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L. E. M. Andersson for the Jefferson Lab Hall A Collaboration mattias.andersson@nuclear.lu.se Department of Nuclear Physics, Lund University, Lund, Sweden Gordon Research Conference on Photonuclear Reactions, Tilton, NH, USA, August 2002



E00-102



E89-003



Figure 1: p_{miss} -dependence of the measured cross sections for the 1p-shell as compared to relativistic DWIA calculations for Ehean = 2.442 GeV. The solid line is the Udías et al. [6-8] calculation and the dashed line is the Kelly [9] calculation.





Figure 2: p_{miss} -dependence of the measured A_{LT} asymmetry for the 1p-shell as compared to relativistic DWIA calculations for $E_{beam} =$ 2.442 GeV. The dashed line is from Kelly, while the other curves are from Udías et al. The densely dotted line includes only the

bound-nucleon spinor distortion. The sparsely dotted line includes only the scattered-state spinor distortion. The dot-dashed line has no spinor distortion included.



Figure 3: p_{miss} -dependence of the measured asymmetry A_{LT} for the different bound-state wave functions and optical potentials for $E_{beam} = 2.442$ GeV. The solid line in both panels are the same and correspond to the Udías et al. calculation shown in Fig. 2. For the three curves in the top panel, the EDAI-O [10] optical potential was used. The dot-dashed curve is for the NLSH-P [11] bound-nucleon wave function and the sparsely dotted line is for the HS [12] bound-nucleon wave function. For the three curves in the bottom panel, the NLSH bound-nucleon wave function was used. The dashed and dotted curves used the EDAD-1 and EDAD-2 [10] optical potentials, respectively.

Conclusions

From the fully relativistic theoretical analysis of Udías et al. [6-8], three major factors which determine the shape of the A_{LT} spectrum were identified:

- 1. the bound-nucleon and ejectile spinor distortion, which produced the observed diffractive structure;
- 2. the bound-nucleon wave function, which shifted the location of the diffractive structure as a function of p_{miss} ; and
- 3. the optical potential, which affected the amplitude of the diffractive structure.

More data were clearly needed at higher p_{miss} to allow the bound-nucleon wave function, optical potential, and spectroscopic factors o be determined independently.

http://www.jlab.org/fissum/e00102/e00102.html In the Fall of 2001, a follow-up experiment [13] was performed in Hall A $|\vec{q}| = 1.066 \text{ GeV}/c, \omega = 0.494 \text{ GeV}$ $Q^2 = 0.892 (\text{GeV}/c)^2$, $x_{\text{B}} = 0.962$

• Data sets were obtained for the 1p-shell, the $1s_{1/2}$ state, and the continuum, for

> $0 <~E_{\rm miss} <~240~{\rm MeV}$ $0 < p_{\rm miss} < 755 \,{
> m MeV}/c.$

- ${}^{1}\mathbf{H}(e, e)$ and ${}^{1}\mathbf{H}(e, ep)$ reactions were used to calibrate
- kinematics and monitor normalization.
- From these data, we intend to determine 1. the limits of validity of the single-particle model of
- valence proton knock-out; 2. the effects of relativity and spinor distortion on valence
- proton knock-out; and
- 3. the bound-state wave function and spectroscopic factors for valence proton knock-out.



Figure 4: The Hall A spectrometers. The electron beam passed through a beam current monitor and beam position monitors before striking a waterfall target located in the scattering chamber. Scattered electrons were detected in the HRS1, while knocked-out protons were detected in the HRSr. Non-interacting electrons were dumped.



Figure 5: The experiment kinematics. The HRS, was fixed at 12.5° throughout the experiment, dramatically simplifying the normalizations and calibrations. The HRSr rotated about the central pivot. Figure courtesy W. Hinton.



Figure 6: The waterfall target [14,15] from above (dimensions in mm). Each waterfall was 125 mg/cm^2 thick. The three-film configuration reduced both the energy loss and the background associated with the target.

E00-102 (continued)



Figure 7: Online yield spectra obtained at $\theta_{pq} = +9.4^{\circ}$ = +175 MeV). Some timing corrections have been performed. The top panel shows a scatter plot of p_{miss} versus E_{miss} . The dark vertical bands project into the peaks located at 12.1 and 18.3 MeV in the bottom panel, corresponding to protons from the $1p_{1/2}$ and $1p_{3/2}$ states of 16O, respectively. The insert shows the corresponding coincidence time-of-flight peak with a FWHM of 2ns.



Figure 8: Projected ALT data in comparison to the calculations of Udías et al. The open circles represent the anticipated data from E00-102. They have been normalized to the fully relativistic

calculation. A 3% systematic uncertainty has been added in quadrature to the anticipated statistical uncertainties to yield the error bars associated with these points. The solid squares are the E89-003 data obtained in slightly different kinematics.

- The analysis is underway. At this point:
- 1, the optimization of the detector databases is 90% completed 2. the determination of the spectrometer optics databases is
- underway; and
- 3. a MySQL database containing all of the experiment setup
- and normalization information has been constructed.

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