

# Ecal Cosmic Testing Report

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STAR Forward Upgrade Face to Face Meeting

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# Goals

- Set up a cosmic test stand in the lab with a 2x2 Ecal module
- Determine the gain for Run 19 Au Au data
- Characterize performance of different SiPMs
- Two Channels on Ecal module will have new S14160-3015HS
  - Channel 0 and Channel 1 (top row in upcoming figures)
- Other two have SiPMs S12572-015P (used in Run 19)
  - Channel 2 and Channel 3 (bottom row in upcoming figures)

# 2x2 Ecal Tower

## Setup

Power from  
Multidrop cable

Scintillator Paddles  
for Trigger

Trigger to TCD

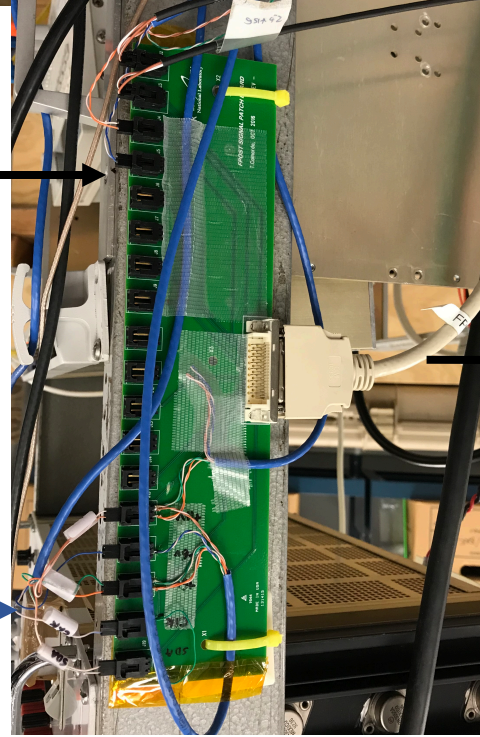
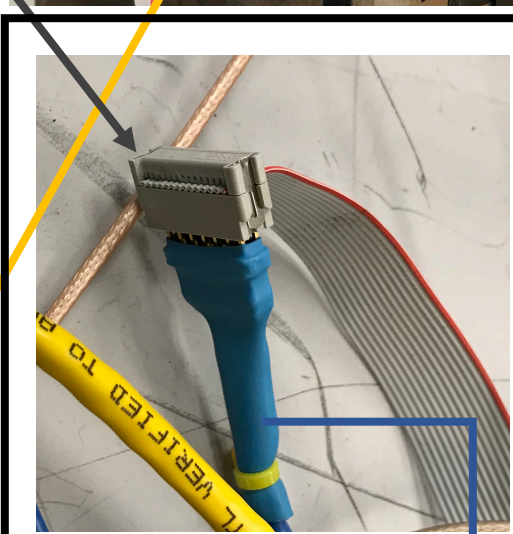
Signal and Control  
connected to computer

Signal Cable  
to DEP

Coincidence  
to DEP

Ecal Signal Cable

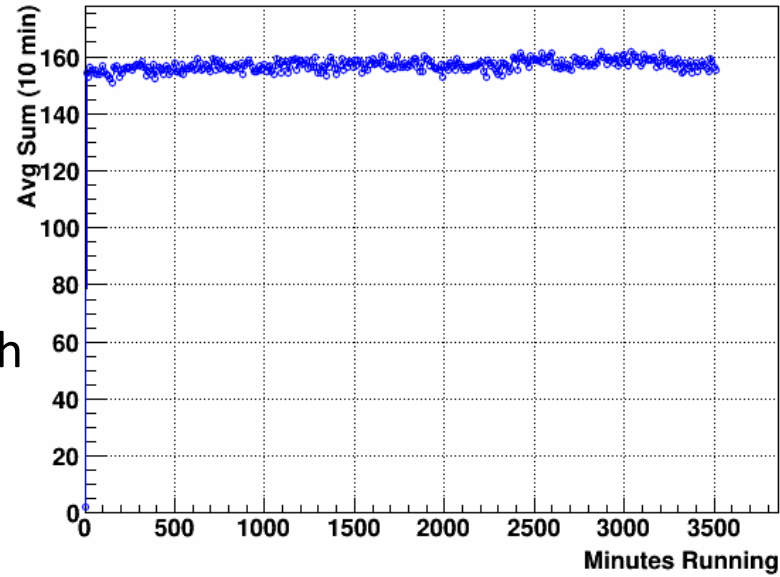
Cable to Patch  
Panel to control  
Voltage using DEP



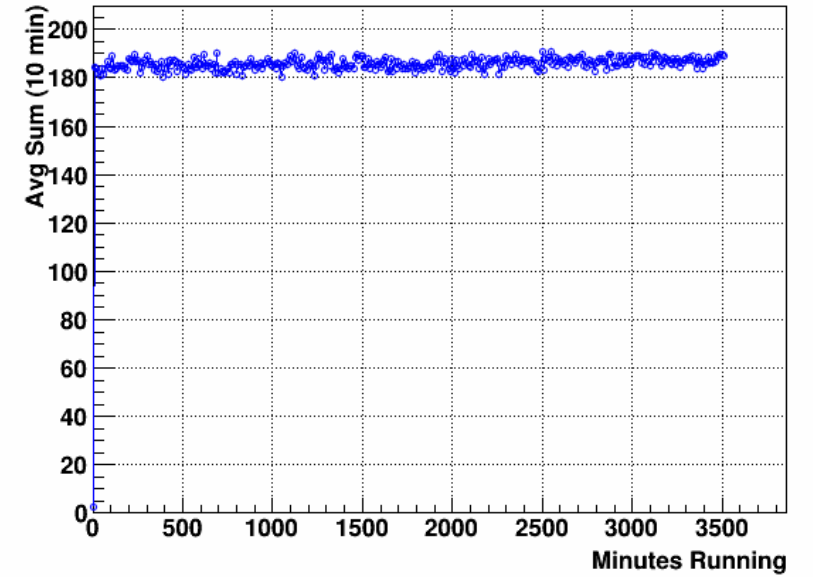
# Led Run

- LED run taken with LED positioned at Channel 4
  - LED fires every 10 sec with 50ns width
  - This means 6 events/minute
- Took 21k events -> 2.5 days
- Plot on right shows Average sum every 10 minutes
  - Pedestal subtracted
- Sanity check to see if any changes in time
- Graph is flat so no time dependence

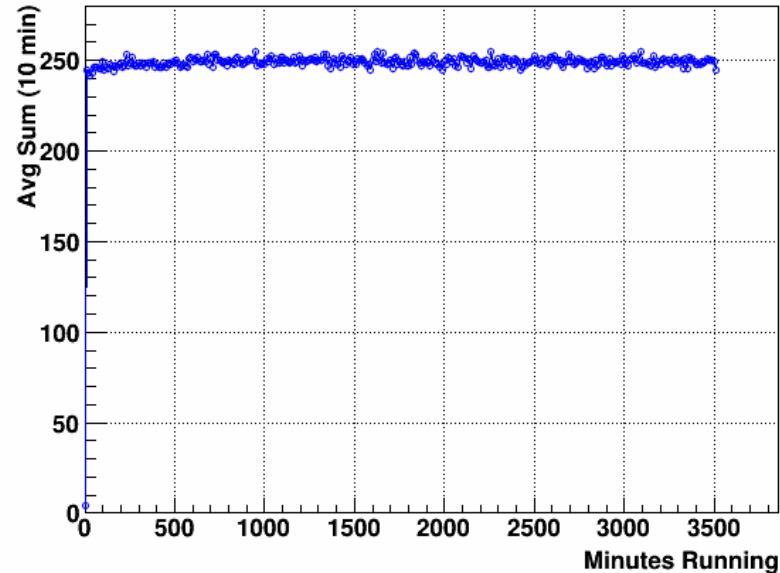
Channel 0



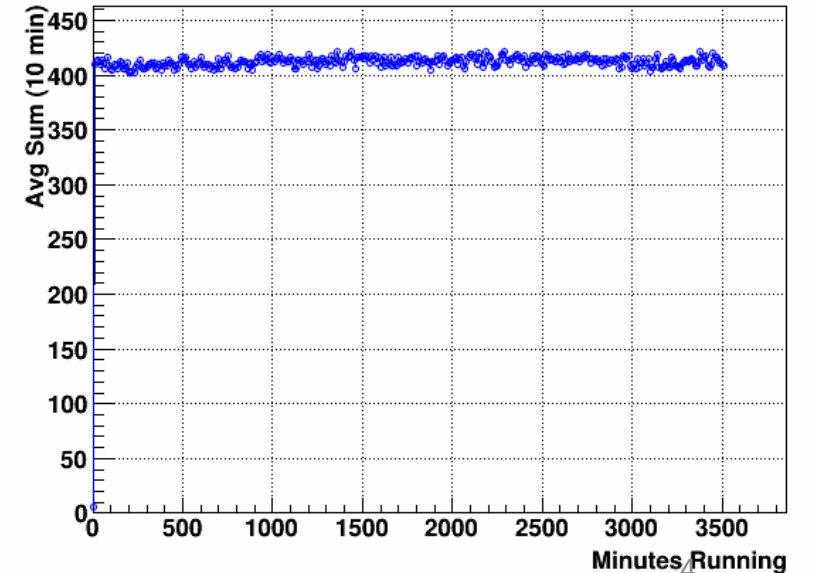
Channel 1



Channel 2

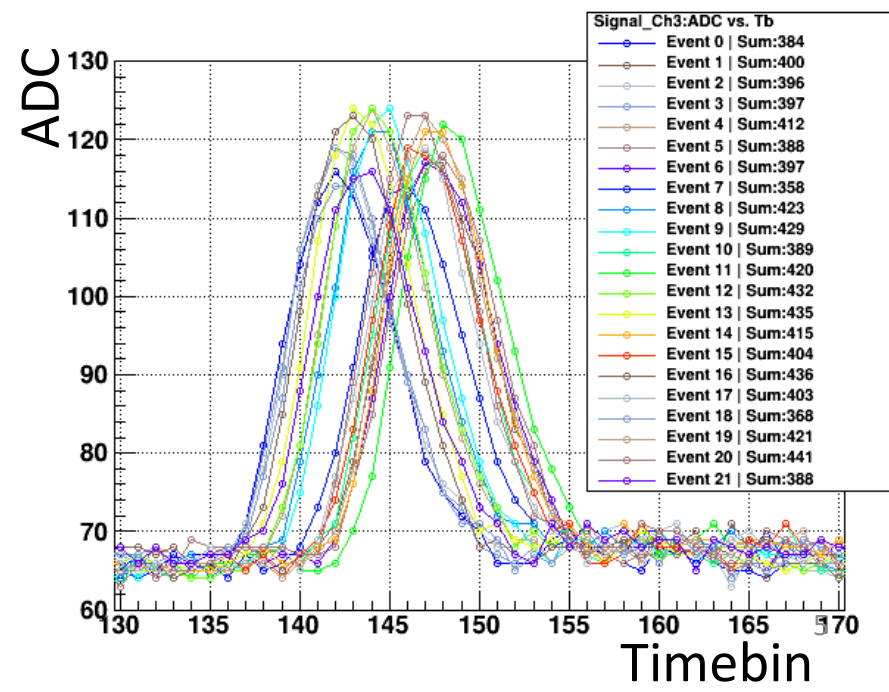
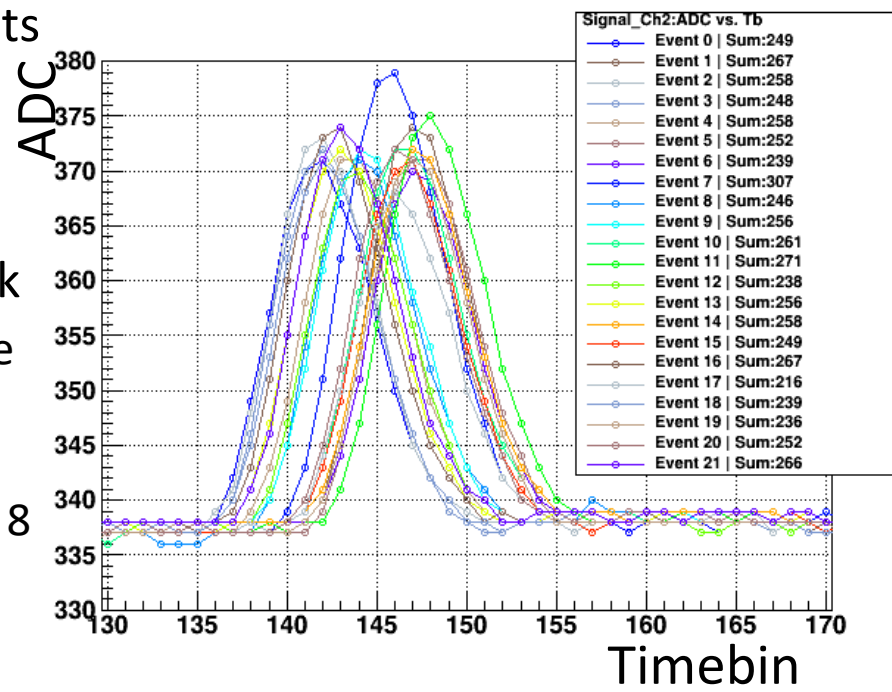
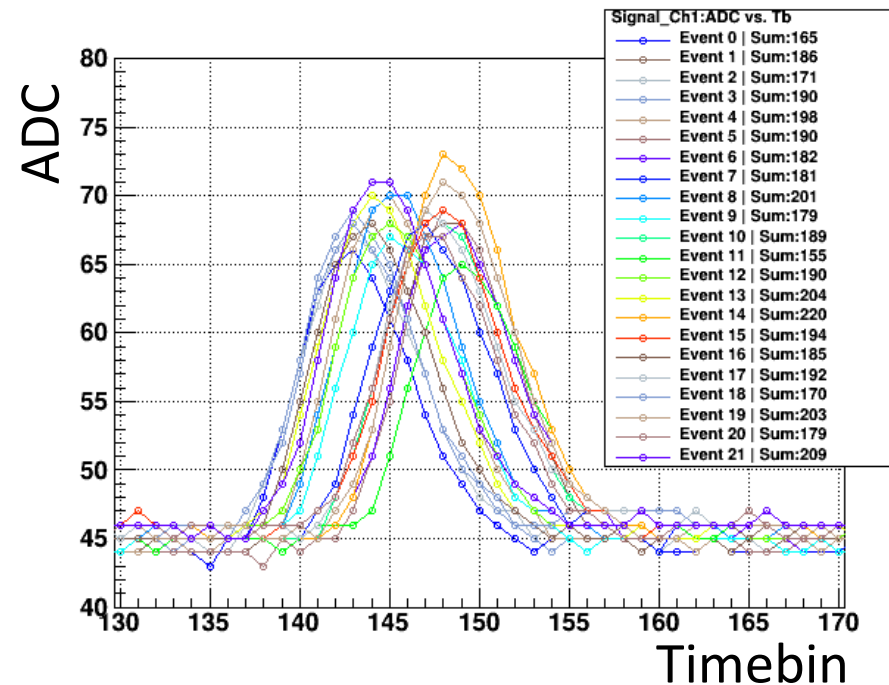
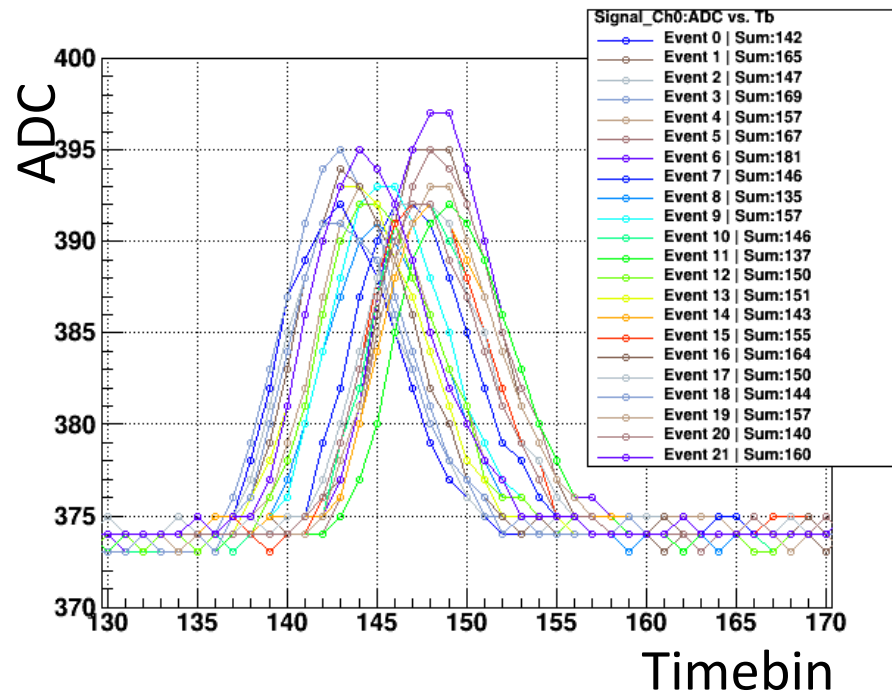


Channel 3



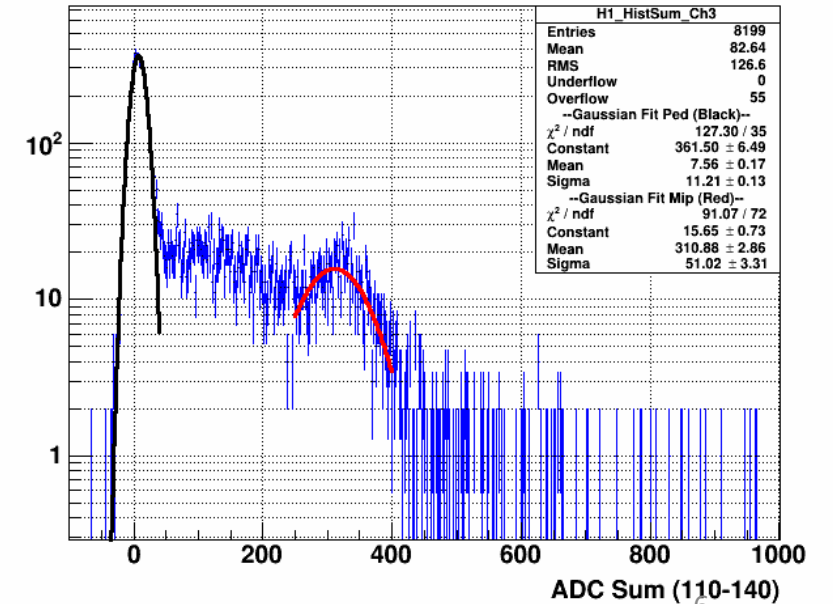
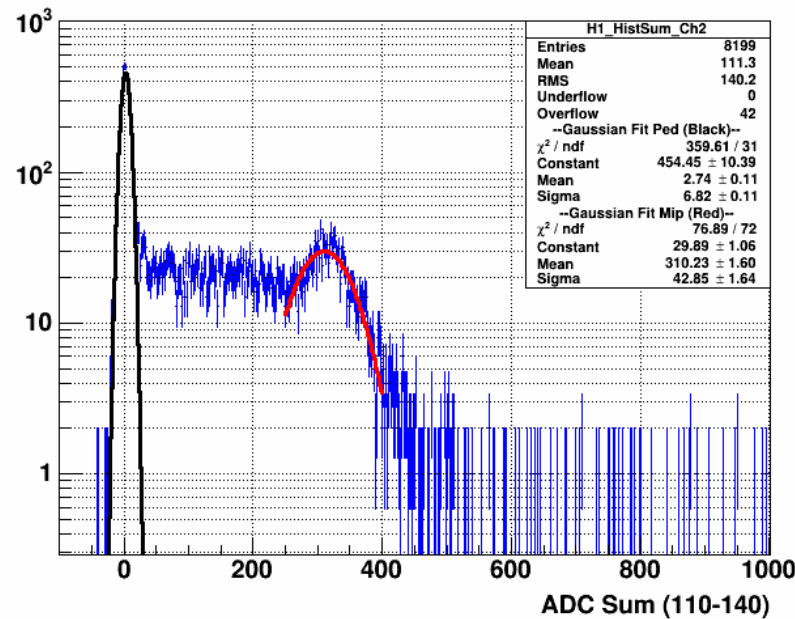
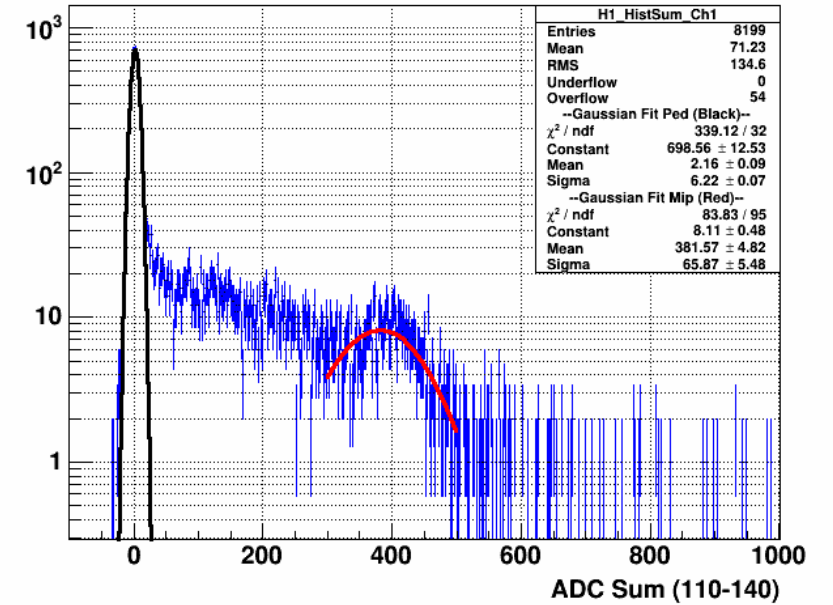
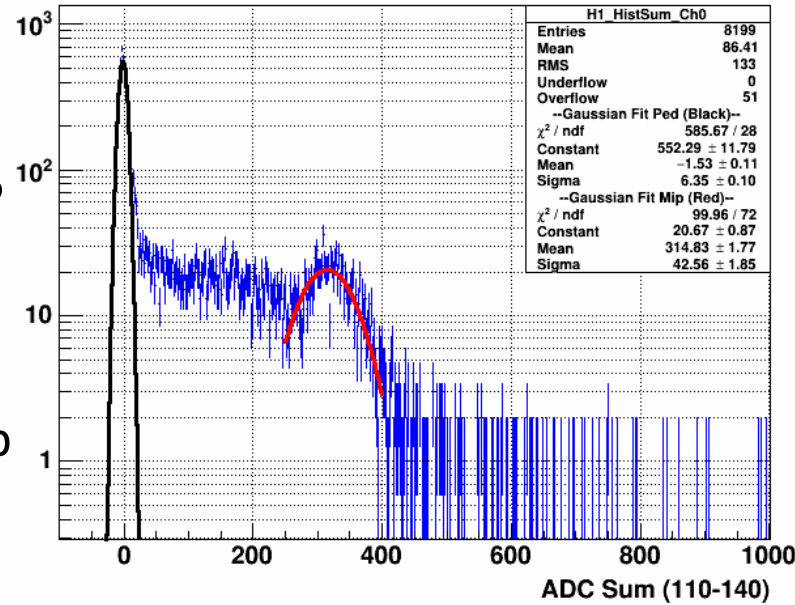
# LEDs continued

- Graph on right is LED signals
- Each event is a snapshot of the signal every 1000 events or roughly 2.8 hours
- Consistent peak heights and sums over entire period
  - 8 timebins compose one clock
  - Trigger will fall randomly onto 1 of 8 timebins between 135-142



# Data from Cosmics

- Trigger on coincidence from trigger paddles shown in setup
- Histograms on right show ADC timebin sum 110-140 (Our cosmic window)
  - Pedestal Subtracted
- Clear peaks seen for all channels
- Improve with an isolation cut

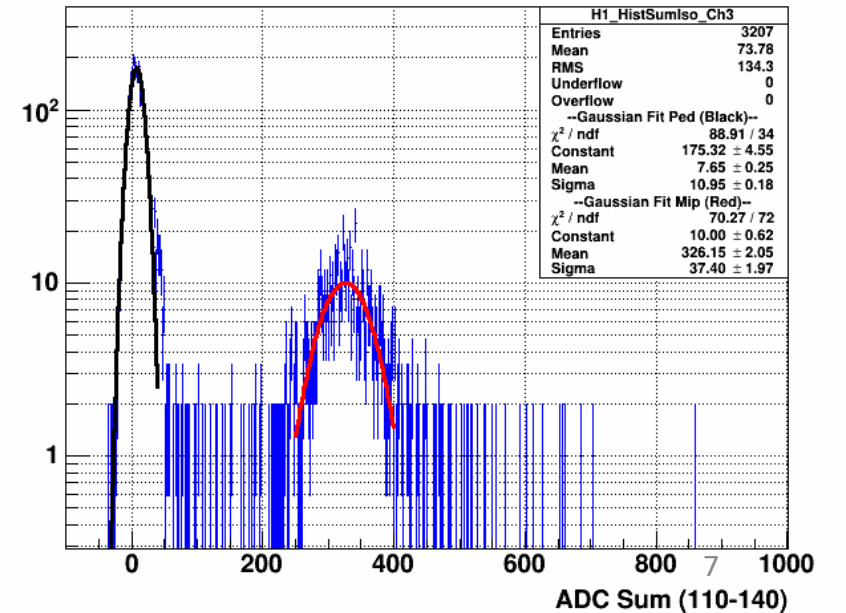
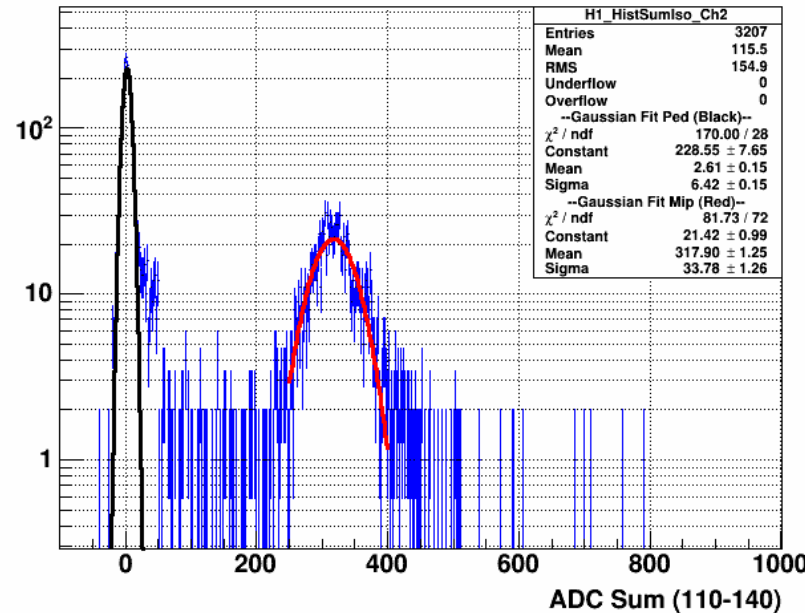
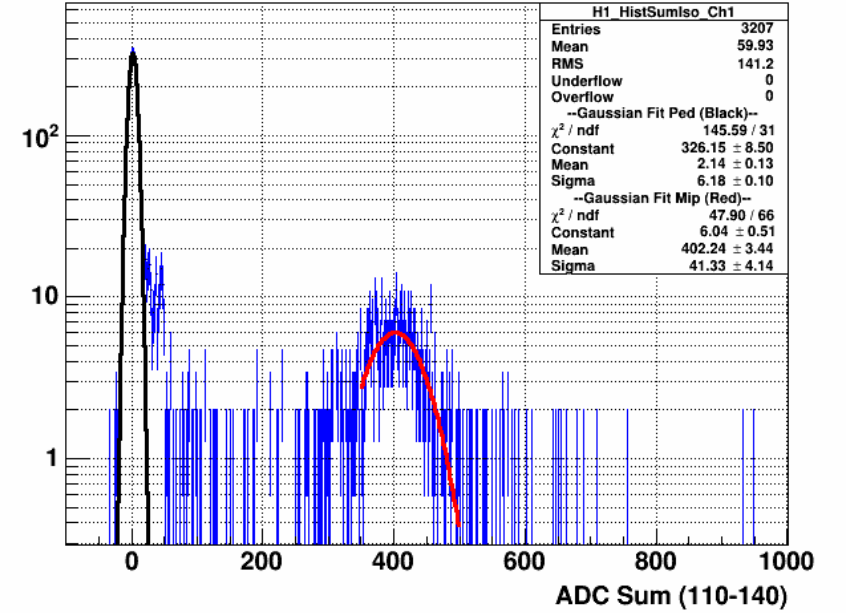
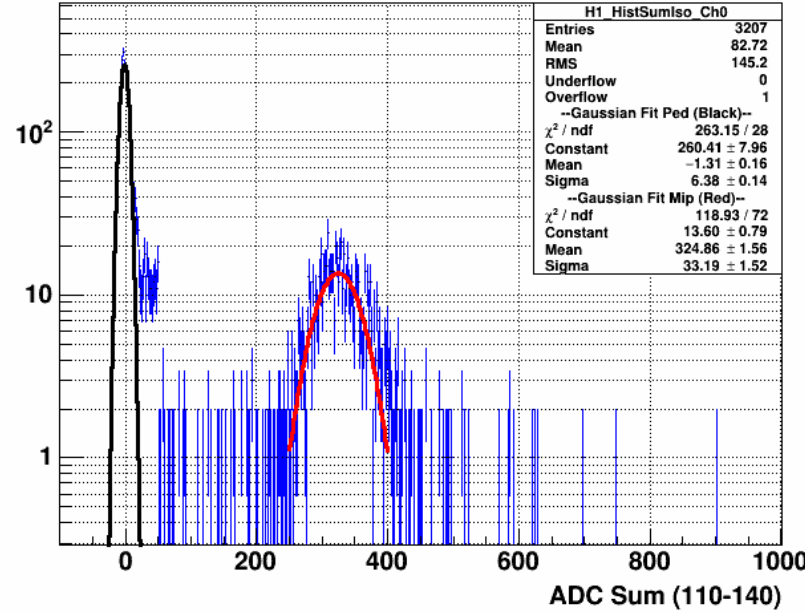


# Isolation Cut on Cosmic Data

- Apply a tower isolation cut by doing the following

1. Compute timebin sum from all 4 towers individually
2. If one and only one tower contains a timebin sum >50 fill in histogram for all 4 towers

- Figure on right shows histogram with this cut applied
- Gets rid of background around peak



# Summary Table from Cosmic Data

Channel	MIP peak	MIP peak (Isolation Cut)	Difference	Energy (Assuming MIP energy 310 MeV) GeV/ch	
				Without Isolation (*10 <sup>-3</sup> )	With Isolation (*10 <sup>-3</sup> )
0	314.83±1.77	324.86±1.56	10.03	9.85	9.54
1	381.57±4.82	402.24±3.44	20.67	8.12	7.71
2	310.23±1.6	317.9±1.25	7.7	9.99	9.75
3	310.88±2.86	326.15±2.05	15.3	9.97	9.50

- Slight difference between MIP peak with and without isolation cut
- Channel 1 has higher MIP peak compared to rest
- Energy is roughly 0.0009 GeV/ch



# Conclusions

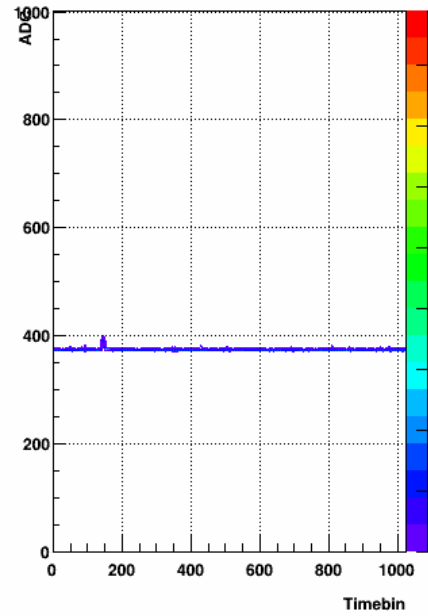
- Overall nice clean signals
- No visible time dependence in system
  - LED data shows consistent pulses each time
- Cosmics show nice clean MIP peaks
  - Using MIP energy of 310MeV gives gain $\sim$ 0.00095 GeV/ch for almost all channels

Thanks to Tim, Akio, Tonko, and Oleg for the continued help!

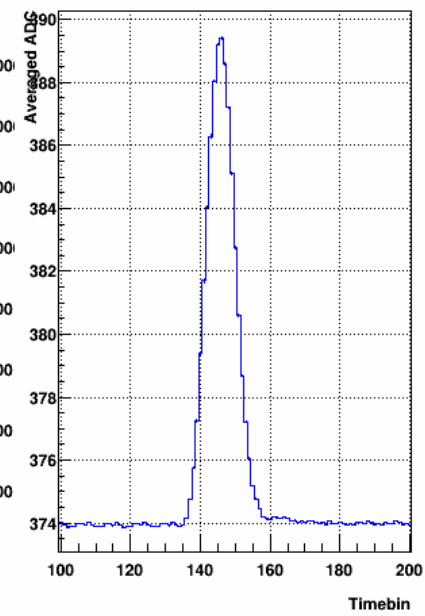
Backup

# LED profile

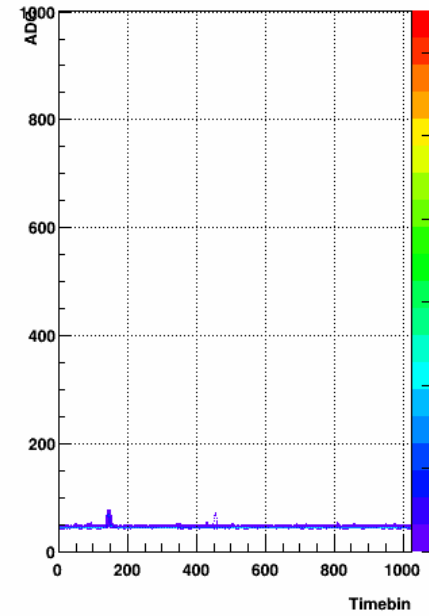
Channel 0 ADC vs. Timebin



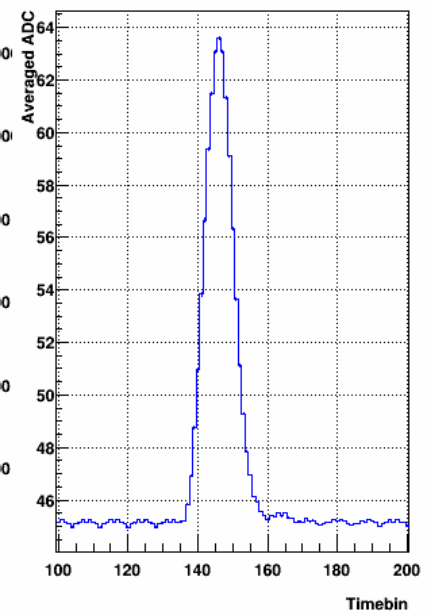
Channel 0 Profile Histogram



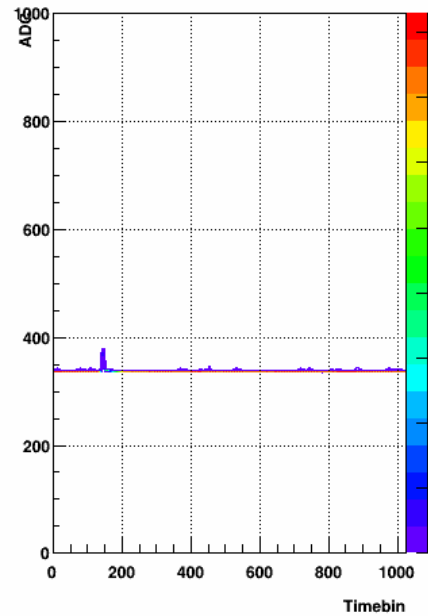
Channel 1 ADC vs. Timebin



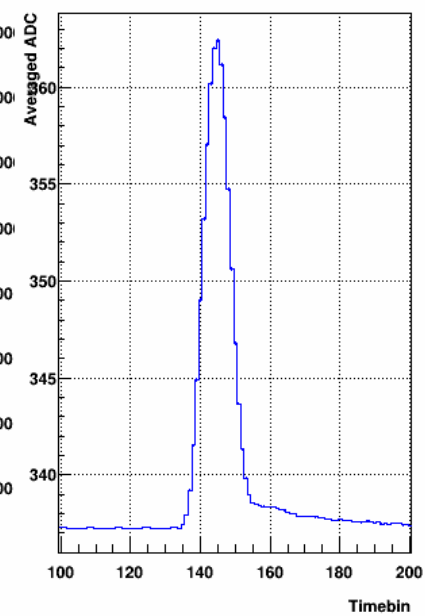
Channel 1 Profile Histogram



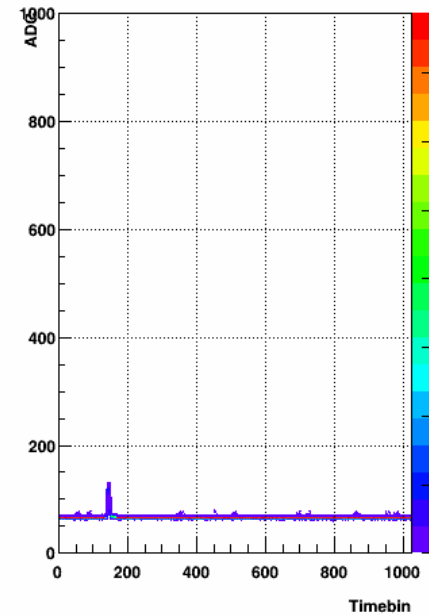
Channel 2 ADC vs. Timebin



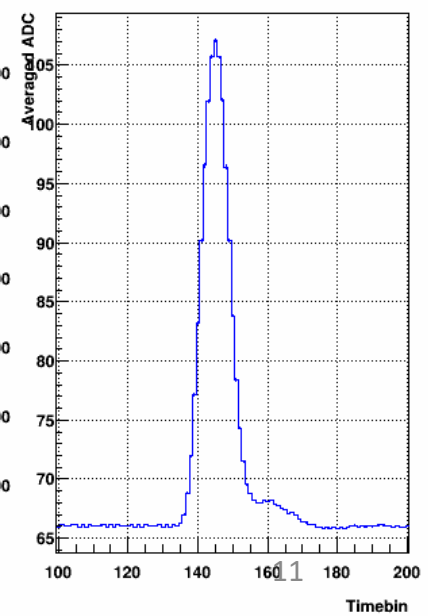
Channel 2 Profile Histogram



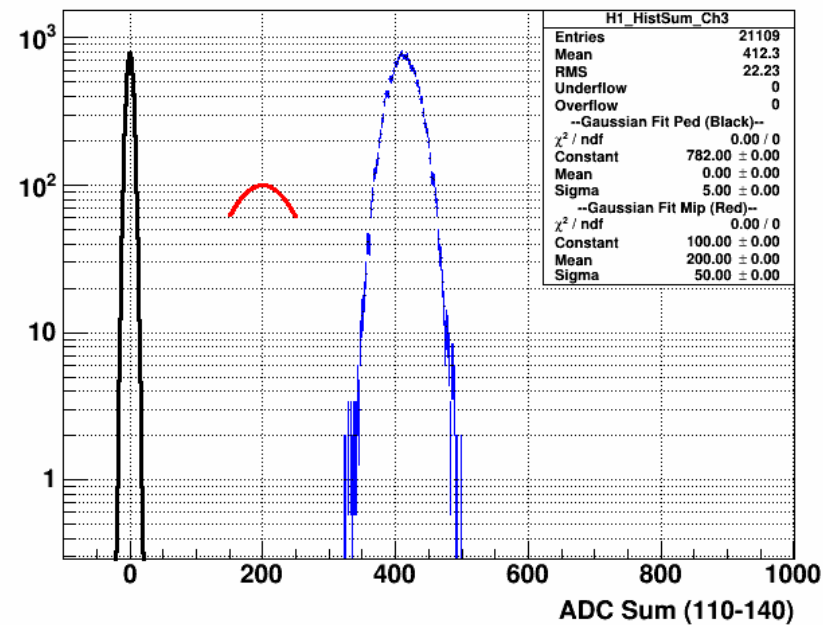
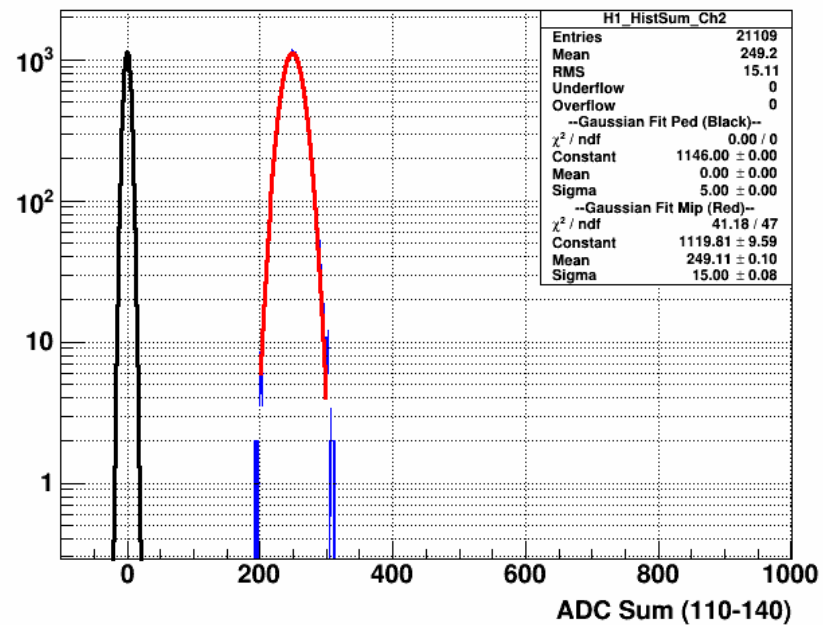
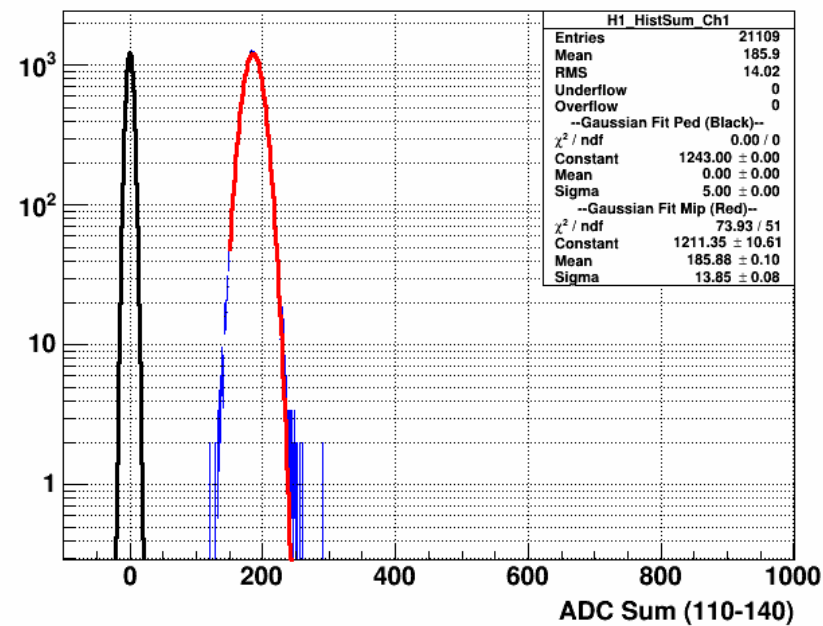
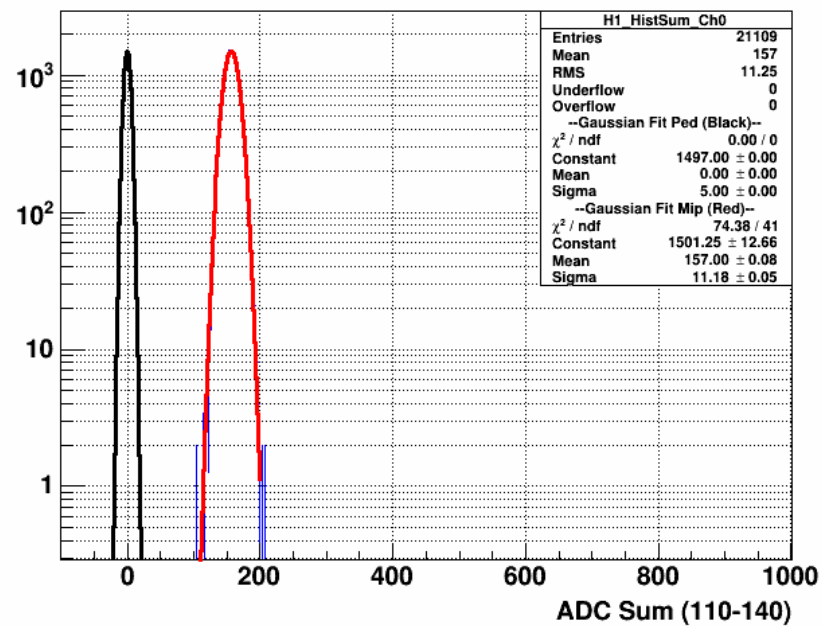
Channel 3 ADC vs. Timebin



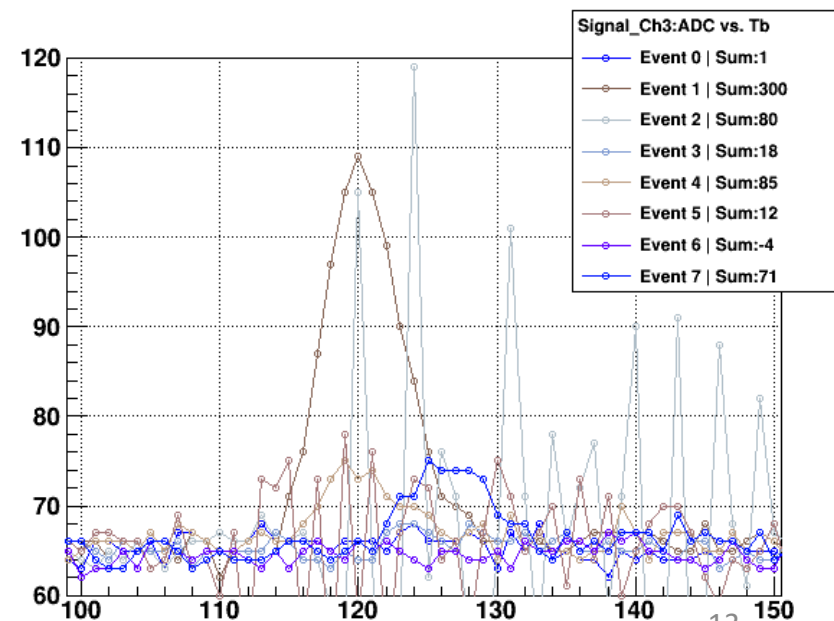
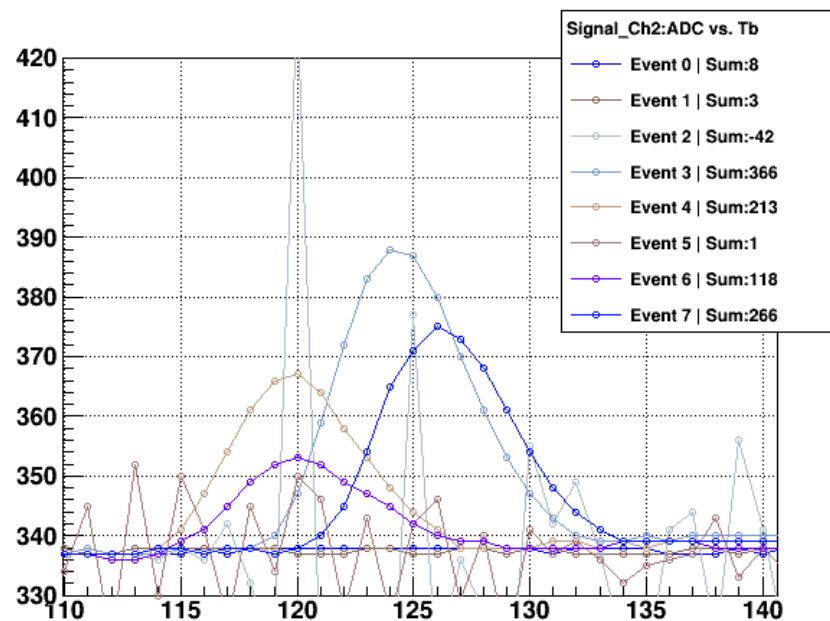
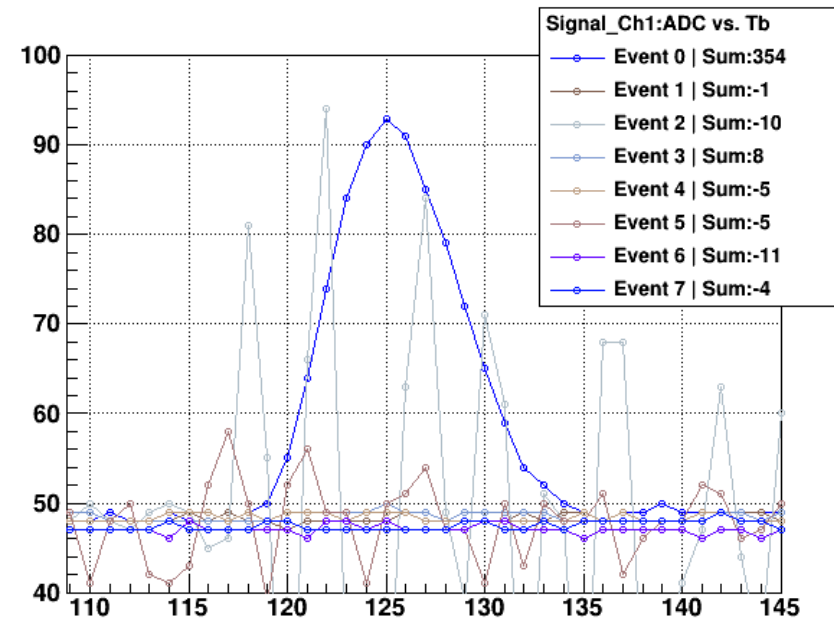
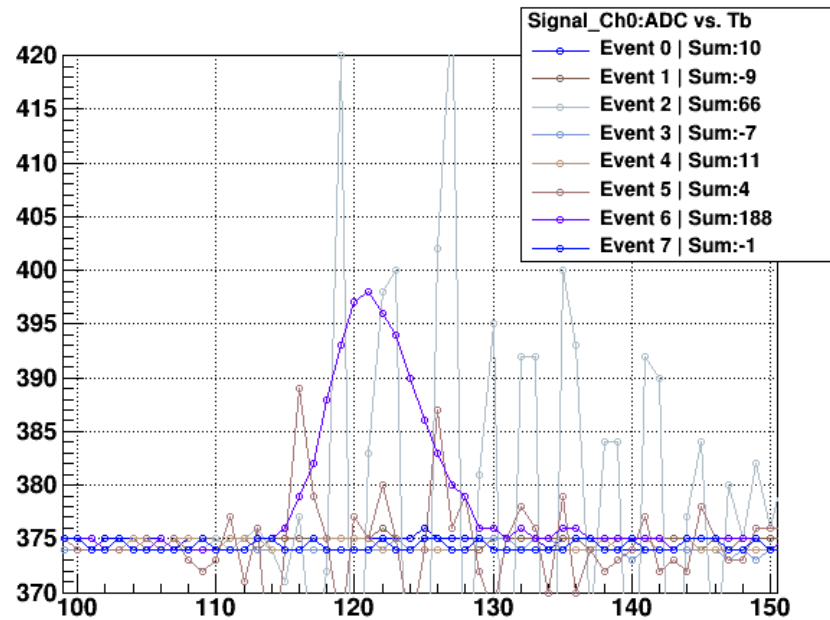
Channel 3 Profile Histogram



# LED Sum in 130-170

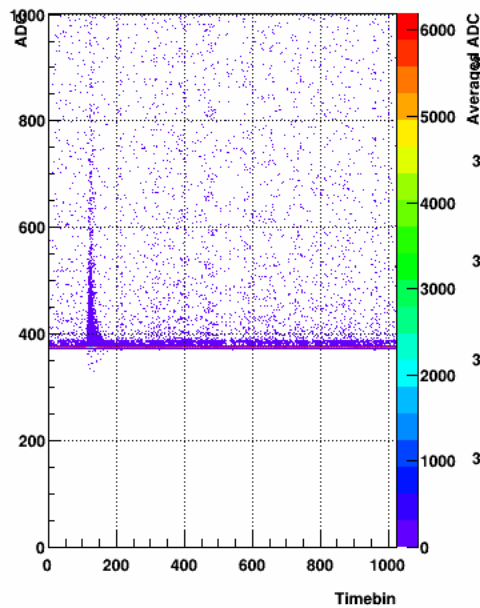


# Waveforms from Cosmic Data

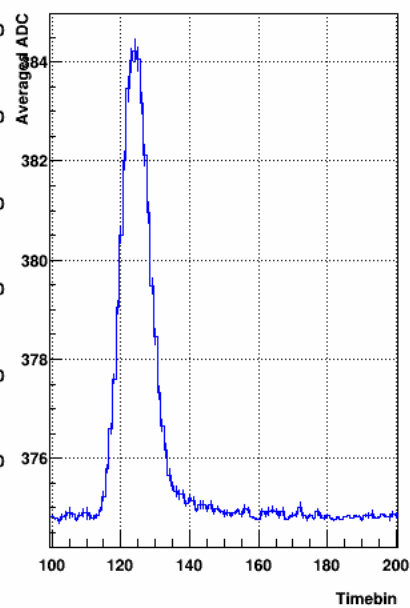


# Cosmic Profile

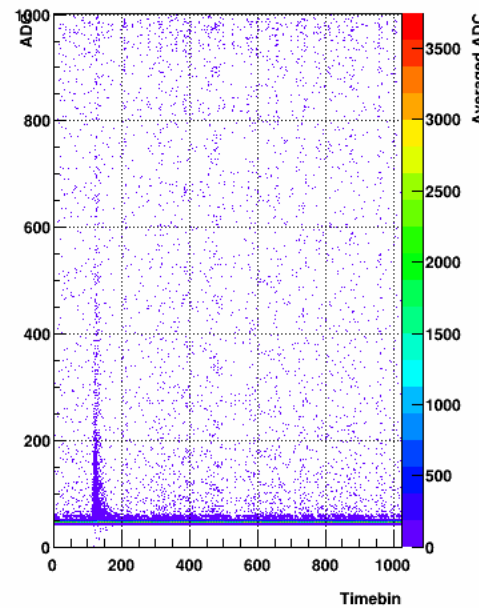
Channel 0 ADC vs. Timebin



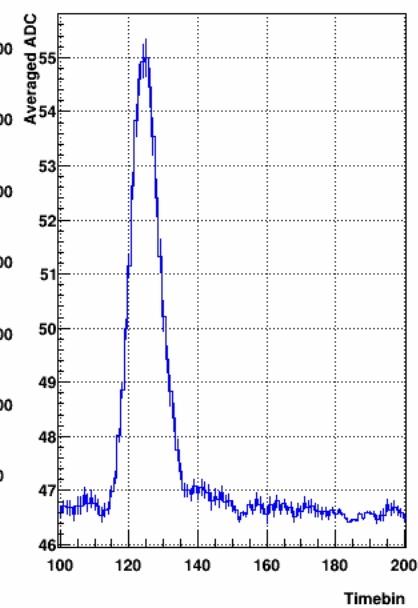
Channel 0 Profile Histogram



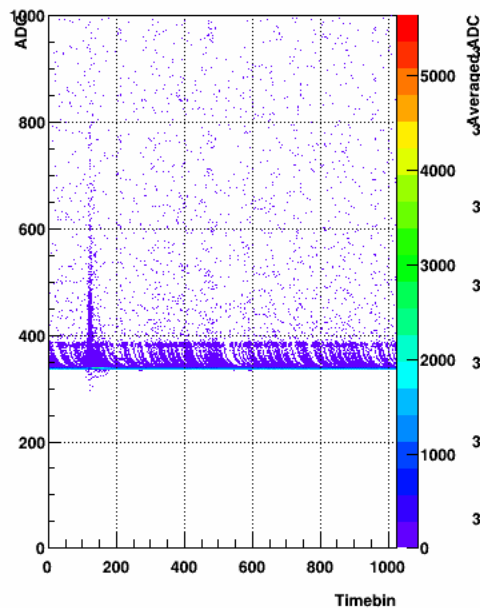
Channel 1 ADC vs. Timebin



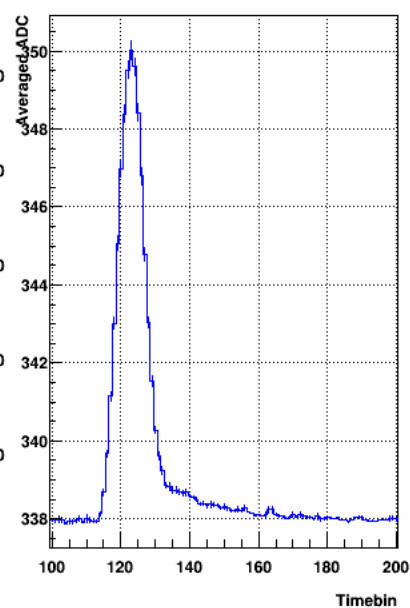
Channel 1 Profile Histogram



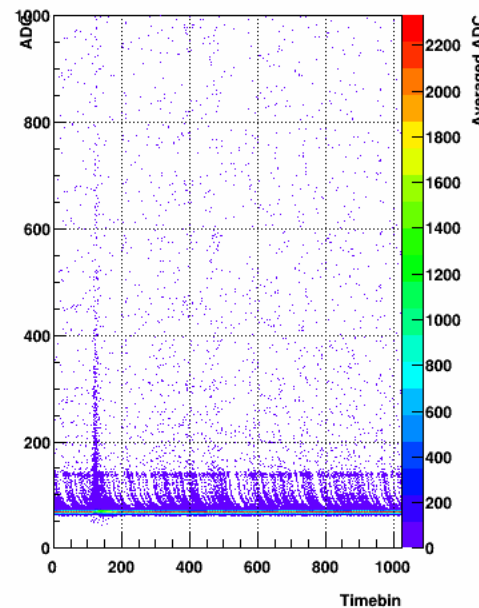
Channel 2 ADC vs. Timebin



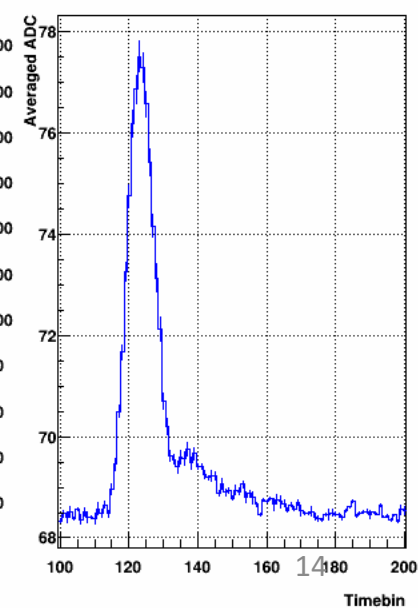
Channel 2 Profile Histogram



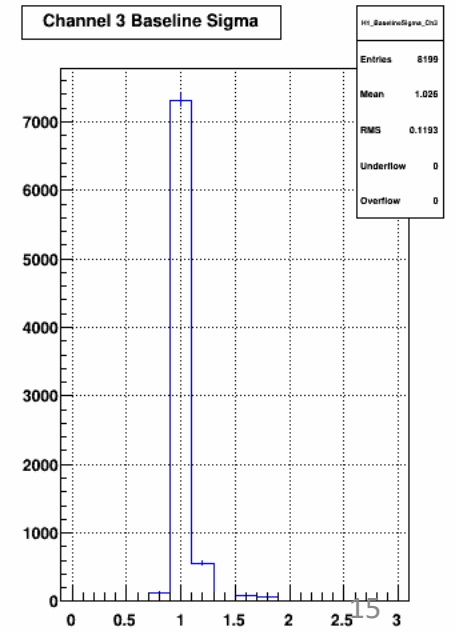
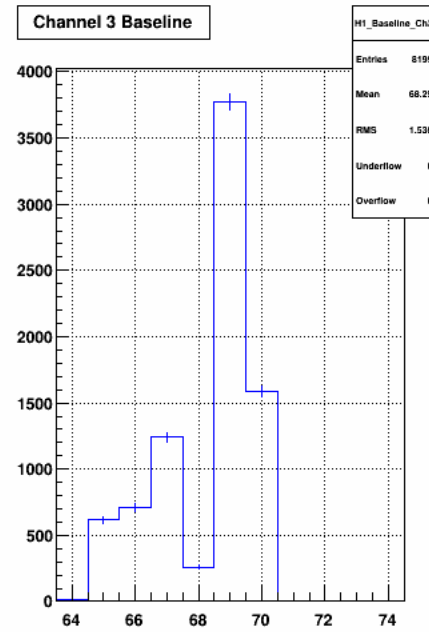
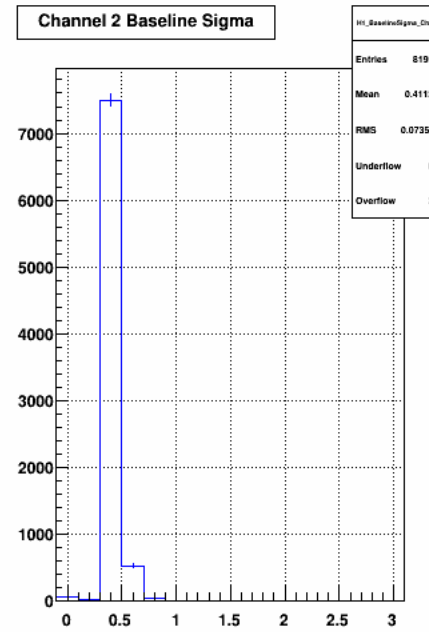
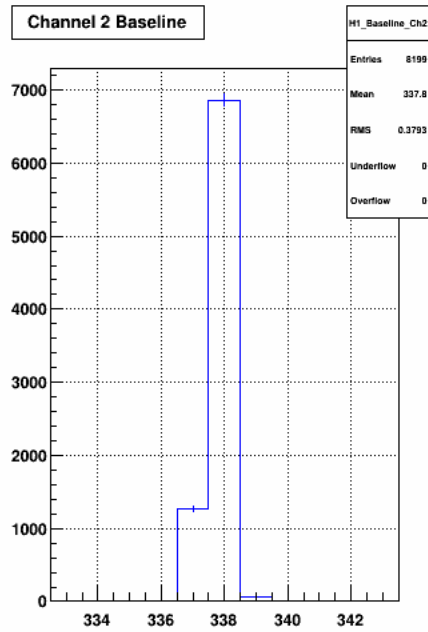
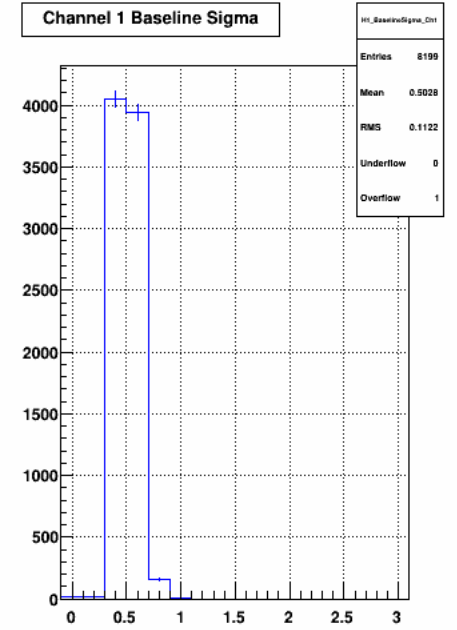
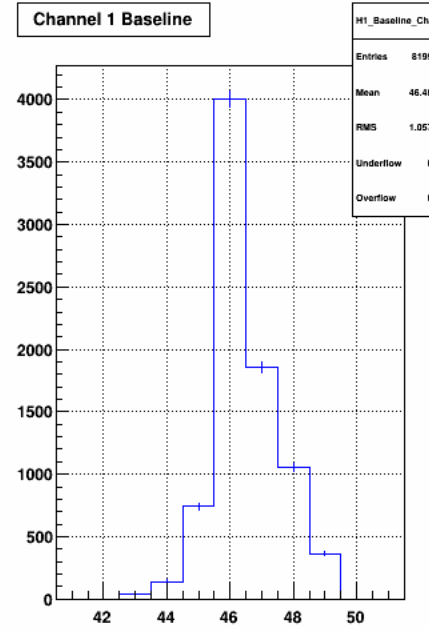
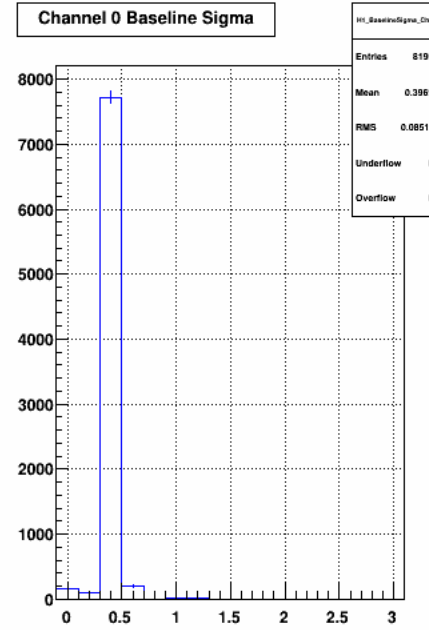
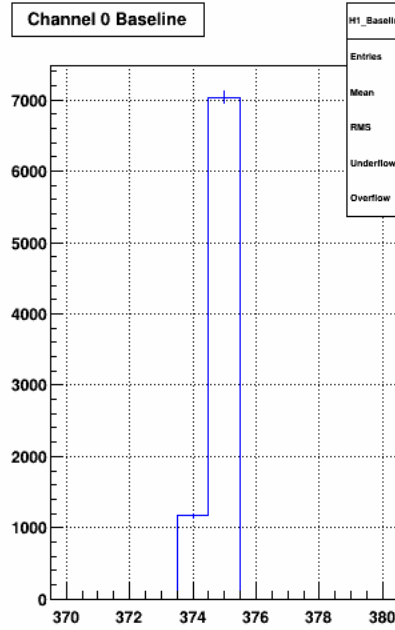
Channel 3 ADC vs. Timebin



Channel 3 Profile Histogram



# Cosmic Pedestal



Sum for non-  
isolated and  
isolated  
tower cut

