Calibration of the HyCal calorimeter for the PRad Experiment at JLab [1]

Li Ye

Mississippi State University

For the PRad Collaboration

The Proton Charge Radius Puzzle refers to the large discrepancy observed 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 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 Møller cross section at very low $Q^2(2 \times 10^{-4} \sim 10^{-1}(\mathrm{GeV/c})^2)$ 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.

Before the production run, a very careful calibration of HyCal was performed with 0.3 GeV - 1.07 GeV tagged photon beam. This talk will present detailed calibration results as well as some preliminary results on ep and ee scattering data.

[1]This work is supported in part by NSF MRI award PHY-1229153, the U.S. Department of Energy under Contacts No. DE-FG02-07ER41528, Thomas Jefferson National Laboratory, Mississippi State University and PRad collaboration

[2]Spokespersons: A. Gasparian (contact), H. Gao, M. Khandaker, D. Dutta