Proton Charge Radius (PRad) Experiment at Jefferson Lab [1]

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In order to investigate the proton radius puzzle, the PRad experiment (E12-11-106[2]) was recently performed with 1.1 and 2.2 GeV unpolarized electron beam on a windowless H_2 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, $Q^2 = 2 \times 10^{-4} - 0.1$ $(GeV/c)^2$, with a sub-percent precision. The PRad experiment utilizes a non-magnetic and calorimetric method with a high efficiency and high resolution calorimeter (HyCal), and two world-largest, high spatial resolution Gas Electron Multiplier (GEM) detectors. Its systematics 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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