Conformal Tracking update

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Updates

- Speed improvement from search criteria when building displaced tracks

  - Reduces time from ~28 seconds to ~0.2, but does reduce the reconstruction of highly displaced tracks

  - Was necessary at this point due to the large number of events which stalled on the grid due to making too many track candidates (time and memory consumption)

- Additional speed improvements from rearranging or rewriting parts of the track extension through the tracker

  - Fixed endcap error gives good pickup of hits in the transition region

- Improved high p_T reconstruction efficiency by use of CA instead of simple extrapolator (tracks with $p_T > 10$ GeV/c)

```
[ DEBUG6 "MyConformalTracking"] Building vertex barrel tracks took 0.0764911 seconds
[ DEBUG6 "MyConformalTracking"] Extending through vertex endcap took 0.00152397 seconds
[ DEBUG6 "MyConformalTracking"] Building vertex tracks took 0.00307393 seconds
[ DEBUG6 "MyConformalTracking"] Building low pt vertex tracks (1) took 0.0375628 seconds
[ DEBUG6 "MyConformalTracking"] Building low pt vertex tracks (2) took 0.0285931 seconds
[ DEBUG6 "MyConformalTracking"] Building low pt vertex tracks with 4 hits took 0.0215721 seconds
[ DEBUG6 "MyConformalTracking"] Extending through trackers took 0.41566 seconds
[ DEBUG6 "MyConformalTracking"] Building displaced tracks using vertex + inner tracker 0.00775909 seconds
[ DEBUG6 "MyConformalTracking"] Extending through trackers took 0.0162761 seconds
[ DEBUG6 "MyConformalTracking"] Building displaced tracks with all detectors took 0.141279 seconds
```

- Running with 3 TeV ttbar events
  - Considering particles with generator status 1 that leave more than 4 hits in different layers of the detector
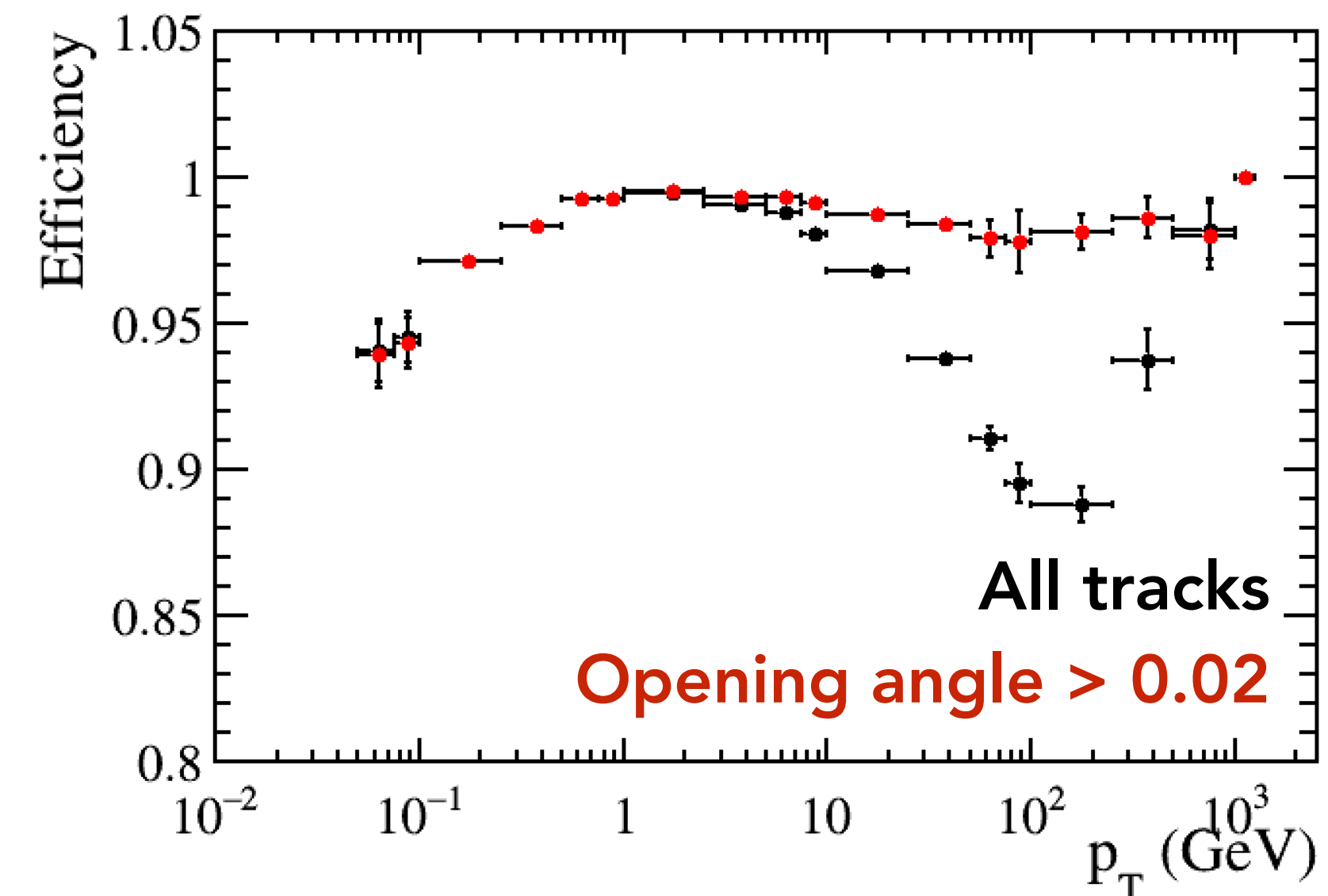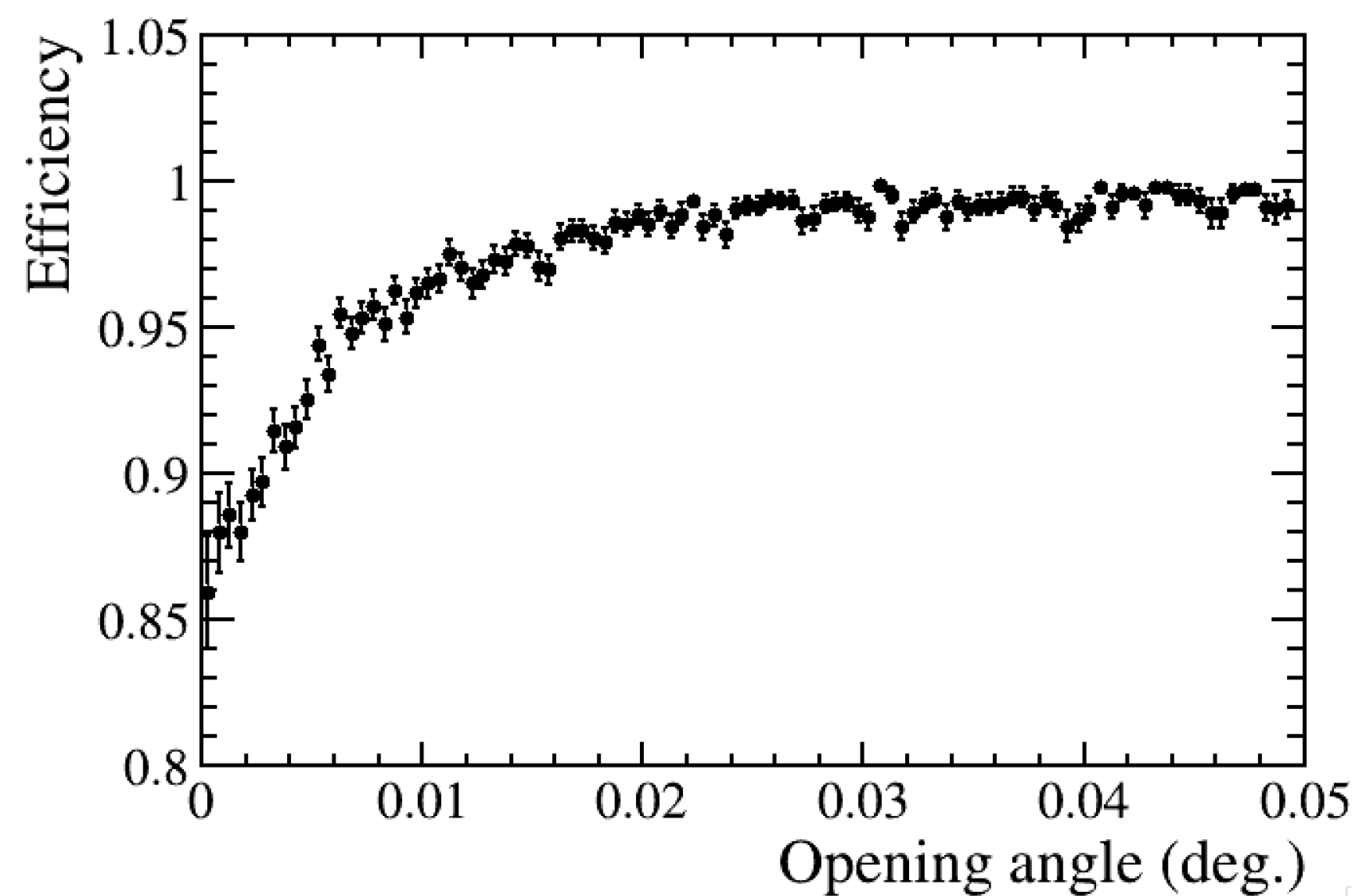
Performance testing

- Running with 3 TeV ttbar events

  - Considering particles with generator status 1 that leave more than 4 hits in different layers of the detector

  - $15° < \theta < 165°$

  - $r_{vertex} < 50$ mm

  - $p_T > 1$ GeV/c

All tracks

Opening angle > 0.02

Performance testing
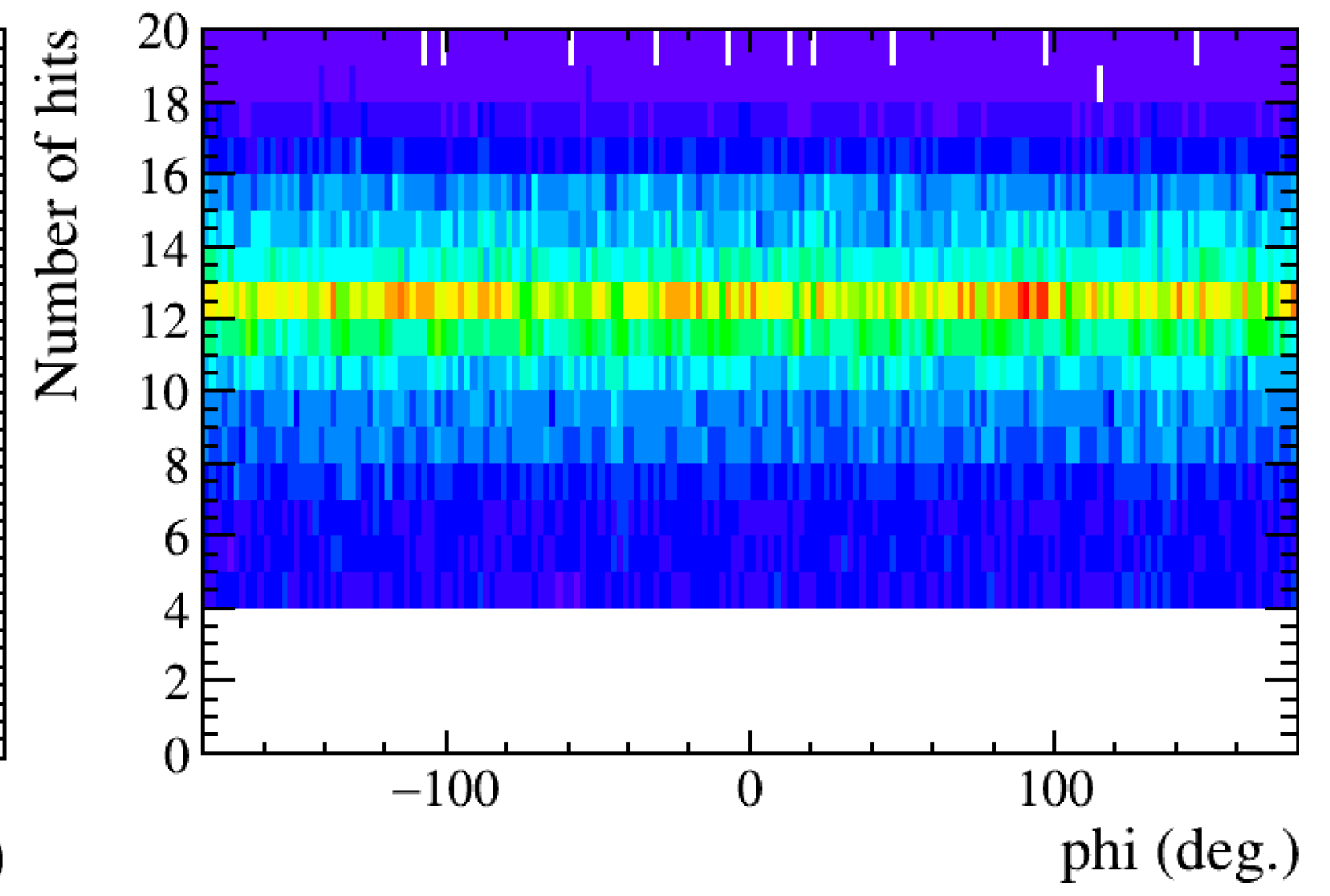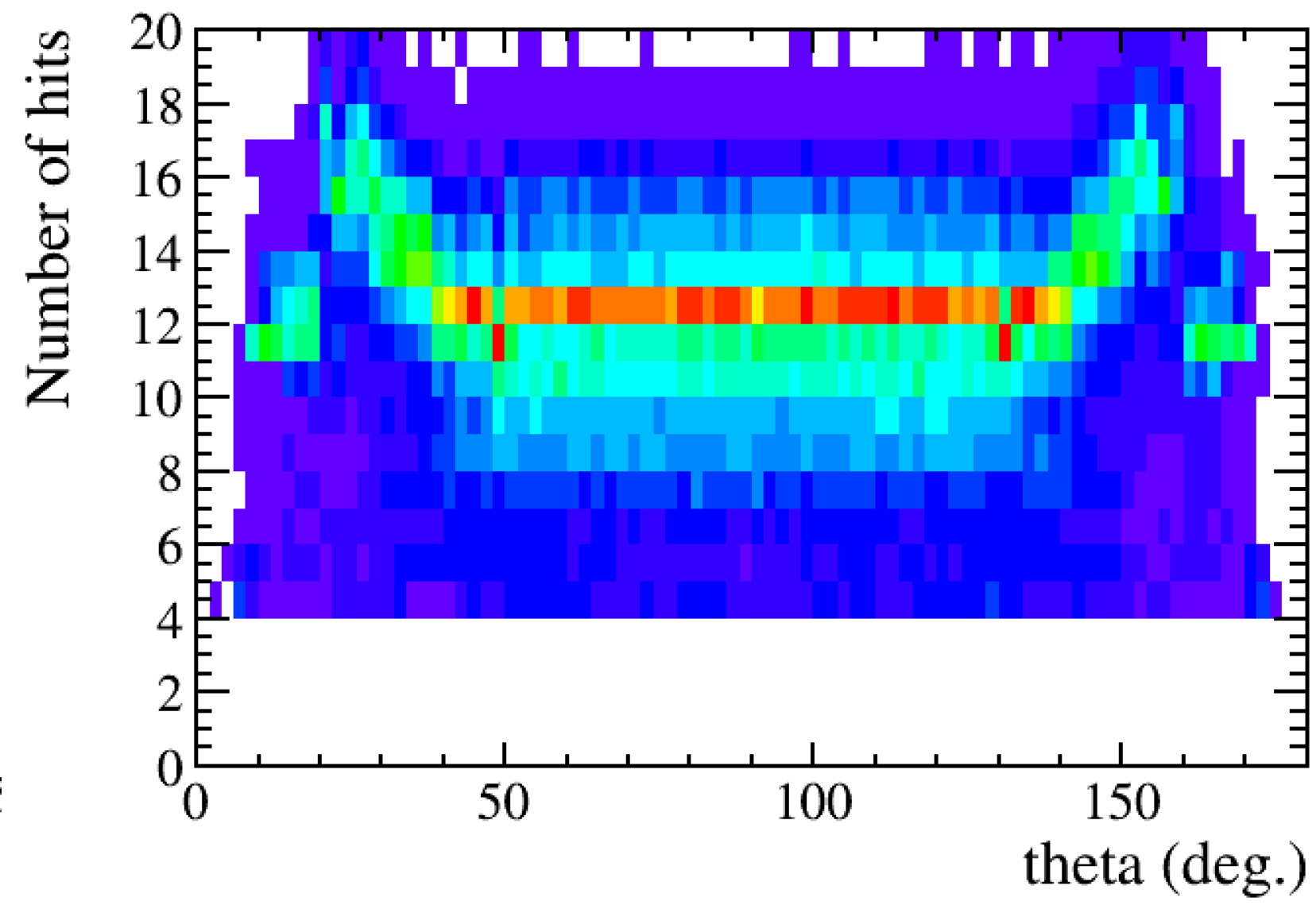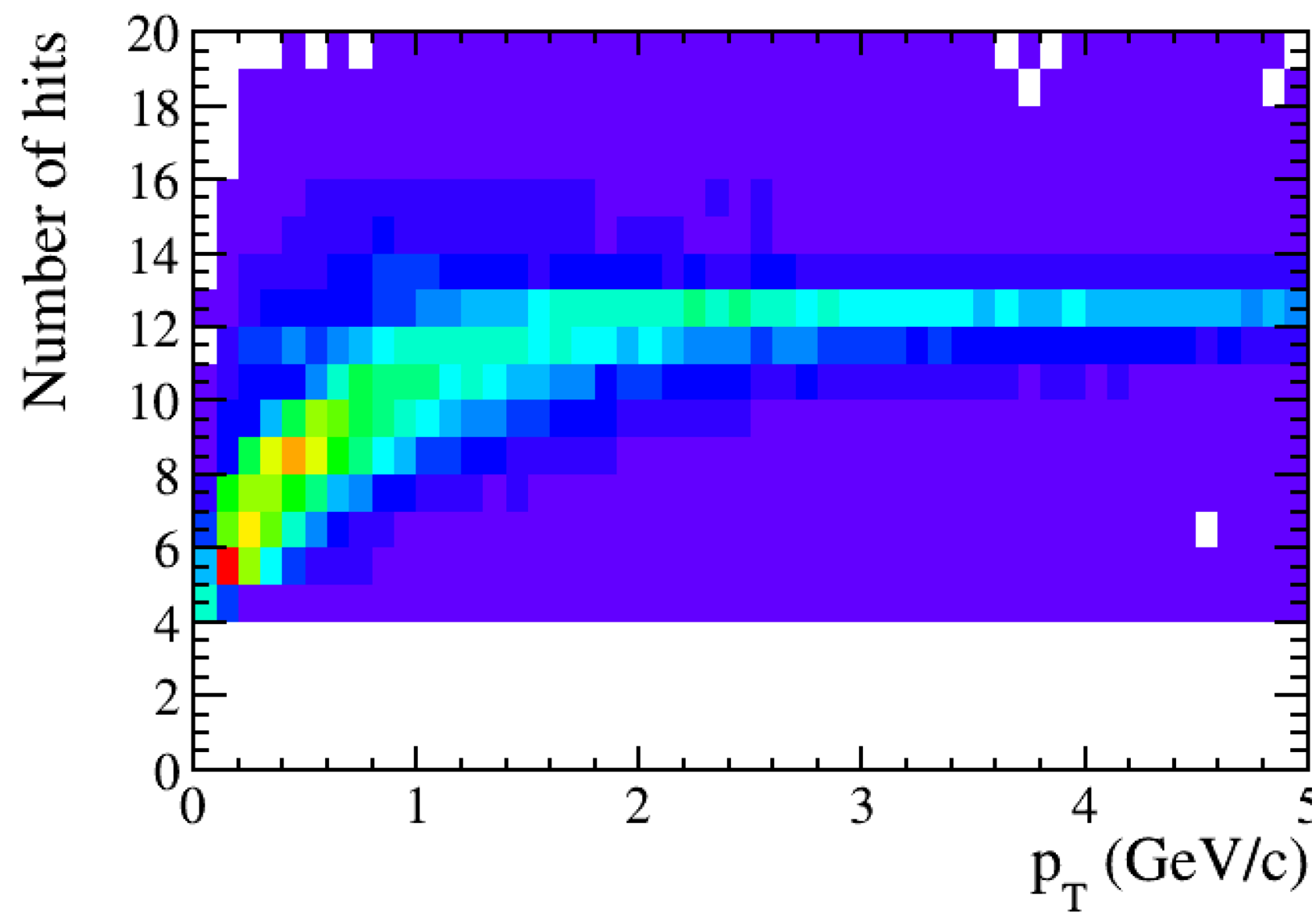
- Running with 3 TeV ttbar events
  - Considering particles with generator status 1 that leave more than 4 hits in different layers of the detector
  - $15° < \theta < 165°$
  - $r_{vertex} < 50$ mm
  - $p_T > 1$ GeV/c **and closest track > 0.02**
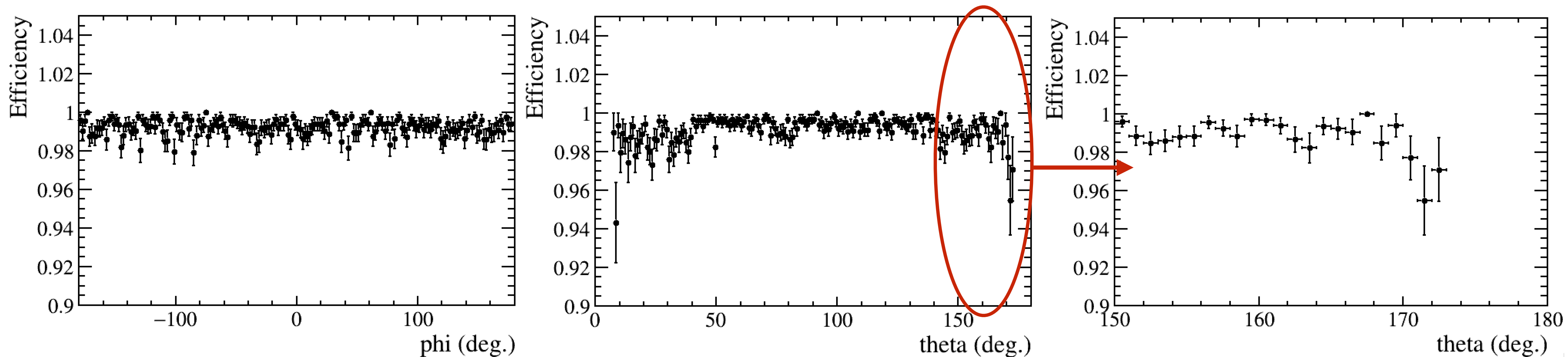
Next step

- The fix to improve timing and prevent crashes with high multiplicity events reduced the tracking efficiency for displaced tracks

  - Coming up with a sensible way to do this without combinatorics exploding is one of the last big issues before overlay studies (the other being generator status 2)

- Also have SiD reco events to compare with CDR, determine what is "reasonable"

- Looking at displaced tracks to see what exactly they are - many appear to be e⁺e⁻ pairs produced in material interactions?

Single muons (old code)

TTbar (new code)