Minimum Bias Rate

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Motivation:

Calorimeters are designed to measure the energy of the particles. However, in addition to the particles of interest, numerous other particles may also be produced from secondary interactions or other background process, which might not be of our interest. These particles create noise in the detector and affect the measurements. Thus, understanding minimum bias rate is important to have Background Estimation. By studying the rate at which these events occur, we can estimate for their influence on the primary particle measurements.

Data set used : electron -proton DIS with 5x41GeV

Rate = $L\sigma$
L = 10^{34} $cm^{-2}s^{-1}$
σ = 7.45 x 10^{10}pb = 7.45 x 10^{-26} cm^2

Number of events in one file : 3649

For 36 Files :

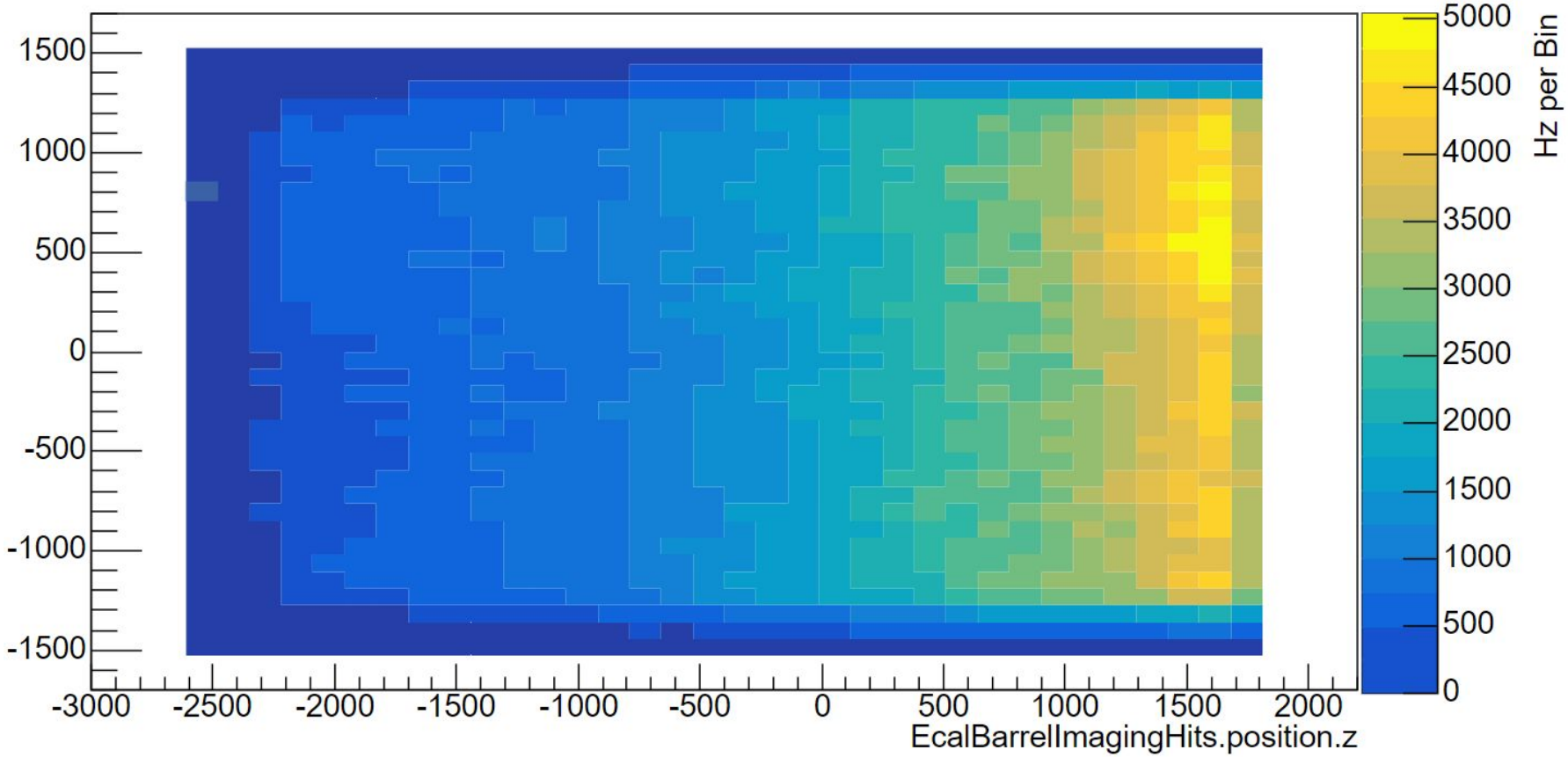
Weight factor to apply rate to each bin = 1/(36x3649x area of bin)

Weighted Rate = 10^{34} $cm^{-2}s^{-1}$ x 7.45 x 10^{-26} cm^2 /(36 x 3649 x area of bin)

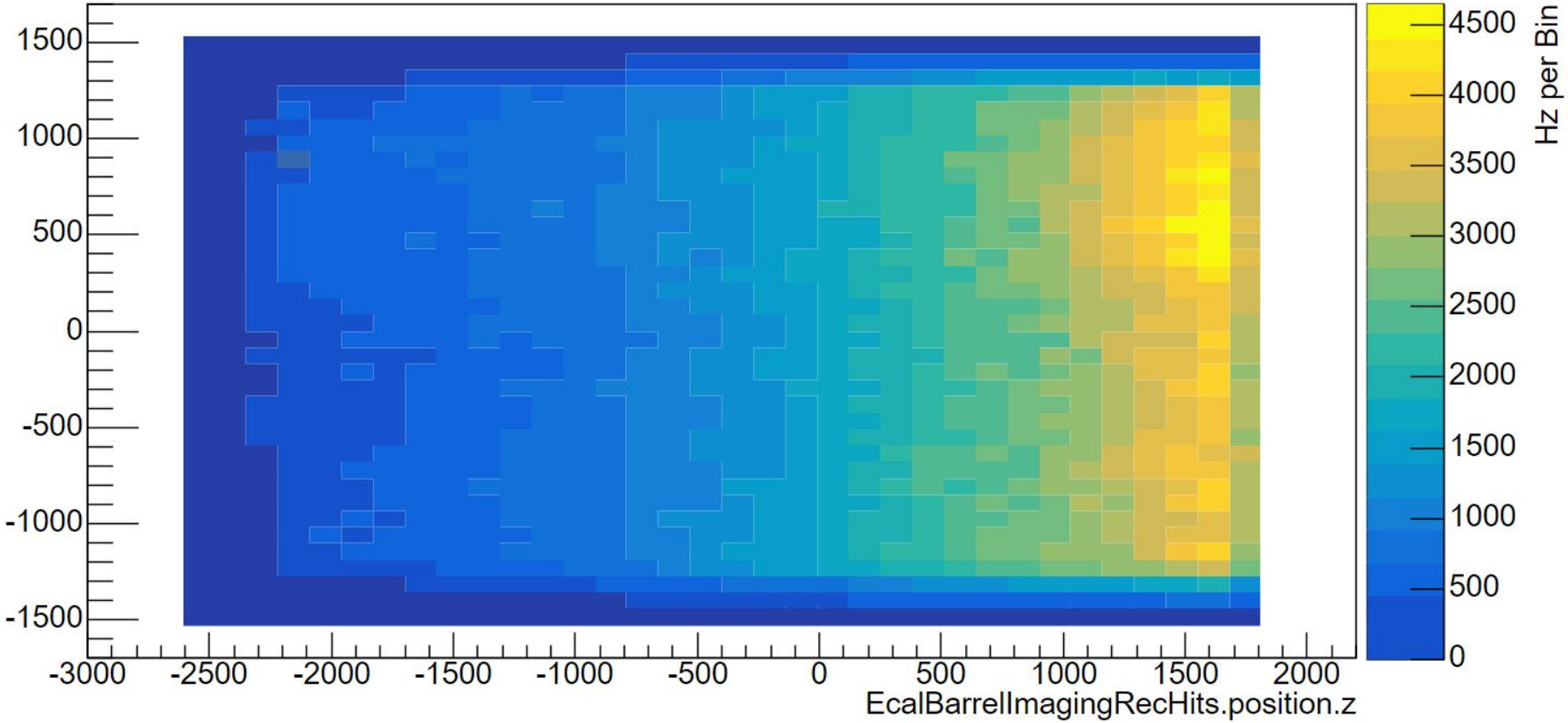
Weight Factor for Imaging Layer = 7.45x10^8 s^{-1}/(36 x 3649 x 11050 mm^2)
= 0.5132 $s^{-1}mm^{-2}$ per event

Weight Factor for ScFi = 7.45x10^8 s^{-1} /(36 x 3649 x 4225 mm^2)
= 1.3423 $s^{-1}mm^{-2}$ per event

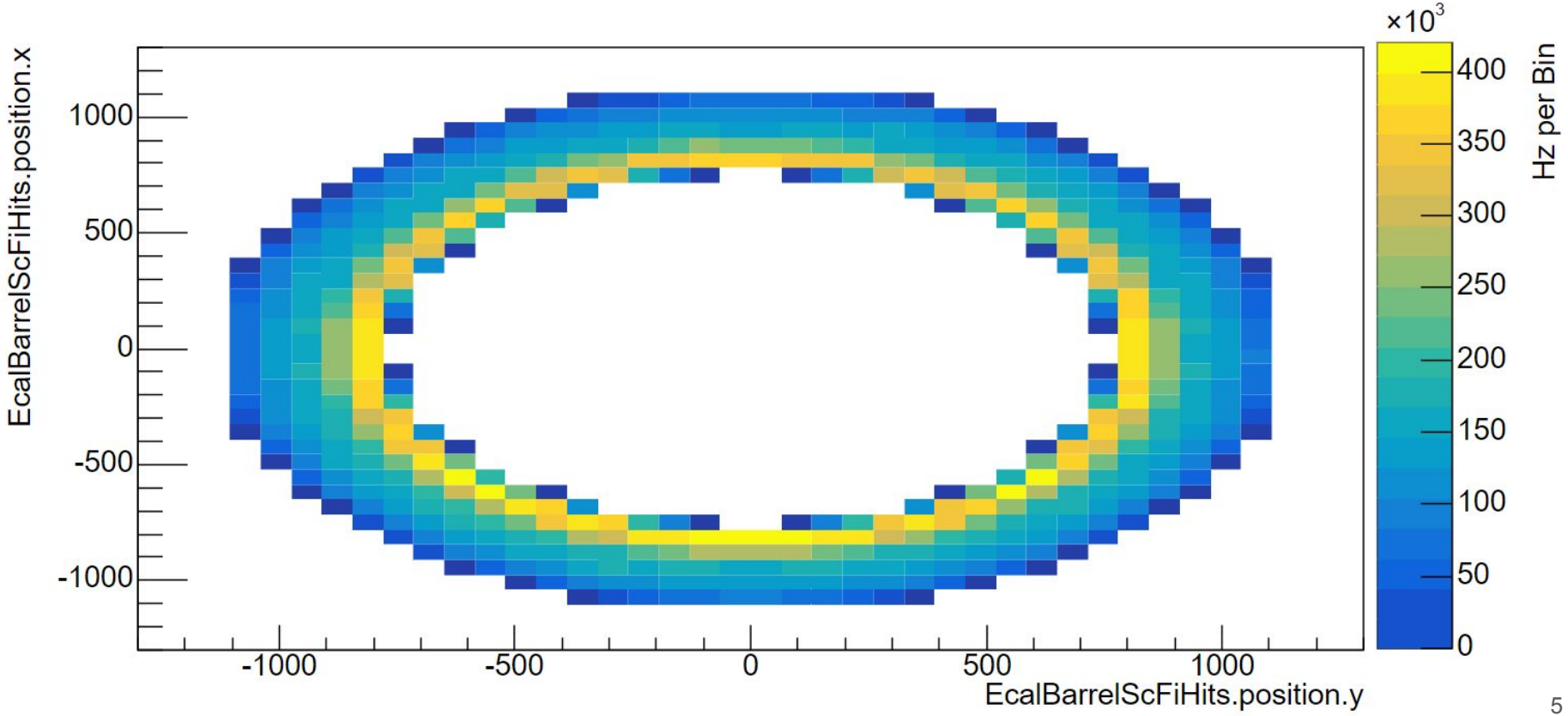
R_pfi_vs_Z_36 files_0.5132_Imaging Layer



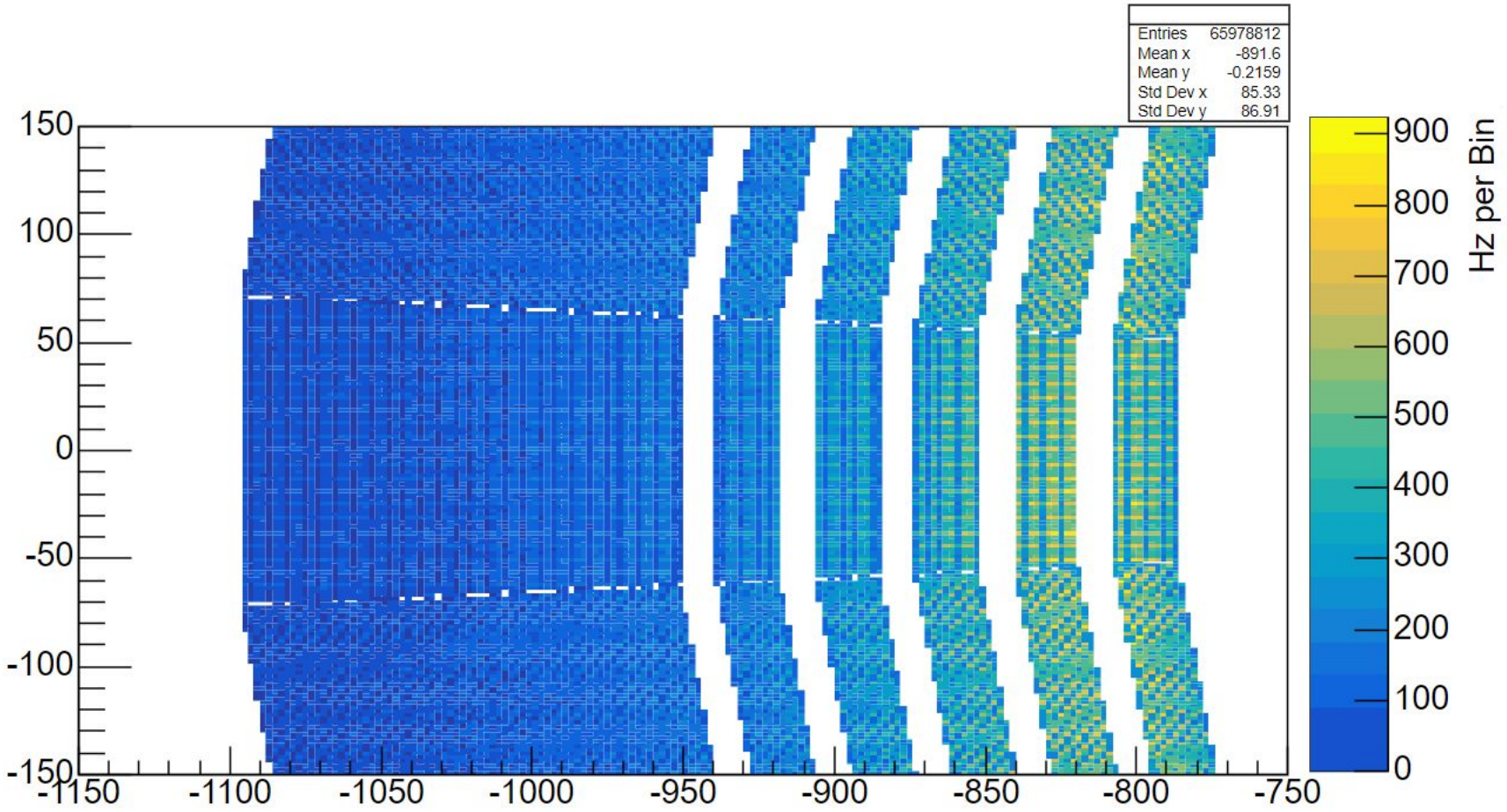
R_pfi_vs_Z_36files_0.5132_Imaging Layer_Reco



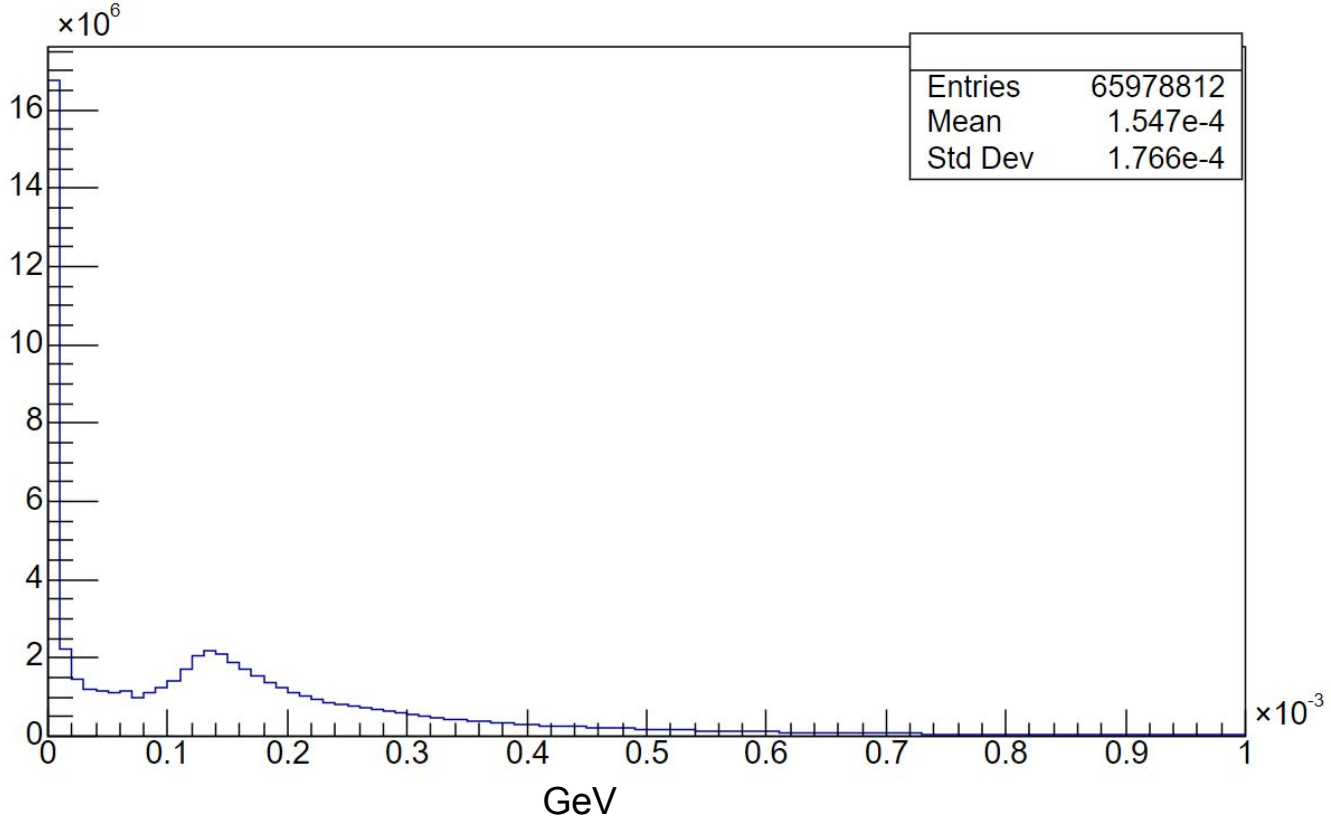
X_vs_Y_36 files _1.3423_ScFi



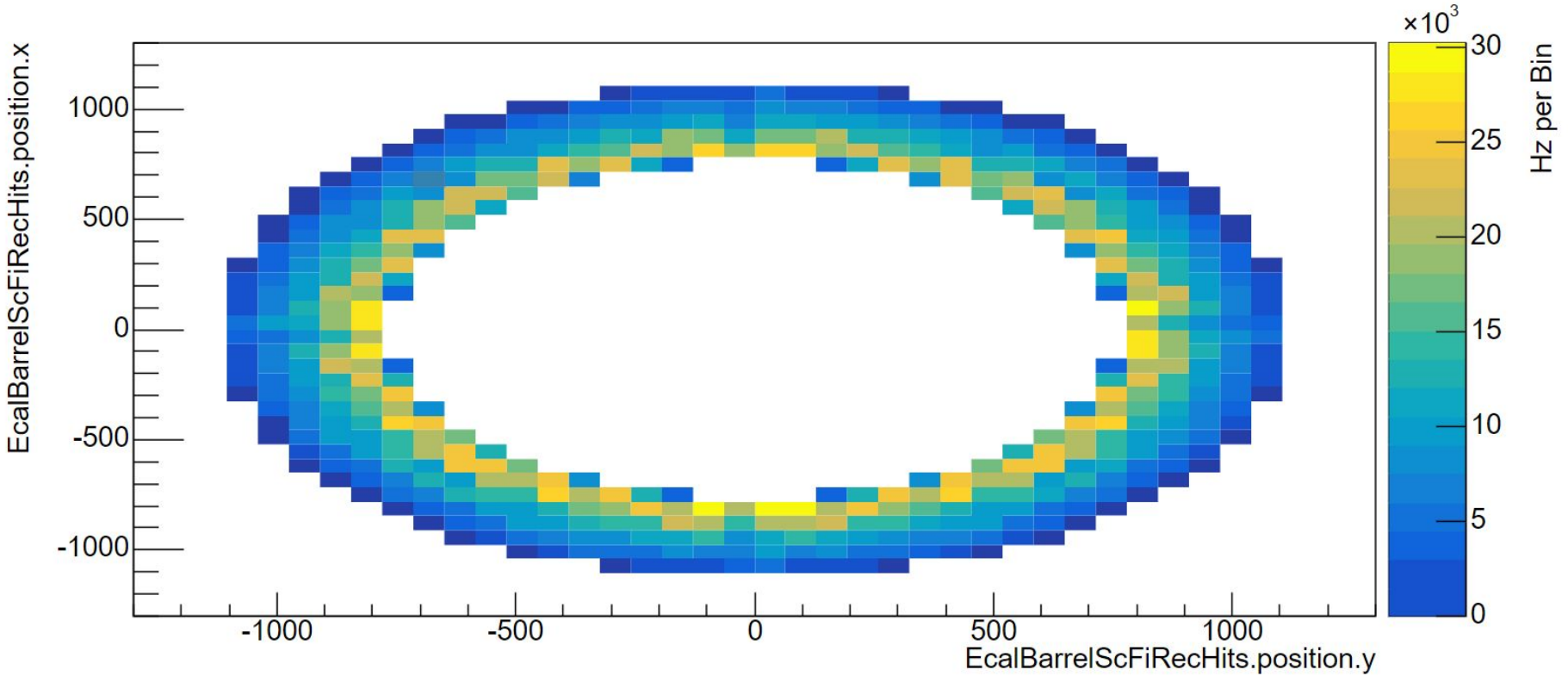
X_vs_Y_36 files _1.3423_ScFi : Rate at various X and Y positions



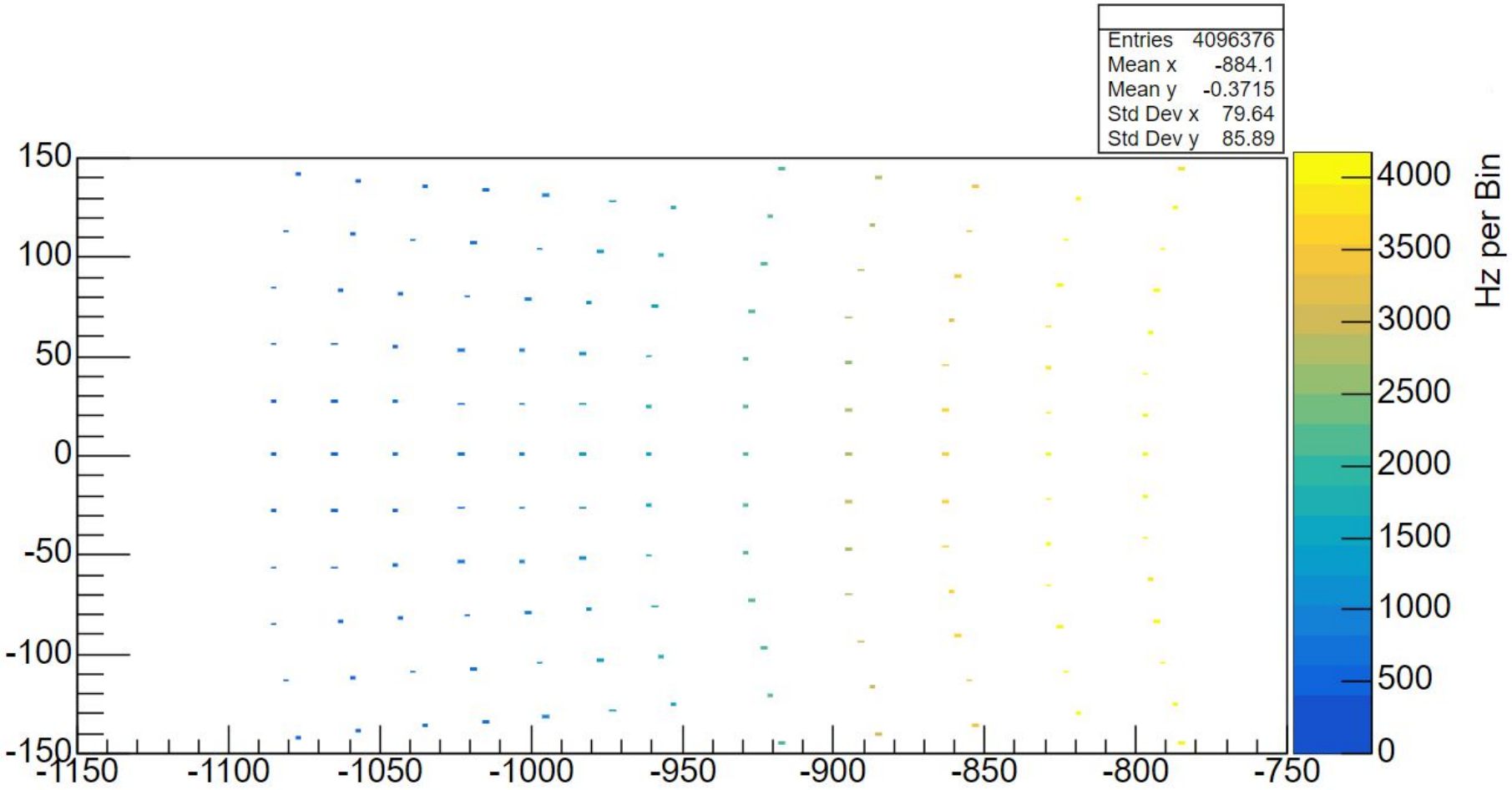
EcalBarrelScFiHits.energy



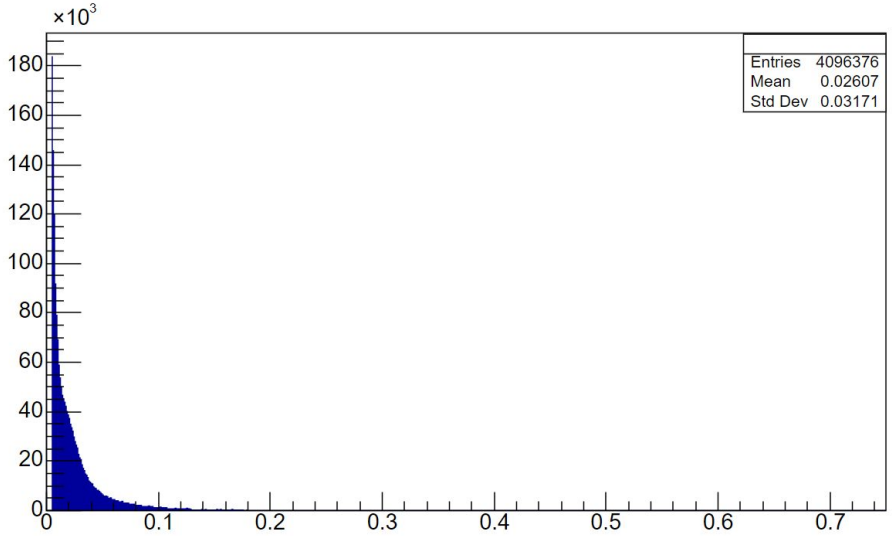
X_vs_Y_36 files _1.3423_ScFi_Reco



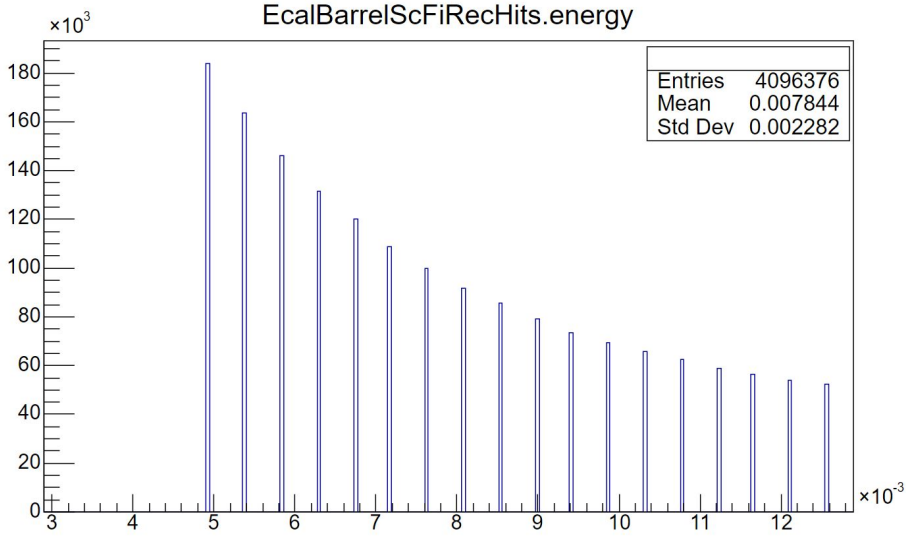
X_vs_Y_36 files _1.3423_ScFi_Reco: Rate at various X and Y positions



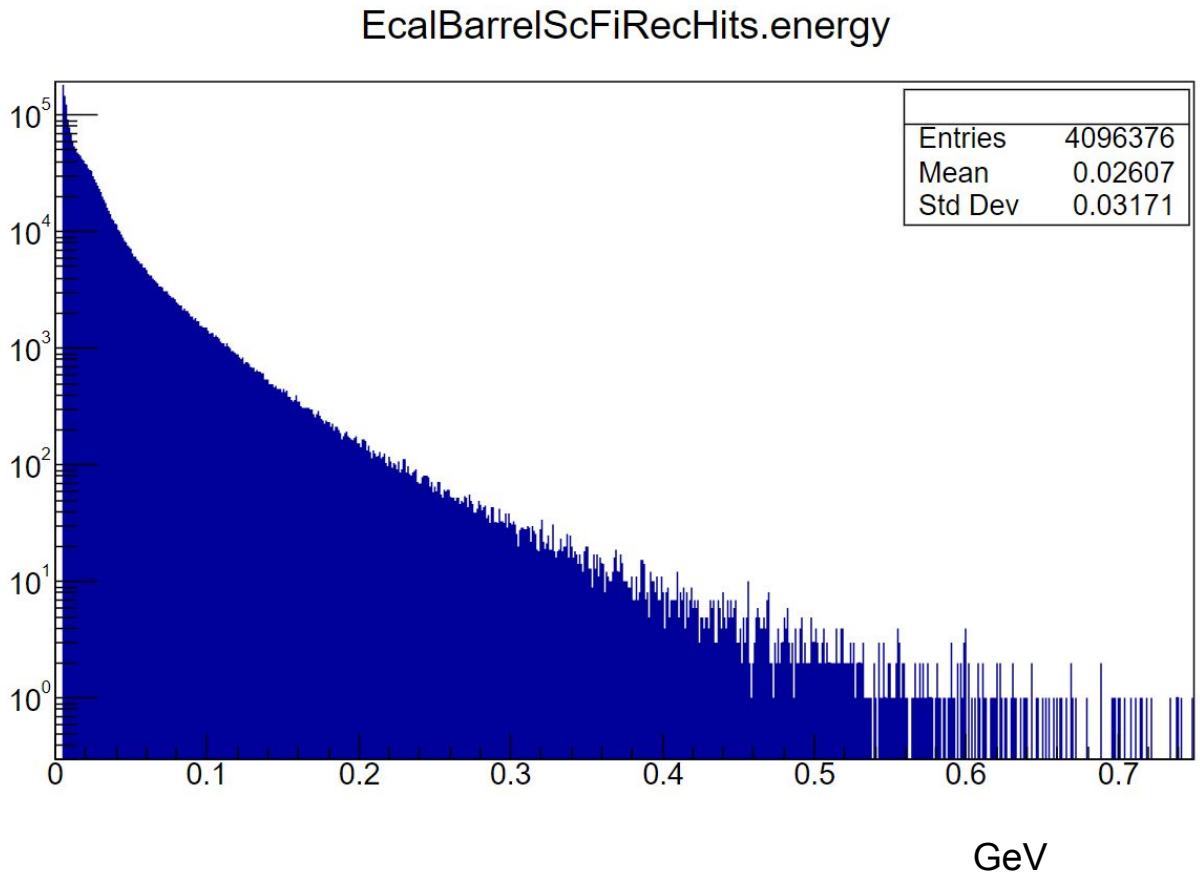
EcalBarrelScFiRecHits.energy

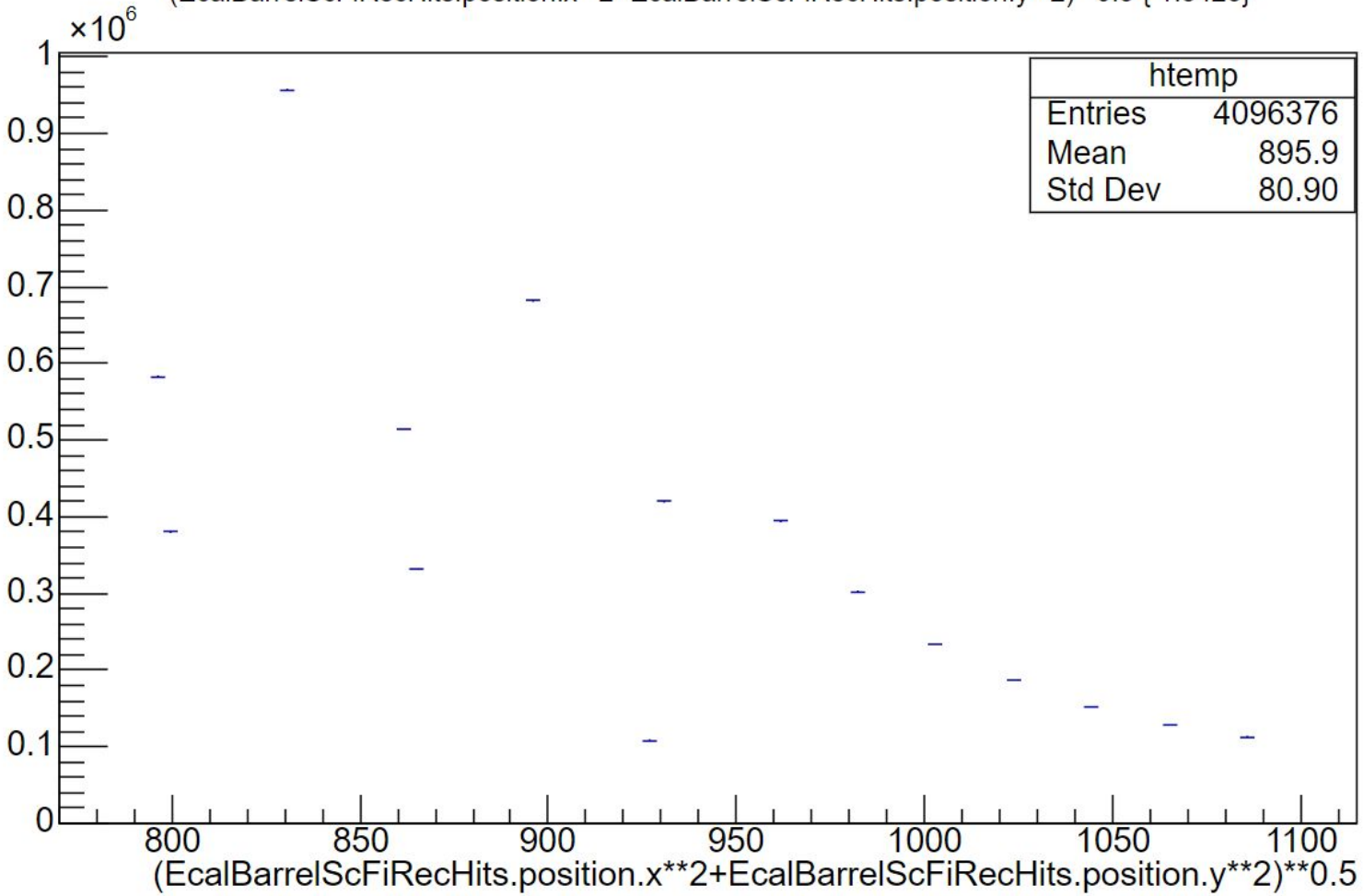


GeV



GeV


EcalBarrelScFiRecHits.energy
Entries 4096376
Mean 0.02607
Std Dev 0.03171
10^5
10^4
10^3
10^2
10^1
10^0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
GeV


(EcalBarrelScFiRecHits.position.x**2+EcalBarrelScFiRecHits.position.y**2)**0.5 { 1.3423}
×10^6
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
htemp
Entries 4096376
Mean 895.9
Std Dev 80.90
800
850
900
950
1000
1050
1100
(EcalBarrelScFiRecHits.position.x**2+EcalBarrelScFiRecHits.position.y**2)**0.5

Layer	Maximum Rate After Reconstruction normalized per readout cell (KHz per bin) 5x41 GeV	Rate (for the sub detector) from wiki * (Hits per sec)18x275 GeV
1	4.0116 KHz	**Without Threshold :** 5.86 x 10^6 **With Threshold :** 4.8 x 10^6
2	3.9837	
3	3.5258	
4	2.8391	
5	2.2033	
6	1.6420	
7	1.26	
8	0.9762	
9	0.7799	
10	0.6356	
11	0.5370	
12	0.4720	

Data set used : electron -proton DIS with 18x275 GeV

Rate = $L\sigma$
L = 10^{34} $cm^{-2}s^{-1}$
σ = 1.4712 x 10^{11}pb = 1.4712 x 10^{-25} cm^2

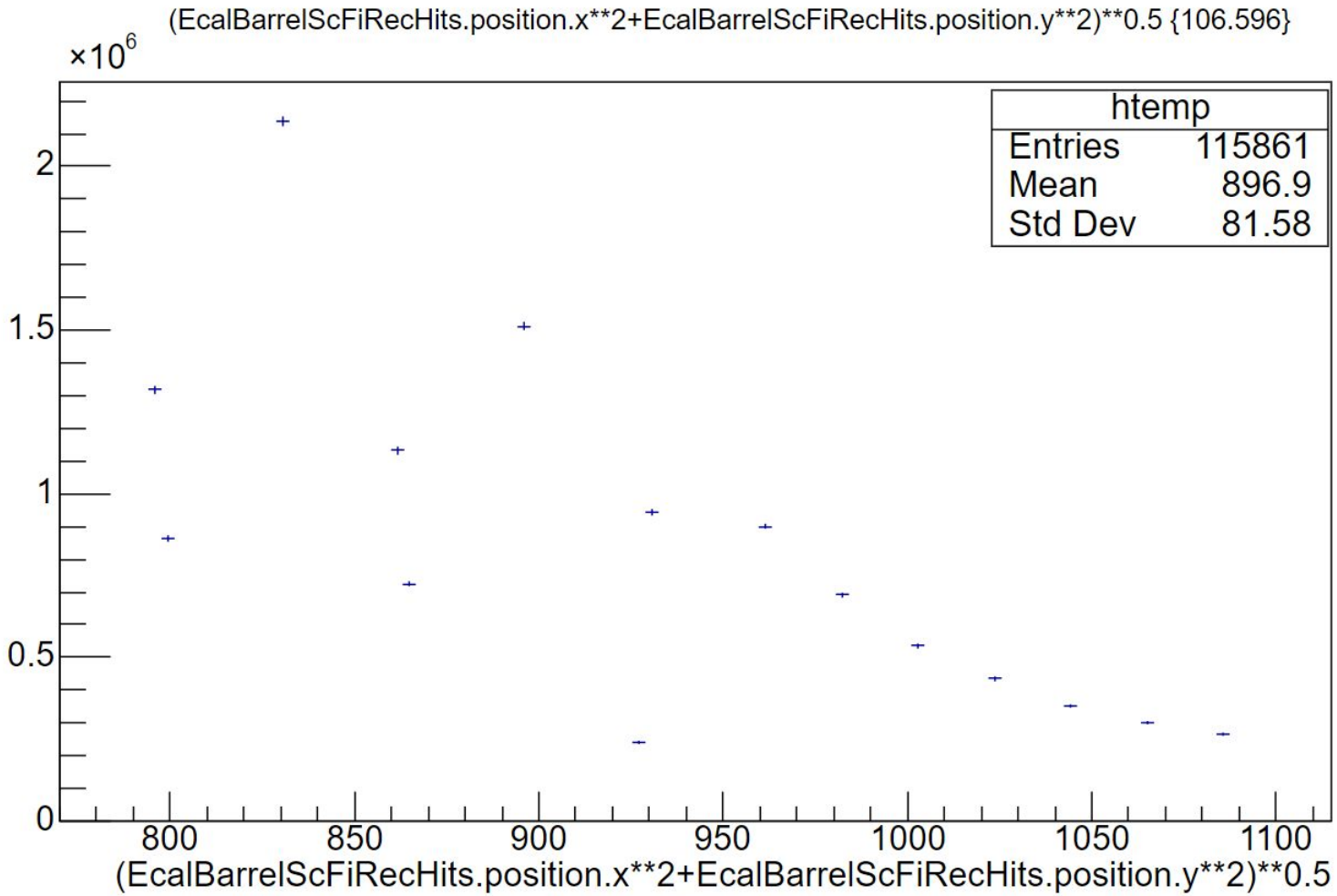
Number of events in one file : 816

For 4 Files :

Weight factor to apply rate to each bin = 1/(4x816x area of bin)

Weighted Rate = 10^{34} $cm^{-2}s^{-1}$ x 1.4712 x 10^{-25} cm^2 /(4 x 816 x area of bin)

Weight Factor for ScFi = 1.4712x10^9 s^{-1} /(4 x 816x 4225 mm^2)
= 106.596 $s^{-1}mm^{-2}$ per event


(EcalBarrelScFiRecHits.position.x**2+EcalBarrelScFiRecHits.position.y**2)**0.5 {106.596}
×10^6
2
1.5
1
0.5
0
800
850
900
950
1000
1050
1100
(EcalBarrelScFiRecHits.position.x**2+EcalBarrelScFiRecHits.position.y**2)**0.5
htemp
Entries 115861
Mean 896.9
Std Dev 81.58

Layer	Maximum Rate After Reconstruction normalized per readout cell (KHz per bin) 18x275 GeV	Rate (for the sub detector) from wiki * (Hits per sec)18x275 GeV
1	9.079	**Without Threshold :** 5.86×10^6 **With Threshold :** 4.8×10^6
2	8.898	
3	7.739	
4	6.3	
5	4.951	
6	3.753	
7	2.879	
8	2.234	
9	1.811	
10	1.463	
11	1.256	
12	1.101	

Rate for the Sub detector after Reconstruction = Sum of rate per read out cell for all Layers x Number of sectors x Number of read out cell in each Layer

$$= 51.464 \text{ kHz} \times 48 \times 5$$

$$= 12.35 \times 10^{6} \text{ Hz}$$