Omega Cross-Section

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Mainz, March 2019

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Starting Point

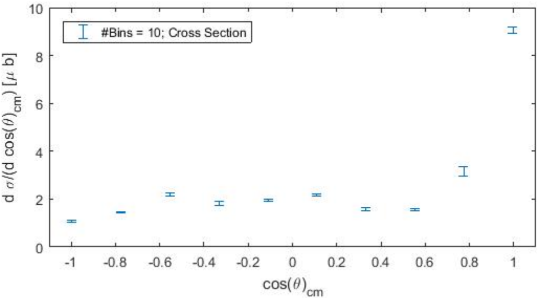


Figure 1: Olis Cross Section; Dip at about $\cos(\theta) = -0.3$

Increasing the Number of Bins

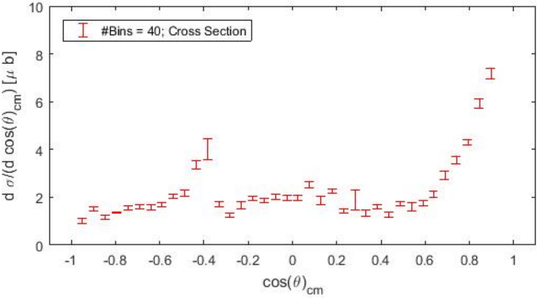


Figure 2: Increased number of bins to 40; now there is still a dip at $\cos(\theta) = -0.3$ but also a peak at $\cos(\theta) = -0.5$

Comparing 10 Bin to 40 Bin Cross Section

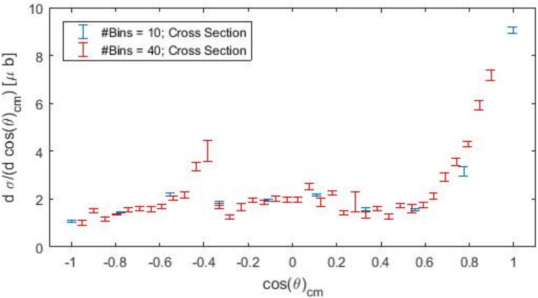
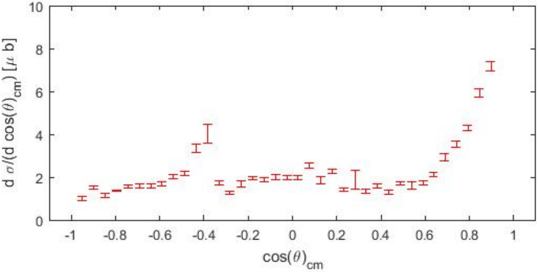
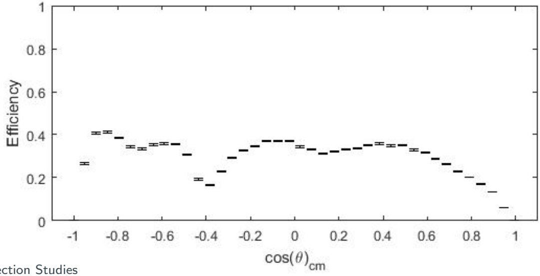


Figure 3: Both Cross Sections are shown.

Efficiency



10
8
6
4
2
0
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
$\cos(\theta)_{cm}$
d σ/(d $\cos(\theta)_{cm}$) [μ b]



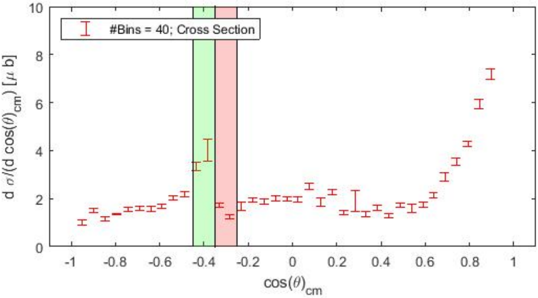
1
0.8
0.6
0.4
0.2
0
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
$\cos(\theta)_{cm}$
Efficiency

Taking a closer Look

$$\omega \to \gamma \ \underset{\hookrightarrow \gamma\gamma}{\pi^0}$$

Closer look at:

- ω
- Bachelor Photon
- π^0
- $\gamma\gamma$
- Proton



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

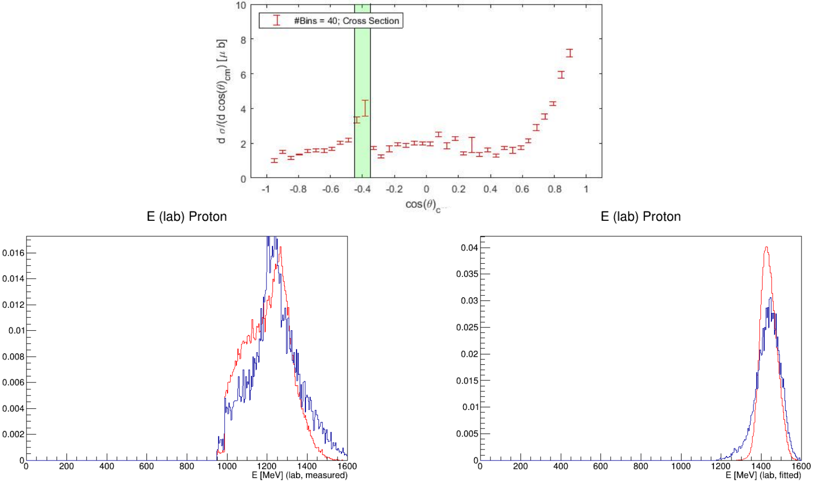


Figure 5: Energy of protons for $\cos(\theta\omega) = [-0.45, -0.35]$. Red are MC and blue are beamtime data. Left side is just measured, right side is after KFit.

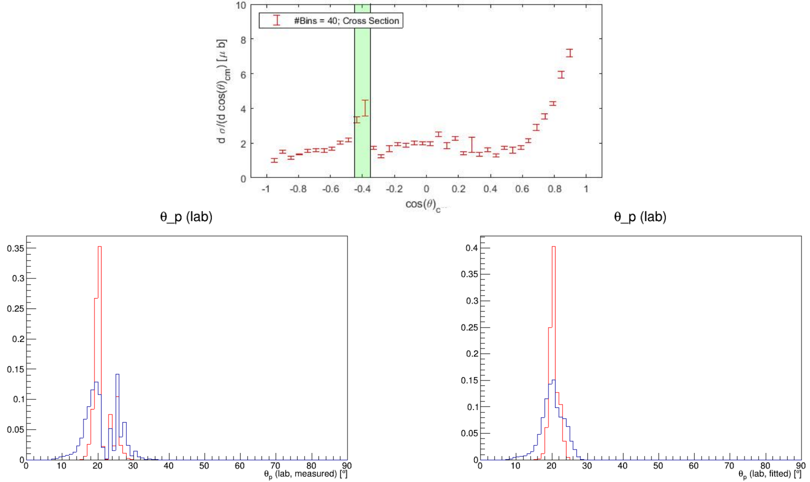


Figure 6: θ of protons for $\cos(\theta\omega) = [-0.45, -0.35]$. Red are MC and blue are beamtime data. Left side is just measured, right side is after KFit.

Energy of Protons for $\cos(\theta_\omega) = [-0.35, -0.25]$ (Dip)

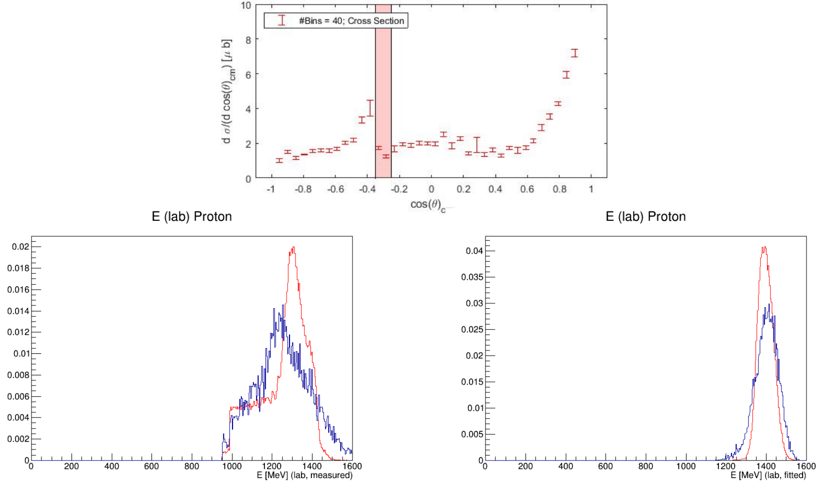
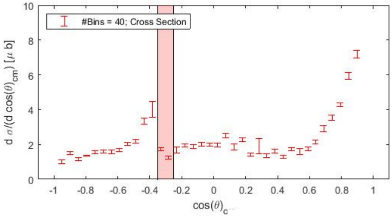
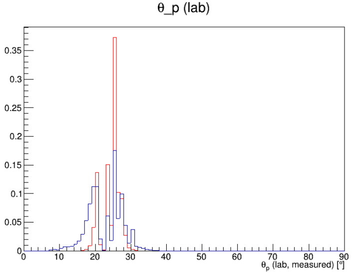


Figure 7: Energy of protons for $\cos(\theta\omega) = [-0.35, -0.25]$. Red are MC and blue are beamtime data. Left side is just measured, right side is after KFit.

θ of Proton for $\cos(\theta_\omega) = [-0.35, -0.25]$ (Dip)





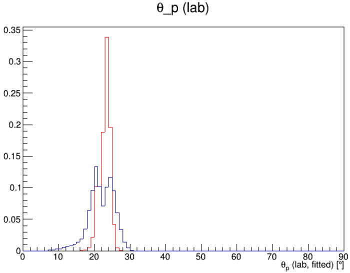


Figure 8: θ of protons for $\cos(\theta\omega) = [-0.35, -0.25]$. Red are MC and blue are beamtime data. Left side is just measured, right side is after KFit.

Proton: θ_{fit} vs. θ_{gen}

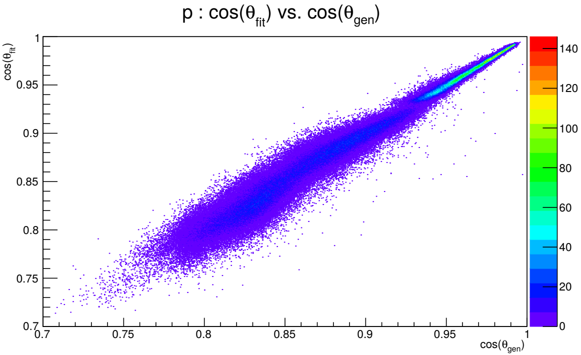


Figure 9: $\cos(\theta_{fit})$ vs. $\cos(\theta_{gen})$ for all protons.

ω: θ_{fit} vs. θ_{gen}

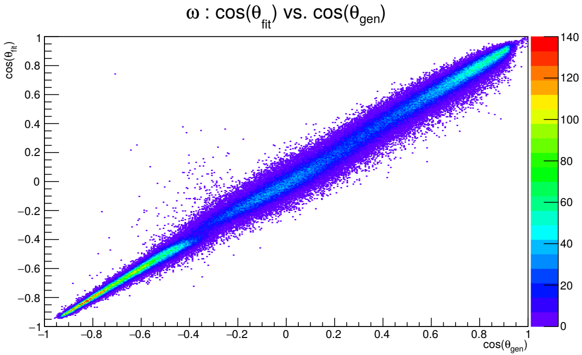


Figure 10: $\cos(\theta_{fit})$ vs. $\cos(\theta_{gen})$ for all ω.

Unfolding

Motivation

- μ is the *true* distribution given by nature
- detector effects are then described by the response function 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 response matrix

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

What is Unfolding?

- Using MC we can train the unfolding algorithm
- Create a 2D-Hist with $\cos(\theta_\omega)$ of all generated and all reconstructed ω (ω which are generated but not reconstructed are label *miss*)
- Then we can solve for μ iteratively

Example with Gaussian

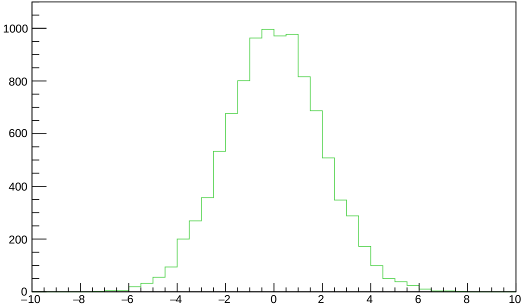


Figure 11: Example for a working Unfolding Algorithm

Example with Gaussian

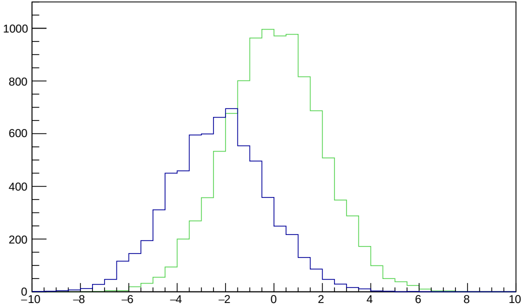


Figure 11: Example for a working Unfolding Algorithm

Example with Gaussian

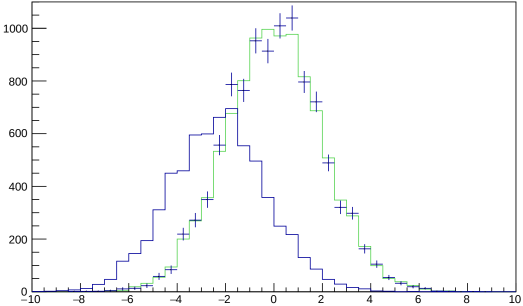


Figure 11: Example for a working Unfolding Algorithm

Folded

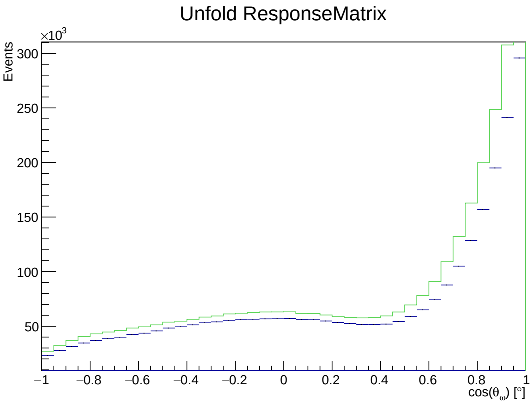


Figure 12: Folded; same cuts

Flat ω

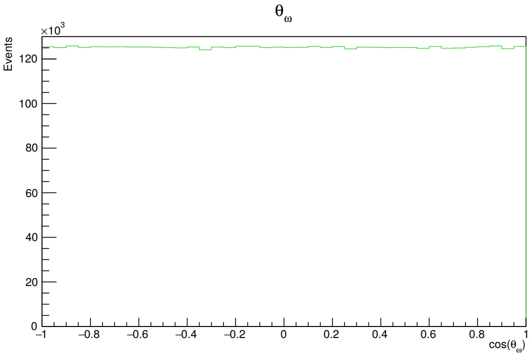


Figure 13: Distribution of the ω in center of mass frame

Flat ω; Folded MC Data

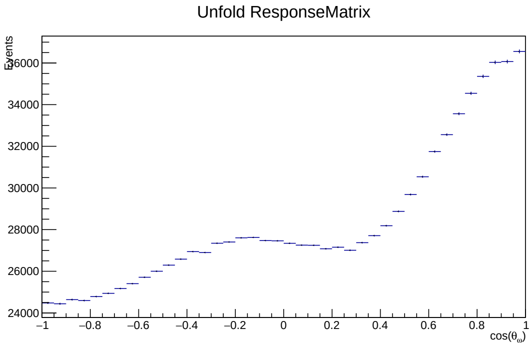


Figure 14: Flat ω was used. MC fitted data were folded.