

News on GEM Readout with the SRS, DATE & AMORE

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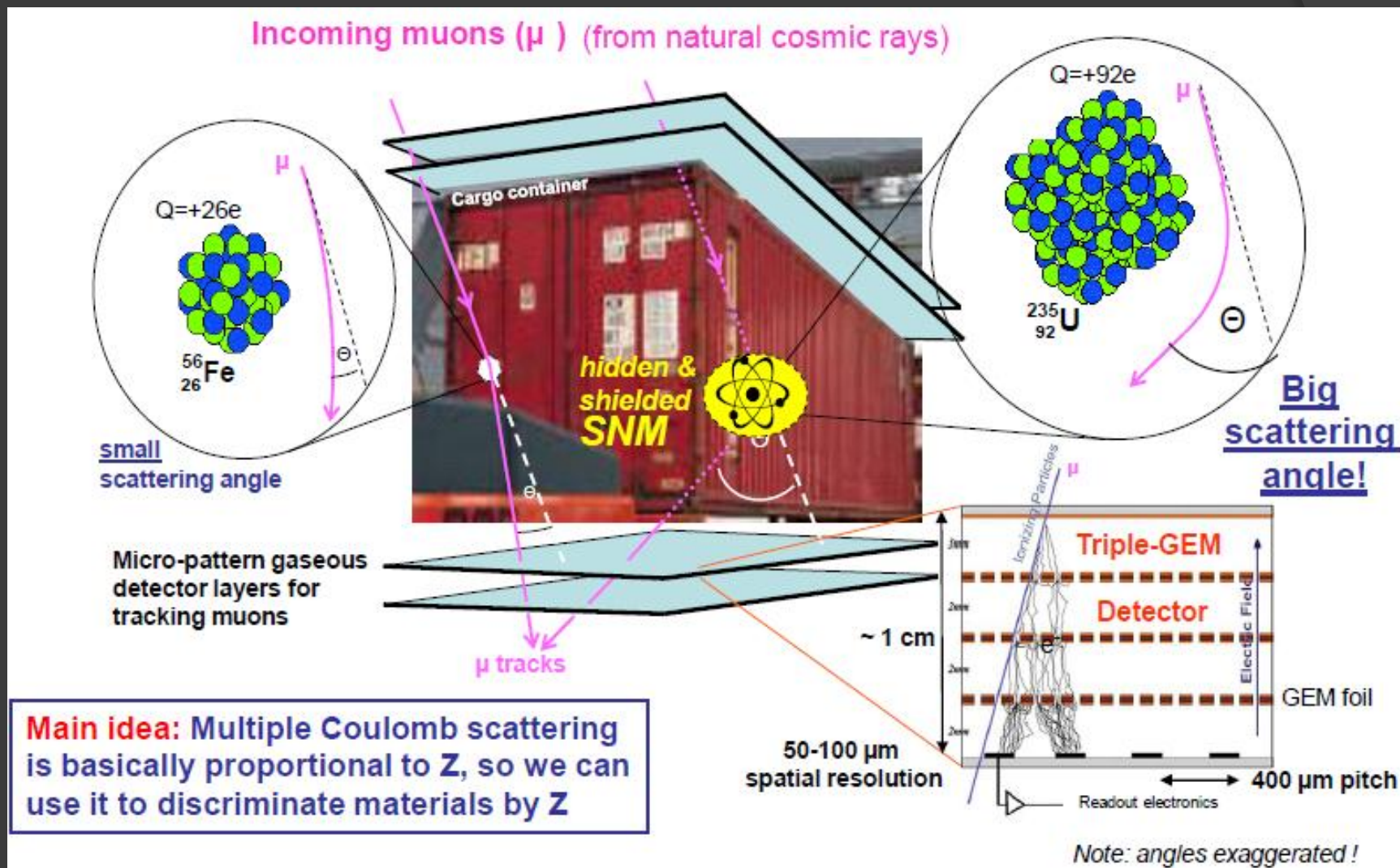


OUTLINE



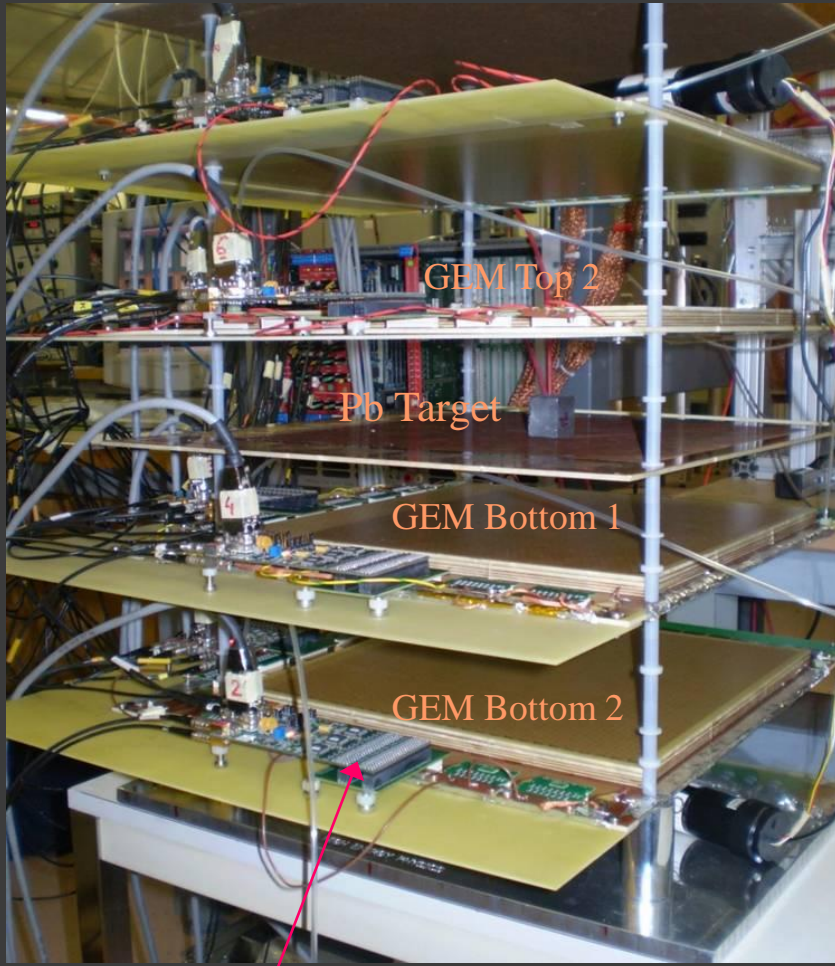
- Principle of Cosmic Ray Muon Tomography (MT)
- Proof of Concept with the Minimal MT Station
- MT Station with the Scalable Readout System
- DATE Framework with UDP Equipment for the SRS Data Acquisition
- AMORE for Event Monitoring & Data Analysis
- Preliminary results of Cosmic ray Muons Data with GEM/SRS
- Conclusion & Perspectives

Principle of the Cosmic Ray Muon Tomography (MT)





Proof of Concept with the Minimal MT Station

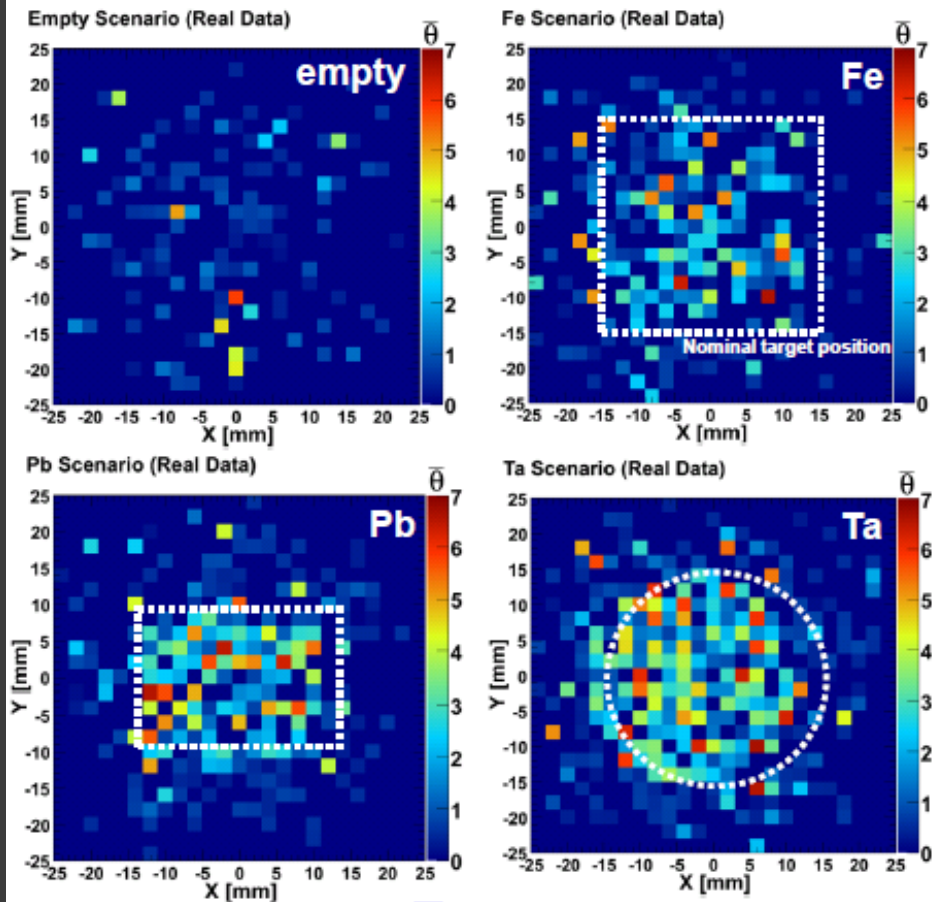


Gassiplex electronics

Setup at CERN (in the GDD Lab)

- Dec '09 –Jan '10 and April '10
- Only 4 Triple GEM detectors used 2 at the top and 2 at the bottom
- 8 Gassiplex front end electronics borrowed from Saclay (Paris).
- Only 5 cm x 5cm area read out for each detector
- DAQ system inspired from CAST/MAMMA DAQ

First-ever experimental GEM-MT Data



Muons reconstructed:

Empty	558
Fe	809
Pb	1091
Ta	1617



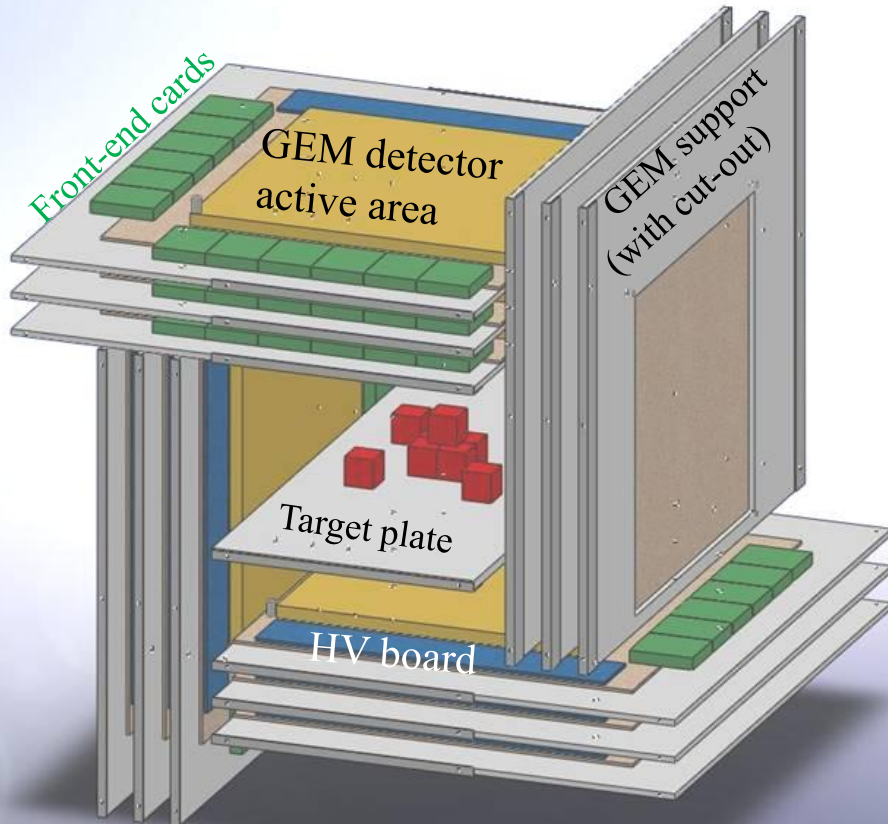
It works !!!



Mean scattering angles $\bar{\theta}$ in $x \times y \times z = 2\text{mm} \times 2\text{mm} \times 20\text{mm}$ voxels (x-y slices taken at $z = 0\text{mm}$)



MT Station with the Scalable Readout System



Full MT Station

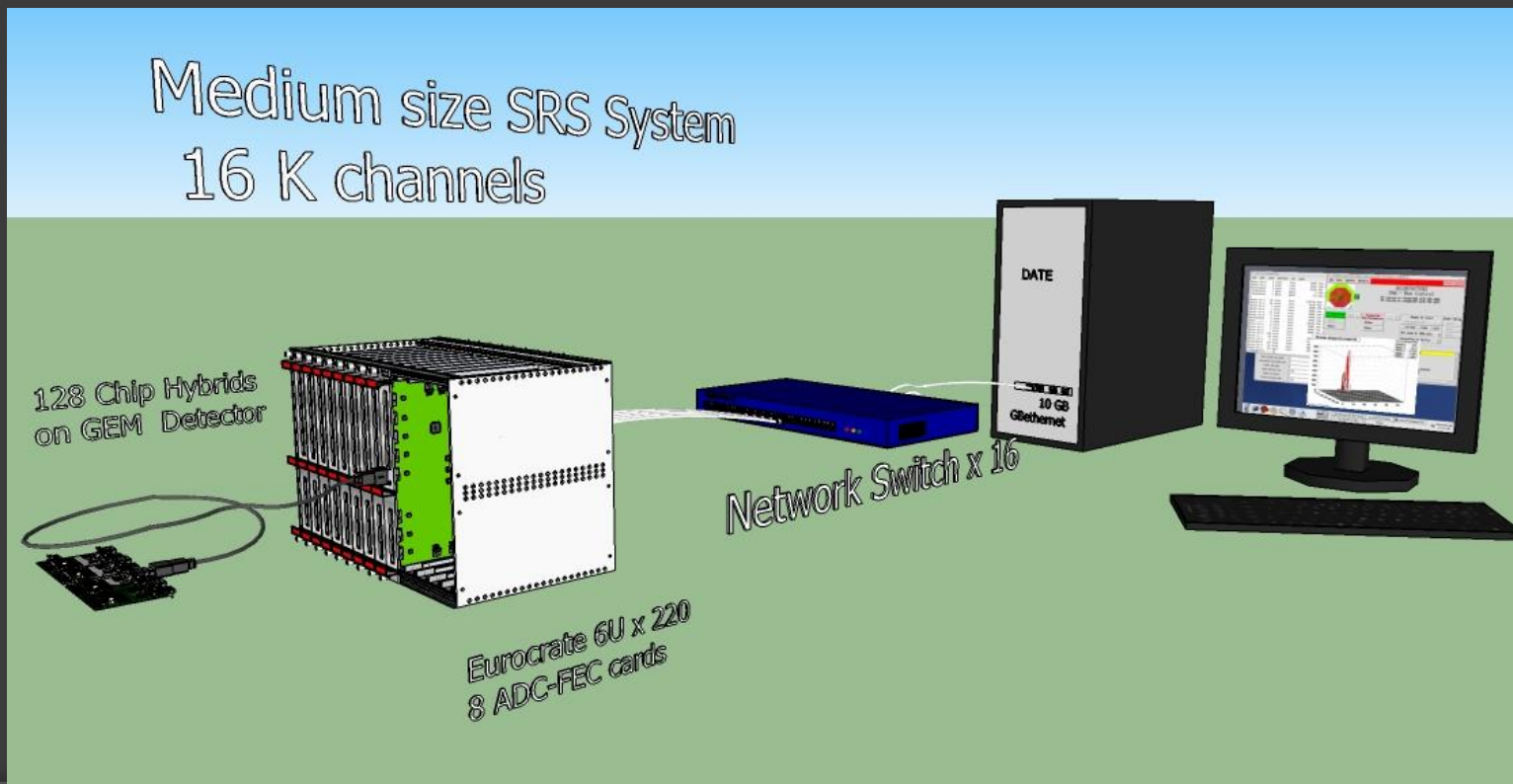
- Cubic-foot size station (30 cm x 30 cm x 30 cm)
- Total of 10 detectors (top and bottom + lateral station)
- Mechanical stand with flexible geometry e.g. variable gaps between detectors
- APV chip + RD51 SRS to read out more than 15 000 channels
- DATE software for DAQ + AMORE for data monitoring & analysis



MT Station with the Scalable Readout System



- The DAQ system for a full MT Station:
 - 120 APV Hybrids and 8 ADC + FEC cards
 - One network switch for the data transfer to the DAQ PC
 - 1 DAQ PC with DATE & AMORE software





DATE Framework with UDP equipment for the SRS Data Acquisition

(Filippo Costa)



- ◎ DATE is ALICE DAQ software
 - Data Acquisition & Test Environment
 - Compatible with Linux SLC4 (Online development for SLC5 release ...)
 - Many features available : run control environment, basic online monitoring of the raw data, electronic logbook.
 - Easy to use software and user friendly GUI for the run control
- ◎ UDP Equipment
 - Ethernet socket added to DATE as an alternative data transfer system
 - One Ethernet port on the FE card connected to another port on the DATE PC via a copper cable or optical fiber cable data, (1Gb/s to 10 Gb/s throughput)
 - The DATE PC can handles many UDP equipments (3 Ethernet ports been tested)



DATE Framework with UDP equipment for the SRS Data Acquisition



The screenshot shows the DATE framework interface. On the left, an 'infoBrowser' window displays a log of system events, including readout version updates, equipment list loading, and data taking start. The main window, 'DAQ_TEST - Run Control', shows the system is 'Ready to start' and 'Beta Taking'. It includes buttons for 'Disconnected Configuration', 'Connected Run Parameters', and 'Ready to start'. Below these are controls for 'Start processes', 'EDM', 'HLT: mode R', 'LDC: Local Recording OFF', and 'GDC: eventBuilding OFF'. A 'Trace' window at the bottom shows a list of events and their details.

- **CPU** Intel Core 2 Duo E8500 - 3,16 GHz (6MB L2 cache, 1333 MHz FSB)
- **RAM** 4 GB (2 x 2GB) SDRAM DDR3-1333
- **OS** SLC4 (2.6.9-89.0.29.EL.cernsmp)
- **10Gb card:** Intel 10 Gb



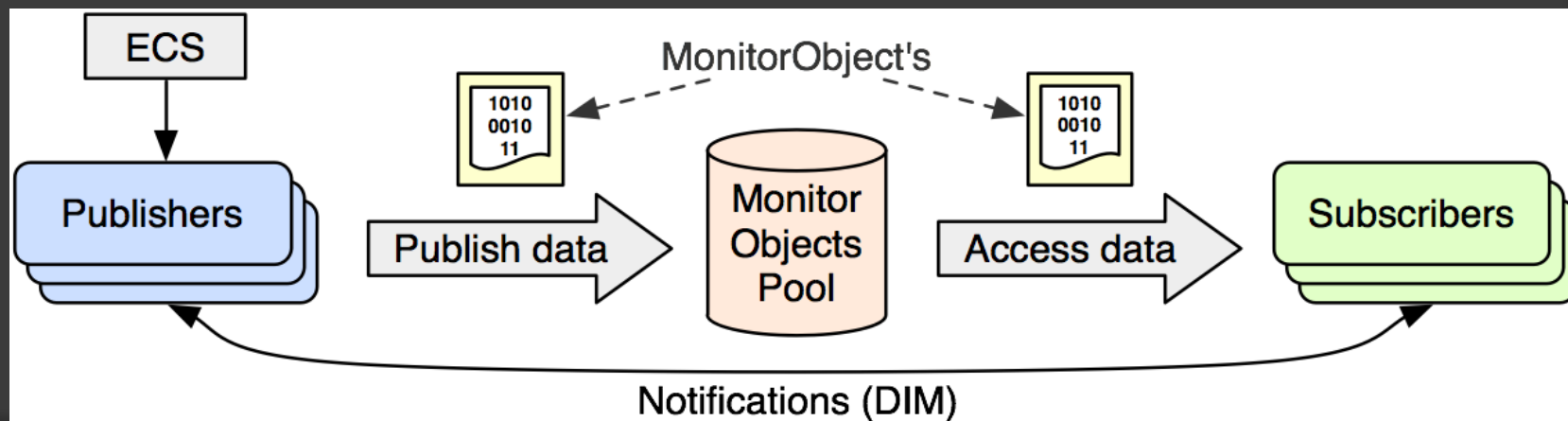
10 Gb cat 6A 10 m



AMORE for SRS Event Monitoring and Data Analysis



- AMORE is ALICE Data Quality Monitoring Software framework
- Automatic Monitoring Environment founded on ROOT & DATE Monitoring Library
- It is based on Publisher/subscriber paradigm with the detectors publishing their data in a monitoring pool and clients subscribing to the pool to collect data for online event monitoring & offline data analysis.
- Communication between publisher and clients through DIM a publish/subscribe system developed at CERN





AMORE for SRS Event Monitoring and Data Analysis



- ◉ AMORE code for the tests on GEM/SRS as it stands:
 - AMORE Agent amoreMTS
 - Great thank to Barthelemy Von Haller (ALICE DAQ team) for the help & support
 - Decoding of the very raw data from the detector
 - “Online” common mode correction, pedestal offset subtraction
 - ROOT histograms of the raw data, the hit & Event Display
 - Mapping, histograms & display parameters set from configuration files



Development of MTS-II using the scalable Readout System



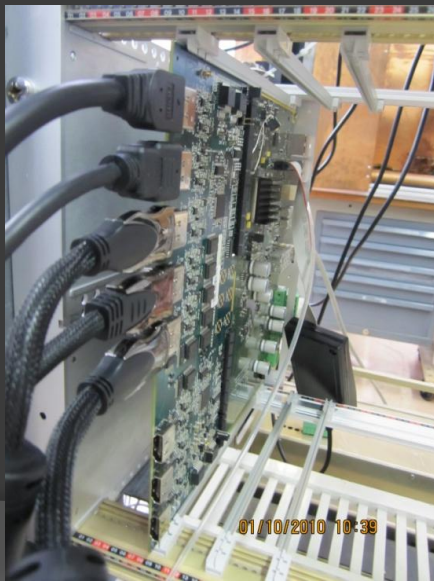
Triple GEM with 11 APV25 hybrids



The experimental setup



ADC + FEC card on the Euro crate

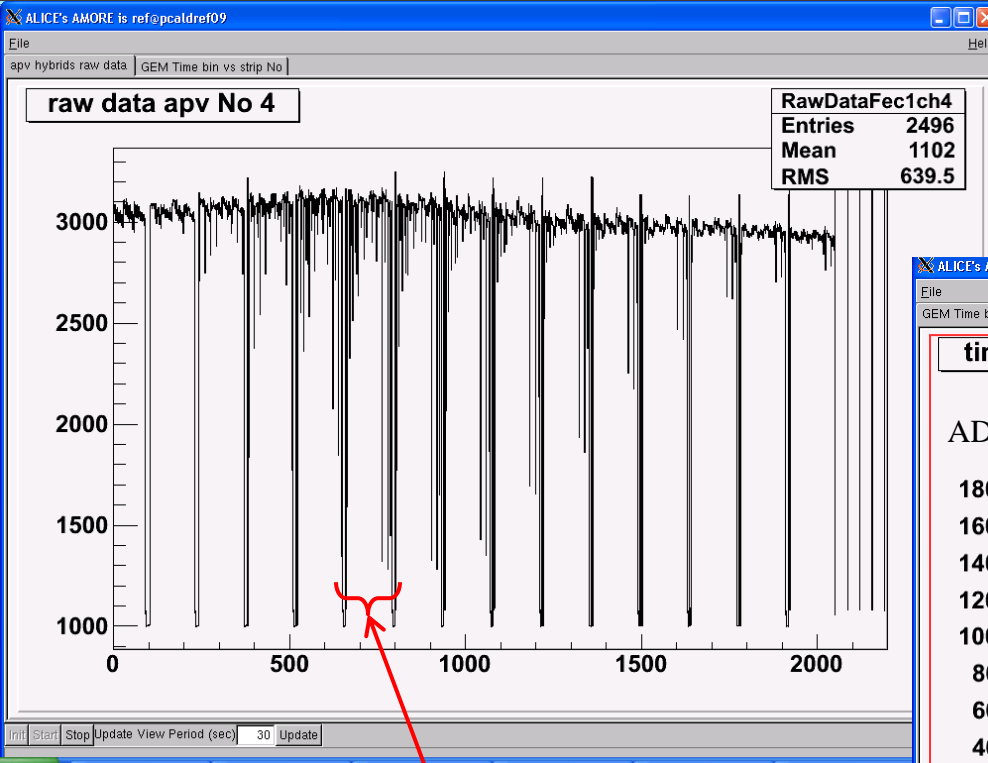




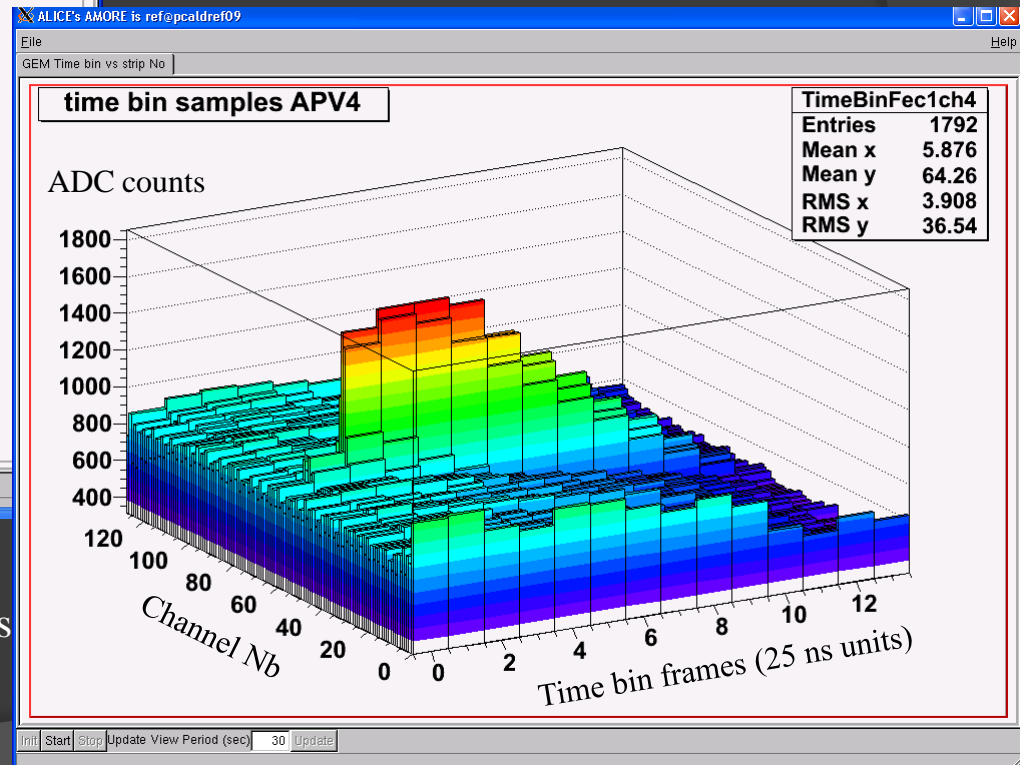
Preliminary Results from Cosmic Ray Muons with GEM/SRS



APV raw data



Data after channel number correction



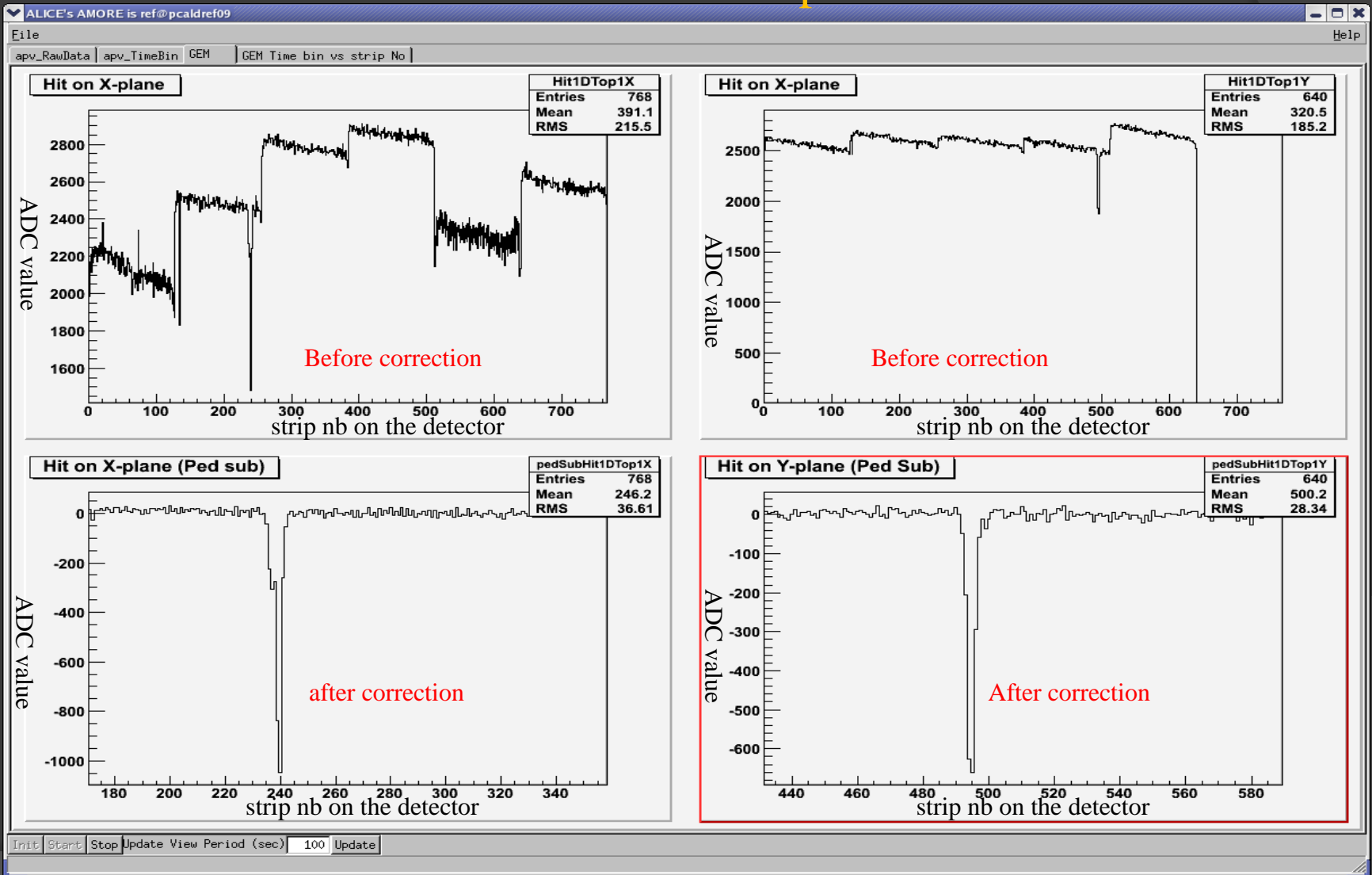
inside 25 ns time bin frame, the APV header word followed by Analog signal of the ADC 128 channels



Preliminary Results from Cosmic Ray Muons with GEM/SRS

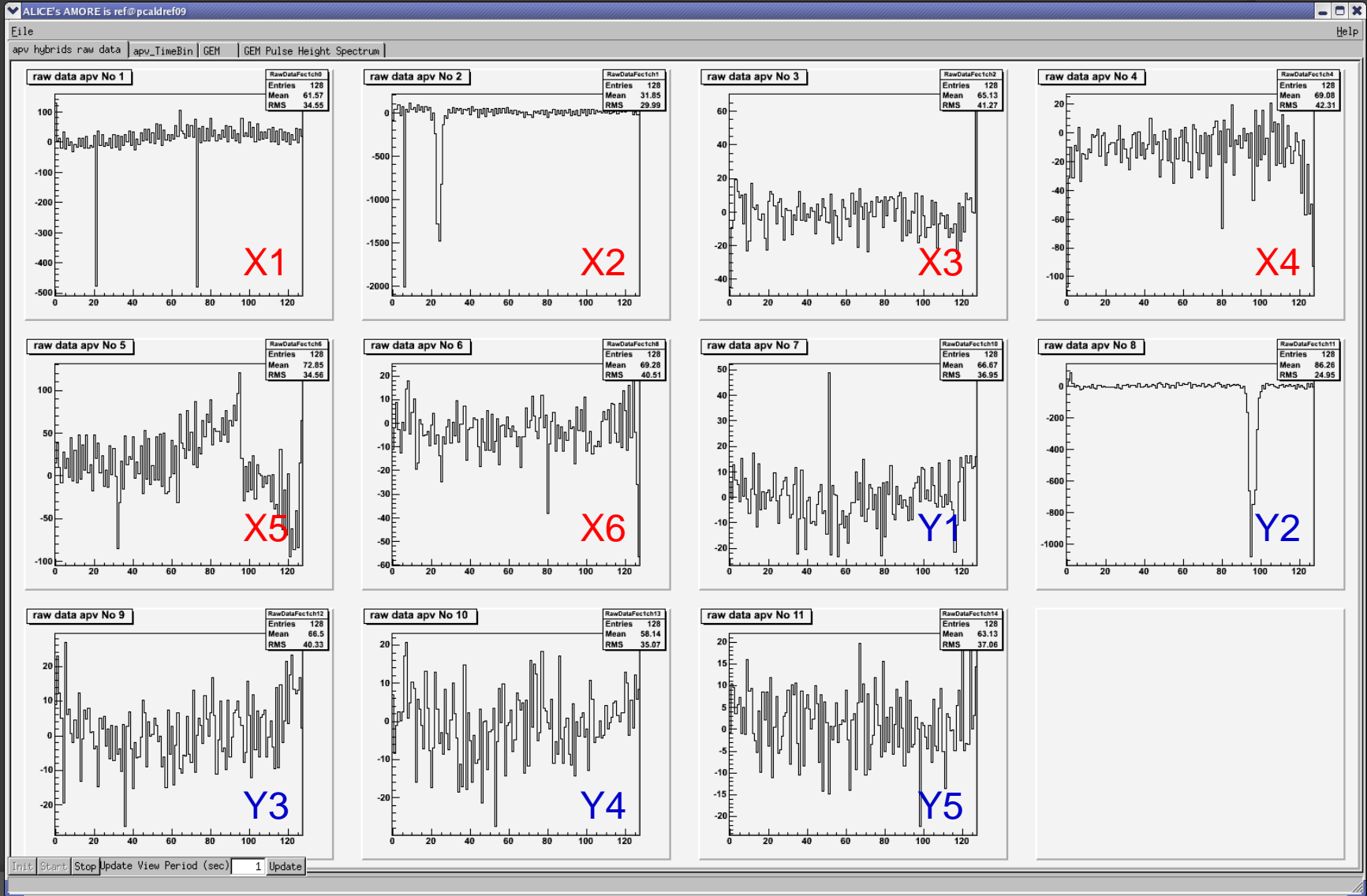


Common mode correction and pedestal subtraction





Preliminary Results from Cosmic Ray Muons with GEM/SRS





Conclusion & Perspective



- ◎ Where we are now
 - We have successfully taken more than 1M cosmic data events with the GEM detector using the whole SRS (APV25, ADC/FEC/DATE + AMORE)
 - Data were taken with 11 hybrids (~1400 channels) connected to the detector
 - Raw offline common mode correction and pedestal subtraction were performed
 - UDP equipment integrated for the data transfer from detector to DAQ DATE PC
 - Development of AMORE Code for online monitoring and data analysis

- ◎ Where we want to be in the next few months for MT Station
 - The production APV25 hybrids, FEC/ADC cards to readout 15 K channels for our 10 GEM detectors.
 - Getting more familiar with the DATE software as Florida Tech will provide the DATE expert for the RD51 collaboration
 - Develop a more robust data analysis code for the common mode and pedestal correction
 - Develop a standard AMORE package for the RD51 users of the SRS