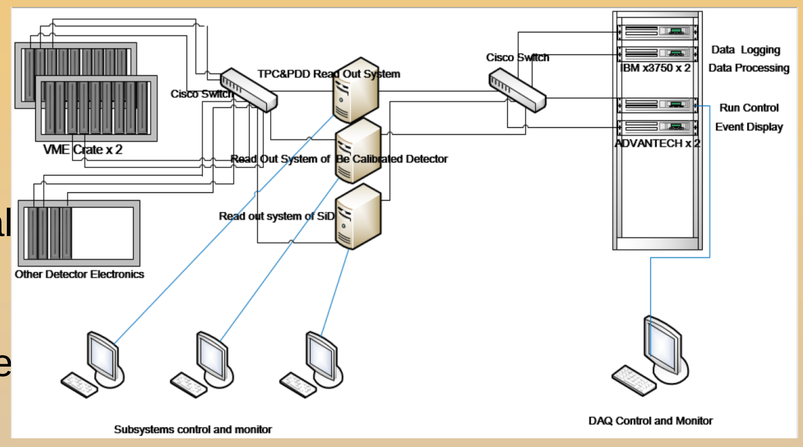


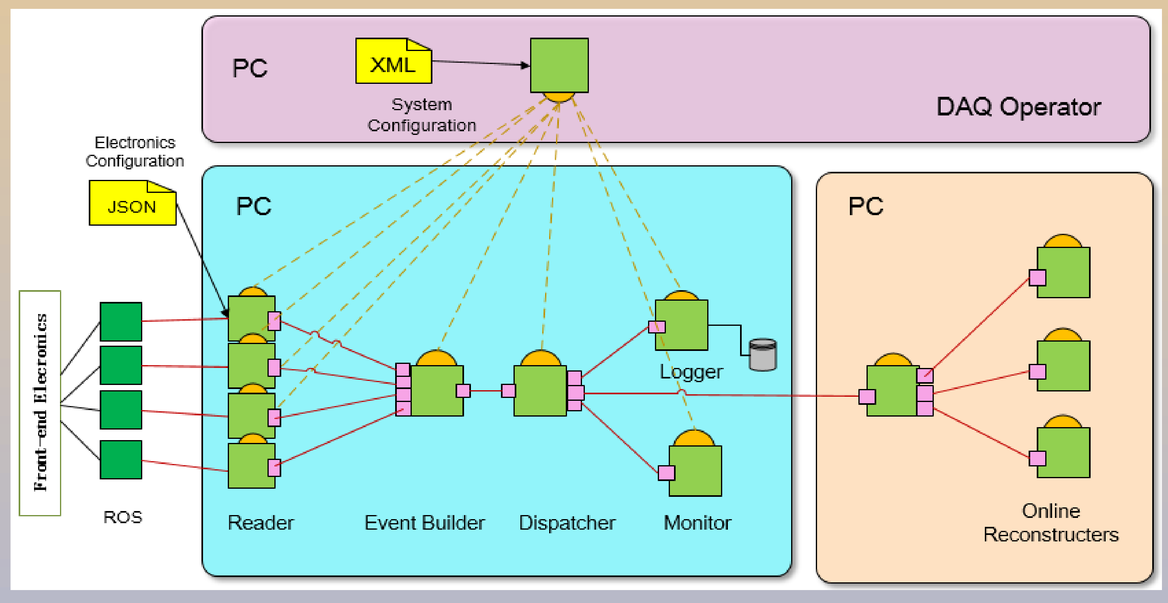
- To determine the difference between extended position and reconstructed position when low energy electron passing through the TPC, as well as the probability of electron scattering after piercing the exit window of the TPC.

- To determine the accuracy of the scanning magnet positioned on high-energy electron, then to determine whether we can remove the online TPC detector for high energy position calibration.

System and Software Architecture Design

- The DAQ system architecture is designed to a multi level system using advanced commercial computer and network technology as shown in the figure on the right side.





- The data flow component diagram of this DAQ software is shown in the figure above. It is based on DAQ-Middleware software framework.

System Requirements

The experiment requires ROS of each detector should be running independently, configure the parameters of detectors and frontend electronics conveniently and system control should be flexible.

- Run mode requirement is shown in the figure on the right side.

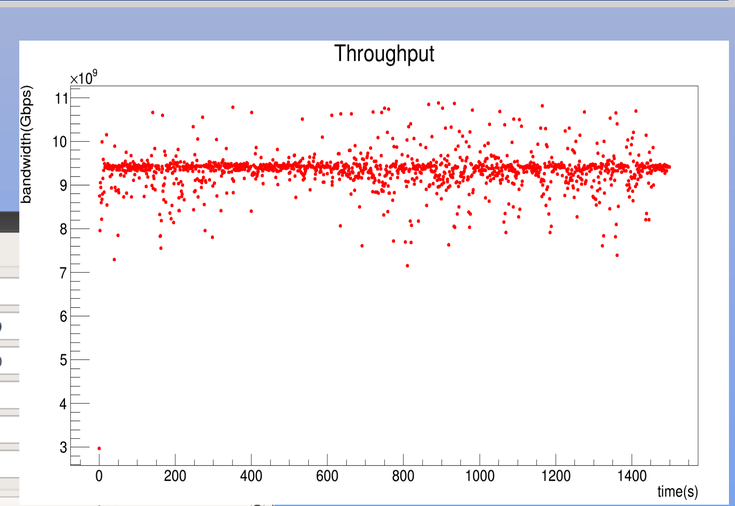
- ROS should be able to read 511 channels of TPC and 200 channels of PDD electronics with 100Hz trigger rate.

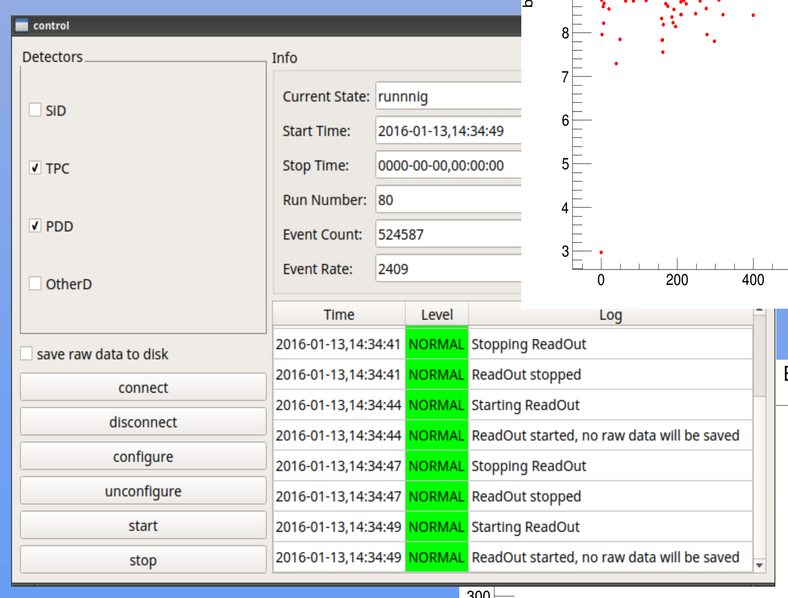
- Control GUI required some information display in real-time, such as run number, number of event read out etc.

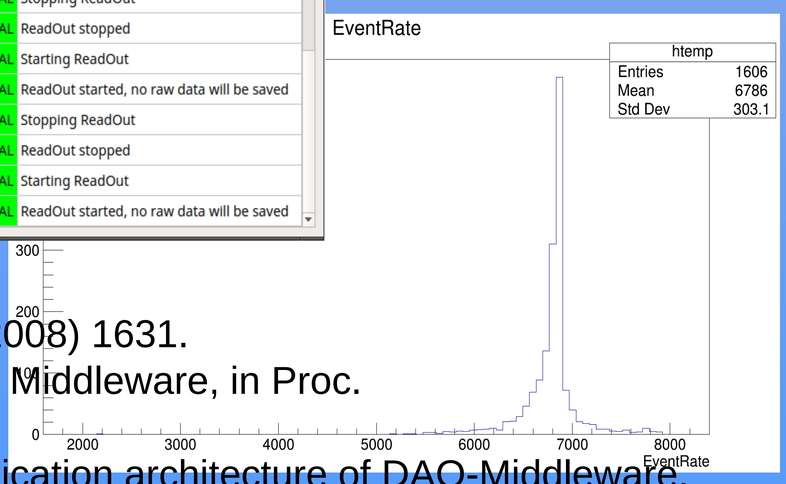
SUMMARY OF RUN MODE REQUIREMENTS

Run Mode	TPC	PDD	Be Calibrated	SiD
Online Calibration Mode	Y		Y	
Independent Calibration Mode			Y	
Debugging Mode I	Y	Y		
Debugging Mode II	Y			
Debugging Mode III		Y		
Energy Calibration Mode				Y

Software Implement and Performance Evaluation







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