Drift Chamber Tracking Efficiency

RGA Run No.: 3252 (10.6 GeV, 100% Solenoid, 100% Torus, Random Trigger)

Simulation: GEMC 2a.2.3 (Background and 6 GeV, 15° θ, -5 ° φ e^- and μ^-)

Reconstruction: CLARA/COATJAVA 5c.2.3

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Outline

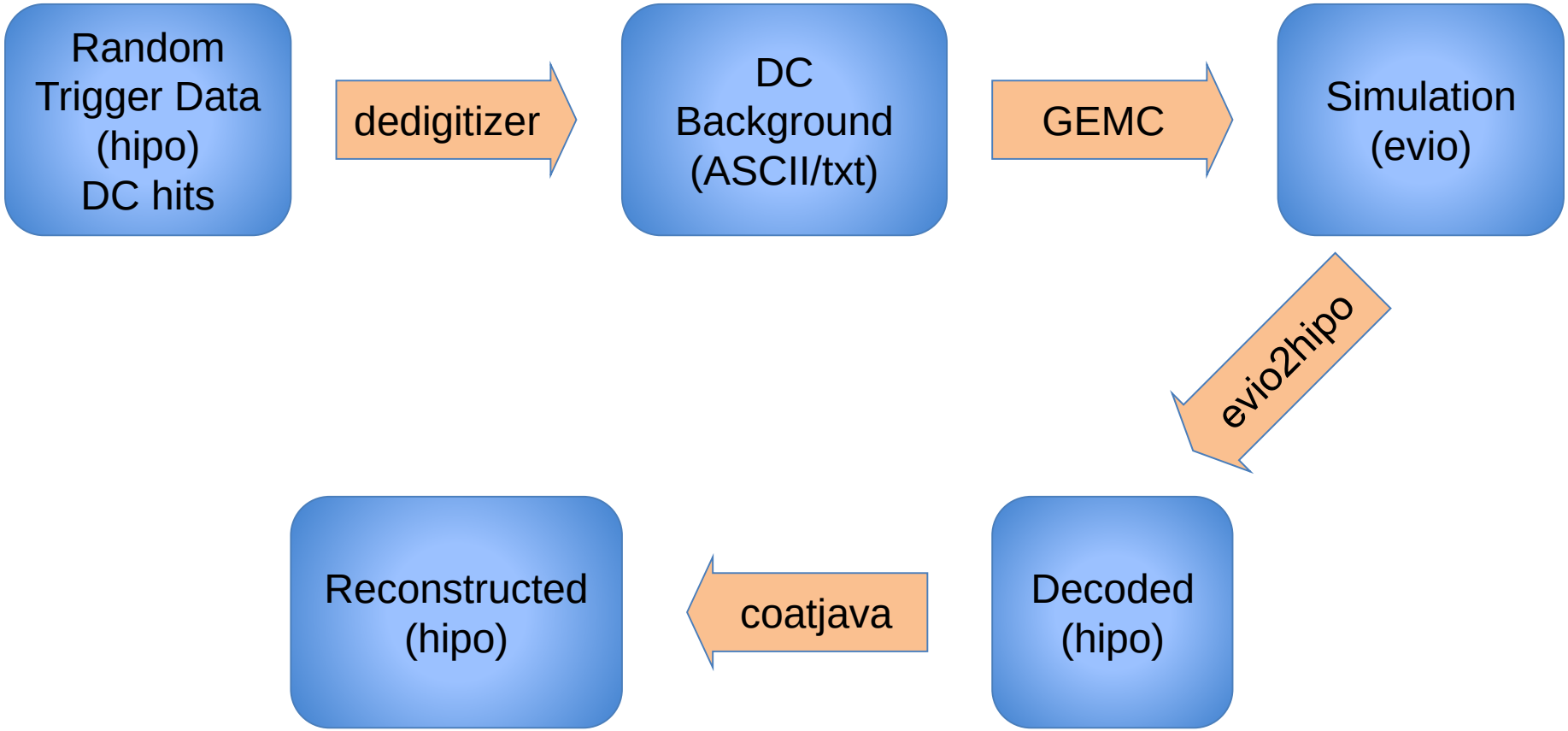
I. Background + Track Merging

II. Improvements in Tracking Algorithm

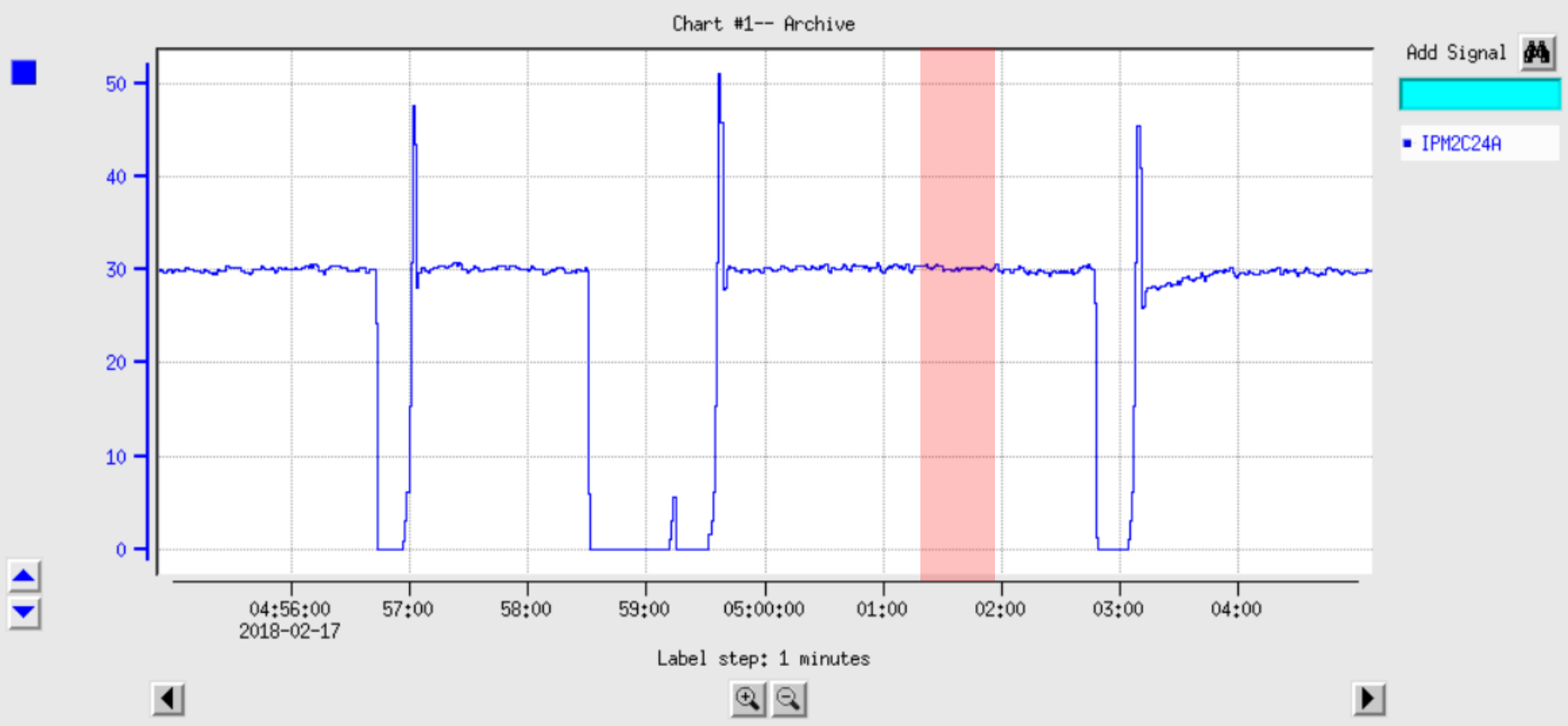
III. Investigation of Tracking Pathologies

IV. Summary and Next Steps

Background Merging Procedure



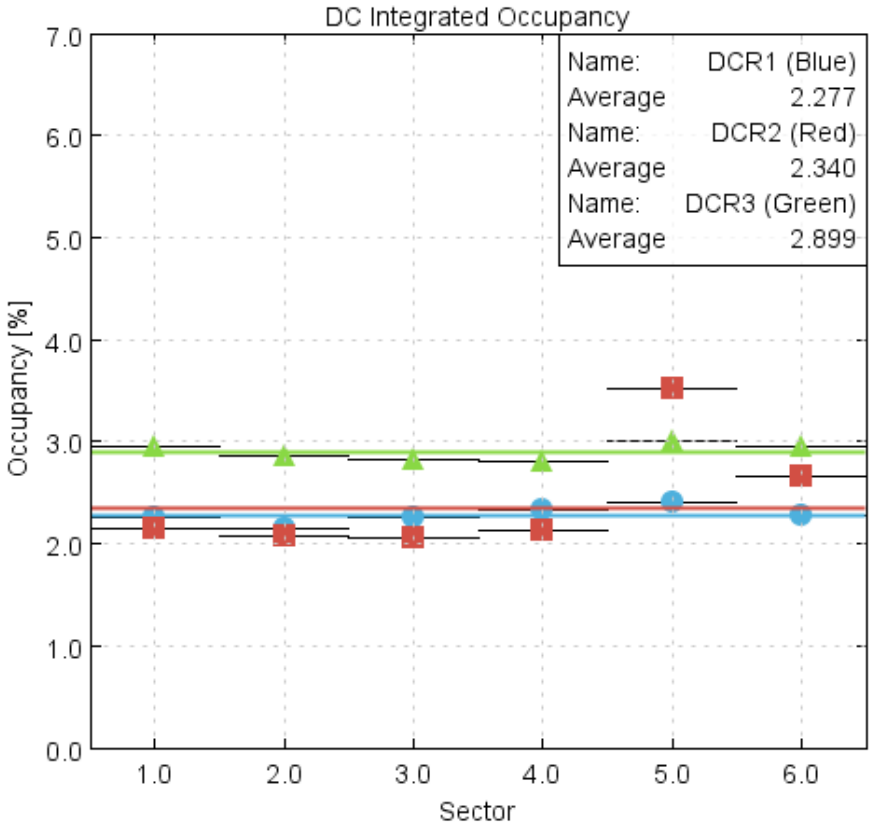
Random Trigger Data: Current



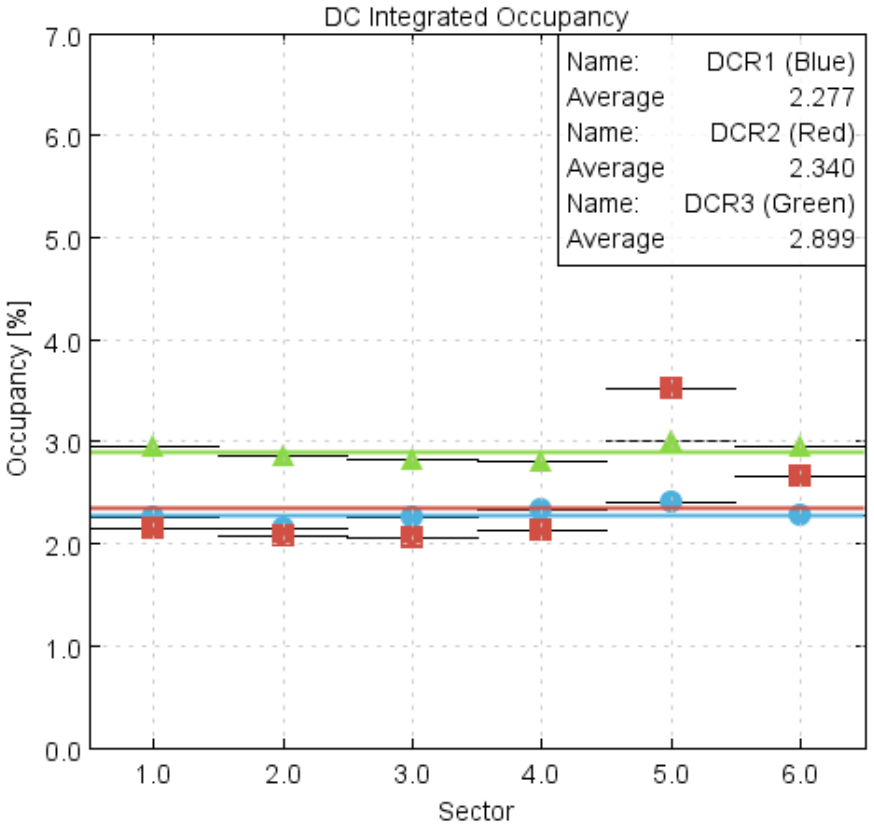
The Unix timestamp in RUN::config bank shows that the data selected for background were taken on Feb. 17, 2018 between 5:01:20 AM to 5:01:50 AM.

Validation of Background Merging

Random Trigger Data

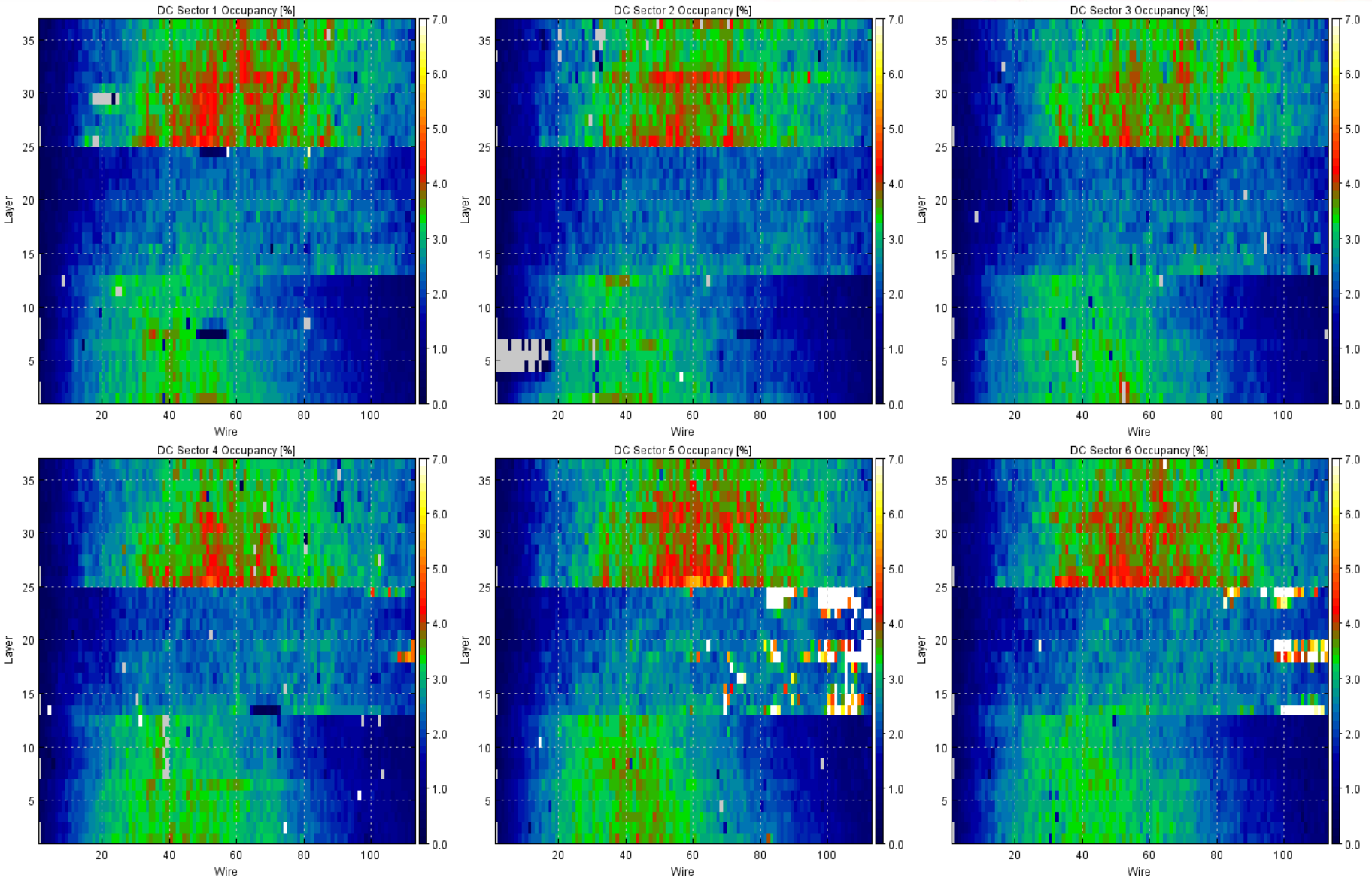


Simulation (Decoded)

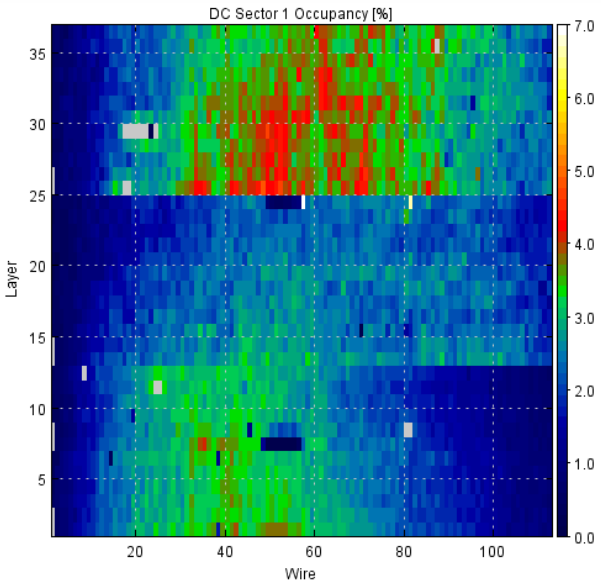


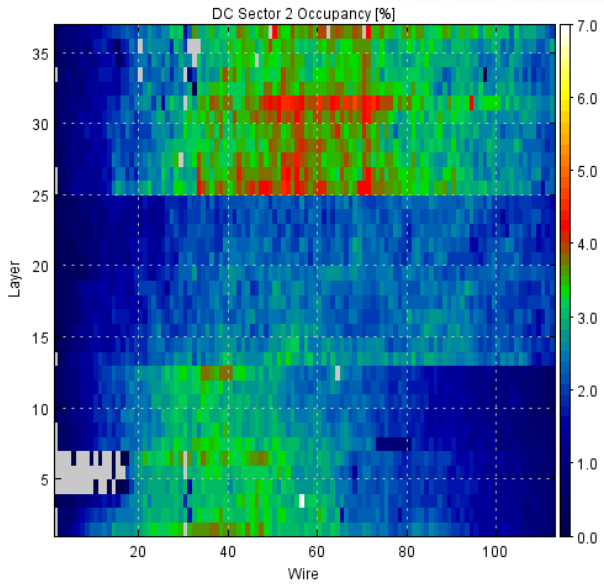
Occupancies should be identical and they are.

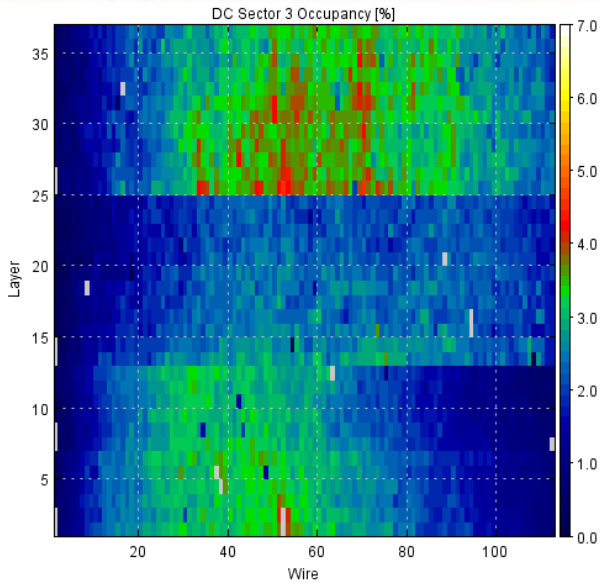
Random Trigger Data: 2D Occupancy

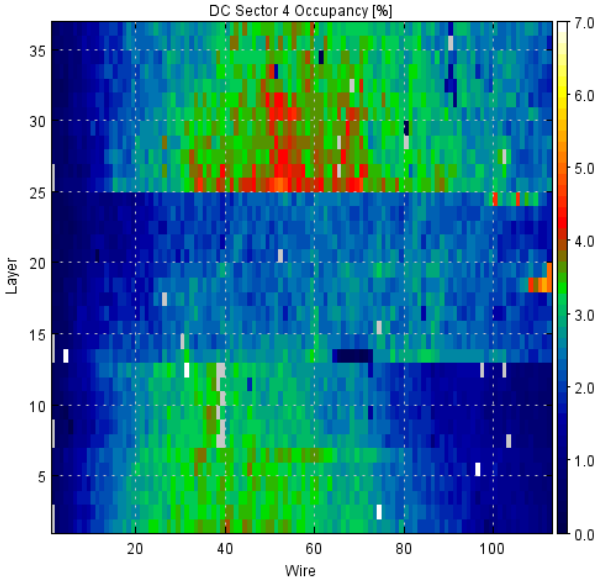


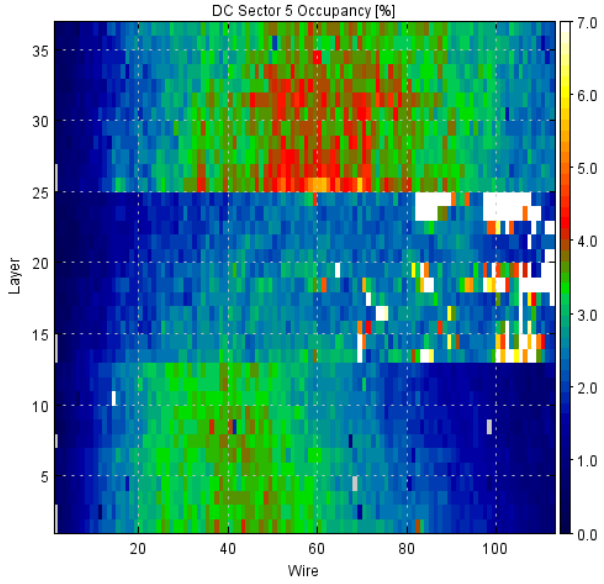
Simulation: 2D Occupancy

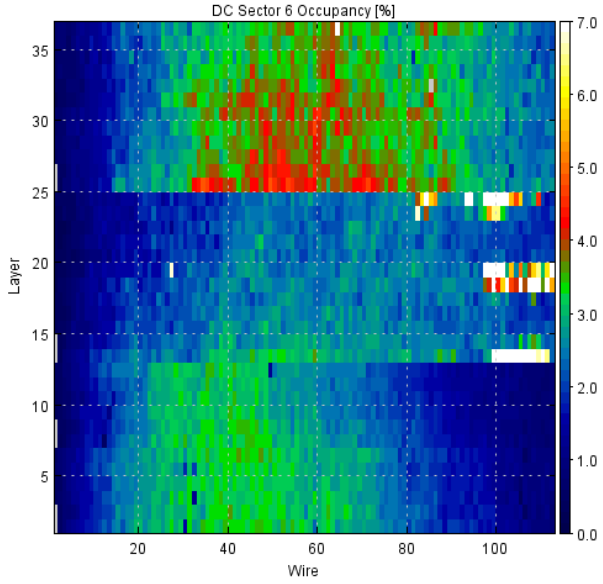




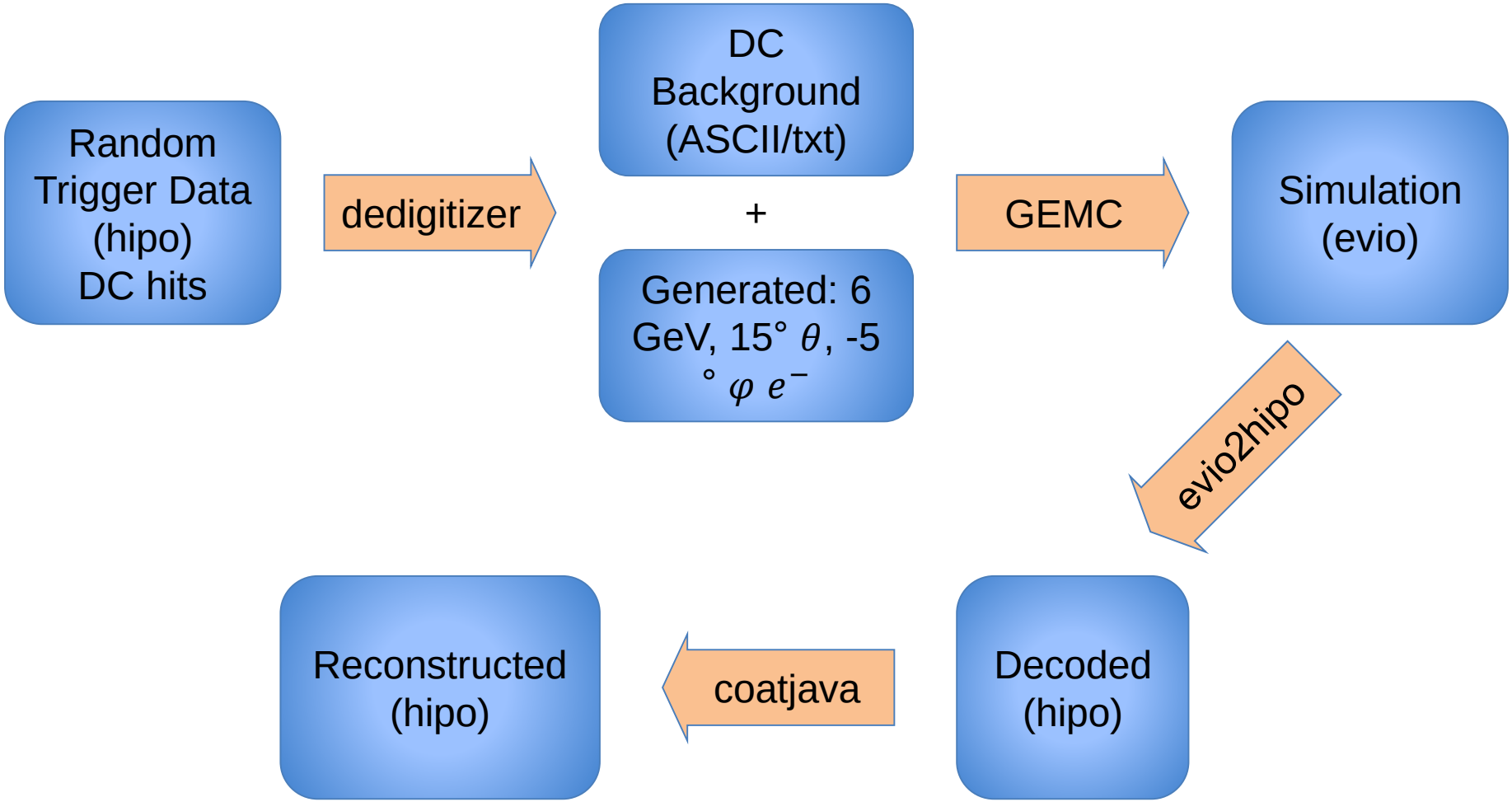






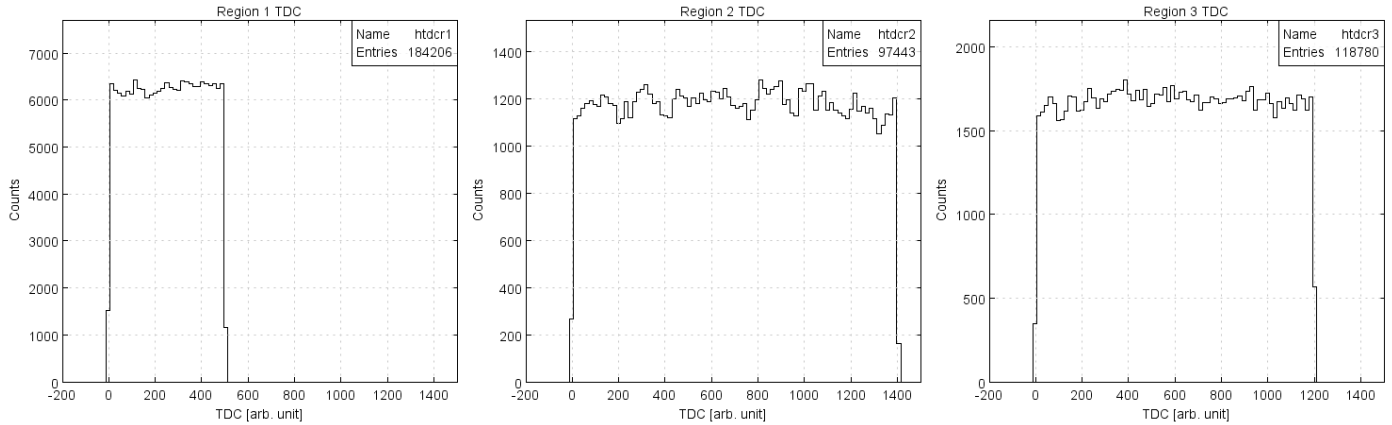


Background + Track Merging Procedure

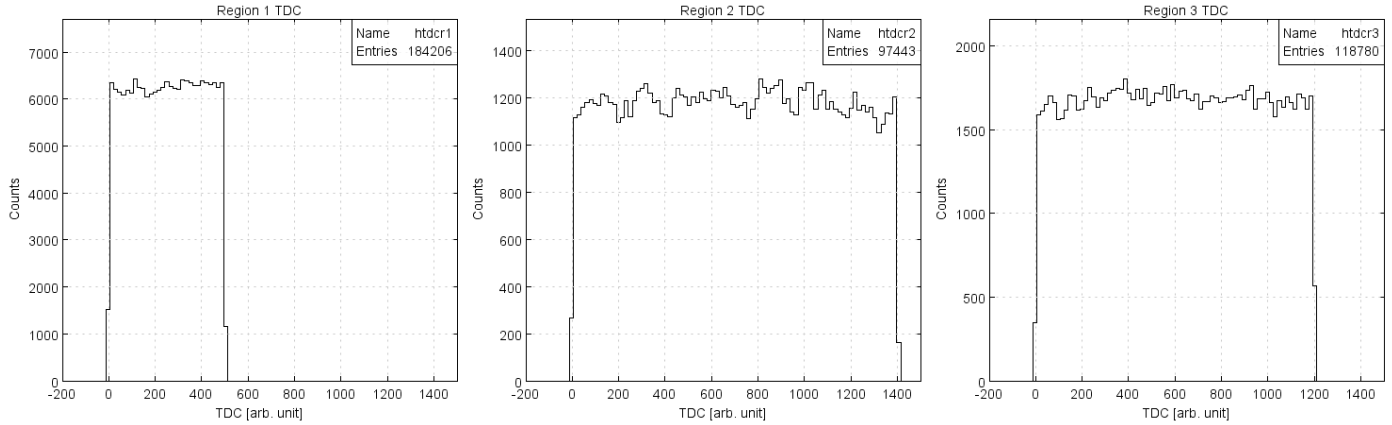


Data and Simulation: TDC

Random Trigger Data



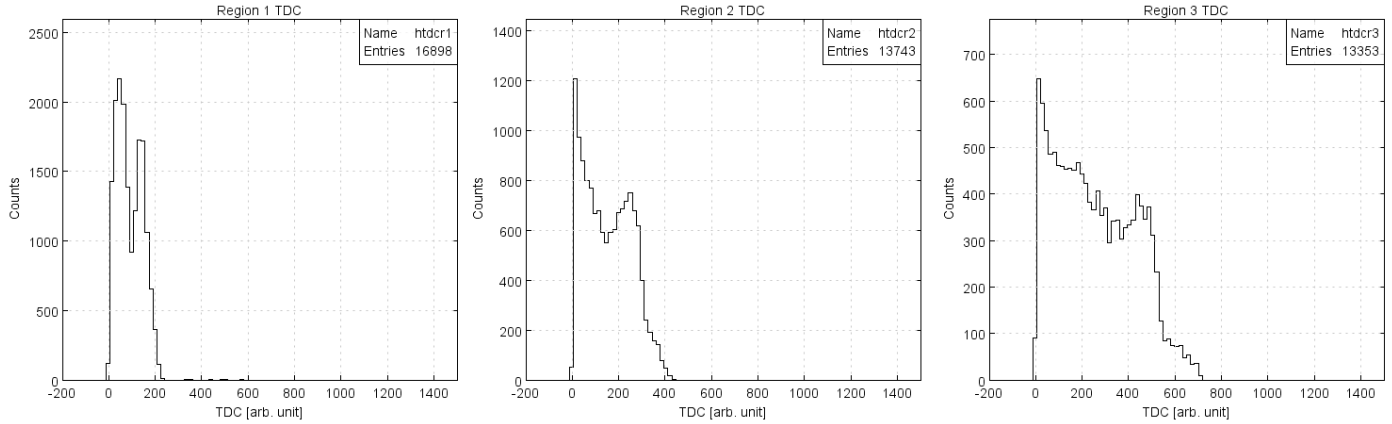
Simulation: Background



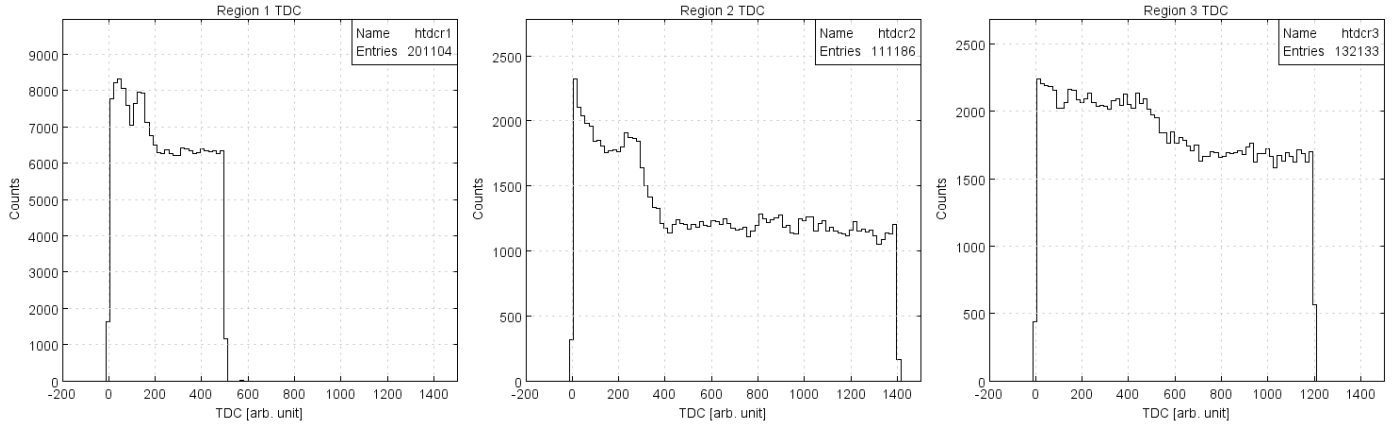
Background should be merged with generated particle without bias in terms of timing.

Simulation: TDC

Simulation: Generated Track



Simulation: Background + Generated Track

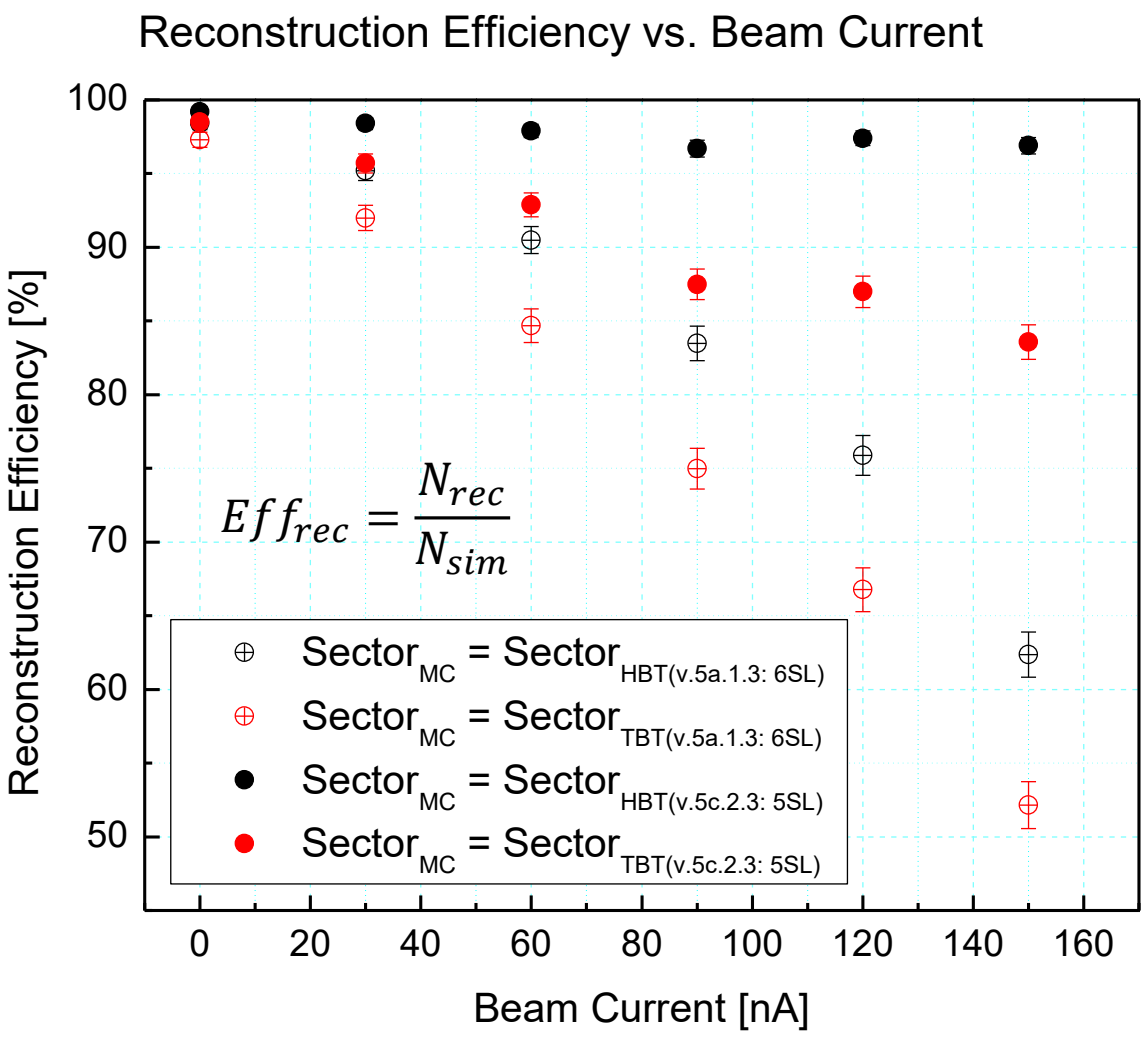


Background is merged with generated particle without bias in terms of timing.

Towards Tracking Efficiency Studies

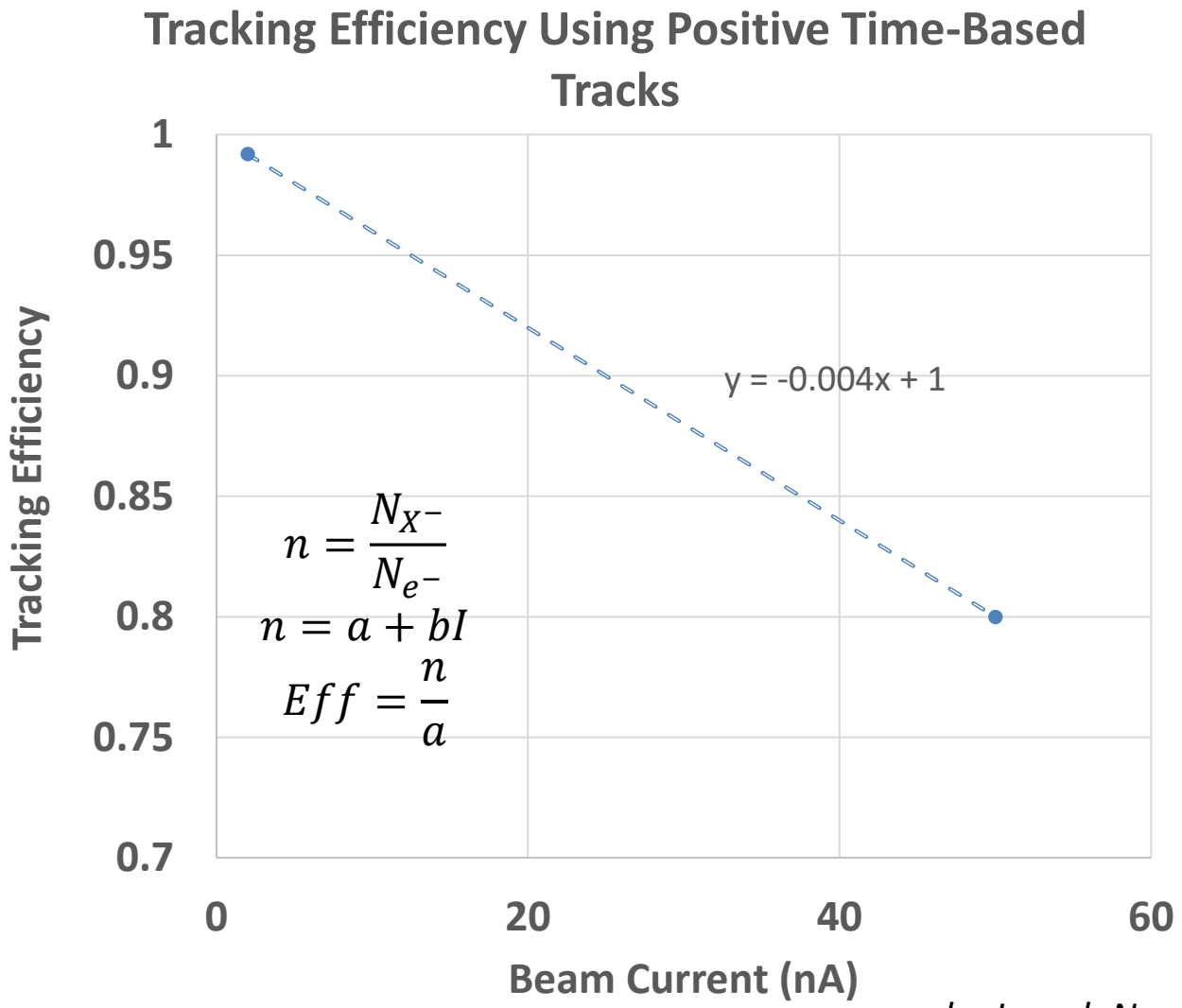
- Background was successfully merged:
  - without losing any DC hits, and
  - without timing bias relative to the generated track.
- Background merging procedure is ready to be used in investigating tracking efficiency as function of background beam current.
- Background files for higher beam currents were created by grouping adjacent event entries into a single event.

Tracking Reconstruction Efficiency



This was performed with 6 GeV, 15° θ, -5 ° φ e^-.

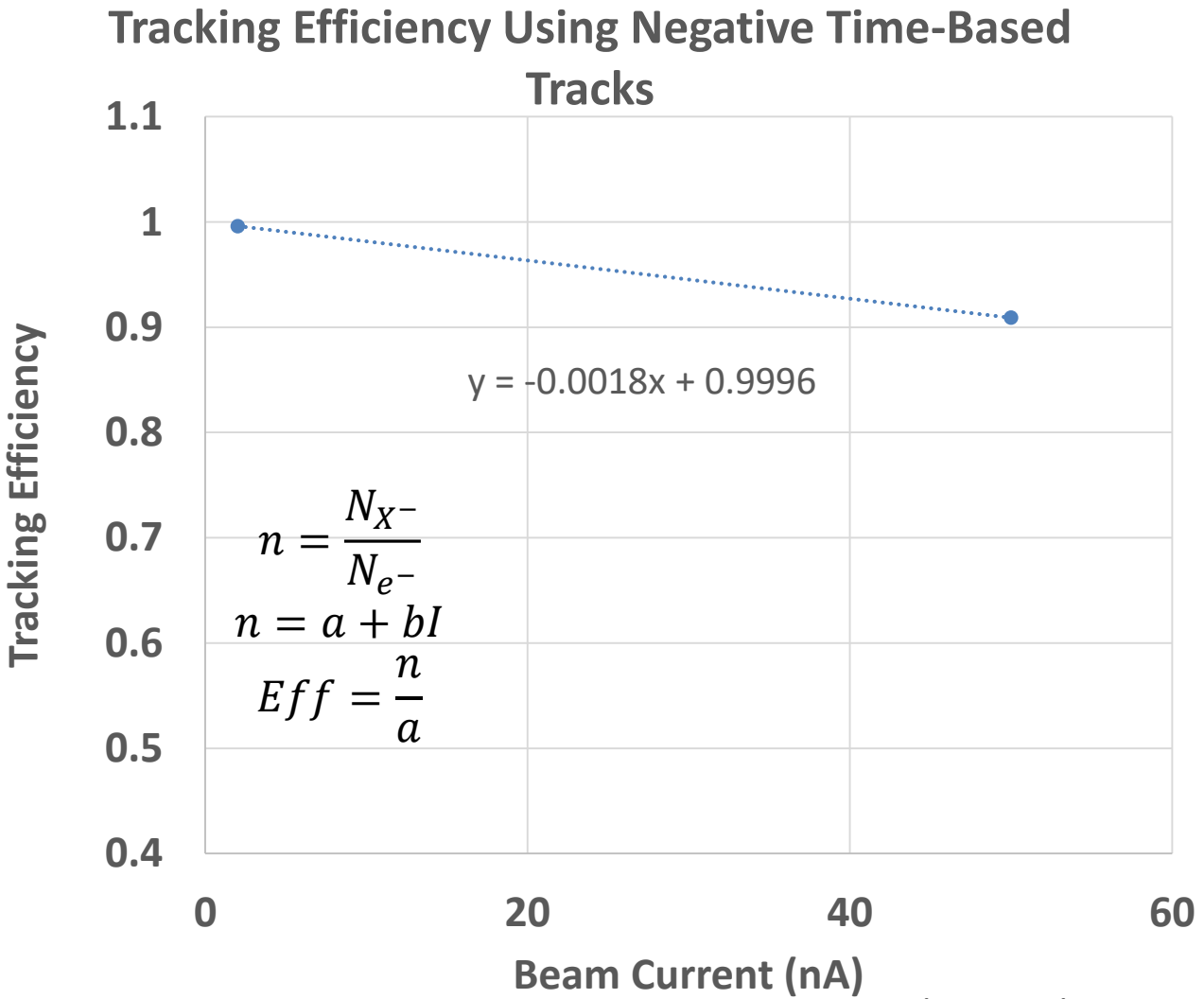
Tracking Efficiency from Data



by Joseph Newton

Rate of negatively charged tracks per electron, normalized to 1 at 0 nA , from the fit.

Tracking Efficiency from Data



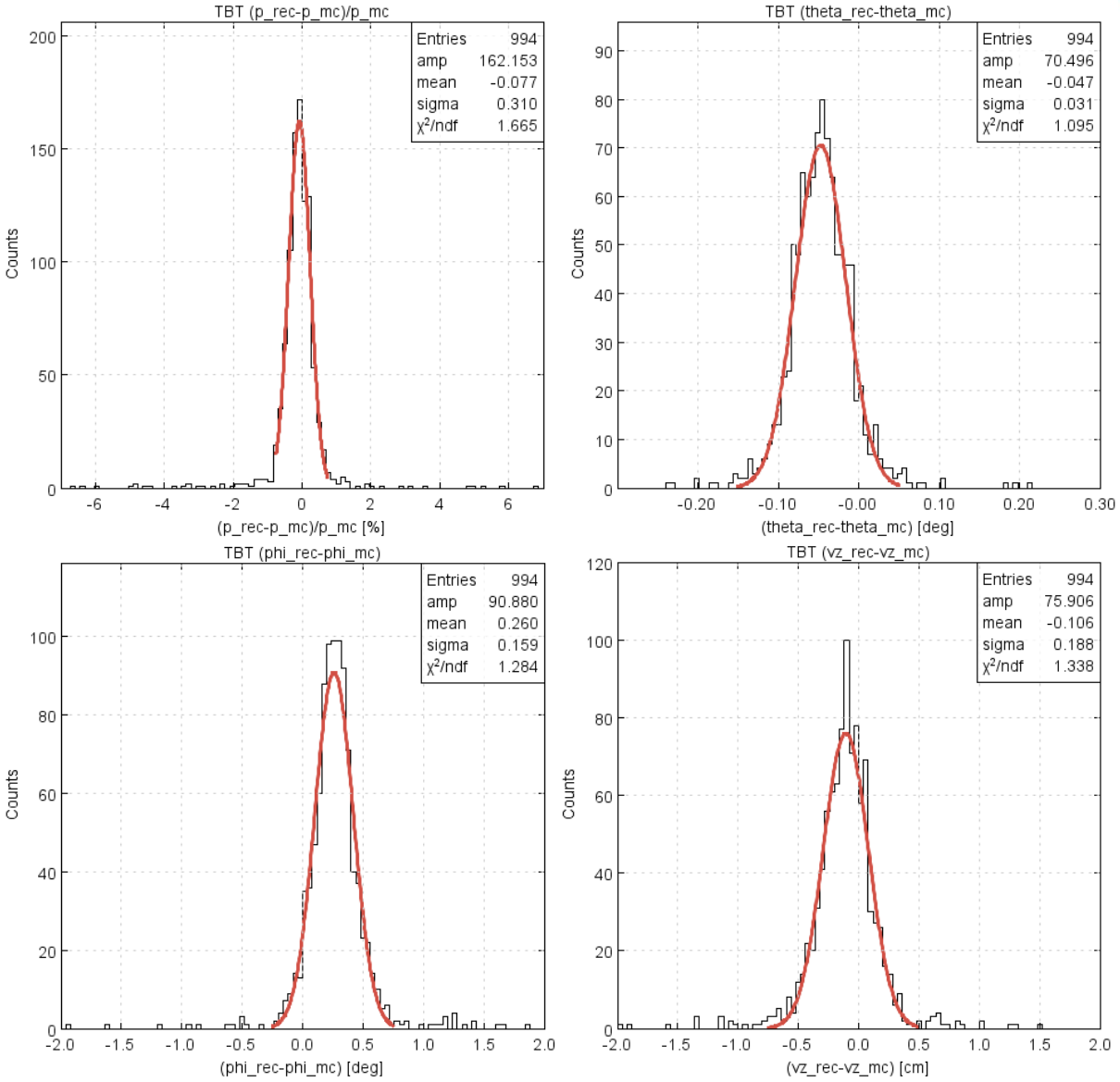
by Joseph Newton

Rate of negatively charged tracks per electron, normalized to 1 at 0 nA , from the fit.

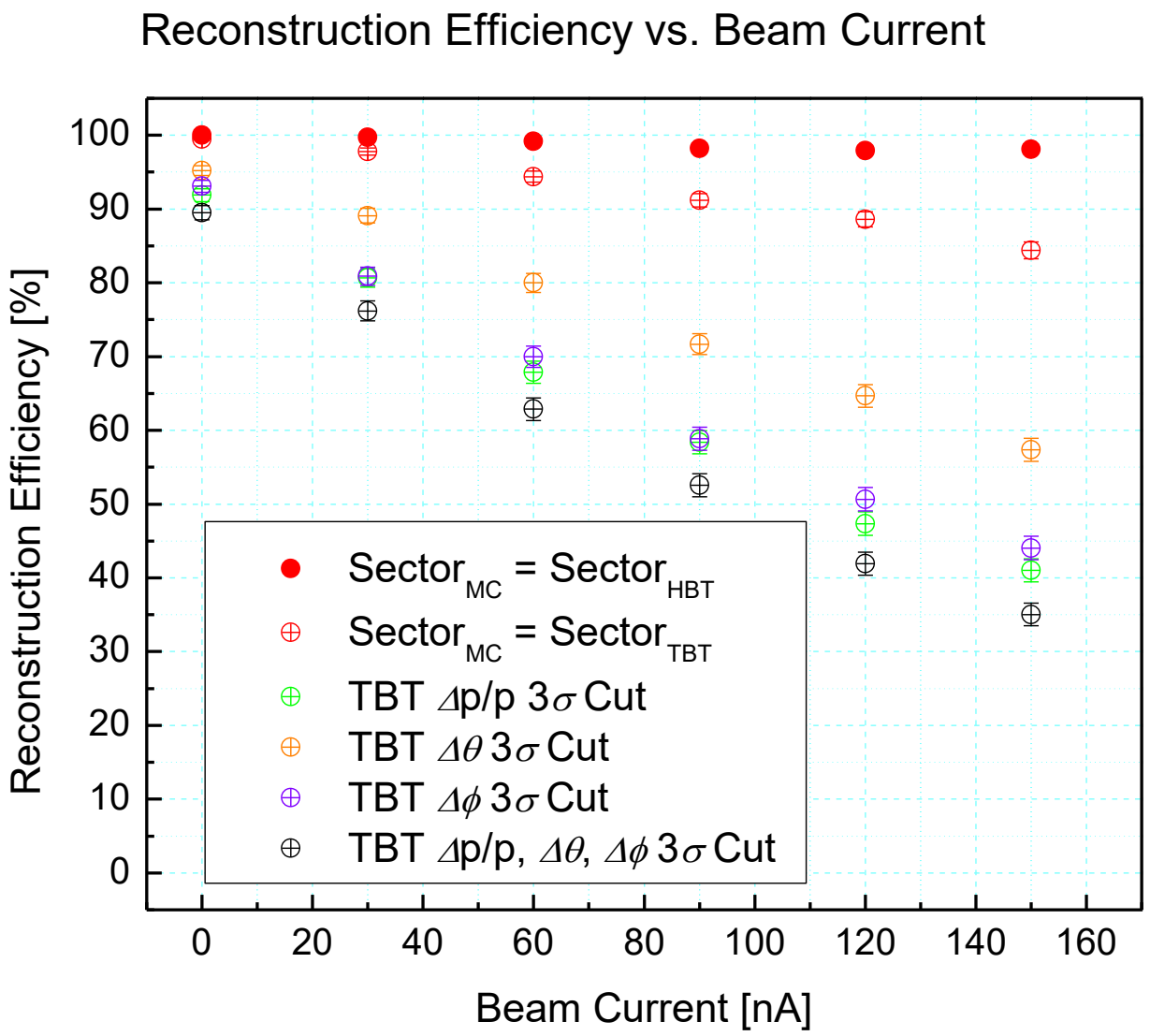
COATJAVA 5c.2.3 Improvements

- Poorly reconstructed segment rejection.
- No isolated hit pruning.
- Removal of overlapping tracks.
- Extension of value of B-field reach of T2D table.
- Reconstruct 6 superlayer tracks and then look of tracks from the track unassociated segments requiring only 5 superlayers.

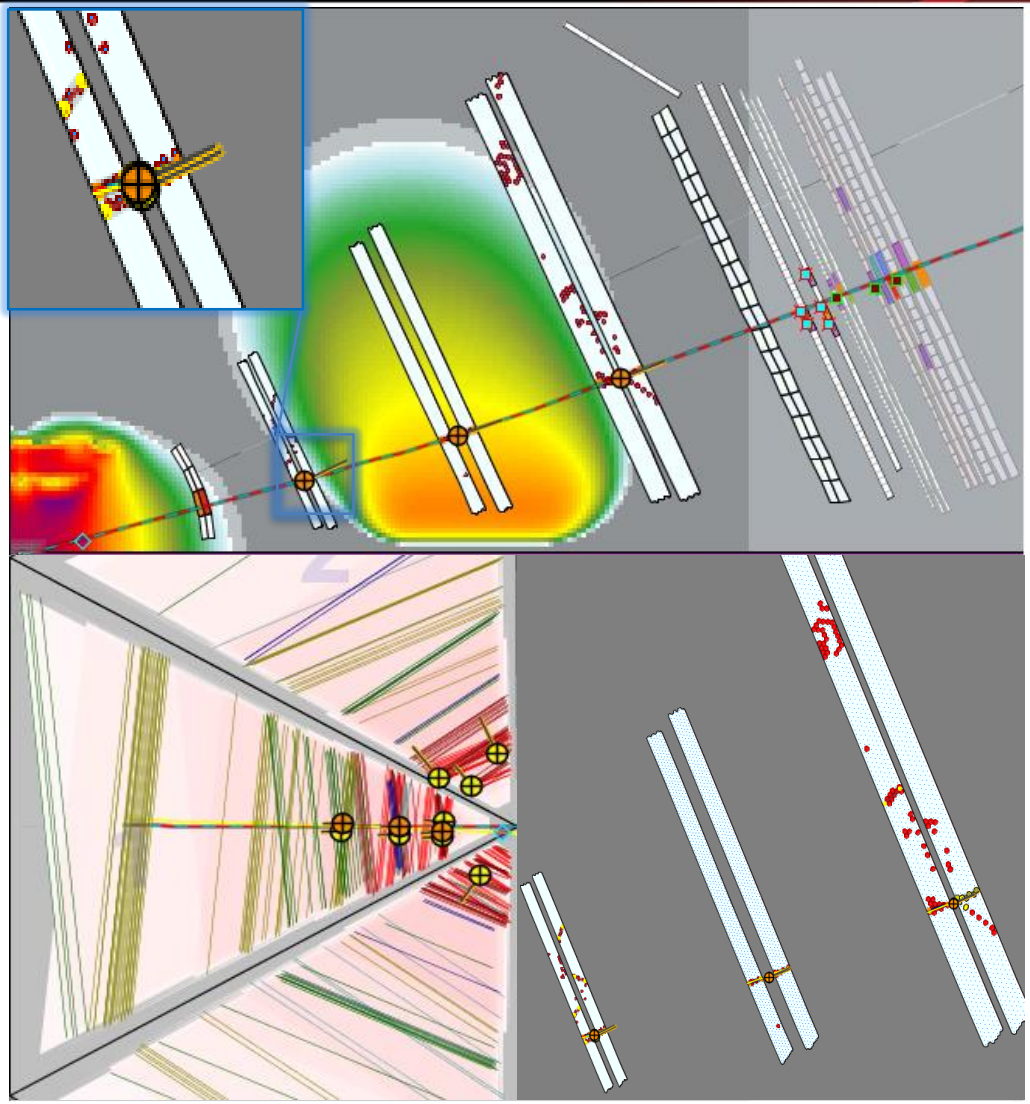
Reconstructed TBTrack: Signal



Tracking Reconstruction Efficiency

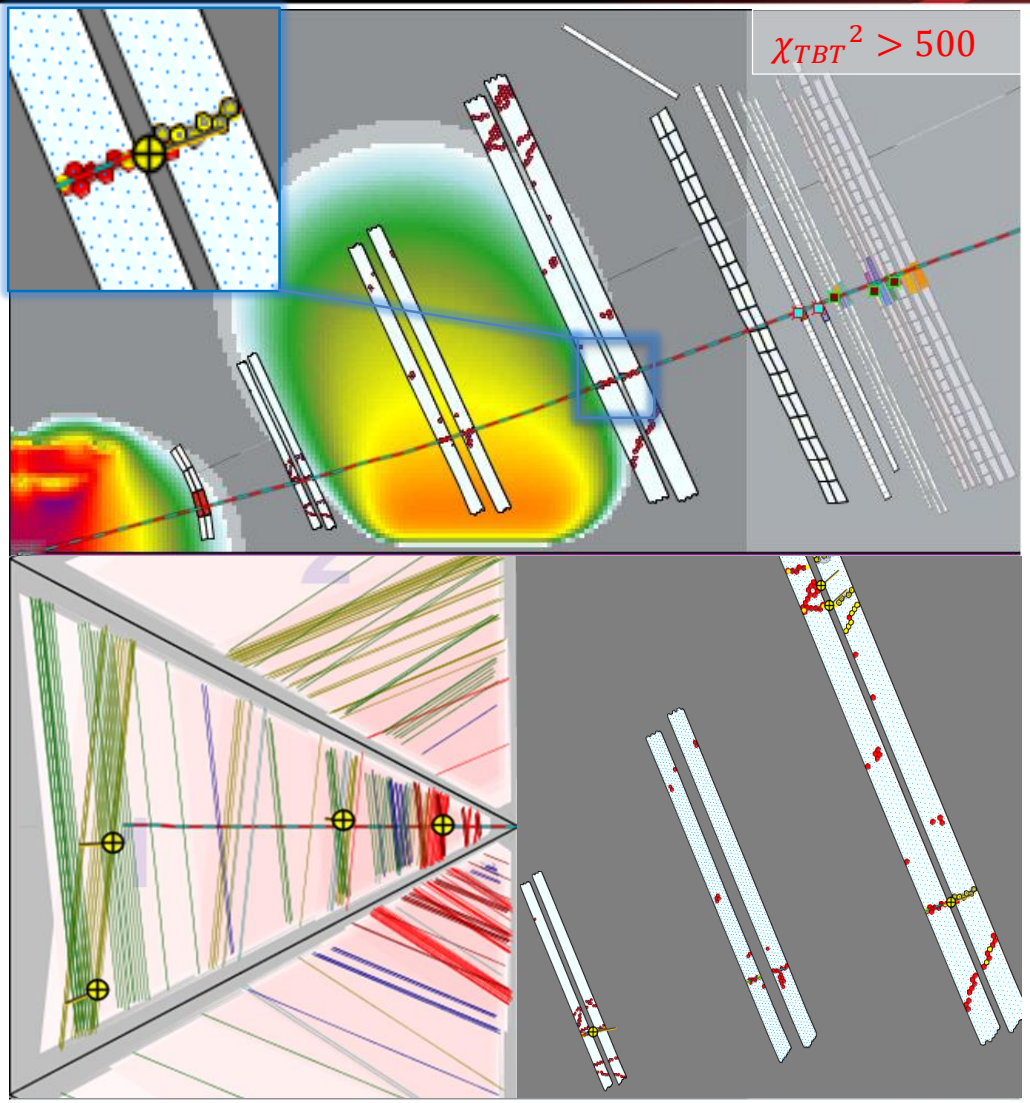


Pathology: Misaligned Segments



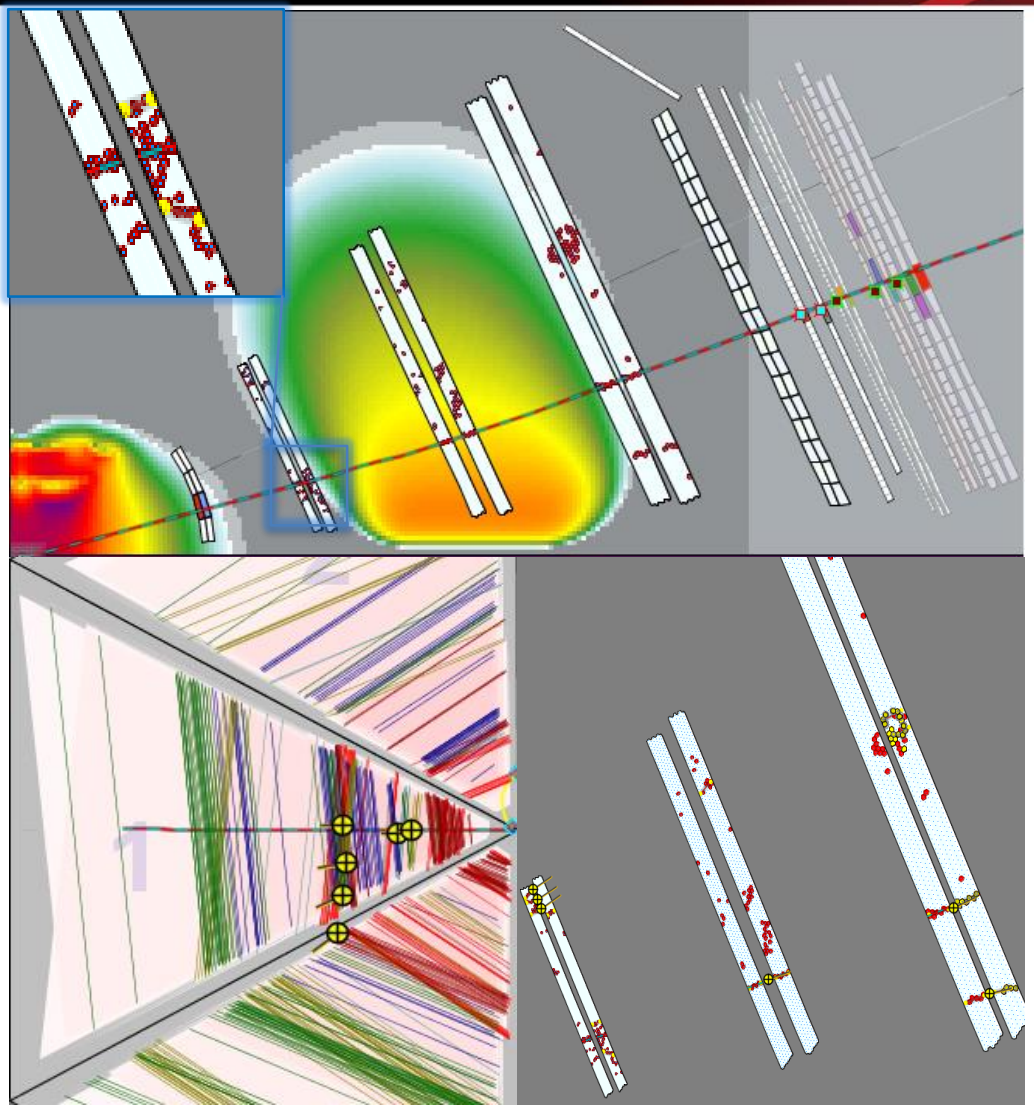
There are sufficient but misaligned segments.

Pathology: Good Hits, No Segment



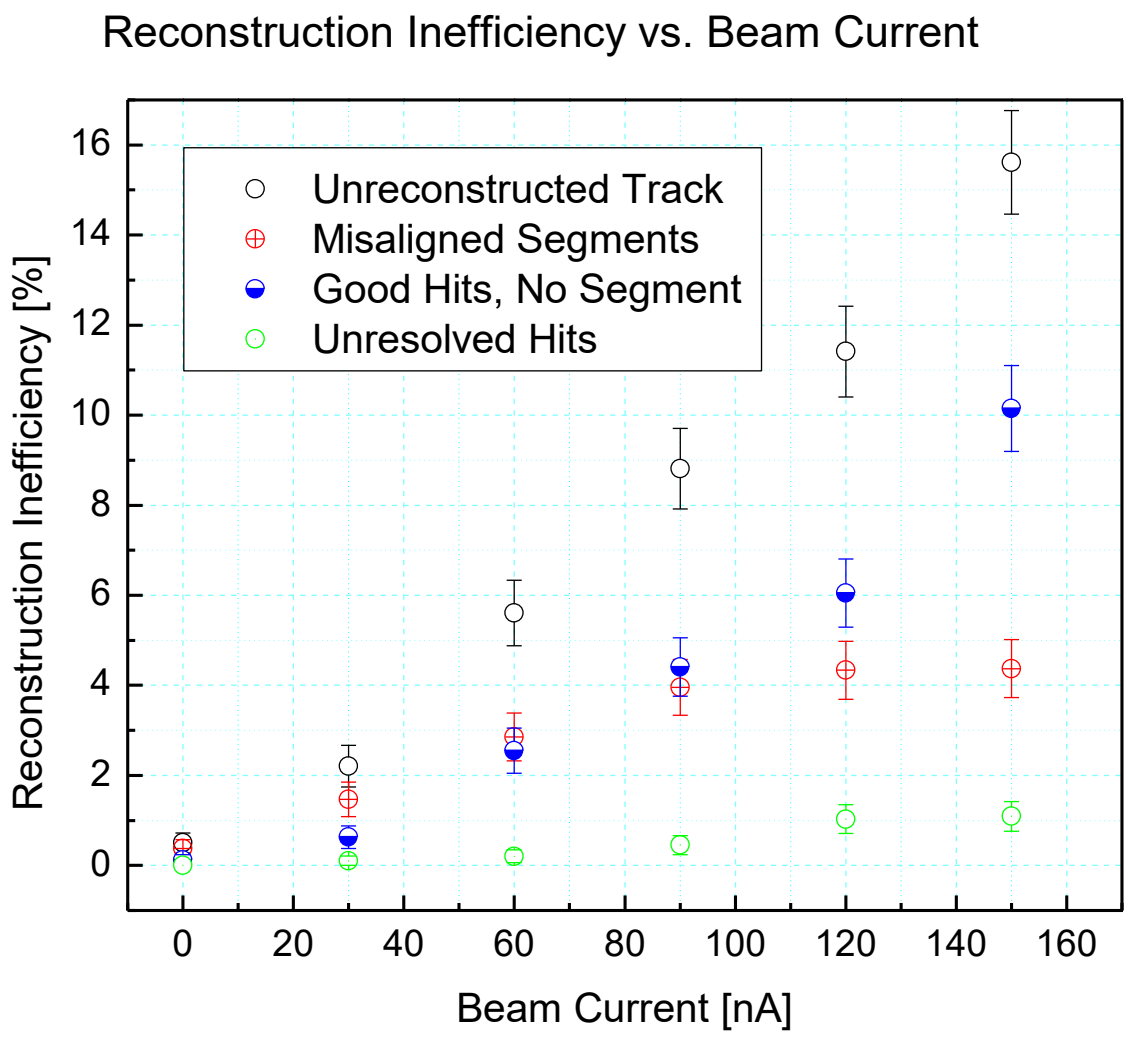
There are reasonable HBT segments without TBT segments in at least two superlayers.

Pathology: Unresolved Hit Pattern



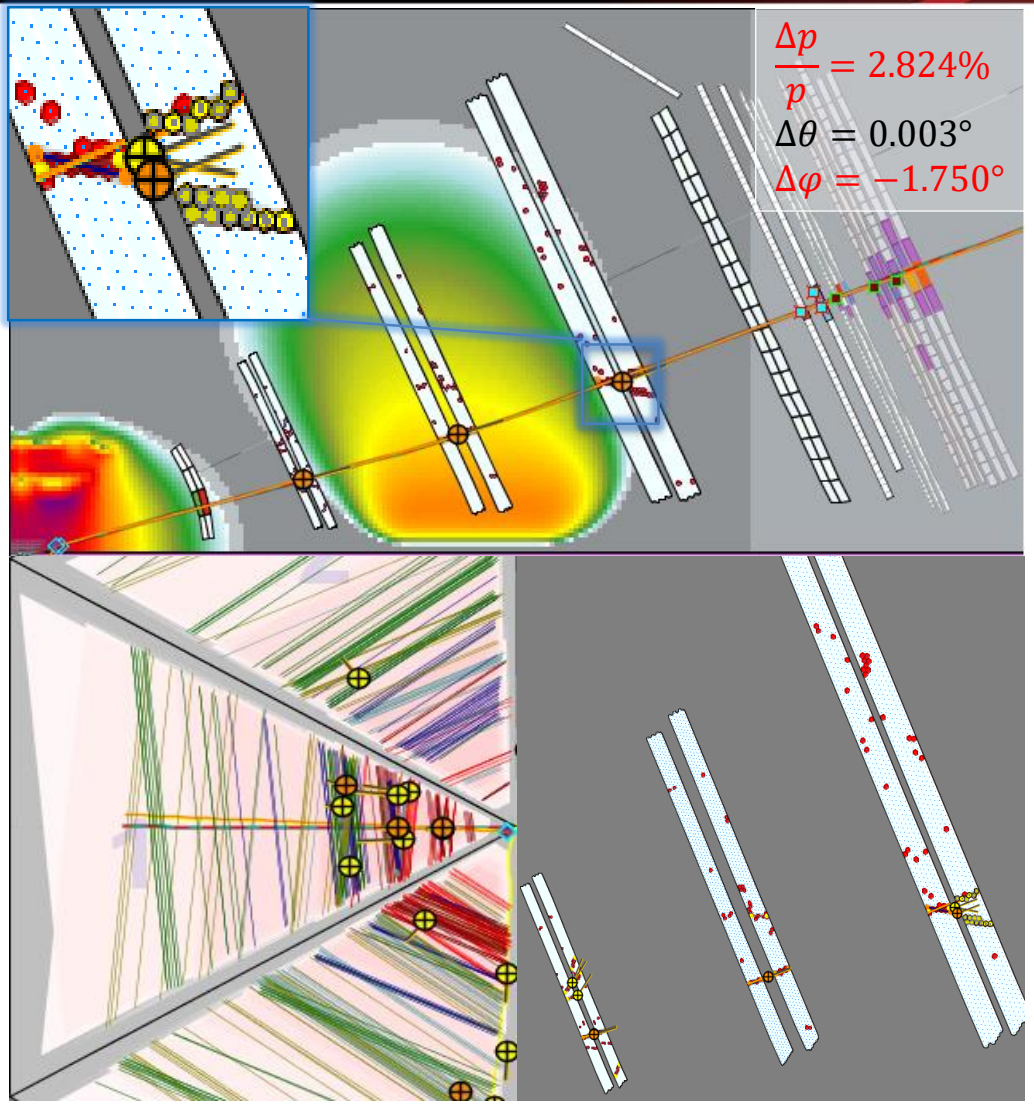
Segments are not reconstructed due to unresolved hit pattern in at least two superlayers.

Unreconstructed TBTracks



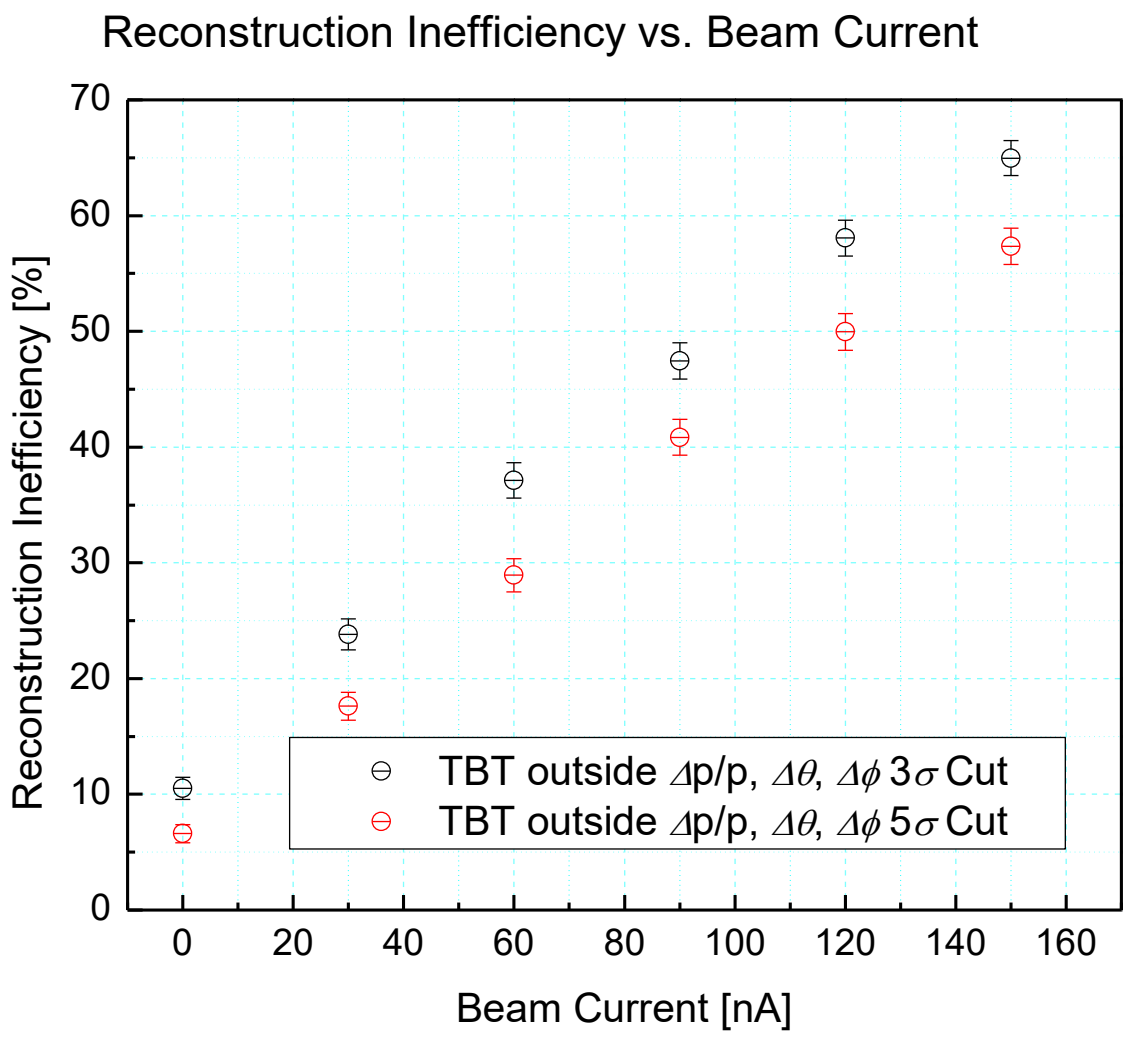
Unreconstructed TBTrack means no TBTrack within the sector of the generated track.

Pathology: Poorly Reconstructed Segment



Poorly reconstructed TBT segments result to tracks with distorted kinematics.

Poorly Reconstructed TBTracks



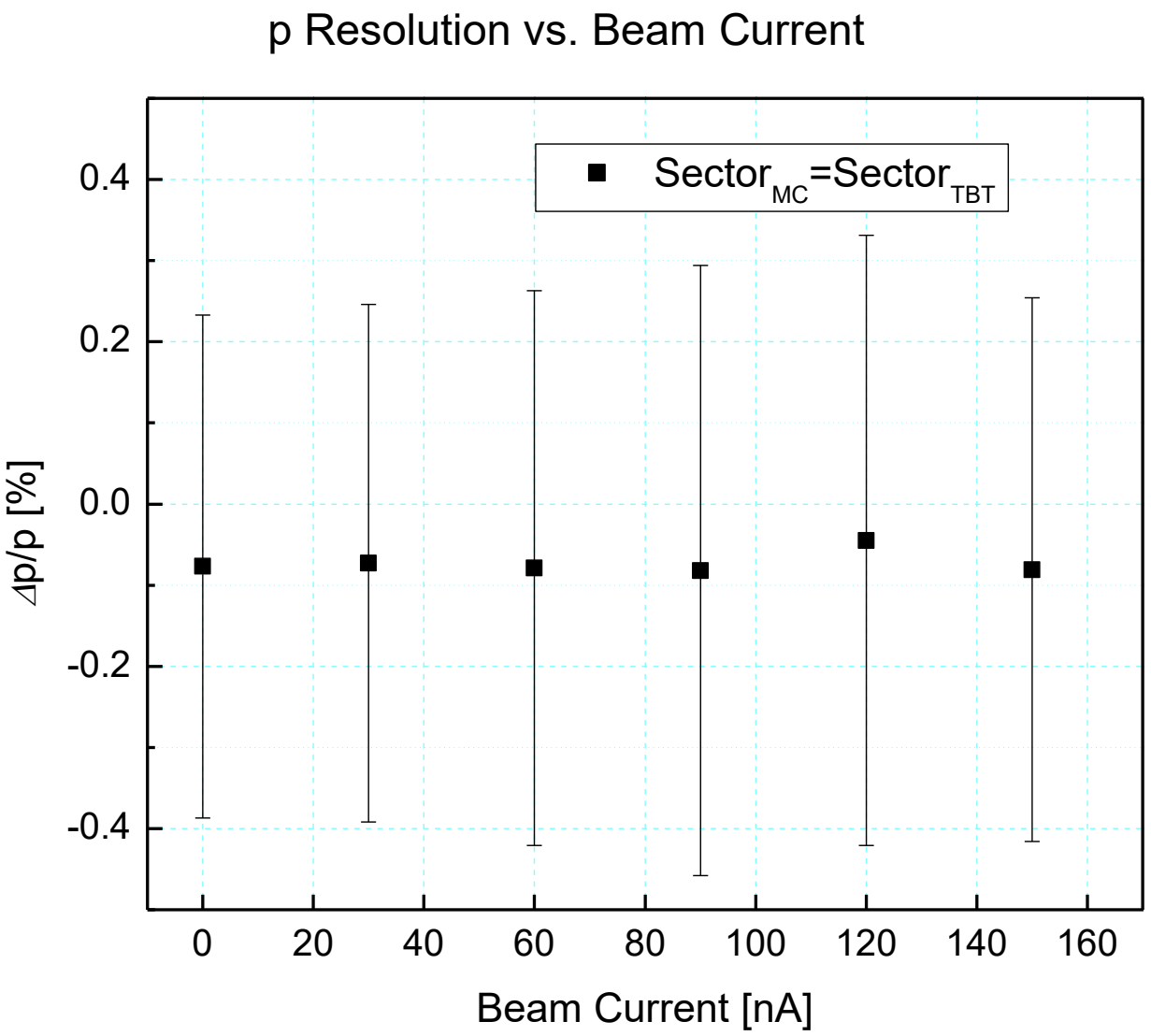
Poorly reconstructed TBTrack is in the signal's sector but outside $\Delta p/p$, $\Delta\theta$, and $\Delta\varphi$'s $n\sigma$.

Summary and Next Steps

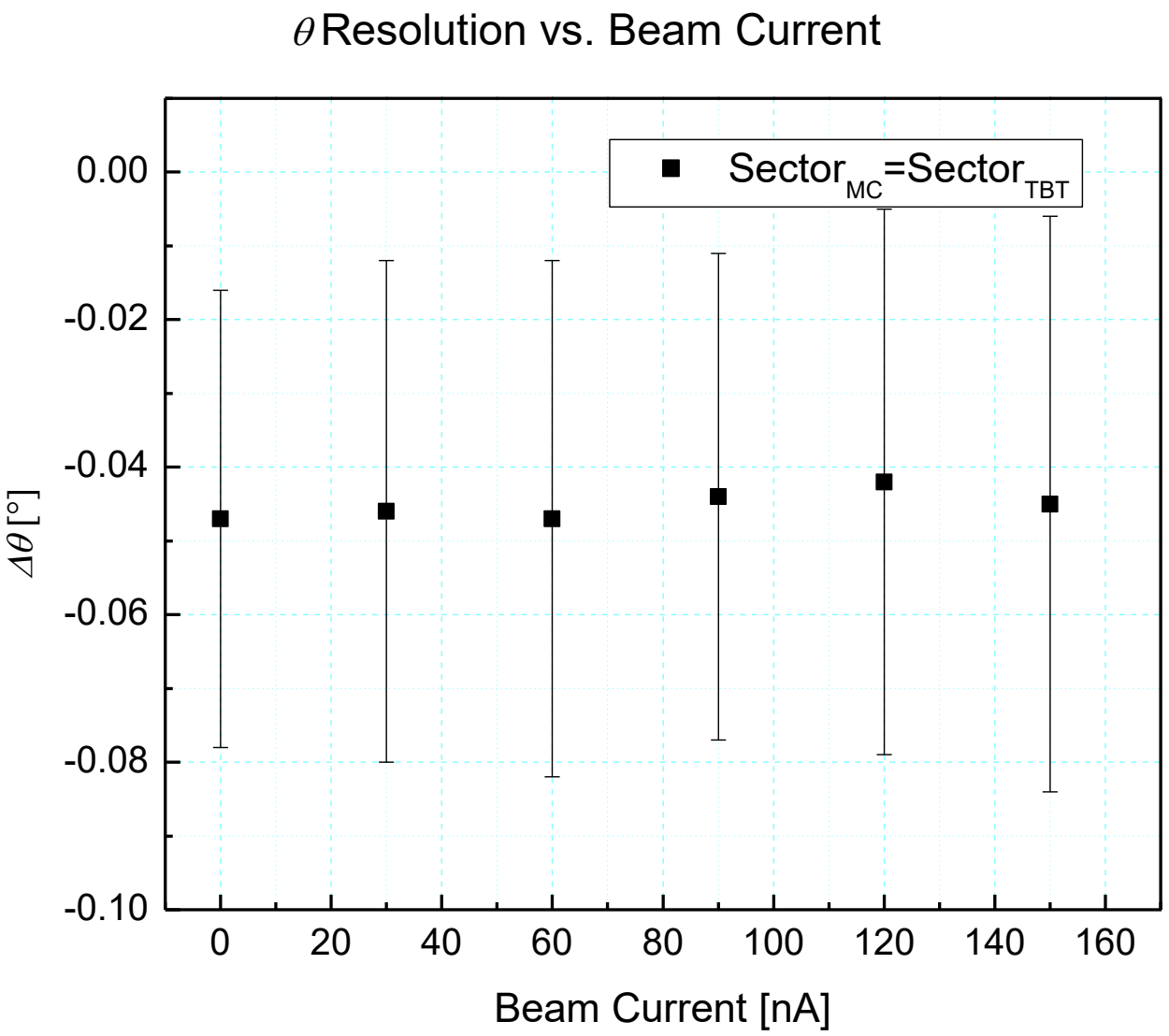
- Background merging was well implemented without discrepancy in hits and without timing bias.
- TBT reconstruction efficiencies were evaluated for different background beam currents.
- TBT reconstruction pathology was investigated: identified and quantified in terms of occurrence.
- Similar studies will be conducted with the recent and future (dead time implemented) GEMC and CLARA/COATJAVA releases.

Thank You!!!

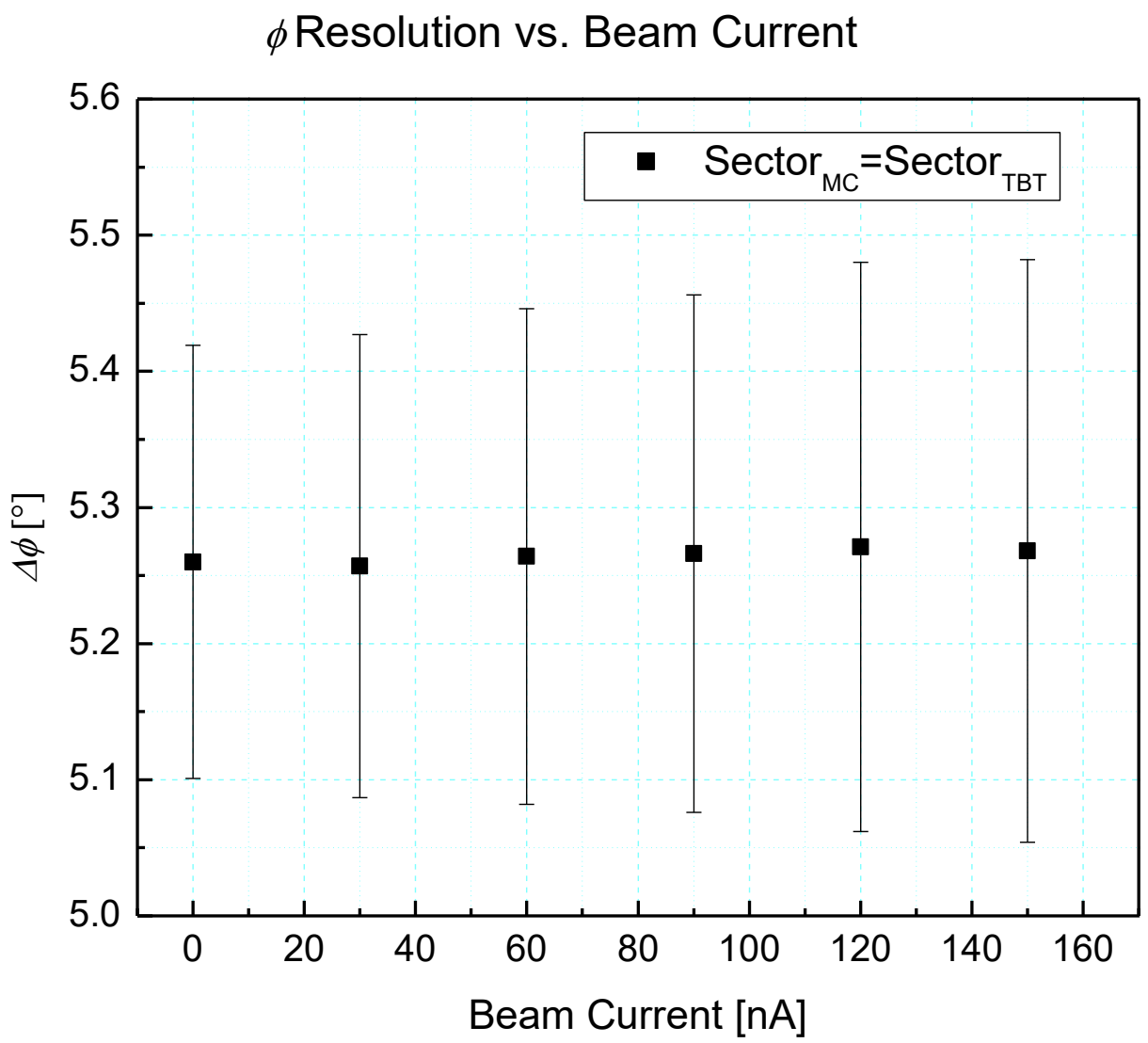
p Resolution



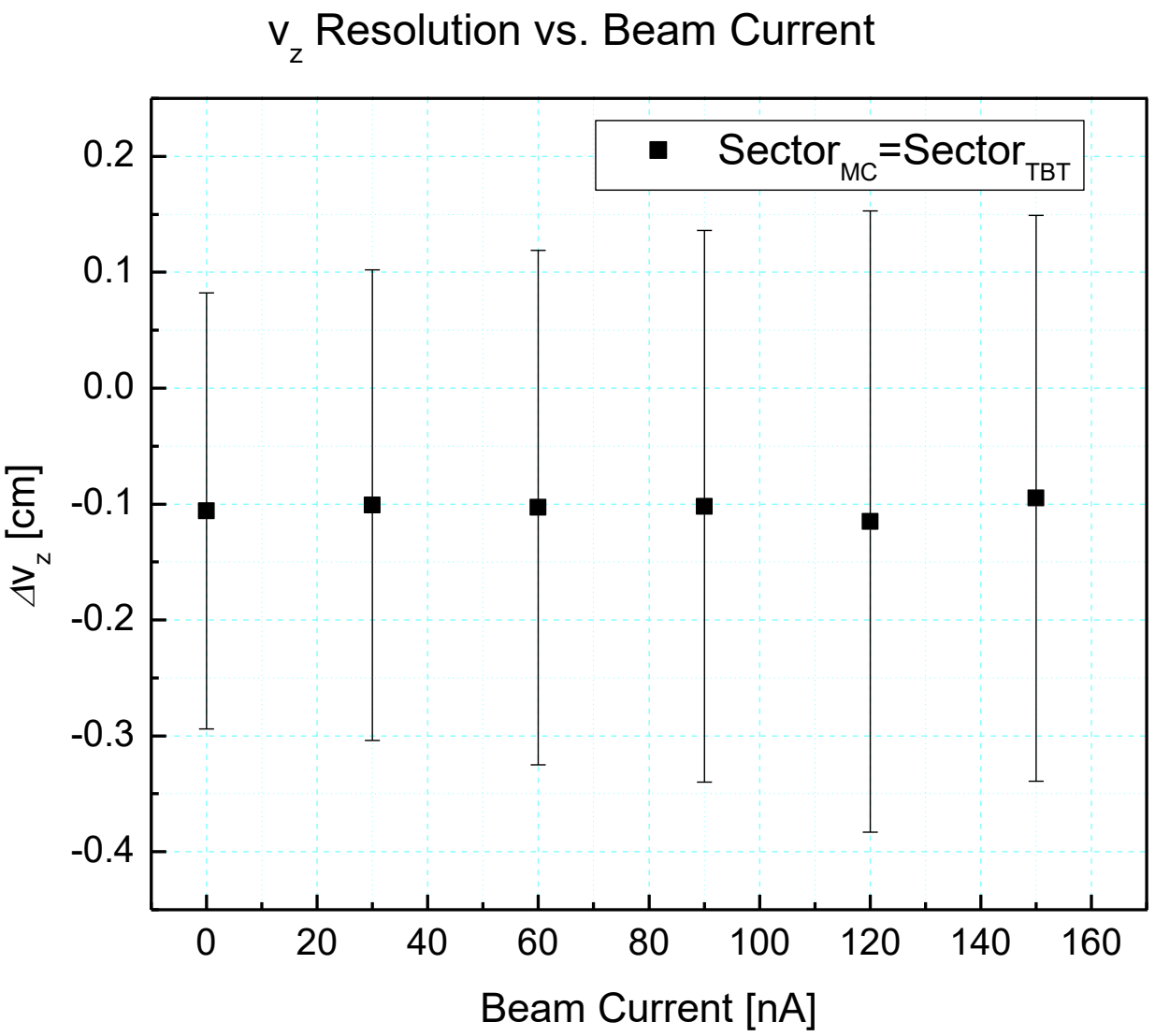
θ Resolution



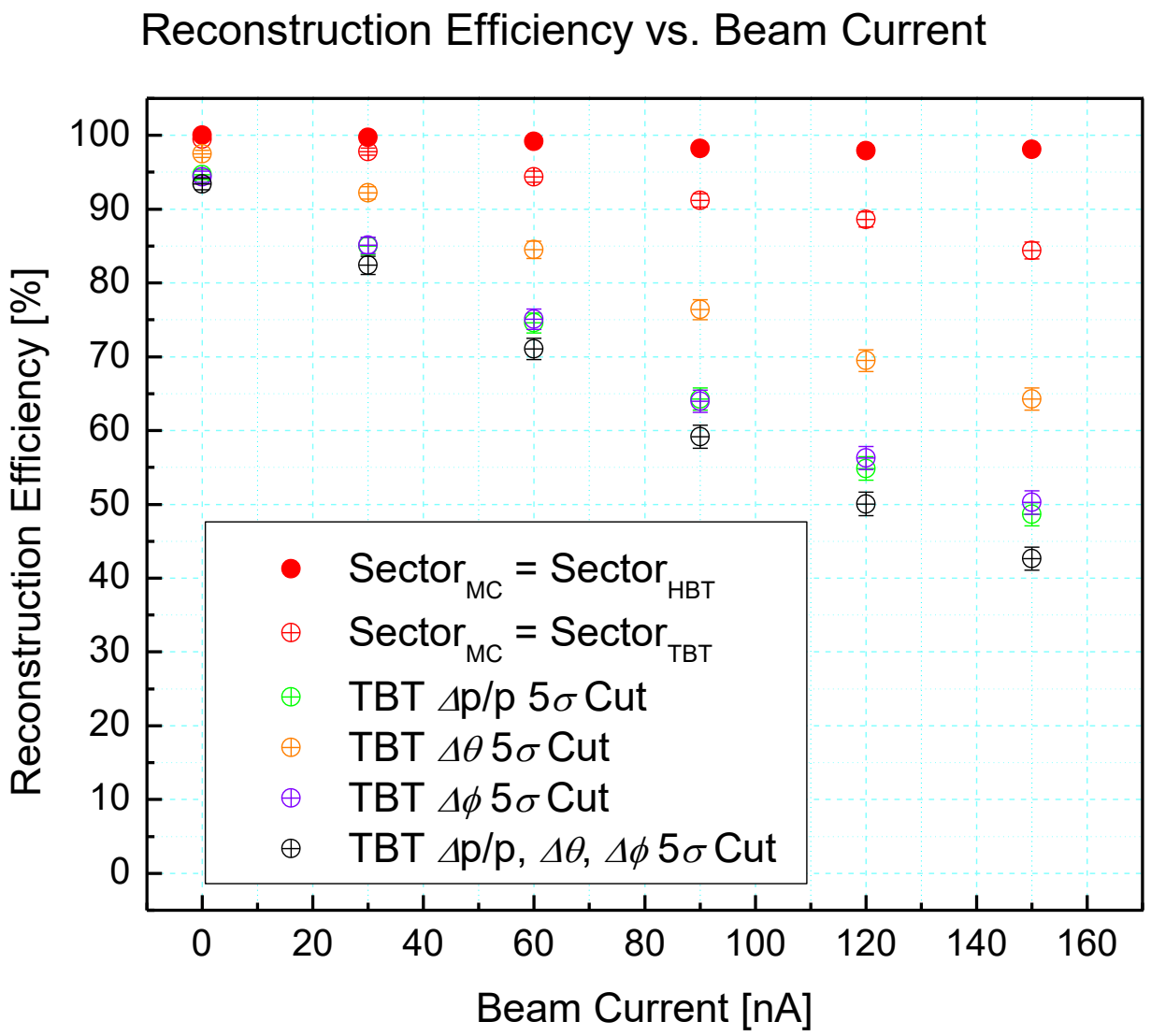
φ Resolution



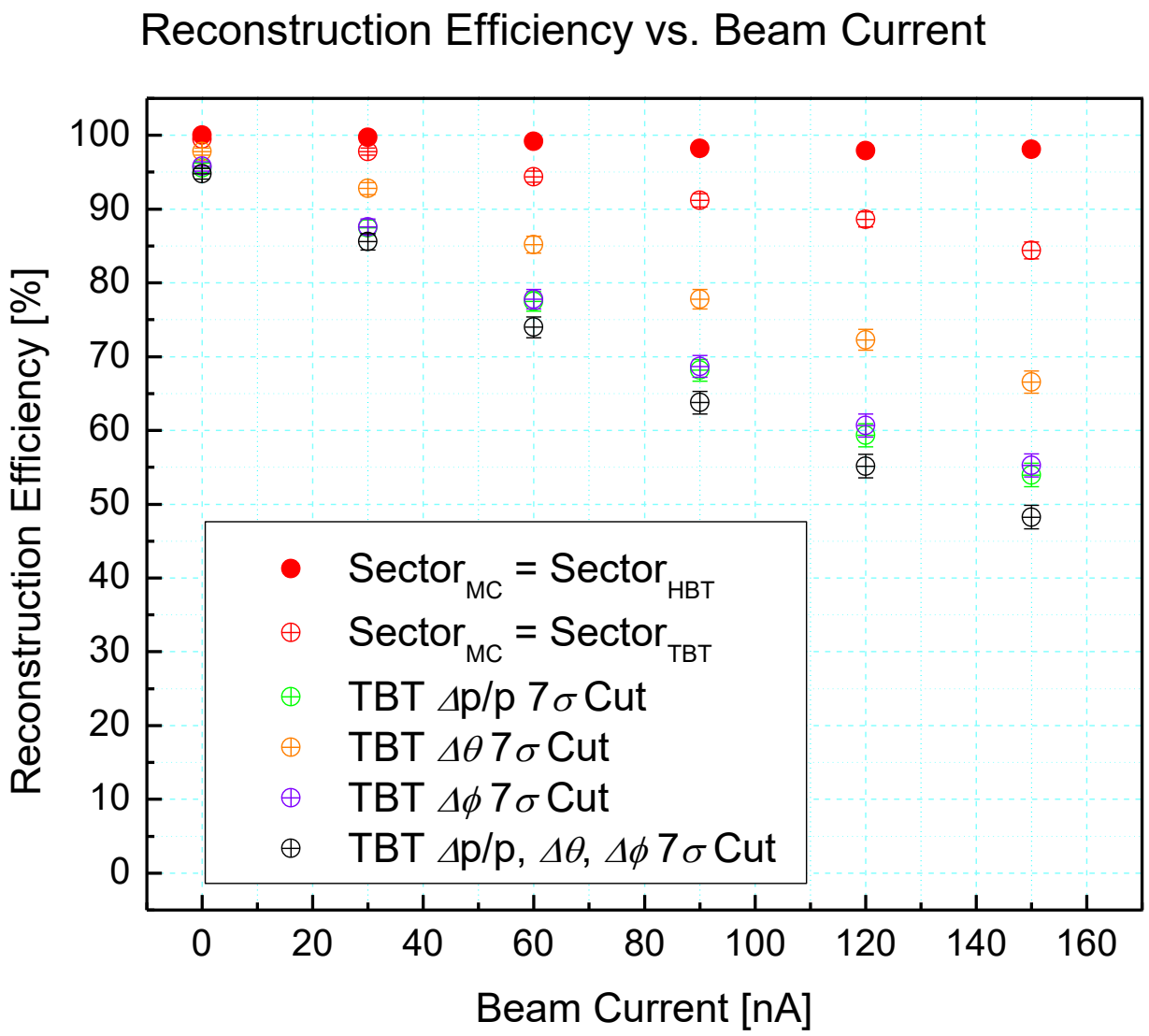
v_z Resolution



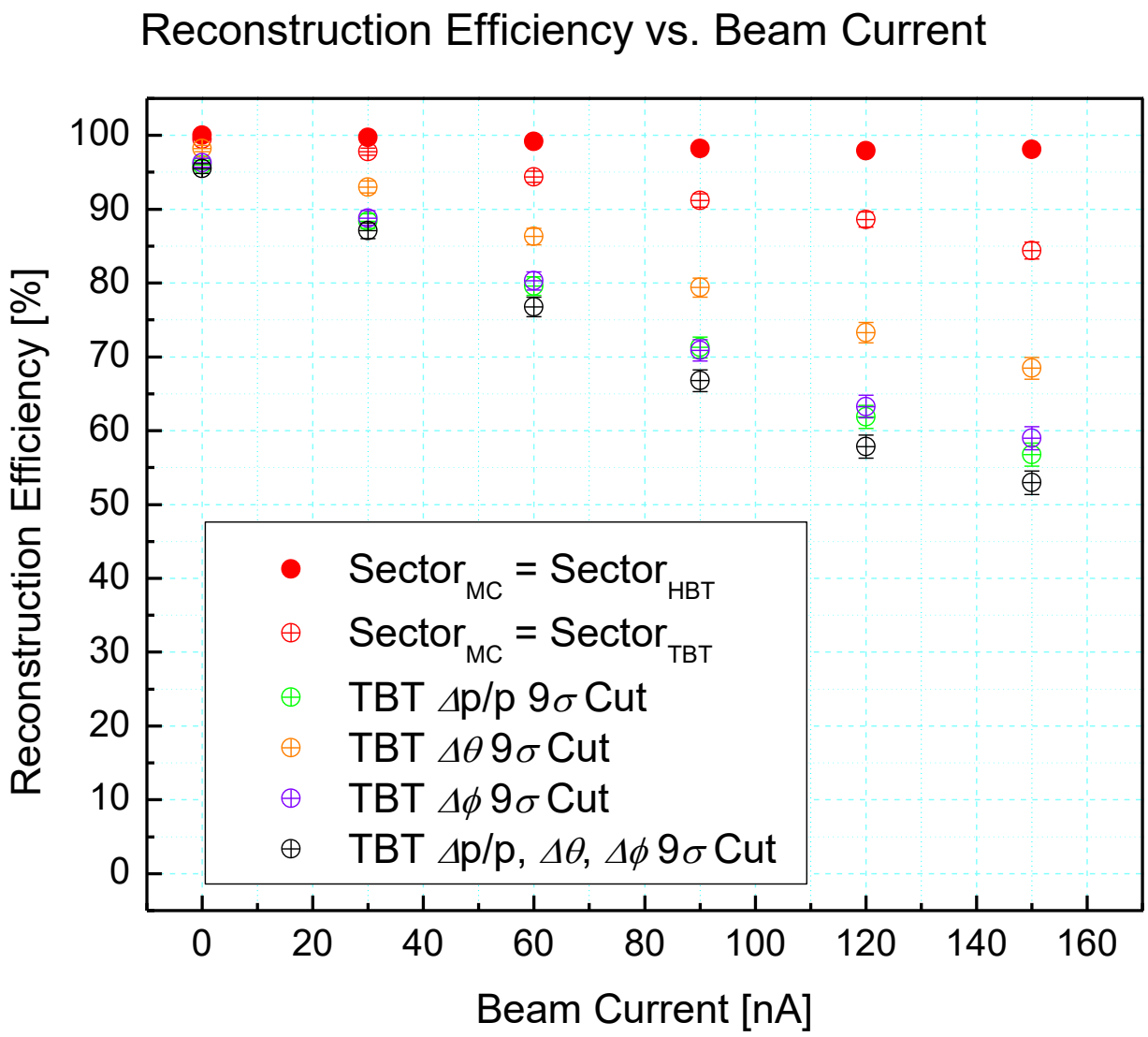
Tracking Reconstruction Efficiency



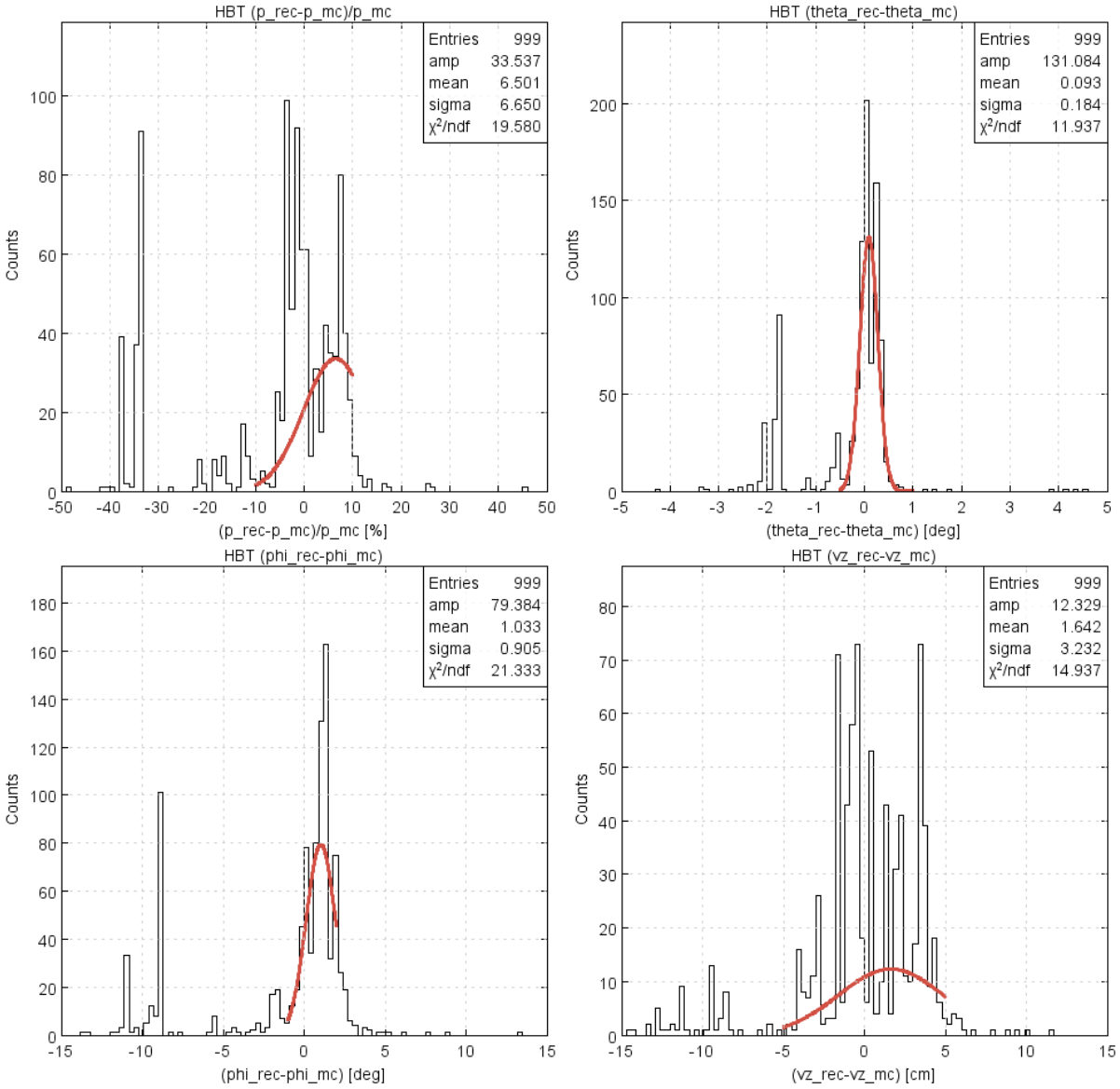
Tracking Reconstruction Efficiency



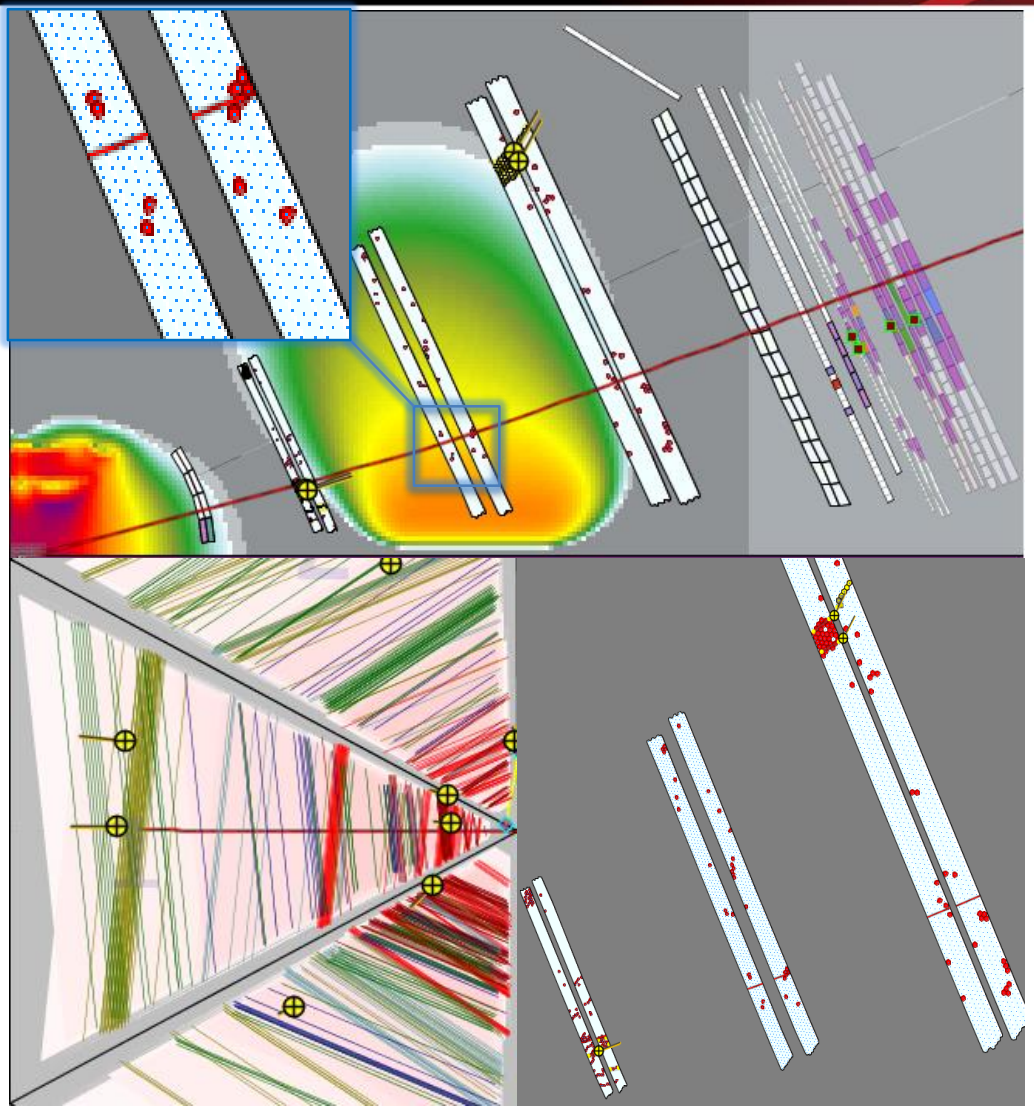
Tracking Reconstruction Efficiency



Reconstructed TBTrack: Signal

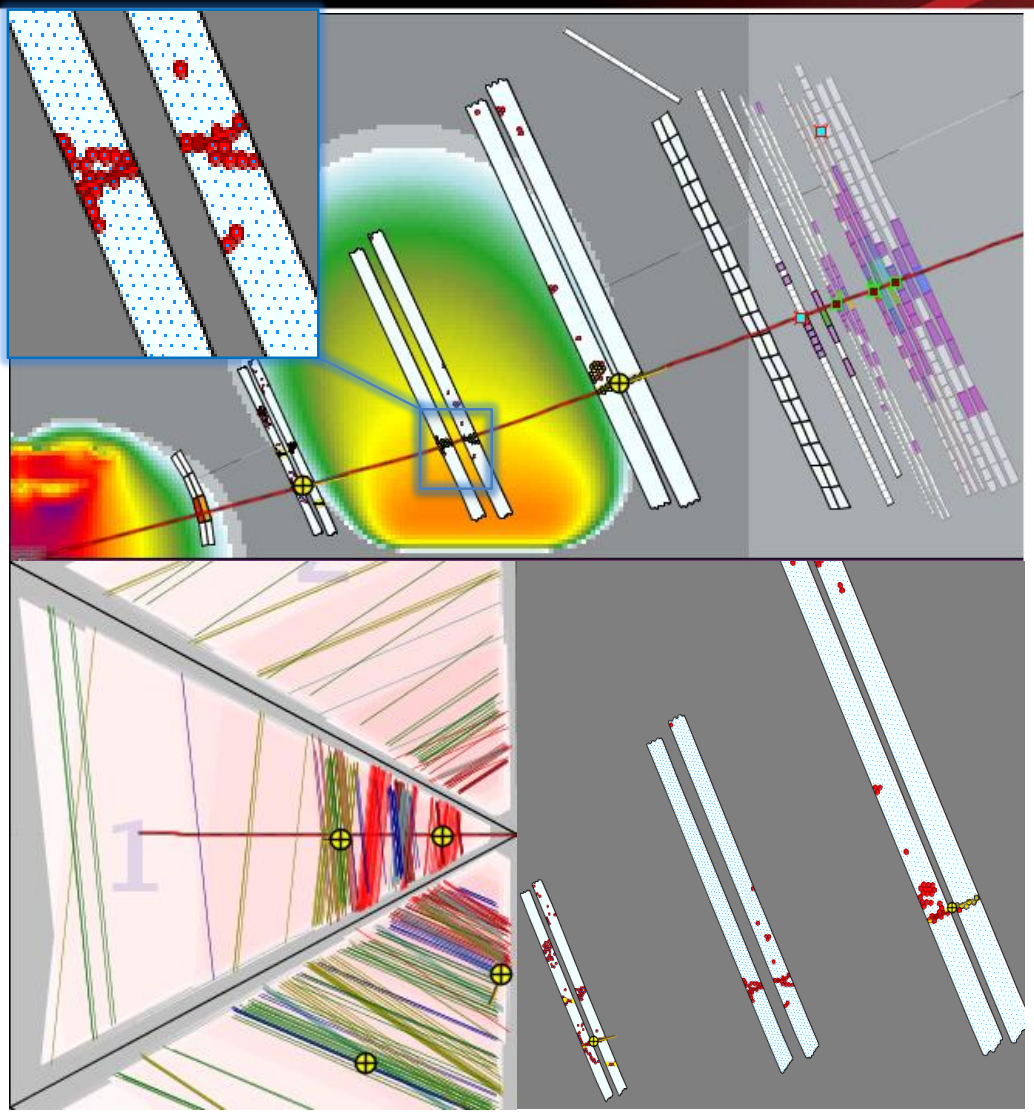


Pathology: Insufficient Hits



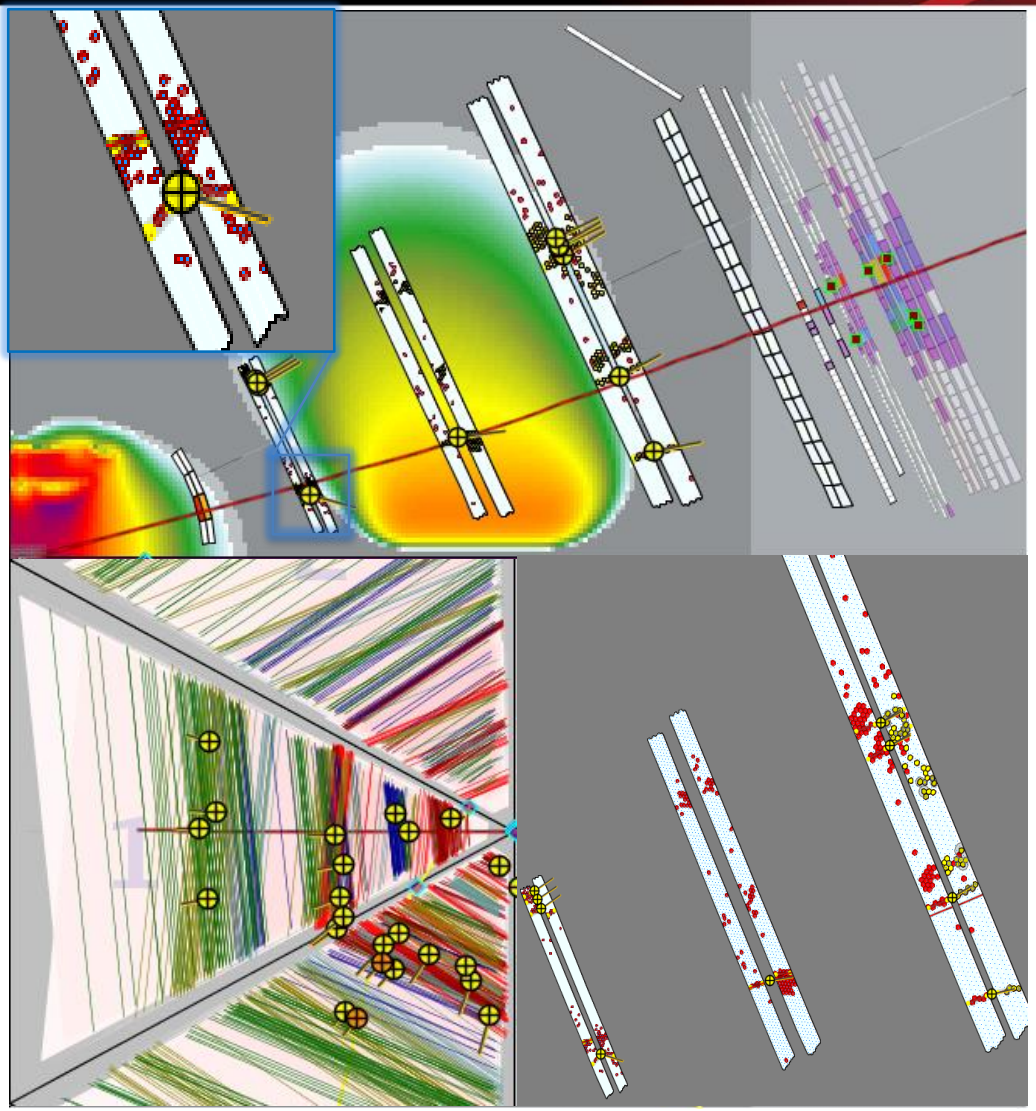
Segments are not reconstructed due to insufficient hit in at least two superlayers.

Pathology: Unresolved Hit Pattern



Segments are not reconstructed due to unresolved hit pattern in at least two superlayers.

Pathology: Misaligned Segments



There are sufficient but misaligned segments.

HBTracking Reconstruction Pathology