pXp analysis

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Overview

- mass distribution of pion pairs using PID

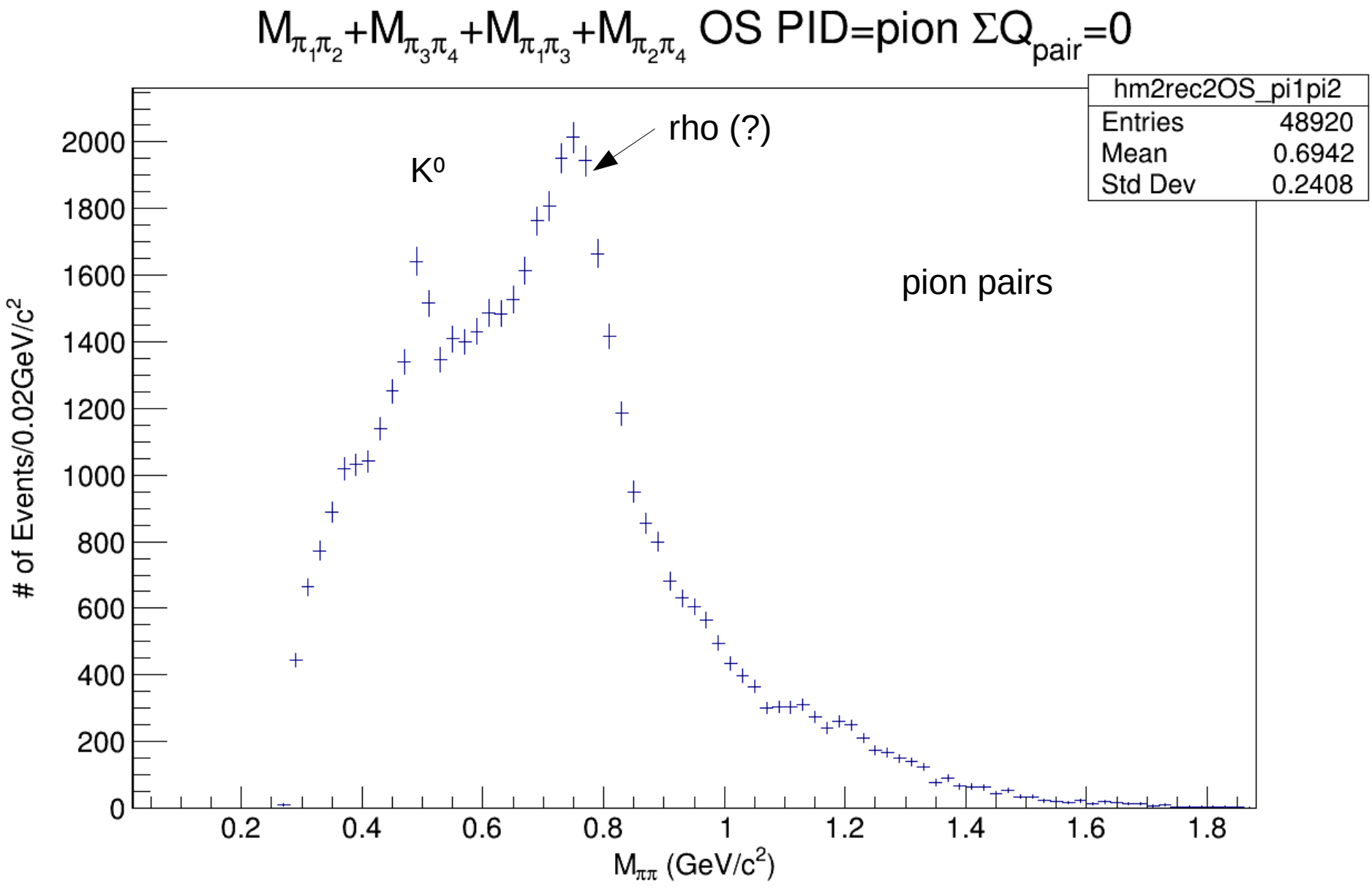
- ratio TTBB/DIAG

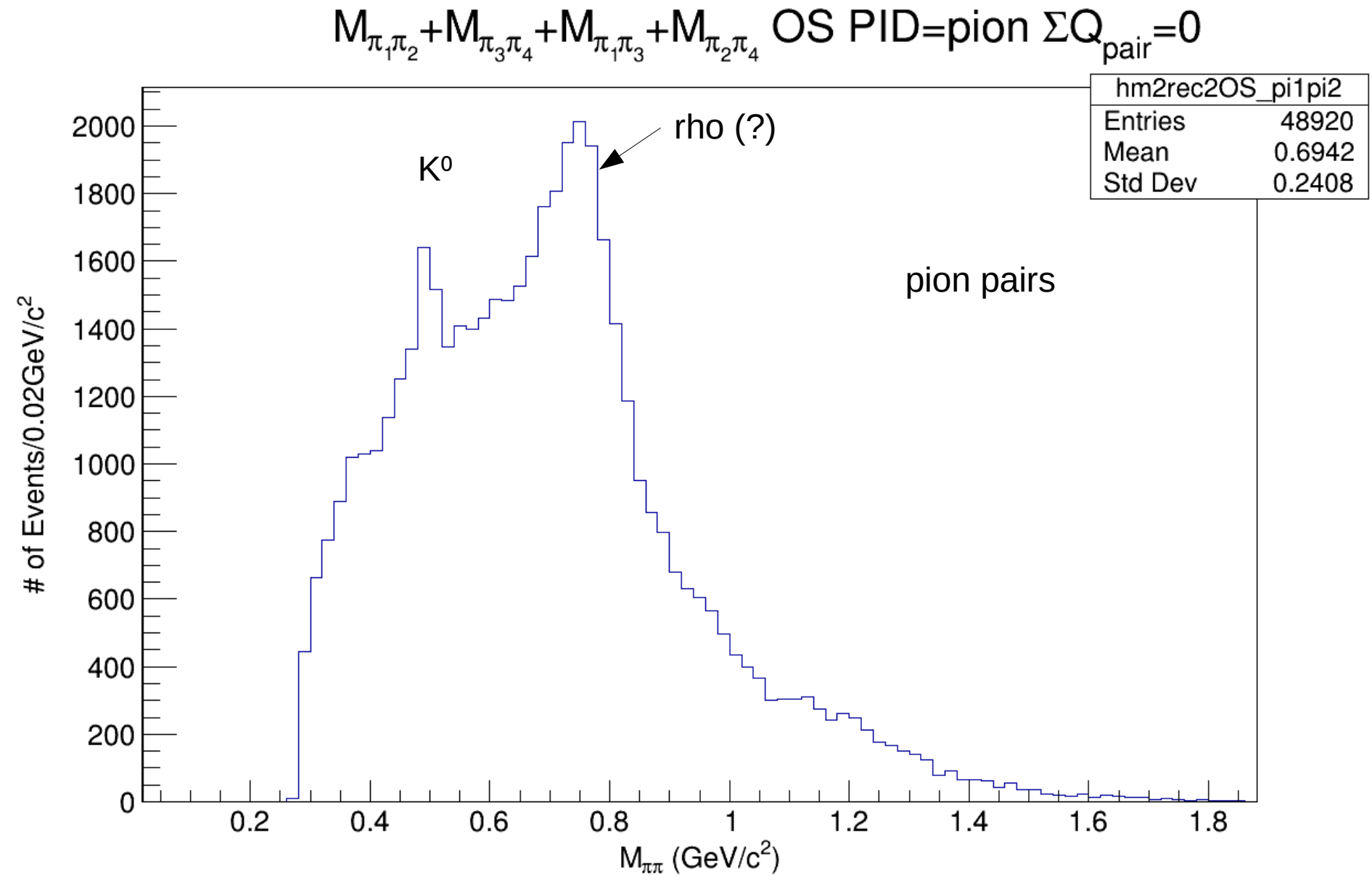
- 4-track 2015 sample

- x and y position of the vertex

- understanding the vertex collection

- we expect to see a secondary vertex for the K-short at 2.68 cm


$M_{\pi_1\pi_2}+M_{\pi_3\pi_4}+M_{\pi_1\pi_3}+M_{\pi_2\pi_4}$ OS PID=pion $\Sigma Q_{pair}=0$
hm2rec2OS_pi1pi2
Entries 48920
Mean 0.6942
Std Dev 0.2408
rho (?)
K^0
pion pairs
# of Events/0.02GeV/c^2
$M_{\pi\pi}$ (GeV/c^2)
0
200
400
600
800
1000
1200
1400
1600
1800
2000
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8


$M_{\pi_1\pi_2}+M_{\pi_3\pi_4}+M_{\pi_1\pi_3}+M_{\pi_2\pi_4}$ OS PID=pion $\Sigma Q_{pair}=0$
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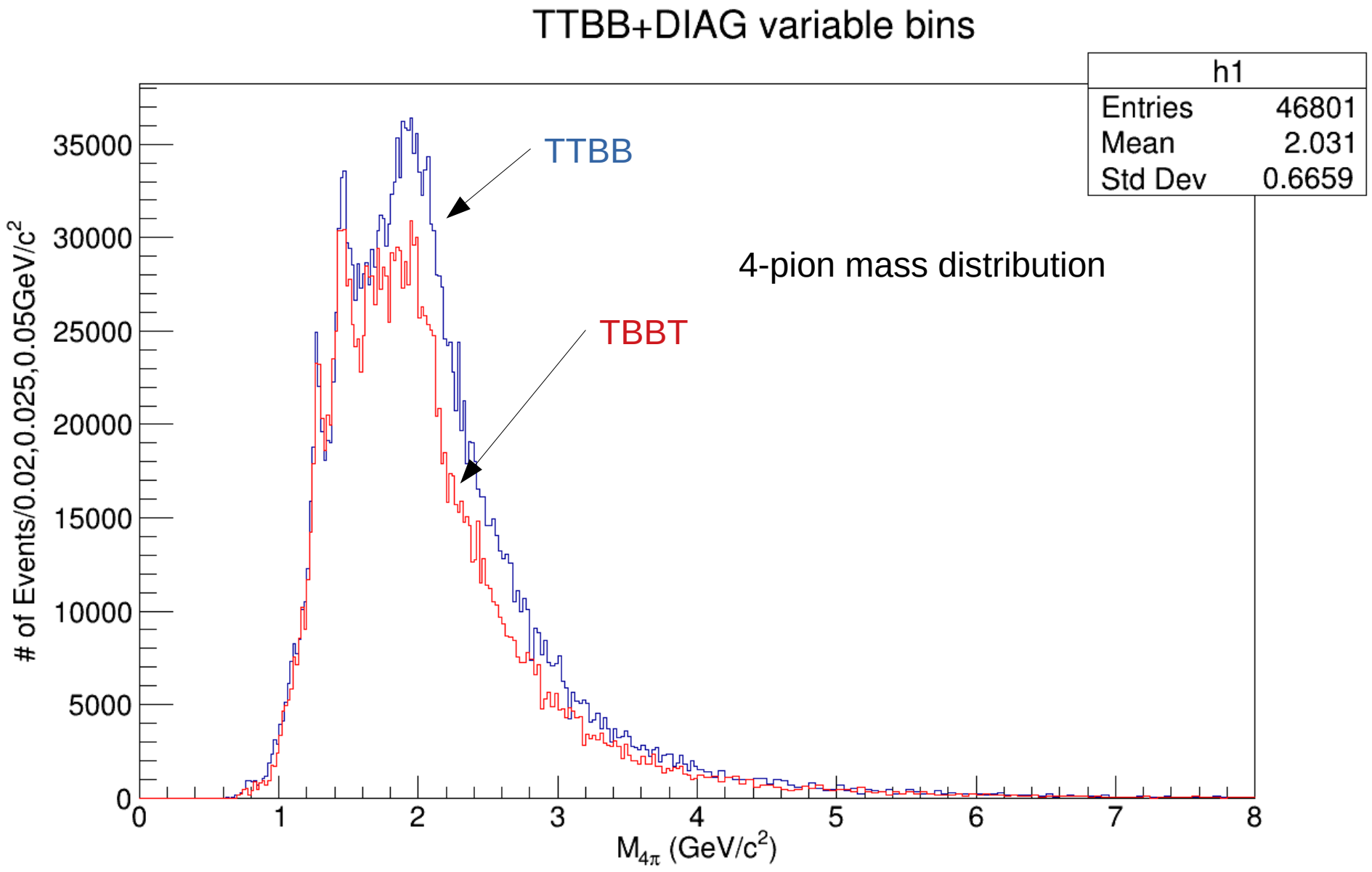
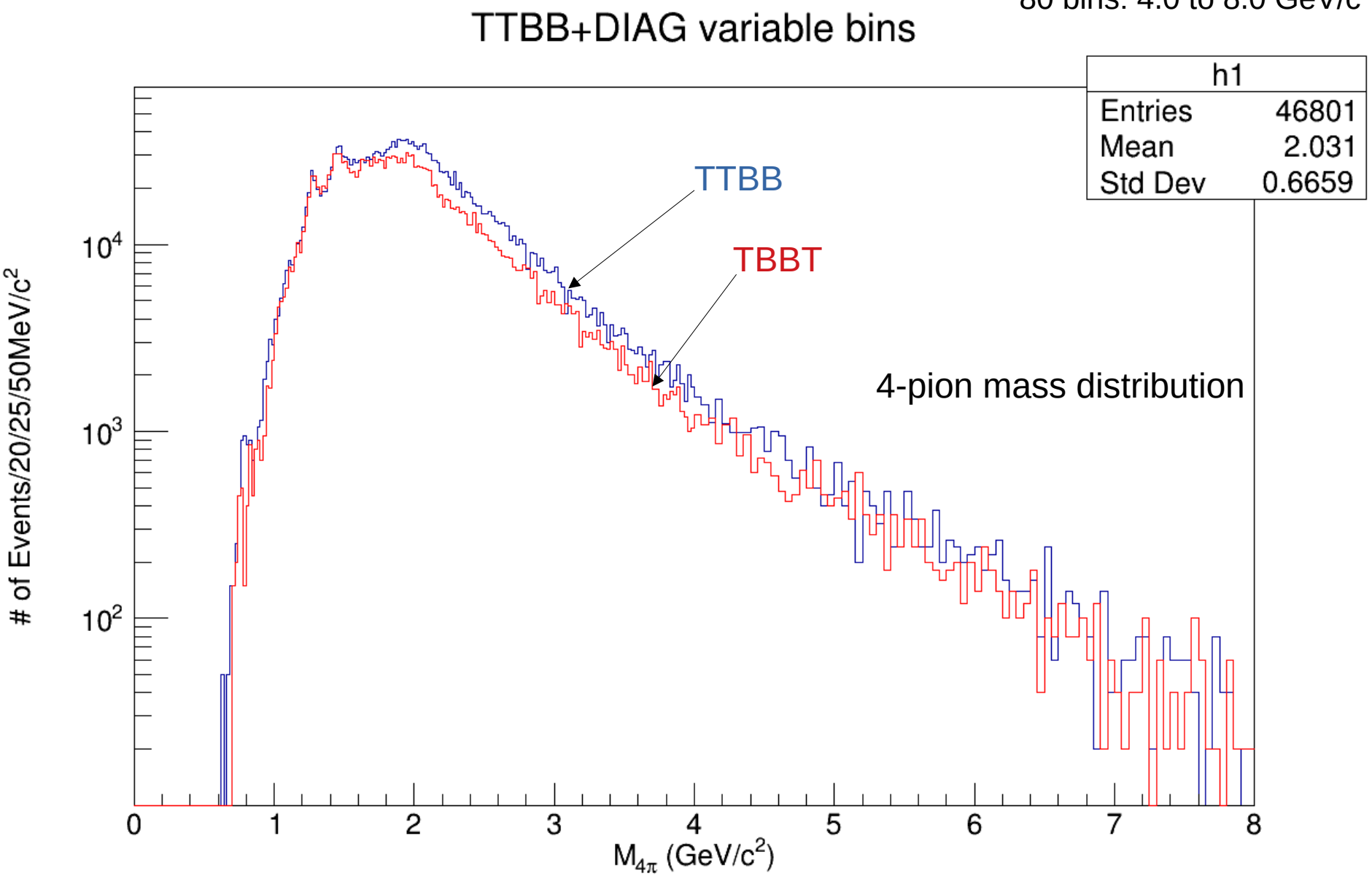
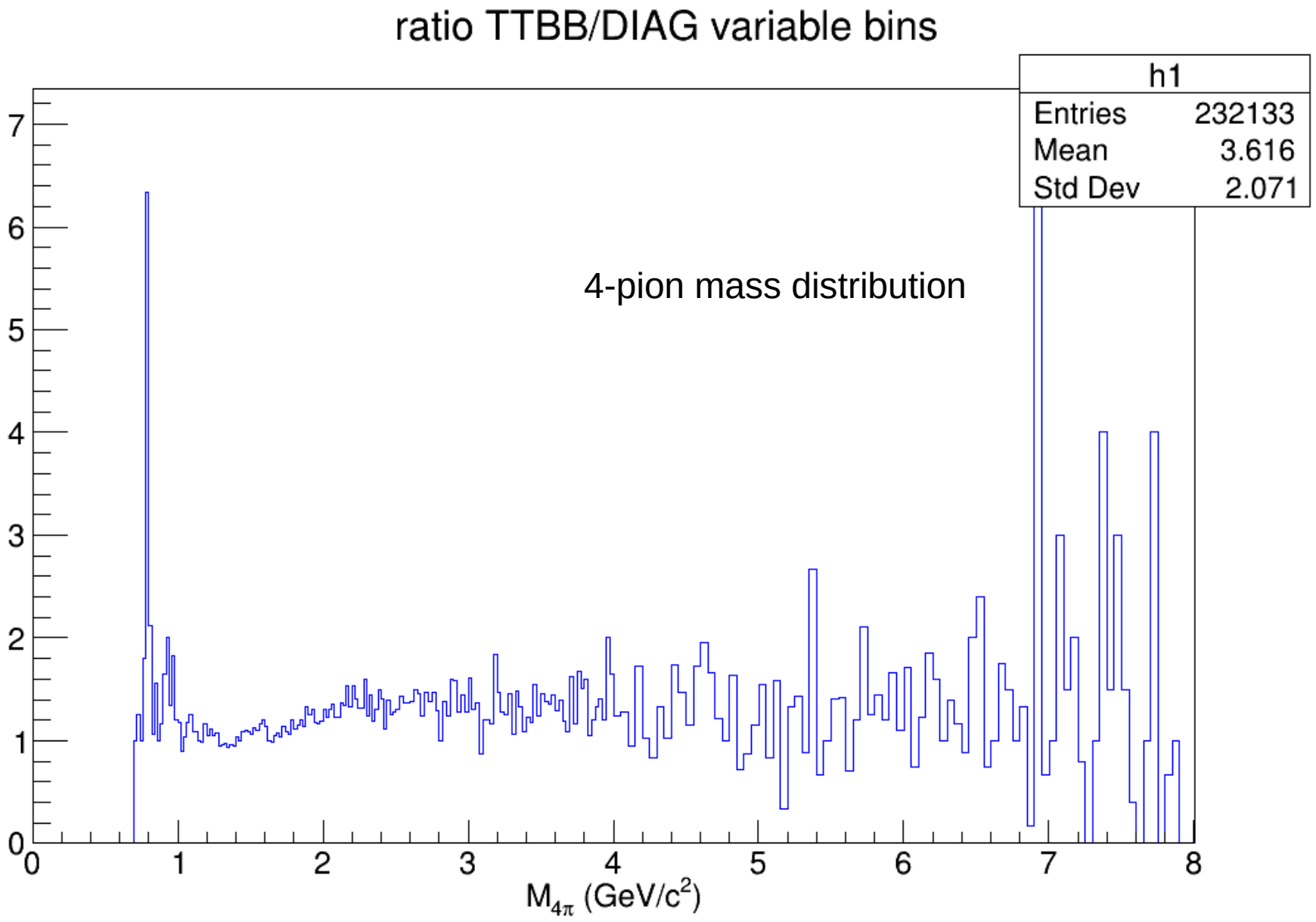
0
200
400
600
800
1000
1200
1400
1600
1800
2000
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8

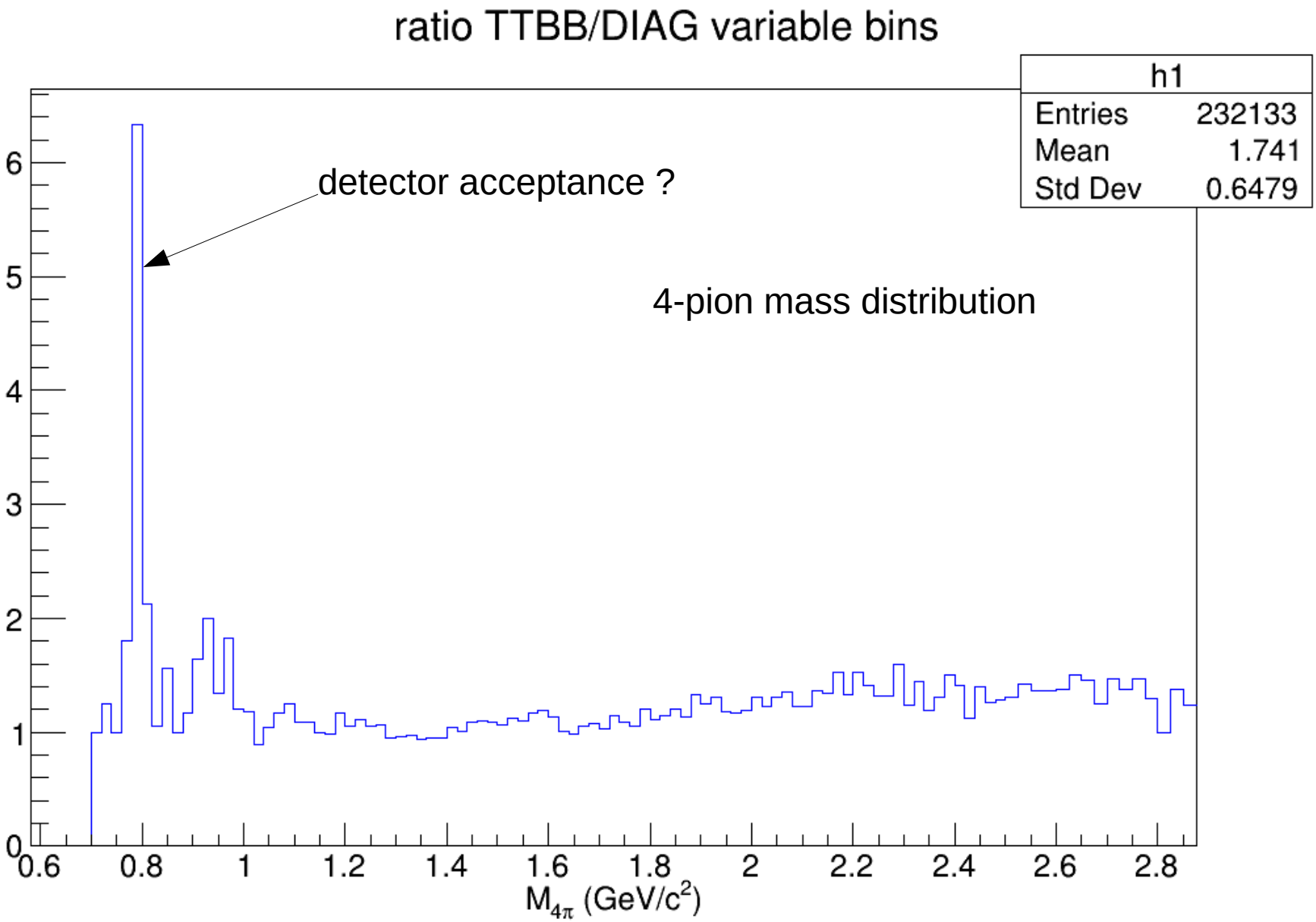

TTBB+DIAG variable bins
h1
Entries 46801
Mean 2.031
Std Dev 0.6659
TTBB
TBBT
4-pion mass distribution
# of Events/0.02,0.025,0.05GeV/c²
M4π (GeV/c²)
0
5000
10000
15000
20000
25000
30000
35000
0
1
2
3
4
5
6
7
8

cut 2, Q=0

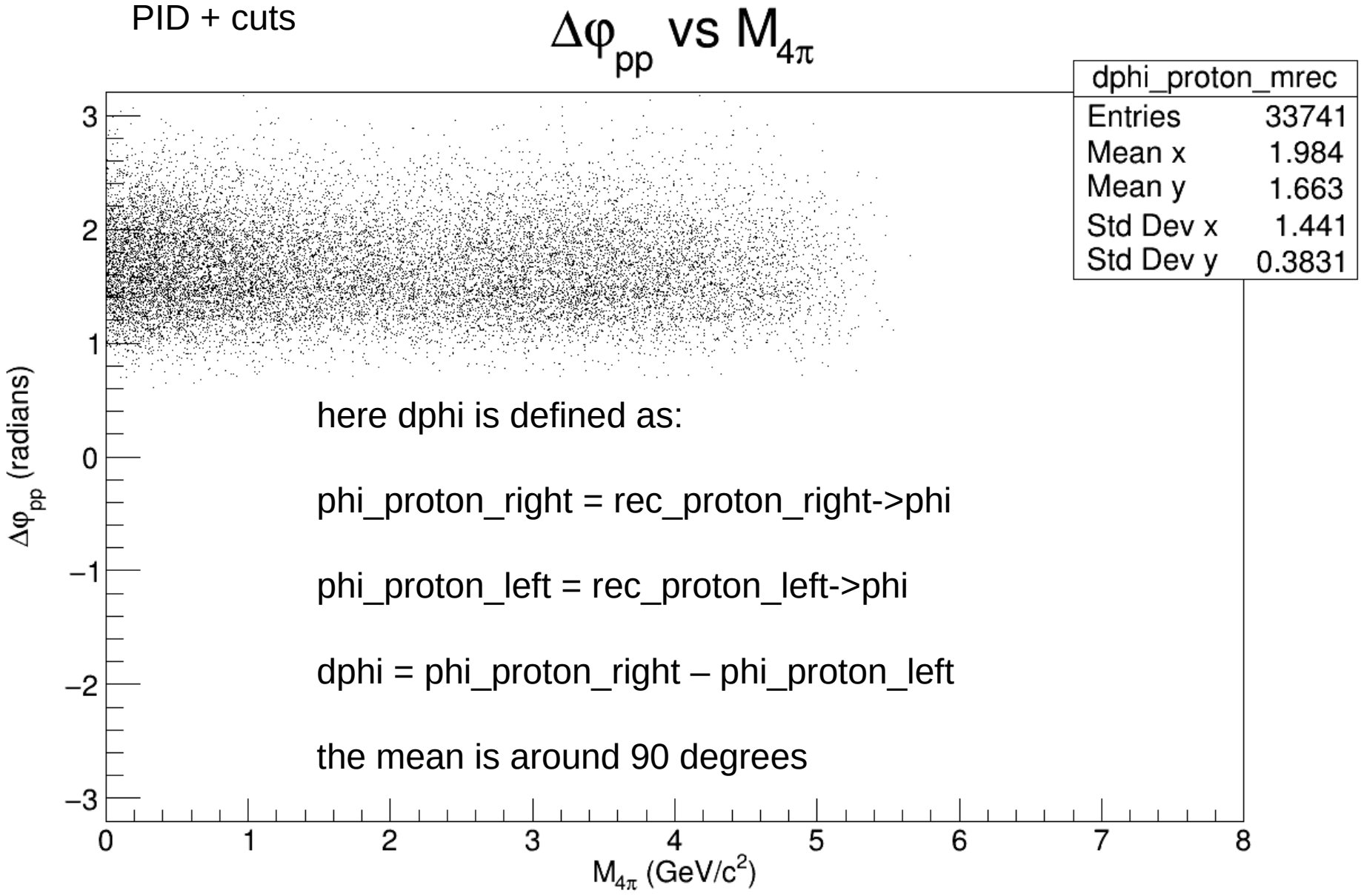
125 bins: 0.0 to 2.5 GeV/c²
60 bins: 2.5 to 4.0 GeV/c²
80 bins: 4.0 to 8.0 GeV/c²

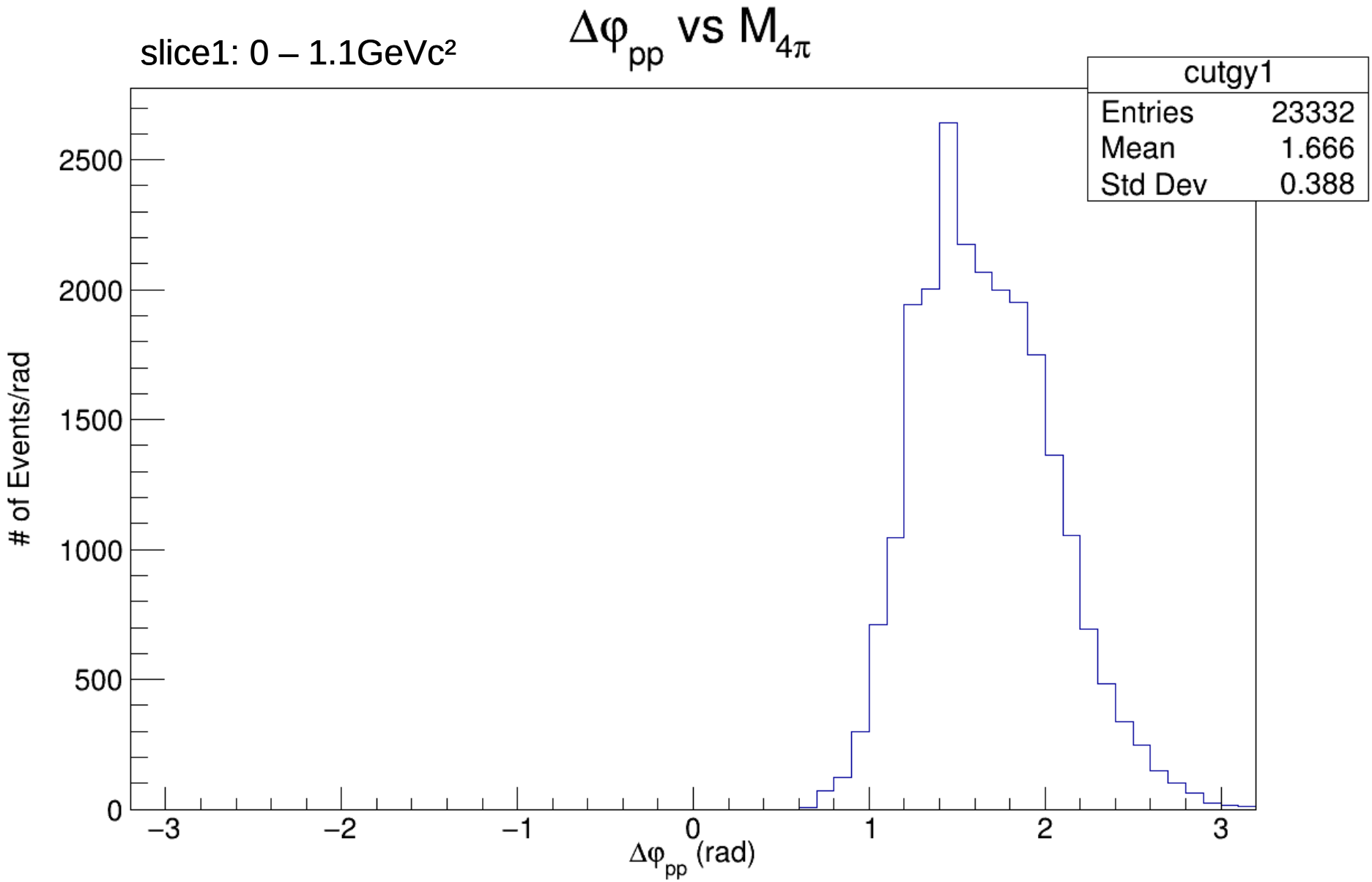


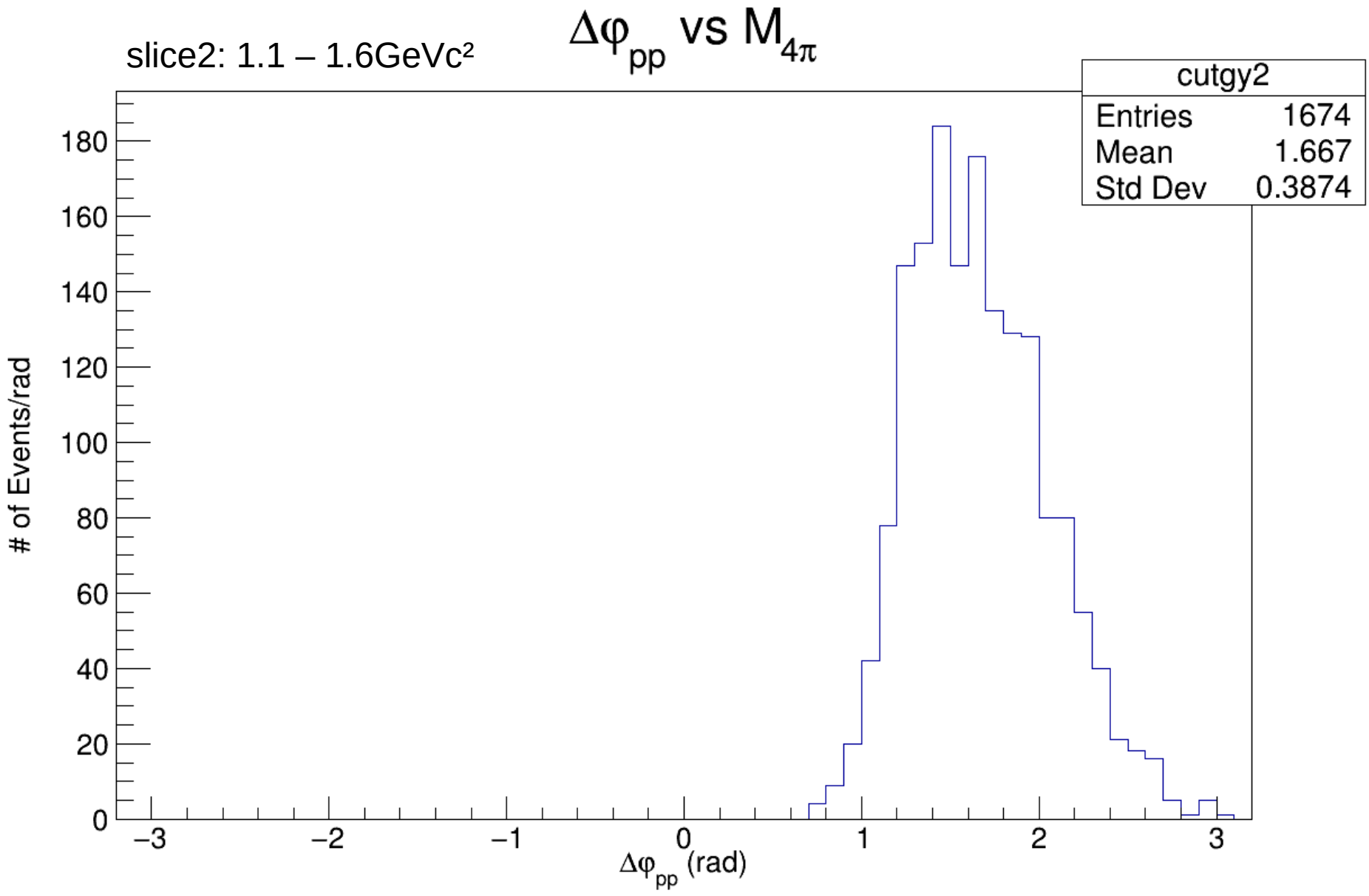

ratio TTBB/DIAG variable bins
h1
Entries 232133
Mean 3.616
Std Dev 2.071
4-pion mass distribution
0
1
2
3
4
5
6
7
8
$M_{4\pi}$ (GeV/c^2)

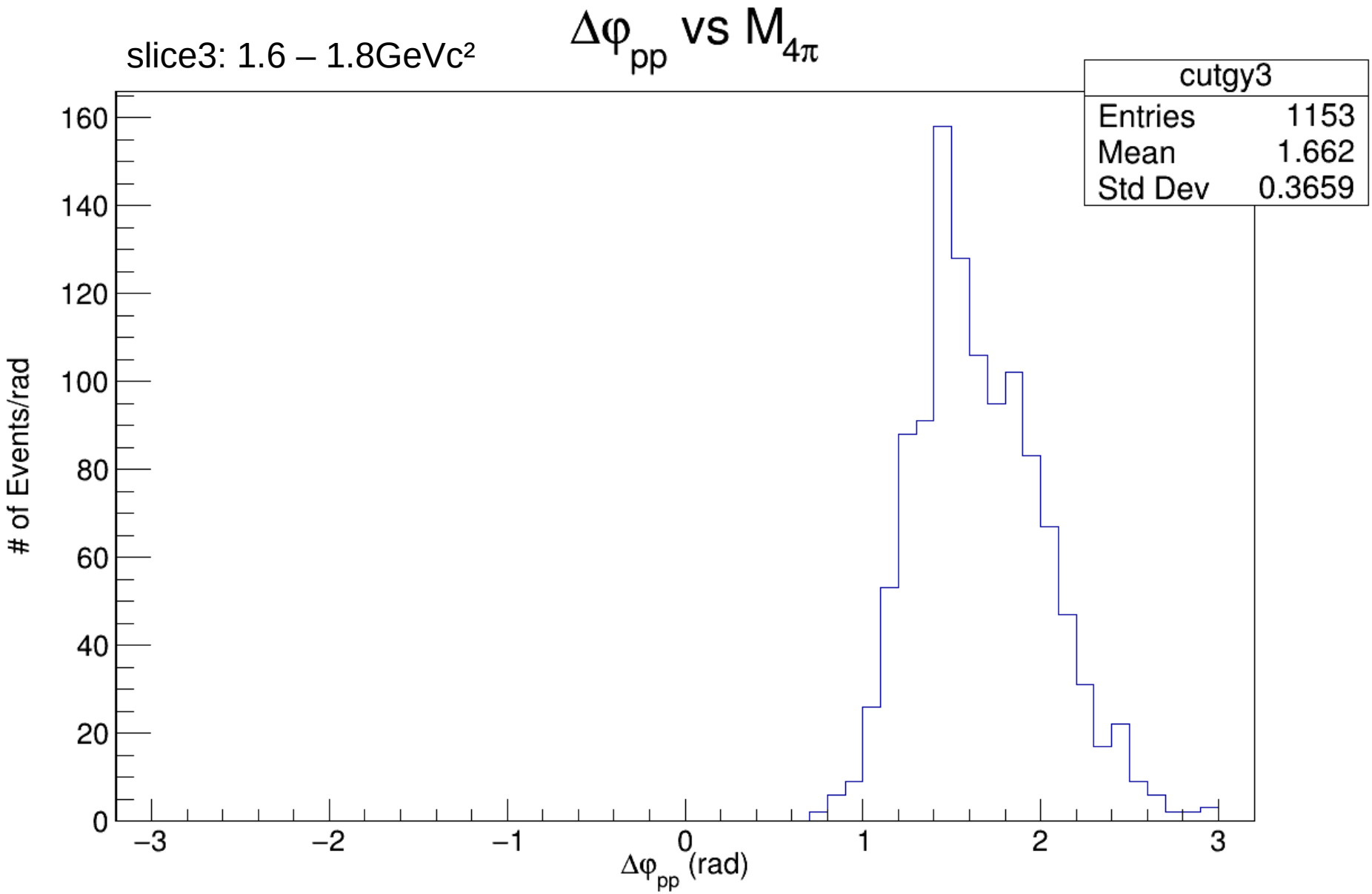

ratio TTBB/DIAG variable bins
h1
Entries 232133
Mean 1.741
Std Dev 0.6479
detector acceptance ?
4-pion mass distribution
0
1
2
3
4
5
6
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
$M_{4\pi}$ (GeV/c^2)

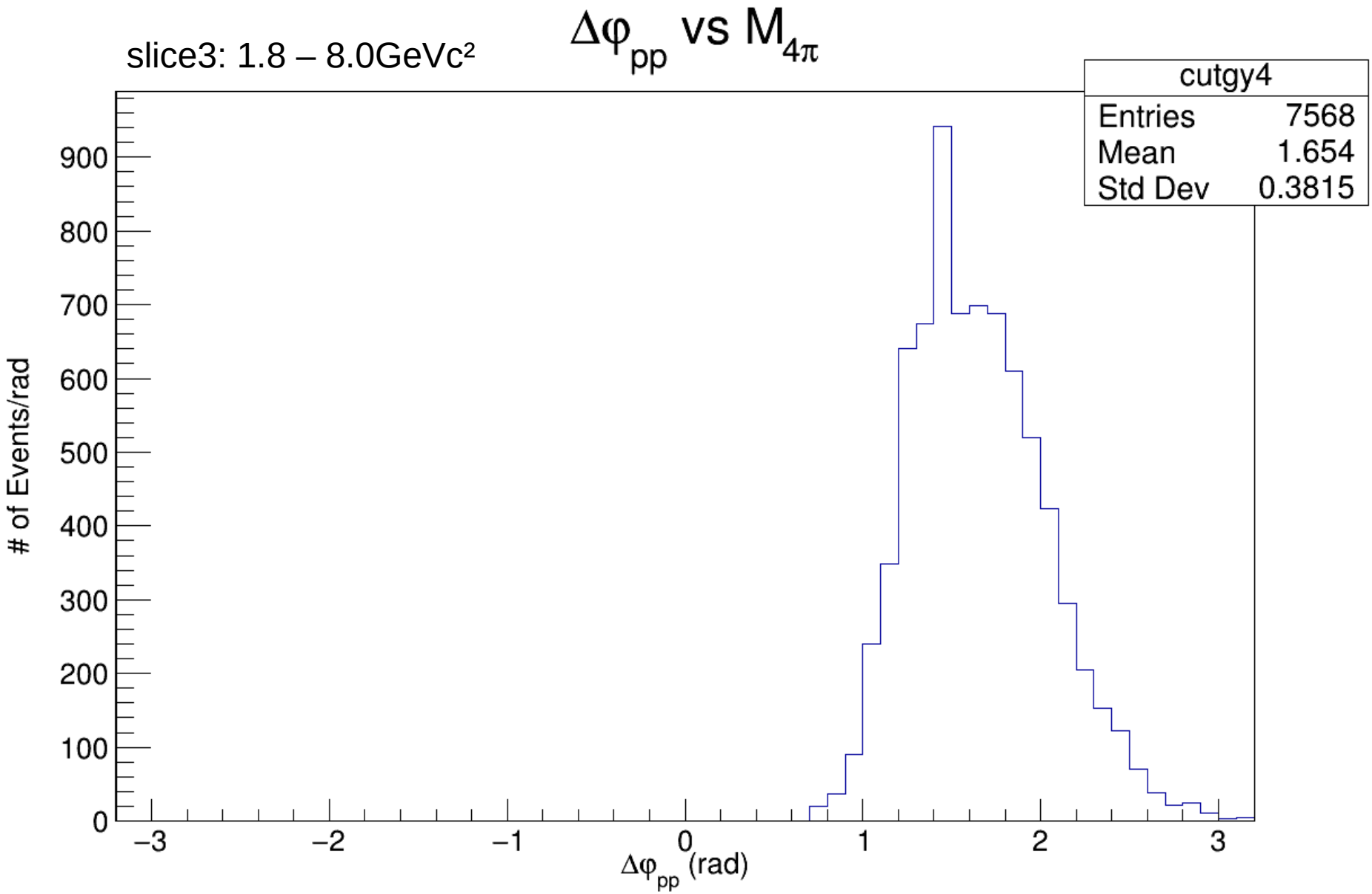
PID + cuts

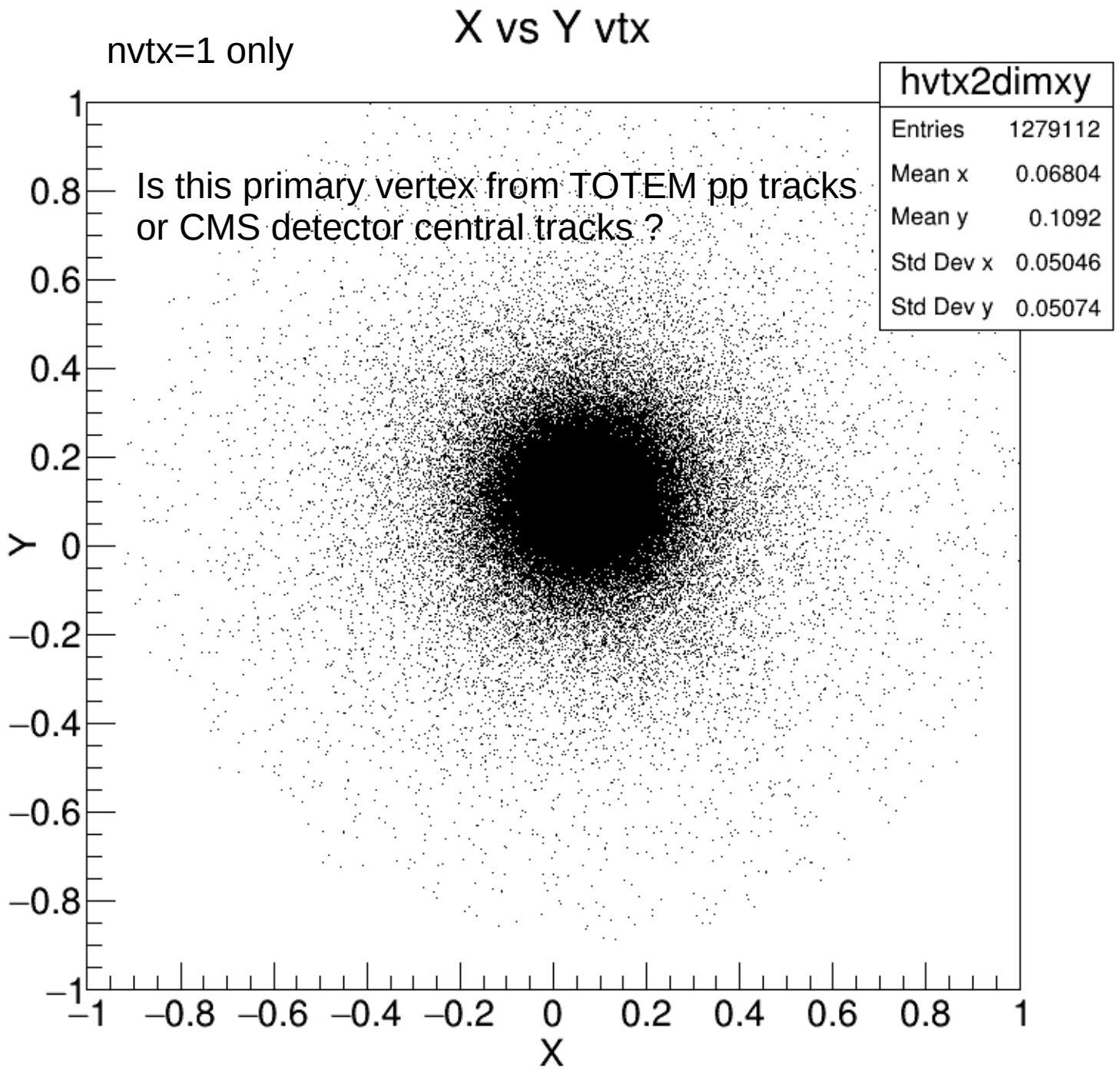

$\Delta\varphi_{pp}$ vs $M_{4\pi}$
dphi_proton_mrec
Entries 33741
Mean x 1.984
Mean y 1.663
Std Dev x 1.441
Std Dev y 0.3831
here dphi is defined as:
phi_proton_right = rec_proton_right->phi
phi_proton_left = rec_proton_left->phi
dphi = phi_proton_right – phi_proton_left
the mean is around 90 degrees
$\Delta\varphi_{pp}$ (radians)
$M_{4\pi}$ (GeV/c^2)


slice1: 0 – 1.1GeVc²
Δφpp vs M4π
cutgy1
Entries 23332
Mean 1.666
Std Dev 0.388
# of Events/rad
2500
2000
1500
1000
500
0
−3
−2
−1
0
1
2
3
Δφpp (rad)

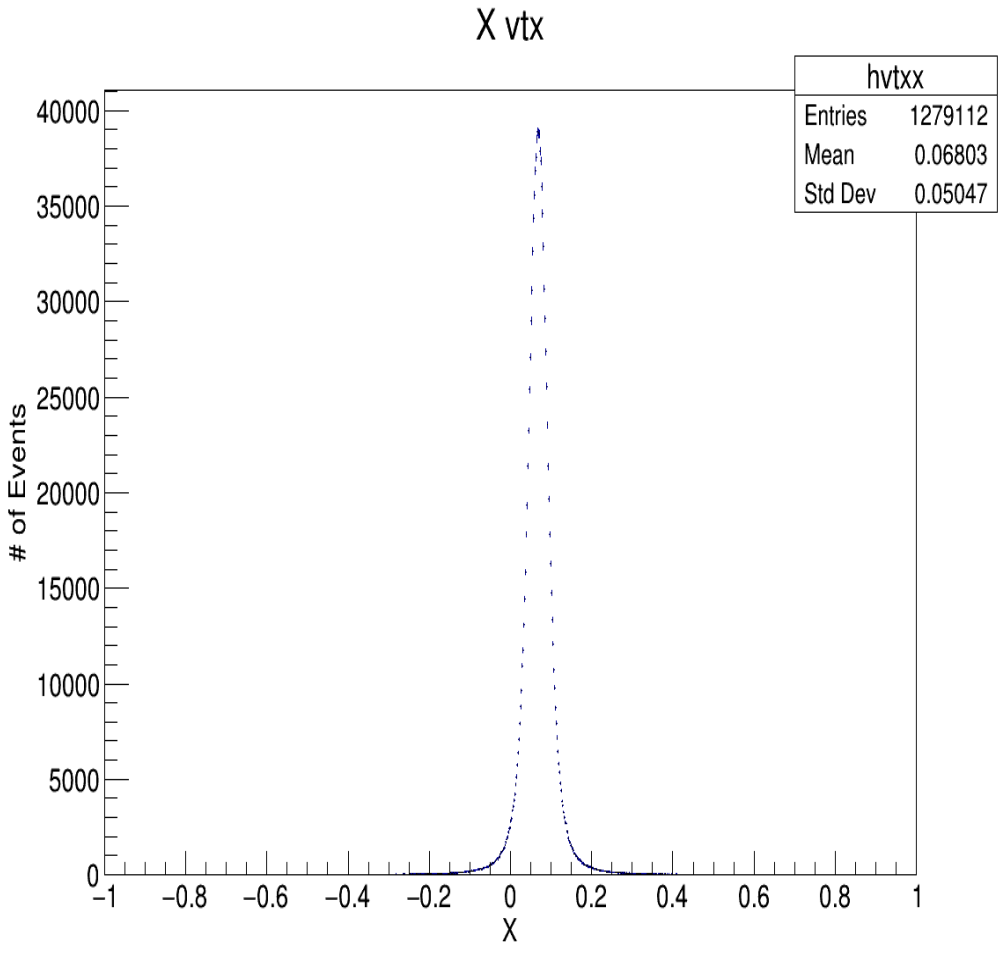

slice2: 1.1 – 1.6GeVc²
Δφpp vs M4π
cutgy2
Entries 1674
Mean 1.667
Std Dev 0.3874
# of Events/rad
Δφpp (rad)
0
20
40
60
80
100
120
140
160
180
−3
−2
−1
0
1
2
3

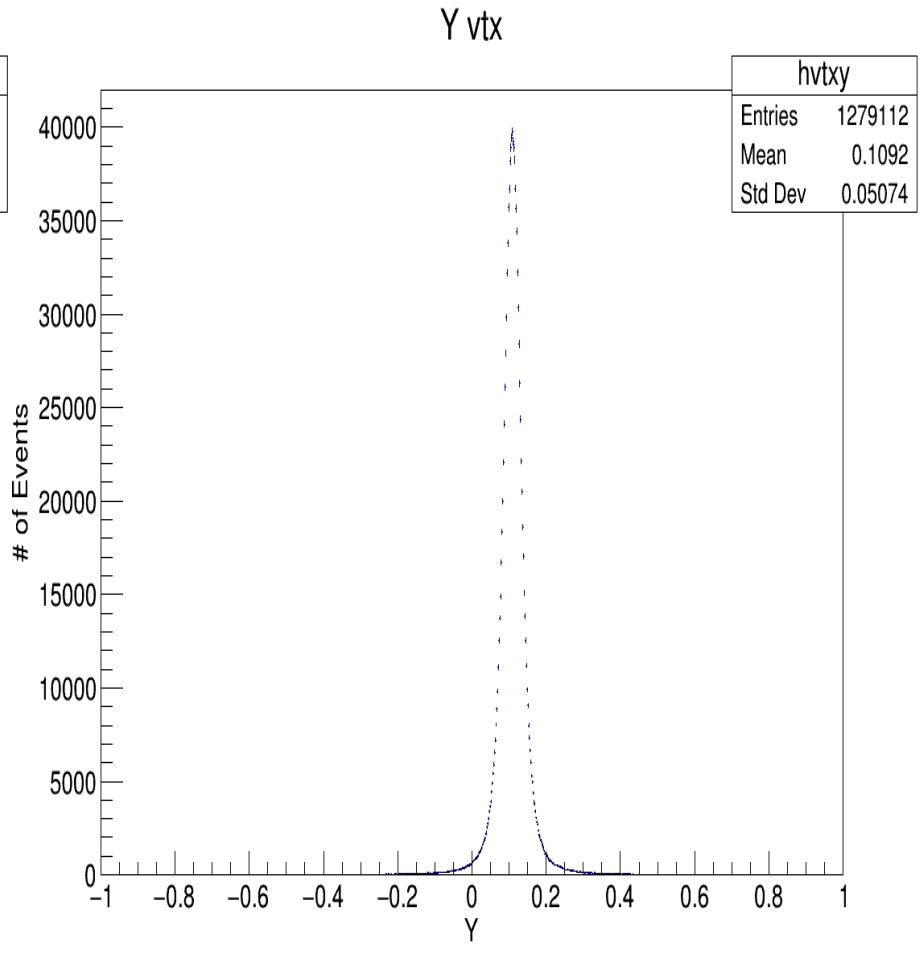

slice3: 1.6 – 1.8GeVc²
Δφpp vs M4π
cutgy3
Entries 1153
Mean 1.662
Std Dev 0.3659
# of Events/rad
Δφpp (rad)
0
20
40
60
80
100
120
140
160
−3
−2
−1
0
1
2
3

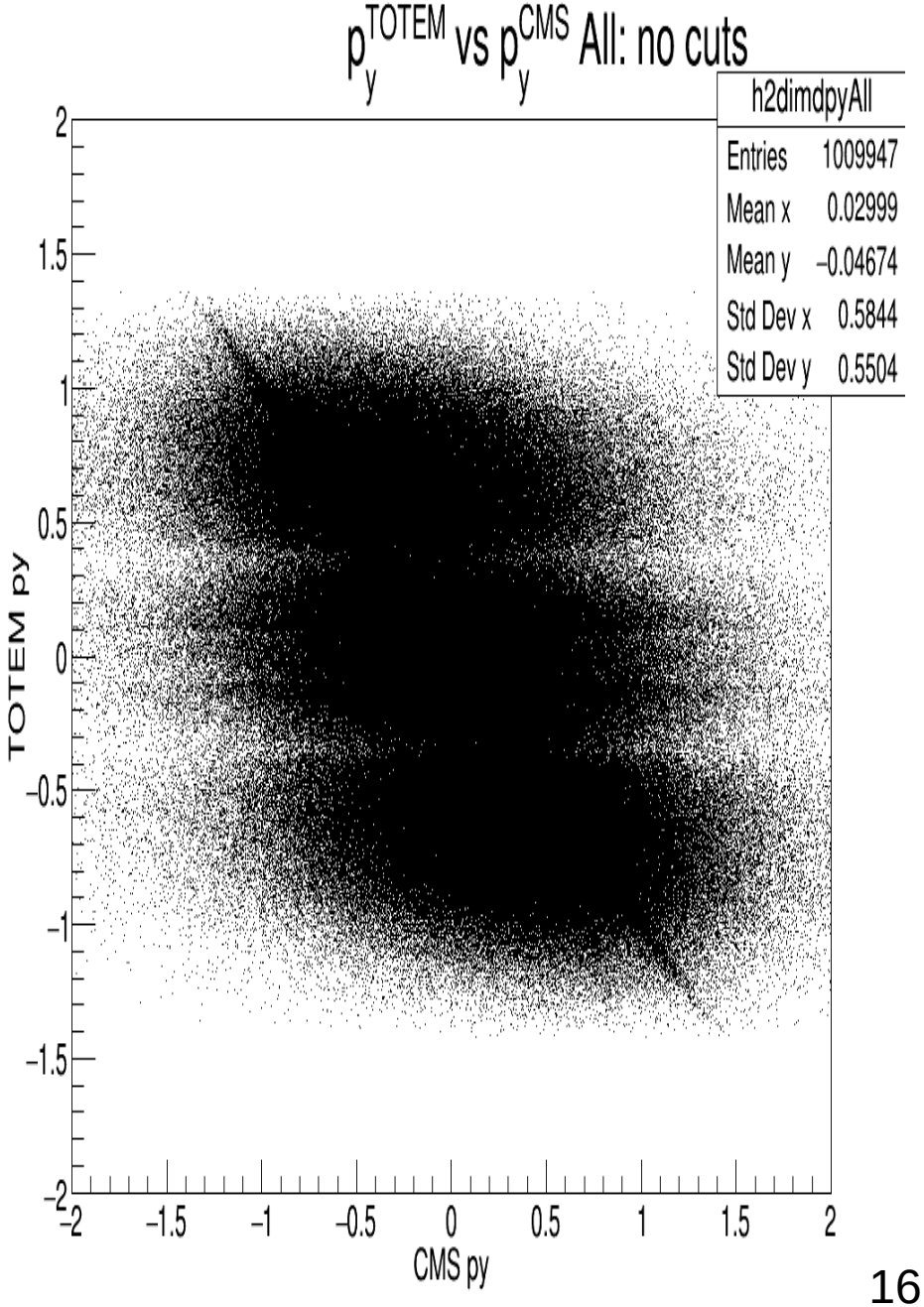

slice3: 1.8 – 8.0GeVc²
Δφpp vs M4π
cutgy4
Entries 7568
Mean 1.654
Std Dev 0.3815
# of Events/rad
Δφpp (rad)
0
100
200
300
400
500
600
700
800
900
−3
−2
−1
0
1
2
3

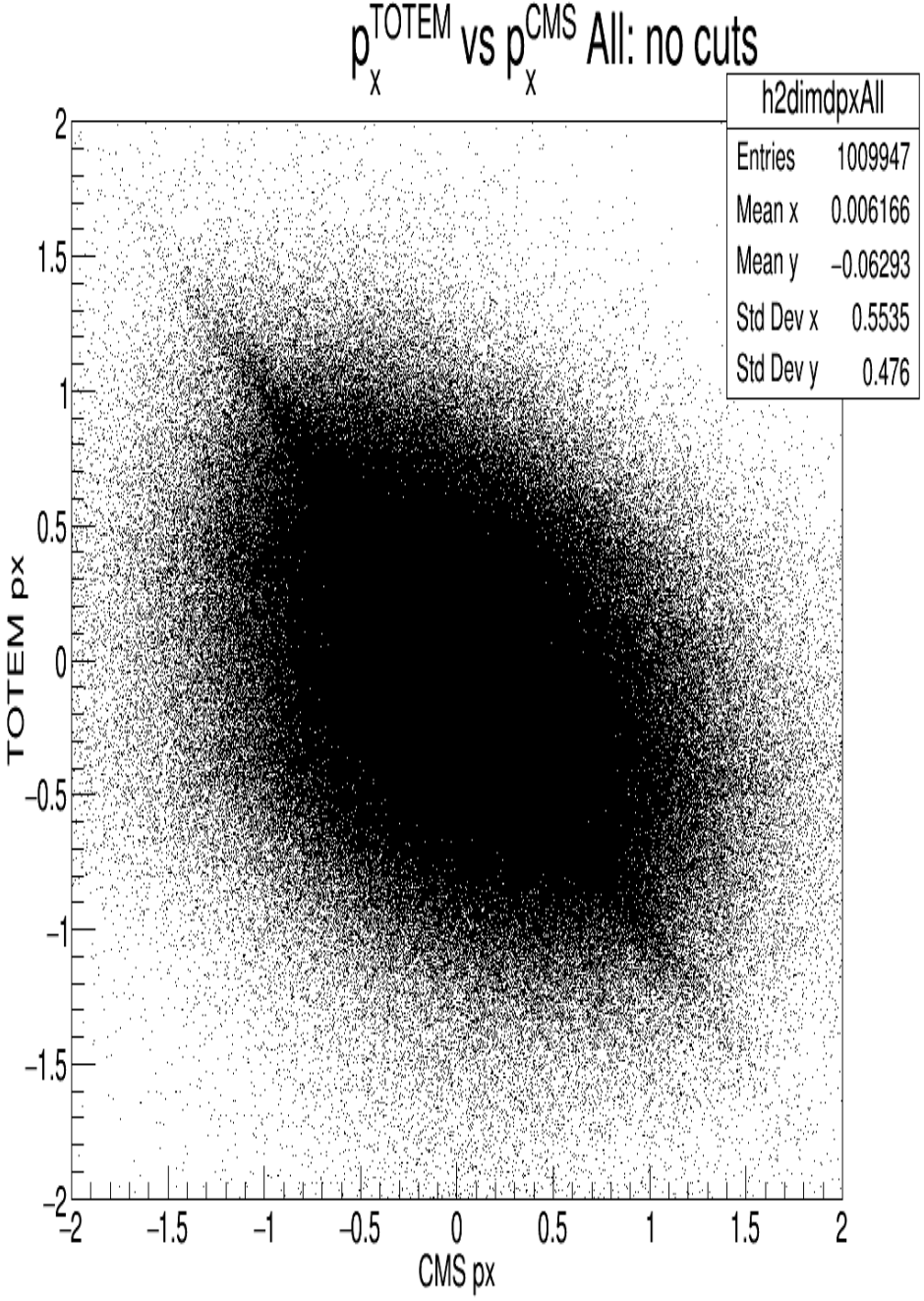

X vs Y vtx
nvtx=1 only
hvtx2dimxy
Entries 1279112
Mean x 0.06804
Mean y 0.1092
Std Dev x 0.05046
Std Dev y 0.05074
Is this primary vertex from TOTEM pp tracks
or CMS detector central tracks ?
Y
X
1
0.8
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
−1
−1 −0.8 −0.6 −0.4 −0.2 0 0.2 0.4 0.6 0.8 1

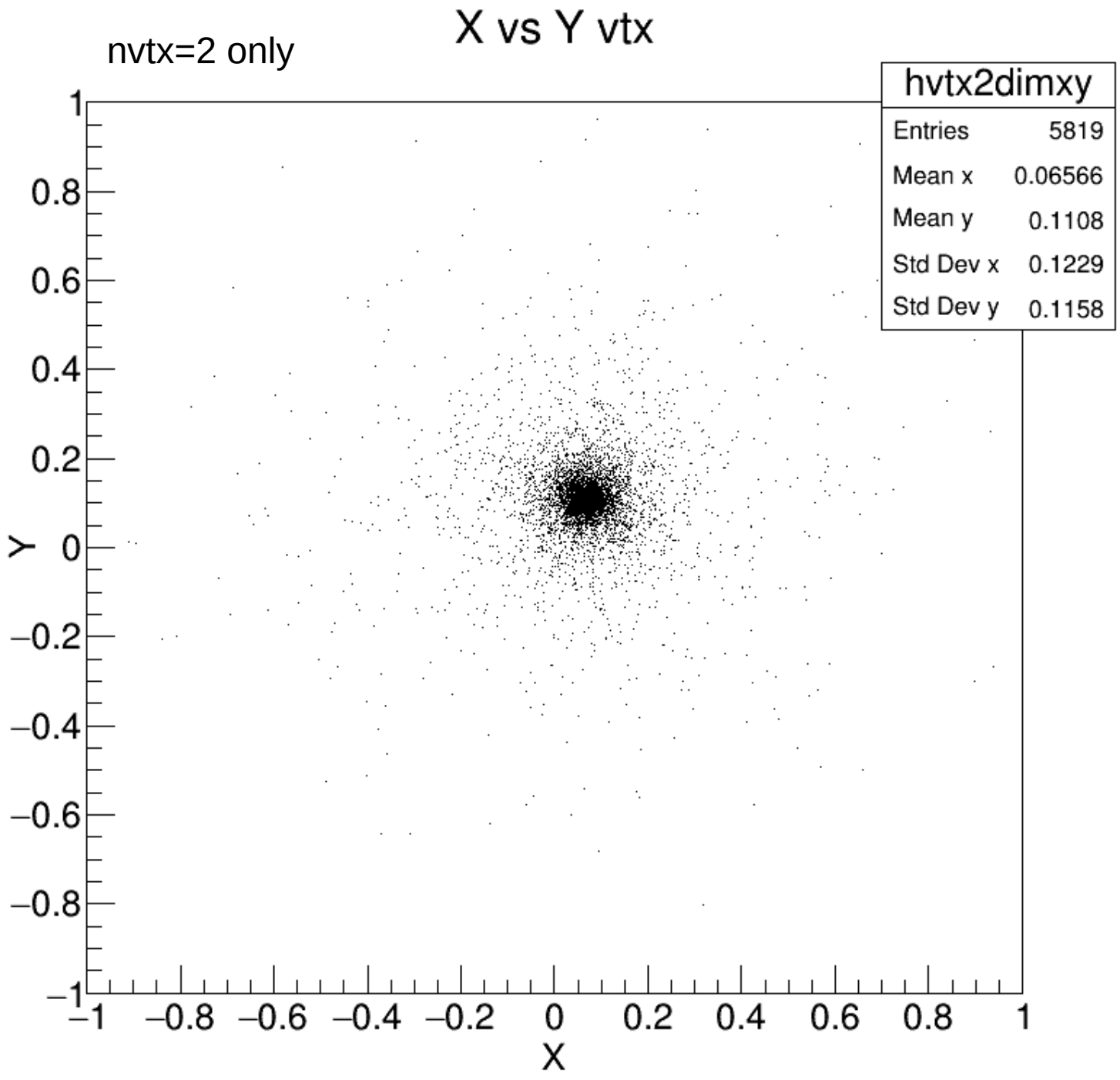
nvtx=1 only


X vtx
hvtxx
Entries 1279112
Mean 0.06803
Std Dev 0.05047
# of Events
X
40000
35000
30000
25000
20000
15000
10000
5000
0
−1
−0.8
−0.6
−0.4
−0.2
0
0.2
0.4
0.6
0.8
1

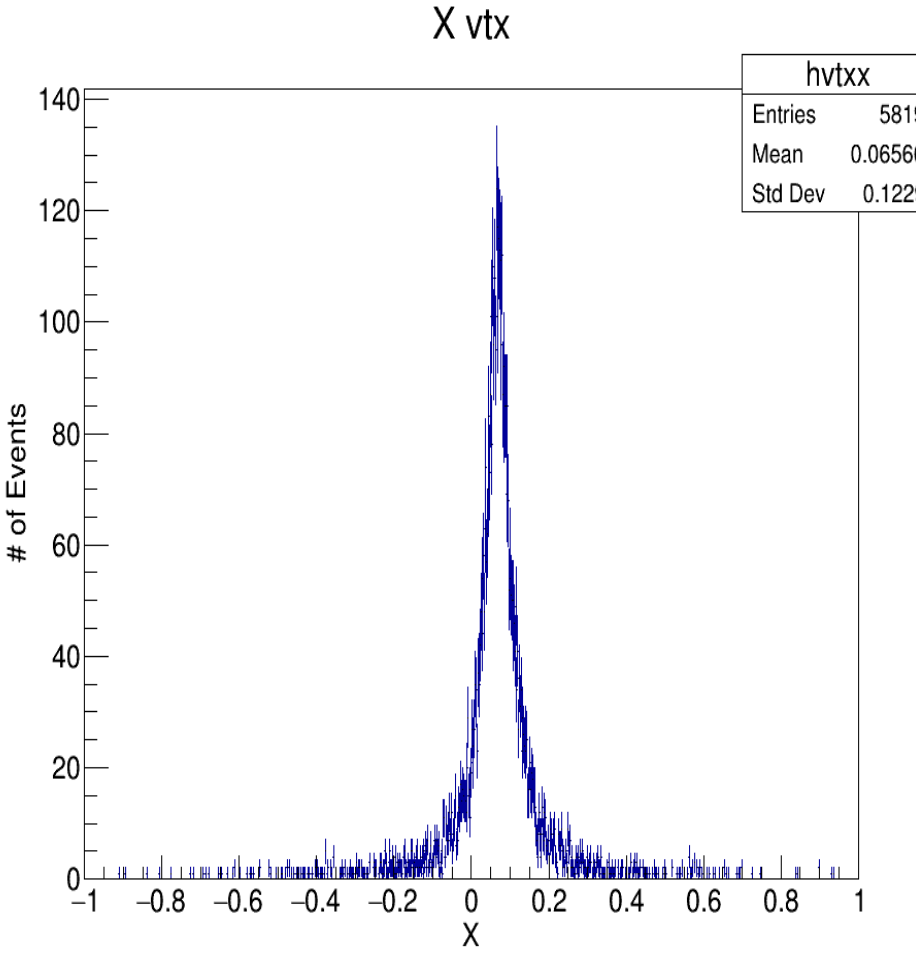

Y vtx
hvtxy
Entries 1279112
Mean 0.1092
Std Dev 0.05074
# of Events
Y
40000
35000
30000
25000
20000
15000
10000
5000
0
−1
−0.8
−0.6
−0.4
−0.2
0
0.2
0.4
0.6
0.8
1

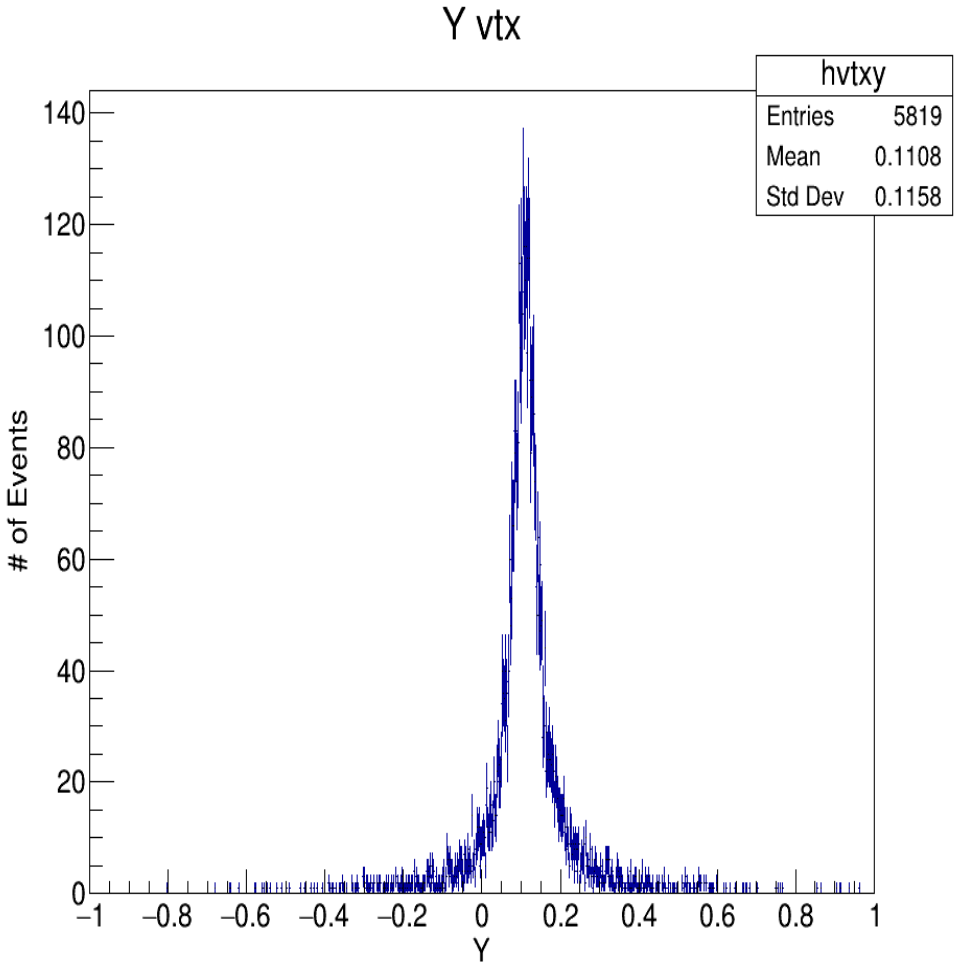

p_y^{TOTEM} vs p_y^{CMS} All: no cuts
h2dimdpyAll
Entries 1009947
Mean x 0.02999
Mean y −0.04674
Std Dev x 0.5844
Std Dev y 0.5504
TOTEM py
CMS py


p_x^{TOTEM} vs p_x^{CMS} All: no cuts
h2dimdpxAll
Entries 1009947
Mean x 0.006166
Mean y −0.06293
Std Dev x 0.5535
Std Dev y 0.476
TOTEM px
CMS px

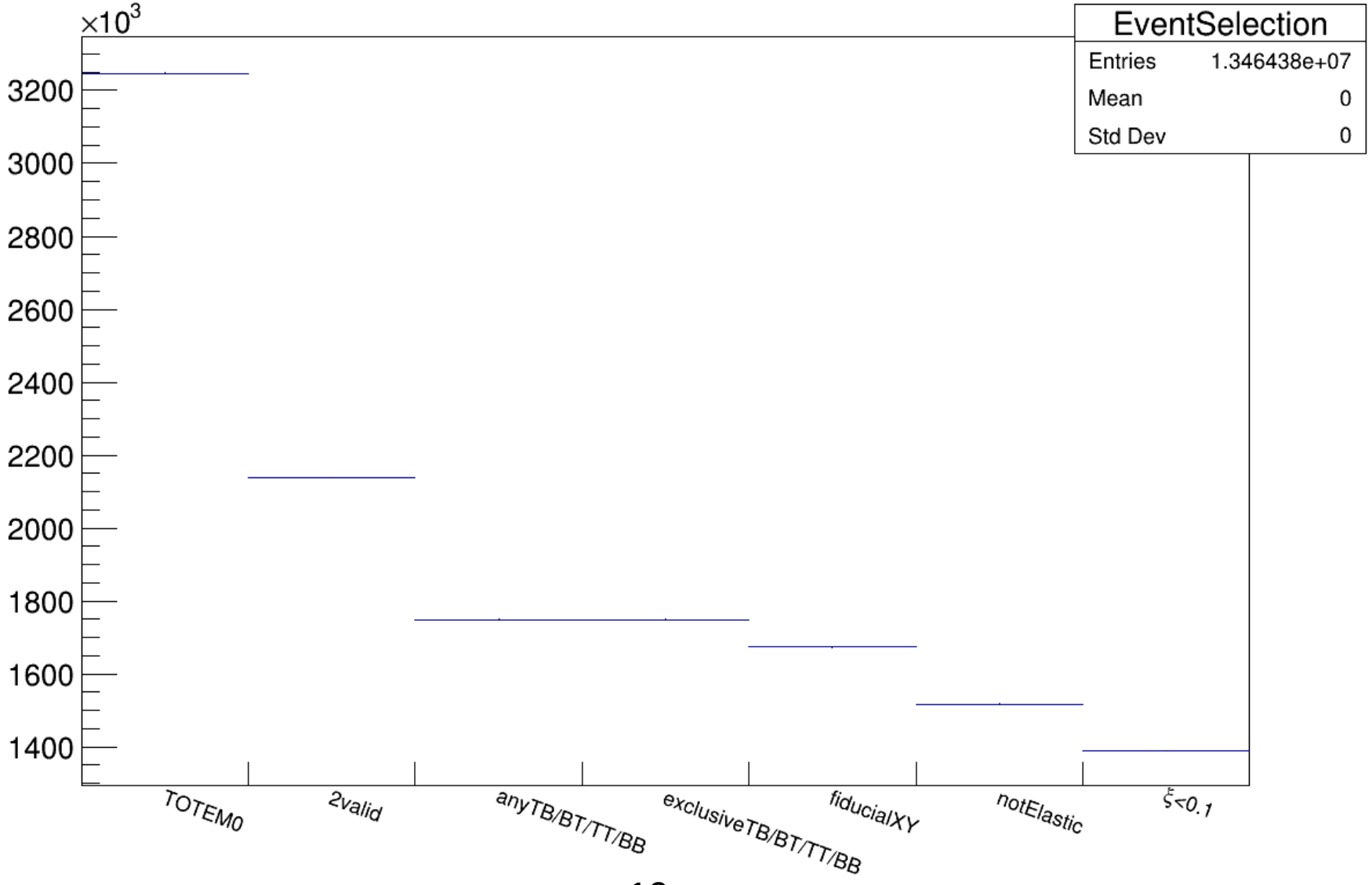

X vs Y vtx
nvtx=2 only
hvtx2dimxy
Entries 5819
Mean x 0.06566
Mean y 0.1108
Std Dev x 0.1229
Std Dev y 0.1158
Y
X
1
0.8
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
−1
−1 −0.8 −0.6 −0.4 −0.2 0 0.2 0.4 0.6 0.8 1

nvtx=2 only

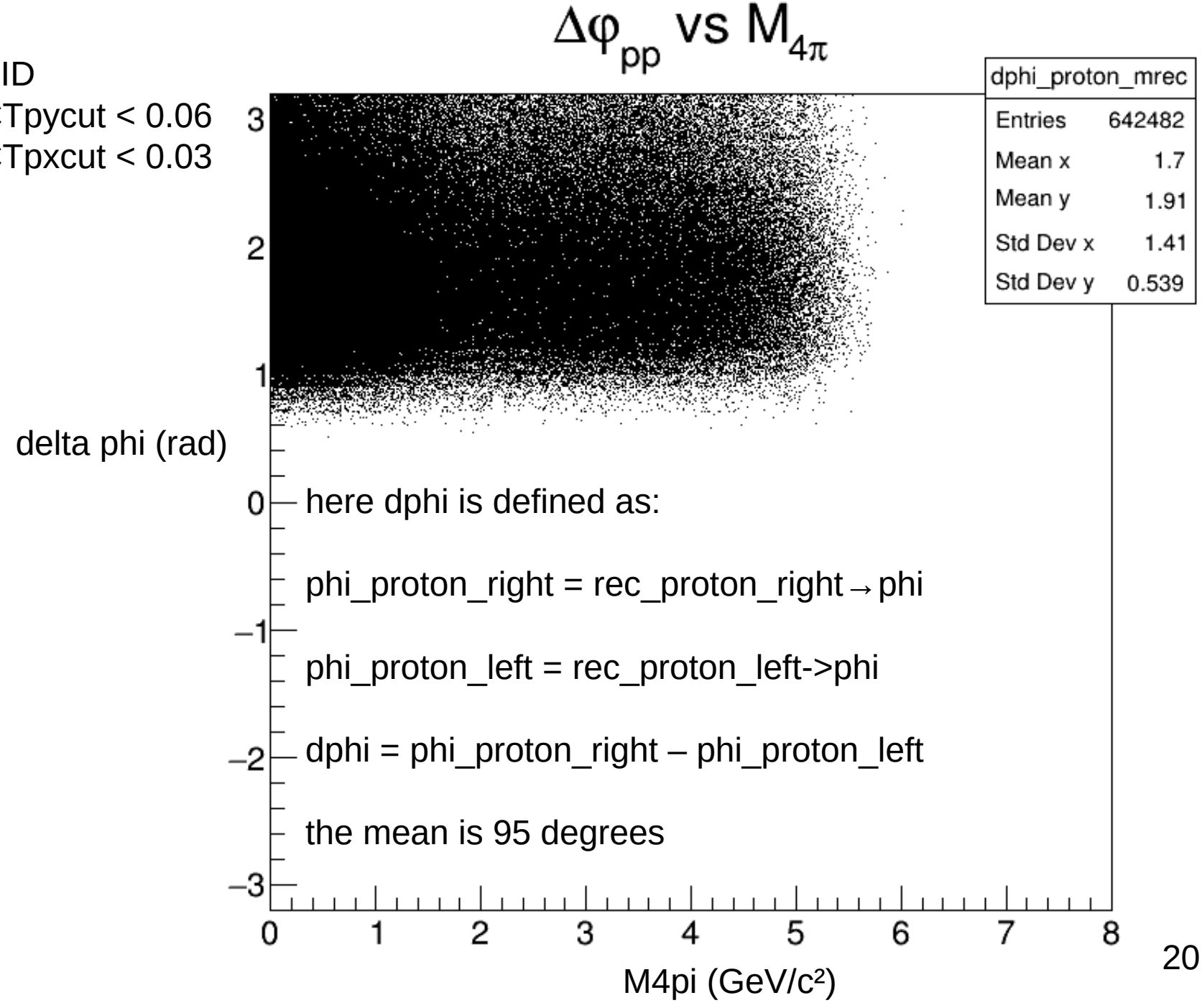

X vtx
hvtxx
Entries 581
Mean 0.0656
Std Dev 0.122
# of Events
X
140
120
100
80
60
40
20
0
−1
−0.8
−0.6
−0.4
−0.2
0
0.2
0.4
0.6
0.8
1

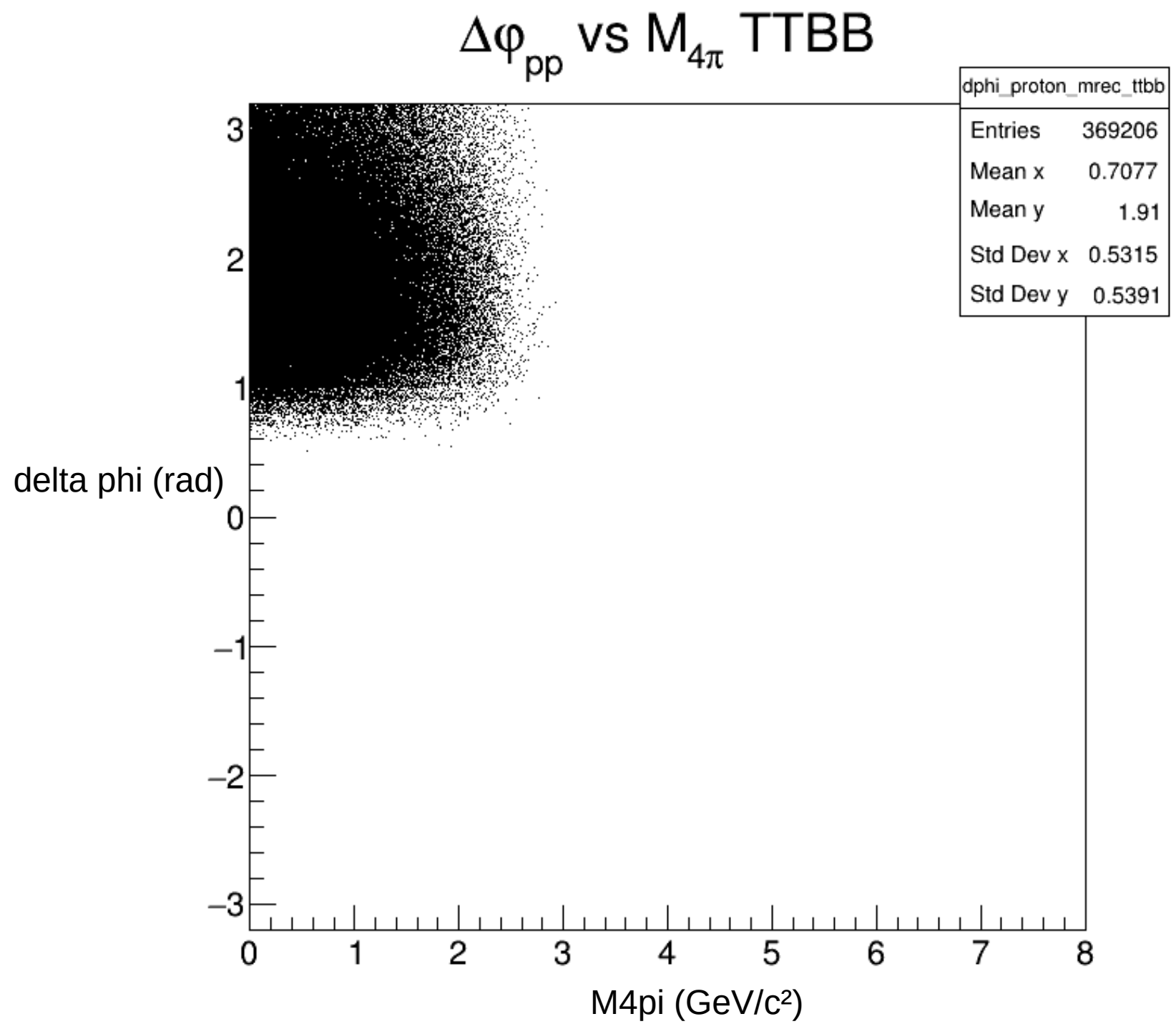

Y vtx
hvtxy
Entries 5819
Mean 0.1108
Std Dev 0.1158
# of Events
Y
140
120
100
80
60
40
20
0
−1
−0.8
−0.6
−0.4
−0.2
0
0.2
0.4
0.6
0.8
1

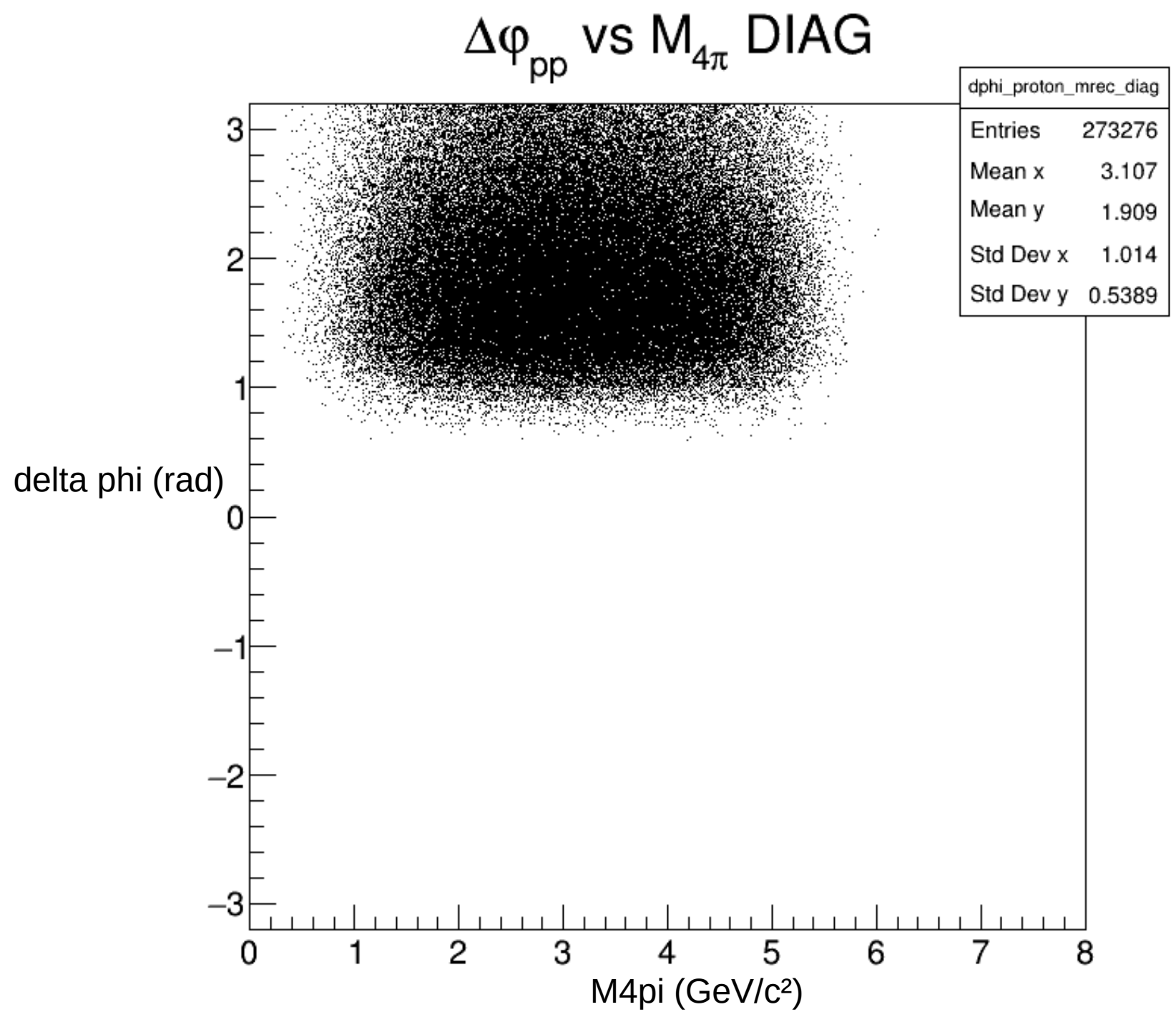
Now:
1. no PID
2. no CTpycut < 0.06
3. no CTpxcut < 0.03

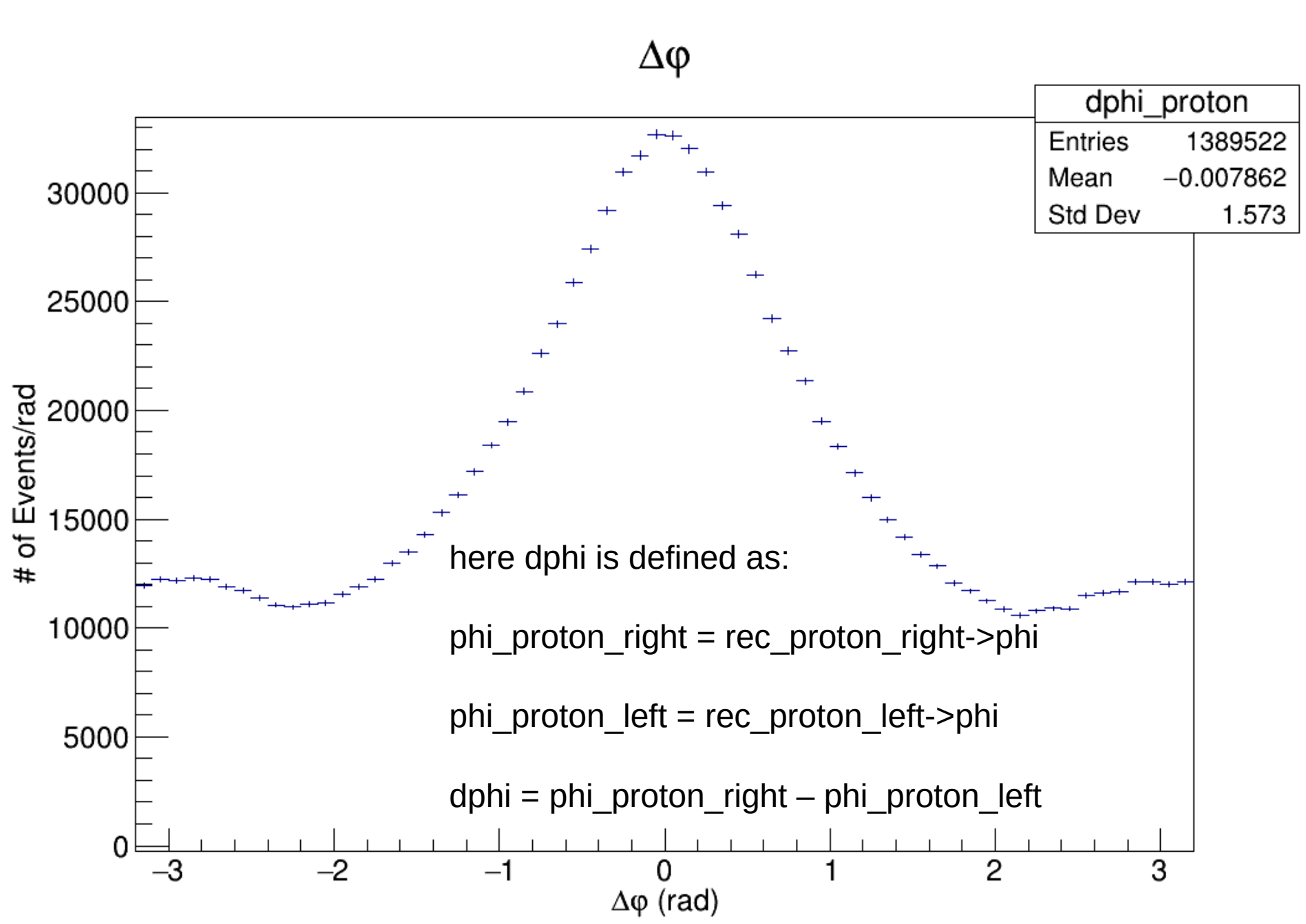


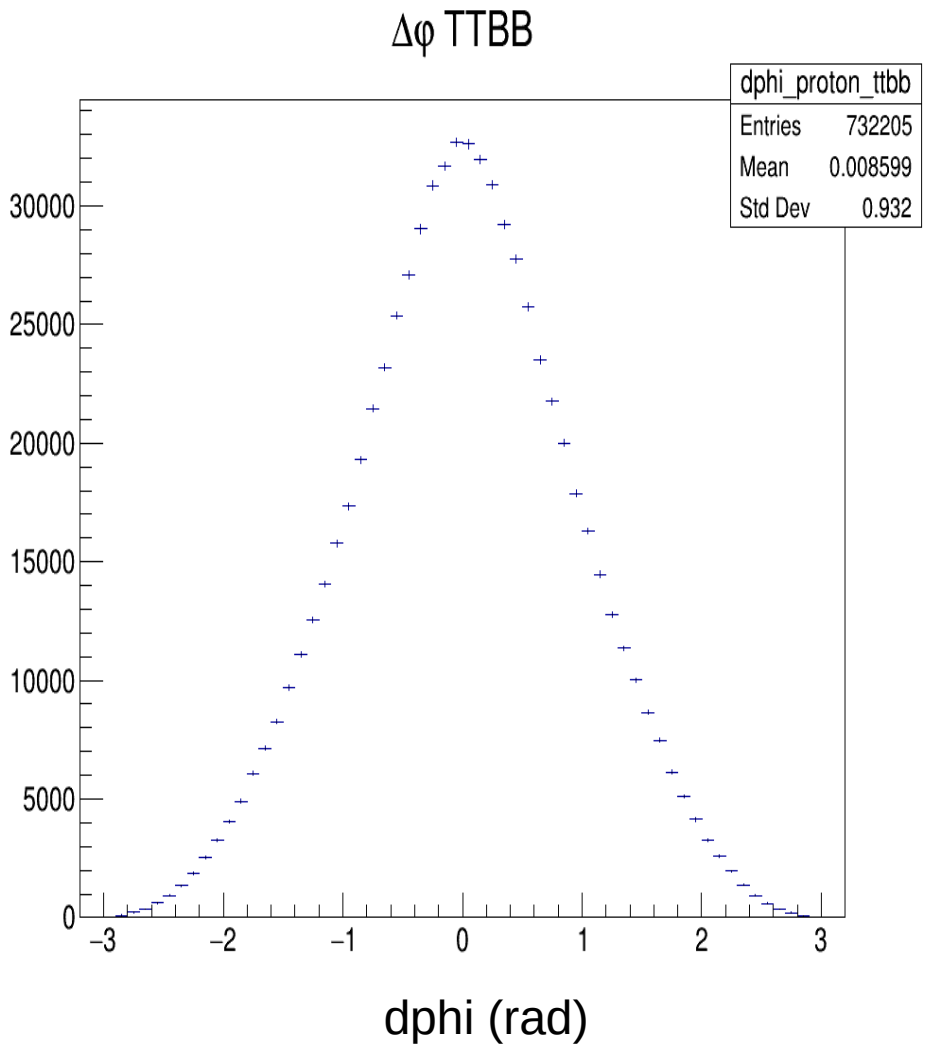
Now:
1. no PID
2. no CTpycut < 0.06
3. no CTpxcut < 0.03

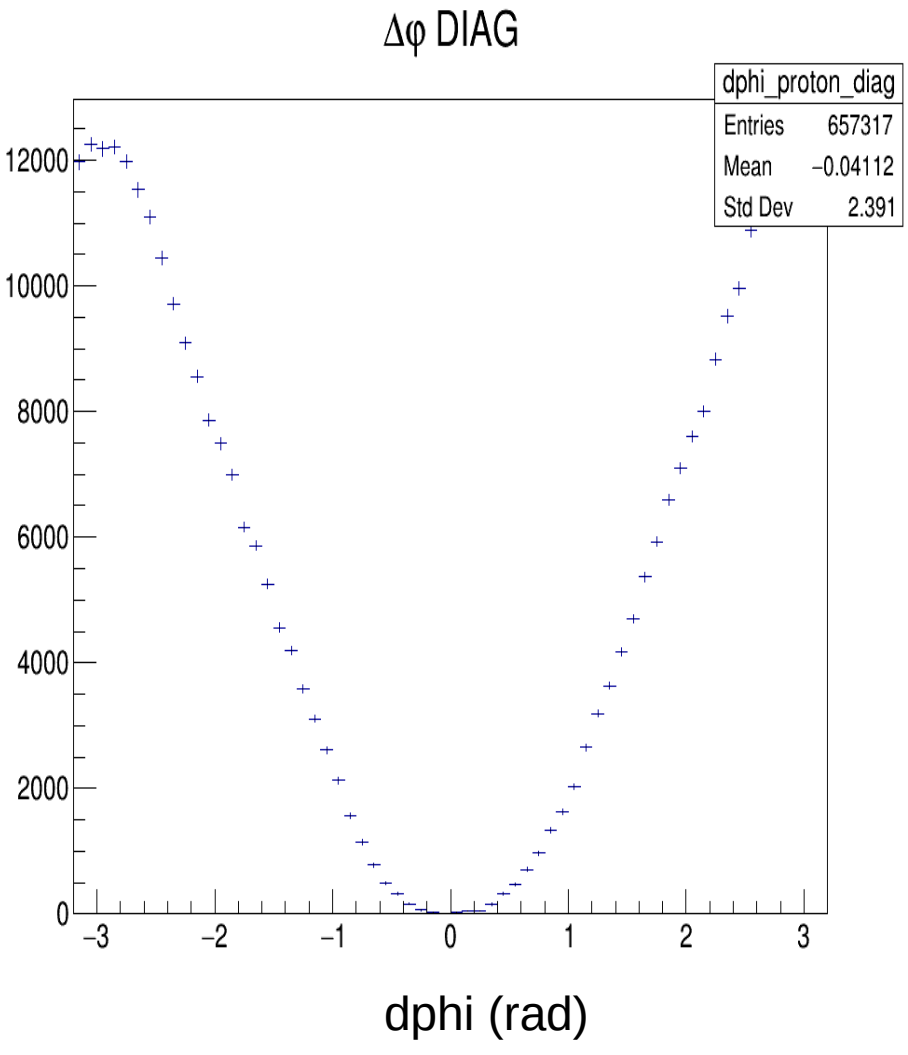



$\Delta\varphi_{pp}$ vs $M_{4\pi}$ TTBB
dphi_proton_mrec_ttbb
Entries 369206
Mean x 0.7077
Mean y 1.91
Std Dev x 0.5315
Std Dev y 0.5391
delta phi (rad)
M4pi (GeV/c²)

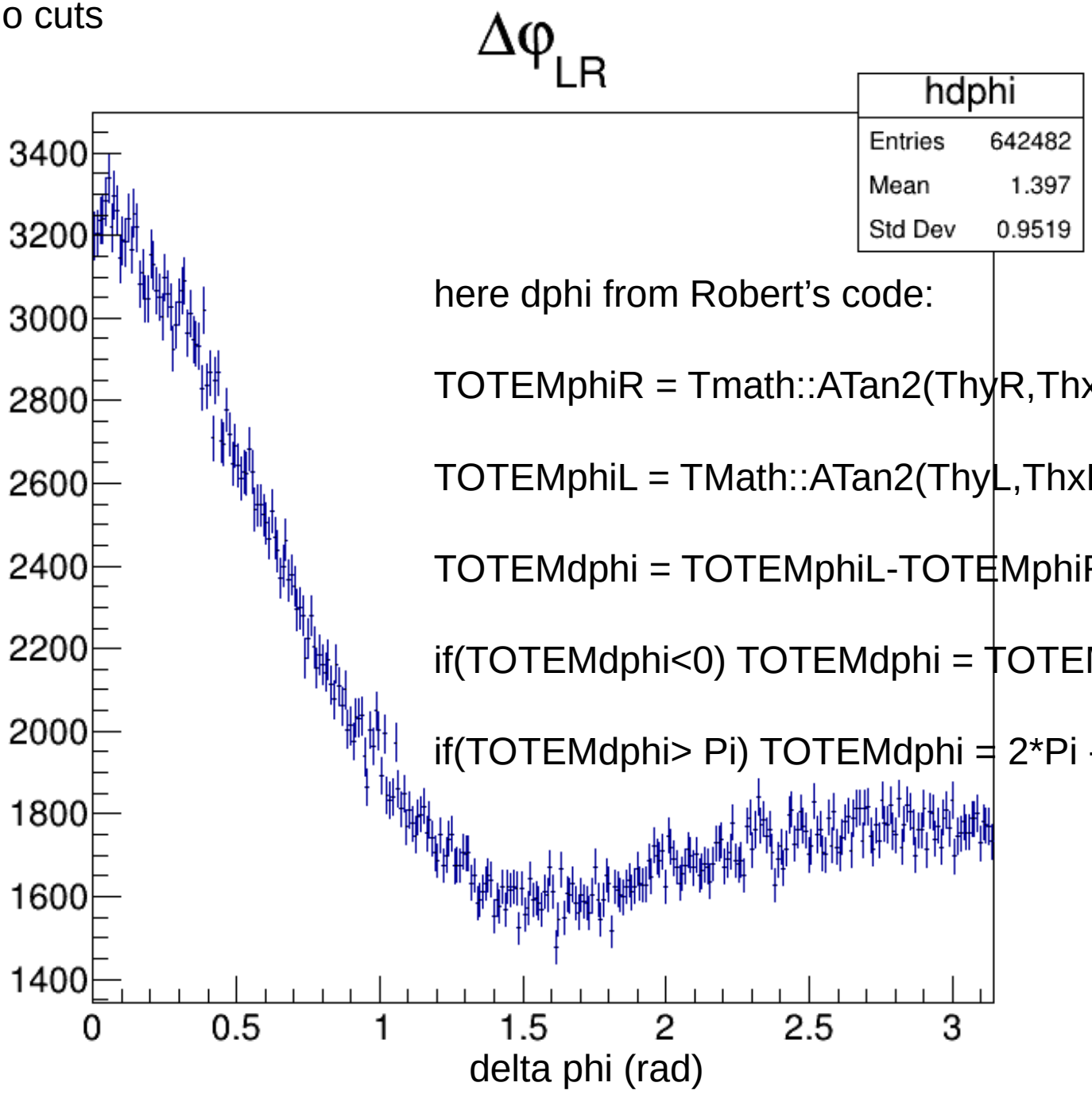

$\Delta\varphi_{pp}$ vs $M_{4\pi}$ DIAG
dphi_proton_mrec_diag
Entries 273276
Mean x 3.107
Mean y 1.909
Std Dev x 1.014
Std Dev y 0.5389
delta phi (rad)
M4pi (GeV/c²)


Δφ
dphi_proton
Entries 1389522
Mean −0.007862
Std Dev 1.573
# of Events/rad
30000
25000
20000
15000
10000
5000
0
−3
−2
−1
0
1
2
3
Δφ (rad)
here dphi is defined as:
phi_proton_right = rec_proton_right->phi
phi_proton_left = rec_proton_left->phi
dphi = phi_proton_right – phi_proton_left


Δφ TTBB
dphi_proton_ttbb
Entries 732205
Mean 0.008599
Std Dev 0.932
30000
25000
20000
15000
10000
5000
0
−3
−2
−1
0
1
2
3
dphi (rad)


Δφ DIAG
dphi_proton_diag
Entries 657317
Mean −0.04112
Std Dev 2.391
12000
10000
8000
6000
4000
2000
0
−3
−2
−1
0
1
2
3
dphi (rad)

no cuts



here dphi from Robert's code:

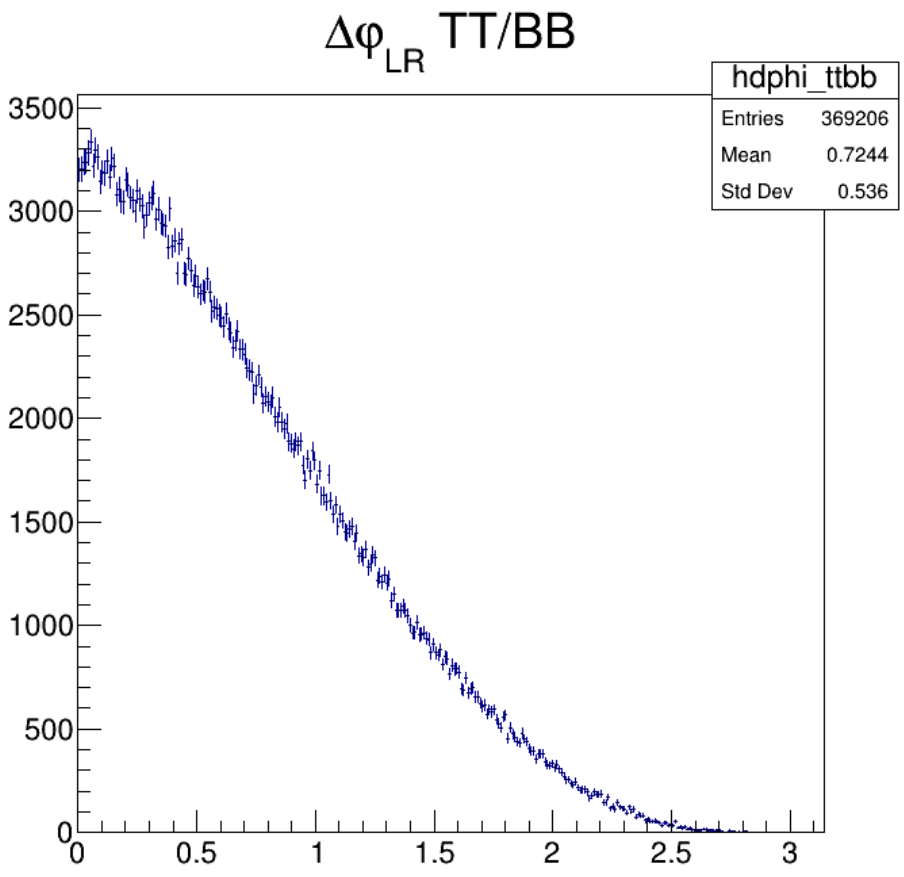
TOTEMphiR = Tmath::ATan2(ThyR,ThxR)

TOTEMphiL = TMath::ATan2(ThyL,ThxL)

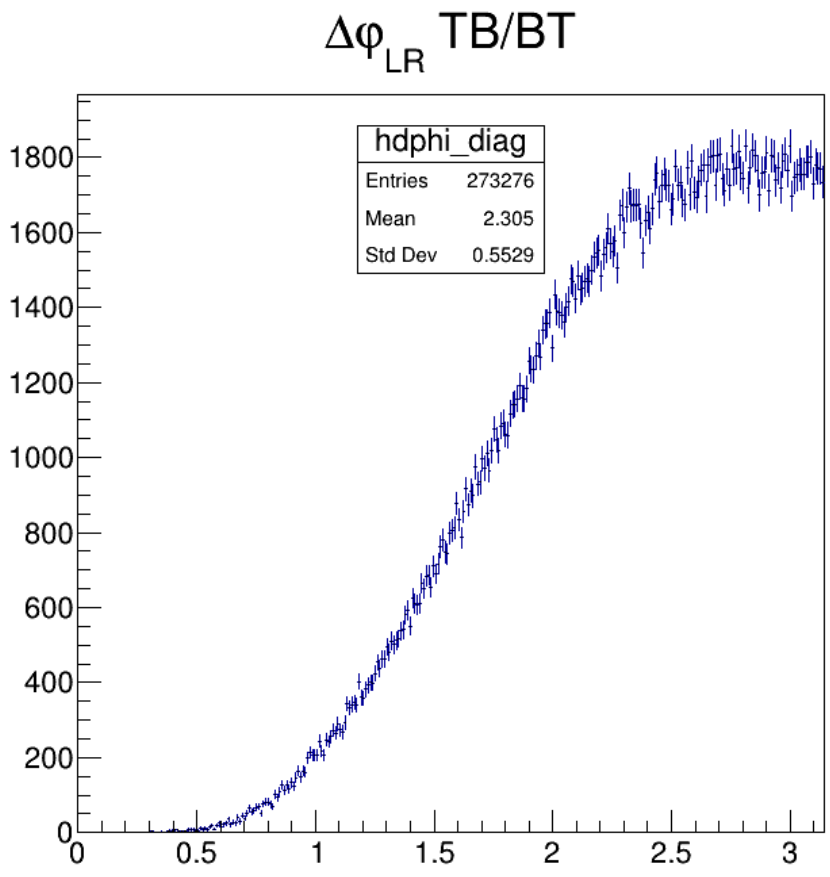
TOTEMdphi = TOTEMphiL-TOTEMphiR

if(TOTEMdphi<0) TOTEMdphi = TOTEMdphi + 2*Pi

if(TOTEMdphi> Pi) TOTEMdphi = 2*Pi - TOTEMdphi

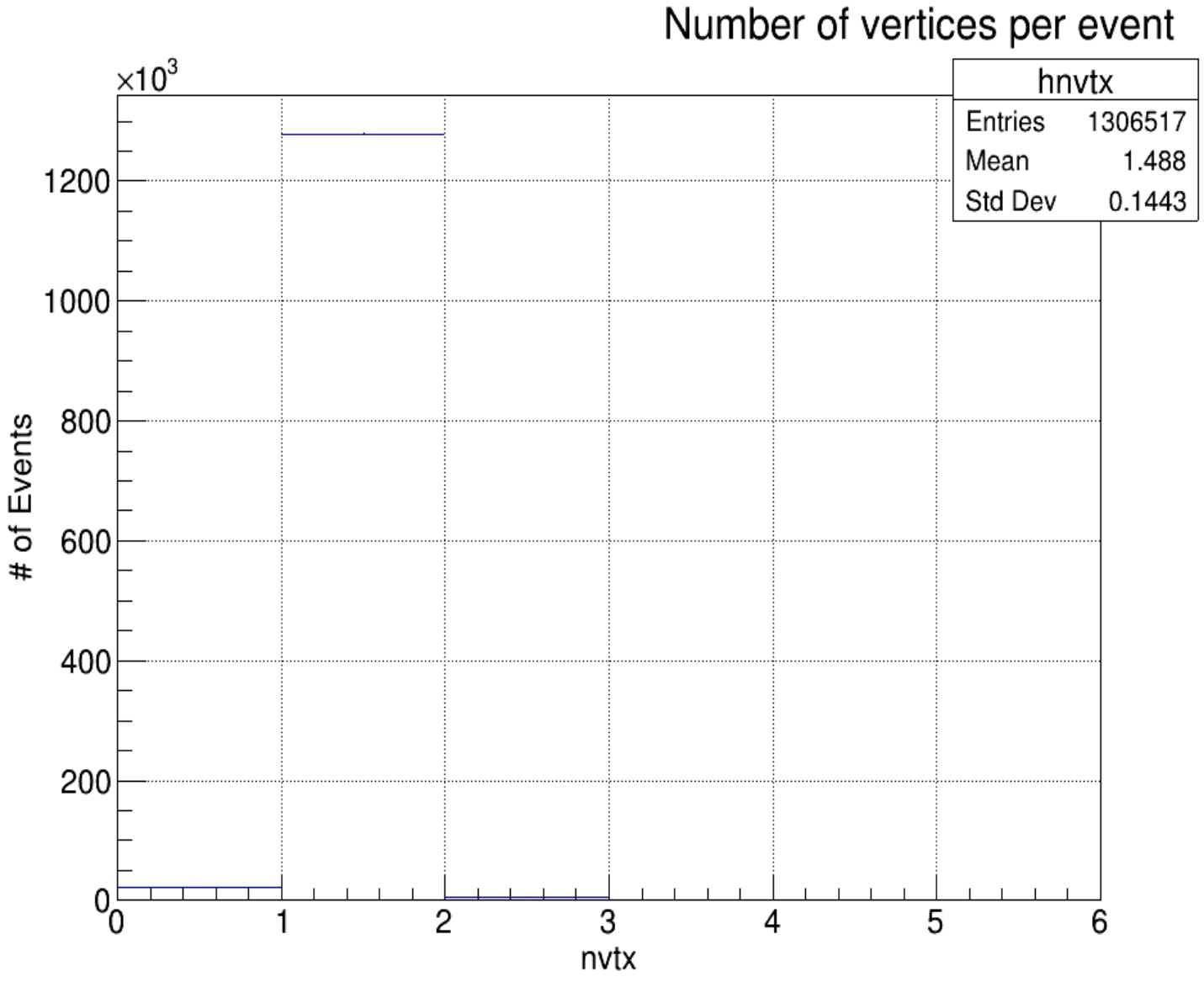


delta phi (rad)

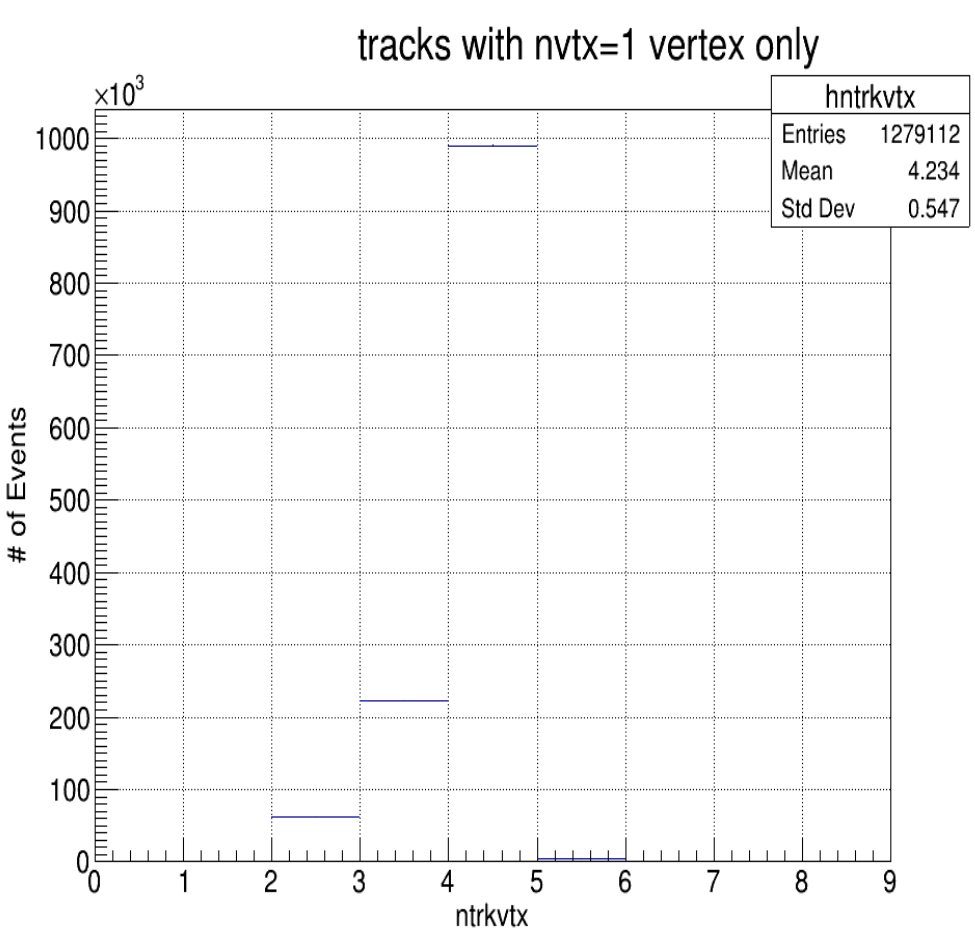


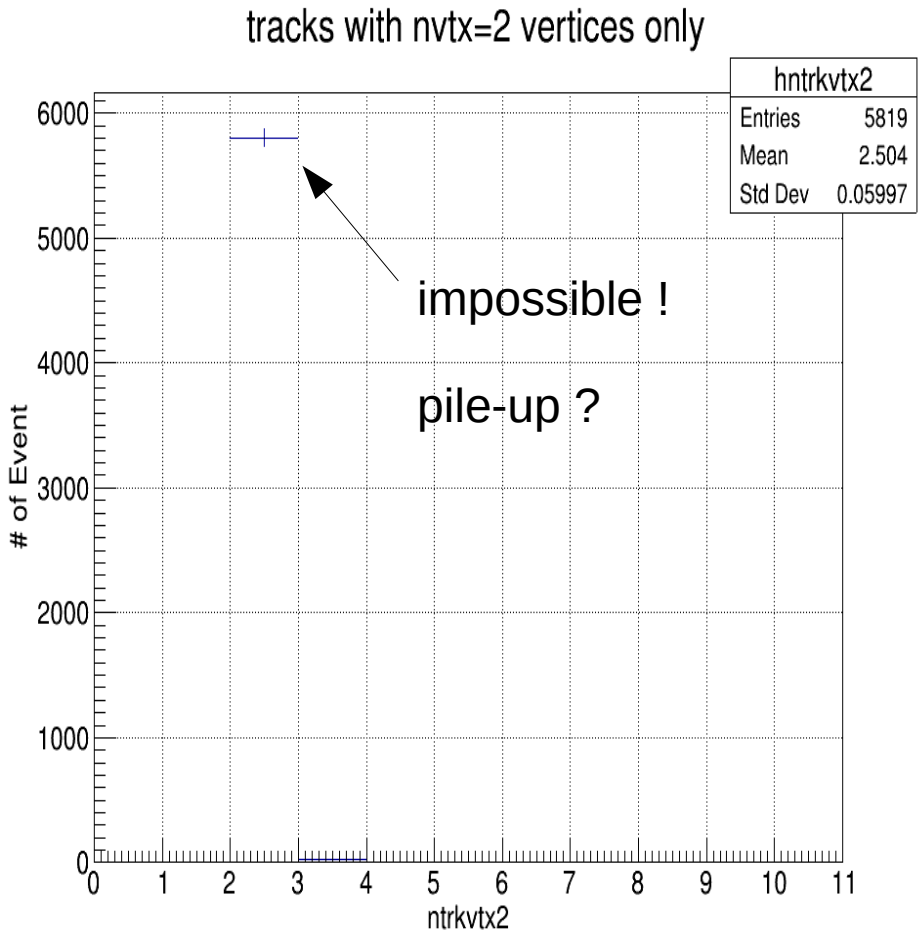
delta phi (rad)

again: no cuts, no conditions, no PID



no cuts, no conditions, no PID





Thanks for your kind help and attention !