Measurement of the Proton Form Factor Ratio at Low Momentum Transfer

Moshe Friedman , for the E08-007 Collaboration

Racah Institute of Physics, the Hebrew University of Jerusalem

The proton electric and magnetic form factors are basic characteristics of the proton, which can be associated with the Fourier transforms of the charge and magnetic current densities in the non-relativistic limit. QCD can make rigorous predictions when the four-momentum transfer squared, Q^2, is very large, however, in the non-perturbative regime this task is too difficult, and several phenomenological models attempts to make predictions in this domain. Measurements of the proton form factors were traditionally based on cross section measurements and used the Rosenbluth separation to extract the electric and magnetic form factors. In this method, the magnetic form factor is suppressed as Q^2 decreases, and precise data at very low Q^2 is not available. In the last two decades, scattering experiments with polarized beams and targets have been used, and allow precise measurements of the proton form factors at much lower Q^2. The second part of experiment E08-007 is attempting to measure the ratio between the proton form factors at $0.01 < Q^2 < 0.08$ GeV^2, lower than ever achieved, by using the double-spin asymmetry technique. The experiment was conducted on spring 2012 at Hall A of the Thomas Jefferson National Accelerator Facility, using a 1-2 GeV polarized electron beam, scattering off a polarized solid ammonia target. Data analysis is currently in final stages. Recently, inconsistencies between different measurements of the proton radius have prompted intense theoretical and experimental activities to resolve the discrepancy. This experiment might improve our understanding of this problem. I will describe the experimental system, and show preliminary results for the asymmetries and expected uncertainties.