

## Individual Proposal Report

**Proposal:** PR-04-111

**Scientific Rating:** N/A

**Title:** Measurement of  $G_E^p/G_M^p$  using Elastic Polarized Reaction  
 $p(e,e'p)$  up to  $Q^2 = 5.6 \text{ (GeV/c)}^2$

**Spokespersons:** X. Zheng, J. Calarco, O. Rondon

**Motivation:** The determination of the proton electromagnetic form factors is of considerable physics interest, and results of high precision at the largest values of  $Q^2$  are of great value. An experimental discrepancy was observed between the results from the Rosenbluth separation technique and those from a recoil polarization technique. The discrepancy at large  $Q^2$  is currently attributed to the effect of two-photon exchange, neglected until recently. Theoretical calculations are presently able to account for part of the observed discrepancy. It is important to pin down the origin of this discrepancy, and confirm it, in order to yield an unambiguous extraction of the proton elastic form factors and to test the two-photon exchange calculations. The separation technique has been checked, including measurements performed at JLab. This proposal is aiming at measuring an asymmetry in a doubly-polarized experiment; this should provide a result identical to the polarization transfer data, but with very different systematic errors. In this context it would then be an important independent experimental cross-check.

**Measurement and Feasibility:** The experiment is proposed for Hall C and requests 23 (17+6) days of running time. This asymmetry measurement will use a polarized  $\text{NH}_3$  target and a polarized electron beam of 5.55 GeV and of 85 nA, as allowed by the target. This is a resubmission of a proposal (PR-04-014), which was deferred by PAC 25. The new experimental scheme has been entirely revisited for this proposal; it is now a coincidence experiment, in which the scattered electron and proton are detected with specific set-ups (BETA spectrometer for the electron and a scintillator hodoscope for the proton). The choice of the spin orientation of the target as well as the detection angles of the scattered electron and proton are imposed by the design of an existing polarized target. The asymmetry measurements, providing the ratio of the electromagnetic proton form factors, will be measured at two  $Q^2$  values (3.2 and 5.6  $(\text{GeV/c})^2$ ), a range which covers completely that of the previous polarization experiment E-99-007 performed in Hall A. The experiment, with the expected precision, appears feasible although some tests of the BETA spectrometer should be performed as required by PAC24.

**Issues:** PAC 25 deferred PR-04-014 since the range in  $Q^2$  covered in the measurement was not large enough and the precision it would have attained was not sufficient. This new proposal has clearly extended the  $Q^2$  with improved precision, answering these objections. The PAC 26 would like to see this experiment performed, but due to limitations in the available beam time, the proposal cannot be accepted at this time.

**Recommendation:** Defer with regret