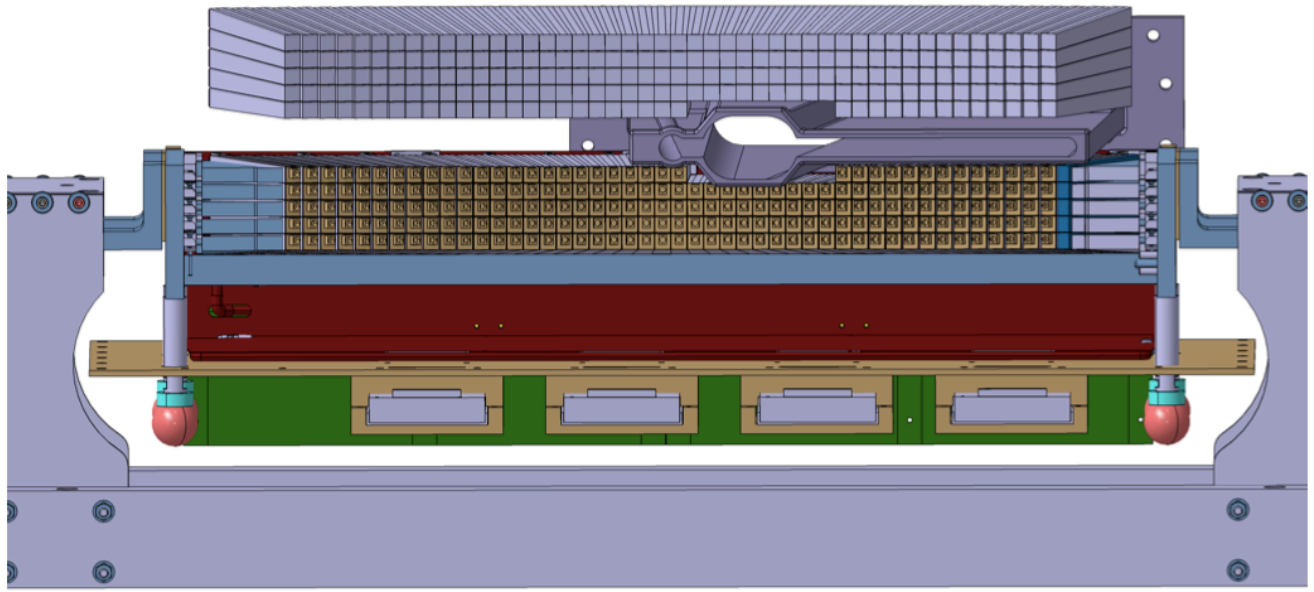
Calorimeter Performance and Status of Calibrations

HPS Collaboration Meeting

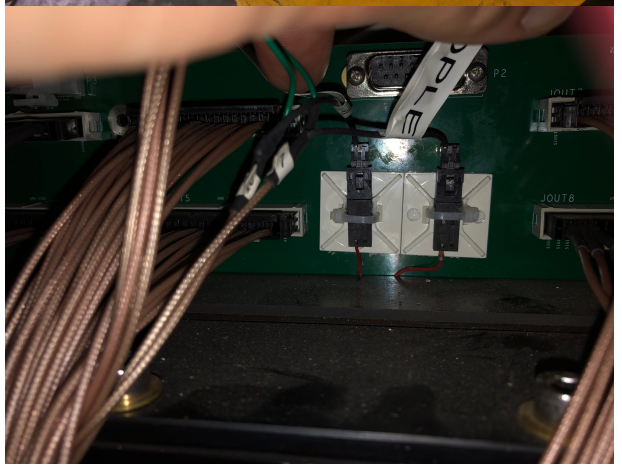
November 2019

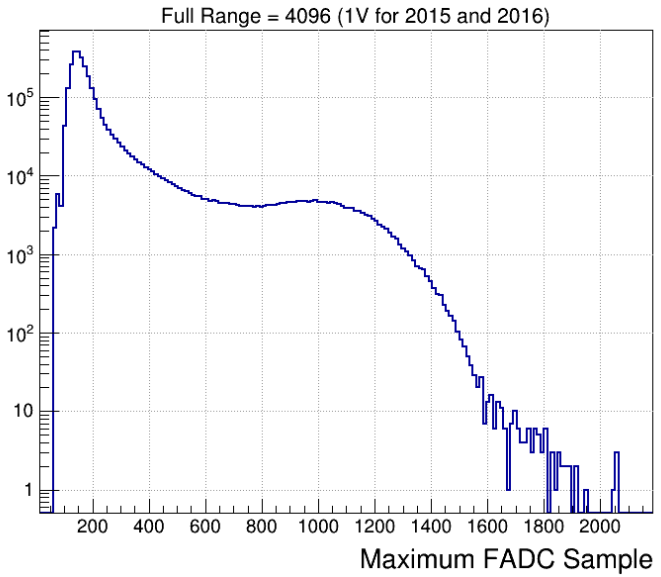
N. Baltzell



Pre-Run Checkout

- Cables, controls, cooling, voltage
- Cosmic stand setup, trigger, software configs, FADC range checks
- Sorted through various signal chain issues
  - resoldering/reseating connectors, on both ends, affected by ongoing physical work around the calorimeter, reseating a couple preamps
- Increased noise relative to 2016, with a component correlated with DAQ activity, raised thresholds 10->15 MeV





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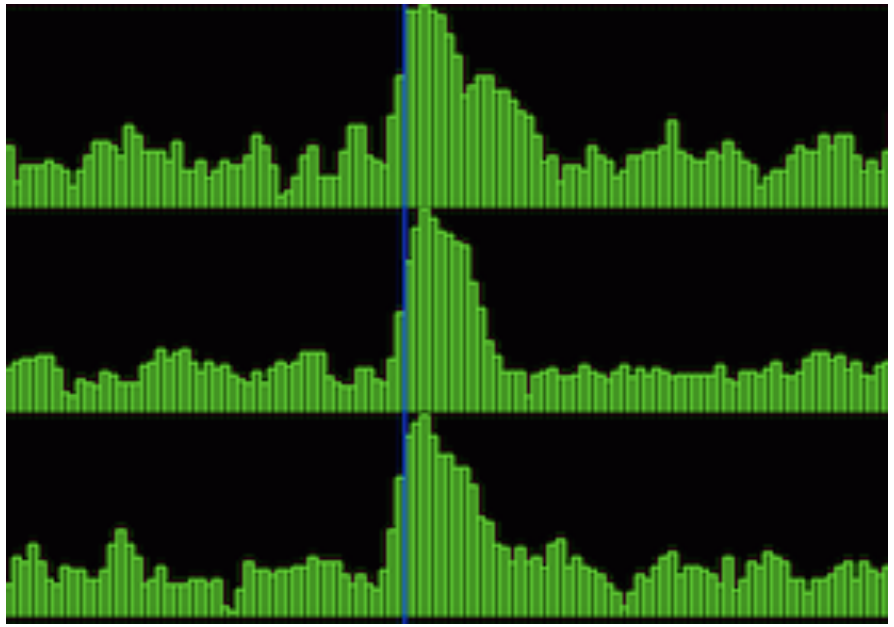
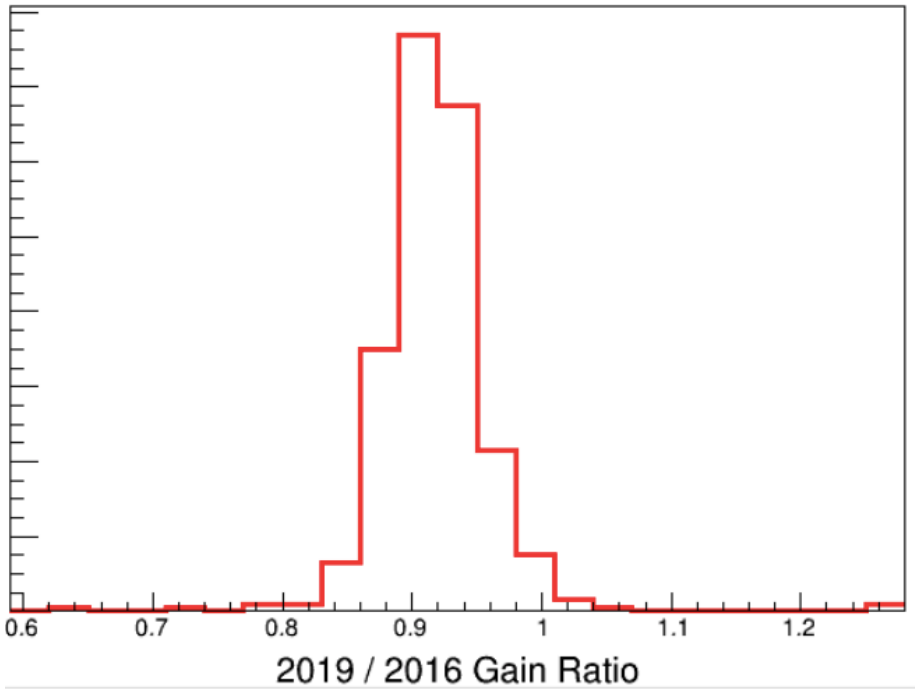
Pre-Run Cosmics

- Acquired weeks of cosmics before the run
  - with varying conditions, but still plenty for a good cosmic gain calibration
- Meanwhile
  - one of the HV channels with circuit board bypass couldn't hold voltage after a couple weeks (problem came back a ~month into the run, again "fixed" by playing with connections)
  - one preamp failure, intermittent, replaced before production running
  - lost one preamp on electron side, bottom, preamp too difficult to access after buttoning up just before the run





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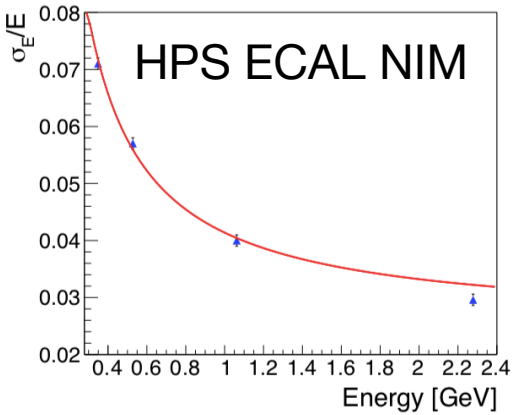
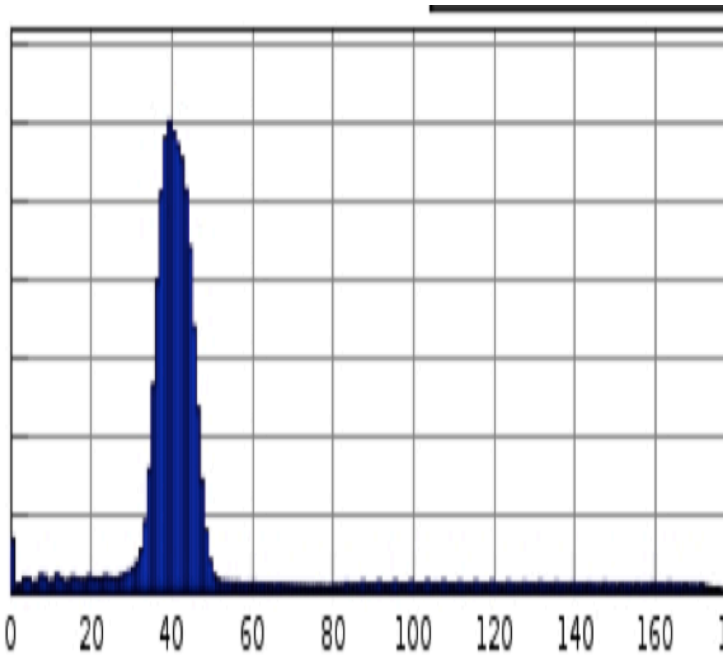
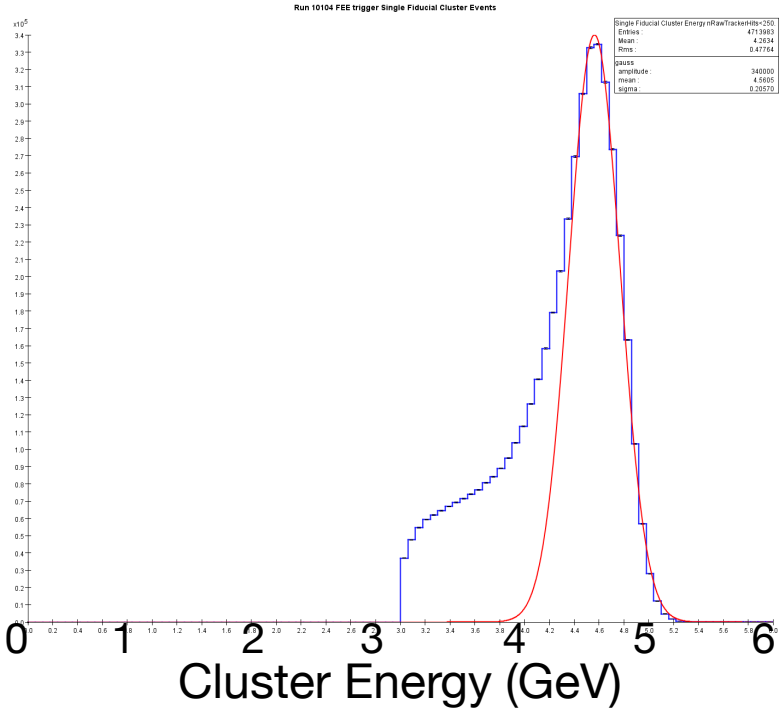
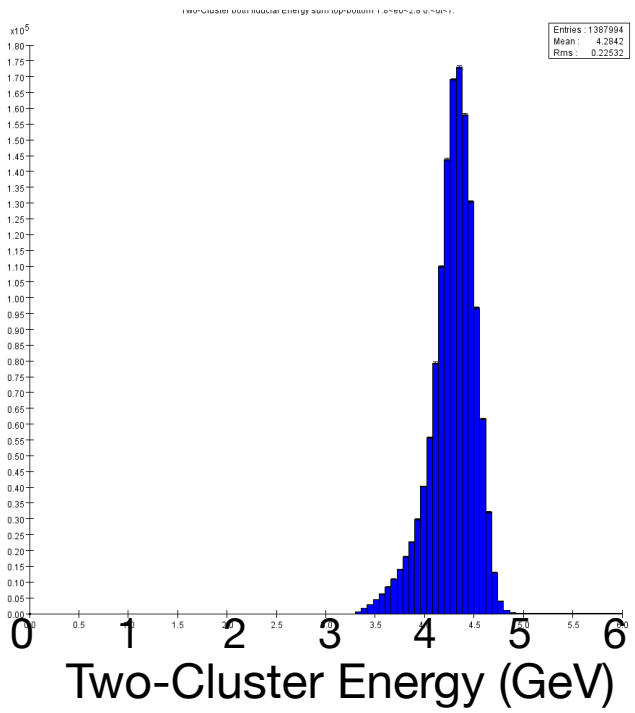
Running at 4.5 GeV

- With only cosmic gains
  - ~4.5% resolution on 4.5 GeV e^- and $e^-\gamma$, and within 10% of nominal beam energy
  - without updated 4.5 GeV sampling fraction, edge shower loss correction









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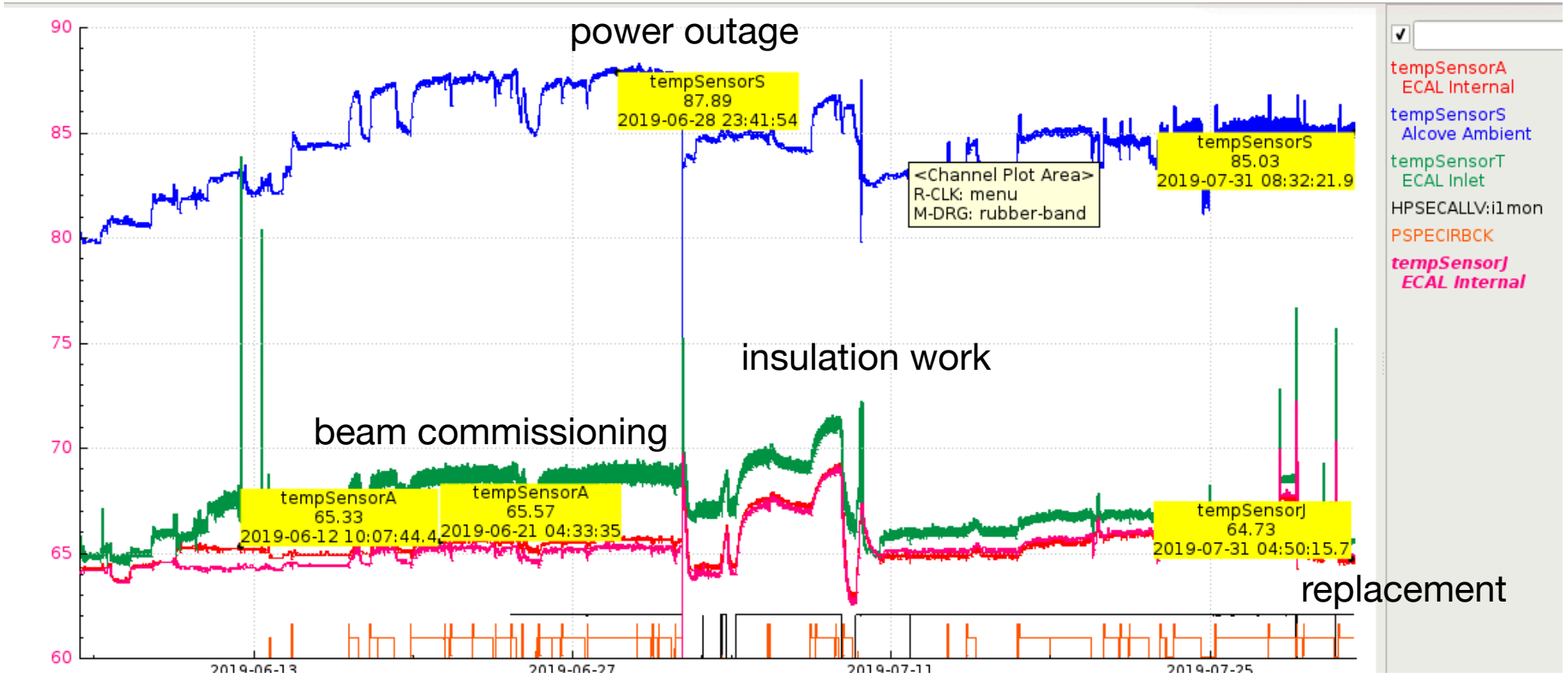
Cooling Issue

- After power outage, interrupting beam commissioning, chiller started to show clear issues with cooling ability
- Eventually replaced it, before big production running, and after that no temperature stability issues



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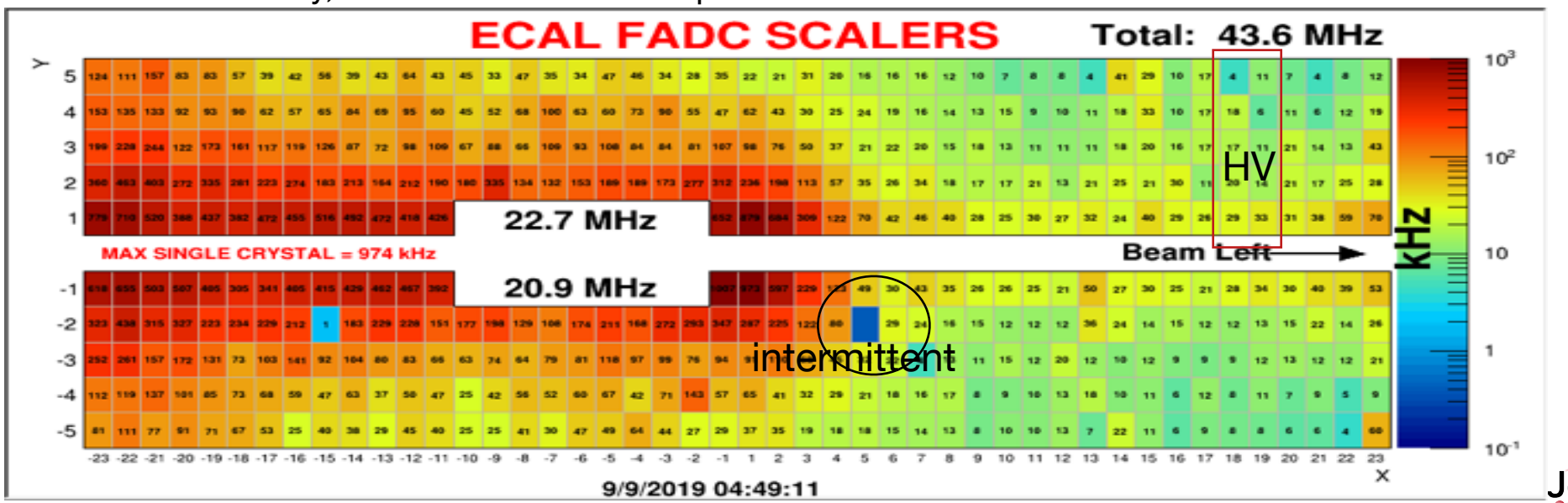
Nuisances

- Single channels
  - Positron side
    - Lost +5/-2 during the run for a few days until an access was appropriate, again resolved by reseating connections
    - Low gain in +7/-3, consistent with cosmics
  - Electron side
    - Lost -15/-2 on electron side
- High Voltage
  - Top 10 (x=18/19) started to draw high current again, correlated with visible gain reduction (~20%)
  - compensated for in trigger software gains, high current lasted for about a week, cosmics after the run show no evidence
- Electronic Noise
  - Correlated with DAQ activity, sometimes makes interpretation of scalers difficult



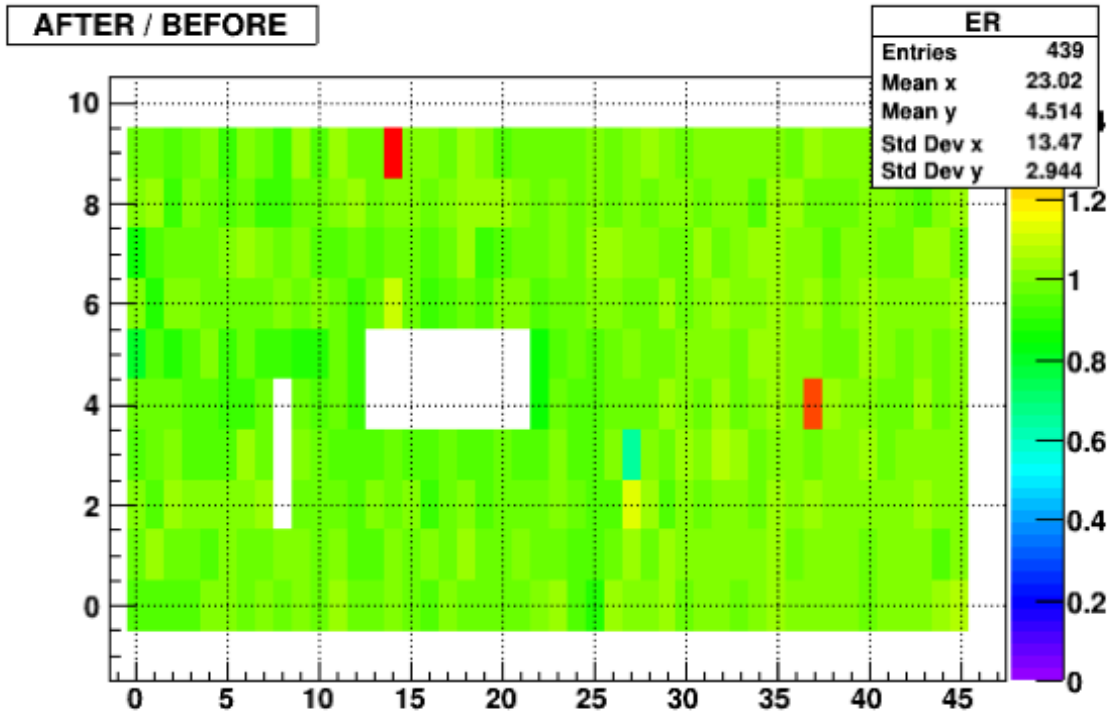
Alignment Surveys

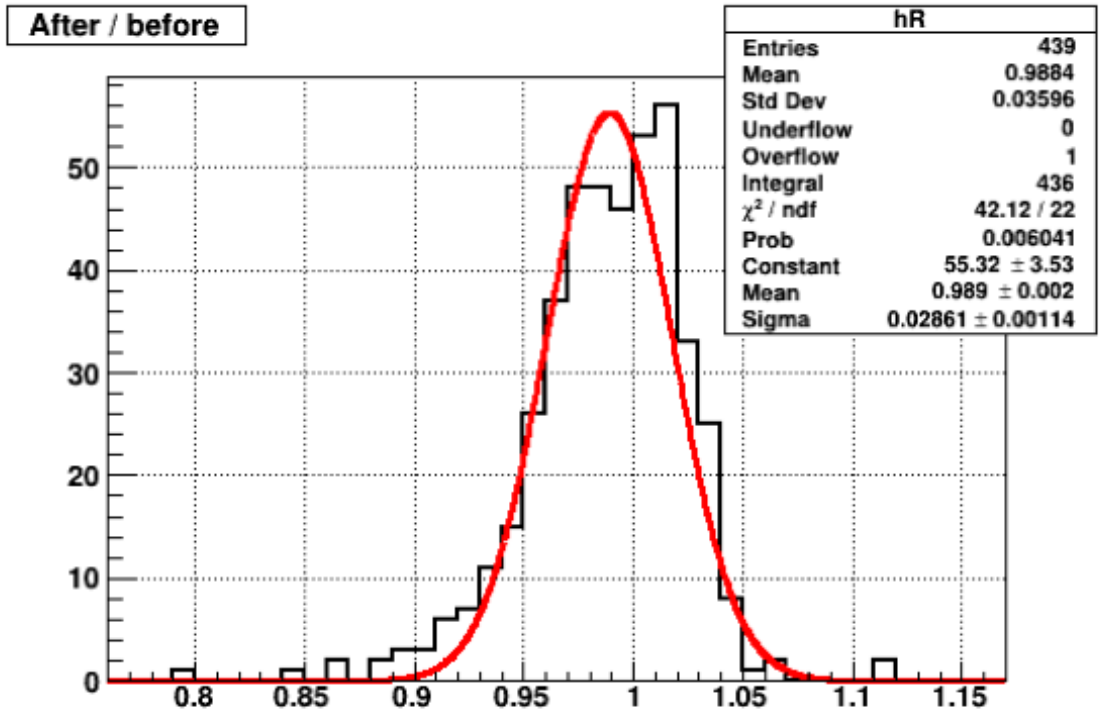
- ~mm shifts in x/y relative to the previous run
- Implemented in software (not in master branch yet)
  - approximately, "accounting" for what must be some human error in the surveys
- Note, previously we did final, global alignment based on the SVT

2019pre-2015			2019 post-pre		
dx (mm)	dy (mm)	dz (mm)	dx (mm)	dy (mm)	dz (mm)
0.70	-0.10	-54.58	-0.96000	0.28000	0.35000
1.13	-0.33	-54.72	-1.16000	0.16000	0.48000
0.54	0.31	-56.81	0.16000	0.41000	-0.55000
0.96	0.41	-57.23	-0.13000	-0.61000	-0.65000
-1.38	1.22	-53.83	-0.05000	-0.02000	-0.36000
-0.91	1.59	-53.78	-0.17000	-0.08000	-0.39000
-1.55	0.80	-55.41	-1.15000	-0.12000	2.09000
-1.02	0.62	-56.30	-1.84000	-0.06000	-0.20000
-0.19		-55.33	The 2 mm dz must be human error.		

Gain Stability

- Plenty of cosmic data was acquired before the run, and ~1 week after the run
  - enough to get a reasonable gain stability measurement for the whole calorimeter
  - variations are larger after the run, few ~% more, but no significant drifts visible





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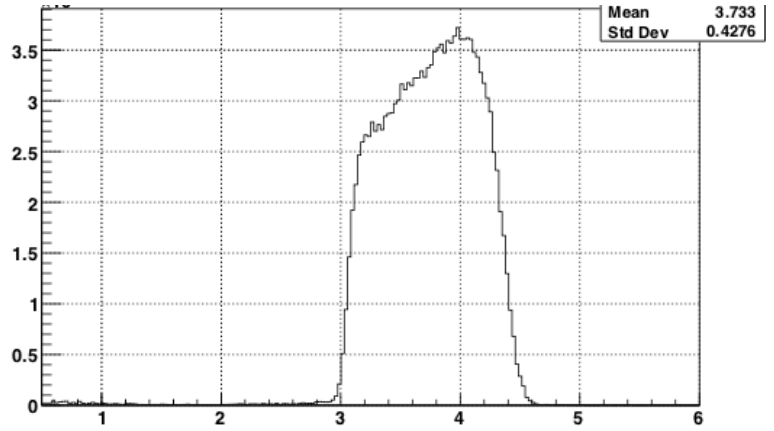
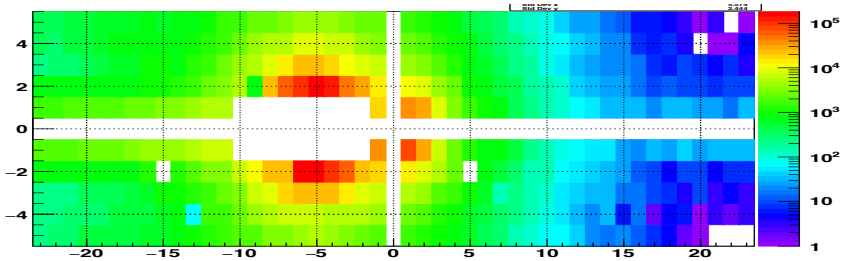
Calibration Status

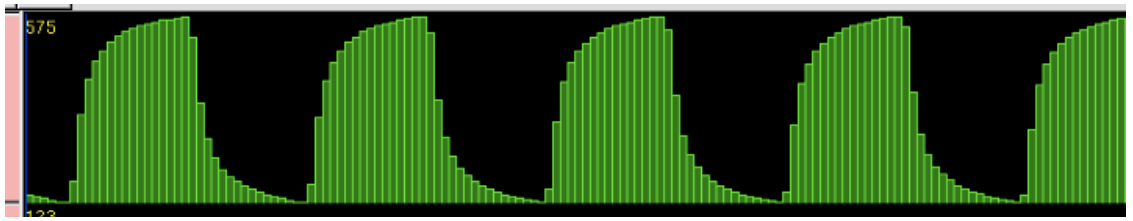
- In progress ...
  - timescale for completion, ~early 2020

- Alignment (Nathan)
  - survey implemented in software
  - to be supplemented/revisited with tracking
- Energy (Andrea/Luca)
  - single-channel gains
    - cosmics done
    - currently working with FEEs
    - to be complemented by WABs
  - simulations needed for corrections
    - "sampling" fractions
    - edge shower loss
- Timing (Nathan)
  - using accelerator RF as the reference
  - channel offsets
  - time-walk (should be unchanged from previous runs)
- Position (Nathan/Andrea/etc)



Edge Crystal Cluster Energy (GeV)


"FEE" Coverage



Accelerator RF, 80x prescaled

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