Hit Merging and PatRec Confusion in Fastsim: Update

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Overview

- At the Orsay meeting, presented first look at a module that merges nearby hits in the tracking detectors
- The module runs after PmcSimulate but before PmcReconstruct
- The module also was designed to flag hits that are close but don't get merged in order to use them in a pattern recognition confusion module that would run after PmcReconstruct.

Since Orsay...

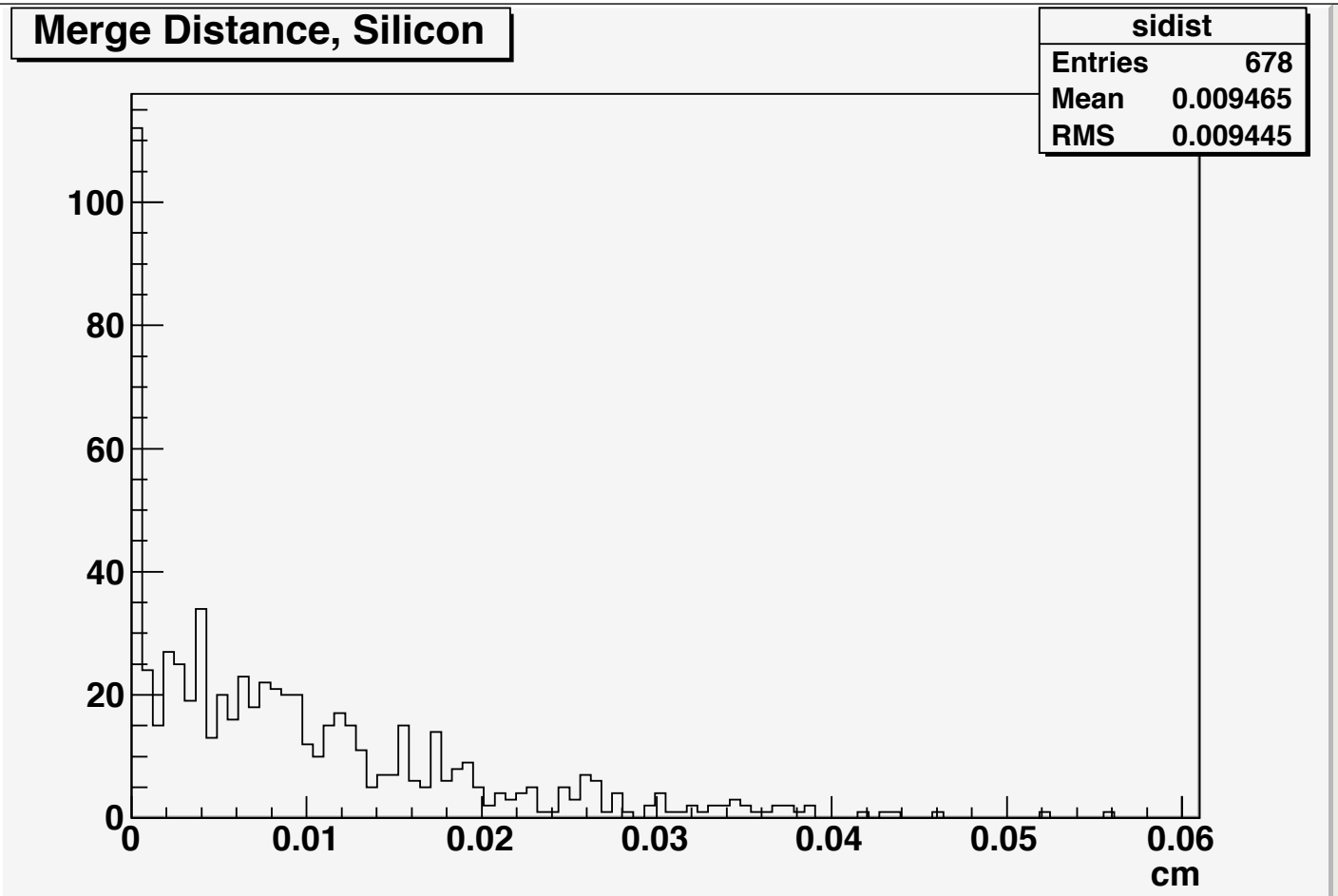
- Incorporated many if not all of the items discussed during the Orsay meeting
- Merging criteria determined by DCH cell size and Silicon strip pitch as opposed to intrinsic resolution
  - Currently DCH cell size is input via TCL-able parameter into the module. Default is 18mm.
    - Should be put into the xml detector description somehow. It will most likely be needed by other code, i.e. dE/dx
  - Silicon pitch pulled from pitch-to-thickness ratio that's already a part of the Silicon hit view object
    - Just had to add an accessor
    - Not sure if this value is used by anyone else? Is it accurate?
  - Thickness comes from geometry

Since Orsay (cont.)...

- Original SimHit position is no longer over-written, but accessible through a new SimHit member, "originalPosition()". The normal "position()" member will return the merged hit position if appropriate, so non-experts shouldn't be affected but experts can still get to the unmerged position.
- Sped the code up a bit. Got rid of all the "poca" calls at the price of having to write some less general code, but it's a lot faster. Still some known speed improvements that could be made, though.
- List of SimHits to be used for pattern recognition confusion is created.
  - Still have to write the patrec confusion module.

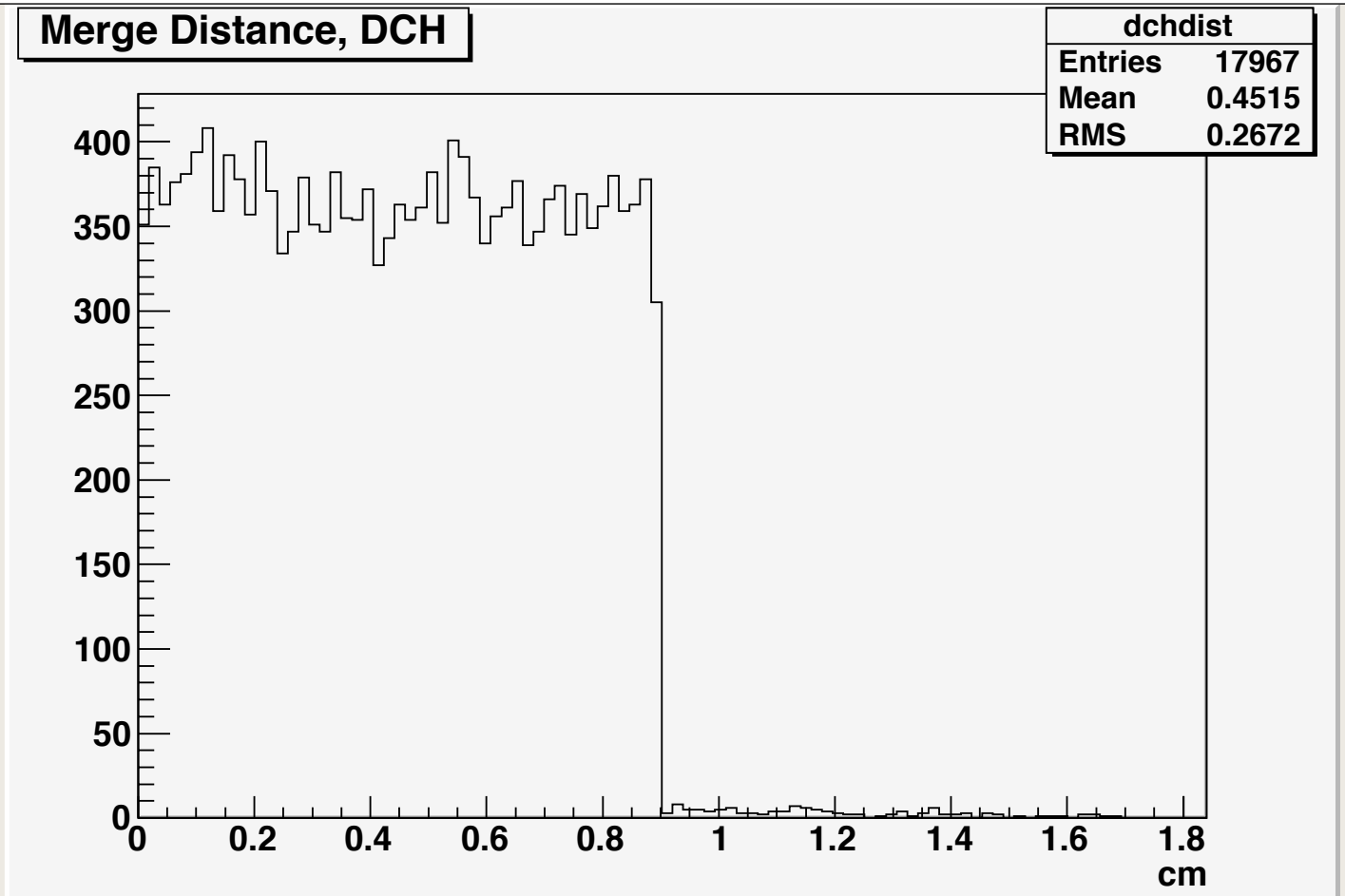
Merging criteria

- Silicon:
  - Effective hit width is calculated based on the track angle w.r.t. the normal to the detector surface in the direction of the measurement.
  - Minimum width set to "1" in units of the pitch.
  - If the separation between the edges of two hits is less than 2*pitch, then merge hits.
    - 2*pitch is somewhat arbitrary. TCL-controllable
  - Pixel-types must be close in both views
  - Strip types still have to be reasonably close (<5cm) in other view
- DCH
  - Hits merged if their separation is less than the DCH cell size
  - Accounts for stereo angle
- All merging is done simply by taking the average position of the two hits in the direction of the hit measurement
- Merged hits are kept on the surface of the corresponding detector element. i.e. DCH hits move in ϕ (and z if stereo) but not in r.
- Track with largest momentum keeps the merged hit, the lower momentum track gets its hit turned off.



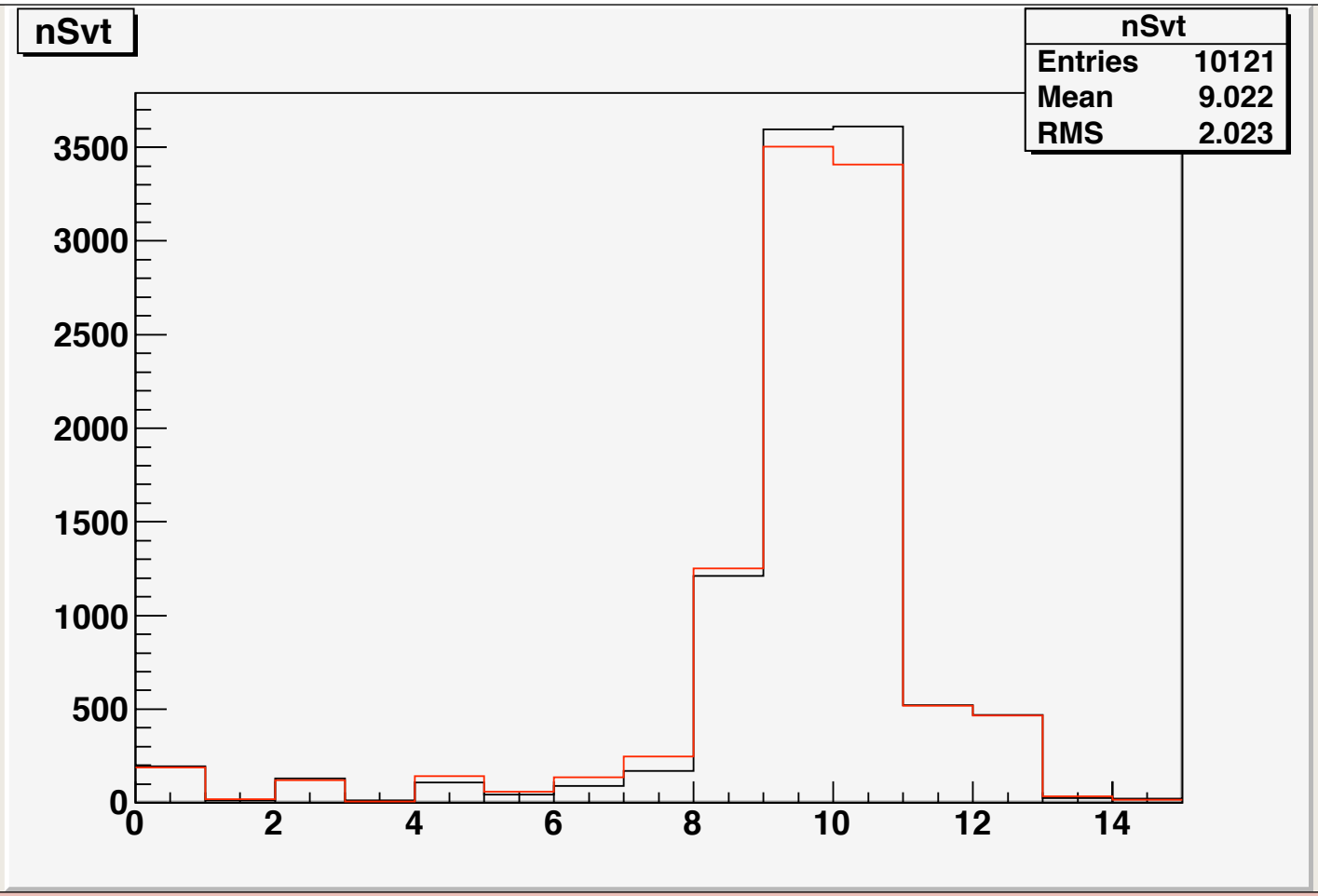
Distance moved by hit in merging, Silicon

Peak at zero from two sources: pixels and interactions.



Distance moved by hit in merging, DCH

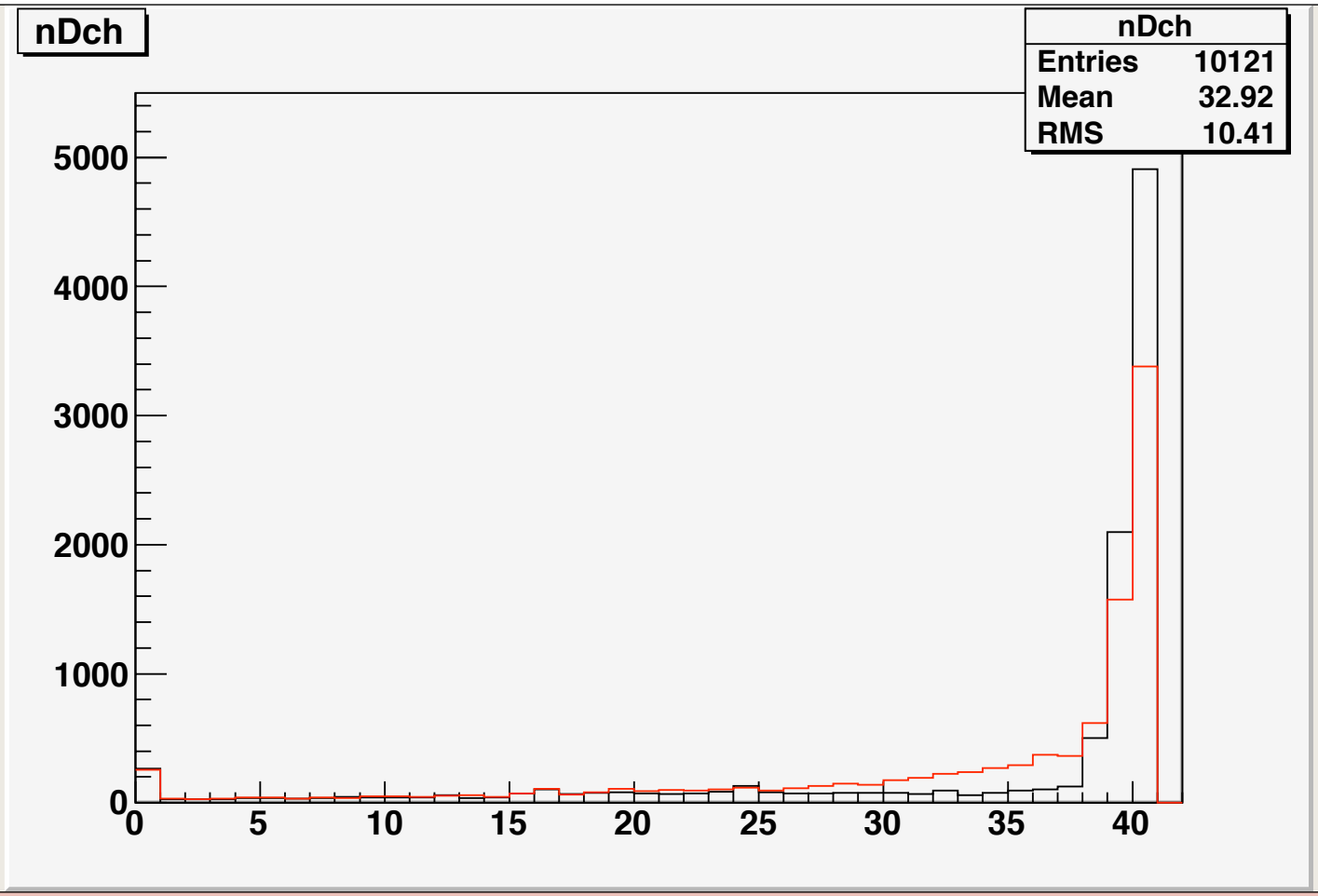
Single merge distance limited by DCH cell size. Small tail above 0.9 cm comes from hits that were merged more than once.



Number of hits in the Silicon

Black: No hit merging

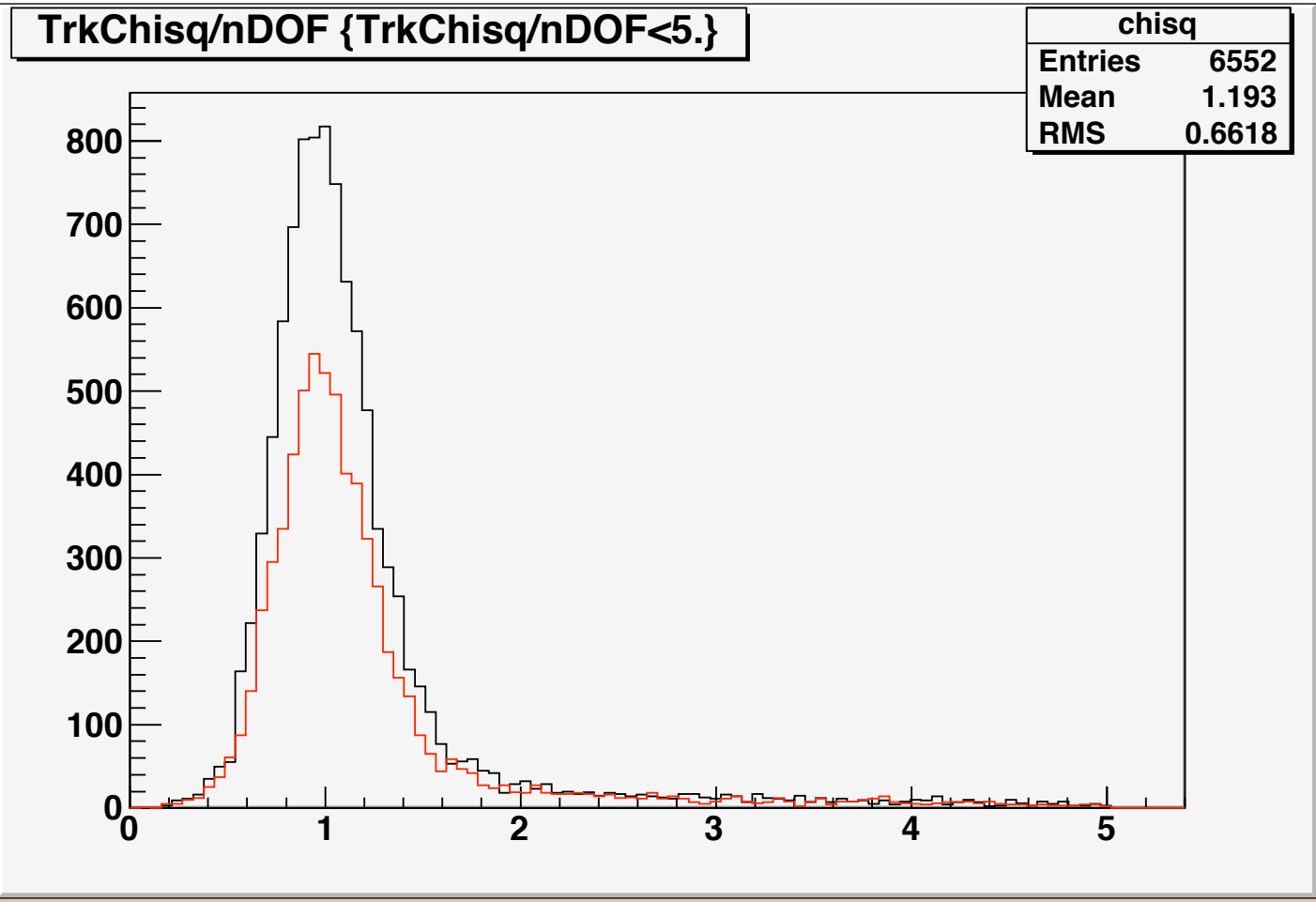
Red: With hit merging



Number of hits in the drift chamber

Black: No hit merging

Red: With hit merging



Track fit χ^2 /dof

Black: No hit merging Red: With hit merging

Note: This loss of tracks in the central peak is disturbing!

Status

- I think the hit merging code is ready to be committed.
  - Just disable the module if it's causing any problems
- Possibly too aggressive on the DCH merging?
  - There's a pretty significant loss of tracks in the central χ^2/dof peak
    - Question: Does fitter drop hits with large χ contribution?
    - There's only a 1% loss of all tracks, but large tail in the χ^2 distribution
      - ("all" means "all", not just primary tracks)
- Add timing as a criteria. (Is the design of time defined yet?)
- Next is to focus on writing the pattern recognition module
- Other suggestions?