Phase II VXDTF2 readiness

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F2F tracking meeting at KEK

February 3, 2018

outline

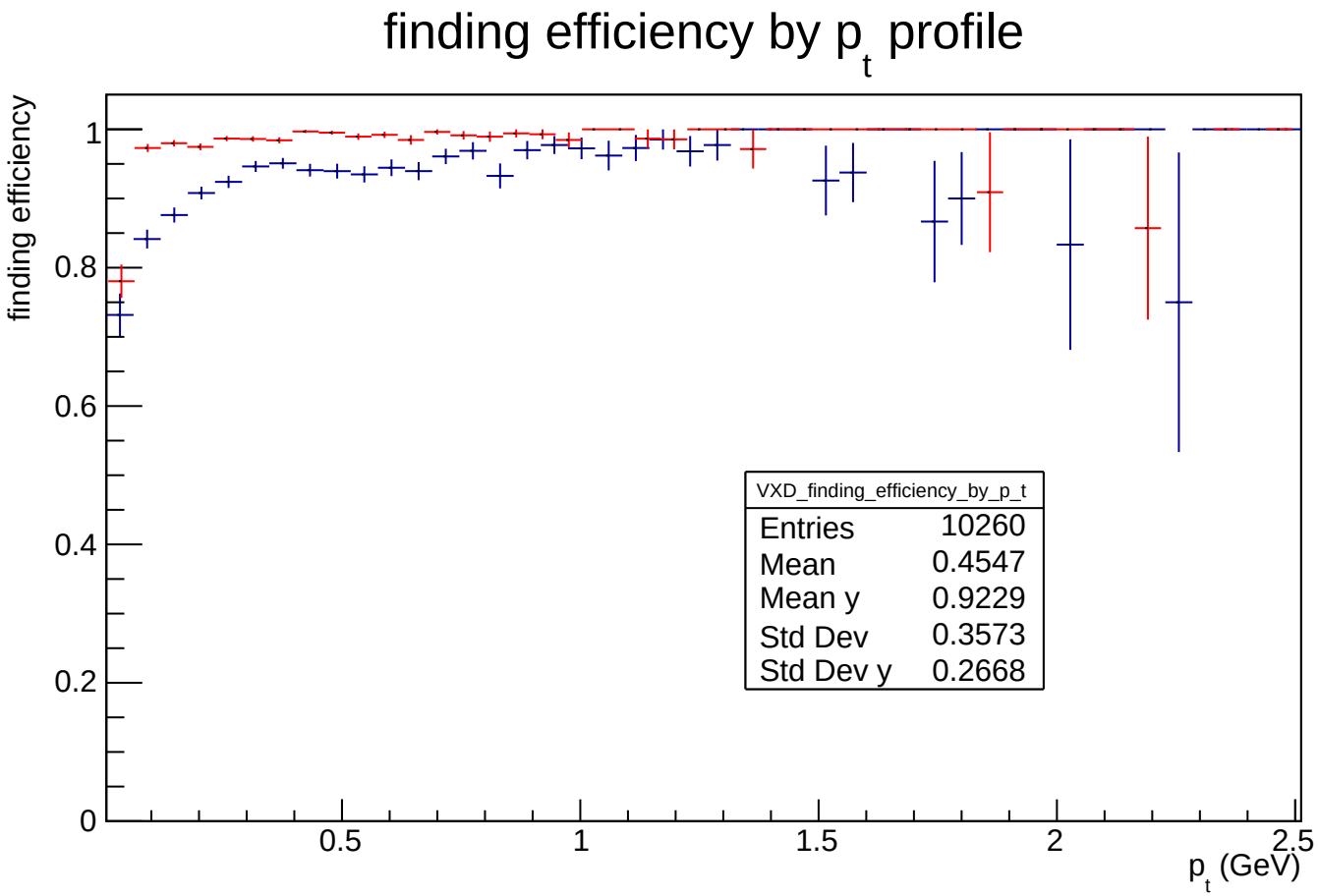
- Phase2 performance SVD tracking
- Phase2 performance full tracking (SVD+CDC)
- Sector map issues
- New VXDTF2 feature
- Tracking DQM module on HLT
- Summary

Phase2 tracking performance

- estimated on 10k Y(4S) events simulated with the Phase2 geometry
- nominal Phase2 bkg from Bkg-Campaign 16
- sector map used is the current default in the DB
- only patter recognition, i.e. no track fit performed
- normalized to MC tracks
- used nominal tracking validation scripts:
  - svdTrackingValidation.py
  - fullTrackingValidation.py

SVD only tracking Validation

- nightly build validation, Phase3 geometry, 0xbkg
- 10k Y(4S), Phase2 geometry, 1x phase2 bkg



SVD only tracking Validation

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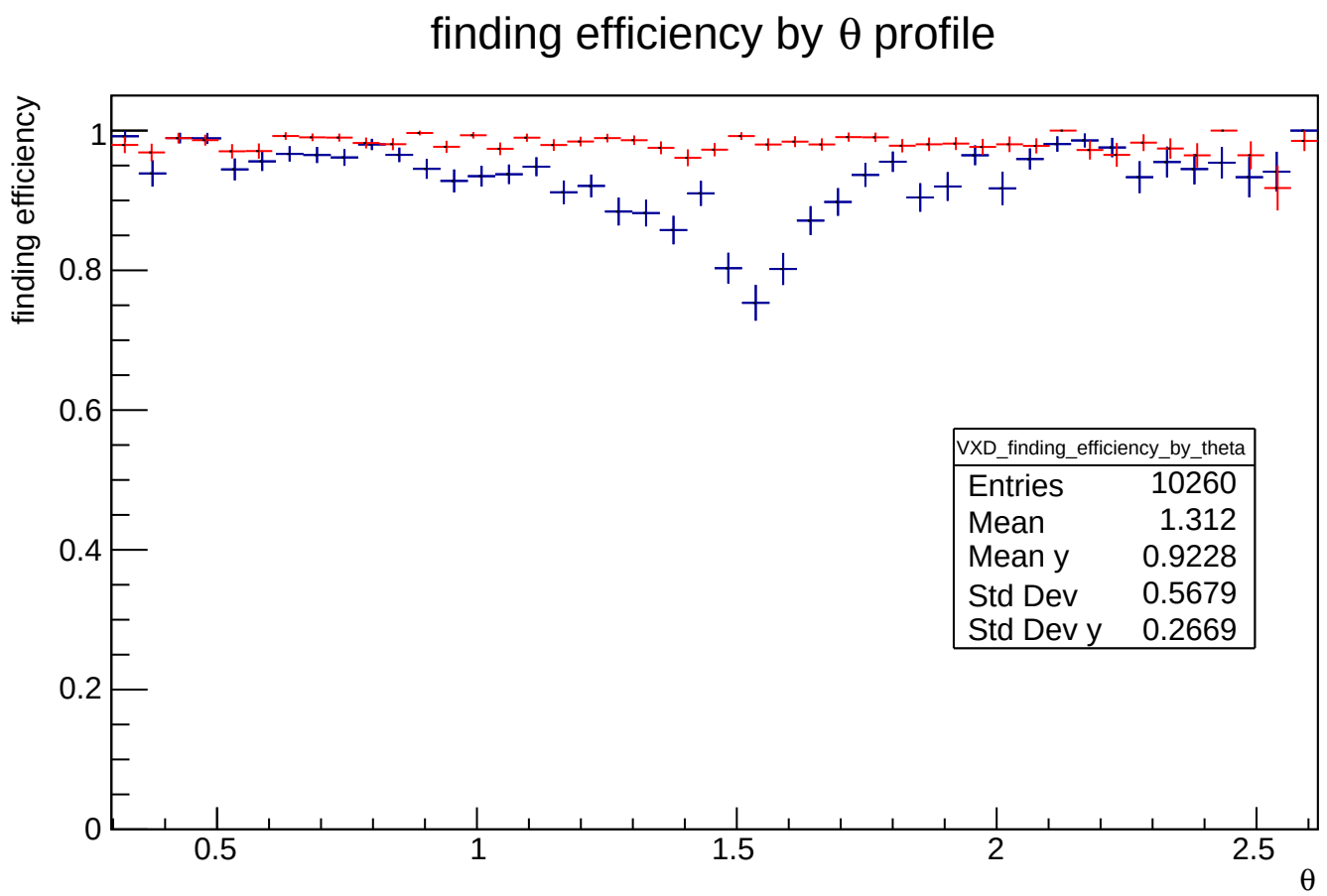

SVD only tracking Validation

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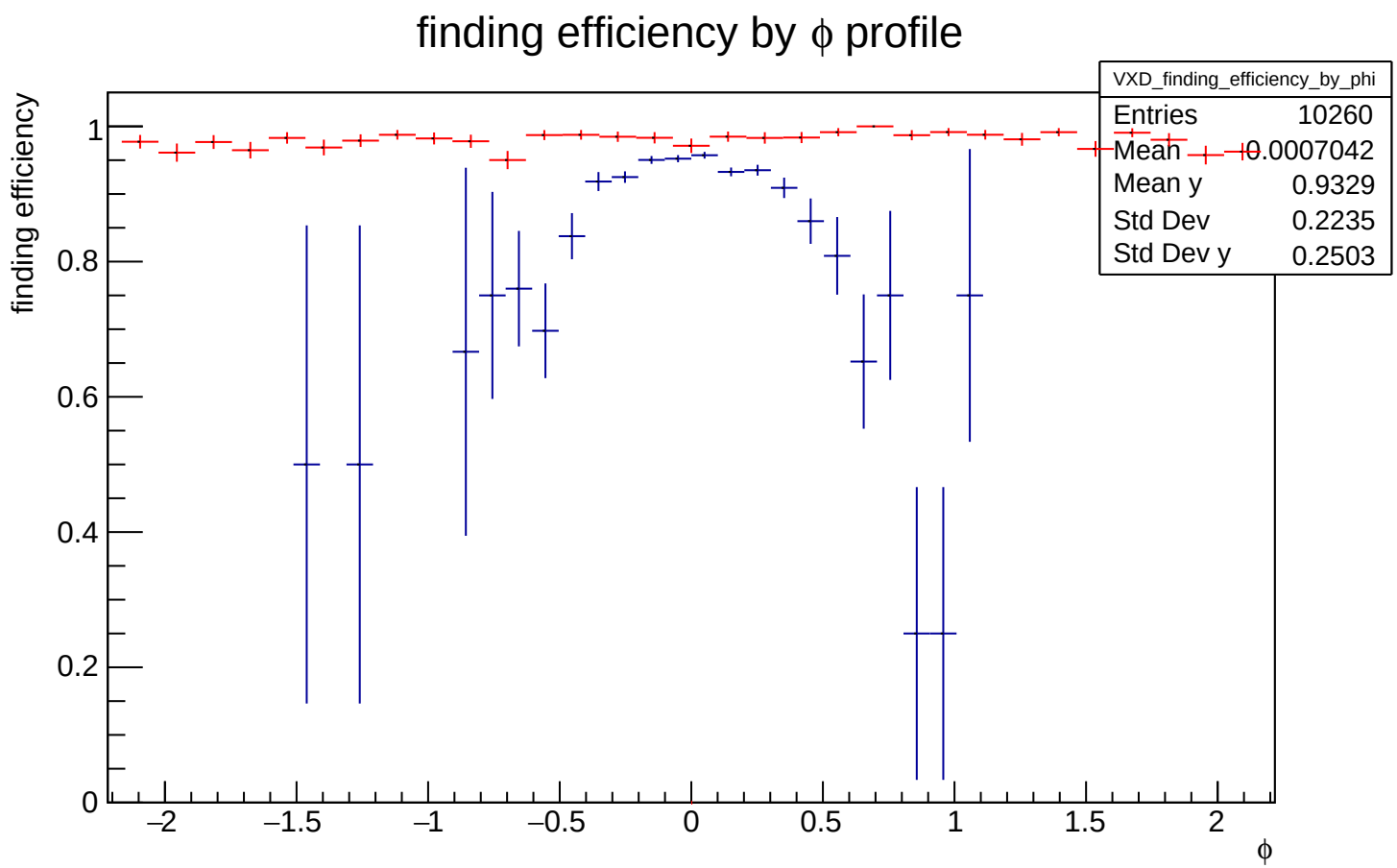
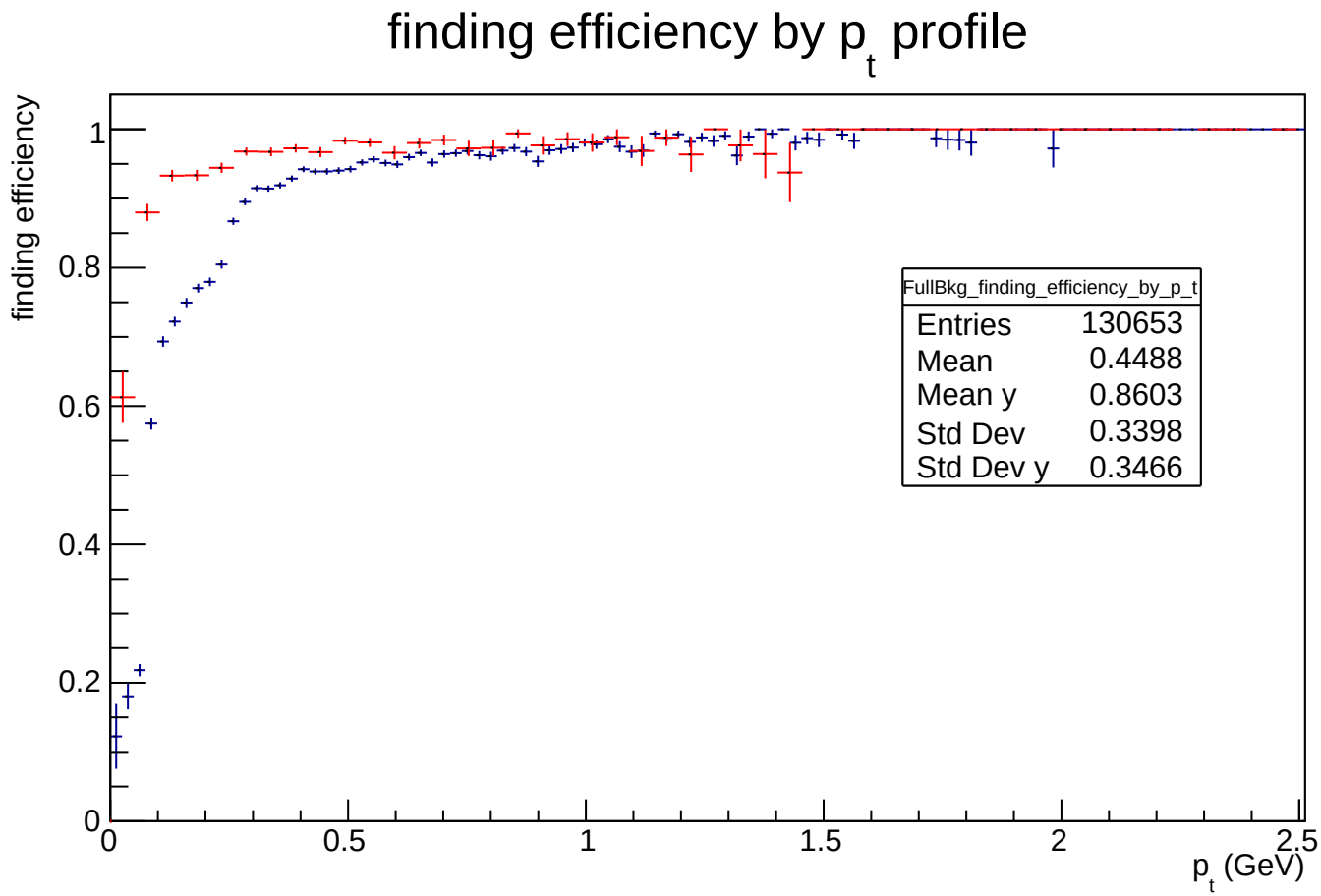
- 10k Y(4S), Phase2 geometry, 1x phase2 bkg



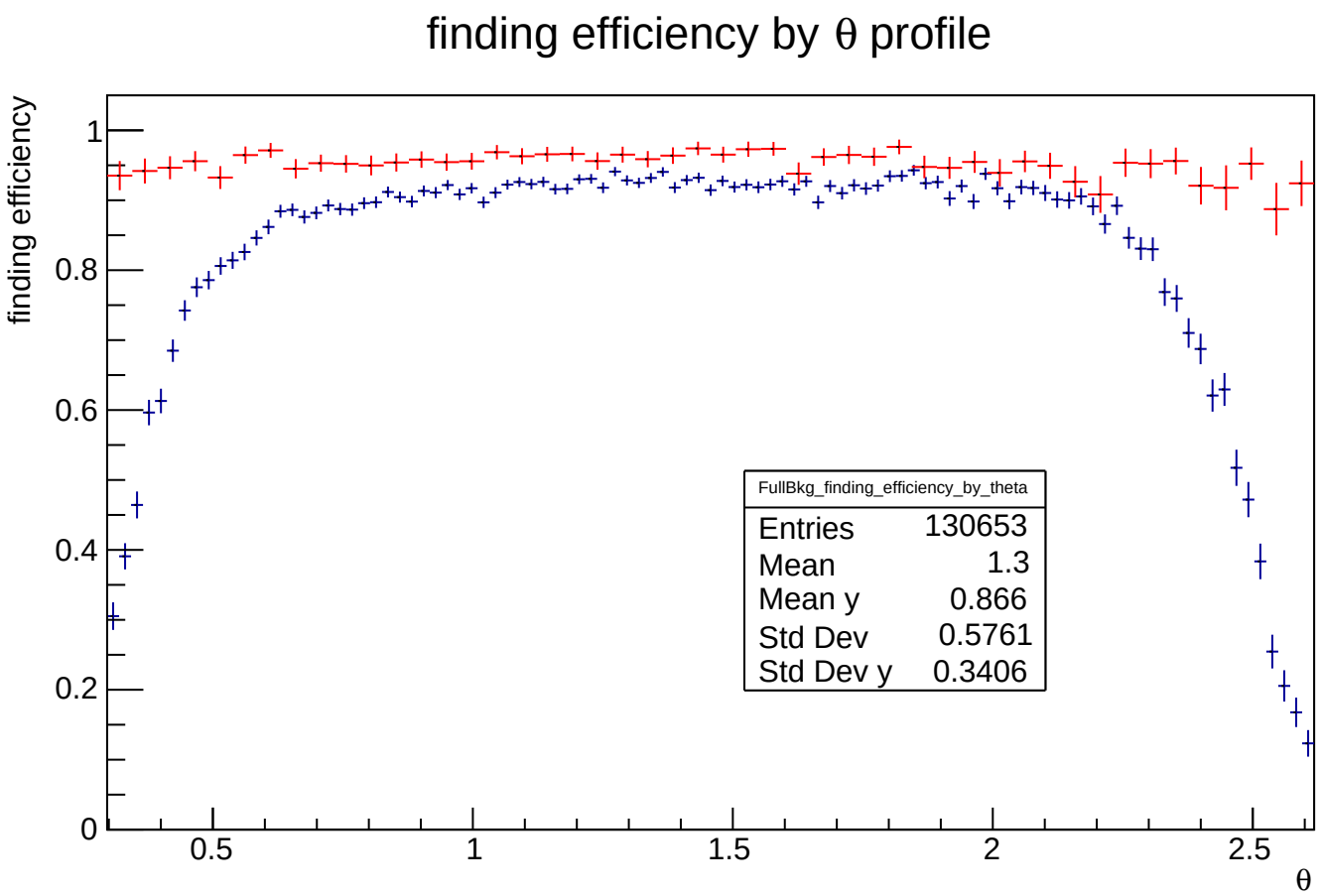
Full tracking Validation

- nightly build validation, Phase3 geometry, 1xbkg
- 10k Y(4S), Phase2 geometry, 1x phase2 bkg



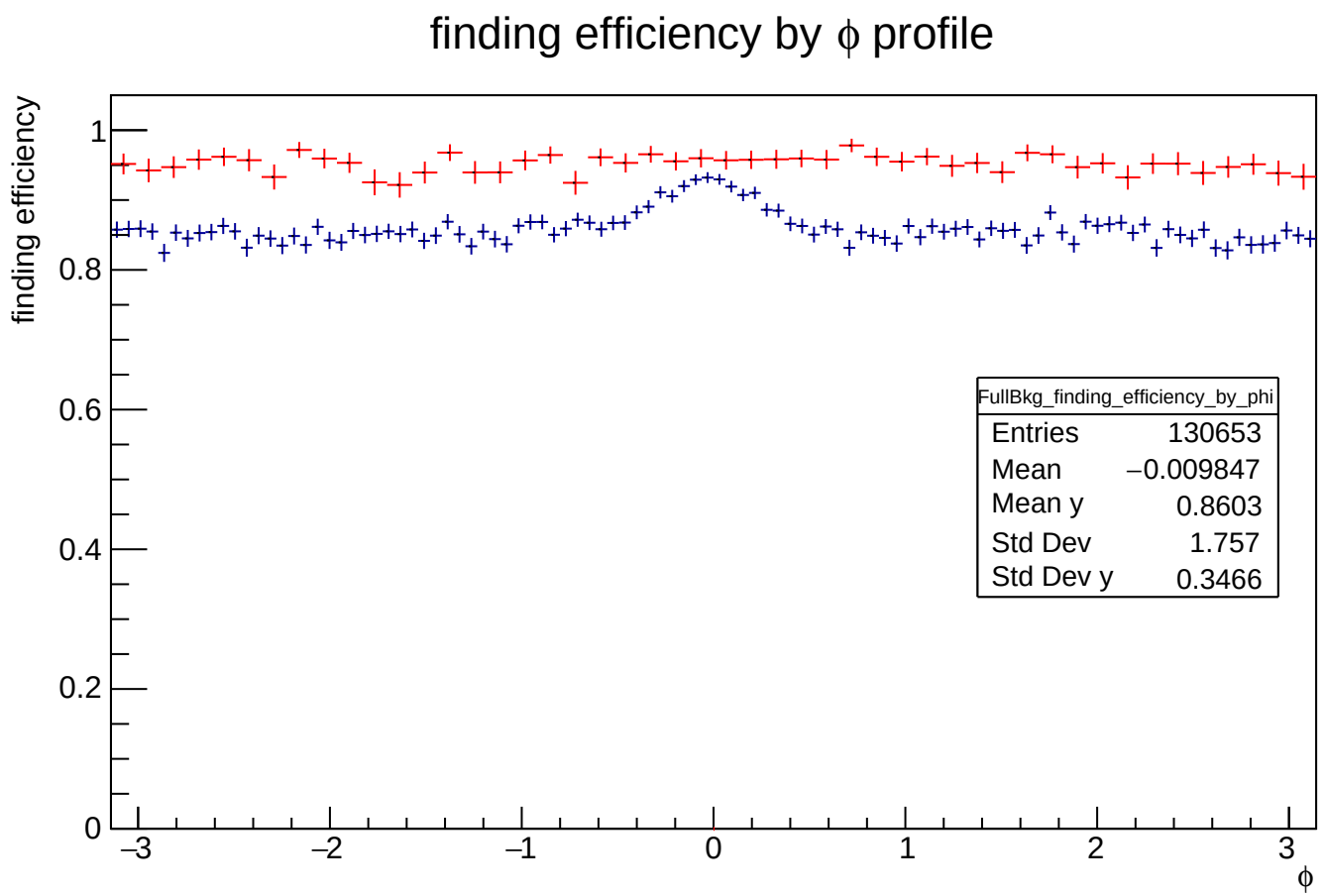
Full tracking Validation

- nightly build validation, Phase3 geometry, 1xbkg
- 10k Y(4S), Phase2 geometry, 1x phase2 bkg

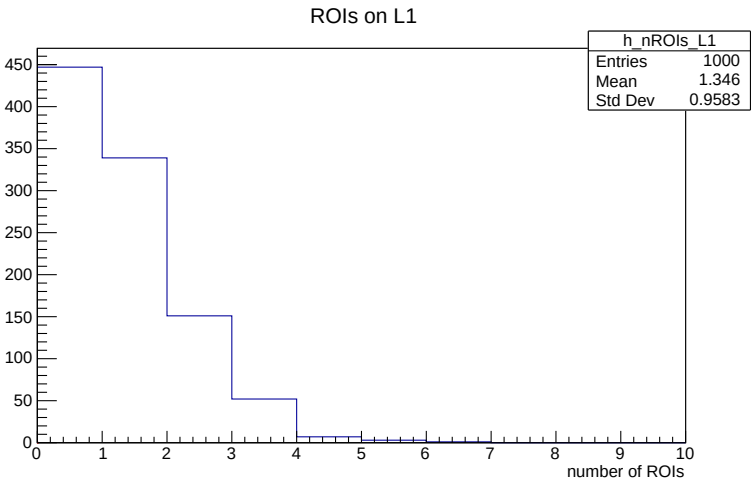


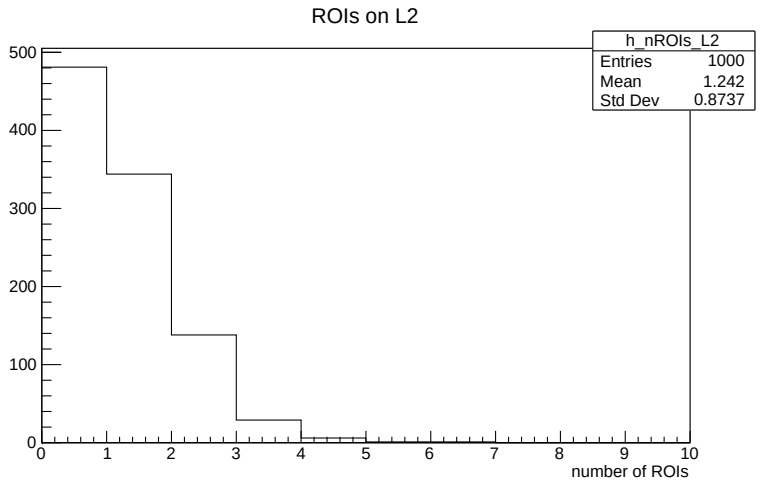
Full tracking Validation

- nightly build validation, Phase3 geometry, 1xbkg
- 10k Y(4S), Phase2 geometry, 1x phase2 bkg



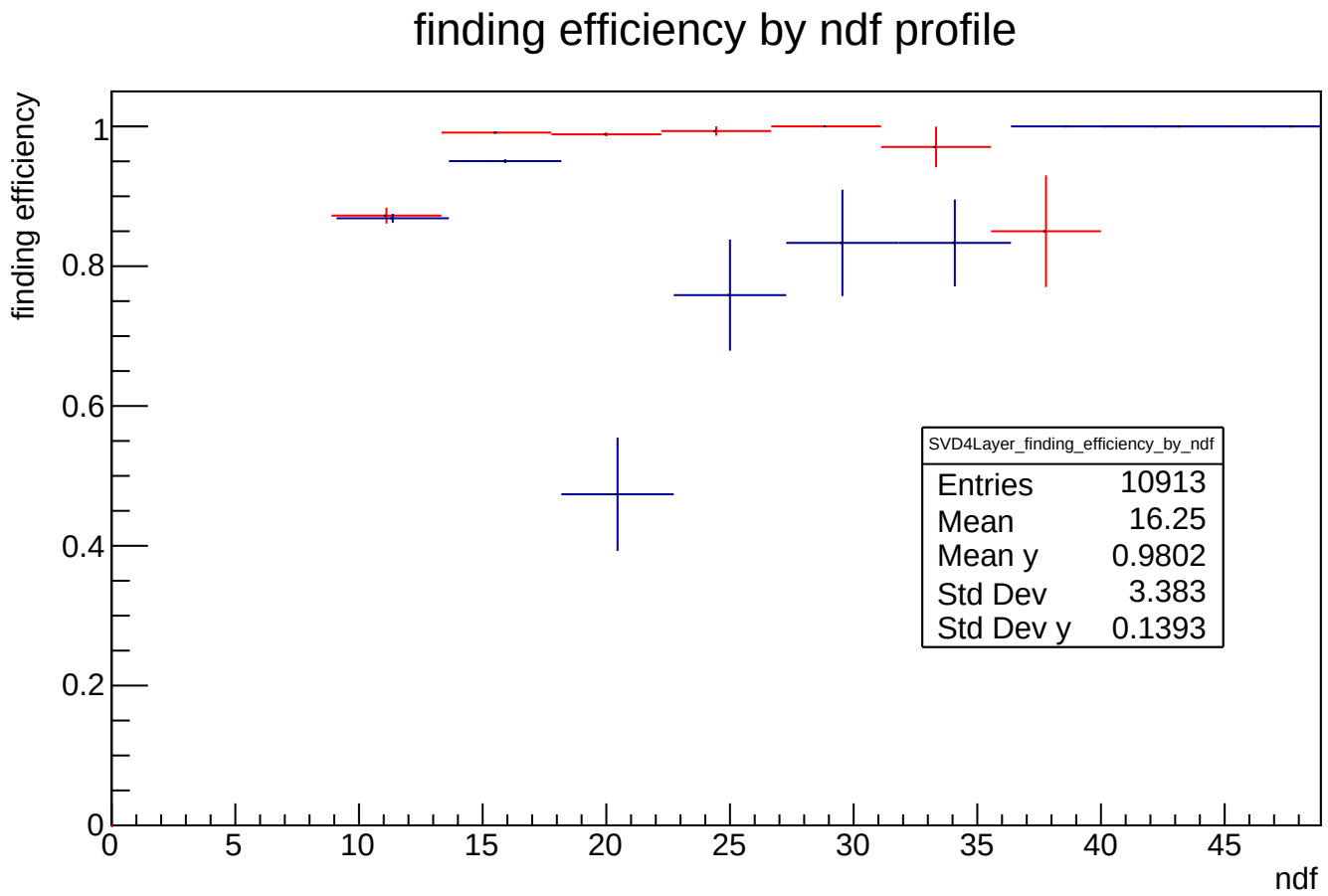
- from ROI validatoin script (1000 events nominal Phase2 bkg)
- only around half of the events have ROIs





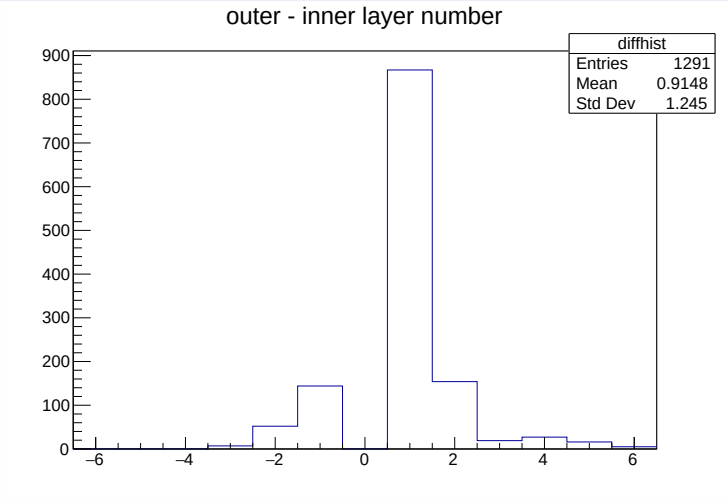
- strange feature in efficiency vs ndf distribution
- for SVD-only in phase2 expected 8 ndf
- a bug in the validation could explain a factor of 2

- nightly build validation, Phase3 geometry, 0×bkg
- 10k Y(4S), Phase2 geometry, 1× phase2 bkg

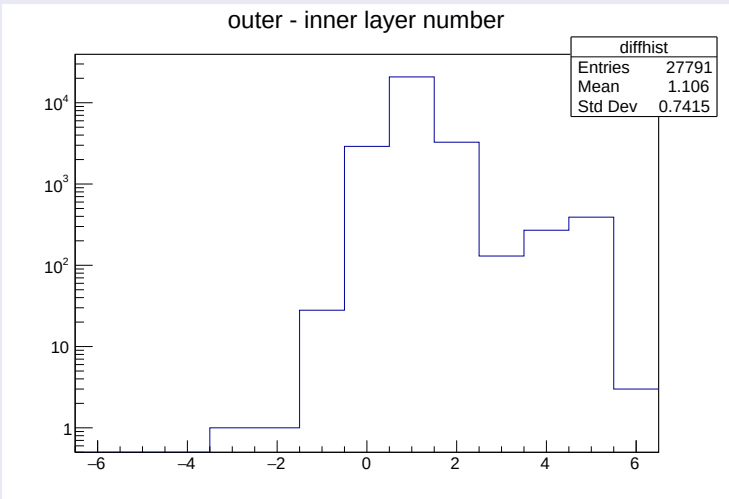


- investigated the difference in layer number between outer and inner sector for segment filter
- expected that outer sector is always on outer layer
- not the case: possible issue with SectorMap

Phase 2 SectorMap



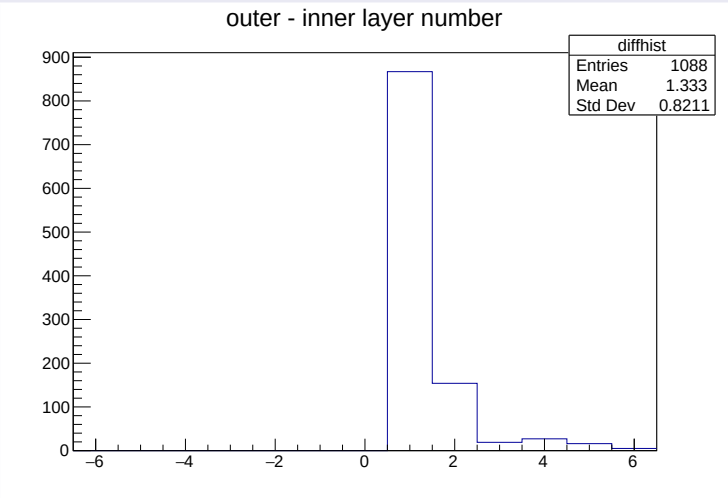
Phase 3 SectorMap (log scale)



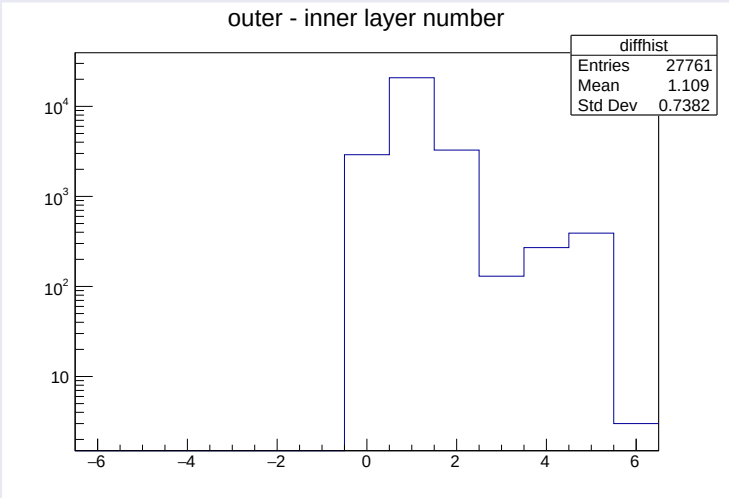
Quick fix for the issue

- agira issue: BII-3084
- reject filters when SectorMap is loaded
  - reject 2-hit filters with: outer layer number $<$ inner layer number
  - reject 3-hit filters with: outer layer number $<$ center layer number OR center layer number $<$ inner layer number
- needs validation; final solution tuning SectorMap at training

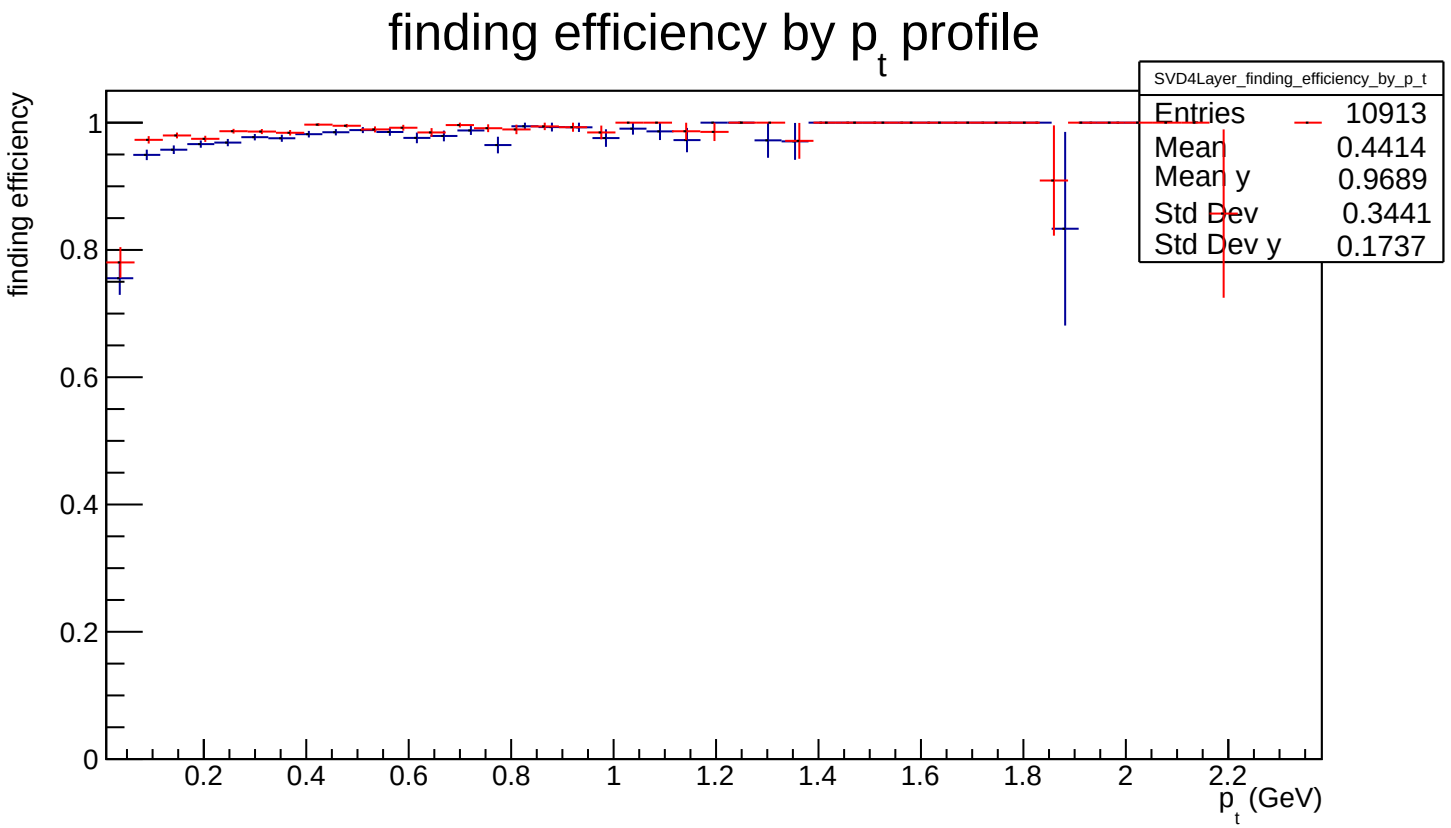
fixed Phase 2 SectorMap



fixed Phase 3 SectorMap (log sc.)



- no track fit
- nightly build validation, Phase3 geometry, 0xbkg
- bugfix applied, my validation run, Phase3 geometry, 0xbkg



Tunable VXDTF2 filters

- new feature one can alter filter cuts
- useful during the beginning as it may be difficult to find tracks
- changes are applied to all filters contained in the SectorMap (several 10s thousand) at loading of the SectorMap
- example script: tracking/examples/AlterVXDTF2FilterCuts.py
- user has to provide the index of the cut variable and a string expression for a function (TF1)
- index can be found in the module description of SectorMapBootstrapModule
- python parameter for SectorMapBootstrapModule:
  - SMBSM1.param("threeHitFilterAdjustFunctions", [(0, "0"), (1, "x+3"), (15, "[0]")])
- NOTE: this is not meant as default option! Tuning of SectorMap should be the goal!

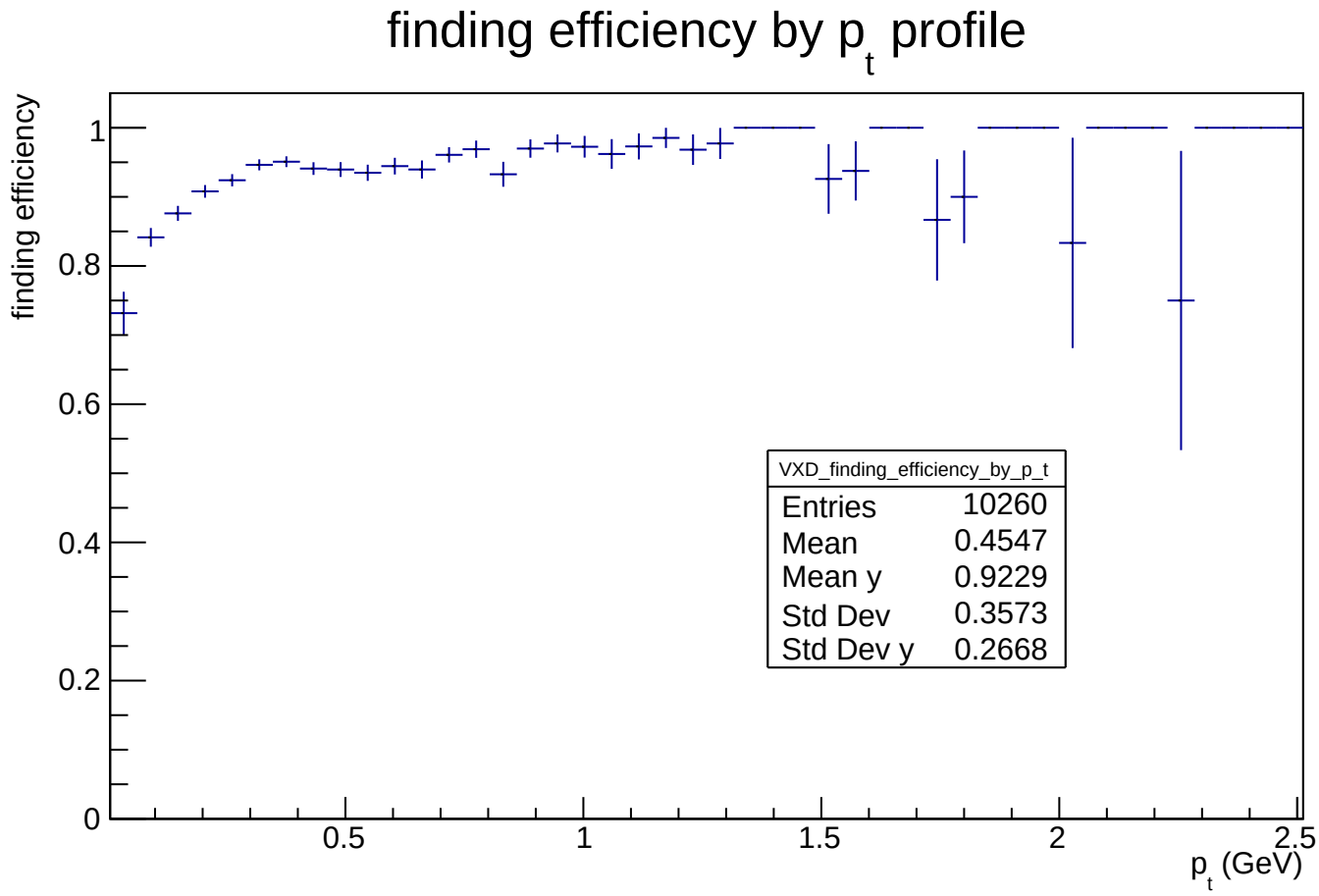
tracking DQM on HLT

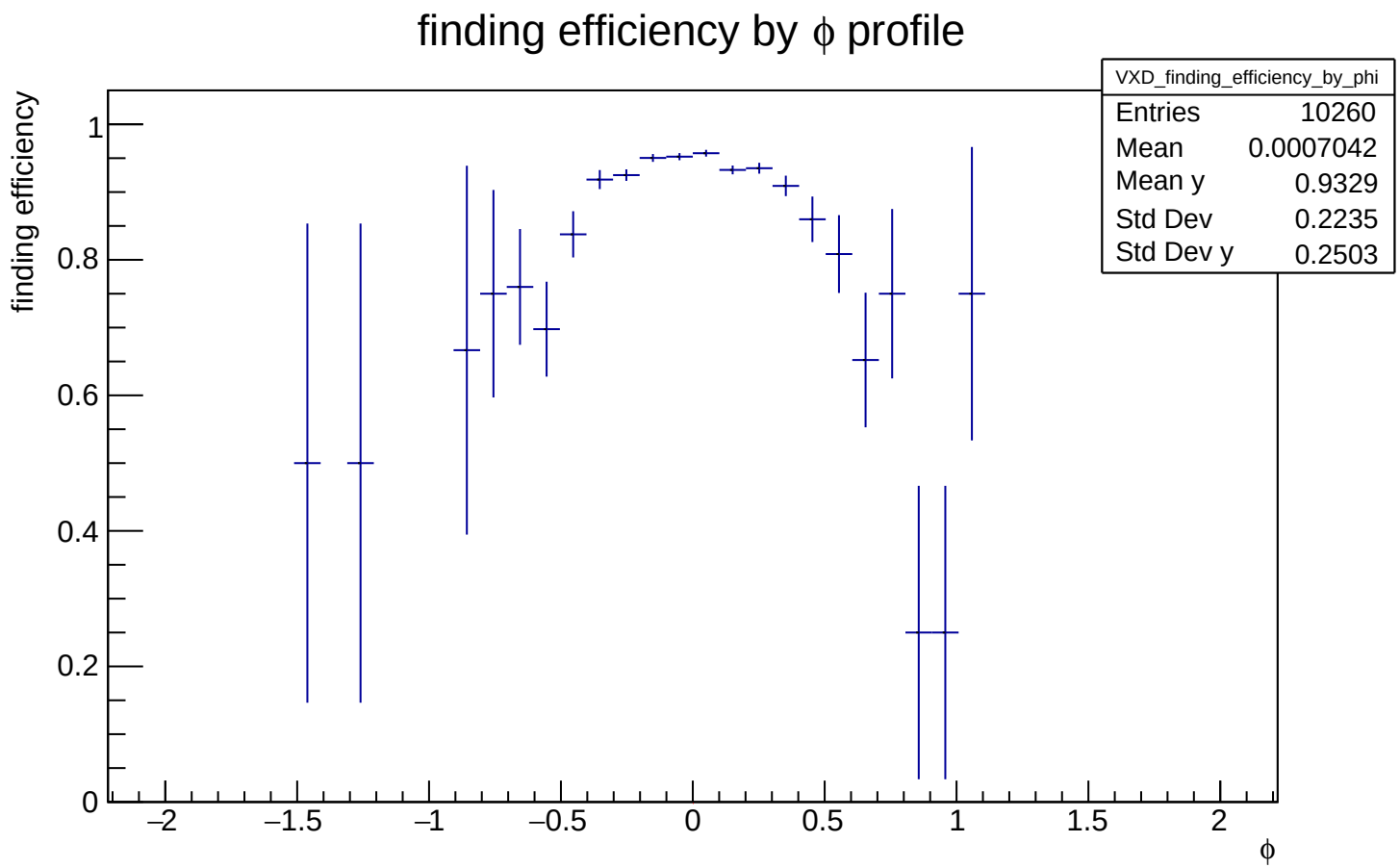
- two agira issues on that: BII-3048 and BII-3061
- dedicated DQM module for running on HLT and monitored by (non-expert) shifters
- current proposal for generated plots:
  - RecoTracks found by CDC track finder: number of tracks; ω; ϕ; $\tan\lambda$; (of their momentum seed)
  - RecoTracks found by VXDTF2: number of tracks; ω; ϕ; $\tan\lambda$; (of their momentum seed)
  - RecoTracks found by by the CKF: number of tracks; ω; ϕ; $\tan\lambda$; (of their momentum seed)
  - number of fitted tracks provided as input to the PXD ROI finder
  - number of CDC hits used in the fitted track
  - number of SVD hits used in the fitted track
- a total of 15 plots
- something missing?

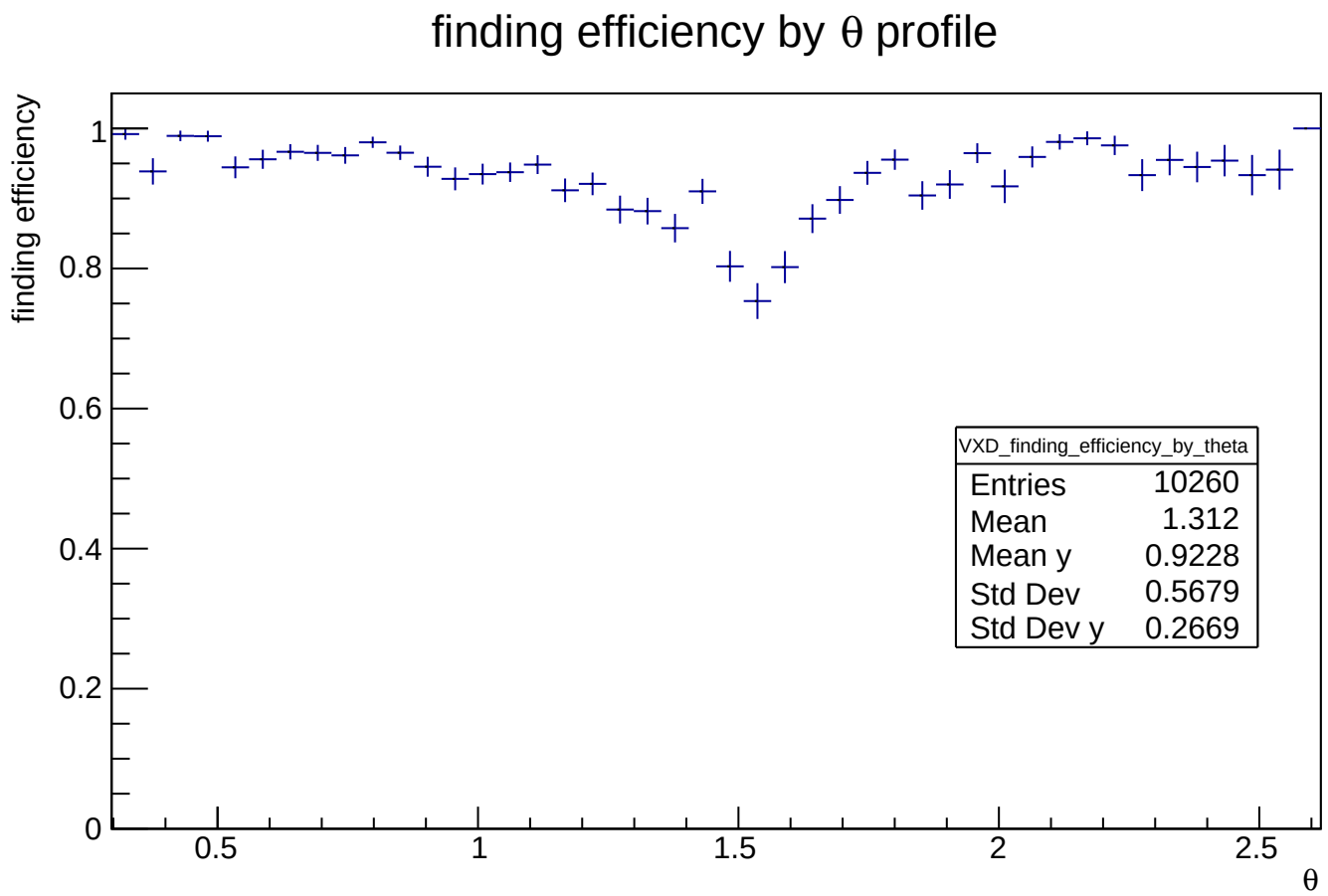
Summary

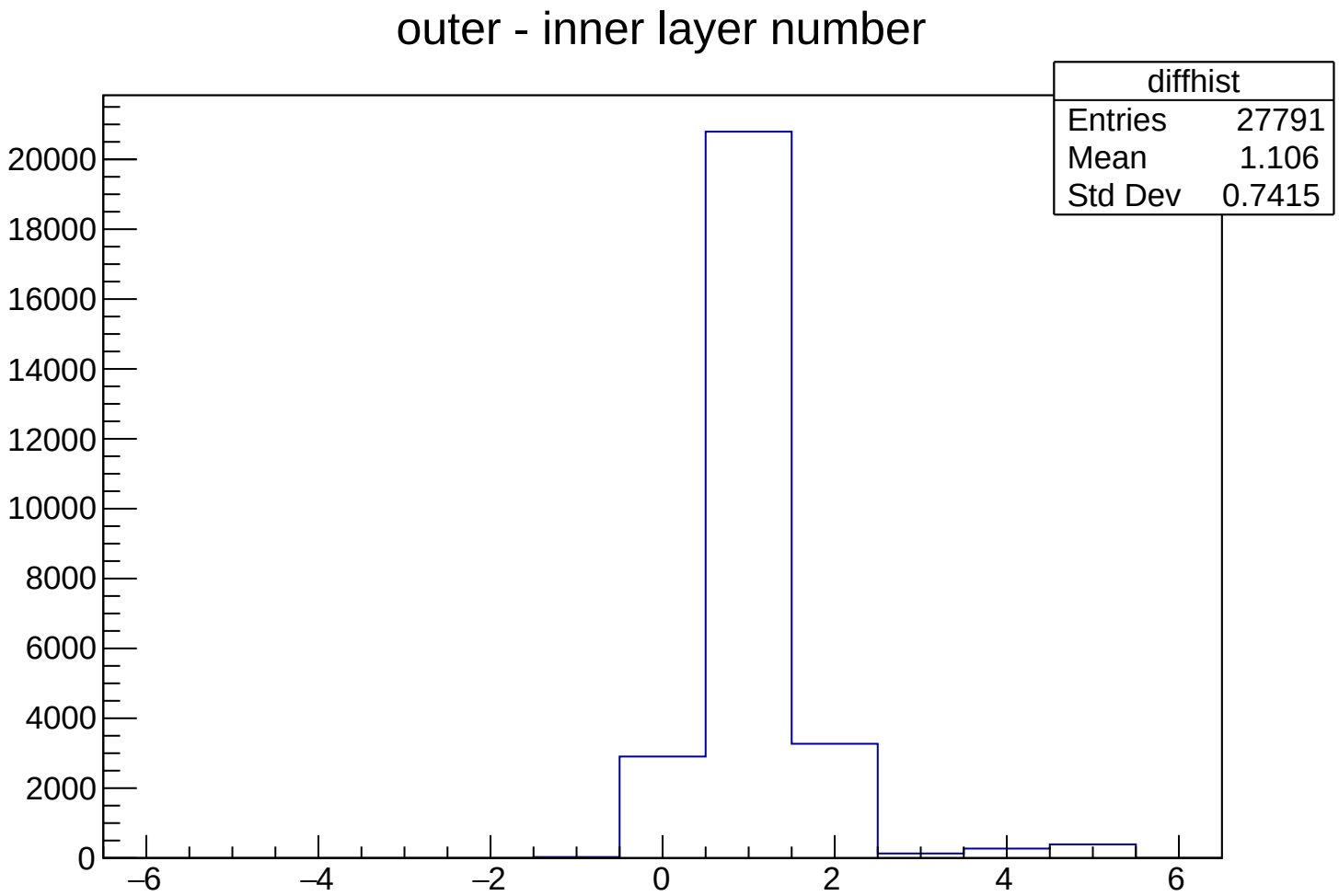
- tracking for Phase2 seems to work
- efficiencies for Phase2 look reasonable
- some issues with the SectorMap discoverd
- new feature for tuning filter cutsa
- tracking DQM on HLT

BACKUP


finding efficiency by p_t profile
finding efficiency
1
0.8
0.6
0.4
0.2
0
0.5
1
1.5
2
2.5
p_t (GeV)
VXD_finding_efficiency_by_p_t
Entries 10260
Mean 0.4547
Mean y 0.9229
Std Dev 0.3573
Std Dev y 0.2668


finding efficiency by ϕ profile
VXD_finding_efficiency_by_phi
Entries 10260
Mean 0.0007042
Mean y 0.9329
Std Dev 0.2235
Std Dev y 0.2503
finding efficiency
1
0.8
0.6
0.4
0.2
0
–2
–1.5
–1
–0.5
0
0.5
1
1.5
2
ϕ


finding efficiency by θ profile
finding efficiency
1
0.8
0.6
0.4
0.2
0
0.5
1
1.5
2
2.5
θ
VXD_finding_efficiency_by_theta
Entries 10260
Mean 1.312
Mean y 0.9228
Std Dev 0.5679
Std Dev y 0.2669


outer - inner layer number
diffhist
Entries 27791
Mean 1.106
Std Dev 0.7415
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
–6
–4
–2
0
2
4
6

WriteSectorMap	bool	False	If set to true at endRun write the SectorMaps to SectorMapsOutputFile.
threeHitFilterAdjustFunctions	list(tuple(int, str))	[]	Vector of vectors containing expressions used to alter the 3-hit filters. The inner vector should contain exactly two strings. The first entry is interpreted as index (integer). The second entry is interpreted as function used to create a TF1. The variable to be altered will be assumed to be called "x" and in addition "[0]" can be used which will be interpreted as FullSecID of the static sector the filter is attached to. No other parameter is allowd. The structure of the 2-hit filter is as follows: ((((((((((#19 <= DistanceInTime <= #20) AND (#17 <= Angle3DSimple <= #18)) AND (#15 <= CosAngleXY <= #16)) AND (#13 <= AngleRZSimple <= #14)) AND (CircleDist2IP <= #12)) AND (#10 <= DeltaSlopeRZ <= #11)) AND (#8 <= DeltaSlopeZoverS <= #9)) AND (#6 <= DeltaSoverZ <= #7)) AND (#4 <= HelixParameterFit <= #5)) AND (#2 <= Pt <= #3)) AND (#0 <= CircleRadius <= #1)) Example: [(1, "12"), (3, "sin(x)"), (4, "x + [0]")] PS: use this feature only if you know what you are doing!
twoHitFilterAdjustFunctions	list(tuple(int, str))	[]	Vector of vectors containing expressions used to alter the 2-hit filters. The inner vector should contain exactly two strings. The first entry is interpreted as index (integer). The second entry is interpreted as function used to create a TF1. The variable to be altered will be assumed to be called "x" and in addition one can use "[0]" can be used which will be interpreted as FullSecID of the static sector the filter is attached to. No other parameter is allowed. The structure of the 2-hit filter is as follows: ((((((#12 <= DistanceInTimeUside <= #13) AND (#10 <= DistanceInTimeVside <= #11)) AND (#8 <= Distance3DSquared <= #9)) AND (#6 <= Distance2DXYSquared <= #7)) AND (#4 <= Distance1DZ <= #5)) AND (#2 <= SlopeRZ <= #3)) AND (#0 <= Distance3DNormed <= #1)) Example: [(1, "12"), (3, "sin(x)"), (4, "x + [0]")] PS: use this feature only if you know what you are doing!