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First Determination of the Proton's Weak Charge – Early results from Qweak

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The Qweak experiment was designed to exploit the small parity violating asymmetry in elastic ep scattering to make the first direct measurement of the proton's weak charge, Q_W^p, and measure the running of the weak mixing angle, $sin^2 q_w$, at low Q^2. The Standard Model predicts the proton's weak charge, based on the running of the weak mixing angle from the Z_0 pole to low energies. The predicted change in $sin^2 q_w$ corresponds to a 10 s effect in the experiment, thus testing the internal consistency of the Standard Model more rigorously than complementary experiments on the weak charge of Cesium (APV) and the electron Q_W^e. The goals of the experiment were to measure Q_W^p to 4.1%, which will yield a measure of $sin^2 q_w$ to 0.3%, and to provide a tight constraint on a combination of the weak vector quark charges C_{1u} and C_{1d}.

The experiment used a 180 μA longitudinally polarized 1.16 GeV/c electron beam on a 35 cm long liquid hydrogen target. Scattered electrons in the angular range 6° < θ < 12° corresponding to Qˆ2 ≈ 0.026 (GeV/c)ˆ2 were detected in an array of eight Cerenkov detectors arranged symmetrically about the beam axis. The experiment completed its last data taking campaign in May 2012. The results from the commissioning run will be presented.

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