

Vertexing performance test

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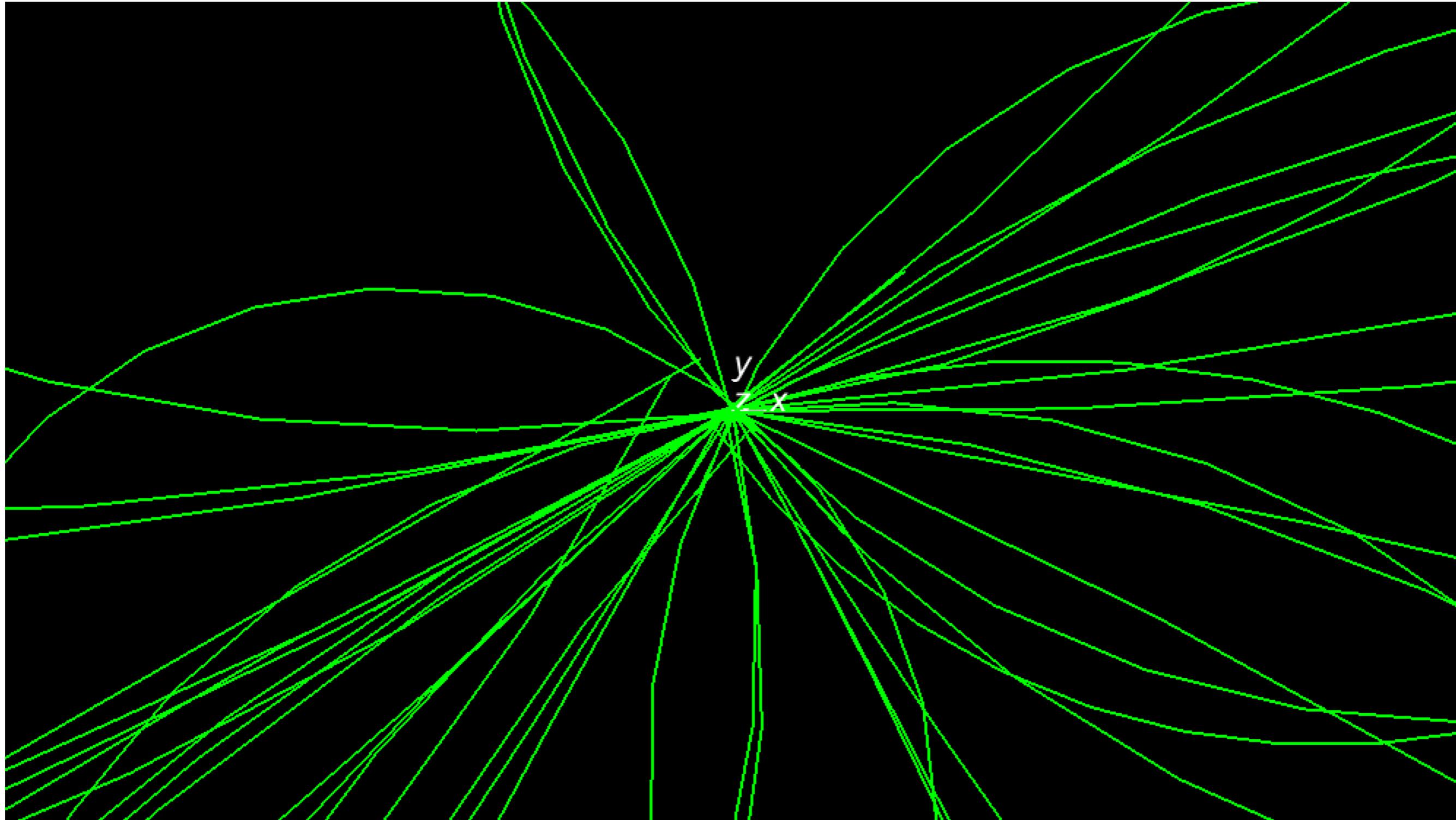
Motivation

- Found different behavior on c-tagging performance from DBD era
—> start checking vertexing (this study) and flavor tagging (Kurata-san)
- Apart from the issue, I was checking how well jet pairing works by using a simple event display. I realized that the event display is useful to investigate vertexing performance.
- Eventually it turned out that the problem seems to be more relevant to flavor tagging part by comparing # of “0 vertex” events for vvcc samples.
- Anyway, some results will be presented here.

Check with event display
~Typical case~

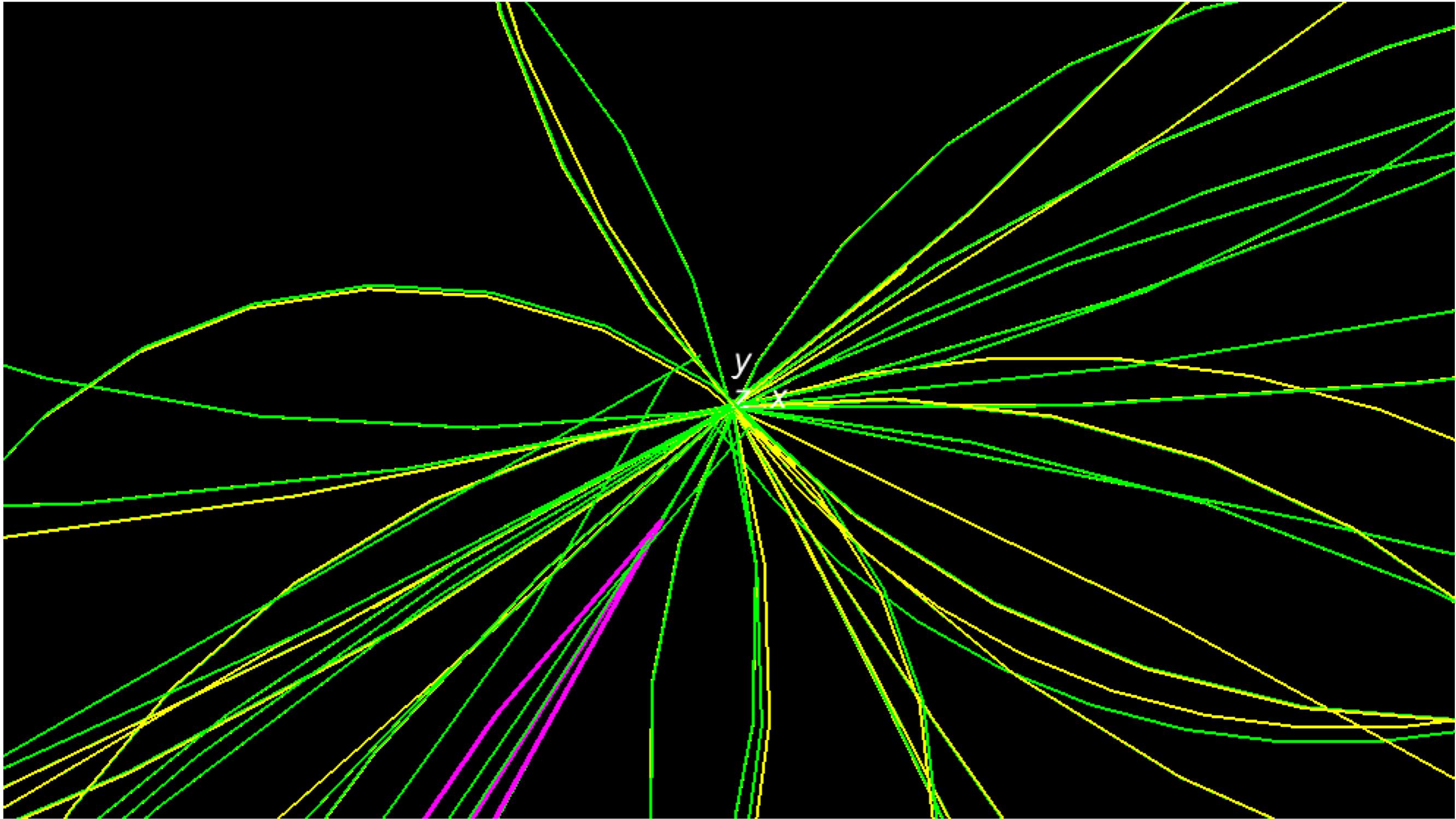
Reconstructed tracks (Helices drawn by track parameters)

starting point $(-d_0 \sin(\phi_0), d_0 \cos(\phi_0), z_0)$



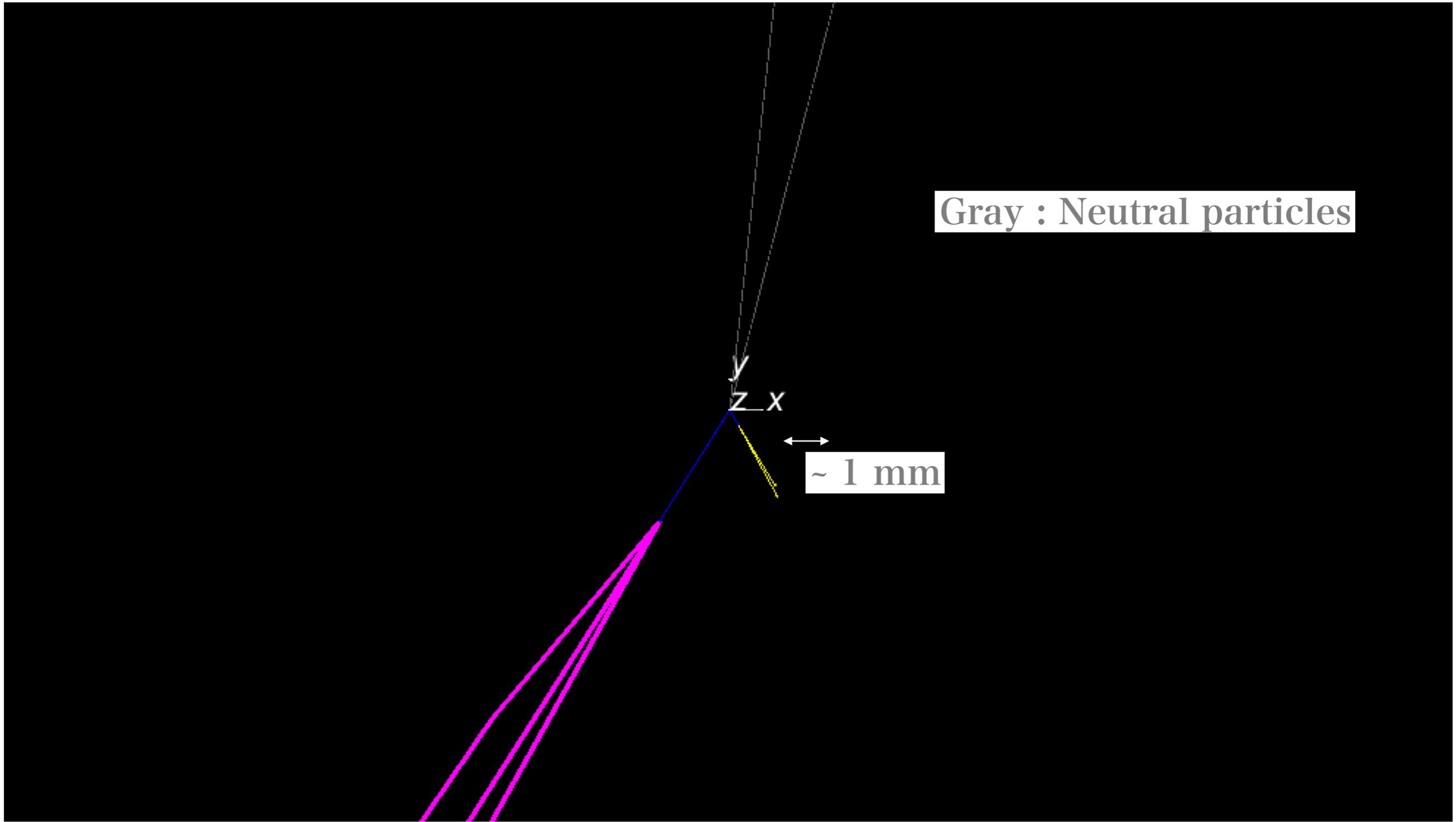
Same event as P. 4

w/ reconstructed primary vertex tracks (yellow) and secondary vertex tracks (magenta)



Same event as P. 4,5

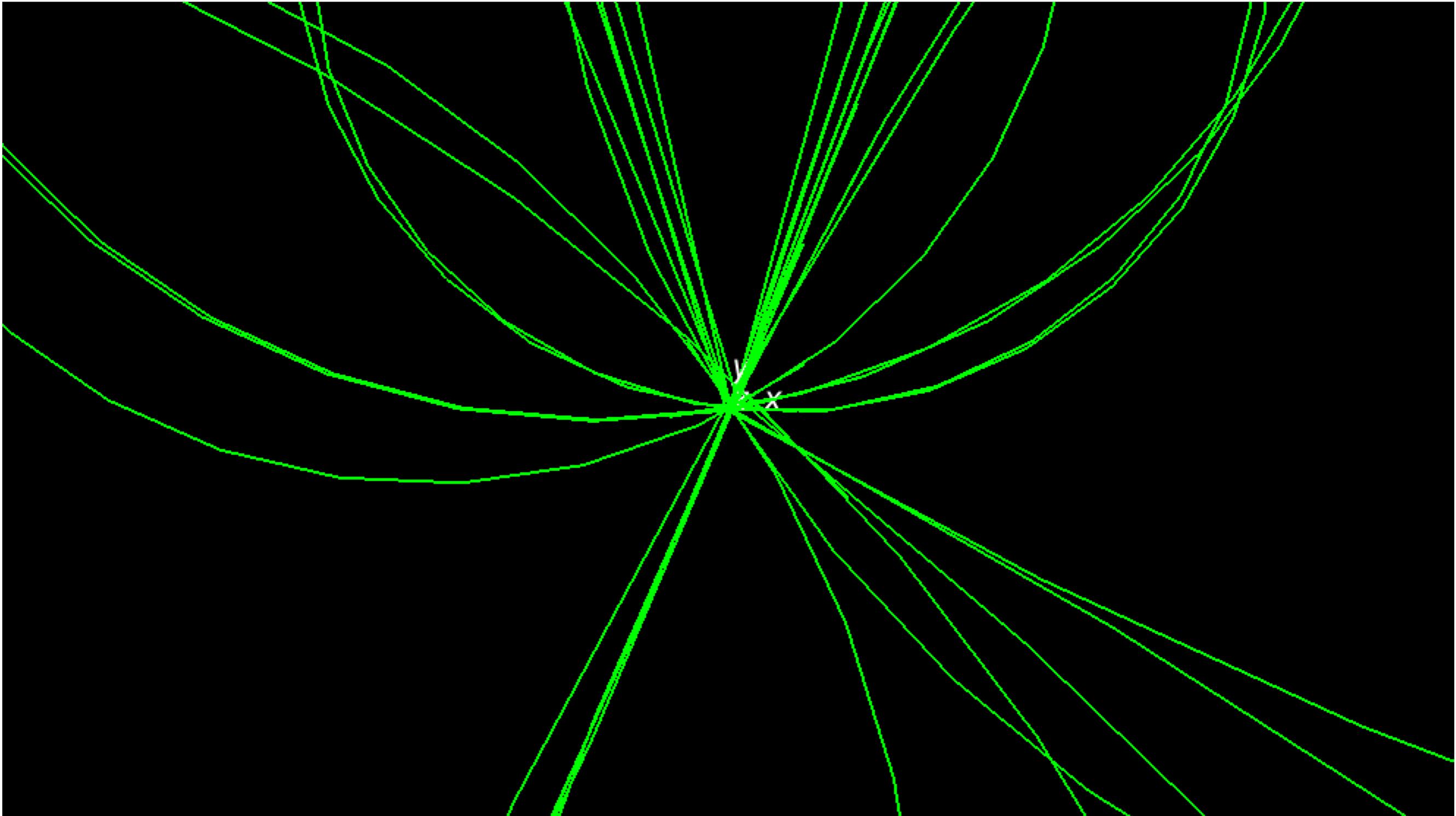
Only MC truth C hadrons (blue) and their first daughters (yellow)
+ secondary vertex tracks (magenta)

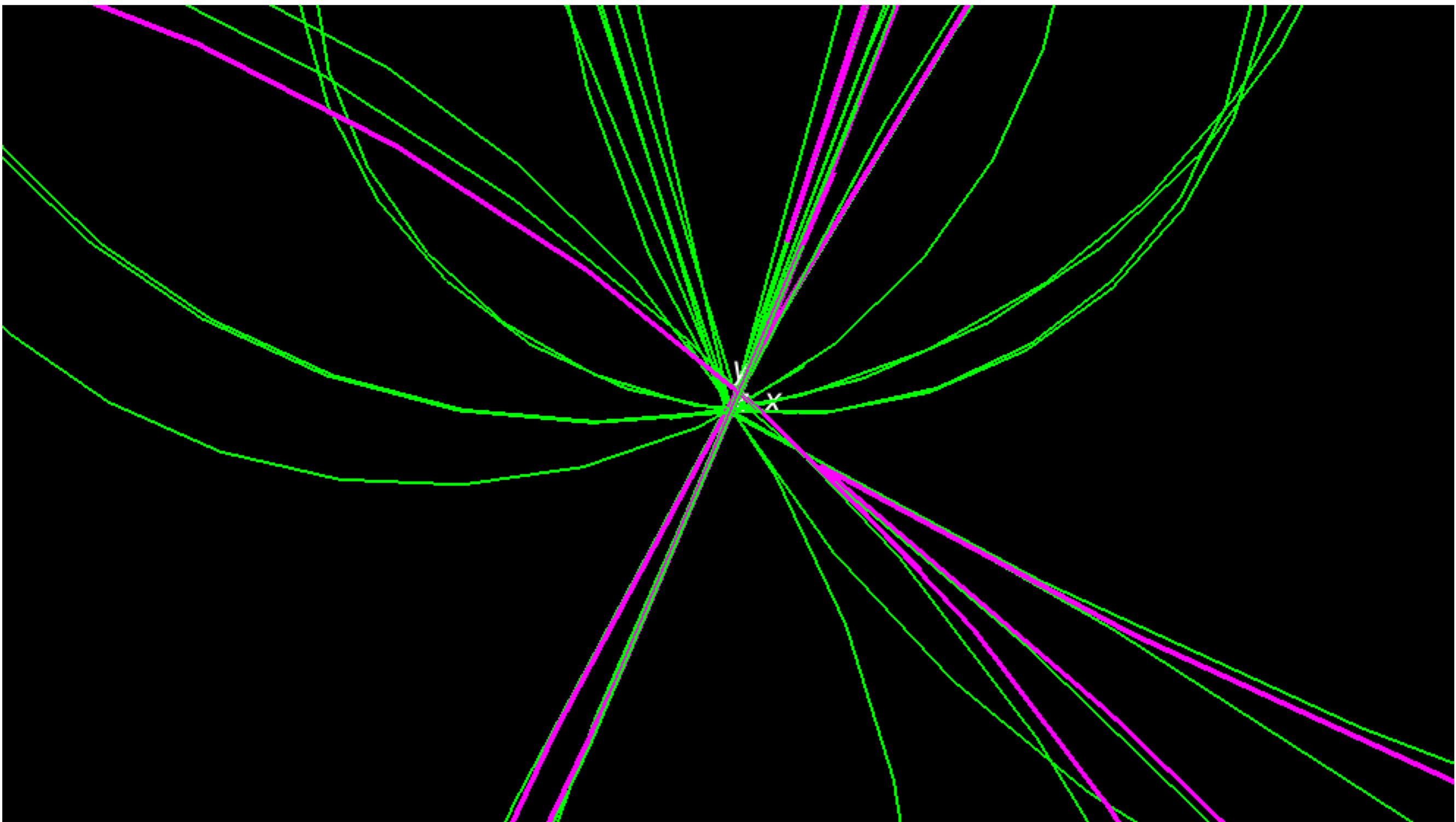


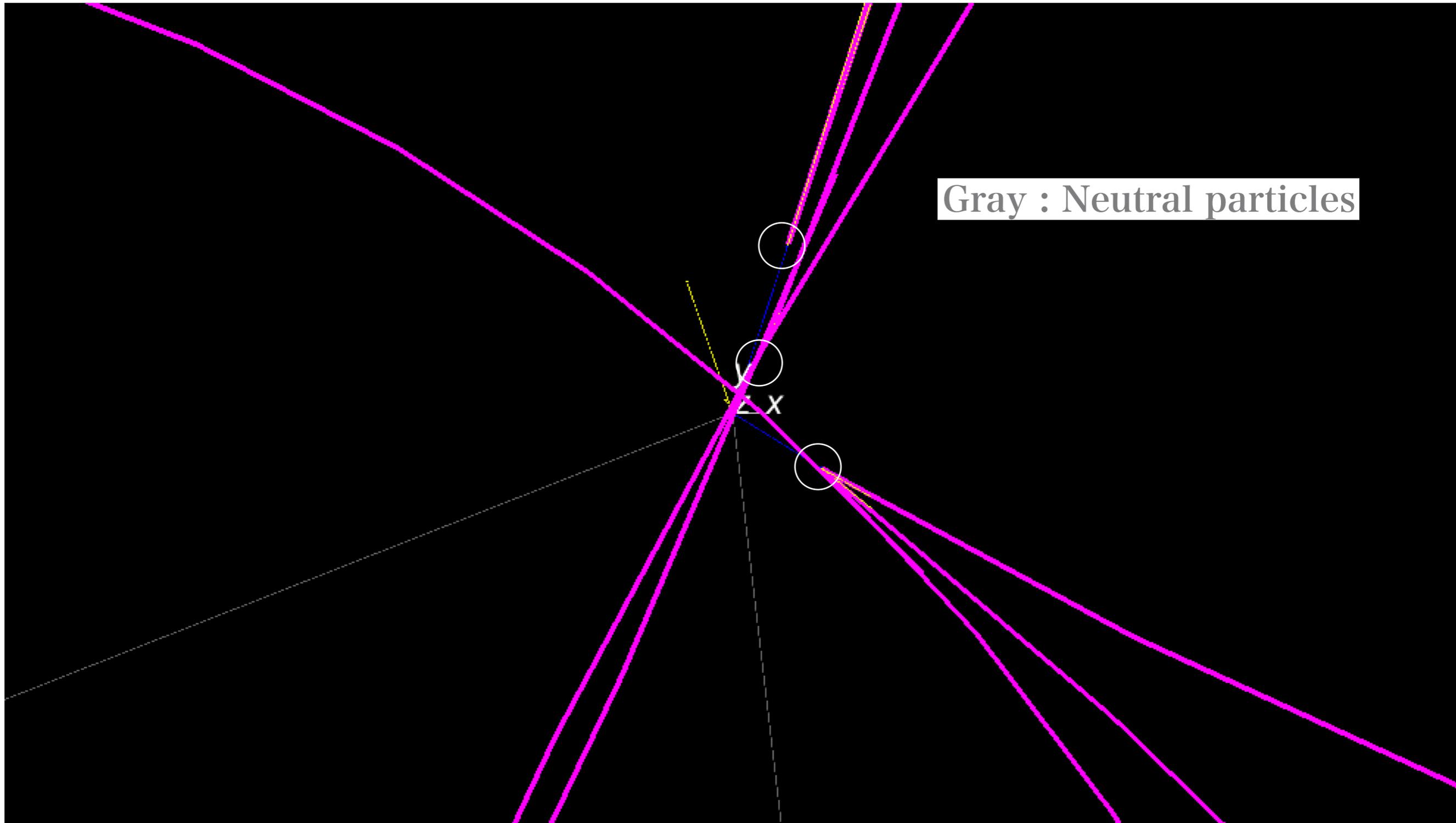
This is typical event.

Confirmed LCFIPlus basically does good job!

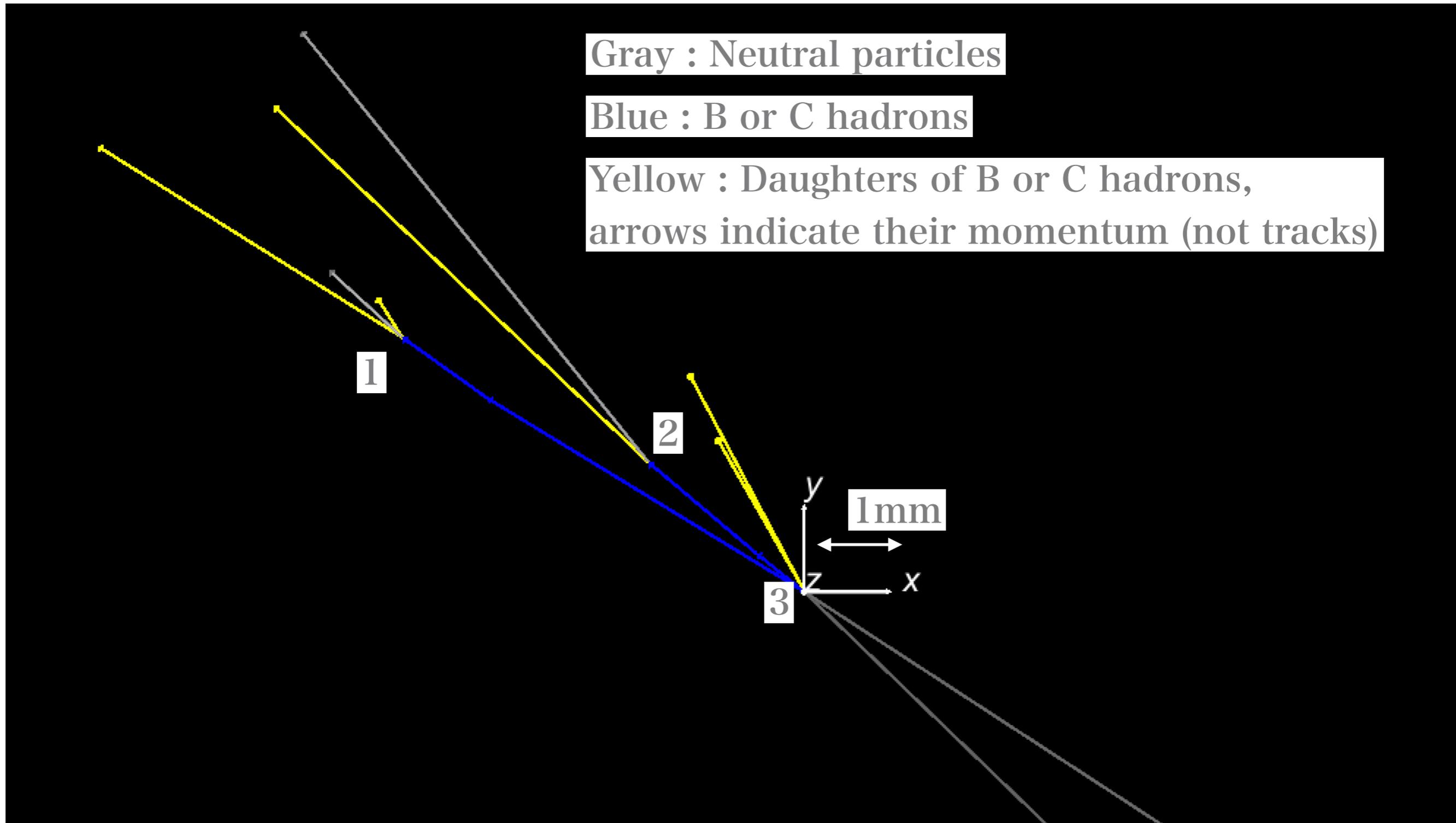
Check with event display
~Rare (good) case~







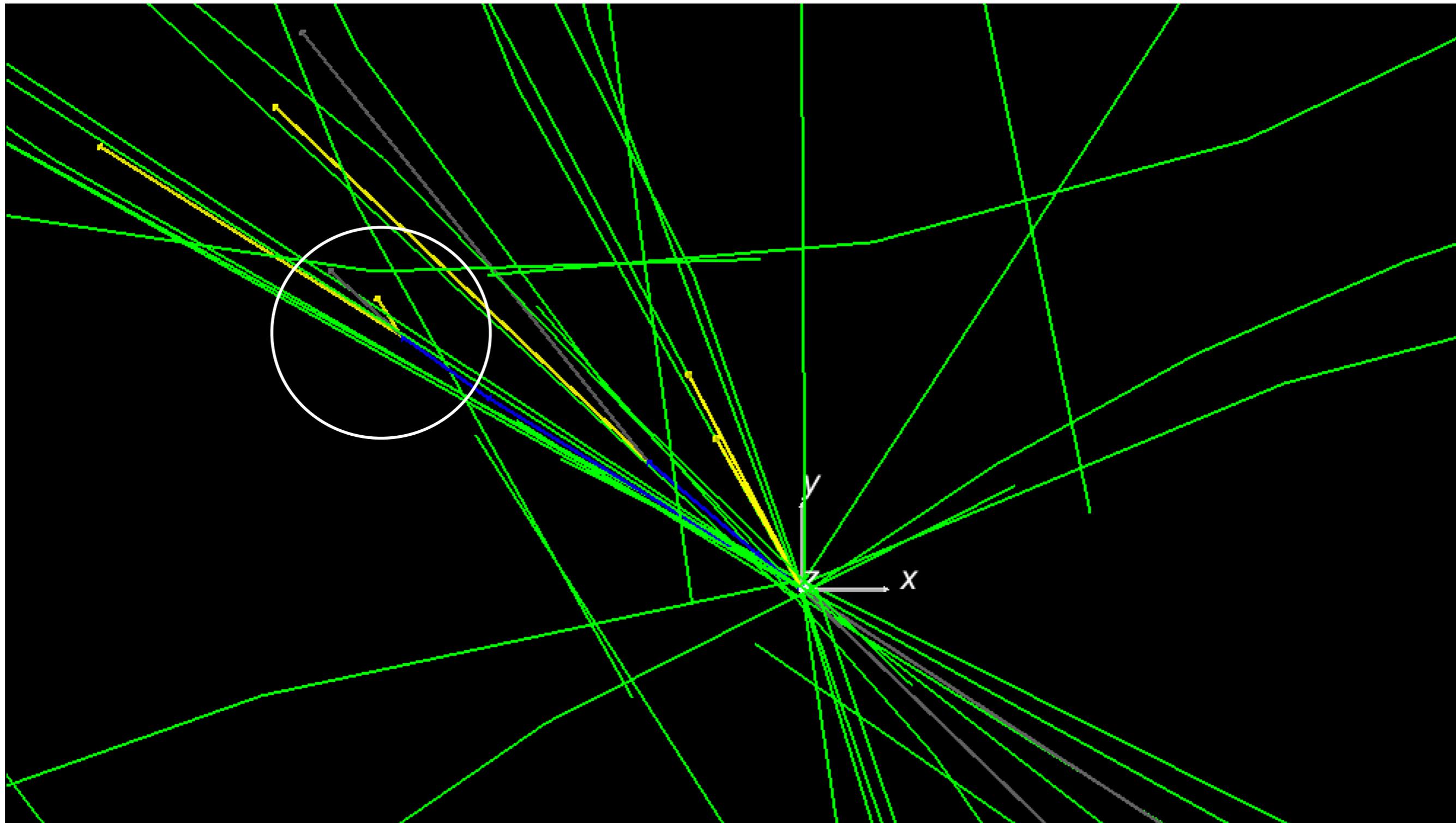
Check with event display
~Rare (bad) case~

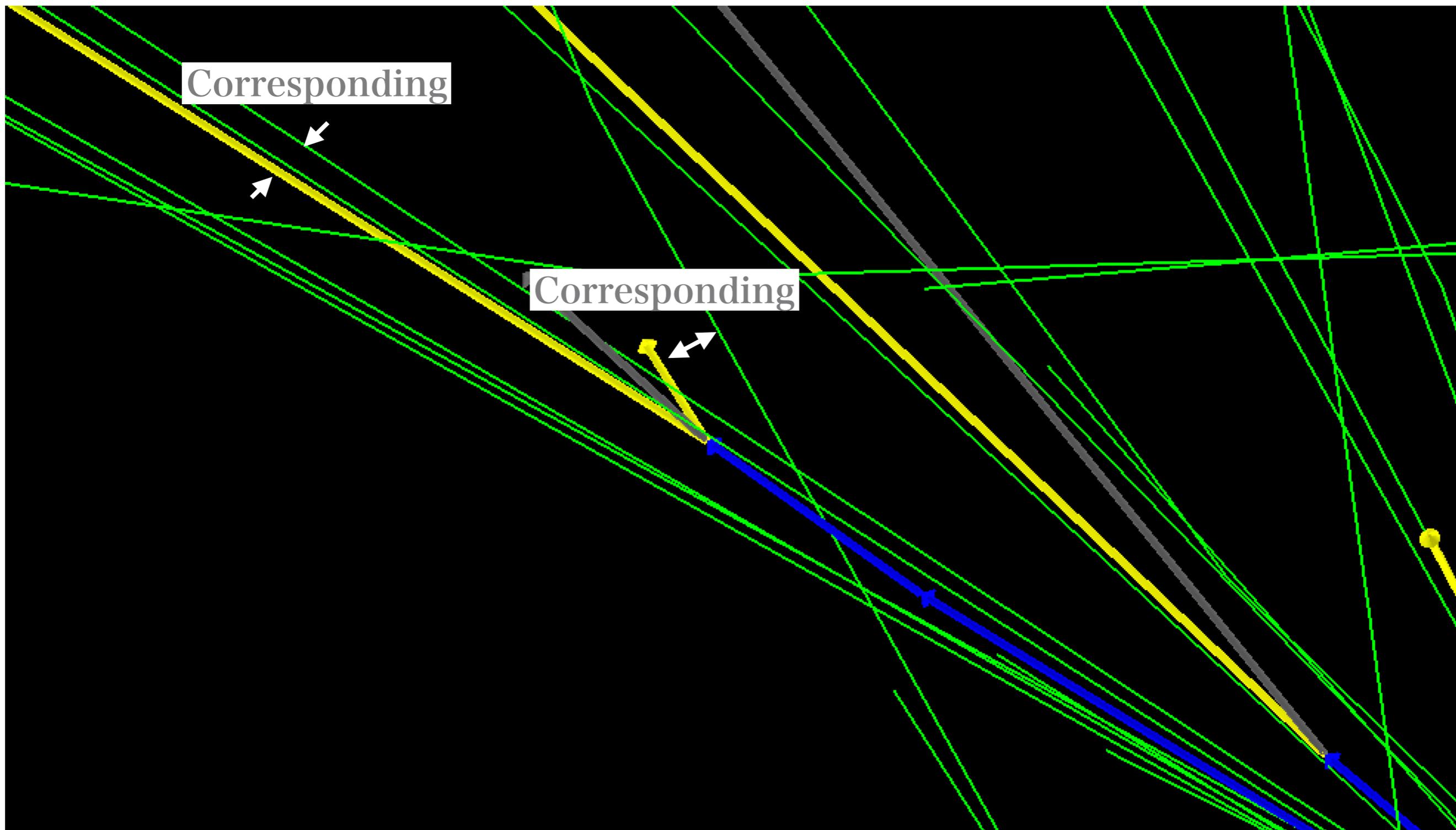


- Three possible secondary vertices in this event.
- Practically only vertex 1 can be reconstructed as secondary vertex.

Superimposing reconstructed tracks

No secondary vertices are reconstructed





From this event display, this secondary vertex should be reconstructed, but unfortunately this is not the case. Any possibility to improve this ?

VertexFinderSuehara::GetVertexList() :

```
if (!cfg.avf && mass > min(v1.E(), v2.E()))continue;
```

mass : invariant mass for two tracks

v1.E(), v2.E() : energy of tracks

The event shown in previous page :

mass = 0.666472 [GeV]

v1.E() = 4.50477 [GeV]

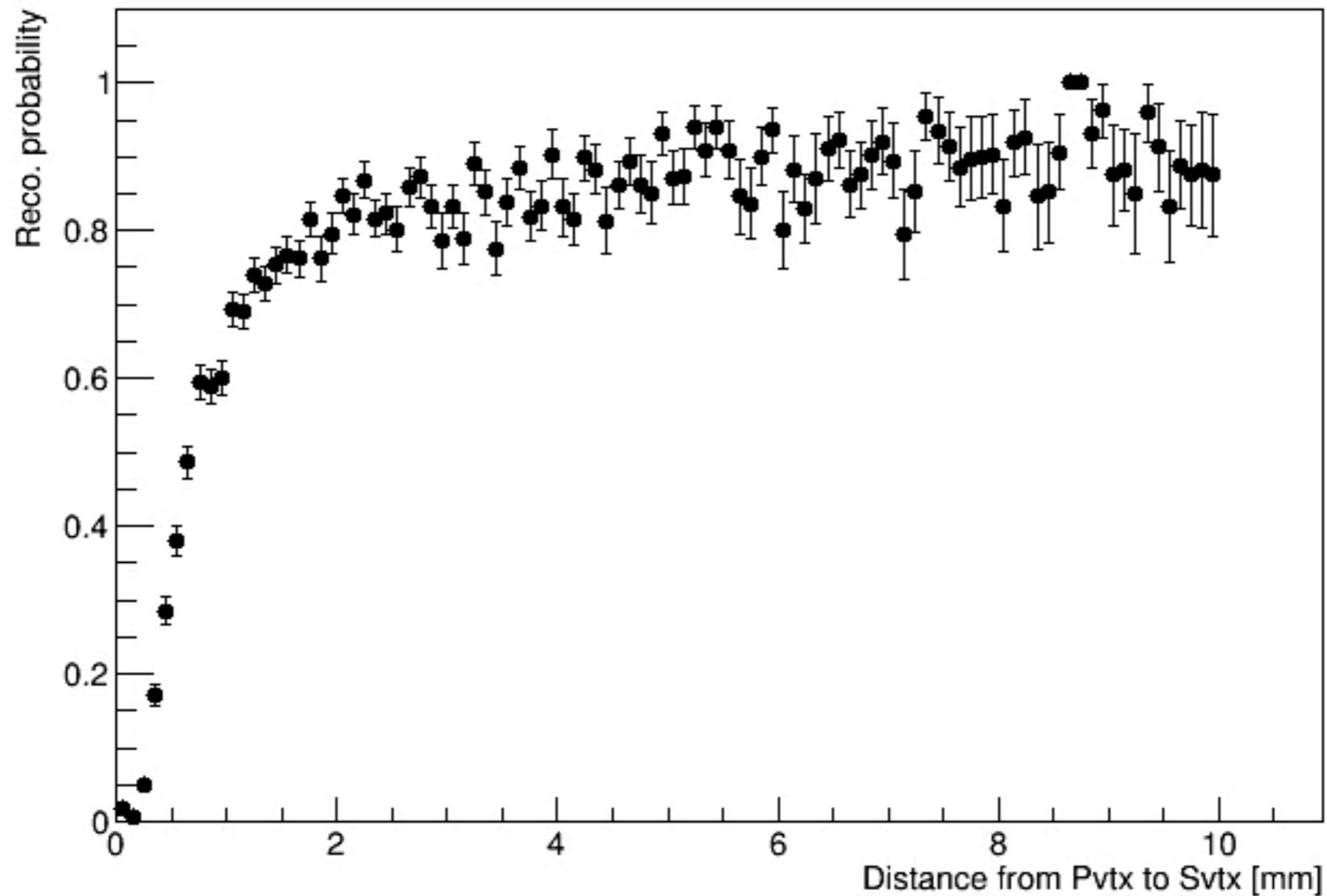
v2.E() = 0.615142 [GeV]

The requirement above prevent reconstructing the secondary vertex.

Confirmed LCFIPlus does its job correctly !

Scanning more events

Efficiency of C-hadron vertex reconstruction



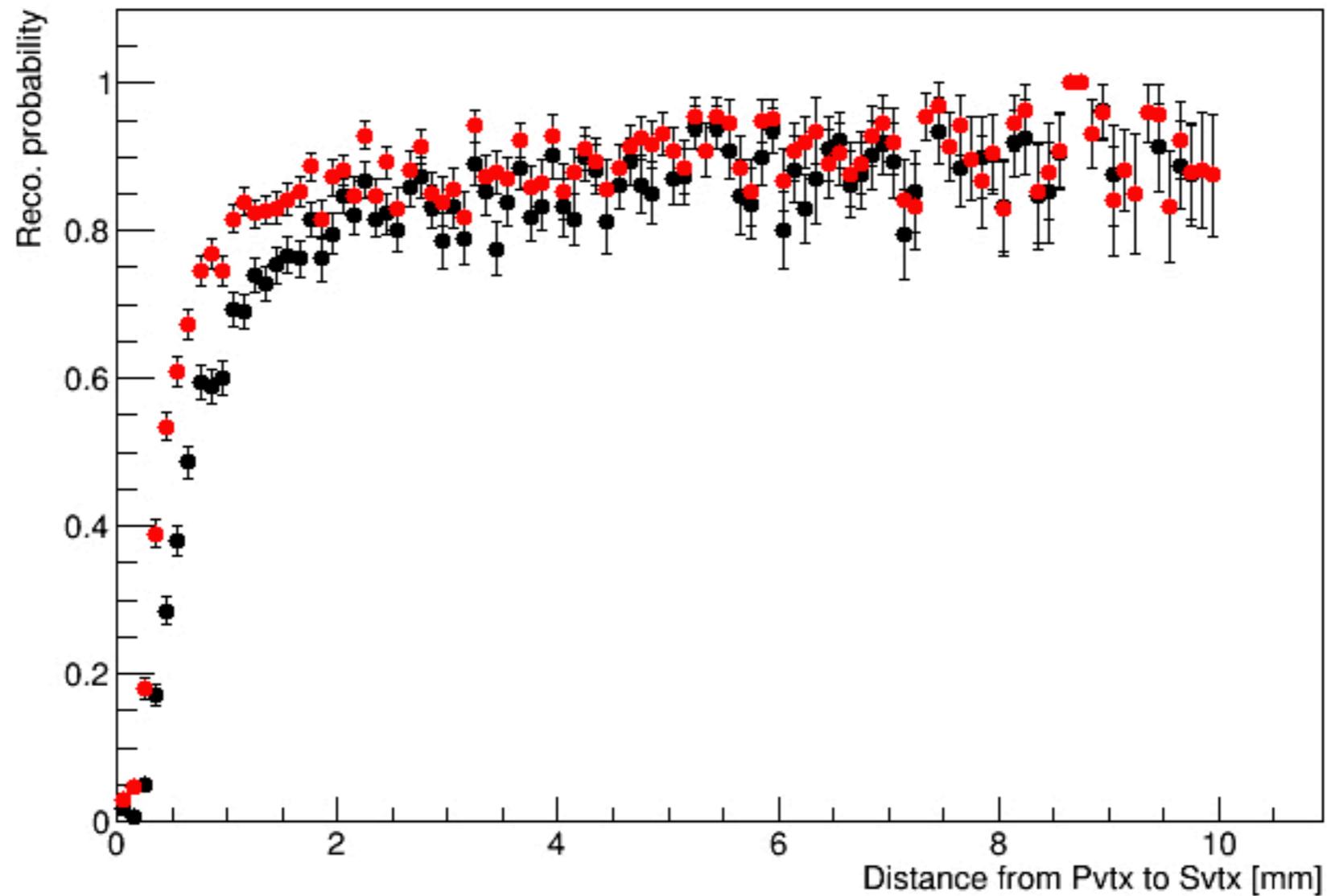
Precondition :

- 1) associated tracks more than 1 exist in track collection
- 2) ndf (\sim # of hits) of these tracks > 30

A trial (Red points) with another parameters of primary vertexing

Sometimes secondary tracks are combined to primary vertex.

What happen if we require tighter constraint for primary vertex tracks



Summary

LCFIPlus vertexing seems to work correctly so far (checked only vvcc sample)

I will check more closely failed events. This may be useful for vertexing parameter tuning.