$\Xi^* \rightarrow \Xi\pi^0$ update

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- Inclusion of hybrid method for accidental subtraction
- Addressing various comments and suggestions

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

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

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

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

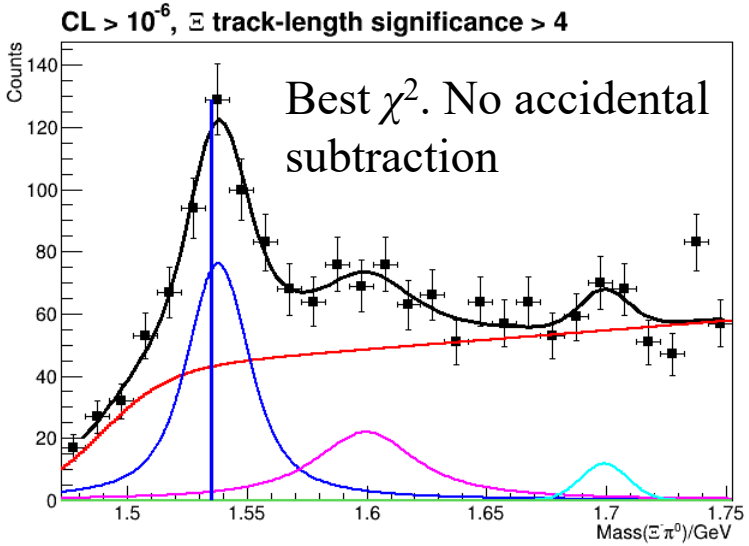
and $\Lambda \rightarrow p\pi^{-}$

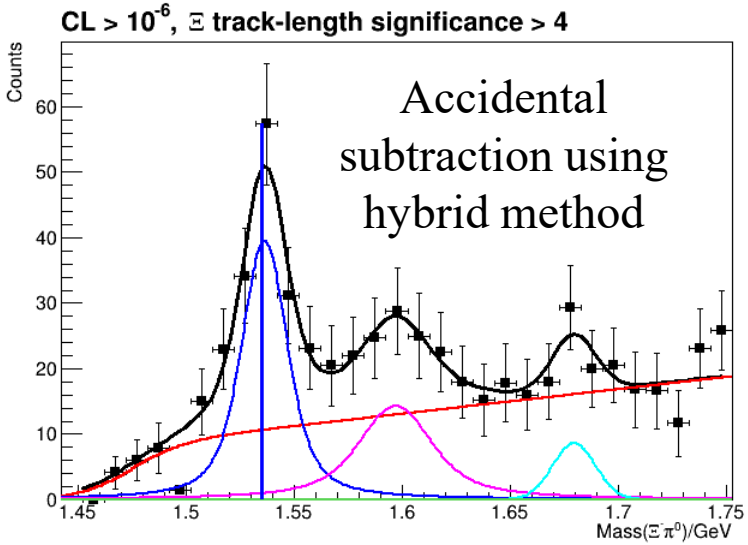
- Mass of Ξ^{-} not constrained

$\Xi^* \rightarrow \Xi\pi^0$ update

- Inclusion of hybrid method for accidental subtraction
- Addressing various comments and suggestions

Accidental subtraction using hybrid method





Note: Error bars need to be fixed?

Ξ^* Analysis

- Requested studies:
  - Refine MC generator distributions
    - Status: Initial attempt with *s* and *t* distributions will be shown today
  - Mass fit Ξ for each bin in Ξ^*
    - Status: First attempt will be shown today
  - *t*-cut dependence on Ξ^* spectrum
    - Status: In progress
  - Vertex dependence on π^0 mass with real and MC data
    - Status: Started MC
  - Vertex angle between momentum and path of Ξ
    - Status: Not started yet
  - Explore sidebands as background shape under Ξ*
    - Status: Not started yet

Ξ^* Generator Refinement

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

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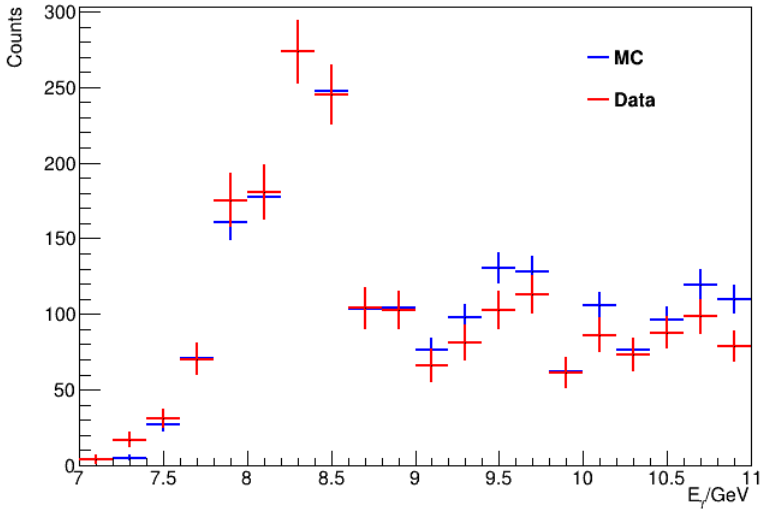
- Started with Mandelstam s and t

Ξ^* Comparison of Reconstructed MC to Actual Data

Confidence level and pathlength significance

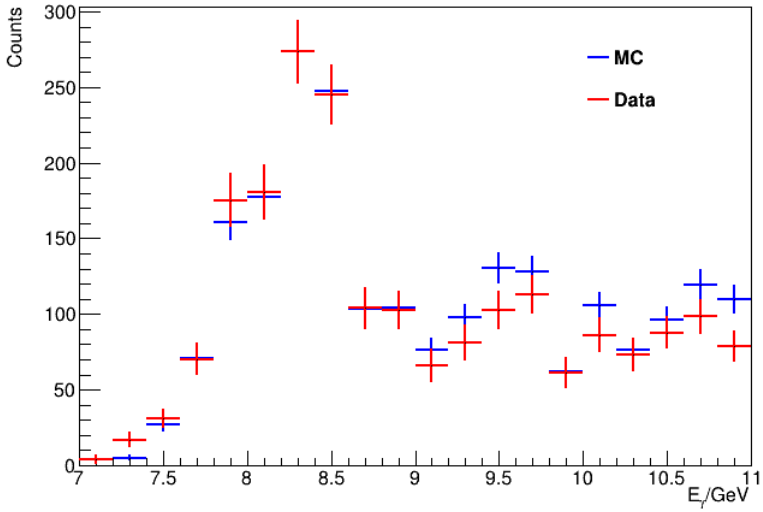
- Same confidence level cut: CL > 10^{-6}
- Same pathlength significance cut > 4

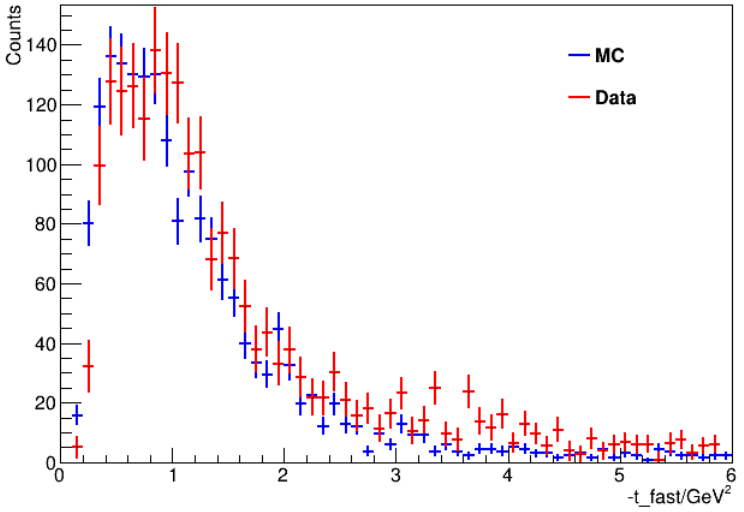
Ξ^* Comparison of Reconstructed MC to Actual Data



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

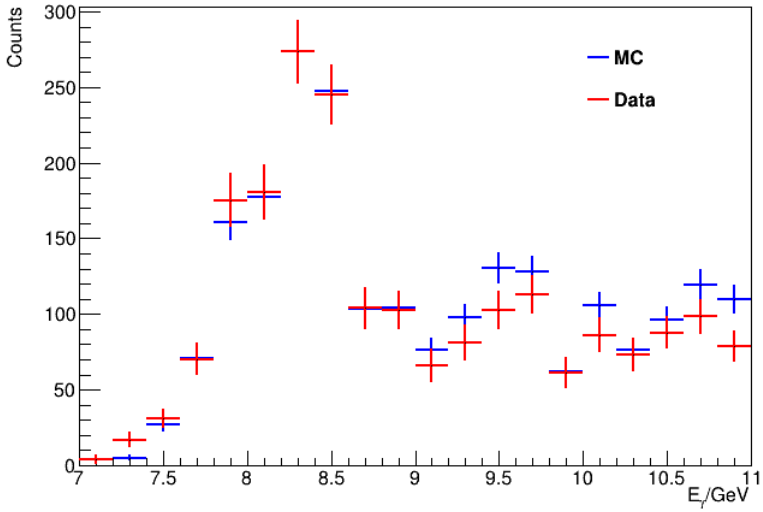
Ξ^* Comparison of Reconstructed MC to Actual Data



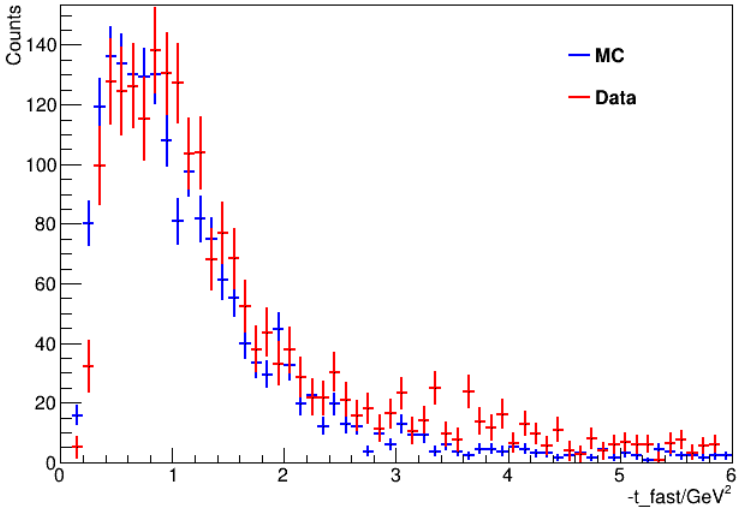


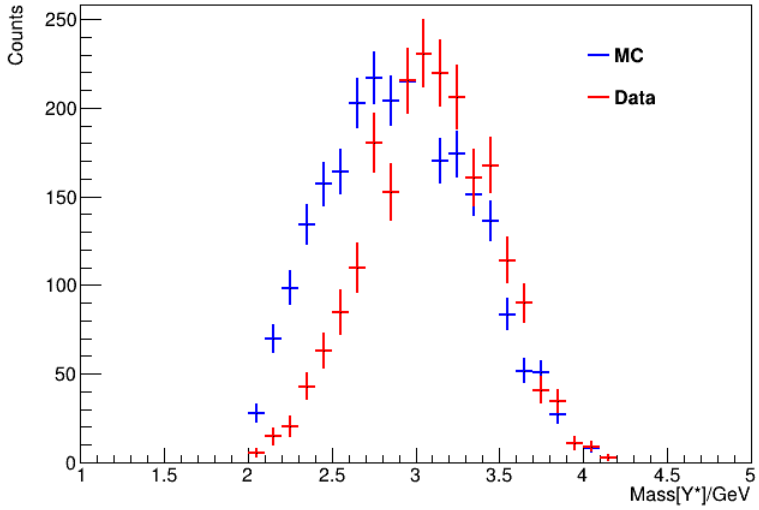
- -*t*(fast) is being refined further

Ξ^* Comparison of Reconstructed MC to Actual Data



Not yet tried to get the Y^* shape to match but the high-mass part of distribution already looks OK





Ground State Ξ^- Fits

- Attempting to remove all non-Ξ^- background by fitting the Ξ^- for each mass[Ξ^- π^0] bin
- Since lifetime of Ξ^- is 1.6e-10, I set width of the ground state Ξ^- to detector resolution found from Monte Carlo study.
- Some of the fits are not great, but we can still get a sense of the contribution to mass[Ξ^- π^0] from the non-Ξ^- background

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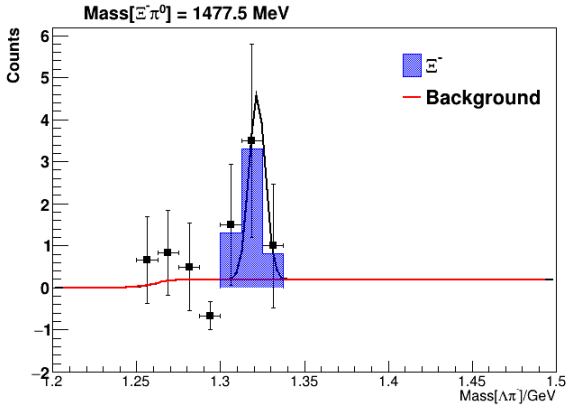
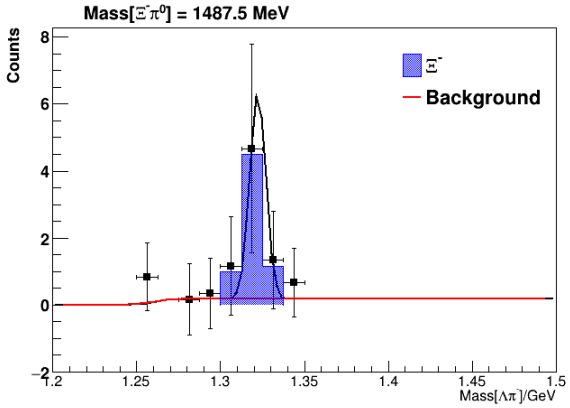
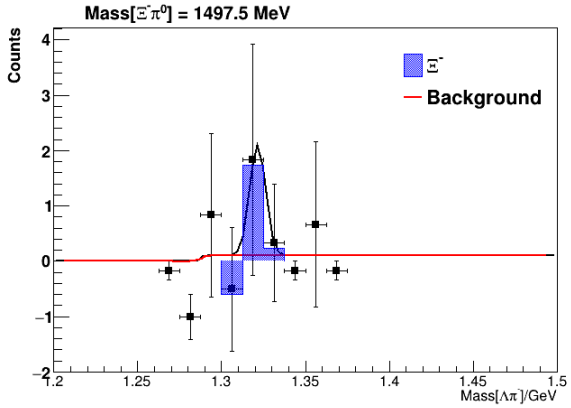
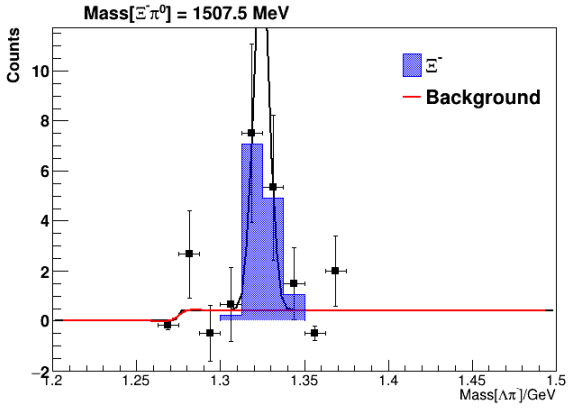
Ground State Ξ^- Fits

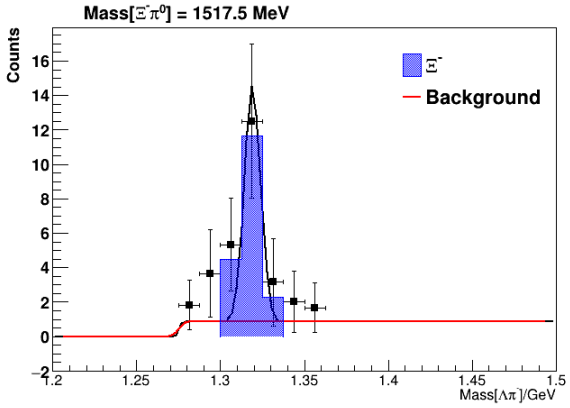
From 1477.5 to 1557.5 MeV

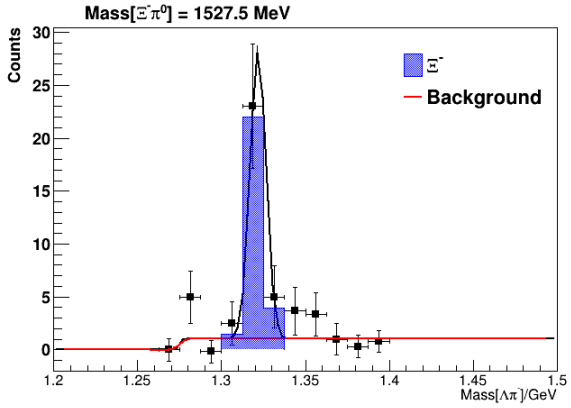

Mass[Ξ⁻π⁰] = 1477.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

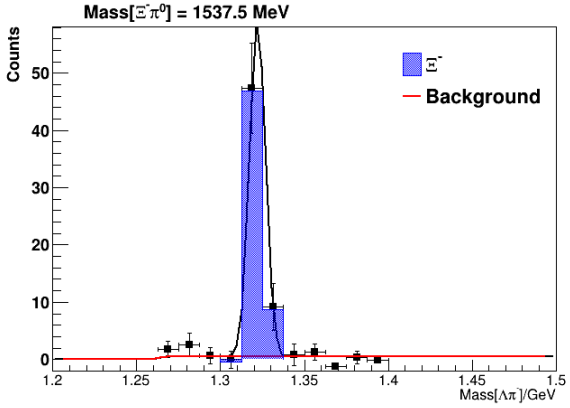

Mass[Ξ⁻π⁰] = 1487.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

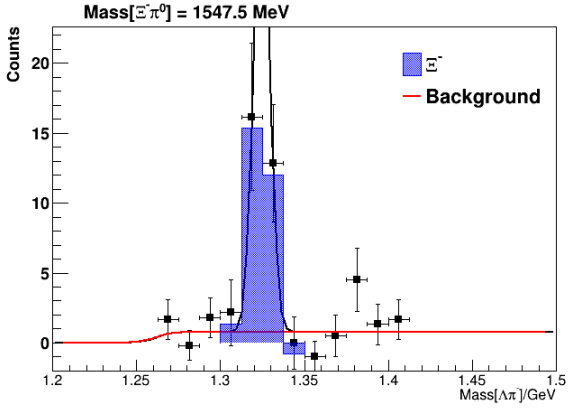

Mass[Ξ⁻π⁰] = 1497.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

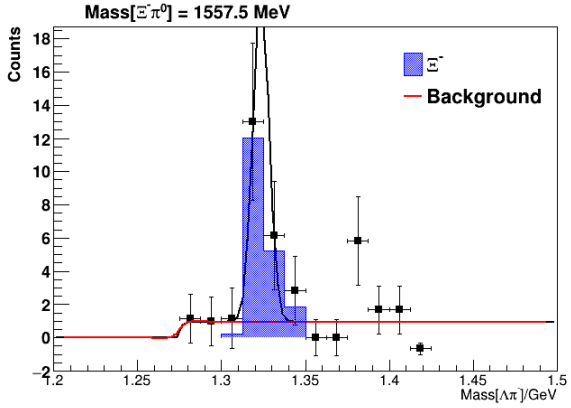

Mass[Ξ⁻π⁰] = 1507.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV


Mass[Ξ⁻π⁰] = 1517.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV


Mass[Ξ⁻π⁰] = 1527.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

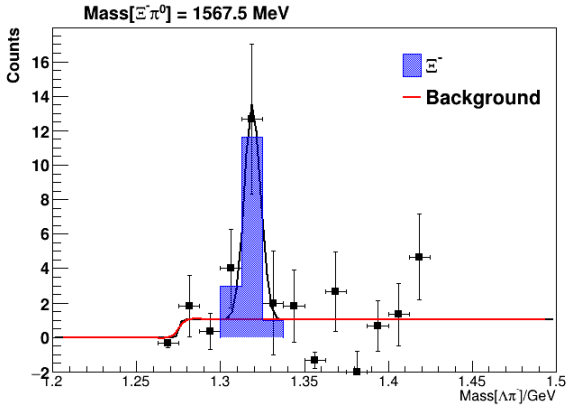

Mass[Ξ⁻π⁰] = 1537.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

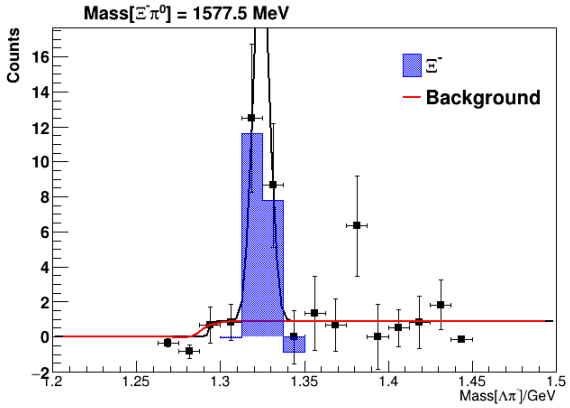

Mass[Ξ⁻π⁰] = 1547.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

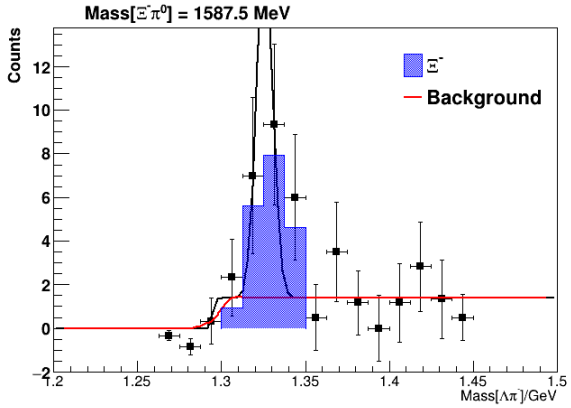

Mass[Ξ⁻π⁰] = 1557.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

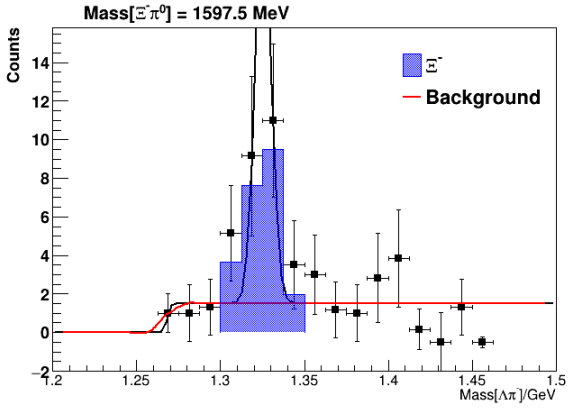
Ground State Ξ^- Fits

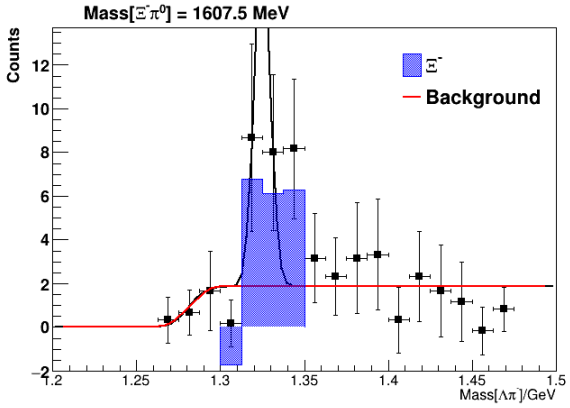
Next: From 1567.5 to 1647.5 MeV

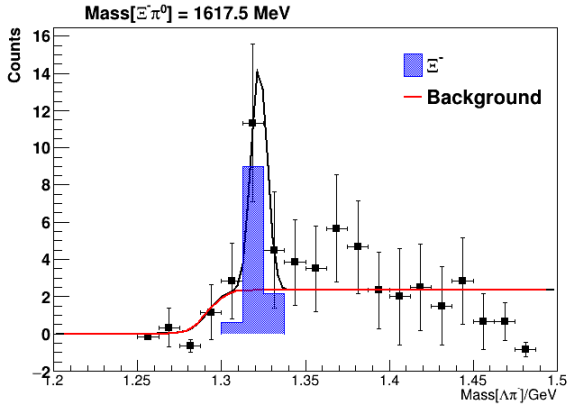

Mass[Ξ⁻π⁰] = 1567.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

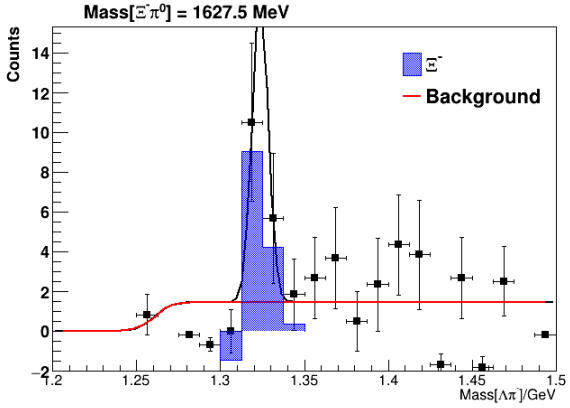

Mass[Ξ⁻π⁰] = 1577.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

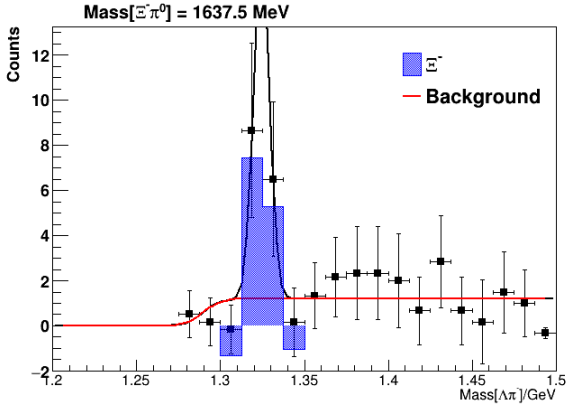

Mass[Ξ⁻π⁰] = 1587.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

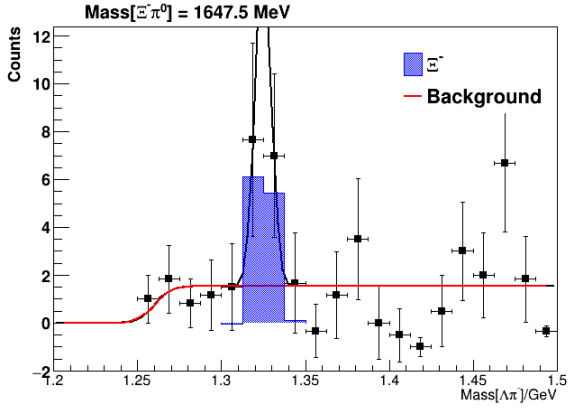

Mass[Ξ⁻π⁰] = 1597.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV


Mass[Ξ⁻π⁰] = 1607.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV


Mass[Ξ⁻π⁰] = 1617.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

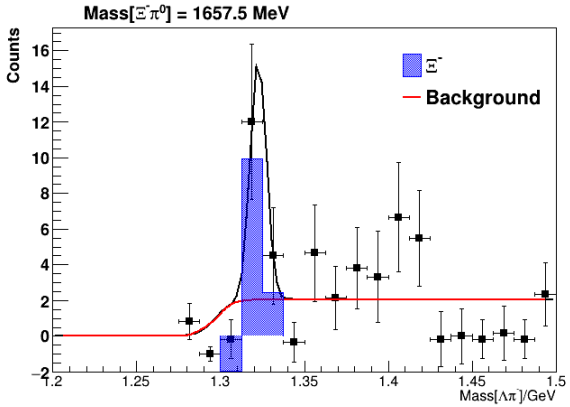

Mass[Ξ⁻π⁰] = 1627.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

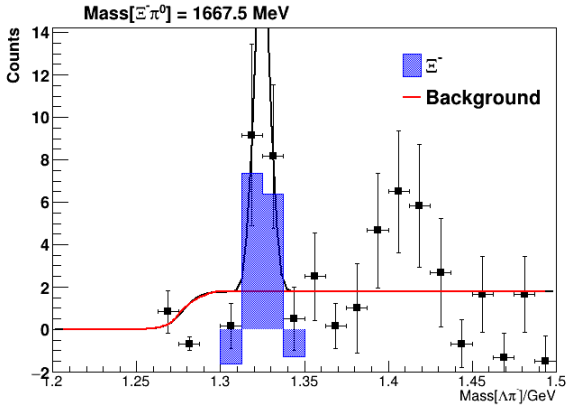

Mass[Ξ⁻π⁰] = 1637.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

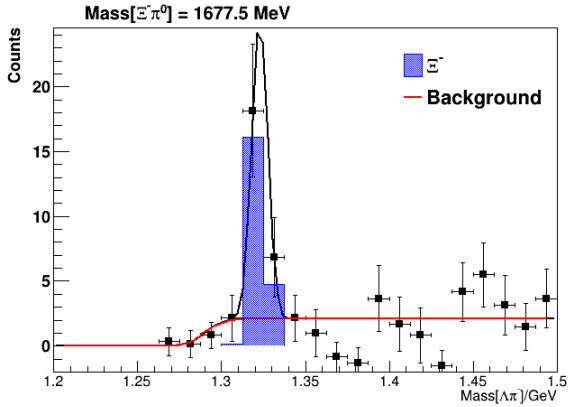

Mass[Ξ⁻π⁰] = 1647.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

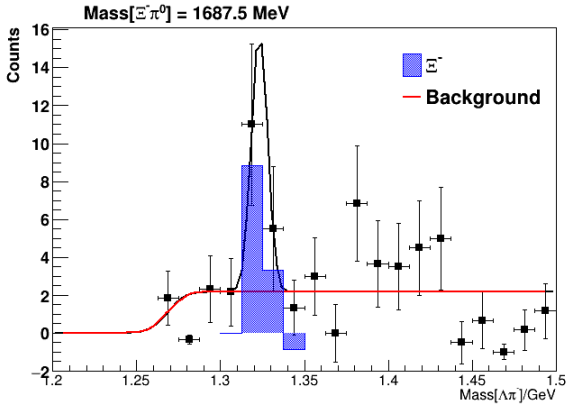
Ground State Ξ^- Fits

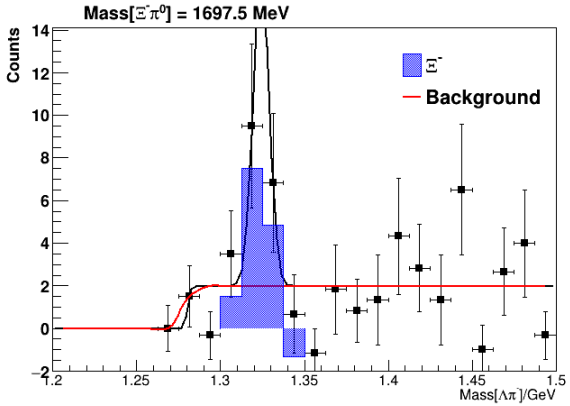
Next: From 1657.5 to 1737.5 MeV

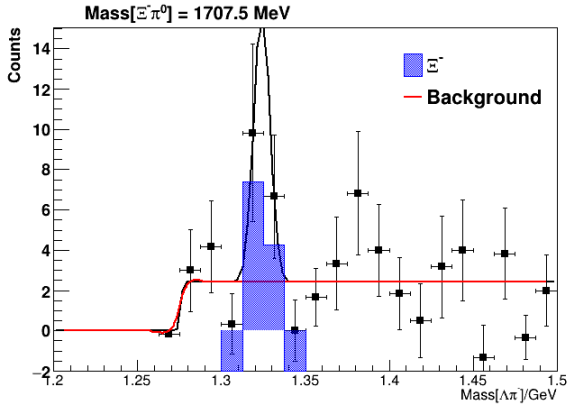

Mass[Ξ⁻π⁰] = 1657.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

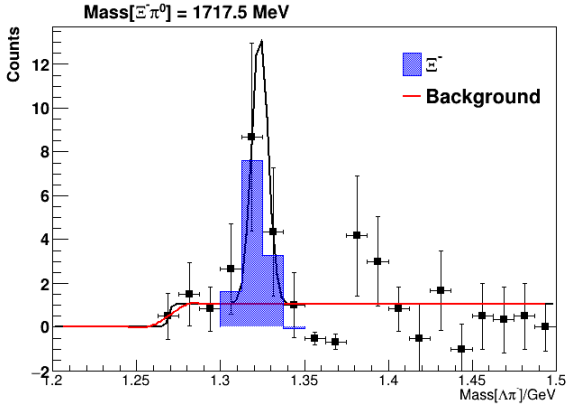

Mass[Ξ⁻π⁰] = 1667.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

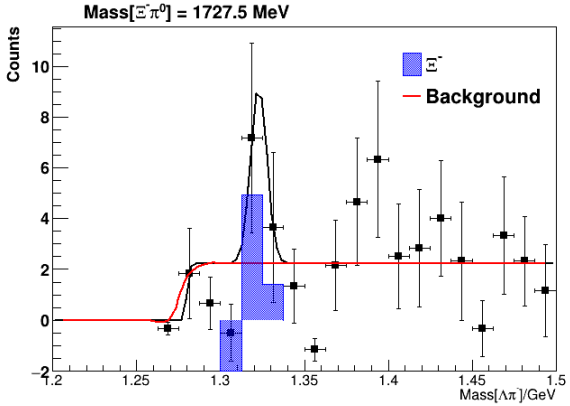

Mass[Ξ⁻π⁰] = 1677.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

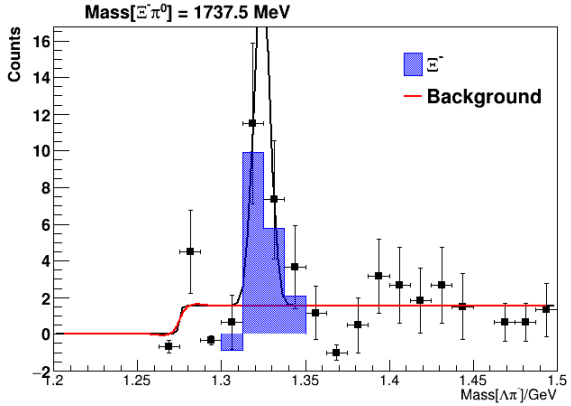

Mass[Ξ⁻π⁰] = 1687.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV


Mass[Ξ⁻π⁰] = 1697.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV


Mass[Ξ⁻π⁰] = 1707.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

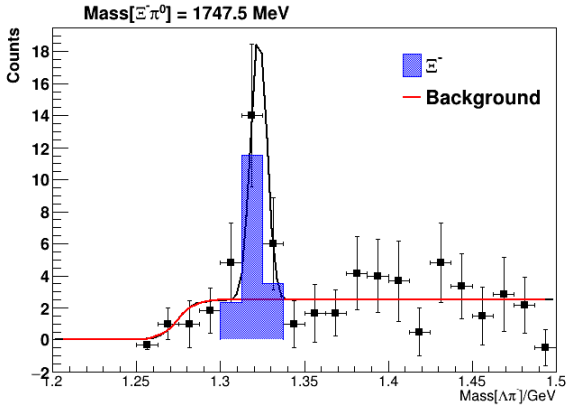

Mass[Ξ⁻π⁰] = 1717.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

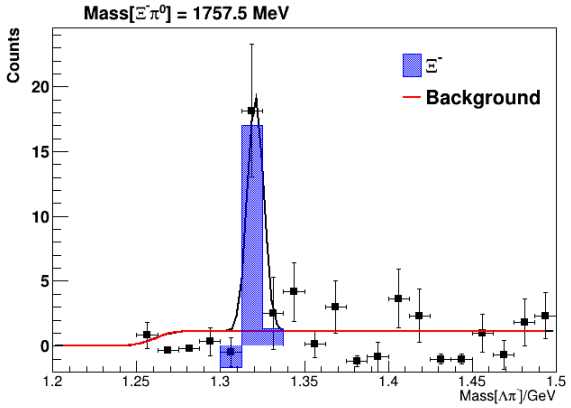

Mass[Ξ⁻π⁰] = 1727.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

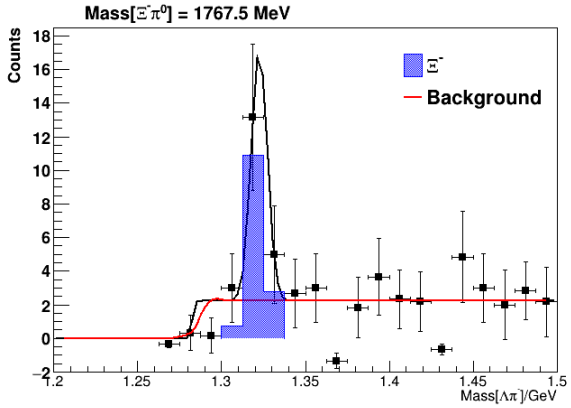

Mass[Ξ⁻π⁰] = 1737.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

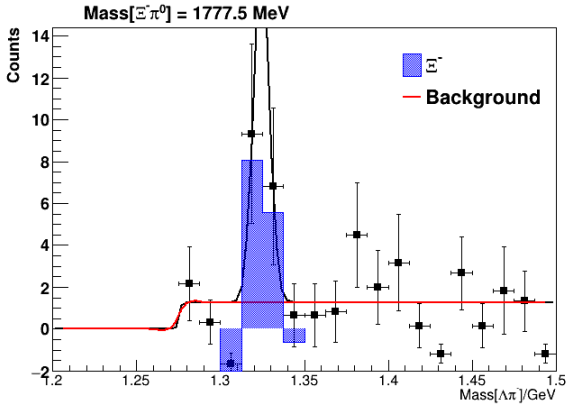
Ground State Ξ^- Fits

Last: From 1747.5 to 1777.5 MeV


Mass[Ξ⁻π⁰] = 1747.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV


Mass[Ξ⁻π⁰] = 1757.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV


Mass[Ξ⁻π⁰] = 1767.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV


Mass[Ξ⁻π⁰] = 1777.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

Comparison of Mass[Ξ^*]

$\Xi(1690)$:

- Fits have shape of $\Xi(1690)$ due entirely to detector resolution

- In general: Not enough statistics for the $\Xi(1690)$

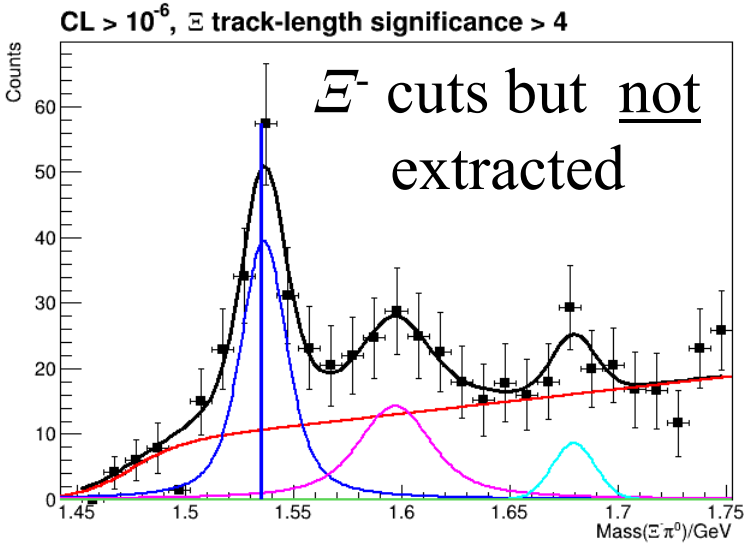
- If we can say anything at all, the best we can do for the $\Xi(1690)$ will probably be an upper limit

$\Xi(1620)$:

- With current statistics, the best we can do for the $\Xi(1620)$ will probably be an upper limit

ASU

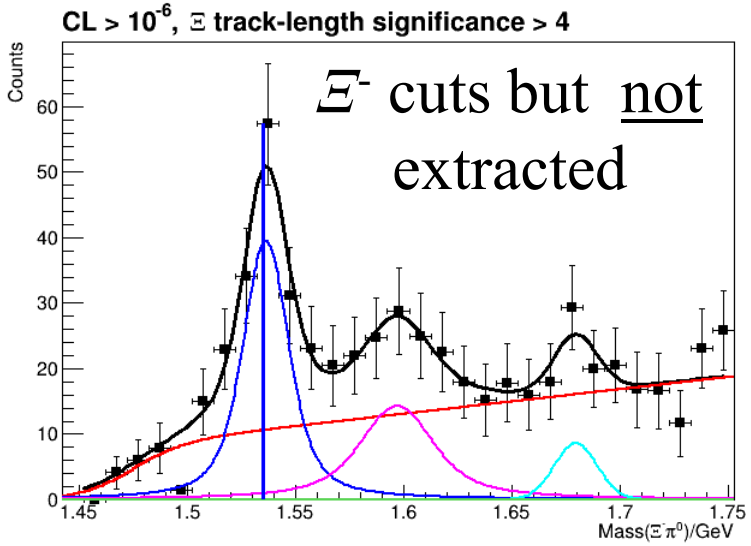
Comparison of Mass[Ξ^*]



- $\Xi(1530)$:
  - Center = 1536(2) MeV
  - Width = 13(17) MeV

Note: Error bars need to be fixed?

Comparison of Mass[Ξ^*]



Note: Error bars need to be fixed?

- $\Xi(1530)$:
  - Center = 1536(2) MeV
  - Width = 13(17) MeV

$\Xi(1530)^-$ MASS

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
1535.0±0.6 OUR FIT					
1535.2±0.8 OUR AVERAGE					
1534.5±1.2		DEBELLEFON	75B	HBC	$K^- p \to \Xi^- \overline{K}\pi$
1535.3±2.0		ROSS	73B	HBC	$K^- p \to \Xi \overline{K}\pi(\pi)$
1536.2±1.6	185	KIRSCH	72	HBC	$K^- p$ 2.87 GeV/c
1535.7±3.2	38	LONDON	66	HBC	$K^- p$ 2.24 GeV/c
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1540 ±3	48	BERTHON	74	HBC	Quasi-2-body σ
1534.7±1.1	334	BALTAY	72	HBC	$K^- p$ 1.75 GeV/c

$\Xi(1530)^-$ WIDTH

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
$9.9^{+1.7}_{-1.9}$ OUR AVERAGE				
9.6±2.8	DEBELLEFON	75B	HBC	$K^- p \to \Xi^- \overline{K}\pi$
8.3±3.6	ROSS	73B	HBC	$K^- p \to \Xi \overline{K}\pi(\pi)$
$7.8^{+3.5}_{-7.8}$	BALTAY	72	HBC	$K^- p$ 1.75 GeV/c
16.2±4.6	KIRSCH	72	HBC	$\Xi^- \pi^0$, $\Xi^0 \pi^-$

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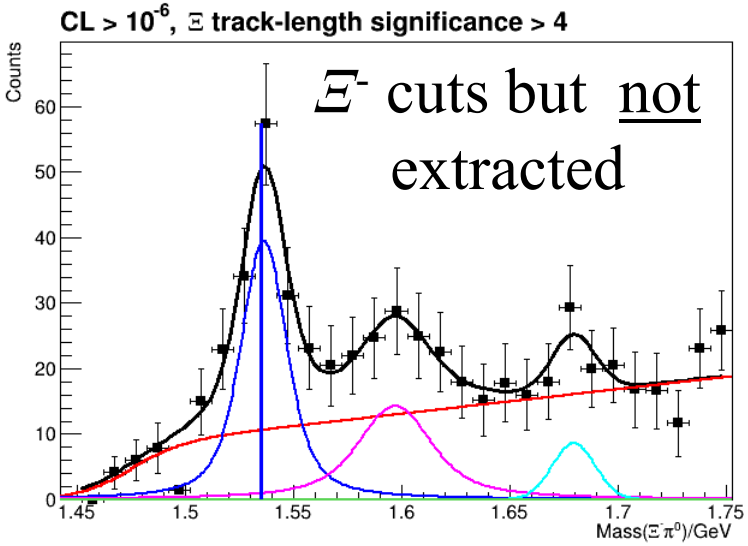
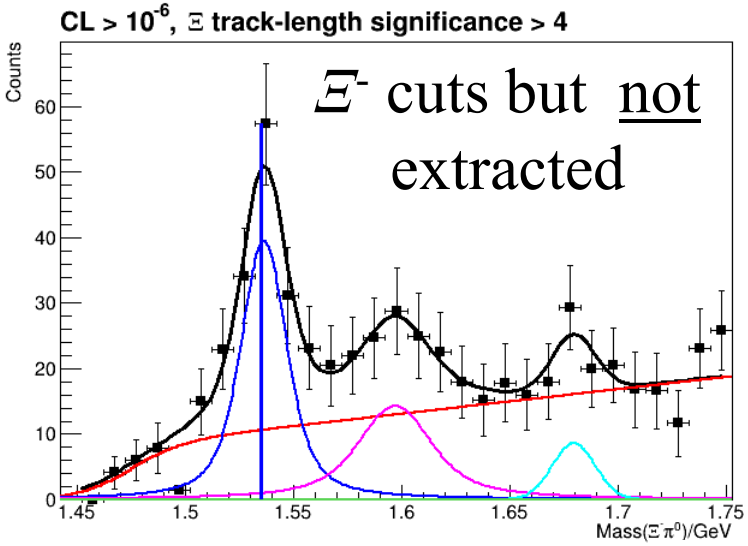


- Ξ(1530):
  - Center = 1536(2) MeV
  - Width = 13(17) MeV
- Ξ(1620):
  - Center = 1597(7) MeV
  - Width = 28(39) MeV

Note: Error bars need to be fixed?

Comparison of Mass[Ξ*]



- Ξ(1530):
  - Center = 1536(2) MeV
  - Width = 13(17) MeV
- Ξ(1620):
  - Center = 1597(7) MeV
  - Width = 28(39) MeV

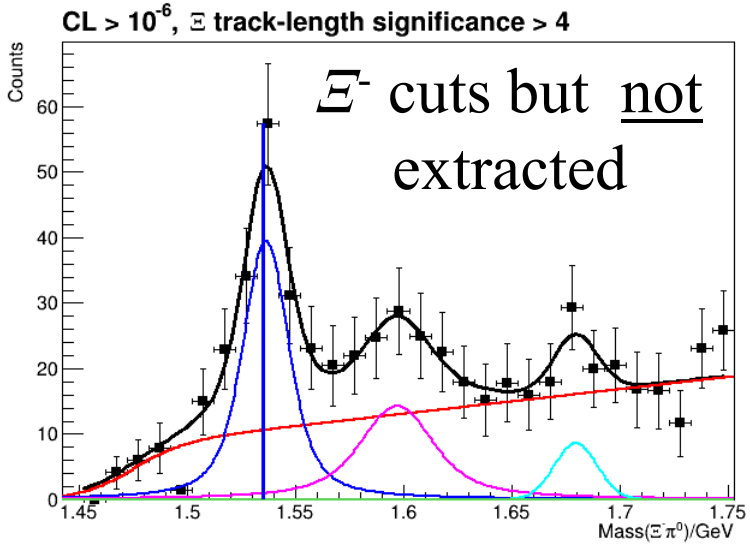
Ξ(1620) MASS

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

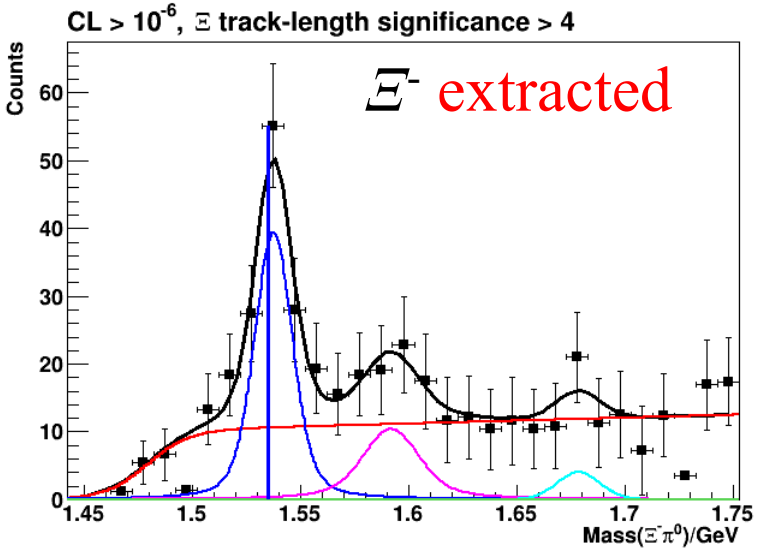
Ξ(1620) WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
$32 \pm {}^{8}_{9}$ 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 of Mass[Ξ*]



- Ξ(1530):
  - Center = 1536(2) MeV
  - Width = 13(17) MeV
- Ξ(1620):
  - Center = 1597(7) MeV
  - Width = 28(39) MeV



- Ξ(1530):
  - Center = 1538(2) MeV
  - Width = 7(14) MeV
- Ξ(1620):
  - Center = 1592(9) MeV
  - Width = 14(34) MeV

Title

Title