



Mu2e OTSDAQ - TARGET/VALOR JROTC Interns

Amber Weatherspoon, Chase Wayland, Anthony Quail

TARGET & VALOR presentations

26th July 2024

About Me - Amber Weatherspoon



School:Niles North

From:Skokie, IL

Why Fermi?:

- Competing in multiple events in science olympiad and a research class inspired me to want to do an internship in STEM.
- I also really wanted to learn more about particle physics, coding, and engineering.

What I want to do in the future:

- I want to Major in biomedical sciences in college and become a dermatologist or biomedical scientist

About Me - Chase Wayland



Me on the first day of the internship

School: Francis W. Parker

From: Chicago, Illinois

Why Fermi:

- I'm extremely Interested in Abstract Math, Particle Physics, and Scientific Research
- I wanted to develop lab skills through hands on experience
- Gain work experience in a collaborative and academic environment

What I want to do in the Future:

- Either:
 - Particle Physics research
 - Pure Math
 - Nuclear Engineering
 - Computer science

About Me - Anthony Quail



School: Marmion Academy
From: Campton Hills, Illinois
Why Fermi:

- I was looking for a STEM work experience, and there is no better place for a high schooler to do that than Fermilab.
- It was recommended by my Senior Army Instructor for JROTC.

What I want to do in the Future:

- Medical Doctor:
 - Neurosurgeon
 - Cancer Specialist

Our Supervisors and Mentors



Ryan Rivera

- Supervisor
- Electrical Engineer
- 20+ Years
- Principal investigator for LDRD that launched OTSDAQ, developed, and updates it.



Eric Flumerfelt

- Alternate supervisor
- Computational Physics Developer
- Develops and maintains OTSDAQ



Talia Saarinen

- SULI Intern
- Went to UC Berkeley for undergrad and is going University of British Columbia for a PhD.

Integrated Engineering Research Center - Our Office

- The largest multipurpose building at Fermilab since Wilson Hall.
- 80,000 square feet and is 10 years in the making.
- We worked on the first floor in the cubicles
- We layed wiring along the ground floor hallway as well as installed it in the Mu2e detector hall

Interior and exterior of IERC

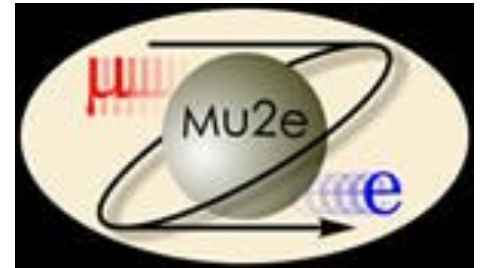
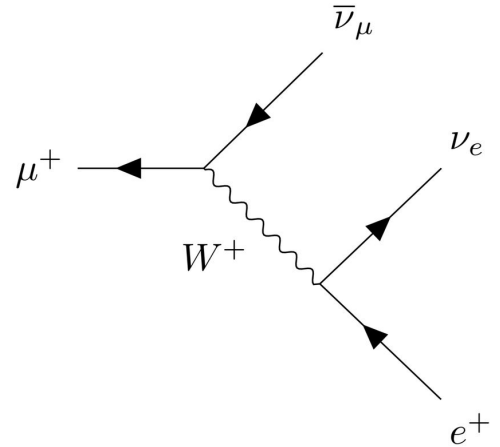


What is Mu2e

Mu2e is an experiment at FermiLab looking for Beyond the Standard Model Physics. The experiment is looking for flavor violations in muon decay as evidence of charged lepton flavor violation.

Typically a muon decays into a 2 neutrinos (a muon and electron neutrino) and an electron with equivalent charge. However, the New Standard Model predicts that one in every 10^{26} muons will decay into an electron without releasing neutrinos.

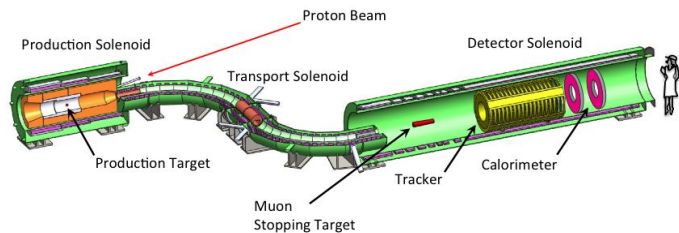
Mu2e has a sensitivity of 10^{-17} , so the experiment is counting on the Standard Model being inaccurate to detect flavor-violating muons reliably. If it regularly detects higher energy electrons, it suggests Beyond the Standard Model Physics.



OTSDAQ - Purpose and Motivation



The OTSDAQ logo



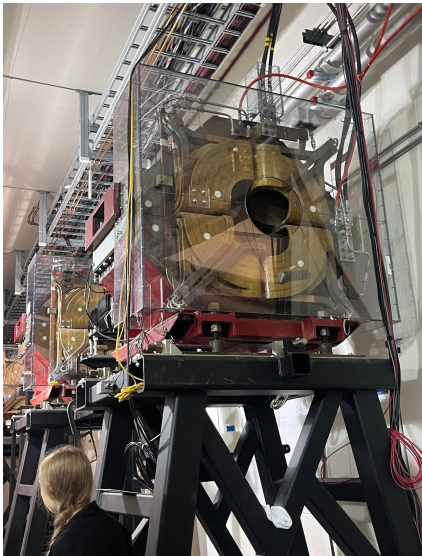
Detectors in Mu2e

The purpose of OTSDAQ is data acquisition on the scale necessary for physics experiments. It is also made to work with inexpensive off-the-shelf hardware for data readout.

The system works directly on the hardware, reading out the Read Out Controllers (ROCs), processing the data and throwing out noise and non-flavor violating hits.

Mu2e will produce 7 petabytes of data over the span of a year of operation, so it's critical to filter out as much data as possible, nearly a 100 to 1 rejection.

Mu2e Detector Hall Pictures



Mu2e Detector Hall Pictures

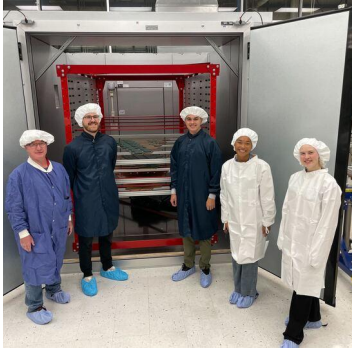


Mu2e Detector Team



We met a few other Fermi employees during our time working in the detector hall. Tom, Jason, and Joe were the adults who gave us the opportunity to lay conduit and wires for the experiment.

It was a great experience to work with the hands-on side of the experience after doing so much technical work. We even have conduits named for each of us in the detector hall!



Reflection- Amber

Favorite Workshops/ Tours

- Tour around Fermilab
- College Admissions Workshop

Favorite Parts

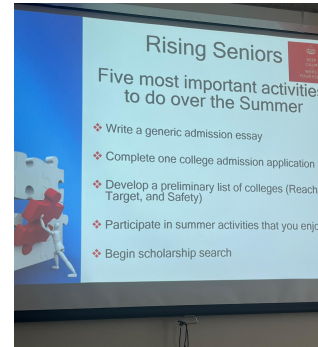
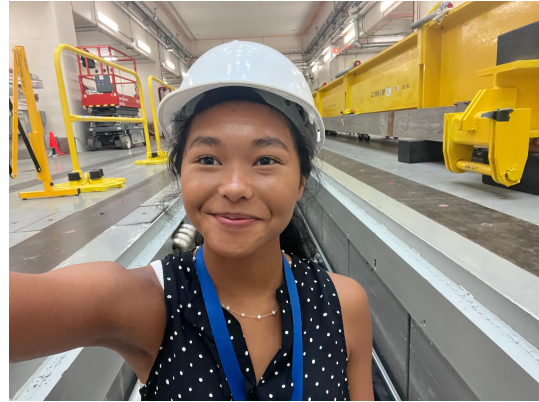
- Laying fiber optic and copper cables for Mu2e
- Learning about Mu2e, particle physics, and medical physics

Takeaway

- I think science is such an intriguing subject with so many different careers and I hope to go into it

Goals:

- Continue to improve my python skills
- Broaden my knowledge of STEM



Reflection - Chase

Favourite Tour

- SQMS (Superconducting Quantum Materials and Sciences lab) tour. I was working through Leonard Susskind Theoretical Minimum so it was especially interesting.

Favourite Parts:

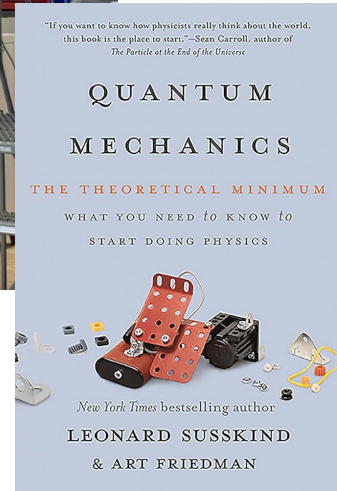
- Contributing to OTSDAQ codebase
- Gaining a greater understanding of BSM physics

Takeaway:

- My interest in math and physics will only grow as a I learn more and I'd like to make it my career

Goal:

- Continue to use lab skills learned through TARGET
- Continue to connect with FermiLab Scientists



Reflection- Anthony

Favorite Workshop:

- Robotics at Fermilab was my favorite workshop, which was presented by Adam Watts.



Favorite parts:

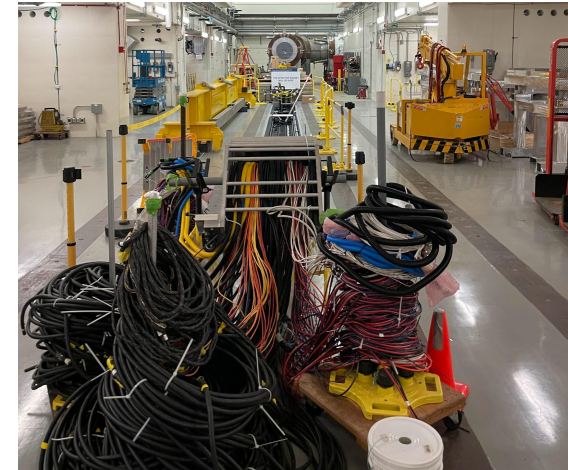
- Working in the Mu2e Detector Hall

Takeaways:

- It is important to go outside your comfort zone, as I gained more knowledge about particle physics than I ever thought I would.

Goals:

- Keep working hard in STEM.
- Continue to apply myself in medicine.



Thank you's

To our Supervisors and Mentors:

Ryan Rivera

Eric Flumerfelt

Talia Saarinen

To the program organizers:

Anahi Ruiz Beltran

Cortez Watkins

The Fermilab staff who volunteered their time to show us the lab and teach our workshops

Personal Thank you's

Amber Weatherspoon

- Mr. Thielsen and Mr. Murphy for writing a phenomenal recommendation for me.
- My whole family for always supporting me through my endeavours.

Anthony Quail

- My parents, who have encouraged my ambitions and curiosity.
- SGM Weldon, for writing me a stellar recommendation letter.

Chase Wayland

- Ms. Brianna Ifft and Mr. Robert Wilson who graciously wrote recommendations for me
- My parents for supporting me through the internship
- The Bus program making sure my fellow interns and I could arrive to Fermilab every day



Thank you for listening!