G_M^p Simulation and analysis plan

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→ Analysis framework based on procedures well tested for precision Cross section measurements, eg.

- M.E. Christy, et al., Phys. Rev. C 70, 015206 (2004).
- A Qattan, et al., Phys. Rev. Lett. 94, 142301 (2005).

→ Simulation software also already exists, with multiple tools available

Ideally have at least 2 (mostly) independent analyses utilizing:

1. complementary procedures

2. independent software when feasible

Cross Section Extraction Methods

For each bin in $\Delta E'$, $\Delta\Omega$, the number of detected electrons is:

$$N^{-} = L*(d\sigma/d\Omega dE')*(\Delta E' \, \Delta\Omega)*\varepsilon*A(E',\theta) + BG$$

with L: Integrated Luminosity (# *of beam electrons*targets/area*)

ε: Total efficiency for detection

$A(E',\theta)$: Acceptance for bin

BG: Background events.

The efficiency and backgroun corrected electron yield is

$$Y = (N^{-} - BG)/\varepsilon \quad = \quad L*\sigma^{\,data}*(\Delta E \, \Delta\Omega)*A(E',\theta)$$

For $A(E',\theta)$ accurately modeled by simulation, determine cross section from

1. $\sigma^{data} = Y/[(\Delta E\ \Delta\Omega)*A(E',\theta)*L]$ (acceptance correction method)

M.E. Christy, et al., Phys. Rev. C 70, 015206 (2004).

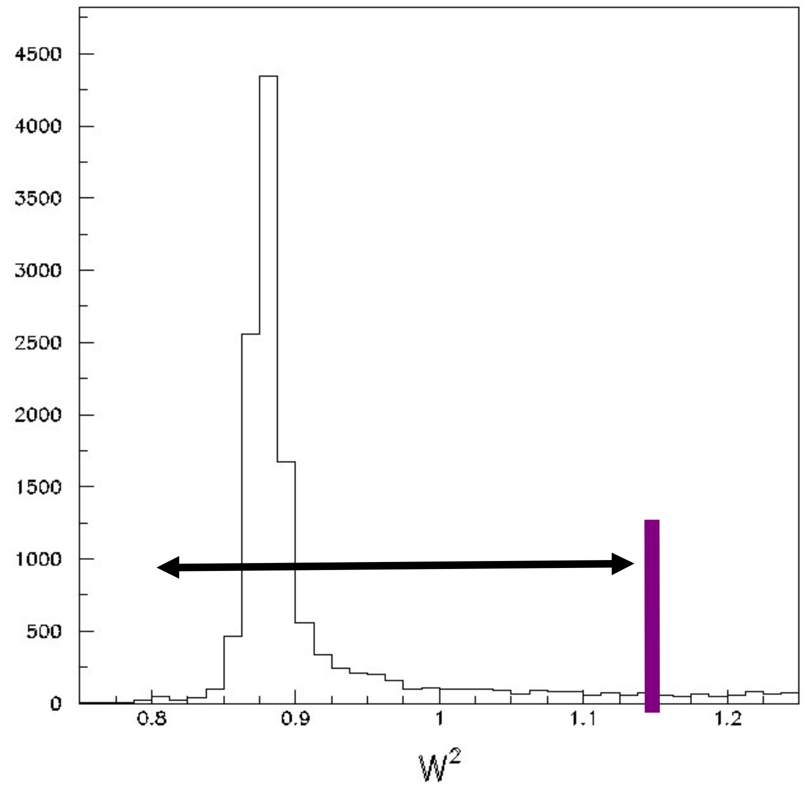
or

2. $\sigma^{data} = \sigma^{mod} * [Y(E',\theta)/Y_{MC}(E',\theta)]$ (MC ratio method)

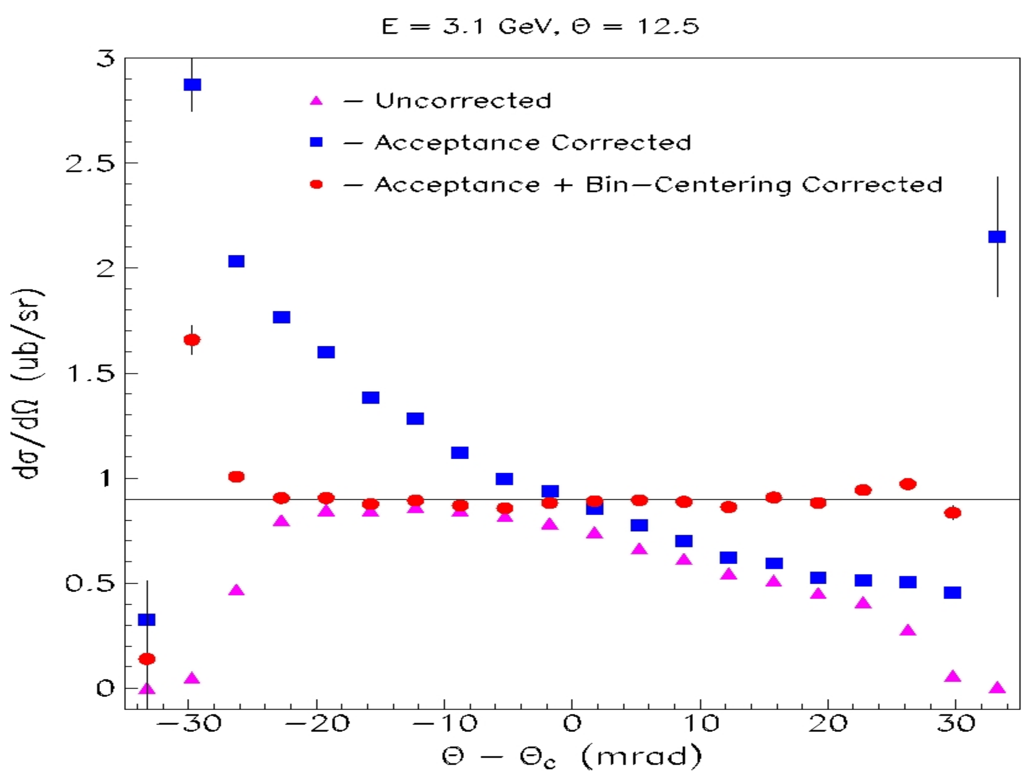
To get Born cross section:

1. radiatively correct data
2. radiated model

Acceptance correction method
(single arm MC uniform generation)

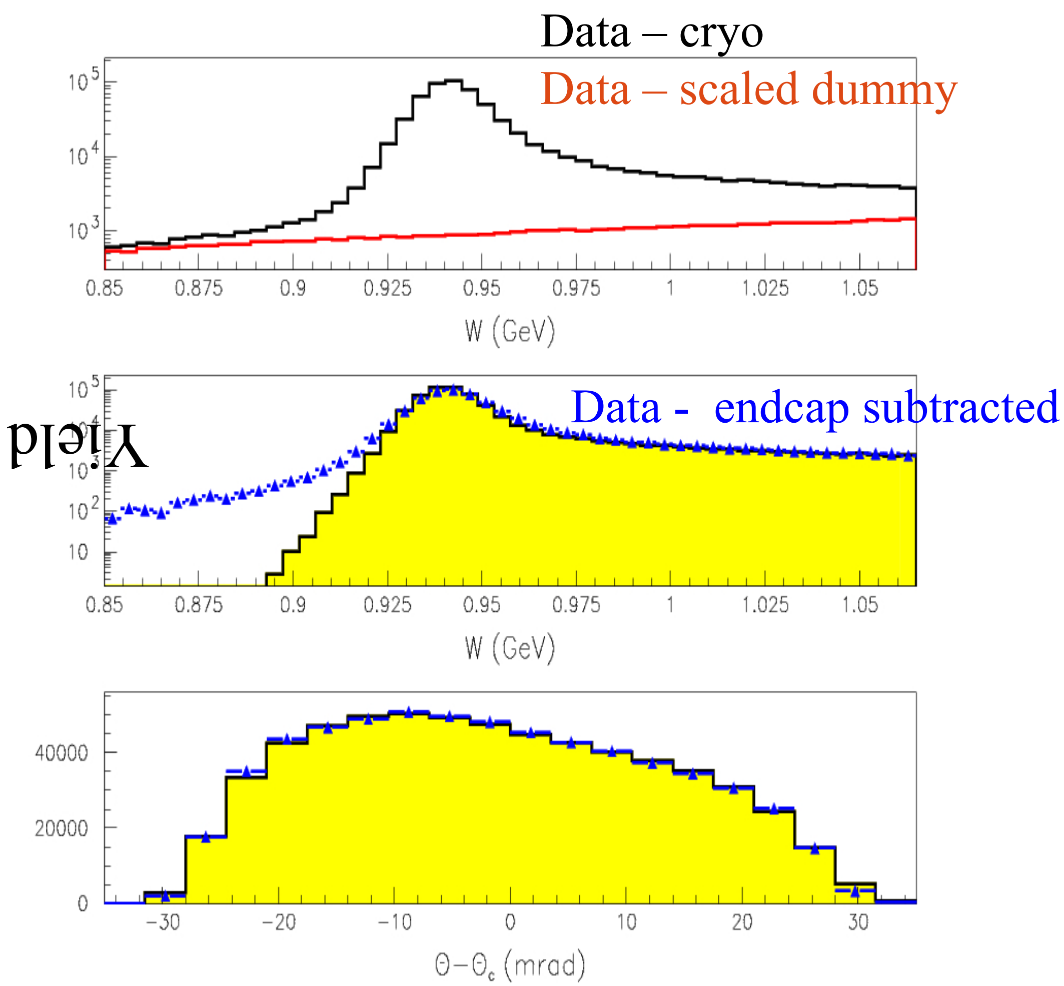


- Apply background subtractions and acceptance corrections in each E'-θ bin.
- Integrate radiative tail in each θ bin.
- Apply radiative corrections (code from SLAC NE11, modified for current target).

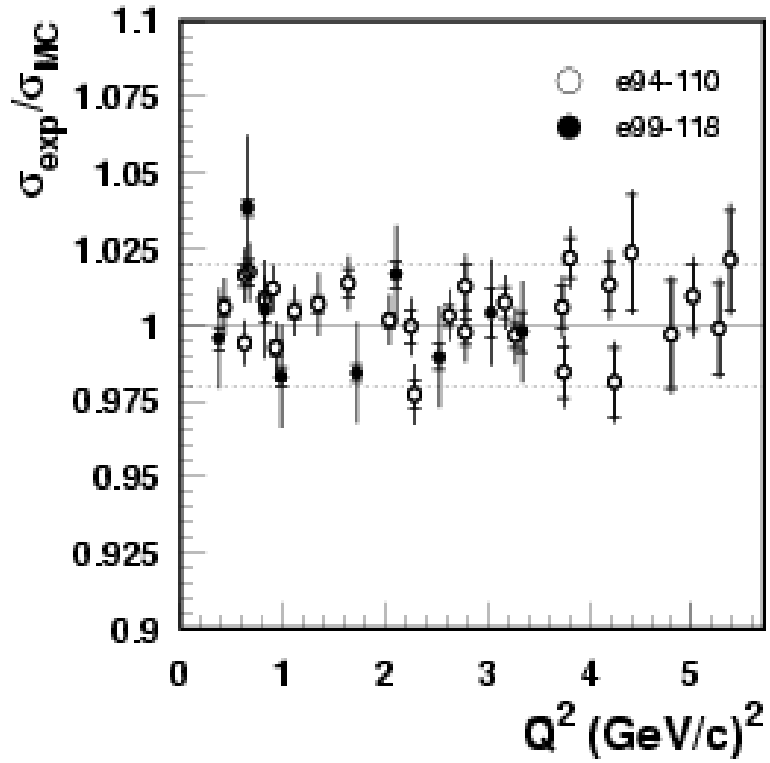


- Use Model to remove θ dependence.
- Do Weighted average over θ.

MC ratio method: SIMC



E94-110 – acceptance correction
E99-118 – SIMC ratio



Summary

→ Methods are complementary and each has advantages and disadvantages

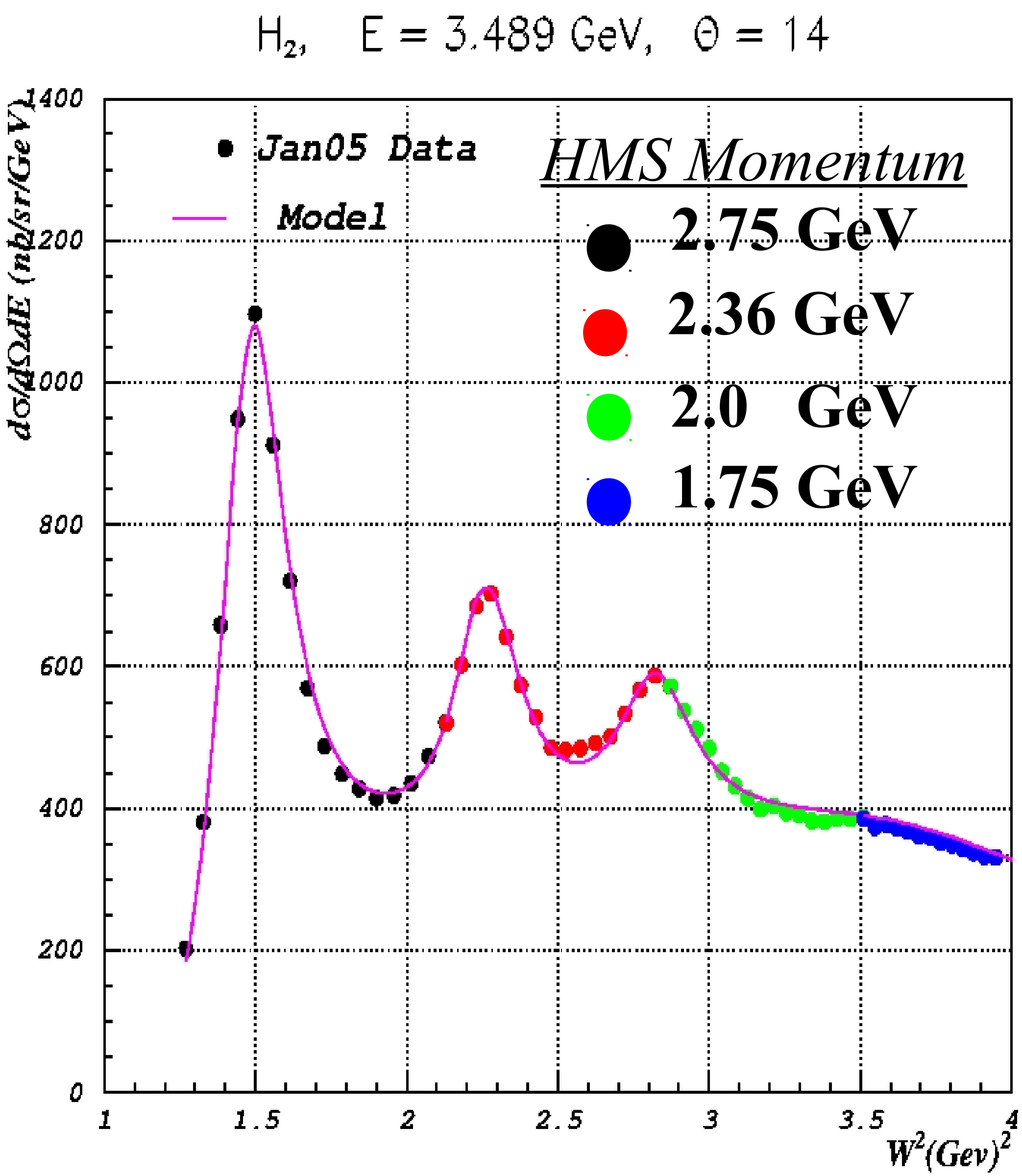
→ Both rely on reliable model of spectrometer optics and acceptance

→ Different radiative correction codes for each method

=> Provide robust cross check of results

Backup

Acceptance Correction Method



(1) Bin efficiency corrected e- yield in $\delta p/p - \theta$.
($\delta p/p$ = +/- 8%, Dq = +/- 35 mrad)

(2) Subtract scaled dummy yield bin-by-bin to remove e- Al background.

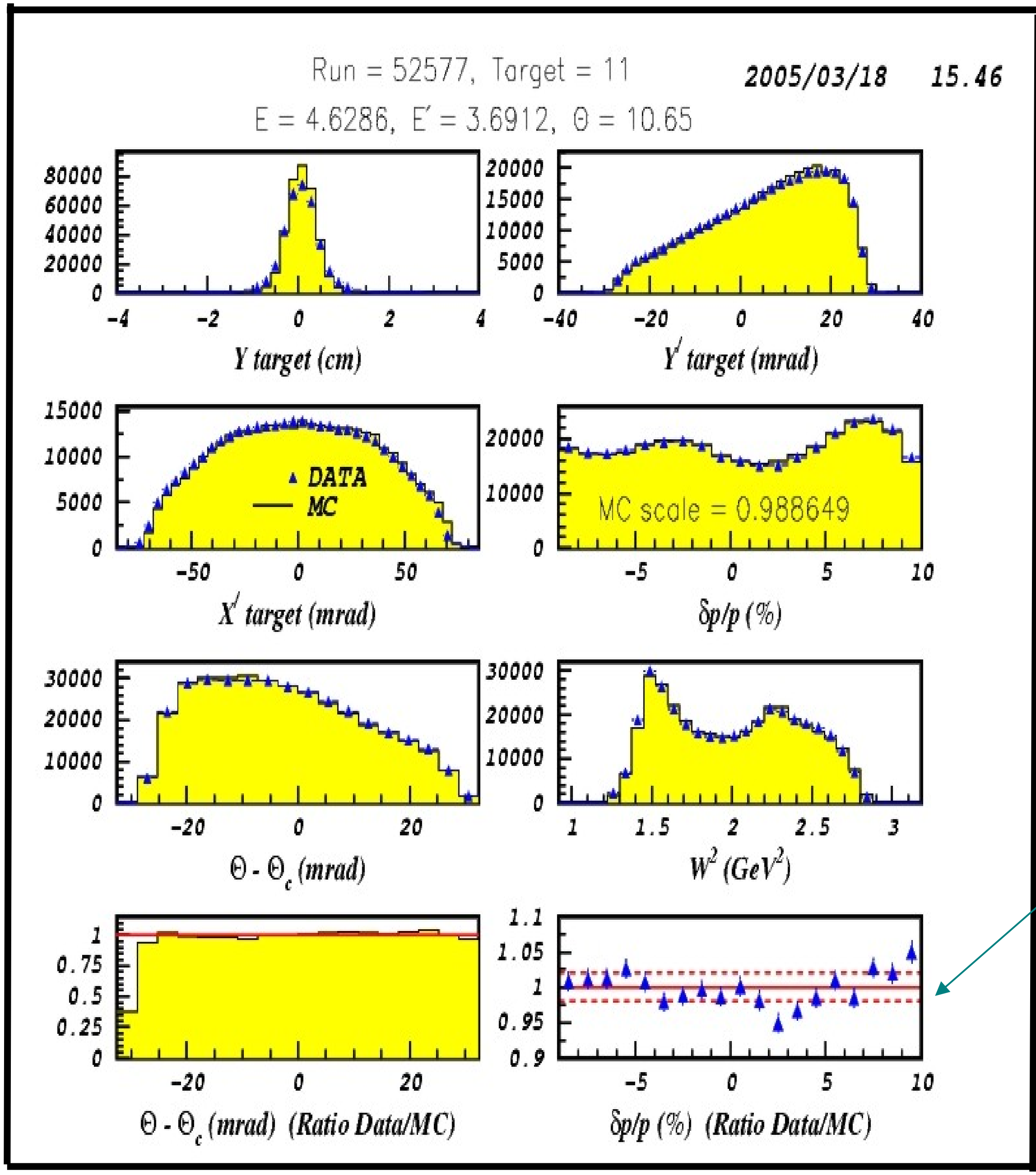
(3) Subtract charge symmetric e- yield bin-by-bin.

(4) Apply acceptance correction for each δ-θ bin.

(5) Apply radiative corrections bin-by-bin.

(6) Apply θ bin-centering correction and average over θ => for each δ bin.

Monte Carlo Ratio Method



(1) Generate MC events with σ model weighting and radiative contributions included.

(2) Scale the MC yield by L_{data}/L_{MC}, where L_{MC} is that needed to produce N_{gen} for the given σ_{mod} and phase space generated into.

(3) Add background contributions to MC or subtract from data.

(4) $d\sigma(\delta, \theta_c) = d\sigma^{mod}(\delta,\theta_c) * Y(\delta)/Y_{MC}(\delta)$ *Where $Y(\delta)$ is the yield for events with any value of θ, i.e. this integrates over θ.*

Warning: For inclusive data, radiative events can come from kinematically far away.

★ Comparison of January '05 proton data to MC using E94-110 resonance region model and externally calculated radiative corrections.

For comparison of SIMC and MCEEP radiative effects see

http://hallaweb.jlab.org/data_reduc/AnaWork2010/mkj_simc_mceep_radcor.pdf