SRS Systems Update

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Project Goals

• Establish a functioning Scalable Readout System (SRS) with DAQ software for use with JLab's 15x15 GEM detector
  • Build a test apparatus for taking data under cosmics/source
  • Establish a baseline behavior of this chamber using the DATE DAQ software for comparison with measurements from CODA
• Re-implement the entire SRS system using CODA as the primary DAQ software
  • Identify and implement the necessary functions from DATE and Slow_Control libraries
  • Repeat measurements using the cosmic/source test apparatus
Scalable Readout System

- Scalable Readout System (SRS) developed by the RD51 collaboration at CERN.
- Current test apparatus is using 6 APV25 hybrids connected to a single FEC/ADC pair

APV25 Hybrid
- 128 channel APV25 chip
- 192-deep analog sampling memory
- Master/slave configuration
- Diode protection against discharge
- RD51 standard 130-pin Panasonic connector interfaces to detector
- HDMI mini (type C) connector

ADC
- 2 x 12-Bit Octal ADC
- 8 x HDMI input channels (16 APV hybrids)
- Virtex LX50T FPGA
- SFP/Gb Ethernet/DTC interface
- NIM/LVDS GPIO (trigger, clock synch, etc.)

FEC

DAQ Computer
- Data Acquisition using DATE (ALICE @ CERN)
- Support added for data transfer via UDP
- Slow control via ethernet
- Online and offline analysis using custom package for AMORE (ALICE @ CERN)

Cosmic Ray Test

- Approximate rate of 0.8 Hz using a coincidence signal from cosmics
- Unable to properly cover the entire active area of the GEM detector
- Majority of signal limited to the first two APVs in either plane
Radioactive Source Test

- Approximate rate of 70 Hz using a discriminated signal from a single scintillator
- Performed using a collimated Ru-106 source
- All signal limited to a single APV in either plane
X-Plane of JLab 15x15 chamber - REF1
Y-Plane of JLab 15x15 chamber - REF1

REF1Y Absolute Strip Occupancy for 110231 Single-Cluster Events

REF1Y Cluster Multiplicity Distribution

REF1Y Cluster Charge Distribution for 110231 Single-Cluster Events

REF1Y Cluster Size Distribution for 110231 Single-Cluster Events
X-Y Planes of JLab 15x15 chamber - REF1

REF1 Charge Sharing (X/Y)

REF1 Hit map

REF1X Time Distribution for 124000 Single-Cluster Events

REF1Y Time Distribution for 110231 Single-Cluster Events
Source Irradiation of JLab 15x15 chamber - REF1
Summary

• JLab's 15x15 chamber is functioning and showing expected behavior
  • A test apparatus for taking data under cosmics is in place and provides reasonable results
  • A baseline has been established for the behavior of this chamber that can be used as a comparison for the results using the CODA system
• Hardware is in place for the implementation of CODA
  • The next step will be identification and implementation of the necessary functions from DATE and Slow_Control
  • Once this system is in place measurements will be repeated to make sure the behavior of the electronics remains unchanged
• Final tasks will encompass measurements of the maximum rate our system is capable of sustaining without recording errors
Source Irradiation of JLab 15x15 chamber - REF1