Cherenkov Analysis

Analysis Workshop

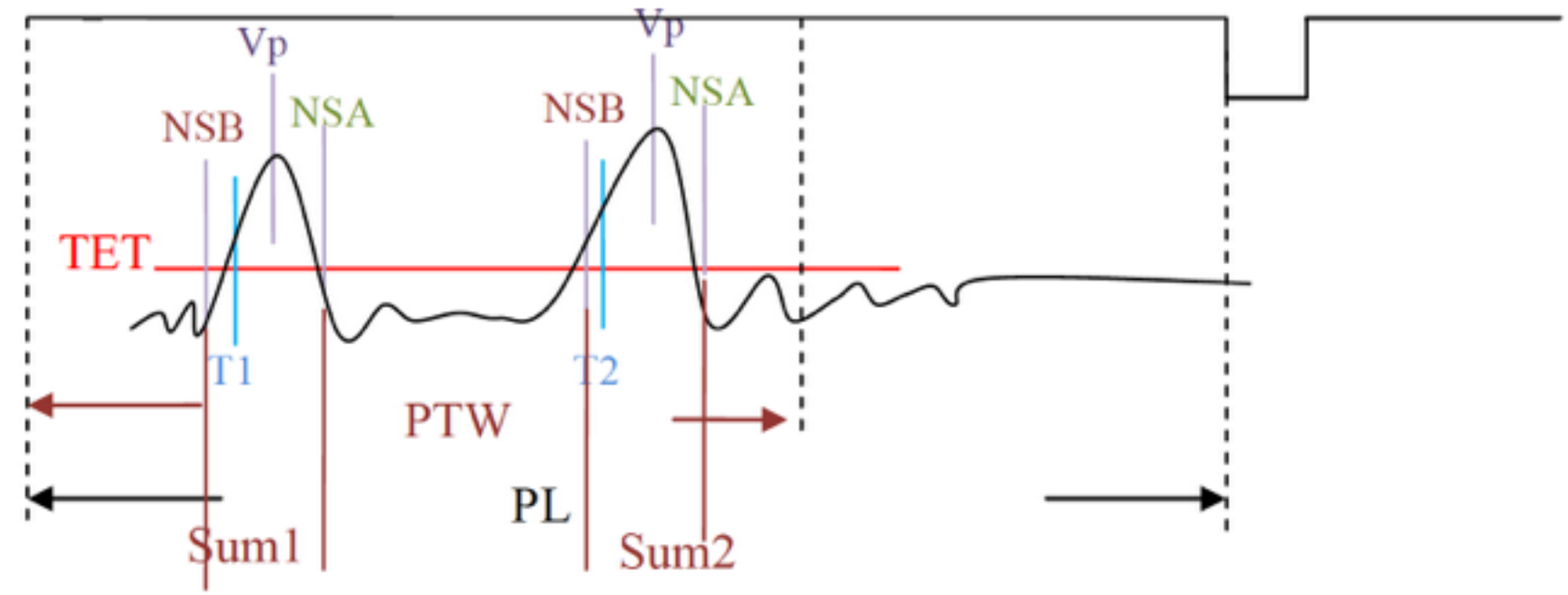
Abel Sun

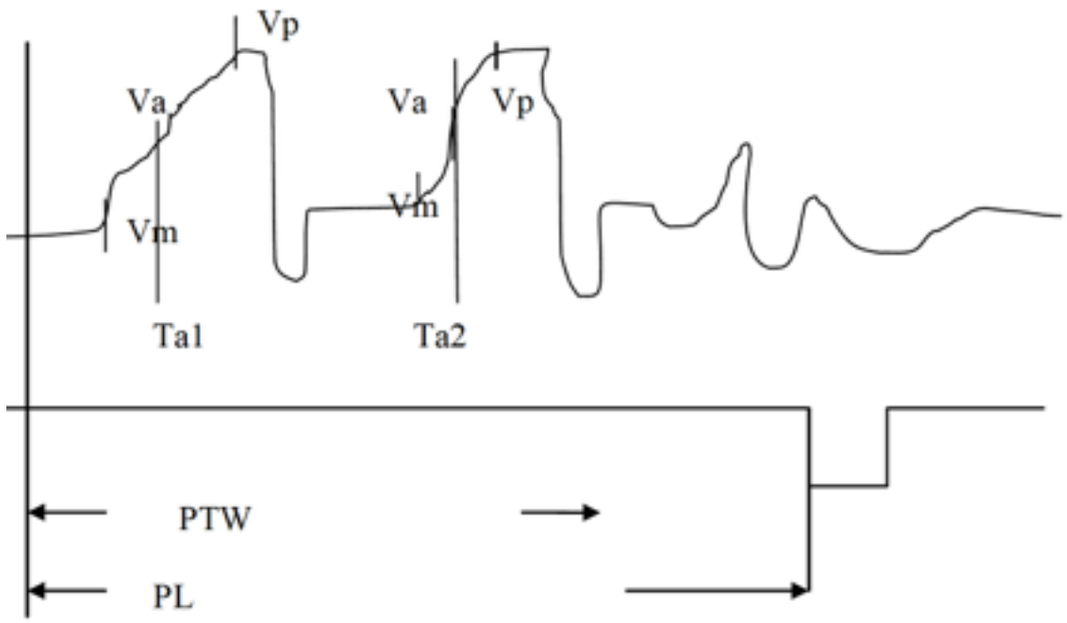
2018.6.26

- SHMS HGC, NGC time window cuts
- SHMS NGC calibration constants
- HMS Cherenkov efficiency correction

SHMS Cherenkov time window cuts

➢ Using multi-hit flash ADC. Flash ADC can give multiple ADC pulse sums and time in ADC channel per event.



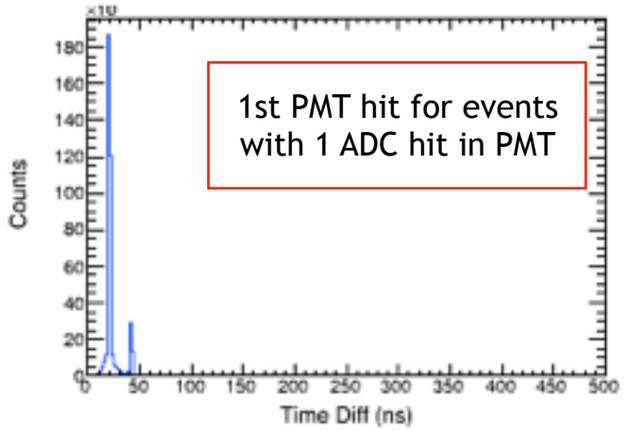


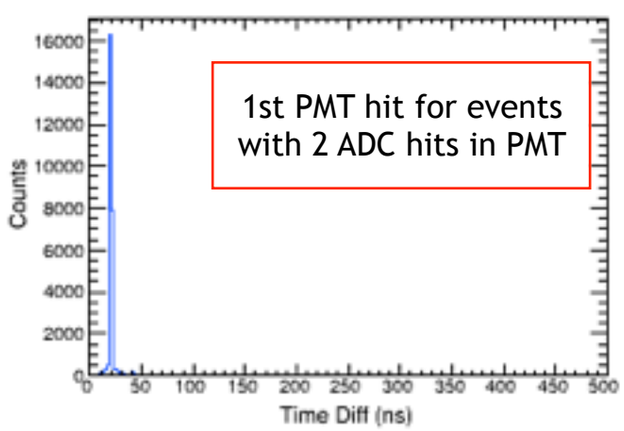
Time measured by fADC is the time for the pulse to reach a voltage above pedestal that is half way (Va) between the minimum voltage above pedestal and the maximum. The time is time of the coarse 4 ns bin of Va and an interpolation (in 62.5 ps bin) to the next coarse 4 ns bin relative to the start of the pulse lookup window.

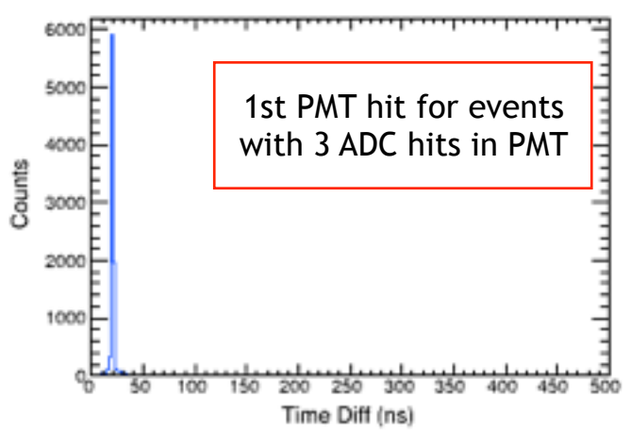
SHMS Cherenkov time window cuts

➢ Heavy Gas Cherenkov

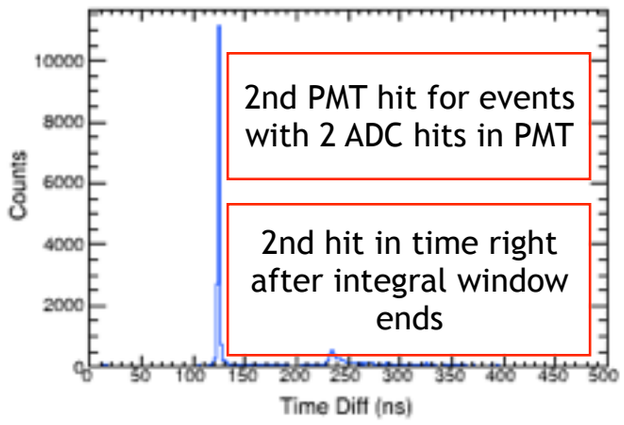
➢ Event selection: H.cal.etracknorm>0.1

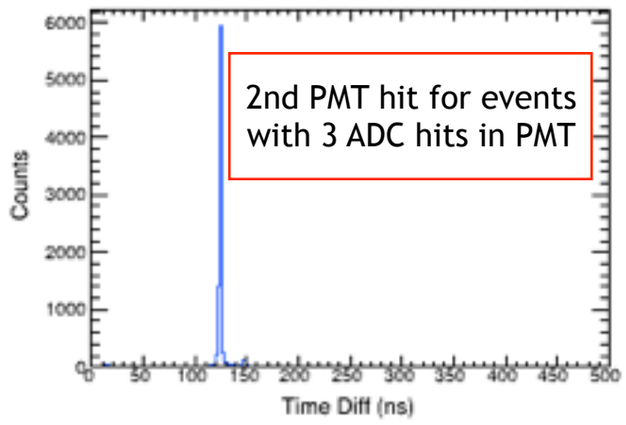




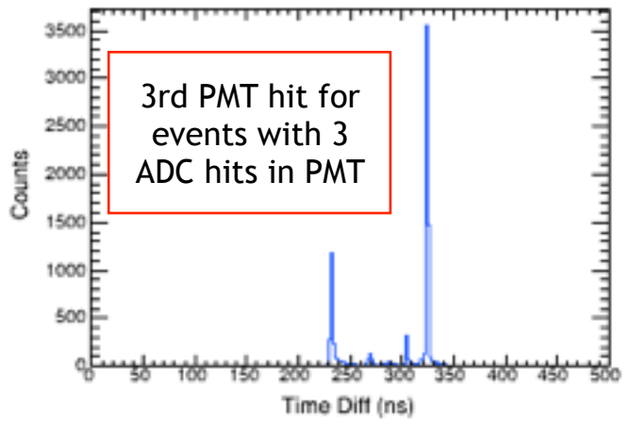


time diff= P.hgcer.adcPulseTime - P.hod.starttime



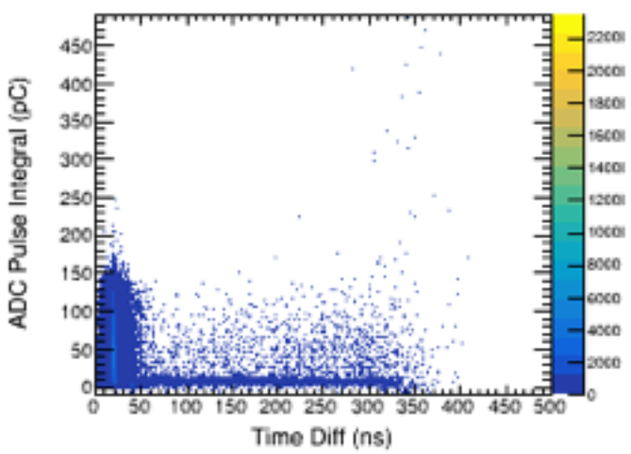


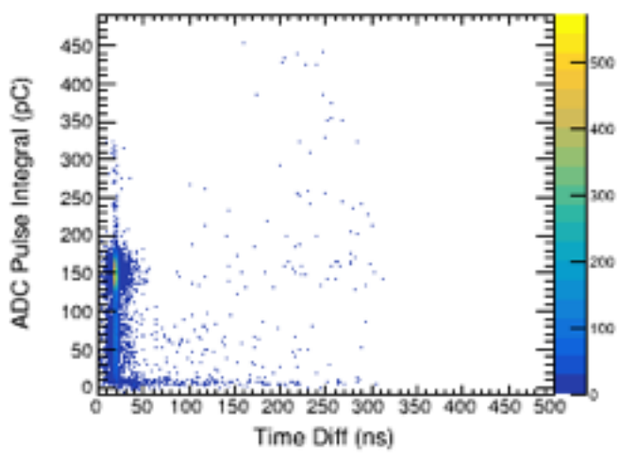
➢ Number of 2-hit events is ~10% of 1-hit events

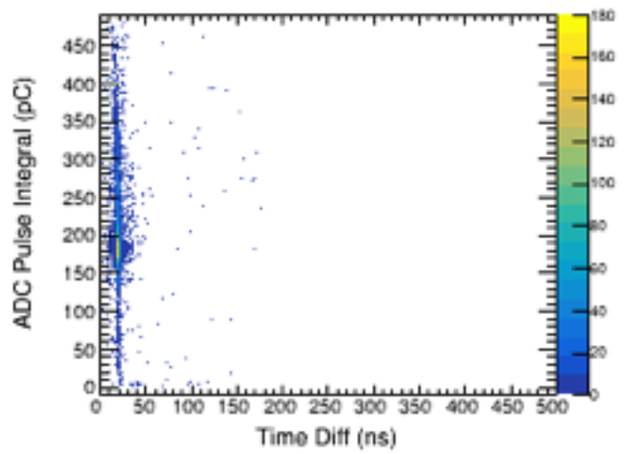


SHMS Cherenkov time window cuts

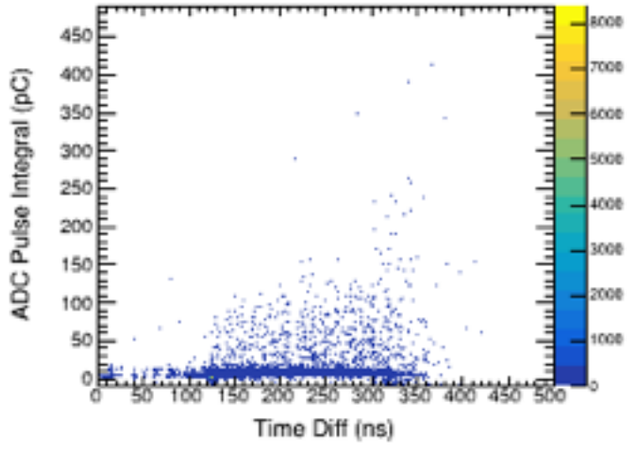
➢ Heavy Gas Cherenkov

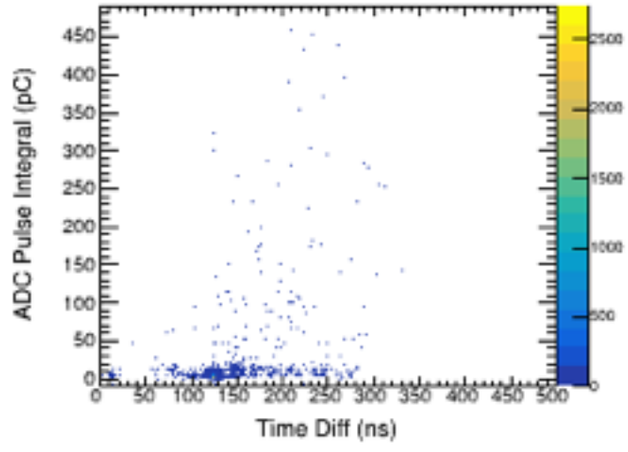






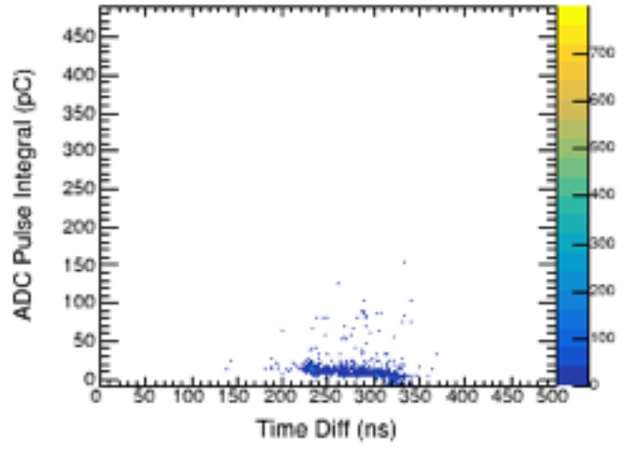
ADC pulse integral has the pedestal subtracted





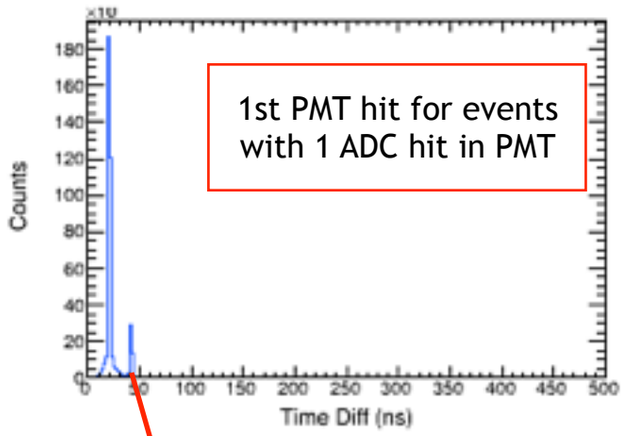
➢ Number of 2-hit events is ~10% of 1-hit events

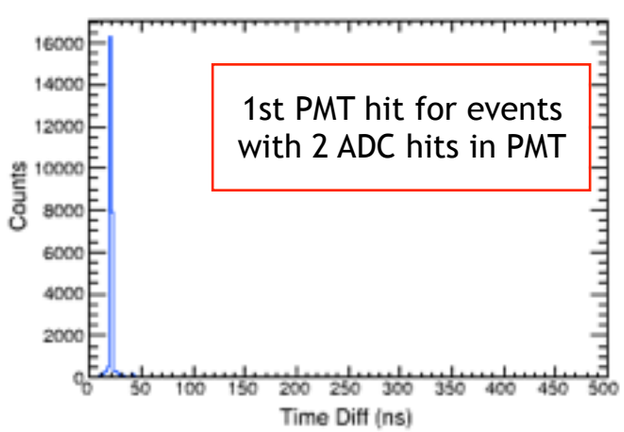
➢ Large number of ADC hits in PMT per event
correlated with one large pulse ADC.
Could come from reflection or ringing in the signals.

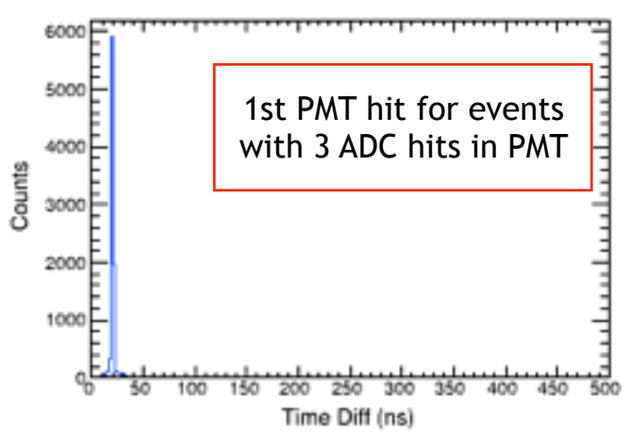


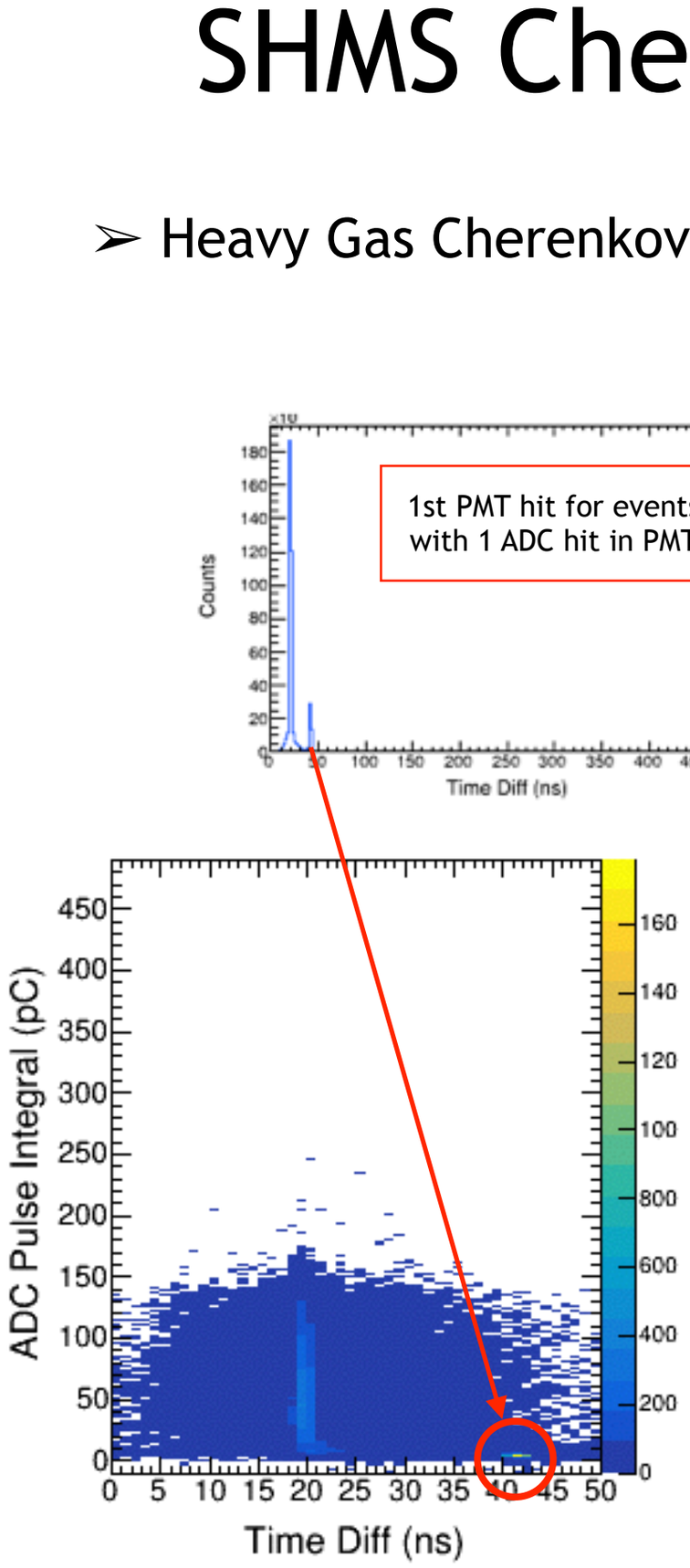
SHMS Cherenkov time window cuts

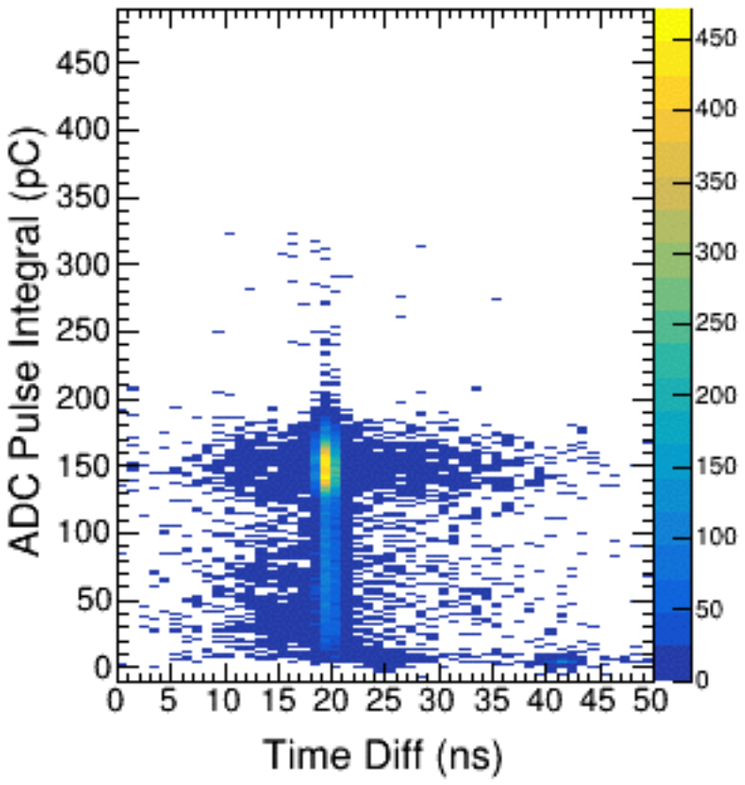
➢ Heavy Gas Cherenkov

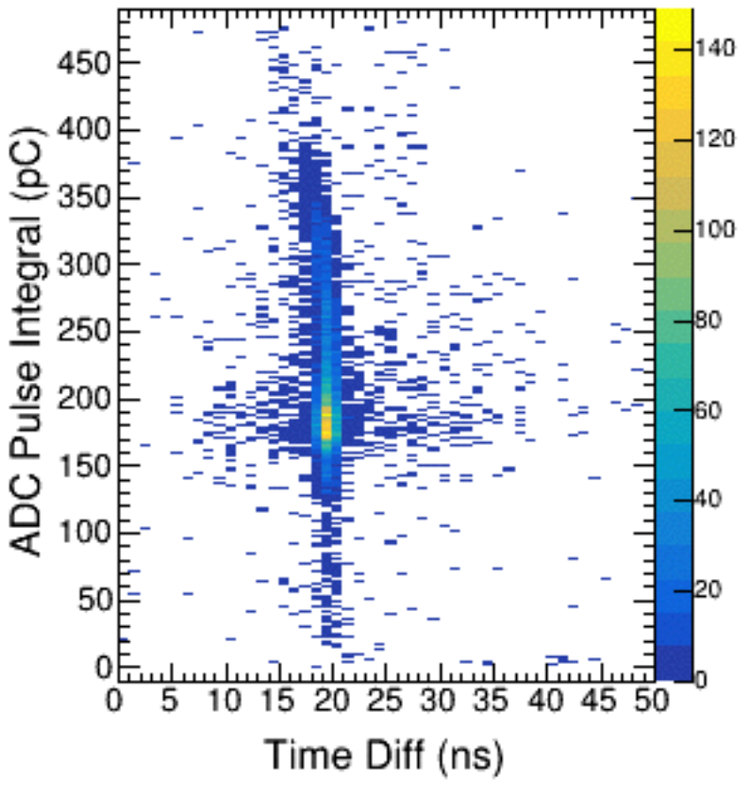








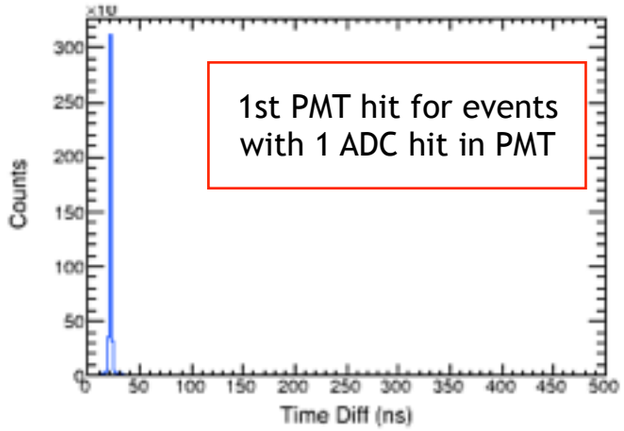


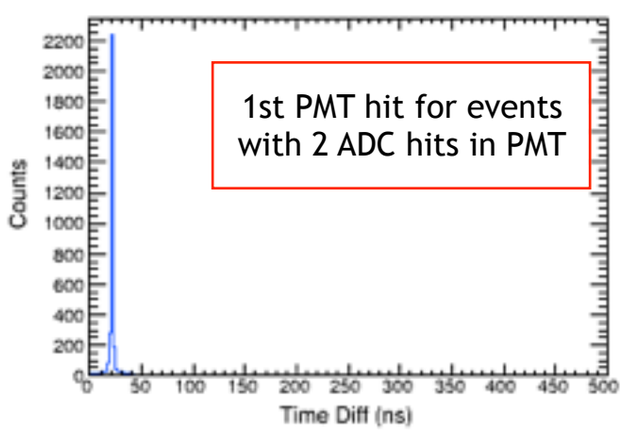


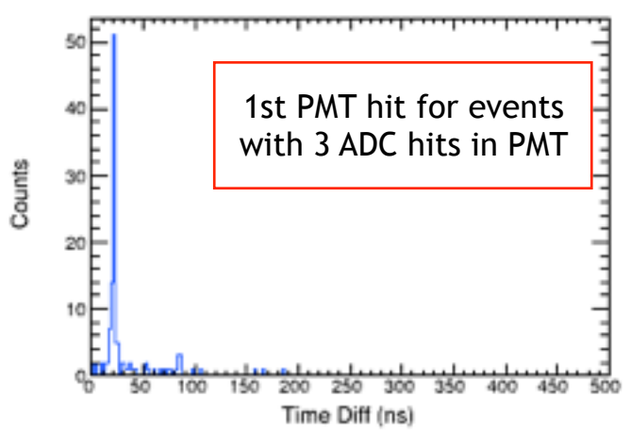
SHMS Cherenkov time window cuts

➢ Noble Gas Cherenkov

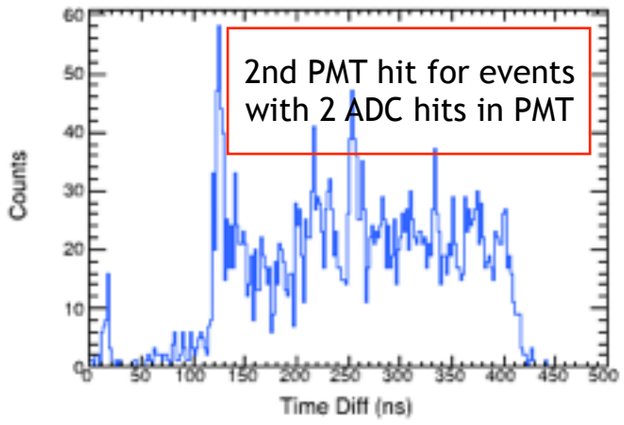
➢ Event selection: H.cal.etracknorm>0.1

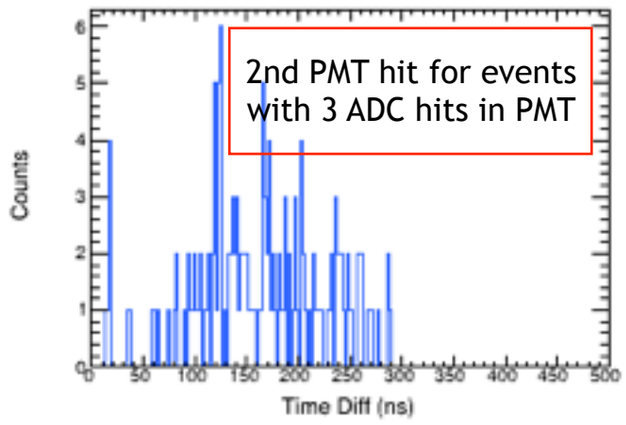




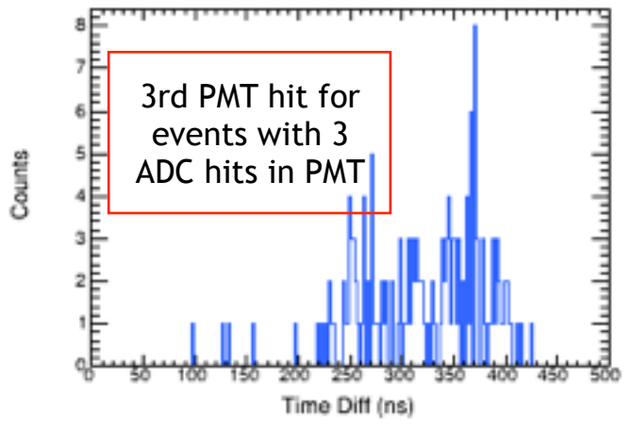


time diff= P.ngcer.adcPulseTime - P.hod.starttime



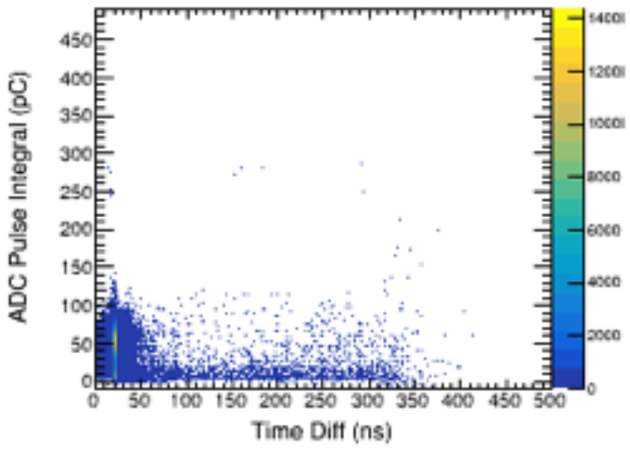


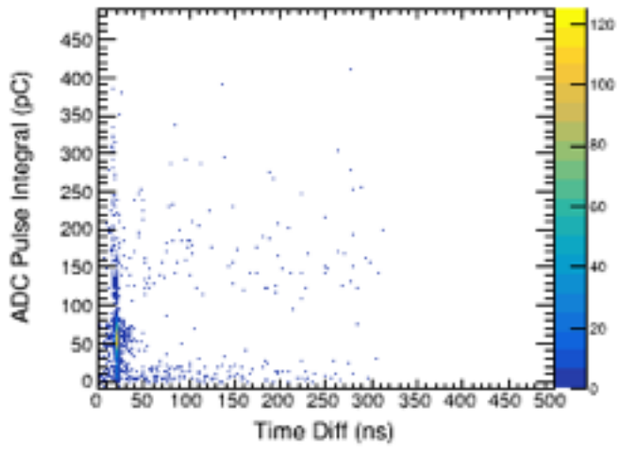
➢ Multi-hit events are less than ~1% of 1-hit events

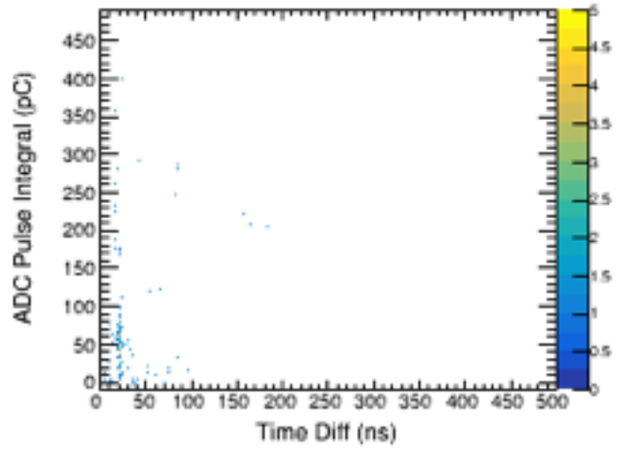


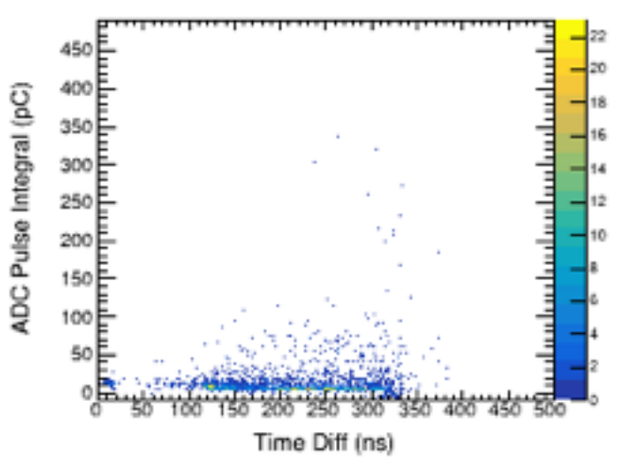
SHMS Cherenkov time window cuts

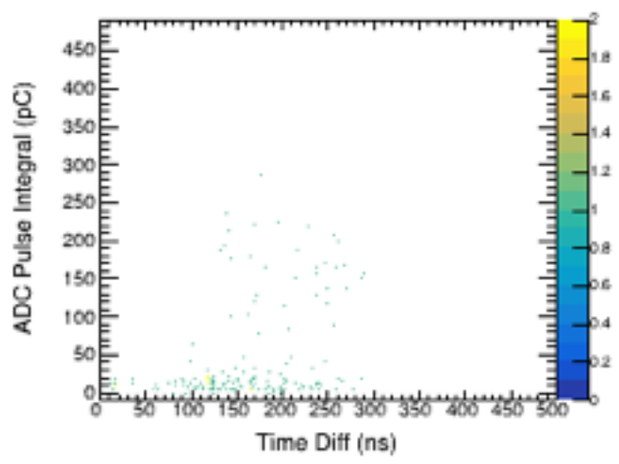
➢ Noble Gas Cherenkov





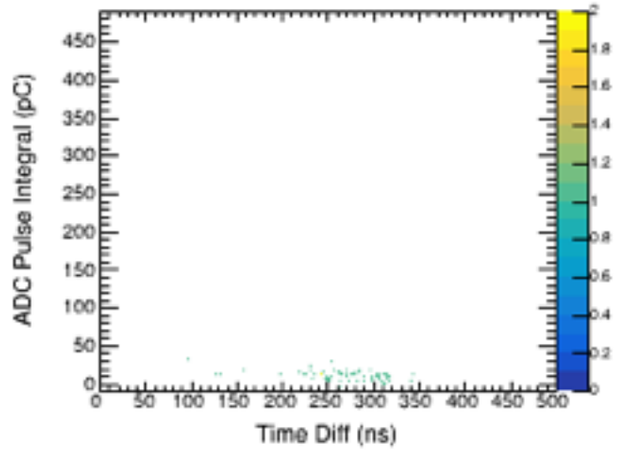






➢ Multi-hit events are less than ~1% of 1-hit events

➢ Multiple ADC hits for PMT due to random noise within fADC pulse window.



SHMS Cherenkov time window cuts

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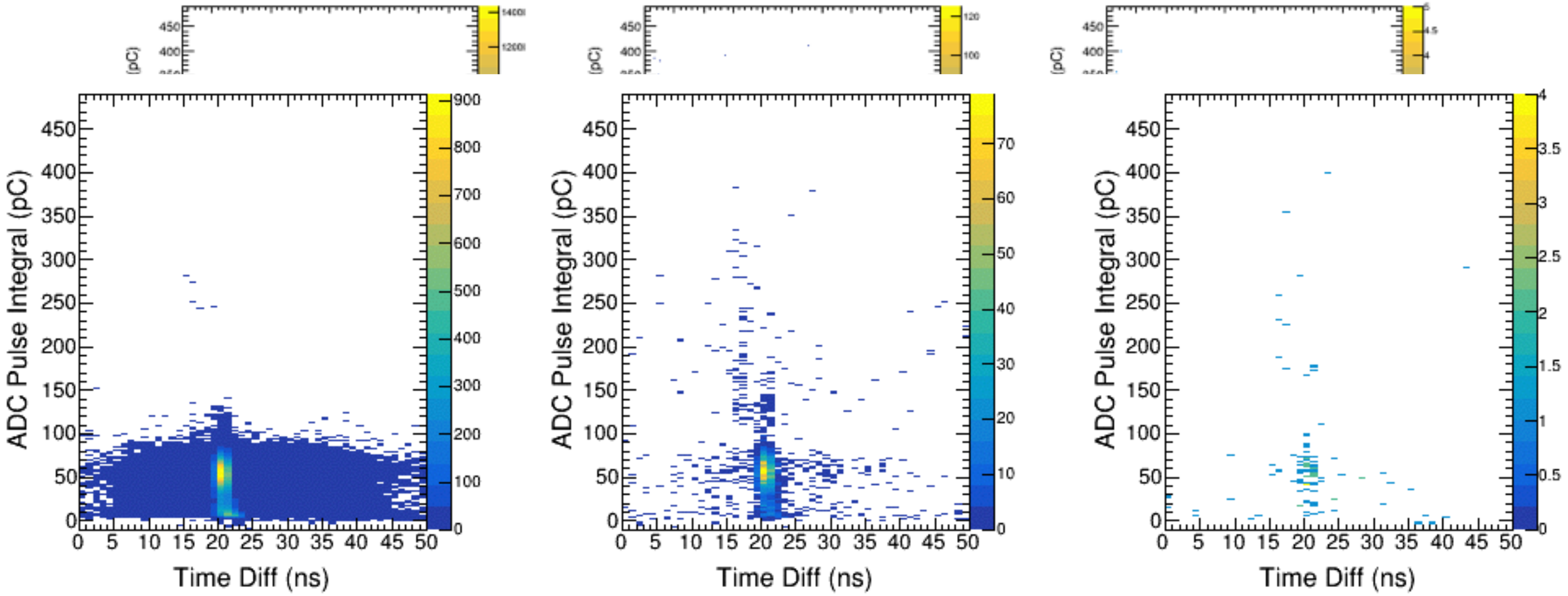

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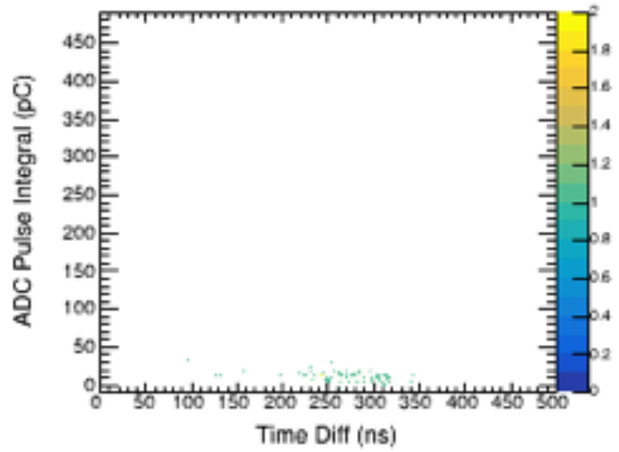
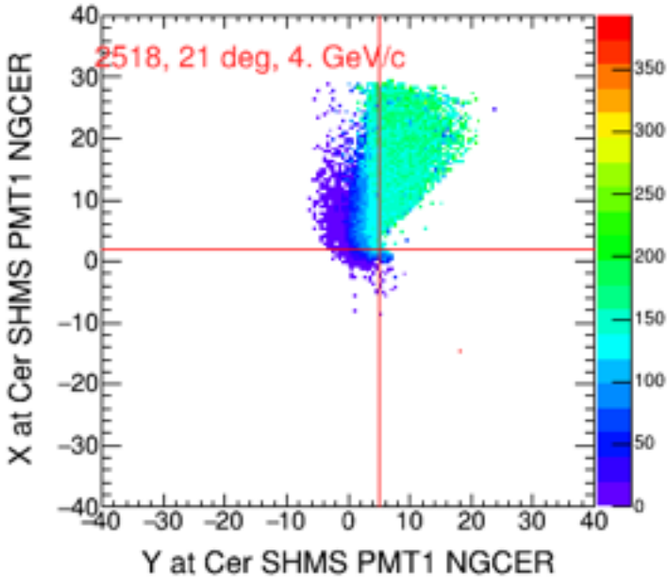
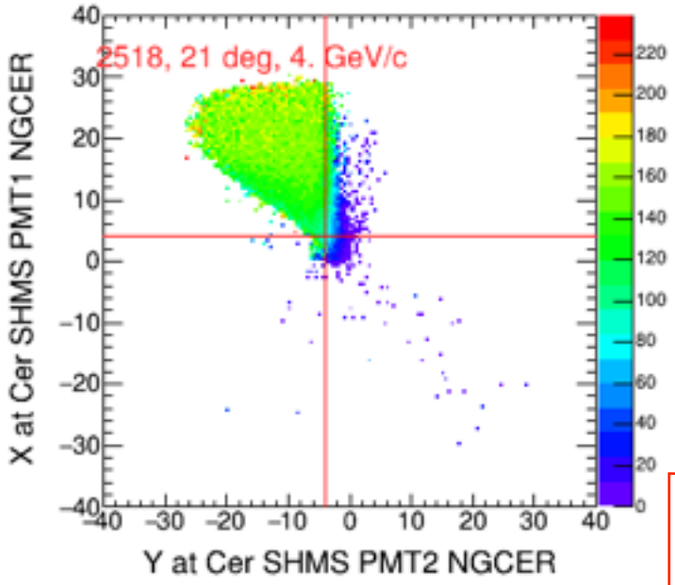


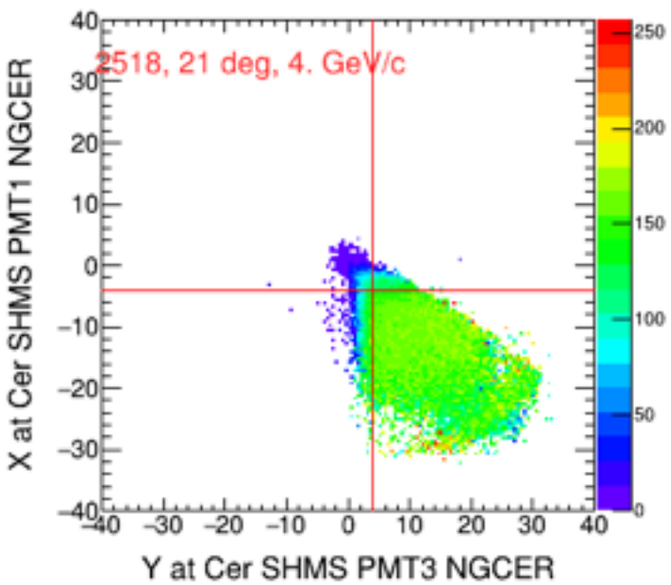
SHMS NGC calibration constants

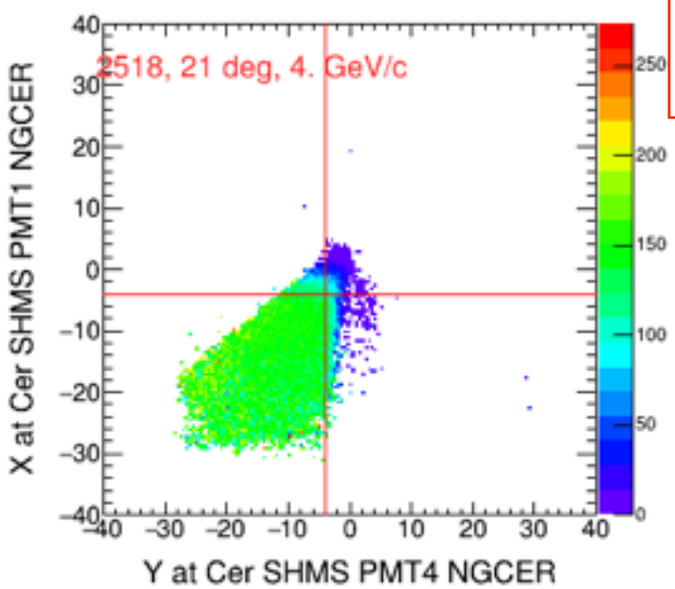
➢ Parameters go to PARAM/SHMS/NGCER/CALIB/pngcer_calib.param

➢ Event selection: 0.9 < P.cal.etracknorm < 1.5, -10 < P.gtr.dp < 22









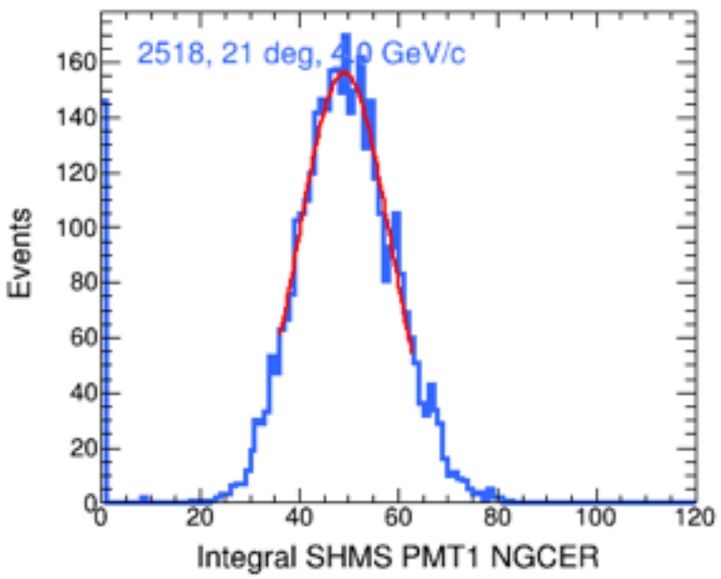
➢ cut off low amplitude region

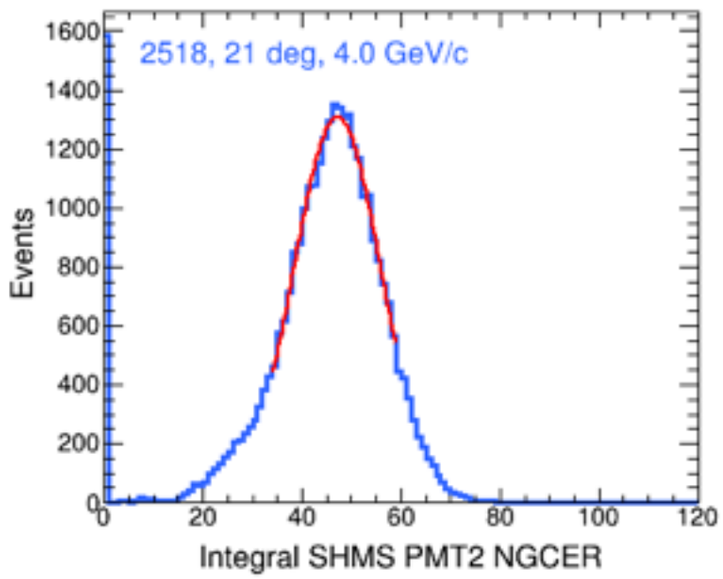
xcut = [2,4,4,4] (in cm)
ycut = [5,4,4,4] (in cm)

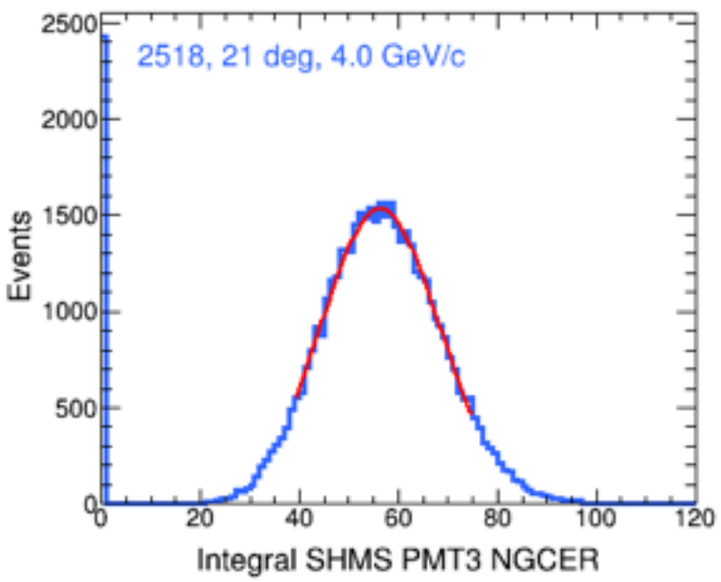
event in one PMT requires pulse integral from other PMTs to be less than 1 (PulseInt<1)

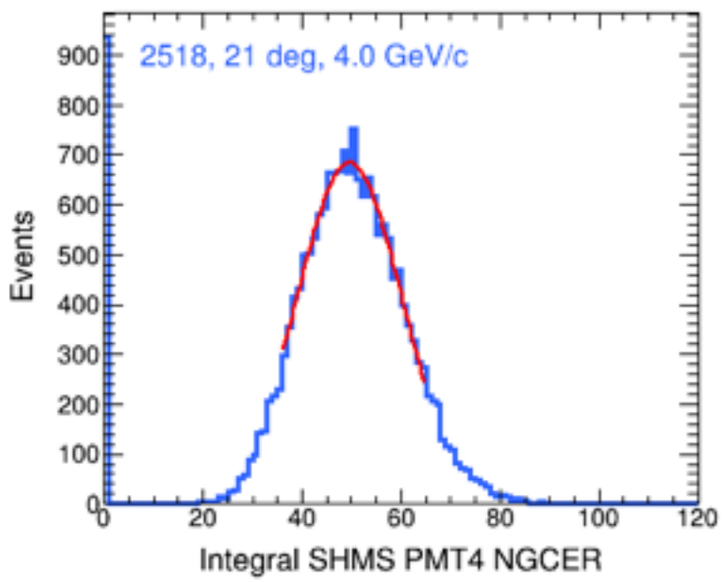
SHMS NGC calibration constants

➢ Parameters go to PARAM/SHMS/NGCER/CALIB/pngcer_calib.param









➢ cut off low amplitude region

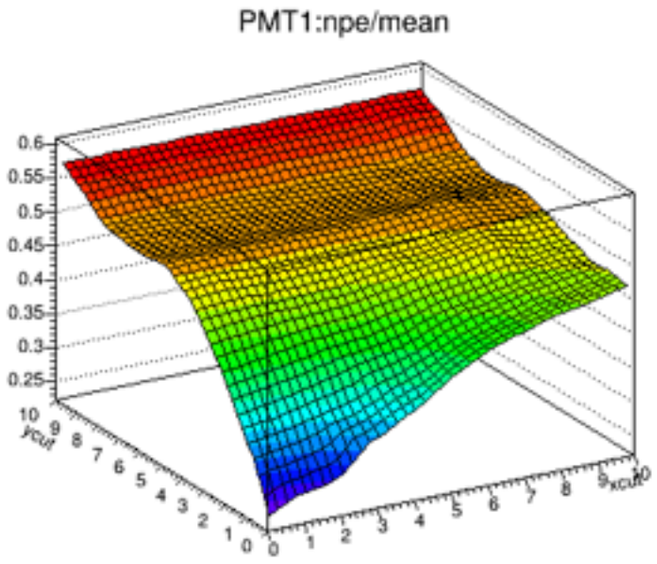
➢ fit integral to get mean and sigma

➢ calculate average npe (mean/sigma)^2

➢ get calibration constants npe/mean which go to calib file

SHMS NGC calibration constants

➢ Parameters go to PARAM/SHMS/NGCER/CALIB/pngcer_calib.param



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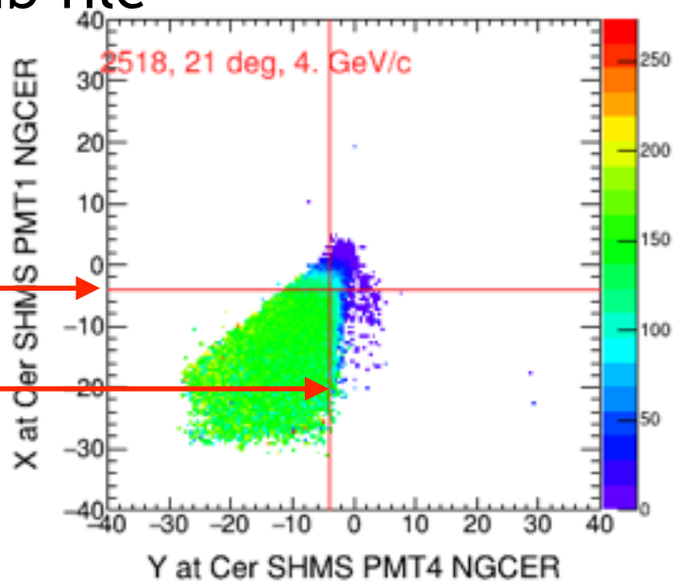
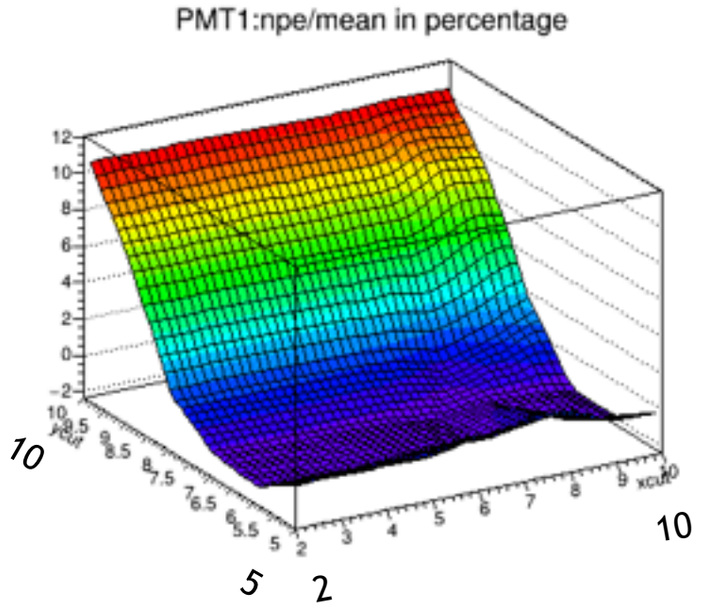
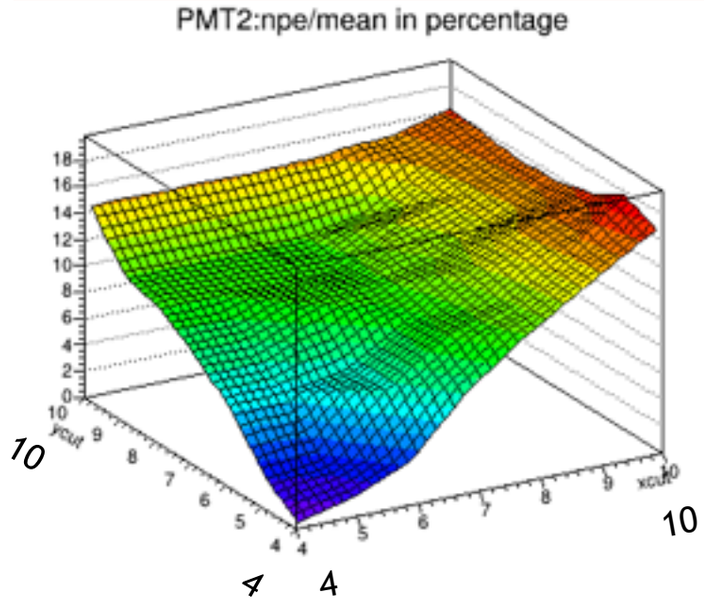


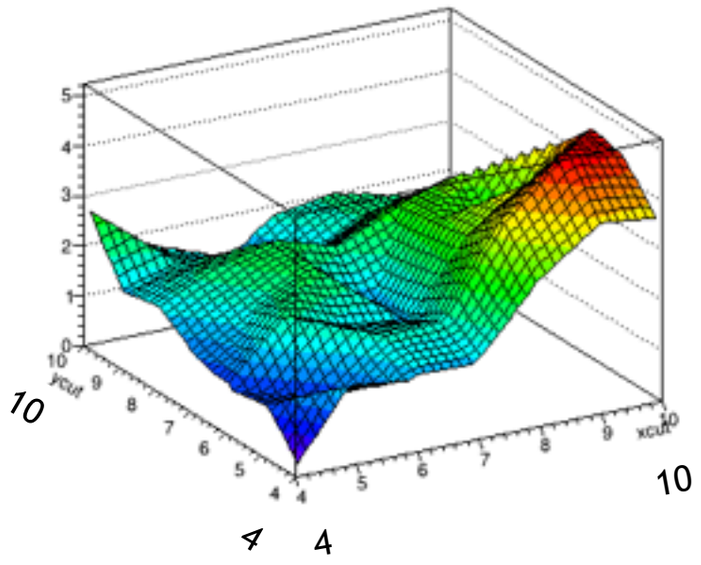
SHMS NGC calibration constants

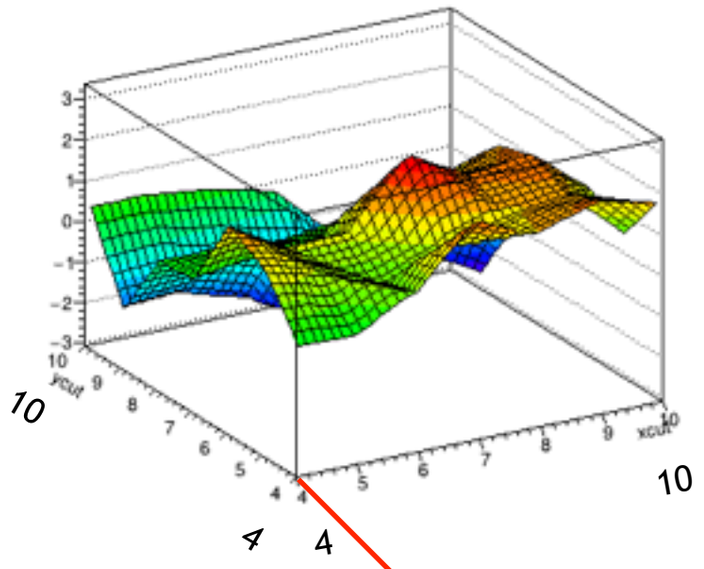
➢ Parameters go to PARAM/SHMS/NGCER/CALIB/pngcer_calib.param

calibration constant in percentage relatives to the value got with “standard” cuts









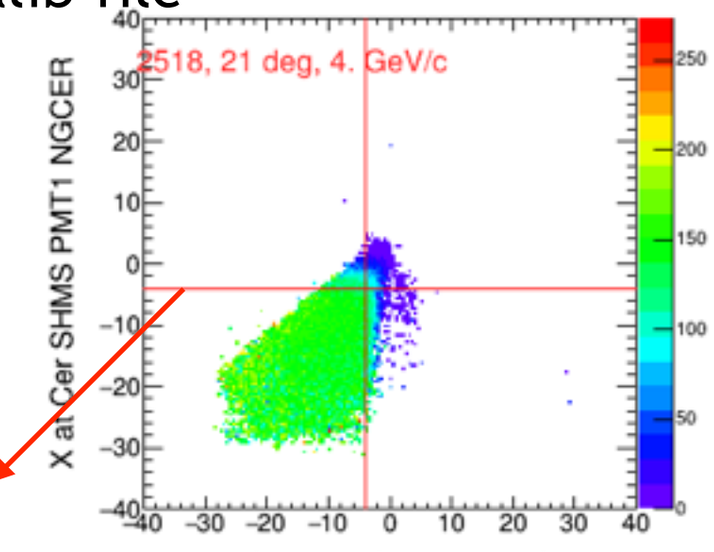
➢ cut off low amplitude region

➢ fit integral to get mean and sigma

➢ calculate average npe (mean/sigma)^2

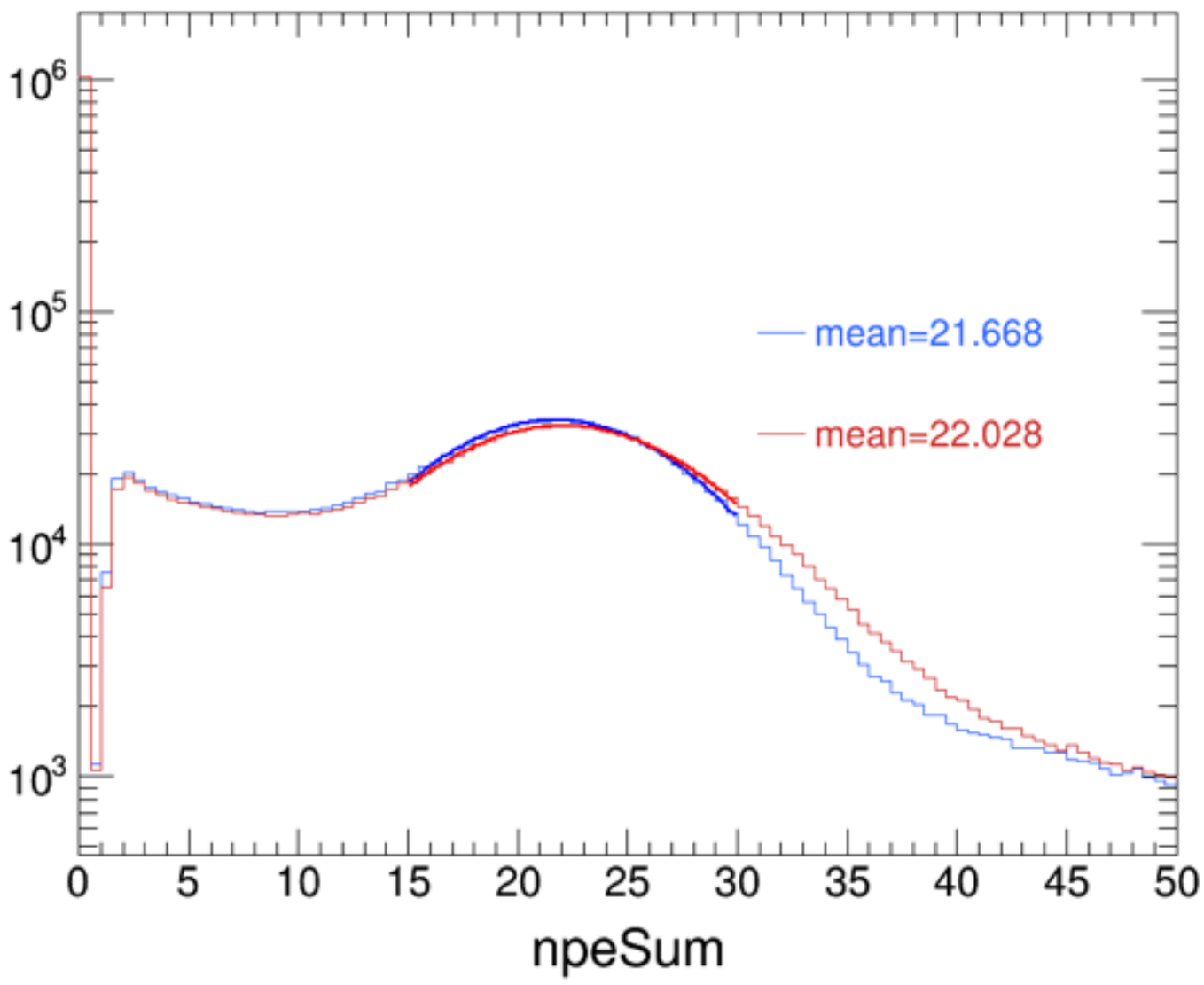
➢ get calibration constants npe/mean which go to calib file

“standard” cuts



SHMS NGC calibration constants

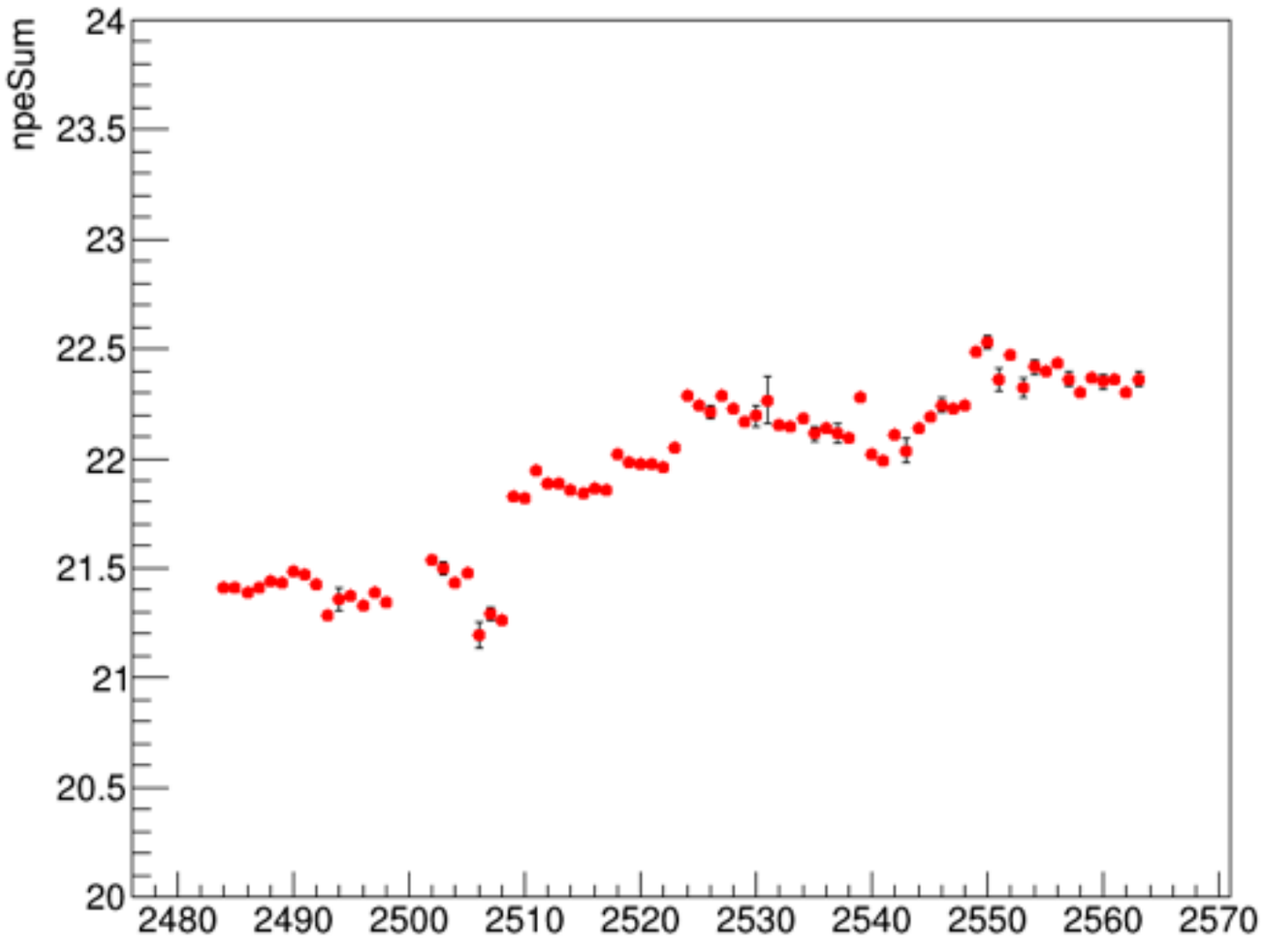
➢ Check with tighter cuts



SHMS NGC calibration constants

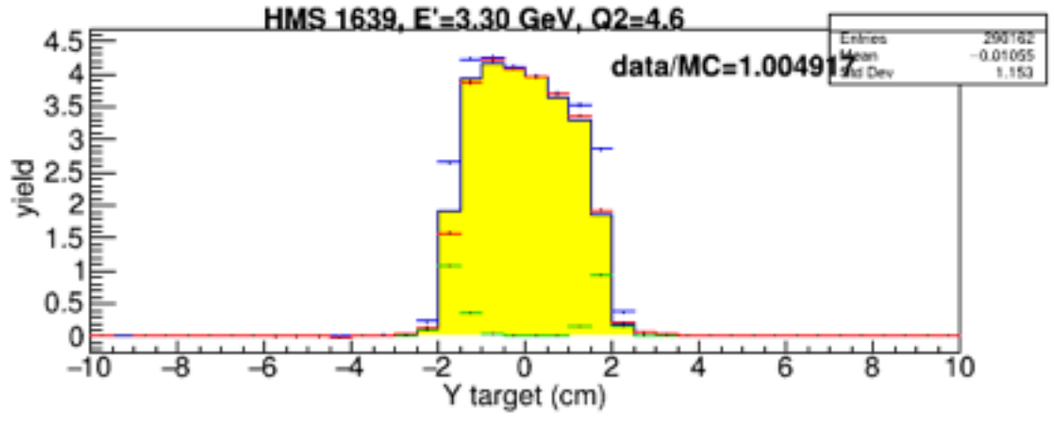
➢ npeSum for all 21 deg runs

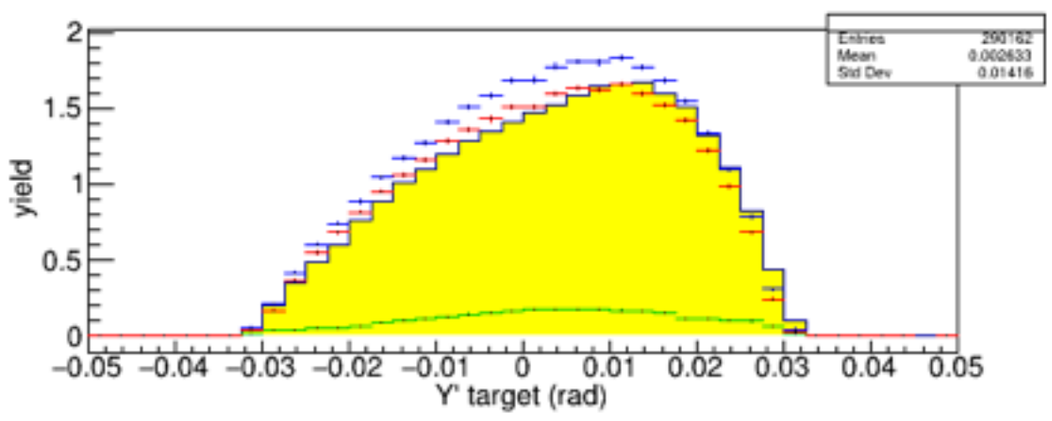
xcut = [2,4,4,4] (in cm)
ycut = [5,4,4,4] (in cm)

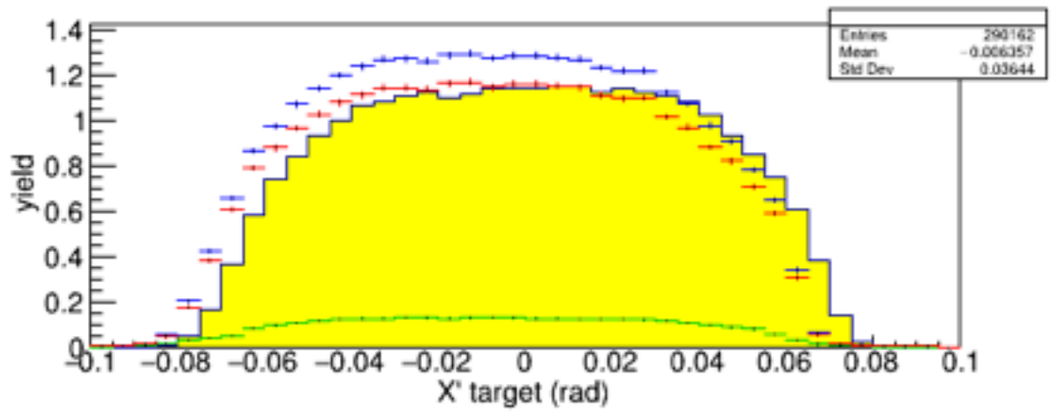


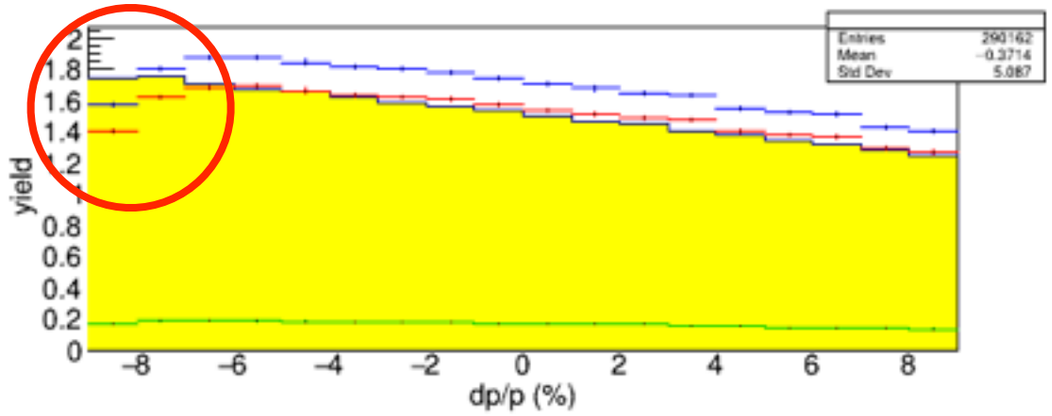
HMS Cherenkov efficiency correction

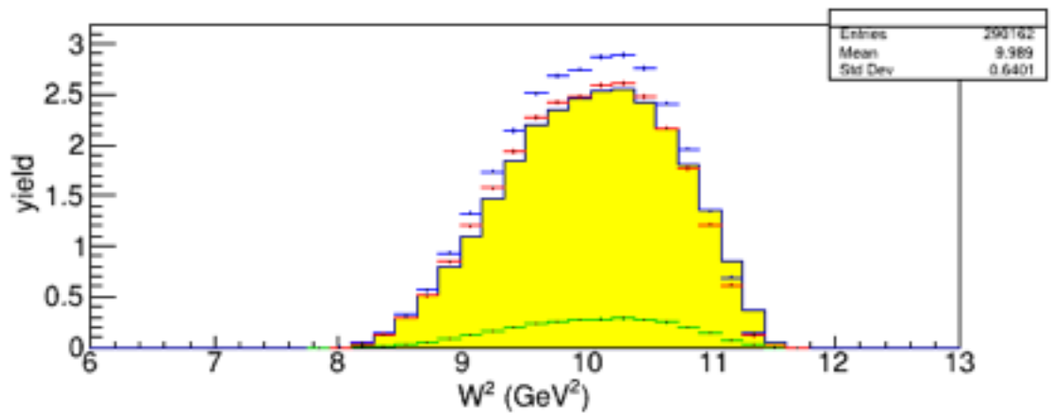
➢ Found a fall-off in delta when doing data/ Monte Carlo comparison

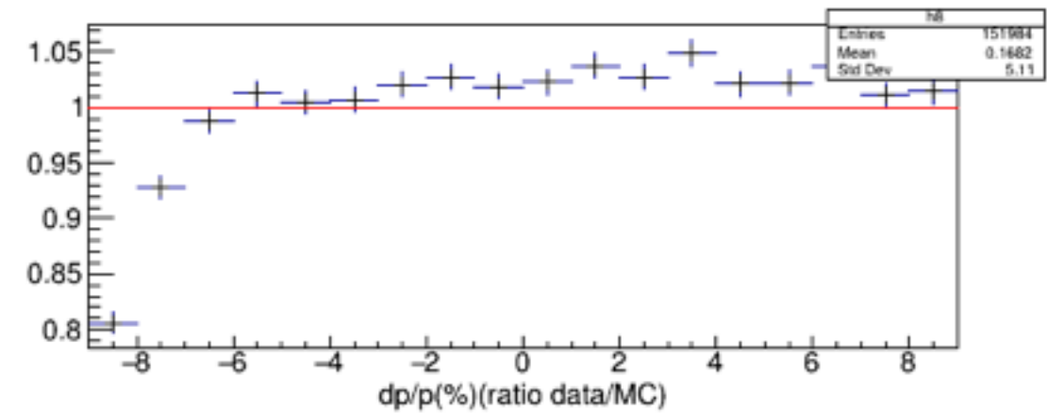






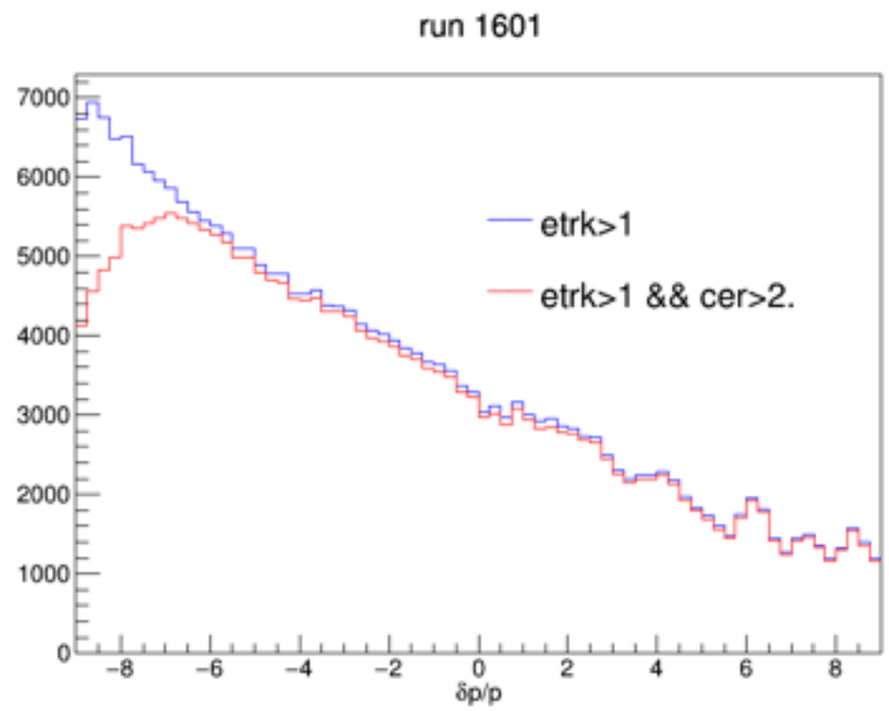


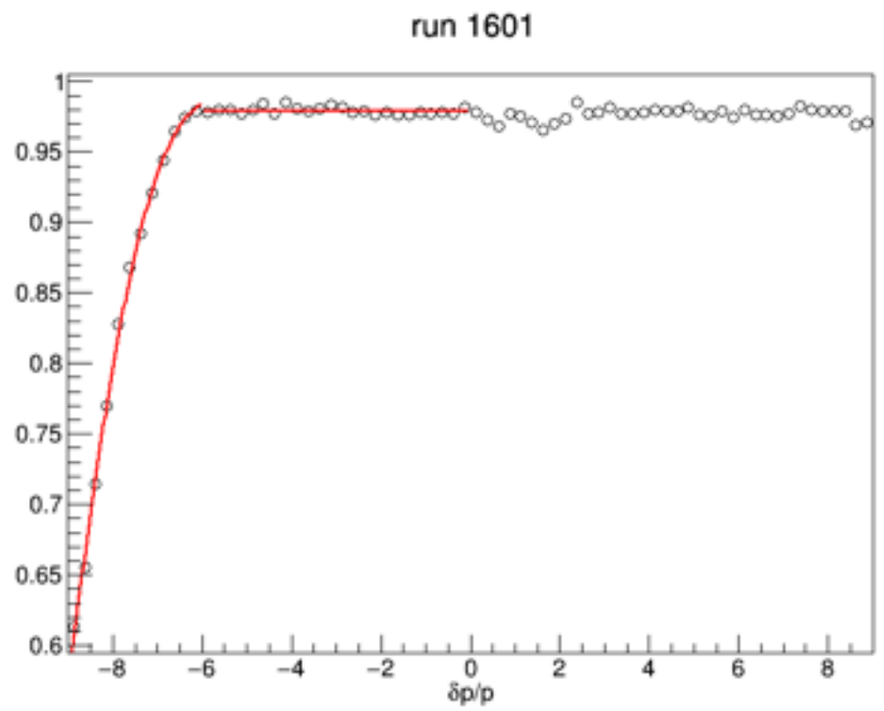


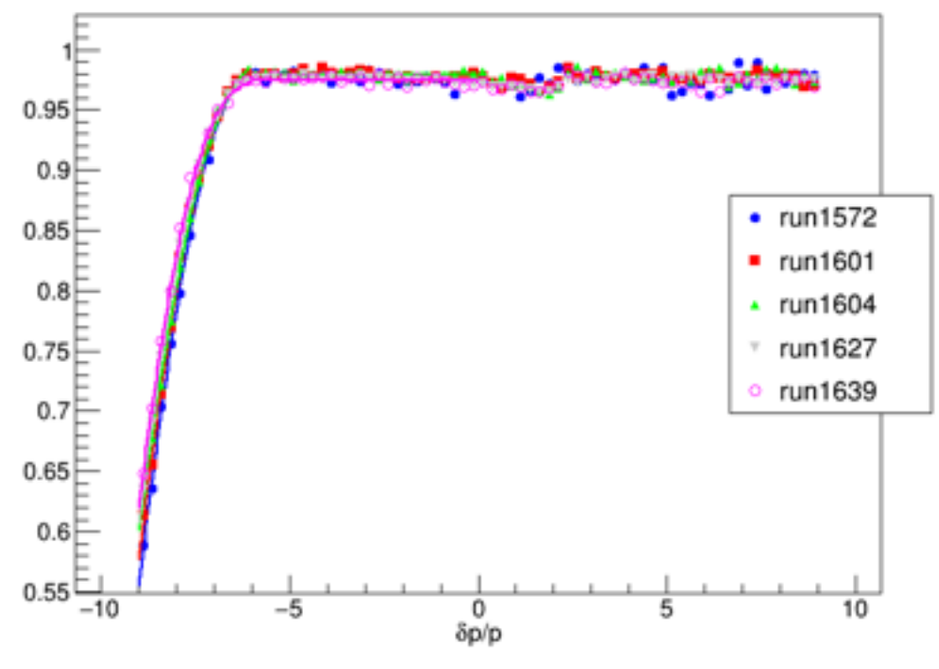


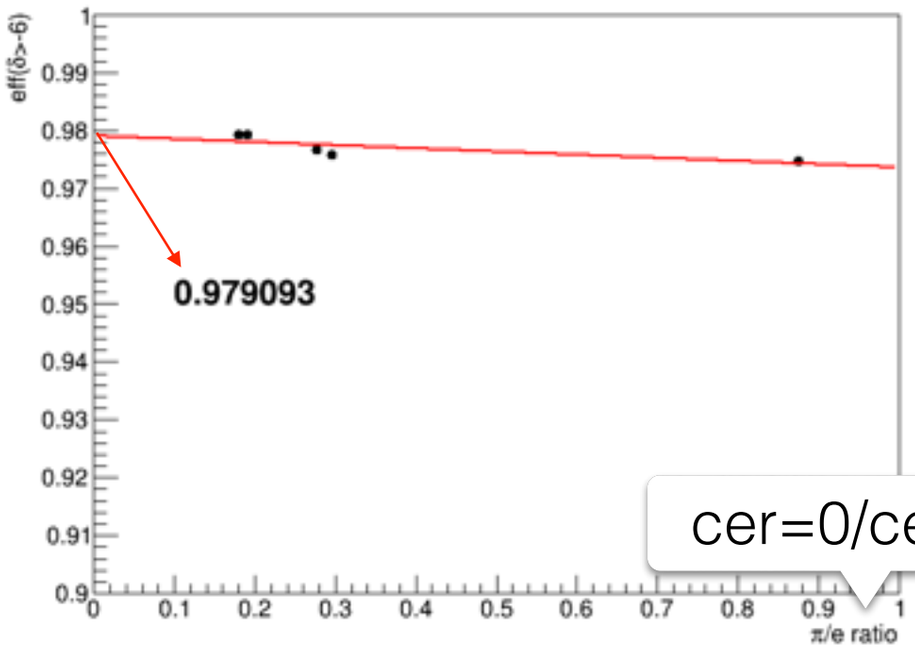
HMS Cherenkov efficiency correction

➢ Cherenkov efficiency drops at negative delta







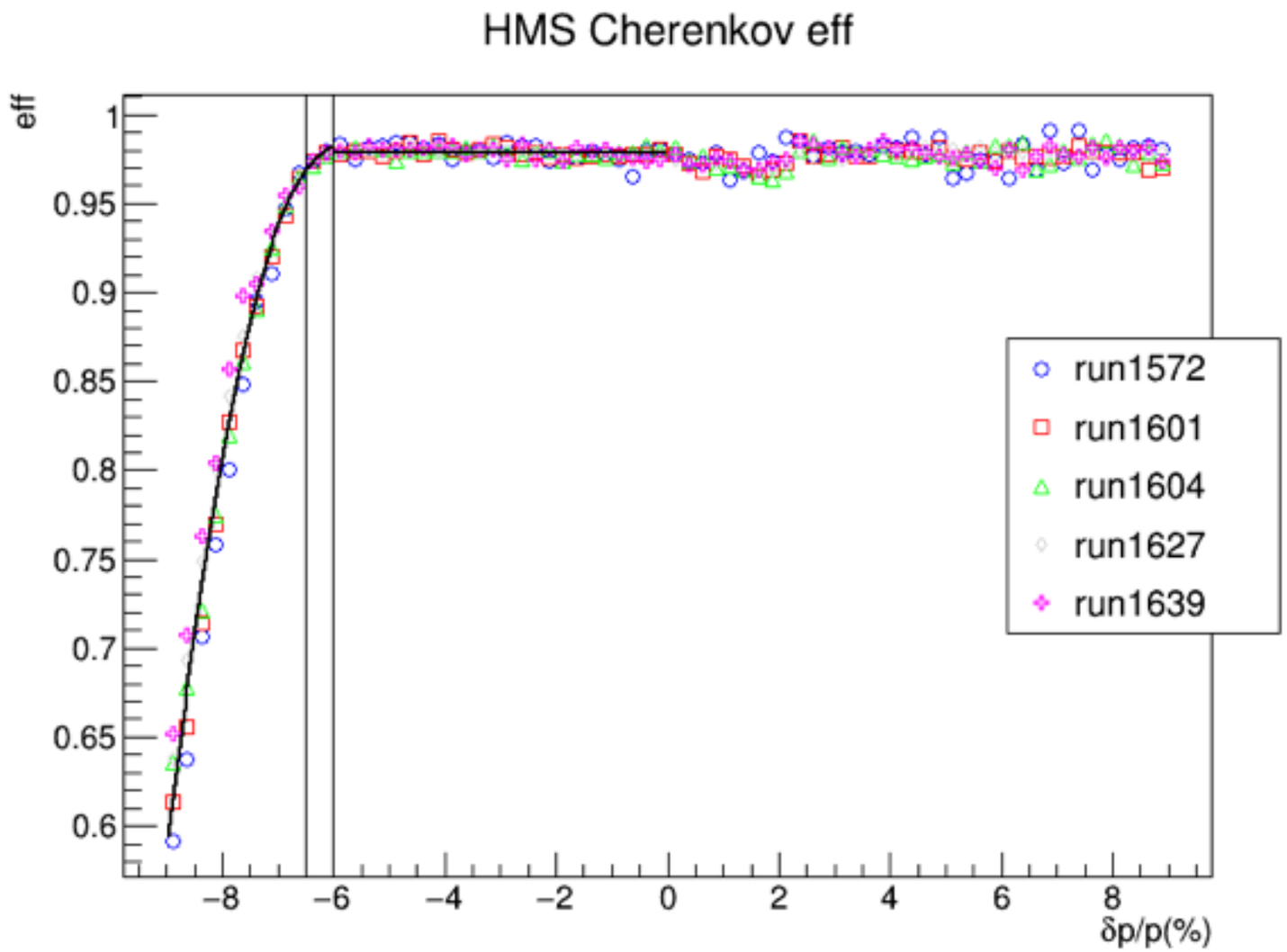


cer=0/cer>3

HMS Cherenkov efficiency correction

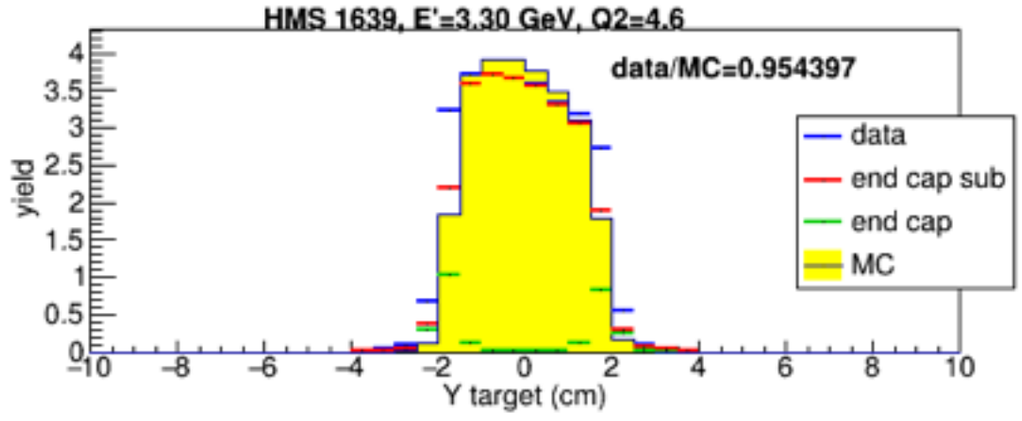
➢ Temporarily correct in delta only

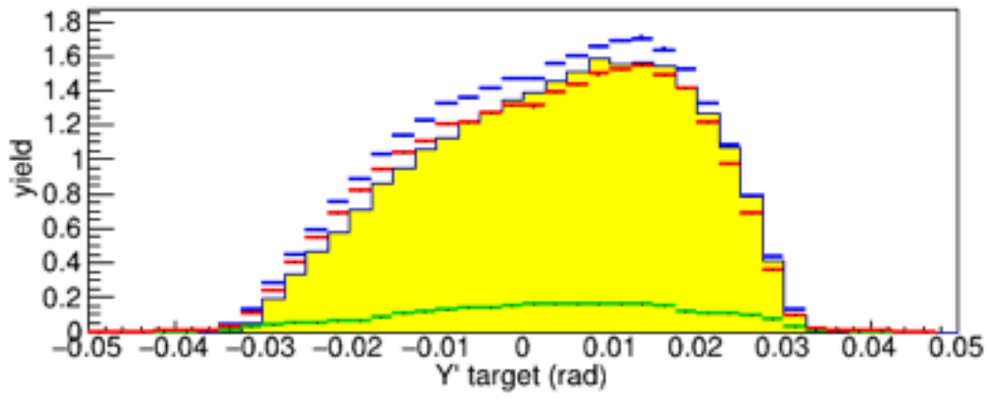
➢ Fit function in -9<delta<-6: 0.986593*exp(0.00985925*(x+5.26549)^3)

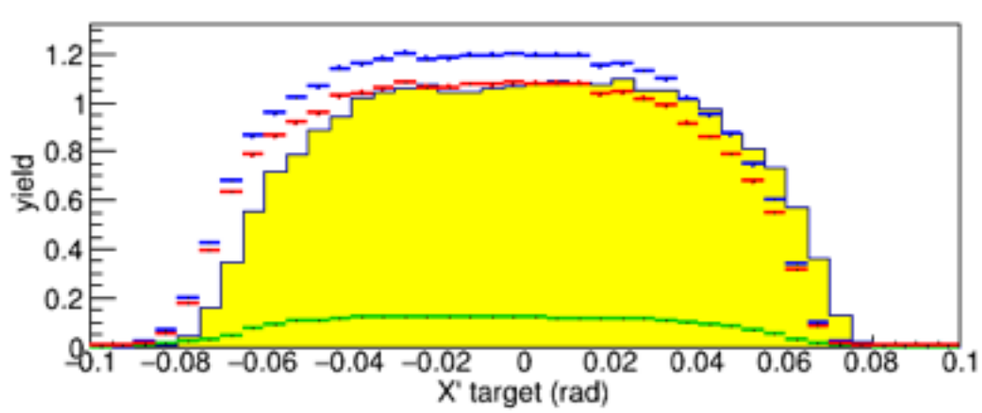


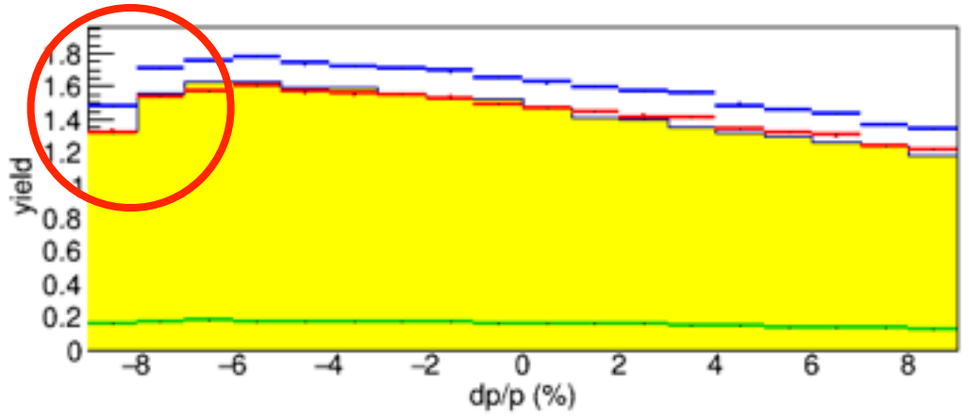
HMS Cherenkov efficiency correction

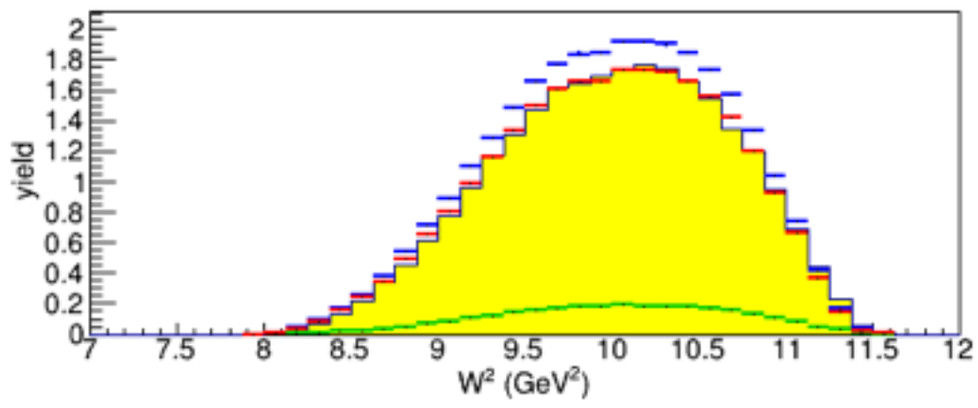
➢ Improvement in data/Monte Carlo comparison

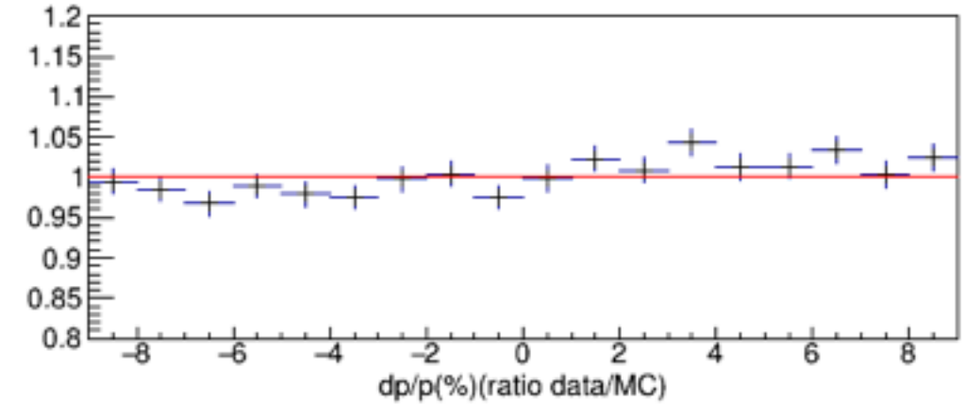












➢ May still need to do efficiency correction in function of (x, y)

Summary

- HGC, NGC time window cuts will be included in phgcer_cuts.param and pngcer_cuts.param

- Work on parameters for ngc calib file should be closed out soon

- Will still work on HMS Cherenkov efficiency modeling after including 59 deg runs

Thank you