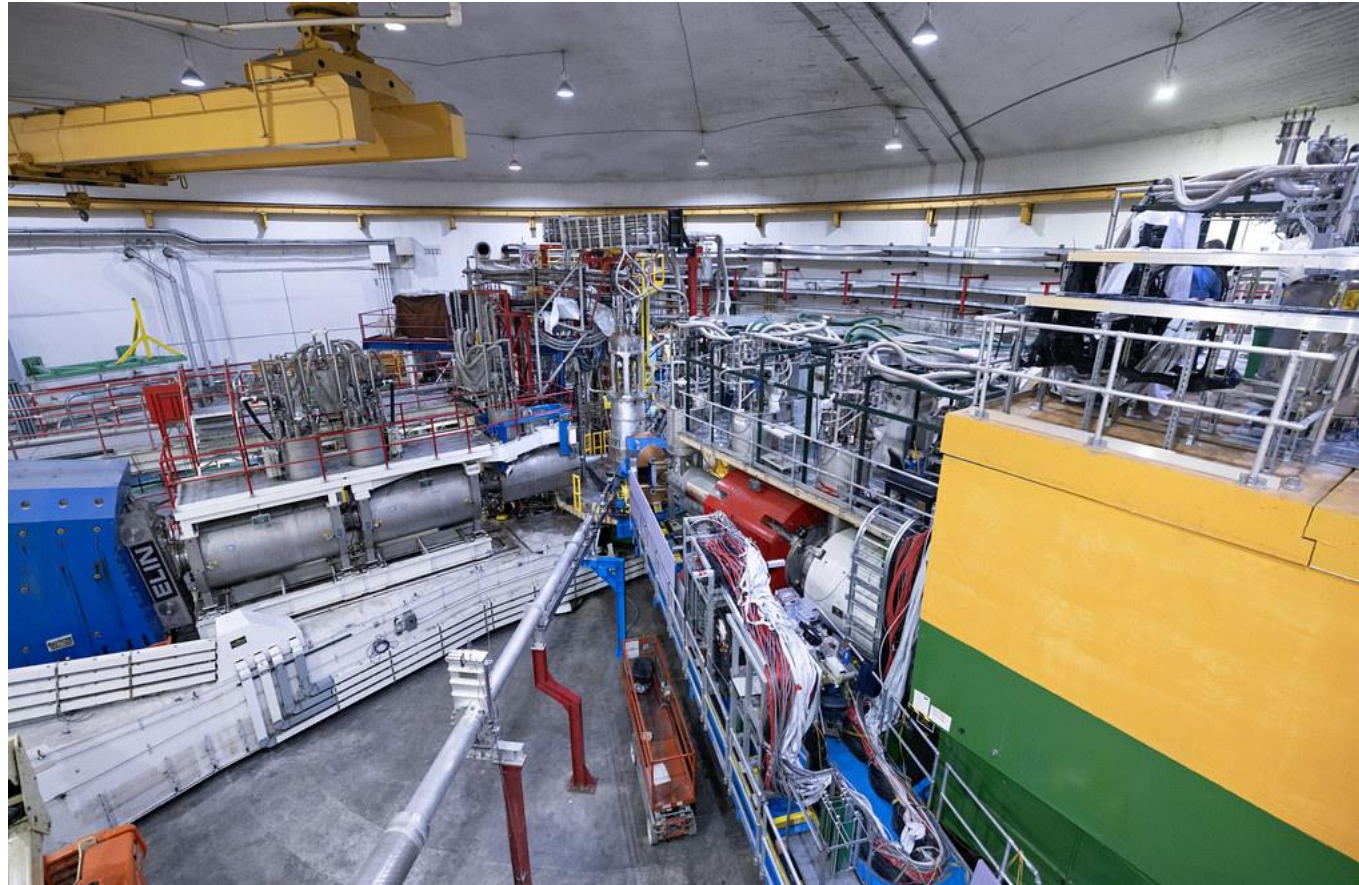




Methodology: how do we plan to extract observable exclusive reactions?

C. Muñoz Camacho

NPS Collaboration Meeting
JLab, May 5-6 (2025)

<https://hallcweb.jlab.org/elogs/NPS-RG1a-Analysis/67>

DVCS cross section data analysis

C. Muñoz (et al.)
NPS analysis meeting
Dec 10, 2024

DVCS cross section

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factors $f(Q^2, x_B, t, \phi)$

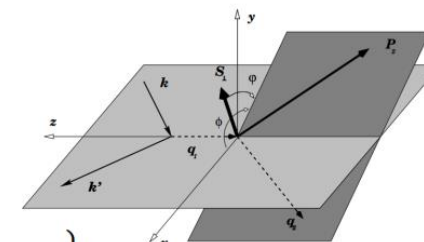
$$\frac{\alpha^3 x_B y}{2 Q^2 \sqrt{1 + \epsilon^2}} \left| \frac{T}{e^3} \right|^2$$

$$|VCS|^2 + \mathcal{I}$$

$\mathcal{B}, t, \phi$

$$\frac{1}{P_2(\phi)} \left\{ c_0^{BH} + \sum_{n=1}^2 c_n^{BH} \cos(n\phi) + s_1^{BH} \sin(\phi) \right\},$$

$$\left[c_n^{DVCS} \cos(n\phi) + s_n^{DVCS} \sin(n\phi) \right],$$



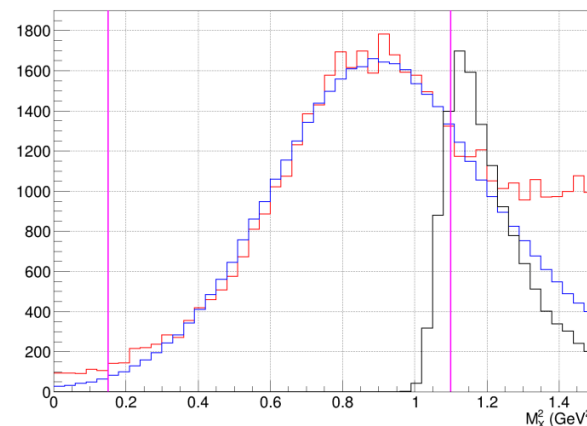
$$\mathcal{I} = \frac{1}{x_B y^3 \Delta^2 P_1(\phi) P_2(\phi)} \left\{ c_0^{\mathcal{I}} + \sum_{n=1}^3 \left[c_n^{\mathcal{I}} \cos(n\phi) + s_n^{\mathcal{I}} \sin(n\phi) \right] \right\},$$

Kinematic factors $f(Q^2, x_B, t, \phi)$

Kinematic factors $f(Q^2, x_B, t, \phi)$

$$\begin{Bmatrix} c_{1, \text{unp}}^{\mathcal{I}} \\ s_{1, \text{unp}}^{\mathcal{I}} \end{Bmatrix} = 8K \begin{Bmatrix} -(2 - 2y + y^2) \\ \lambda y(2 - y) \end{Bmatrix} \begin{Bmatrix} \Re \\ \Im \end{Bmatrix} \mathcal{C}_{\text{unp}}^{\mathcal{I}}(\mathcal{F})$$

- Pi0 calibration (of data)
- High statistics simulation for all settings
- Simulation energy (calibration) and smearing
- Cuts optimization (HMS, Calorimeter, target)
- Corrections:
 - Accidentals (for p0 accidental subtraction is more involved)
 - Multiple clusters in calorimeter
 - Efficiencies (HMS tracking, VTP trigger, etc)
 - Target density
- Pi0 subtraction (simulations needed for settings)
- Cross-section extraction (minimization to fit CFF combinations)
- Systematics estimates:
 - Missing mass cut
 - Deadtime, efficiencies, luminosity, etc



$$\chi^2 = \sum_{\mathbf{i}_e} \frac{[N^{\text{Exp}}(\mathbf{i}_e) - N^{\text{MC}}(\mathbf{i}_e)]^2}{[\sigma^{\text{Exp}}(\mathbf{i}_e)]^2}$$

$$0 = - \frac{1}{2} \frac{\partial \chi^2}{\partial X_{jv}^{\Lambda}} \bigg|_{\bar{\mathbf{x}}_{jv}}$$

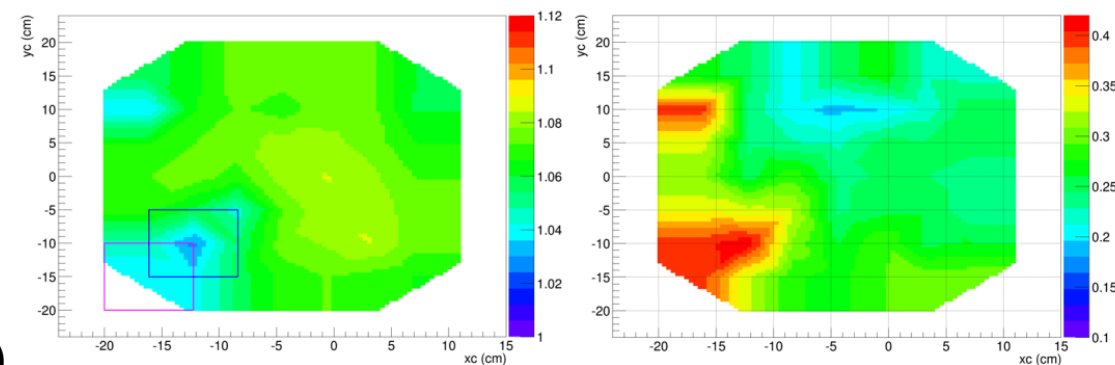


Figure 5.5: Left (Right): value of the interpolated parameter μ (σ) with respect to the impact position of the photon in the calorimeter for kin48_2. The parameter σ is expressed in GeV. The magenta and blue rectangles represent the boundaries of 2 out of the 49 rectangular regions where the coefficients μ_j and σ_j are computed.

