Electroproduction of the $pp\pi^-$ System off the Deuteron Beyond the Quasifree Region

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Summary

The proposed research aims at the experimental investigation of the exclusive reaction $ed \to e'pp\pi^-$ not far above threshold, as well as in Δ–region, and at momentum transfer $Q^2 \geq 1$ GeV^2. In this kinematical region the reaction is known to be extremely sensitive to short–range correlations in the deuteron. In particular, we propose to perform the experimental measurements : – at $Q^2 > 1$ GeV^2, – at $\Delta M = M_{pp\pi^-} - (m_p + m_p + m_{\pi^-}) <$ 600 MeV, – with constraints on proton momenta $p_p > 300$ MeV/c.

The CEBAF CLAS detector fits these conditions perfectly for experimental measurements of the $ed \to e'\, pp\pi^-$ reaction with four charged particles in the final state. The main motivation for this experiment is, of course, the following: **the short distances in the deuteron will contribute significantly to the cross section with the kinematical constraints outlined above**.

The main issues of the proposed experiment are :

– Exclusive measurements of the reaction $ed \to e'pp\pi^-$ will permit study of the "simplest" reaction mechanisms when the **proton momenta are large** ($p > 300 MeV/c$) **compared to the typical momentum of a nucleon in the deuteron** ($p < 100 \div 150 MeV/c$). This could allow in turn to draw conclusions about the possible **contribution of more exotic states in the deuteron** (short-range correlations, $6q$ states, $\Delta\Delta$ admixture in deuteron, etc.).

– Detailed investigation of the pp final state interaction (FSI) in a wide range of Q^2 and $M_{pp\pi^-}$. It will provide information about the **size of the proton emission source** in this reaction, and about the dynamics of the reaction which mainly relies on the short distances in the deuteron.

– Detailed investigation of the $p\pi^-$ invariant mass distribution will allow to study the contribution and the dynamical features of the diagrams with Δ-isobar in intermediate and final states. Valuable experimental information could be obtained for understanding the **influence of the nuclear medium on the dynamical features of Δ-isobar production in nuclei**.

– Detailed investigation of the $pp\pi^-$ invariant mass distribution in the region close to the threshold of π^--production off the deuteron will make it possible **to clarify the situation with regard to the existence of a narrow NN-decoupled dibaryon resonance**.

– Detailed investigation of the $pp\pi^-$–system in the kinematical region close to the Δ–region ($\Delta M > 200$ MeV) will **test theoretical predictions which concern basic and specific features of the triangle diagrams**.