Study on Connected “primary tracks” in fake vertices

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Goal & Method

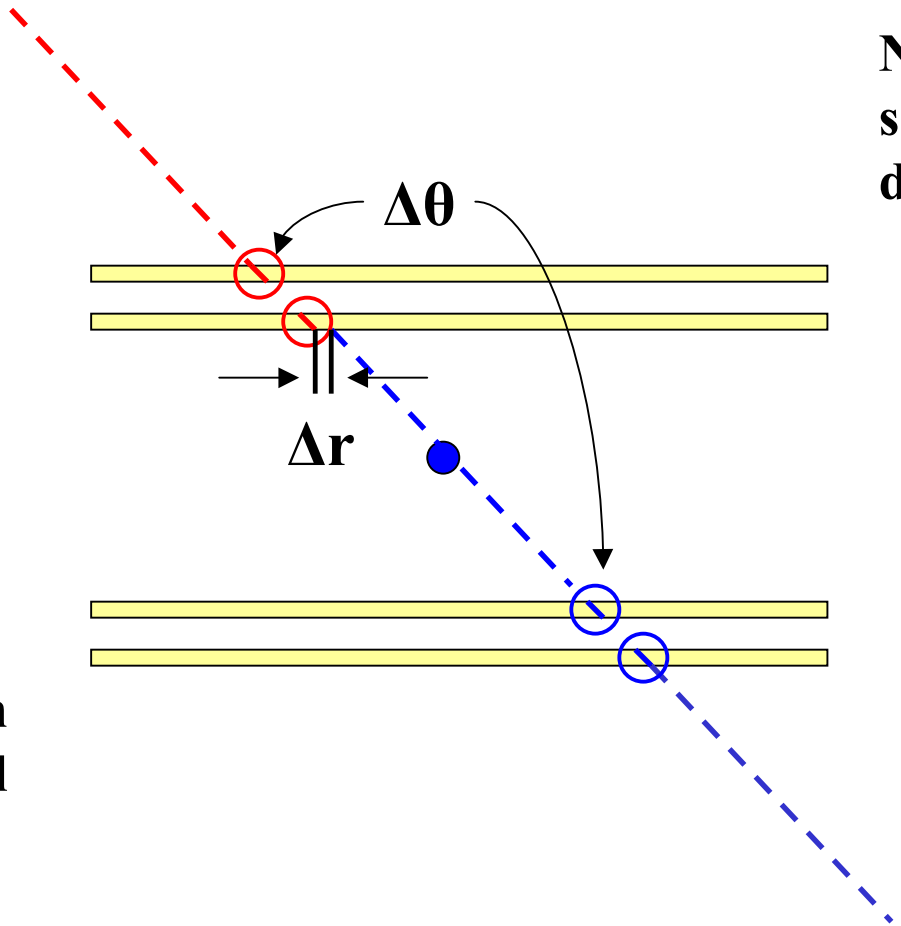
- Goal : To be able to recognize upstream connected tracks with (if possible) the same efficiency as Jikou in manual check, so as to be able to reduce the number of fake predicted vertices.

- Method :
  - (A) Use the information (supplied by Jikou) on 8 upstream connected tracks (corresponding to 4 events) to:
    i) Investigate the code failures
    ii) Introduce new cuts & a new method consistent with the way upstream connected tracks are recognized in manual check
  - (B) Use all existent located events to check the efficiency of the new cuts.

Old and New algorithm on eliminating connected tracks

- The initial algorithm on examining upstream connected tracks is slightly different than the manual check method.
- Thus we modified the algorithm to check connectivity in the "same" way as it is performed in manual check.
  - Initial Algorithm : Fit the 3 downstream segments of the upstream track and all segments of the "vertex" track and calculate position displacement and angle difference of these two tracks at z = last segment of upstream track.
  - New Algorithm : Fit the 2 downstream segments of the upstream track and the 2 upstream segments of the "vertex" track and with this info calculate position displacement and angle difference of these two tracks at z = one plate upstream of the "vertex" track

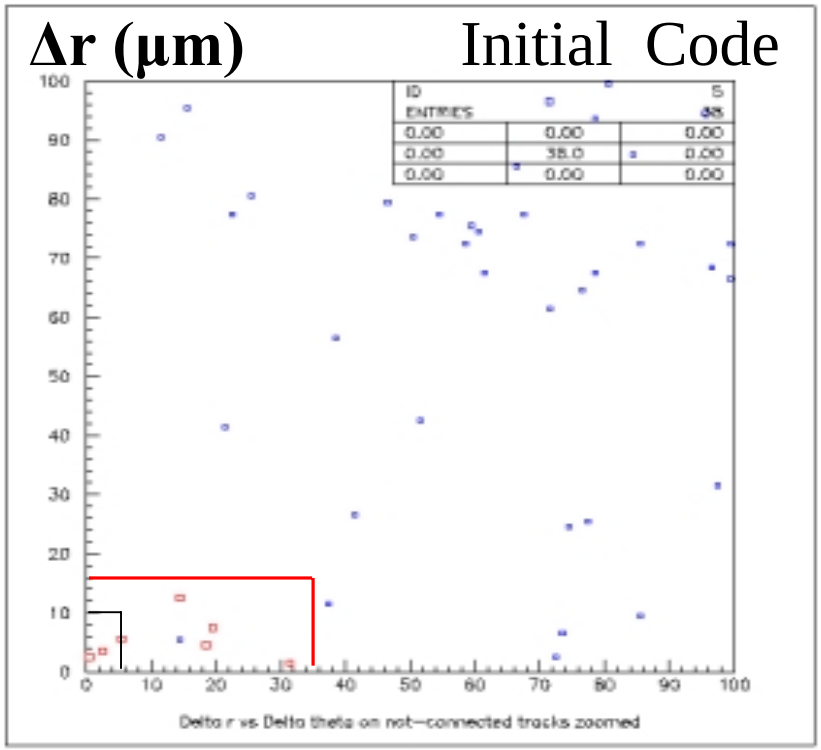
Algorithm on eliminating connected tracks cont.

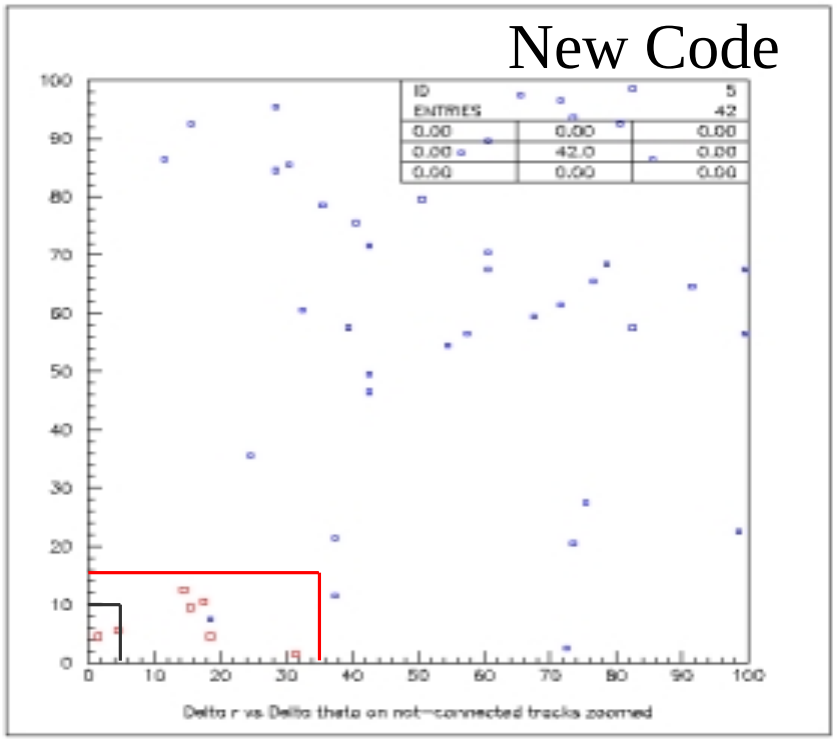


New : 2 upstream segments and 2 downstream

Old : 3 upstream segments and all downstream

Results on 8 connected tracks (4 events)





Red dots : Connected tracks

Blue dots : Not connected tracks

Black Line : Initial Cuts (10μm , 5 mrad)

Red Line : New Cuts (15 μm , 35 mrad)

Results on 8 connected tracks (4 events) (comments)

- Both versions of the code give similar results.
- One of 8 tracks could not be found by the code since this track does not end upstream the vertex track. It has (wrongly) picked up one downstream segment so it is not considered by the code.
- Only 2 tracks passed the initial cuts on !r and !" which were initially missed due to incomplete m-file.
- New cuts on !r and !" recognize all connected tracks correctly but they also pick up a false combination (having on the same time rejected ~ 400000)

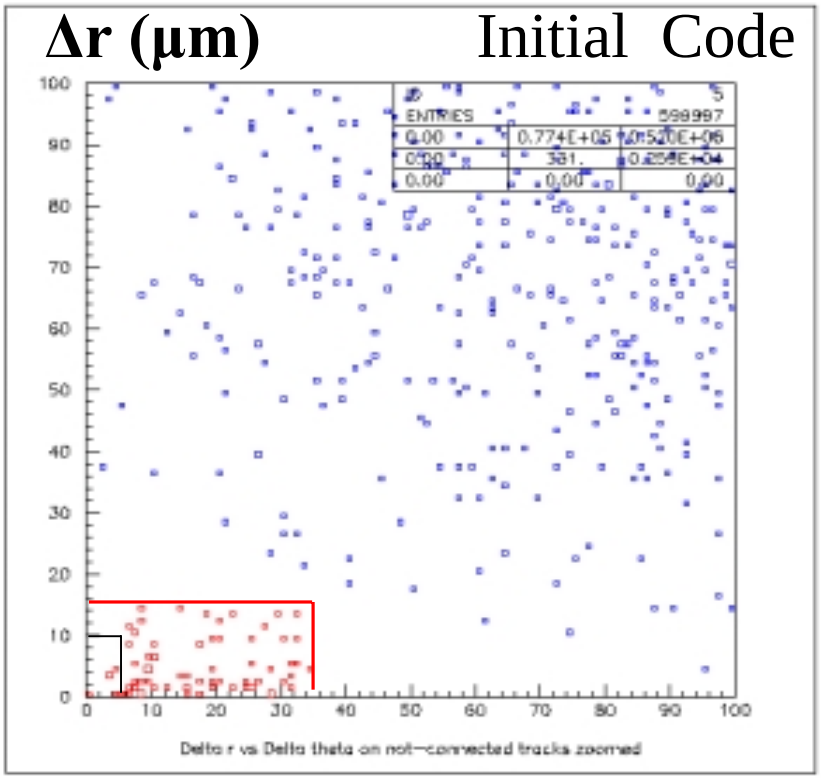
Test on All Located Events

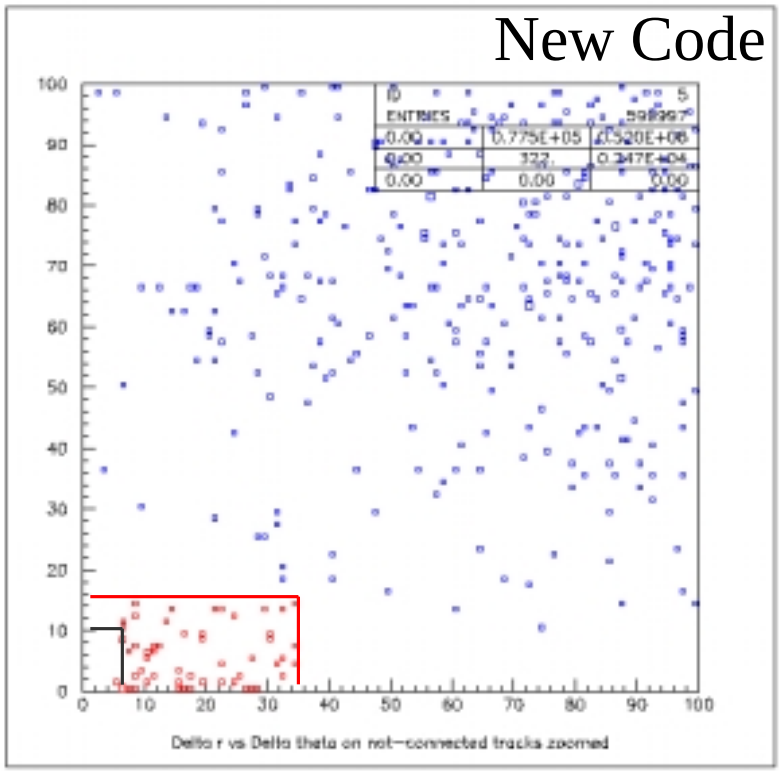
- Finding upstream connected tracks is very important but at the same time any set of cuts or any algorithm should not characterize as connected tracks those that are not.

- In order to examine further the new cuts and both algorithms performance we decided to test them on all located events.

- For this we processed all vertex tracks of located events, which in principle should not be found to be upstream connected.

Results on All Located Events (~300)





Red dots : Connected tracks

Blue dots : Not connected tracks

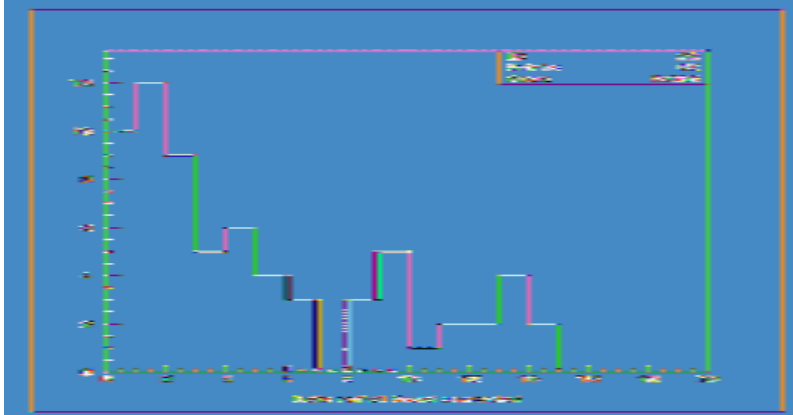
Black Line : Initial Cuts (10μm , 5 mrad)

Red Line : New Cuts (15 μm , 35 mrad)

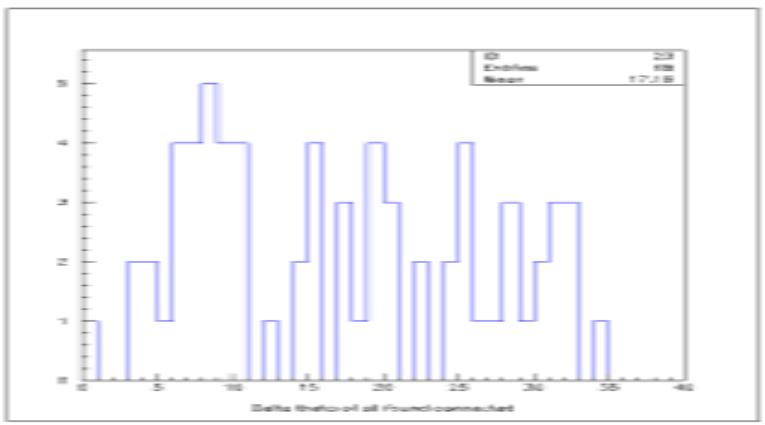
Results on All Located Events cont.

FOUND CONNECTED

Δr (μm)

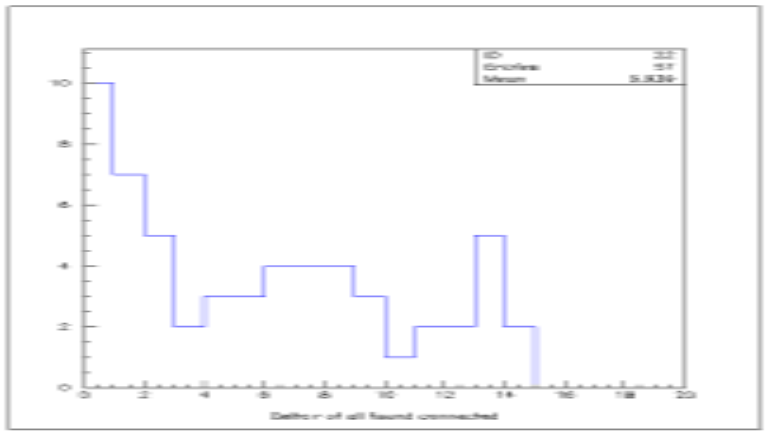


Δθ (mrad)

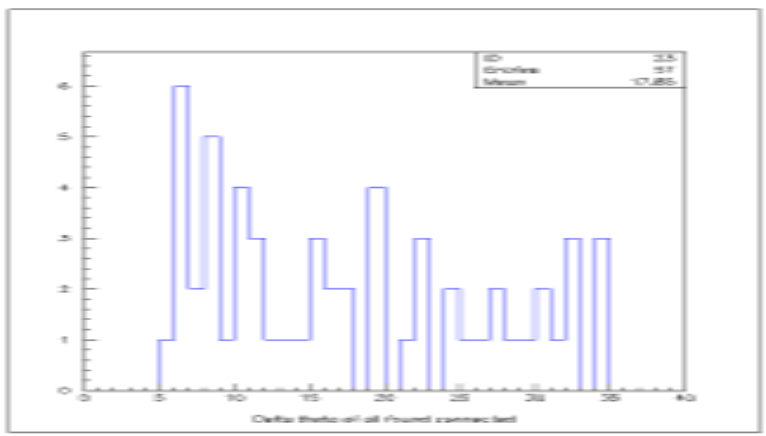


Initial Code

Δr (μm)



Δθ (mrad)

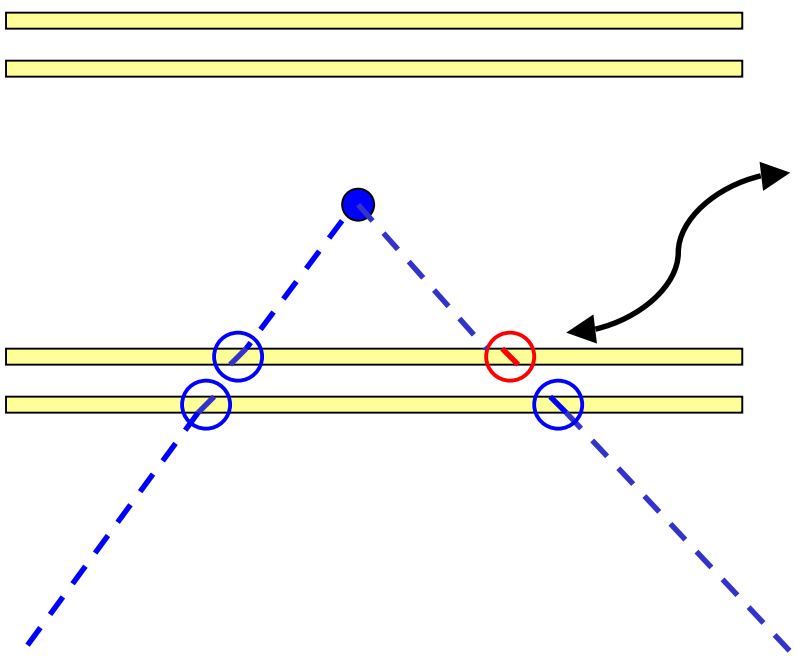


New Code

Results on All Located Events cont.

- A number of vertex tracks in located events (68 with old version and 57 with new version) are “found” to be upstream connected with both versions of the code with the new cuts.
- This number of upstream connected tracks is smaller with the old (more conservative) cuts (5 for the old version and 0 for the new version of the code)
- However 60 % (42/68 old version, and 33/57 new version) of these “upstream” connected tracks were found to have an additional “interesting” feature :
  - The vertex track starts one segment downstream of the vertex plate and their “upstream” connection (track) is a one segment-track starting at the vertex plate.
  - So is it possible that they are indeed connected in this manner?

True Vertex tracks found upstream connected (cont.)



60 % of found upstream connected tracks in true vertices miss a segment in the vertex plate and the upstream connection is an one-segment track starting at the vertex plate.

Results on All located after checking primary tracks with Japanese List

- Discussing these results with Nonaka he suggested on cross-checking these primary tracks with their list.
- After doing that with the results from the new version of the code and the new cuts we found that :
  - **23 / 57 Primary tracks are not in their list**
  - **1 event is not in their list**
  - **33 / 57 Primary tracks exist in their primary list**

23 Connection with one-segment upstream starting at the vertex plate

6 Connection with upstream track with segments upstream the vertex plate

4 Connection found by both our code and the Japanese code

Conclusions - On going work

- The reason we did not recognize upstream connected tracks at least for these 4 events was inadequate (conservative) cuts on $!r$ and $!"$.
- Introducing new cuts and a new method (closer to the one followed by Eye - Scan) we were able to find these upstream connected tracks on the 4 events .
- These new cuts tested on true vertices , resulted in a small fraction of vertex tracks found upstream connected and this needs to be understood.
- However the results can be considered “safe” as far as rejecting true vertex tracks is concerned.
- For that we have already started proccesing the 80 good quality events supplied by Nonaka and we will start sending our predictions to Jikou.