PRad-II: Preparing the Upgraded High Precision e-p Experiment for Proton Charge Radius Extraction

Erik A. Wrightson

Abstract

PRad-II is the upgraded version of the PRad experiment that will start running in January 2026 in Hall B of Jefferson Lab (JLab). This experiment will extract the charge radius of the proton with the highest precision ever done via electron scattering. There is an expected precision improvement over the 2019 PRad results by a factor of 3. This improved precision will help address the discrepancies first noticed in muonic hydrogen spectroscopy in 2010 creating the so-called Proton Radius Puzzle. We will also cover a 5-order-of-magnitude range in Q^2, including the lowest ever reached for electromagnetic form factor extraction to the order of 10^{-5} and help understand potential discrepancies between the original PRad data and data from Mainz in the form factor value. This talk will briefly cover the main goals and experimental setup of PRad-II. There will be special focus on the Hybrid Calorimeter (HyCal) which serves as the primary calorimetric detector for this magnetless experiment, its new flash-ADC data acquisition system, and its testing performances as the system installation is underway at JLab. This system will allow for full waveforms to be saved and will be combined with other improvements to allow for better event reconstruction than could have been achieved previously.