

Update on the SRS electronics at UVa

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EIC Weekly meeting, 04/13/2015

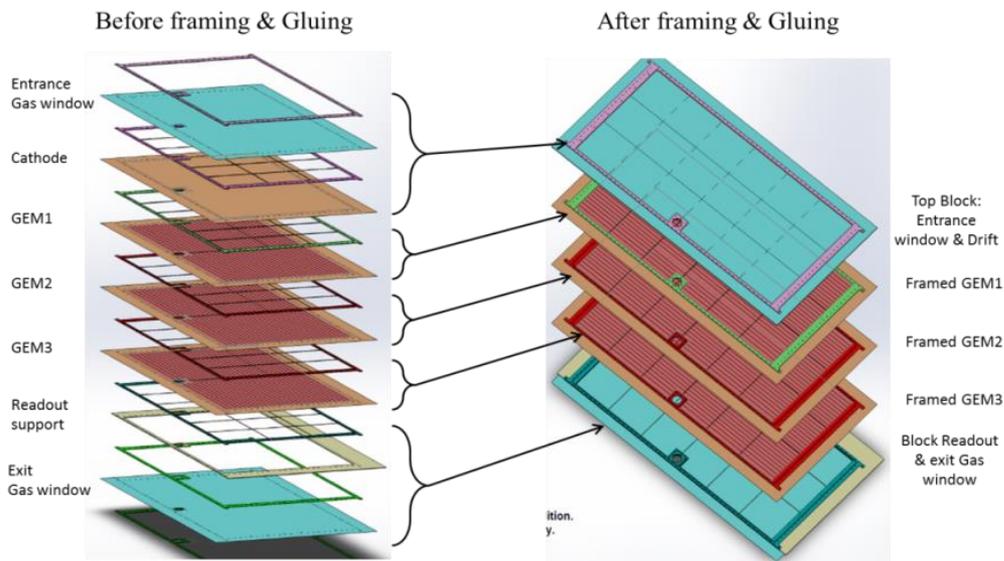
Mid-size APV25-SRS Electronics @ UVa

- We acquire an additional 4 FEC/ADCs
 - Our original 4 FECv6 swapped for FECv3 because of non availability of DTCC f/w for FECv6
 - 5 FEC/ADCs and 96 APV25 cards and we still have one FEC from Florida Tech
- Also borrow one additional SRU from ALICE DAQ Group
- Had various issues programming the firmware and setting the Ethernet configuration of the FECs but things are running smoothly now
- Still have 1 FEC with hardware problem
→ (still under investigation)
- Setting of the second SRU as well



Large GEMs and SRS Electronics for the pRad

Design of the pRad GEM detector



Requirement for pRad

- 2 Large GEM chamber → 9216 electronic channels to read out
- Electronics: 2 SRUs and 6 FEC/ADCs
- Each SRU → 3 FEC/ADCs + 36 APVs → CODA DAQ PC
- Expected trigger rate 1 to 2 kHz

SRS for pRad

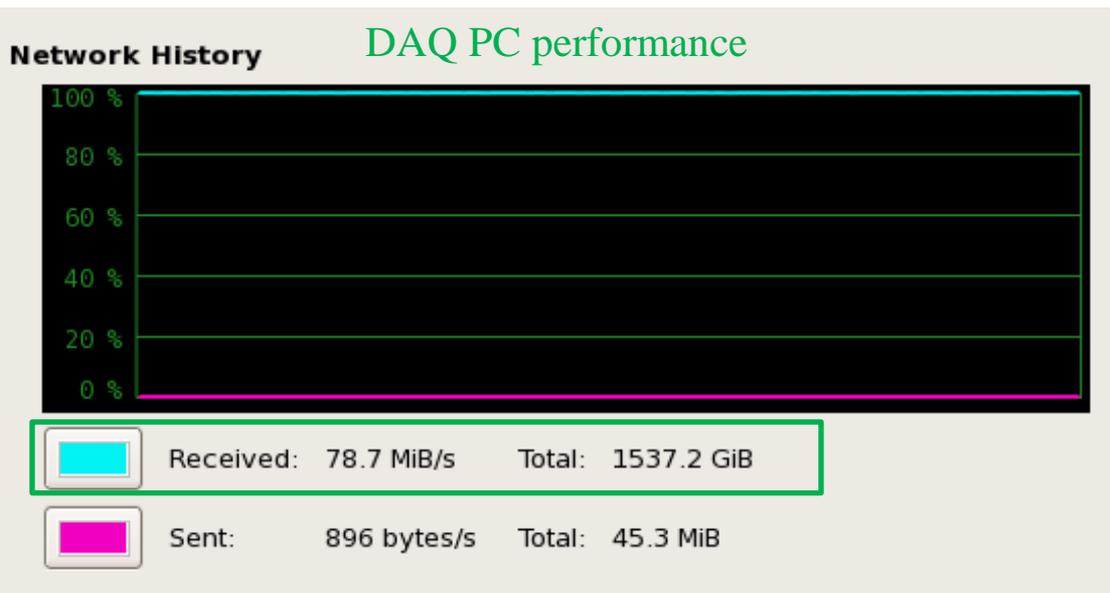


pRad GEM foil



Performance tests: 4 FEC/ADCs and 64 APV25 FE cards

- Maximum trigger rate of 1.2 kHz for 3 APV time bins with no loss of UDP packets
 - With 1 Gb link, expected transmission rate up to 125 MB/s → experimental limitation is ~ 80 MB/s
- Limitation from the DAQ PC: Saturation: 100 % network transmission at 78.7 MiB/s
 - can we stretch to 100 MB/s and 1.5 kHz trigger rate with a more powerful PC



DAQ_TEST	
LDC status display	
LDC name	aloneldc
host	srsDaq
Current Trigger rate	1234.000
Average Trigger rate	1215.182
Number of sub-events	2030569
Sub-event rate	1234
Sub-events recorded	2030571
Sub-event recorded rate	1234
Bytes injected	131921979612
Byte injected rate	80.170 MB/s
Bytes recorded	131921979612
Byte recorded rate	80.196 MB/s
Nb. evts w/o HLT decision	0
mem allocation failed	0
average time bmAllocate	

Performance tests

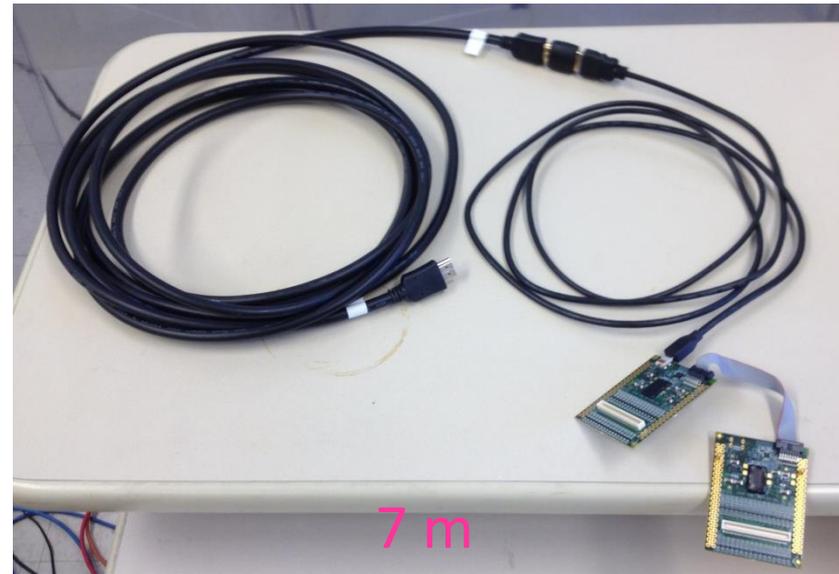
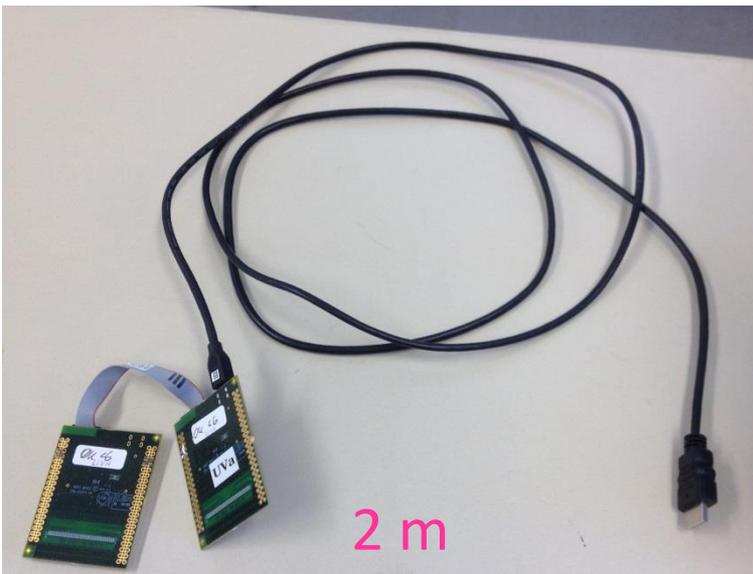
Measured maximum trigger rate

	32 APVs	64 APVs
3 TS	2.3 kHz	1.2 kHz
6 TS	1.15 kHz	
12 TS	0.6 kHz	

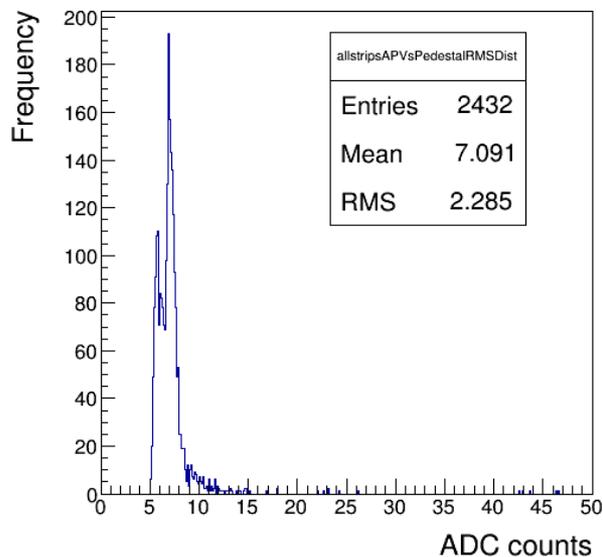
- High rate means less APV25 cards **and/or** less time samples (TS)
- **2.3 kHz trigger rate** with 3 time samples with 32 APV25 cards
- Very similar to the pRad requirements for the readout electronic

LDC status display	
LDC name	alonedc
host	srsDaq
Current Trigger rate	2330.400
Average Trigger rate	2293.252
Number of sub-events	2034115
Sub-event rate	2330
Sub-events recorded	2034115
Sub-event recorded rate	2330
Bytes injected	66279603304
Byte injected rate	75.933 MB/s
Bytes recorded	66279538136
Byte recorded rate	75.920 MB/s
Nb. evts w/o HLT decision	0
mem allocation failed	0
average time bmAllocate	

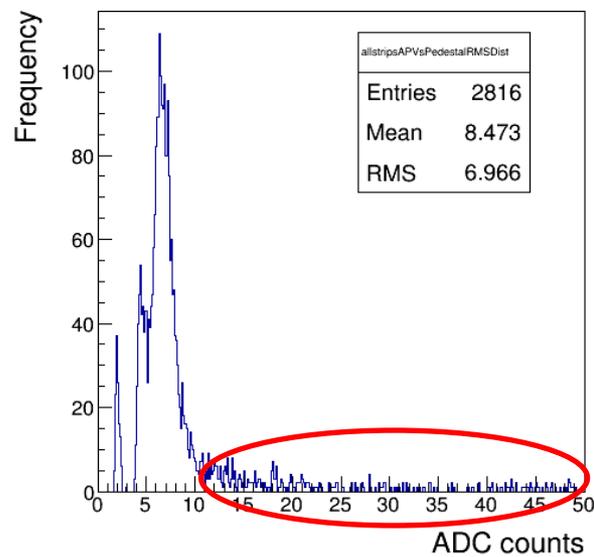
HDMI Cable length



2m long HDMI: pedestal rms distribution



7m long HDMI: pedestal rms distribution



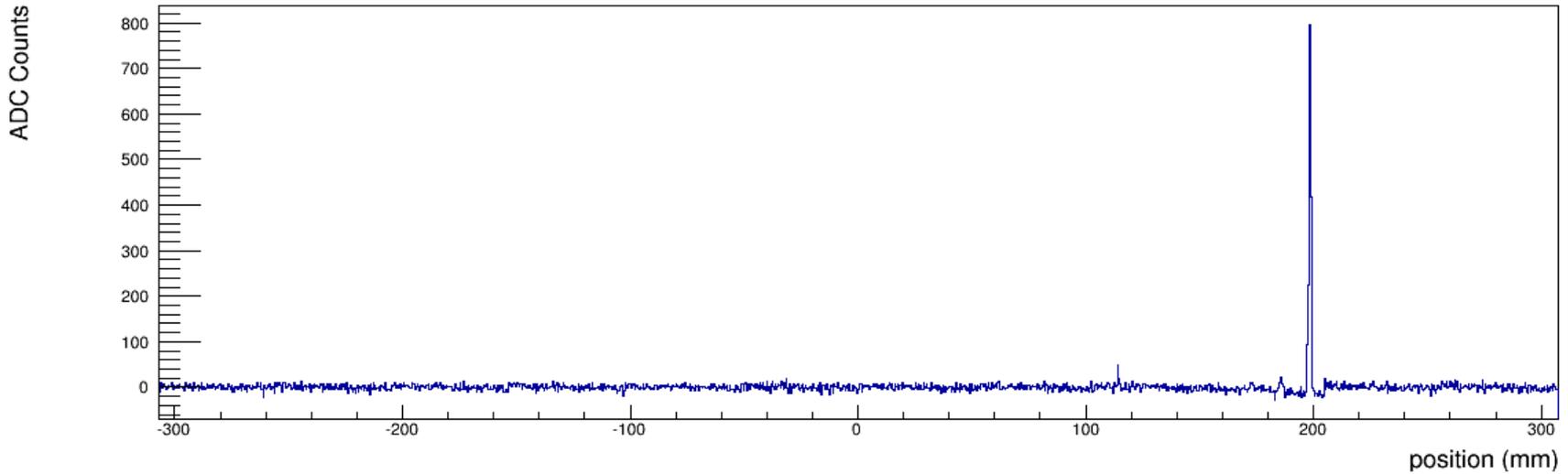
With 7 m HDMI cables

- Overall noise slightly increases
- Few channels ($< 5\%$) have a high noise with long HDMI cables

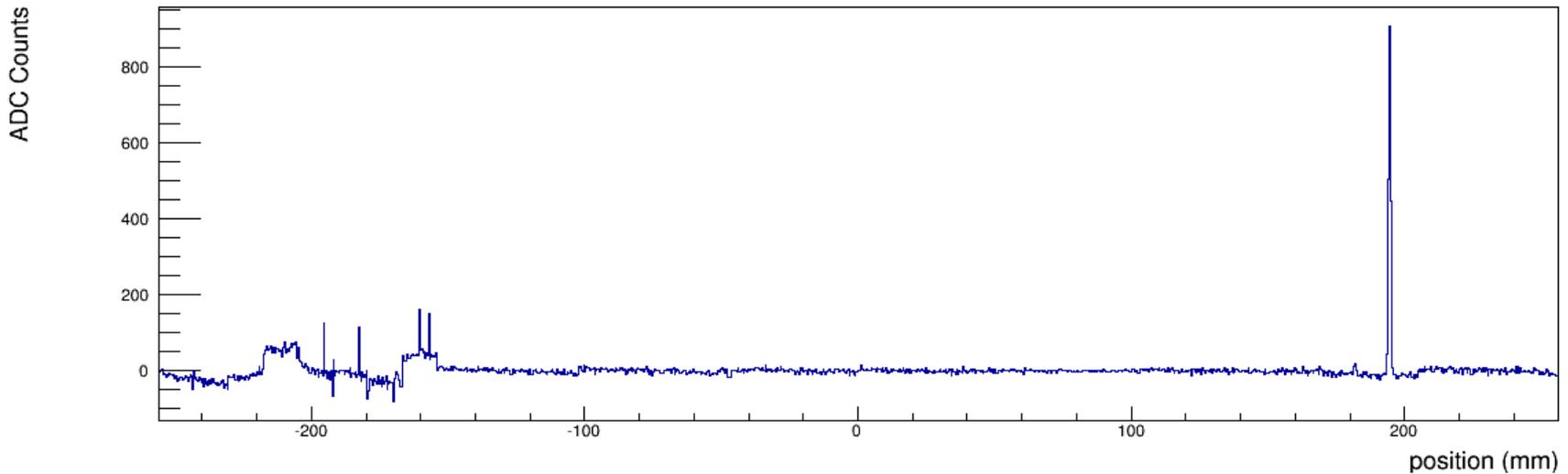
Cosmic data in SBS GEM with HDMI Cable length

Still a very good signal to noise ratio with cosmic

SBSGEMProd9: Hit in X



SBSGEMProd9: Hit in Y



Conclusion

- Expansion of SRS electronic @ UVa with the addition of 4 FEC/ADCs and one SRU (> 12 k channels)
- Performance test of the trigger rate capability of the system
 - Can reach over 2 kHz with 64 cards (8200 ch) when APV25 frames is limited to three time samples.
The maximum trigger rate is limited by data transfer to the DAQ PC (event size) rather than the SRS system → Possibility to improve the maximum trigger rate?
- Preliminary study of the impact of long HDMI cable on the pedestal noise
 - Effect is very limited and does not affect in a significant way the signal to noise ratio
- Integration of the SRS into JLab DAQ framework (CODA) is been done by colleagues at MSU
 - Basic work of SRS into CODA was completed and preliminary test successful
 - More test are planned for this week at UVa with the CODA DAQ PC
- **The SRS electronic will be ready for the pRad experiment**

Back up

pRad Experiment in Hall B @ JLab:

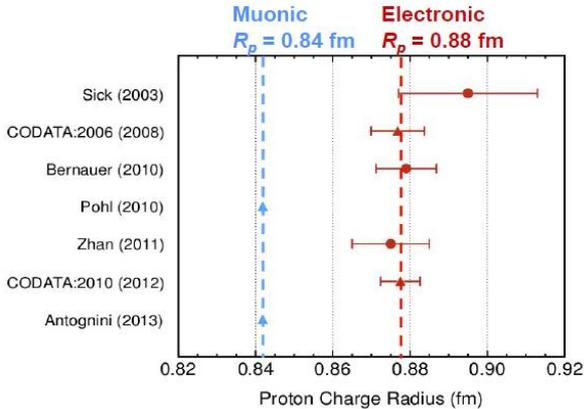
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The proton radius puzzle

- >7 σ discrepancy between **muonic** and **electronic** measurements
- High-profile articles in Nature, NYTimes, etc.
- Puzzle unresolved, possibly New Physics

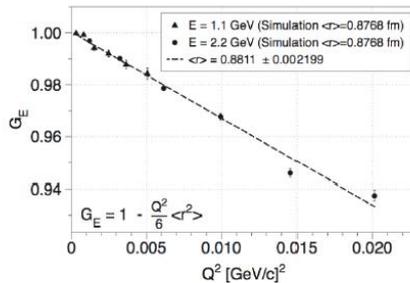
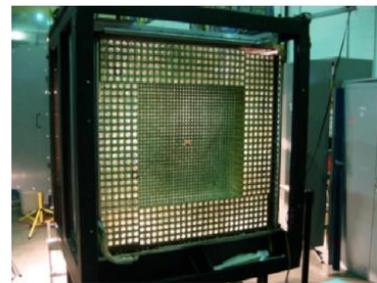


- ▲ Spectroscopy
- Scattering
- $R_p = 0.84184(67)$ fm
- $R_p = 0.875(10)$ fm
- $R_p = 0.8775(51)$ fm
- $R_p = 0.84087(39)$ fm



The PRad proton radius proposal (JLAB)

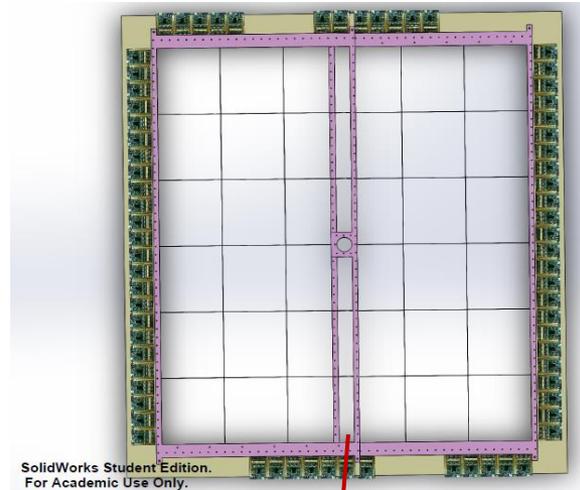
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- Low intensity beam in Hall B @ Jlab into windowless gas target
- Scattered ep and Moller electrons into HYCAL at 0°
- Lower Q^2 than Mainz. Very forward angle, insensitive to 2γ , G_M
- Conditionally approved by PAC38 (Aug 2011): "Testing of this result is among the most timely and important measurements in physics."
- Approved by PAC39 (June 2012), graded "A"

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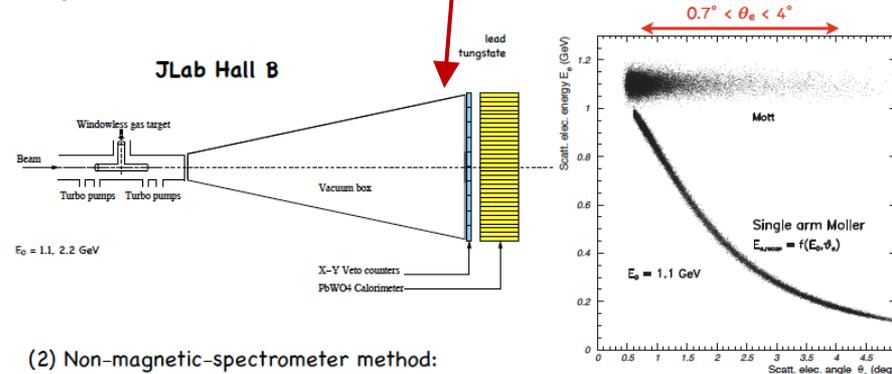
GEM chambers: X-Y veto counter



E12-11-106: Experimental method

(1) minimize experimental background:
high density windowless H_2 gas flow target

(3) Effective separation of Moller events from the ep elastic scattered events for angles $\theta_e > 0.7^\circ$.



(2) Non-magnetic-spectrometer method:
high resolution, high acceptance crystal calorimeter