



User Documents and Examples

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Acknowledgment

- Some of the slides shown were originally created for previous Geant4 tutorials and provided with courtesy for this course
- We wish to thank our Geant4 colleagues for allowing us to re-use their material
- The credits for slides re-used in this presentation
 - D. Wright, SLAC, G4 tutorial at KISTI, 2012



Outline

- User documents
 - Installation Guide,, Application Developers' Guide, Physics Reference Manual, Toolkit Developers Guide
- Examples
 - Basic, extended and advanced examples
- User Aids
 - LXR source code browser
 - HyperNews User Forum

Geant4 Web Pages

<http://geant4.cern.ch>

Geant 4

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Search Geant4

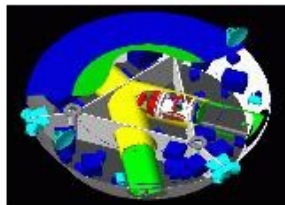
Geant4 is a toolkit for the simulation of the passage of particles through matter. Its areas of application include high energy, nuclear and accelerator physics, as well as studies in medical and space science. The two main reference papers for Geant4 are published in *Nuclear Instruments and Methods in Physics Research A* [506 \(2003\) 250-303](#), and *IEEE Transactions on Nuclear Science* [53 No. 1 \(2006\) 270-278](#).

Applications



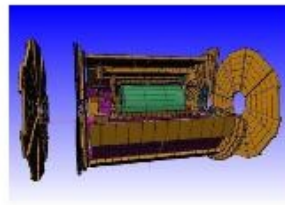
A [sampling of applications](#), technology transfer and other uses of Geant4

User Support



[Getting started, guides and information](#) for users and developers

Results & Publications



[Validation of Geant4](#), results from experiments and publications

Collaboration



[Who we are](#): collaborating institutions, [members](#), organization and legal information

News

- *29 June 2012 - **Release 9.6 BETA** is available from the [Beta download](#) area.*
- *20 April 2012 - **Patch-04** to **release 9.4** is available from the [archive download](#) area.*
- *27 March 2012 - **Patch-01** to **release 9.5** is available from the [download](#) area.*
- *8 March 2012 - [2012 planned developments](#).*
- *4 November 2011 - **Geant4-MT prototype 9.4.p01** is available from the [download](#) area.*

Events

- [Geant4 Tutorial at Jefferson Lab](#), Newport News, Virginia (USA), **9-13 July 2012**.
- [17th Geant4 Collaboration Meeting](#), Chartres (France), **10-14 September 2012**.
- [Past events](#)

User Documents

- URL:
geant4.web.cern.ch/geant4/support/userdocuments.shtml
- Installation Guide
- Application Developers Guide
- Toolkit Developers Guide
 - For those who want to contribute to the extension of the functionality of the Geant4 toolkit
- Physics Reference Manual
 - A detailed description of the physics interactions provided in the Geant4 toolkit

Installation Guide

- URL:
- geant4.web.cern.ch/geant4/UserDocumentation/UsersGuides/InstallationGuide/html/ (link)
- List of supported platforms
 - Currently Linux, Mac OSX, Windows
- List of required software
 - C++ compiler, GNUmake, CMake, Geant4 toolkit
 - Choices for visualization software
- How to install using CMake or GNUmake
- How to make an executable program
 - geant4.web.cern.ch/geant4/UserDocumentation/UsersGuides/ForApplicationDeveloper/html/ch02s07.html#sect.HowToMakeExec.Cmake.ExampleB1 (link)

Application Developers Guide

- URL:
- geant4.web.cern.ch/geant4/UserDocumentation/UsersGuides/ForApplicationDeveloper/html/index.html (link)
- Introduces new users to Geant4 toolkit
- Describes the most useful tools
- Describes how to set up and run a simulation application
- Intended as an overview of the toolkit, not an exhaustive treatment. For more details:
 - [Physics Reference Manual](#)
 - [Toolkit Developers' Guide](#)

Physics Reference Manual

- URL:
- geant4.web.cern.ch/geant4/UserDocumentation/UsersGuides/PhysicsReferenceManual/fo/PhysicsReferenceManual.pdf
(link)
- Presents the theoretical formulation, model or parameterization of the physics interactions included in Geant4
- Describes the probability of occurrence of an interaction and the sampling mechanisms required to simulate it
- Serves as a reference for toolkit users and developers who wish to consult the underlying physics of an interaction
- The manual contains some gaps in documentation - we're working on it
- Now distributed only in pdf

Toolkit Developers Guide

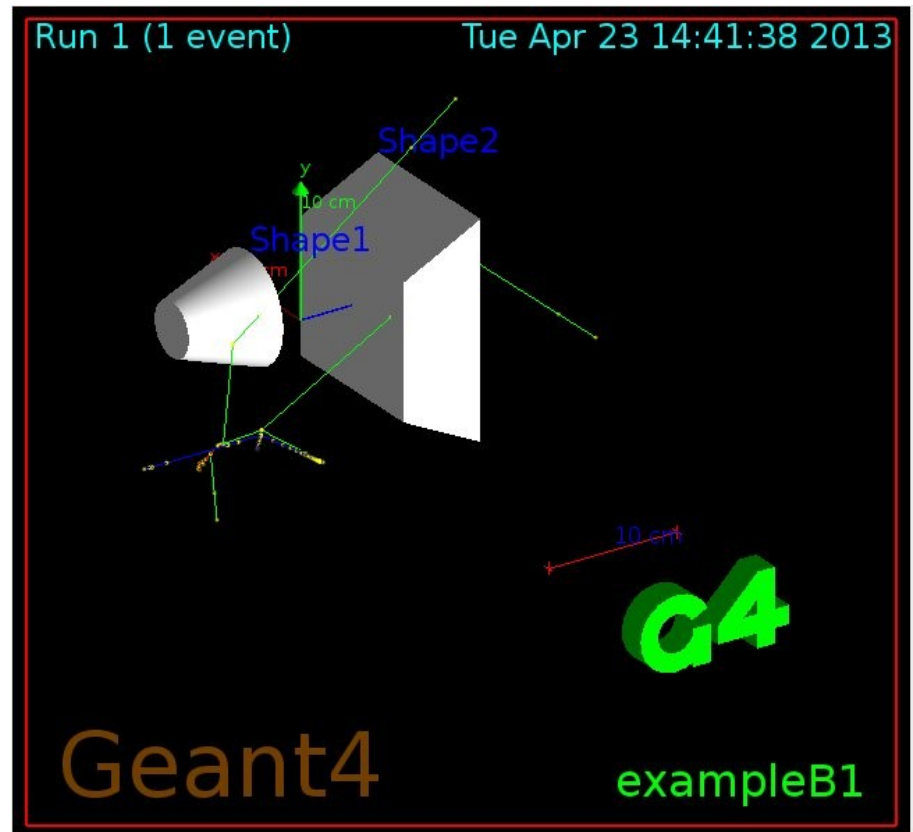
- URL:
- geant4.web.cern.ch/geant4/UserDocumentation/UsersGuides/ForToolkitDeveloper/html/index.html (link)
- For developers and experienced users of Geant4
 - already familiar with functionality of Geant4 toolkit as explained in the "User's Guide For Application Developers"
 - A working knowledge of programming using C++ is assumed
- Includes
 - A description of the object oriented design of the Geant4 toolkit
 - Philosophy behind design choices
 - A guide for users who want to extend the functionality of Geant4: adding new solids, modifying the navigator, creating new fields, etc.

Examples

- Basic examples
 - Four examples oriented to “novice” users
 - Covering the most typical use-cases of a Geant4 application with keeping simplicity and ease of use
- Extended examples -> purpose:
 - Test and validate processes and tracking
 - Demonstrate Geant4 tools
 - Extend the functionality of Geant4
- Advanced examples -> purpose:
 - Illustrate realistic applications of Geant4 in typical experimental environments
- Extended and advanced examples currently undergoing redesign and upgrade

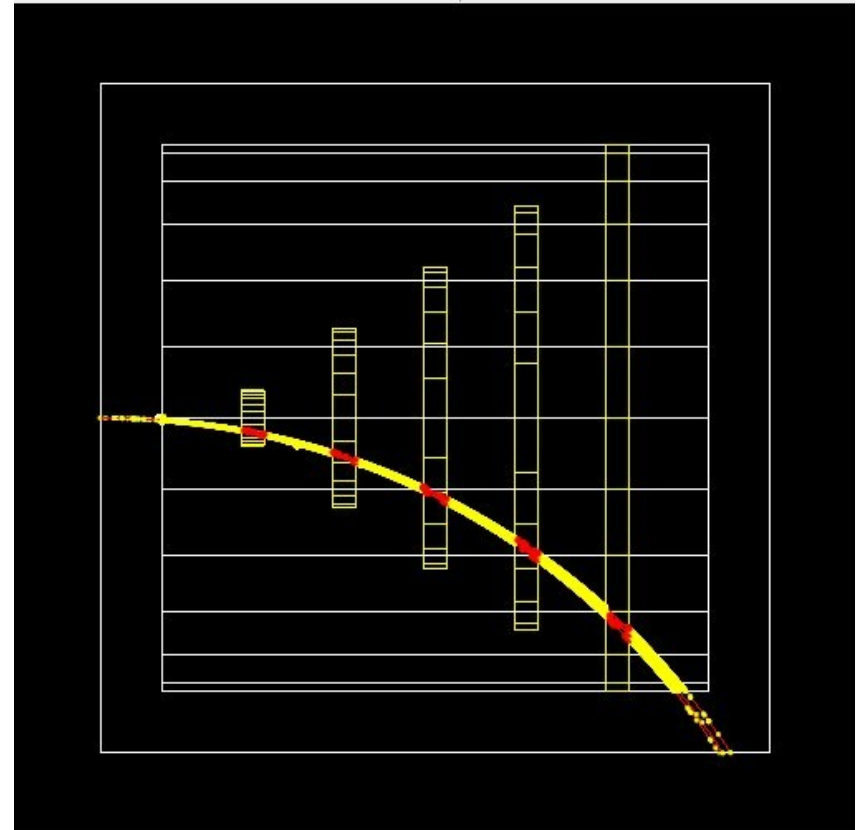
Example B1

- Simple geometry with a few solids
- Geometry with simple placements (G4PVPlacement)
- Scoring total dose in a selected volume via user action classes
- Geant4 physics list (QBBC)



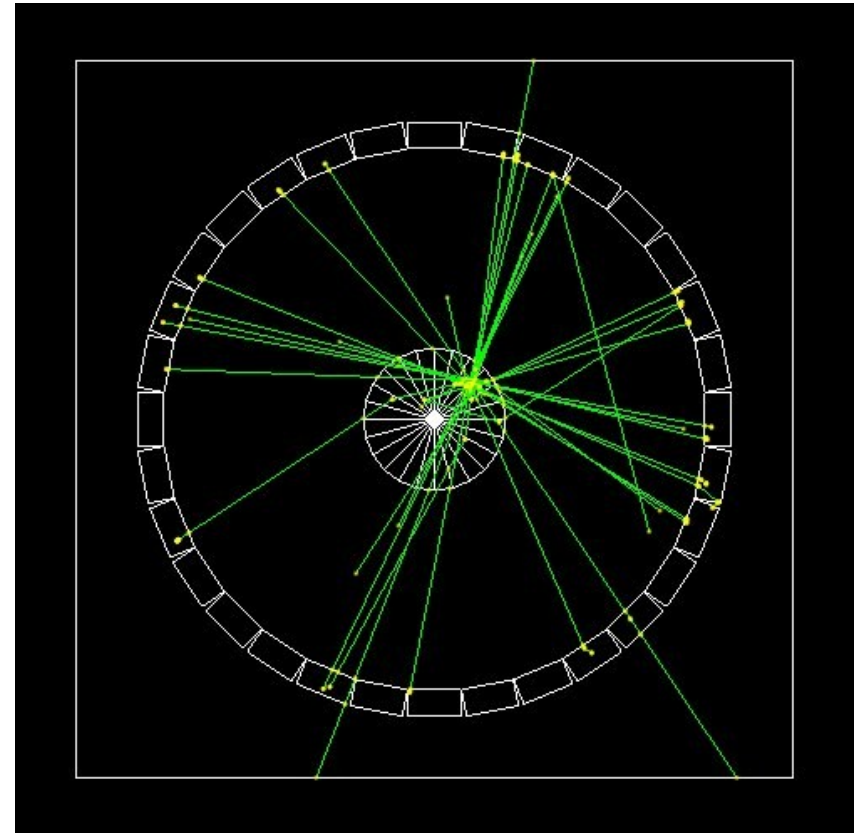
Example B2

- Simplified tracker geometry with global constant magnetic field
- Geometry with simple placements (G4PVPlacement) and parameterisation (G4PVParameterisation)
- Scoring within tracker via G4 sensitive detector and hits
- Geant4 physics list (FTFP_BERT) with step limiter



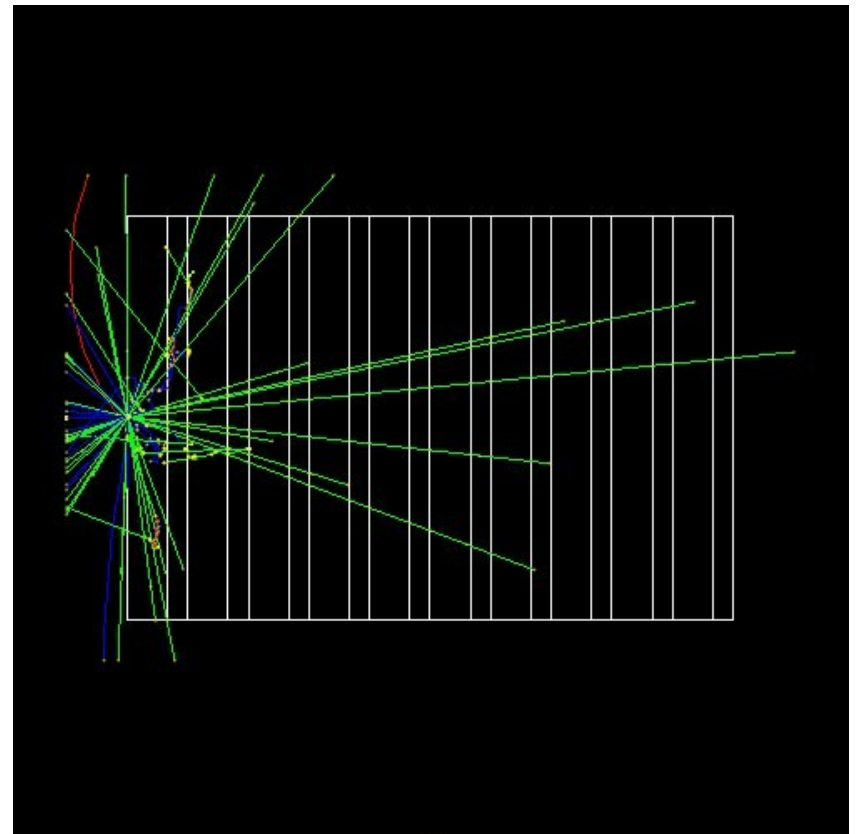
Example B3

- Schematic Positron Emitted Tomography system
- Geometry with simple placements with rotation (G4PVPlacement)
- Radioactive source
- Scoring within Crystals via G4 scorers
- Modular physics list built via builders provided in Geant4



Example B4

- Simplified calorimeter with layers of two materials
- Geometry with replica (G4PVReplica)
- Scoring within layers in 4 ways:
 - a) via user actions
 - b) via user own object
 - c) via G4 sensitive detector and hits
 - d) and via scorers
- Geant4 physics list (FTFP_BERT)
- UI commands defined using G4GenericMessenger



Extended Examples

- Section 10.3 of Application Developers Guide
- Examples for testing and validation of processes and tracking:
 - electromagnetic (TestEm0 - TestEm18)
 - hadronic (Hadr00 - Hadr02)
 - EM field (field01 - field04)
 - Geometry (volume overlap test)
- Examples to demonstrate Geant4 tools:
 - analysis, event generator, persistency, visualization
 - biasing (B01 - B02), optical, run and event
- Examples which extend the functionality of Geant4
 - parallel computing (ExDINE, MPI and TopC)

Advanced Examples

- Section 10.4 of Application Developers Guide
- Examples of realistic applications of Geant4 in typical experimental environments
 - Gamma ray telescope, X-ray telescope, underground physics, hadron therapy, human phantom, ...
- Examples of how to use analysis tools (histograms, ntuples, plotting and so on)
- Visualization examples
- Examples of advanced user interface facilities

LXR Code Browser

- URL: www-geant4.kek.jp/LXR/ (link)
- Search entire Geant4 source tree by
 - File name (e.g. G4Track.hh)
 - Identifier
 - Text
- Result: a source file fully hyper-linked to classes and methods
 - Tells where classes and methods are defined
 - Also where they are referenced
- Also have a Doxygen version:
 - www-geant4.kek.jp/Reference (link)

HyperNews User Forum

- URL:
- hypernews.slac.stanford.edu/HyperNews/geant4/cindex (link)
 - See also top of Geant4 home page
- Discuss problems with other users, post questions for experts, etc.
- 23 forums roughly based on Geant4 categories
- 4 forums for specific application areas
- New forums may be requested by users
- To join: click on "New Member" at top of page and fill out form

Summary

- User guides:
 - Installation and Application Developers Guides tell you how to get started building Geant4 and then building and running a simulation
 - Physics Reference Manual and Toolkit Developers Guide to learn about the physics of Geant4 and for a deeper knowledge of the structure and philosophy of Geant4
- Examples
 - Basic, Extended, Advanced
- A cross reference browser (LXR) is available for studying source code (also Doxygen)
- A user forum is available for sharing ideas, asking questions