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Searching for Magnetic Monopoles with CUORE

Project Overview

This project is a continuation of the magnetic monopole search being conducted in Professor Winslow's group involving the use of data from the Cryogenic Underground Observatory for Rare Events (CUORE. Although CUORE's primary purpose is investigating Neutrino-less Double Beta Decay as well as dark matter candidates, I will be tasked with adapting the experiment for the monopole search.

Personal Role, Responsibilities

My role in this project will involve continuing the work I have left off from the last two semesters. As it stands I have build the adequate tools for finding candidate track-like events and gleaming some basic spatial data from them. I have also built the preliminary tools for reconstructing data like stopping-power. I will continue the development of such tools, applying advanced methods such as Multi-objective optimization to reach my goals. In the process, I may also have to look into the implementation of such tools like a "Re-capitation module" for reconstructing energy deposition signatures of events of interest.

Goals

The primary goal of this project is finishing the development of the tools mentioned above. If this can be accomplished, then the aim is conducting a magnetic monopole search. In the process, a paper may be written on the tools being developed, with the ultimate aim of publication.

Personal Statement

My personal goals for the UROP are to gain experience with statistics and data analysis in physics. Even if what I am doing in this project will not be what I ultimately focus on in my career, data science will surely be a part of my journey. Moreover, the actual content of the physics that I learn will no doubt be beneficial as I continue my study of advanced physics. As far as the overall aim of the project, the search for magnetic monopoles has not been done so far at CUORE. This means that the research I do could potentially be groundwork for future research in this search.