Simulation of a Liquid Argon Electromagnetic Calorimeter in Geant4

Dean Reiter
Cornell University

(Dated: May 9, 2025)

I. INTRODUCTION

What is Geant4 -summary -how it works, what it models -when, how, who its used

Scope and goals -goal to learn geant4, motivation - electromagnetic calorimeter - what is a calorimeter, why - electromagnetic vs hadronic - sampling vs homogenous - issues and engineering: efficiency, resolution, sampling fraction -scope: modeling basic calorimeter - example models

II. SIMULATION SETUP

- Detector model - based on example b4d – modified DetectorConstruction, RunAction, EventAction - geometry: layers, absorber, gap - change: geom calculated from layer thickness and material ratio - large size, so energy can only leak by reflecting out incident surface - scoring volumes, energy deposit - change: created scorers for each layer, removed track scorers - event - what is an event - particlegun - electron, variable energy - steps, tracks, scoring - physics list - end of event -change: 2d histograms, profiles, energy deposition, removed track info - run - what is a run - run initialization - analysis manager, end of run - file save - execution and computation - macro file to run 1000 events for various beam E - powershell script to automate runs for various geometries

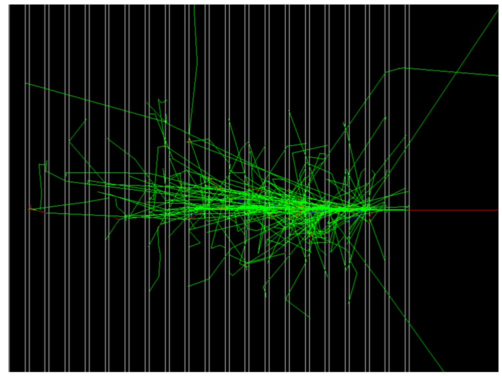

FIG. 1. Visualization of a simulated particle shower produced by a 1 GeV electron in a sampling calorimeter. Cross-sectional view is shown, with the electron incident from the right. The liquid argon and lead layers (white wire-frame) are 8 cm and 2 cm thick, respectively. Tracks are shown for particles with negative charge (red), positive charge (blue), and neutral charge (green).

III. DATA AND ANALYSIS

IV. CONCLUSION

ACKNOWLEDGMENTS

[Acknowledgements]