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Study of Tagged Processes with 4He and ALERT at 22 GeV

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Decades after the discovery of the European Muon Collaboration (EMC) effect, theorists and experimentalists are still working to unravel its origin and deploy new methods to understand the in-medium modifications of nucleon structure. One novel way to probe the EMC effect is to study the fundamental structure of light nuclei, such as ^{2}H and ^{4}He, via the deeply virtual Compton scattering (DVCS) process, enabling access to their three-dimensional (3-D) distributions through generalized parton distributions (GPDs). The forthcoming CLAS12 experiment will use the newly built a low energy radial tracker (ALERT) to study tagged DVCS on ^{4}He with an 11 GeV beam via the detection of low-momentum recoil fragments such as ^{2}H, ^{3}H, ^{3}He, ^{4}He, and protons in a wide kinematic range for the momentum transfer squared, 1 < Q^2 < 7 GeV^2, as well as the Bjorken-x, 0.1 < x_B < 0.7.

The measurement of beam spin asymmetry (BSA) in coherent DVCS on ^{4}He is a critical observable in ALERT-type studies as it offers a way to investigate the partonic spatial distributions and thus probe the 3-D tomography of nuclei. Combining this coherent nuclear BSA data with free proton DVCS results will better distinguish various competing theories on medium-stimulated effects. Extending the study of nuclear DVCS on ^{4}He at 22 GeV, using the TOPEG event generator, CLAS12 GEant4 Monte-Carlo package, and the Forward Tagger improves detection of photons at low polar angle, enhancing DVCS acceptance. The 22 GeV beam energy and luminosity upgrade will enhance the statistical precision and broaden the kinematical coverage in Q^{2}, allowing access to lower x_B region (0.08 < x_B < 0.15) for detailed x_B-dependence studies. Preliminary results on the phase-space coverage and BSAs from DVCS on ^{4}He will be presented for coherent and incoherent DVCS.

Primary author: OUILLON, Mathieu (Mississippi State University)

Co-authors: EL FASSI, Lamiaa (Mississippi State University); DUPRÉ, Raphaël (IJCLab - CNRS - Univ. Paris-Saclay)

Presenter: OUILLON, Mathieu (Mississippi State University)

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