C12-24-RunGroupH

CLAS12 Run Group H:
CLAS12 Run-group H Experiments with a Transversely Polarized Target

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The CLAS12 run-group H (RGH) combines 3 experiments, involving a transversely polarized target:

1. C12-11-111 Transverse spin effects in SIDIS at 11 GeV with a transversely polarized target using CLAS12.

2. C12-12-009 Measurement of transversity with dihadron production in SIDIS with transversely polarized target.

3. C12-12-010 Deeply Virtual Compton Scattering at 11 GeV with transversely polarized target using the CLAS12 Detector.

These experiments have been approved with rating A by PAC39 and selected among the high-impact JLab measurements by PAC41. At PAC52, the experiments have been considered for jeopardy process and received the C2 condition. In the present proposal, the Authors address the specific requests of PAC52 to assess in more details the revised experimental configuration, in particular regarding the achievable physics impact in conjunction with the required beam time.

The goal of the RGH experiments is to measure the transverse target single- and double-spin asymmetries in semi-inclusive and hard exclusive reactions to study some interesting types of parton distributions and correlation functions among the Transverse Momentum Dependent (TMDs) and Generalized Parton Distributions (GPDs).

C12-11-111 is devoted to the study of the semi-inclusive reaction $ep^{\uparrow} \to ehX$, with the goal to access several parton distribution functions specific for a transversely polarized nucleon. These include transversity (describing the correlation between the transverse nucleon polarization and the transverse polarization of partons), the Sivers function (describing the transverse momentum of unpolarized partons), and the so-called "pretzelosity" function, describing the transverse momentum of transversely polarized partons. Furthermore, double-spin asymmetries provide access to the so-called "worm-gear" function, sensitive to the correlation between the transverse momentum of longitudinally polarized partons and the nucleon transverse polarization. RGH data will also provide constraints on the transverse-momentum dependent Collins fragmentation function.

C12-12-009 is the study of the semi-inclusive reaction $ep^{\uparrow} \to eh_1h_2X$ to access the transversity distribution and its first moment, the tensor charge, in a reaction that can be described by a standard collinear formalism and provides a benchmark for the alternative transverse-momentum dependent (TMD) extraction.

C12-12-010 is a measurent of the deeply virtual Compton scattering (DVCS) on the proton, using azimuthal spin asymmetries to provide access to the GPD E which is poorly constrained by previous experiments. The knowledge of the GPD E is necessary to quantify the quarks' orbital momentum contribution to the proton spin. It should be emphasized that only the transverse-target spin asymmetry of DVCS has a strong sensitivity to the

GPD E. RGH will measure also double-spin asymmetries for proton DVCS, giving access to the real part of the target-spin dependent DVCS amplitude.

The results obtained in this set of experiments provide information about the nucleon structure. They allow to get the $x, Q^2, z, P_{h\perp}$ dependencies in a wide kinematic range thanks to the large acceptance of CLAS12, with flavor sensitivity ensured by particle identification systems. This measurements are critical to for studies of transverse spin phenomena in QCD with high impact physics such as the elusive nucleon tensor charge that is relevant for a broad community including LQCD and BSM physics.