

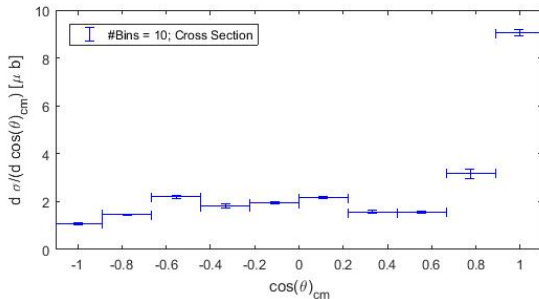
Omega Cross-Section

Martin Sobotzik

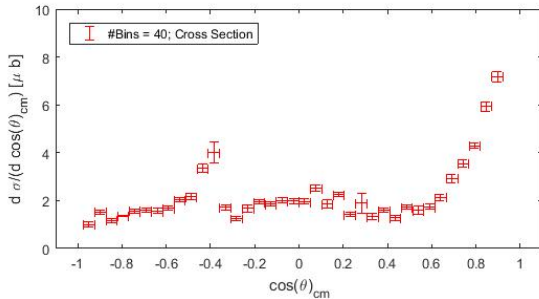
Mainz, March 2019

Institute for Nuclear Physics
Johannes Gutenberg-University of Mainz

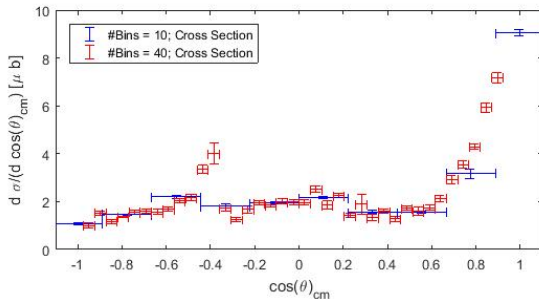




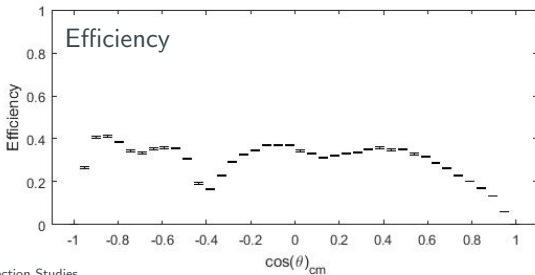
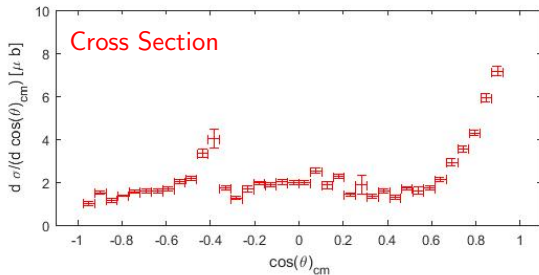
Olis Cross Section; Dip at about $\cos(\theta) = -0.3$



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

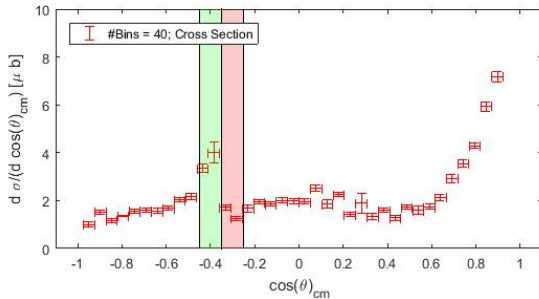


Both Cross Sections are shown.



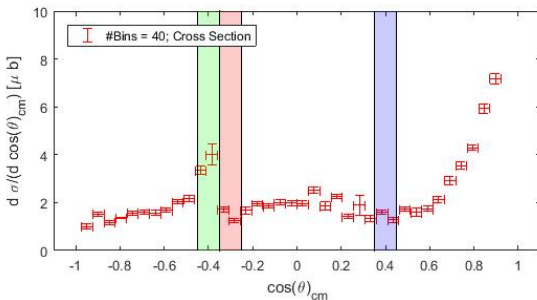
$$\gamma p \rightarrow \begin{matrix} \omega \\ \downarrow \\ \gamma \pi^0 \\ \downarrow \gamma \gamma \end{matrix} p$$

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

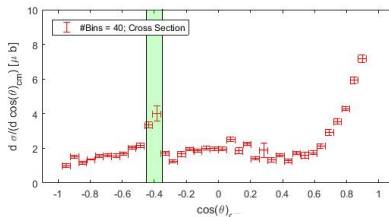


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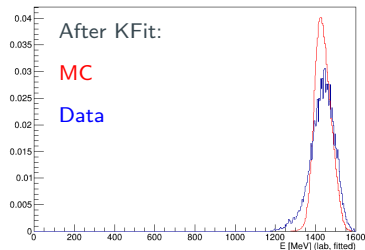
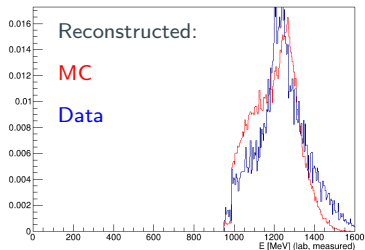


Energy of Proton for $\cos(\theta_\omega) = [-0.45, -0.35]$ (Peak)



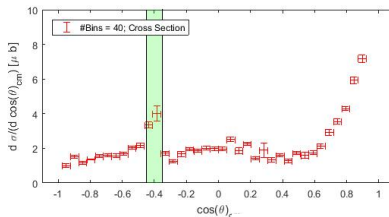
$E(\text{lab})$ Proton

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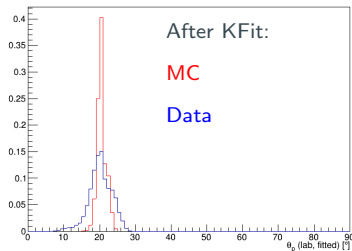
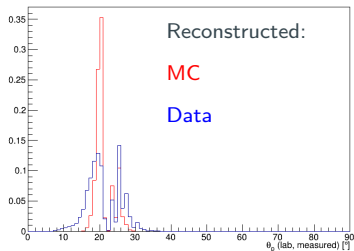
Energy of protons for $\cos(\theta_\omega) = [-0.45, -0.35]$. Red are MC and blue are beamtime data. Left side is just measured, right side is after KFit.

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



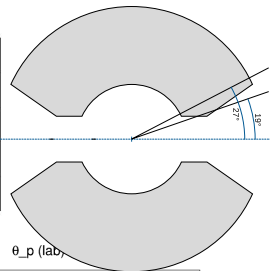
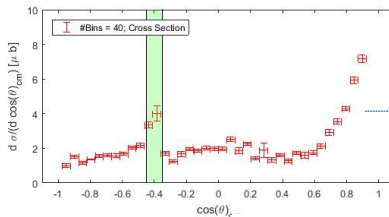
θ_p (lab)

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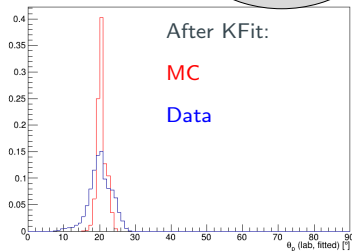
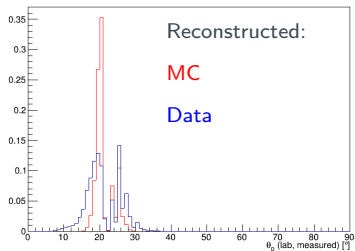
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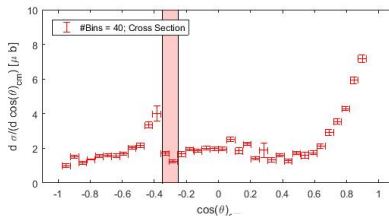
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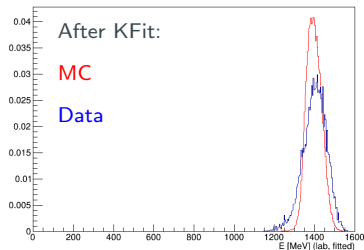
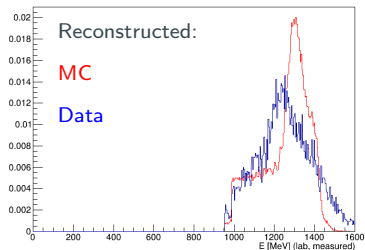
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Energy of protons for $\cos(\theta_\omega) = [-0.35, -0.25]$ (Dip)

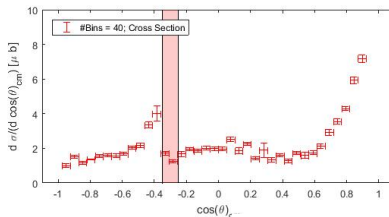


E (lab) Proton

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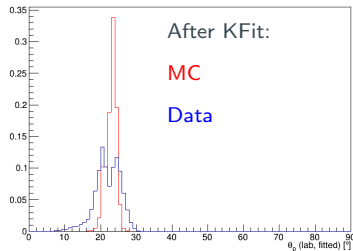
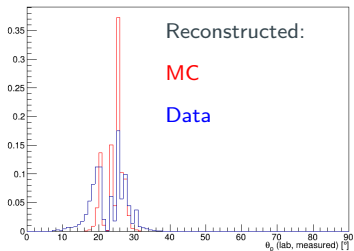


Energy of protons for $\cos(\theta_\omega) = [-0.35, -0.25]$. Red are MC and blue are beamtime data. Left side is just measured, right side is after KFit.



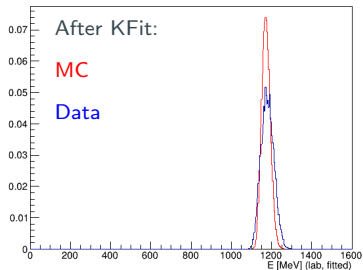
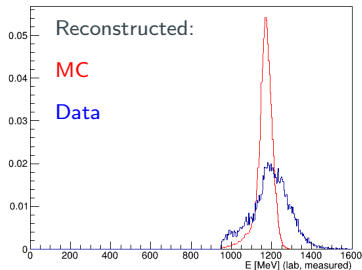
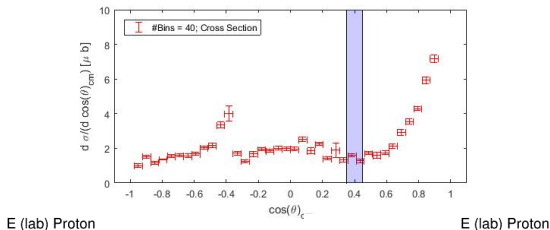
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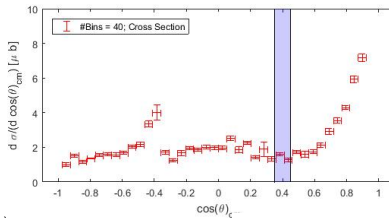
θ of protons for $\cos(\theta_\omega) = [-0.35, -0.25]$. Red are MC and blue are beamtime data. Left side is just measured, right side is after KFit.

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



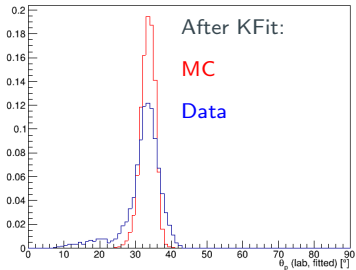
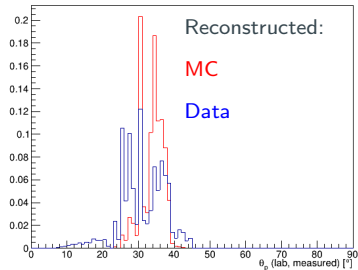
Energy of protons for $\cos(\theta_\omega) = [0.35, 0.45]$. Red are MC and blue are beamtime data. Left side is just measured, right side is after KFit.

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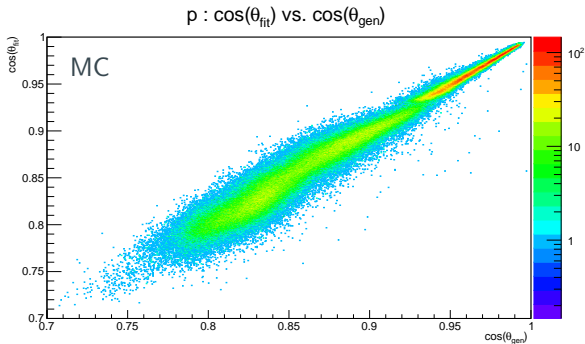
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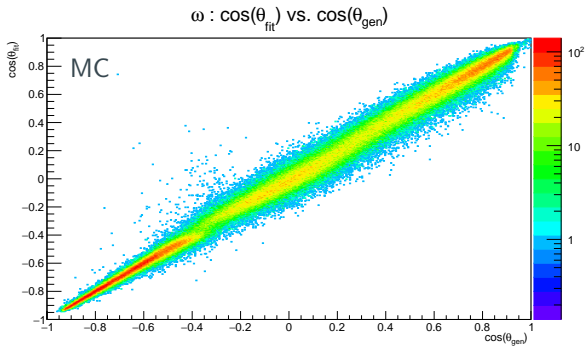


θ of protons for $\cos(\theta_\omega) = [0.35, 0.45]$. Red are MC and blue are beamtime data.

Left side is just measured, right side is after KFit.



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



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

Unfolding



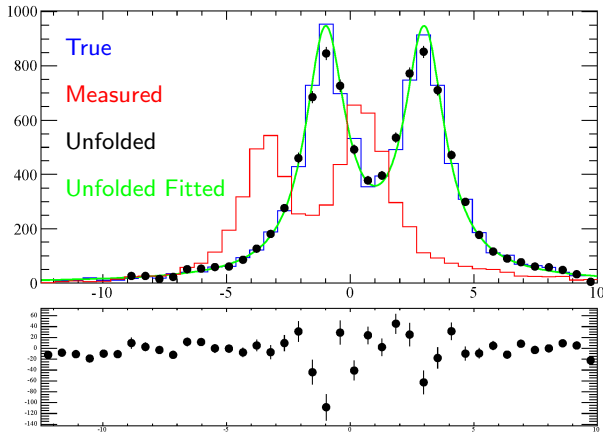
- μ is the **true distribution** given by nature
- detector effects are then described by the **migration matrix** R (inefficiencies, bias and smearing)
- This results in the **measured distribution** ν

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

- True distribution can be calculated by inverting the migration matrix R

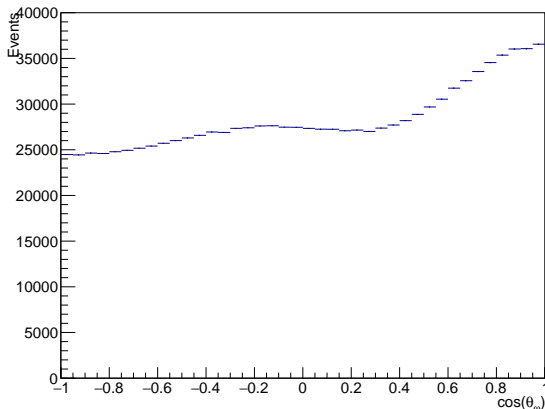
$$\mu = R^{-1} \nu$$

- Use numerical methods to invert the migration matrix



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

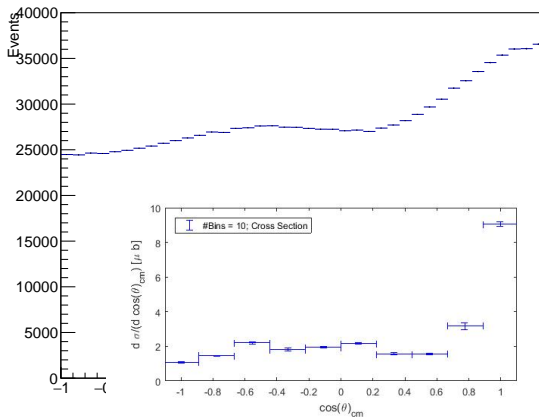
Unfold ResponseMatrix



- A migration matrix is calculated with a flat ω phase space
- This migration matrix is then used to unfold realistic MC
- \rightarrow Unfolding was unsuccessful

Flat ω was used. MC fitted data were unfolded.

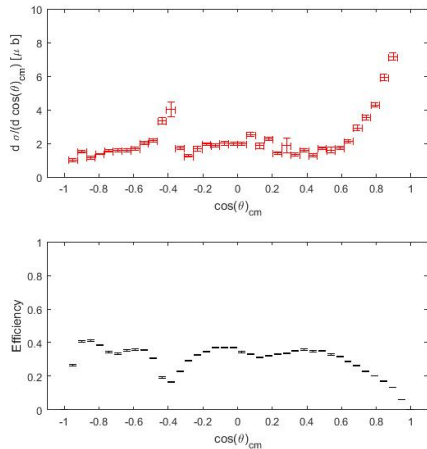
Unfold ResponseMatrix



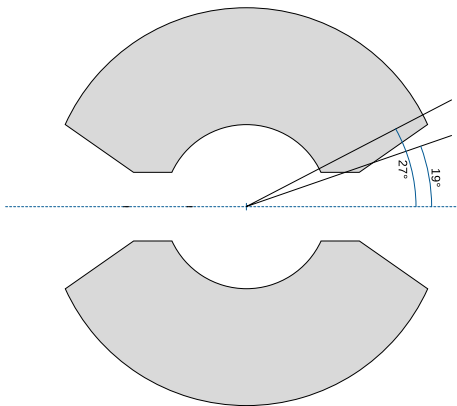
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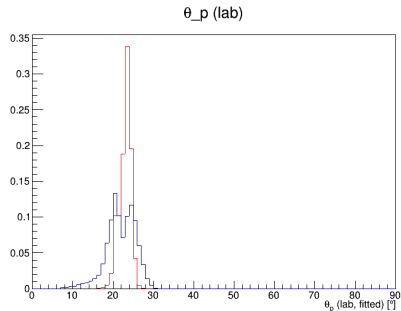
- Drop in the measured cross section at $\cos(\theta_\omega) \approx -0.35$ is caused by a drop in the efficiency



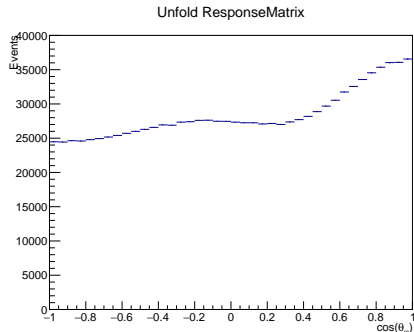
- Drop in the measured cross section at $\cos(\theta_\omega) \approx -0.35$ is caused by a drop in the efficiency
- Inefficiency is caused by the protons hitting the edge of the CB
→ They are not reconstructed properly

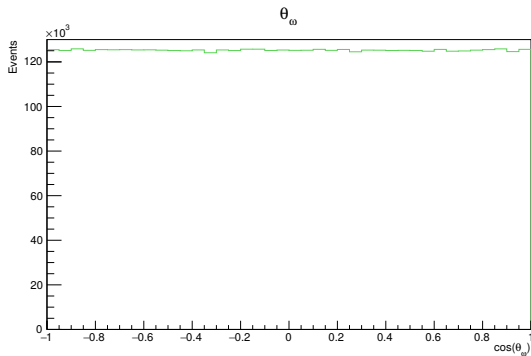


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- Inefficiency is caused by the protons hitting the edge of the CB
→ They are not reconstructed properly
- There are differences between MC and data
- Unfolding does not work





Flat generated ω