

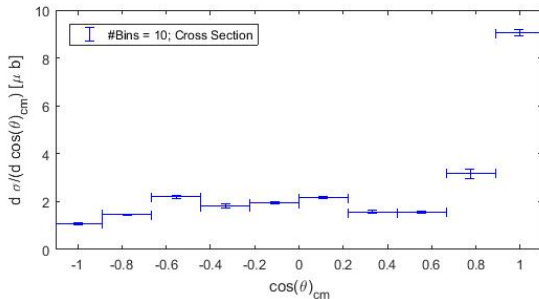
Omega Cross-Section

Martin Sobotzik

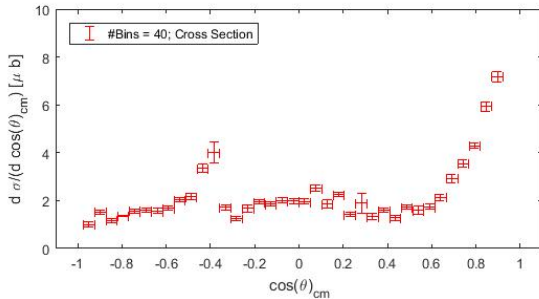
Mainz, March 2019

Institute for Nuclear Physics
Johannes Gutenberg-University of Mainz

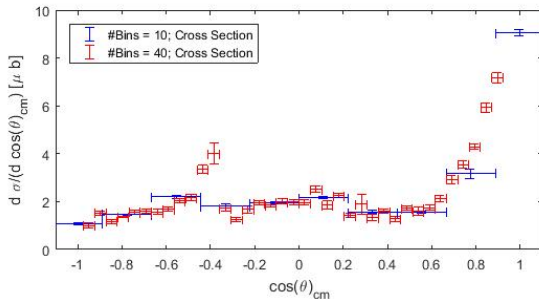




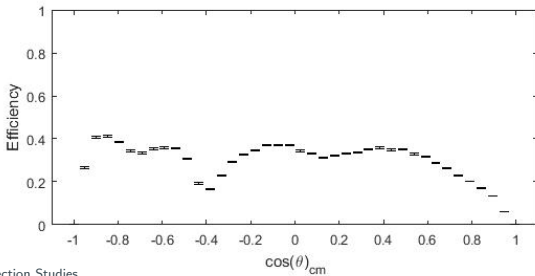
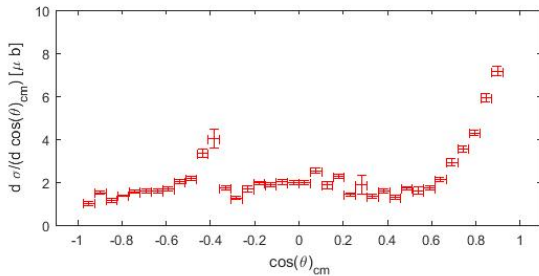
Olis Cross Section; Dip at about $\cos(\theta) = -0.3$



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

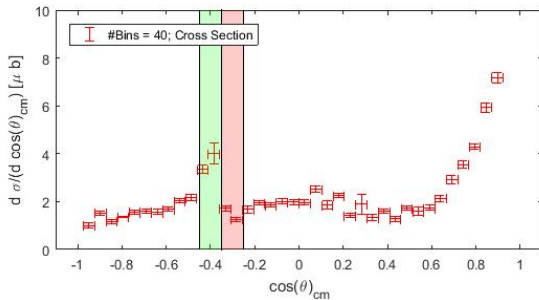


Both Cross Sections are shown.



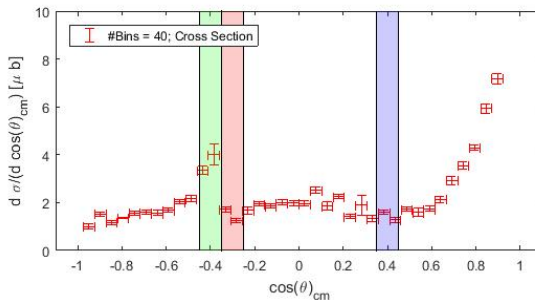
$$\gamma p \rightarrow \begin{array}{c} \omega \\ \downarrow \\ \gamma \pi^0 \\ \downarrow \\ \gamma \gamma \end{array} p$$

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



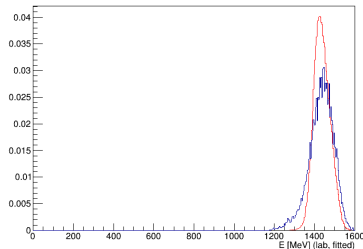
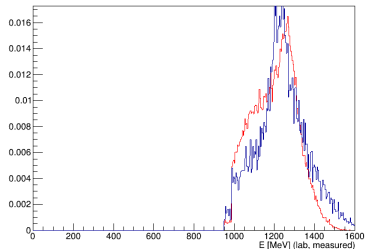
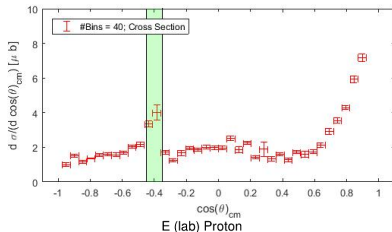
$$\gamma p \rightarrow \begin{matrix} \omega \\ \downarrow \\ \gamma \pi^0 \\ \downarrow \gamma \gamma \end{matrix} p$$

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



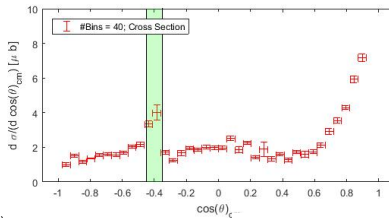
Energy of Proton for $\cos(\theta_\omega) = [-0.45, -0.35]$ (Peak)

The energy of protons looks similar for MC and Data



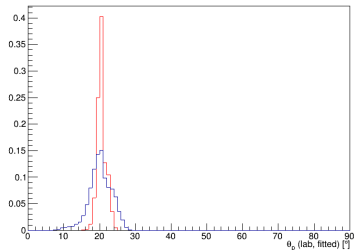
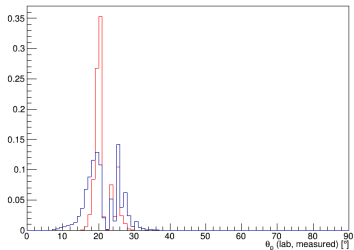
Energy of protons for $\cos(\theta_\omega) = [-0.45, -0.35]$. Red are MC and blue are beamtime data. Left side is just measured, right side is after KFit.

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



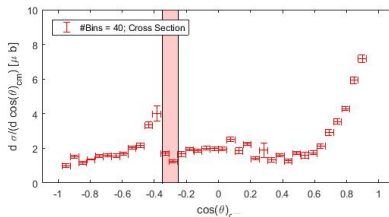
θ_p (lab)

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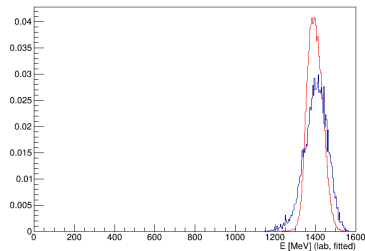
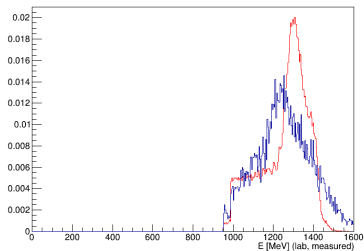
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Energy of Protons for $\cos(\theta_\omega) = [-0.35, -0.25]$ (Dip)



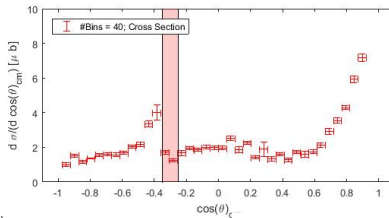
E (lab) Proton

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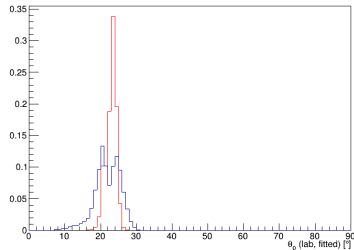
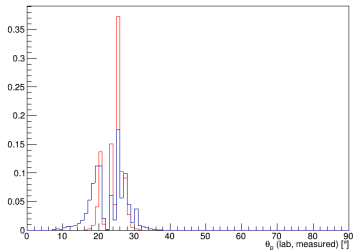
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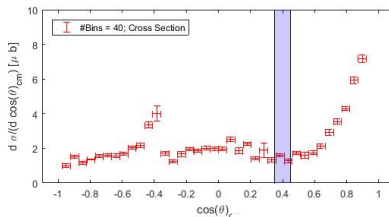
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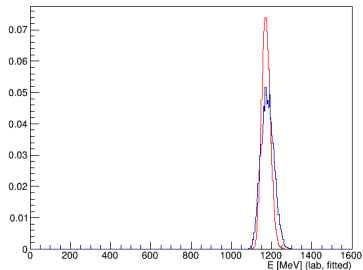
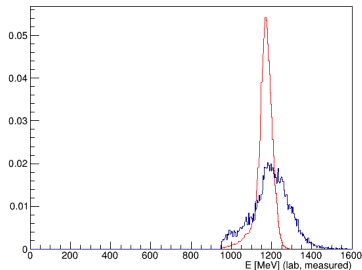
θ of protons for $\cos(\theta_\omega) = [-0.35, -0.25]$. Red are MC and blue are beamtime data. Left side is just measured, right side is after KFit.

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



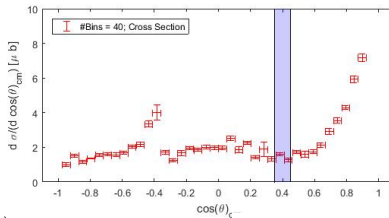
E (lab) Proton

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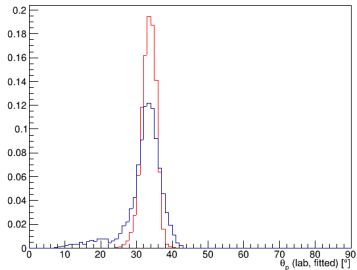
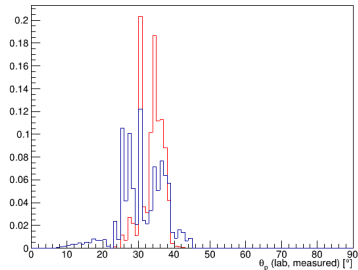
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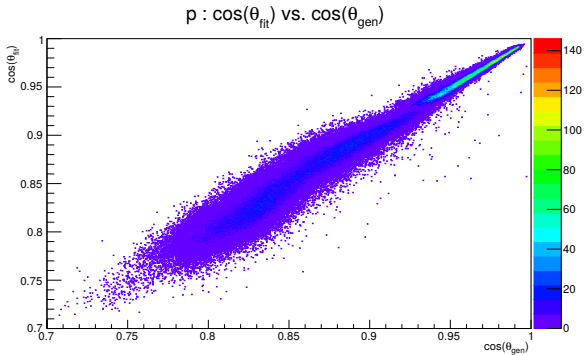
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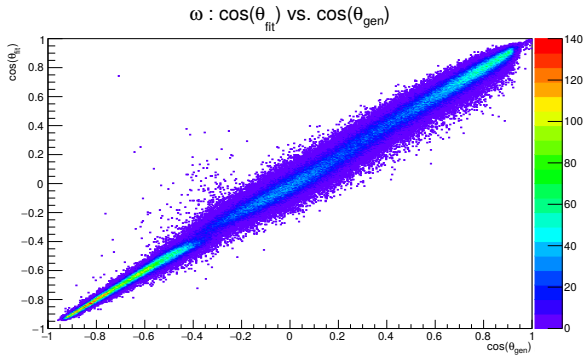


θ of protons for $\cos(\theta_\omega) = [0.35, 0.45]$. Red are MC and blue are beamtime data.

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



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



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

Unfolding



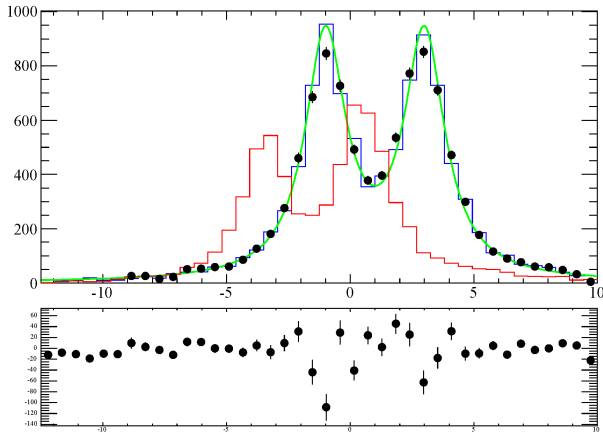
- μ is the *true* distribution given by nature
- detector effects are then described by the migration matrix R .
(inefficiencies, bias and smearing)
- This results in the distribution ν .

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

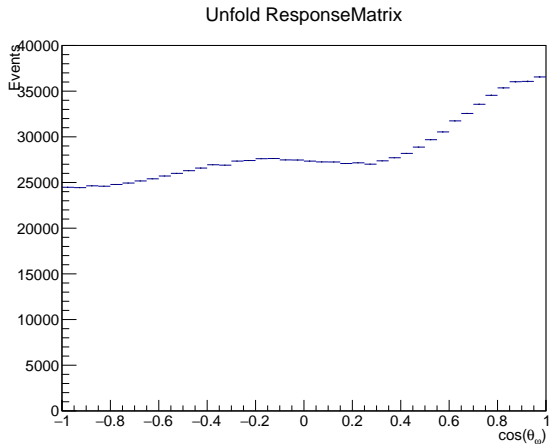
- With infinite statistics, it would be possible to recover the original distribution by inverting the migration matrix

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

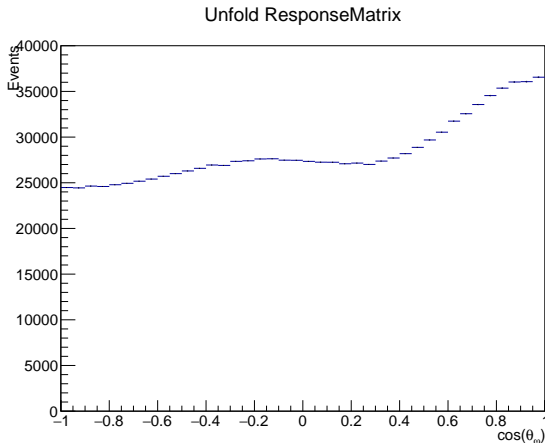
- Use numerical methods to invert the migration matrix



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



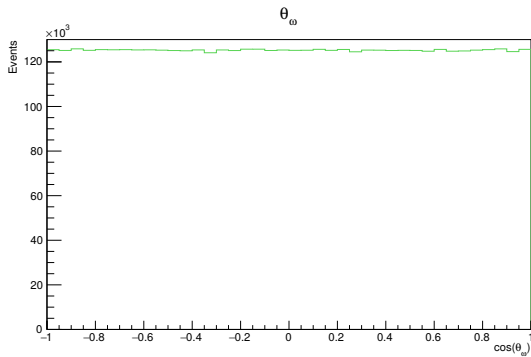
Flat ω was used. MC fitted data were unfolded.



Flat ω was used. MC fitted data were unfolded.

- ω are generated with a flat phase space
- A migration matrix is calculated
- This migration matrix is then used to unfold realistic MC
- Unfortunately, the unfolded cross section does not have the desired shape
→ Unfolding was unsuccessful

- 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
→ They are not reconstructed properly
- There are differences between MC and Data
- The differences are too big to make the Unfolding work



Flat generated ω