PID efficiencies

Shuo Jia

HMS,electron arm

Basic cuts

cointime:2.5(fall)/1.5(spring)
HMS(SHMS) delta:-8,8(-10,20)
HMS(SHMS) acceptance constrain
SHMS pi cut
accidental background: 6 peaks

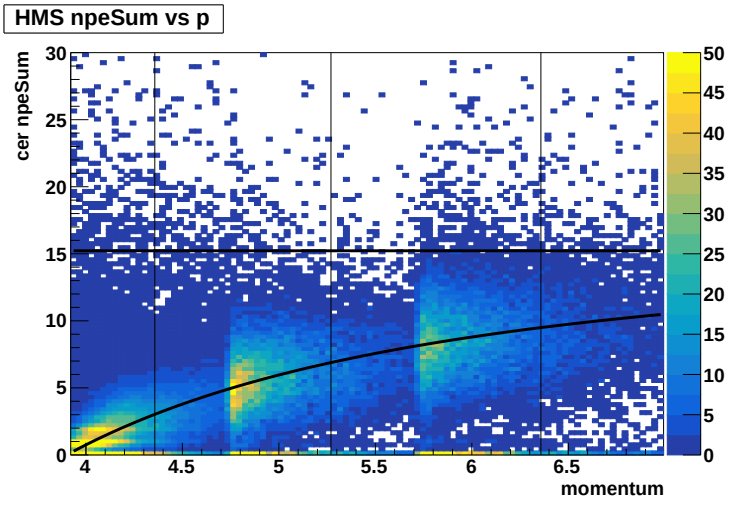
HMS Calorimeter

Cherenkov cut: 12
Calorimeter cut: varies

HMS Cherenkov

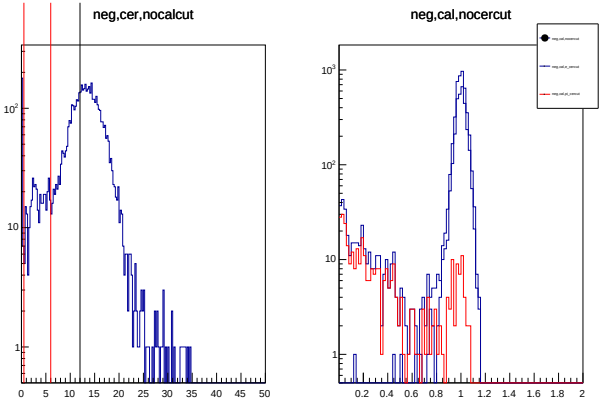
Cherenkov cut: varies
Calorimeter cut: 1

HMS Cer, not a good pion rejector



HMS Cherenkov detector has pion threshold 3.8, which is not a good pion rejector. To select good electron sample, I use cernpe greater than 12.

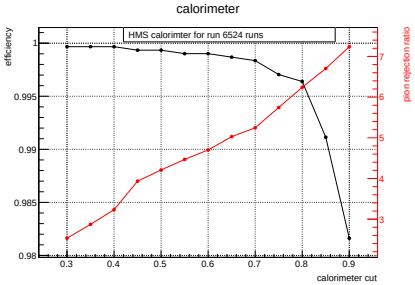
efficiency with cut

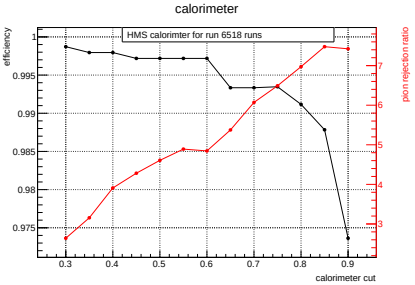


RunNumber 6524, in run group 360, momentum 4.736, neg

$$cal\_eff = \frac{e\_did[cer\_cut\&cal\_cuts]}{e\_sample[cer\_cut]}$$

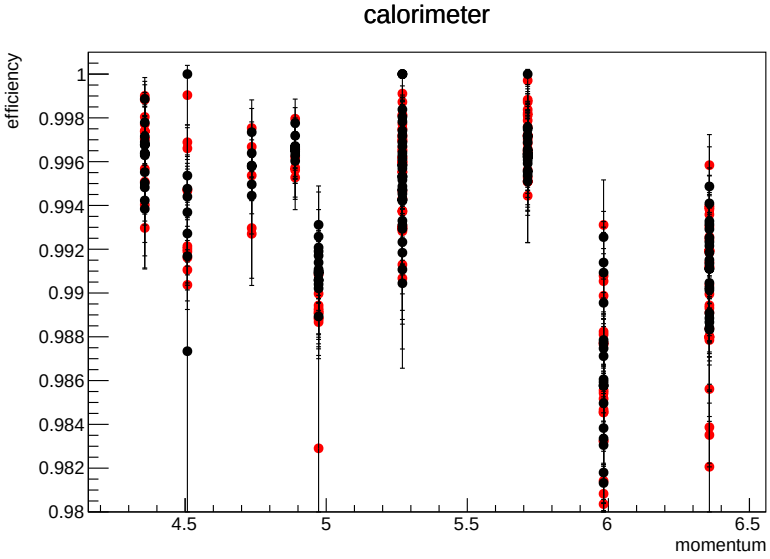
efficiency with cut



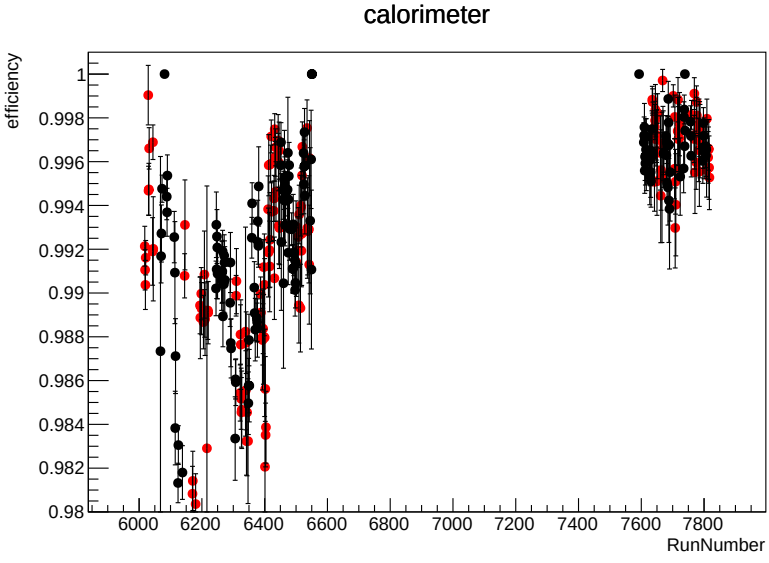


left is neg run 6524,right is pos run 6518, in run group 360, momentum 4.736

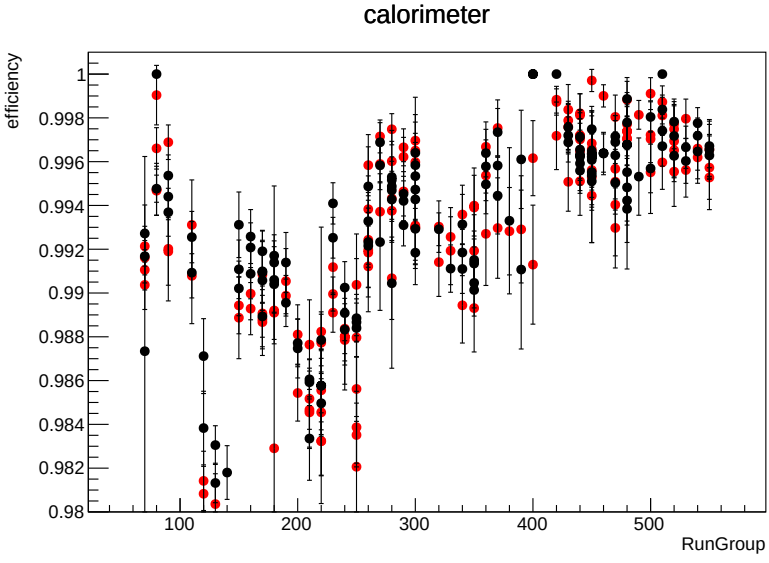
HMS Detector efficiency verse momentum



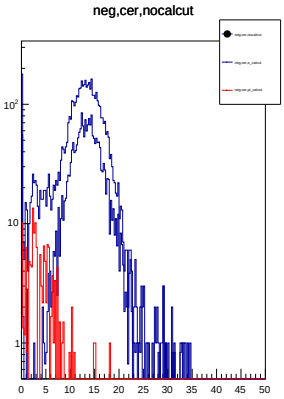
HMS Detector efficiency verse RunNumber

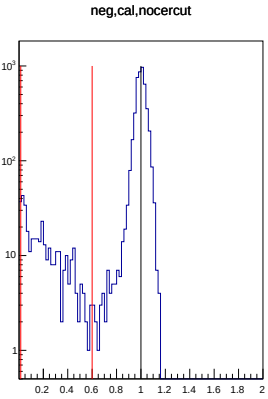


HMS Detector efficiency verse RunGroup



efficiency with cut

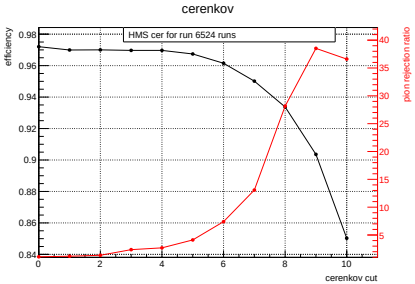


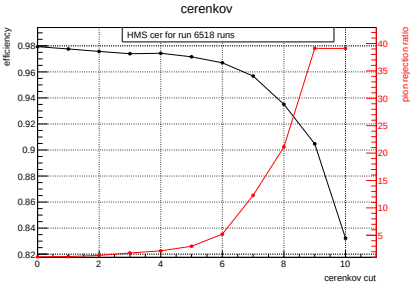


RunNumber 6524, in run group 360, momentum 4.736, neg, cal cut greater than 1

$$cer\_eff = \frac{e\_did[cal\_cuts\&cer\_cuts]}{e\_sample[cal\_cut]}$$

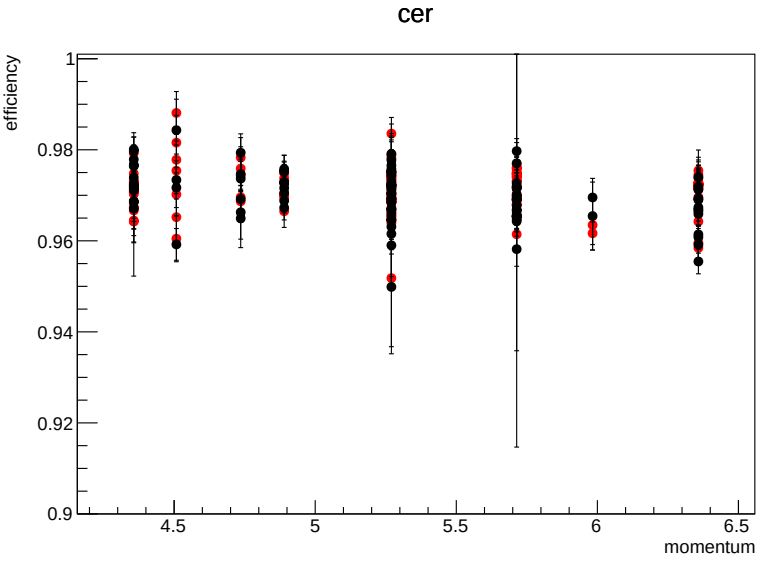
efficiency with cut



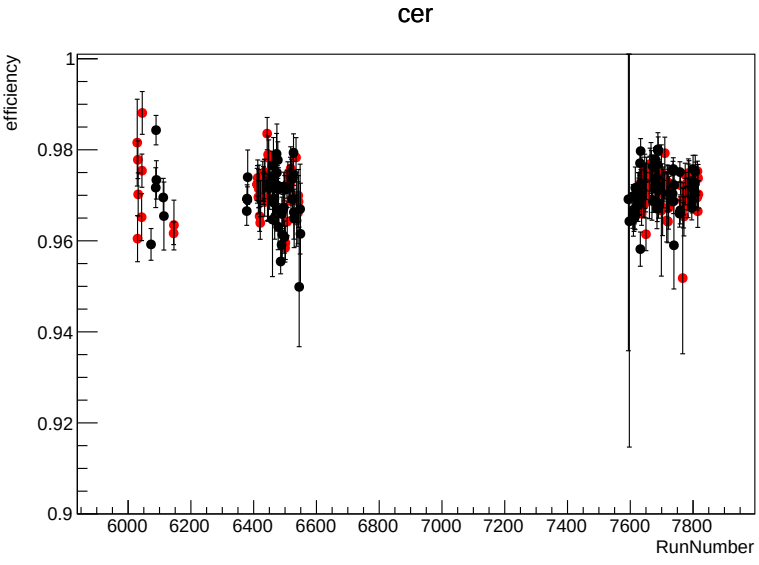


left is neg run 6524,right is pos run 6518, in run group 360, momentum 4.736

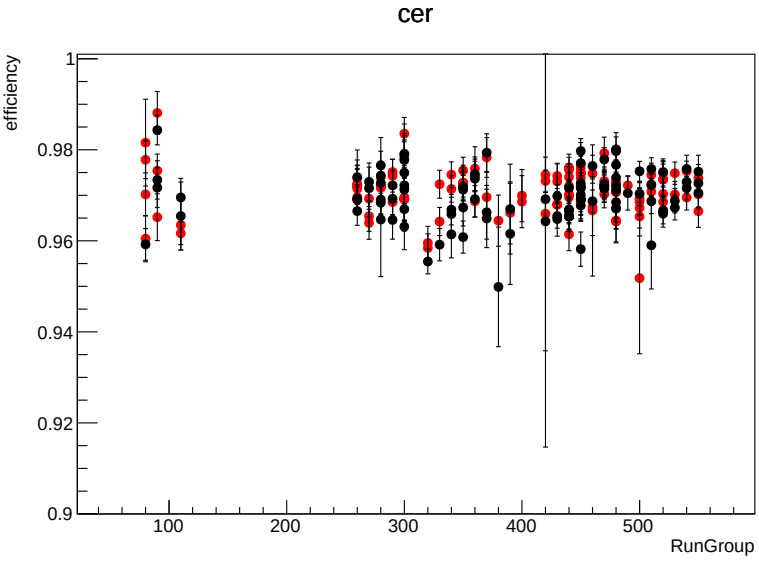
HMS Detector efficiency verse momentum



HMS Detector efficiency verse RunNumber



HMS Detector efficiency verse RunGroup



SHMS pion arm

Basic cuts

cointime:2.5(fall)/1.5(spring)
HMS(SHMS) delta:-8,8(-10,20)
HMS(SHMS) acceptance constrain
HMS e cut
accidental background: 6 peaks

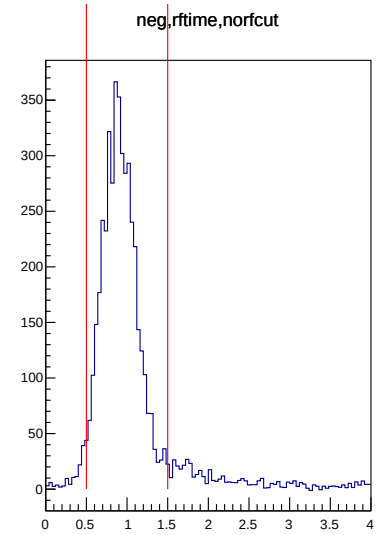
SHMS Calorimeter

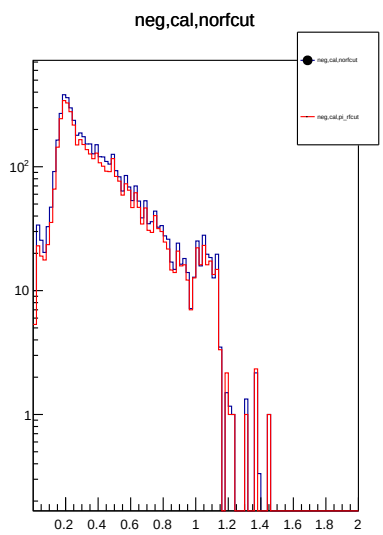
Aerogel Cherenkov cut: 2
rftime cut: 0.5,1.5
Calorimeter cut: varies

SHMS aerogel Cherenkov

Aerogel Cherenkov cut: varies
rftime cut: 0.5,1.5
Calorimeter cut: 0.05,0.85

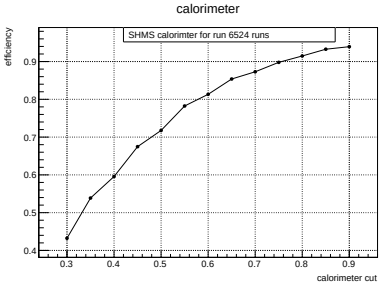
SHMS efficiency with cut

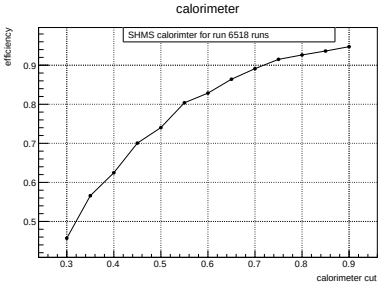




neg run 6524,in run group 360, momentum 4.736

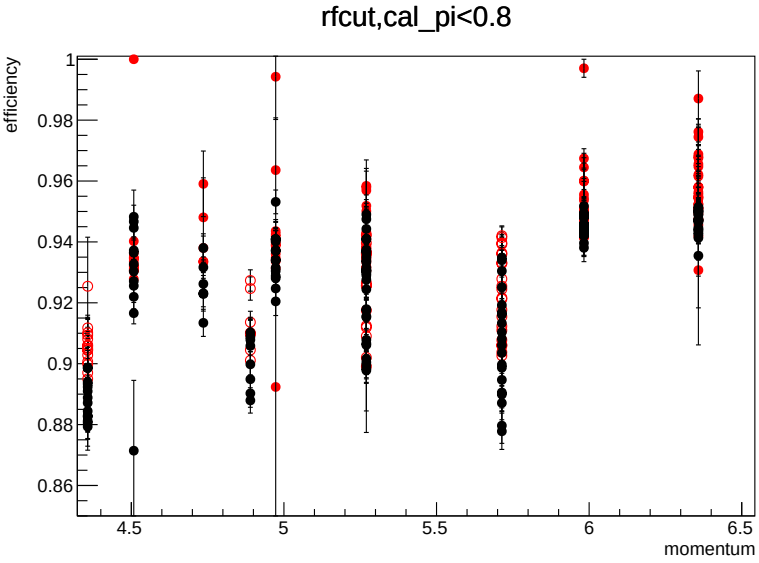
SHMS efficiency with cut



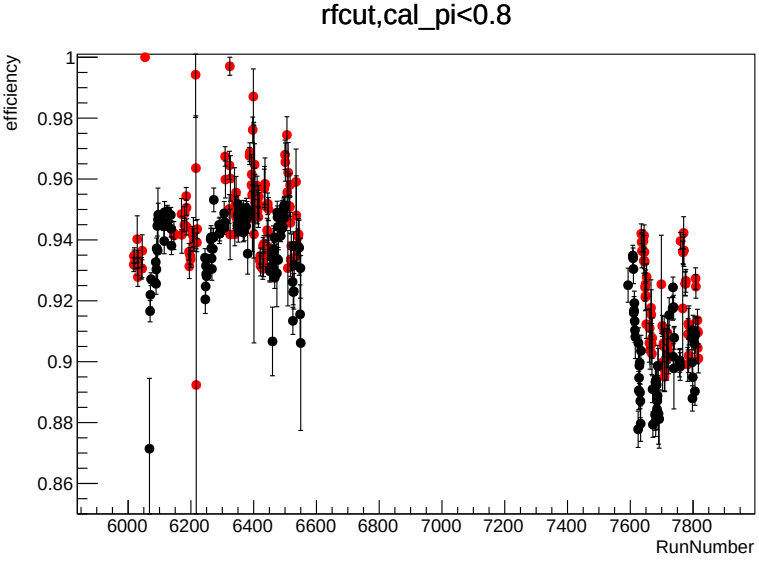


left is neg run 6524,right is pos run 6518, in run group 360, momentum 4.736

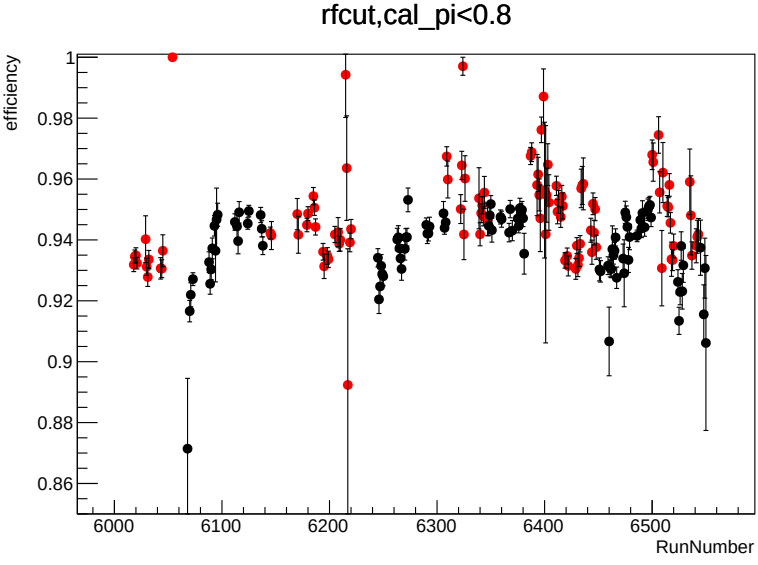
SHMS cal efficiency verse momentum



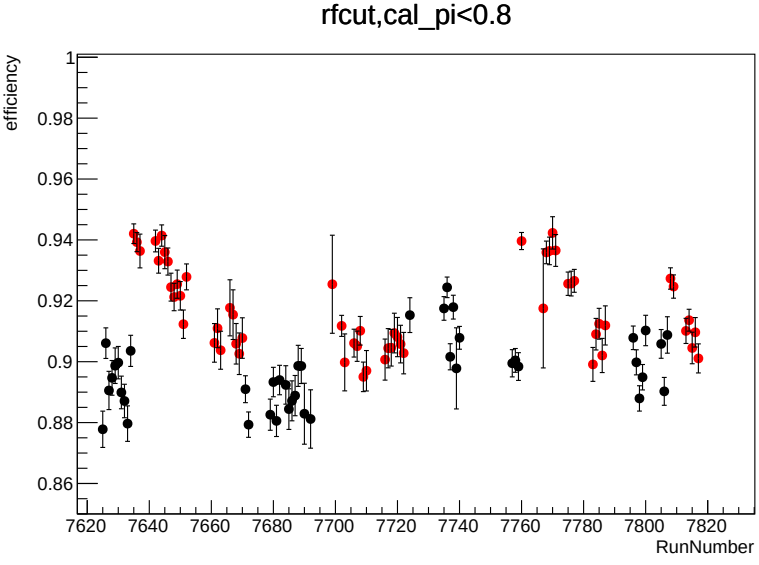
SHMS cal efficiency verse RunNumber



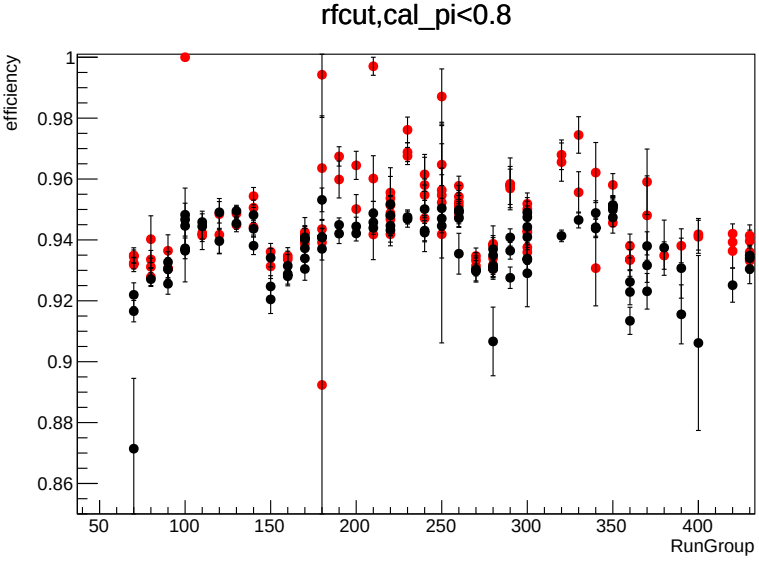
SHMS cal efficiency verse RunNumber



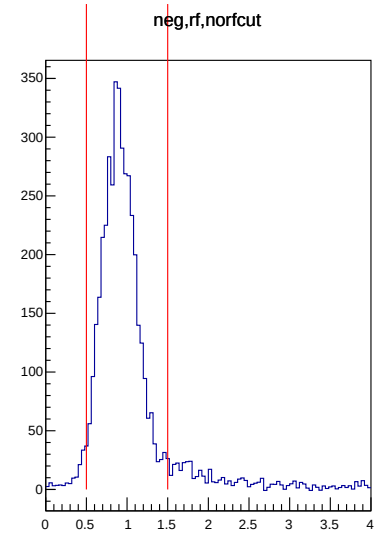
SHMS cal efficiency verse RunNumber

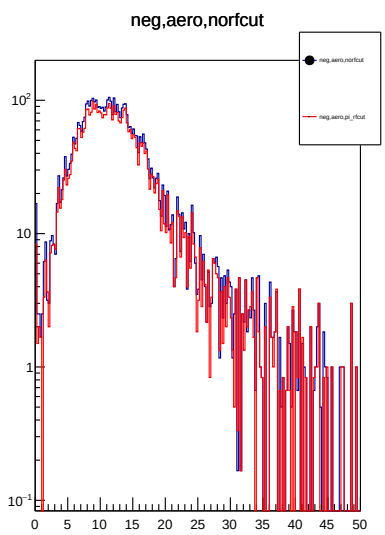


SHMS cal efficiency verse RunGroup



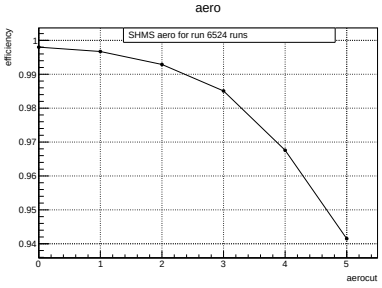
SHMS efficiency with cut

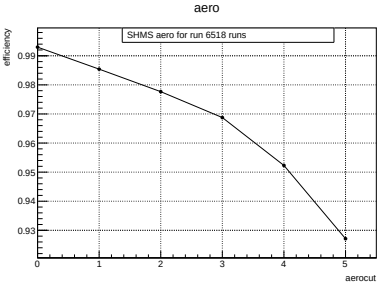




neg run 6524,in run group 360, momentum 4.736

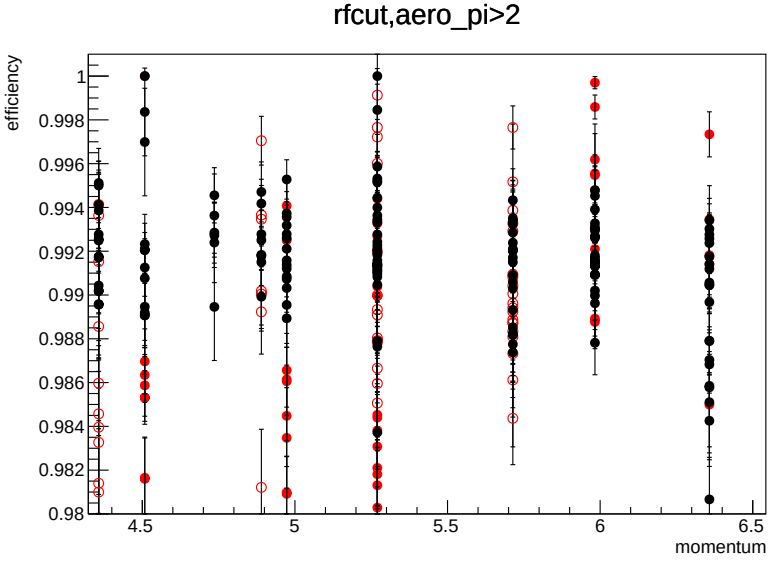
efficiency with cut



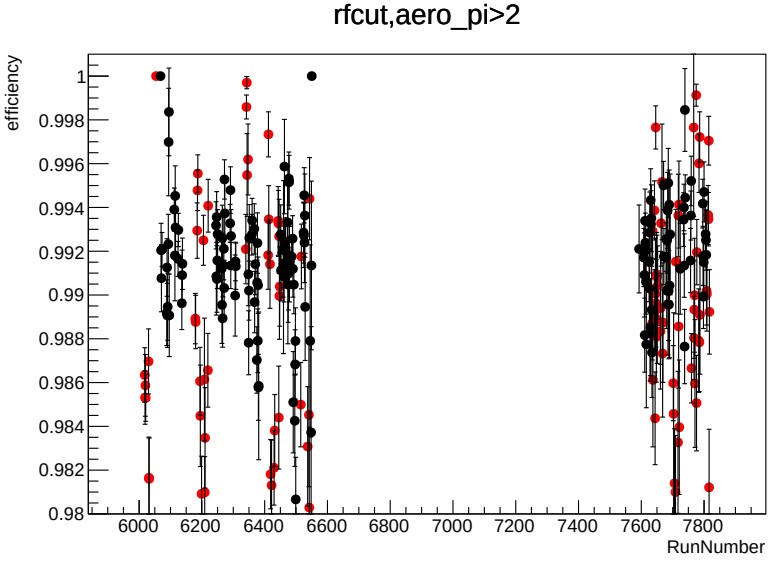


neg run 6524,in run group 360, momentum 4.736

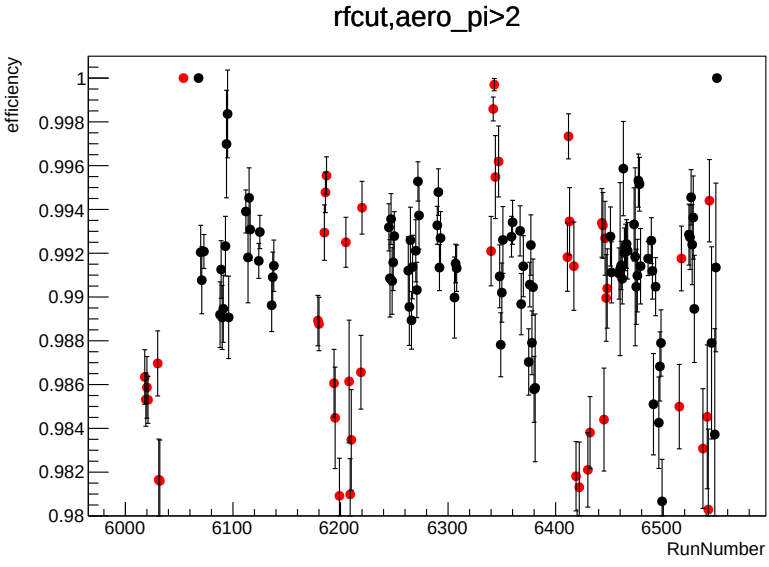
SHMS aero efficiency verse momentum



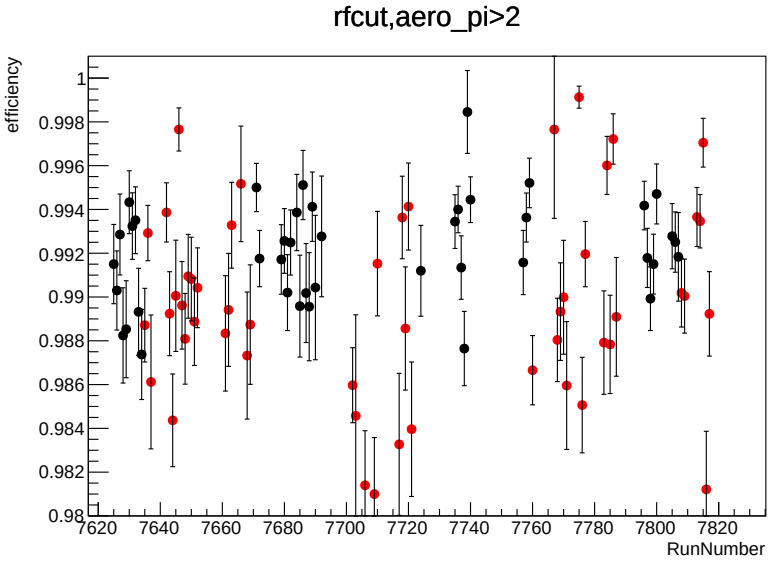
SHMS aero efficiency verse RunNumber



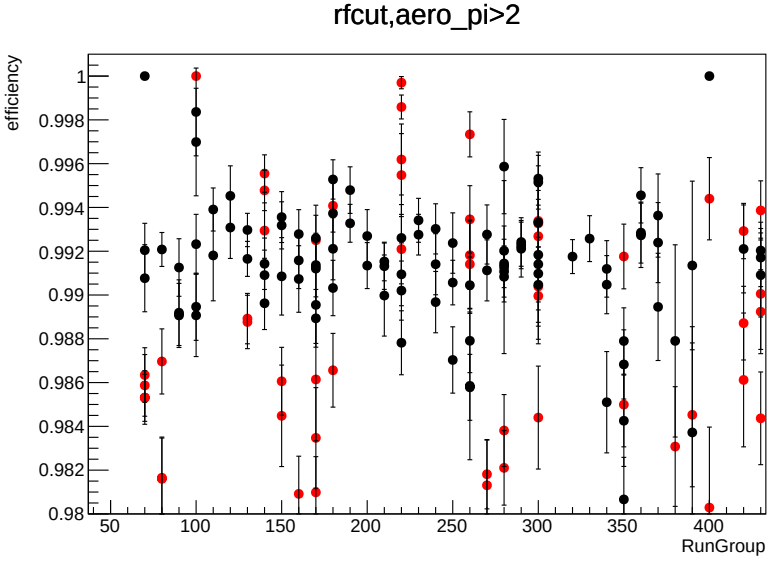
SHMS aero efficiency verse RunNumber



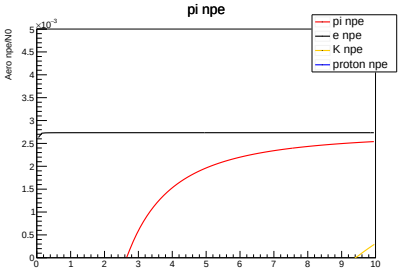
SHMS aero efficiency verse RunNumber



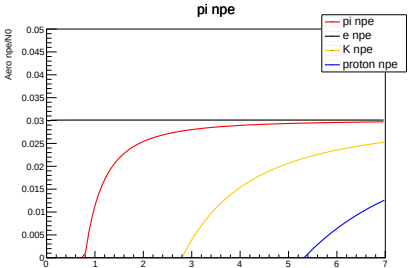
SHMS aero efficiency verse RunGroup



SHMS rftime cut, pion efficiency and kaon contamination



hgcer npe verse momentum



aero npe verse momentum

SHMS pion arm

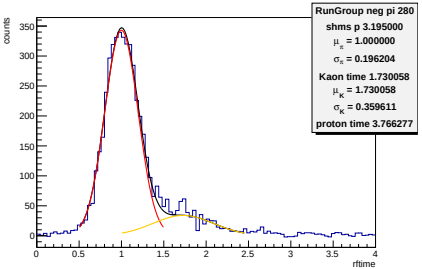
Basic cuts

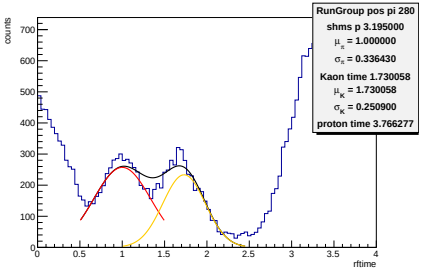
cointime:2.5(fall)/1.5(spring)
HMS(SHMS) delta:-8,8(-10,20)
HMS(SHMS) acceptance constrain
HMS e cut
accidental background: 6 peaks
Aerogel Cherenkov cut: 2
Calorimeter cut: 0.05,0.85

SHMS rftiming

0.5,1.5
-$3\sigma, 3\sigma$

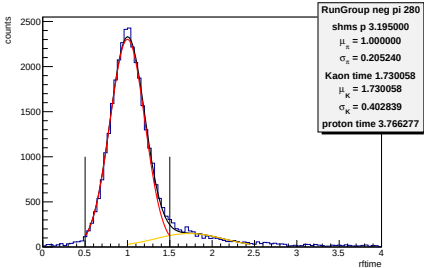
rf cut, pion efficiency and kaon contamination

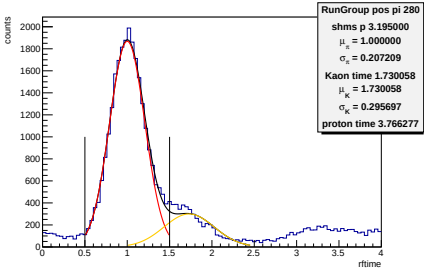




HGcer greater than 2. Cut pions to show kaons here.

rf cut, pion efficiency and kaon contamination

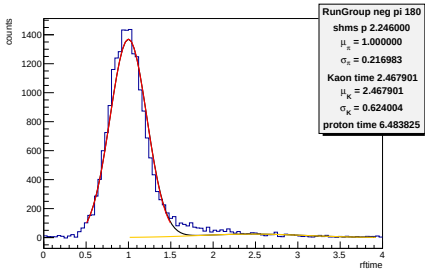


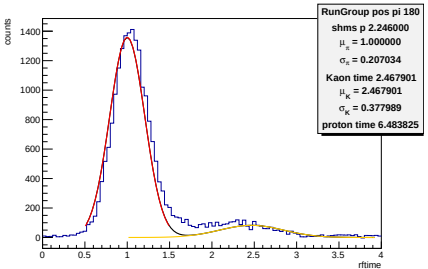


pi_eff from gaussian distribution

kaon con $= \frac{kaonfitintegral[rfcut]}{allfitintegral[rfcut]}$

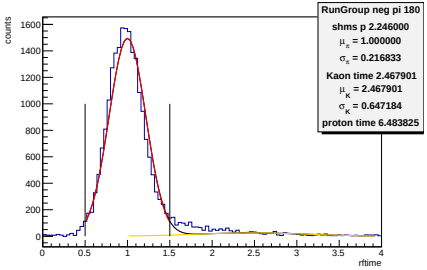
rf cut, pion efficiency and kaon contamination

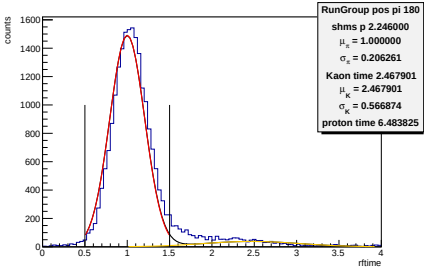




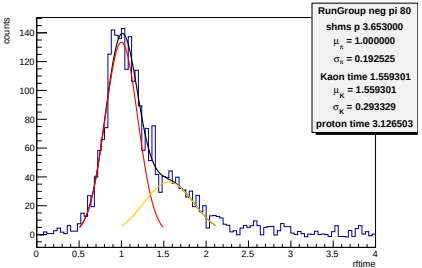
HGcer greater than 2. Cut pions to show kaons here.

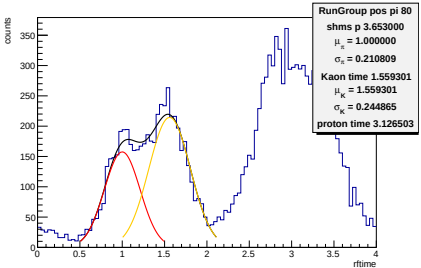
rf cut, pion efficiency and kaon contamination





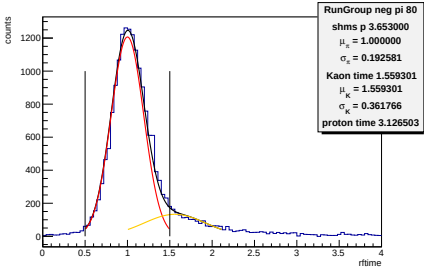
rf cut, pion efficiency and kaon contamination

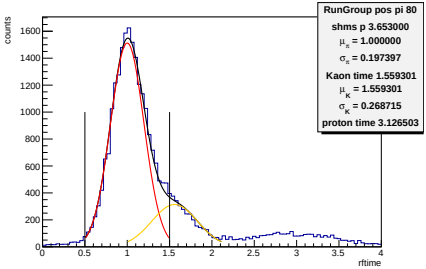


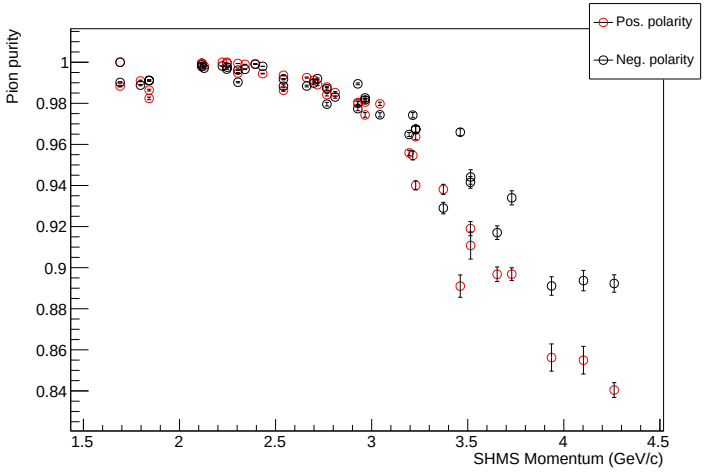


HGcer greater than 2. Cut pions to show kaons here.

rf cut, pion efficiency and kaon contamination



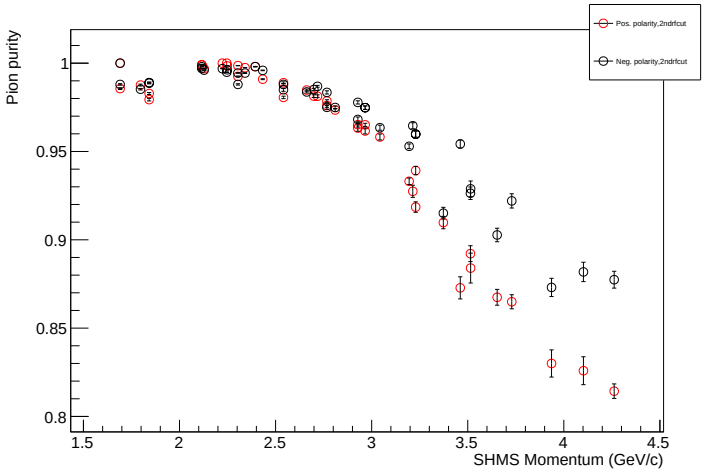




pion eff from gaussian fit sigma estimate

kaon con $= \frac{kaonfit[newrfcut]}{allfit[newrfcut]}$

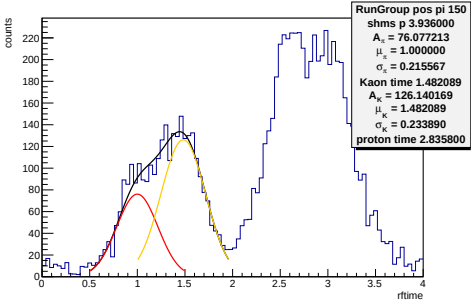
What if I use 3 sigma cut on pi fit

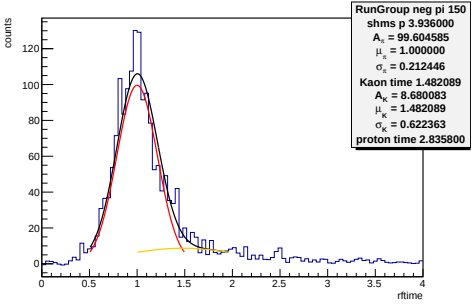


pion eff $= 99.7$

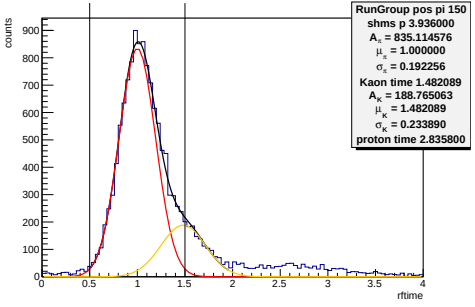
kaon con $= \frac{kaonfit[newrfcut]}{allfit[newrfcut]}$

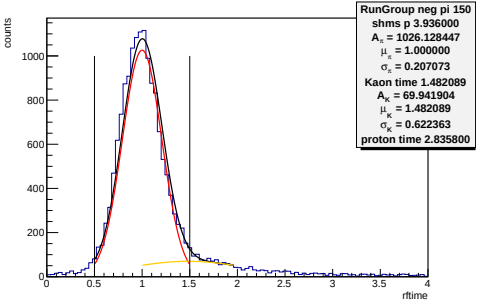
150, SHMS momentum 3.936



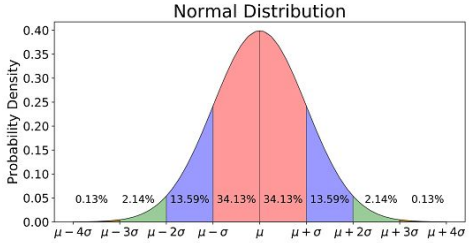


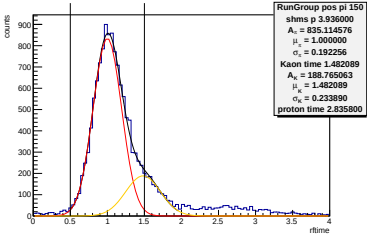
150, SHMS momentum 3.936





Some definition





pion efficiency $= \frac{pionfit[rfcut]}{pionfit[allrange]}$

Kaon con. $= \frac{kaonfit[rfcut]}{pionfit[rfcut]}$

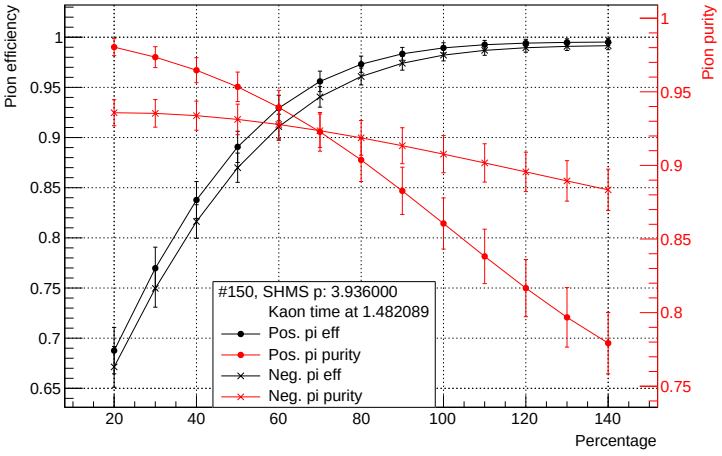
error $= \sqrt{\frac{p(1-p)}{N}}$

For different rf timing cut,

percentage: 1+(Kpeak - Pipeak)*percentage

eg. pion peak at 1, kaon peak at 1.6, then percentage 80 means (1.6-1)*80%+1 = 1.48, rf right hand side cut is at 1.48

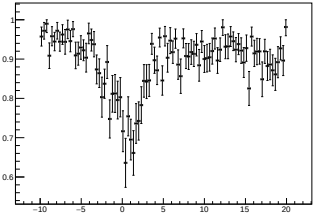
150, SHMS momentum 3.936



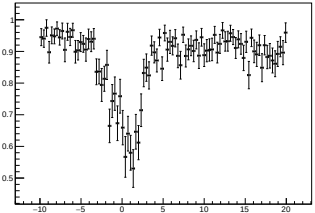
pion purity = 1-kaon con.

150, SHMS momentum3.936

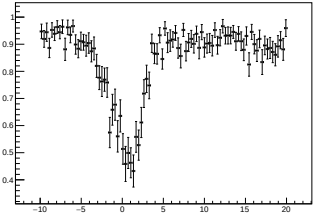
HGC cut 0



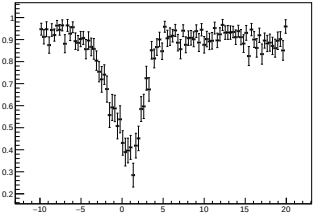
HGC cut 1



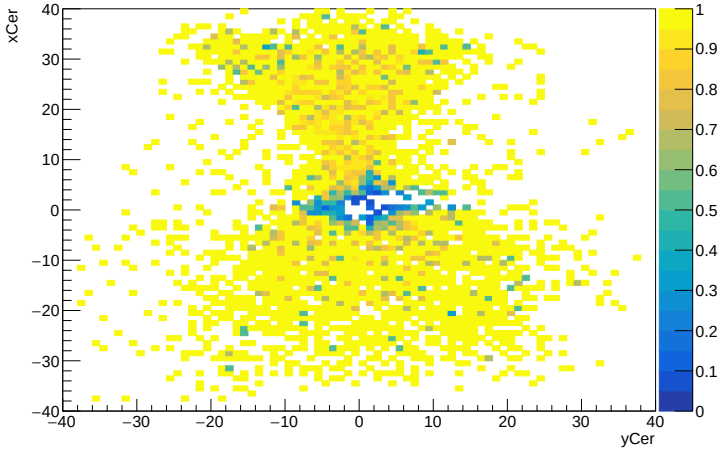
HGC cut 2



HGC cut 3



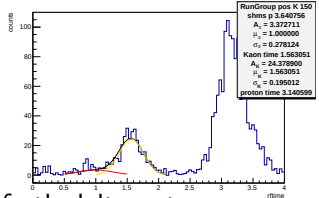
150, SHMS momentum 3.936



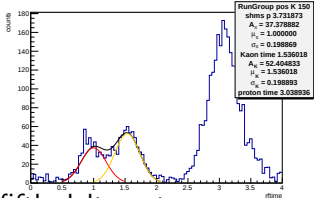
150, SHMS momentum 3.936

HGC less than 2, no aero cut

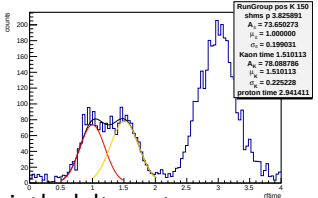
first delta cut



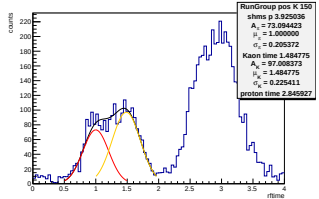
second delta cut



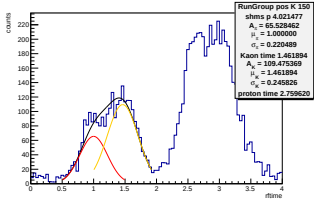
delta cut



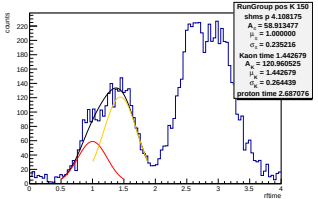
forth delta cut



fifth delta cut



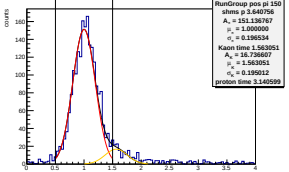
sixth delta cut



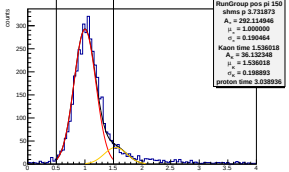
150,SHMS momentum 3.936

No HGC cut, aero greater than 4

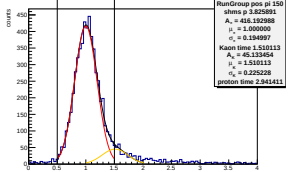
first delta cut



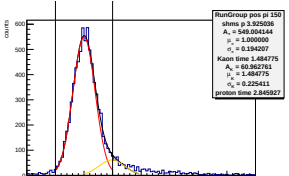
second delta cut



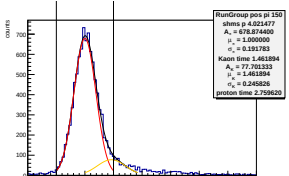
third delta cut



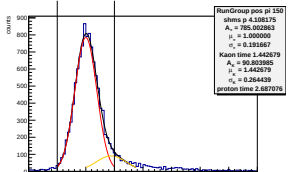
forth delta cut



fifth delta cut



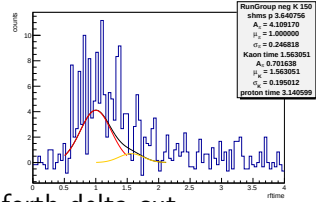
sixth delta cut



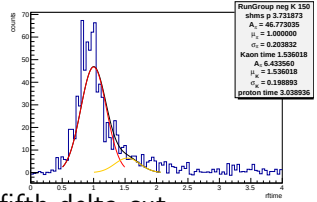
150, SHMS momentum 3.936

HGC less than 2, no aero cut

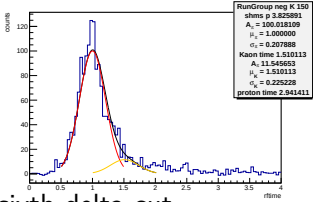
first delta cut



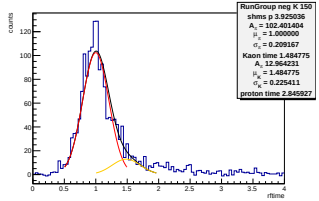
second delta cut



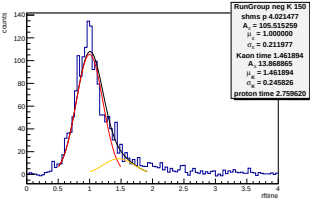
delta cut



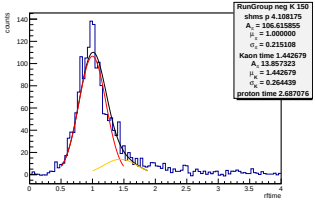
forth delta cut



fifth delta cut



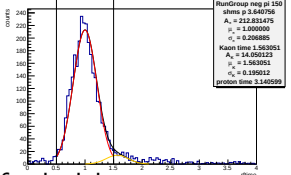
sixth delta cut



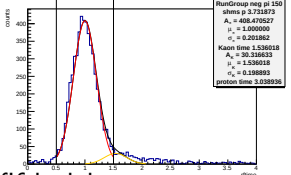
150,SHMS momentum 3.936

No HGC cut, aero greater than 4

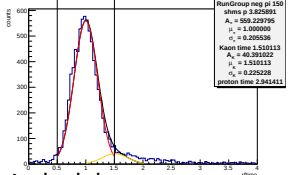
first delta cut



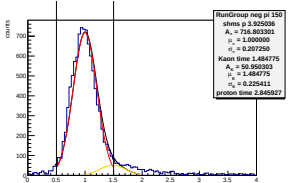
second delta cut



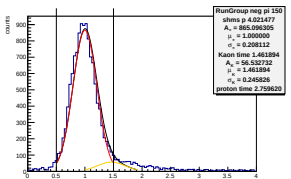
third delta cut



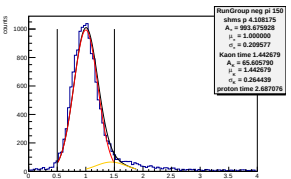
forth delta cut



fifth delta cut

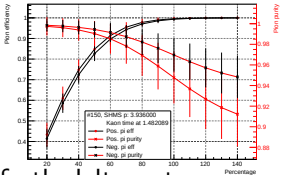


sixth delta cut

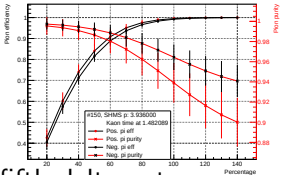


150,SHMS momentum 3.936

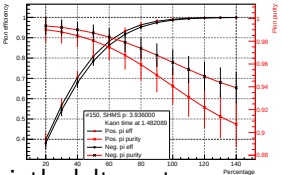
first delta cut



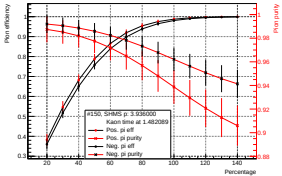
second delta cut



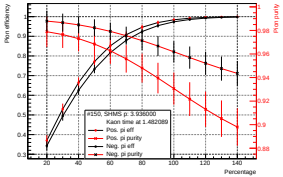
third delta cut



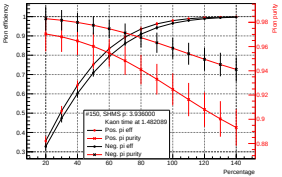
forth delta cut



fifth delta cut



sixth delta cut

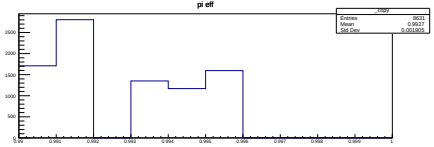


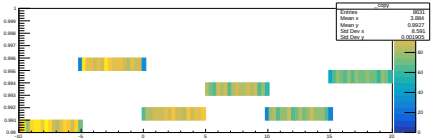
How to use it

- less than 2.9, use pion eff, pion purity is 1
- 2.9 to 3.9, use percentage where pi eff converge, 99%

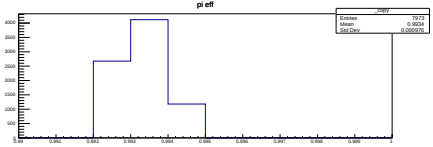
How to apply the eff and purity?
I'm thinking of add two branches on my data, so for an event with different delta, it will have an pi eff and pi purity. That branches can be used as weighting

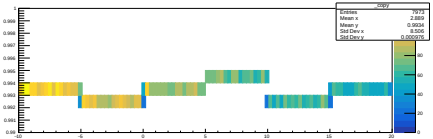
pos. pi eff.



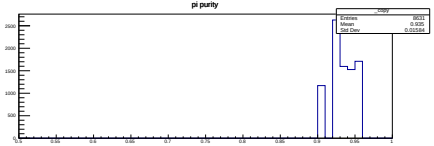


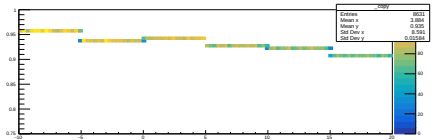
neg. pi eff.



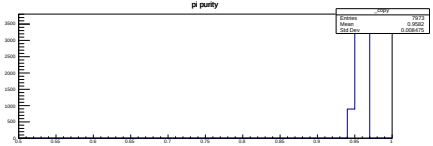


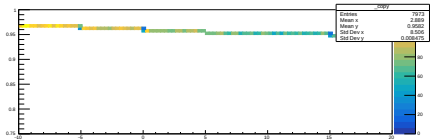
pos. pi purity.





neg. pi purity.





backup