Automation of Tile Scanning and a Silicon Photomultiplier Characterization Set-Up

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Introduction

- Light yield mapping with scintillating tiles and silicon photomultipliers
- Many scintillating tiles used in the Longitudinal Forward Hadronic Calorimeter in the Electron-Ion Collider
- High precision needed
- Translation stage used for source scanning
Background: the Electron-Ion Collider (EIC)

- Very broadly exploring quark-gluon plasma
- High precision tracking, PID, & calorimetry
- Very high luminosity and polarization
- Exclusive events can also be detected

- One beam of electrons and one beam of protons/heavy ions
Background: Longitudinal Forward Hadronic Calorimeter (LFHCal)

- Electromagnetic showers only have one component, whereas hadronic showers are more complex
- Want to capture energy and turn it into something tangible
- Have to fully stop particles
- Particle flow measurements & reconstruction
- Backward (electron-going) covering $-3.5 < \eta < -1.0$, barrel covering $-1.0 < \eta < 1.0$, and forward (ion-going) covering $1.0 < \eta < 3.5$. 
Scintillating Tiles & Silicon Photomultipliers

- ~600,000 tiles needed
- Generation of photons
- SiPM-on-tile method
- Tile design – dimples, ESR foil
Methodology

1. Design the dark box
2. Install the translation stage
3. Write the code & set up software
4. Take scanning data with the Strontium-90 source
5. Analyze the data

Part I: The Box

We had to design and build a new box as the current dark box was too small for the translation stage.
Part II: The Translation Stage

I assembled a translation stage and worked on software to control the stage, as well as collect data simultaneously.
Part III: The Scanning

Scan path for a 5 cm x 5 cm tile

Trigger tile AutoCAD design

Janus software set up for data collection
Future Plans

- Take SiPM data
- Do source testing
- Translation stage/suction cup system
Questions?