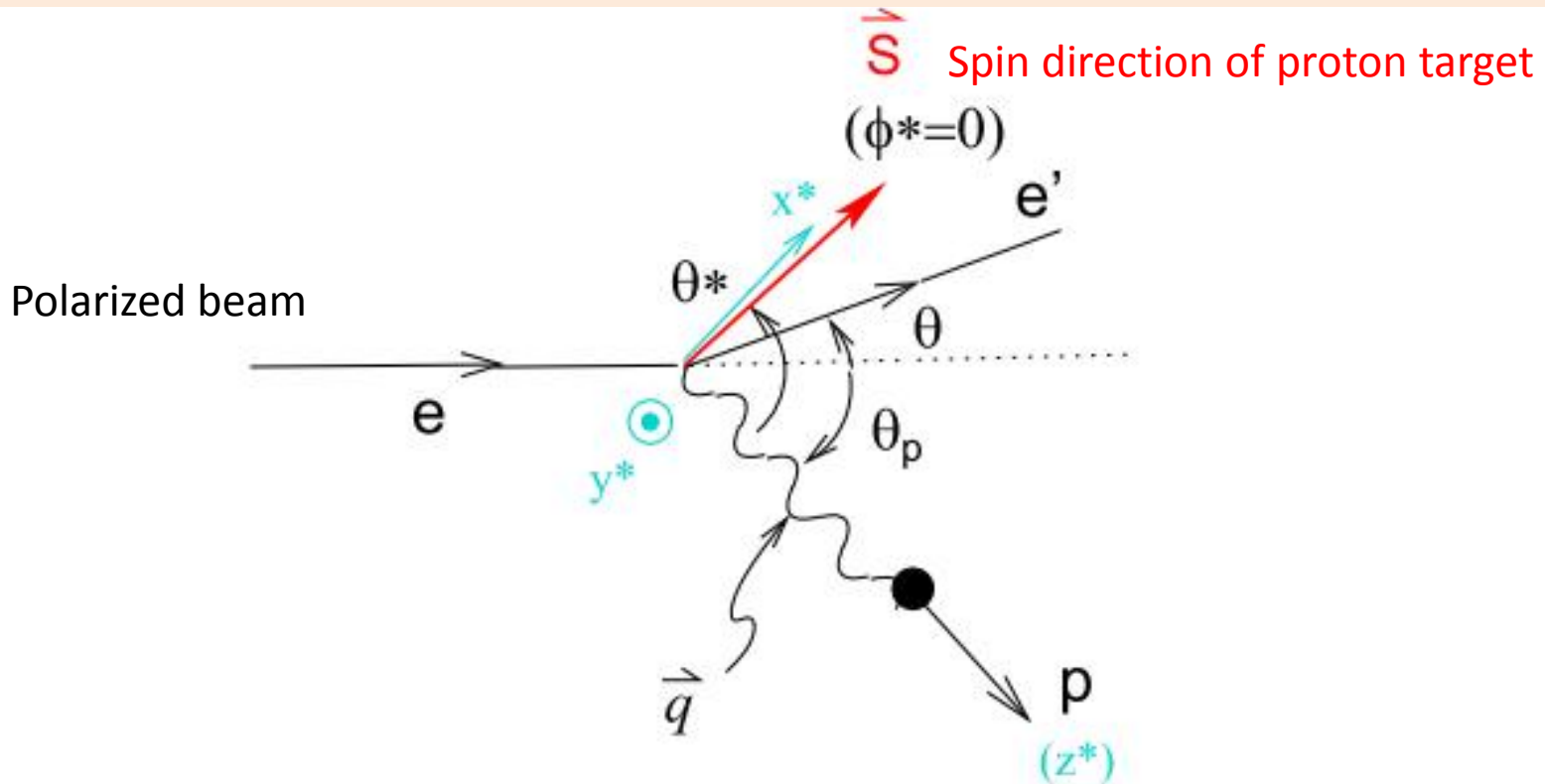


Precision Measurement of
Proton G_E/G_M at $Q^2 = 7.7$
using polarized target

Mark Jones

Hall A Collaboration Meeting
December 2010

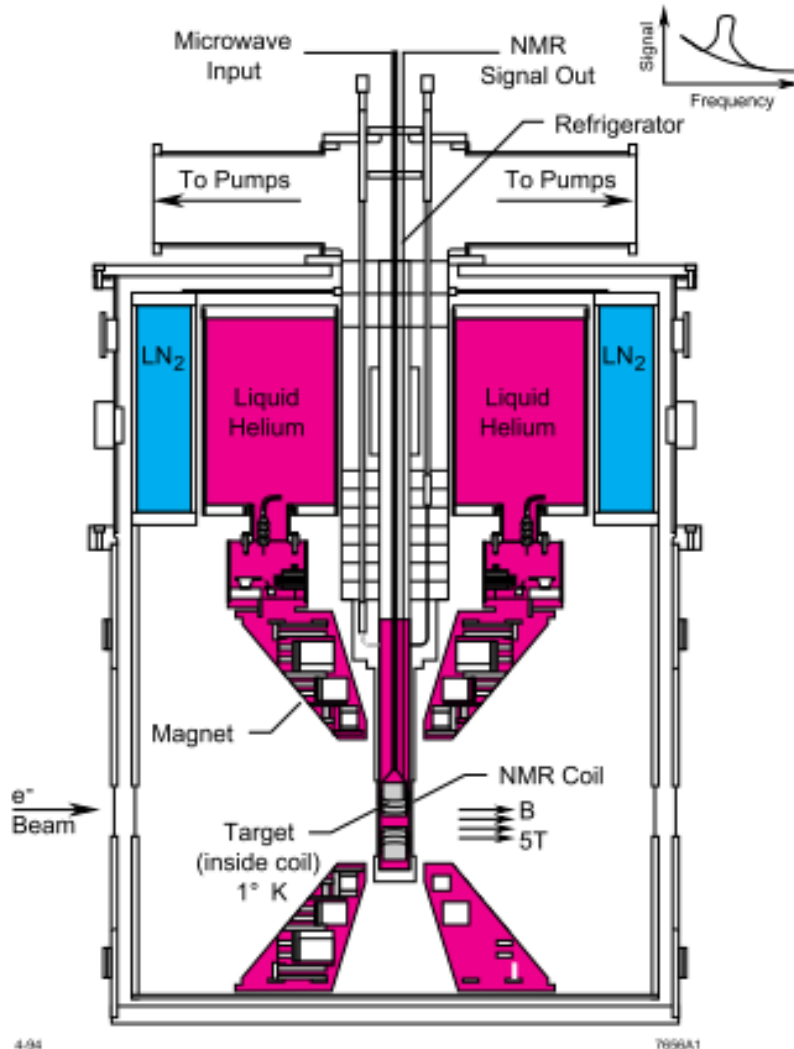
Elastic ep double spin asymmetry



$$A_p = \frac{-br \sin \theta^* \cos \phi^* - a \cos \theta^*}{r^2 + c} \quad r = \frac{G_E}{G_M}$$

Best determination of G_E/G_M when θ^* , angle between target spin and momentum transfer is 90°

Polarized Target



Important target parameters

- Target material NH_3
- Run at 85 nA
- Average target polarization = 70%

$$A_m = \frac{N^+ - N^-}{N^+ + N^-}$$

$$A_p = \frac{A_m}{f P_B P_T}$$

f = dilution factor = Y_H / Y_{TOT}

P_B = beam polarization

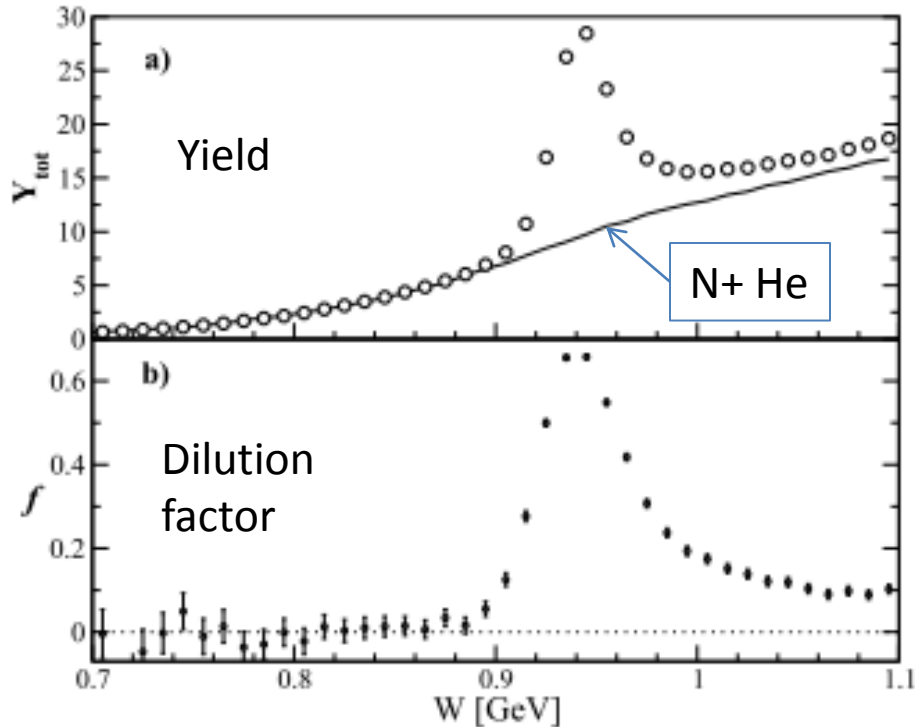
P_T = target polarization

Hall C experiment

Detected elastic electrons in HMS at $Q^2 = 1.5 \text{ GeV}^2$

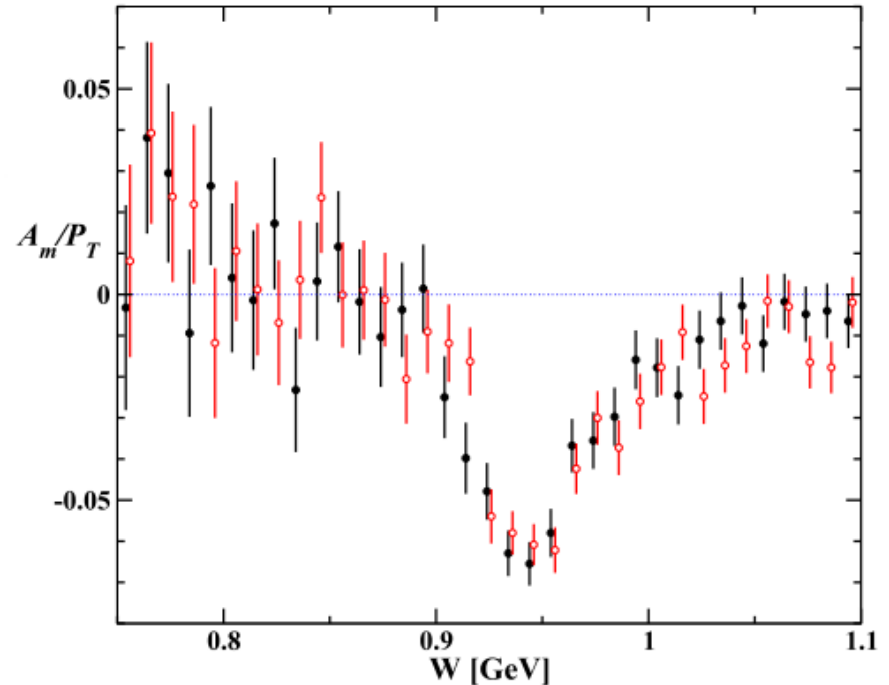
Target polarization vector pointing at 90° to beam direction

Yield and dilution factor



Dilution factor about 50%

Measured Asymmetry



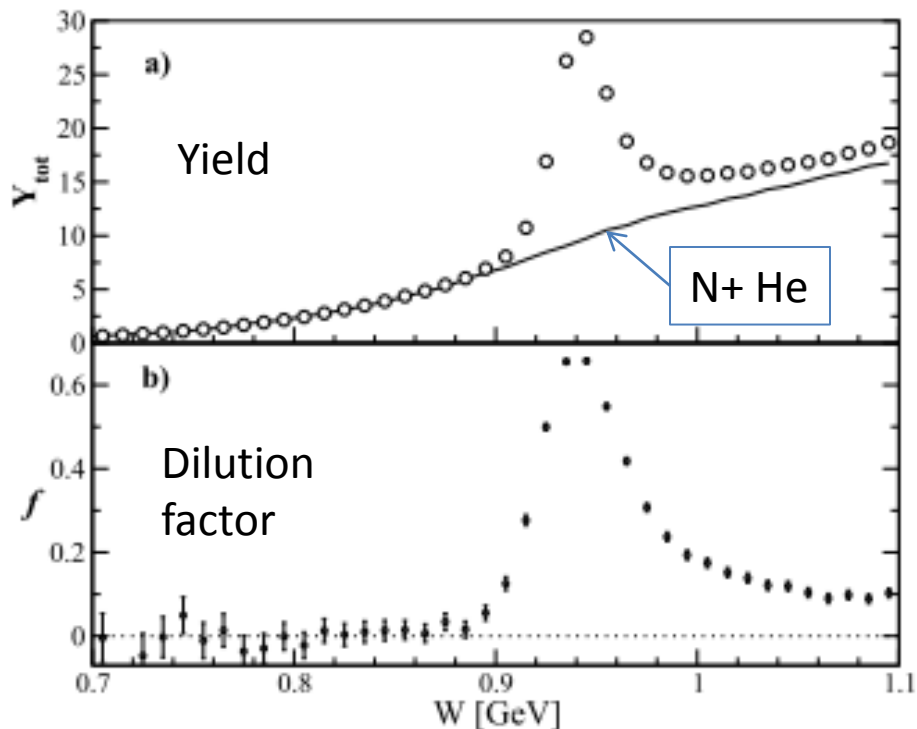
Black points are TOP target

Red points are BOTTOM target

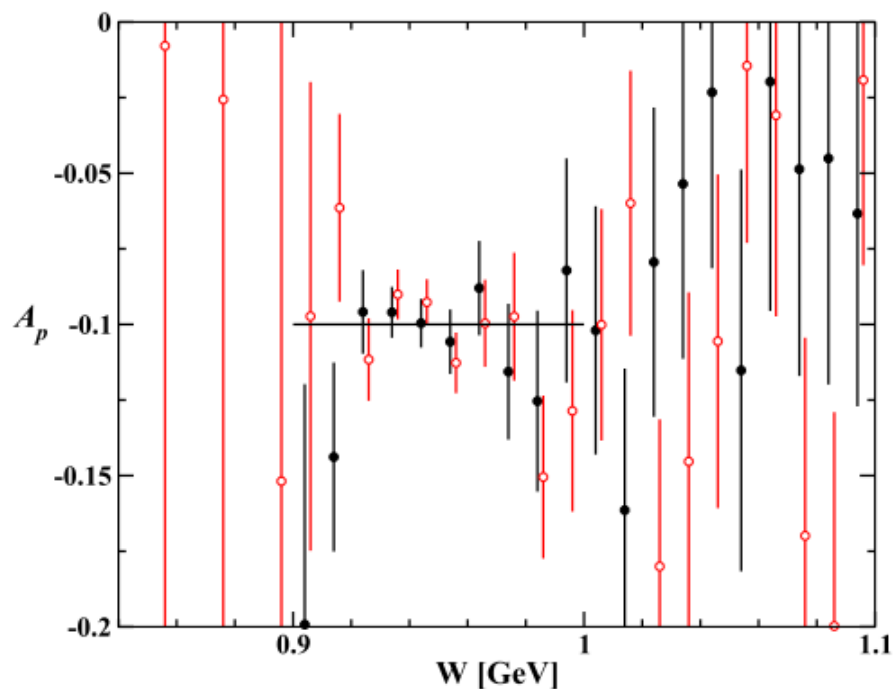
Hall C experiment

Detected elastic electrons in HMS at $Q^2 = 1.5 \text{ GeV}^2$

Yield and dilution factor



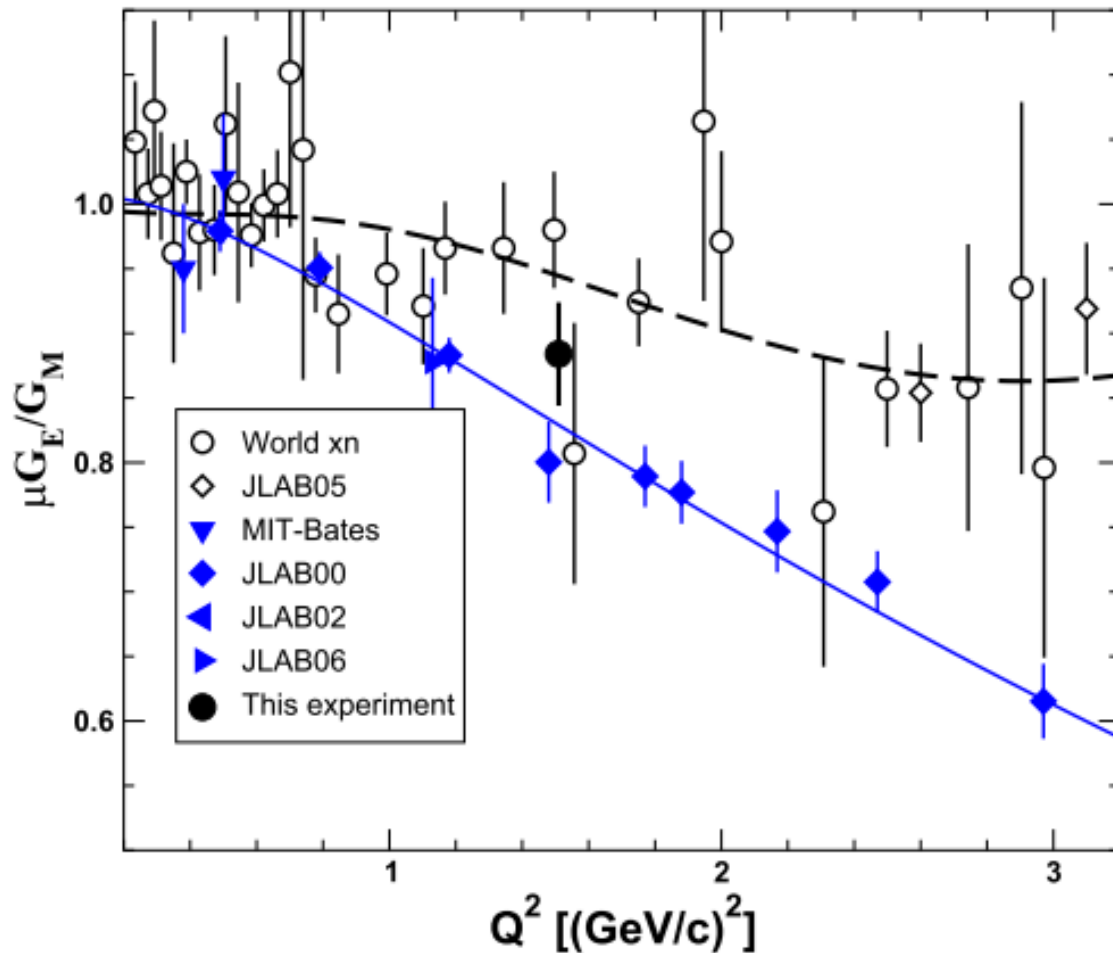
Physics Asymmetry



Black points are TOP target

Red points are BOTTOM target

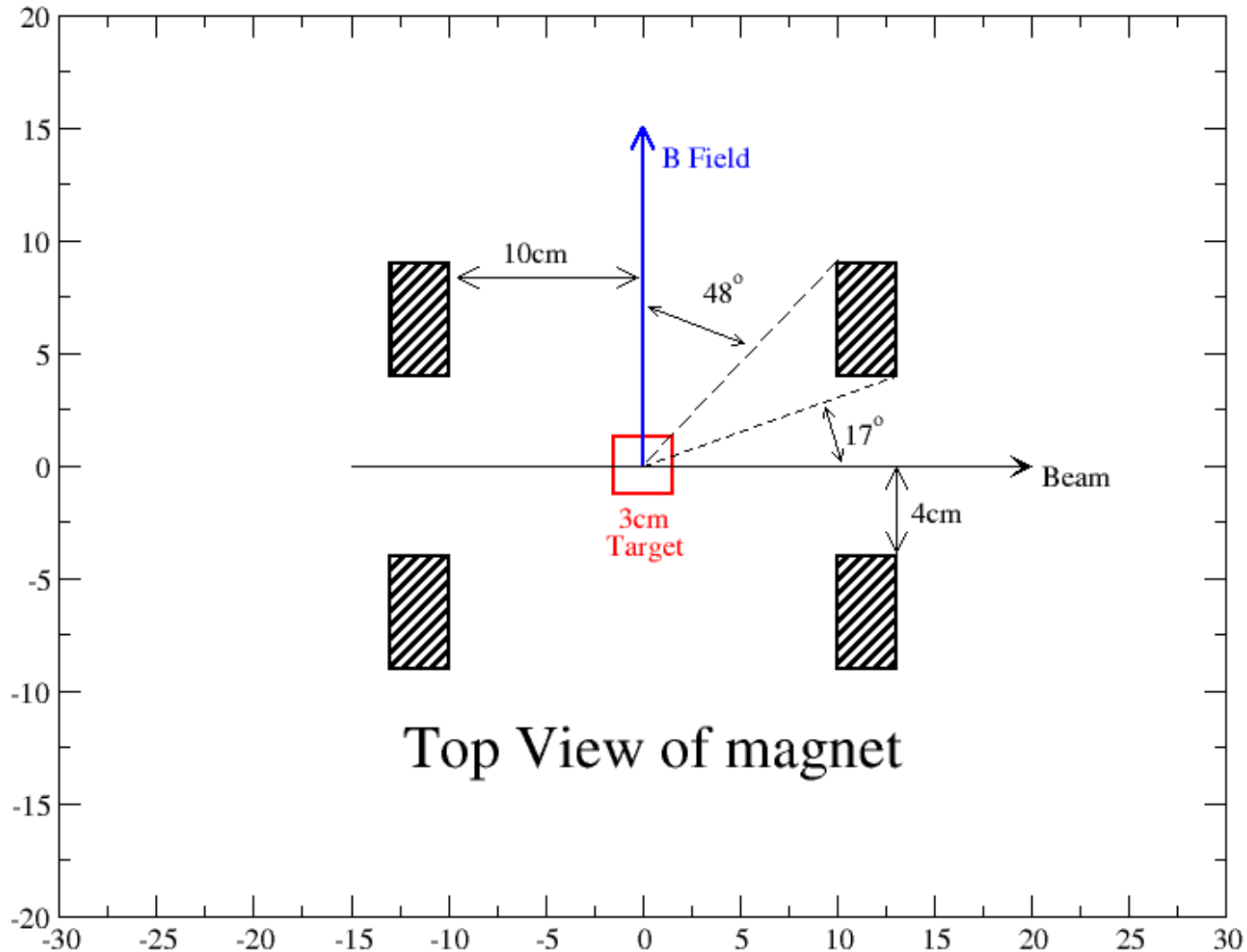
Hall C experiment



Error bar too large. Not a conclusive measurement

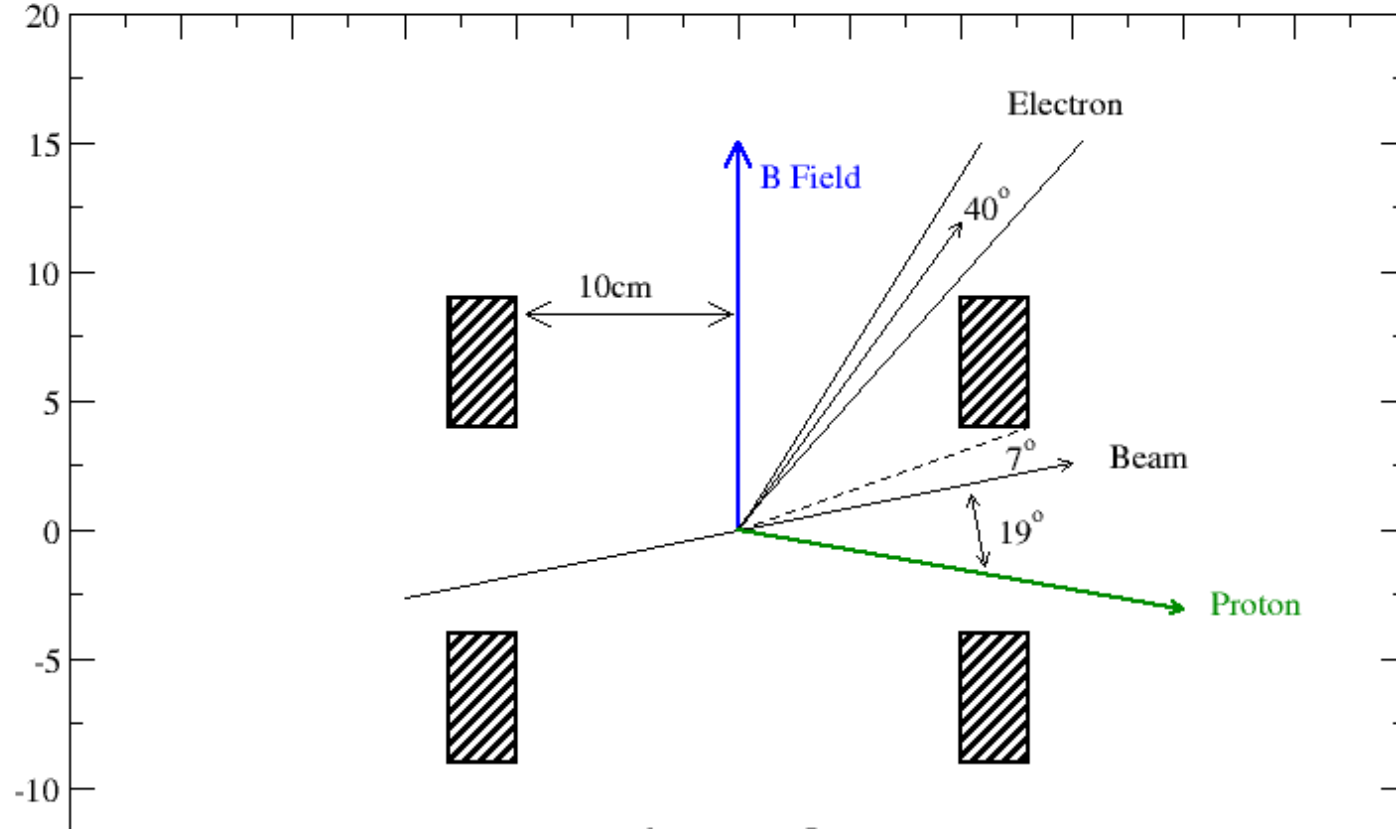
Limitations of target

Target field oriented 90° to beam direction



Layout of Kinematics

Rotate target until field at 80° to the beam direction



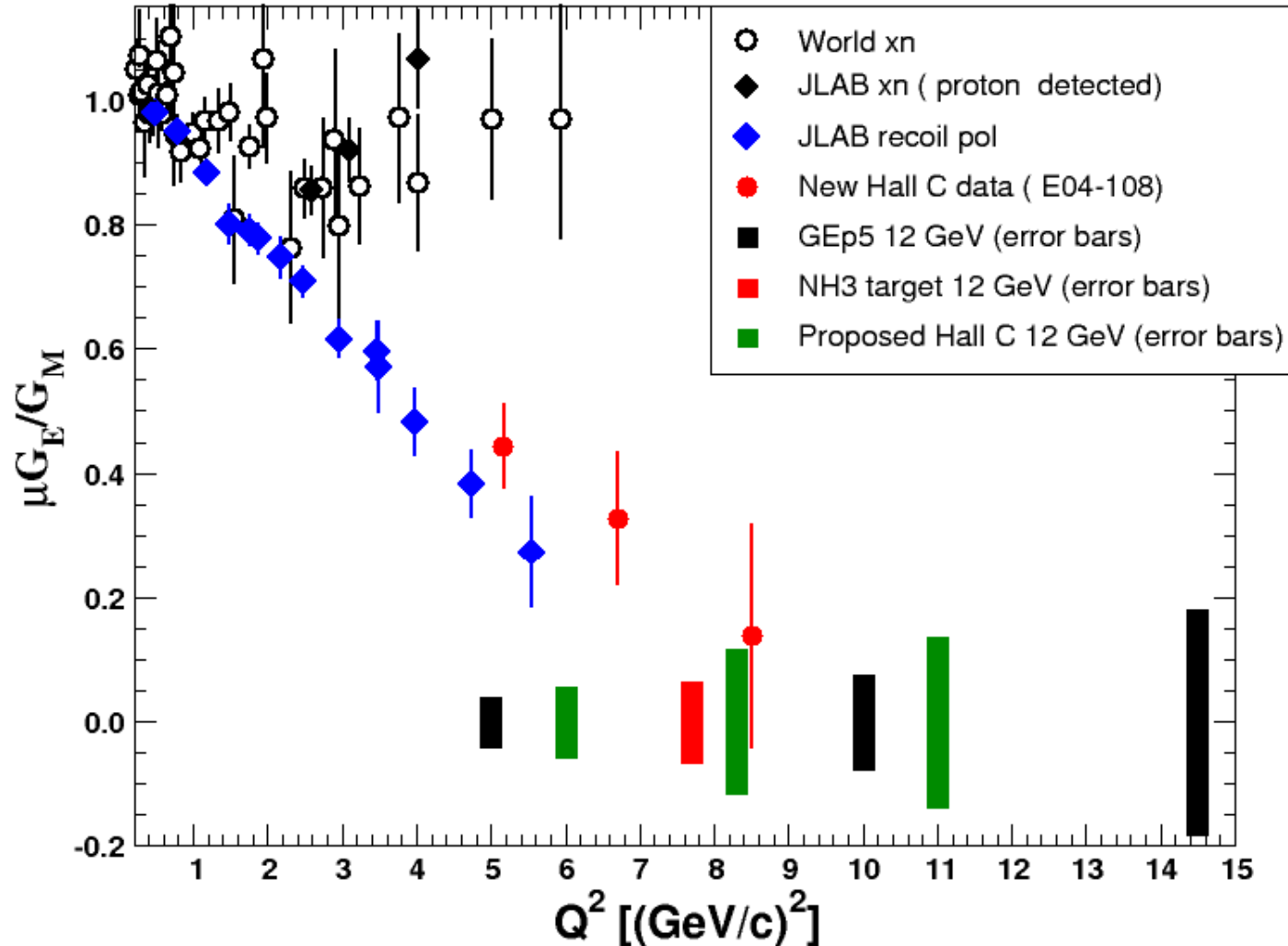
E_{beam} (GeV)	Q^2	θ_e (deg)	P_e (GeV)	Θ_p (deg)	P_p (GeV)
6.6	7.7	40	2.5	19.0	4.95

Detector setup

- Electron detector
 - BigCal at 3.8m distance
 - Blocks arrange as for Gep5 in 0.8m by 3m
 - Cover 170msr acceptance
 - Use GEMs as in Gep5
- Proton Detector
 - Use HCAL as planned for SBS experiments
 - Cover 40 msr acceptance
 - Use GEMs for angle determination
- Identify elastic events by angular correlation with additional cut on energy/angle correlation.

Expected error bar

Assume $P_B = 85\%$ $P_T = 70\%$ and $f = 80\%$ for 30 days with $I = 85\text{nA}$



Conclusions

- Only exploratory estimate of rates and possible setup
- Have experience with BigCal set at 3.4m for the SANE experiment
- Need a detailed Monte Carlo
- Previous proposal PR04-111 is excellent starting point for new proposal
- $\Delta(\mu G_E/G_M) = 0.05$ at $Q^2 = 7.7 \text{ GeV}^2$
- Definitive measurement with different technique
- Interest from

D. Day, N. Kalantarians, X. Zheng *University of Virginia*

M. Kohl, A. Liyanage *Hampton University*

Charles Perdrisat *College of William & Mary*

Vina Punjabi *Norfolk State University*

Ed Brash *Christopher Newport University*

Backup slides

