

DAQ system and its software

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On behalf of PRad Collaboration

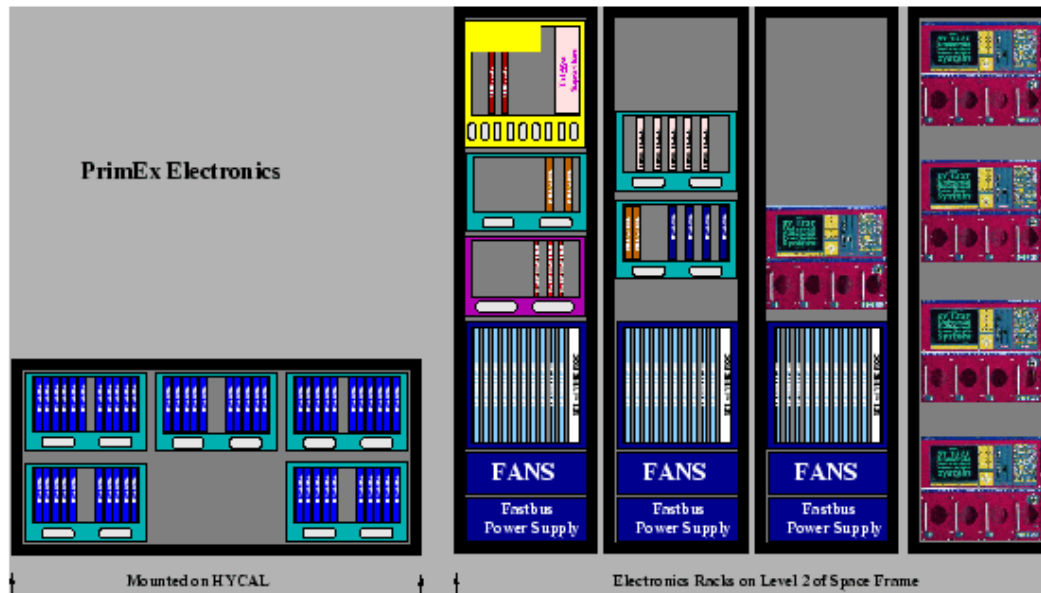
11/12/2015

Outline

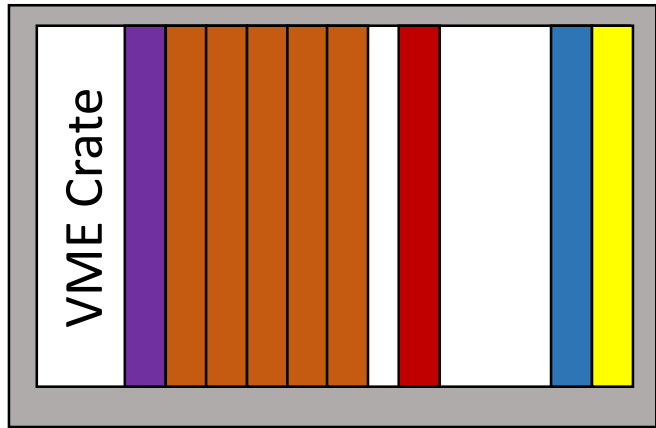
- DAQ system for HyCal
- DAQ system for GEM
- Software
 - Online software
 - Offline software
- Cosmic tests
- Summary

DAQ System for HyCal

- Based on previous PrimEx electronics
- 3 Fastbus crates with 30 ADC modules will read the 1728 channels from HyCal
- Total sum of energy as the physics trigger, a total of 52 UVA120A modules for the linear sum of dynode signal as the trigger
- Light monitoring system to monitor the gain for each channel

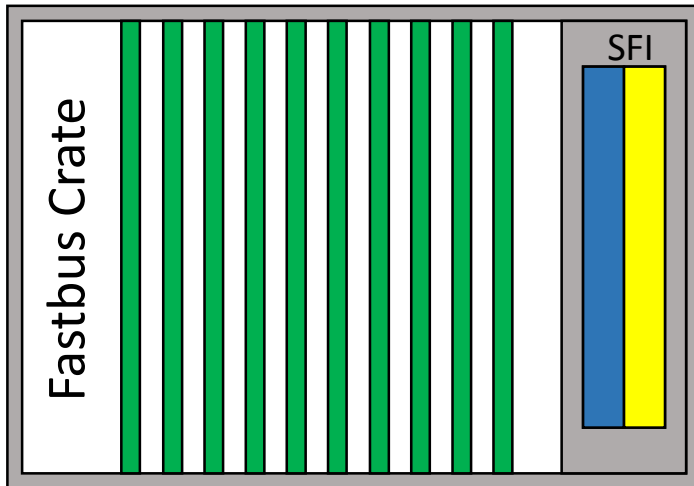


DAQ System for HyCal



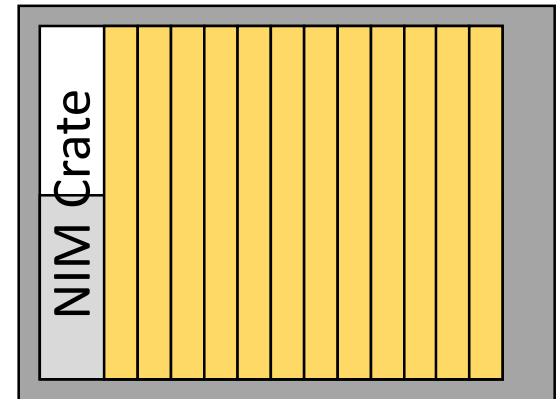
TDC/Trigger Crate

- 1x v1190 TDC
- 1x MVME 2436 ROC
- 1x JLAB TI (MASTER)
- 5x JLAB DISCRIMINATORS



3x ADC Crates

- 10x LRS1881M ADCs
- 1x MVME 5100 ROC
- 1x JLAB TI (SLAVE)

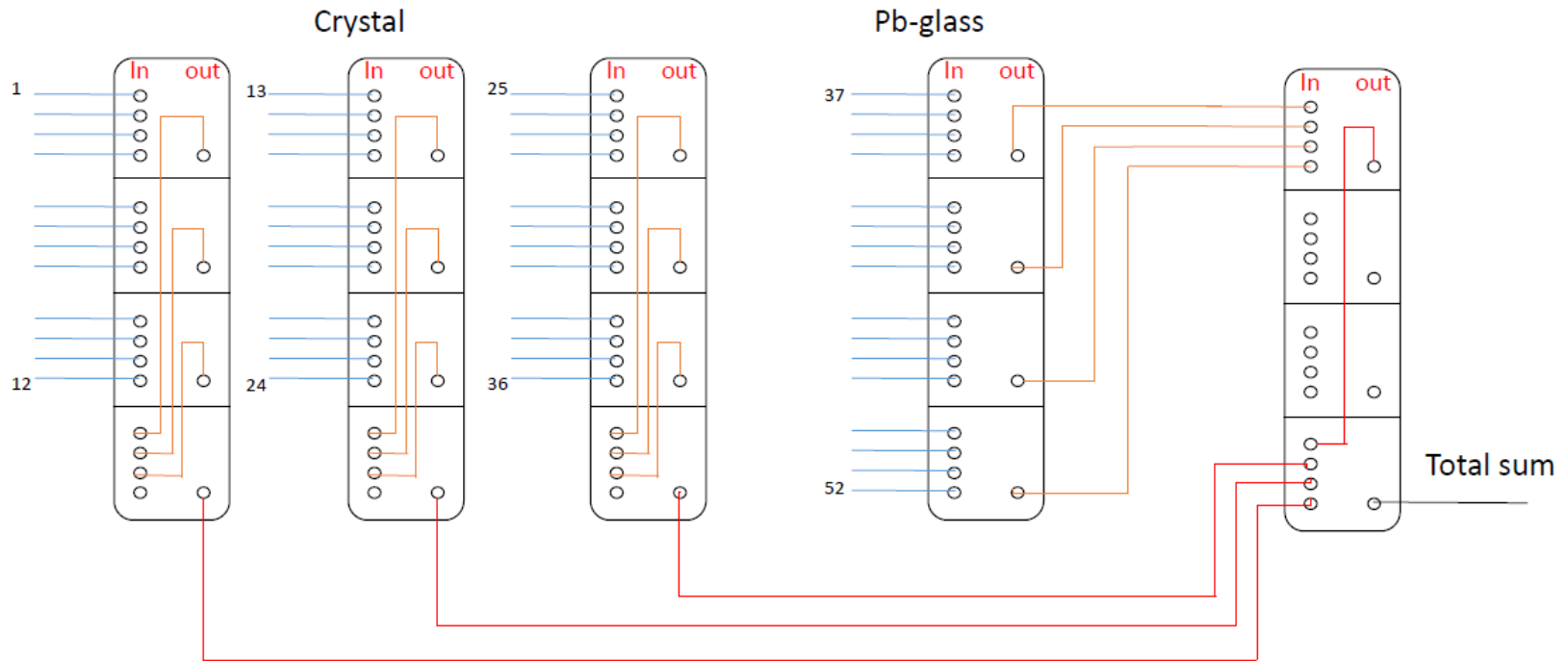


5x Linear Sum Crates

- 8x ~ 12x UVA 120A
- (52 output groups in total)
- Linear sum modules
- Mounted on HyCal box

DAQ System for HyCal

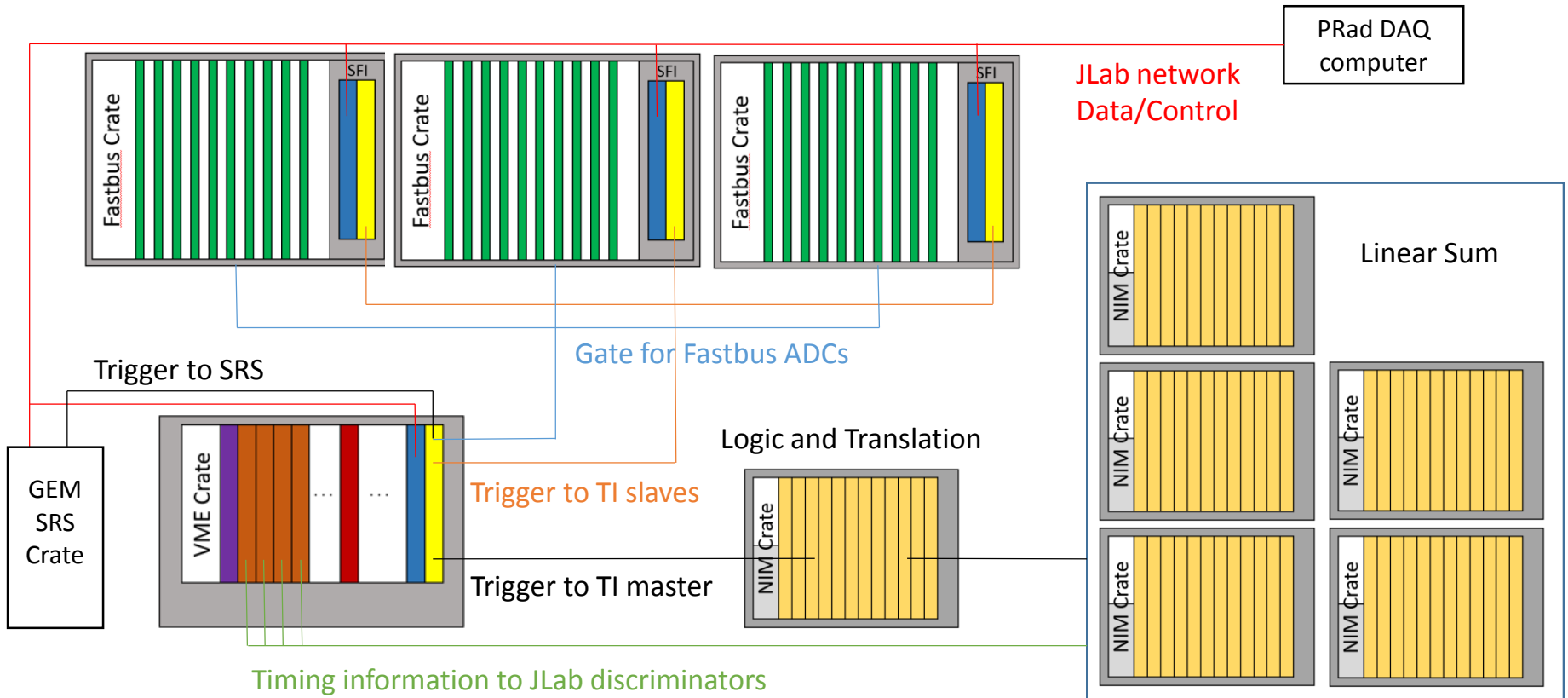
- 2 more NIM crates for the logic and translation (from NIM to ECL) modules
- Total sum of all the channels as the trigger



DAQ System for GEM

- Wait for Krishna's input
- Shows SRS system

DAQ System Overview



DAQ Software

- Standard CODA 2.6.2
- Modified readout list from previous PrimEx (since it was for HallB CODA, and configuration changed)

The screenshot shows the Run Control rcGui-21 interface. The top bar includes menu items: Platform, Sessions, Configurations, Options, Expert, Help. The main area is divided into several sections:

- Run Parameters:** Expid (PRAD), Session (PRAD01), Configuration (TTest), Output File (/home/pradrun/coda/data/T1_test217.dat).
- Run Status:** Run Number (217), Run State (booted), Event Limit (0), Total Events (302), Data Limit (0.0).
- Table:** A table with columns: Name, State, EvtRate, DataRate, In-EvtRate, In-DataRate. Rows include ER6, primexts2, primexts5, primexroc6, primexroc4, and primexts2.
- Graph:** A line graph showing Event Rate vs Time (15:10:20). The rate starts at 0 and rises to approximately 60 events per second.
- Log:** A table of messages with columns: Name, Message, Time, Severity. Messages include CODA_DP communication errors, configuration status for various components, and successful downloads.

The screenshot shows the Xcefdmp interface. The top bar includes menu items: Data_Source, Dictionary, View, Options, Help. The main area is divided into several sections:

- Data Source:** adrun/coda/data/T1_test217.dat
- Dictionary:** /home/pradrun/coda/2.6.2/com
- Tag Name:** 1
- Event Number:** 3
- Event Number Slider:** A slider set to 1.
- Dump Options:** Decimal Dump, Hex Dump, Enable Dictionary, Disable Dictionary.
- Action Buttons:** View File, Spy Event, View Next, View Previous, Refresh, Quit.
- Info:** Info -> To start, enter a file name; Info -> Number of events: 274.
- Event Tree:** A tree view showing the event structure: type_13_physics_event -> header -> ROC1, ROC11, ROC12, ROC14. Each ROC node has associated data points (0x4, 0x3).

Online software

- The software for HyCal is based on previous primex software package, modified according to the new PRad DAQ configuration.
- Current online software
 - HyCal event viewer
 - HyCal gain equalizer
 - High voltage monitor and control
 - Temperature monitor
 - HyCal movement control and calibration scripts (needs updated coordinate input)
- Implementation ongoing
 - Other subsystem monitors (LMS, ROCs, Triggers, DAQ Crates)
 - Integrated alarm server

Online software for GEM

- Inputs from Krishna
- Shows CODA can read SRS data

The screenshot displays the 'Run Control rcGui-65' application window. The interface includes a menu bar (Platform, Sessions, Configurations, Options, Expert, Help), a toolbar with control buttons, and a main workspace divided into several sections:

- Run Parameters:** Fields for Expid (PRAD), Session (PRAD01), Configuration (PRadGEM), and Output File (/home/pradrn/ppentest/test529.dat).
- Run Status:** Run Number (529), Run State (active), Event Limit (0), Total Events (852), and Data Limit (0.0).
- Table:** A table with columns: Name, State, EvrRate, DataRate, In-EvrRate, In-DataRate.

Name	State	EvrRate	DataRate	In-EvrRate	In-DataRate
ER7	active	50.0	96.4	22.4	47.3
EB7	active	50.0	99.2	24.3	50.8
FGemROC	active	50.0	99.2	25.5	52.9
- Graph:** A line graph showing the Event Rate for EB7 over time. The x-axis represents time from 23:35:10 to 23:35:30, and the y-axis represents the Event Rate from 0 to 60. The graph shows several peaks around 23:35:10 and 23:35:20, followed by a sharp increase to approximately 50 at 23:35:25.
- Log:** A table of messages with columns: Name, Message, Time, Severity.

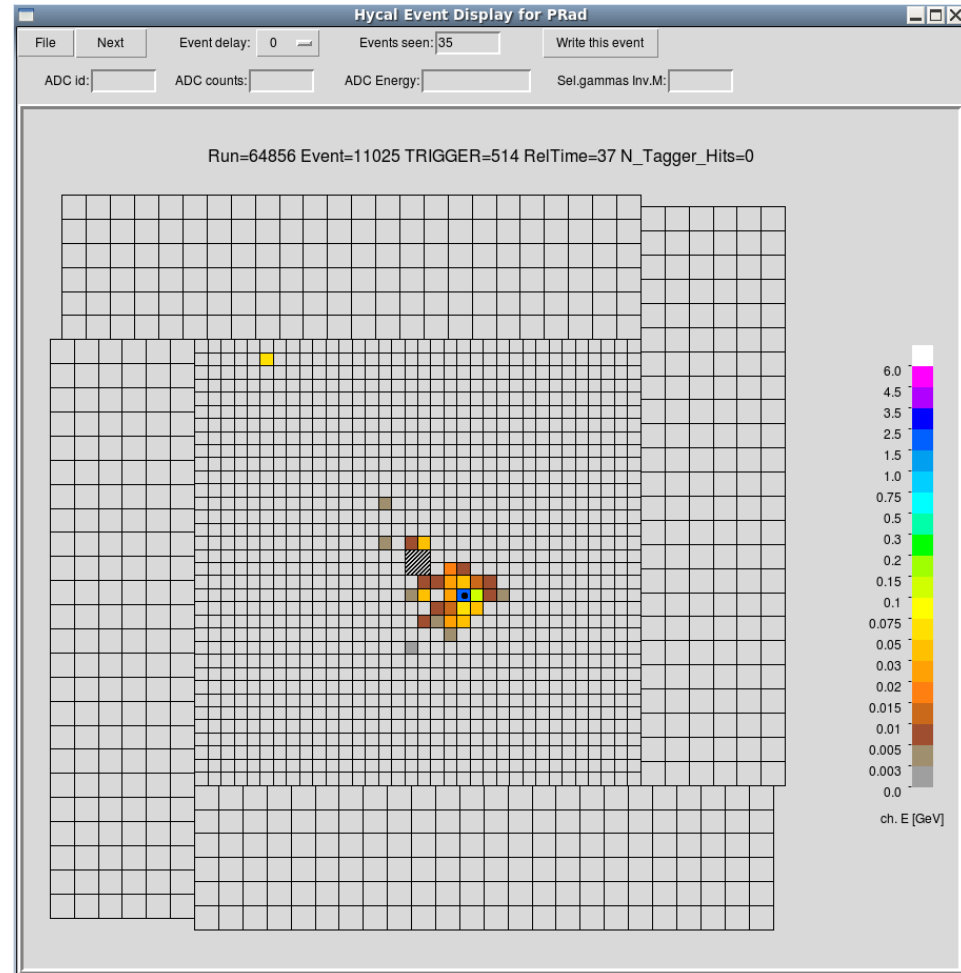
Name	Message	Time	Severity
rcGui-65	Configure is started.	23:34:22 11/05	Info
ControlDesigner	configure is started	23:34:22 11/05	Info
sms_PRadGEM	Configure succeeded.	23:34:26 11/05	Info
sms_PRadGEM	Download is started.	23:34:31 11/05	Info
sms_PRadGEM	Download succeeded.	23:34:35 11/05	Info
sms_PRadGEM	StartRun is started.	23:34:45 11/05	Info
sms_PRadGEM	StartRun succeeded.	23:34:45 11/05	Info

An inset window titled 'CODA MASTER' is visible in the bottom right, showing a 'Config' section with status indicators for ER7 (configured), EB7 (configured), and mROC (paused), along with buttons for Reset, Kill, Reboot, and Startup options (ET System, Event Builder, Event Recorder, Run Control). The date and time shown are 'Thu Nov 5 23:34:19 EST 2015'.

Offline software

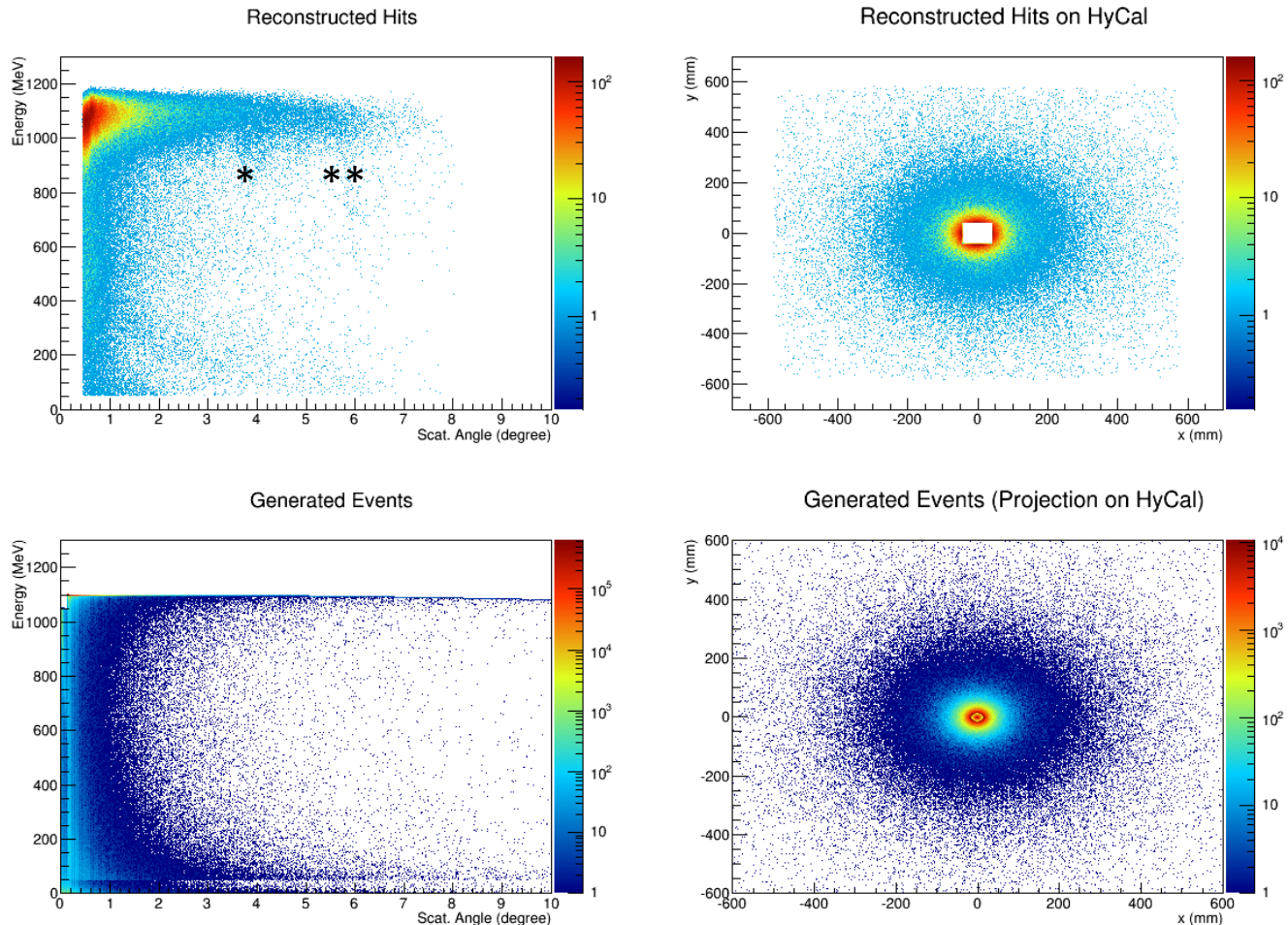
- Replay code for CODA file
- HyCal events reconstruction program
- HyCal offline events viewer, based on PrimEx event display

Offline events viewer (input from simulation)



Offline software

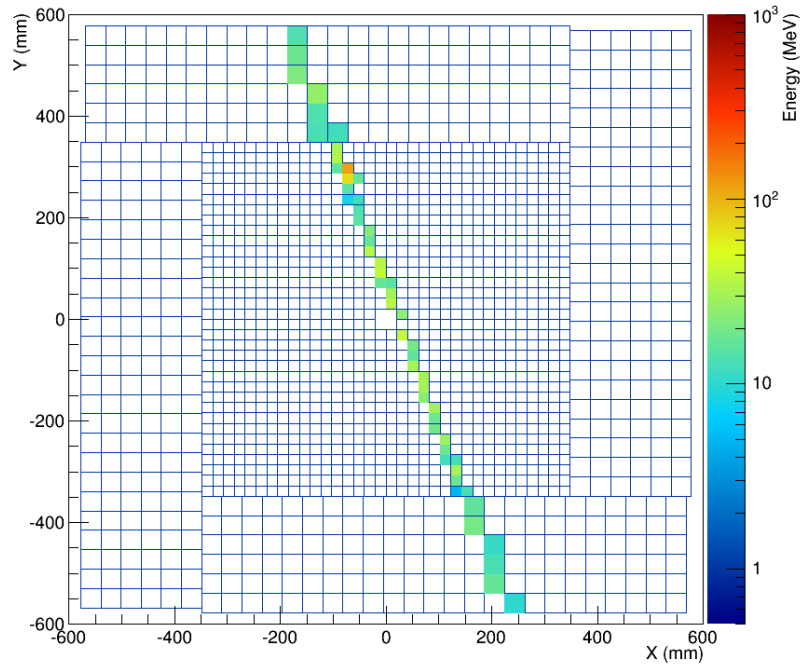
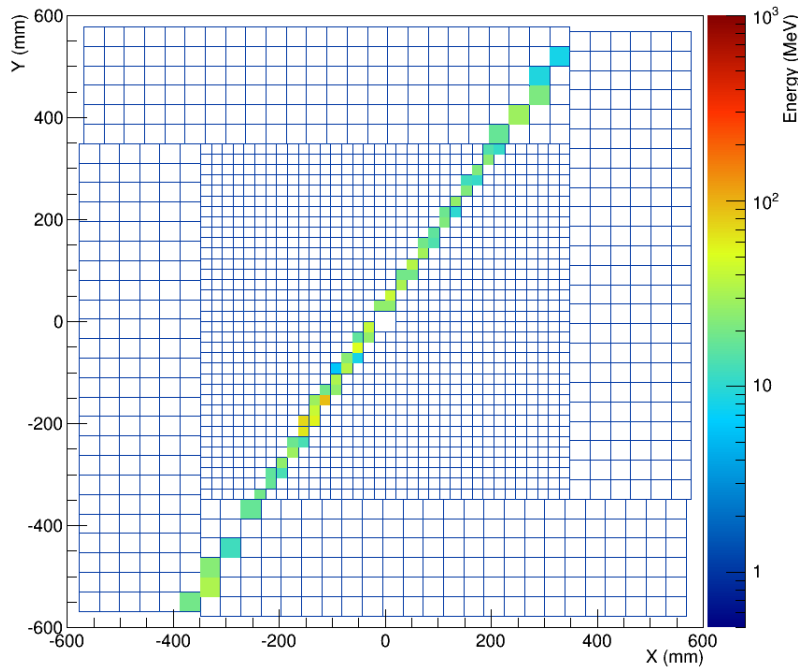
- Reconstruction with simulation input



- * Shift between Lead glass and Lead Tungsten
- ** Phi coverage start to be $< 2\pi$

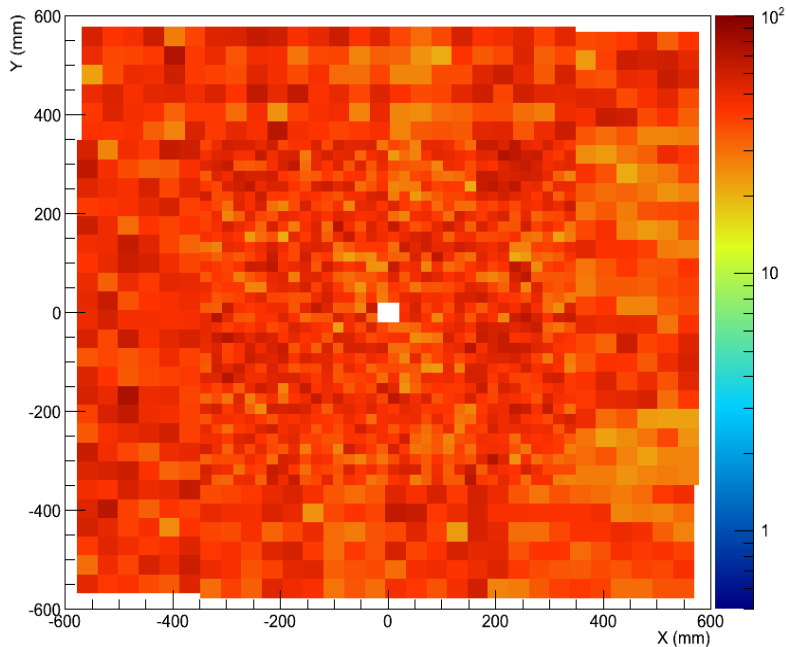
Cosmic tests for HyCal

- Cosmic rays detected by HyCal and reconstructed by DAQ

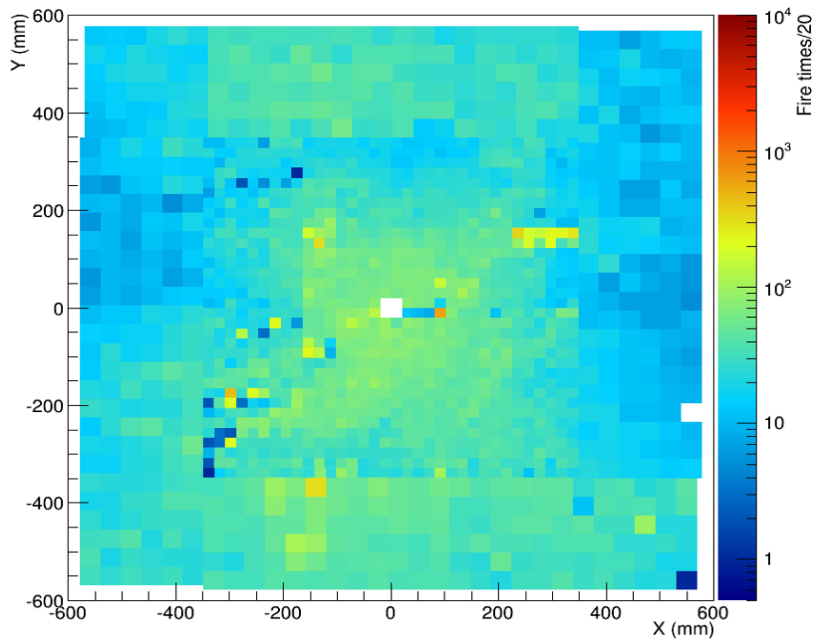


Cosmic tests for HyCal

- Pedestal is at 500 ~ 700 channels
- A few modules have low occupancy, but the gain for each modules is not optimized yet.



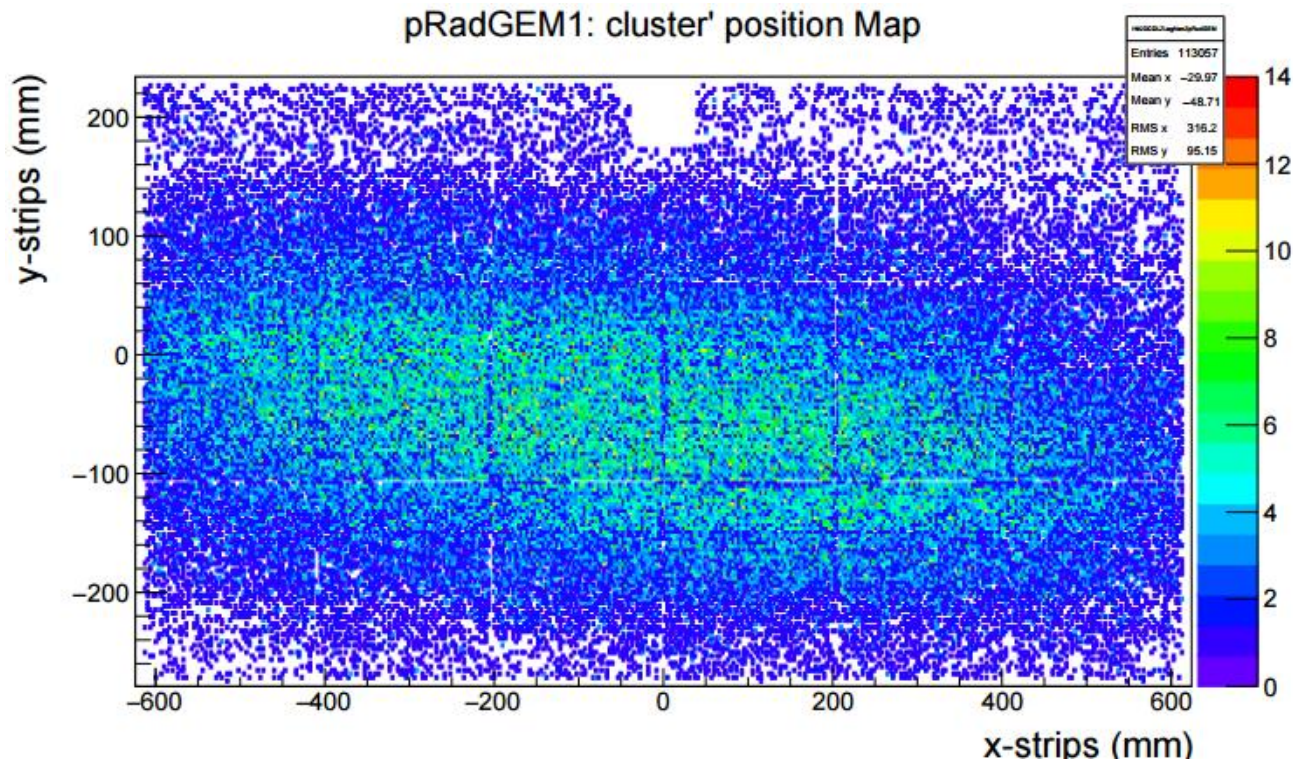
Pedestal Map



Occupancy

Cosmic tests for GEM

- Test was conducted in the Lab at UVA
- Triggered by a scintillator on the top of GEM chamber, only covered the central part



Summary

- HyCal is ready to take data, and has already taken some cosmic data in Hall B
- Integration of GEM will be finished in several weeks, we can read SRS data through CODA now
- Online software package is functioning, will be improved at the meantime

Month	Nov. 2015			Dec. 2015			Jan. 2016					Feb. 2016				Mar. 2016				
Week	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17	W18	W19	W20
GEM	Finalize the GEM DAQ			Cosmic test								Long cosmic run for efficiency data								
DAQ							Integration of whole DAQ system													
Software	Finalize the software package						Along with software test					Continue on software improvement and debugging								

↓
The whole system is ready

Thanks

- Thanks the help from David Abbott, Sergey Boyarinov, David Lawrence, Bryan Moffit, Xuefei Yan and Weizhi Xiong