Comparison Data – MC

Data reconstruction

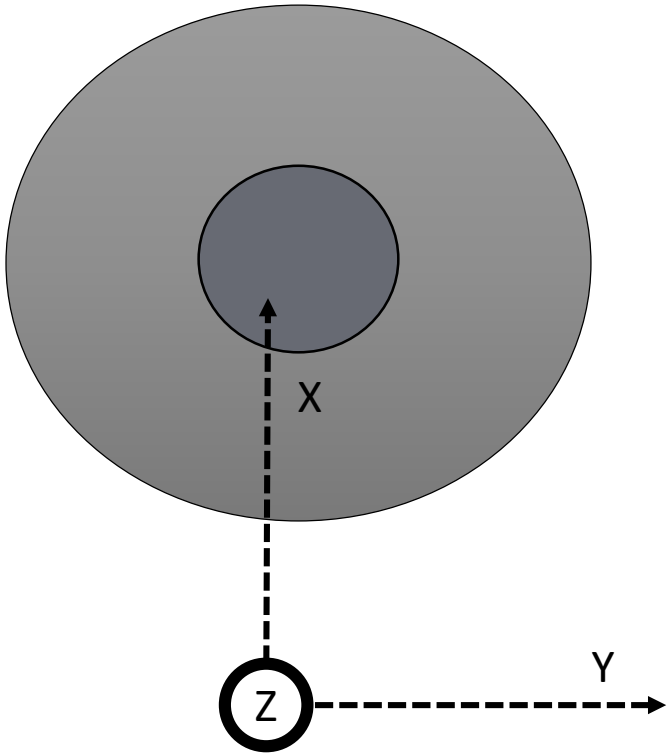
Acceptance comparison with MC simulation

Corinne, Yannis, Theodoros, Sabine

Data

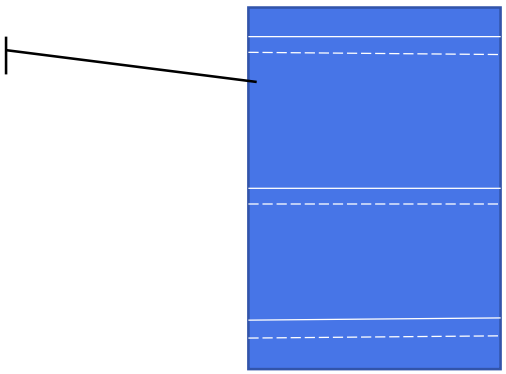
- Preselection by Theodoros $\rightarrow$ Rootfile
- Data Looking towards the tumulus
- $Evts\ with\ at\ least \sum ADC > 200, per\ plane$
  - No cut on the middle 2 planes

Numbering & Coordinate System



Used in this presentation Yannis uses a different description

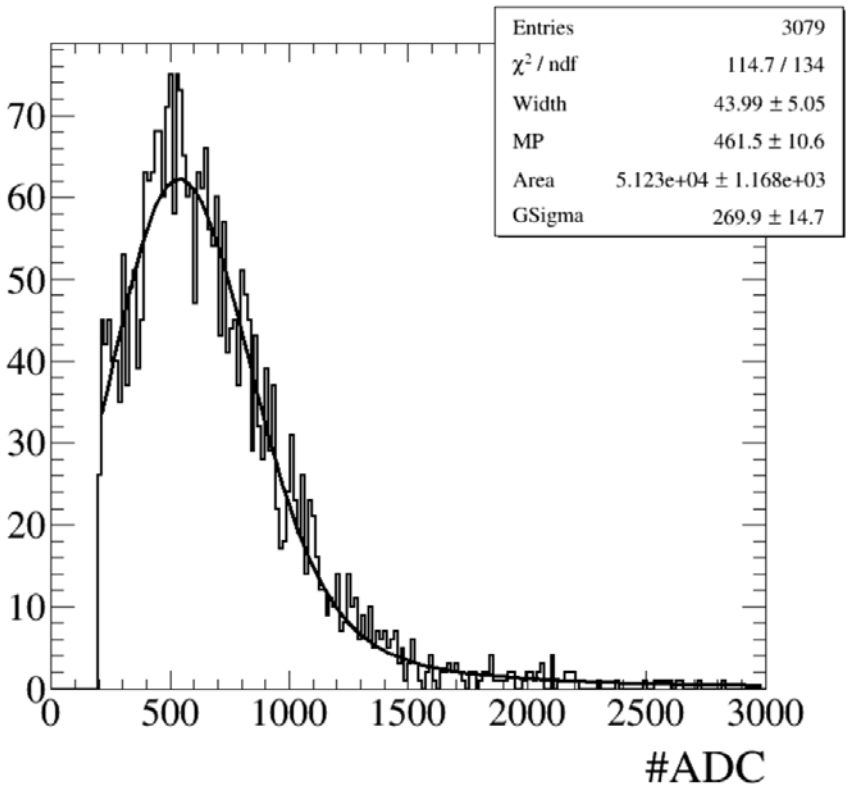
Plane 1 to 6



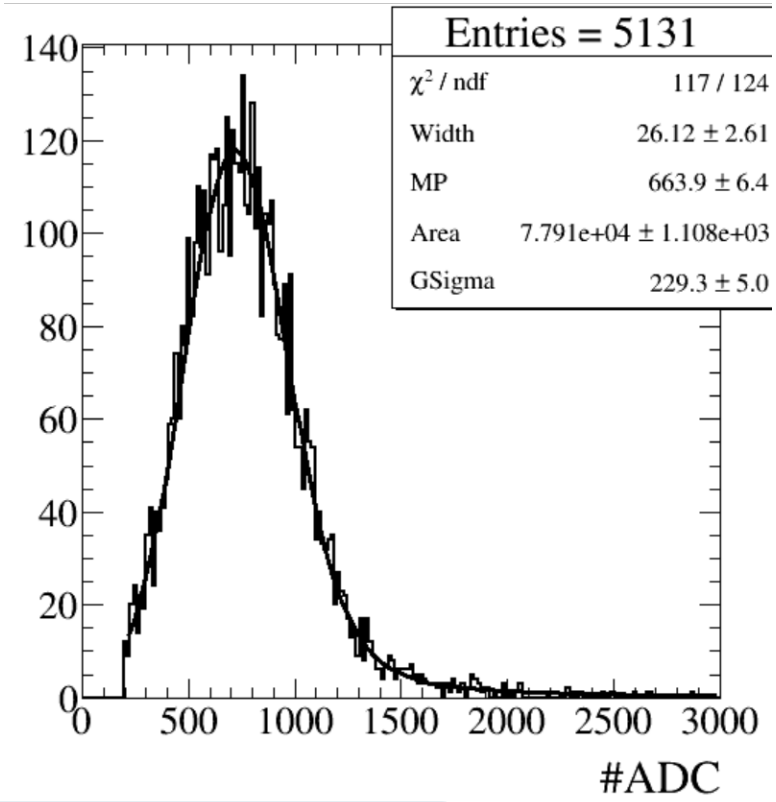
Z, strips along Y
Y, strips along Z
Z
Y
Z
Y

Simulation: E (kev) to ADC

Data (Example)



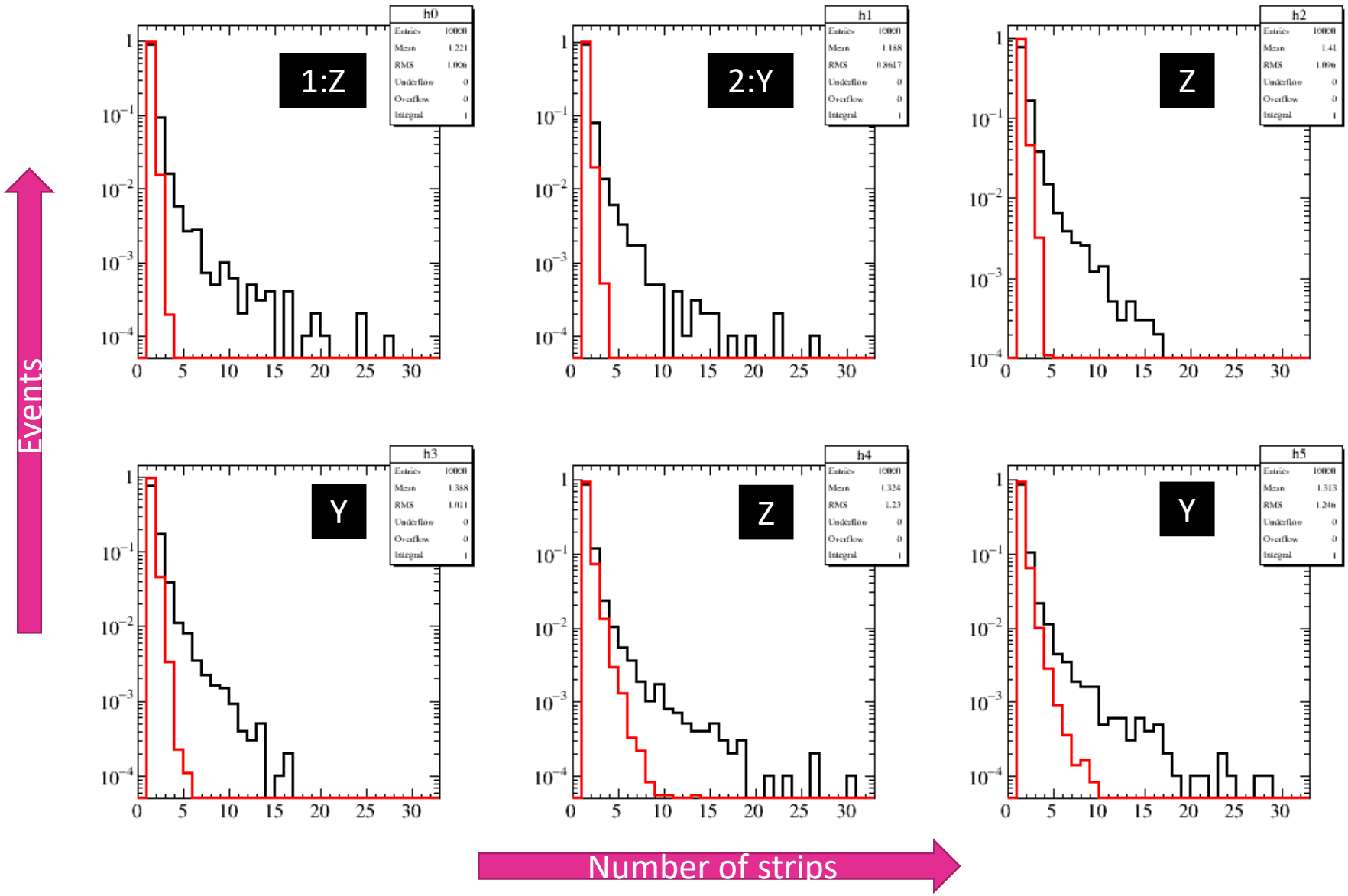
MC (Example)



Simulation to be adjusted channel per channel, but qualitatively Ok for now

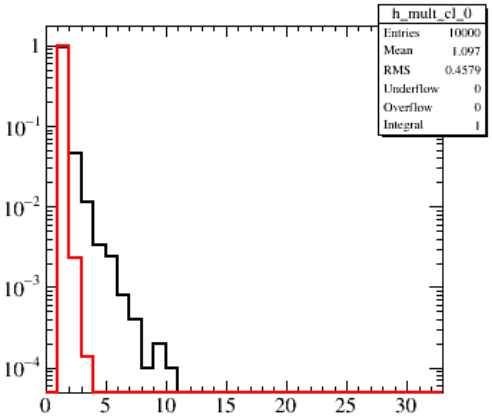
Raw Multiplicity

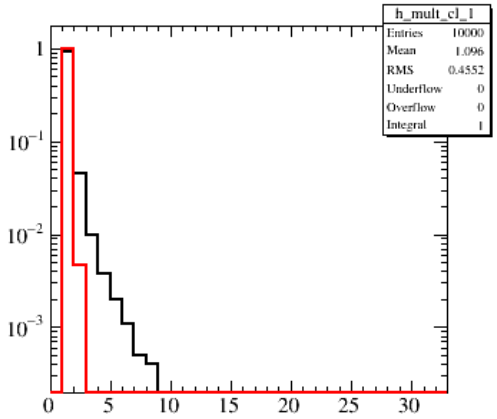
Data
Simulation

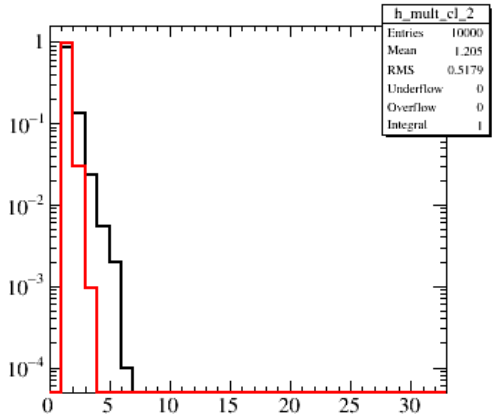


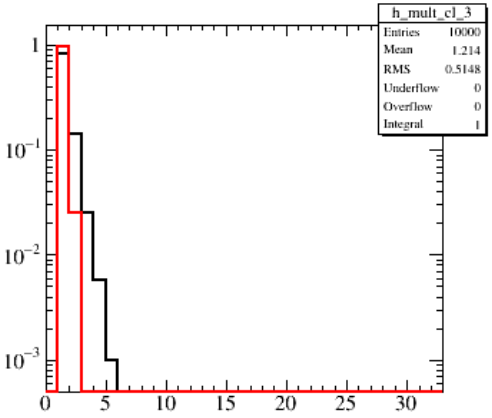
Clustering

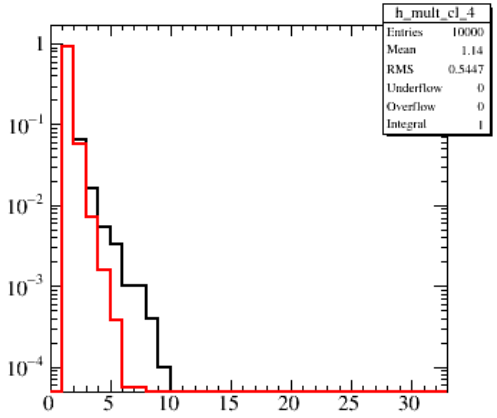
- Simple clustering associating neighbors

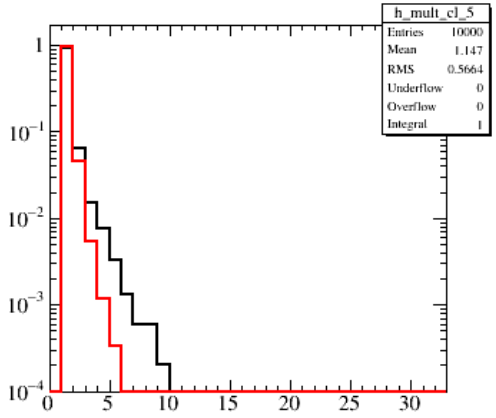






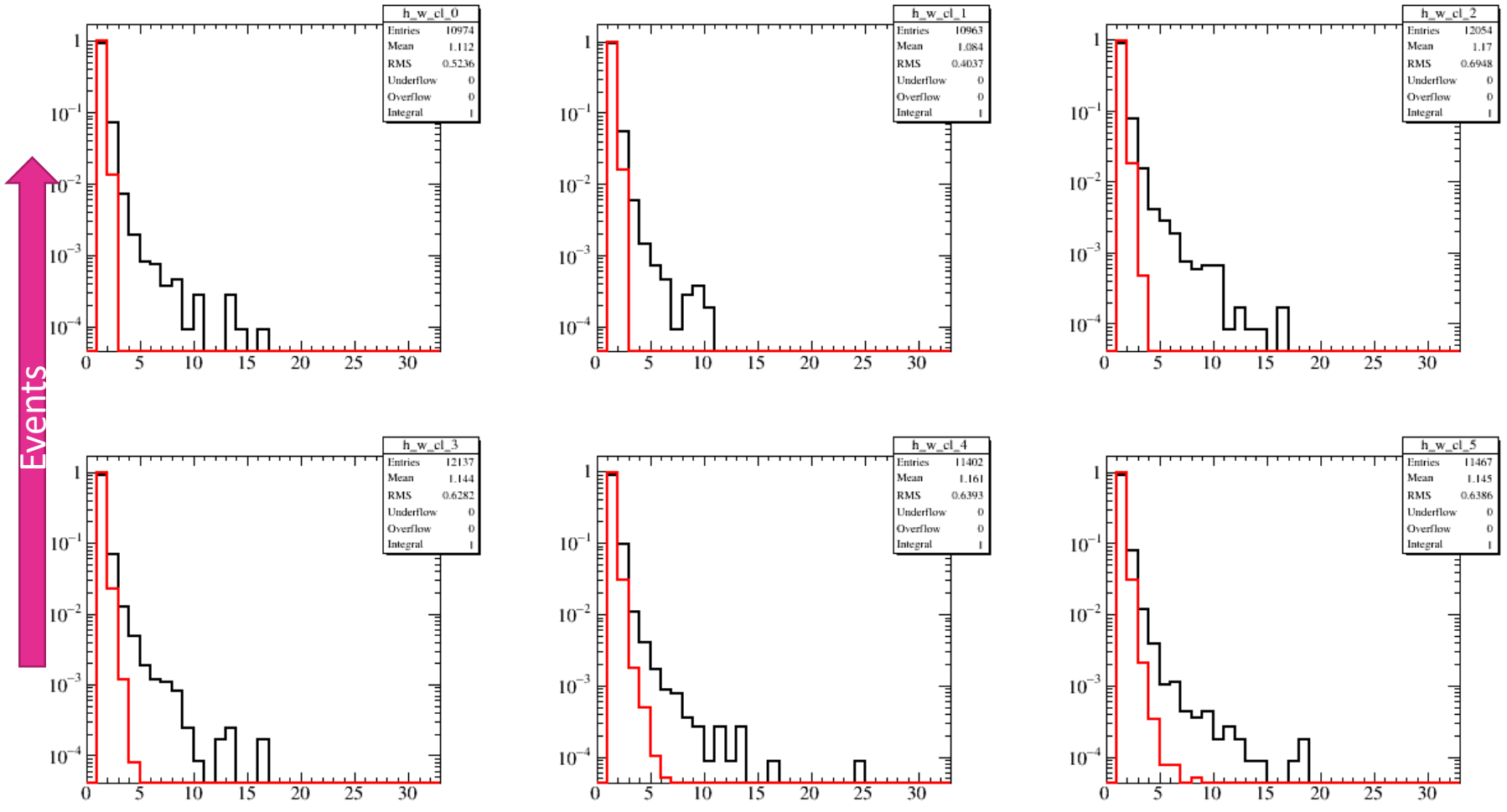






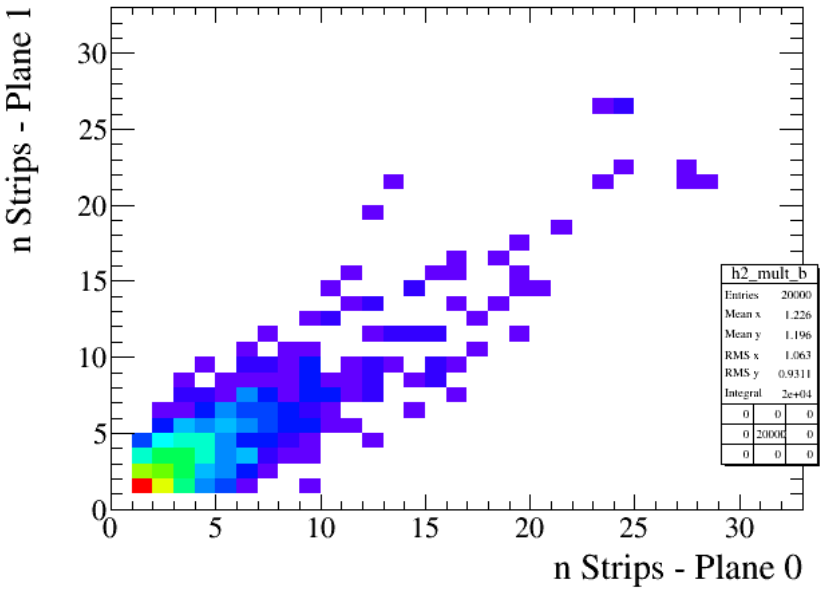
Number of clusters

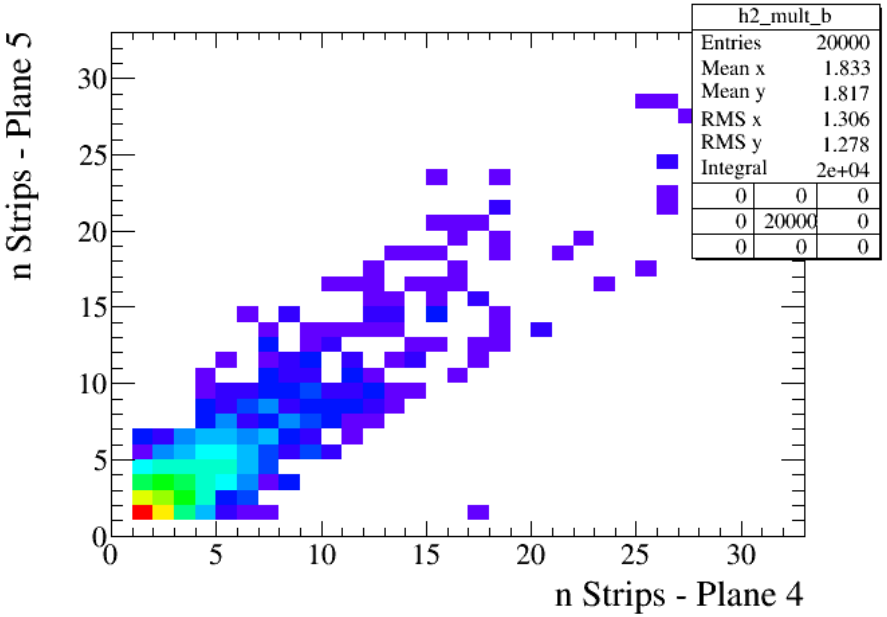
Cluster's width



Investigating whether the larger multiplicity could be due to electrons

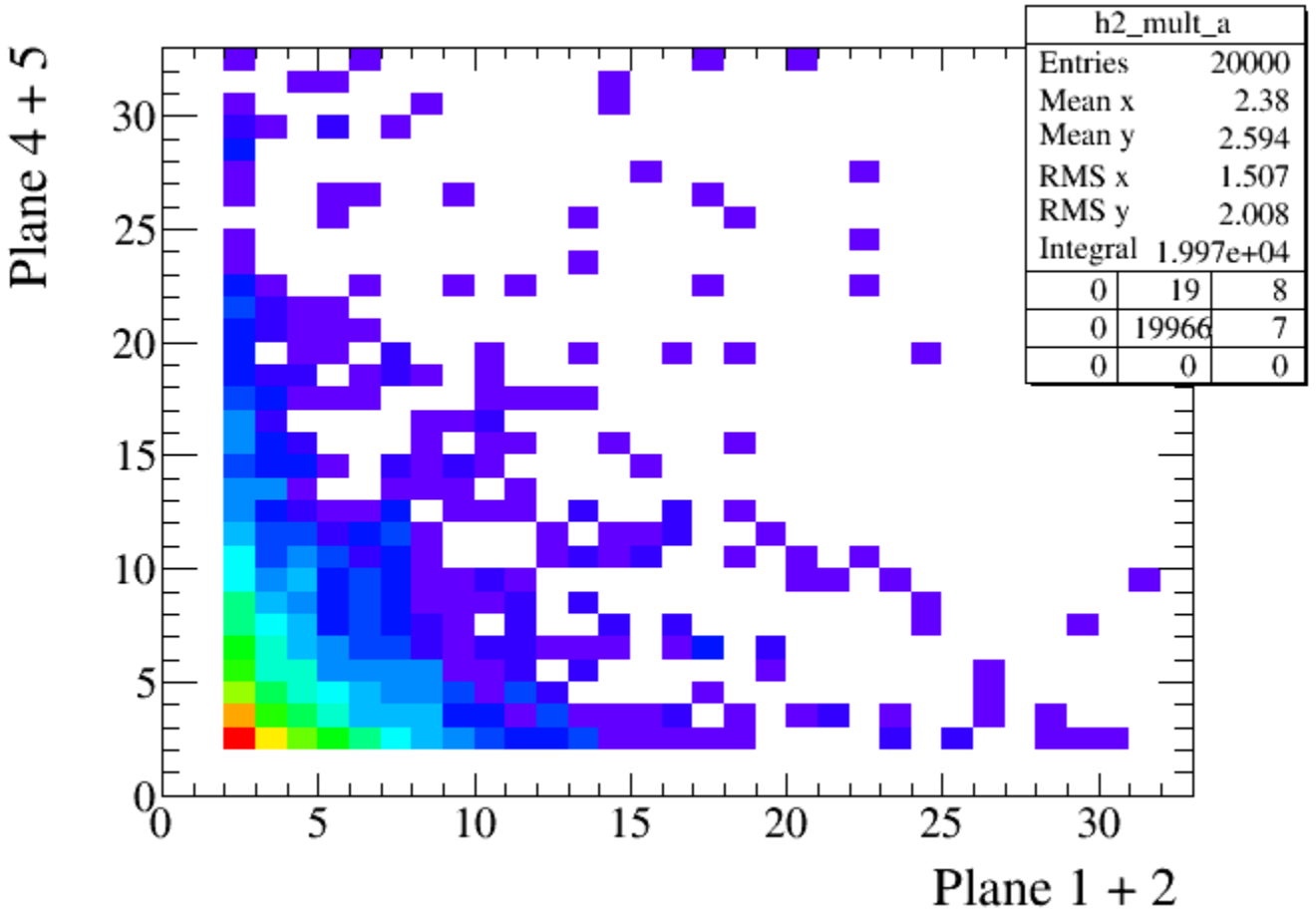
Electrons ?



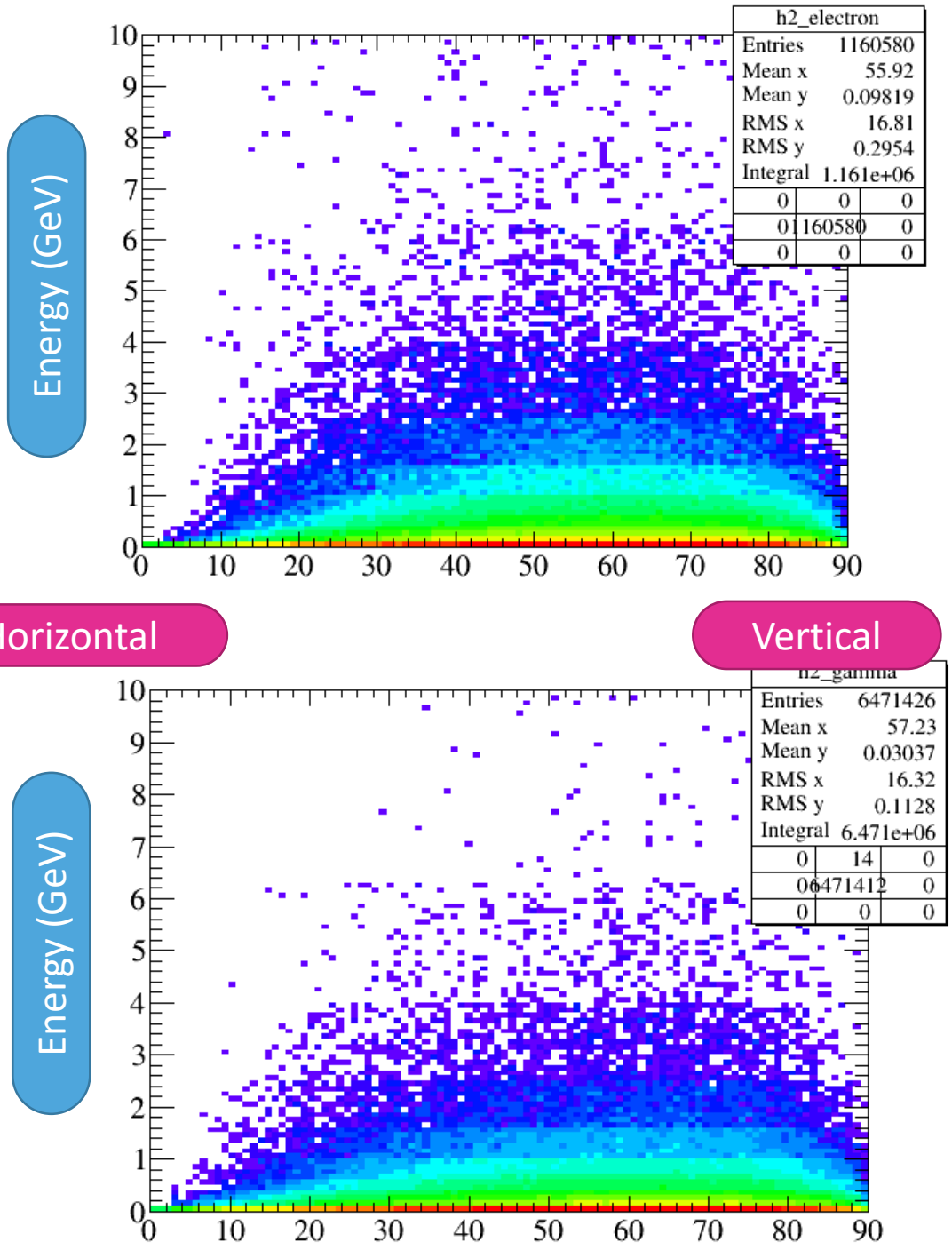


Seems to be of physical origin

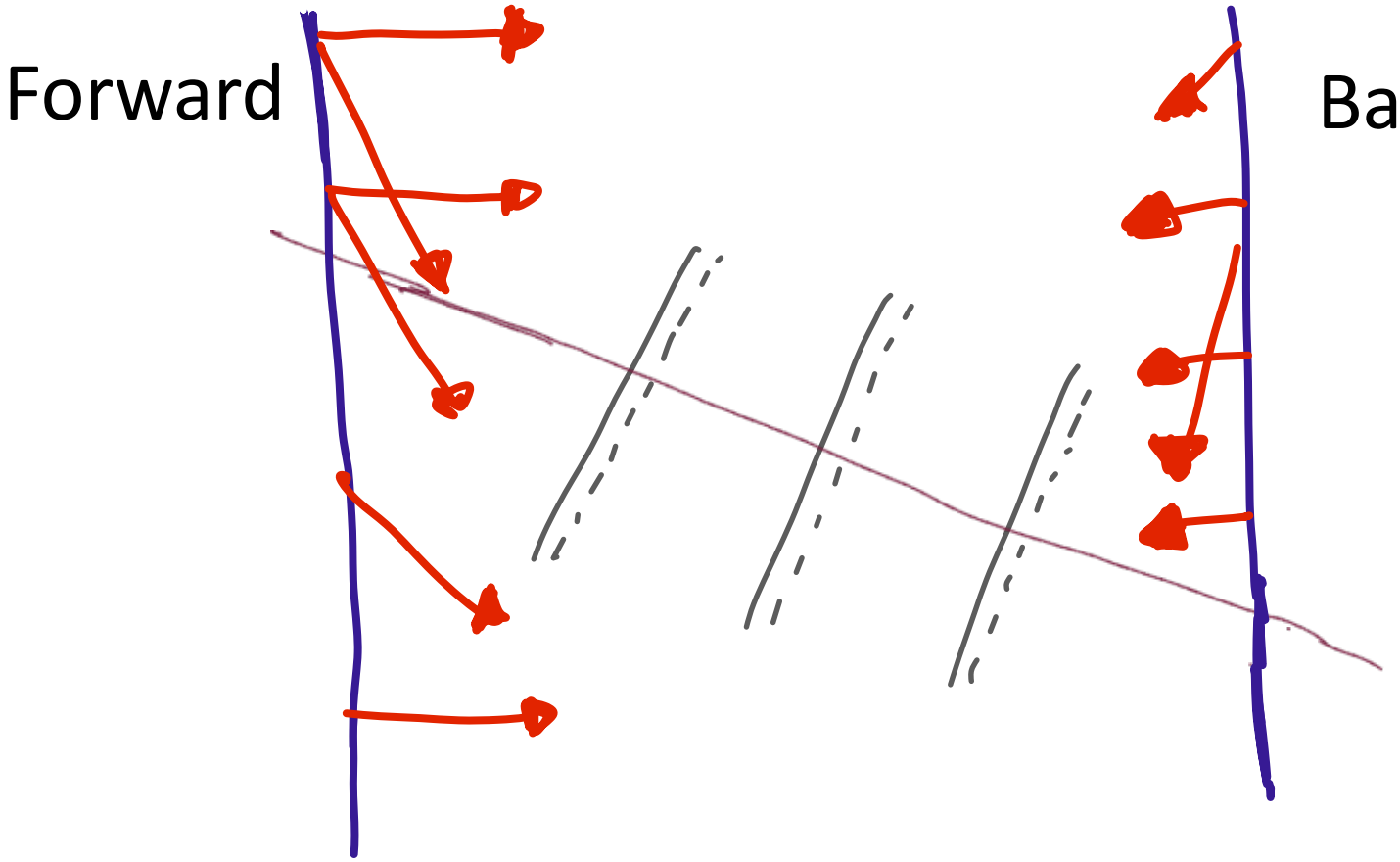
Electrons ? ~No correlation Front-Back



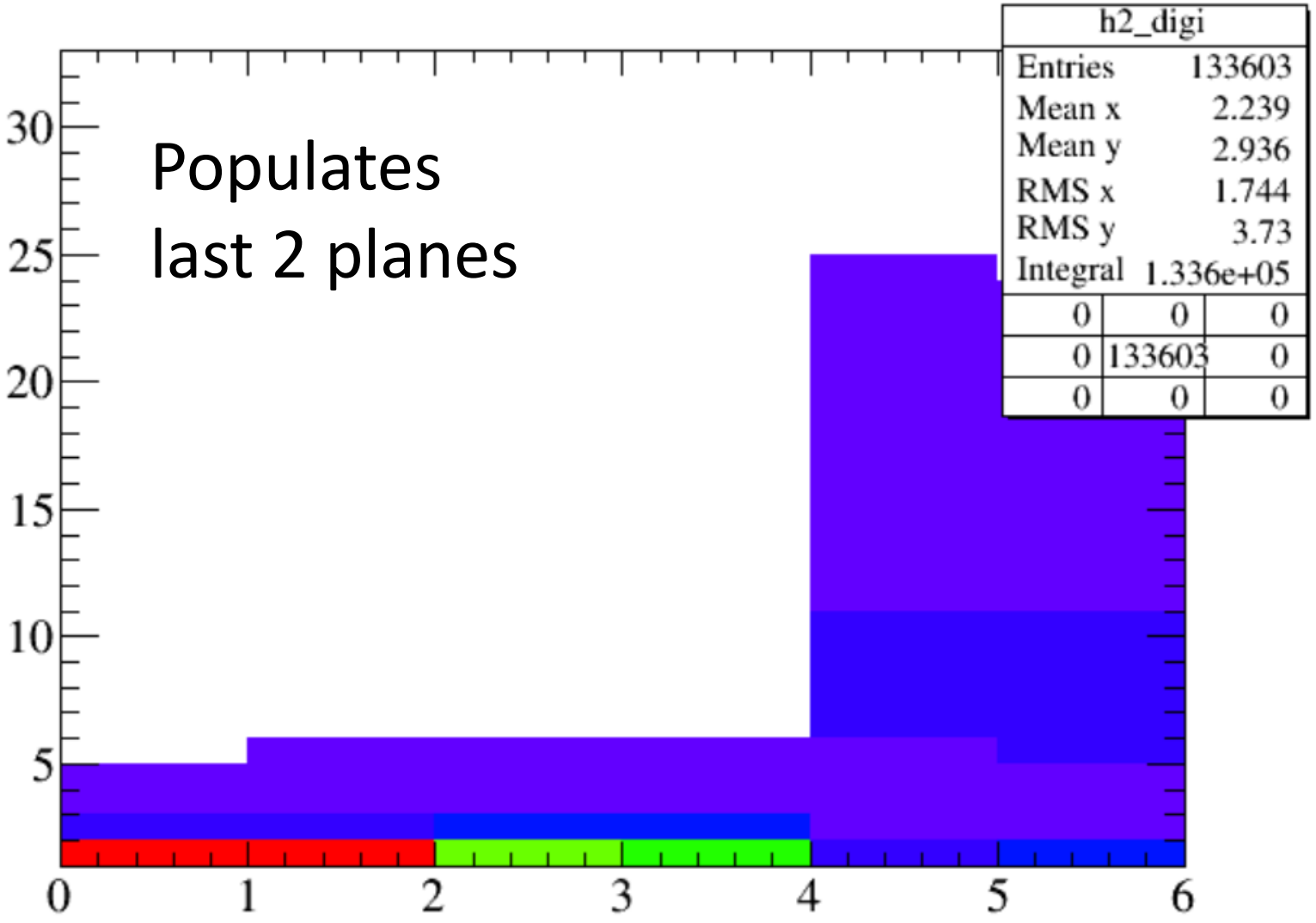
Electrons/ Gamma (CRY)



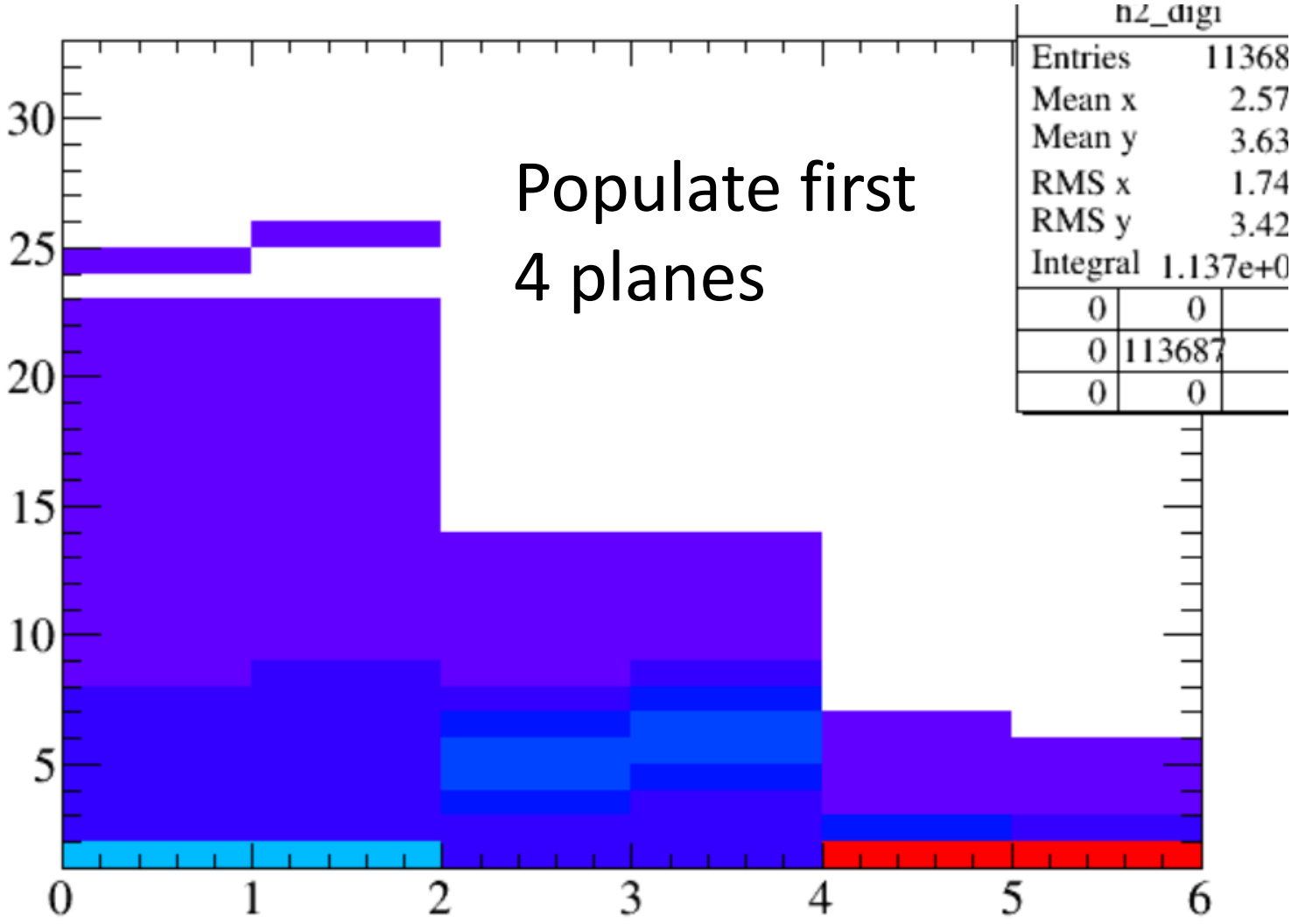
Fast simulation { $\cos^2\theta$ μ^- 10 GeV
isotrope e^- 5 GeV



5 GeV forward electrons



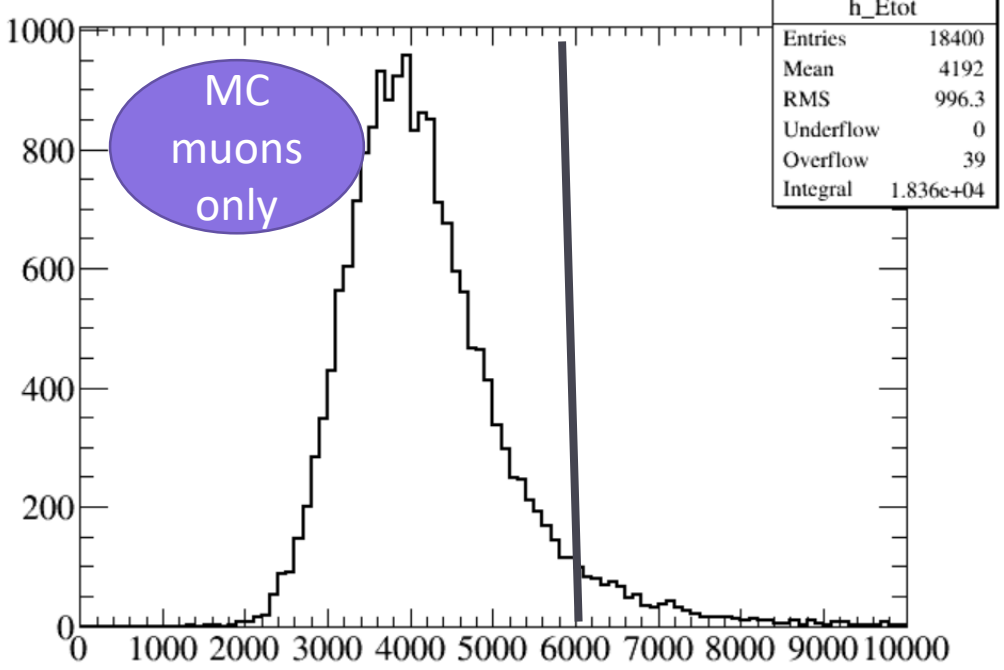
5 GeV backward electrons

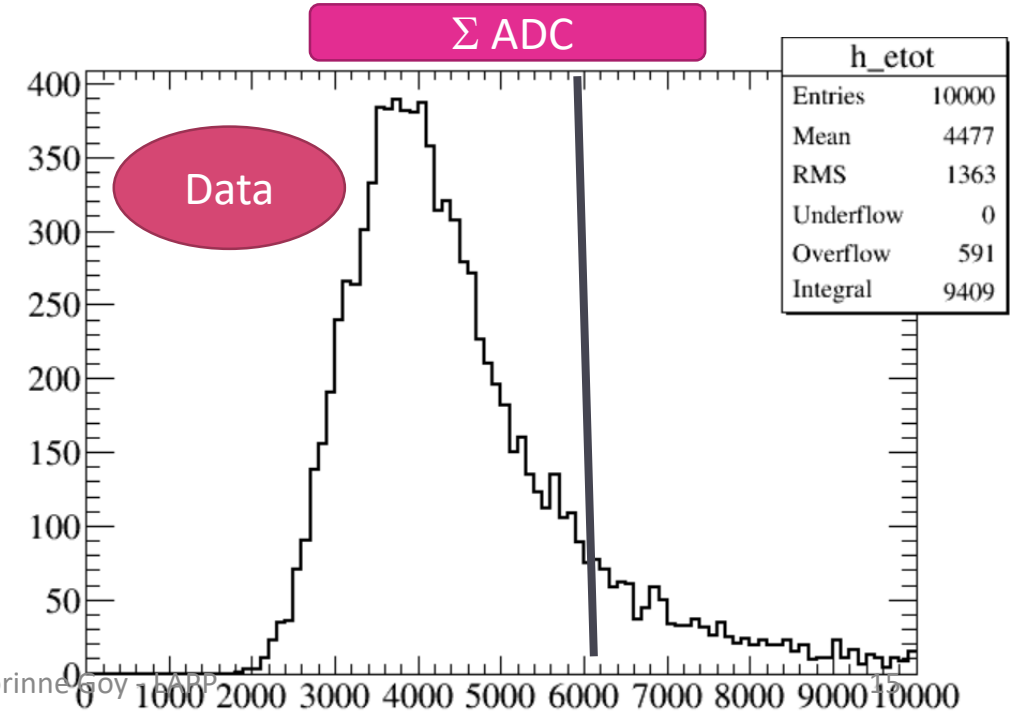


Classical cut!

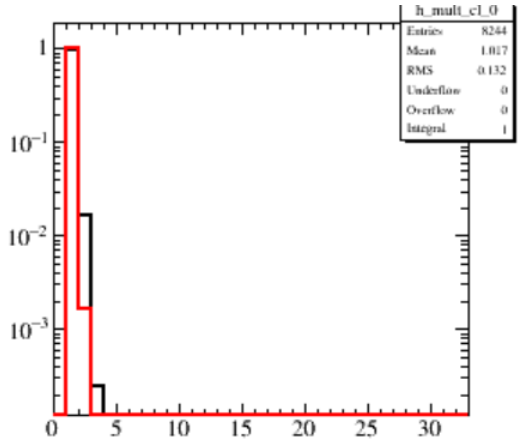
Σ ADC < 6000 counts

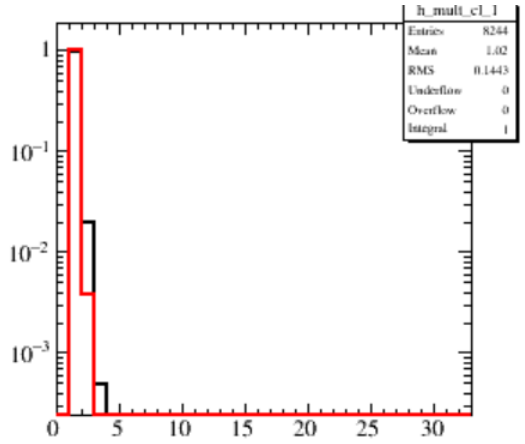
To mitigate the background from electrons

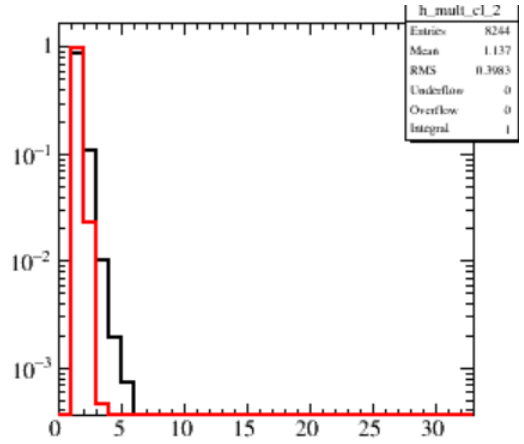


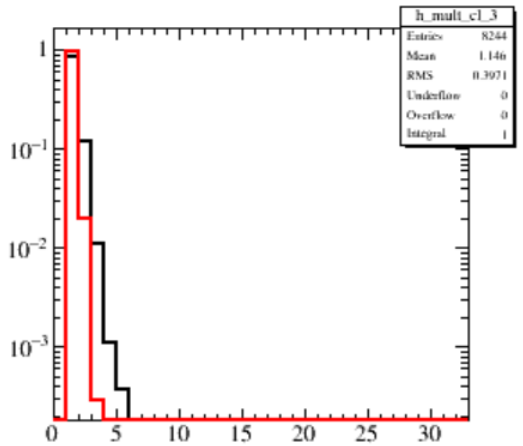


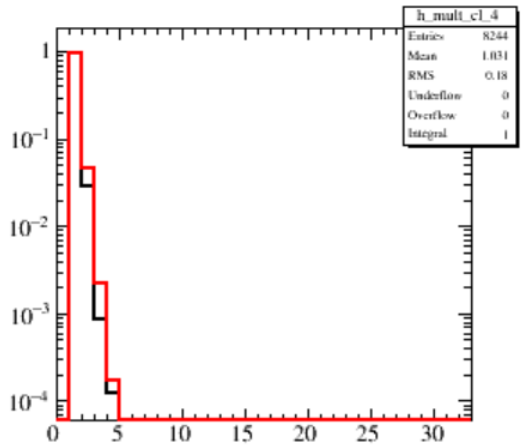
Cluster multiplicity

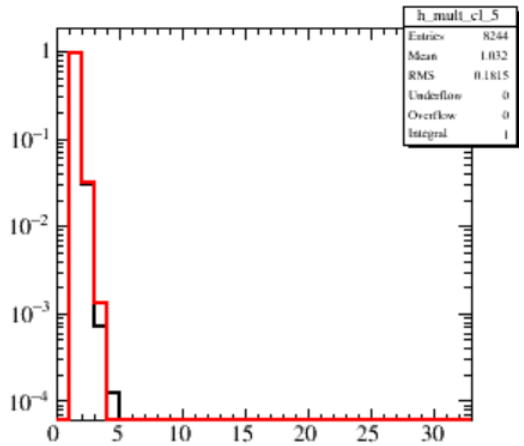






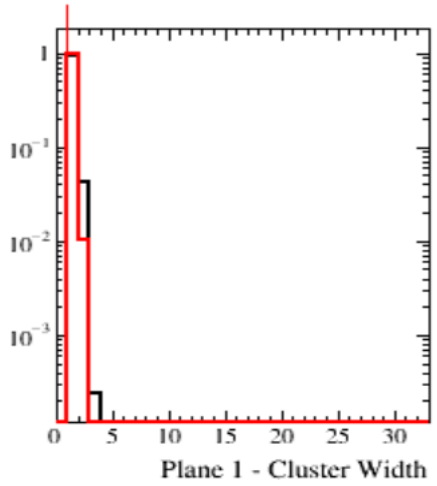


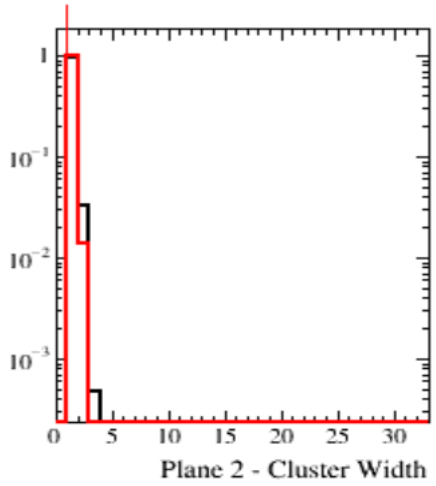


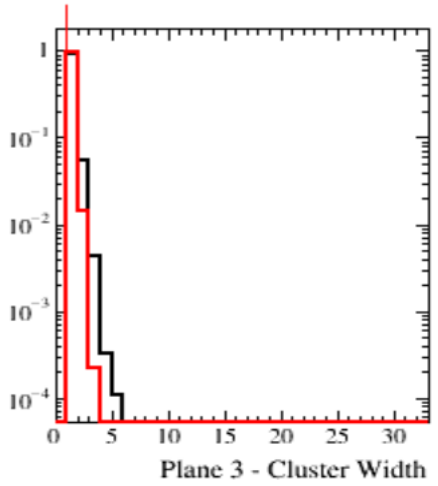


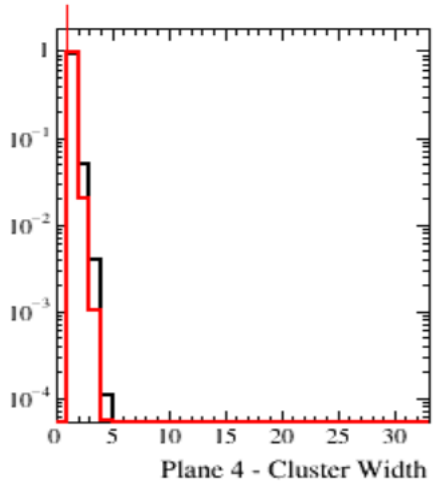
Nb of clusters

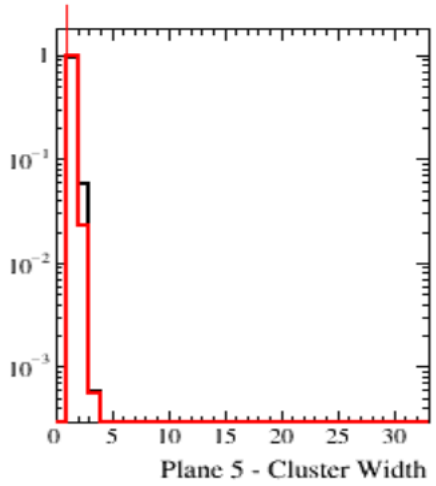
Cluster Width → W <= 3

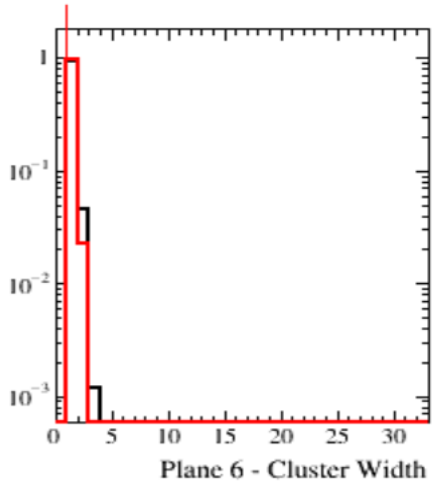




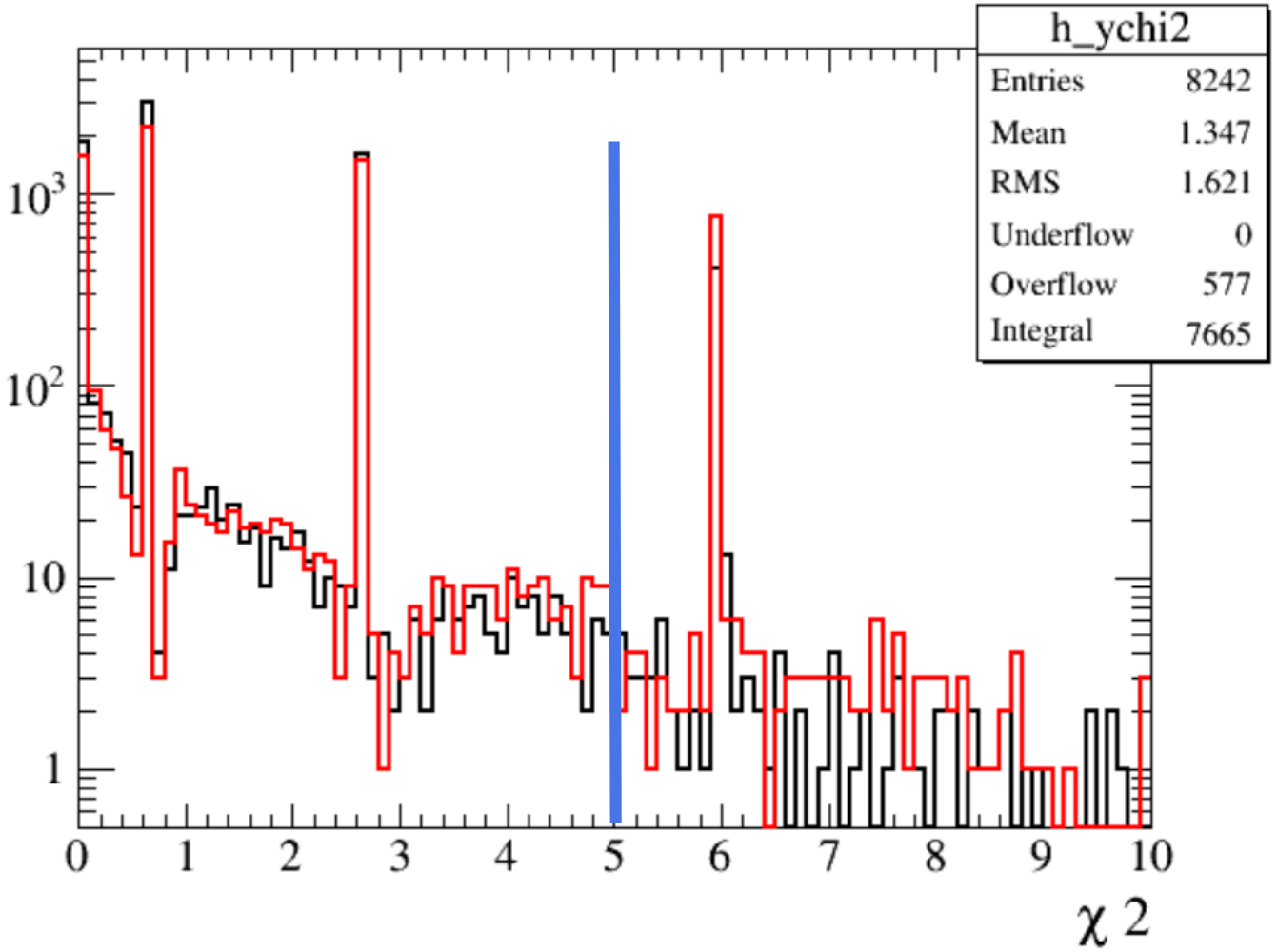






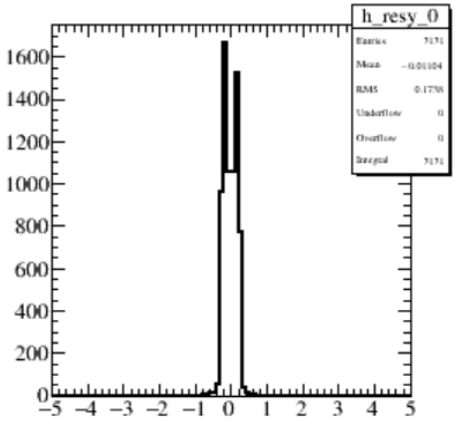


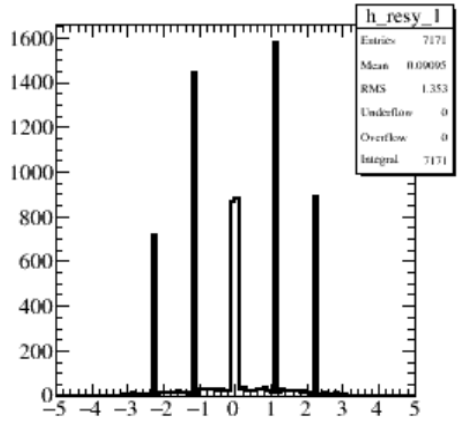
χ2 of the fitted track in y & z direction

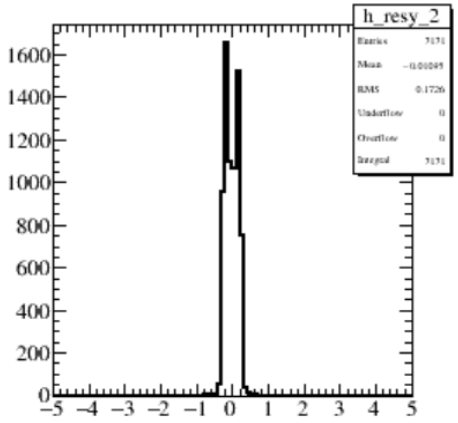


Residuals after $\chi 2$ cut < 5

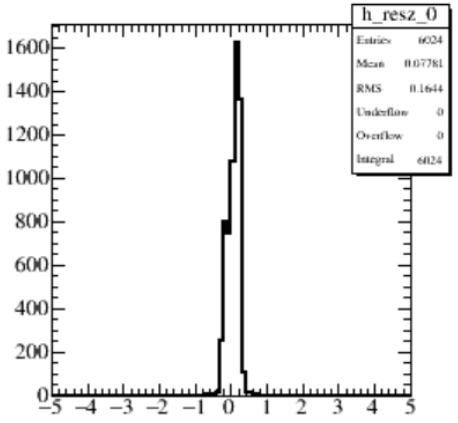
Y

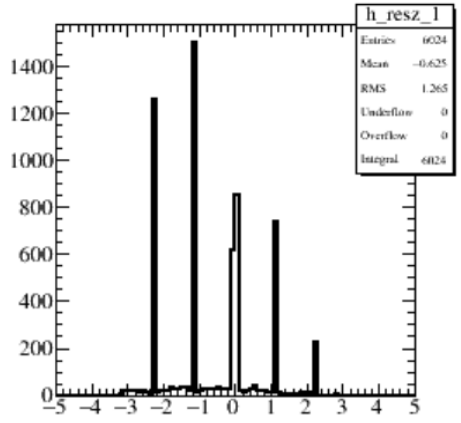


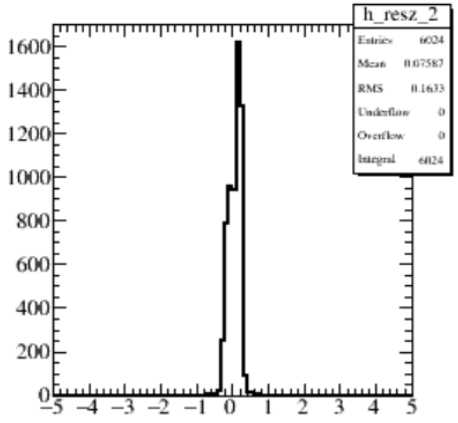




Z

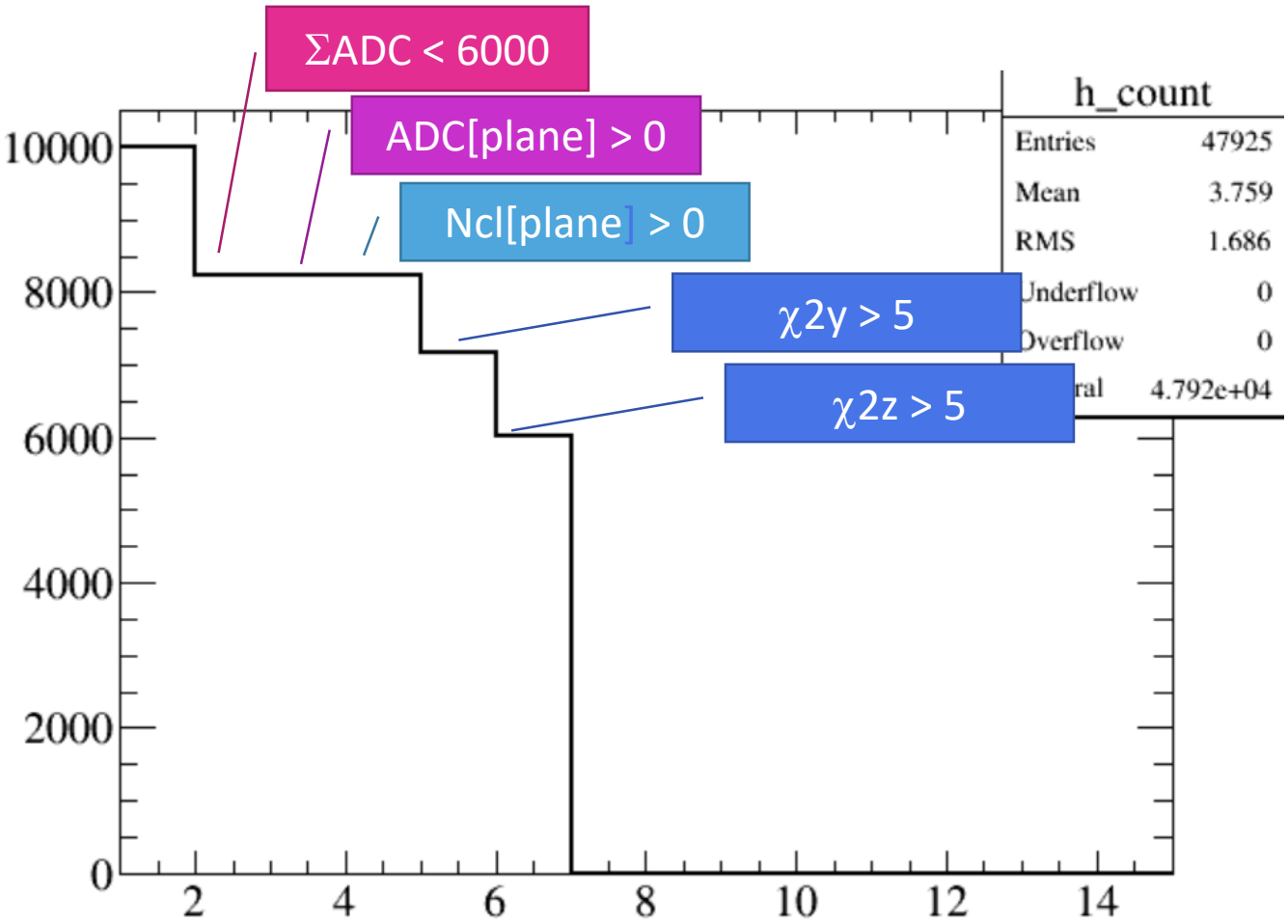






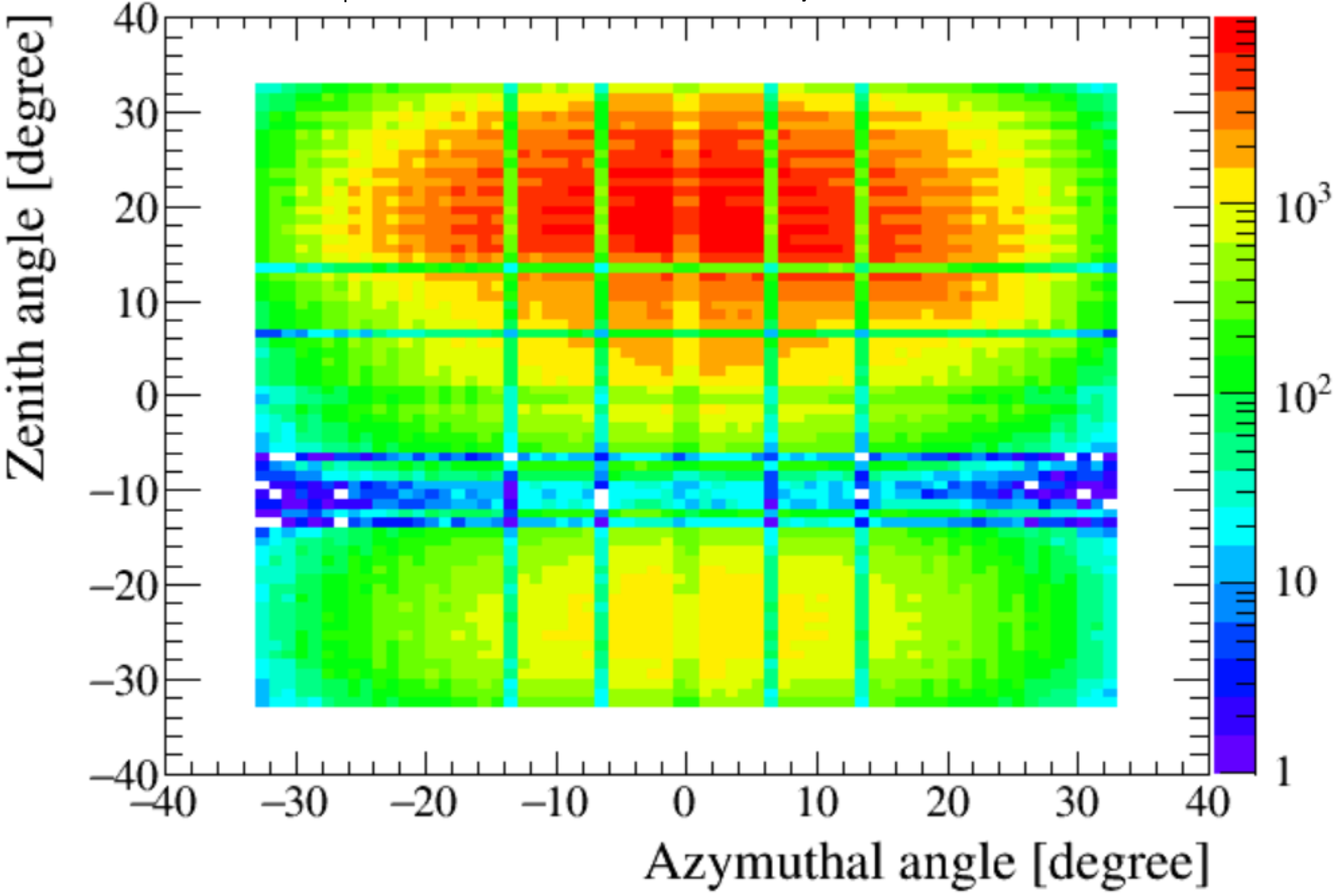
cm

Cut flow (data)

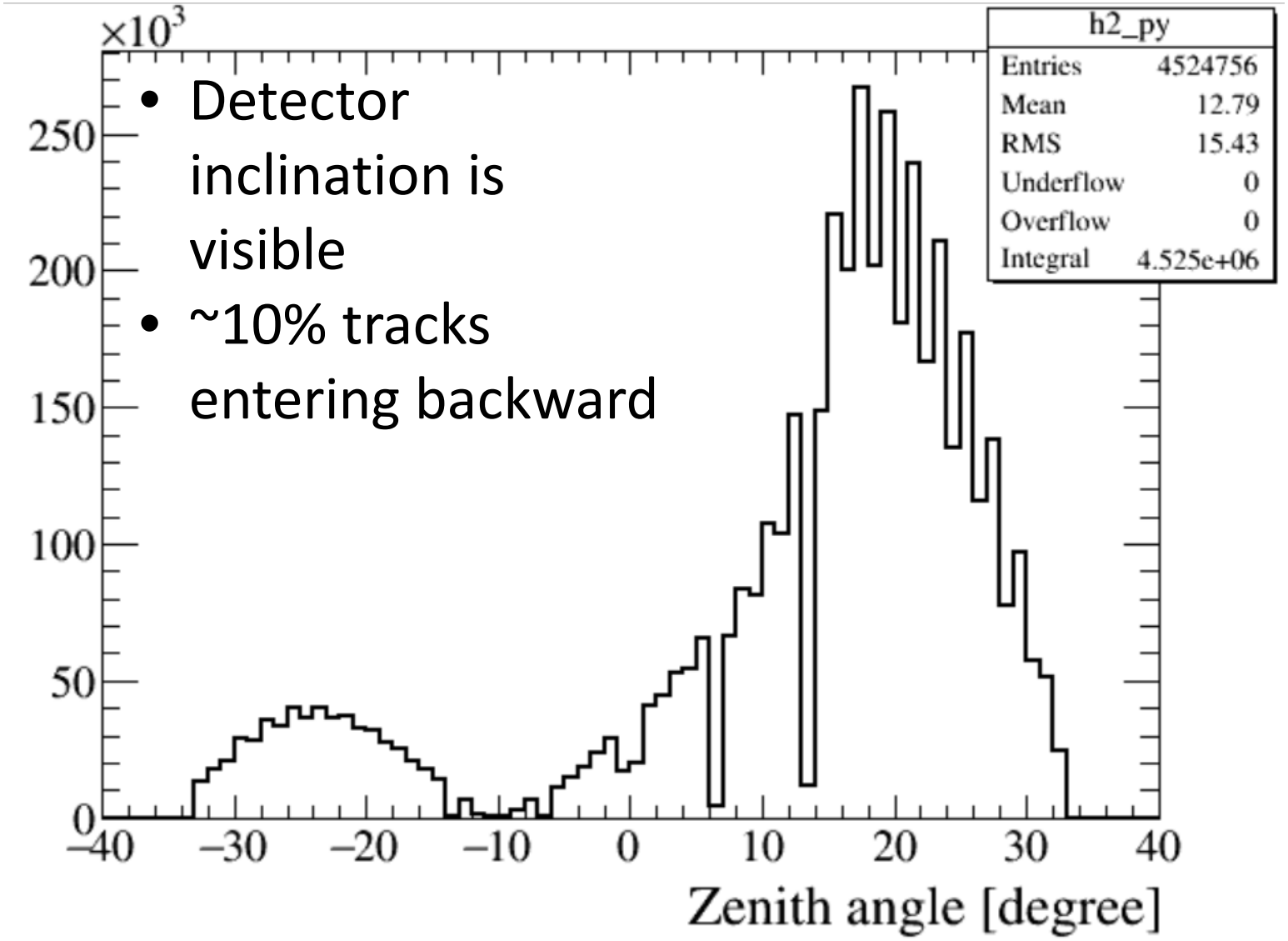


All events : ~ 5 millions tracks

φ and θ are in the coordinate system of the detector

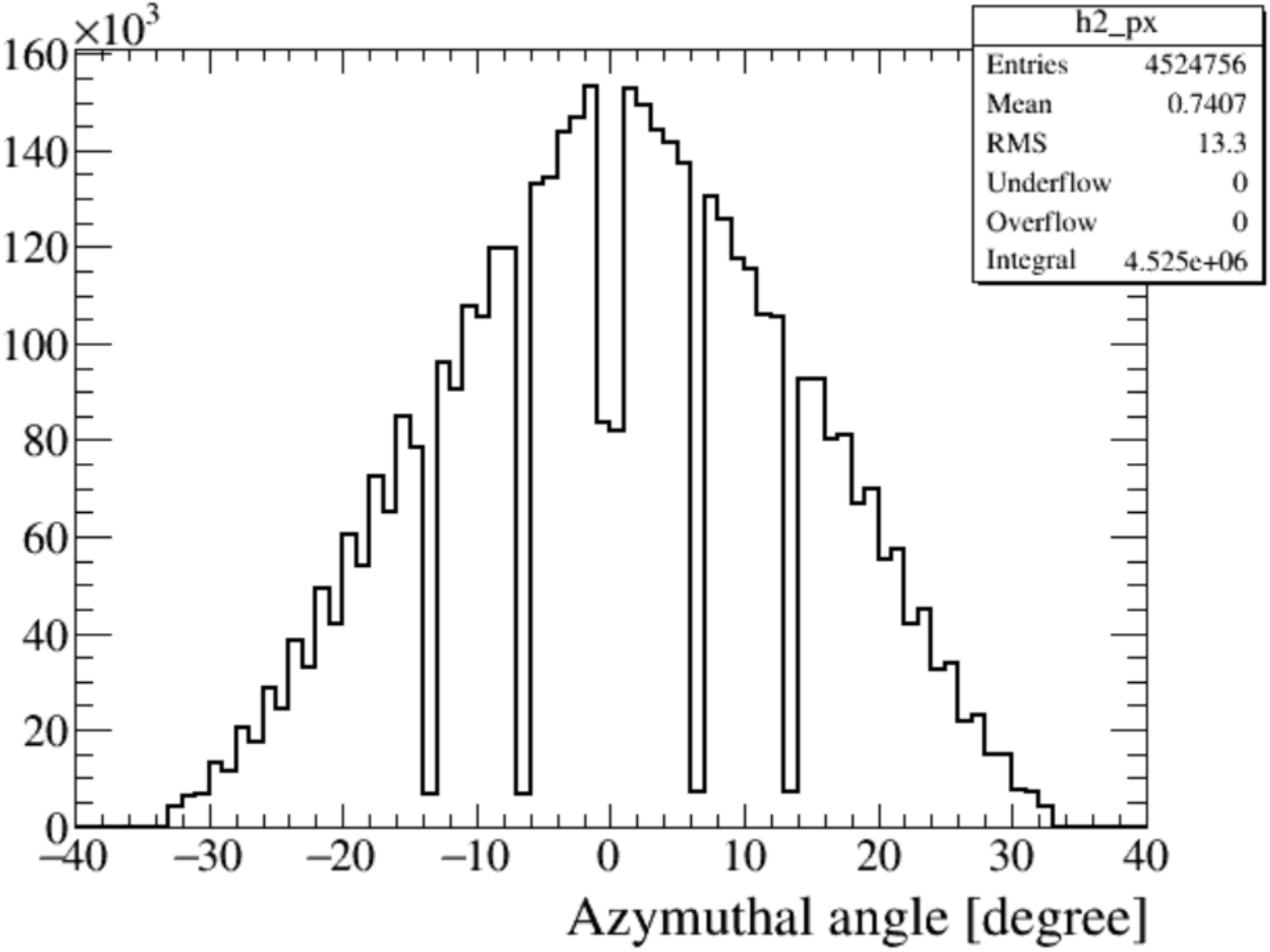


Data :Theta projection

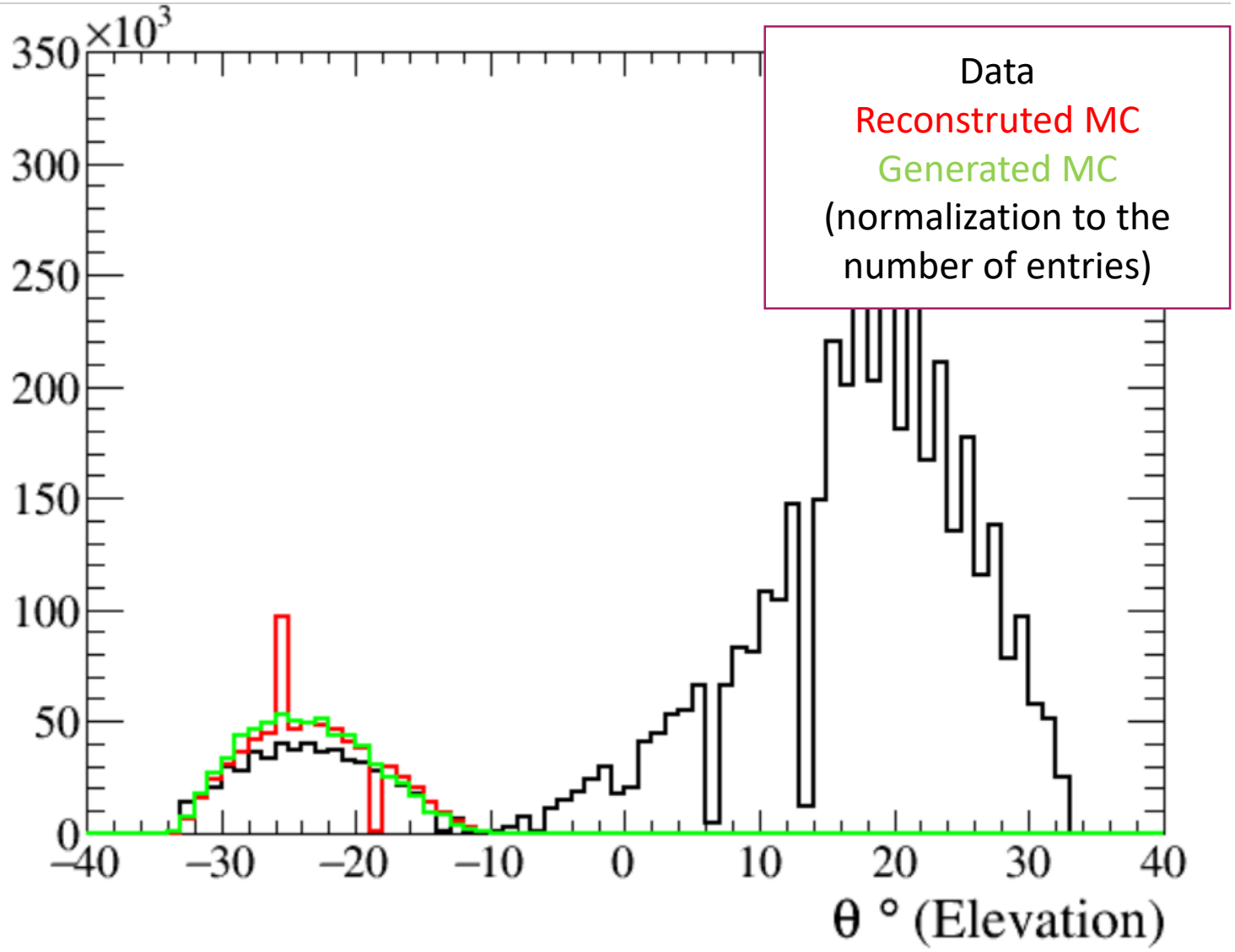


- Detector inclination is visible
- ~10% tracks entering backward

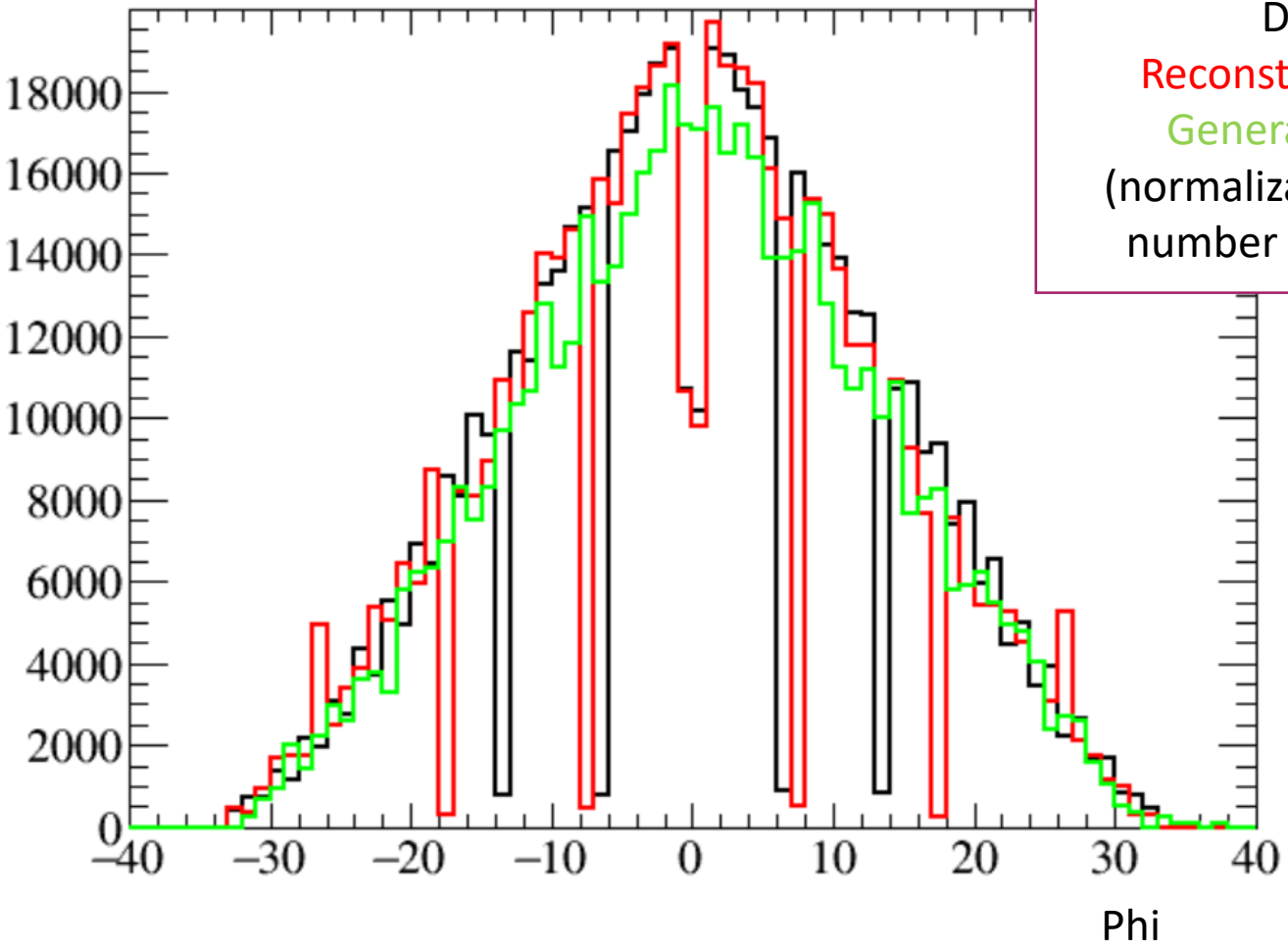
Data : Phi projection



Bwd gen. tracks : theta



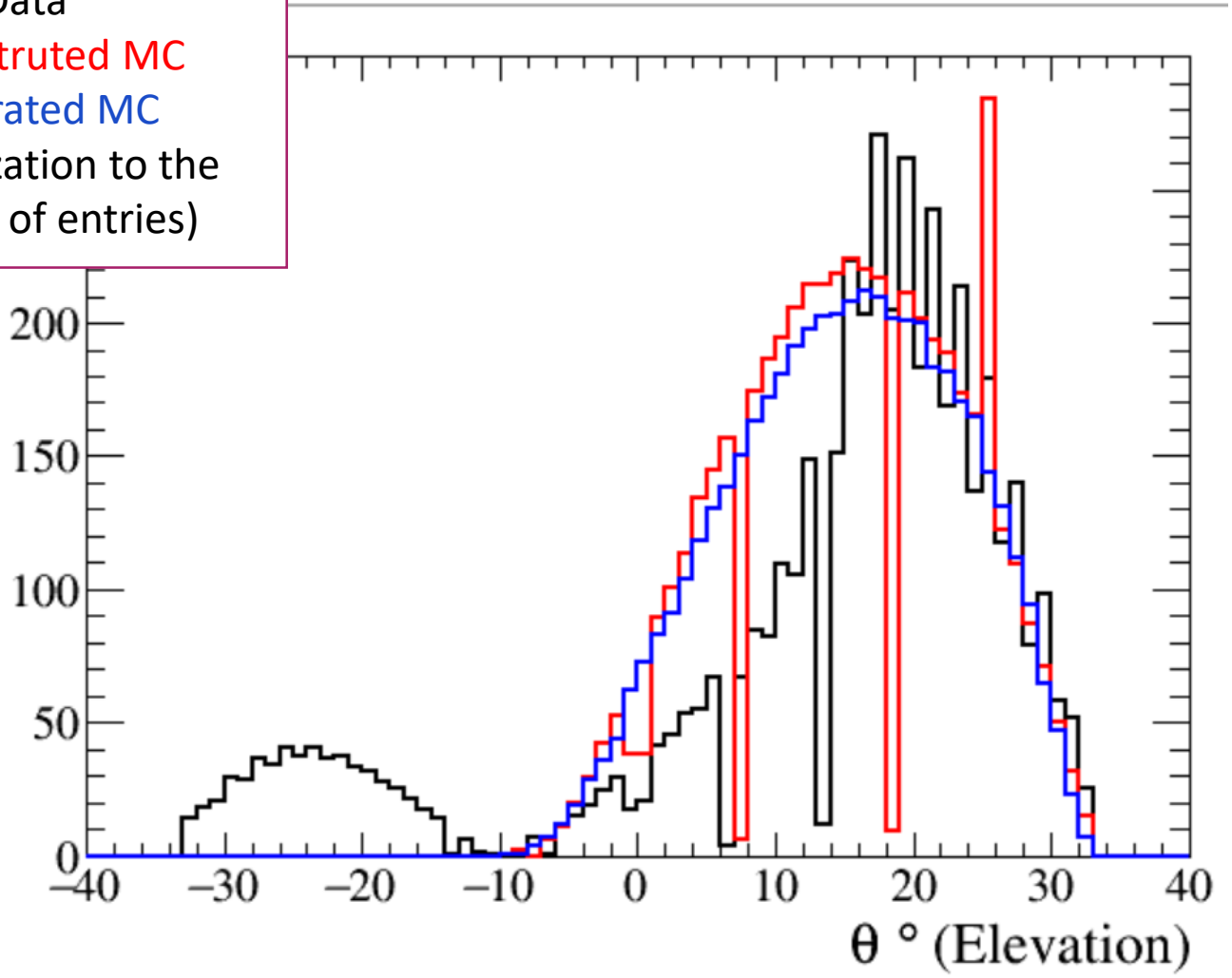
Bwd tracks and comparison with fast simulation: φ



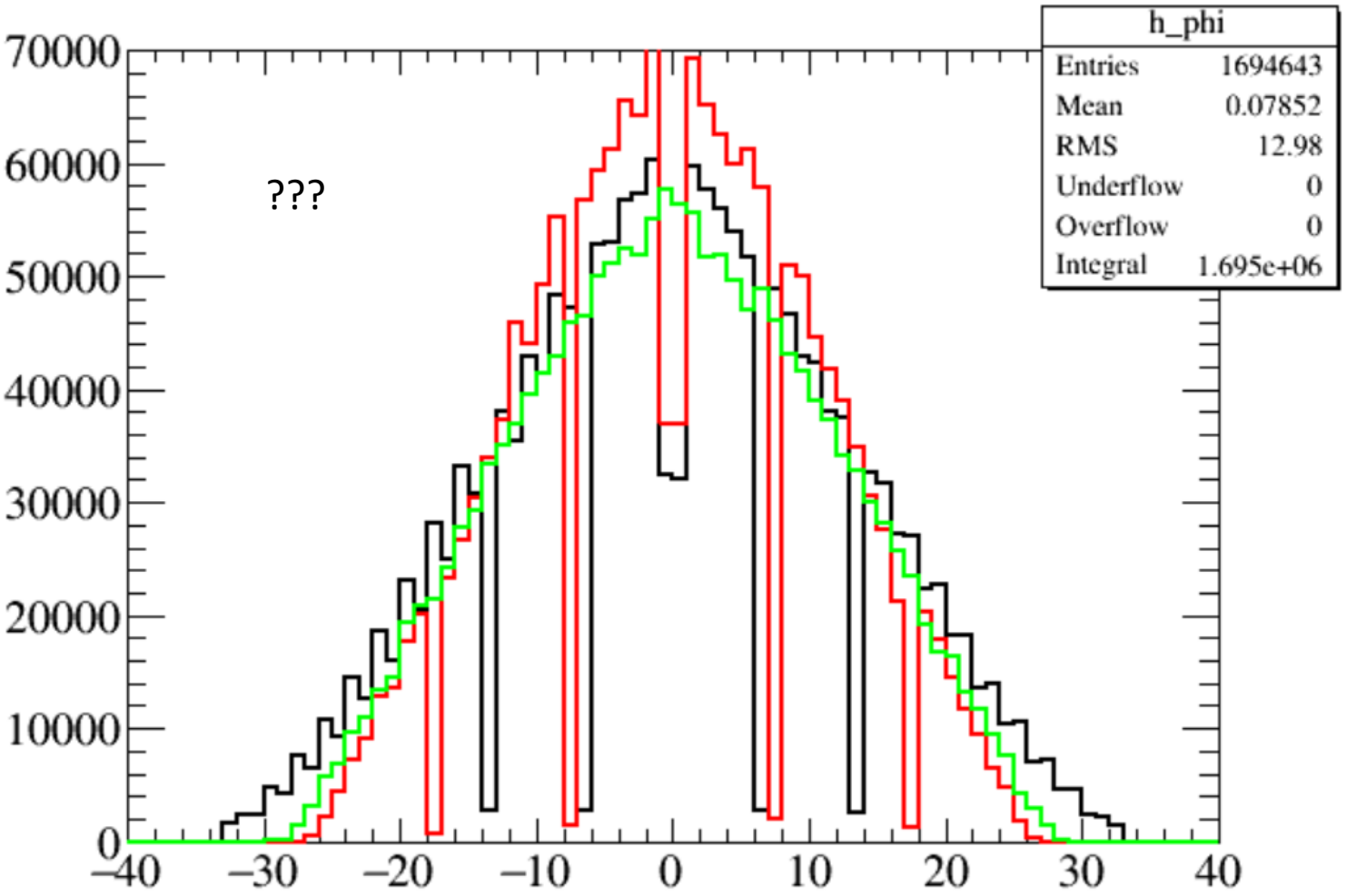
Data
Reconstruted MC
Generated MC
(normalization to the number of entries)

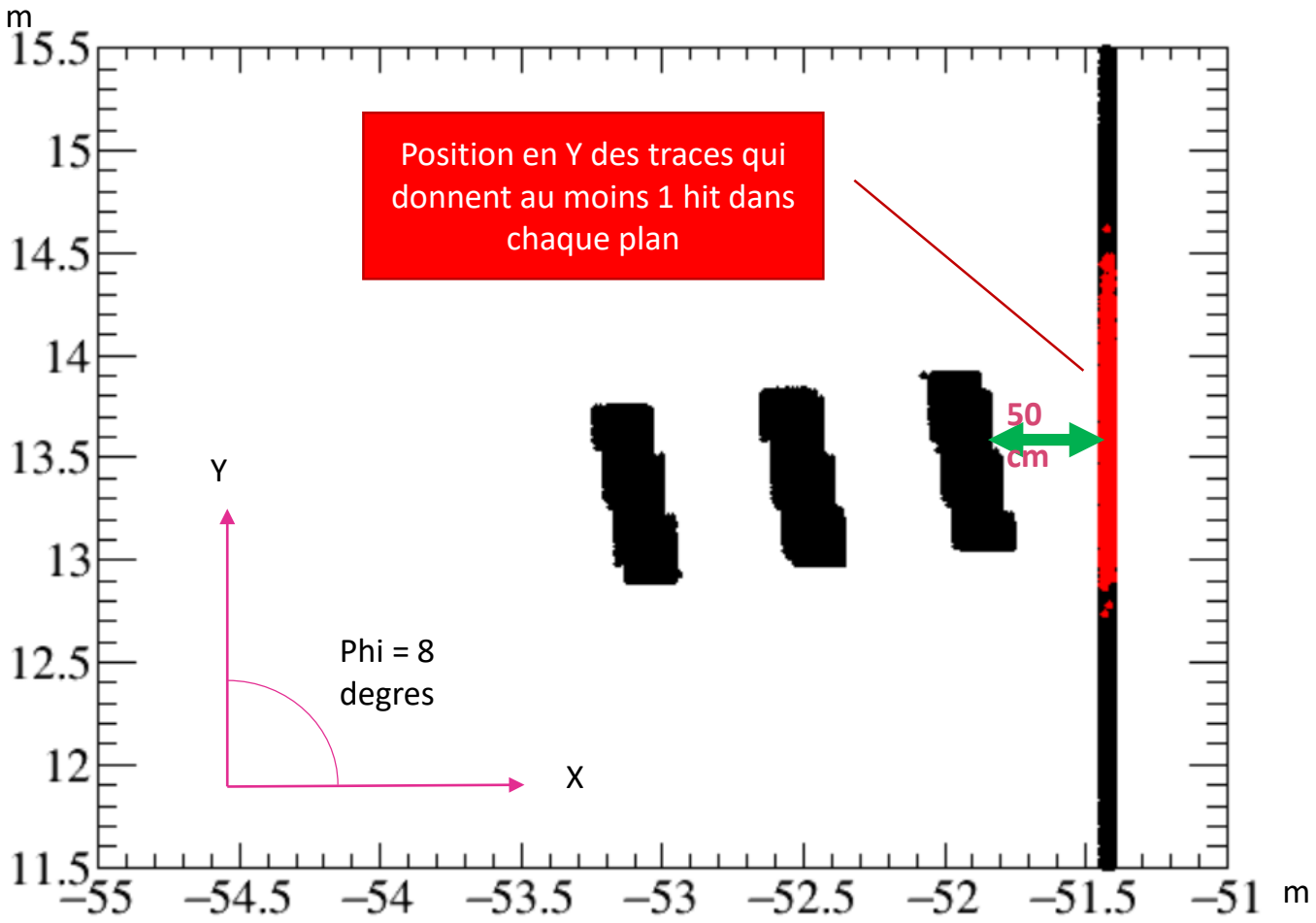
Forward track: theta comparison

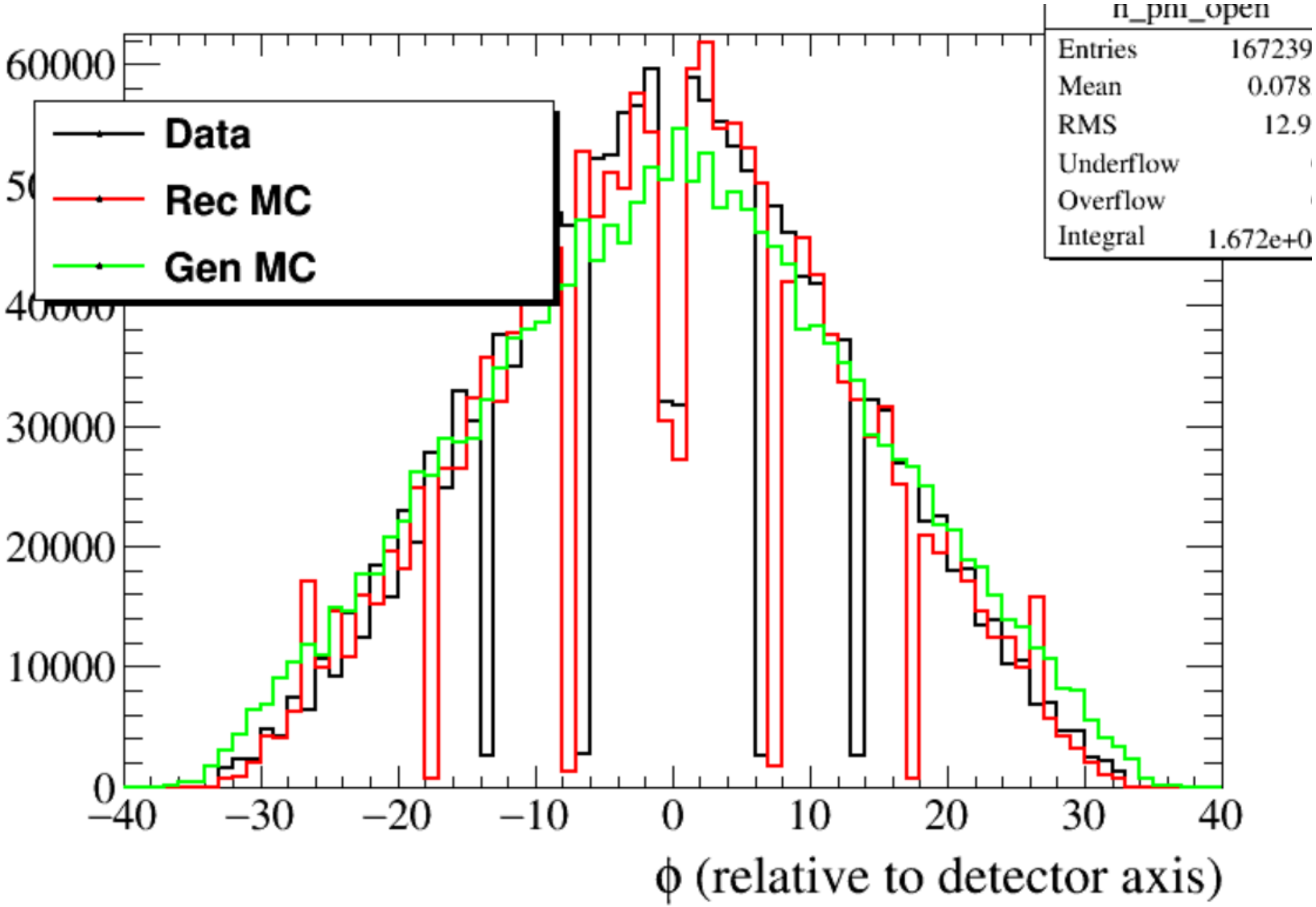
Data
Reconstruted MC
Generated MC
(normalization to the number of entries)



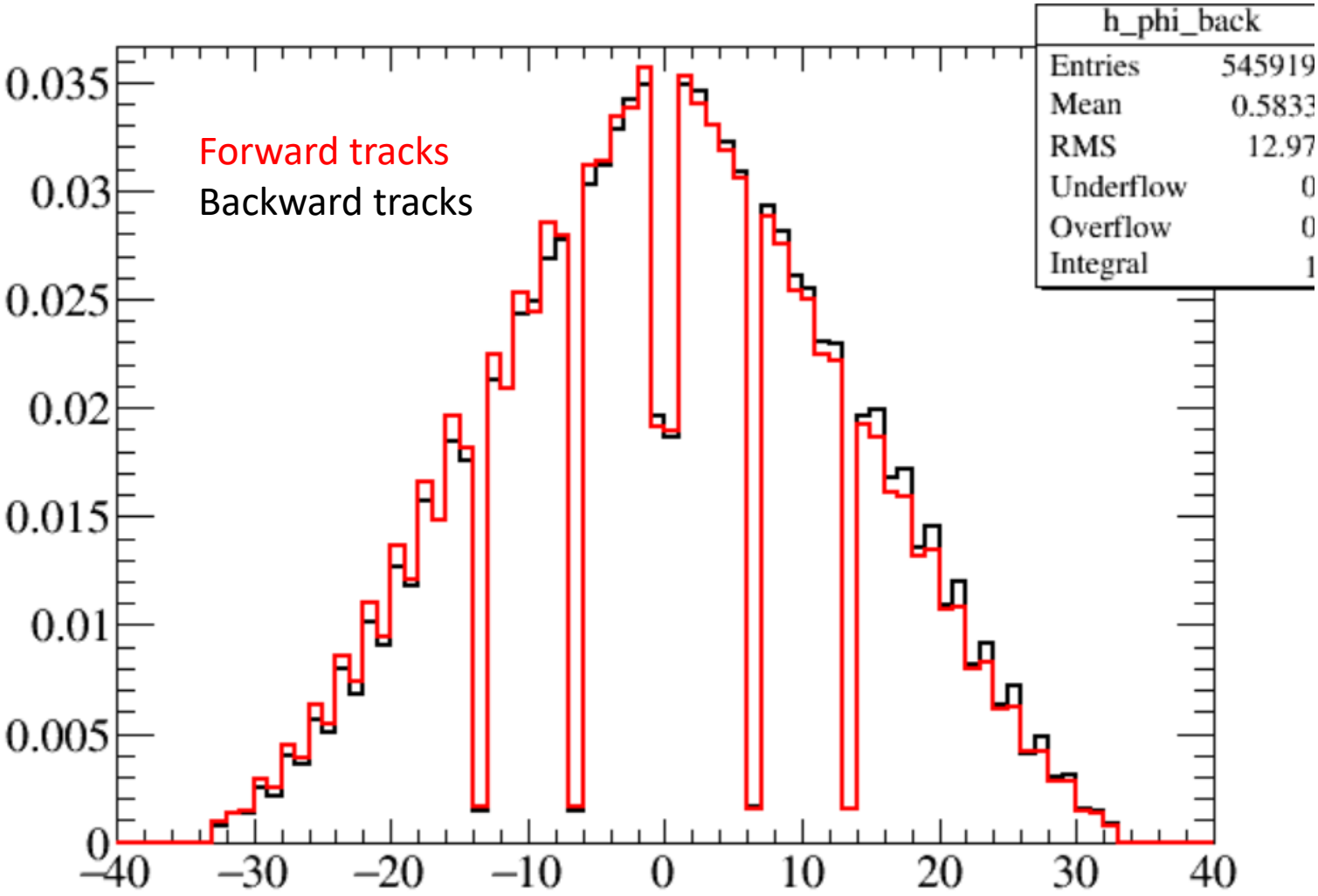
Phi – Open sky (Theta > 20 deg)




m
15.5
15
14.5
14
13.5
13
12.5
12
11.5
−55
−54.5
−54
−53.5
−53
−52.5
−52
−51.5
−51
m
Position en Y des traces qui donnent au moins 1 hit dans chaque plan
50 cm
Y
X
Phi = 8 degres


h_phi_open
Entries 167239
Mean 0.078
RMS 12.9
Underflow
Overflow
Integral 1.672e+0
Data
Rec MC
Gen MC
60000
30000
20000
10000
0
−40
−30
−20
−10
0
10
20
30
40
ϕ (relative to detector axis)

Comparison data phi fwd open sky/phi bwd



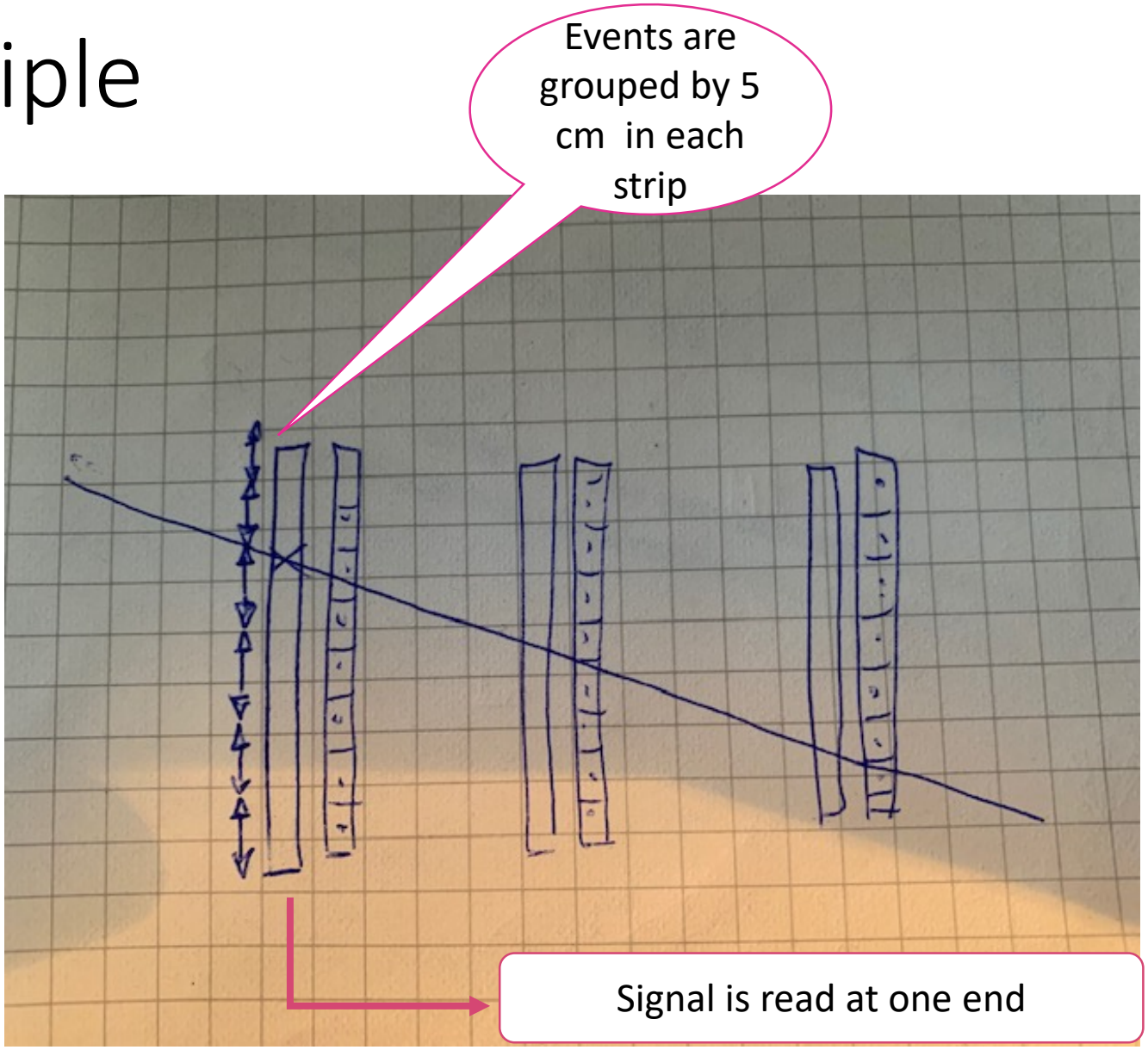
Outlook

- Fast simulation useful to understand the basic principles
- Detailed simulation (see Yannis)

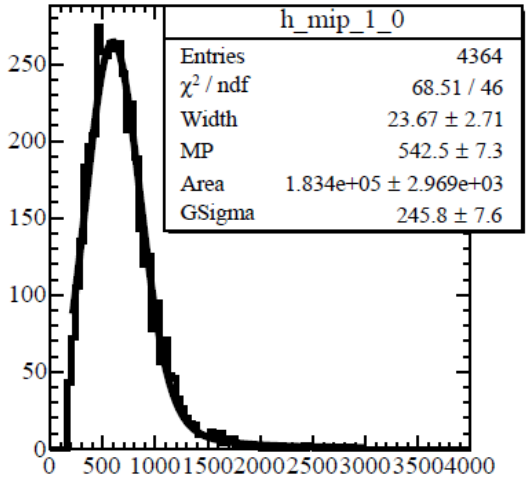
Improvement of simulation

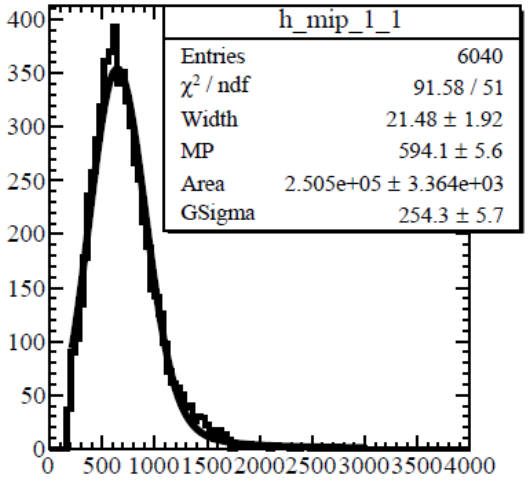
Status of Mip/attenuation studies

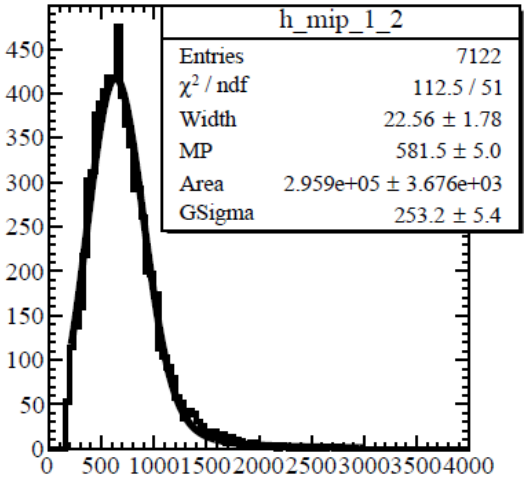
Principle

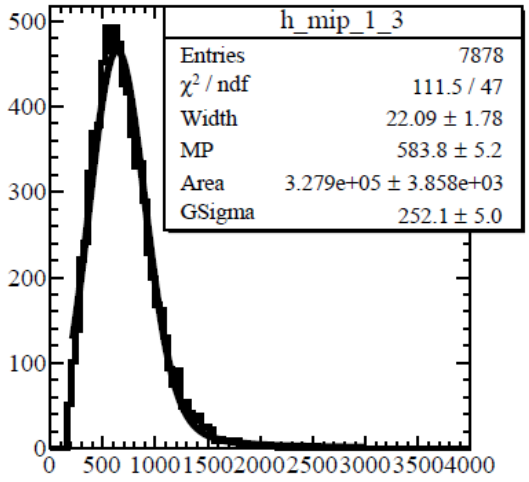

Events are grouped by 5 cm in each strip
Signal is read at one end

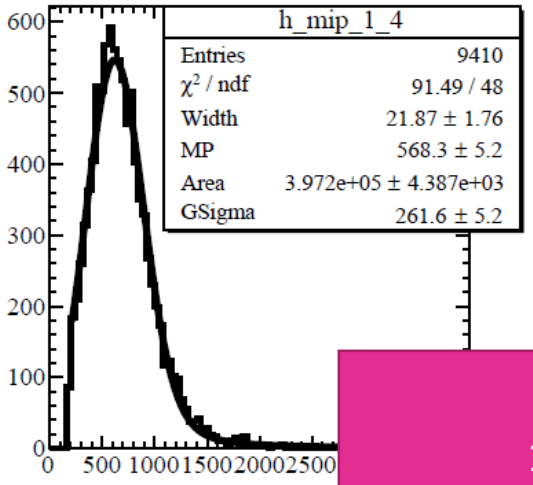
MIP distribution in 1 strip every 5 cm

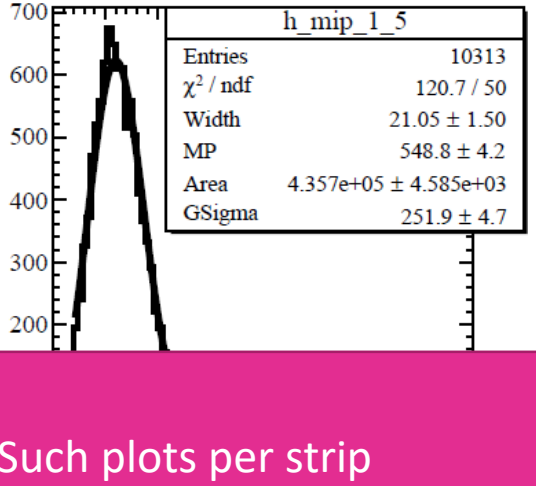




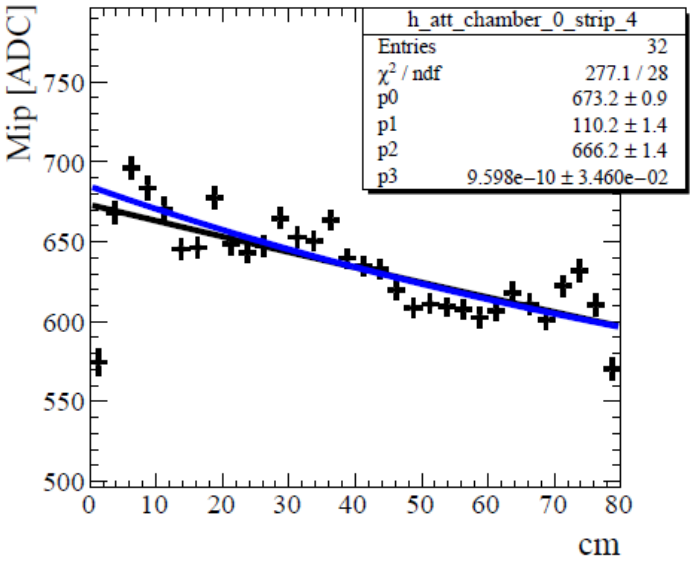


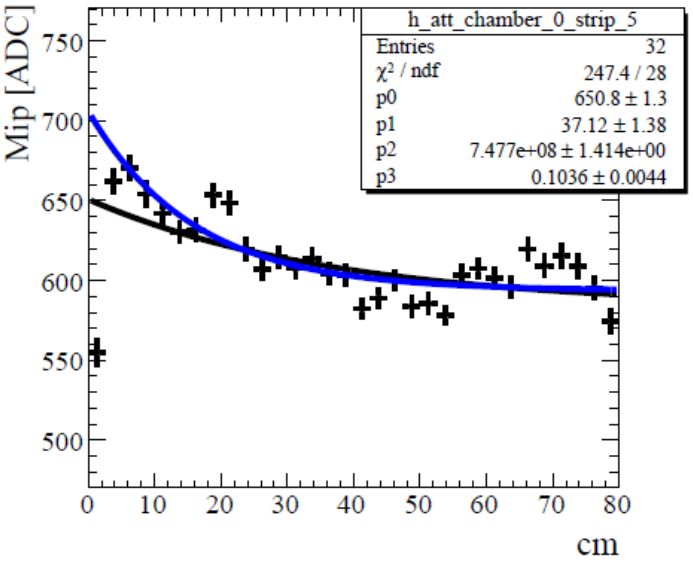


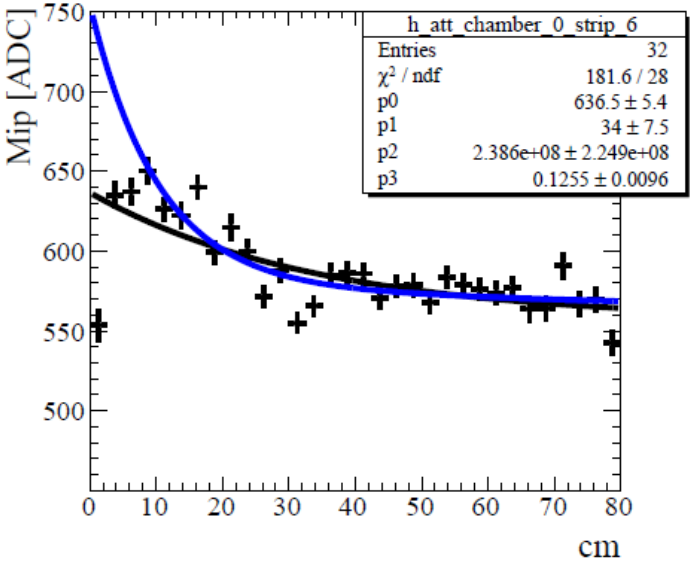


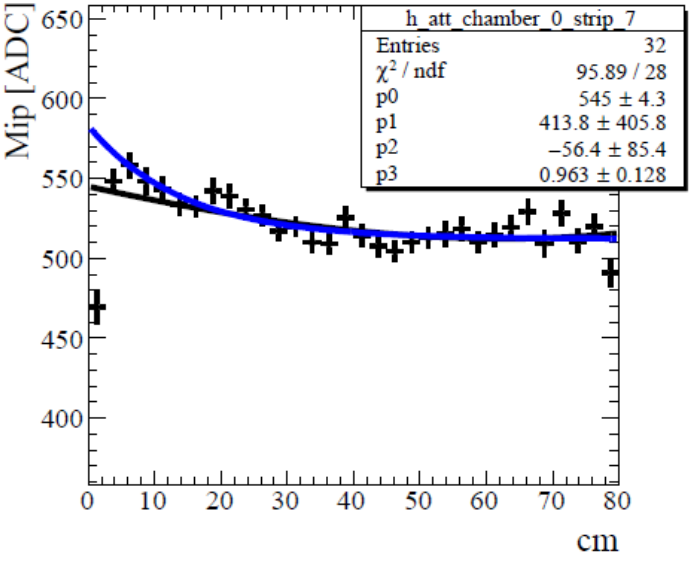


16 Such plots per strip

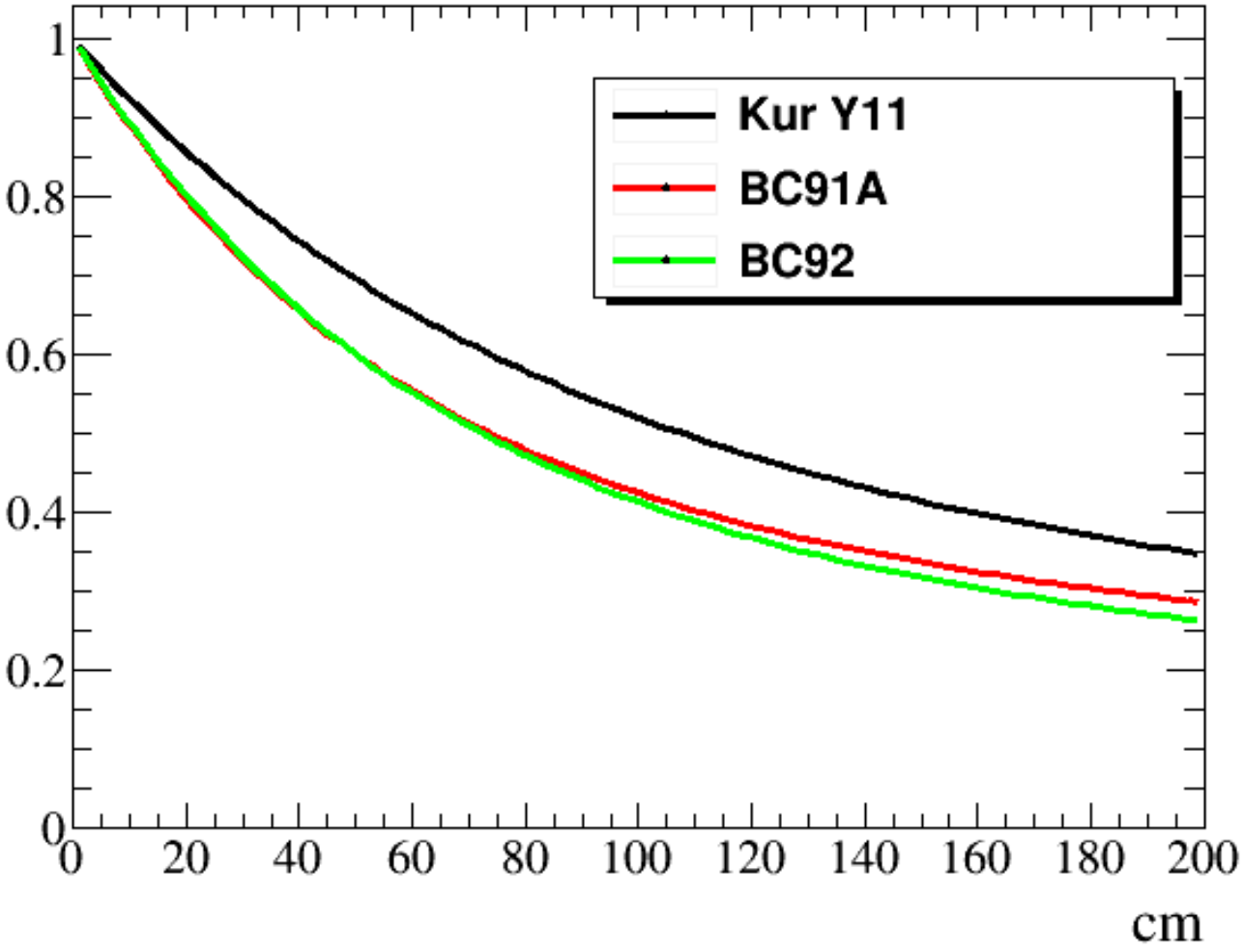

h_att_chamber_0_strip_4
Entries 32
χ² / ndf 277.1 / 28
p0 673.2 ± 0.9
p1 110.2 ± 1.4
p2 666.2 ± 1.4
p3 9.598e−10 ± 3.460e−02
Mip [ADC]
cm


h_att_chamber_0_strip_5
Entries 32
χ² / ndf 247.4 / 28
p0 650.8 ± 1.3
p1 37.12 ± 1.38
p2 7.477e+08 ± 1.414e+00
p3 0.1036 ± 0.0044
Mip [ADC]
cm


h_att_chamber_0_strip_6
Entries 32
χ² / ndf 181.6 / 28
p0 636.5 ± 5.4
p1 34 ± 7.5
p2 2.386e+08 ± 2.249e+08
p3 0.1255 ± 0.0096
Mip [ADC]
cm


h_att_chamber_0_strip_7
Entries 32
χ² / ndf 95.89 / 28
p0 545 ± 4.3
p1 413.8 ± 405.8
p2 −56.4 ± 85.4
p3 0.963 ± 0.128
Mip [ADC]
cm

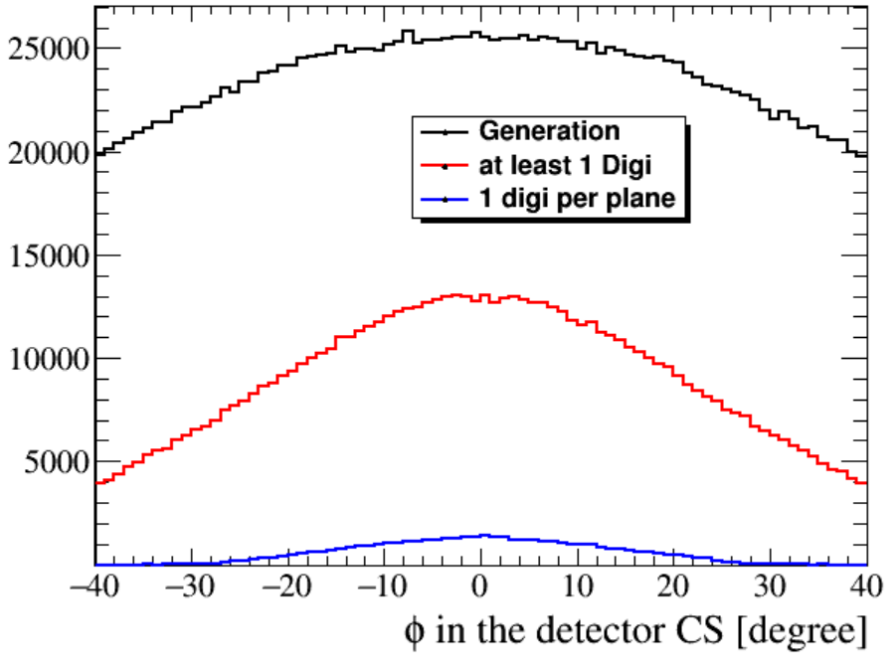
Attenuation from the spec.

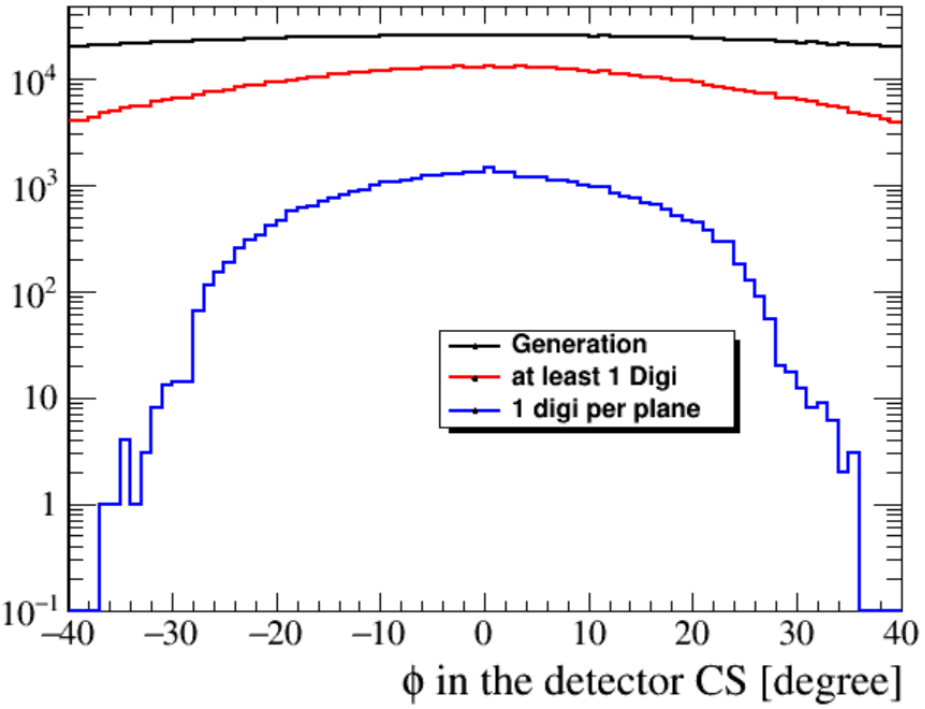


On going work

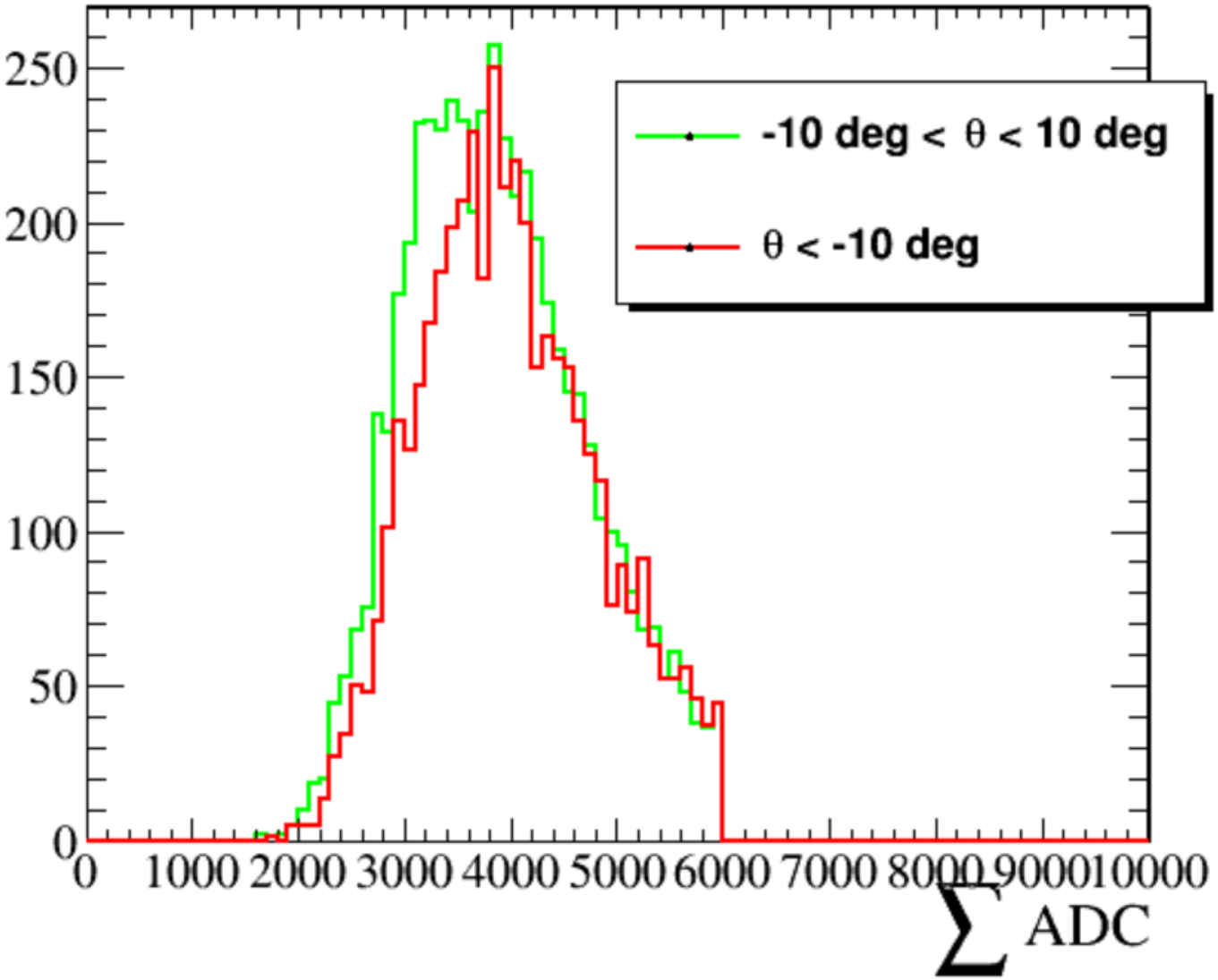
Generated phi :

1 strip/plane seems to create the cut-off

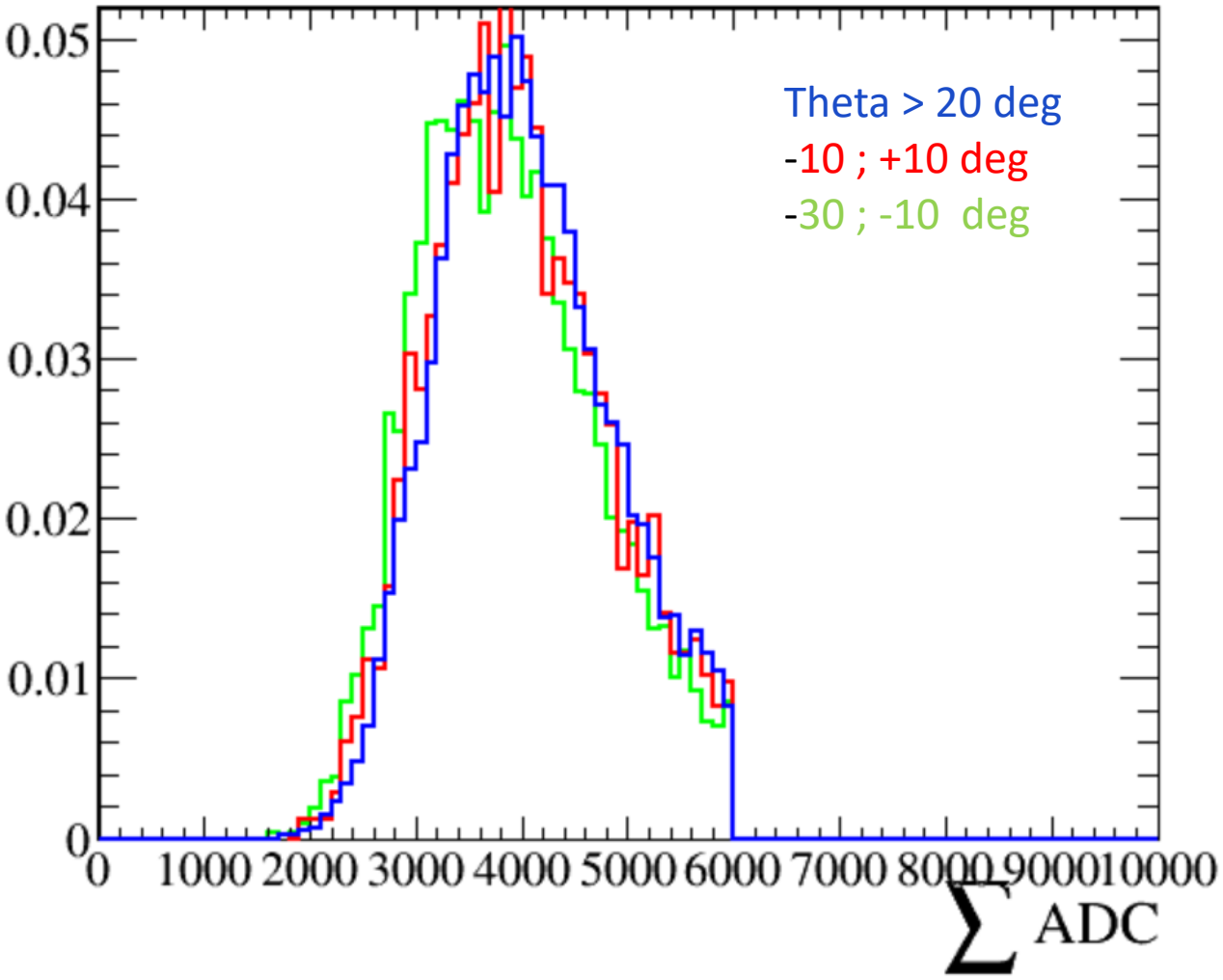




Etot distribution

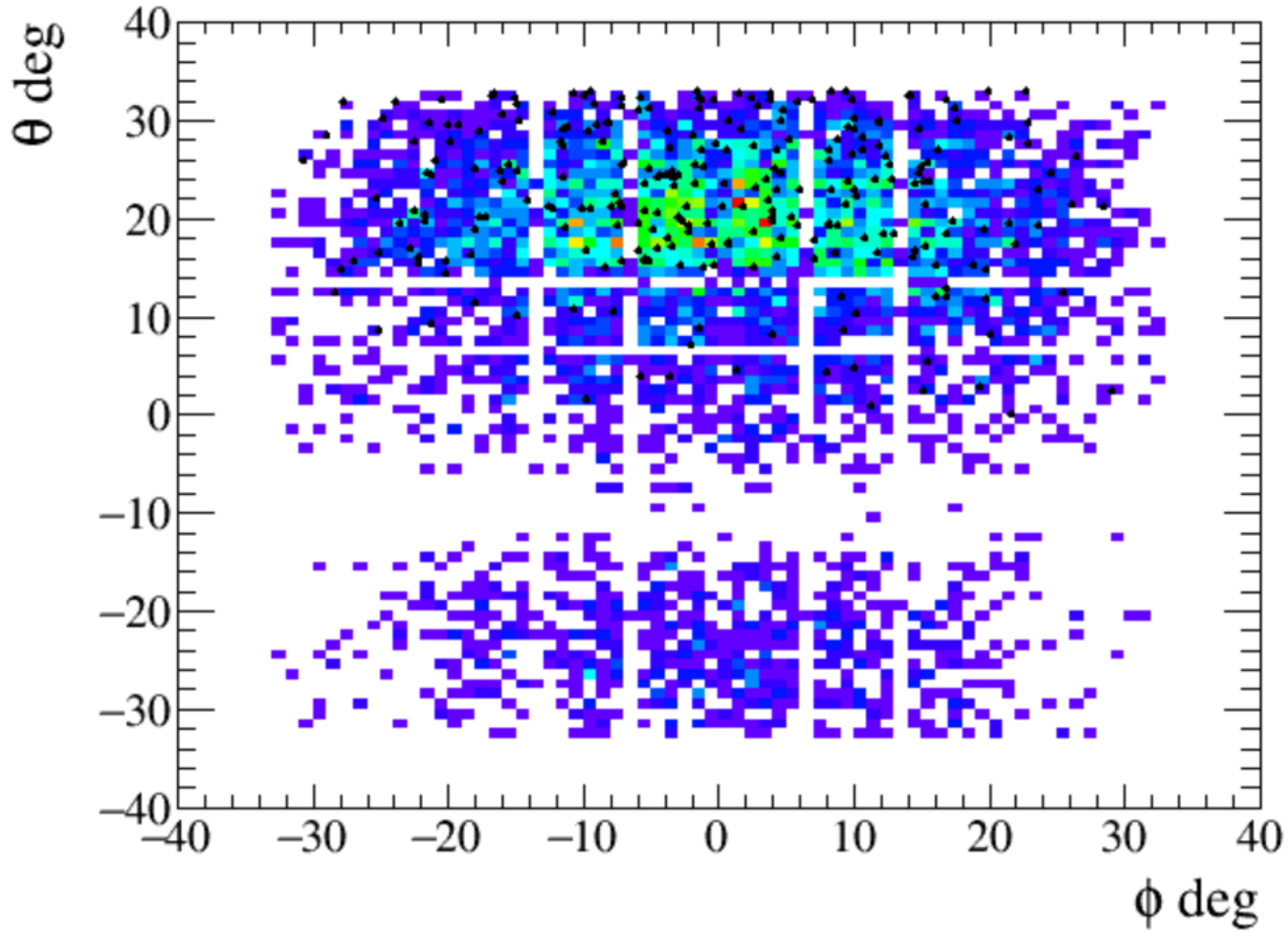


Normalized

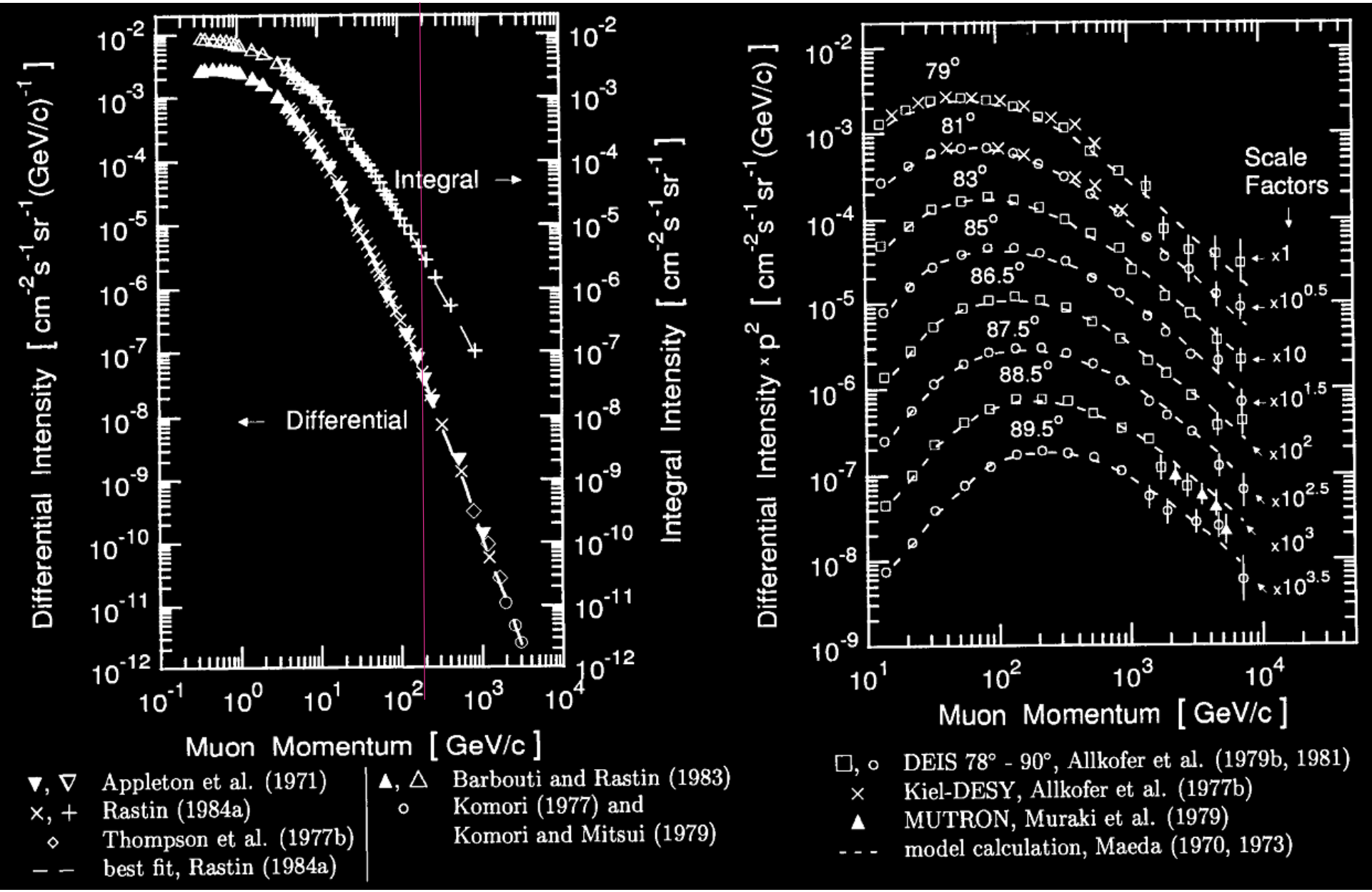

0.05
0.04
0.03
0.02
0.01
0
0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000
∑ ADC
Theta > 20 deg
-10 ; +10 deg
-30 ; -10 deg

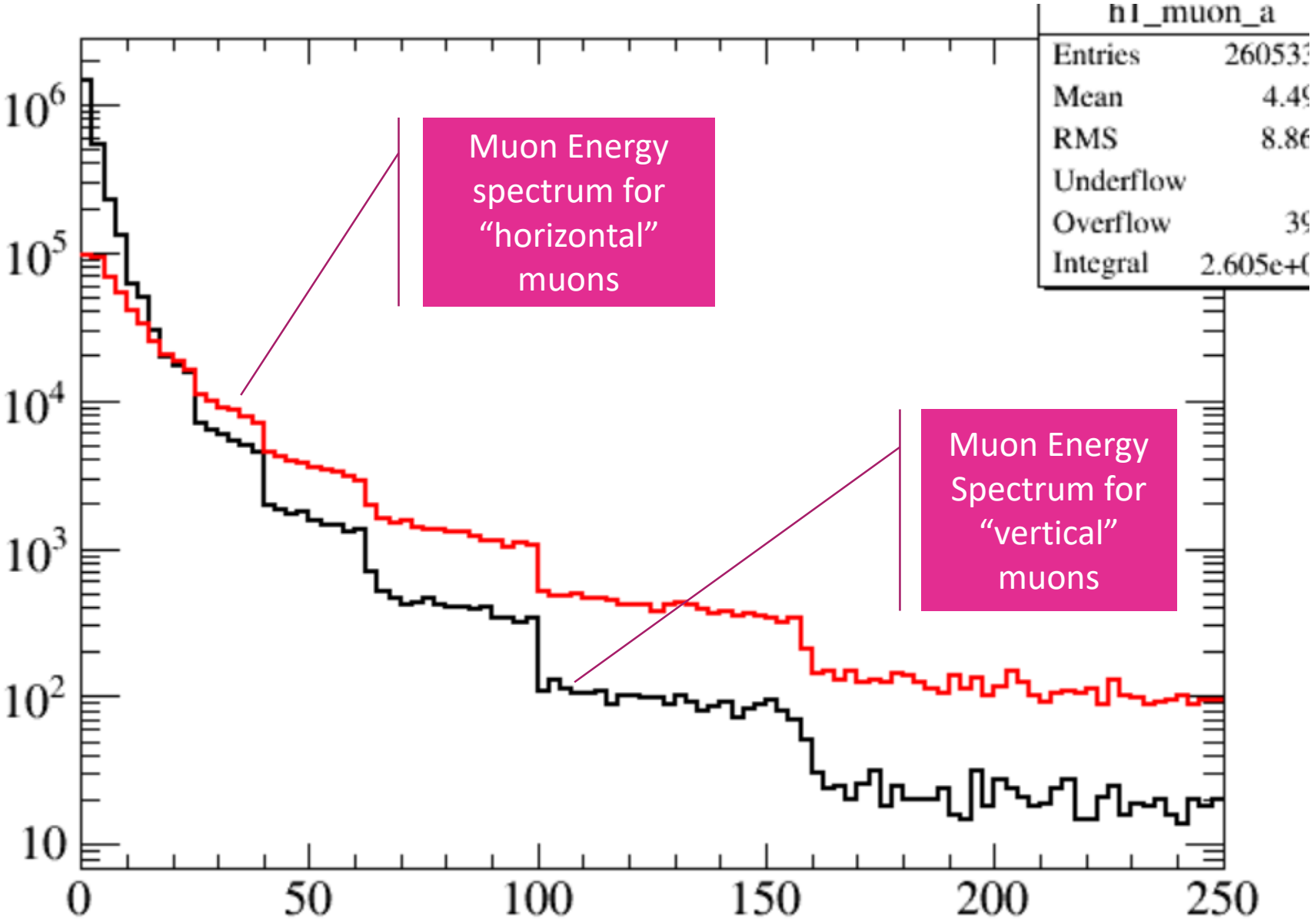
Backup

Phase space corresponding to the first strip in the first layer



http://www.cloudylabs.fr/wp/muonsphys/




h1_muon_a
Entries 260533
Mean 4.49
RMS 8.86
Underflow
Overflow 39
Integral 2.605e+0
Muon Energy spectrum for "horizontal" muons
Muon Energy Spectrum for "vertical" muons
10^6
10^5
10^4
10^3
10^2
10
0
50
100
150
200
250

Generator : CRY