Status of VXDTF-related modules

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ÖAW Österreichische Akademie der Wissenschaften

What happened since last F2F meeting (Sept/Oct 2014)?

Been there, done that:

- Supervising Diploma student Thomas Madlener - (watch his talk: VXD studies - current status of TRackCand Converter modules)
- B2Vector3 - an interface compatible replacement for TVector3 (faster, smaller and faster)
- New geometry SVD - new sector maps
- Bugfixes (including the mean one which caused such bad PXD-efficiencies)
- Redesign of the VXDTF (segmentNetwork, selectionVariables (former known as filters) and observers)

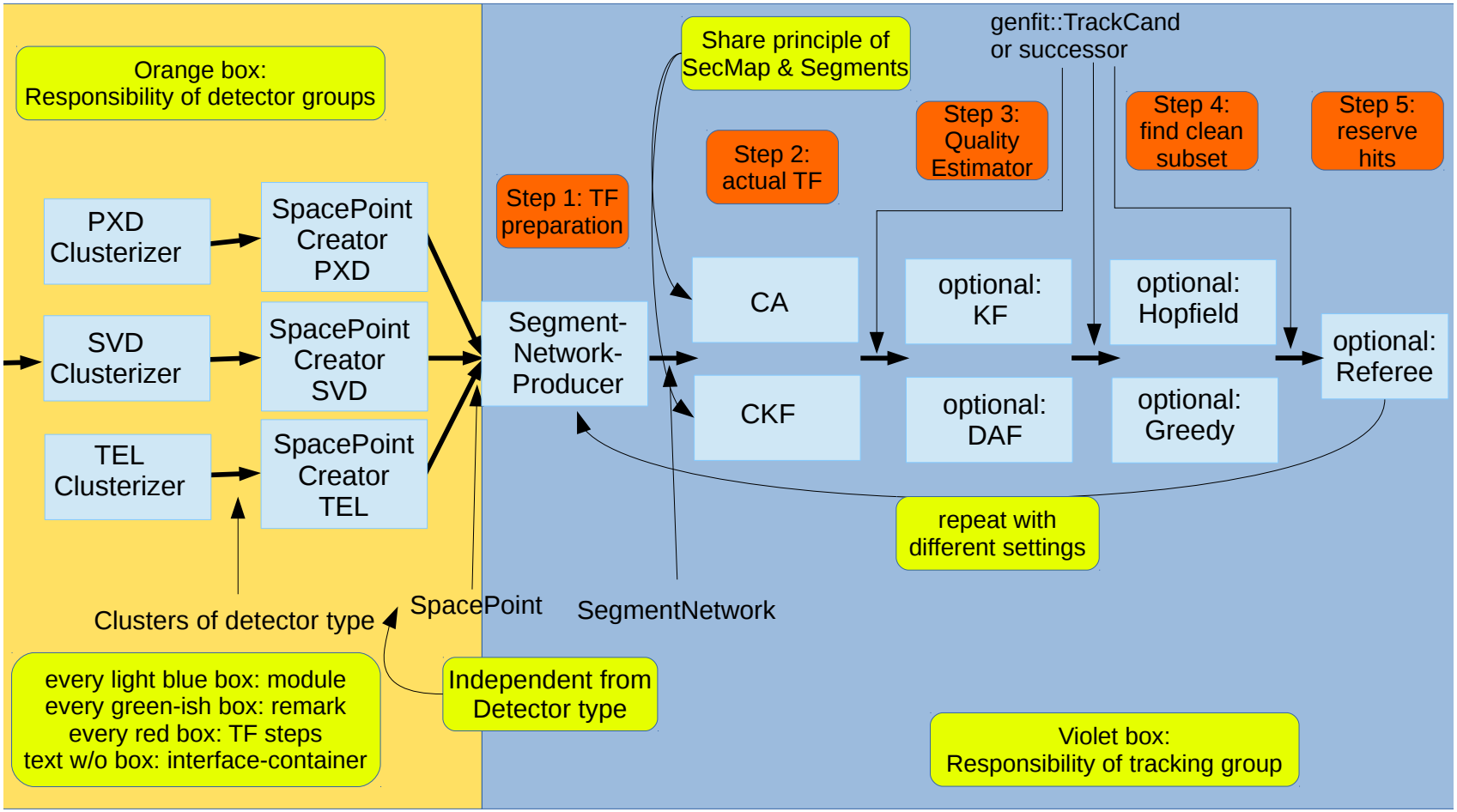
B2Vector3 - features:

- Advantages:
  - No TObject dependency (reduces size and execution time)
  - Supports several data types (typedef B2Vector3D for double and B2Vector3F for float)
  - (Much) smaller (B2Vector3F: 96 bit vs 256 bit in TVector3)
  - Easier to serialize (array of data types, no single X,Y,Z)
  - Faster calculations (no root look-ups, serializable code)
  - Goal: replace TVector3 via typedef
- Additional stuff:
  - Fully convertible to TVector3 and vice versa
- Downsides / TODO:
  - Interface not fully compatible yet
    - Interaction with TMatrix only via conversion to TVector3
    - Some members still missing (e.g. rotate via arbitrary axis)
    - Many member functions not tested so far (only all operators, constructors and some basic math stuff is covered by now)

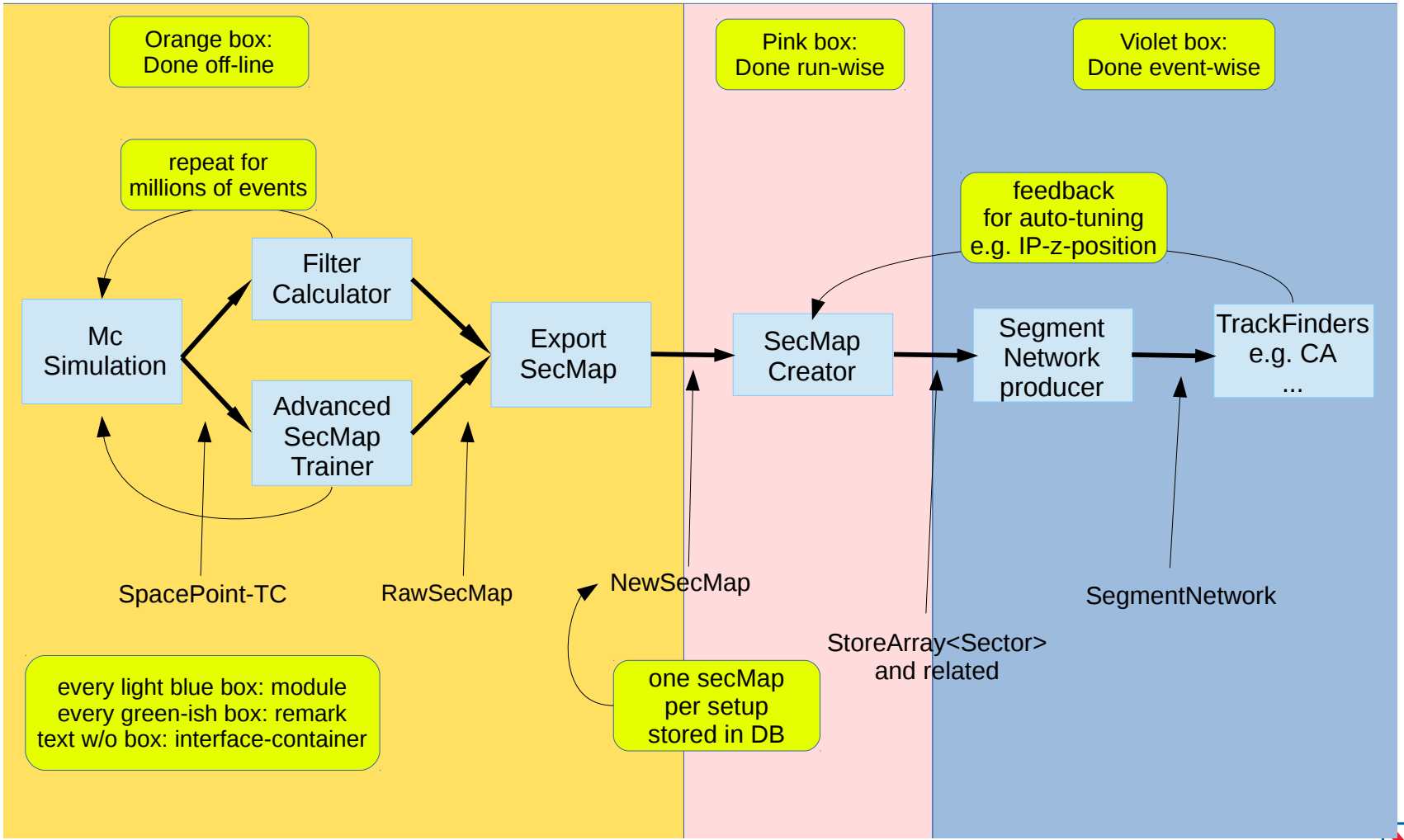
new geometry for SVD

- New secMaps uploaded in during B2GM in November 2014 - used as standard since then
- Impact on VXDTF-efficiency - no relevant difference detected (plots follow in bugfix section)
- Result of geo-update-procedure-discussion:
  1. Person responsible for updates informs everyone via mailing list including a patch for the new geometry
  2. Possibly affected persons apply patch and test possible impact on their stuff
  3. They inform the geo-guy or -girl whether they have to adapt something and how long that would take
  4. Coordinated update of the geo including patches needed from other people
- Alternatively: branching - procedure for that has to be defined yet

Future state of the trackFinderVXD-approach (event-part)



The way of the sectorMap (open to discussion)



Progress regarding the regesign:

- Draft for SegmentNetwork existing (not in use yet)
- SelectionVariables ($\hat{=}$ "Filters" of old design) for segFinder implemented
- Currently working on Observers (storing infos to root and accessing MC-data yet missing)
- Progress is behind schedule, should be finished asap (of course), current hope: until next F2F-meeting in April!
- Time spent for redesign purposes only at 17% (many other tasks interfering), should be improved!

Observers - done so far

The easy ones - no mc and no data storing:

- CountUsedObserver: count how often a specific selectionVariable was used
- CountAcceptRejectObserver: count how often a specific selectionVariable was accepted or rejected
- CountBadCaseObserver: count how often a specific selectionVariable produced inf or nan results
- InfoObserver: prints selectionVariable, input (hits, range) and results
- ProvideBasicInfoObserver: executes: CountUsedObserver, CountAcceptRejectObserver, CountBadCaseObserver, InfoObserver

Observers - still missing

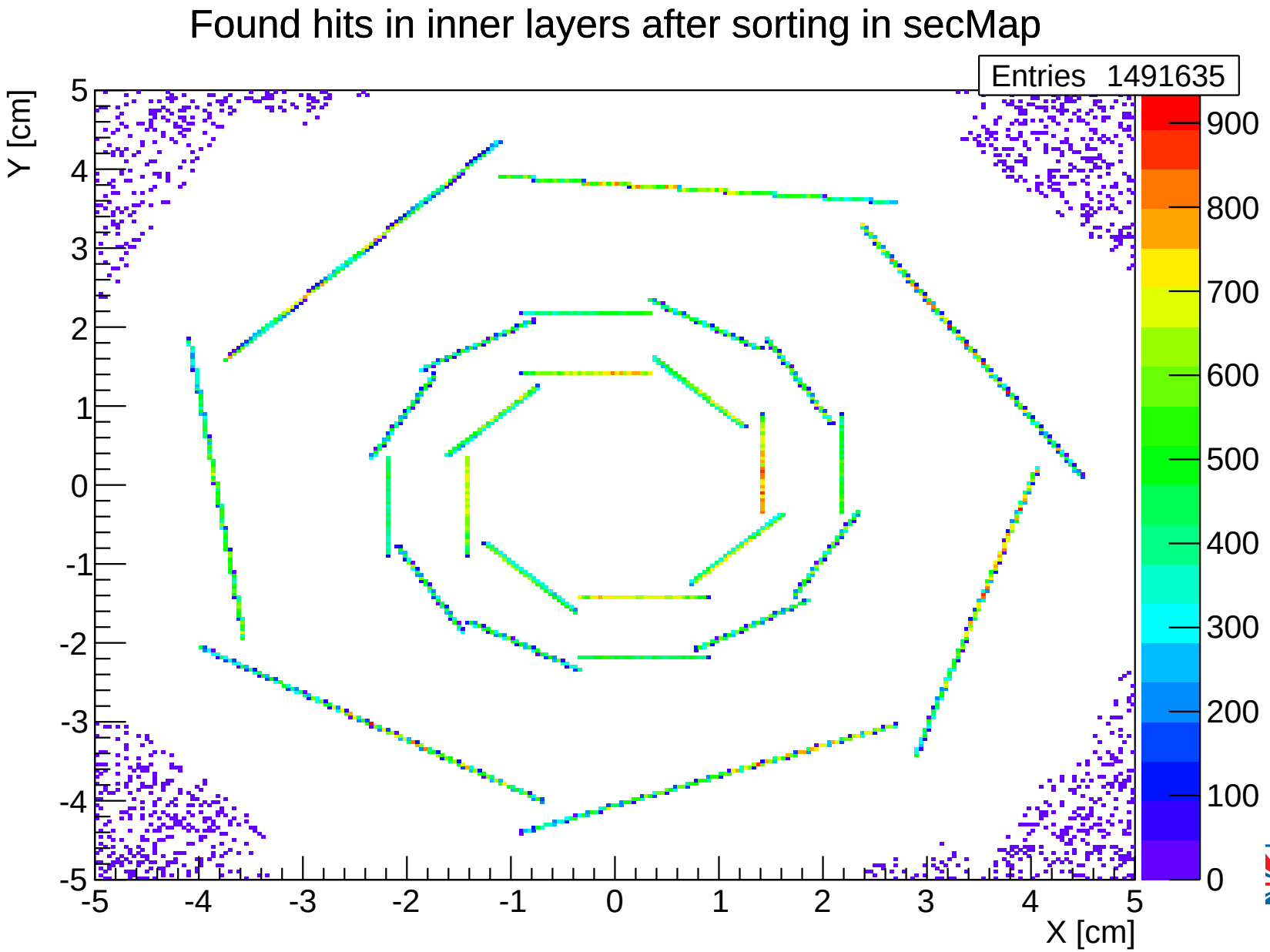
The not-so-easy ones - accessing MC data & store to root:

- count how often a specific selectionVariable was accepted or rejected for:
  - good (same hit and isPrimary == true), bad or contaminated ($> 66\%$ (can we have this as a globally accessible value?) purity) objects
  - pT, p, Φ, Θ, particle-type, secID-combi, mcParticleID
  - other stuff I haven't thought of yet
- print info to screen or store it to root file (coded for each secID-combination for each sectorMap)

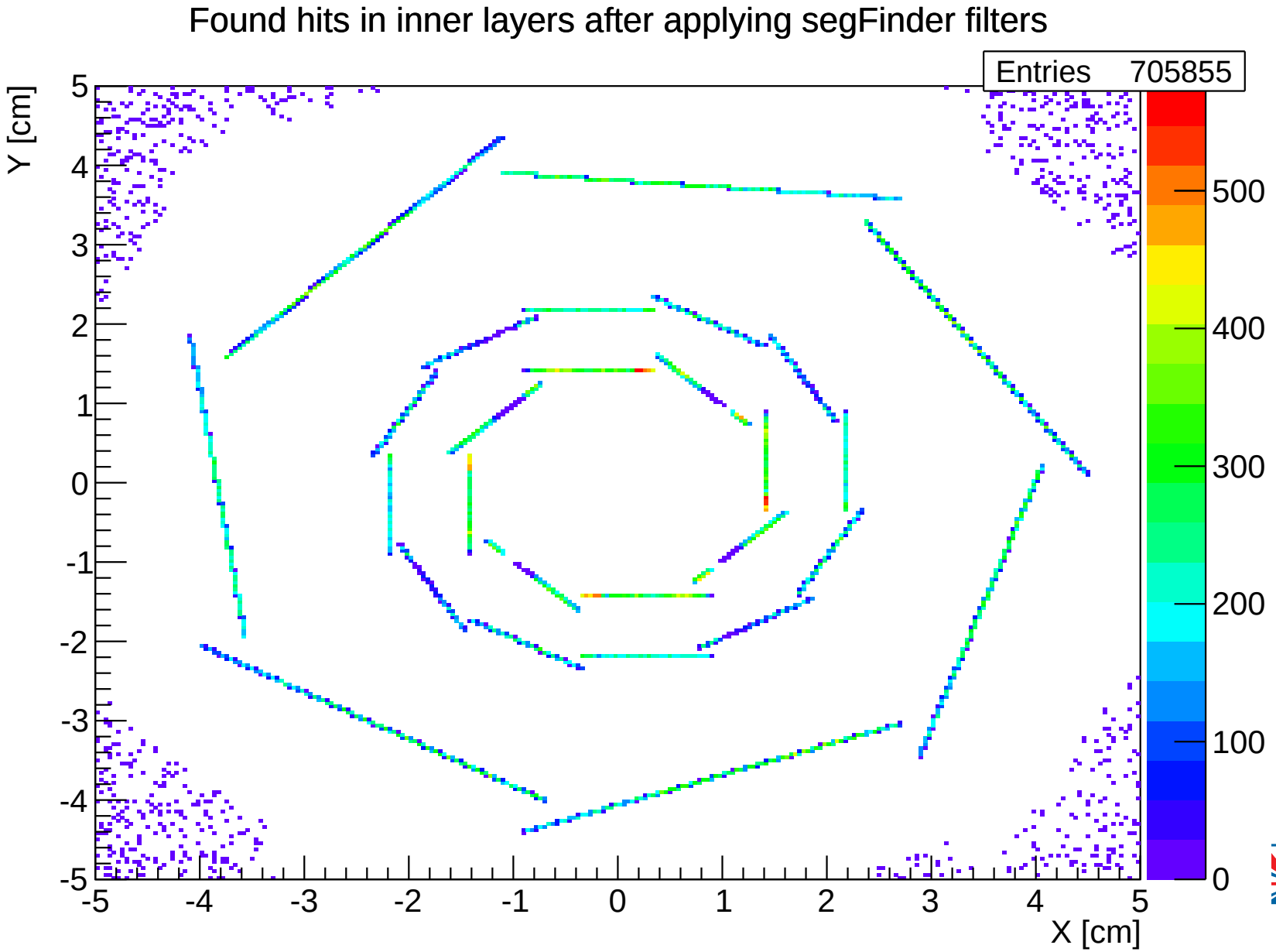
Progress regarding bugfixes:

- Among other minor issues, the PXD-efficiency-suppressing bug has been fixed (r14907 or newer)
- ratio nHits used CA:MC $\in$ [0,1], where 1 is best
  - before bugfix: PXD: 0.196, SVD: 0.809
  - after bugfix: PXD: 0.778, SVD: 0.808
- 6-layer-tracking is now on a reasonable level again (but still not good enough)
- Known issues left:
  - $\Theta = 90°$-bug still existing (reason still unknown)
  - Bad secMap-cuts due to issues with relations (see Madleners talk)
  - Bad secMap-cuts due to using TrueHits for secMap-calculation instead of Clusters (planned to switch to SpacePoints ($\hat{=}$ cluster-based) soon)

r14930 - evtGen no BG



r14890 - evtGen no BG



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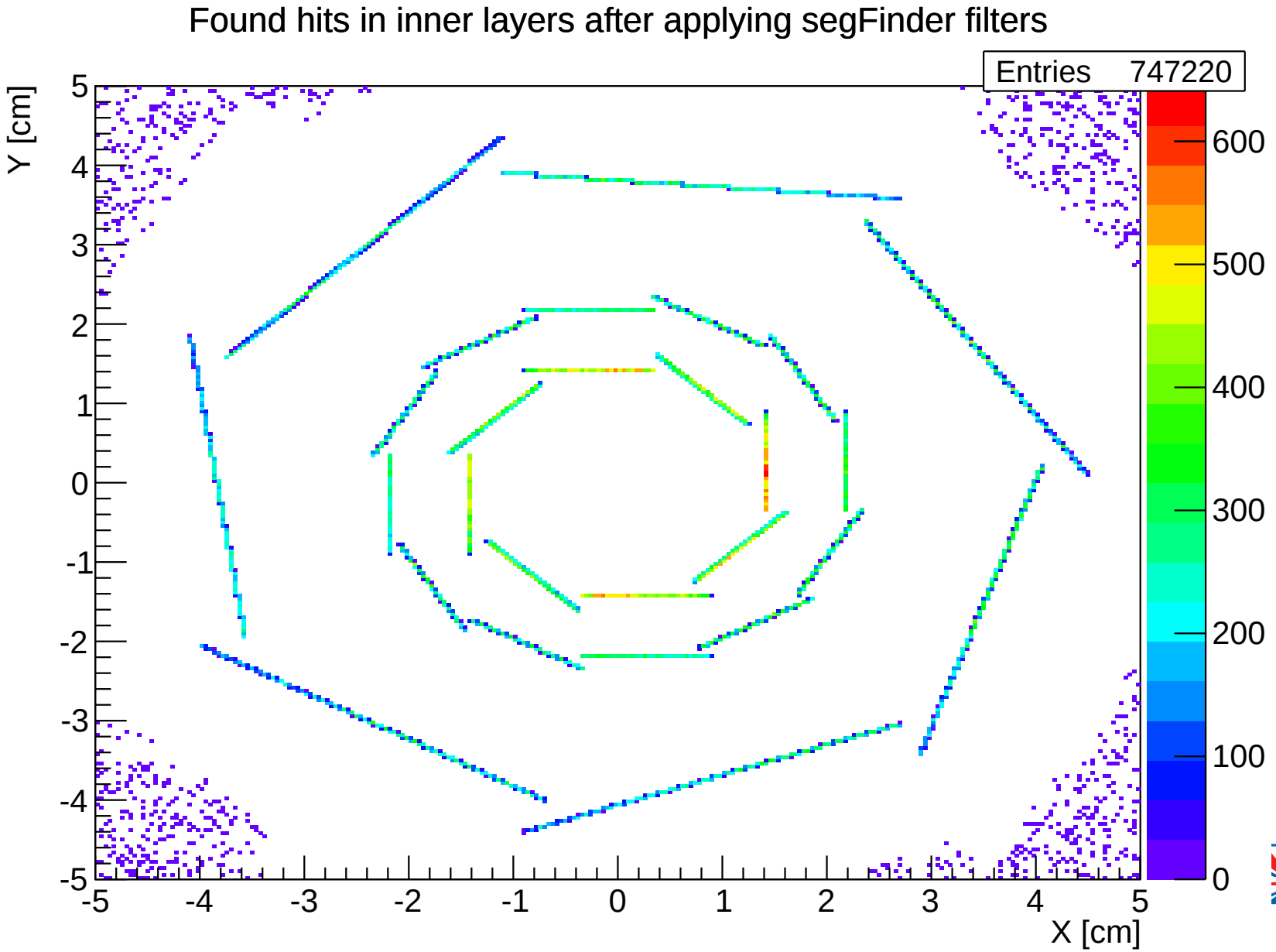

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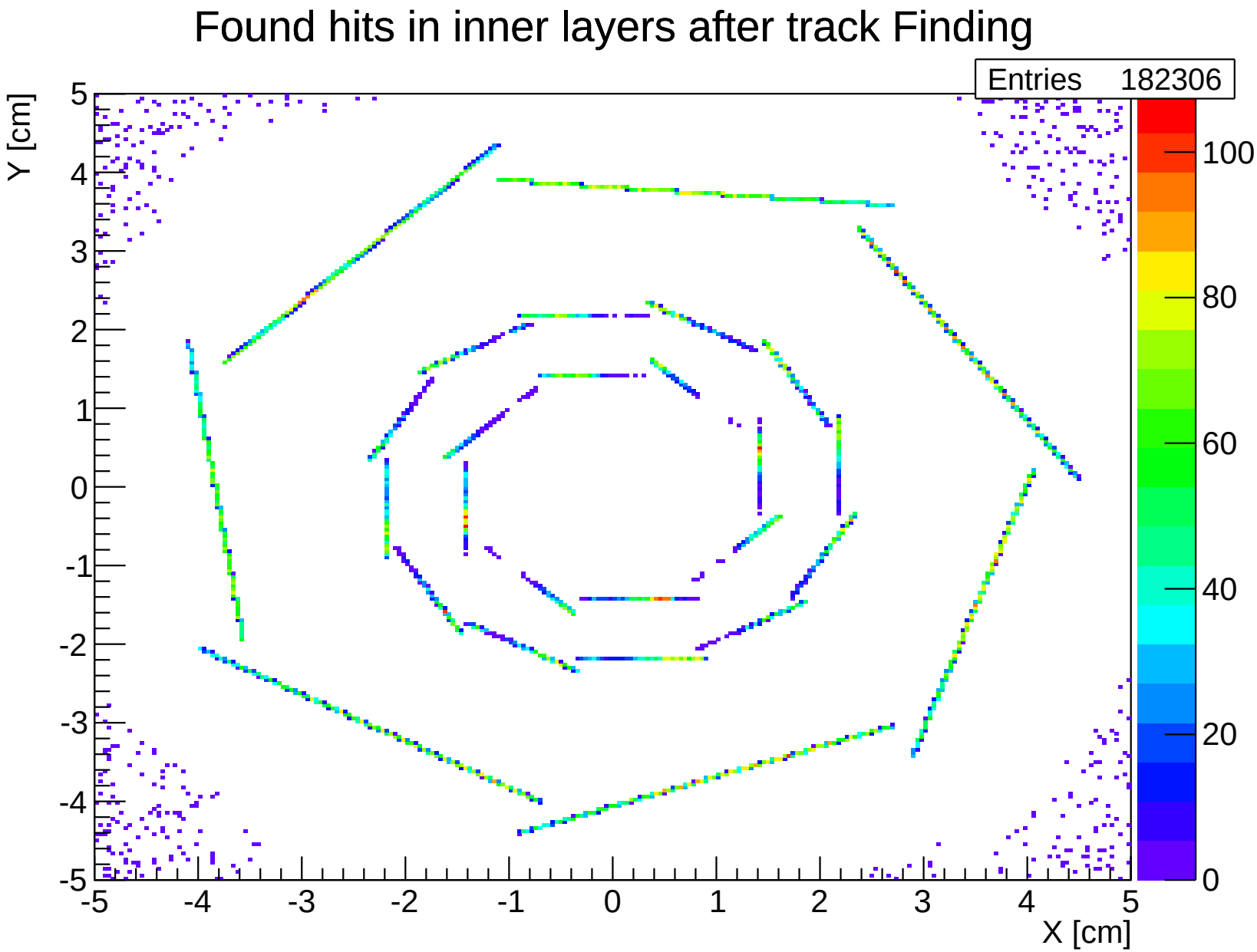

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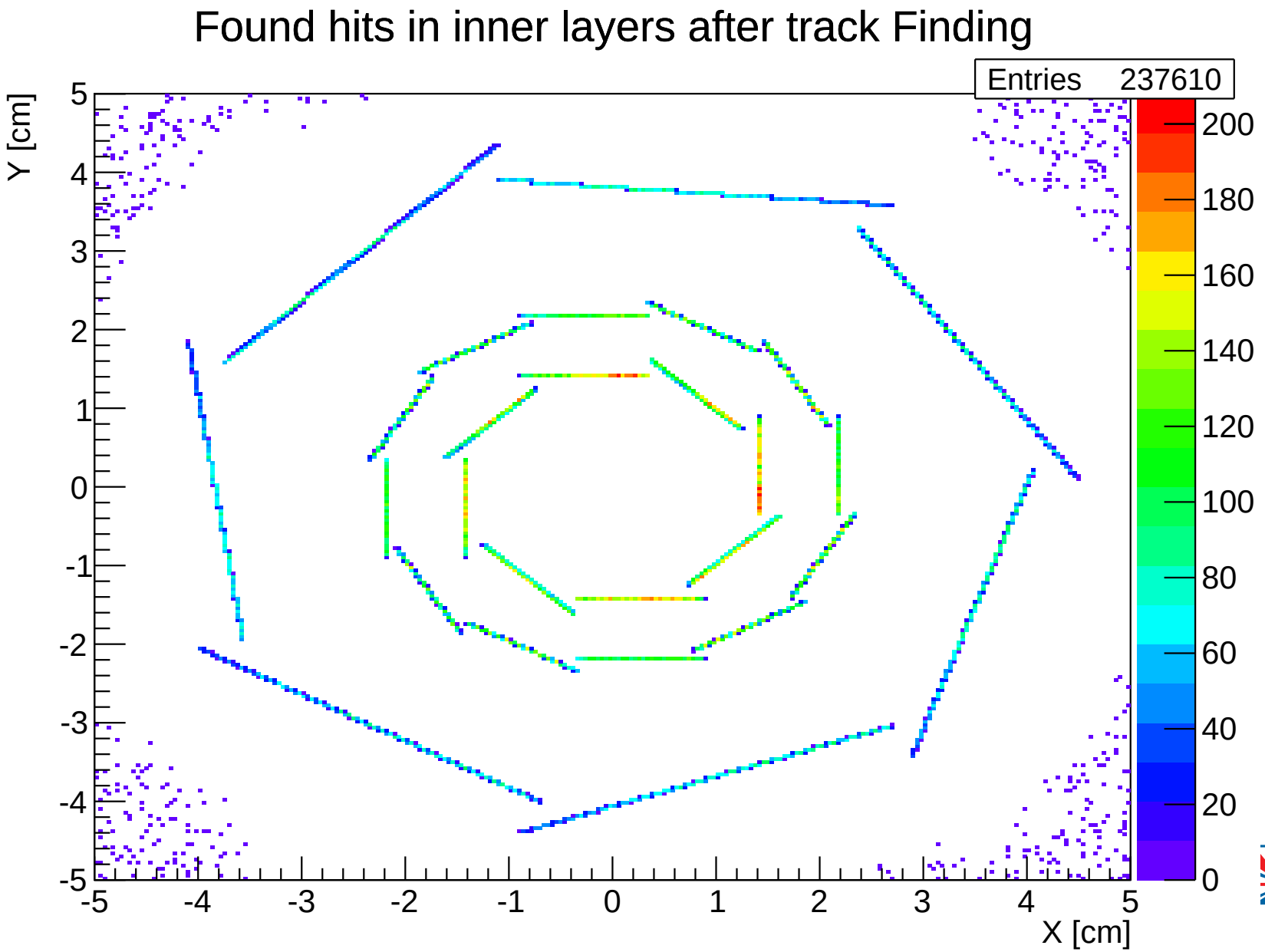

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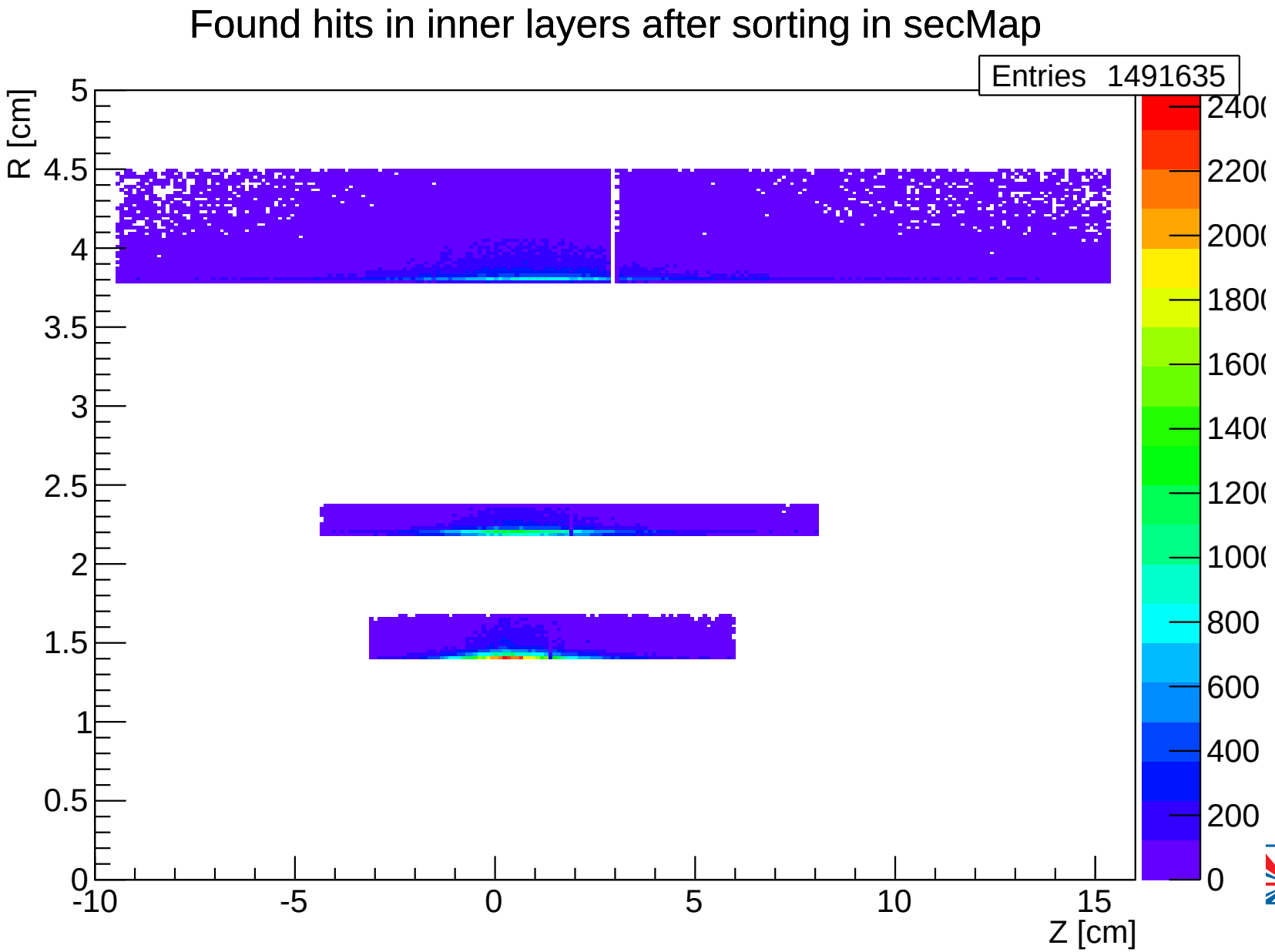

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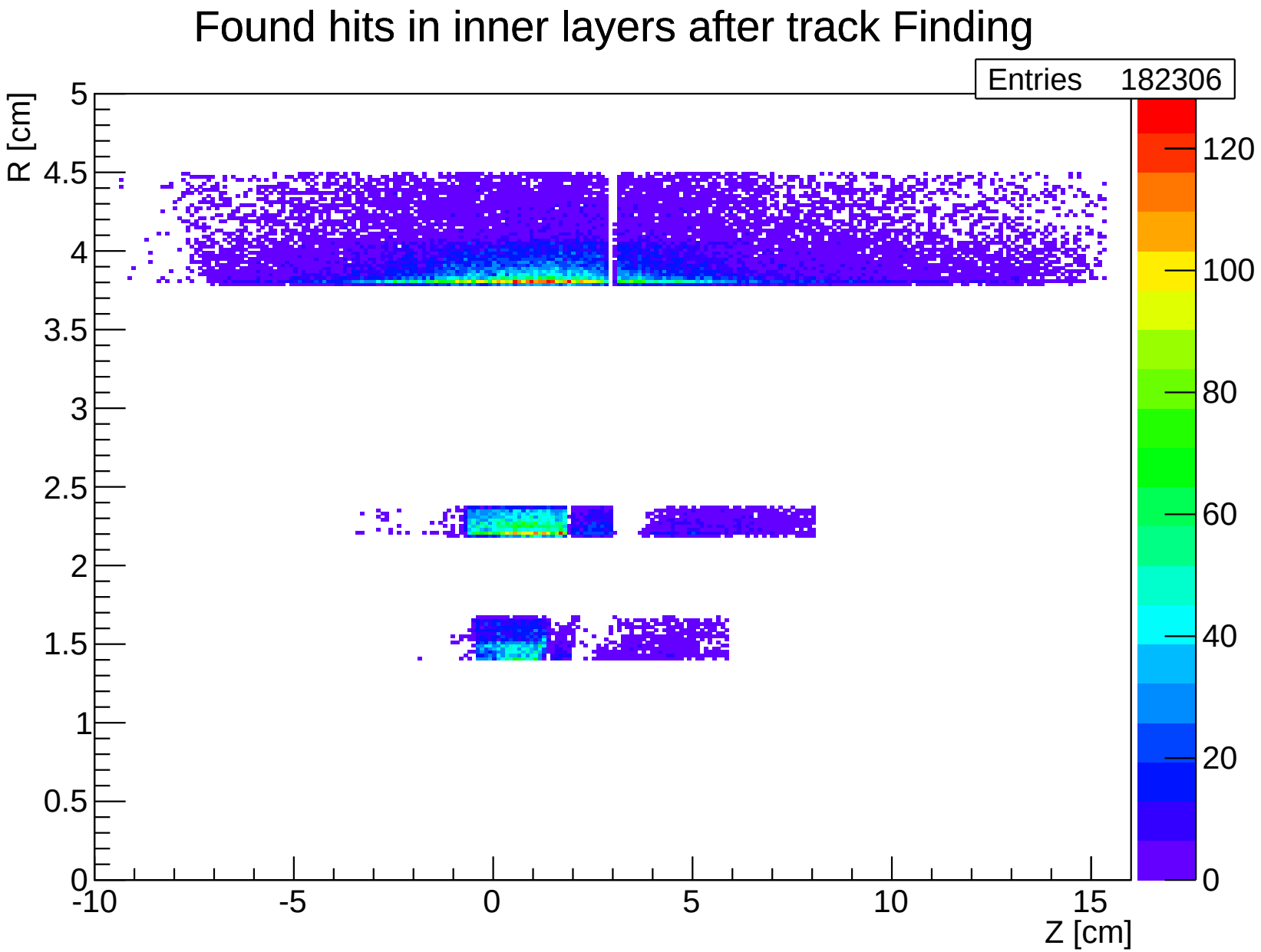

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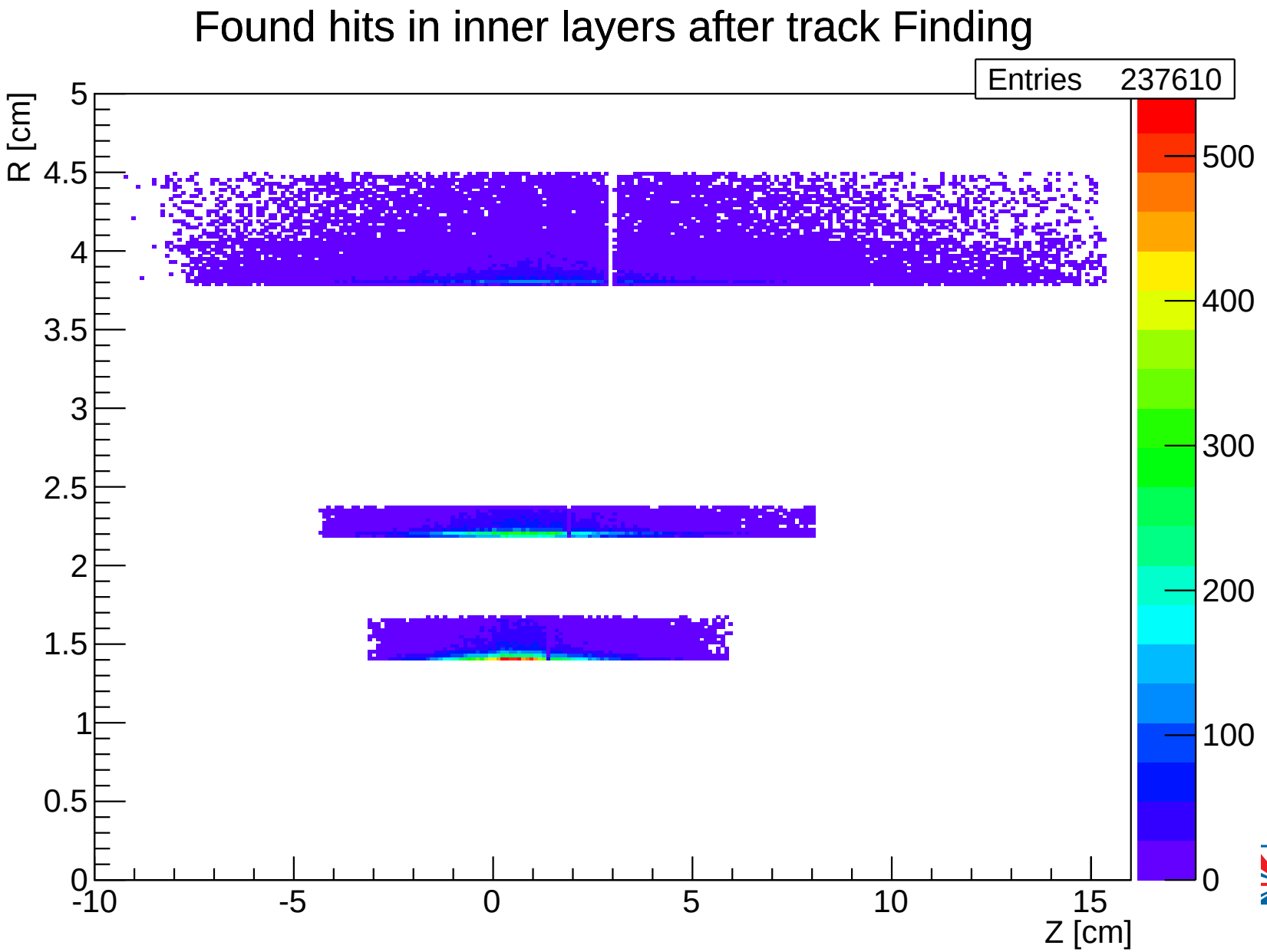
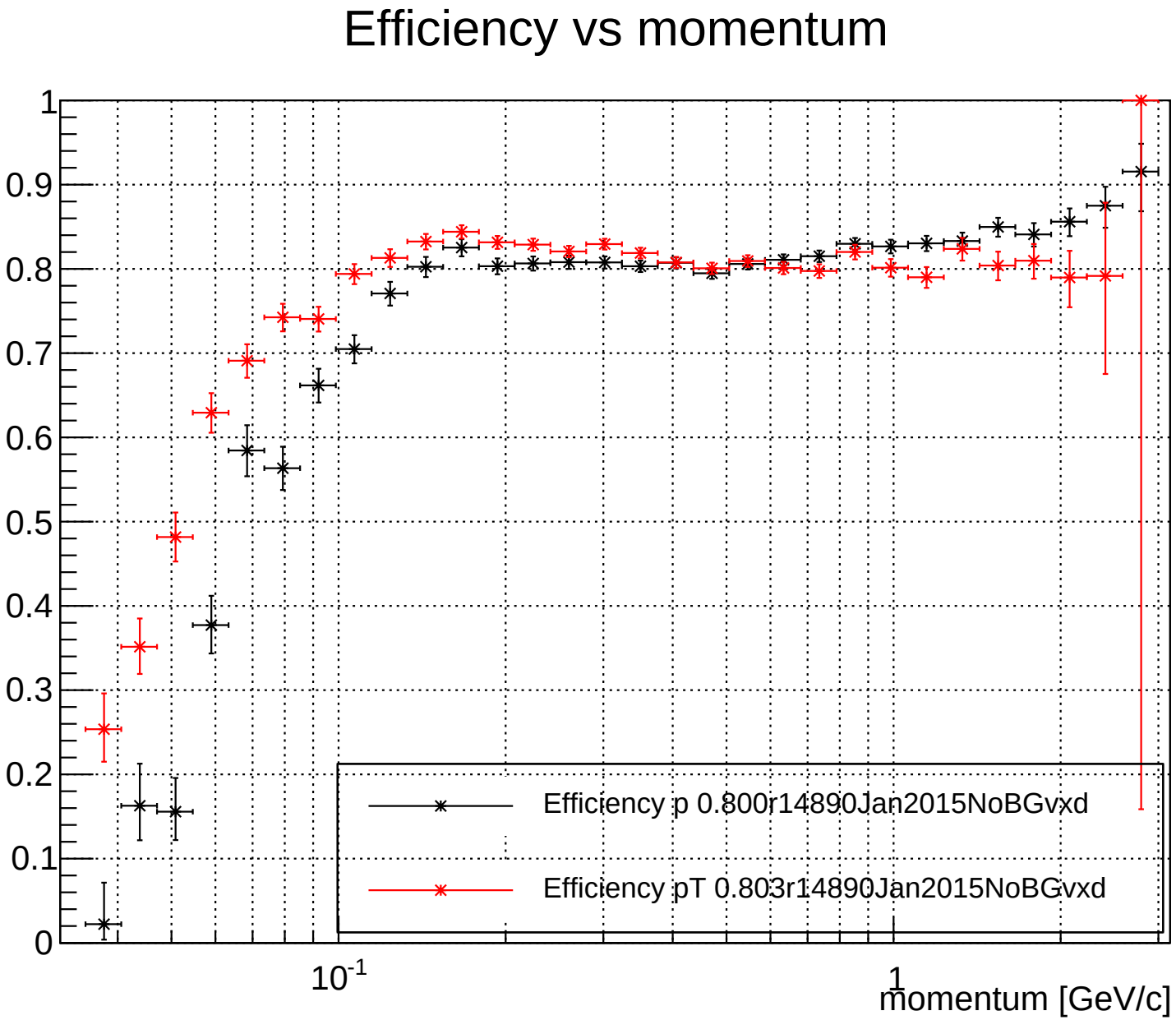


r14890 - evtGen no BG - vxd efficiency p-pT



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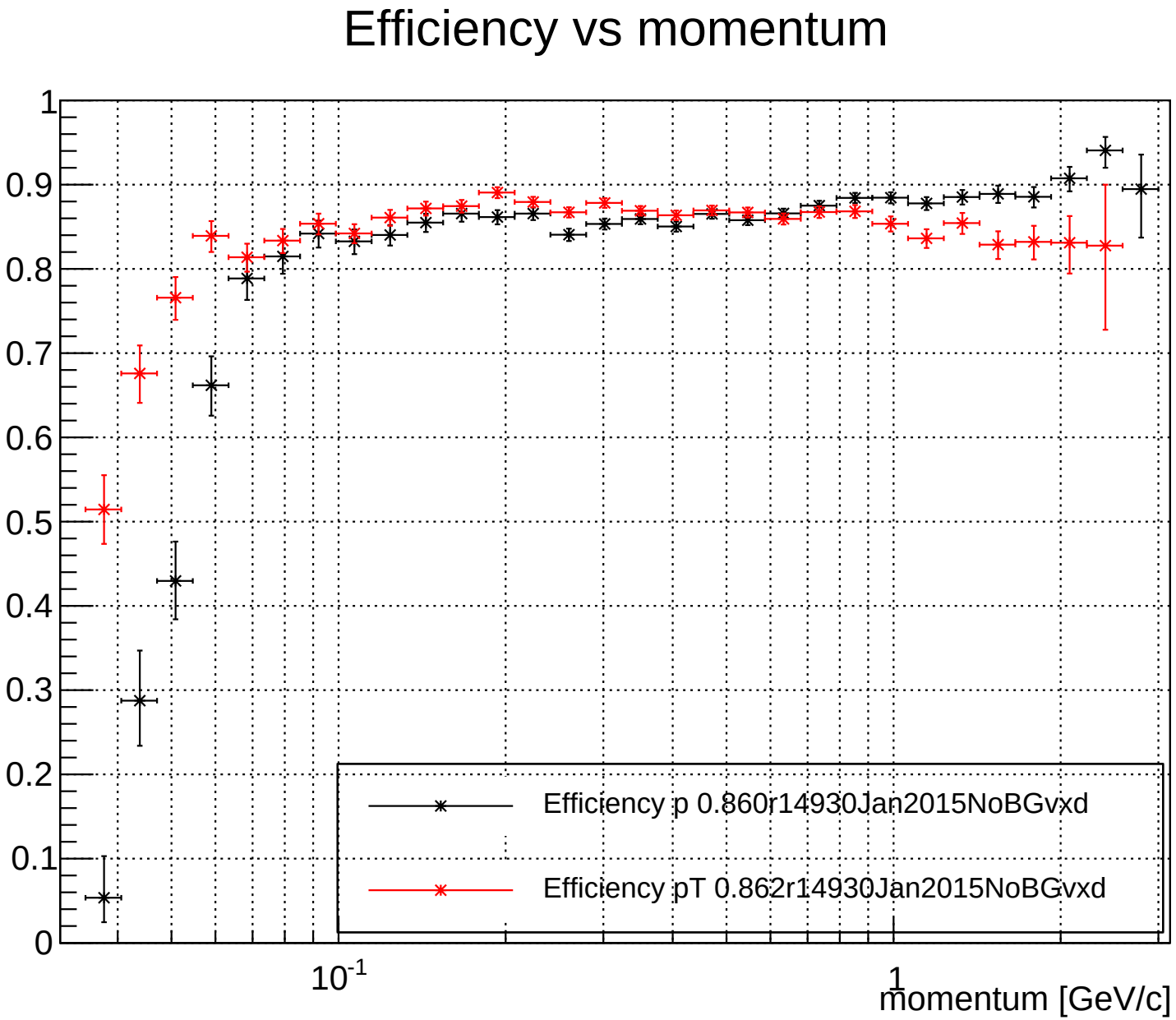

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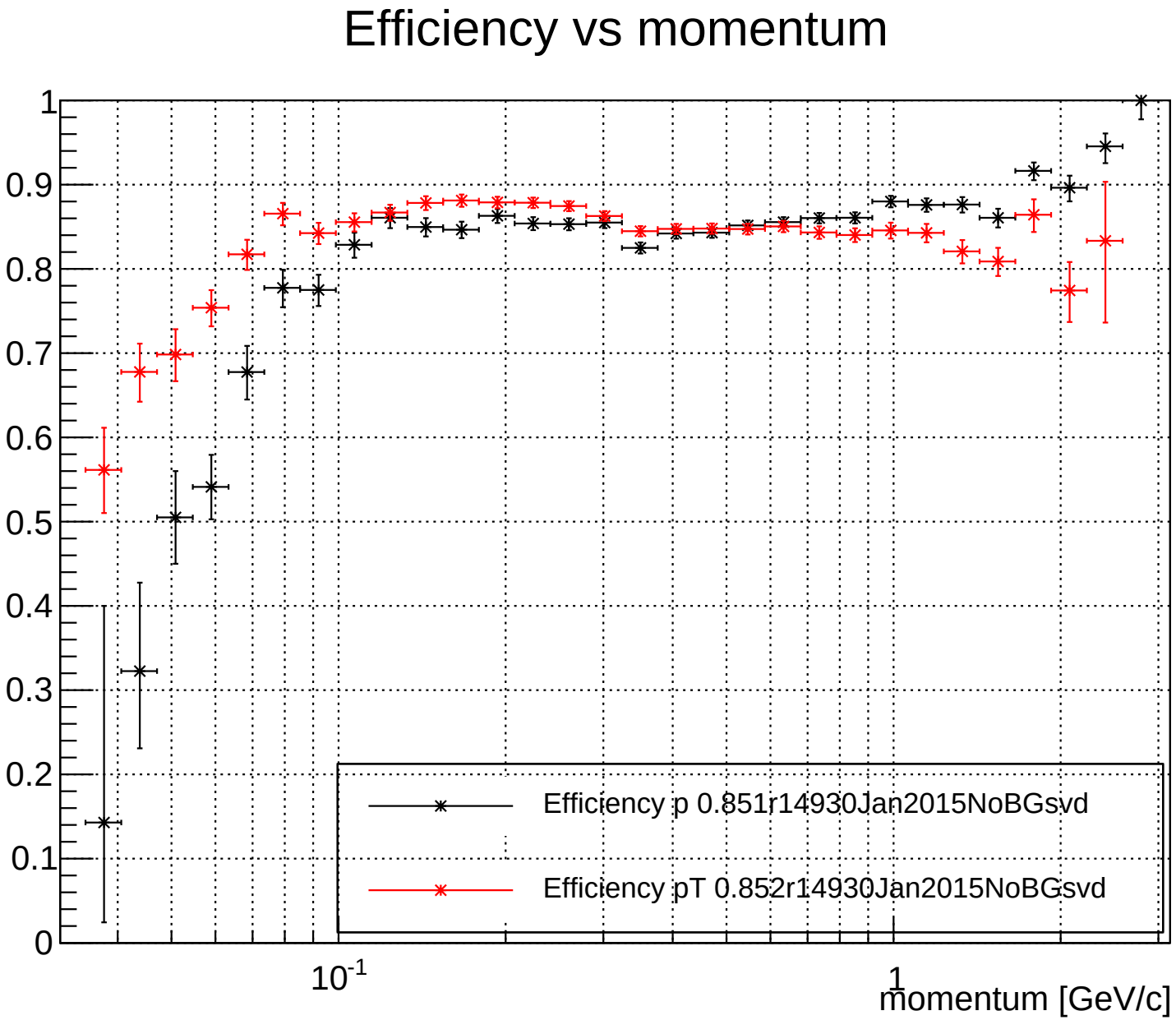
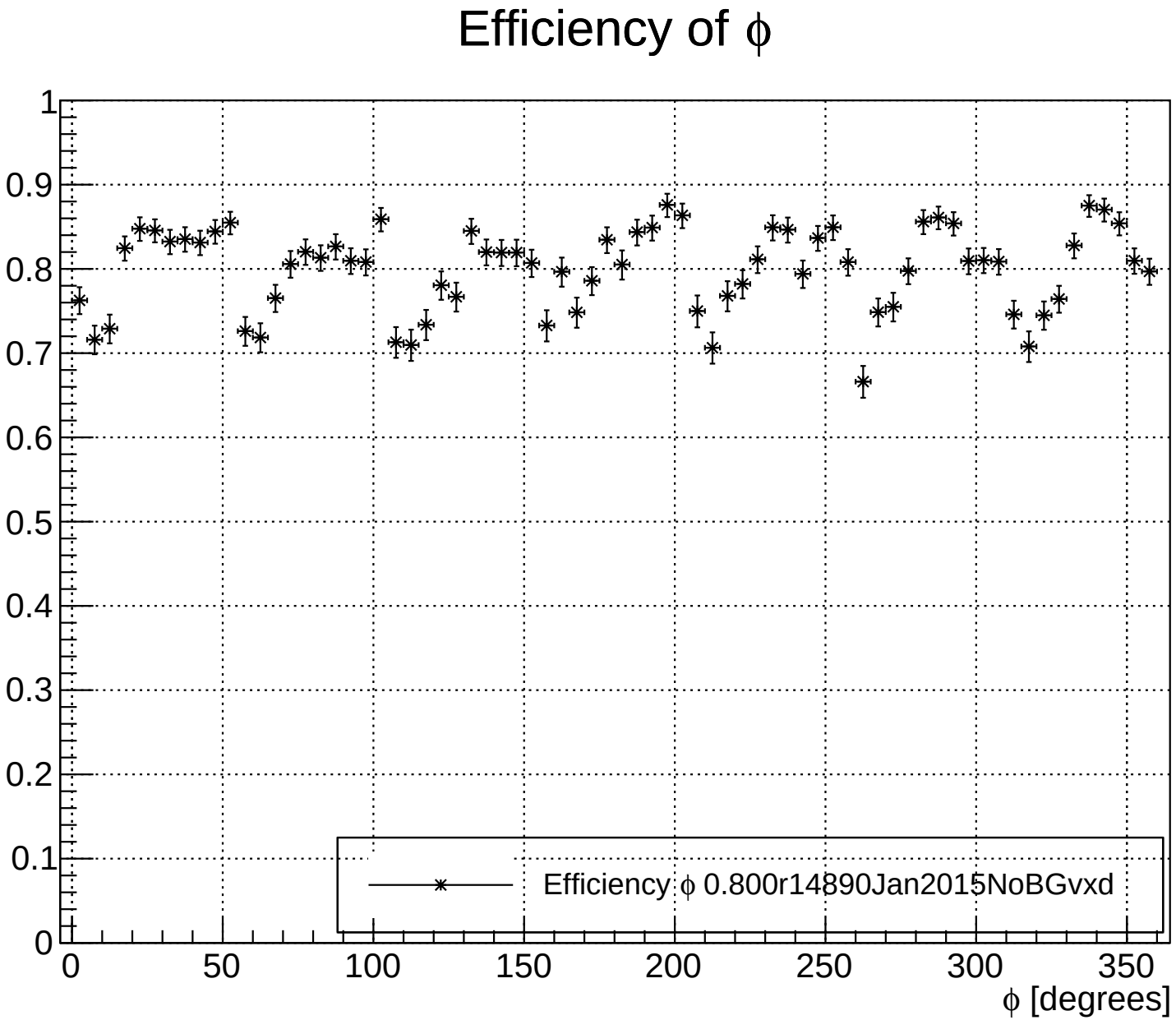


r14890 - evtGen no BG - vxd efficiency Phi



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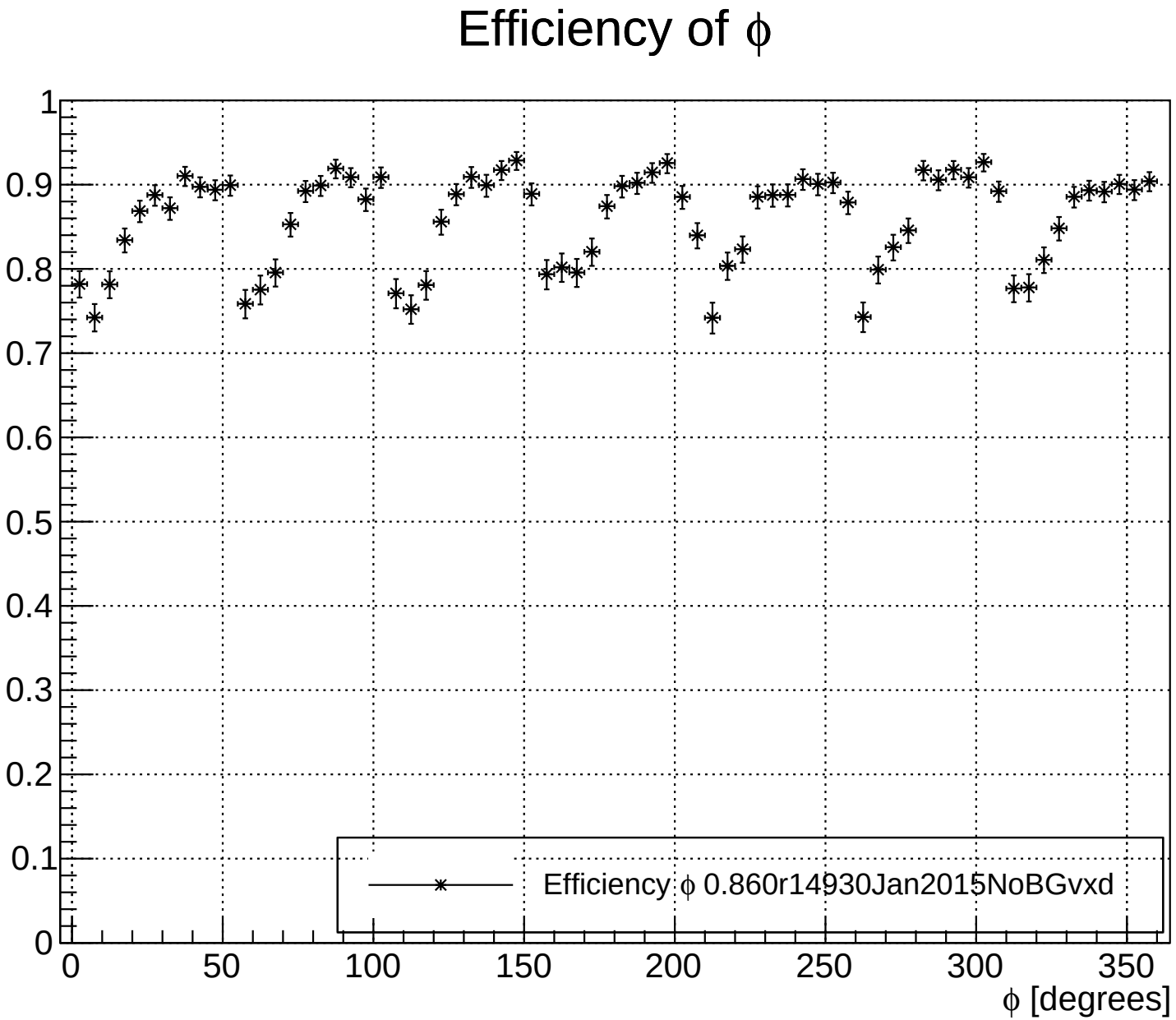

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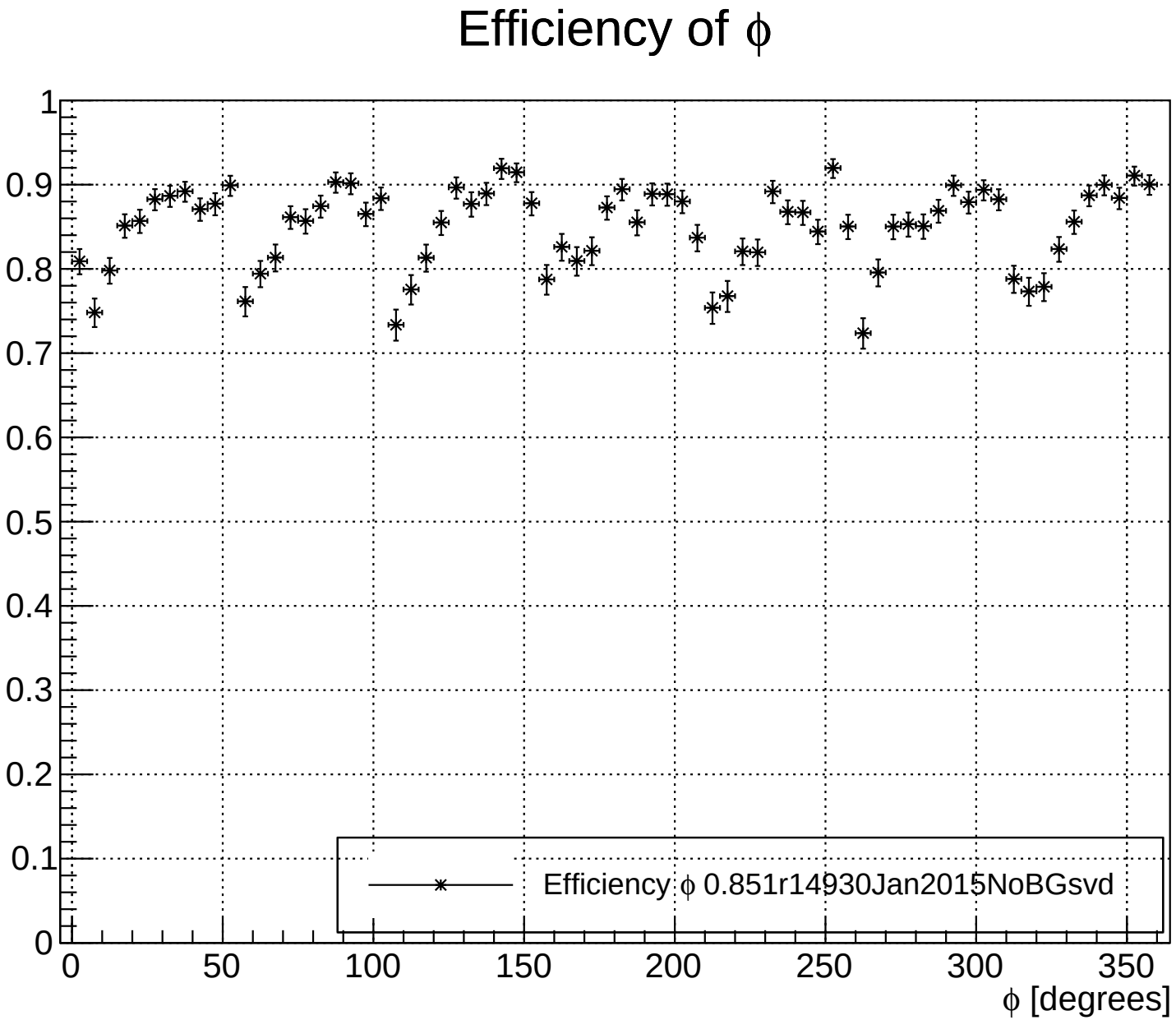
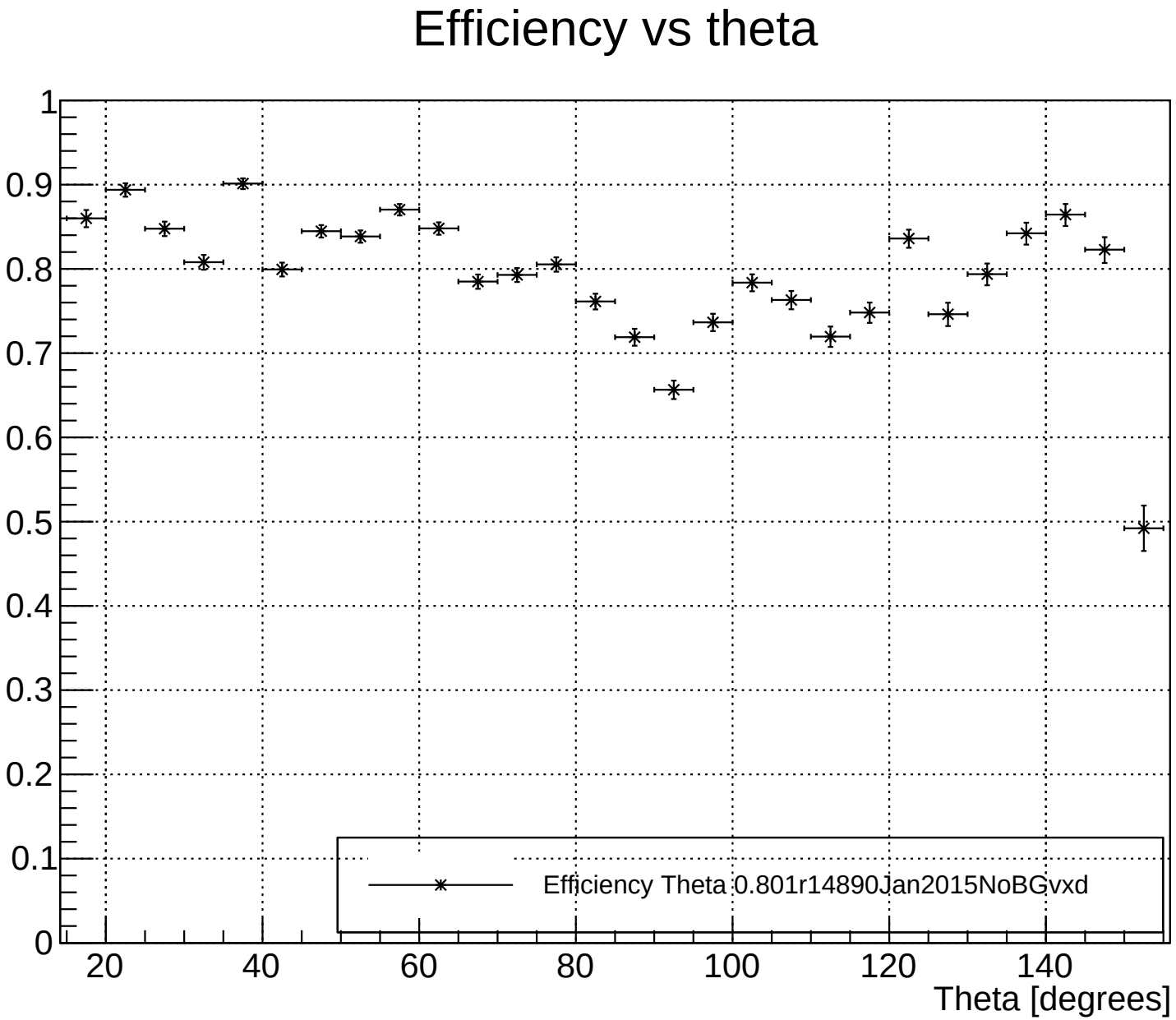


r14890 - evtGen no BG - vxd efficiency Theta



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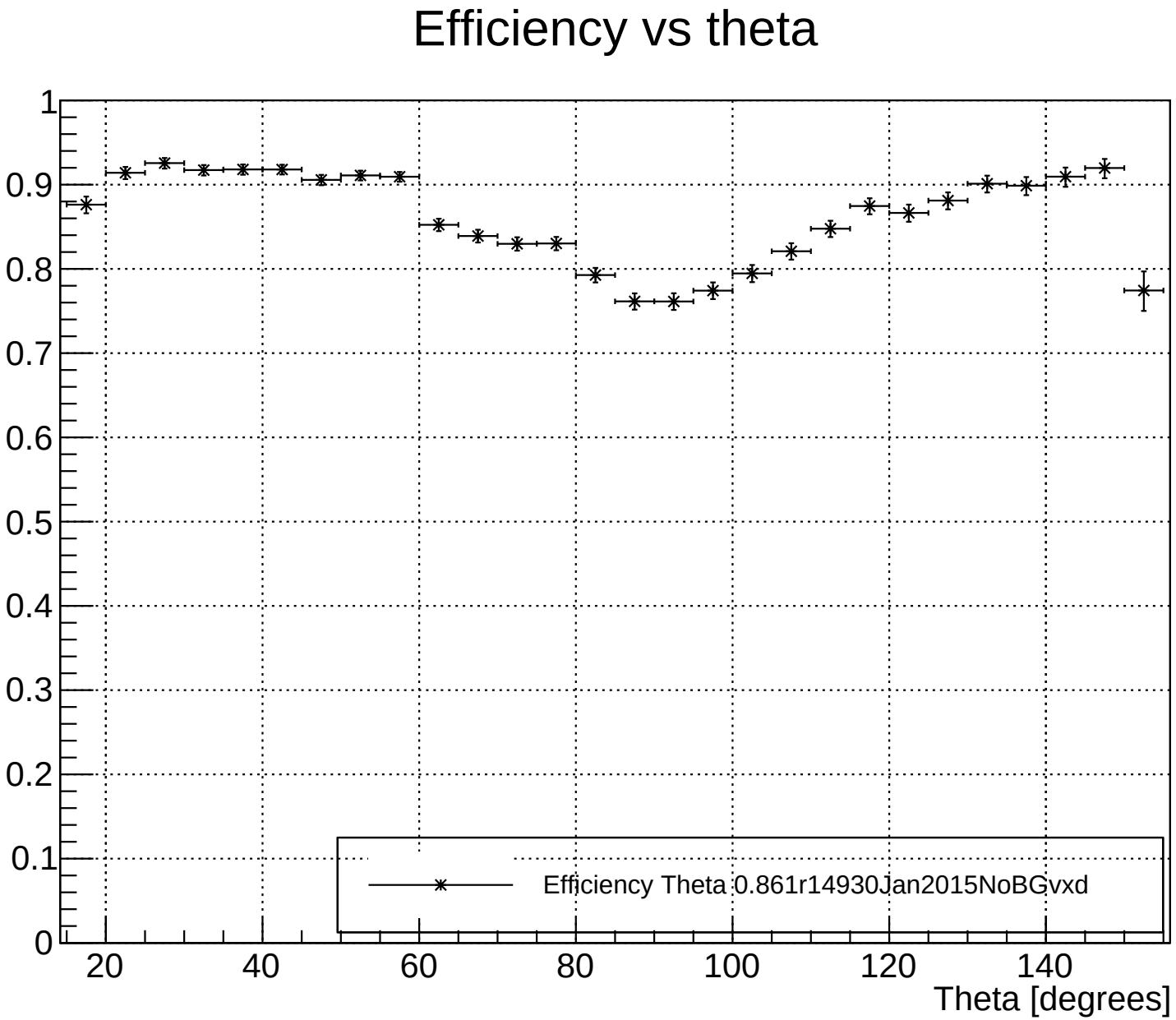

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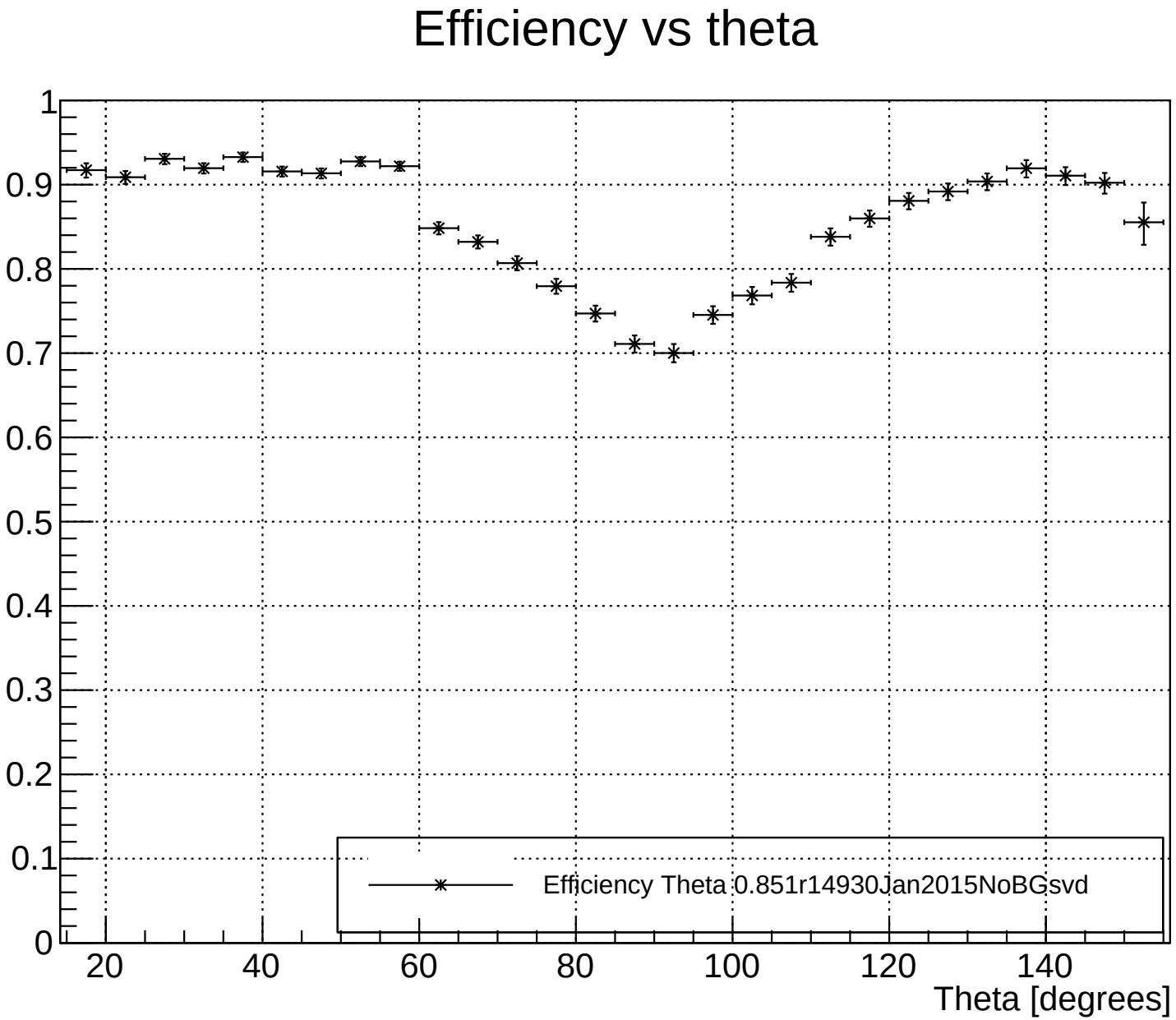
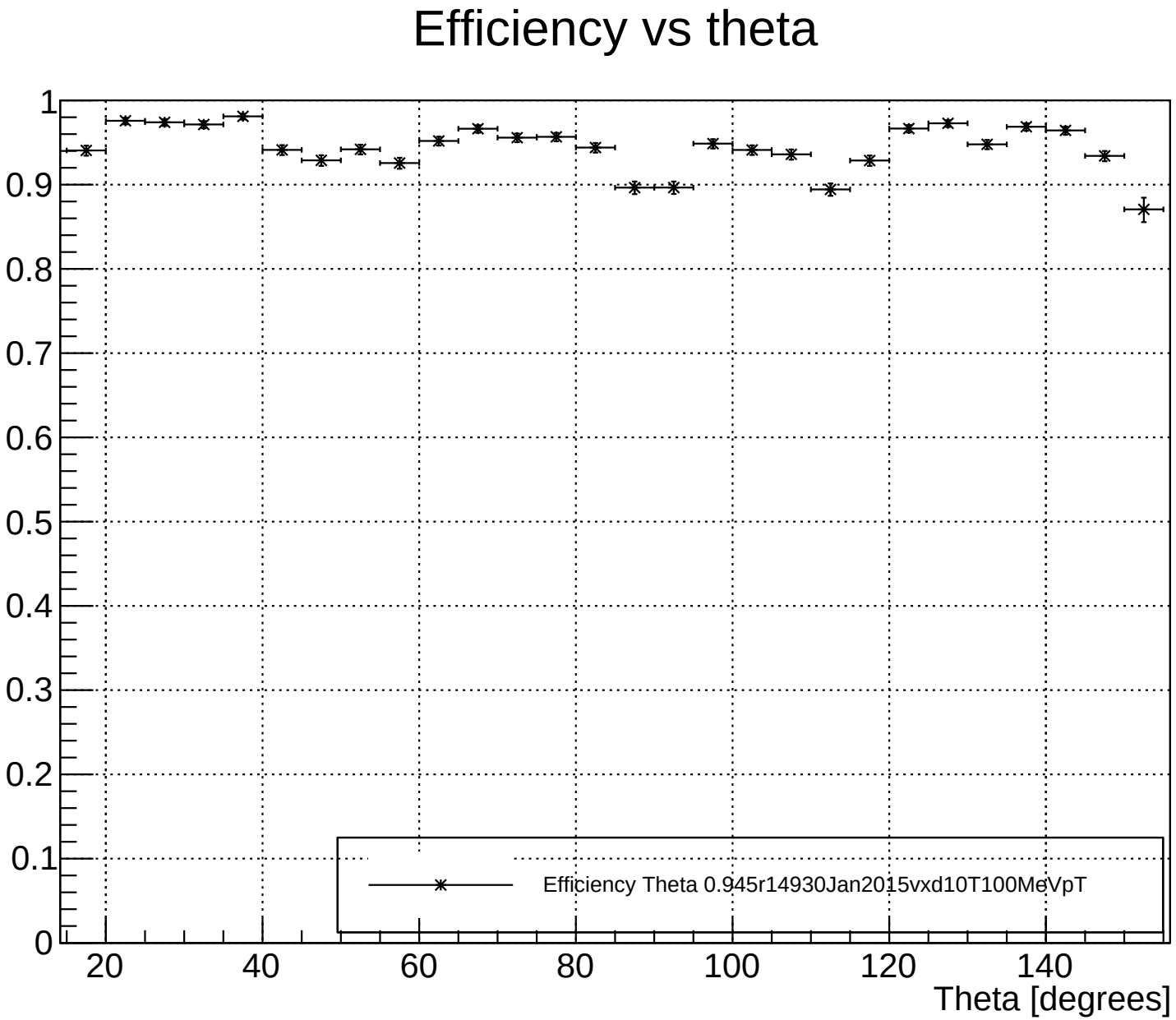
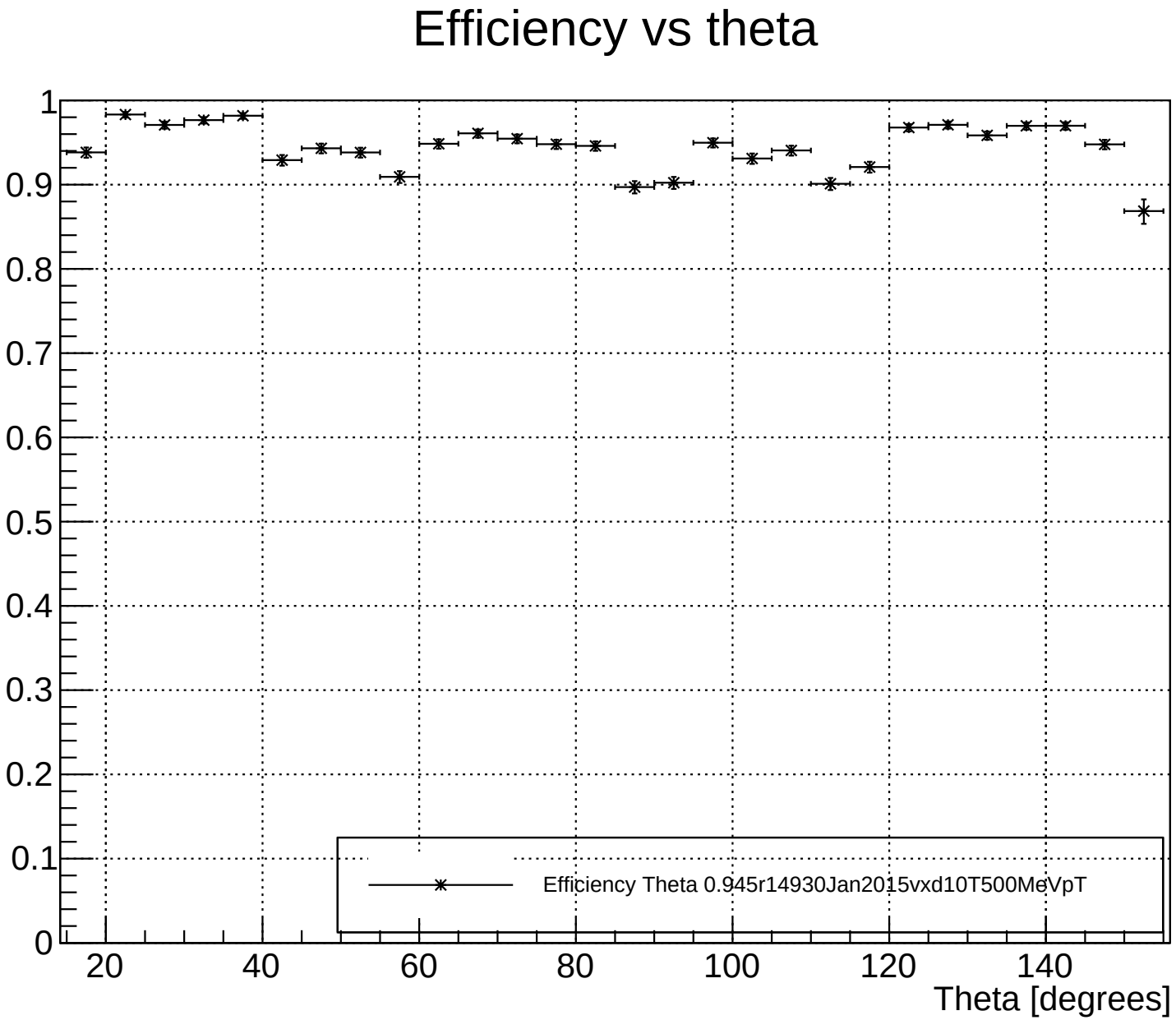


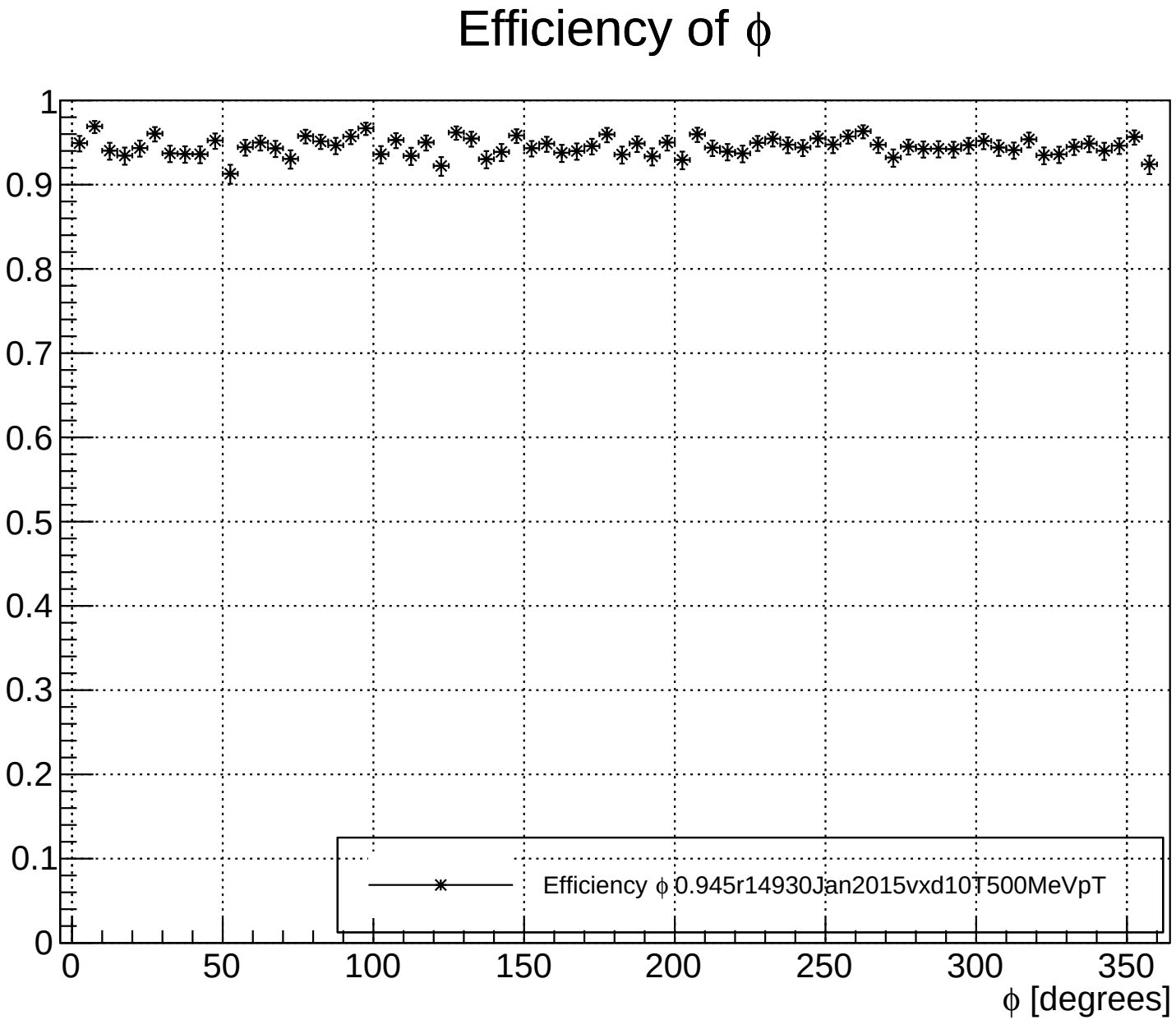
10my 100MeV pT - vxd efficiency Theta



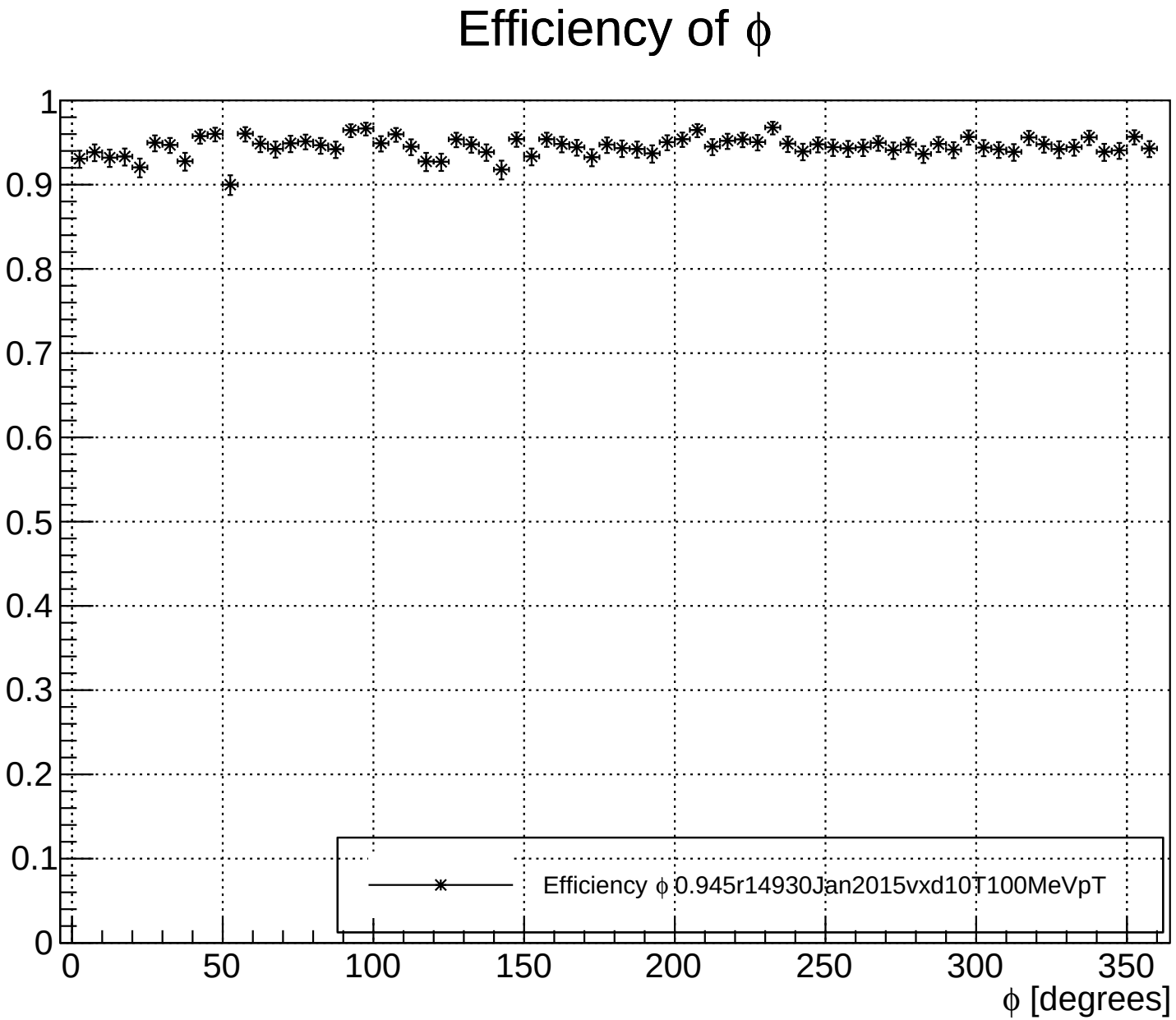
10my 500MeV pT - vxd efficiency Theta



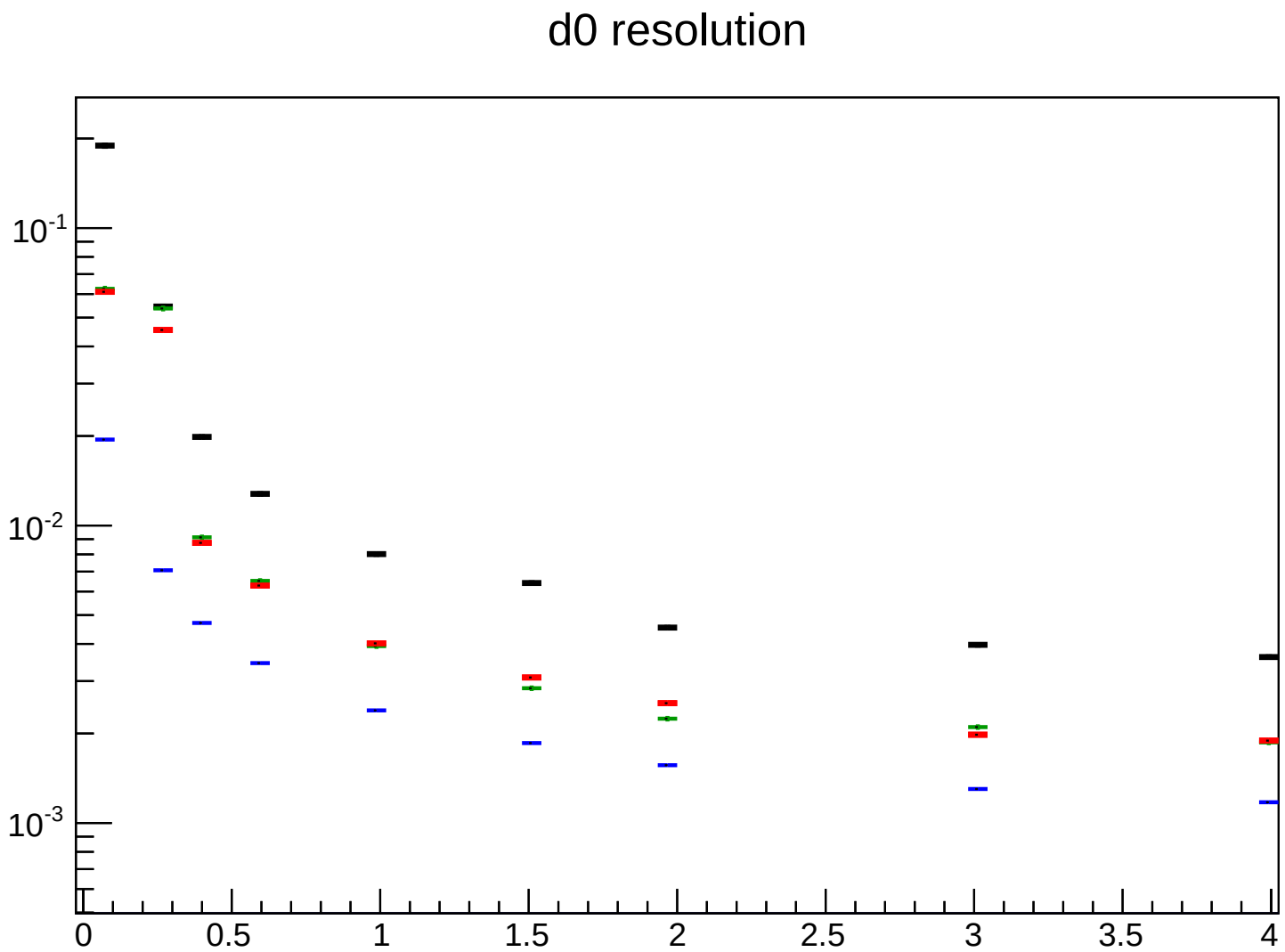
10my 100MeV pT - vxd efficiency Phi



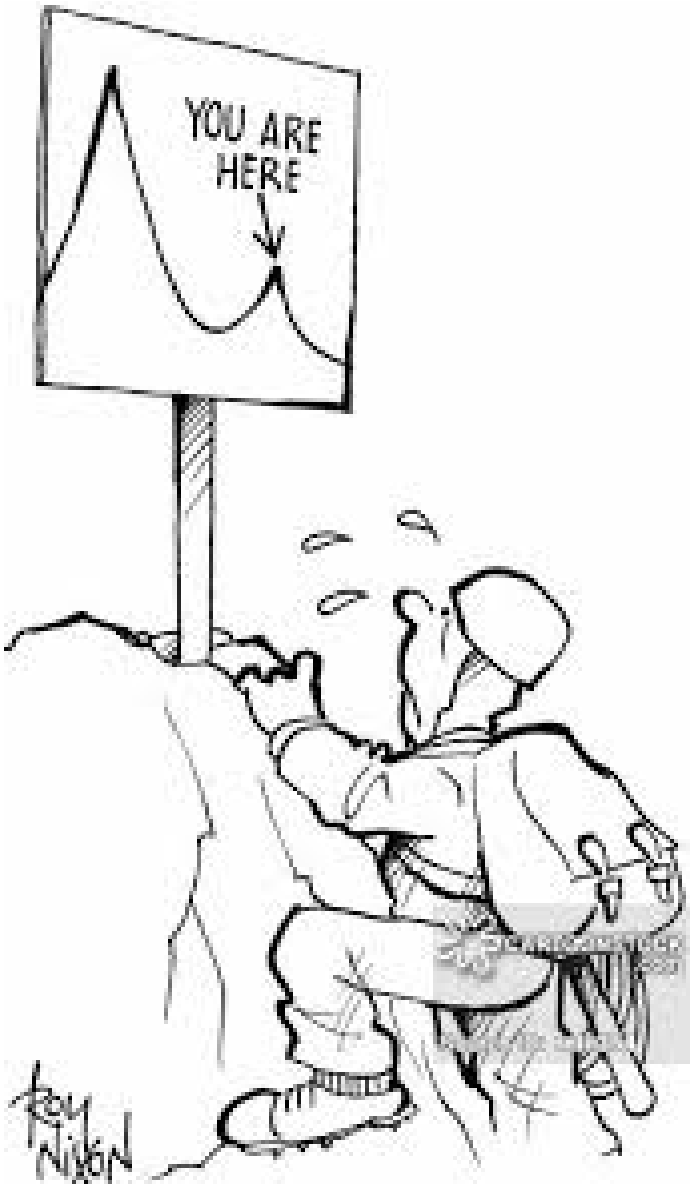
10my 500MeV pT - vxd efficiency Phi



blue: MC, black: with bug, red/green: post bug



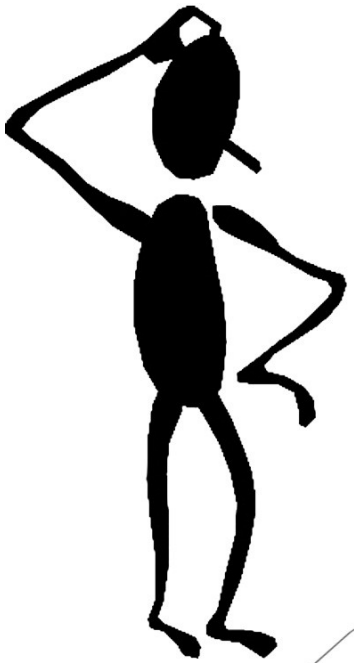
enjoy the scenery!

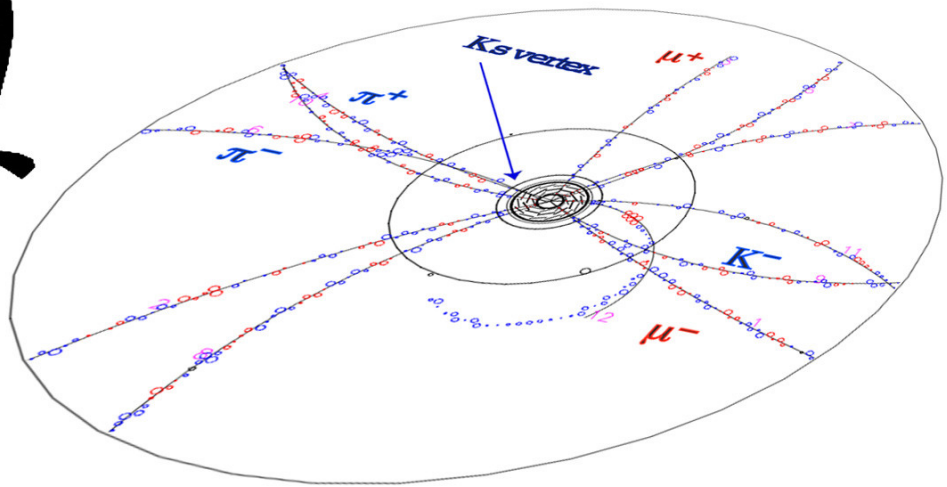


Next proposed steps - ordered (time planned):

- Quick and dirty efficiency-finetuning for connecting the dots-conference (?) (1-3 week)
  - Converting VXDTF-, TFRedesign- and FilterCalculatorModule to SpacePoints (should then easily be migrated to tracknodes of segmentNetwork)
- Finishing Observer-stuff (1-2 weeks)
- Starting to use new sectorMap-container $\rightarrow$ to be coordinated with Eugenio
- Migrating to segmentNetwork, finishing its module
- Implementing SelectionVariables for nbFinder and others
- Migrating modules: CA, Hopfield, KF(genfit-pipe), CF, Greedy, Referee (simple version)
- Connecting the modules, make sure everything works
- Expected milestone to be reached: end of April

that's all, folks!





Any suggestions, ideas or requests?

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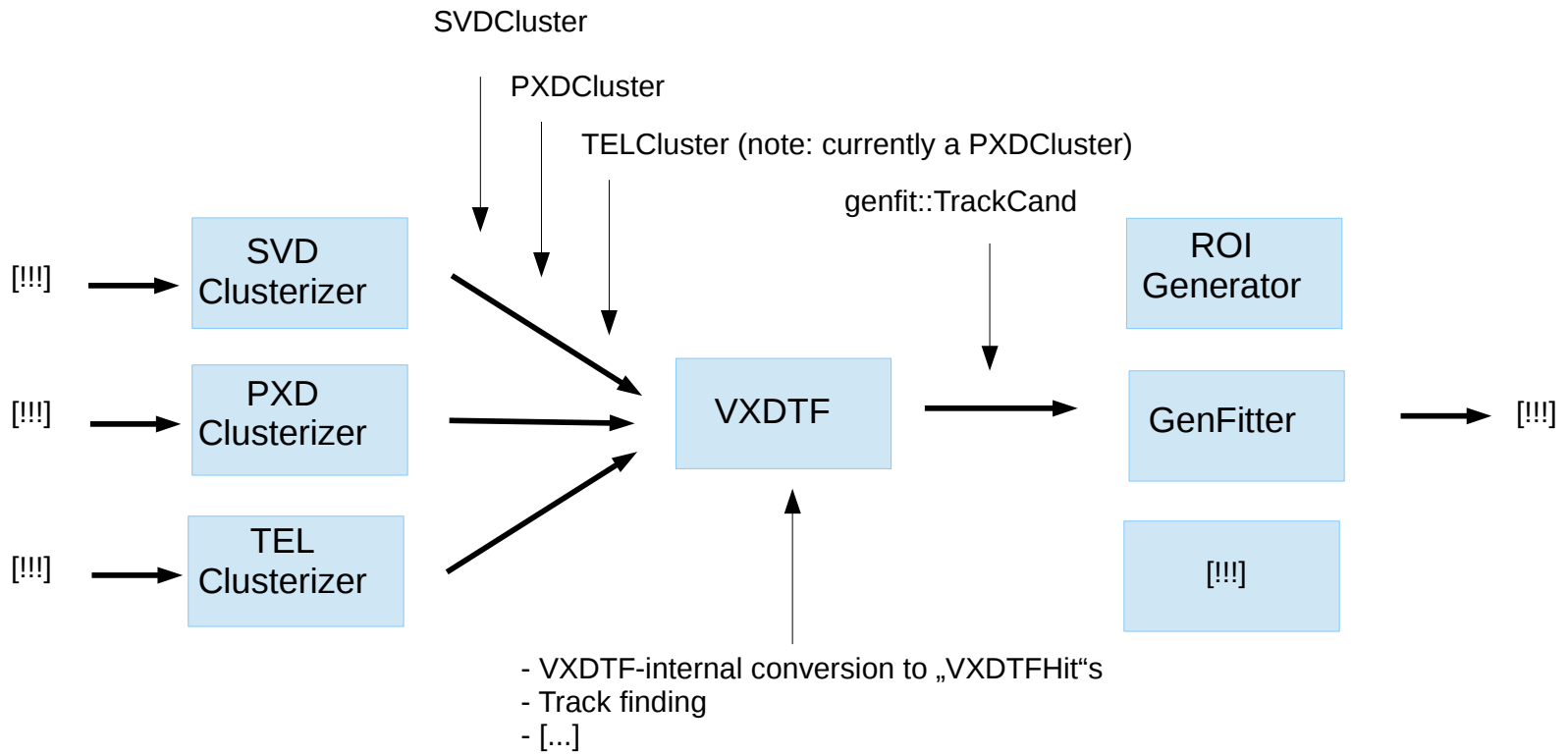
The redesign task-force

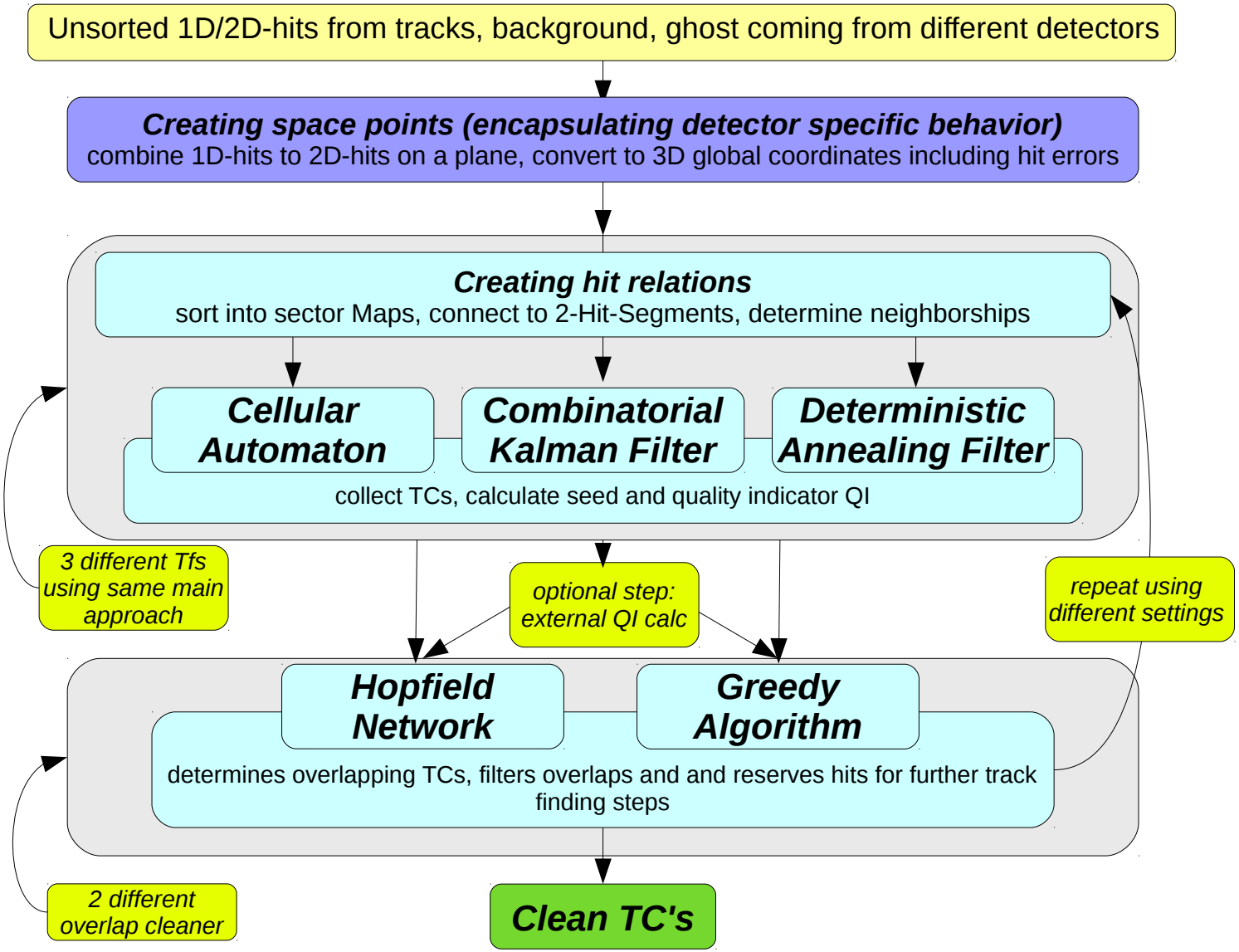
Who participates actively

- Eugenio Paoloni: the sectorMap-*Creator* (design for interfaces, off-line and on-line)
- Thomas Madlener: personal coach for the sectorMaps (training of the cuts, choosing sector size, filter types, pT-cuts, ...)
- Rudolf Frühwirth: father of the trackFinder (TF concept is his initial idea, now consulting task)
- Martin Heck: convener (mainly consulting tasks)
- Jakob Lettenbichler: midwife of the TF (responsible for the rest)

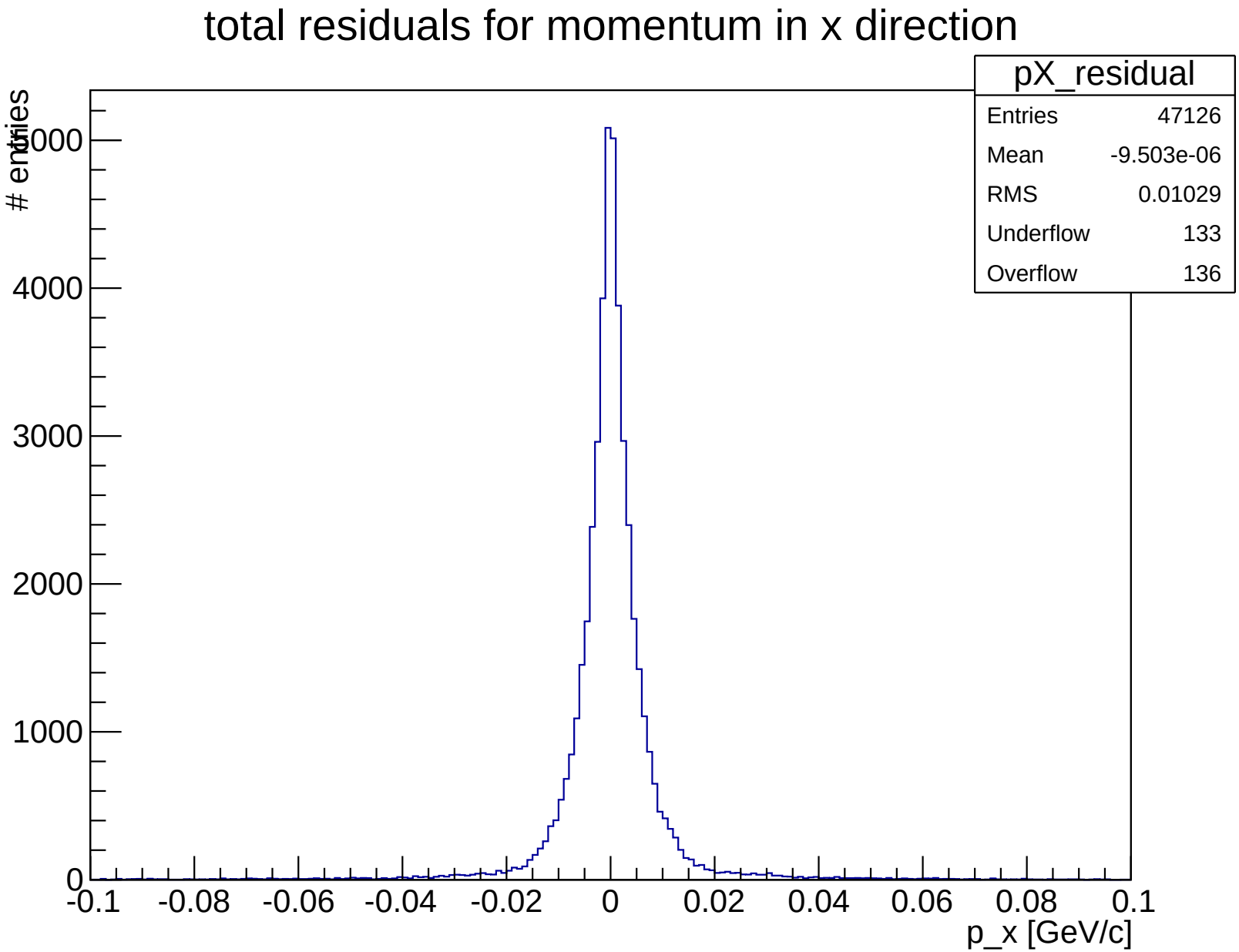
Current state of this part of the reconstruction chain



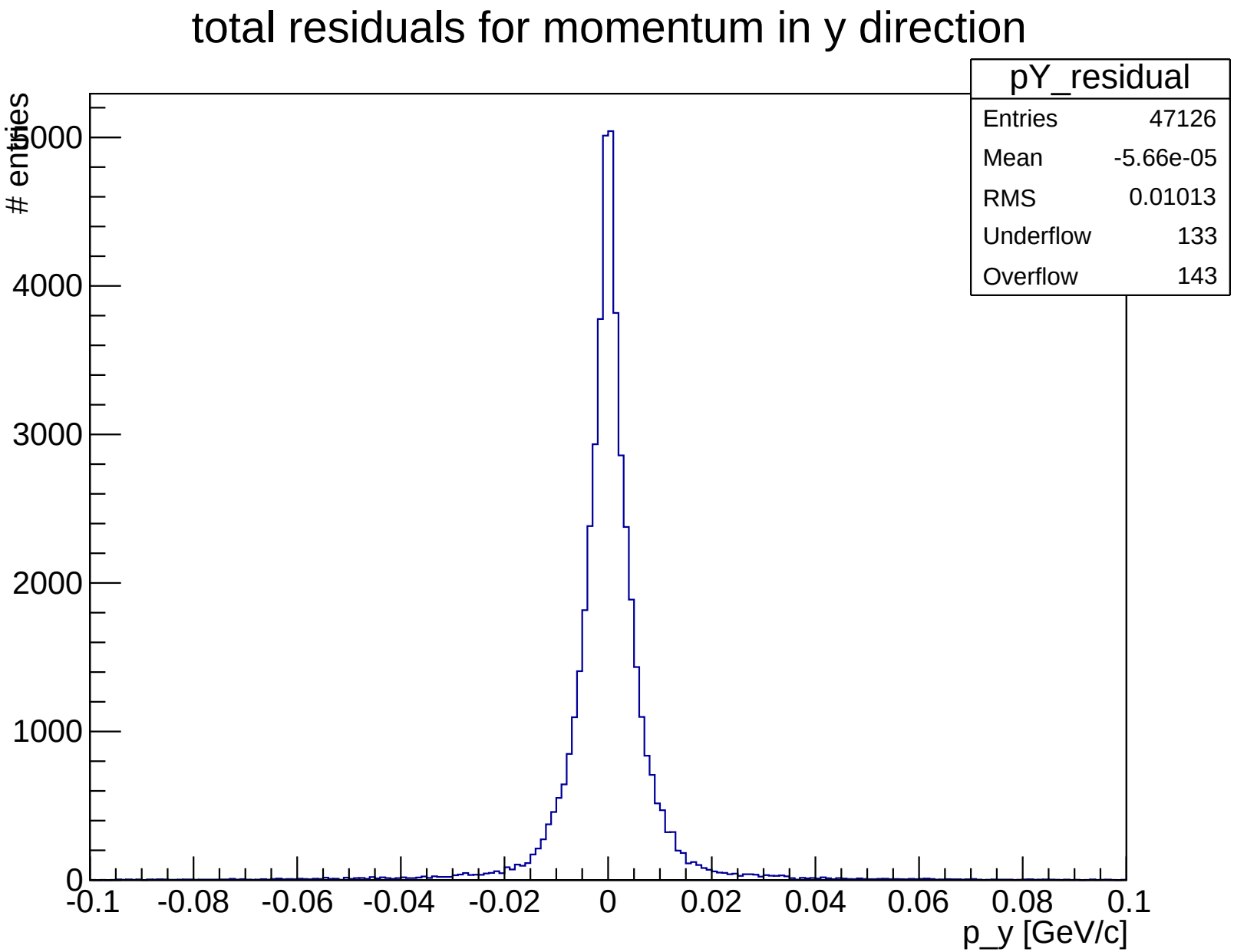
[!!!] : shortcut for „a lot of important stuff which is not part of this discussion“


Unsorted 1D/2D-hits from tracks, background, ghost coming from different detectors
Creating space points (encapsulating detector specific behavior)
combine 1D-hits to 2D-hits on a plane, convert to 3D global coordinates including hit errors
Creating hit relations
sort into sector Maps, connect to 2-Hit-Segments, determine neighborships
Cellular Automaton
Combinatorial Kalman Filter
Deterministic Annealing Filter
collect TCs, calculate seed and quality indicator QI
3 different Tfs using same main approach
optional step: external QI calc
repeat using different settings
Hopfield Network
Greedy Algorithm
determines overlapping TCs, filters overlaps and and reserves hits for further track finding steps
2 different overlap cleaner
Clean TC's

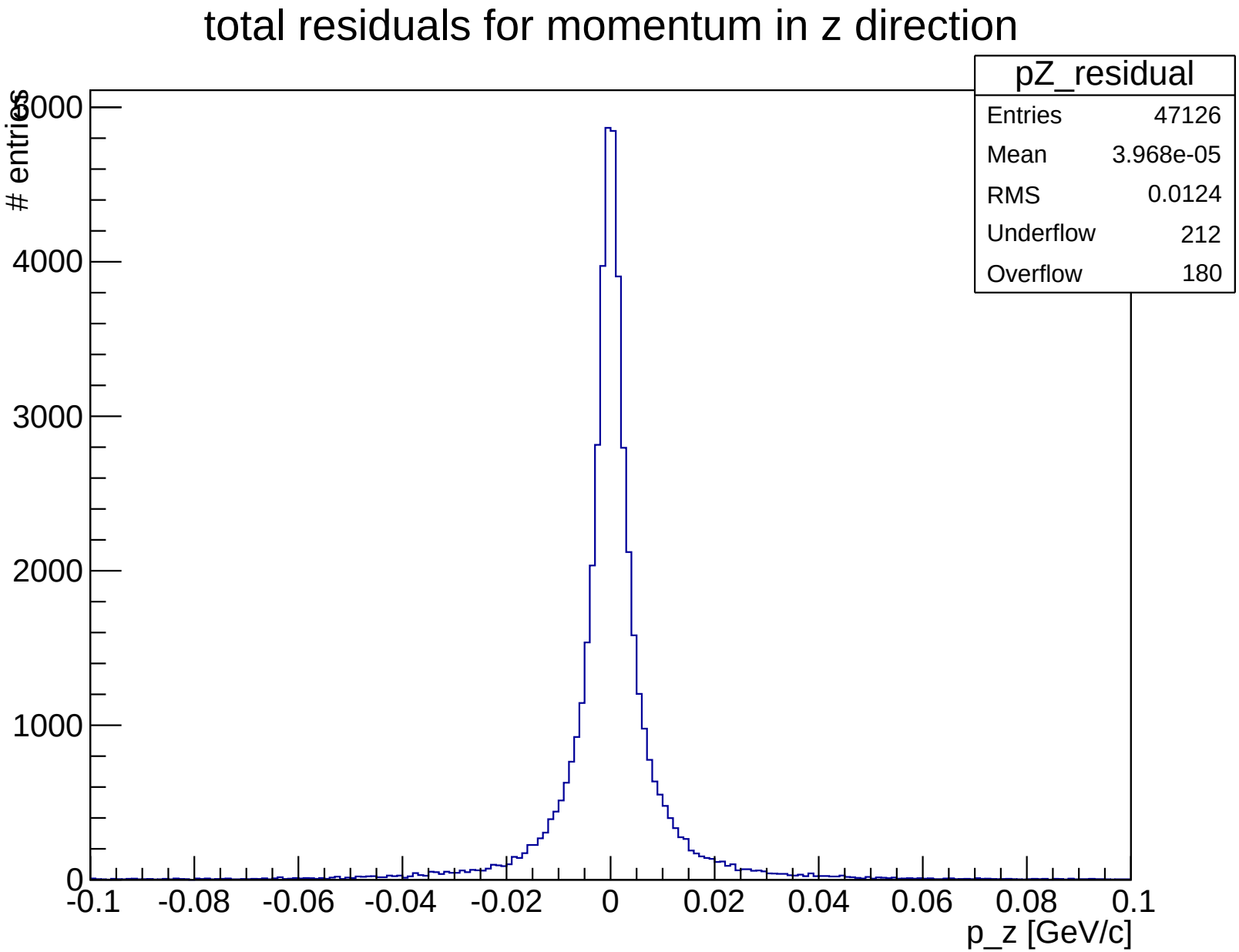
10my 100MeV pT - vxd px residuals (reconstructed all)



10my 100MeV pT - vxd py residuals (reconstructed all)



10my 100MeV pT - vxd pz residuals (reconstructed all)



10my 100MeV pT - vxd pT residuals (reconstructed all)