Cherenkov Analysis

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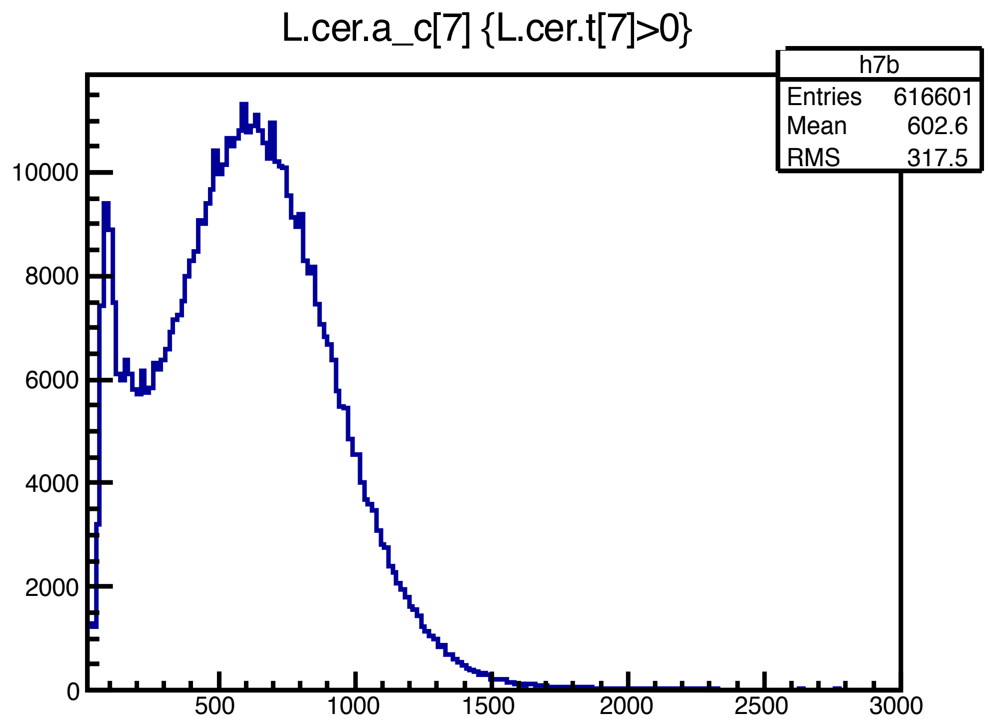
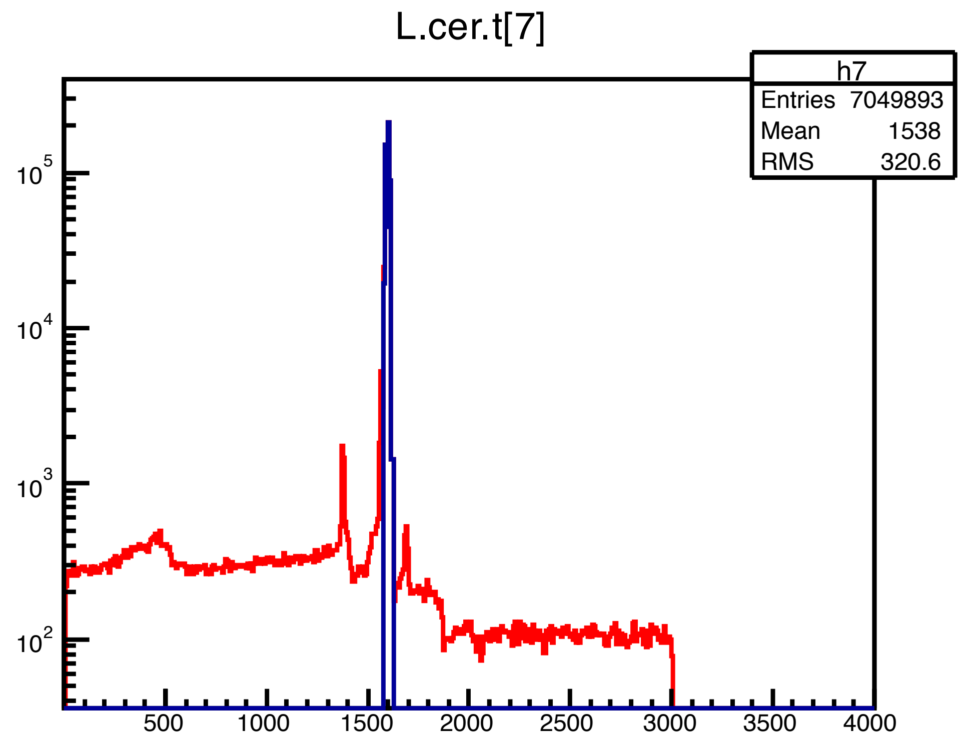
Method

- Isolate and fit the single photoelectron (SPE) peak
- Use location of SPE peak to fit the "good event" peak



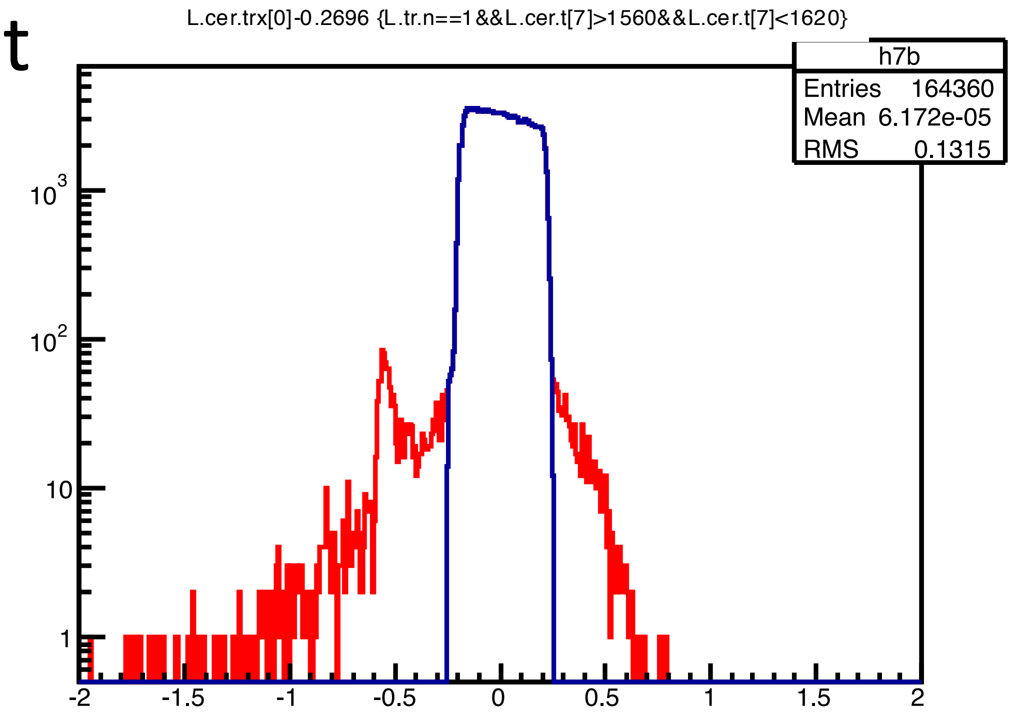
Isolate and Fit the SPE Peak

- Make cut on TDC spectra on "good time" events



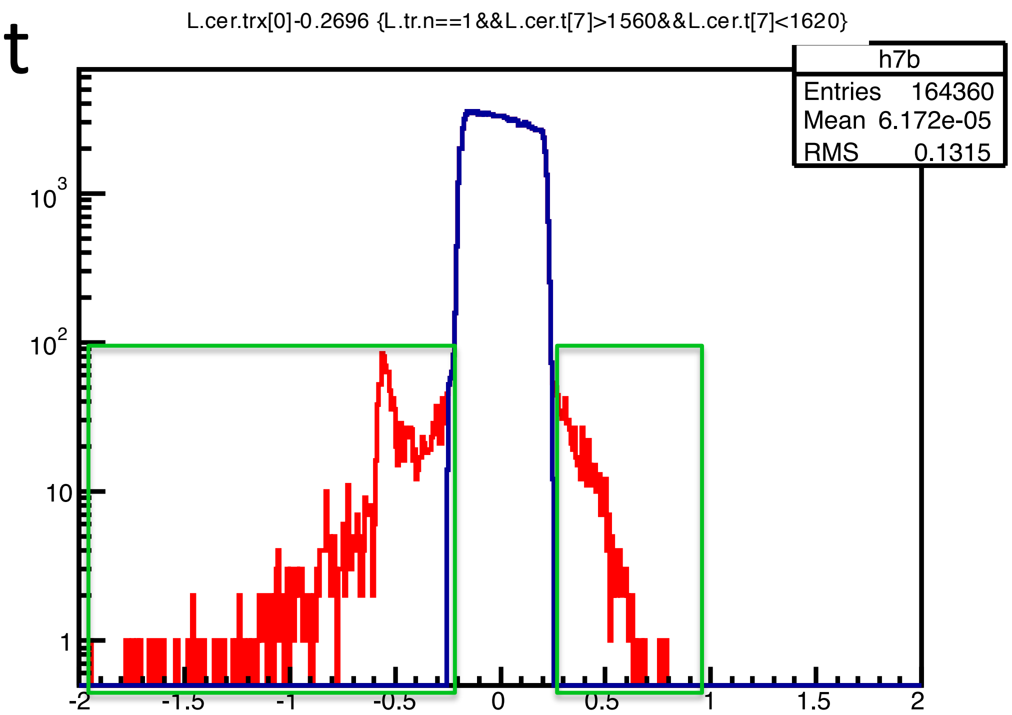
Isolate and Fit the SPE Peak

- Apply TDC cut to plot of Cherenkov tracking variables



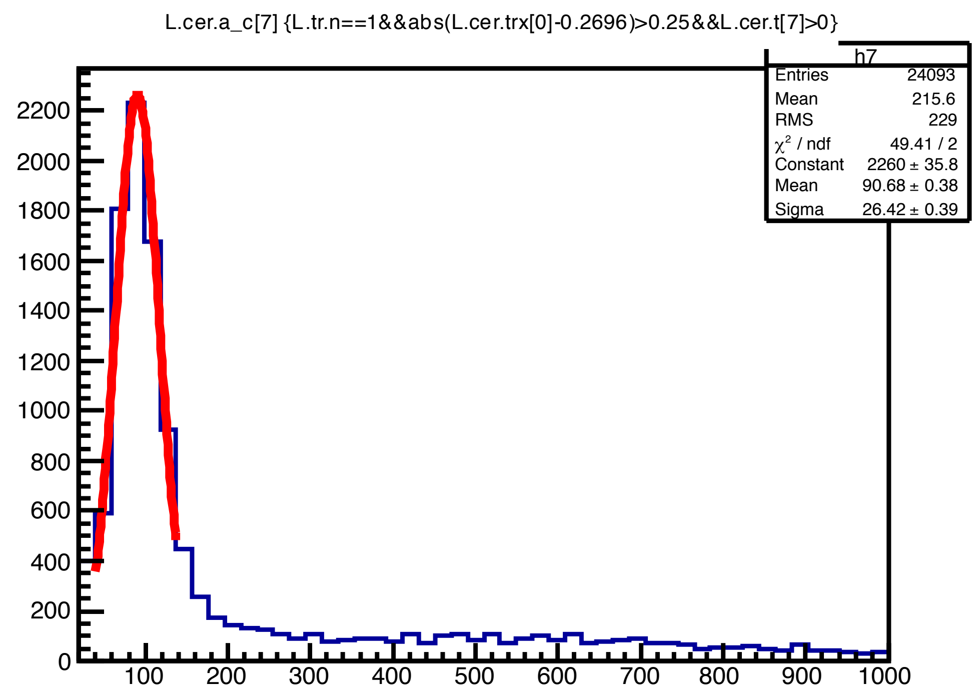
Isolate and Fit the SPE Peak

- Apply TDC cut to plot of Cherenkov tracking variables
- Make a cut on the tails to isolate the SPE peak



Isolate and Fit the SPE Peak

- Apply tracking variable cut to ADC spectra, isolating the SPE peak
- Fit peak with a Gaussian



Fitting the "Good Event" Peak

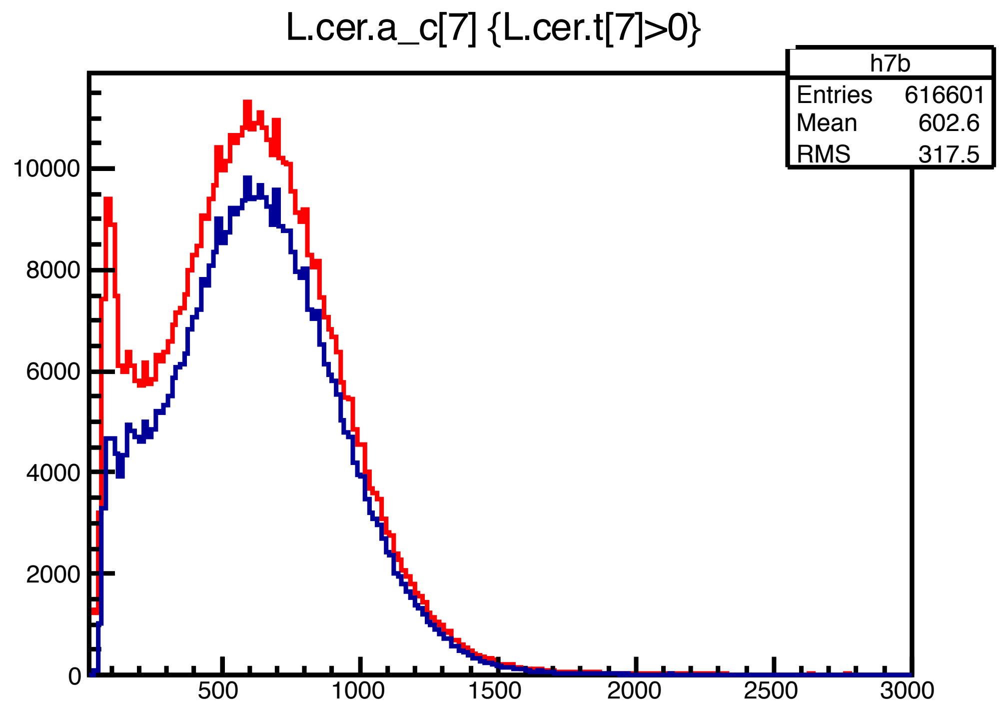
- Cuts made to isolate good events:

- L.tr.n==1
  - *Only single track events*

- L.cer.t[7]>1560&&L.cer.t[7]<1620
  - *TDC cut on "good time" events*

- abs(L.cer.trx[0]-0.2696)<0.25&& abs(L.cer.try-0.03663)<0.06
  - *Cuts on tracking variables in the x and y plane*

- (L.prl1.e+L.prl2.e)>2000&& (L.prl1.e+L.prl2.e)<4000
  - *Pion rejector cuts*



Blue line: spectra with cuts

Fitting the "Good Event" Peak

- Function is a combination of Gaussian and Poisson distributions

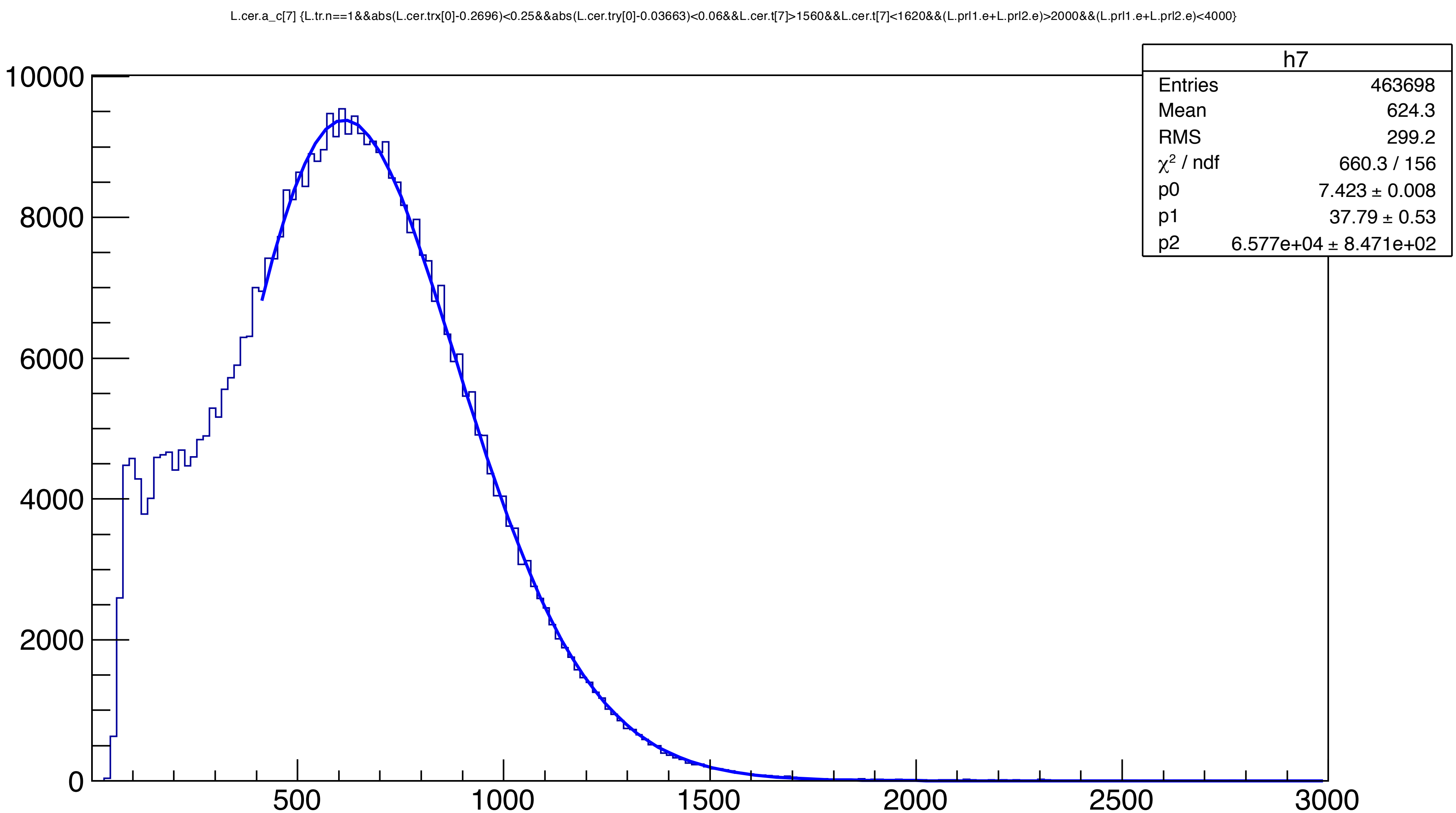
$$A(x) = C \cdot \sum_n \mathrm{Poisson}(n,\mu) \cdot \mathrm{Gaus}(x,n,\sigma).$$

$$\mathrm{Poisson}(n,\mu) = \frac{e^{-\mu}\mu^n}{n!}$$

$$\mathrm{Gaus}(x,n,\sigma) = \frac{1}{\sqrt{2\pi}\sqrt{n}\sigma} e^{-\frac{(x-nA_0)^2}{2n\sigma^2}}$$

- Where:
  - C = amplitude factor
  - σ = average # of photoelectrons
  - μ = width of single photoelectron response
  - A_0 = Location of single photoelectron peak

Fitting the “Good Event” Peak



Results

LHRS		
mirror #	**SPE peak**	**NPE**
0	76.5 ± 1.1	5.74 ± 0.02
1	80.1 ± 1.2	4.94 ± 0.04
2	141.3 ± 8.1	5.06 ± 0.01
3	128.1 ± 1.9	3.68 ± 0.01
4	89.4 ± 0.4	6.79 ± 0.01
5	120.9 ± 0.6	4.23 ± 0.01
6	133.8 ± 1.2	3.44 ± 0.01
7	90.7 ± 0.4	7.42 ± 0.01
8	86.5 ± 1.2	6.05 ± 0.02
9	85.2 ± 1.1	6.97 ± 0.01

RHRS		
mirror #	**SPE peak**	**NPE**
0	29.1 ± 2	7.30 ± 0.09
1	54.8 ± 3	6.84 ± 0.05
2	83.4 ± 0.3	10.30 ± 0.02
3	59.9 ± 3	6.98 ± 0.03
4	91.3 ± 0.1	8.52 ± 0.01
5	99.9 ± 0.7	10.58 ± 0.02
6	100.4 ± 0.6	8.02 ± 0.01
7	89.5 ± 0.9	10.49 ± 0.03
8	88.1 ± 0.2	8.62 ± 0.02
9	83.6 ± 0.3	7.77 ± 0.04