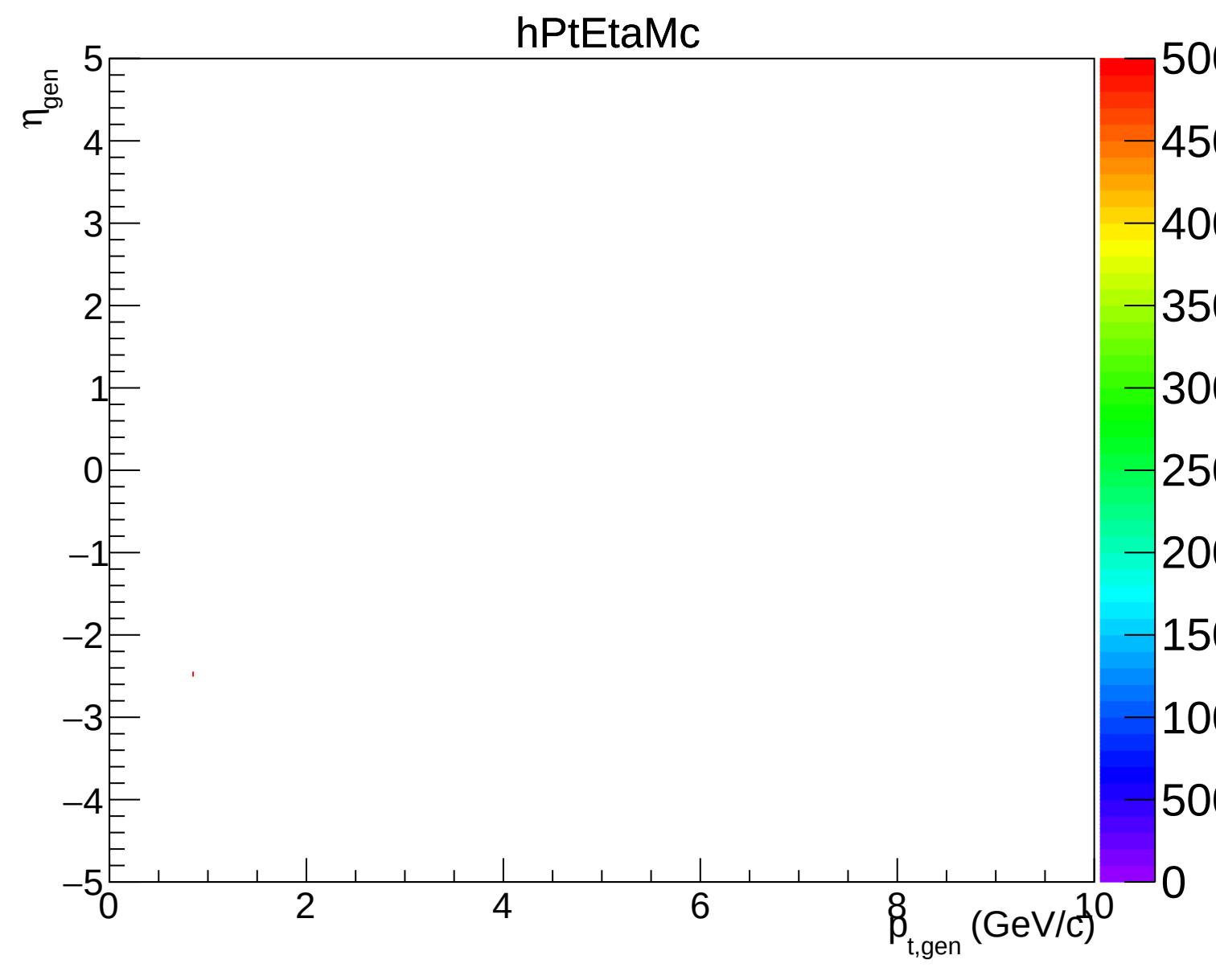
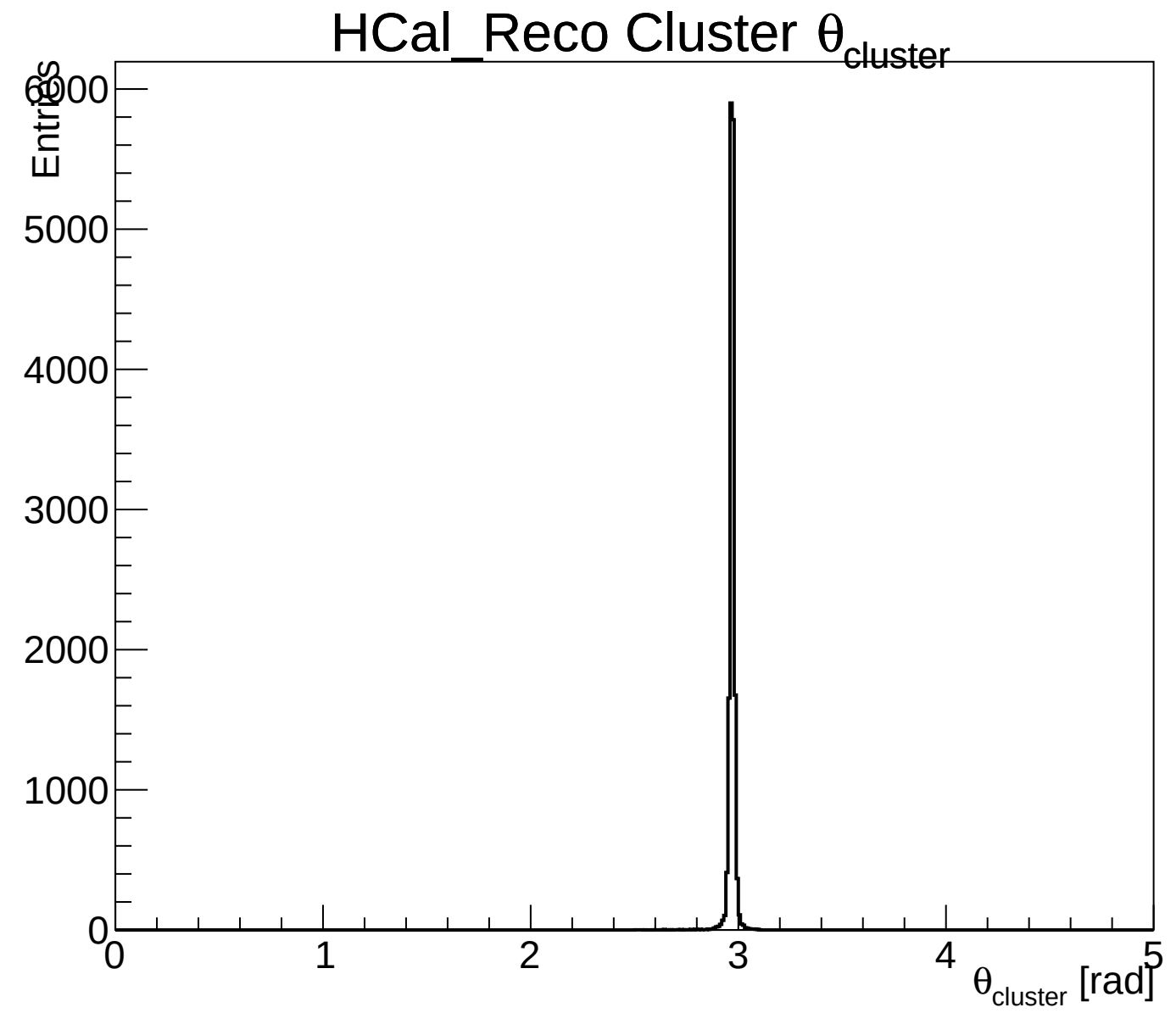
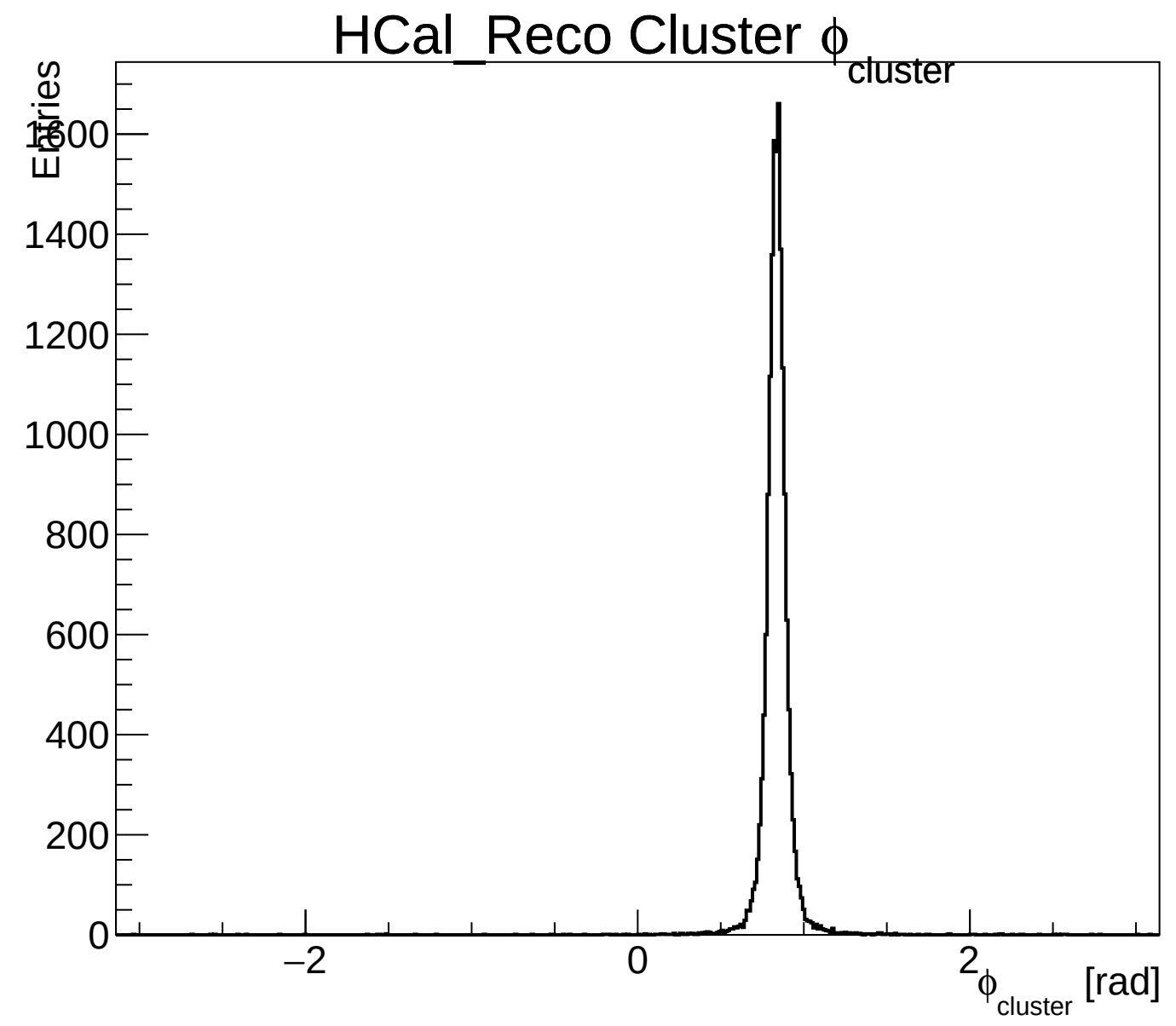
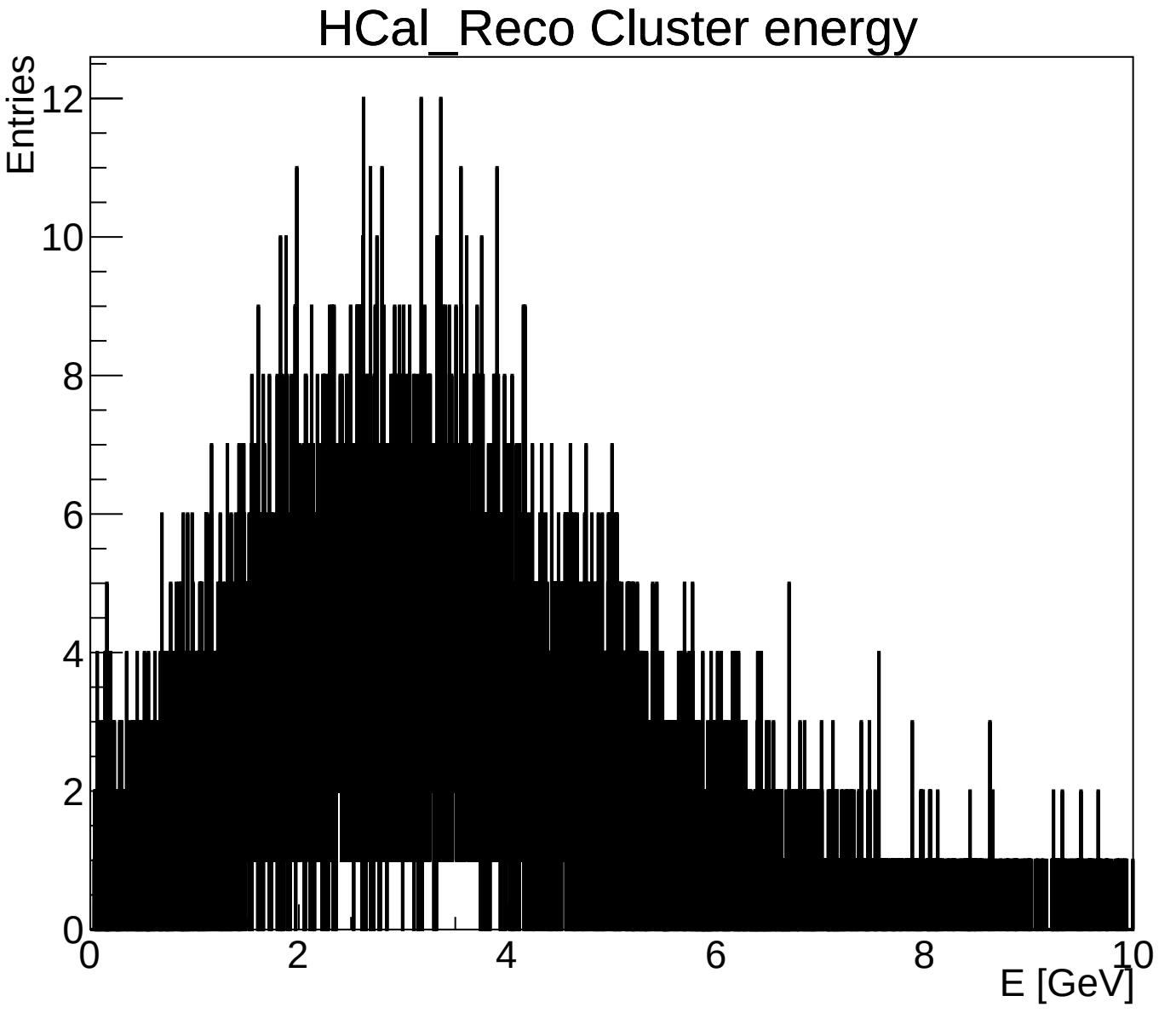
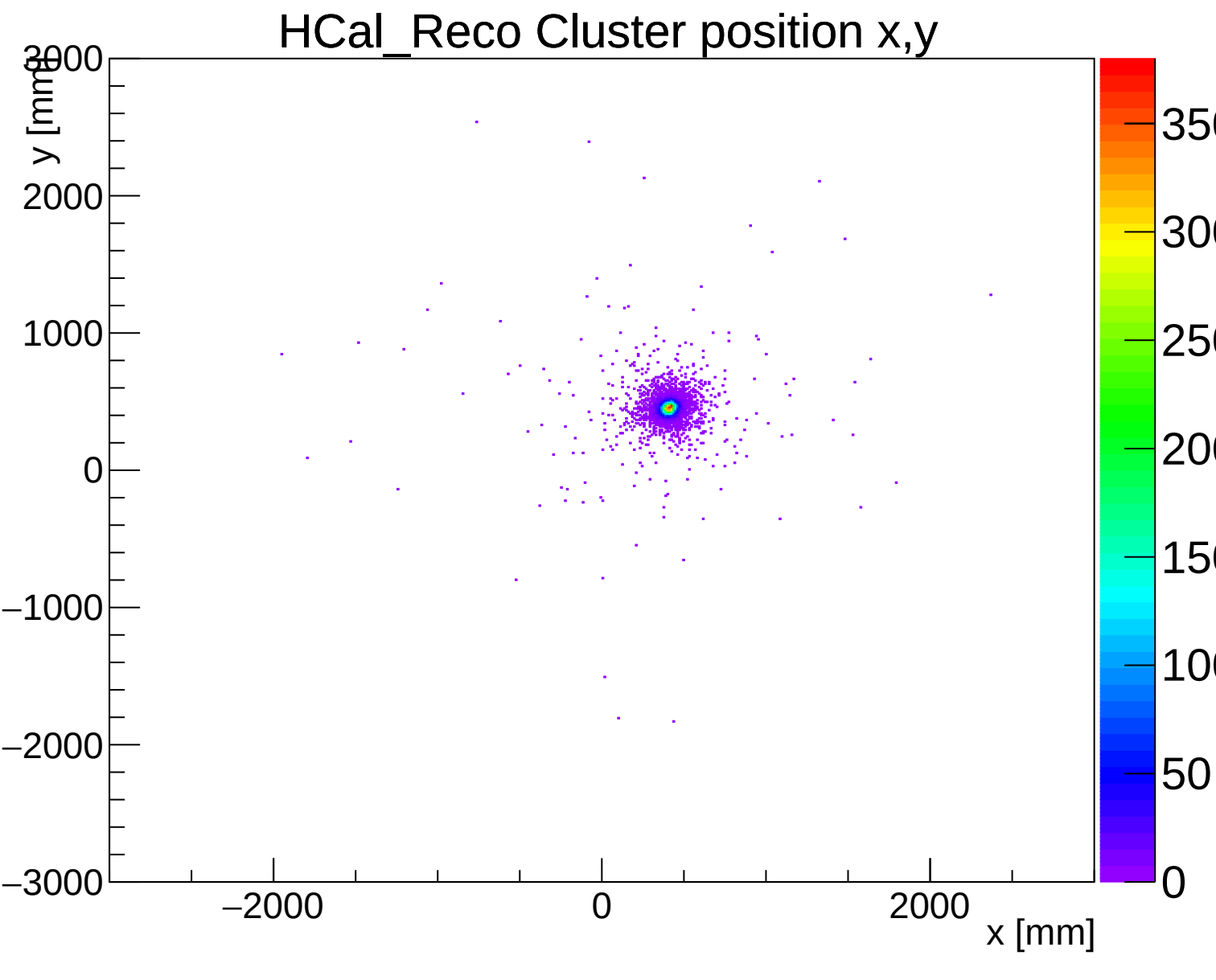
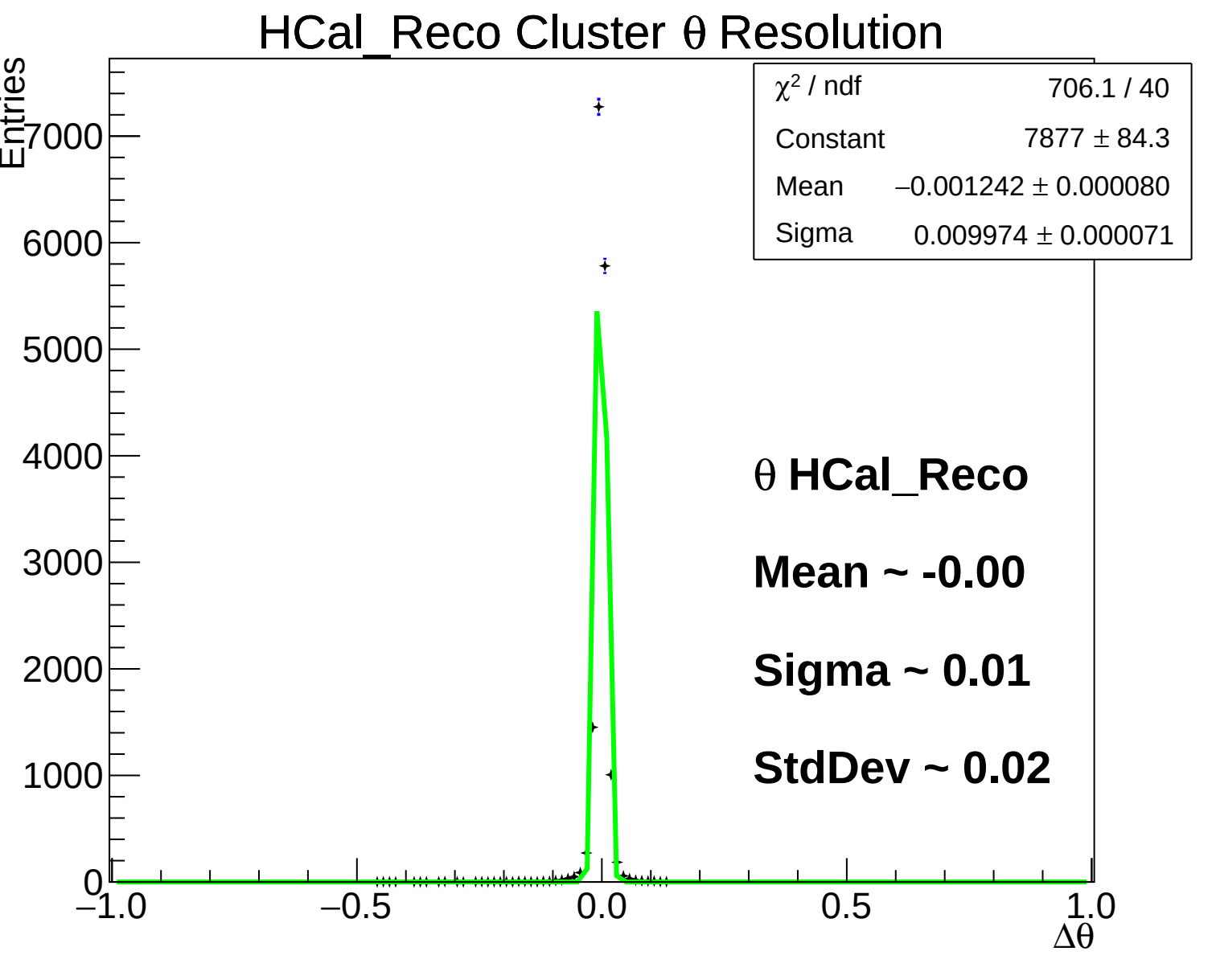

hPtEtaMc
η_{gen}
5
4
3
2
1
0
−1
−2
−3
−4
−5
0
2
4
6
8
10
$p_{t,gen}$ (GeV/c)
500
450
400
350
300
250
200
150
100
50
0

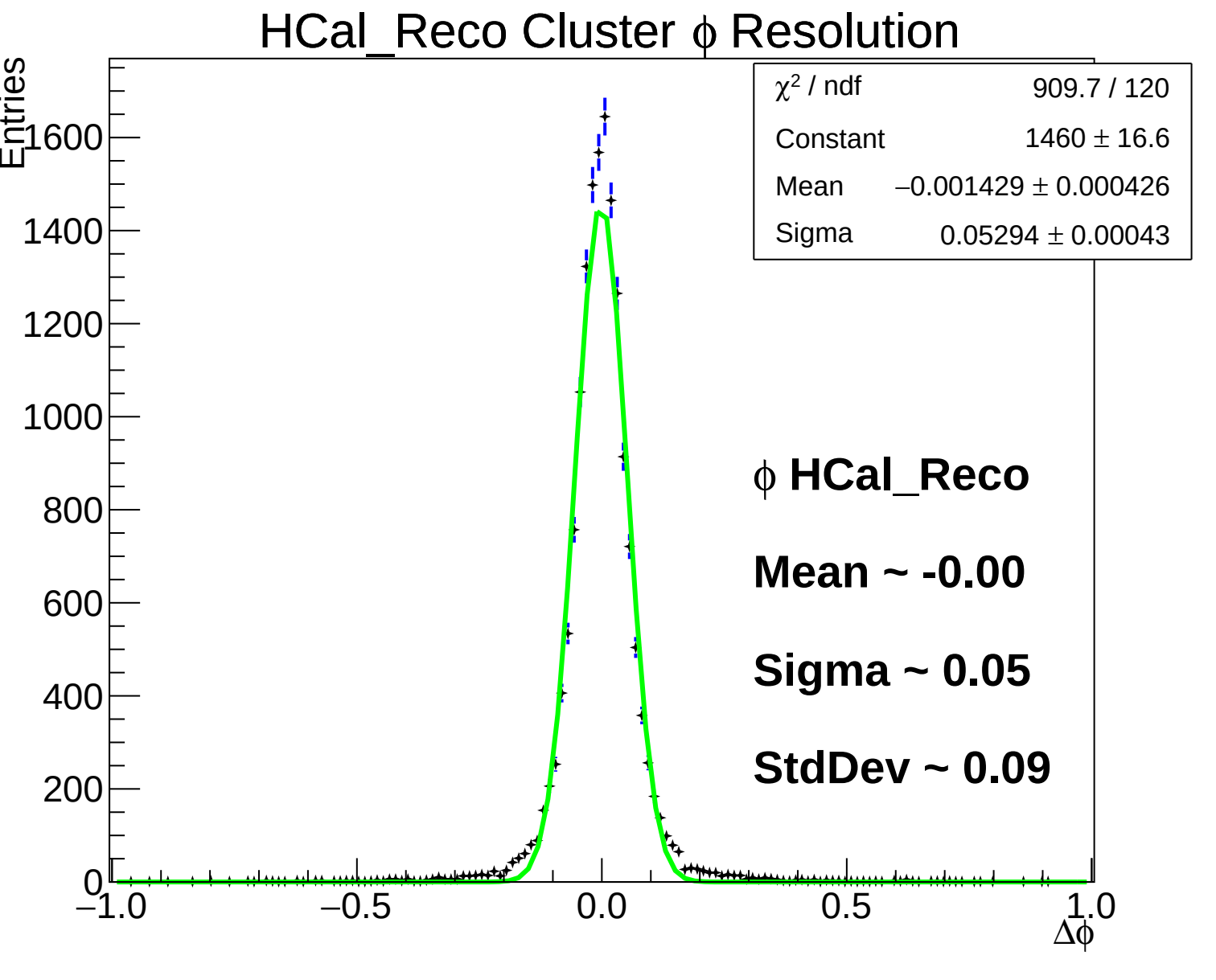

HCal_Reco Cluster θcluster
Entries
6000
5000
4000
3000
2000
1000
0
0
1
2
3
4
5
θcluster [rad]

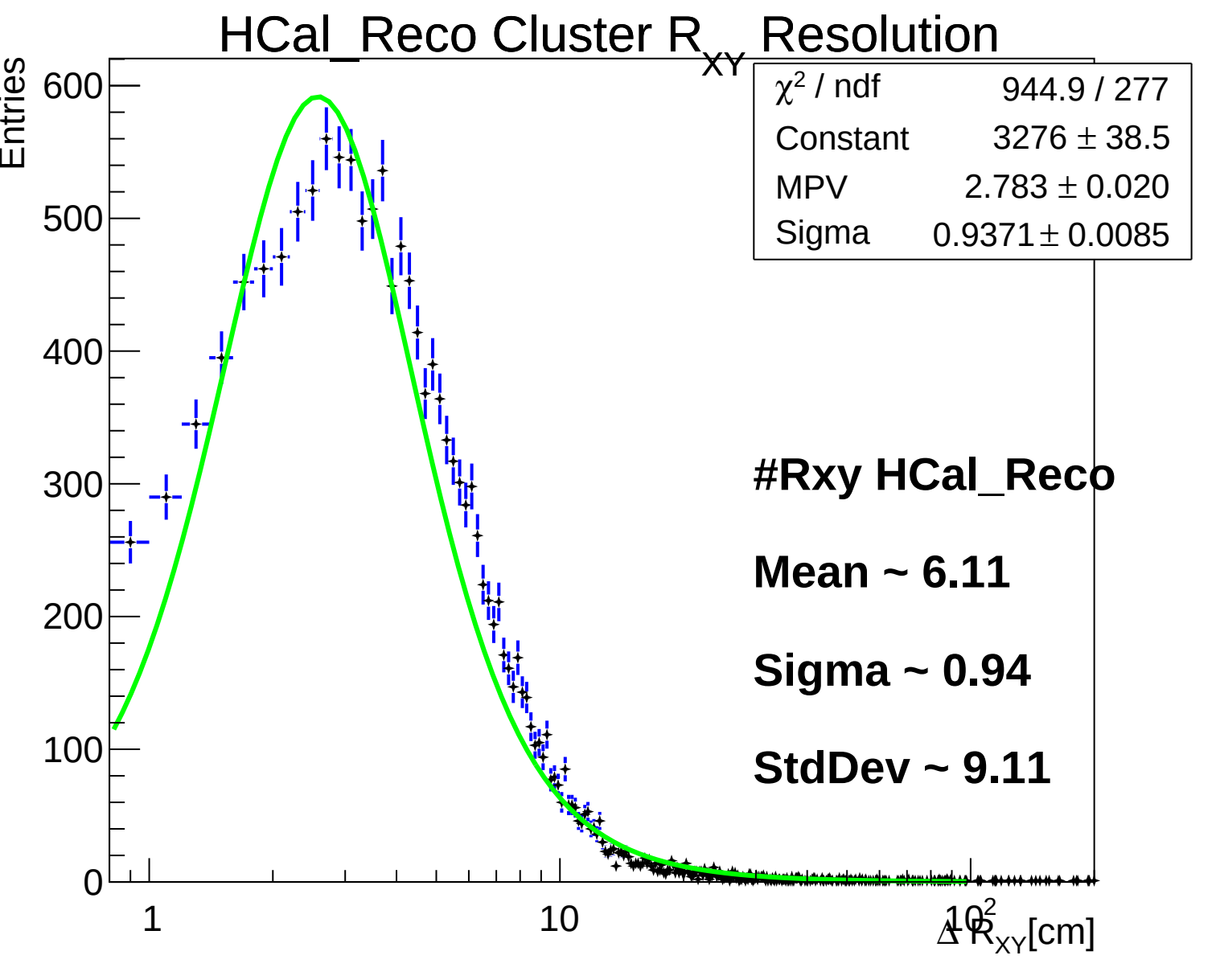

HCal_Reco Cluster $\phi_{cluster}$
Entries
1600
1400
1200
1000
800
600
400
200
0
−2
0
2
$\phi_{cluster}$ [rad]

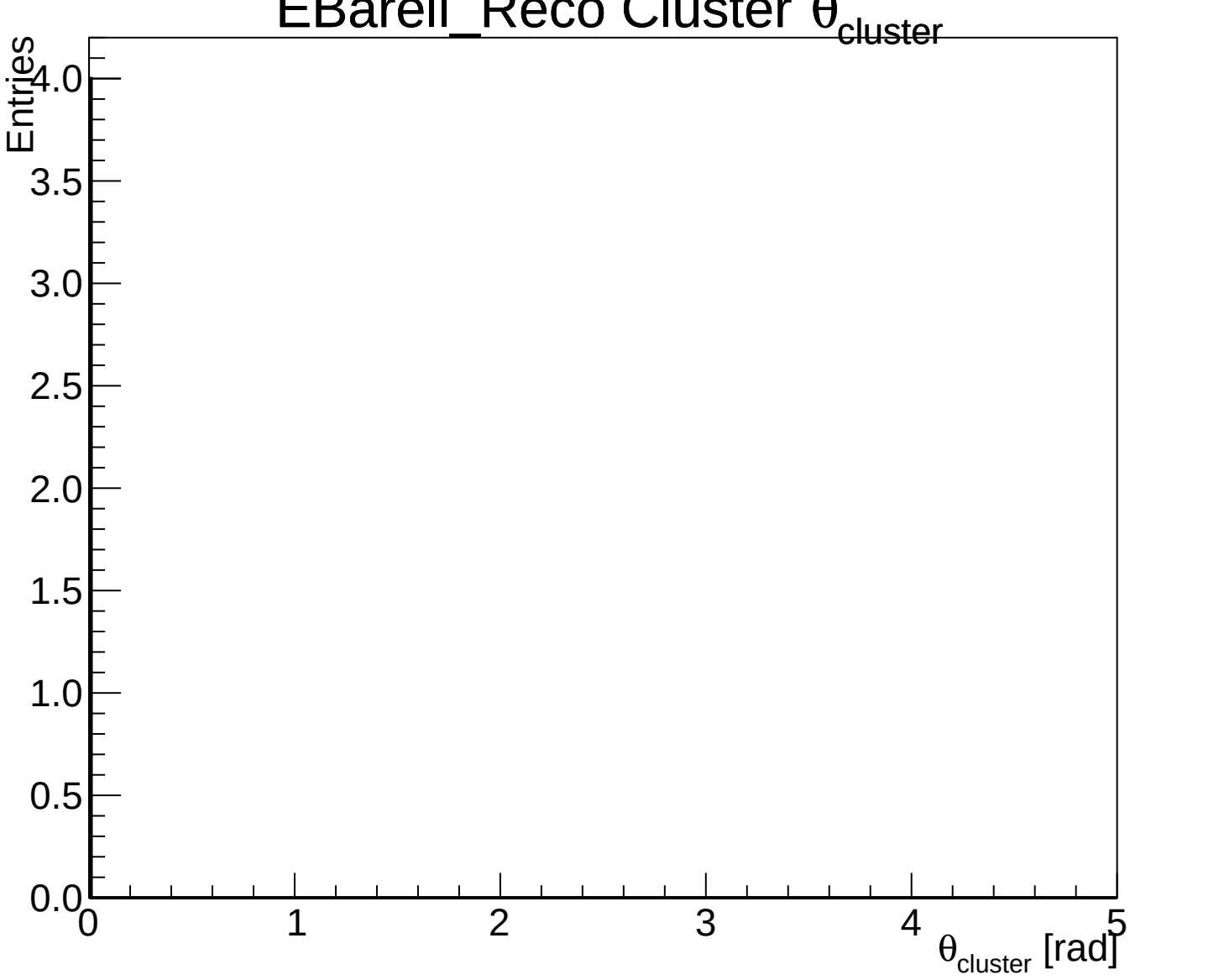

HCal_Reco Cluster energy
Entries
0
2
4
6
8
10
12
0
2
4
6
8
10
E [GeV]

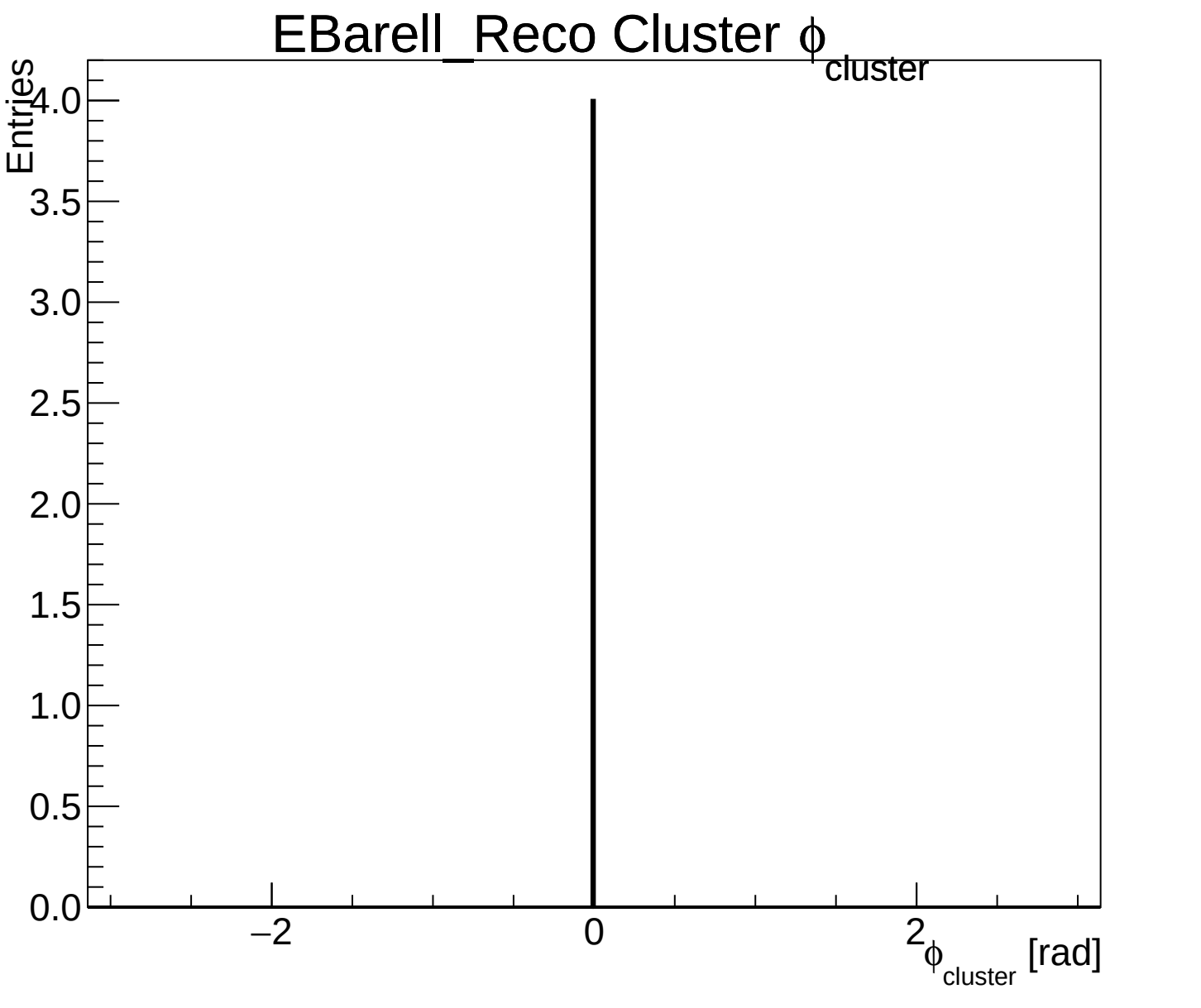

HCal_Reco Cluster position x,y
y [mm]
3000
2000
1000
0
−1000
−2000
−3000
−2000
0
2000
x [mm]
350
300
250
200
150
100
50
0

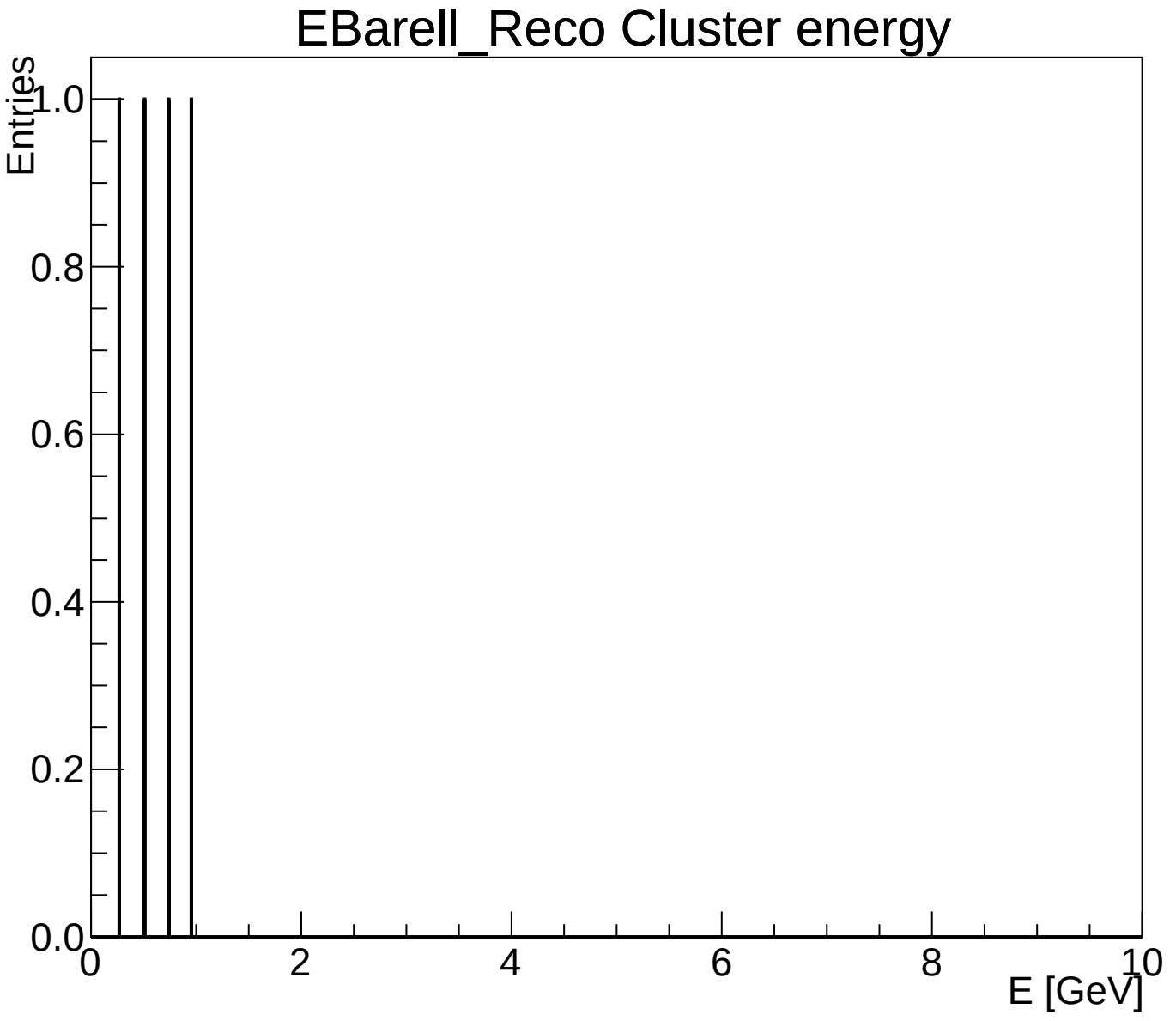

HCal_Reco Cluster θ Resolution
Entries
7000
6000
5000
4000
3000
2000
1000
0
–1.0
–0.5
0.0
0.5
1.0
Δθ
χ² / ndf 706.1 / 40
Constant 7877 ± 84.3
Mean –0.001242 ± 0.000080
Sigma 0.009974 ± 0.000071
θ HCal_Reco
Mean ~ -0.00
Sigma ~ 0.01
StdDev ~ 0.02

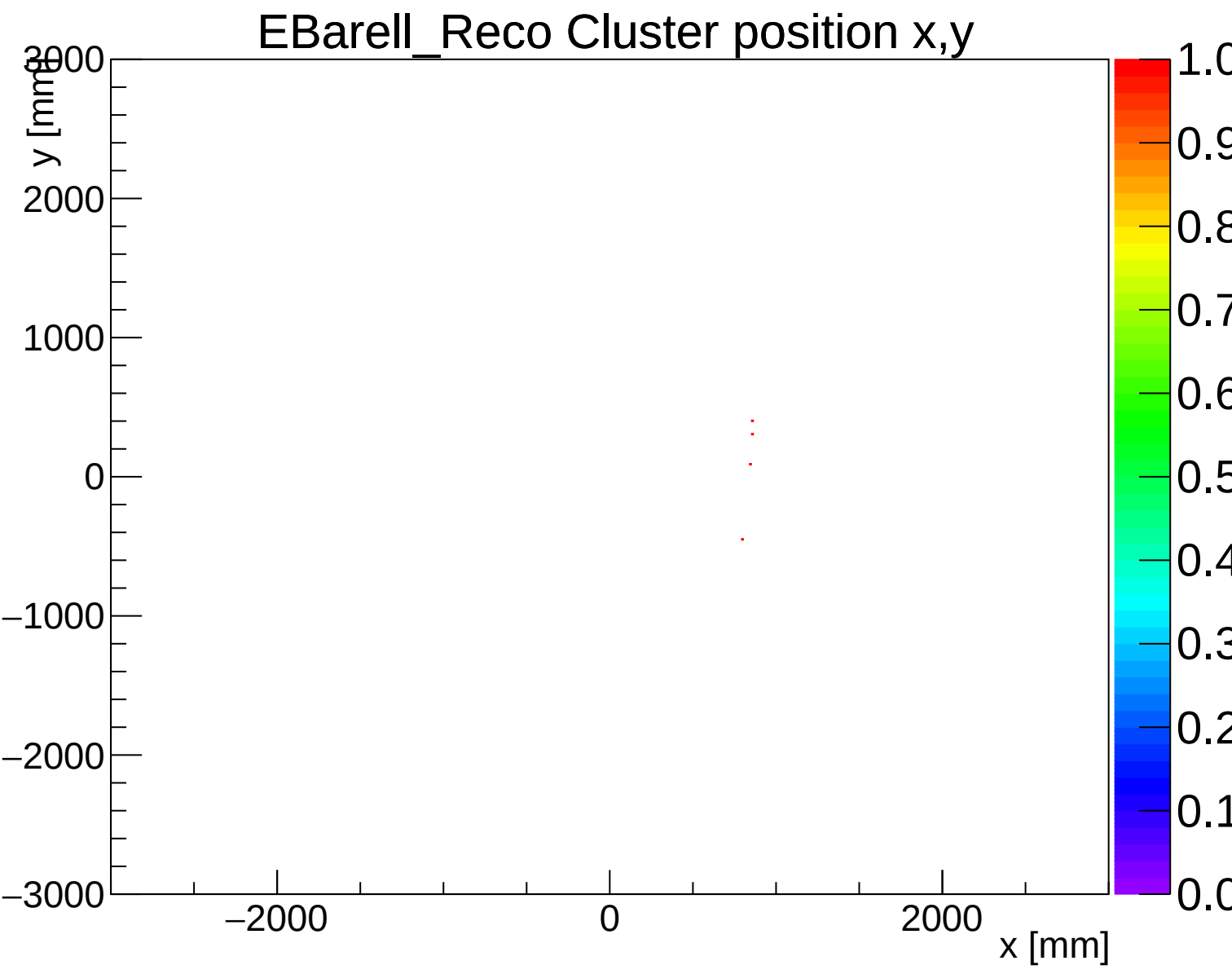

HCal_Reco Cluster ϕ Resolution
Entries
1600
1400
1200
1000
800
600
400
200
0
–1.0
–0.5
0.0
0.5
1.0
Δϕ
χ² / ndf 909.7 / 120
Constant 1460 ± 16.6
Mean –0.001429 ± 0.000426
Sigma 0.05294 ± 0.00043
ϕ HCal_Reco
Mean ~ -0.00
Sigma ~ 0.05
StdDev ~ 0.09

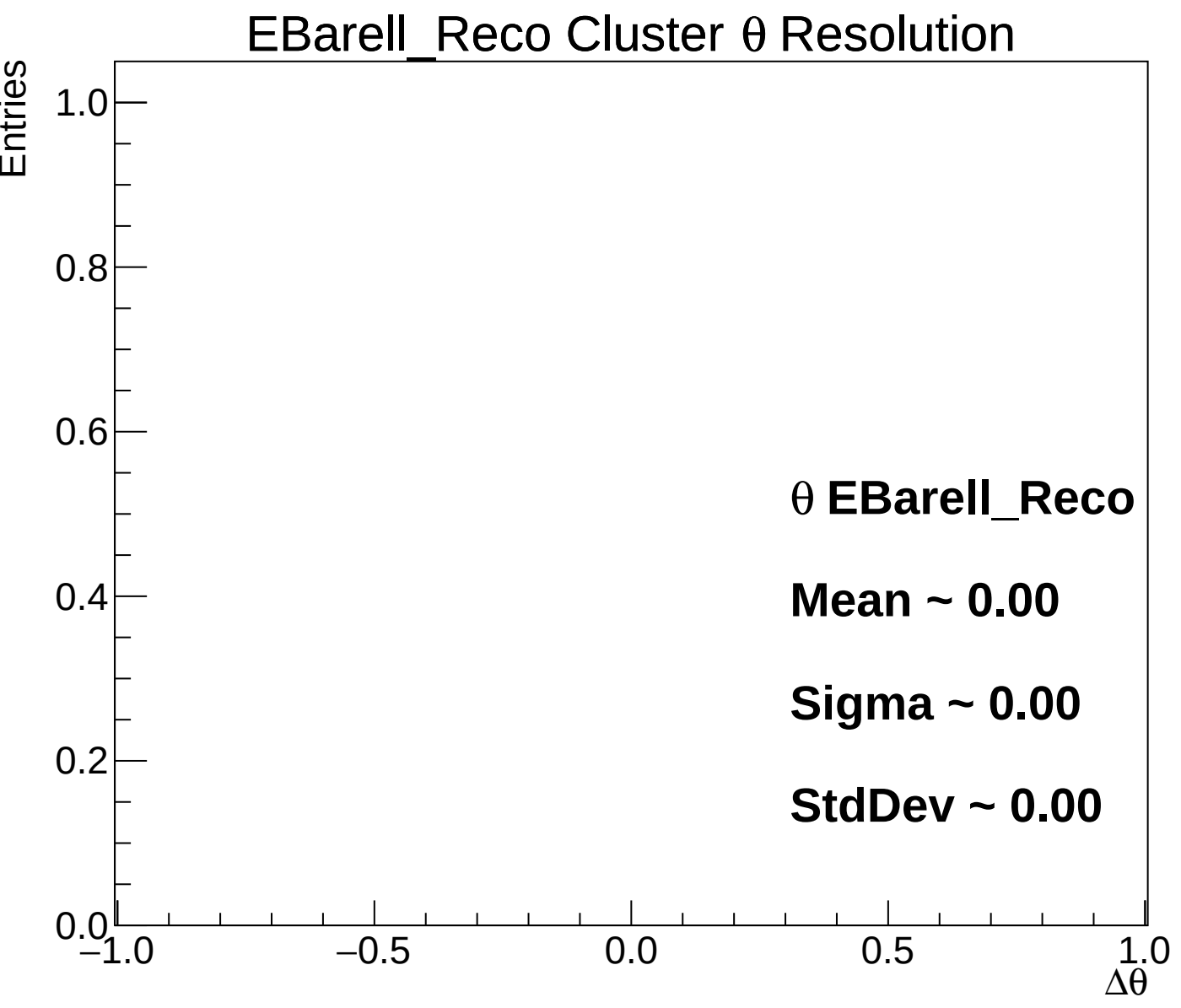

HCal_Reco Cluster R_XY Resolution
χ² / ndf 944.9 / 277
Constant 3276 ± 38.5
MPV 2.783 ± 0.020
Sigma 0.9371 ± 0.0085
#Rxy HCal_Reco
Mean ~ 6.11
Sigma ~ 0.94
StdDev ~ 9.11
Entries
600
500
400
300
200
100
0
1
10
10²
ΔR_XY[cm]

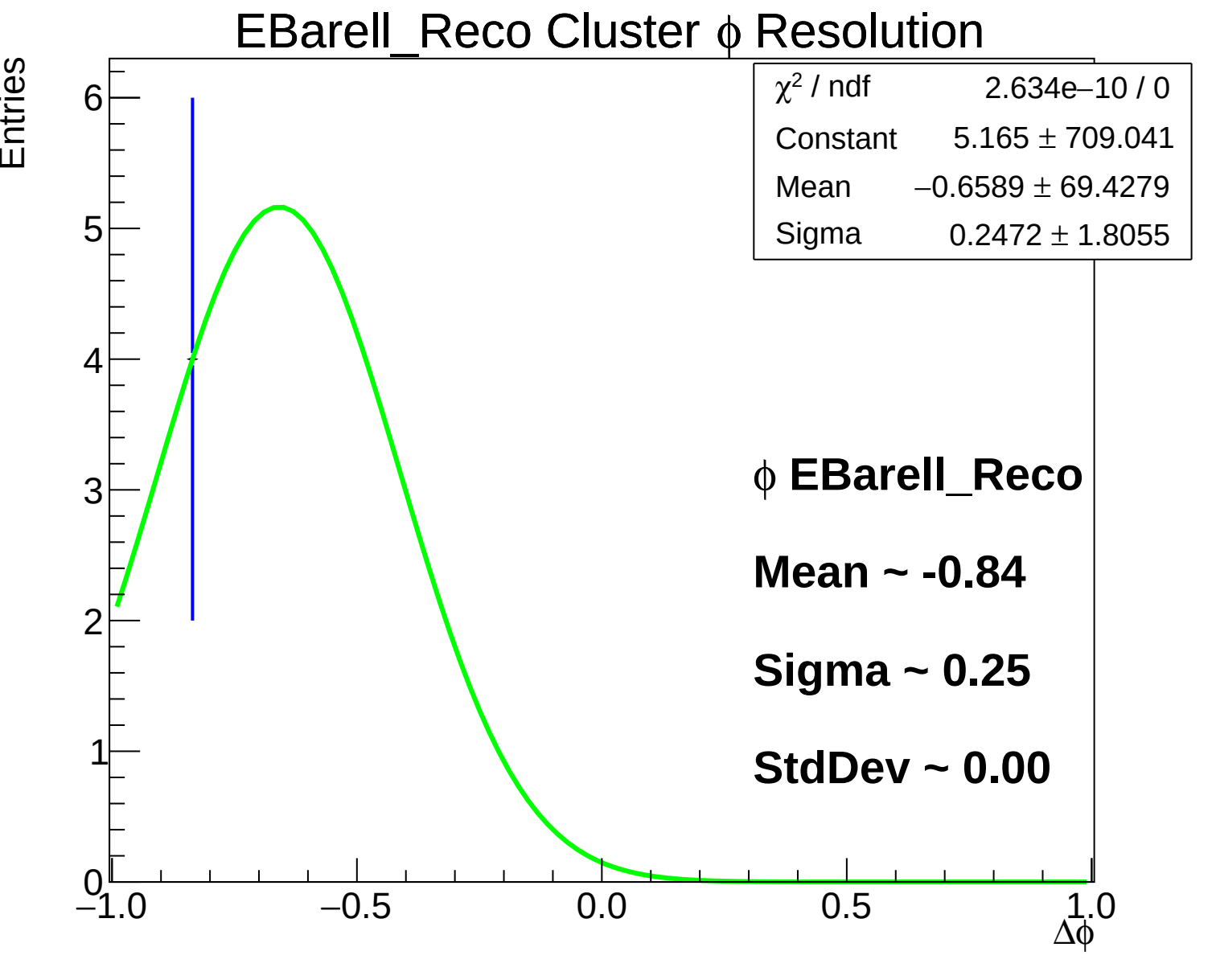

EBarell_Reco Cluster θcluster
Entries
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
1
2
3
4
5
θcluster [rad]

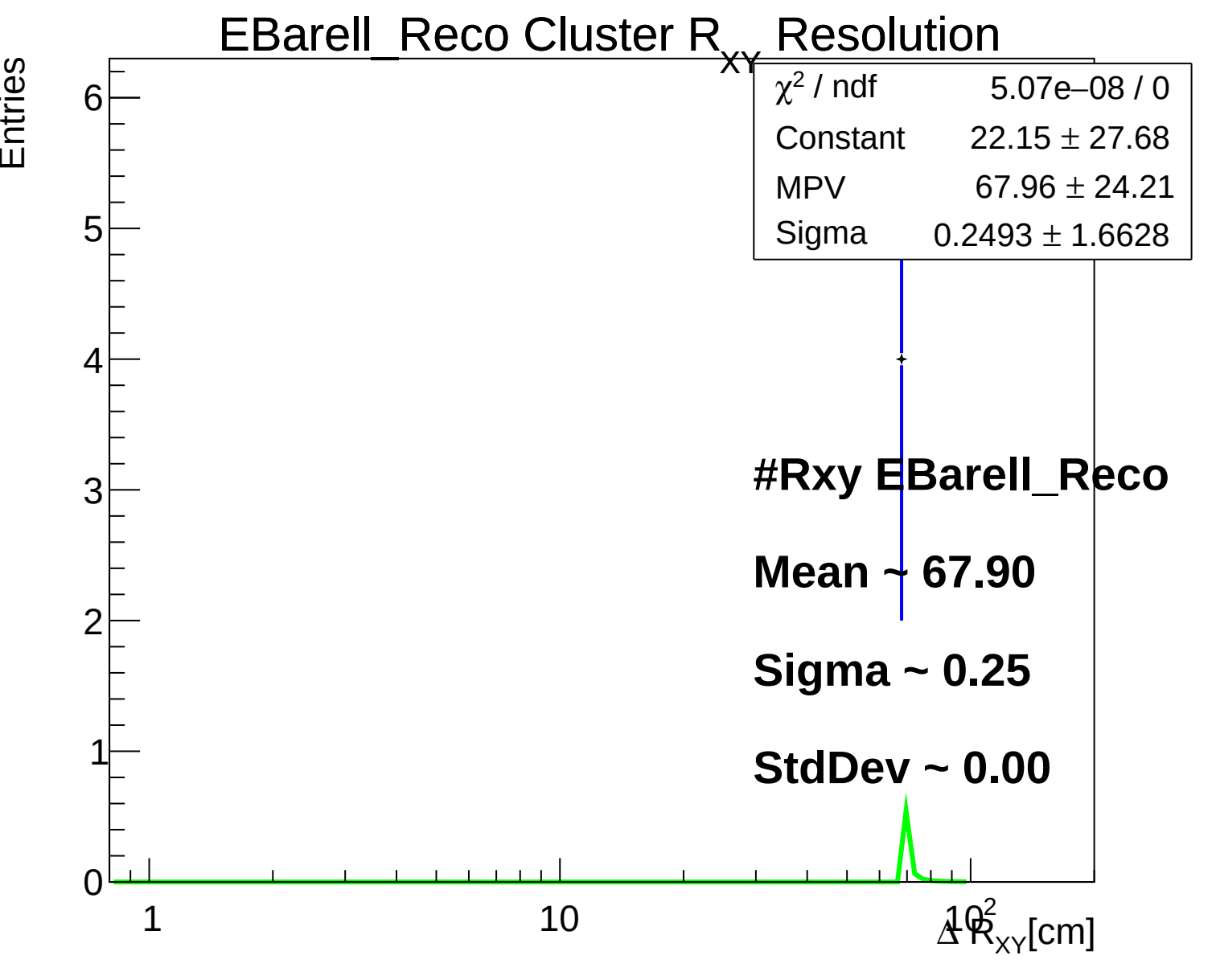

EBarell_Reco Cluster ϕcluster
Entries
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−2
0
2
ϕcluster [rad]

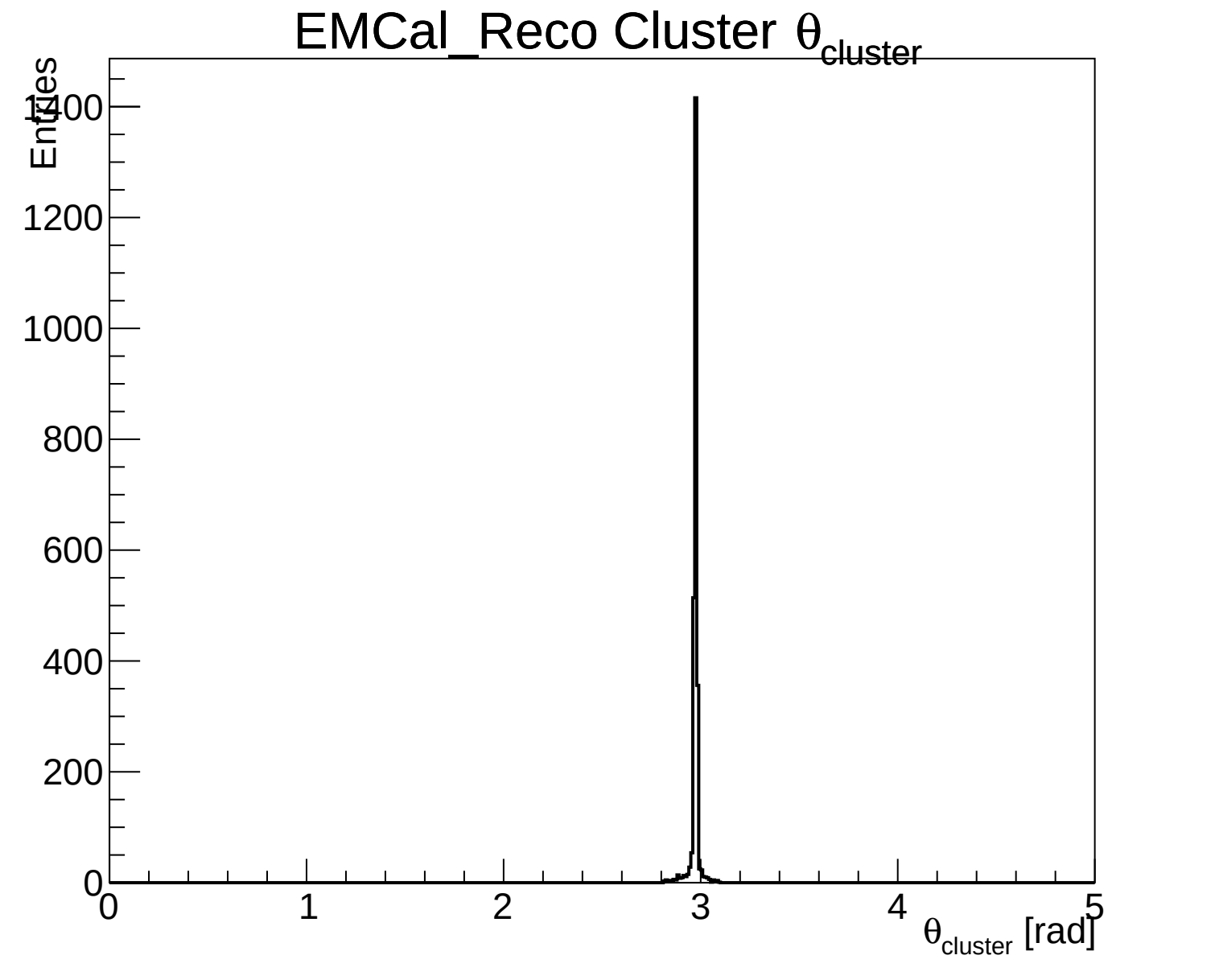

EBarell_Reco Cluster energy
Entries
1.0
0.8
0.6
0.4
0.2
0.0
0
2
4
6
8
10
E [GeV]

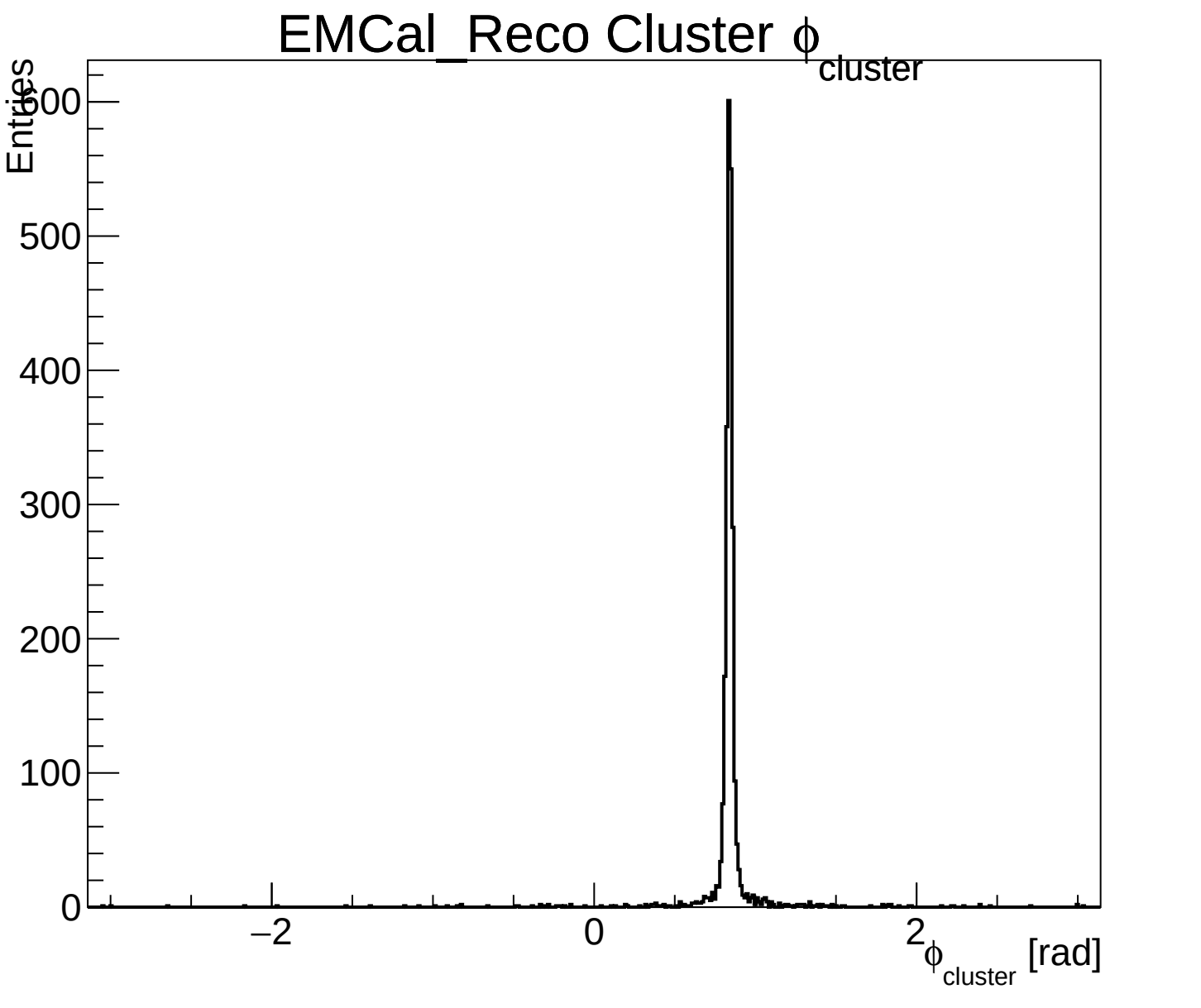

EBarell_Reco Cluster position x,y
y [mm]
3000
2000
1000
0
−1000
−2000
−3000
−2000
0
2000
x [mm]
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0

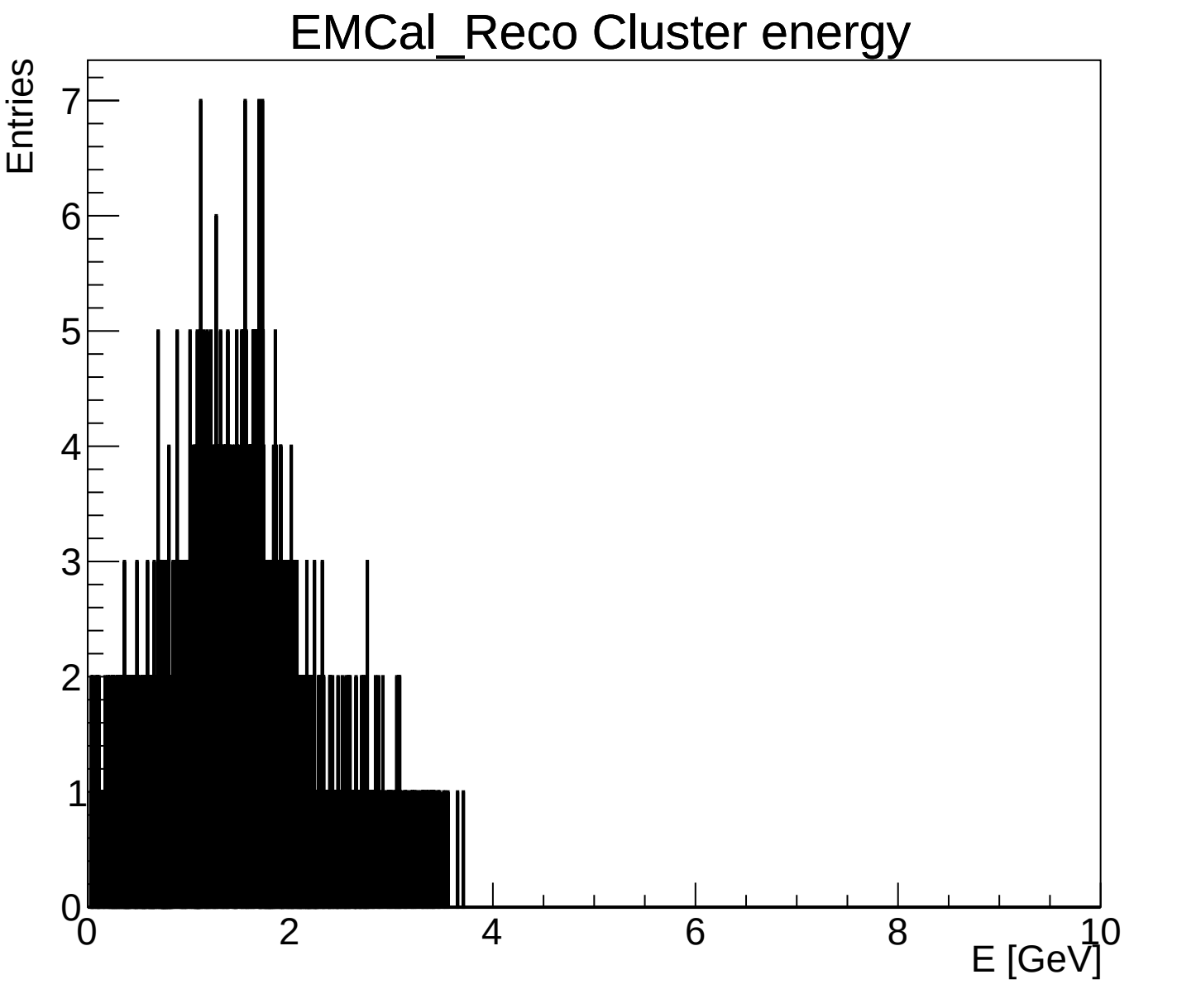

EBarell_Reco Cluster θ Resolution
Entries
1.0
0.8
0.6
0.4
0.2
0.0
–1.0
–0.5
0.0
0.5
1.0
Δθ
θ EBarell_Reco
Mean ~ 0.00
Sigma ~ 0.00
StdDev ~ 0.00

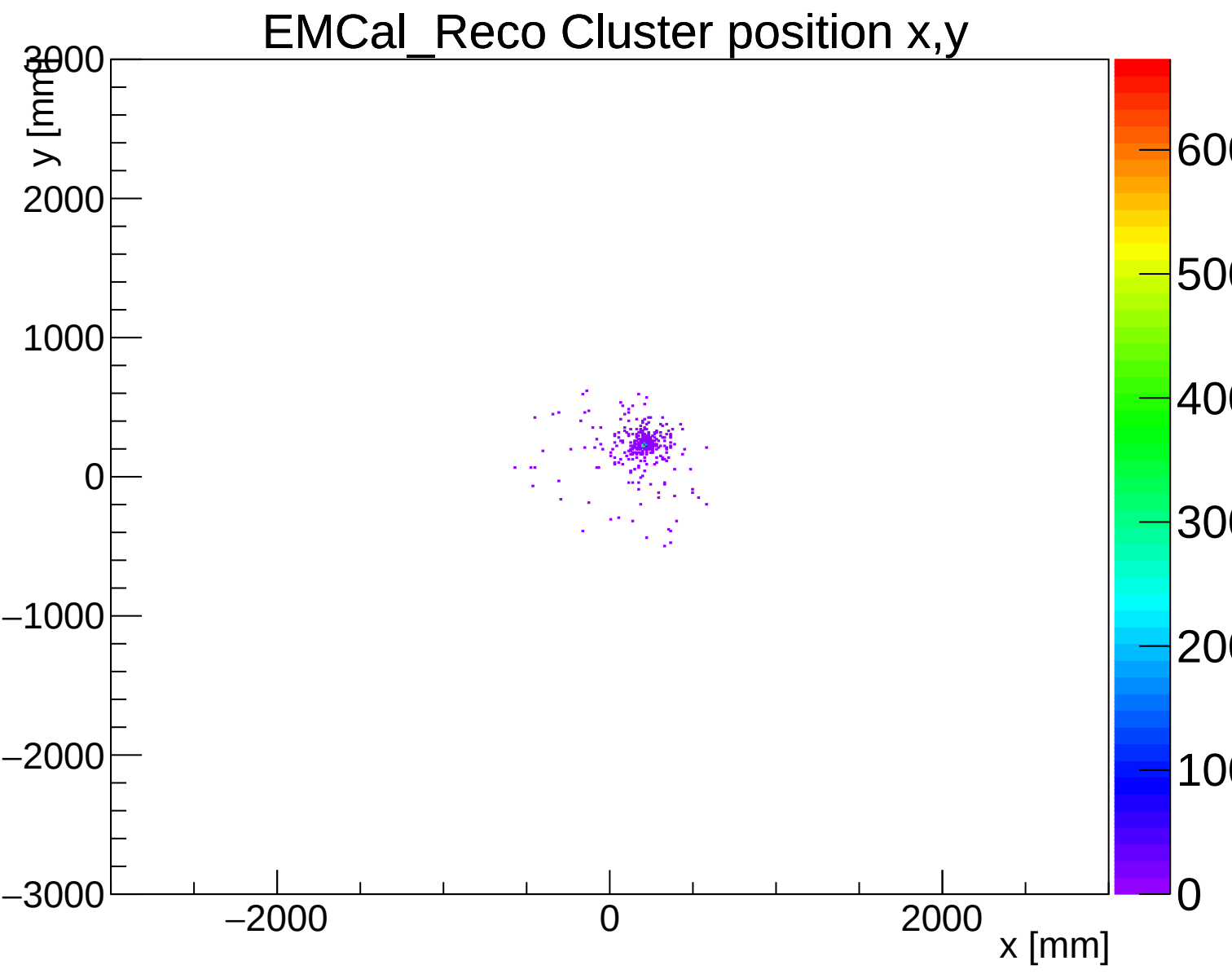

EBarell_Reco Cluster ϕ Resolution
Entries
χ² / ndf 2.634e−10 / 0
Constant 5.165 ± 709.041
Mean −0.6589 ± 69.4279
Sigma 0.2472 ± 1.8055
ϕ EBarell_Reco
Mean ~ -0.84
Sigma ~ 0.25
StdDev ~ 0.00
0
1
2
3
4
5
6
−1.0
−0.5
0.0
0.5
1.0
Δϕ

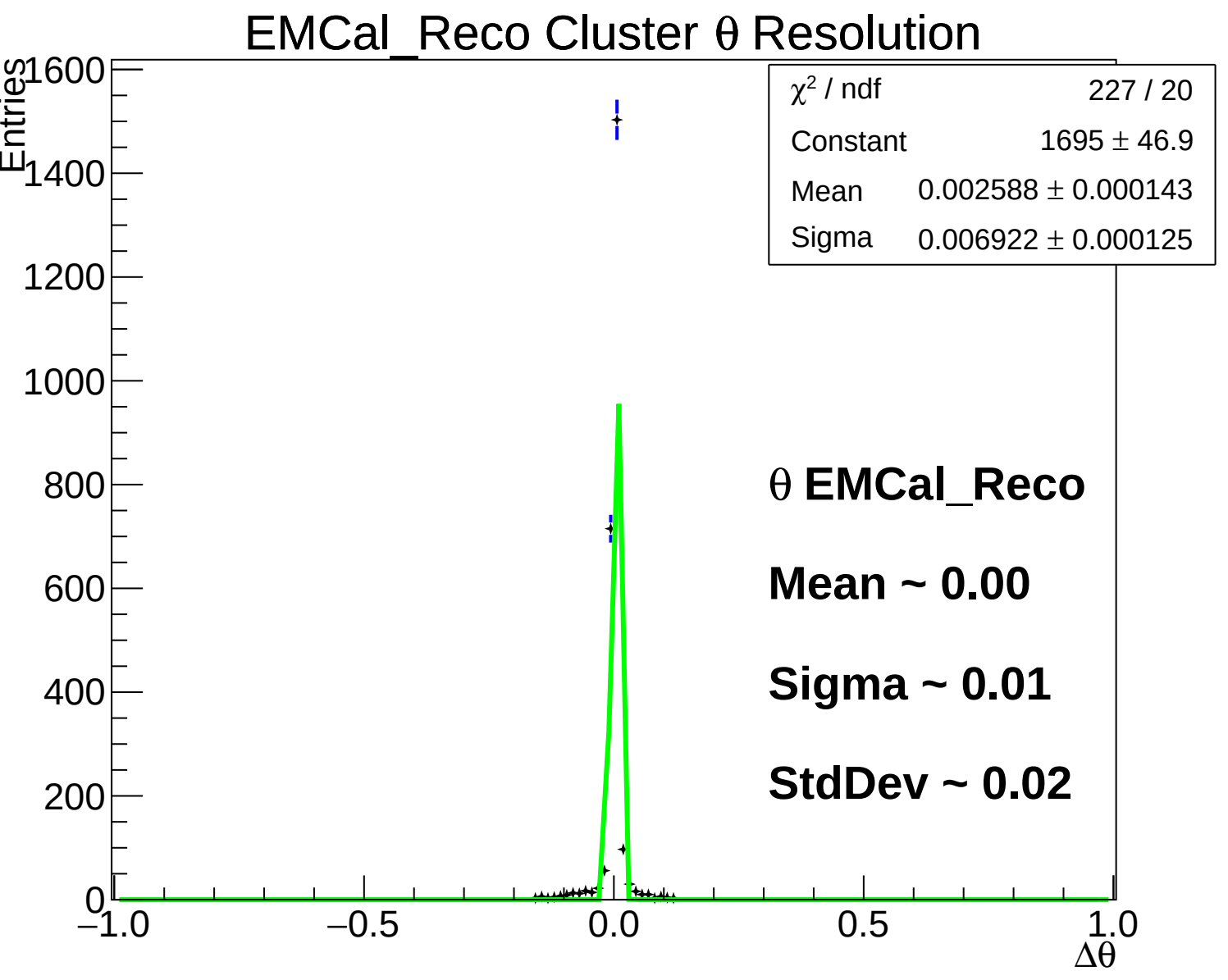

EBarell_Reco Cluster R_XY Resolution
Entries
χ² / ndf 5.07e–08 / 0
Constant 22.15 ± 27.68
MPV 67.96 ± 24.21
Sigma 0.2493 ± 1.6628
#Rxy EBarell_Reco
Mean ~ 67.90
Sigma ~ 0.25
StdDev ~ 0.00
0
1
2
3
4
5
6
1
10
10²
ΔR_XY[cm]

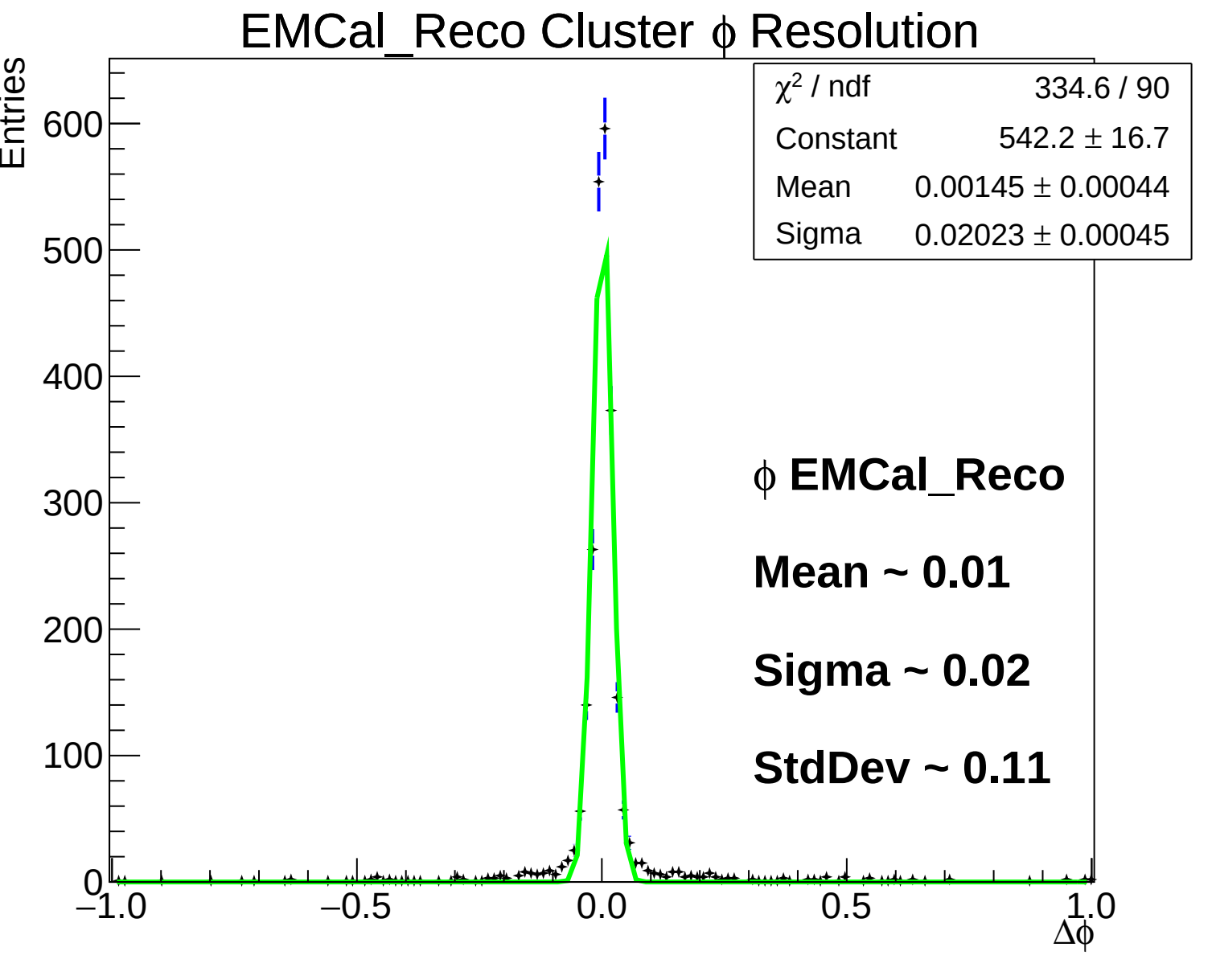

EMCal_Reco Cluster θcluster
Entries
1400
1200
1000
800
600
400
200
0
0
1
2
3
4
5
θcluster [rad]

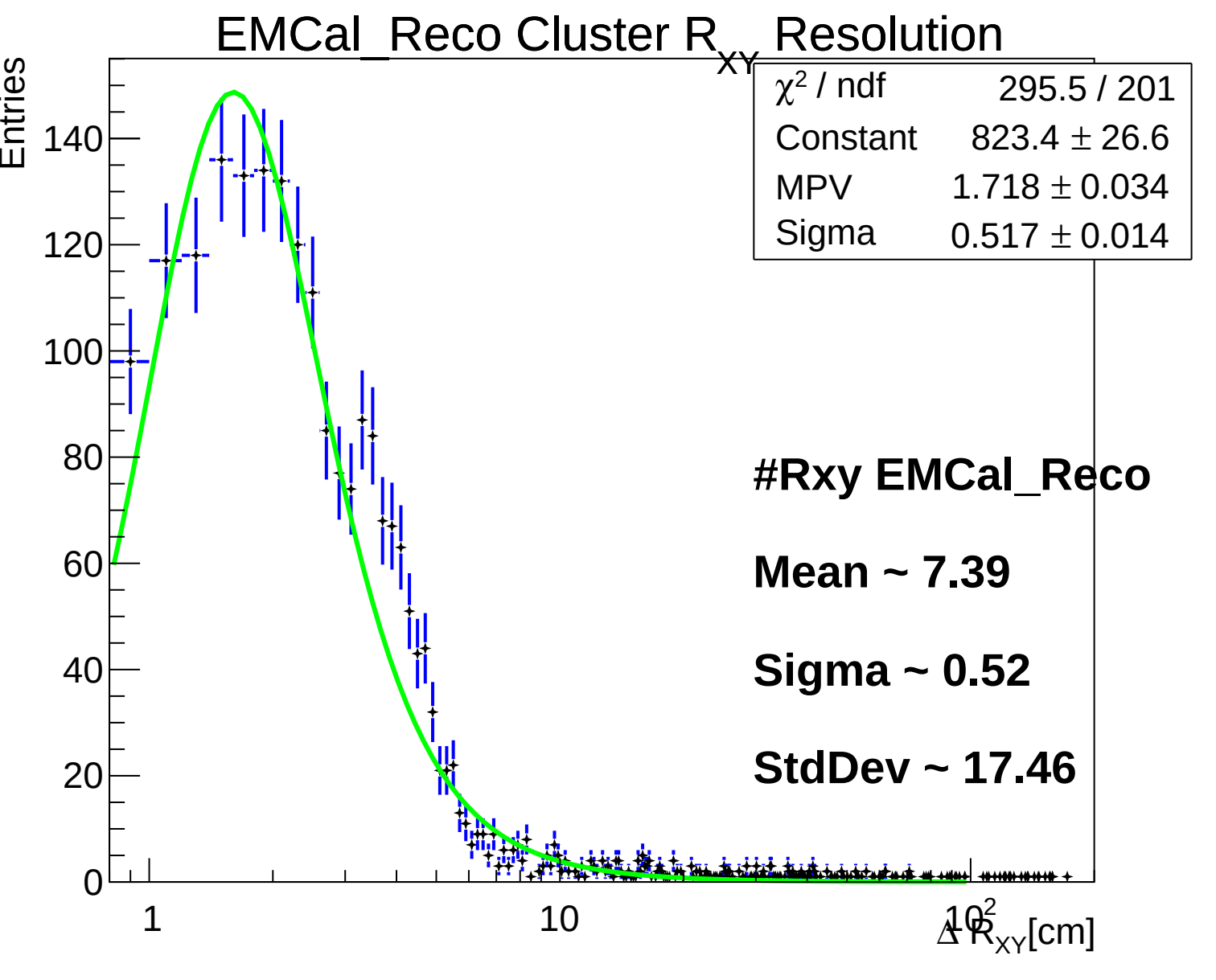

EMCal_Reco Cluster $\phi_{cluster}$
Entries
600
500
400
300
200
100
0
−2
0
2
$\phi_{cluster}$ [rad]

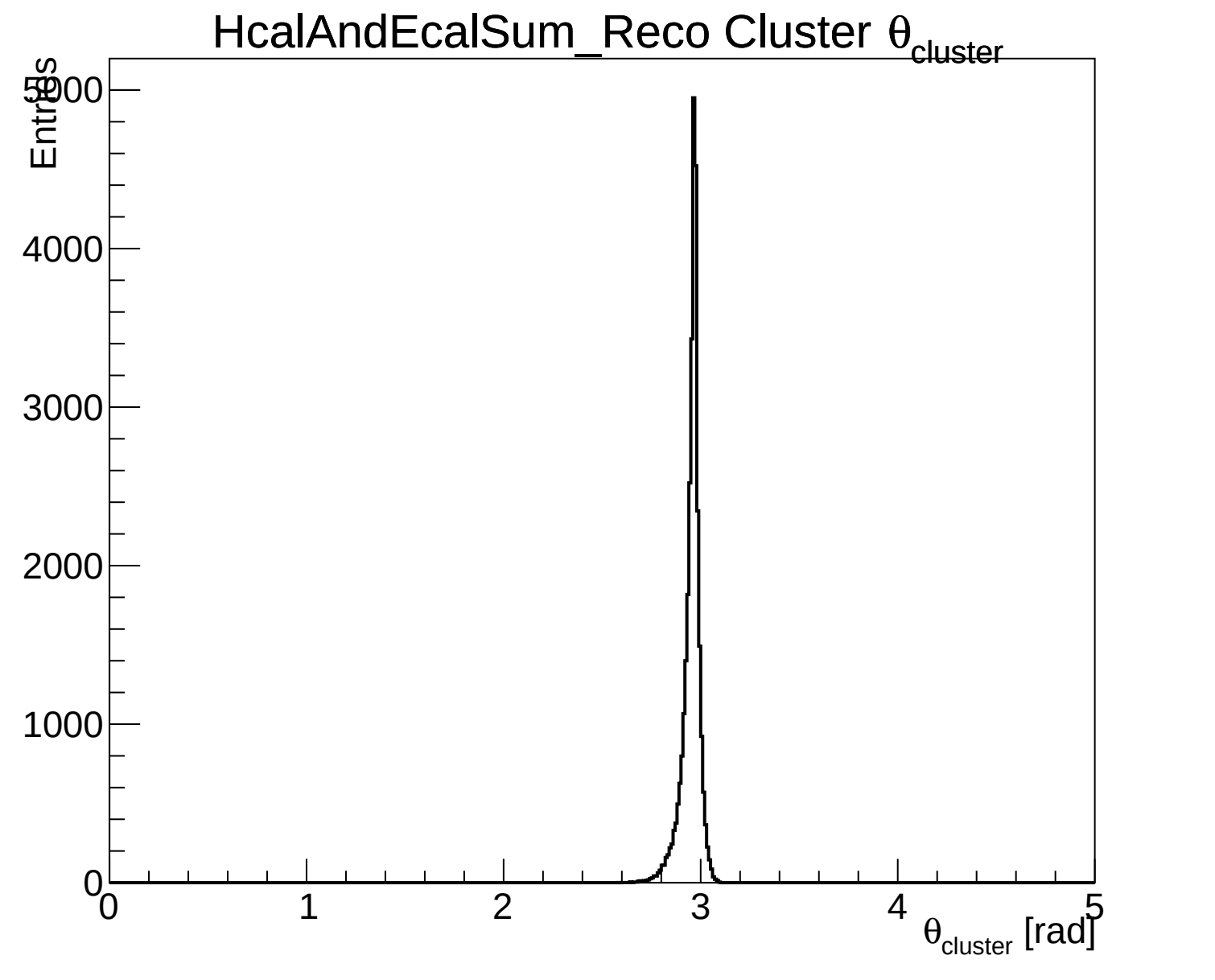

EMCal_Reco Cluster energy
Entries
0
1
2
3
4
5
6
7
0
2
4
6
8
10
E [GeV]

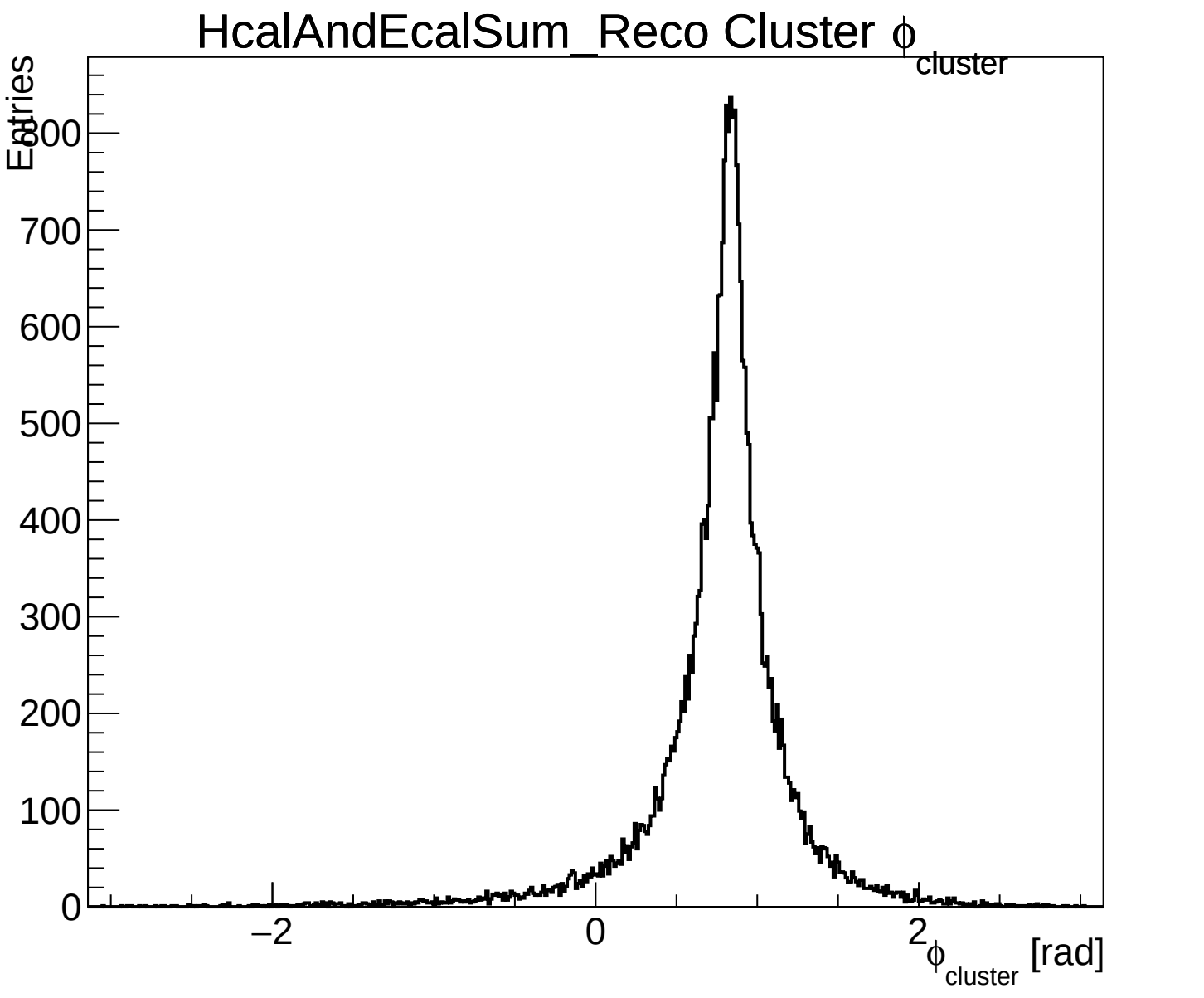

EMCal_Reco Cluster position x,y
y [mm]
3000
2000
1000
0
−1000
−2000
−3000
−2000
0
2000
x [mm]
60
50
40
30
20
10
0

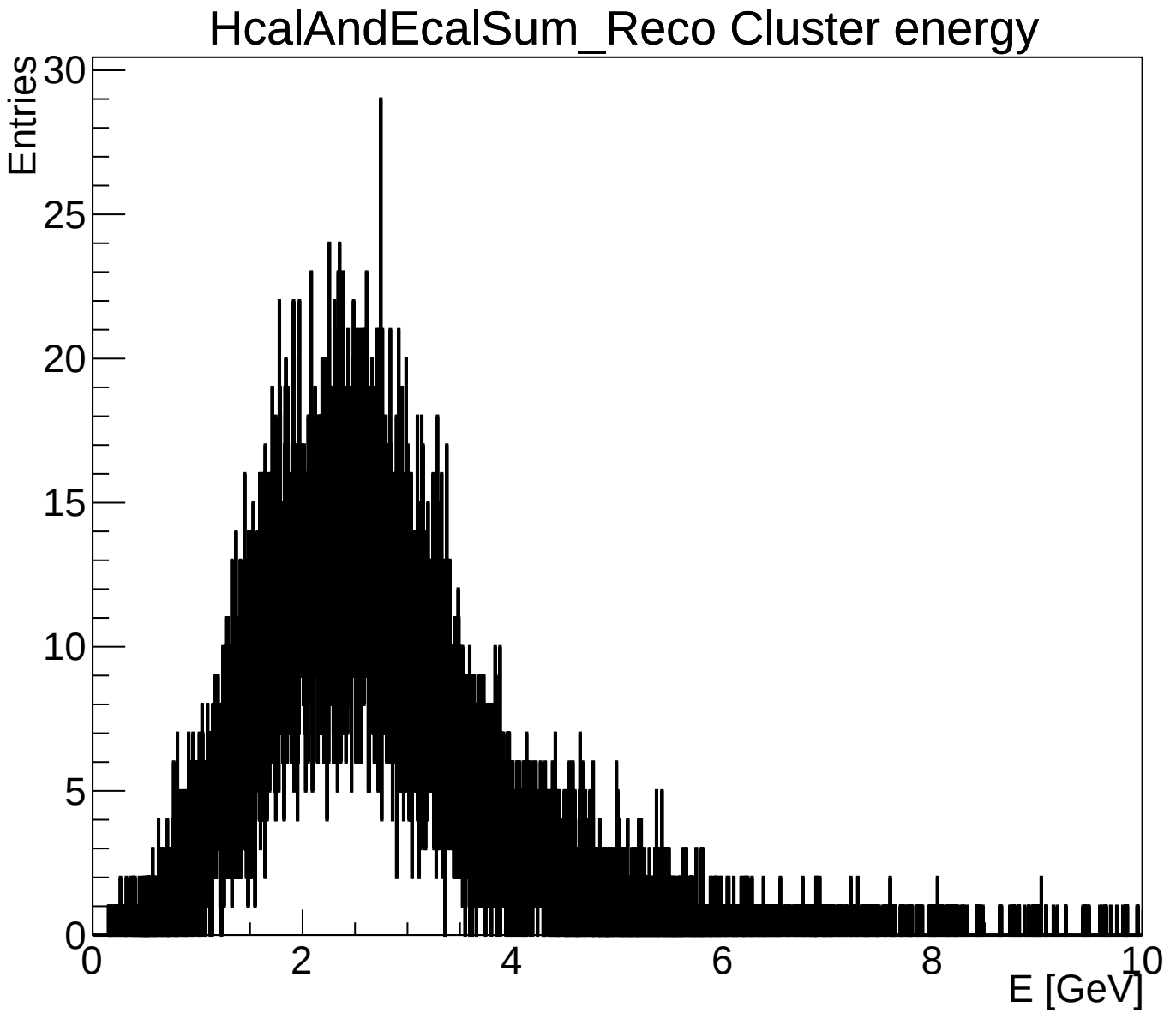

EMCal_Reco Cluster θ Resolution
Entries
1600
1400
1200
1000
800
600
400
200
0
–1.0
–0.5
0.0
0.5
1.0
Δθ
χ² / ndf 227 / 20
Constant 1695 ± 46.9
Mean 0.002588 ± 0.000143
Sigma 0.006922 ± 0.000125
θ EMCal_Reco
Mean ~ 0.00
Sigma ~ 0.01
StdDev ~ 0.02

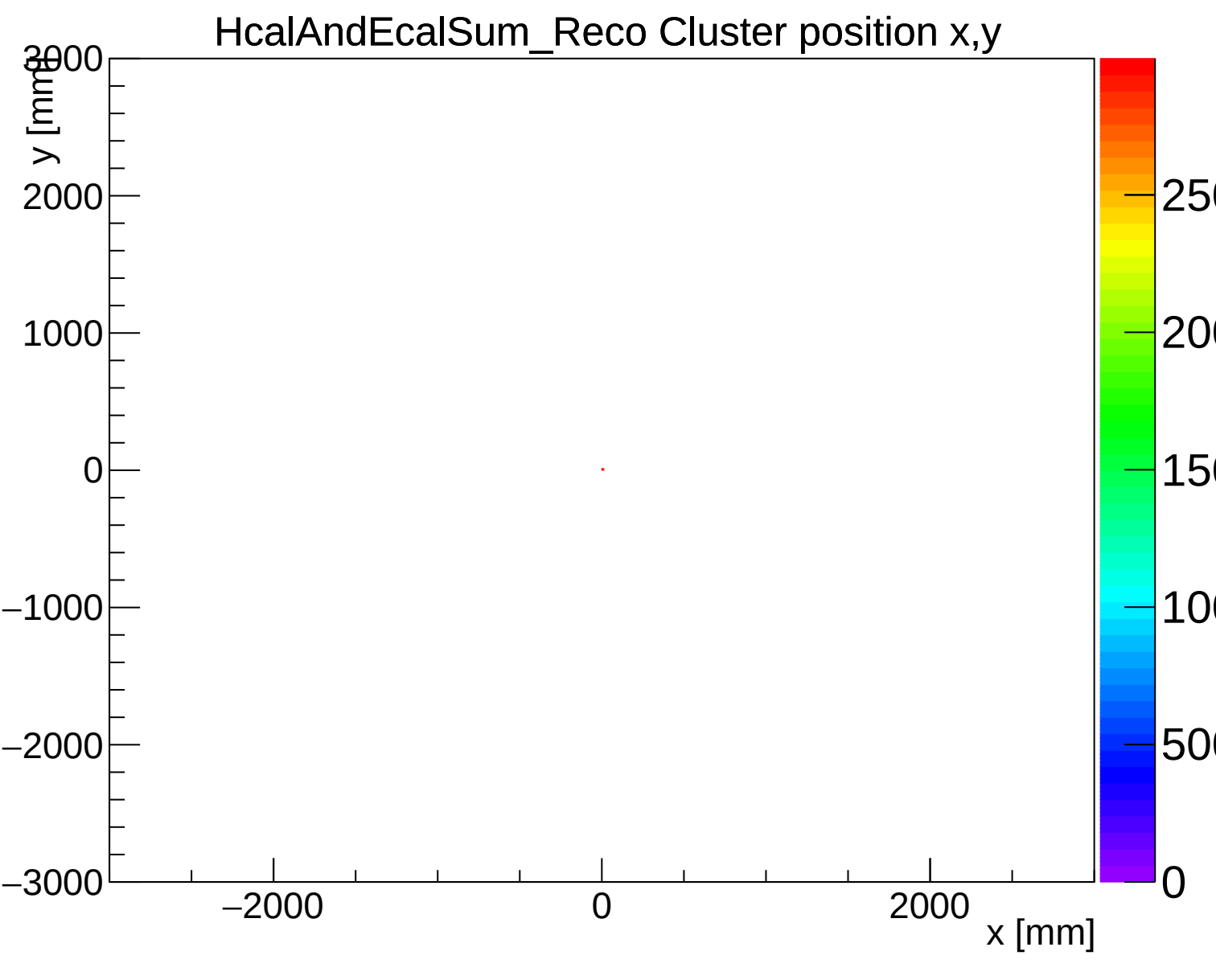

EMCal_Reco Cluster ϕ Resolution
χ² / ndf 334.6 / 90
Constant 542.2 ± 16.7
Mean 0.00145 ± 0.00044
Sigma 0.02023 ± 0.00045
ϕ EMCal_Reco
Mean ~ 0.01
Sigma ~ 0.02
StdDev ~ 0.11
Entries
600
500
400
300
200
100
0
–1.0
–0.5
0.0
0.5
1.0
Δϕ

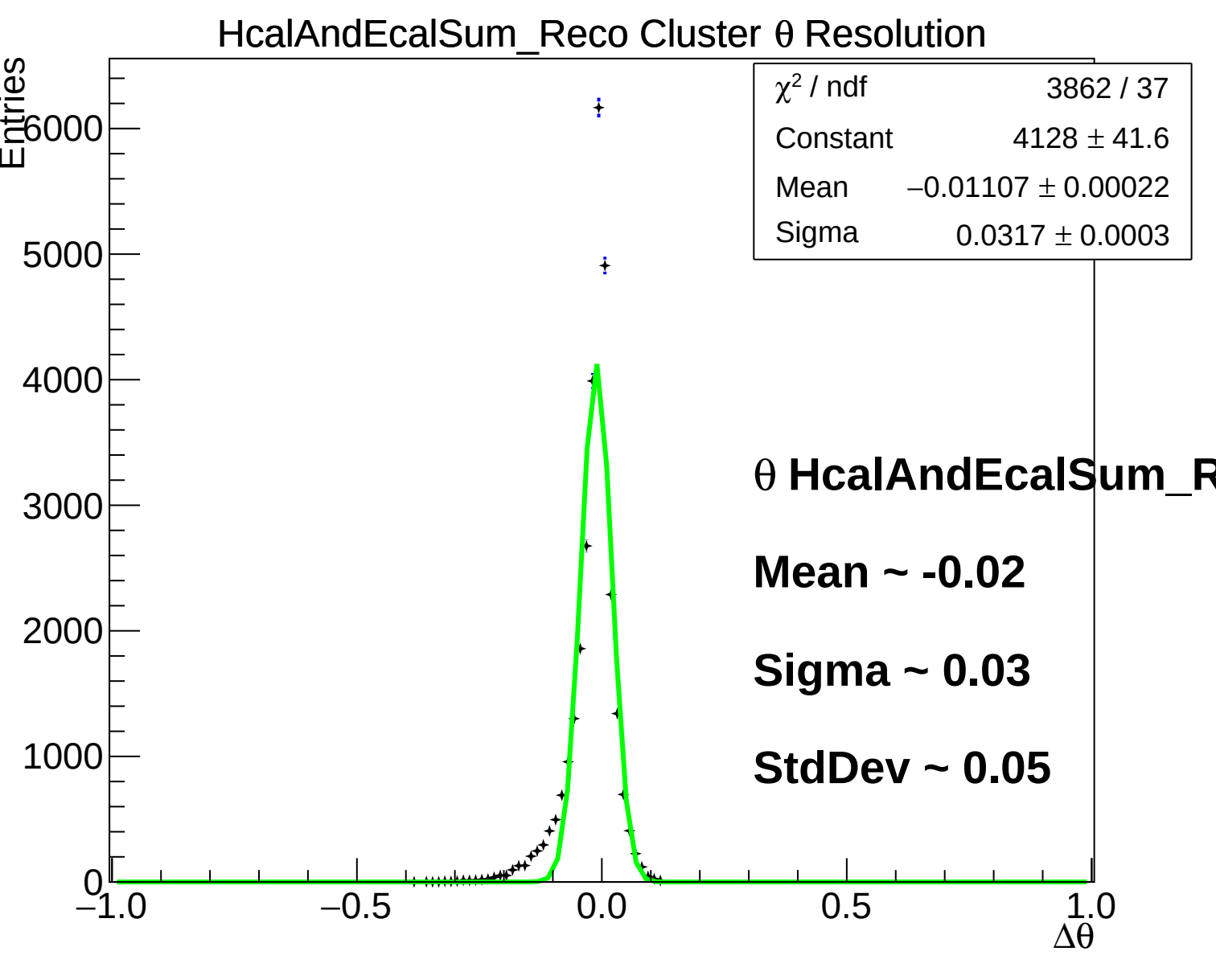

EMCal_Reco Cluster R_{XY} Resolution
χ^2 / ndf 295.5 / 201
Constant 823.4 ± 26.6
MPV 1.718 ± 0.034
Sigma 0.517 ± 0.014
#Rxy EMCal_Reco
Mean ~ 7.39
Sigma ~ 0.52
StdDev ~ 17.46
Entries
0
20
40
60
80
100
120
140
1
10
10^2
ΔR_{XY}[cm]

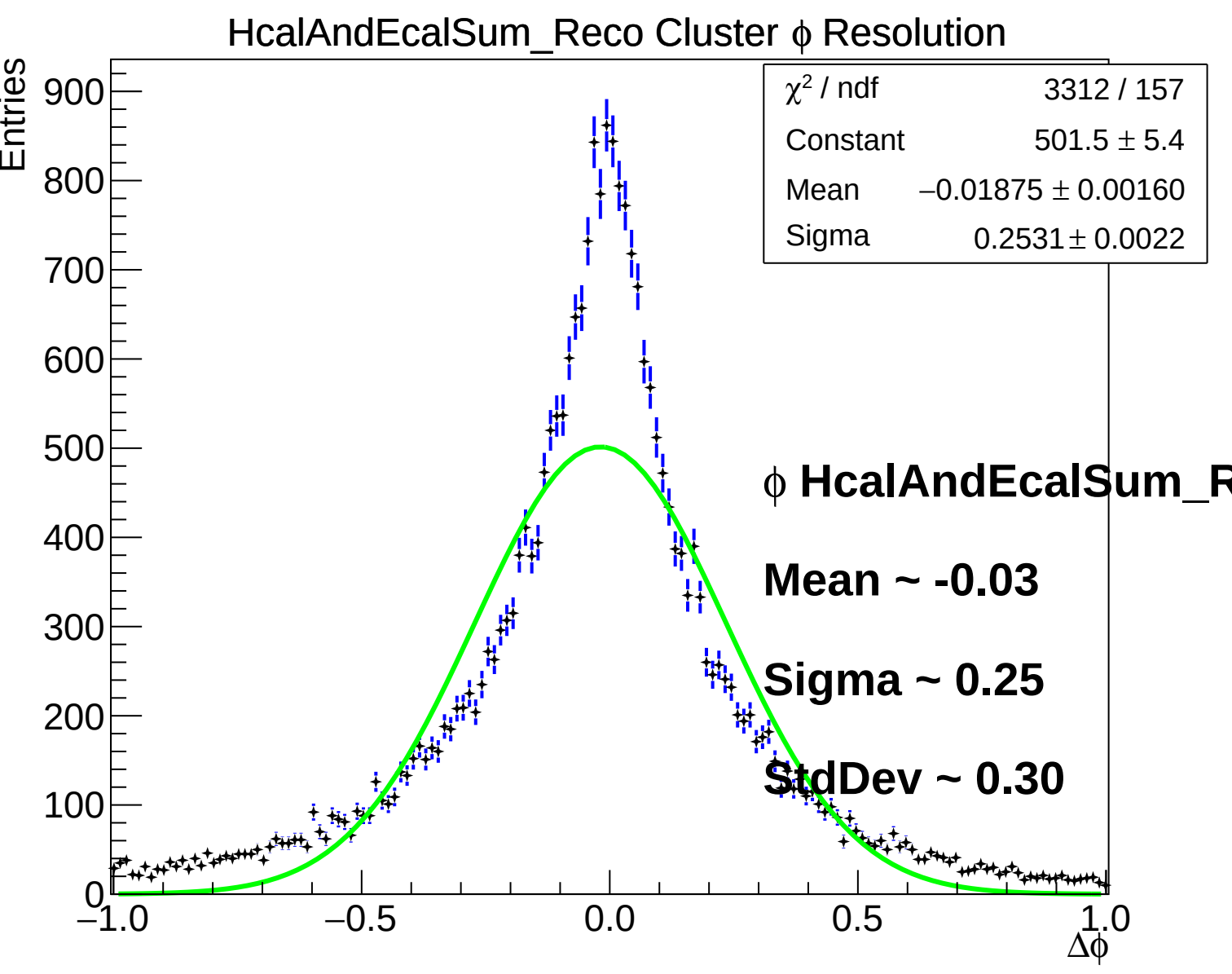

HcalAndEcalSum_Reco Cluster θcluster
Entries
5000
4000
3000
2000
1000
0
0
1
2
3
4
5
θcluster [rad]

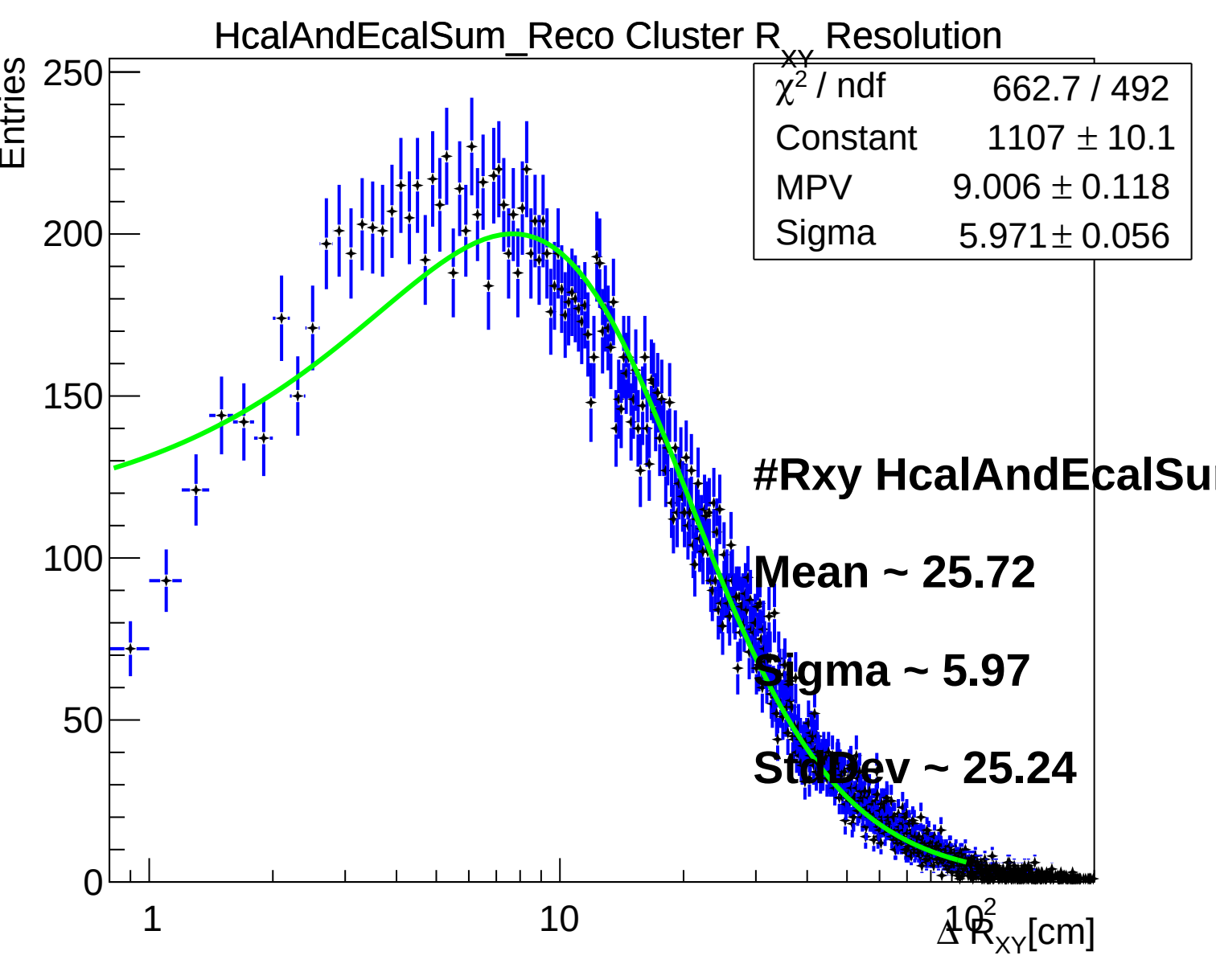

HcalAndEcalSum_Reco Cluster ϕ cluster
Entries
800
700
600
500
400
300
200
100
0
−2
0
2
ϕ cluster [rad]

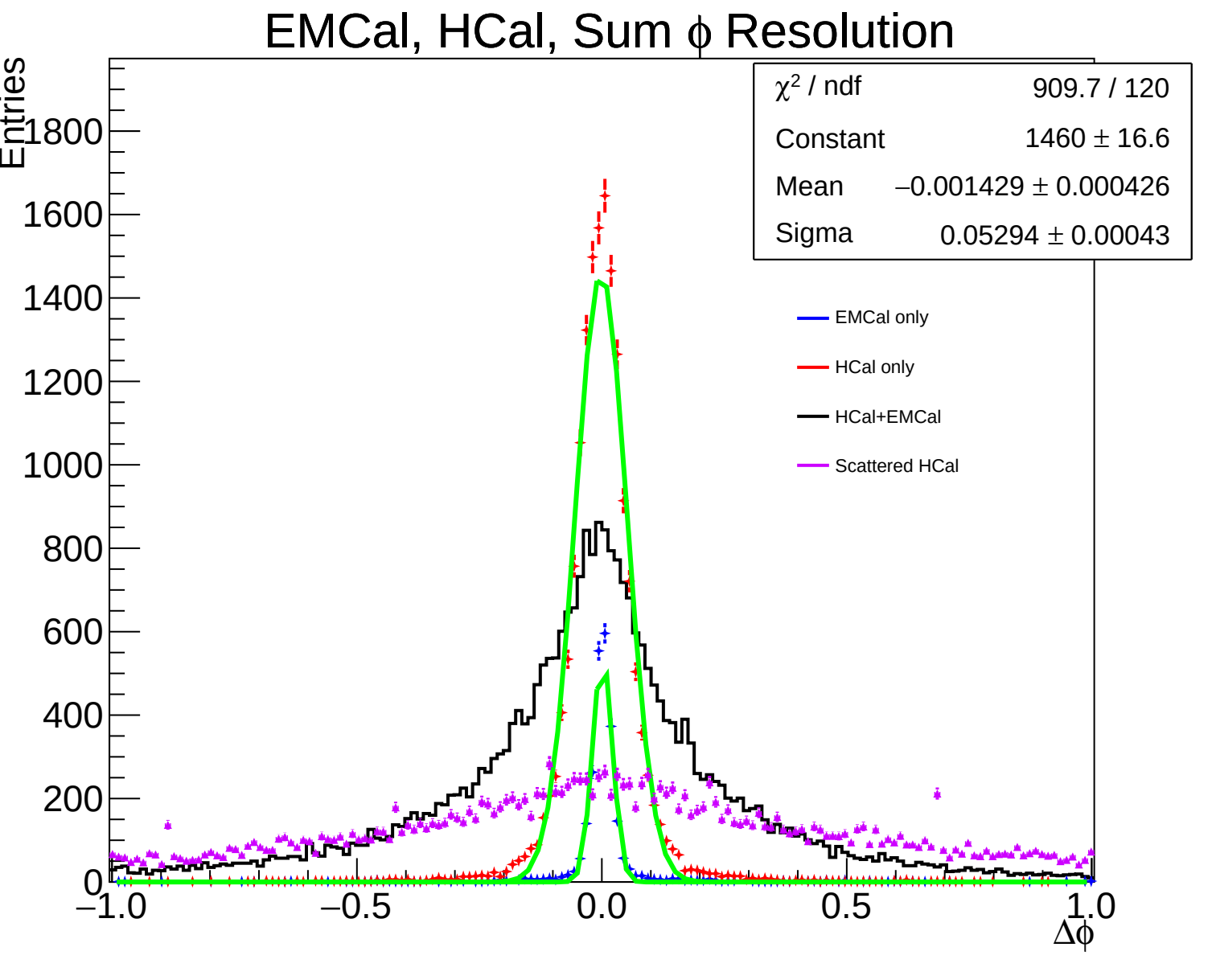

HcalAndEcalSum_Reco Cluster energy
Entries
30
25
20
15
10
5
0
0
2
4
6
8
10
E [GeV]

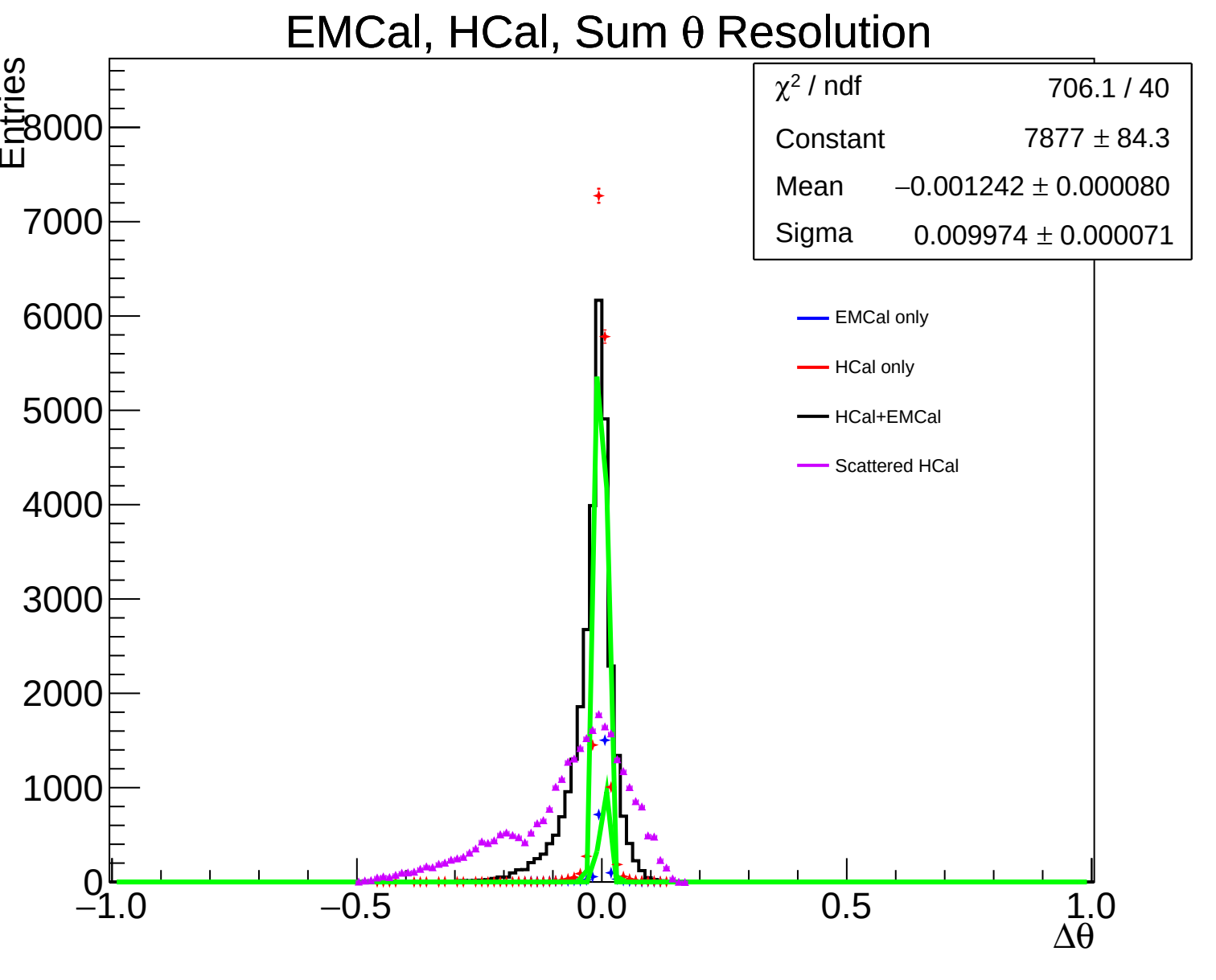

HcalAndEcalSum_Reco Cluster position x,y
y [mm]
3000
2000
1000
0
−1000
−2000
−3000
−2000
0
2000
x [mm]
250
200
150
100
50
0

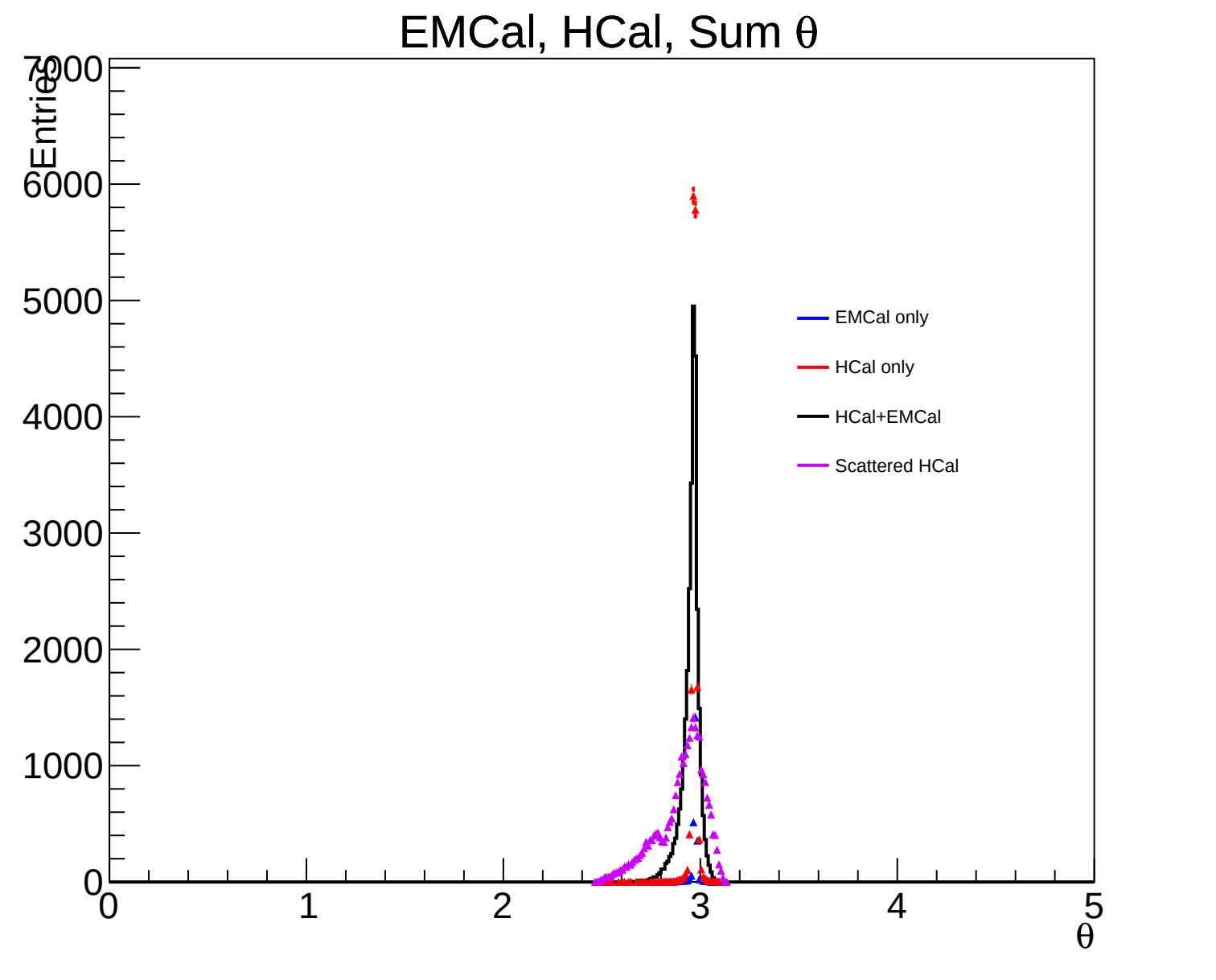

HcalAndEcalSum_Reco Cluster θ Resolution
Entries
6000
5000
4000
3000
2000
1000
0
–1.0
–0.5
0.0
0.5
1.0
Δθ
χ² / ndf 3862 / 37
Constant 4128 ± 41.6
Mean –0.01107 ± 0.00022
Sigma 0.0317 ± 0.0003
θ HcalAndEcalSum_R
Mean ~ -0.02
Sigma ~ 0.03
StdDev ~ 0.05

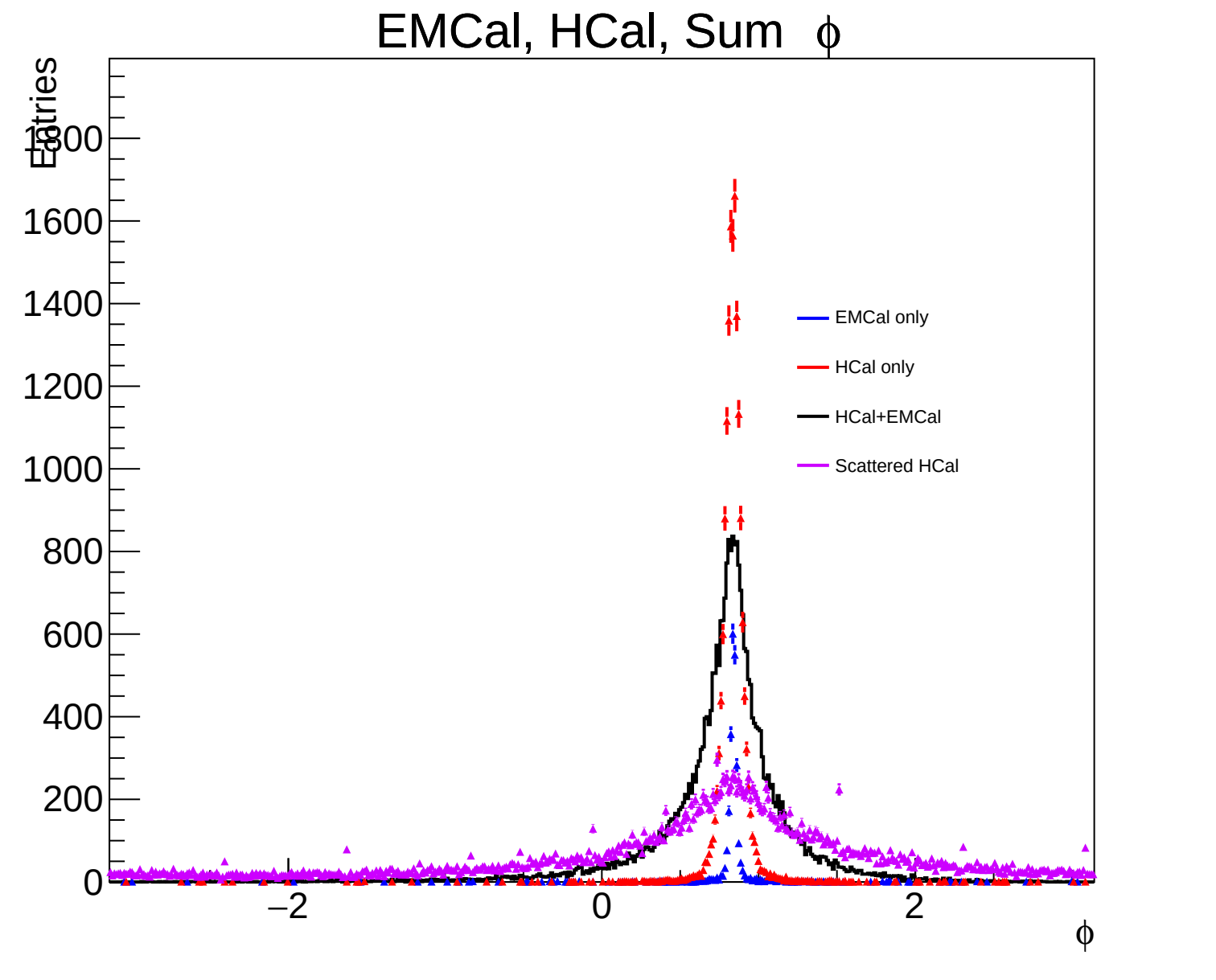

HcalAndEcalSum_Reco Cluster ϕ Resolution
Entries
900
800
700
600
500
400
300
200
100
0
–1.0
–0.5
0.0
0.5
1.0
Δϕ
χ² / ndf 3312 / 157
Constant 501.5 ± 5.4
Mean –0.01875 ± 0.00160
Sigma 0.2531 ± 0.0022
ϕ HcalAndEcalSum_R
Mean ~ -0.03
Sigma ~ 0.25
StdDev ~ 0.30

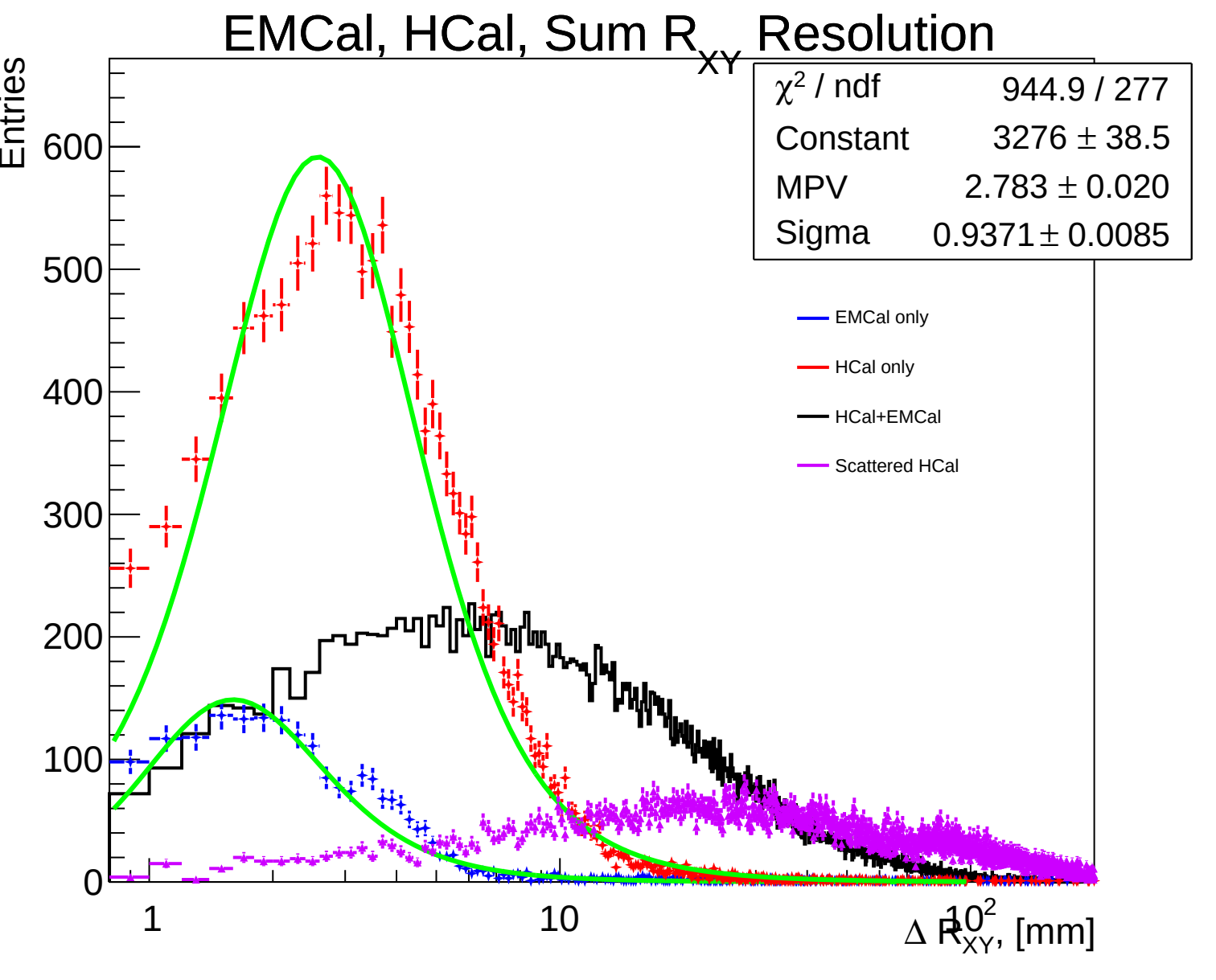

HcalAndEcalSum_Reco Cluster R_{XY} Resolution
Entries
250
200
150
100
50
0
1
10
10^2
ΔR_{XY}[cm]
χ^2 / ndf 662.7 / 492
Constant 1107 ± 10.1
MPV 9.006 ± 0.118
Sigma 5.971 ± 0.056
#Rxy HcalAndEcalSu
Mean ~ 25.72
Sigma ~ 5.97
StdDev ~ 25.24

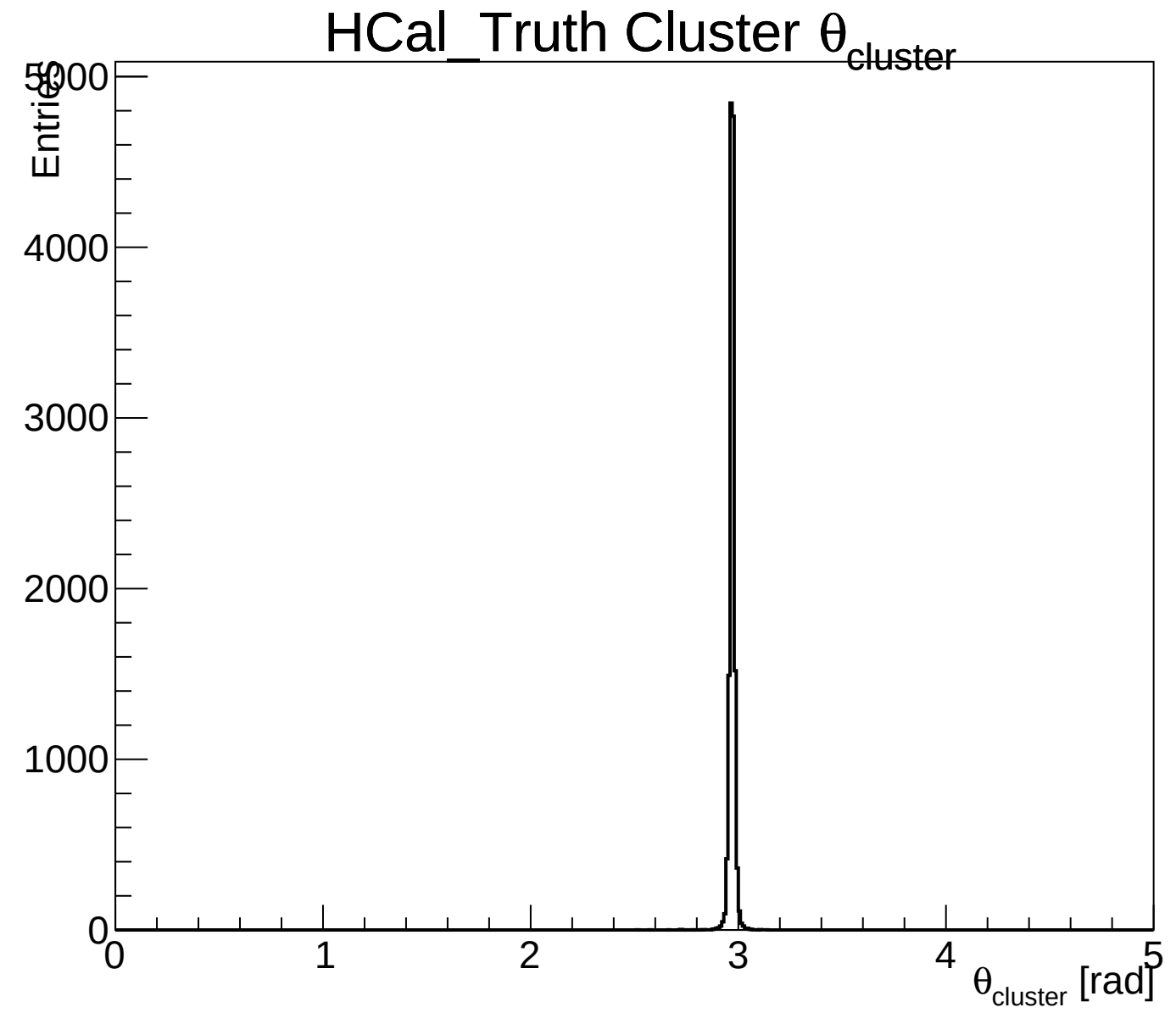

EMCal, HCal, Sum ϕ Resolution
Entries
1800
1600
1400
1200
1000
800
600
400
200
0
−1.0
−0.5
0.0
0.5
1.0
Δϕ
χ² / ndf 909.7 / 120
Constant 1460 ± 16.6
Mean −0.001429 ± 0.000426
Sigma 0.05294 ± 0.00043
EMCal only
HCal only
HCal+EMCal
Scattered HCal

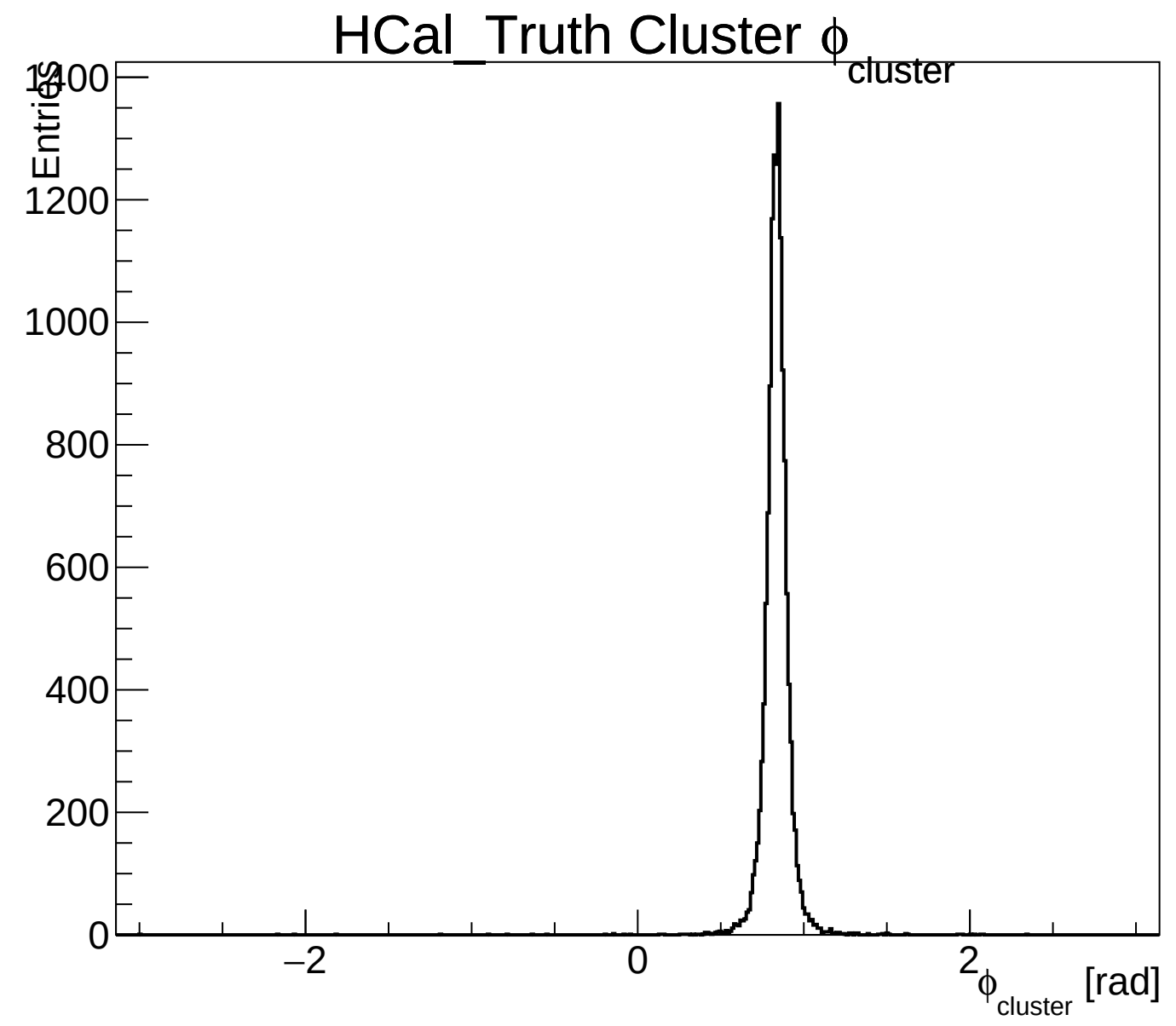

EMCal, HCal, Sum θ Resolution
Entries
8000
7000
6000
5000
4000
3000
2000
1000
0
–1.0
–0.5
0.0
0.5
1.0
Δθ
χ² / ndf 706.1 / 40
Constant 7877 ± 84.3
Mean –0.001242 ± 0.000080
Sigma 0.009974 ± 0.000071
EMCal only
HCal only
HCal+EMCal
Scattered HCal

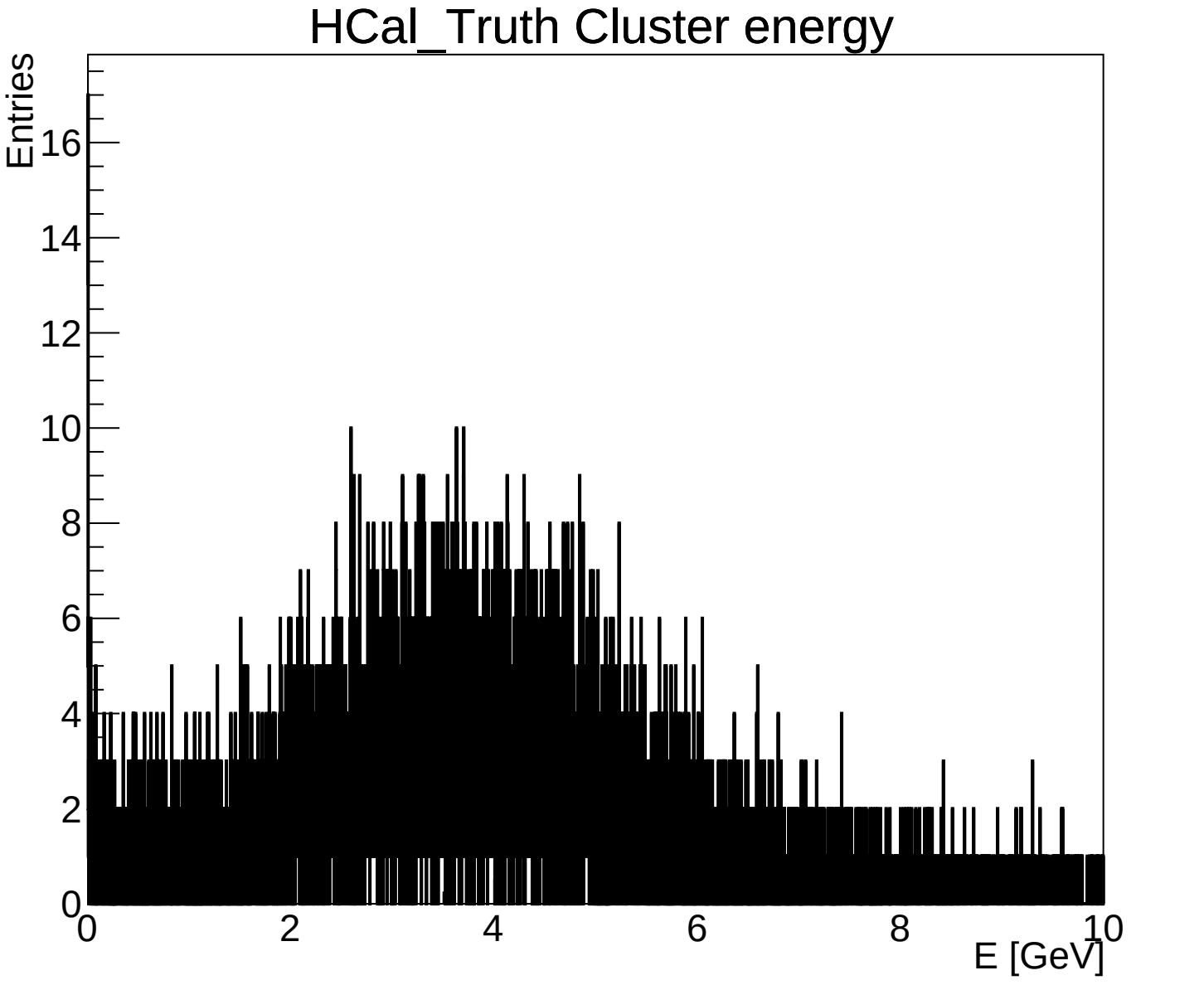

EMCal, HCal, Sum θ
Entries
7000
6000
5000
4000
3000
2000
1000
0
0
1
2
3
4
5
θ
EMCal only
HCal only
HCal+EMCal
Scattered HCal

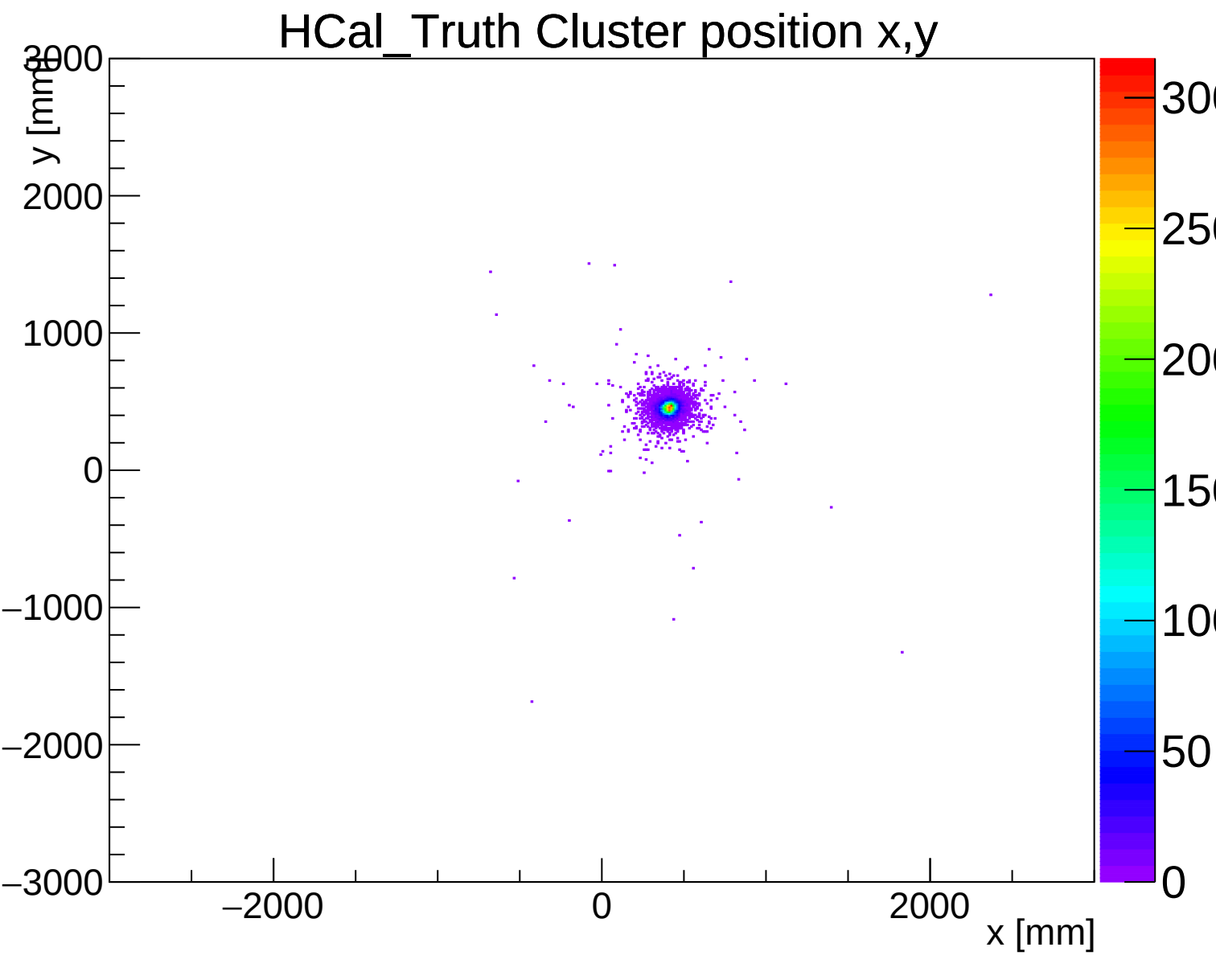

EMCal, HCal, Sum ϕ
Entries
1800
1600
1400
1200
1000
800
600
400
200
0
−2
0
2
ϕ
EMCal only
HCal only
HCal+EMCal
Scattered HCal

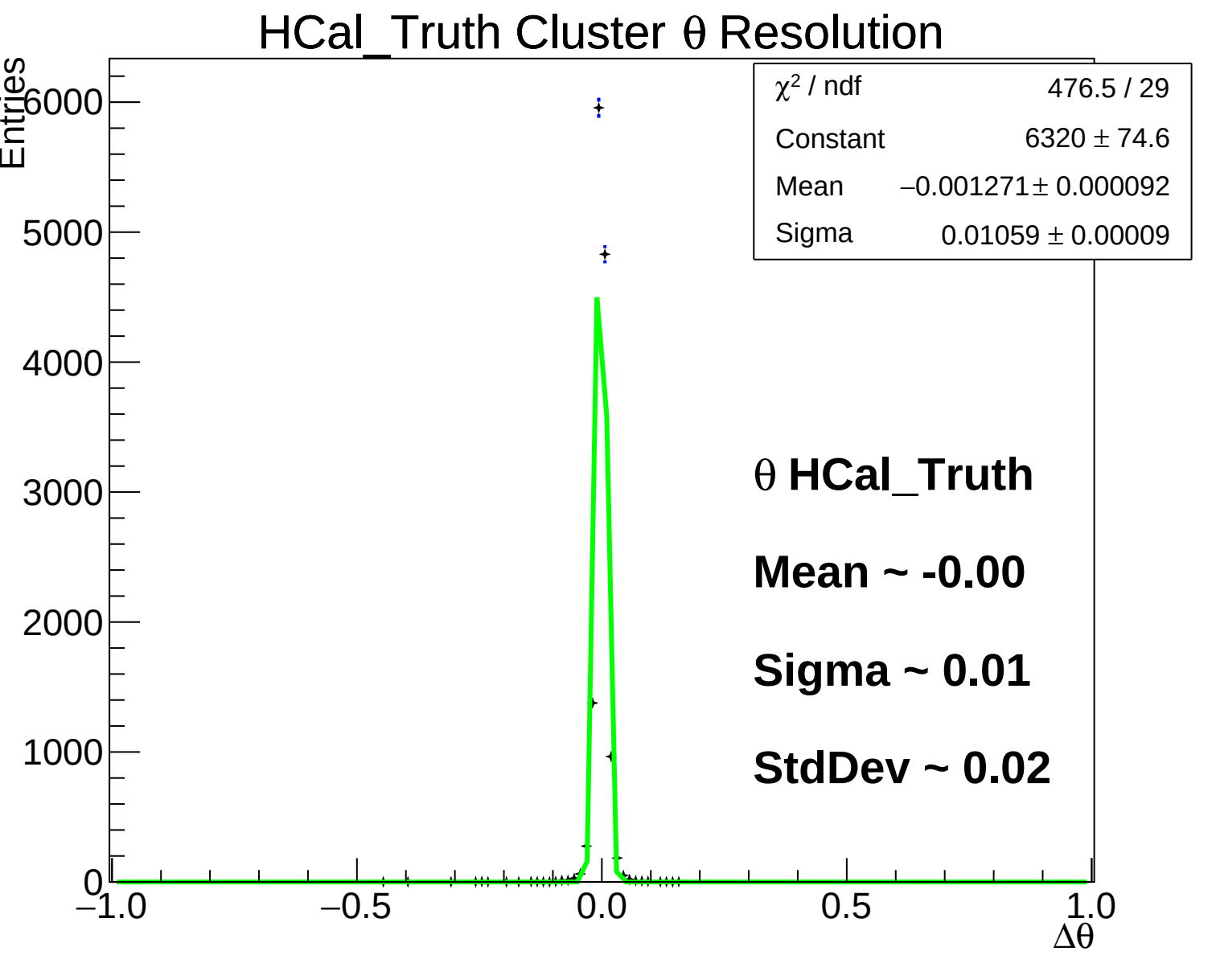

EMCal, HCal, Sum R_{XY} Resolution
χ^2 / ndf 944.9 / 277
Constant 3276 ± 38.5
MPV 2.783 ± 0.020
Sigma 0.9371 ± 0.0085
EMCal only
HCal only
HCal+EMCal
Scattered HCal
Entries
0
100
200
300
400
500
600
1
10
10^2
ΔR_{XY}, [mm]

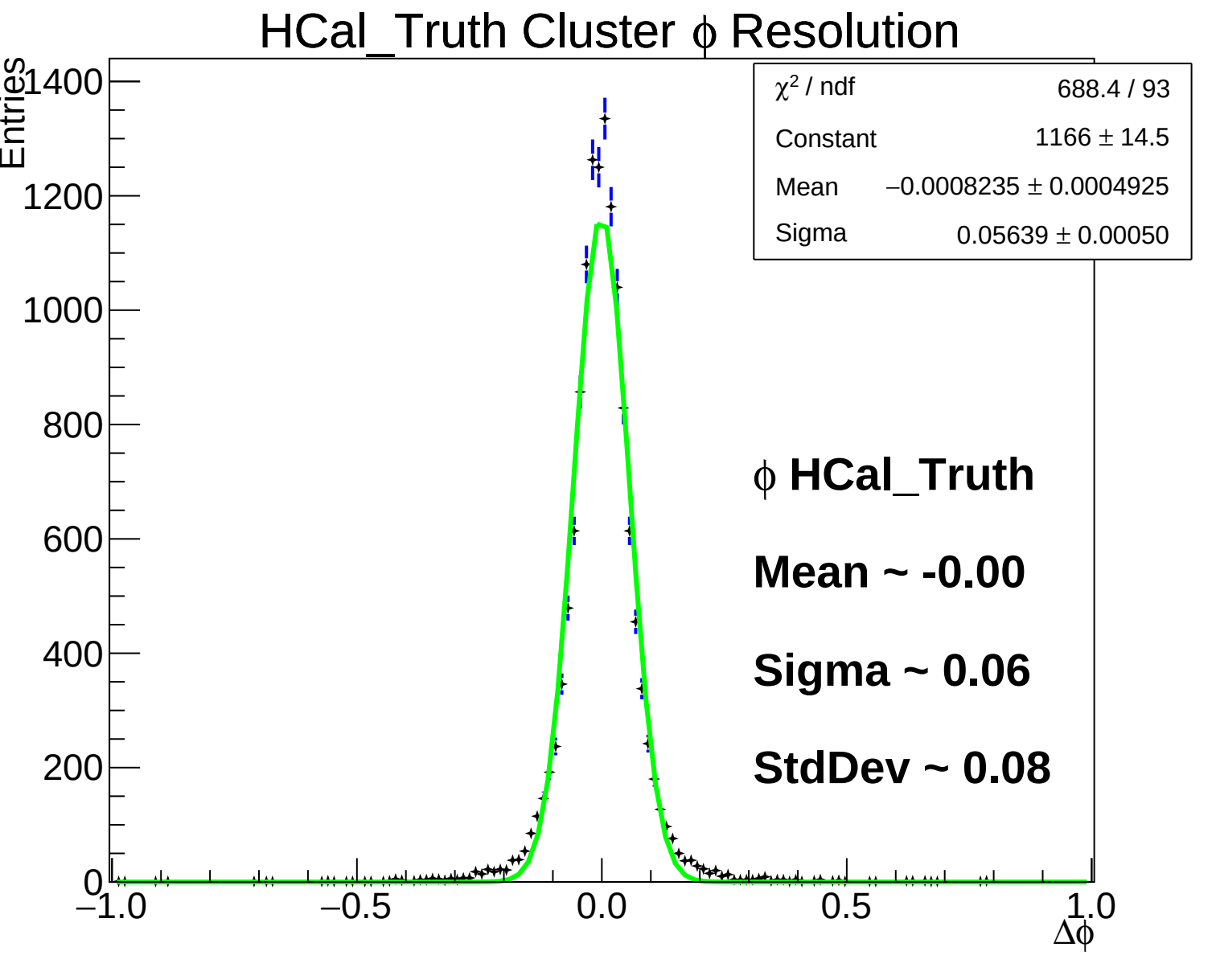

HCal_Truth Cluster θcluster
Entries
5000
4000
3000
2000
1000
0
0
1
2
3
4
5
θcluster [rad]

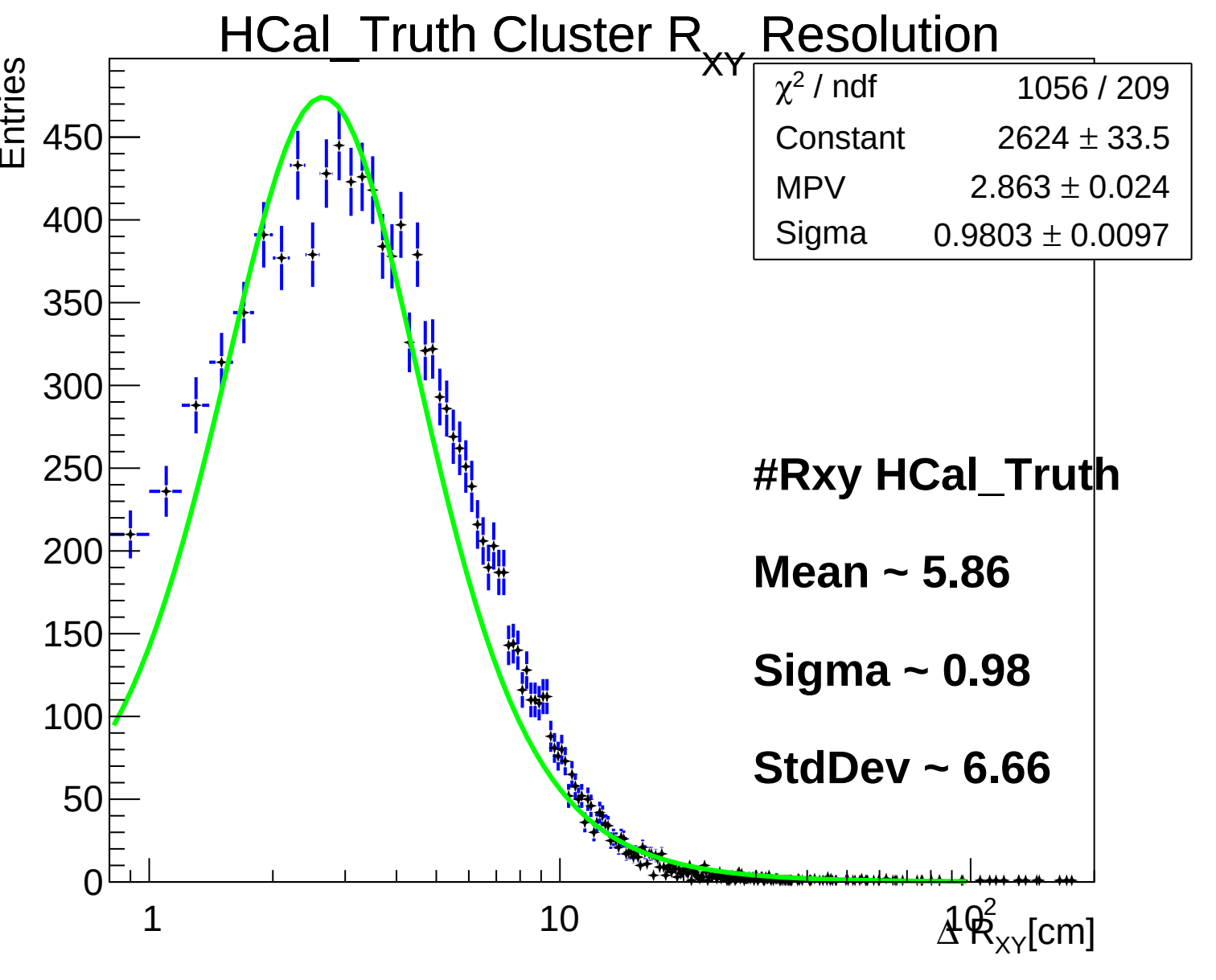

HCal_Truth Cluster ϕcluster
Entries
1400
1200
1000
800
600
400
200
0
−2
0
2
ϕcluster [rad]

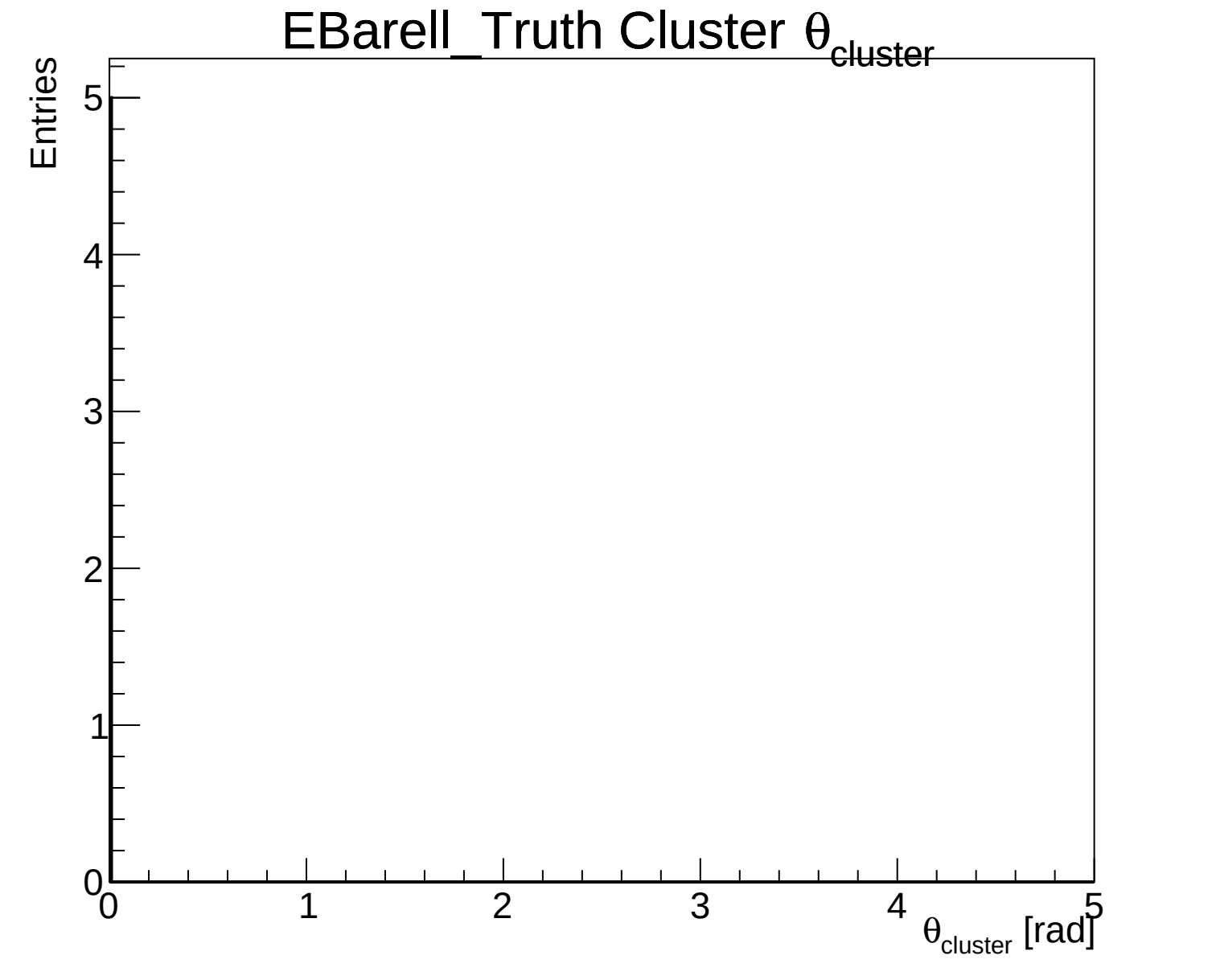

HCal_Truth Cluster energy
Entries
0
2
4
6
8
10
12
14
16
0
2
4
6
8
10
E [GeV]

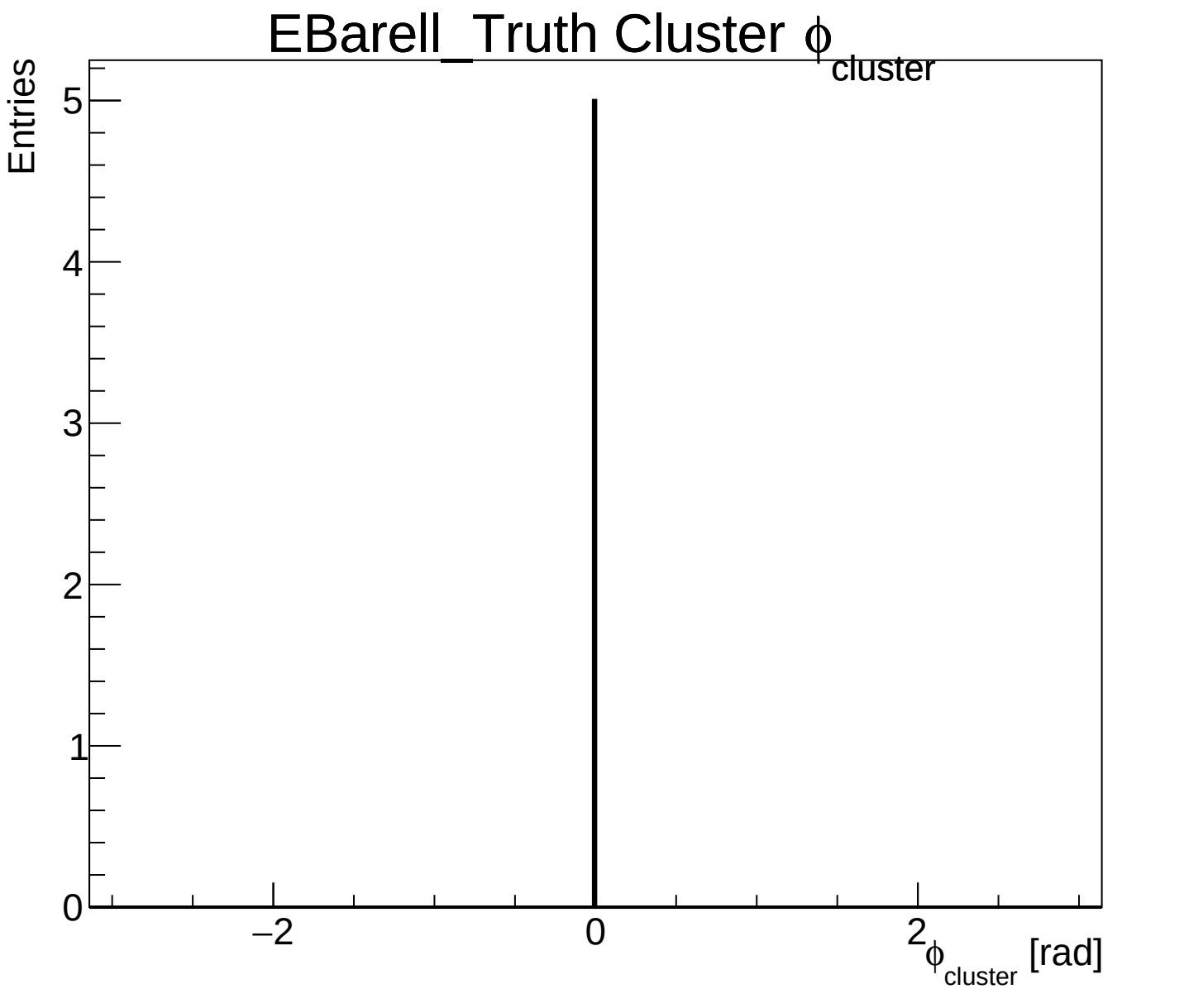

HCal_Truth Cluster position x,y
y [mm]
3000
2000
1000
0
−1000
−2000
−3000
−2000
0
2000
x [mm]
300
250
200
150
100
50
0

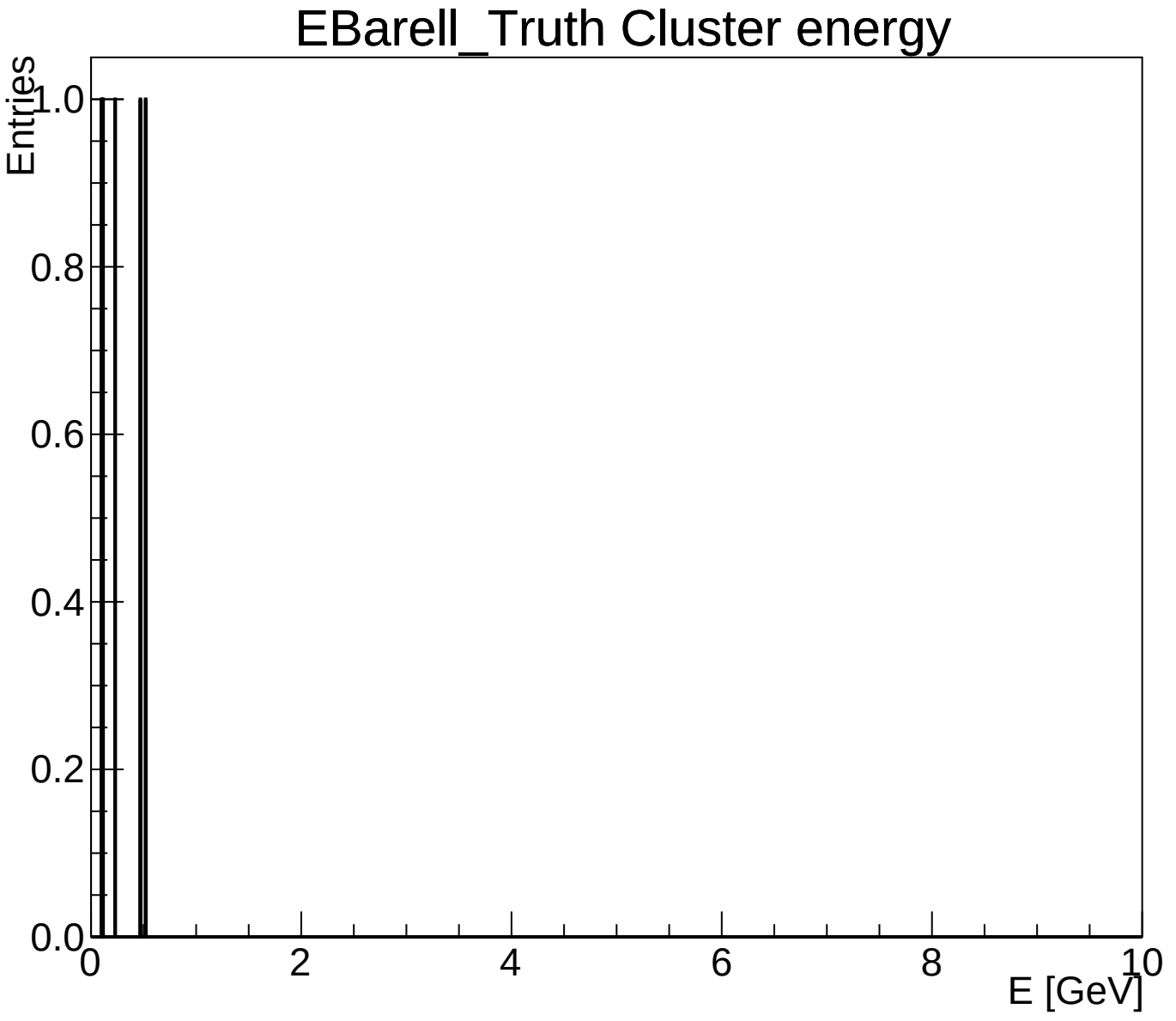

HCal_Truth Cluster θ Resolution
χ² / ndf 476.5 / 29
Constant 6320 ± 74.6
Mean –0.001271 ± 0.000092
Sigma 0.01059 ± 0.00009
θ HCal_Truth
Mean ~ -0.00
Sigma ~ 0.01
StdDev ~ 0.02
Entries
6000
5000
4000
3000
2000
1000
0
–1.0
–0.5
0.0
0.5
1.0
Δθ

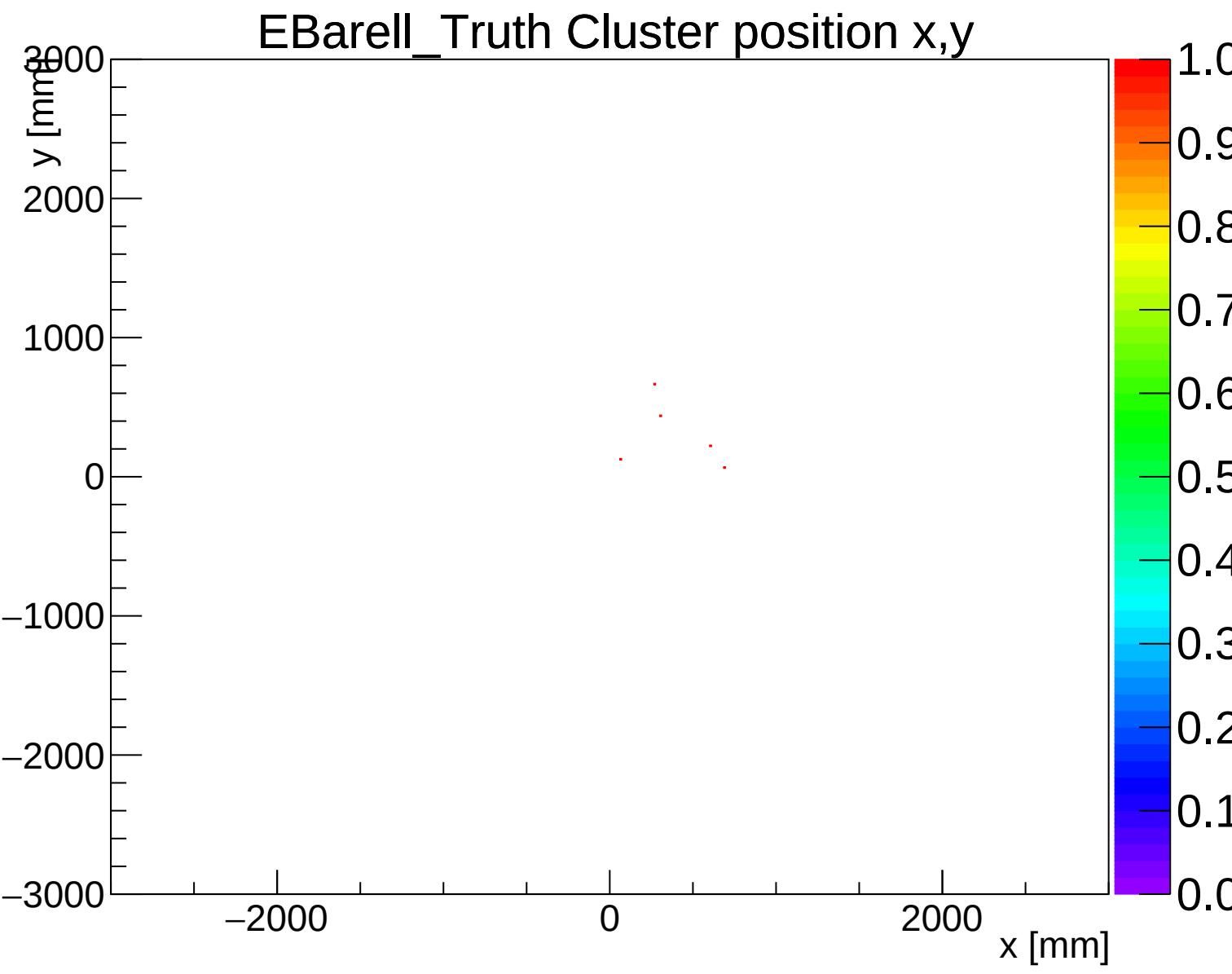

HCal_Truth Cluster ϕ Resolution
Entries
1400
1200
1000
800
600
400
200
0
–1.0
–0.5
0.0
0.5
1.0
Δϕ
χ² / ndf 688.4 / 93
Constant 1166 ± 14.5
Mean –0.0008235 ± 0.0004925
Sigma 0.05639 ± 0.00050
ϕ HCal_Truth
Mean ~ -0.00
Sigma ~ 0.06
StdDev ~ 0.08

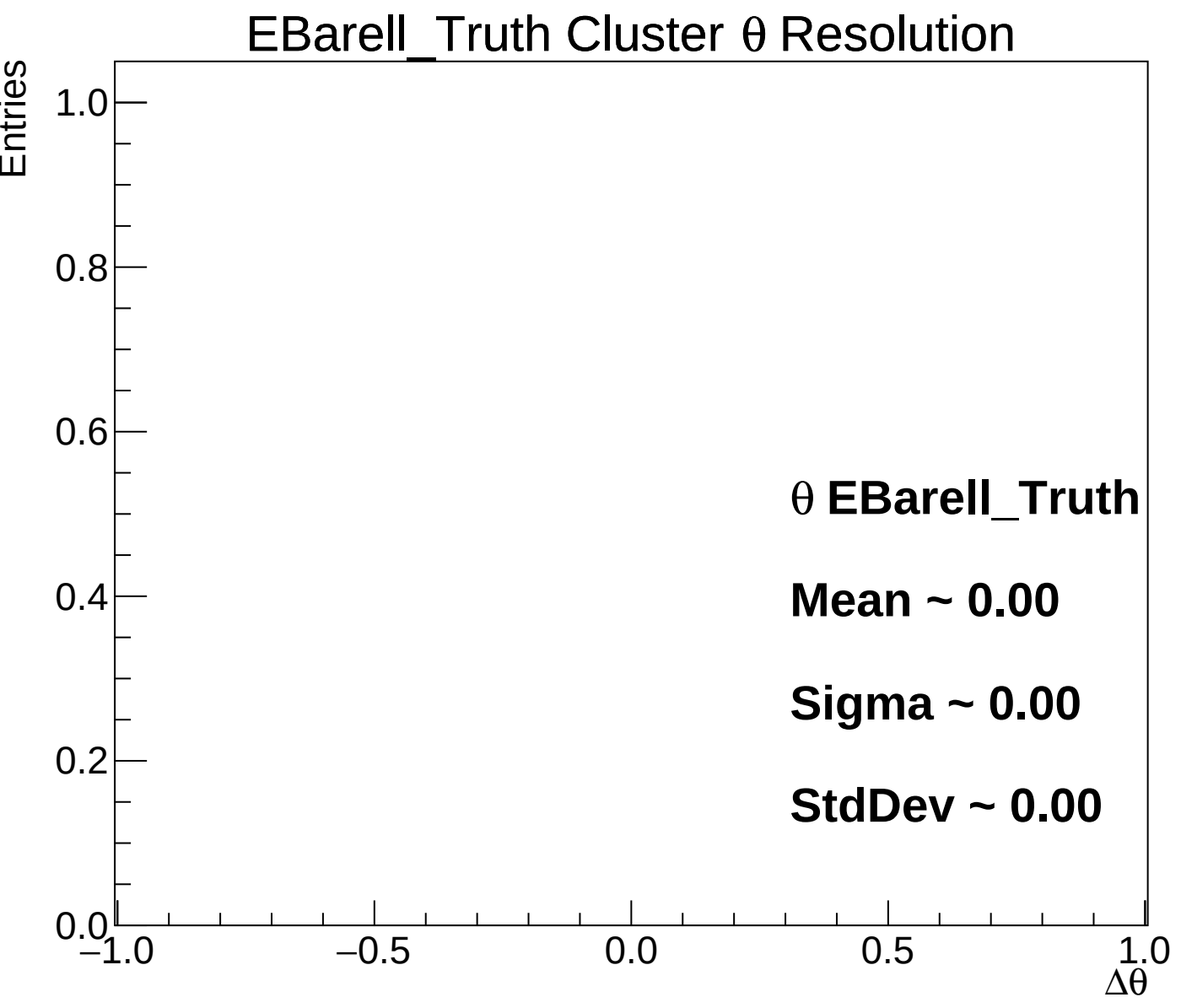

HCal_Truth Cluster R_XY Resolution
Entries
χ² / ndf 1056 / 209
Constant 2624 ± 33.5
MPV 2.863 ± 0.024
Sigma 0.9803 ± 0.0097
#Rxy HCal_Truth
Mean ~ 5.86
Sigma ~ 0.98
StdDev ~ 6.66
ΔR_XY[cm]

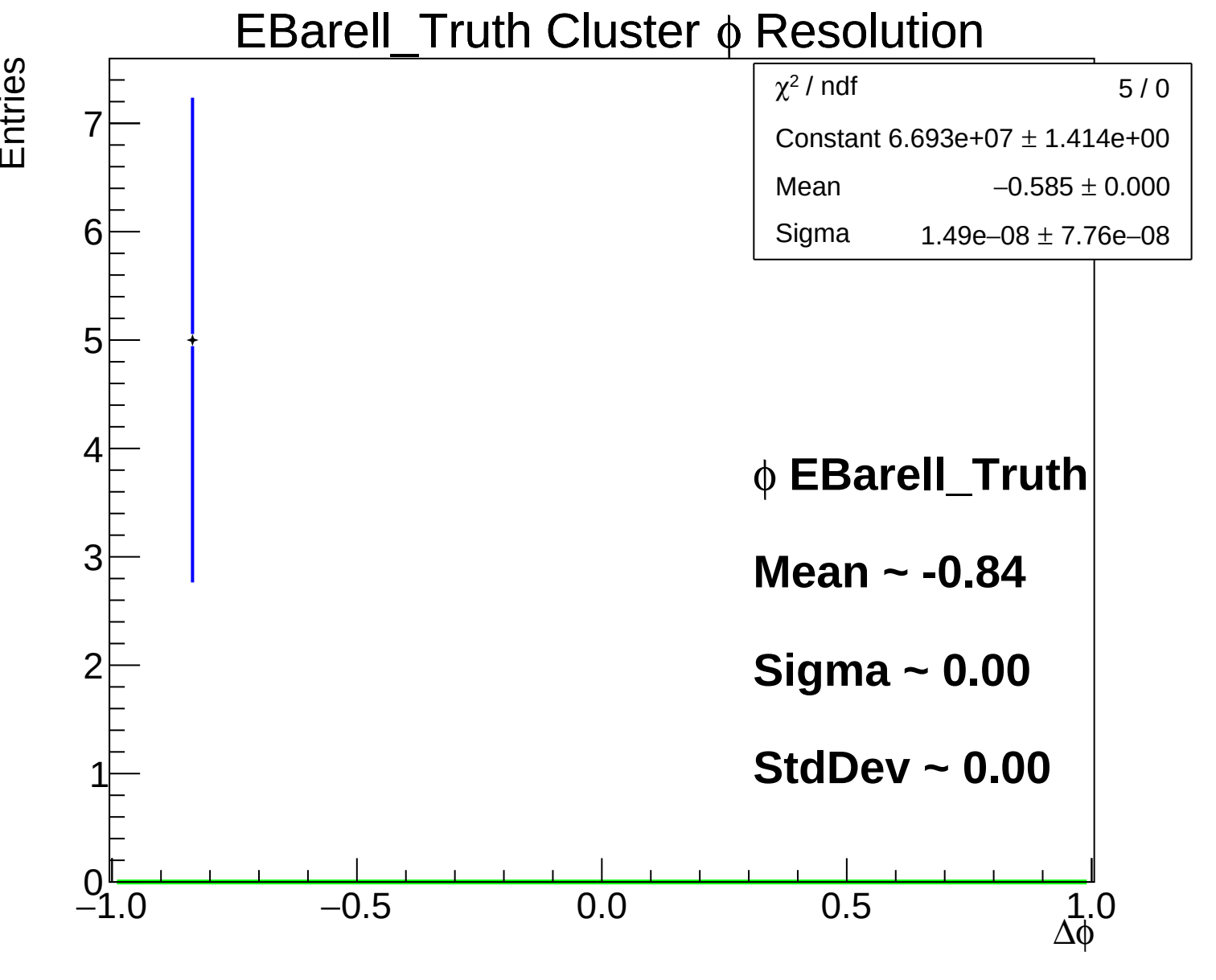

EBarell_Truth Cluster θcluster
Entries
0
1
2
3
4
5
0
1
2
3
4
5
θcluster [rad]

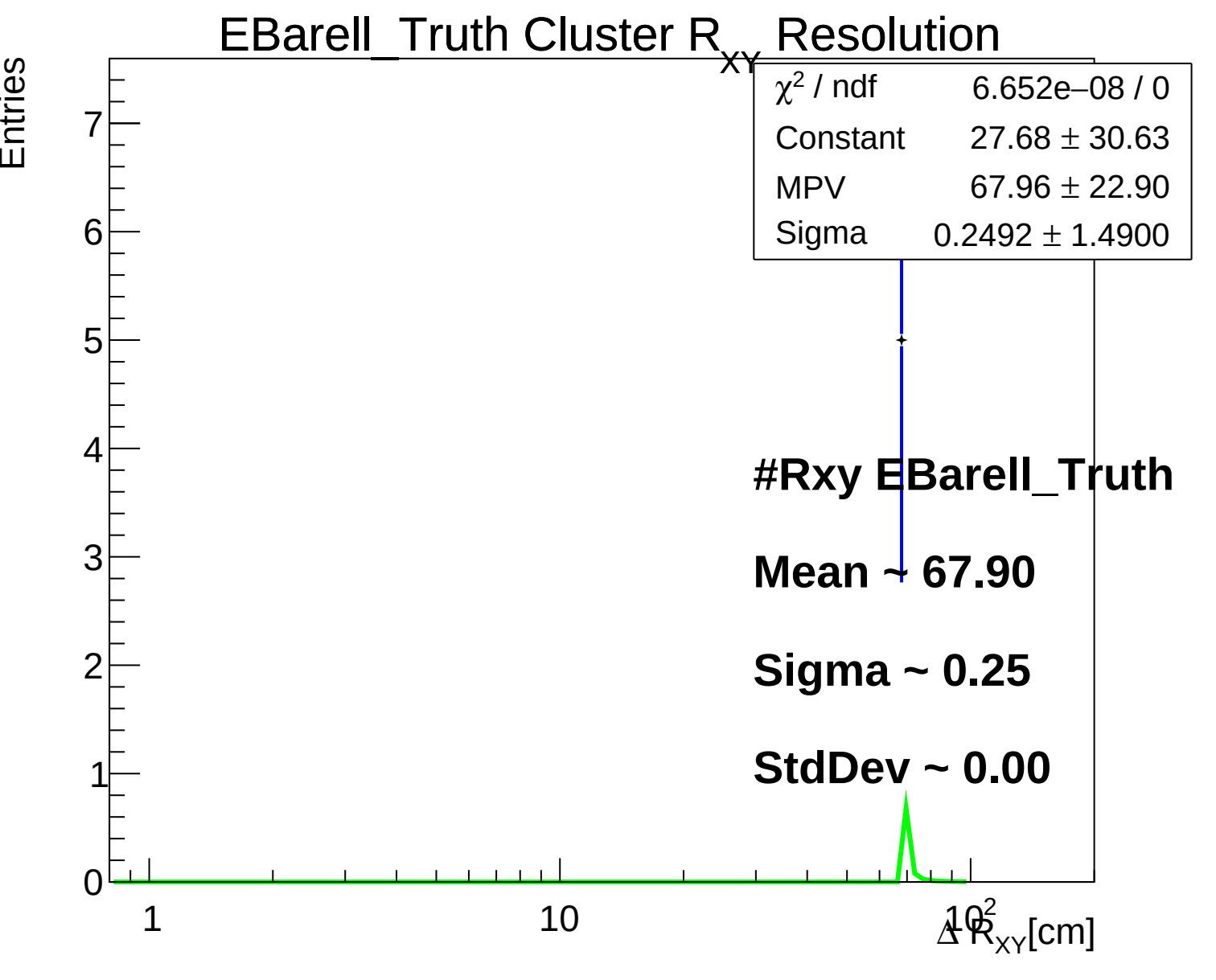

EBarell_Truth Cluster ϕcluster
Entries
5
4
3
2
1
0
−2
0
2
ϕcluster [rad]

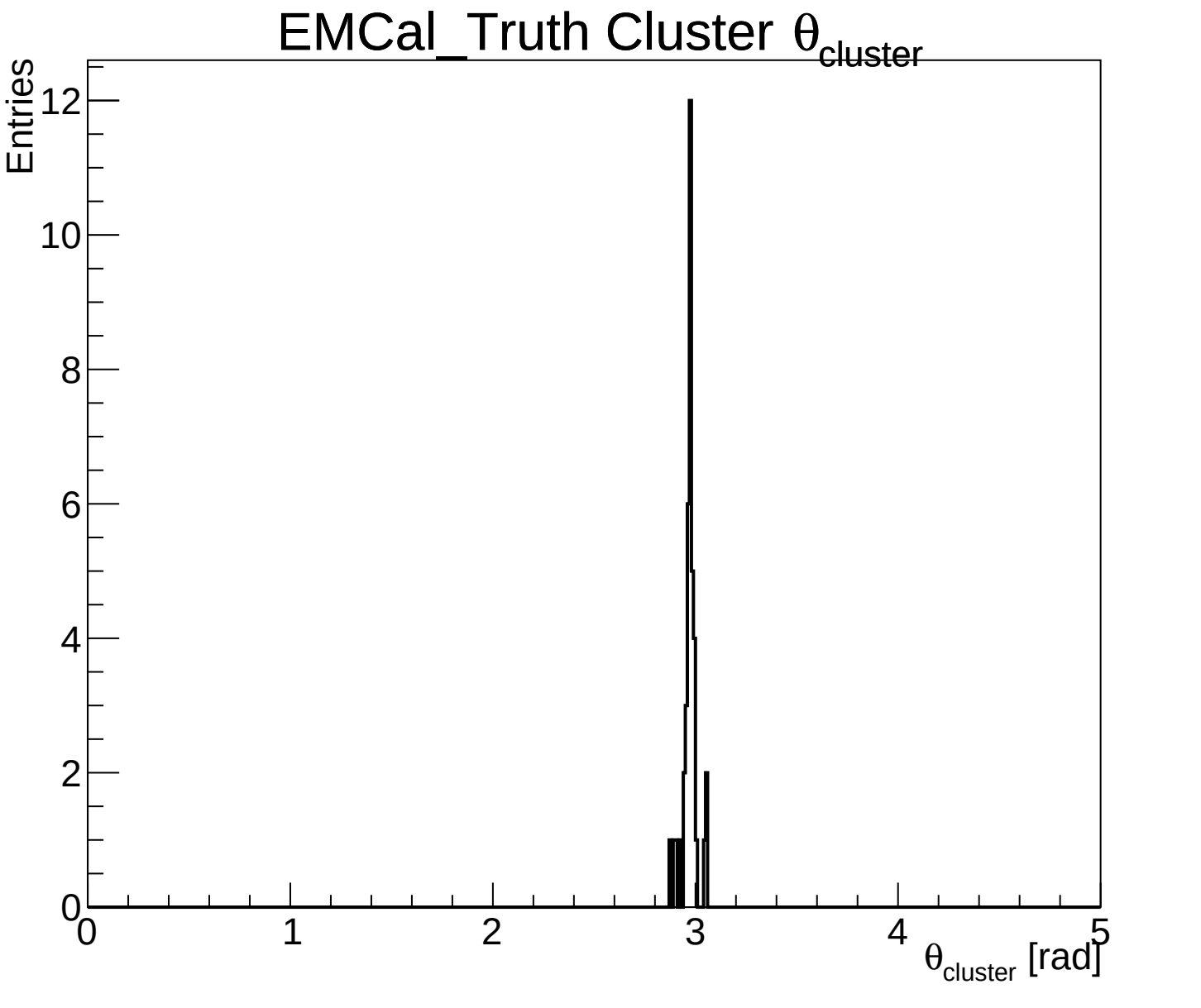

EBarell_Truth Cluster energy
Entries
1.0
0.8
0.6
0.4
0.2
0.0
0
2
4
6
8
10
E [GeV]

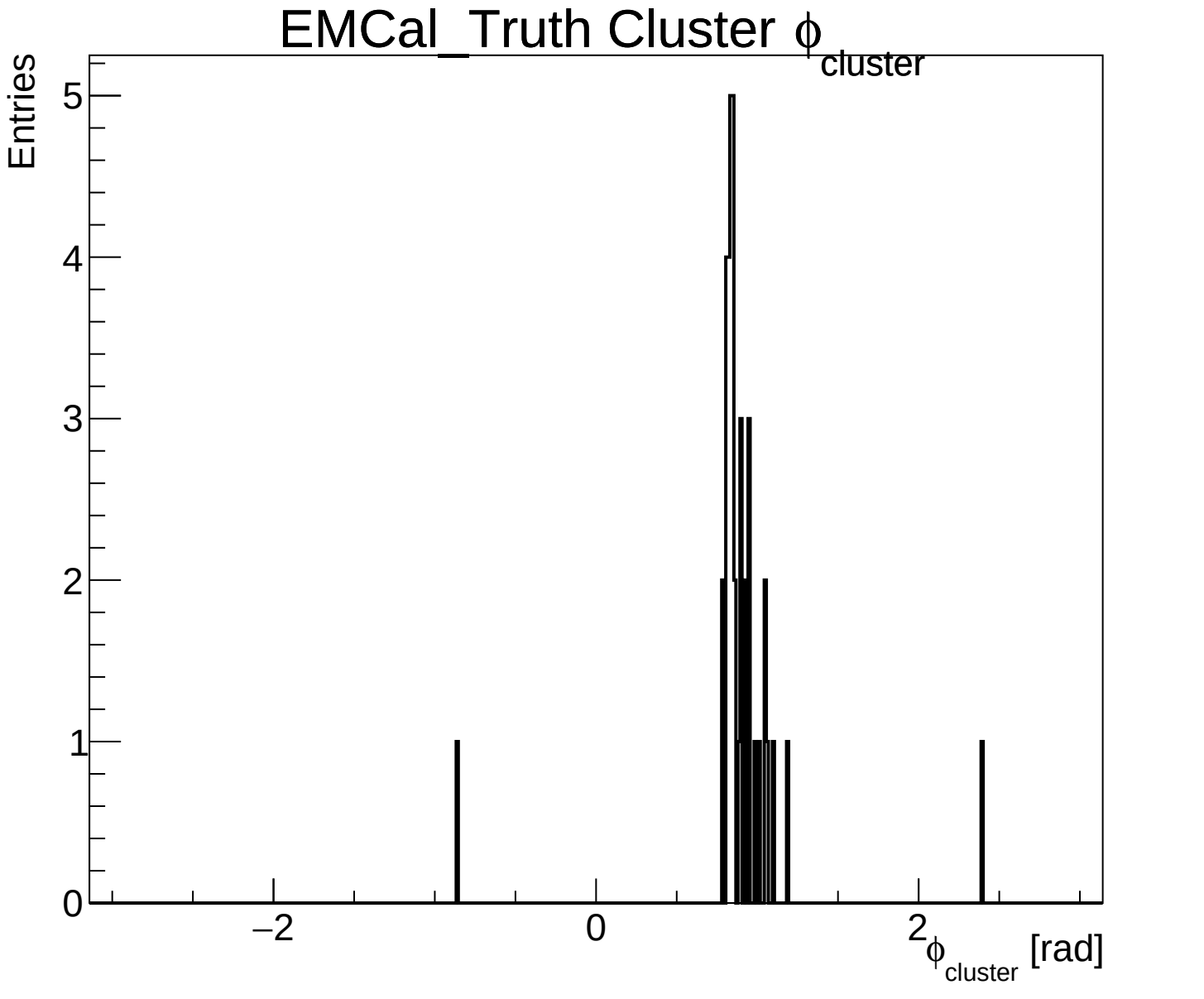

EBarell_Truth Cluster position x,y
y [mm]
3000
2000
1000
0
−1000
−2000
−3000
−2000
0
2000
x [mm]
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0

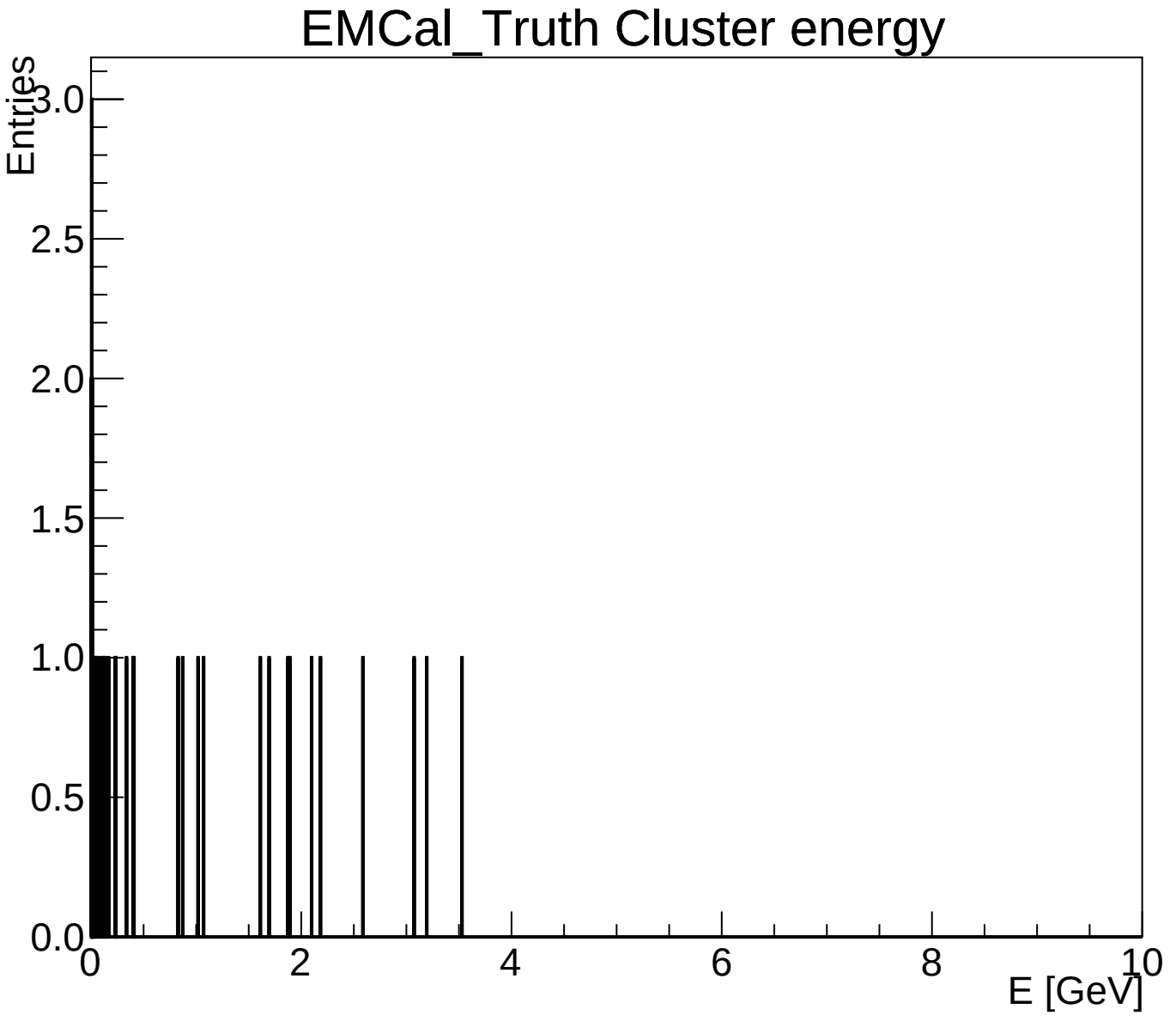

EBarell_Truth Cluster θ Resolution
Entries
1.0
0.8
0.6
0.4
0.2
0.0
–1.0
–0.5
0.0
0.5
1.0
Δθ
θ EBarell_Truth
Mean ~ 0.00
Sigma ~ 0.00
StdDev ~ 0.00

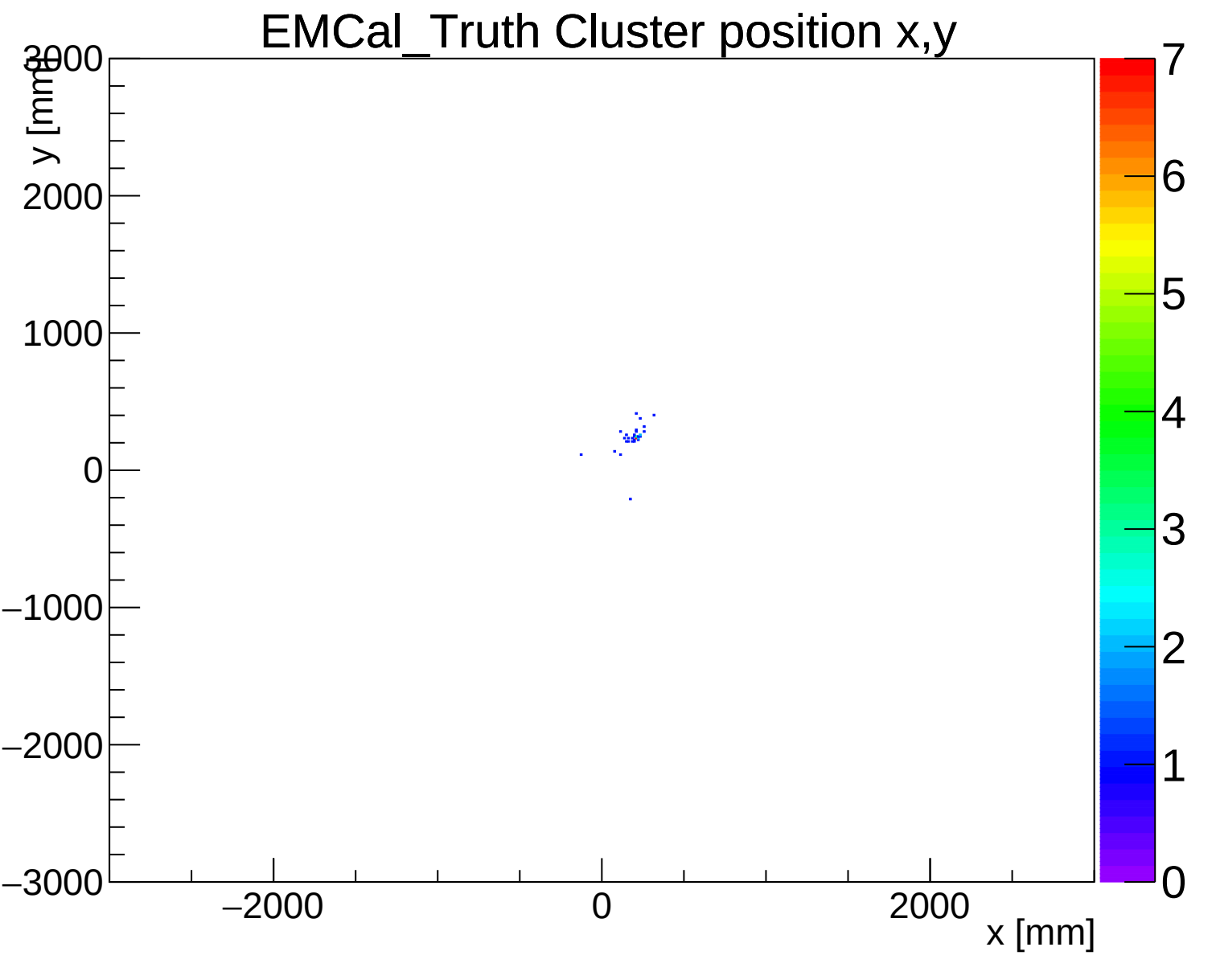

EBarell_Truth Cluster ϕ Resolution
Entries
χ² / ndf 5 / 0
Constant 6.693e+07 ± 1.414e+00
Mean –0.585 ± 0.000
Sigma 1.49e–08 ± 7.76e–08
ϕ EBarell_Truth
Mean ~ -0.84
Sigma ~ 0.00
StdDev ~ 0.00
0
1
2
3
4
5
6
7
–1.0
–0.5
0.0
0.5
1.0
Δϕ

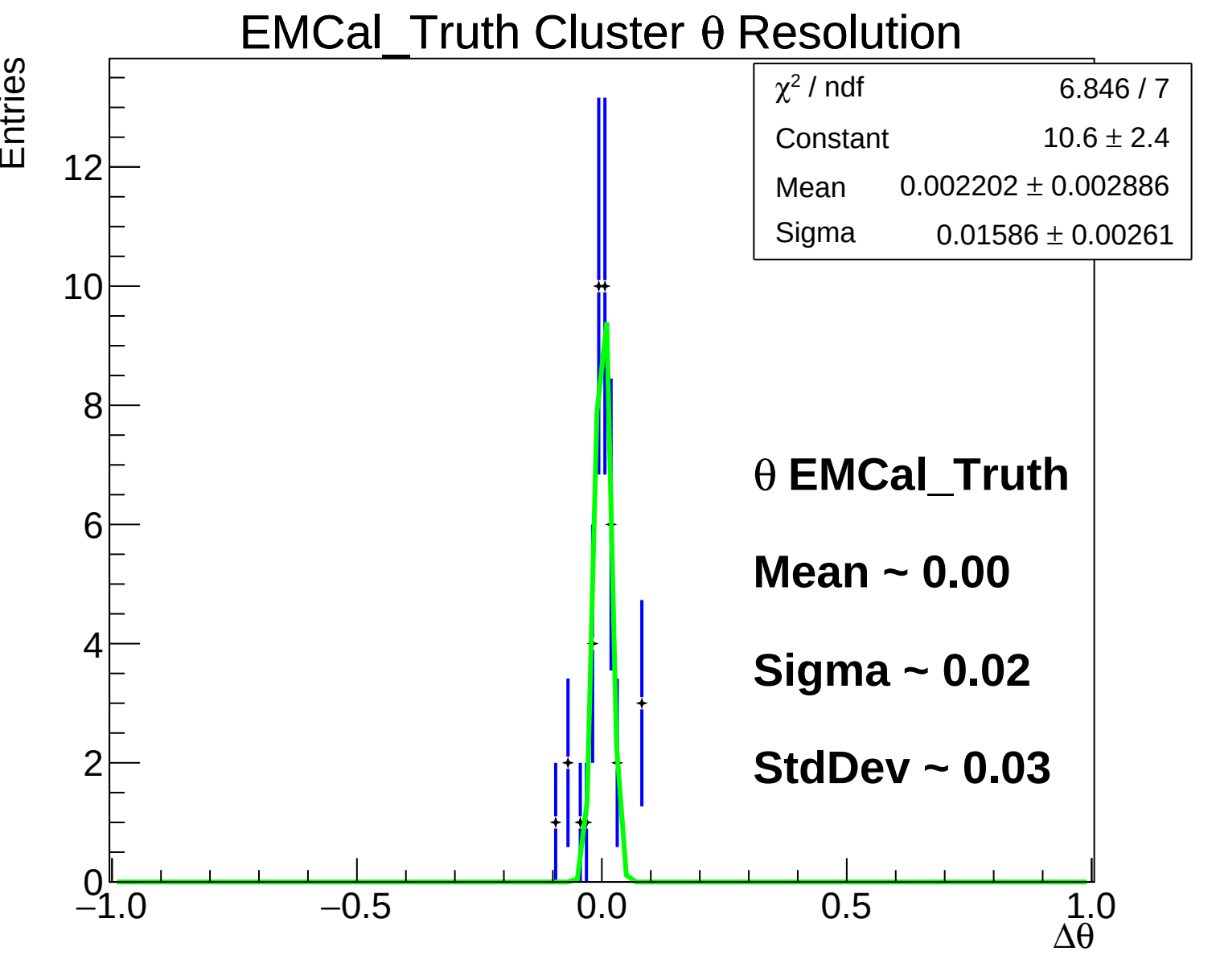

EBarell_Truth Cluster R_XY Resolution
Entries
χ² / ndf 6.652e–08 / 0
Constant 27.68 ± 30.63
MPV 67.96 ± 22.90
Sigma 0.2492 ± 1.4900
#Rxy EBarell_Truth
Mean ~ 67.90
Sigma ~ 0.25
StdDev ~ 0.00
0
1
2
3
4
5
6
7
1
10
10²
ΔR_XY[cm]

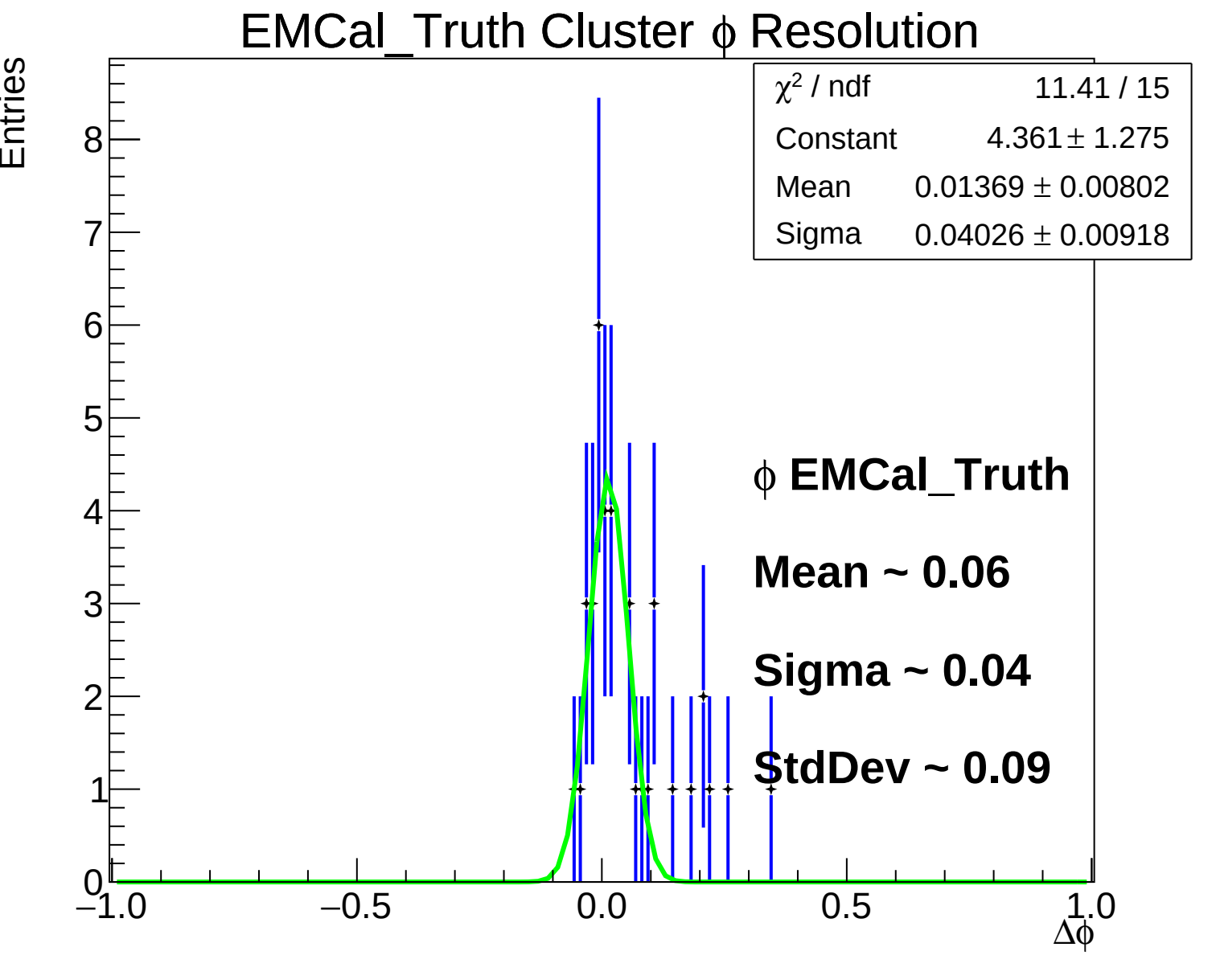

EMCal_Truth Cluster θcluster
Entries
0
2
4
6
8
10
12
0
1
2
3
4
5
θcluster [rad]

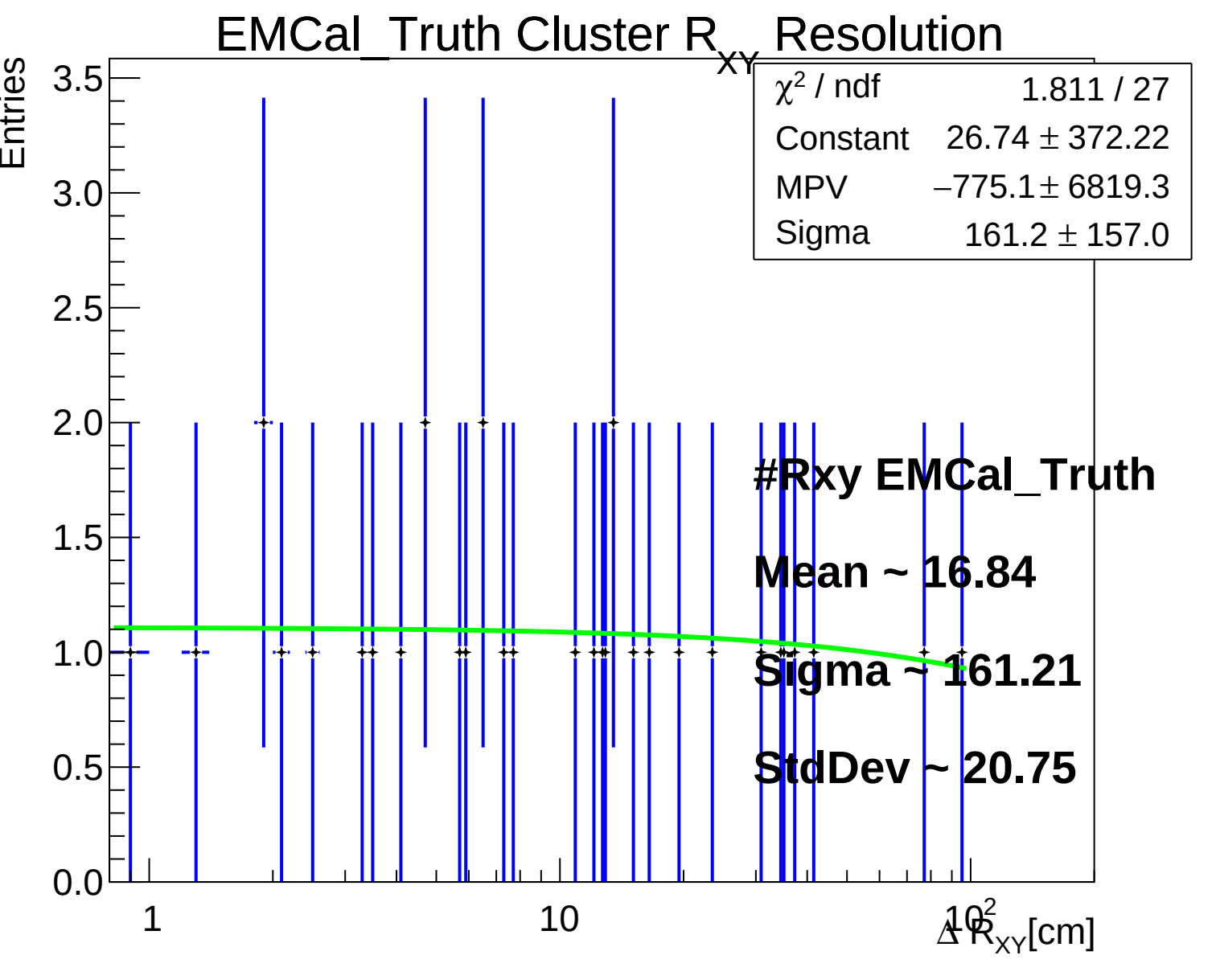

EMCal_Truth Cluster $\phi_{cluster}$
Entries
0
1
2
3
4
5
−2
0
2
$\phi_{cluster}$ [rad]

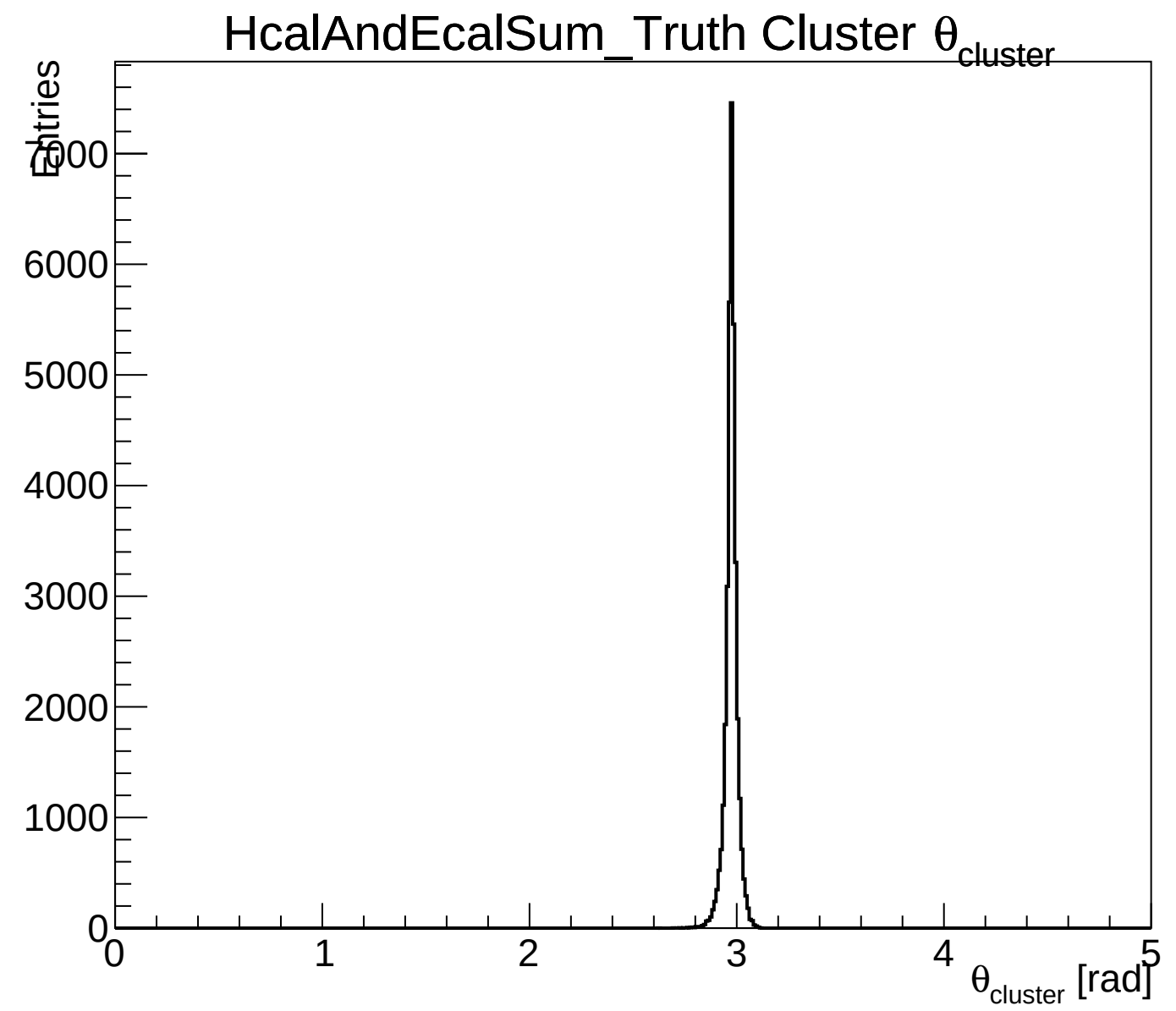

EMCal_Truth Cluster energy
Entries
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
2
4
6
8
10
E [GeV]

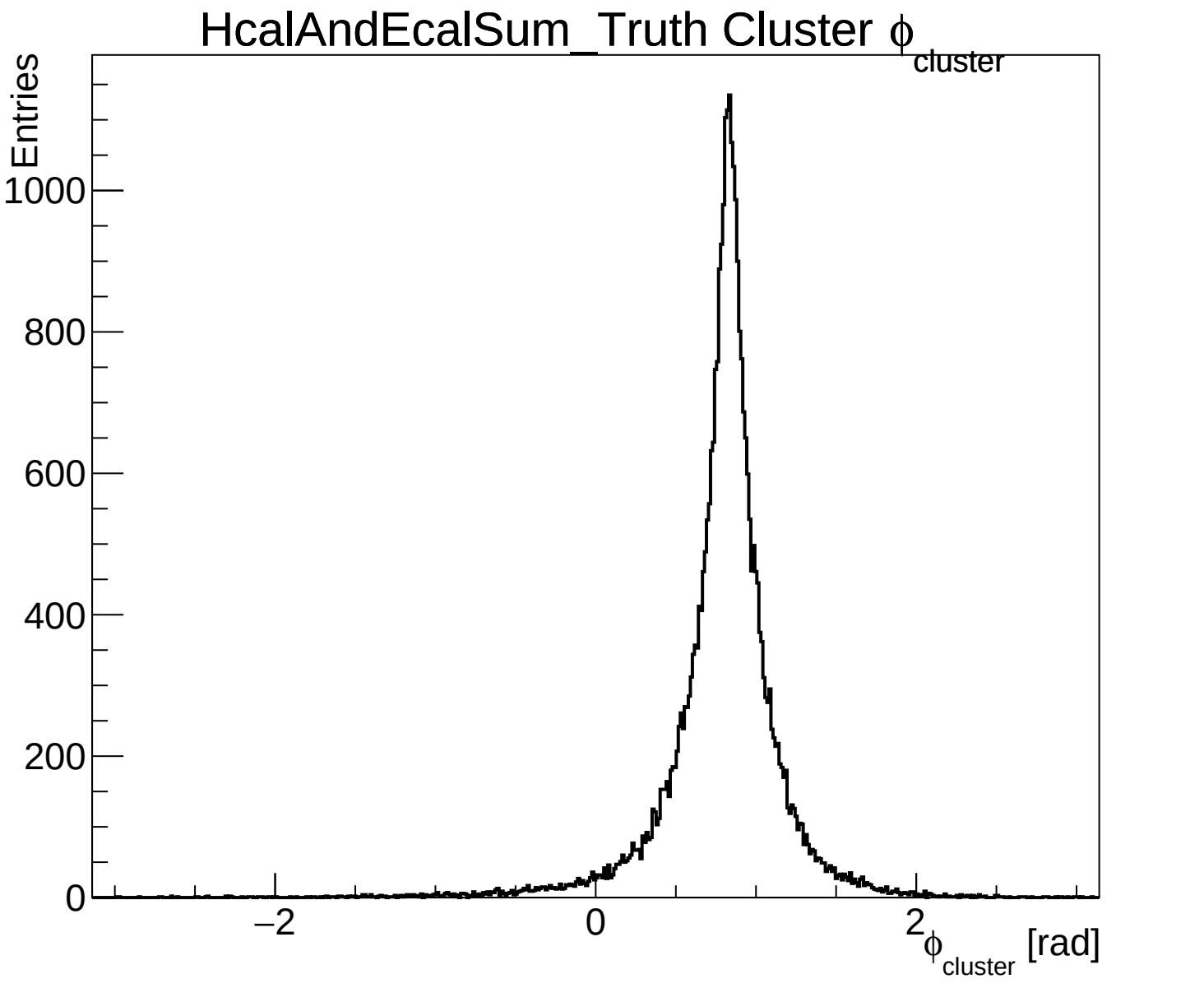

EMCal_Truth Cluster position x,y
y [mm]
3000
2000
1000
0
−1000
−2000
−3000
−2000
0
2000
x [mm]
7
6
5
4
3
2
1
0

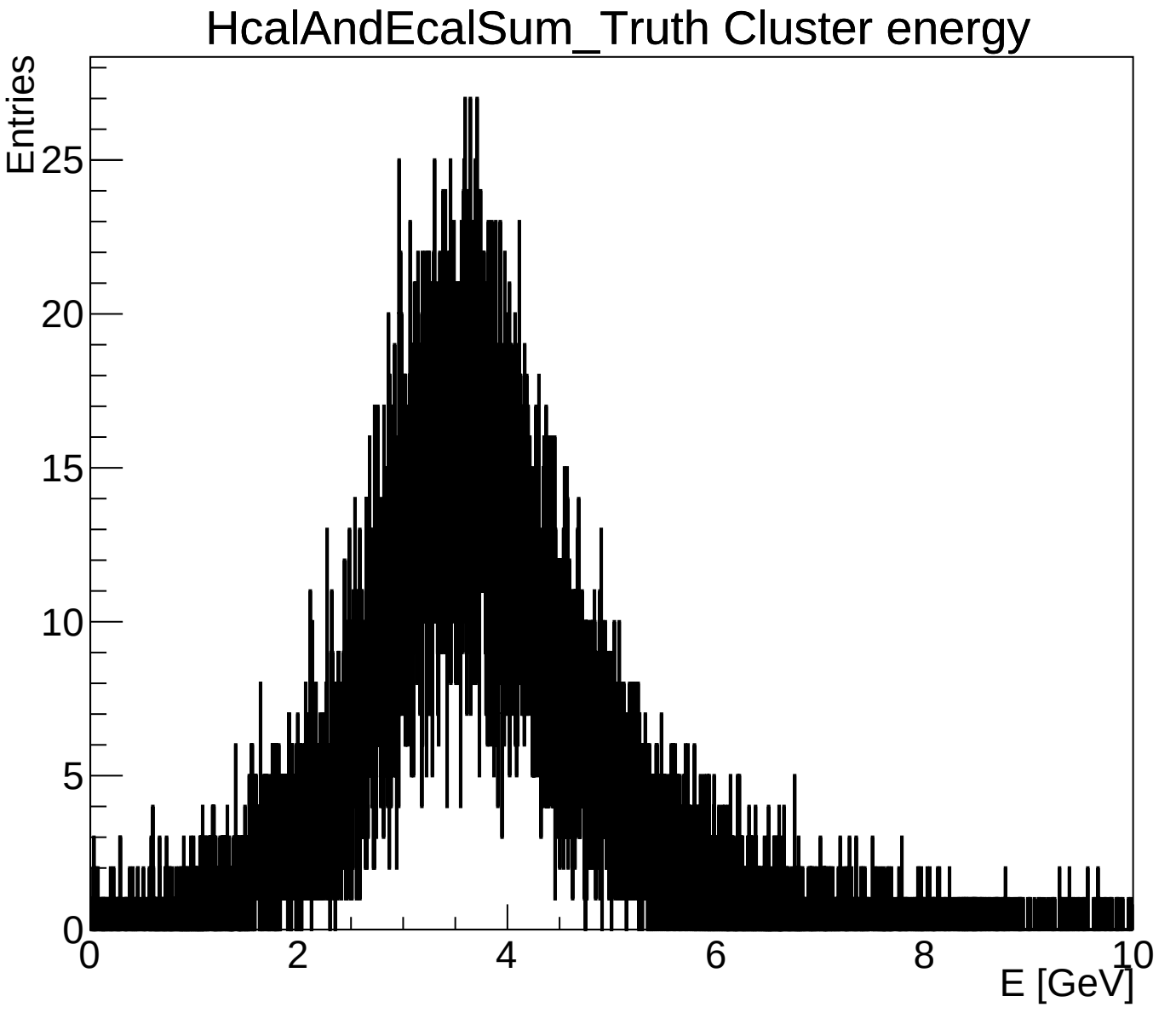

EMCal_Truth Cluster θ Resolution
Entries
χ² / ndf 6.846 / 7
Constant 10.6 ± 2.4
Mean 0.002202 ± 0.002886
Sigma 0.01586 ± 0.00261
θ EMCal_Truth
Mean ~ 0.00
Sigma ~ 0.02
StdDev ~ 0.03
0
2
4
6
8
10
12
–1.0
–0.5
0.0
0.5
1.0
Δθ

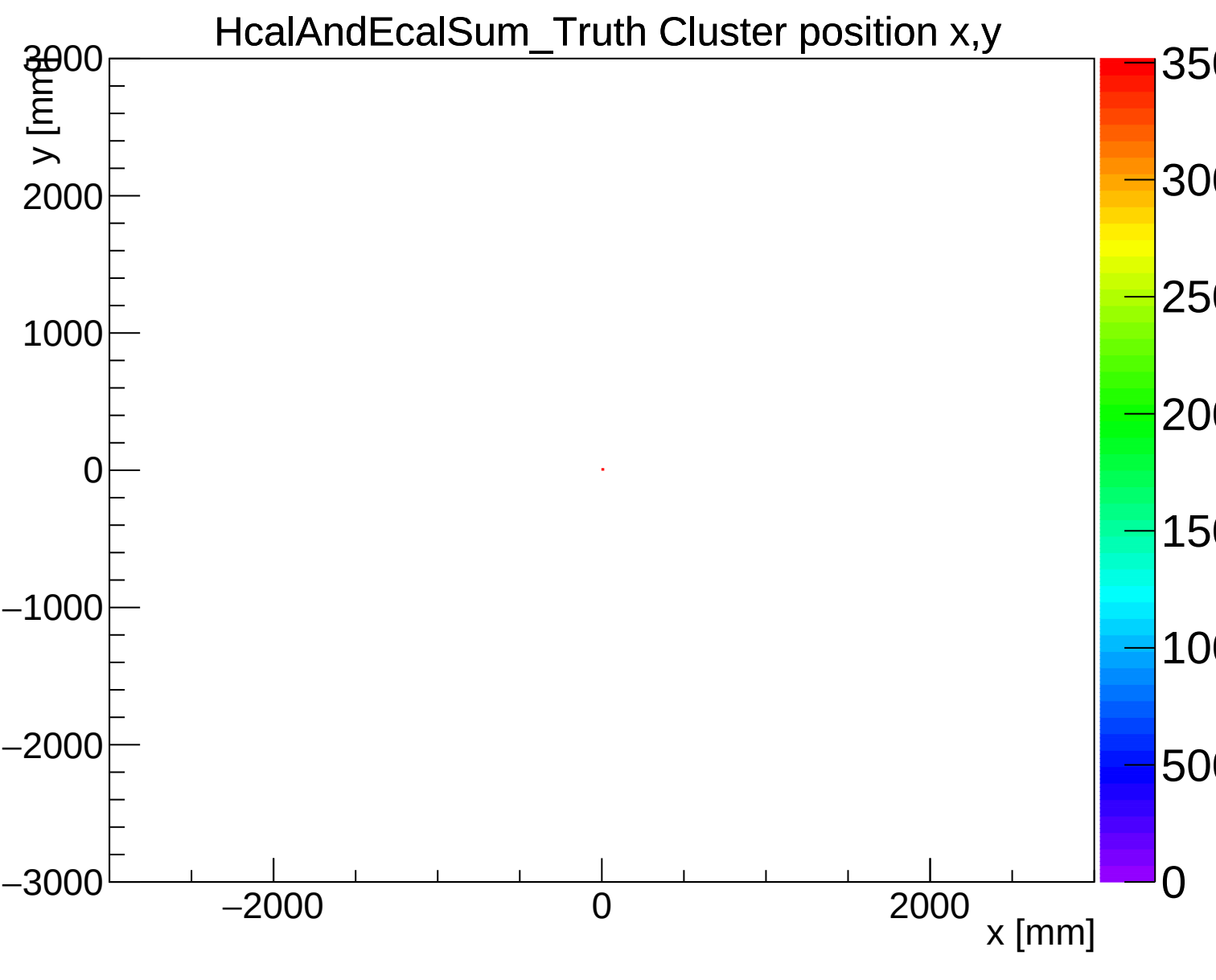

EMCal_Truth Cluster ϕ Resolution
Entries
χ² / ndf 11.41 / 15
Constant 4.361 ± 1.275
Mean 0.01369 ± 0.00802
Sigma 0.04026 ± 0.00918
ϕ EMCal_Truth
Mean ~ 0.06
Sigma ~ 0.04
StdDev ~ 0.09
0
1
2
3
4
5
6
7
8
–1.0
–0.5
0.0
0.5
1.0
Δϕ

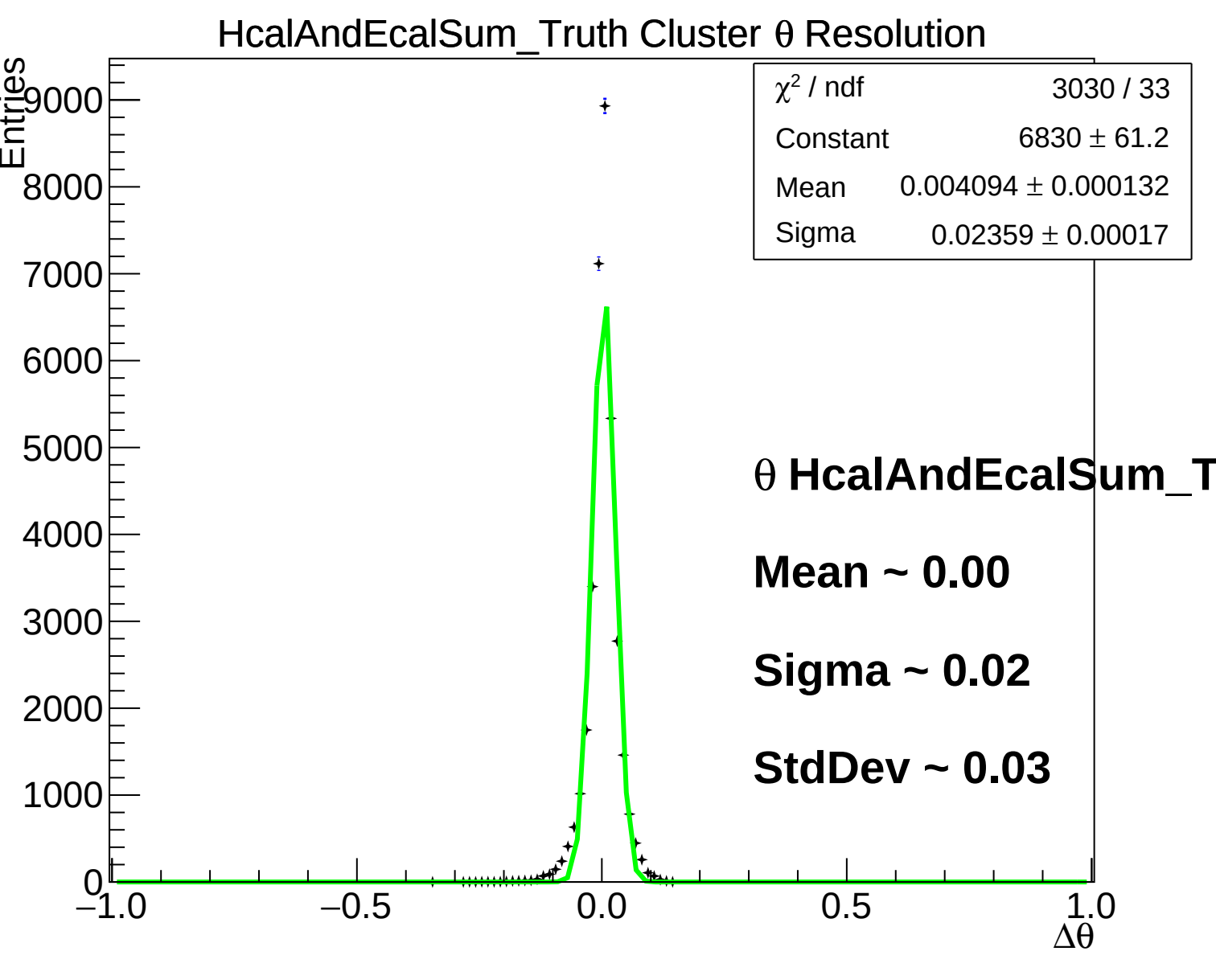

EMCal_Truth Cluster R_XY Resolution
χ² / ndf 1.811 / 27
Constant 26.74 ± 372.22
MPV −775.1 ± 6819.3
Sigma 161.2 ± 157.0
#Rxy EMCal_Truth
Mean ~ 16.84
Sigma ~ 161.21
StdDev ~ 20.75
Entries
ΔR_XY[cm]
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1
10
10²

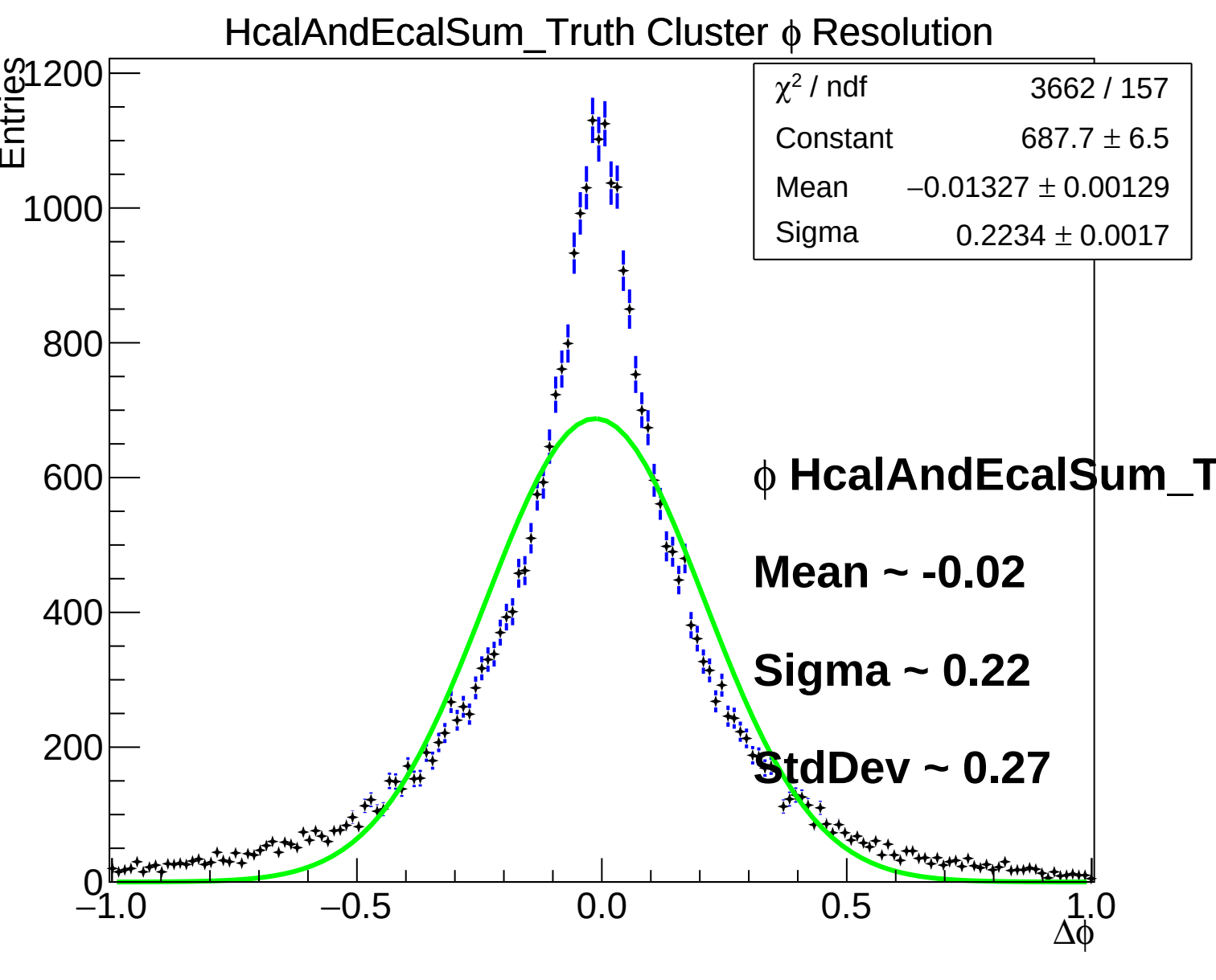

HcalAndEcalSum_Truth Cluster θcluster
Entries
7000
6000
5000
4000
3000
2000
1000
0
0
1
2
3
4
5
θcluster [rad]

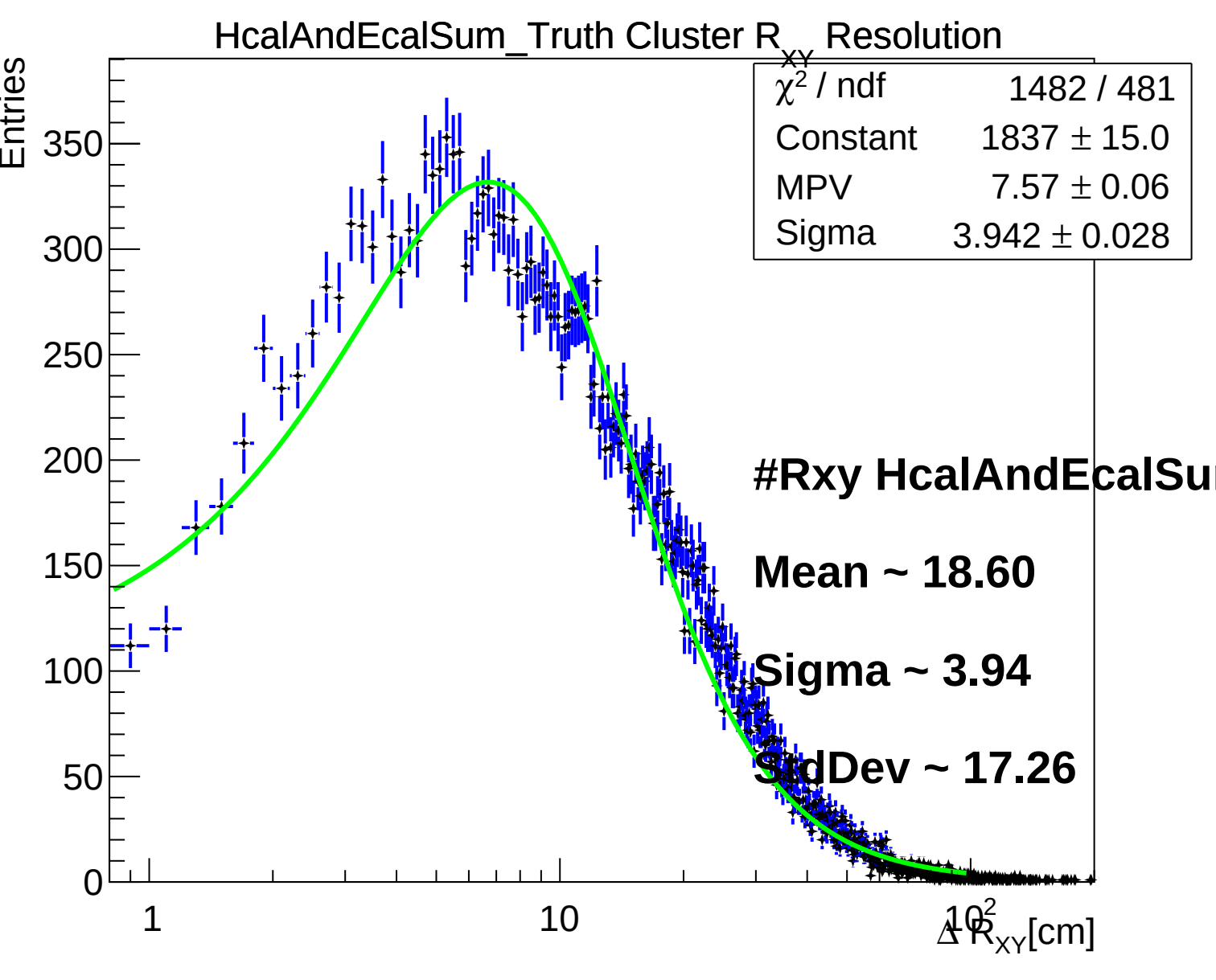

HcalAndEcalSum_Truth Cluster ϕcluster
Entries
1000
800
600
400
200
0
−2
0
2
ϕcluster [rad]

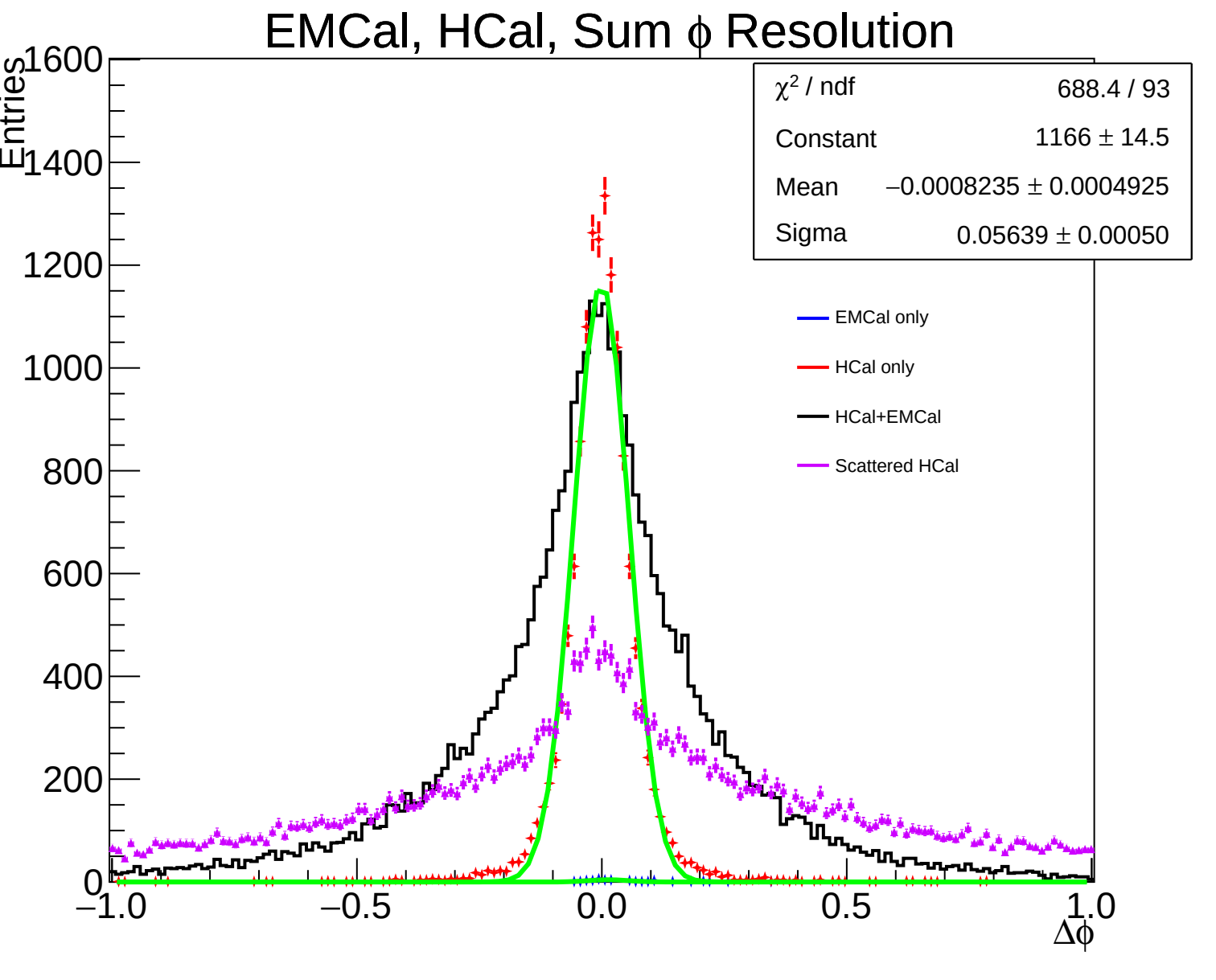

HcalAndEcalSum_Truth Cluster energy
Entries
0
5
10
15
20
25
0
2
4
6
8
10
E [GeV]

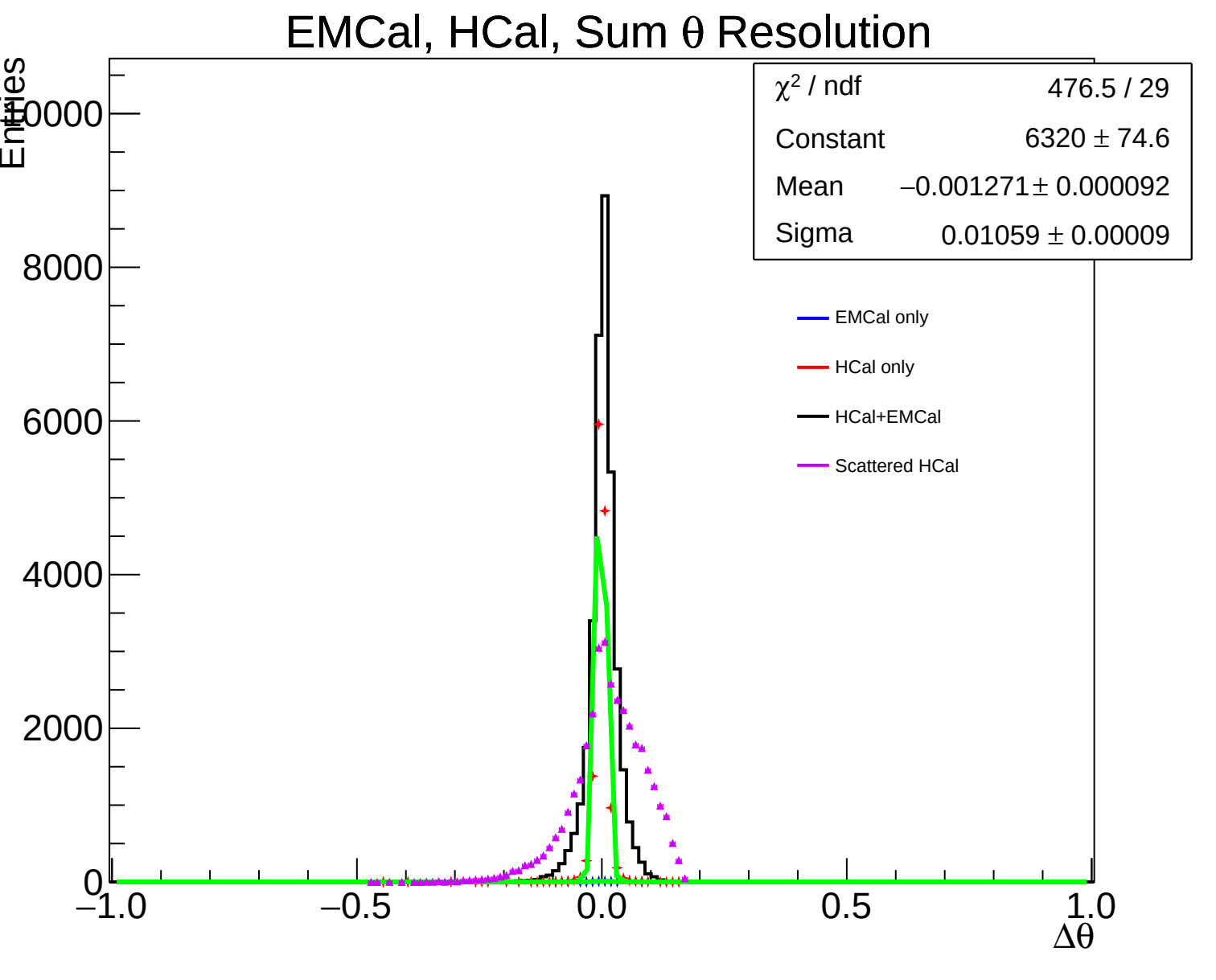

HcalAndEcalSum_Truth Cluster position x,y
y [mm]
3000
2000
1000
0
−1000
−2000
−3000
−2000
0
2000
x [mm]
350
300
250
200
150
100
50
0

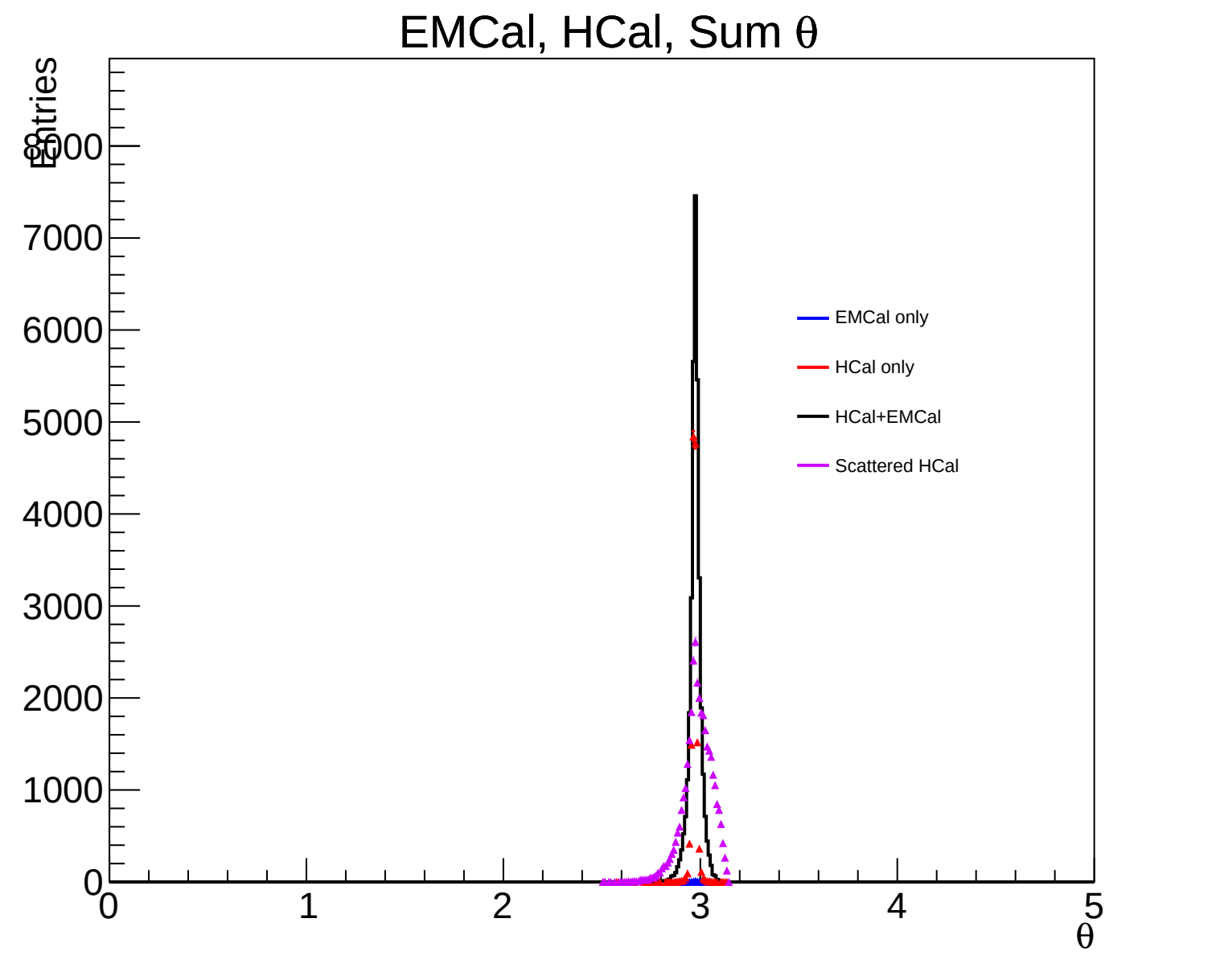

HcalAndEcalSum_Truth Cluster θ Resolution
Entries
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
–1.0
–0.5
0.0
0.5
1.0
Δθ
χ² / ndf 3030 / 33
Constant 6830 ± 61.2
Mean 0.004094 ± 0.000132
Sigma 0.02359 ± 0.00017
θ HcalAndEcalSum_T
Mean ~ 0.00
Sigma ~ 0.02
StdDev ~ 0.03

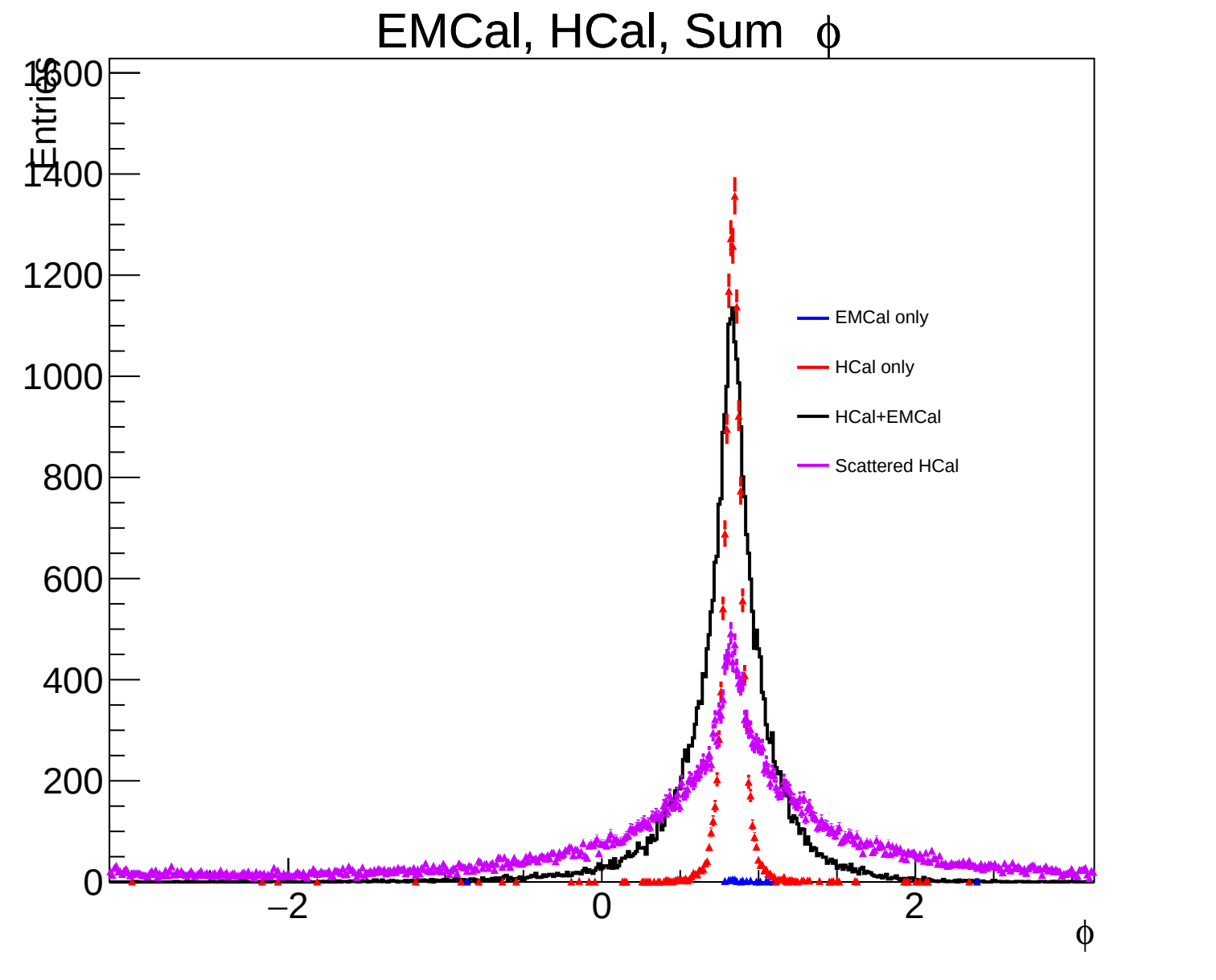

HcalAndEcalSum_Truth Cluster ϕ Resolution
Entries
1200
1000
800
600
400
200
0
–1.0
–0.5
0.0
0.5
1.0
Δϕ
χ² / ndf 3662 / 157
Constant 687.7 ± 6.5
Mean –0.01327 ± 0.00129
Sigma 0.2234 ± 0.0017
ϕ HcalAndEcalSum_T
Mean ~ -0.02
Sigma ~ 0.22
StdDev ~ 0.27

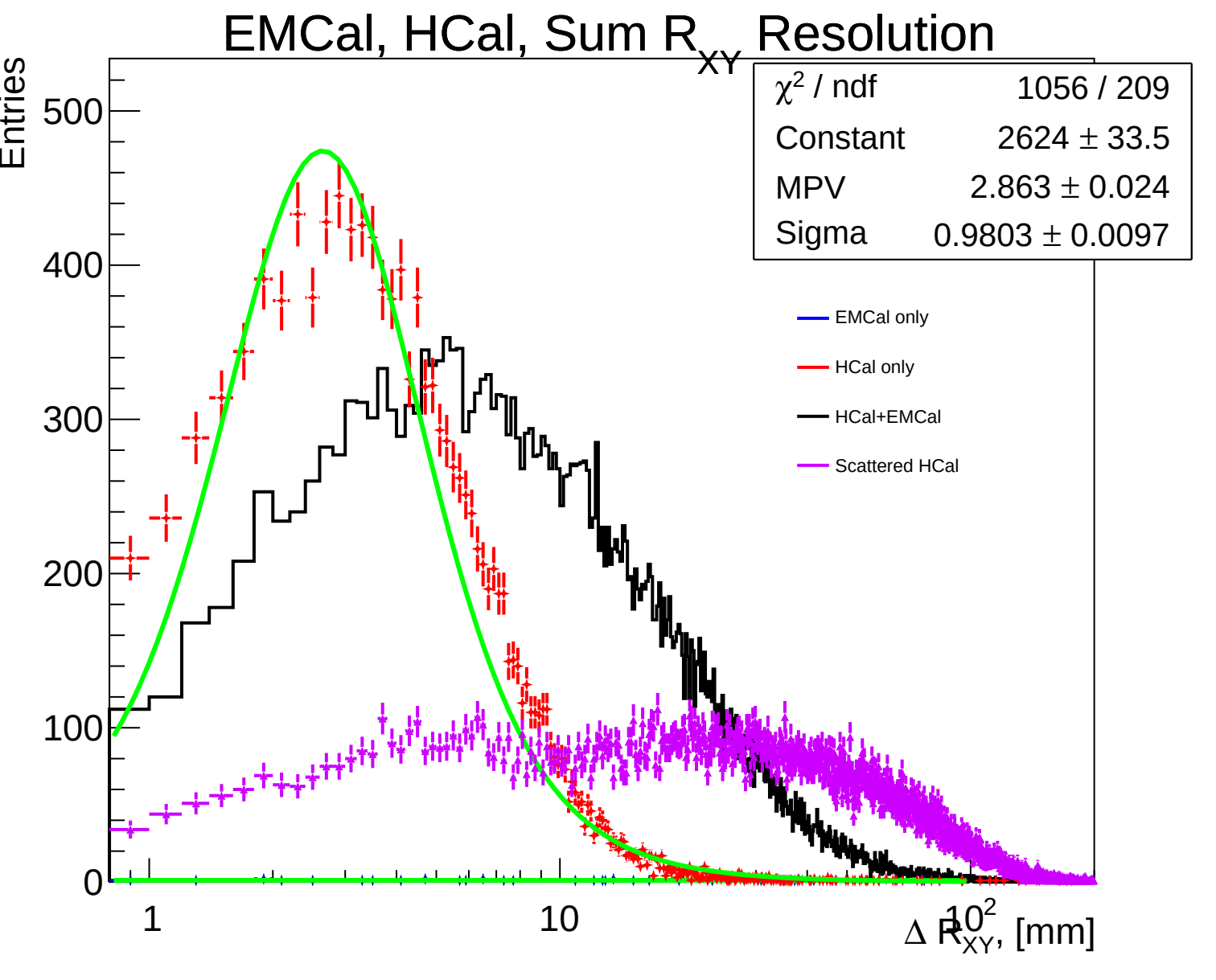

HcalAndEcalSum_Truth Cluster R_{XY} Resolution
Entries
χ^2 / ndf 1482 / 481
Constant 1837 ± 15.0
MPV 7.57 ± 0.06
Sigma 3.942 ± 0.028
#Rxy HcalAndEcalSu
Mean ~ 18.60
Sigma ~ 3.94
StdDev ~ 17.26
0
50
100
150
200
250
300
350
1
10
10^2
ΔR_{XY}[cm]

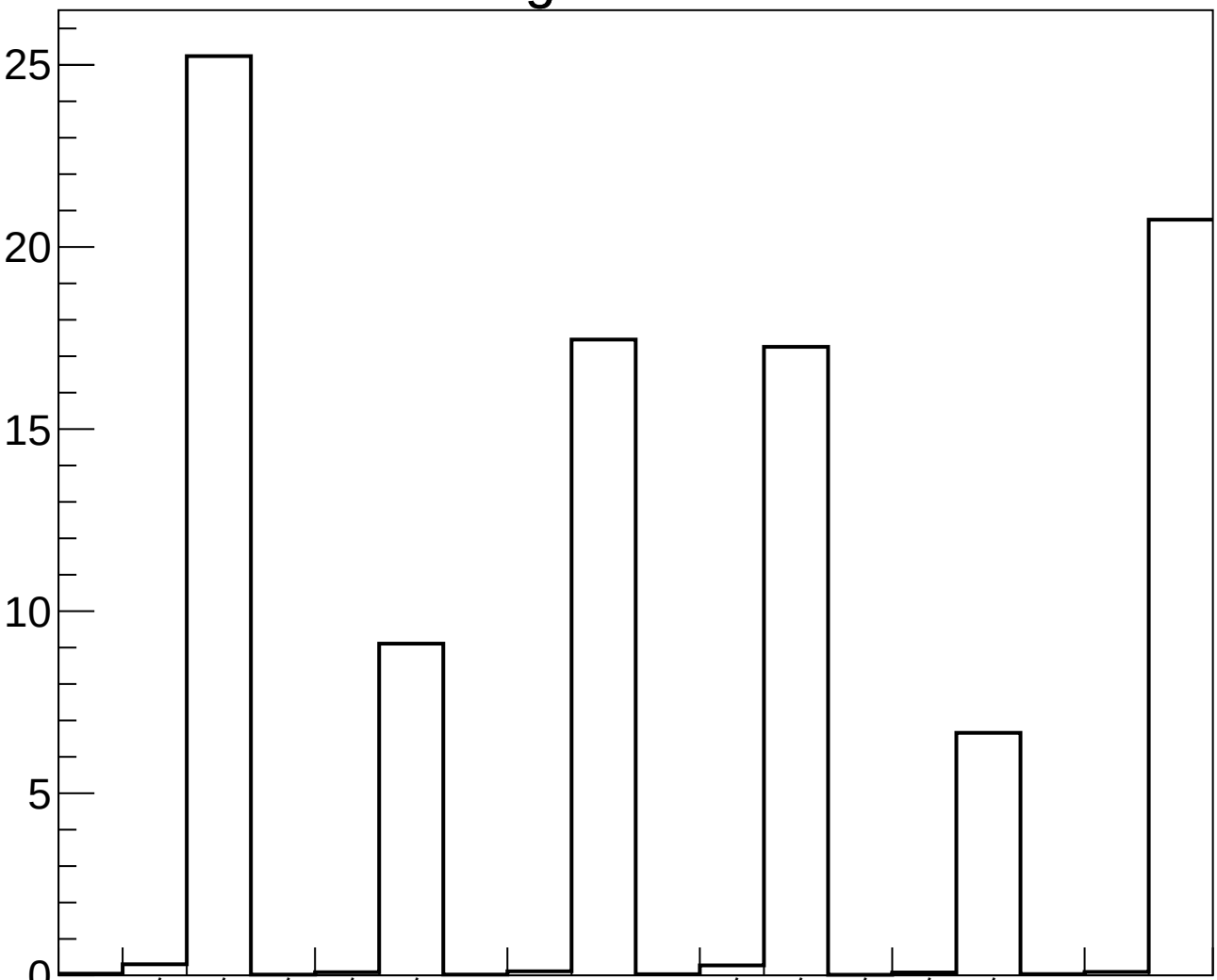

EMCal, HCal, Sum ϕ Resolution
Entries
1600
1400
1200
1000
800
600
400
200
0
−1.0
−0.5
0.0
0.5
1.0
Δϕ
χ² / ndf 688.4 / 93
Constant 1166 ± 14.5
Mean −0.0008235 ± 0.0004925
Sigma 0.05639 ± 0.00050
EMCal only
HCal only
HCal+EMCal
Scattered HCal


EMCal, HCal, Sum θ Resolution
Entries
10000
8000
6000
4000
2000
0
−1.0
−0.5
0.0
0.5
1.0
Δθ
χ² / ndf 476.5 / 29
Constant 6320 ± 74.6
Mean −0.001271 ± 0.000092
Sigma 0.01059 ± 0.00009
EMCal only
HCal only
HCal+EMCal
Scattered HCal


EMCal, HCal, Sum θ
Entries
8000
7000
6000
5000
4000
3000
2000
1000
0
0
1
2
3
4
5
θ
EMCal only
HCal only
HCal+EMCal
Scattered HCal


EMCal, HCal, Sum ϕ
Entries
1600
1400
1200
1000
800
600
400
200
0
−2
0
2
ϕ
EMCal only
HCal only
HCal+EMCal
Scattered HCal


EMCal, HCal, Sum R_{XY} Resolution
Entries
500
400
300
200
100
0
1
10
10^2
ΔR_{XY}, [mm]
χ^2 / ndf 1056 / 209
Constant 2624 ± 33.5
MPV 2.863 ± 0.024
Sigma 0.9803 ± 0.0097
EMCal only
HCal only
HCal+EMCal
Scattered HCal


Sigma values
25
20
15
10
5
0
hcal+emcal θ
hcal+emcal ϕ
hcal+emcal #Rxy
hcal only θ
hcal only ϕ
emcal only #Rxy
emcal only θ
emcal only ϕ
hcal+emcal #Rxy
hcal+emcal θ Truth
hcal+emcal ϕ Truth
hcal only #Rxy Truth
hcal only θ Truth
hcal only ϕ Truth
emcal only #Rxy Truth
emcal only θ Truth
emcal only ϕ Truth
emcal only #Rx