Determination of the beam asymmetry Σ in η- and η'-photoproduction using Bayesian statistics

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I hereby declare that this thesis was formulated by myself and that no sources or tools other than those cited were used.

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Contents

APPENDIX A

A.1 Statistical error for the asymmetry $A(\phi)$

Let $\tilde{N}_i^{\parallel/\perp}$ be the normalized event yields at bin ϕ_i. As mentioned in section 4.1, the asymmetry A_i at bin i is then given by

$$A_i = \frac{\tilde{N}_i^{\perp} - \tilde{N}_i^{\parallel}}{p_\gamma^{\parallel}\tilde{N}_i^{\perp} + p_\gamma^{\perp}\tilde{N}_i^{\parallel}} = \Sigma \cos\left(2\left(\alpha^{\parallel} - \phi_i\right)\right), \tag{A.1}$$

where the event yields are normalized over all M ϕ-bins

$$\tilde{N}_i^{\parallel/\perp} = \frac{N_i^{\parallel/\perp}}{\sum_{j=1}^{M} N_j^{\parallel/\perp}}.$$

To estimate statistical errors according to Gaussian error propagation, the partial derivatives with respect to $N_i^{\parallel/\perp}$ have to be built:

$$\left(\Delta A_i\right)^2 = \left(\frac{\partial A_i}{\partial \tilde{N}_i^{\parallel}}\Delta\tilde{N}_i^{\parallel}\right)^2 + \left(\frac{\partial A_i}{\partial \tilde{N}_i^{\perp}}\Delta\tilde{N}_i^{\perp}\right)^2, \tag{A.2}$$

where

$$\left(\frac{\partial A_i}{\partial \tilde{N}_i^{\parallel}}\right)^2 = \left[\frac{\tilde{N}_i^{\perp}\left(p_\gamma^{\perp} + p_\gamma^{\parallel}\right)}{\left(p_\gamma^{\parallel}\tilde{N}_i^{\perp} + p_\gamma^{\perp}\tilde{N}_i^{\parallel}\right)^2}\right]^2 \qquad \left(\Delta\tilde{N}_i^{\parallel}\right)^2 = \frac{\tilde{N}_i^{\parallel}}{\left(\sum_{j=1}^{M}\tilde{N}_j^{\parallel}\right)^2} + \frac{\tilde{N}_i^{\parallel}}{\left(\sum_{j=1}^{M}\tilde{N}_j^{\parallel}\right)^2} \tag{A.3}$$

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List of Figures

List of Tables