HMS Cherenkov Calibration

Method-2

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Procedure

- The number of photo-electrons (NPE) are estimated from (mean/sigma)^2 where mean and sigma are obtained from fitting the good ADC pulse integral for each pmt with Gaussian fit. Then the SPE integral is estimated by dividing the mean by the estimated number of photoelectrons (NPE).

- The cuts that used on the ADC pulse integral (H.cer.goodAdcPulseInt) are the following:

1. Requiring good Adc multiplicity == 1 for the PMT under calibration.

2. 0.9 < H.cal.etottracknorm < 1.35 to choose electrons.

3. -9 < P.gtr.dp < 9.

4. Mirror X and Y cuts for each PMT.
   PMT1: -1 < XatCer < 20, -12< YatCer < 16
   PMT2: -27 < XatCer < -3, -10 < YatCer < 12

5. Detector timing window cuts (H.cer.goodAdcTdcDiffTime) (already set in the corresponding parameter file in hallc_replay).

6. Considered signal in single PMT.

* Also tried using the following Poisson-like fitting function: $p_0\left(\frac{p_1}{p_2}\right)^{\frac{x}{p_2}} \frac{\exp\left(\frac{-p_1}{p_2}\right)}{Gamma\left(\frac{x}{p_2}+1\right)}$

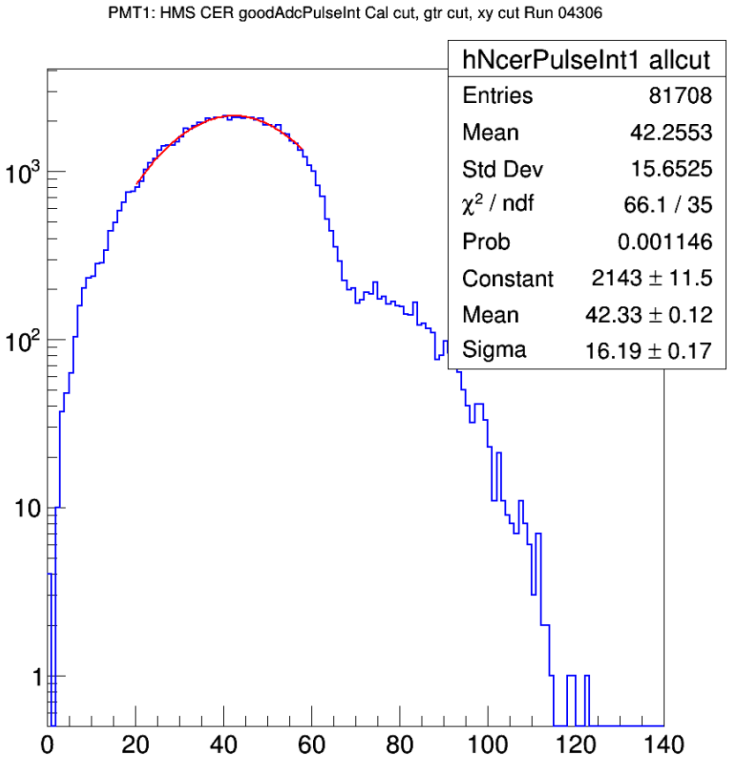
Using the Gamma(x+1) function to replace x!, this extends the Poisson distribution to all real positive numbers.
P0: scaling factor
P1: mean of the distribution as plotted.
P2: works out to be the calibration constant.

HMS Run 04306
(1-pass QE, 3/4)

Method 1:
Calibration = 1 / 8.417

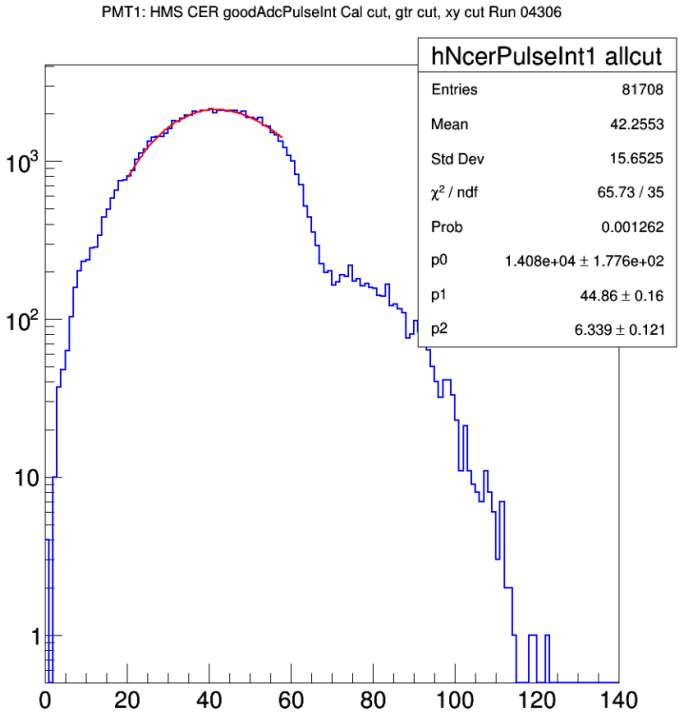
- Root tree variable: H.cer.goodAdcPulseInt with all cuts mentioned for **PMT 1**.
- 200000 replay

Gaussian-Fit



Method 2: NPE = 6.83822, SPE = 6.18978,
Calibration = 1 /6.18978

Poisson like Fit



Method 2:Calibration = 1 /6.339

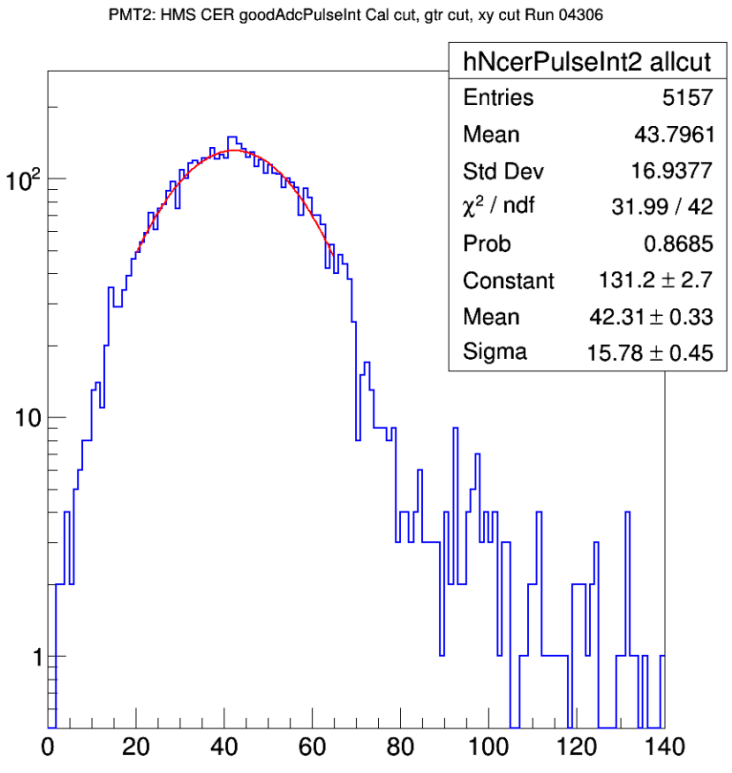
Fit function: $p_0\left(\frac{p_1}{p_2}\right)^{\frac{x}{p_2}} \frac{\exp\left(\frac{-p_1}{p_2}\right)}{Gamma\left(\frac{x}{p_2}+1\right)}$

HMS Run 04306
(1-pass QE, 3/4)

Method 1:
Calibration = 1 / 7.532

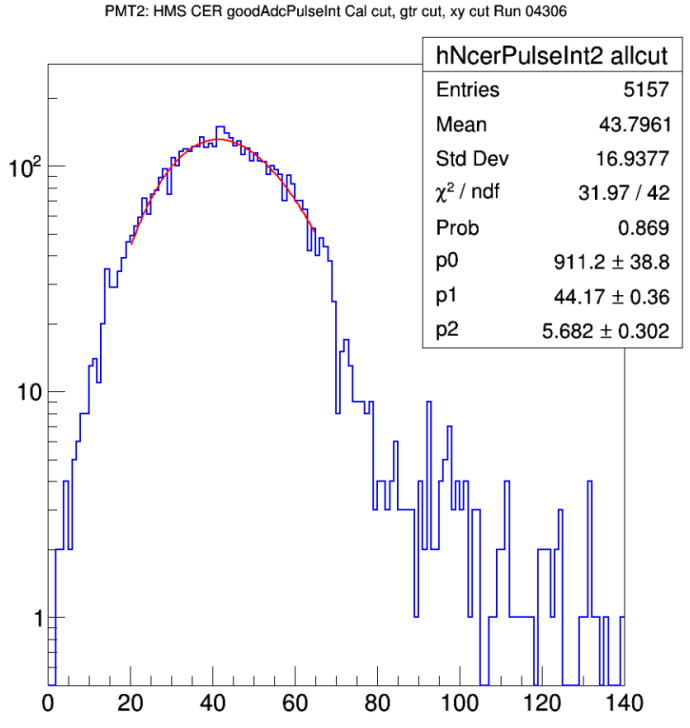
- Root tree variable: H.cer.goodAdcPulseInt with all cuts mentioned for **PMT 2**.
- 200000 replay

Gaussian-Fit



Method 2: NPE = 7.19115, SPE = 5.88378,
Calibration = 1 / 5.88378

Poisson like Fit



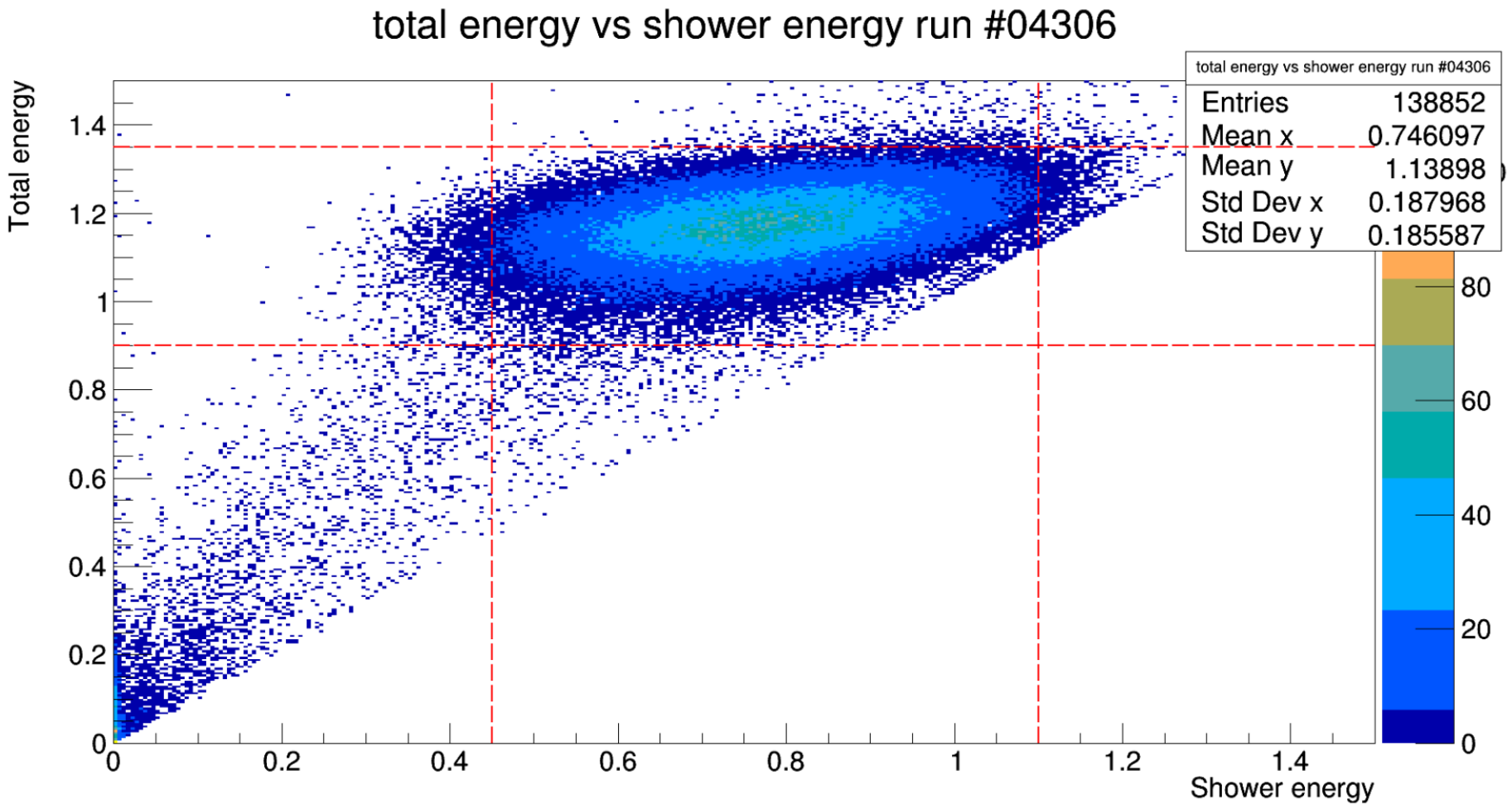
Method 2:Calibration = 1 / 5.682

Fit function: $p_0\left(\frac{p_1}{p_2}\right)^{\frac{x}{p_2}} \frac{\exp\left(\frac{-p_1}{p_2}\right)}{Gamma\left(\frac{x}{p_2}+1\right)}$

HMS Run 04306
(1-pass QE, 3/4)

200000
replay

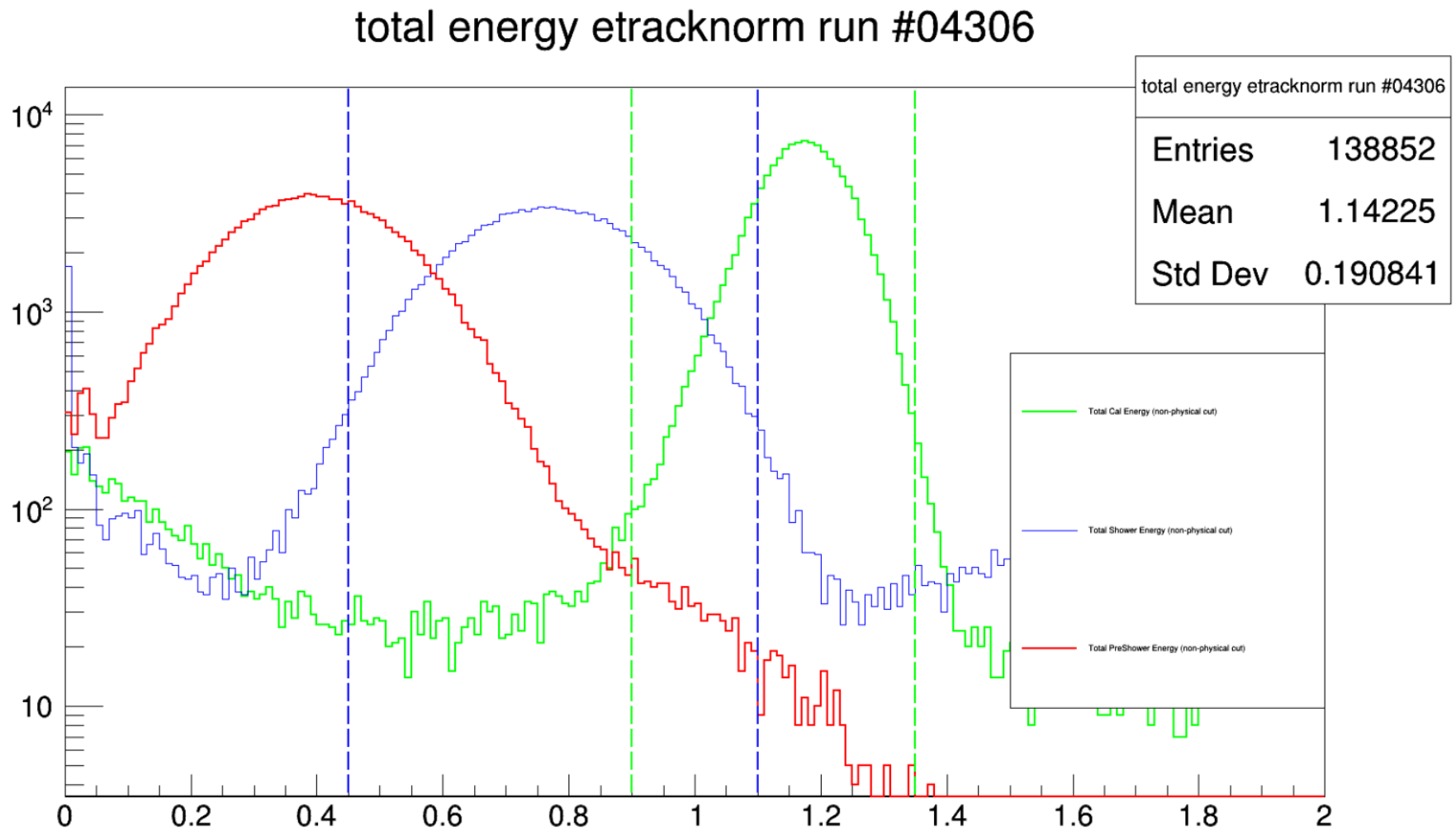
- 2D histogram of total energy vs. shower energy to determine calorimeter cuts (non-physical cuts applied).



HMS Run 04306
(1-pass QE, EL-CLEAN)

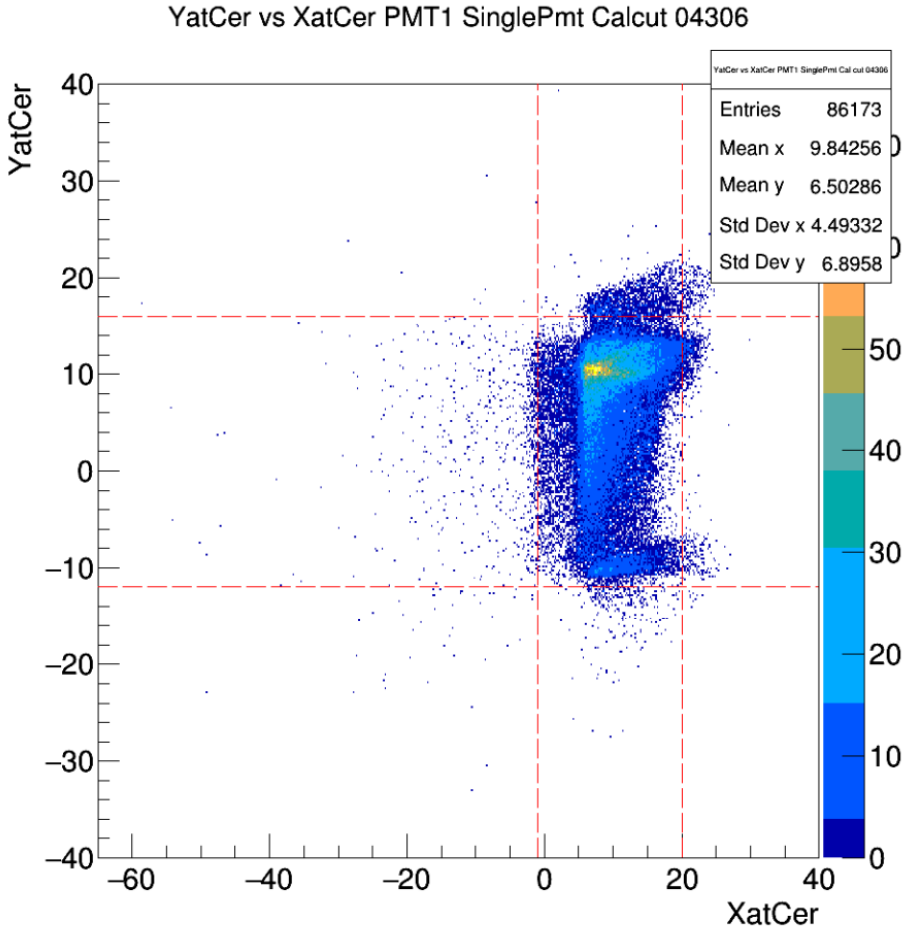
200000 replay

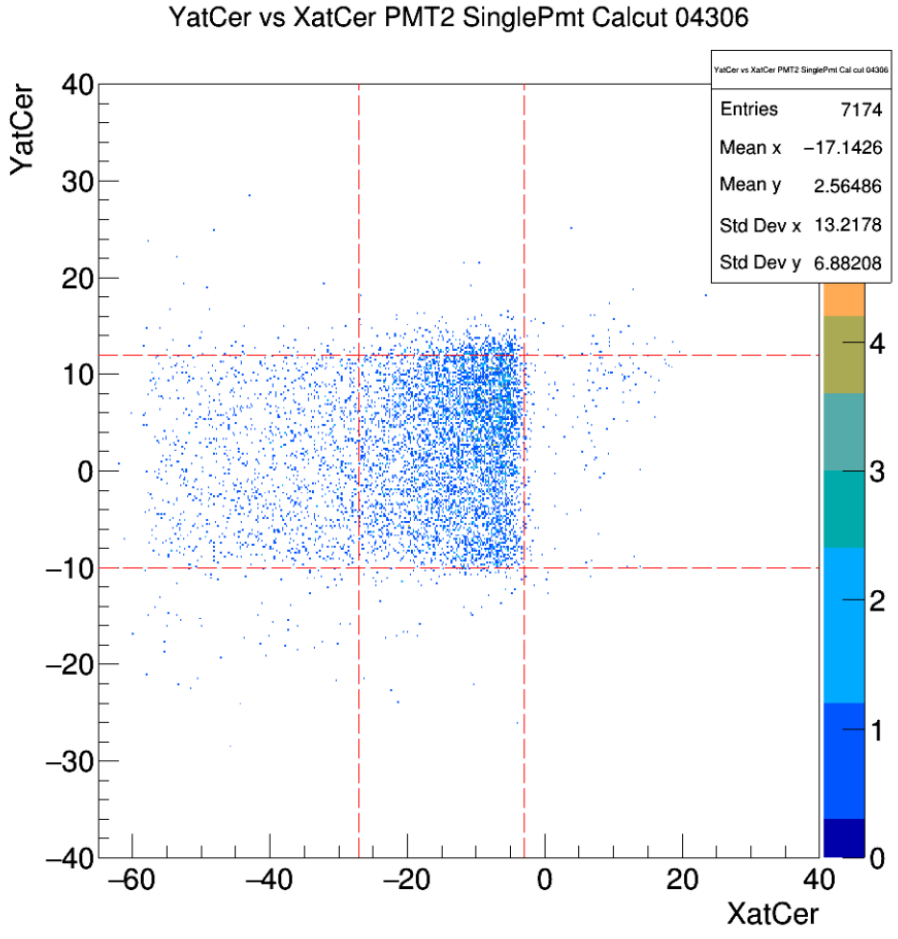
- 1D histogram of raw calorimeter energy to determine calorimeter cuts.



HMS Run 04306
(1-pass QE, 3/4)

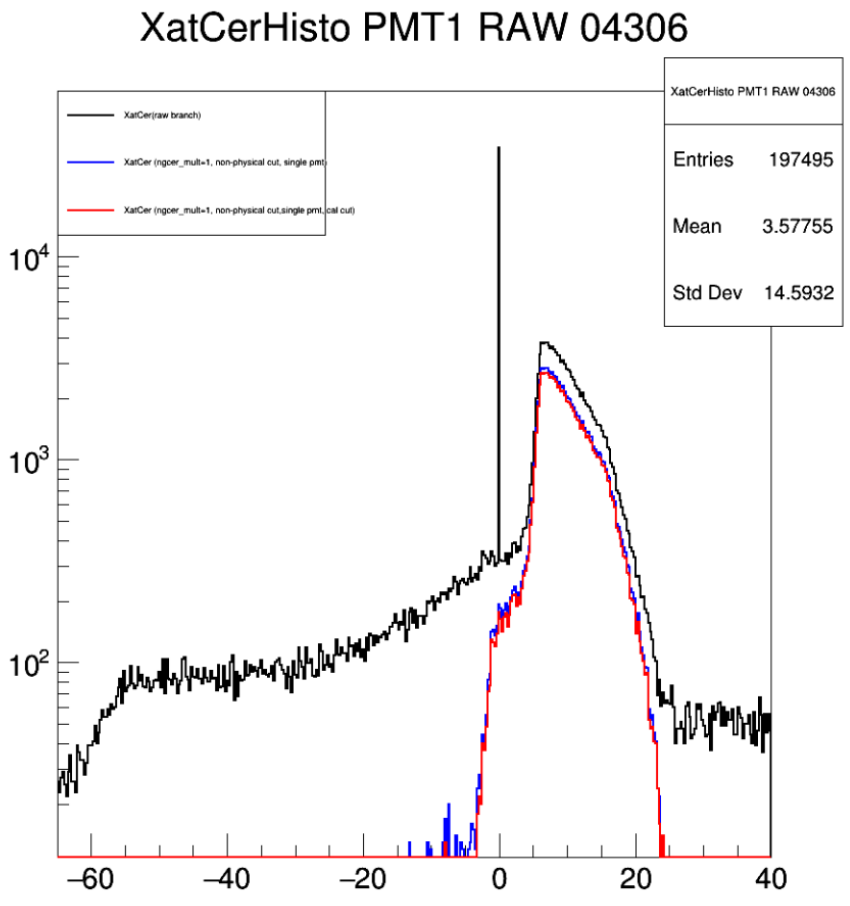
2D histogram of YatCer vs XatCer (single PMT cut, calorimeter cut). Determined from mean NPE distribution.

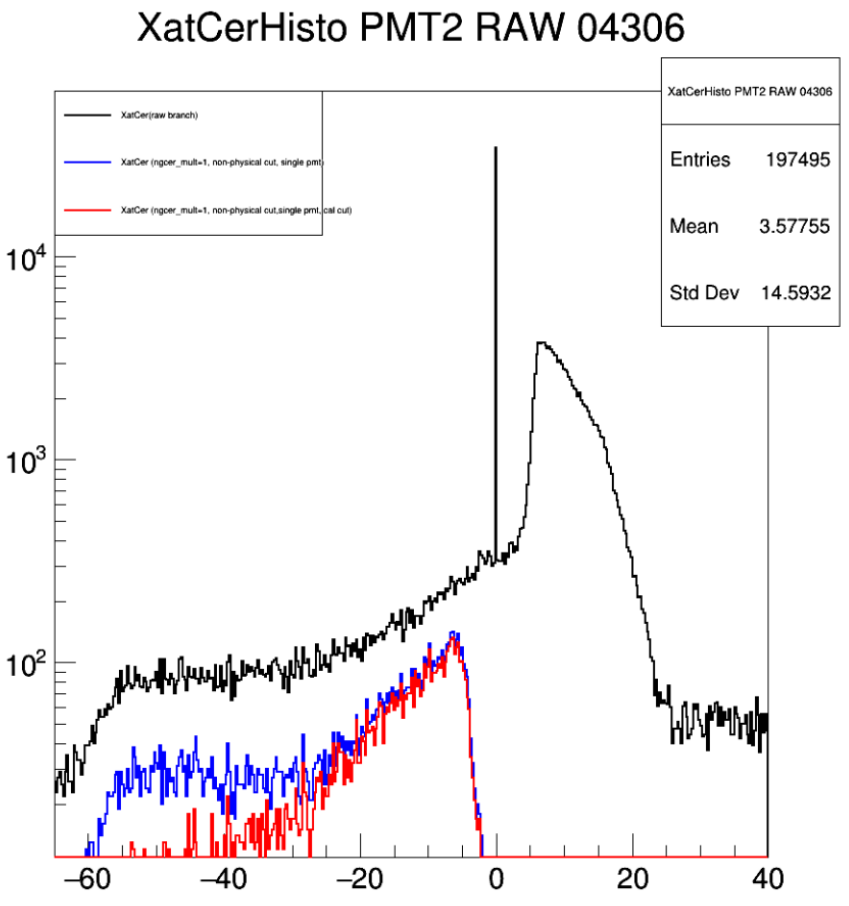




HMS Run 04306
(1-pass QE, 3/4)

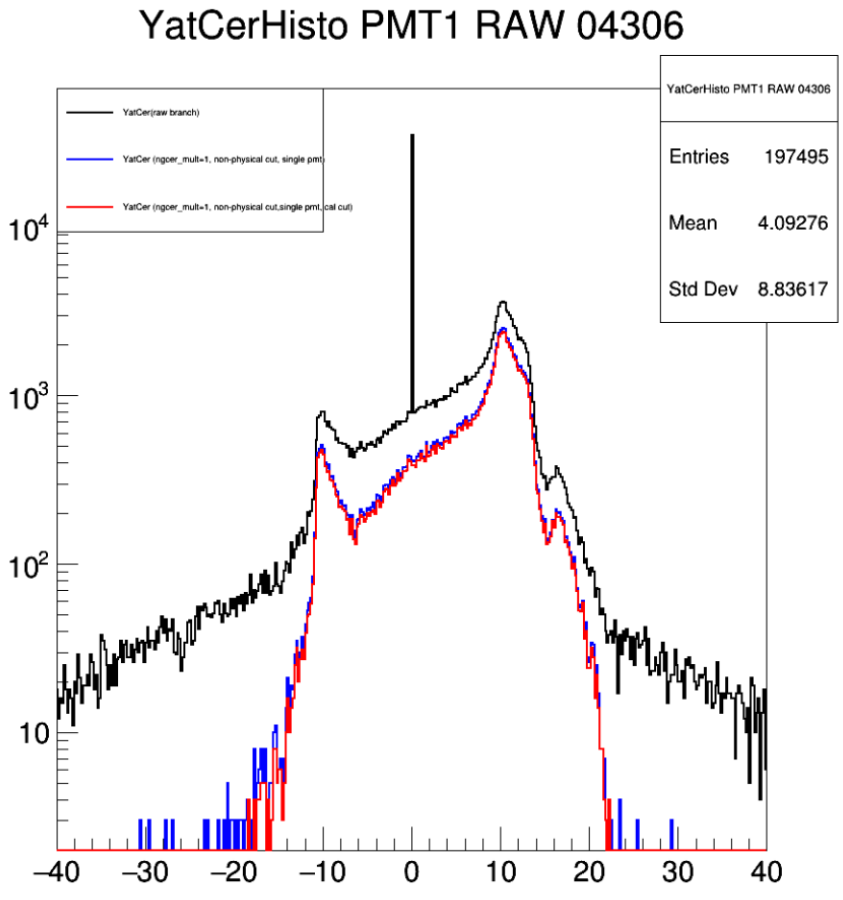
Different cuts on XatCer (Red one is with single Pmt cut and calorimeter cut).

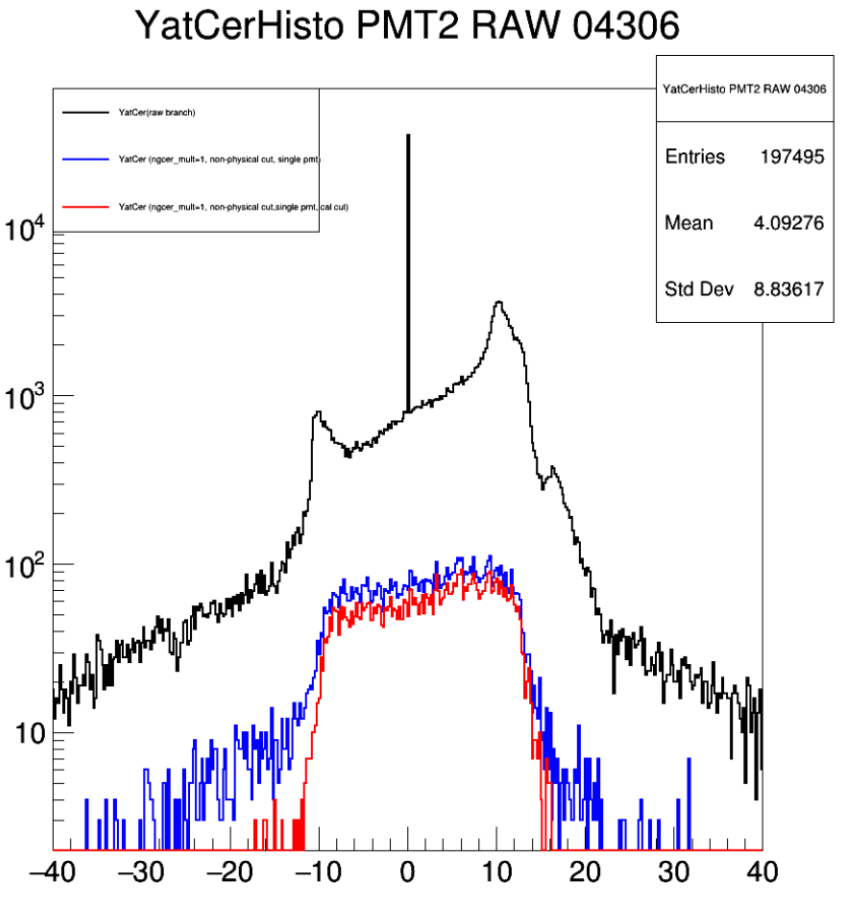




HMS Run 04306
(1-pass QE, 3/4)

Different cuts on YatCer (Red one is with single Pmt cut and calorimeter cut).

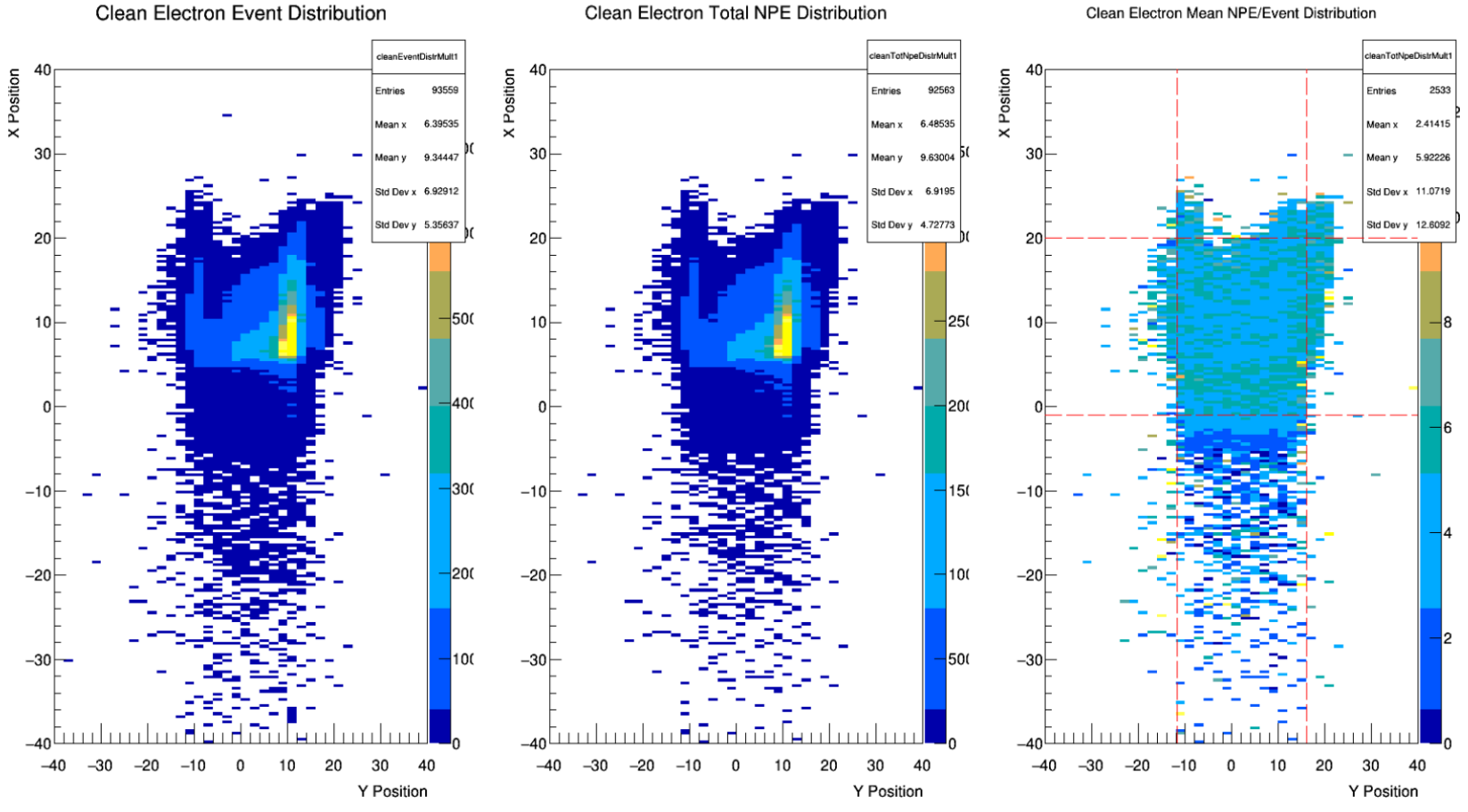




HMS Run 04306
(1-pass QE, 3/4)

200,000 events

- Mean NPE distribution in mirror X-Y plane for PMT 1.
- Cuts applied: H.cer.goodAdcMult[0]==1 && H.cal.etottracknorm > 0.9 && H.cal.etottracknorm < 1.35 && (H.cal.etottracknorm - H.cal.eprtracknorm) > 0.45 && (H.cal.etottracknorm - H.cal.eprtracknorm) < 1.1



HMS Run 04306
(1-pass QE,3/4)

200,000 events

- Mean NPE distribution in mirror X-Y plane for PMT 2.
- Cuts applied: H.cer.goodAdcMult[1]==1 && H.cal.etottracknorm > 0.9 && H.cal.etottracknorm < 1.35 && (H.cal.etottracknorm - H.cal.eprtracknorm) > 0.45 && (H.cal.etottracknorm - H.cal.eprtracknorm) < 1.1