d_2^n Big Bite Gas Cerenkov Analysis: One PhotoElectron Calibration

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Outline

One PhotoElectron LED Setup

LED Setup

- There are 20 pmts on the Big Bite Cerenkov
- During an LED run the one photoelectron location on the ADC was obtained
- One side of the pmts were looked at, at a time. While the other side consisted of 3 LEDs(marked in figure by blue suns).
- The pmts are labled 1-20
  - PMTs 1-10 being on the beamside (near,small angle) and passing through two amplifiers.
  - PMTs 11-20 away from the beam (far,large angle) passing through one amplifier.

One PhotoElectron LED Setup

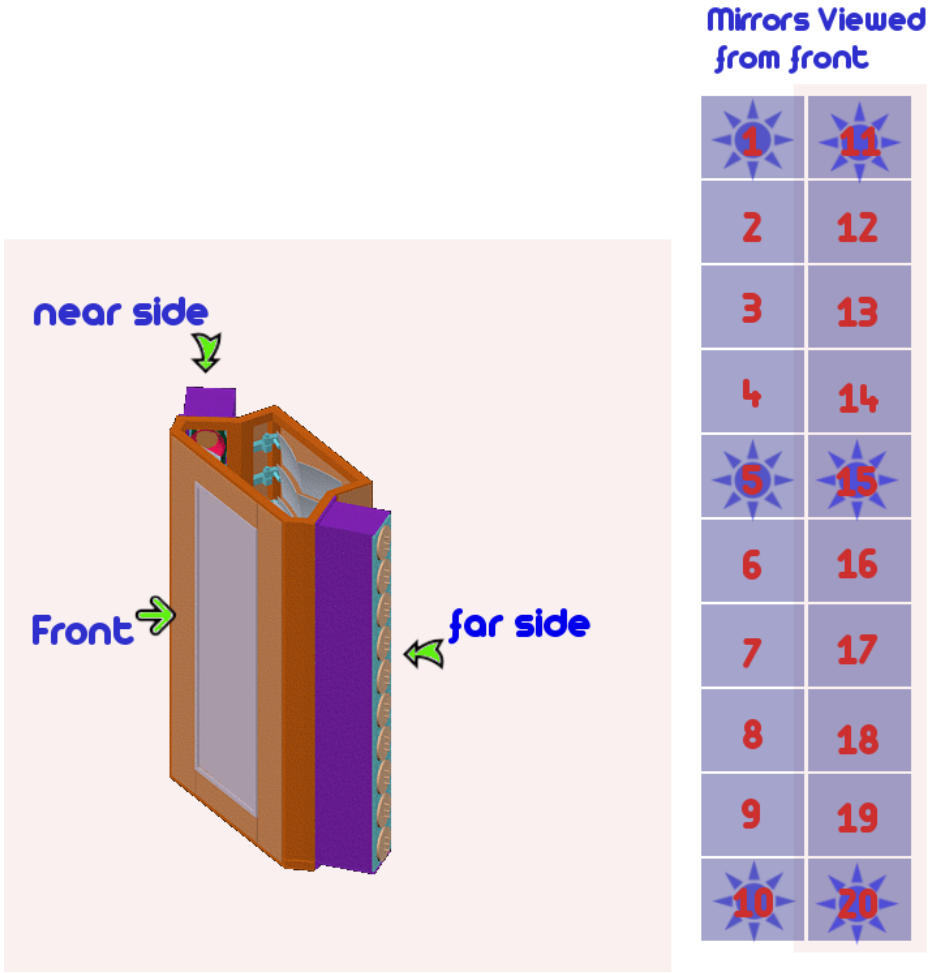

Figure 1: CAD rendering of the Big Bite Cerenkov and layout of the mirrors corresponding to the PMTs, the blue suns mark the location of the LEDs during the LED run.

Fitting Function

Poisson Gaussian Convolution

- A Gaussian-Poisson Function was used to fit the photoelectron peaks for the LED runs.
- Fit made for pedestal subtracted 3 photoelectron peaks and uses 6 parameters.
- *Parameters*:

Par[]	Name
0	Number of PhotoElectrons(PE)
1	$1PE\ Location$
2	Scale
3	σ_{1PE}
4	σ_{2PE}
5	σ_{3PE}

The Fitting Function

The Function

- Function used is

$$\frac{par[2]\,e^{-par[0]}\,par[0]^{(i)}\,e^{\left(\frac{-(x[0]-(i)par[1])^2}{2ipar[i+2]^2}\right)}}{(i!)\,\sqrt{i}}$$

- Where i runs from $1 \rightarrow 4$.

Offset and Gain Calibration Determination

10 Nearside Fitted PMTs

- The one photoelctron peak for run 1833 was adjusted so that it fell on ADC channel 30 after pedestal subtraction.
- HV for run 1833:

PMT	HV (V)
1	1402
2	1411
3	981
4	1251
5	1150
6	1167
7	1390
8	1151
9	851
10	1290

Offset and Gain Calibration Determination

10 Nearside UnCalibrated PMTs

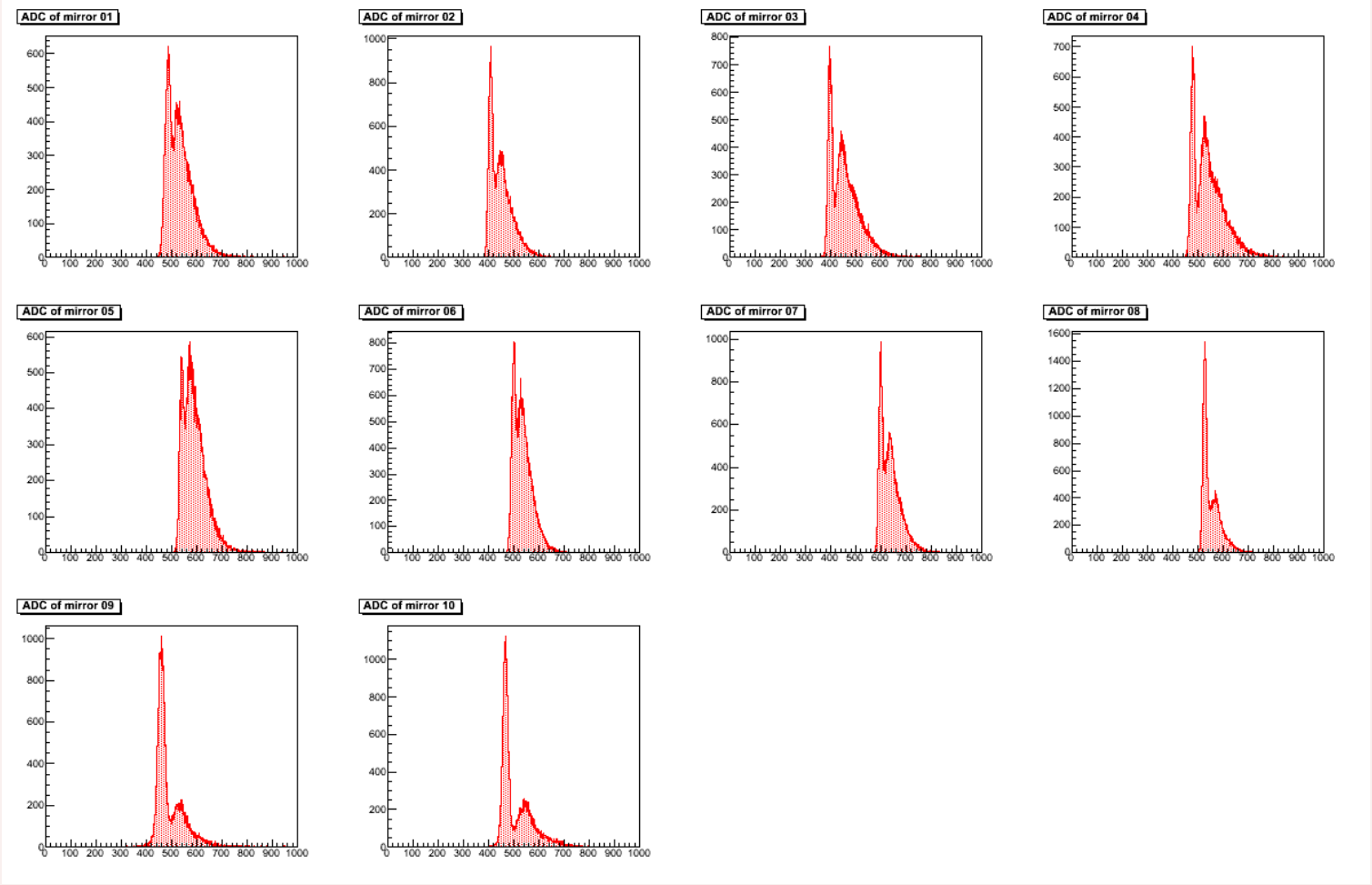

Figure 2: Plots of not calibrated 10 nearside PMTs ADC specra.

Offset and Gain Calibration Determination

10 Nearside Fitted PMTs

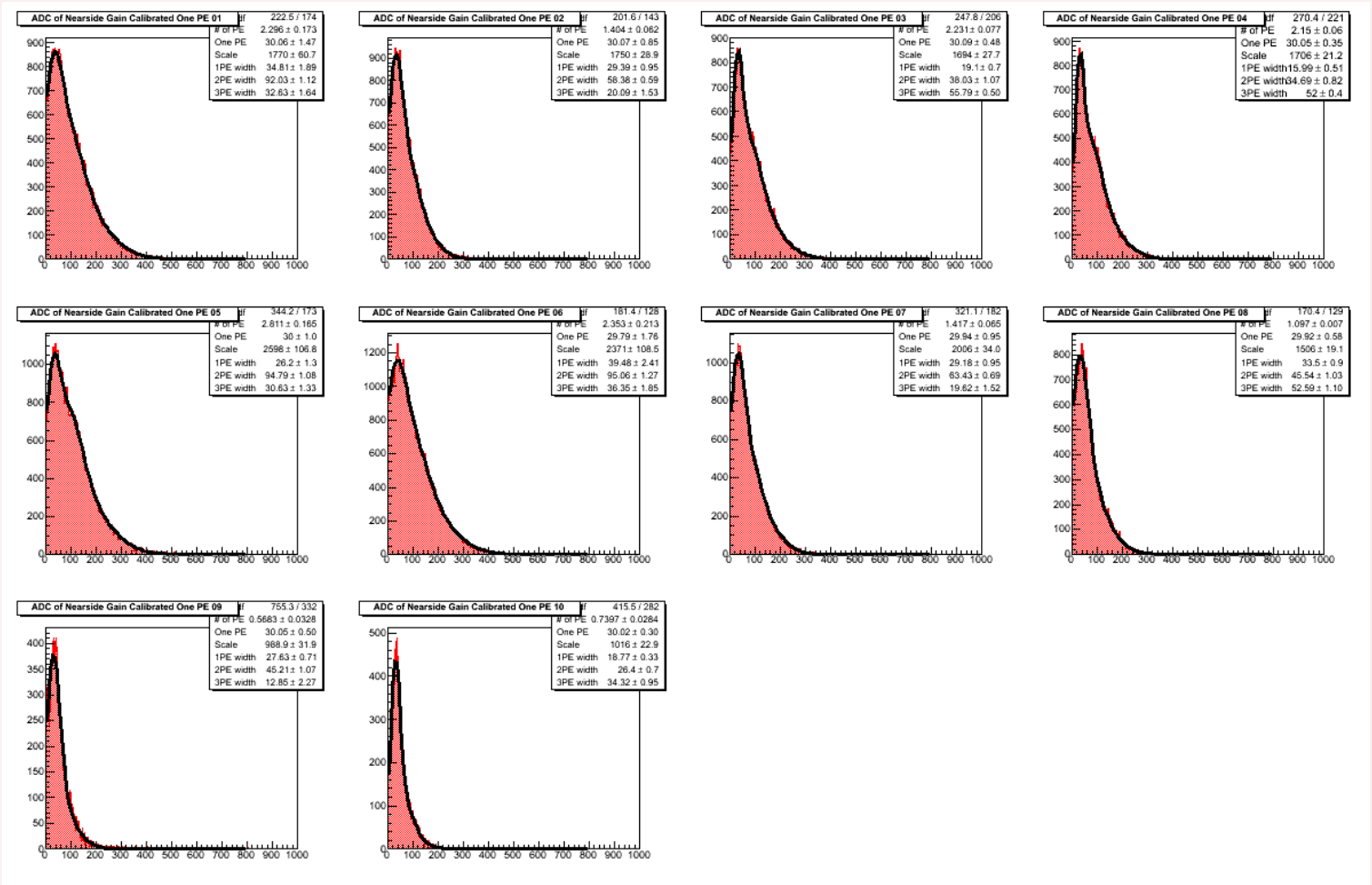

Figure 3: Plots of fitted 10 nearside PMTs ADC specra.

Fitted Results

Nearside Fitted Values Table

PMT	Channel	Pedestal	Gain Constant	$\frac{\chi^2}{ndef}$
1	30.06	503.1	1.918	1.28
2	30.07	422.5	1.440	1.41
3	30.09	418.1	1.347	1.20
4	30.05	498.3	1.185	1.22
5	30.00	553.3	2.100	1.99
6	30.40	513.6	2.650	1.42
7	30.01	613.1	1.680	1.76
8	30.02	546.7	1.865	1.32
9	30.05	483.3	0.770	2.30
10	30.03	491.2	0.880	1.47

Offset and Gain Calibration Determination

10 Farside Fitted PMTs

- The one photoelctron peak for run 1837 was adjusted so that it fell on ADC channel 30 after pedestal subtraction.
- HV for run 1837:

PMT	HV (V)
11	1522
12	1750
13	1469
14	1554
15	1371
16	2070
17	1820
18	1451
19	1403
20	1657

Offset and Gain Calibration Determination

10 Farside UnFitted PMTs

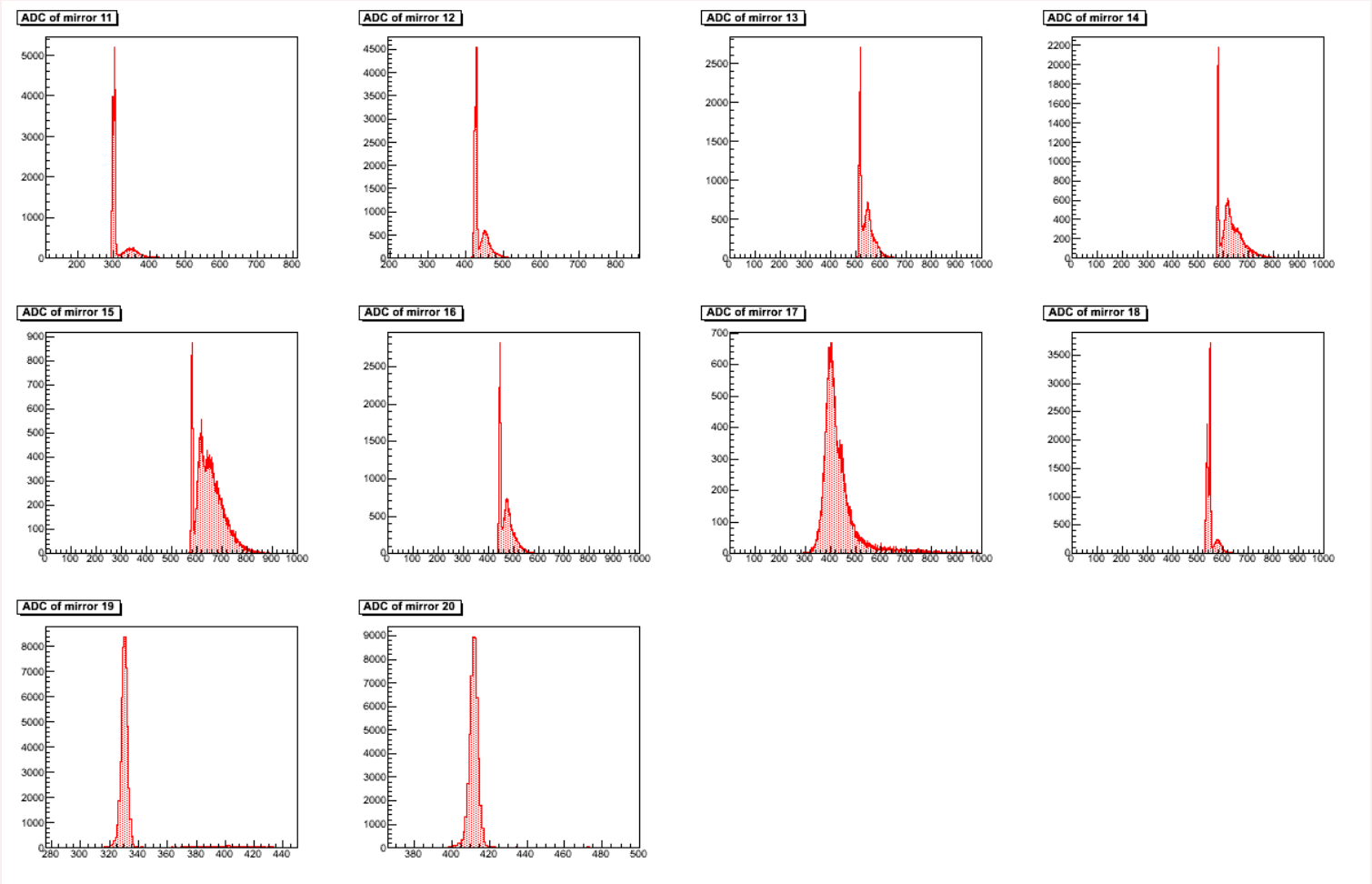

Figure 4: Plots of not calibrated 10 farside PMTs ADC specra.

Fitted Results

10 Farside Fitted PMTs

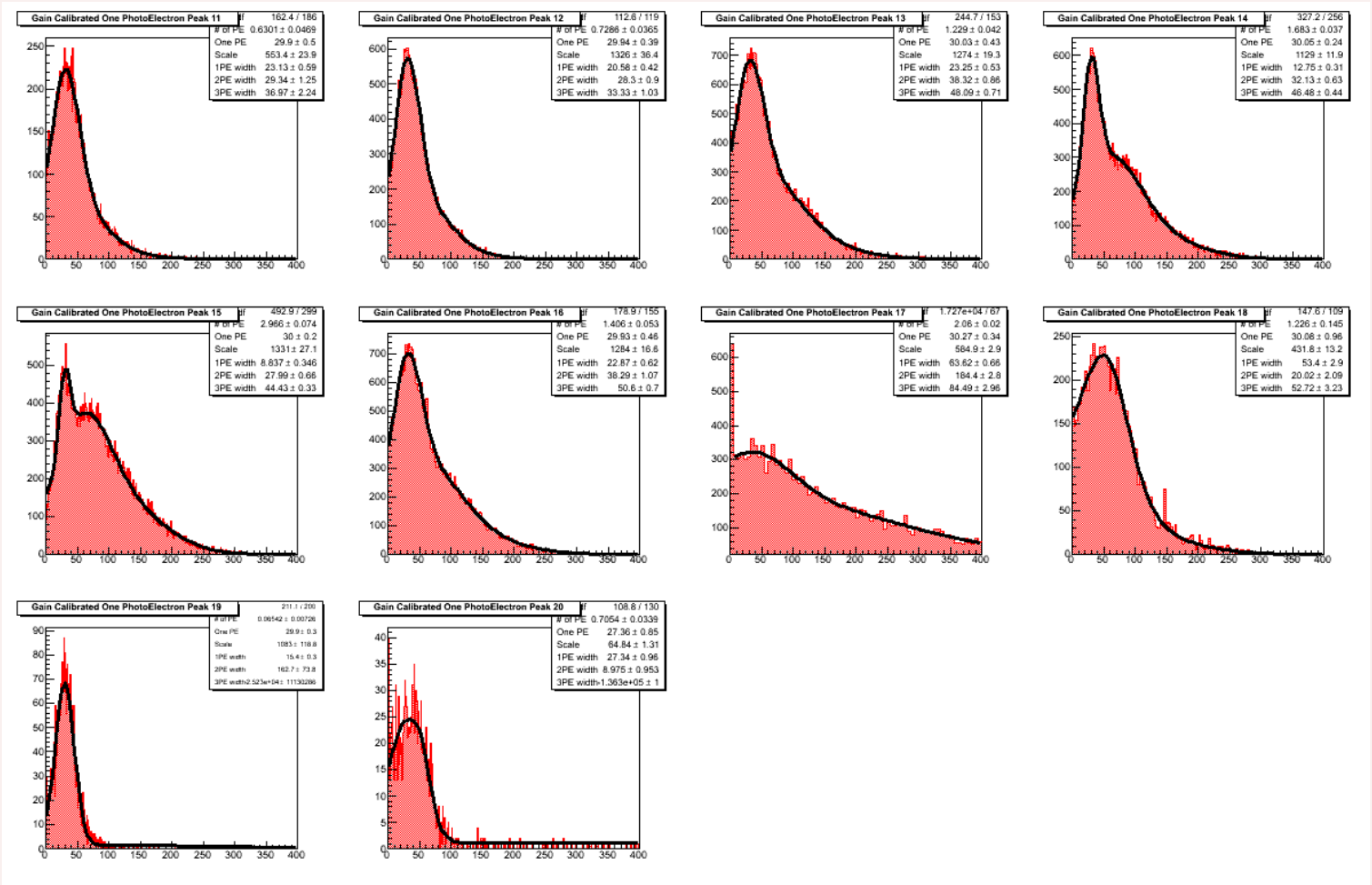

Figure 5: Plots of fitted 10 farside PMTs ADC specra.

Fitted Results

Farside Fitted Values Table

PMT	Channel	Pedestal	Gain Constant	$\frac{\chi^2}{ndef}$
11	29.9	320.1	1.290	0.87
12	29.94	435.6	2.139	0.95
13	30.03	531.2	2.32	1.60
14	30.05	594.1	1.405	1.45
15	30.00	590.2	1.220	1.65
16	29.93	457.3	2.339	1.15
17	30.27	430.0	5.35	NA
18	30.08	561.9	2.957	1.35
19	29.9	350.2	0.595	1.06
20	27.36	440	1.328	0.84

Summary

Comments

- The $\chi^2/ndef$ not minimized for all pmts.
  1. Pedestal overlap with the one photoelectron peak leads to an unclean seperation.
  2. PMT 17 is noisy.
  3. PMT 20 has very little signal.

To-Do

To Do

- Check other LED calibrations for earlier runs.
- Apply gain calibration constants to production runs to obtain photoelectron yeilds.
- Begin charting experimental conditions over time (magnet current, HVs, beam currents, ect).
- Talked to Yi, and found target data at */w/work5602/transversity/d2n_target*.