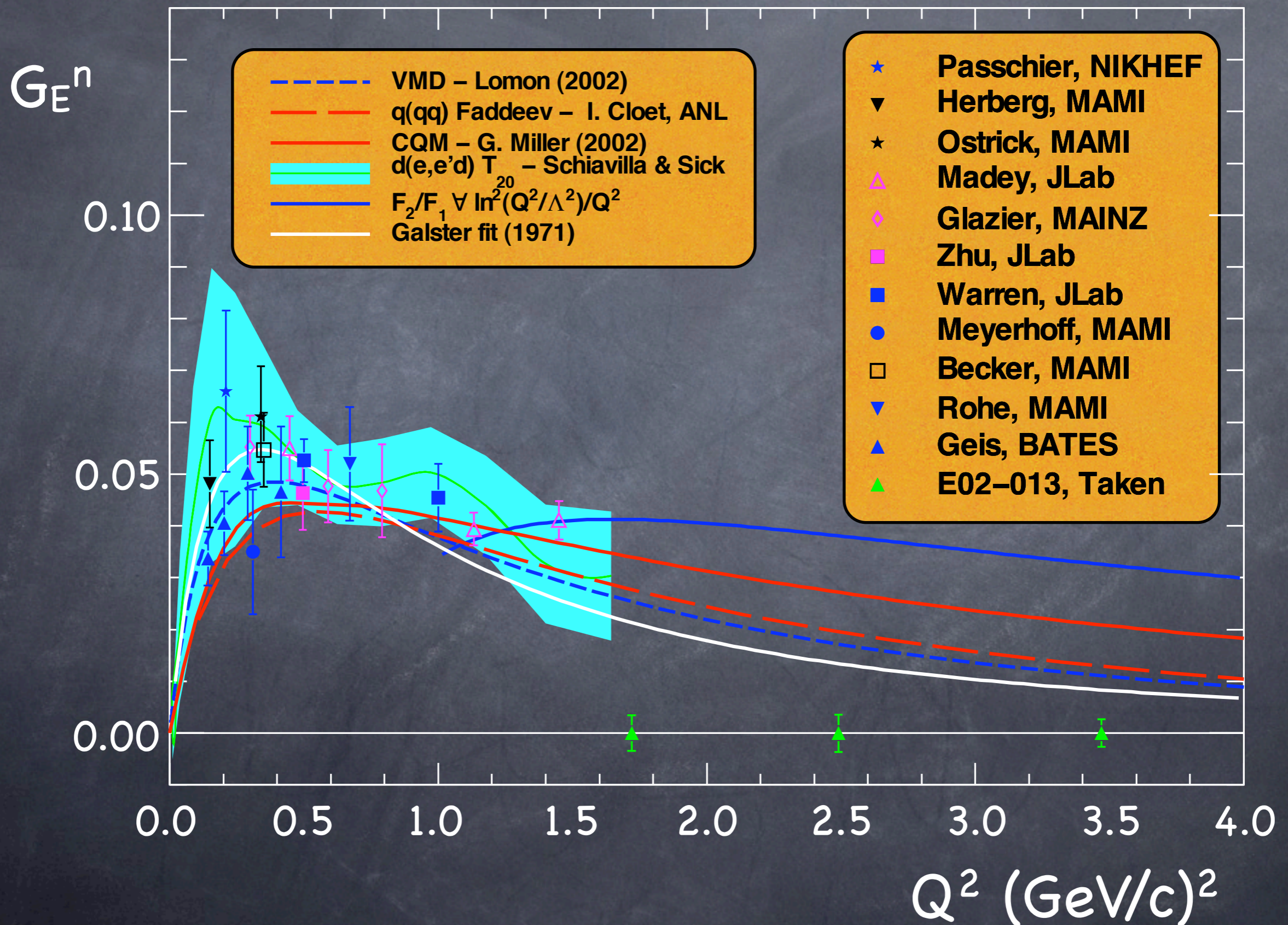


The ${}^3\text{He}(e,e'n)$ Channel in A_y and G_E^n Measurements

Elena Long

Joint Division of Nuclear Physics and Physical
Society of Japan Meeting
October 14th, 2009

G_E^n : World Data



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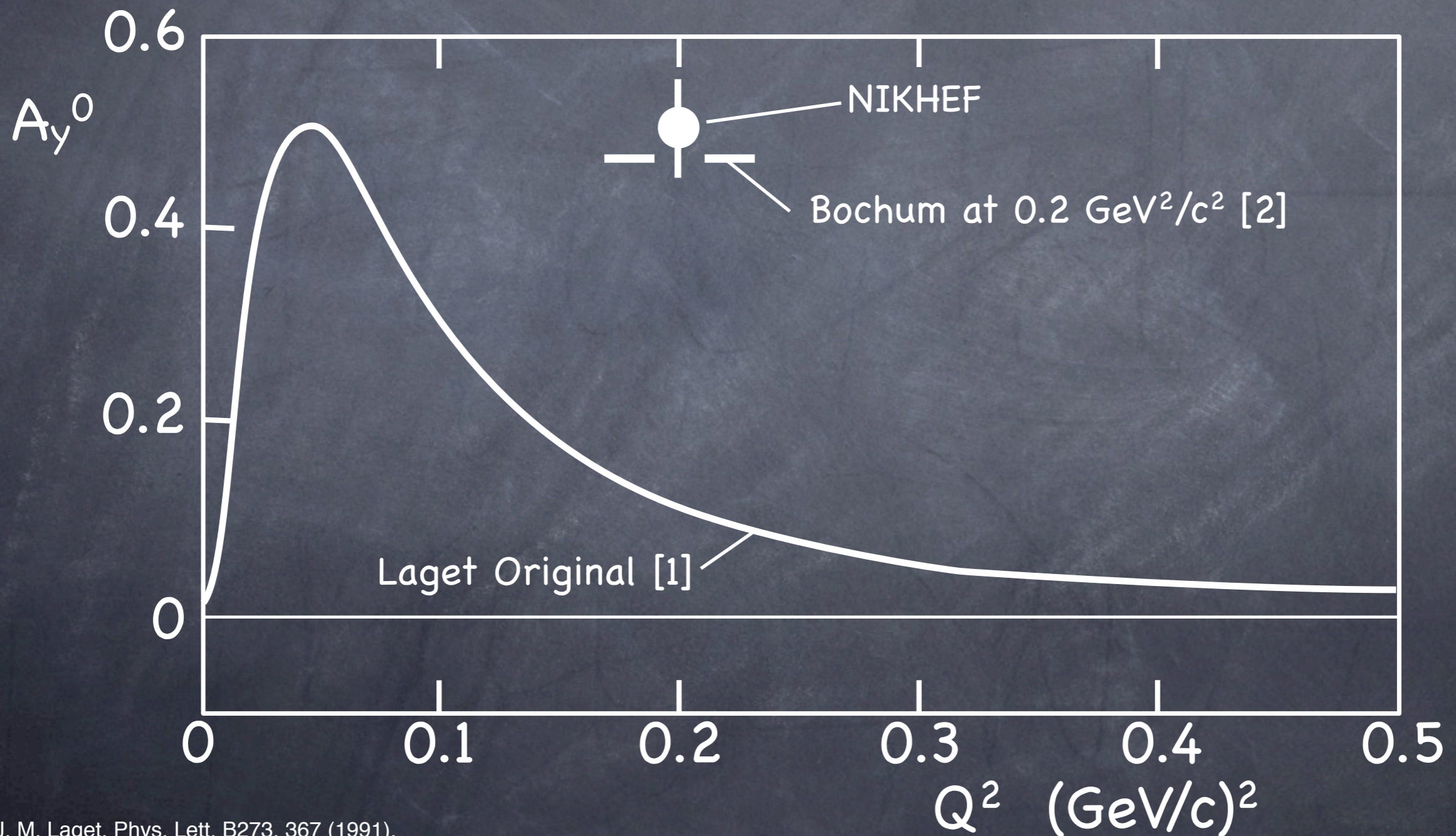
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- Previous experiment at NIKHEF measured A_y at 0.2 $[\text{GeV}/c]^2$
- Faddeev calculations by Bochum group correctly predicted FSI result where other groups expected a much lower value

Need to make sure that the Nagorny plots are ok to use

$$A_y: {}^3\text{He}^\uparrow(e, e'n)$$



[1] J. M. Laget, Phys. Lett. B273, 367 (1991).

[2] W. Gloeckle, H. Witala, D. Huber, H. Kamada, and J. Golak, Phys. Rept. 274, 107 (1996).

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- At high Q^2 , any non-zero result is indicative of effects beyond impulse approximation

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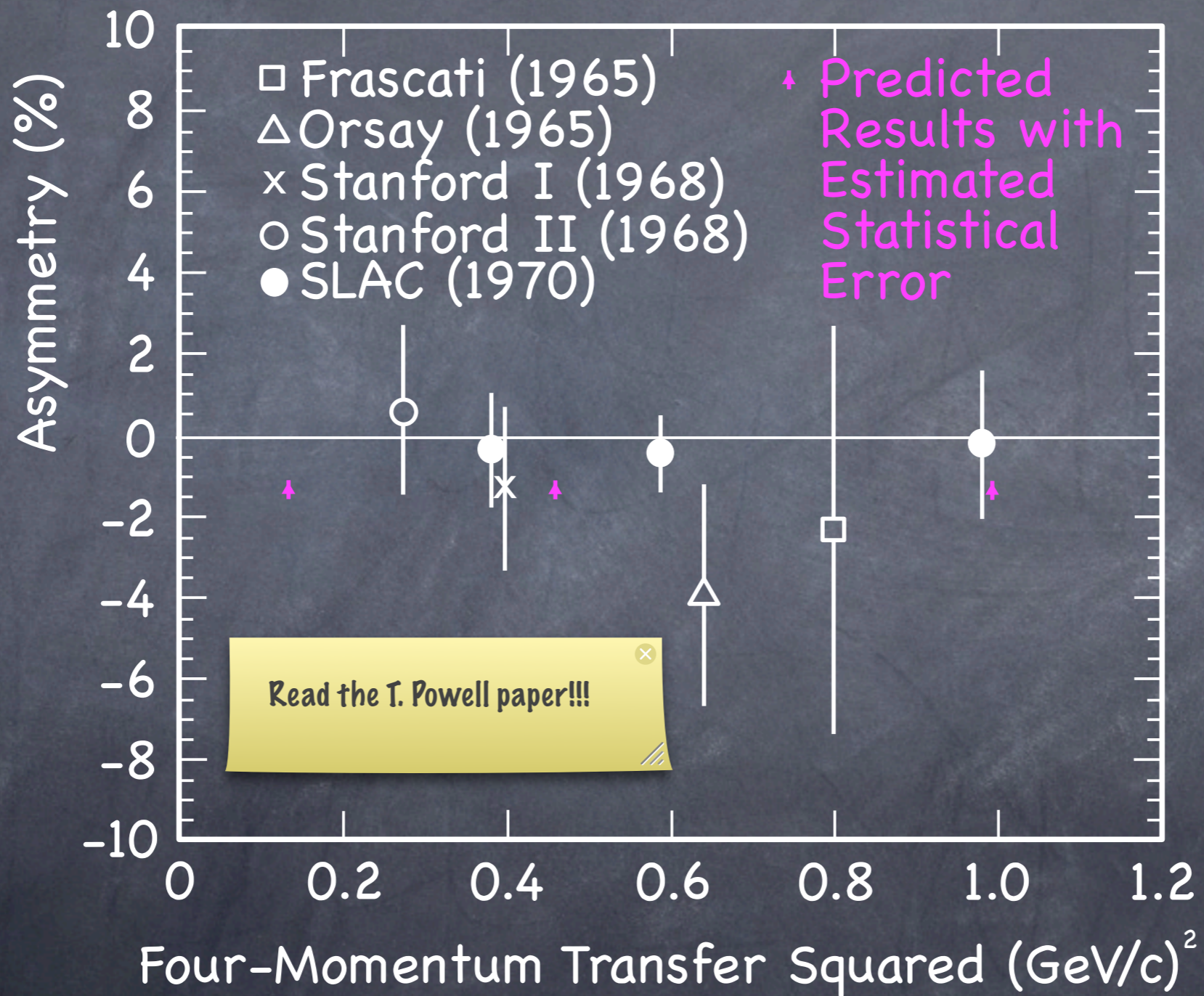
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- As more precise data is taken, multiple photon exchange cannot be ignored
- A precise, non-zero measurement of A_y will provide new experimental constraints on GPD models and form factor extractions

$A_y: {}^3\text{He}^\uparrow(e,e')$



T. Powell *et al.*, PRL 24, 753 (1970)

T. Averett, J.P. Chen, X. Jiang, *et al.*, E05-015 Jefferson Lab Proposal,
 URL: http://www.jlab.org/exp_prog/proposals/05/PR05-015.pdf (2005)

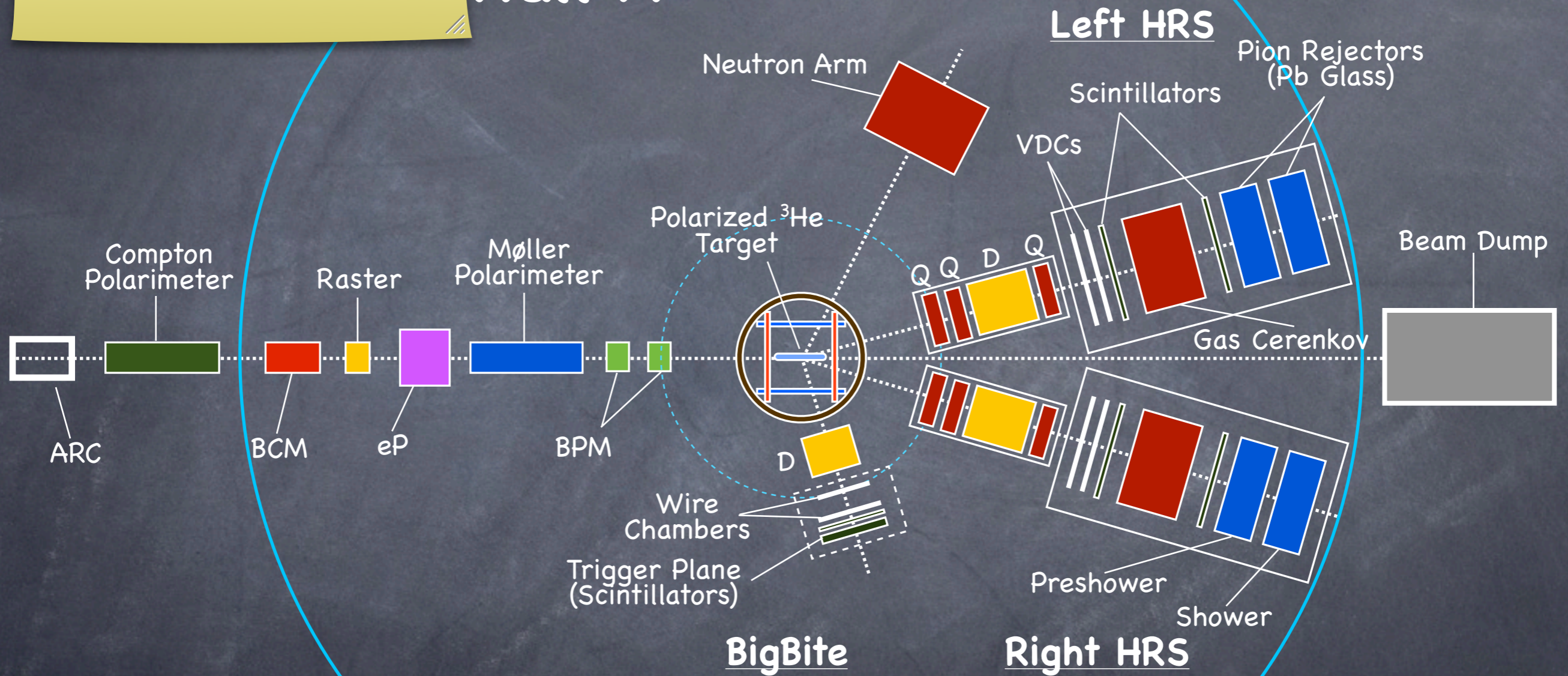
A_y : ${}^3\text{He}^\uparrow(e,e'n)$ and ${}^3\text{He}^\uparrow(e,e')$

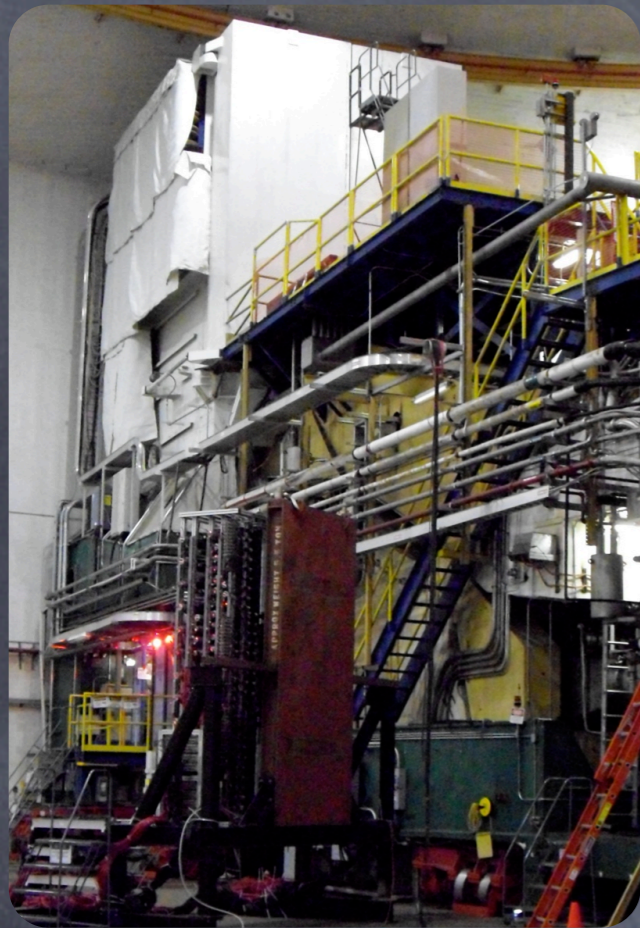
- These experiments, E08-005 ($e,e'n$) and E05-015 (e,e'), ran from April 26th through May 10th in Jefferson Lab's Hall A
- The kinematics taken were:

E_0 [GeV]	E' [GeV]	θ_{lab} [°]	Q^2 [GeV/c] ²	$ q $ [GeV/c]	θ_q [°]
1.25	1.22	17	0.13	0.359	71
2.43	2.18	17	0.46	0.681	62
3.61	3.09	17	0.98	0.988	54

q long. ${}^3\text{He}(e, e') \rightarrow G M n$
 q trans. ${}^3\text{He}(e, e' n) \rightarrow G E n$
 low p-miss ${}^3\text{He}(e, e' p) \rightarrow G E p \ \& \ G M p$
 $\rightarrow G E p \ \& \ G M p$ for checking purposes
 A_x, A_y, A_z

Hall A

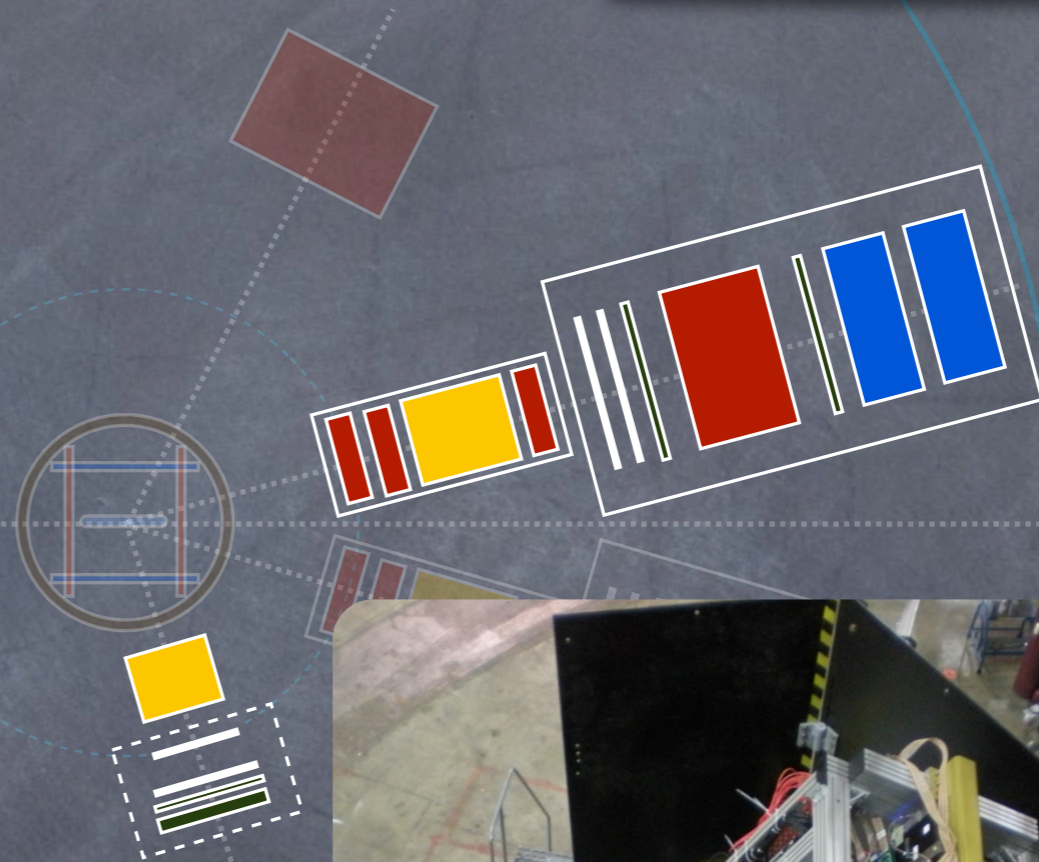




Left HRS

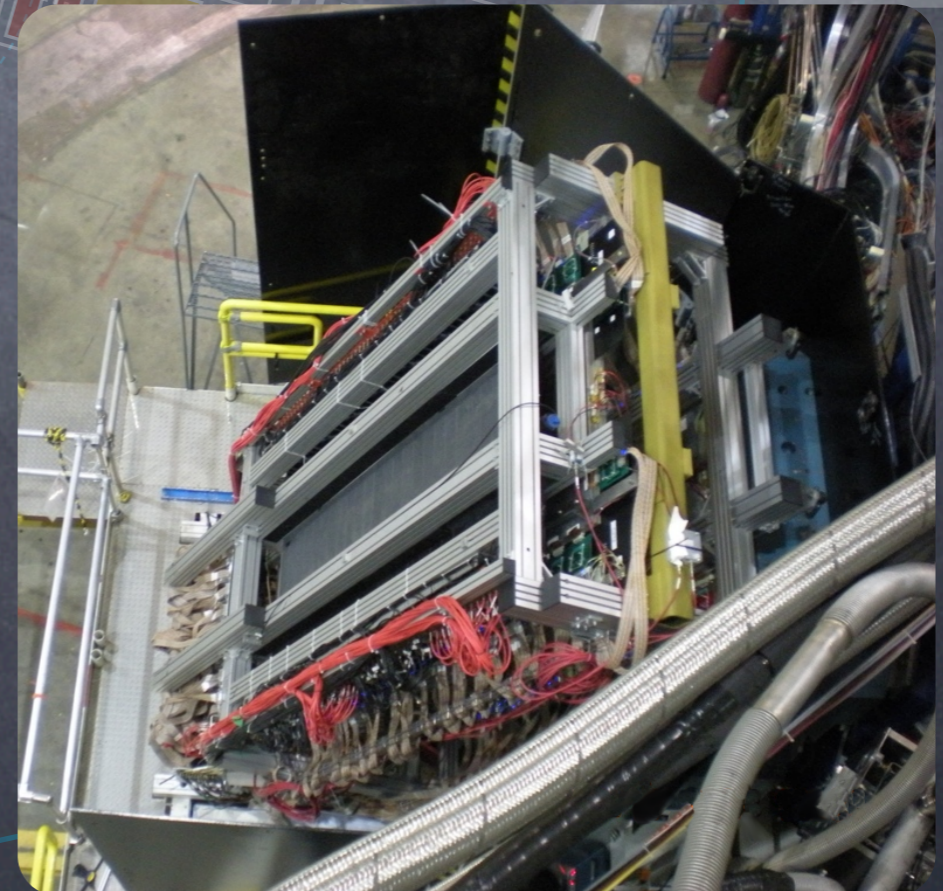
- Detects electrons from ${}^3\text{He}(e,e')$, ${}^3\text{He}(e,e'd)$, and ${}^3\text{He}(e,e'p)$

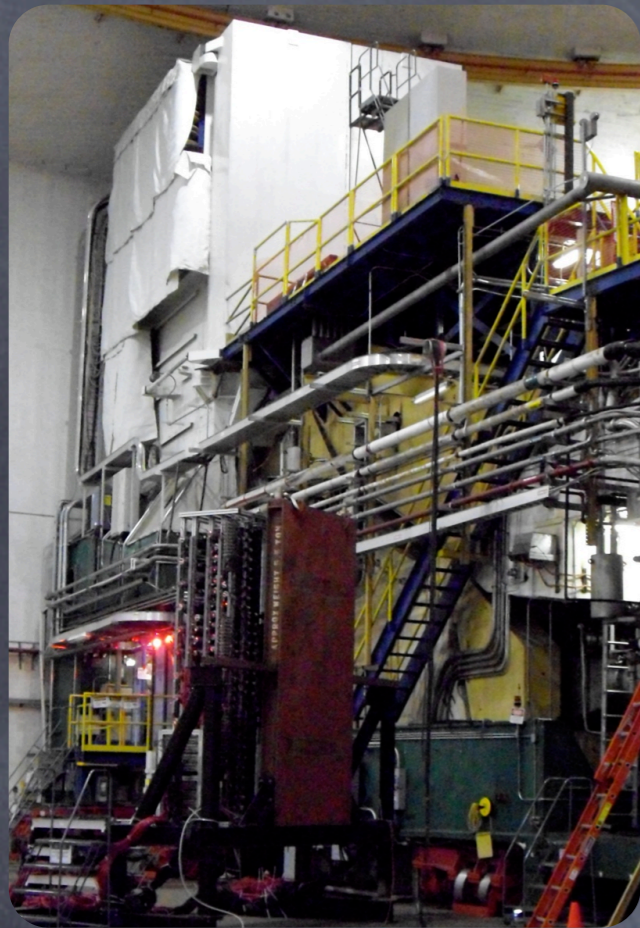
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BigBite

- Detects protons and deuterons from ${}^3\text{He}(e,e'p)$ and ${}^3\text{He}(e,e'd)$
- Along with LHRS allows $A_y, A_x,$ and A_z measurements to be made
- At low P_m , G_E^p and G_M^p are also measured (for checking purposes)





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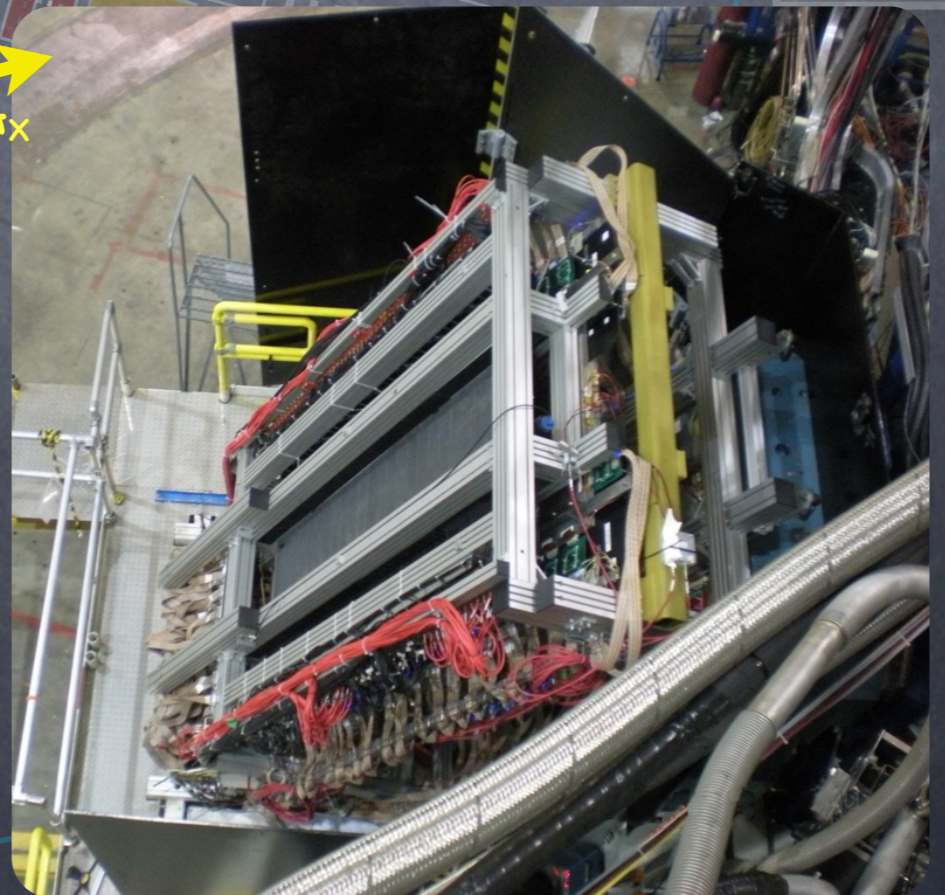
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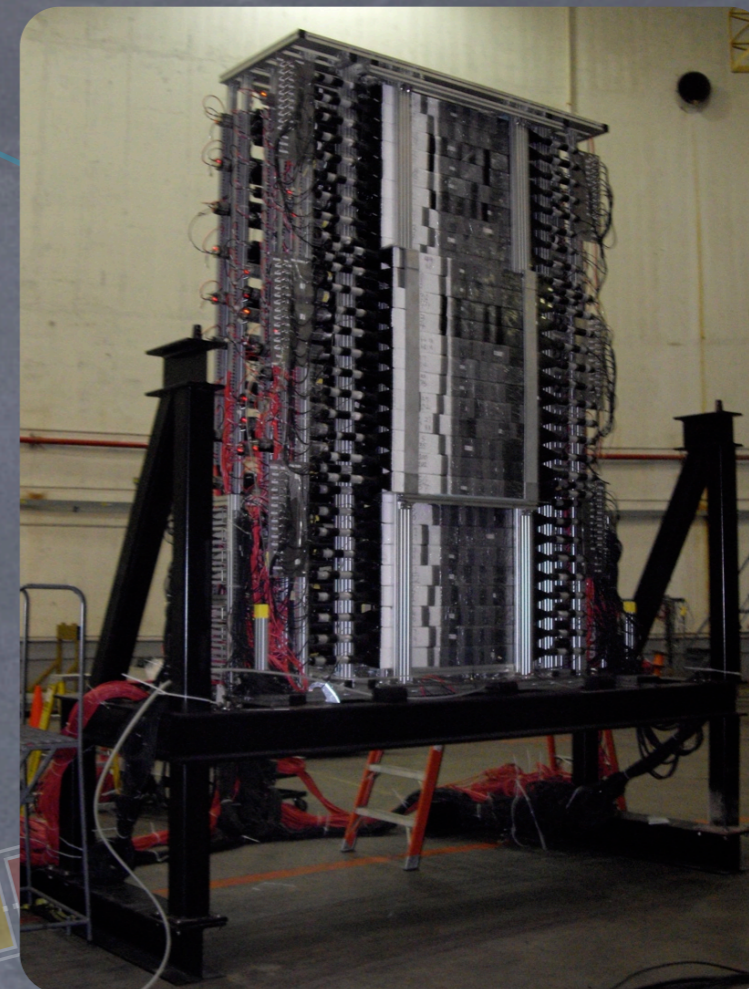
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 A_y

Hall A Neutron Detector

- Detects neutrons from ${}^3\text{He}(e,e'n)$
- Along with RHRS allows G_E^n and A_y measurements to be made



Right HRS

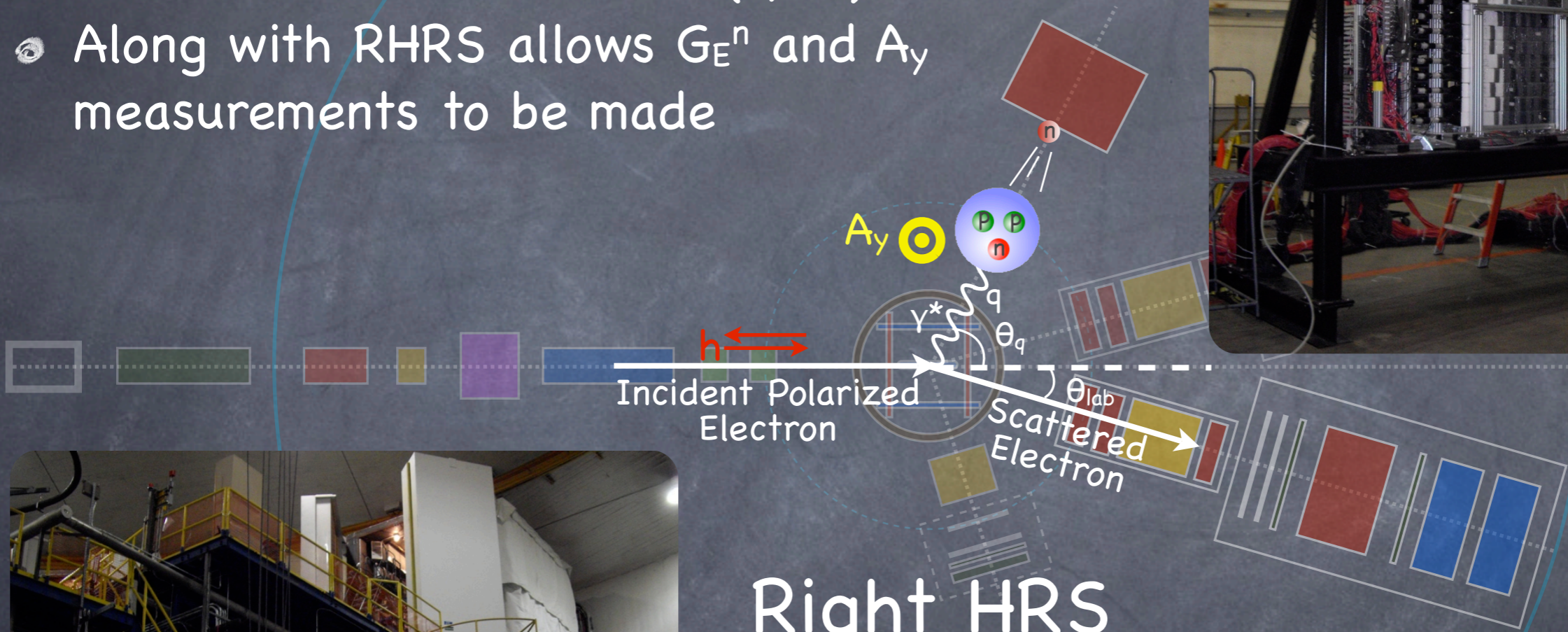
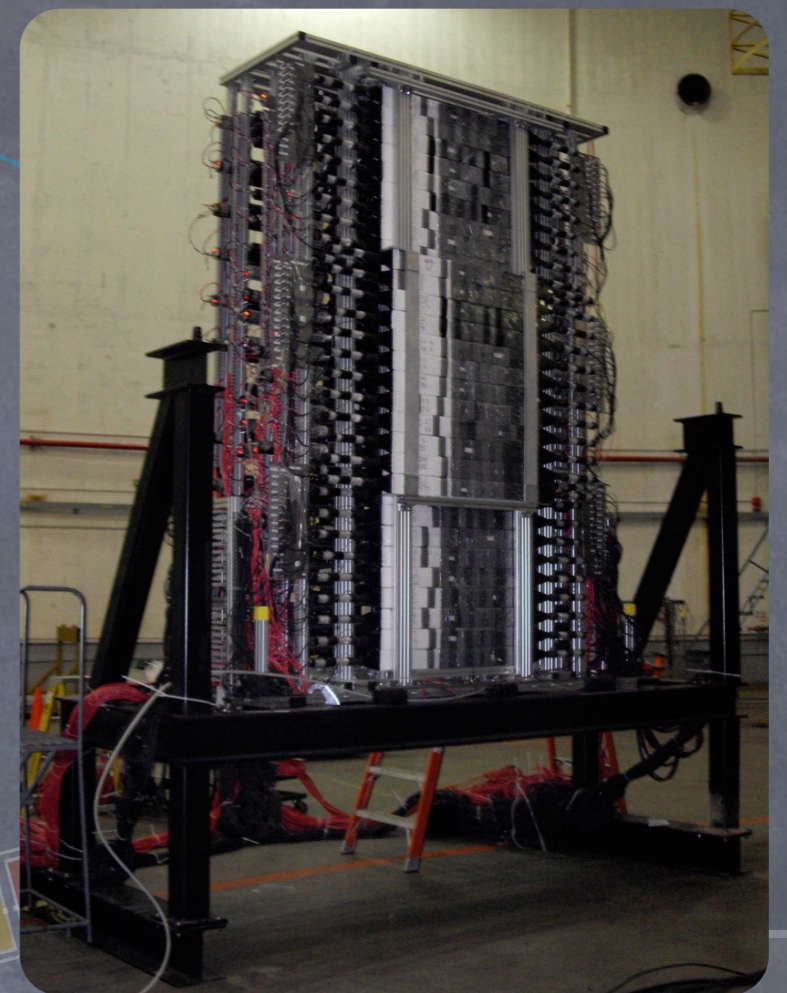
- Detects quasi-elastically scattered electrons from ${}^3\text{He}(e,e'n)$ and ${}^3\text{He}(e,e')$
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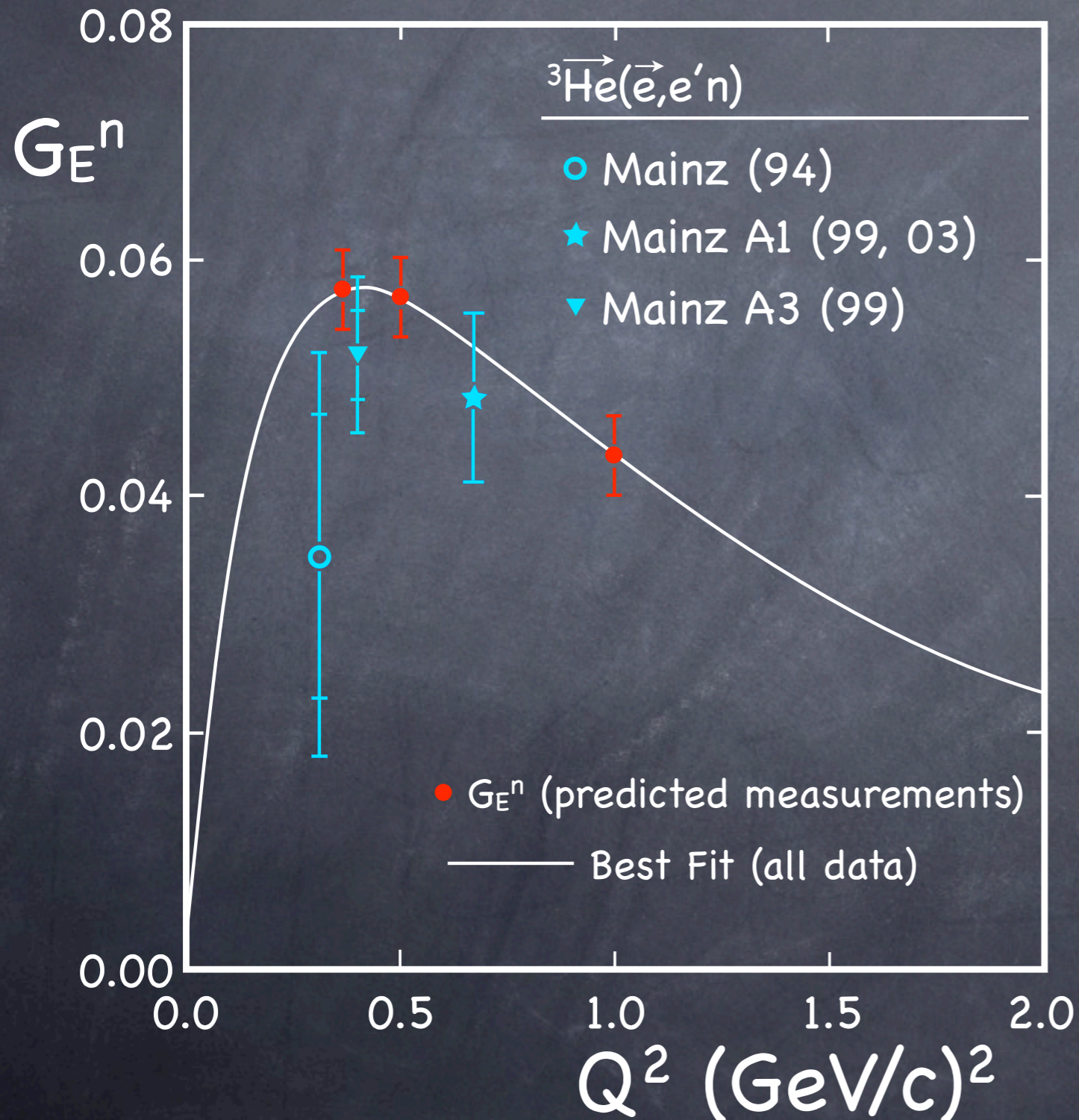
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G_E^n : Electric Form Factor of the Neutron

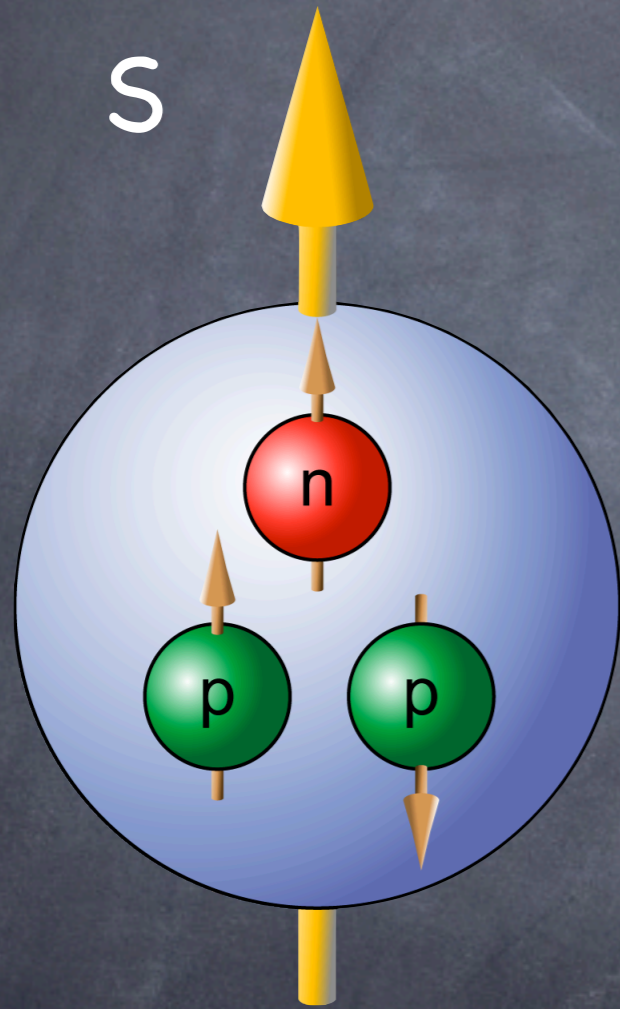


- RHRS Central Momentum is $E' = 2.175$ GeV, 2.225 GeV, and 2.250 GeV
- Acceptance of ± 0.103 GeV
- Data will cover the $0.4 - 0.5$ $(\text{GeV}/c)^2$ peak as well as 1.0 $(\text{GeV}/c)^2$

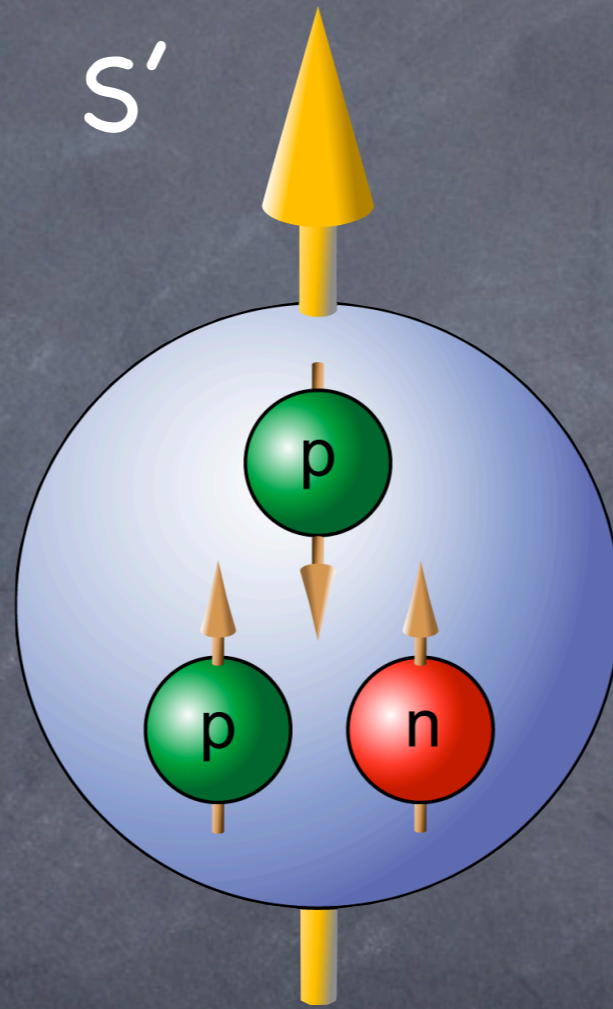
G_E^n : Electric Form Factor of the Neutron

- The data points taken will also provide a comparison between the world deuteron data as well as the world ^3He data
 - No free neutron target available
 - ^2H has a loosely bound neutron
 - ^3He has a similar magnetic moment to its neutron
- Agreement between ^2H and ^3He is expected

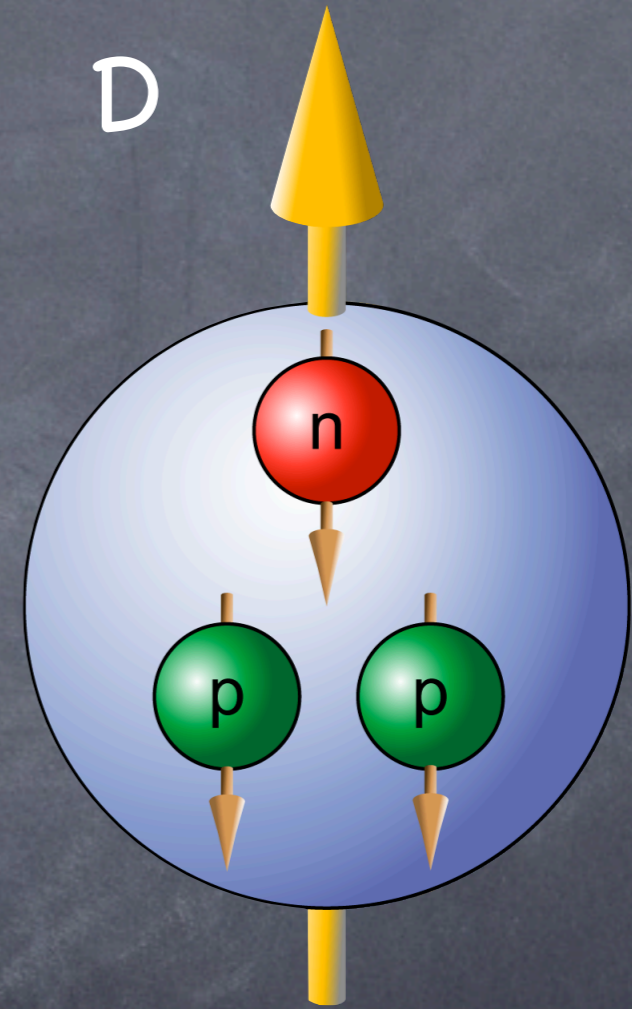
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90% Spatially
Symmetric



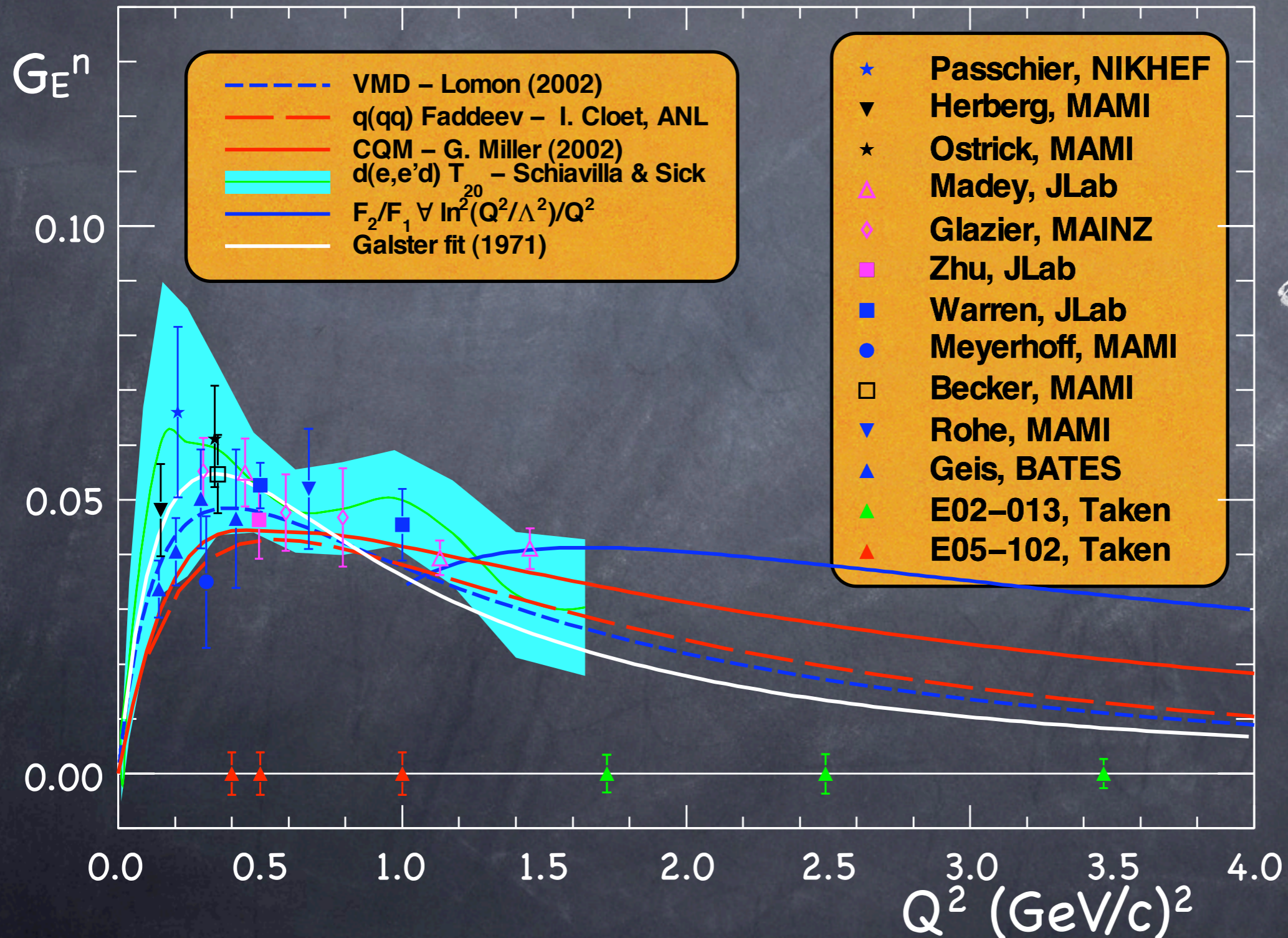
~1.5% Mixed
Symmetry
Configuration



~8.5%

Not
Observables

G_E^n : Electric Form Factor of the Neutron



Form Factor
 Extraction
 must
 account for
 non-zero A_y

Thank You

Thanks to the E05-015, E08-005, and E05-102 Collaborations

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T. Averett, College of William and Mary (E05-015, E08-05)

J. P. Chen, Thomas Jefferson National Accelerator Facility (E05-015)

S. Gilad, Massachusetts Institute of Technology (E05-102)

D. Higinbotham, Thomas Jefferson National Accelerator Facility (E05-102, E08-005)

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W. Korsch, University of Kentucky (E05-102)

B. E. Norum, University of Virginia (E05-102)

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