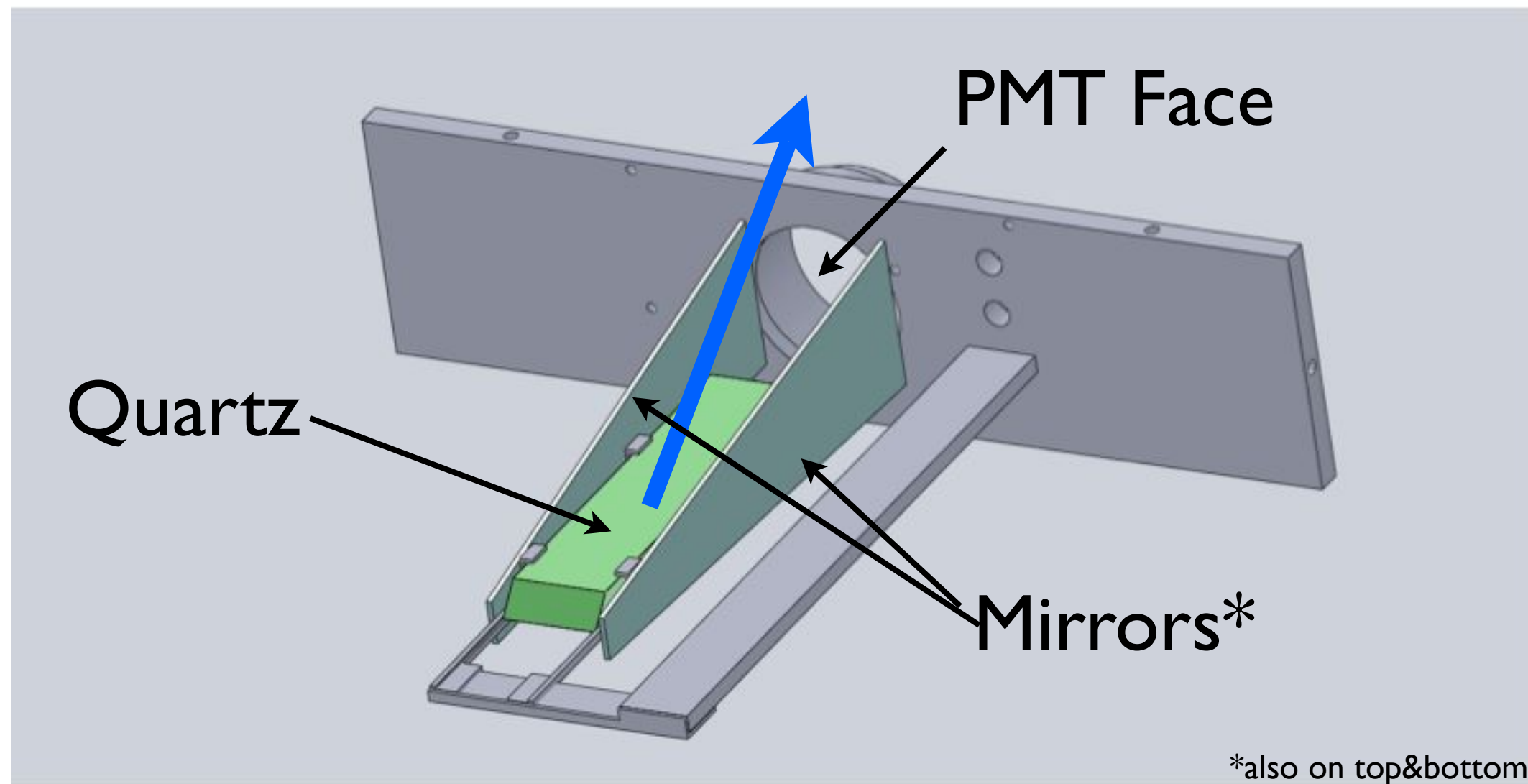


PREX Detector Cosmic Tests

UMass-Amherst
06/10/2013

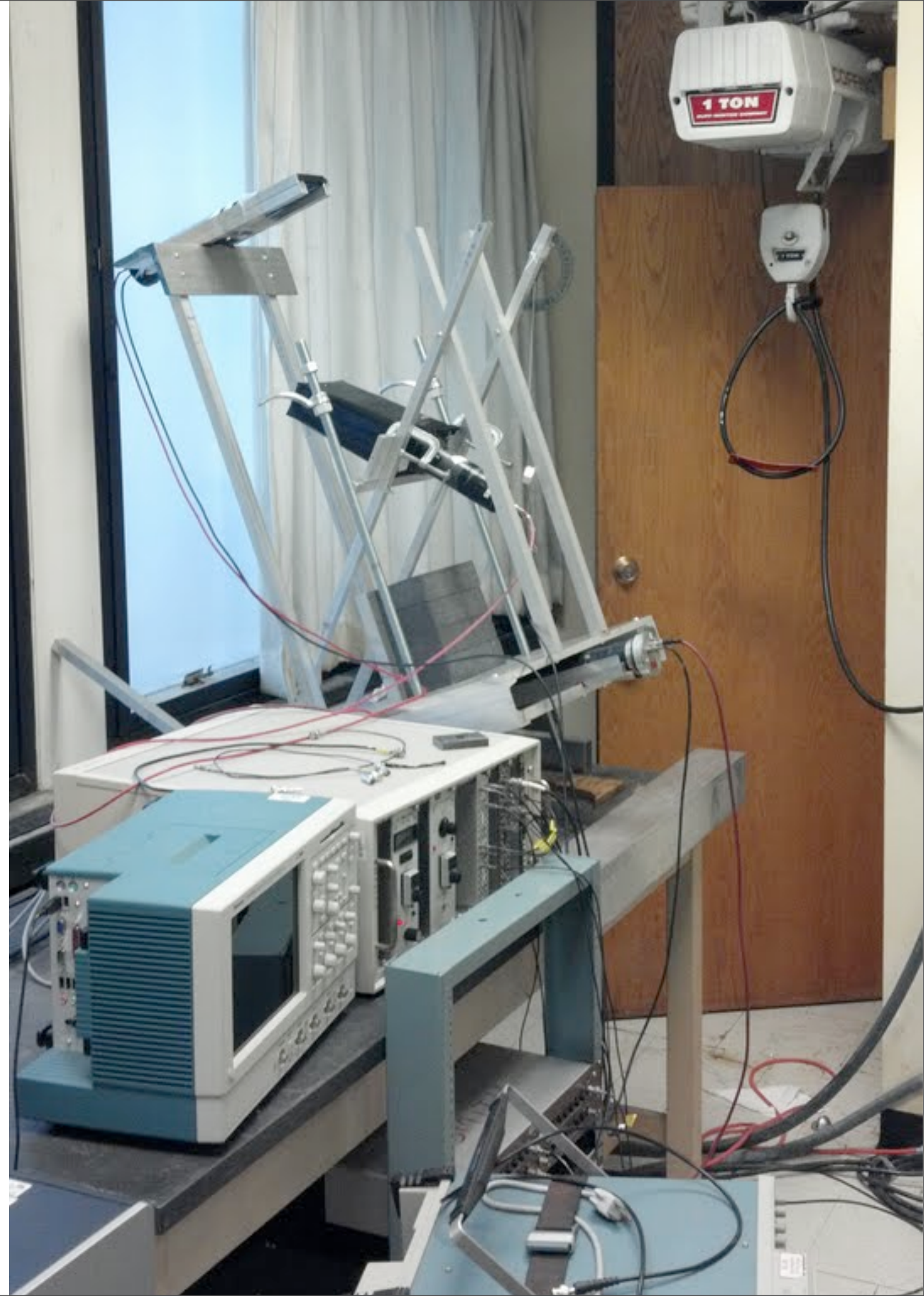
PREX Detector Summary

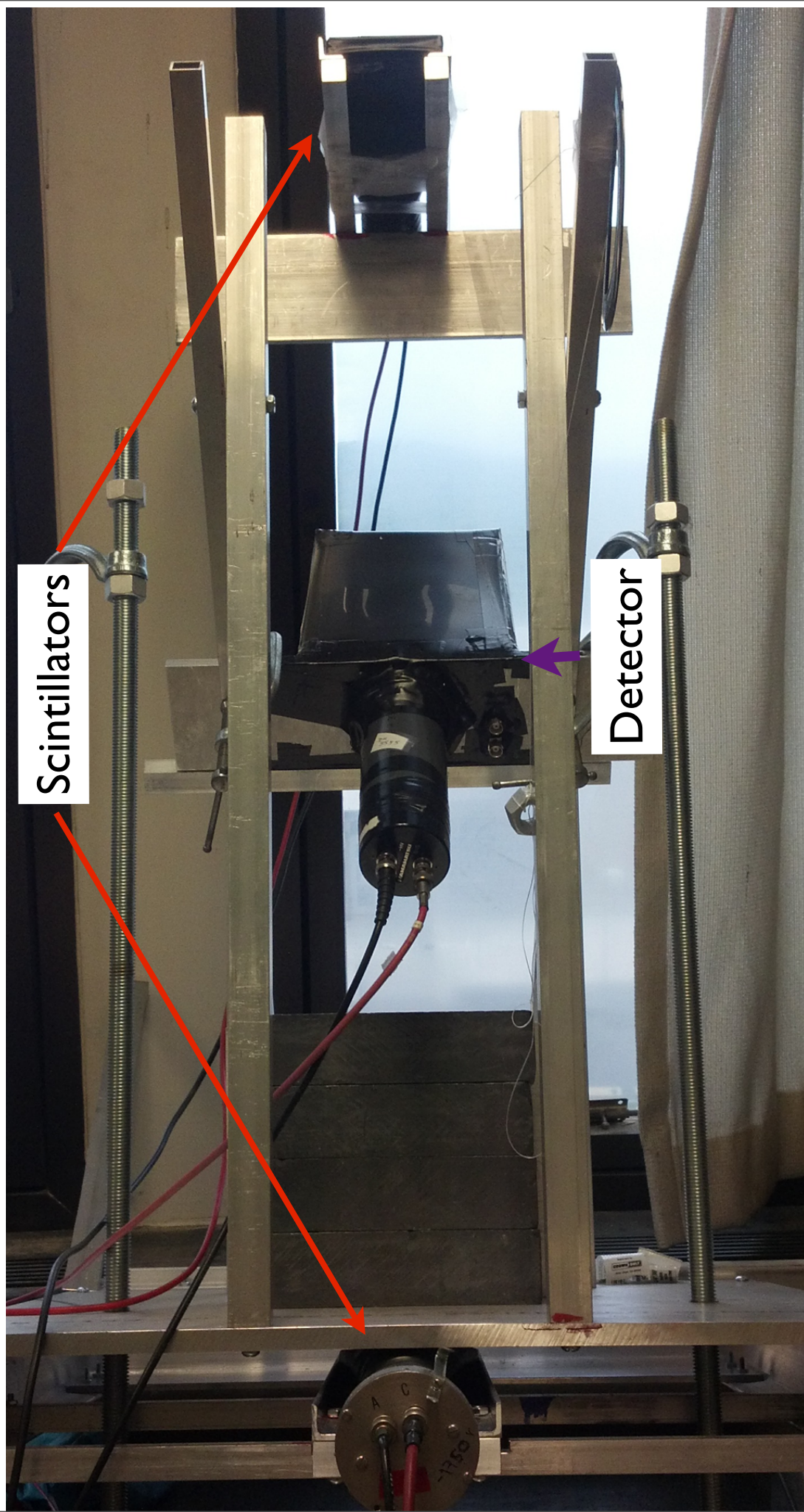


The electrons passed through the quartz block at a 45 deg. angle. (blue line). The main flux of Cerenkov photons left the quartz face pointed at the PMT, minimizing # of bounces off mirrors.

Cosmic Test Apparatus

- Uses a pair of scintillators to trigger DAQ.
- Spaced 1m to minimize accepted solid angle
- 20cm of Pb between scintillators used to cut off $< 100\text{MeV}$ muons.
- Orient quartz at 45 deg. relative to active scint. region.

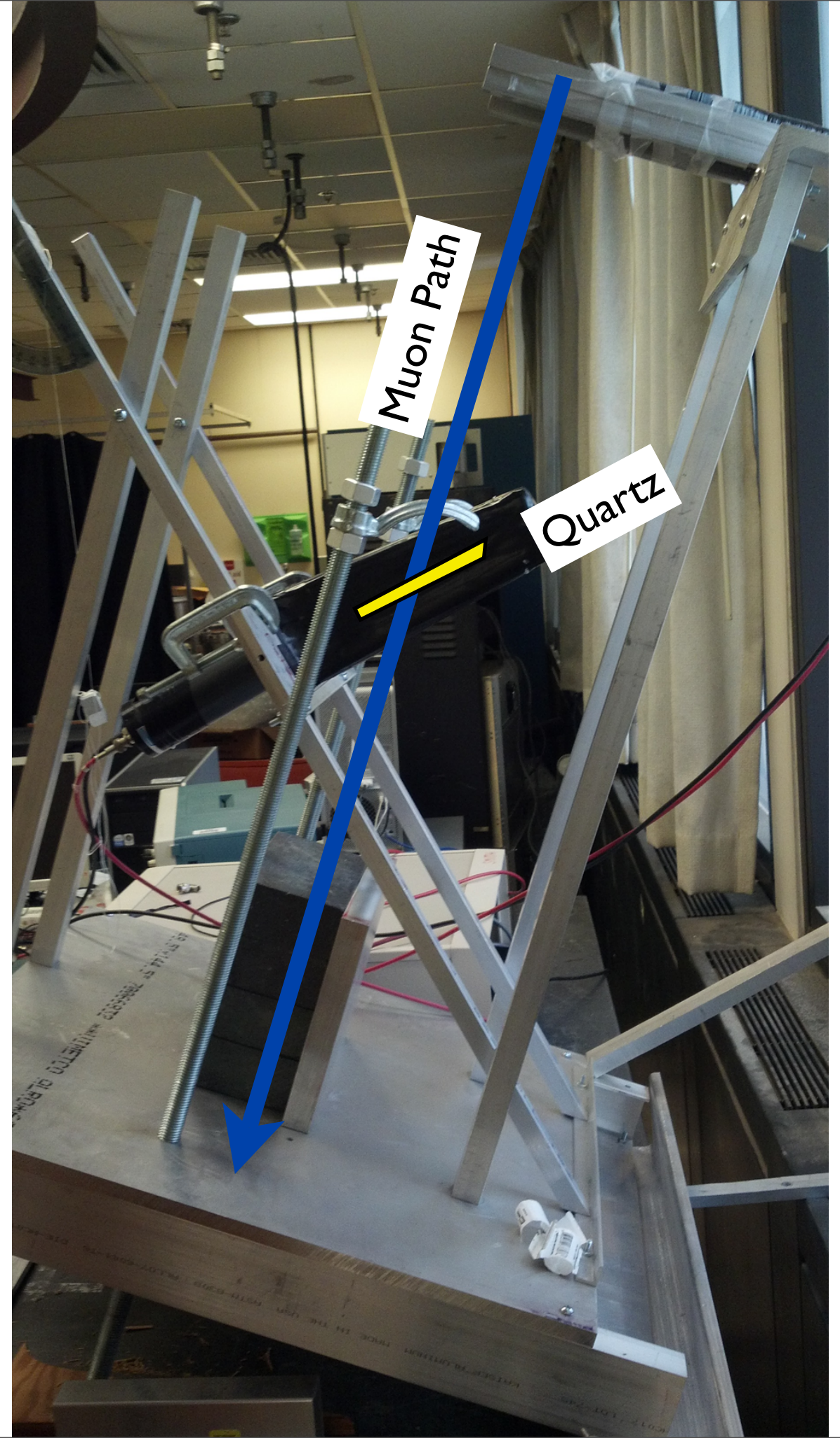




P i c t u r e s

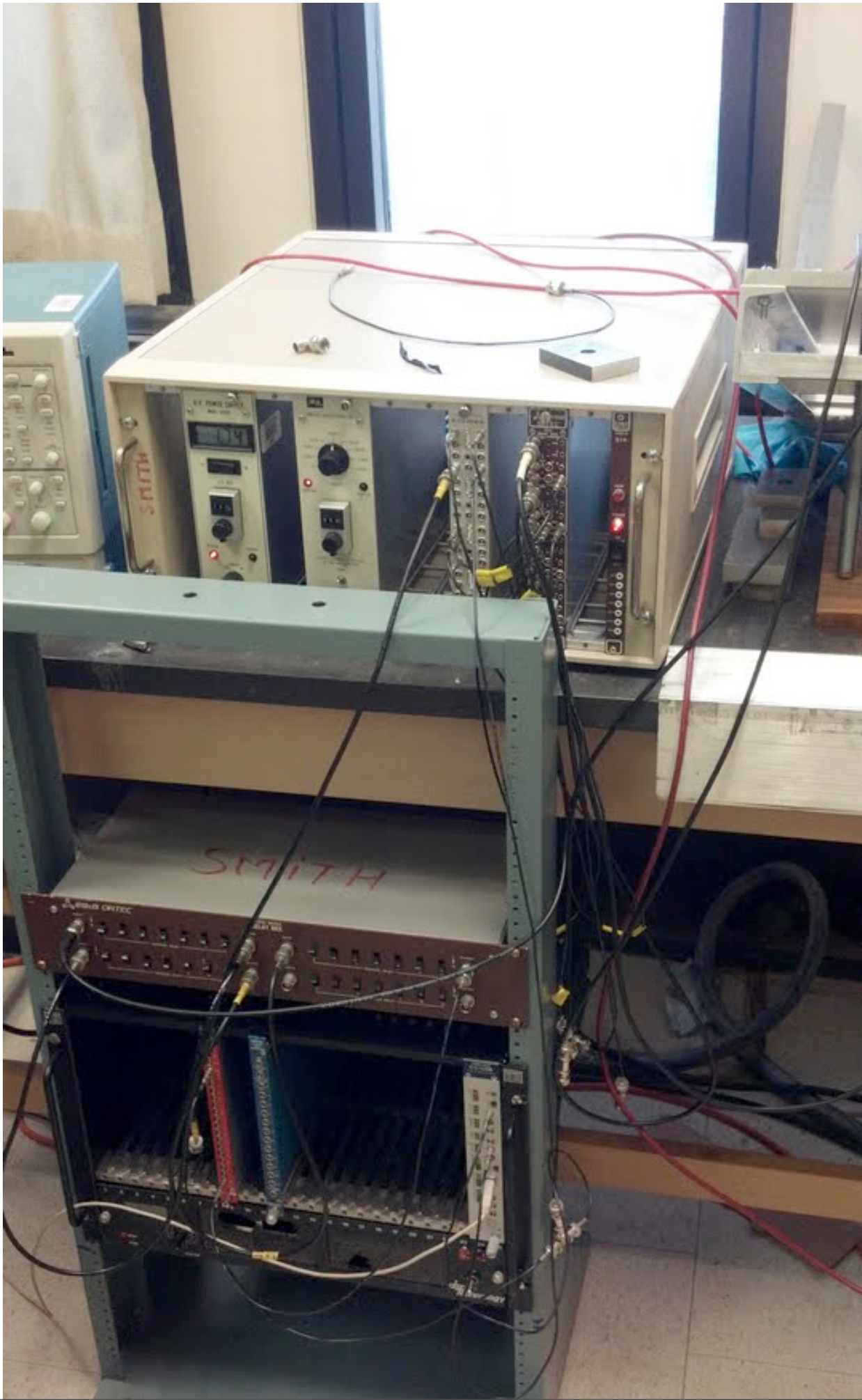
Detector Stand

- Aluminum frame.
- Supports scintillators, Pb bricks, and detectors in rigid alignment.
- Able to be tilted in order to maximize flux of cosmic particles triggering scintillators.
- Quartz and mirrors contained in kapton cover for light-tightness.

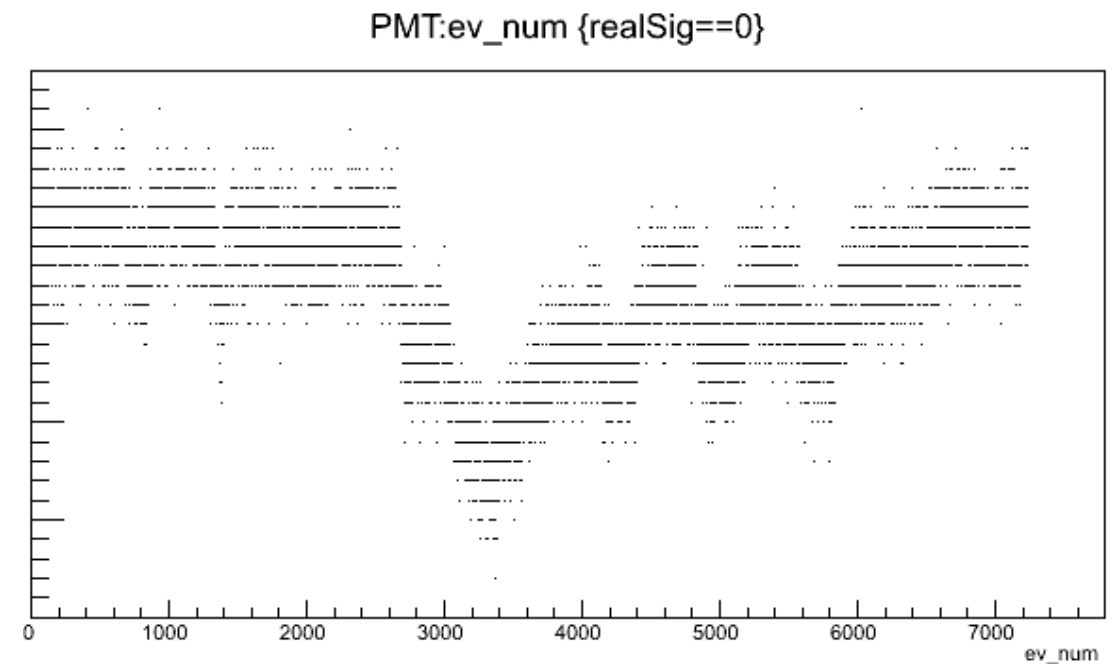
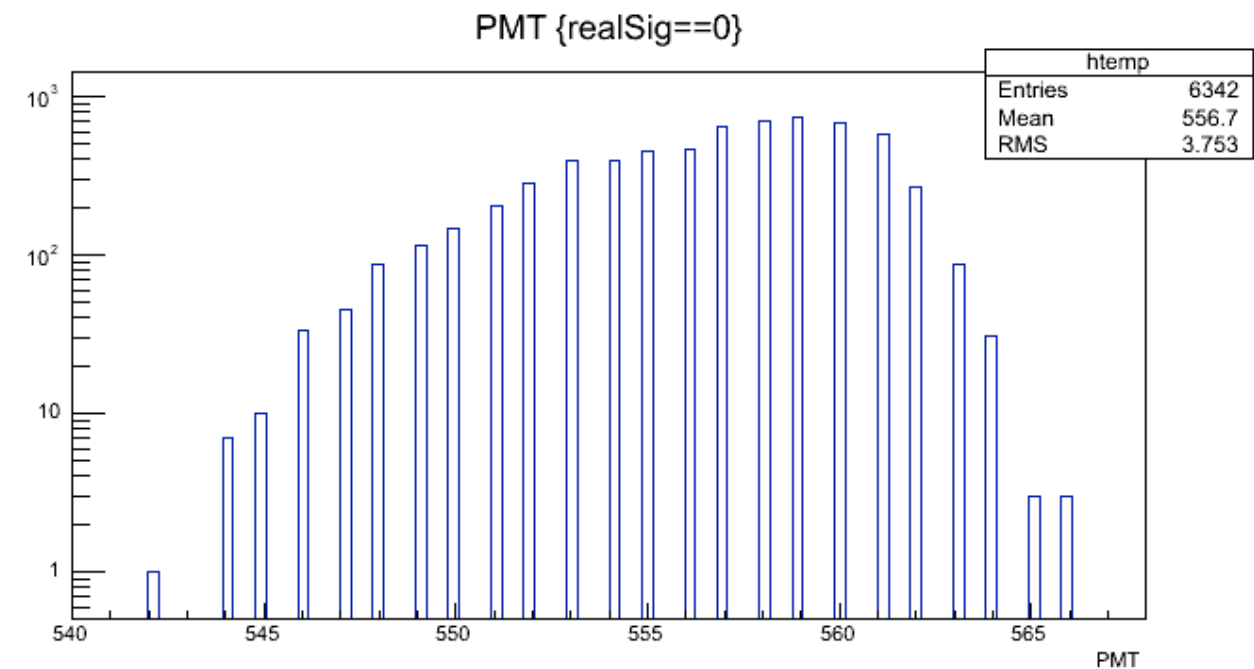
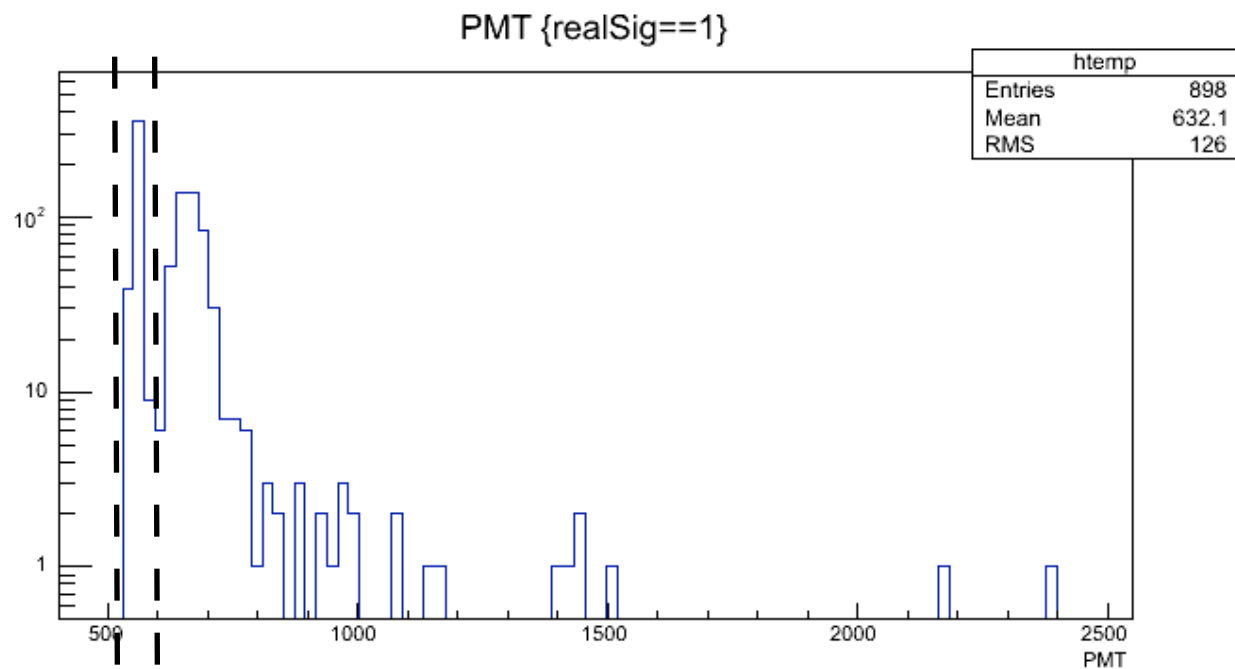


Electronics

- ADC is a CAEN C1205 module, with 21 fc/channel conversion.
- Coinc. trigger and timed trigger (controller module) or-ed together, ensuring same triggering gate sent to recording electronics.

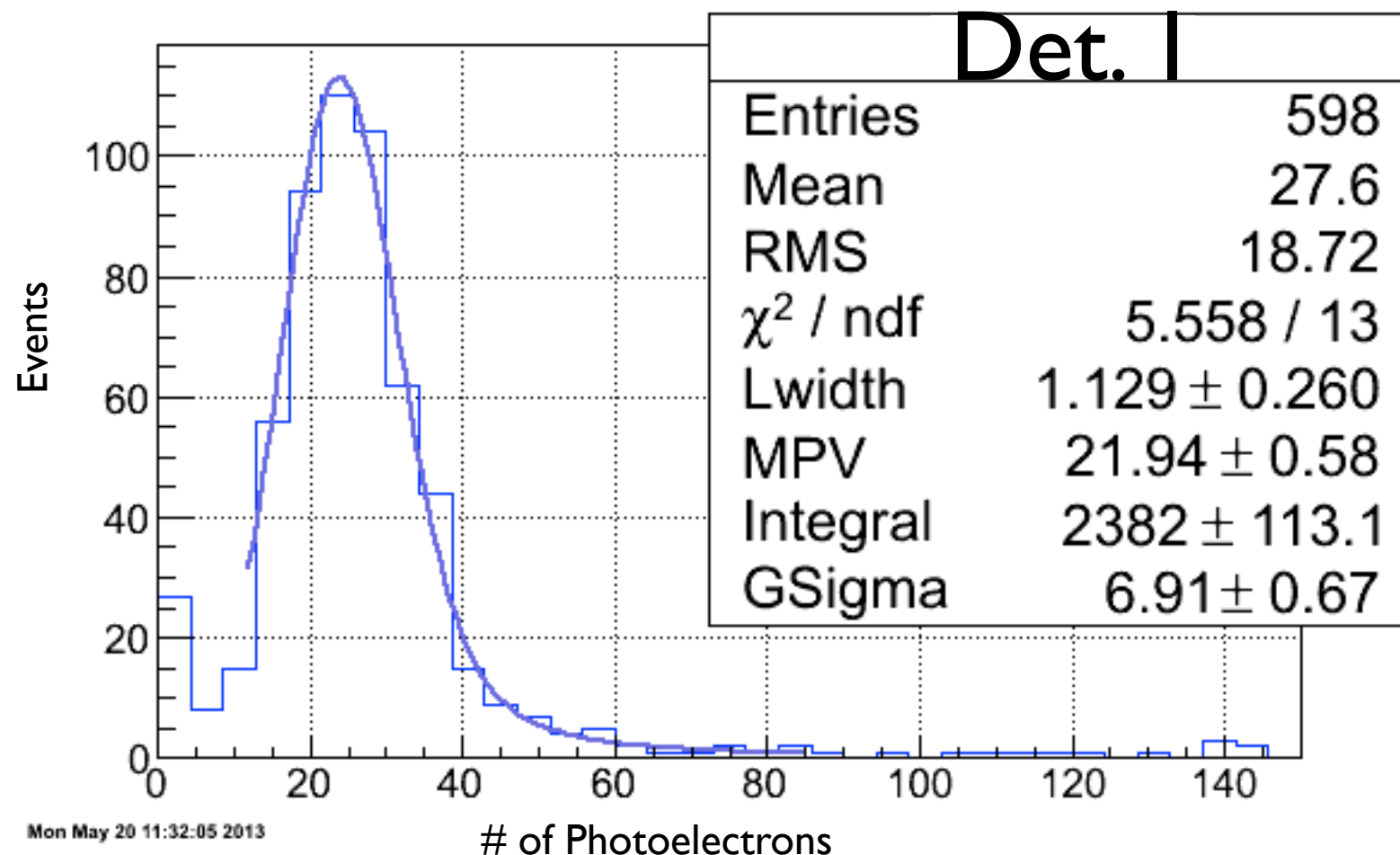


Raw Data



DAQ triggered either by coincidence (UL) or by timed (UR) trigger. Timed trigger used to measure pedestal, improving calibration of coincidence-trigger data.

Measured Signal



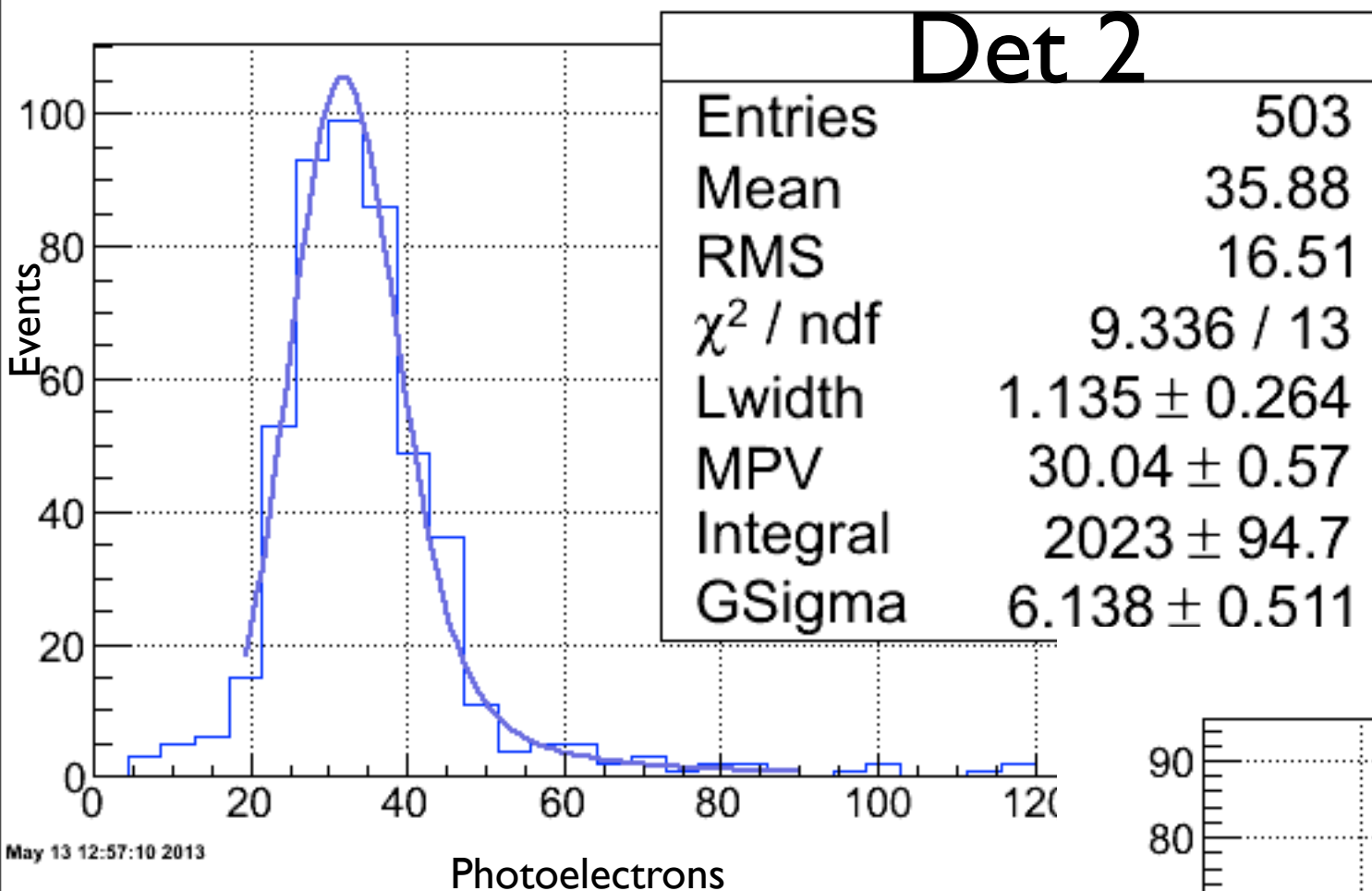
$$\begin{aligned} \text{PEs} &= \text{Signal (in ch)} * \\ &21 \text{ fc/ch (ADC gain)} * \\ &\text{PMT gain} * e^- \end{aligned}$$

Measured at least 500 events on each detector. Calculated ped.-subtracted results in terms of PEs at the anode.

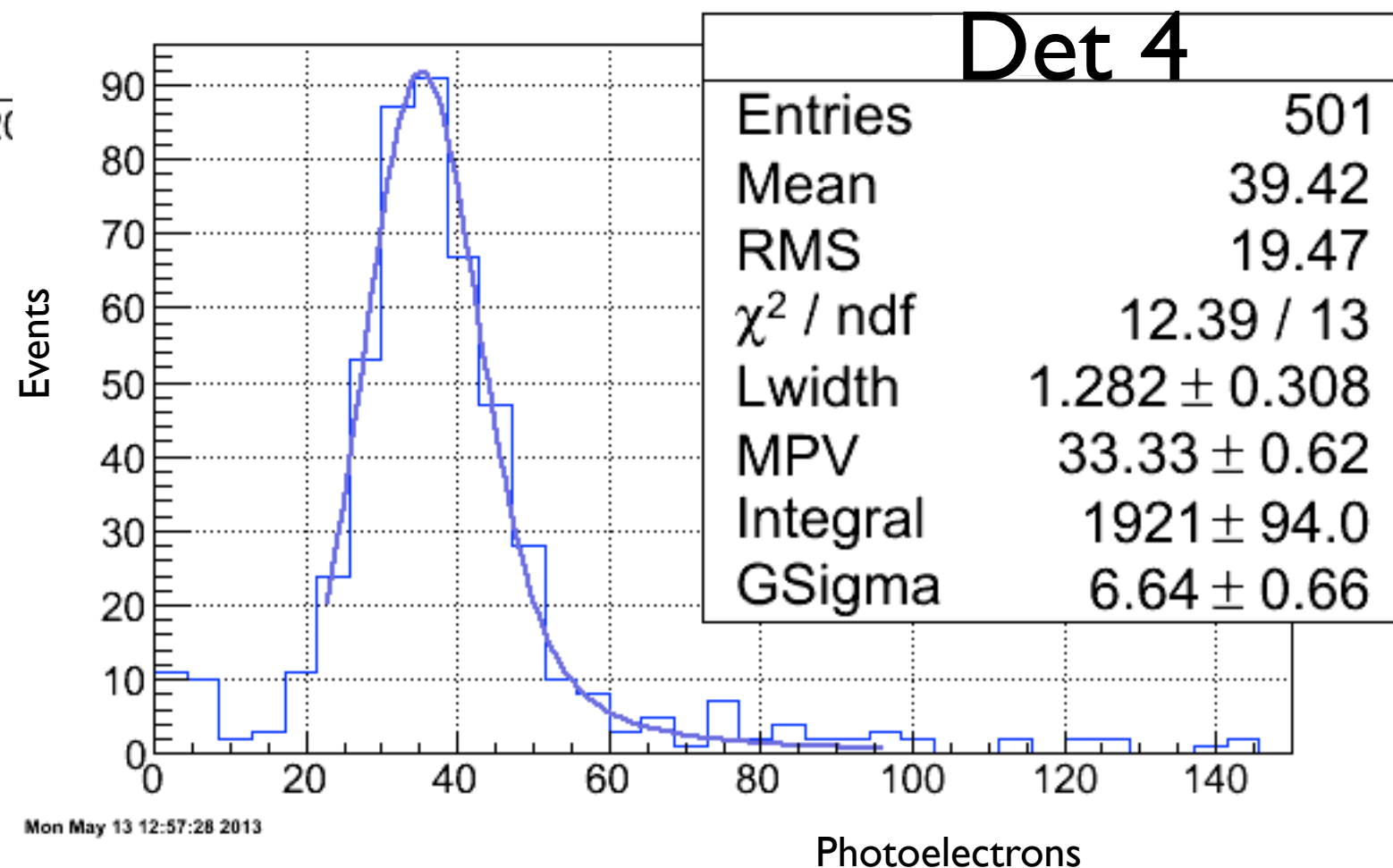
Det1 (right arm thin, gain $6.04\text{E}5$) measures 22 PE's @ 30% resolution.

All gains measured relative to PMT ZK4035 (w/ ZK4035 gain found in single photon measurement)

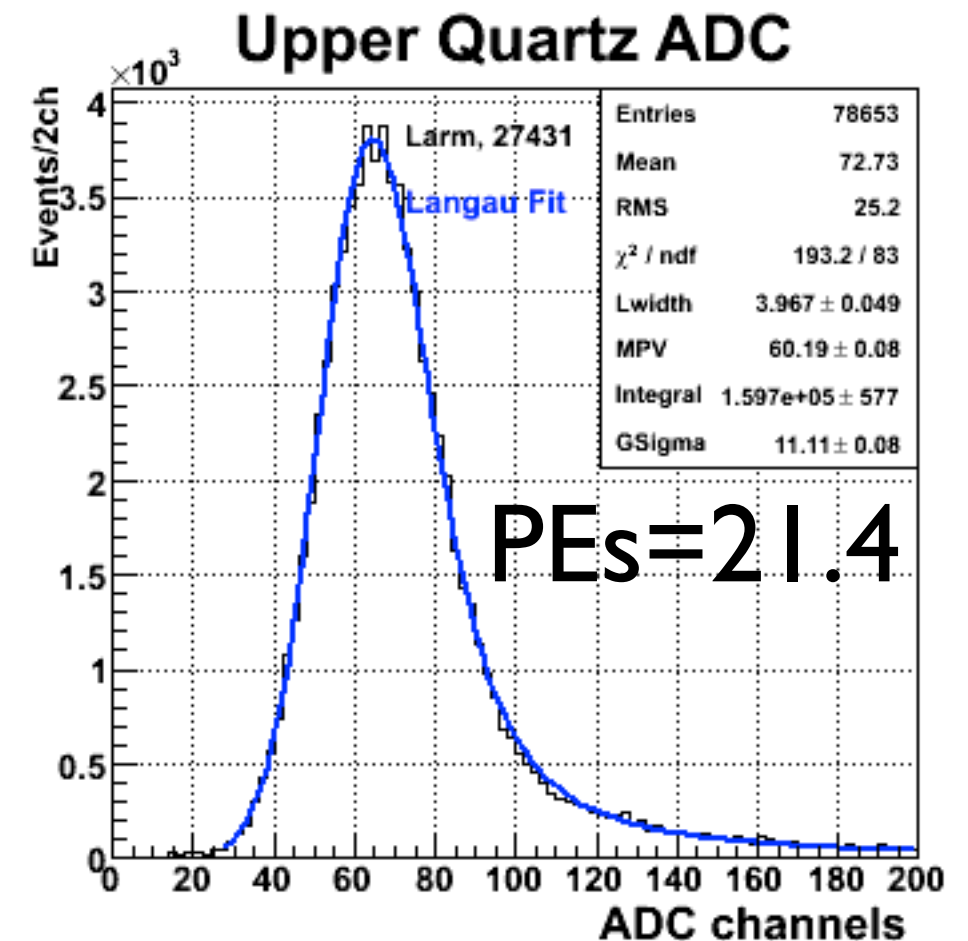
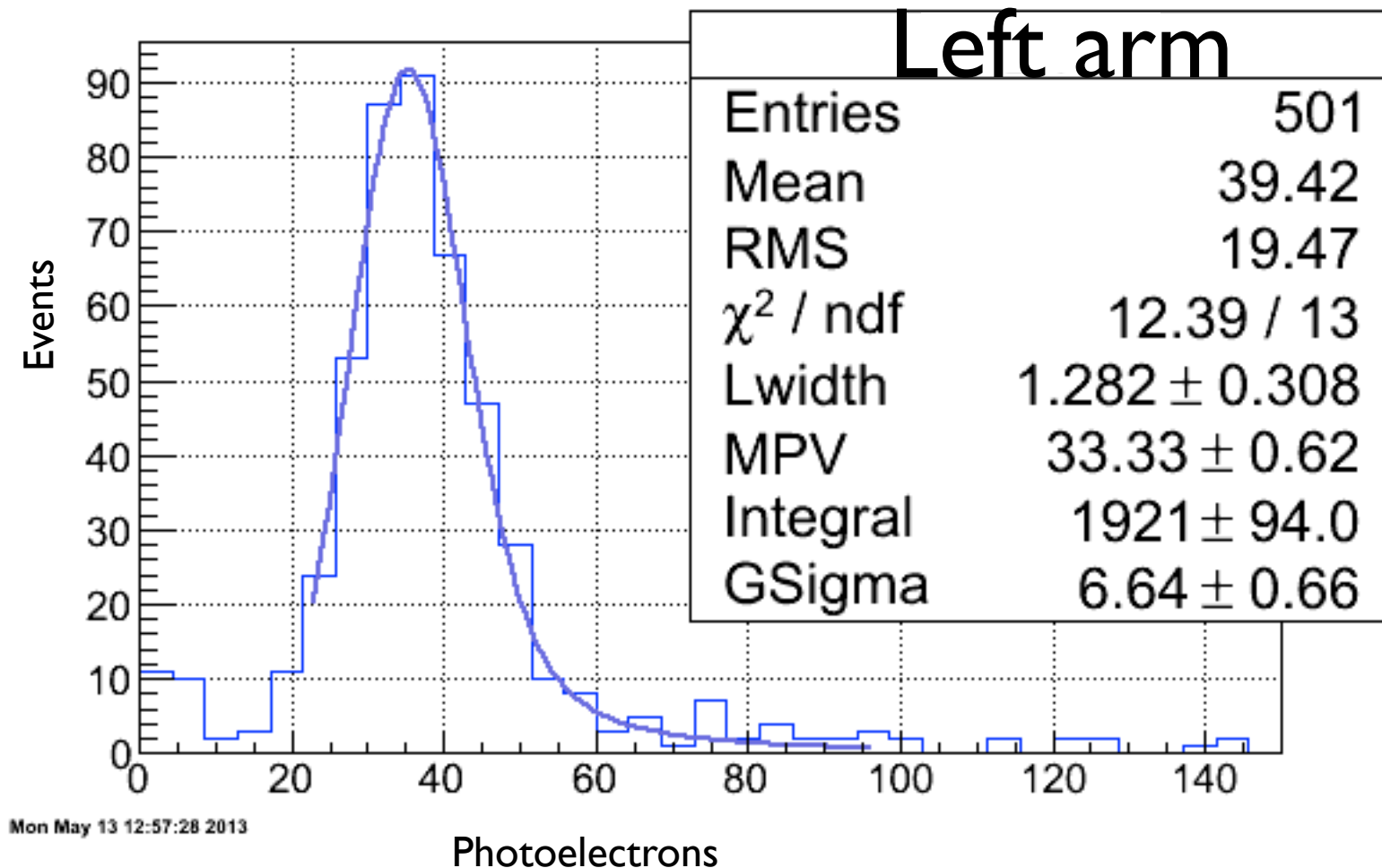
Measured Signal



- Both thick quartz (1cm) detectors.
- Det2 gain = $4.31\text{E}5$
- Det4 gain = $8.78\text{E}5$
- ~30-33 PEs, 20% resolution

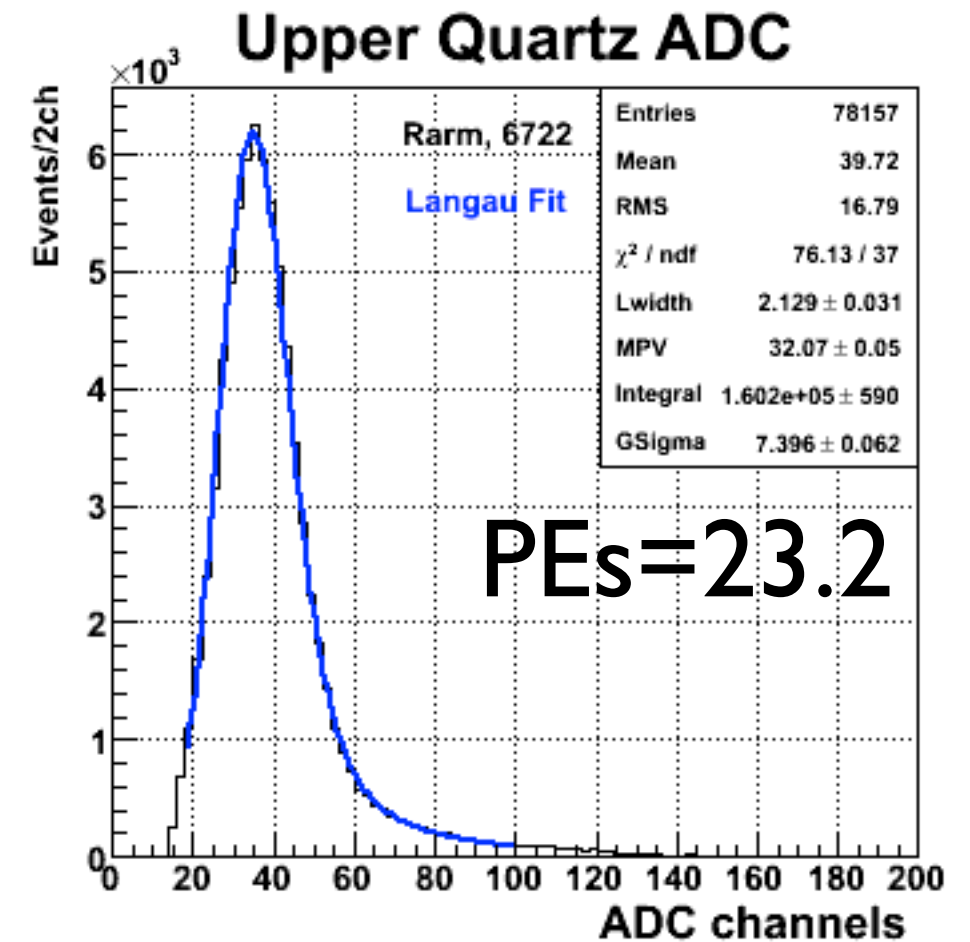
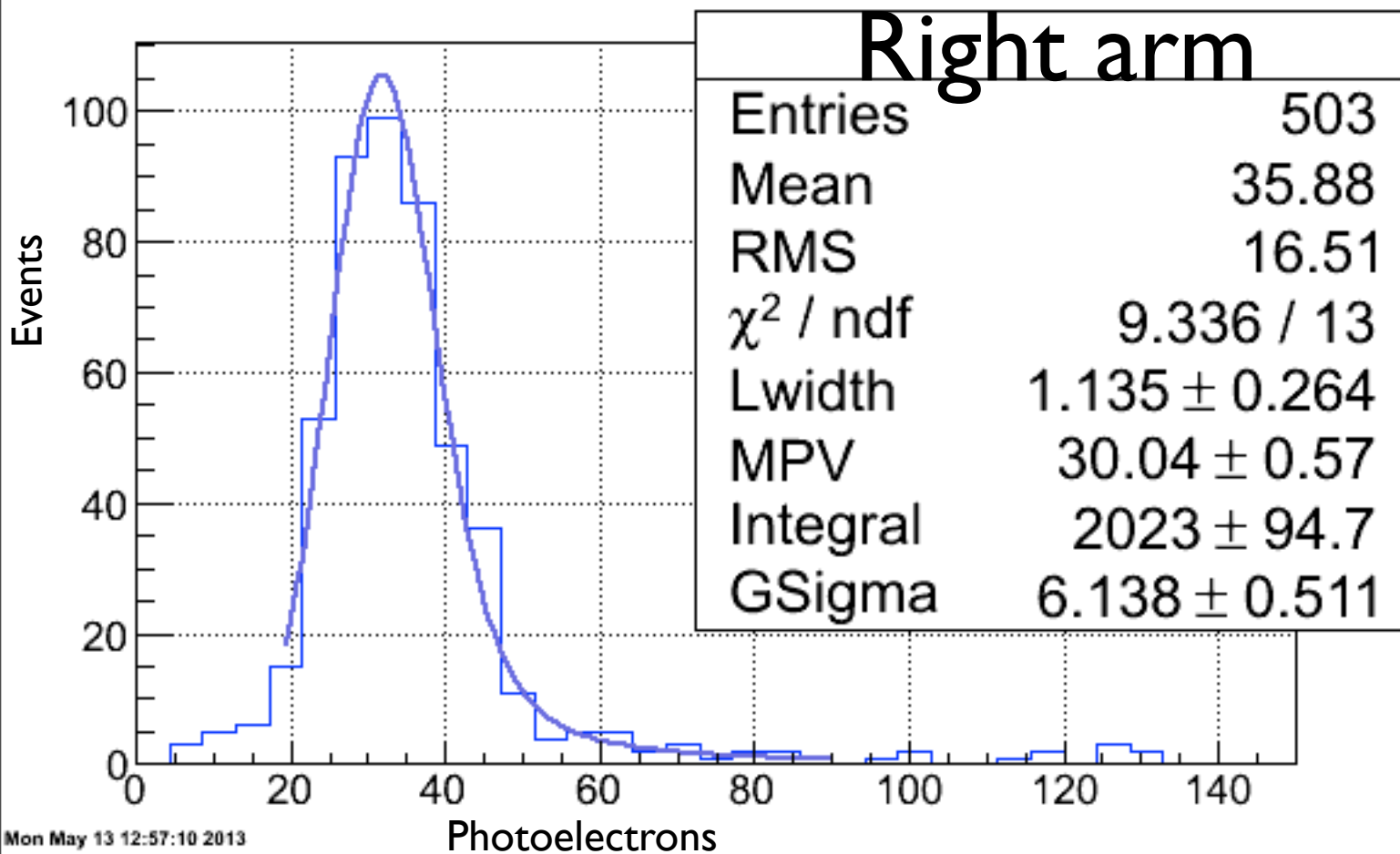


Comparison- Left Upper



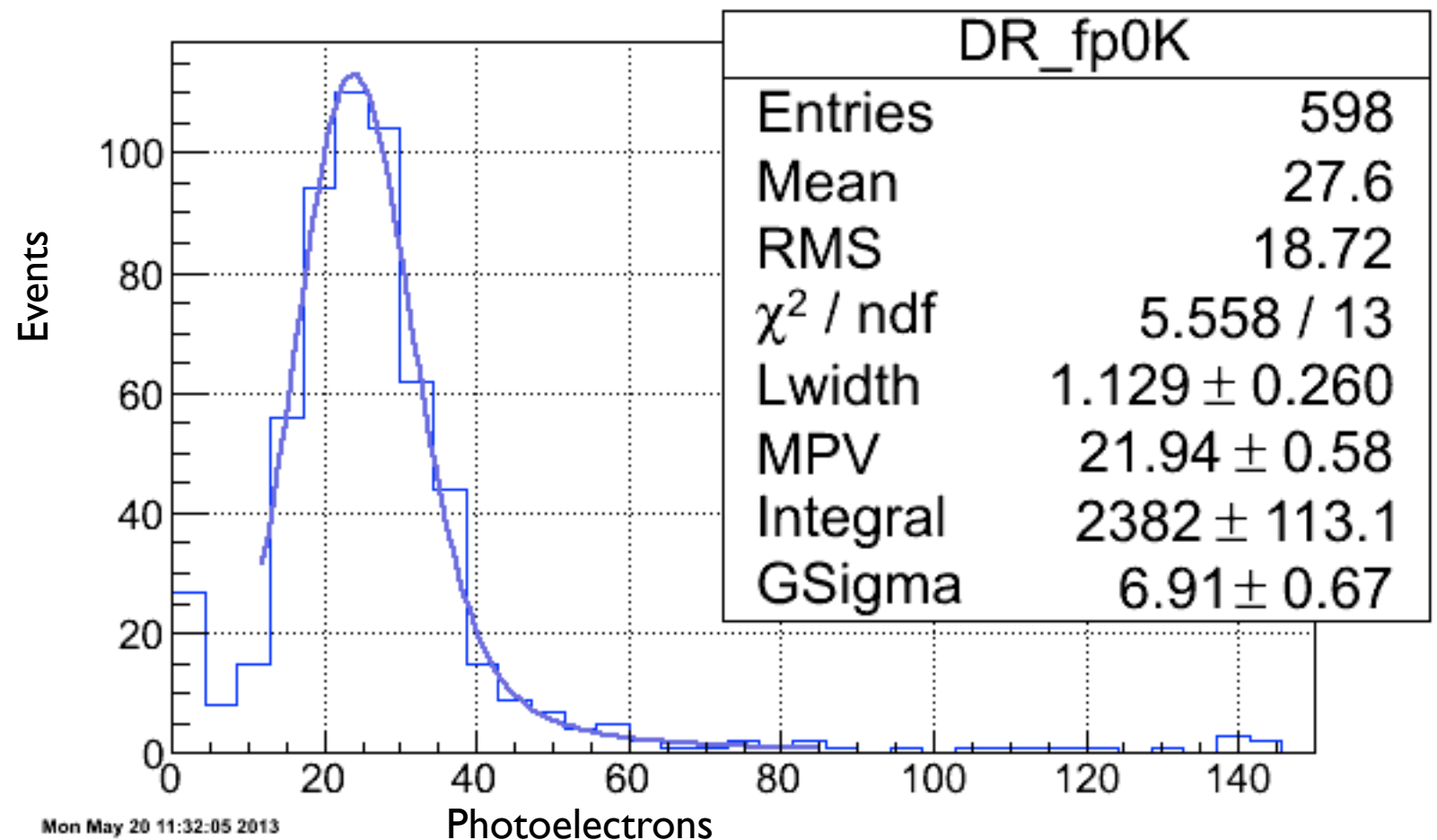
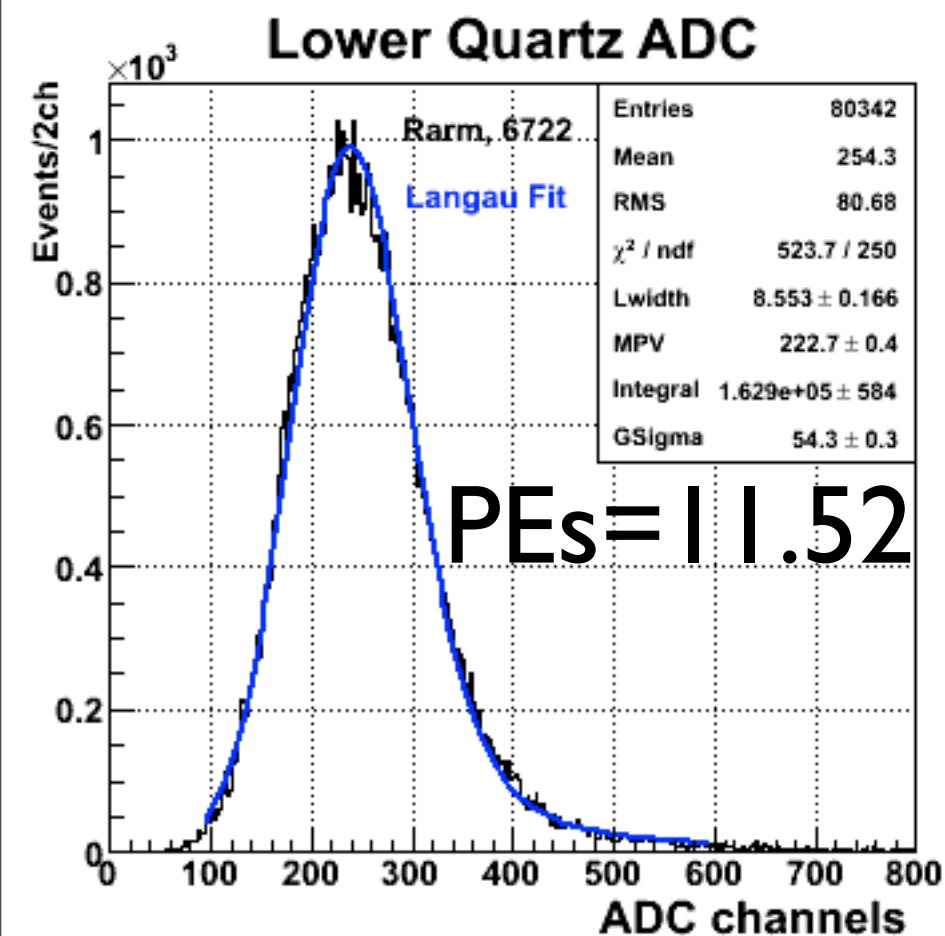
These plots are the cosmics (left) & JLab (right) comparison for detector 4. Both show ~20% resolution but different calculated PEs.

Comparison- Right Upper



Both show ~20% resolution, different measured PEs.

Comparison- Right Lower



The right-lower detector signals differ in resolution - on site (left) found 24.4%, while the UMass (right) cosmics show 31.4%. No explanation as yet.

Note the JLab MPV is actually 22.27 channels, as this signal was 10x amplified.

Reflectivities

- Also measuring mirror reflectivities at Smith.

UVS-PREX Sample

