

Introduction

Experiment 96-005, "Electric Form Factor of the Neutron Extracted from the ${}^3\text{He}(e, e'n)pp$ Reaction" was approved with B+ scientific rating at the February 1997 PAC meeting. Since then there have been many important developments in the field that we believe motivate submission of an update at this time. Our goal is to obtain an upgrade of the scientific rating and approval for a modest increase in the scope of the approved measurements.

The successful measurements of G_E^n at lower Q^2 at Mainz¹⁻⁴ and NIKHEF⁵ coupled with the delays associated with executing the G_E^n program in Hall C at JLAB strongly suggest that we should have the option of mounting the polarized ${}^3\text{He}$ experiment in Hall A as soon as possible. This will require two issues to be resolved at this time. First, the scientific rating should be increased to a value that is commensurate with the high interest in these measurements in the scientific community and with the competitive Hall A schedule. Second, the collaboration strongly feels that the program must include a range of Q^2 that connects with the Mainz data and offers a view of the Q^2 evolution of the results. Thus we are requesting an additional 15 days to include Q^2 points of 0.7 and 1.3 GeV^2 . This range of Q^2 is lower than our previous proposal (1-2 GeV^2) to facilitate comparison with Mainz and to better connect with the region where precise non-relativistic calculations are now possible.

Recent Developments

There are several important recent developments regarding G_E^n measurements and the performance of polarized ${}^3\text{He}$ experiments. Figure 1 shows the recent measurements performed at Mainz and NIKHEF in the low Q^2 range ($Q^2 < 0.7 \text{ GeV}^2$). It is clear that there has been considerable progress and that the strategy of comparing measurements from deuteron and ${}^3\text{He}$ targets will be crucial in establishing a reliable and accurate picture. The apparent disagreement between the deuteron measurement² and the polarized ${}^3\text{He}$ target measurement³ near $Q^2 = 0.35 \text{ GeV}^2$ has led to increased efforts to examine the corrections due to FSI and MEC in both methods. Indeed, substantial FSI corrections have led to revisions in the extracted values of G_E^n from the deuteron data (particularly at the lowest $Q^2 < 0.2 \text{ GeV}^2$). In addition, new theoretical calculations are in progress to address the role of FSI and MEC in the polarized ${}^3\text{He}$ case⁶. It is likely that the PWIA analysis used to obtain the polarized ${}^3\text{He}$ result is not sufficient for reliable extraction G_E^n at this low Q^2 and a more complete theoretical treatment is required. Indeed, FSI effects are not negligible for the deuteron at this Q^2 and one expects that ${}^3\text{He}$ will require even larger corrections. It is clear that when this discrepancy is resolved we will have a great deal of confidence in the results.

The polarized ${}^3\text{He}$ results⁴ at $Q^2 = 0.67 \text{ GeV}^2$ seem to connect well with the trend of the lower Q^2 deuteron measurements. It is expected that the effects of FSI are significantly smaller at this higher Q^2 because the (p, n) cross section decreases rapidly with energy in this range of Q^2 . This argument is supported quantitatively by the calculations of Laget⁷. The correction to the extracted value of G_E^n for these effects is estimated to be less than 10% at the $Q^2 = 0.67 \text{ GeV}^2$ Mainz kinematics⁴. Thus it appears that at $Q^2 > 0.7 \text{ GeV}^2$ the PWIA analysis should provide a reliable baseline for extraction of G_E^n .

Since the submission of our original proposal, the measurement techniques we propose to use have been shown to be a powerful method of addressing the neutron form factors. The