Wire Chamber Updates

Xin Qian

Duke University, TUNL

Outline

- Slot Slit for BigBite Out-of-plane Optics (Doug)
- ^{3}He Target Collimator
- Testing 2-Chambers in BigBite Hadron package (Mitra, Khem, Brad)
- Testing New Tracking Software (Ole)
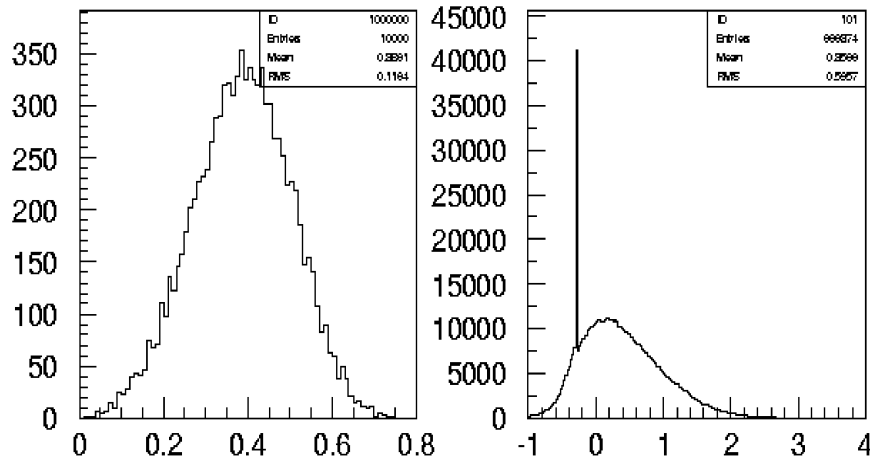 - GEN data
  - Tracking MC

Part 1. Slot Slit Design
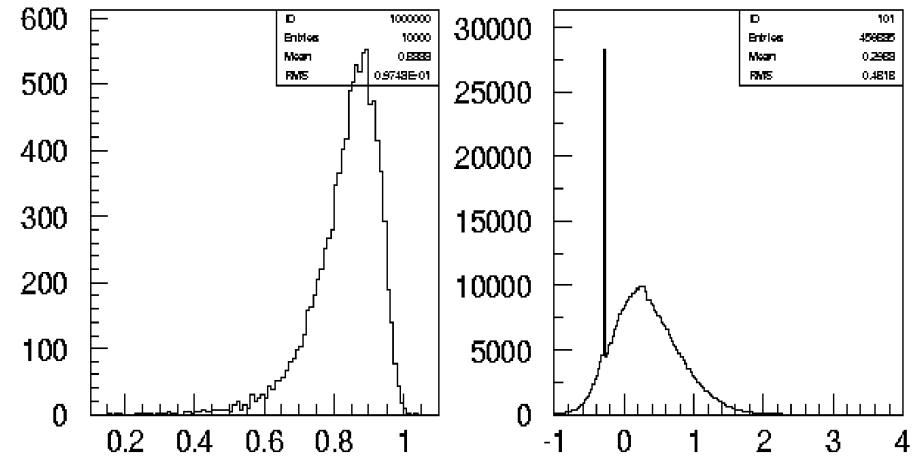
Slot-Slit Design (1.05 GeV electron)
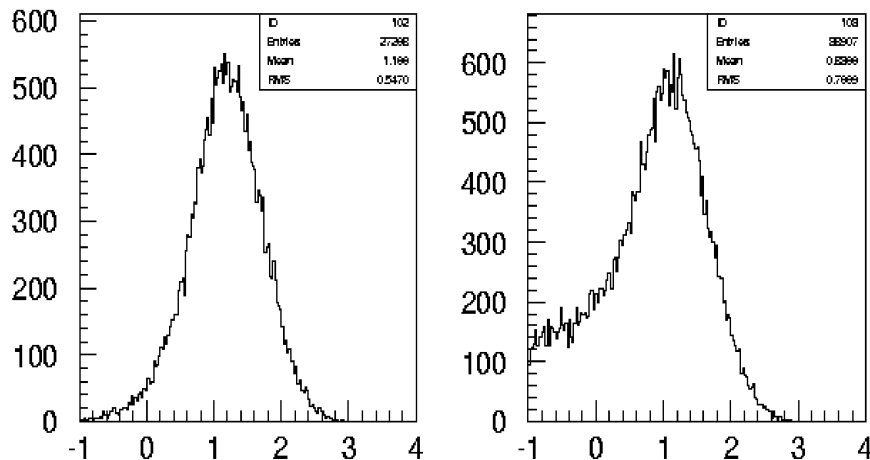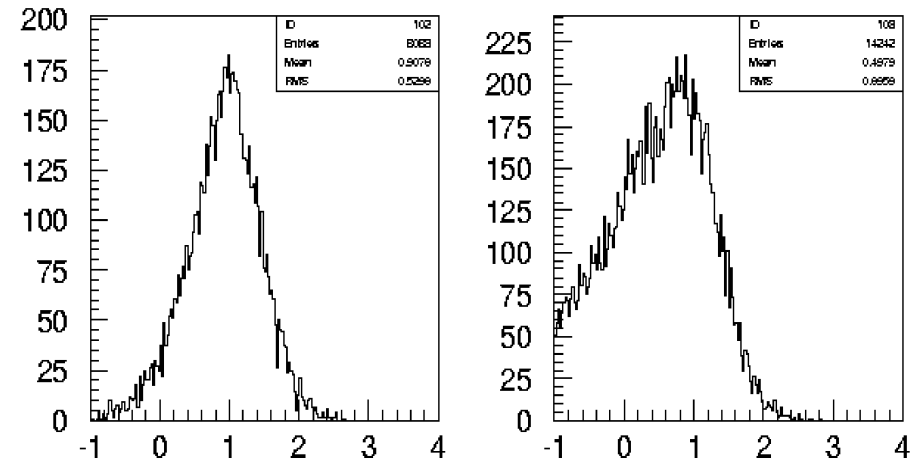
Slot-Slit Design (1.8 GeV)

Slot Slit Design

- 1.5 cm thick Lead
- 13 slots cover +- 32 cm.
- Each slot will have 4.9 cm
- The slot size is +- 0.45 cm
- About 5 sigma
- Slot size is determined by balance the rates and resolution.
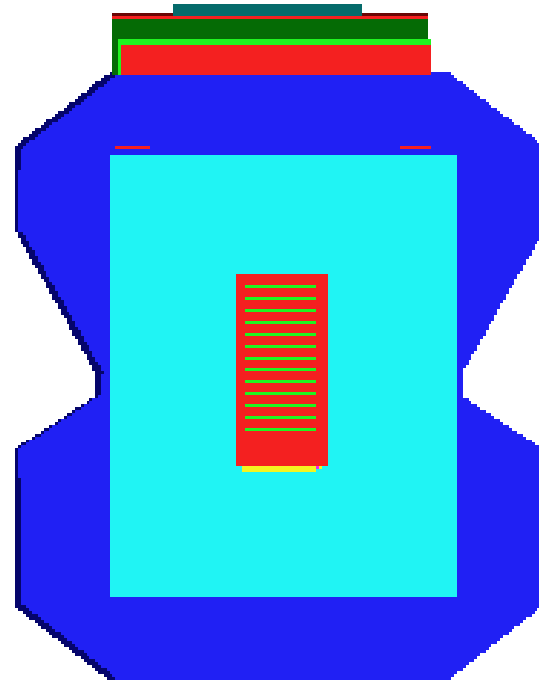
Central View (12 holes)
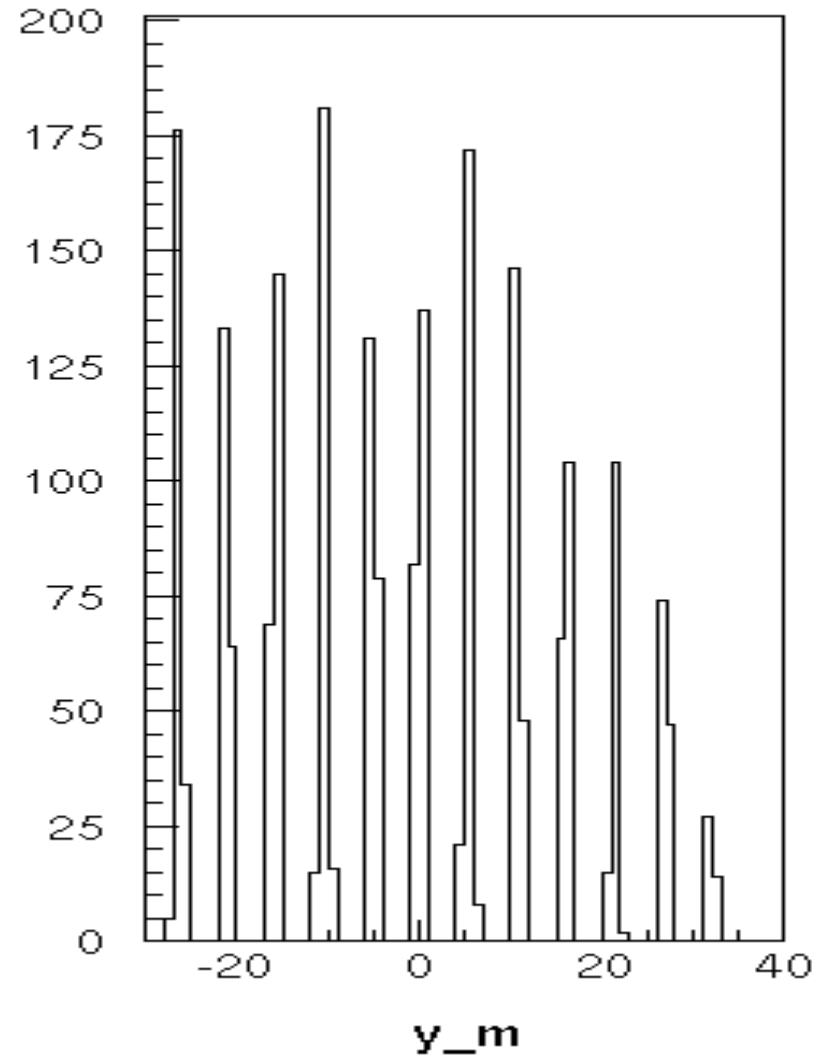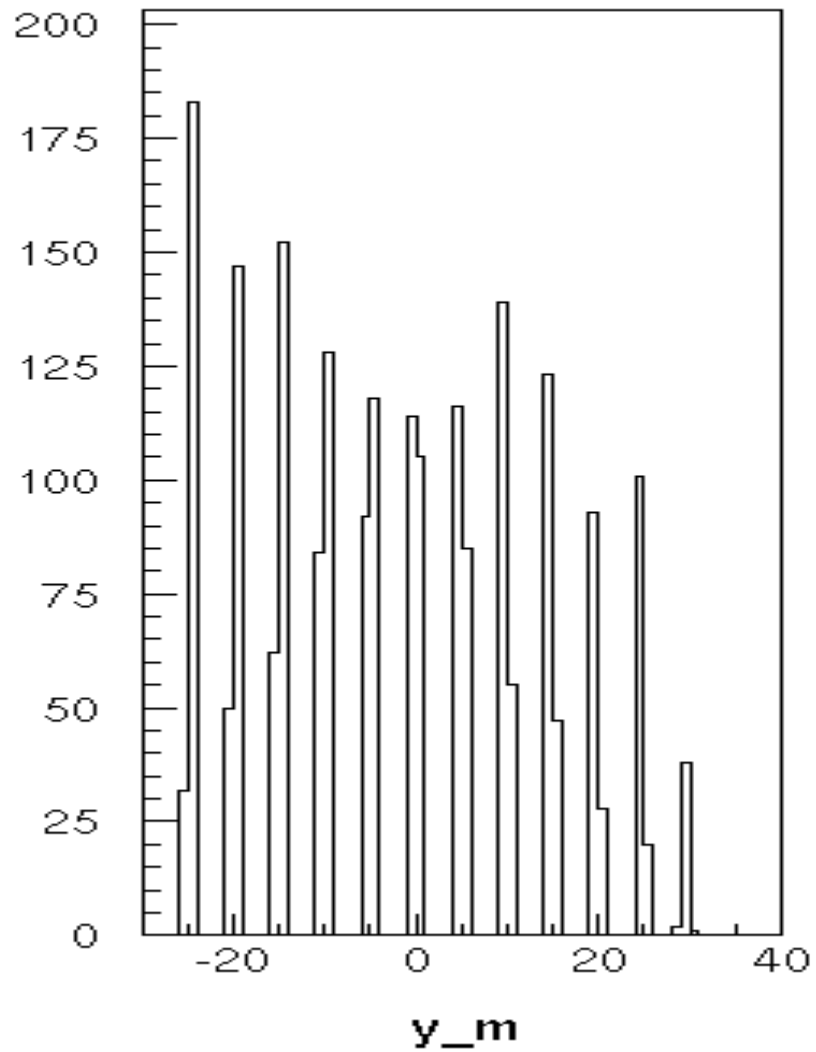
Upstream View (12 holes)
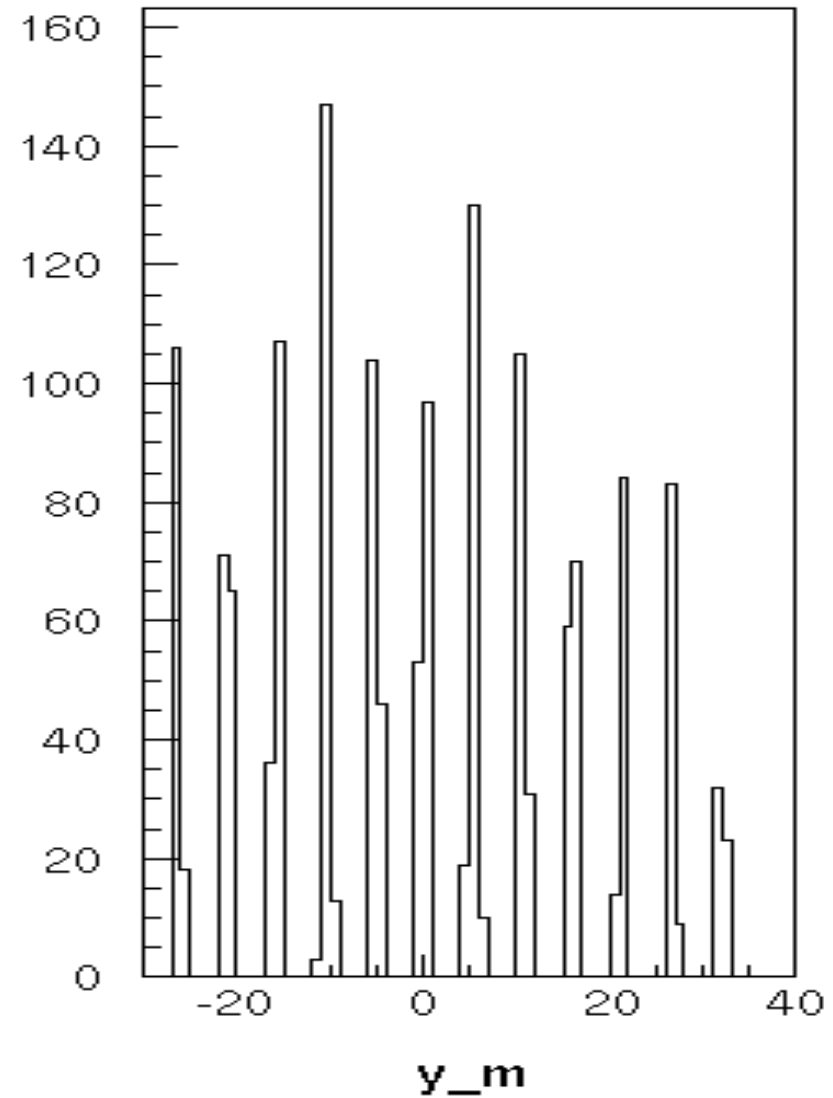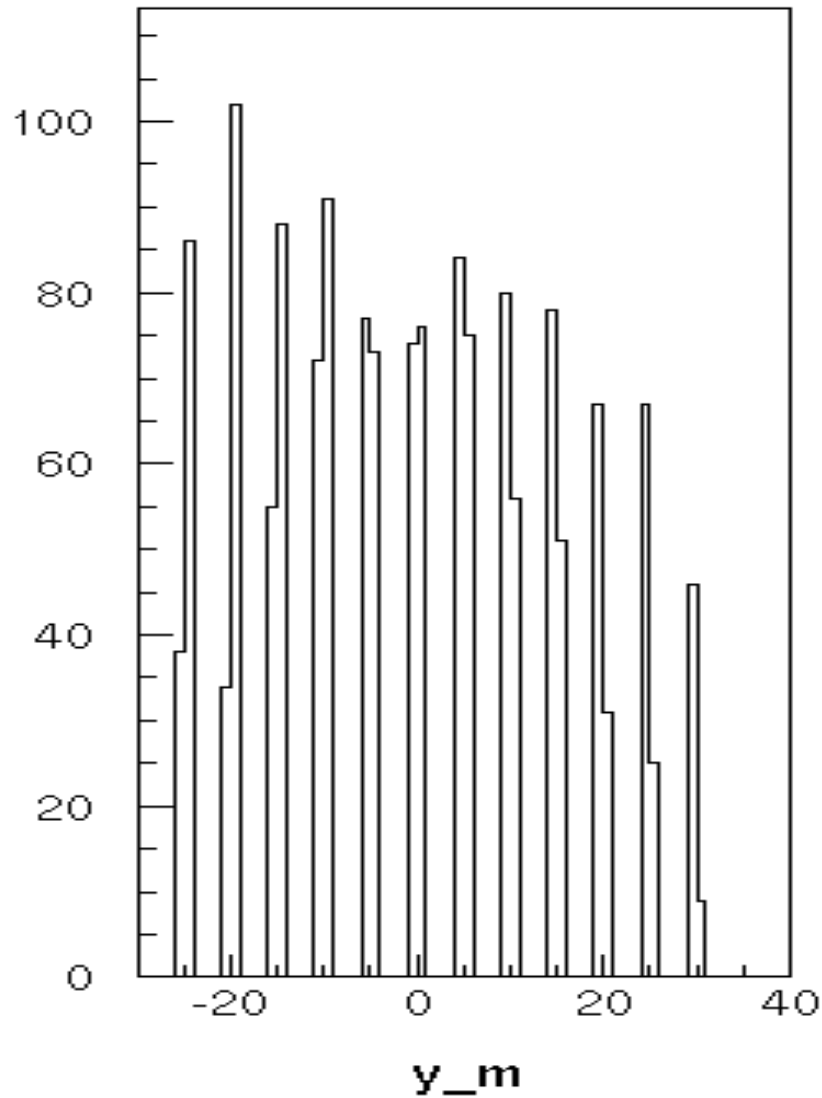
Downstream View (11 holes)

2006/11/18   22.30
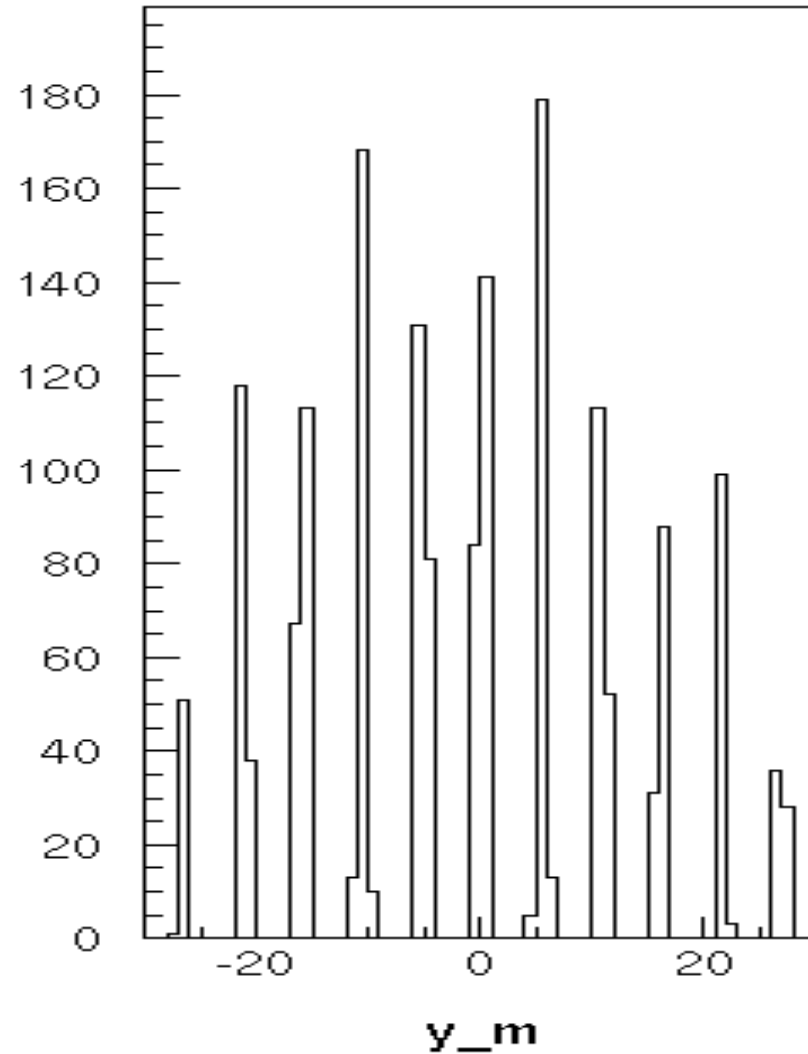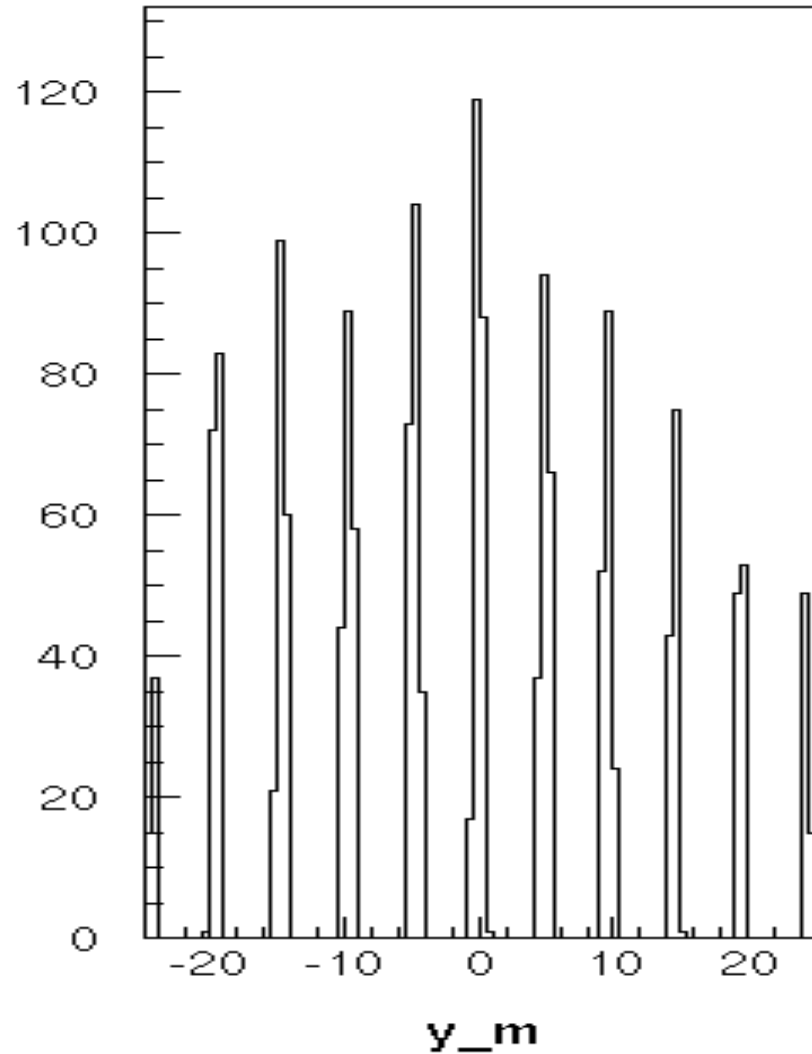
Part 2. Near Target Collimator

CEBAF Hall A End Station
Cut plane at y = 0 cm

CEBAF Hall A End Station
Cut plane at y = 0 cm

CEBAF Hall A End Station
Cut plane at y = 0 cm

CEBAF Hall A End Station
Cut plane at y = 0 cm
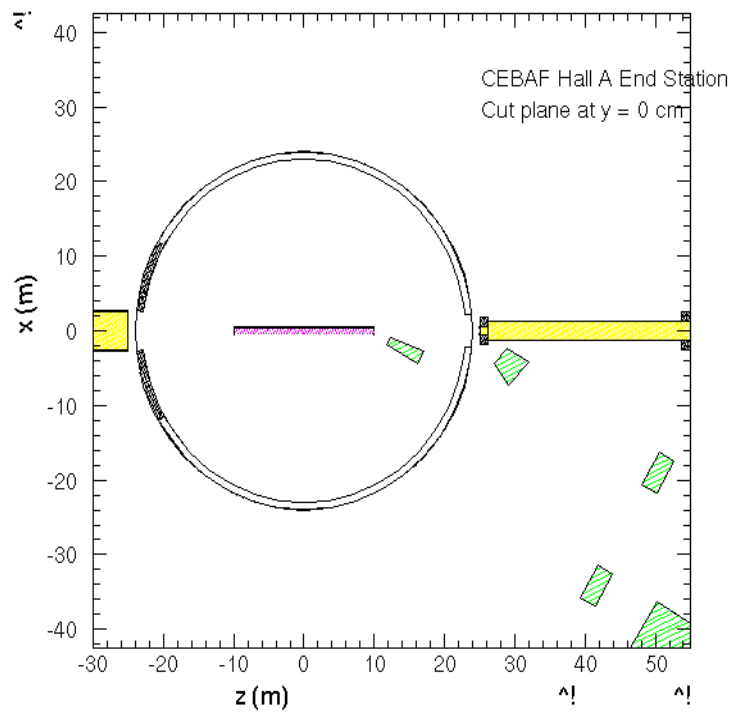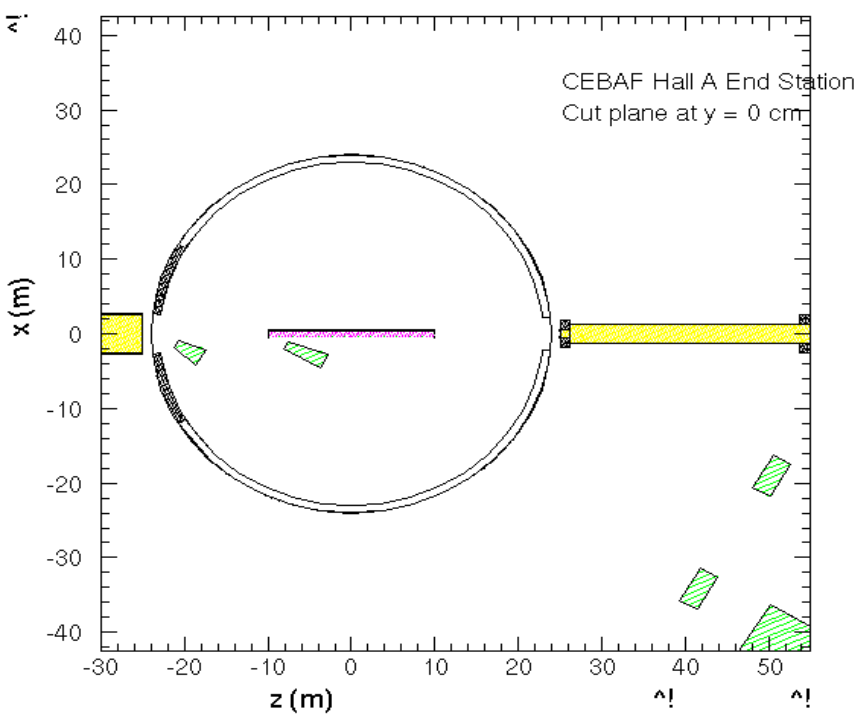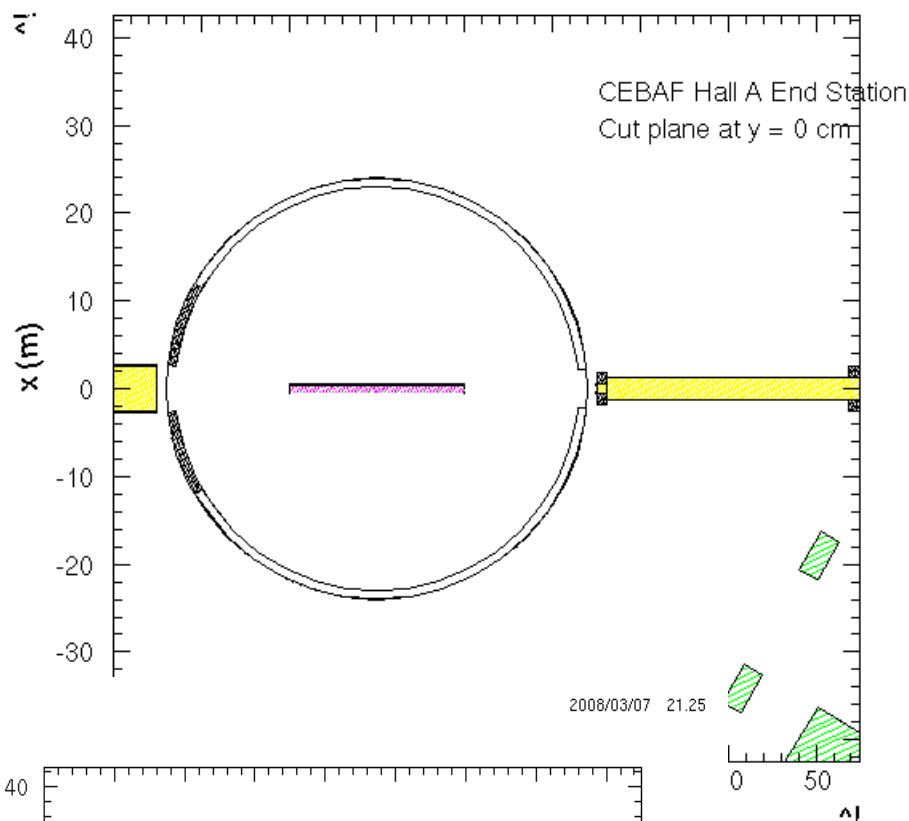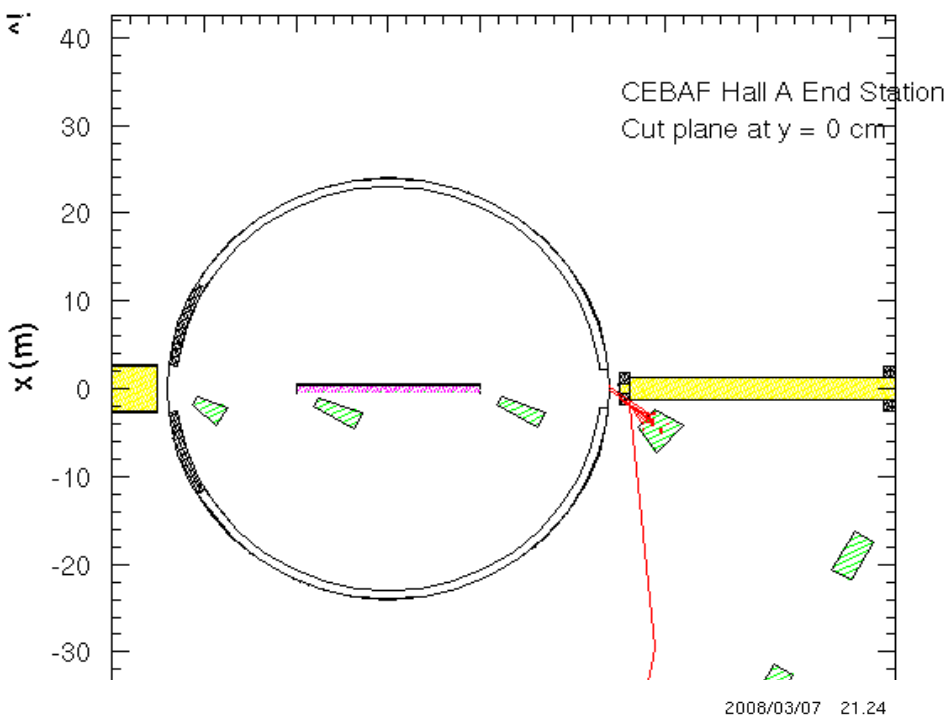
Rates Study

- No: 24 +- 2.5 MHz

- Down only: 19.8 +- 2.3 MHz

- Both: 12.3 +- 1.7 MHz

- Up only: 12.3 +- 1.8 MHz

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- Collimator downstream seems to have a mixed effect

- The effect is <u>not significant</u>.

Part 3. 2-Chamber Test

2 Chambers in Hall A
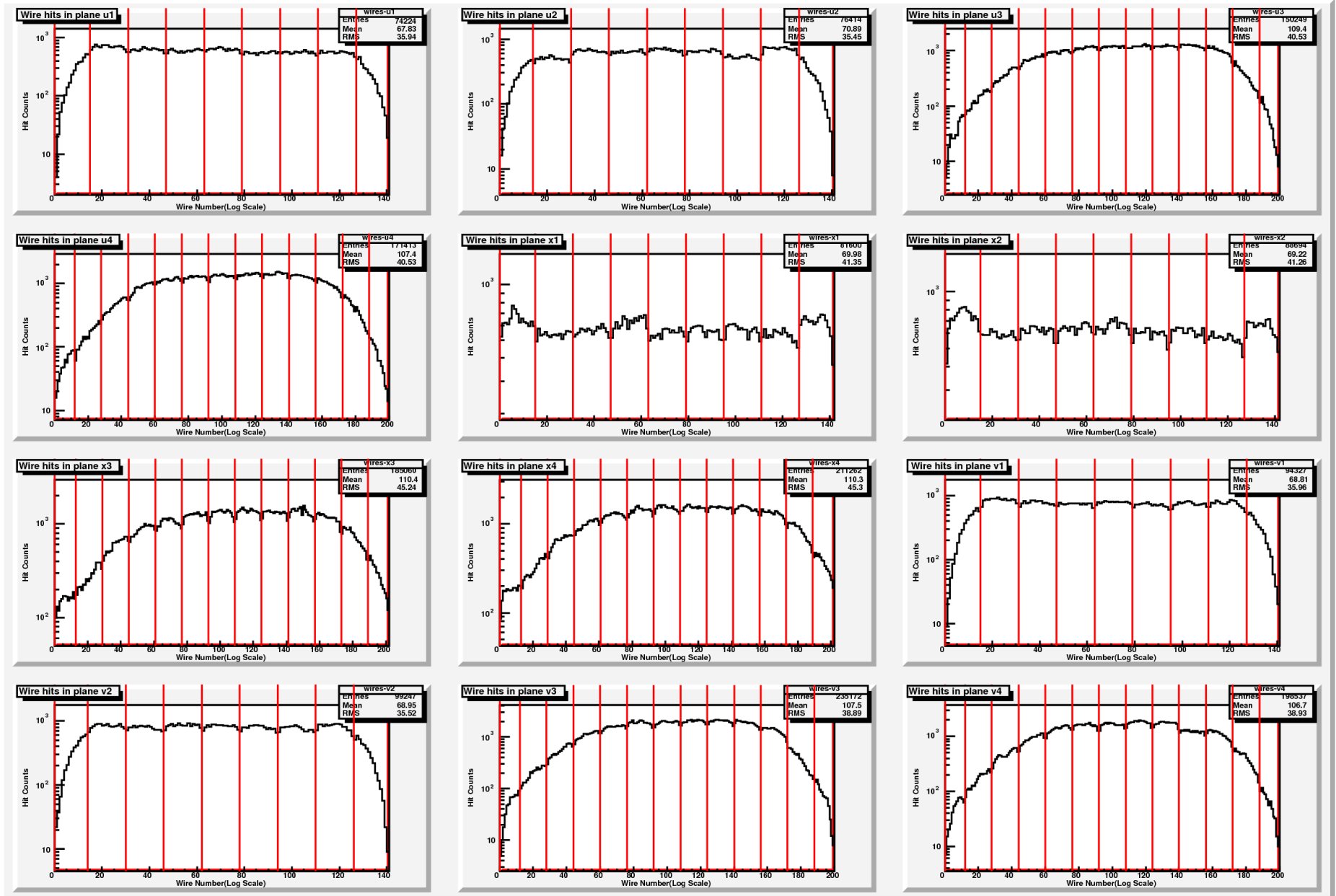
2 Chambers in Hall A

- Results are not good.

- At the edges of each card, we can see clearly that the number of hits is smaller than the number in the middle.

- Some cards have noise.

Drift Time Plot
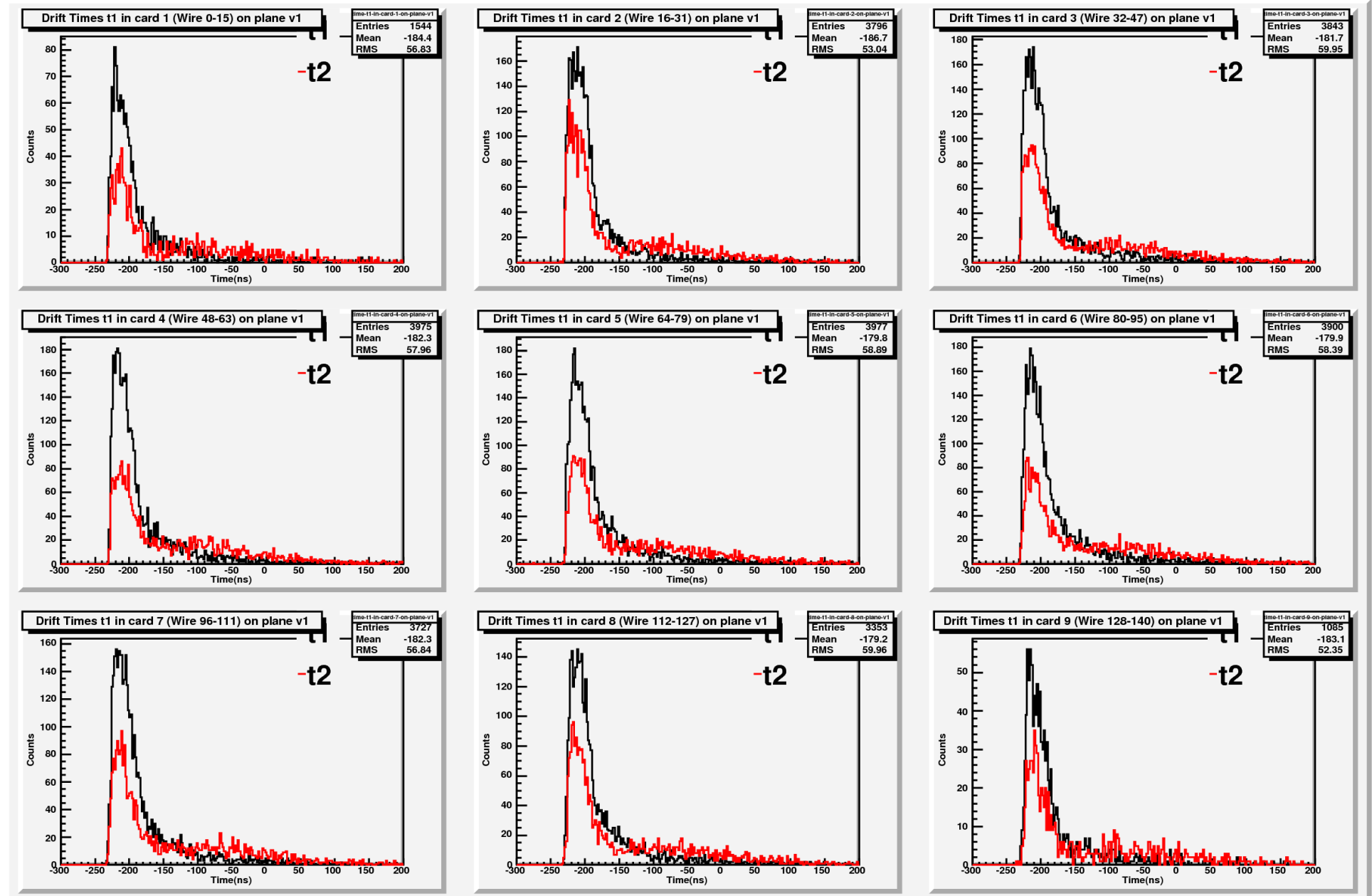
Drift Time Plot

- Clearly, something is wrong.

- We have too many T2.
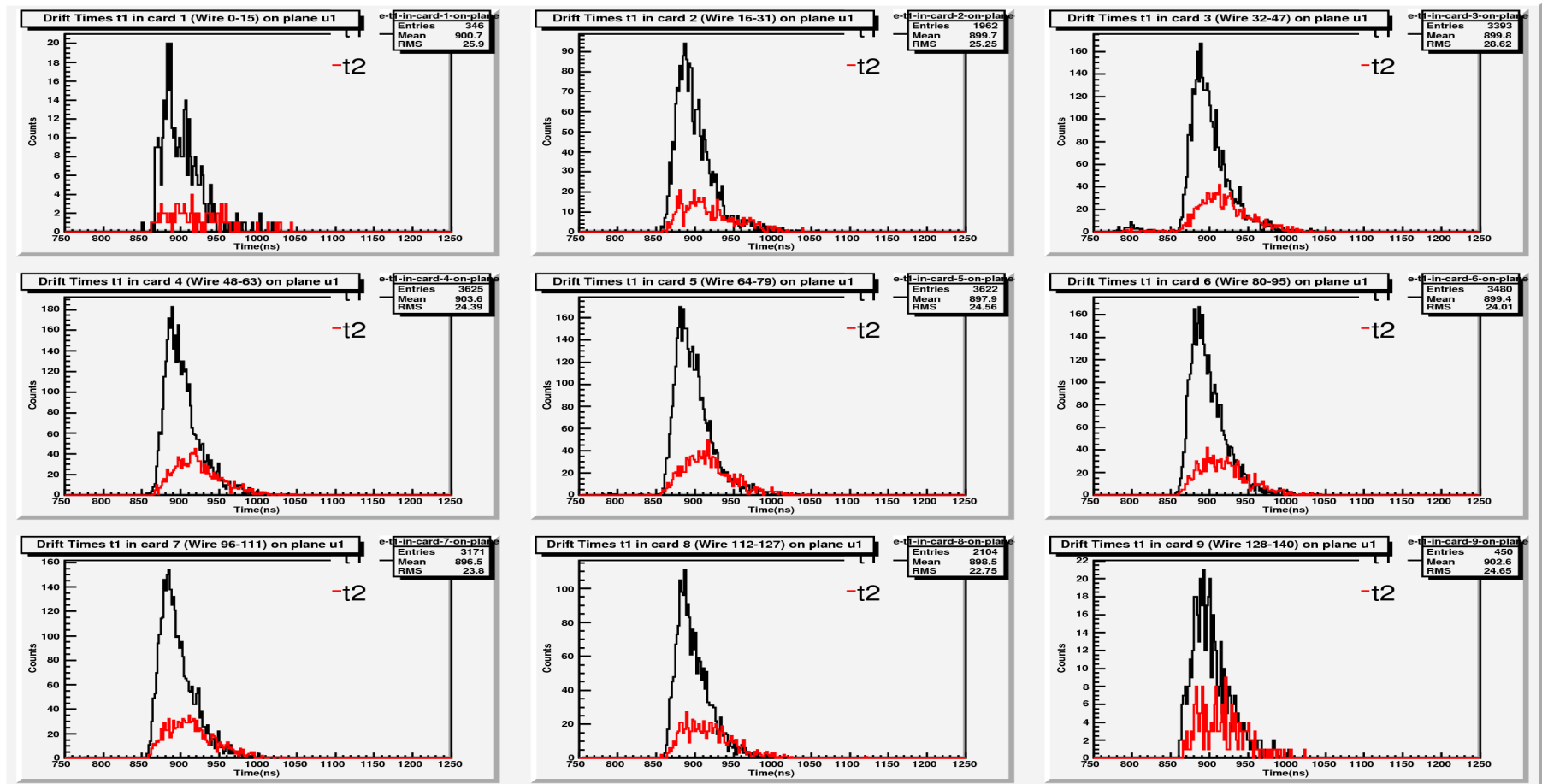
Event Display
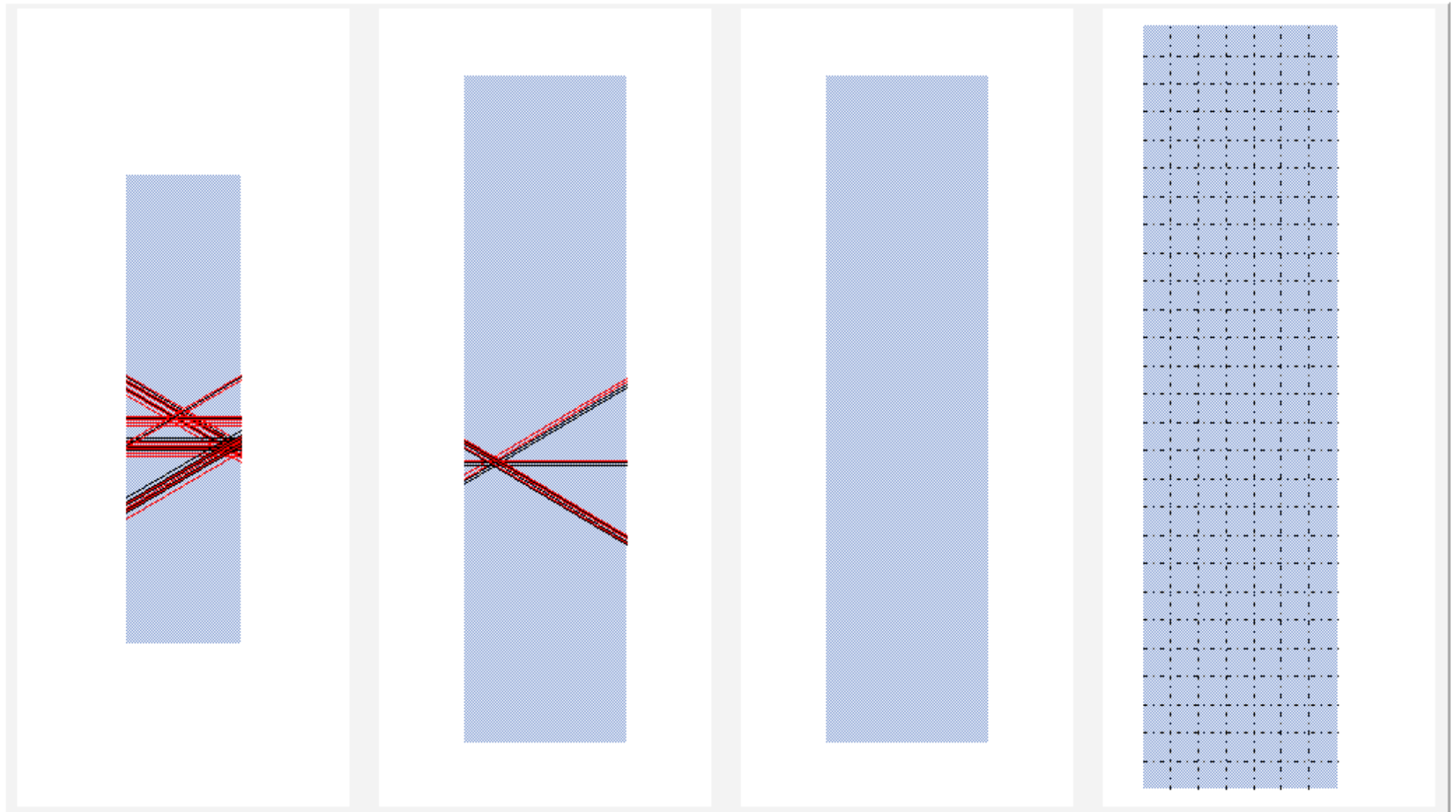
Event Display
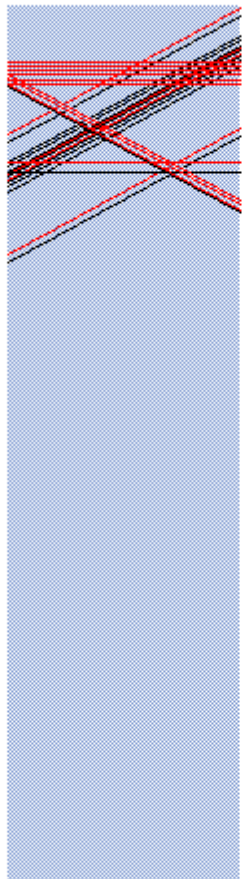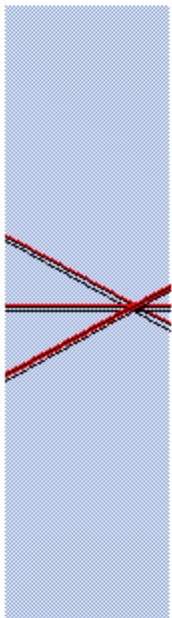
Conclusion

- <u>Something is not right</u>.

- Wires within same card are firing simultaneously all the time.

- Probably due to the Voltage of the Level Translator.

- I did a test by changing the ribbon cable from level translator to the A/D cards. The problem stays. (Rule out the cable problem)

- Need more tests.

Part 4: Test New Tracking Code

Test With GEN data (4e-4)

- OLD Algorithm

- RUN 4427 H^2 2.5uA

  – 1-track: 1200

  – >1-track: 1

  – 876 + <u>301</u>

  – Naive eff: 0.77

- RUN 4594 ^{3}He 6uA

  – 1-track: 1195

  – >1-track: 1

  – 791 + <u>405</u>

  – Naive eff: 0.65

- New Algorithm

- RUN 4427 H^2 2.5uA

  – 1-track: 1174

  – >1-track: 3

  – 876 + <u>325</u>

- RUN 4594 ^{3}He 6uA

  – 1-track: 1427

  – >1-track: 3

  – 791 + <u>639</u>

Tracks Found by BOTH
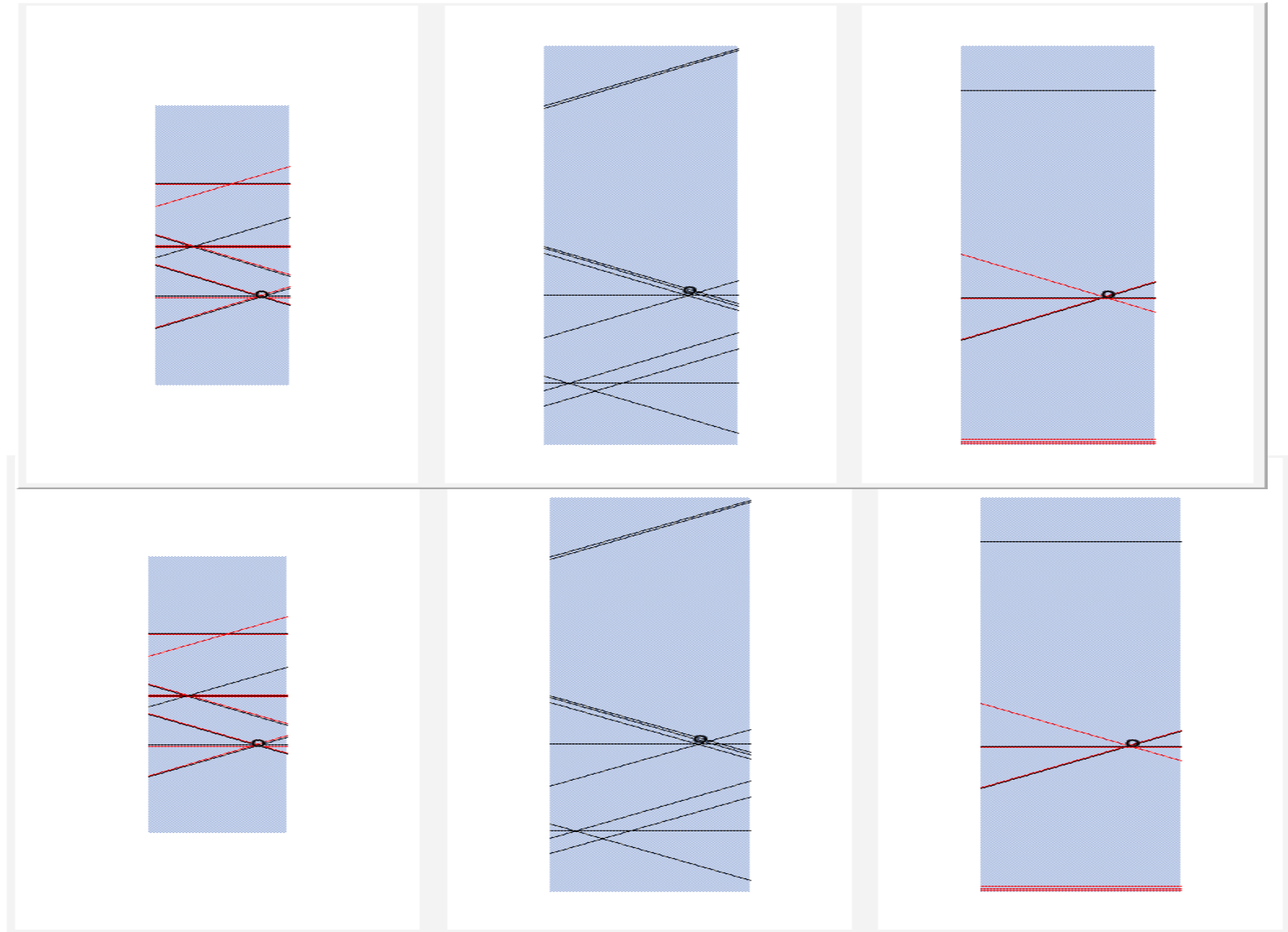
Tracks Found By Old Algorithm Only

Tracks Found By New Algorithm Only
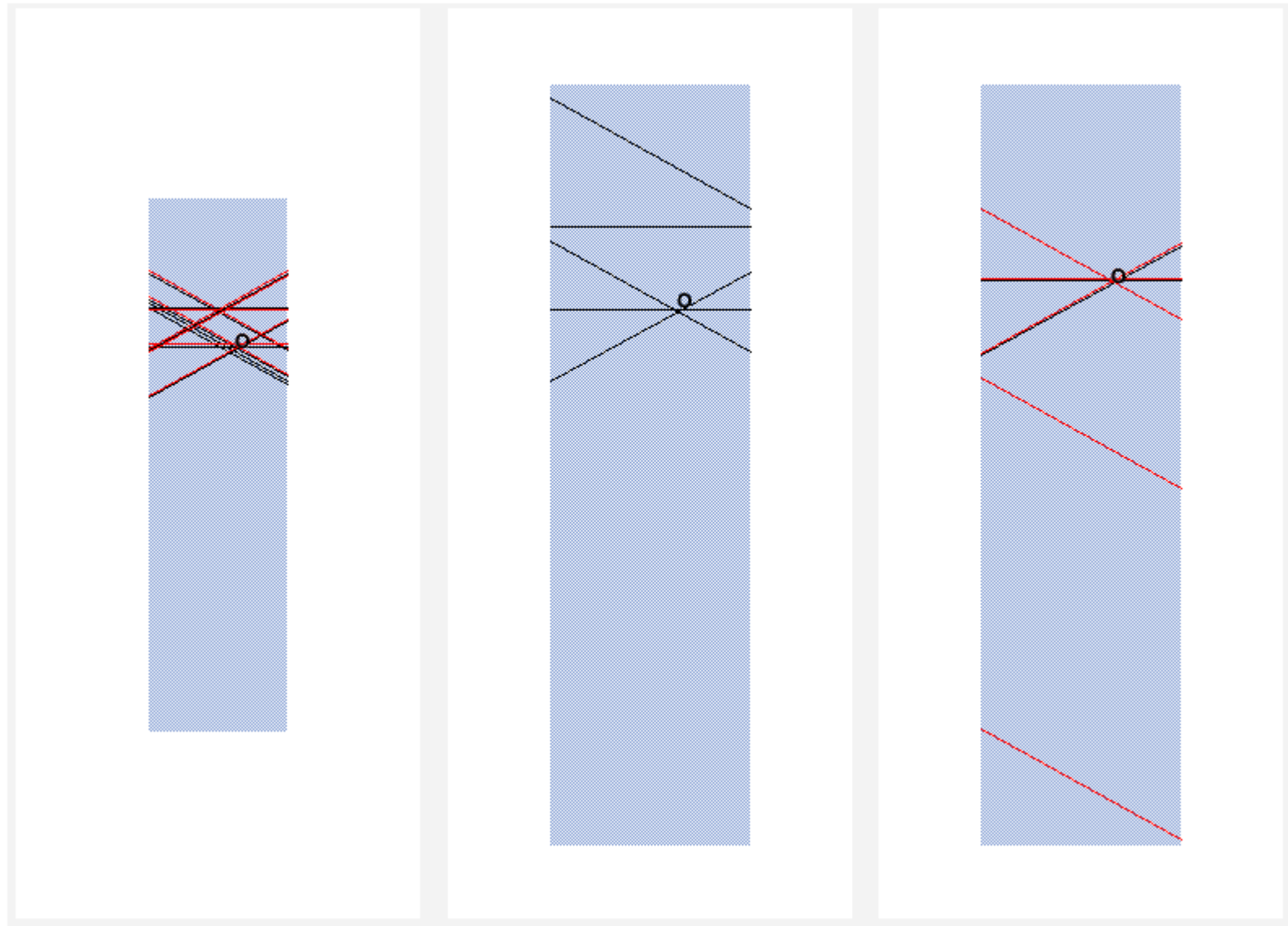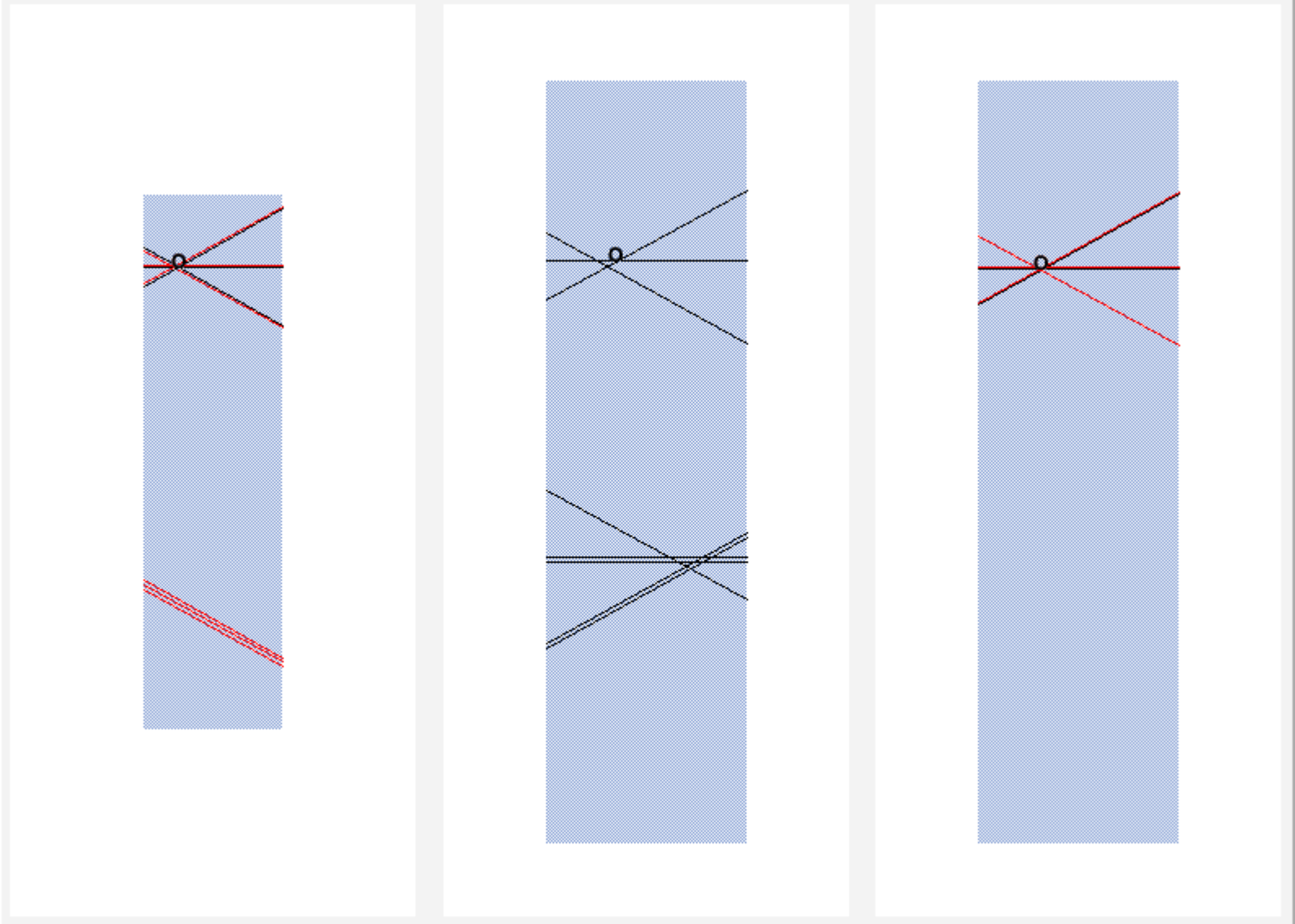
Test With GEN data (2E-3)

- OLD Algorithm
- RUN 4427 H^2 2.5uA
    - 1-track: 1200
    - >1-track: 1
    - 1078 + 123
    - Naive eff: 0.73
- RUN 4594 ^{3}He 6uA
    - 1-track: 1195
    - >1-track: 1
    - 1022 + 174
    - Naive eff: 0.57

- New Algorithm
- RUN 4427 H^2 2.5uA
    - 1-track: 1500
    - >1-track: 18
    - 1078 + 440
- RUN 4594 ^{3}He 6uA
    - 1-track: 1886
    - >1-track: 28.
    - 1022 + 892
    - Can improve stats. by ~1.25

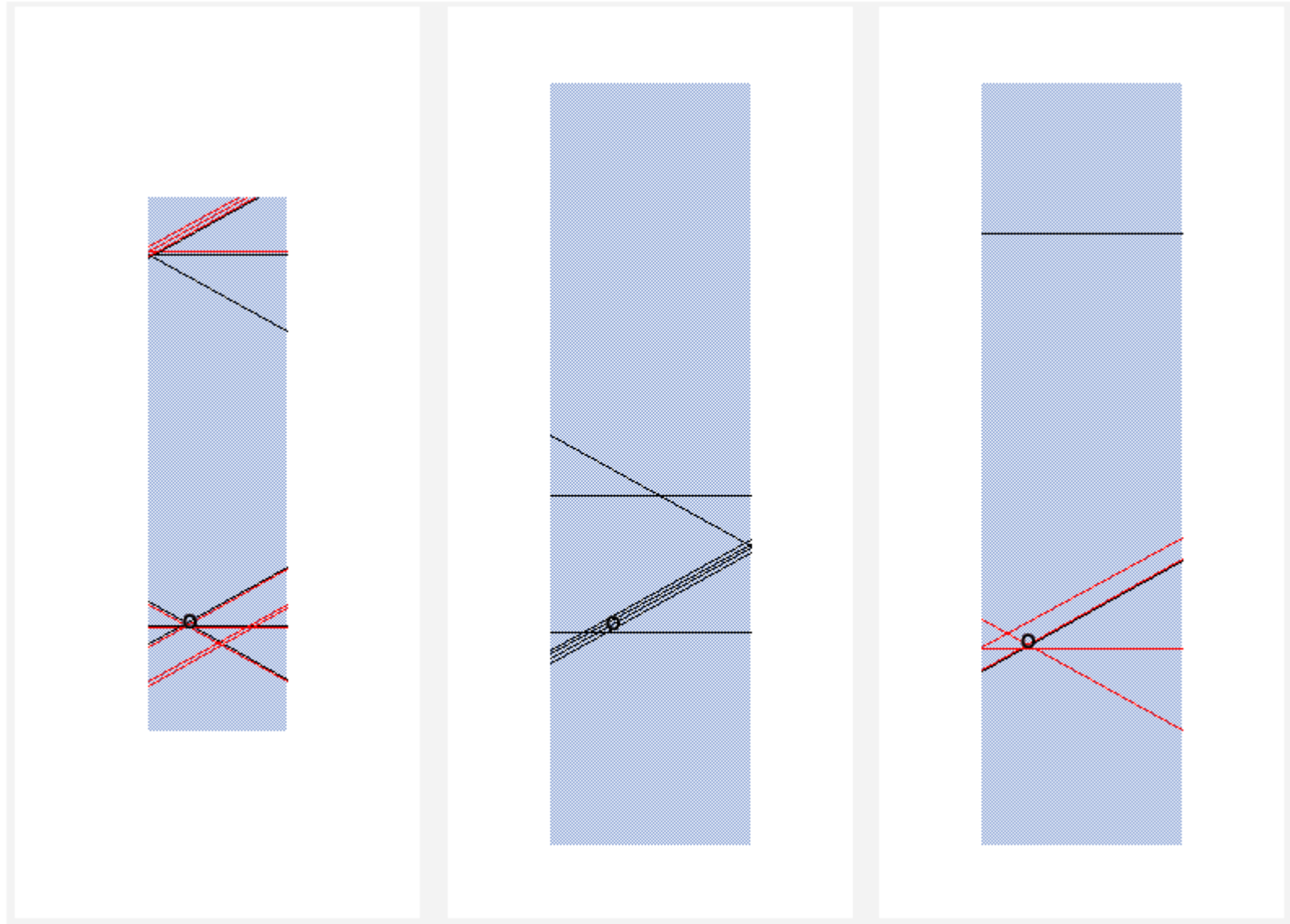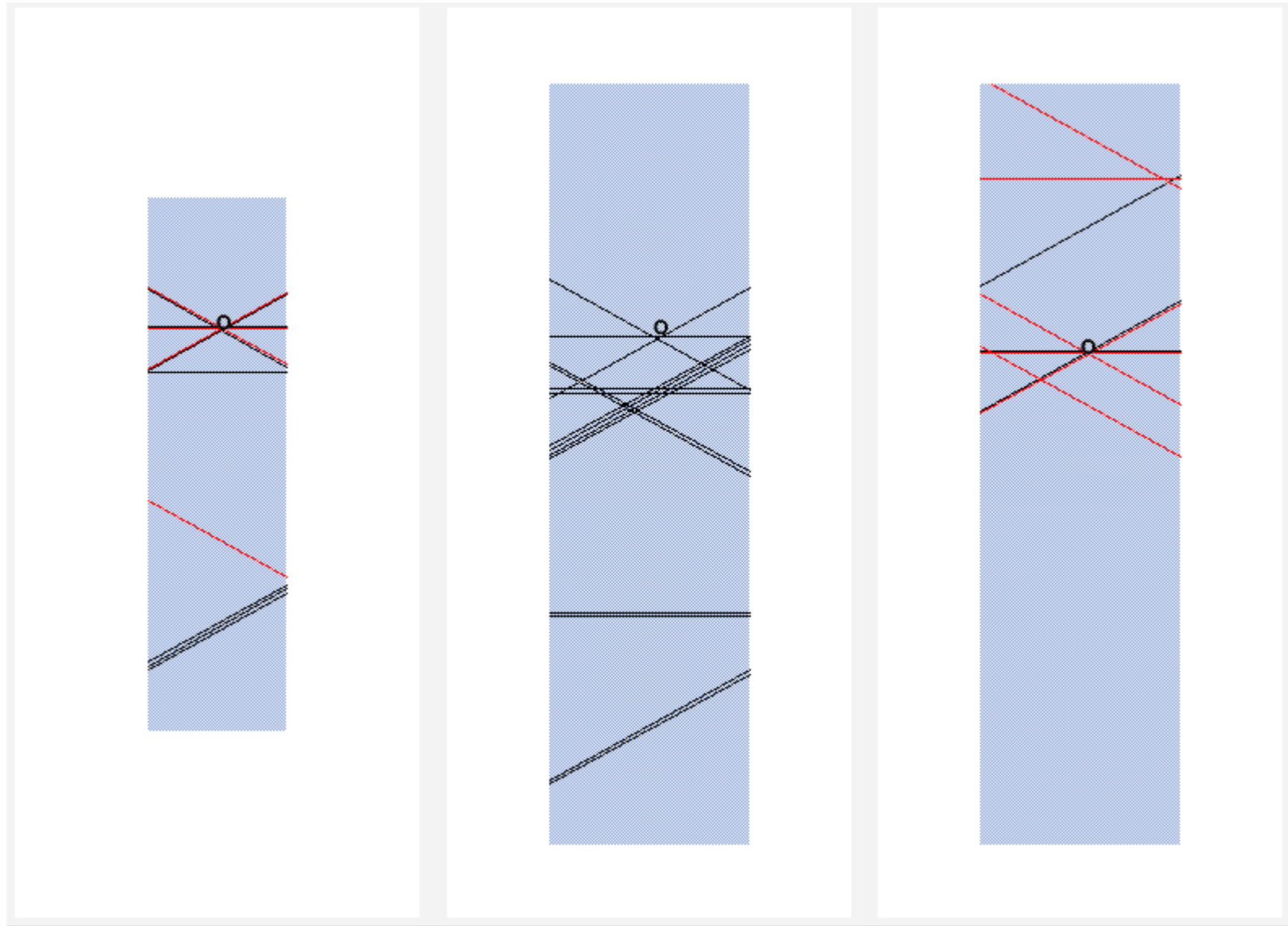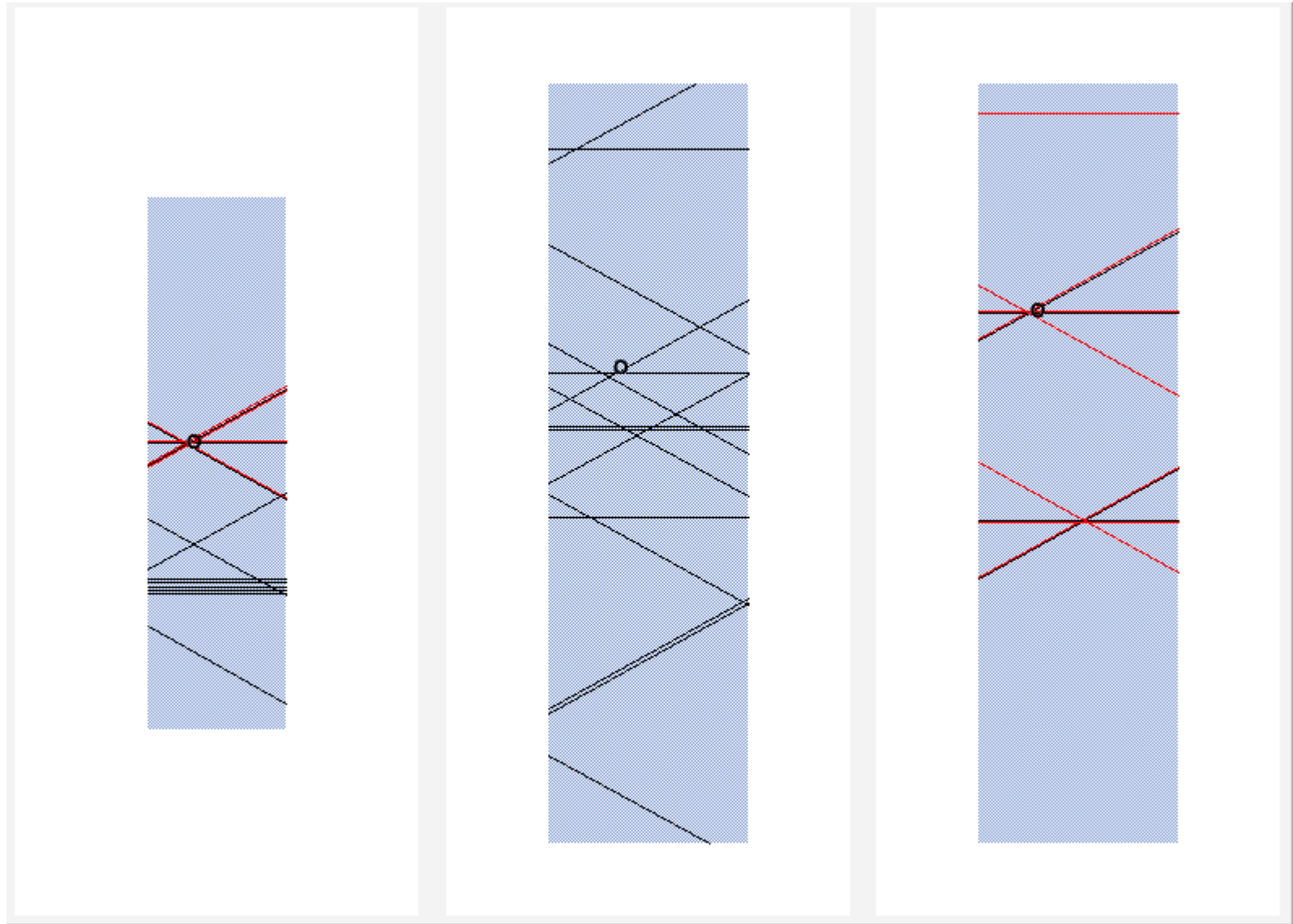# Tracks Found by old code
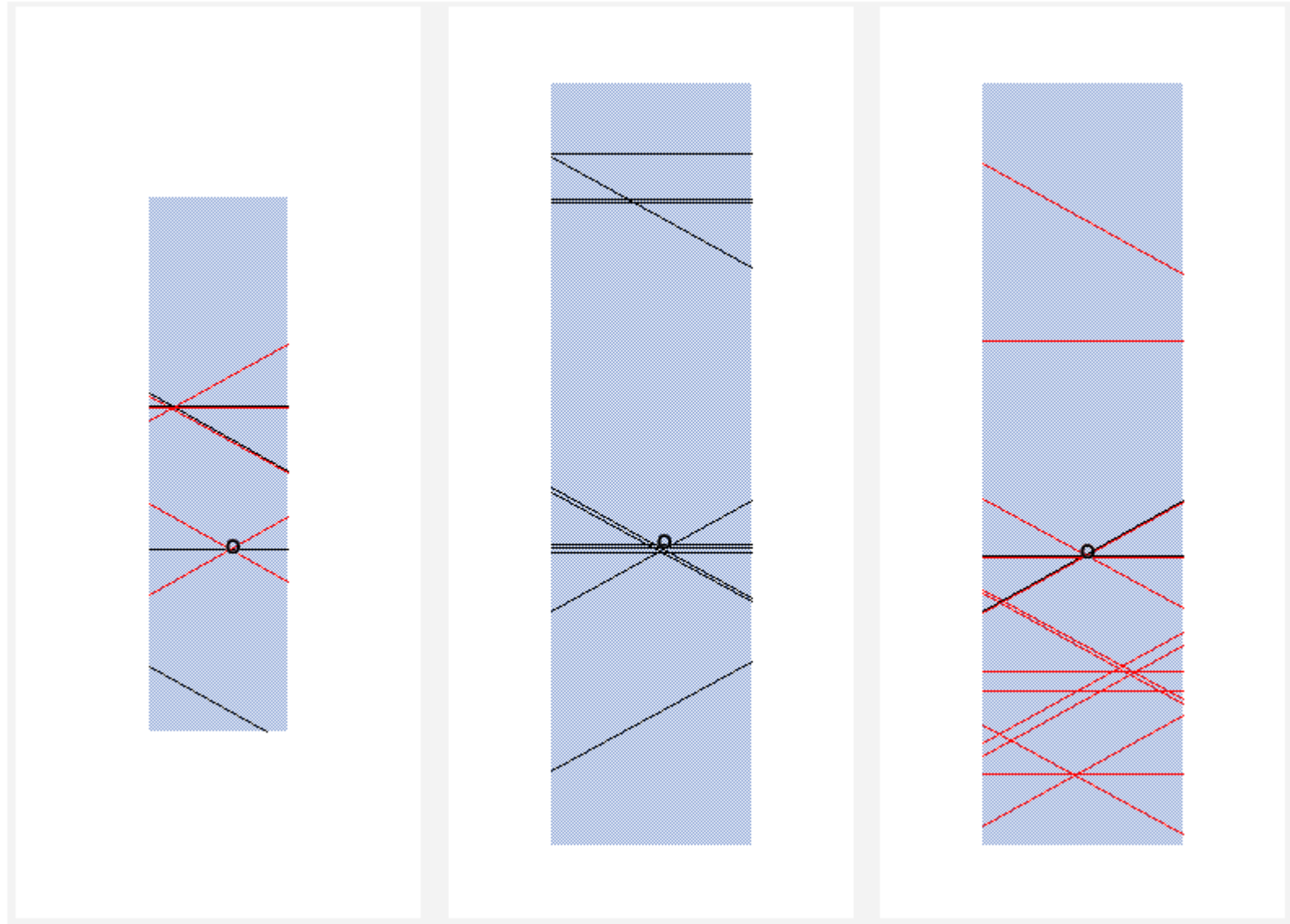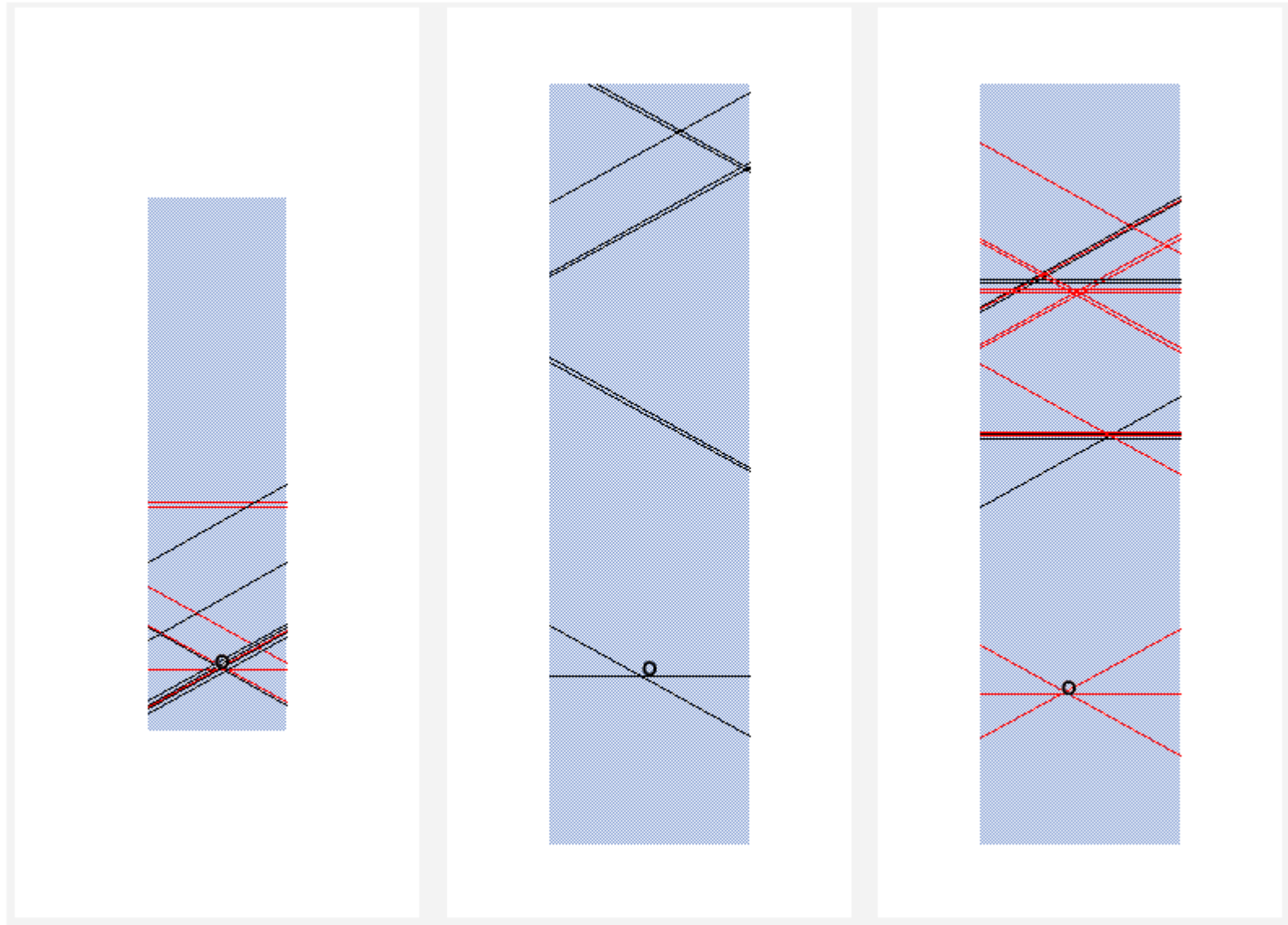
Tracks Found by old code

Tracks Found by old code

Tracks Found by new code
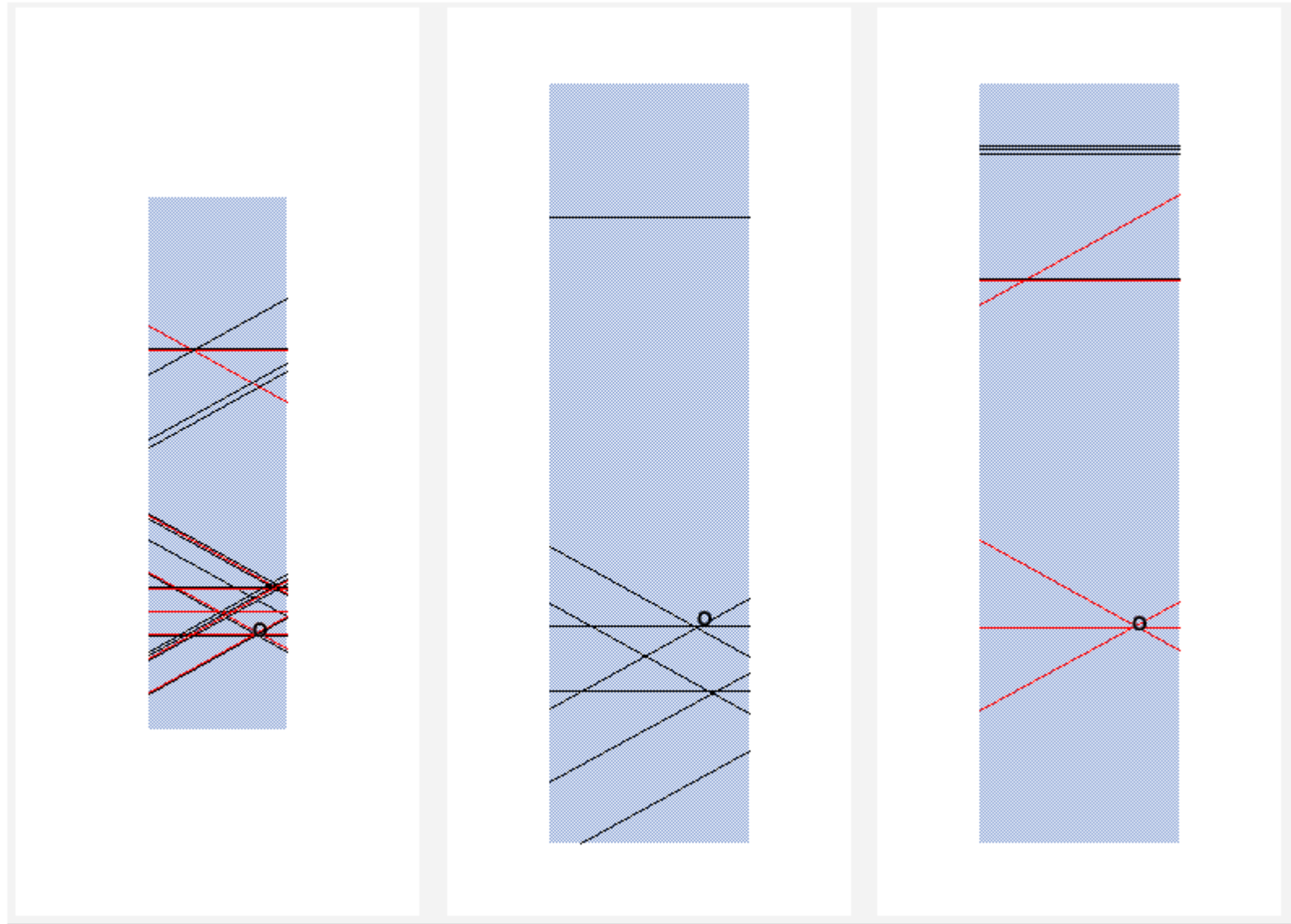
Tracks Found by new code

Tracks Found by new code

Conclusion

- Tracks found by old code only:
  - Clearly, some planes are not firing.
  - Real tracks?
  - If they are real, new code will not find track with low hitting efficiency.
- Tracks found by new code are good tracks.
  - Old code may suffer from high bg rates or shower cut
- New code requires a <u>high hitting efficiency.</u>

Tracking MC Data (100% hitting eff)

- OLD (No BG)
  - 15-plane configuration
  - Find 1447 tracks
  -
  - 18-plane configuration
  - Find 1432 tracks
  -
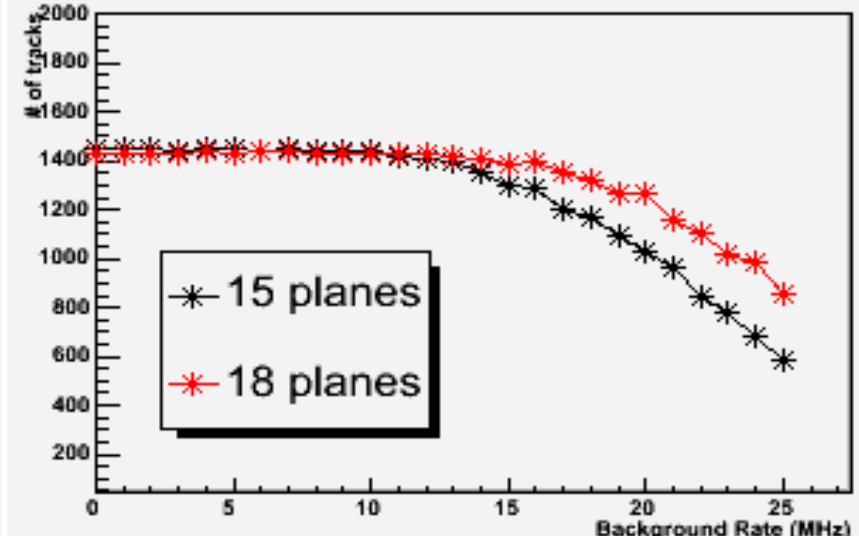 - 12-plane configuration
 - Find 1413 tracks

- NEW (NO BG)
  - 15-plane configuration
  - Find 1444 tracks
  -
  - 18-plane configuration
  - Find 1428 tracks
  - (1e-4)
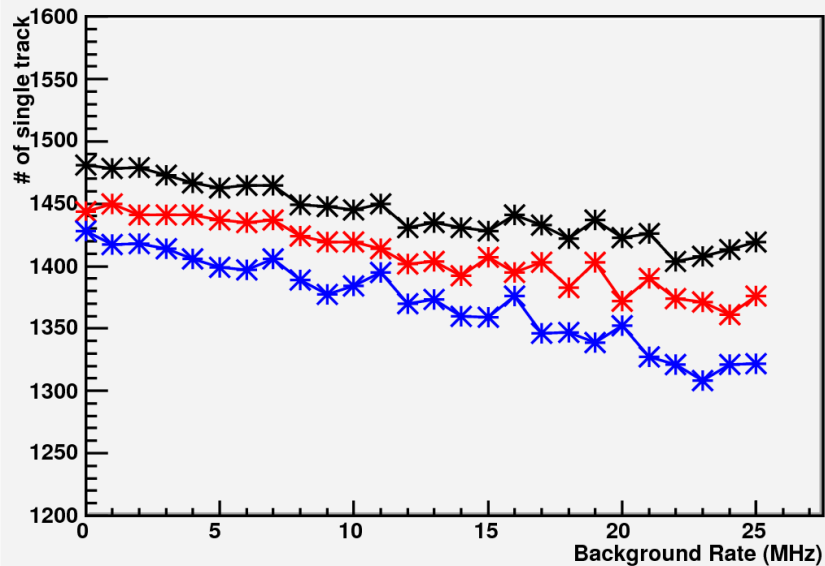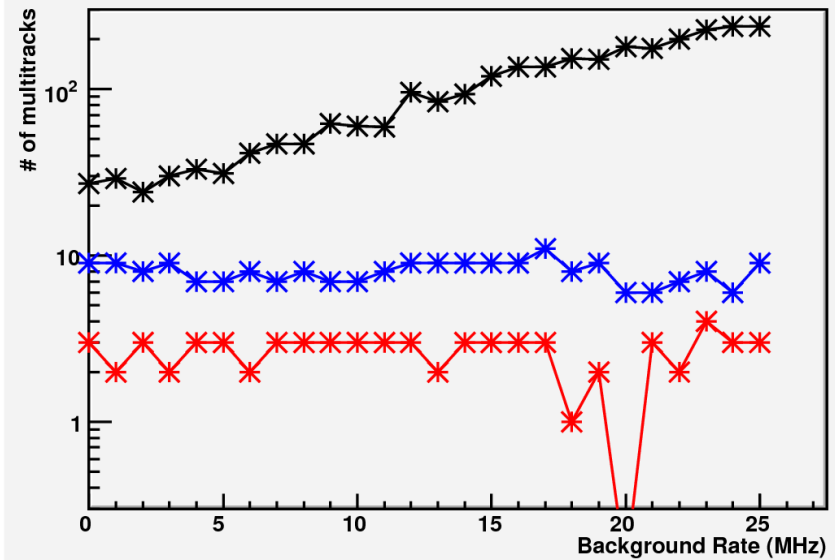 - 12-plane configuration
  - 1481

# Tracking MC Data

- Results are good in 15 planes 2.5 chambers and 18 planes 3 chambers.

- Difference between 12 planes and 15 planes in the old code possibly due to Chi2 cut.

- Difference between 12 planes with new code and 15 planes with old code suggest the resolution in the tracking is too small

- Obtain 1472 (1481) with 15 plane in new code by increasing the resolution from 4e-4 to 1e-3.
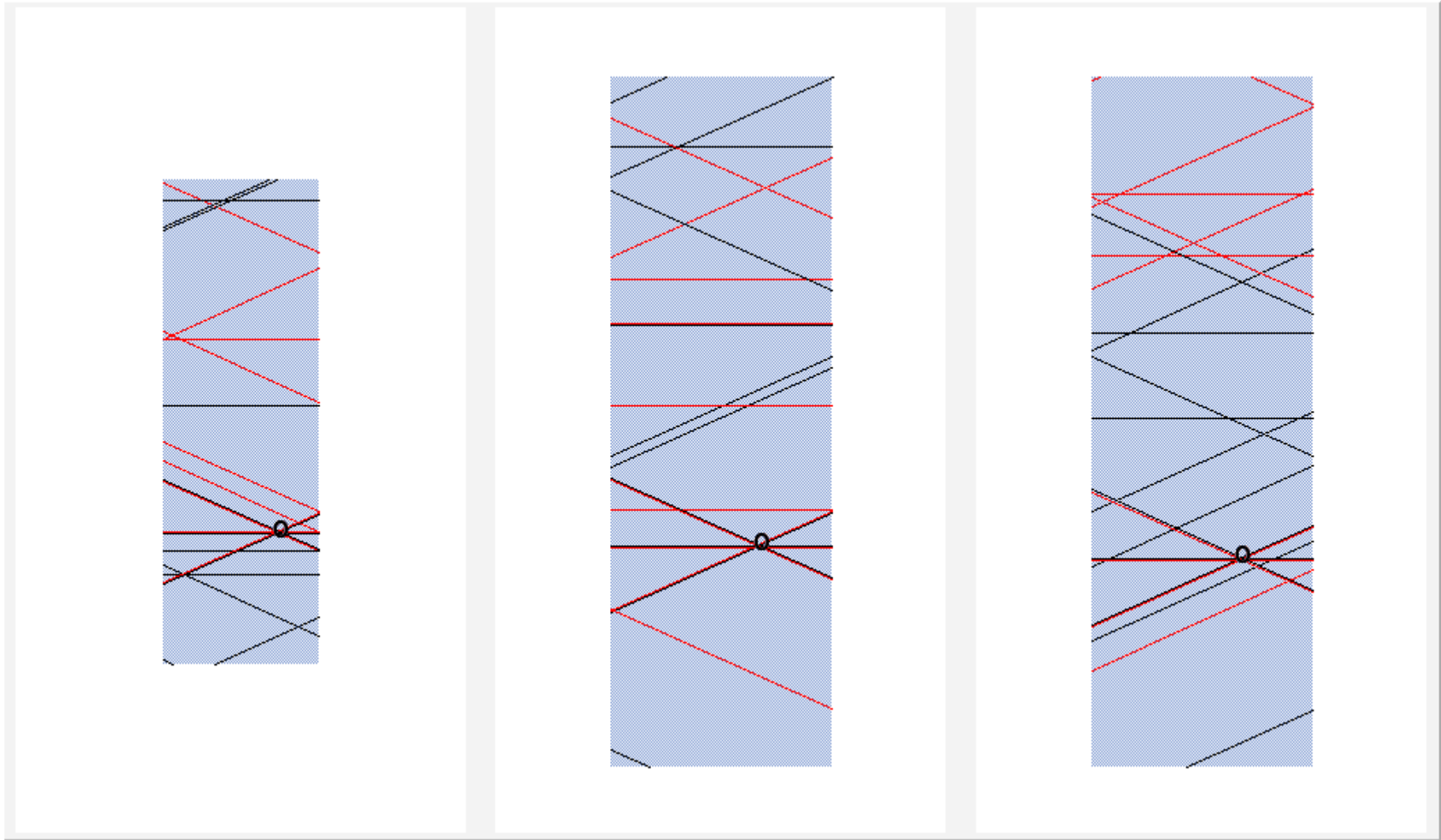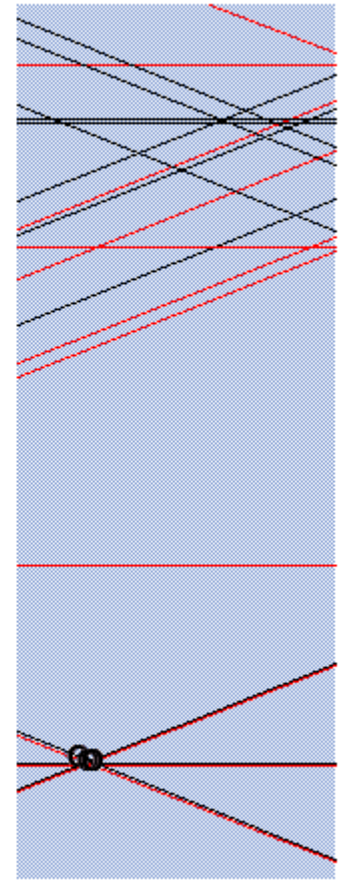
Speed & Eff for the Old Algorithm
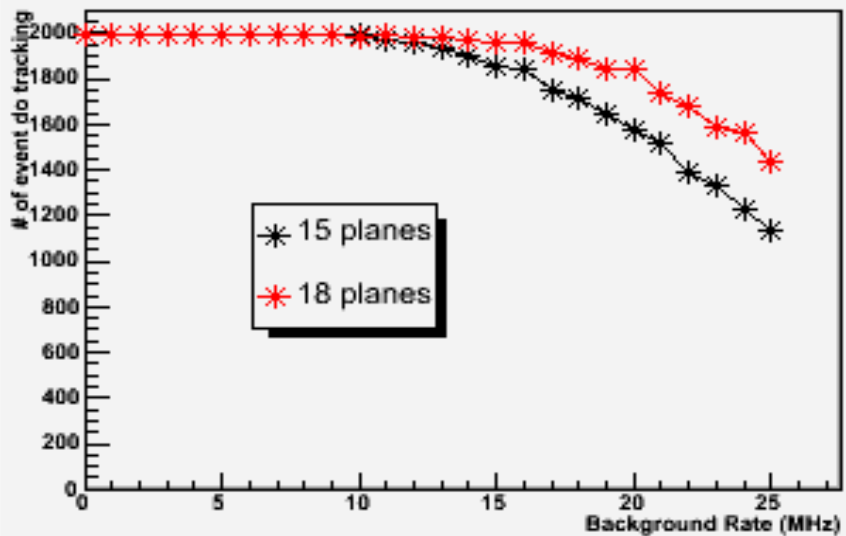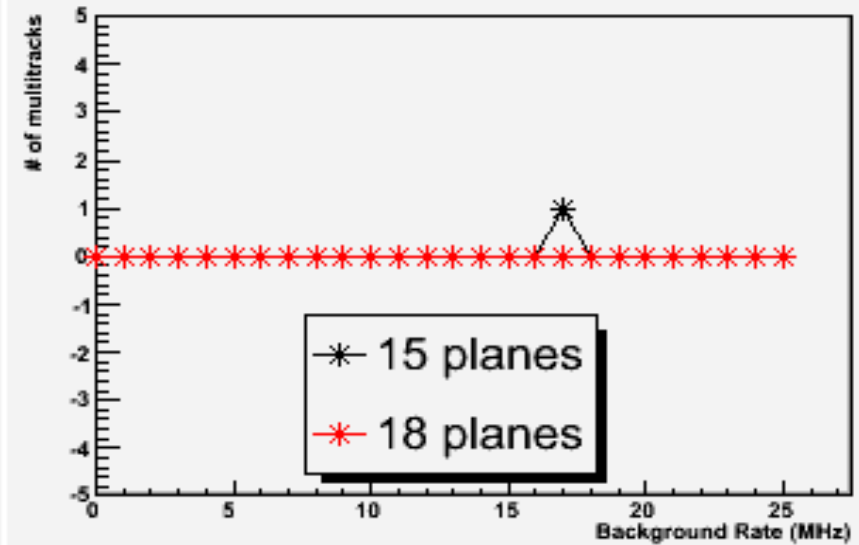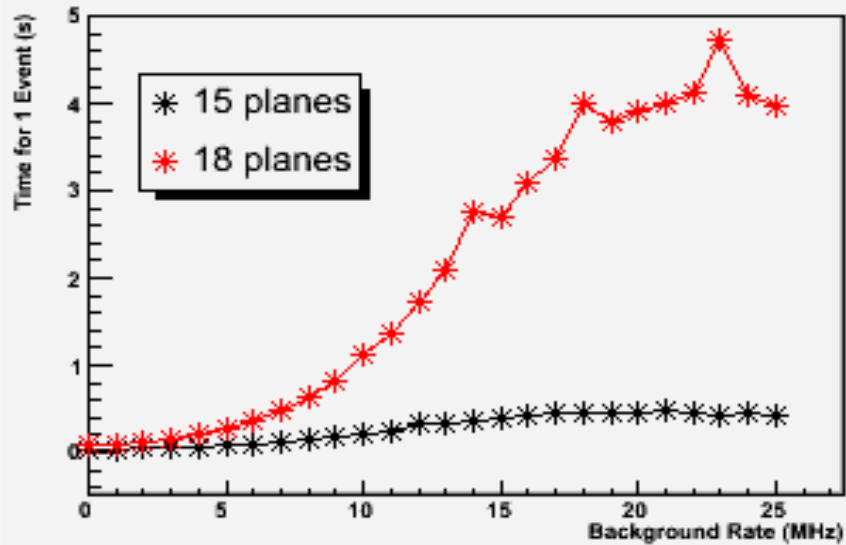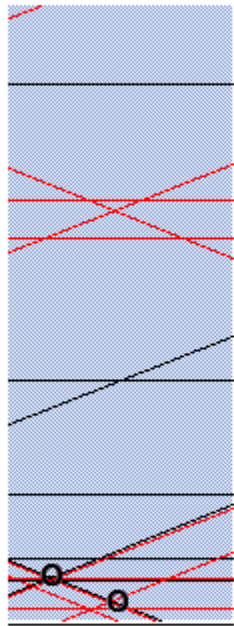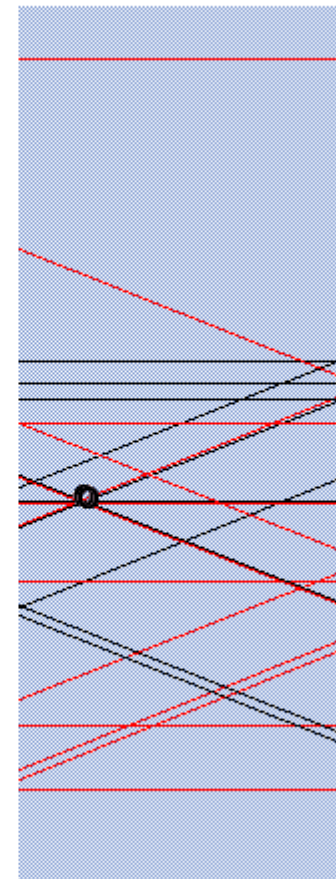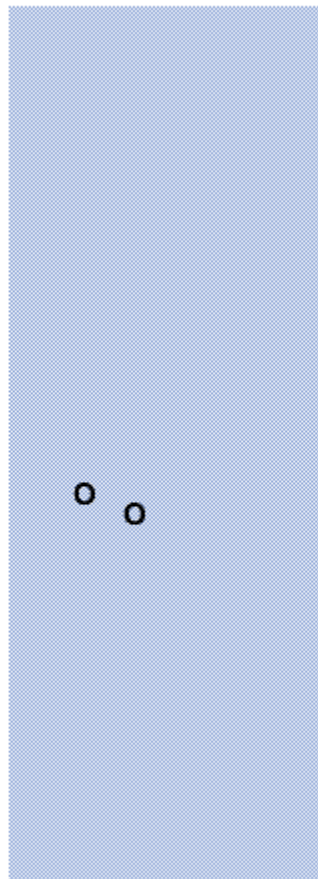
Speed & Eff for the New Algorithm
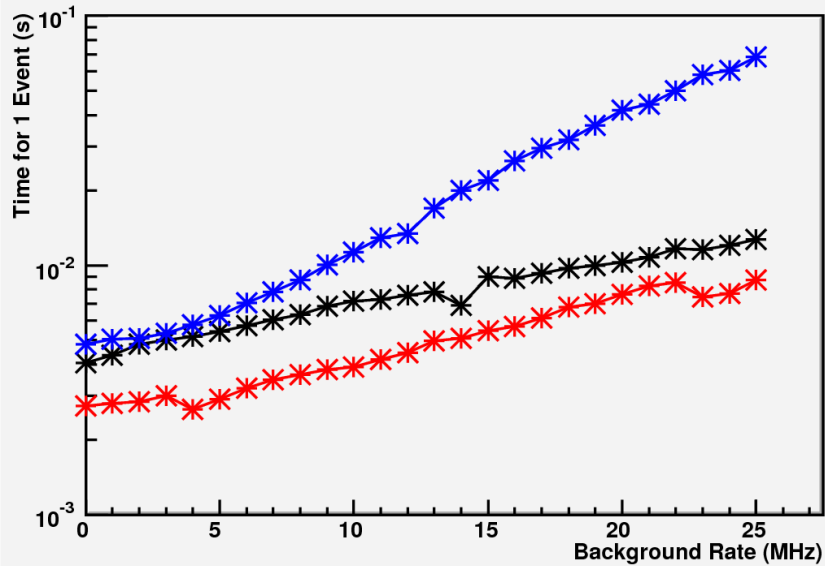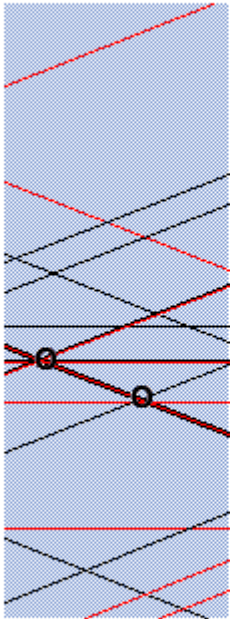
New Tracking with 3 chamber at 25 MHz
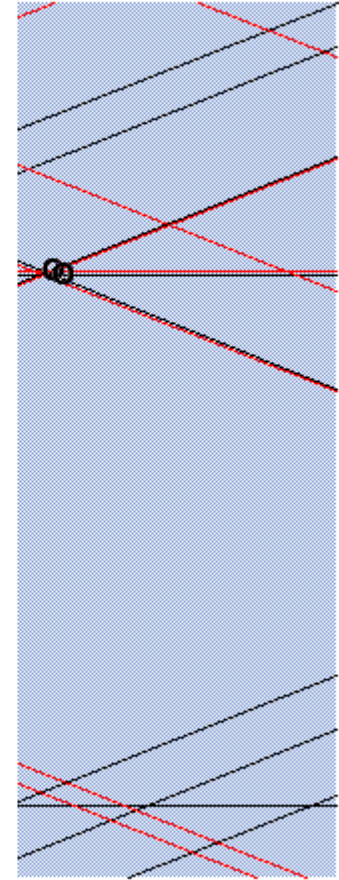
Multi-track with 2 chamber configuration

- BUG HERE

- Did not see in 3-Chamber (nopart=0)

Multi-track with 2 chamber configuration

Multi-track with 2 chamber
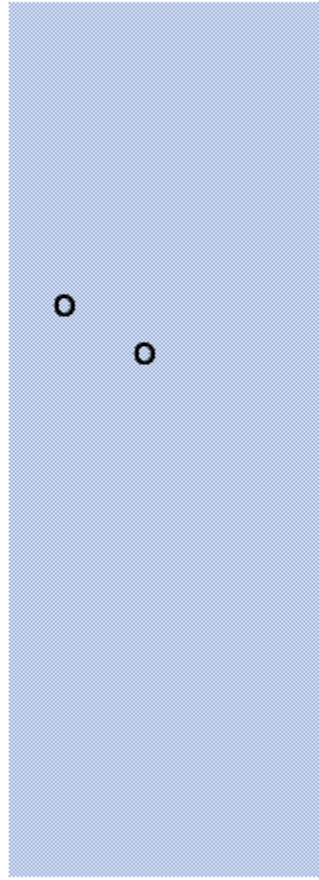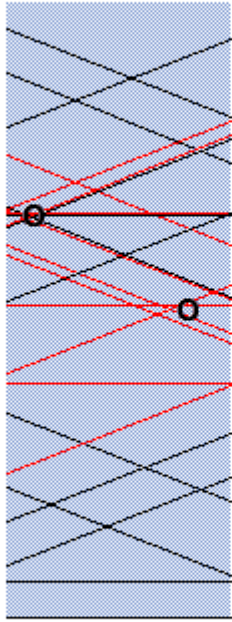
Conclusion

- New Tracking Code can find <u>much more</u> tracks, especially with a <u>larger resolution</u>.
  - Imply a <u>very low tracking efficiency</u> for the old code.
- New Tracking Code miss some of the tracks which are found by old tracking code.
  - Clearly, there are planes not firing.
  - Are they real tracks?
  - <u>New code need a high hitting efficiency.</u>
- New Tracking code is very fast, improve by <u>at least 2 order of magnitude</u> even in the worst situation.

Conclusion

- Multi-track <u>does not increase much</u> with increasing background for 3-chamber situation.
    - Seems to be <u>a big problem for 2-Chamber configuration</u>
    - New code <u>has a bug</u> in dealing with two chambers
- Tracking efficiency <u>does not drop much with increasing background</u> for new code.
    - Still need to see why dropping?
- New code has <u>very high requirement of alignment</u>
    - Challenge to the calibration and tracking procedure
- Both codes are very useful.

We reach our goal in Tracking!!!