Status of software for secondary tracks

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Overview

• STT + MVD PR works only for tracks coming from the IP (within some mm).
A track finder for secondary tracks, coming from V^0 decays, is needed
    • it is inspired from the primary track finder and borrows functions from it
    • but has no constraints on the origin of the track → some original parts

• **at present, only the STT hits are involved** in the procedure

• … but **in the future also MVD and GEM hits will be added**

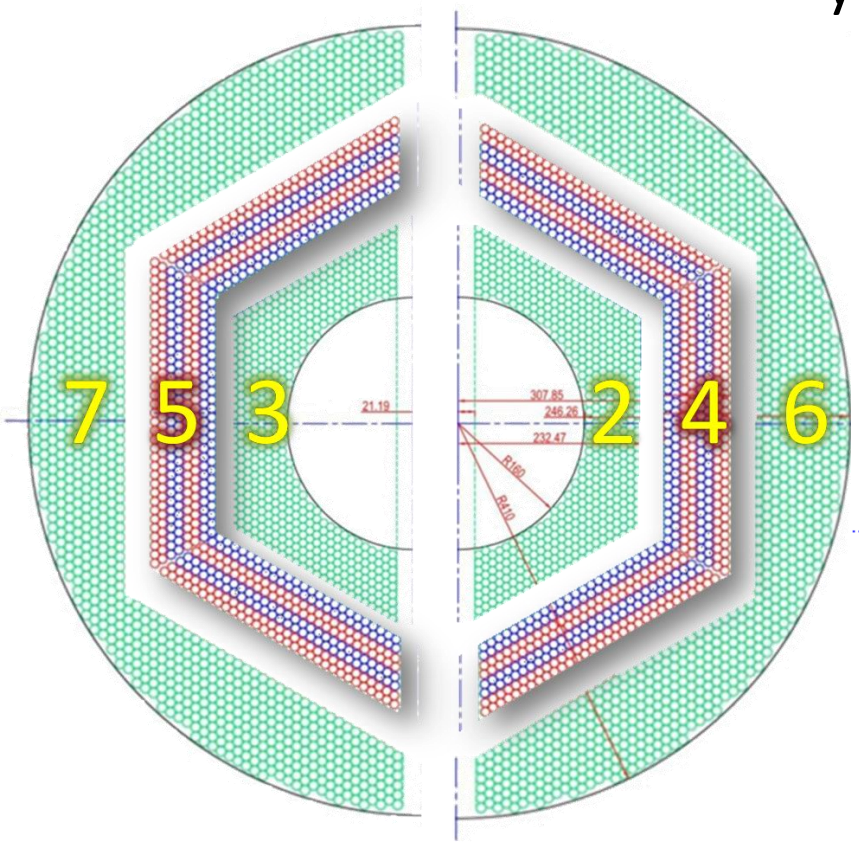
• the results which will be shown are still **preliminary** since **the code is still in progress**

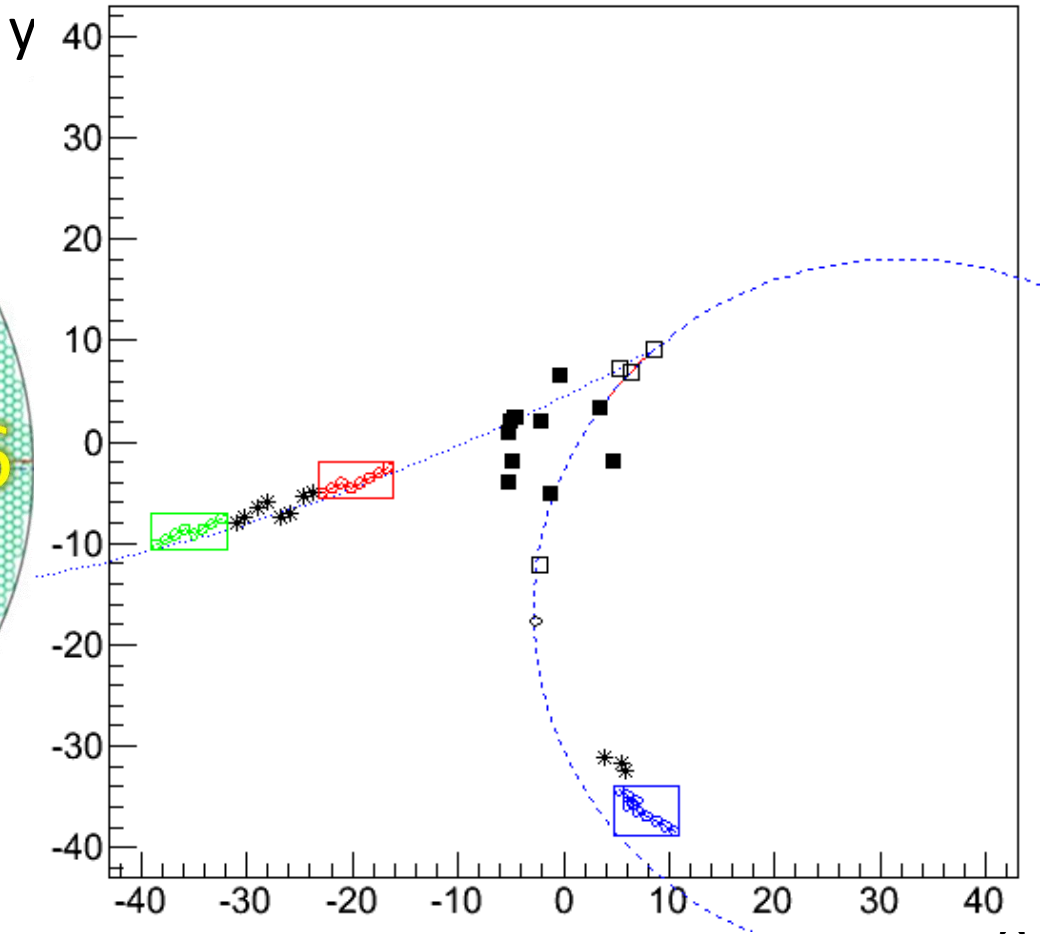
• in its final version, the secondary track finder will be applied on the hits left unassigned from the primary track finder

Procedure

Cluster finding

- The parallel hits are considered first, in the xy plane
- They are grouped in sectors depending on their position
- They are clustered with a vicinity criterion





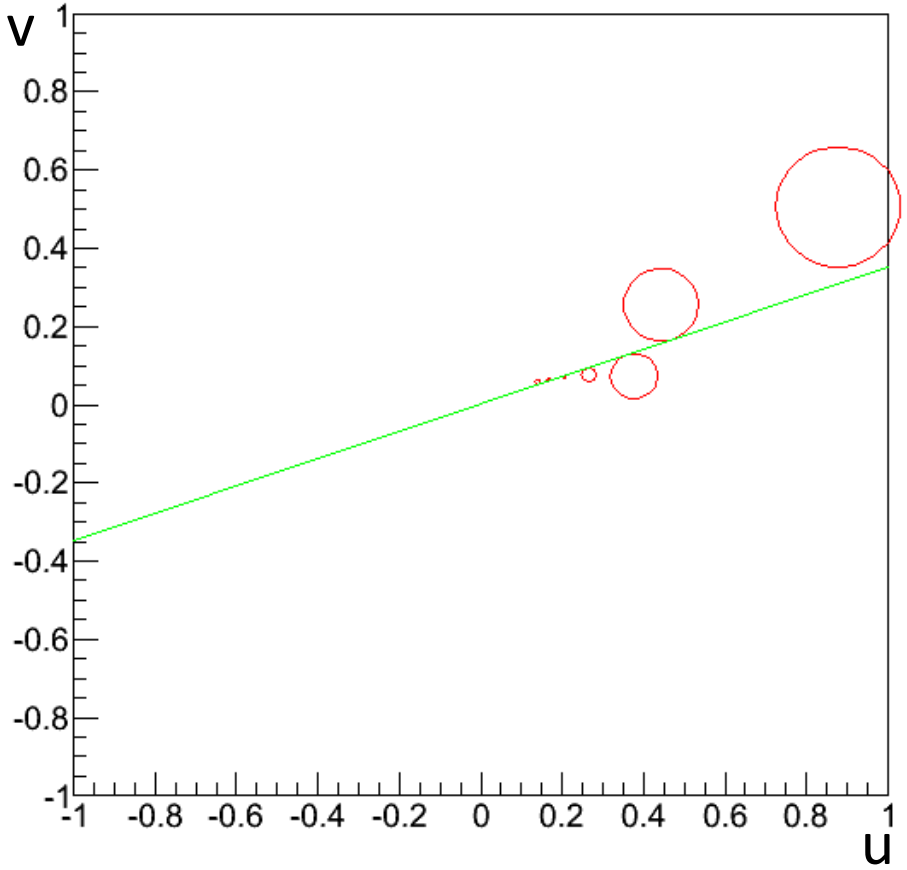
Procedure

xy fitting

• A translation is performed on the center of the tube with smallest drift radius in the cluster

• A fit in the conformal plane is performed for each cluster with GLPK

• When possible, the inner parallel cluster and outer parallel are matched and fitted together, otherwise the single cluster is fitted alone



$$u = \frac{x}{x^2 + y^2 - r_d^2}$$

$$v = \frac{y}{x^2 + y^2 - r_d^2}$$

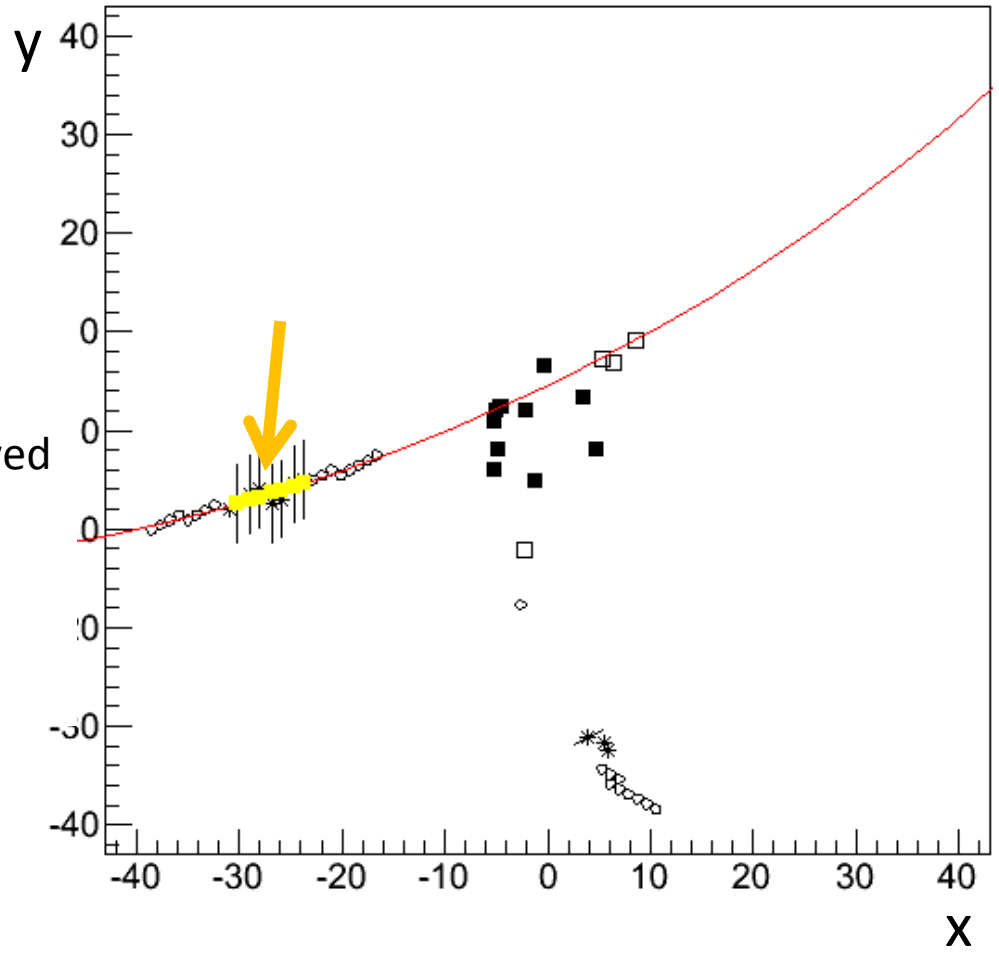
$$r_c = \frac{r_d}{x^2 + y_2 - r_d^2}$$

Procedure for skewed

Skewed tubes association

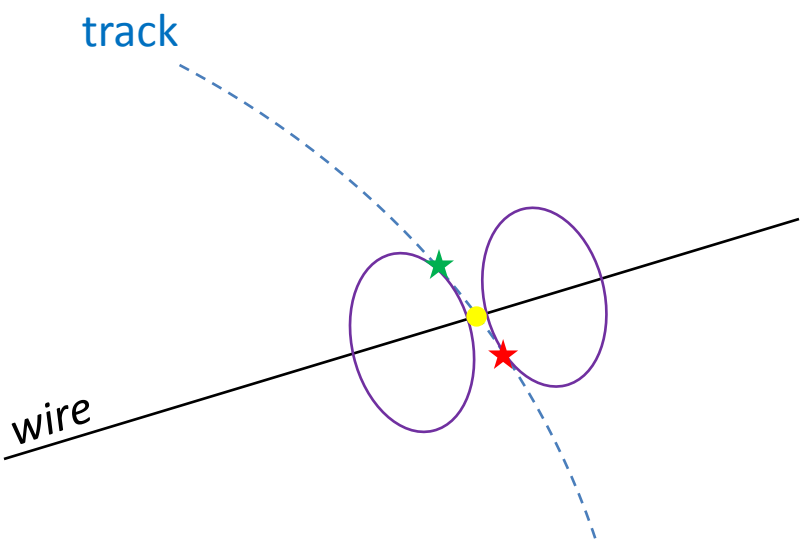
- In the xy plane the projection of the skewed wires is drawn

- If they intercept the trajectory they are associated to the track



$$z(s) = z_0 + s \cdot \sin\lambda$$

Z calculation

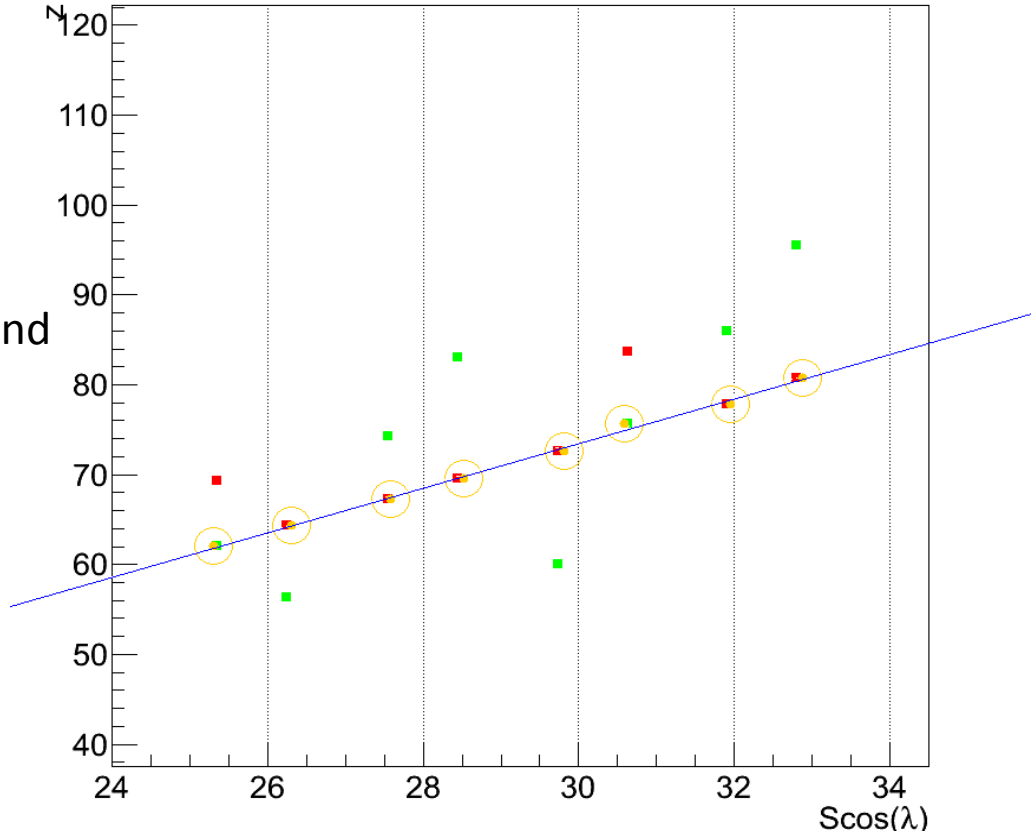


• The drift circles of the skewed tube projected in the xy plane are ellipsis

• If the intersection wire-to-track is the yellow point, the real intersections of the ellipsis can be the green or the red point

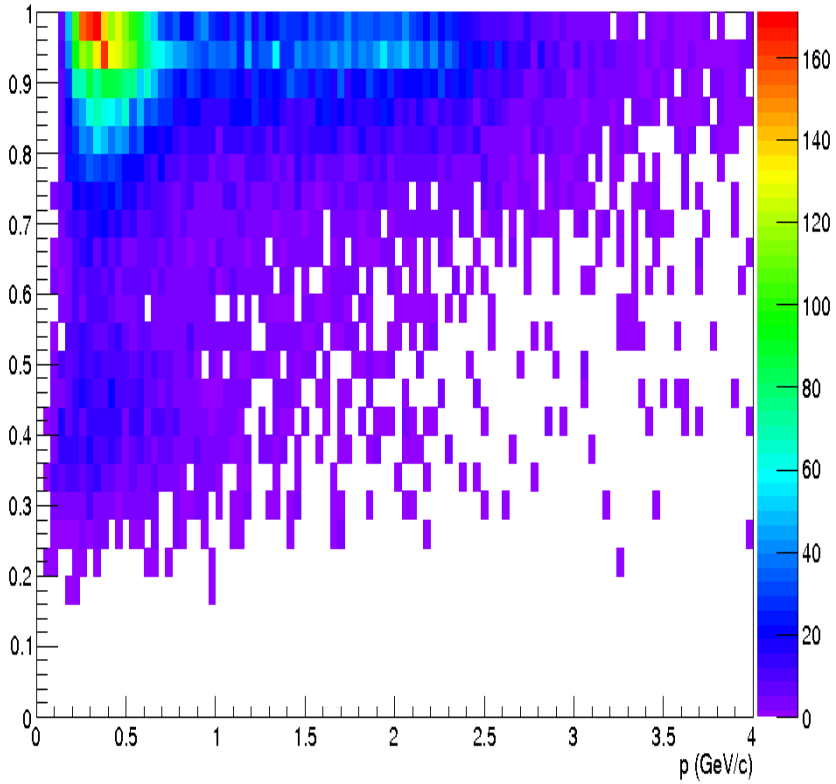
• They correspond to two different scos(λ) and z values

• By plotting these couples for all the hits in the z vs scos(λ) plane it is well recognizable which of the two is correct since the correct choices lie on a straight line.

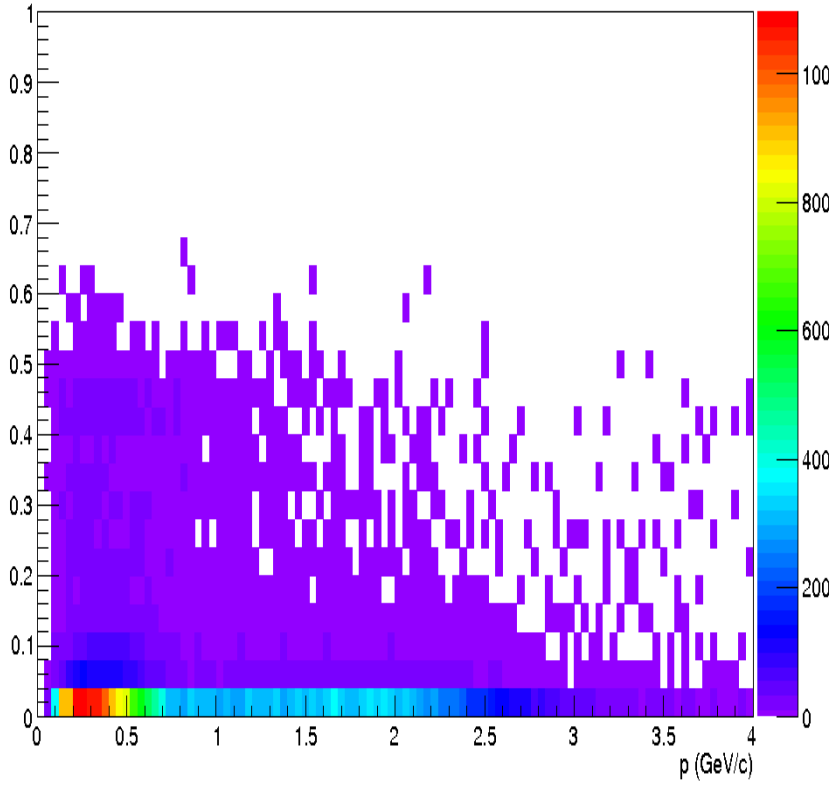


Efficiency/Contamination

#correctly assigned hits/#true hits for primary tracks



 # wrongly assigned hits/# total assigned hits to primary tracks



Tracks with #MC hits < 30

ΛΛbar events

Antiproton beam momentum = 4 GeV/c

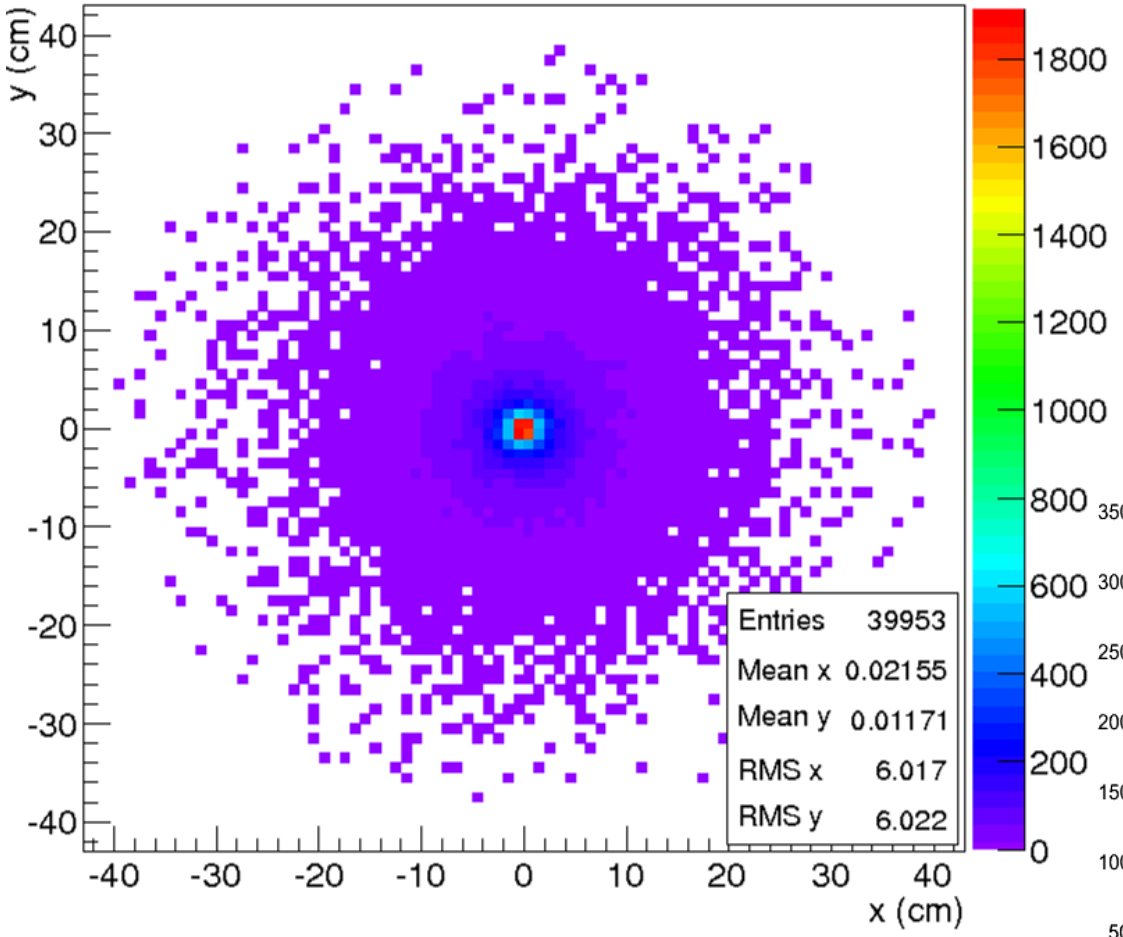
Phase space was used to produce ΛΛbar events, no forward peaking in the angular distribution was taken into account in the event generation

```
Decay pbarpSystem
  1.0  anti-Lambda0  Lambda0    PHSP;
Enddecay

Decay Lambda0
  1.0  p+ pi-      PHSP;
Enddecay

Decay anti-Lambda0
  1.0  anti-p- pi+      PHSP;
Enddecay
```

43 sets with 500 events each = 21500 ΛΛbar events

MC vertex position

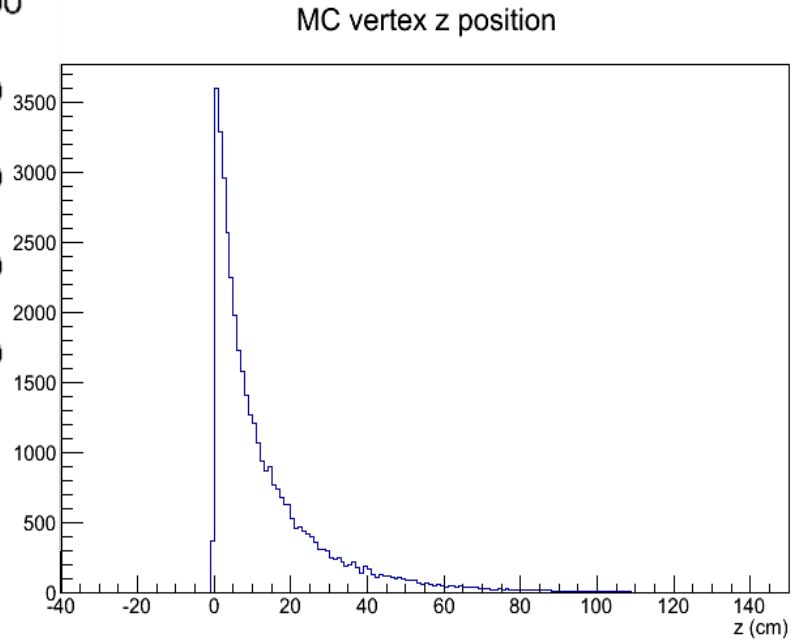
MC vertices of the Λ and Λbar which leave at least one track in the STT



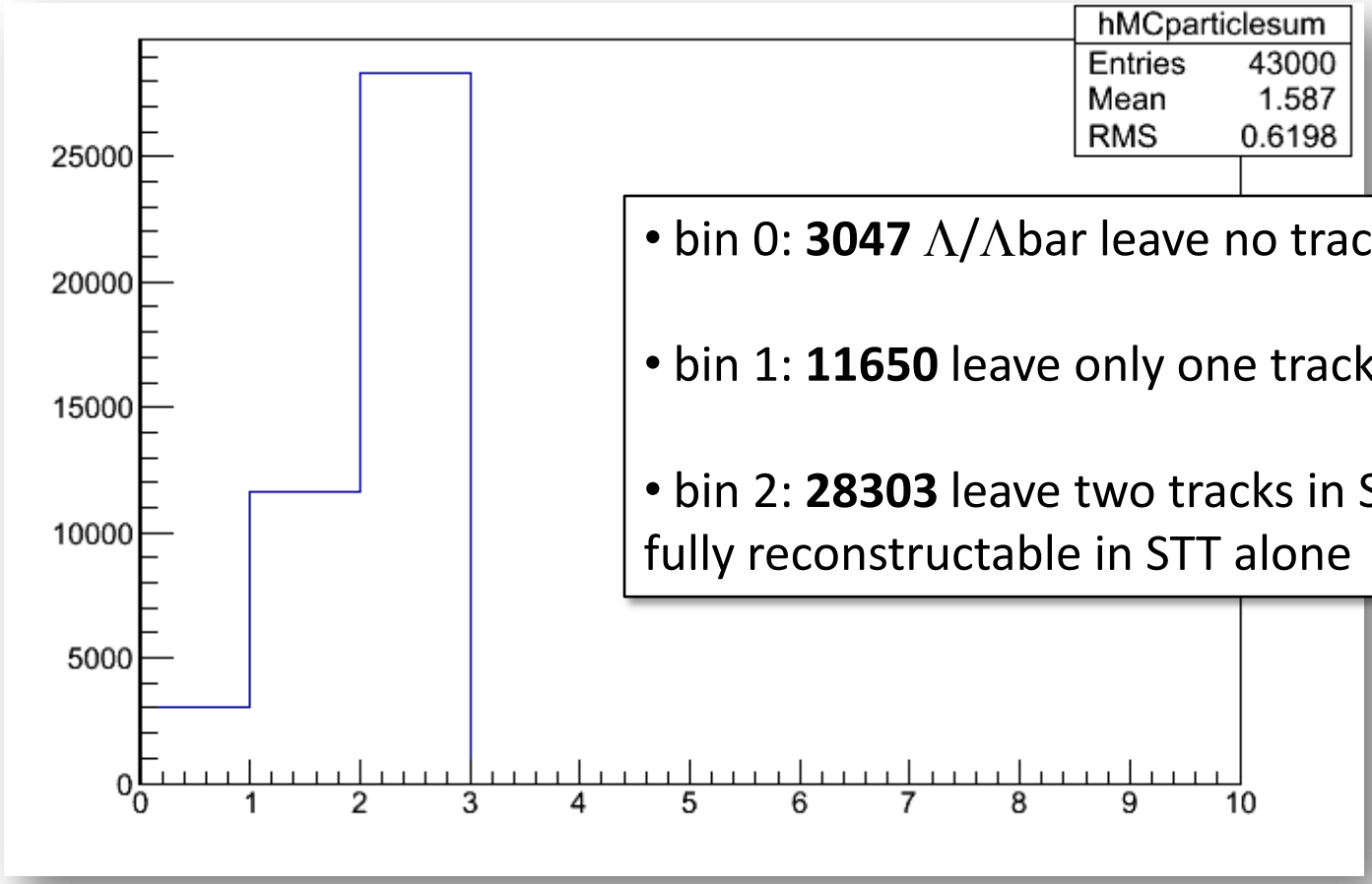
TOTAL ENTRIES: **39953**

ENTRIES WITH
R < 15 cm: **36492 (91%)**

The vertices within 15 cm from the IP leave hits also in the MVD



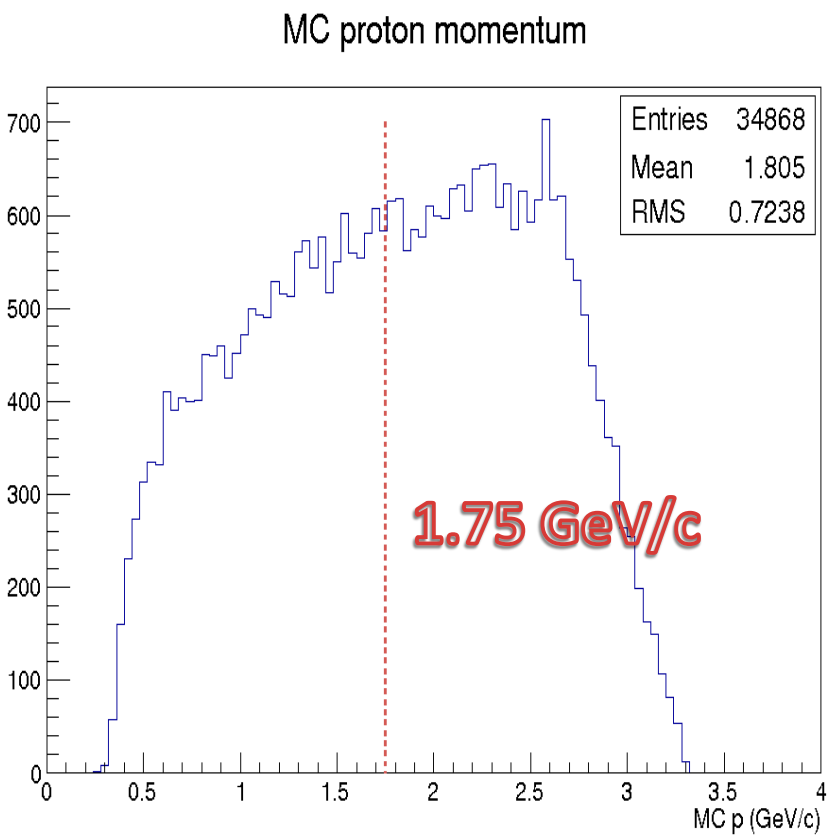
Reconstructable Lambda in STT

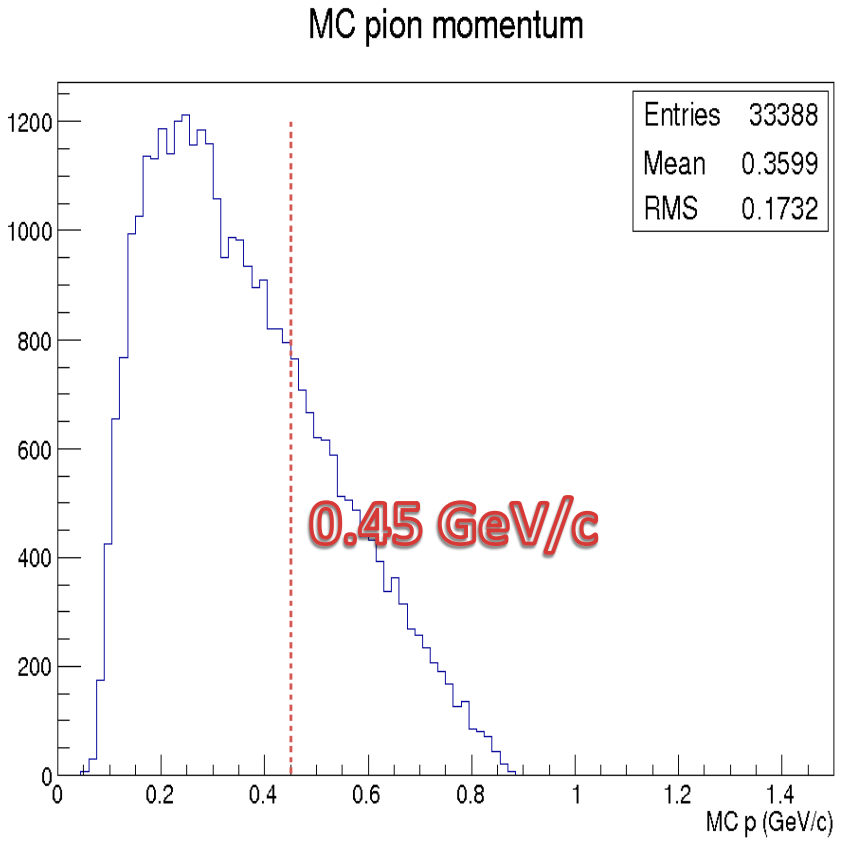


- bin 0: **3047** Λ/Λbar leave no track in STT
- bin 1: **11650** leave only one track in STT
- bin 2: **28303** leave two tracks in STT → IM fully reconstructable in STT alone

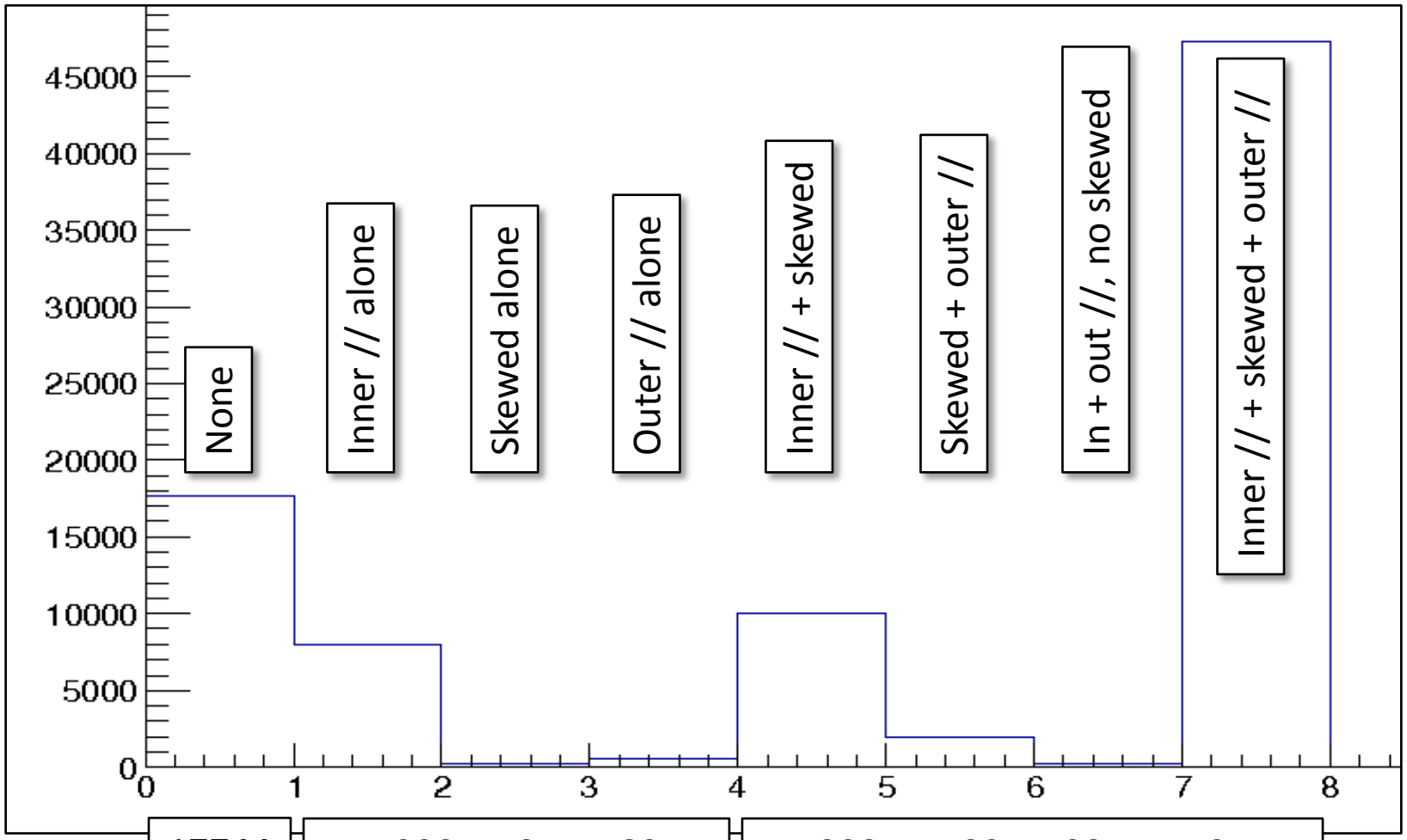
MC momentum distribution

MC momentum of particles from the Λ and Λbar decay with at least one track in the STT





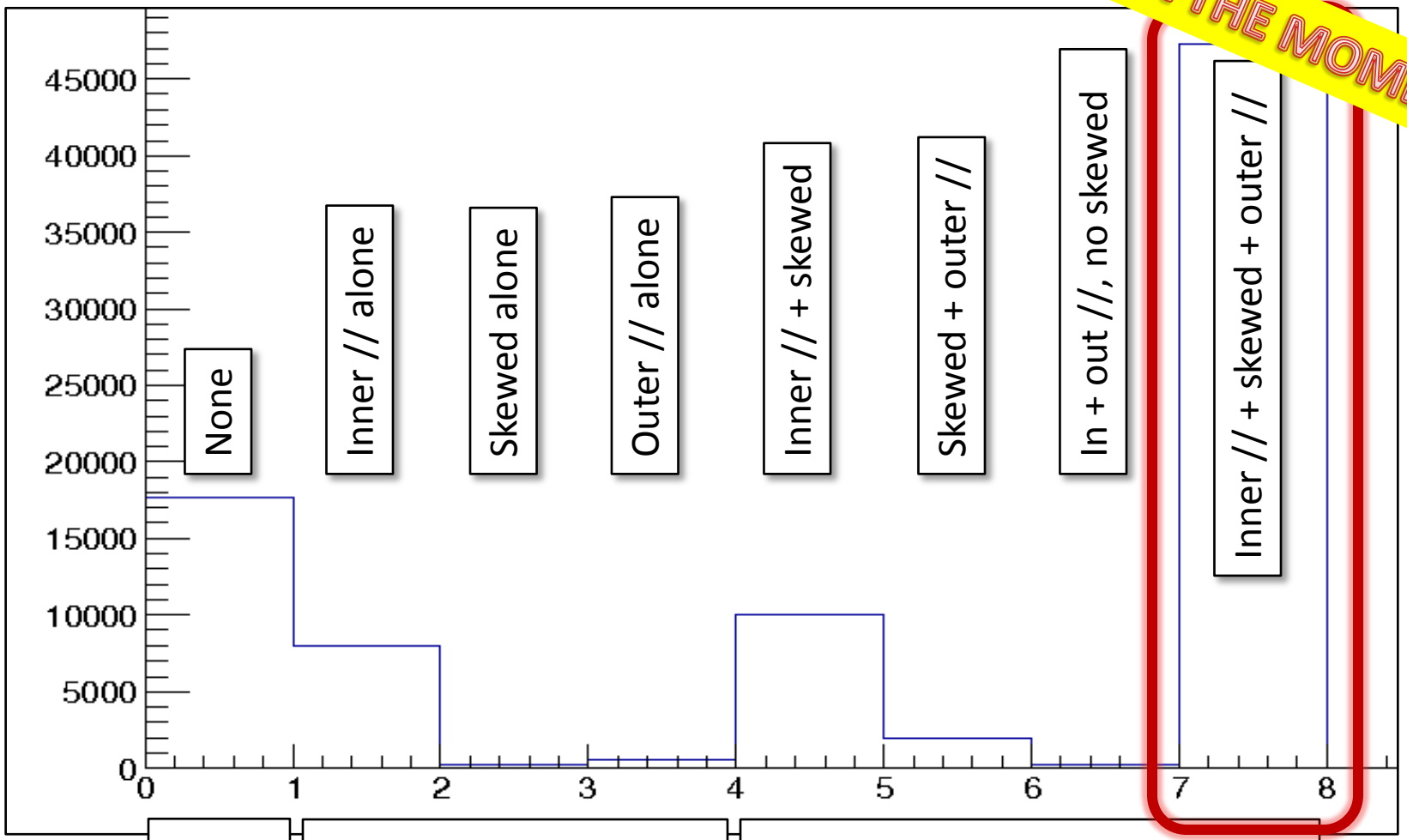
Tracks in sectors



17744 **21%**	7990 + 195 + 582 **10%** **13% of the tracks which enter STT**	10004 + 1991 + 237 + 47257 **69%** **87% of the tracks which enter the STT**

Tracks in sectors

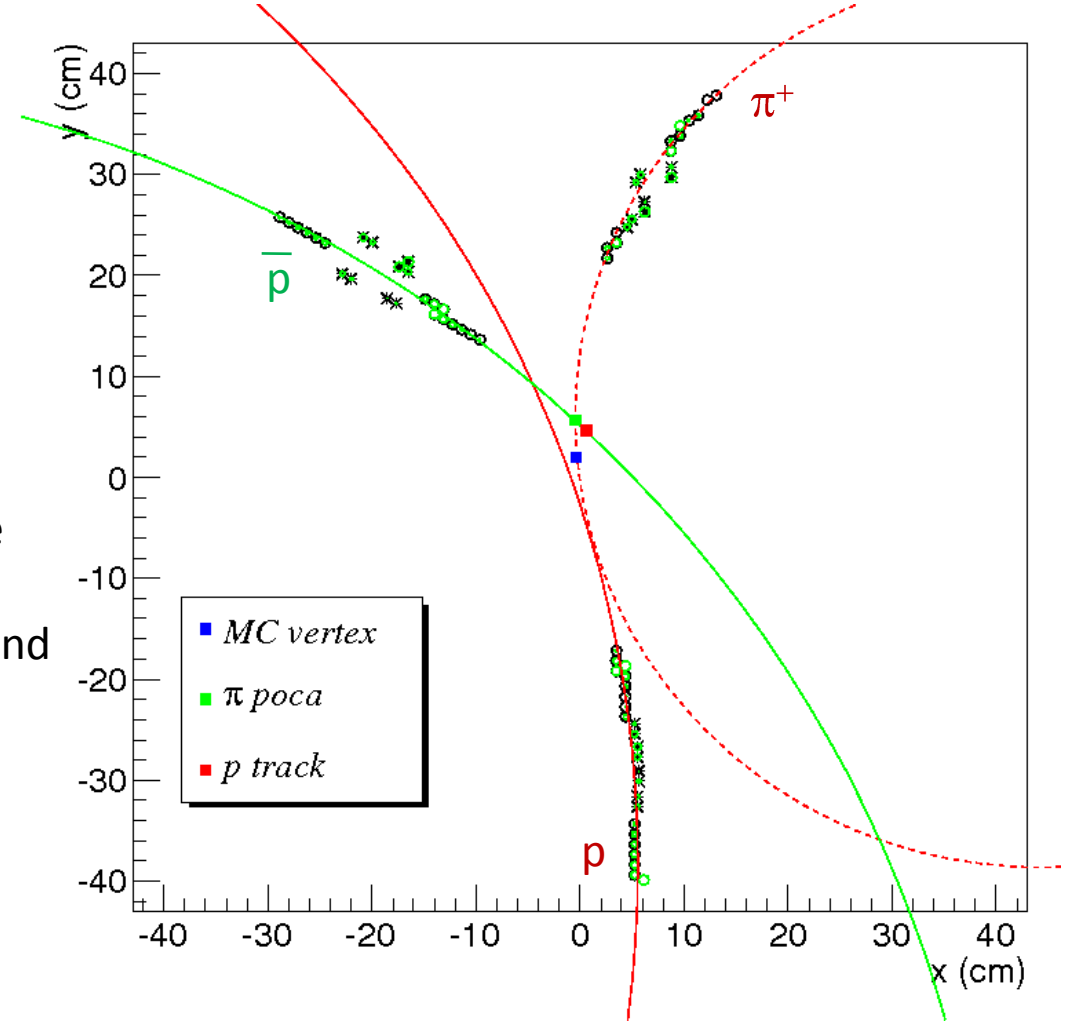
FOR THE MOMENT



17744	7990 + 195 + 582	10004 + 1991 + 237 + 47257
21%	**10%**	**69%**
	13% of the tracks which enter STT	**87% of the tracks which enter the STT**

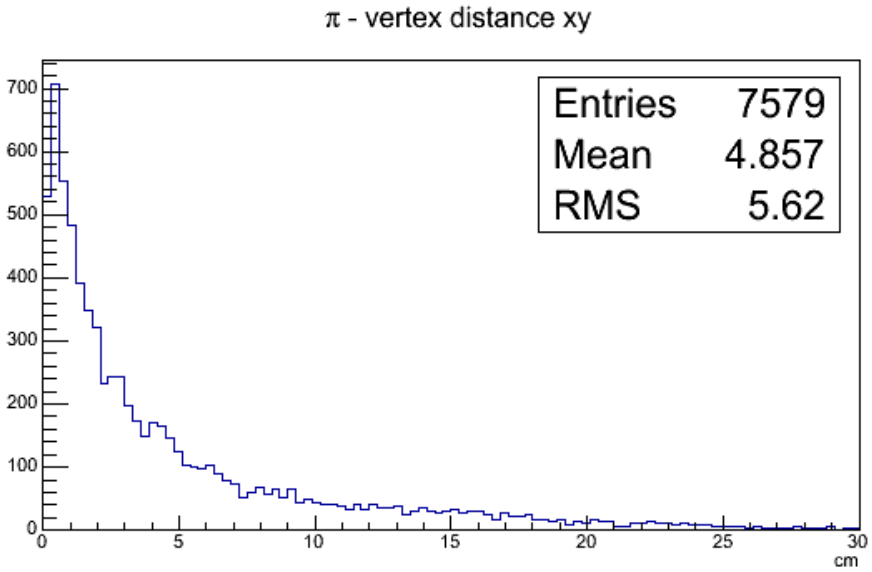
Simple Vertex Finder

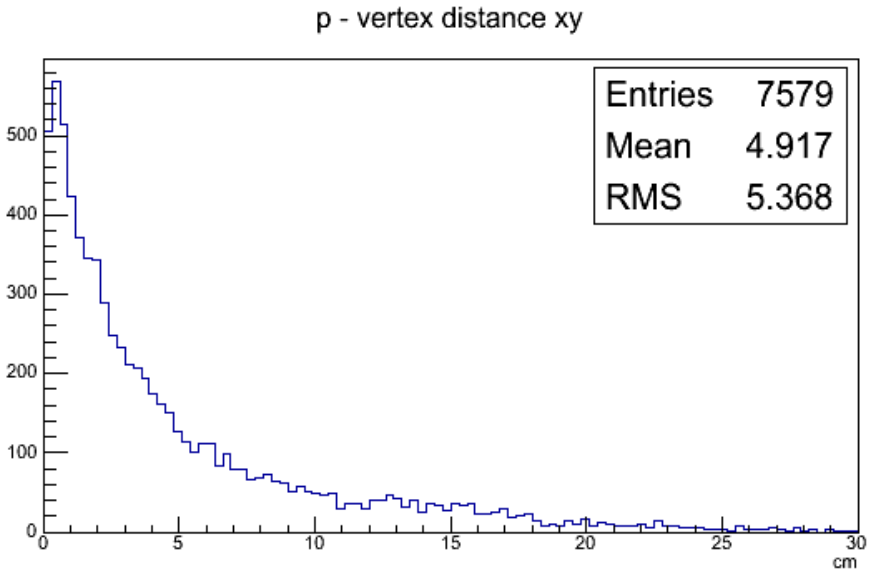
- **no Kalman filter** has been applied to the tracks
- **only STT hits** have been used, no MVD/GEM association
- **MC PID** to identify pions and protons

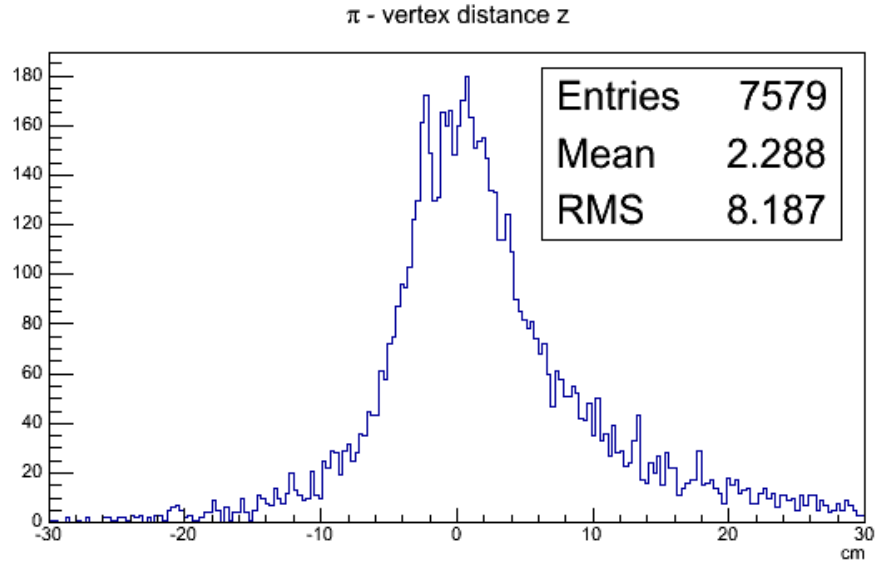


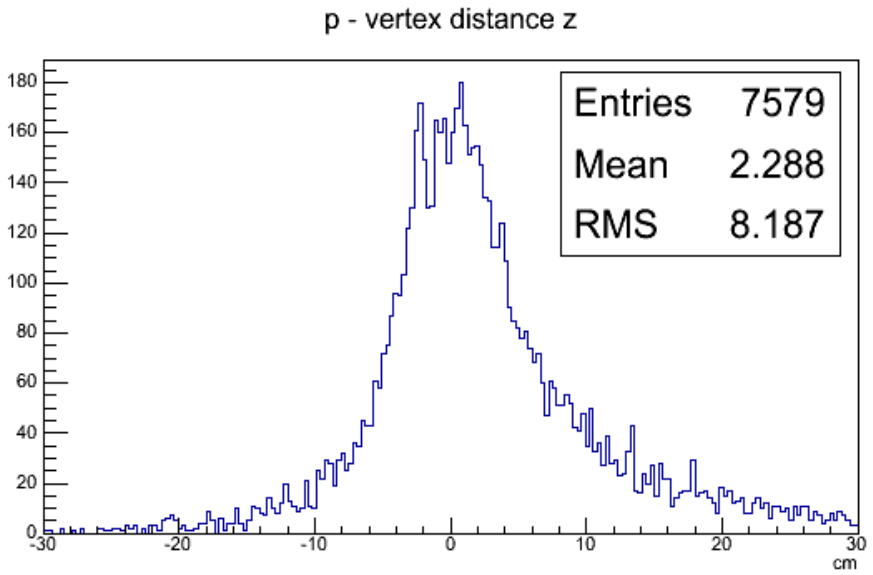
- A very **simple vertex finder** has been implemented: the distance between the pion and the proton helix of opposite charges is calculated and the *poca* is found
- the distance @ *poca* must be < 10 cm
- when more than one association πN is available, the best *poca* is the choice.

Distance from MC vertex - 3 sectors

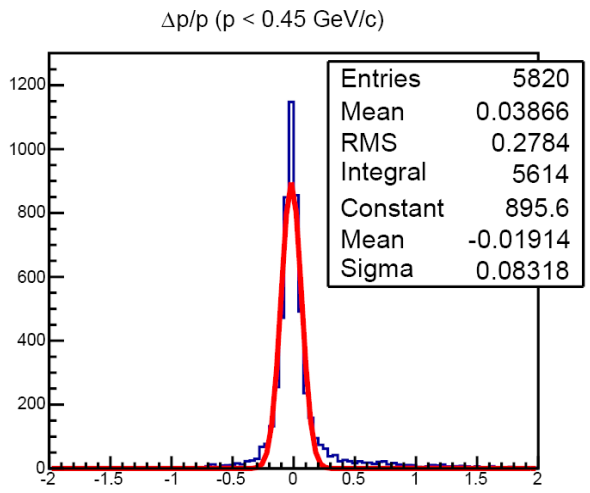


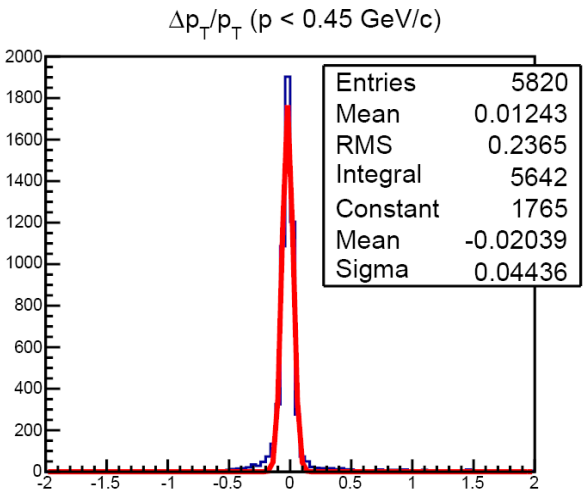


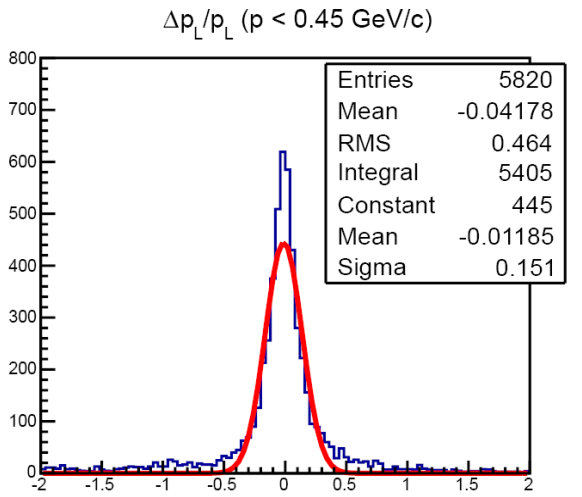


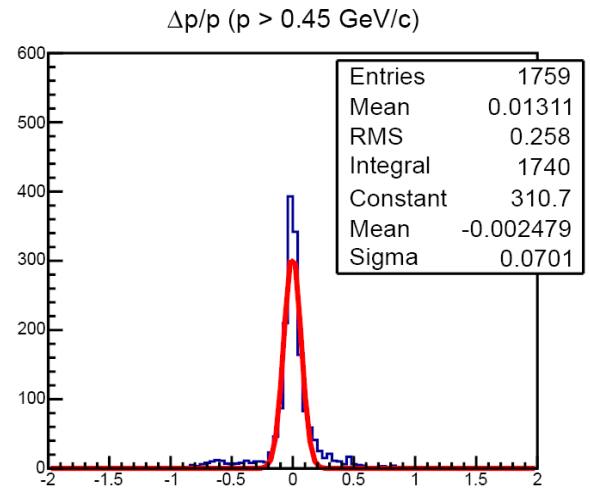


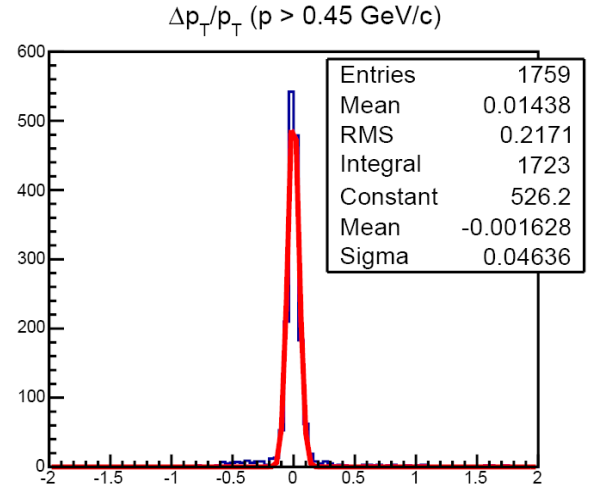
Pions - 3 sectors

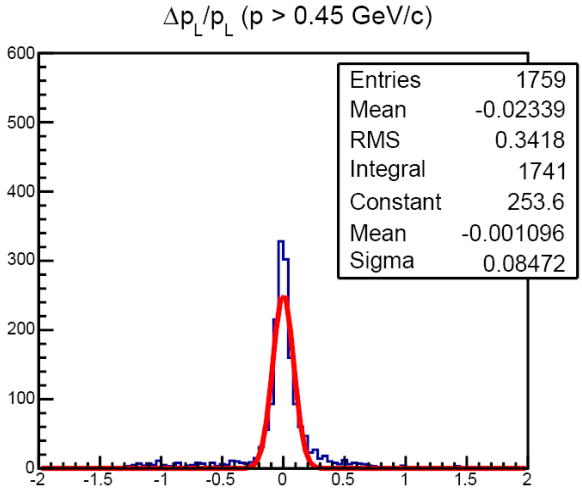




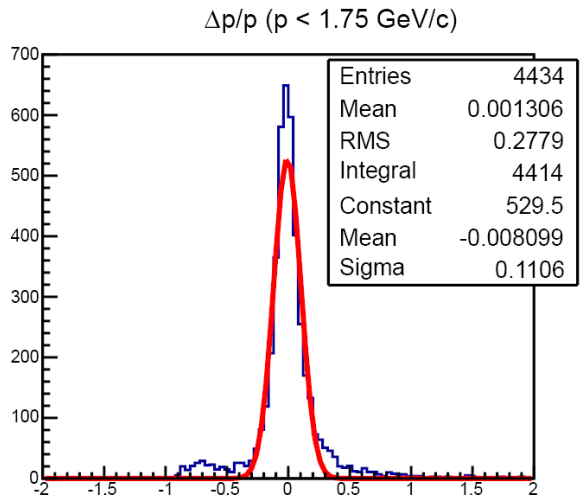


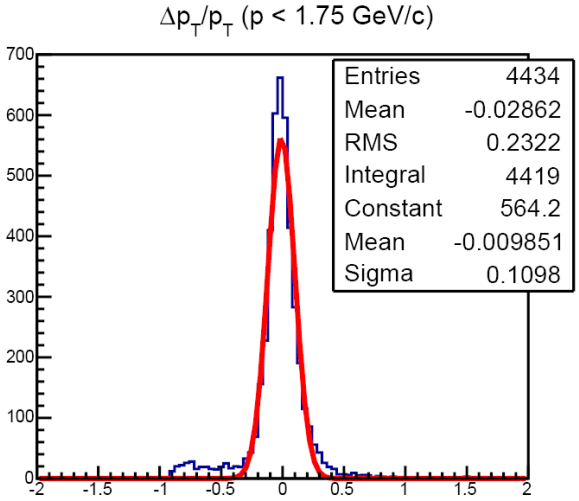


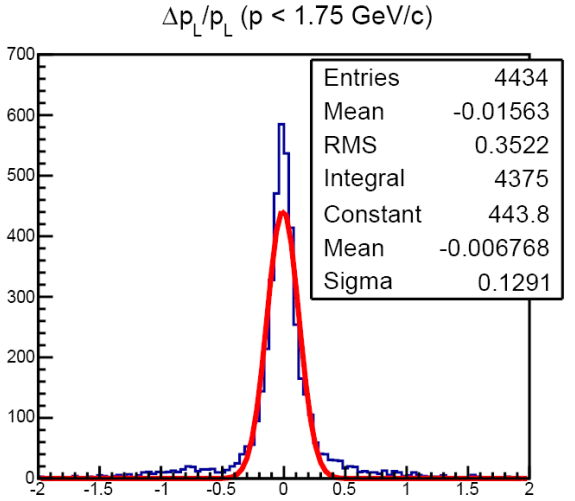


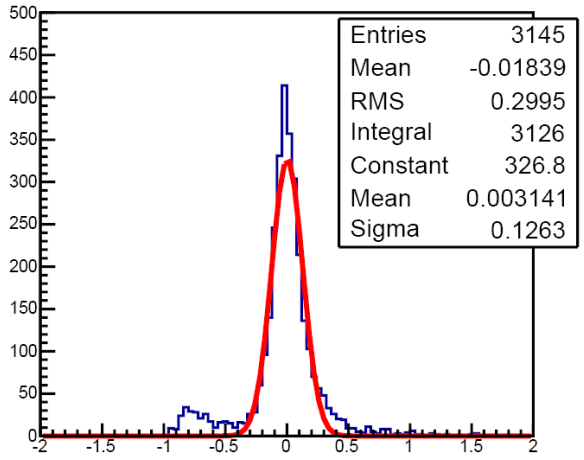


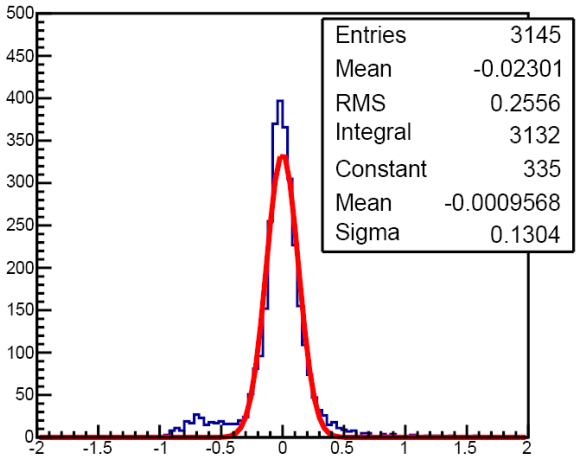
Protons – 3 sectors

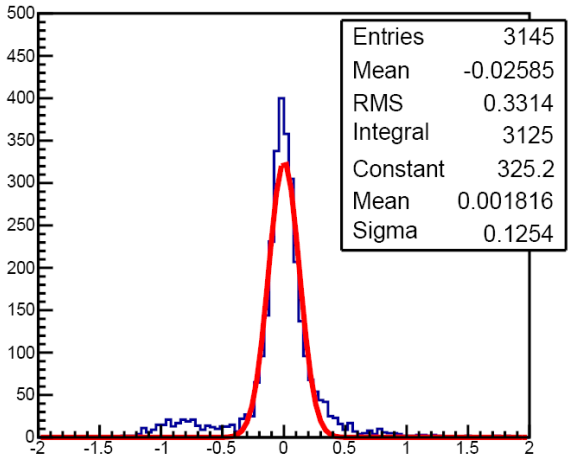




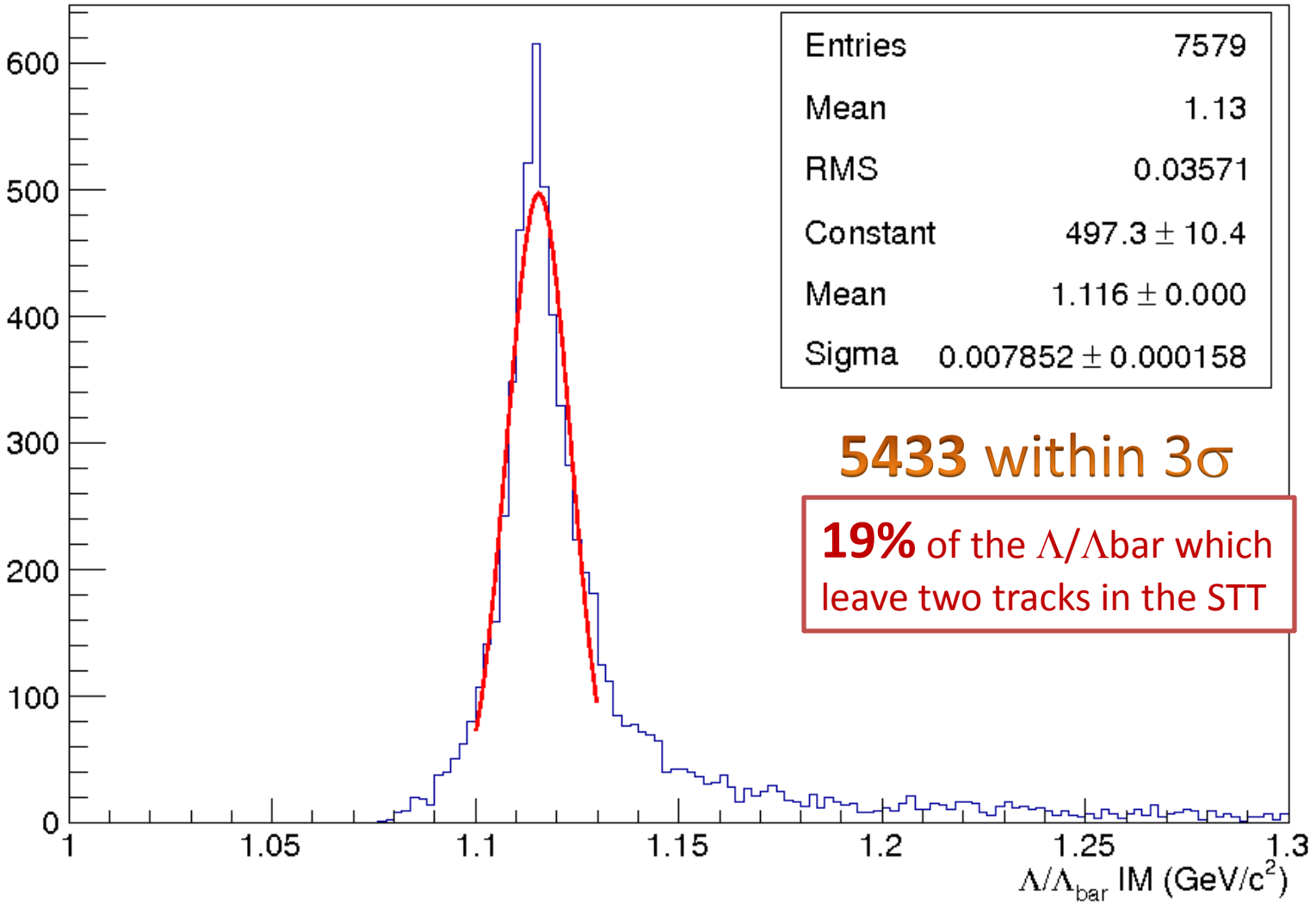








Invariant Mass - 3 sectors

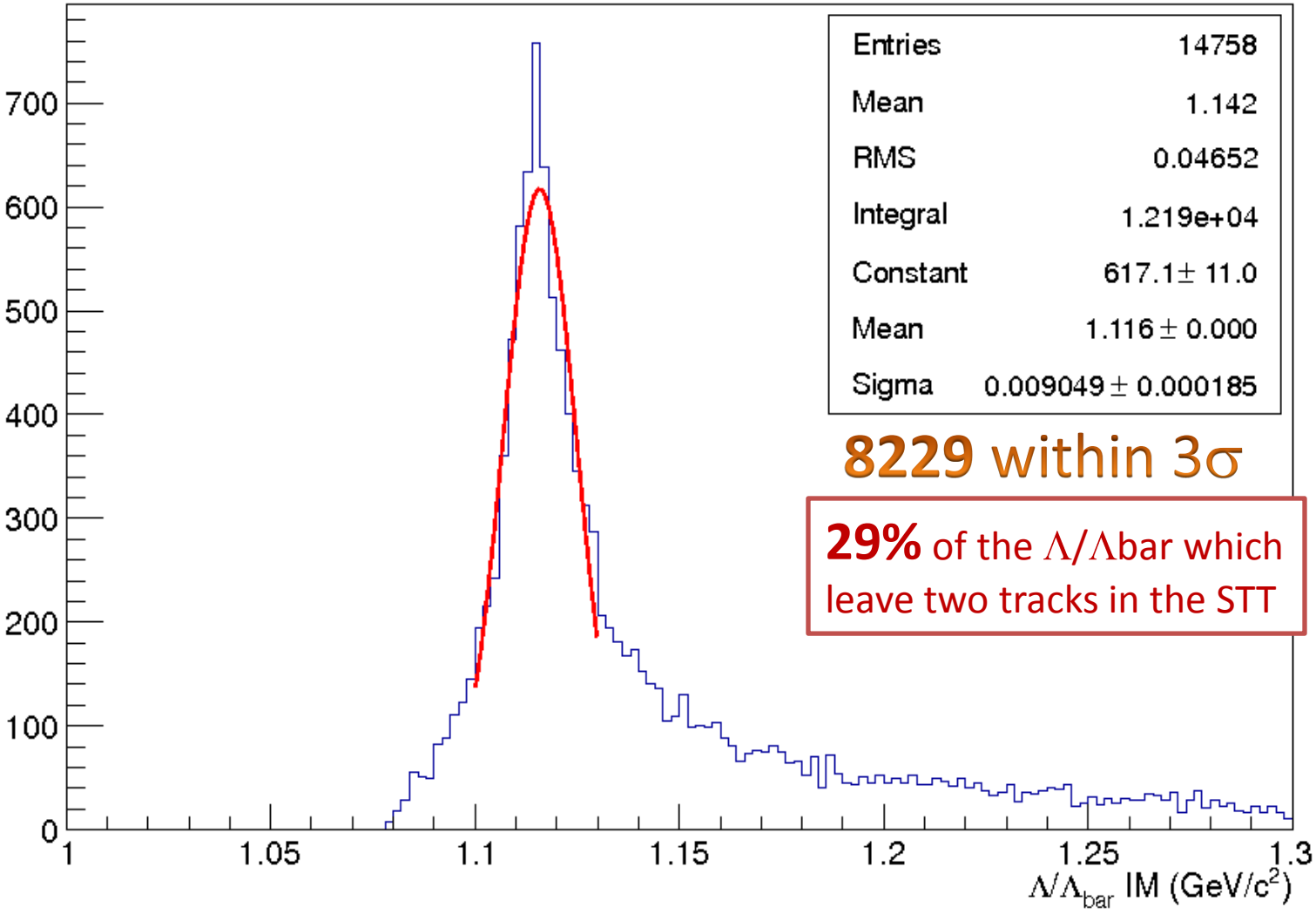


5433 within 3σ

19% of the Λ/Λbar which leave two tracks in the STT

Warning: *just the simple vertex finder was used, no kinematic fit. Its application will improve results and lower the tail*

Invariant Mass - All sectors



8229 within 3σ

29% of the Λ/Λbar which leave two tracks in the STT

Warning: *just the simple vertex finder was used, no kinematic fit. Its application will improve results and lower the tail*

Summary

- the code for the secondary track finder is still to be completed

- the improvements have to be added to increase the efficiency for the standalone STT reconstruction

- the MVD and GEM hits have to be added to increase the overall efficiency

- a more detailed analysis with forward boosted events is necessary. For that also the application of the Kalman filter and the kinematic fit is needed

Thank you!