REPORT FOR THE MAILING LIST

13/JULY/06

Hi all

We (Kevin Fissum and me, Joaquin Lopez Herraiz, Ph.D. student from Madrid) have been preparing in Lund the simulation tool for the analysis of the e00102 experiment. Now that the code is running and the output has been checked, we are ready to start the analysis.

I will summarize the main steps that we have follow and the results we have yield so far.

1) MOTIVATION FOR A [mceep+RDWIA] CODE

Theoretical calculations for (e,e'p) bound-state proton knock-out, in general neglect many effects present in the experiment, like the energy spread of the beam or the spectrometer acceptances. To compare with experimental data, theoreticians usually take kinematical values at central values of the spectrometer acceptances. Although a good agreement has been achieved between fully relativistic theoretical calculations and experimental measurements for many (e,e'p) observables, analysis of high Q2 experiments require a more realistic treatment of the experimental acceptances. On the other hand, simulation codes developed to take into account experimental effects, like mceep, have usually employed very simple models of the (e,e'p) reaction, in order to avoid long computational time.

2) MOTIVATION FOR A [mceep+RDWIA] CODE based on a grid of response functions

In this work, we perform and analysis combining the best of both approaches in order to obtain results suitable for comparison with experimental data. Response functions are obtained with a Relativistic Distorted Wave Impulse Approximation (RDWIA) calculation from the code of Udias and Vignote (thanks for their help). These response functions are evaluated for a range of values of the kinematic variables that covers the full acceptance of the experiment, and are stored in a file. The MCEEP code was improved with the ability to read these response files and to interpolate them to obtain the results for the actual kinematics of each simulated event. With this procedure, we can introduce a very sophisticated fully relativistic code, without the drawback of a extremely long computational time for the simulated events.

3) CHECKING mceep

Before starting with the mceep+RDWIA code, we compared the results from mceep v3.9 and mceep v3.5 using the same input decks and a default model for the physics model of the ee'p reaction in 16O. We found some important differences, but with the help of P.E.Ulmer we found that they were due to different default values in v3.5 and v3.9 of the nucleon form factors. Using same form factors in both versions we got the same results.

4) CHECKING mceep+RDWIA

Before starting the analysis of the e00102 experiment, we decided to check the output of the mceep+RDWIA code using the results of the previous calculations for the experiment e89003.

Mceep+RDWIA is supposed to be more accurate than RDWIA alone, because RDWIA codes assume central values of the kinematics variables. Nevertheless, if we reduce the acceptances of the spectrometers, set the energy spread of the beam to 0, and not consider radiation effects in mceep, we expect to have similar results with mceep+RDWIA and RDWIA alone.

We performed simulations for the 1p12 state for 8 different kinematics corresponding to theta_pq (angle between the ejected proton and the virtual photon)={-20º, -16º, -8º, -2.5º, +2.5º, +8º,

+16º,+20º}, using an energy of the beam of 2442GeV. Two different settings of the spectrometer acceptances were considered: Extended acceptances correspond to (4.5% momentum, +-25 mrad (in-plane) and +-50mrad (out-of-plane) angles) and reduced acceptances to (1.0% momentum, +-2.5mrad (in-plane) and +-5.0 mrad (out-of-plane) angles).

In the first figure, we have compared our results for these 8 kinematics (using expanded and reduced acceptances settings) with Udias and Vignote calculations (Madrid group) as published in Kevin et al. [PRC 70, 034606]). An excellent agreement between them can be noticed, especially with the reduced acceptances one, as we expected.

In the second figure, four different kinematics are shown: theta_pq = (+-2.5º and +-20º) The effect of reducing the acceptances is clearly noticed.

5) FOLLOWING STEPS

We are starting to create the grid of response functions for the e00102 experiment. We are temporarily focusing on 1p12, but will add the other "states" once we are convinced the most simply situation is working to perfection.

Once we are happy with the behaviour of the realistic physics for simple cases (no energy loss, no radiation), we will make the simulations more and more realistic and start comparing to data

6) FINAL REMARKS

- A formal written report will be created for submission to the collaboration.
- Please check the on-line logbook periodically to view our progress.
- We are open to comments, suggestions, and criticisms.
- We anticipate a meeting at Jlab in late Sept to go over the results in detail.

FIGURE CAPTIONS:

Fig. 1. A comparison between the cross-section output for the removal of protons from the 1p1/2-state of 16O as a function of Pmiss for the e89003 experiment using mceep(with extended and reduced acceptances)+RDWIA and RDWIA alone (From the calculations of Udias and Vignote (Madrid Group) for the e89003 experiment [PRC 70, 034606])

Fig. 2. Cross-Section as a function of PMiss for 4 different kinematics of the e89003 experiment. Results obtained with mceep+RDWIA code. Contour plots correspond to extended acceptances (4.5% momentum, +-25 mrad (in-plane) and +-50mrad (out-of-plane) angles) and black boxes to reduced acceptances (1.0% momentum, +-2.5mrad (in-plane) and +-5.0 mrad (out-of-plane) angles).