Group meeting
July 12th, 2024

Instruction responsibilities

- Classes for Fall 2024:
  - PHY 331:
    - Need to make syllabus
  - PHY 361:
    - Need to make syllabus

Service responsibilities

- Committee:
  - GlueX Compton Analysis Review Committee:
    - Waiting for author response

Group responsibilities

- Undergrad: Met with Dylan on Thursday

Analysis

Presentations:

- Presentation to cross section meeting

KKpi analysis:

- Work in progress
  - Had to fix energy cut

Ξ^* analysis:

- Requested studies:
  - Vertex dependence on π^0 mass with real and MC data (status: started MC)
  - t-cut dependence on Ξ^* spectrum (status: in progress)
  - Vertex angle between momentum and path of Ξ (status: not started)
  - Refine MC generator distributions (status: Initial run with s and t distributions are complete)
  - Mass fit Ξ for each bin in Ξ^* (status: complete)

Ξ^* Generator Refinement

- Starting with code from Brandon build for $\Xi(1530)$ and modifying for general Ξ^*

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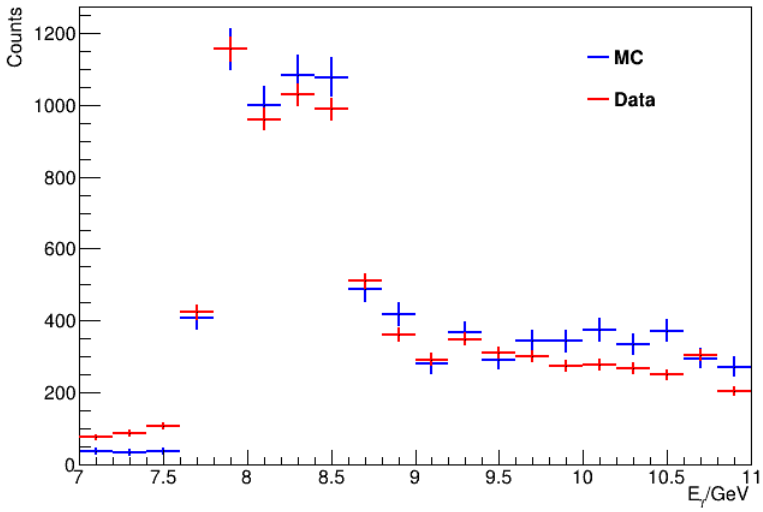
- We can lock down the kinematics of the initial reaction by specifying s, t and m_{Y*}
- Started with Mandelstam s and t
- Will move to m_{Y*} refinement next time

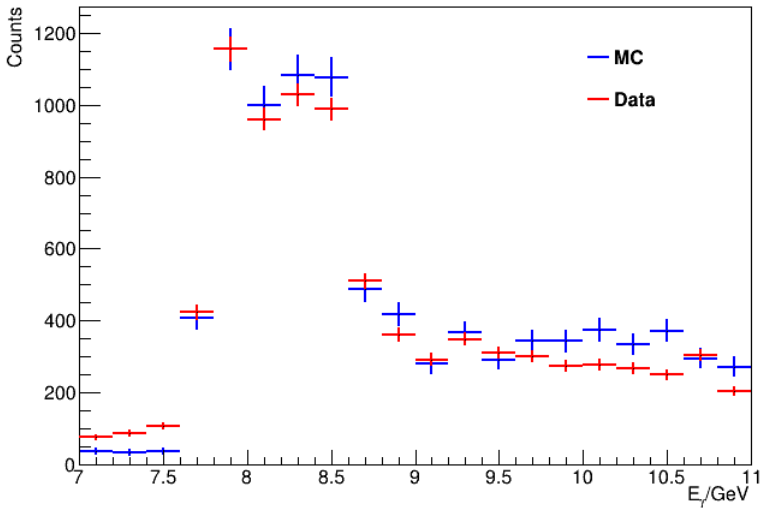
Ξ^* Generator Refinement

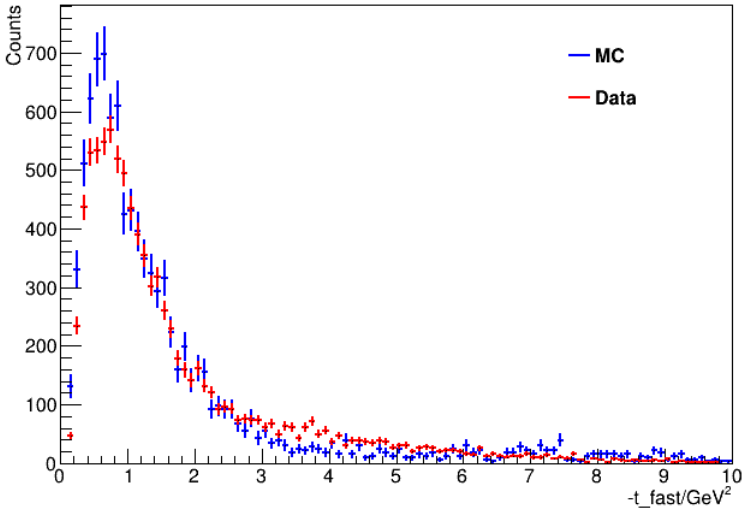


Note: $s = 2E_\gamma m_p + m_p^2$

- Looks OK, but can probably be refined more

Ξ^* Generator Refinement





- -*t* (fast) looks good, except between 0.4 and 0.7

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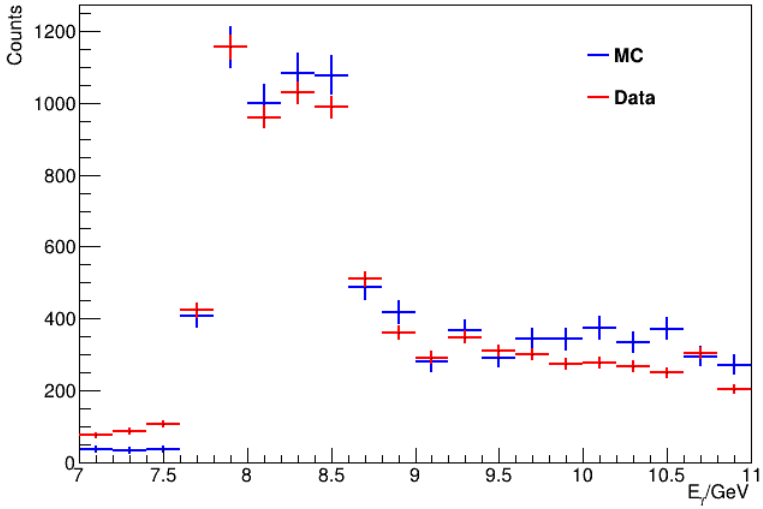

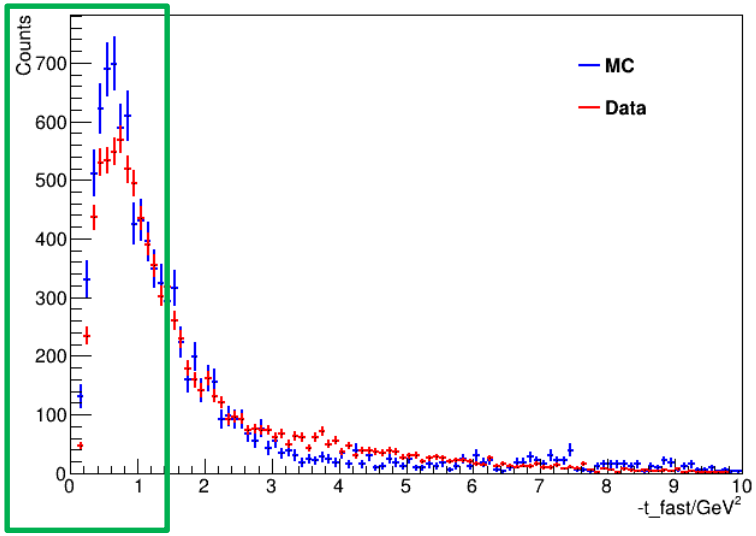

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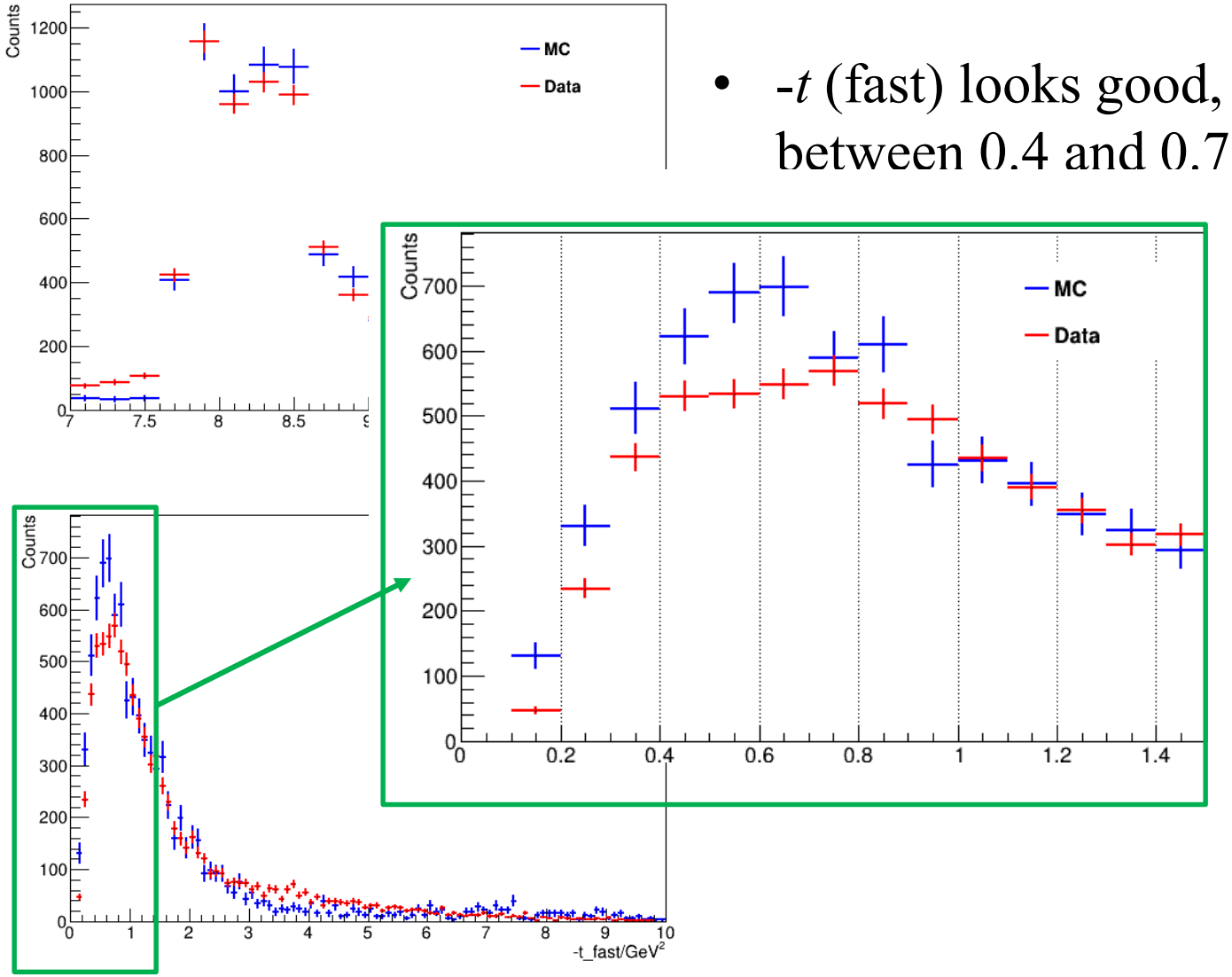

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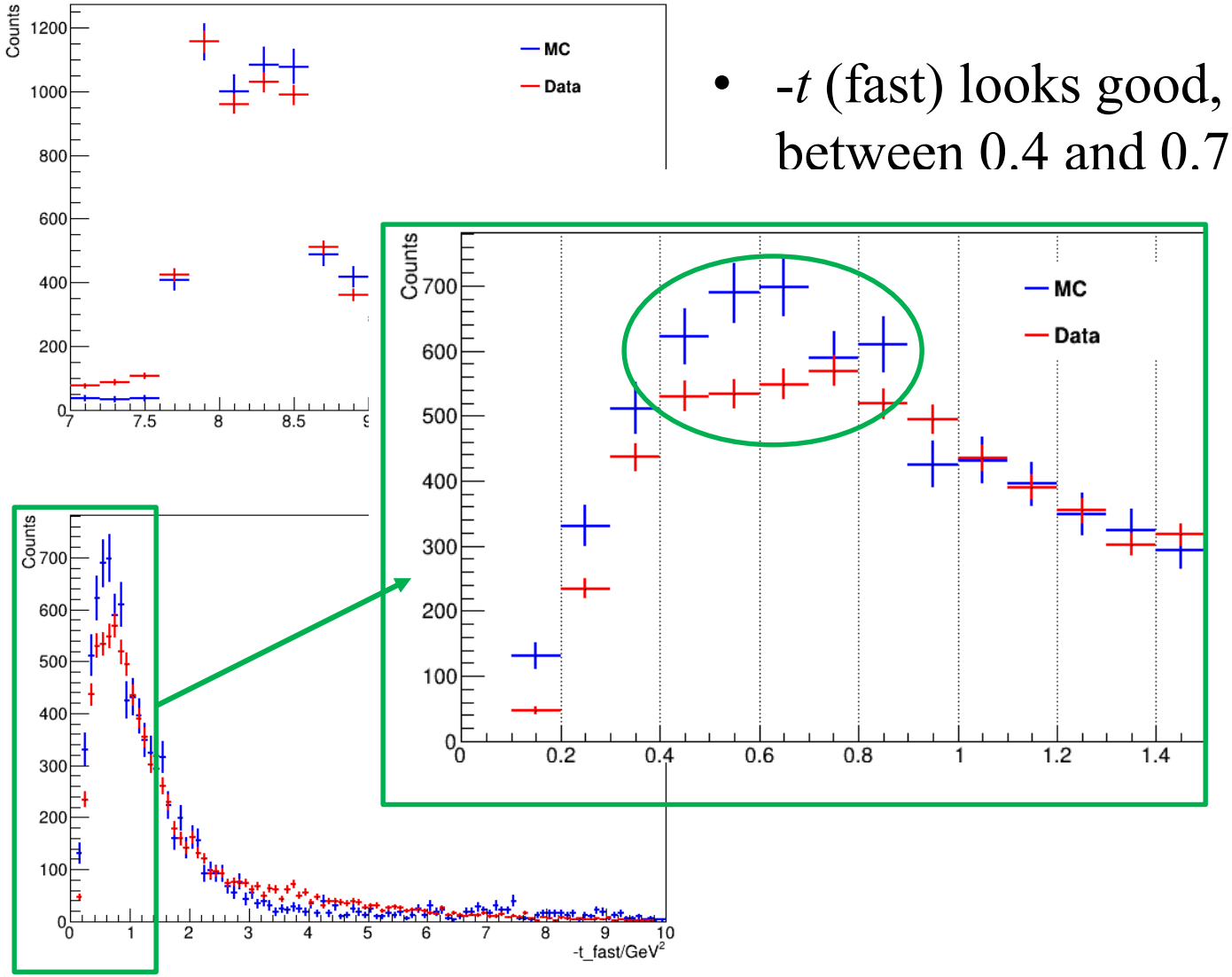

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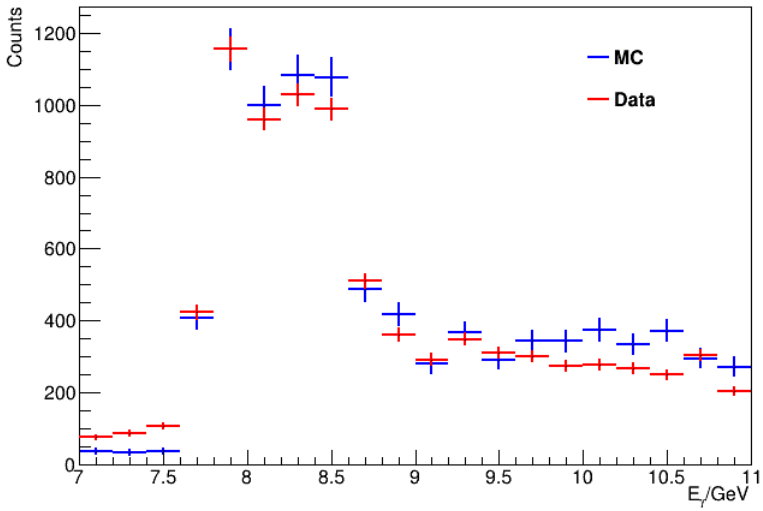
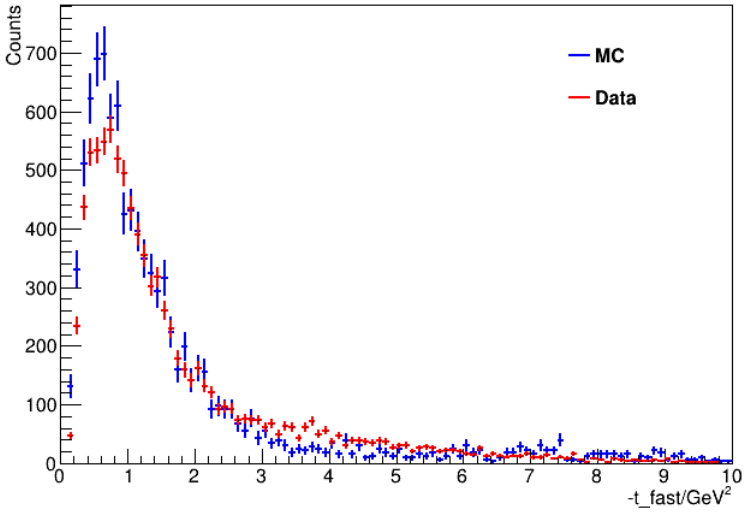
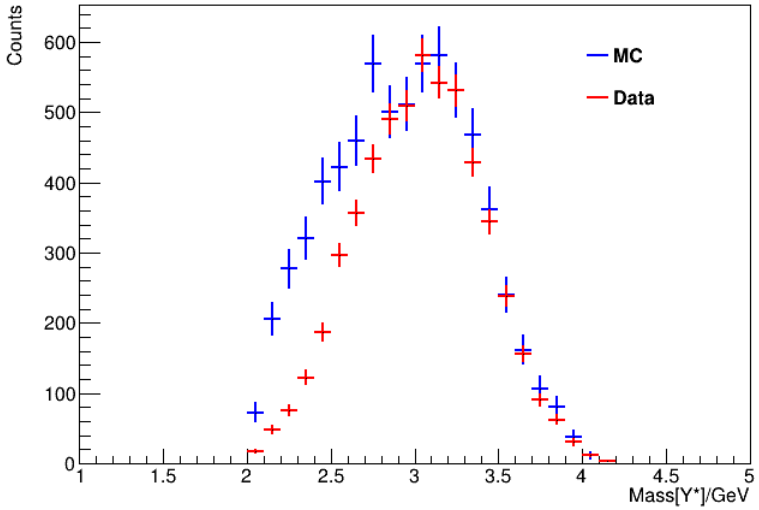


Not yet tried to get the Y^* shape to match and the high mass part of distribution already looks good ☺





Title

Title

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$KK\pi$ Polarization Setup

Data and cuts

Dataset:

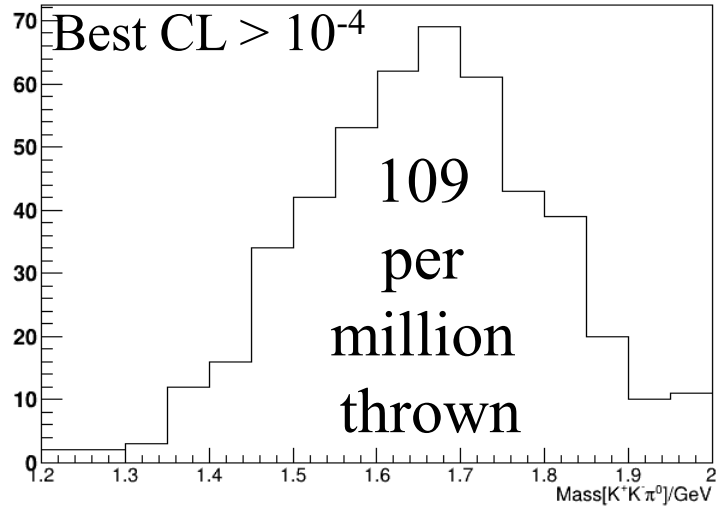
- Spring 2018 data

Restrictions:

- Incident photon timed to be within central peak
- Only best Confidence Level (*CL*) per event kept
- *CL* must be above 10^{-4}
- Kaons must be forward directed (seen in TOF)
- Kaons must have momentum < 3 GeV
- Missing mass within 3 standard deviations of central peak
- 0.12 GeV < Mass[π^0] < 0.15 GeV

Contamination study (4.4 million thrown)

$\pi^+\pi^-\pi^0$ seen as $K^+K^-\pi^0$



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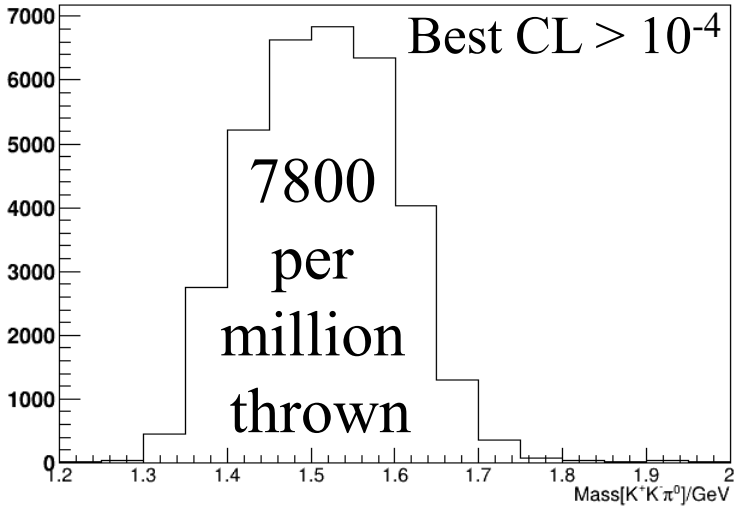

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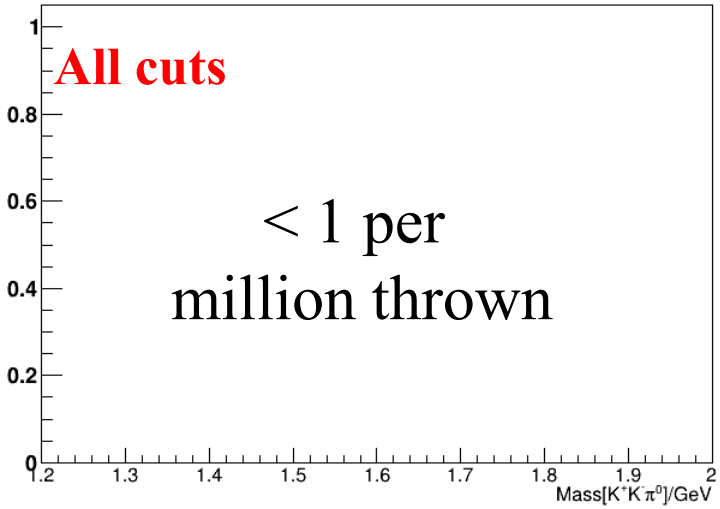

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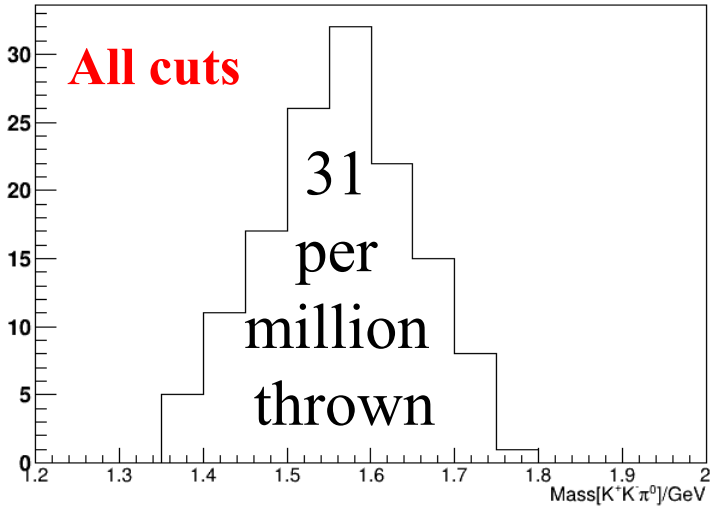

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Will loosen this cut

ASU

Coherent peak

- Ran PWA over coherent edge with polarization set to zero

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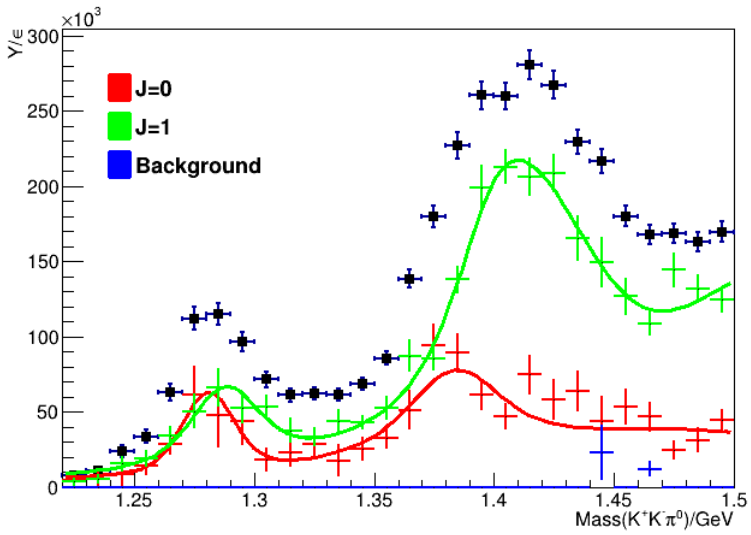

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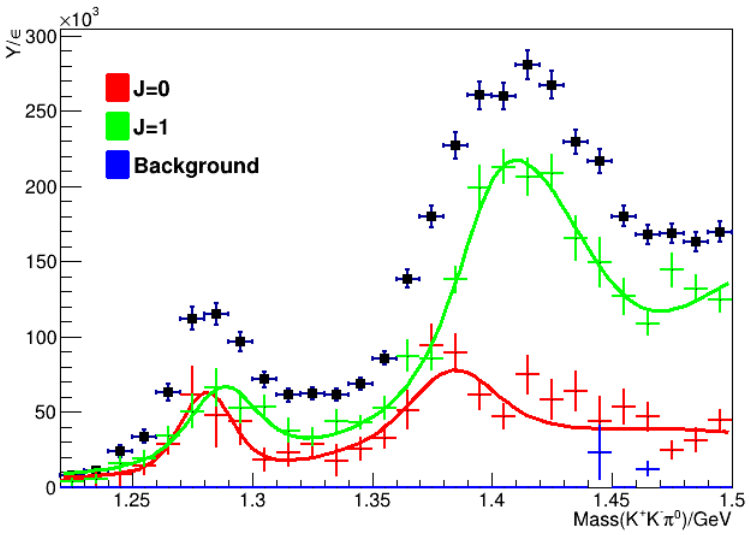

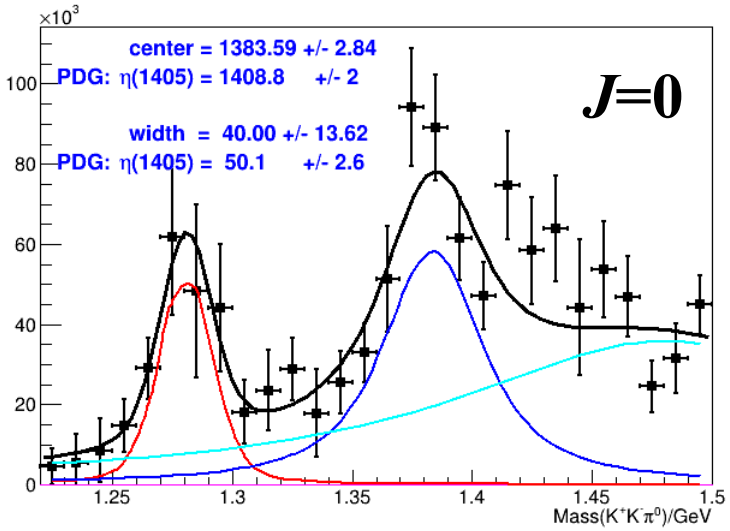

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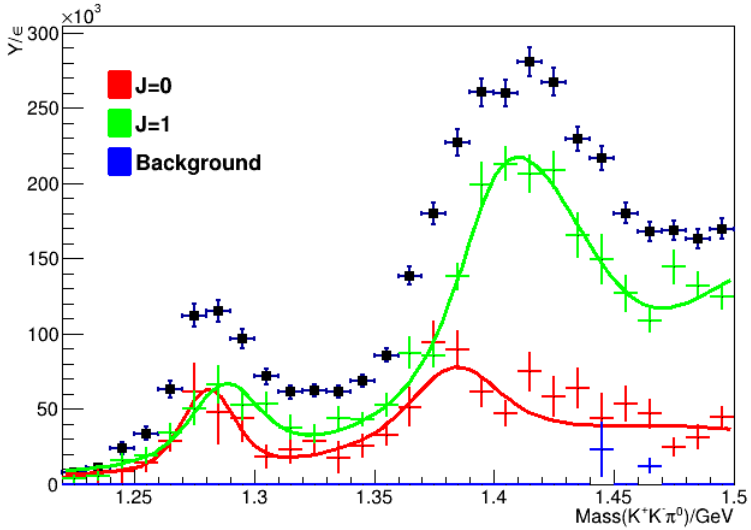

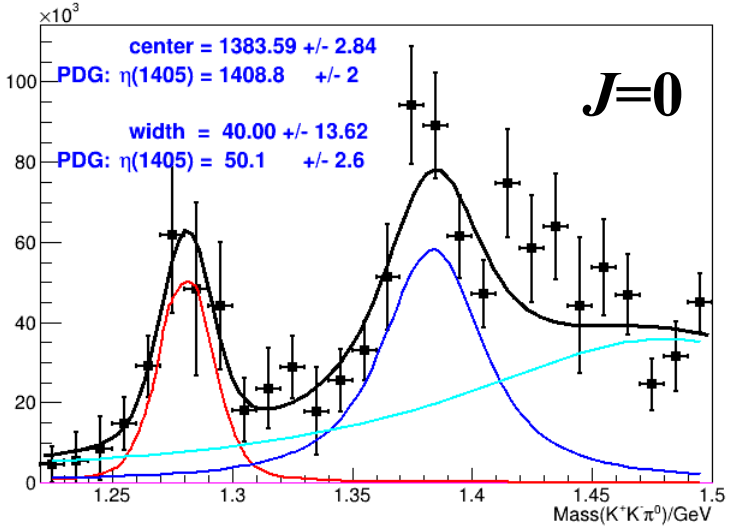

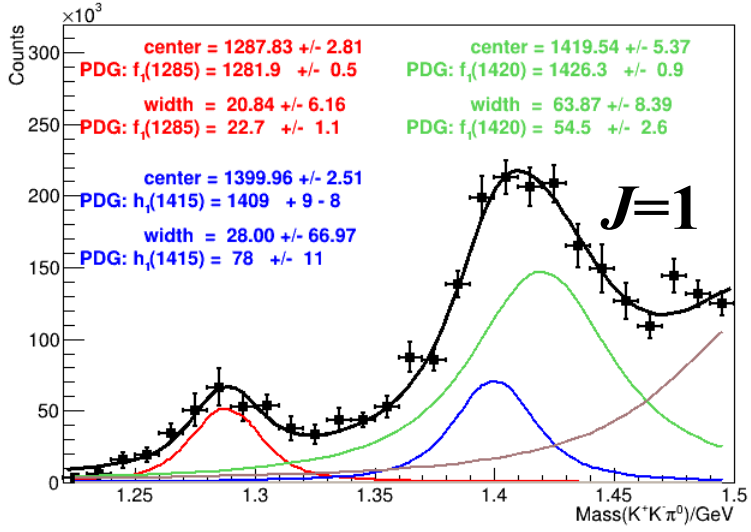

Coherent peak

- Next step completed was to include all of the intensity terms

Coherent peak

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Unnecessary ☹

Intensity

$$I(\Phi,\Omega,\Omega_H) = 2\kappa \sum_k$$

$$\Big\{(1-P_\gamma)\left[\left|\sum_{i_N,m}[J_i^N]^{(+)}_{m,k} Im(Z) + \sum_{i_U,m}[J_i^U]^{(-)}_{m,k} Im(Z)\right|^2 + \left|\sum_{i_N,m}[J_i^N]^{(-)}_{m,k} Re(Z) + \sum_{i_U,m}[J_i^U]^{(+)}_{m,k} Re(Z)\right|^2\right] +$$

$$(1+P_\gamma)\left[\left|\sum_{i_N,m}[J_i^N]^{(-)}_{m,k} Im(Z) + \sum_{i_U,m}[J_i^U]^{(+)}_{m,k} Im(Z)\right|^2 + \left|\sum_{i_N,m}[J_i^N]^{(+)}_{m,k} Re(Z) + \sum_{i_U,m}[J_i^U]^{(-)}_{m,k} Re(Z)\right|^2\right]\Big\}$$

The $[J_i^{N,U}]^{(\epsilon)}_{m,k}$ are the free complex parameters in the fit for a given reflectivity amplitude.

where $Z^i_m(\Omega,\Omega_H) = e^{-i\Phi} X^i_m(\Omega,\Omega_H)$ is the phase-rotated decay amplitude and Φ is the angle between the production plane and the photon polarization

Justin Stevens, https://halldweb.jlab.org/doc-private/DocDB/ShowDocument?docid=4858

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A2

$$(1+P_\gamma)\Big[\Big|\sum_{i_N,m}[J_i^N]^{(-)}_{m,k}Im(Z) + \sum_{i_U,m}[J_i^U]^{(+)}_{m,k}Im(Z)\Big|^2 + \Big|\sum_{i_N,m}[J_i^N]^{(+)}_{m,k}Re(Z) + \sum_{i_U,m}[J_i^U]^{(-)}_{m,k}Re(Z)\Big|^2\Big]\Big\}$$

D2

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Justin Stevens, https://halldweb.jlab.org/doc-private/DocDB/ShowDocument?docid=4858

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B1

C1

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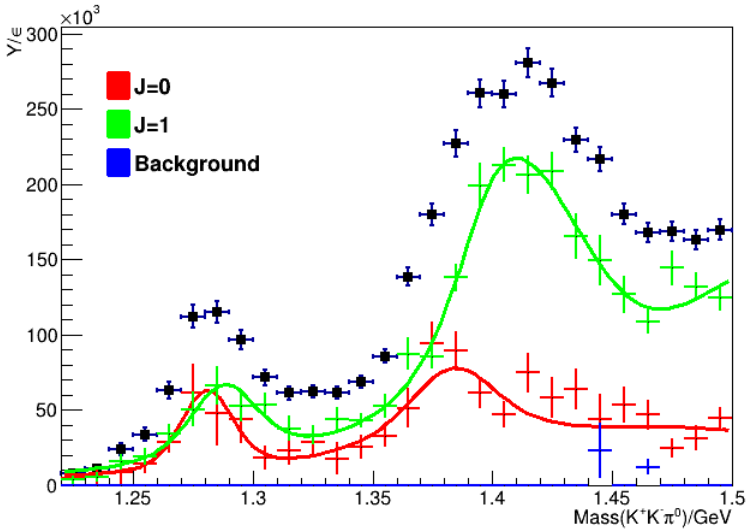
Constrained:

- A1 to D1
- A2 to D2
- B1 to C1
- B2 to C2

Justin Stevens, https://halldweb.jlab.org/doc-private/DocDB/ShowDocument?docid=4858

PWA Test



Original version:
½ of the intensity terms

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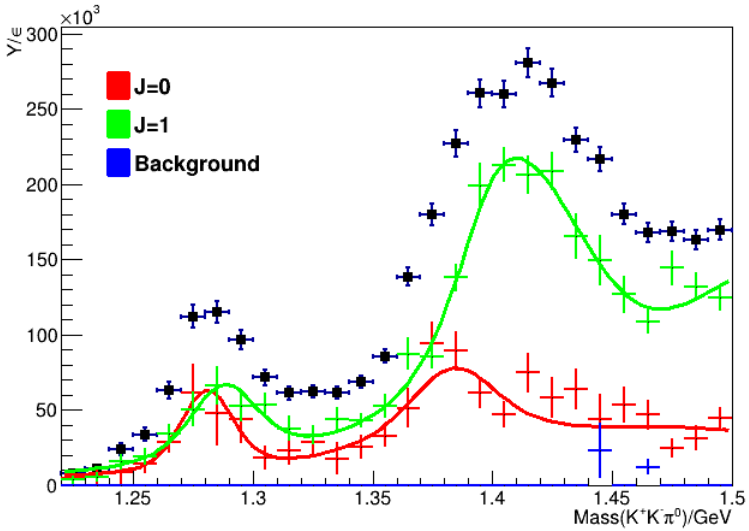

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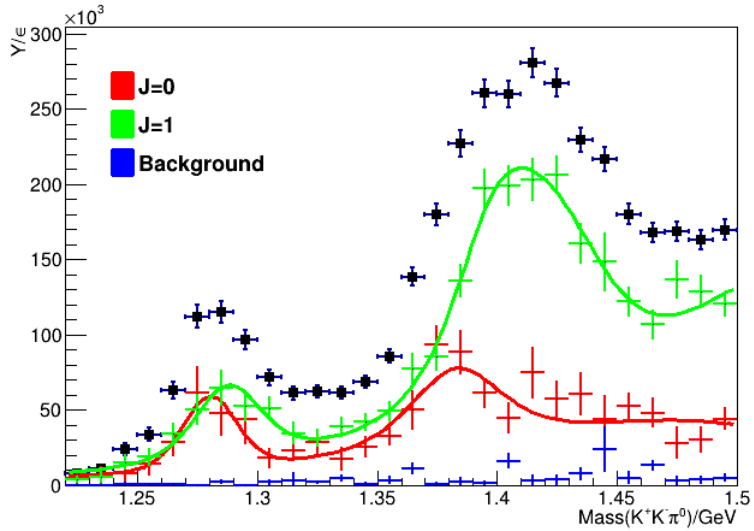

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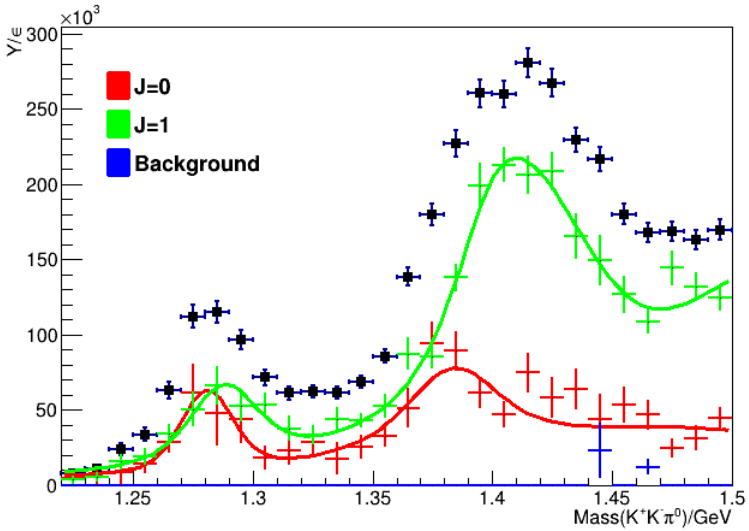

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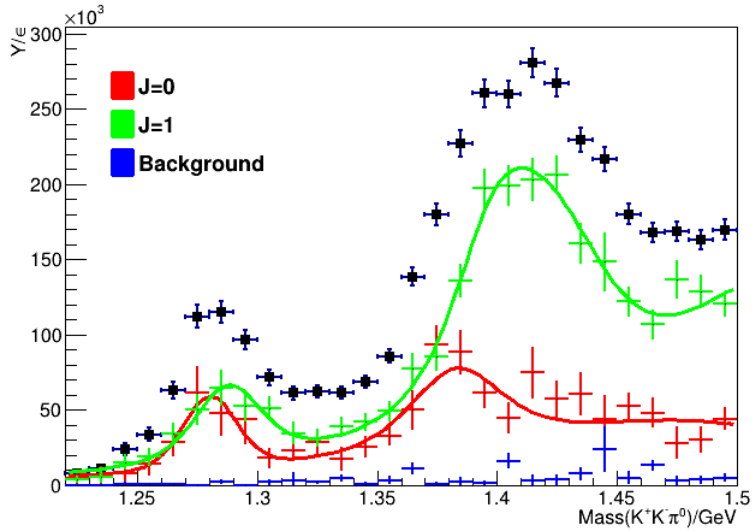

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Good to see the agreement, but otherwise: A waste of time ☹

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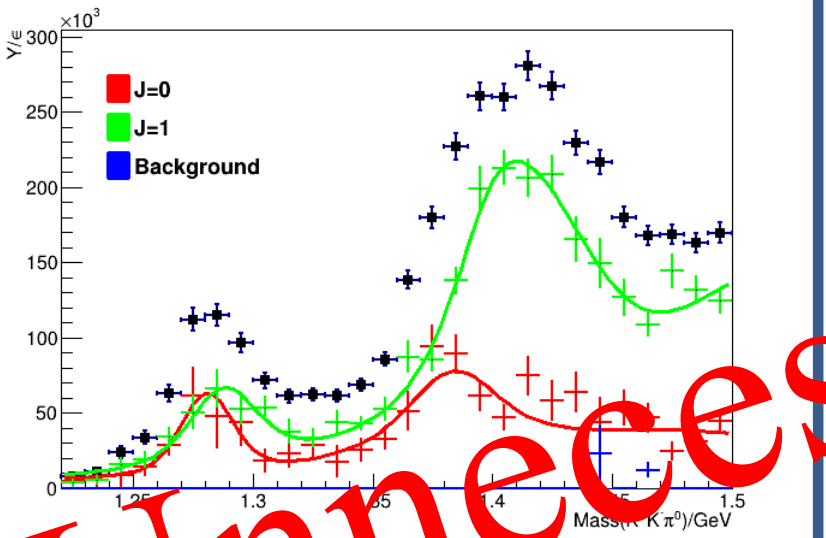

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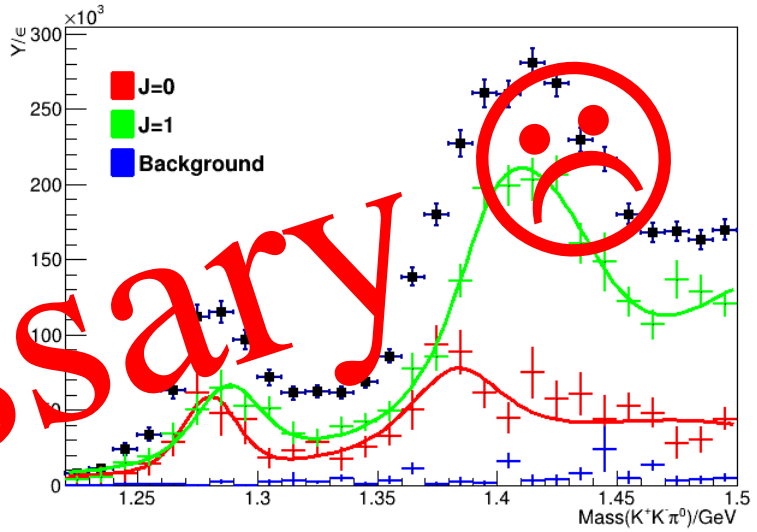

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Constrained:

- A1 to D1
- A2 to D2
- B1 to C1
- B2 to C2

Problem: Even with the polarization information, there is no way to distinguish *N* (natural exchange) from *U* (unnatural exchange) → Can continue to lump together coefficients into A, B, C and D terms with the constraints:

- A to D
- B to C

PWA

- Next step: Turn on polarization!

Ξ^* bump hunt

Reaction

$$\gamma\, p \rightarrow K^{+}K^{+}\Xi^{-}\pi^{0},$$

where $\Xi^{-} \rightarrow \Lambda\pi^{-}$

Reaction

$$\gamma\, p \rightarrow K^{+}K^{+}\Xi^{-}\pi^{0},$$

where $\Xi^{-} \rightarrow \Lambda\pi^{-}$

and $\Lambda \rightarrow p\pi^{-}$

Reaction

$$\gamma\, p \rightarrow K^{+}K^{+}\Xi^{-}\pi^{0},$$

where $\Xi^{-} \rightarrow \Lambda\pi^{-}$

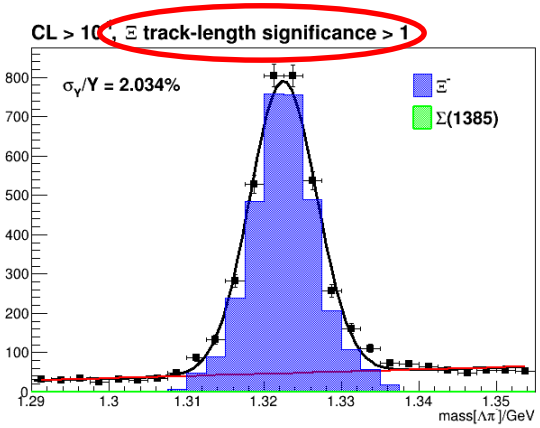
and $\Lambda \rightarrow p\pi^{-}$

- Mass of Ξ^{-} not constrained

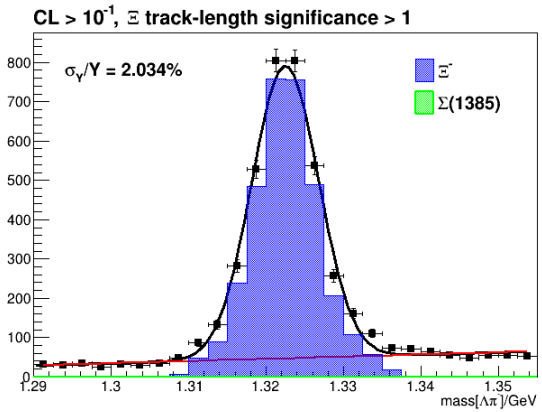
Pathlength study

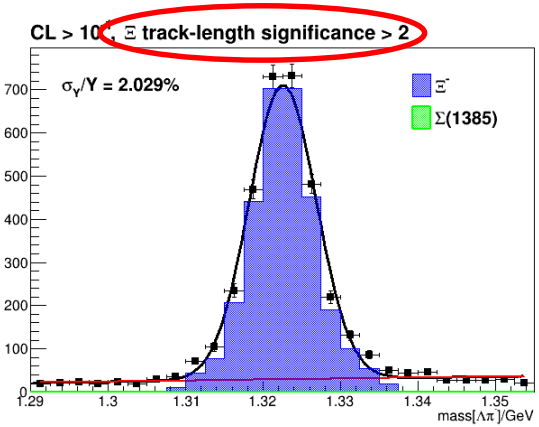
- Vertex analysis now uses pathlength significance as given on page 13 of https://halldweb.jlab.org/DocDB/0046/004607/004/DSelectorDoc.pdf

- As was suggested, I made sure that the end of the Ξ^- path was downstream of the origin

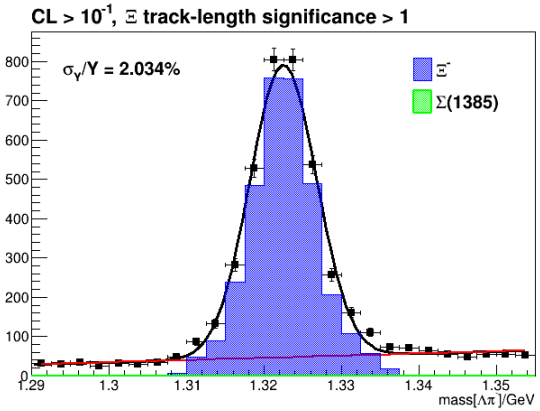

CL > 10^-1, Ξ track-length significance > 1
σ_Y/Y = 2.034%
Ξ⁻
Σ(1385)
800
700
600
500
400
300
200
100
0
1.29
1.3
1.31
1.32
1.33
1.34
1.35
mass[Λπ]/GeV

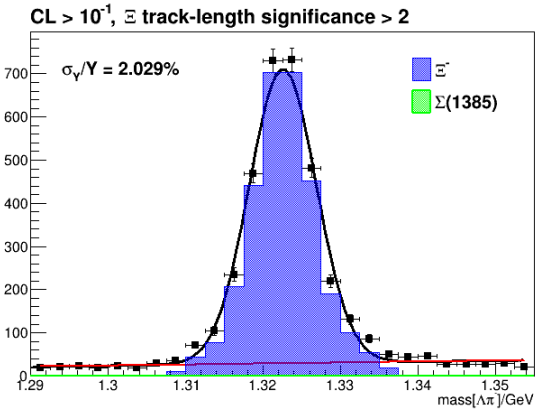
$CL > 10^{-1}$

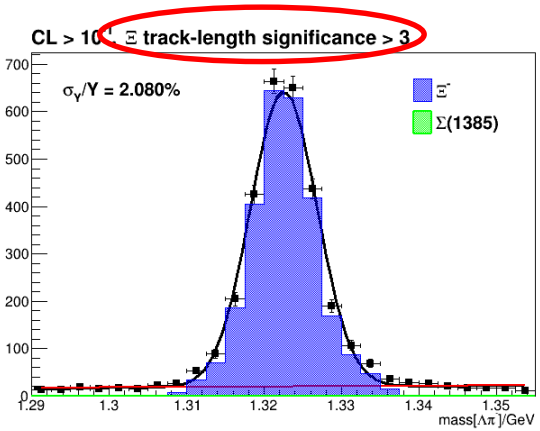

CL > 10^-1, Ξ track-length significance > 1
σ_Y/Y = 2.034%
Ξ⁻
Σ(1385)
mass[Λπ]/GeV


CL > 10^-1, Ξ track-length significance > 2
σ_Y/Y = 2.029%
Ξ⁻
Σ(1385)
mass[Λπ]/GeV

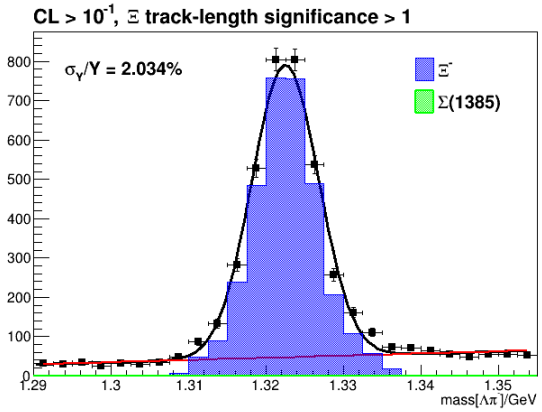
$CL > 10^{-1}$

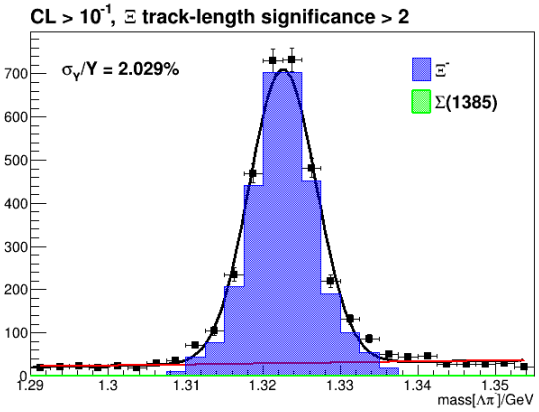

CL > 10^-1, Ξ track-length significance > 1
σY/Y = 2.034%
Ξ⁻
Σ(1385)
mass[Λπ]/GeV

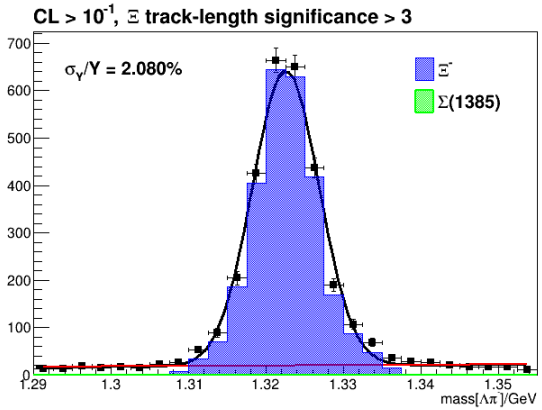

CL > 10^-1, Ξ track-length significance > 2
σY/Y = 2.029%
Ξ⁻
Σ(1385)
mass[Λπ]/GeV

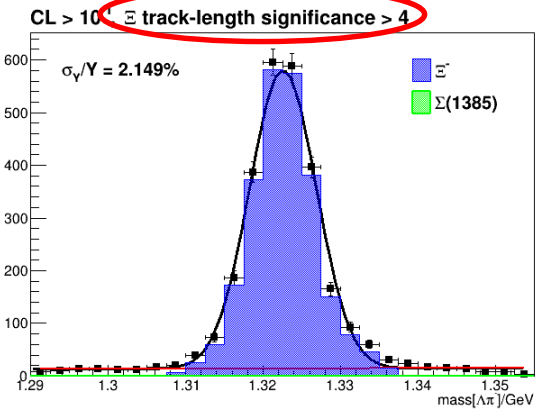

CL > 10^-1, Ξ track-length significance > 3
σY/Y = 2.080%
Ξ⁻
Σ(1385)
mass[Λπ]/GeV

$CL > 10^{-1}$

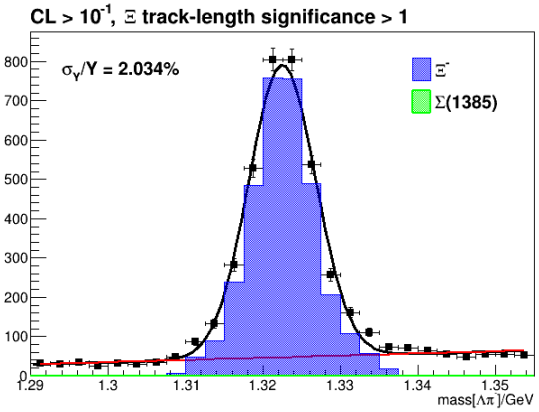

CL > 10-1, Ξ track-length significance > 1
σY/Y = 2.034%
Ξ-
Σ(1385)
mass[Λπ]/GeV

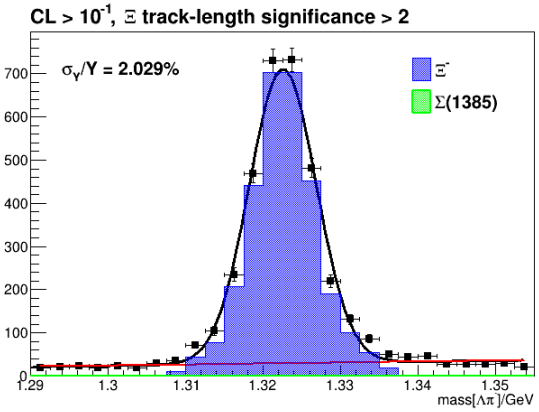

CL > 10-1, Ξ track-length significance > 2
σY/Y = 2.029%
Ξ-
Σ(1385)
mass[Λπ]/GeV


CL > 10-1, Ξ track-length significance > 3
σY/Y = 2.080%
Ξ-
Σ(1385)
mass[Λπ]/GeV

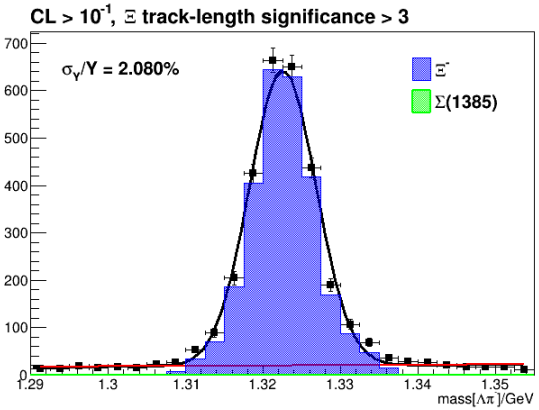

CL > 10-1, Ξ track-length significance > 4
σY/Y = 2.149%
Ξ-
Σ(1385)
mass[Λπ]/GeV

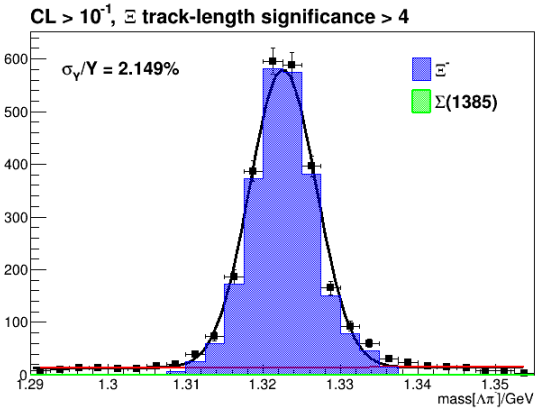
$CL > 10^{-1}$

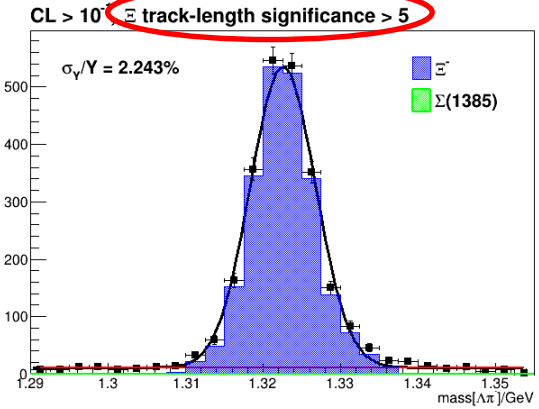

CL > 10^-1, Ξ track-length significance > 1
σY/Y = 2.034%
Ξ-
Σ(1385)
mass[Λπ]/GeV

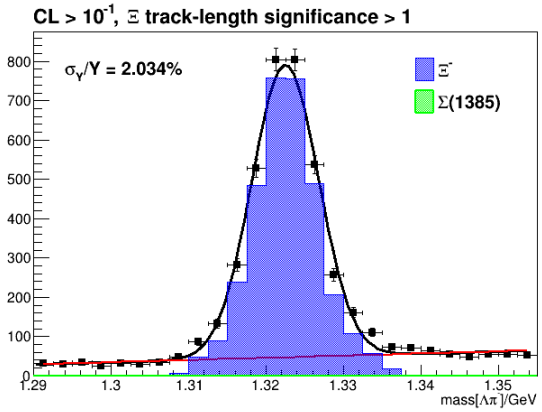

CL > 10^-1, Ξ track-length significance > 2
σY/Y = 2.029%
Ξ-
Σ(1385)
mass[Λπ]/GeV

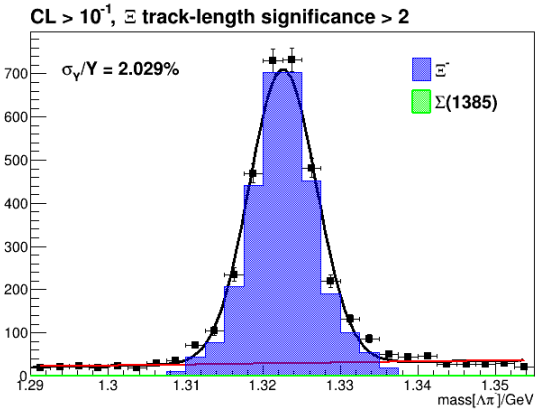
$CL > 10^{-1}$


CL > 10^-1, Ξ track-length significance > 3
σY/Y = 2.080%
Ξ-
Σ(1385)
mass[Λπ]/GeV

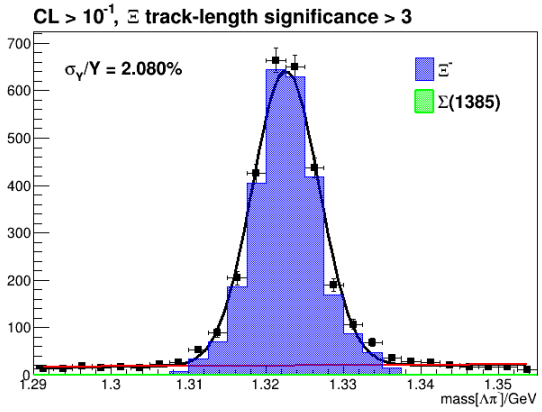

CL > 10^-1, Ξ track-length significance > 4
σY/Y = 2.149%
Ξ-
Σ(1385)
mass[Λπ]/GeV

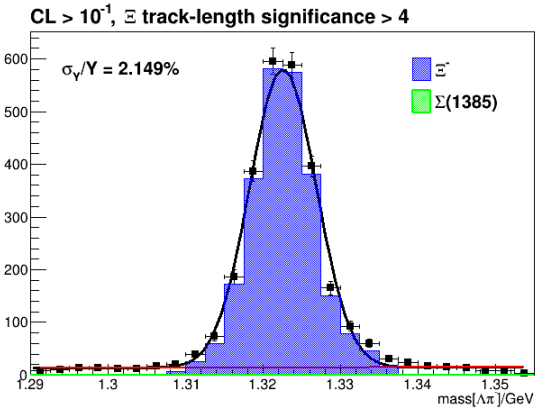

CL > 10^-1, Ξ track-length significance > 5
σY/Y = 2.243%
Ξ-
Σ(1385)
mass[Λπ]/GeV

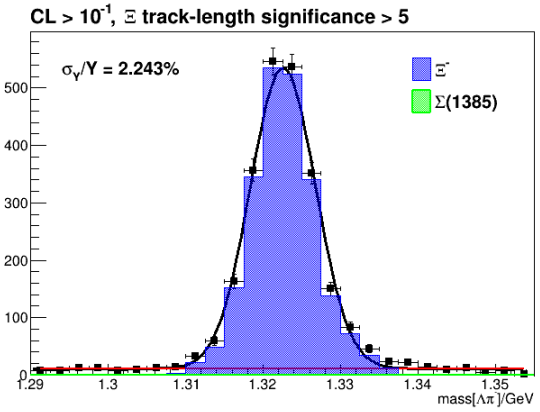

CL > 10-1, Ξ track-length significance > 1
σY/Y = 2.034%
Ξ-
Σ(1385)
mass[Λπ]/GeV

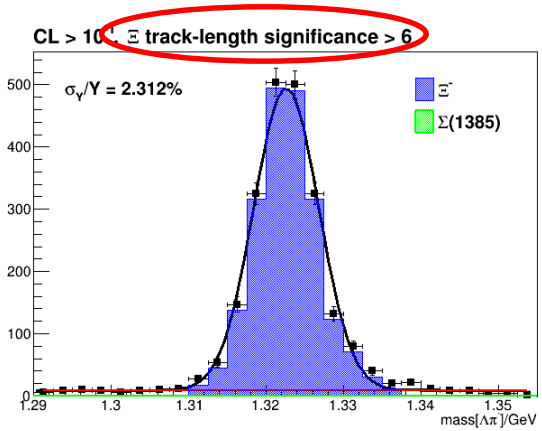

CL > 10-1, Ξ track-length significance > 2
σY/Y = 2.029%
Ξ-
Σ(1385)
mass[Λπ]/GeV

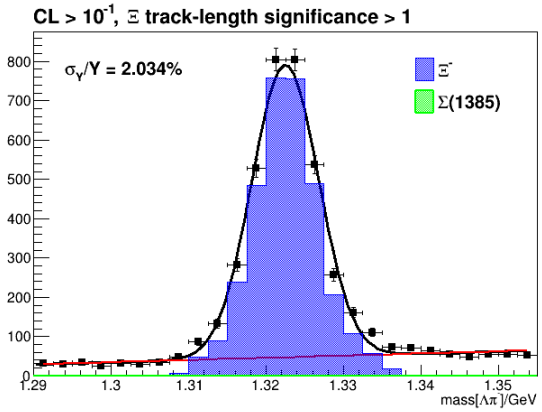
$CL > 10^{-1}$

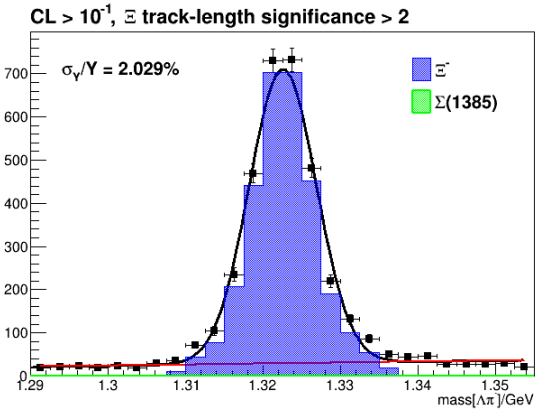

CL > 10-1, Ξ track-length significance > 3
σY/Y = 2.080%
Ξ-
Σ(1385)
mass[Λπ]/GeV


CL > 10-1, Ξ track-length significance > 4
σY/Y = 2.149%
Ξ-
Σ(1385)
mass[Λπ]/GeV

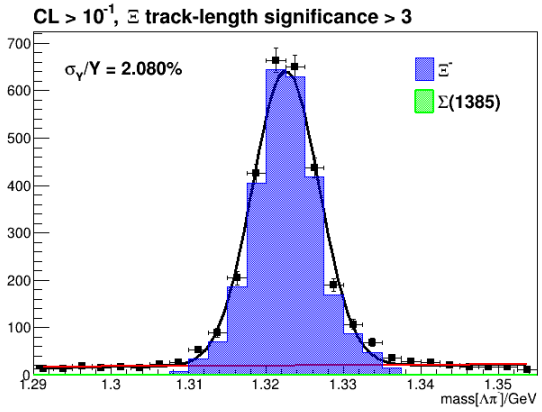

CL > 10-1, Ξ track-length significance > 5
σY/Y = 2.243%
Ξ-
Σ(1385)
mass[Λπ]/GeV

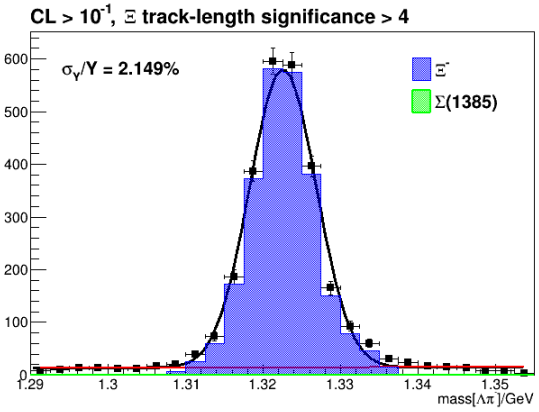

CL > 10-1, Ξ track-length significance > 6
σY/Y = 2.312%
Ξ-
Σ(1385)
mass[Λπ]/GeV

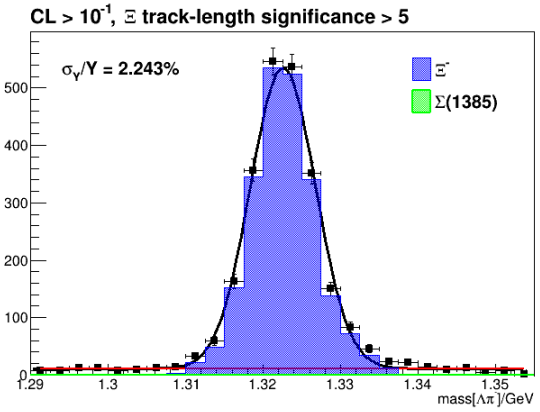

CL > 10-1, Ξ track-length significance > 1
σY/Y = 2.034%
Ξ-
Σ(1385)
mass[Λπ]/GeV

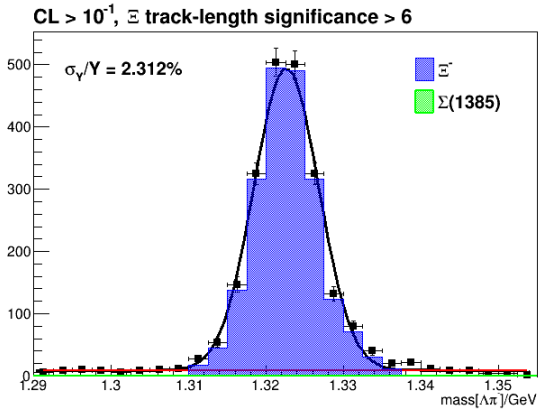

CL > 10-1, Ξ track-length significance > 2
σY/Y = 2.029%
Ξ-
Σ(1385)
mass[Λπ]/GeV

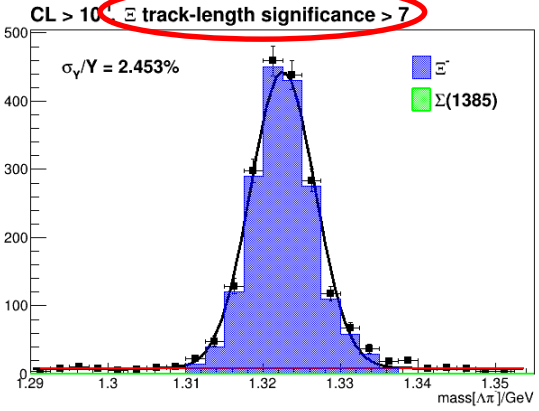
$CL > 10^{-1}$

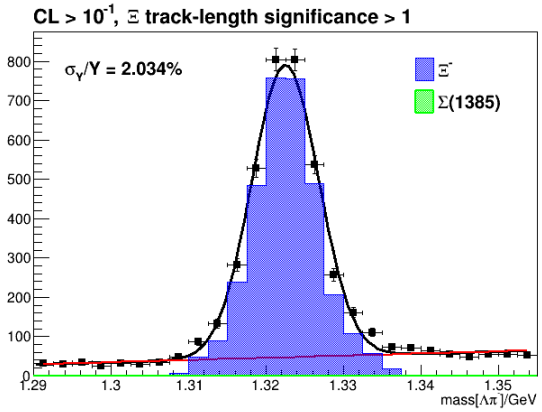

CL > 10-1, Ξ track-length significance > 3
σY/Y = 2.080%
Ξ-
Σ(1385)
mass[Λπ]/GeV

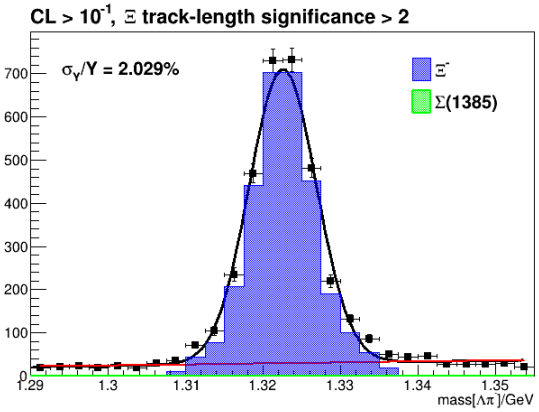

CL > 10-1, Ξ track-length significance > 4
σY/Y = 2.149%
Ξ-
Σ(1385)
mass[Λπ]/GeV


CL > 10-1, Ξ track-length significance > 5
σY/Y = 2.243%
Ξ-
Σ(1385)
mass[Λπ]/GeV

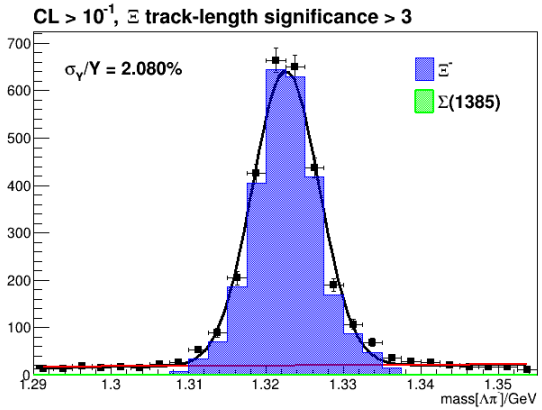

CL > 10-1, Ξ track-length significance > 6
σY/Y = 2.312%
Ξ-
Σ(1385)
mass[Λπ]/GeV

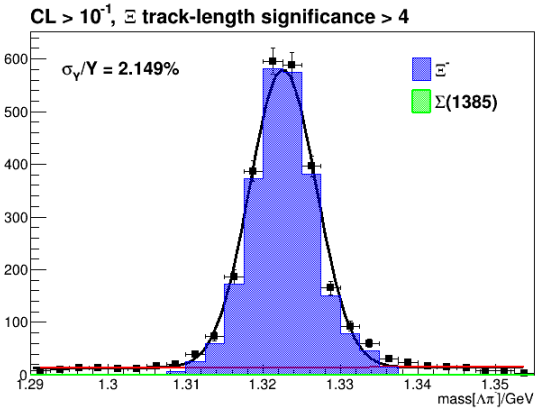

CL > 10-1, Ξ track-length significance > 7
σY/Y = 2.453%
Ξ-
Σ(1385)
mass[Λπ]/GeV

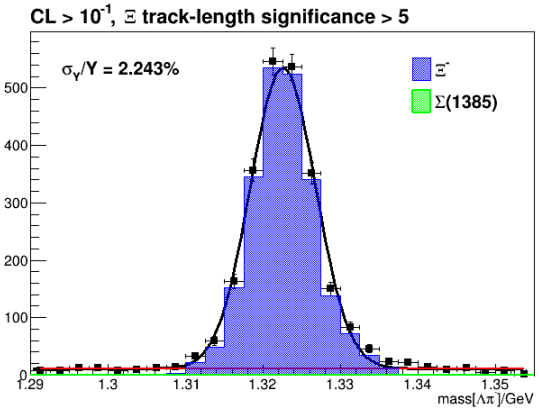

CL > 10-1, Ξ track-length significance > 1
σY/Y = 2.034%
Ξ-
Σ(1385)
mass[Λπ]/GeV

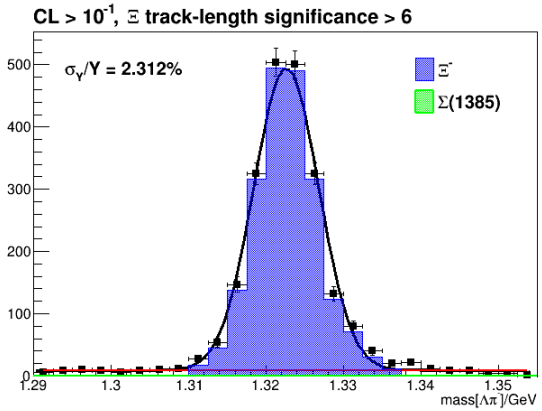

CL > 10-1, Ξ track-length significance > 2
σY/Y = 2.029%
Ξ-
Σ(1385)
mass[Λπ]/GeV

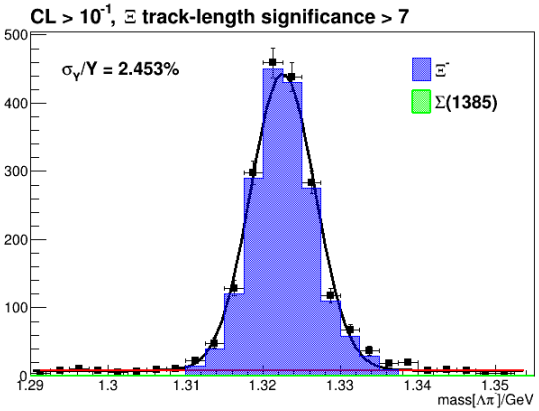
$CL > 10^{-1}$

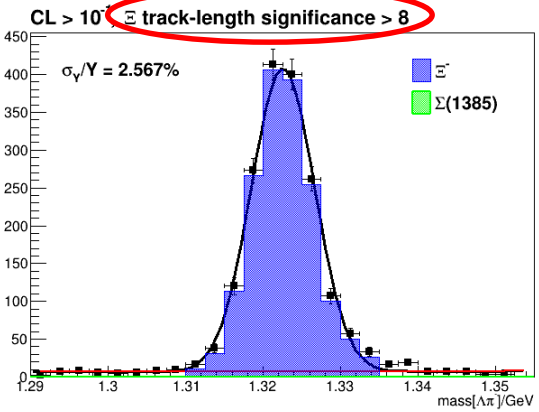

CL > 10-1, Ξ track-length significance > 3
σY/Y = 2.080%
Ξ-
Σ(1385)
mass[Λπ]/GeV

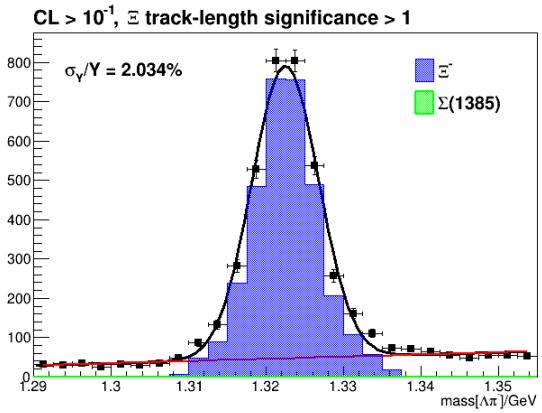

CL > 10-1, Ξ track-length significance > 4
σY/Y = 2.149%
Ξ-
Σ(1385)
mass[Λπ]/GeV

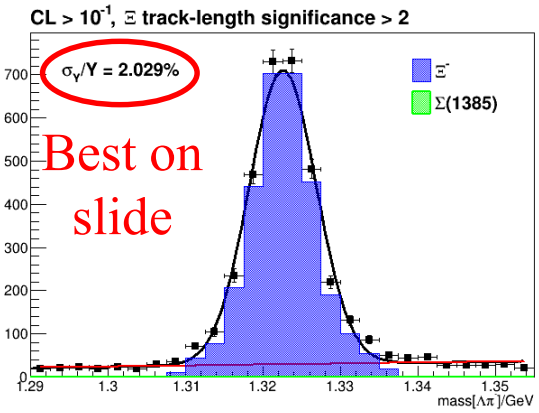

CL > 10-1, Ξ track-length significance > 5
σY/Y = 2.243%
Ξ-
Σ(1385)
mass[Λπ]/GeV


CL > 10-1, Ξ track-length significance > 6
σY/Y = 2.312%
Ξ-
Σ(1385)
mass[Λπ]/GeV

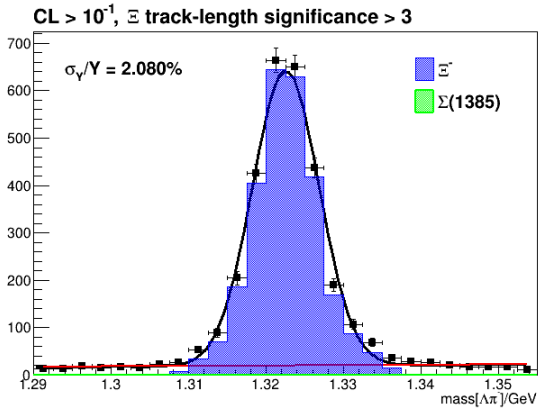

CL > 10-1, Ξ track-length significance > 7
σY/Y = 2.453%
Ξ-
Σ(1385)
mass[Λπ]/GeV

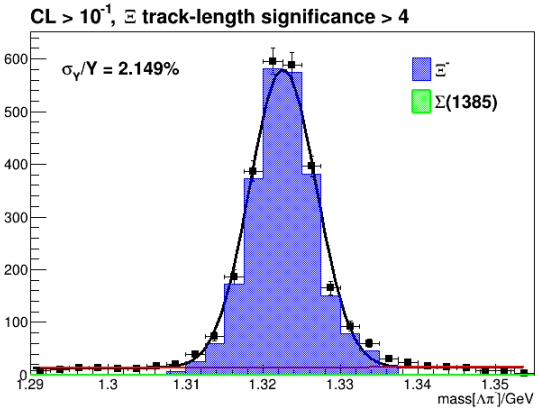

CL > 10-1, Ξ track-length significance > 8
σY/Y = 2.567%
Ξ-
Σ(1385)
mass[Λπ]/GeV

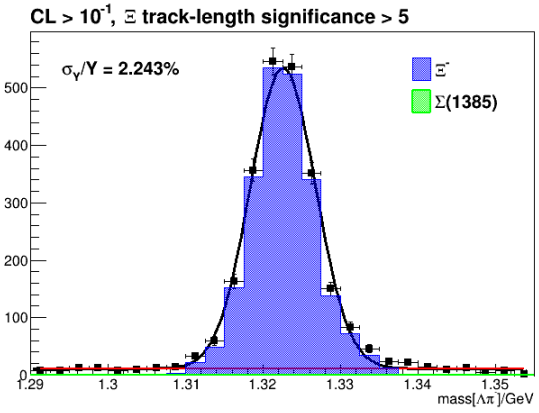

CL > 10-1, Ξ track-length significance > 1
σY/Y = 2.034%
Ξ-
Σ(1385)
mass[Λπ]/GeV

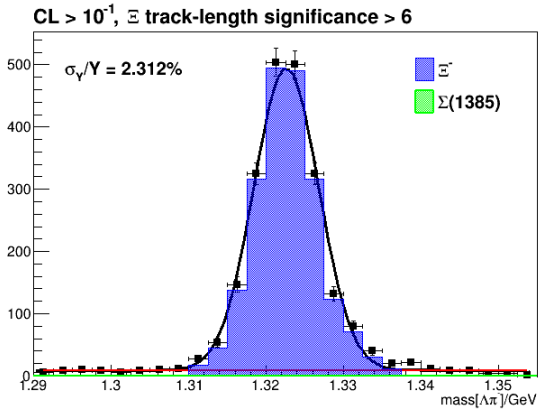

CL > 10-1, Ξ track-length significance > 2
σY/Y = 2.029%
Best on slide
Ξ-
Σ(1385)
mass[Λπ]/GeV

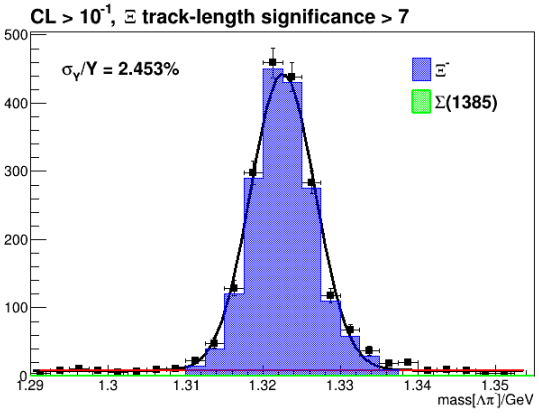
$CL > 10^{-1}$

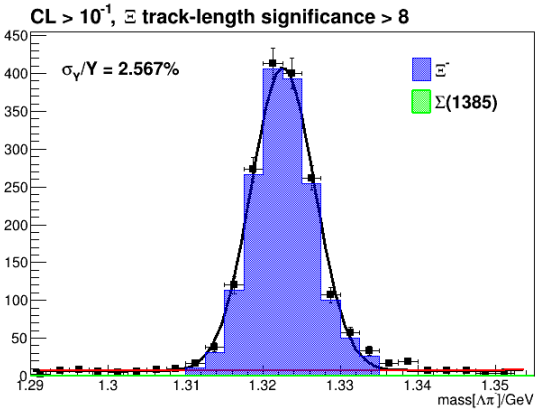

CL > 10-1, Ξ track-length significance > 3
σY/Y = 2.080%
Ξ-
Σ(1385)
mass[Λπ]/GeV

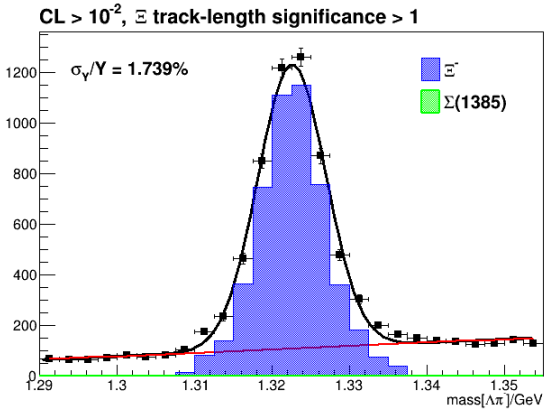

CL > 10-1, Ξ track-length significance > 4
σY/Y = 2.149%
Ξ-
Σ(1385)
mass[Λπ]/GeV

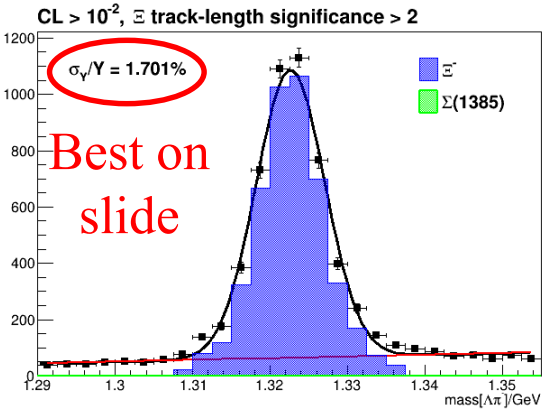

CL > 10-1, Ξ track-length significance > 5
σY/Y = 2.243%
Ξ-
Σ(1385)
mass[Λπ]/GeV


CL > 10-1, Ξ track-length significance > 6
σY/Y = 2.312%
Ξ-
Σ(1385)
mass[Λπ]/GeV

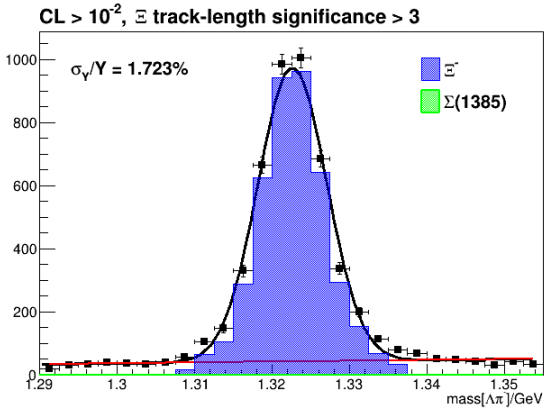

CL > 10-1, Ξ track-length significance > 7
σY/Y = 2.453%
Ξ-
Σ(1385)
mass[Λπ]/GeV

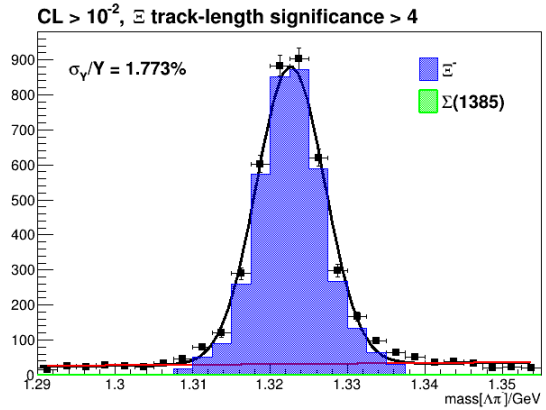

CL > 10-1, Ξ track-length significance > 8
σY/Y = 2.567%
Ξ-
Σ(1385)
mass[Λπ]/GeV

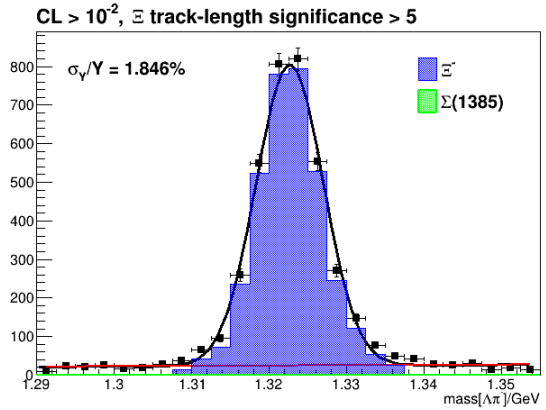

CL > 10-2, Ξ track-length significance > 1
σY/Y = 1.739%
Ξ-
Σ(1385)
mass[Λπ]/GeV

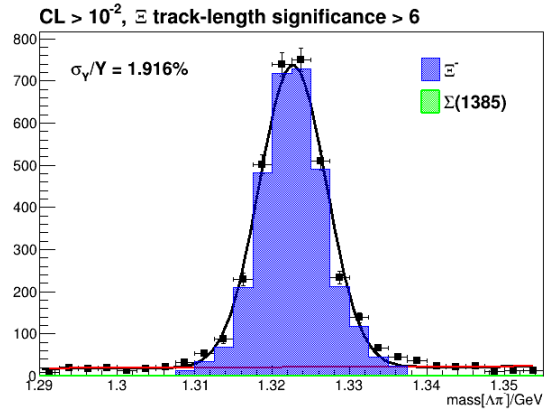

CL > 10-2, Ξ track-length significance > 2
σY/Y = 1.701%
Best on slide
Ξ-
Σ(1385)
mass[Λπ]/GeV

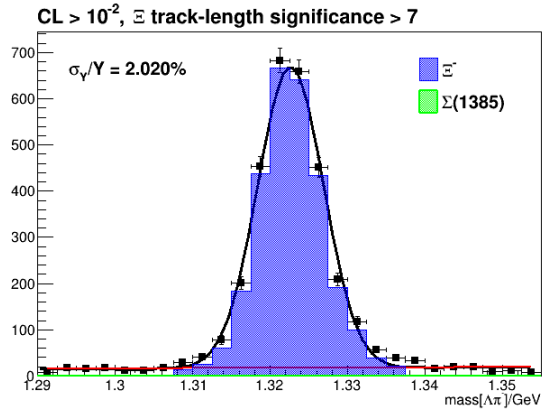
$CL > 10^{-2}$

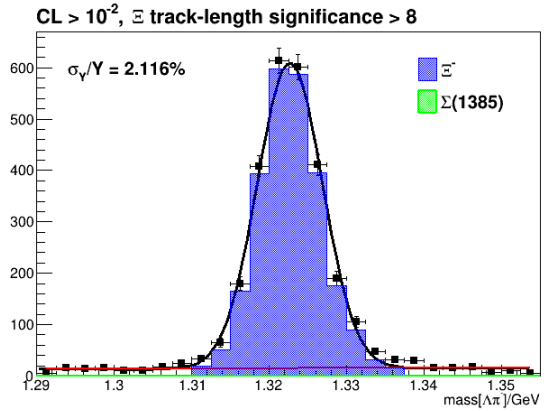

CL > 10-2, Ξ track-length significance > 3
σY/Y = 1.723%
Ξ-
Σ(1385)
mass[Λπ]/GeV

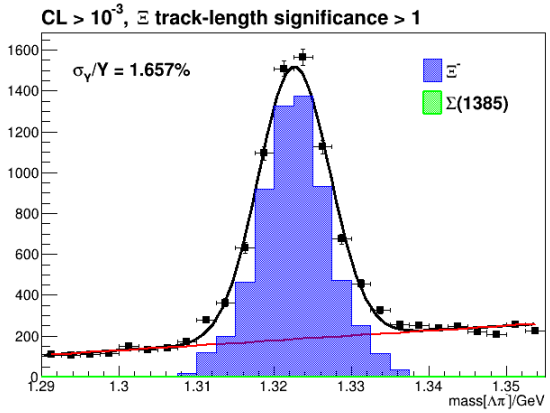

CL > 10-2, Ξ track-length significance > 4
σY/Y = 1.773%
Ξ-
Σ(1385)
mass[Λπ]/GeV

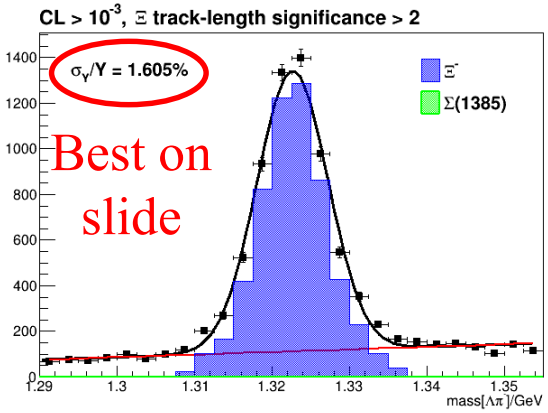

CL > 10-2, Ξ track-length significance > 5
σY/Y = 1.846%
Ξ-
Σ(1385)
mass[Λπ]/GeV


CL > 10-2, Ξ track-length significance > 6
σY/Y = 1.916%
Ξ-
Σ(1385)
mass[Λπ]/GeV

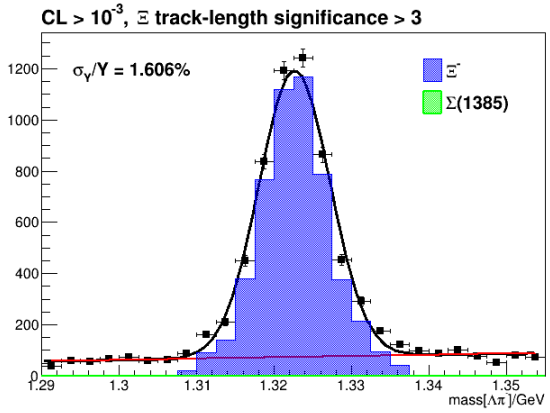

CL > 10-2, Ξ track-length significance > 7
σY/Y = 2.020%
Ξ-
Σ(1385)
mass[Λπ]/GeV

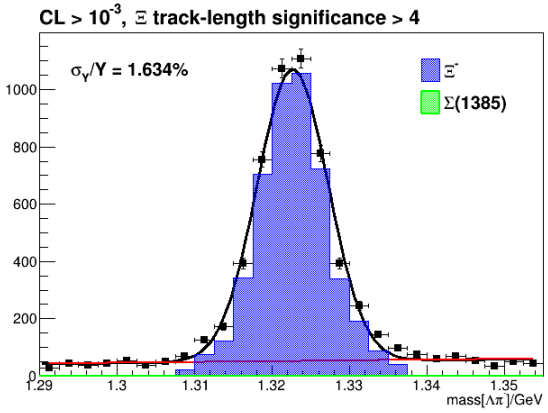

CL > 10-2, Ξ track-length significance > 8
σY/Y = 2.116%
Ξ-
Σ(1385)
mass[Λπ]/GeV

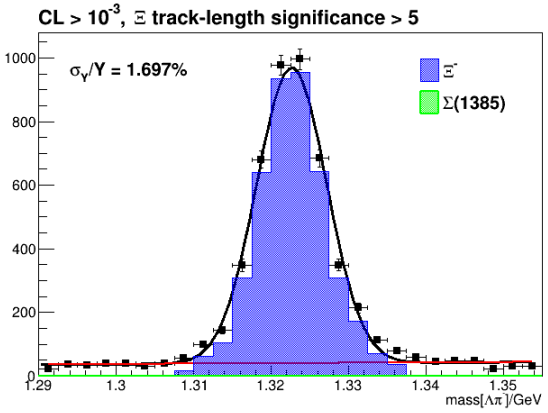

CL > 10-3, Ξ track-length significance > 1
σY/Y = 1.657%
Ξ-
Σ(1385)
mass[Λπ]/GeV

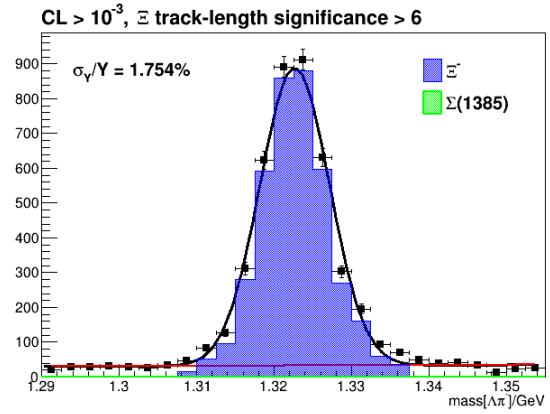

CL > 10-3, Ξ track-length significance > 2
σY/Y = 1.605%
Best on slide
Ξ-
Σ(1385)
mass[Λπ]/GeV

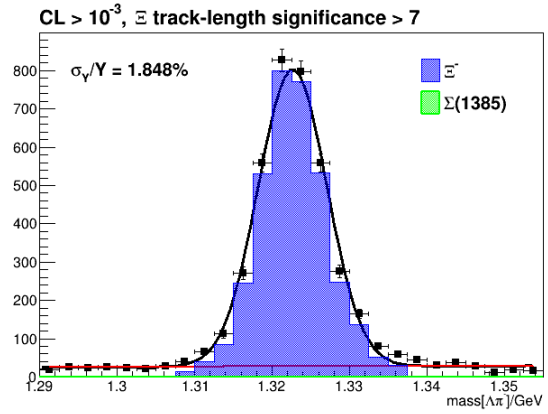
$CL > 10^{-3}$

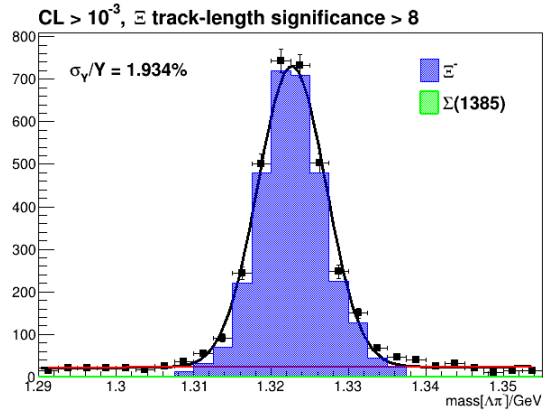

CL > 10-3, Ξ track-length significance > 3
σY/Y = 1.606%
Ξ-
Σ(1385)
mass[Λπ]/GeV

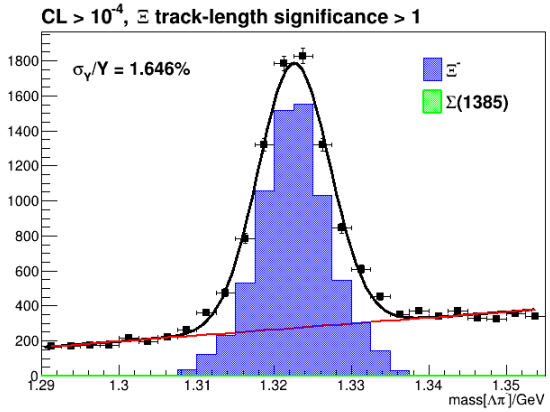

CL > 10-3, Ξ track-length significance > 4
σY/Y = 1.634%
Ξ-
Σ(1385)
mass[Λπ]/GeV

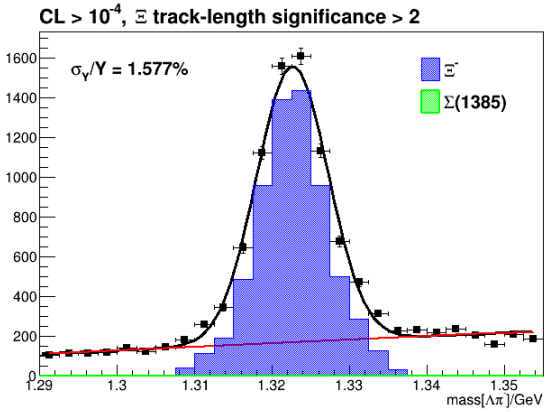

CL > 10-3, Ξ track-length significance > 5
σY/Y = 1.697%
Ξ-
Σ(1385)
mass[Λπ]/GeV


CL > 10-3, Ξ track-length significance > 6
σY/Y = 1.754%
Ξ-
Σ(1385)
mass[Λπ]/GeV

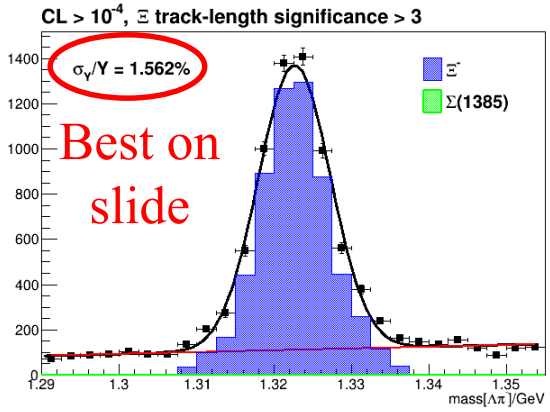

CL > 10-3, Ξ track-length significance > 7
σY/Y = 1.848%
Ξ-
Σ(1385)
mass[Λπ]/GeV


CL > 10-3, Ξ track-length significance > 8
σY/Y = 1.934%
Ξ-
Σ(1385)
mass[Λπ]/GeV

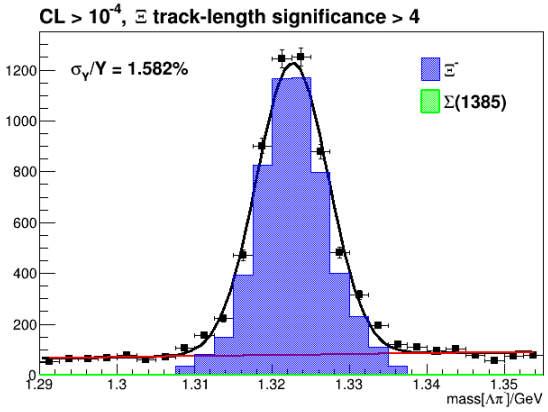


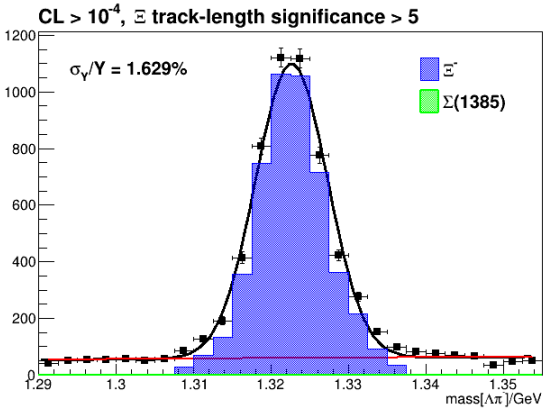


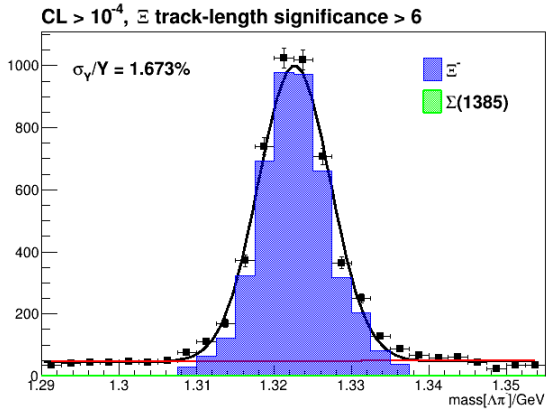
$CL > 10^{-4}$

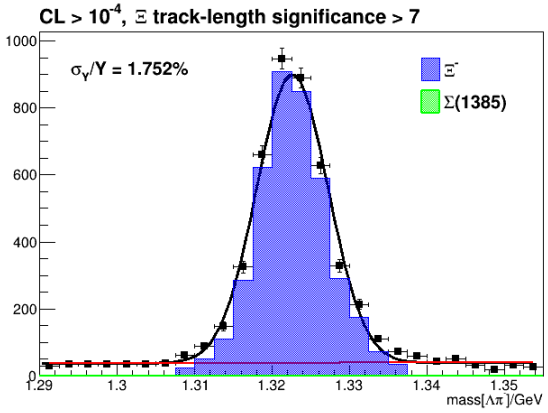


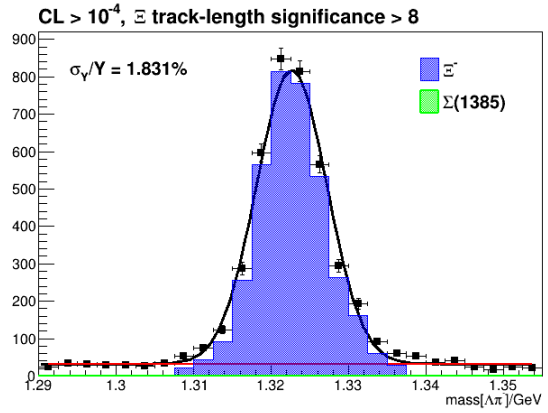
Best on slide

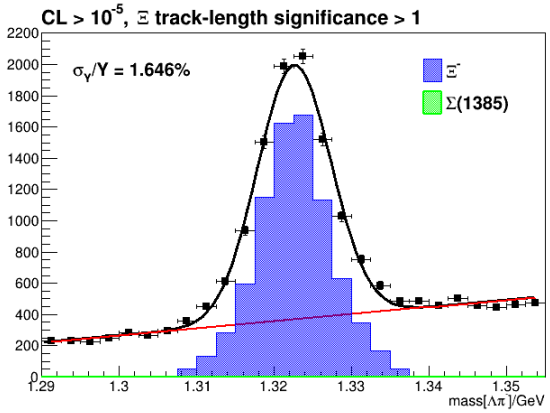


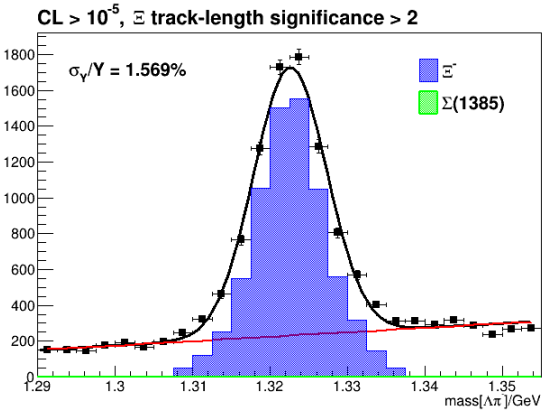




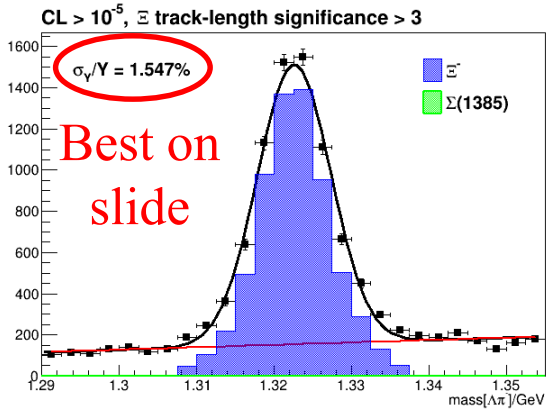




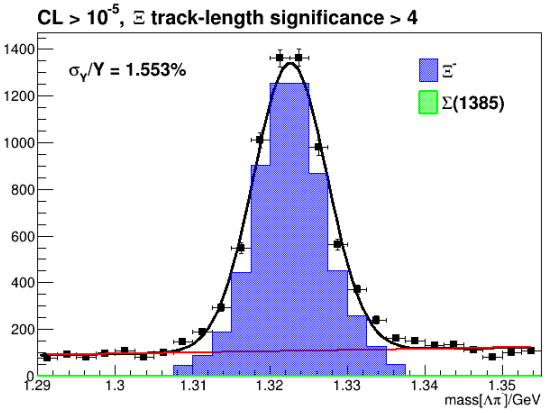


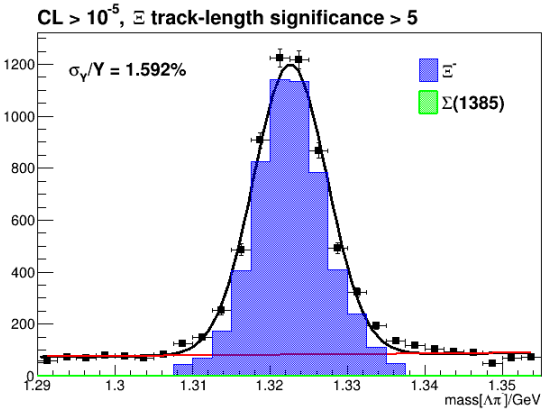


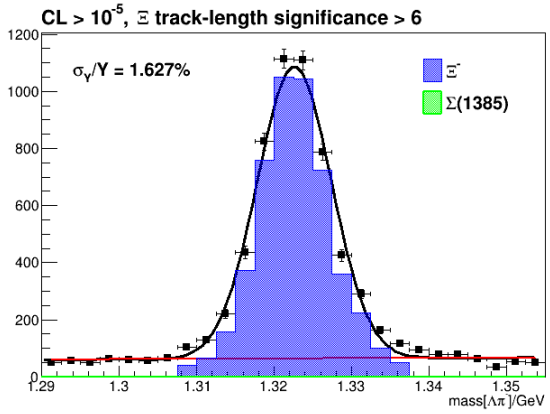
$CL > 10^{-5}$

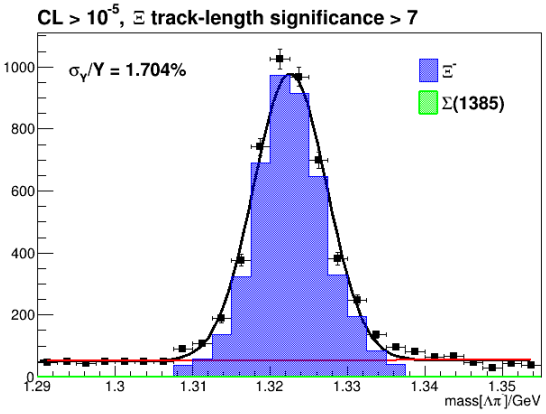


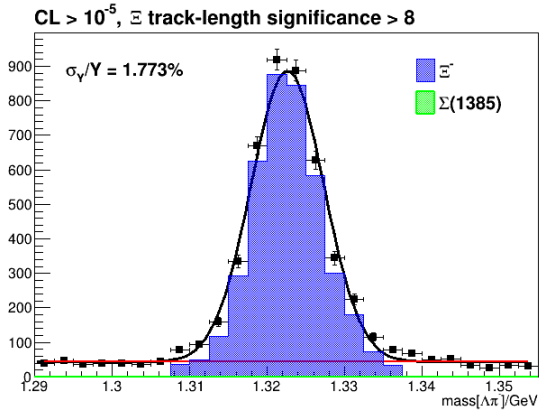
Best on slide

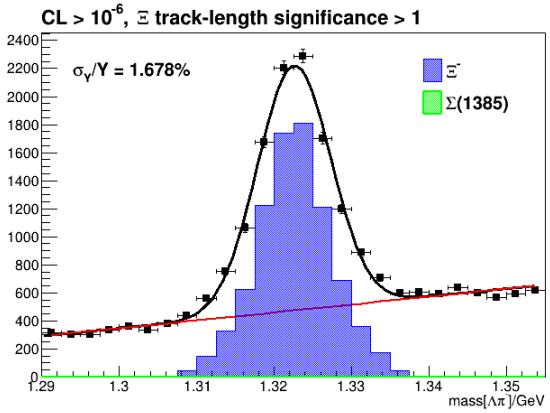


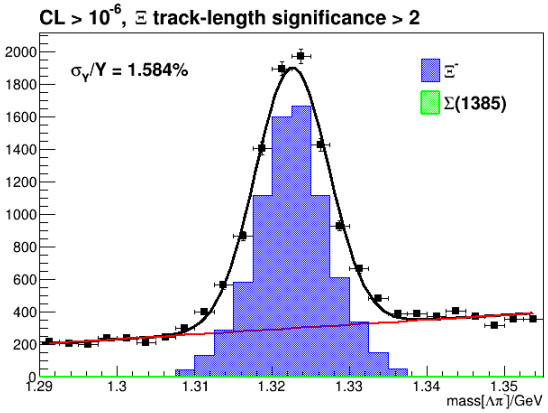




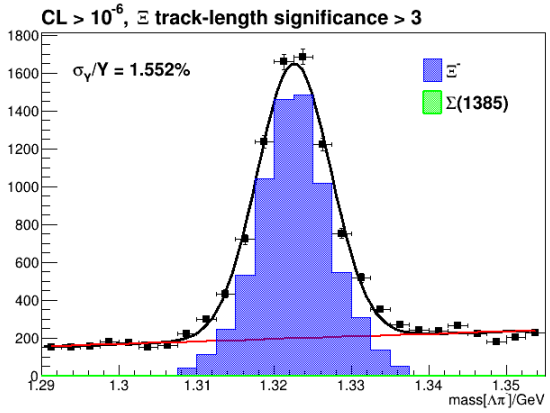


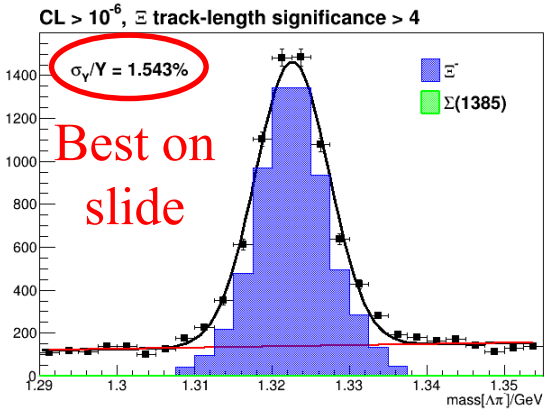


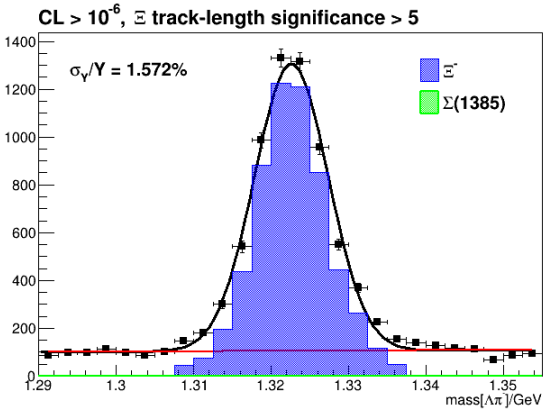

CL > 10^-6, Ξ track-length significance > 1
σ_Y/Y = 1.678%
Ξ⁻
Σ(1385)
mass[Λπ]/GeV

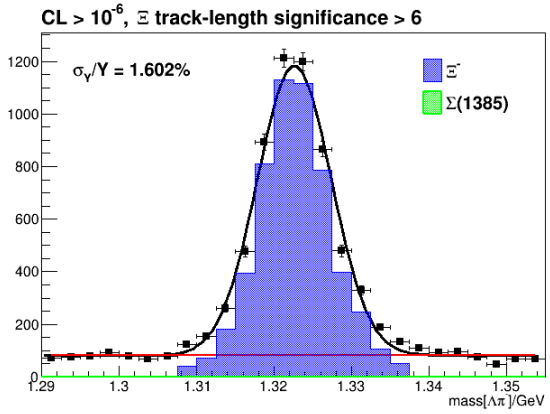

CL > 10^-6, Ξ track-length significance > 2
σ_Y/Y = 1.584%
Ξ⁻
Σ(1385)
mass[Λπ]/GeV

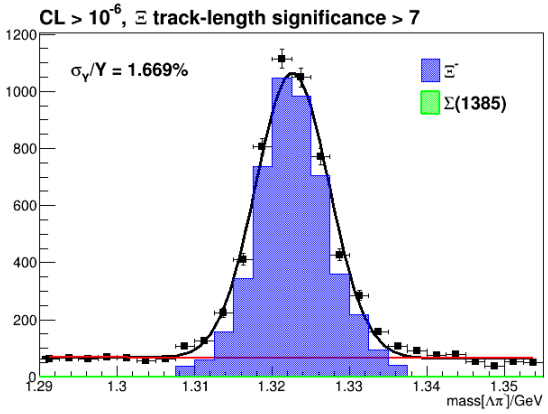
$CL > 10^{-6}$

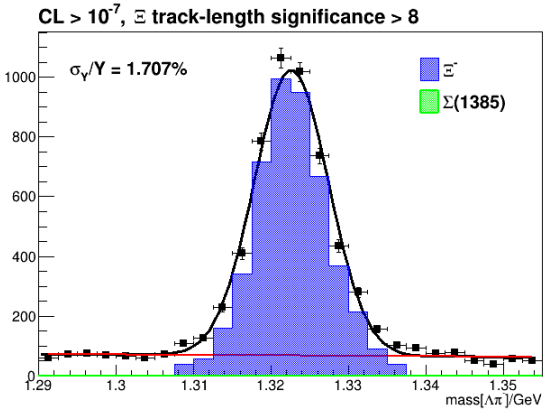

CL > 10^-6, Ξ track-length significance > 3
σ_Y/Y = 1.552%
Ξ⁻
Σ(1385)
mass[Λπ]/GeV

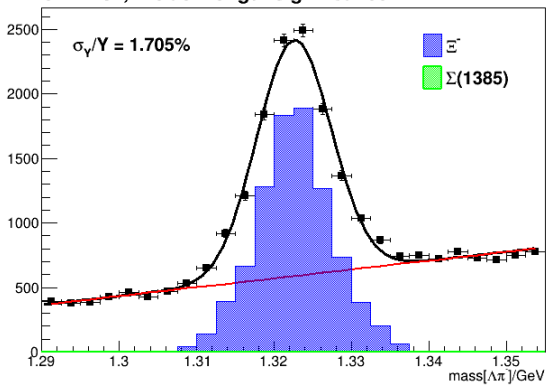

CL > 10^-6, Ξ track-length significance > 4
σ_Y/Y = 1.543%
Best on slide
Ξ⁻
Σ(1385)
mass[Λπ]/GeV

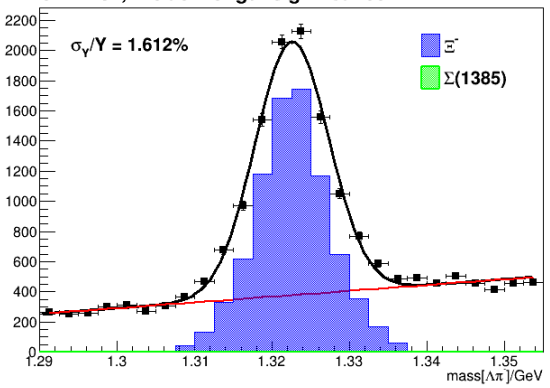

CL > 10^-6, Ξ track-length significance > 5
σ_Y/Y = 1.572%
Ξ⁻
Σ(1385)
mass[Λπ]/GeV


CL > 10^-6, Ξ track-length significance > 6
σ_Y/Y = 1.602%
Ξ⁻
Σ(1385)
mass[Λπ]/GeV

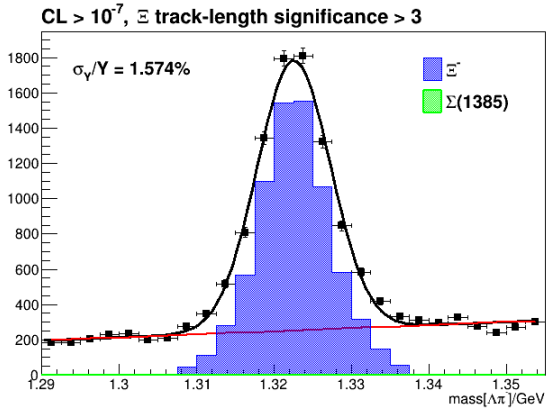

CL > 10^-6, Ξ track-length significance > 7
σ_Y/Y = 1.669%
Ξ⁻
Σ(1385)
mass[Λπ]/GeV

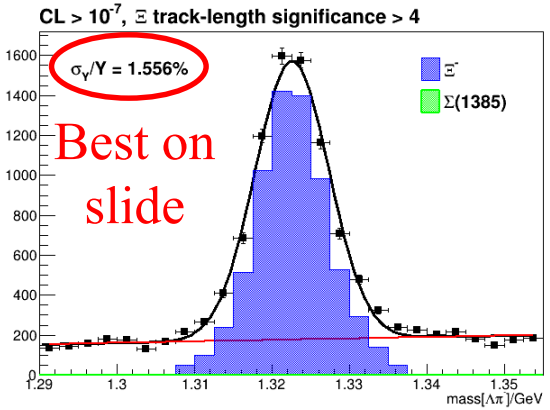

CL > 10^-7, Ξ track-length significance > 8
σ_Y/Y = 1.707%
Ξ⁻
Σ(1385)
mass[Λπ]/GeV



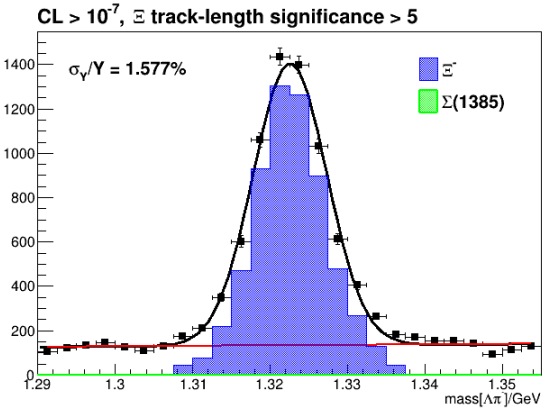


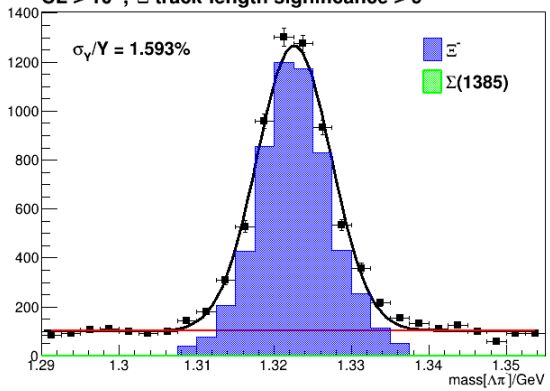
$CL > 10^{-7}$

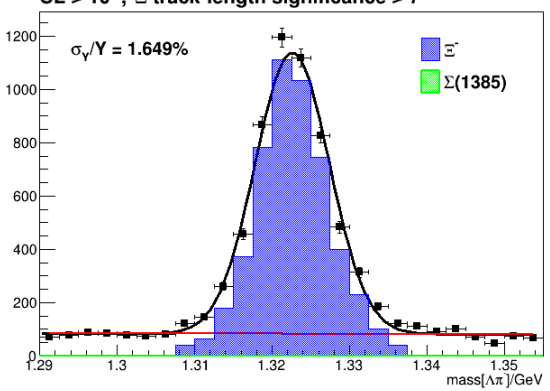


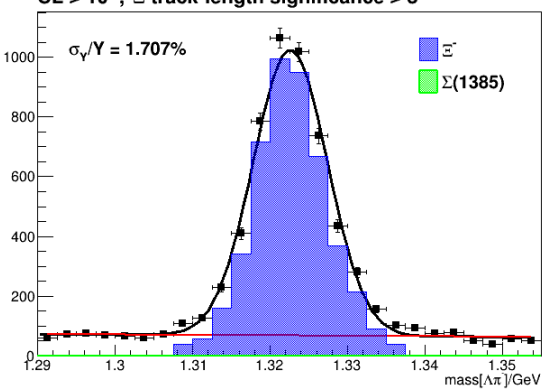


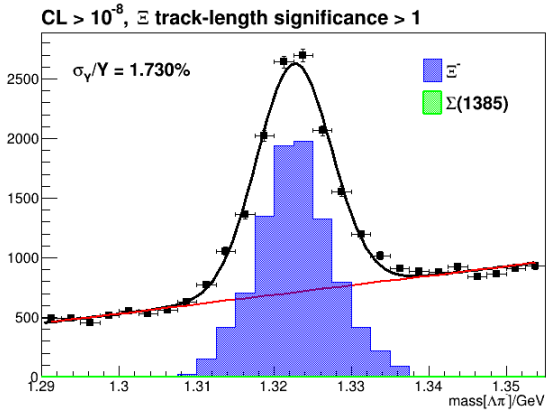
Best on slide

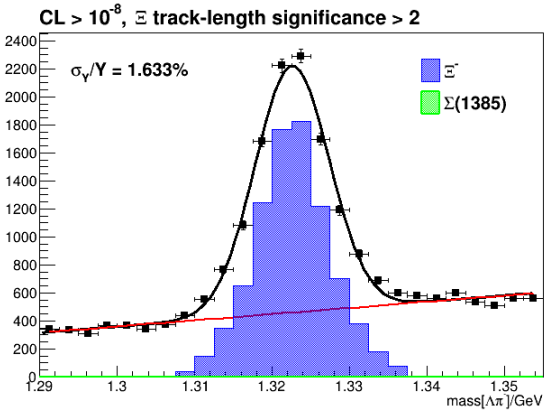




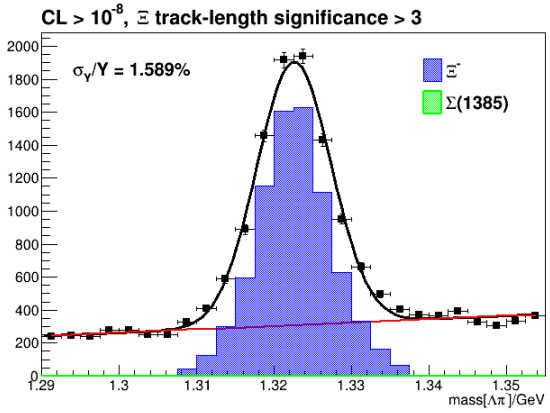


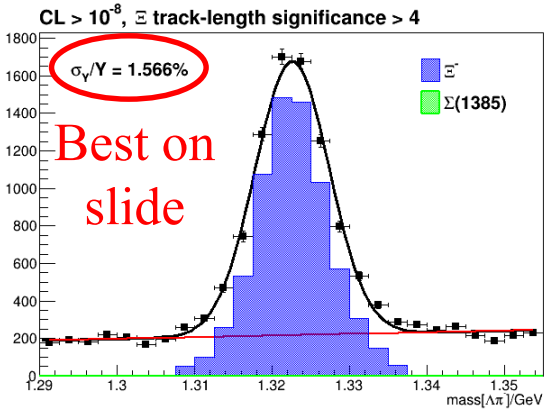


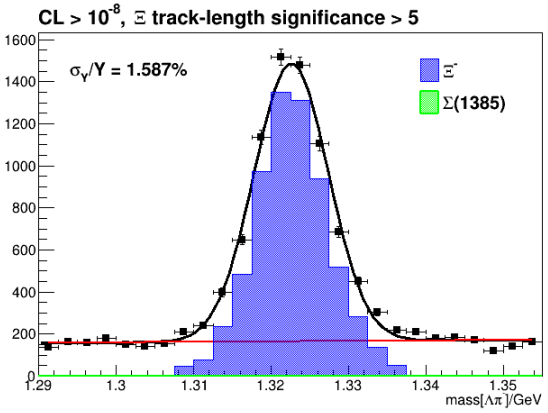

CL > 10^-8, Ξ track-length significance > 1
σ_Y/Y = 1.730%
Ξ⁻
Σ(1385)
mass[Λπ]/GeV

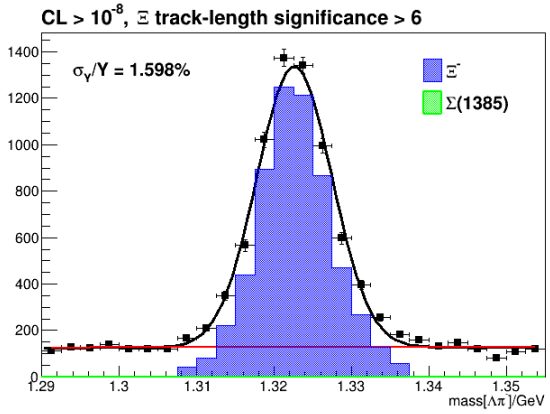

CL > 10^-8, Ξ track-length significance > 2
σ_Y/Y = 1.633%
Ξ⁻
Σ(1385)
mass[Λπ]/GeV

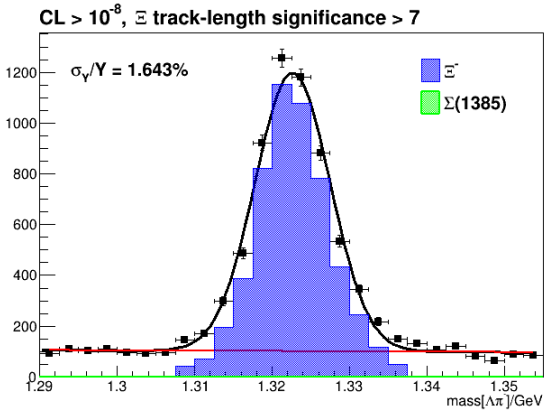
$CL > 10^{-8}$

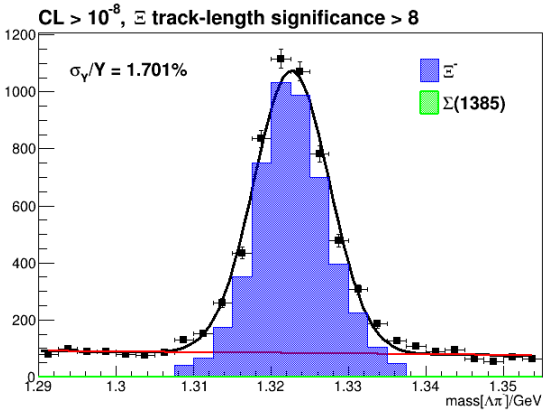

CL > 10^-8, Ξ track-length significance > 3
σ_Y/Y = 1.589%
Ξ⁻
Σ(1385)
mass[Λπ]/GeV


CL > 10^-8, Ξ track-length significance > 4
σ_Y/Y = 1.566%
Best on slide
Ξ⁻
Σ(1385)
mass[Λπ]/GeV

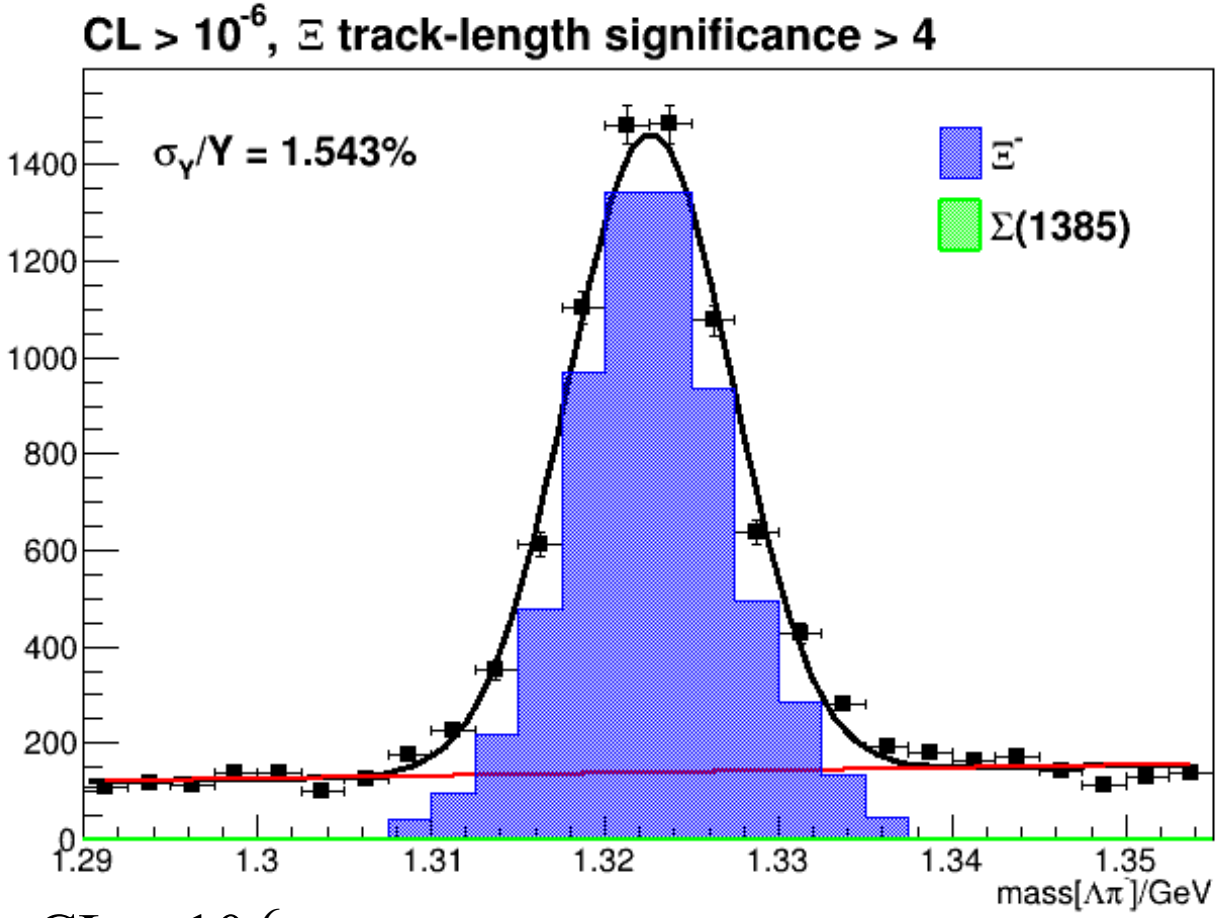

CL > 10^-8, Ξ track-length significance > 5
σ_Y/Y = 1.587%
Ξ⁻
Σ(1385)
mass[Λπ]/GeV


CL > 10^-8, Ξ track-length significance > 6
σ_Y/Y = 1.598%
Ξ⁻
Σ(1385)
mass[Λπ]/GeV


CL > 10^-8, Ξ track-length significance > 7
σ_Y/Y = 1.643%
Ξ⁻
Σ(1385)
mass[Λπ]/GeV


CL > 10^-8, Ξ track-length significance > 8
σ_Y/Y = 1.701%
Ξ⁻
Σ(1385)
mass[Λπ]/GeV

Overall best (lowest value of σ_Y/Y)



- CL > 10^{-6}
- Ξ track-length significance > 4

Monte Carlo

- Threw 3.4 million events (so far)
- Generated flat in mass[$\Xi^-\pi^0$] from 1.46 GeV to 1.75GeV

Monte Carlo

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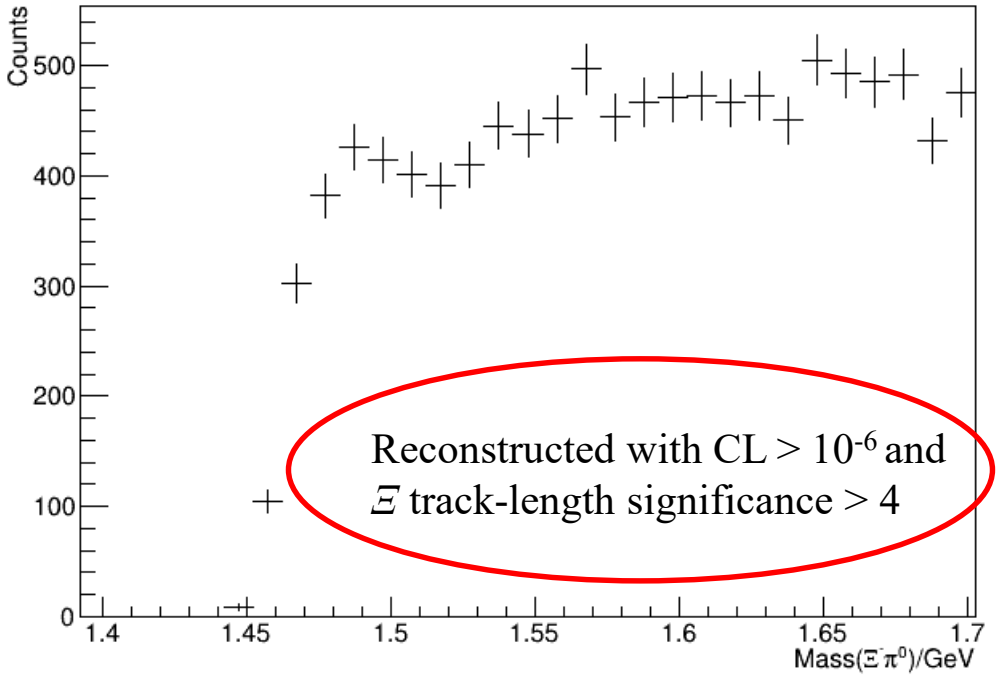
- Generated flat in mass[$\Xi^-\pi^0$] from 1.46 GeV to 1.75GeV



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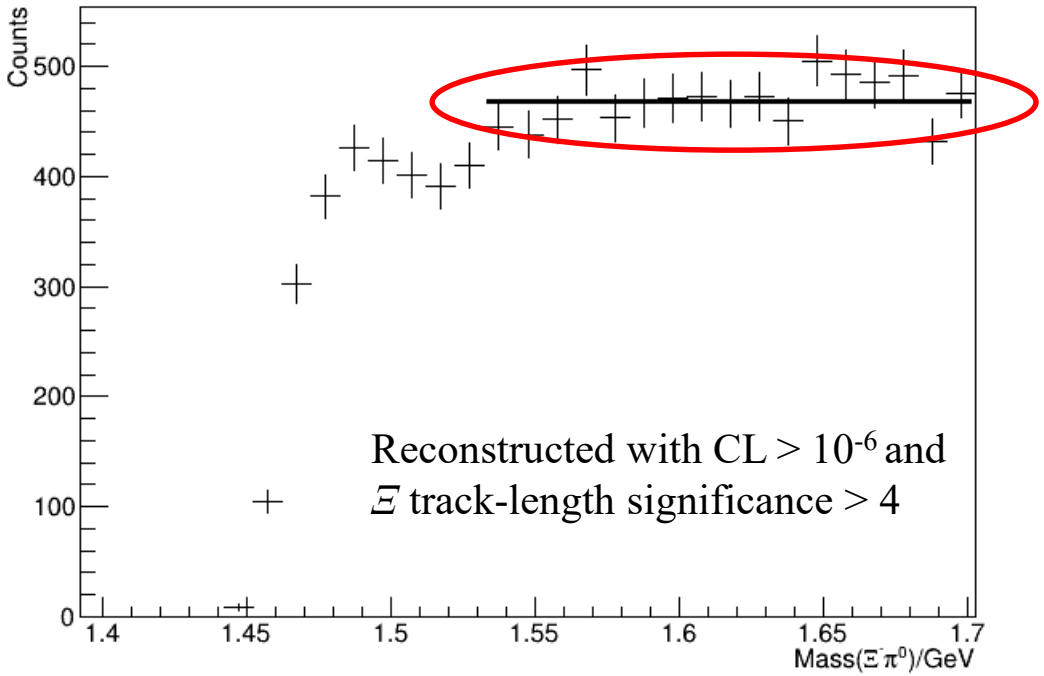

Fairly flat for mass > 1.54 GeV

Monte Carlo

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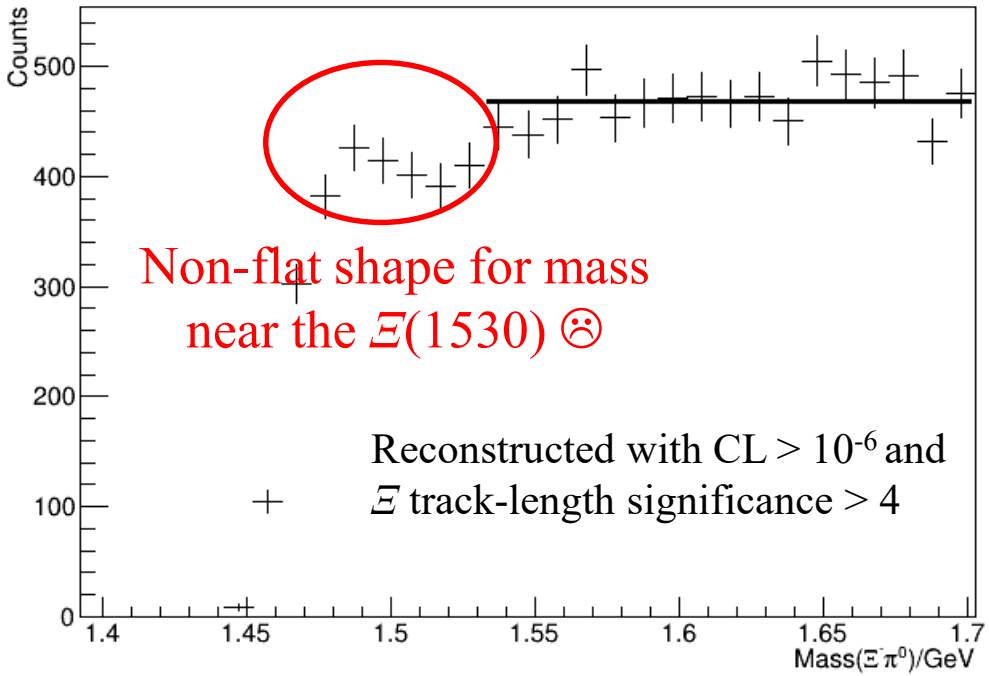
- Generated flat in mass[$\Xi^-\pi^0$] from 1.46 GeV to 1.75GeV



Monte Carlo

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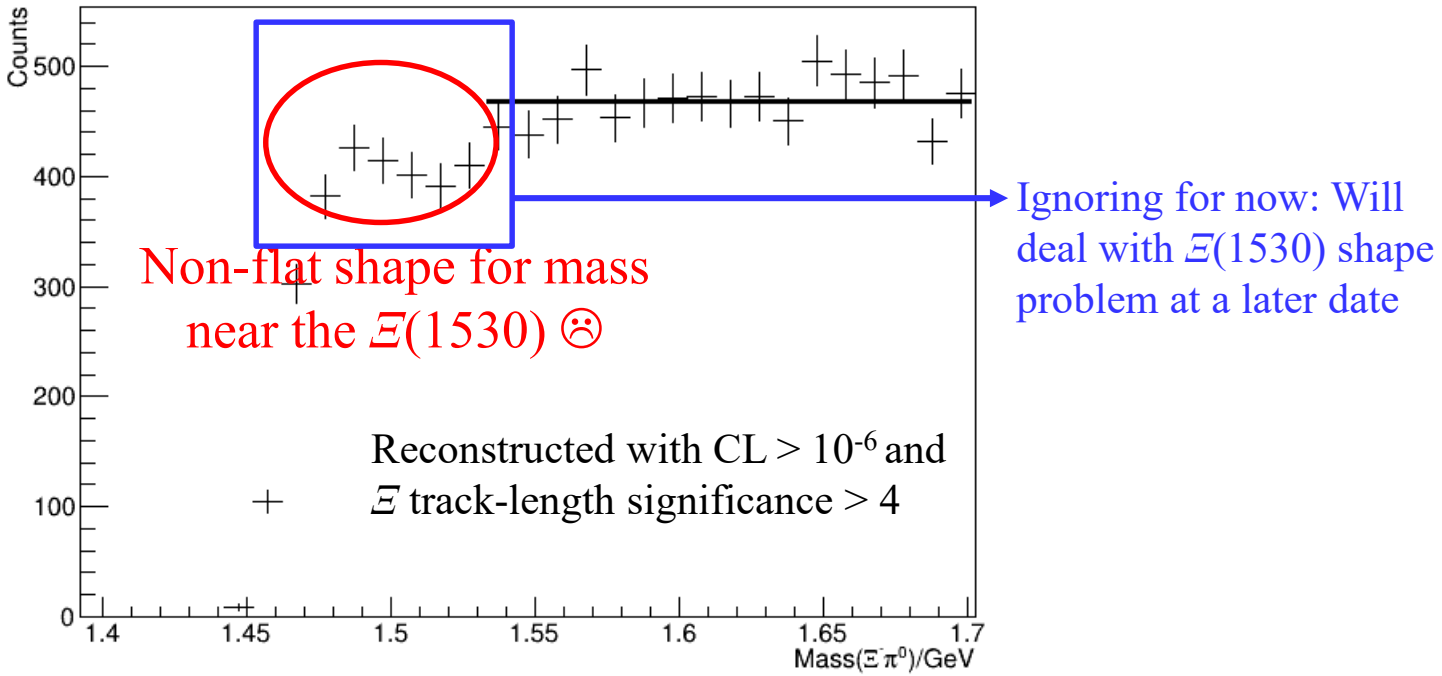

Monte Carlo: Resolution of mass[$\Xi^-\pi^0$]

- [Mass True – Mass Reconstructed] versus Mass True

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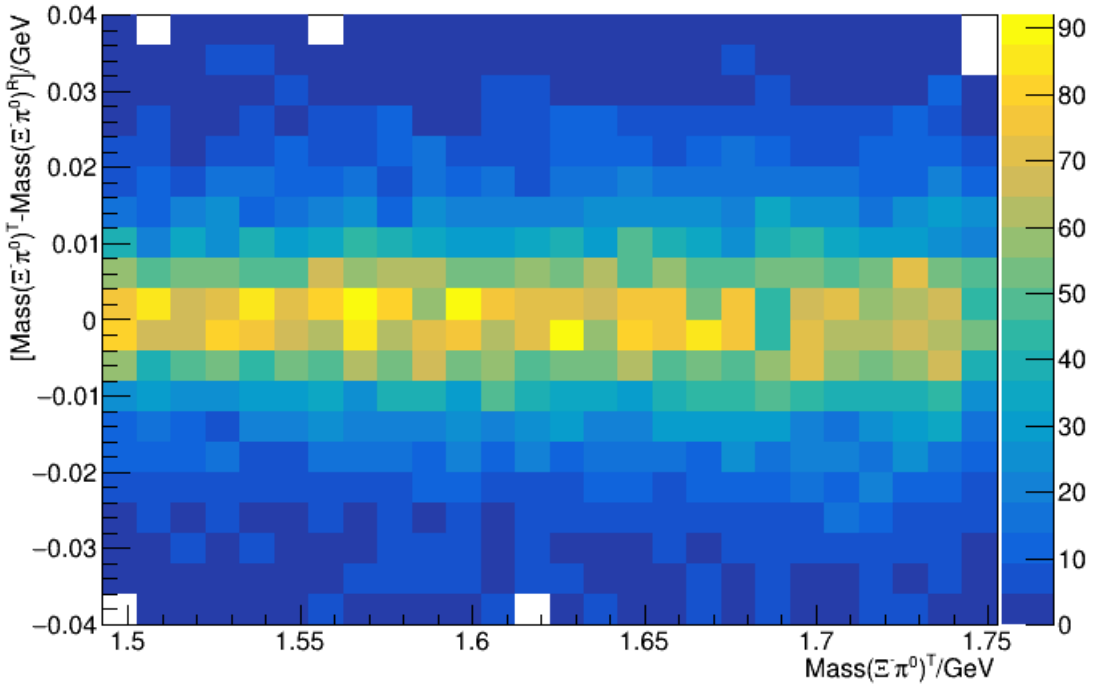
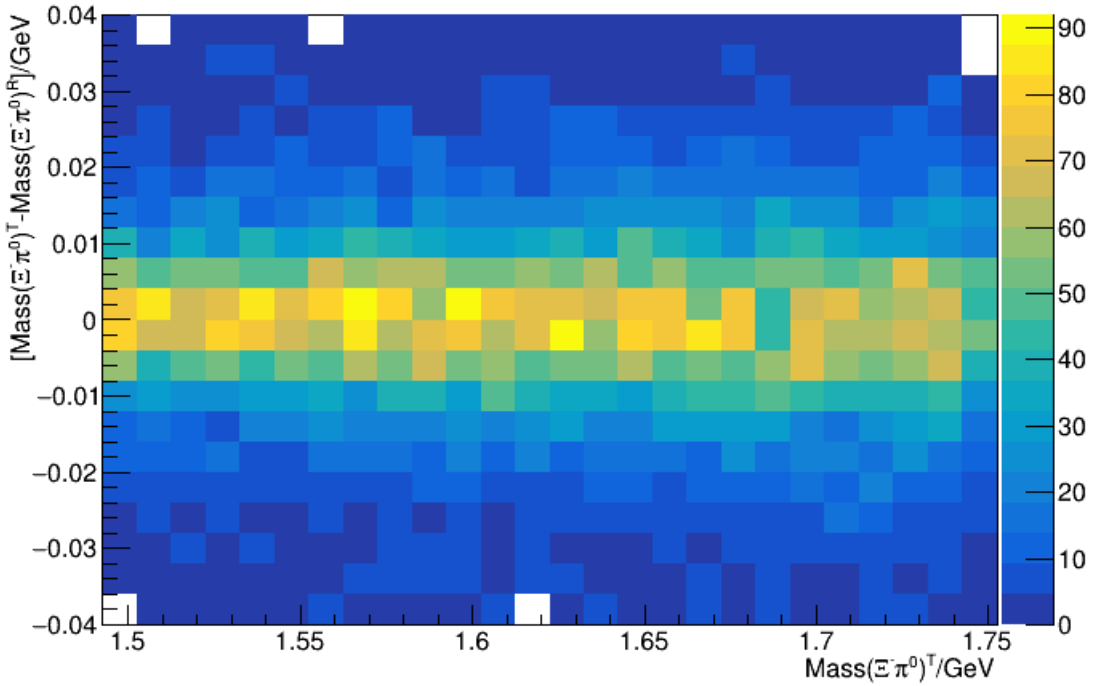
- [Mass True – Mass Reconstructed] versus Mass True

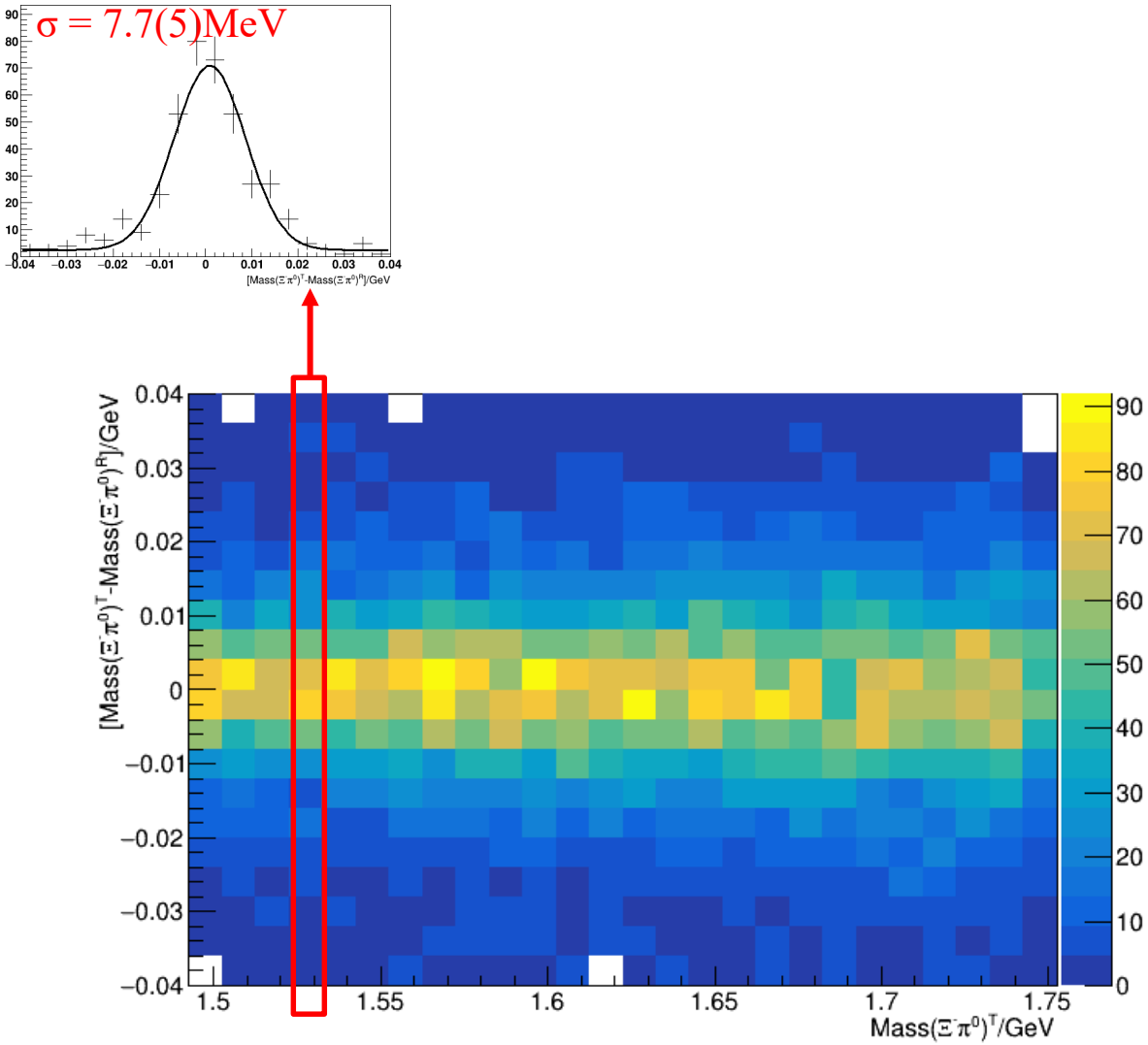


Monte Carlo: Resolution of mass[$\Xi^-\pi^0$]

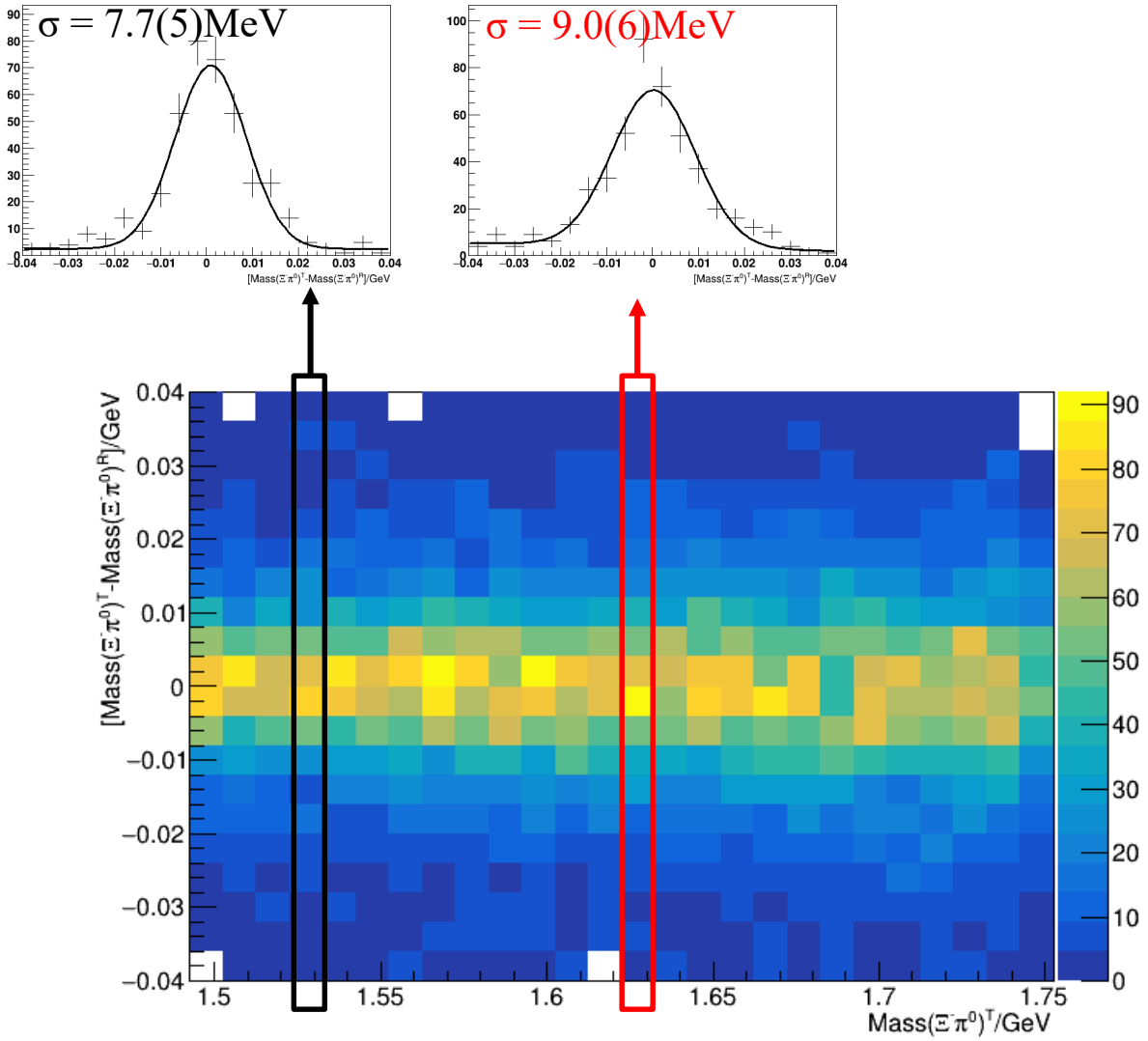
- [Mass True – Mass Reconstructed] versus Mass True
- Will zoom in on masses near the $\Xi(1530)$, $\Xi(1620)$ and $\Xi(1690)$



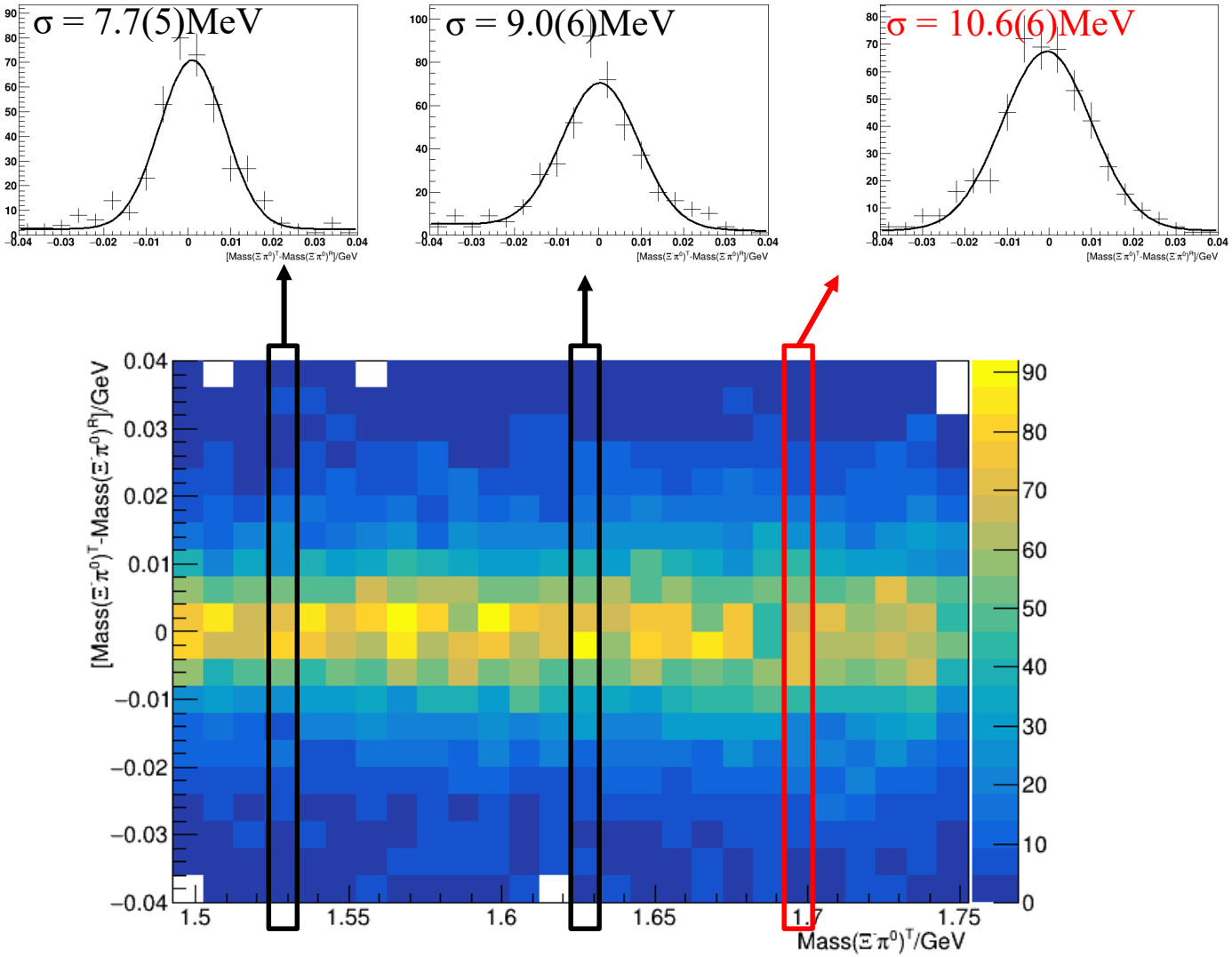
Monte Carlo: Resolution of mass[$\Xi^-\pi^0$]



Monte Carlo: Resolution of mass[$\Xi^-\pi^0$]



Monte Carlo: Resolution of mass[$\Xi^-\pi^0$]



Fits to $\Xi(1530)$, $\Xi(1620)$ and $\Xi(1690)$

The fit:

- Background: 2nd order polynomial multiplied by sigmoid

Fits to $\Xi(1530)$, $\Xi(1620)$ and $\Xi(1690)$

The fit:

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- Three Ξ^*, each represented by a Voight function with appropriate smearing parameter σ (as determined in prior slide)

Fits to $\Xi(1530)$, $\Xi(1620)$ and $\Xi(1690)$

The fit:

- Background: 2nd order polynomial multiplied by sigmoid
- Three Ξ^*, *e*ach represented by a Voight function with appropriate smearing parameter σ (as determined in prior slide)

Note on what will be shown:

- The $\Xi(1530)$ that will be shown have no serious issues

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Note on what will be shown:

- The $\Xi(1530)$ that will be shown have no serious issues

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Note on what will be shown:

- The $\Xi(1530)$ that will be shown have no serious issues
- The $\Xi(1620)$ that will be shown might be real (but might not ☹)
- The $\Xi(1690)$ that will be shown all have zero width and are probably a statistical fluctuation. The line shapes (**cyan**) will be entirely due to the resolution of the reconstructed mass($\Xi^-\pi^0$)

ASU

Fits to $\Xi(1530)$, $\Xi(1620)$ and $\Xi(1690)$

Cuts on GlueX data:

Fits to $\Xi(1530)$, $\Xi(1620)$ and $\Xi(1690)$

Cuts on GlueX data:

- Using best σ_Y/Y :
  - CL>10^{-6}
  - Ξ track-length significance > 4

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Cuts on GlueX data:

- Using best σ_Y/Y :
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- Ξ^- cut:
  - Kept event when
    1.30 < mass[$\Lambda\pi^-$]/GeV < 1.35

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- Ξ^- cut:
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    $1.30 < \text{mass}[\Lambda\pi^-]/\text{GeV} < 1.35$

- K^* cut:
  - Remove event when
    $0.85 < \text{mass}[K^+\pi^0]/\text{GeV} < 0.95$

Fits to $\Xi(1530)$, $\Xi(1620)$ and $\Xi(1690)$

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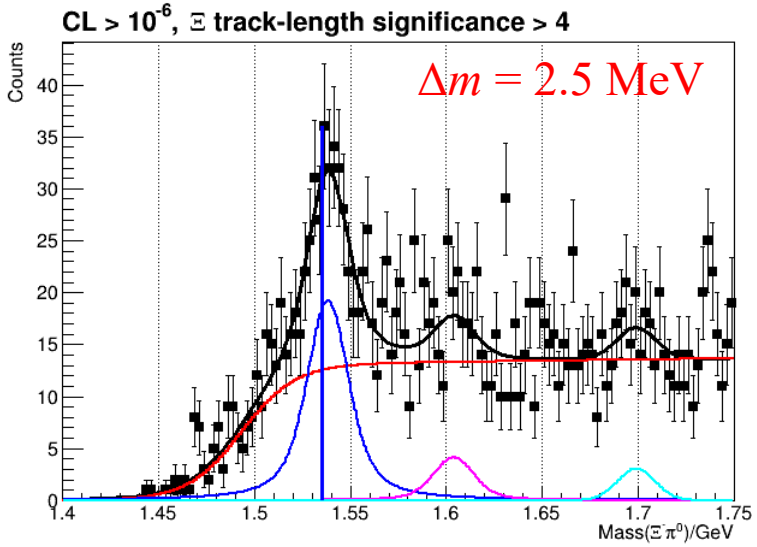
  - Remove event when
    $0.85 < \text{mass}[K^+\pi^0]/\text{GeV} < 0.95$

Other:

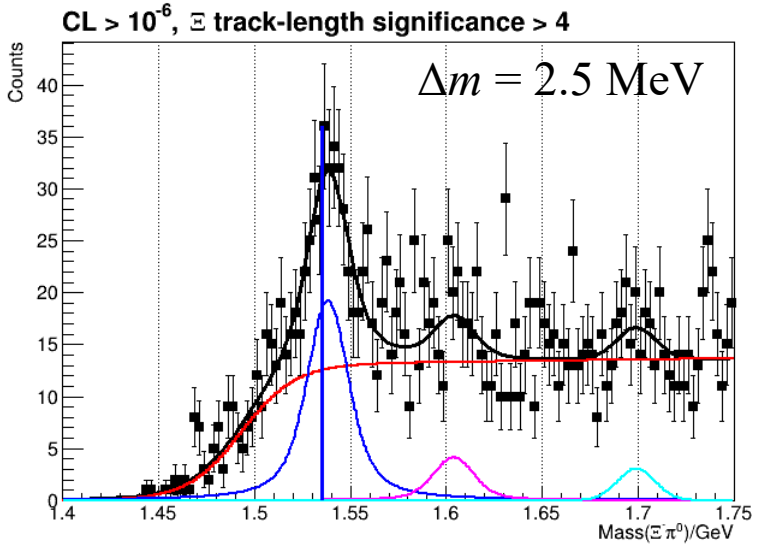
- Explored various mass binning

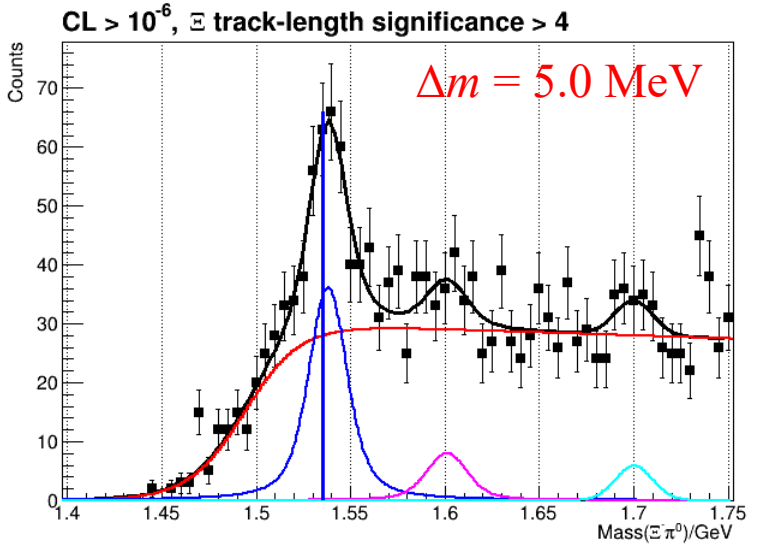
Mass binning

Mass binning

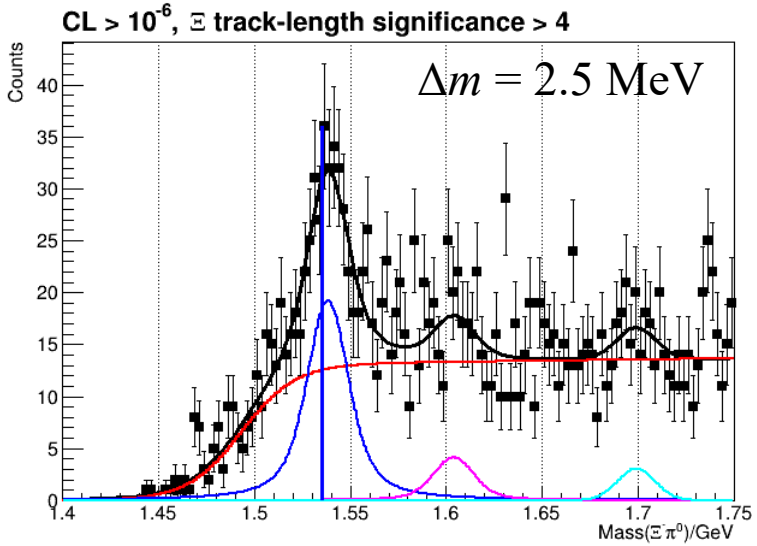


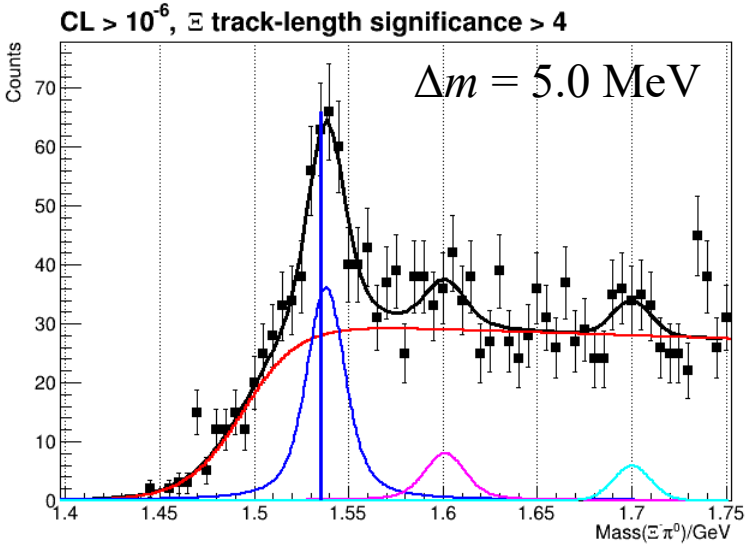
Mass binning

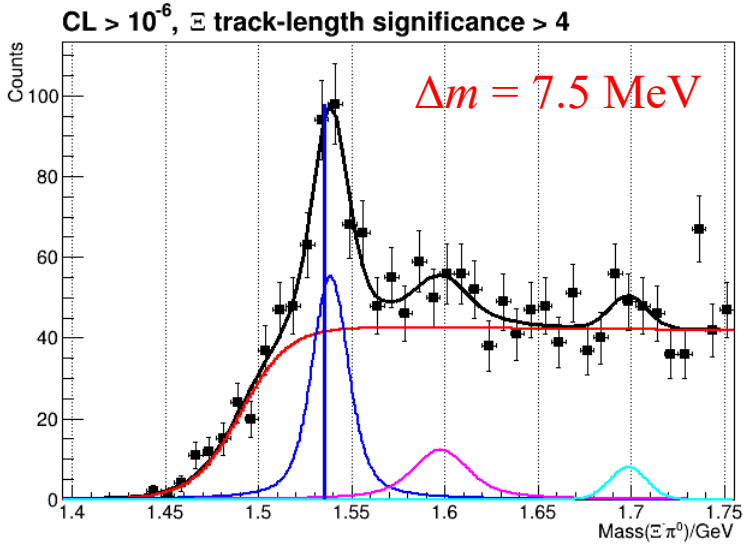




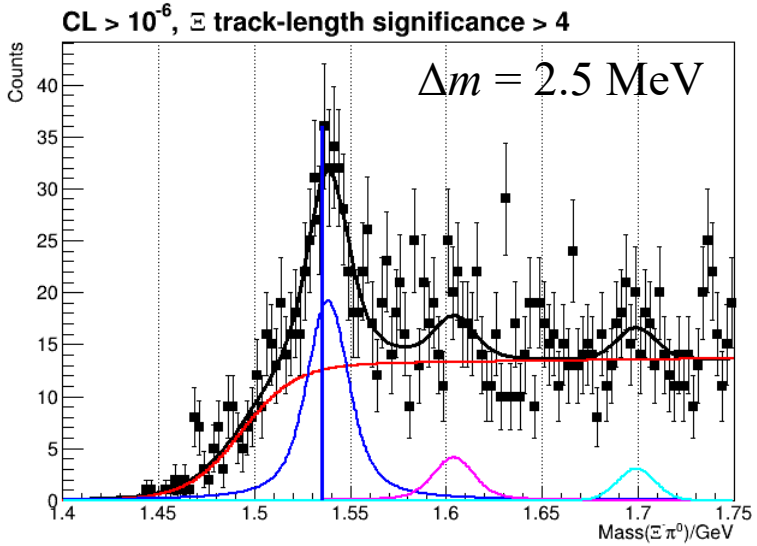
Mass binning

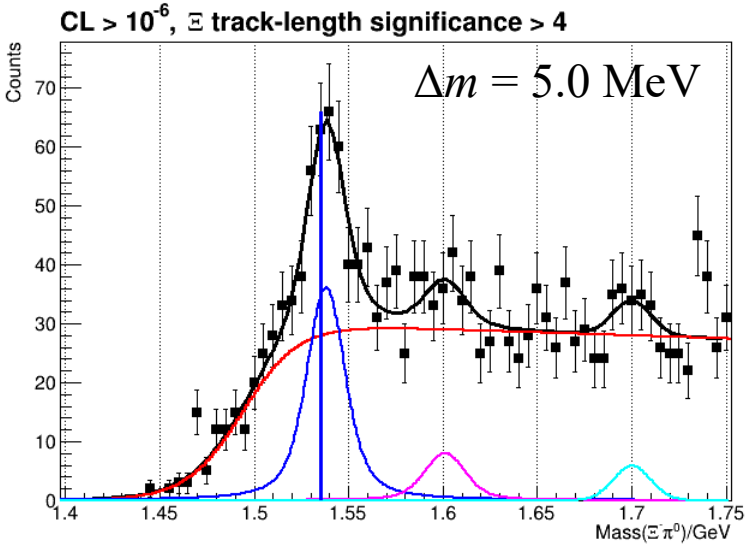


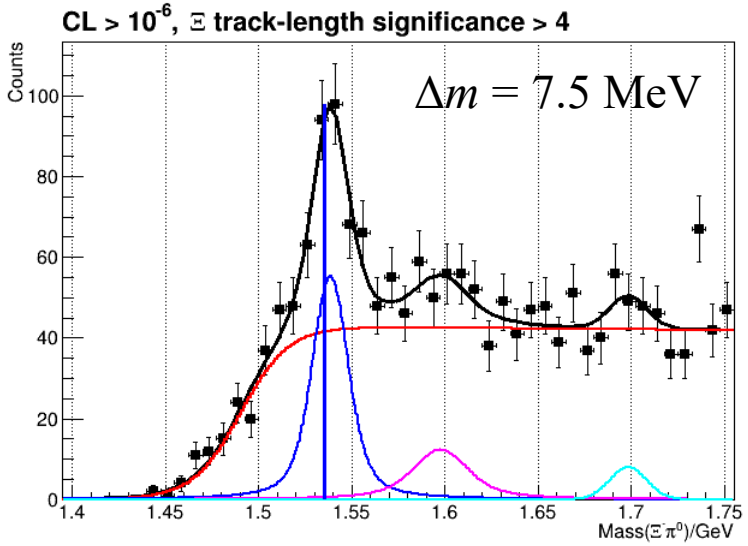


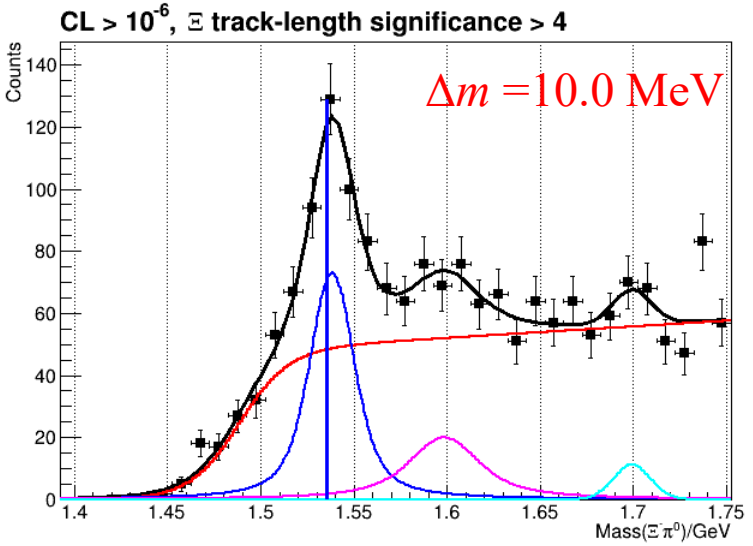


Mass binning





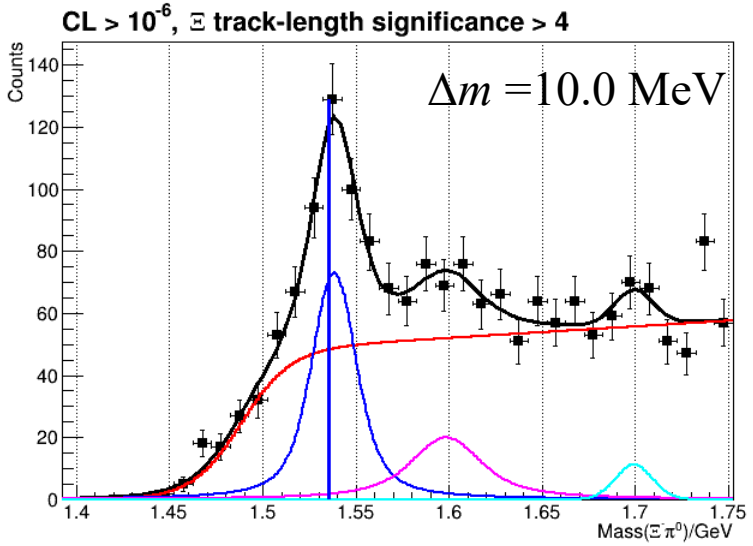




Fit results

$\Xi(1530)$:

- Center = 1538(2) MeV [PDG: 1535.2 +/- 0.8 MeV]
- Width = 16(10) MeV [PDG: $9.9^{+1.7}_{-1.9}$ MeV]



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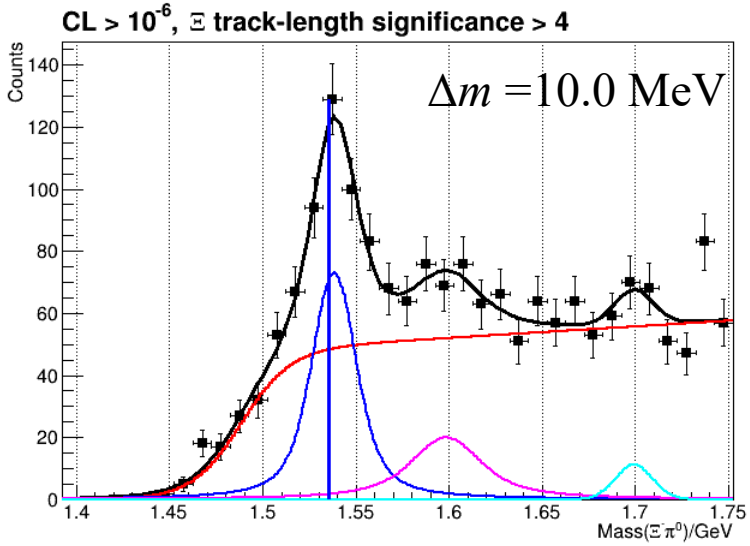
$\Xi(1620)$:

- Center = 1598(8) MeV
- Width = 34(37) MeV



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$\Xi(1620)$:

- Center = 1598(8) MeV
- Width = 34(37) MeV

$\Xi(1620)$ $I(J^P) = \frac{1}{2}(?^?)$ Status: **

J, *P* need confirmation.

OMITTED FROM SUMMARY TABLE

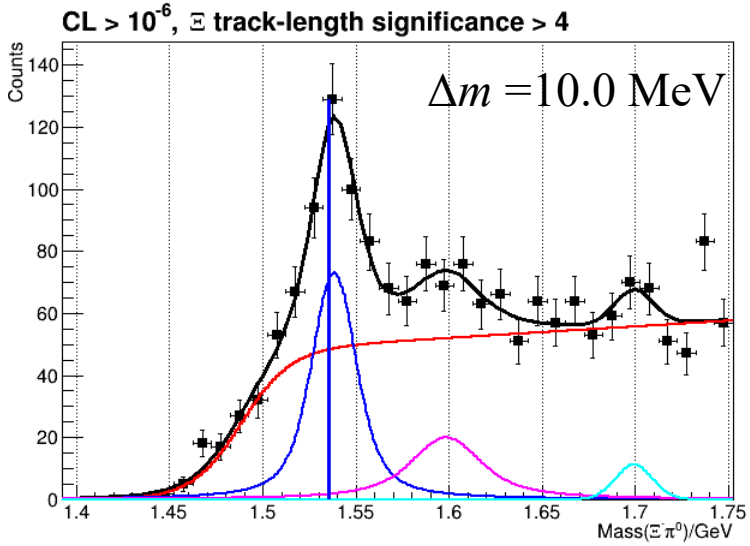
The clearest evidence is a peak in $\Xi^-\pi^+$ seen by SUMIHAMA 19. Older low-statistics experiments (e.g., BORENSTEIN 72 and HASSALL 81) have looked for the state but have not seen any effect.

$\Xi(1620)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
≈ 1620 OUR ESTIMATE					
$1610.4 \pm 6.0^{+6.1}_{-4.2}$		SUMIHAMA	19	BELL	$\Xi_c^+ \to \Xi(1620)\pi^+$
1624 ± 3	31	BRIEFEL	77	HBC	$K^- p$ 2.87 GeV/c
1633 ±12	34	DEBELLEFON	75B	HBC	$K^- p \to \Xi^- \overline{K}\pi$
1606 ± 6	29	ROSS	72	HBC	$K^- p$ 3.1–3.7 GeV/c

$\Xi(1620)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
32^{+8}_{-9} OUR AVERAGE		Error includes scale factor of 2.2. See the ideogram below.			
$59.9 \pm 4.8^{+2.8}_{-7.1}$		SUMIHAMA	19	BELL	$\Xi_c^+ \to \Xi(1620)\pi^+$
22.5± 7.5	31	[1] BRIEFEL	77	HBC	$K^- p$ 2.87 GeV/c
40 ±15	34	DEBELLEFON	75B	HBC	$K^- p \to \Xi^- \overline{K}\pi$
21 ± 7	29	ROSS	72	HBC	$K^- p \to \Xi^- \pi^+ K^{*0}(892)$



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- Center = 1598(8) MeV
- Width = 34(37) MeV

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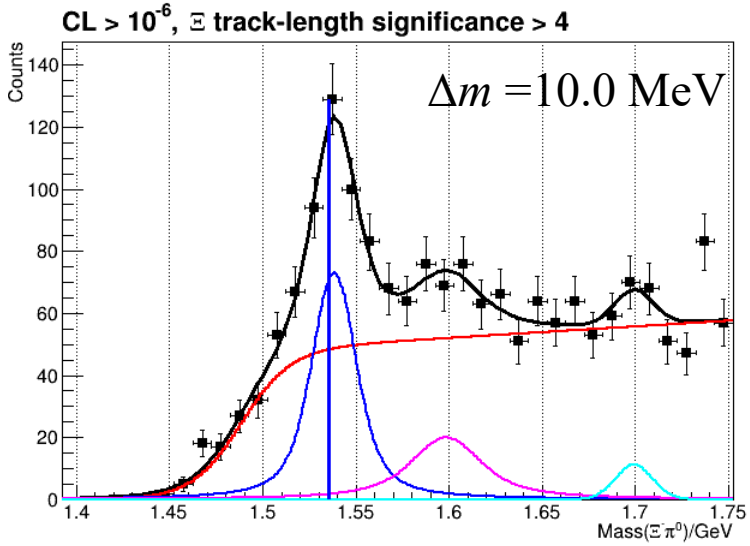
1606 ± 6	29	ROSS	72	HBC	$K^- p$ 3.1–3.7 GeV/c

Ξ(1620) WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
32 $^{+8}_{-9}$ OUR AVERAGE		Error includes scale factor of 2.2. See the ideogram below.			
$59.9 \pm 4.8^{+2.8}_{-7.1}$		SUMIHAMA	19	BELL	$\Xi_c^+ \to \Xi(1620)\pi^+$
22.5± 7.5	31	[1] BRIEFEL	77	HBC	$K^- p$ 2.87 GeV/c
40 ±15	34	DEBELLEFON	75B	HBC	$K^- p \to \Xi^- \overline{K}\pi$
21 ± 7	29	ROSS	72	HBC	$K^- p \to \Xi^- \pi^+ K^{*0}(892)$



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1633 ±12	34	DEBELLEFON	75B	HBC	$K^- p \to \Xi^- \overline{K}\pi$
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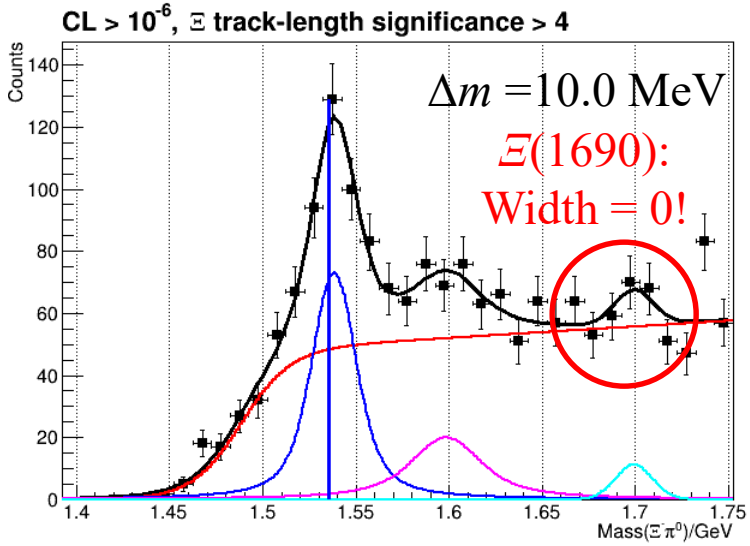
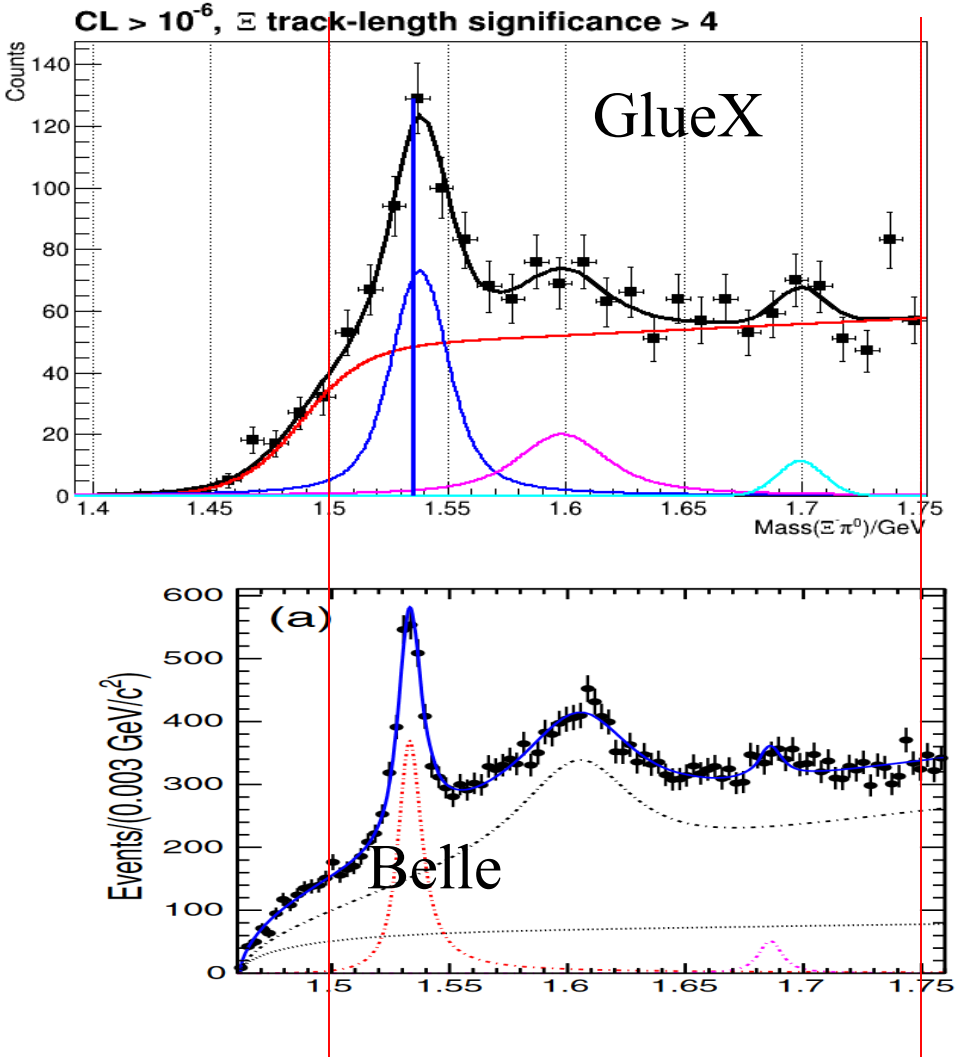
Ξ(1620) WIDTH

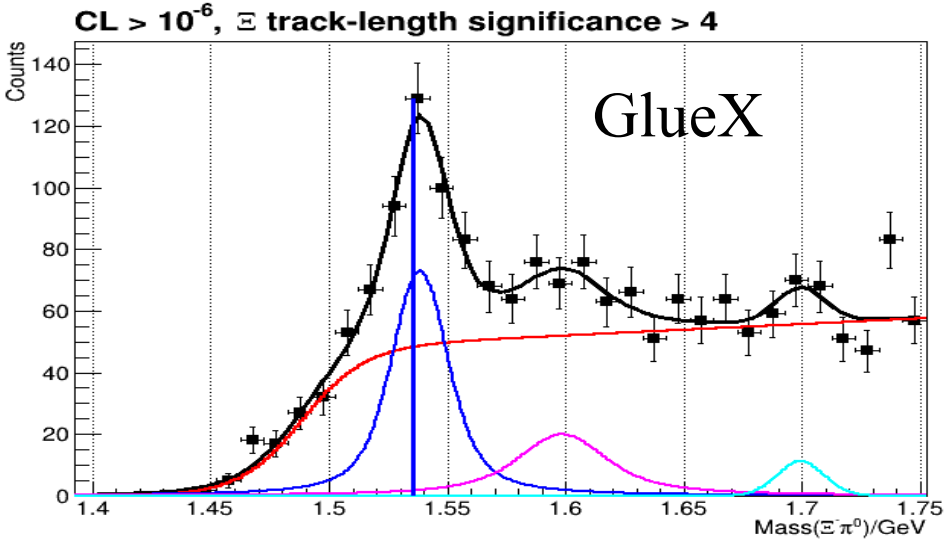
VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
32^{+8}_{-9} OUR AVERAGE		Error includes scale factor of 2.2. See the ideogram below.			
$59.9 \pm 4.8^{+2.8}_{-7.1}$		SUMIHAMA	19	BELL	$\Xi_c^+ \to \Xi(1620)\pi^+$
22.5± 7.5	31	[1] BRIEFEL	77	HBC	$K^- p$ 2.87 GeV/c
40 ±15	34	DEBELLEFON	75B	HBC	$K^- p \to \Xi^- \overline{K}\pi$
21 ± 7	29	ROSS	72	HBC	$K^- p \to \Xi^- \pi^+ K^{*0}(892)$

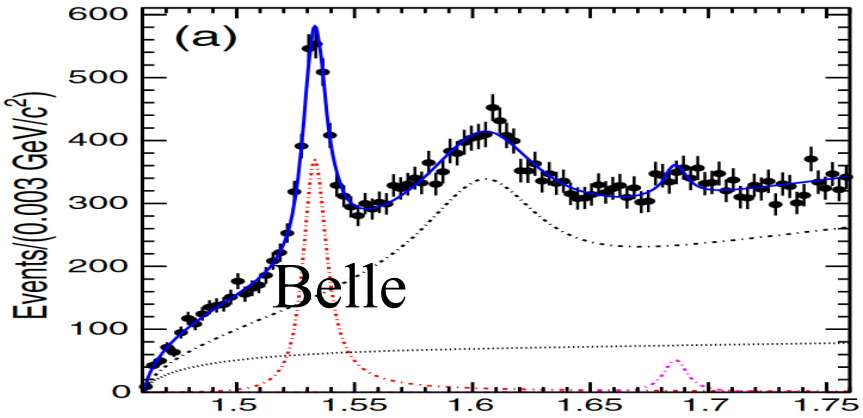


Comparison to Belle



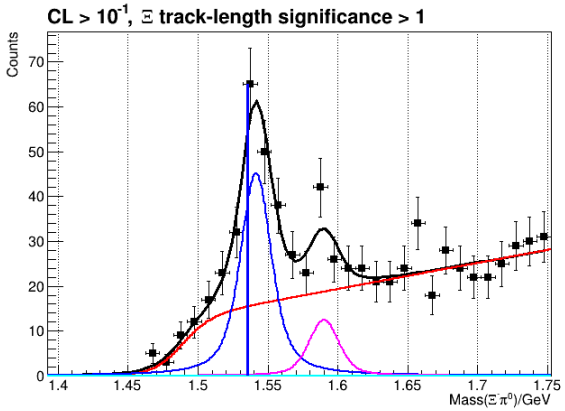
Comparison to Belle

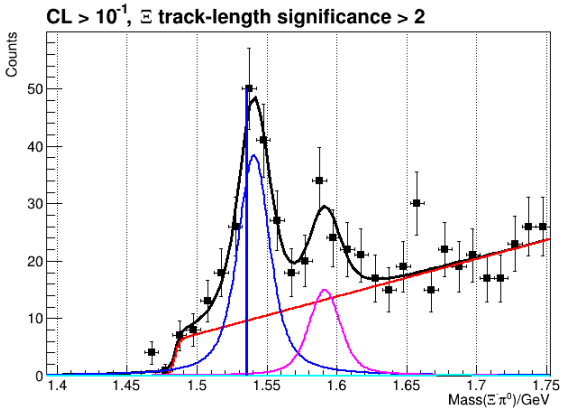




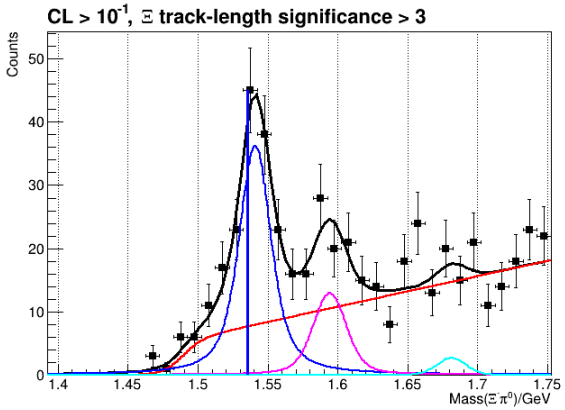
The other fits

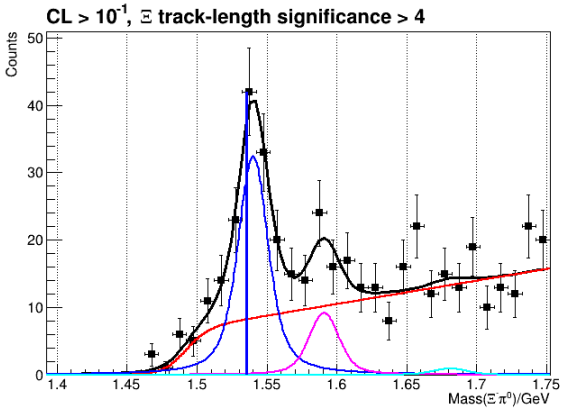
I have put all of the other fits (each CL and track-length significance) on the following slides

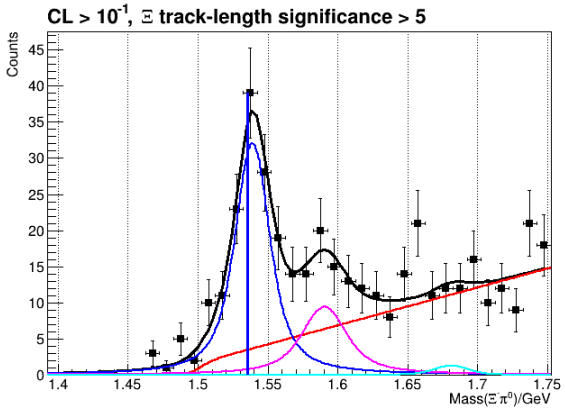

CL > 10^-1, Ξ track-length significance > 1
Counts
Mass(Ξπ⁰)/GeV

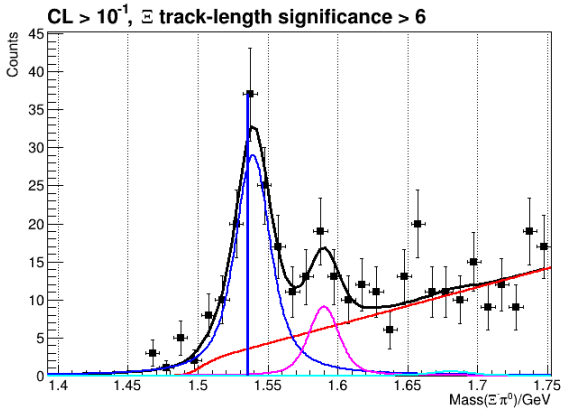

CL > 10^-1, Ξ track-length significance > 2
Counts
Mass(Ξπ⁰)/GeV

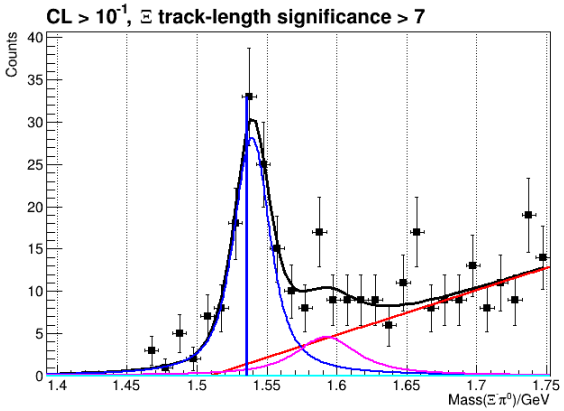
$CL > 10^{-1}$

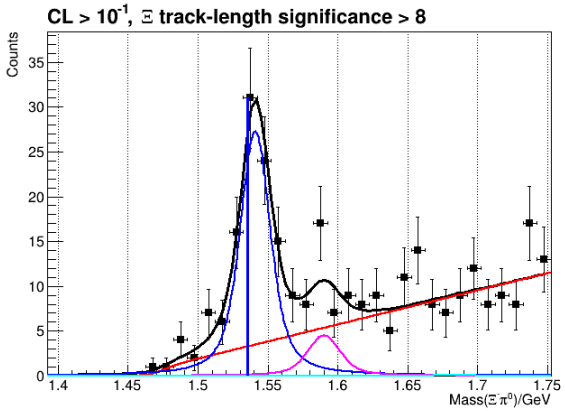

CL > 10^-1, Ξ track-length significance > 3
Counts
Mass(Ξπ⁰)/GeV

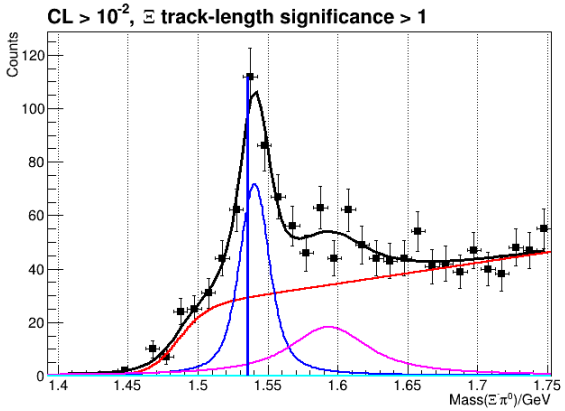

CL > 10^-1, Ξ track-length significance > 4
Counts
Mass(Ξπ⁰)/GeV

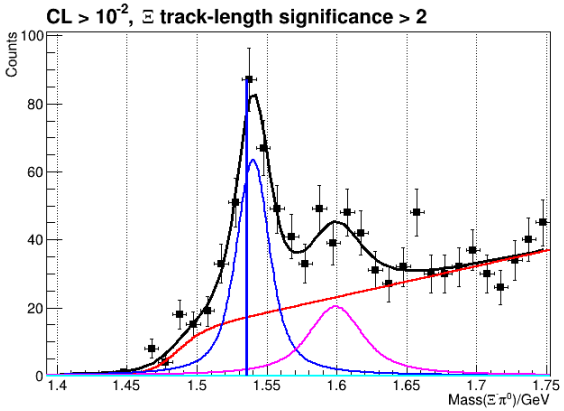

CL > 10^-1, Ξ track-length significance > 5
Counts
Mass(Ξπ⁰)/GeV


CL > 10^-1, Ξ track-length significance > 6
Counts
Mass(Ξπ⁰)/GeV

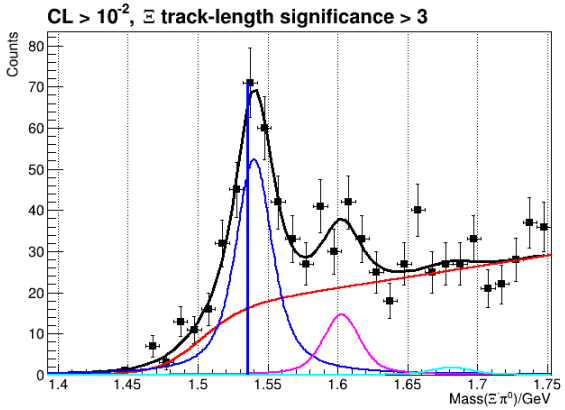

CL > 10^-1, Ξ track-length significance > 7
Counts
Mass(Ξπ⁰)/GeV

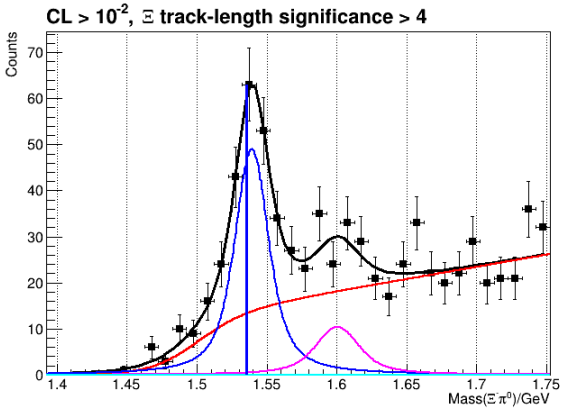

CL > 10^-1, Ξ track-length significance > 8
Counts
Mass(Ξπ⁰)/GeV

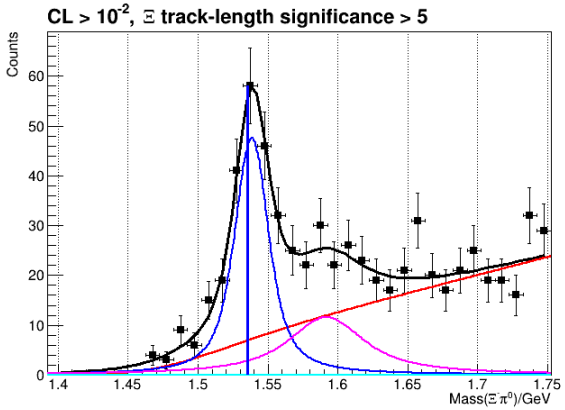

CL > 10^-2, Ξ track-length significance > 1
Counts
Mass(Ξπ⁰)/GeV

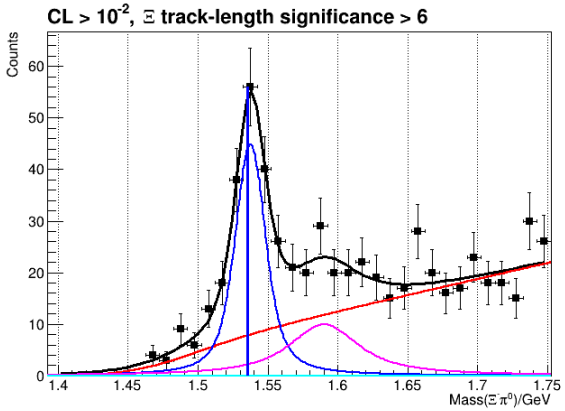

CL > 10^-2, Ξ track-length significance > 2
Counts
Mass(Ξπ⁰)/GeV

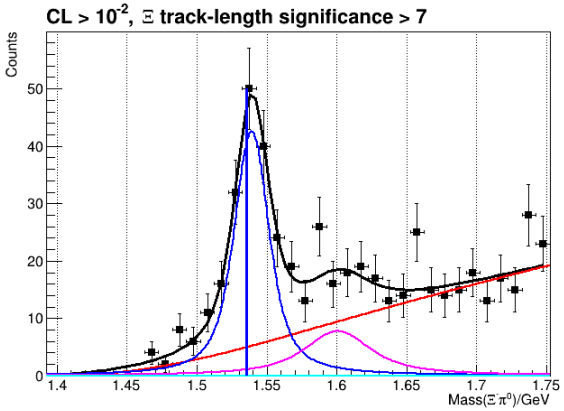
$CL > 10^{-2}$

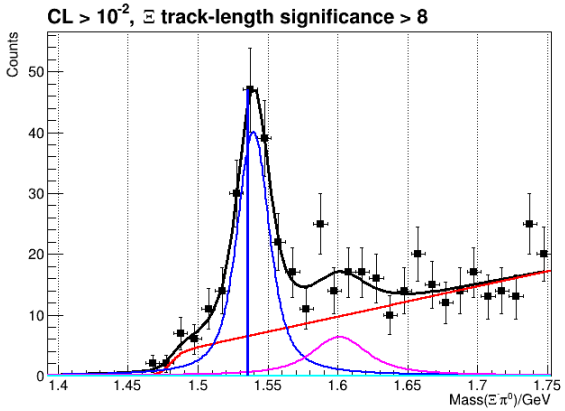

CL > 10^-2, Ξ track-length significance > 3
Counts
Mass(Ξπ⁰)/GeV

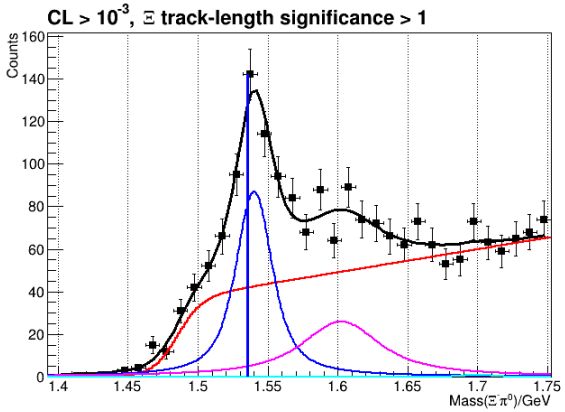

CL > 10^-2, Ξ track-length significance > 4
Counts
Mass(Ξπ⁰)/GeV

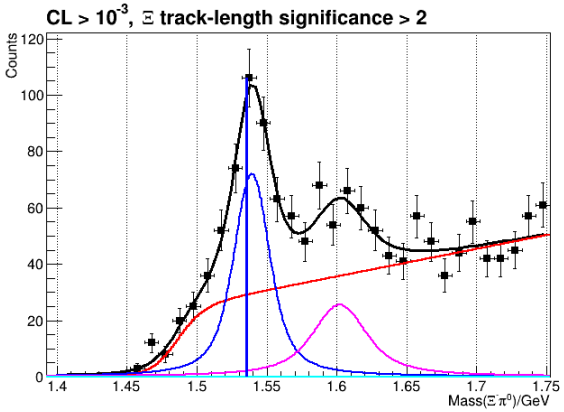

CL > 10^-2, Ξ track-length significance > 5
Counts
Mass(Ξπ⁰)/GeV


CL > 10^-2, Ξ track-length significance > 6
Counts
Mass(Ξπ⁰)/GeV

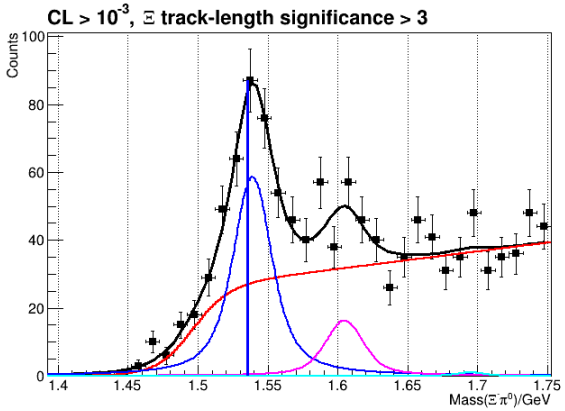

CL > 10^-2, Ξ track-length significance > 7
Counts
Mass(Ξπ⁰)/GeV

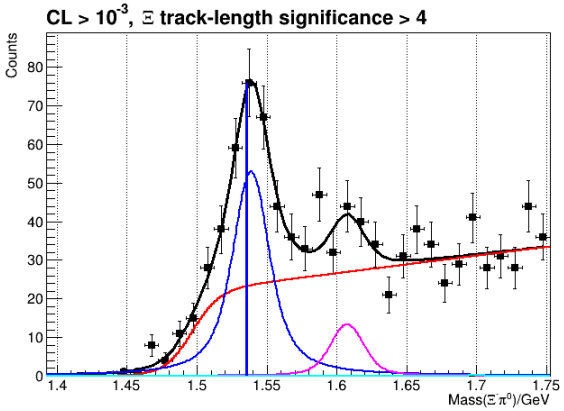

CL > 10^-2, Ξ track-length significance > 8
Counts
Mass(Ξπ⁰)/GeV

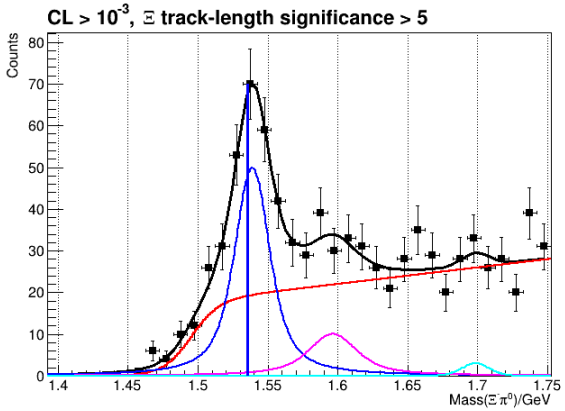

CL > 10^-3, Ξ track-length significance > 1
Counts
Mass(Ξπ⁰)/GeV

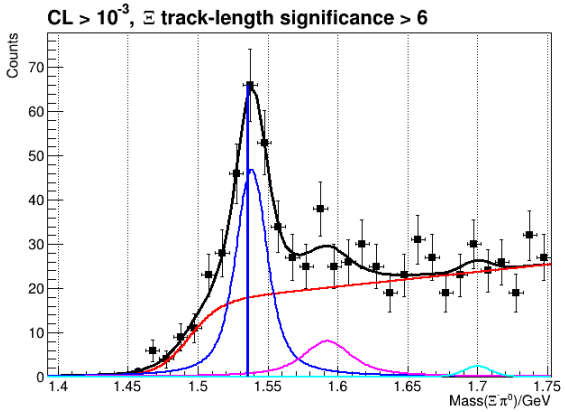

CL > 10^-3, Ξ track-length significance > 2
Counts
Mass(Ξπ⁰)/GeV

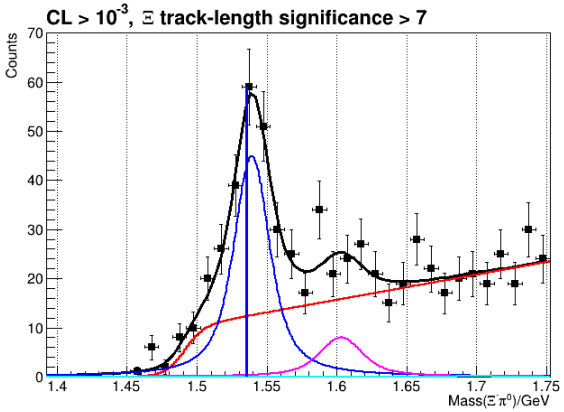
$CL > 10^{-3}$

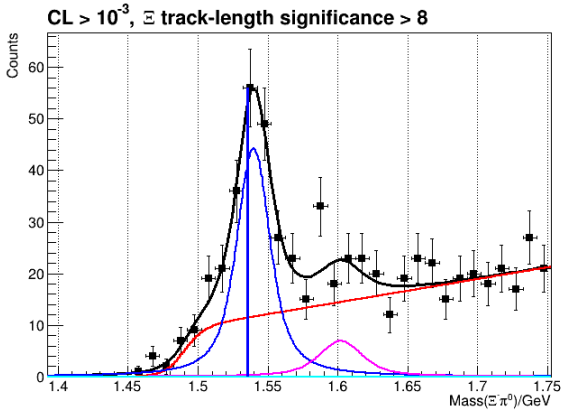

CL > 10^-3, Ξ track-length significance > 3
Counts
Mass(Ξπ⁰)/GeV

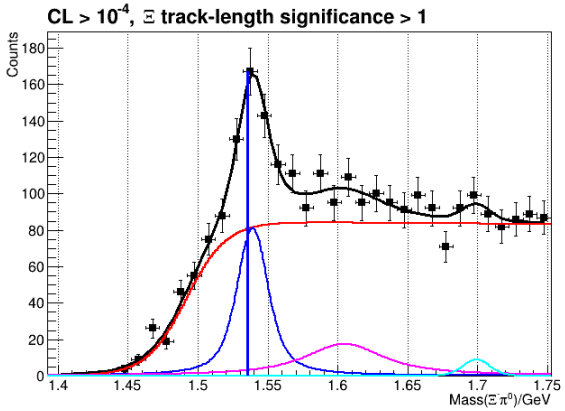

CL > 10^-3, Ξ track-length significance > 4
Counts
Mass(Ξπ⁰)/GeV

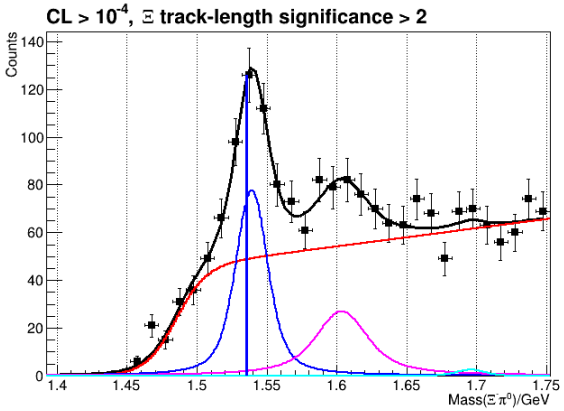

CL > 10^-3, Ξ track-length significance > 5
Counts
Mass(Ξπ⁰)/GeV


CL > 10^-3, Ξ track-length significance > 6
Counts
Mass(Ξπ⁰)/GeV

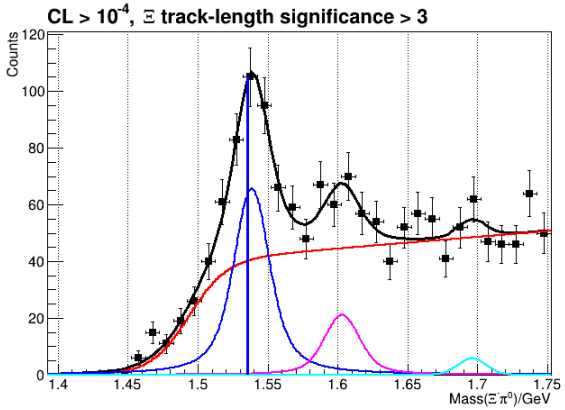

CL > 10^-3, Ξ track-length significance > 7
Counts
Mass(Ξπ⁰)/GeV

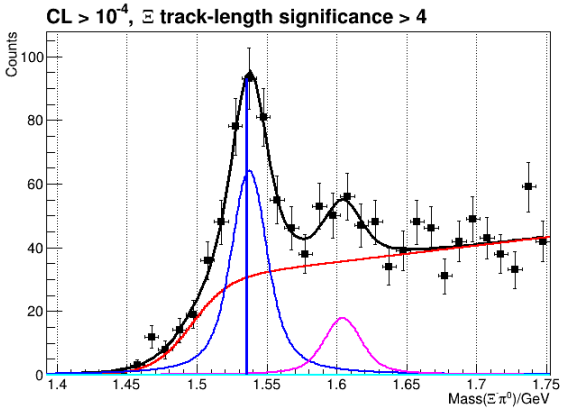

CL > 10^-3, Ξ track-length significance > 8
Counts
Mass(Ξπ⁰)/GeV

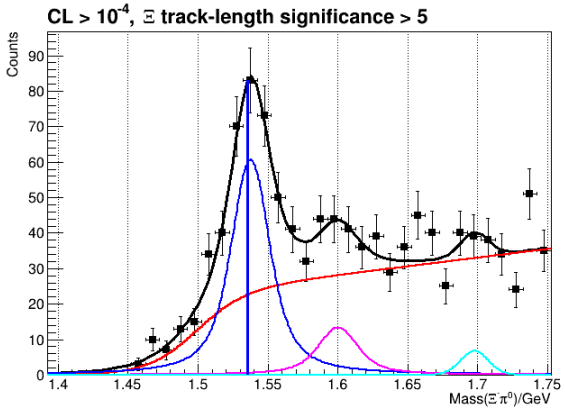

CL > 10^-4, Ξ track-length significance > 1
Counts
Mass(Ξπ⁰)/GeV

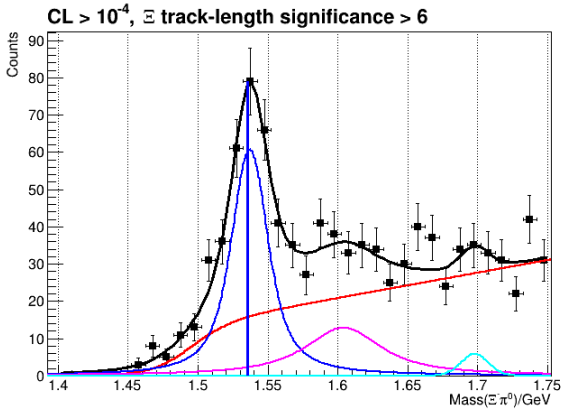

CL > 10^-4, Ξ track-length significance > 2
Counts
Mass(Ξπ⁰)/GeV

$CL > 10^{-4}$


CL > 10^-4, Ξ track-length significance > 3
Counts
Mass(Ξπ⁰)/GeV


CL > 10^-4, Ξ track-length significance > 4
Counts
Mass(Ξπ⁰)/GeV


CL > 10^-4, Ξ track-length significance > 5
Counts
Mass(Ξπ⁰)/GeV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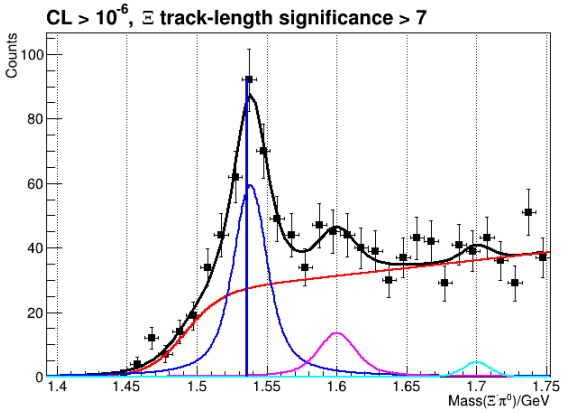
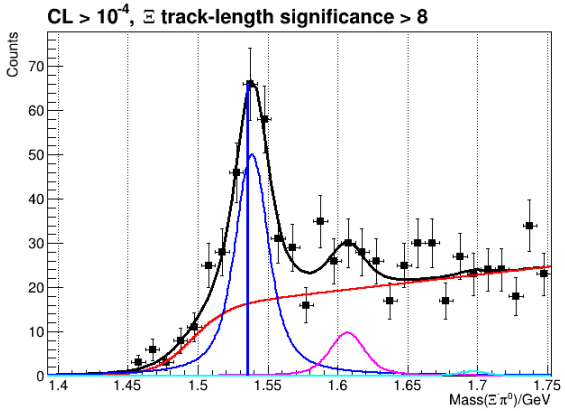
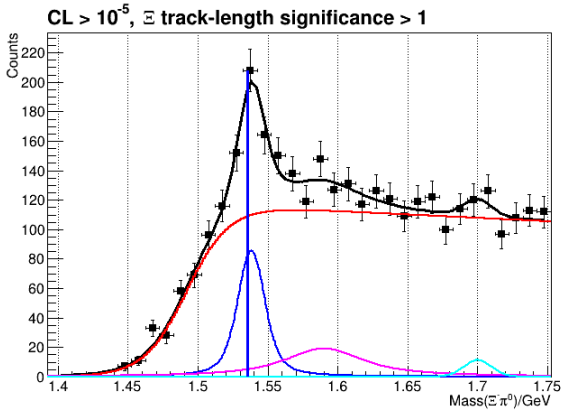
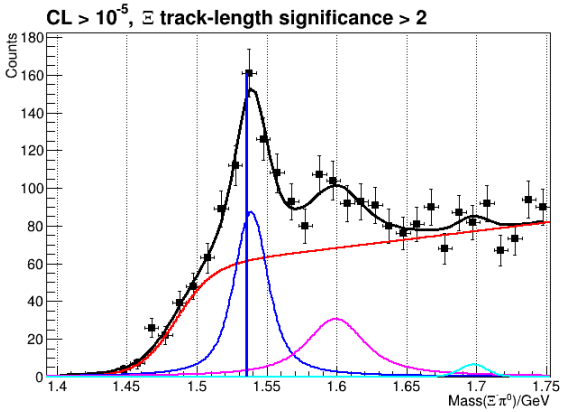
Counts
Mass(Ξπ⁰)/GeV

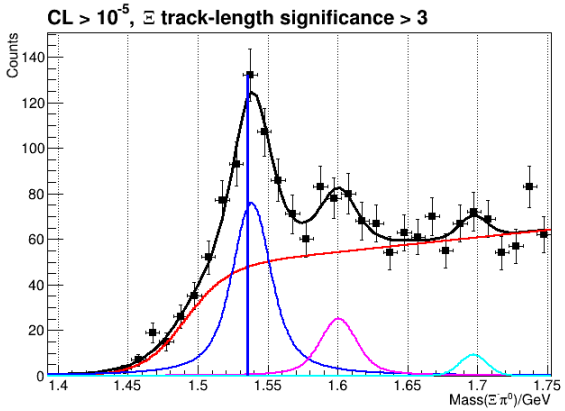

CL > 10^-6, Ξ track-length significance > 7
Counts
Mass(Ξπ⁰)/GeV

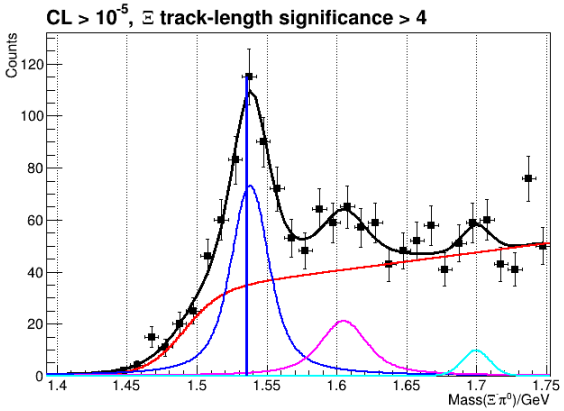

CL > 10^-4, Ξ track-length significance > 8
Counts
Mass(Ξπ⁰)/GeV

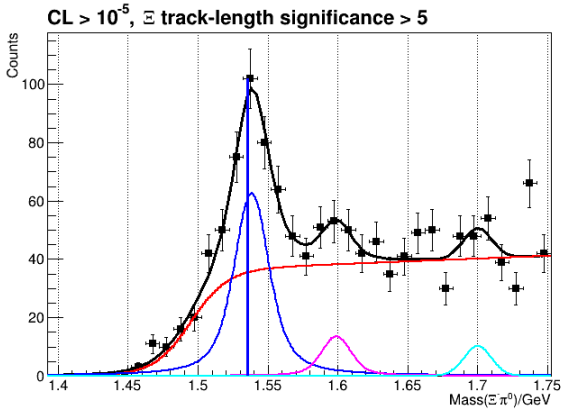

CL > 10^-5, Ξ track-length significance > 1
Counts
Mass(Ξπ⁰)/GeV

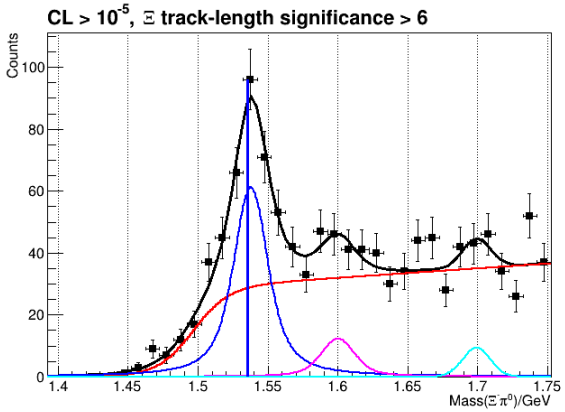

CL > 10^-5, Ξ track-length significance > 2
Counts
Mass(Ξπ⁰)/GeV

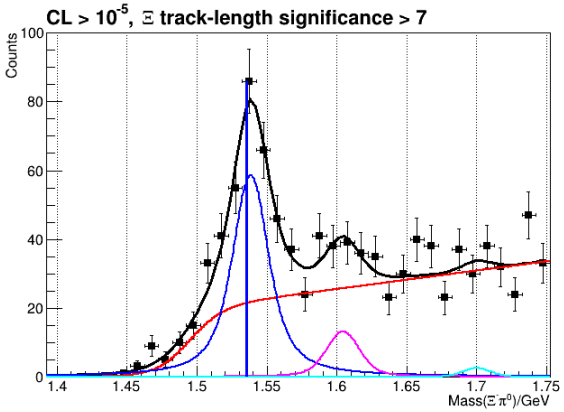
$CL > 10^{-5}$

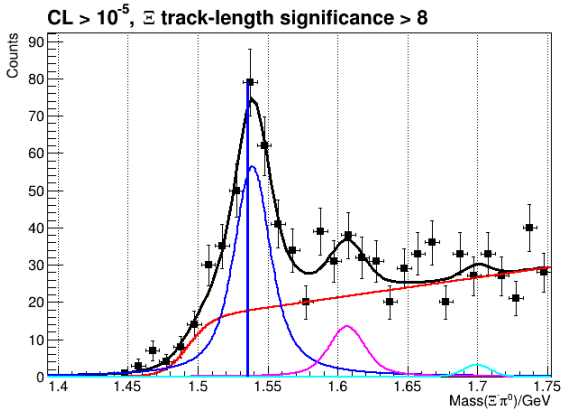

CL > 10^-5, Ξ track-length significance > 3
Counts
Mass(Ξπ⁰)/GeV

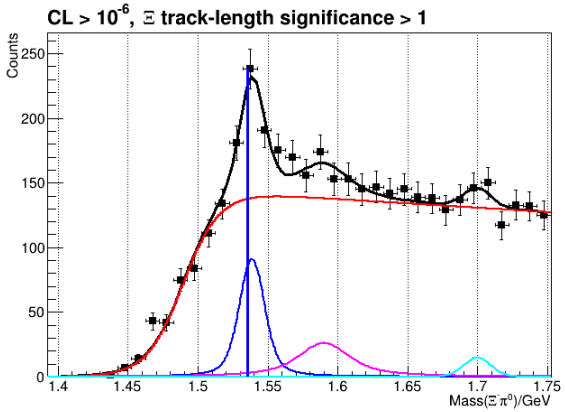

CL > 10^-5, Ξ track-length significance > 4
Counts
Mass(Ξπ⁰)/GeV

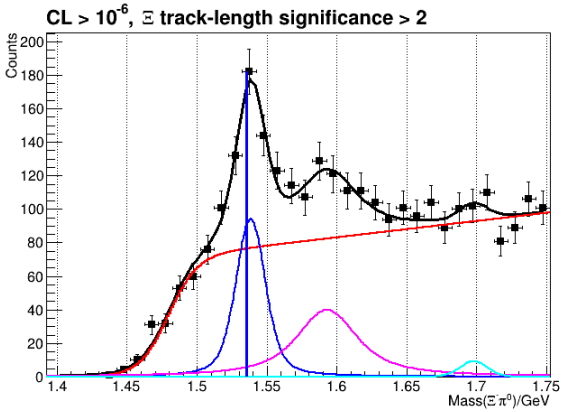

CL > 10^-5, Ξ track-length significance > 5
Counts
Mass(Ξπ⁰)/GeV


CL > 10^-5, Ξ track-length significance > 6
Counts
Mass(Ξπ⁰)/GeV

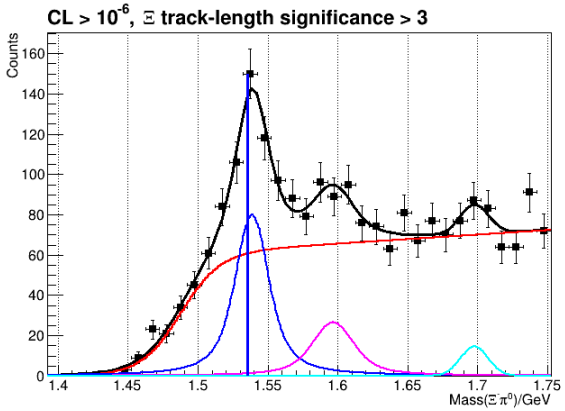

CL > 10^-5, Ξ track-length significance > 7
Counts
Mass(Ξπ⁰)/GeV

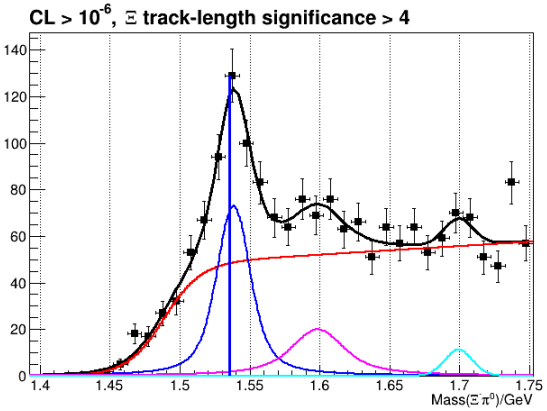

CL > 10^-5, Ξ track-length significance > 8
Counts
Mass(Ξπ⁰)/GeV

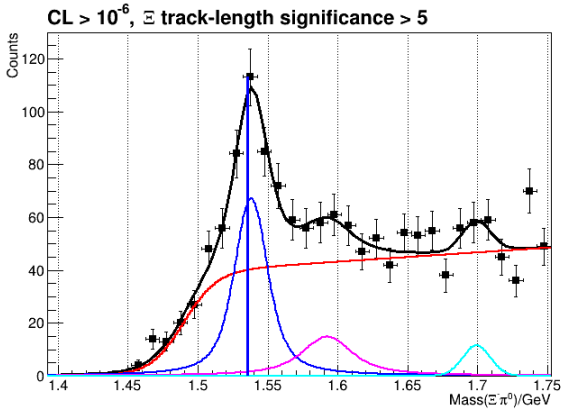

CL > 10^-6, Ξ track-length significance > 1
Counts
Mass(Ξπ⁰)/GeV

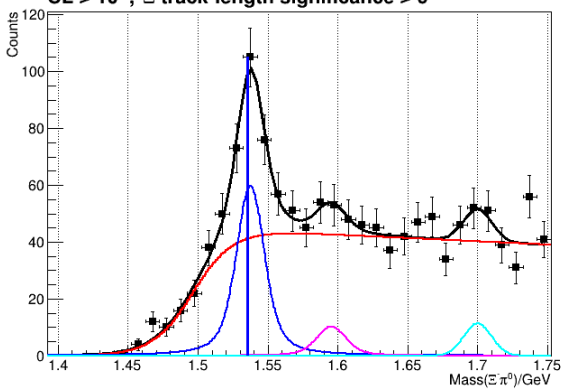

CL > 10^-6, Ξ track-length significance > 2
Counts
Mass(Ξπ⁰)/GeV

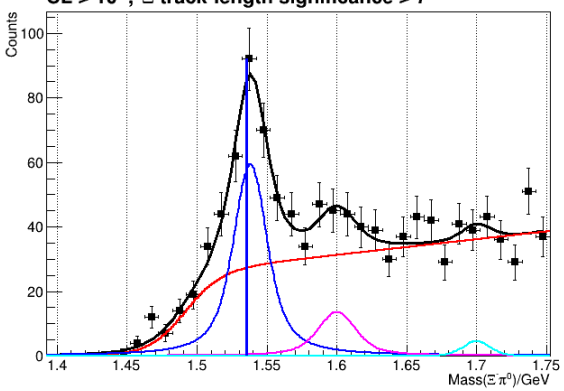
$CL > 10^{-6}$

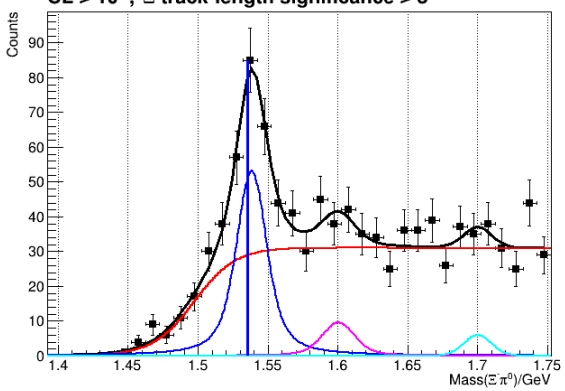

CL > 10^-6, Ξ track-length significance > 3
Counts
Mass(Ξπ⁰)/GeV

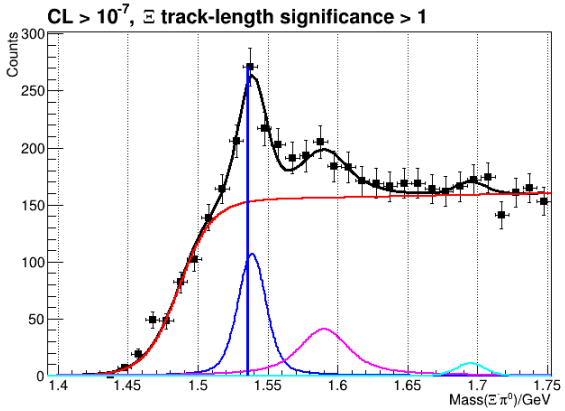

CL > 10^-6, Ξ track-length significance > 4
Counts
Mass(Ξπ⁰)/GeV

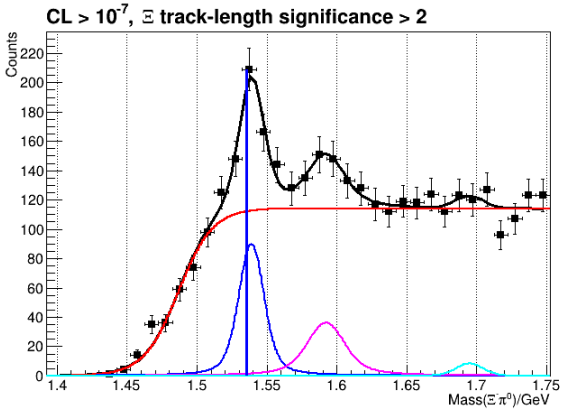

CL > 10^-6, Ξ track-length significance > 5
Counts
Mass(Ξπ⁰)/GeV


CL > 10^-6, Ξ track-length significance > 6
Counts
Mass(Ξπ⁰)/GeV

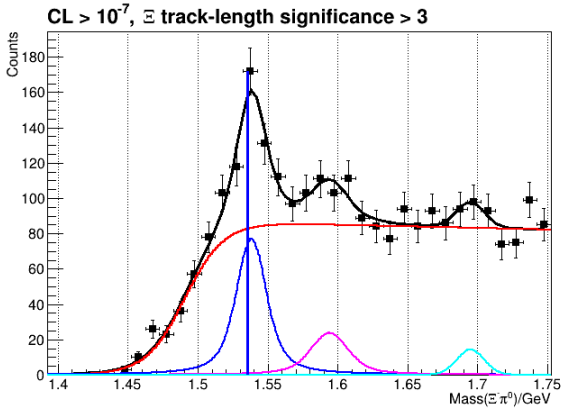

CL > 10^-6, Ξ track-length significance > 7
Counts
Mass(Ξπ⁰)/GeV

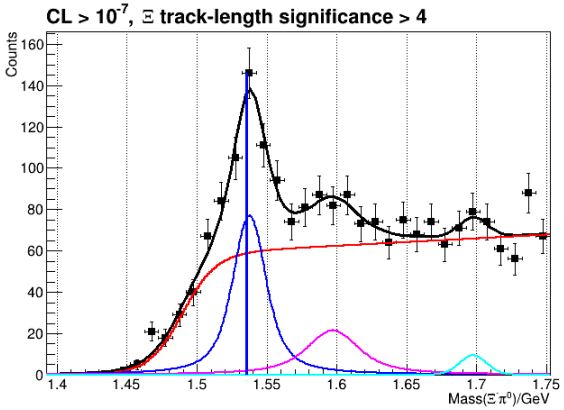

CL > 10^-6, Ξ track-length significance > 8
Counts
Mass(Ξπ⁰)/GeV

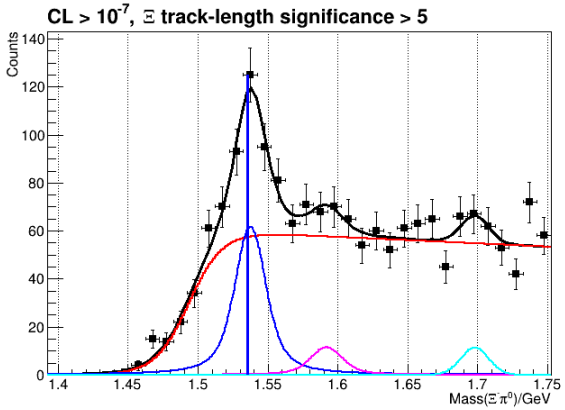

CL > 10^-7, Ξ track-length significance > 1
Counts
Mass(Ξπ⁰)/GeV

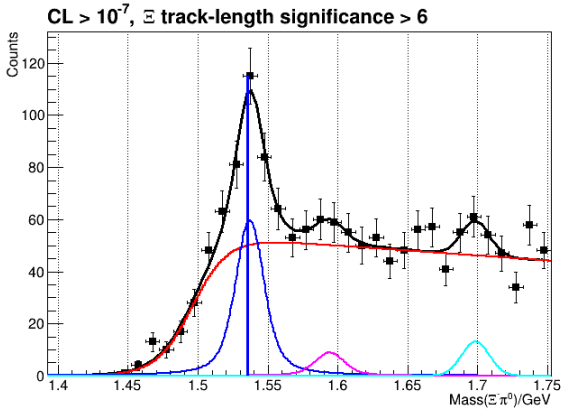

CL > 10^-7, Ξ track-length significance > 2
Counts
Mass(Ξπ⁰)/GeV

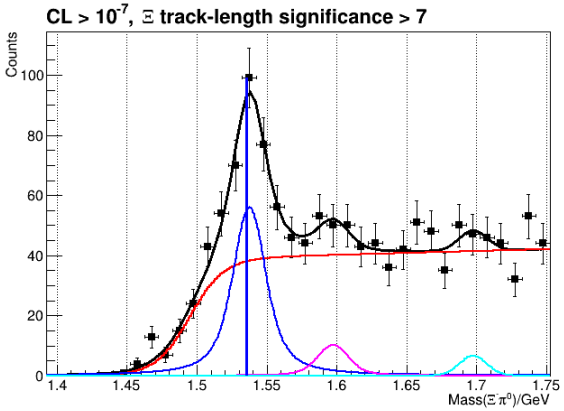
$CL > 10^{-7}$

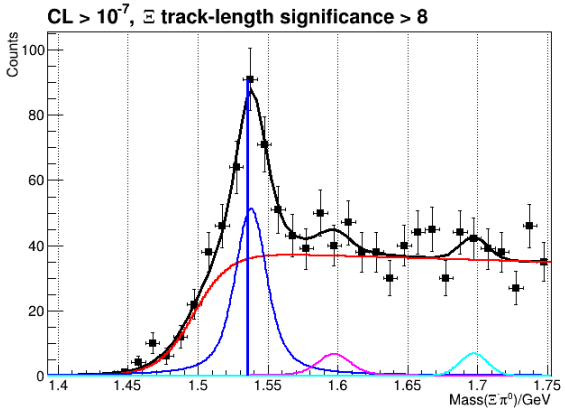

CL > 10^-7, Ξ track-length significance > 3
Counts
Mass(Ξπ⁰)/GeV

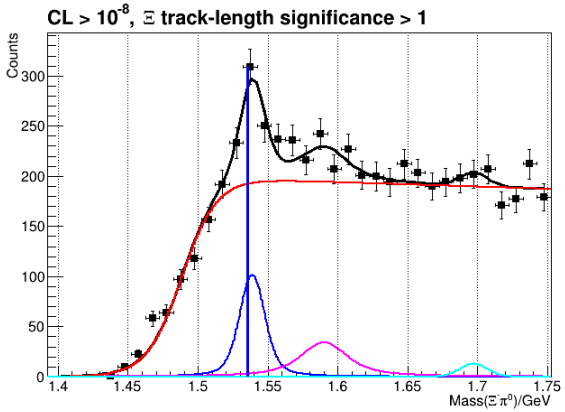

CL > 10^-7, Ξ track-length significance > 4
Counts
Mass(Ξπ⁰)/GeV

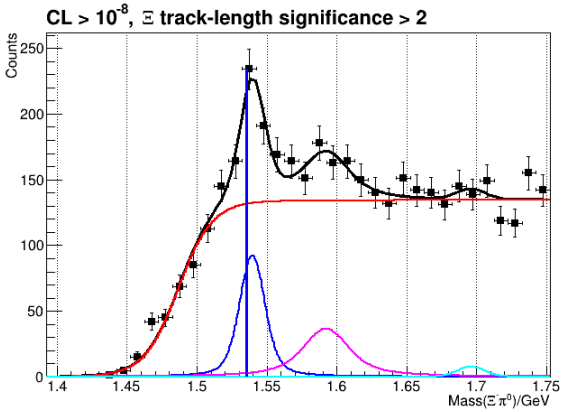

CL > 10^-7, Ξ track-length significance > 5
Counts
Mass(Ξπ⁰)/GeV


CL > 10^-7, Ξ track-length significance > 6
Counts
Mass(Ξπ⁰)/GeV

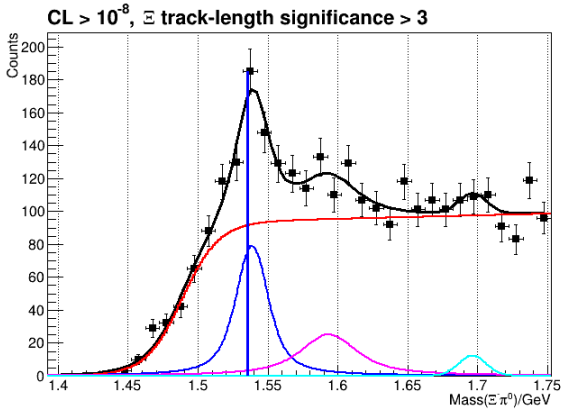

CL > 10^-7, Ξ track-length significance > 7
Counts
Mass(Ξπ⁰)/GeV

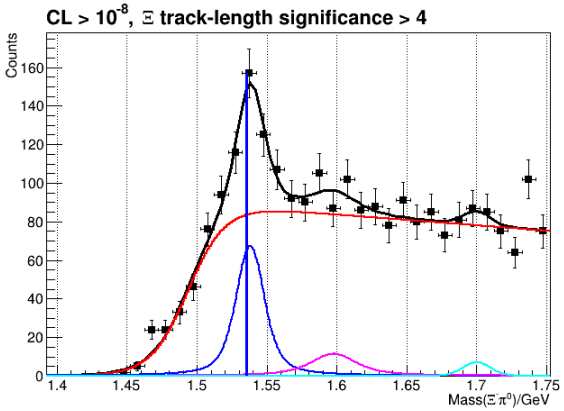

CL > 10^-7, Ξ track-length significance > 8
Counts
Mass(Ξπ⁰)/GeV

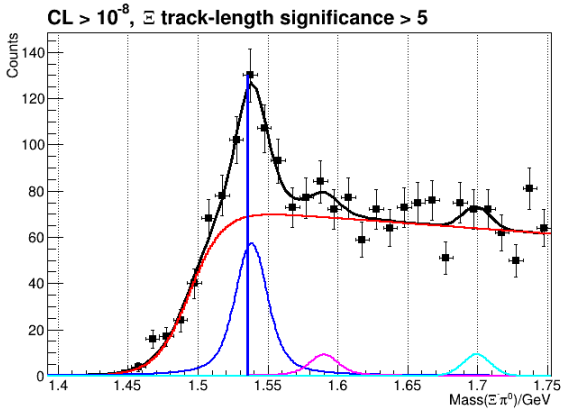

CL > 10^-8, Ξ track-length significance > 1
Counts
Mass(Ξπ⁰)/GeV

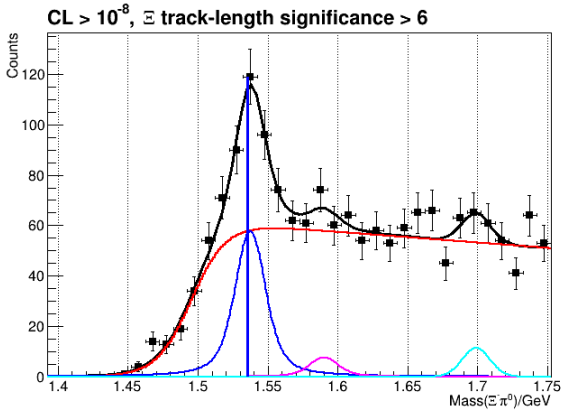

CL > 10^-8, Ξ track-length significance > 2
Counts
Mass(Ξπ⁰)/GeV

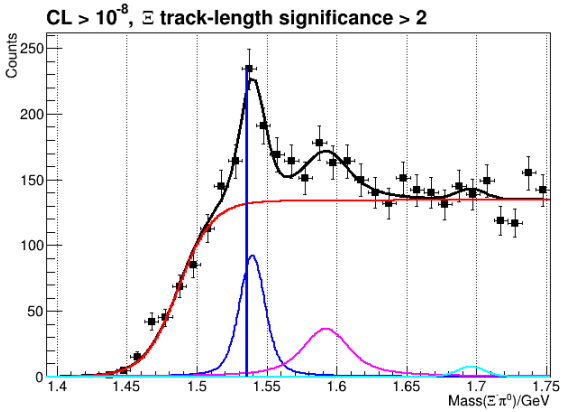
$CL > 10^{-8}$

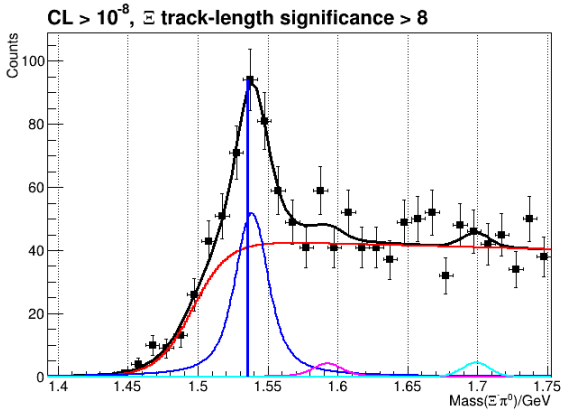

CL > 10^-8, Ξ track-length significance > 3
Counts
Mass(Ξπ⁰)/GeV


CL > 10^-8, Ξ track-length significance > 4
Counts
Mass(Ξπ⁰)/GeV

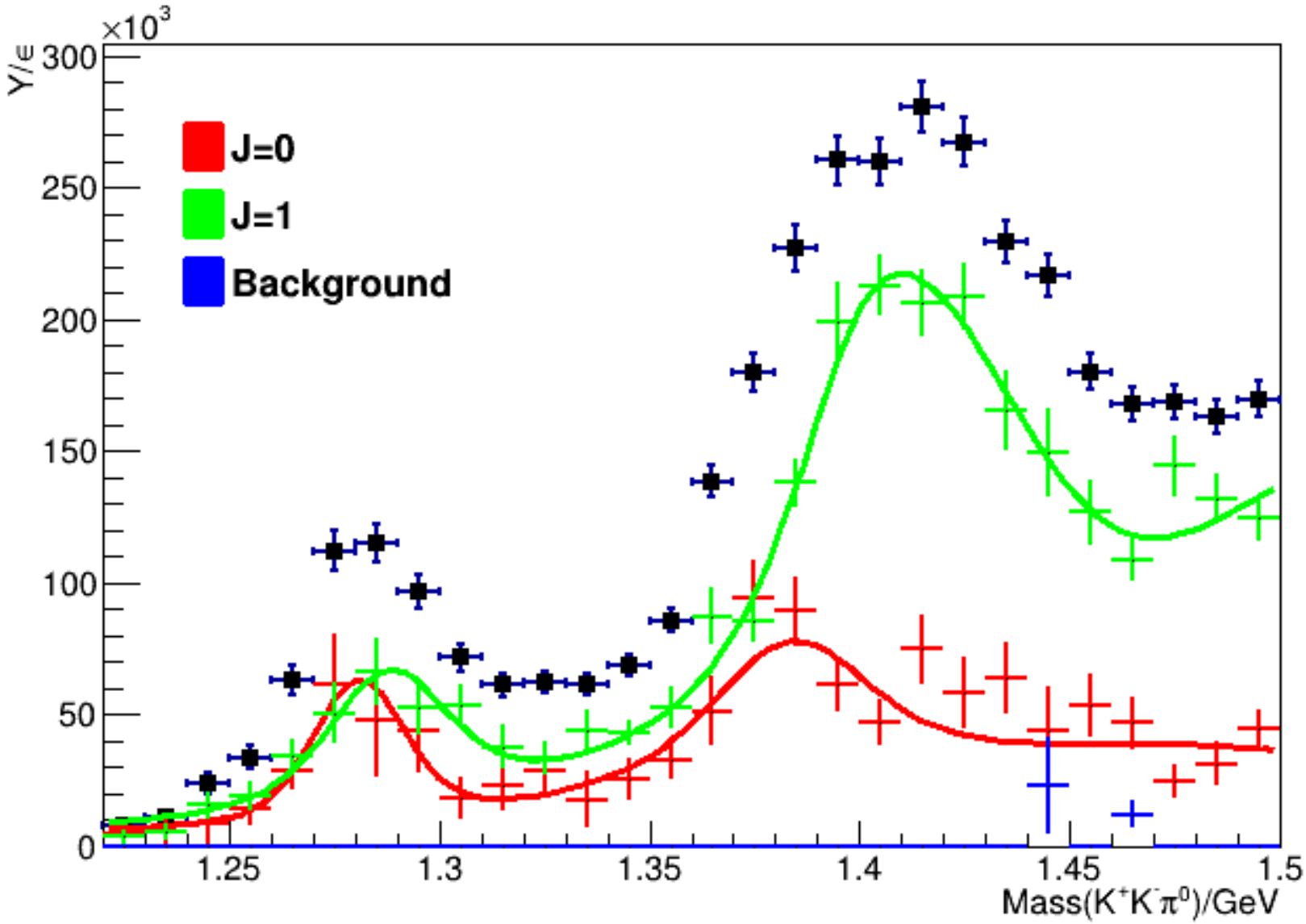

CL > 10^-8, Ξ track-length significance > 5
Counts
Mass(Ξπ⁰)/GeV


CL > 10^-8, Ξ track-length significance > 6
Counts
Mass(Ξπ⁰)/GeV


CL > 10^-8, Ξ track-length significance > 2
Counts
Mass(Ξπ⁰)/GeV


CL > 10^-8, Ξ track-length significance > 8
Counts
Mass(Ξπ⁰)/GeV

PeakV3


×10^3
Y/ε
300
250
200
150
100
50
0
J=0
J=1
Background
1.25
1.3
1.35
1.4
1.45
1.5
Mass(K⁺K⁻π⁰)/GeV

Peak V2 (only L0S0, L1S0, L0S1)