Particle Identification & Momentum Resolution

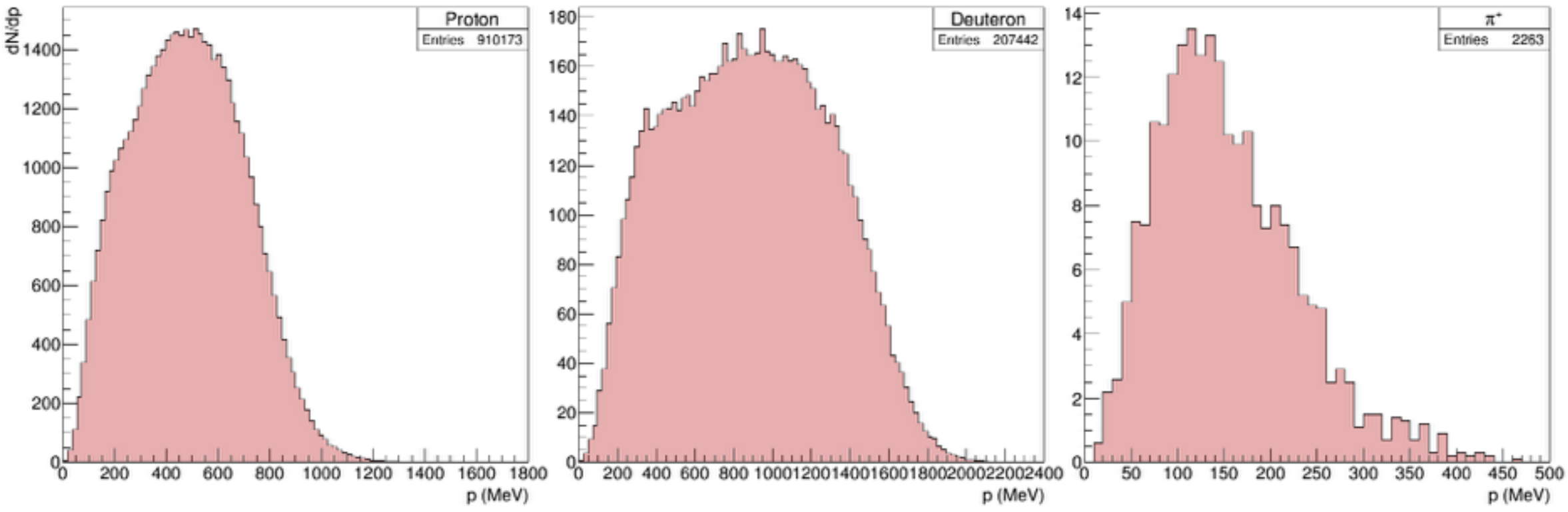
Step

1. Get momentum distribution of particles.
2. MC simulation with given range of momentum.
3. Apply dE/dx resolution.
4. Apply Momentum resolution.

Momentum Distribution

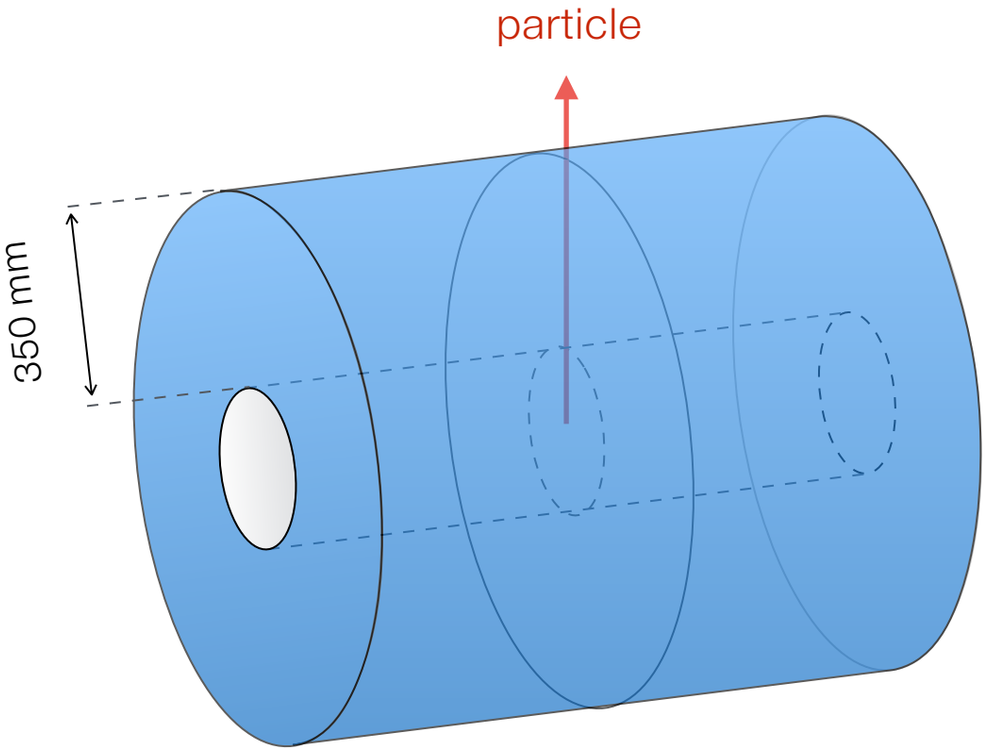
IQMD AuAu 250 MeV/u Soft Model.

Proton (~33%) Deuteron (~7%) π^+ (~1%)



MC Simulation

Ar/CO_2 (90/10) Gas



1. Fixed drift length = 350 mm

2. Random momentum distribution from IQMD data. (previous slide)

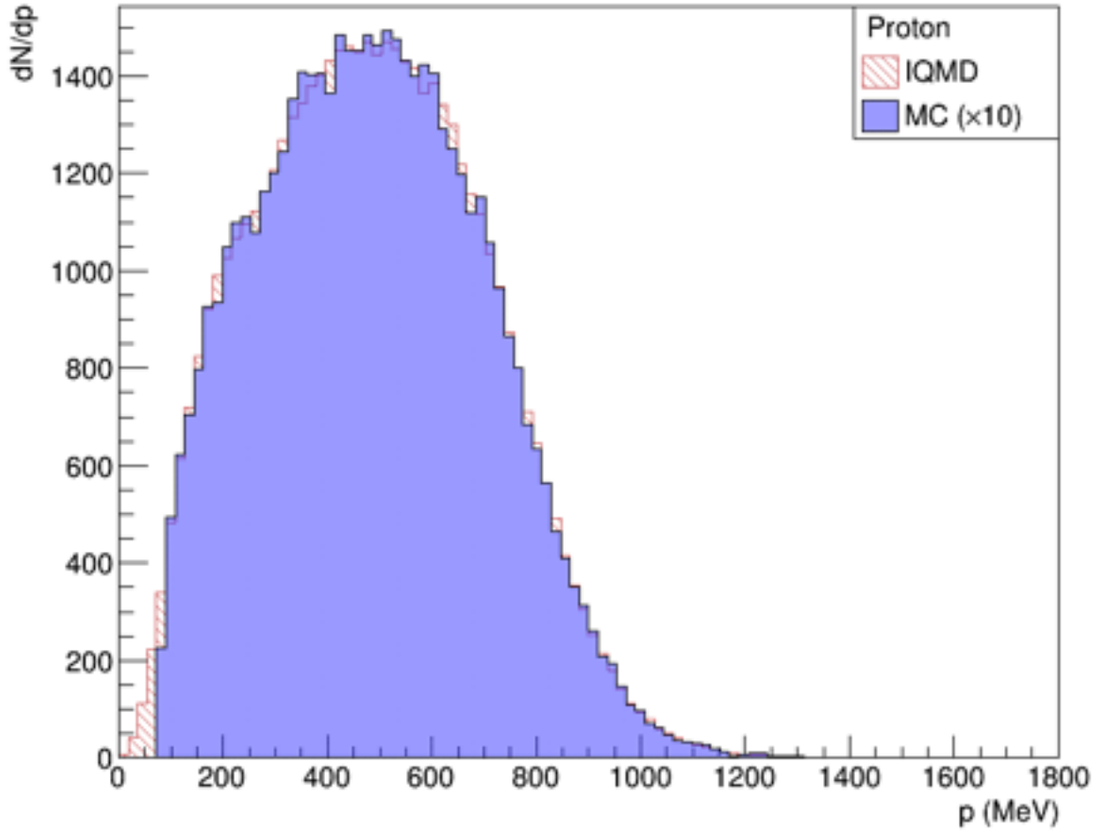
3. Event number, proportional to IQMD data. (previous slide)

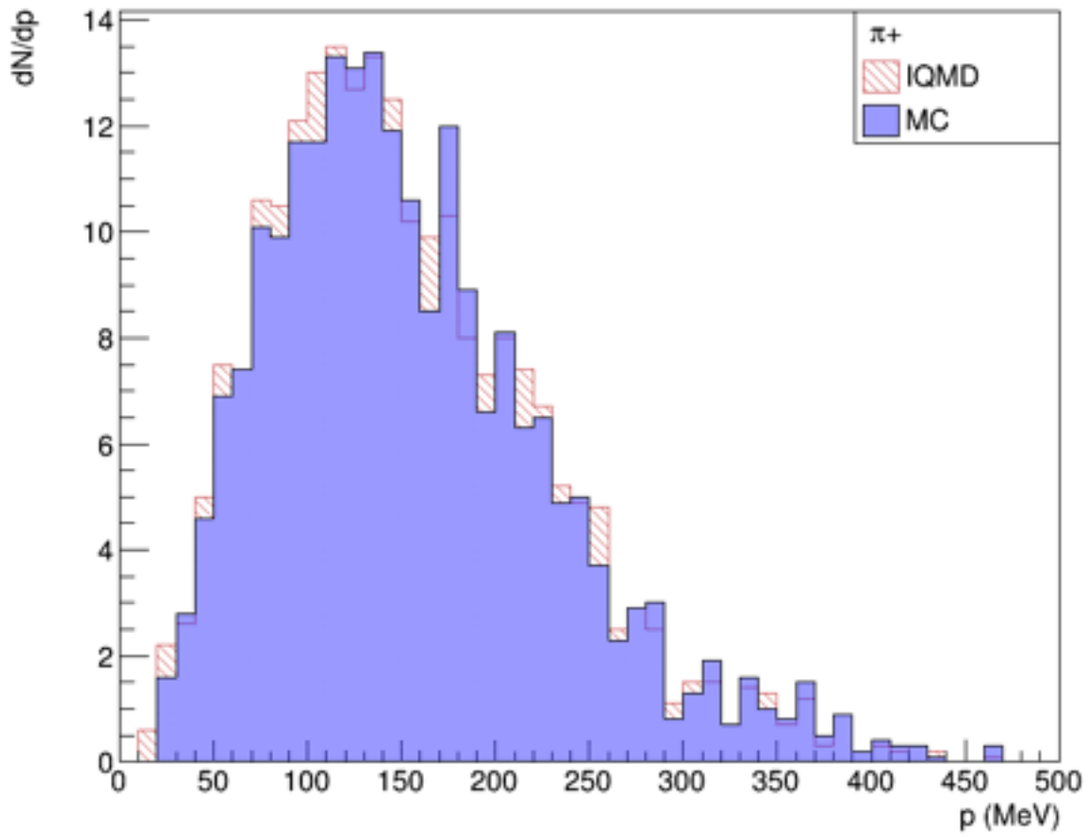
Momentum Distribution

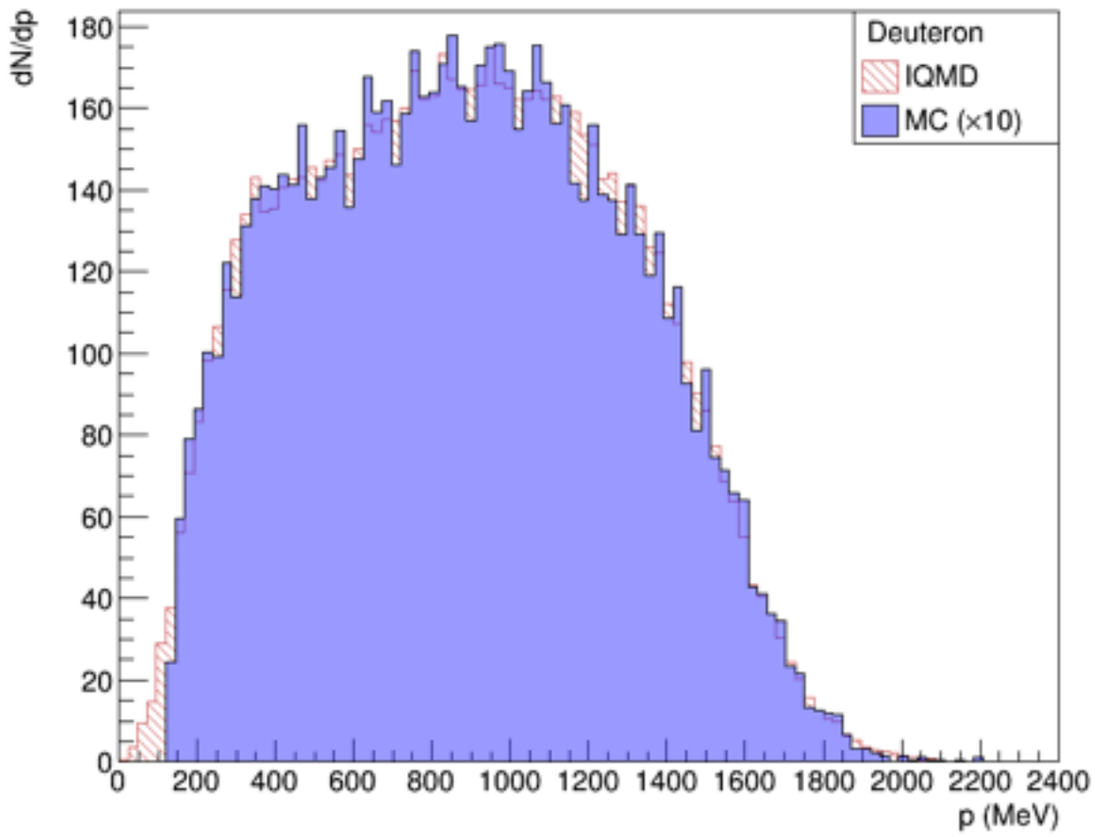
from

"IQMD Data"

"MC Simulation"





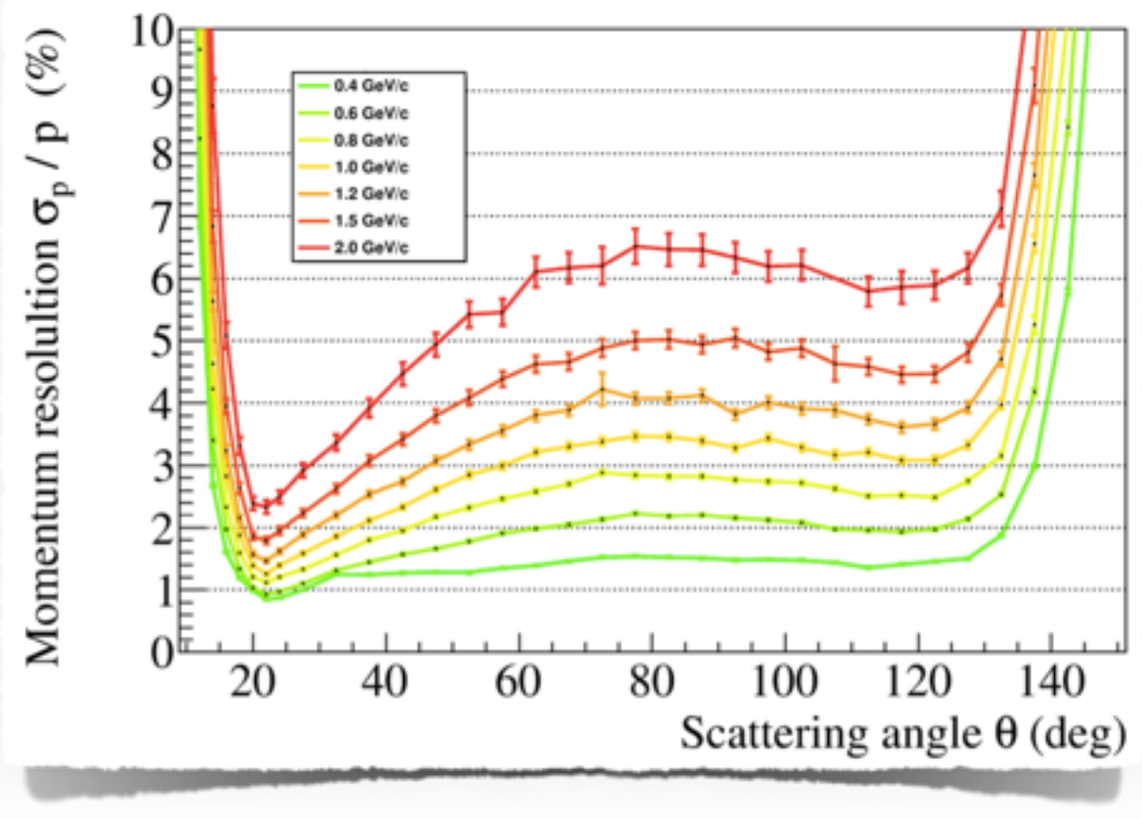


Resolution

$$\text{Resolution of } x = \frac{\sigma_x}{x}$$

Energy resolution at PANDA found to be always better than ~10%.

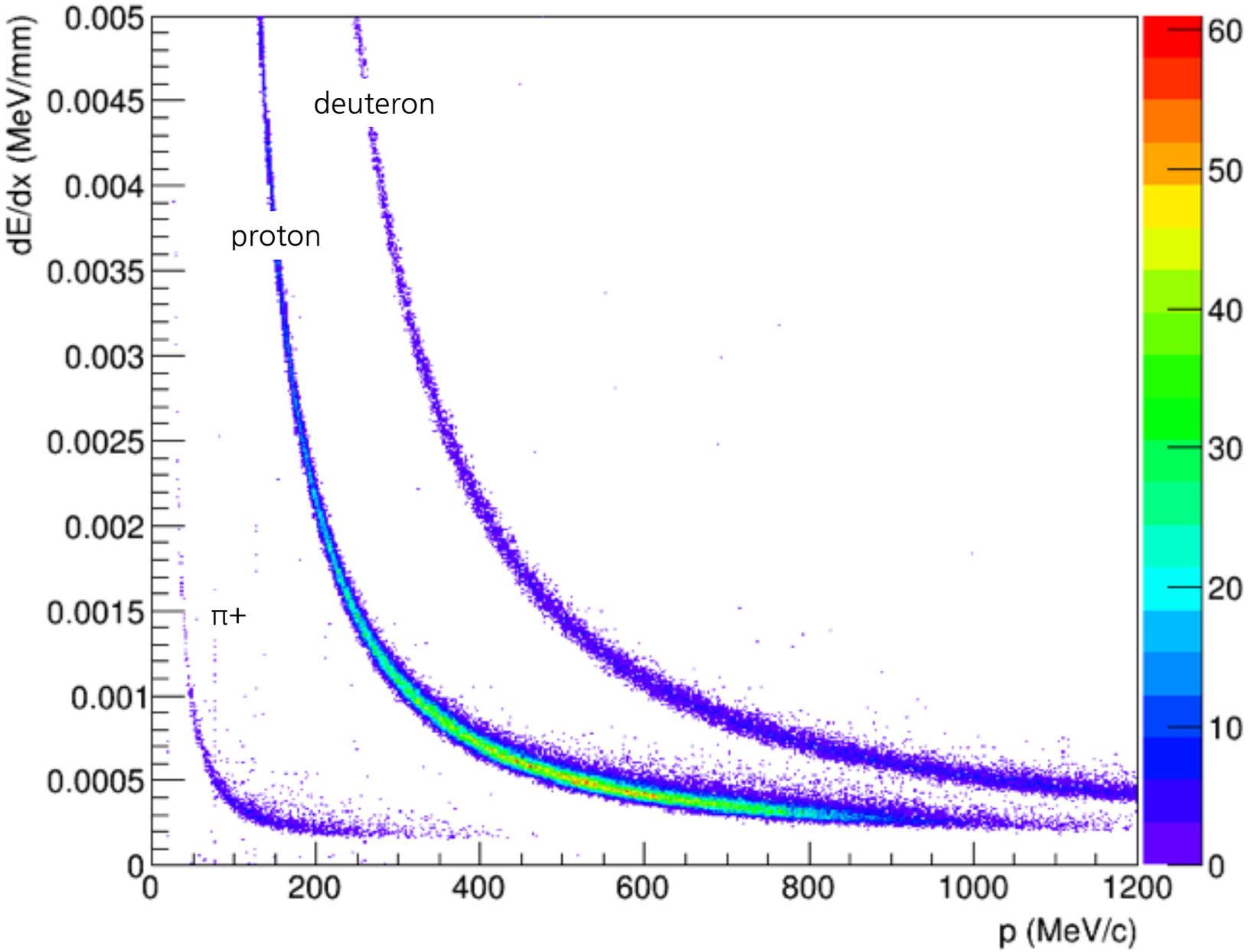
Momentum resolution :



Technical Design Report for PANDA Experiment
PANDA Collaboration (August 29, 2011)

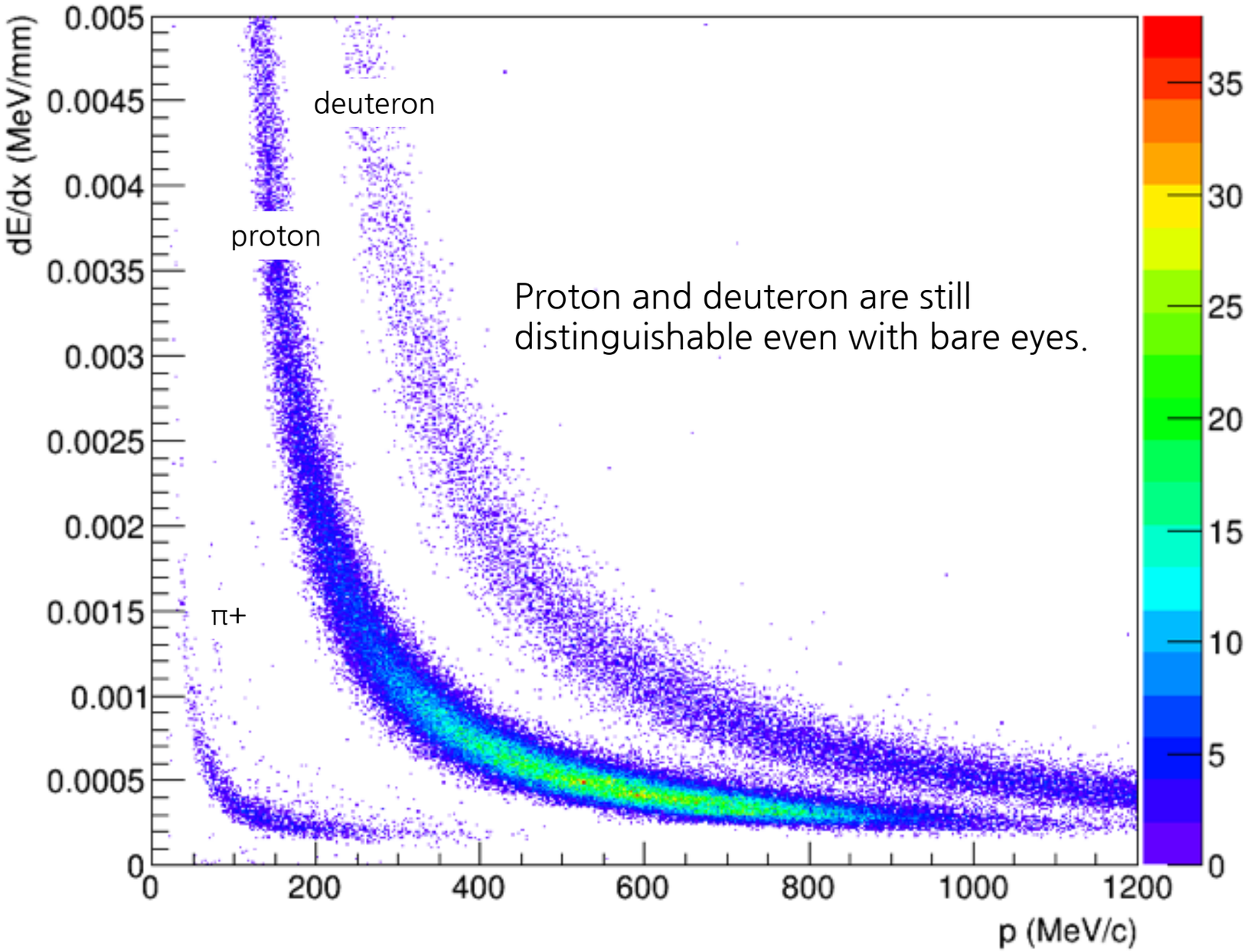
dE/dx Plot

Perfect Resolution
(no secondary particle hits collected)



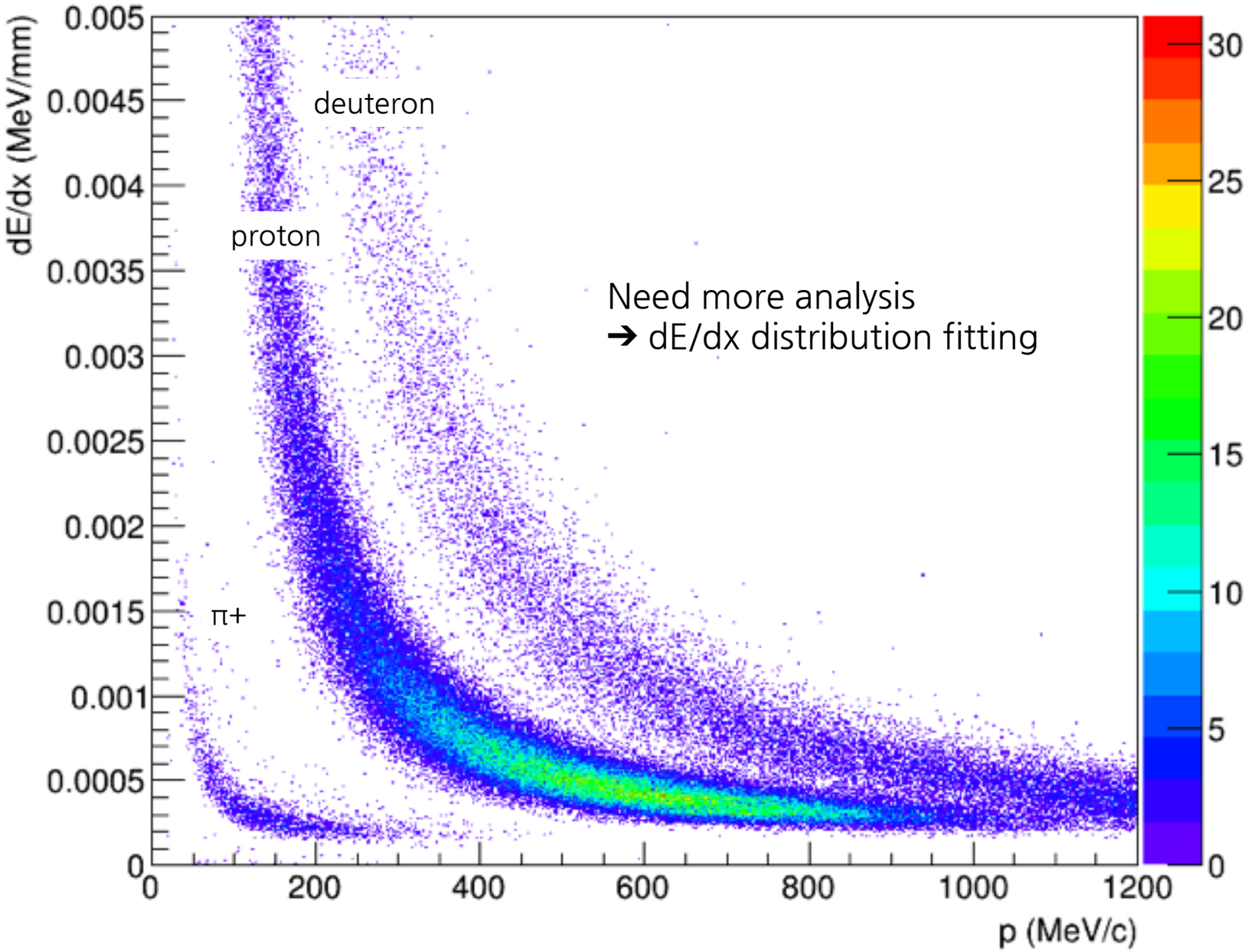
dE/dx Plot

Energy Resolution : 10%
Momentum Resolution : 5 %



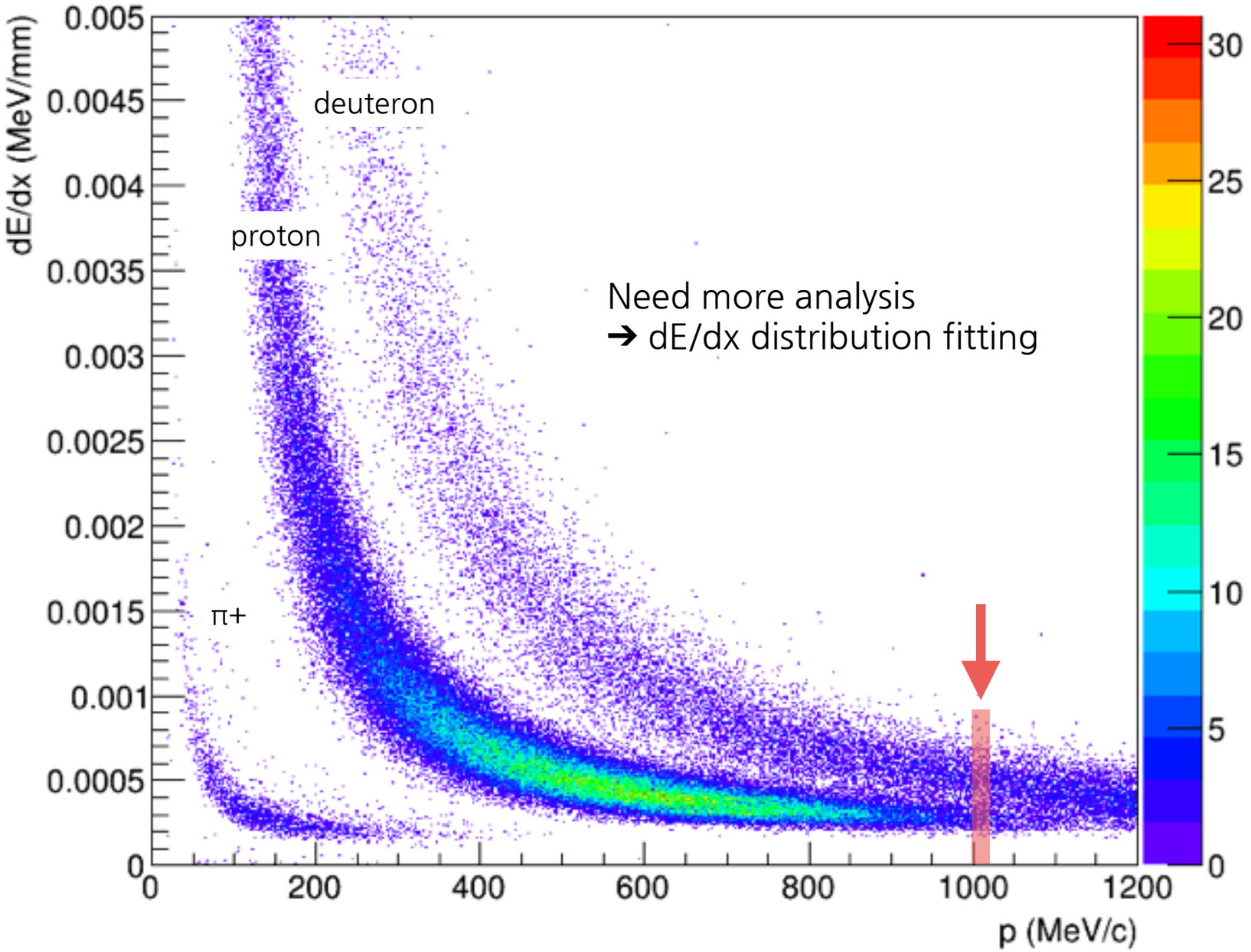
dE/dx Plot

Energy Resolution : 10%
Momentum Resolution : 10 %



dE/dx Plot

Energy Resolution : 10%
Momentum Resolution : 10 %

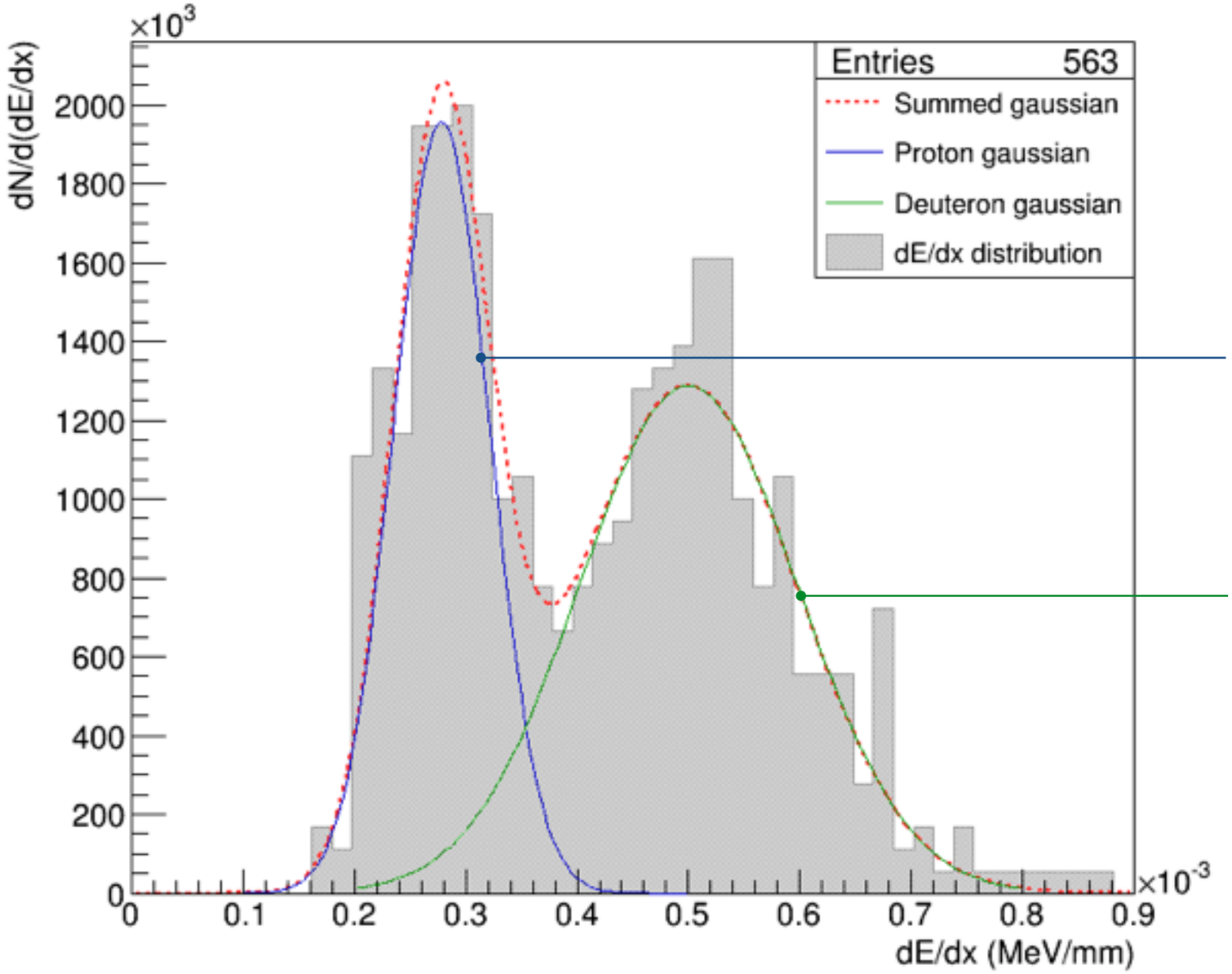


dE/dx Projection

Energy Resolution : 10%

Momentum Resolution : 10 %

Momentum Range (MeV) : 1000 < p < 1020



Proton

Mean : 0.278×10^{-3}

Sigma : 0.043×10^{-3}

Resolution : 15.5 %

Deuteron

Mean : 0.500×10^{-3}

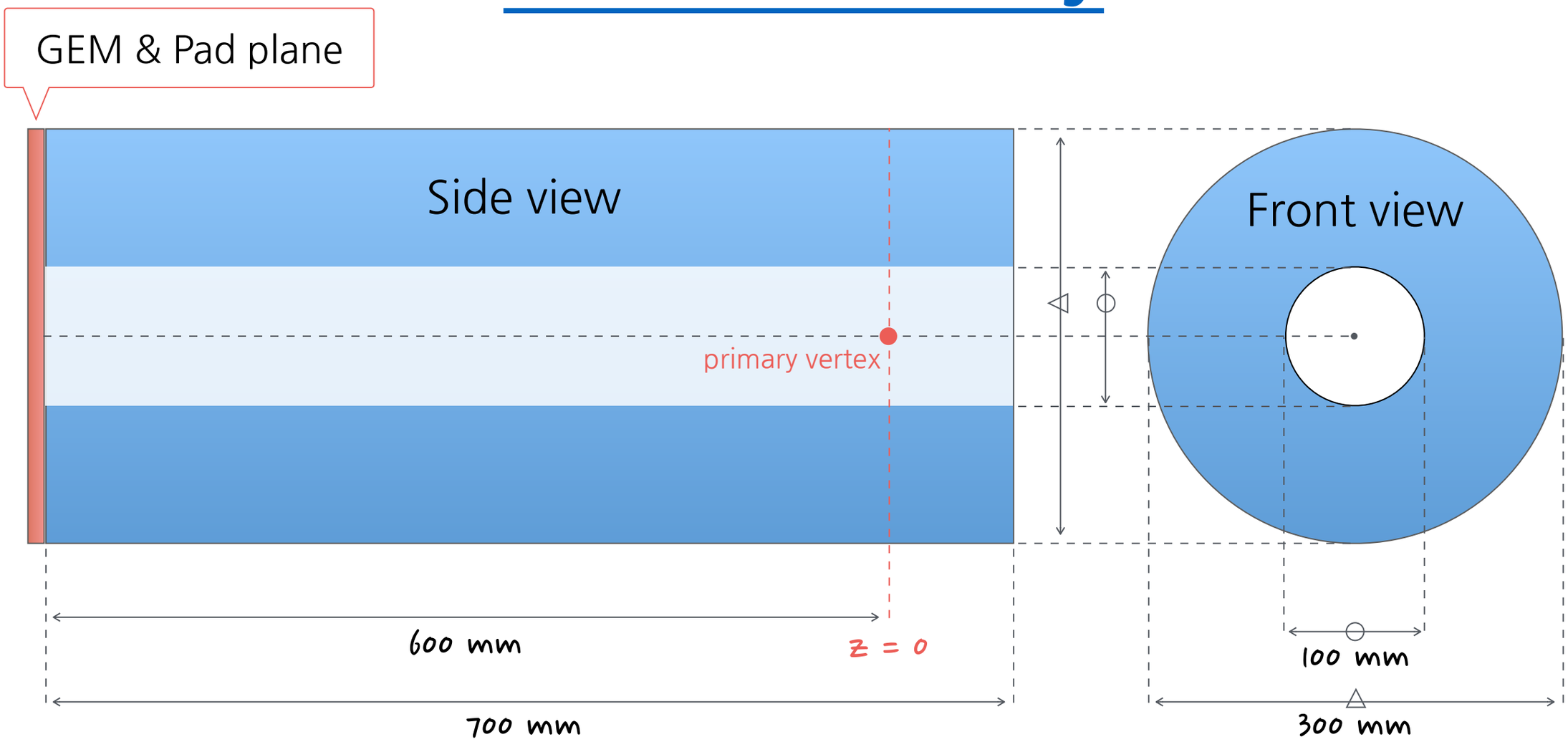
Sigma : 0.098×10^{-3}

Resolution : 19.6 %

FOPIROOT

prototype

TPC Geometry



FOPIROOT

DIGI Macro

FOPI macro	Modified
extracted z < 0 data	included z < 0 data
drift length = z	drift length = z - zGem

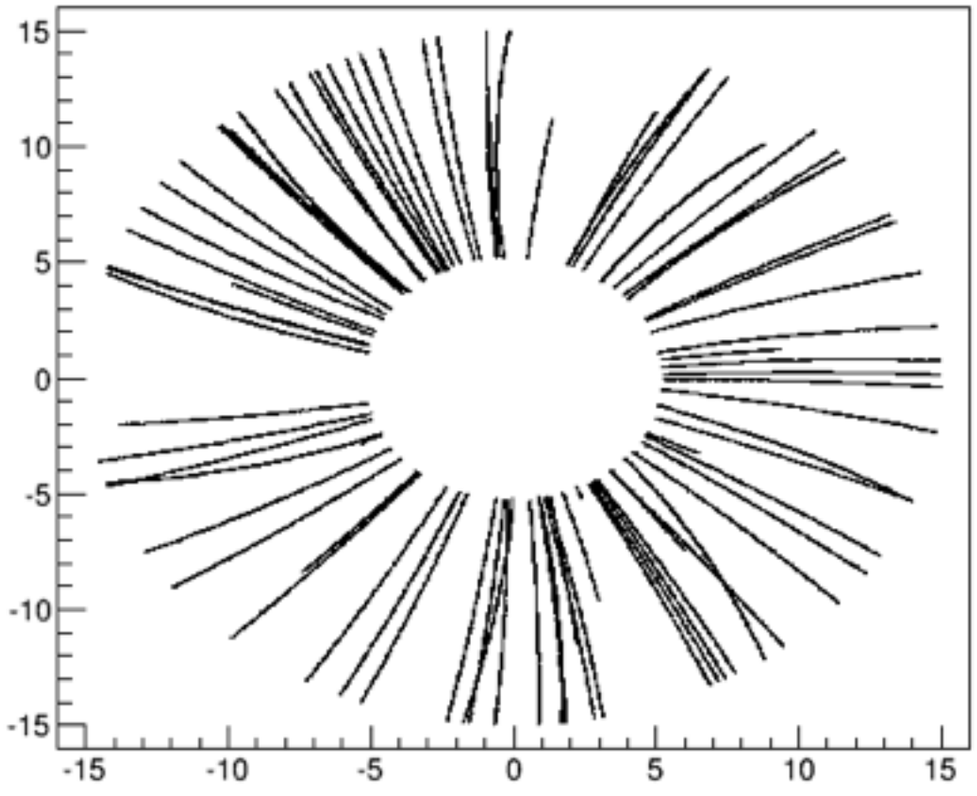
Proton(#100)
200 MeV, Random angle, 0.5 T(z)

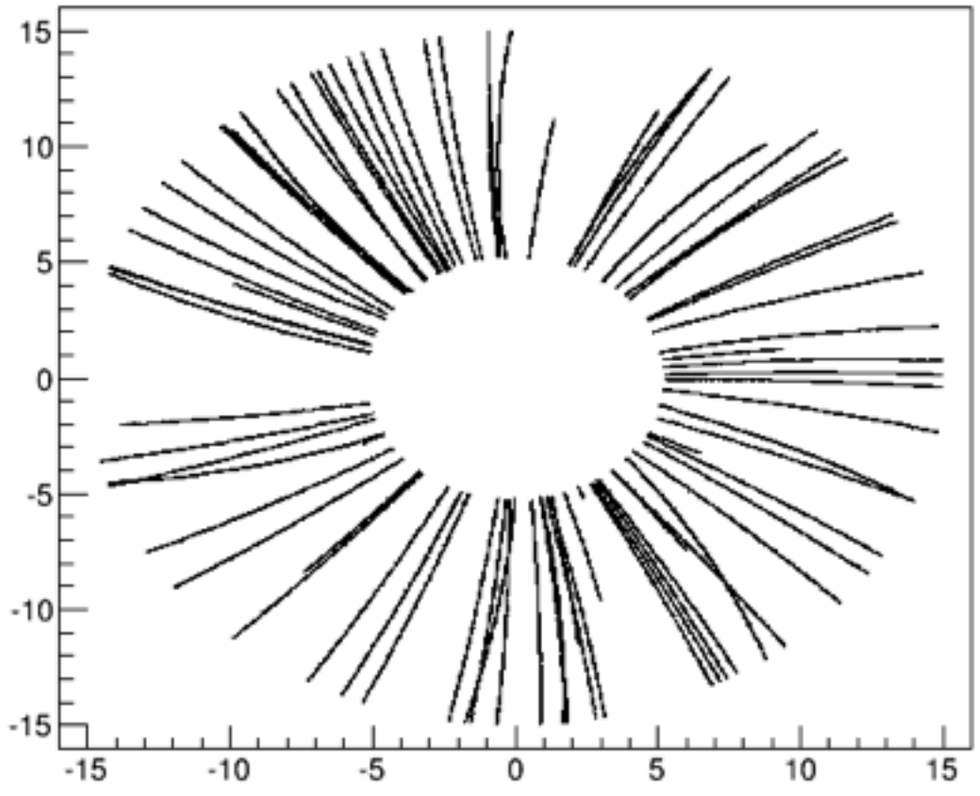
FOPIROOT

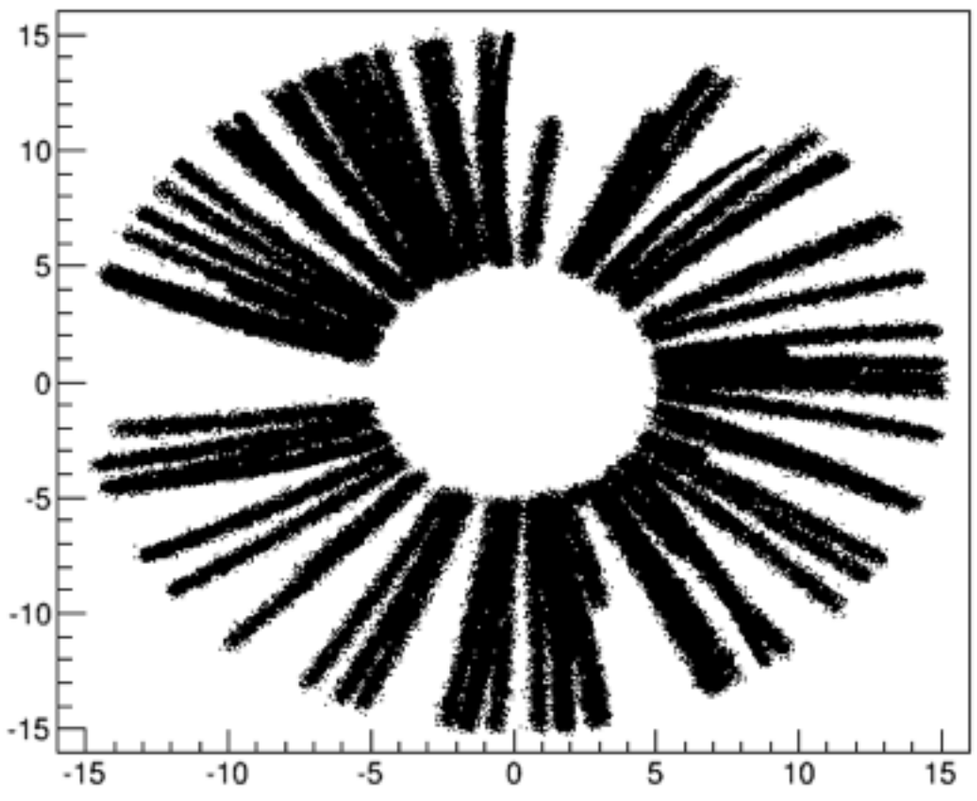
DIGI Tasks

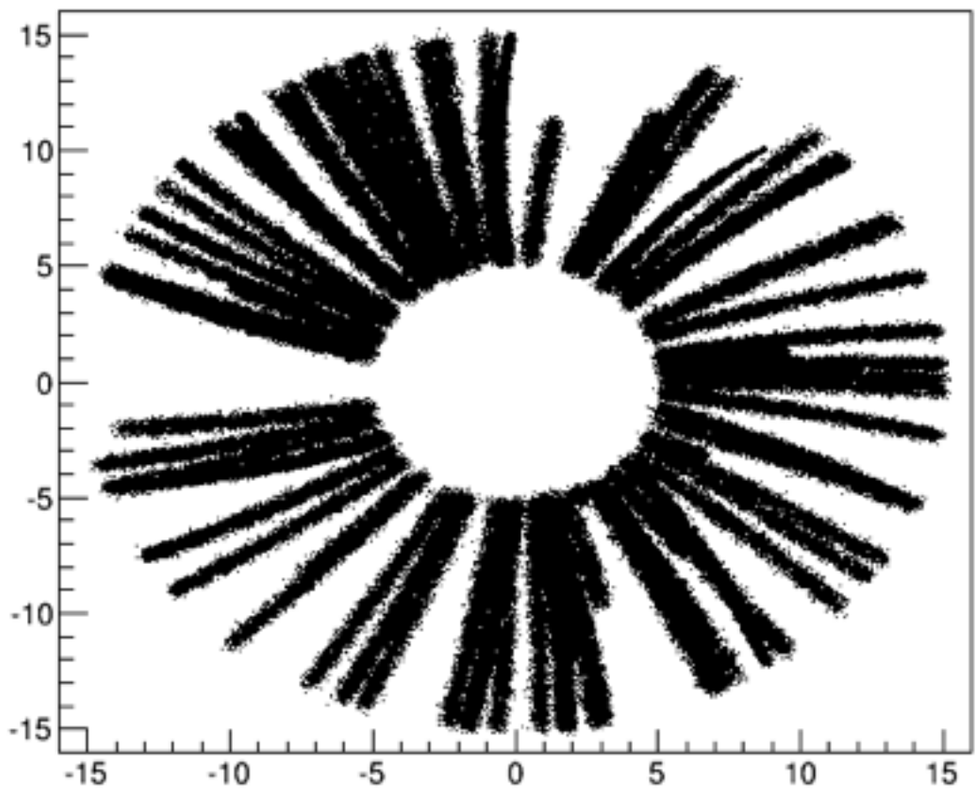
Task	Data Set
MC	TpcPoint
TpcClusterizerTask	TPcPrimaryCluster
TpcDriftTask	TpcDrifedElectron
TpcGemTask	TpcAvalanche
TpcPadResponseTask	TpcSignal
TpcElectronicsTask	TpcDigi

ROOT Geo.

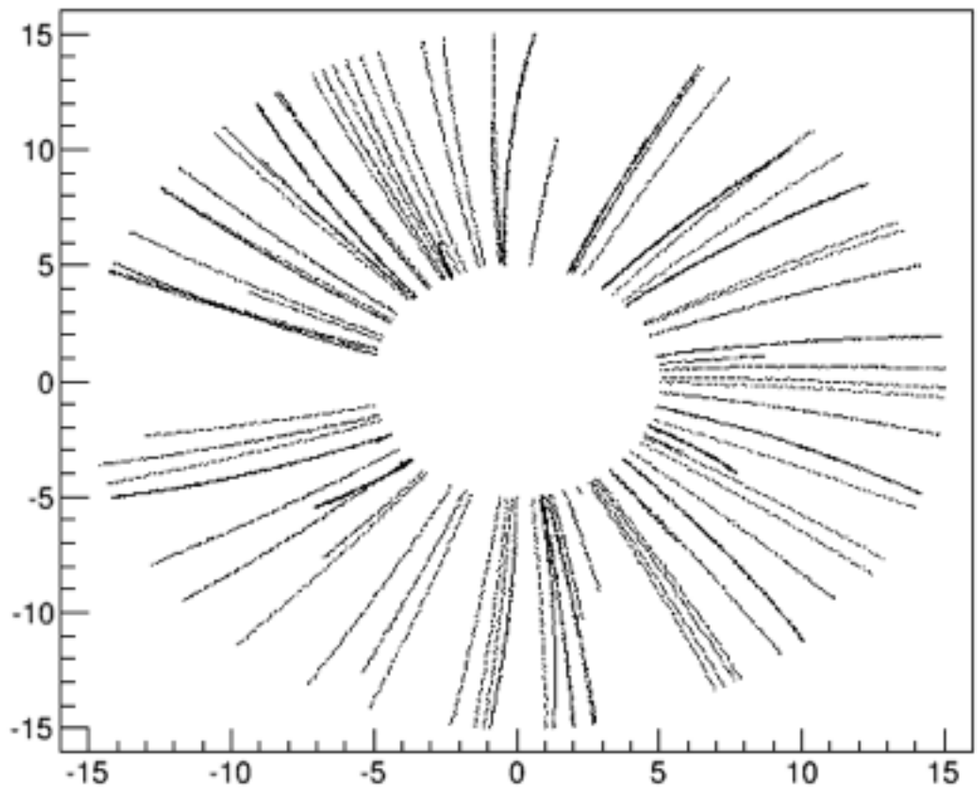

TpcPoint x vs y (MC)
15
10
5
0
-5
-10
-15
-15
-10
-5
0
5
10
15

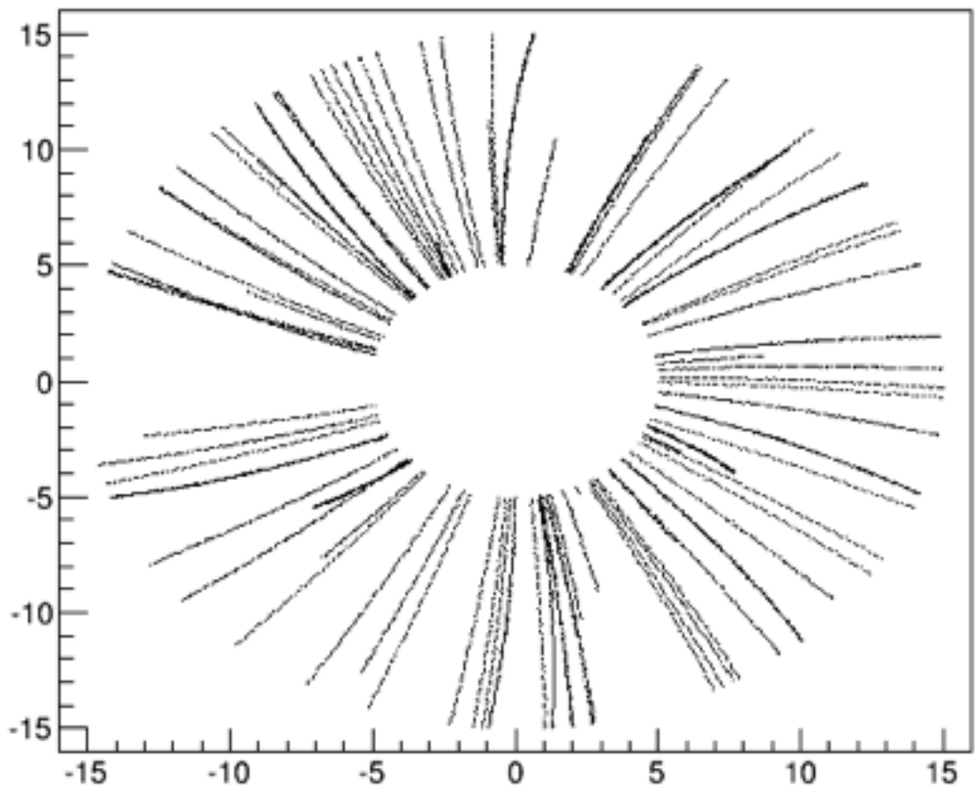

TpcPrimaryCluster.pos x vs y
15
10
5
0
-5
-10
-15
-15
-10
-5
0
5
10
15

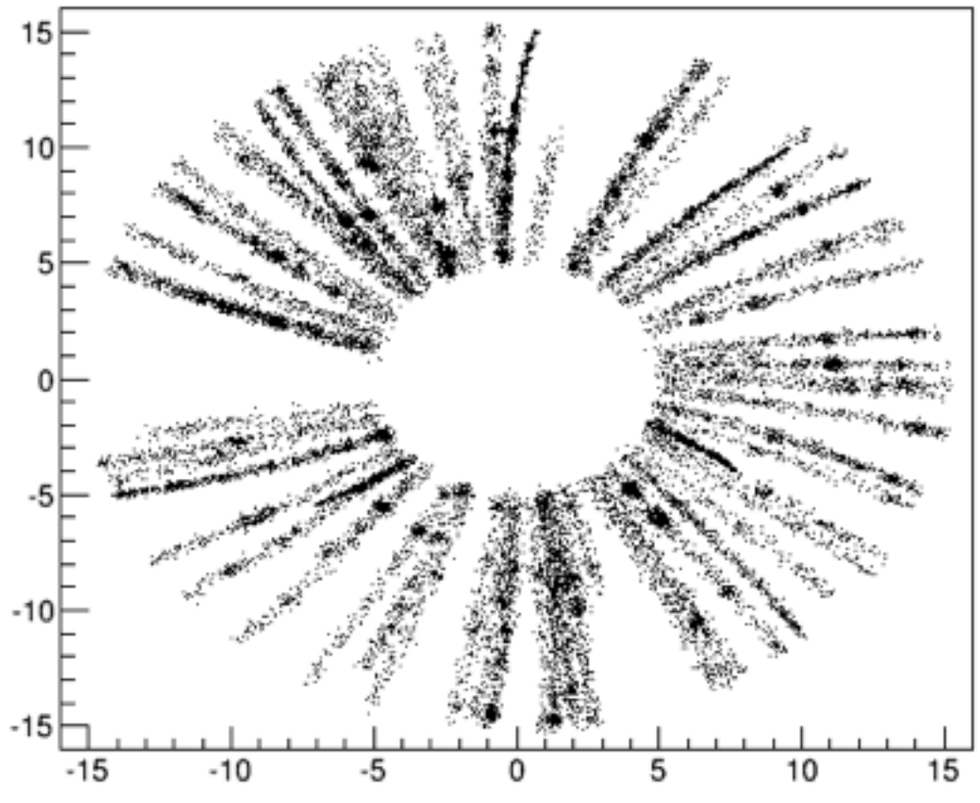

TpcDriftedElectron x vs y
15
10
5
0
-5
-10
-15
-15
-10
-5
0
5
10
15

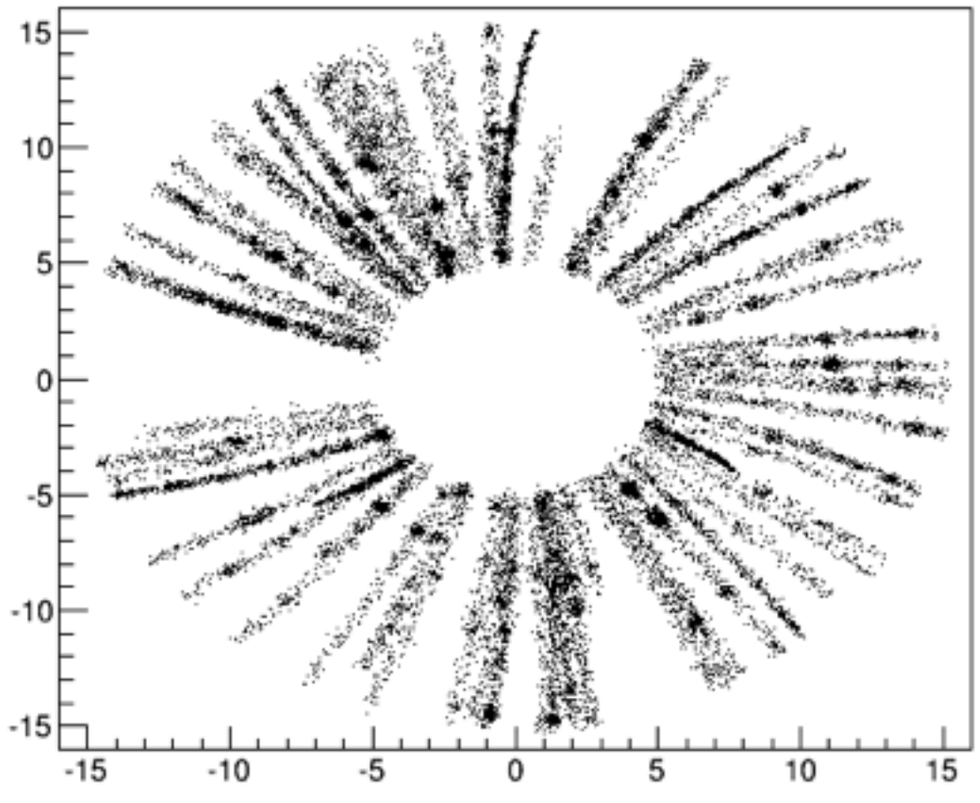

TpcAvalanche x vs y
15
10
5
0
-5
-10
-15
-15
-10
-5
0
5
10
15

Ascii Geo.

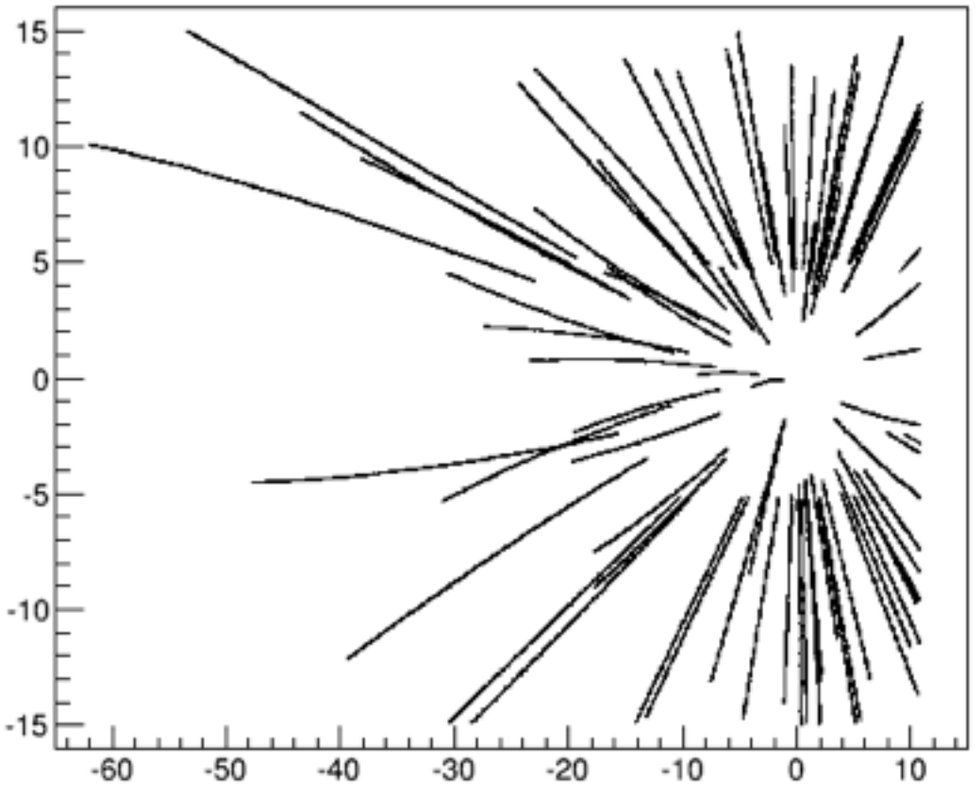

TpcPoint x vs y (MC)
15
10
5
0
-5
-10
-15
-15
-10
-5
0
5
10
15

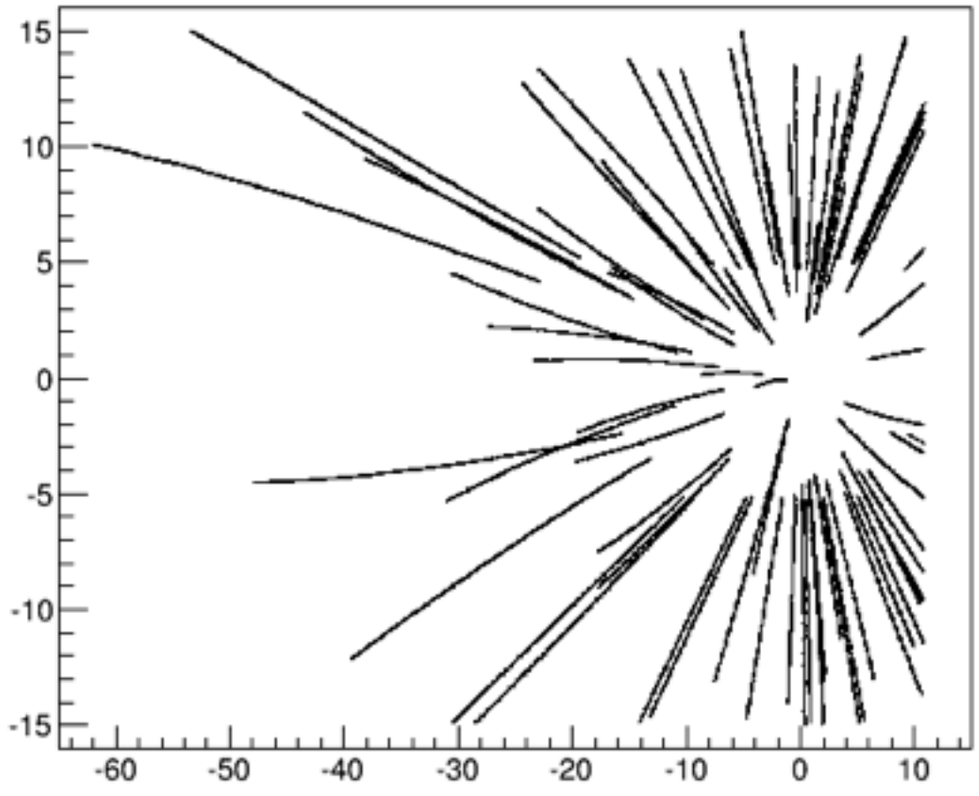

TpcPrimaryCluster.pos x vs y
15
10
5
0
-5
-10
-15
-15
-10
-5
0
5
10
15

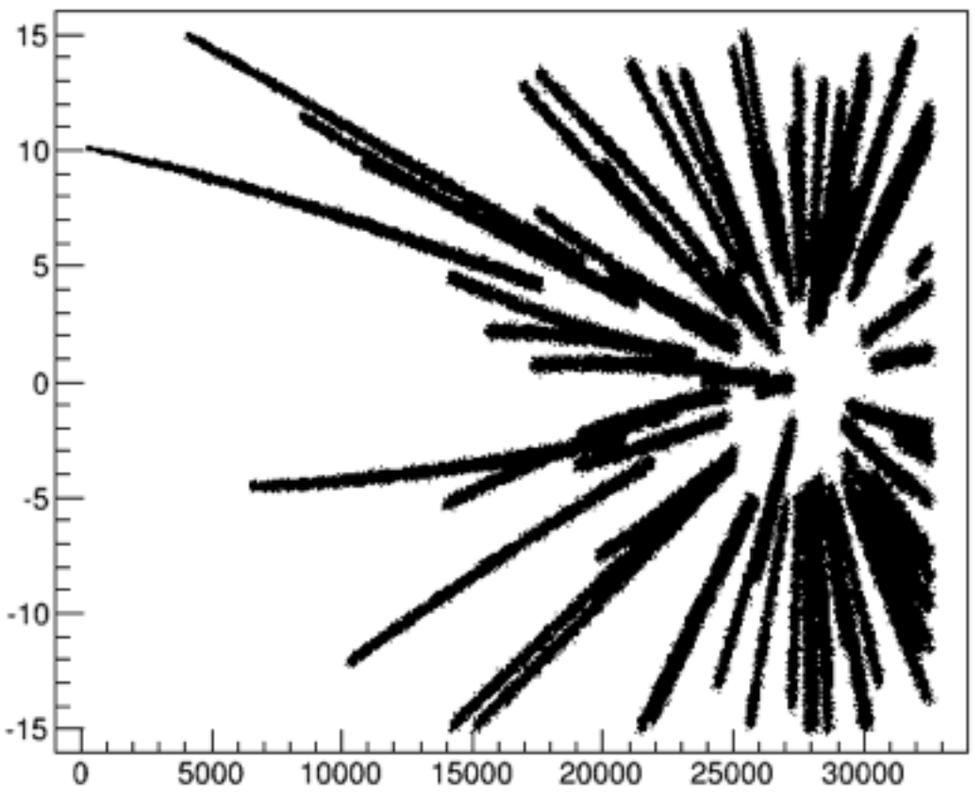

TpcDriftedElectron x vs y
15
10
5
0
-5
-10
-15
-15
-10
-5
0
5
10
15

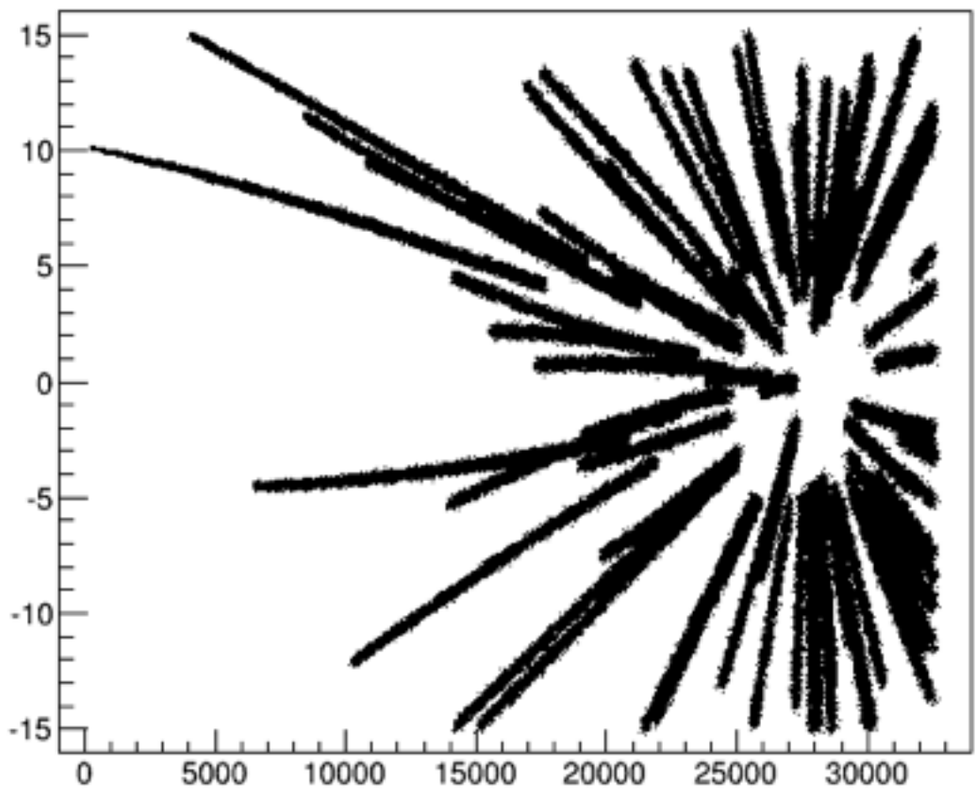

TpcAvalanche x vs y
15
10
5
0
-5
-10
-15
-15
-10
-5
0
5
10
15

ROOT Geo.

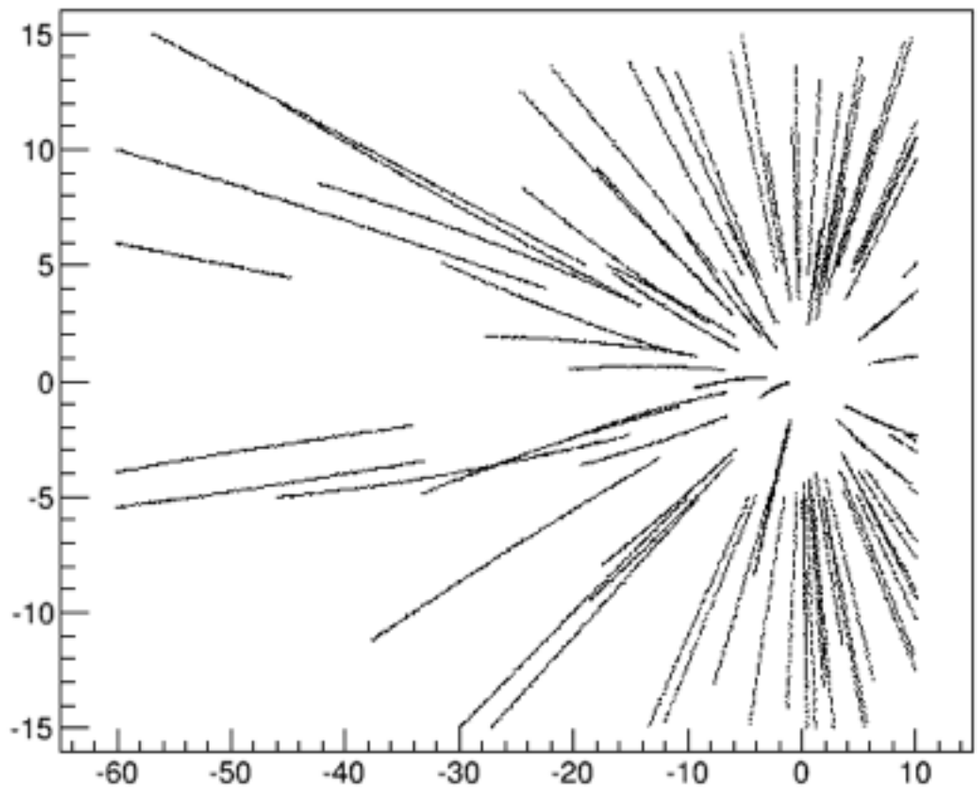

TpcPoint z vs y (MC)
15
10
5
0
-5
-10
-15
-60
-50
-40
-30
-20
-10
0
10

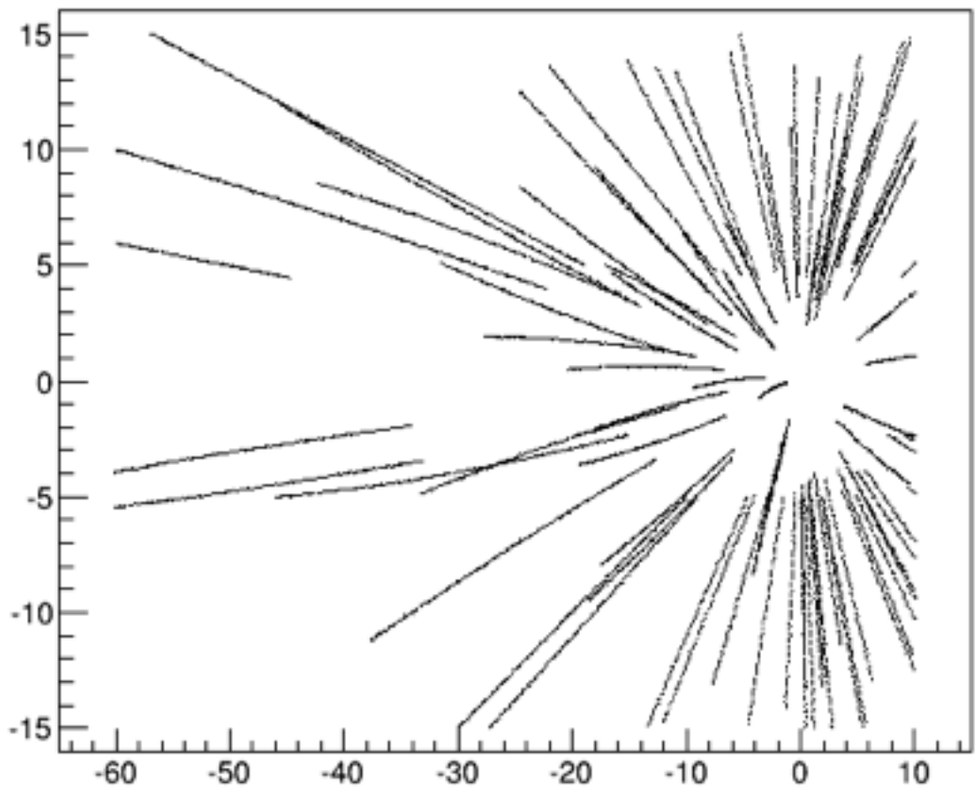

TpcPrimaryCluster.pos z vs y
15
10
5
0
-5
-10
-15
-60
-50
-40
-30
-20
-10
0
10

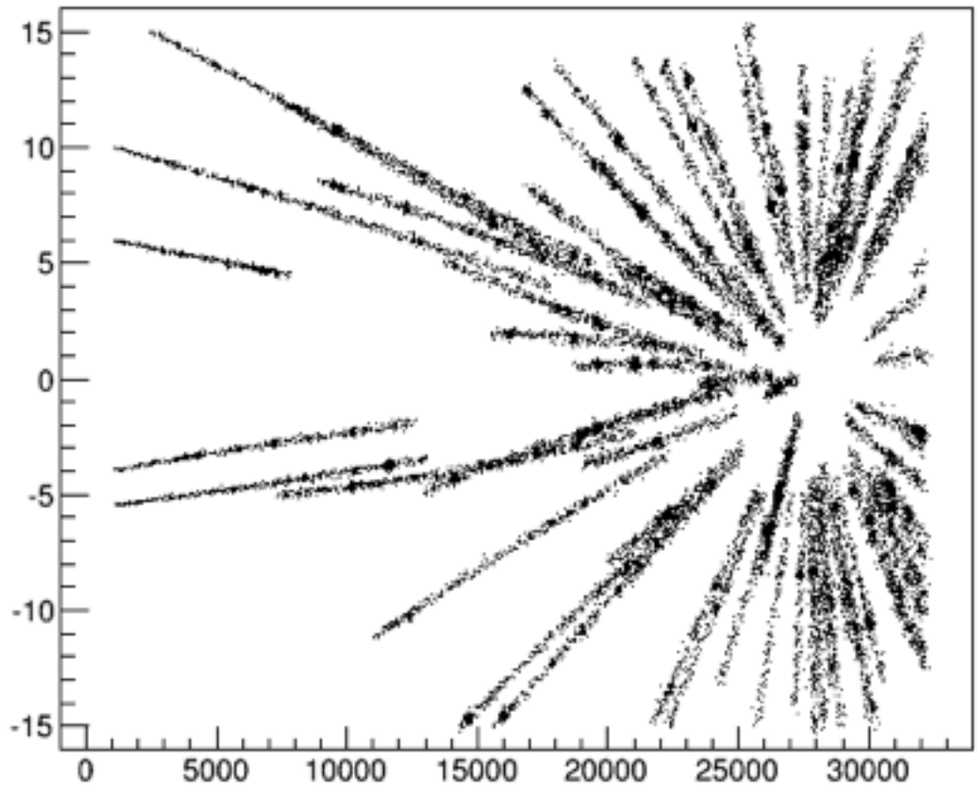

TpcDriftedElectron t vs y
15
10
5
0
-5
-10
-15
0
5000
10000
15000
20000
25000
30000

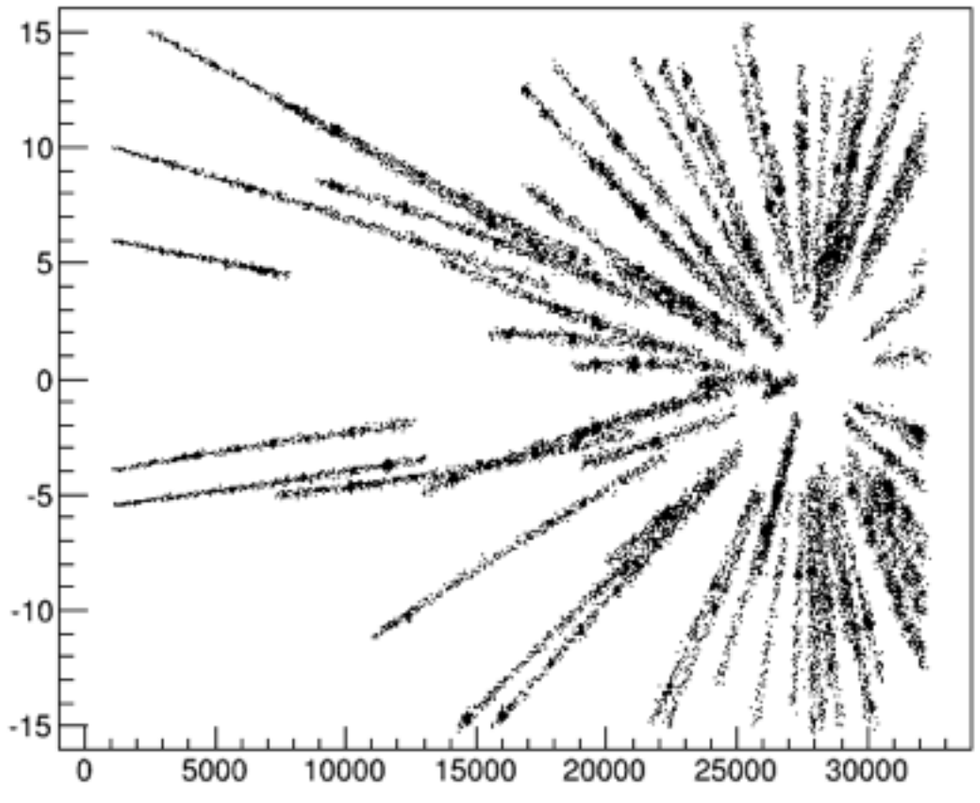

TpcAvalanche t vs y
15
10
5
0
-5
-10
-15
0
5000
10000
15000
20000
25000
30000

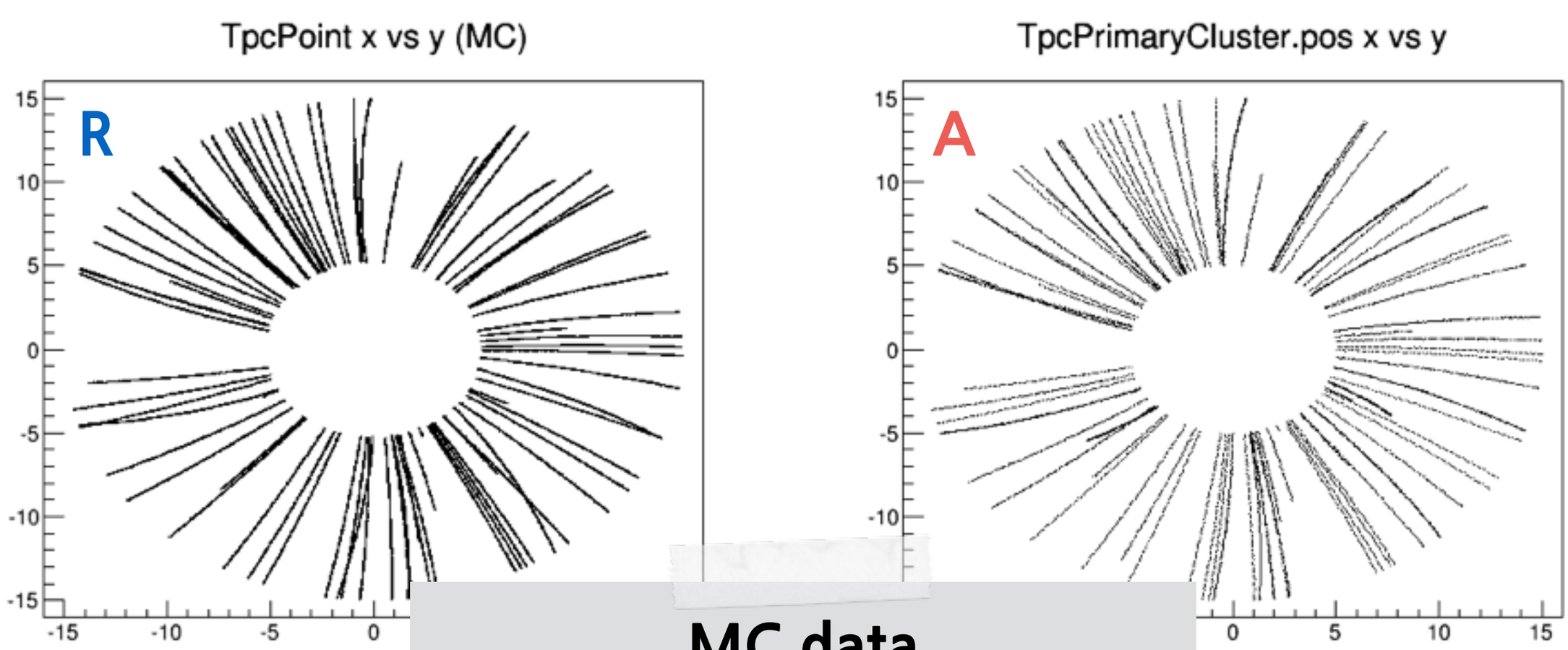
Ascii Geo.


TpcPoint z vs y (MC)
15
10
5
0
-5
-10
-15
-60
-50
-40
-30
-20
-10
0
10


TpcPrimaryCluster.pos z vs y
15
10
5
0
-5
-10
-15
-60
-50
-40
-30
-20
-10
0
10


TpcDriftedElectron t vs y
15
10
5
0
-5
-10
-15
0
5000
10000
15000
20000
25000
30000


TpcAvalanche t vs y
15
10
5
0
-5
-10
-15
0
5000
10000
15000
20000
25000
30000


TpcPoint x vs y (MC)
R
TpcPrimaryCluster.pos x vs y
A
MC data
Difference in Thickness!!
TpcPoint z vs
Cluster.pos z vs y
R
A

Conclusion and Plan

1. DIGI data still shows different output from two cases. (Gas problem?)
2. Try to get position of each pad (to read **TpcDigi**).
3. Reconstruction.