Geant4 Advanced Course 2022 @ CERN

Report of Contributions

Contribution ID: **1** Type: **not specified**

Overview

Monday 10 October 2022 14:10 (20 minutes)

- An overview of the topics covered in the course - and how they fit

Presenter: APOSTOLAKIS, John (CERN)

Contribution ID: **2** Type: **not specified**

User Documents and Examples

- Installation Guide
- Application & Toolkit developers manuals
- Physics reference manual
- Basic examples in Geant4 distribution
- Extended and advanced examples in Geant4 distribution
- GitHub, LXR source code browser
- Reporting problems/requirements, HyperNews

Presenter: FOLGER, Gunter

Contribution ID: **3** Type: **not specified**

User Interface - I

- Syntax of UI command
- Interactive mode / batch mode
- G4UIExecutive class

Presenter: NOVAK, Mihaly (CERN)

Contribution ID: **4** Type: **not specified**

Visualization - I

- Introduction to Visualization
- Quick Looks at Visualization Drivers
- Basic Visualization Commands

Presenter: NOVAK, Mihaly (CERN)

Contribution ID: **5** Type: **not specified**

User Actions, Hits and Digits

- Mandatory user actions
- Optional user actions
- Sensitive detectors
- Hit/digits collections

Presenter: POKORSKI, Witold (CERN)

Contribution ID: **6** Type: **not specified**

Scoring

Wednesday 12 October 2022 14:50 (40 minutes)

- Introduction to Scoring
- Command-based scoring
- Sensitive detector vs. primitive scorer
- Basic structure of detector sensitivity
- Sensitive detectors and hits

Presenter: ASAI, Makoto

Contribution ID: **7** Type: **not specified**

Multithreading - I

- Introduction to multithreading
- UI commands for multithreading

Presenter: APOSTOLAKIS, John (CERN)

Contribution ID: **8** Type: **not specified**

Discussion

Monday 10 October 2022 17:45 (15 minutes)

- EM physics
- Hadronic physics

Presenters: RIBON, Alberto (CERN); APOSTOLAKIS, John (CERN); IVANTCHENKO, Vladimir (CERN)

Contribution ID: **9** Type: **not specified**

Material Definition

- Defining Materials
- NIST Material database

Presenter: NOVAK, Mihaly (CERN)

Contribution ID: **10** Type: **not specified**

Geometry - I

- G4VUserDetectorConstruction class
- Geometrical shapes: solids
- Logical & Physical volumes
- Placements, Parametrised, Replicated volumes, basics
- Geometry checking tools
- GDML interface
- Magnetic field, basics

Presenter: COSMO, Gabriele (CERN)

Contribution ID: **11** Type: **not specified**

Hands-on - II

Exercise on physics processes & setup
Electromagnetic examples

Presenters: NOVAK, Mihaly (CERN); IVANTCHENKO, Vladimir (CERN)

Contribution ID: **12** Type: **not specified**

Generators

- G4VUserPrimaryGeneratorAction class
- Primary vertex and primary particle
- Built-in primary particle generators
- Interfaces with external generators

Presenter: POKORSKI, Witold (CERN)

Contribution ID: **13** Type: **not specified**

Physics Lists

Thursday 13 October 2022 15:30 (1h 10m)

- Introduction to Physics Lists
- The Geant4 Physics List interface
- Using pre-packaged physics lists
- How to choose a physics list
- Examples

Presenter: FOLGER, Gunter

Contribution ID: **14** Type: **not specified**

Particles and processes

- Particles
- Processes
- What happens at a step
- Cuts

Presenter: IVANTCHENKO, Vladimir (CERN)

Contribution ID: **15** Type: **not specified**

Event biasing

- Overview
- Geometrical biasing
- Bremsstrahlung splitting

Presenter: ASAI, Makoto

Contribution ID: **16** Type: **not specified**

Additional User classes

Wednesday 12 October 2022 16:00 (30 minutes)

- User limits
- User information classes
- Stack management

Presenter: ASAI, Makoto

Contribution ID: **17** Type: **not specified**

Multithreading

Wednesday 12 October 2022 14:00 (50 minutes)

- Why use multi-threading in Geant4
- What data is shared between threads
- User commands to control threading and regular and error output
- User code / actions in multi-threaded (MT) mode

Presenter: APOSTOLAKIS, John (CERN)

Contribution ID: **18** Type: **not specified**

Hadronics physics II

Thursday 13 October 2022 16:40 (40 minutes)

- Pre-compound and de-excitation models
- Intra-nuclear cascade models (Bertini, Binary, Liege (INCL))
- String models (Fritiof, Quark Gluon String)
- Capture/stopping models
- Fission models
- Elastic process
- Neutron physics
- Ion physics

Presenter: RIBON, Alberto (CERN)

Contribution ID: **19** Type: **not specified**

Questions & Answers

Wednesday 12 October 2022 17:15 (45 minutes)

General discussion on topics raised on Mattermost

Contribution ID: **20** Type: **not specified**

Geometry I

- G4VUserDetectorConstruction class
- Geometrical shapes: solids
- Logical & Physical volumes
- Placements, Parametrised, Replicated volumes, basics
- Geometry checking tools
- GDML interface

Presenter: COSMO, Gabriele (CERN)

Contribution ID: **21** Type: **not specified**

Magnetic Field

Tuesday 11 October 2022 16:00 (1h 15m)

- Magnetic field
- Field integration and other types of field
- Steppers & Interpolation

Presenter: APOSTOLAKIS, John (CERN)

Contribution ID: **22** Type: **not specified**

Physics: particles and processes

Monday 10 October 2022 14:30 (1 hour)

- Particles
- Ions
- Processes
- What happens at a step
- Order of initialisation and execution
- Cuts
- How to prepare custom particle and process

Presenter: IVANTCHENKO, Vladimir (CERN)

Contribution ID: **23** Type: **not specified**

Electromagnetic physics

Monday 10 October 2022 15:50 (1h 5m)

- Energy loss
- Cuts per region
- Models per region
- Atomic de-excitation
- Multiple and single scattering
- Documentation for electromagnetic physics

Presenter: IVANTCHENKO, Vladimir (CERN)

Contribution ID: **24** Type: **not specified**

Electromagnetic physics II - Optical Photons

Thursday 13 October 2022 14:00 (1 hour)

Optical photons - generation, propagation and their physics processes

Presenter: HOWARD, Alexander (Imperial College (GB))

Contribution ID: **25** Type: **not specified**

Open Discussion

Any Geant4 topic - submit questions on Mattermost

Presenters: HOWARD, Alexander (Imperial College (GB)); APOSTOLAKIS, John (CERN); NOVAK, Mihaly (CERN); IVANTCHENKO, Vladimir (CERN)

Contribution ID: **26** Type: **not specified**

Fast Simulation

- Fast parameterised simulation
- G4VFastSimulationModel
- G4FastSimulationManagerProcess
- Use of “Ghost” volumes
- Techniques of fast simulation
- Demo/Exercises

Presenter: ZABOROWSKA, Anna (CERN)

Contribution ID: **27** Type: **not specified**

Physics Biasing

Physics biasing techniques

Presenters: RIBON, Alberto (CERN); ASAI, Makoto

Contribution ID: **28** Type: **not specified**

Definition of UI commands

Wednesday 12 October 2022 16:30 (20 minutes)

- G4UIExecutive
- Definition of custom UI commands

Presenter: ASAI, Makoto

Contribution ID: **29** Type: **not specified**

Event Biasing

Friday 14 October 2022 14:00 (50 minutes)

- Introduction
- Early Provided Biasing Options
- Primary Particle Biasing
- Options In Hadronic
- Geometry-based importance biasing
- Weight Window Technique
- User defined biasing
- Reverse Monte-Carlo
- Generic Biasing Scheme

Presenter: VERDERI, Marc (Centre National de la Recherche Scientifique (FR))

Contribution ID: **30** Type: **not specified**

Fast Simulation

Friday 14 October 2022 16:00 (1 hour)

- Fast parameterised simulation
- G4VFastSimulationModel
- G4FastSimulationManagerProcess
- Use of “Ghost” volumes
- Techniques of fast simulation

Primary author: ZABOROWSKA, Anna (CERN)

Presenters: RIBON, Alberto (CERN); ZABOROWSKA, Anna (CERN)

Contribution ID: **31** Type: **not specified**

Afternoon Session 1

Contribution ID: **32** Type: **not specified**

Afternoon Session 2

Contribution ID: **33** Type: **not specified**

Physics Biasing

Friday 14 October 2022 14:50 (30 minutes)

Physics biasing techniques

Presenter: RIBON, Alberto (CERN)

Contribution ID: **34** Type: **not specified**

Discussion

Friday 14 October 2022 15:20 (20 minutes)

- Event biasing
- Physics biasing

Presenters: RIBON, Alberto (CERN); VERDERI, Marc (Centre National de la Recherche Scientifique (FR))

Contribution ID: **35** Type: **not specified**

Questions & Answers

Friday 14 October 2022 17:00 (30 minutes)

General discussion
Answers on topics raised on Mattermost

Contribution ID: **36** Type: **not specified**

Geometry

Tuesday 11 October 2022 14:00 (1h 15m)

- Placements, Replicated and Parameterised volumes, introduction
- Divided volumes
- Geometrical regions
- Touchables and Nested parameterisations
- Assembly volumes
- Reflected volumes
- Geometry optimization
- Parallel geometries
- Moving geometries
- CAD interface

Presenter: COSMO, Gabriele (CERN)

Contribution ID: **37** Type: **not specified**

Discussion

Thursday 13 October 2022 15:00 (20 minutes)

Optical Physics

Presenter: HOWARD, Alexander (Imperial College (GB))

Contribution ID: **38** Type: **not specified**

Discussion

Thursday 13 October 2022 17:20 (35 minutes)

- Physics lists
- Hadronic physics

Presenters: RIBON, Alberto (CERN); FOLGER, Gunter

Contribution ID: **39** Type: **not specified**

Hadronic Physics - I

Monday 10 October 2022 16:55 (50 minutes)

Introduction (what is it, why we need it, what are the challenges)
Overview of the hadronic physics framework
Hadronic cross-sections
Hadronic final-state models
Hadronic data libraries

Presenter: RIBON, Alberto (CERN)

Contribution ID: **40** Type: **not specified**

Discussion on UI, user actions and scoring

Wednesday 12 October 2022 16:50 (25 minutes)

- UI commands
- User actions
- Scoring

Presenter: ASAI, Makoto

Contribution ID: **41** Type: **not specified**

Scoring (repeat)

- Sensitive detectors & Hits
- Basic scoring commands
- Advanced scoring

Presenters: APOSTOLAKIS, John (CERN); ASAI, Makoto

Contribution ID: **42** Type: **not specified**

Definition of UI commands (repeat of morning)

- G4UIExecutive
- Definition of custom UI commands

Presenters: APOSTOLAKIS, John (CERN); ASAI, Makoto

Contribution ID: **43** Type: **not specified**

Additional User classes (repeat)

- User limits
- User information classes
- Stack management

Presenters: APOSTOLAKIS, John (CERN); ASAI, Makoto

Contribution ID: **44** Type: **not specified**

Discussion

- UI commands
- User actions
- Scoring

Presenter: APOSTOLAKIS, John (CERN)

Contribution ID: **45** Type: **not specified**

Practicalities (repeat - adapted)

- Welcome to the (time-shifted) course
- Practical aspects - Zoom, Mattermost, Questions, …

Presenter: APOSTOLAKIS, John (CERN)

Contribution ID: **46** Type: **not specified**

Multithreading II

- thread safety
- split classes

Presenter: APOSTOLAKIS, John (CERN)

Contribution ID: **47** Type: **not specified**

Discussion

Tuesday 11 October 2022 17:15 (20 minutes)

Magnetic Field

Presenter: APOSTOLAKIS, John (CERN)

Contribution ID: **48** Type: **not specified**

Discussion

Tuesday 11 October 2022 15:15 (20 minutes)

Geometry

Presenters: Dr COSMO, Gabriele (CERN); APOSTOLAKIS, John (CERN)

Contribution ID: **49** Type: **not specified**

Welcome and Practicalities

Monday 10 October 2022 14:00 (10 minutes)

- Welcome to the course
- Practical aspects - Zoom, Mattermost, Questions, ...

Presenter: APOSTOLAKIS, John (CERN)

Contribution ID: **50** Type: **not specified**

Homework of Day 1

Tuesday 11 October 2022 17:35 (40 minutes)

Questions from exercises provided on Day 1