

DEEPLY VIRTUAL ELECTROPRODUCTION OF VECTOR MESONS

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This experiment aims at measuring the exclusive electroproduction of vector mesons (ρ , ω and ϕ) in the Bjorken regime ($Q^2, \nu \gg$ and $x_B = \frac{Q^2}{2M\nu}$ finite) with the JLab large acceptance spectrometer (CLAS). The x_B and t dependences of these reactions allow to access, through perturbative QCD (pQCD), new structure functions of the nucleon, called "Skewed Parton Distributions" (SPD's). These structure functions are generalisations of the parton distributions usually measured in inclusive Deep Inelastic Scattering and their first moment link them to the elastic form factors of the nucleon. More fundamentally, it has been shown recently that their second moment gives access to the sum of the intrinsic spin and the orbital momentum of the quarks in the nucleon, which will contribute to solve the so-called "spin puzzle of the nucleon" (only $\approx 25\%$ of the nucleon spin is carried by the quarks' intrinsic spin).

The combination of JLab's 6 GeV continuous electron beam with the large acceptance CLAS detector allows to reach the Bjorken regime up to Q^2 values of 4.5 GeV² for these reactions, with reasonable count rates. Experimentally, the aim is to identify the $\gamma_L^* p \rightarrow p(\rho_L, \omega_L, \phi_L)$ channels where the L index indicates the *longitudinal* polarisation state. For these channels, pQCD gives predictions at leading order. The experimental program consists of several points :

- Identify the $\gamma_L^* p \rightarrow p(\rho_L, \omega_L, \phi_L)$ reactions via the angular distribution analysis of the decay products of the vector meson and check that there is indeed helicity conservation with respect to the incident photon.
- Measure the Q^2 dependence of these reactions which is predicted to be in $\frac{1}{Q^6}$ in leading order pQCD to make sure that we indeed reach the Bjorken regime.
- Measure the ratio $\frac{\rho_L}{\omega_L}$ predicted to be equal to ≈ 5 and the Q^2 dependence of the $\frac{\sigma_L}{\sigma_T}$ ratio predicted to be proportionnal to Q^2 .
- If those conditions are verified, attempt to extract for the first time from the cross-sections, a first estimate of the SPDs.

Detailed simulations showed, for instance, that we could measure the Q^2 dependence of the forward differential cross-section for the ρ channel, up to $Q^2 \approx 4$ GeV² at $x_B = .3$, in 400 hours of beam time and with a luminosity of 10^{34} cm⁻²s⁻¹, leading to a test of the Q^2 "scaling" over more than an order of magnitude.