Secondary & Primary track finders combined

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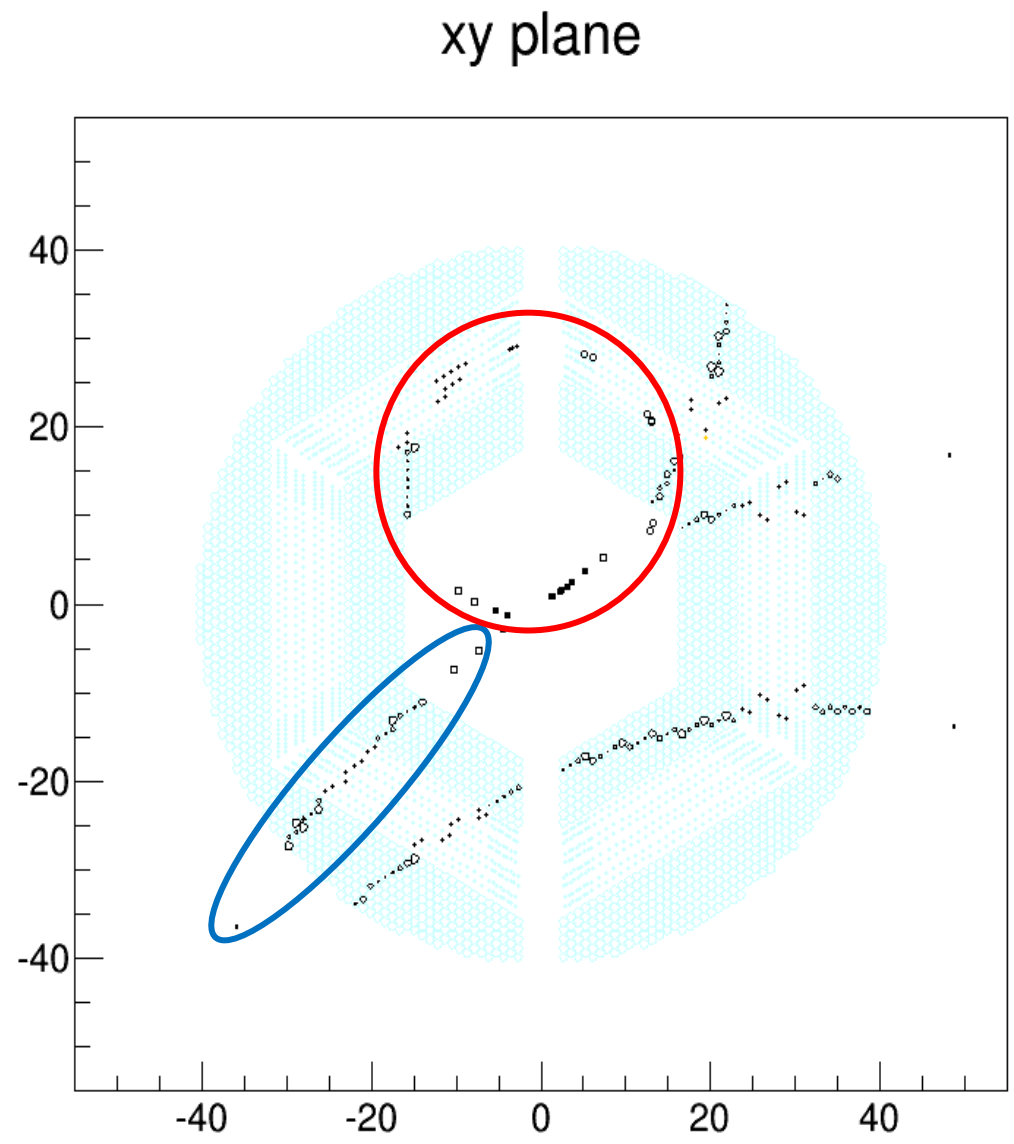
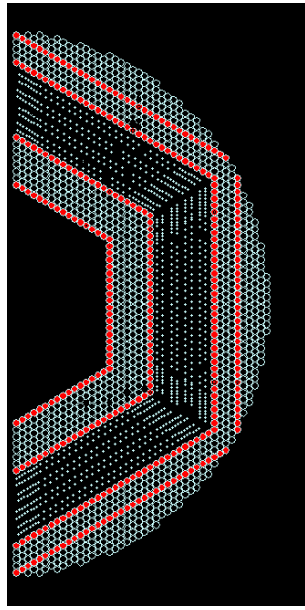
Summary

- In the past I used to test the secondary track finder code *alone* against the primary track finder, BUT...
- The secondary track finder should work **together** with the primary track finder (as it was foreseen at the very beginning), SO...
- Here is a test of the secondary + primary track finder against the primary track finder alone to see if there is some improvement
- The primary track finder is the existing one in its default layout
- The secondary track finder is the one I wrote so far…

Re-Summary of the procedure of the secondary TF



- LONG tracks, where it all starts from the 4 pivotal layers in the STT
- FORWARD tracks, where it all starts from the 3 GEM stations



- Key factors:
  - Conformal transformation
  - Legendre/Hough transformation
  - Z finding with the skewed tubes
  - Analytical fit

Quality Assurance

- All the results have been obtained with the new Quality Assurance procedure, FairLink based, and the new macros inserted by Stefano in svn

- recoqa_complete.C

```
// Ideal Track finder
PndMCIdealTrackFinderNewLinks* idealTracking
= new PndMCIdealTrackFinderNewLinks();
  idealTracking->AddBranchName("MVDHitsPixel");
  idealTracking->AddBranchName("MVDHitsStrip");
  idealTracking->AddBranchName("STTHit");
  idealTracking->AddBranchName("GEMHit");
  fRun->AddTask(idealTracking);

// QA task
PndTrackingQualityTaskNewLinks* trackingQA = new
PndTrackingQualityTaskNewLinks("SttMvdGemTrack", "IdealTrack");
  fRun->AddTask(trackingQA);
```

- QA_histos.C fills the histograms and writes them in a file
- comp_recoqa.C overlaps the histograms from two files to make a comparison

Quality Assurance

- All the results have been obtained with the new Quality Assurance procedure, FairLink based, and the new macros inserted by Stefano in svn

- recoqa_complete.C

```
// Ideal Track finder
PndMCIdealTrackFinderNewLinks* idealTracking
= new PndMCIdealTrackFinderNewLinks();
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  idealTracking->AddBranchName("MVDHitsStrip");
  idealTracking->AddBranchName("STTHit");
  idealTracking->AddBranchName("GEMHit");
  fRun->AddTask(idealTracking);

// QA task
PndTrackingQualityTaskNewLinks* trackingQA = new
PndTrackingQualityTaskNewLinks("SttMvdGemTrack", "IdealTrack");
  fRun->AddTask(trackingQA);
```
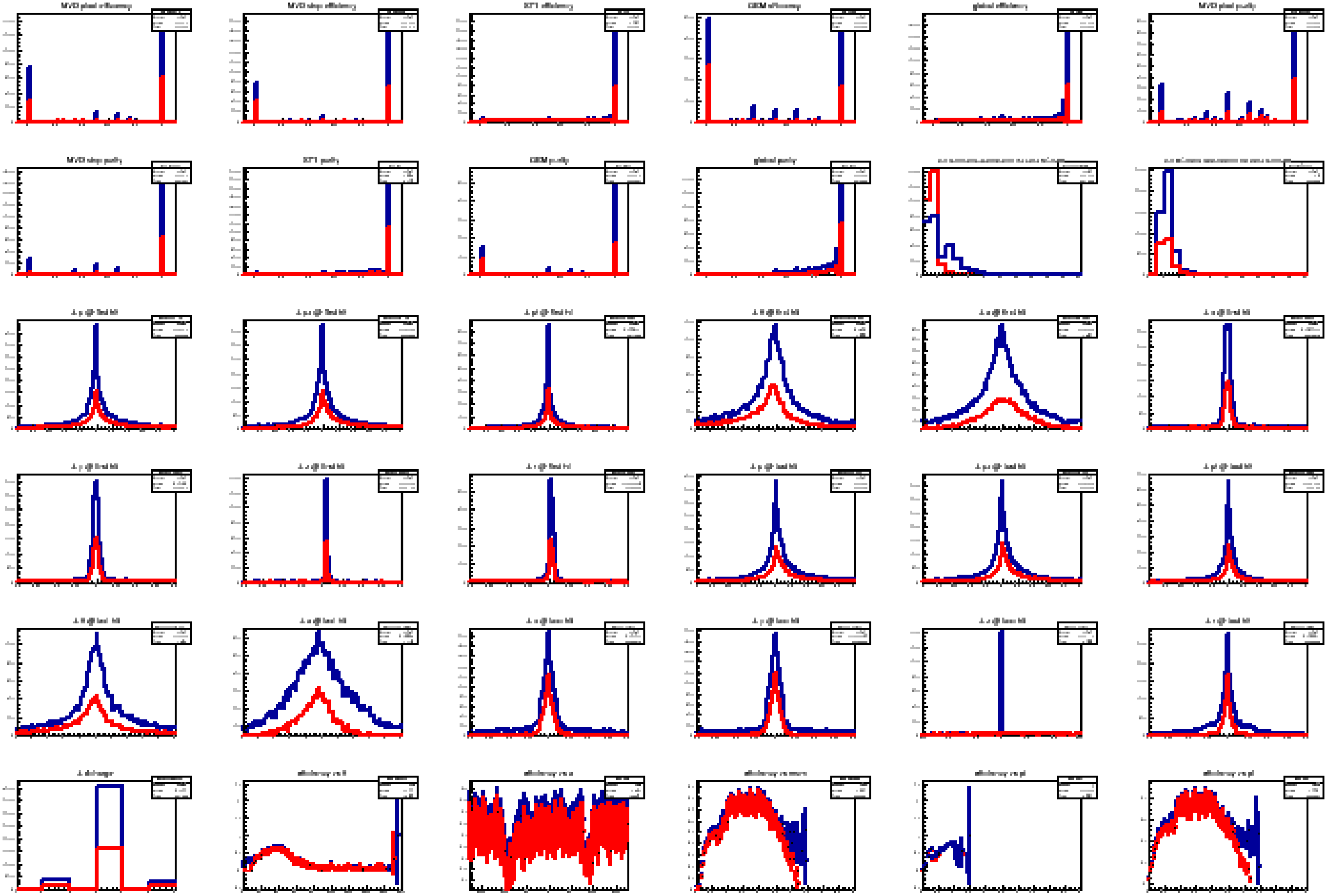

- QA_histos.C fills the histograms and writes them in a file
- comp_recoqa.C overlaps the histograms from two files to make a comparison

Full comparison of primary (red) and combined (red) track finders

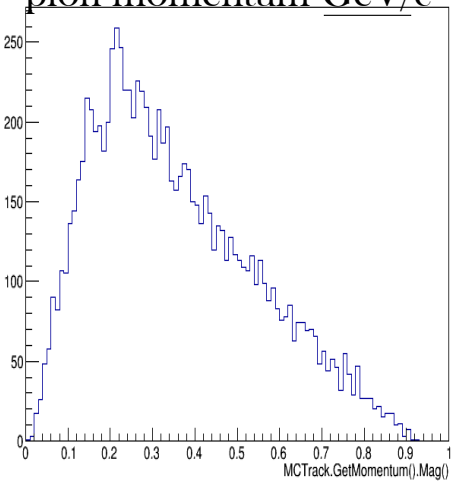


$\bar{p}p \to \Lambda\bar{\Lambda}$ PHSP

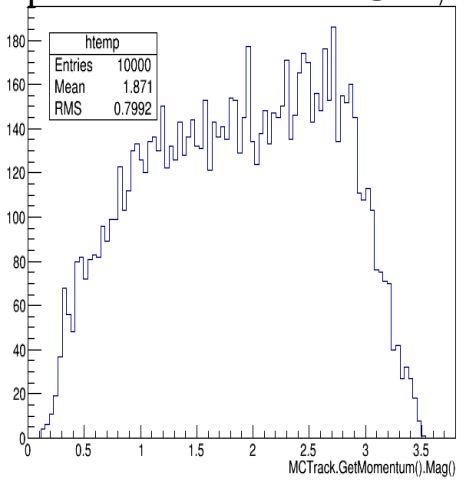
```
noPhotos

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

End
```

5000 events

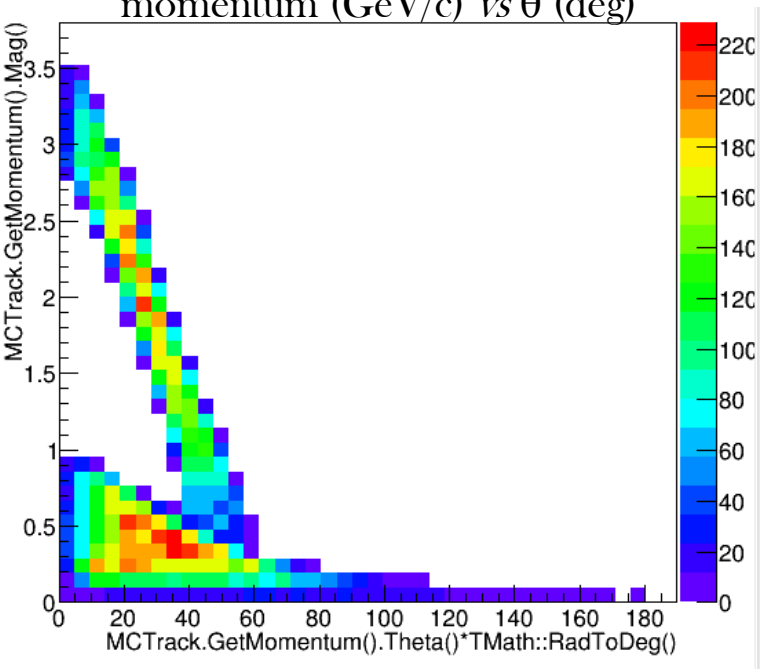
pion momentum GeV/c



proton momentum GeV/c



momentum (GeV/c) *vs* θ (deg)

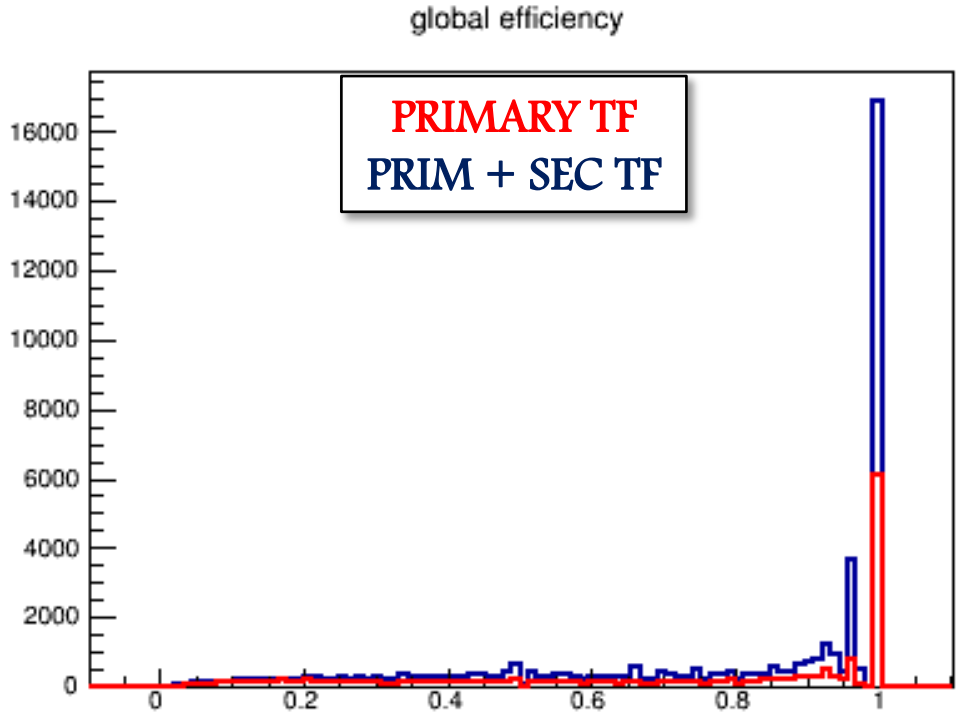


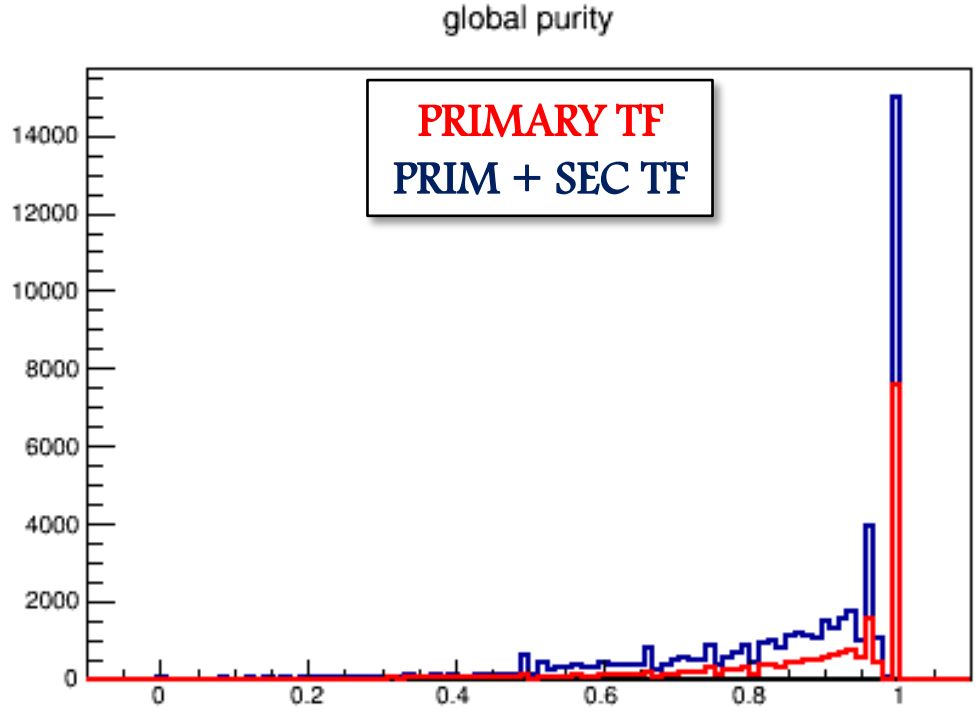
$\bar{p}p \to \Lambda\bar{\Lambda}$ track efficiency and purity

SINGLE TRACK
→ **Defined on hits**

$$\text{EFFICIENCY} = \frac{\#\ \text{CORRECTLY ASSIGNED HITS}}{\#\ \text{MC POINTS}}$$

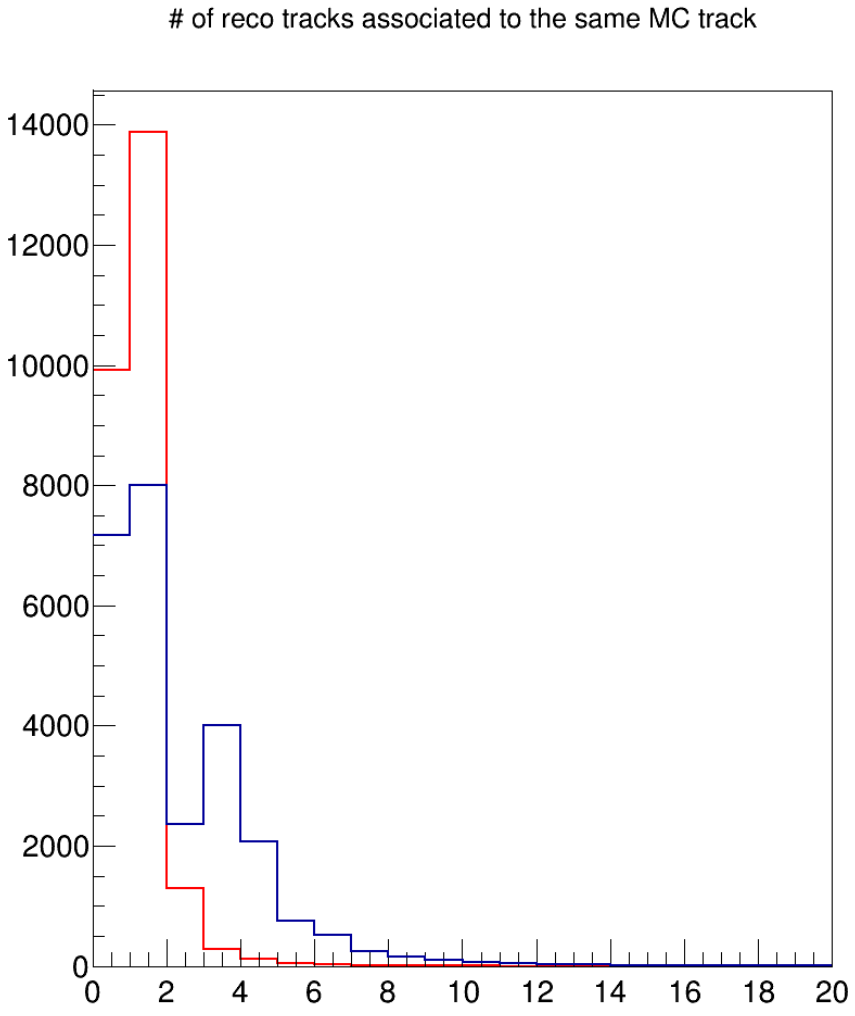
$$\text{PURITY} = \frac{\#\ \text{CORRECTLY ASSIGNED HITS}}{\#\ \text{RECO HITS}}$$

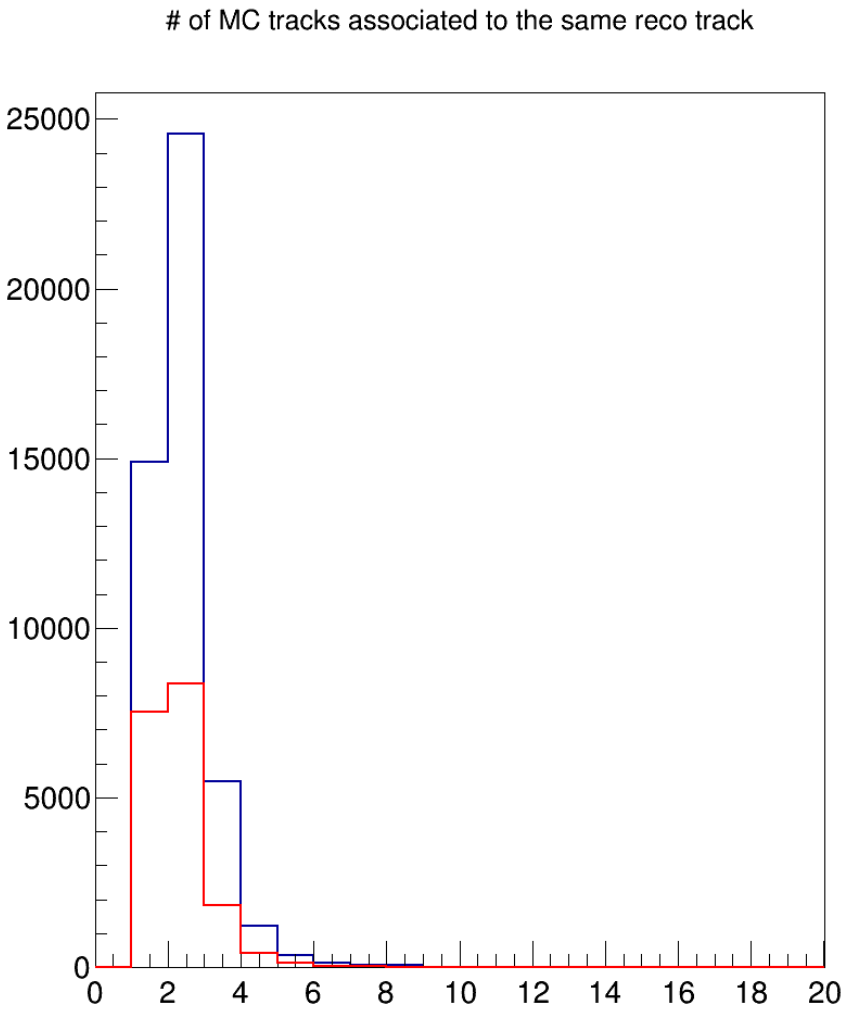




$\bar{p}p \to \Lambda\bar{\Lambda}$ counters

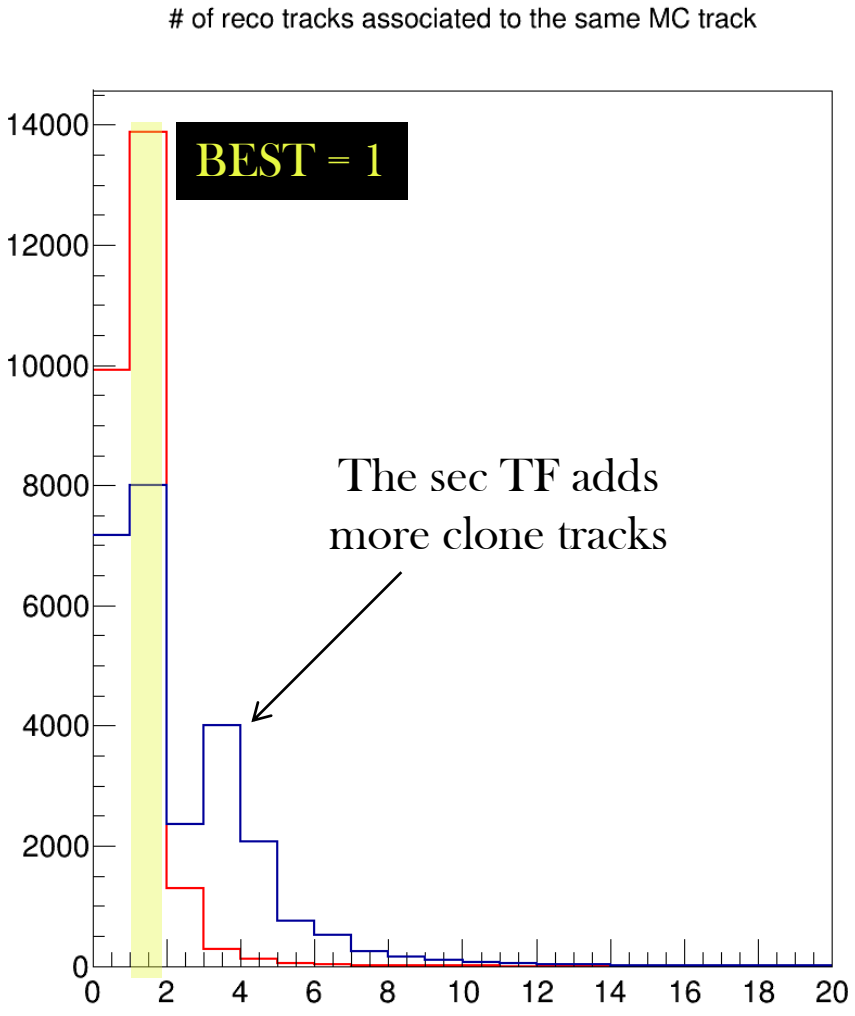
PRIMARY TF
PRIM + SEC TF

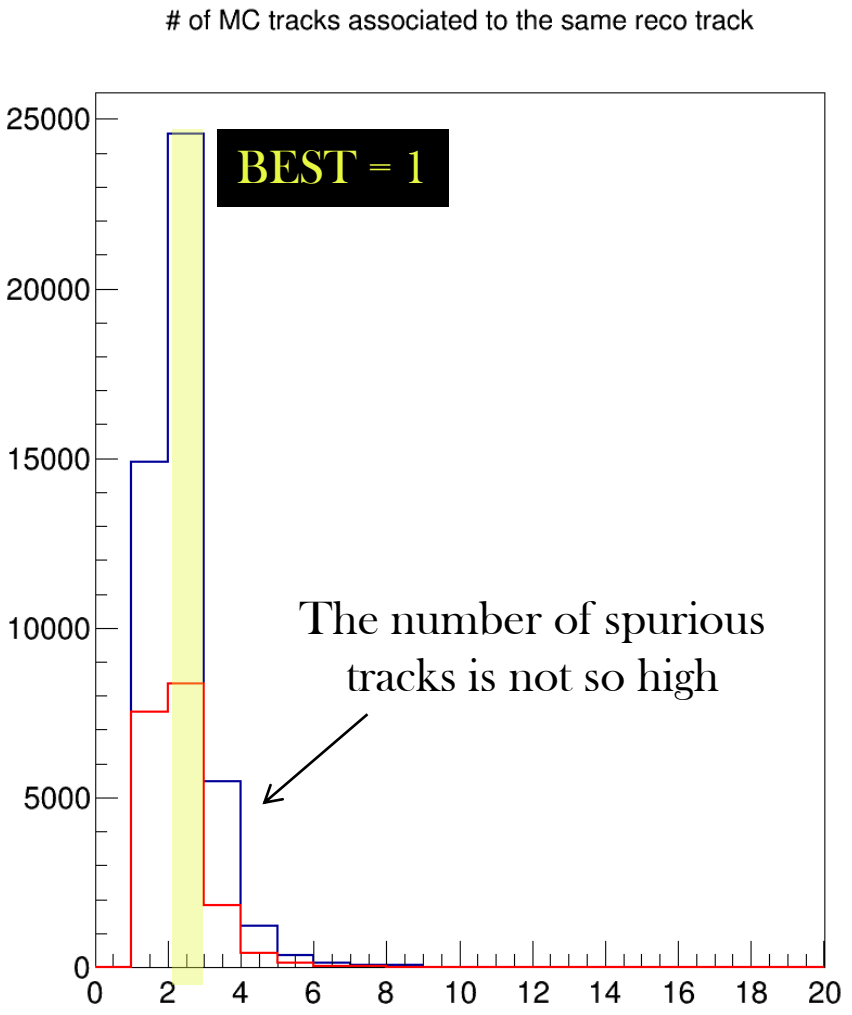




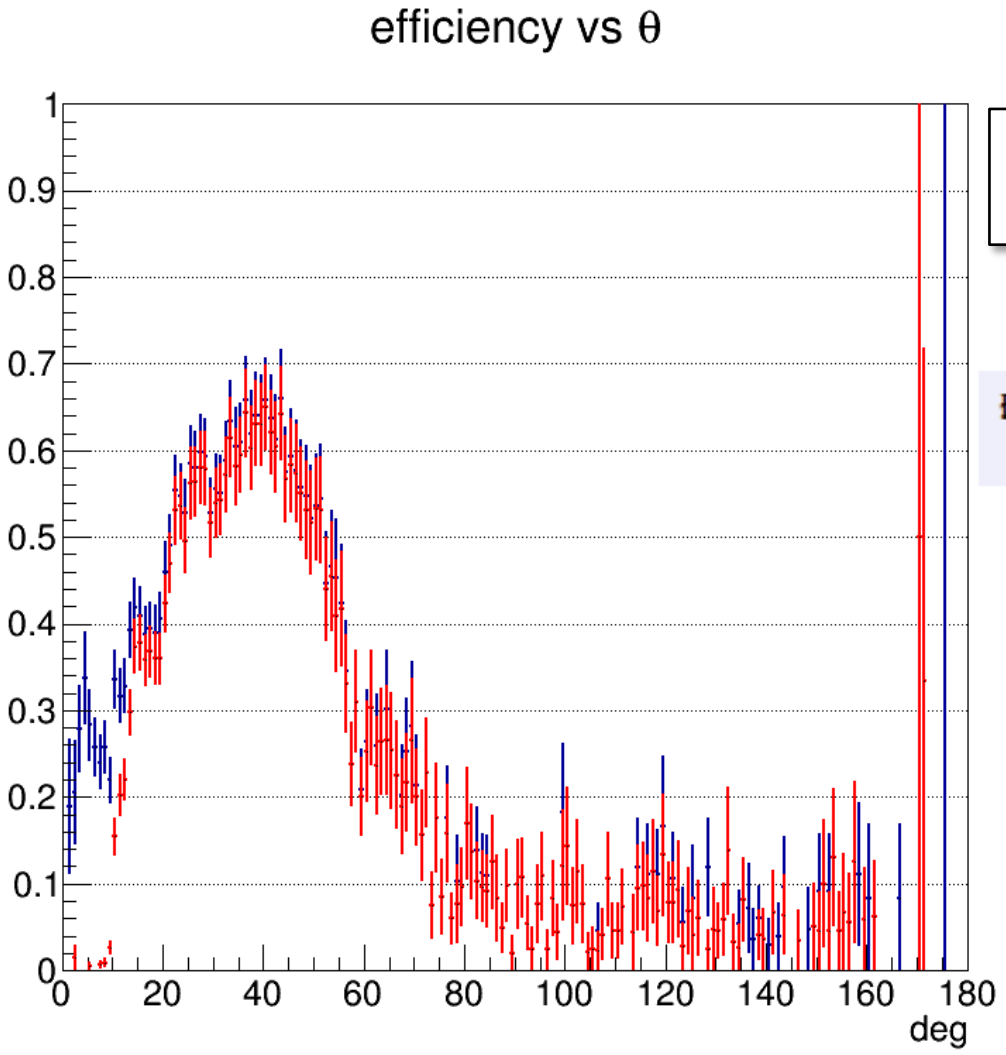
$\bar{p}p \to \Lambda\bar{\Lambda}$ counters

PRIMARY TF
PRIM + SEC TF





$\bar{p}p \to \Lambda\bar{\Lambda}$ efficiency vs θ

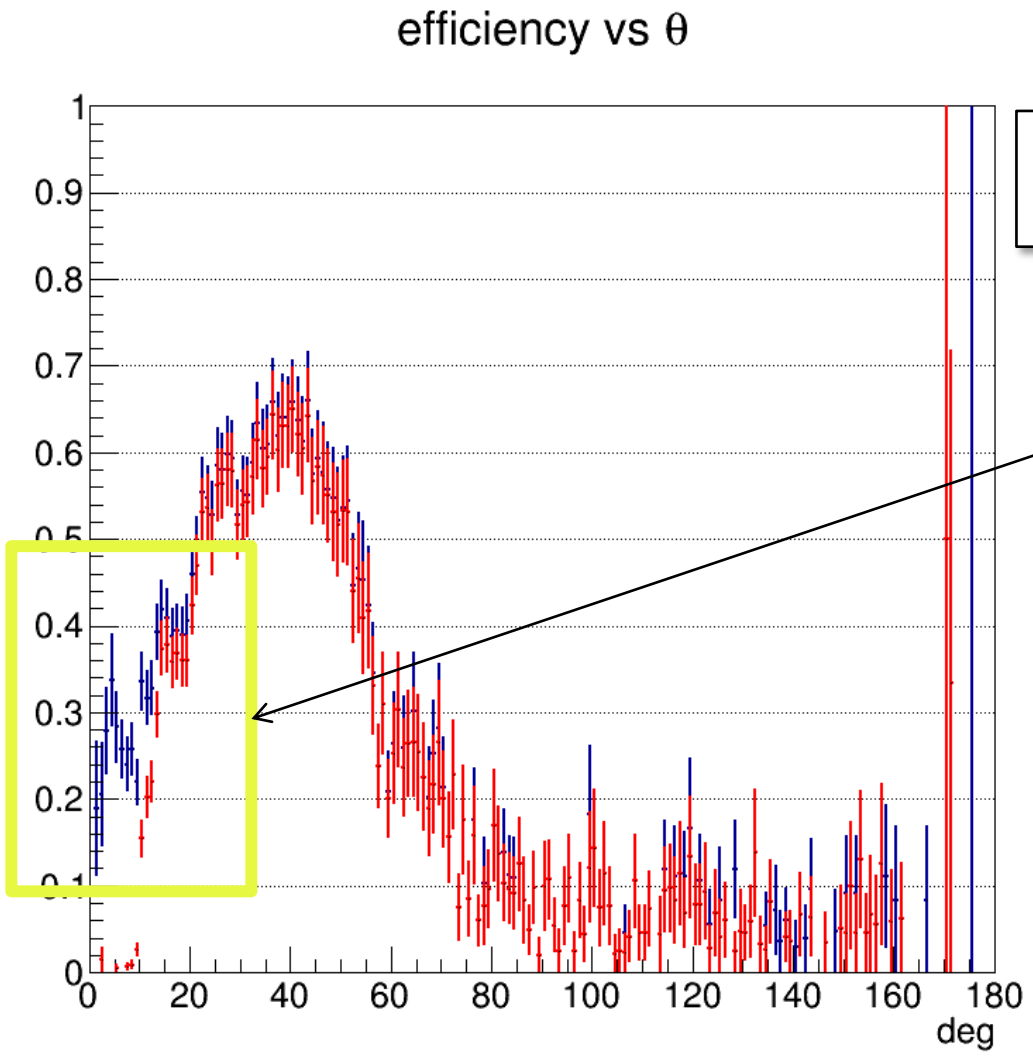


PRIMARY TF

PRIM + SEC TF

$$\text{EFFICIENCY} = \frac{\#\ \text{TRACKS WITH SINGLE TRACK EFF} > 80\%}{\#\ \text{MC RECONSTRUCTABLE * TRACKS}}$$

$\bar{p}p \rightarrow \Lambda\bar{\Lambda}$ efficiency vs θ



PRIMARY TF
PRIM + SEC TF

At lower theta values the secondary track finder contributes to raise the efficiency

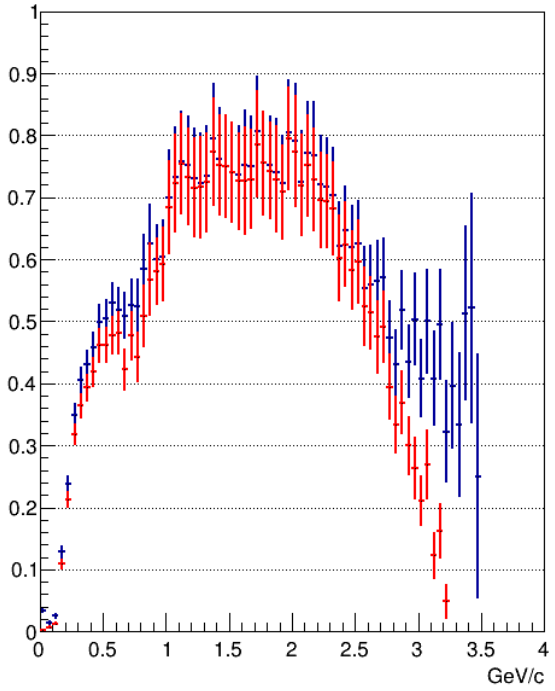
The primary track finder is very good at higher angles

$\bar{p}p \to \Lambda\bar{\Lambda}$ efficiency

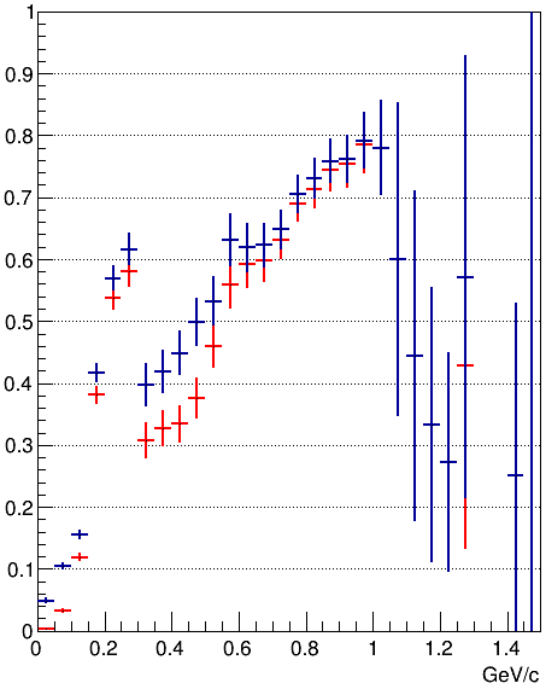
EFFICIENCY = # TRACKS WITH SINGLE TRACK EFF > 80% / # MC RECONSTRUCTABLE *TRACKS

PRIMARY TF
PRIM + SEC TF

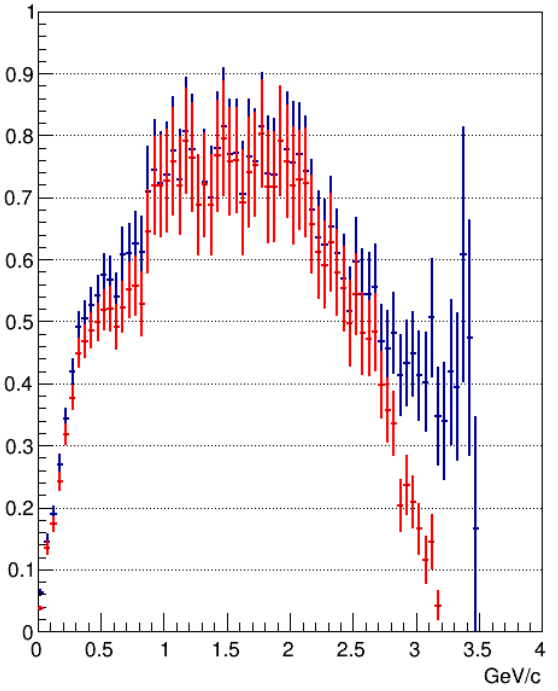
efficiency vs mom



efficiency vs pt



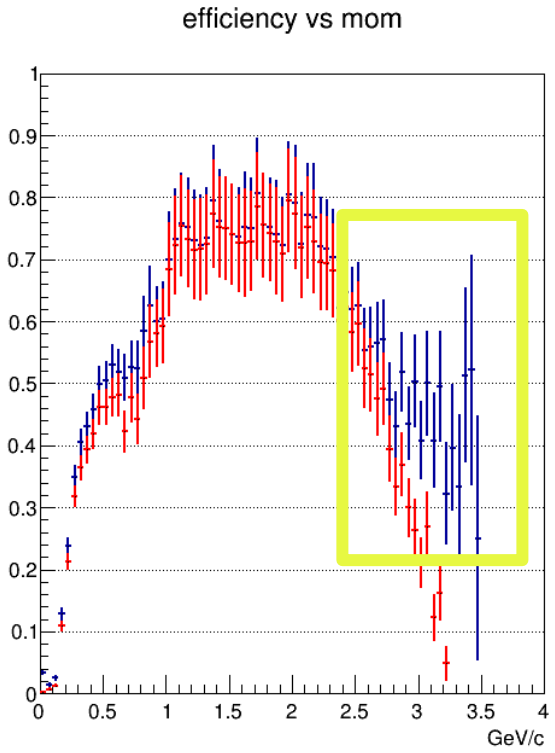
efficiency vs pl

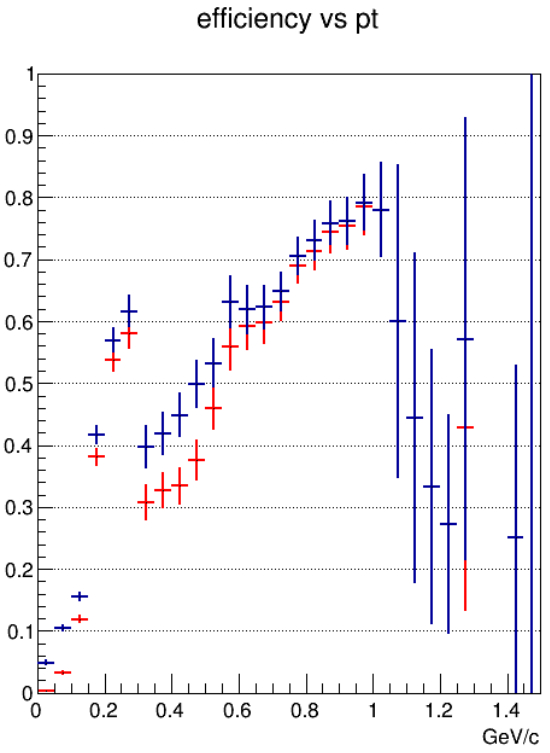


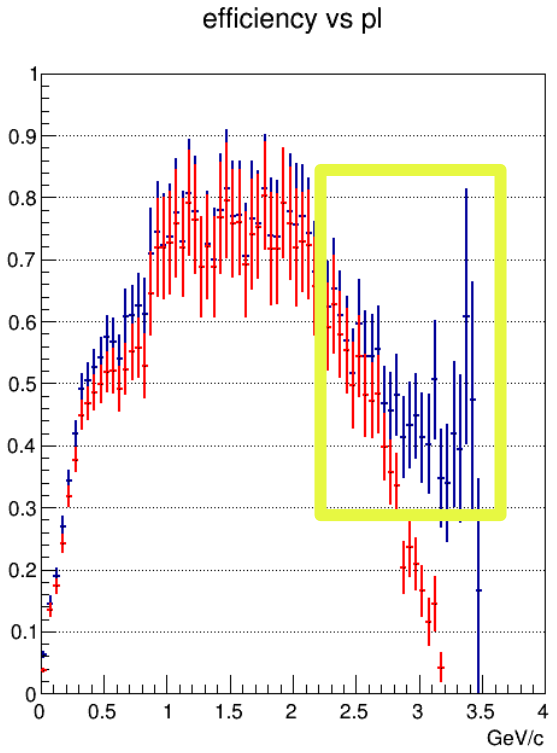
$\bar{p}p \rightarrow \Lambda\bar{\Lambda}$ efficiency

$$\text{EFFICIENCY} = \frac{\#\ \text{TRACKS WITH SINGLE TRACK EFF} > 80\%}{\#\ \text{MC RECONSTRUCTABLE * TRACKS}}$$

PRIMARY TF
PRIM + SEC TF



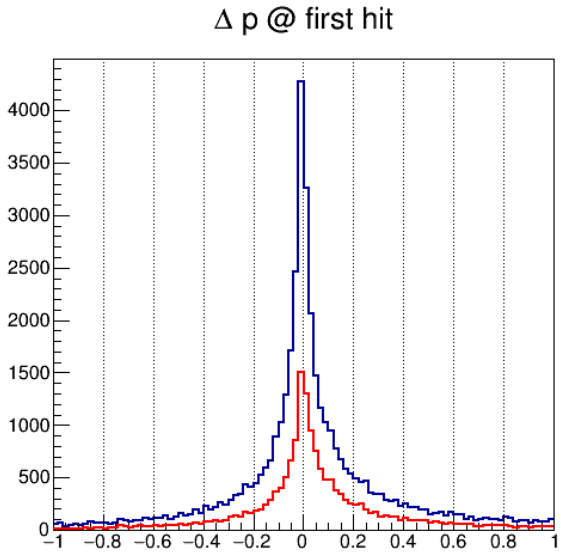


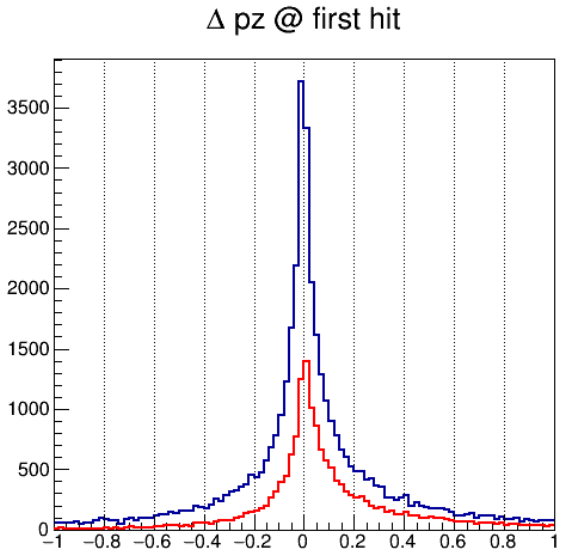


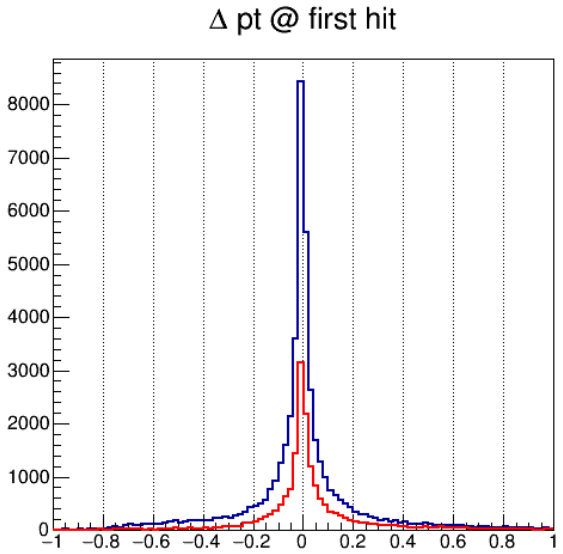
The efficiency at lower theta values of the secondary track finder reflects on the efficiency at higher longitudinal momenta → boosted tracks

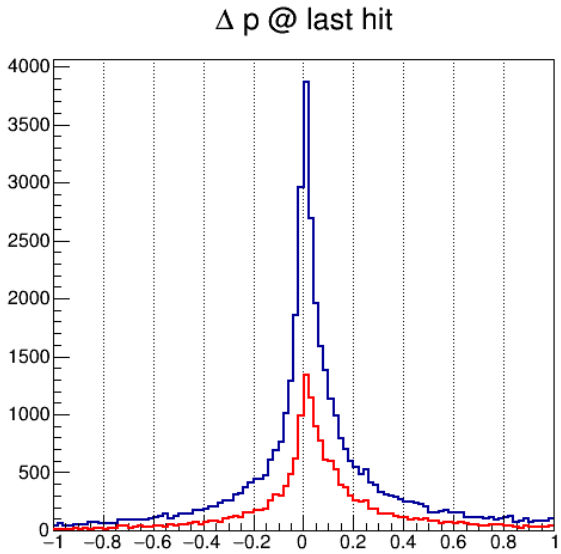
$\bar{p}p \to \Lambda\bar{\Lambda}$ momentum distribution

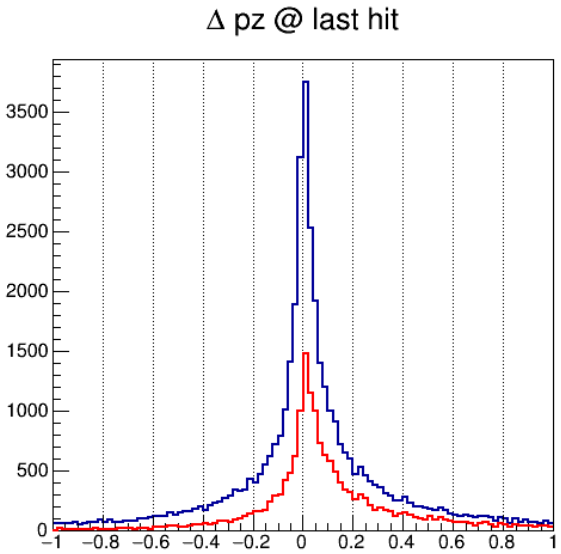
PRIMARY TF
PRIM + SEC TF

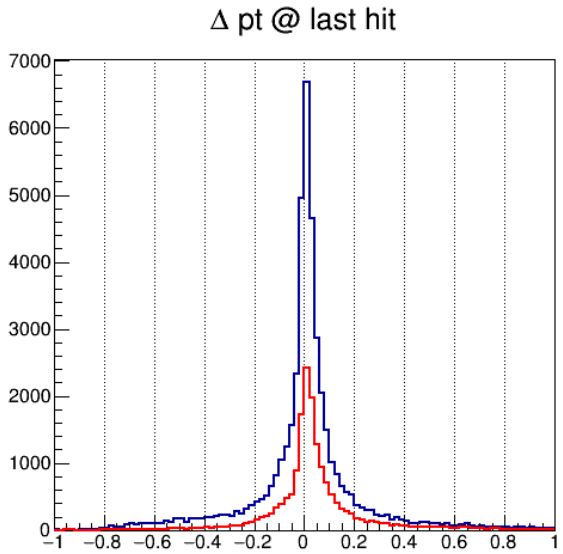






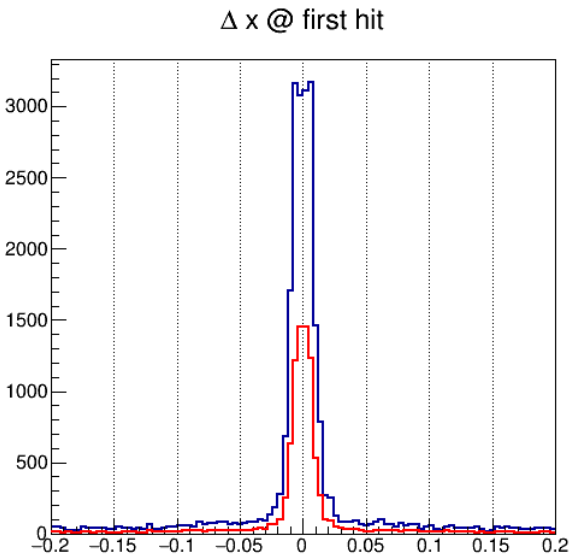


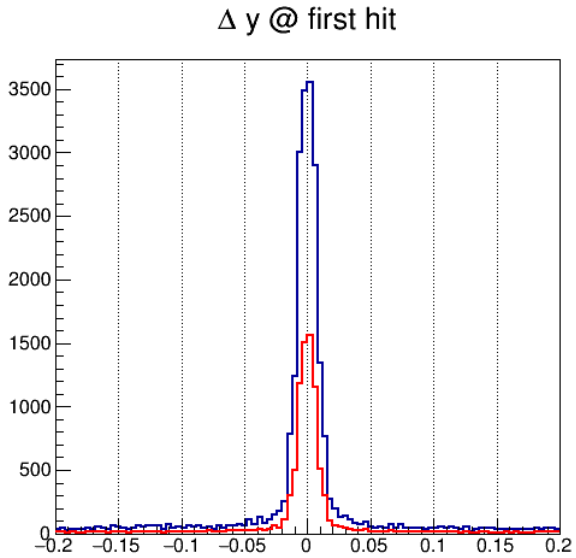


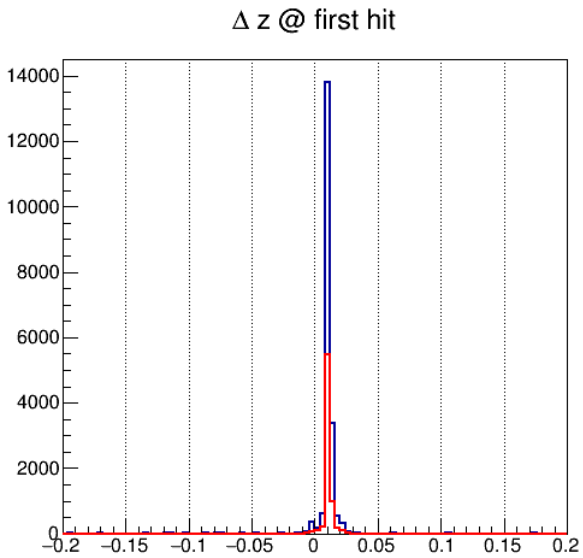


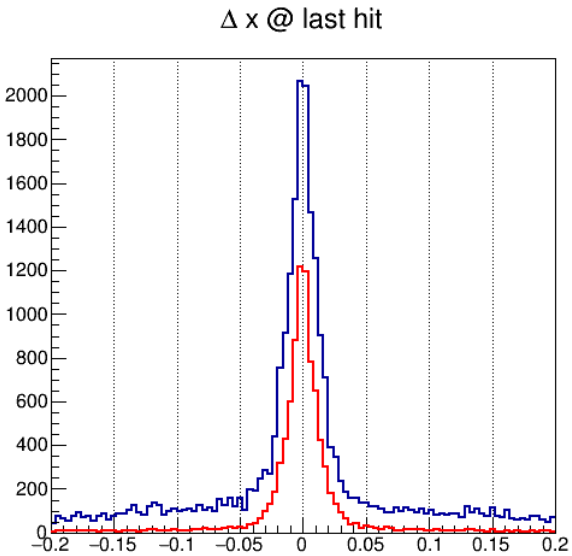
PRIMARY TF
PRIM + SEC TF

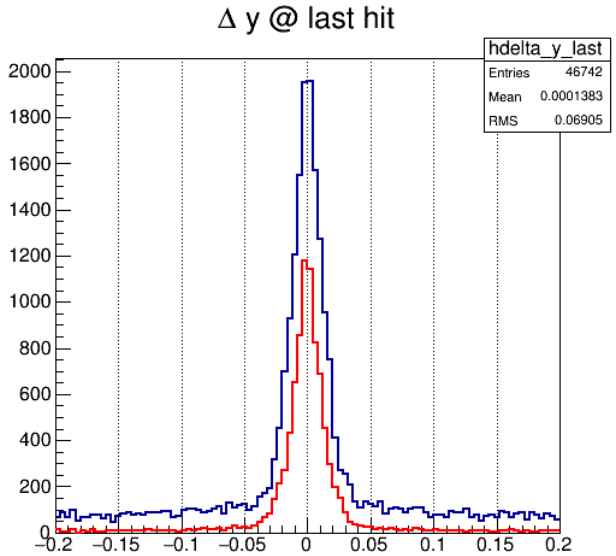
$\bar{p}p \to \Lambda\bar{\Lambda}$ position distributions

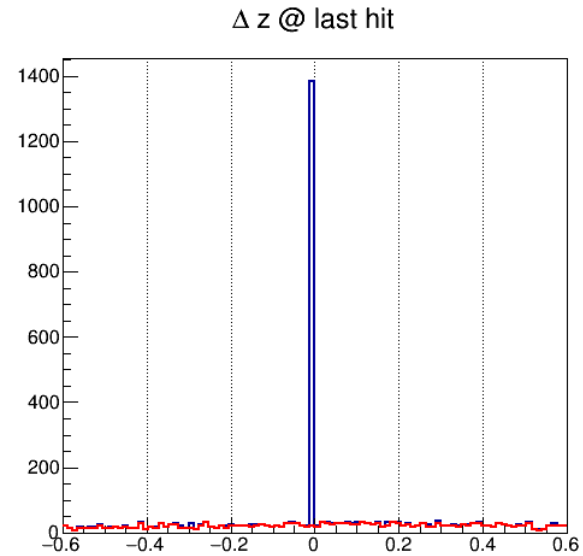










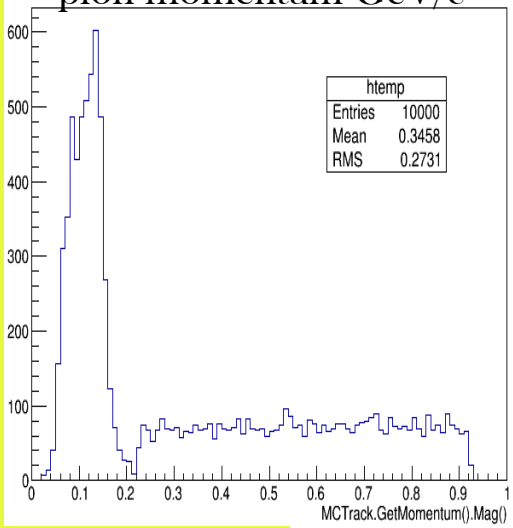


$\bar{p}p \rightarrow \Lambda\bar{\Lambda}$ ~ boost model @ p_{beam} = 4 GeV/c

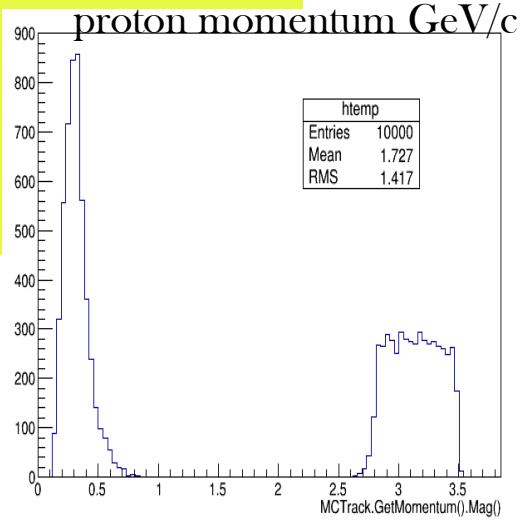
```
noPhotos

Decay pbarpSystem
   1.0  anti-Lambda0  Lambda0
                  LambdaLambdaBar  4;
Enddecay

Decay Lambda0
   1.0  p+ pi-      PHSP;
Enddecay

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

End
```

5000 events

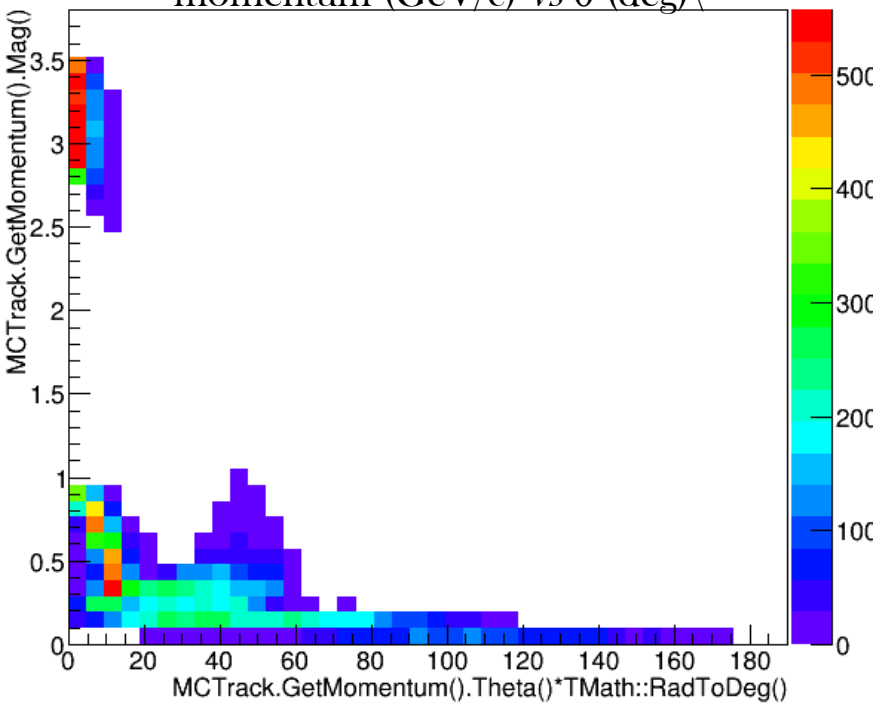
pion momentum GeV/c



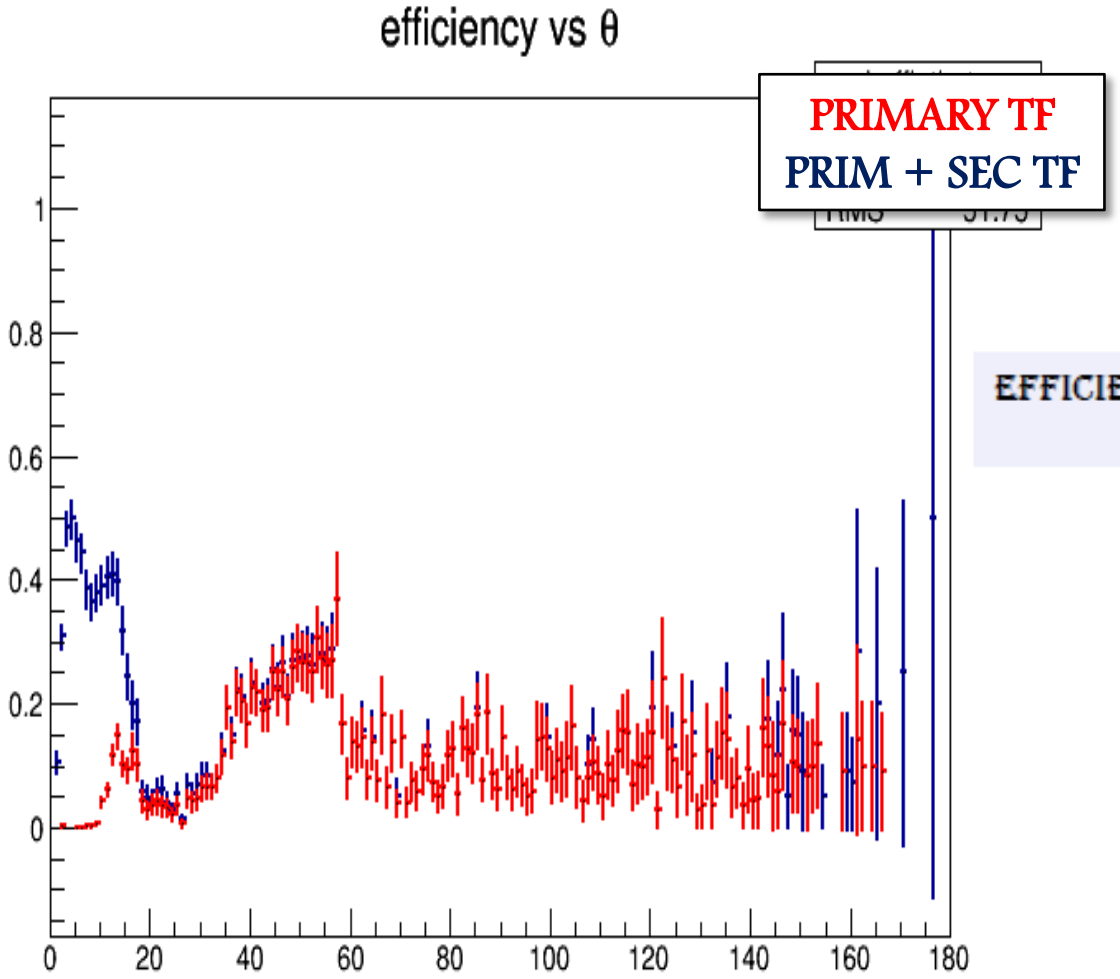
proton momentum GeV/c



momentum (GeV/c) *vs* θ (deg)\



$\bar{p}p \to \Lambda\bar{\Lambda}$ efficiency vs θ

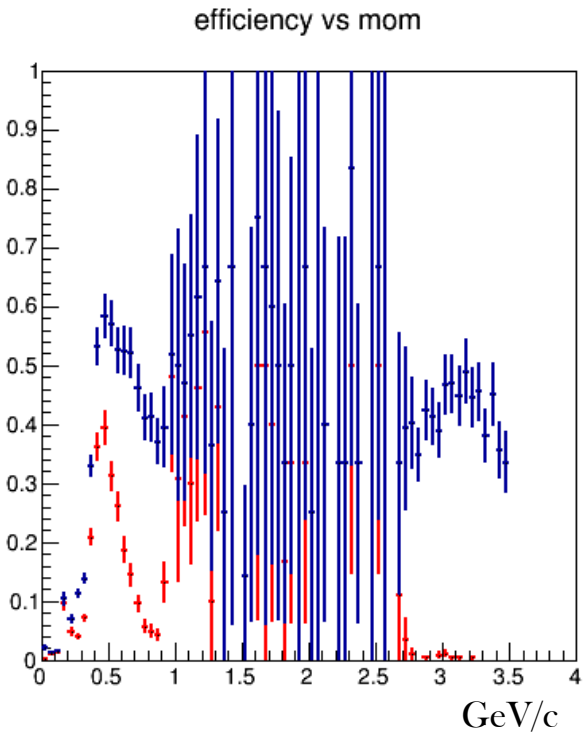


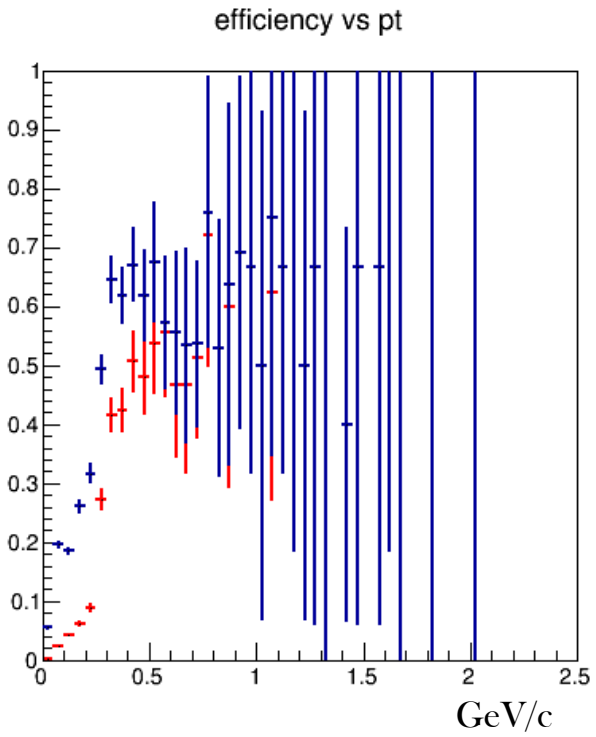
$$\text{EFFICIENCY} = \frac{\#\ \text{TRACKS WITH SINGLE TRACK EFF} > 80\%}{\#\ \text{MC RECONSTRUCTABLE * TRACKS}}$$

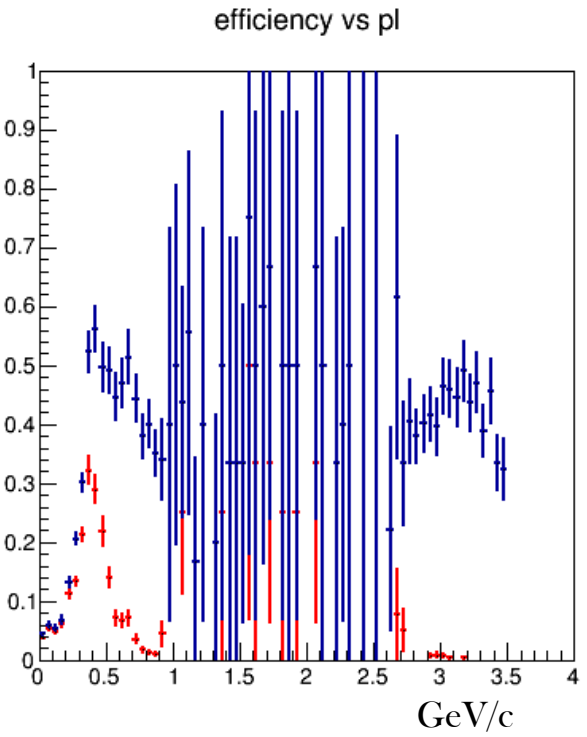
SINGLE EVENT
→ **Defined on tracks**

$\bar{p}p \to \Lambda\bar{\Lambda}$ efficiency *vs* momentum

PRIMARY TF
PRIM + SEC TF



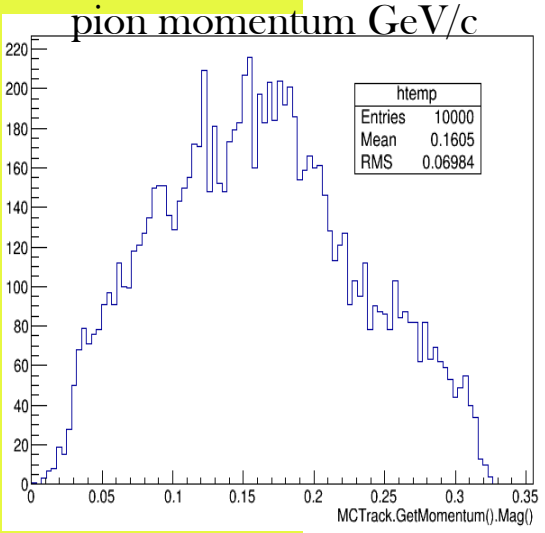


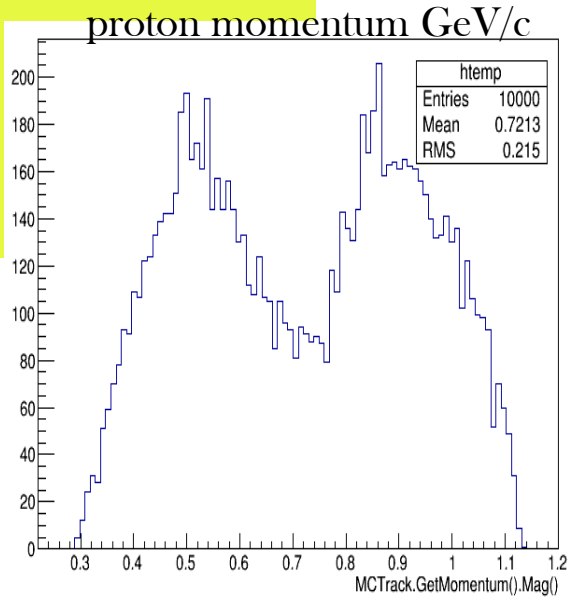


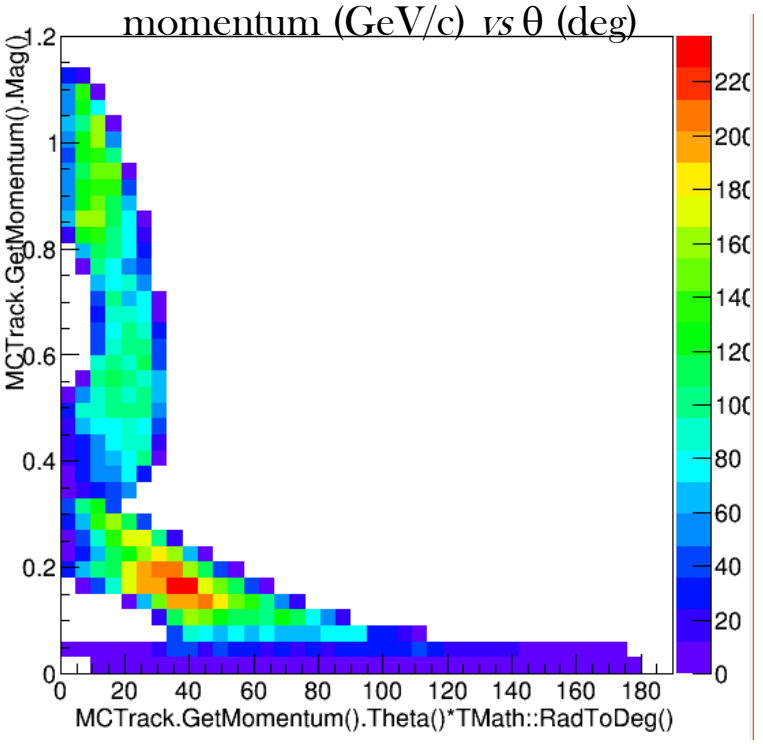
$\bar{p}p \to \Lambda\bar{\Lambda}$ ~ boost model @ p_{beam}=1.64 GeV/c

```
noPhotos

Decay pbarpSystem
   1.0  anti-Lambda0  Lambda0
                LambdaLambdaBar 1.64;
Enddecay

Decay Lambda0
   1.0  p+ pi-      PHSP;
Enddecay

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

End
```

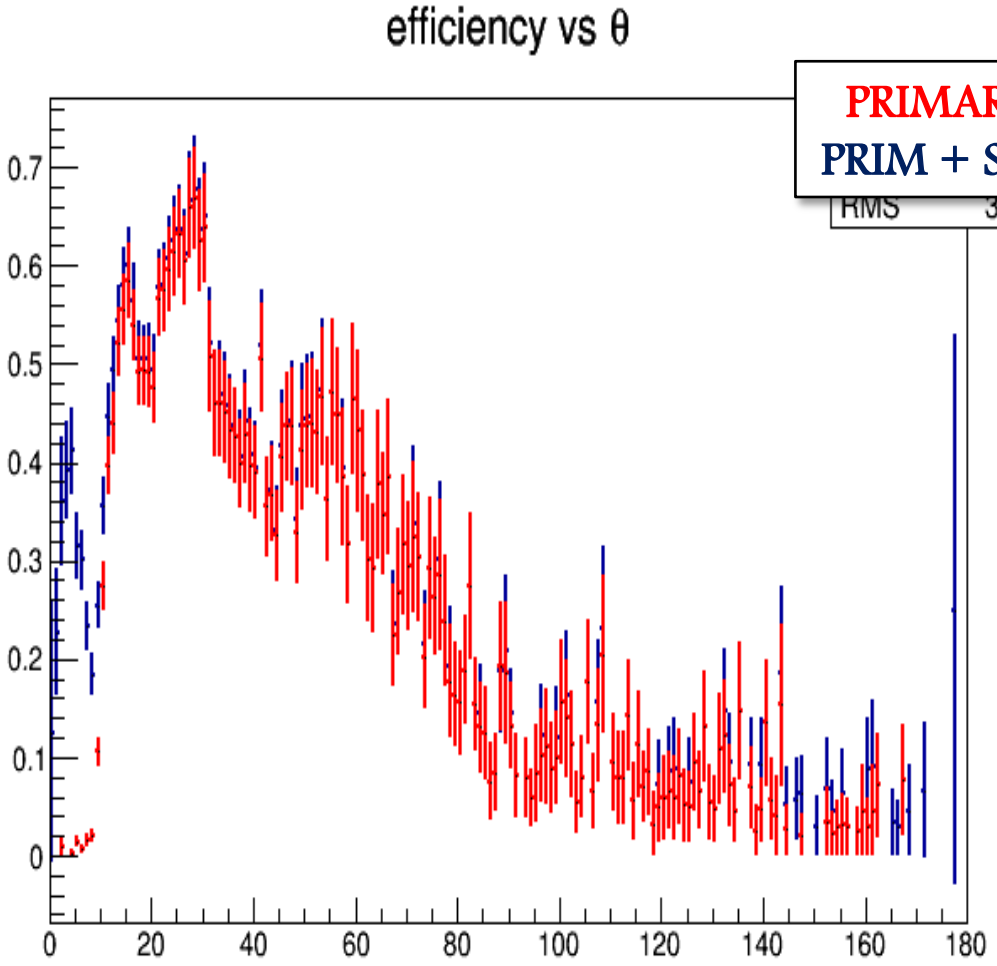
5000 events







$\bar{p}p \rightarrow \Lambda\bar{\Lambda}$ efficiency vs θ

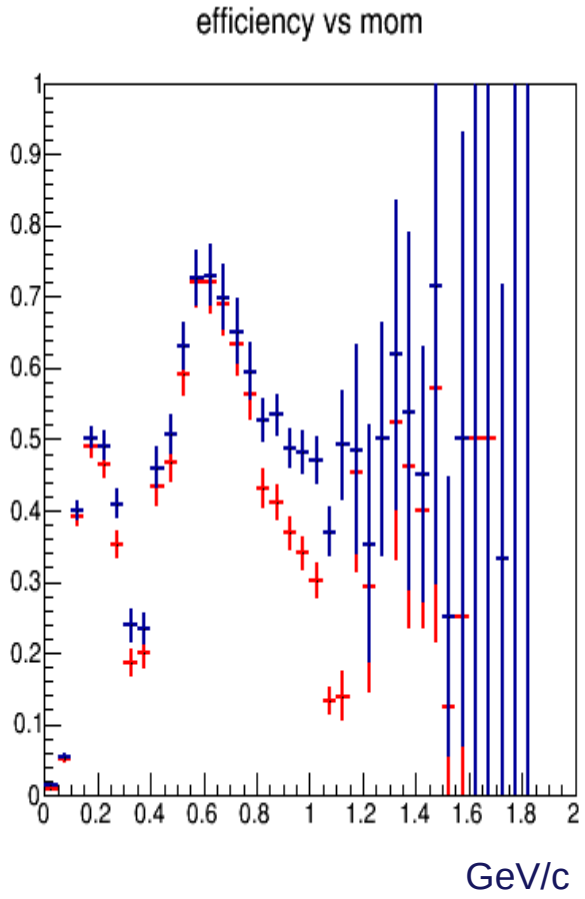


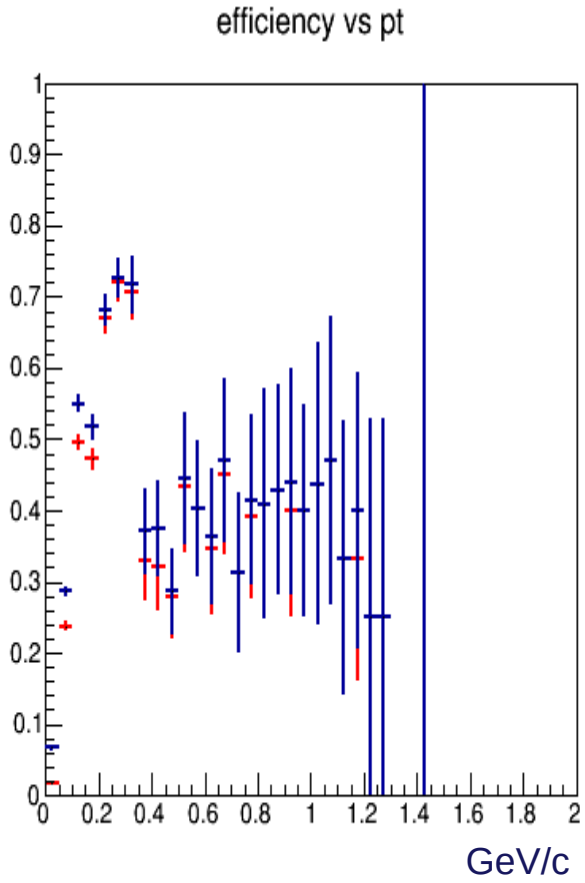
EFFICIENCY = # TRACKS WITH SINGLE TRACK EFF > 80% / # MC RECONSTRUCTABLE * TRACKS

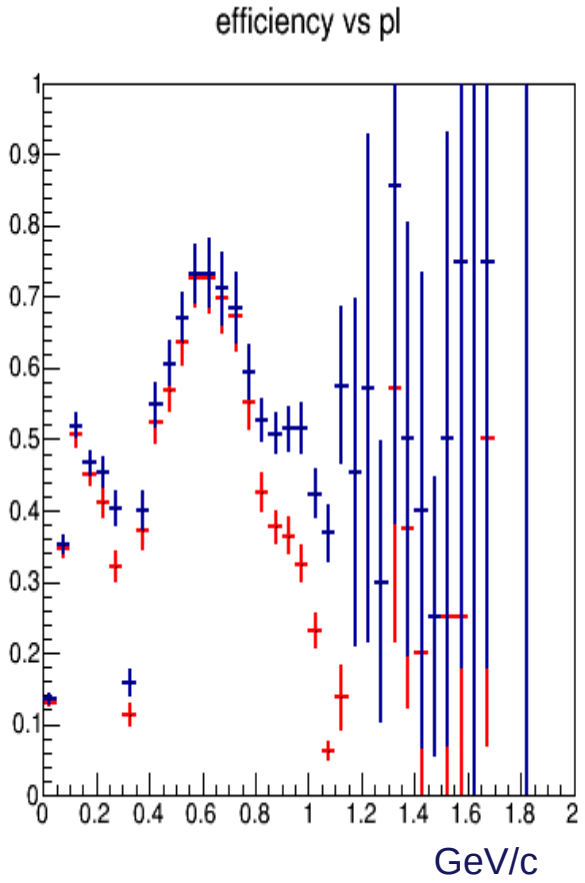
SINGLE EVENT
→ Defined on tracks

$\bar{p}p \to \Lambda\bar{\Lambda}$ efficiency *vs* momentum

PRIMARY TF
PRIM + SEC TF







Conclusions

- The secondary track finder as it is now enhances the performances of the primary track finder @ **lower theta**, which means in practice for **highly forward boosted** particles.
- The performances in the region where the primary track finder behaves in a good way are not improved by the secondary track finder → it is not useful to run the part of code which covers these regions
- The lower momentum region is still untreated and needs a dedicated code
- The number of clone tracks is still high for the secondary track finder, so a clone identifier – suppressor is needed
- The performances after the appliance of the Kalman filter are still to be evaluated

Conclusions

- The secondary track finder as it is now enhances the performances of the primary track finder @ **lower theta**, which means in practice for **highly forward boosted** particles.
- The performances in the region where the primary track finder behaves in a good way are not improved by the secondary track finder → it is not useful to run the part of code which covers these regions
- The lower momentum region is still untreated and needs a dedicated code
- The number of clone tracks is still high for the secondary track finder, so a clone identifier – suppressor is needed
- The performances after the appliance of the Kalman filter are still to be evaluated

Thank you for your attention