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

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The "Proton Charge Radius Puzzle" refers to 7 σ discrepancy between the proton charge radius extracted from muonic hydrogen Lamb shift measurements and that from the atomic hydrogen Lamb shift and e-p elastic scattering measurements. In order to get a better understanding of this puzzle, the PRad experiment (E12-11-106[2]) was proposed and recently performed with 1.1 and 2.2 GeV unpolarized electron beam in Hall B at Jefferson Lab.

The experiment aims to extract the electric form factor and the charge radius of proton by simultaneously measuring the e-p elastic scattering cross section and the Moller cross section at very low Q^2 (2×10^{-4} to 10^{-1} GeV^2) region, with sub-percent precision. A windowless hydrogen gas flow target was used to better control the background. A high-efficiency and high-resolution calorimeter (HyCal) and a pair of Gas Electron Multiplier (GEM) chambers were used in the experiment.

This talk will focus on comparing the detailed simulation of PRad experiment and its background with preliminary spectra from the data.

[1] This work is supported in part by the U.S. Department of Energy under Contacts No. DE-FG02-03ER41231, NSF MRI award PHY-1229153

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