

Project:

Analysis & Dark Matter Physics Simulation for the Dark Photon

Team Members:

- Nikhil Chaba, nchaba2021@my.fit.edu
- Samuel Rock, srock2023@my.fit.edu
- Jacob Woods, jwoods2022@my.fit.edu

Advisor:

- Pietro Iapozzuto, piapozzuto2015@my.fit.edu

Clients:

- Dr. Marcus Hohlmann - Physics Professor
- Other Graduate Students

Progress of Current Milestone (Matrix):

Task	Completion %	Nikhil	Sam	Jacob	To do
Integrated a Machine Learning research paper to develop alongside the Weizsacker-Williams approximation	90%	-	1/2	1/2	We have the cross section being calculated, we want to use the machine learning paper to generate events using the cross section
Tested the Weizsacker-Williams approximation codebase	100%	1/3	1/3	1/3	-
Analyzed a gold e-collision at the reconstruction/root level produced from Machine	80%	1/2	-	1/2	We have ran successfully creating a root file, we now want to test different results to confirm the reconstructed root file is correct

learning generator and approximation codebase					
Wrote user manual	10%	1/2	1/2	-	Continue updating with relevant information, maybe add section for knowledge base on T Foam or like-structures we will use in a script/program

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

- **Task 1:** In the goal of replacing MadGraph software with another calculation for the cross section and generating events we have been introduce to two different rearch papers. A machine learning implementation of event generation using a package called T Foam. We have also been using the Weizsacler Williams approximation codebase to implement event/cross section generation. Through combining these two papers we have replaced the original MadGraph pipeline.
- **Task 2:** A key point for testing the Weiszacker Williams approximation algorithm is that we need to translate the code base from python to C. A big challenge for this task is understanding where in the code certain equations are used and then implementing the same equation into our C code base.
- **Task 3:** With our new pipeline we have been able to produce a root file and reconstructed root file. The challenge here is matching the electron energies between branches within the reconstructed root branch. We have not been able to get greater than 15% matching for events.
- **Task 4:** Nothing was added or removed from the user manual documentation, but may add a section for knowledge base/definitions of relevant terms and structures we implement and use.

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

- Nikhil Chaba: Wrote part of the Milestone 5 Presentation. Ran DDSIM on HEPMC and root files, explained T Foam.
- Samuel Rock: Wrote part of the Milestone 5 documentation and presentation. Wrote part of the code analysis for the ML EIC code base.

- Jacob Woods: Wrote part of the Milestone 5 documentation and presentation. Ran lhe through pythia8 script to produce a HepMc file and ran analyzation scripts on the produced reconstructed.root file. Implemented part of the Weiszacker Williams approximation codebase in C.

Plan for the next Milestone (Matrix)

Task	Nikhil	Sam	Jacob
Finished the new pipeline	1/3	1/3	1/3
Analyzed a gold -e collision using new pipeline production	1/3	1/3	1/3
Wrote user manual	1/3	1/3	1/3

Discussion of each planned task for the next Milestone:

- **Task 1:** We want to have the new pipeline fully running and able to be replicated with our results
- **Task 2:** When the pipeline is fully functioning we will be able to analyze the root files production from this new path
- **Task 3:** Update the user manual/lab report.

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

10/26

Client feedback on the current milestone

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

10/8, 10/15, 10/22, 10/26

Faculty Advisor feedback on each task for the current Milestone

- Task 1:

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

Advisor Initials: _____ Date: _____

Client Signature: _____ Date: _____