

HMS PID

Gas Cherenkov Detector

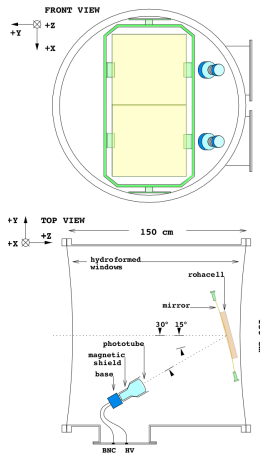
Shuo Jia

HMS Gas Cherenkov Detector

A Large cylindrical tank which containing two mirrors which focus light onto two 5 inch Burle8854 multiplier photo tubes.

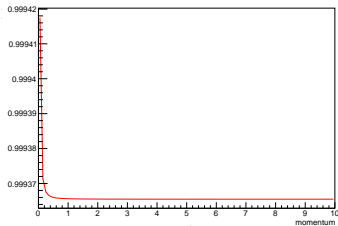
$$\phi_{in} = 59'', L = 60''$$

The tank is filed with 0.5 atm C₄F₈O, which have pion threshold of around 3.8 or 3.9 GeV/c.

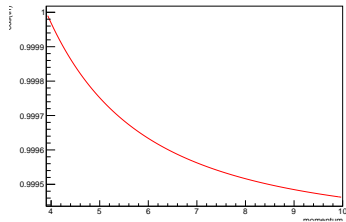


$$\cos(\theta) = \frac{c}{vn} = \frac{1}{\beta n} = \frac{\sqrt{p^2 + m^2}}{np}$$

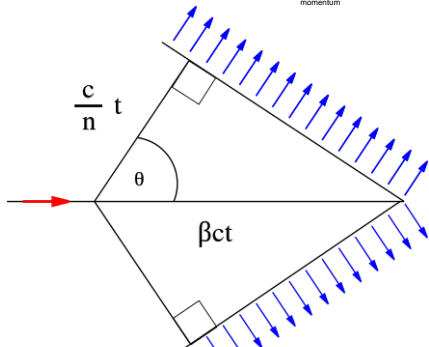
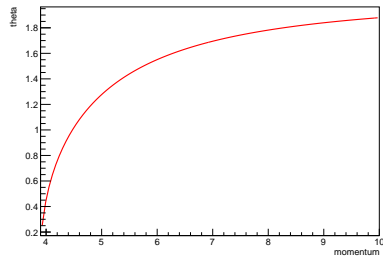
e



pi



pi



For a given Cherenkov device, the Number of photoelectrons detected is

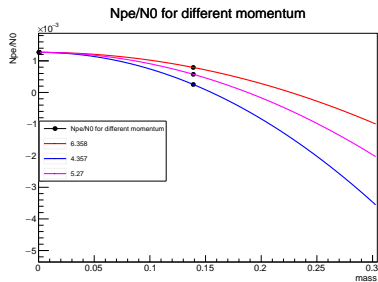
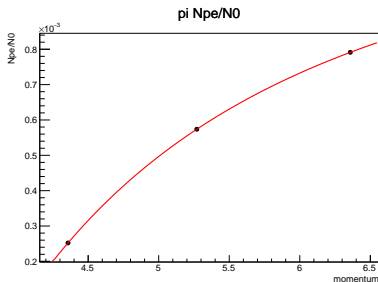
$$N_{p.e.} = L \frac{\alpha^2 z^2}{r_e m_e c^2} \int \epsilon(E) \sin^2 \theta(E) dE$$

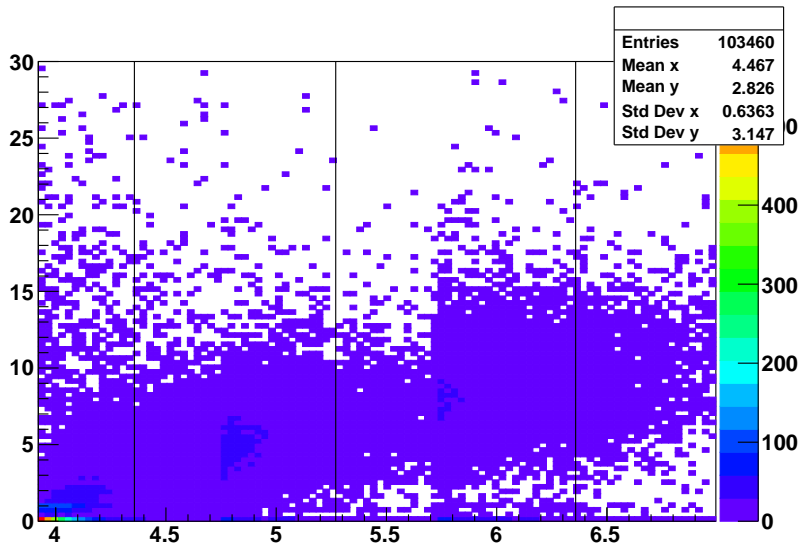
We define Cherenkov detector quality factor N_0

$$N_0 = \frac{\alpha^2 z^2}{r_e m_e c^2} \int \epsilon dE$$

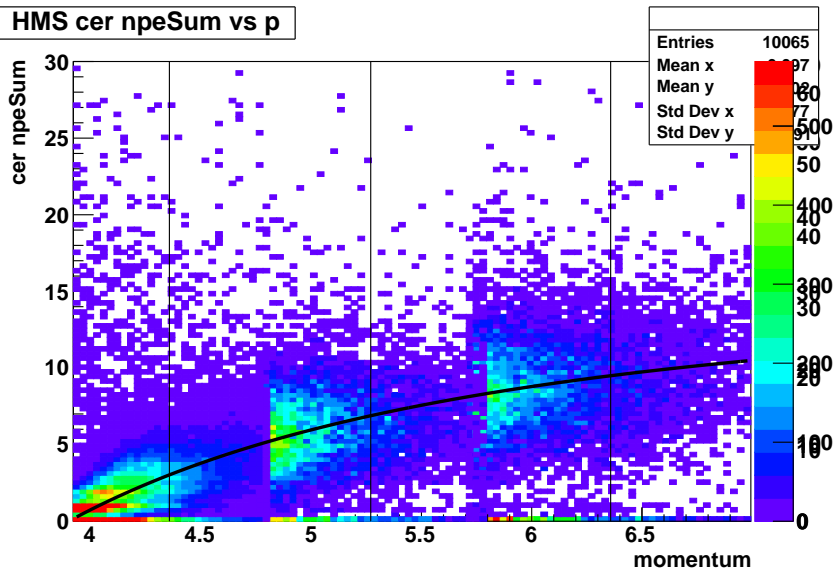
so that,

$$N_{p.e.} \approx L N_0 \langle \sin^2 \theta \rangle = L N_0 \frac{(n^2 - 1) P^2 - m^2}{n^2 p^2}$$

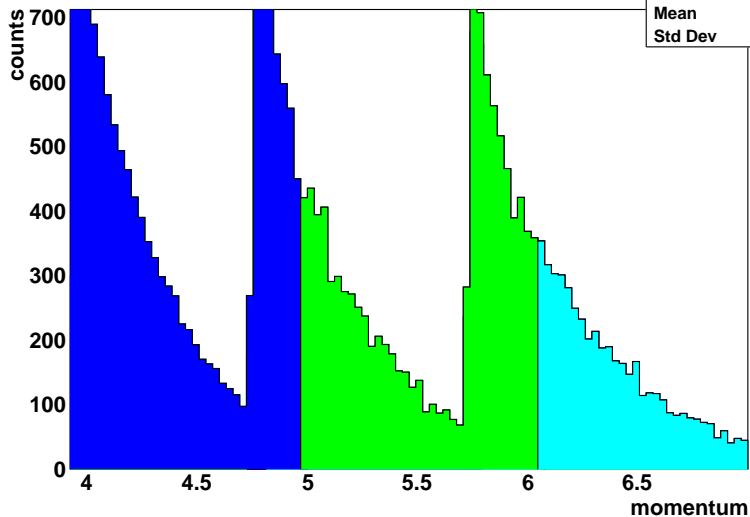




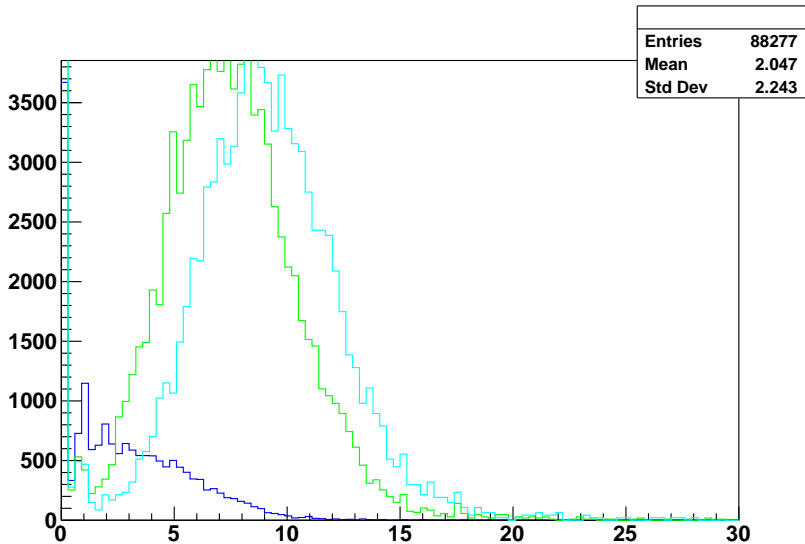
HMS cer npeSum vs p

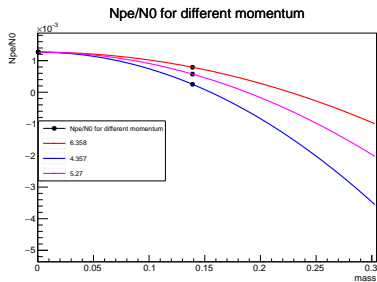


HMS momentum



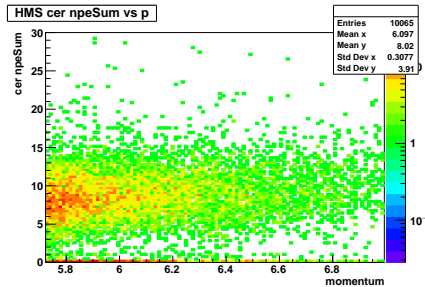
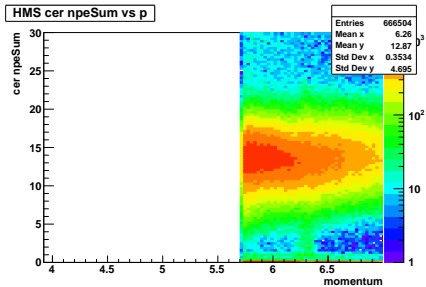
Entries	10065
Mean	6.098
Std Dev	0.3078





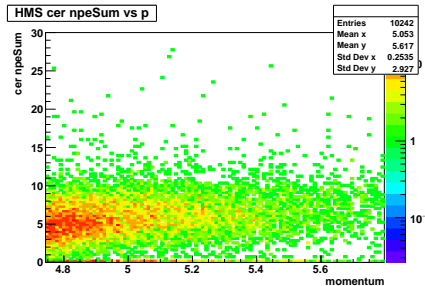
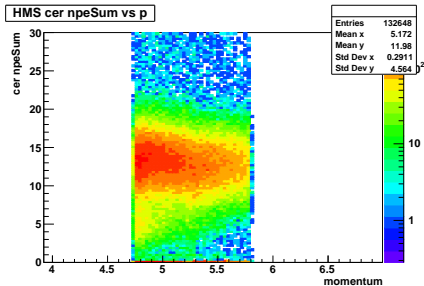
momentum		npe/n0	N_e/N_{pi}
6.358	pi	0.000811	1.588424
6.358	e	0.001289	
4.357	pi	0.000272	4.735817
4.357	e	0.001289	
5.27	pi	0.000594	2.170092
5.27	e	0.001289	

no cal pion cut, $\text{hms}_p = 6.358$



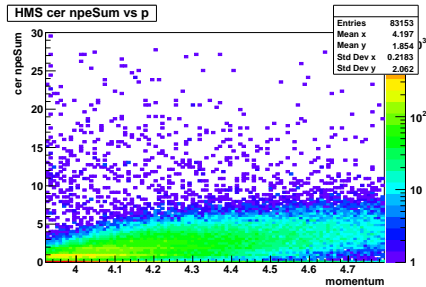
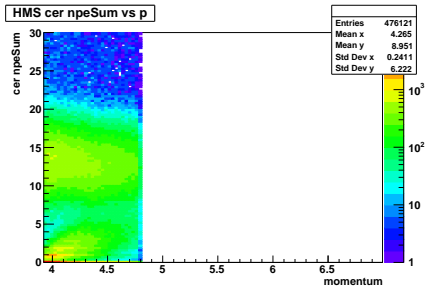
momentum: 6.358, calculated ratio: 1.588424

no cal pion cut, $\text{hms}_p = 5.27$



momentum: 5.27, calculated ratio: 2.170092

no cal pion cut, $\text{hms}_p = 4.357$

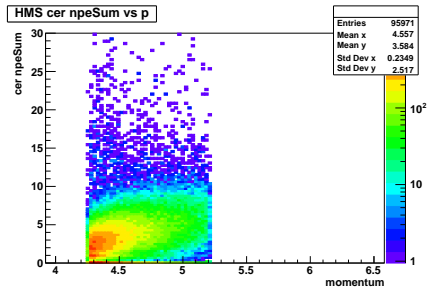
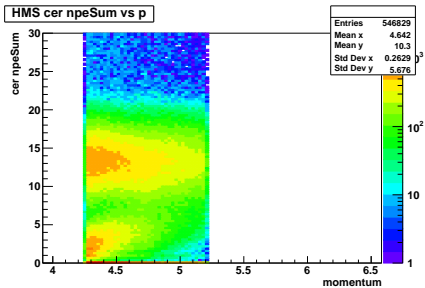


momentum: 4.357, calculated ratio: 4.735817

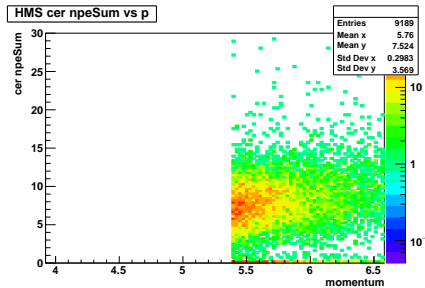
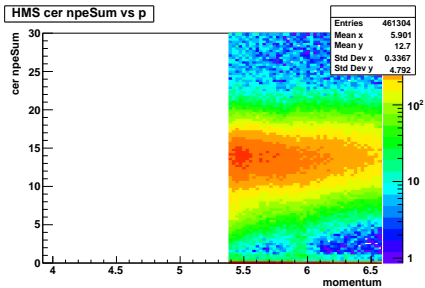
The tank is filled with pure gas, C₄F₈O at 0.5 atm $\beta = \frac{1}{n_{gas}}$

$$\frac{|p|}{\sqrt{(m^2+p^2)}} = \frac{1}{n_{gas}}$$

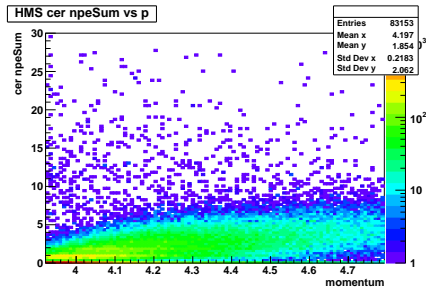
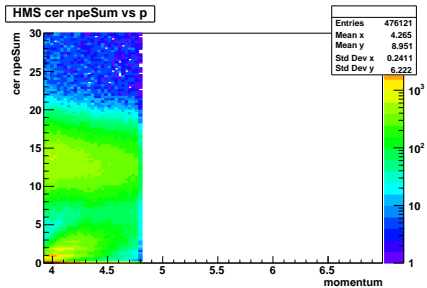
no cal pion cut, $\text{hms}_p = 4.736$



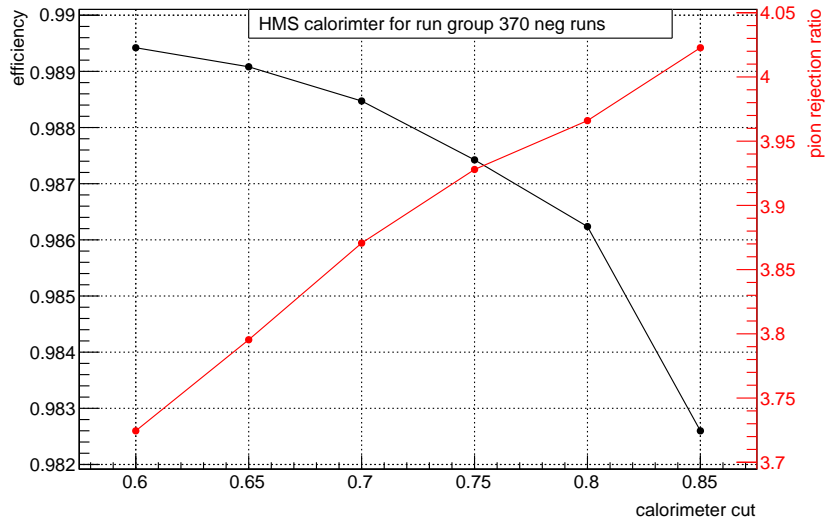
no cal pion cut, $\text{hms}_p = 5.983$



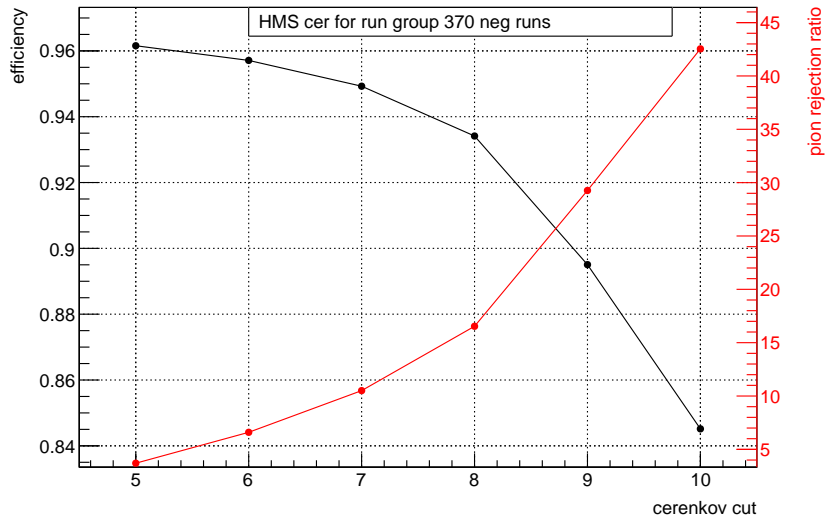
no cal pion cut, $\text{hms}_p = 4.357$



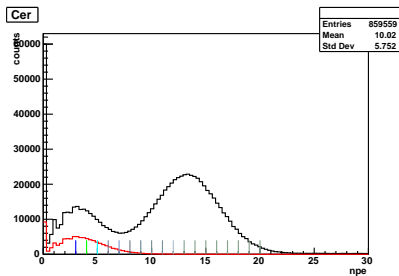
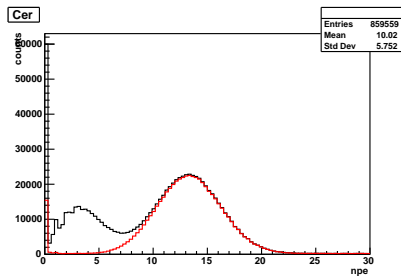
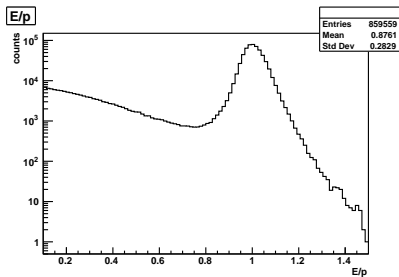
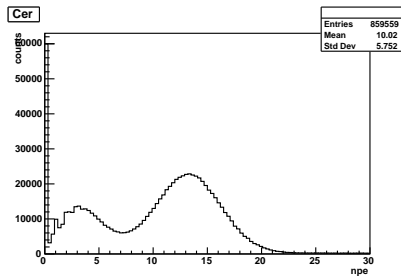
calorimeter



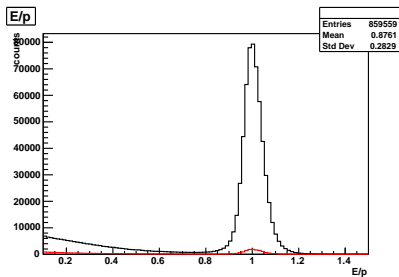
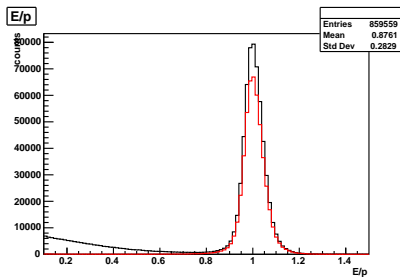
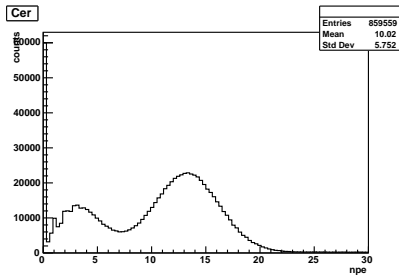
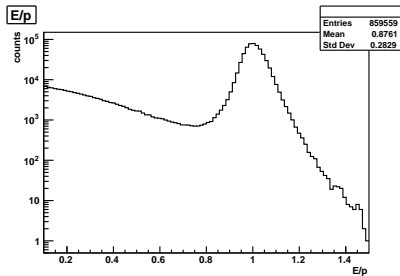
cerenkov



HMS_PID_370cer_neg



HMS_PID_370_neg



cal_cer

