A Study of Λ(1520) Photoproduction

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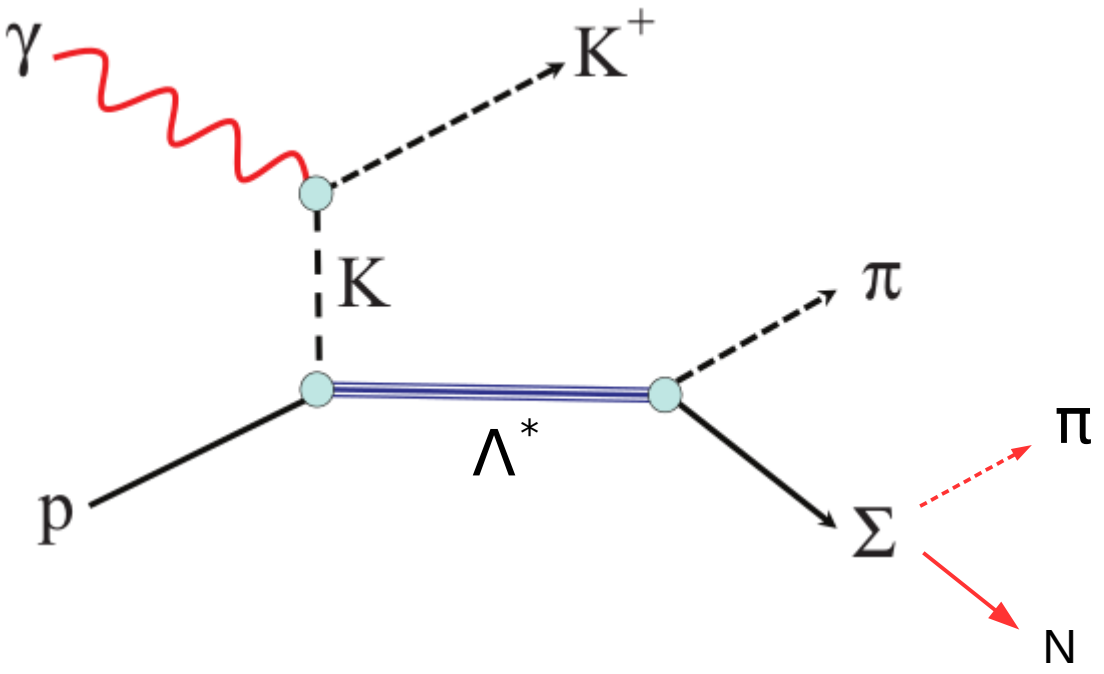
Outline

- Motivation
- Particle Identification (PID)
- Preliminary Cuts
- Yield Extraction and Fit
- Detector Efficiency
- Luminosity
- Differential Cross-section
- Summary & Future Work

Motivation



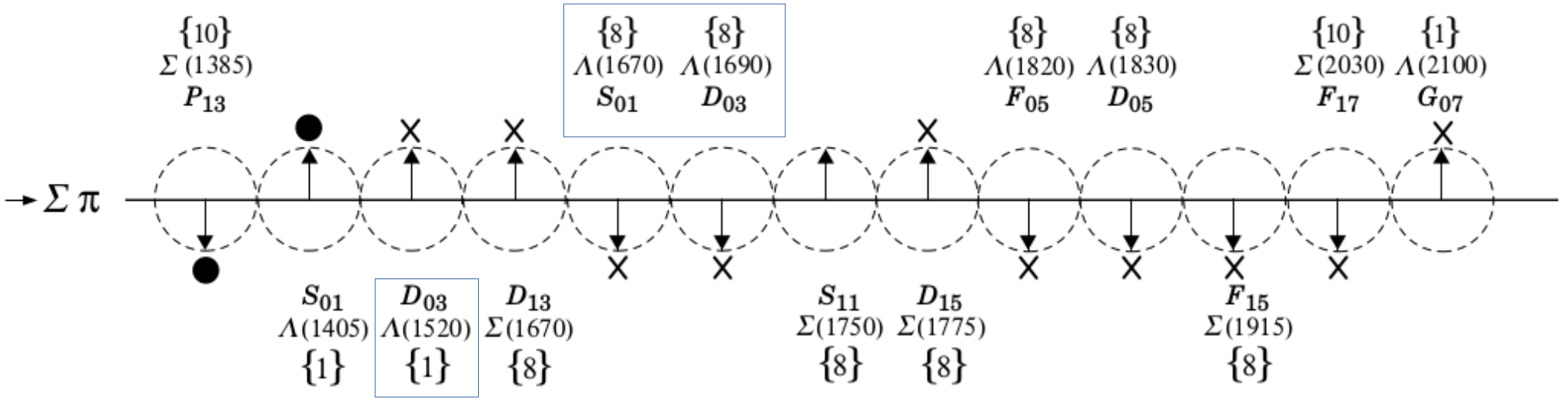
$$\gamma + p \rightarrow K^{+} + \Lambda^{*}$$

$$\Lambda^{*} \rightarrow \Sigma^{+} + \pi^{-}$$

$$\Lambda^{*} \rightarrow \Sigma^{-} + \pi^{+}$$

- $\Lambda(1405)1/2^{-}$ and $\Lambda(1520)3/2^{-}$ are rated 4-star by Particle Data Group
- Insight into higher resonances $\Lambda(1670)1/2^{-}$ and $\Lambda(1690)3/2^{-}$

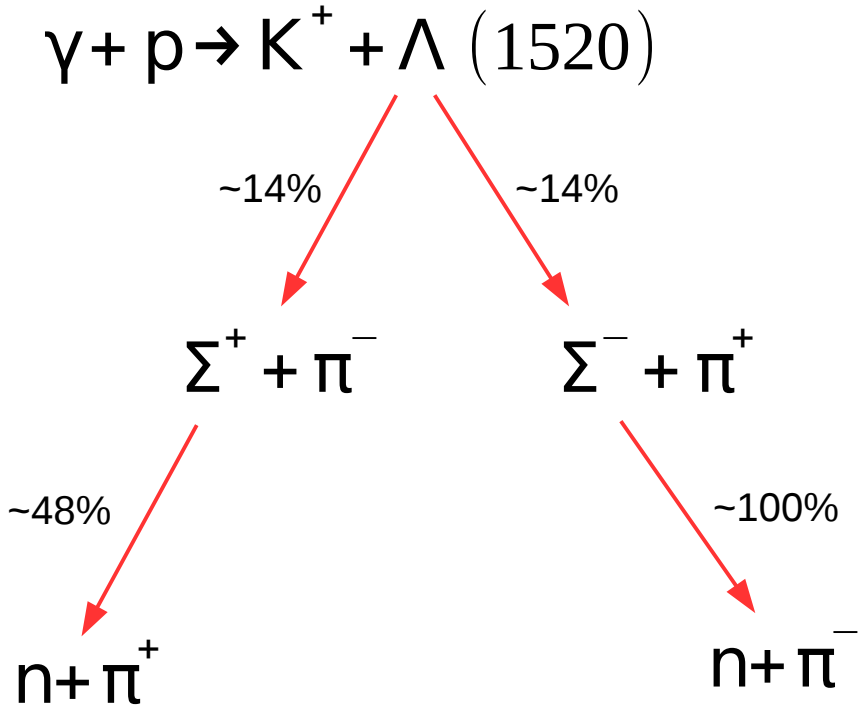
Motivation



Particle	J^P	Overall status	$N\overline{K}$	$\Lambda\pi$	$\Sigma\pi$	Other channels
$\Lambda(1116)$	$1/2+$	****		F		$N\pi$(weakly)
$\Lambda(1405)$	$1/2-$	****	****	o	****	
$\Lambda(1520)$	$3/2-$	****	****	r	****	$\Lambda\pi\pi, \Lambda\gamma$
$\Lambda(1600)$	$1/2+$	***	***	b	**	
$\Lambda(1670)$	$1/2-$	****	****	i	****	$\Lambda\eta$
$\Lambda(1690)$	$3/2-$	****	****	d	****	$\Lambda\pi\pi, \Sigma\pi\pi$

pdg.lbl.gov

PID

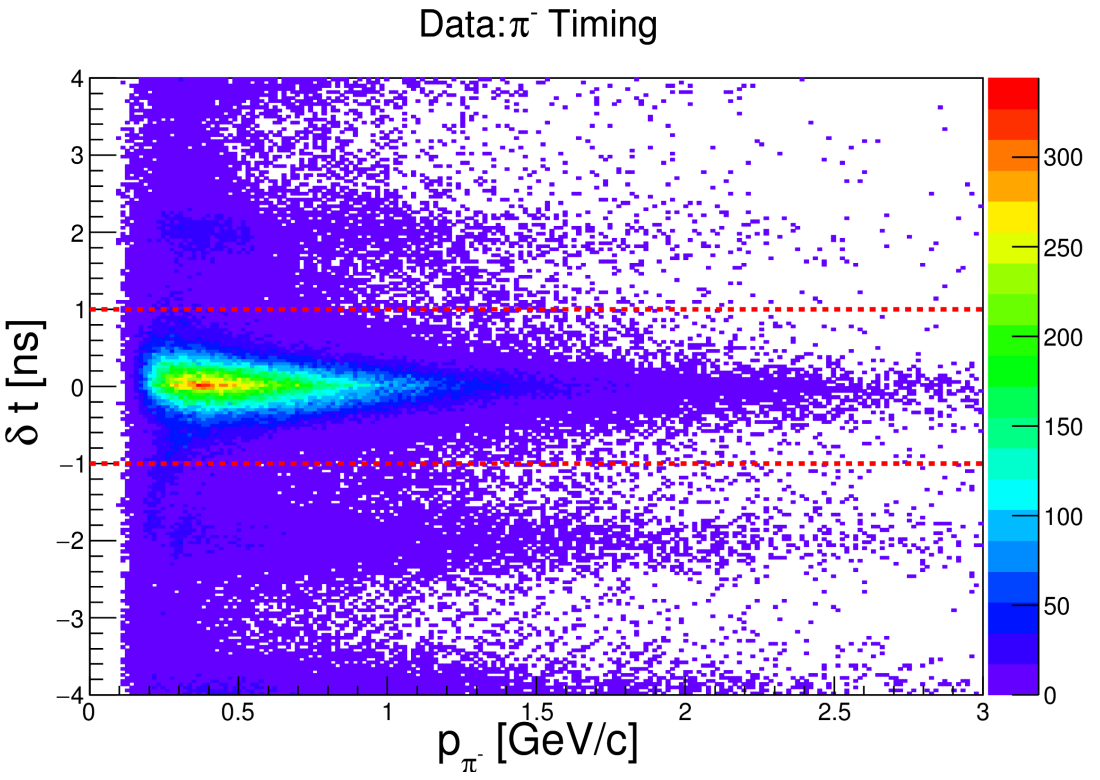


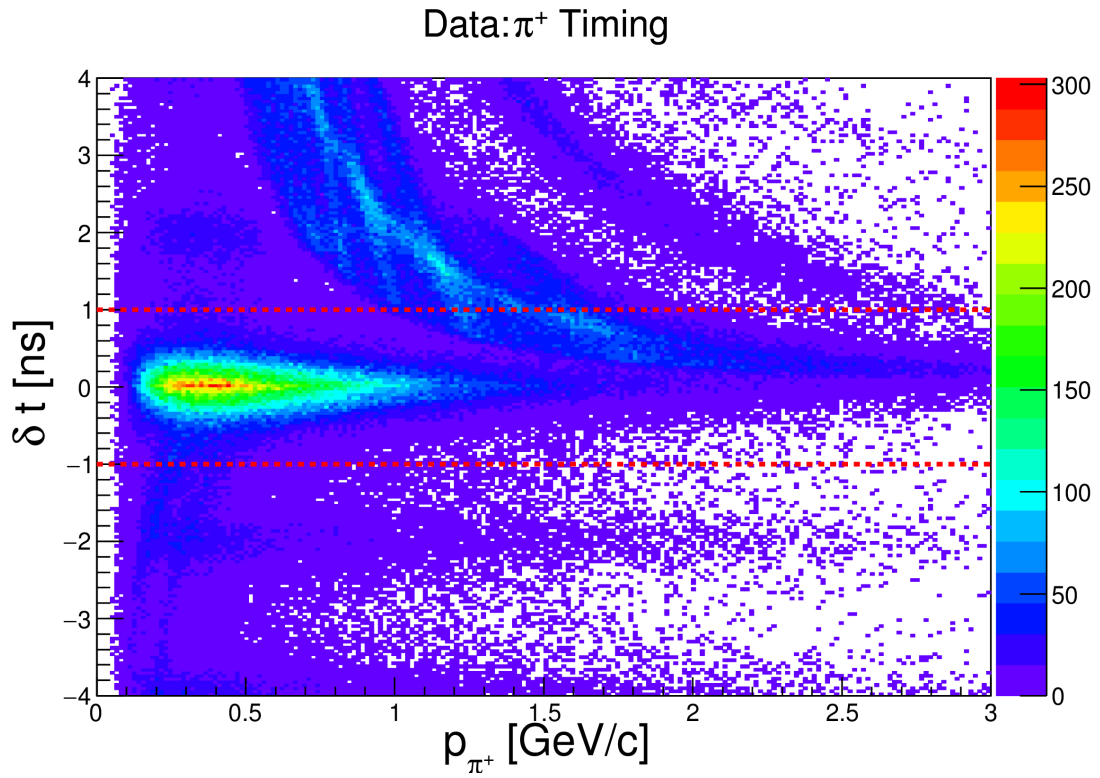
$$\delta t = t_{meas} - t_{calc}$$

$$t_{meas} = t_{SC} - t_{\gamma}$$

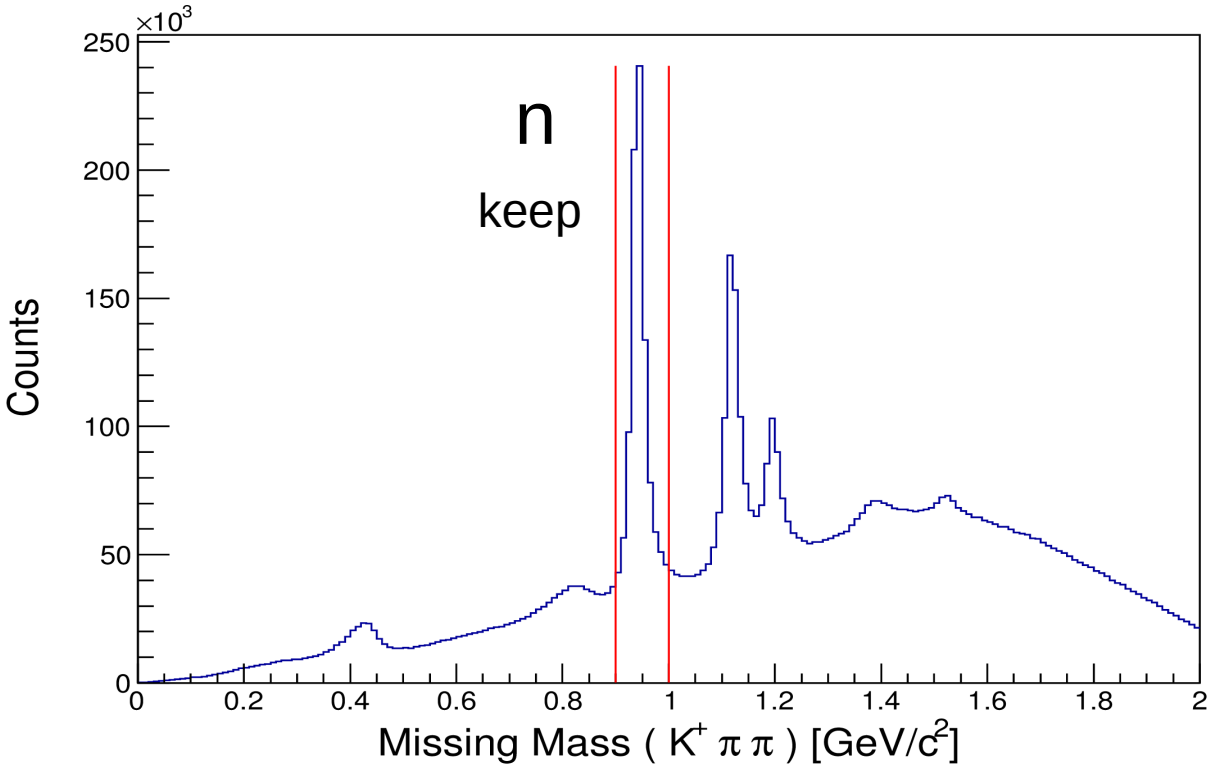
$$t_{calc} = \frac{d_{path}}{c}\frac{E_i}{p_i}$$

Similar |δt| < 1 [ns] for K^+ was done

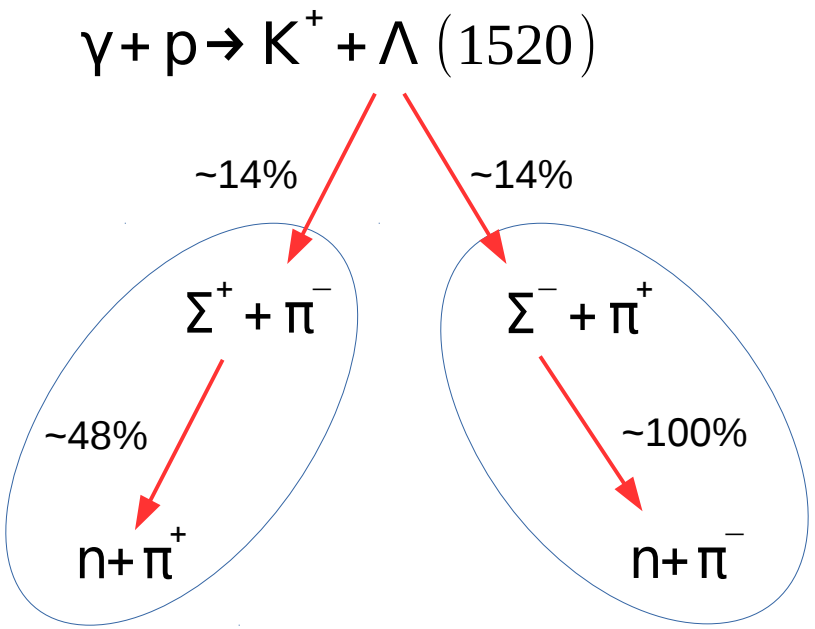


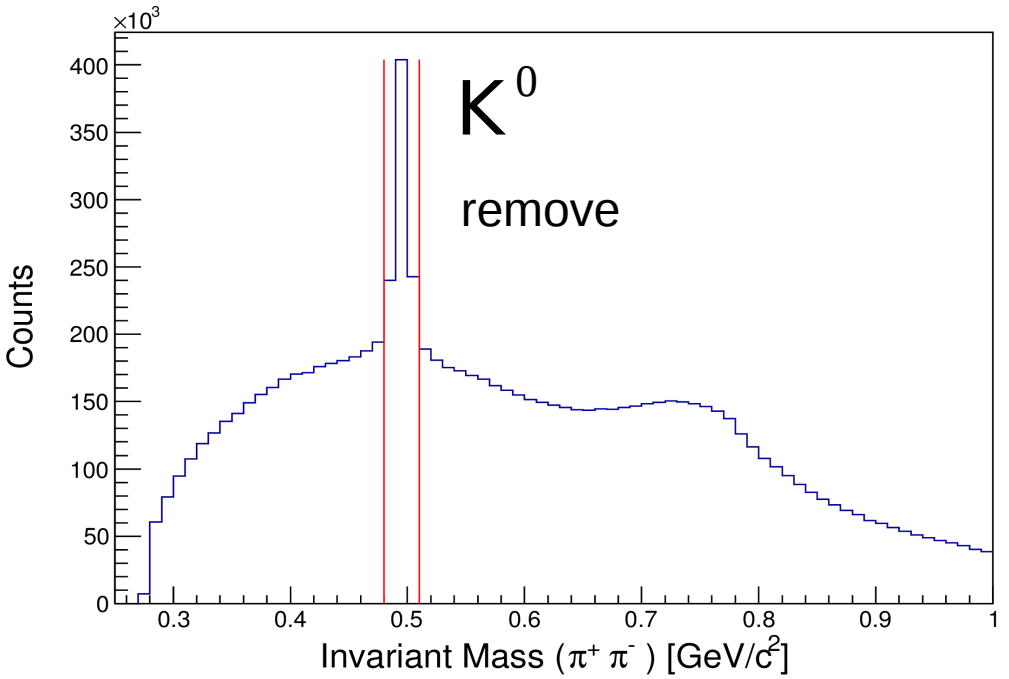


Cuts

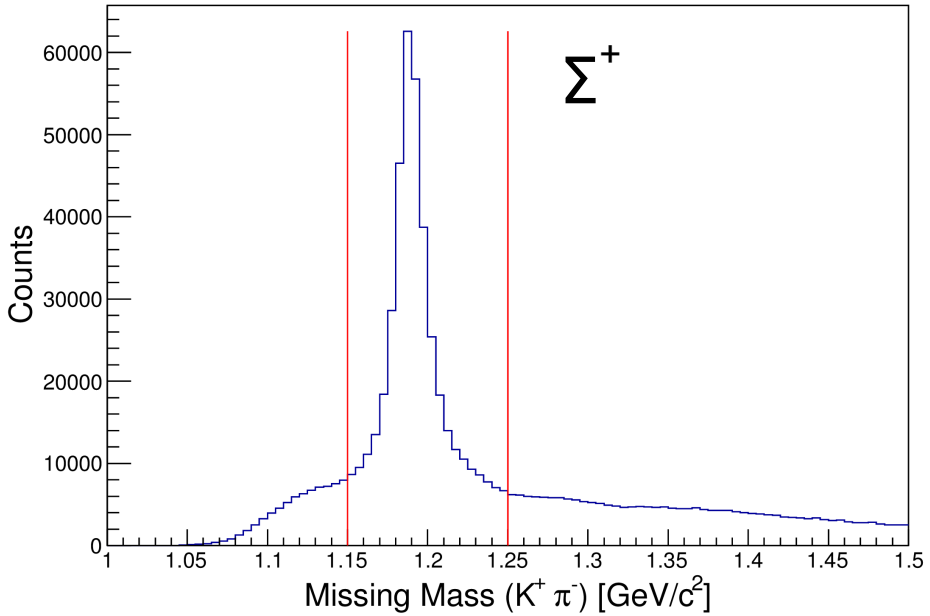


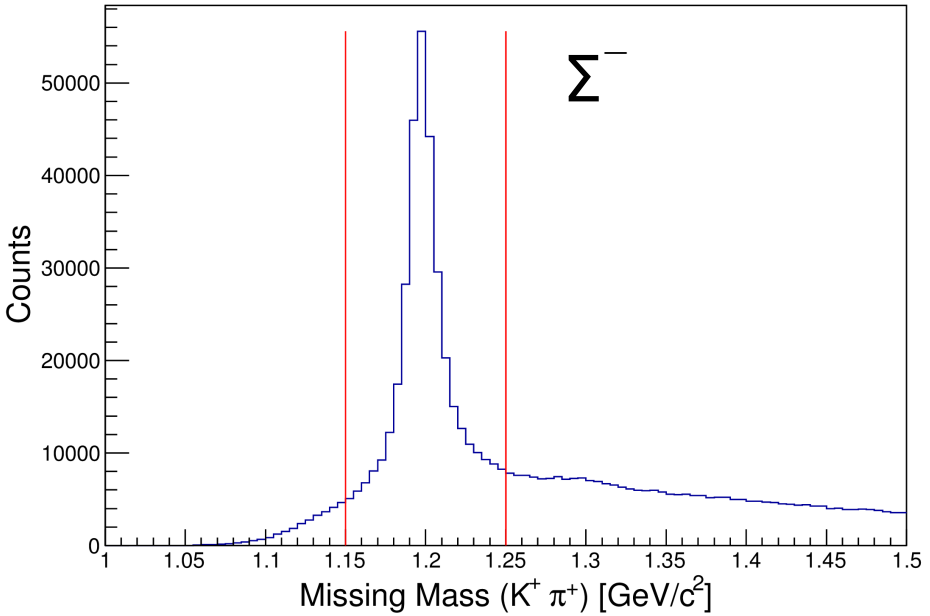
$0.9 < MM(K^+\pi\pi) < 1.0$ [GeV]

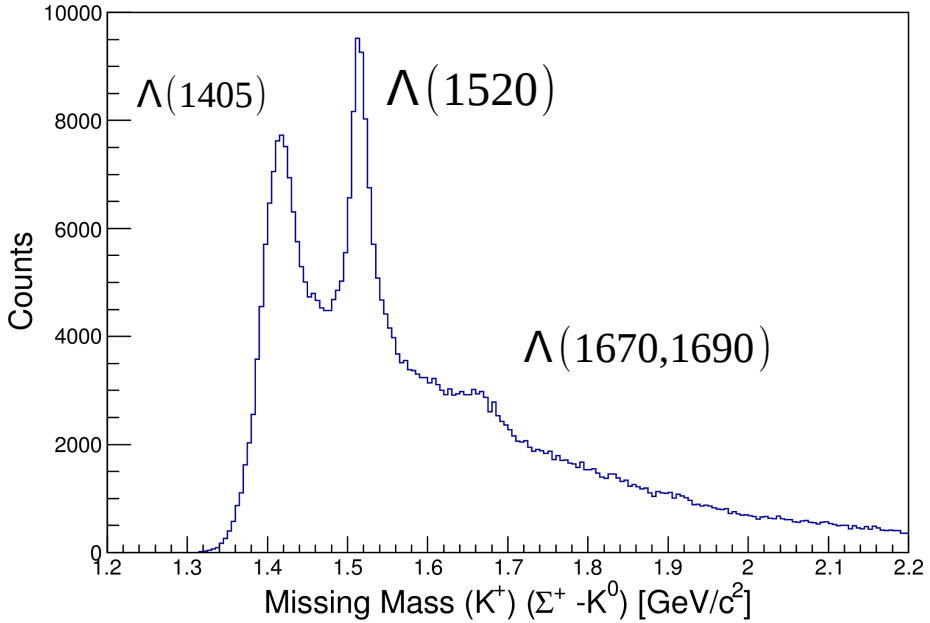


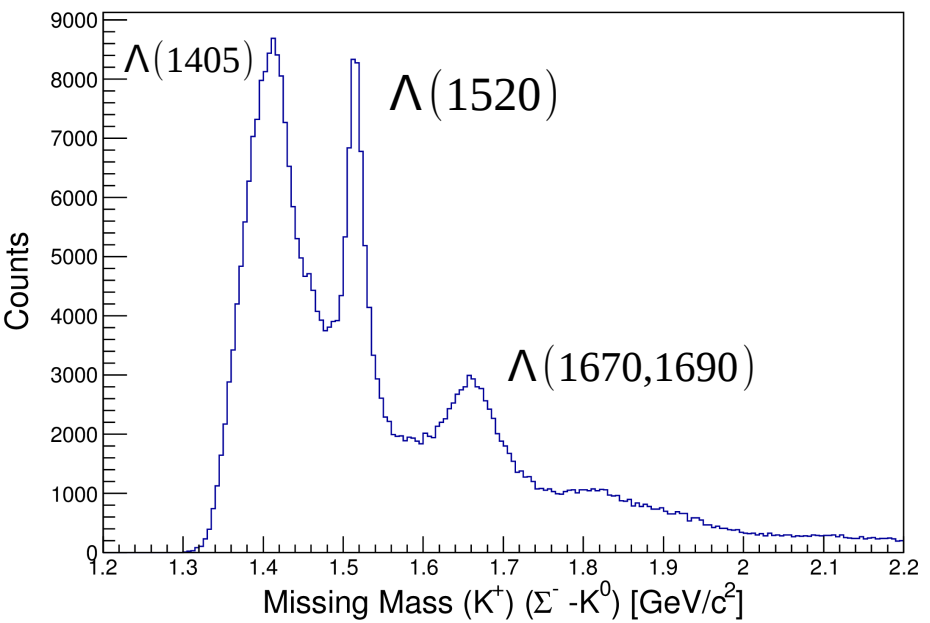


Cuts

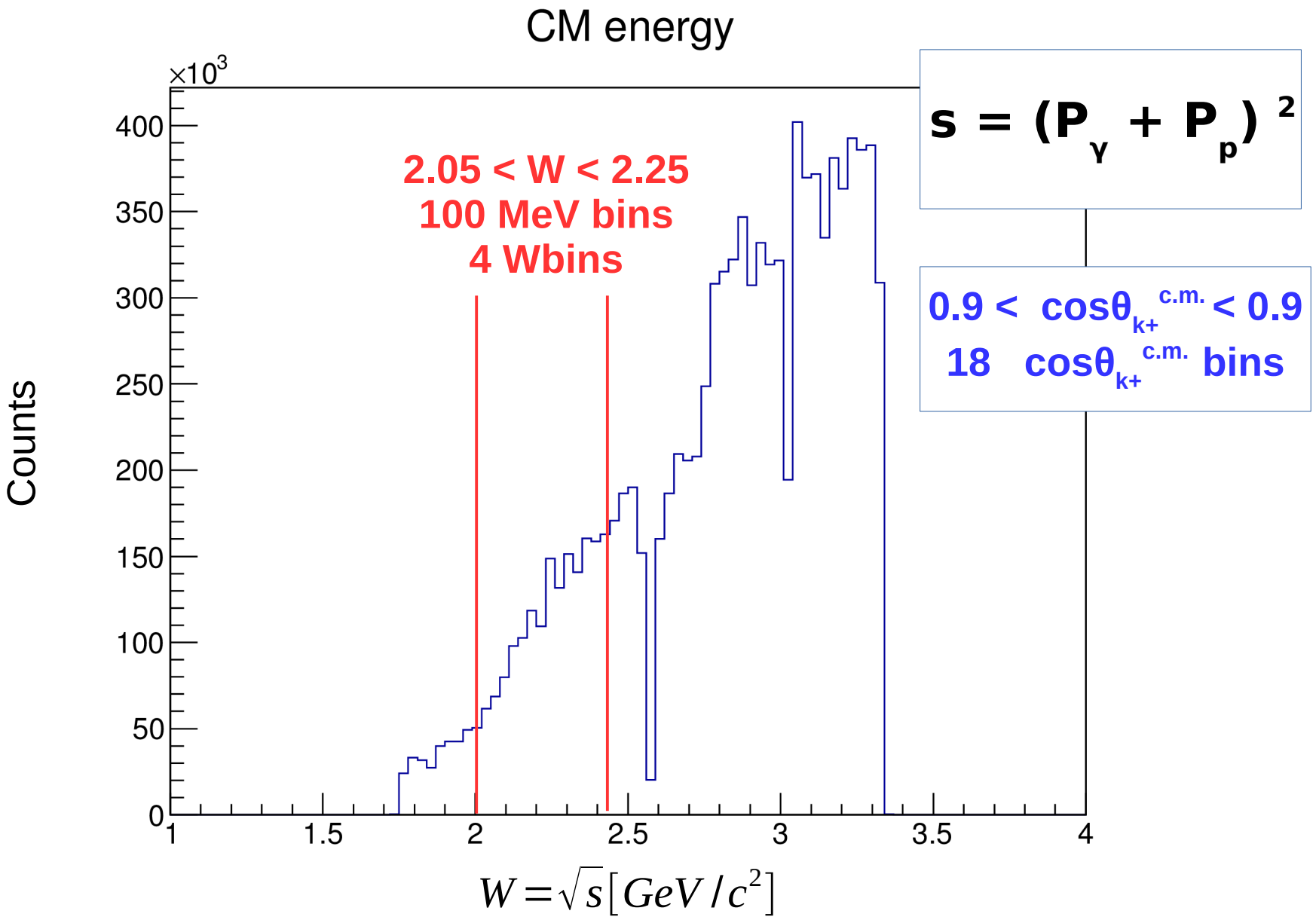

Σ^+
Counts
Missing Mass ($K^+ \pi^-$) [GeV/c^2]


Σ^-
Counts
Missing Mass ($K^+ \pi^+$) [GeV/c^2]

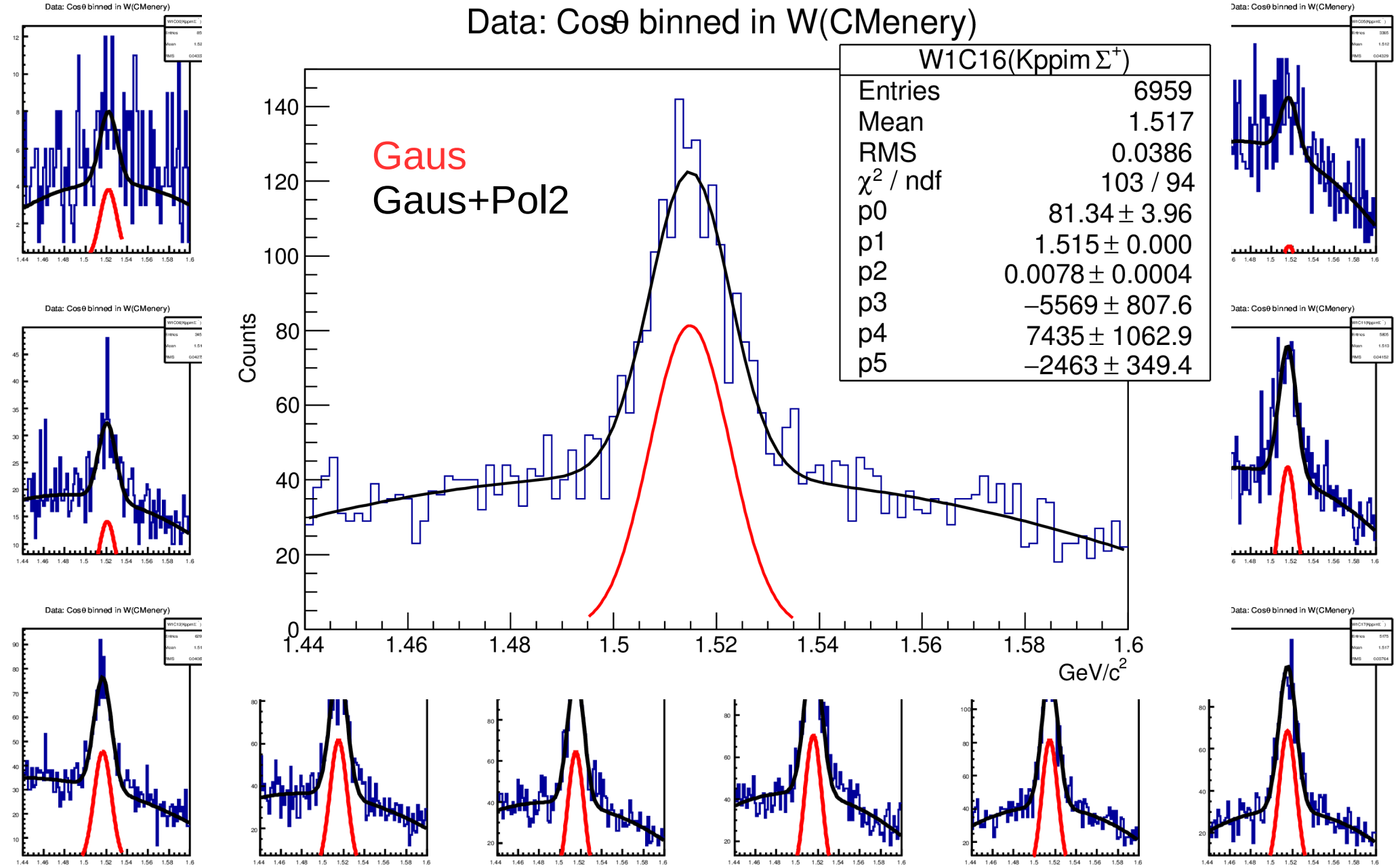

$\Lambda(1405)$
$\Lambda(1520)$
$\Lambda(1670,1690)$
Counts
Missing Mass (K^+) (Σ^+ -K^0) [GeV/c^2]


$\Lambda(1405)$
$\Lambda(1520)$
$\Lambda(1670,1690)$
Counts
Missing Mass (K^+) (Σ^- -K^0) [GeV/c^2]

Analysis W


CM energy
$\times 10^3$
400
350
300
250
200
150
100
50
0
1
1.5
2
2.5
3
3.5
4
Counts
$W = \sqrt{s}\,[GeV/c^2]$
2.05 < W < 2.25
100 MeV bins
4 Wbins
$s = (P_\gamma + P_p)^2$
$0.9 < \cos\theta_{k+}^{c.m.} < 0.9$
18 $\cos\theta_{k+}^{c.m.}$ bins

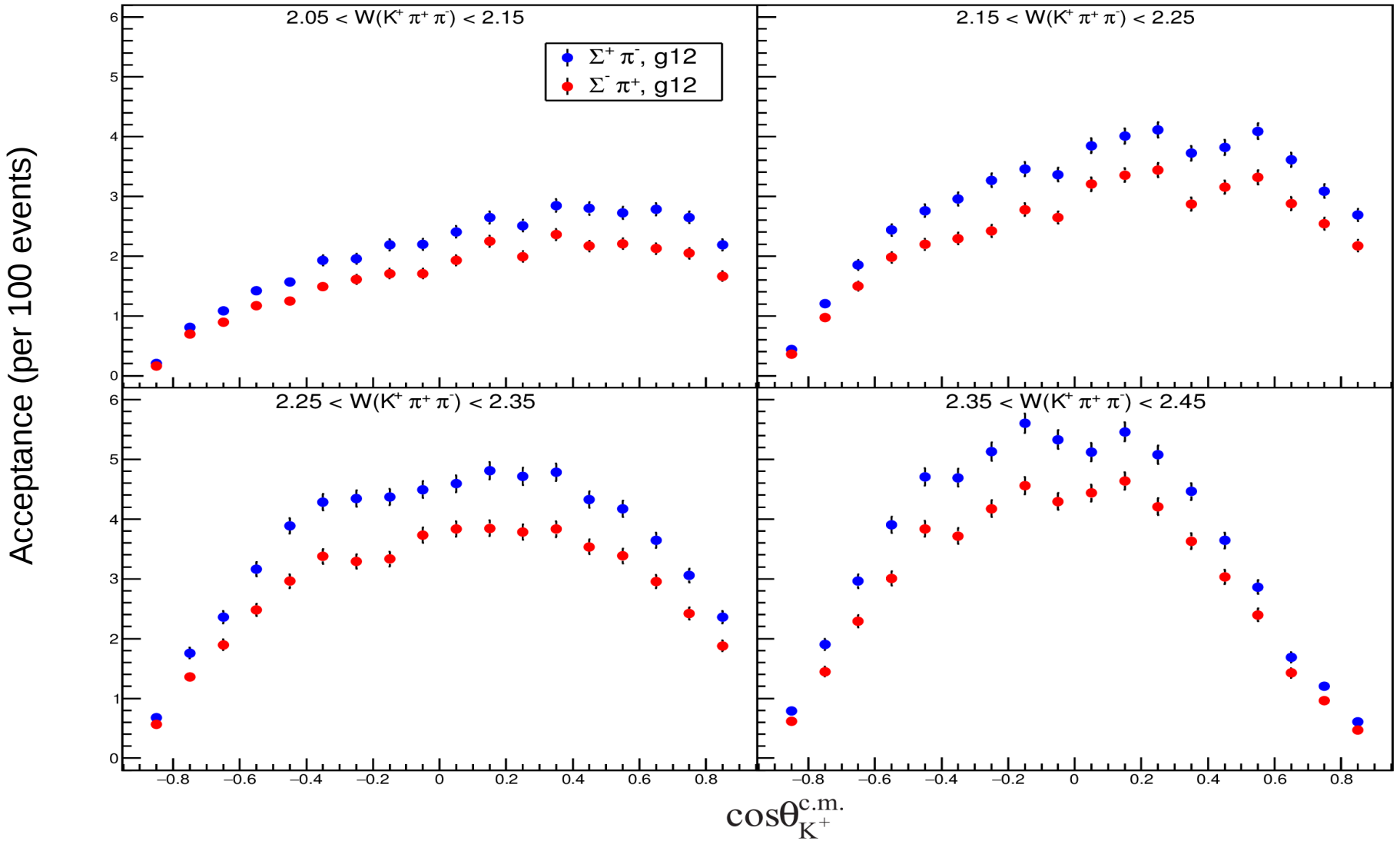
Yield Extraction & Fit



Detector Efficiency

GEANT Based MC Simulation

$$Acceptance = \frac{Accepted\ Events}{Generated\ Events}$$

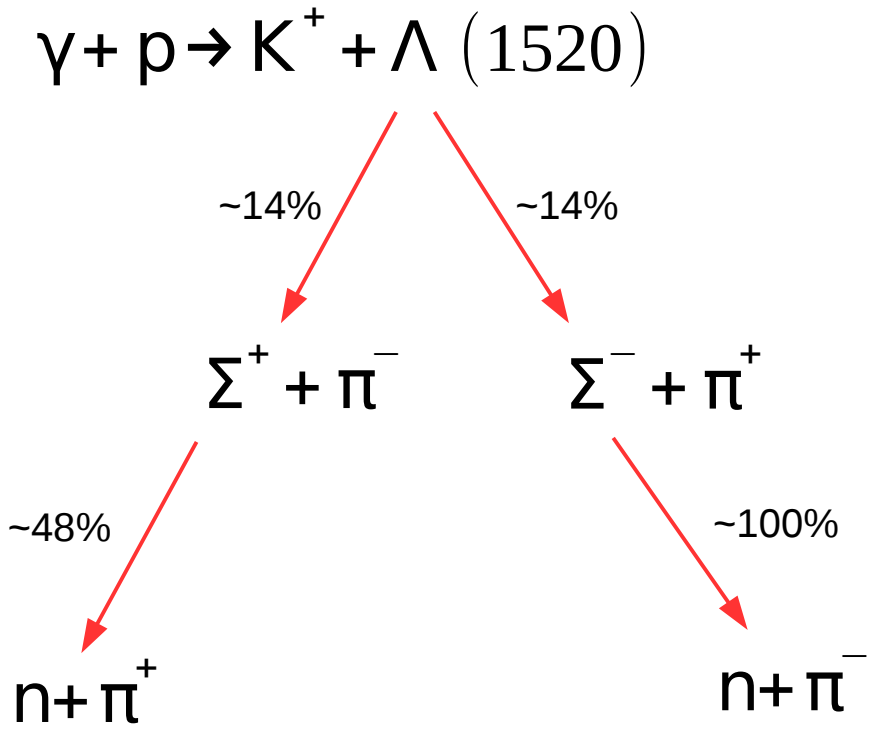


Luminosity Calculation

$$L\ (W) = \frac{\rho_p\ N_A\ l_T}{A_p}\ N_\gamma\ (W) \sim 10^{36}\ cm^{-2}\ (per\ \ Wbin)$$

$\rho_p = 0.0711\ g\ cm^{-3}$
$l_T = 40\ cm\ (g\ 12)$
$l_T = 24\ cm\ (g\ 10)$
$N_\gamma = Photon\ Flux$
$A_p = 1.00794\ gm\ mol^{-1}$

Differential Cross-section



Differential Cross-section

$$\frac{d\sigma}{dCos\theta_{c.m.}} = \frac{Y_d}{\Delta Cos\theta_{c.m.} A L(E_\gamma)}$$

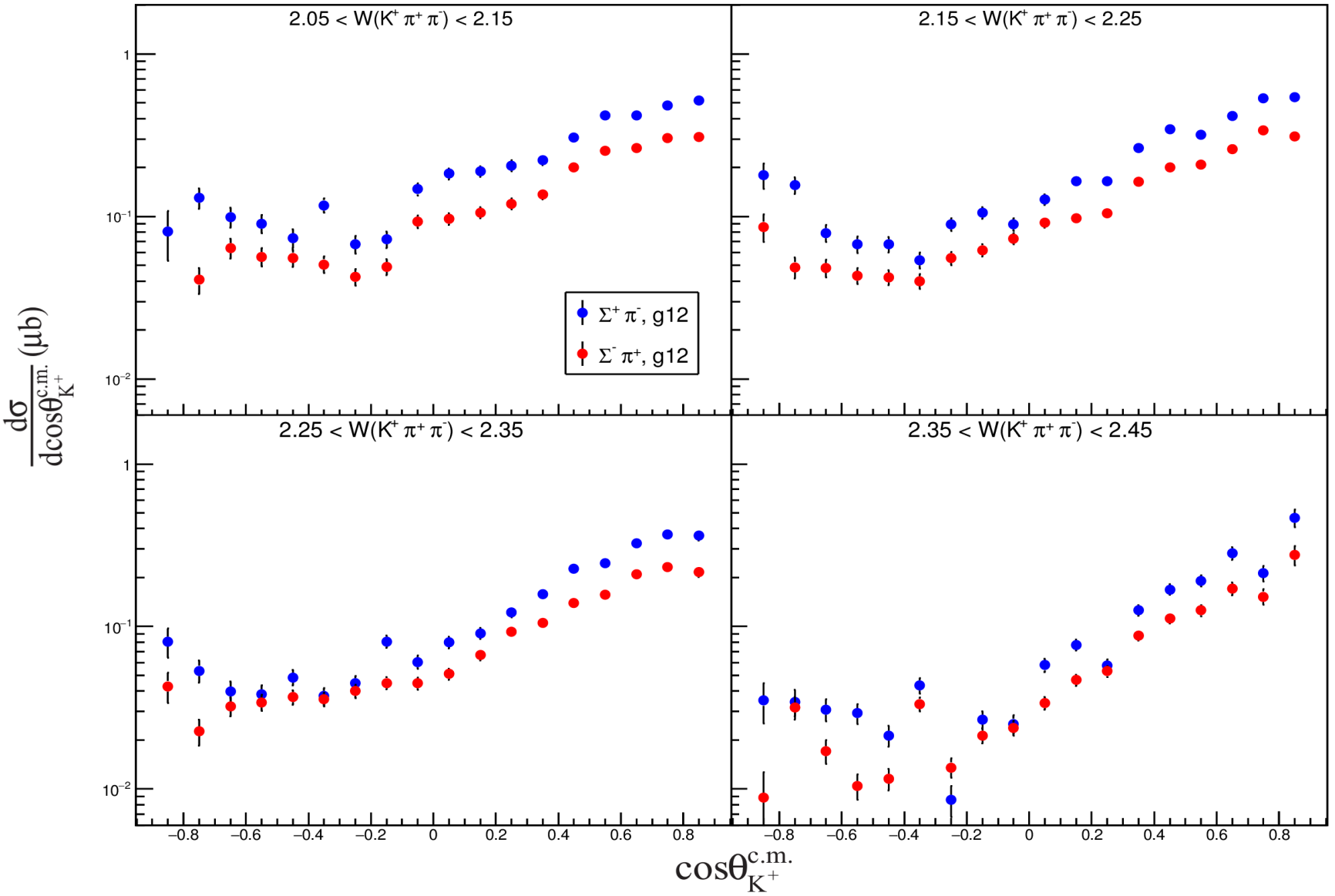
$Y_d = Signal\ Yield$

$A = Acceptance$

$\Delta\ cos\theta = Width\ of\ cos\theta\ bin$

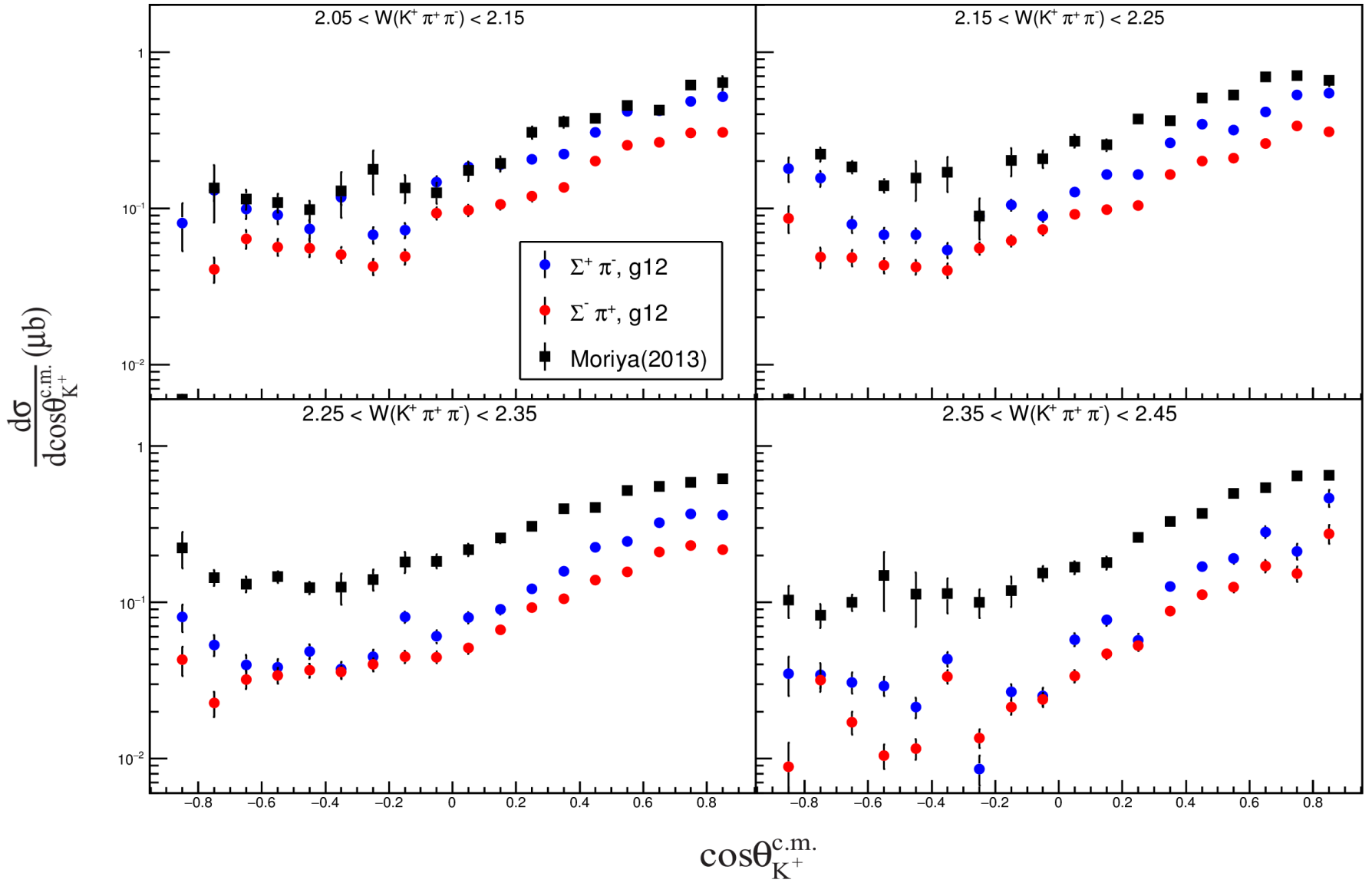
$L(W) = Luminosity$

Differential Cross-section g(12)



Very Preliminary!!!

Differential Cross-section (Comparison)



Very Preliminary!!!

Summary & Future Work

- This work presents preliminary look at the Λ(1520) cross-section using CLAS g12
- In-detail analysis to follow for g12
- For now, the results show consistent shape for cross-section
- Works on normalization will lead us closer to our goal
- In Future,preliminary analysis for higher mass resonances, ie, Λ(1670) & Λ(1690) will be done