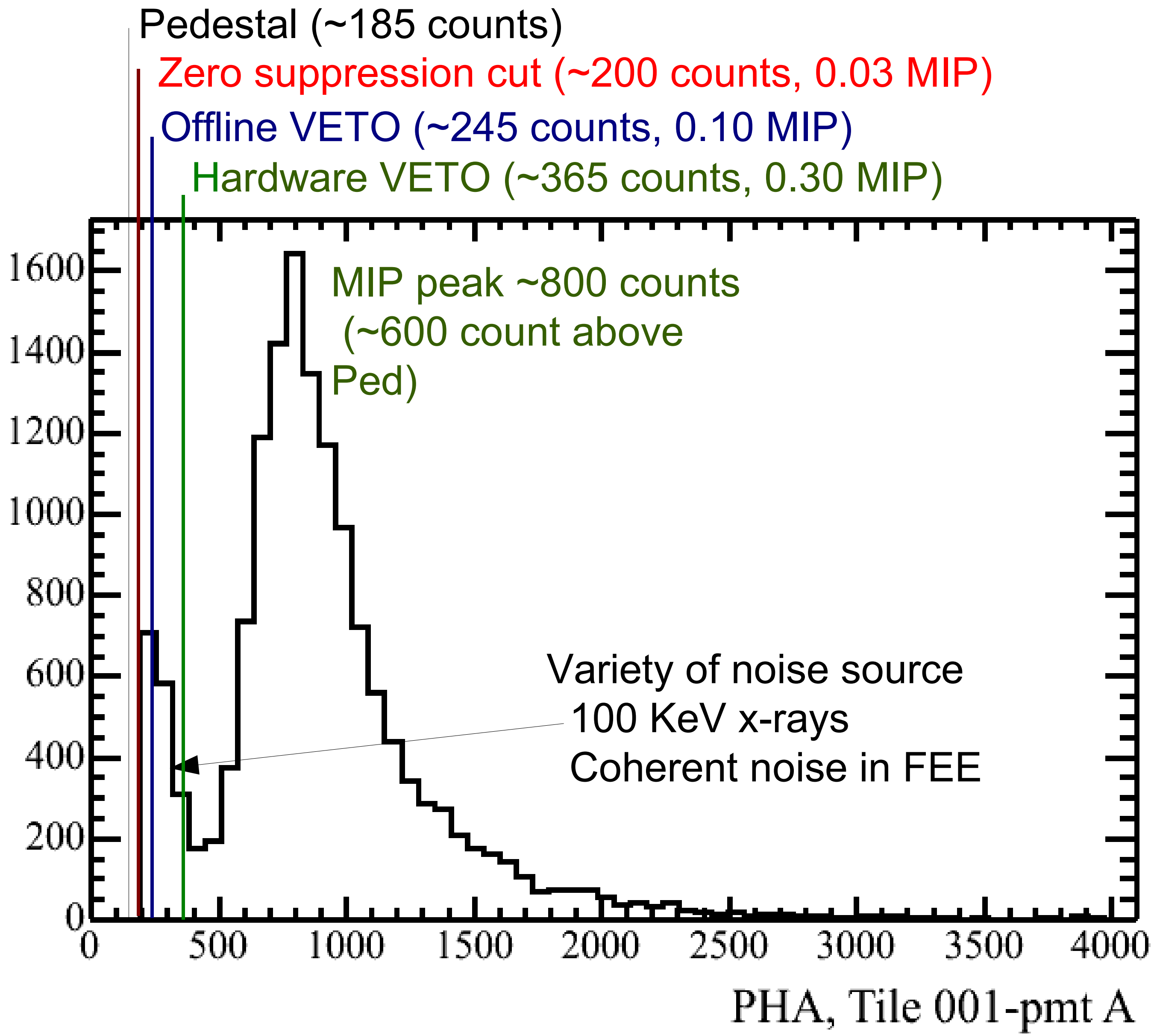
ACD calibrations and data analysis

- Basics: Types of calibrations
- Calibration area and scripts
- Pedestals
  - Most discussion of pedestals left to other talks
- MIP peaks with cosmic muons
  - Track selection
- Veto set point calibration

ACD pulse height basics



Particle Data Calibration Area

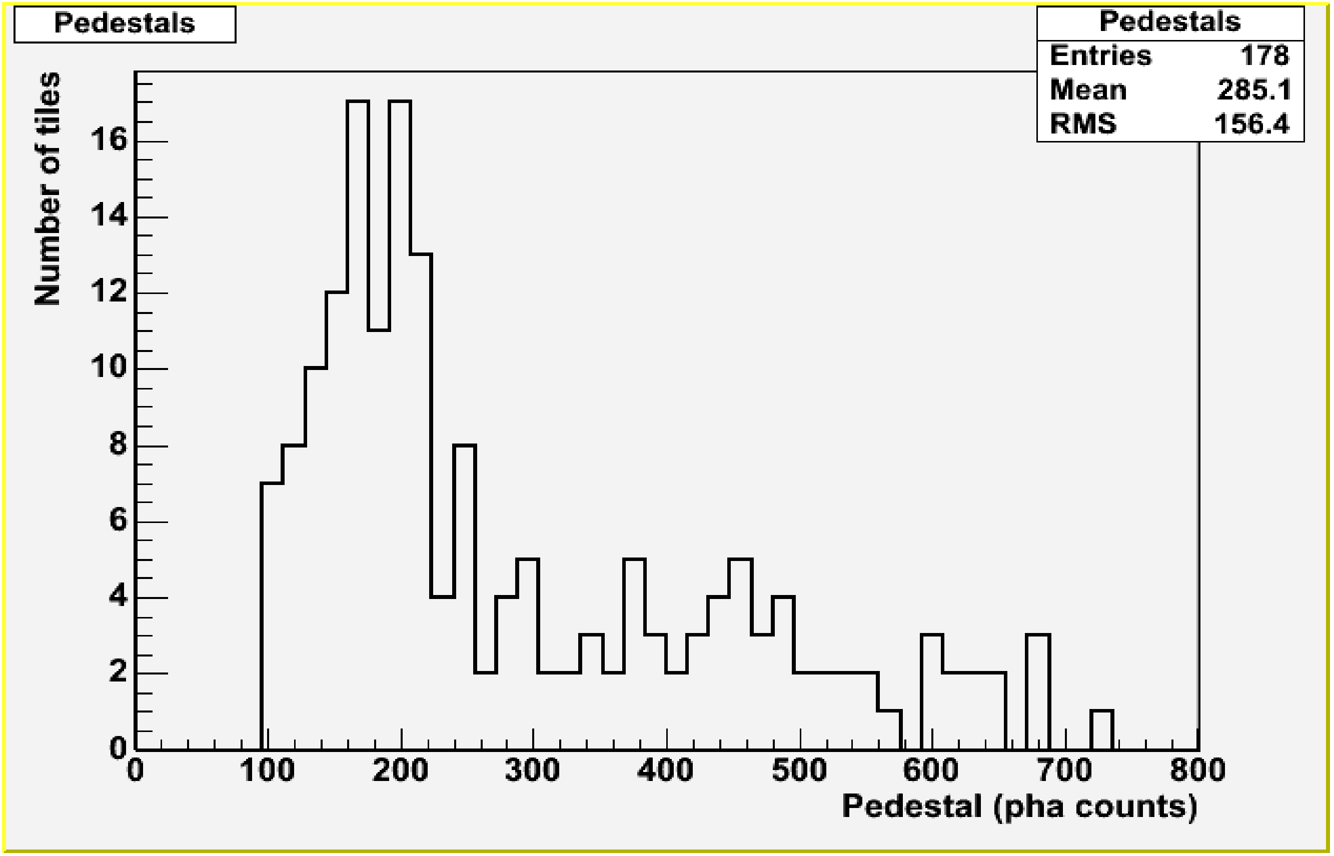
- Output of particle calibrations are on the web at:
  - ftp://ftp-glast.slac.stanford.edu/glast.calibrations/ACD
      - AKA /nfs/slac/g/glast/calibrations/ACD
    - The GROUND_LAT subdirectory has all the ground muon runs
      - One subdirectory per run by run number (ie 135005345)
      - Groups of like runs are joined (ie SLAC_PHASE_0_B2)
- Several types of calibrations are there
  - Pedestals (in SLAC_PHASE_0_B13)
  - Muon peaks using all tracks (in SLAC_PHASE_0_B2)
    - Also, with 1 / cosH < 1.2 (_NormalIncident)
    - Also, using tracking to get path in tile (_PathLength)
- Output includes
  - text files,
  - xml files (format not finalized yet)
  - validation plots & root files

Calibration scripts

- These live in the GlastRelease (&EM) package calibGenACD
- Some more documentation is in confluence
  - https://confluence.slac.stanford.edu/display/ACD/ACD+calibrations
- Main scripts (so far)
  - runPedestal.exe
    - extracts the pedestal values (from a non-zero supressed run)
  - runMuonCalib_Roi.exe
    - Does a MIP peak calibration, but uses the ACD in self-trigger mode instead of the TKR
      - (This is how calibrations were done off the LAT)
  - runMuonCalib_Tkr.exe
    - Does a MIP peak calibration, using the TKR
  - runVetoCalib.exe
    - Works out the hardware veto set point of each channel

Pedestals

- Even with no input signal the PHAs are non zero
- Use B/13 (ie, non-zero suppressed) run to get pedestals
  - Configuration is chosen to give pedestals at least 100 pha counts

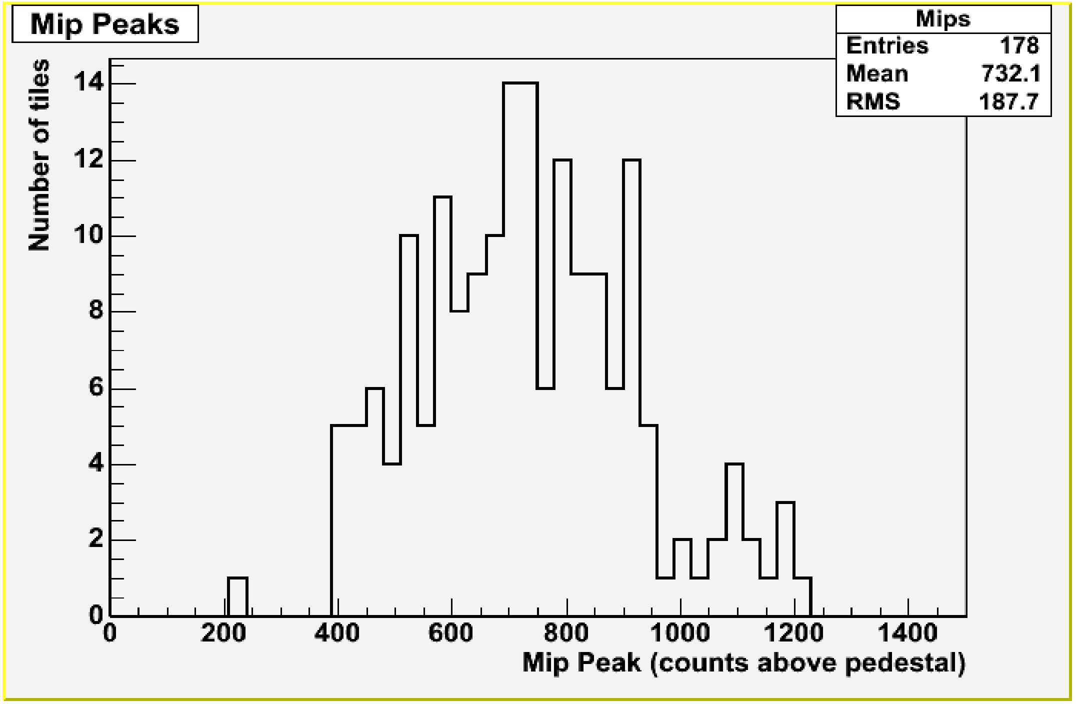


Comments about Pedestals

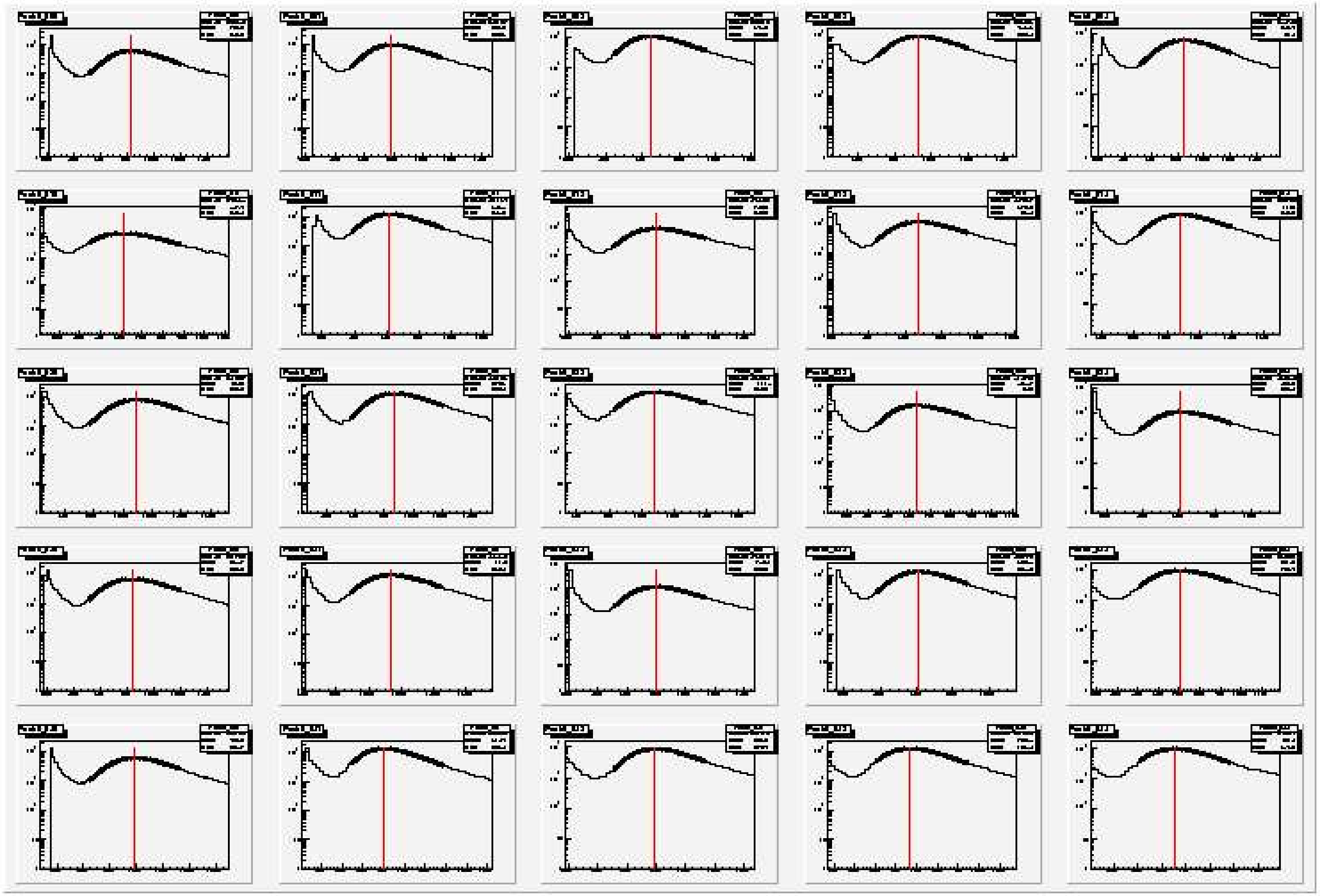
- They have been very stable when measured under *identical* conditions (< 3 count variation)
- However, they are affected by:
  - Temperature
  - 3.3V FREE card bias voltage
  - Timing delay between trigger and data latching
  - Time between events
- See talks by Larry Wai and Alex Moiseev for much for details about these
- We need a better way to update the zero-suppression setting to reflect pedestal changes
  - Thus far we have been using the same setting for all runs, this has to change soon

MIP peaks

- Select events to be close to normal incidence on ACD, or correct for path length
- Subtract pedestals
- Fit for most probable value of MIP distribution
  - HV bias is set so that mip peaks are > 400 counts above pedestal



- MIP peak calibration curves (TOP, A pmts)



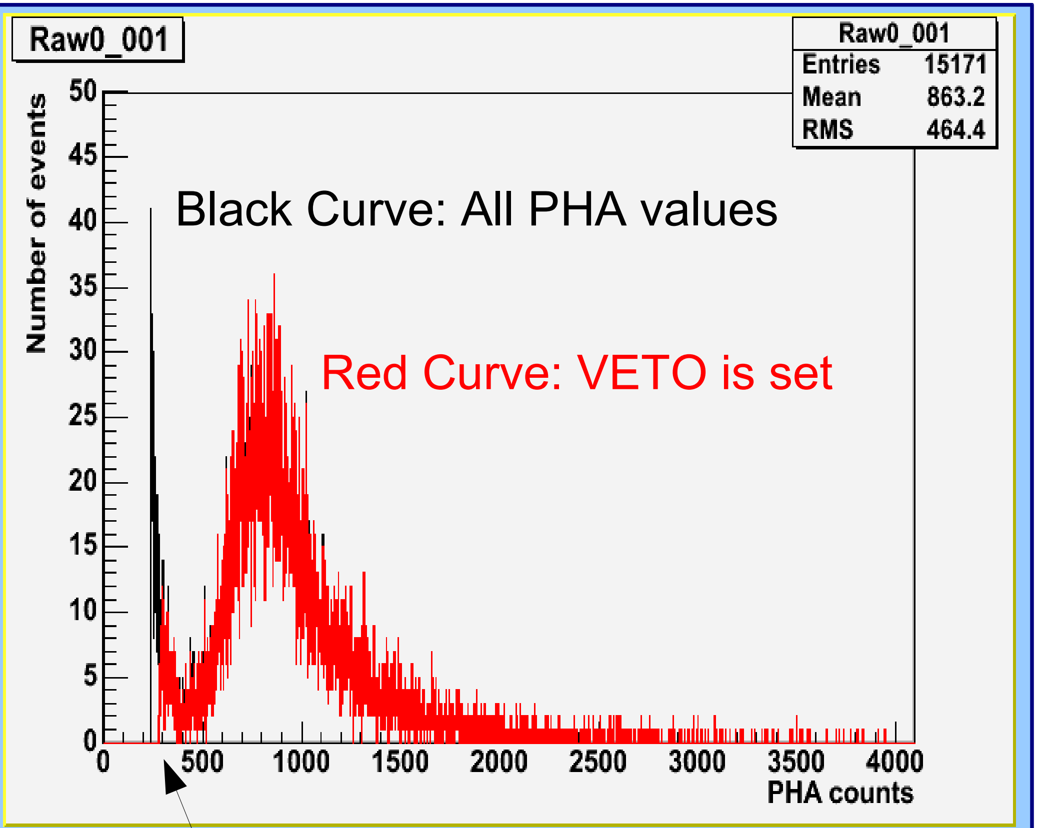
•Comments about MIP peak calibration

- We can get accurate MIP peaks for all the tiles, need to agree on selection/ fitting method
- We want to use this information in two ways
  - Setting the hardware VETO thresholds, (see later slides)
  - Calibrating the hits to MIPs and MeV
    - We are making xml files, with calibrations, coming to point where we want to be using them in the reconstruction

Checking the ACD hardware veto setting

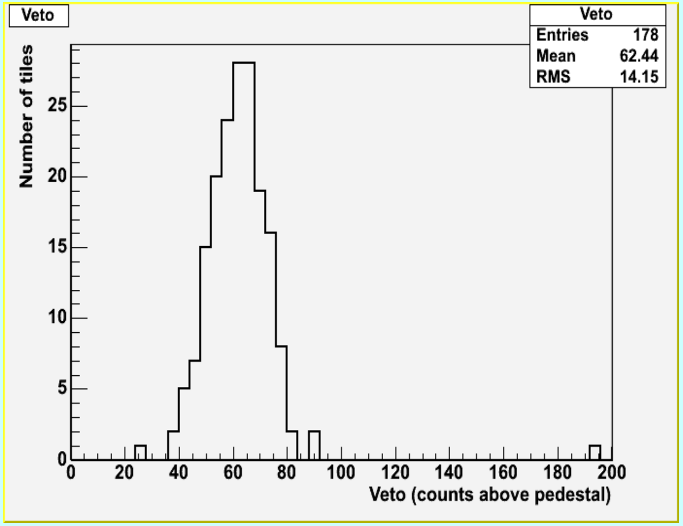
- The hardware veto is generated in the front-end electronics
  - Discriminator with coarse and fine settings
  - Both are 6 bit registers (0-63)
  - 32 fine counts = 1 coarse count
- Multi-step process to configure the veto correctly
  - Use charge injection calibration and/or muon data to map veto setting to PHA value
  - Use muon data to get MIP peaks in terms of PHA counts
  - Combine the two to set the veto as a MIP fraction
    - ie, set the veto to 0.3 mips

Veto turn on curve



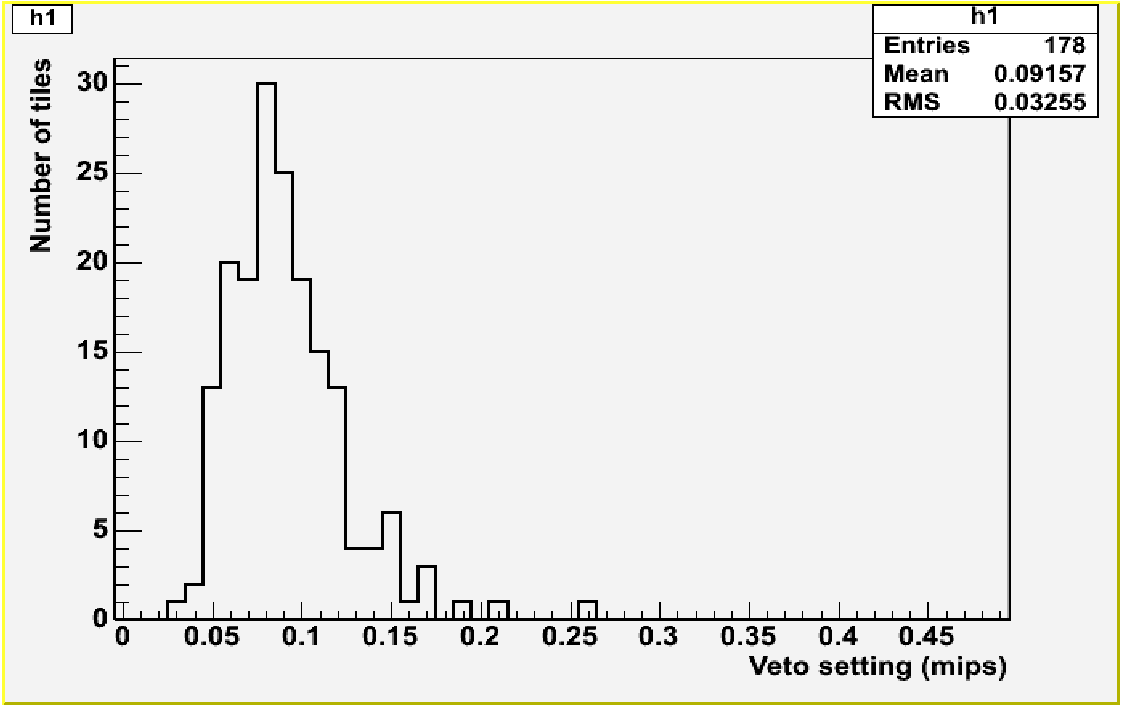
For this channel the VETO turn on point is ~ 495 PHA counts.
This is about 55 counts above pedestal

The set points delivered by the ACD group have the VETO signals starting about 60 counts above pedestals



Vetos were set lower that expected

- Compare veto values to MIP peak values
- Find that veto values were about 0.1 MIPs (wanted 0.2)
  - Spread of distribution is fairly large (0.032 MIPs)
  - Should be able to improve this considerably



Comments about Veto settings

- There is significant evidence that the settings dictionary built at GSFC is no longer valid
  - Changes in low bias voltages from using flight electronics
- Should we rebuild the dictionary?
  - To what extent can we use charge injection data to help us do this
  - How much muon data, and what kind of runs do we need to do this?
- Do we want to feed information about hardware veto settings back into simulation