SHMS Scintillator Paddles Acceptance Study: Part 2 Using H(e, e'p) Elastics Data

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PURPOSE OF STUDY:

- Determine which SHMS paddles in (S1X, S2X) hodoscope planes are relevant for the CaFe kinematics in momentum acceptance of (+5, +20)% and turn OFF SHMS scintillator paddles that are irrelevant to the CaFe kinematics.

- Turning OFF paddles outside the SHMS momentum acceptance (+5,+20)% will make the potentially high SHMS rates more manageable, as SHMS (e-) will be stationed at very low angles (6.8, 8.3) deg

- Even though coincidence rates should NOT be a problem, (~ few kHz of DAQ rate from rate estimates), singles-rates can be a problem, but we cannot simulate background in SIMC. We can only simulate the reaction of interest.

ONLY USE SHMS ACCEPTANCE REQUIRED BY CAFE: (5, 20)%

TURN PADDLES 1-6 OFF

Paddle 7

LEAVE PADDLES 7 and above ON

Paddle13

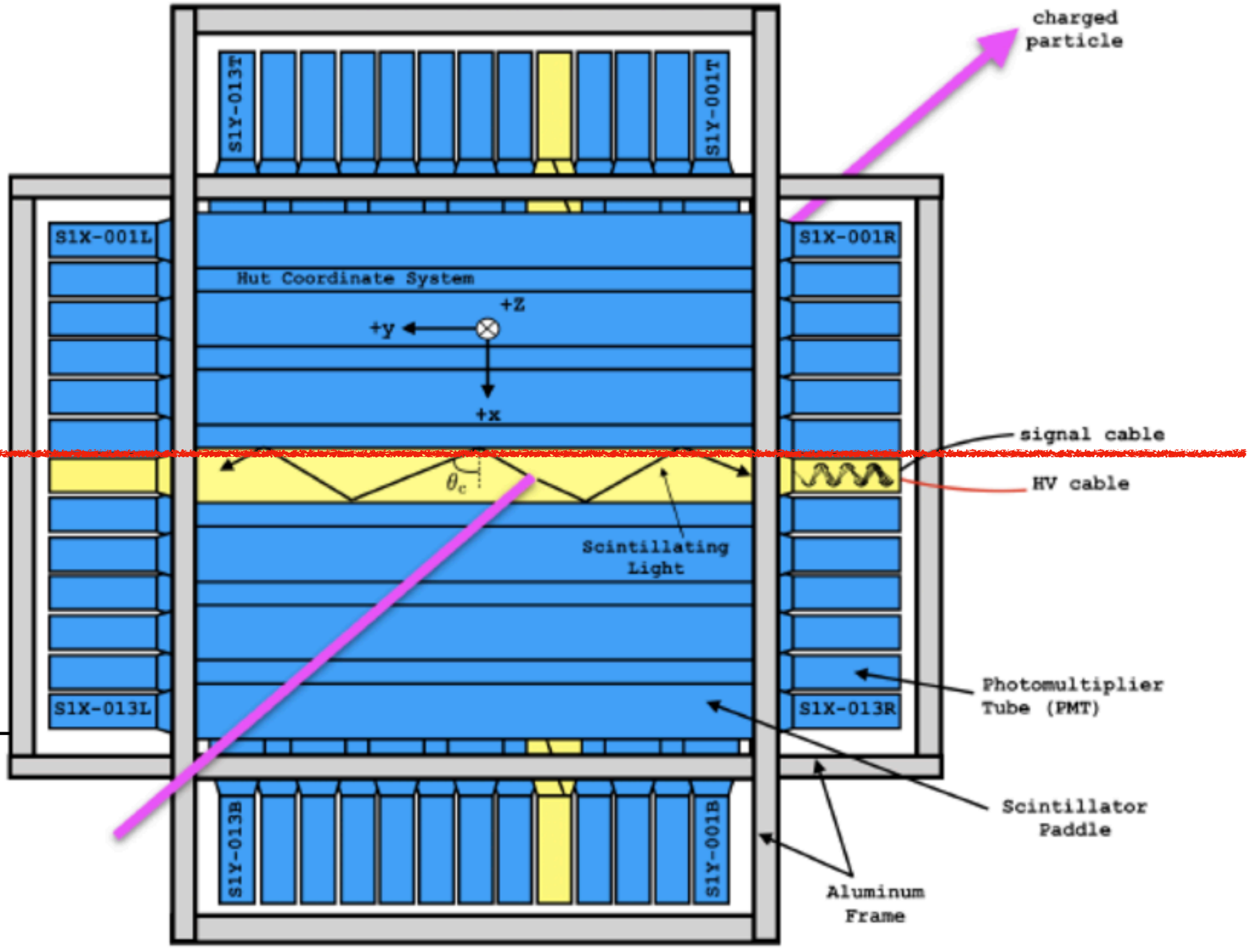
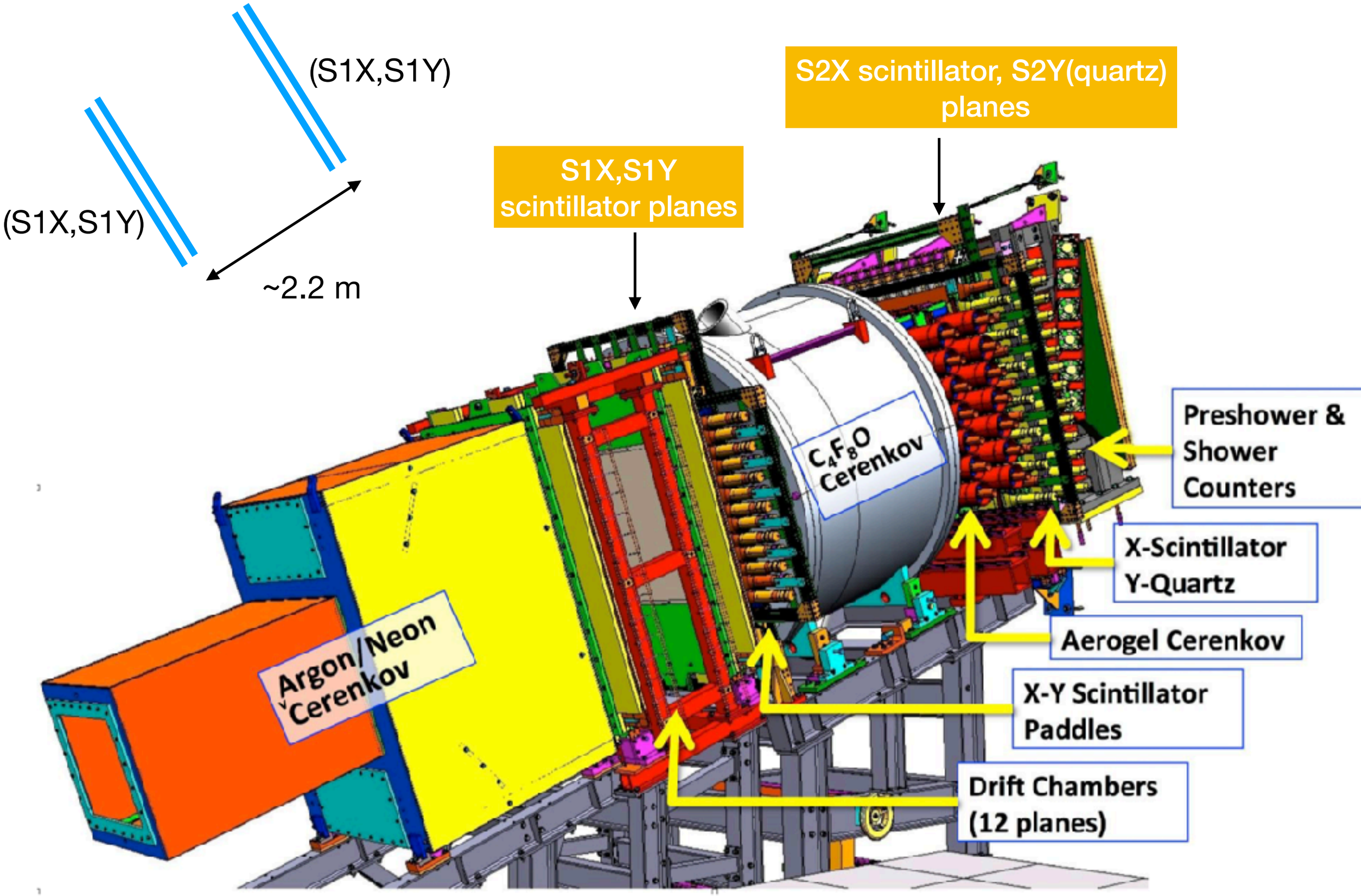


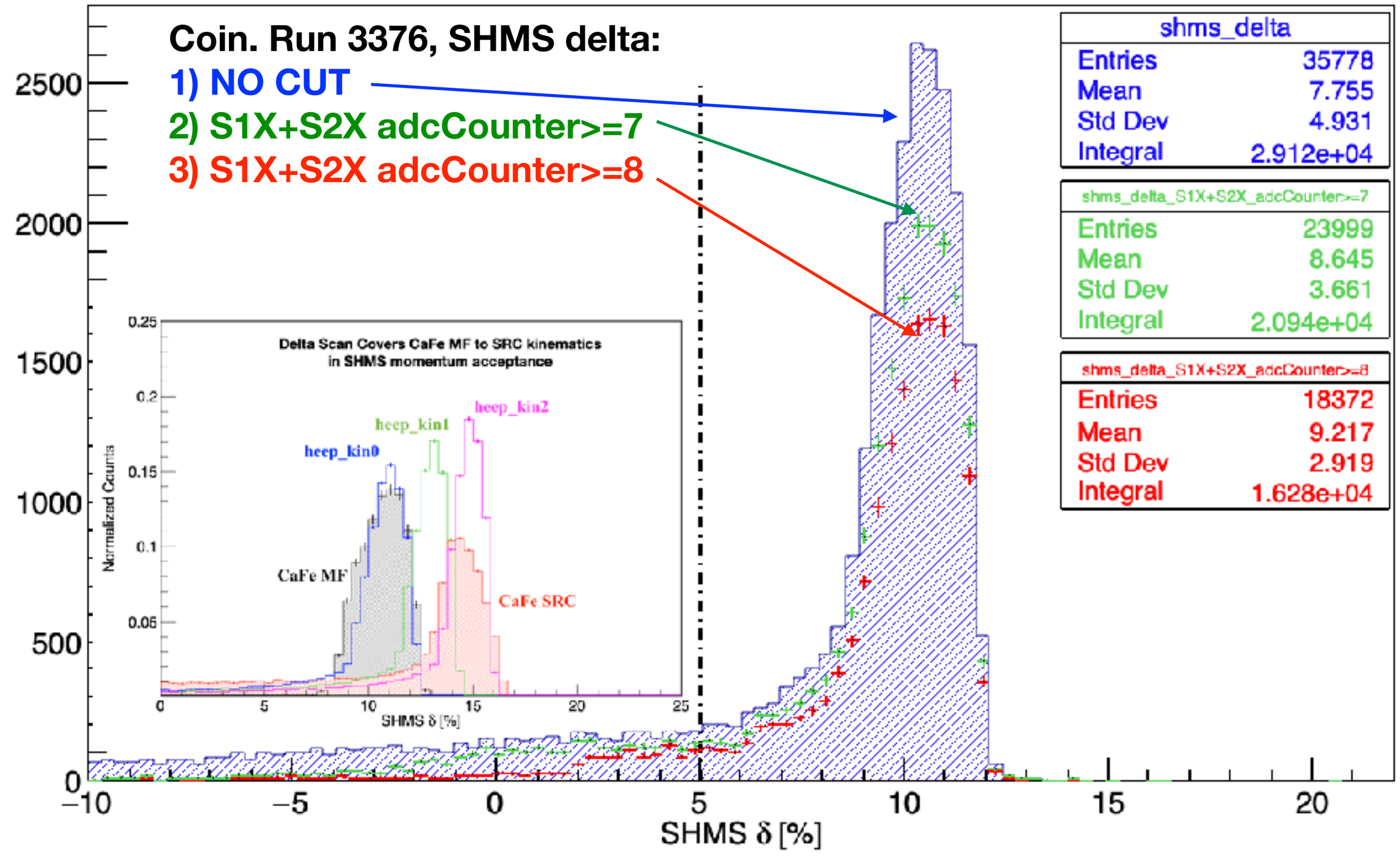
Figure 3.26: Front view of the SHMS S1X (front) and S1Y (back) hodoscope planes.


(S1X,S1Y)
(S1X,S1Y)
~2.2 m
S2X scintillator, S2Y(quartz) planes
S1X,S1Y scintillator planes
C_4F_8O Cerenkov
Argon/Neon Cerenkov
Preshower & Shower Counters
X-Scintillator Y-Quartz
Aerogel Cerenkov
X-Y Scintillator Paddles
Drift Chambers (12 planes)

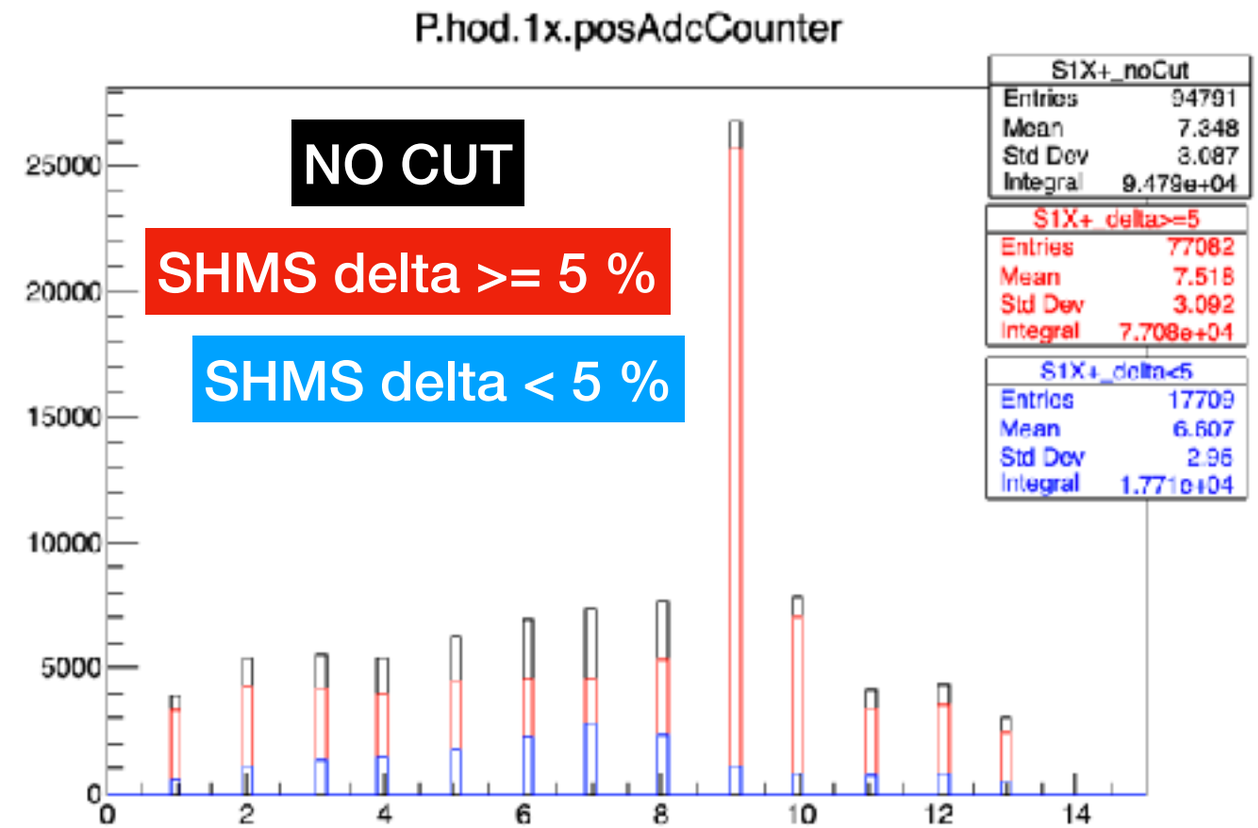
- I looked at SHMS+HMS coin run 3376 (trigger hms3/4+shms3/4), which has very similar coverage to the CaFe elastics heep_kin0
- Made acceptance cut on run 3376 corresponding to CaFe kinematics

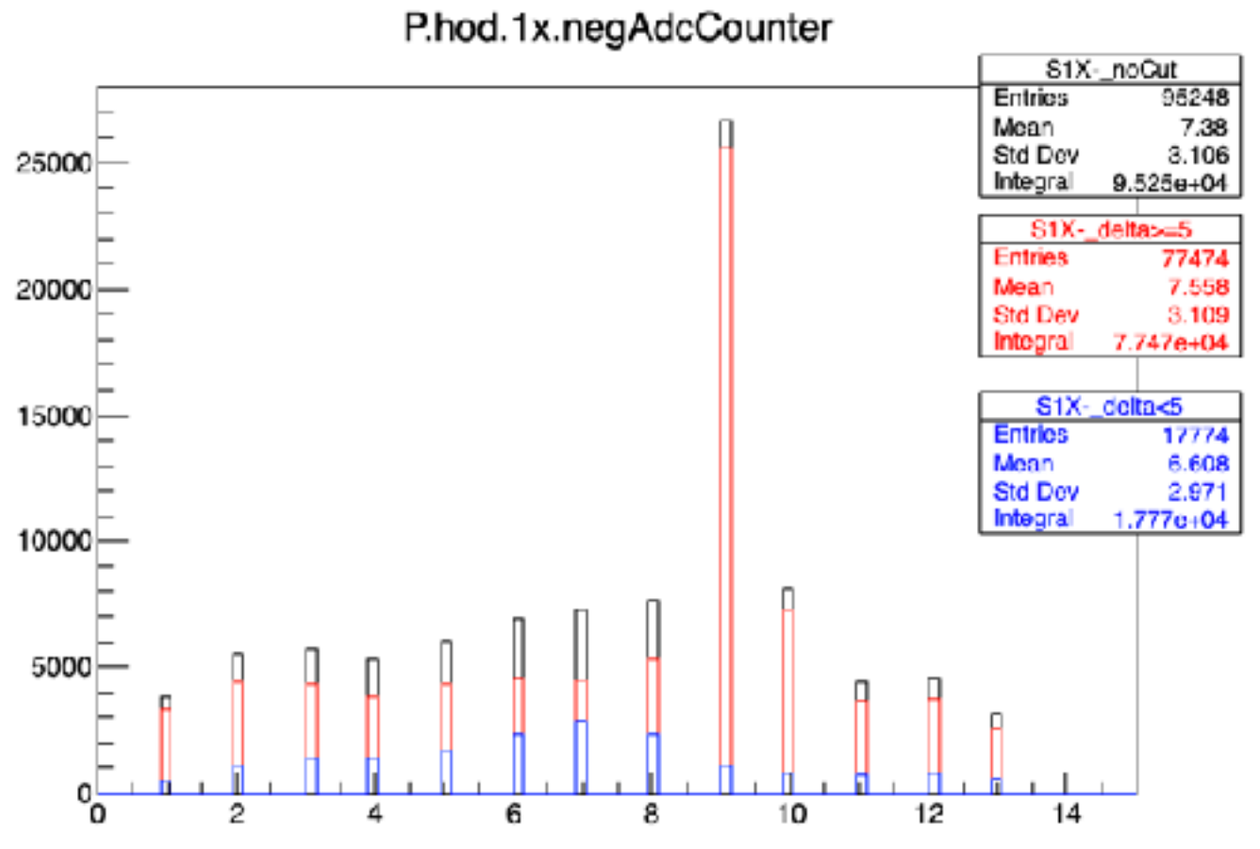
HCLOG run 3376: https://logbooks.jlab.org/entry/3557662

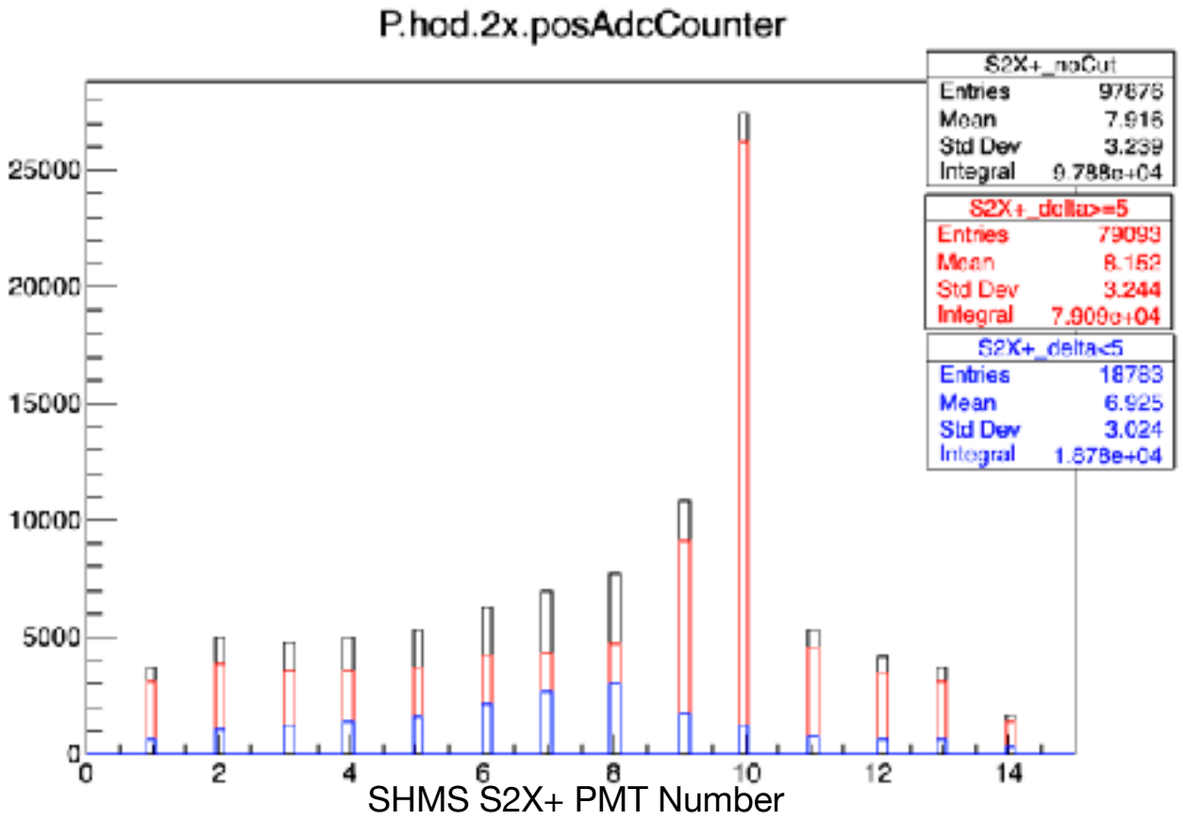
```
3376
gpbeam = 10.6005
gtargmass_amu = 1.00794
hpartmass = 0.938272
ppartmass = 0.00051099
htheta_lab = -47.605
ptheta_lab = 8.495
hpcentral = 1.8899
ppcentral = 8.541
```

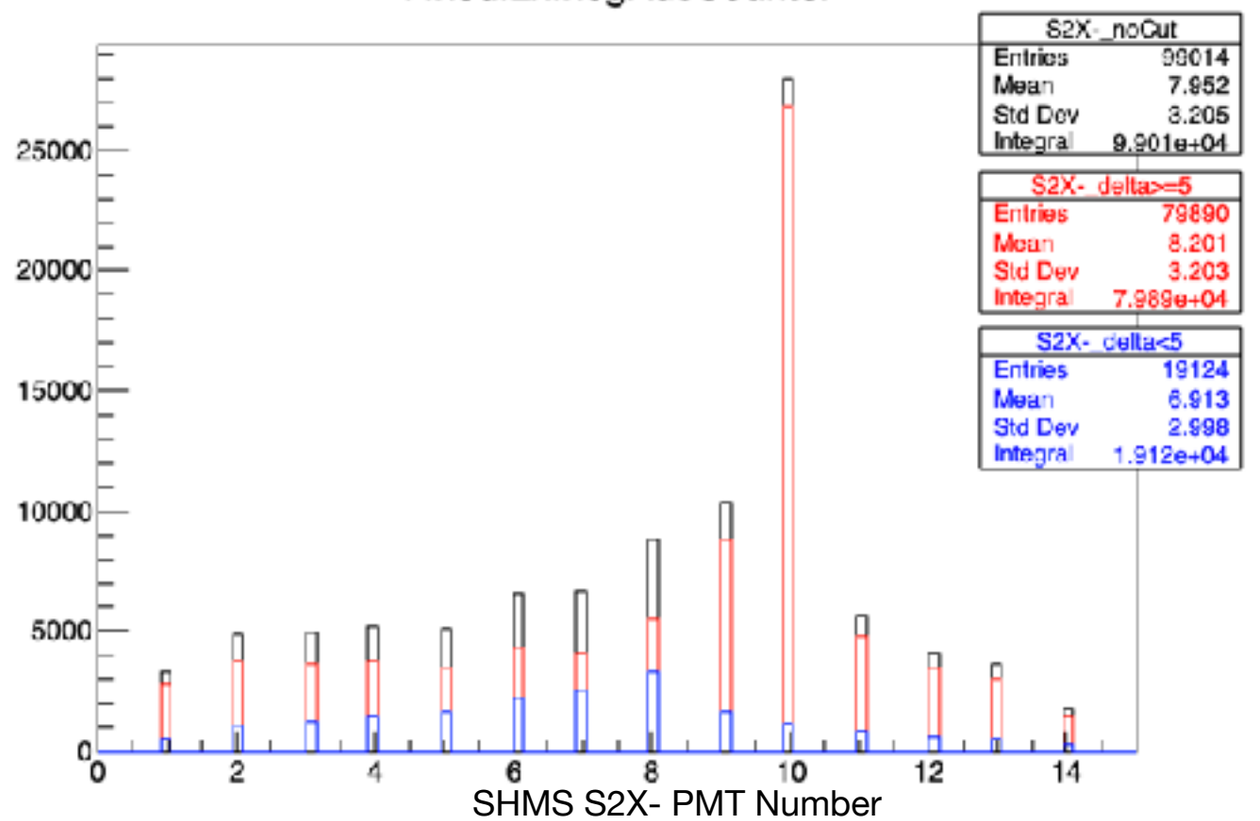


SHMS S1X, S2X adcCounter dependence on momentum acceptance cuts

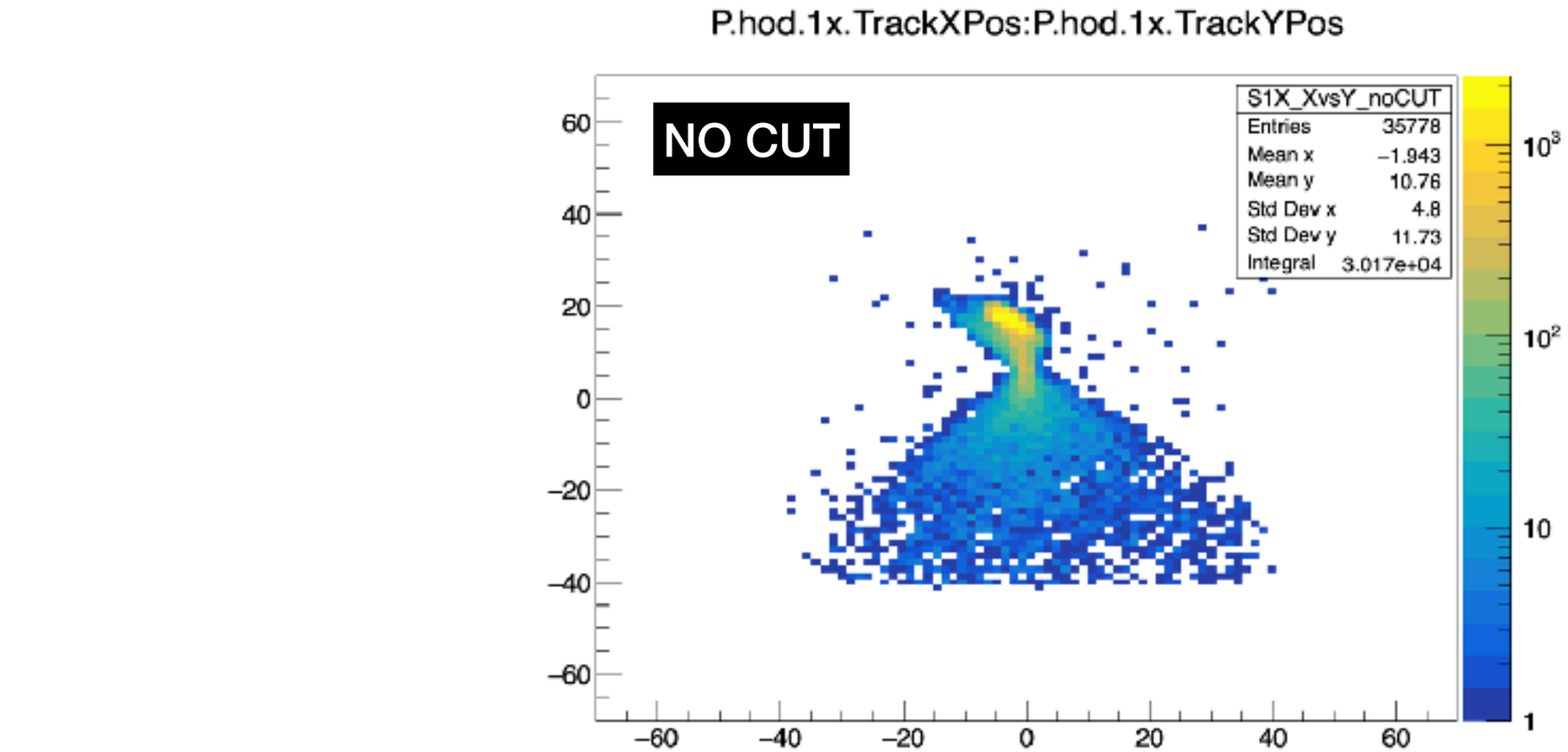


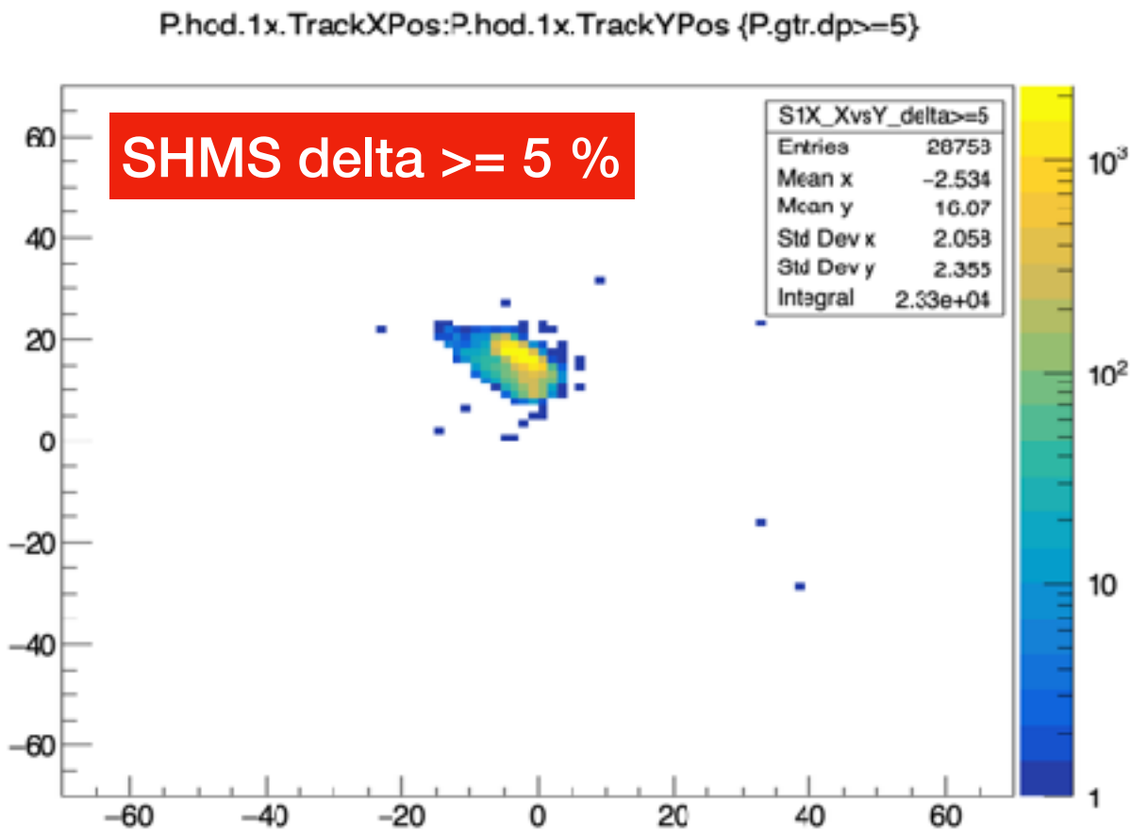


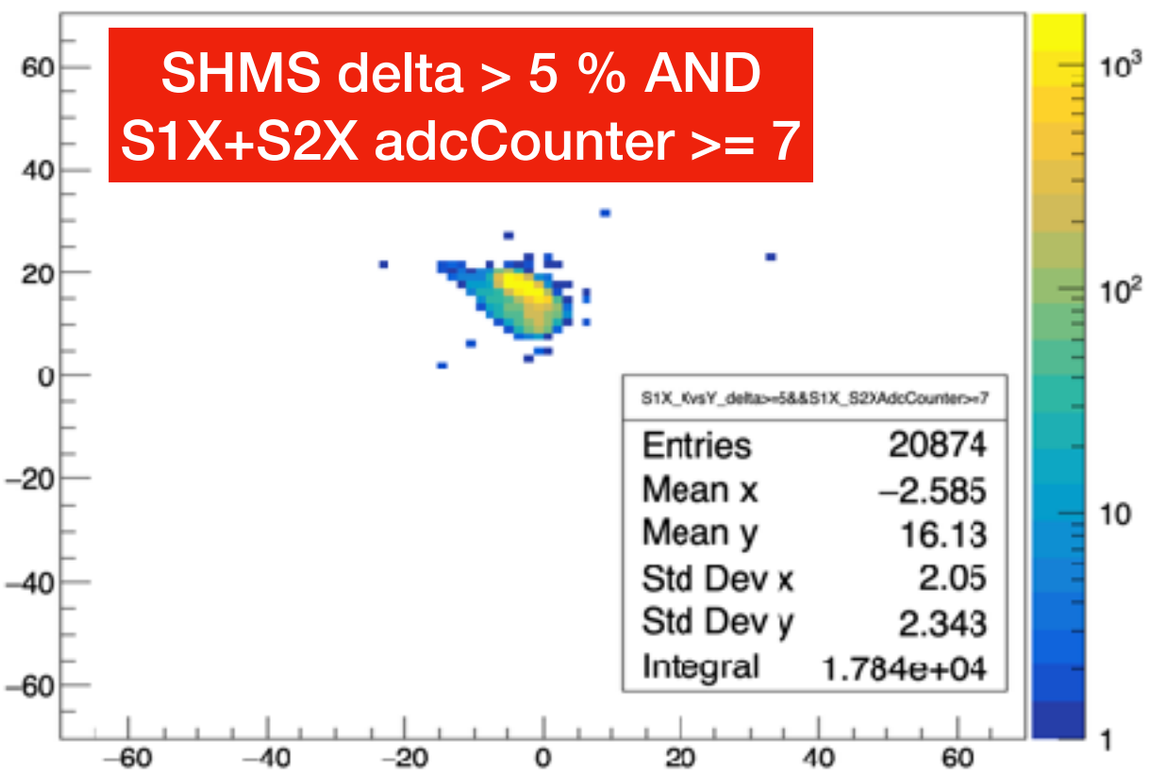


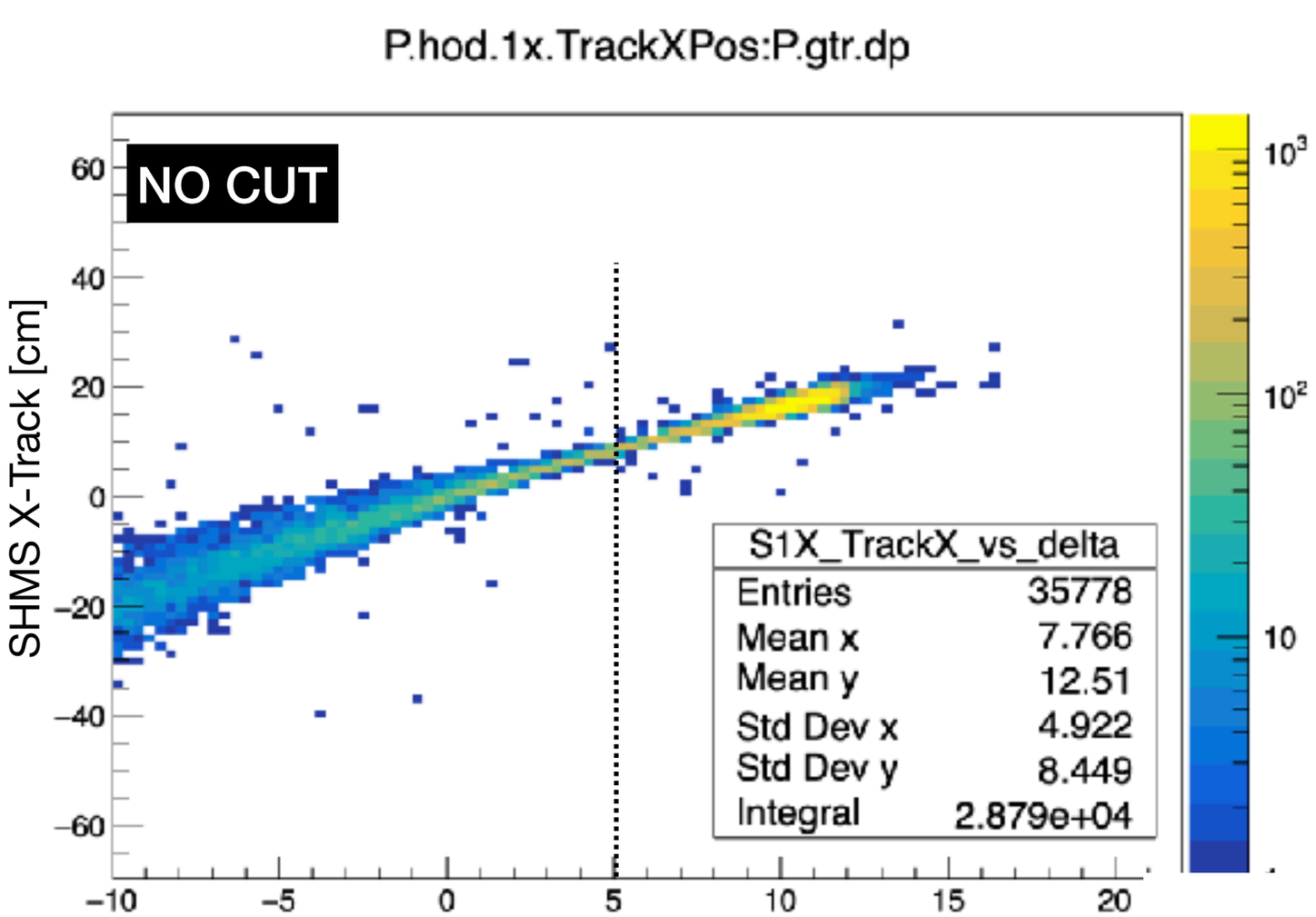


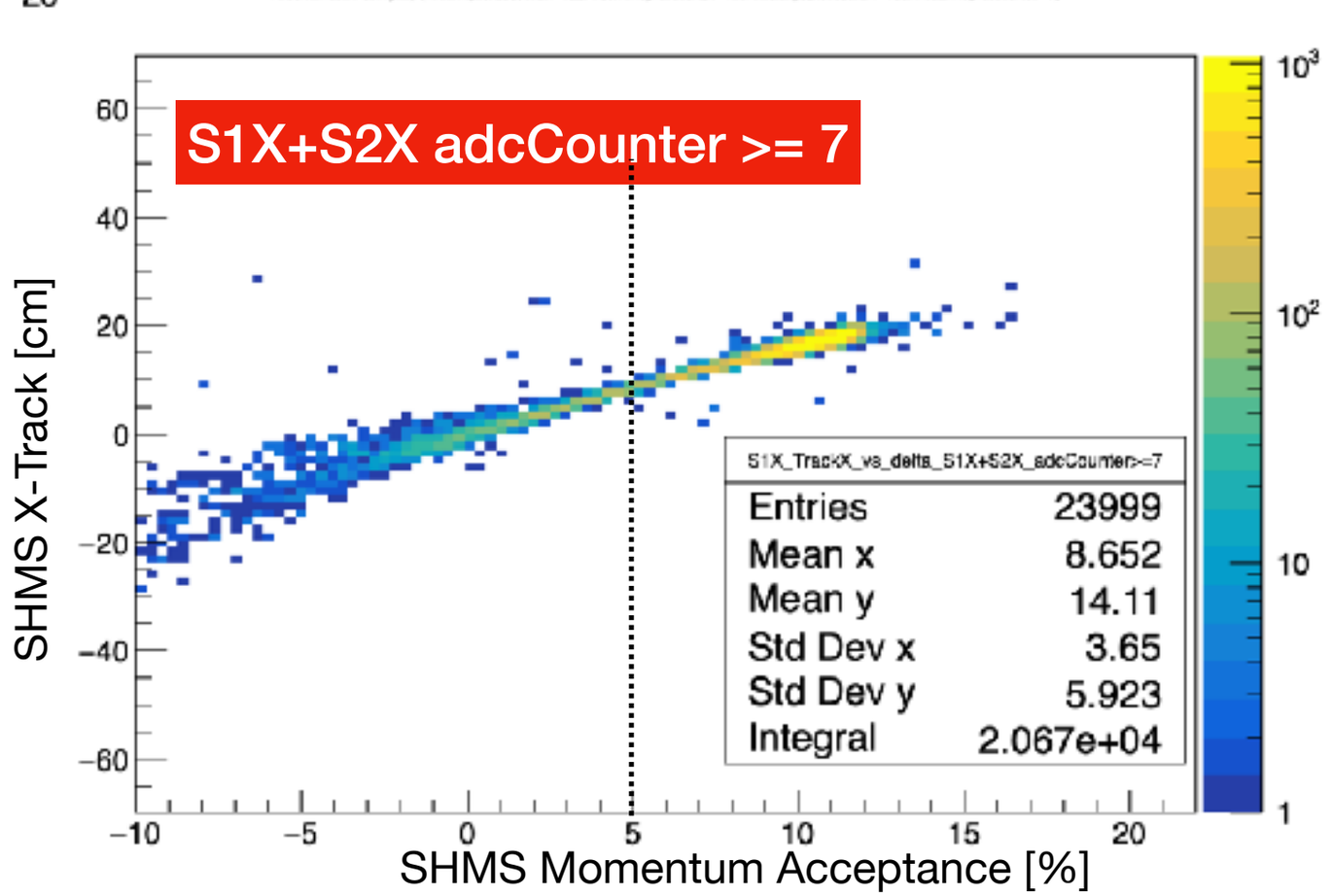
SHMS X-track vs Y-track projected at S1X Scintillator Plane

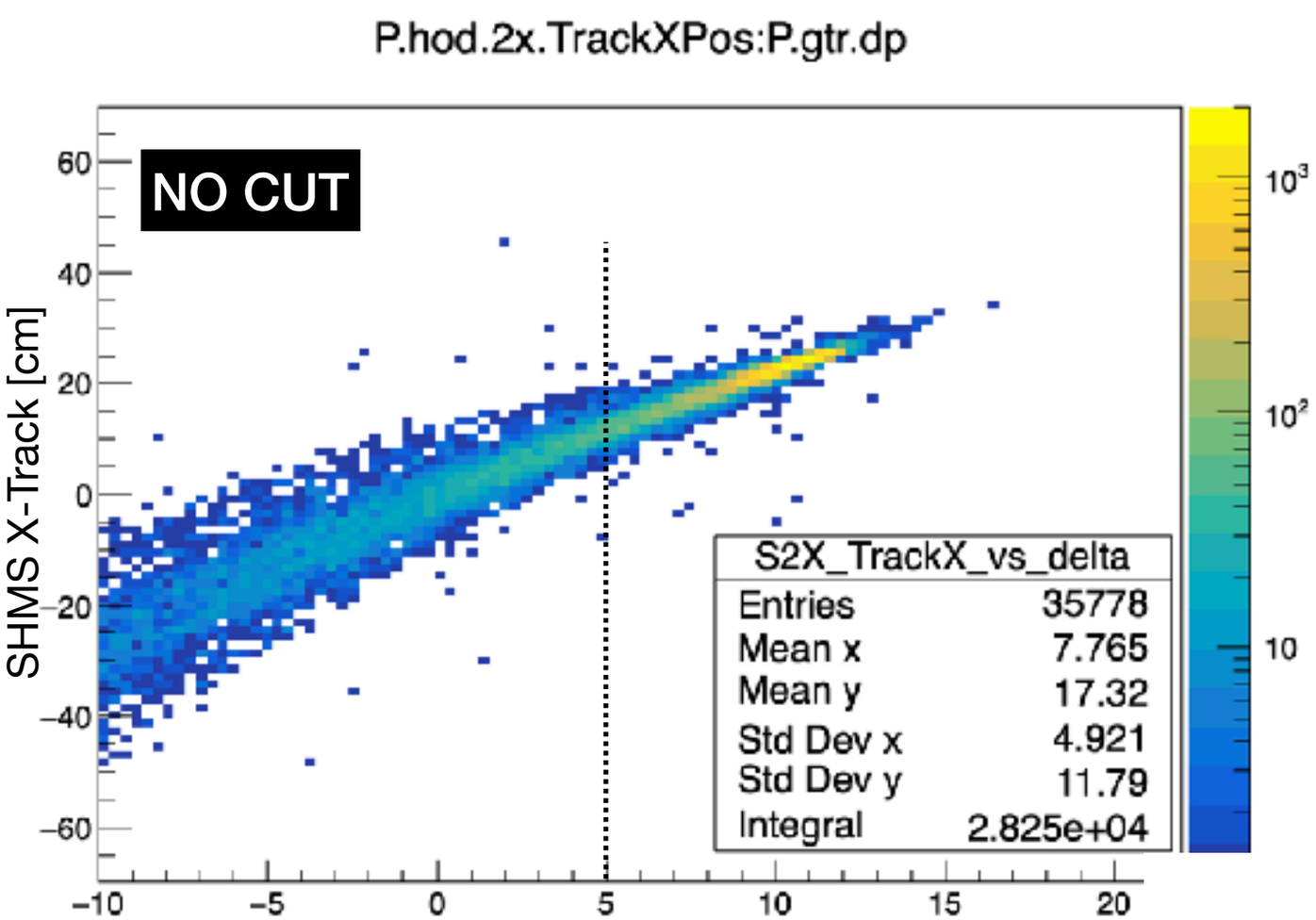


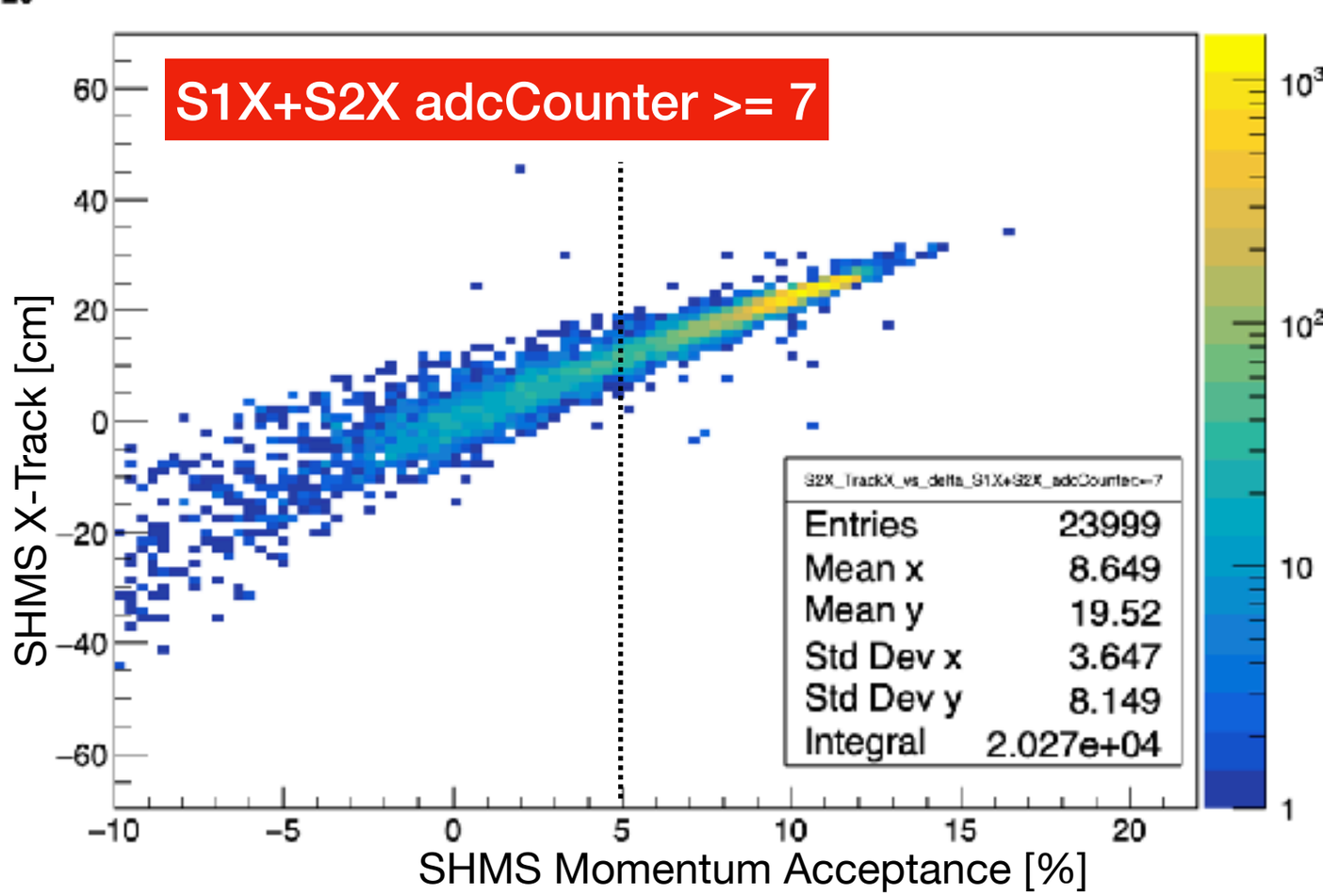


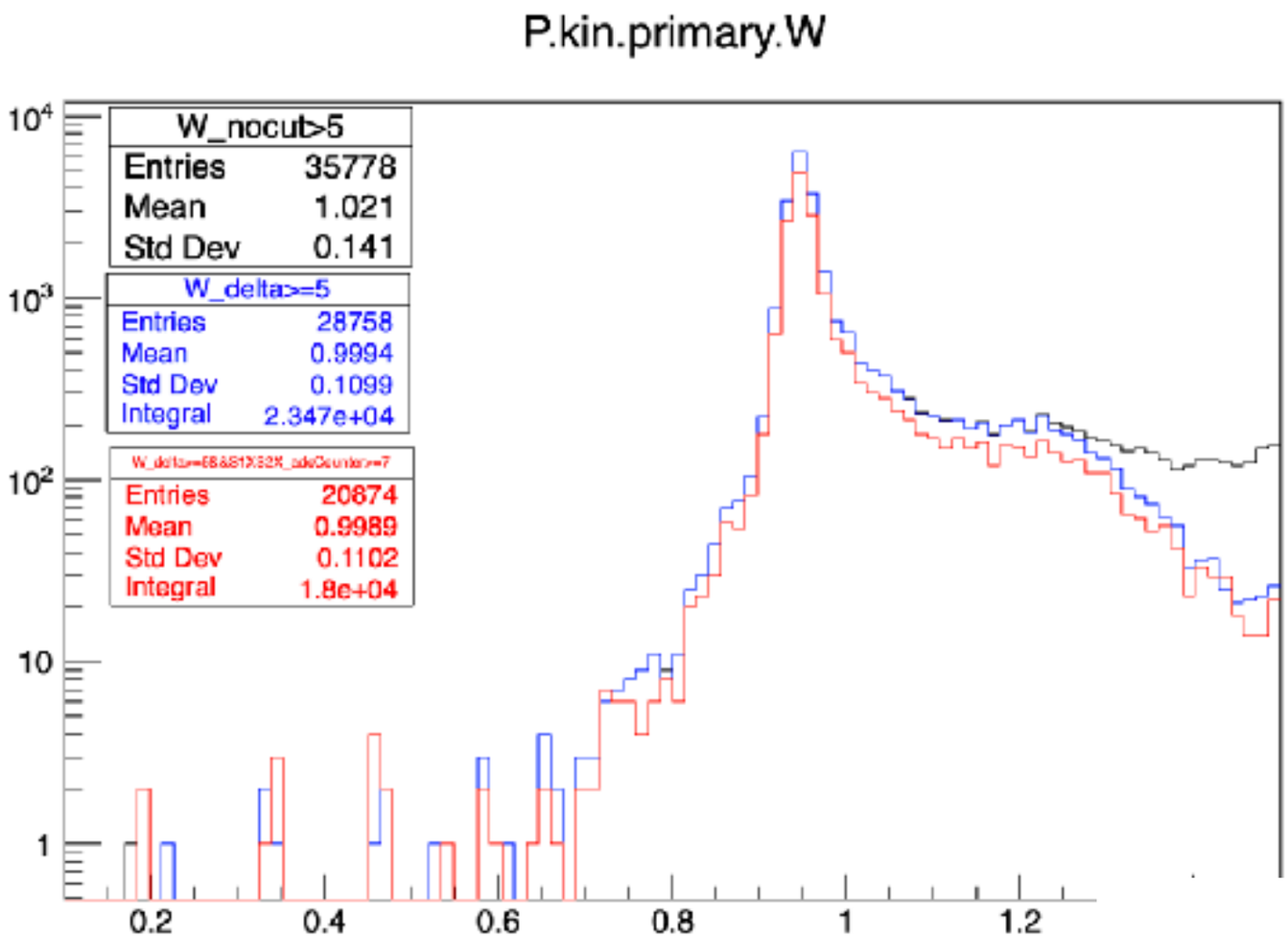



P.hod.1x.TrackXPos:P.gtr.dp
NO CUT
S1X_TrackX_vs_delta
Entries 35778
Mean x 7.766
Mean y 12.51
Std Dev x 4.922
Std Dev y 8.449
Integral 2.879e+04
SHMS X-Track [cm]
SHMS Momentum Acceptance [%]


S1X+S2X adcCounter >= 7
S1X_TrackX_vs_delta_S1X+S2X_adcCounter>=7
Entries 23999
Mean x 8.652
Mean y 14.11
Std Dev x 3.65
Std Dev y 5.923
Integral 2.067e+04
SHMS X-Track [cm]
SHMS Momentum Acceptance [%]


P.hod.2x.TrackXPos:P.gtr.dp
NO CUT
SHMS X-Track [cm]
SHMS Momentum Acceptance [%]
S2X_TrackX_vs_delta
Entries 35778
Mean x 7.765
Mean y 17.32
Std Dev x 4.921
Std Dev y 11.79
Integral 2.825e+04


S1X+S2X adcCounter >= 7
SHMS X-Track [cm]
SHMS Momentum Acceptance [%]
Entries 23999
Mean x 8.649
Mean y 19.52
Std Dev x 3.647
Std Dev y 8.149
Integral 2.027e+04



LEGEND

NO CUT

SHMS delta >= 5 %

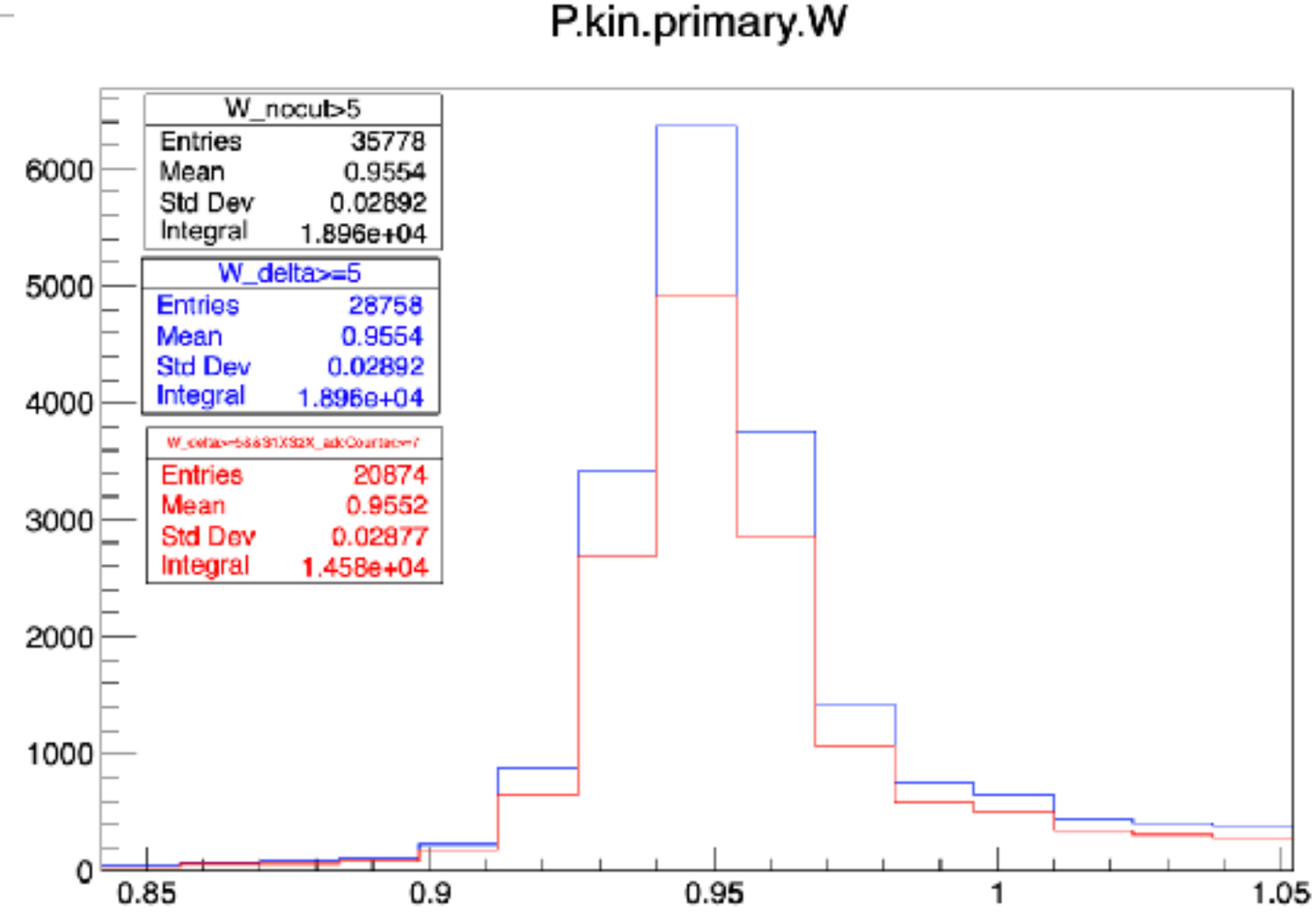
SHMS delta >= 5 % + S1X_S2X_adcCounter >= 7

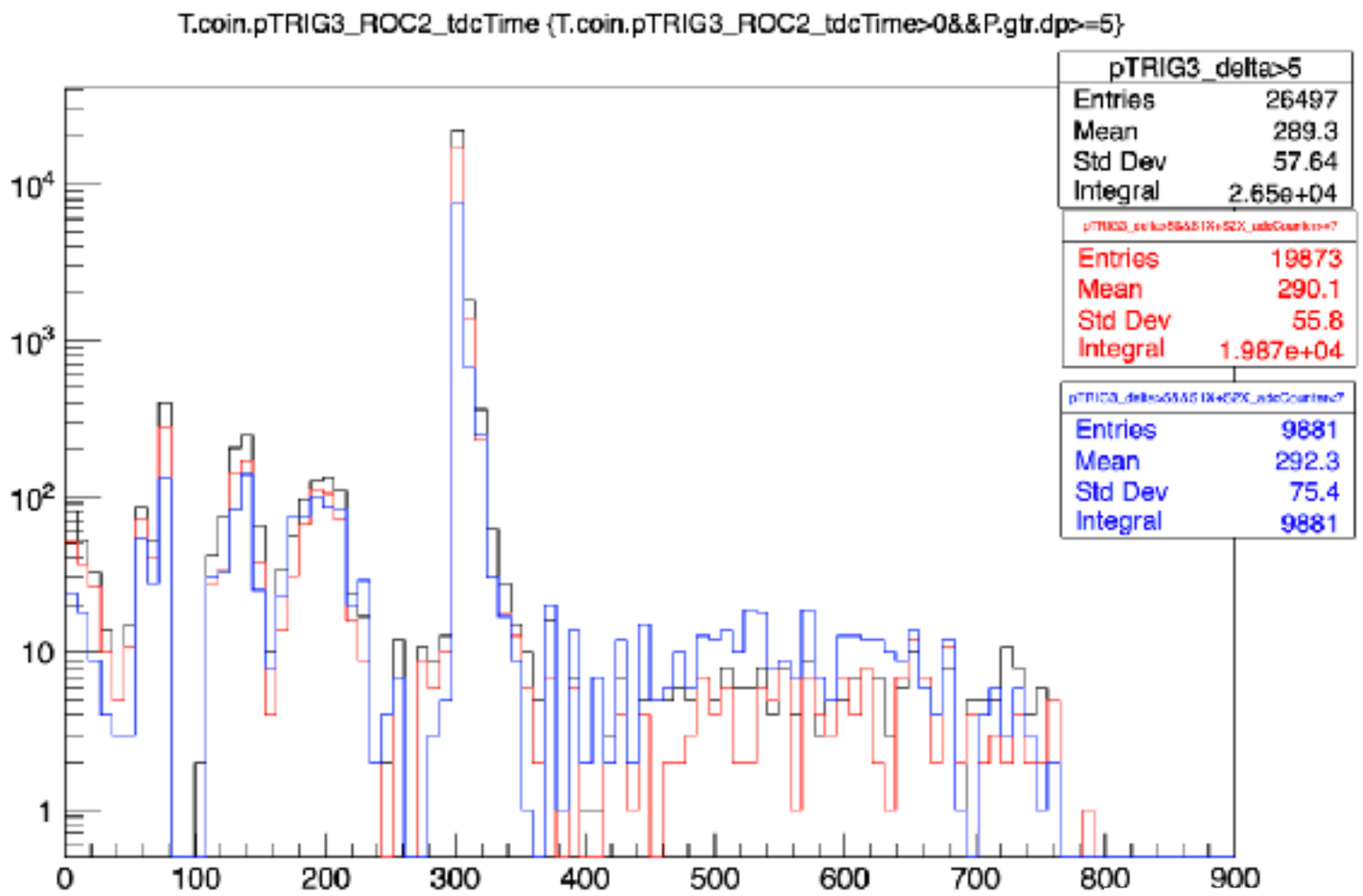
**** try doing a coin. Time cut**

How many protons with delta >= 5 % survived the S1X+S2X adcCounter>=7 CUT ???

1.458 / 1.896 = 76.8 (~ 77%)

# of elastic protons (W: 0.85, 1.05)





SHMS EL-CLEAN

1) delta>=5%

2) delta>=5%, S1X+S2X adcCounter>=7

3) delta>=5%, S1X+S2X adcCounter<7

Fraction of triggers w/ adcCounter >=7

1.987 / 2.65 = 0.749 (~75%)

SHMS +HMS 3/4 COIN

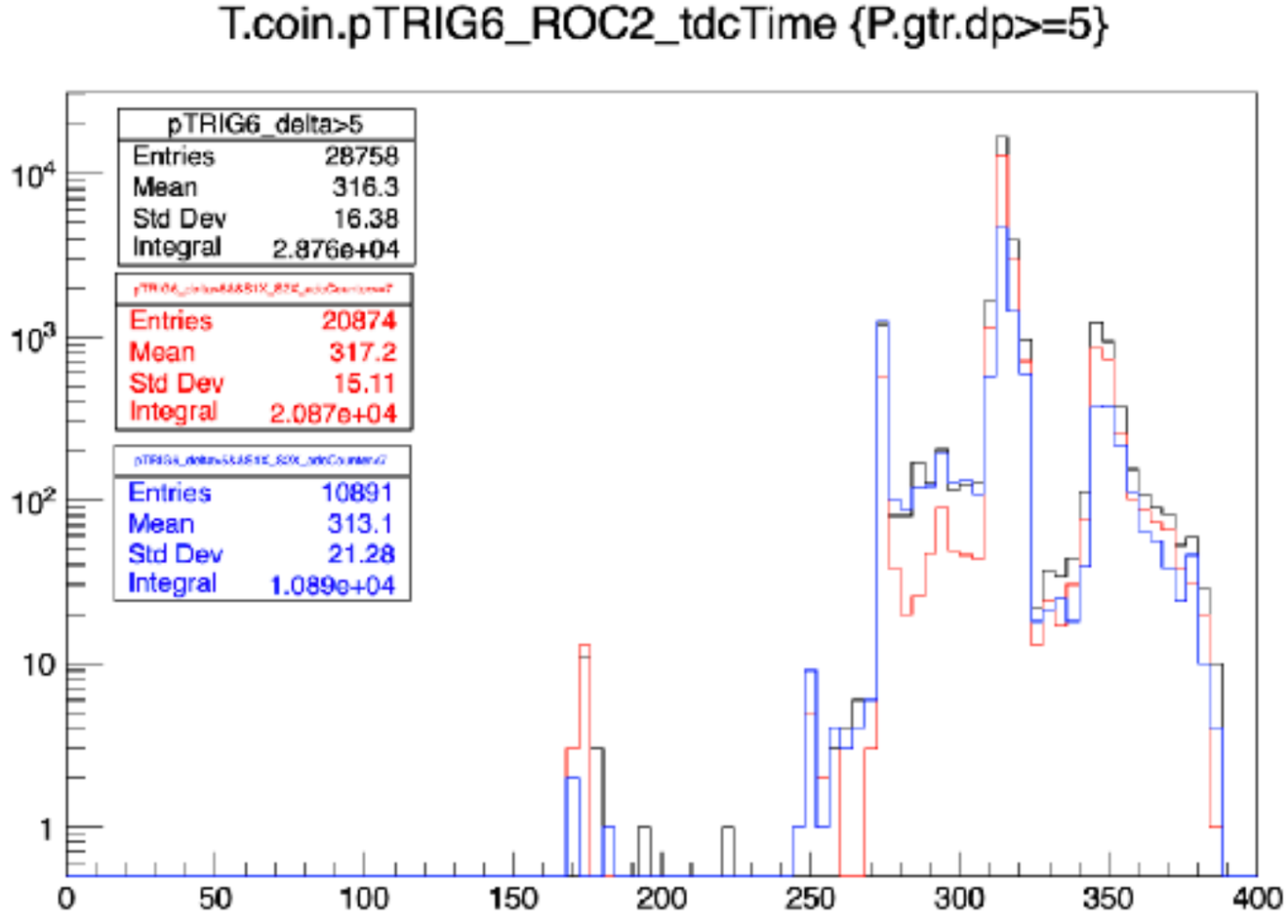
1) delta>=5%

2) delta>=5%, S1X+S2X adcCounter>=7

3) delta>=5%, S1X+S2X adcCounter<7

Fraction of triggers w/ adcCounter >=7

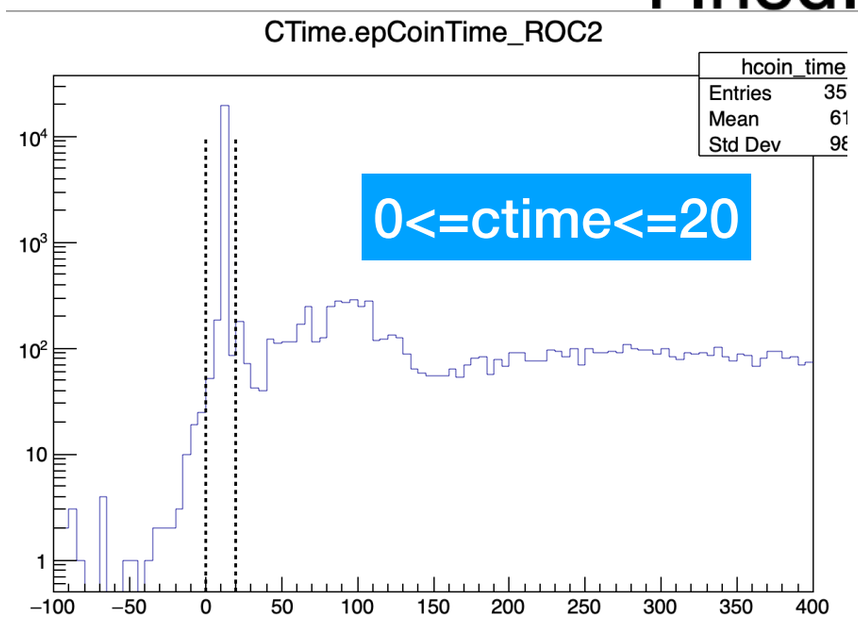
2.087 / 2.876 = 0.725 (~72.5%)

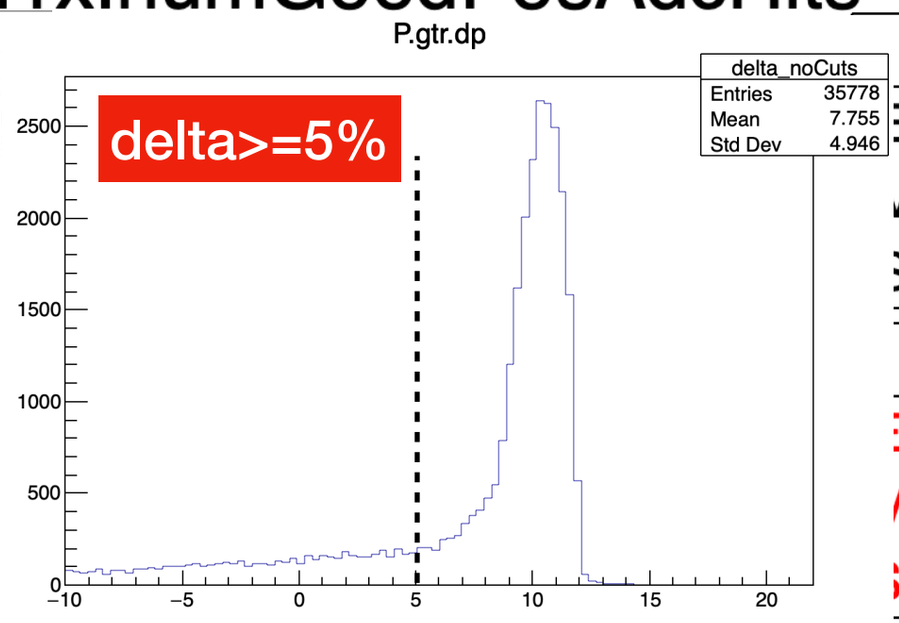


Study the effects of a coincidence time cut (next slides)

Tools Help

P.hod.1x.numGoodPosAdcHits



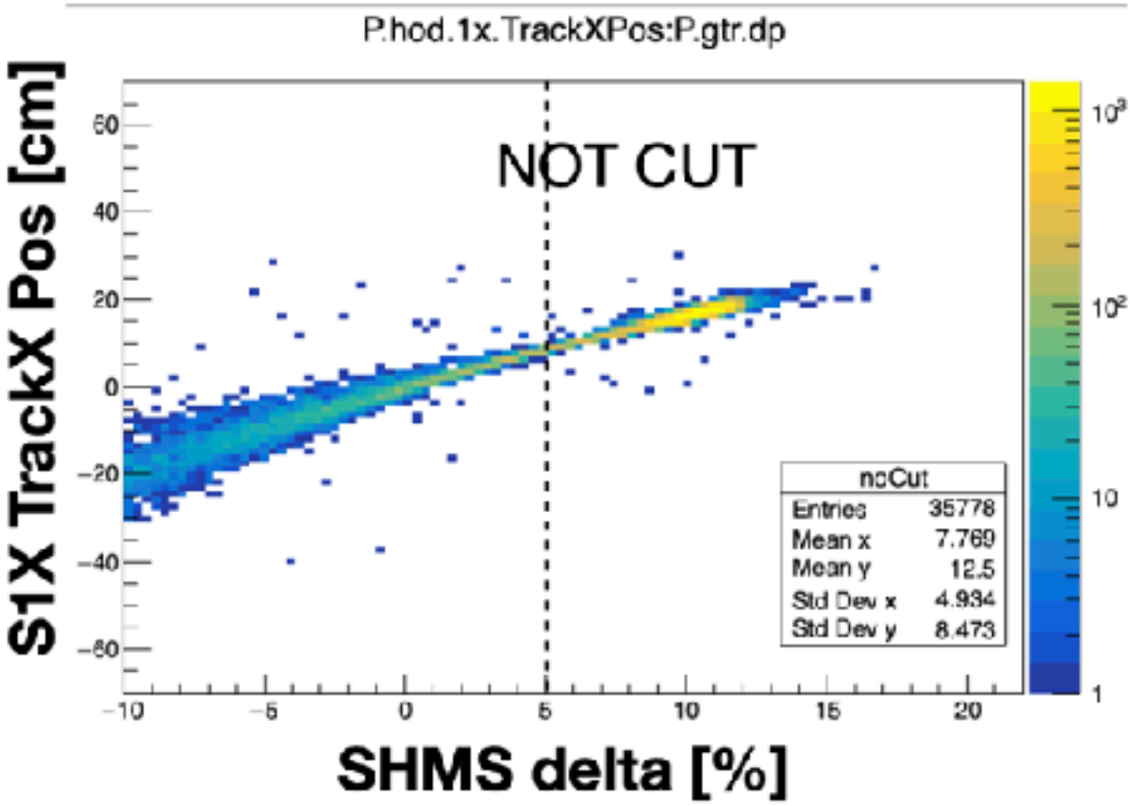


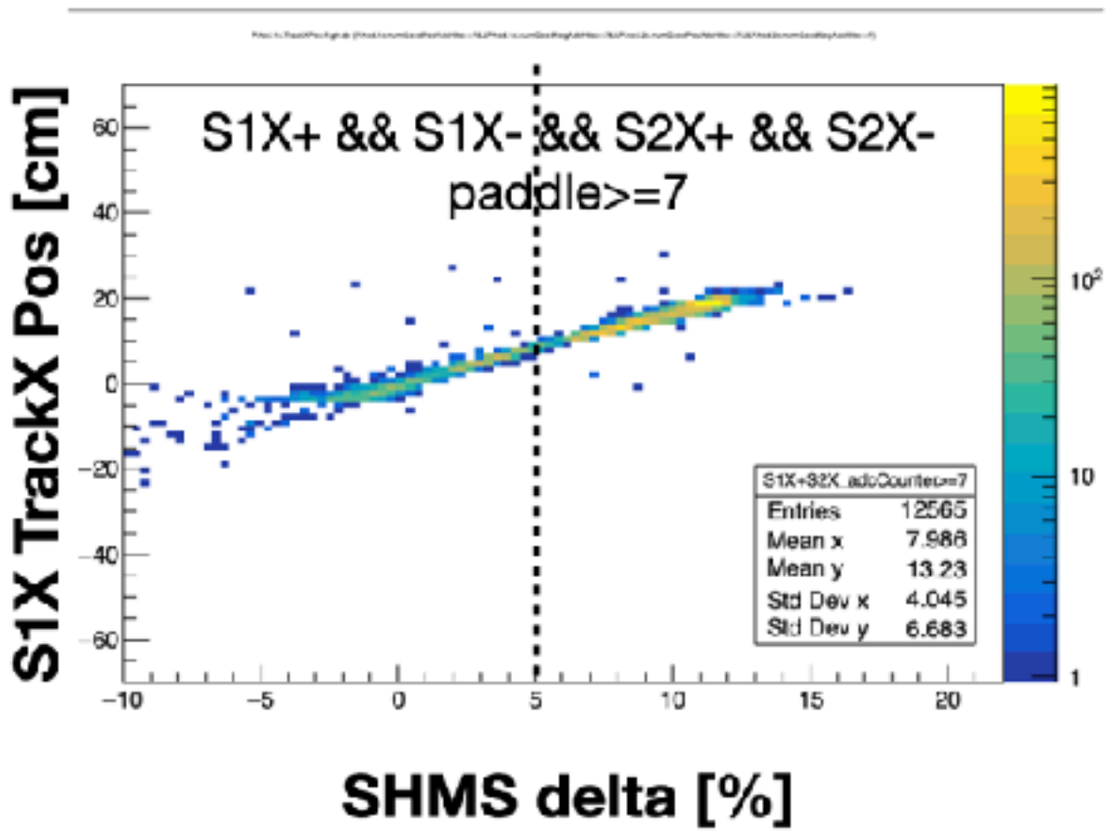
noCuts	
Entries	465114
Mean	7.802
Std Dev	2.584

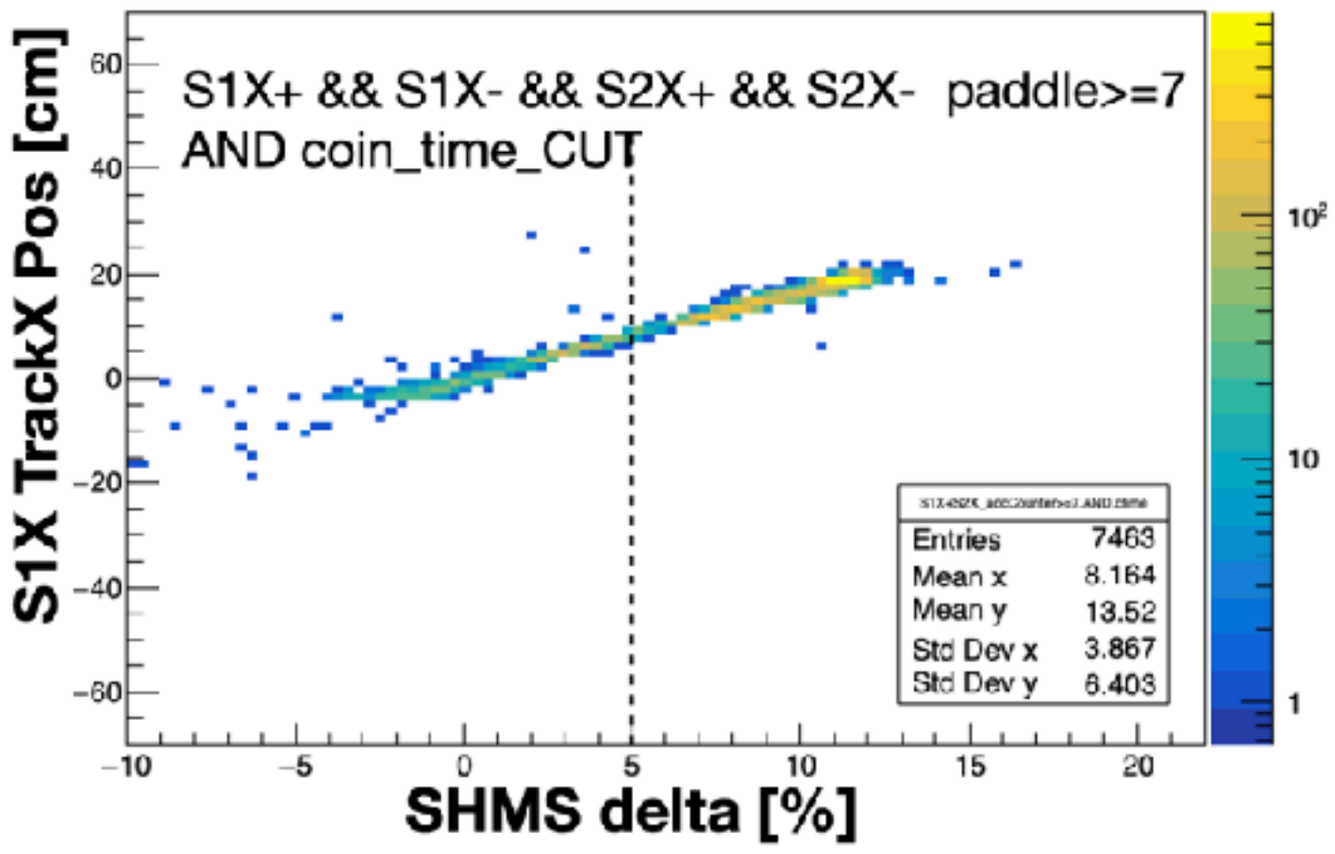
delta>=5	
Entries	373191
Mean	8.137
Std Dev	2.516

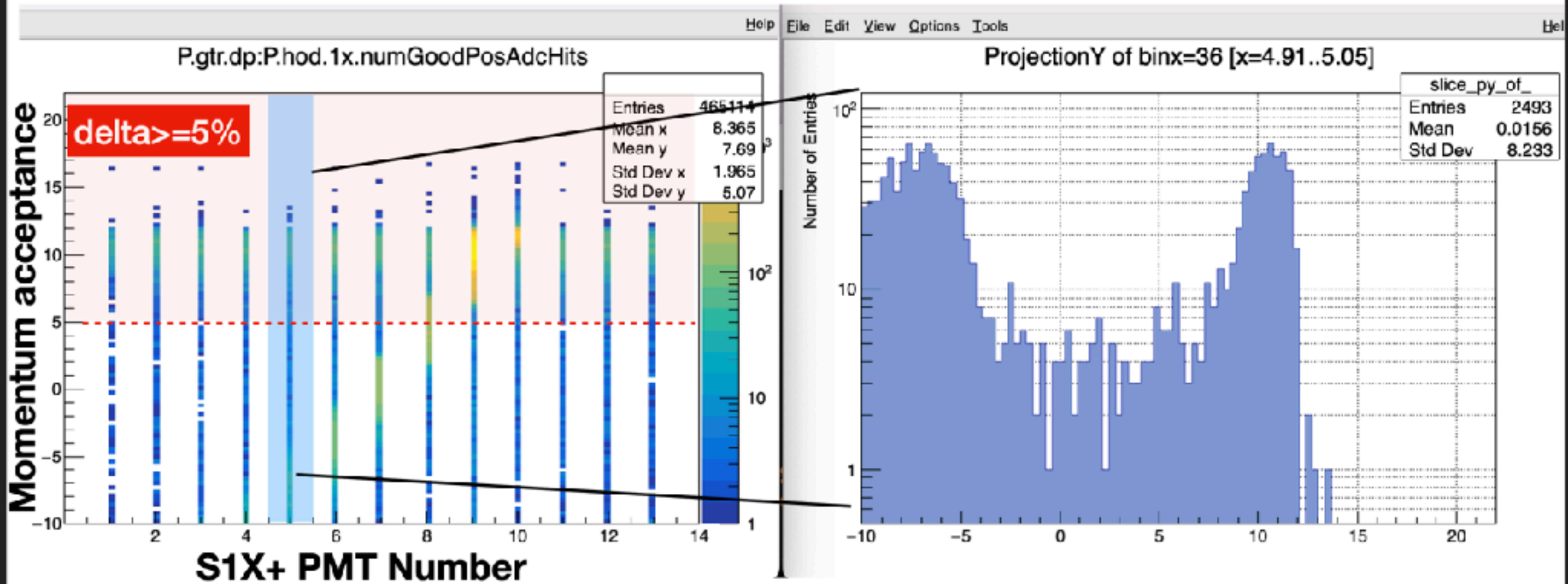
ctime.AND.delta>=5	
Entries	213408
Mean	8.752
Std Dev	1.744

Coin time cut does reduce the scin. paddle counters, but NOT completely turned OFF.


P.hod.1x.TrackXPos:P.gtr.dp
NOT CUT
ncCut
Entries 35778
Mean x 7.769
Mean y 12.5
Std Dev x 4.934
Std Dev y 8.473
S1X TrackX Pos [cm]
SHMS delta [%]


S1X+ && S1X- && S2X+ && S2X-
paddle>=7
S1X+S2X_adcCounter>=7
Entries 12565
Mean x 7.986
Mean y 13.23
Std Dev x 4.045
Std Dev y 6.683
S1X TrackX Pos [cm]
SHMS delta [%]


S1X+ && S1X- && S2X+ && S2X- paddle>=7
AND coin_time_CUT
Entries 7463
Mean x 8.164
Mean y 13.52
Std Dev x 3.867
Std Dev y 6.403
S1X TrackX Pos [cm]
SHMS delta [%]



Slice of SHMS S1X+ paddle 5 counter in momentum ACCEPTACNE delta

Observation: - two bands of momentum acceptance across all paddles
- even when we select delta >= 5%, the lower paddle numbers still have momentum acceptance delta ~ 10%, so cutting out the lower paddle numbers cuts out events at delta~10%

** It is very weird, but it seems to me, this approach is Not trustworthy. I will go ahead and look at the simulation And see if I can turn off paddles and carry out simulation