Hall A Collaboration Meeting

Gen Collaboration

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Outline

- Collaboration
- Electric Form Factor of the Neutron
- Measurement Technique
- Apparatus used
- Charge Identification
- Missing Mass
- Quasi Elastic Selection
- Asymmetry Calculation
- Gen Calculation
- To Do
- Conclusion

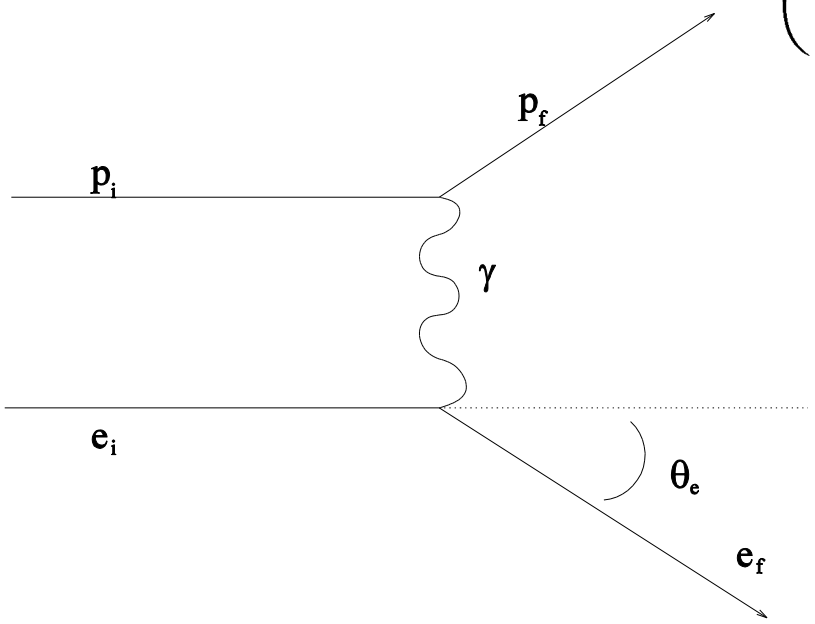
Collaborators

Name	Institution/Graduation	Activity
Bogdan	Jefferson Lab	Spokesperson
Gordon Cates	University of Virginia	Spokesperson
Nilanga	University of Virginia	Spokesperson
Sergey Abrahamyan	Sometime in 09?	Monte Carlo and Shower Calibration
Brandon Craver	Expected Summer 08	NIM paper on Wire Chamber
Aidan Kelleher	Expected Fall 08	
Ameya Kolarkar	Winter 07	University of Boston
Jonathan Miller	Expected Fall 08	Analysis of Kinematic 4
Seamus Riordan	Spring 08	Analysis of Kinematic 3 & 4 and Thesis
Tim Ngo	Summer 07	???

The electric Form Factor of the Neutron

$$\frac{d\sigma}{d\Omega} = \left(\frac{d\sigma}{d\Omega}\right)_{Mott}\left[\frac{G_E^2 + \tau G_M^2}{1+\tau} + 2\tau G_M^2 \tan^2\frac{\theta}{2}\right]$$

$$\left(\frac{d\sigma}{d\Omega}\right)_{Mott} = \left(\frac{\alpha\cos\frac{\theta}{2}}{2E_i \sin^2\frac{\theta}{2}}\right)^2 \frac{E_f}{E_i}$$



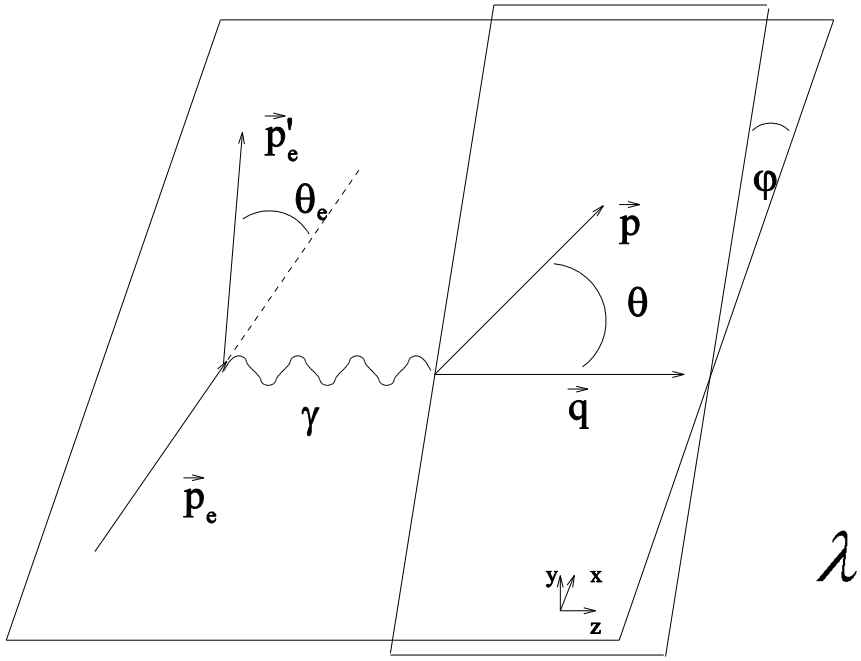
$$\tau = \frac{Q^2}{4M}$$

How are we measuring it?

Polarized helium 3 acts as a polarized neutron target. Recoiling neutron and electron are detected in coincidence.

$$\sigma^{pol} = \Sigma + h\Delta$$

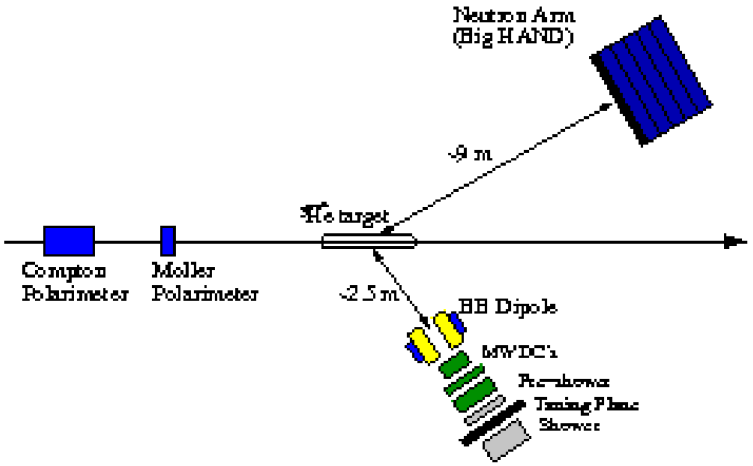
$$A = \frac{\sigma_+ - \sigma_-}{\sigma_+ + \sigma_-}$$



$$\lambda = \frac{G_E}{G_M}$$

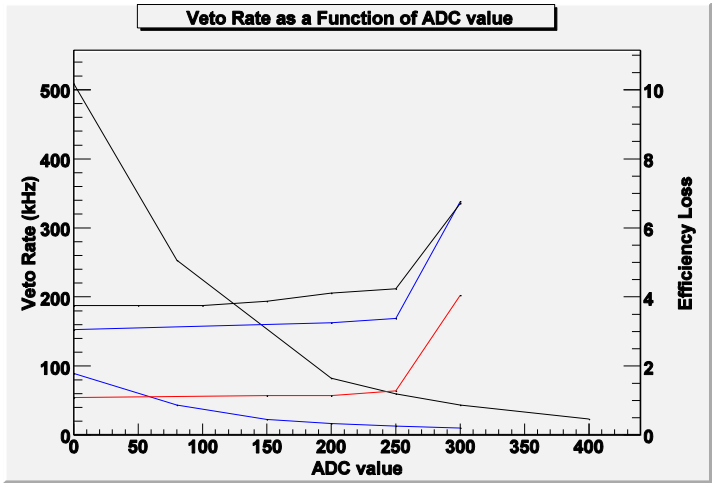
$$= \frac{a(Q^2, pol, \theta)\lambda + b(Q^2, pol, \theta)}{c(Q^2, pol, \theta)\lambda^2 + d(Q^2, pol, \theta)}$$

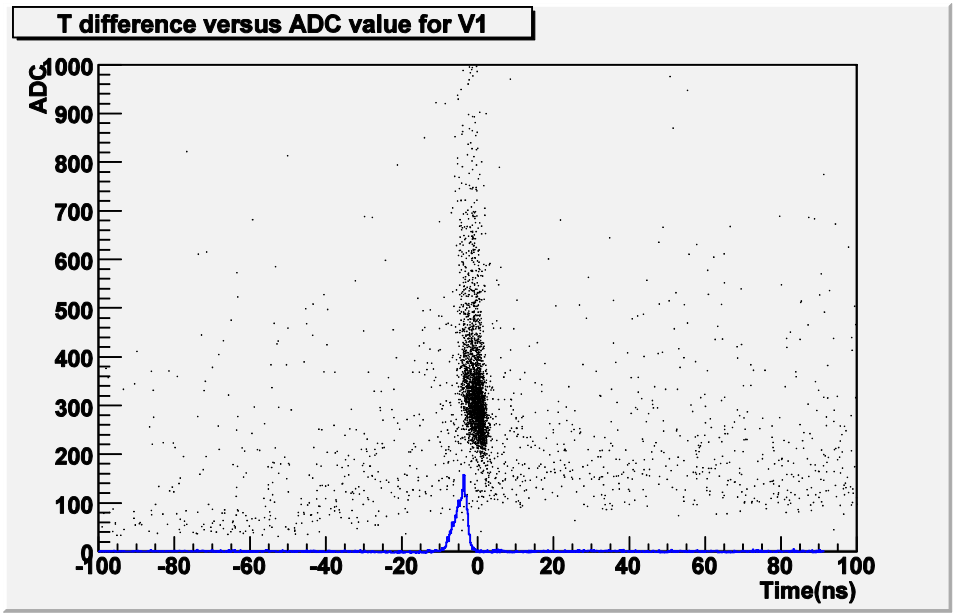
What are we using to make the measurement?



- The Neutron Arm provides quasi-elastic selection (using time of flight and hit location) and charge identification.
- Big Bite provides the trigger, and selects for (e,n) events.
- The Target provided high polarization throughout the experiment (50%).

Charge Identification

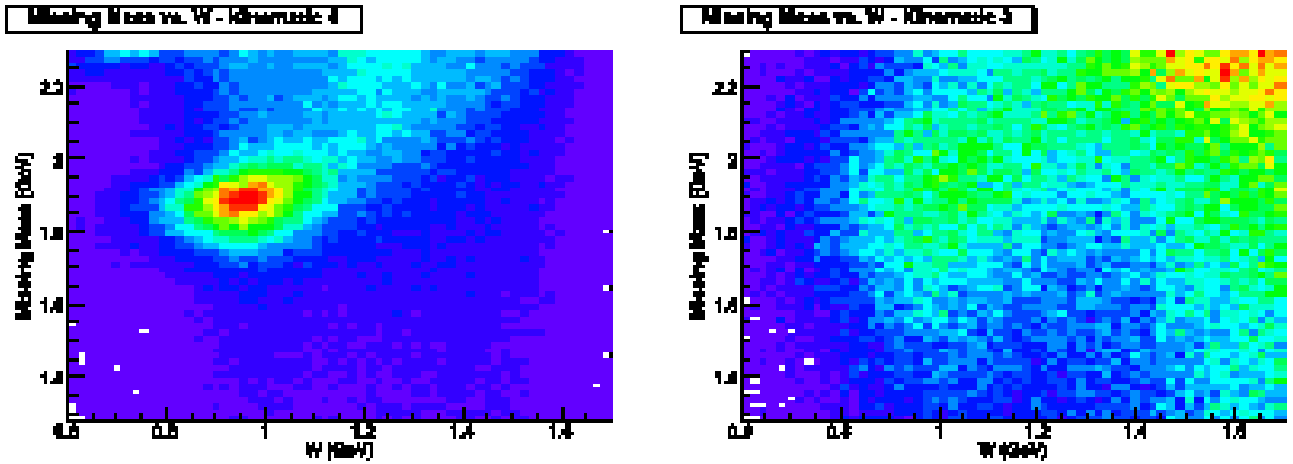




How the rates change in the veto detectors at different cuts on the amplitude.

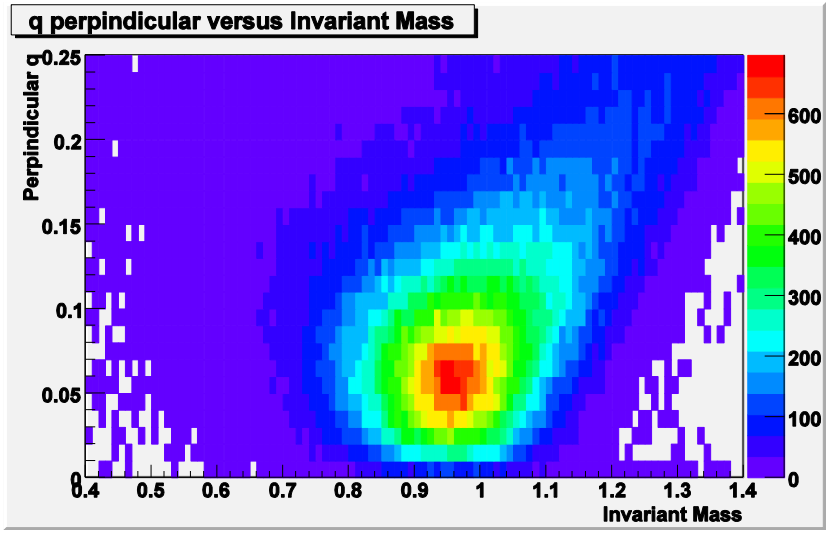
Placing a cut on the amplitude in the veto of 200, removes accidentals both at the time of the coincidence, and hits coming in before the event in the neutron bars.

Missing Mass



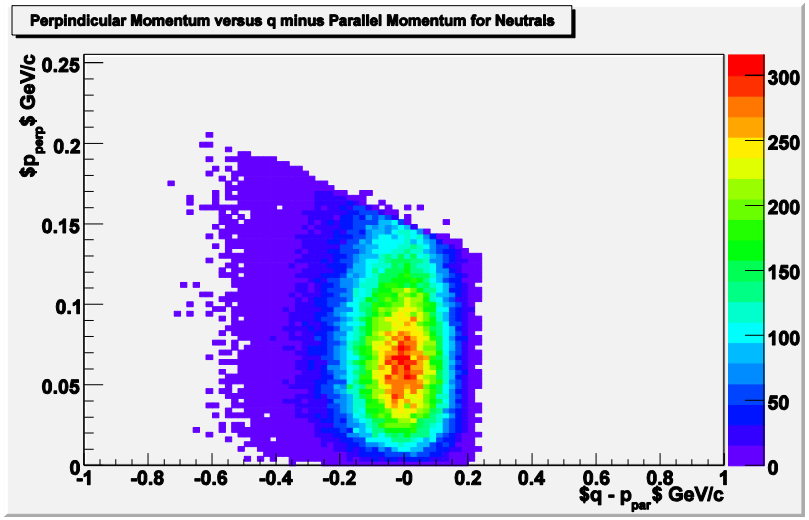
Large cuts on missing mass are needed in kinematic 3 to remove pion electroproduction. These cuts are still necessary in kinematic 4.

Quasi-Elastic Selection

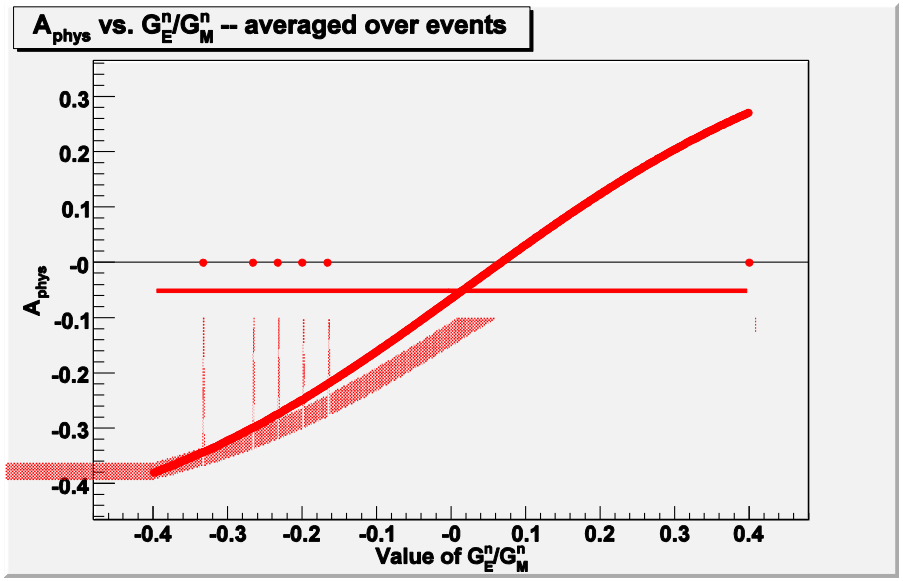


To select quasi-elastic neutrons, time of flight and missing q perpendicular is used in addition to the invariant mass.

After the time of flight and q perpendicular cuts are in place, the familiar missing parallel and perpendicular momentum



Asymmetry Calculation



$$A_{corr,n} = \frac{A_n - (-D_n)A_p}{D_n}$$

- Calculate proton asymmetry based upon proton form factor ratio.
- Account for proton to neutron conversion via dilution factors.
- Calculate physical asymmetry from this corrected quantity via beam polarization, target polarization, neutron polarization, and nitrogen dilution.

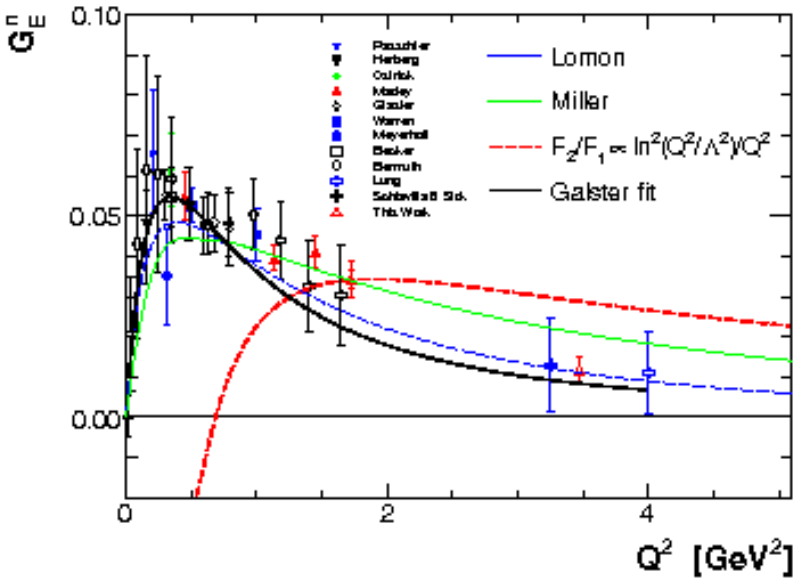
GEn Calculation

Name	Kin3 Value	Kin 3 error	Kin 4 value	Kin 4 error
Lambda	-0.213	0.057	-0.207	0.029
Q^2	3.47		1.72	
Gen	0.0117	0.0031	0.0343	0.0048
Number of QE	15325		156061	

To Do

- Improve Tracking Code for greater efficiency
- Monte Carlo to account for Pion Electroproduction
- Shower Calibration
- Results for Kinematic 1 & 2
- Finalize Target and Neutron Arm calibrations.

Conclusion



- Preliminary values of Gen for kinematics 3 and 4.
- Expect a large increase of statistics after improvements to calibrations and analysis and Monte Carlo.