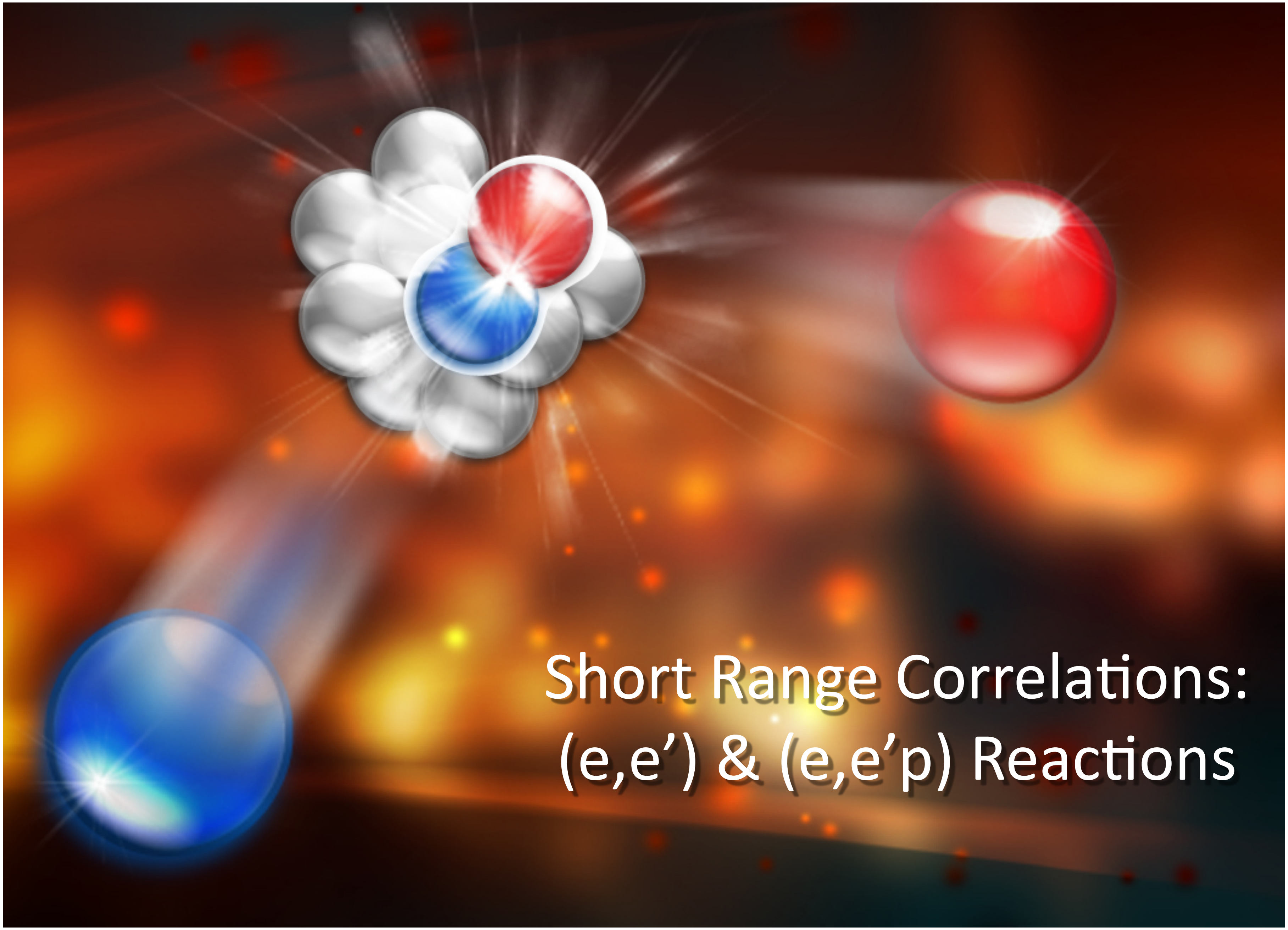


Short Range Correlations: (e,e’) & (e,e’p) Reactions

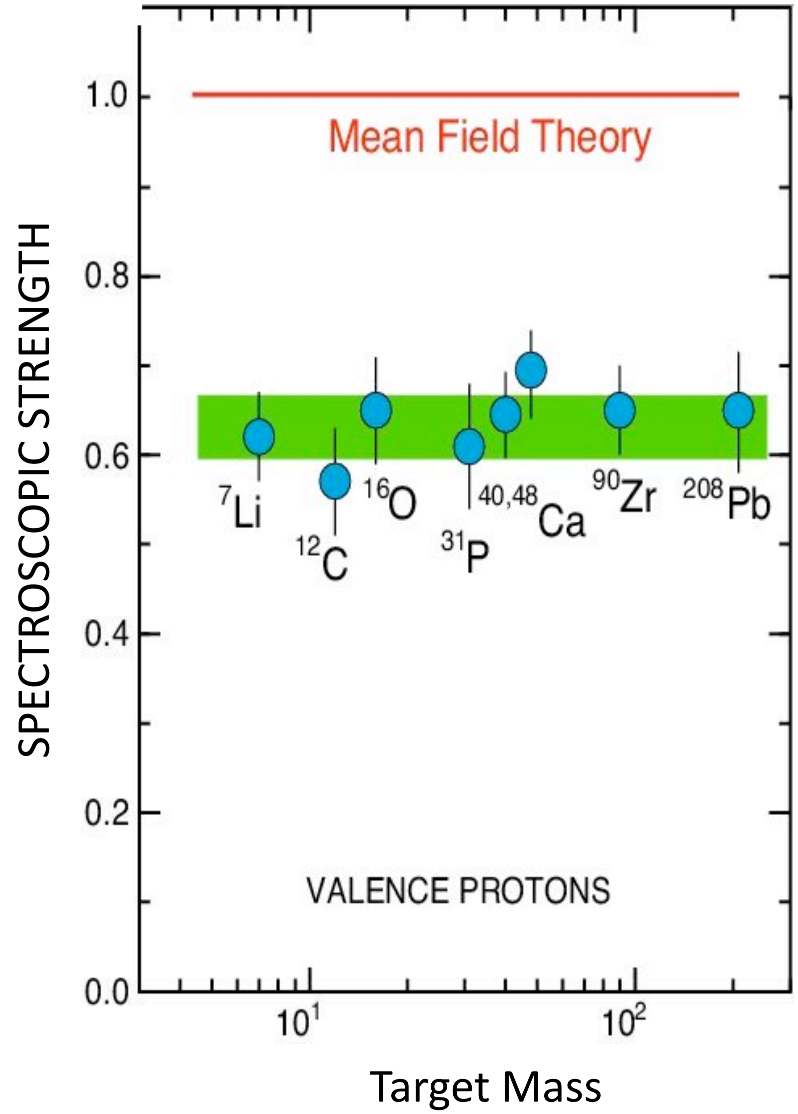
Outline of SRC Talks

- Monday Morning: History & Kinematics
- Monday Afternoon: Jefferson Lab Equipment (Tour after talk!) & Life Of An Experiment
- Tuesday Morning: Recent (e,e') &(e,e'p) Results
- Tuesday Afternoon: Recent (e,e'pN) Results
- Wednesday: Future SRC Experiments

Results from (e,e'p) Measurements

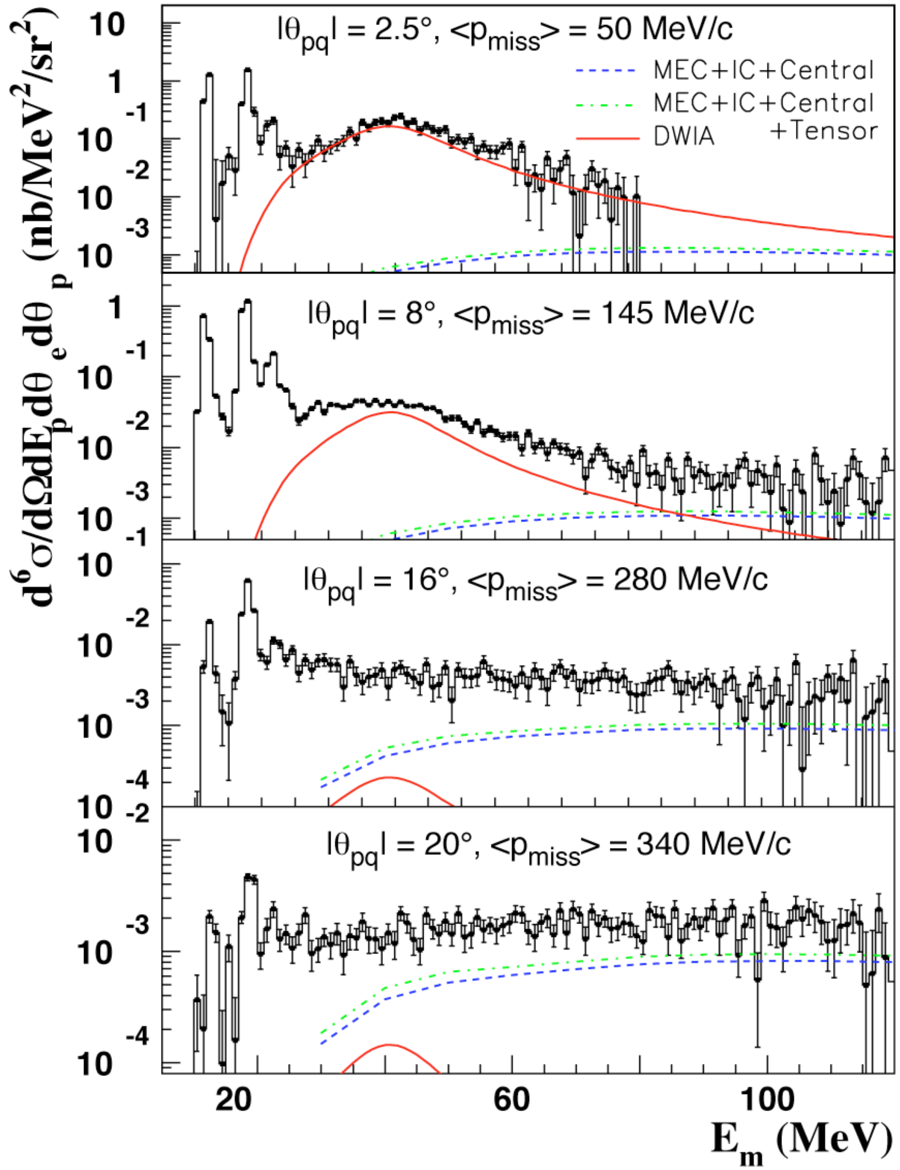
Independent-Particle Shell-Model is based upon the assumption that each nucleon moves independently in an average potential (mean field) induced by the surrounding nucleons

The (e,e'p) data for knockout of valence and deeply bound orbits in nuclei gives spectroscopic factors that are 60 – 70% of the mean field prediction.



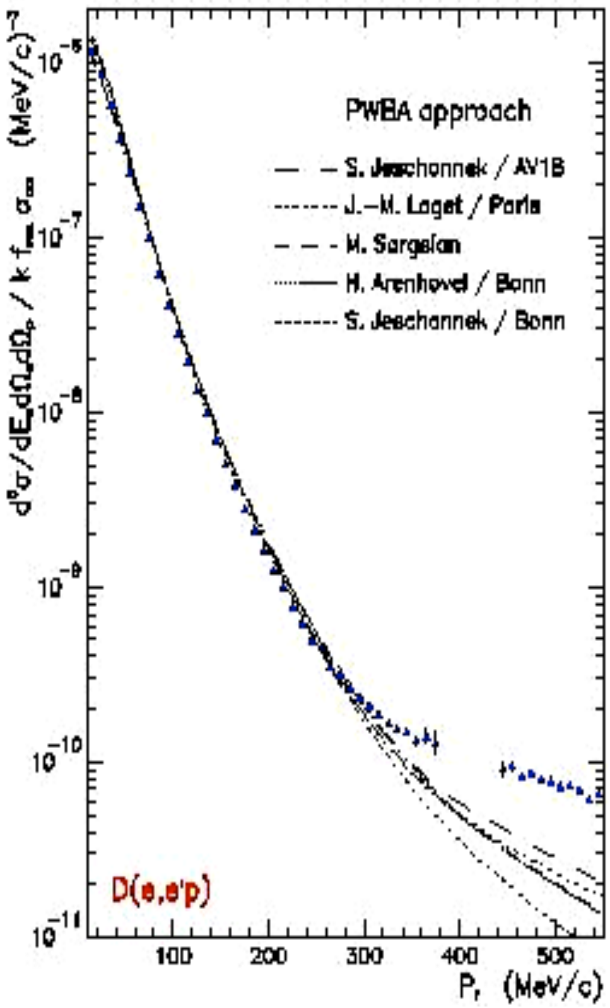
E89-003 ^{16}O(e,e'p) (Hall A)

- Cross-section data at E_m up to 120 MeV over range of p_m up to 340 MeV/c
- Broad peak at $E_m \approx 40$ MeV due to knock-out of $1s_{1/2}$-state protons
- Assuming a similar p_m-behaviour as of the valence states, a large cross-section excess is observed at larger p_m-values
- Calculations by Ryckebusch of (e,e'pp) and (e,e'pn) contributions are in *reasonable* agreement with the data

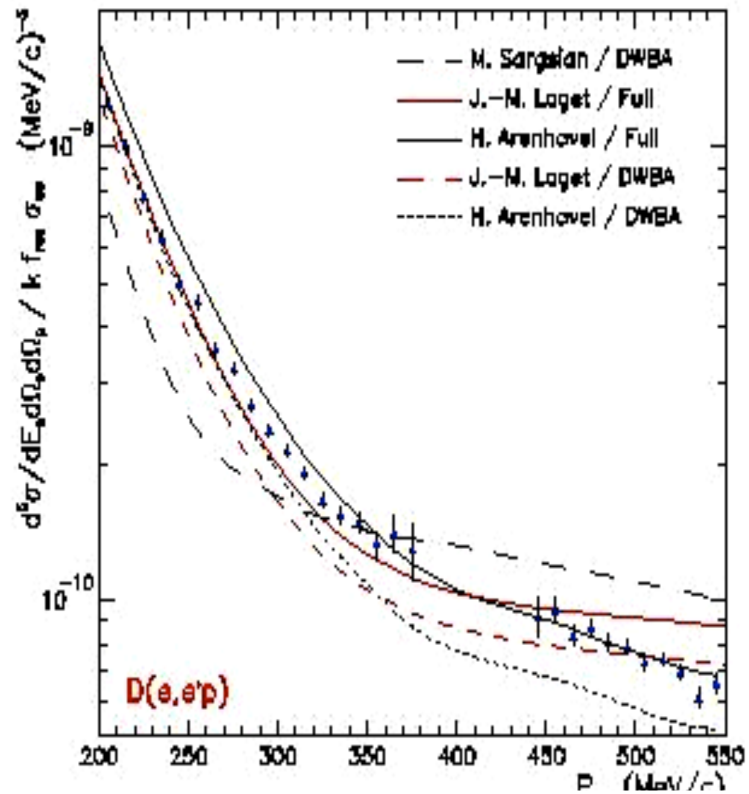


Back To Basics

^{2}H(e,e'p)n Q^2 = 0.67 GeV^2 x = 0.96



High momentum structure of ^{2}H?

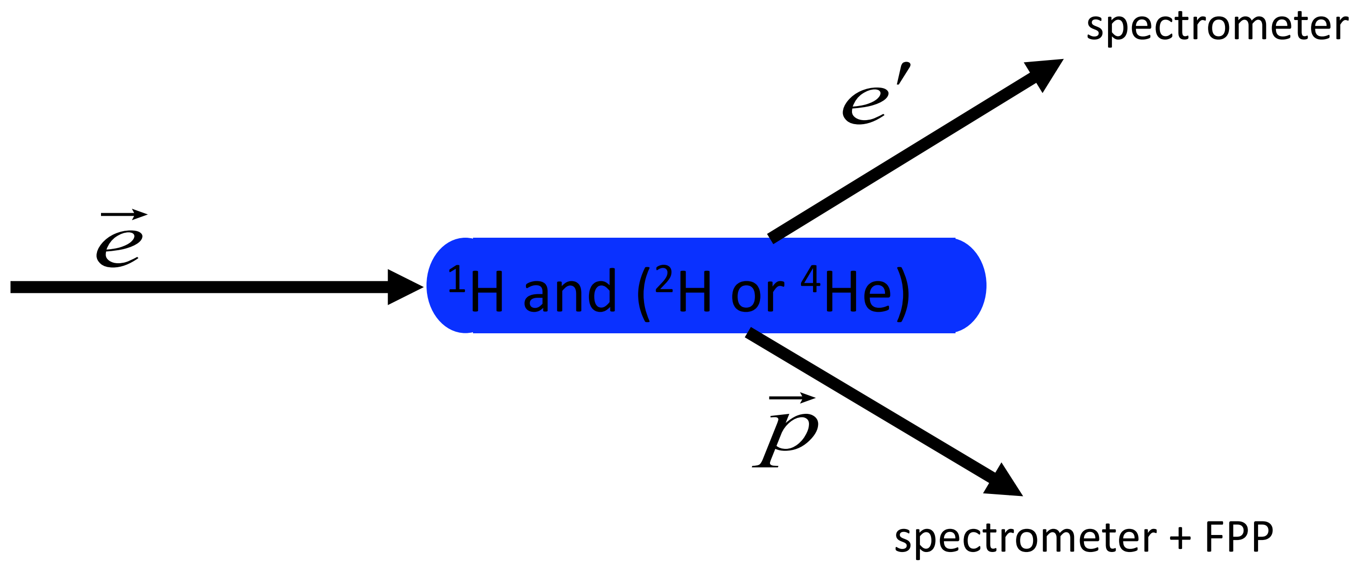


JLab Hall A

→ **Evidence for large FSI**

P.E. Ulmer *et al.*, Phys. Rev. Lett. **89**, 062301 (2002).

Polarization Transfer in Hall A



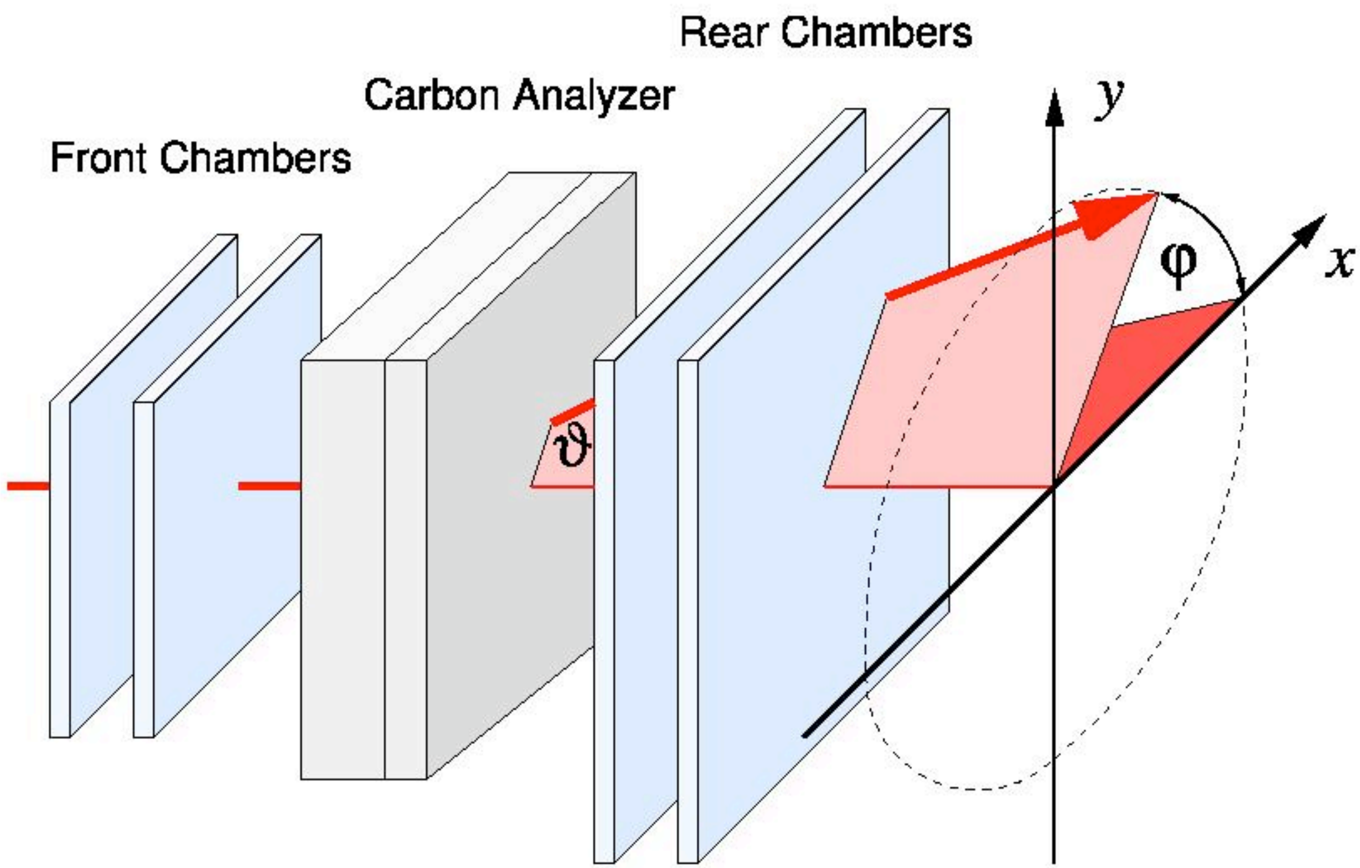
$$^2\mathrm{H}(\vec{e},e'\vec{p})n \qquad ^4\mathrm{He}(\vec{e},e'\vec{p})^3\mathrm{H}$$

$$\nwarrow\!\!\searrow \qquad \swarrow\!\!\nearrow$$

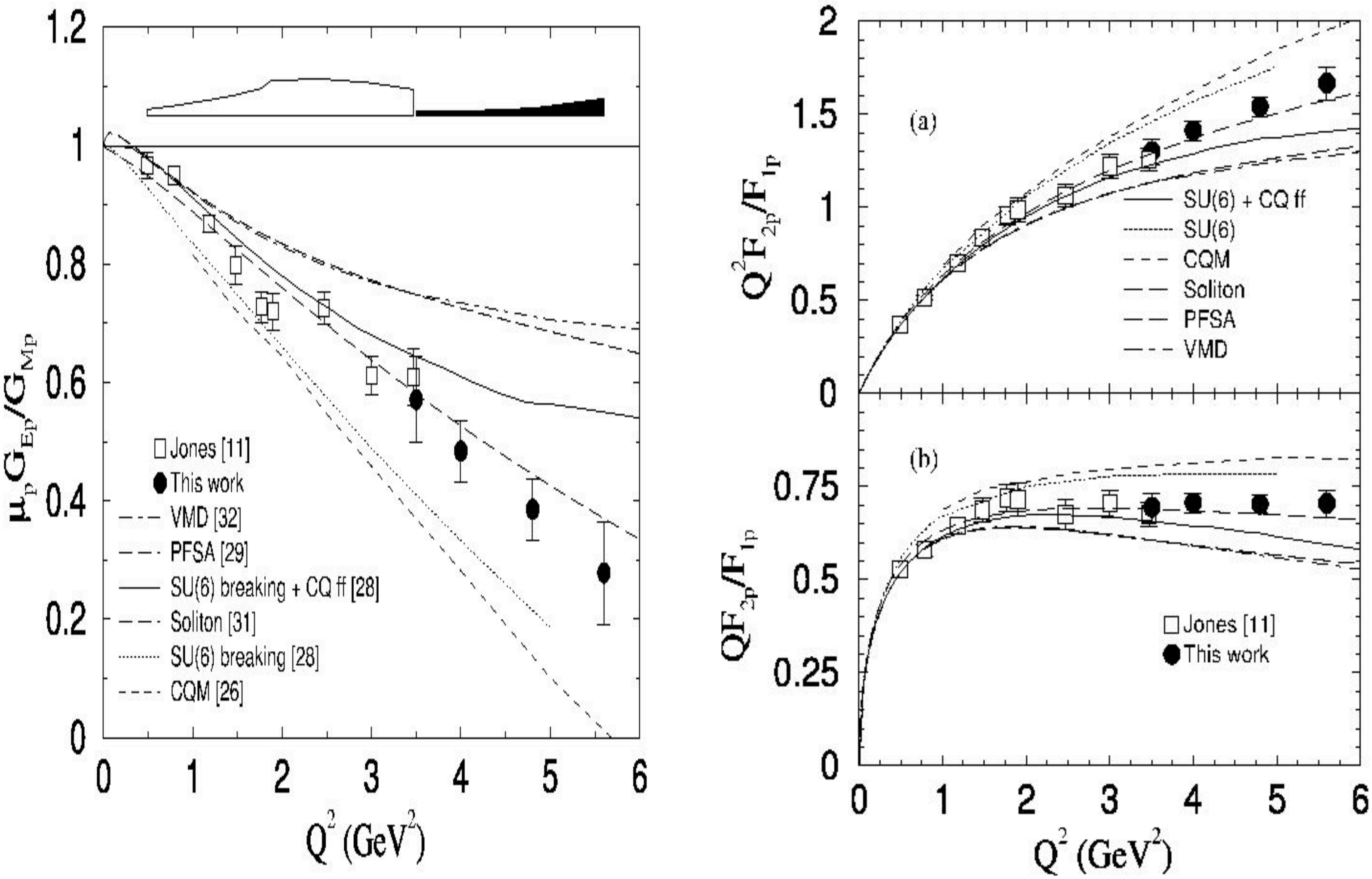
$$^1\mathrm{H}(\vec{e},e'\vec{p})$$

Jefferson Lab

Measuring the Proton Polarization: FPP

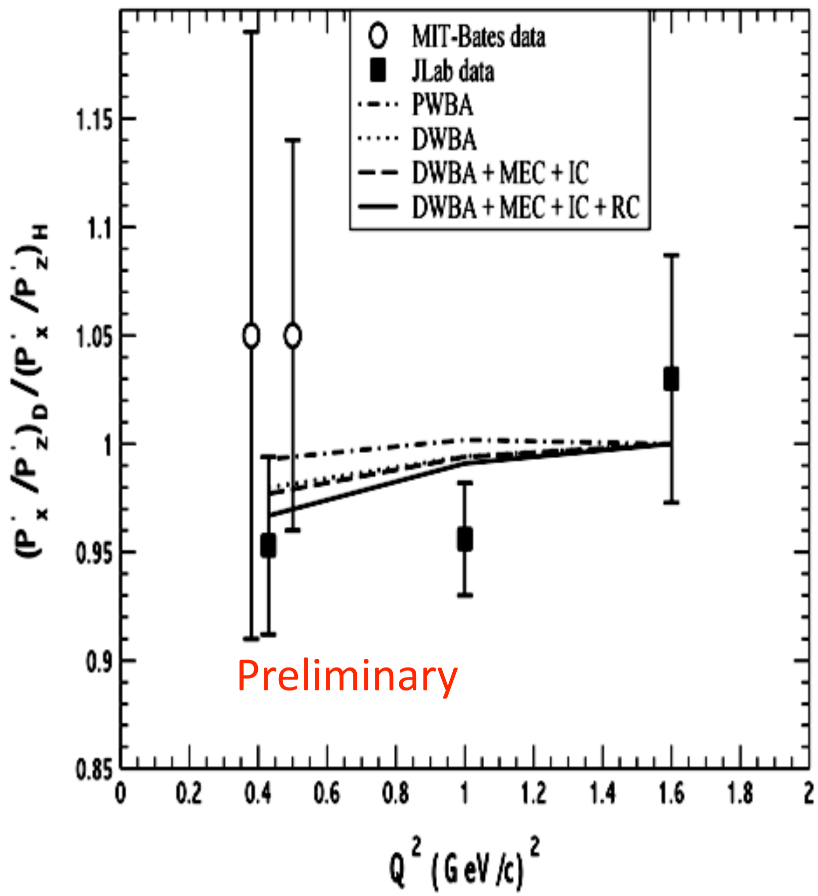


Proton Elastic Form Factors via $^1H(\vec{e},e'\vec{p})$



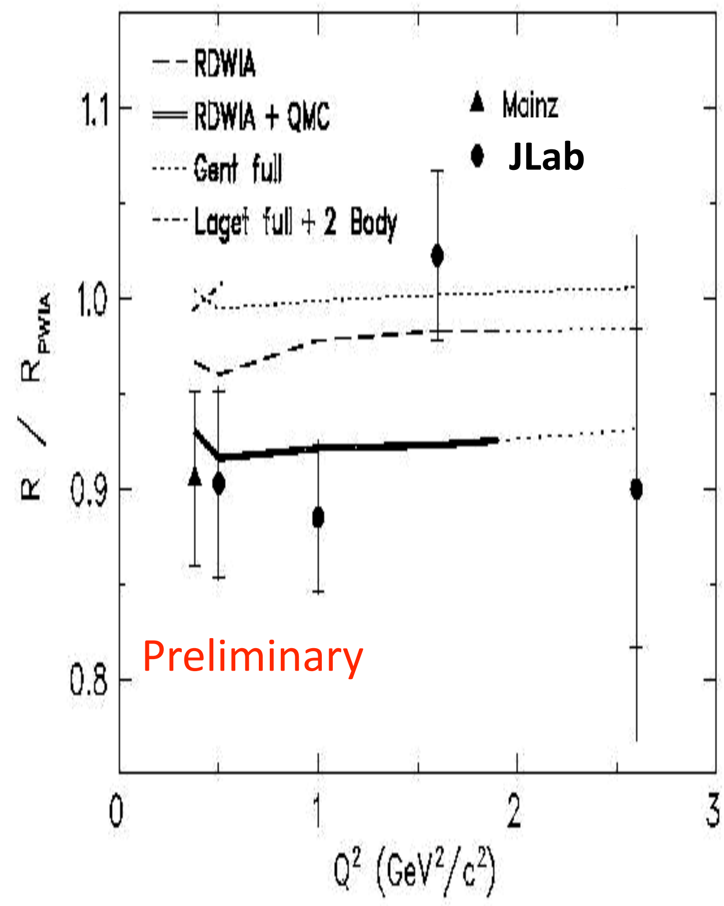
O. Gayou, *et al.*, Phys. Rev. Lett. **88**, 092301 (2002).

$^{2}\mathrm{H}(\vec{e},e'\vec{p})n$



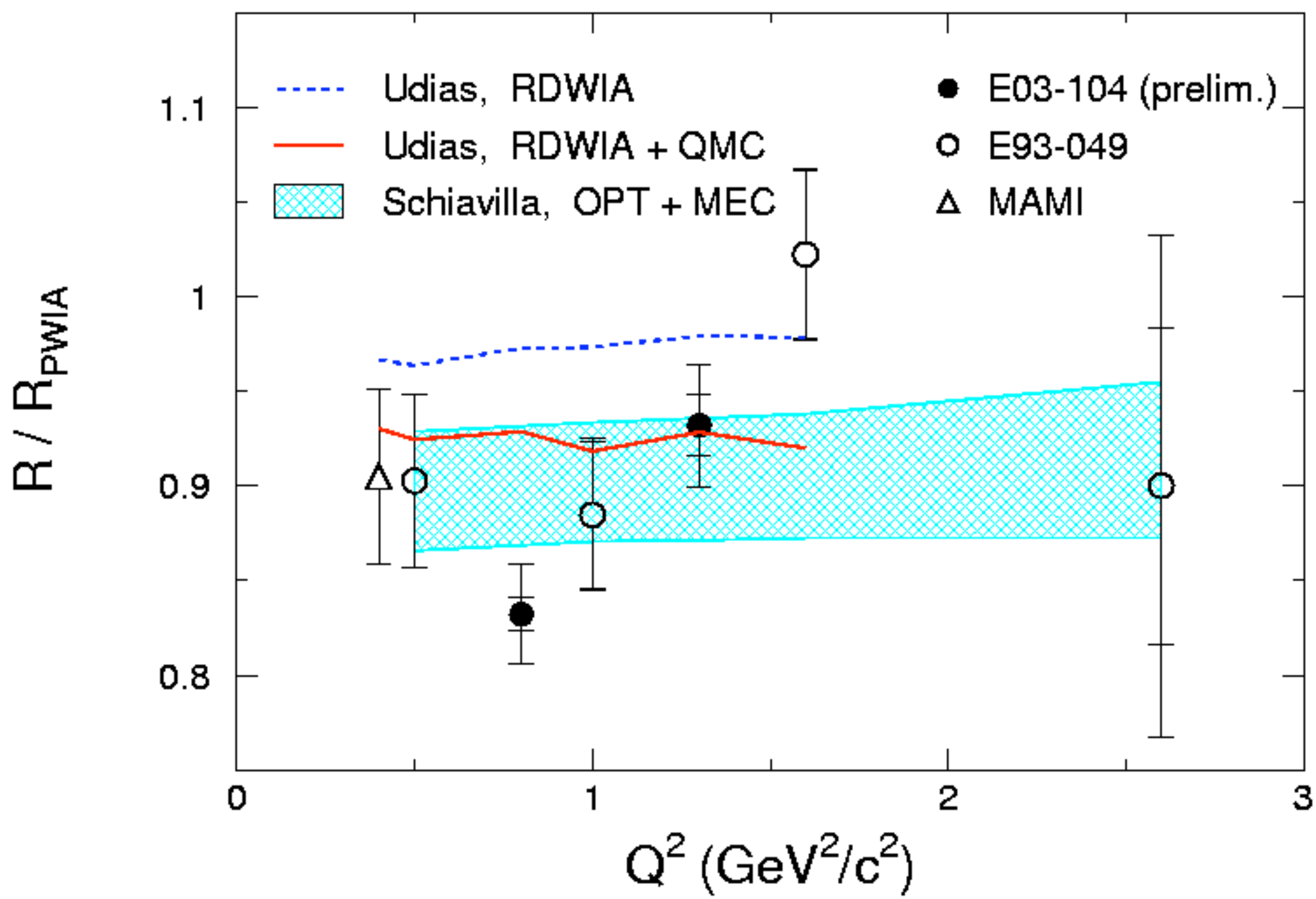
Calculations by Arenhövel

$^{4}\mathrm{He}(\vec{e},e'\vec{p})^{3}\mathrm{H}$



RDWIA calculations by Udias *et al.*

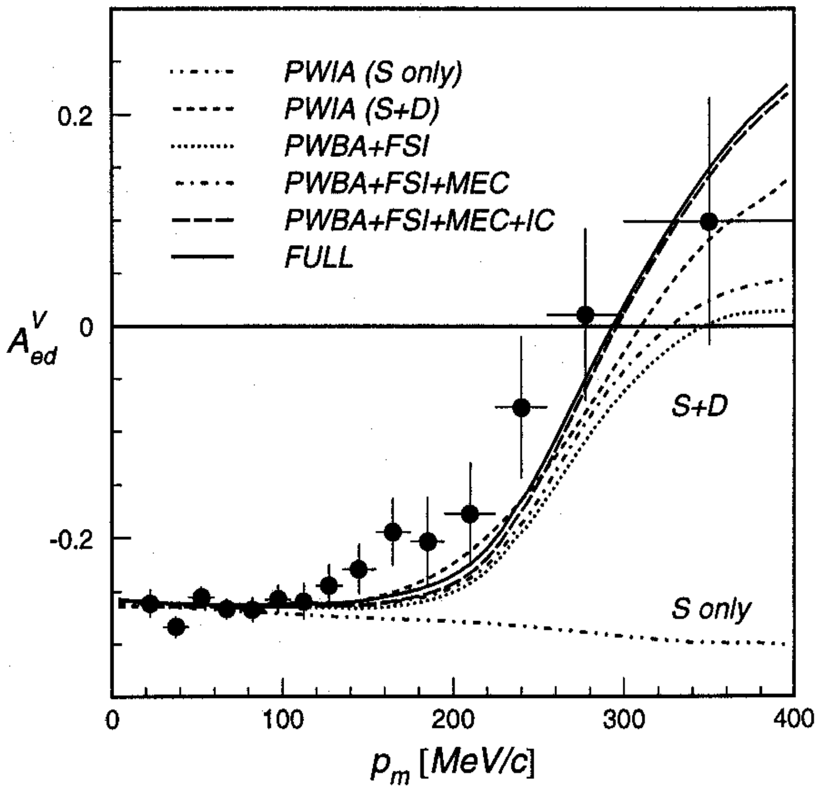
$^4He(\vec{e},e'\vec{p})$



Deuteron Asymmetry Data

Observables: We Measure Cross Sections and Asymmetries.

$$^{2}\vec{\mathrm{H}}(\vec{e},e'p)$$



Sensitive to *D*-state

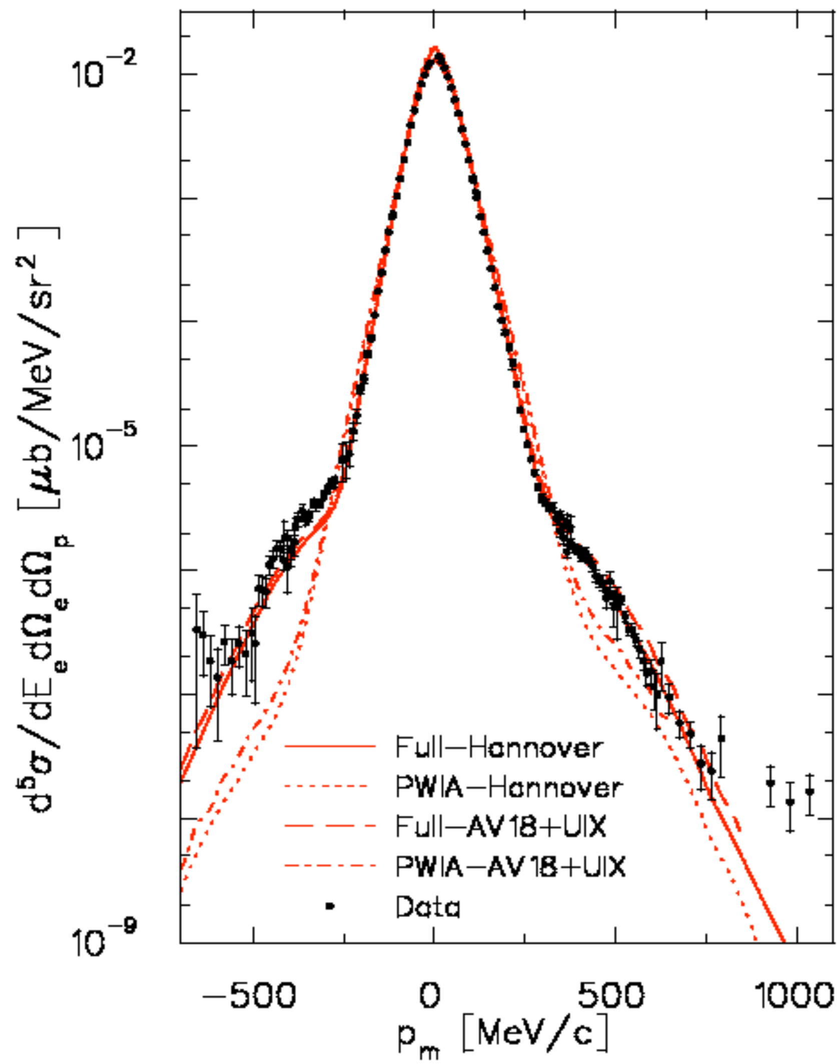
AmPS
NIKHEF-K

I. Passchier *et al.*, Phys. Rev. Lett. **88**, 102302 (2002).

E89-044 $^3He(e,e'p)d$ Results (Hall A)

M. Rvachev *et al*., Phys. Rev. Lett. **94** (2005) 192302.

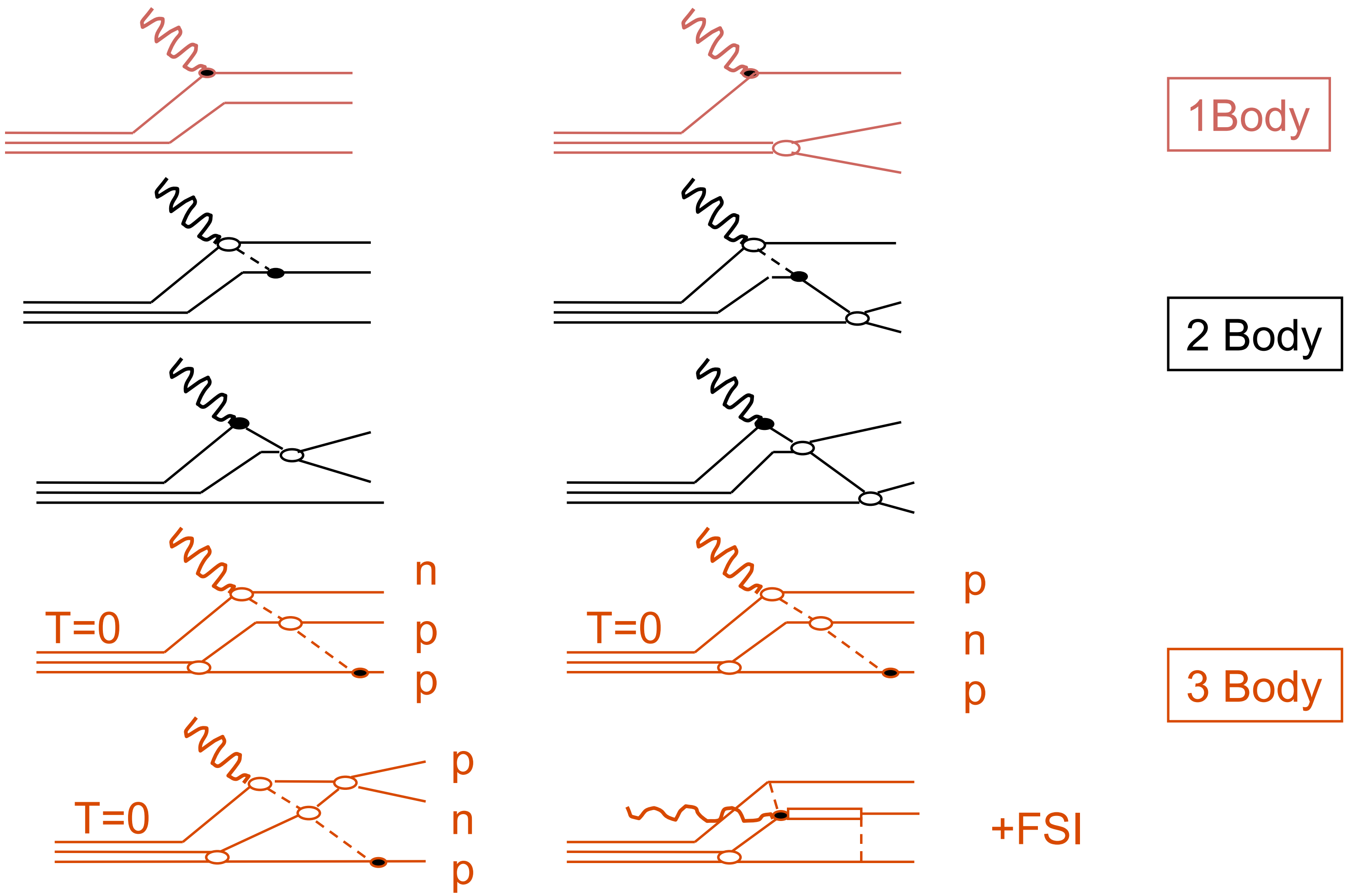
- $x_B = 1$
- fixed (**q**,w) kinematics
- $Q^2 = 1.5\ [GeV/c]^2$
- low p_m PWIA works
- medium p_m FSI
- high p_m multiple effects
  - R. Schiavilla *et al*.,nucl-th/0508048



Diagrammatic Calculations (Laget)

^{3}He Three-Body Disintegration

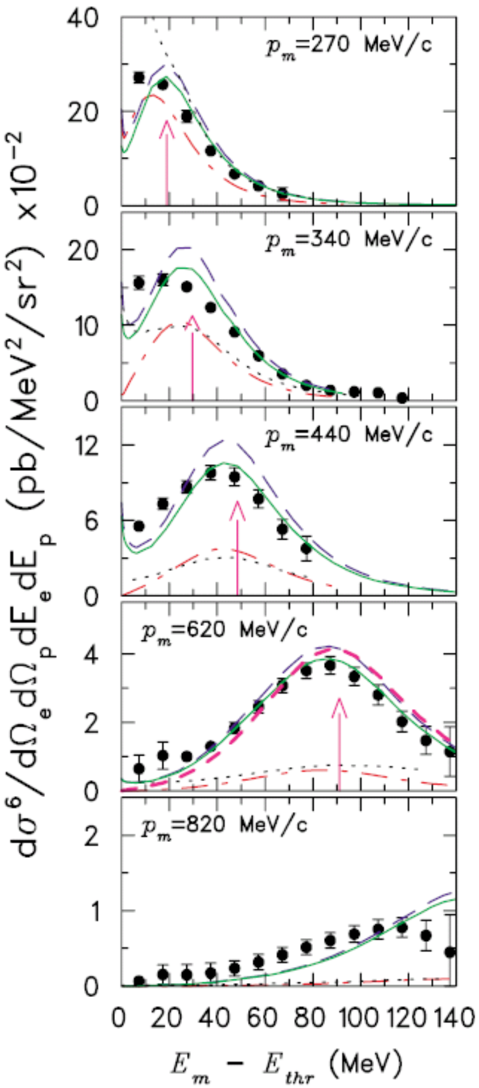
Ground-State Faddeev WF (Paris potential)

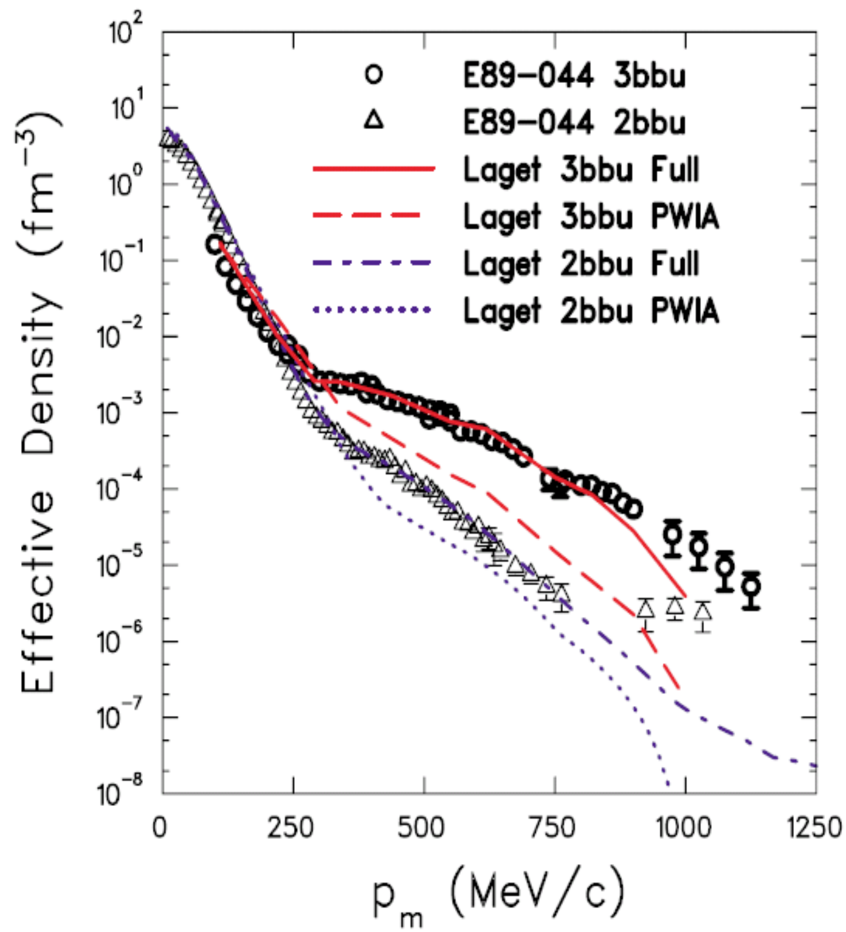


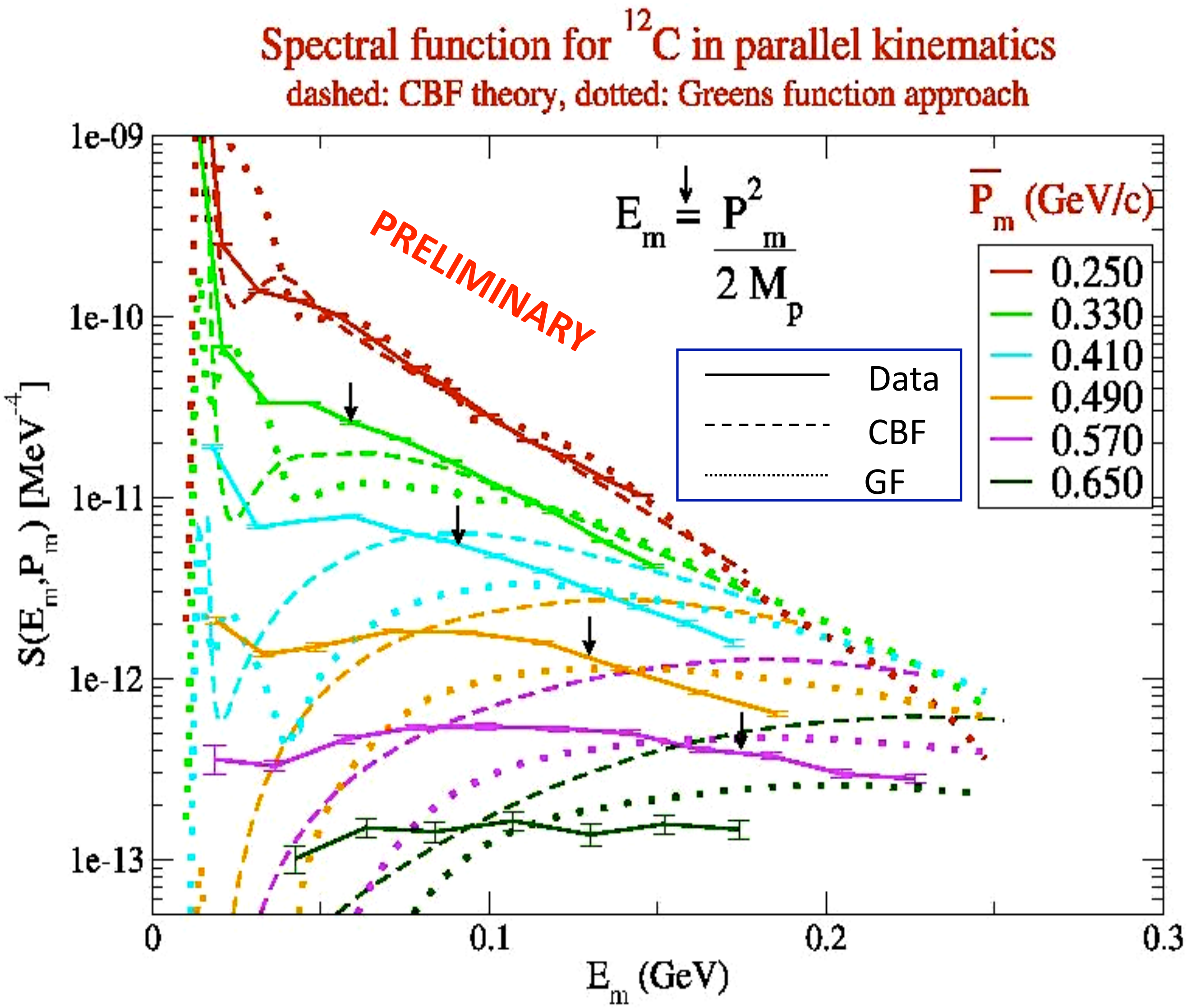
Jefferson Lab

E89-044 $^3He(e,e'p)pn$ Results (HallA)

F. Benmokhtar *et al.*, Phys. Rev. Lett. **94** (2005) 082305.







Data do not seem to follow naïve expectation for *NN* correlation peak.

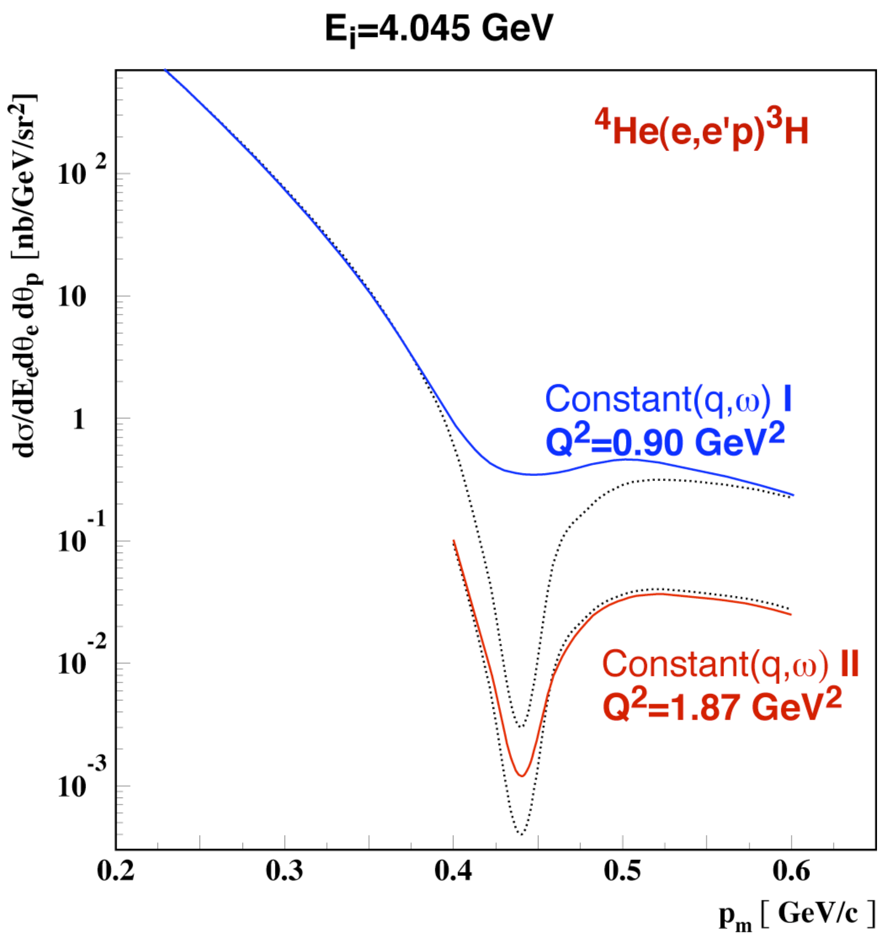
Data: D. Rohe, E97-006 (Preliminary)

GF: H. Müther *et al.*, Phys. Rev. C **52**, 2955 (1995).

CBF: O. Benhar *et al.*, Nucl. Phys. **A579**, 493 (1994).

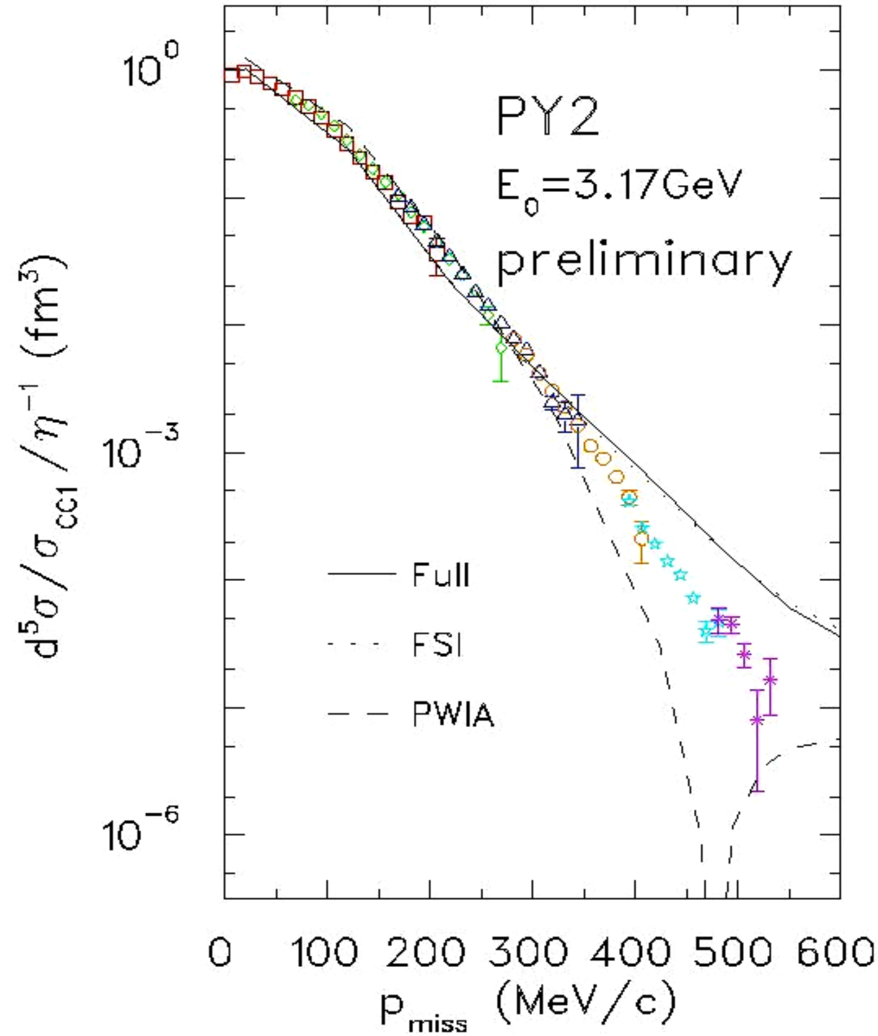
JLab Hall C

E97-111 ^{4}He(e,e'p)^{3}H



- ➔ ^{4}He(e,e'p) cross section in PWIA shows sharp minimum at ~450 MeV/c due to s-wave Short-Range Correlations
- ➔ How to Suppress FSI in (e,e'p)?
- higher momentum transfer
  - momentum of outgoing proton increases
  - FSI (elastic rescattering) decreases
- parallel kinematics
  - always selects minimum p_{miss}
  - in perpendicular kinematics: rescattered low p_{miss} nucleons can contribute at larger p_{miss}
  - Generalized Eikonal Approximation predicts minimal sensitivity to FSI for parallel kinematics

$^4He(e,e'p)^3H$



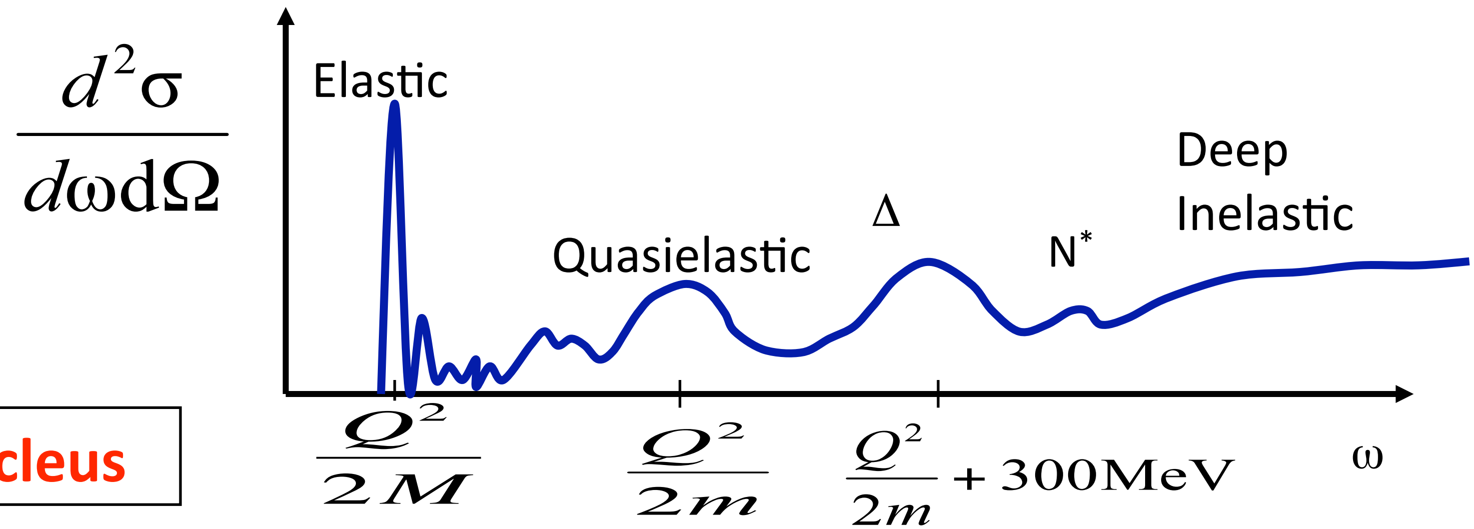
It looks like the minimum is filled in here as well.

JLab Hall A Experiment E97-111, J. Mitchell, B. Reitz, J. Templon, cospokesmen

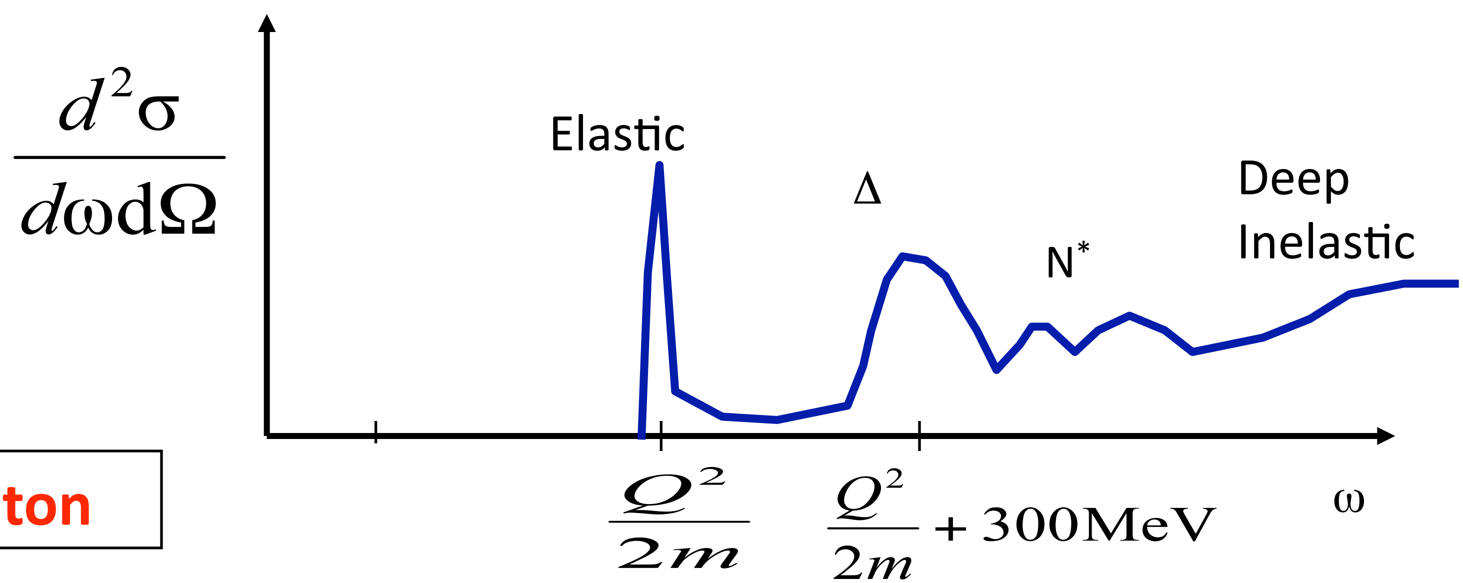
It is always darkest before the dawn.

(i.e. this seems like a mess)

Electron Scattering at Fixed Q^2



Nucleus



Proton

Inclusive scattering at large x

E91-009

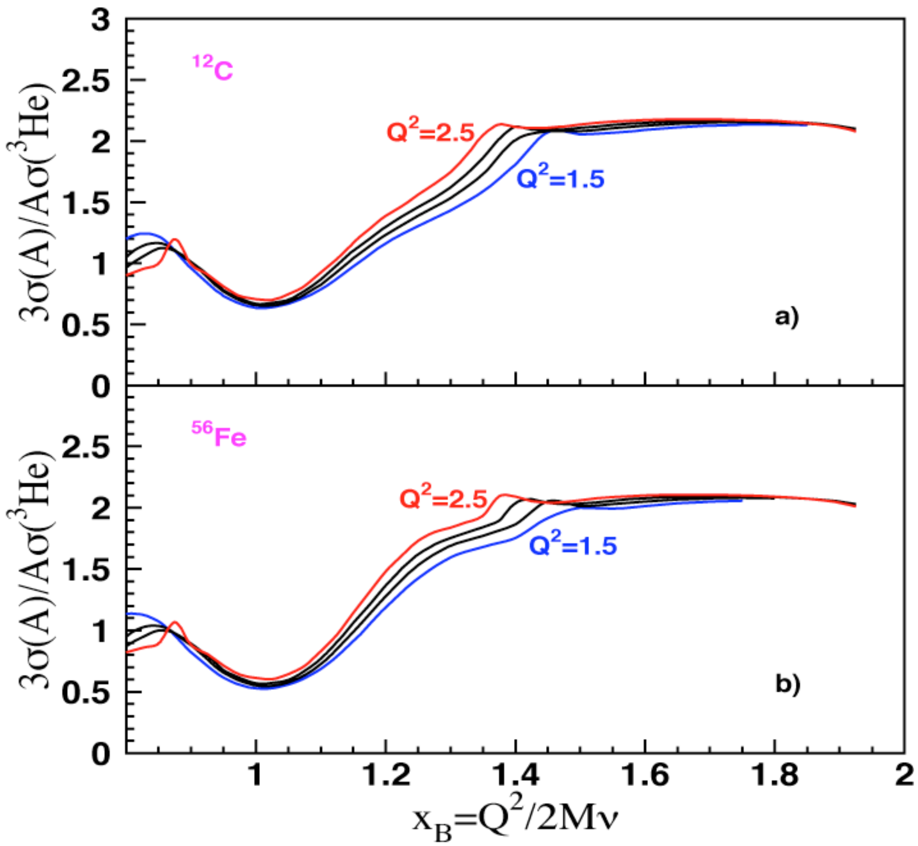
Define y as the x_B-value at which the minimum p_{miss} exceeds p_{Fermi}

SRC model predicts:

- Scaling for $x_B > y$ and $Q^2 > 1.5$ GeV^2
- No scaling for $Q^2 < 1$ GeV^2
- In scaling regime ratio Q^2-independent and only weakly A-dependent

Glauber Approximation predicts:

- No scaling for $x_B < 2$ and $Q^2 > 1$ GeV^2
- Nuclear ratios should vary with A and Q^2



CLAS A(e,e') Data

K. Sh. Egiyan *et al.,* Phys. Rev. C **68** (2003) 014313.

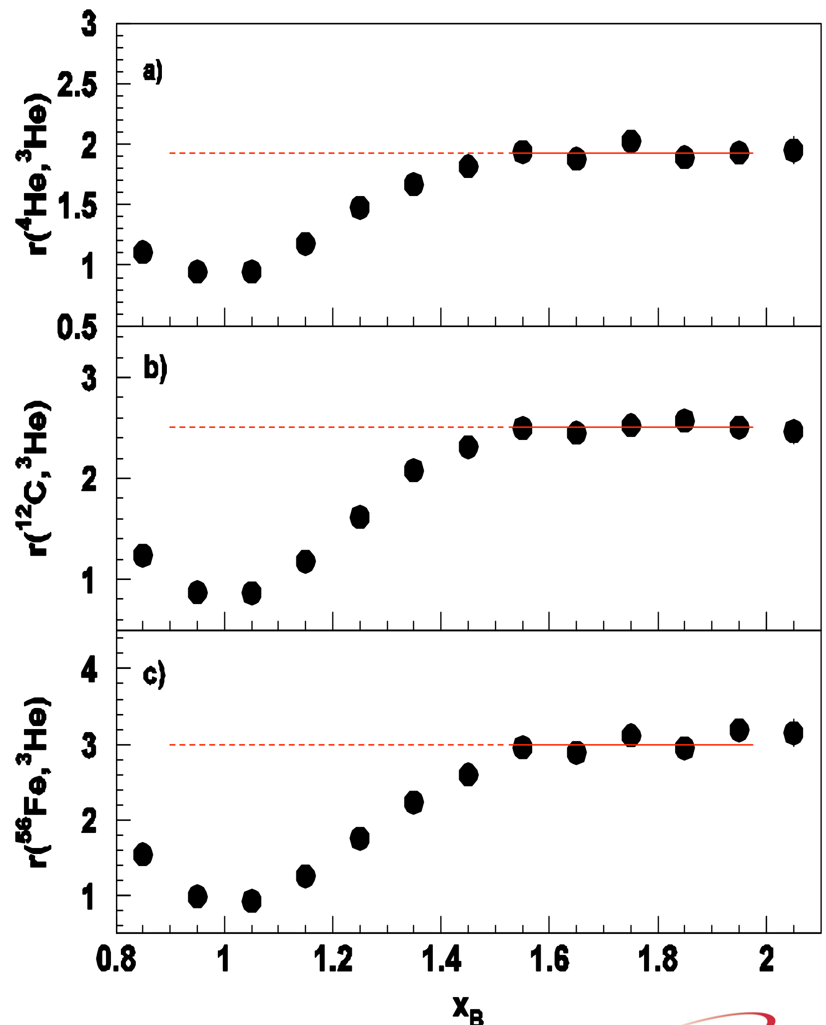
Originally done with SLAC data by D.B. Day *et al.*, Phys. Rev. Lett. 59 (1987) 427.

$$x = \frac{Q^2}{2M\omega} > 1.5 \quad \text{and} \quad Q^2 > 1.4\ [\text{GeV/c}]^2$$

then

$$r(A,{}^3He) = a_{2n}(A)/a_{2n}({}^3He)$$

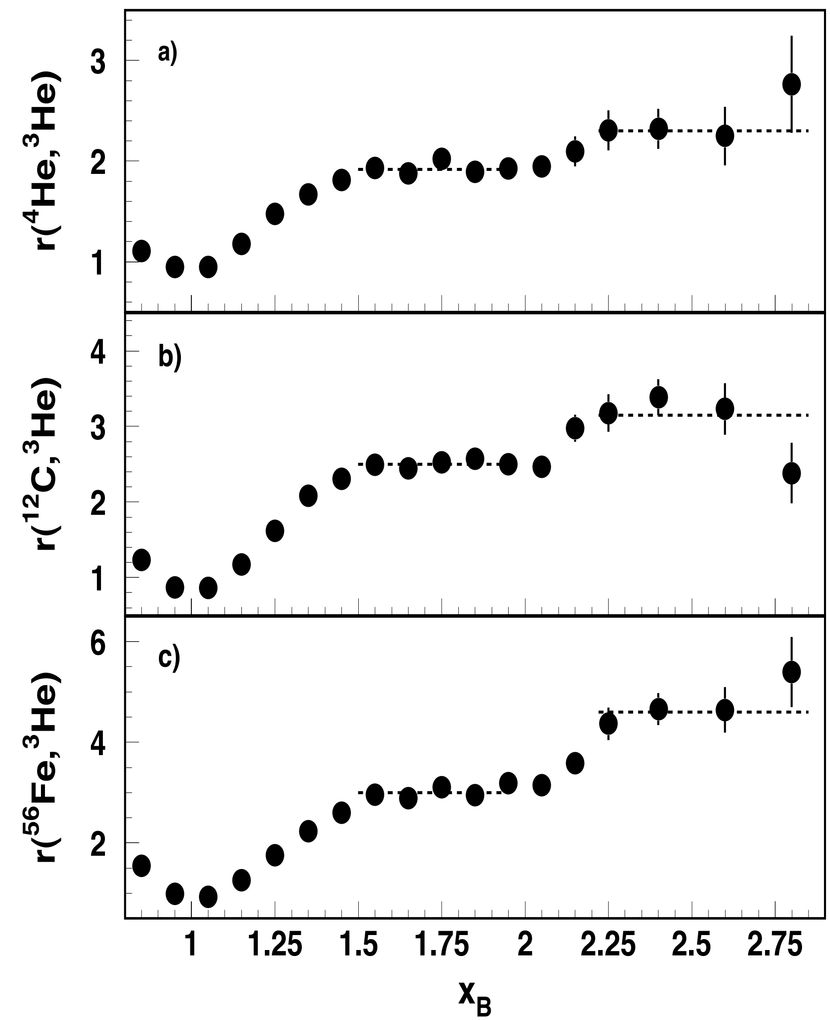
The observed *scaling* means that the electrons probe the high-momentum nucleons in the 2N-SRC phase, and the scaling factors determine the per-nucleon probability of the 2N-SRC phase in nuclei with A>3 relative to ^3He



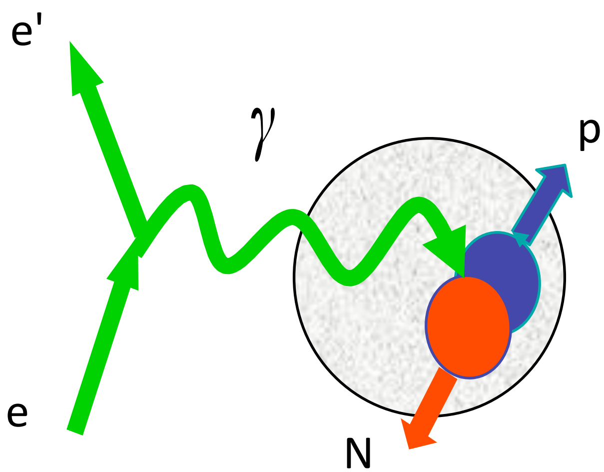
Estimate of ^{12}C Two and Three Nucleon SRC

K. Sh. Egiyan *et al.,* Phys. Rev. Lett. **96** (2006) 082501.

- K. Egiyan *et al*. related the known correlations in deuterium and previous r(^{3}He,D) results to find:
- ^{12}C 20% two nucleon SRC
- ^{12}C <1% three nucleon SRC



Kim's Data Teaches Us What To do



A pair with "large" relative momentum between the nucleons and small CM momentum

high Q^2 to minimize MEC
x>1 to suppress isobar contributions
anti-parallel kinematics to suppress FSI
High P_m To Be Sensitive to SRC