Group meeting
August 9th, 2024

Instruction responsibilities

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

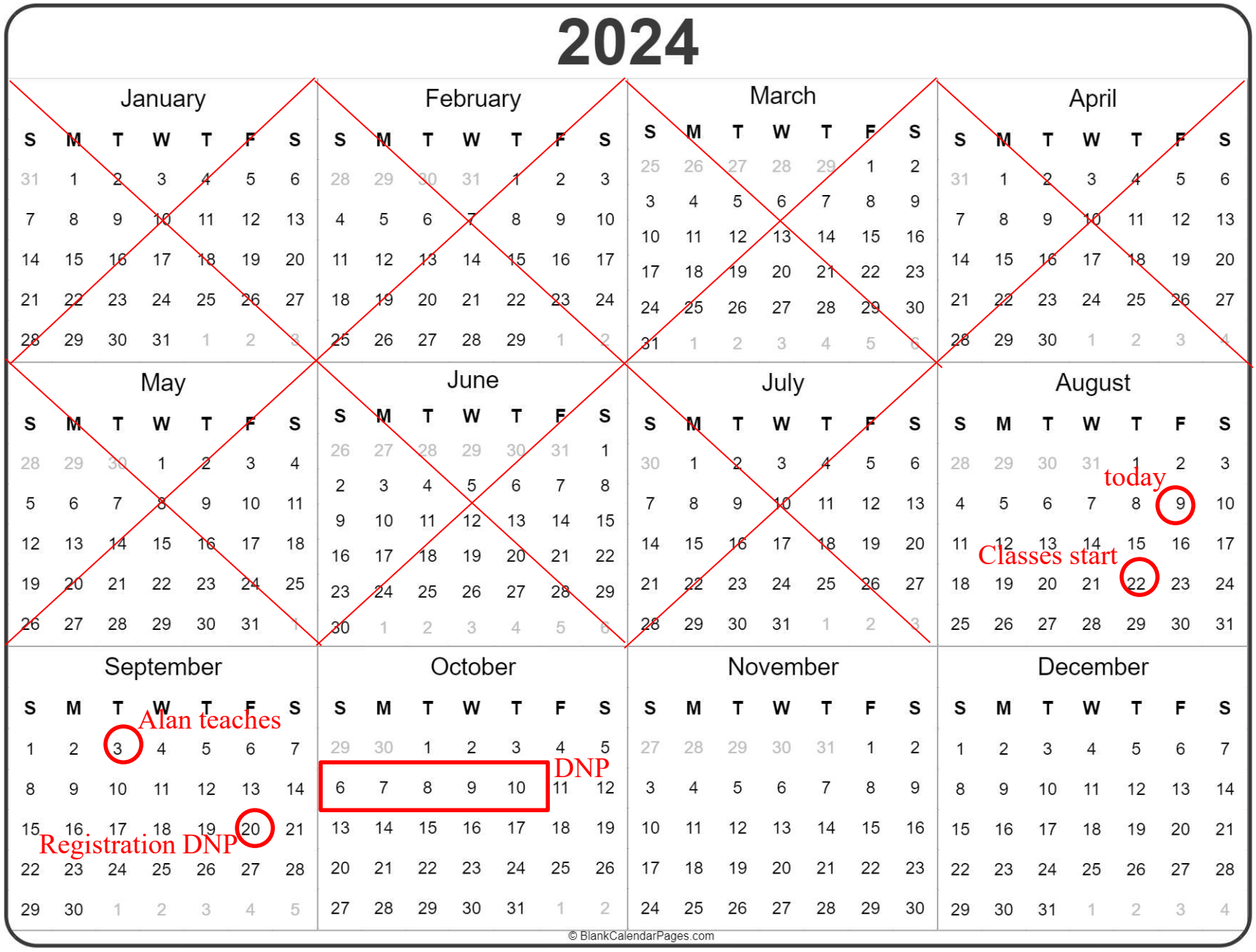
Service responsibilities

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

Group responsibilities

- Undergrad: Met with Dylan on Tuesday
- I approved AY 24/25 offer letters. The letters should have been sent to grad students

Timelines


2024
January
February
March
April
May
June
July
August
September
October
November
December
today
Classes start
Alan teaches
DNP
Registration DNP
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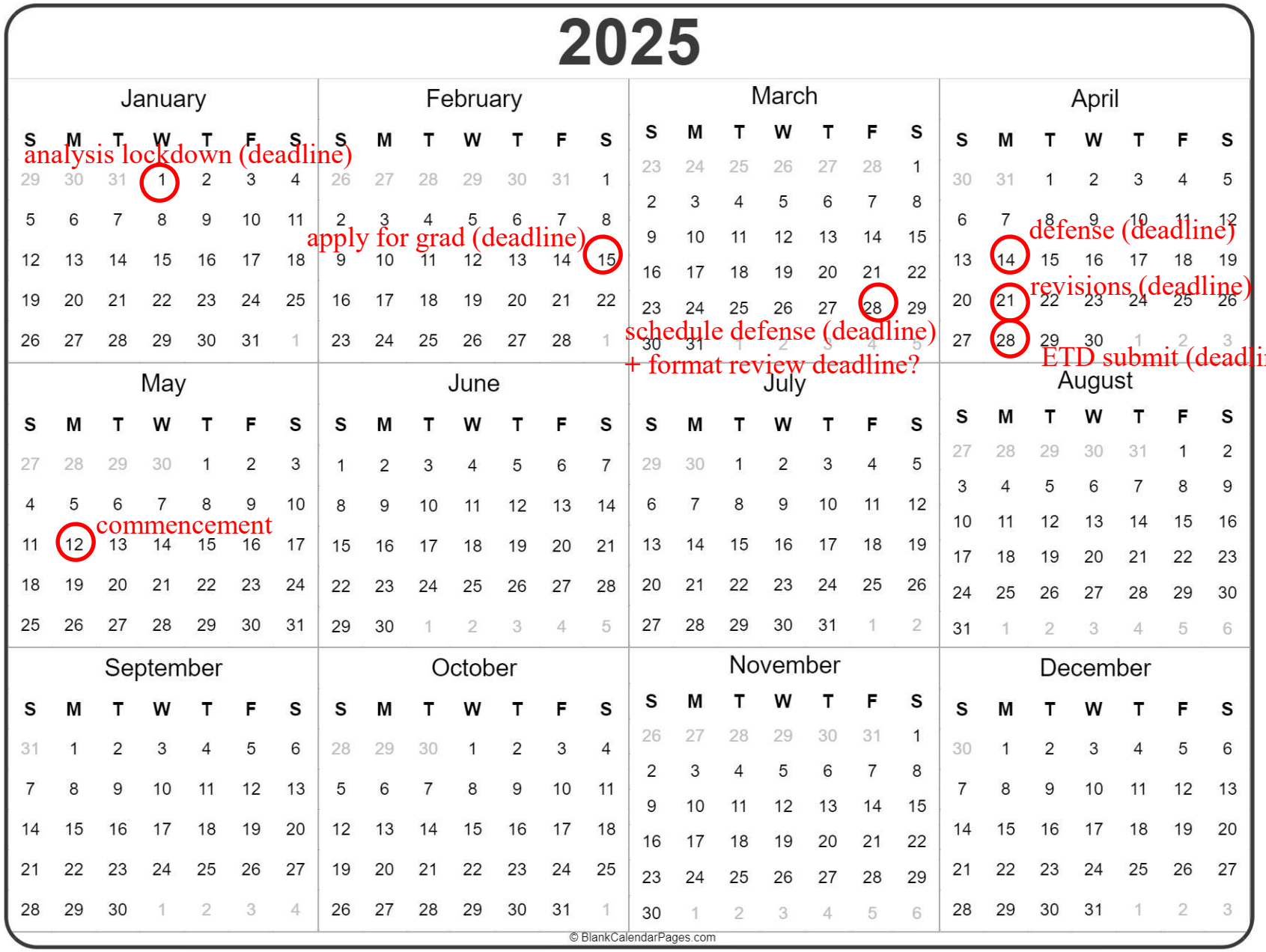
2025
January
February
March
April
May
June
July
August
September
October
November
December
analysis lockdown (deadline)
apply for grad (deadline)
defense (deadline)
revisions (deadline)
schedule defense (deadline)
+ format review deadline?
ETD submit (deadline)
commencement
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$\Xi^* \rightarrow \Xi\pi^0$ update

- Material for this update is very similar to what I had shown 2 weeks ago
- Biggest change is that all of the studies now include hybrid method of accidental subtraction
- Note: My MC calculations now use same setting as given here: https://halldweb.jlab.org/gluex_sim/SubmitSim.html

ASU

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

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

Reaction

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

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

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

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

- Mass of Ξ^{-} not constrained

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

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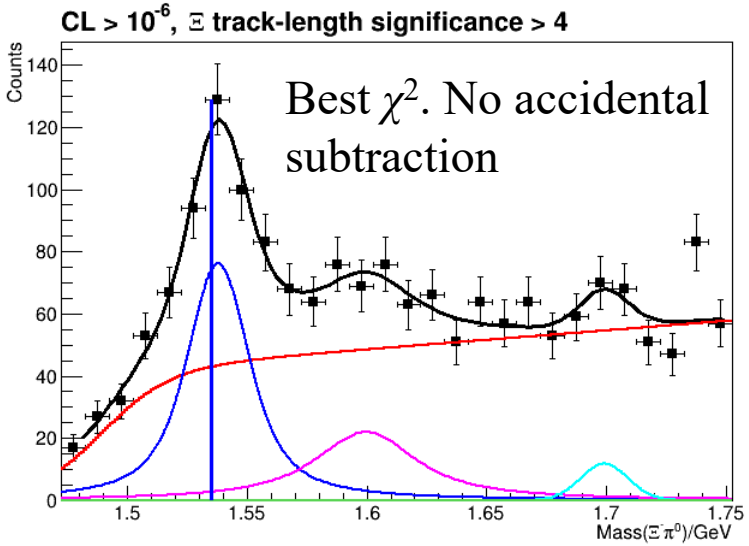
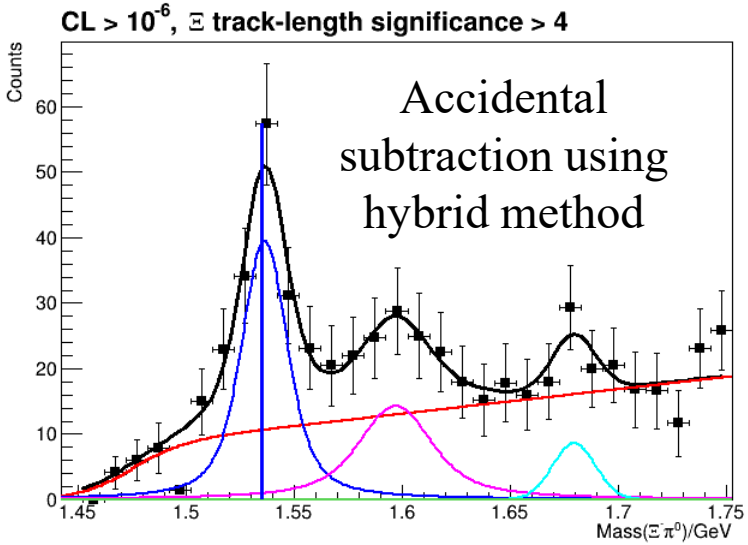
Accidental subtraction using hybrid method





Note: Error bars look too big ☹

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

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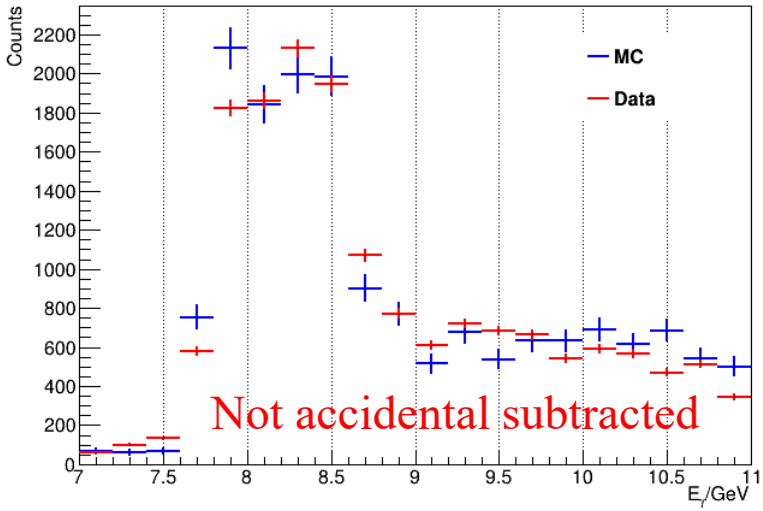
- Started with Mandelstam s and t
- Will move to m_{Y*} refinement next time

Ξ^* Comparison of Reconstructed MC to Actual Data

Confidence level and pathlength significance

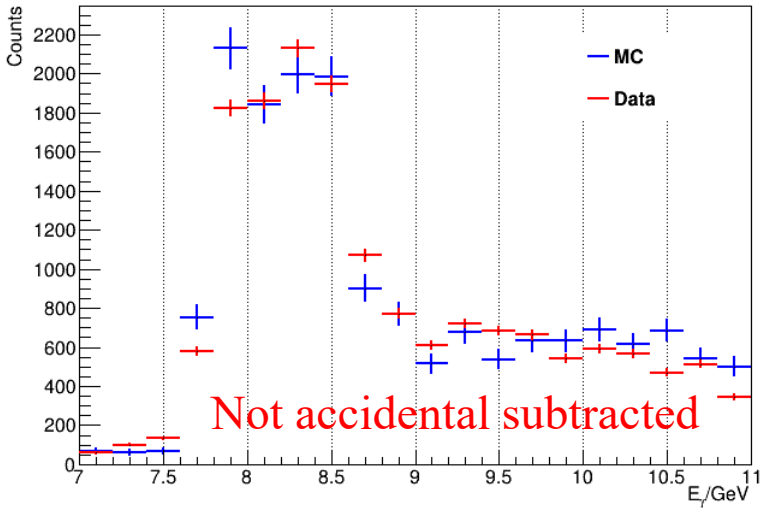
- Same confidence level cut: CL > 10^{-6}
- Same pathlength significance cut > 4

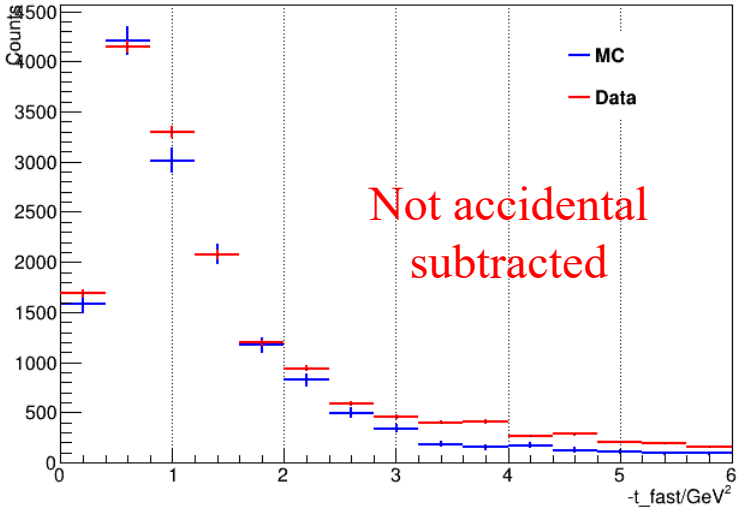
Ξ^* Comparison of Reconstructed MC to Actual Data



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

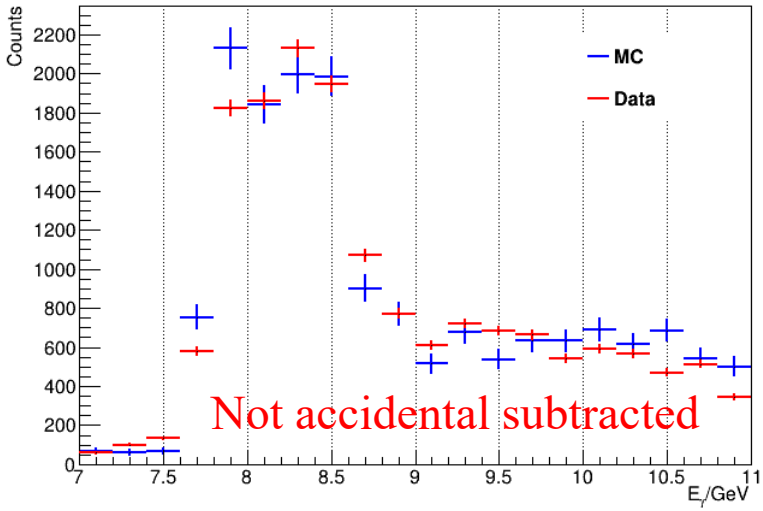
Ξ^* Comparison of Reconstructed MC to Actual Data



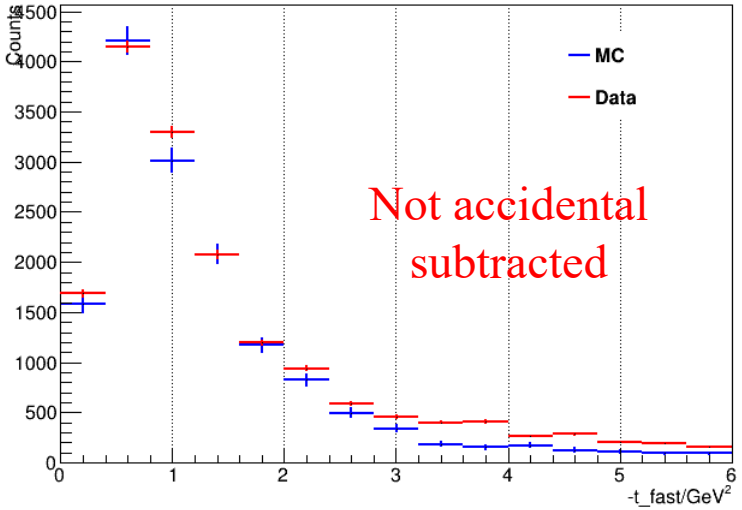


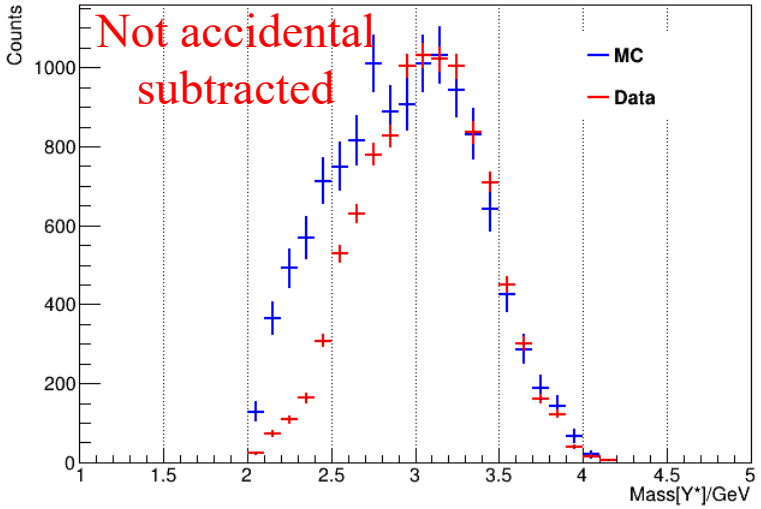
- -*t*(fast) looks reasonable

Ξ^* Comparison of Reconstructed MC to Actual Data



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





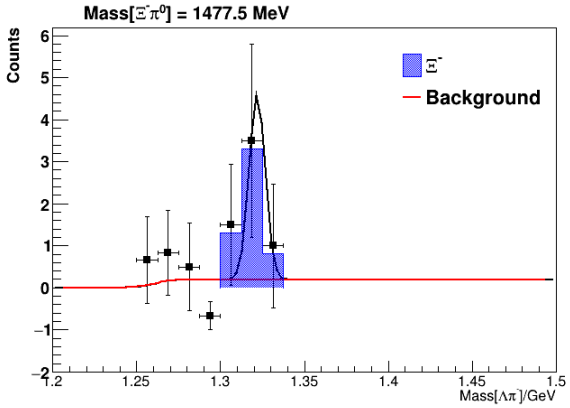
Ground State Ξ^- Fits

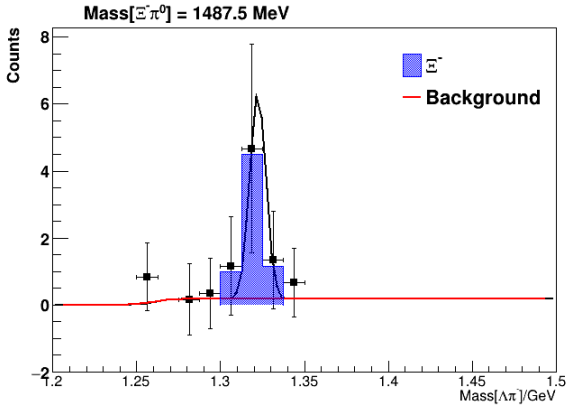
- Attempting to remove all non-Ξ^- background by fitting the Ξ^- for each mass[Ξ^- π^0] bin
- Since lifetime of Ξ^- is 1.6e-10, I set width of the ground state Ξ^- to detector resolution found from Monte Carlo study.
- Some of the fits are not great, but we can still get a sense of the contribution to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

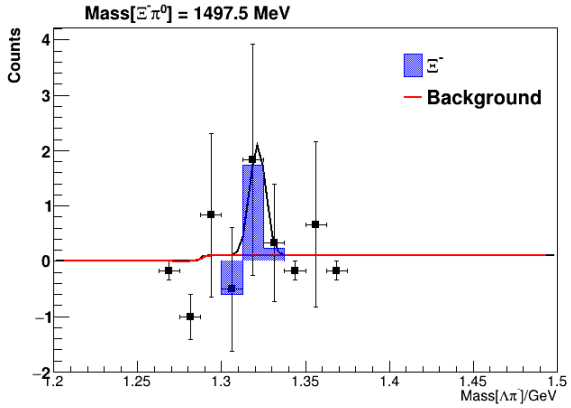
ASU

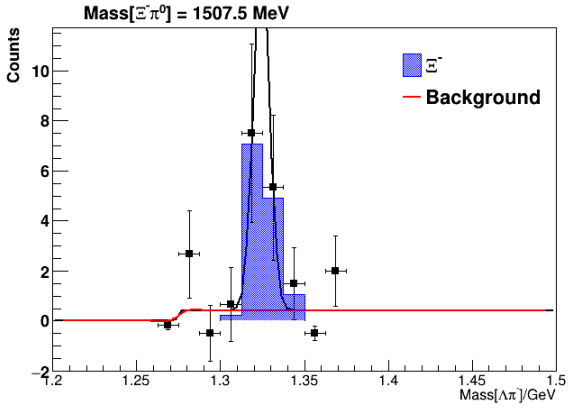
Ground State Ξ^- Fits

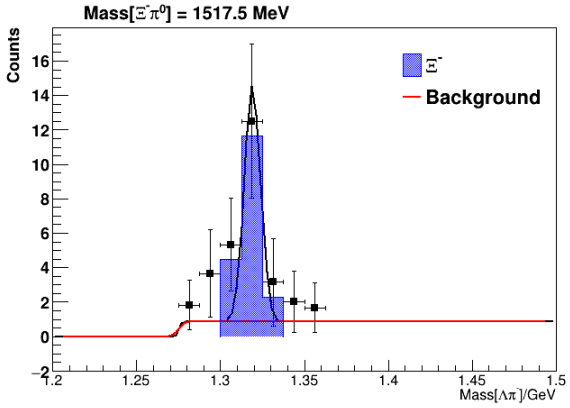
From 1477.5 to 1557.5 MeV

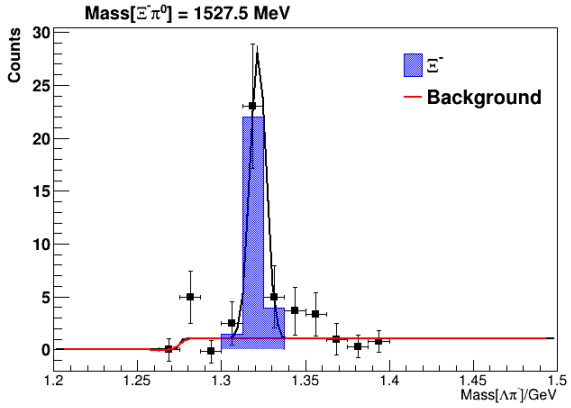

Mass[Ξ⁻π⁰] = 1477.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

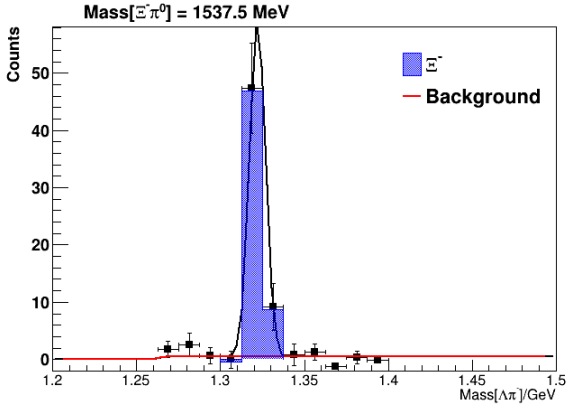

Mass[Ξ⁻π⁰] = 1487.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

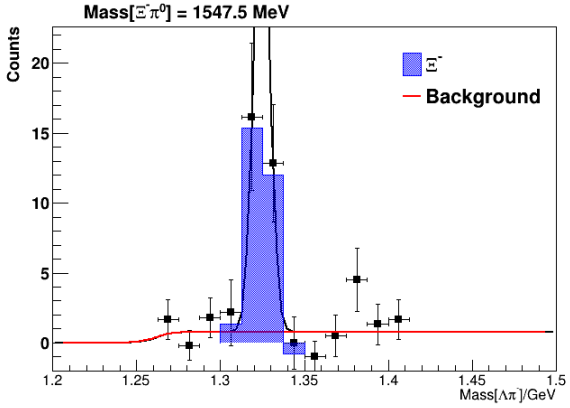

Mass[Ξ⁻π⁰] = 1497.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

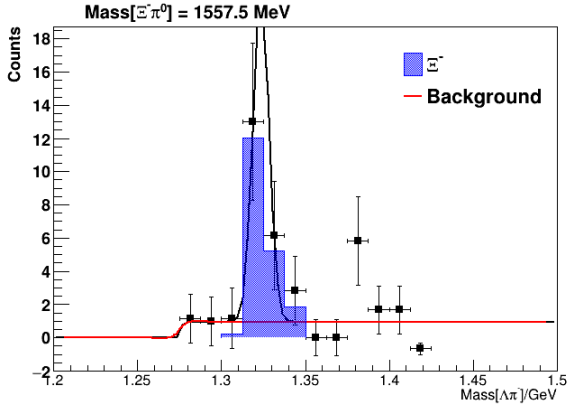

Mass[Ξ⁻π⁰] = 1507.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV


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


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

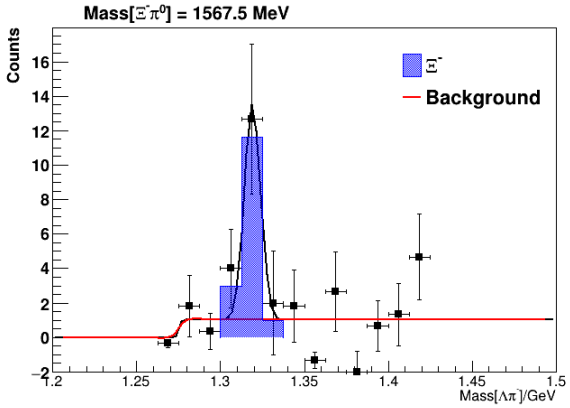

Mass[Ξ⁻π⁰] = 1537.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

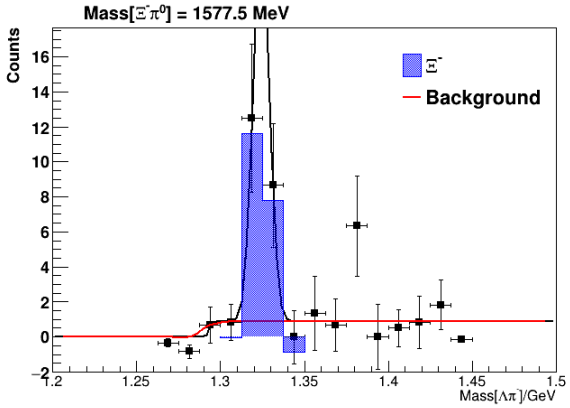

Mass[Ξ⁻π⁰] = 1547.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

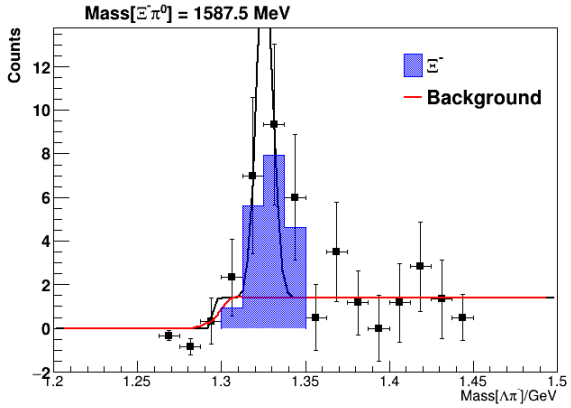

Mass[Ξ⁻π⁰] = 1557.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

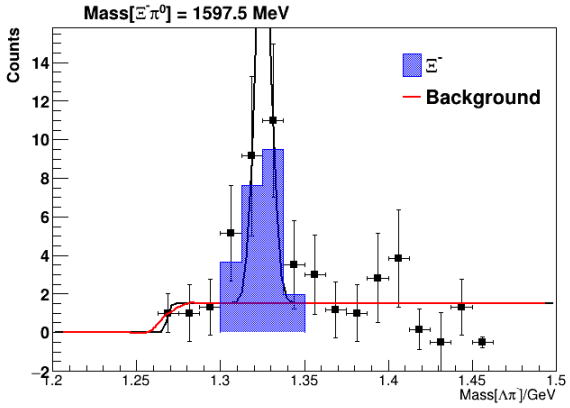
Ground State Ξ^- Fits

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
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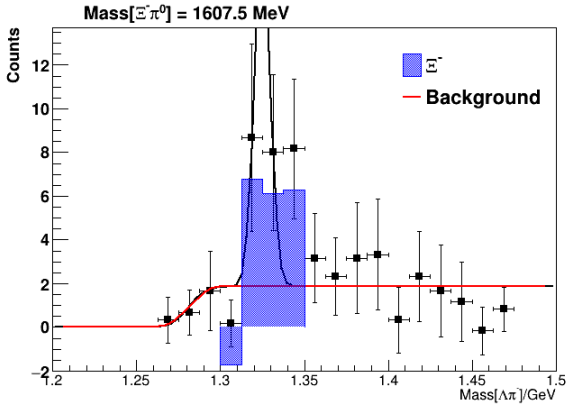
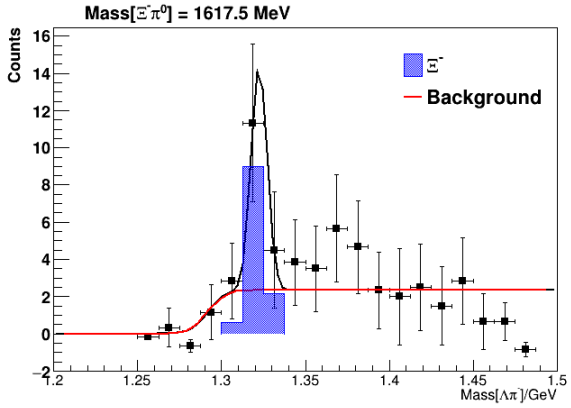

Mass[Ξ⁻π⁰] = 1607.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV


Mass[Ξ⁻π⁰] = 1617.5 MeV
Counts
Ξ⁻
Background
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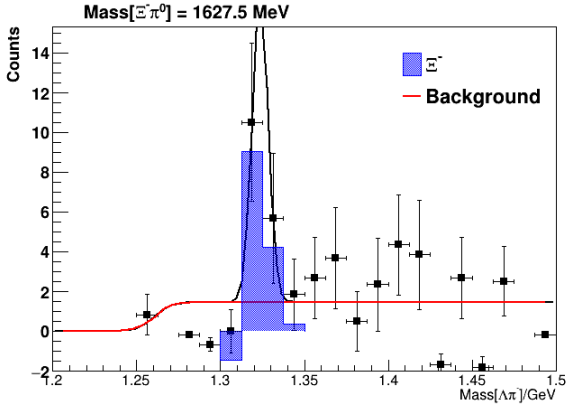
Mass[Ξ⁻π⁰] = 1627.5 MeV
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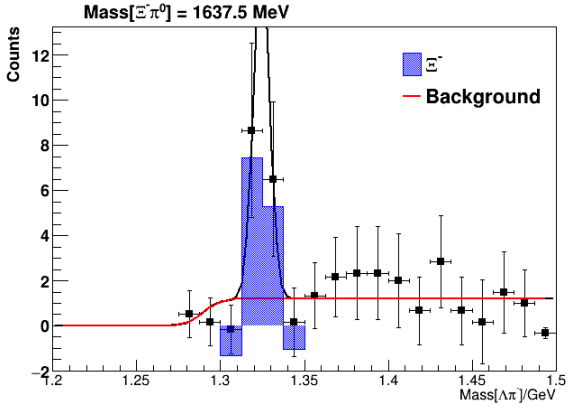
Mass[Ξ⁻π⁰] = 1637.5 MeV
Counts
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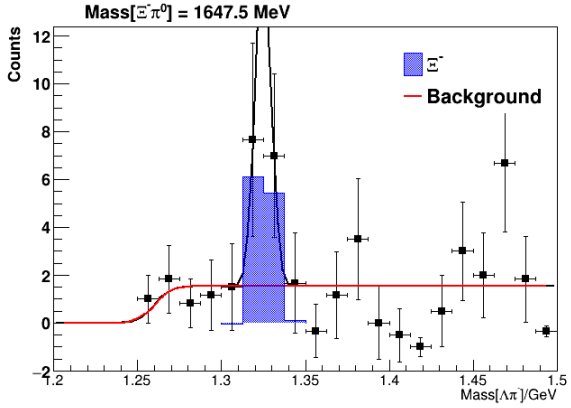
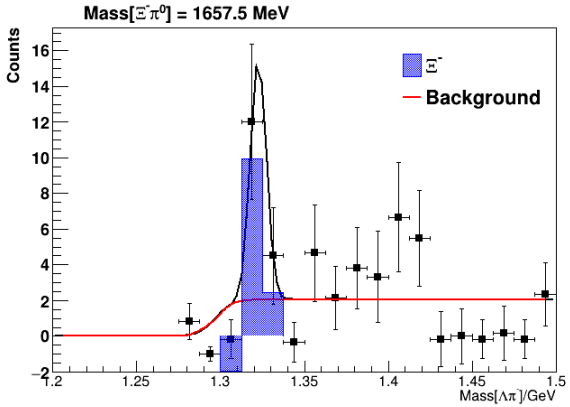
Background
Mass[Λπ⁻]/GeV


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
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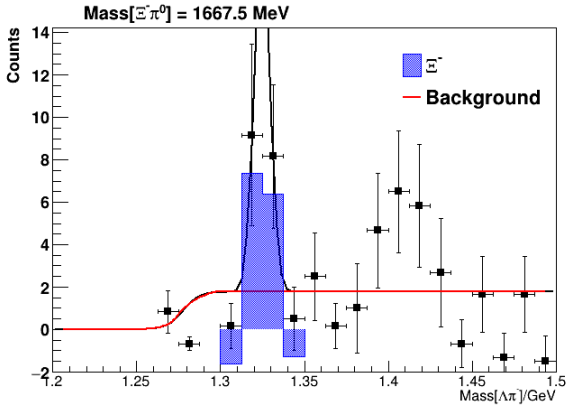
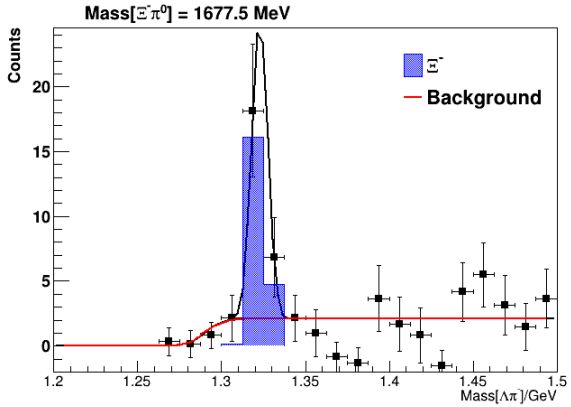
Mass[Λπ⁻]/GeV


Mass[Ξ⁻π⁰] = 1667.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV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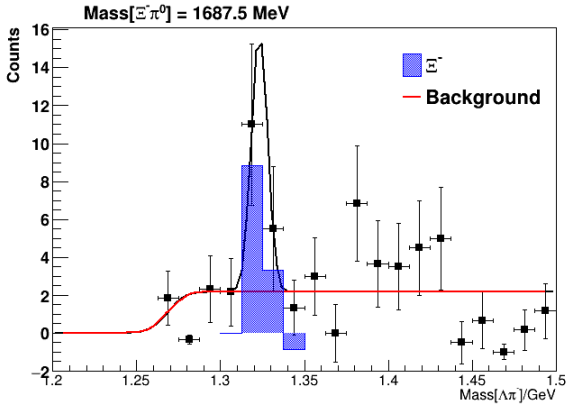
Mass[Ξ⁻π⁰] = 1687.5 MeV
Counts
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Background
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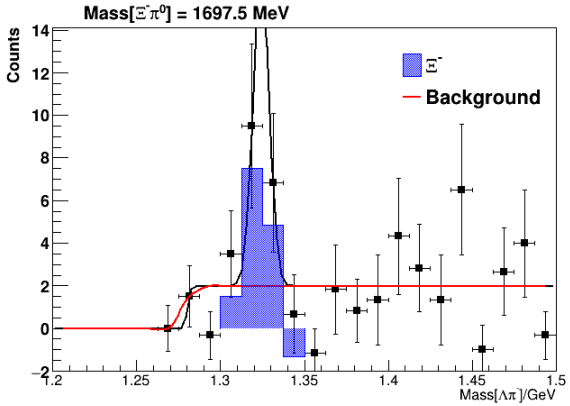
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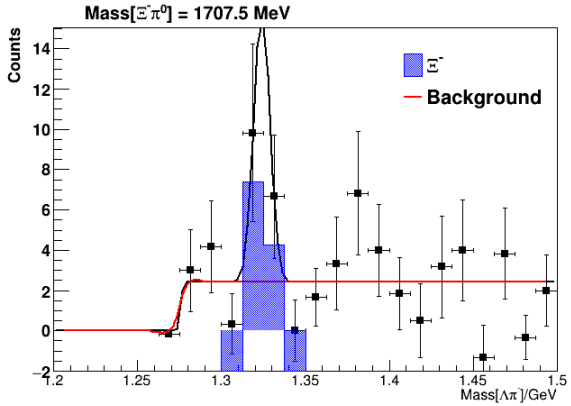
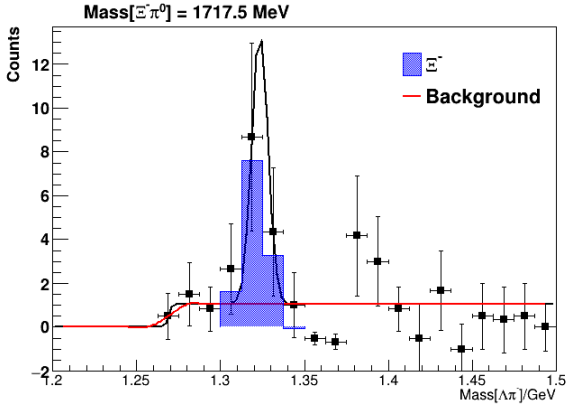
Background
Mass[Λπ⁻]/GeV


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


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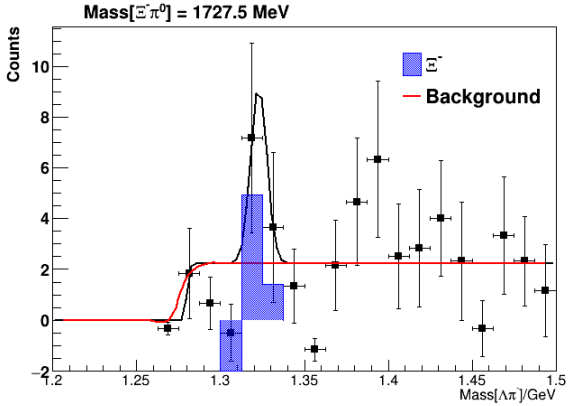
Background
Mass[Λπ⁻]/GeV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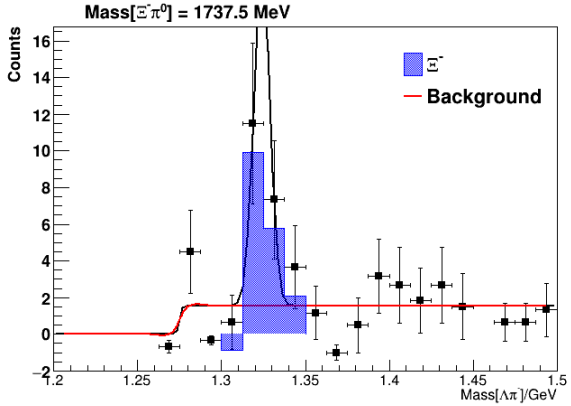
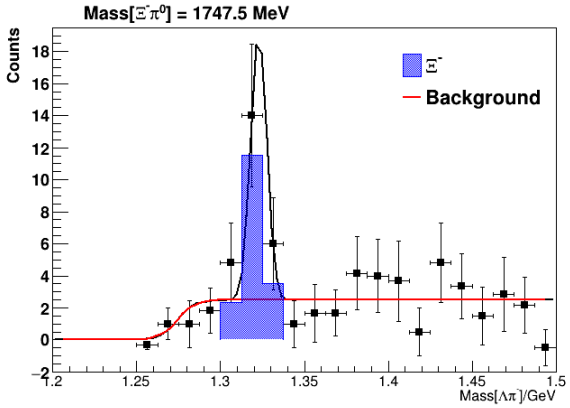

Mass[Ξ⁻π⁰] = 1737.5 MeV
Counts
Ξ⁻
Background
Mass[Λπ⁻]/GeV

Ground State Ξ^- Fits

Last: From 1747.5 to 1777.5 MeV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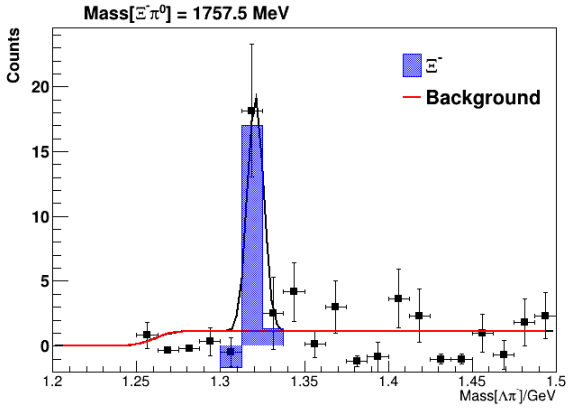
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Background
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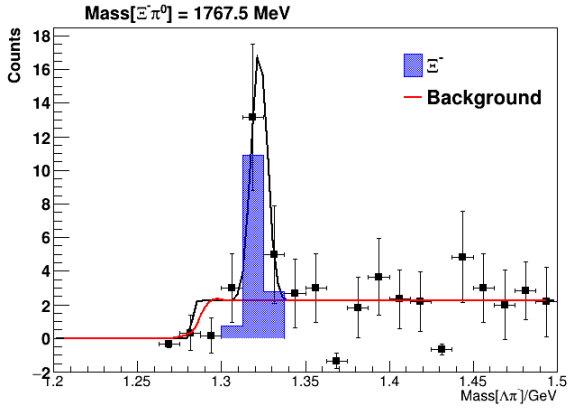
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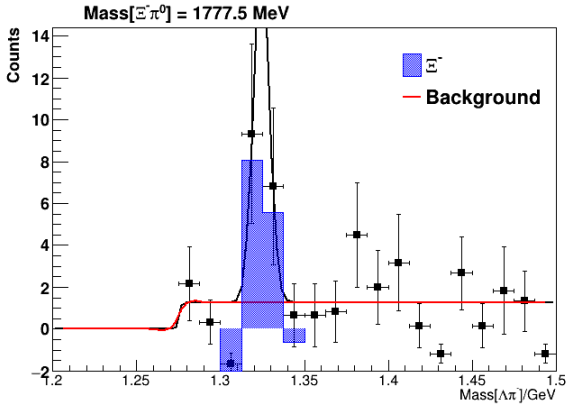
Background
Mass[Λπ⁻]/GeV


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

Comparison of Mass[Ξ^*]

$\Xi(1690)$:

- Prior fits had 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

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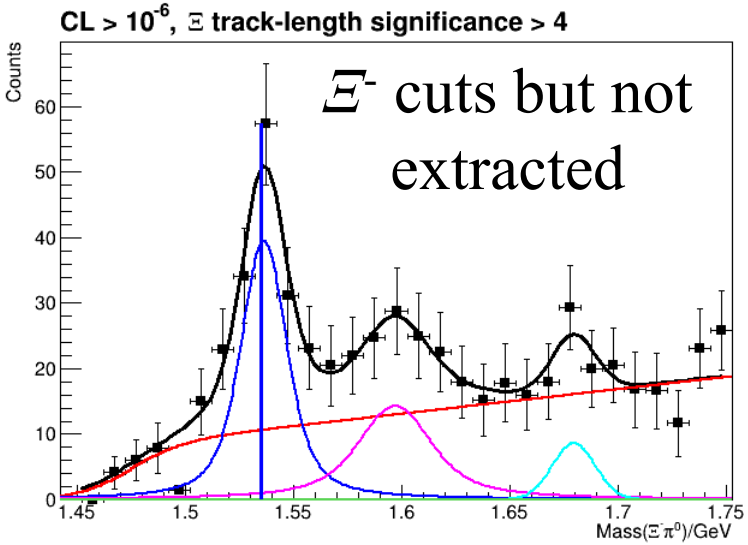
ASU

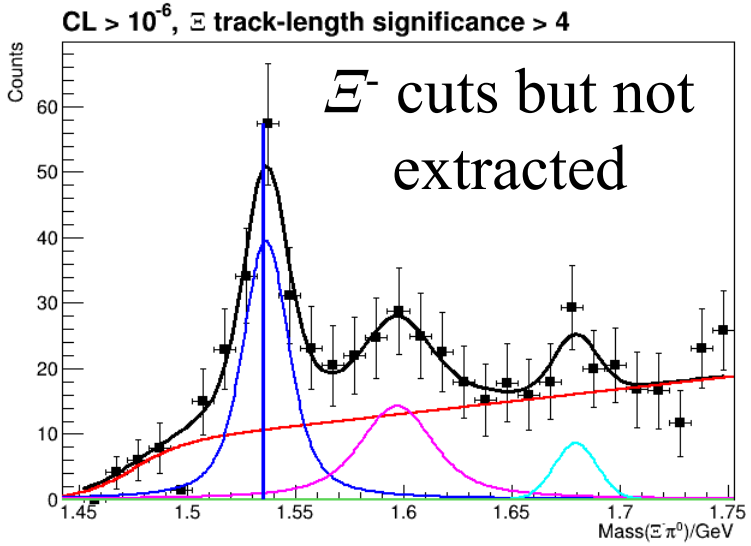
Comparison of Mass[Ξ^*]



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

Note: Error bars look too big ☹

Comparison of Mass[Ξ*]



Note: Error bars look too big ☹

- Ξ(1530):
  - Center = 1536(2) MeV
  - Width = 13(17) MeV

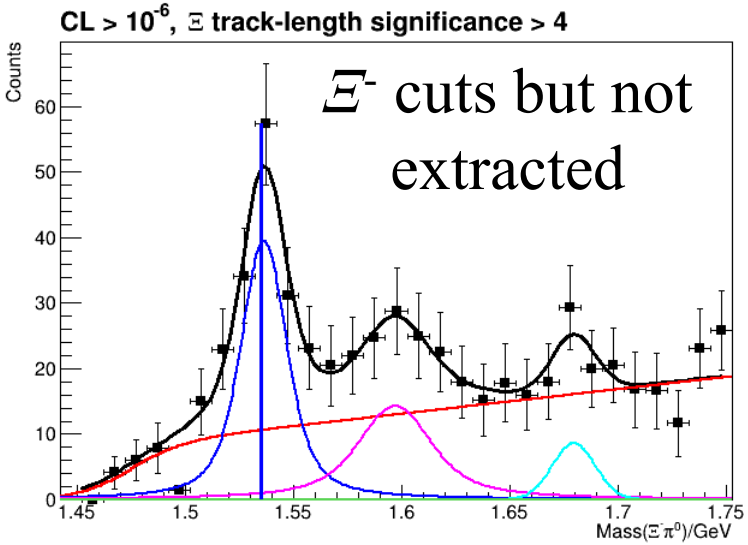
Ξ(1530)⁻ MASS

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

Ξ(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	$\Xi^- \pi^0$, $\Xi^0 \pi^-$

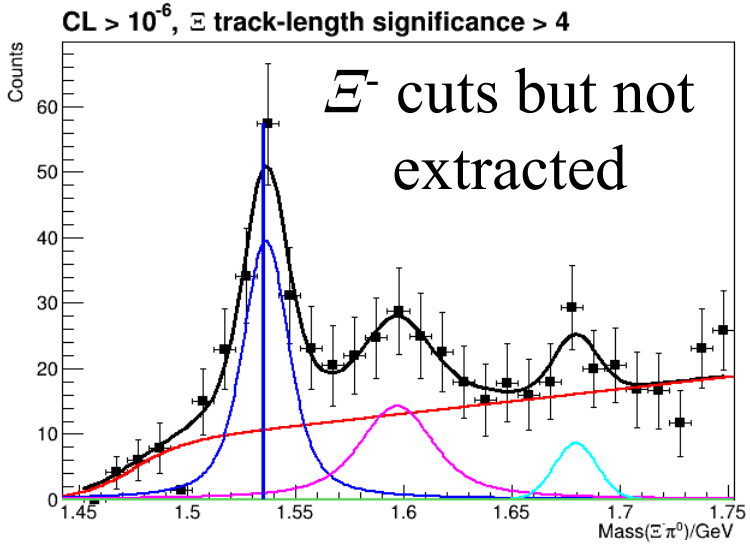
Comparison of Mass[Ξ^*]



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

Note: Error bars look too big ☹

Comparison of Mass[Ξ^*]



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

Note: Error bars look too big ☹

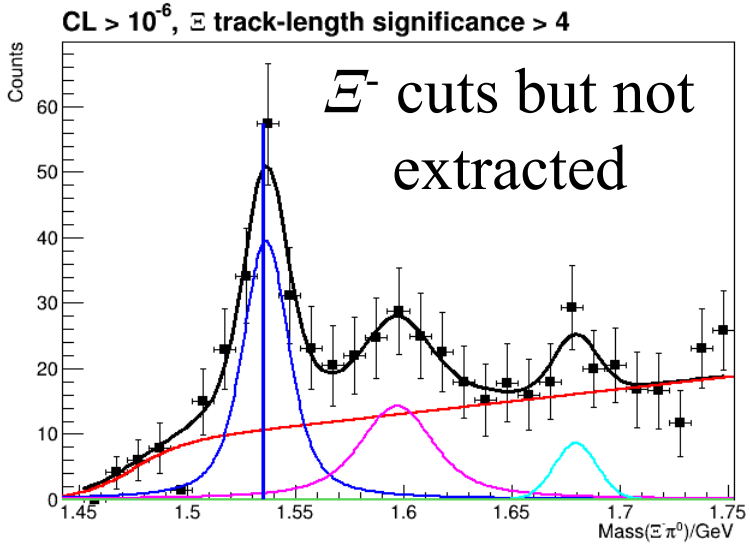
$\Xi(1620)$ MASS

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

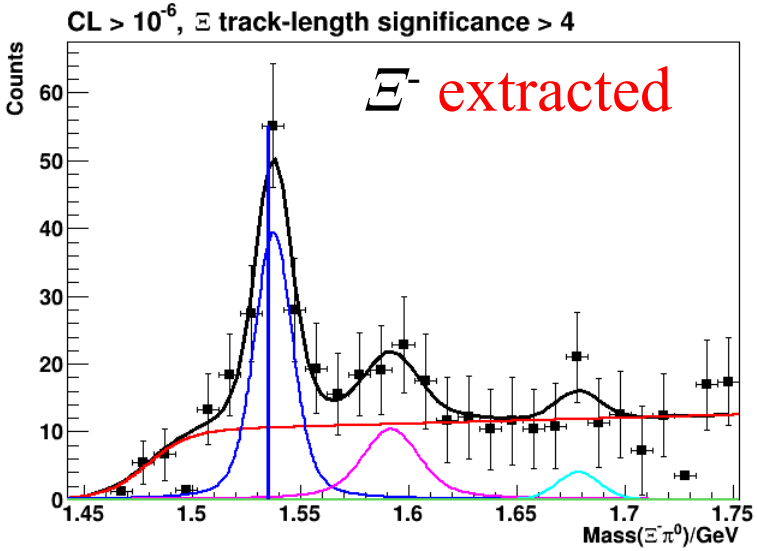
$\Xi(1620)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
$32 \pm {}^{8}_{9}$ 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

$KK\pi$ update

- I have some new material on DIRC

PID with and without DIRC

Let:

- $\varepsilon_{\text{Good}}$: Efficiency for correctly identifying $K^+K^-\pi^0$

PID with and without DIRC

Let:

- $\varepsilon_{\text{Good}}$: Efficiency for correctly identifying $K^+K^-\pi^0$
- ε_{Bad} : Efficiency for identifying $K^+\pi^-\pi^0$ as $K^+K^-\pi^0$

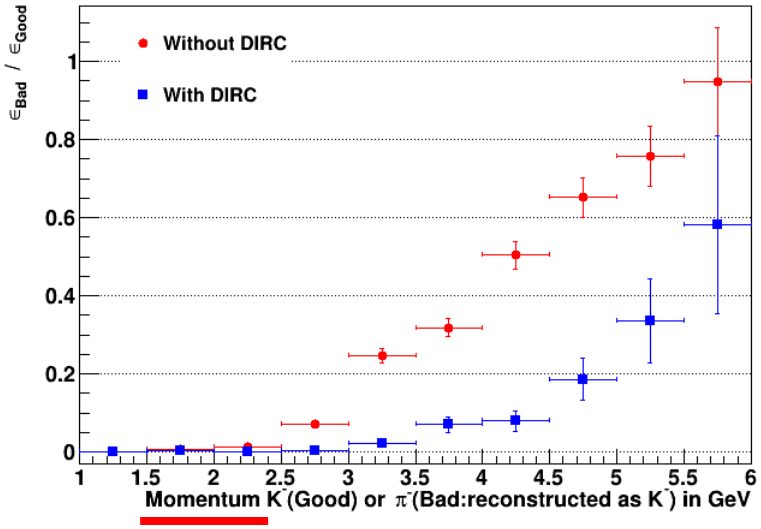
PID with and without DIRC

Let:

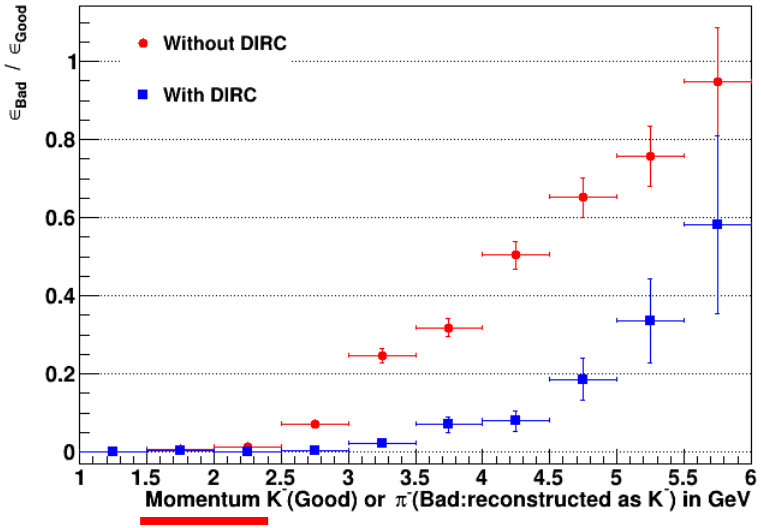
- ε_{Good} : Efficiency for correctly identifying $K^+K^-\pi^0$
- ε_{Bad} : Efficiency for identifying $K^+\pi^-\pi^0$ as $K^+K^-\pi^0$

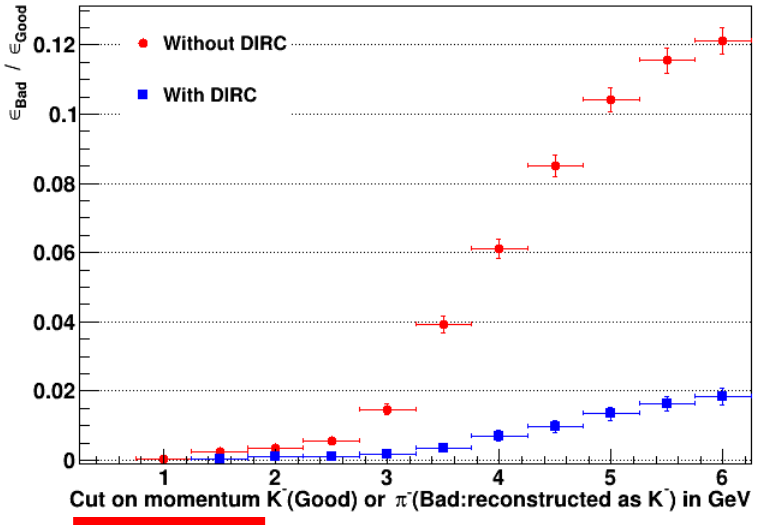
We want the ratio $\varepsilon_{Bad}/\varepsilon_{Good}$ to be small

PID with and without DIRC



PID with and without DIRC





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