Investigations of Short Range Correlations in ^{3}He

Nucleon-nucleon (NN) Short Range Correlations (SRCs) are an important part of the nuclear wavefunction. Nucleons in an SRC are at comparatively short distances and thus, higher densities than mean field nucleons. These SRC nucleons account for almost all of the high momentum ($p > p_{fermi} \sim 0.25$ GeV) nucleons and most of the kinetic energy in the nucleus. Recently published results [1] by the CLAS Collaboration measured the ratio of *pp* to *pn* spectator pair cross sections (Fig. 1) in the ^{3}He(*e,e′pp*)*n* reaction at large relative momenta of the pair $0.3<p_{rel}<0.5$ GeV. The ratio is approximately consistent with the product of the ratio of the number of pairs and the ratio of the elementary *ep* and *en* cross sections for *pp* and *pn* pairs. Also it's important to note that the same ratio is consistent with a *pp* to *pn* pair ratio of 1/18 measured in direct pair knockout in ^{12}C(*e,e′pN*) at $0.3<p_{rel}<0.5$ GeV at relatively low p_{tot}(<0.15 GeV).

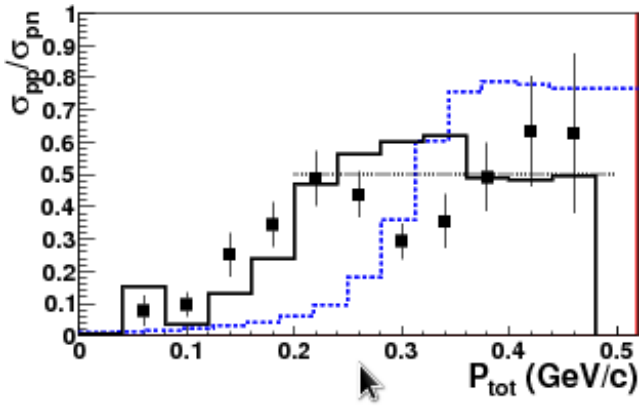

Figure 1. Measured ratio of *pp* to *pn* spectator pair cross sections in the ^{3}He(*e,e′pp*)*n* reaction at large relative momenta of the pair $0.3<p_{rel}<0.5$ GeV. The solid histogram shows Golak one-body calculations. The dotted line at 0.5 shows the simple-minded pair counting result. The data and one-body calculation have been multiplied by 1.5 to approximately account for the average *ep* and *en* elementary cross sections.

The second part of the analysis [2] was dedicated to the investigation of kinematics that are sensitive to the high-momentum components of the momentum distribution and are not significantly affected by final state interactions. We investigated the momentum distribution of the *pp* pair from ^{3}He(*e,e′pp*)*n* with a cut on at $p_n<0.2$ GeV in two different configurations:

1. When two protons are flying forward relative to virtual photon θ_{p1q}, $\theta_{p2q}<35^o$.
2. When a slow proton is backward $\theta_{psq}>100^o$.

The first kinematics correspond to kinematics at $x_B>1$. Fig. 2a shows the first and Fig. 2b the second configuration. The points show the data, the dotted line shows the one-body calculation, and the dashed line shows the one-body + FSI calculation. The data confirms the expectations of a model that combines the dominant parts of the amplitudes: Faddeev three-body wavefunction, FSIs, and meson exchange and Δ formation amplitudes. Note that at $x_B>1$ kinematics, the high momentum component is dominated by FSIs, while the effect is much smaller for backward kinematics.

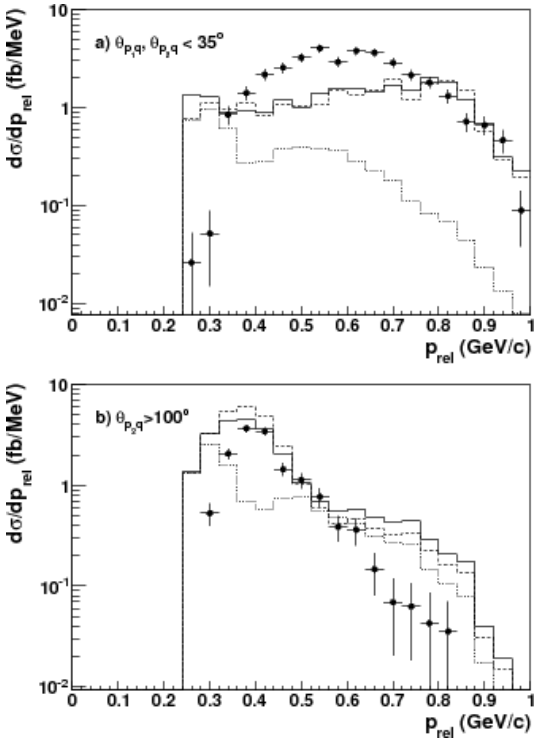

Figure 2. Relative momentum cross section of the correlated pair a) When the two protons are flying forward relative to the virtual photon θ_{p1q}, $\theta_{p2q}<35^o$, b) When the slow proton is backward $\theta_{psq}>100^o$.

[1] H. Baghdasaryan *et al. (CLAS collaboration)*, Phys. Rev. Lett. 105, 222501 (2010).
[2] H. Baghdasaryan *et al. (CLAS collaboration)*, Phys. Rev. C 85, 064318 (2012).