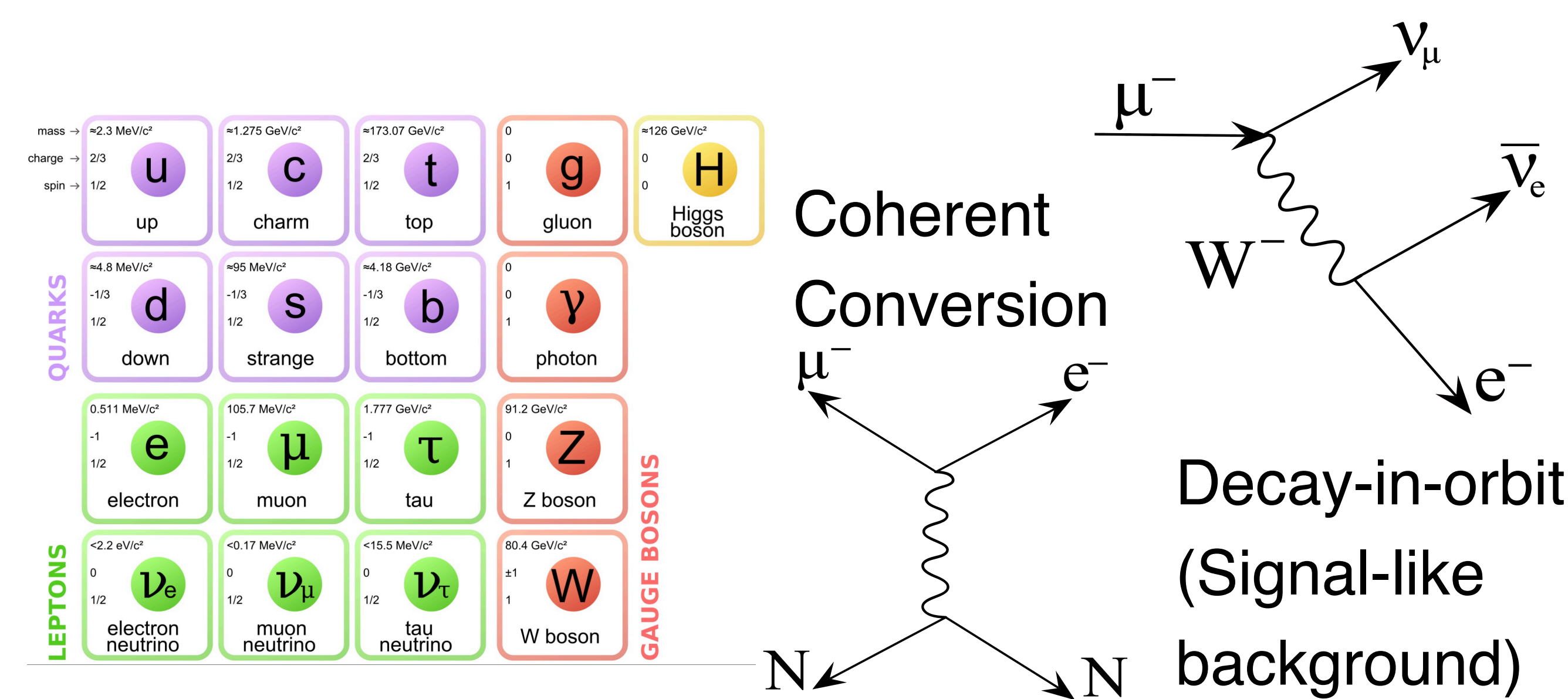


Mu2e *otsdaq* Documentation and Online Reconstruction Analytics

Talia Saarinen ❖ SULI ❖ Advisors: Eric Flumerfelt, Gianantonio Pezzullo, Ryan Rivera

About Mu2e

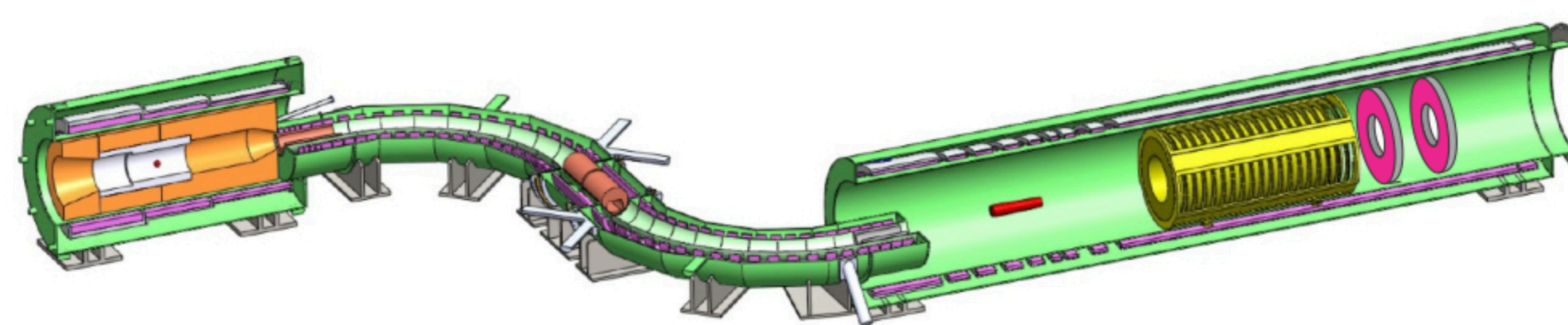
The goal of the Mu2e experiment is to detect muon-to-electron conversion in the field of an aluminum nucleus. If detected, this decay would be the first experimental confirmation of charged lepton flavor violation. Since Mu2e has a projected sensitivity of 10^{-17} compared to a 10^{-54} branching ratio for CLFV processes per ν SM, this observation would be a clear signature of physics beyond the standard model.



(Left) § Elementary Particles and Forces, (Right) Example Feynman Diagrams for Signal (coherent conversion) and signal-like background (decay-in-orbit)

A particle's journey through the experiment:

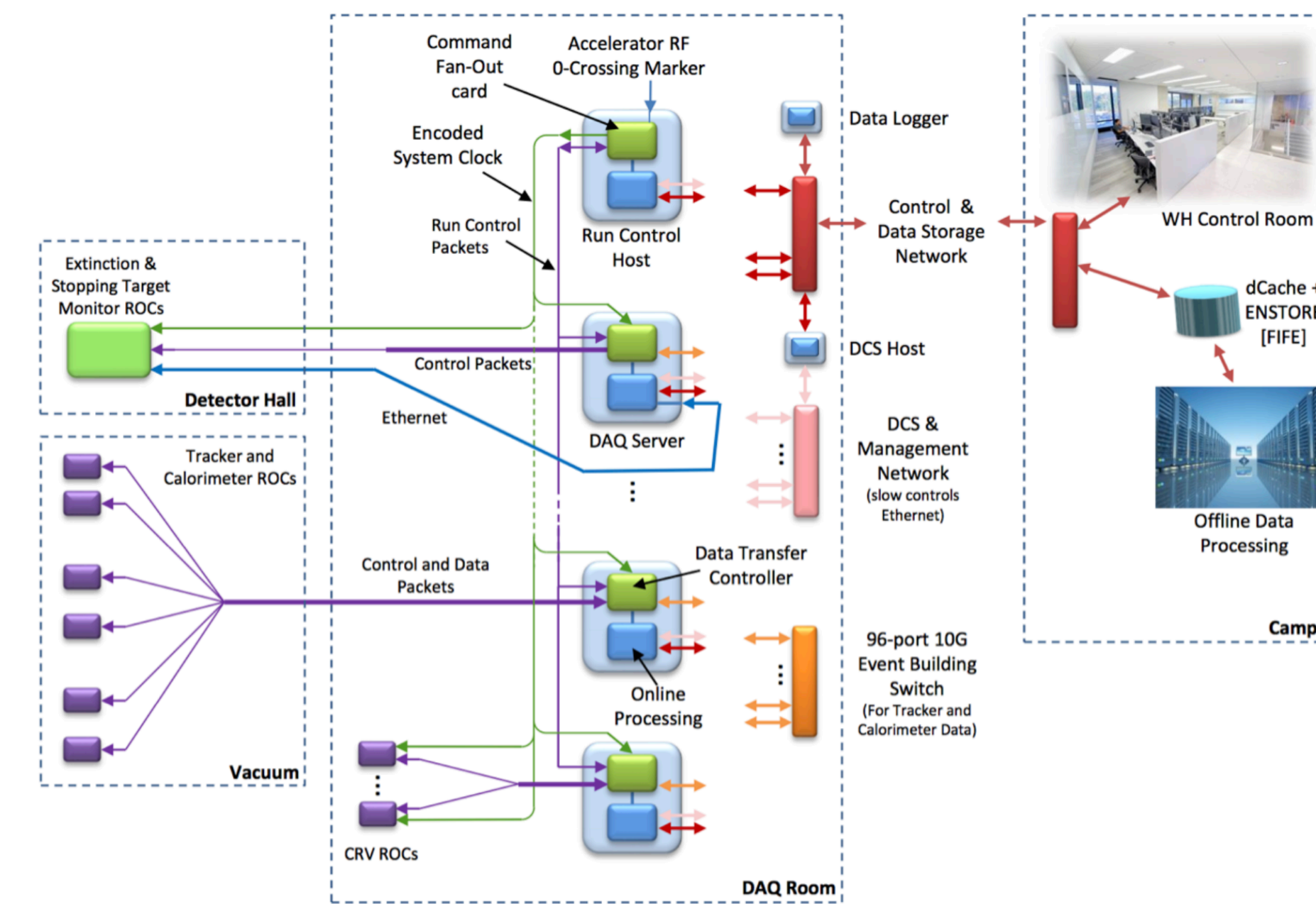
- Protons delivered from Booster Beam to production target. Pions produced. These decay to muons
- Muons travel through the transport solenoid to stopping target. Around $10^{18}/10^{20}$ muons are captured by aluminum nuclei and decay.
- Decay products spiral into straw tracker before reaching calorimeter then muon stopping target.



† Mu2e Experiment Overview

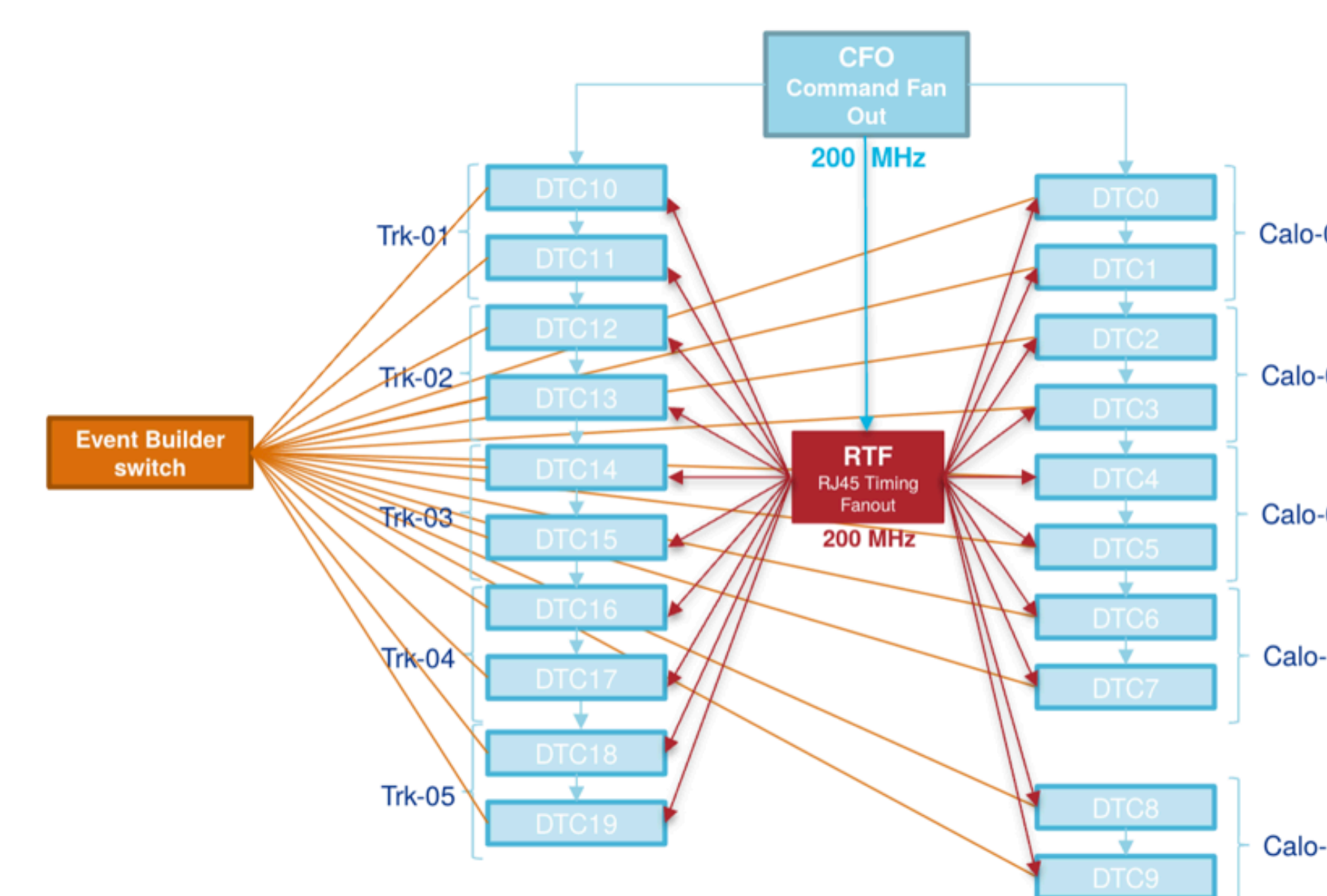


Data Acquisition Flow



‡ Overview of the TDAQ System

Mu2e uses the *otsdaq* software for run controls, and *art* and *artdaq* for data transfer, event building, and reconstruction. Components of data flow include Run Control Hosts, Data Transfer Controllers (DTCs), and Readout Controllers (ROCs).

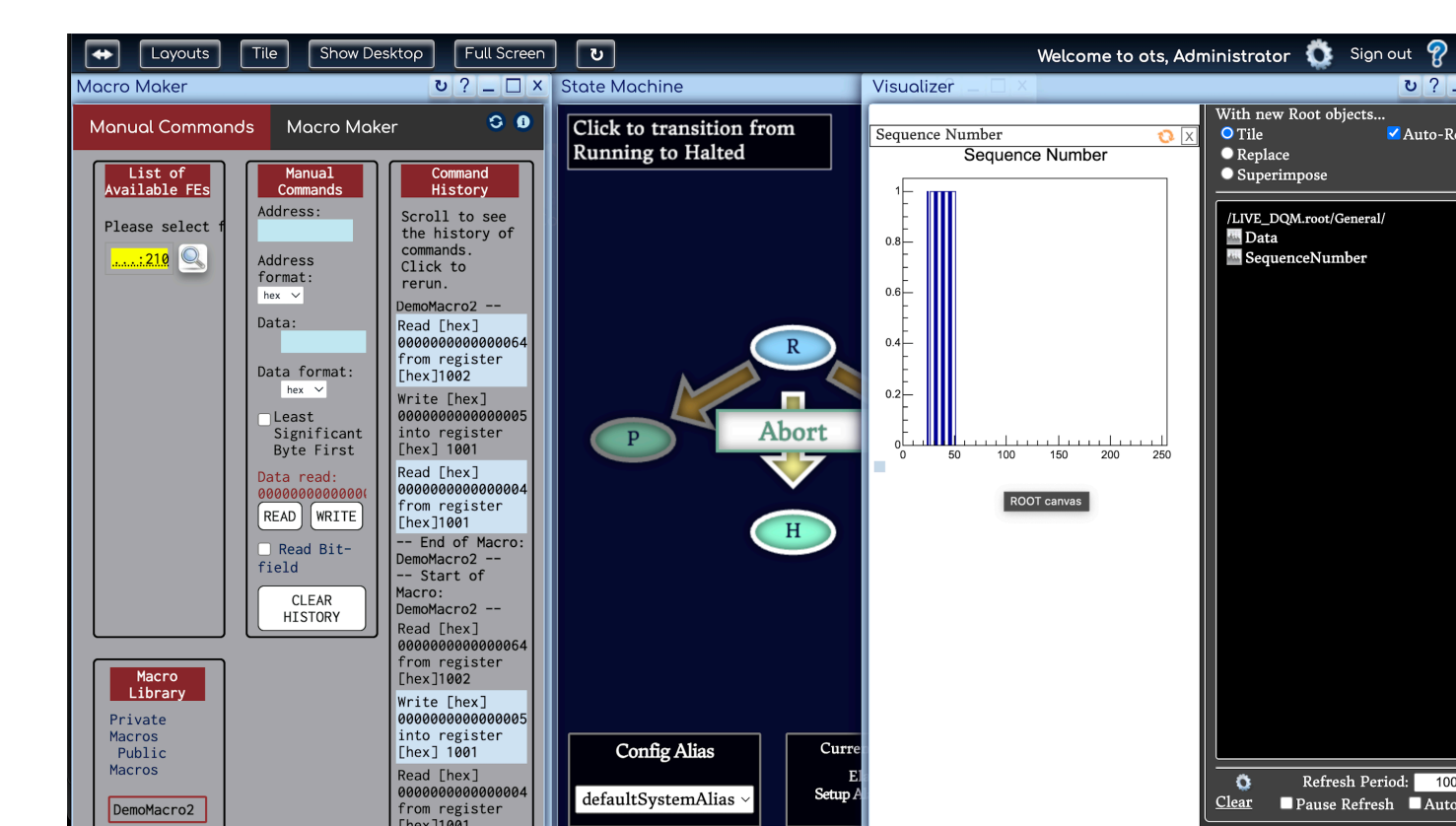


‡ CFO and Event Builder Visualization

otsdaq Documentation: Shift Manual

I created an *otsdaq* Shift Manual with instructions to get started with *otsdaq* and troubleshoot some common errors.

I also updated the *otsdaq* tutorial webpage slide decks with the help of Chase Wayland, Anthony Quail, and Amber Weatherspoon (TARGET students).

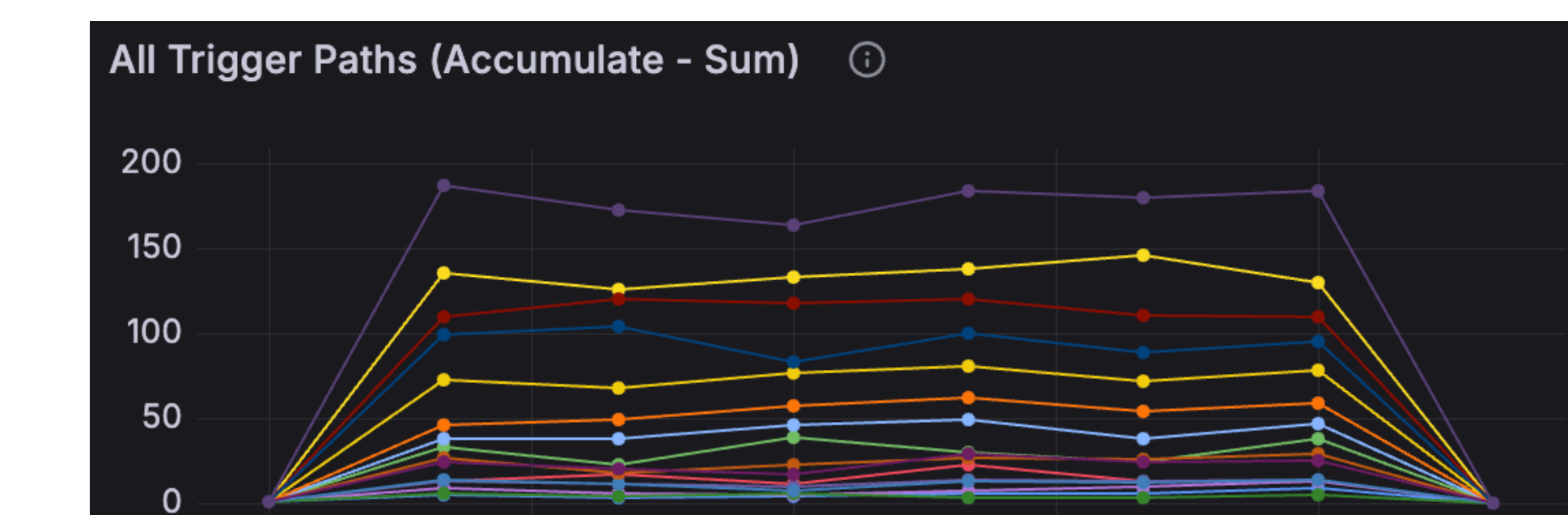


Otsdaq Desktop View

Over the summer, the operating system of Mu2e devices were updated to Alma-Linux 9, and the package manager in use was changed from UPS to Spack. These updates came with a need for updated operating instructions.

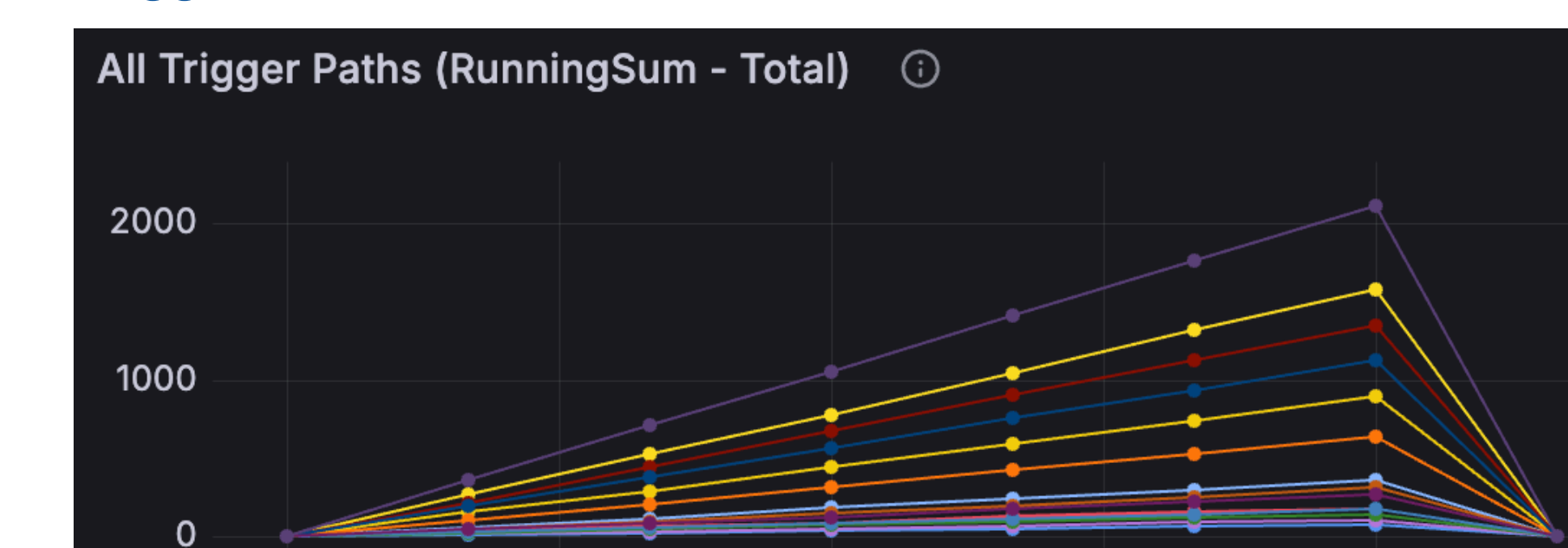
Online Reconstruction Metrics

An art module was added to record and display trigger rates during data-taking. This module was tested with background-only data. Types of trigger rates recorded includes the total passing rate and rates for individual streams, trigger count in an interval, and trigger count in an interval/interval length, and a running sum of counts.



Legend (both plots)

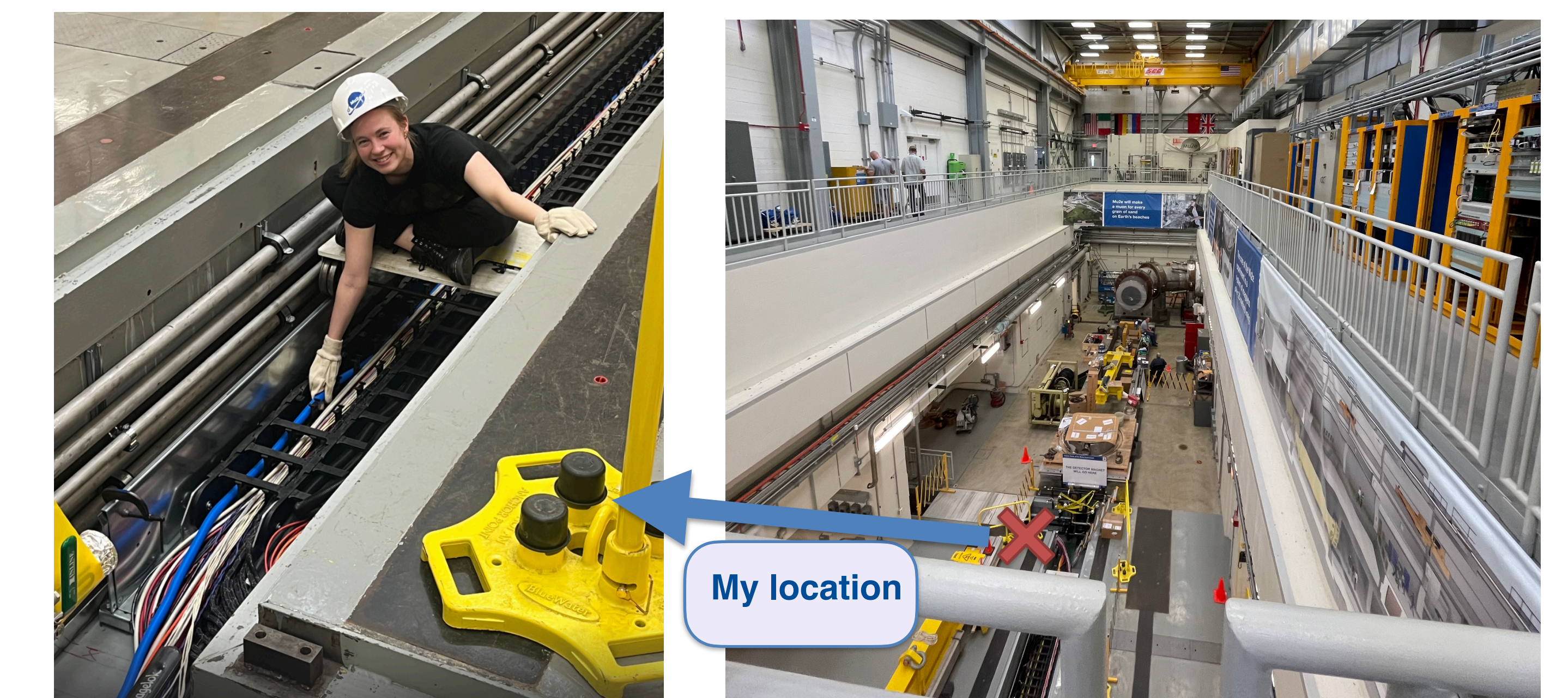
Trigger Path Rates: Rate in an Interval



Trigger Path Rates: Running Sum

Fiber Optic Cable Installation

I assisted in the installation of fiber-optic cables running from the DAQ room down to the detector hall floor. These cables that will transmit data for the calorimeter.



Acknowledgments and References

I would like to thank Dr. Eric Flumerfelt, Mr. Ryan Rivera, and Dr. Gianantonio Pezzullo for their guidance and support over the course of this project.

§ https://www.quantumdiaries.org/wp-content/uploads/2014/03/2000px-Standard_Model_of_Elementary_Particles.svg_.jpg † https://mu2e.fnal.gov/images_v2/mu2edisk.jpg ‡ https://mu2e.fnal.gov/atwork/general/blessed/trigger_DAQ/index.shtml ♠