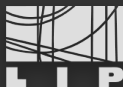


Cosmic Muon Detection Simulation

Lip Final Workshop

Özgür Özer

Professor: Daniel Galaviz
Supervisor: Tomás Correia Sousa



LABORATÓRIO DE INSTRUMENTAÇÃO
E FÍSICA EXPERIMENTAL DE PARTÍCULAS
partículas e tecnologia

08/09/2022



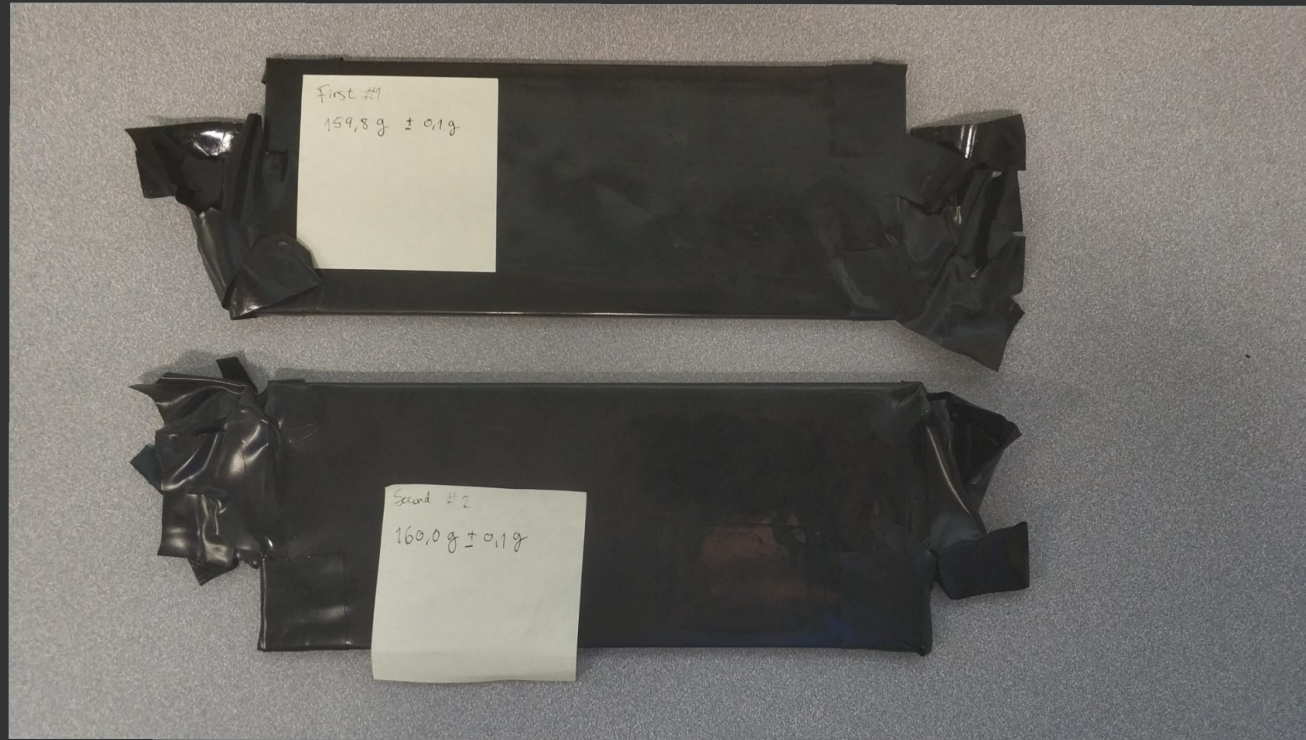
A Brief Introduction



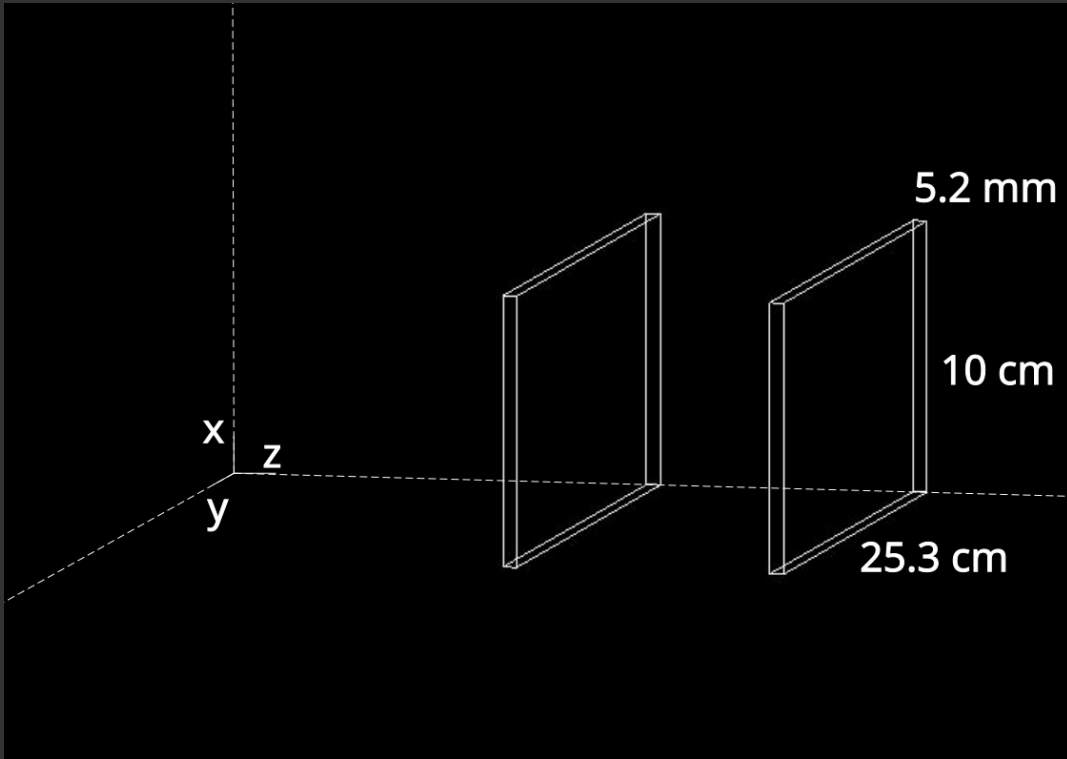
Outline

- 1) Detector Construction
- 2) What is CRY?
- 3) CRY Simulation
- 4) CRY to Geant4 Macro
- 5) Geant4 Results
- 6) Future Work

Detectors

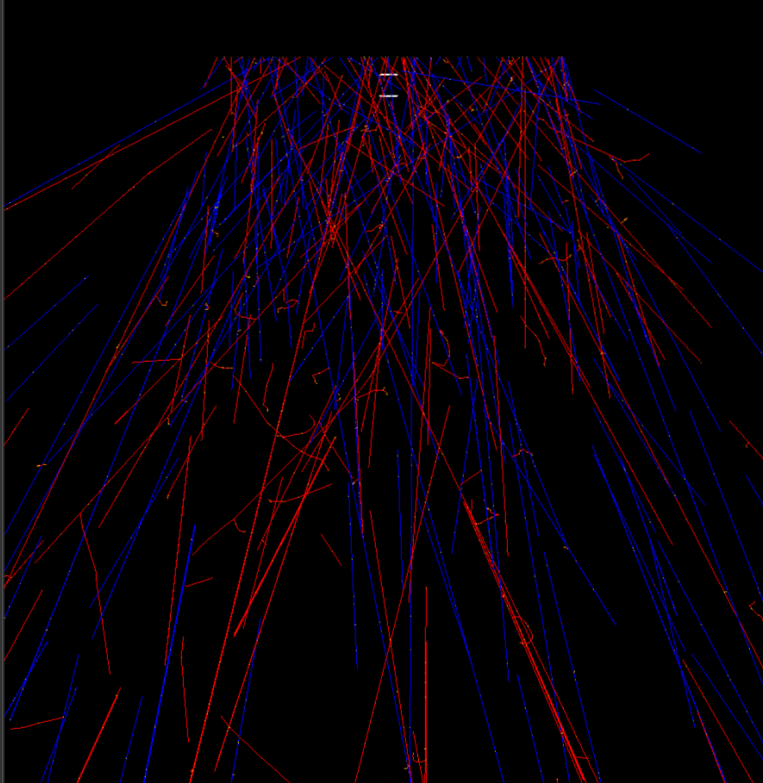


Detector Construction



- Two EJ-200 plastic Scintillator with polyvinyltoluene base
- 253 cm^2 area x 5.2 mm thickness

What is CRY?



Input

- 1)Altitude
- 2)Latitude
- 3)Particles of interest
- 4)Area
- 5)Number of Particles



Output

- 1)Particle type
- 2)Kinetic energy
- 3)Position on the area
- 4)Charge of the particle

<https://nuclear.llnl.gov/simulation/main.html>

CRY Simulation

- Altitude taken was 0 m (sea level)
- Only muons were simulated
- Latitude was 38.717° (Lisbon)
- Over 1 m^2 area perpendicular to the surface of the earth
- 50000 particles

CRY to Geant4 Macro

.csv file

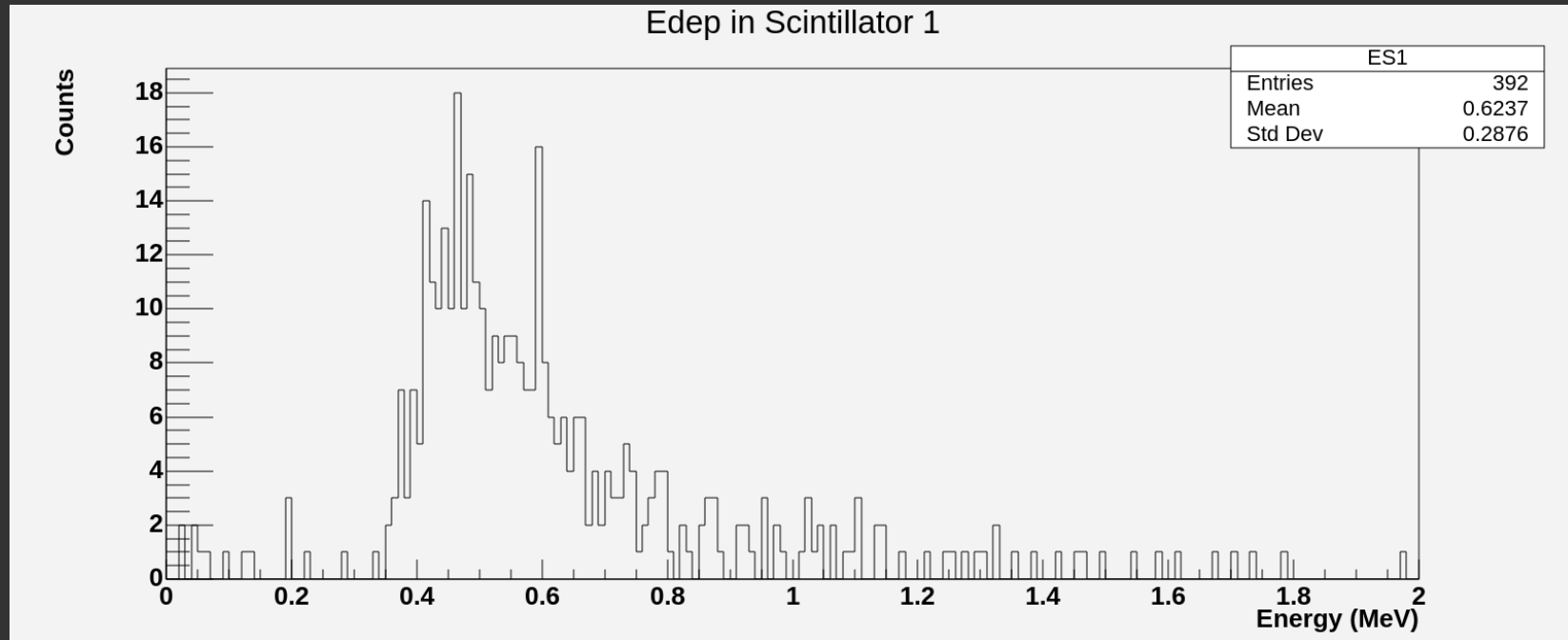
	ke	x	y	z	px	py	pz	charge
1	1413.5	0.131664	-0.492707	0	0.26661	0.254994	-0.929461	1
2	6038.73	-0.31156	0.138744	0	0.0112506	0.585222	-0.810795	1

Python Code

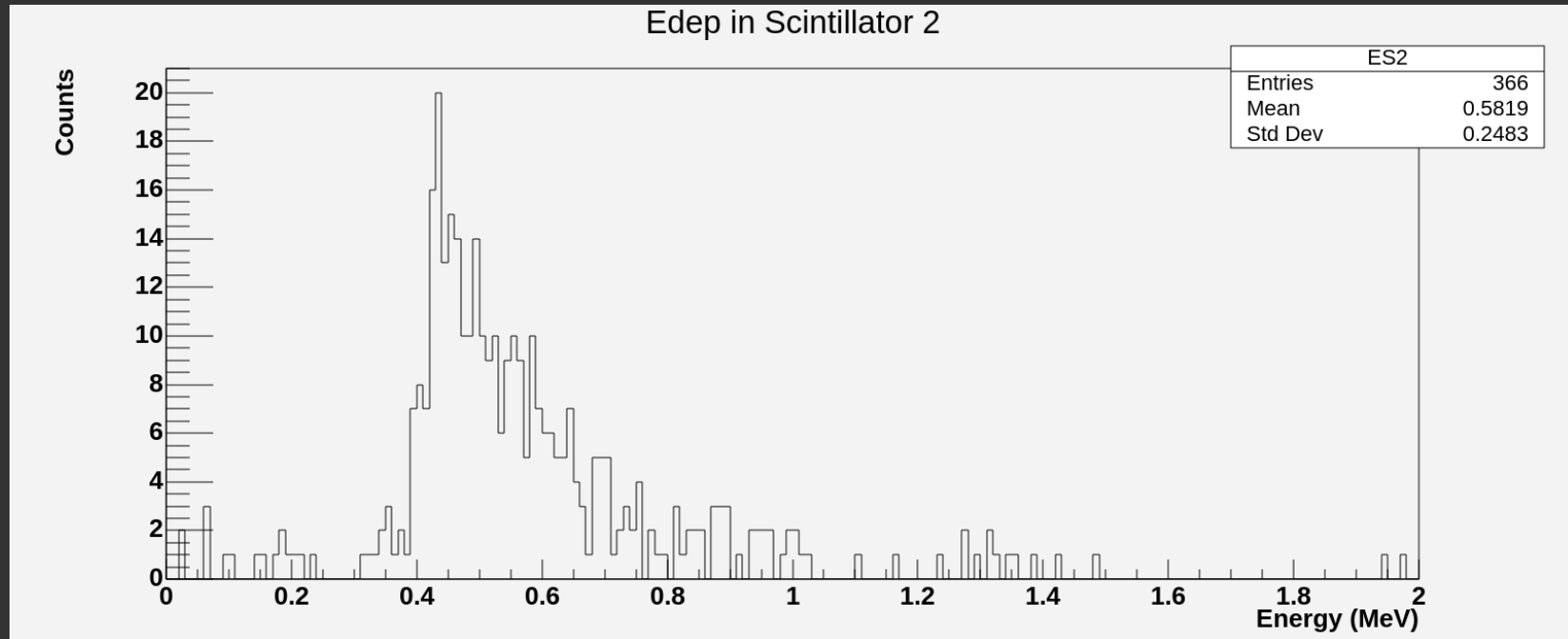
Geant4 Macro

```
1 /gps/source/clear
2 /gps/source/add 1
3 /gps/particle mu+
4 /gps/direction 0.26661 0.254994 -0.929461
5 /gps/ene/mono 1413.5 MeV
6 /gps/position 0.131664 -0.492707 0 m
7 /gps/source/add 1
8 /gps/particle mu+
9 /gps/direction 0.0112506 0.585222 -0.810795
10 /gps/ene/mono 6038.73 MeV
11 /gps/position -0.31156 0.138744 0 m
```

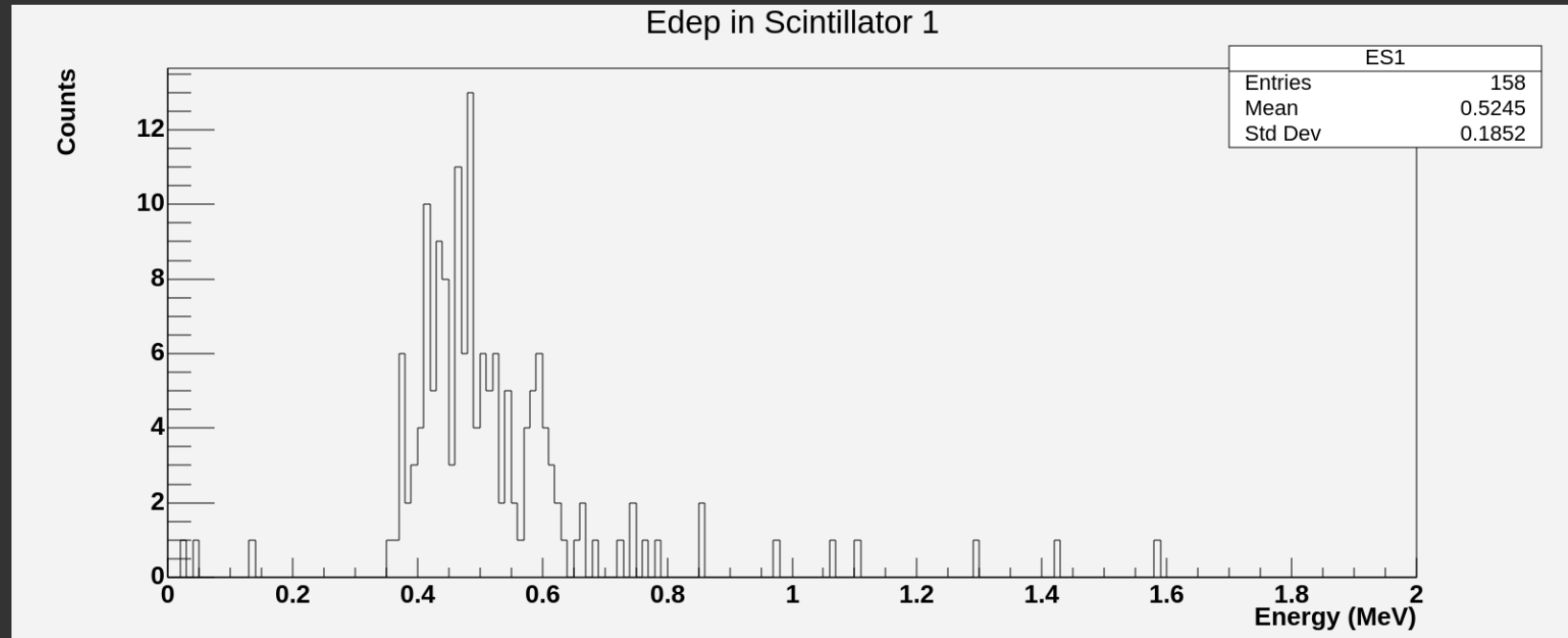

Energy Deposition of Top Scintillator at 0°



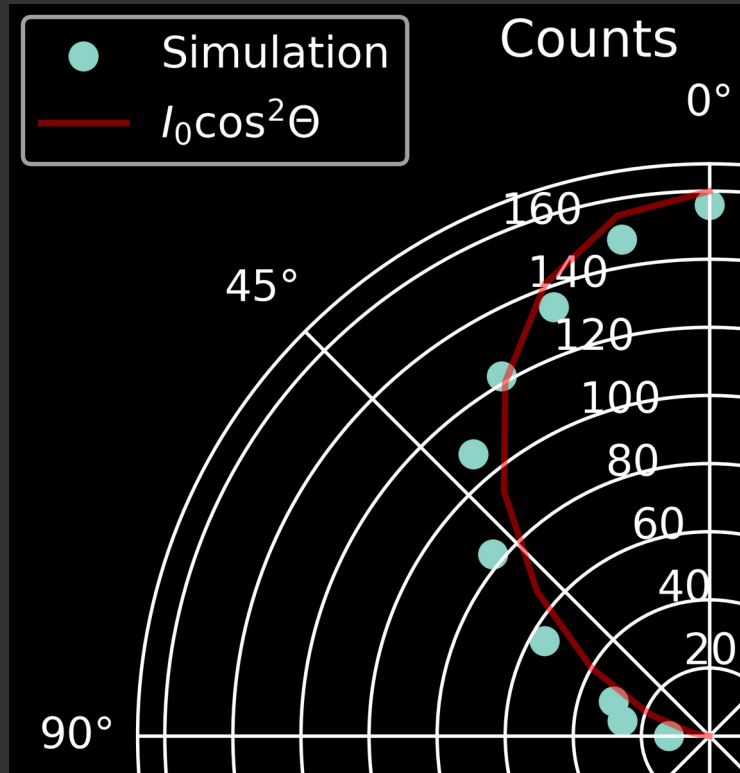
Energy Deposition of Bottom Scintillator at 0°



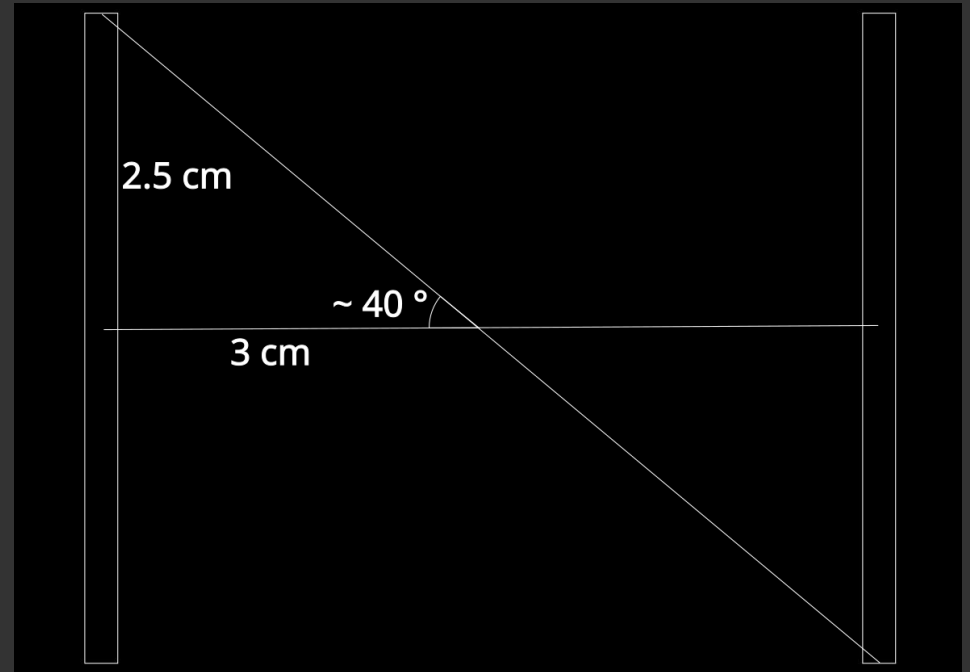
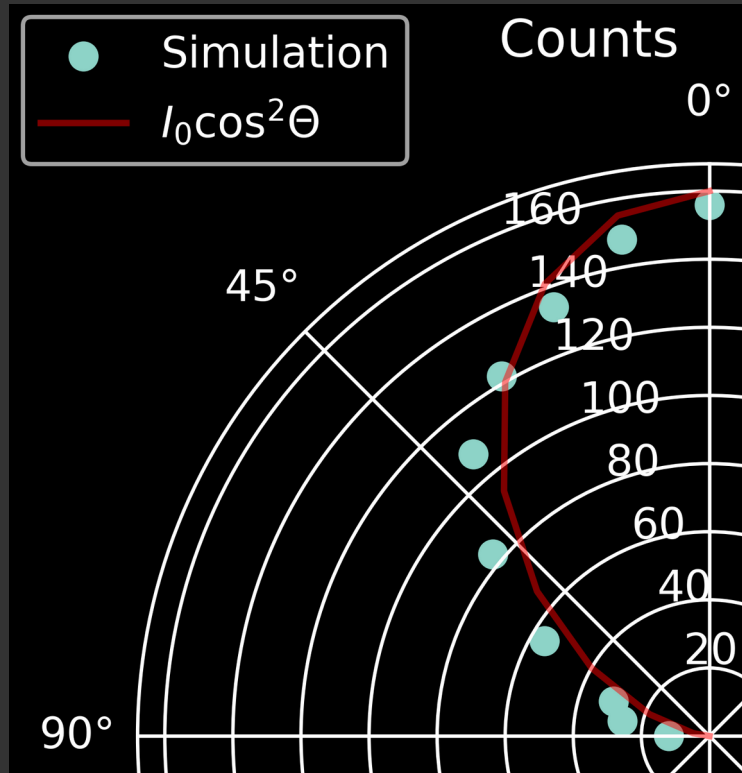
Energy Deposition of Top Scintillator at 0° in Coincidence



Angular Distribution



Angular Distribution



Future Work

- Distributions with varying distance between the detectors
- Energy and angular distribution results at once
- Enlarging the CRY simulated area
- Including particles that may decay to muons in CRY simulation
- Experiment

Thank you for your attention!

ozerozgur@protonmail.com

