Omega Cross-Section

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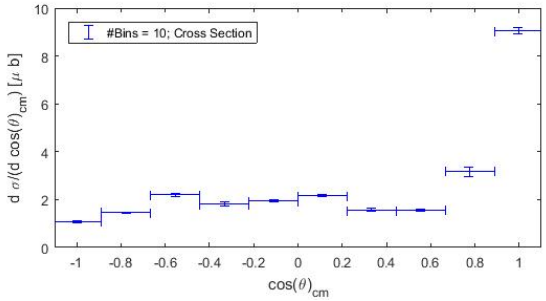
Starting Point



Olis Cross Section; Dip at about $\cos(\theta) = -0.3$

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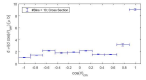
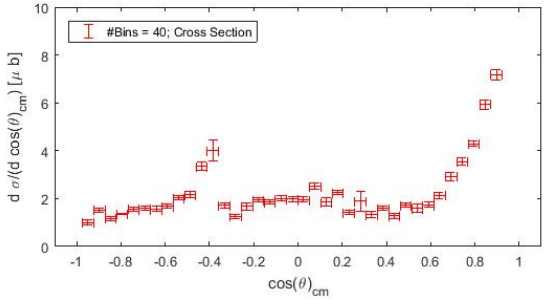


Increasing the Number of Bins



Increased number of bins to 40; now there is still a dip at $\cos(\theta) = -0.3$ but also a peak at $\cos(\theta) = -0.4$

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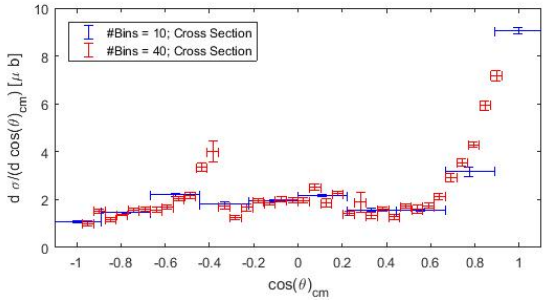
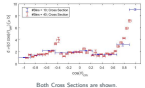
Comparing 10 Bin to 40 Bin Cross Section

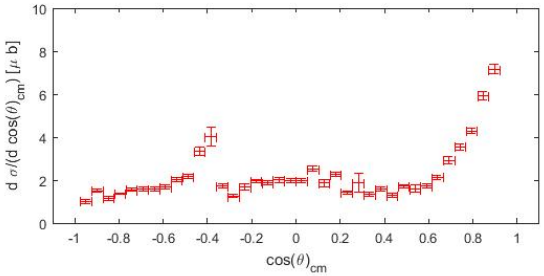


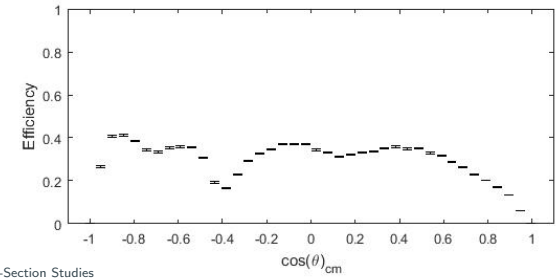
Both Cross Sections are shown.

Comparing 10 Bin to 40 Bin Cross Section



Efficiency





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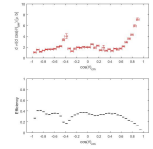
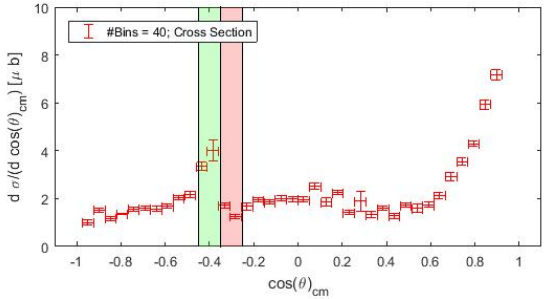


Cross Section and efficiency. There is an efficiency drop at $\cos(\theta) \approx -0.3$

Taking a closer Look

$$\gamma p \rightarrow \quad \omega \quad p$$
$$\hookrightarrow \gamma\pi^0$$
$$\hookrightarrow \gamma\gamma$$

There is a 1:1 correlation between the polar angle of p and ω for fixed $E(\gamma)$!



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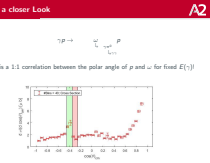

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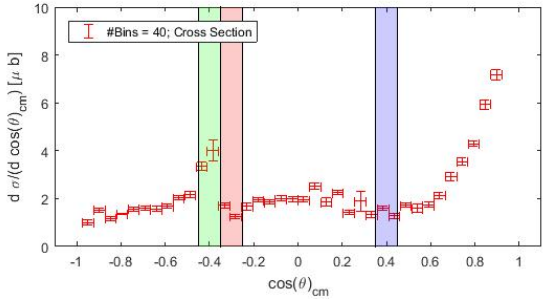
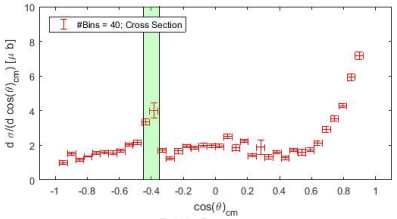
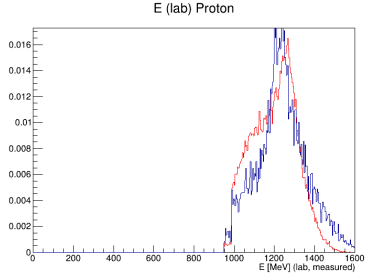


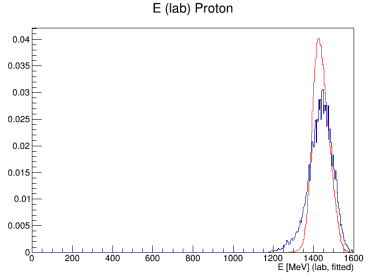
Taking a closer Look

Energy of Proton for $\cos(\theta_\omega) = [-0.45, -0.35]$ (Peak)



The energy of protons looks similar for MC and Data





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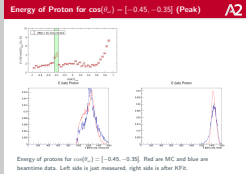

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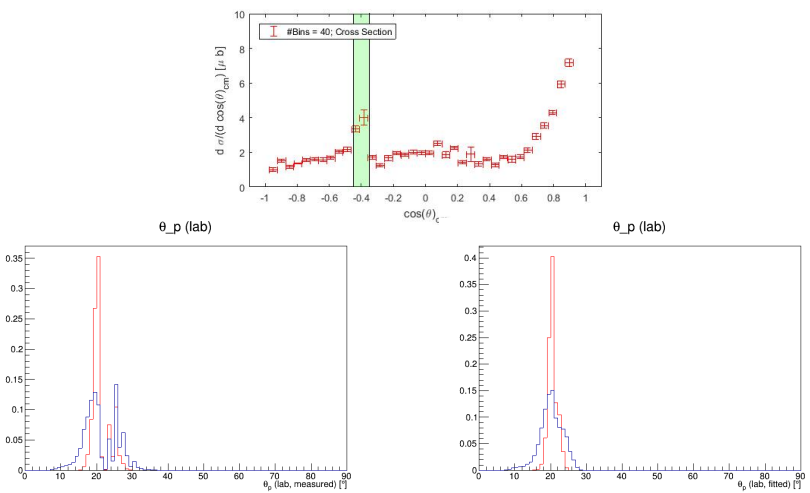

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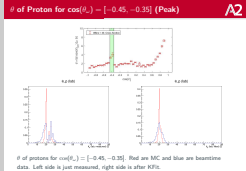

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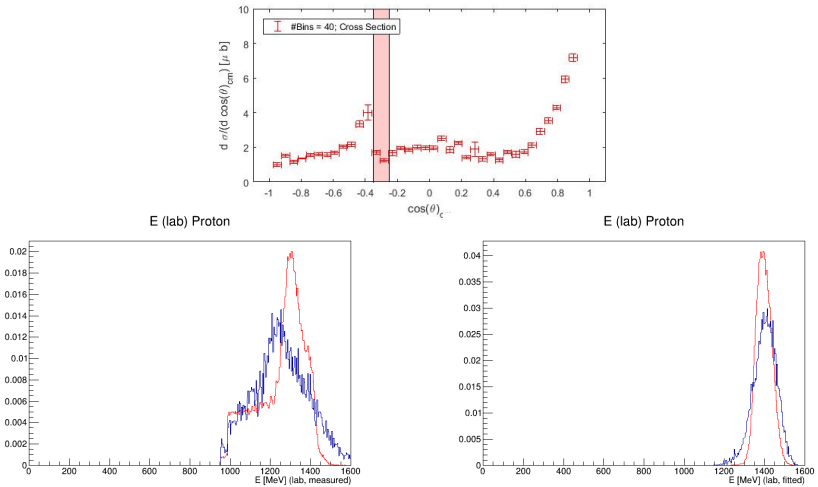

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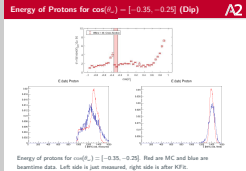

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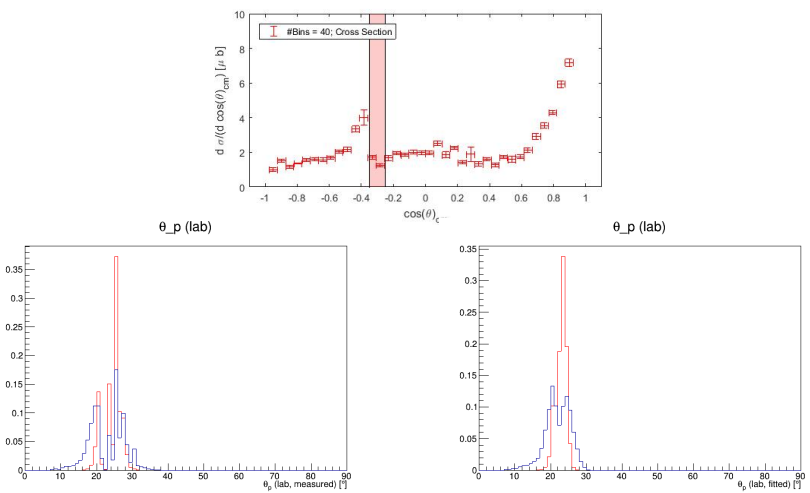

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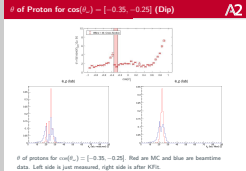
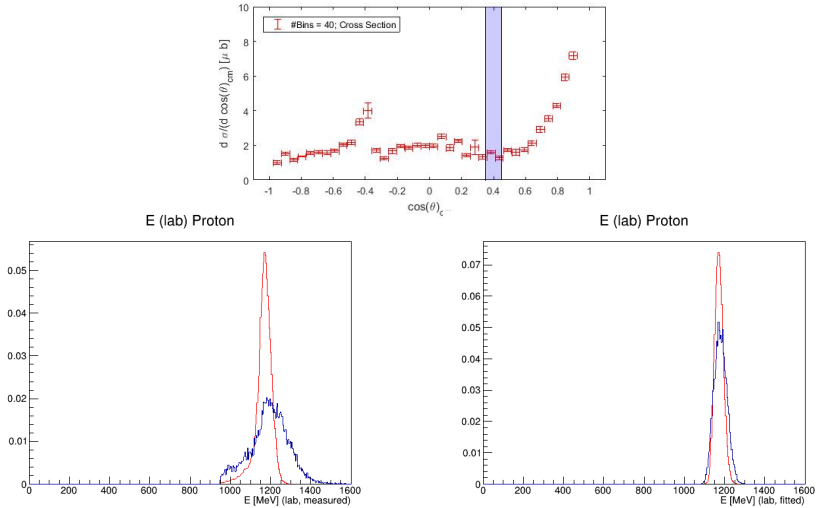


Energy of Protons for $\cos(\theta_\omega) = [0.35, 0.45]$ (Good)



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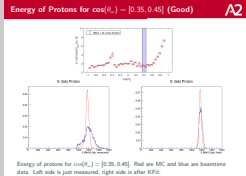

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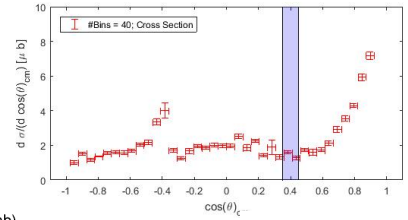

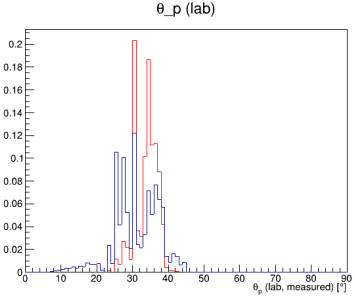

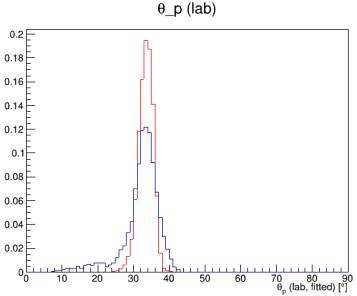

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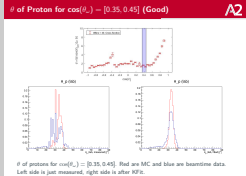
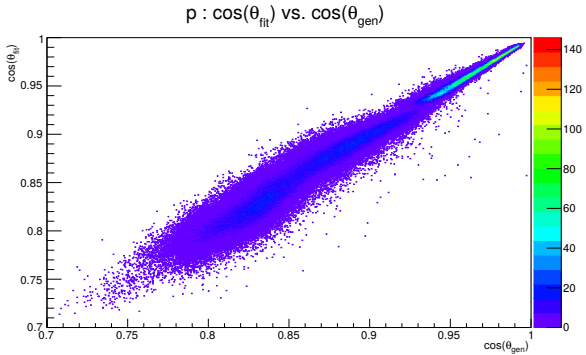
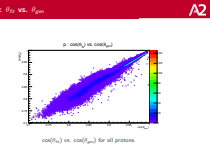
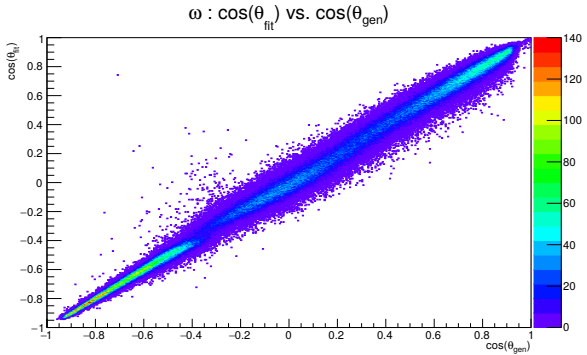


Proton: θ_{fit} vs. θ_{gen}

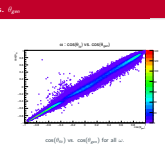


$\cos(\theta_{fit})$ vs. $\cos(\theta_{gen})$ for all protons.





$\cos(\theta_{fit})$ vs. $\cos(\theta_{gen})$ for all ω.



Unfolding

Motivation

- μ is the *true* distribution given by nature
- detector effects are then described by the migration matrix R. (inefficiencies, bias and smearing)
- This results in the distribution ν.

$$\nu_i = \sum_{j=1}^{M} R_{ij}\mu_j$$

- With infinite statistics, it would be possible to recover the original distribution by inverting the migration matrix

$$\mu = R^{-1}\nu$$

- Use numerical methods to invert the migration matrix

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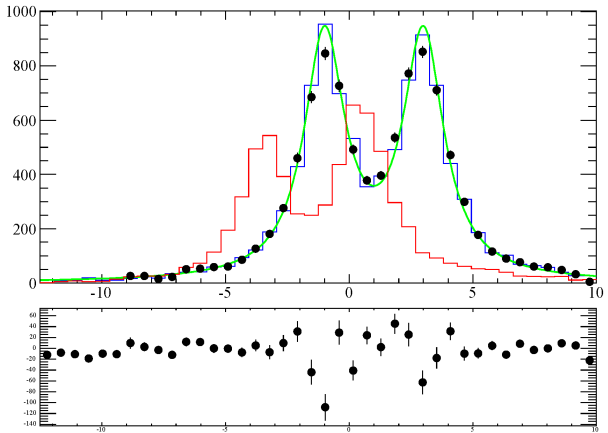
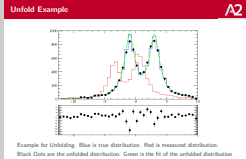
Unfold Example

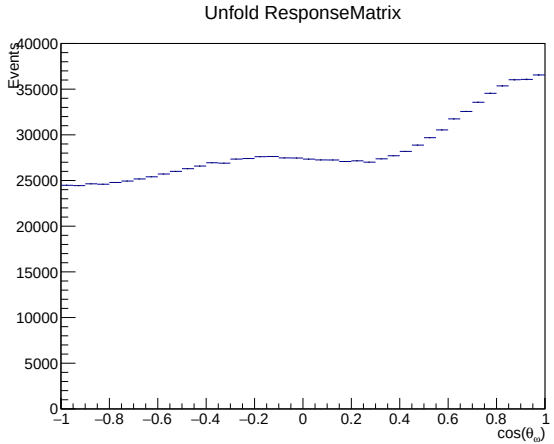


Example for Unfolding. Blue is true distribution. Red is measured distribution. Black Dots are the unfolded distribution. Green is the fit of the unfolded distribution



In region of $cos\theta(\omega)_{gen} \approx -0.35$, see broader distribution of $cos\theta(\omega)_{fit}$ −¿ simple 1D efficiency correction may not work well enough

Flat ω; Folded MC Data



Flat ω was used. MC fitted data were unfolded.

Flat ω; Folded MC Data

Conclusion

- Drop in the measured cross section at $\cos(\theta_\omega) \approx -0.35$ is caused by a drop in the efficiency at that region
- Inefficiency is caused by the protons hitting the edge of the CB
  $\rightarrow$ They are not reconstructed properly
- There are differences between MC and Data
- The differences are too big to make the Unfolding work

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