Muon g-2 Experiment Monitoring

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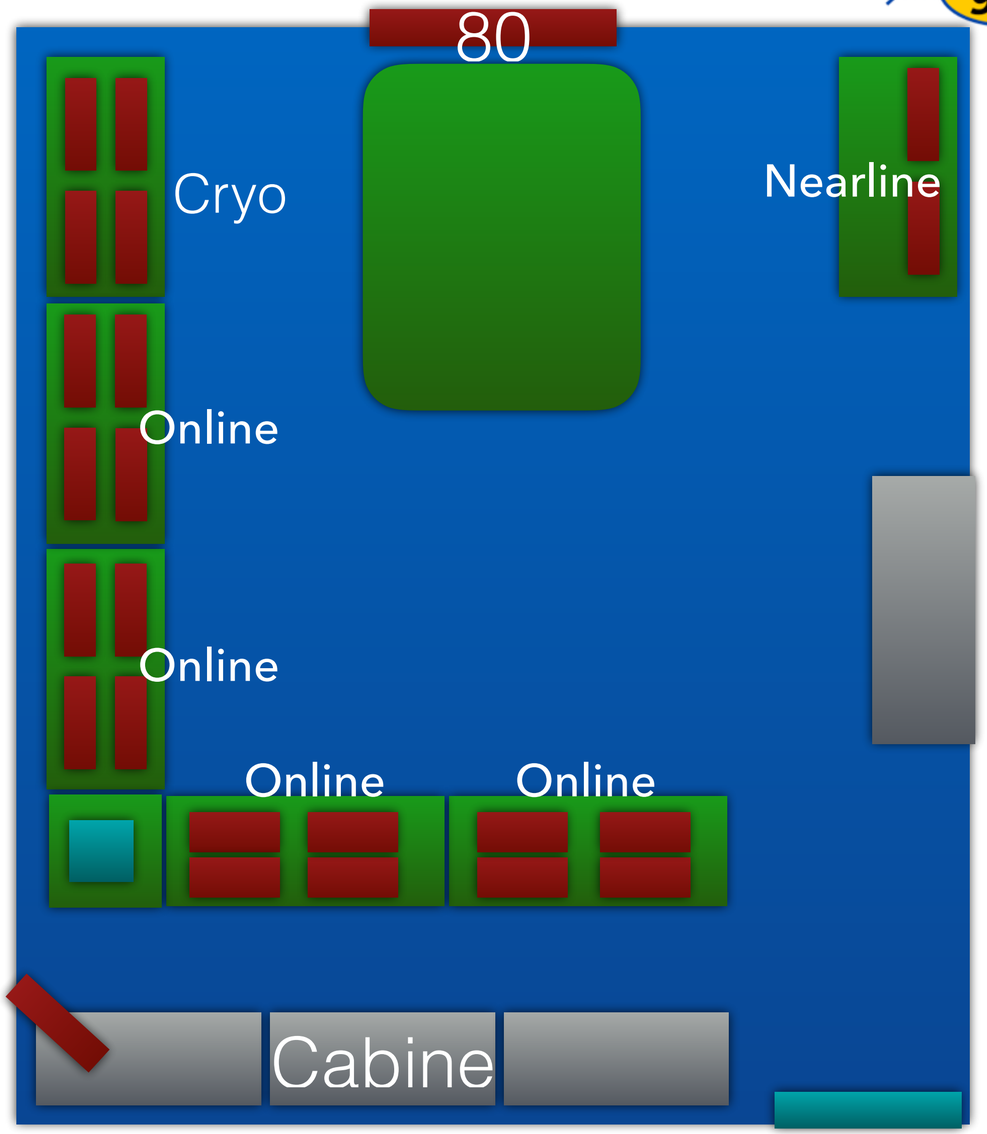
8 November 2016

Control Room Layout

- 2 computers installed with 8 monitors have been installed
- 3rd computer for field monitoring is currently being set up.
- Still need to add one more for full online monitoring.
- Need a machine that can run the event display for the 80" screen.
- Plan to add videoconferencing.



Monitoring Screens

Required displays:

MIDAS for detectors
MIDAS for field
DQM for detectors
DQM for field
Run log

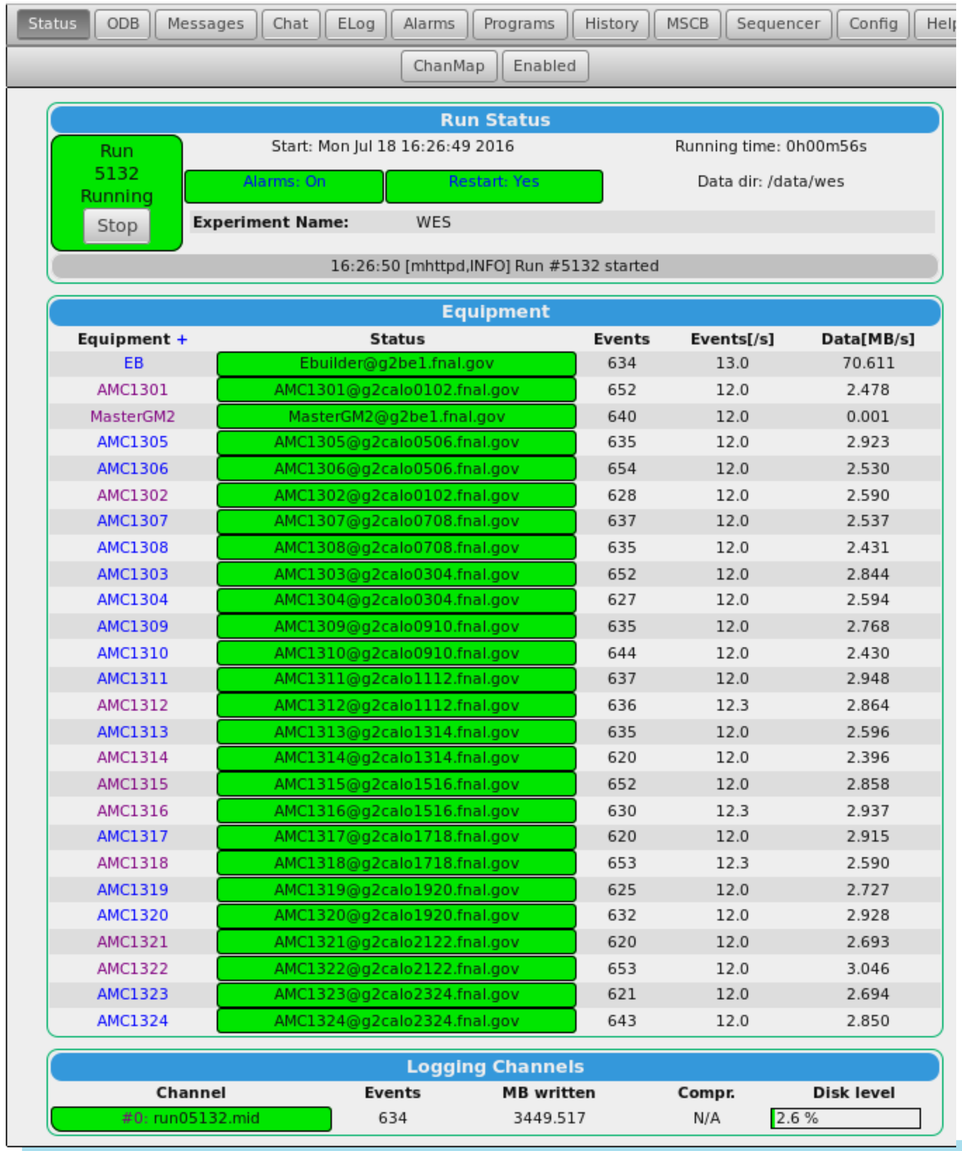
Trend plots
Laser monitor
Rider monitor
Kicker monitor
CTAG display

Logbook
Video feed
MIDAS History
High Voltage control
Nearline monitor

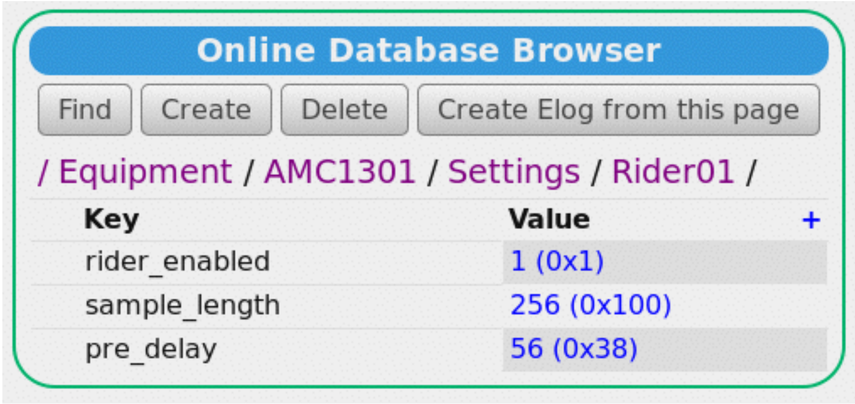
Run status
DAQ status
SiPM Monitor
FTS Display
Accelerator status

+Paraview on 80” screen

MIDAS Web Control



- Midas web server used for experiment monitoring and control.
- Includes control of hardware/software settings via editing the Midas Online Database.
- Alarm system provides visual and audible warnings and alerts.



MIDAS Control with Javascript

We are creating custom pages with JS that interact with the MIDAS ODB to improve control over the experiment.

Frontend Enable

Frontend	Enable	Send to EB	Repeat First Event	TQ on	Raw data	Raw prescale	Raw prescale offset	Histogram data	Histogram data flush	Histogram flush offset	Waveform Length	GPU WaveformLength
AMC1301	☐	☐		☐	☐	2	0	☐	10	0		560000
AMC1302	☑	☑		☐	☐	10	0	☐	10	0		560000
AMC13Simulator02	☑	☐	☑								560000	
AMC13Simulator01	☑	☐	☑								560000	
AMC13Simulator03	☑	☐	☑								64	

Being implemented by Z. Helton (UKY Undergraduate) and R. Chislett (UCL)

Include

Equipment	Include in FE Enable
AMC1301	☑
EB	☐
AMC1302	☑
MasterGM2	☐
AMC13Simulator02	☑
AMC13Simulator01	☑
AMC13Simulator03	☑
AMC1303	☐

FTS Monitor

FTS status for gm2-fts-gm2samgpvm01

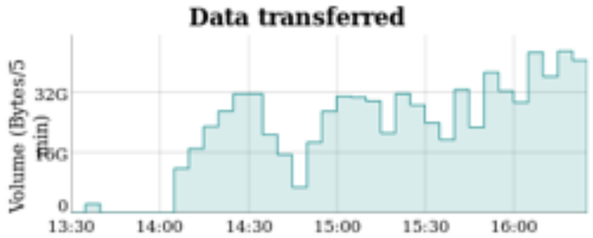
Generated at 2016-06-24 16:27:04 CDT (update)

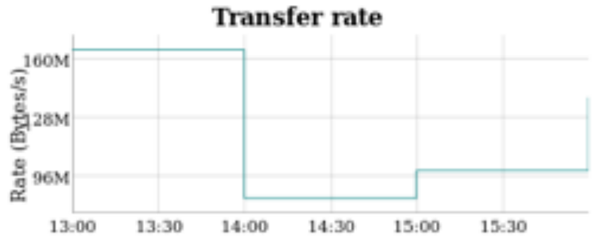
Summary

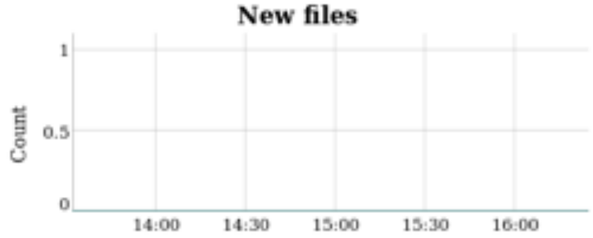
FTS: OK	SAM: OK

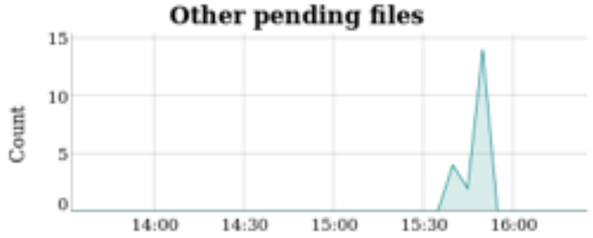
Completed files:	244
Failed transfers:	0
All error files:	0
Waiting on tape:	1719
Other pending files:	0
New files:	0

- An FTS server is running on g2be2 to copy data from our local RAID to the Fermilab dCache.
- The server provides monitoring plots so we can track the data transfer and easily see the quantity of data left on disk.









Monitoring Webpage

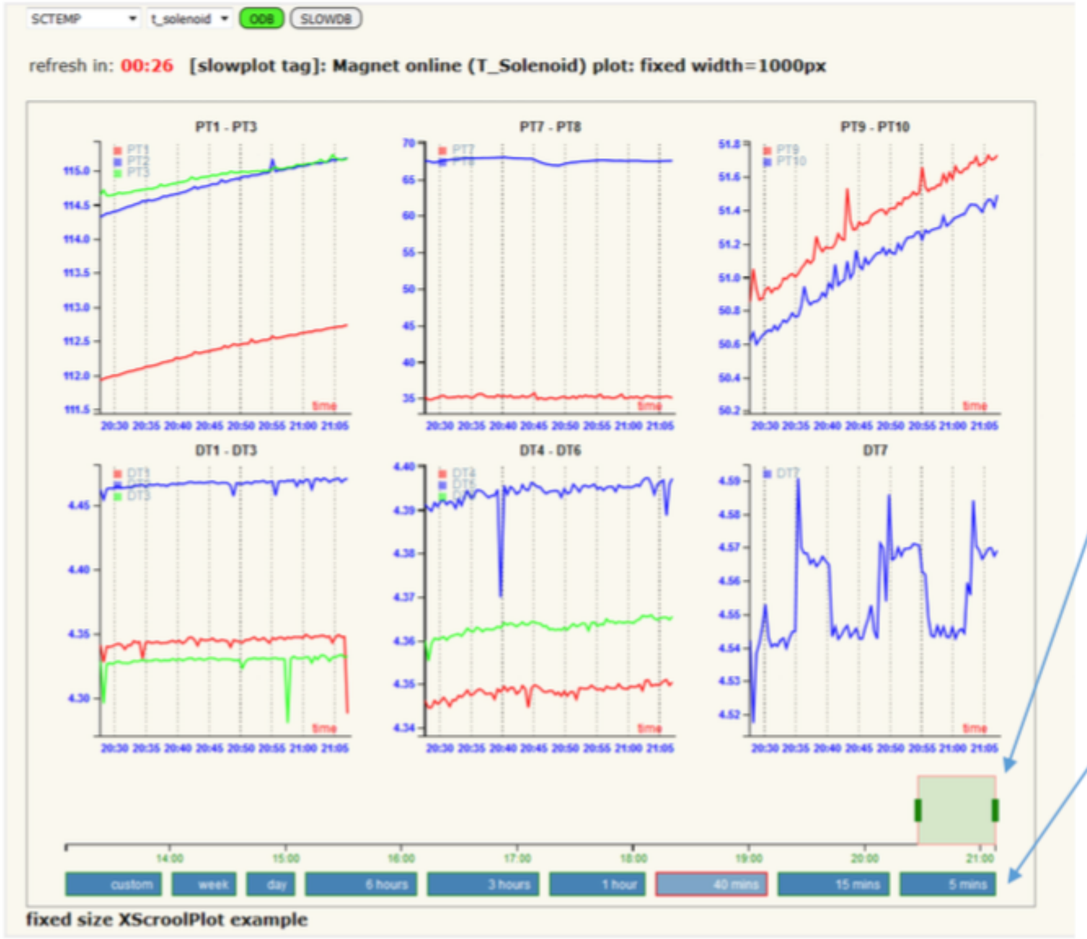
- Webpage for experiment monitoring is being written using Django, a python-based web framework.
- Allows for web 2.0 technologies such as AJAX, vector graphics, and JQuery plugins.
- Modular and extendable
- Being developed by Novosibirsk (I. Logoschenko, A. Anisenkov)

Many sensors on one plot

Everything is clickable

Automatic refresh for real-time data

The same interface for real-time or historical data



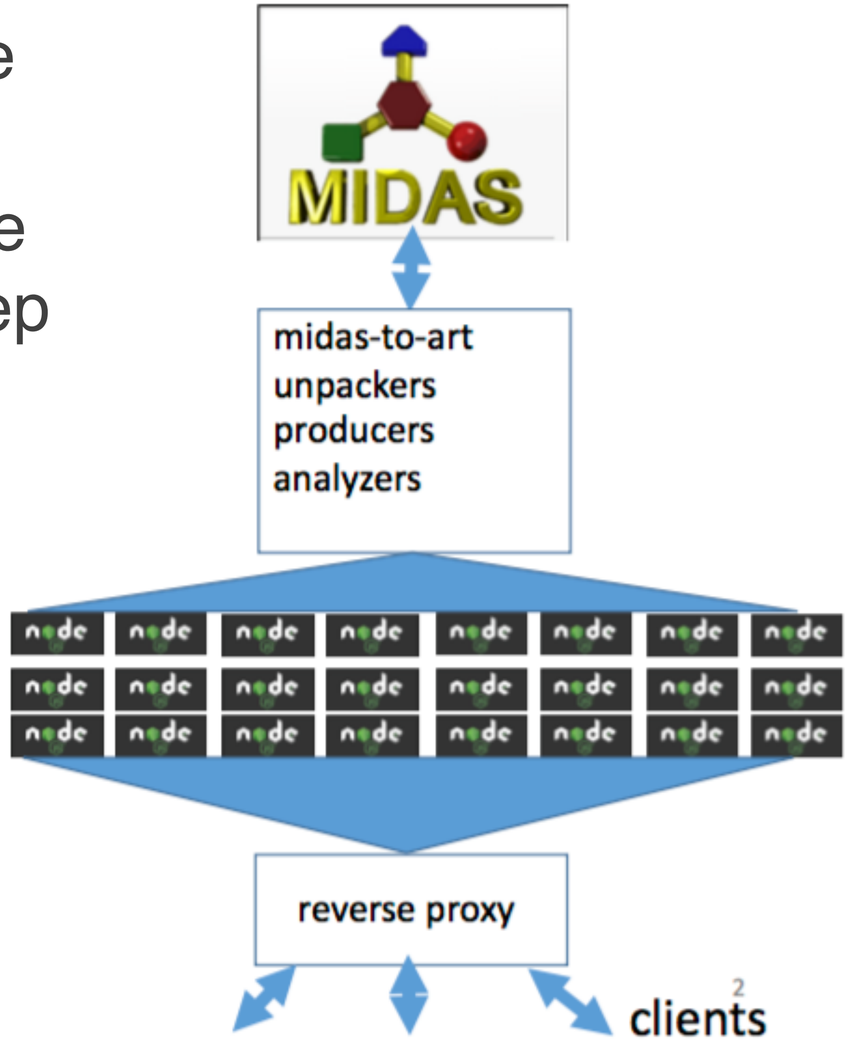
Common time scale for all plots on a page

Standard time windows

See talk by M. Eads for more details.

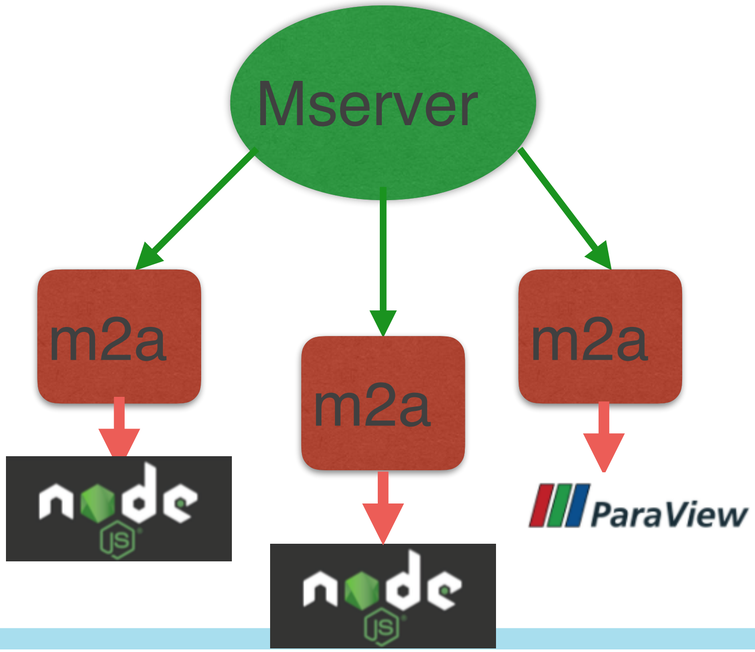
DQM with *art*/JS

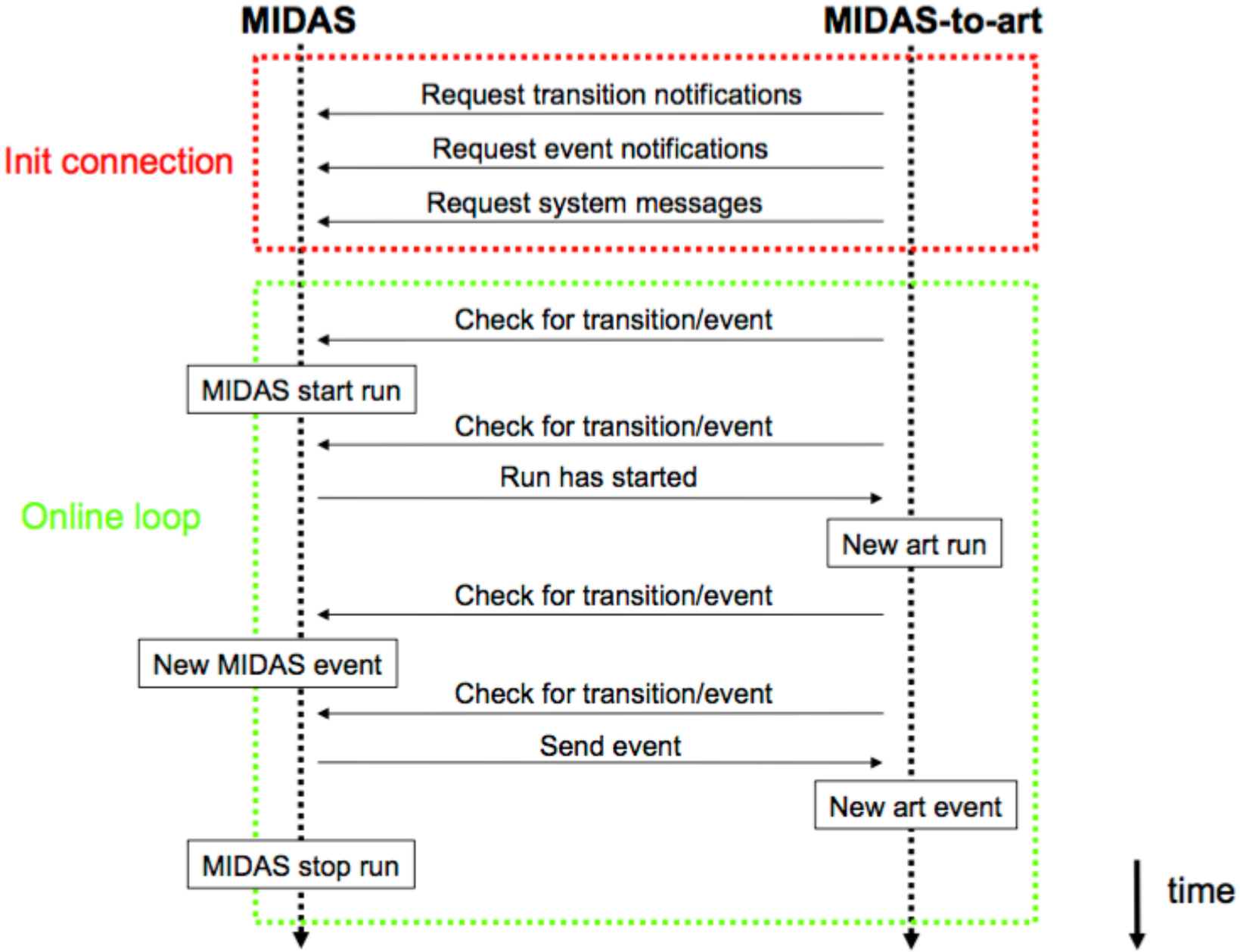
- We have enabled our midas2art utility to run online and read data from the Midas mserver.
- We can then attach our art analyzer modules to the process to perform any analysis tasks that can keep up with the data acquisition.
- A web server using ZeroMQ with node.js then provides the data to a web gui where plots are displayed.
- Plots created using plotly.
- Need HTML development.
- Current development is being performed by A.Fienberg (U. Washington), R. Fatemi and L. Kelton (U. Kentucky).



Midas2art online

- Connects directly to mserver.
- Non-blocking
- Based on NOvA DQM model

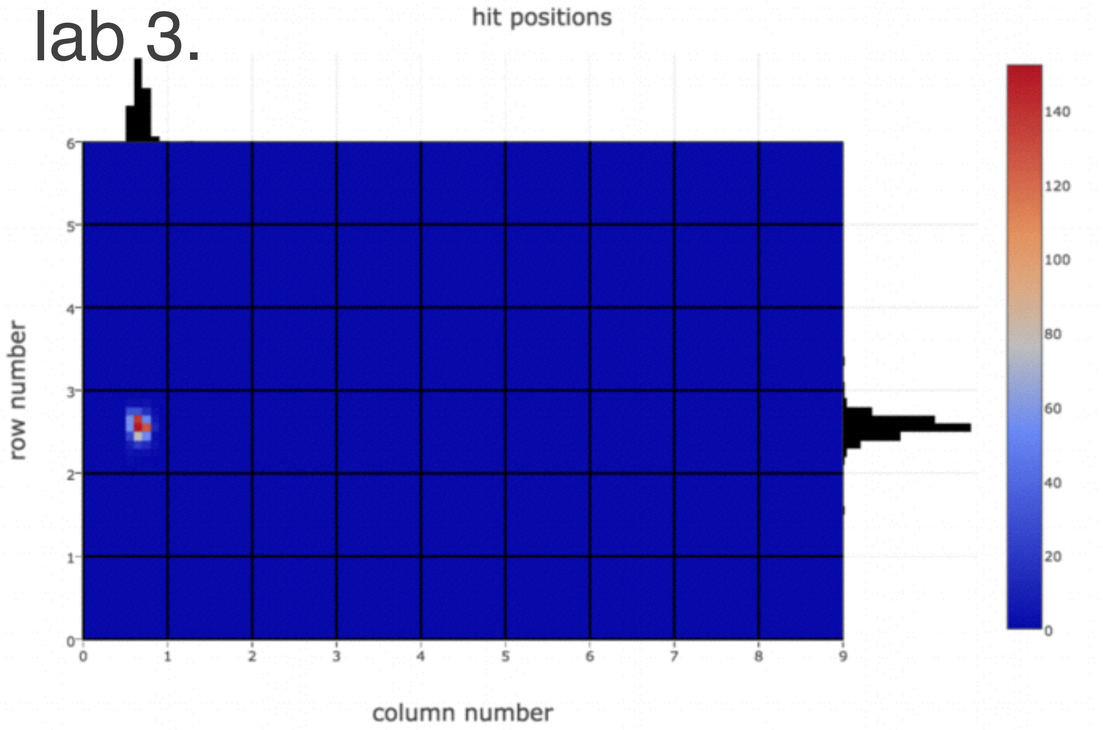


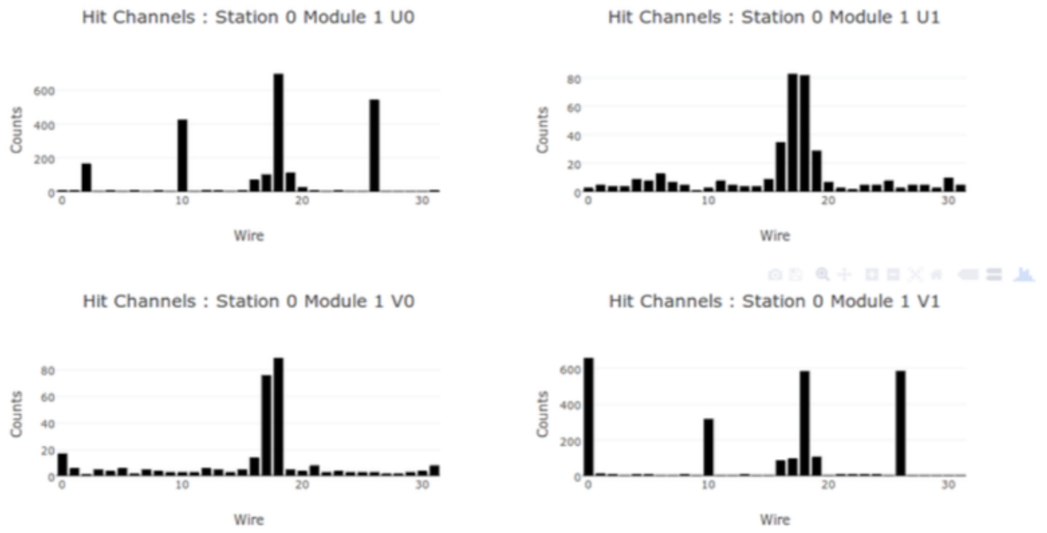


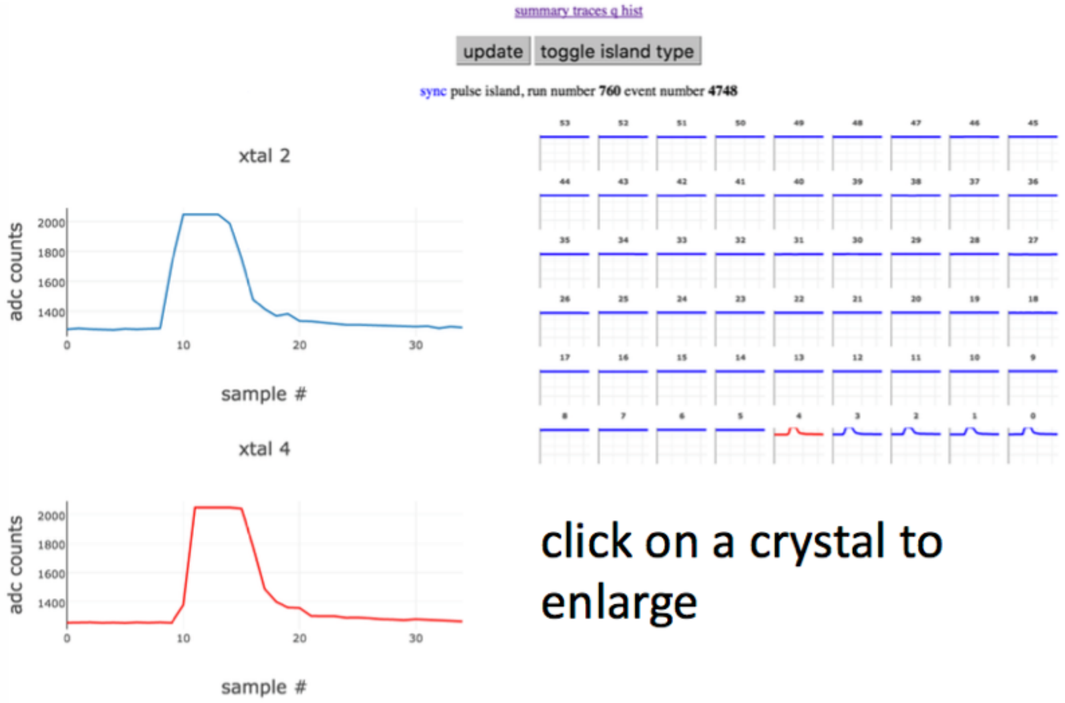
Fermilab

Test Implementations

- Tested with calorimeter emulator for 24 calorimeters.
- Used to display data from 420 Rider channels (7 crates) in test setup.
- Monitored tracker cosmic test-stand at lab 3.

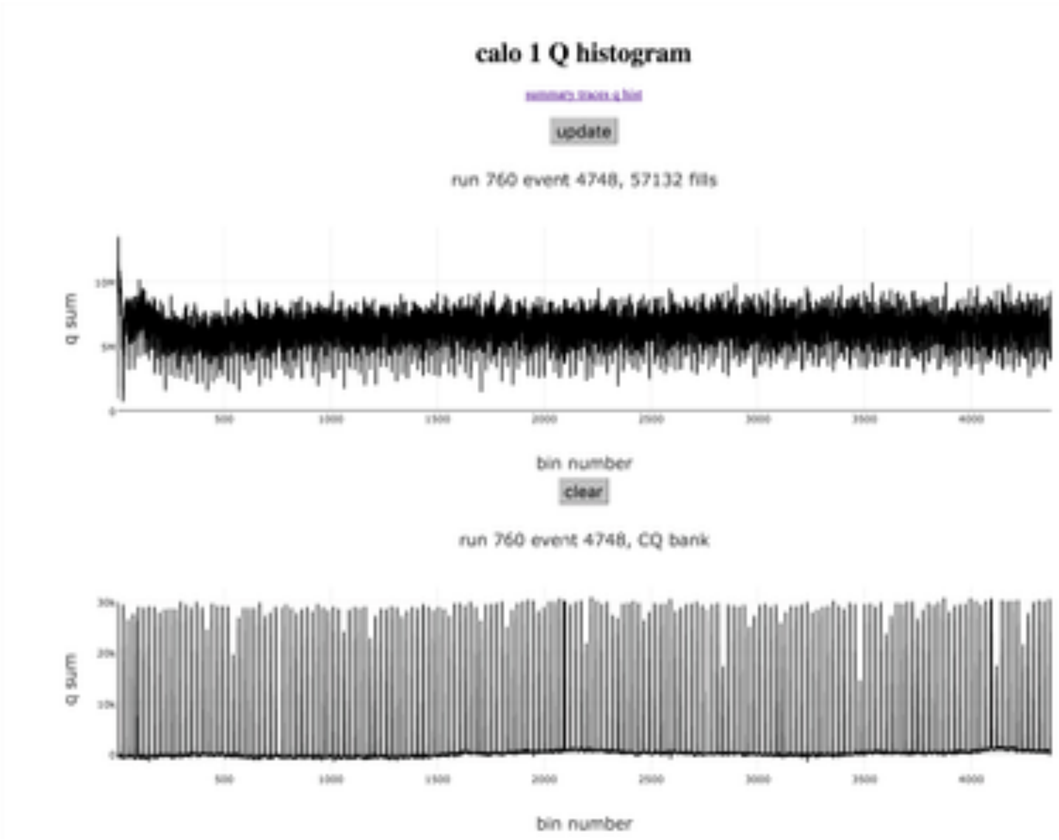


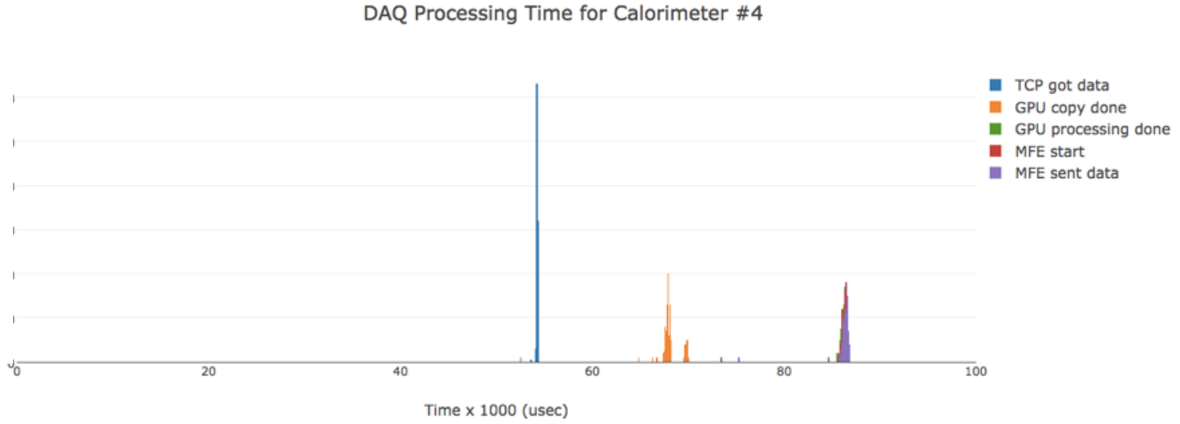




DQM with *art*/JS

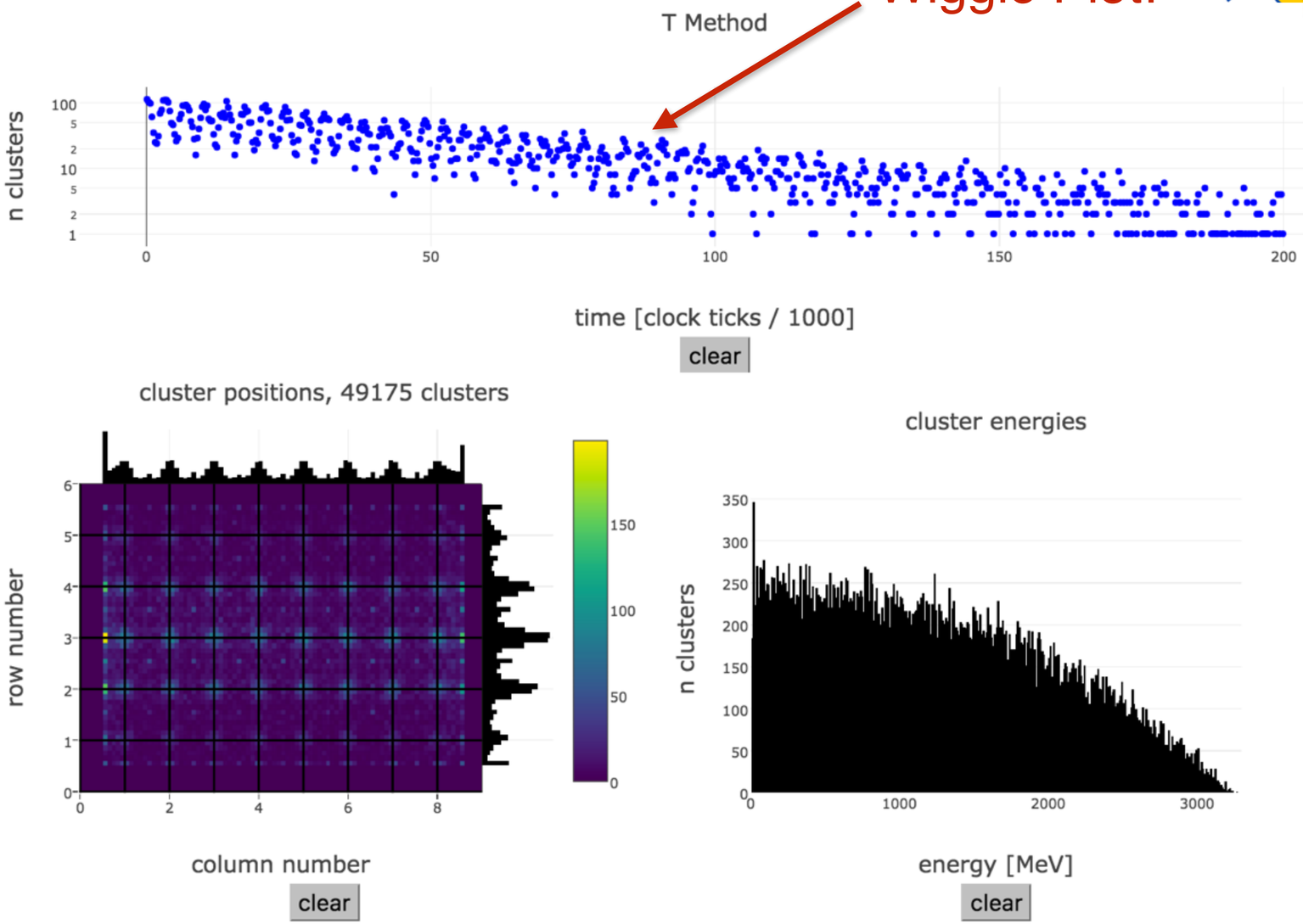
DQM is running to monitor our test setup with 7 uTCA crates.



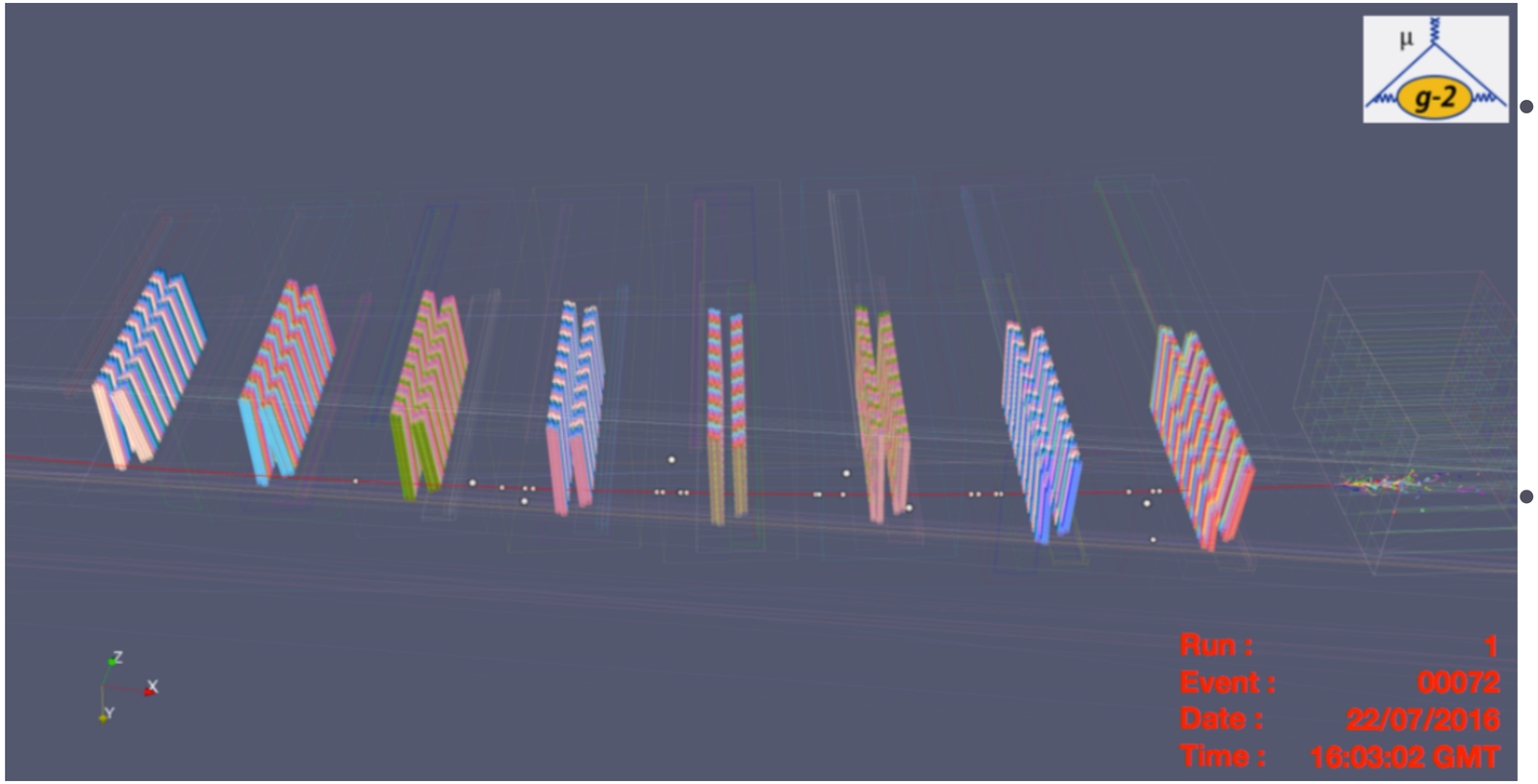


GPU Pulse fitting

- We have implemented a GPU-based pulse fitting algorithm in our online system, that saves fit parameters for each pulse, which allows for fast reconstruction of positron decays in the online system.



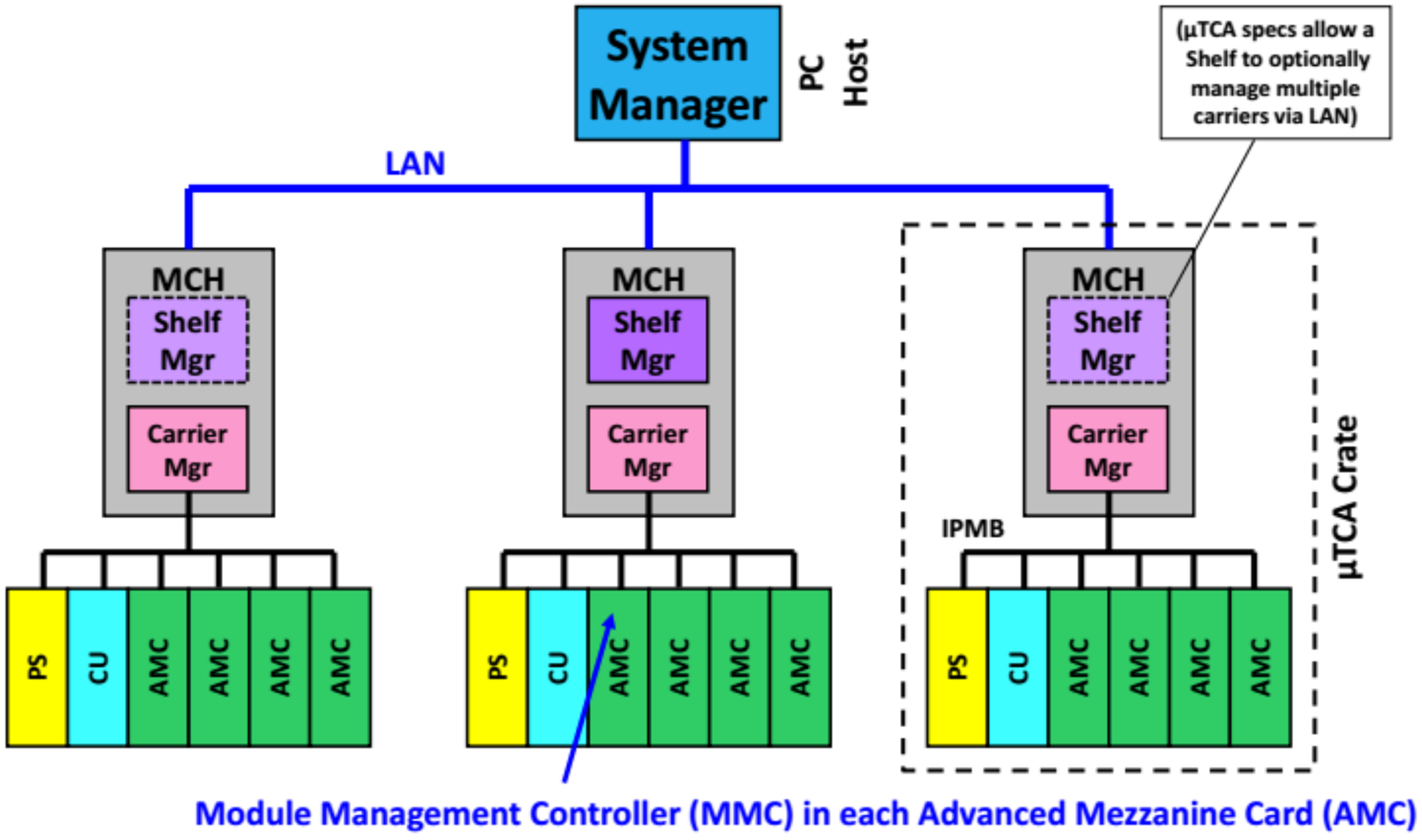
Paraview Event Display



- Event display will run as an *art*-online process that connects to mserver using midas2art, with module that outputs vtk object for Paraview visualization.
- Development is underway.
  - Dubna: N. Khomutov, V. Krylov
  - Liverpool: W. Turner

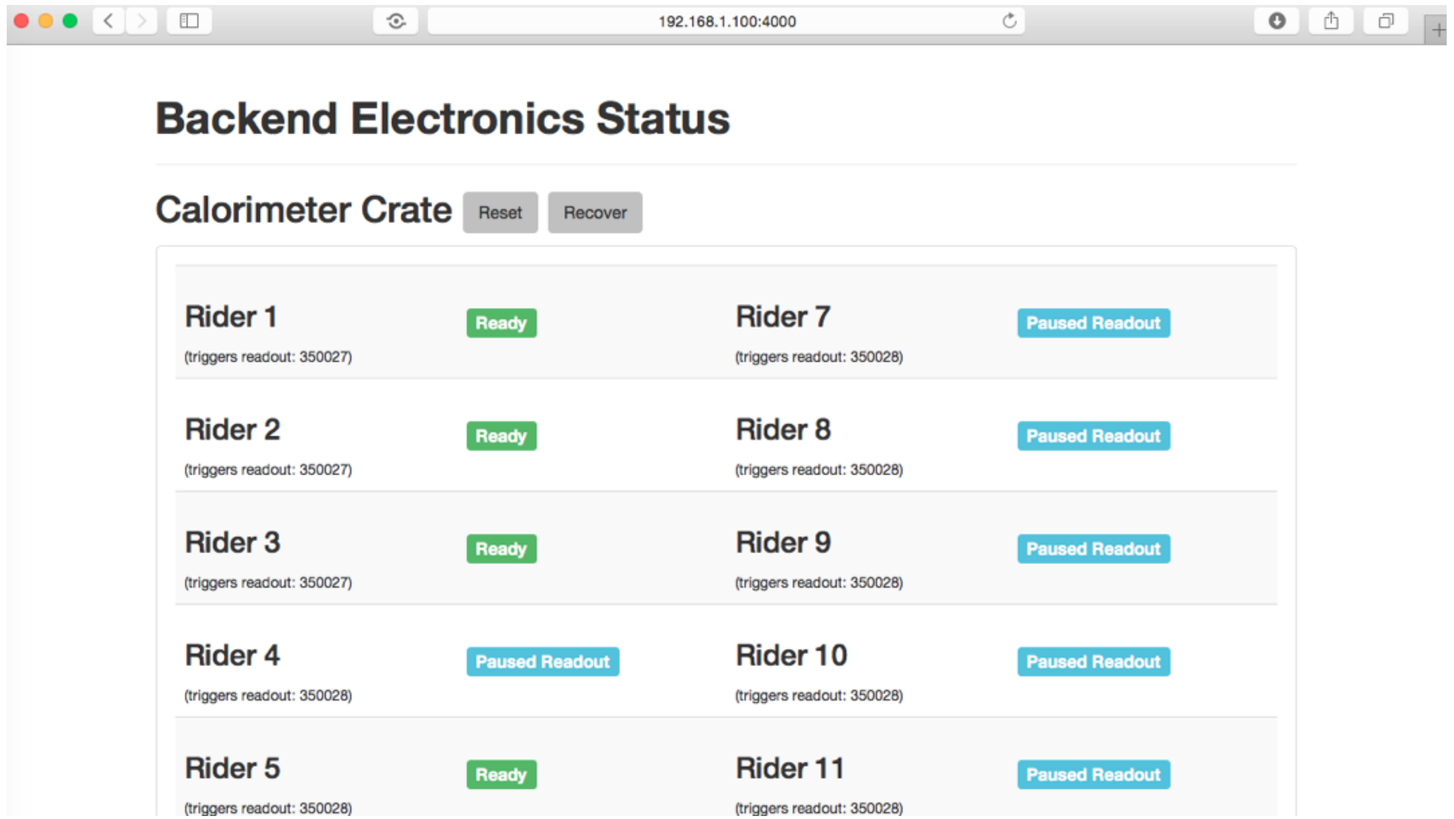
uTCA Monitoring

- Will provide “slow control” information such as temperatures, fan speeds, and voltages from each module in every uTCA crate.
- Will communicate with Midas via a dedicated interface.
- Based on design for CMS that has been developed at U. Wisconsin.
- Being adapted to our g-2 system by A. Chapelain (Cornell U).



Rider/FC7 monitoring

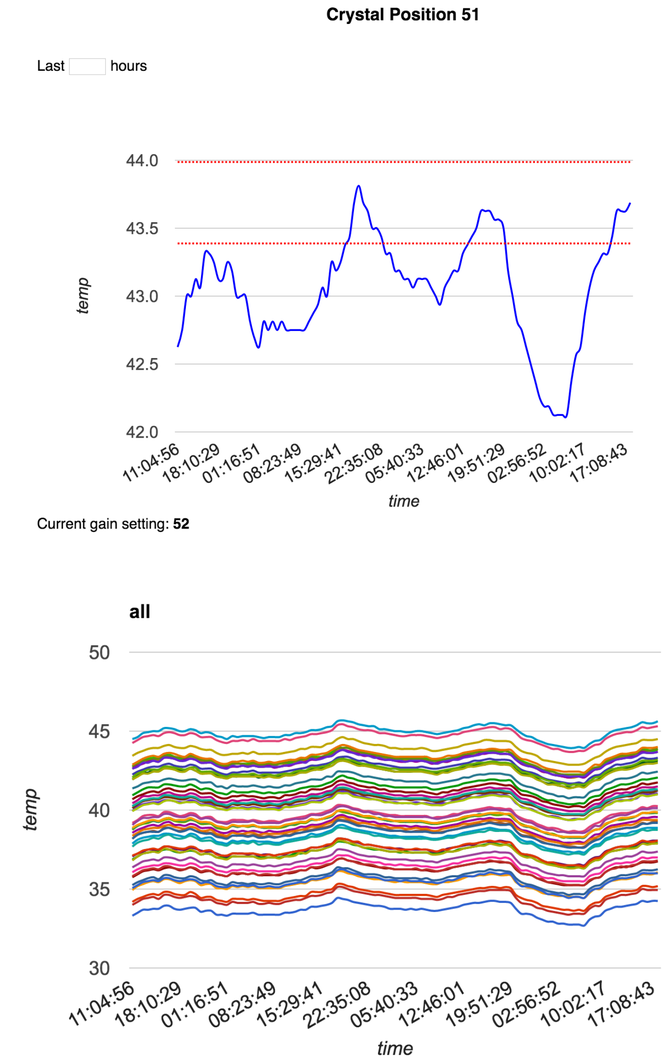
- A python-based web interface will communicate with each mezzanine card (Rider or FC7) via IPMI commands to determine the current status of each.
- The web interface displays a summary of all uTCA crates, and you can click through to get details of each individual module.
- Being developed by D. Sweigart (Cornell U).



Above: A prototype of our Rider monitor in use during the SLAC test beam last June.

SiPM Monitoring

- Python-based web gui used at SLAC.
- Displays temperatures, controls bias voltages, and programs gain amplifiers.
- Saves current settings and can reload old settings from file (or database).
- Written and maintained by A. Fienberg (U. Washington)
- Will be integrated into main slow control system (see talk by M. Eads)



Alarm system

- Baseline is to use the included MIDAS Alarm system.
  - Two alarm levels (warning or alert).
  - Visual and audible alarms.
  - Can configure alarms to stop the run.
  - Alarms based on ODB parameters -> very easy to set alarms on any slow control parameters.
  - Can post to Slack (or other medium).
- Drawbacks
  - Only works while DAQ is running.
  - We would like an alarm if the DAQ crashes (catch 22)
  - Interfacing with non-MIDAS sources is cumbersome, but possible.
- Would like to see what is used by other experiments.

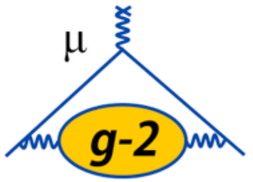
Operations

- Expect 7 shifters to be “on” in a 24 hour period. Six regular shifters on 8-hour shifts + 1 Nearline analysis expert.
- When running smoothly, might reduce to one night-shifter in Roc-West and add remote operations.
- Will form DAQ operations group to maintain additional on-call experts to diagnose and resolve DAQ problems.
- We will hold training sessions to bring collaborators up to speed.
- A DAQ instruction manual has been written, and will be kept up to date.

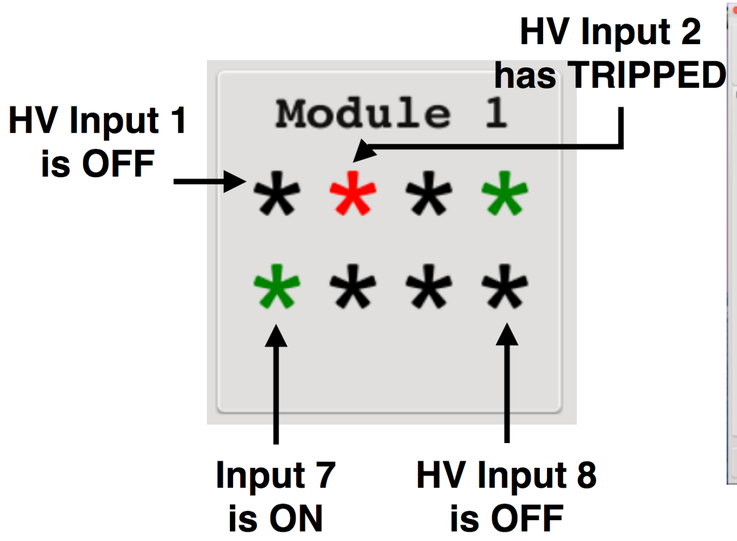
Summary

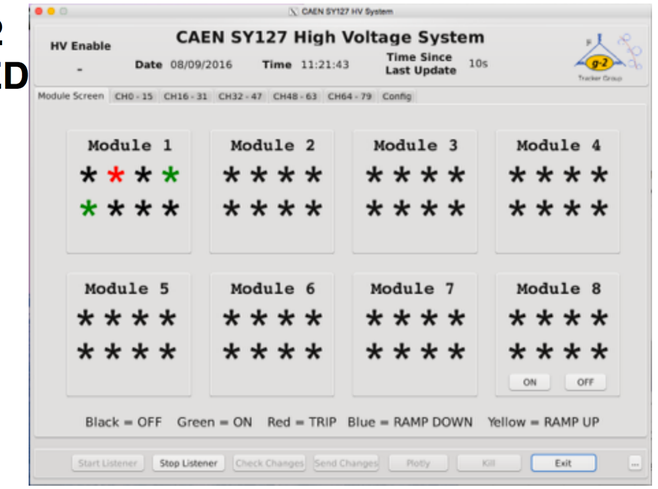
- Many monitoring systems are already in very sophisticated states, but some are yet to be developed.
- Require more information on interfacing with ACNET.
- Need more development on Kicker, Quad, Laser, and IBMS monitoring and Paraview event display.
- Hardware is about 50% there. Exploring additional funding options to complete control room.
- Roc West is also available for light shifts, though screen-space is limited.

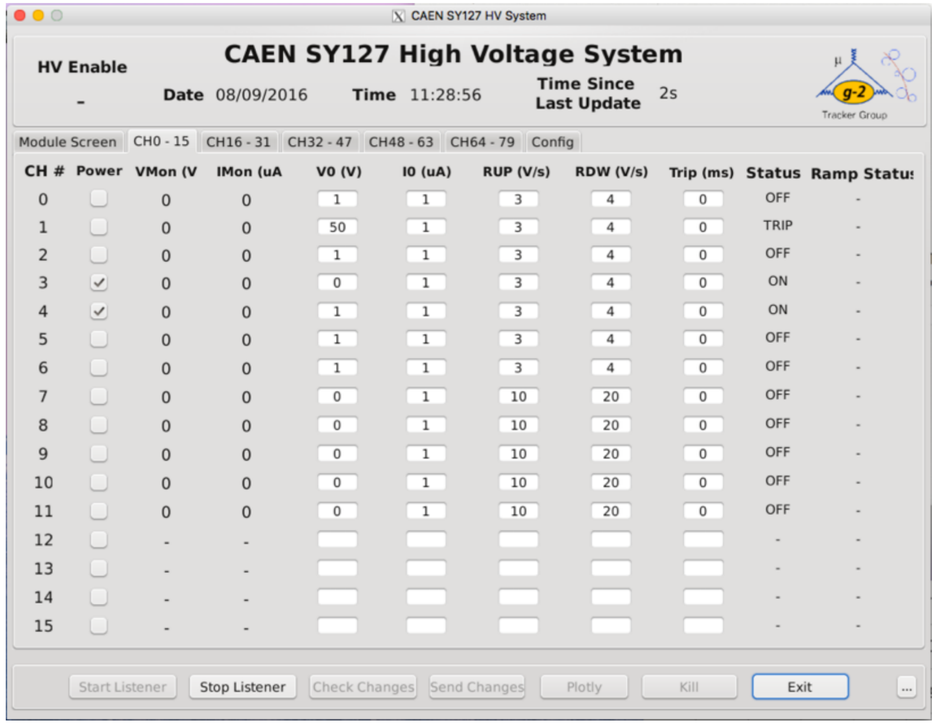
Backup



HV Monitoring and Control







- GUI to provide channel-by-channel control over tracking detector HV.
- Three dedicated servers to read HV status via serial DB9 connection.
- Developed and maintained by UCL.