

Individual Proposal Report

Proposal : PR 04-014
Scientific rating : N/A
Title : Measurement of G_E^p/G_M^p using elastic polarized reaction $e(p,e')p$ up to $Q^2 = 3.50 \text{ (GeV/c)}^2$
Spokespersons : X. Zheng, J.R. Calarco and O.R. Rondon

Motivation: The determination of the proton EM form factors is of considerable physics interest, generating a wealth of experiments aiming at reaching the largest values of Q^2 possible. An experimental discrepancy has recently been observed between the results from the conventional Rosenbluth separation technique and those from a recoil polarization technique, when the two sets of results are interpreted in the absence of two-photon contributions. Initially the discrepancy raised experimental questions, and, as a consequence, the separation technique has been checked by a new analysis of the existing data and measurements performed at JLab. The discrepancy at large Q^2 has been attributed to the effect of two-photon exchange, which was neglected until recently, and theoretical calculations have accounted for part of the experimental deviation.

It is important to pin down the origin of the observed experimental discrepancy in order to allow the unambiguous extraction of the proton elastic form factors and to test the two-photon exchange calculations. This proposal is aiming at providing a new experimental observable. The measurement of the asymmetry in a doubly-polarized experiment should indeed provide an identical result to the transfer polarization data. This would then be a cross check, but with very different systematic errors.

Measurement and Feasibility: The experiment is proposed for Hall C and requests 25 days of running time. It is an asymmetry measurement using a polarized NH_3 target and a polarized electron beam of 6 GeV. This is a single-arm experiment, with the detection of the elastically scattered electron in HMS with its standard equipment. The electron beam intensity is limited to 85 nA by the polarized target. The spin orientation of the target and the scattered electrons detection angle are optimized in the angular regions allowed by the design of an existing polarized target. The asymmetry measurements, providing the ratio of the EM proton form factors, will be measured at two Q^2 values (2.1 and 3.5 $(\text{GeV/c})^2$) with a measurement at lower Q^2 (3.6 GeV beam) to control the value of the product of the polarizations of the beam and target. The experiment appears feasible with the expected precision.

Issues: The PAC has, however, considered that given the present experimental situation a cross check of the transfer polarization data is not sufficient at the level of accuracy proposed. It has not been convinced that the range in Q^2 covered in the measurement is large enough nor that the precision it can attain makes a sufficiently compelling case for approval.

Recommendation : Defer