

Proton Charge Radius (PRad) Experiment at Jefferson Lab ¹

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For the PRad Collaboration

In order to investigate the proton radius puzzle, the PRad experiment (E12-11-106²) was recently performed with 1.1 and 2.2 GeV unpolarized electron beam on a windowless H₂ gas flow target in Hall B at Jefferson Lab. The experiment aims to extract the electric form factor of proton in an unprecedented low four-momentum transfer squared region, $Q^2 = 2 \times 10^{-4} - 0.1 \text{ (GeV/c)}^2$, with a sub-percent precision. The PRad experiment utilizes a non-magnetic calorimetric method with a high efficiency and high resolution calorimeter (HyCal), and two world-largest, high spatial resolution Gas Electron Multiplier (GEM) detectors. The systematic uncertainties are well controlled by two main advantages of this experiment: (1) The absolute $e - p$ elastic scattering cross section will be normalized to the well-known Møller scattering process, which is measured simultaneously within similar kinematics and experimental acceptances; (2) The gas flow target has no cell windows at both up- and downstream, which was one of the primary background sources in the previous $e - p$ elastic scattering experiments. Thus the PRad experiment has systematic uncertainties totally different from the previous magnetic spectrometric $e - p$ elastic scattering experiments. In this talk, we will present the details of the experiment and preliminary analysis of the 1.1 GeV and 2.2 GeV data.

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