Comment on “Measurement of Two- and Three-Nucleon Short-Range Correlation Probabilities in Nuclei”

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Comment on "Measurement of 2- and 3-nucleon short range correlation probabilities in nuclei"

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Egiyan *et al.* [1] reported the first observation of a 3-nucleon Short Range Correlation (SRC) plateau in inclusive A/^{3}He (e,e') ratios at $x_B = Q^2/2m\omega > 2$ at a momentum transfer centered at $Q^2 \approx 1.6$ GeV^2; yet, a subsequent measurement by Fomin *et al.* [2] at $Q^2 = 2.9$ GeV^2 did not reproduce the results. While the difference could be due to a Q^2 dependence, that would be unexpected [3] especially since the two measurements agreed in the $x_B < 2$ region.

The experiments used very different electron spectrometers. Fomin *et al.* used a small solid angle spectrometer with an energy resolution, $\delta E/E \approx 10^{-3}$; while Egiyan *et al.* used a large acceptance spectrometer with $\delta E/E \approx 6\times10^{-3}$ [4, 5]. While both experiments presented their data as a function of x_B, they measured scattering electron energies, E', to determine $\omega = E_{beam} - E'$ and x_B.

Fig. 1 shows the Egiyan *et al.* ^{4}He/^{3}He cross section ratios as a function of E' for a central Q^2 of 1.6 [GeV/c]^2 with the data points placed at the center of each bin. This shows that the energy resolution of $\pm0.6\%$ is smaller than the bin spacing at small E' ($x_B \approx 1$) but significantly larger than the bin spacing at large E' ($x_B \approx 2$).

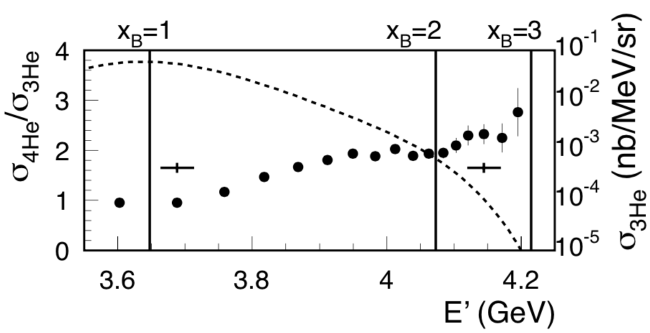

FIG. 1: The Egiyan cross section ratios plotted against the scattered electron energy, E', assuming an average Q^2 of 1.6 [GeV/c]^2. The dashed-dotted curve shows the ^{3}He(e,e') cross section [6]. The horizontal error bars at $E' = 3.68$ and 4.14 GeV show the $\pm0.6\%$ energy resolution.

Fig. 1 also shows that the ^{3}He cross section [6] at $x_b > 2$ decreases rapidly [6]. Small bins where a cross section is decreasing rapidly, especially near a kinematic end point, can be susceptible to a large fraction of events migrating from one bin to another [7].

To test if this could be the source of the discrepancy, we performed a Monte Carlo simulation that generated electron scattering events at $Q^2 = 1.6$ GeV^2 based on the ^{3}He cross section shown in Fig. 1 and then smeared E' for each event with an energy resolution of $\sigma = 0.6\%$. The results, shown in Fig. 2, show how combining a decreasing cross-section with the moderate resolution can create large bin-migration effects and how most of the events within the reconstructed x_B bin were likely from lower initial x_B values.

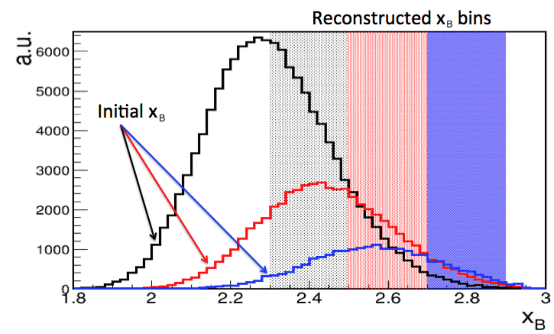

FIG. 2: (Color online) Using the Monte Carlo to fold the CLAS resolution with the ^3He cross section, one can determine the initial x_B values (shown in the histograms) that are populating the last three Egiyan *el al.* bins (shown as vertical bands). The simulation shows that for these points, the data populating the bins originates mostly from outside the range of the bin.

Thus, we find that the Egiyan *et al.* results at $x_B > 2$ are subject to large bin migration effects that, along with any backgrounds, need to be taken into account before taking a ratio. We also note that by checking unphysical regions, such as $x_B > 2$ deuterium data, the magnitude of these undesired effects can be experimentally determined.

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