ITTF on strangeness :

– Cascade reconstruction –

- What is a cascade, how we reconstruct them
- ITTF on the background
- Charge related effects (background)
- Field related effects (background)
- ITTF on the signal : distributions
- Invariant mass peaks

In this talk :
« Efficiency » = ITTF / TPT
(even though it's somehow a bad designation)

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In this talk :
« Efficiency » = ITTF / TPT
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Dca = distance of closest approach

Pvx = primary vertex

Strangeness :

- $\Xi^- = dss$ $\quad \Xi \rightarrow \Lambda + \pi^-$

  $X \rightarrow (p + p^-) + p^- \quad ct \approx 4.92\ cm$

- $\Omega^- = sss$ $\quad \Omega \rightarrow \Lambda + K^-$

  $W \rightarrow (p + p^-) + K^- \quad ct \approx 2.46\ cm$

Detectors used : TPC alone

Data analysed : AuAu 200 *GeV* data (highest Ξ statistics)

Cascade = 3 charged tracks

ITTF efficiency on tracks is cubed for multistrange baryons !!

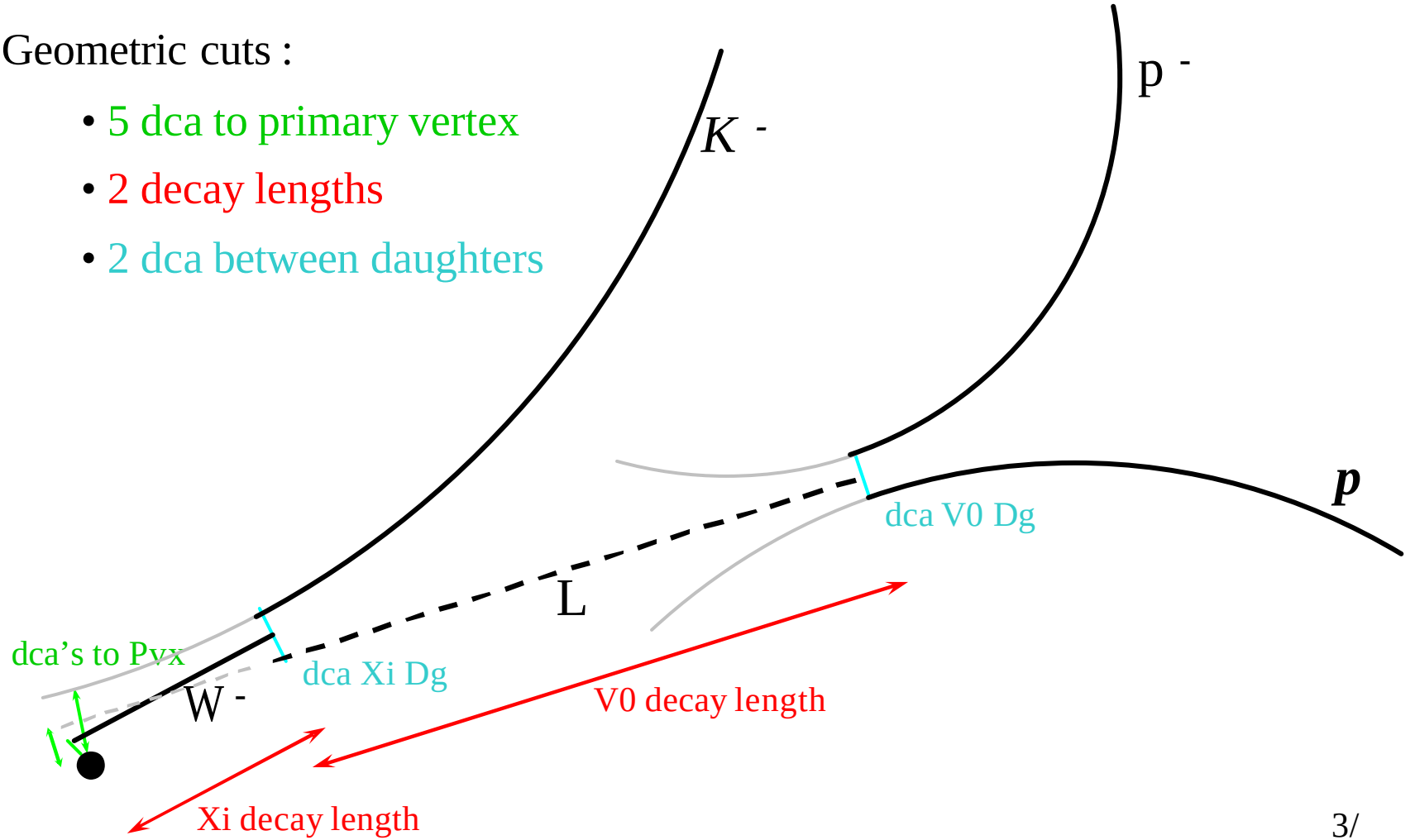
Therefore :

90 % efficiency on tracks Þ 73 % efficiency on cascades !

Cascade reconstruction :

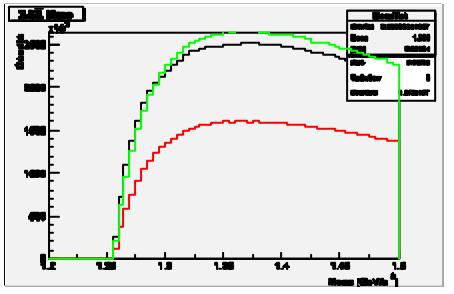
Geometric cuts :

- 5 dca to primary vertex
- 2 decay lengths
- 2 dca between daughters



Tips to read the following plots :

- Plots of the variables :



  - Black curve = TPT
  - Red curve = ITTF
  - Green curve = ITTF scaled to have the name number of entries as TPT

- What is an efficiency curve :
  - That’s green divided by black, i.e. perfect match ***in shape*** is a flat line = 1

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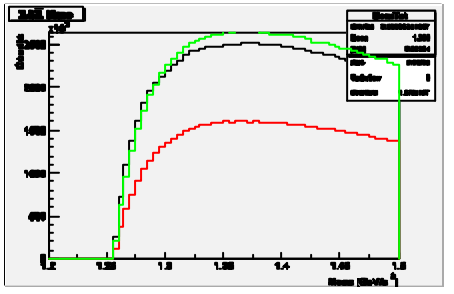

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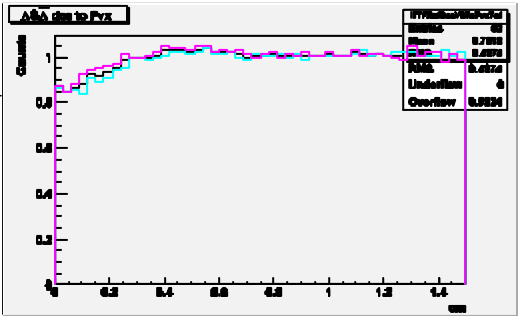
- Plots of the efficiencies :



  - Black curve = Xi + antiXi
  - Cyan curve = Xi
  - Magenta curve = antiXi

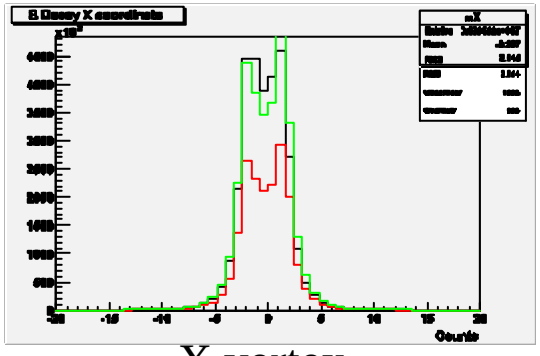
About the colors used…

- We don't know if TPT is right or wrong
  TPT is not The Absolute Truth

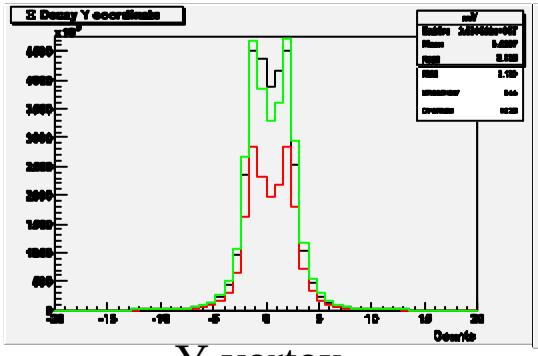
- Therefore, when we see differences between ITTF and TPT,
  we don't know if ITTF is to blame

- In the comparison plots I made,
  the **red ellipses** don't mean that ITTF is bad,
  they **just mean there is a difference with TPT**.

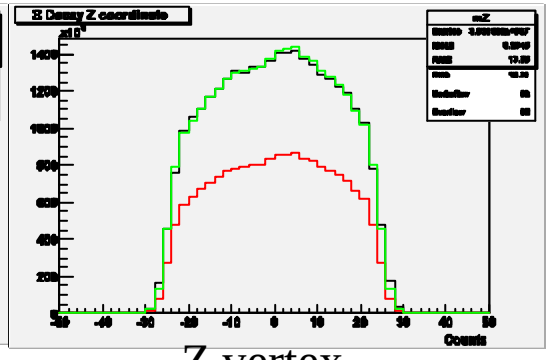
Position of the Xi vertex :



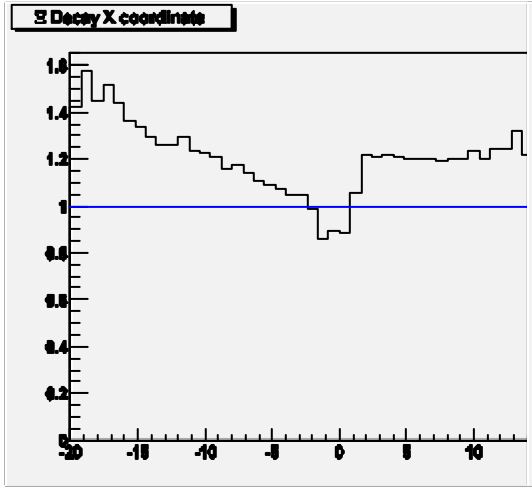
X vertex

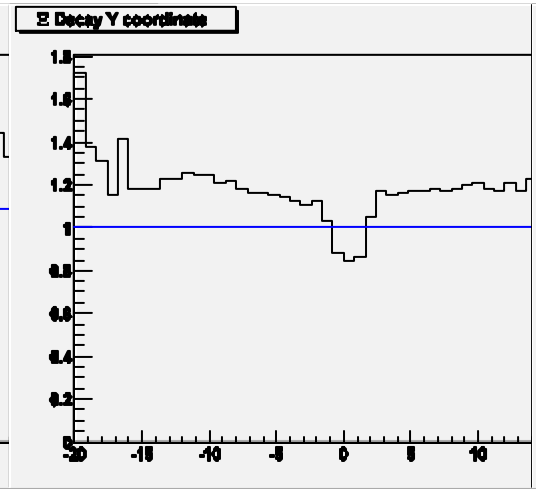


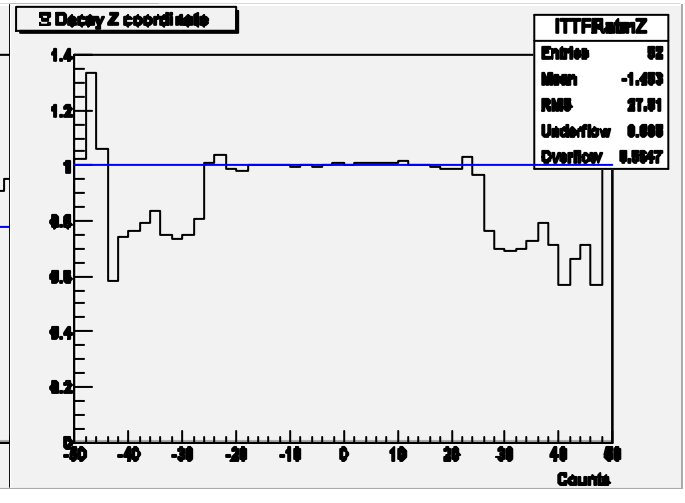
Y vertex



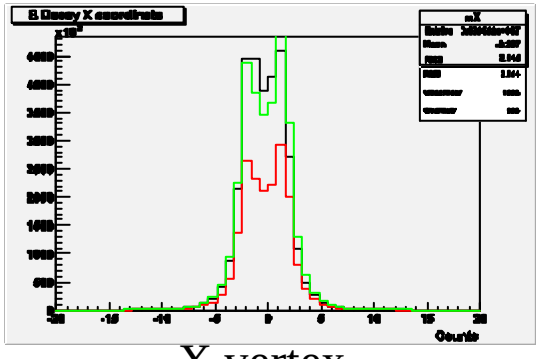
Z vertex



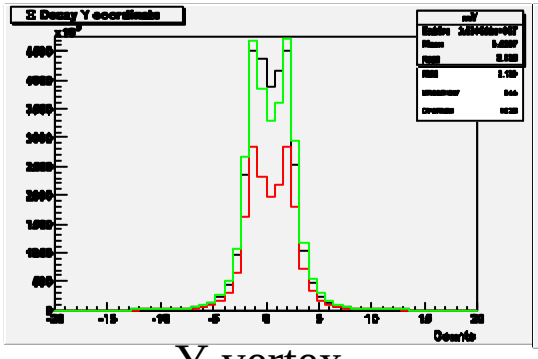




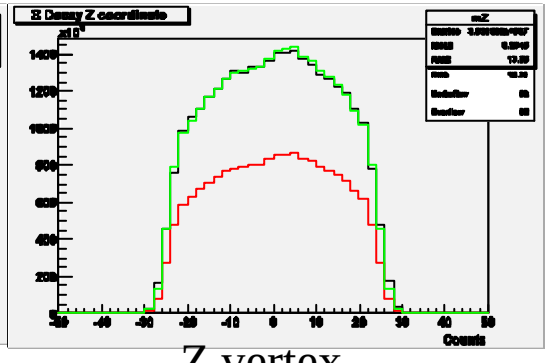
Position of the Xi vertex :



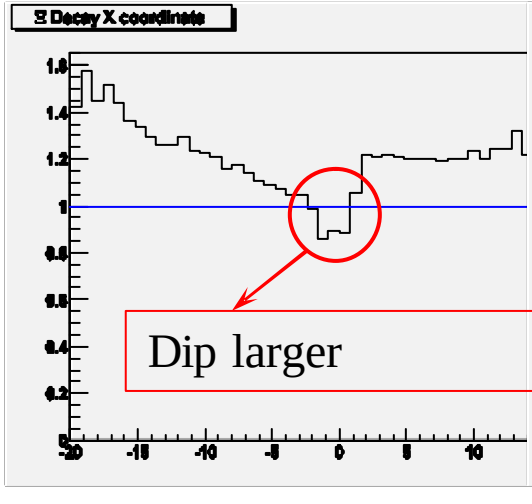
X vertex

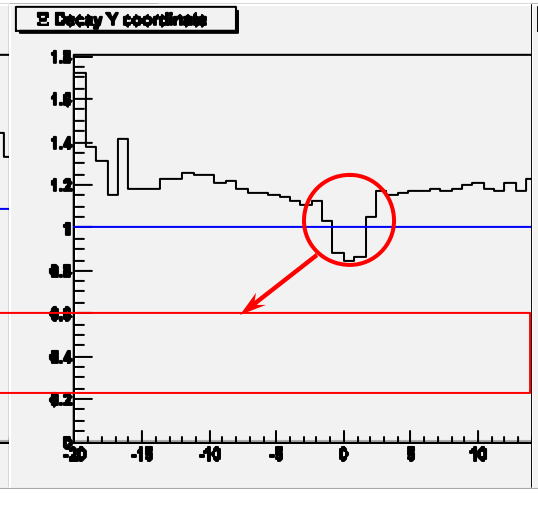


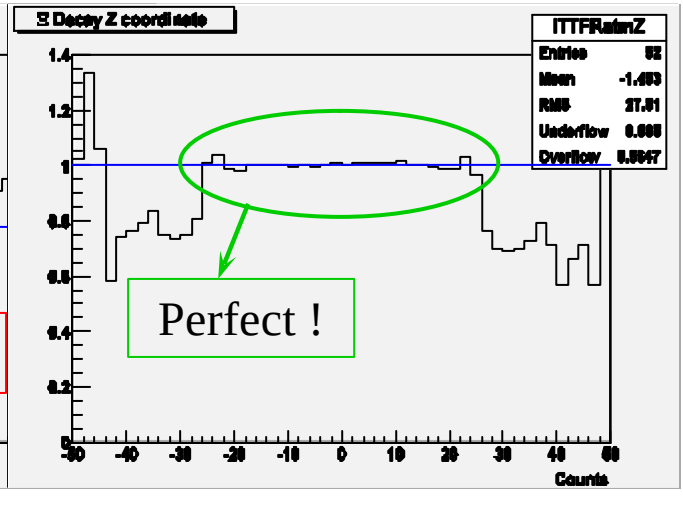
Y vertex



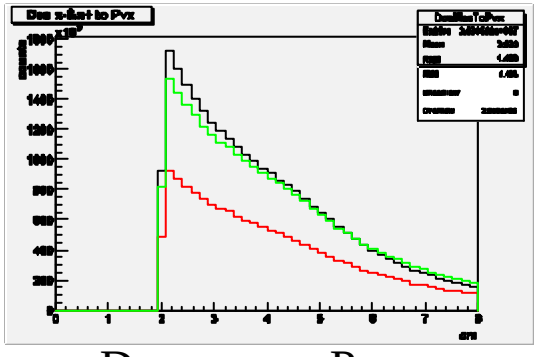
Z vertex



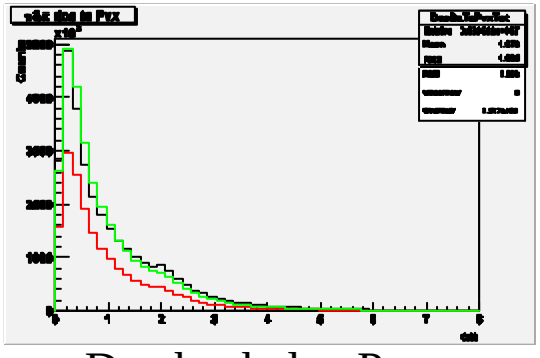




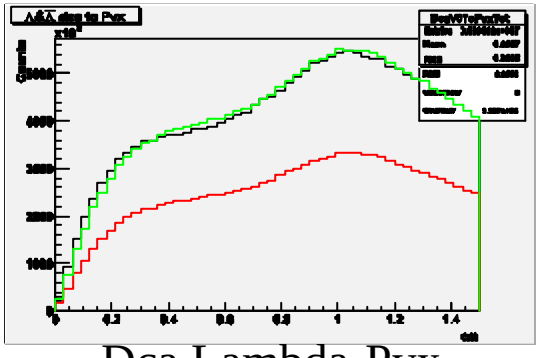
Dca's to primary vertex :



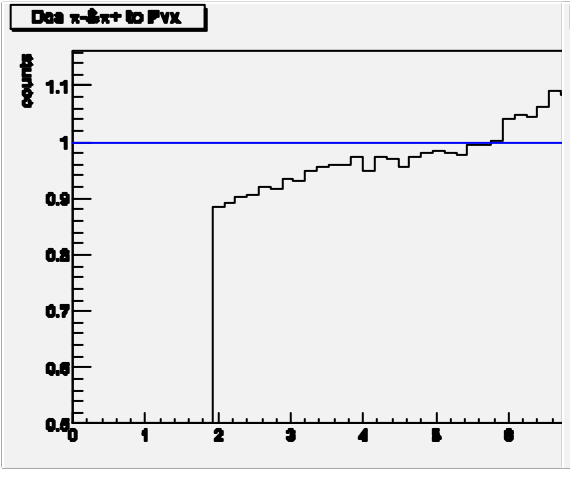
Dca meson-Pvx

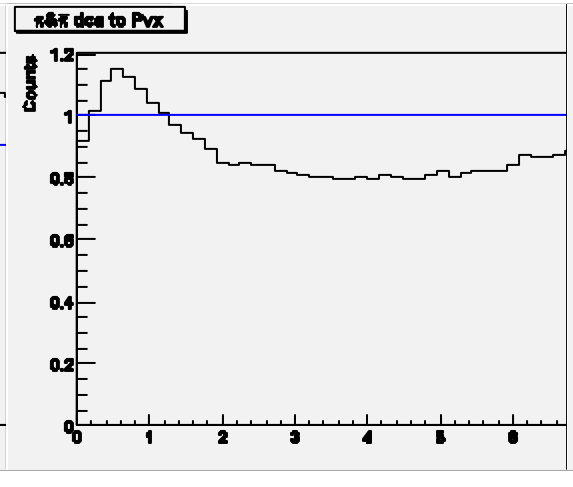


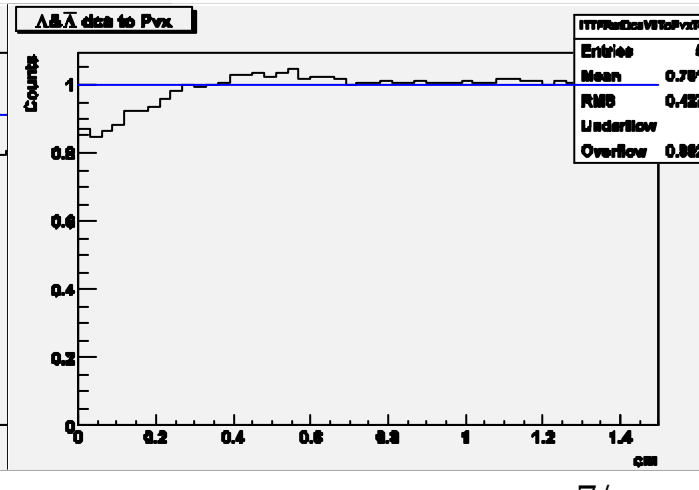
Dca bachelor-Pvx



Dca Lambda-Pvx







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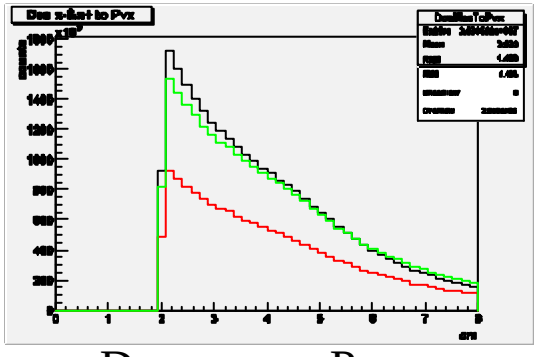

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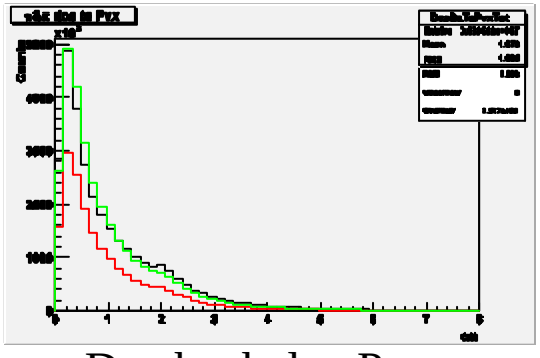
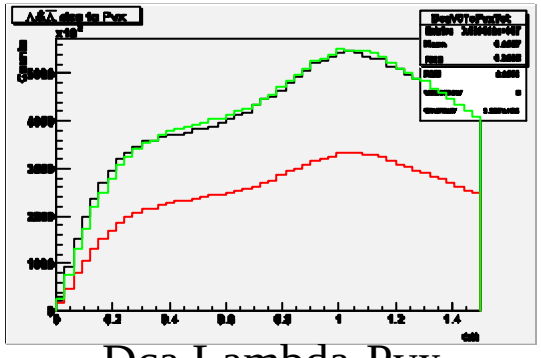
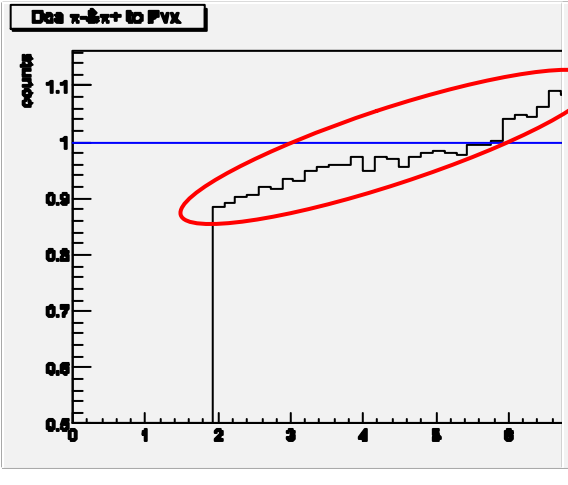
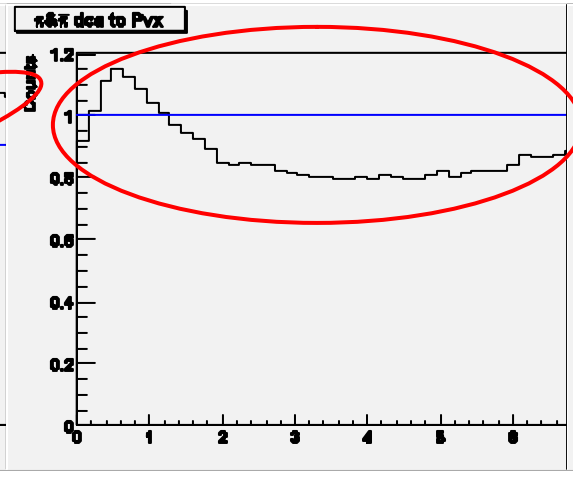


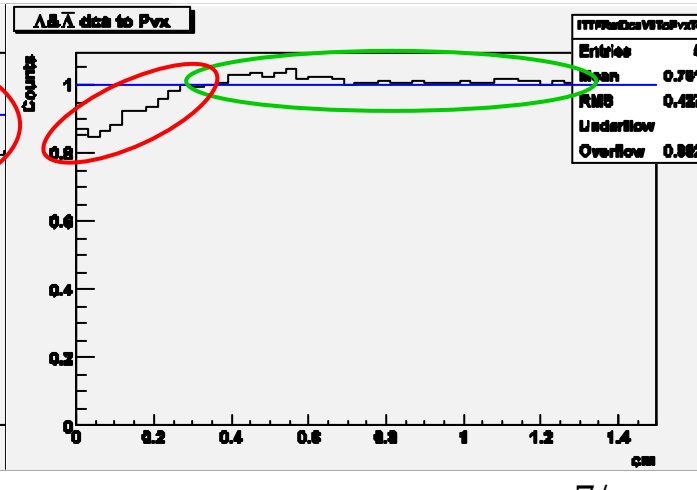
Dca bachelor-Pvx



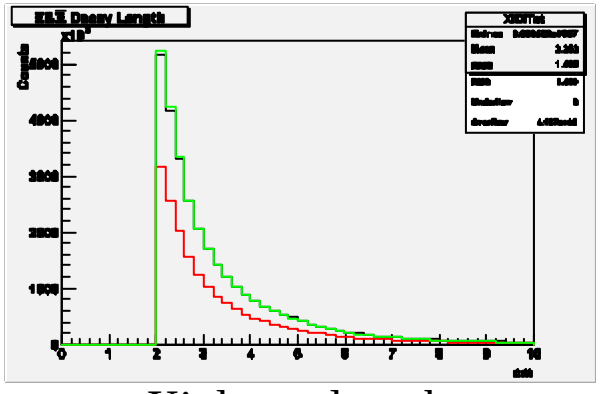
Dca Lambda-Pvx



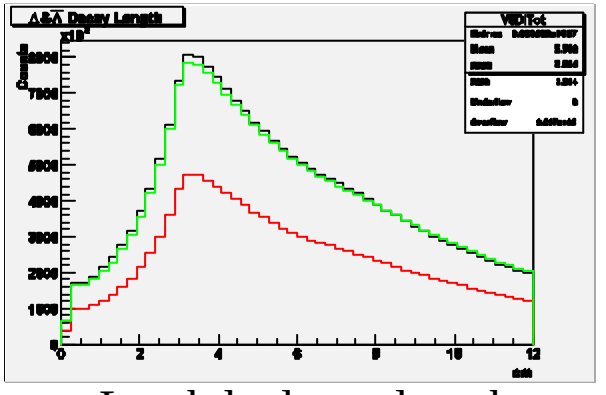




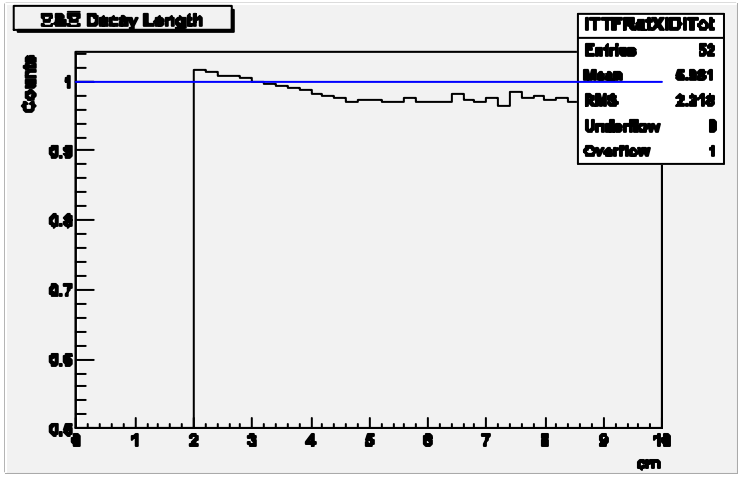
Decay lengths :

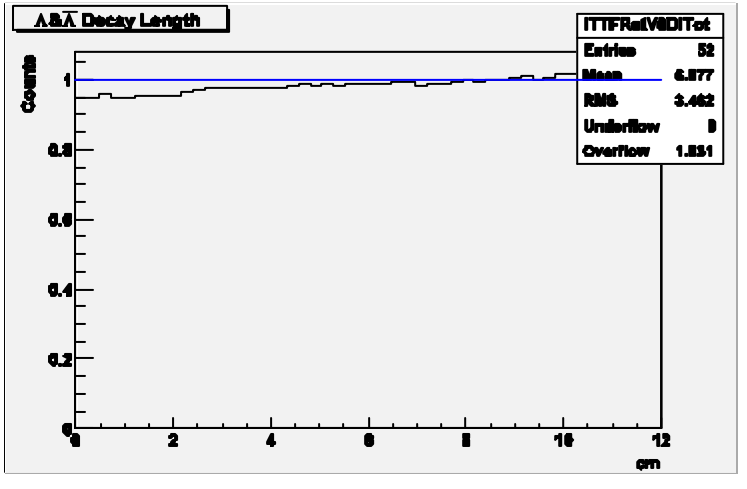


Xi decay length

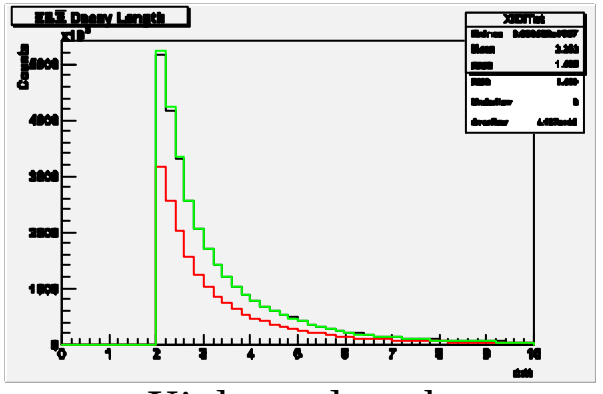


Lambda decay length

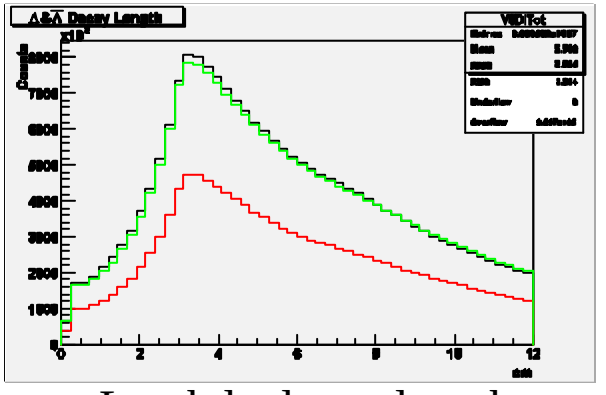




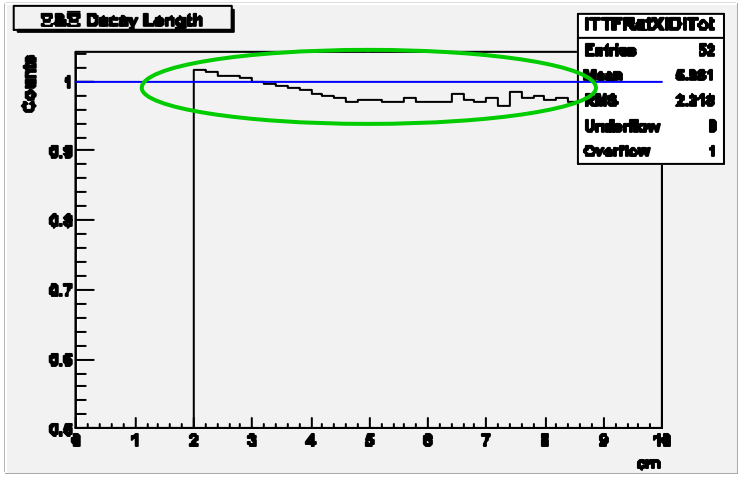
Decay lengths :

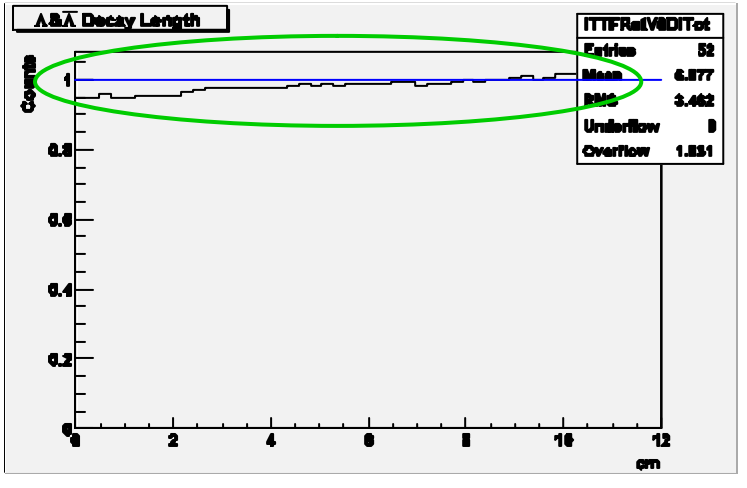


Xi decay length

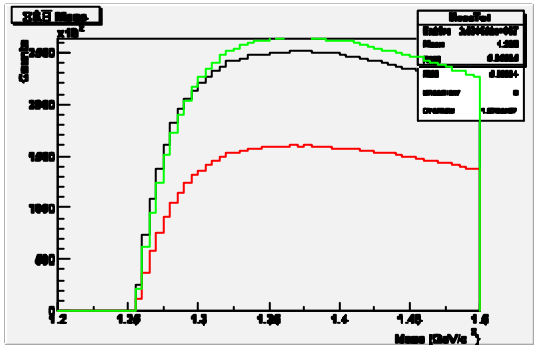


Lambda decay length

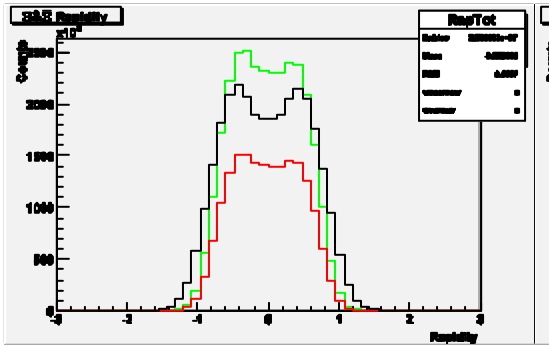




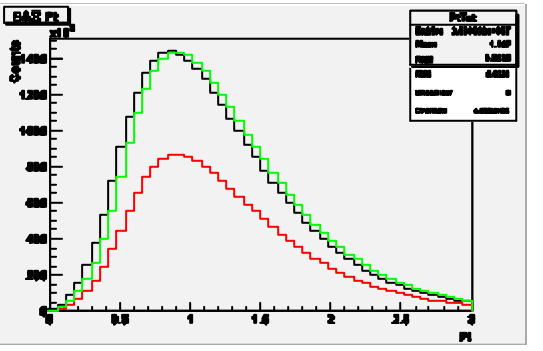
Kinematics :



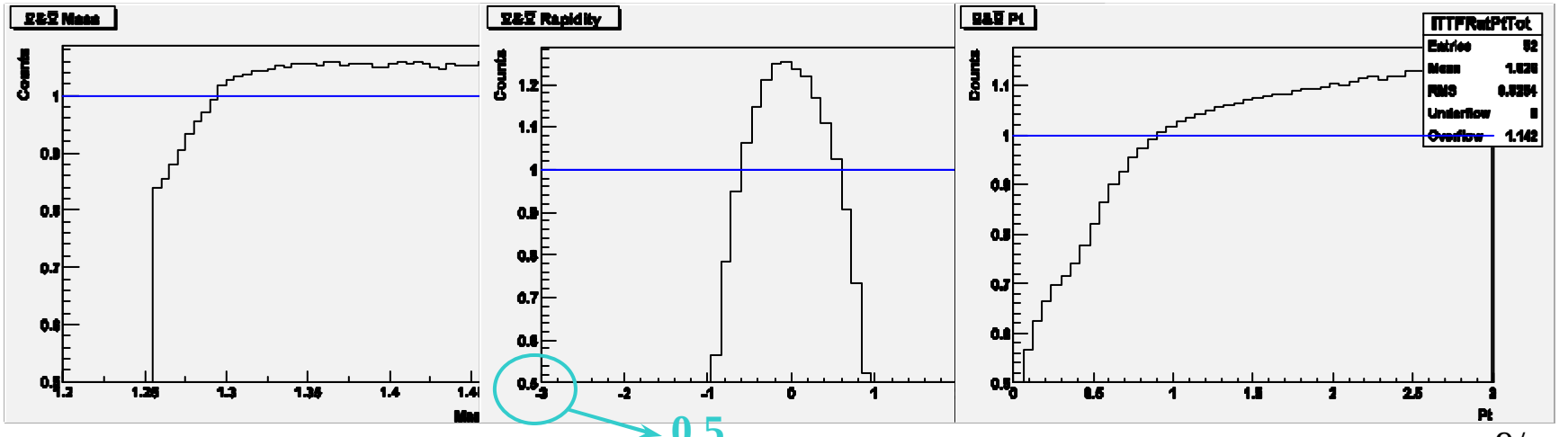
Invariant mass



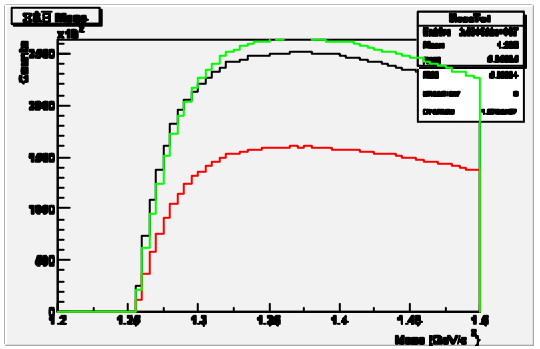
Rapidity



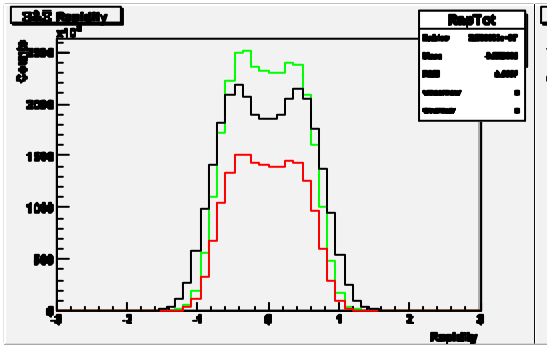
$p_\perp$



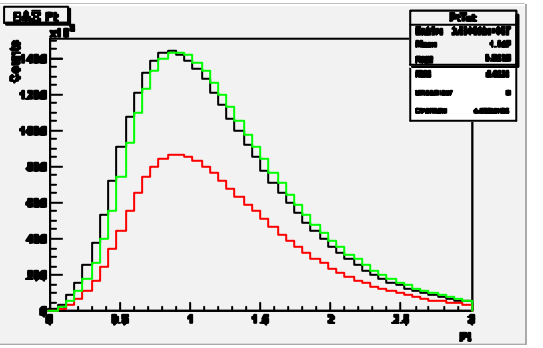
Kinematics :



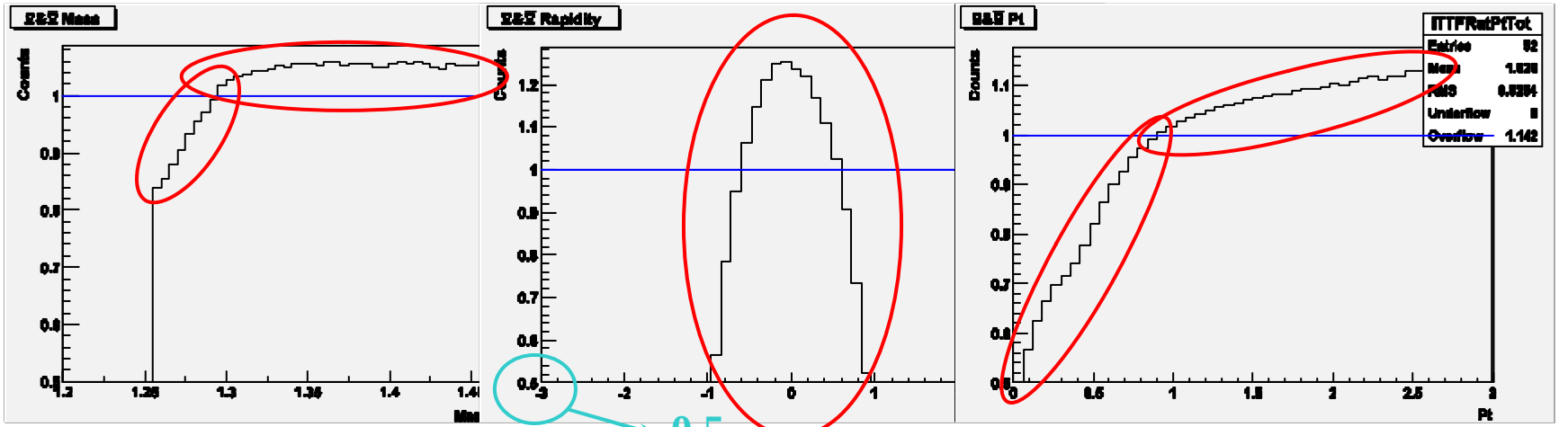
Invariant mass



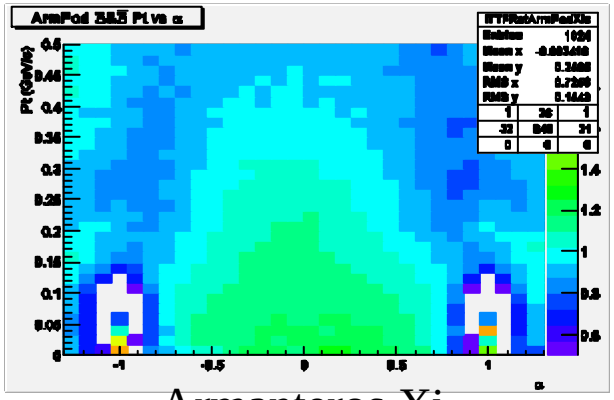
Rapidity



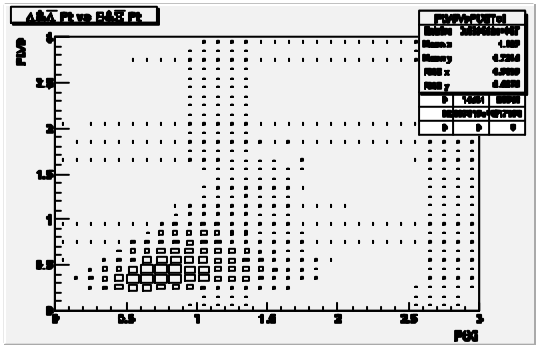
$p_\perp$



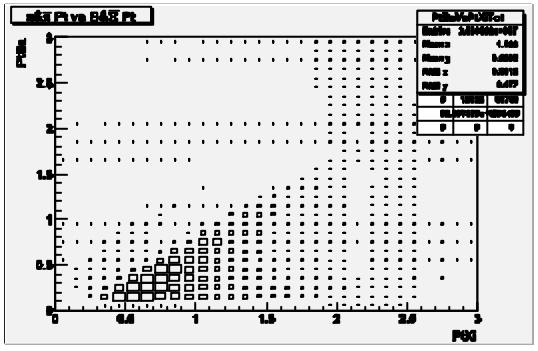
2D-kinematics :



Armanteros Xi

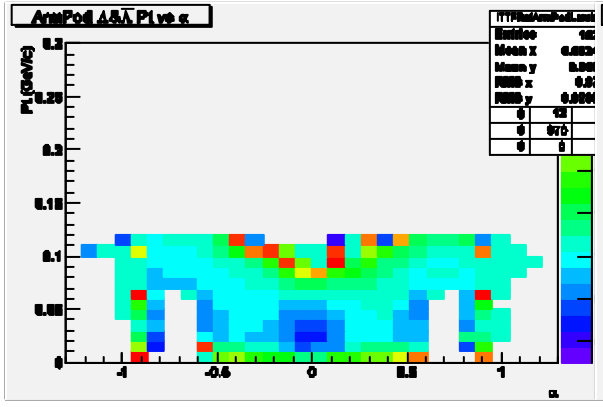


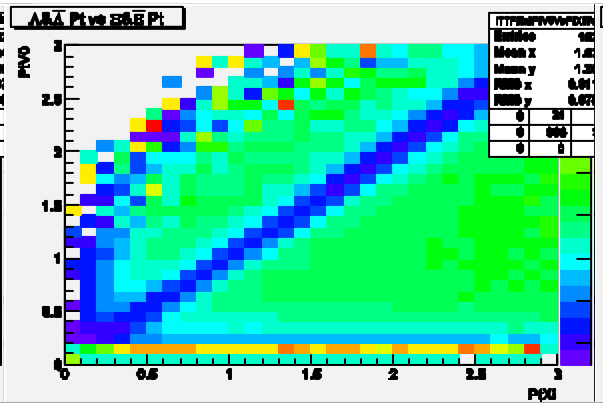
$p_\perp$ Lambda vs $p_\perp$ Xi

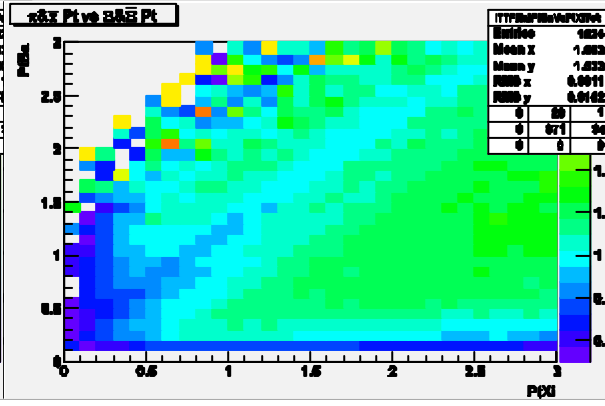


$p_\perp$ bachelor vs $p_\perp$ Xi

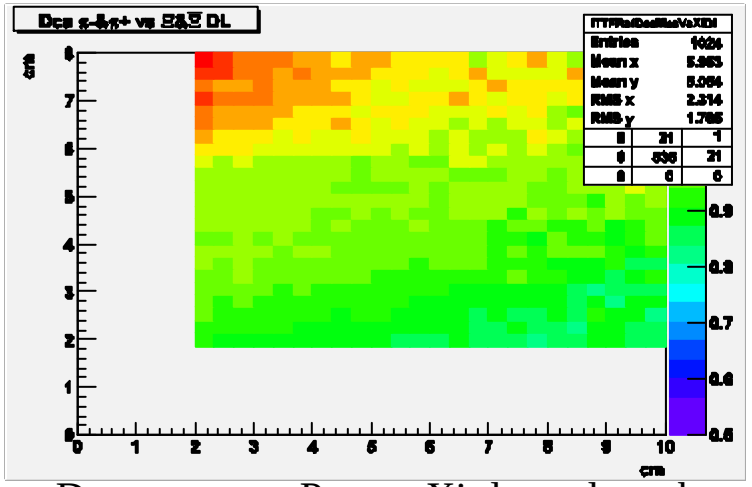
Armanteros Lambda



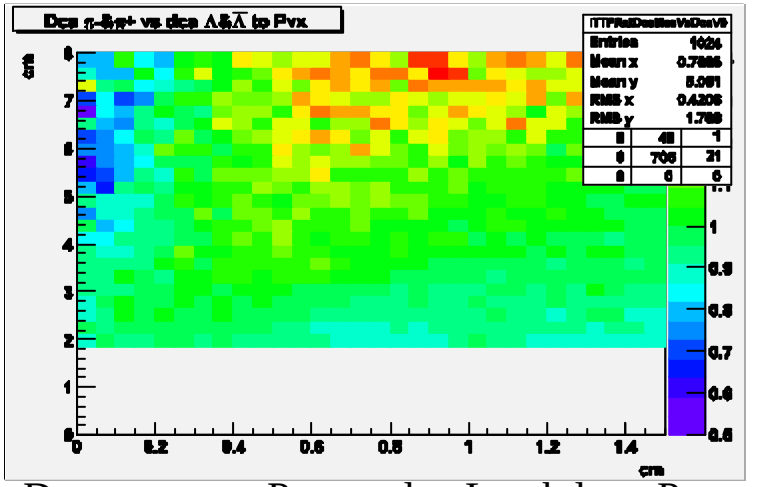




Correlations :

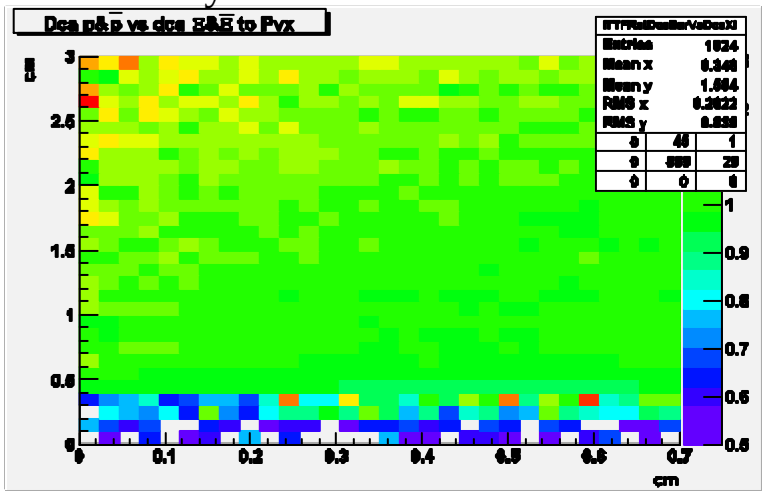


Dca meson to Pvx vs Xi decay length

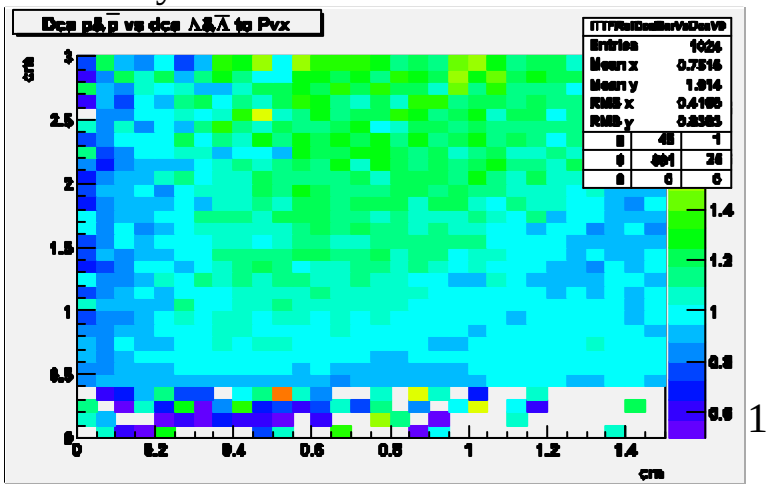


Dca meson to Pvx vs dca Lambda to Pvx

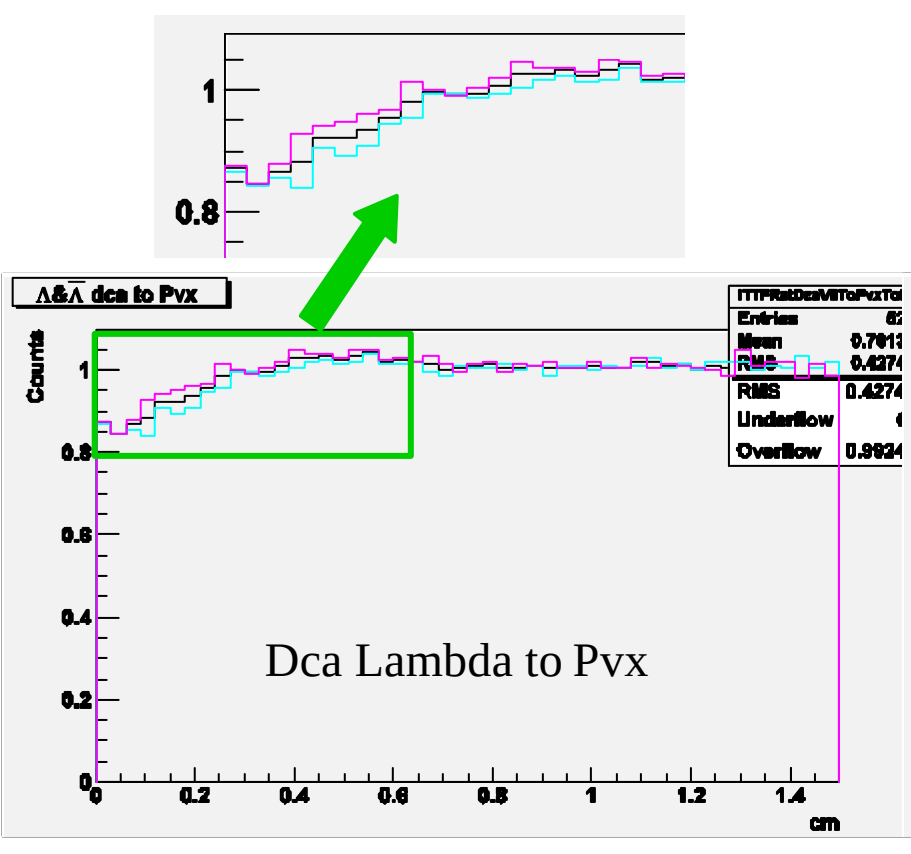
Dca baryon to Pvx vs dca Xi to Pvx

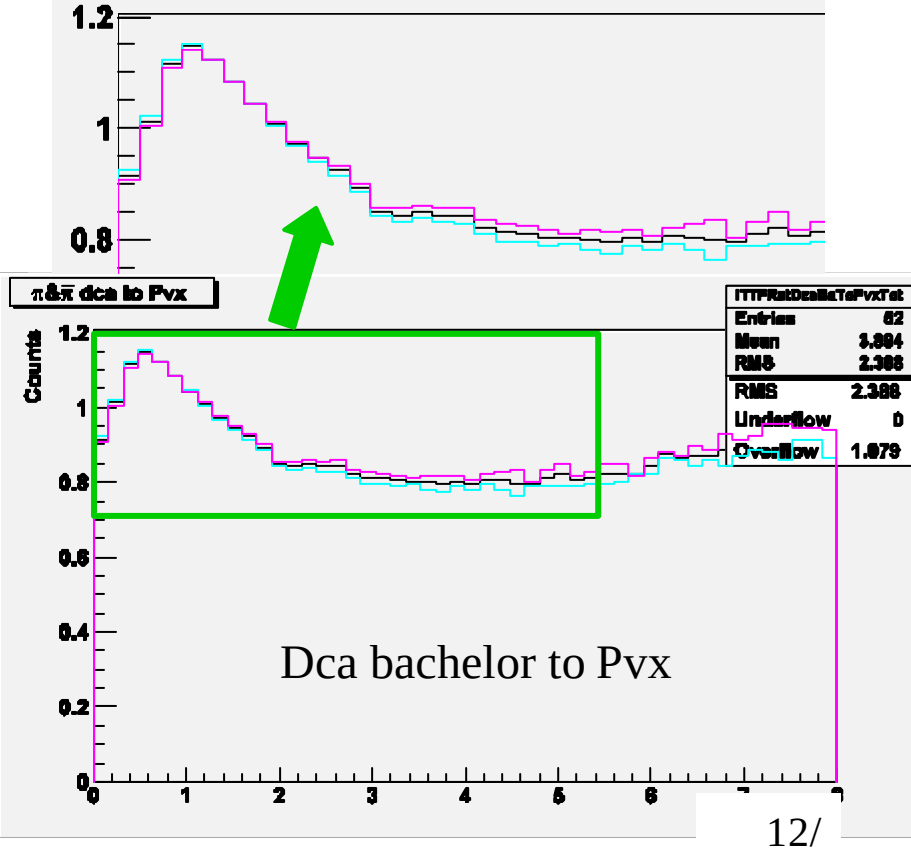


Dca baryon to Pvx vs dca Lambda to Pvx

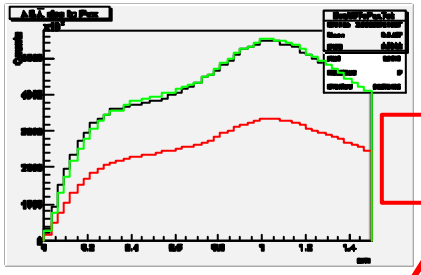


Dca Xi daughters to Pvx :

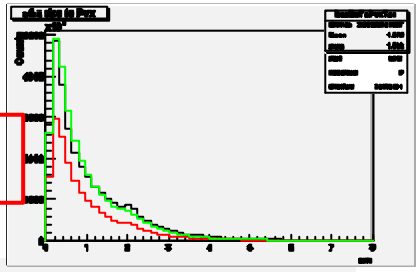


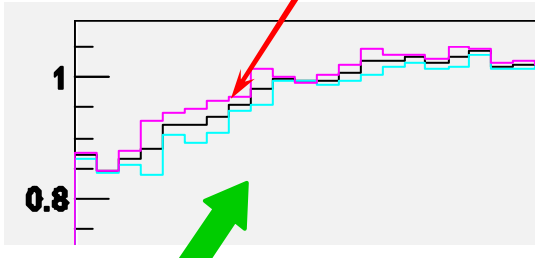


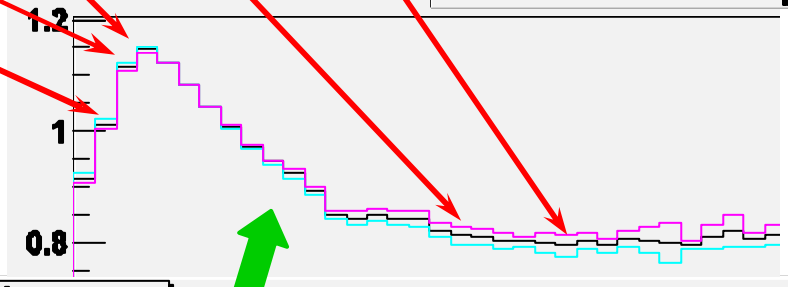
Dca Xi daughters to Pvx :

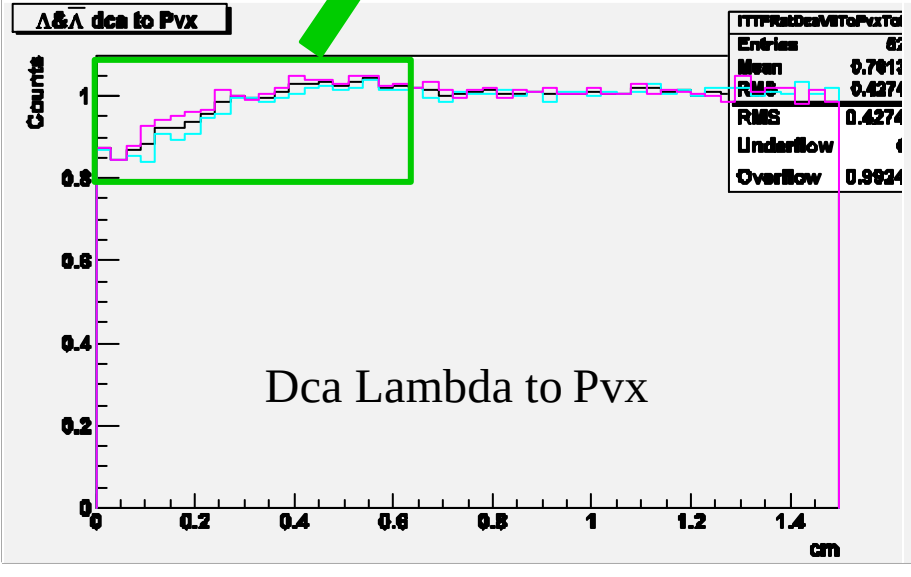


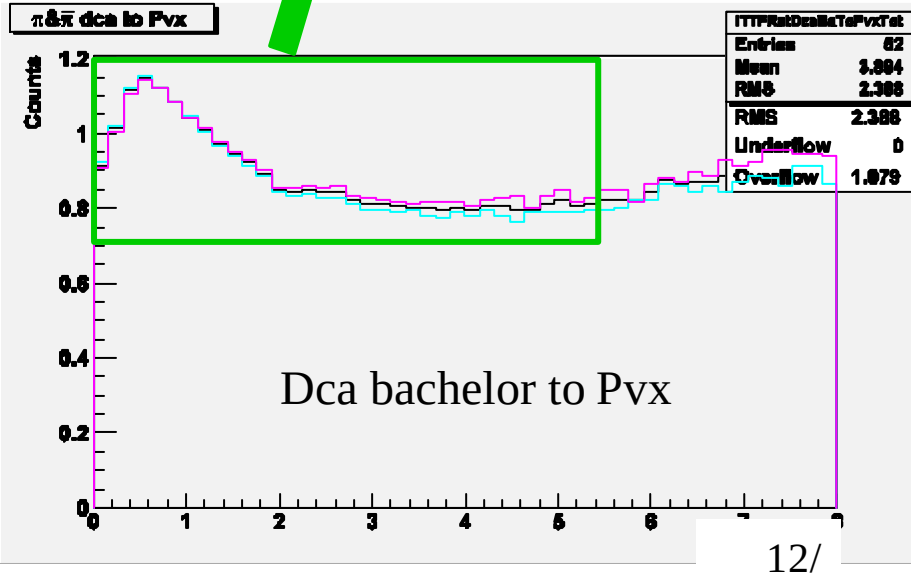
9 σ | 19 σ | 8 σ | 3 σ | 5 σ | 5 σ



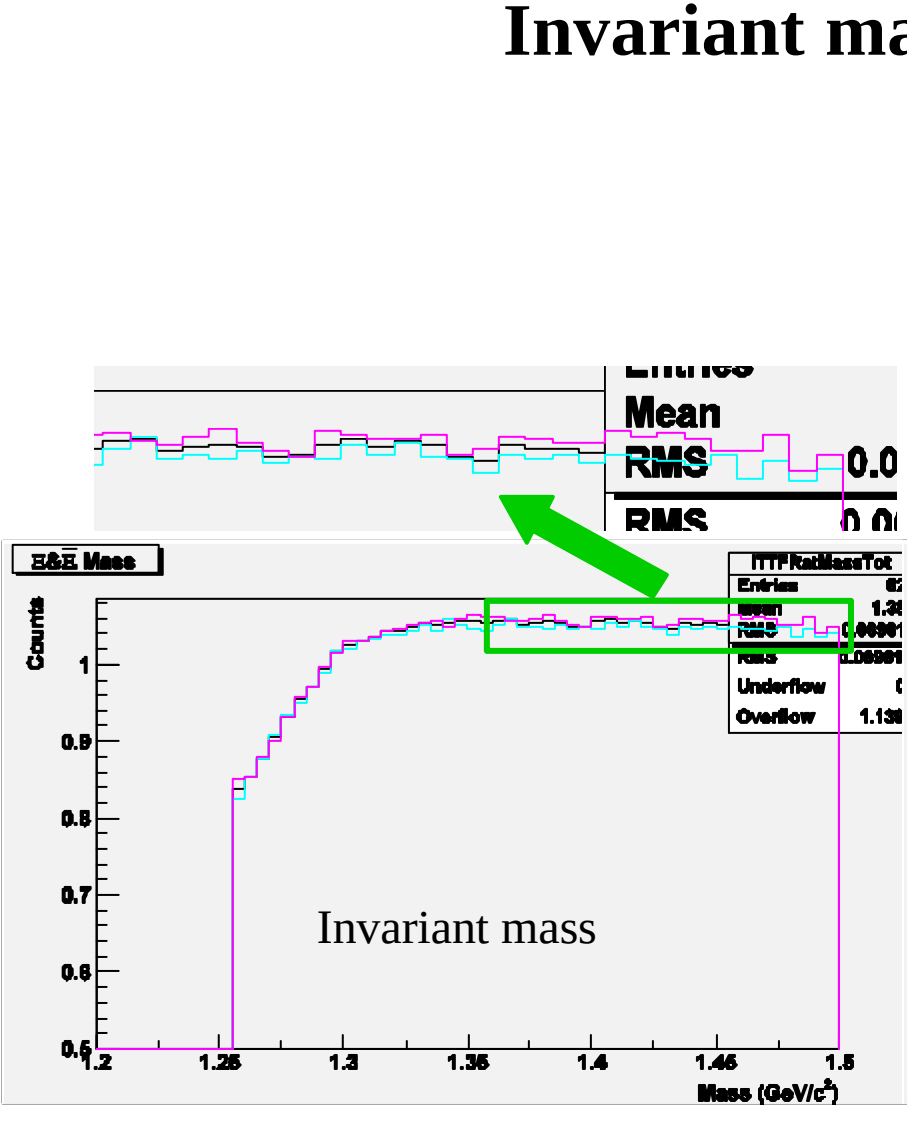


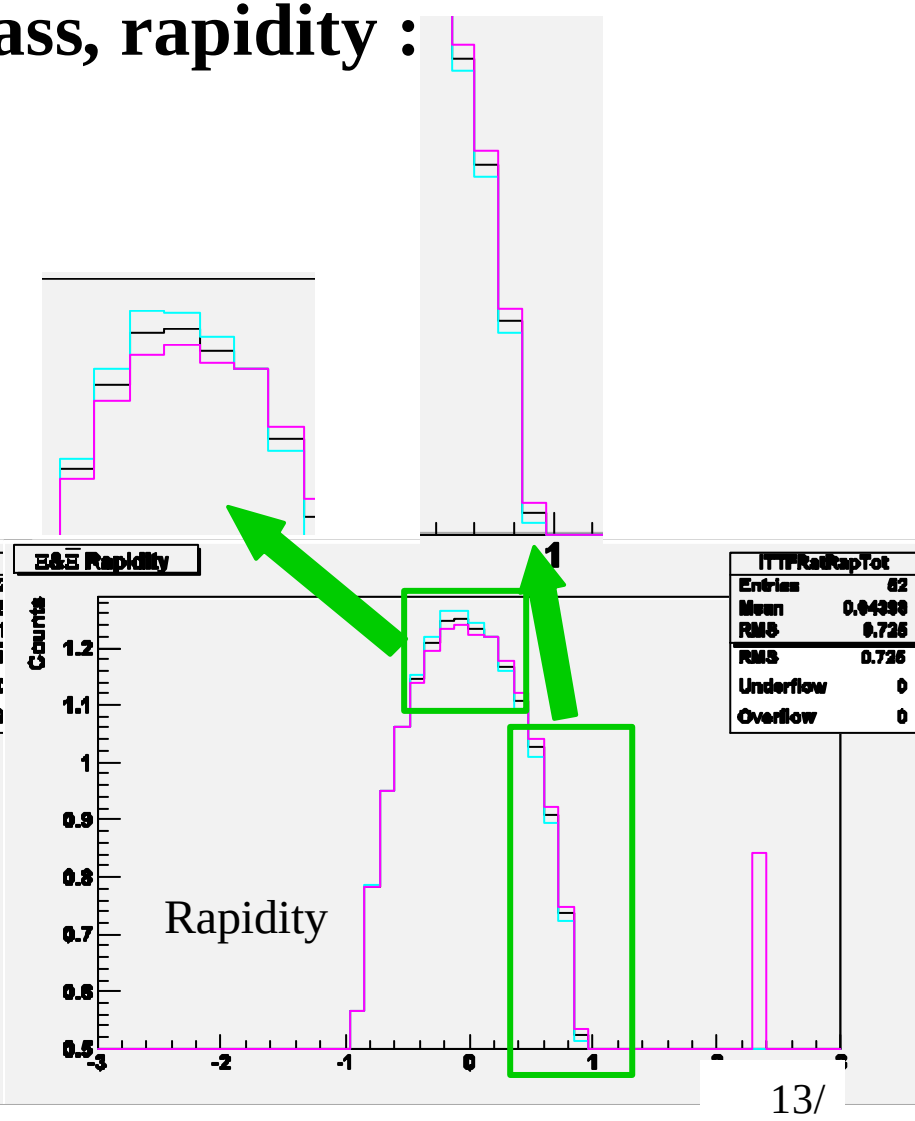




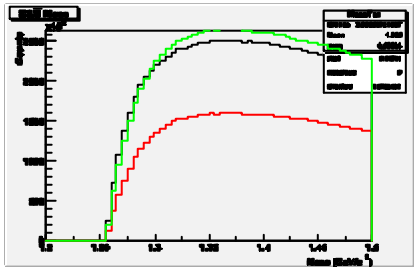


Invariant mass, rapidity :





Invariant mass, rapidity :

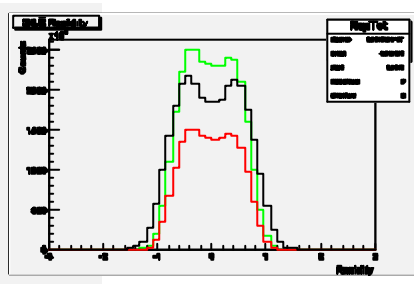


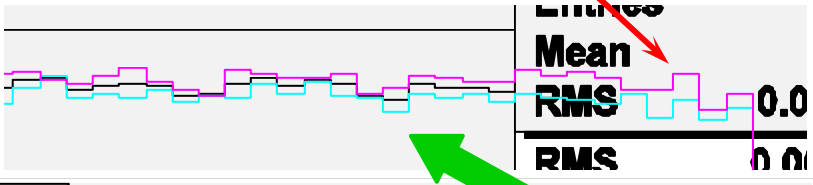
3 σ

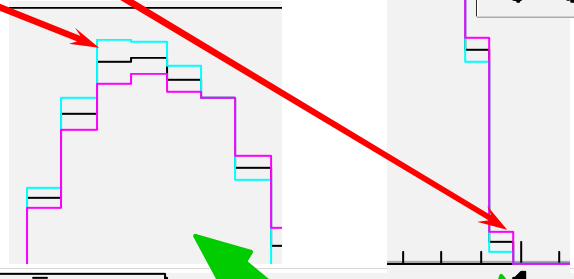
18 σ

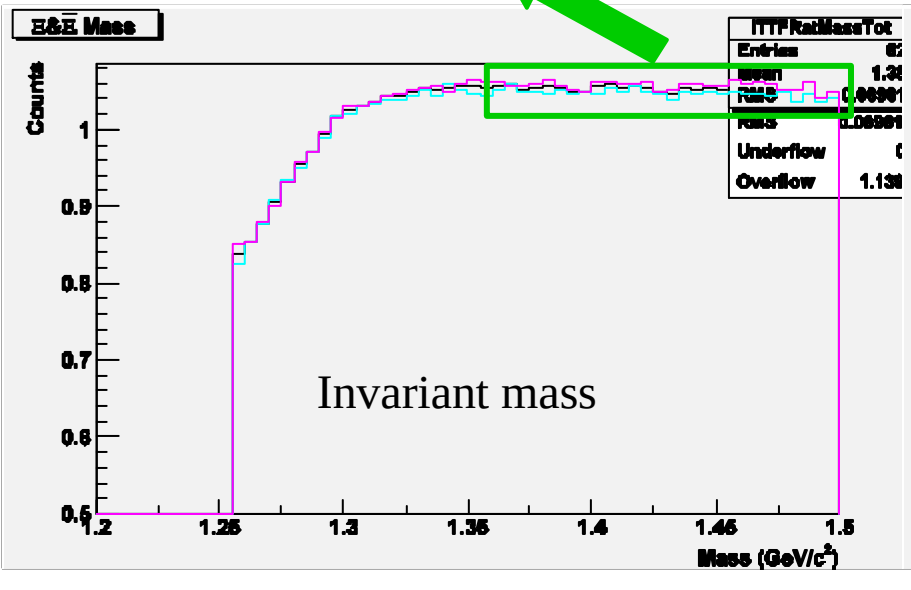
6 σ

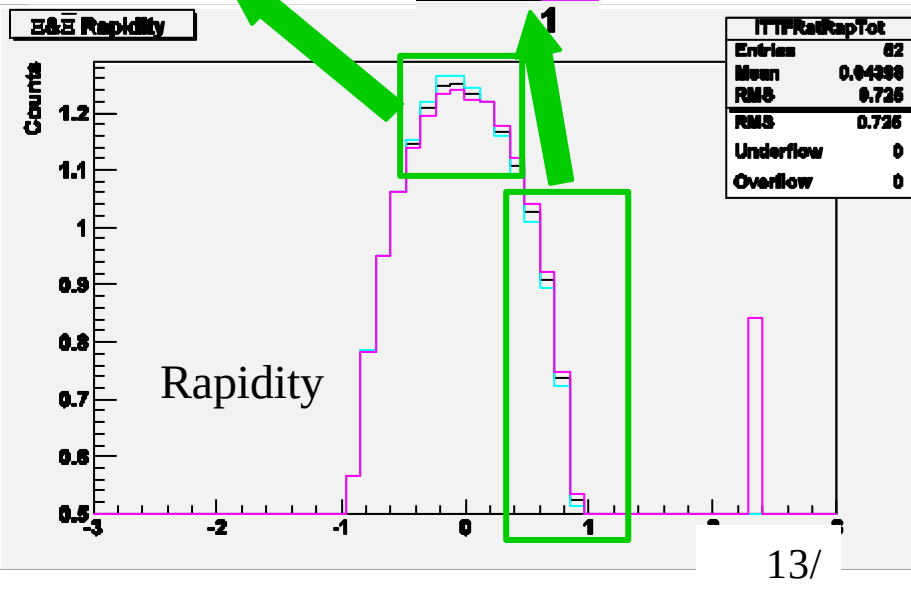
13 σ



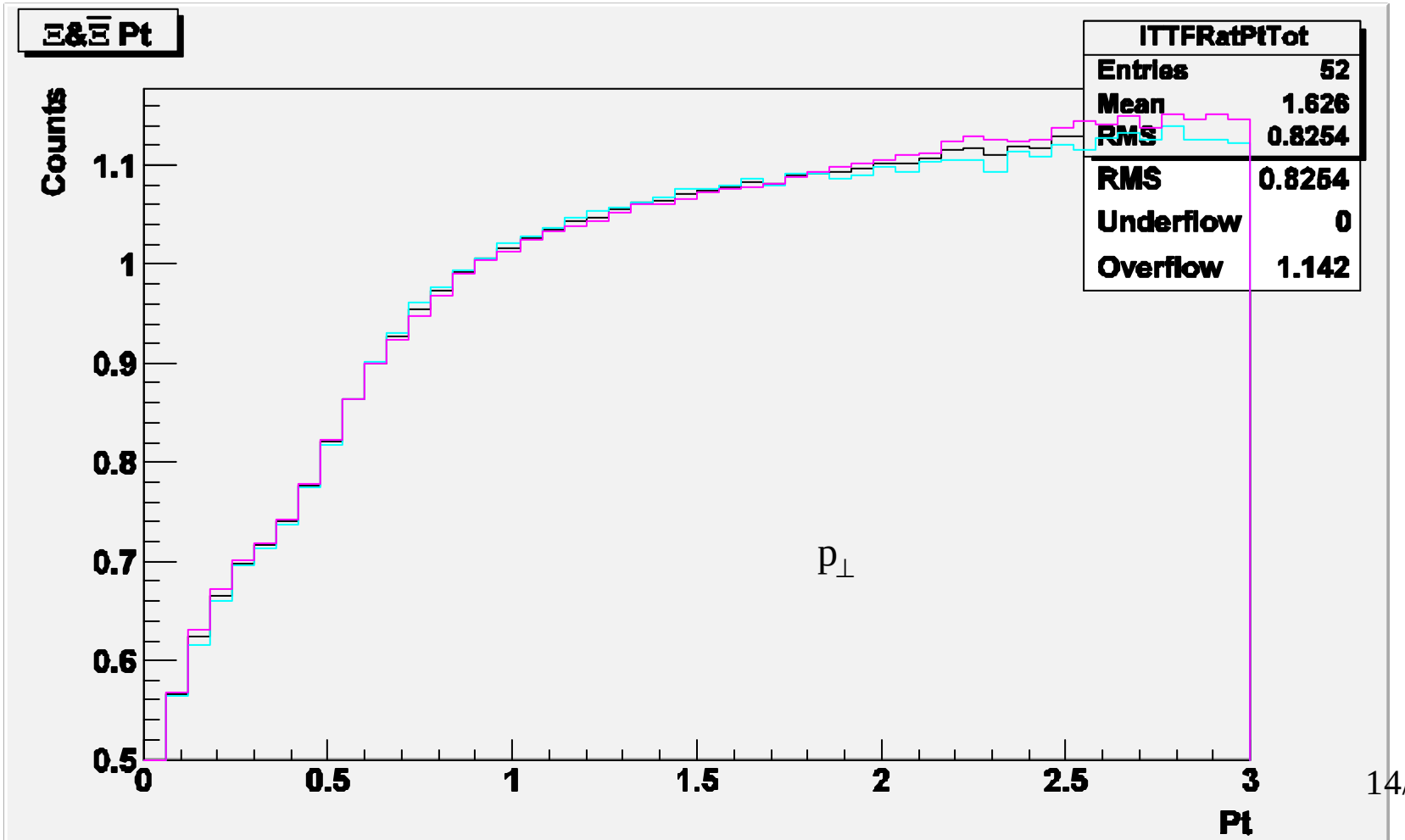


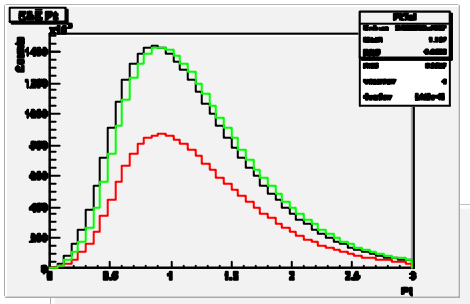






$p_{\wedge}$:


Ξ&Ξ̄ Pt
ITTFRatPtTot
Entries 52
Mean 1.626
RMS 0.8254
RMS 0.8254
Underflow 0
Overflow 1.142
Counts
1.1
1
0.9
0.8
0.7
0.6
0.5
0
0.5
1
1.5
2
2.5
3
Pt
$p_{\perp}$



$p_\wedge$:

1.7 σ | 1.8 σ | 5 σ | 4 σ | 5 σ | 2.5 σ

ITTFRatPtTot	
Entries	52
Mean	1.626
RMS	0.8254
RMS	0.8254
Underflow	0
Overflow	1.142

Counts

1.1
1
0.9
0.8
0.7
0.6
0.5

$p_\perp$

0 0.5 1 1.5 2 2.5 3

Pt

What changes when the field is reversed :

In Reversed Full Field (instead of Full Field) :

- **Dca Lambda to Pvx :** see nothing
- **Dca bachelor to Pvx :** same deviation
- **Rapidity :** depends on where you're looking
- $\mathbf{p_{\wedge}}$ **:** also depends on where you're looking

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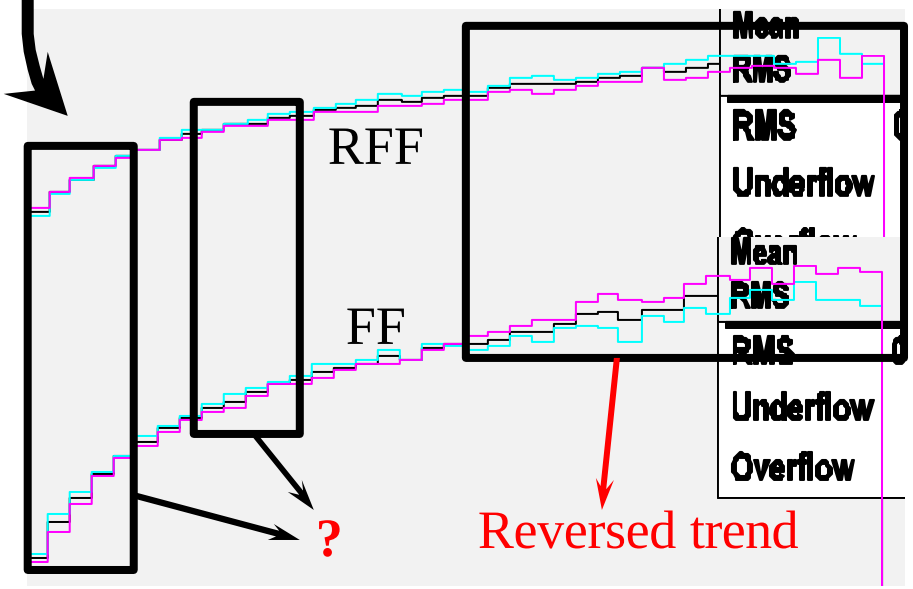
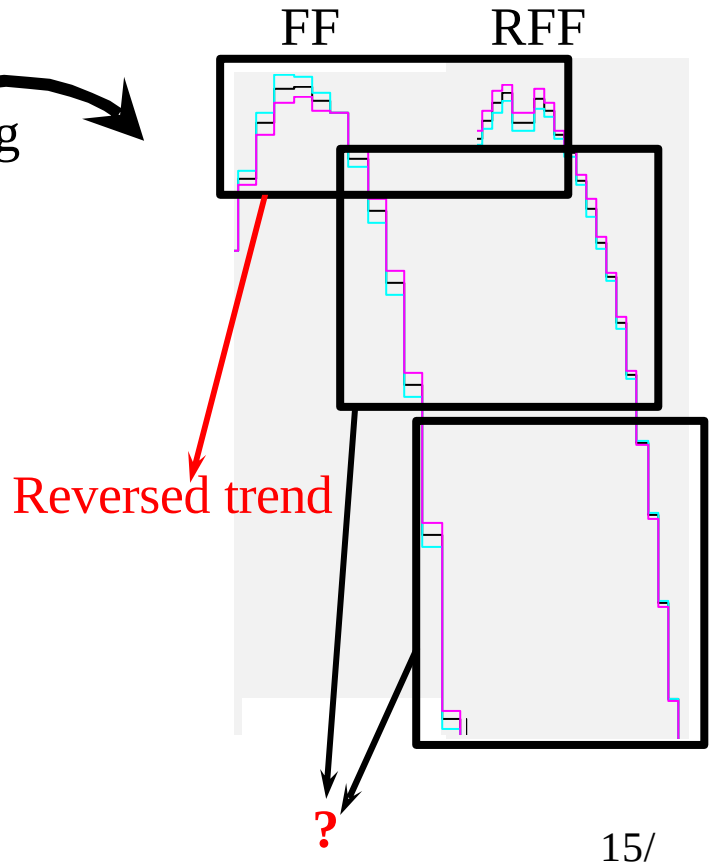
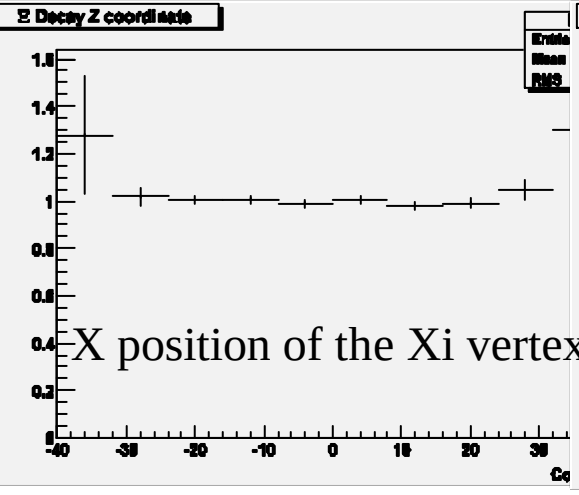




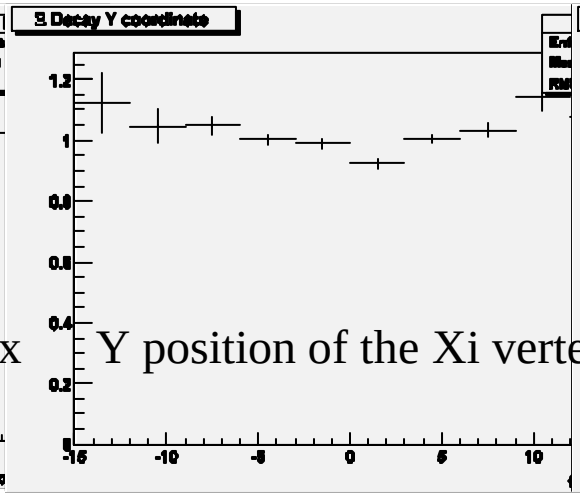
Signal distributions :

- For geometric variables : efficiency has rougly the same shape for signal and background !
- Yet, very, very small statistics for the signal
- Impossible to see if Xi ≠ antiXi
- Impossible to see if FF ≠ RFF

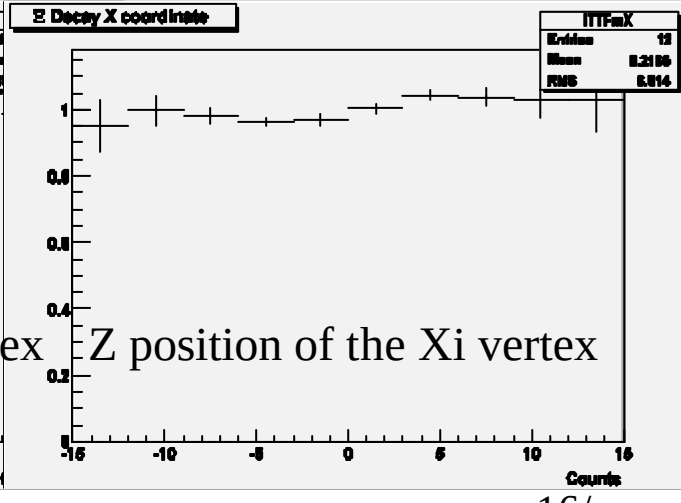
(Tight cuts + dEdx)



X position of the Xi vertex



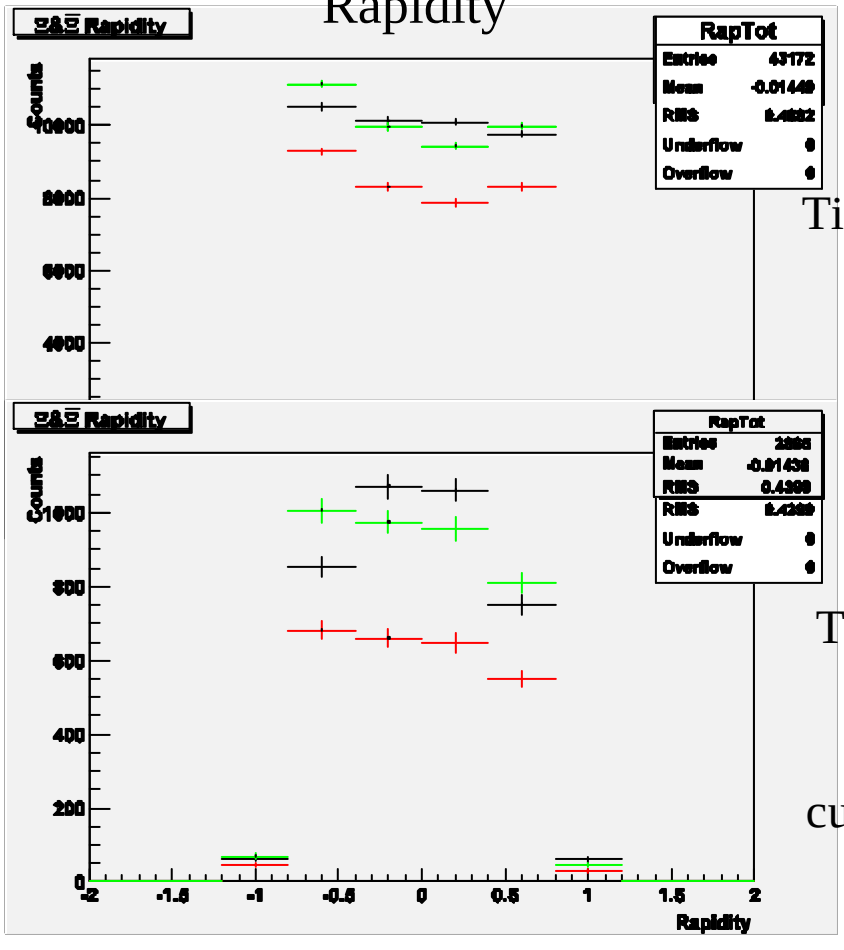
Y position of the Xi vertex



Z position of the Xi vertex

Kinematics :

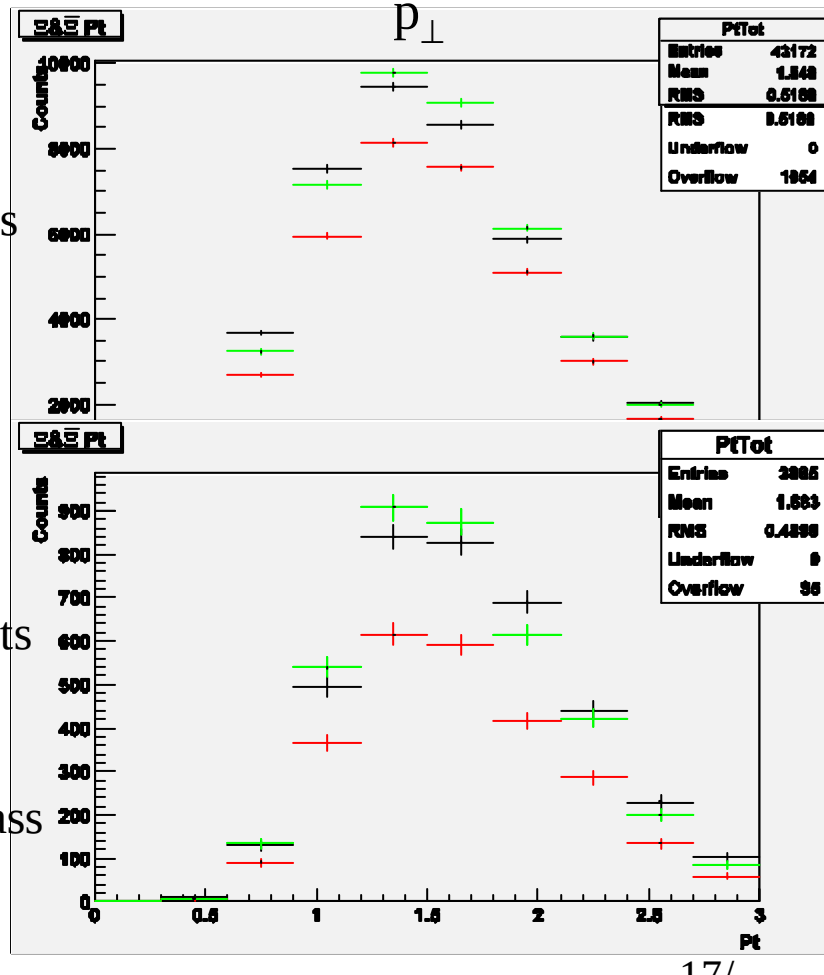
Rapidity



Tight cuts
+
dEdx

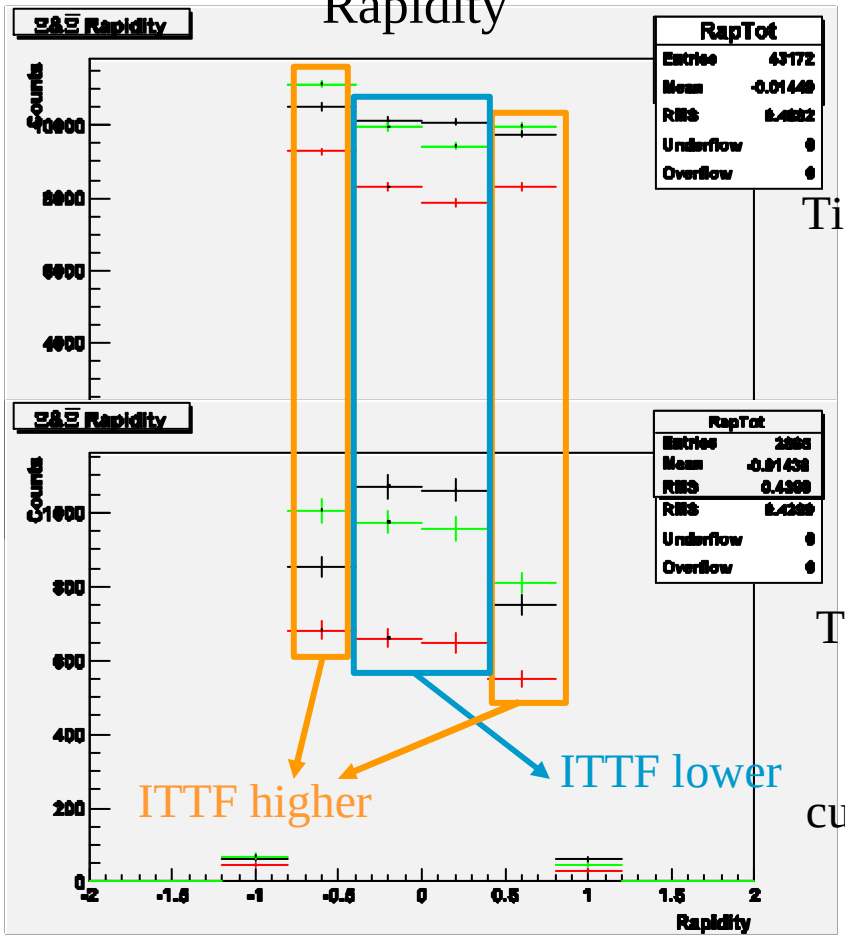
Tight cuts
+
dEdx
+
cut in mass

$p_\perp$



Kinematics :

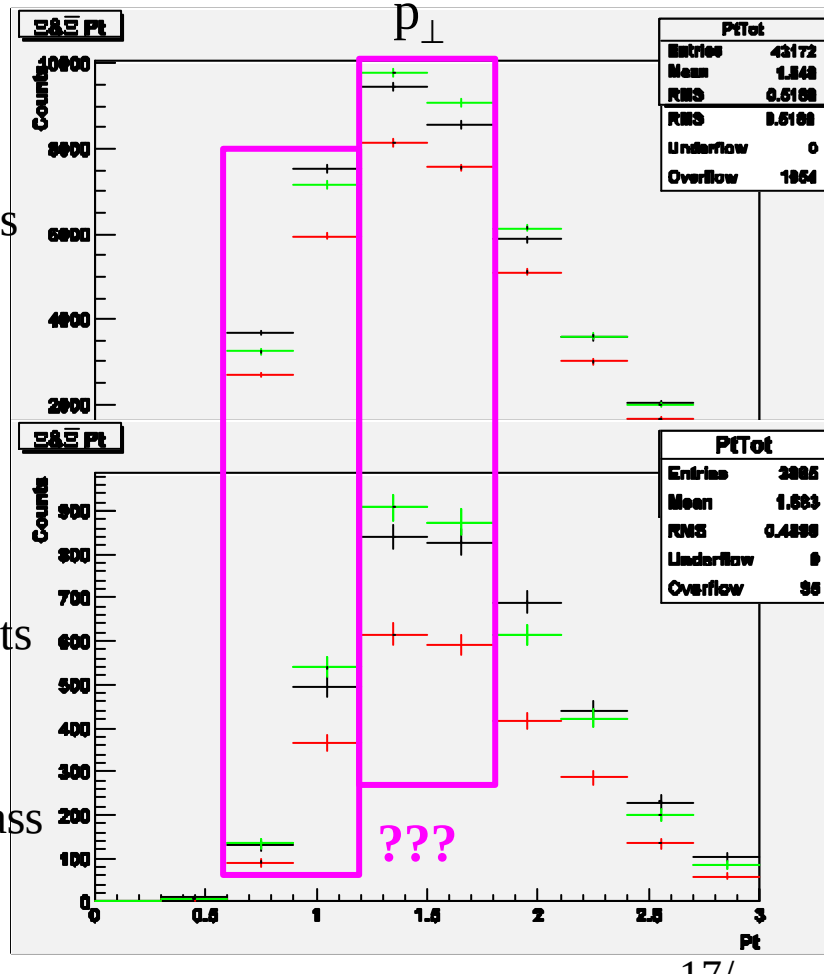
Rapidity



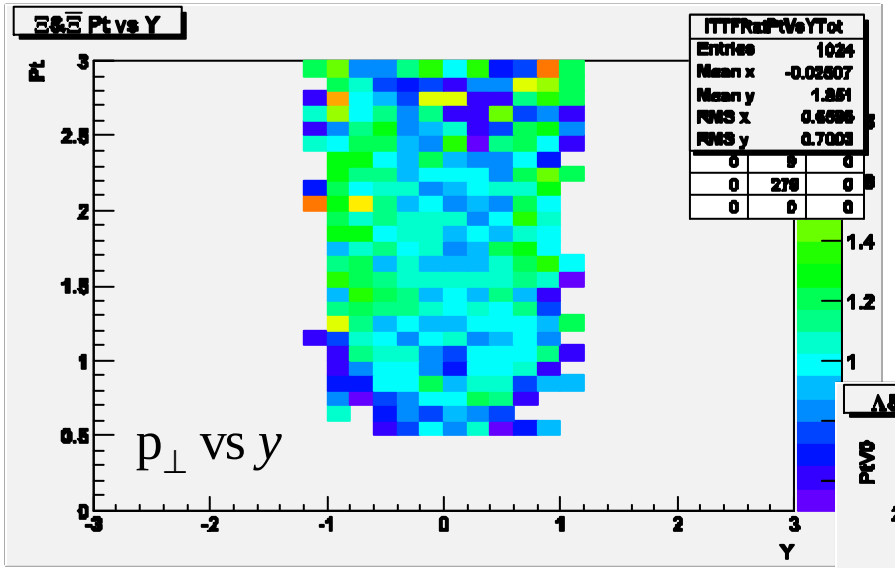
Tight cuts
+
dEdx

Tight cuts
+
dEdx
+
cut in mass

$p_\perp$



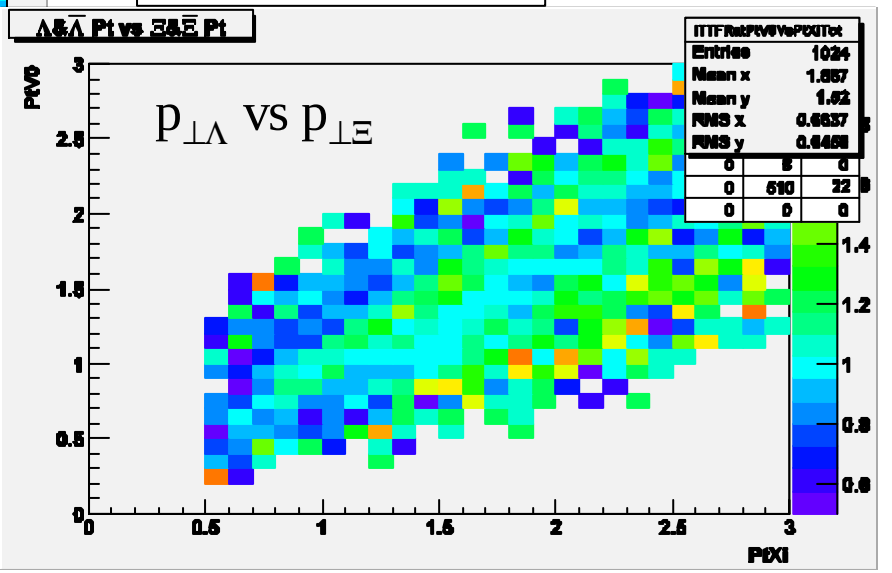
Kinematics (2) :



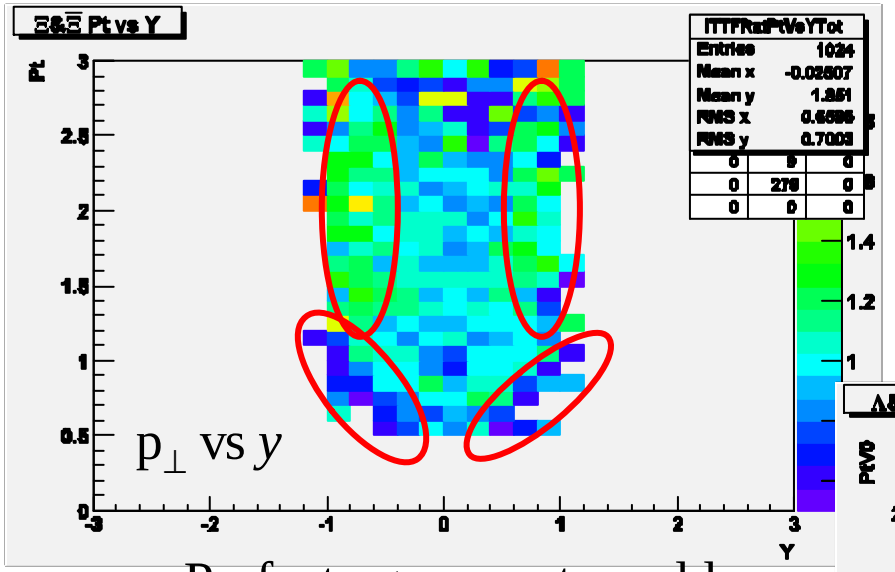
Cyan efficiency lower than **green** efficiency

Blue efficiency even lower

(Tight cuts + dEdx)



Kinematics (2) :

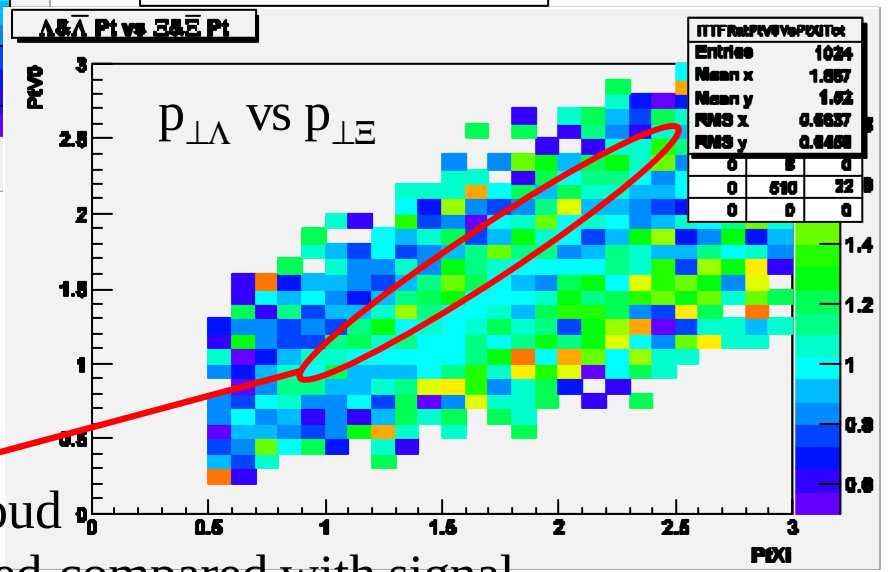


Perfect agreement would be entire cyan blue plot

Cyan efficiency lower than **green** efficiency

Blue efficiency even lower

(Tight cuts + dEdx)

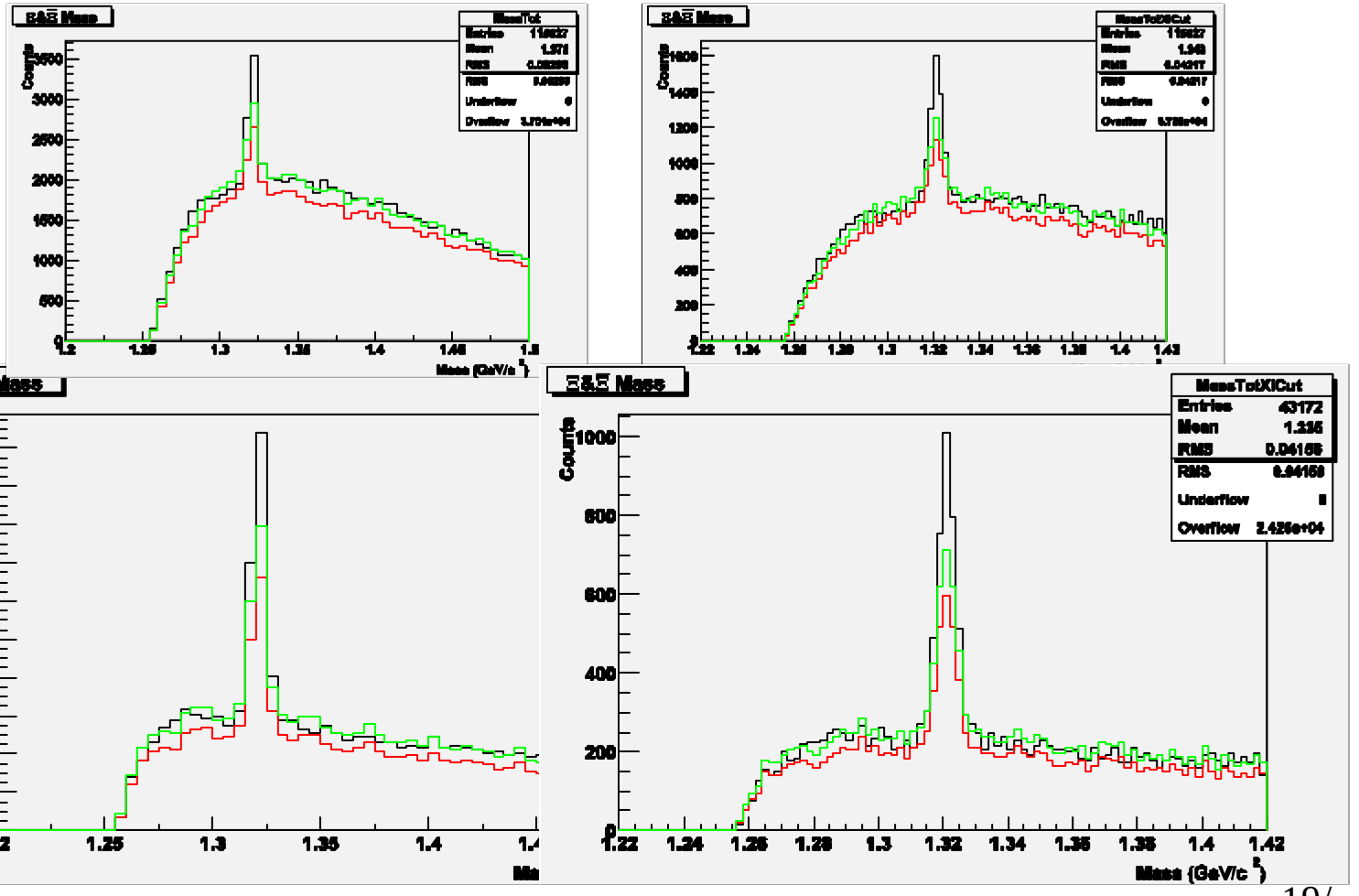


In this region : backgroud

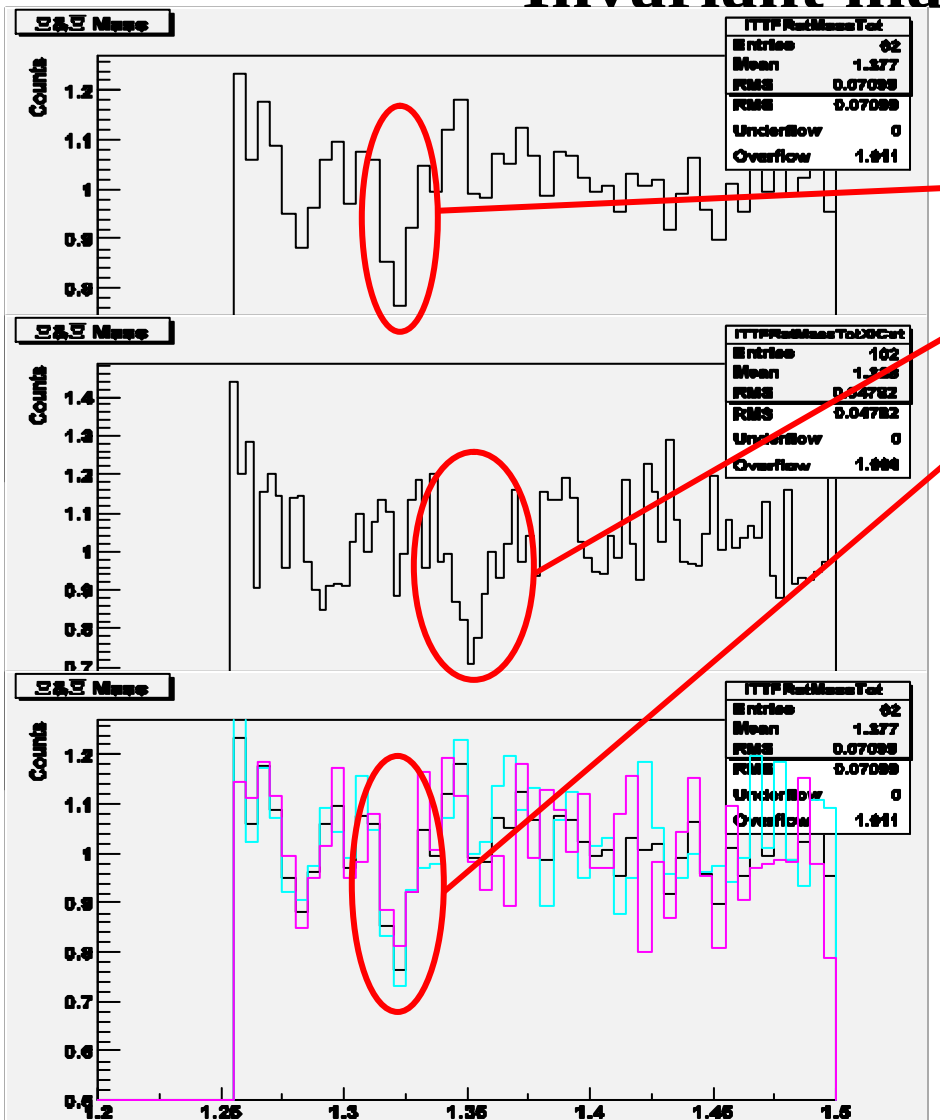
⇒ background enhanced compared with signal

Invariant mass peaks :

dEdx

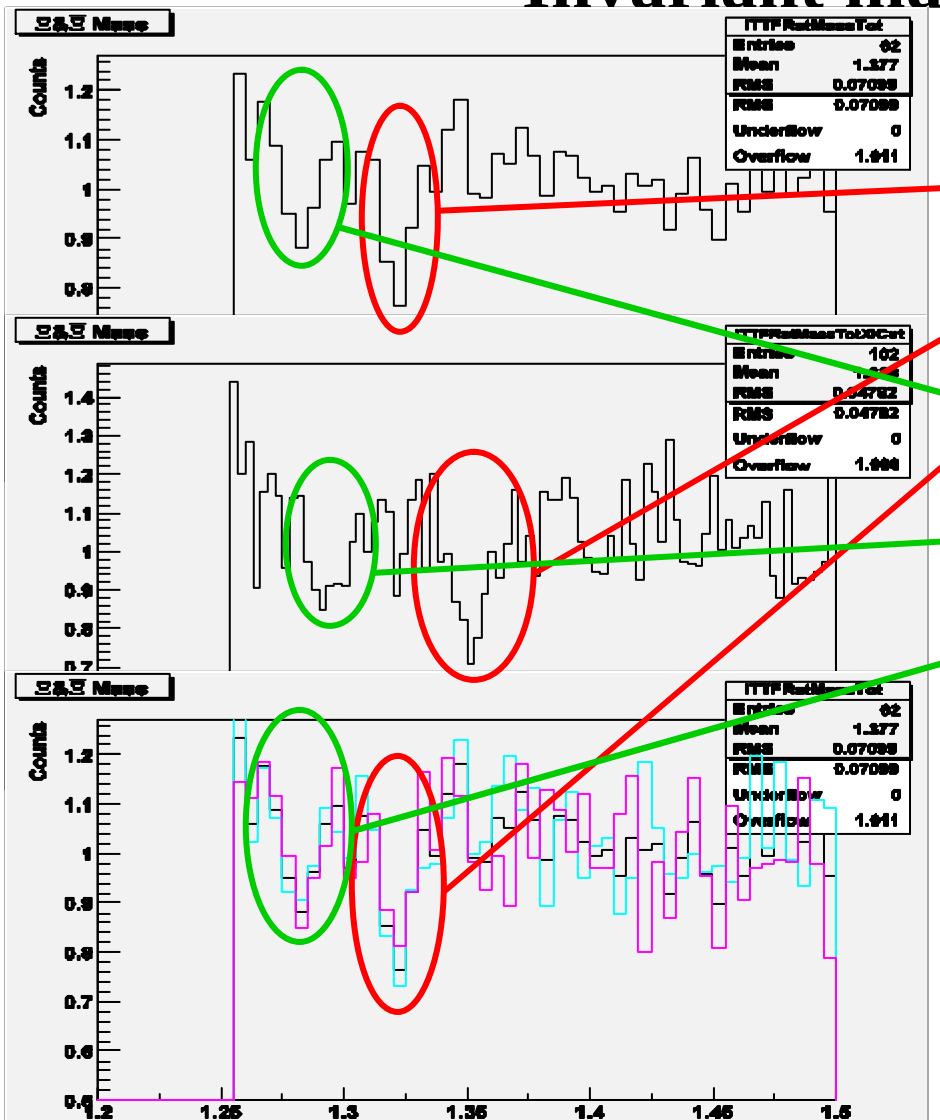


Invariant mass peaks :



Invariant mass drop !

Invariant mass peaks :



Invariant mass drop !

Second invariant mass drop !

Might be due to less track splitting in ITTF ?
(More statistics would be needed to conclude)

Invariant mass peaks :

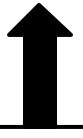
Calculated from the invariant mass plots, after tight geometrical cuts + dEdx cuts, over 170 533 Au-Au 200 *GeV* events

ITTF finds
43 ± 3 % fewer X than TPT

A track efficiency of 92 % would be responsible of half of this loss.
A track efficiency of 83 % would be responsible of the whole loss.

Invariant mass peaks :

- We can consider that efficiency for V0's is ≅ 70 % (Betty's result)
- We can consider that efficiency for Xi's is ≅ 60 %
- V0's are 2 tracks, Xi's are 3 tracks
- A track efficiency of 84 % explains perfectly those 2 numbers
- Track efficiency probably isn't responsible for everything, but cuts' influence is low (more stat would be needed to check that)
- $\langle p_\perp \rangle$ of Xi daughters isn't much higher than $\langle p_\perp \rangle$ of « non-daughters » particles, ⇒ drop of the track efficiency in $\langle p_\perp \rangle$ may not explain



A track efficiency of 92 % would be responsible of half of this loss.
A track efficiency of 83 % would be responsible of the whole loss.

Conclusions :

- **Background :**
  - Dip at 0 for the X and Y position of the reconstructed Xi vertex
  - Dca's have a different shape
  - Drop in efficiency is higher at low $p_{\perp}$
  - Drop in efficiency is higher at low invariant mass
  - Drop in efficiency is higher at « high » rapidity
  - **Not the same efficiency for Xi's and anti-Xi's**
  - **Asymetry Xi/antiXi changes / doesn't change when field sign changes**
- **Signal :**
  - Dca's have a different shape
  - Drop in efficiency is higher at rapidity 0
  - **43 % fewer Xi's are found**

Titre :