Dual tracks study

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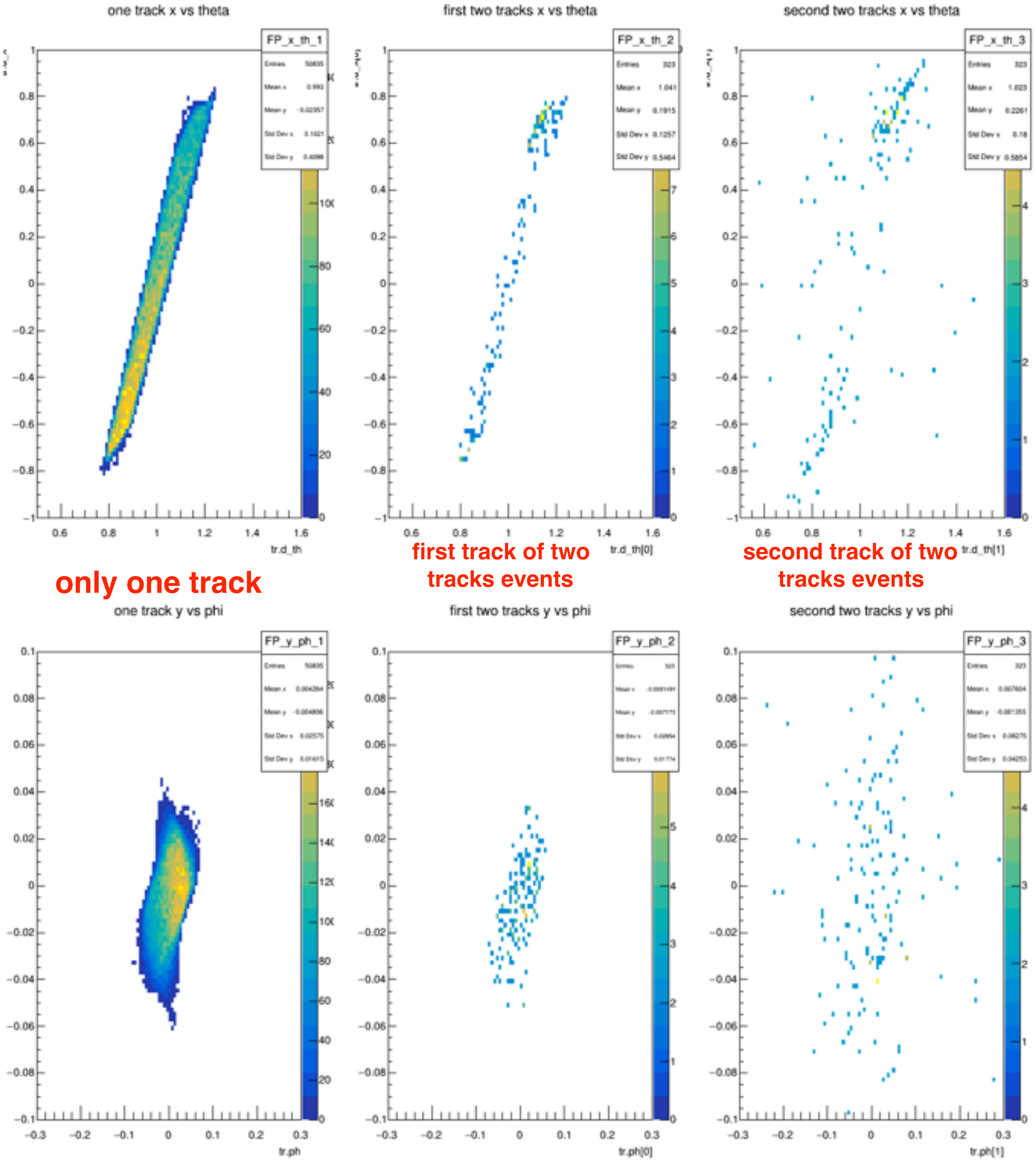
ACC: abs(theta)<0.06 && abs(phi)<0.03 && abs(dp)<0.045;
beta: beta>0;
Ep: E/p>0.75;
CK: cer.asum_c>2000;
VZ: abs(tr.vz)<0.1;
trigger2: (s0&s2)&cer

Run 1213
(tritium kin1)

After (beta+Ep+ACC+CK+VZ+trigger2) cut,
99.6% events have only one track;
0.3% events have two tracks;

Focal plane

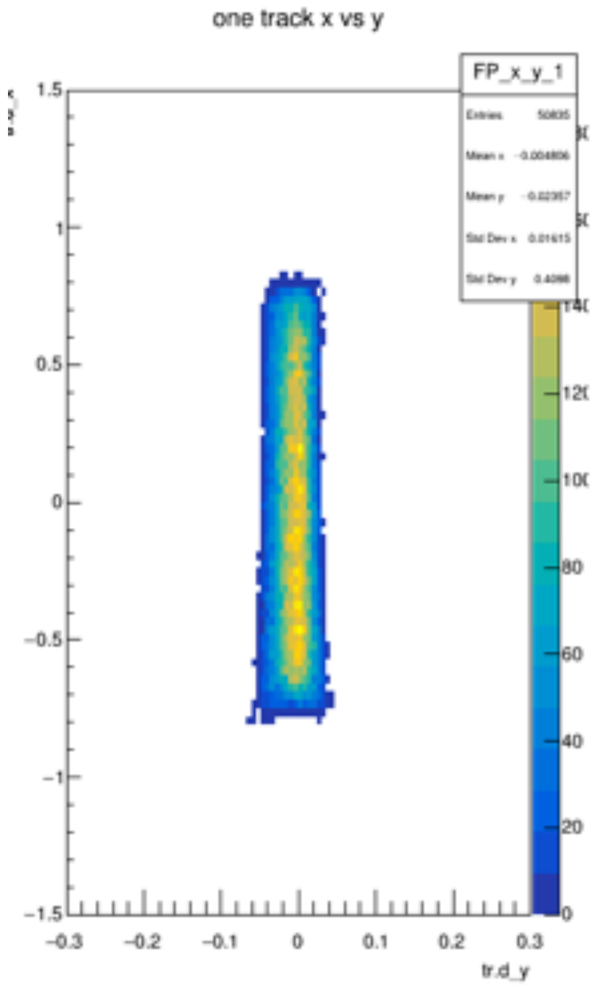


tr.d_x:tr.d_th

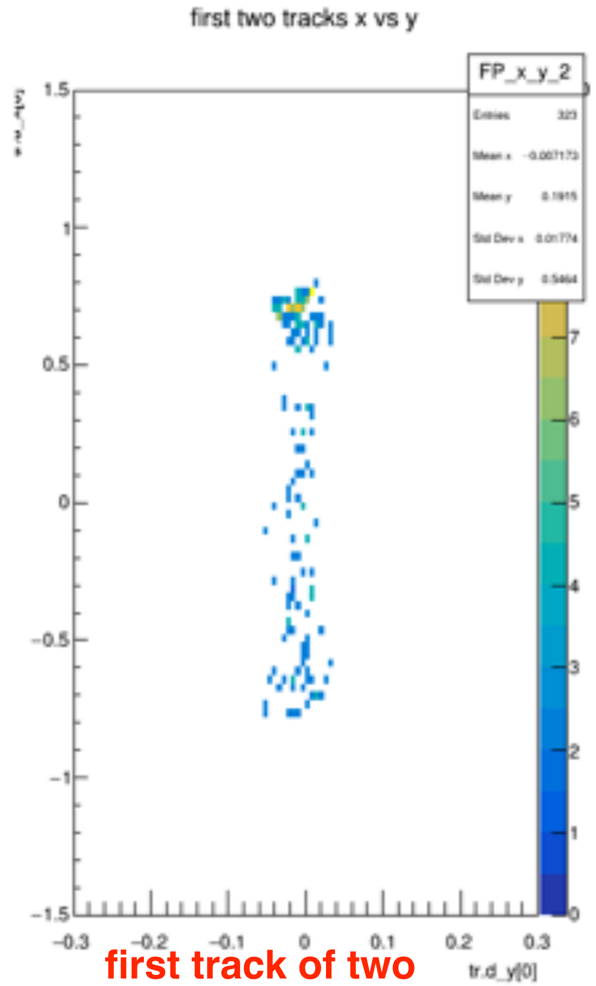
tr.d_y:tr.d_ph

Focal plane

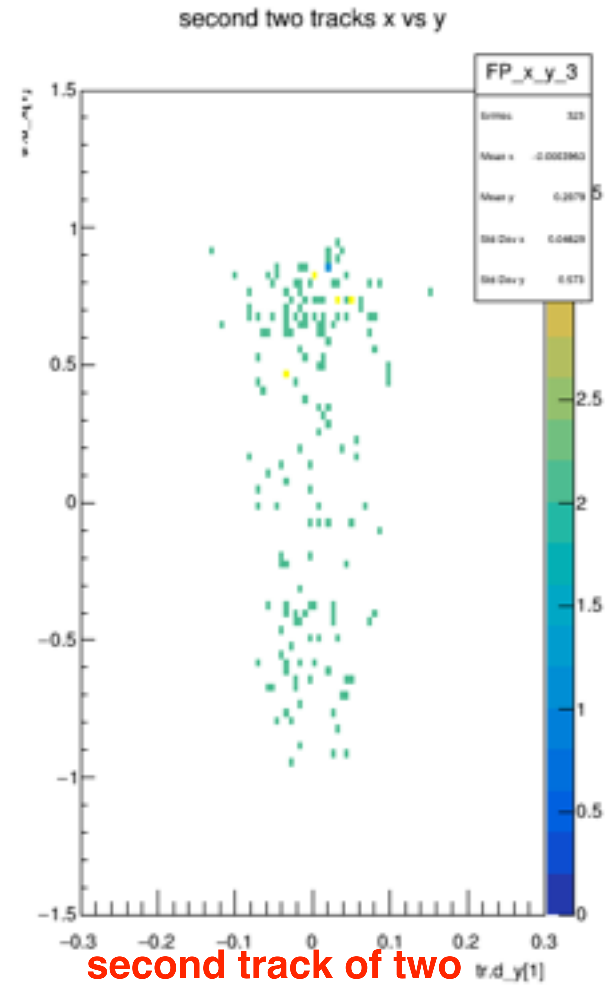
tr.d_x:tr.d_y



only one track

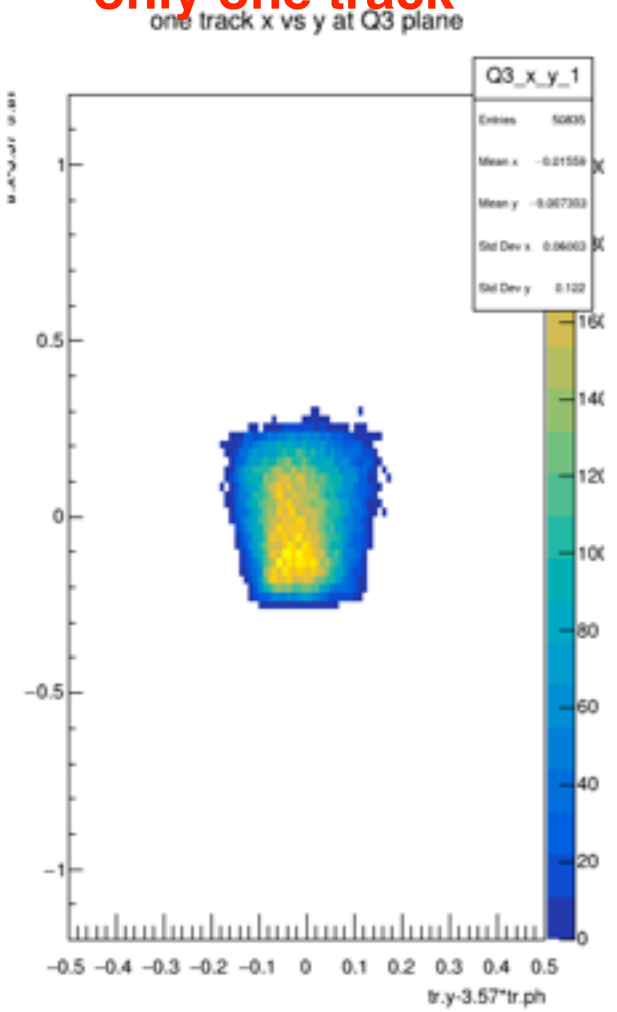


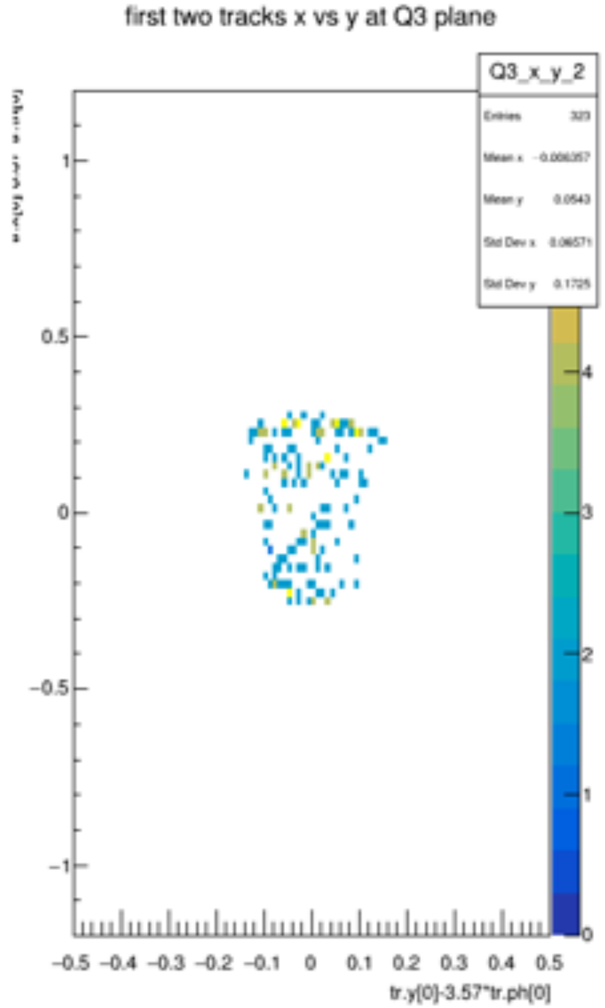
first track of two tracks events

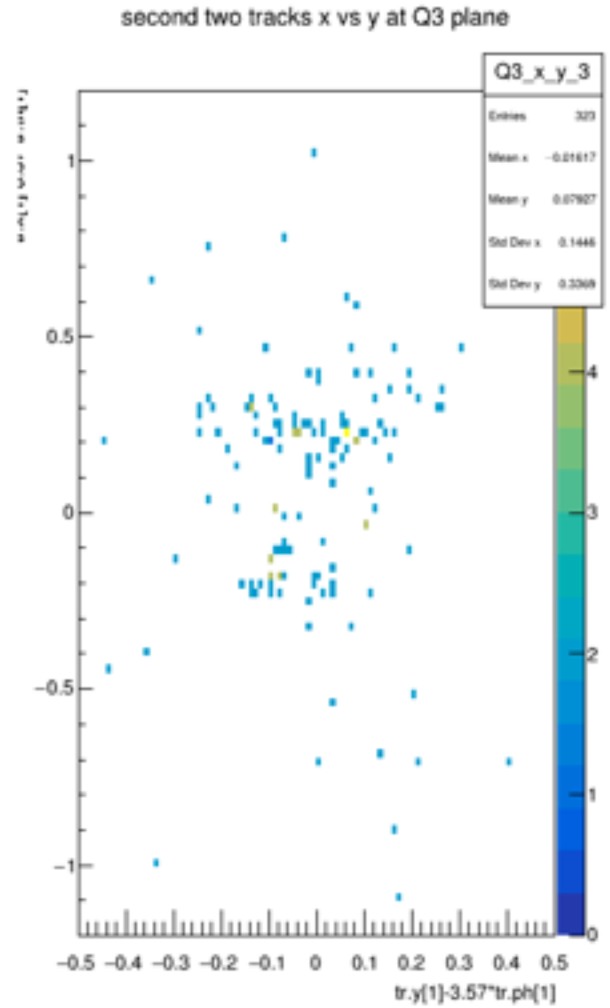


second track of two tracks events

Q3 plane





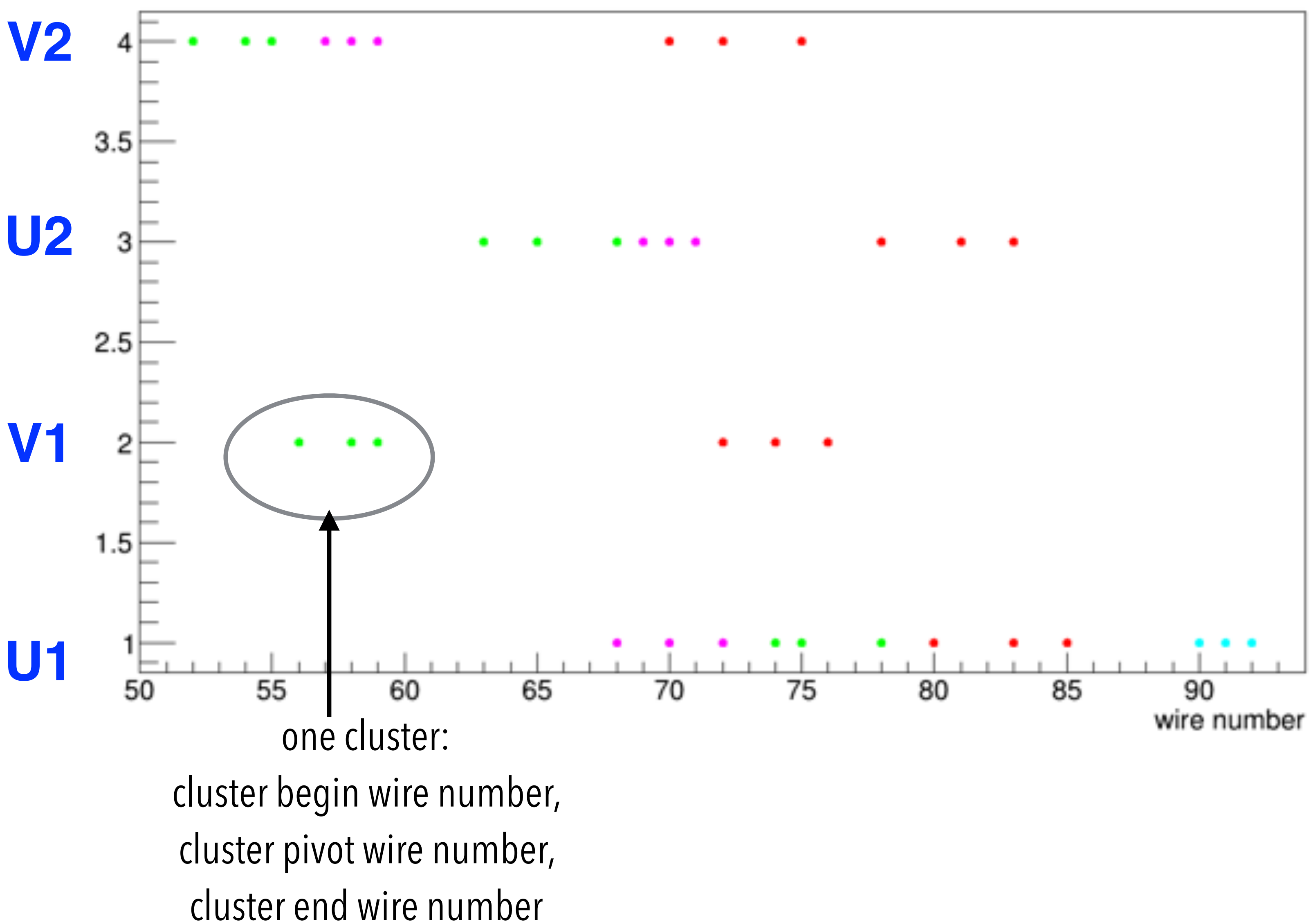


the first track of Dual tracks events looks normal

How Analyzer construct tracks:

- Only VDC planes variable used;
- Find clusters at four VDC planes->fit tracks;
- Dual track events: at least two clusters at each plane;

For one event: clusters found for each plane; (same color for matched clusters between different VDC planes)



first track

second track

unable to construct track, since not every plane has cluster

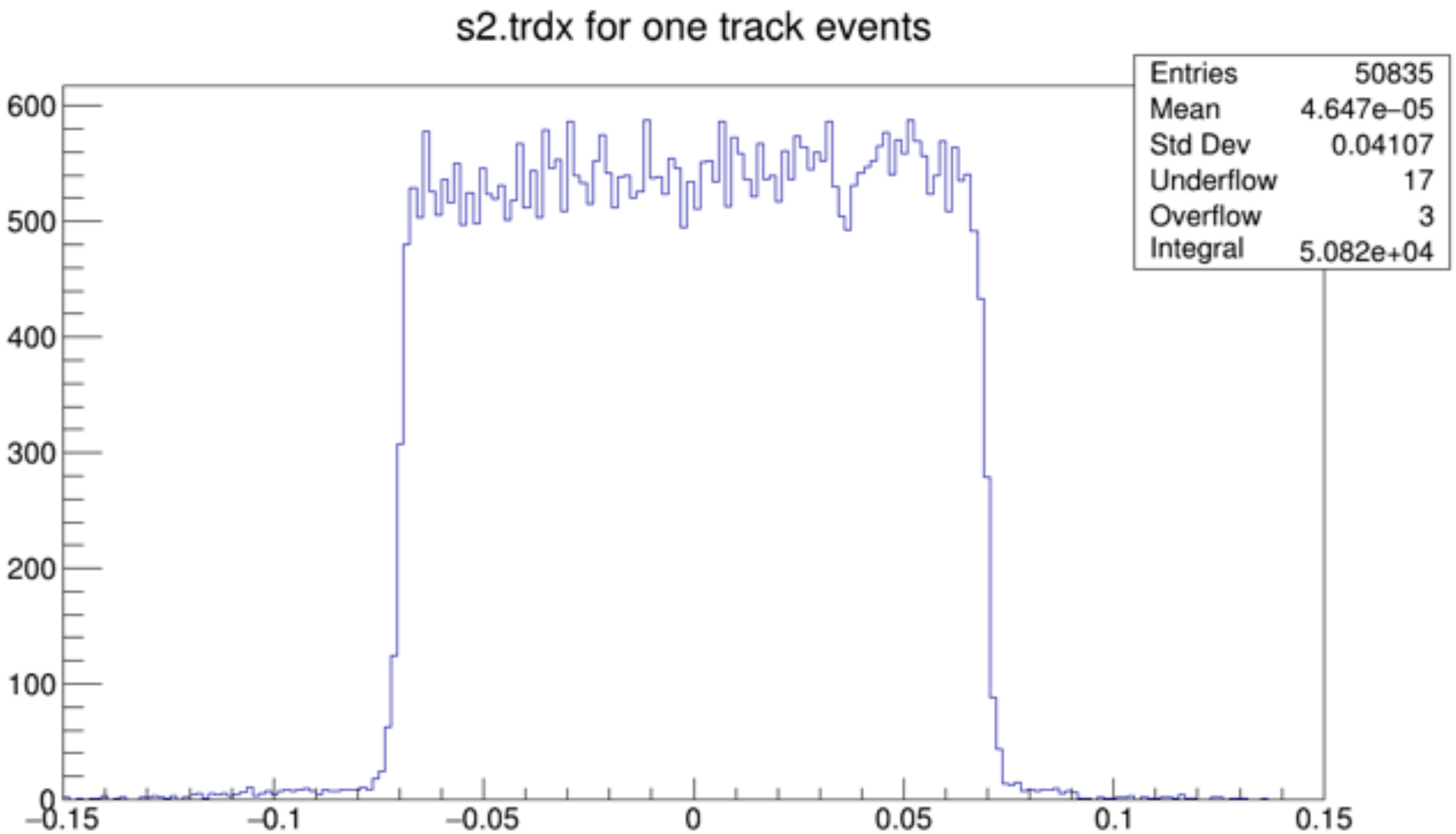
According to Analyzer: first track should have the smallest chi2/ndof

How to select the good one from two tracks

1. S2 hit paddle

- S2 hit paddles: both left PMT and right PMT tdc bigger than 0;
- L.s2.trdx: the distance between the track projection and the closest hit in S2 dispersive plane;
- s2.trdx should be smaller than half paddle width (~0.07m)

For example: s2.tr_dx for only one track good events



How to select the good one from two tracks

- S2 hit paddles: both left PMT and right PMT tdc bigger than 0;
- Apply abs(L.s2.trdx[0])<0.075 and abs(L.s2.trdx[1])<0.075 to the two tracks events separately;

For 162 dual tracks' events:

	total events	first track pass trdx cut	second track pass trdx cut
s2 with1 hit	59	53	12
s2 with 2 hits	78	75	63
s2 with 3 hits	22	21	16
s2 with 4 hits	3	3	3
sum	162	152	94

- By using s2.trdx cut, could get rid of ~42% second track
- ~6% first track isn't good, needs to use the second track

How to select the good one from two tracks

(After requiring abs(s2.trdx[0])<0.075 && abs(s2.trdx[1])<0.075, 87 events left;)

2. Shower clusters

- For a good electron track, it should be closed to the cluster in shower;

↓

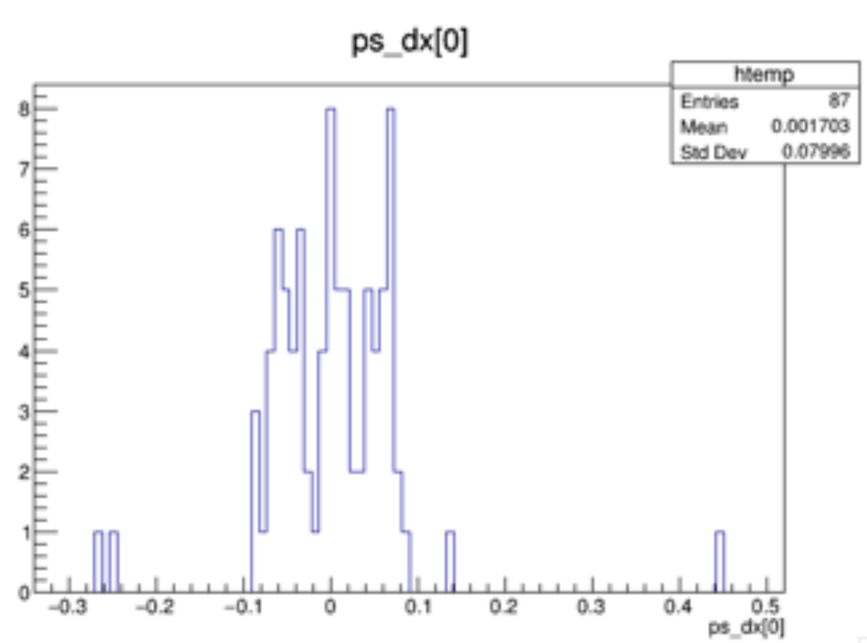
problems:

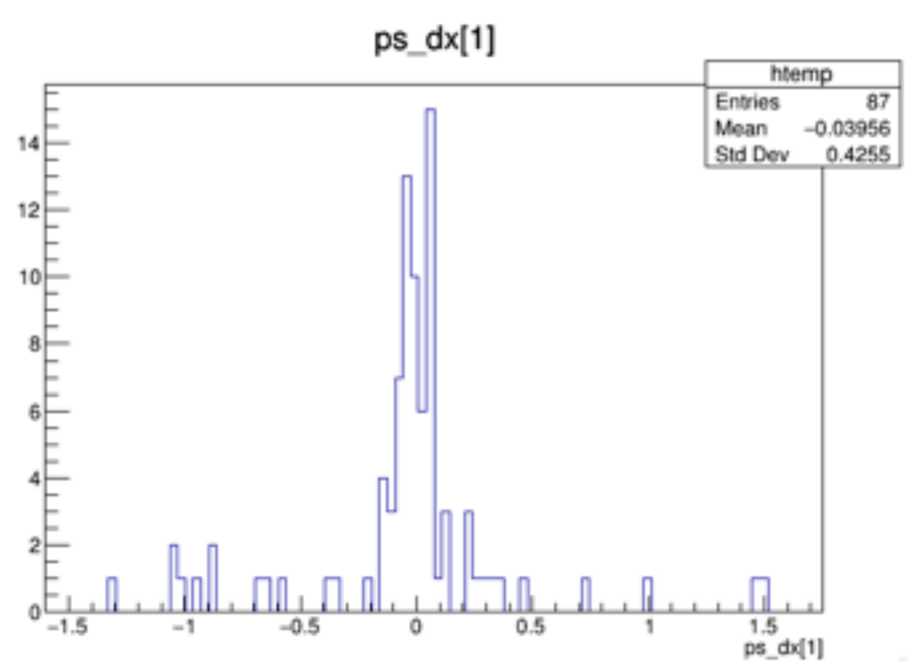
Analyzer only gives the position of the largest clusters;
There could be a second cluster for the other track;

↓

quick look:

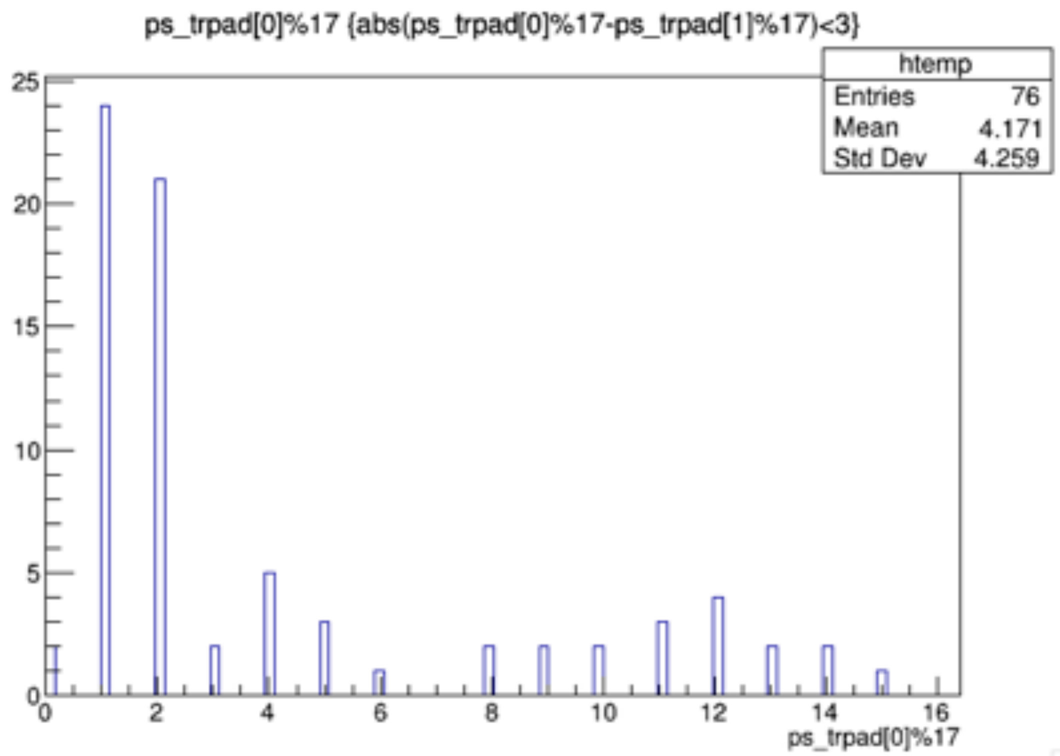
- find all the blocks that corrected ADC value is bigger than 100;
- find the closest block (with >100 ADC) to the track projection; **ps_trpad**
- calculate the distance between the track projection and the block center; **ps_dx**





For 87 events:

- abs(ps_trpad[0]%17-ps_trpad[1]%17)<3:   76



lots of clusters at the edge;
>> bad construction at edge;
>> edge scattering;

- abs(ps_trpad[0]%17-ps_trpad[1]%17)>=3:   11

two well separated clusters in shower:

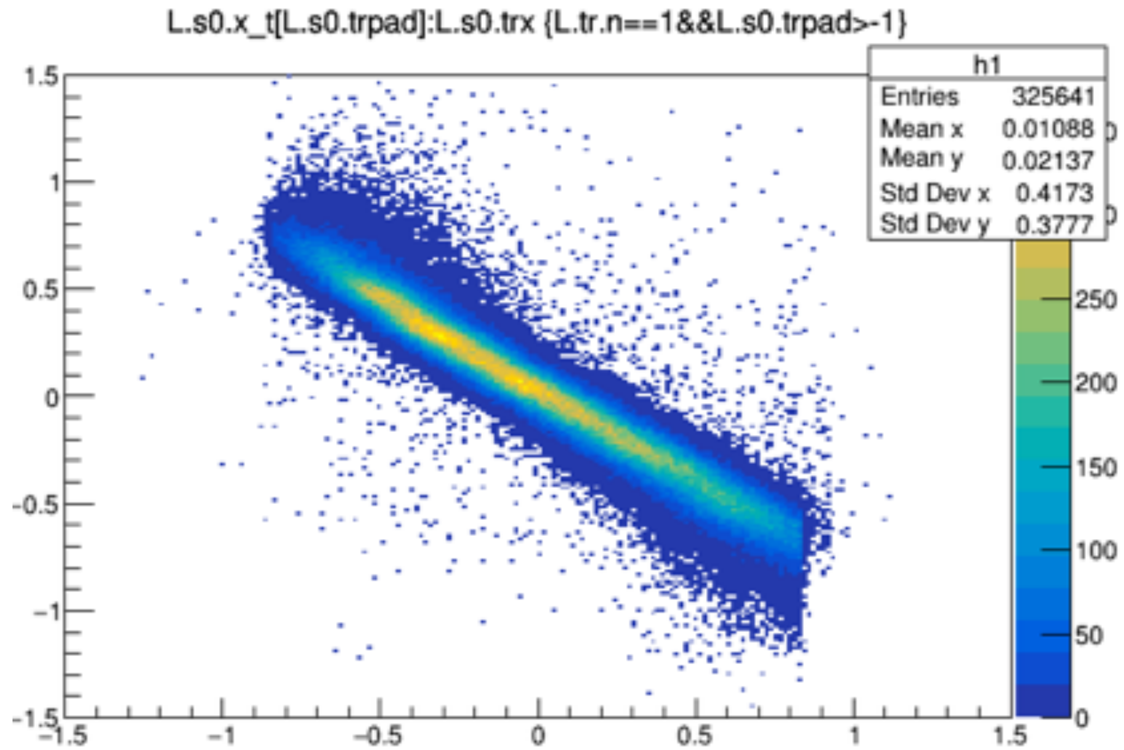
→ two electrons(2)

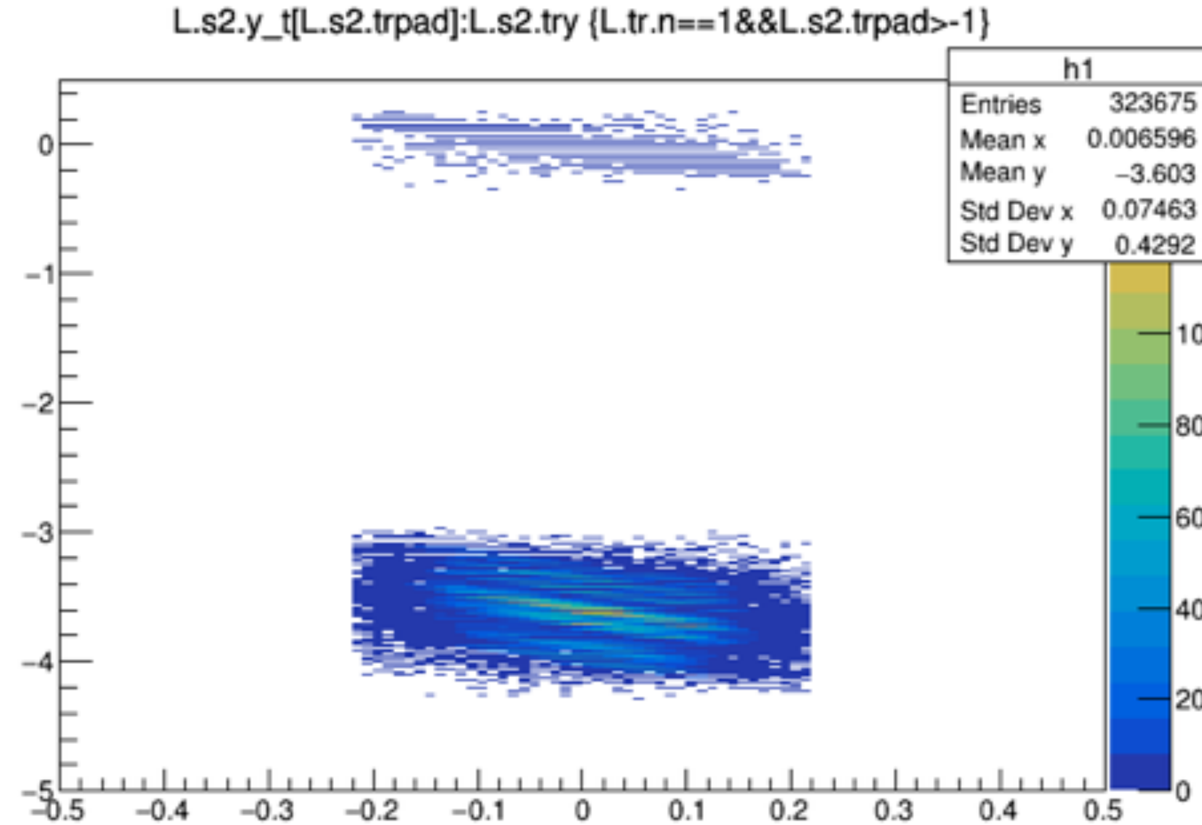
→ one big cluster and one small cluster: electron+pion/muon (9)

Conclusions:

1. The focal plane distribution of the first track in dual tracks events look similar as the only one track good events distribution;
2. Analyzer construct two tracks because there are at least two clusters in each VDC plane;
3. Analyzer sort tracks by chi2/ndof;
4. By using abs(s2.trdx)<0.075, can get rid of about 42% of second tracks; On the other hand, the first track is not always the better one;
5. The relation between the track projection and the clusters in shower shows that some dual tracks come from two electrons, some come from one electron and one pion/muon, another are probably bad construction or edge scattering messed up construction;

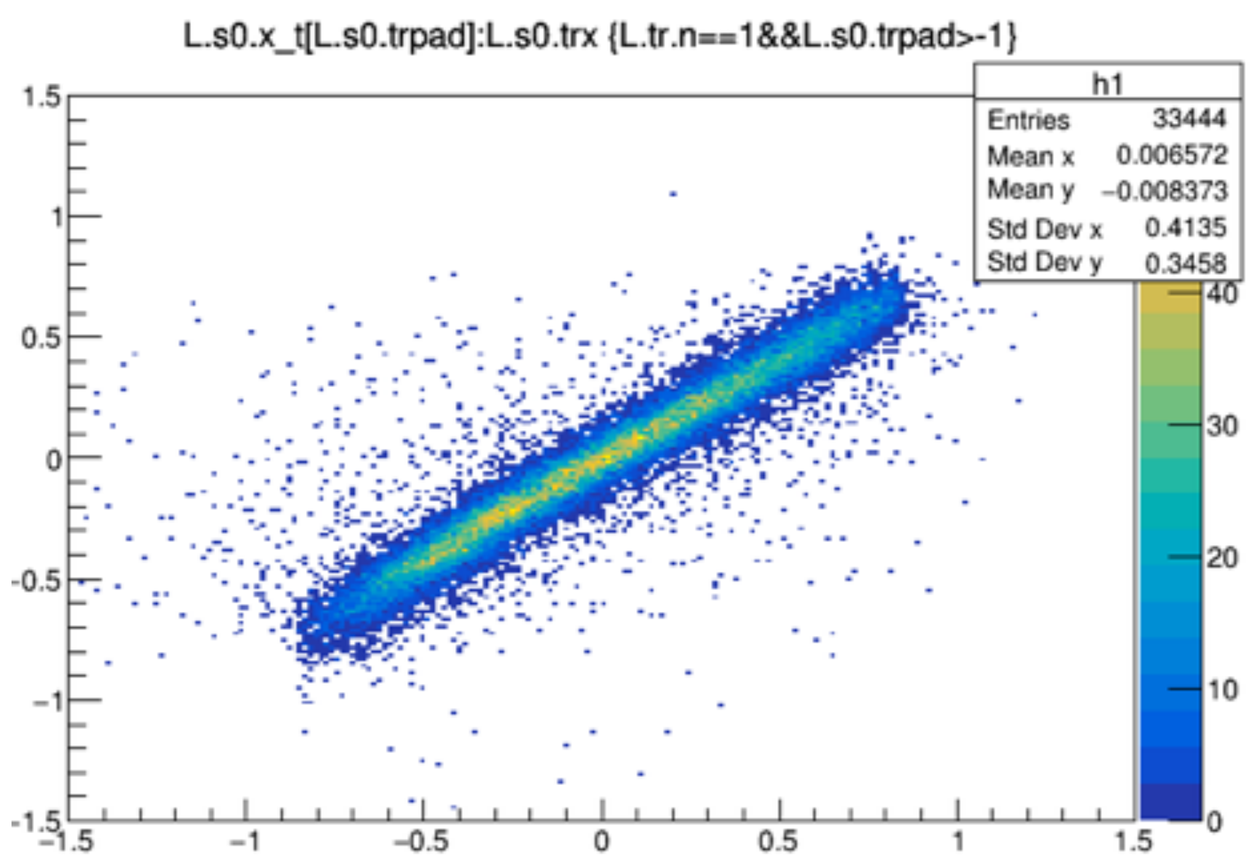
MARATHON (time calibration might have issue)

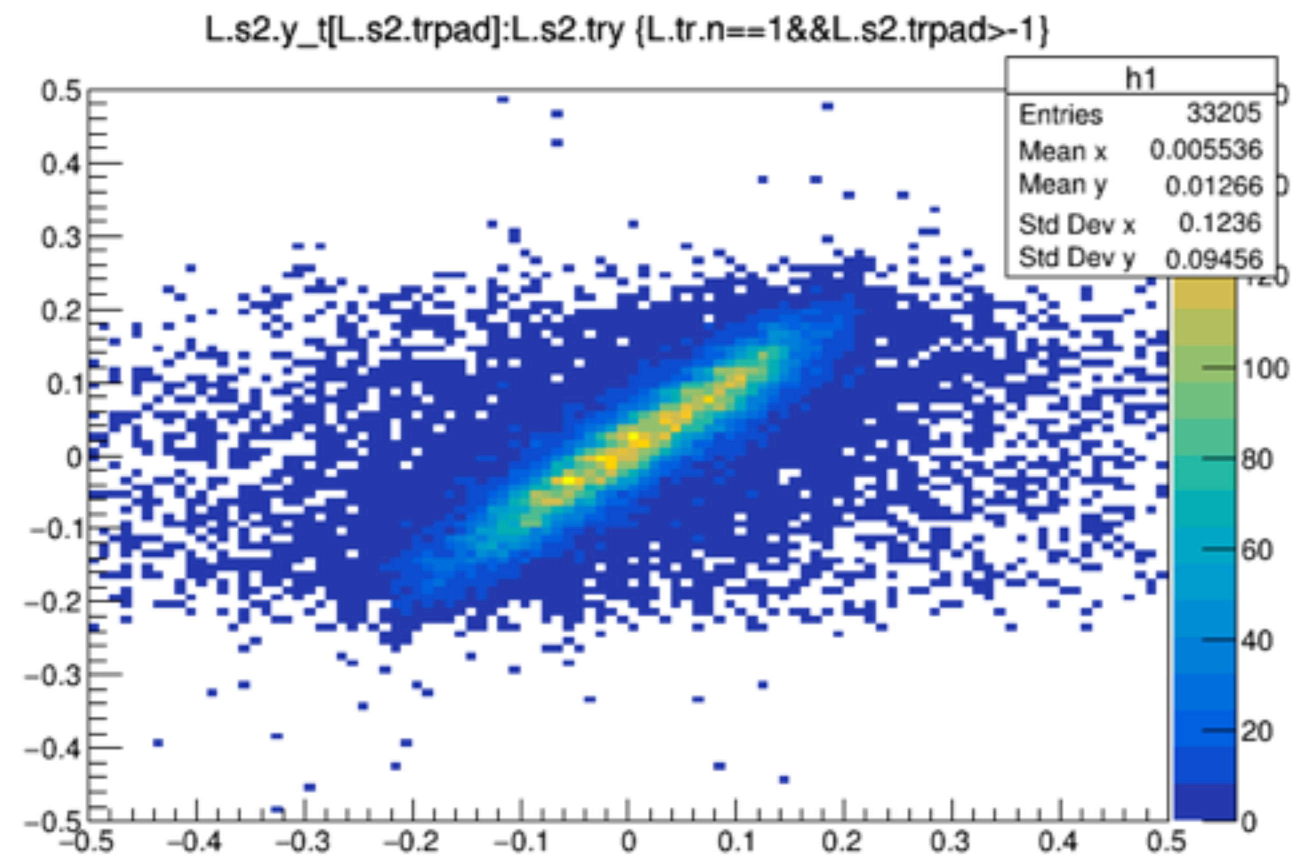




y_t=c/2*(Rt_c-Lt_c)

GMP





backup

Two electrons

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------ Event 1--------
****** cer ******
6.9      -8.7     -19.1    5435.4   12.6     23.9     13.9     28.7     3623.2   3.2
first track:  -0.349  0.064
first track hit block (rough):  5
second track:  0.773  -0.004
second track hit block (rough):  8

*** pre-shower && shower ****
-11.7    184.5    0.6      -3.7     10.5     5.7      -1.6     1.4      -5.1     22.0     1.7      1122.1   3.5      11.2     -1.0     -6.0     -9.8
62.4     1709.1   18.3     16.2     -11.4    -6.8     9.6      -7.2     -3.9     -4.0     4.9      3.5      -1.6     8.9      0.9      9.6      -9.6

-8.3     23.5     7.8      0.7      16.3     8.3      -8.8     -0.8     16.5     -5.2     3.7      1402.1   31.5     9.7      -4.0     2.8      11.5
53.7     1122.2   -0.7     -5.5     -8.1     -4.7     -17.3    -2.9     -5.6     -18.7    -0.8     -1.9     -5.9     6.3      18.7     13.5     -8.4

first track:  -0.444  0.139  -0.545  0.129
first track hit block:  (11,0)  (11,0)

second track:  1.082  -0.041  1.009  -0.058
second track:  (1,1)  (1,1)
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------ Event 64--------
****** cer ******
10.7     13.8     -10.0    29.8     2.2      516.0    835.5    3018.2   7.5      23.8
first track:  0.234  0.019
first track hit block (rough):  7
second track:  -0.212  0.027
second track hit block (rough):  5

*** pre-shower && shower ****
-9.0     1.1      3.8      2.2      -2.7     6.7      1269.0   6.4      5.1      33.2     806.2    6.2      4.6      -0.7     -9.0     -2.9     -18.4
14.3     -2.7     4.3      -2.6     5.8      -3.2     9.6      2.1      0.3      -1.0     0.4      -0.7     -7.8     2.2      -5.5     -3.7     -46.7

2.7      1.7      9.3      -5.5     -4.0     60.3     1012.4   -0.8     -2.8     14.8     816.2    -6.4     12.2     6.5      4.5      -0.7     -16.3
-14.4    -2.4     -4.0     -7.0     -6.5     16.5     756.5    -5.8     1.2      8.0      19.0     -1.9     -2.8     7.6      -18.7    8.5      -23.7

first track:  0.337  0.044  0.250  0.031
first track hit block:  (6,0)  (6,0)

second track:  -0.243  0.080  -0.339  0.069
second track:  (10,0)  (10,0)
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One electron+pion/muon

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------ Event 7---------
****** cer ******
-2.8     -5.4     4912.9   37.0     -6.5     7.6      18.2     17.6     -2.0     9.0
first track:  -0.288  -0.067
first track hit block (rough):  4
second track:  0.206  0.009
second track hit block (rough):  7

*** pre-shower && shower ****
-0.9     3.5      -0.4     -3.7     0.6      8.7      115.1    -1.5     -3.0     -6.1     2.8      -4.5     -10.9    4.2      -0.0     -5.0     4.7
-11.1    4.5      -14.0    -2.6     -2.3     -9.3     0.9      1.0      -5.0     2.0      1835.4   40.9     -8.9     -0.6     0.9      2.4      18.8

-8.3     -4.1     -15.0    -5.5     -14.1    1.2      -1.6     -0.8     -1.2     5.6      -7.8     -3.7     -11.6    -15.2    3.1      -16.4    -0.5
-5.3     -8.4     -8.9     -14.6    -3.2     -0.2     -8.9     119.6    -2.2     3.3      201.1    803.9    10.8     -10.4    7.7      -19.7    -14.0

first track:  -0.344  -0.143  -0.442  -0.163
first track hit block:  (10,1)  (11,1)

second track:  0.236  0.015  0.143  0.000
second track:  (6,0)  (7,0)
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