Short Decay Search

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Motivation

- Short decay search efficiency is low due to vertex-IP resolution.

  -Low momentum tracks spoil the vertex resolution and result in a long tail in IP distribution.

- Improve primary vertex-IP resolution and apply a new selection in order to tag short decay topologies.

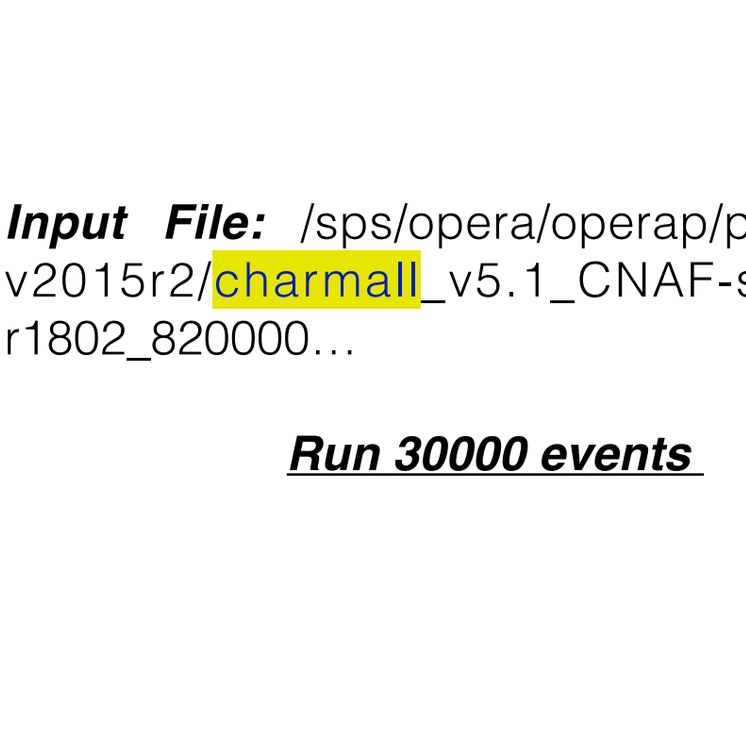
  -starting sample is 1 mu for charm search

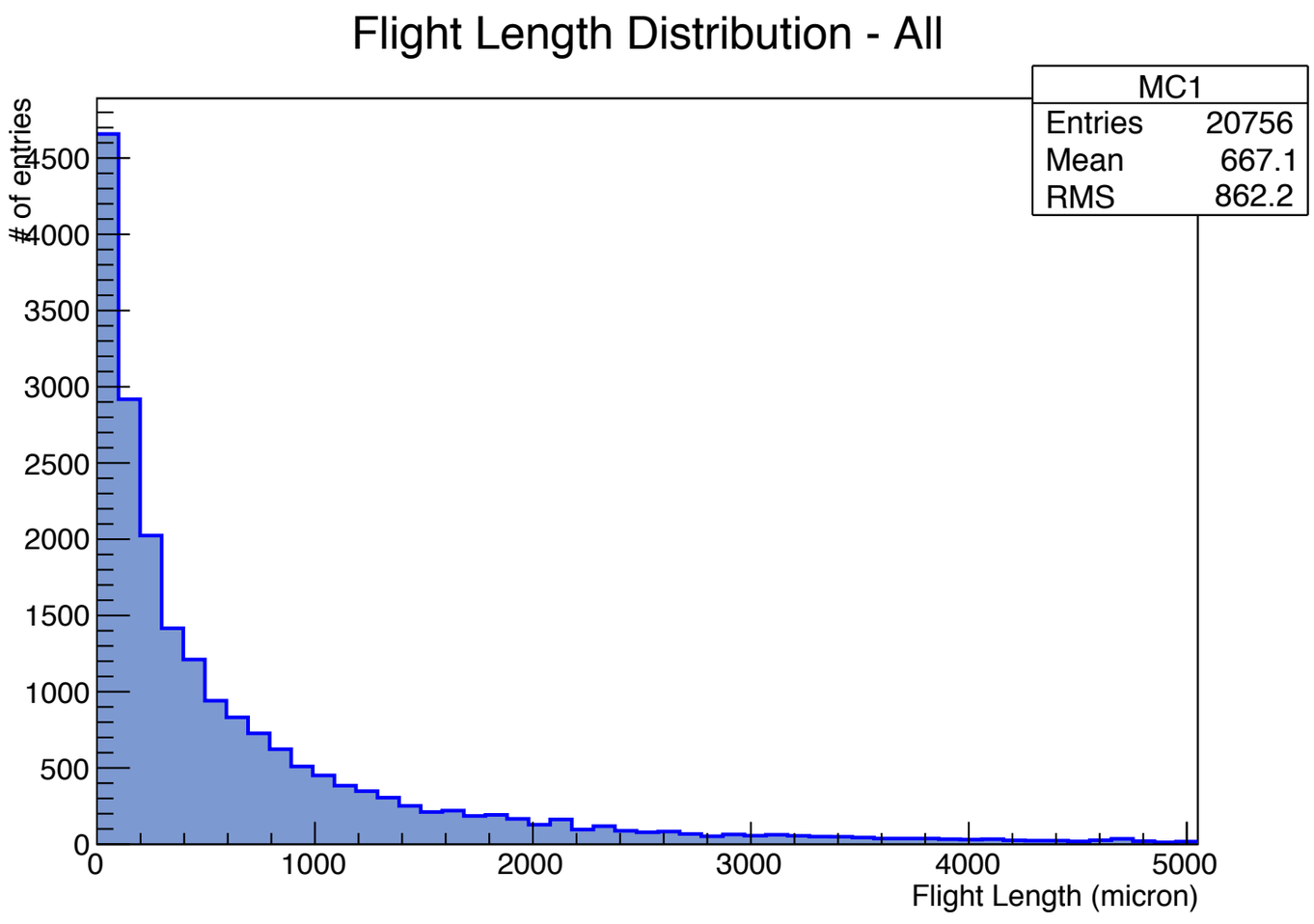
  -apply similar selection for tau search in 0 mu

Flight Length Distributions of MC Events

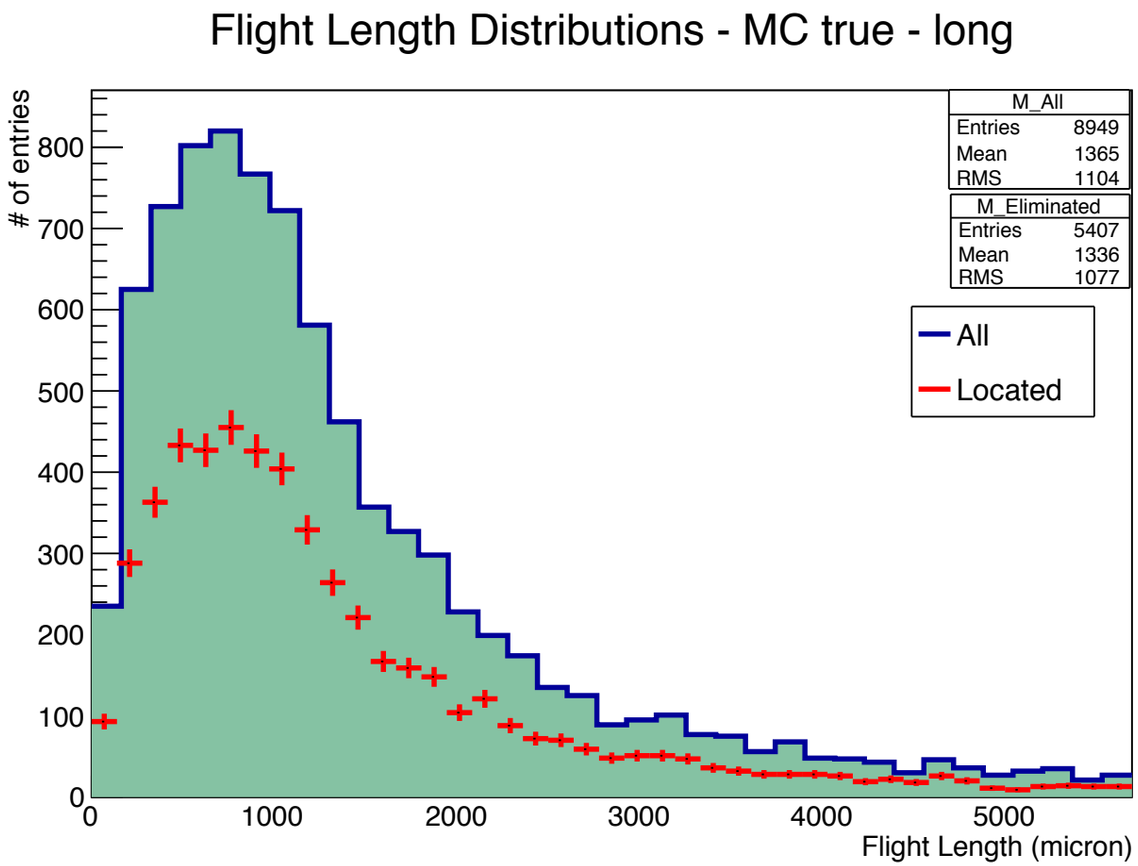
Input File: /sps/opera/operap/production/v2015r2/charmall_v5.1_CNAF-svn-trunk-r1802_820000…

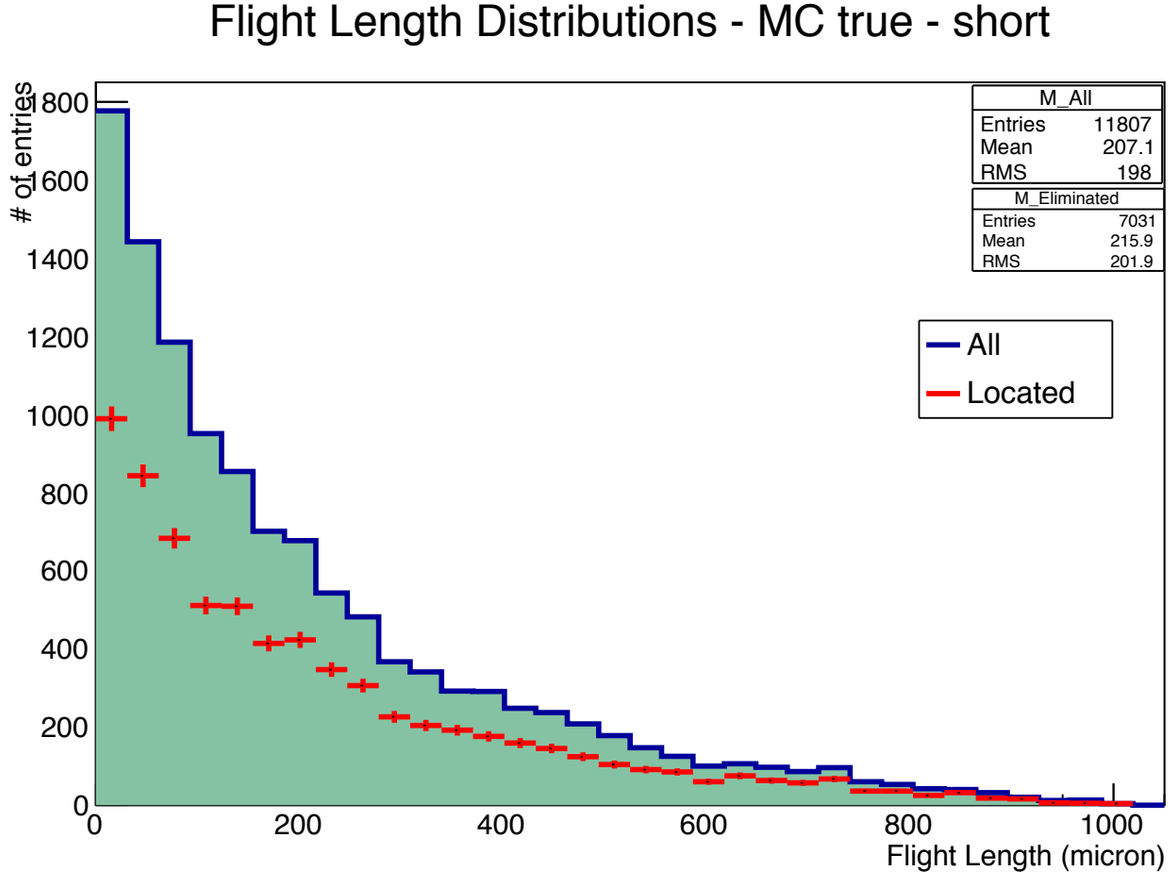
Run 30000 events



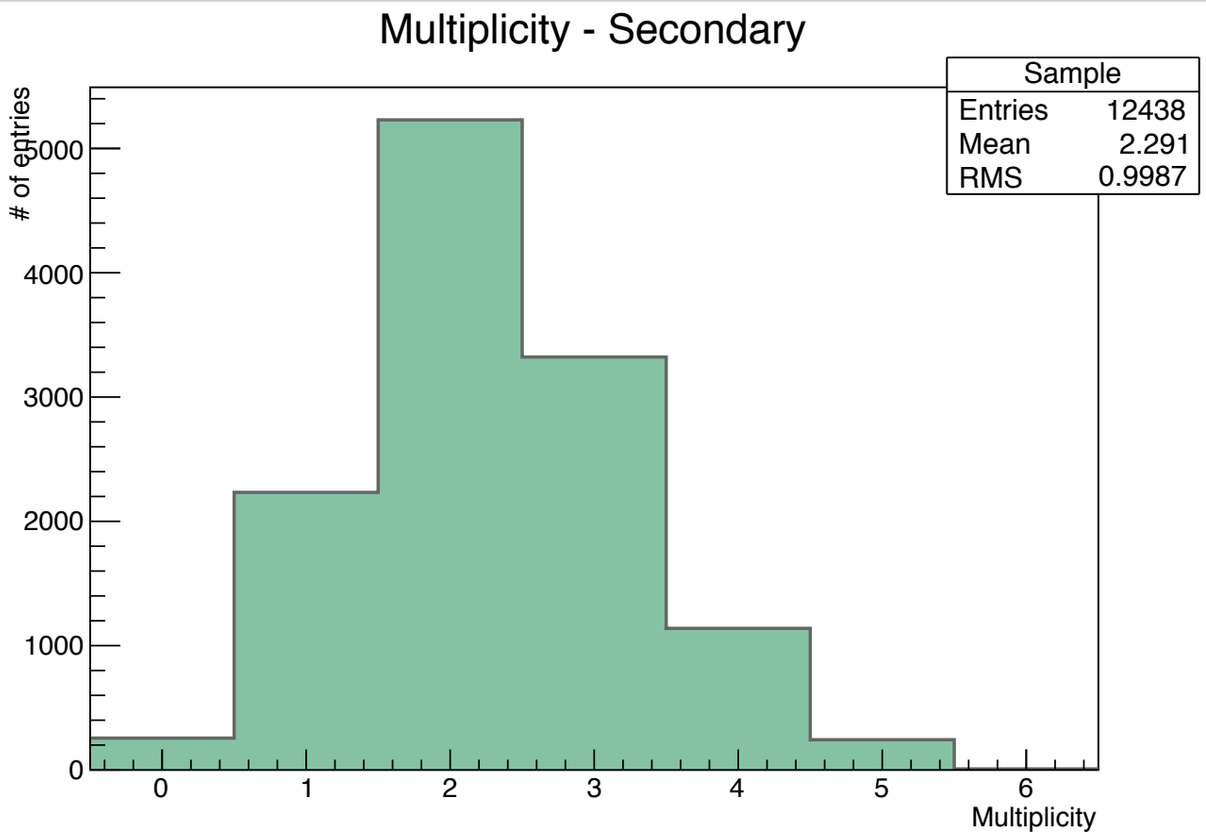


Flight Length Distributions



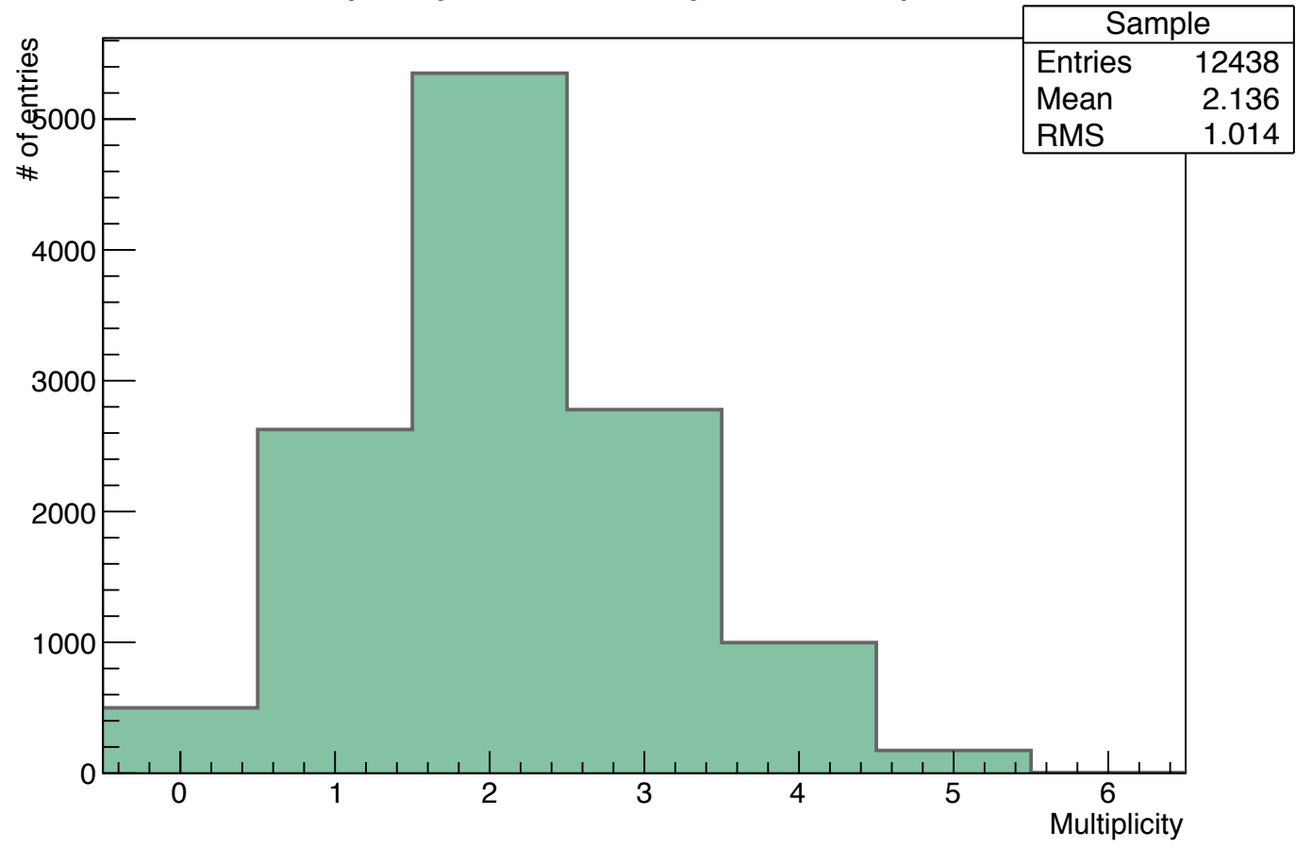


Multiplicity Distributions of Secondary Vertex



- No Cut

- After applying, Microscope acceptance(slope cut)



Data

```
 20  68564.3 37432.3 47530.3  5
200 126913 190060  0.029  0.063 68570 37445 47728   0.3  -1 -1  1
200 126890 230105 -0.043  0.156 68556 37463 47728   0.2  -1 -1  1
200 126953 180049 -0.423  0.062 68481 37446 47728   1.5  -1 -1 -1
200 127082 170026  0.280  0.013 68620 37433 47728   1.9   1 -1  1
200 126897 200060 -0.171  0.232 68532 37483 47728   5.0  -1 -1  1
```

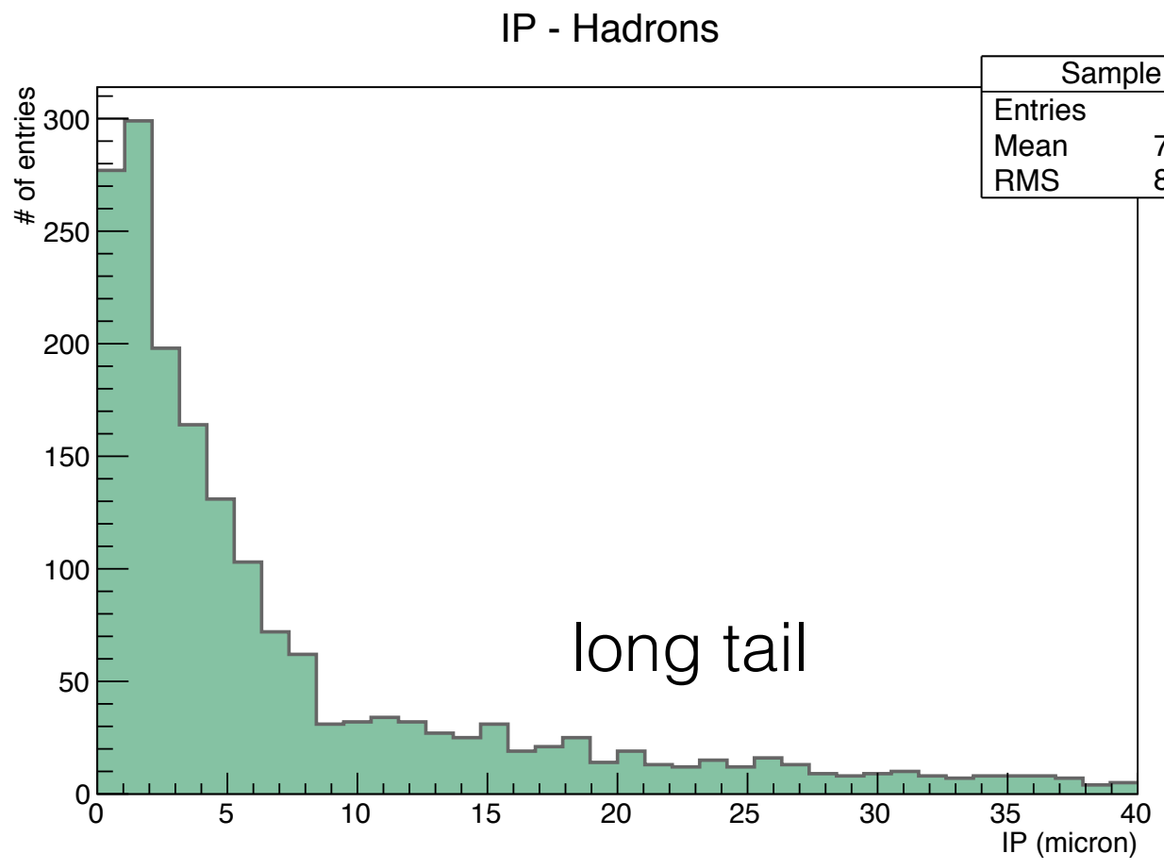
No ID flags

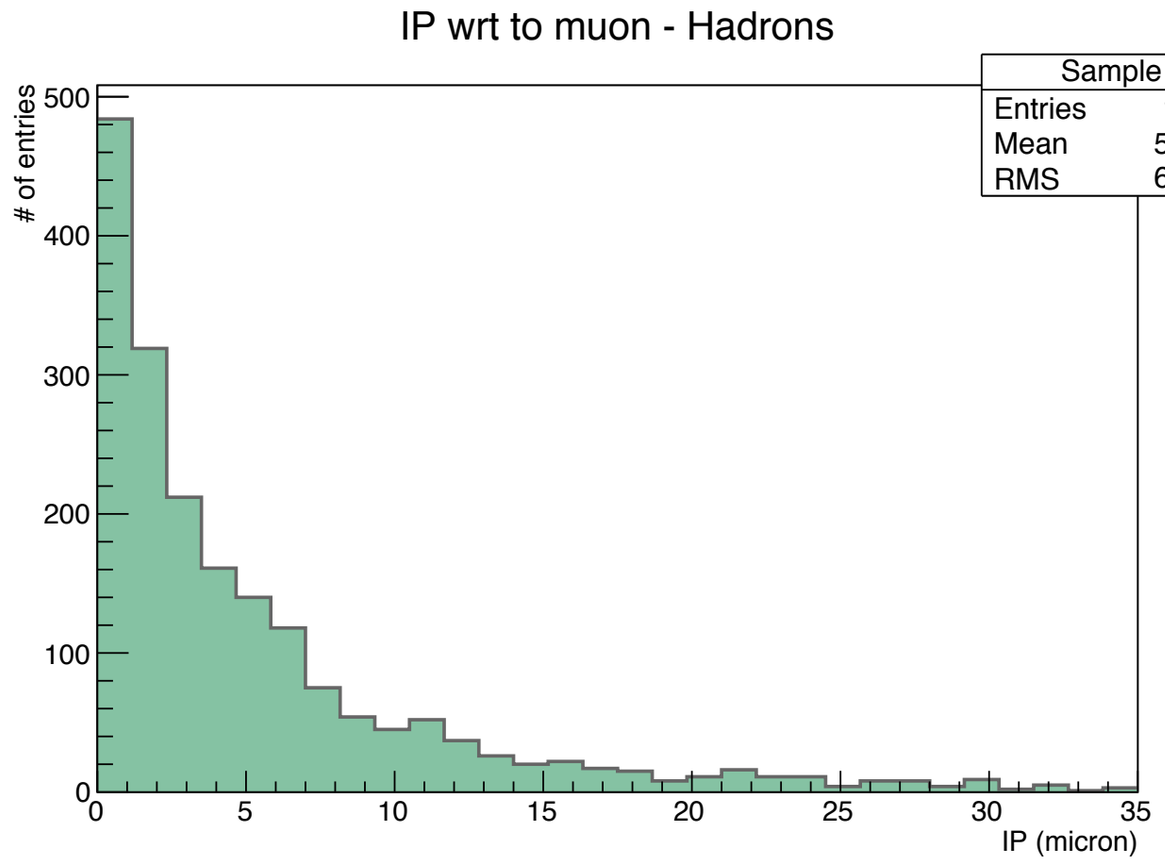
2010-2011-2012
Data sample is used for event selection

```
32 102653.6  57629.0   32222     7.3  4
300   59708  200038  0.0565 -0.0155 102803.9  57593.5  34859.0   5.5   2  1  1 -1
290   85353  190032  0.1947 -0.1518 103430.8  57044.8  36159.0  17.1   1  2  1 -1
310   72616  160012 -0.0764  0.1040 102550.6  57763.7  33559.0   4.4   2  2 -1 -1
320   75661  310333  0.4127 -0.2855 102669.7  57617.7  32259.0   0.8   4 -1 -1 -1
```

Events with Track ID flags are selected

IP Distribution of Primary Tracks 10-12





Event Selection

1) MuonID==1(muon is attached to vertex)

2) Multiplicty>1

3) The last segment of hadron track must be in the two most downstream plate

4) Slopex<0.4 && Slopey<0.4

5) IP (wrt muon) / deltaZwM >0.004

event selected

deltaZwM :
the distance between muon segment and vertex position
+
hadron segment position and vertex position

Event Selection

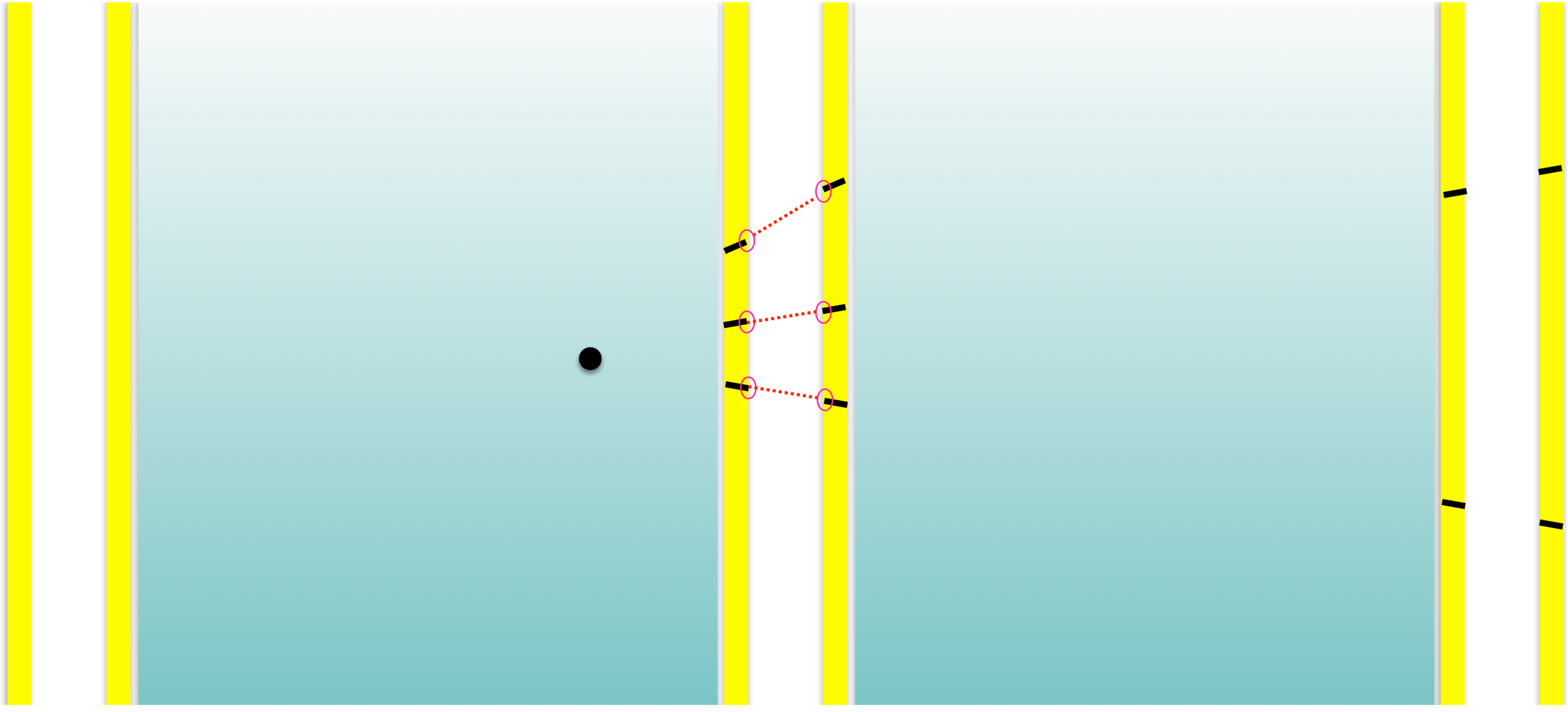
Starting sample	1023
Selected events	118
Manual checked and analyzed	44
Cannot be manually checked (BrokenDisk)	28
To be checked manually in January and February	46

Potential Charm candidate: 6

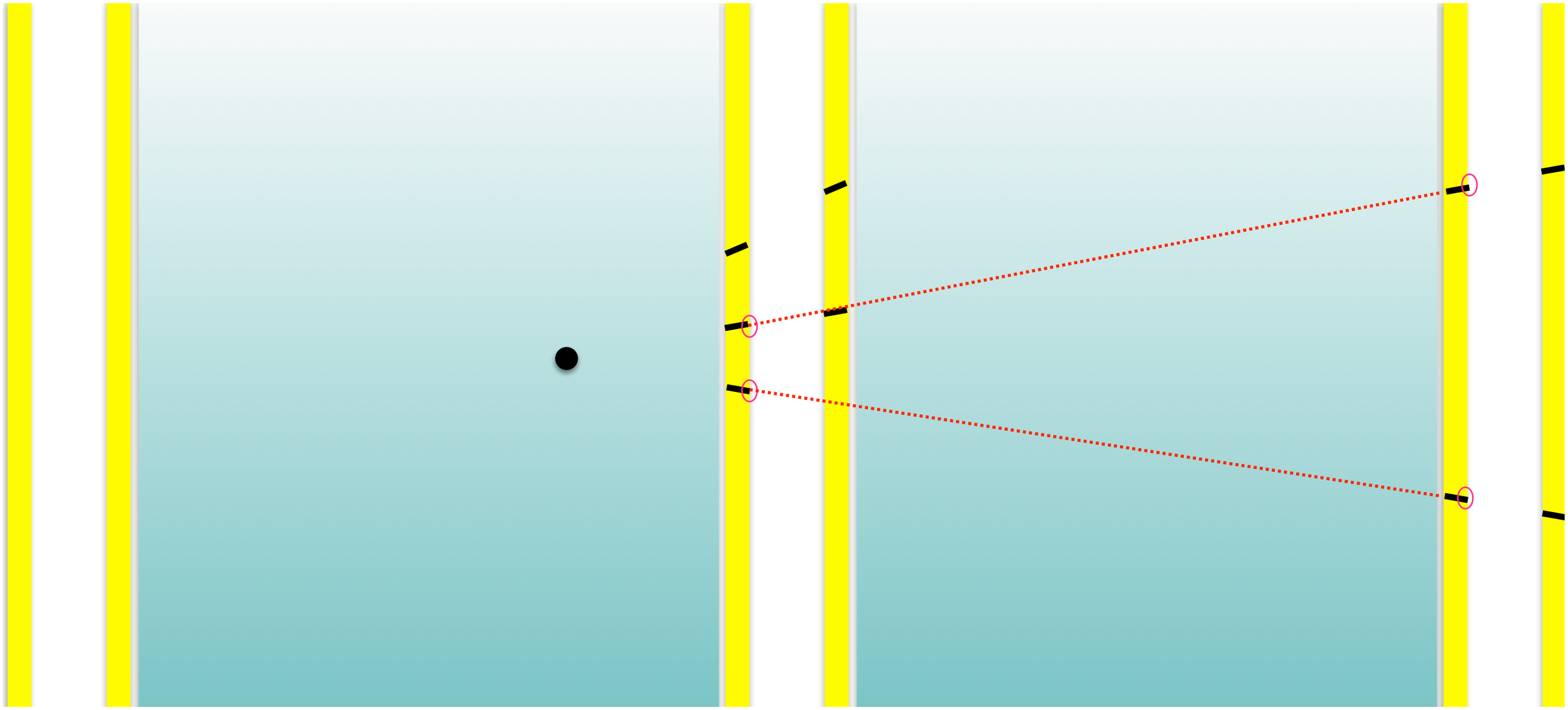
Momentum measurement

Manual Check -1

In this analysis last visible segment information of tracks are used to clarify vertex point. Although measurement of last segments of each track is difficult for most of the events and it takes long time, I measured last segments for almost all of the events.



Manual Check-2



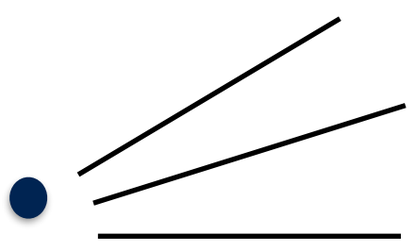
Particle Types

- All events includes muon (CC type)
- Hadrons
- LowMom Hadrons
- Fake Hardons

Charm Candidate -1106407

primary

```
 0.043  0.229  25919.2  89586.1     42542
-0.1633 -0.0501  25874.3  89524.4  42542.0
 0.3646 -0.3114  25989.7  89463.3  42542.0
```



	IP	IP wrt muon
Muon	0.28	-
Hadron	0.28	0.28
Grey	3.7	1.1

decay canditate

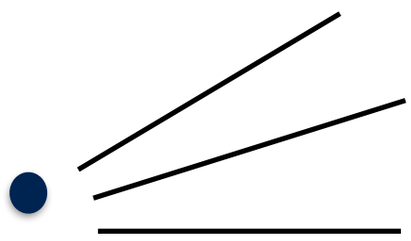
```
0.188  -0.040   25900.9  89519.1  42542
```

	IP	IP wrt muon
Hadron	50.1	23.9

Charm Candidate -1207401

primary

```
 0.093   0.003   39864.9   92283.4    16893
 0.009   0.285   39783.5   92541.4    16893
-0.327   0.120   39489.0   92382.4    16893
```



	IP	IP wrt muon
Muon	1.8	-
Hadron	6.6	2.2
Hadron	6.0	2.7

decay canditate

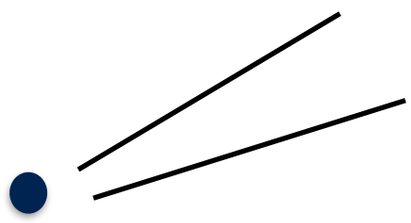
```
0.023 -0.144   39790.0   92167.4    16893
```

	IP	IP wrt muon
Hadron	19.3	8.9

Charm Candidate -1105233

primary

```
-0.223   0.0076 86908 27011.4   58301
 0.132  -0.023 87257.7 26984.2   58096
```



	IP	IP wrt muon
Muon	0.28	-
Hadron	0.28	0.28

decay canditate

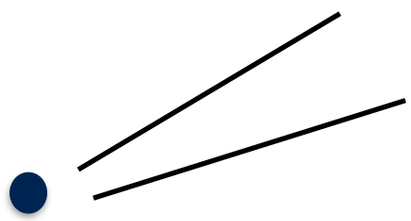
```
-0.047  -0.160 87116.7 26865.4   58096
 0.065   0.031 87207.0 27026.9   58096
```

	IP	IP wrt muon
Hadron	1.8	3.9
Hadron	1.8	1.8

Charm Candidate -1105019

primary

```
 0.005   0.081   47496.9   71241.5    11581
-0.416   0.053   47180.0   71220.0    11581
```



	IP	IP wrt muon
Muon	1.2	-
Hadron	1.2	1.2

decay canditate

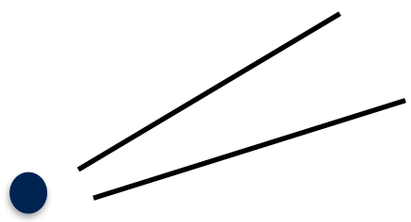
```
 0.005   0.081   47496.9   71241.5    11581
-0.416   0.053   47180.0   71220.0    11581
```

	IP	IP wrt muon
Hadron	0.2	10.7
Hadron	0.2	5.9

Charm Candidate -1003674

primary

```
 0.106   0.064 71301.6 5107.8  41325
-0.077   0.050 71138.9 5089.1  41325
-0.042   0.211 71129.9 5482.2  42625
```



	IP	IP wrt muon
Muon	3.1	-
Hadron	3.1	3.1
Gamma	30	

```
0.143   0.051 71324.3 5114.5  41325
0.193   0.136 71366.2 5184.5  41325
```

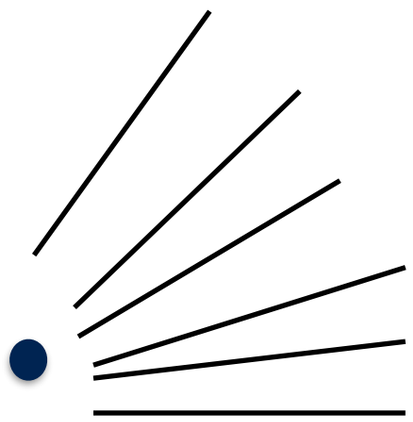
decay canditate

	IP	IP wrt muon
Hadron	0.3	6.9
Hadron	0.3	9.0

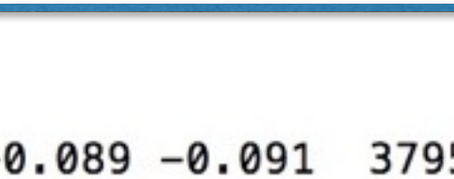
Charm Candidate -1106059

primary

```
-0.089 -0.091   37957.6   56488.1    60421
 0.141  0.225   38087.1   56675.6    60421
-0.386  0.172   37783.4   56648.3    60421
 0.579 -0.161   38351.6   56446.2    60421
 0.034  0.069   38028.6   56577.1    60421
-0.298  0.319   37826.1   56723.8    60421
```



	IP	IP wrt muon
Muon	2.8	-
Hadron	2.8	2.8
Back black	5.3	2.2
Grey	6.5	0.3
Grey	6.2	1.0
Grey	8.8	5.0

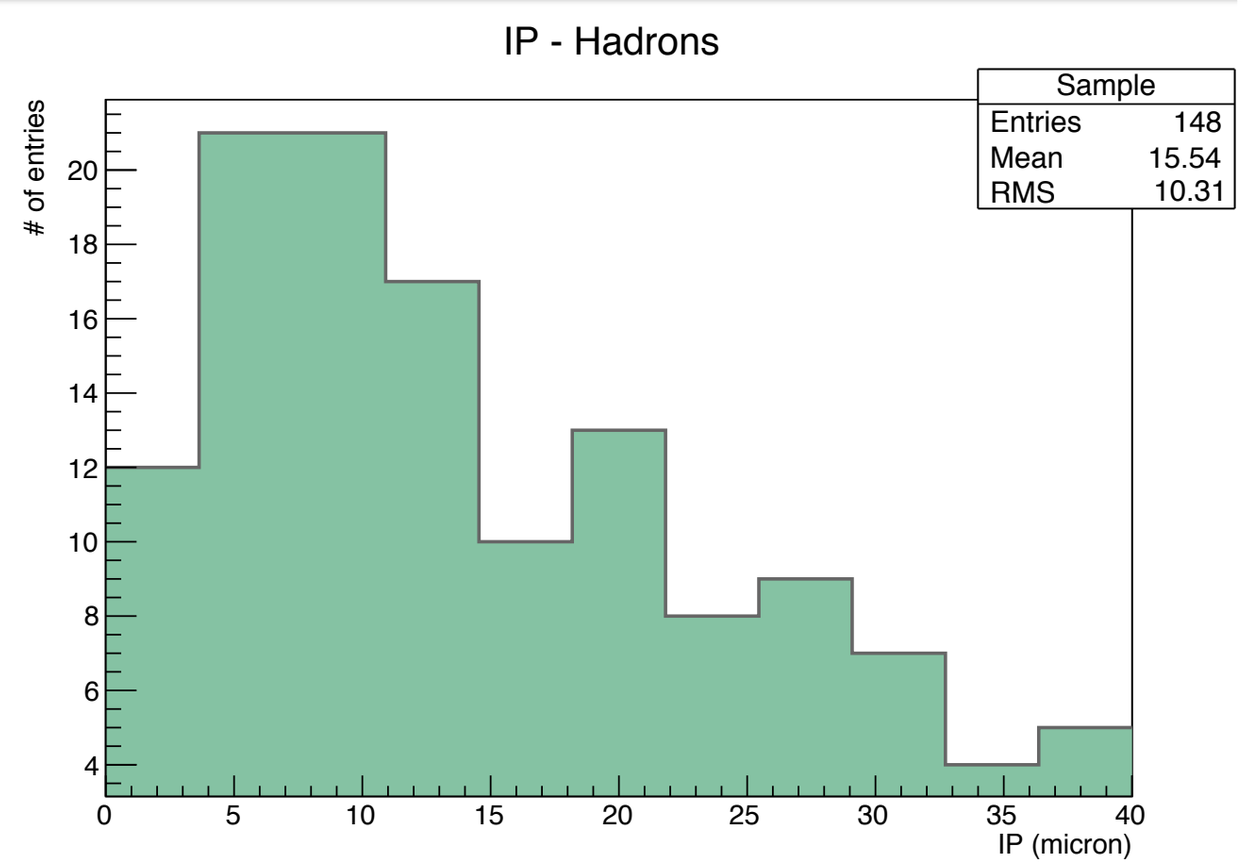


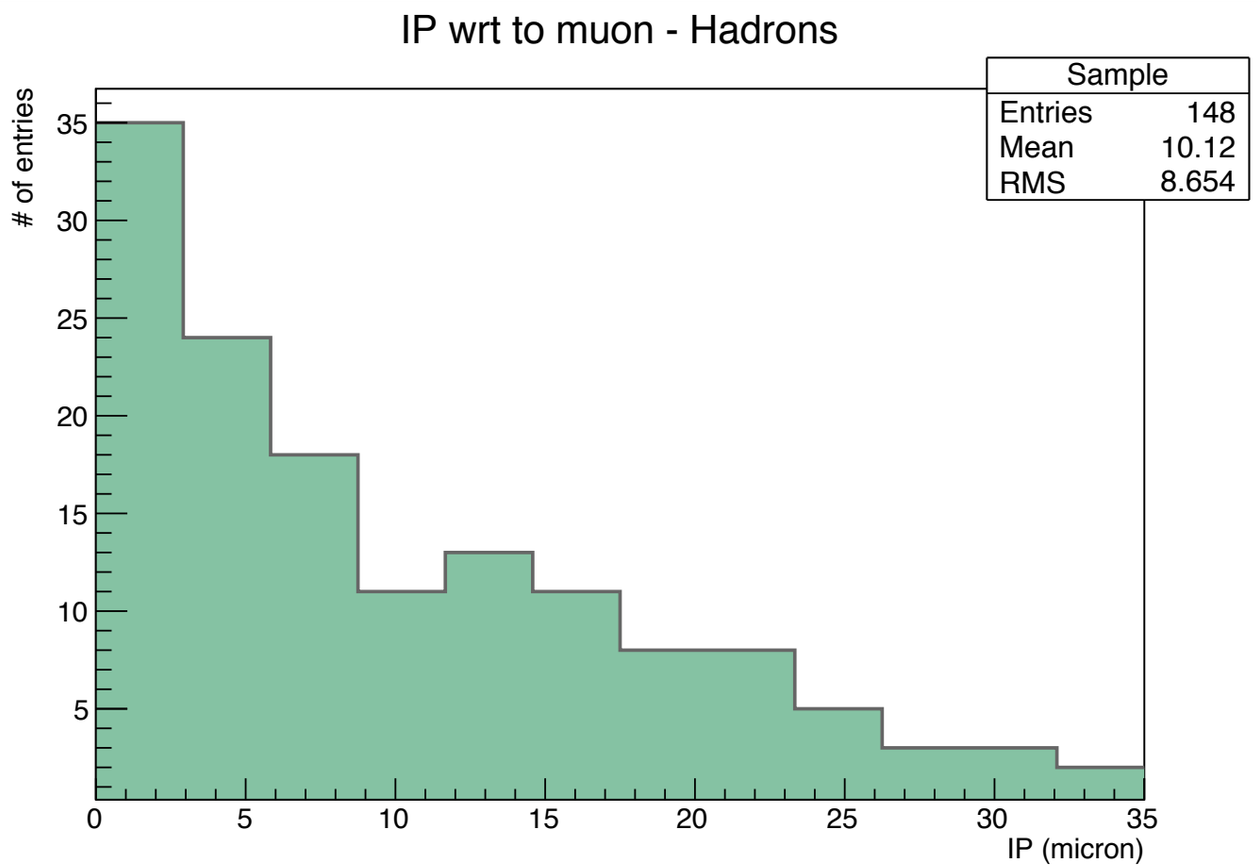
decay canditate

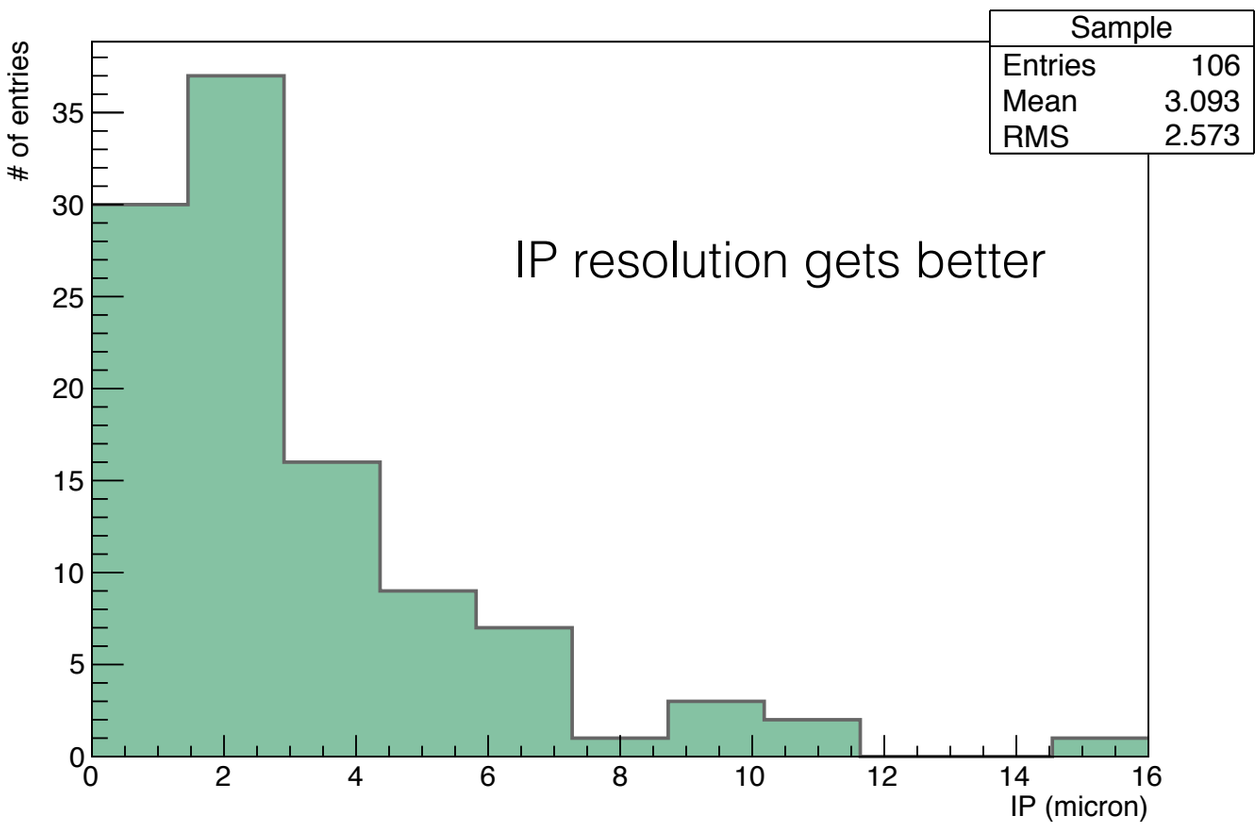
```
 0.200 -0.172   38127.7   56433.1    60421
-0.062  0.123   37962.3   56620.3    60421
```

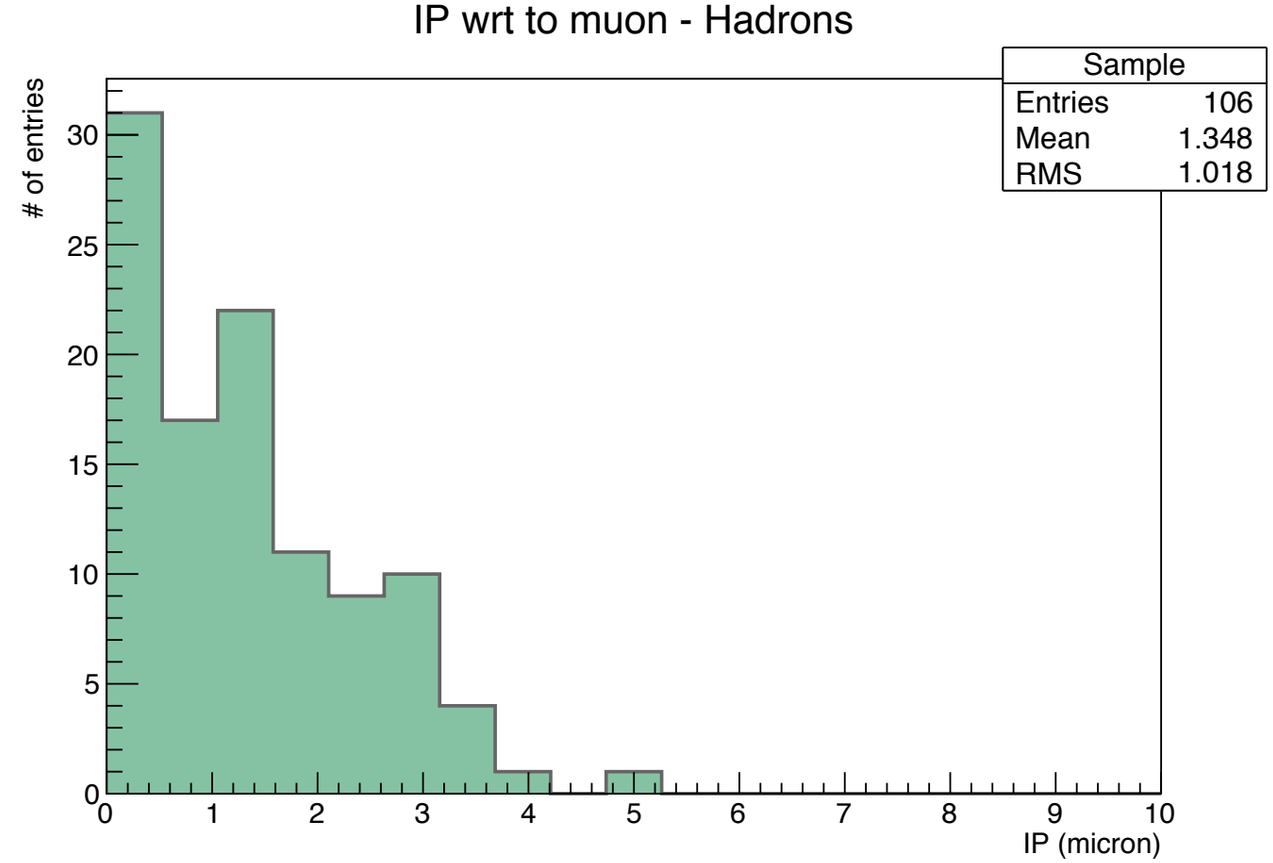
	IP	IP wrt muon
Hadron	0.3	5.9
Hadron	0.3	3.6

Impact Parameter before and after MC









Summary /Outlook

-IP distribution has long tail after manual check IP resolution gets better.

-Out of 44 decay search events 6 potential charm candidate events found

  -momentum will be measured.

-Perform data/MC comparision

-Results on charm sample is encouraging for short tau decay.

-Apply selection to 0mu sample for short tau.

THANK YOU