

# Testing the Limits of the Single Particle Model in $^{16}\text{O}(e,e'p)$

Status of E00102

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Hall A Collaboration Meeting  
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# People Involved

- Spokespersons: L.Weinstein (ODU),  
K.Fissum (Lund),  
A.Saha (Jlab),  
W.Bertozzi (MIT)
- Graduate Students: M.Andersson (Lund),  
K.Foe (ODU)
- Postdocs: J.Lachniet (ODU)

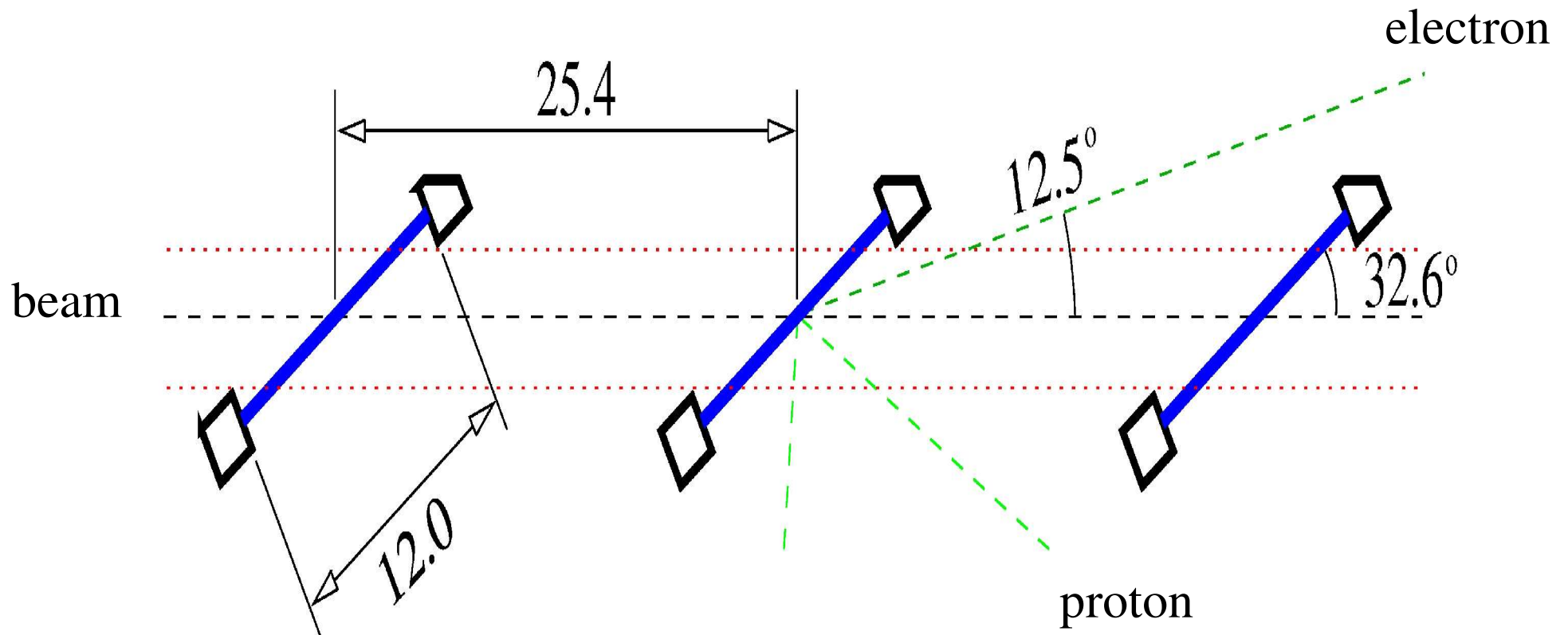
Mattias Andersson recently defended his Licentiate Thesis at the University of Lund based on the E00102 data, available at:

<http://www.jlab.org/~fissum/e00102/e00102.html>

# Goals of E00102

- Measurement of cross-section,  $R_{lt}$  and  $A_{lt}$  for the  $^{16}\text{O}(e,e'p)$  reaction with higher precision and to higher missing momentum than in E89003.
- Determine the limits of validity of the single-particle model of valence proton knock-out.
- Determine effects of relativity and spinor distortion on valence proton knock-out using the diffractive character of the  $A_{lt}$  asymmetry.
- Determine bound-state wave function and spectroscopic factors for valence proton knockout.

# E00102 Waterfall Target



# E00102 Kinematic Settings

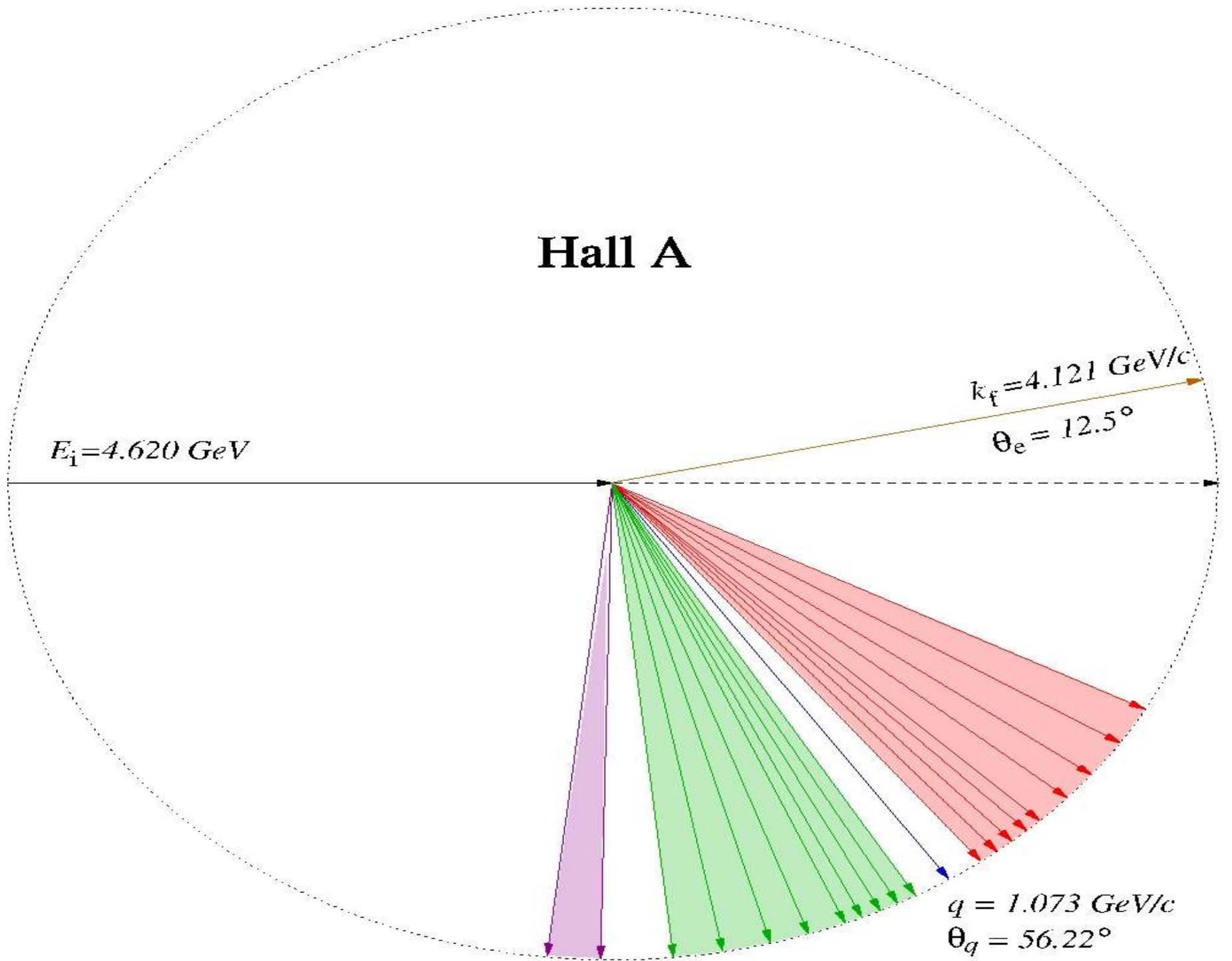
- $E_0 = 4.620 \text{ GeV}$
- $Q^2 = 0.902 \text{ (GeV/c)}^2$  {Electron angle fixed at  $12.5^\circ$  }
- $|\vec{q}| = 1.073 \text{ GeV/c}$
- $\omega = 0.499 \text{ GeV}$
- $E_{\text{miss}} = 0 \text{ to } 0.240 \text{ GeV}$  {Proton angle varied between  $28.27^\circ$  and  $96.10^\circ$ }
- $P_{\text{miss}} = -0.515 \text{ to } 0.755 \text{ GeV/c}$  {E89003 covered  $P_{\text{miss}}$  up to  $0.345 \text{ GeV/c}$ }

# Hall A

$E_i = 4.620 \text{ GeV}$

$k_f = 4.121 \text{ GeV}/c$   
 $\theta_e = 12.5^\circ$

$q = 1.073 \text{ GeV}/c$   
 $\theta_q = 56.22^\circ$



# E00102 Kinematic settings

Measurement	$p_{\text{miss}}$ (MeV/ $c$ )	$\theta_{\text{pq}}$ (deg)	$\theta_{\text{p}}$ (deg)
I-	-515	-27.95	28.27
H-	-430	-23.27	32.95
G-	-345	-18.60	37.62
F-	-280	-14.90	41.32
E-	-210	-11.20	45.02
D-	-175	-9.40	46.82
C-	-140	-7.50	48.72
B-	-105	-5.60	50.62
A-	-70	-3.75	52.47
q	0	0	56.22
A+	+70	+3.75	59.97
B+	+105	+5.60	61.82
C+	+140	+7.50	63.72
D+	+175	+9.40	65.62
E+	+210	+11.20	67.42
F+	+280	+14.90	71.12
G+	+345	+18.60	74.82
H+	+430	+23.27	79.49
I+	+515	+27.95	84.17
J+	+635	+34.87	91.09
K+	+725	+39.88	96.19

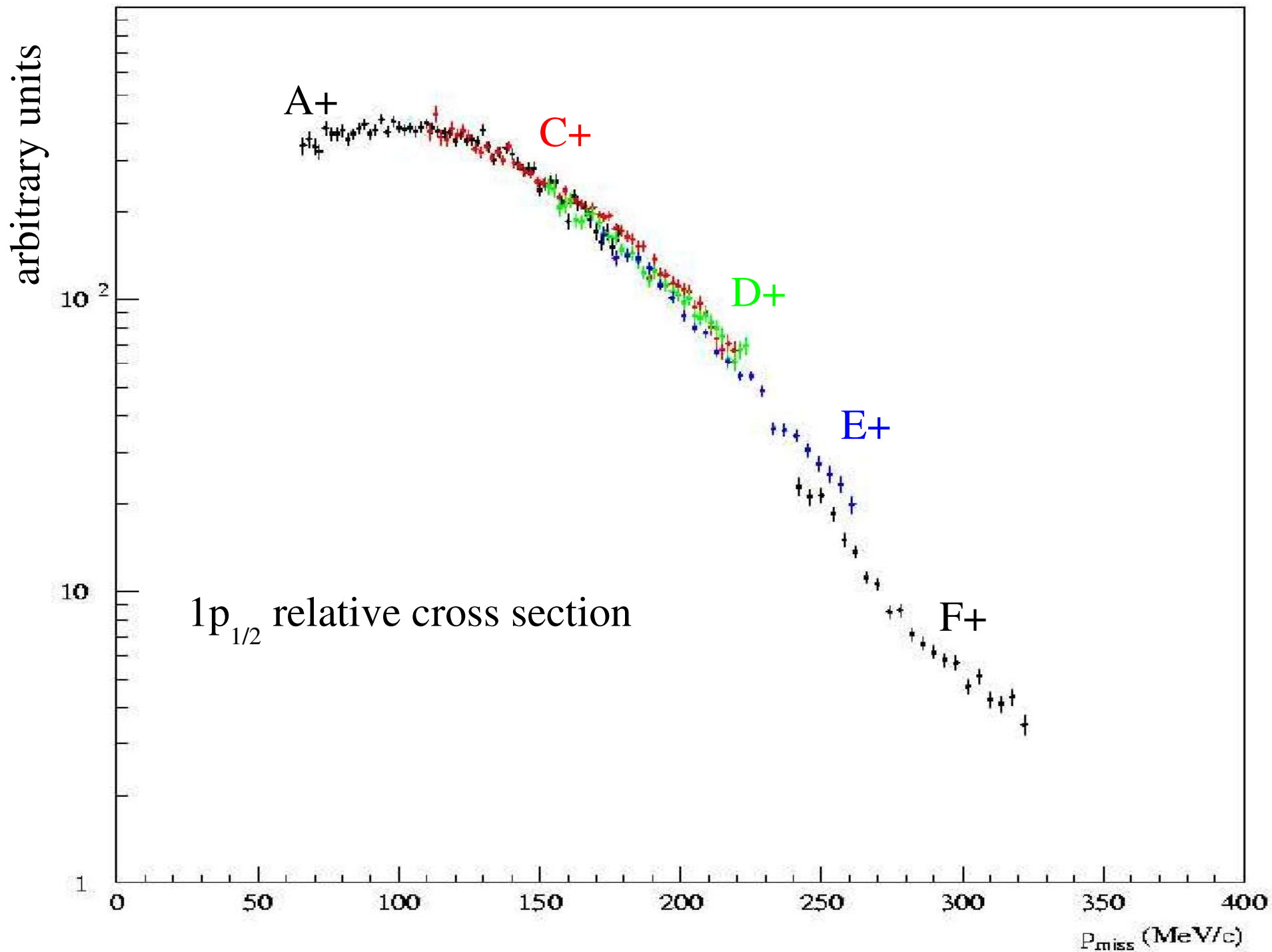
# Tasks Completed

- Beam position/Beam energy calibrations.
- Optics calibration and spectrometer mispointing.
- First pass replay using ESPACE.
- Water-foil thickness measurement from  $^{16}\text{O}(e,e'p)$  to BeO (e,e'p) yield comparison.
- Comparison of H(e,e'p) elastic yield to MCEEP simulation.
- Trigger efficiency/Tracking efficiency study
- Converted end-of-run-file information to MySQL database (host?)
- Determination of  $1p_{1/2}$  cross section relative to H(e,e')



## $1p_{1/2}$ relative cross section (M.Andersson)

- Determination of  $1p_{1/2}$  cross section relative to  $H(e,e')$
- Uses data in the range:  
$$0 < P_{\text{miss}} < 350 \text{ MeV}/c$$
corresponding to kinematic settings A+,C+,D+,E+,F+
- $P_{\text{miss}}$  bins are 2 MeV/c for A+ through D+, 4 MeV/c for E+,F+
- Only central foil was used.
- Acceptance cuts:  $\pm 50$  mr in  $\theta$  and  $\phi$ ,  $\pm 3.5\%$  in  $\delta p$
- Statistical uncertainty is 7% or less. Systematic uncertainty estimated at  $\approx 5\%$ .



# Work in progress

- Trigger efficiency from  $H(e,e'p)$  elastic events.
- Extraction of electronic deadtime from pulser data.
- Determination of focal plane relative efficiency profile.
- VDC tracking efficiency.
- Conversion from ESPACE to ROOT analyzer.

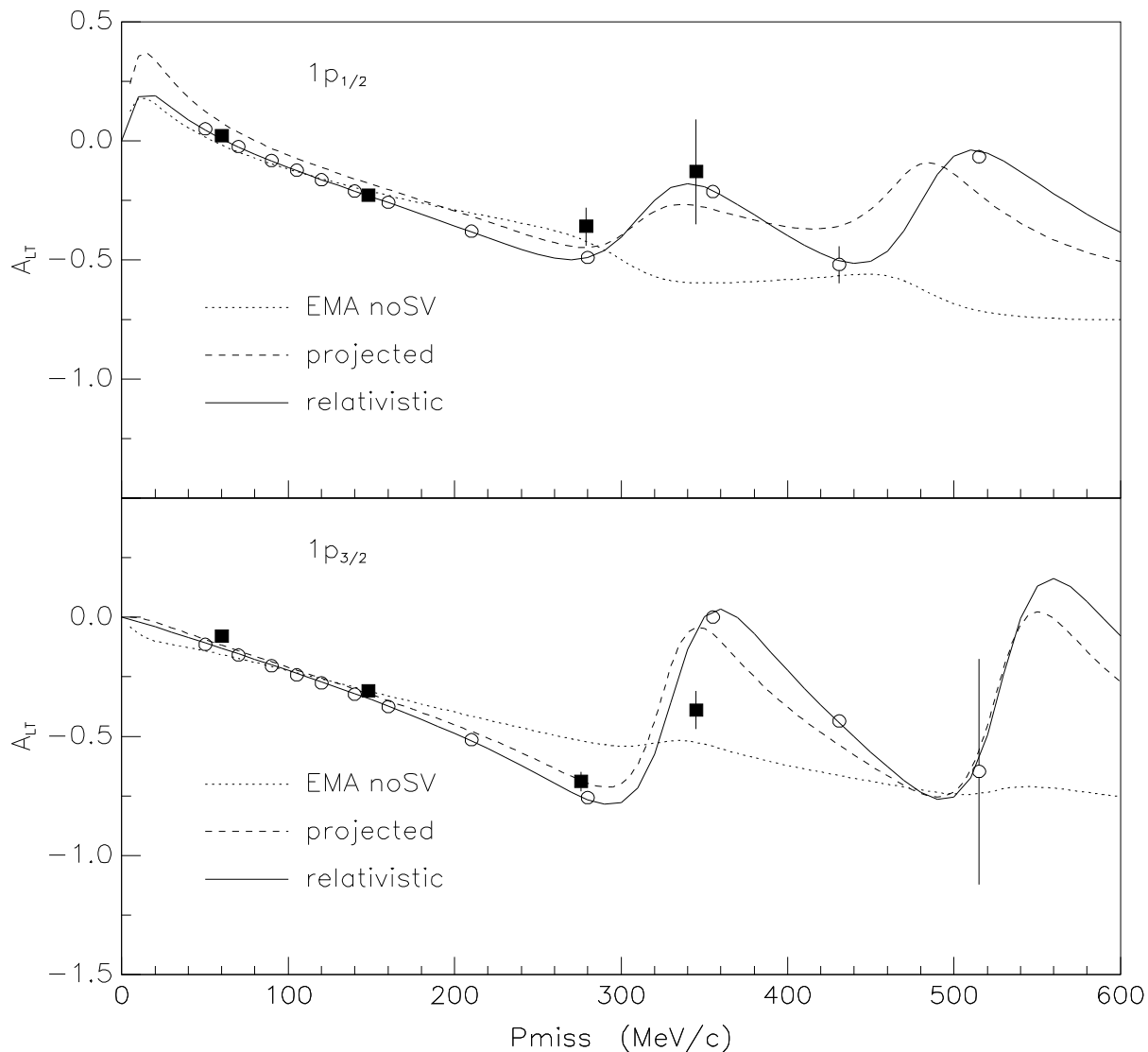
## Coming Soon

- J.Udias student to Lund for simulation work.
- Implement correct target geometry and energy loss corrections.
- ROOT-based replay of data set.
- $H(e,e')$  cross-section measurement and comparison to world data.

...and later

- Oxygen cross section determination and response function extraction

# Projected $A_{LT}$ for Proton Knockout from $1p_{1/2}$ and $1p_{3/2}$ -states of $^{16}\text{O}$



○ Anticipated data points  
from E00-102

■ Data obtained from  
E89003

Compared to calculations  
by Udias *et al.*