Cross section measurement of the exclusive single pion electroproduction for $Q^2 < 5$ GeV^2 from CLAS.

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Abstract

The study of nucleon excitations is the essential key to our understanding of the effective degrees of freedom at different distance scales where the transition from the contributions of both quark core and meson-baryon cloud to the quark core dominance takes place. The exclusive meson electroproduction off protons is a powerful tool to probe these effective degrees of freedom in excited nucleon states.

During the last decade, a broad experimental program has been executed with the CLAS detector in Hall B at Jefferson Lab, to study the excited states of the proton using polarized electron beams and (un)polarized proton targets. CLAS is well suited for the study of a broad range of kinematics in the invariant mass W and photon virtuality Q^2 with nearly complete angular coverage for the hadronic decays.

In this talk, results of our latest analysis work will be presented on differential cross sections, structure functions and moments from the reaction of $ep \rightarrow e'n\pi^+$ for 1.6 GeV $\leq$ W $\leq$ 2.0 GeV, and 1.8 GeV^2 $\leq$ Q^2 $\leq$ 4.0 GeV^2. The recent extraction of the helicity amplitudes ($A_{1/2}$, $A_{3/2}$, and $S_{1/2}$) will be also presented for the $F_{15}(1680)$ and the $P_{13}(1720)$ states, in particular.

Result of this new analysis as well as ongoing work on the $p\pi^0$ and $p\pi^+\pi^-$ exclusive electroproduction channels in similar kinematics, will allow for the determination of electro-couplings of several high-lying excited proton states ($W \geq 1.6$ GeV) at distances where quark degrees of freedom become increasingly important and eventually dominant as photon virtuality increases.