Nucleon Structure in the Nuclear Environment

After discovery of EMC effect, representing a clear signature that the structure of the nucleon bound in nuclear medium is different from that of a free nucleon, a lot of effort was put into understanding of these nuclear modifications. With advent of high luminosity accelerators (CEBAF) in conjunction with large acceptance detectors (CLAS) it became possible to explore these modifications in more details. In the series of articles [1], published by CLAS Collaboration, the nucleon structure function F_2 was measured in a wide continuous range of x and Q^2. These data, combined with previous world measurements, allowed to transform the nucleon structure from the momentum representation (x-space) to the moments representation (n-space), where the perturbative QCD evolution decouples from the intrinsic nucleon properties. In the moments representation the part of asymptotic (DIS) structure of the nucleon (leading twist) can be easily separated from the rescattering of the struck quark (higher twists). The leading twist part shows clear nuclear modification, compatible with that measured by EMC in x-space, but higher twists have different behavior. The latter has implications on the quark confinement potential in the free and bound nucleon. By defining an arbitrary cut-off of the free quark propagation we can compare the shapes of the confinement bag for these two situations. The data indicate a slightly larger confinement bag for the bound nucleon accompanied by some reduction in the number of free high-momentum quarks.

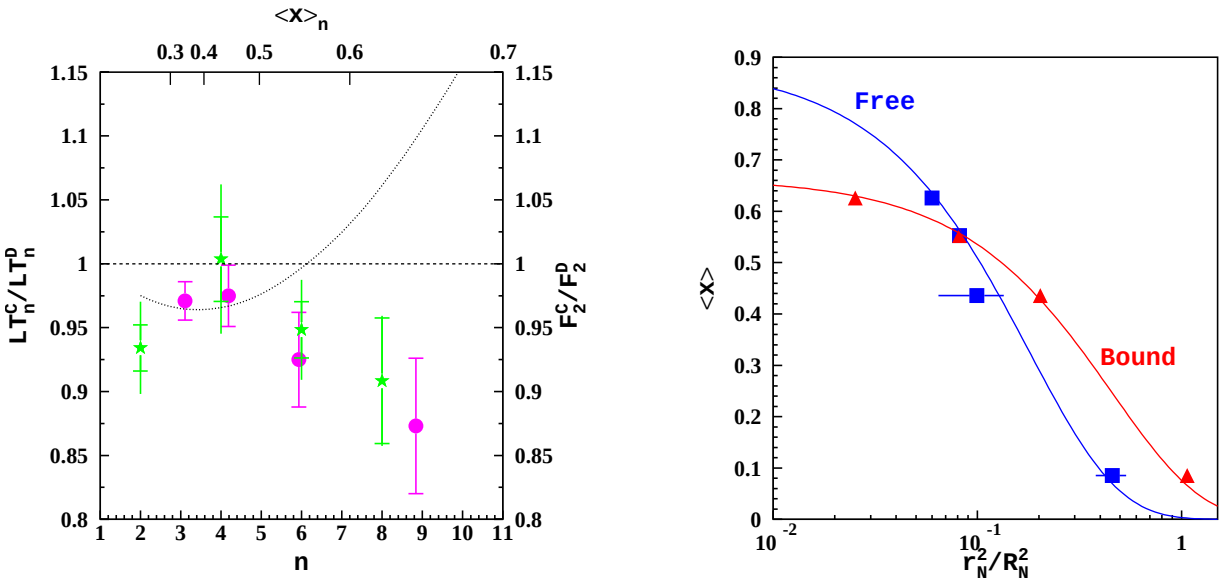

Figure 1: The left panel shows the carbon to deuteron ratio of the leading twist moments (green stars) obtained in this analysis compared to the corresponding ratio of structure functions obtained by EMC (magenta circles) and two scenarios: the dashed line - no nuclear effects, the dotted line - Fermi motion only. The right panel shows the deduced relation of the average quark momentum ($\langle x \rangle$) and free propagation distance (r_N/R_N) for the free nucleon (blue squares) and that bound in the nucleus (red triangles).

[1] M. Osipenko *et al.* (CLAS Collaboration), *Phys. Rev.* **D67**, 092001 (2003); *Phys. Rev.* **C73**, 045205 (2006); *arXiv:* **nucl-ex/1002.3776** (2010).