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Determination of the $N\Delta$ Axial Vector Transition Form Factor $G_A^{N\Delta}$ from the $ep \rightarrow e'\Delta^{++}\pi^-$ Reaction

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We propose to measure the $ep \rightarrow e'\Delta^{++}\pi^-$ cross section near threshold in order to extract the axial vector form factor $G_A^{N\Delta}$ for the $N \rightarrow \Delta(1232)$ transition using current algebra and the Partially Conserved Axial Vector Current theorem (PCAC) for soft pions. No previous experimental results for this form factor have been published.

Nambu and Schrauner[1] developed a theoretical framework for connecting $\nu N \rightarrow eN\pi$ to $eN \rightarrow e'N\pi$ near threshold, and showed that the latter reaction is directly related to the axial vector form factor of the nucleon. This work was later extended by Adler and Weisberger[2] to the $ep \rightarrow e'\Delta^{++}\pi^-$ process near threshold, where the π^- is constrained to near-zero momentum in the hadronic center-of-mass system.

The only existing near-threshold data on the $ep \rightarrow e'\pi^-\Delta^{++}$ reaction come from an experiment at DESY.[3,4,5] In this case production hadrons were detected with full angular acceptance. The total flux incident on the target was 3.3×10^{12} electrons, corresponding to an integrated luminosity of 1.26×10^6 μb^{-1}. For comparison, the integrated luminosity available from already-approved CLAS experiments is 3.5×10^{10} μb^{-1}. Inadequate counting statistics precluded such an anlysis of the DESY data.

The measurement near threshold of the cross section for the $ep \rightarrow e'\pi^-\Delta^{++}$ reaction with the CLAS detector will provide information of unprecedented quality on the kinematic dependence of the axial vector form factor for the $N \rightarrow \Delta$ transition. The required data will be automatically acquired during experiments previously approved for Period 1 running. We will also have the opportunity to test the proposed relation between the axial vector form factors for the nucleon and the $N \rightarrow \Delta$ transition. This connection arises in a specific theoretical model based on the Fermi-Watson theorem, whereby the form factor for the vertex $< \Delta^{++}|A_\mu|p >$ is directly proportional to the nucleon axial vector form factor $G_A(Q^2)$.

References

[1] Y. Nambu and E. Schrauner, Phys. Rev. **128**, 862 (1962).

[2] S. L. Adler and W. I. Weisberger, Phys. Rev. **169**, 1392 (1968).

[3] P. Joos *et al.*, Phys. Lett. **52B**, 481 (1974).

[4] P. Joos *et al.*, Phys. Lett. **62B**, 230 (1976).

[5] K. Wacker *et al.*, Nucl. Phys. **B144**, 269 (1978).