

1 Summary

Measurements of parity violation in elastic $\bar{e}p$ scattering directly measure the couplings of the Z boson to the proton. In the standard model of electroweak interactions, these couplings are well defined in terms of the parameters of the model. When we consider the currents to be carried by the quarks, clear statements can also be made about the contributions of the various flavors of quarks to these currents.

We expect CEBAF to be an ideal laboratory for the study of $\bar{e}p$ parity violation, primarily due to its excellent beam emittance, high current, and a well controlled beam polarization that may very well exceed 50%. We have identified two specific kinematic regions that are particularly interesting. One, at $Q^2 \approx 0.1 \text{ GeV}^2$, will be mainly sensitive to contributions from flavor singlet pieces of the quark currents, assuming that matrix elements of s-quarks in the proton are not negligible. Another, at $Q^2 \approx 0.02 \text{ GeV}^2$, will allow us to extract a value of $\sin^2\theta_W$ that is rather insensitive to uncertainties in the proton form factors. These two measurements can run concurrently since they would use the same beam and target.

We propose that, as soon as beam is available at CEBAF, we begin a series of initial measurements to determine the feasibility of these measurements. This would also, of course, include studies of the many possible sources of systematic error. These measurements would not only serve as necessary ground work for ensuing precision measurements of parity violation, but they would also provide an enormous amount of data relevant to CEBAF operation. *Specifically, we request 3 weeks of initial beam time for R&D with a partial apparatus and a solid target with the following provisions:*

- 2 weeks with 50% polarized beam and 1 week with unpolarized beam
- Rapid reversal from 1 Hz to 1 kHz under experimenter control
- $\approx 50 \mu\text{A}$ average beam current, or highest available
- 30 ns beam chopping period