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First results from the Qweak measurement of the proton's weak charge[1]

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The Qweak experiment has made the first direct measurement of the weak charge of the proton, Q_W^p, through precision measurement of the parity-violating asymmetry in elastic scattering of longitudinally polarized electrons from unpolarized protons. The data were taken in Hall C at Jefferson Laboratory, during 12 months of running over a 2 year period, ending in May 2012. A beam current of up to 180 μA on a 35 cm long liquid-hydrogen target produced a scattered electron flux of $\sim$6.5 GHz incident on the detectors with $Q^2 \sim 0.026$ (GeV/c)^2. It is expected that the weak charge of the proton will be extracted with a 4.1% combined statistical and systematic uncertainty. The proton weak charge is suppressed in the Standard Model so that these data may be used to determine the weak mixing angle, $\sin^2\theta_W$, with a relative uncertainty of 0.3%, providing a competitive measurement of the running of $\sin^2\theta_W$ to low Q^2. In addition, these data will impose a strong constraint on a combination of the vector weak charges of the u and d quarks, C_{1u} and C_{1d}, which is distinct from and complimentary to the combination from measurements of parity violation in atomic systems, and thereby provide an independent constraint on physics beyond the Standard Model. A first look at a subset of the data will be presented.

[1]For the Qweak Collaboration