Studies of the background under the K- peak in Monte-Carlo simulation

bmnsim_DCMSMM_XeCsI_3.9_AGeV_mb_50k_new_1.root, **50000 events**

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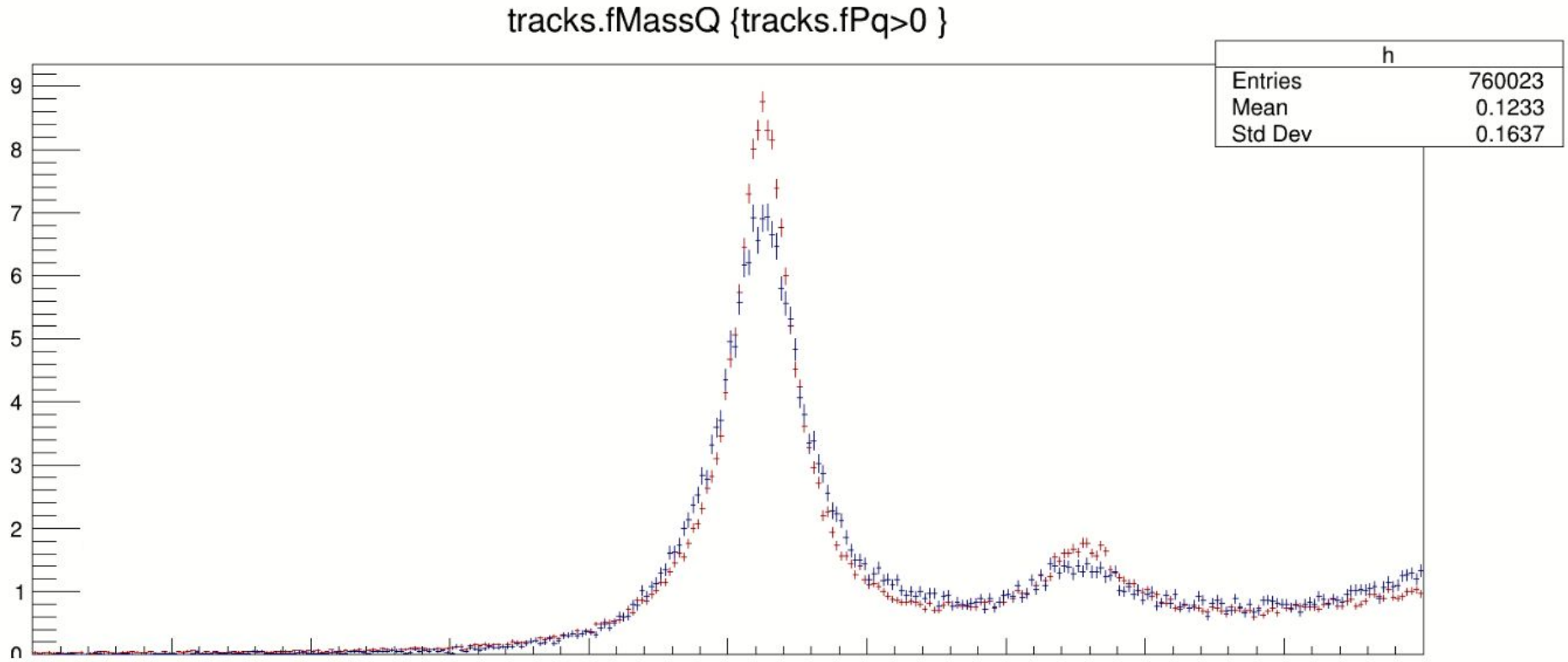
Goal of task: To reduce the background level in experimental data

1. To study the structure of the background under the K- peak in Monte-Carlo simulation
2. To create special cuts for tracks in Monte-Carlo simulation
3. To apply obtained result for experimental data analysis

Comparison of m^2 spectra for MC and Exp Data



Red - ExpData Blue - MCData

Track cuts for StsVector (Exp. Data)

Weak cuts

1) GetNStsHits()>=4

2) (Abs(dx) < 6 && Abs(dy) < 6)

3) -1.0 < PrimaryVertex.fX < 1.5

-1.0 < PrimaryVertex.fY < 1.2

-0.5 < PrimaryVertex.fZ < 0.5

4) primaryVertex->GetNTracks()>=2

Strong cuts

1)GetNStsHits()>=5

2)(Abs(dx) < 6 && Abs(dy) < 6)

3) -1.0 < PrimaryVertex.fX < 1.5

-1.0 < PrimaryVertex.fY < 1.2

-0.5 < PrimaryVertex.fZ < 0.5

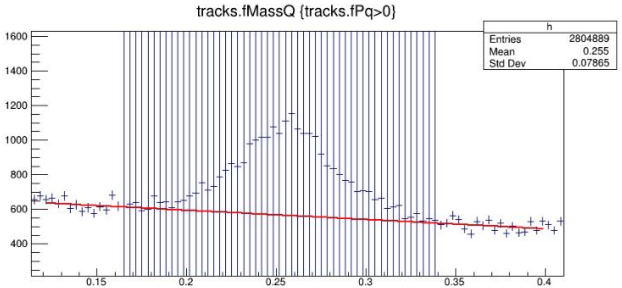
4) abs (Xpv - PrimaryVertex.fX) < 1.

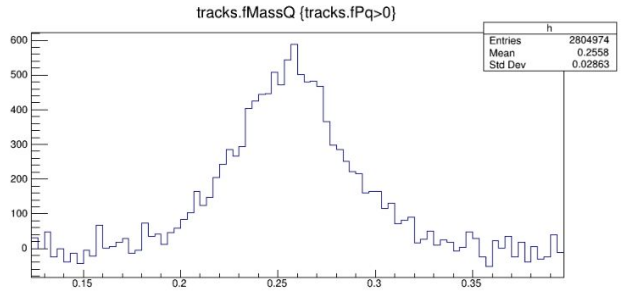
abs (Ypv - PrimaryVertex.fY) < 1.

5)primaryVertex->GetNTracks()>=2

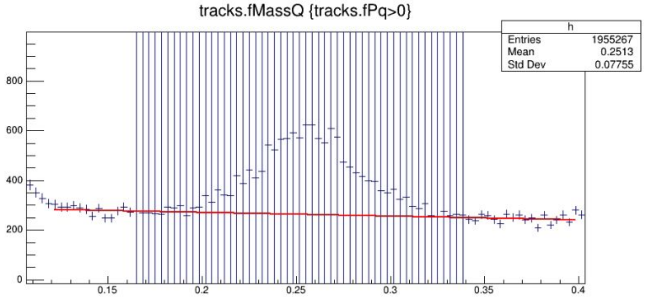
6) TMath::Sqrt(dxCsc*dxCsc+dyCsc*dyCsc)<5

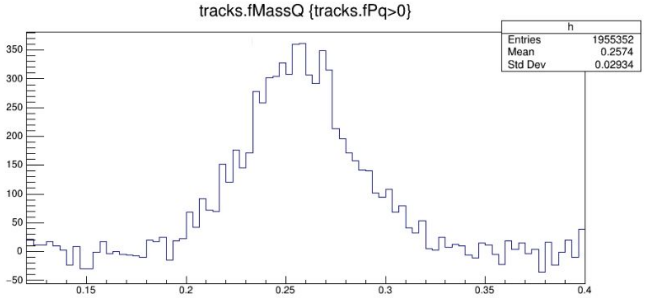
The difference between **weak** and **strong** cuts under the peak of K-





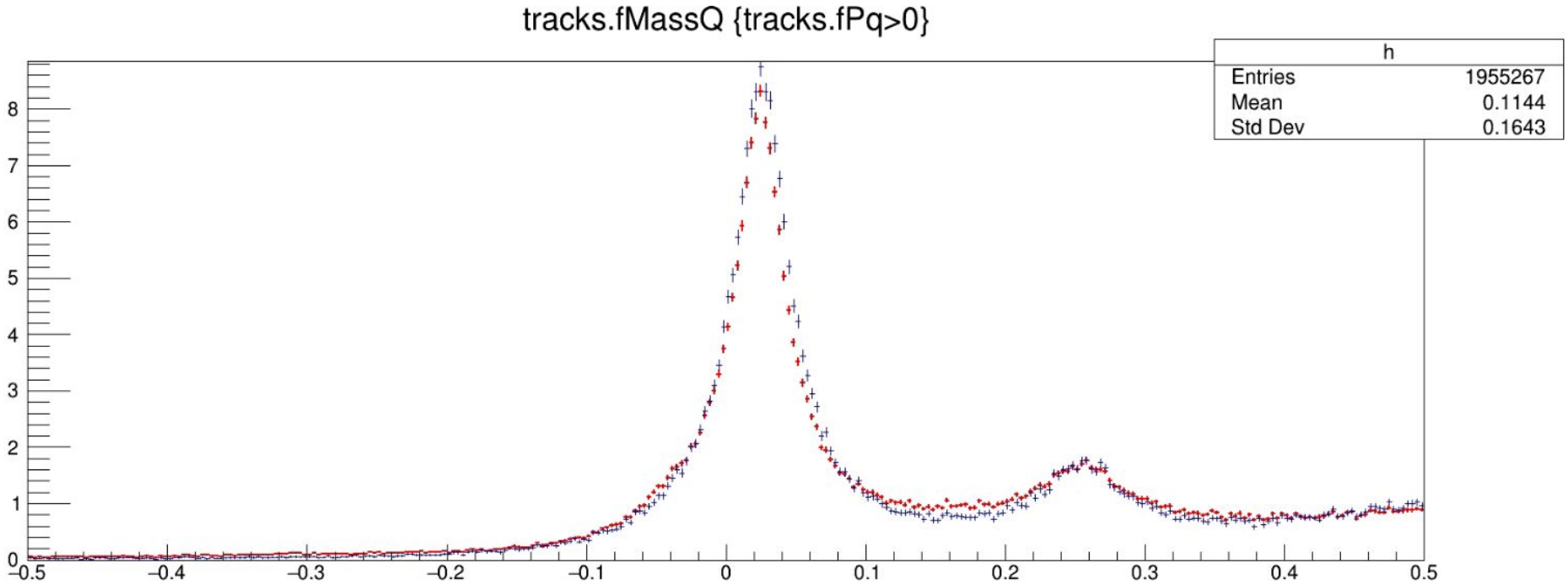
hExpmass500GlCut_pF.root(**Weak cuts**)
47736.1 - sum of content under the red line
58553 - integral (0.12,0.4)
10816.9 - signal
signal/integral = 0.18





hExpmass500allCont_pF.root(**Strong cuts**)
22230.4 - sum of content under the red line
28882 - integral (0.12,0.4)
6651.6 - signal
signal/integral = 0.23

m^2 spectra for Exp. Data

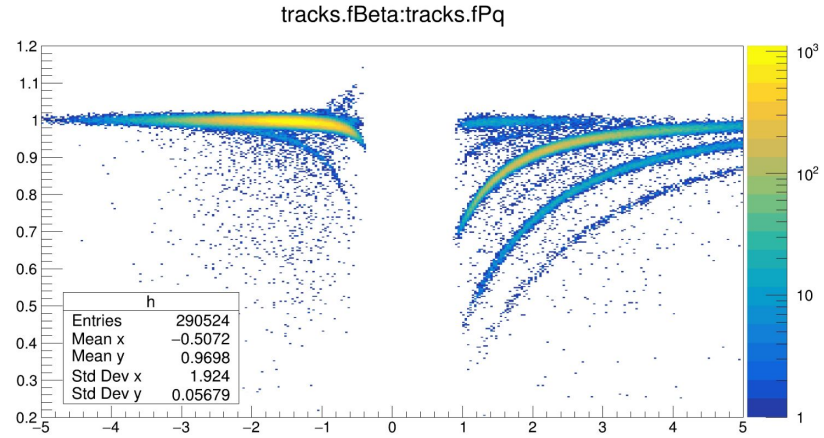


Red - Weak cuts for track

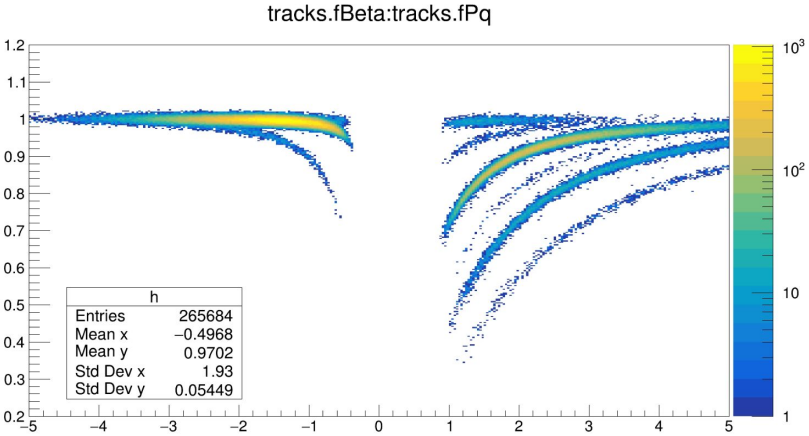
Blue - Strong cuts for track

The method of selection of background tracks

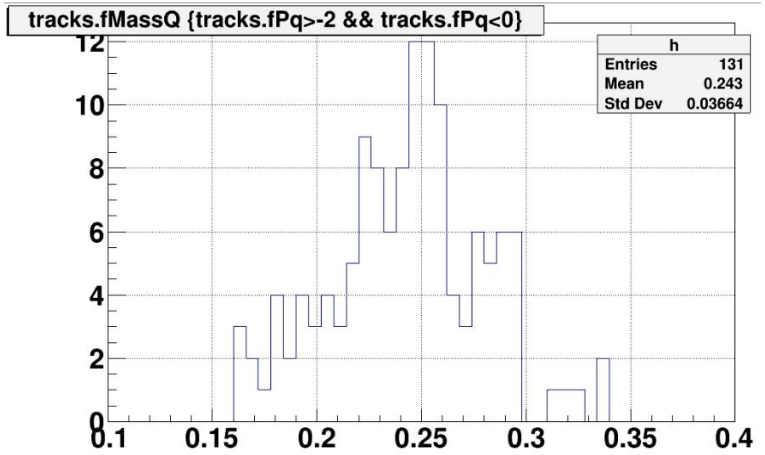
before



after



- It was used information about Id of track to select background tracks
- It was chosen the area of K- peak ($0.16 < m^2 < 0.34$) and ($-2 < p/q < 0$)



Studies of the background structure

All background identified tracks were divided into 5 groups:

1. There was right hit of Tof 400 in 6sm area of the extrapolation point, but incorrect matching occurred

2. Decay cases - track belonging to tof400 hit was produced by identified track and identified track was K-

3. There was a right point of Tof 400, but there was no such Tof 400 hit

4. False tracks (<50% of true hits)

5. Other tracks

Overall statistics

- **50 000 events, 3.9 AGev MCData**
- **44 - background tracks**
- **87 - right tracks**

13/44 - Wrong matching

6/44 - decay of K-

5/44 - it has no hit,but has a point

2/44 - false tracks

17/44 - other tracks

Possible solutions for Exp Data

1. To use correlation of residuals between Tof400 and Csc
2. To use information about time of hit (selection of fast hits for track)
3. To choose ‘right’ pair track-hit with ‘right’ mass of particle

Thank you for attention!

Back up

Studies of the background(BEFORE)

It was chosen the area of K- peak ($0.16 < m^2 < 0.34$) and ($-2 < p/q < 0$)

All background identified tracks were divided into 3 groups:

1. Id of identified sts tracks = Id of tracks belonging to CSC hits

2. Id of identified sts tracks != Id of tracks belongs to CSC hits

3. There were Id of tracks belongs to Tof400 hits = Id of identified sts tracks in 6sm area of the extrapolation point, but incorrect matching occurred

decay before Tof400

TrueCsc	Event	stsTrack ID	iHitMin	TofHit Track ID	CscHit Track ID	Pdg stsTrack	MotherId of stsTrack	MotherId of TofHit Track	Pdg of TofHit Track	Number of Tof hits in 6sm area
1	2895	282	14	1455	282	-211	-1	235	2212	2
2	9002	191	6	616	191	-321	-1	191	-321	1
3	12121	235	1	250	235	-211	-1	-1	211	1
4	15143	63	39	3175	63	-321	-1	63	-211	1
5	15623	117	10	2107	117	-211	-1	2092	2212	1
6	18875	142	16	2692	142	-211	-1	142	-211	2
7	20774	154	16	1687	154	-321	-1	154	-211	1
8	20964	40	0	253	40	-211	-1	168	-211	1
9	24670	356	5	920	356	-211	-1	356	2212	1
10	27827	167	0	201	167	-211	-1	192	-211	1
11	30835	124	5	1314	124	-211	-1	18	-211	1
12	31729	218	35	2057	218	-321	-1	2056	211	2
13	31853	169	17	2476	169	-211	-1	169	2212	1
14	32755	220	23	2507	220	-211	-1	2494	2212	1
15	37573	41	9	1350	41	-321	-1	41	-211	1
16	41322	362	5	914	362	-321	-1	362	13	3

decay before CSC

FalseCsc	Event	stsTrack ID	iHitMin	TofHit Track ID	CscHit Track ID	Pdg stsTrack	MotherId of stsTrack	MotherId of TofHit Track	Pdg of TofHit Track	MotherId of CscHit Track	Pdg of CscHit Track	Number of Tof hits in 6sm area
1	8176	444	38	4555	814	-211	-1	3	-211	444	13	1
2	10637	226	12	182	680	-211	-1	-1	-211	226	-211	2?
3	10637	260	9	680	463	-211	-1	226	-211	260	13	
4	17042	313	3	865	849	-211	-1	313	2212	313	-211	2
5	17277	117	1	366	368	-211	-1	359	2212	117	2212	1
6	19559	300	22	1752	189	-211	-1	1747	2212	-1	-211	1
7	21472	337	23	208	923	-211	-1	-1	2212	403	-211	1
8	29922	215	9	861	630	-211	-1	857	11	187	-211	1
9	32356	112	0	140	126	-211	-1	112	2212	112	1000010020	1
10	41159	312	4	342	342	-211	-1	-1	-211	-1	-211	1
11	41322	303	3	841	841	-211	-1	371	211	371	211	3
12	42491	322	10	714	704	-211	-1	322	2212	322	-211	2
13	49894	146	9	1372	1372	-211	-1	1371	13	1371	13	1

Explanation

1 Group(True Csc)

Green tracks - MotherId of tracks belonging to tof400 hits = Id of identified sts tracks, It means that sts tracks decays into several tracks **before Tof400**, one of them belongs to tof400 hit.

Purple tracks - There was tof400 point with trackId = Id of identified sts tracks, but these points has no tof 400 hits

White tracks - In these cases there were no right tof400 hits

2 Group(False Csc)

Green tracks - MotherId of tracks belonging to tof400 hits = Id of identified sts tracks, It means that sts tracks decays into several tracks **before CSC**, one of them belongs to tof400 hit.

Purple tracks - There was tof400 point with trackId = Id of identified sts tracks, but these points has no tof 400 hits

White tracks - In these cases there were no right tof400 hits

3 Group(WrongChoice)

Wrong hit were closer than right hit due to extrapolation uncertainty, random process of the rescattering, energy loss of particles in matter

Overall statistics

42 - background tracks, 87 - true tracks

14/42 - green tracks (from decays)

9/42 - white tracks

5/42 - purple tracks (no hits)

1/42 - from decays, but another hit in 6sm area

13/42 - 3 group(**WrongChoice)**

Track cuts for MC data

1)GetNStsHits()>=5

2)`TMath::Sqrt(dx*dx+dy*dy)<6`

3) -1.0 < PrimaryVertex.fX < 1.5

-1.0 < PrimaryVertex.fY < 1.2

-0.5 < PrimaryVertex.fZ < 0.5

4) abs (Xpv - PrimaryVertex.fX) < 1.

abs (Ypv - PrimaryVertex.fY) < 1.

5)primaryVertex->GetNTracks()>=2

6) `TMath::Sqrt(dxCsc*dxCsc+dyCsc*dyCsc)<6`

dx = x(Extrapolated track to Tof400) - xHitTof

dxCsc = x(Extrapolated track to Csc) - xHitCsc

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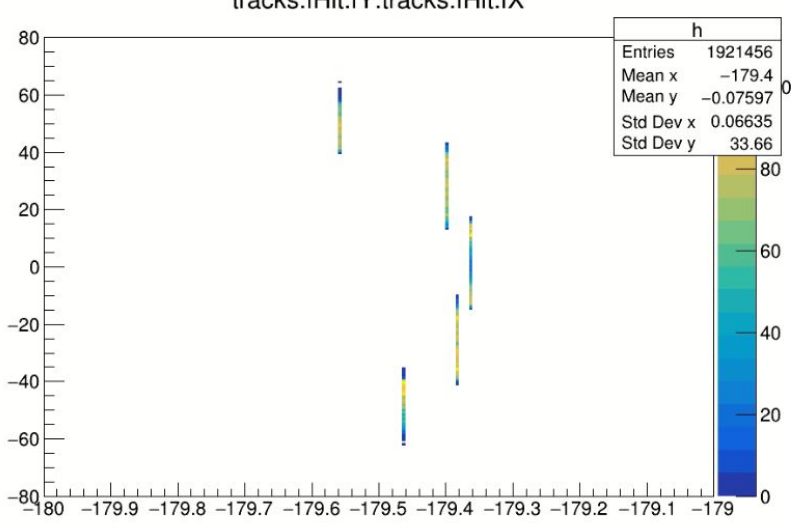
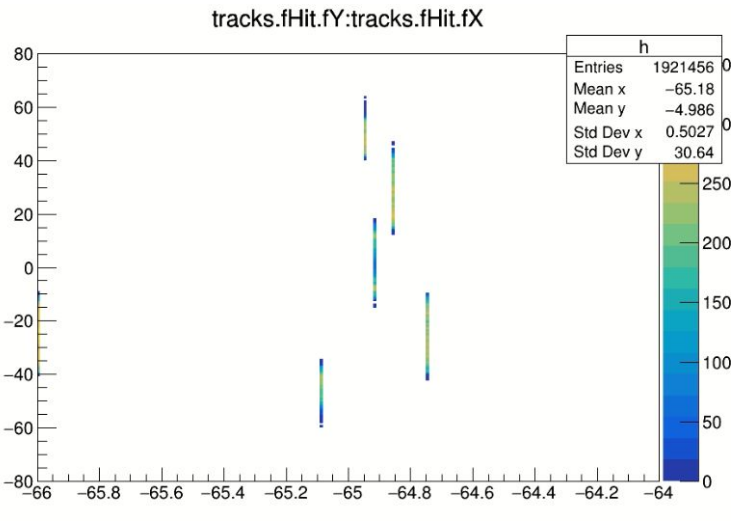
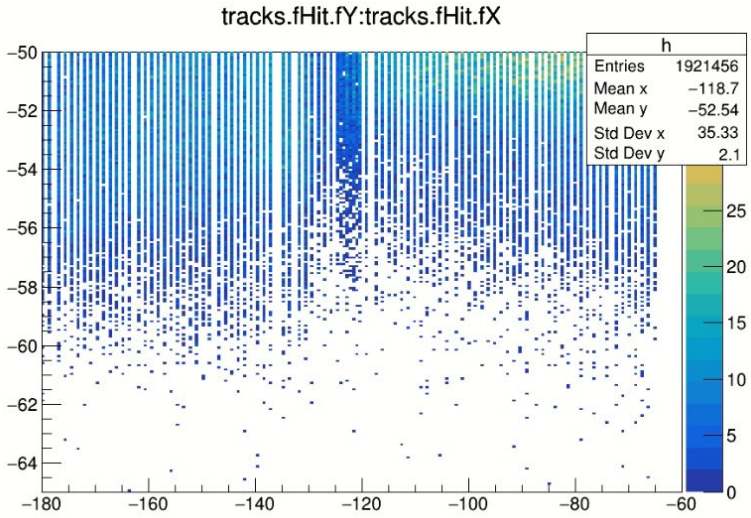
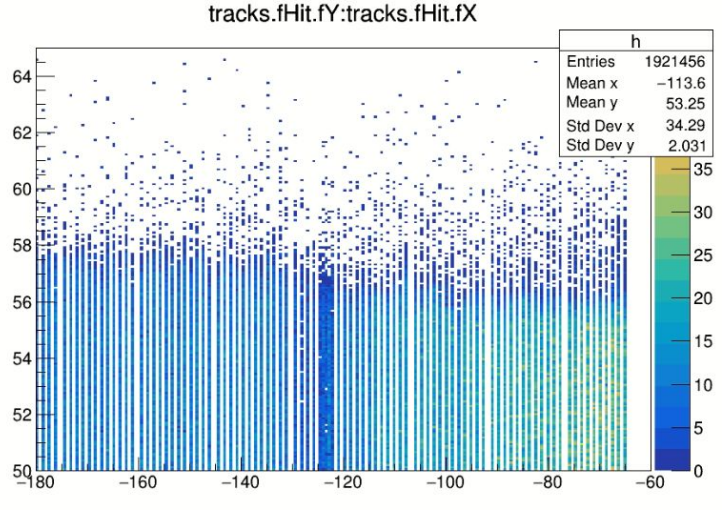
ZhitCsc > 390 && ZhitCsc < 410
```


tracks.fHit.fY:tracks.fHit.fX
h
Entries 1921456
Mean x −179.4
Mean y −0.07597
Std Dev x 0.06635
Std Dev y 33.66


tracks.fHit.fY:tracks.fHit.fX
h
Entries 1921456
Mean x −65.18
Mean y −4.986
Std Dev x 0.5027
Std Dev y 30.64


tracks.fHit.fY:tracks.fHit.fX
h
Entries 1921456
Mean x −118.7
Mean y −52.54
Std Dev x 35.33
Std Dev y 2.1


tracks.fHit.fY:tracks.fHit.fX
h
Entries 1921456
Mean x −113.6
Mean y 53.25
Std Dev x 34.29
Std Dev y 2.031