Measurement of the Neutron Magnetic Form Factor G_M^n at High Q^2 Using the Ratio Method on Deuterium

Work by L.Baashen (FIU), B.A. Raue (FIU), G. Gilfoyle (Richmond), L.C. Smith (UVA)

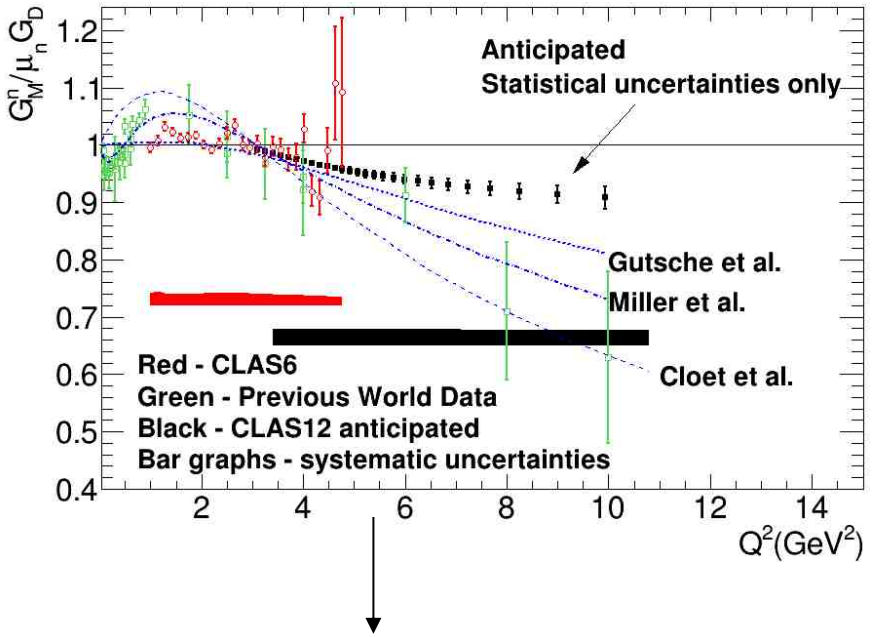


Figure shows world's data for G_M^n including anticipated results. Curves show recent theoretical calculations from Gutsche et al. (PRD 97, 054011, 2018)), Miller et al. (arXiv 1912.07797 [nucl-th], 2020) and Cloet et al (Few Body syst., 46:1-36, 2009)

Motivation:

1- The neutron magnetic form factor is a fundamental observable related to the distribution of magnetization in the nucleon.

2- The form factors provide important constraints for GPDs.

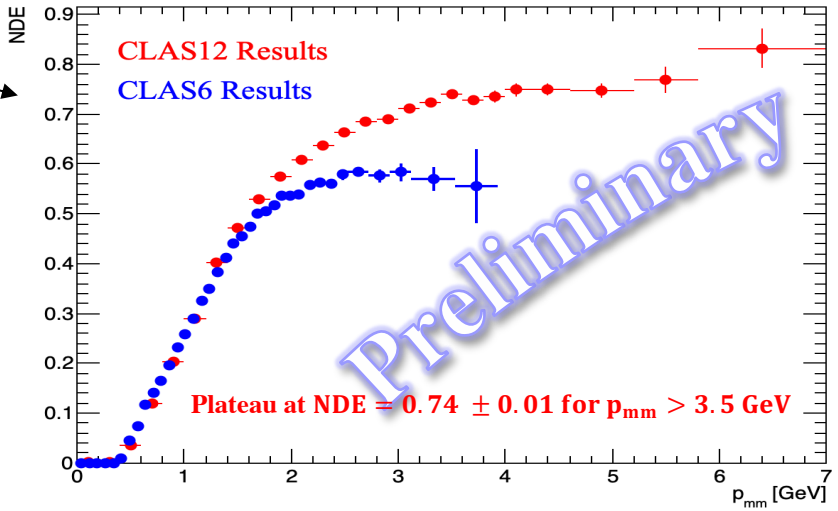
Goal:

Extract G_M^n at high Q^2 using the ratio of quasi-elastic e-n and quasi-elastic e-p on deuteron: $R = \frac{d(e,e'n)p}{d(e,e'p)n}$

Requires:

Precise measurement of the neutron detection efficiency (NDE).

Using RG-A data from fall 2018 (pass 1 cooking) ~ 359 runs.



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Analysis status for quasi-elastic e-p/e-n:

1. Using RG-B data from spring 2019 (pass 1 cooking) ~ 223 production runs.
2. For e-p events: Select two tracks, one electron in Forward Detector and one proton in PCAL/ECAL Detector.
3. For e-n events: Select one track, one electron in Forward Detector.

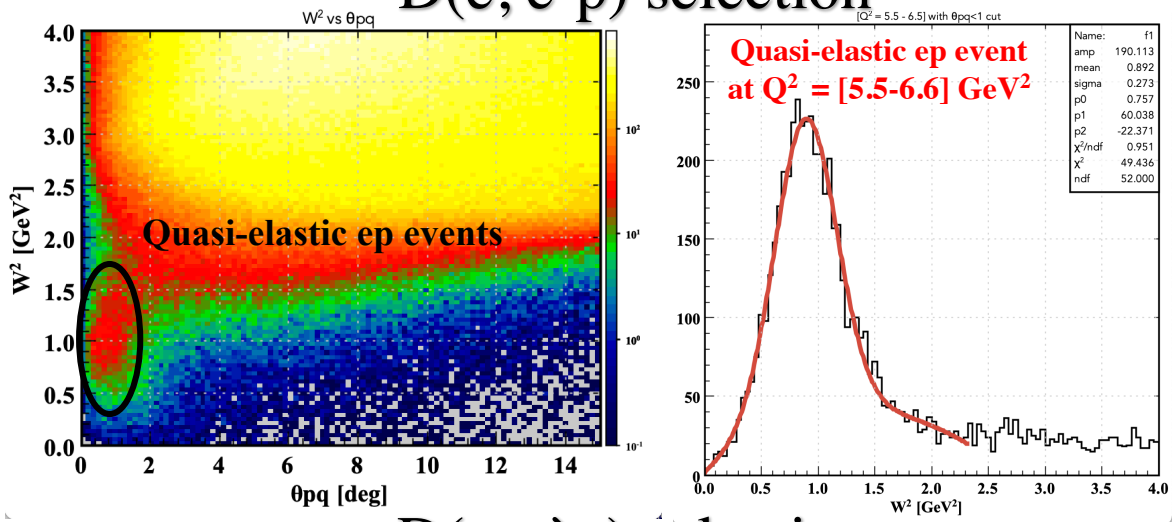
Quasi-elastic event selection:

1. Apply cut on $W^2 < 4.0$ to both e-p and e-n events.
2. Apply cut on $\theta_{pq} < 1$ (angle between the virtual photon and scattered nucleon 3-momenta) to both to reduce inelastic background.

Progress:

Studying acceptance matching of e-p and e-n events.

D(e, e`p) selection



D(e, e`n) selection