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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 $^A$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 $x_B \leq 2$ 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 $\delta E/E \approx 6 \times 10^{-3}$ [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 $\pm 0.6\%$ 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 $\pm 0.6\%$ energy resolution.](image1)

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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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 $^3$He cross section, one can determine the initial $x_B$ values (shown in the histograms) that are populating the last three Egiyan et 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.](image2)