Global Reco study at GSI and beyond

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Intro

- Global reconstruction studies with Genfit using 2 different configurations:
  - Full FOOT setup
  - GSI setup

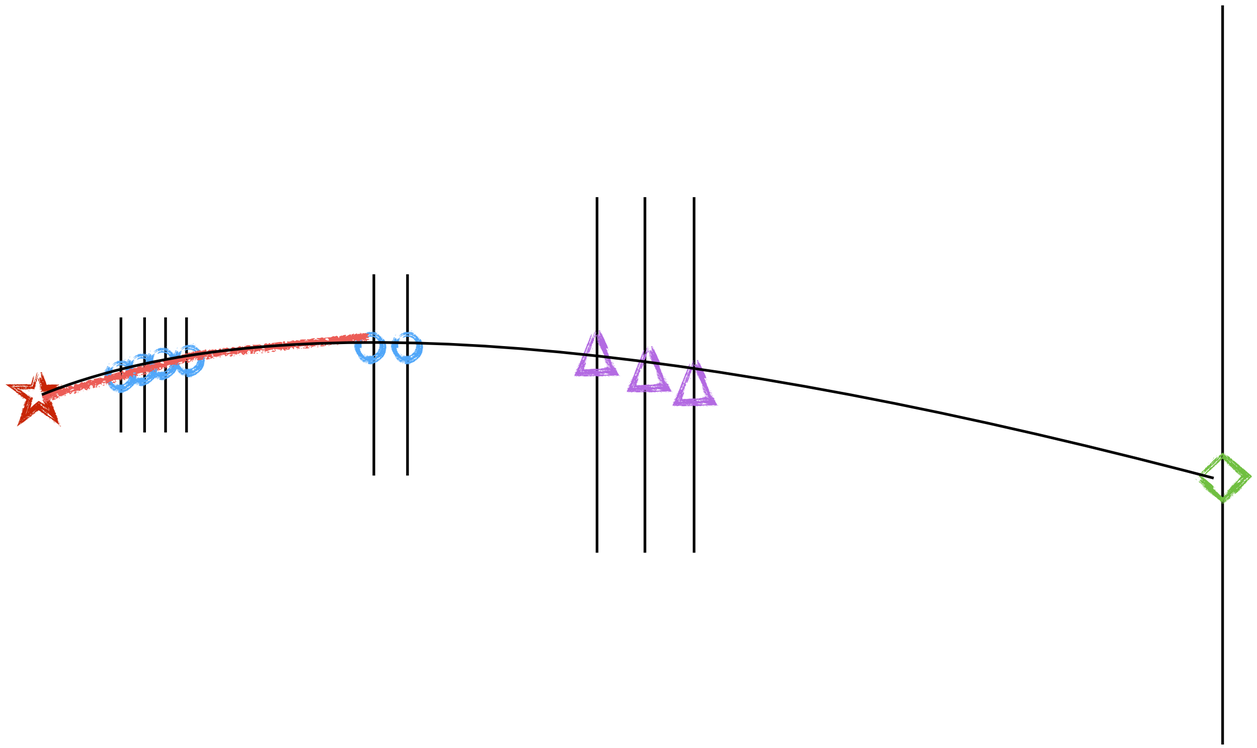
Full FOOT setup

Intro

- Using information by VT, IT, MSD, TW.

- Preliminary selection of the measurements to be used in the fit. All information used are at the reco-level (data-like).

- Starting from VT tracks and using their cluster.
  - Linear extrapolation to IT. Iterative extrapolation to MSD and TW.
    - Testing all possible charges seem by TW in extrapolation.
      - Fixing final charge hypothesis(es) from the TW measurement after extrapolation.



- **Caveat:** TW charge identifi cation considered to be perfect and took from MC due to a TW code issue (already in contact with Marco)

Tracking numbers

* Selection Efficiency: $Eff_{Sel} = \frac{N_{candidates}}{N_{visible}}$

* Tracking Efficiency: $Eff_{trk} = \frac{N_{converged}}{N_{candidates}}$

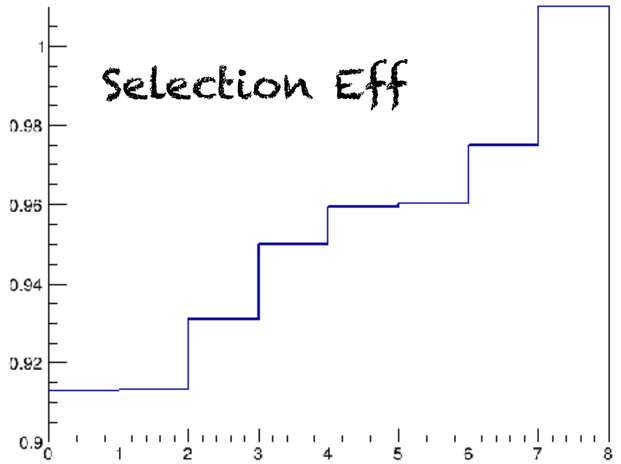
* Purity: $P = \frac{N_{good\ match}}{N_{converged}}$

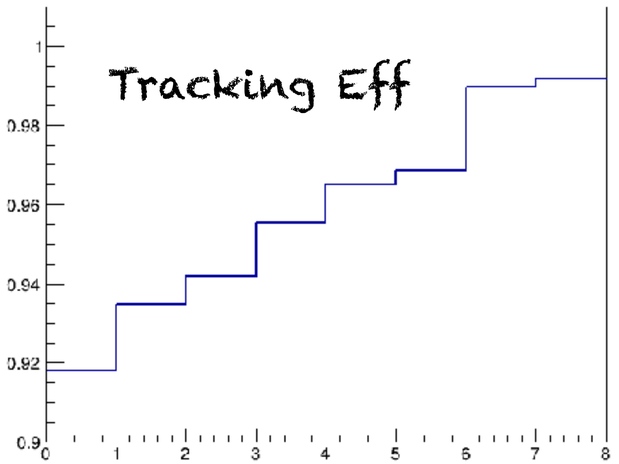
* $N_{visible}$ = generated particles in the geometric acceptance

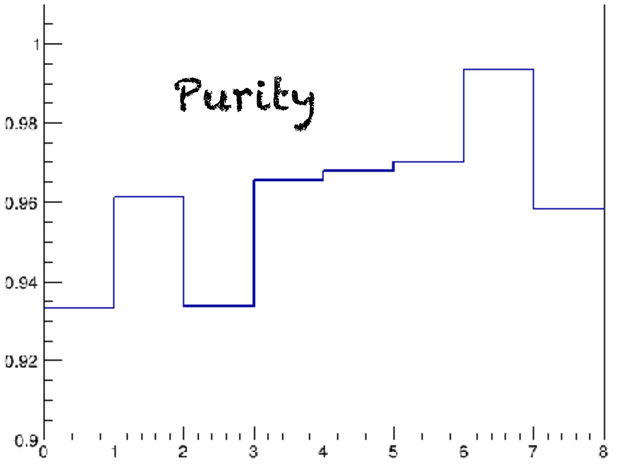
* $N_{candidates}$ = group of measures to be fitted

* $N_{converged}$ = track converged in the kalman fit

* $N_{good\ match}$ = tracks which majority of measures from the same particle hypothesis made in the fit, among the converged tracks. Truth info used here. (Fitted as Li, came from Li hits).





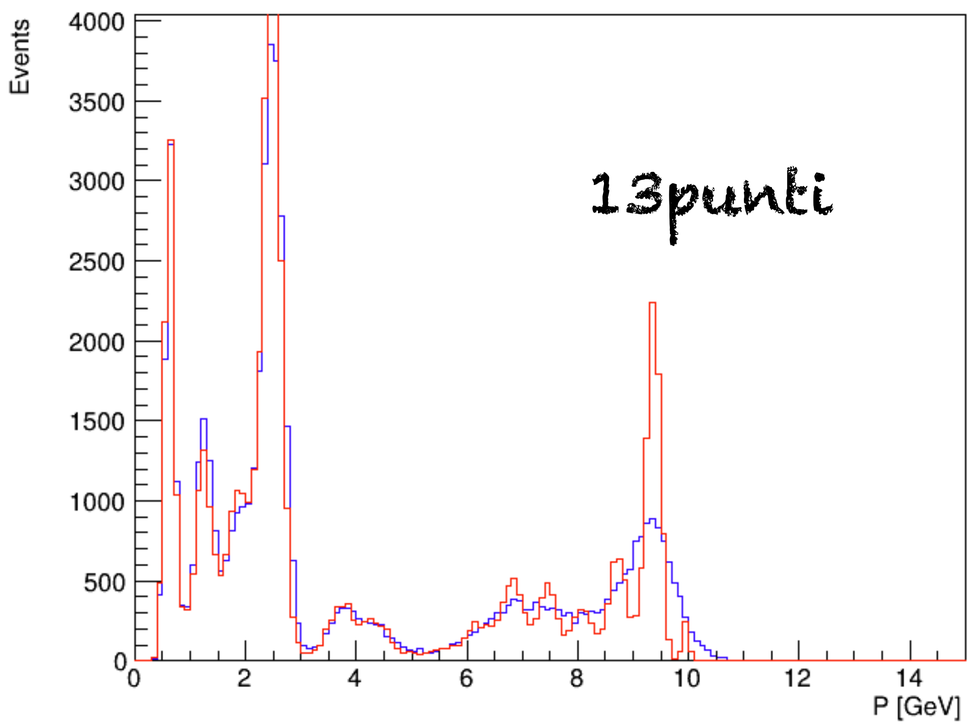


Momentum Distribution

* Momentum distribution expected and measured are in agreement.

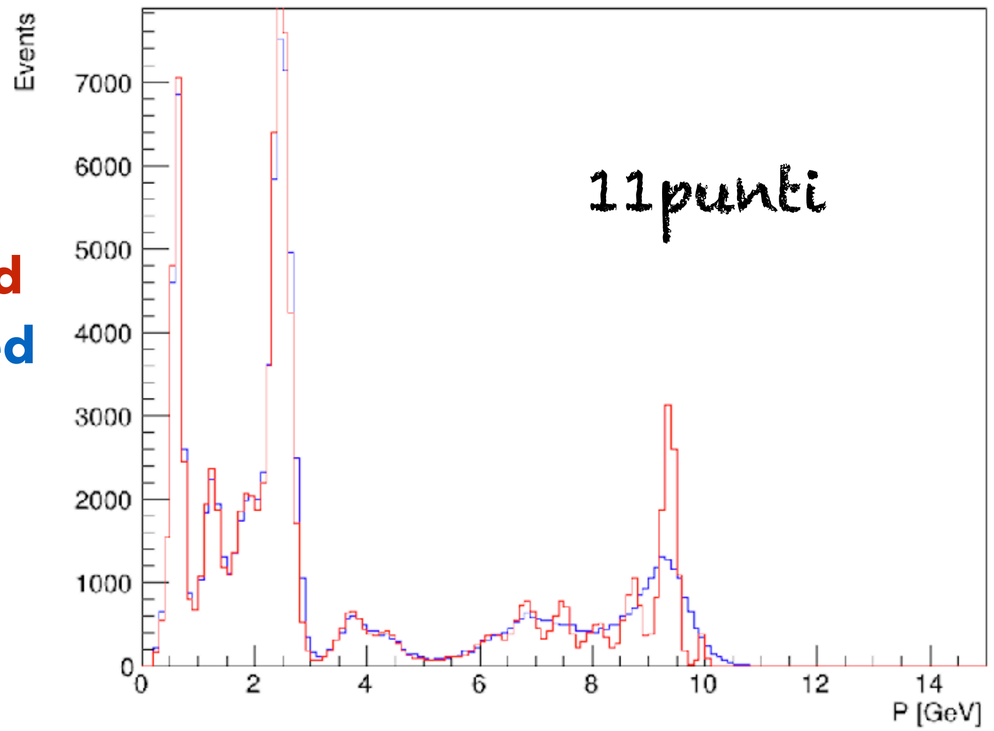
* Future effort to try reproducing also high P peaks

* No big change in the minimum number of required measures (keep in mind we have 13 layers here)



Expected

Measured

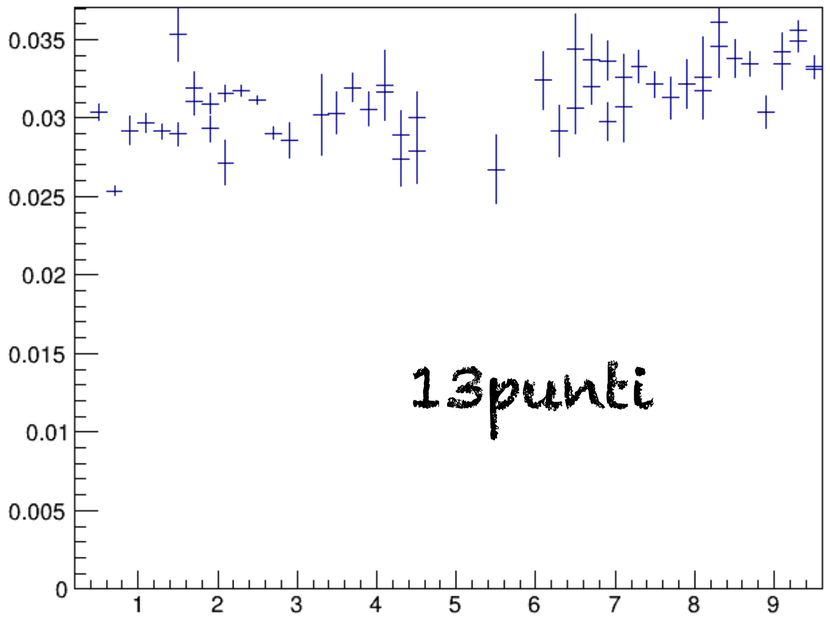


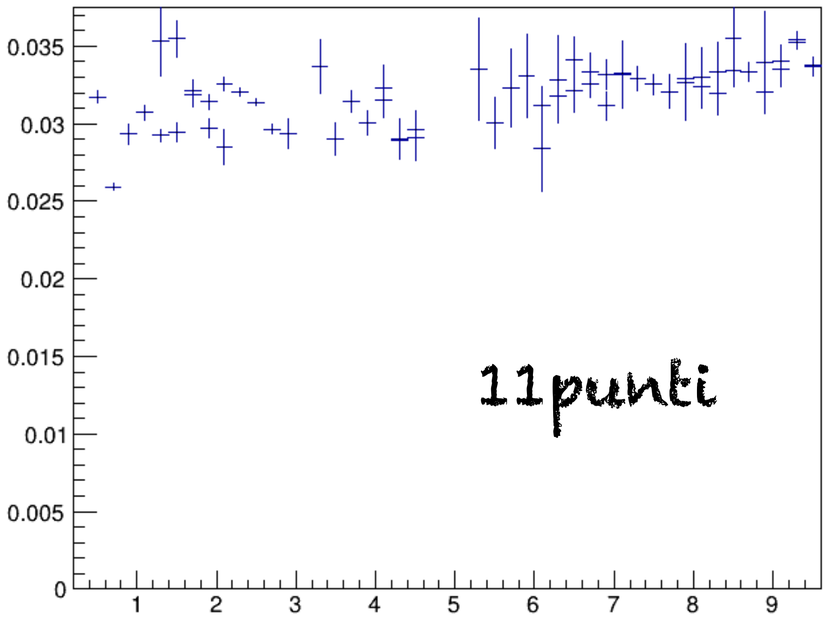
Momentum Resolution

* **Preliminary!** Fragments inclusive momentum resolution.

* Detailed check to be completed on the resolution measurement automatic procedure.

* Value around 3%. Comparable between the 2 choices.

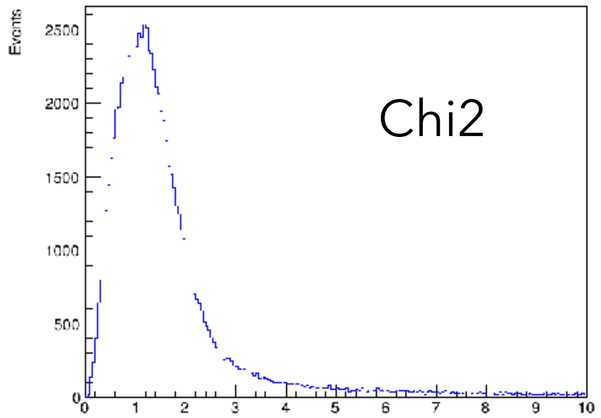


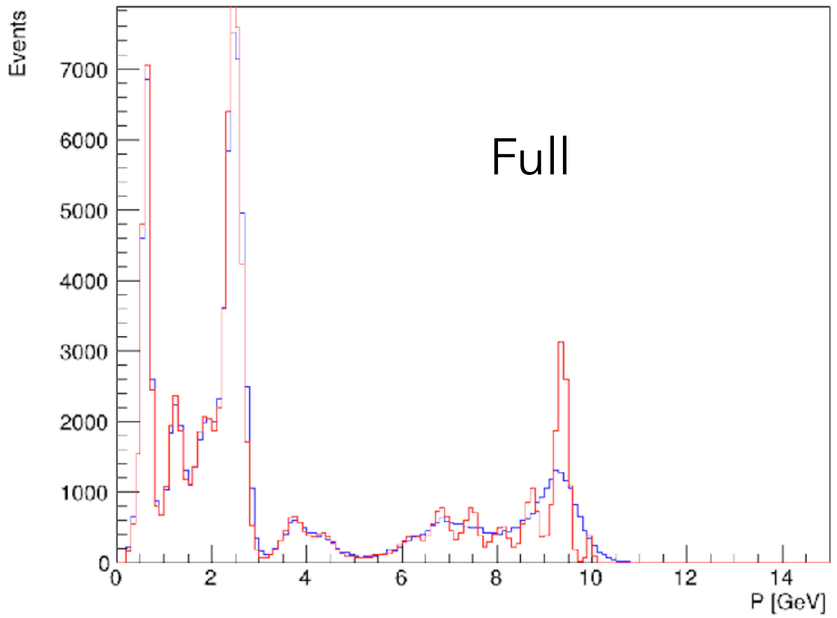


Test without the IT

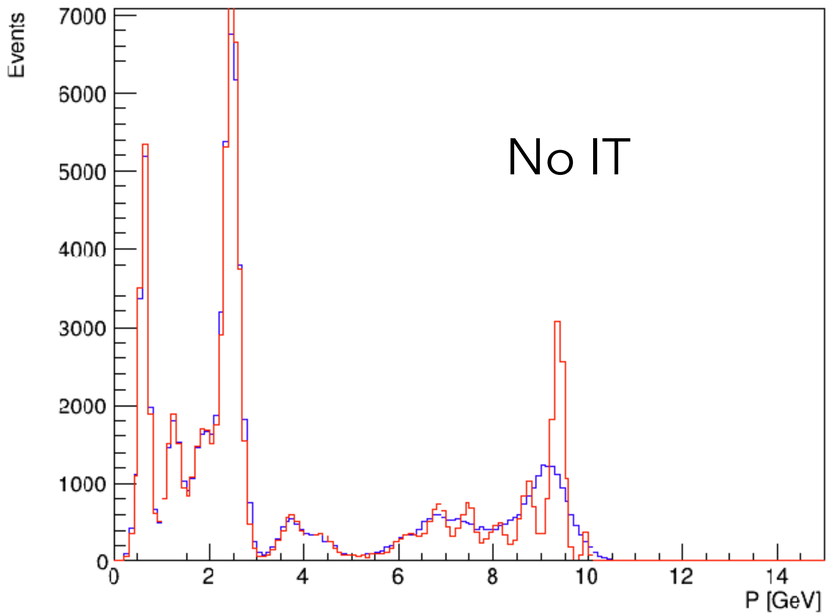
* Study on track candidates with at least 11 measurements: remove IT contribution

* Few less events, but P agreement remains nice!



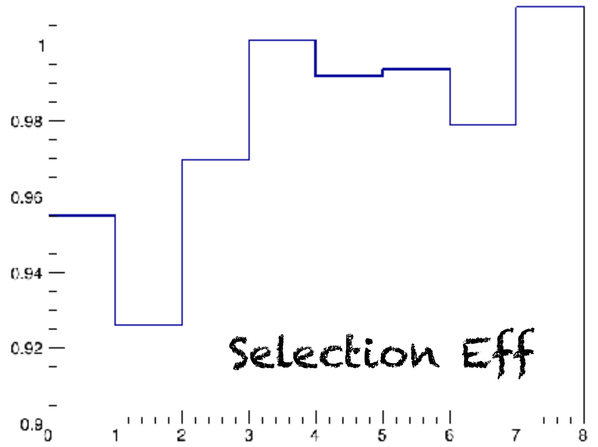


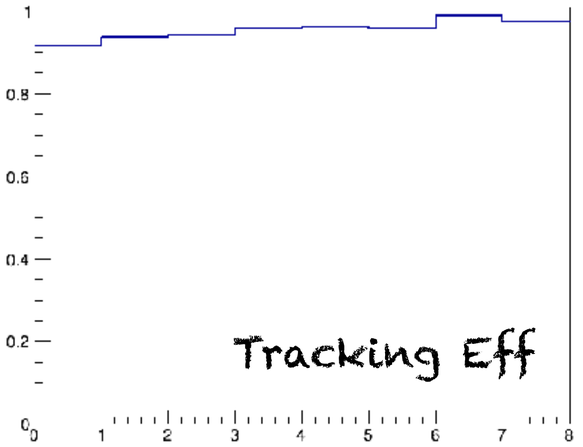
Expected
Measured

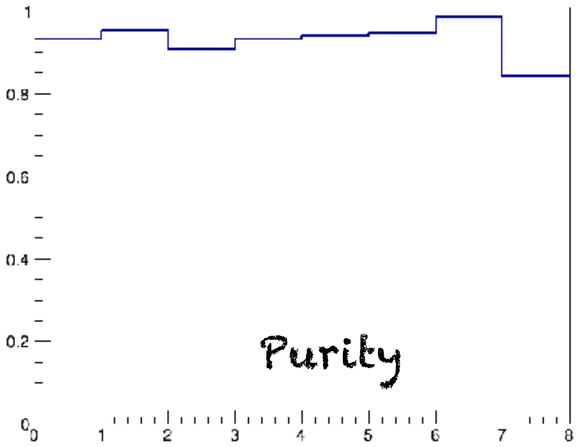


Test without the IT

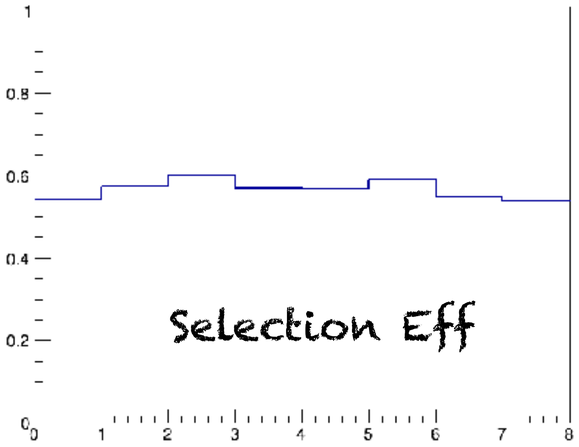
Full

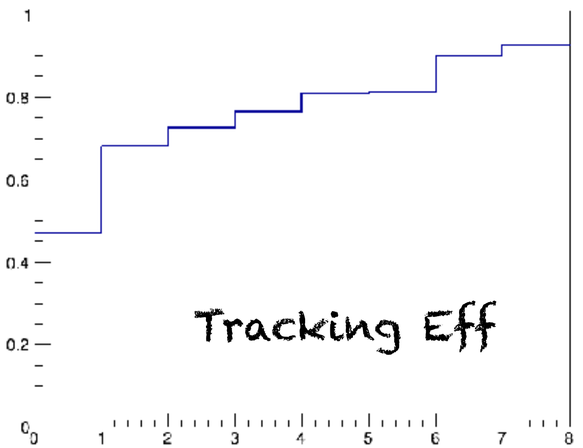


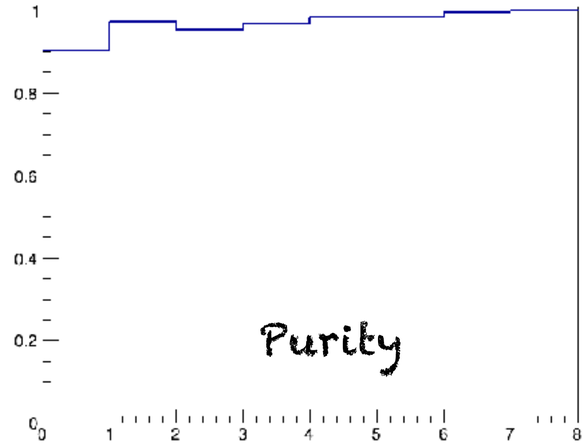




No IT





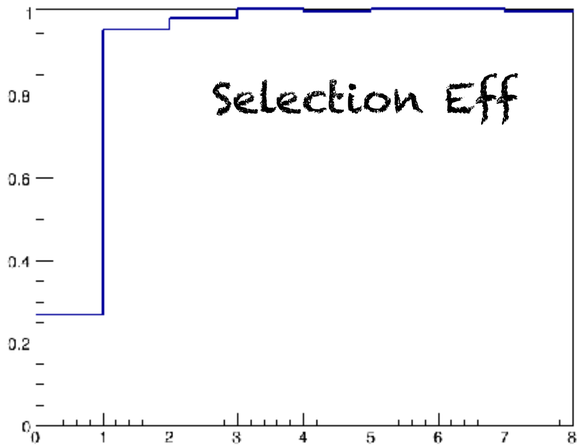


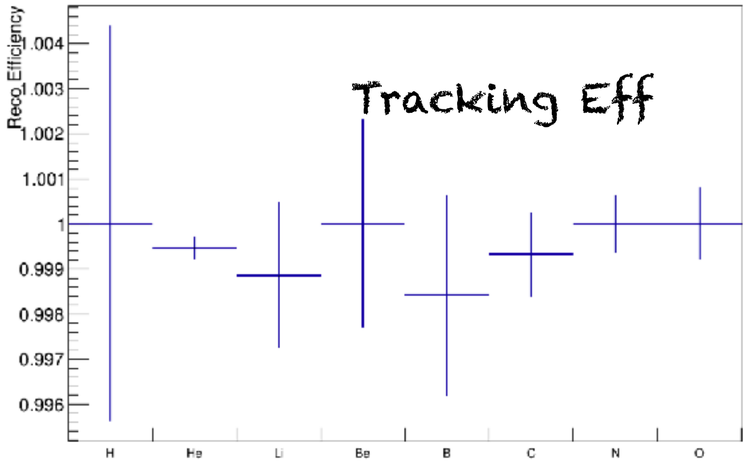
GSI setup

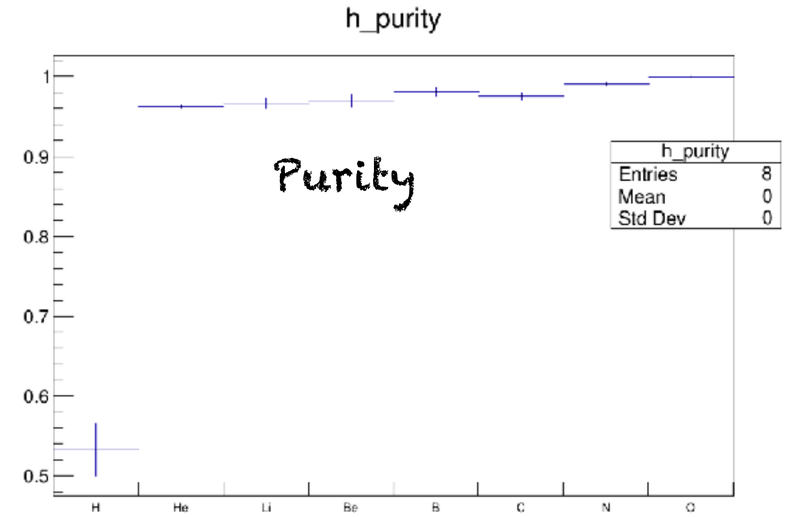
GSI tracking strategy

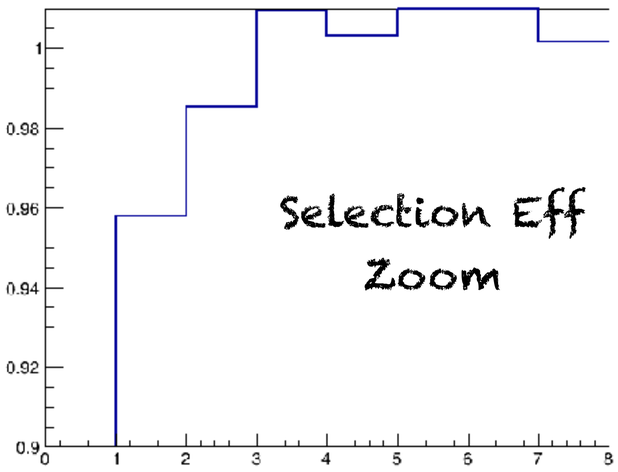
* No B field
* Including VT, MSD, TW
* Tracking using the very same algorithm developed the full-setup (no changes!)
  - Nice check for algorithm stability
  - Good for testing the method on data
* Also a dedicated linear pre-selection developed by Roberto. Last checks to be ready!

GSI numbers

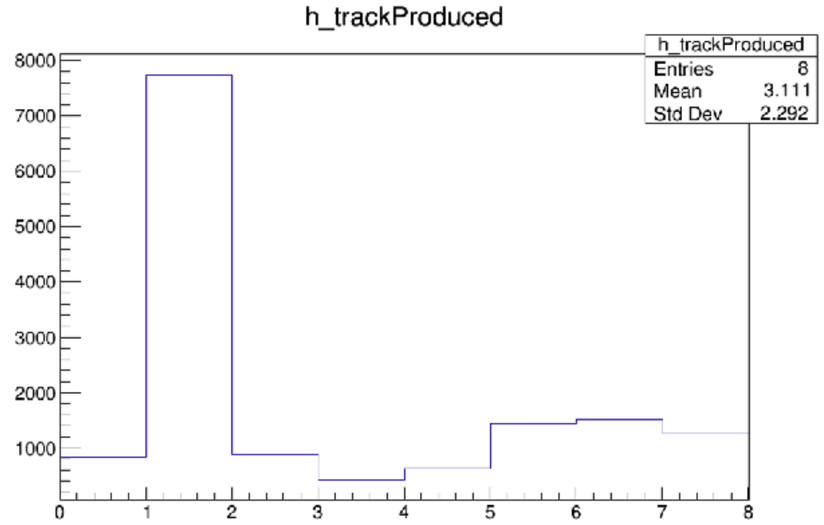




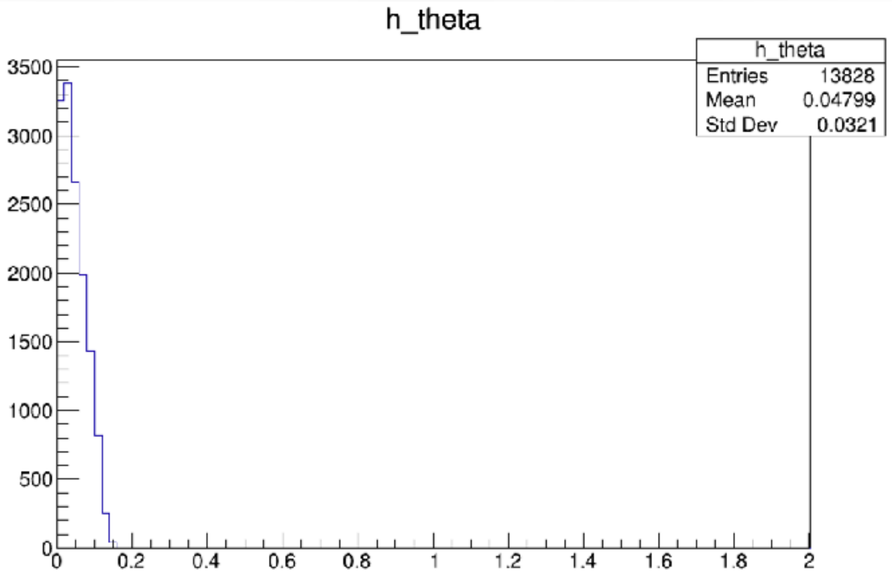


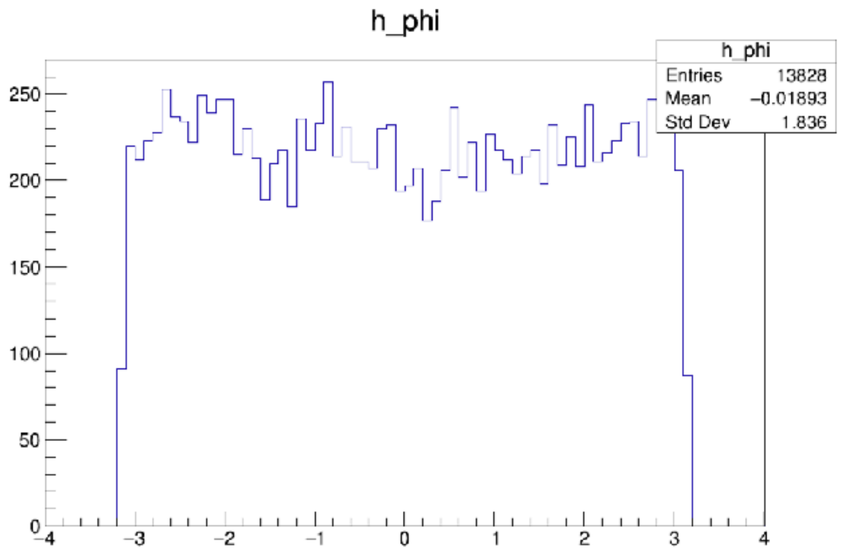


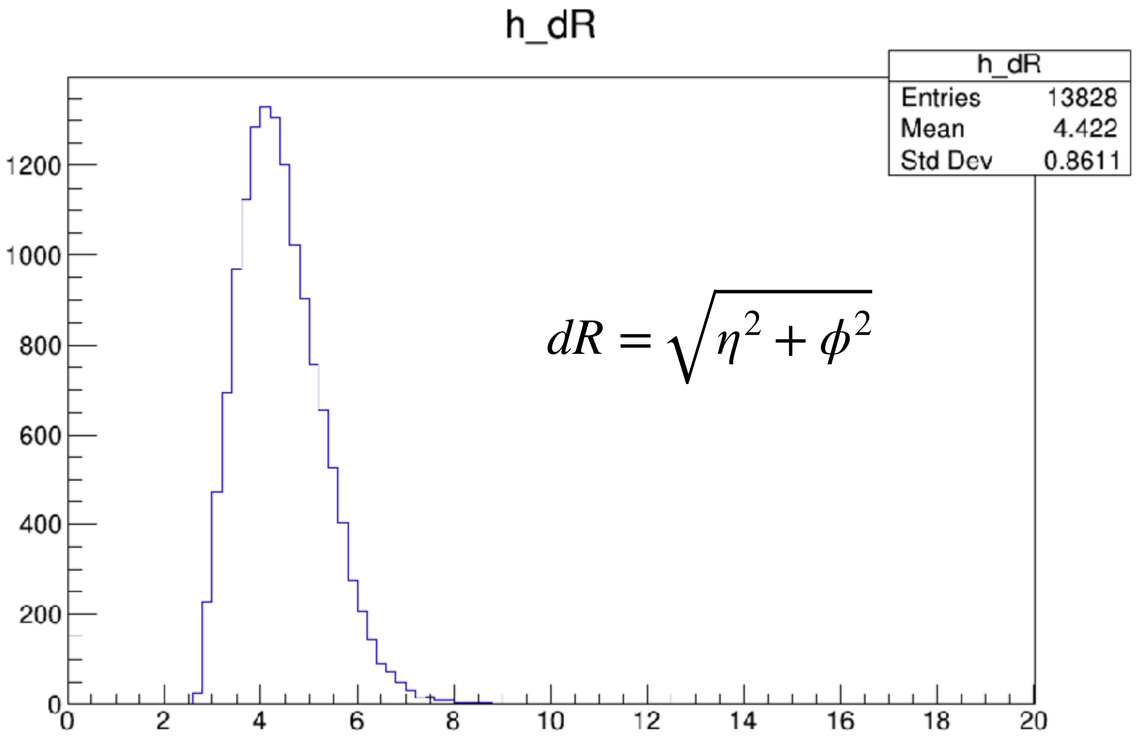
- Good eff, but for H
- Nice Purity after fit



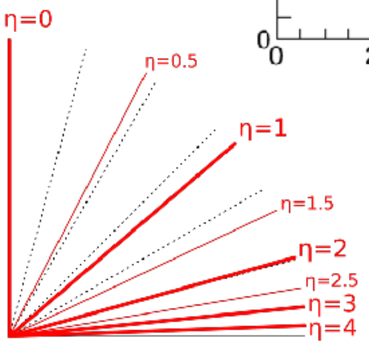
Angular distributions

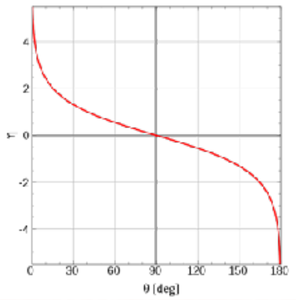


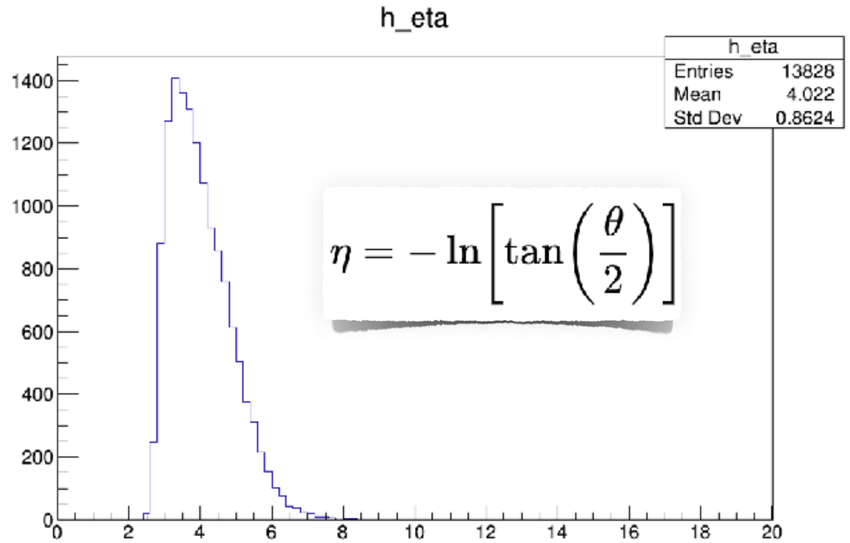




$$dR = \sqrt{\eta^2 + \phi^2}$$

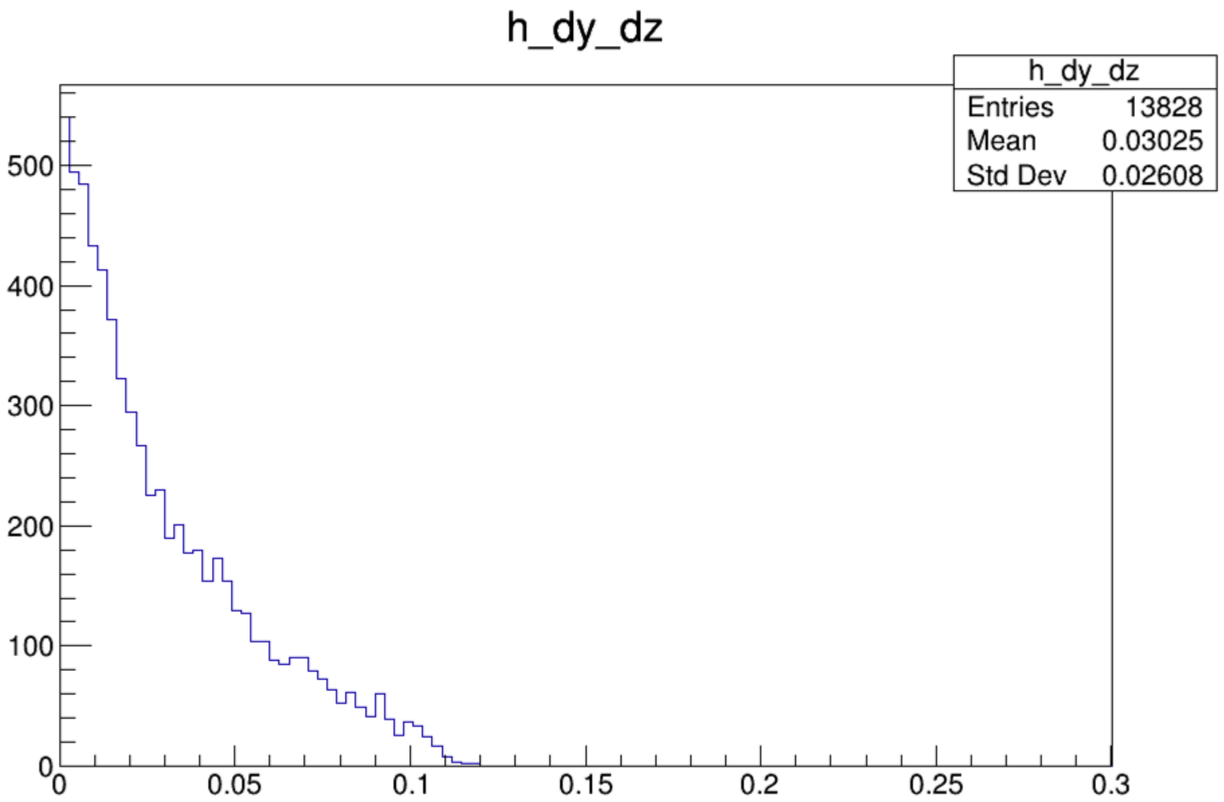


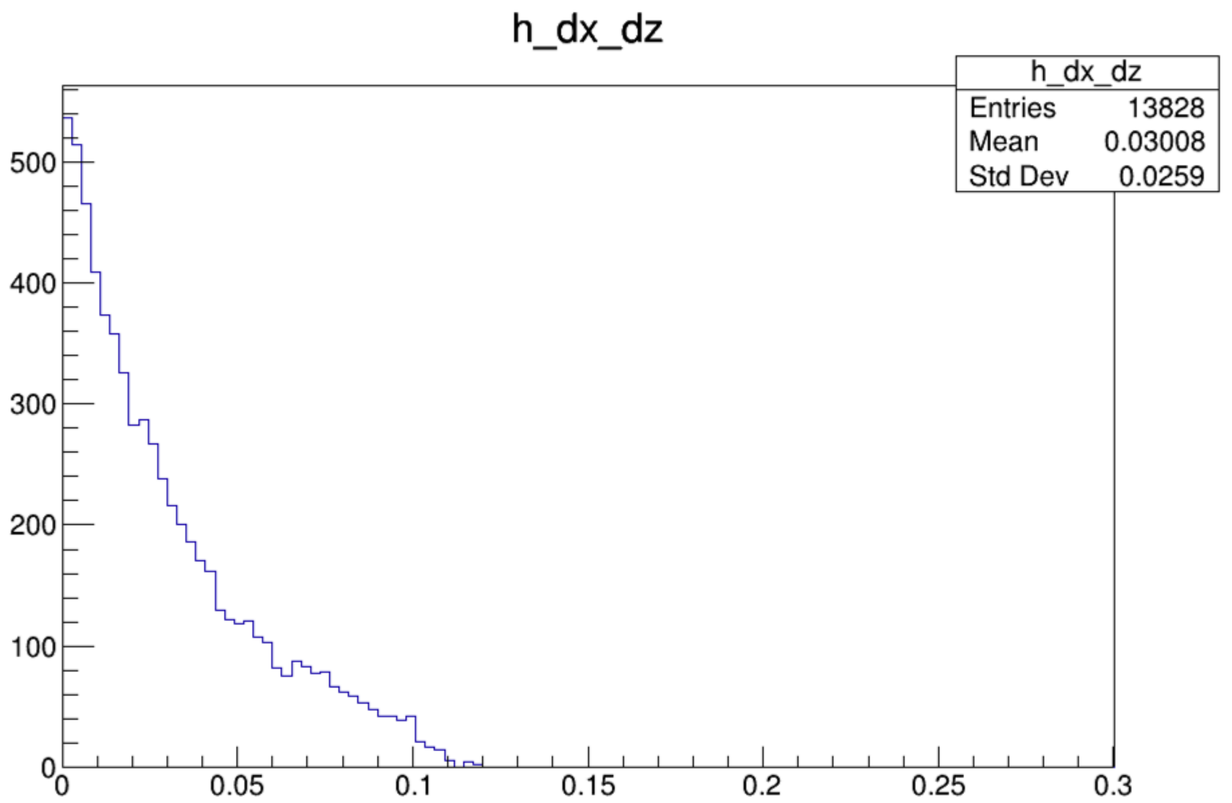


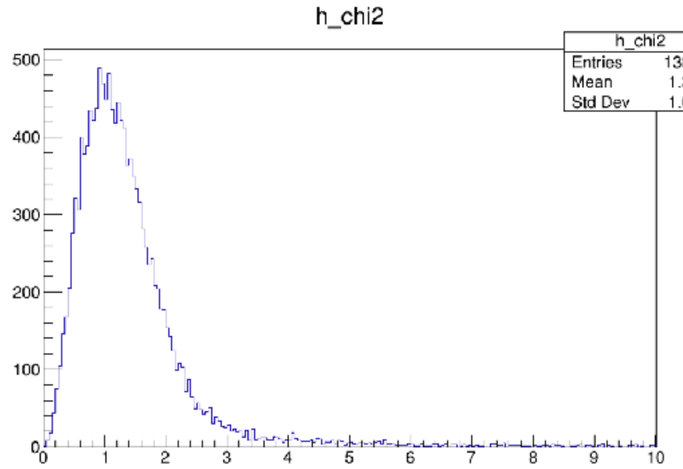


$$\eta = -\ln\left[\tan\left(\frac{\theta}{2}\right)\right]$$

Angular distributions







Conclusion

- Results from global reconstruction with Genfit, performed using repo-level info (data-like). **Caveat:** considering TW charge id perfect.

- Fit on both GSI-setup and Full-setup

- Full:
  - Both tracking and section off > 0.95 –> combined > 0.9
  - Good purity and momentum measurement.

- GSI:
  - Very high eff and purity (but for H)
  - Angular quantities shown, able for precise extrapolation

- **FUTURE:** checks and optimisation

Conclusion

* Starting from master, almost ready for a new merge. Good before GSI to be able processing data.

* Added full isotope list in FootGlobal.par and UpdatePDG class

* To be able running on GSI2021 data: changed DI config and TAVTDetector.cfg (before equal to TAVTDetector.map)

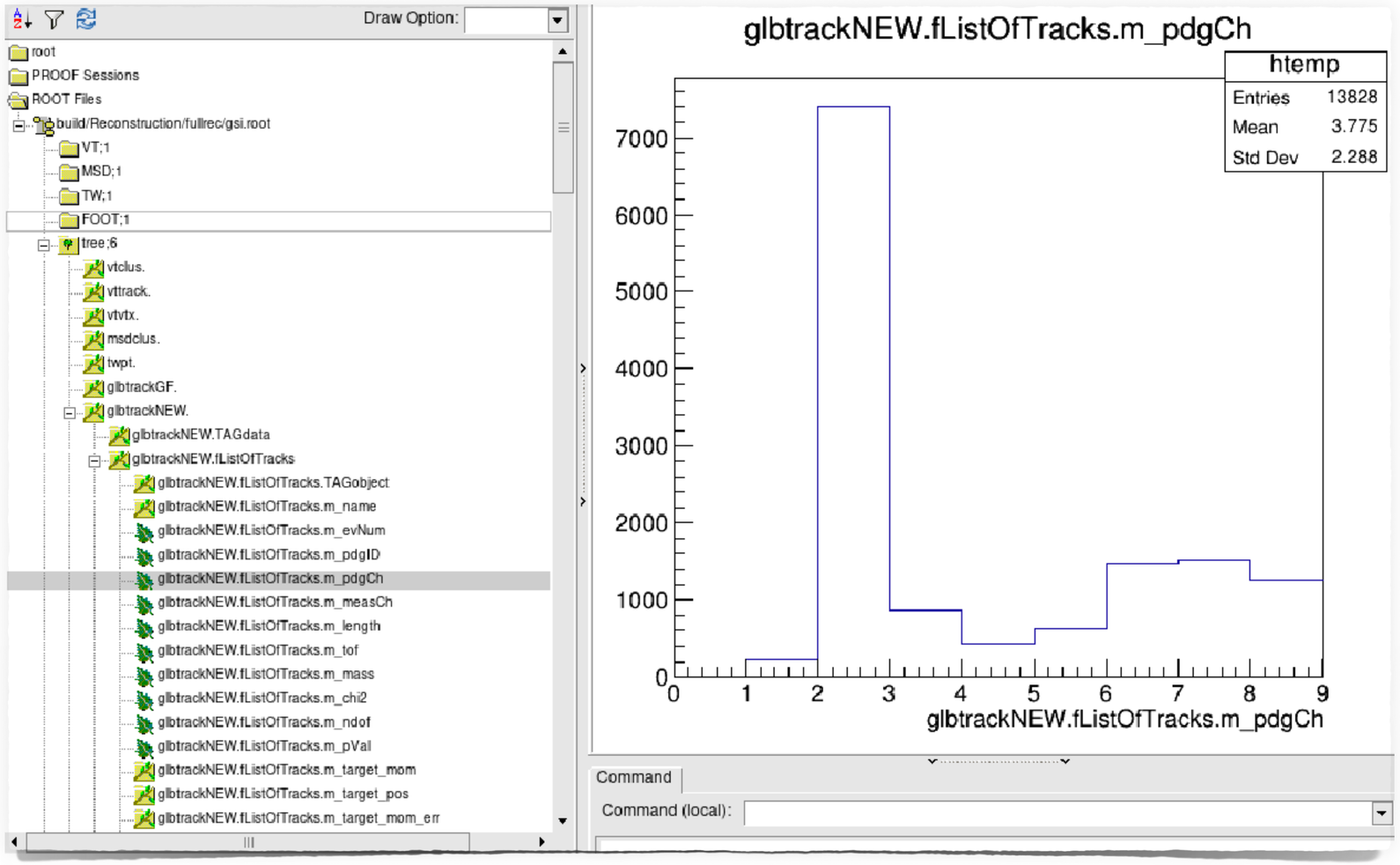
```
DetectorName: "DI"
NumberFiles: 1
"./geomaps/GSI2021/TADIdetector.geo": -1
```

```
// -+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
// -+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
//
// Geometry file for FOOT magnets
//

// -+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
// Parameters of the magnets
// Types 0 const, 1 function, 2 map file
// -+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
Magnets:     2
Type:        0

MagValueX:  0   MagValueY:  0   MagValueZ:  0
```

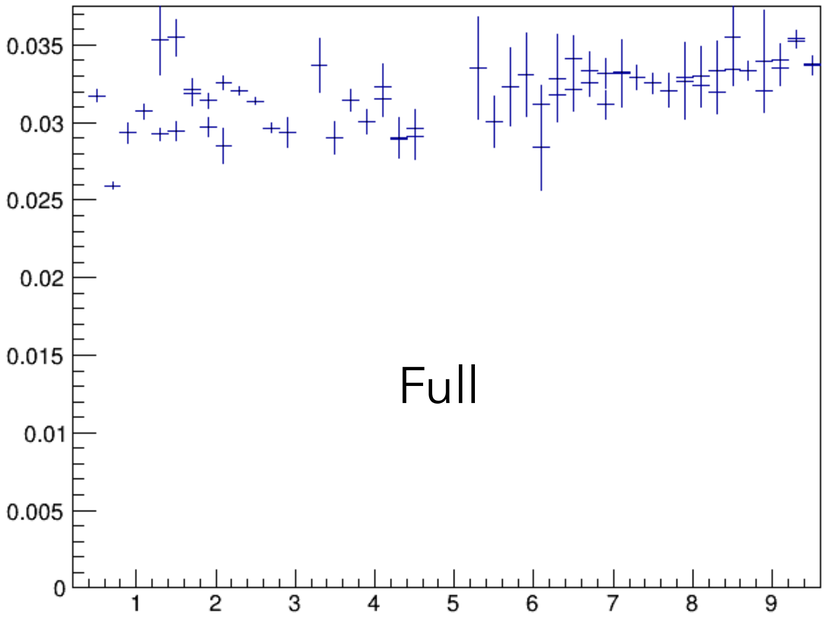
```
FootGlobal.par ×   TAVTdetector.cfg ×   TADIgeoField.cxx ×   Base
// -+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
// -+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
//
// This is a Configuration File for FOOT Vertex Detector
//

// -+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
// Parameters for Analysis
// -+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
TracksMaximum:            30
PlanesForTrackMinimum:     3
SearchHitDistance:       0.03
TrackChi2Limit:            8.
BMTrackChi2Limit:         10.
Sensors:                   4

// -+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
// Parameter of the Detector Planes
// -+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
// Status On = 1., Out = -1.
// Position Algorithm 1= Center of Gravity, +100  =  Complex Algorithm

// -*-*-*-*-*-*-*-*-*-*-*-*-*-*-*- Plane 1 -*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-
InputNumber:              1
Status:                   0
MinNofPixelsInCluster:    0
MaxNofPixelsInCluster:   400
DeadPixels:              -1
```

Conclusion

- Able running in parallel on Tier3 batch system. Some changes needed.
- Global tracking info available in a dedicated branch with all the needed info for further analysis steps. Implemented in TAGfoot/TAGglobalTrack.
- After GSI, good to find a uniform tracking output with TOE



Backup


0.035
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0.005
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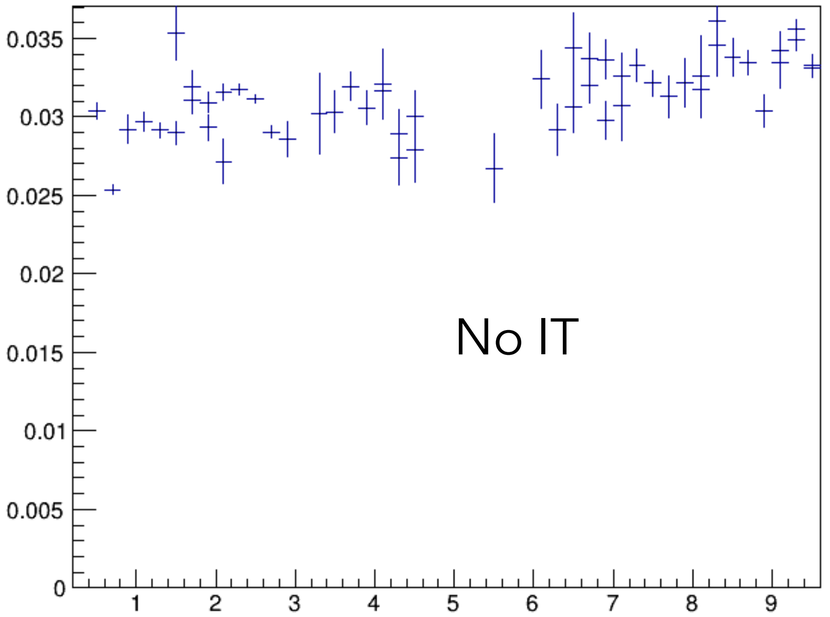
9
Full


0.035
0.03
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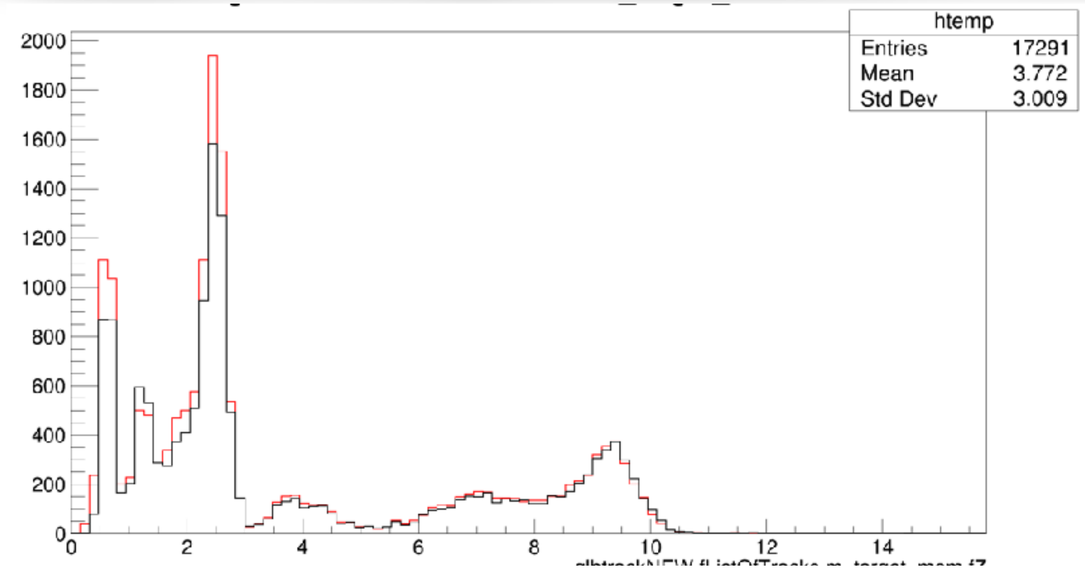
No IT



- Confront componenti di p estrapolate al target
- Ottimo accordo

10 kev