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Blinded by the Light: Calibration of a Cherenkov Detector (G)*

Tuesday 12 June 2018 14:00 (15 minutes)

Quantum chromodynamics (QCD), the fundamental theory of the strong interaction, tells us that when quarks are close together (high energy) the interaction is feeble but when they are far apart (low energy) the strong force is intense. Currently, QCD can accurately describe the high energy regime, but calculations are difficult in the non-perturbative, low energy regime. At Jefferson Lab (JLab), 12 GeV electrons impinge upon a variety of targets in experimental Hall C, making it a prime location to probe how QCD transitions from the high energy to low energy regime.

There are two spectrometers in Hall C called the High Momentum Spectrometer and the Super High Momentum Spectrometer (SHMS). The SHMS features a suite of detectors used to track and identify particles to extract meaningful quantities from the experiment. One such detector is a gas Cherenkov used for identification of charged particles based off their velocity. If a particle passes through the detector faster than the speed of light in the media, characteristic Cherenkov radiation (photons) will be produced. The detector is outfitted with photomultiplier tubes which collect this light and convert it to an electrical signal, which is measured. Lighter particles of equal momenta produce more light, allowing us to distinguish between different species.

In this presentation I give a general overview of the JLab accelerator facility and the experimental Hall C. This will include a description of the detector stack in the SHMS and the role the HGC plays. I will then talk about the HGC specifically, how it was designed and the theory behind Cherenkov radiation. Next the calibration procedure will be shown, demonstrating how the detector is gain-matched and capable of performing particle separations. Afterwards I will show how the efficiency of the HGC is determined. Lastly I will show some simulations of the HGC and how they compare to the experimental data.

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