



**MARSHALL B. C. SCOTT**

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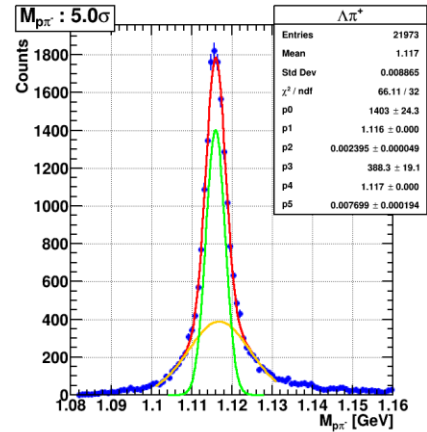
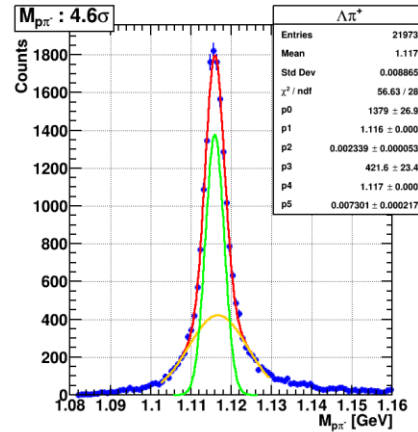
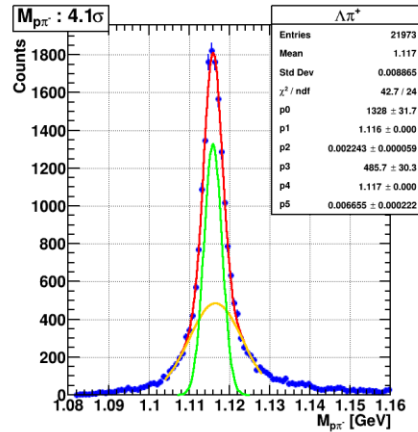
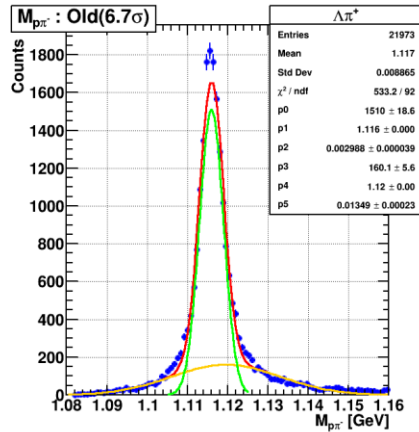
# KL4 RXN AND GENERATING STEPS

- KL4 :  $K^0_L + p \rightarrow \pi^+ + \Lambda$ 
  - $\Lambda \rightarrow p + \pi^-$  (63.9%) ; Current priority
  - $\Lambda \rightarrow n + \pi^0$  (35.8%)
- Backgrounds : (Primary)  $K^0_L + p \rightarrow \pi^+ + \Sigma^0$  , (Secondary)  $K^0_L + p \rightarrow K^+ + \Xi^0$
- Generated histograms/root files (Monitoring Histograms, ReactionFilter, mcthrown\_tree)
  - `hd_root --nthreads=8 -PPLUGINS=PEVENTRFBUNCH:USE_TAG=KLong -PVERTEX:USEWEIGHTEDAVERAGE=1 -PPLUGINS=monitoring_hists foo_smeared.hddm`
  - `hd_root --nthreads=8 -PPLUGINS=PEVENTRFBUNCH:USE_TAG=KLong -PVERTEX:USEWEIGHTEDAVERAGE=1 -PPLUGINS=ReactionFilter -PReaction1=10_14__8_18 foo_smeared.hddm`
  - `hd_root --nthreads=8 -PPLUGINS=PEVENTRFBUNCH:USE_TAG=KLong -PVERTEX:USEWEIGHTEDAVERAGE=1 -PPLUGINS=mcthrown_tree foo_smeared.hddm`



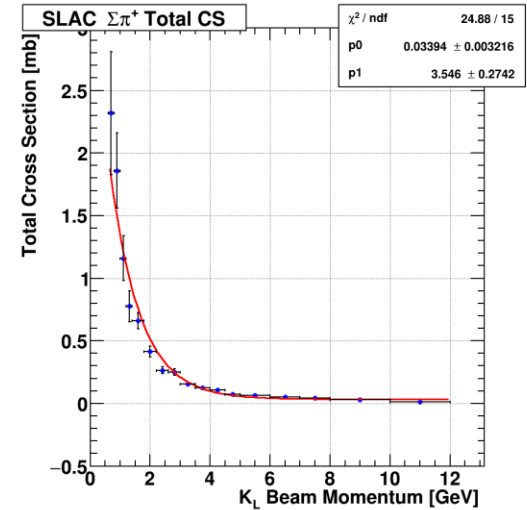
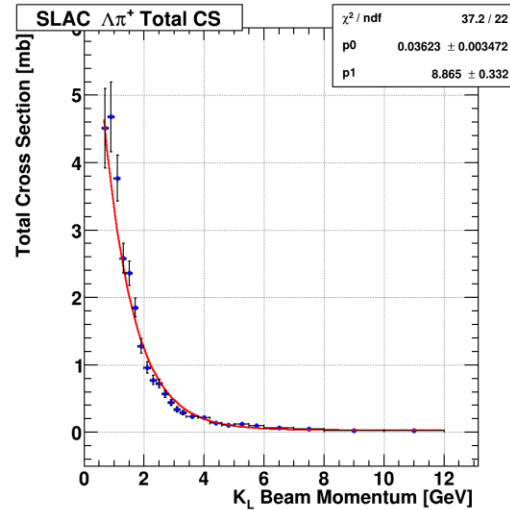
# IMPROVED FIT

- I altered the fit range I was using to improve the fit.
- The results below show that by decreasing the background range, the fit is improved.



# CROSS SECTIONS FROM SLAC

- Cross sections were taken from the SLAC neutral kaon scattering paper : Yamartino *et al.* (<https://journals.aps.org/prd/abstract/10.1103/PhysRevD.10.9>)
- The total cross sections, in mb, are plotted vs.  $K_L$  beam momentum.
- Fitted with Function =  $A + Be^{-x}$

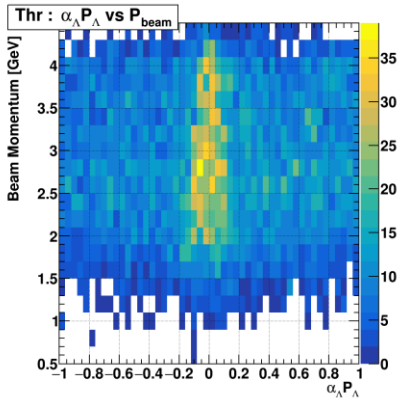
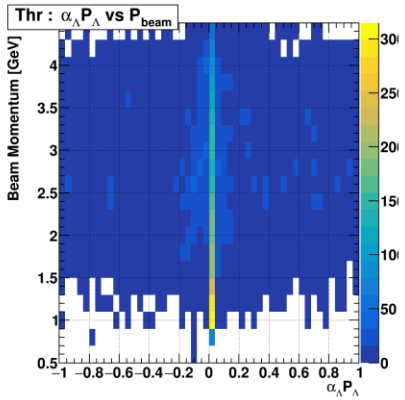
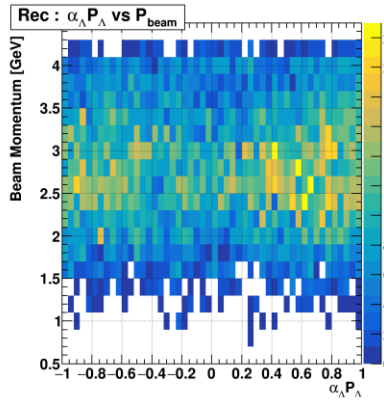
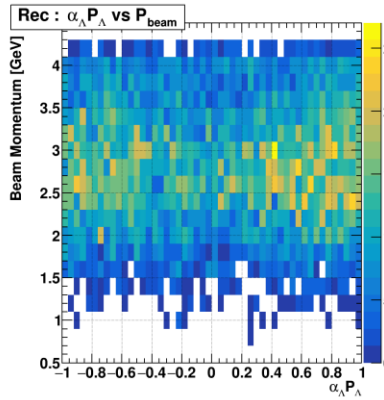
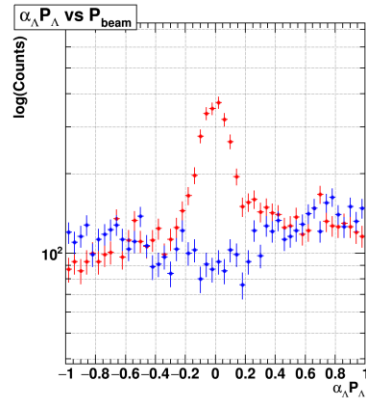
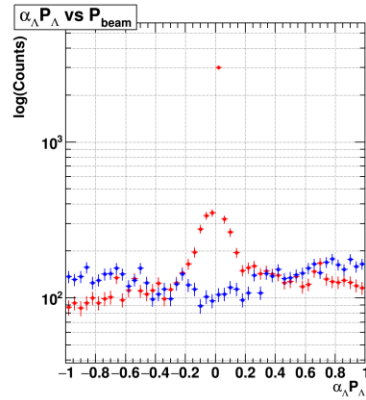


# POLARIZATION

- Lambda polarization can be inferred from its decay products.
- Related to the angle the proton momentum vector makes with the reaction normal.
- Reaction normal
  - SLAC :  $n = p_{K0} \times p_{\pi^+} / |p_{KL}| |p_{\pi^+}|$ 
    - Yamartino *et al.* (<https://journals.aps.org/prd/abstract/10.1103/PhysRevD.10.9>)
  - BNL :  $n = p_{K0} \times p_{\Lambda} / |p_{KL}| |p_{\Lambda}|$ 
    - I have added a negative sign to this definition so that the normals have the same orientation when comparing plots.
    - Bonner *et al.* (<https://doi.org/10.1103/PhysRevD.38.729>)
- Polarization
  - SLAC :  $\alpha_{\Lambda} P_{\Lambda} = 3 \cdot p_{\text{pro}, \Lambda \text{cm}} \cdot n / |p_{\text{pro}, \Lambda \text{cm}}|$
  - BNL :  $\alpha_{\Lambda} P_{\Lambda} = 2 (N_{+} - N_{-}) / (N_{+} + N_{-})$ 
    - $N_{+}(N_{-}) =$  Number of events with  $\cos\theta > 0$  ( $\cos\theta < 0$ ) , and  $\cos\theta = p_{\text{pro}, \Lambda \text{cm}} \cdot n / |p_{\text{pro}, \Lambda \text{cm}}|$

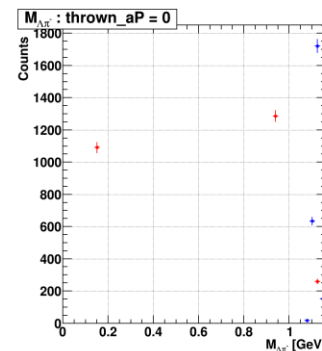
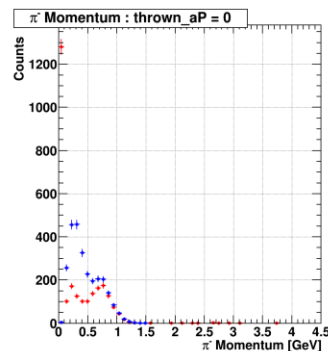
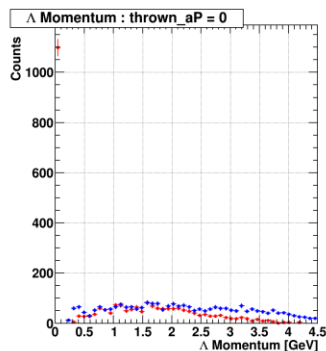
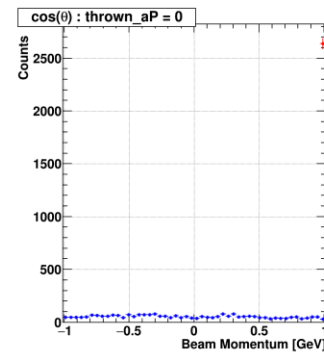
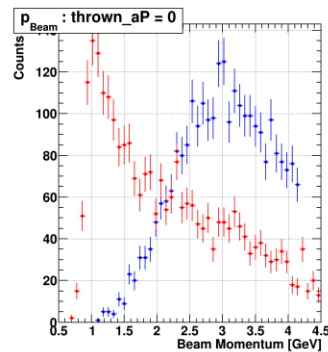
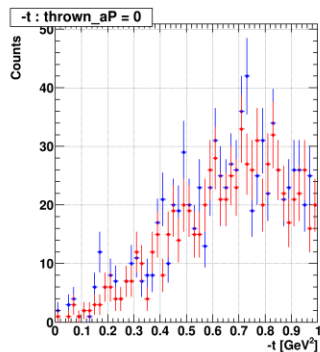


- More than  $\sim 12\%$  of events have  $aP = 0$  for the thrown particles.
- The top plot shows the results without any cuts.
- The bottom plot shows the same distributions with a thrown  $aP \neq 0$  cut.



# THROWN $aP = 0$ : DISTRIBUTIONS

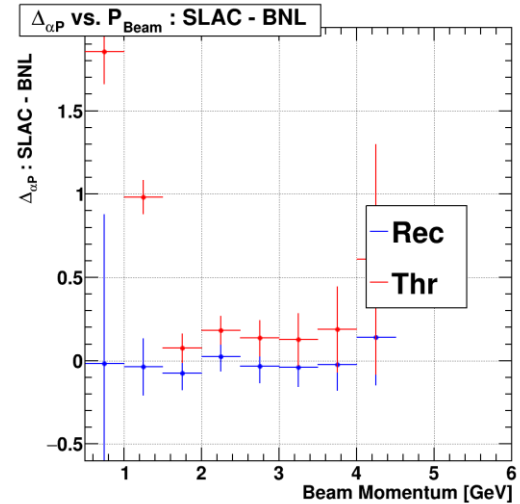
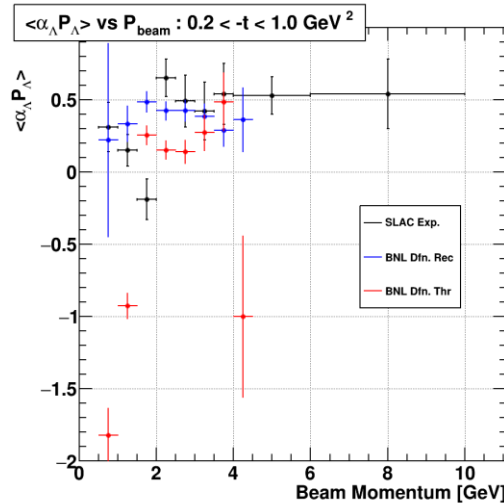
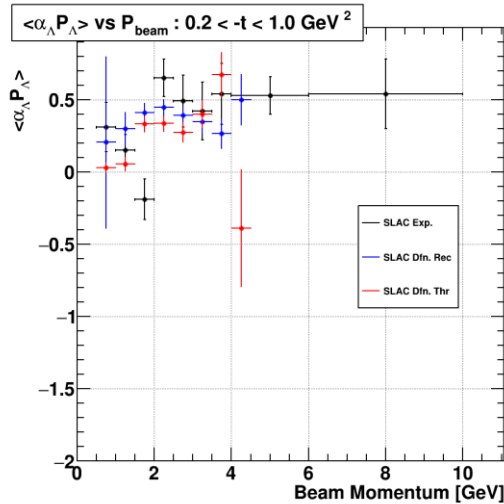
- These events don't seem to be "true" lambda events.
  - Strongly peaked around low beam momenta
  - $\Lambda$  and  $\pi^-$  momenta are essentially zero.
  - Invariant mass is less than 1 GeV



# AP RESULTS

## Rec. and Thr. aP results along with the SLAC experimental results.

- The first column has the SLAC definition, the second the BNL definition, and the last the difference between them.
- The rec. results are consistent across definitions.
- Both the rec and thr results are fairly consistent with the SLAC results.





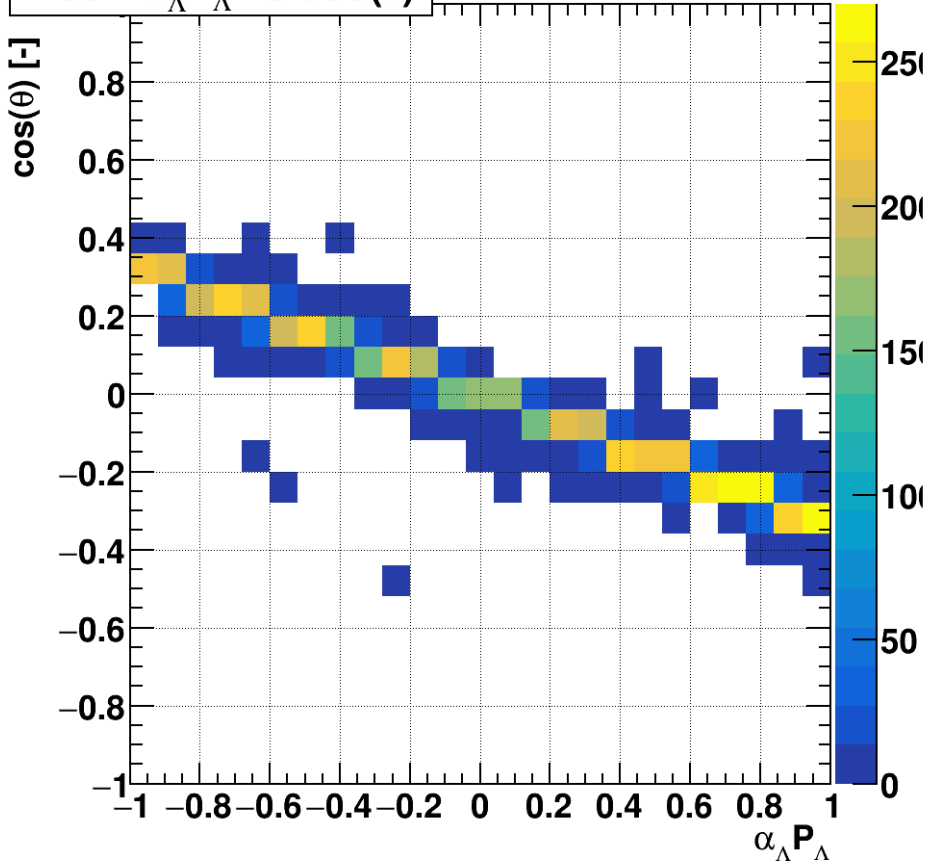
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UNIVERSITY

WASHINGTON, DC

# Backup Slides



Rec :  $\alpha_{\Lambda} P_{\Lambda}$  vs  $\cos(\theta)$



Thr :  $\alpha_{\Lambda} P_{\Lambda}$  vs  $\cos(\theta)$

