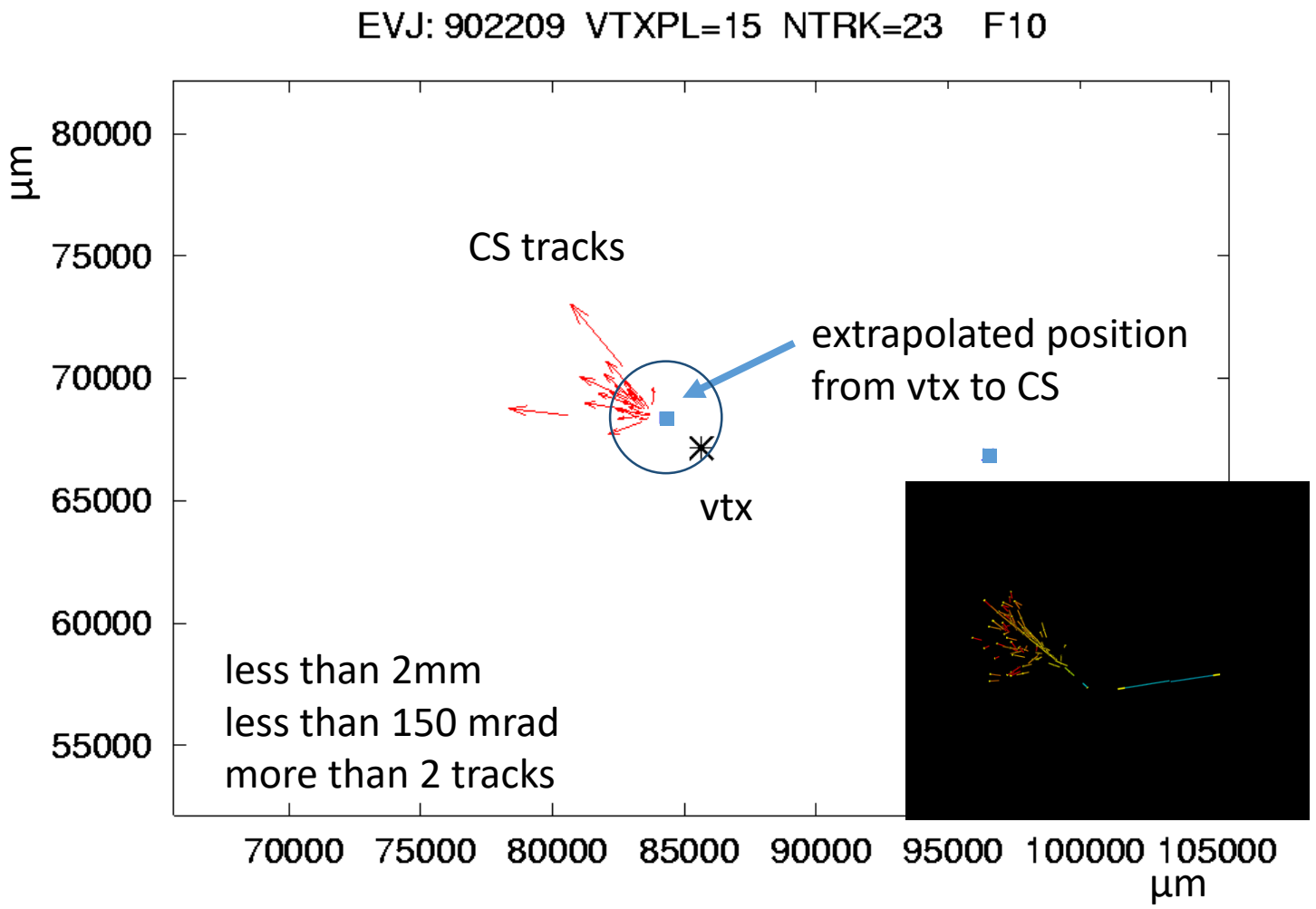
Electron search using track density at CS

Takahiro Matsushita

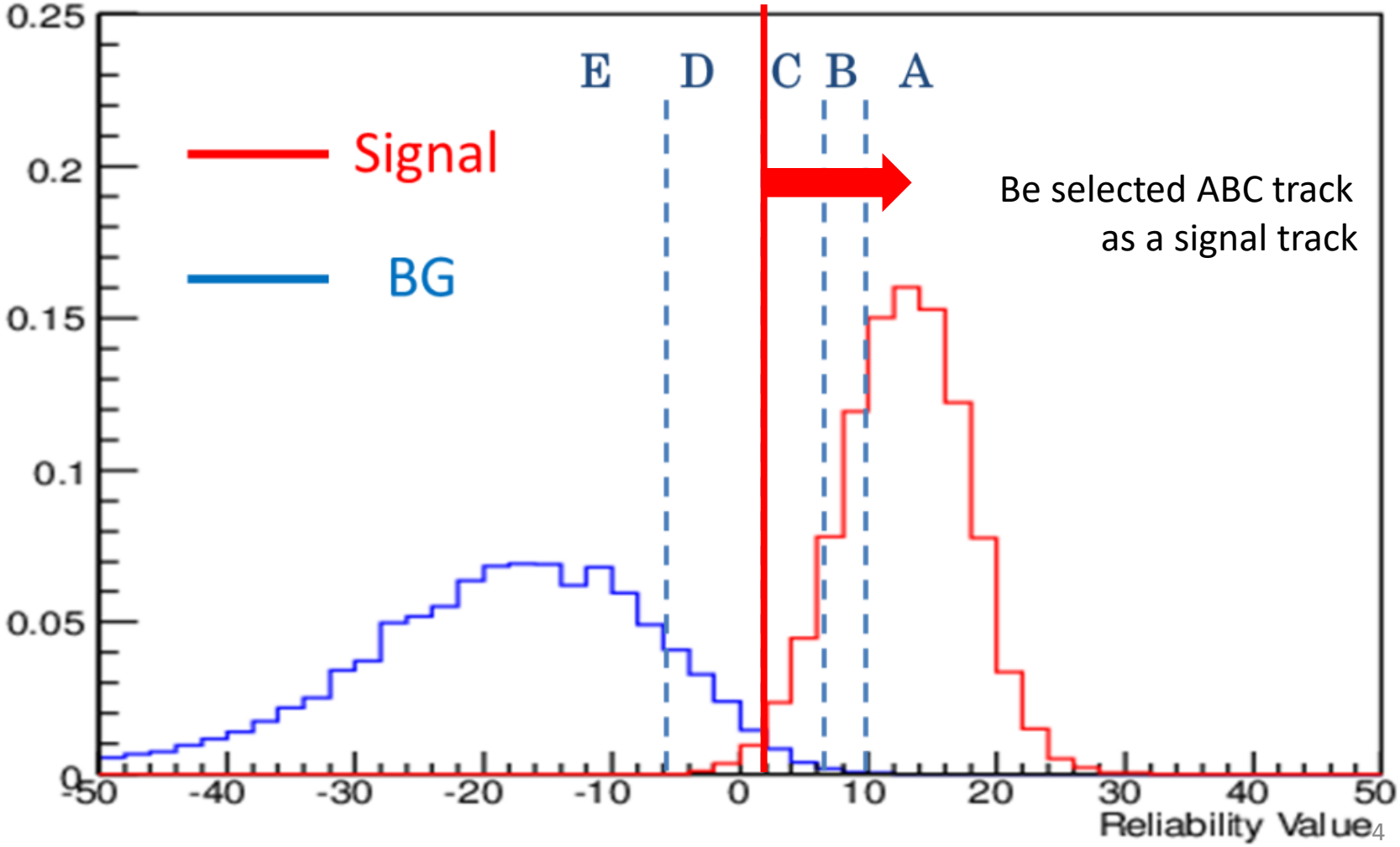
Introduction

- This is new technique for electron search.
- I try to search electron shower from density of tracks including low quality tracks and found new shower events.

Introduction
conventional method



Introduction
track ranking



New method

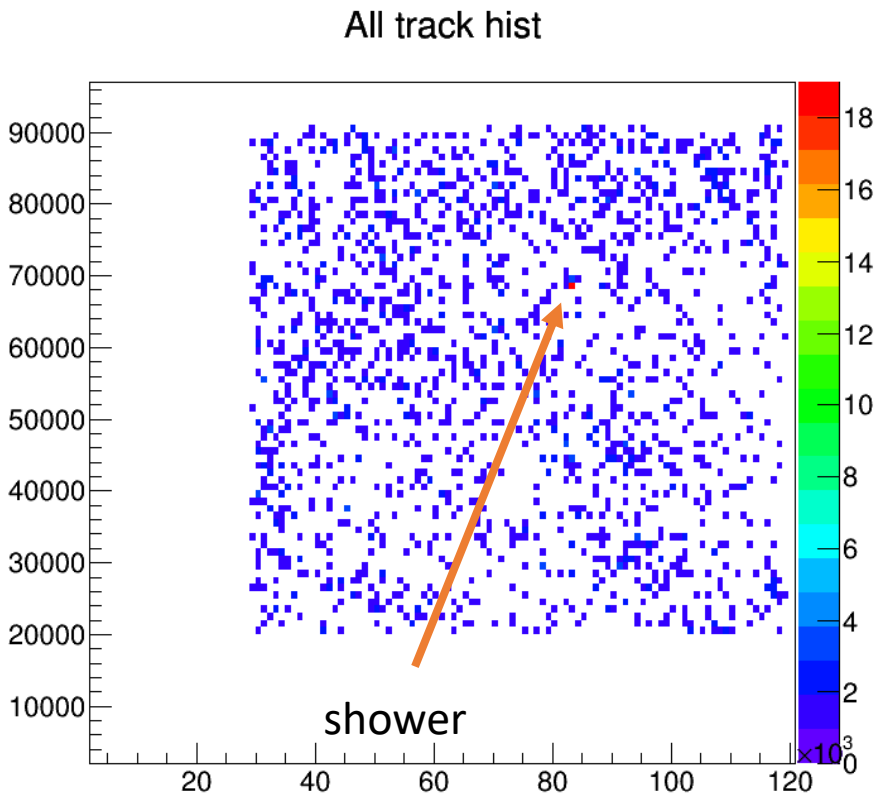
- Ranking cut can remove many noise but sometimes it may remove real tracks.
- In this time I use ABCDE all tracks to use low quality tracks.

- I make track density 2D histogram(x,y) with all tracks .
- Search electron shower by choosing high significance bins.

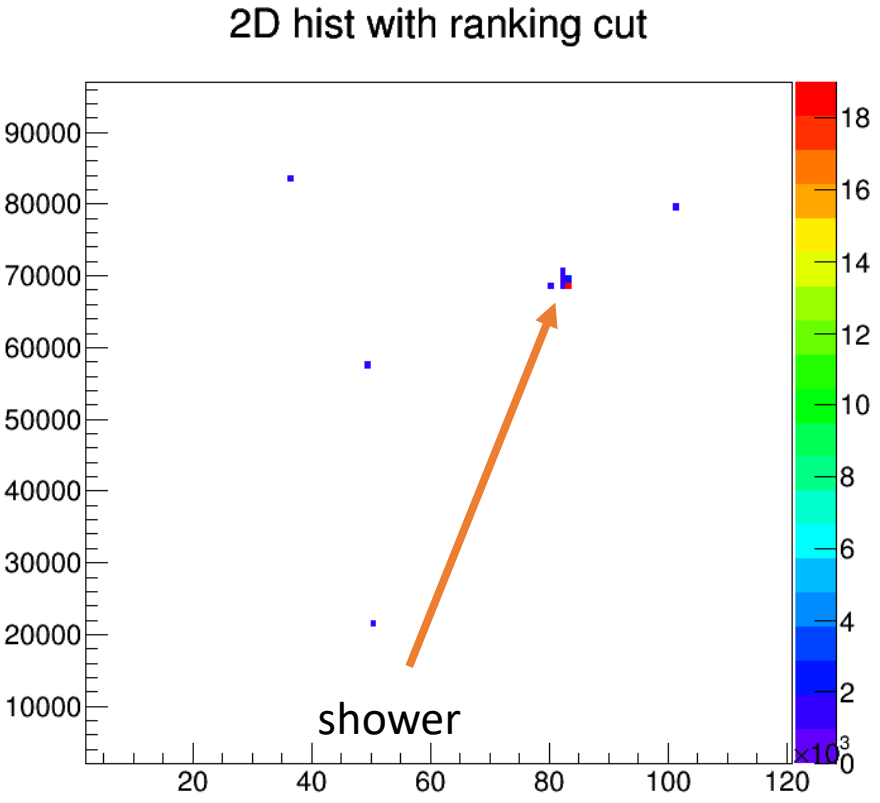
Significance = (tracks in a bin – average number of tracks in a bin)
/RMS of number of tracks in a bin

- I do it to 1mm^2 and 4mm^2 bin but now I speak about 1mm^2 bin.
- For the first time, I studied with previously located 21 ve events.

New method example

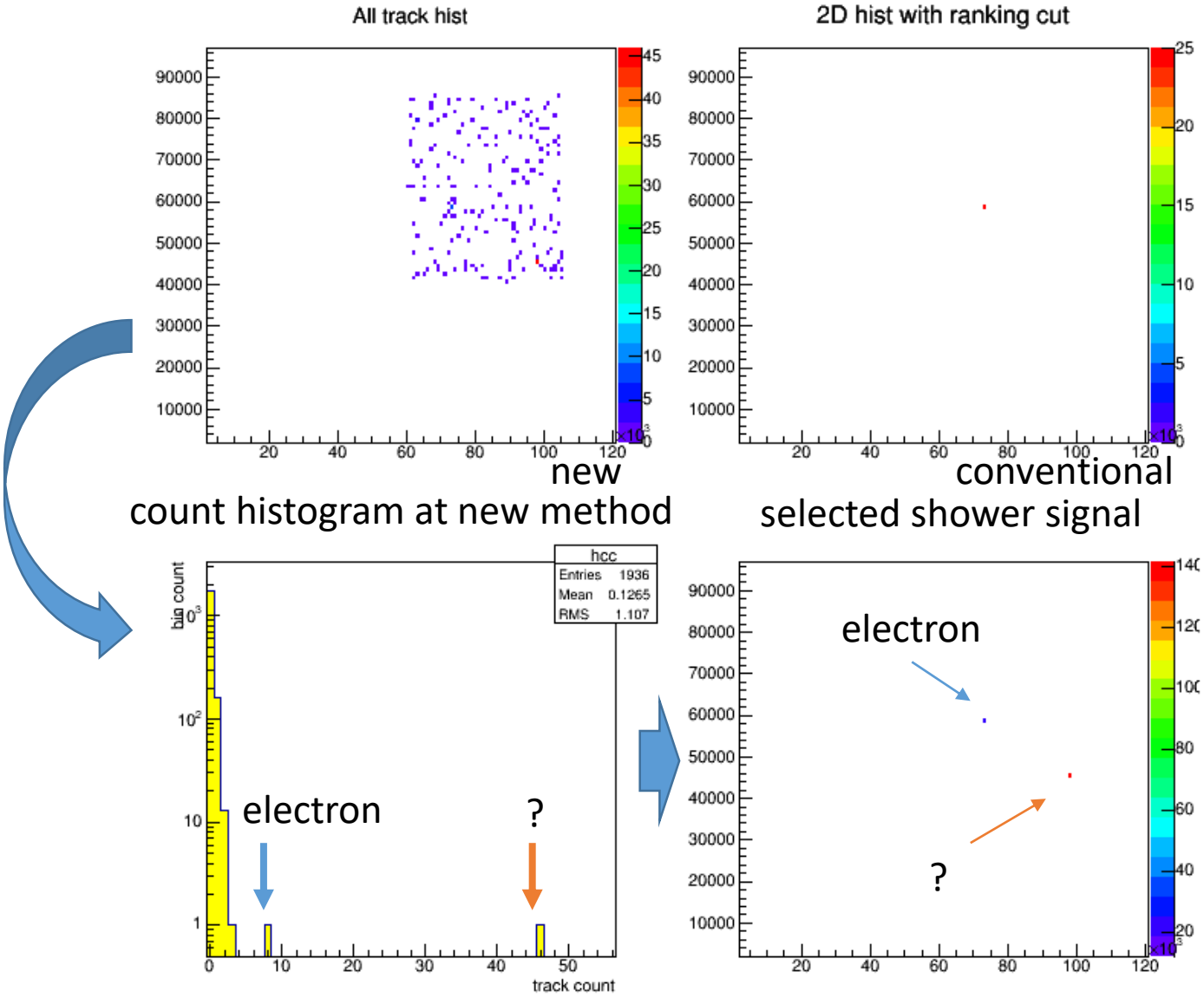


new

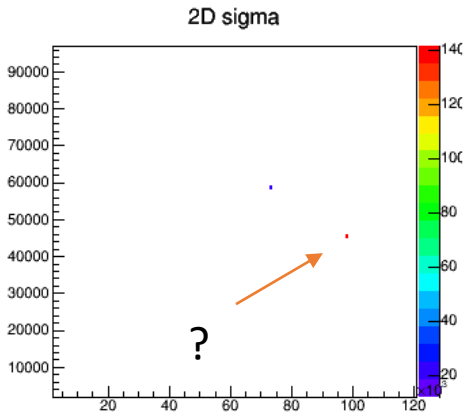


conventional

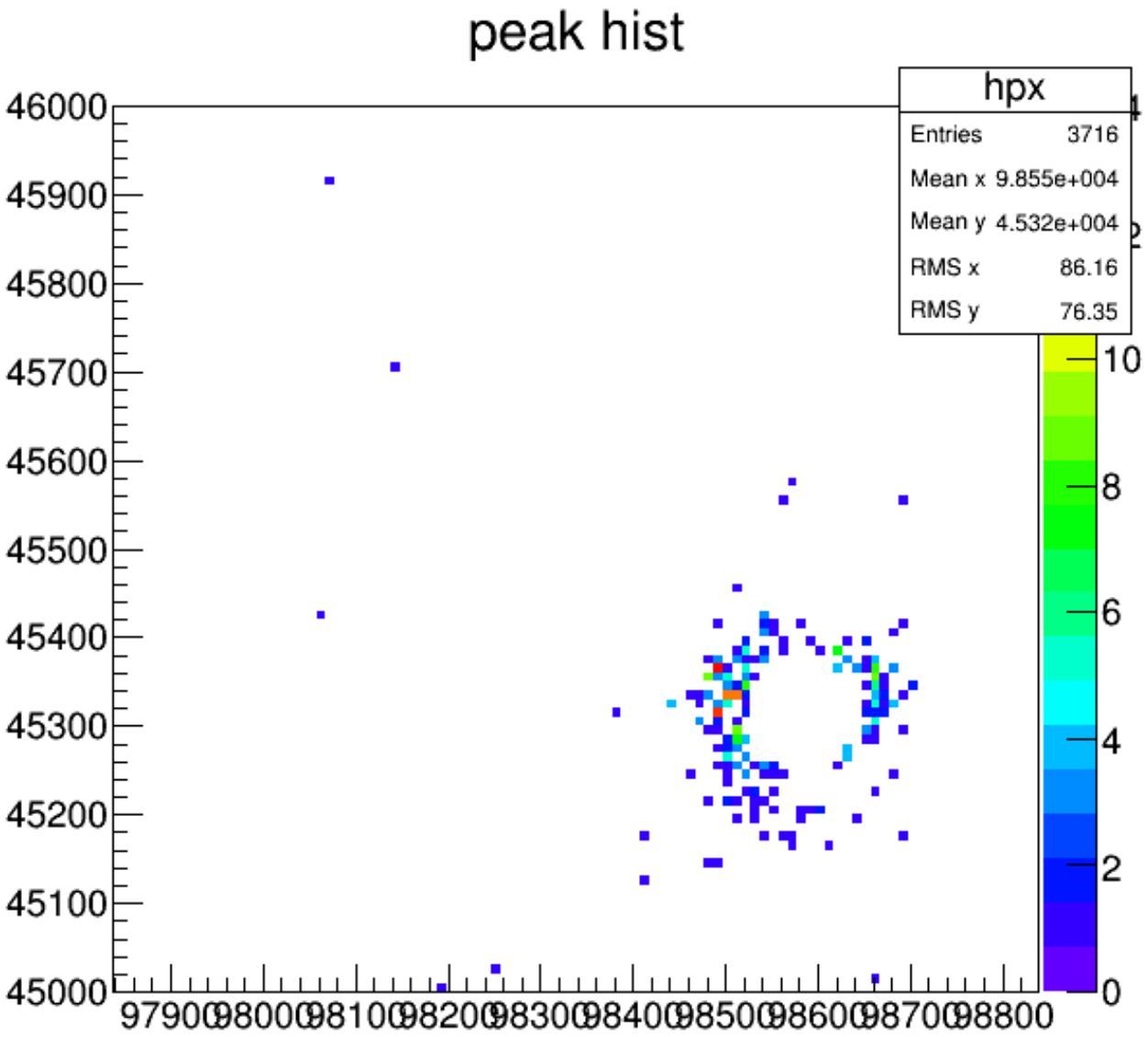
New method another event



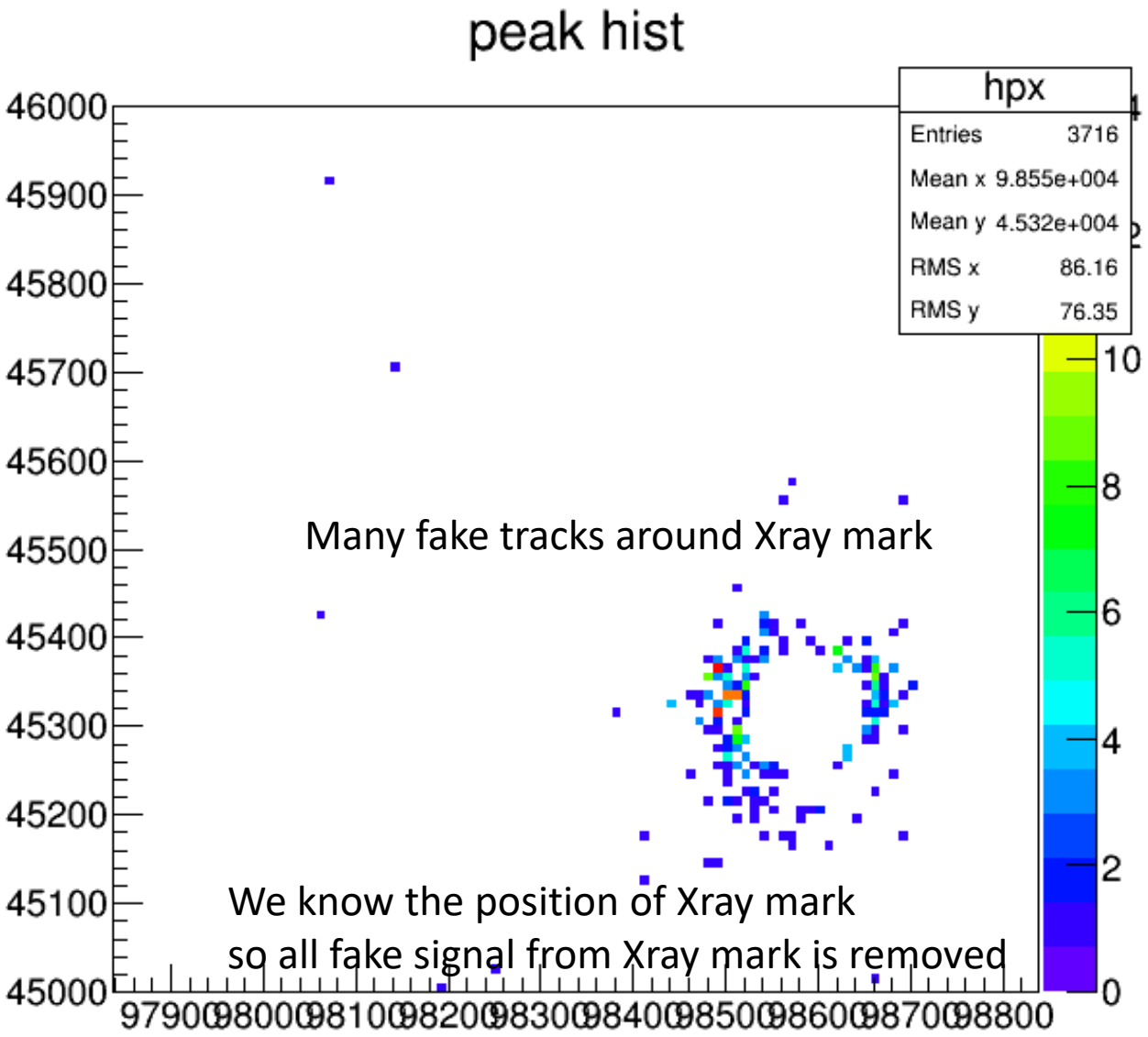
Xray mark


2D sigma
90000
80000
70000
60000
50000
40000
30000
20000
10000
20
40
60
80
100
120
?

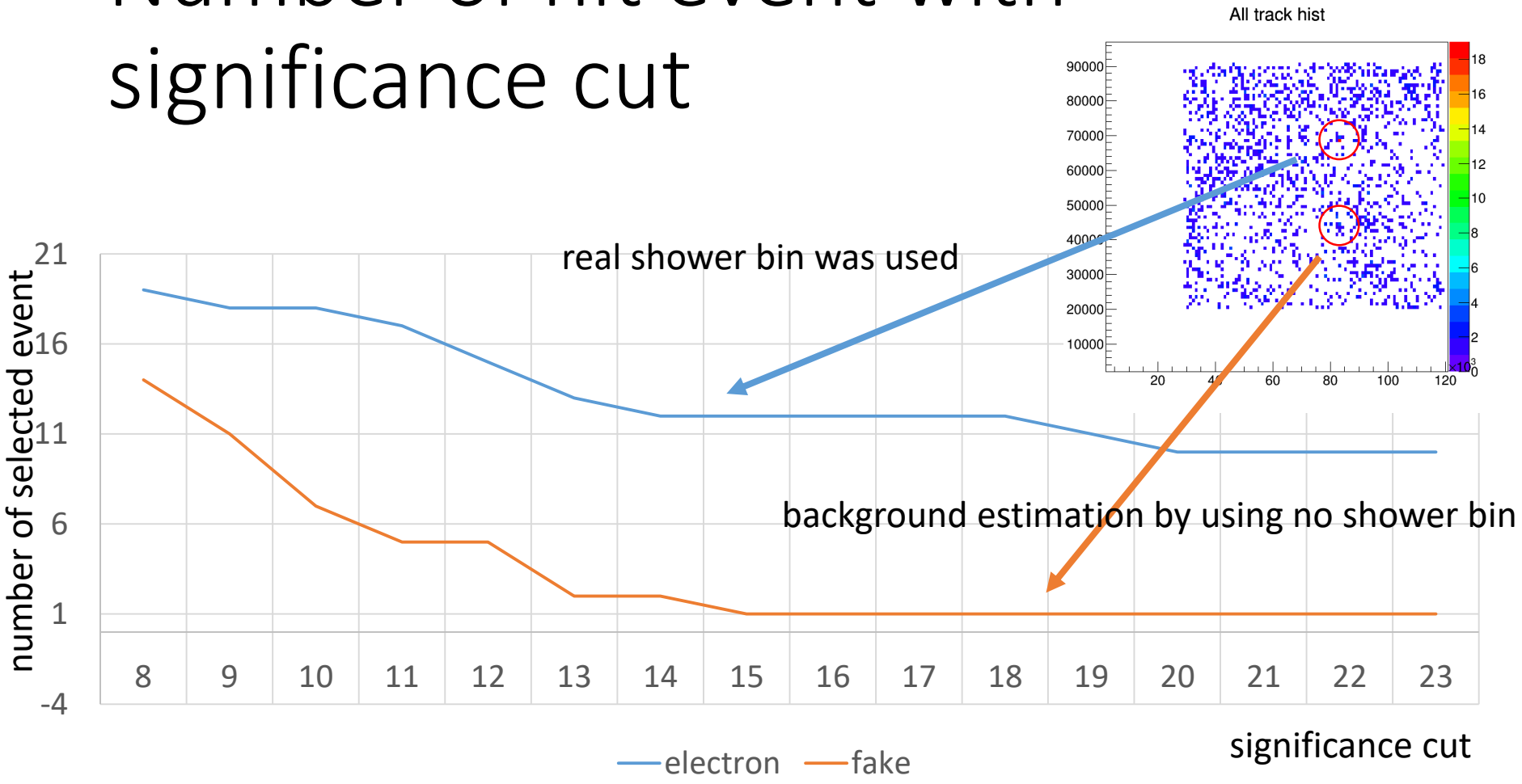
Xray mark


peak hist
hpx
Entries 3716
Mean x 9.855e+004
Mean y 4.532e+004
RMS x 86.16
RMS y 76.35
46000
45900
45800
45700
45600
45500
45400
45300
45200
45100
45000
97900
98000
98100
98200
98300
98400
98500
98600
98700
98800
10
8
6
4
2
0

Xray mark

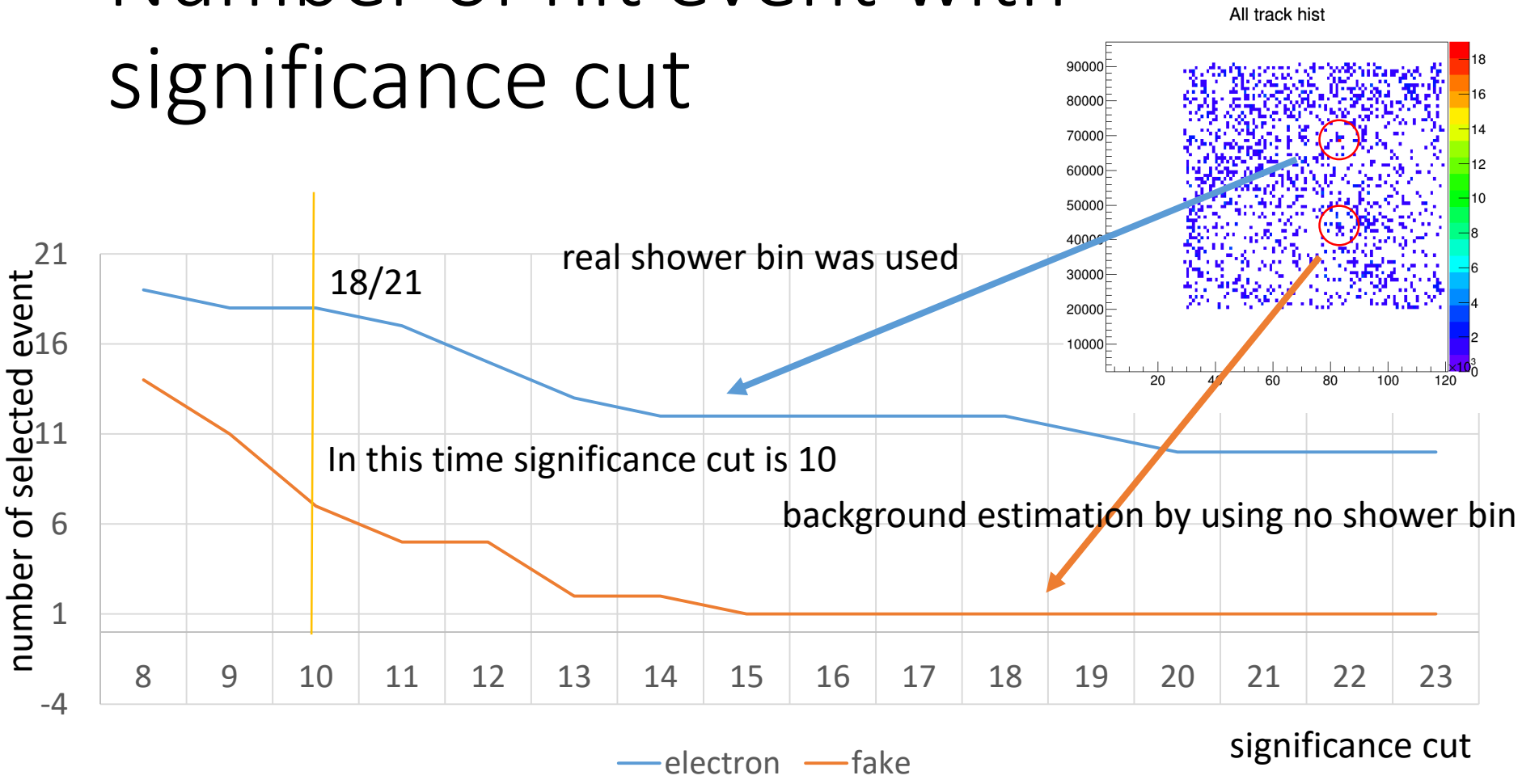

peak hist
hpx
Entries 3716
Mean x 9.855e+004
Mean y 4.532e+004
RMS x 86.16
RMS y 76.35
Many fake tracks around Xray mark
We know the position of Xray mark
so all fake signal from Xray mark is removed

Number of hit event with significance cut



I evaluated the number of event selected at each significance based on found 21 nue event

Number of hit event with significance cut

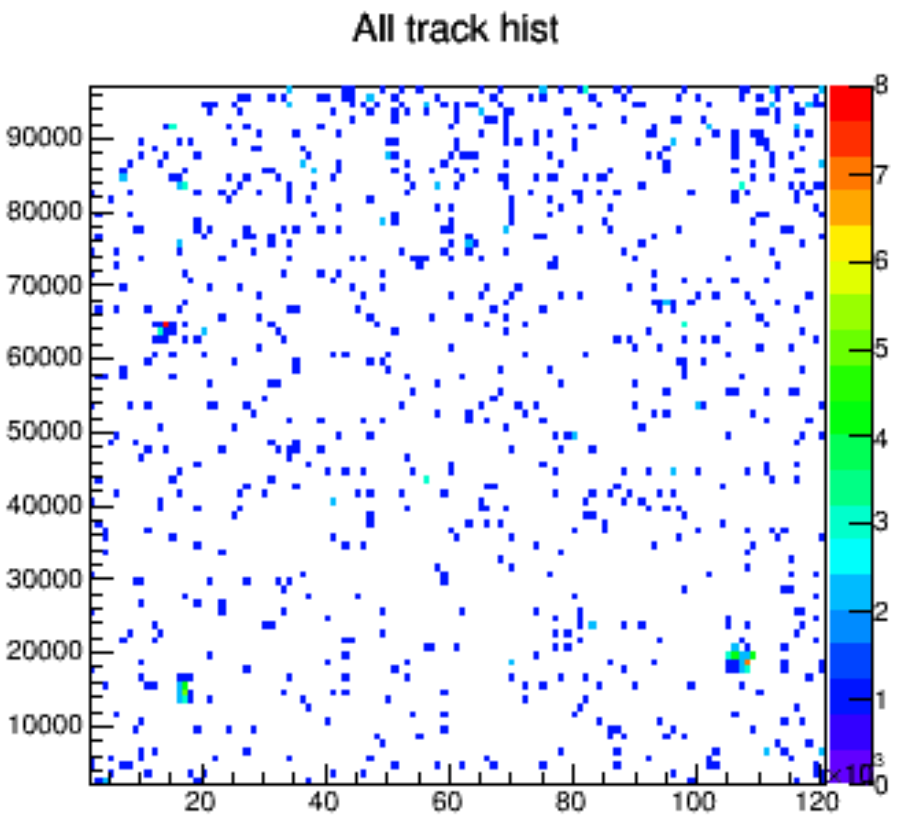


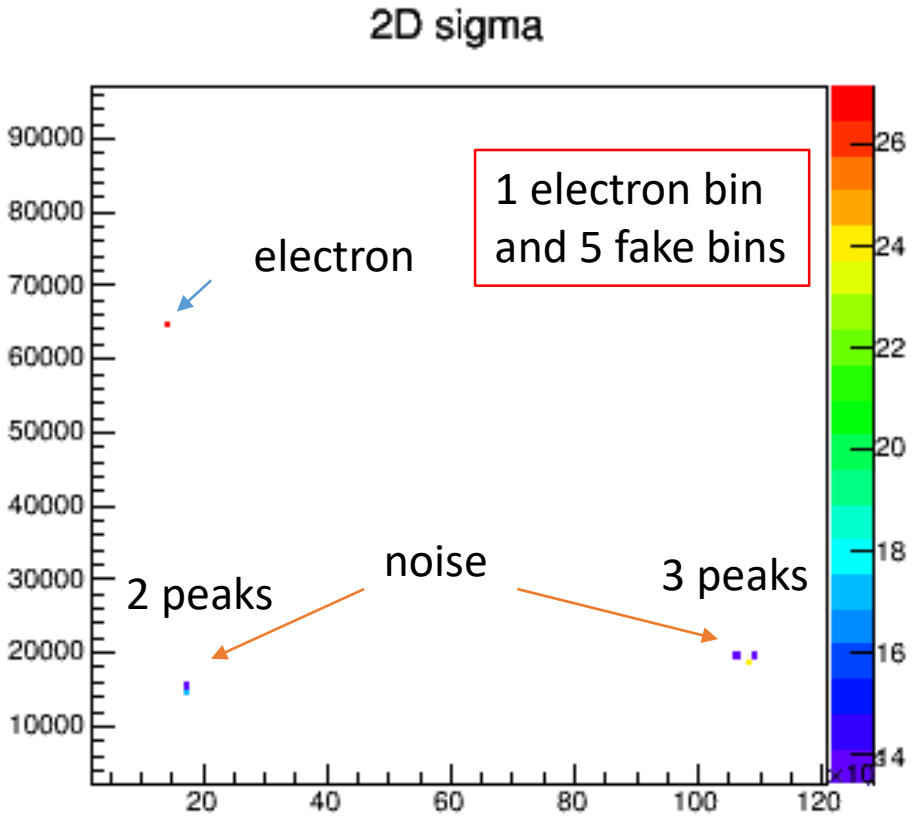
I evaluated the number of event selected at each significance based on found 21 nue event

Selection

- significance cut
- track parallelity
- minimum distance from vtx

Additional 1:track parallelity

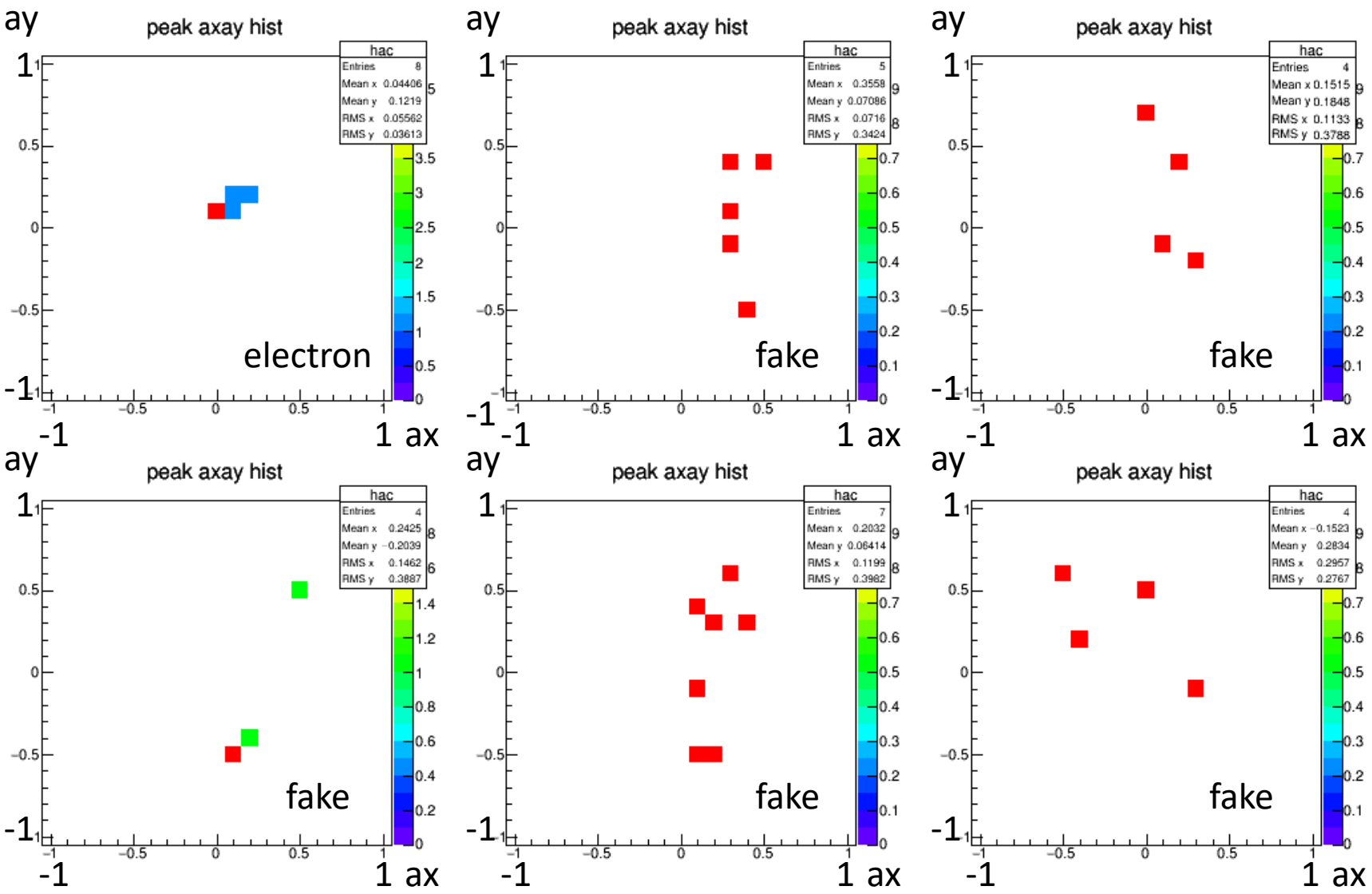




We could not select only shower signal by using only significance cut

Additional 1:track parallelity

angle distribution of each selected bin

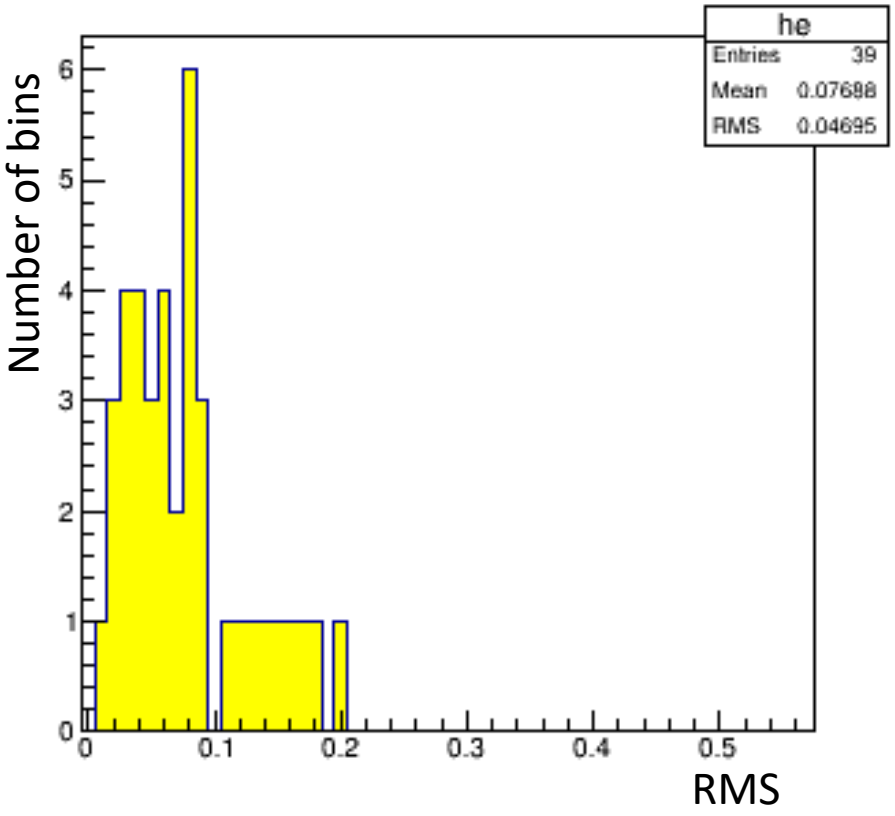


I could remove fake track by using track parallelity

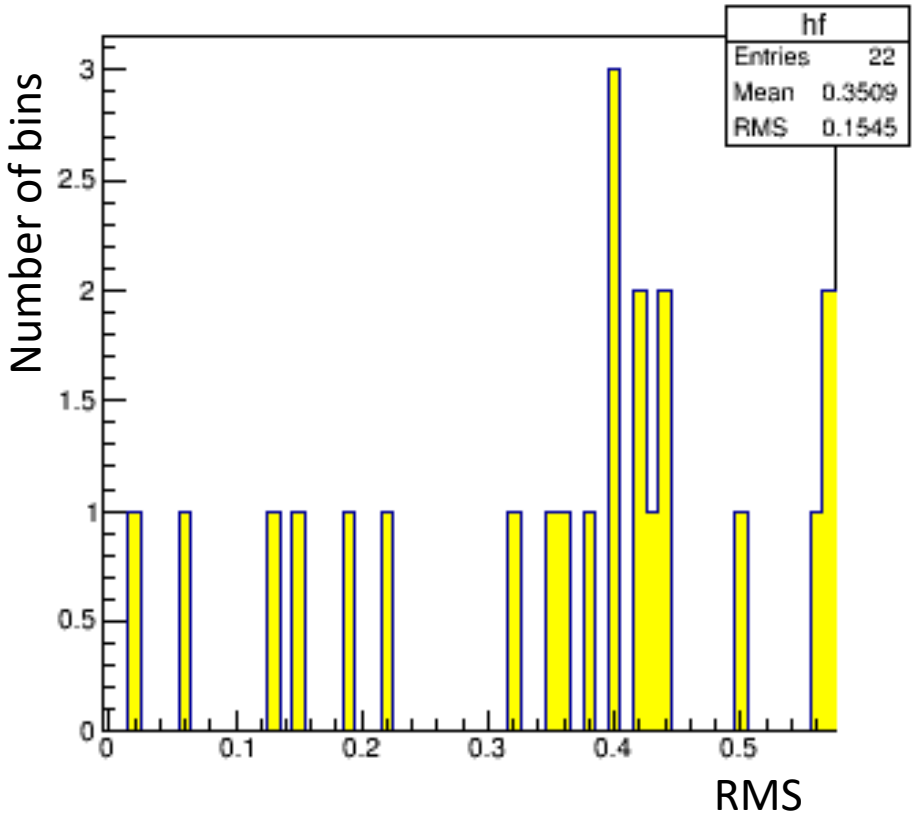
Additional 1:track parallelity

RMS of track angles in a bin(root mean square of x and y projection)

electron bin



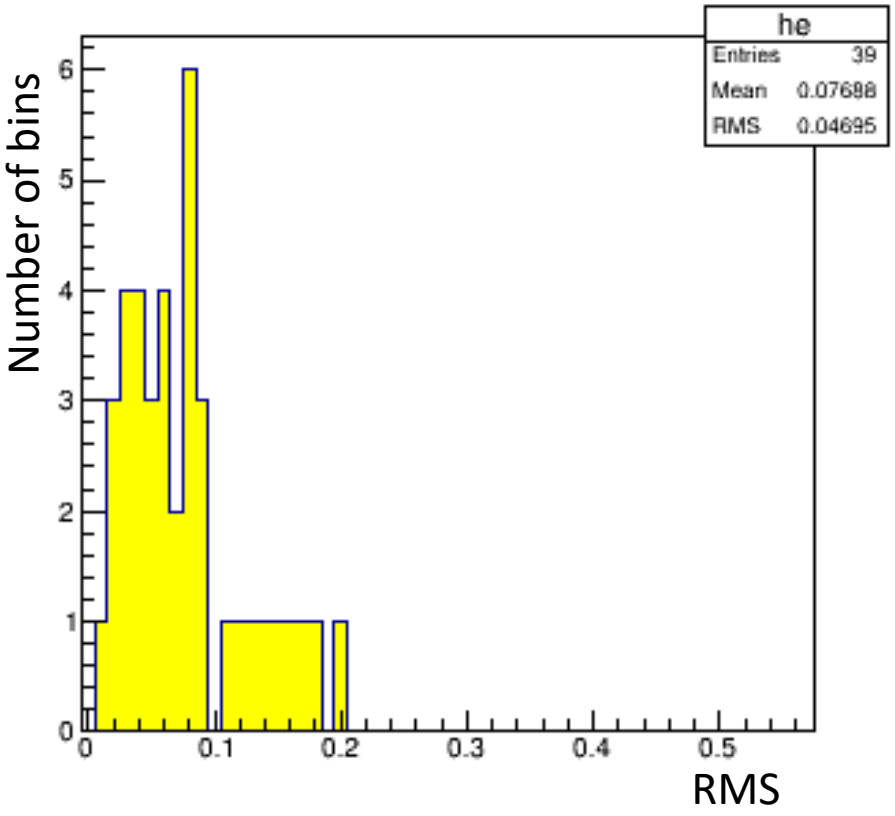
fake bin



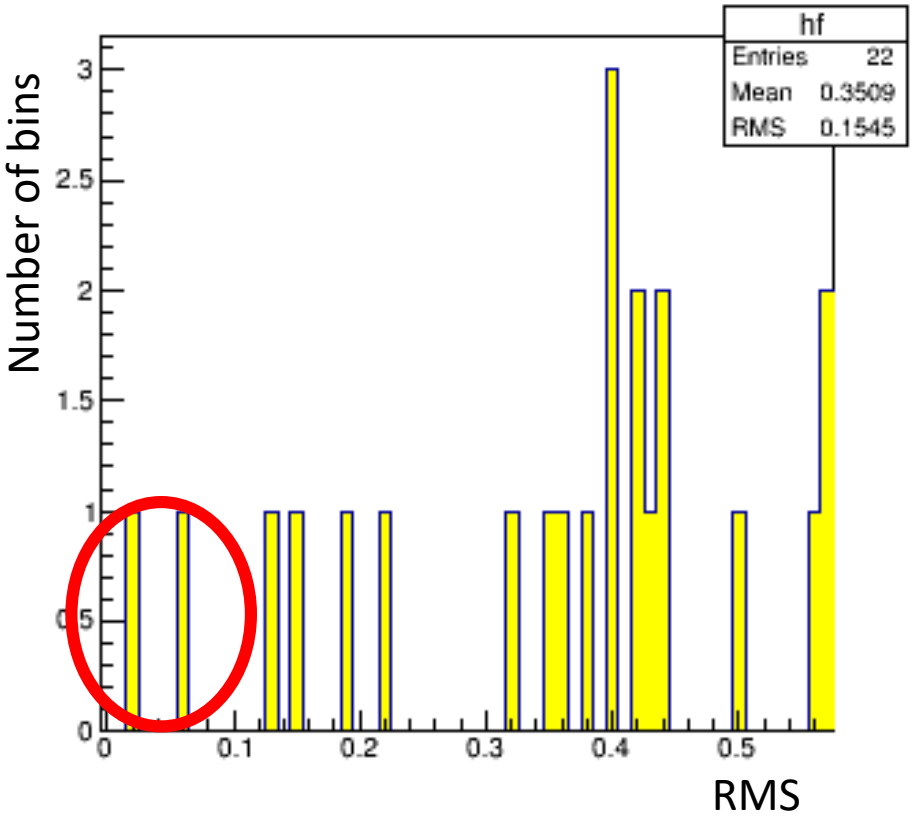
Additional 1:track parallelity

RMS of track angles in a bin(root mean square of x and y projection)

electron bin



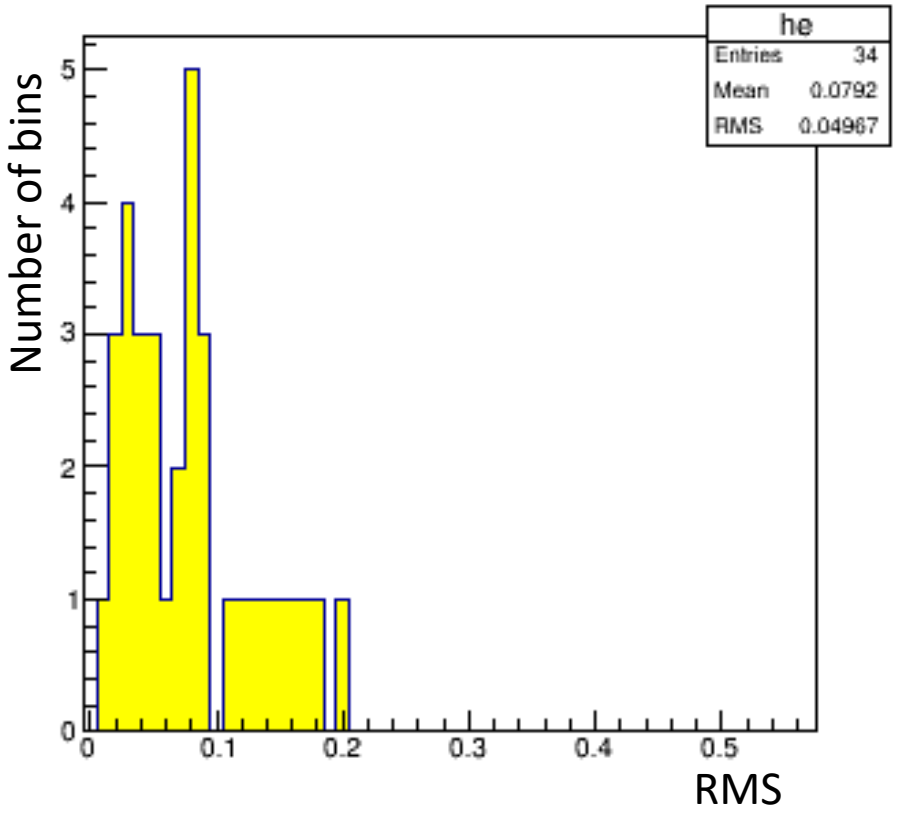
fake bin



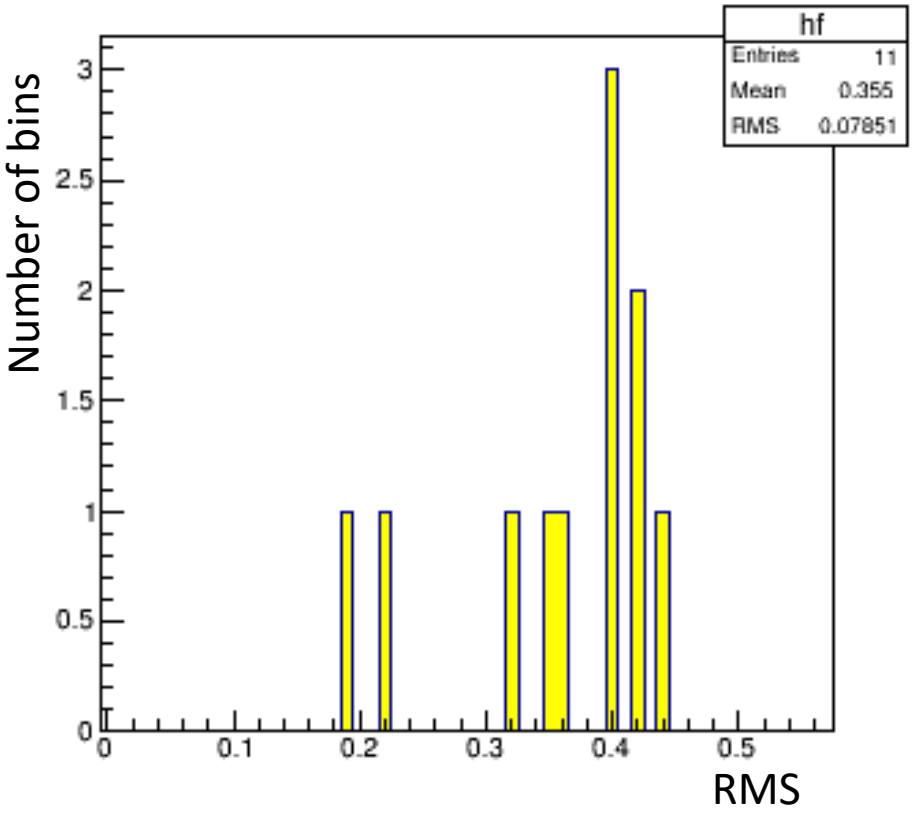
A few tracks sometimes it become parallel at coincidence

Additional 1-A:track parallelity More than 3 track in a bin

electron bin

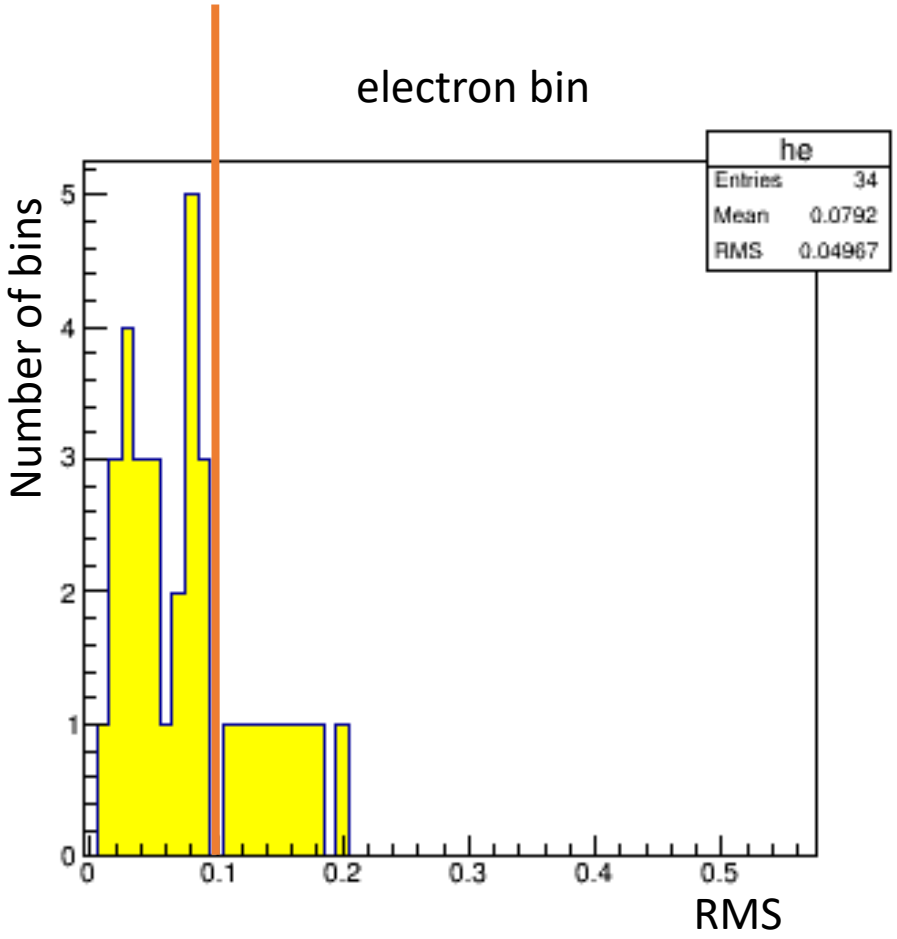


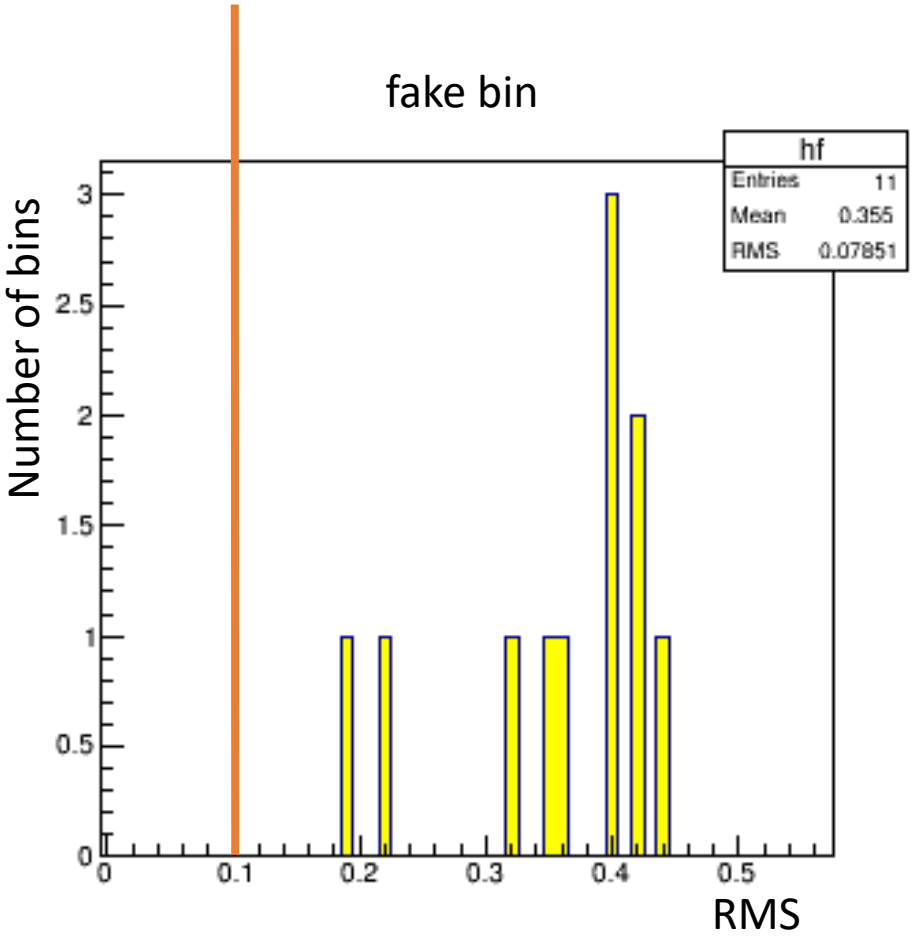
fake bin



To remove fake tracks (RMS<0.1), requested “more than 3 tracks in a bin”

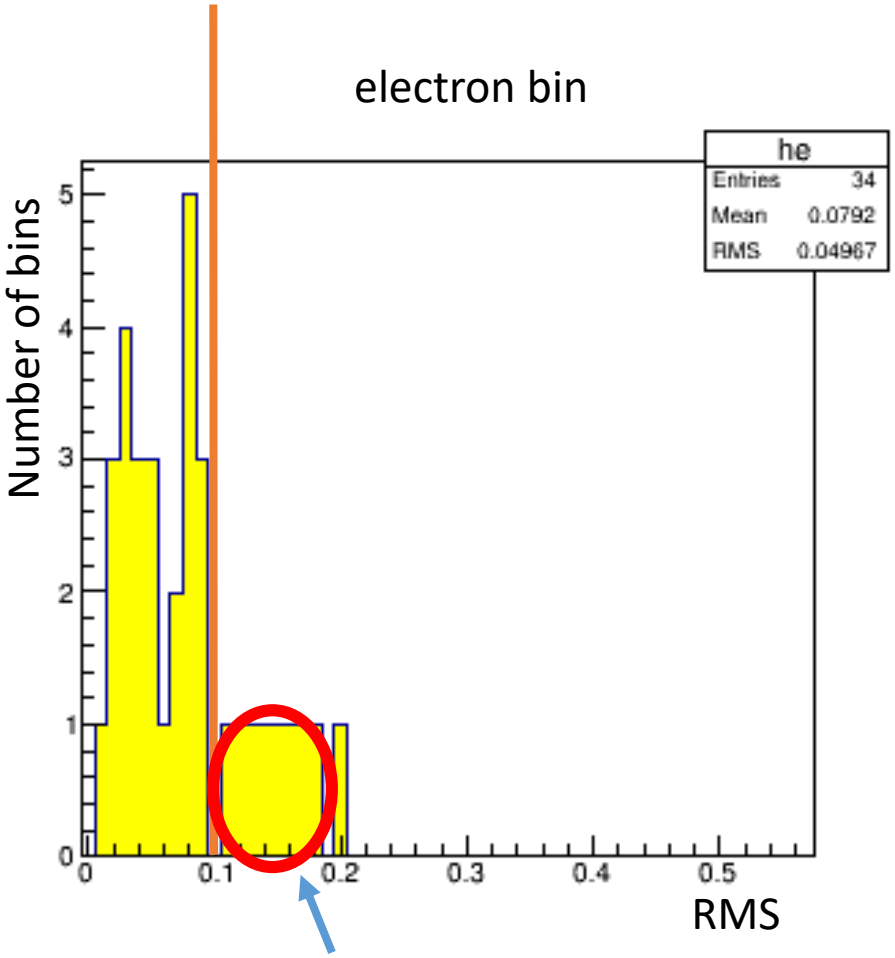
Additional 1-A:track parallelity More than 3 track in a bin

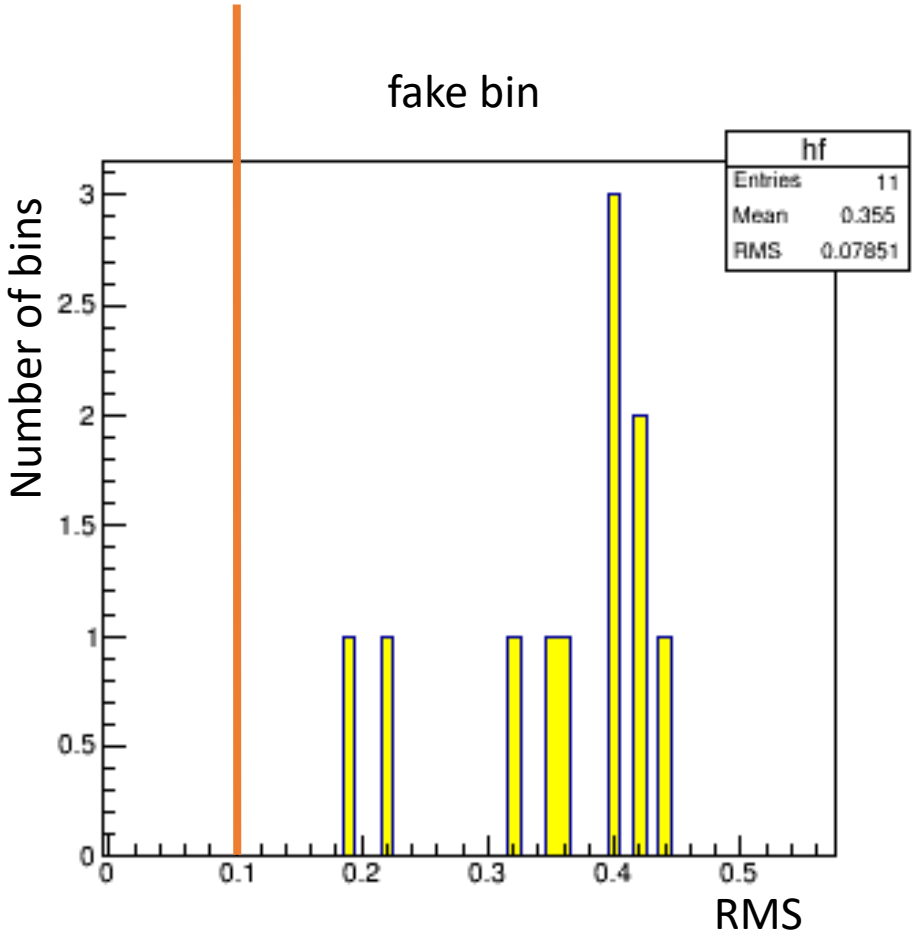




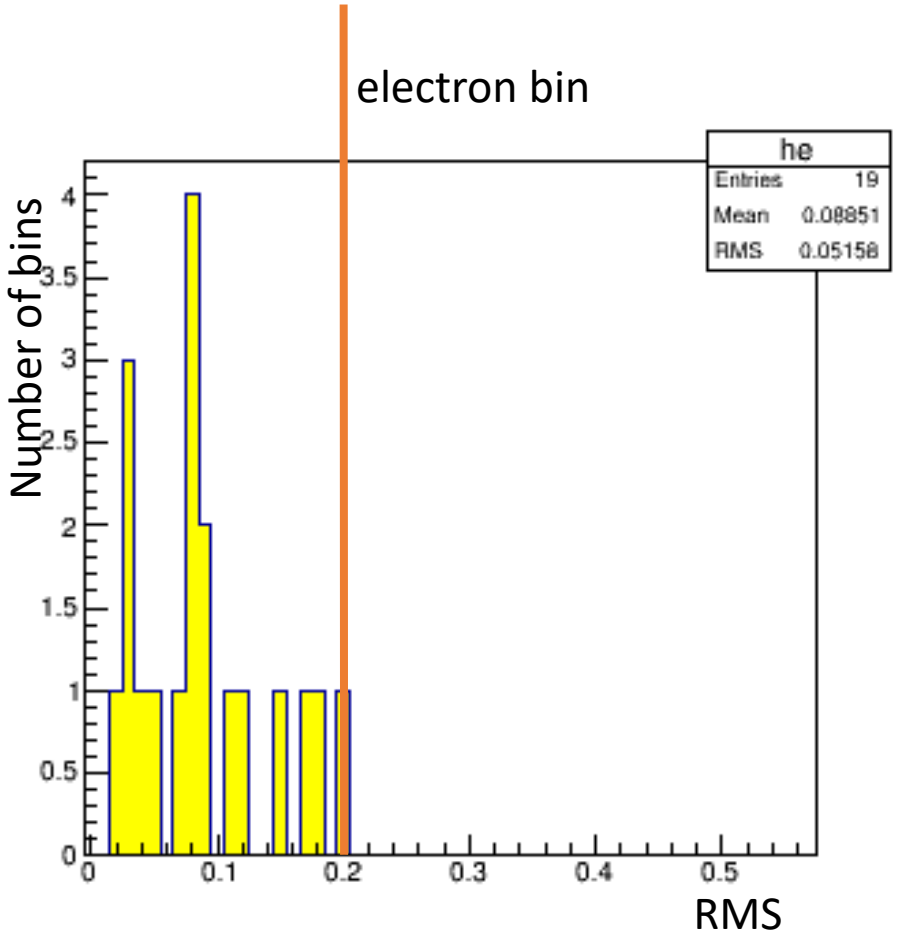
Track parallelity selection is set “RMS<0.1” for more than 3 track in a bin

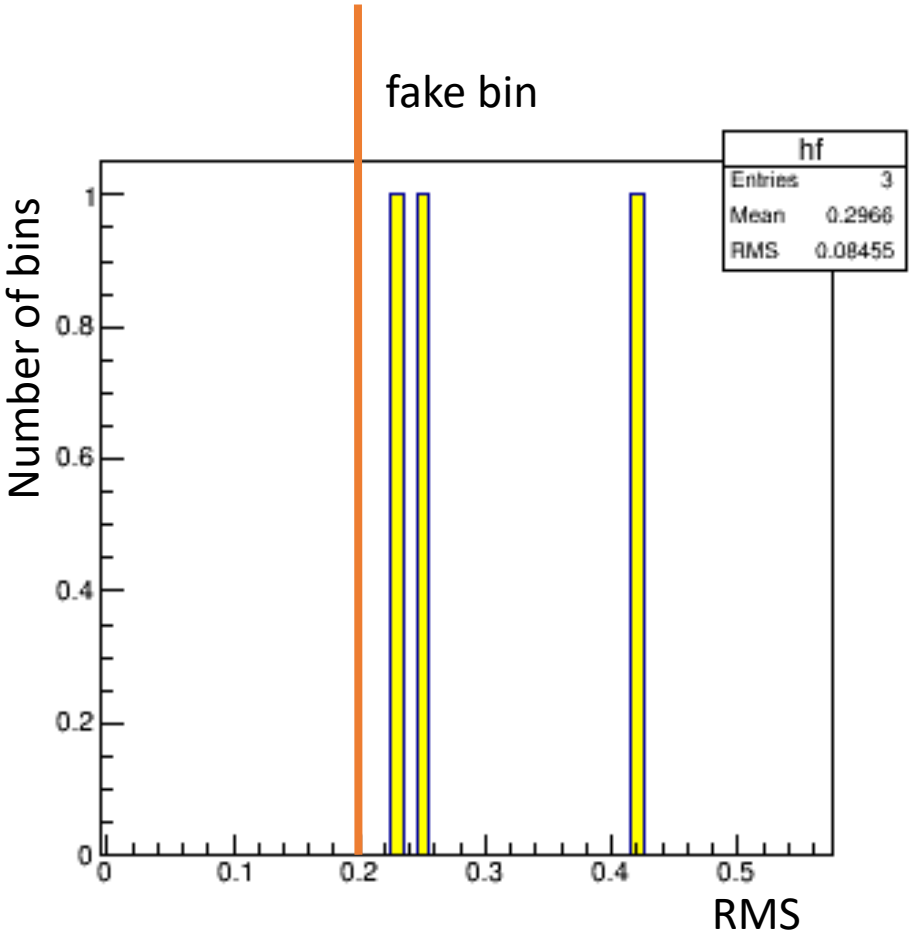
Additional 1-A:track parallelity More than 3 track in a bin





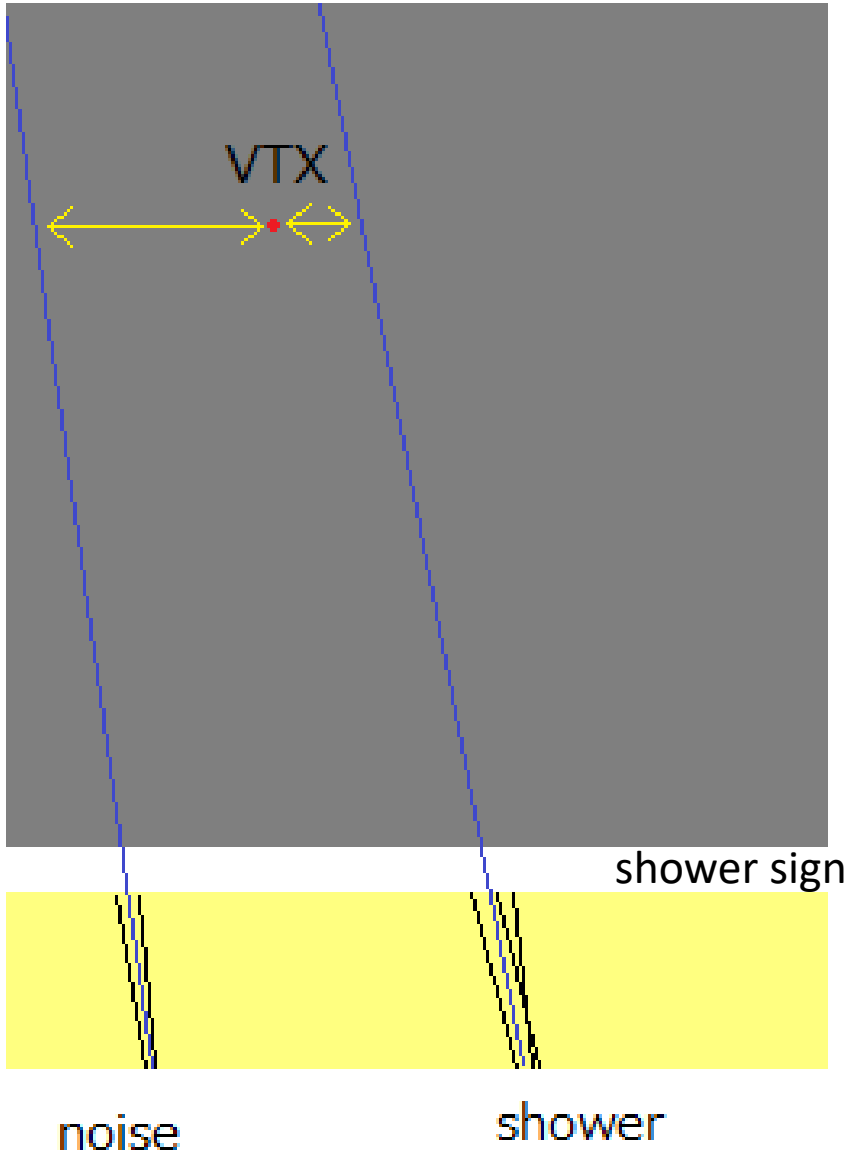
Additional 1-B:track parallelity
More than 5 track in a bin





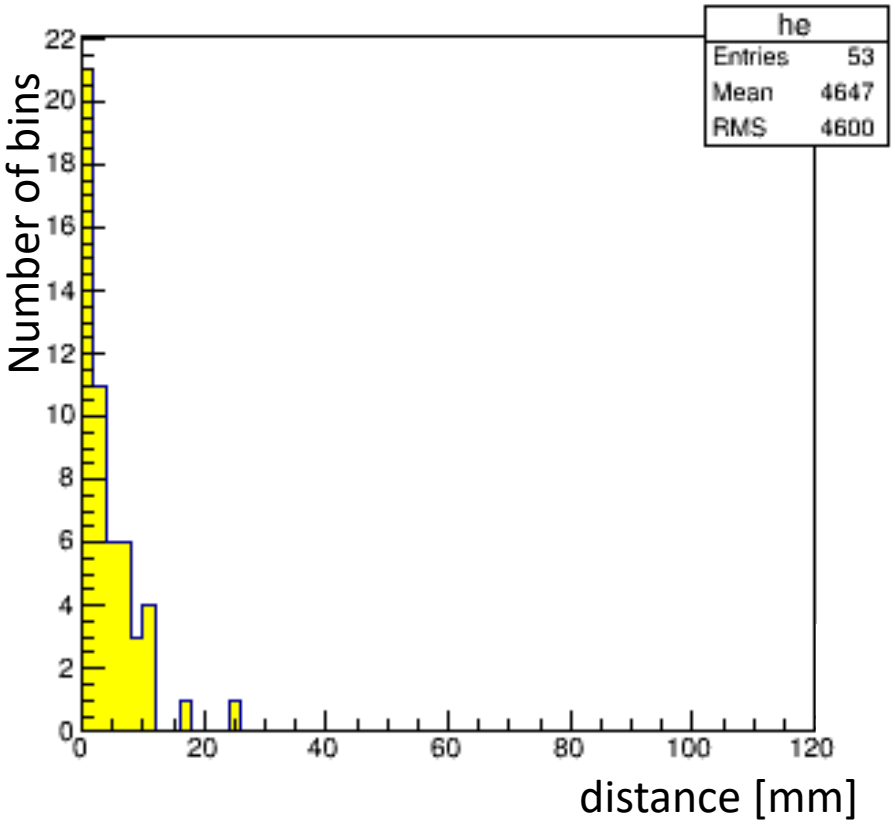
To remove fake tracks (RMS<0.2), requested “more than 5 tracks in a bin”

Additional 2:minimum distance from vtx

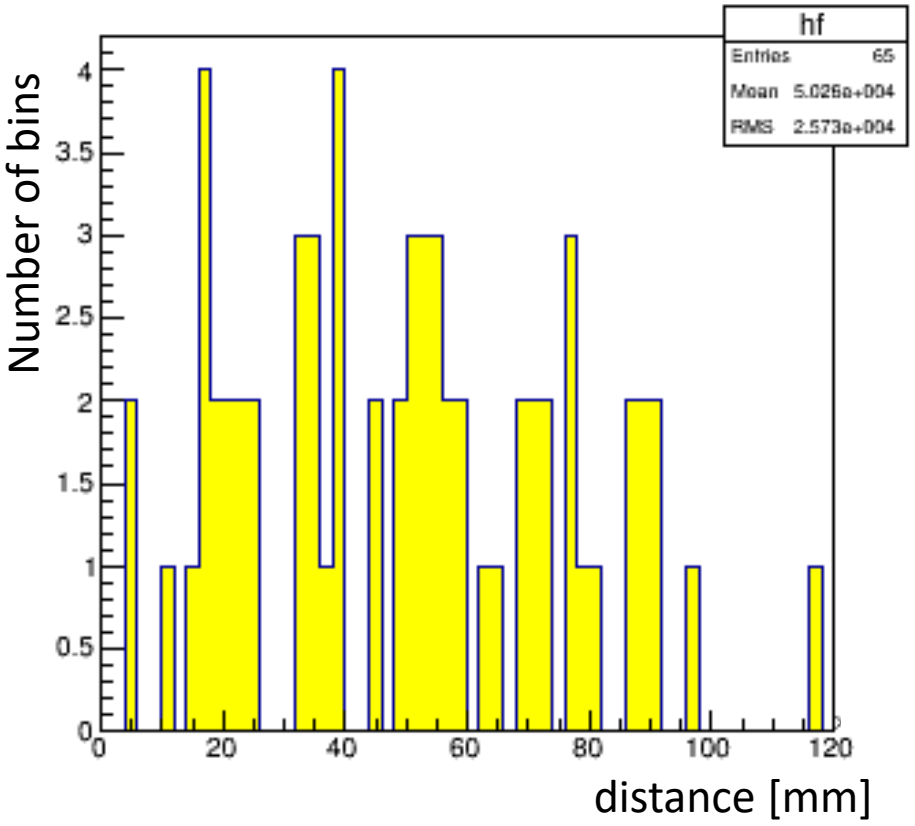


Additional 2:minimum distance from vtx

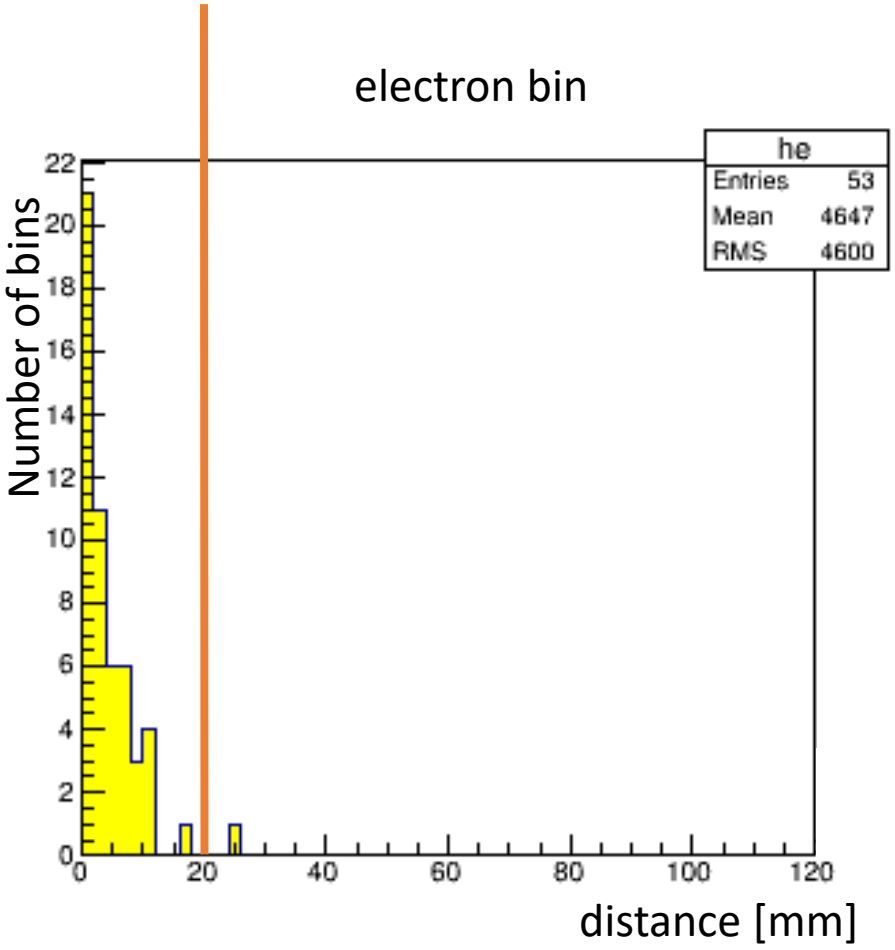
electron bin

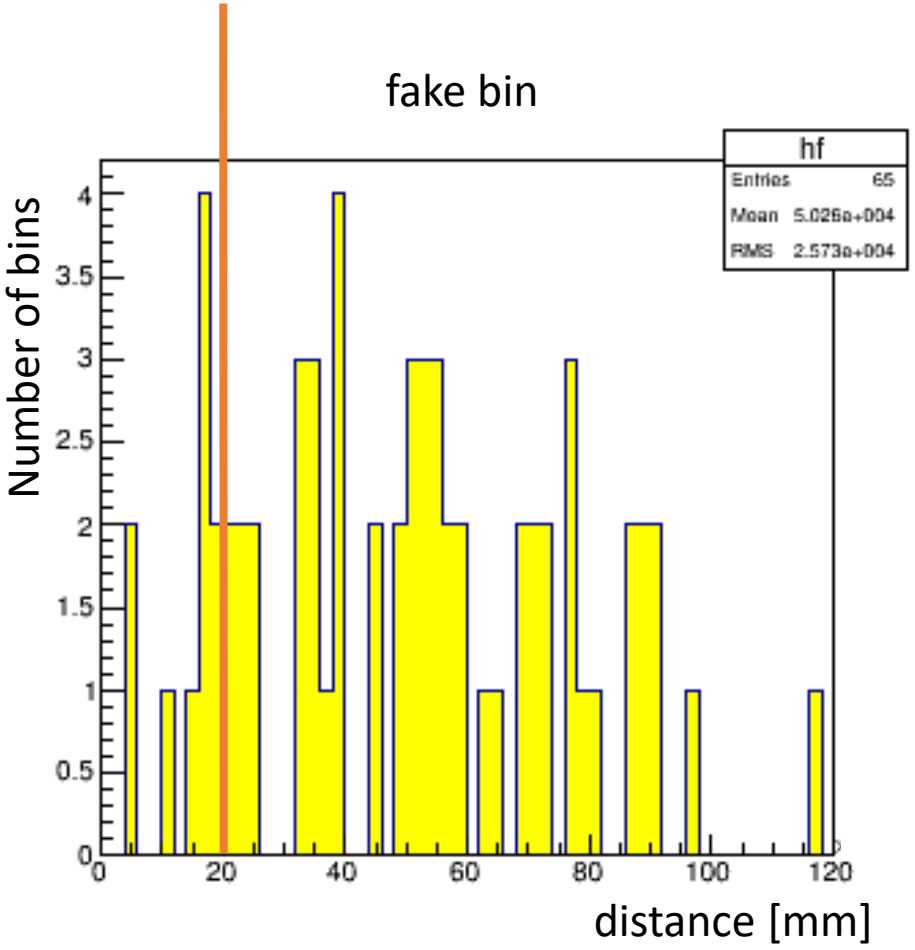


fake bin



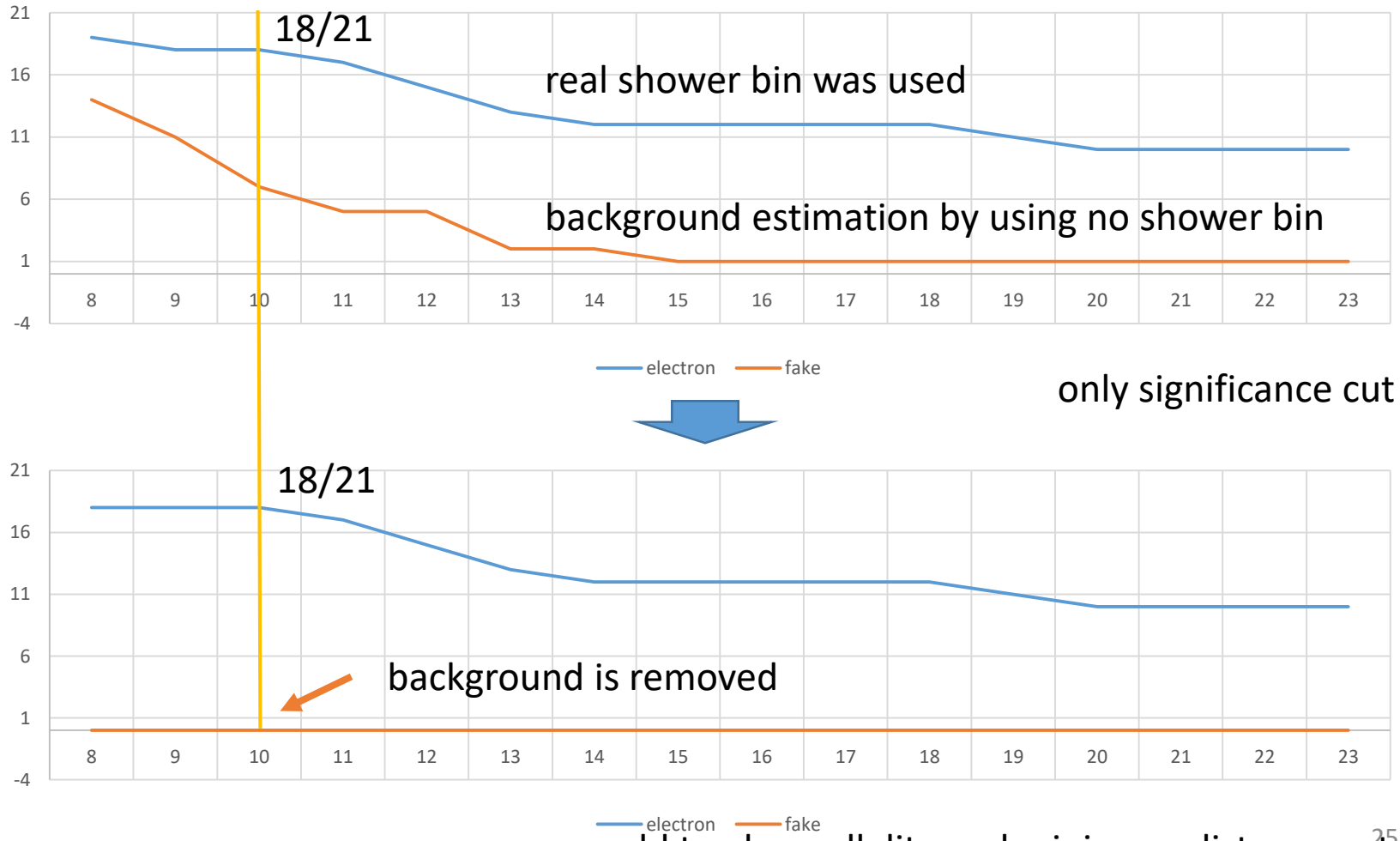
Additional 2:minimum distance from vtx





Minimum distance selection is set less than 2 cm

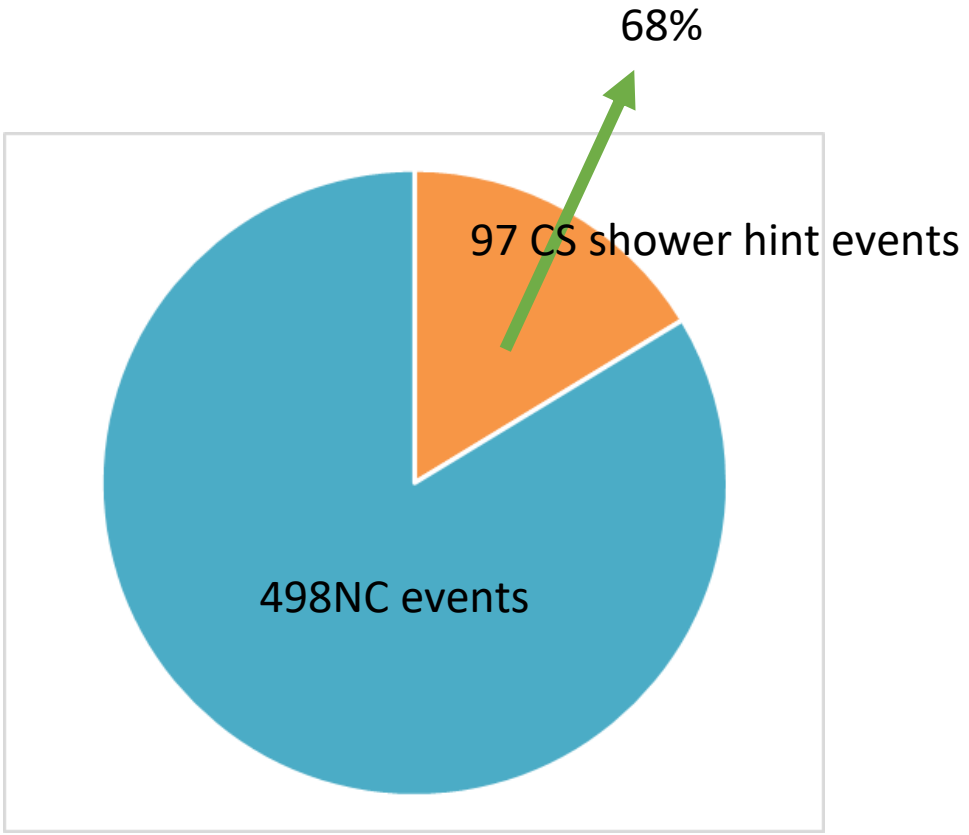
Result:method confirm



add track parallelity and minimum distance cut

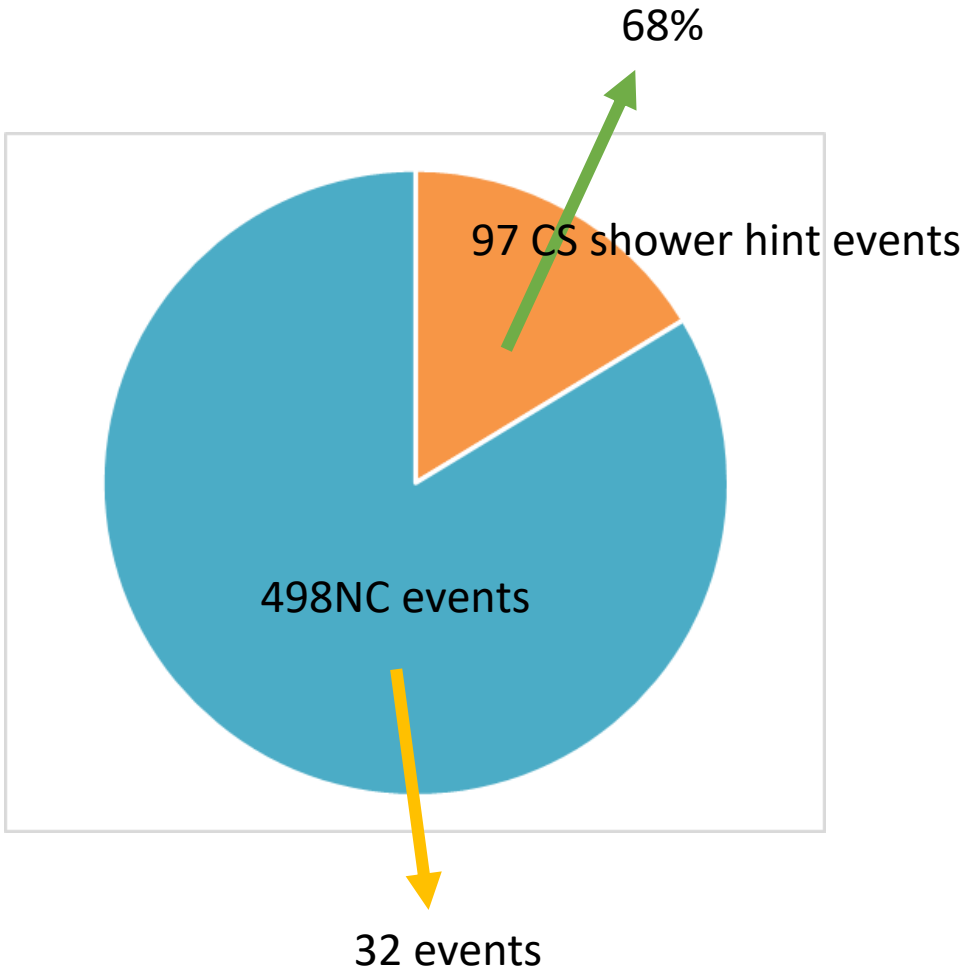
Result:apply to real data

- I applied to 21 nue event and detection efficiency was 18/21(86%).
- I tried this method to CS shower hint events and detection efficiency was 68%.
- I applied to 498 NC events.



Result:apply to real data

- I applied to 498 NC events and chosen 32 events.
- 8 events are conformed as γ ray events in the past.
- I checked 4 events and found 3 new showers.



Summary

- I try to search electron shower from density of tracks including low quality tracks.
- I applied to 498 NC events and chosen 32 events.
- I checked 4 events and found 3 new showers.
- After that, I will check other 28 events and study details of new shower event at ECC.

Back up

More than 2 track in a bin