Geant4 Simulation Science

Instructor: Haruo Ikeda (ikeda@awa.tohoku.ac.jp, RCNS Annex I 03, room 122)
GPPU Experimental Point (GEP): 3

Goal of Study

Geant4 is a toolkit for the simulation of the passage of particles through matter. Its areas of application include high energy, nuclear and accelerator physics, and low energy, neutrino and dark matter physics. This course will cover the toolkit from basic coding through advanced topics. The goal of this study is students will make their own Monte Carlo simulation for their physics detectors.

Contents

This class will give a basic overview on the main characteristics of the Geant4 Monte Carlo toolkit. Theoretical lessons will be coupled to practical exercises that will give the possibility to the student to move the first steps with the code, from the installation, to the run of a simple application. GPPU prepares a laptop linux PC with geant4 installation. Students will learn basic geant4 coding methods (running geant4, geometry construction, primary particles definition, physics lists definition and scoring results) with lectures, write simple example codes by themselves, and analyze the Monte Carlo results. Finally, students will make a simple Monte Carlo simulation and present their simulation results. This class will help students to make and analyze their own Monte Carlo simulations.
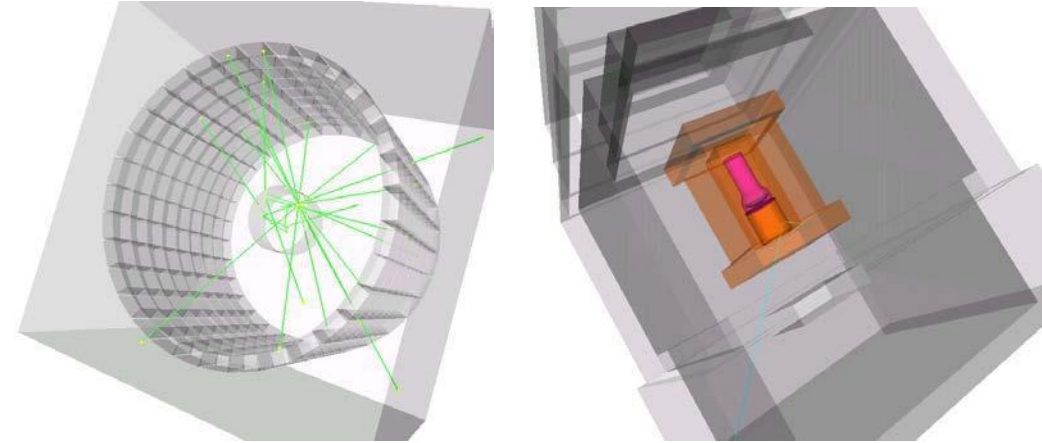
Textbook and References

Handout is provided.
[1] GEANT4 – a simulation toolkit: S. Agostinelli *et al.*, *Nuclear Instruments and Methods in Physics Research A*, **506**, 250-303 (2003).
[2] http://geant4.web.cern.ch/geant4/support/userdocuments.shtml

Progress Schedule

✧ Day 1

Introduction to Geant4 (Lecture)
Geometry and Material (Lecture and Hands-on)

✧ Day 2

Primary Particle (Lecture and Hands-on) Physics (Lecture and Hands-on)

✧ Days 3 (- 4)

Scoring (Lecture and Hands-on)
Simple detector and analysis (Hands-on)

Other Details

Course Period	Feb/Mar 2026
Place	Research Center for Neutrino Science Annex (I 03) 1—5 room 224
Number of Students	1 - 4
Evaluation method	Presentation at last day (100%).

In Addition

A linux computer with geant4 installation is prepared for this class.
Please contact Ikeda in advance if the following requirements apply.
(1. You want to use your own laptop PC. 2. You have never used C++ or Linux.)