

Project:

Analysis & Dark Matter Physics Simulation for the Dark Photon

Team Members:

- Nikhil Chaba, [nchaba2021@my.fit.edu](mailto:nchaba2021@my.fit.edu)
- Samuel Rock, [srock2023@my.fit.edu](mailto:srock2023@my.fit.edu)
- Jacob Woods, [jwoods2022@my.fit.edu](mailto:jwoods2022@my.fit.edu)

Faculty Advisor:

- Pietro Iapozzuto, [piapozzuto2015@my.fit.edu](mailto:piapozzuto2015@my.fit.edu)

Clients:

- Dr. Marcus Hohlman - Physics Professor
- Pietro Iapozzuto - Graduate Student with Dr. Hohlman
- Other Graduate Students

Progress of Current Milestone (Matrix):

Task	Completion %	Nikhil	Sam	Jacob	To do
Complete pseudorapidity, momentum, azimuthal, energy, and past related graphs with updated background subtracted signal of dark matter at the end of EIC pipeline	100%	-	50%	50%	-
Streamline the process	-	1/3	1/3	1/3	Can always improve
Get cross-section comparison at the generator level and at the reconstruction level	50%	1/3	1/3	1/3	Get cross-section value(s) at the reco level and compare
Visualization of Tracks	50%	100%	-	-	Produce visualizations off of the data we are finding now, and find/show collision sites

Discussion of each accomplished task (and obstacles) for the current Milestone:

- Task 1: For one pair of values completed, had initial problems in creating the root file for analysis, given the masses. Plan to automate toward multiple values of interest.
- Task 2: Constant ongoing process, so far data creation and analysis have gotten streamlined in repeatability, getting the cross-section and subtraction are still being worked on to get automated/streamlined.
- Task 3: Halfway through for one pair of values, a value has been found in a HEPMC file, but that value is then needed for a calculation in the root file.
- Task 4: Constant ongoing improvement in getting a better image.

Discussion of the contribution of each team member to the current Milestone:

- Nikhil Chaba: Displayed more visualization of the particle collider
- Samuel Rock: Wrote a Python script that scanned through a HEPMC file to find the sigma cross-section value for a given MadGraph run. Wrote part of the Milestone 3 documentation and presentation
- Jacob Woods: Wrote a script to compare matching particles in 2 different root files to calculate background subtraction. Wrote part of the Milestone 3 documentation and presentation

Plan for the next Milestone (Matrix)

Task	Nikhil	Sam	Jacob
Optimize background subtraction and path flow	-	50%	50%
Find a location where physicists should put another detector, aka a vertex	100%	-	-
Continue streamlining and cross-section validation	-	50%	50%

Discussion of each planned task for the next Milestone:

- Task 1: Find a way to automate finding background subtraction for multiple points of interest
- Task 2: Calculate the best position to fit a second detector for better results in finding dark matter
- Task 3: Continue with streamlining the whole and any new processes, and the validation of the cross-section in the given data

Date(s) of meeting(s) with Client during the current milestone:

Client feedback on the current milestone

- x

Date(s) of meeting(s) with Faculty Advisor during the current milestone:

3/31, 4/7, 4/14

Faculty Advisor feedback on each task for the current Milestone

- Task 1:
- Task 2:
- Task 3:
- Task 4:

Faculty Advisor Signature: \_\_\_\_\_ Date: \_\_\_\_\_