Abstract 4

This week was largely focused on completing a series of trainings that are necessary to allow me to work here at the facilities at JLAB. The most pertinent of these training was in becoming qualified as a Radiological Worker 1, which essentially means I am deemed, by the Department of Energy, as being qualified to work in areas with varying radiological activity and I am equipped with the knowledge to navigate said areas and radiological sources. Because these trainings garnered a series of steps such as a written test and a practical examination, which I only could take yesterday, I haven’t had the ability to continue my experimentation on the scintillating materials yet. I completed a variety of other prerequisites as well such as a general student safety course and established a Jefferson Lab computer account where I can gain access to Jefferson Lab cloud, thus allowing me to access a plethora of the lab’s data. Specifically, although my understanding is tentative, with this I can access the machine that is used for light yield characterizations of the crystals via the Virtual Desktop Infrastructure, which is a remote access service facilitated by Jefferson Lab that allows accredited users to access the internal network of Jefferson Lab which consists of a variety of machines. This also brings me to my introduction to ROOT. Via this VDI, I was able to access the ROOT installed on other machines in JLAB, and I’ve begun familiarizing myself with the mechanics of the toolkit. I had been using ROOT files to interpret the data in my light-yield experiments at CUA and to generate the histograms and the respective Gaussian fits for the different curves generated by the photomultiplier tube’s calibration and the scintillation process; however, most of the terminal commands were predisposed for me. I have been reading up on the introductory documentation provided by CERN to understand the underlying mechanics of terminal commands, how to interpret data, and how to uniquely generate plots.

Additionally, I worked on a program to model the differential cross-section of Moller scattering, which is electron-electron scattering, named after Christian Moller, the Danish physicist who developed the initial formalism in 1932. The modern formalism works on the basis of quantum electrodynamics and the interpretation of Feynman diagrams, both of which I’ve been trying to understand better because the result is pretty elegant as it only depends on ordinary trigonometric functions.

There is a MOLLER experiment looking to be undertaken here at JLAB, in this case, MOLLER stands for, Measurement of Lepton-Lepton Electroweak Reaction, but evidently the name alludes to the Moller formalism. Similar to methods of electron-proton scattering, 11 GeV electron beams will scatter off electrons in a liquid hydrogen target. The intention of this experiment is to analyze the asymmetries that may occur in the scattering of electrons with different helicities (Why might a spin left and a spin right electron have different cross-sections?), this asymmetry violates parity, a fundamental concept that describes equivalence under spatial inversion. Parity does not apply to particles governed by the weak interaction (i.e. leptons). Characterizing this asymmetry with high precision allows physicists to search for physics potentially beyond the Standard Model.

Looking forward, I hope to finally work in the Jefferson Lab facilities to continue characterizing the behavior of these crystal blocks and conduct more coherent and precise data analysis on the results.