# G-2 tracker DAQ

Becky Chislett

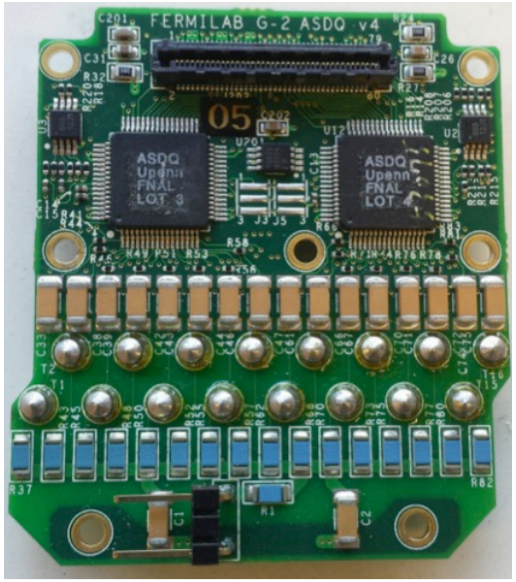
MUSE General Meeting
29th September 2016

# Introduction

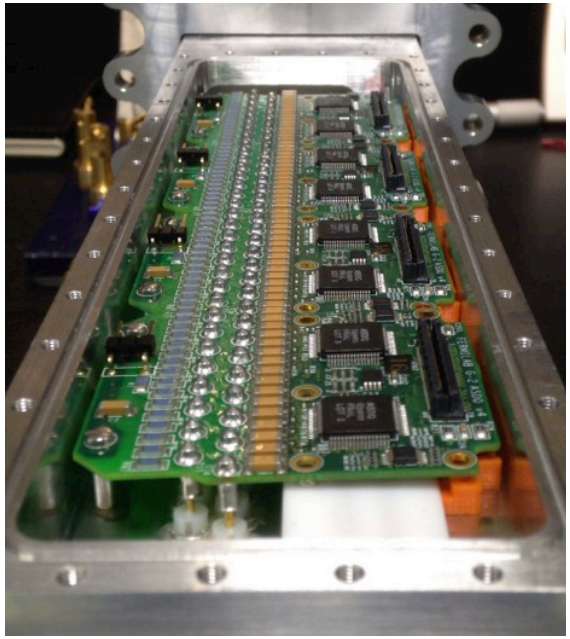
UCL

# Tracker Frontend Readout

***The tracker readout hardware consists of ASDQs, TDCs, Logic boards, FC7s and an AMC13***

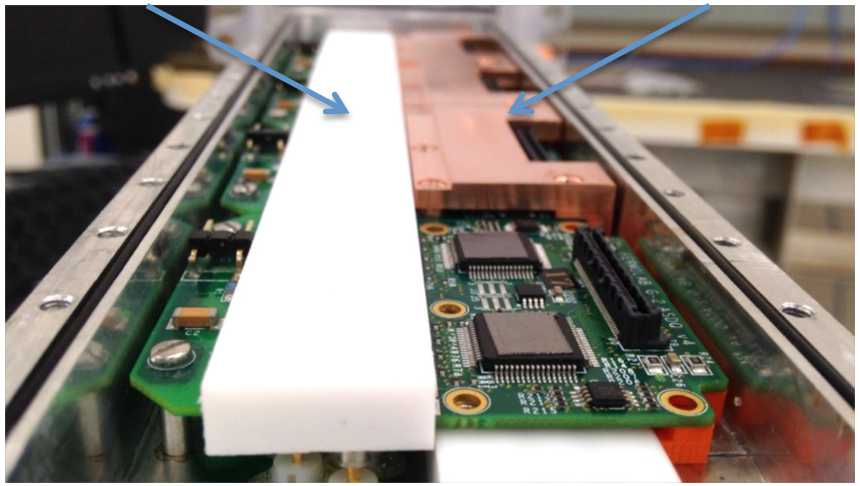







**The ASDQs plug onto the end of the straws :**

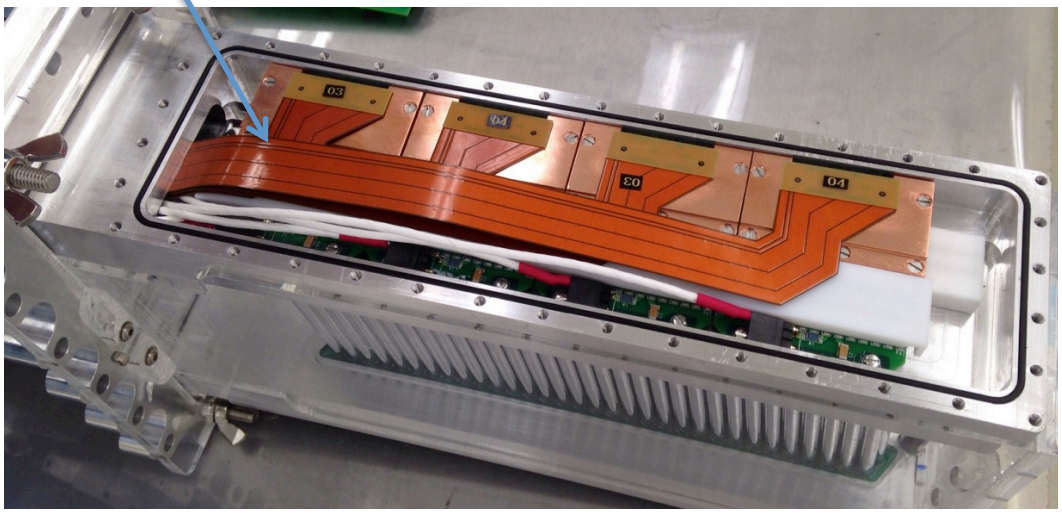
- 8 ASDQs per manifold (4 boards)
- Take care of pulse shaping, baseline restoration and discrimination
- Produce a digital output

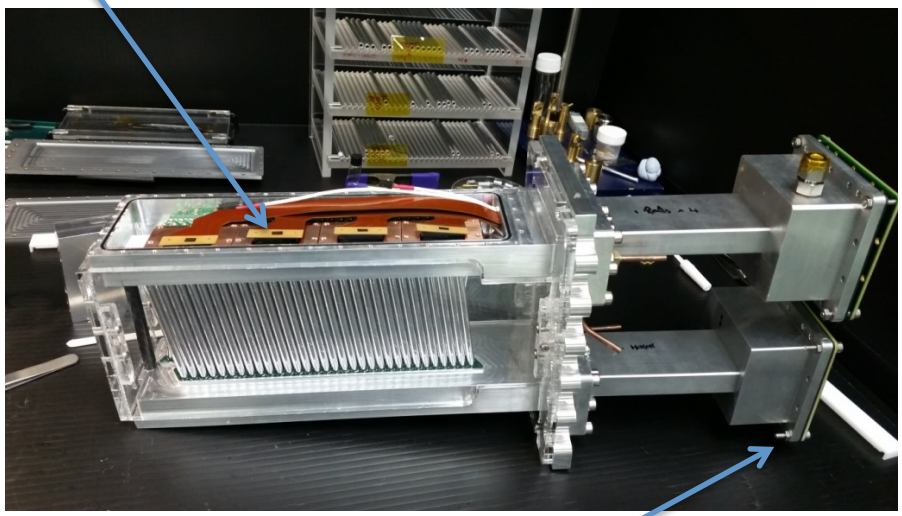


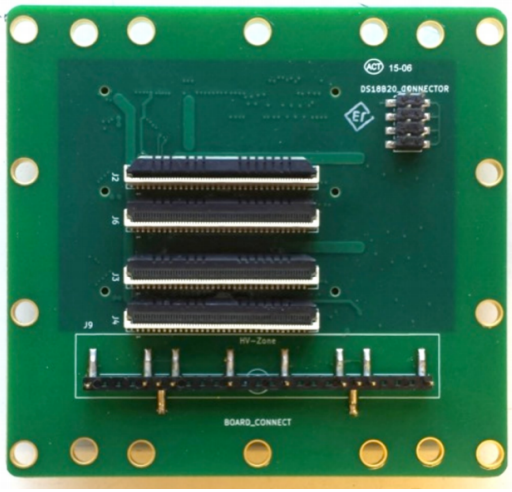
# Tracker Frontend Readout

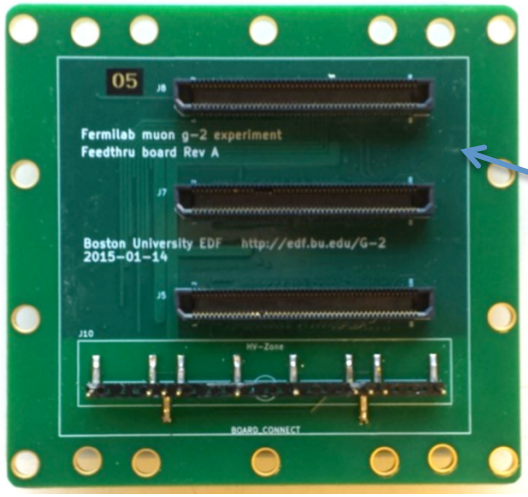
**The flexi cables plug onto the ASDQs :**

- Provide power and reference voltages
- Carry the signal from the ASDQs










**The flexi cables connect to the feedthrough board :**

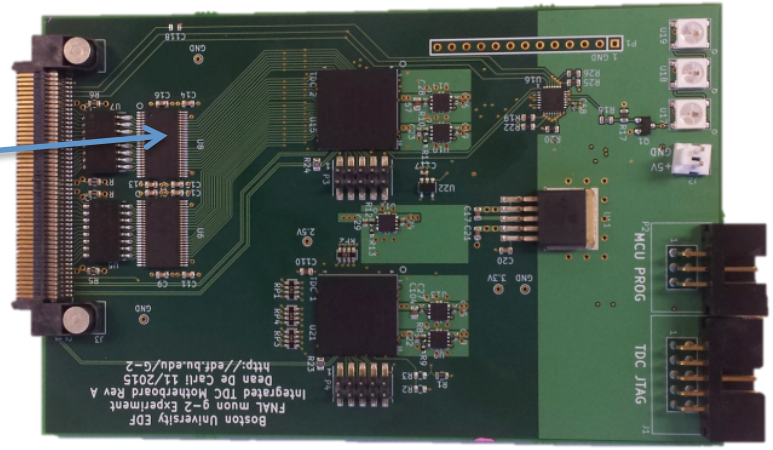
- Forms the gas seal
- Acts as a backplane for the boards

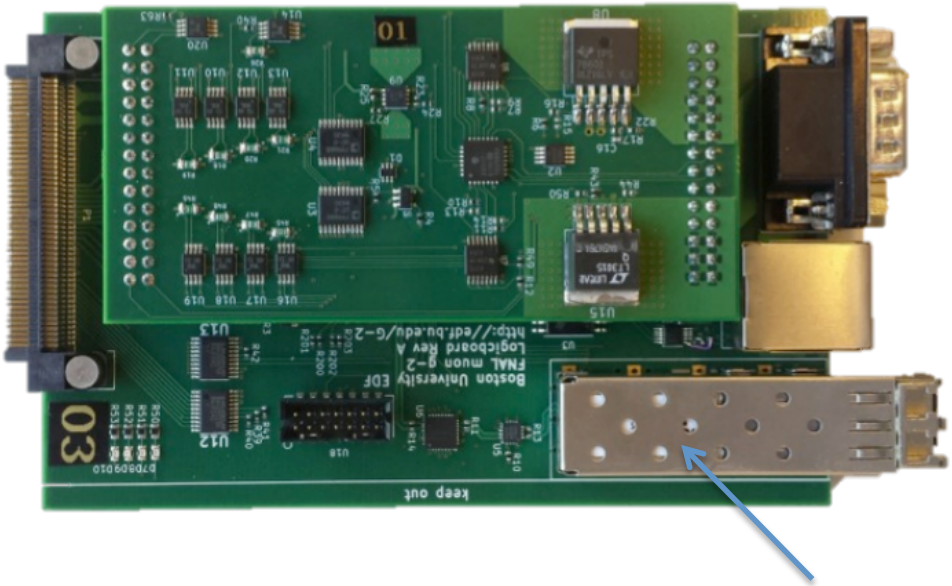
# Tracker Frontend Readout

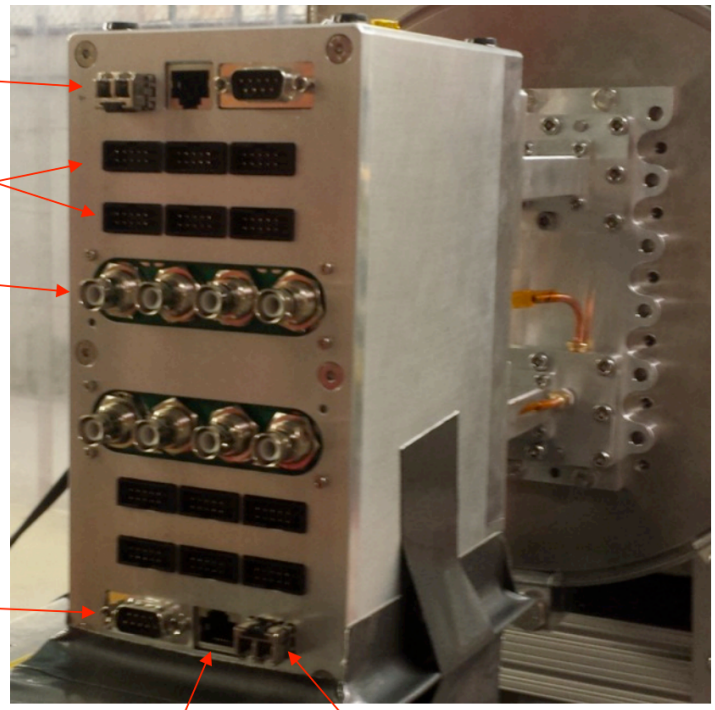
UCL

## The data is passed to the TDCs :

- 2 TDC boards per manifold each with 2, 16 channel FPGAs
- Convert the digital signals from the ASDQs








## The TDCs pass the data onto the logic boards :

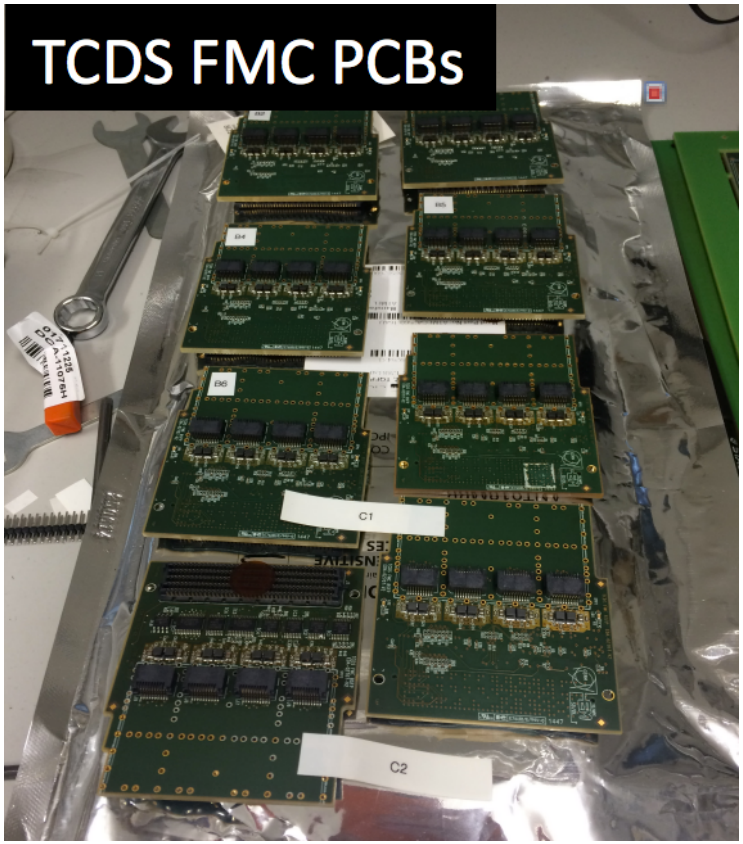
- Buffers and sends out the data from the TDCs
- Slow Control connection for programming settings and loading firmware
- Regulates voltages from ±5V Low voltage input

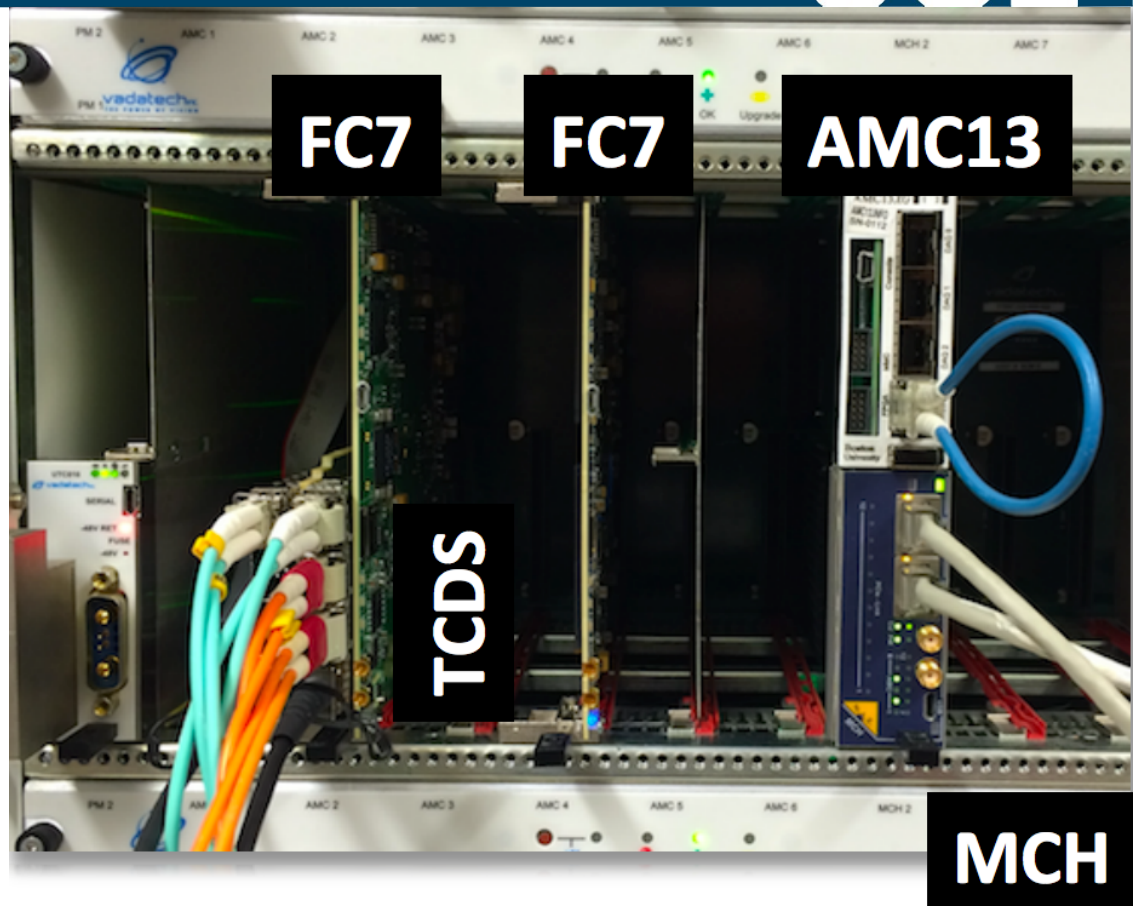
# Tracker Backend Readout

UCL

**The data from the logic board is sent over fibre to the FC7 :**

- Takes 16 fibre inputs (1 whole tracker station per FC7)
- Collects the data from all 16 Logic boards and sends it out
- Provides the clock to the logic board




**The FC7 sends the data on to the AMC13 :**

- Forms the connection to the PC via 10Gb ethernet
- Data send out over fibre to a PCIe card in the PC

# Tracker DAQ

UCL

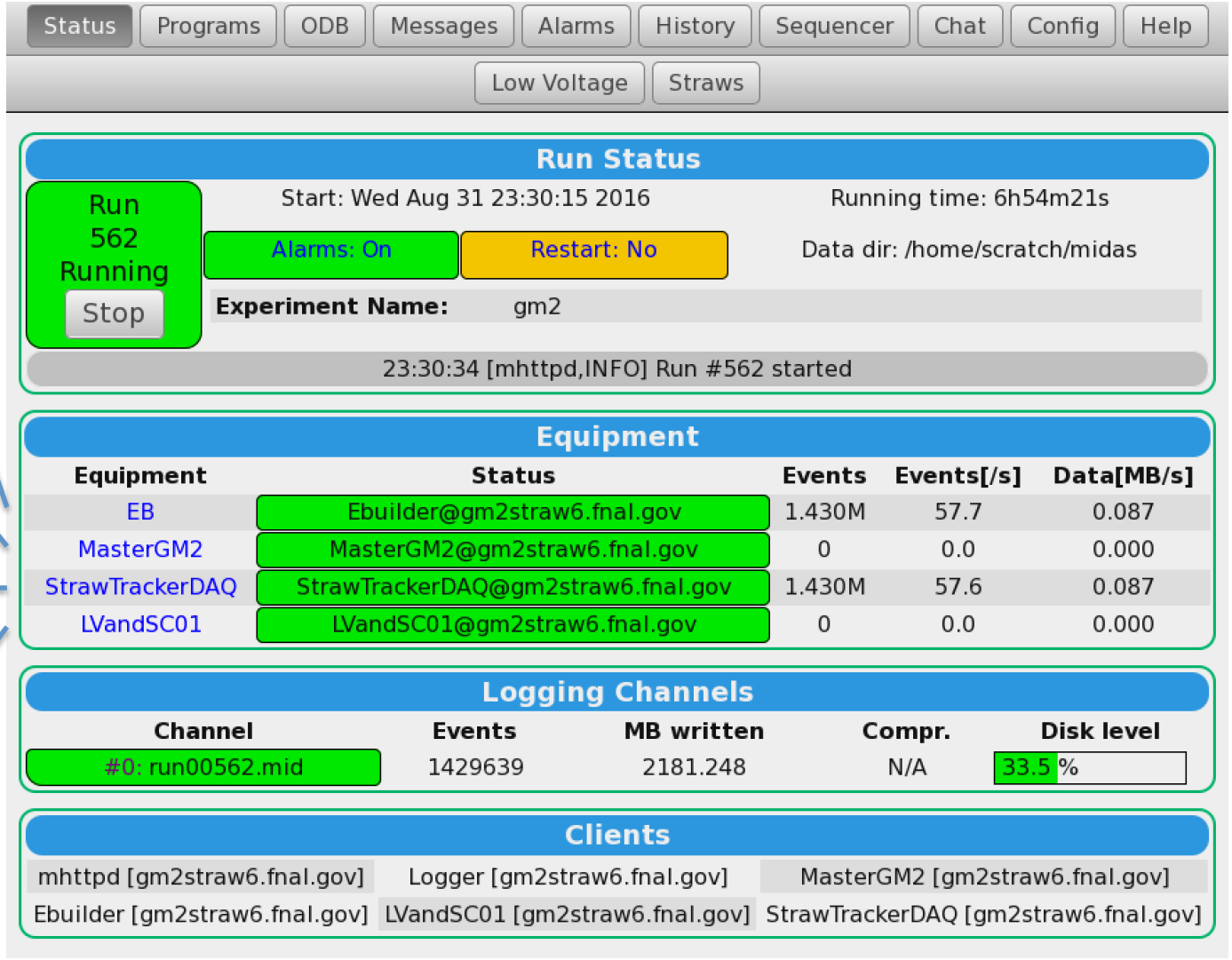
***The g-2 DAQ software uses MIDAS***

**Event builder**, combines the events from the different frontends

**Master GM2** stores the trigger information (begin of fill)

**Straws frontend** collects the straws data into a MIDAS bank

**Slow Controls frontend** records monitoring data (currents, temperatures etc. )




***Ran stably for more than 7 hours at 50Hz rate***

# Tracker DAQ

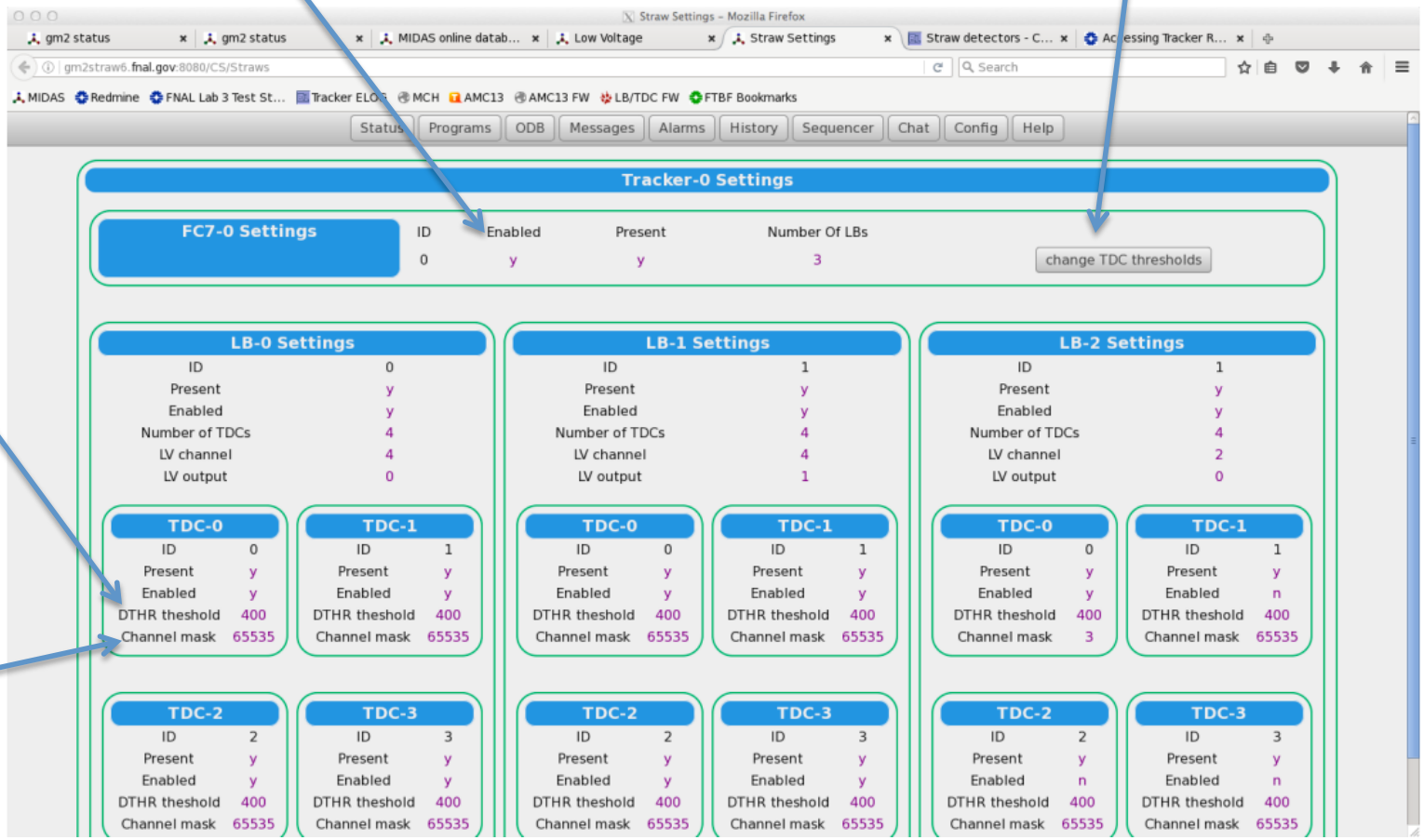
***Custom web pages have been written for easy straws control for variables that need changing often***

Enabled and present values for each piece of hardware

Button to change thresholds of all boards at the same time

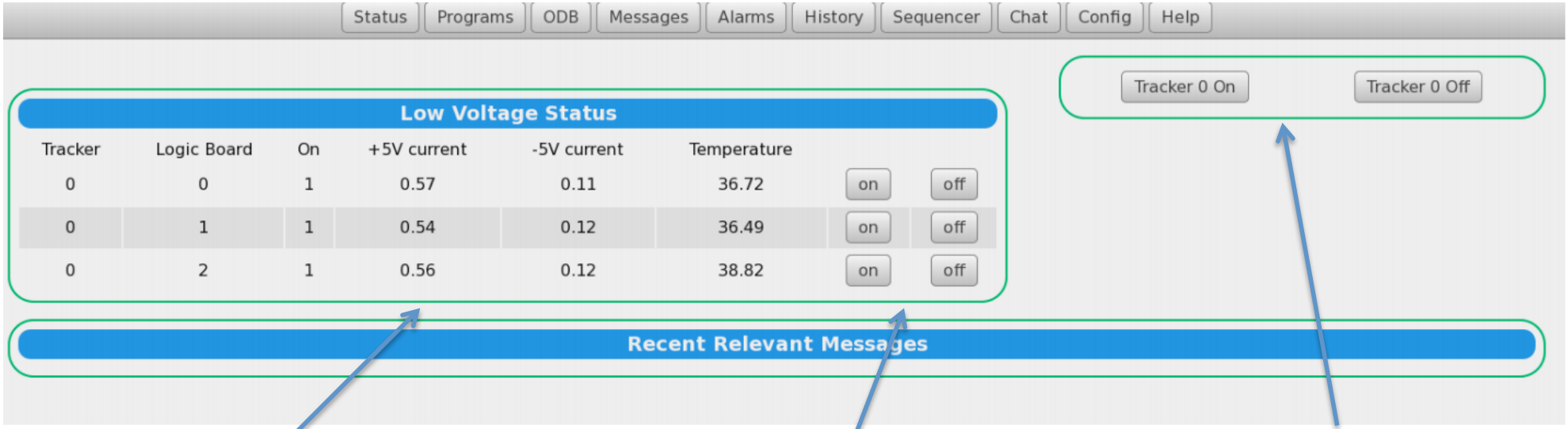
Threshold for the ASDQs

Channel mask – used to mask off any channels behaving badly



# Tracker DAQ

***A custom web page for Low Voltage monitoring and control is also available***




Easy view of the currents and temperatures and which boards are on

Buttons to turn the boards on and off individually

Option to turn a whole tracker on or off

***Recent error messages are also displayed on the page so it will inform you if the press of the button was unsuccesful***

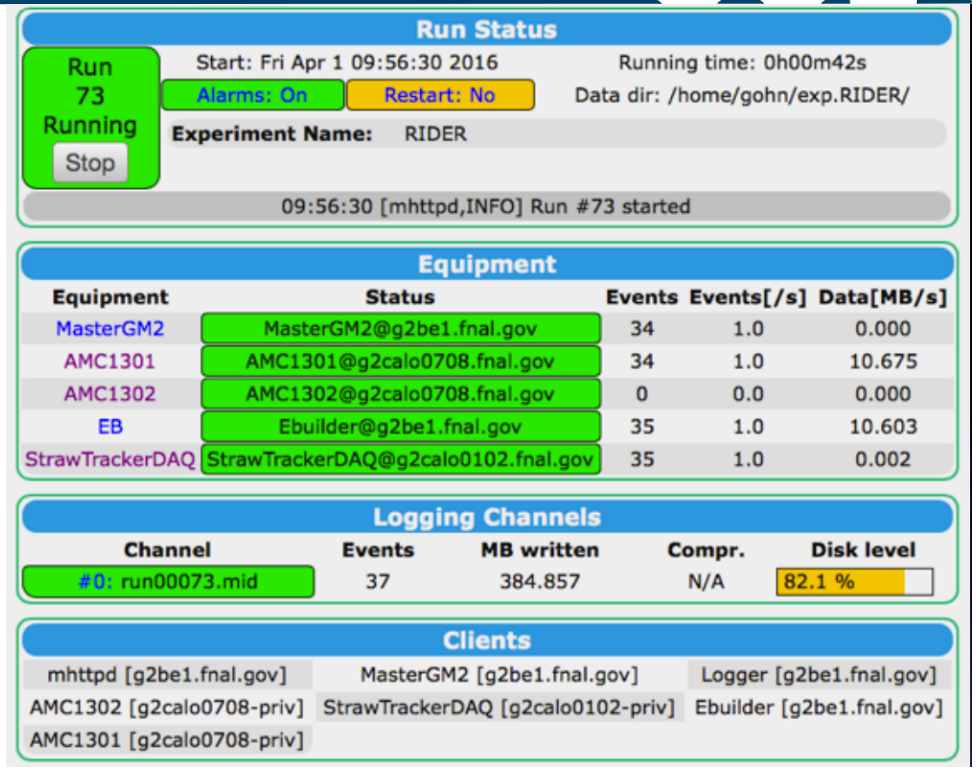
# Calo-Tracker DAQ Integration

UCL

***The DAQ systems for the calo and the tracker were integrated along with the clock and controls system***

Tracker DAQ/Calorimeter DAQ comparison

- Same top-level hardware (AMC13)
- Common clock, triggers, event builder
- Different frontend electronics (ASDQ/TDC vs Rider)
- Tracker records hit times, calorimeter records waveforms
- Lower data volume in tracker → no need for GPUs
- Common protocol for board register read/write (IPbus)



**Run Status**

Run 73 Running — Stop

Start: Fri Apr 1 09:56:30 2016 — Running time: 0h00m42s

Alarms: On — Restart: No — Data dir: /home/gohn/exp.RIDER/

**Experiment Name:** RIDER

09:56:30 [mhttpd,INFO] Run #73 started

**Equipment**

| Equipment | Status | Events | Events[/s] | Data[MB/s] |
|---|---|---|---|---|
| MasterGM2 | MasterGM2@g2be1.fnal.gov | 34 | 1.0 | 0.000 |
| AMC1301 | AMC1301@g2calo0708.fnal.gov | 34 | 1.0 | 10.675 |
| AMC1302 | AMC1302@g2calo0708.fnal.gov | 0 | 0.0 | 0.000 |
| EB | Ebuilder@g2be1.fnal.gov | 35 | 1.0 | 10.603 |
| StrawTrackerDAQ | StrawTrackerDAQ@g2calo0102.fnal.gov | 35 | 1.0 | 0.002 |

**Logging Channels**

| Channel | Events | MB written | Compr. | Disk level |
|---|---|---|---|---|
| #0: run00073.mid | 37 | 384.857 | N/A | 82.1 % |

**Clients**

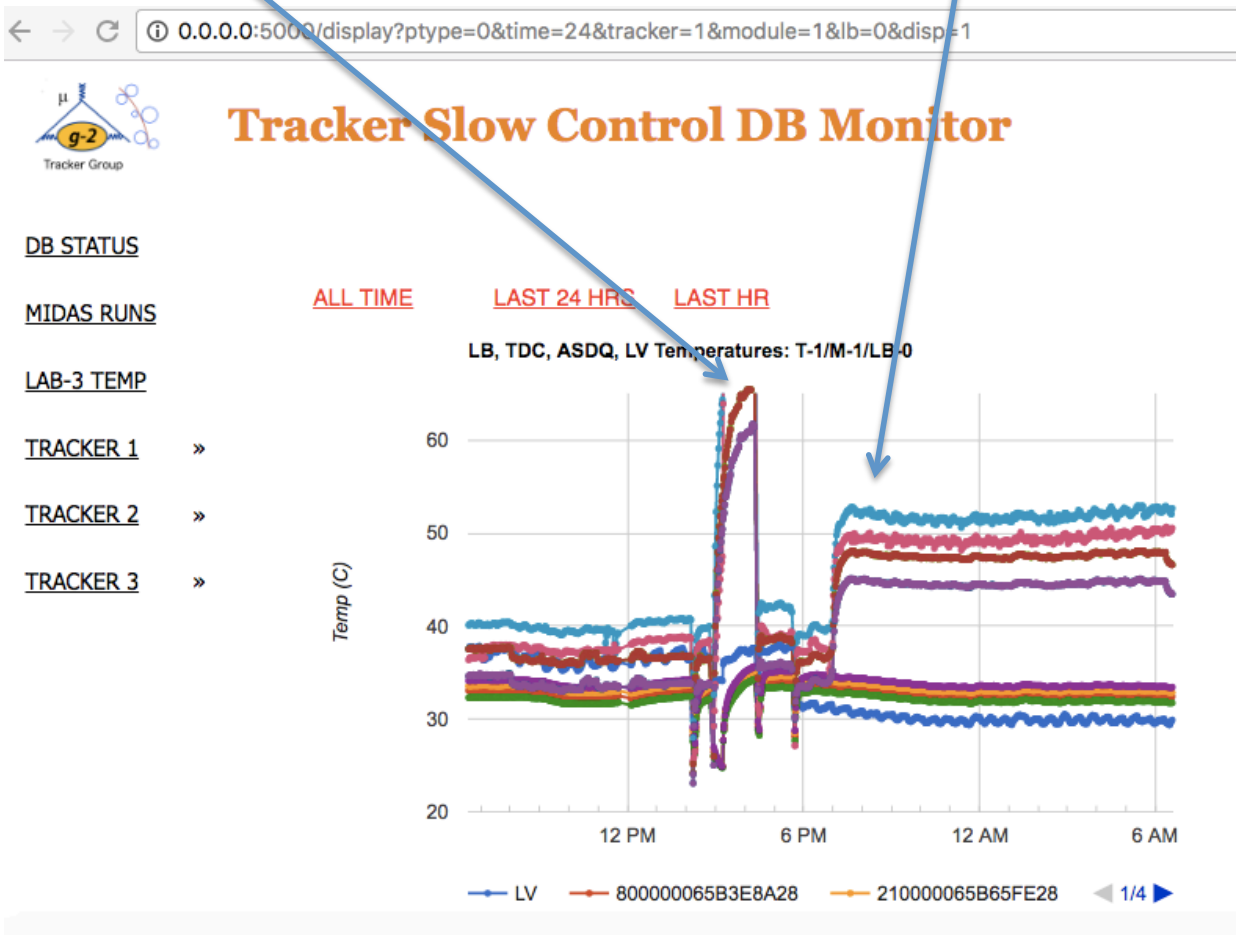
| | | |
|---|---|---|
| mhttpd [g2be1.fnal.gov] | MasterGM2 [g2be1.fnal.gov] | Logger [g2be1.fnal.gov] |
| AMC1302 [g2calo0708-priv] | StrawTrackerDAQ [g2calo0102-priv] | Ebuilder [g2be1.fnal.gov] |
| AMC1301 [g2calo0708-priv] | | |

# Tracker Slow Controls

***The Low Voltage and Slow Controls frontend reads temperatures, currents, voltages etc. from the electronics boards and stores them in the ODB and an sql database***

Forgot to plug fan back in

Fan fell off




The information put into the database is displayed on a webpage which auto updates once a minute

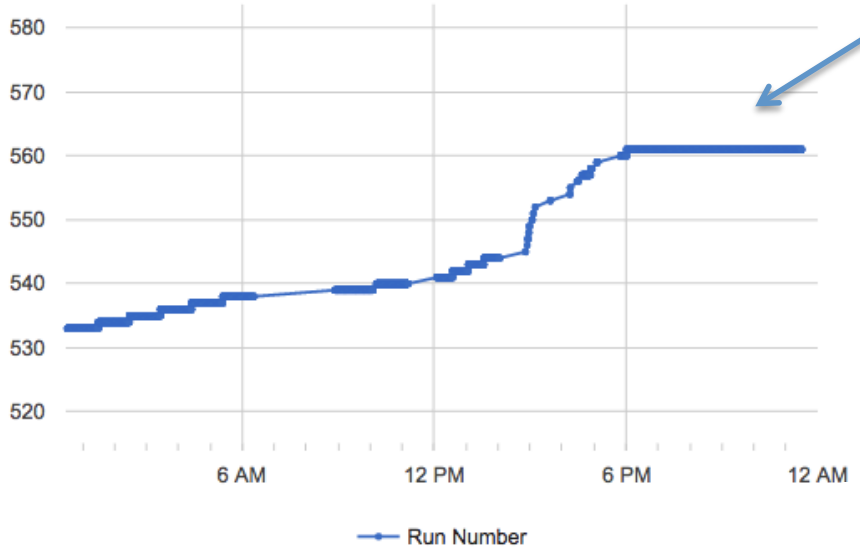
Displays :

- Temperatures
- Currents
- Voltages
- DAQ errors
- MIDAS runs

The DAQ throws an warning/ error if these values get too large

# Tracker Slow Controls

ALL TIME LAST 24 HRS LAST HR

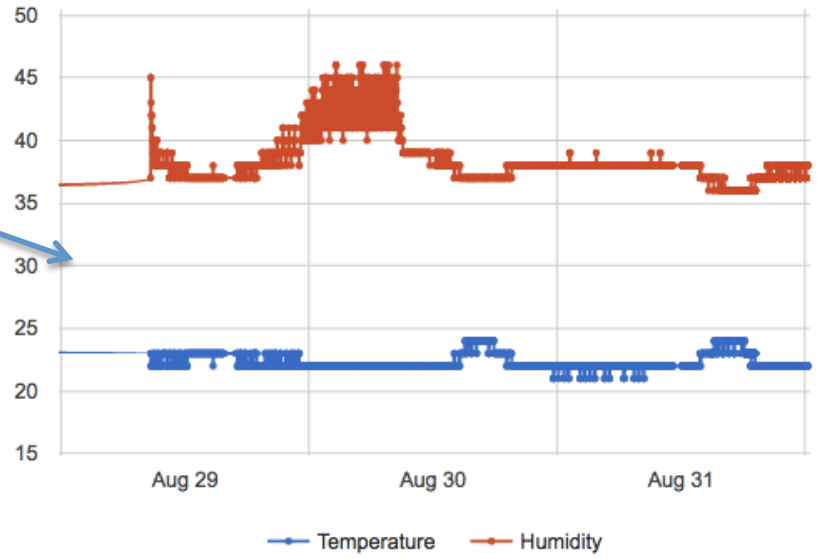



**Run number vs time**

3 different time view options and click and zoom

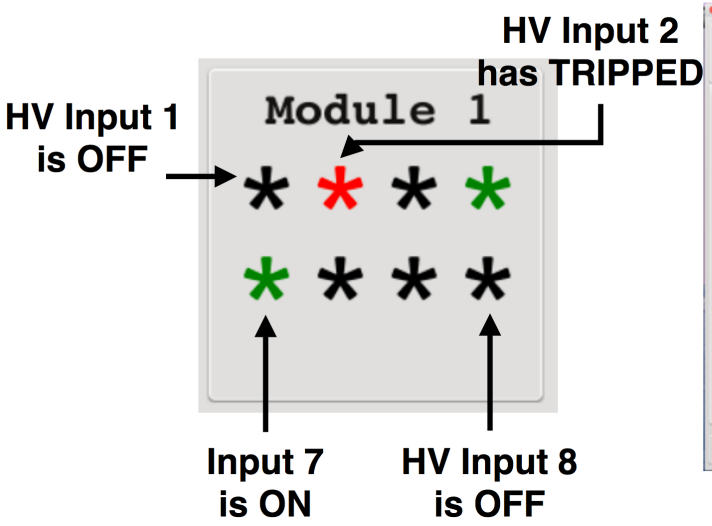
ALL TIME LAST 24 HRS LAST HR

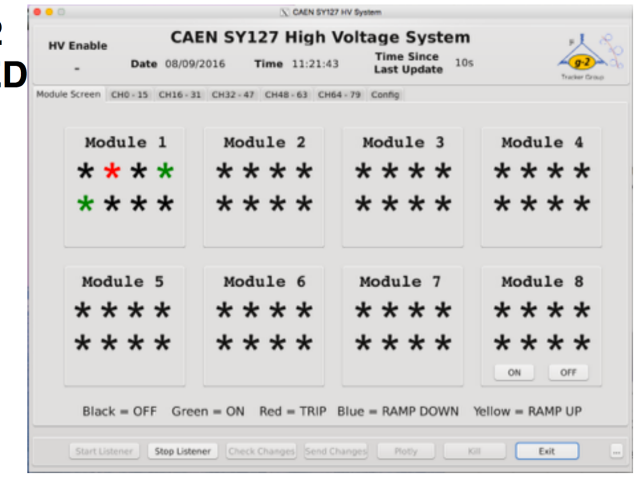
**Lab temperature and humidity**



# High Voltage control

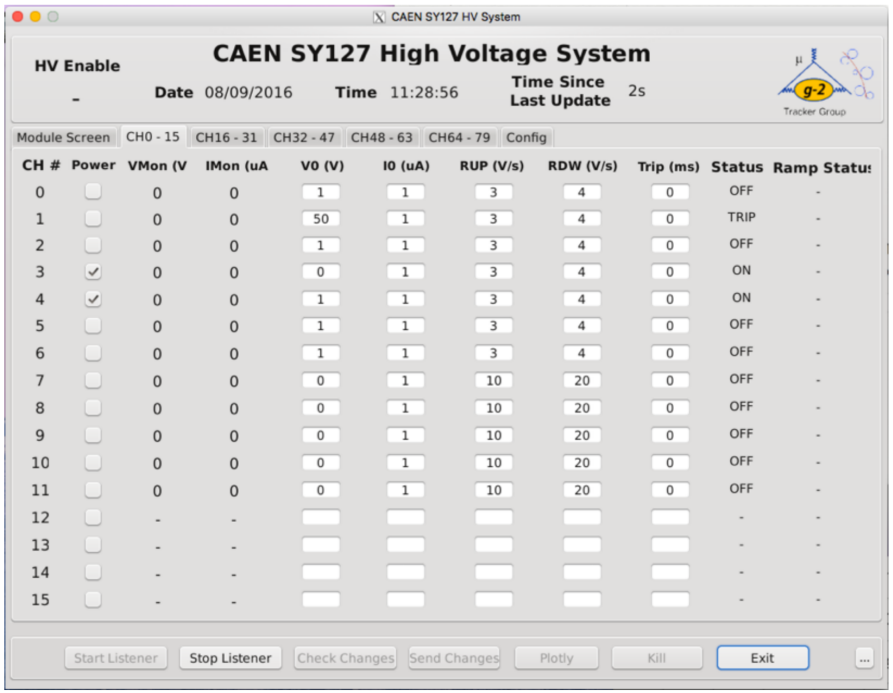
## *An HV GUI is available for HV control and monitoring*



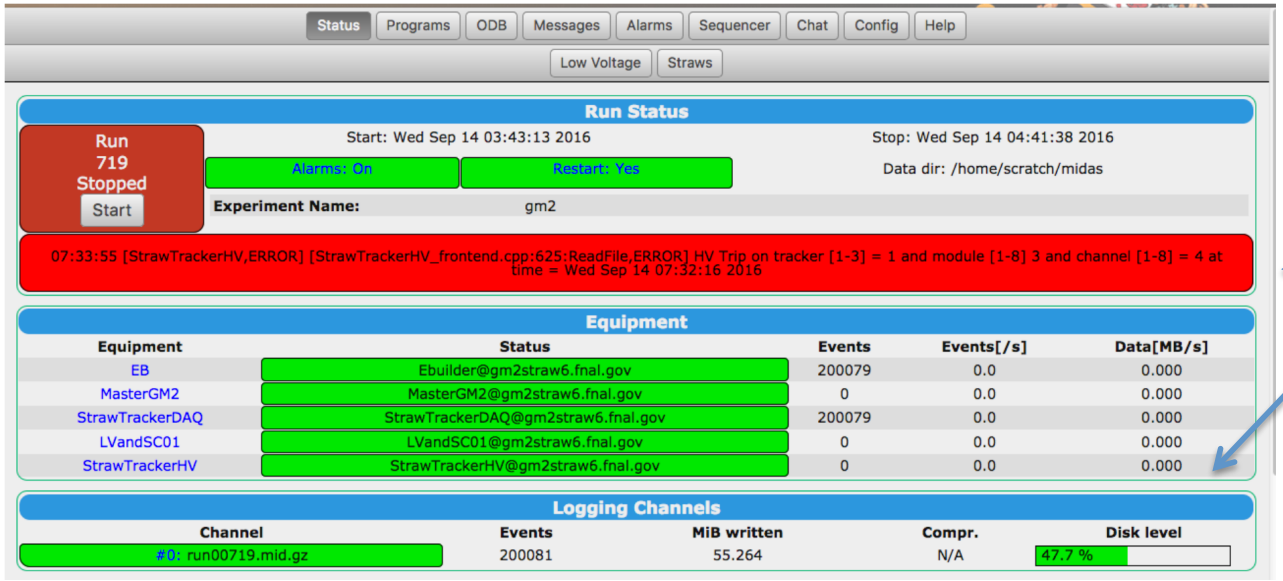

An easy display to see which HV channel are on or have tripped

There is also a page which allows the user to turn channels on/off and change the voltages



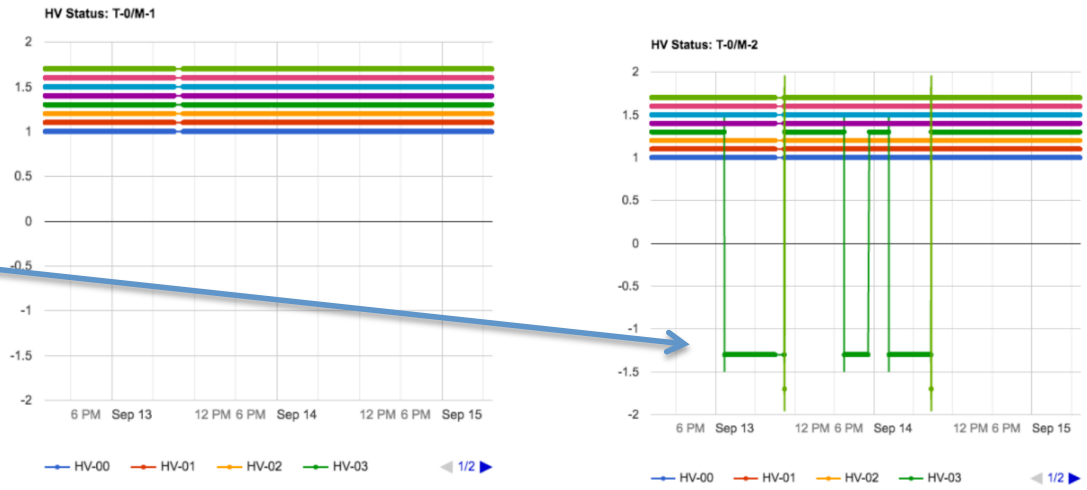
# High Voltage control

***The information from the HV GUI is read by the HV frontend and displayed in the Slow Control Monitoring pages***




HV frontend throws an error to MIDAS if the HV trips to alert the user

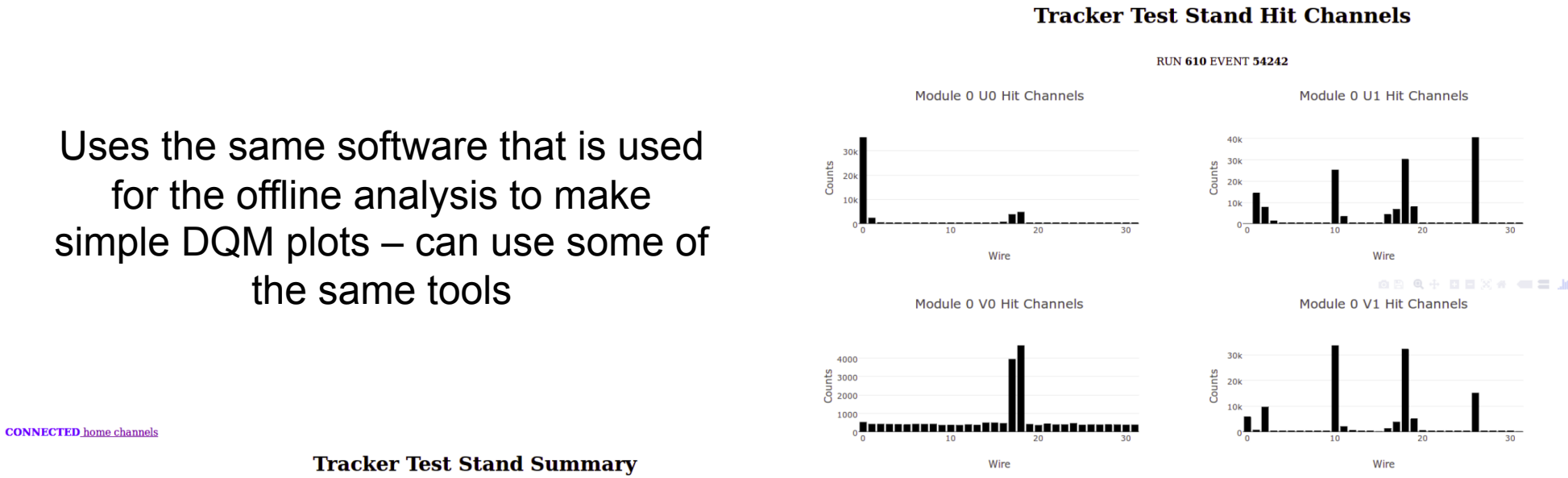
The Slow Control monitoring allows you to see when the HV tripped – good to know when analysing the data!

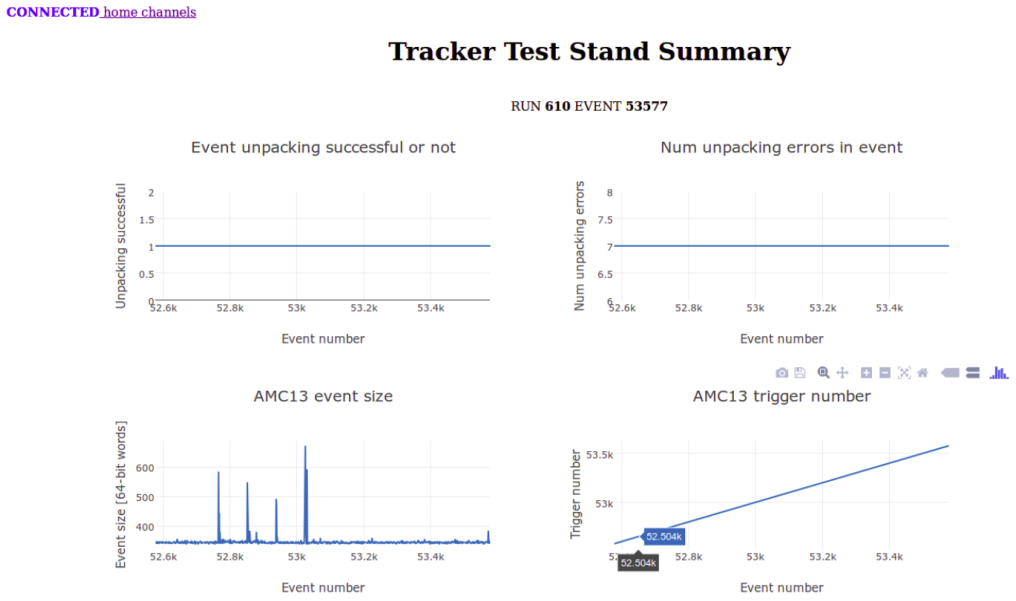


# Straw Tracker DQM

***The DQM for the experiment will use MIDAS-to-art online which is sent to a node web client***

Uses the same software that is used for the offline analysis to make simple DQM plots – can use some of the same tools




Have some basic useful plots in there currently but work is ongoing – need to decide on the exact plot combination

# Summary

***The Straw Tracker DAQ system is generally running well and is being well tested at FNAL and Liverpool***

- The g-2 DAQ system uses **MIDAS with µTCA hardware communicating via IPBus**
- There are many **tools available for monitoring** of SCs, LV, HV and the data
- The tracker DAQ has been **integrated with the calorimeter DAQ and clock and controls systems**
  → Further and longer tests of this will be performed
- A system with **2 tracker modules** is currently running well
  → Allowed for testing using 2 different FC7s successfully
- Continuing data taking is allowing **infrequent errors to be picked up** and solved and for **small improvements for increased usability**
- The system has **proved to be robust**, running over night for runs of up to 12 hours without error