Inspection of Tracks in a b-jet with FPCCD

Tatsuya Mori

Performance evaluation of flavor tagging

- using FPCCD and FPCCDTrackFinder
- considering pair-BG
- Sample: Z → bb, cc, qq @ 250 GeV
- Flavor Tagging Algorithm: LCFIPlus
  - sample: 2000 events individually
  - training sample: 14000 events individually

Degradation from pair BG

setup	b-tag purity [%] @ efficiency 80 %	c-tag purity [%] @ efficiency 60 %
CMOS + std tracking (without pairs)	82.5	44
CMOS + FPCCDTrackFinder (without pairs)	83	42.7
with pairs	40.7	21.5
FPCCD + FPCCDTrackFinder (without pairs)	85	50
with pairs	21.5	18.5

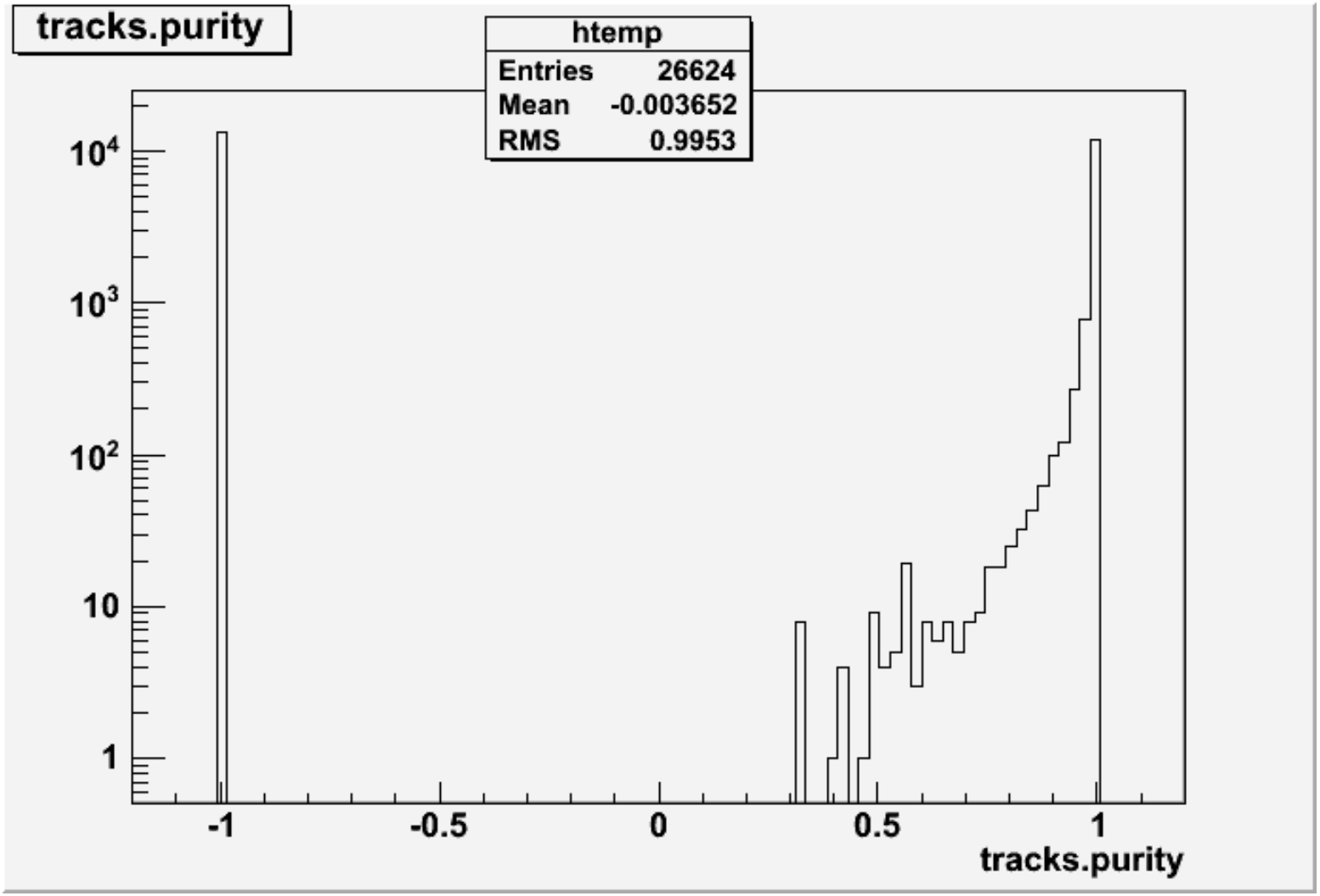
I checked how pairs deteriorated flavor tagging

Setup for checking tracks in b-jets

- Sample: Z → bb @ 250 GeV with pair BG
- CMOS + FPCCDTrackFinder
  - I assume that the reason purity degrades is the same as the case of FPCCD
- analyze tracks in b-jets
  - # of b-jets: 1102
  - # of tracks in b-jets: 26624

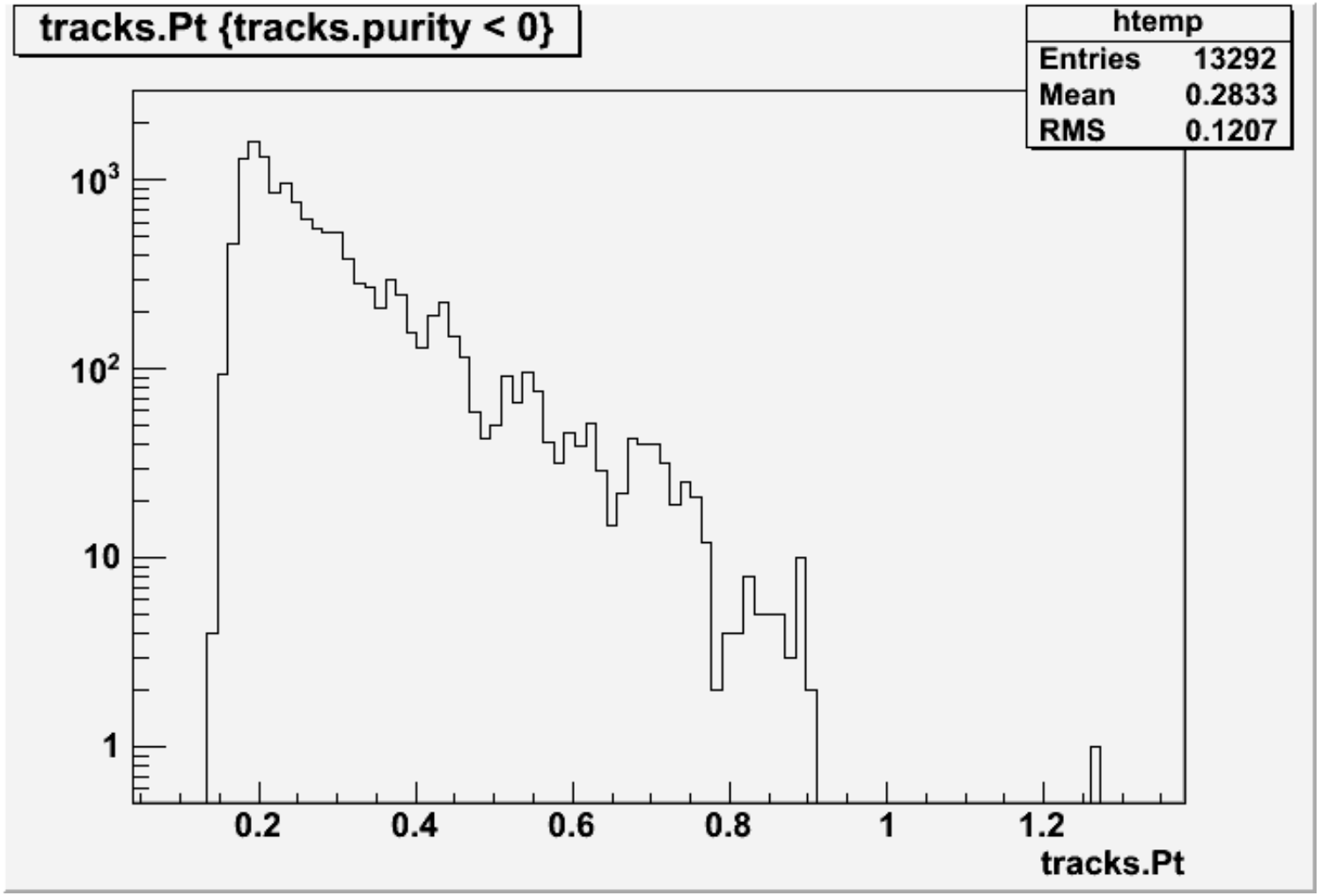
- **Term Definition for Track**
- purity ≡ (# of true assigned hits)/(# of all assigned hits)
- purity == -1 : named pair BG track in this slide
  - the track which comprises only pair BG hits,
    but those hits are not assured to originate from just only one pair BG

purity distribution



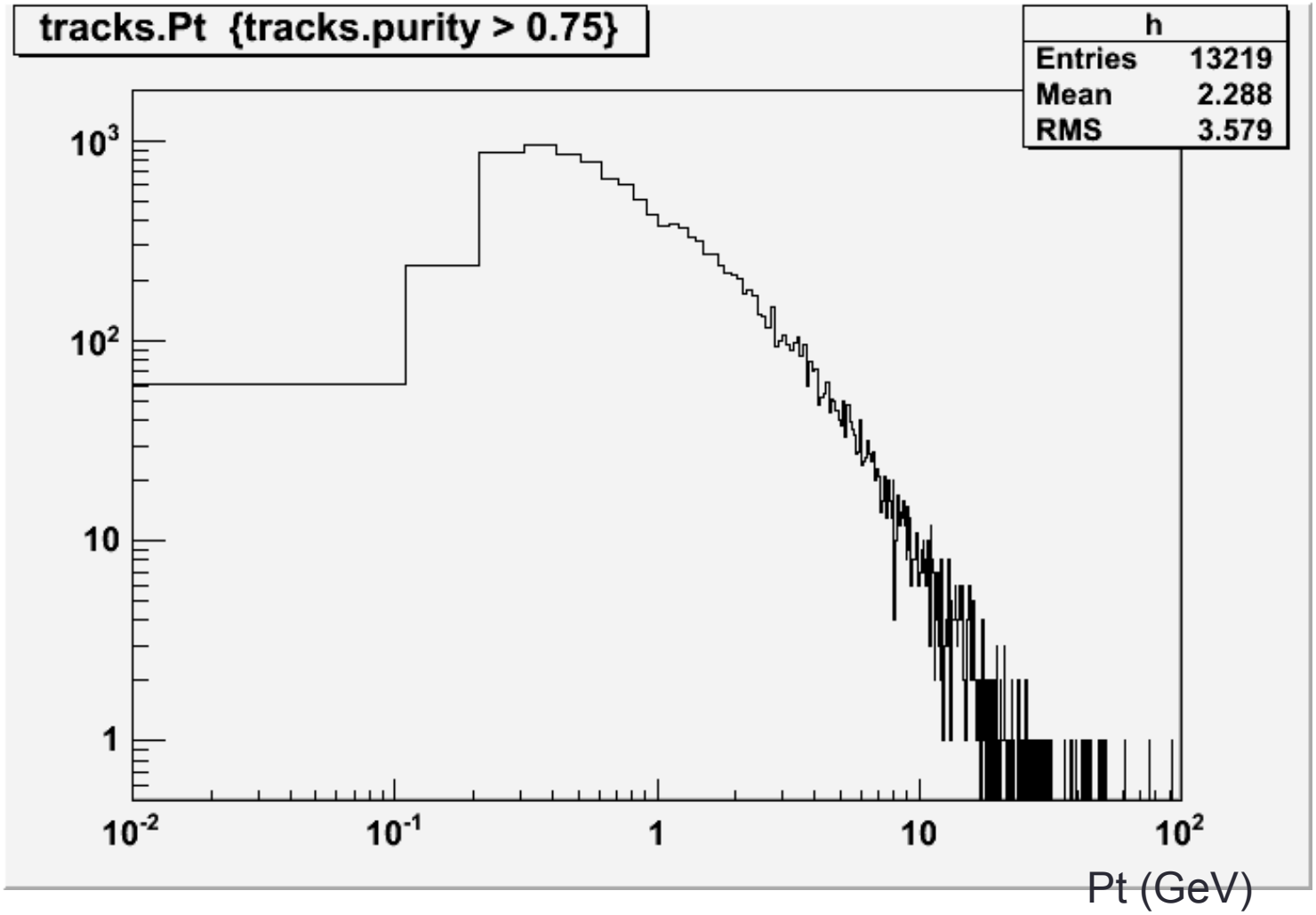
→Half of the tracks in b-jet are pair BG tracks

Pt distribution of pair BG tracks



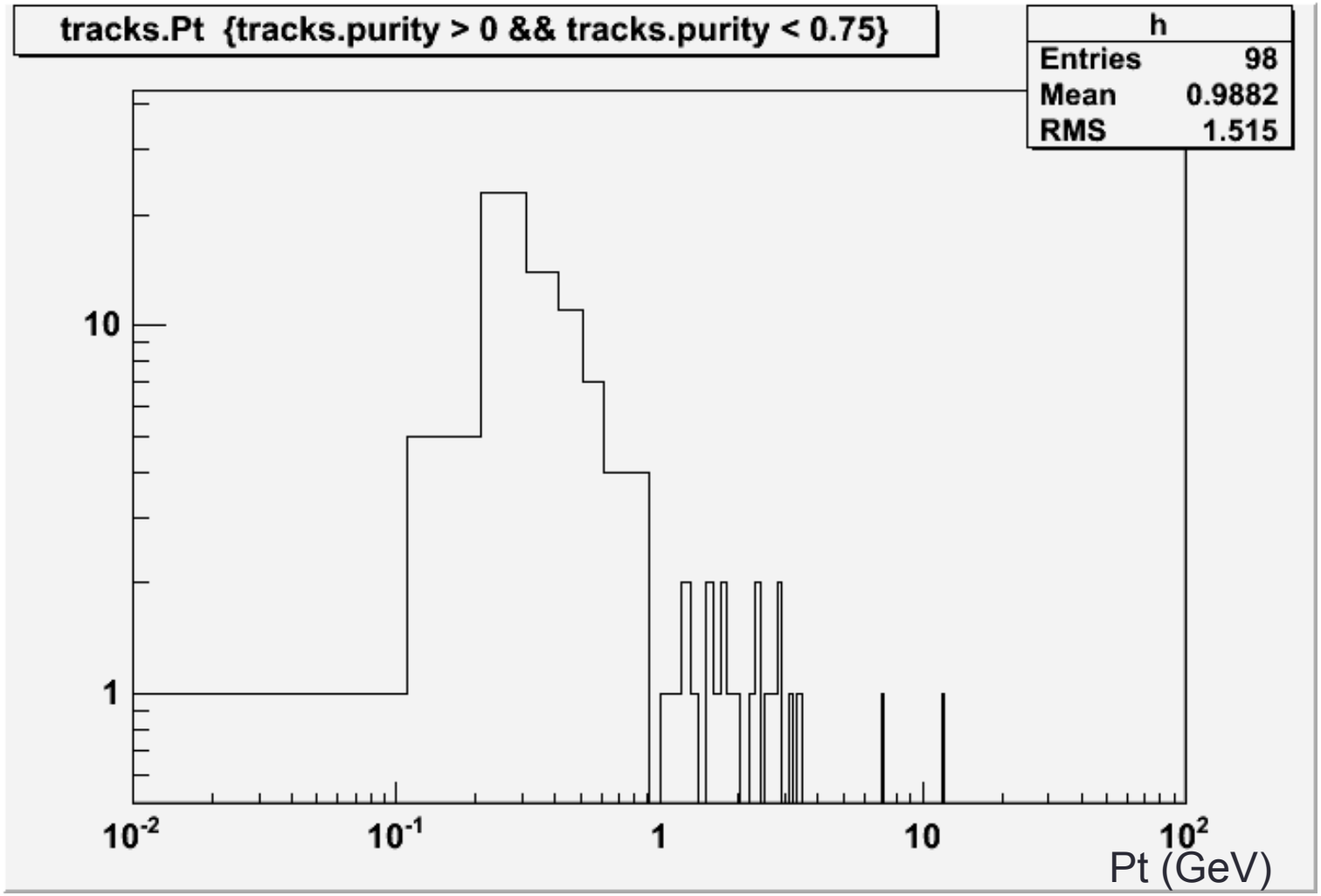
Pair BGs in b-jets have low Pt

Pt distribution of tracks with purity > 0.75

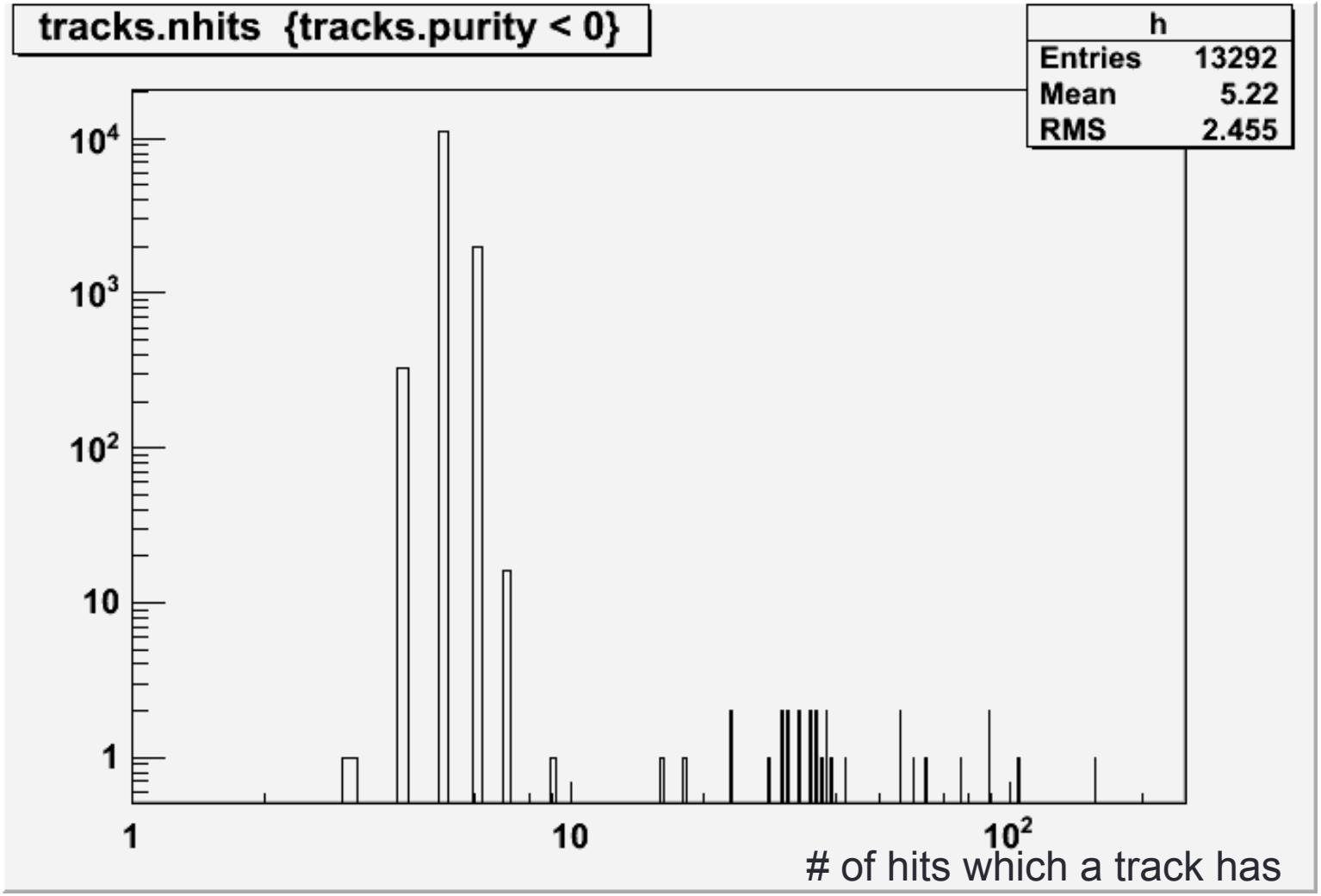


→A lot of low Pt tracks with purity > 0.75 are used

Pt distribution of tracks with 0 < purity < 0.75



Strategy of reducing pair BG tracks

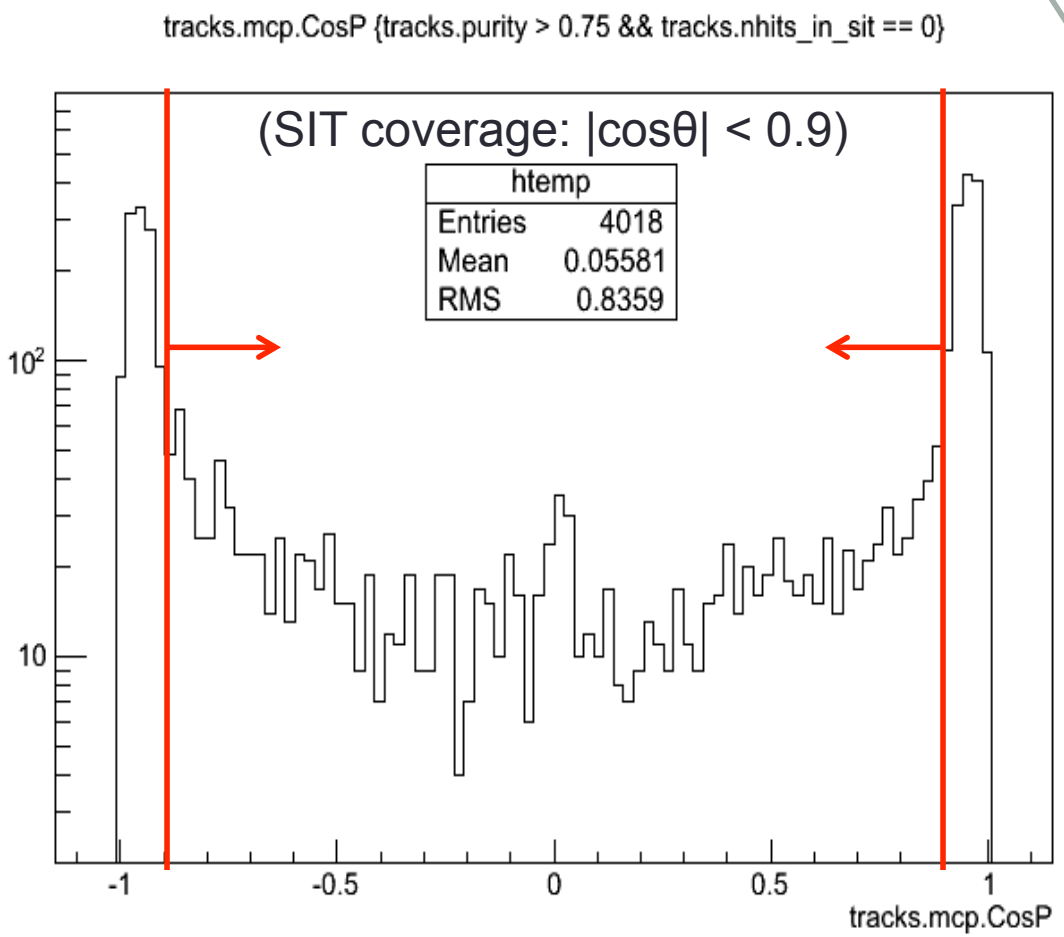


Most of pair BG tracks have only 4 ~ 6 vxd hits

→If we require tracks to have SIT hit >= 1, most pair BG tracks are reduced

Checking how many tracks with purity > 0.75 have no SIT hits

purity > 0.75 : 13219
purity > 0.75 && no SIT hits : 4018
purity > 0.75 && no SIT hits && |cosθ| < 0.9 : 1555



MCP corresponding to these tracks

- 20% : have no SIT hits
- 80% : have SIT hits >= 1

FPCCD Track Finder should be modified about assignment of SIT hits

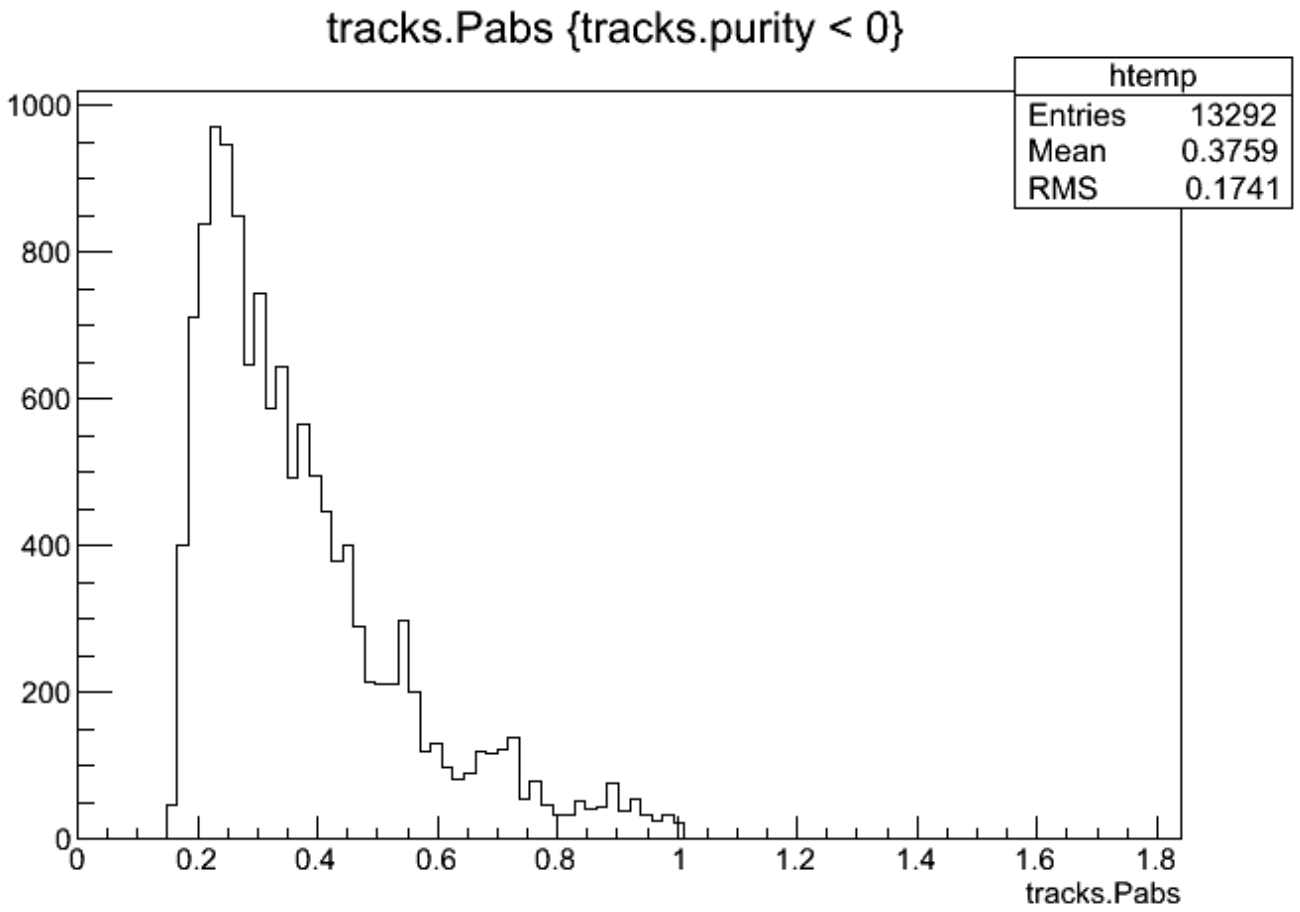
Summary and Plan

- Summary
  - 50 % of tracks in b-jet are pair BG tracks
    - Those tracks have Pt < 1 GeV
  - Most pair BG tracks don't have SIT hit
    - We should require tracks to have SIT hits

- Plan
  - Requirement that "SIT hits >= 1 || TPC >= 1 || FTD hits >= 1" will be implemented in FPCCDTrackFinder

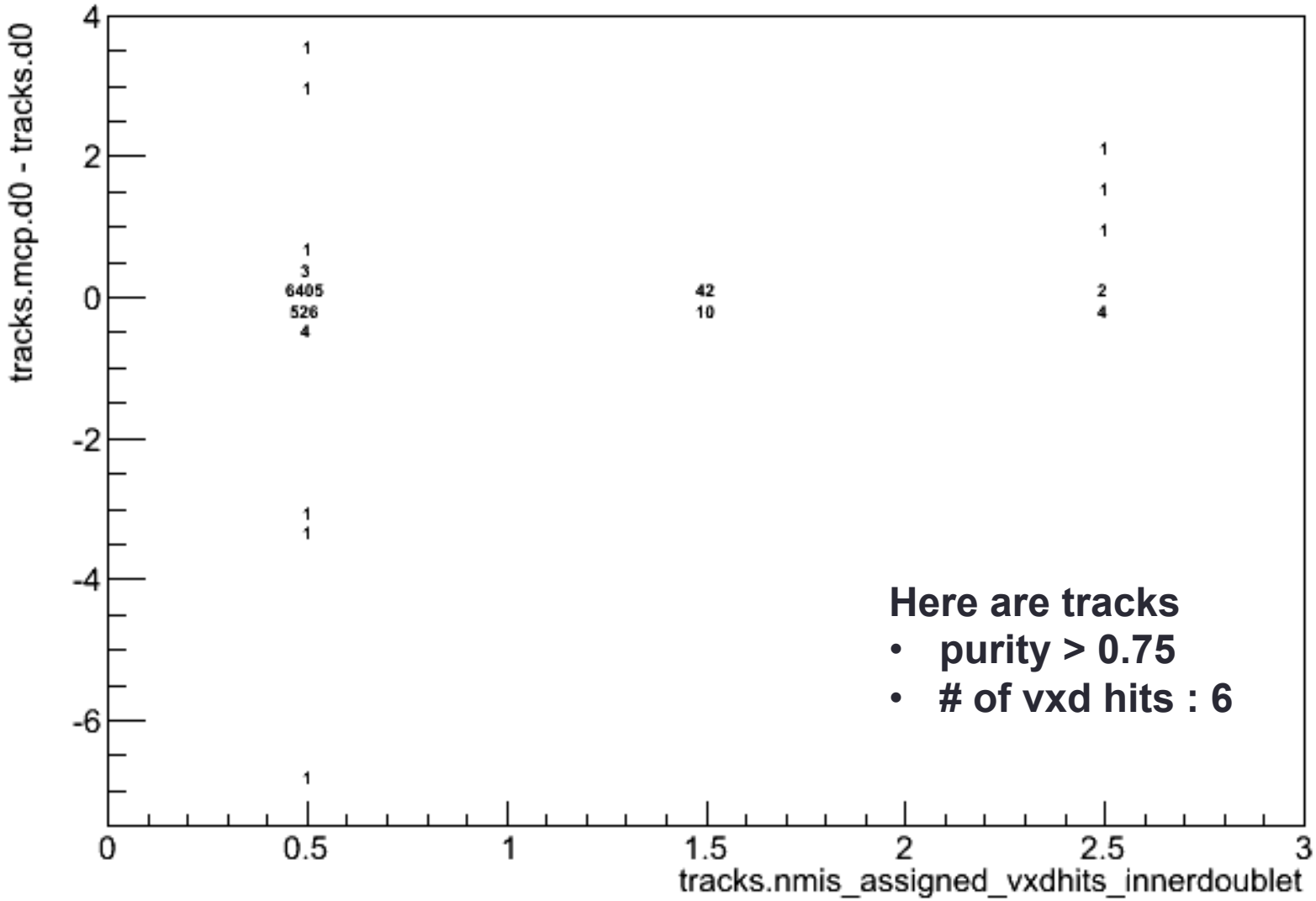
Backup

Pabs distribution (purity == -1)

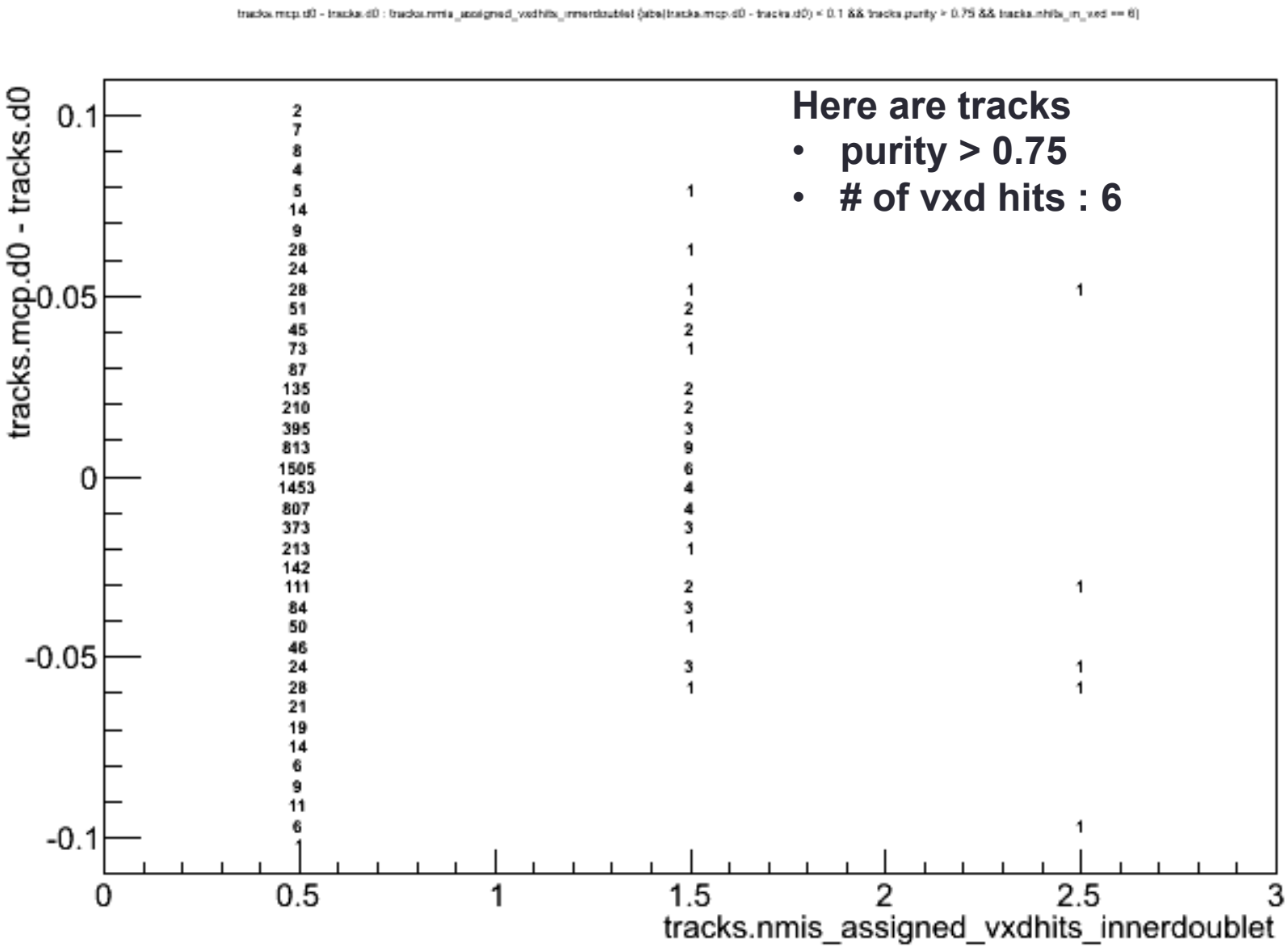


Relation between impact parameter and vxd hit

discrepancy of d0 vs # of mis-assigned vxd hits in innermost doublet layer

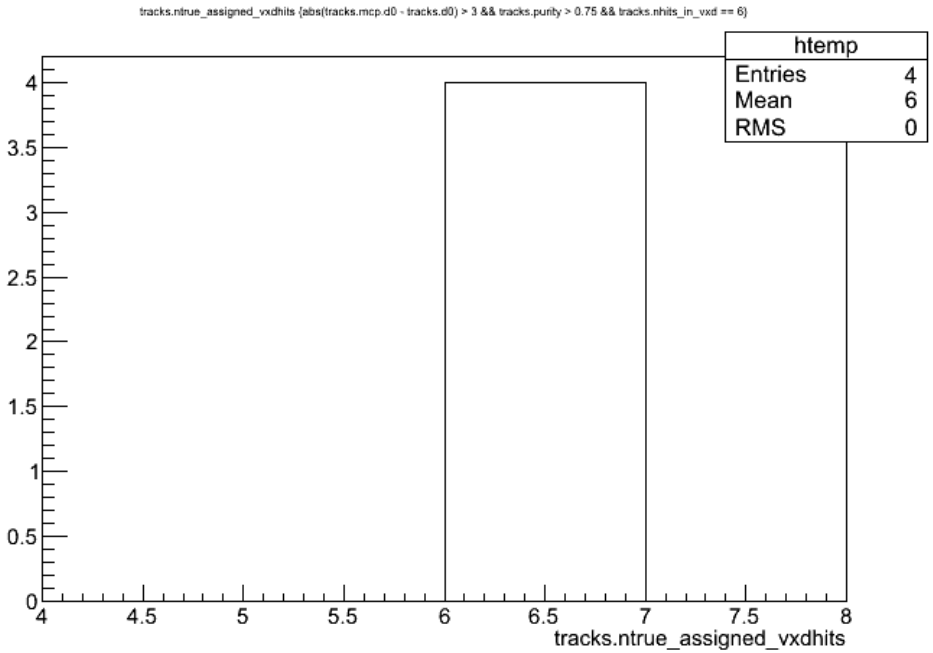


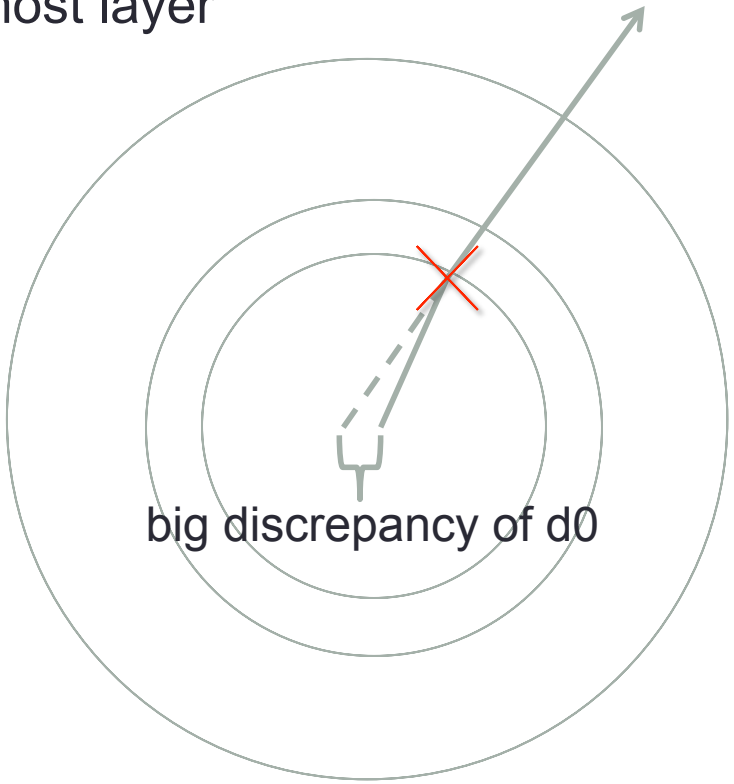
Close-up View



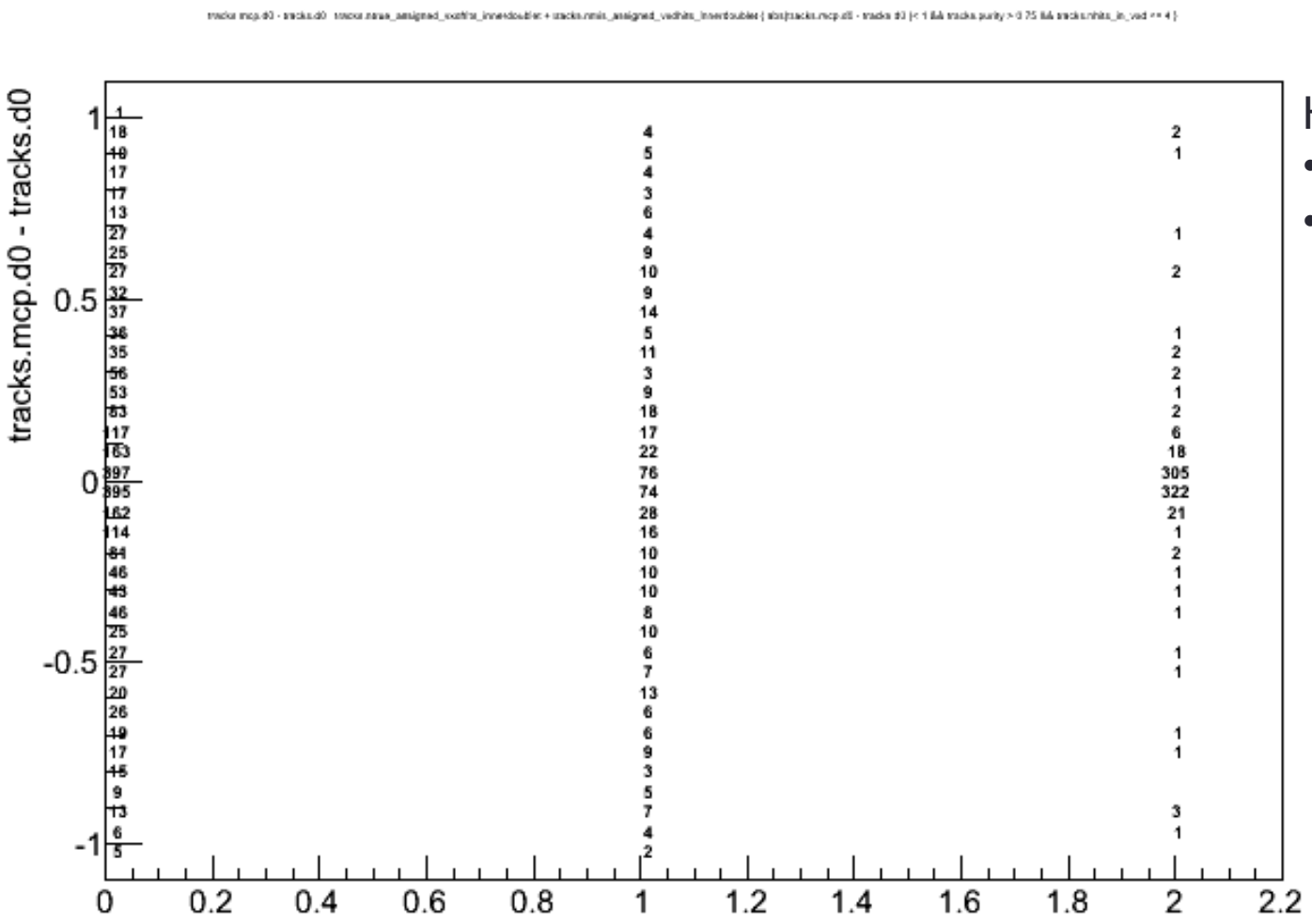
Things we found

- 99% of tracks having 6 vxd hits don't cause mis-assignment in innermost doublet layer
- There are tracks with |discrepancy of d0| > 3
  - These tracks have all true vxd hits (see lower plot), so maybe big multiple-scattering happens in innermost layer





discrepancy of d0 vs # of vxd hits in innermost doublet layer



Here are tracks
- purity > 0.75
- # of vxd hits <= 4

(not considering whether mis-assigned hits or true-assigned hits)

Comparison of d0 resolution

- d0 resolution

condition	sigma d0 [mm]
0 inner doublet hit (purity > 0.75 && nvxd <= 4)	11.6
1 inner doublet hit	1.49
2 inner doublet hits	0.105
(EX) 2 inner doublet hits (purity > 0.75 && nvxd == 6)	0.0422

Conclusion:
The existence of inner doublet hits improve d0 resolution, but tracks having 6 vxd hits have better d0 resolution (0.0422 mm).
At least, when tracks have only less than 4 vxd hits, then we should probably require 2 vxd hits in innermost doublet layer.