Missing plane algorithm

(Comparison Cellular Automata for track search with standart track-finder)

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KPH, University Mainz

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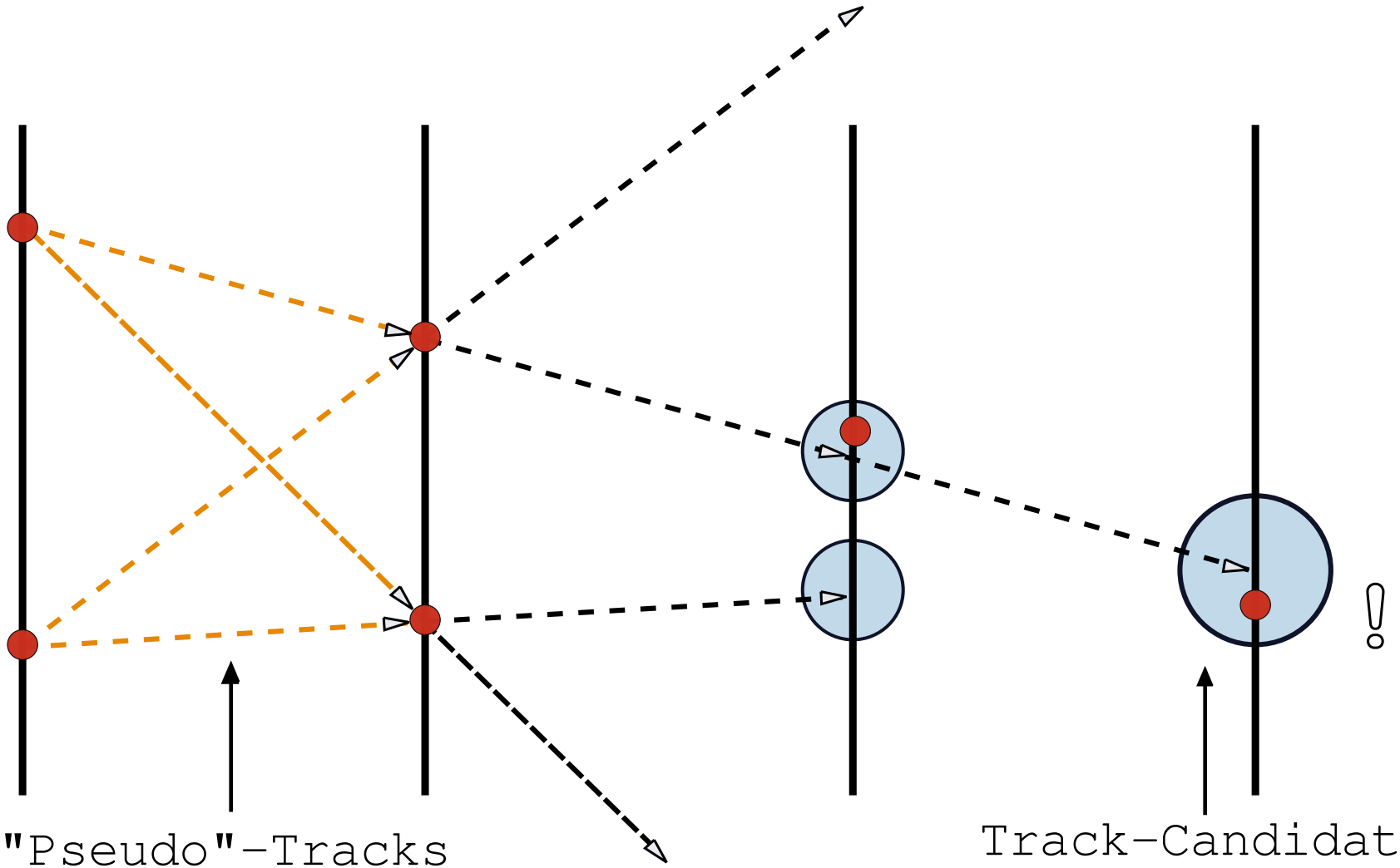
Outline

- Missing plane algorithm
  - Description & results for Track-Following
  - Description & results for Cellular Automation
  - Test with real missing sensor
- Results

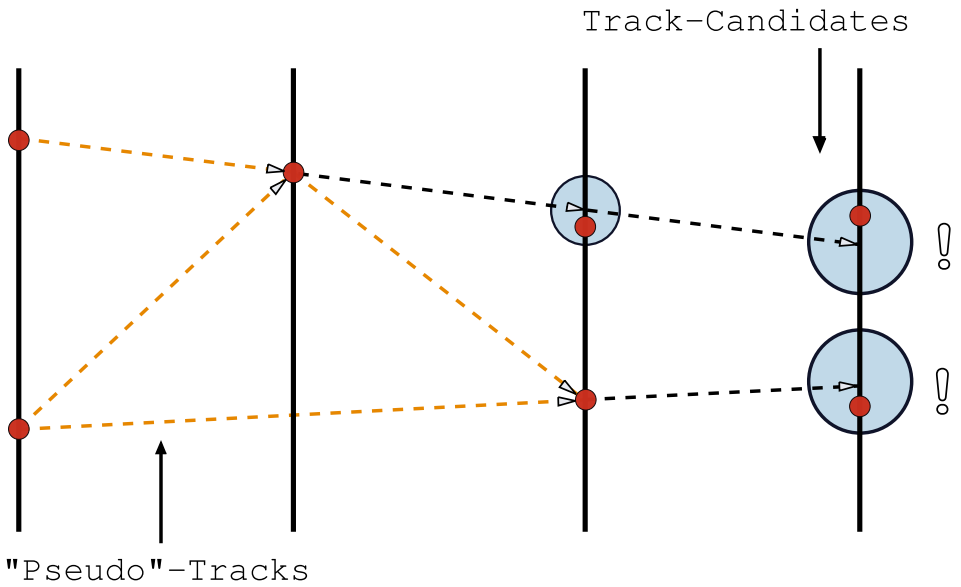
All results are presented for simulation:
5 trks/event, P_{beam}=8.9 GeV/c

Normal algorithm for Track-Following (by M. Michel)



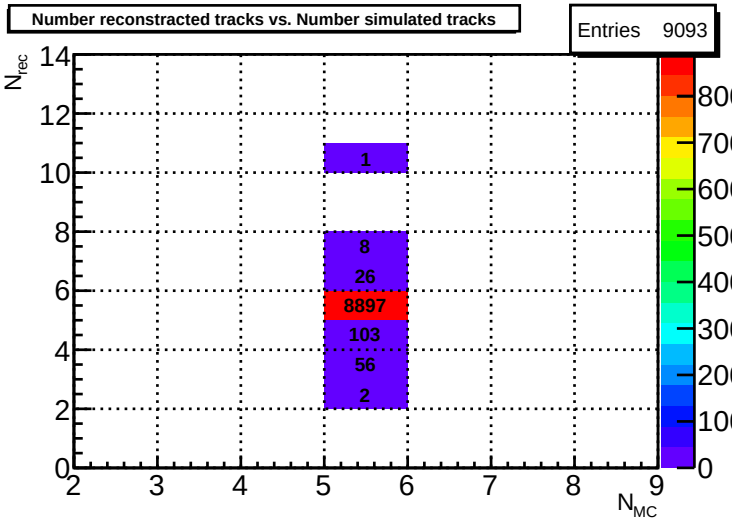
Missing plane algorithm (by M. Michel)

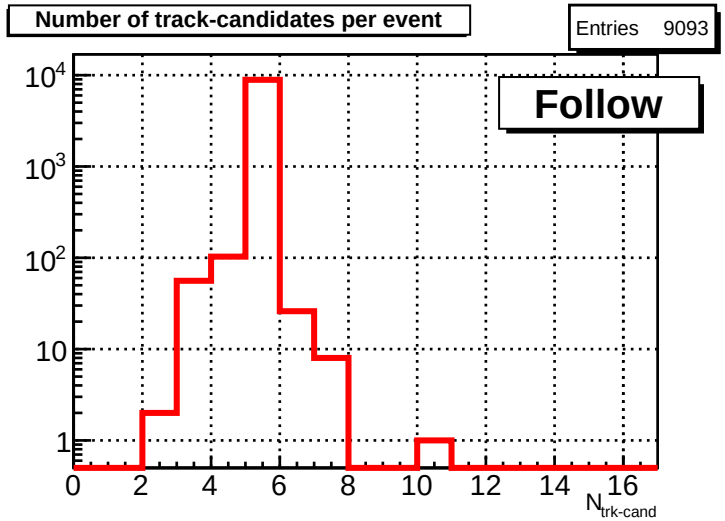
- Initial vectors are built between 1&2, 1&3, 2&3 planes
- For search started from 1&3, 2&3 only free hits are used

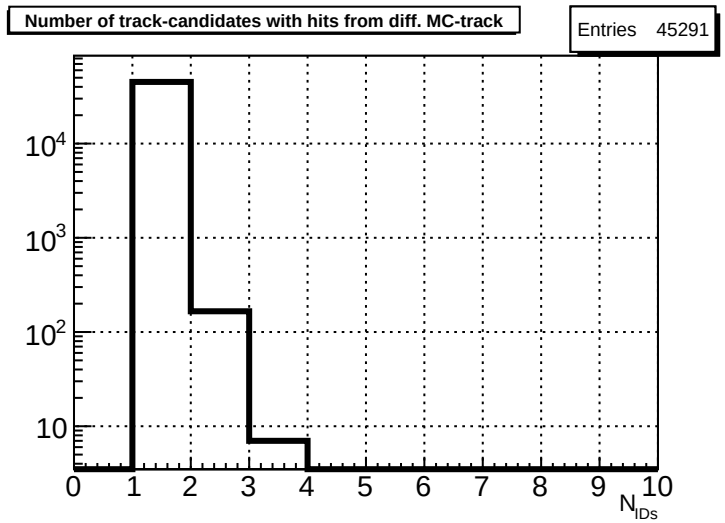


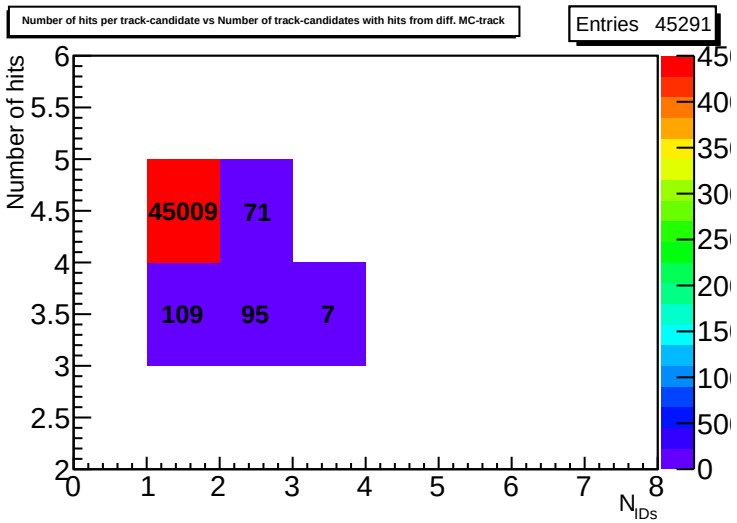
Tracks with missed hits can be found.
Number of ghost tracks is small.

Results for normal Track-Following algorithm

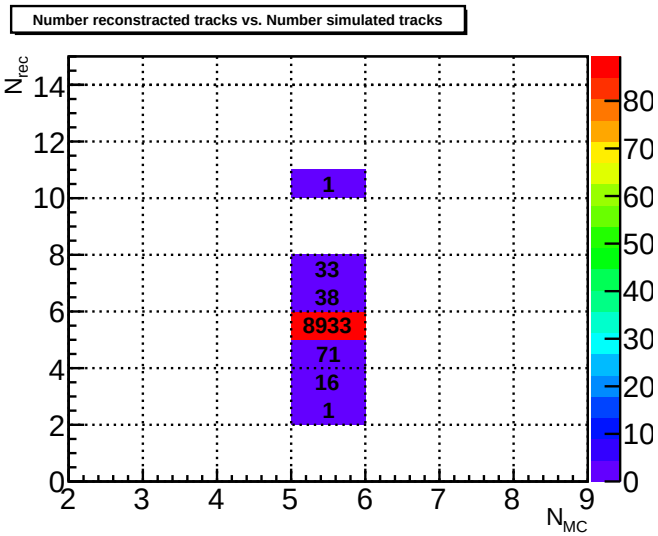


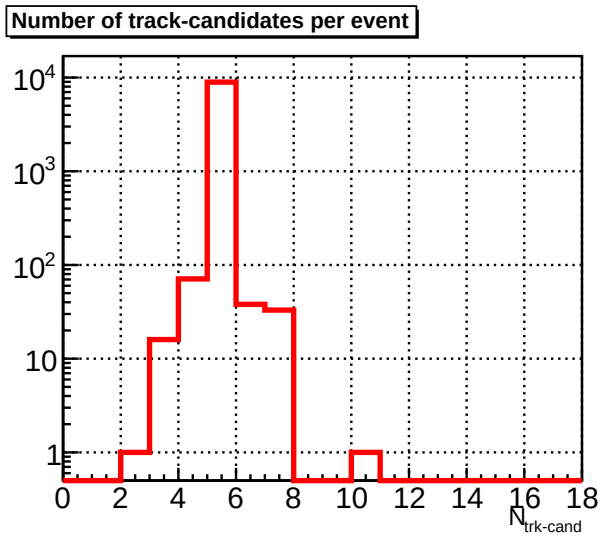


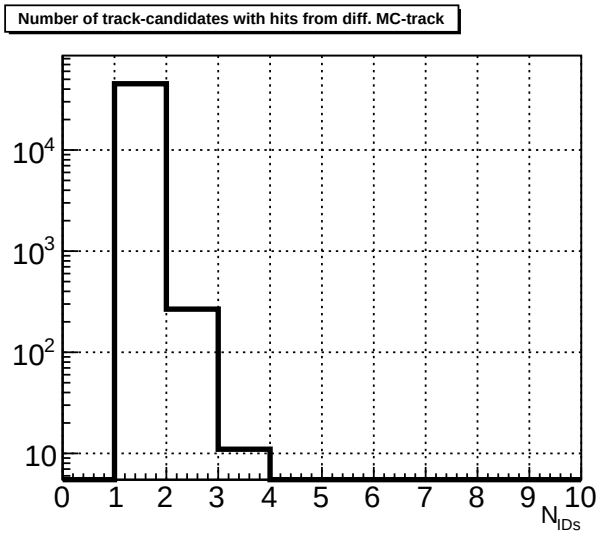


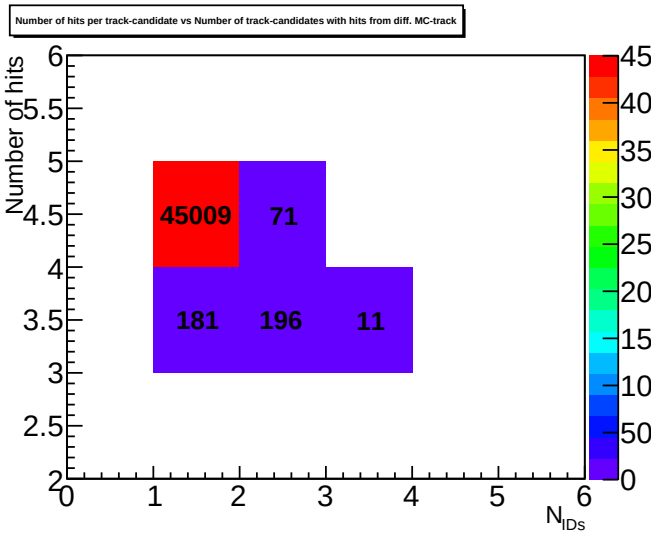


Results for missing plane algorithm for Track-Following









Summary (Track-Following)

- for normal case:
  good tracks = 45118
  bad tracks = 173
- missing planes algorithm:
  good tracks = 45190
  bad tracks = 278

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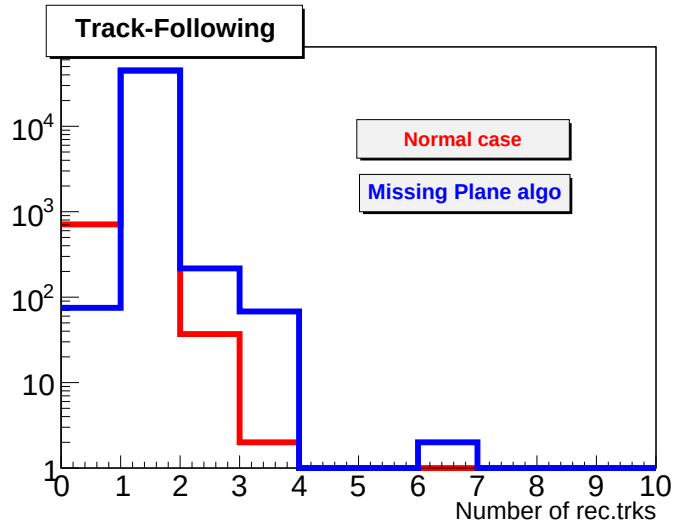
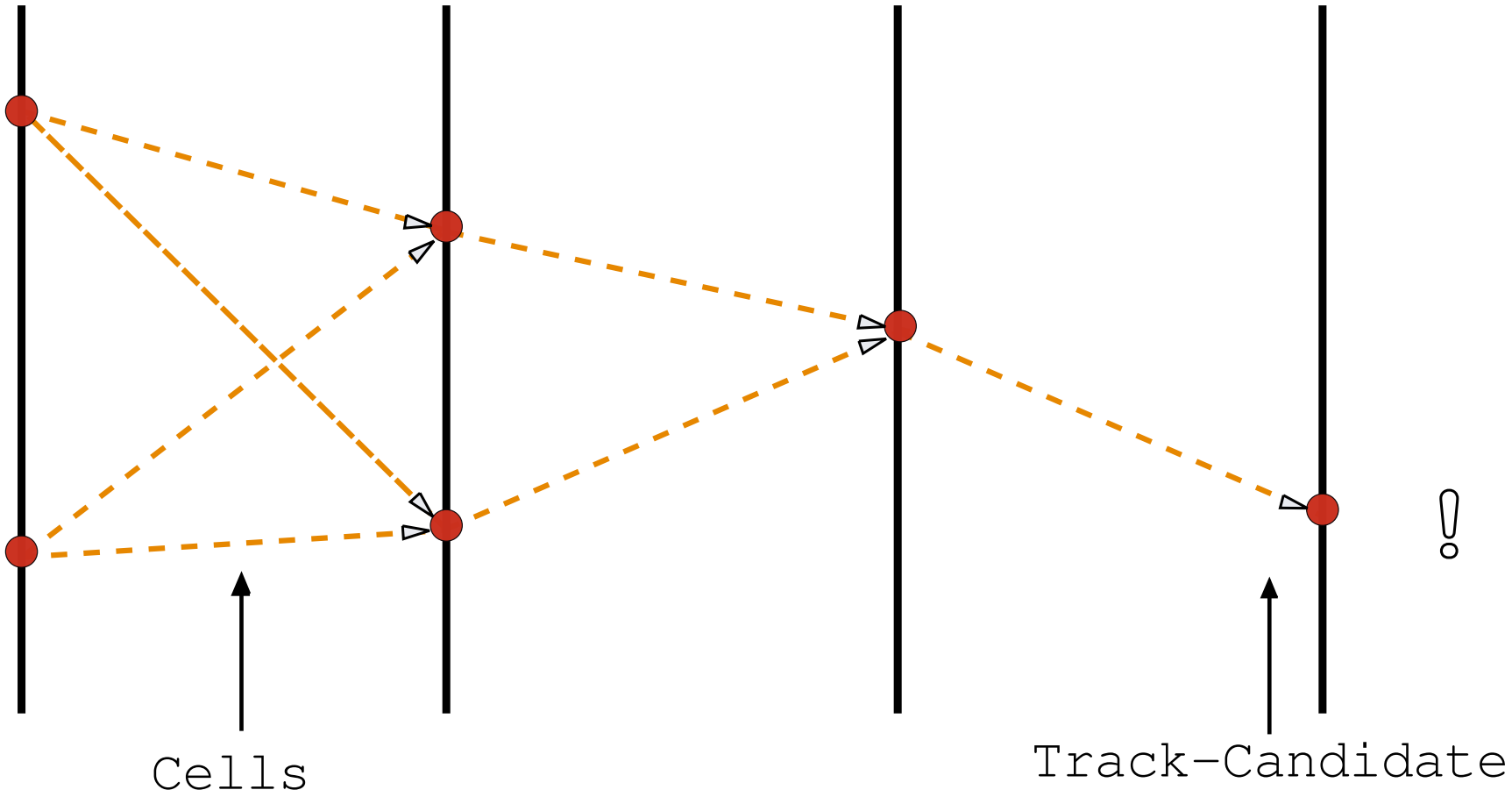


Additional tracks due to "missing planes" algorithm, %

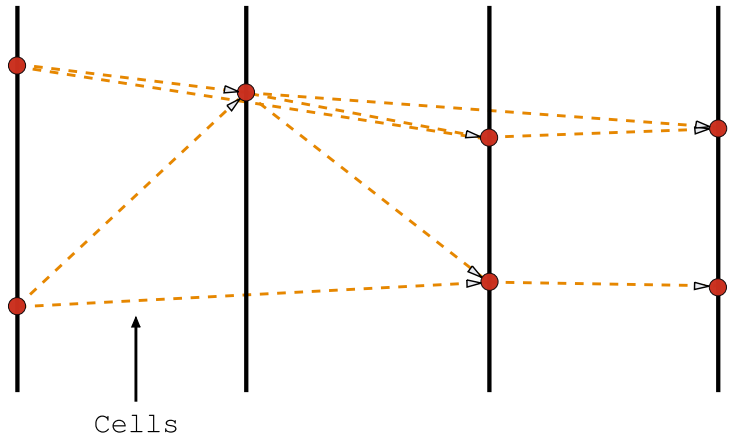
N_{trk}^{MC}	1.5 GeV/c	8.9 GeV/c	15 GeV/c
1	0.94	0.02	0.01
2	1.1	0.14	0.11
3	1.3	0.21	0.24
5	1.6	0.39	0.43

Normal algorithm for Cellular Automata



Missing plane algorithm for Cellular Automata

- Cells are built between neighboring layers and skipping over one layer
- Both kinds of cells participate in track-search simultaneously



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Number of ghost tracks could be large.

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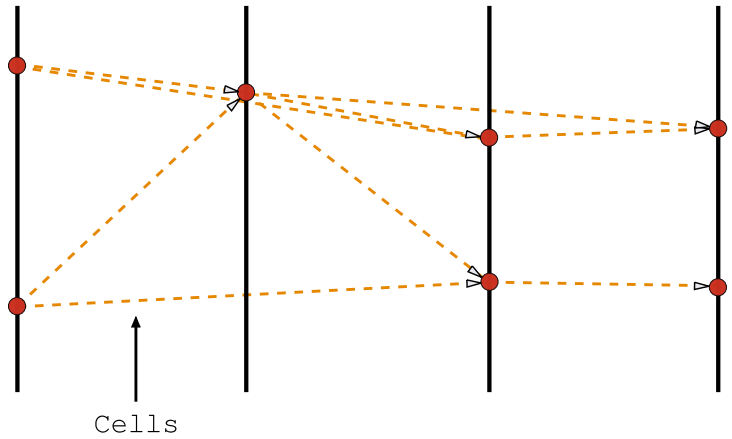

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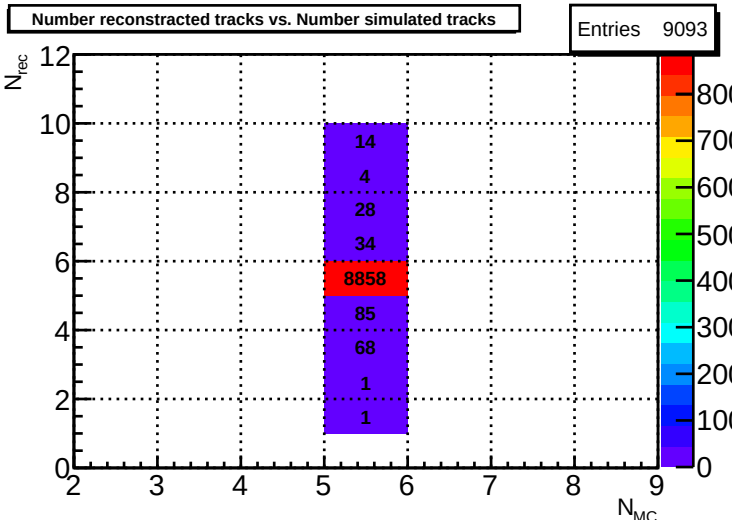
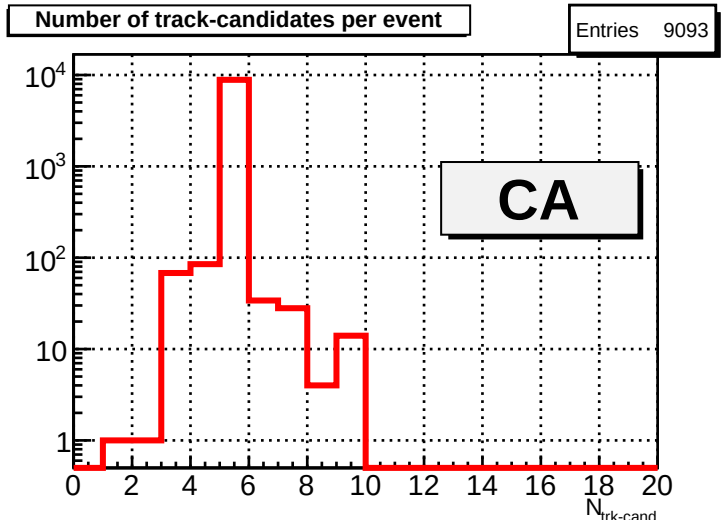
Filter for Cellular Automata

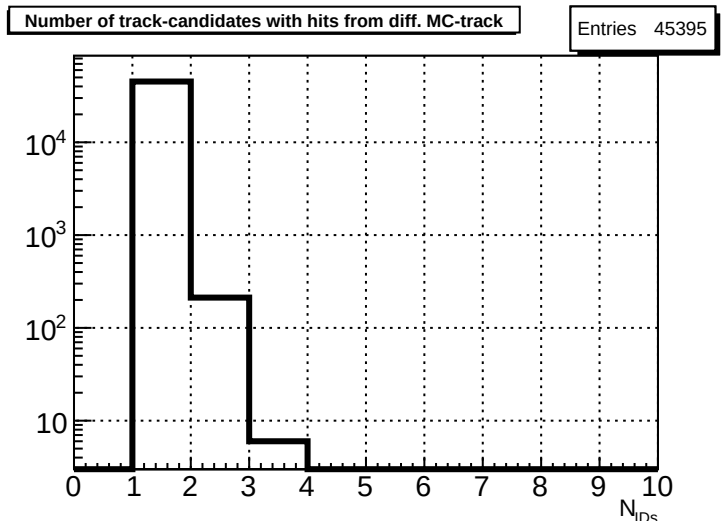
Idea

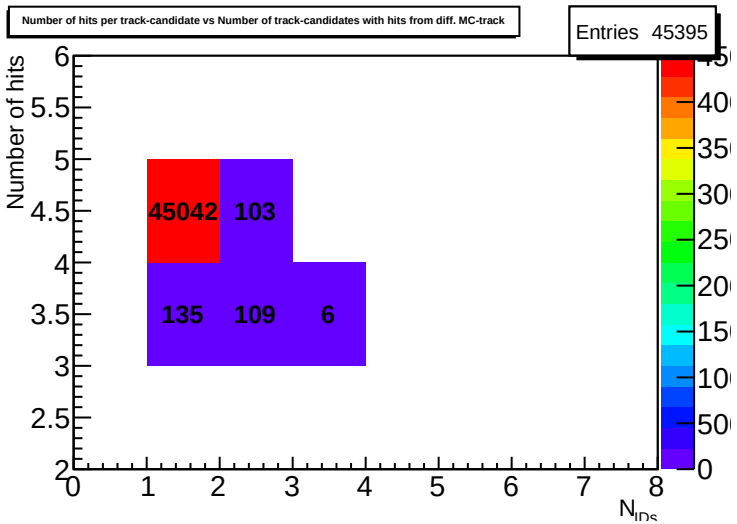
- 4 point and 3 point tracks
  - All tracks with 4 hits are saved.
  - Compare tracks with 4 hits and with 3 hits.
  - If all points from a "3 hits" track already participate in a "4 hits" track, throw the "3 hits" track away.
- 3 points tracks
  - Compare tracks with 3 hits between each other.
  - If at least 2 hits are participate in two(or more) tracks, the more straight track is chosen.

Results for normal Cellular Automata algorithm

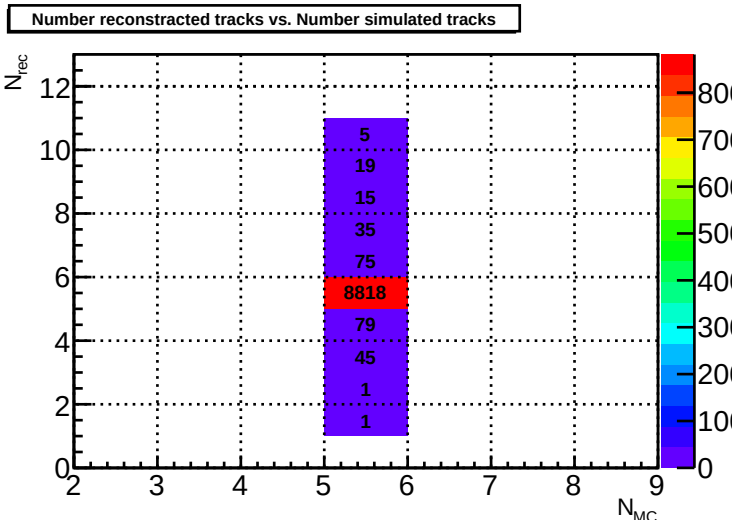


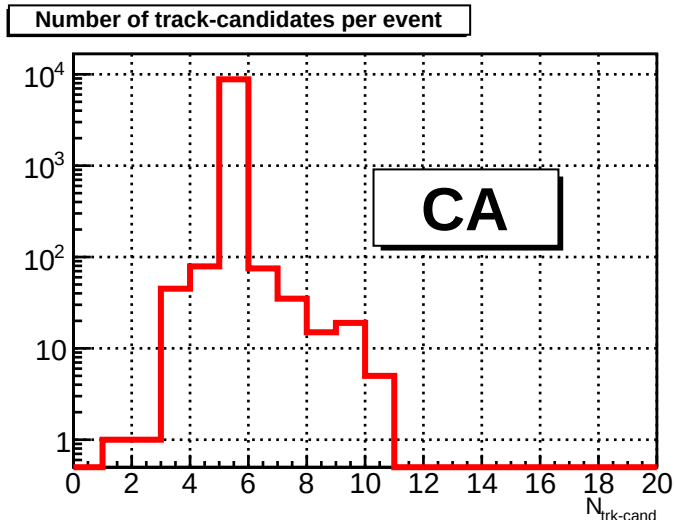


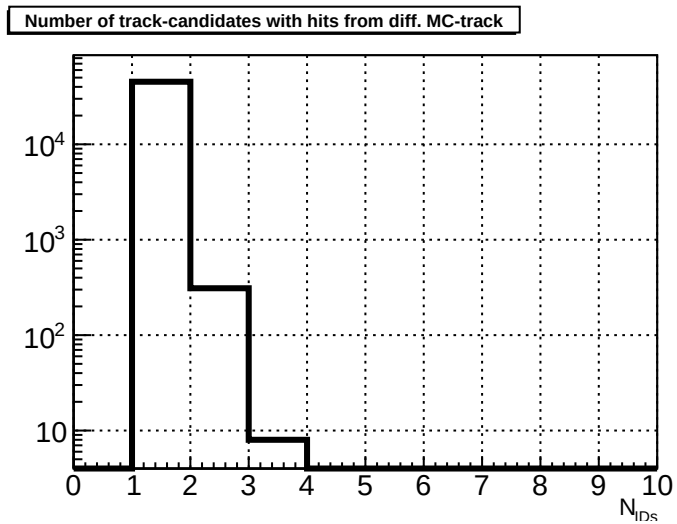


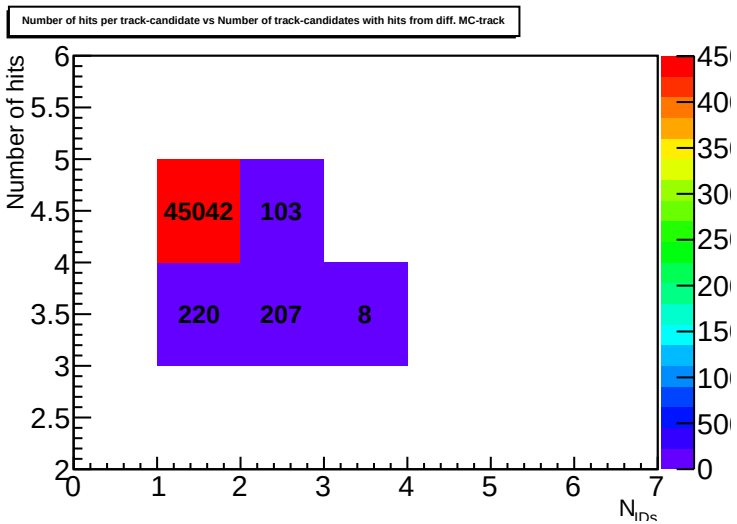


Results for missing plane algorithm for Cellular Automata









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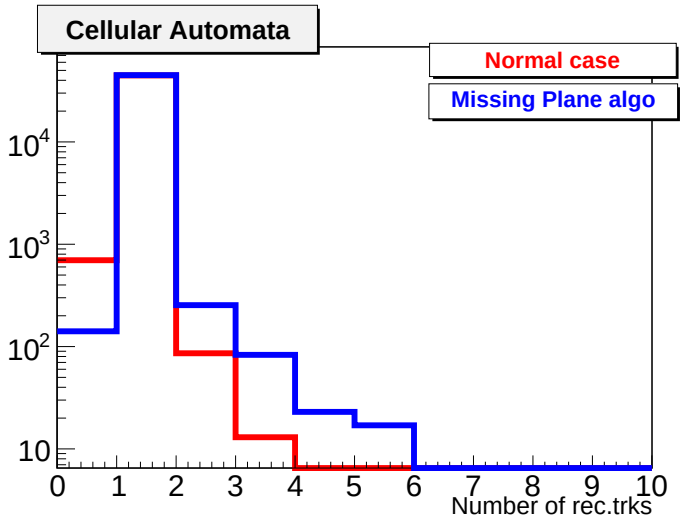

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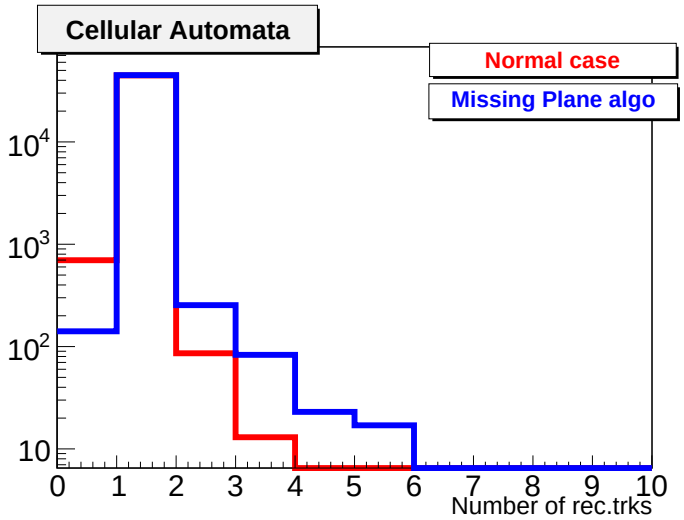

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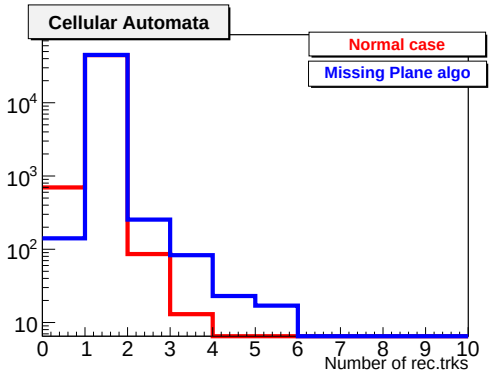
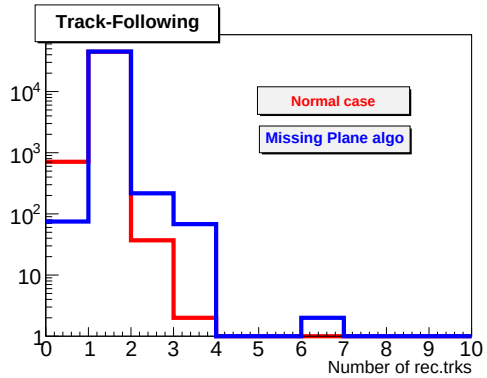
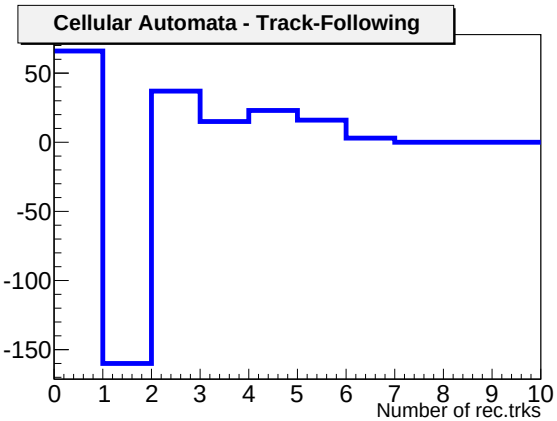
MCid participation (CA vs. Follow)







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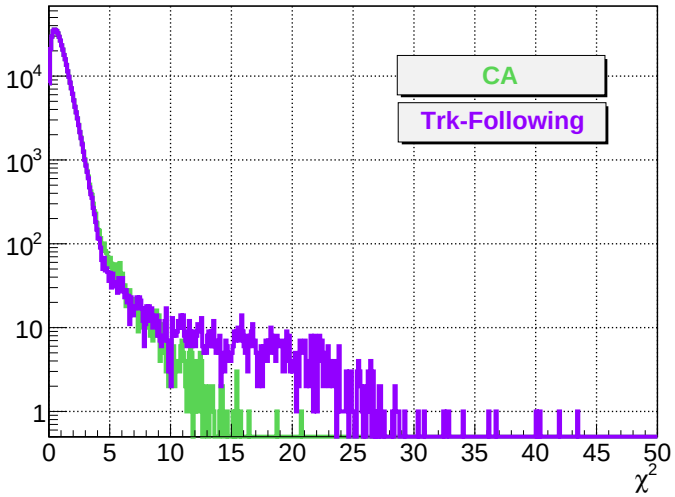
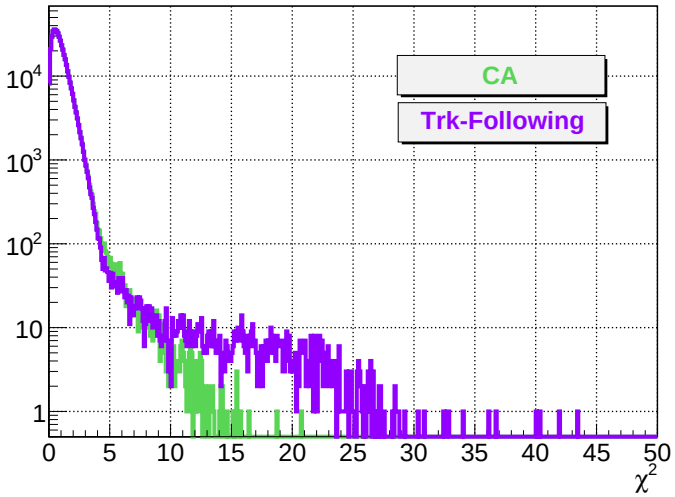
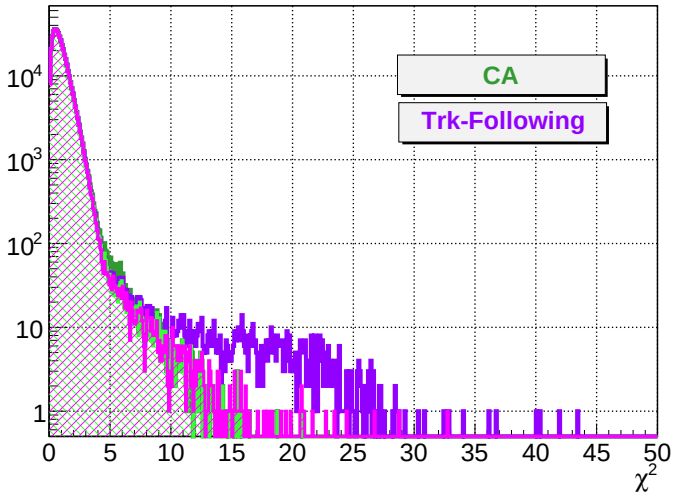
χ^2 cut?


CA
Trk-Following
10^4
10^3
10^2
10
1
0
5
10
15
20
25
30
35
40
45
50
χ^2

χ^2 cut?


CA
Trk-Following
10^4
10^3
10^2
10
1
0 5 10 15 20 25 30 35 40 45 50
χ^2


CA
Trk-Following
10^4
10^3
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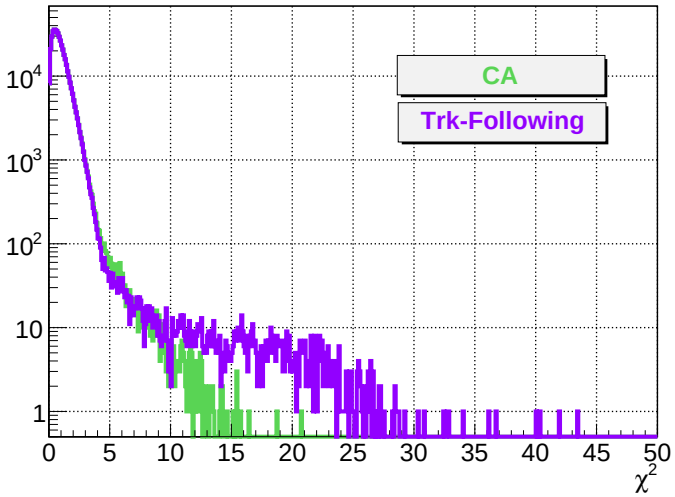
10
1
0 5 10 15 20 25 30 35 40 45 50
χ^2

χ^2 cut?


CA
Trk-Following
10^4
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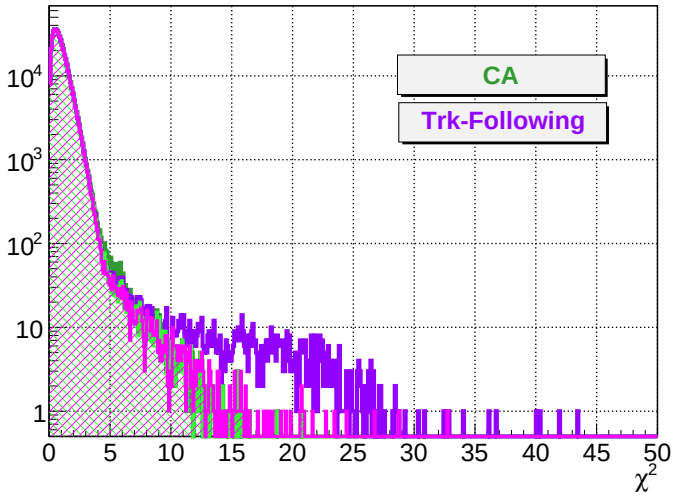
10
1
0 5 10 15 20 25 30 35 40 45 50
χ^2


CA
Trk-Following
10^4
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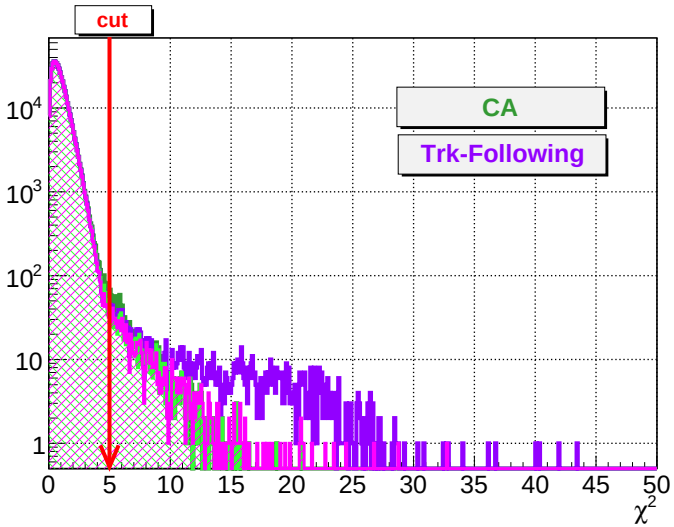
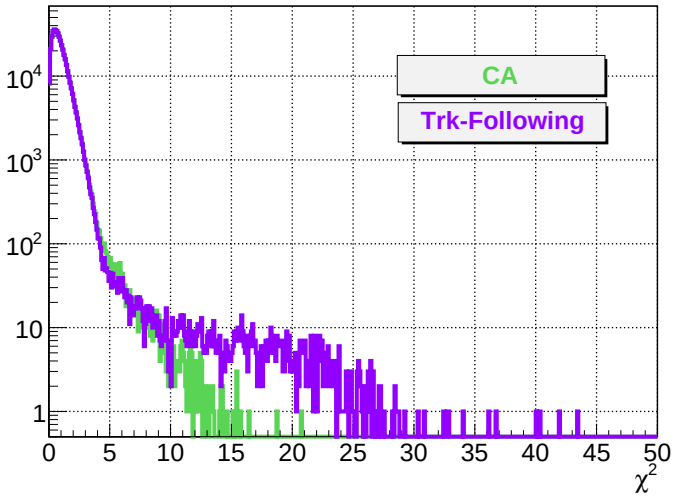
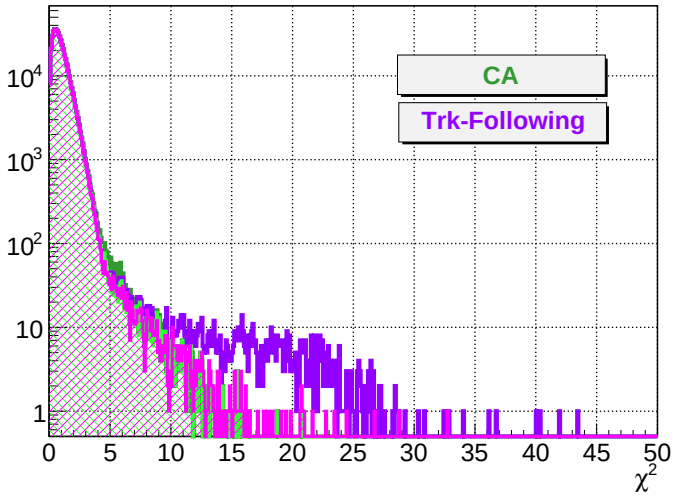
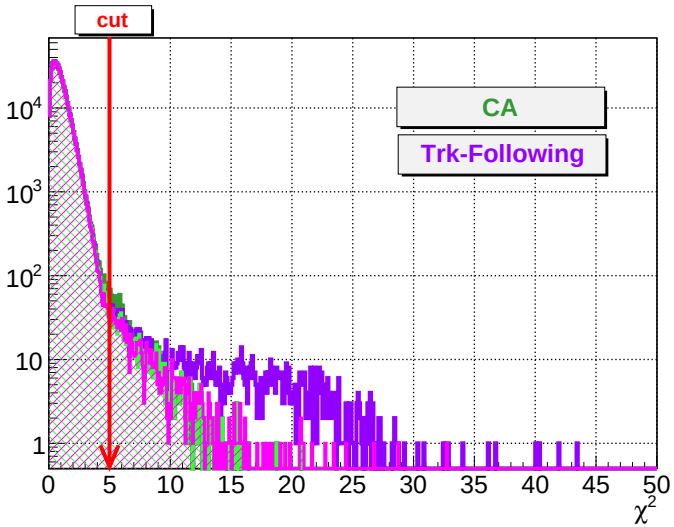
1
0 5 10 15 20 25 30 35 40 45 50
χ^2


cut
CA
Trk-Following
10^4
10^3
10^2
10
1
0 5 10 15 20 25 30 35 40 45 50
χ^2

χ^2 cut?



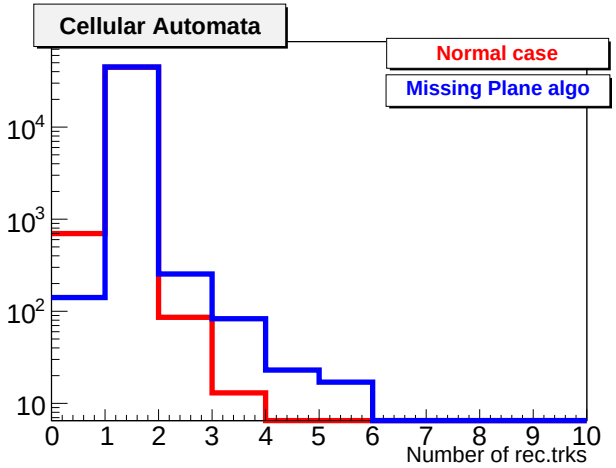


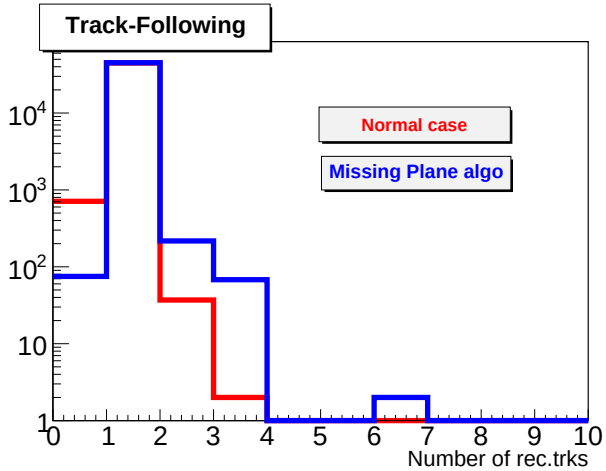


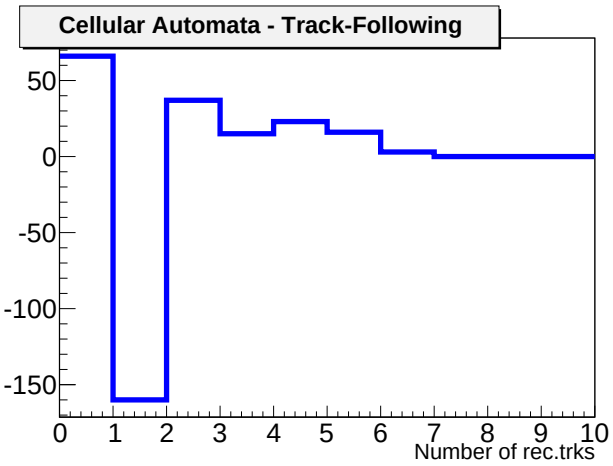
χ^2 cut:

0.2 % CA
0.3 % CA(+missing planes)
0.1 % F
0.4 % F(+missing planes)

MCid participation (CA vs. Follow)







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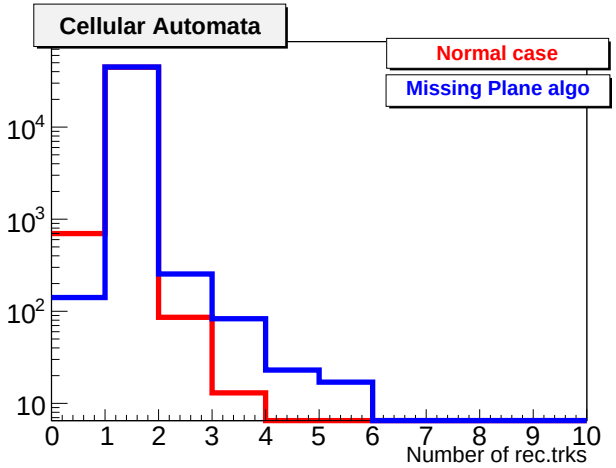
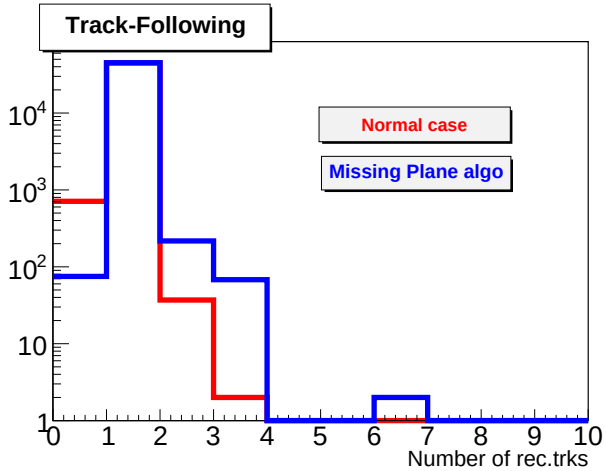
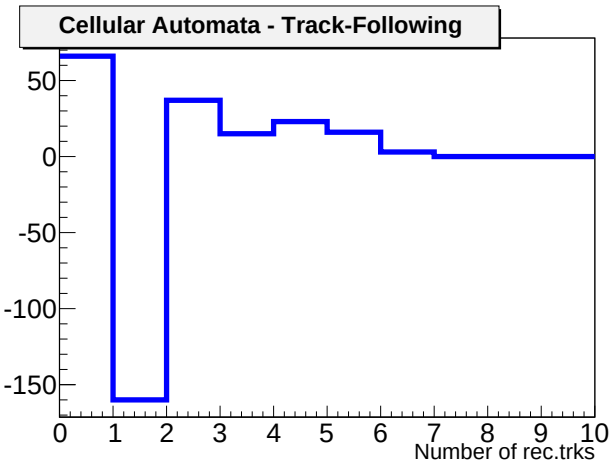
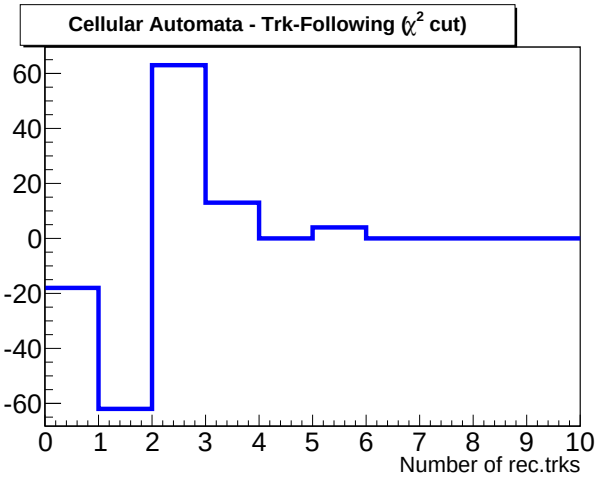
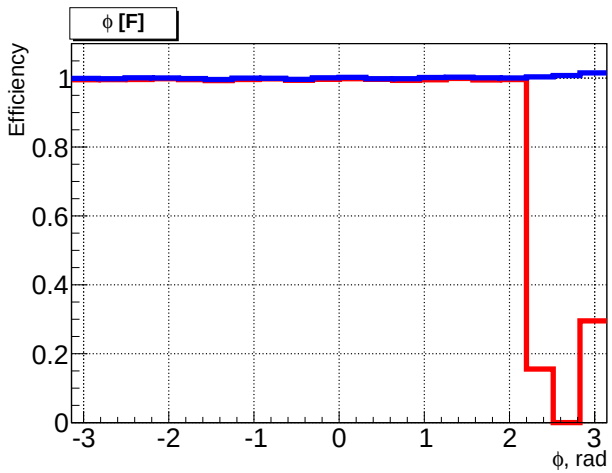


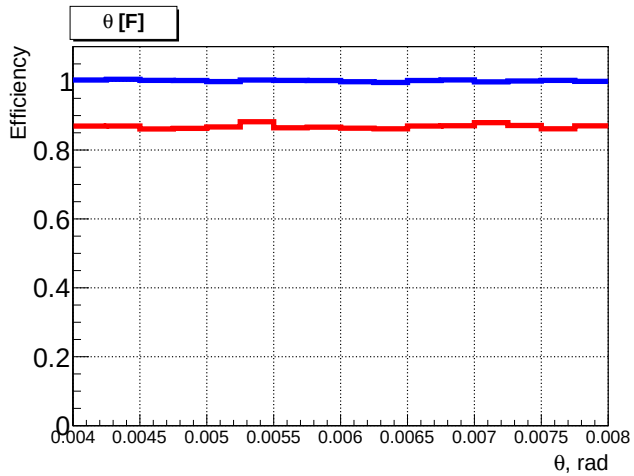


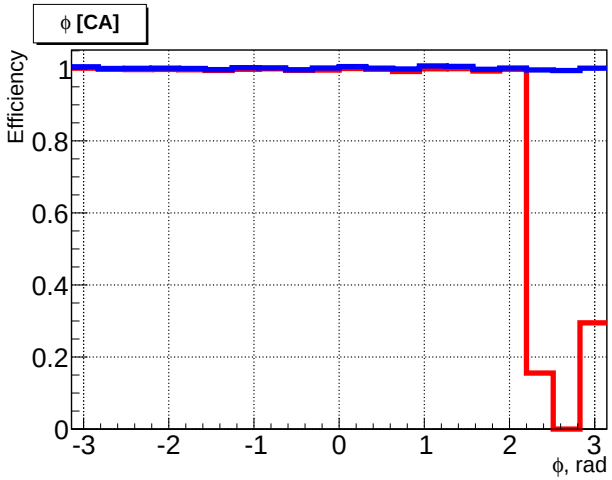


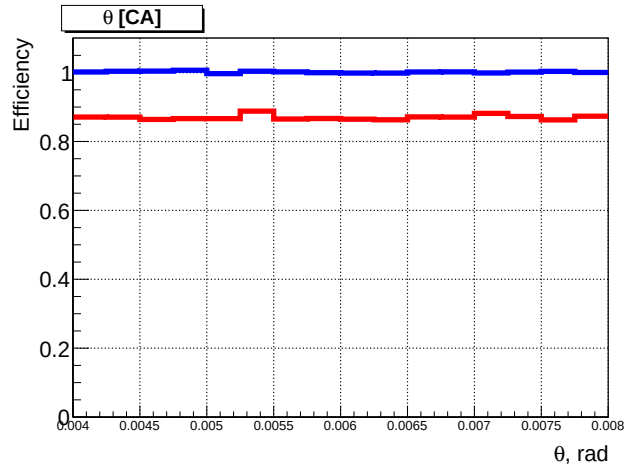


Test with real missing sensor.Efficiency









Summary

- Cellular Automata gives lower number of ghost tracks for high density of tracks (5 trk/sensor)
  (it was shown on the previous meeting)
- For low density of tracks number of ghost tracks slightly higher for Cellular Automata algorithm
  (χ^2 cut can help)
- Missing plane algorithms were implemented for both algorithms

Plan

Background studies with DPM and $p\bar{p} \to \pi^+\pi^-$ generator by M. Zambrana & D. Khaneft