



User Documents and Examples I

SLAC Geant4 Tutorial

7 March 2006

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Geant4 V8 p01



Outline

- User Documents
 - Application Developers' Guide
 - Installation Guide
- Novice Examples
 - Simple: trivial detector with non-interacting particles
 - Detailed: complex detector with full physics
- User Aids
 - LXR source code browser
 - HyperNews User Forum



New Geant4 Web Pages

<http://geant4.web.cern.ch/geant4>

Geant 4

[Download](#) | [User Forum](#) | [Gallery](#) | [Site Index](#)
[Contact Us](#)

Search Geant4

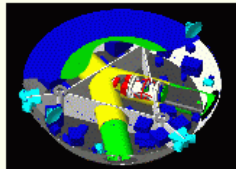
Geant4 is a toolkit for the simulation of the passage of particles through matter. Its areas of application include high energy, nuclear and accelerator physics, as well as studies in medical and space science. The two main reference papers for Geant4 are published in Nuclear Instruments and Methods in Physics Research, [NIM A 506 \(2003\) 250-303](#), and J. Allison et al., IEEE Trans. Nucl. Sci. 53, February 2006 (in press).

Applications



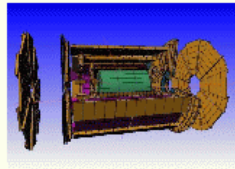
A [sampling of applications](#), technology transfer and other uses of Geant4

User Support



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

Results & Publications Collaboration



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



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

News

- ◆ *10 February 2006* - Patch 01 of release 8.0 is available from the [download](#) area.
- ◆ *16 December 2005* - Geant4 release **8.0** is available from the [download](#) area.
- ◆ [less recent news](#)

Events

- ◆ [4-day Geant4 tutorial](#), SLAC, Stanford (USA), **7-10 March 2006**.
- ◆ 4-day Geant4 tutorial, Jefferson Lab, Newport News, Virginia (USA), **22-25 May 2006**.
- ◆ [past events](#)

The [original web pages](#) will be available during the transition period.

[Applications](#) | [User Support](#) | [Results & Publications](#) | [Collaboration](#) | [Site Map](#)
[XHTML 1.0](#) | [CSS2](#)
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Last update: Fri 24 Feb 2006 02:30:52 PM PST



Installation Guide

- URL:
<http://geant4.web.cern.ch/geant4/G4UsersDocuments/UsersGuides/InstallationGuide/html/index.html>
- List of required software
 - C++ compiler, CLHEP, GNU make, Geant4 toolkit
 - choices for visualization software
- How to install on Linux
- Tips for installing on Windows



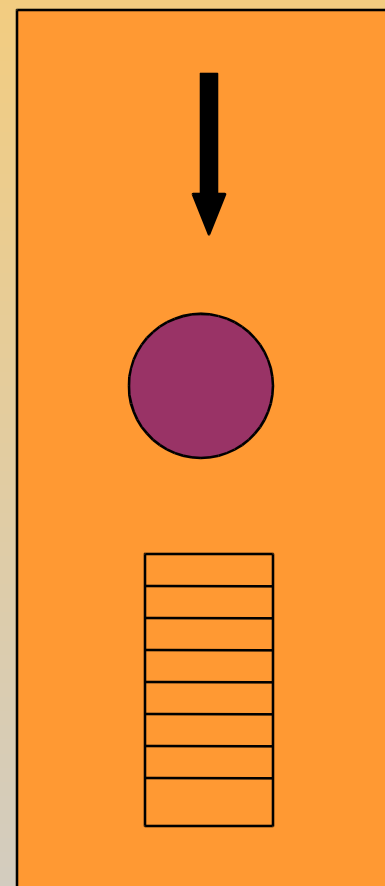
Application Developers Guide

- URL:
<http://geant4.web.cern.ch/geant4/G4UsersDocuments/UsersGuides/ForApplicationDeveloper/html/index.html>
- Introduces new users to the 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](#)



Novice Example N01

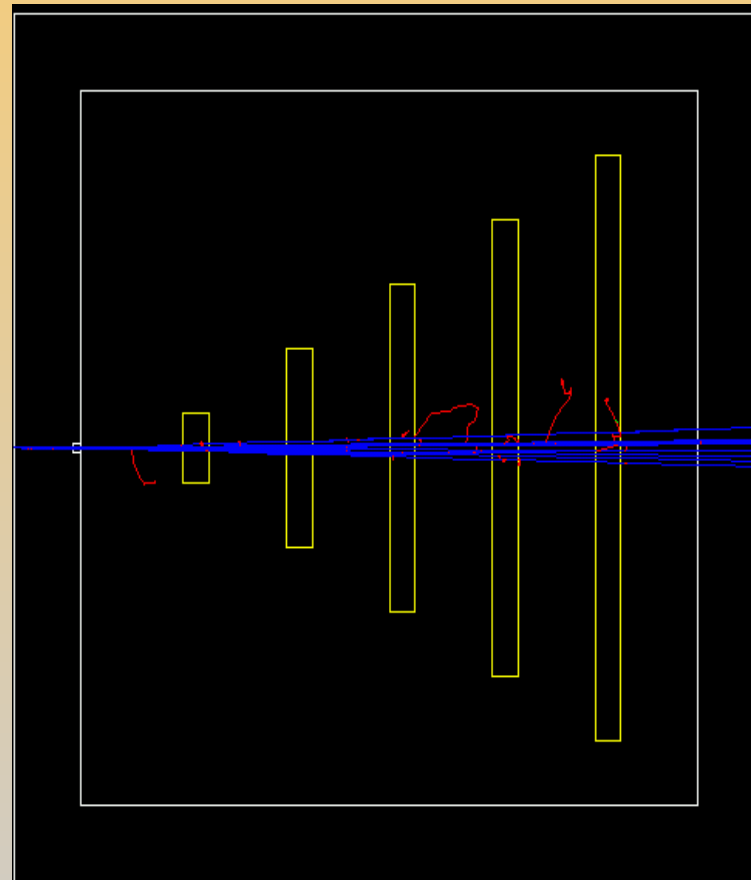
- Fixed geometry: Ar gas mother volume with Al cylinder and Pb block with Al slices
- Incident particle is a geantino – no physics interactions
- No magnetic field and only the transportation process is enabled
- Hard coded batch job and verbosity





Novice Example N02

- Pb target, Xe gas chambers (parameterized volumes)
- All EM processes + decay included for γ , charged leptons and charged hadrons
- Detector response
 - Trajectories and chamber hit collections may be stored
- Visualization of detector and event
- Command interface introduced
 - Can change target, chamber materials, magnetic field, incident particle type, momentum, etc. at run time

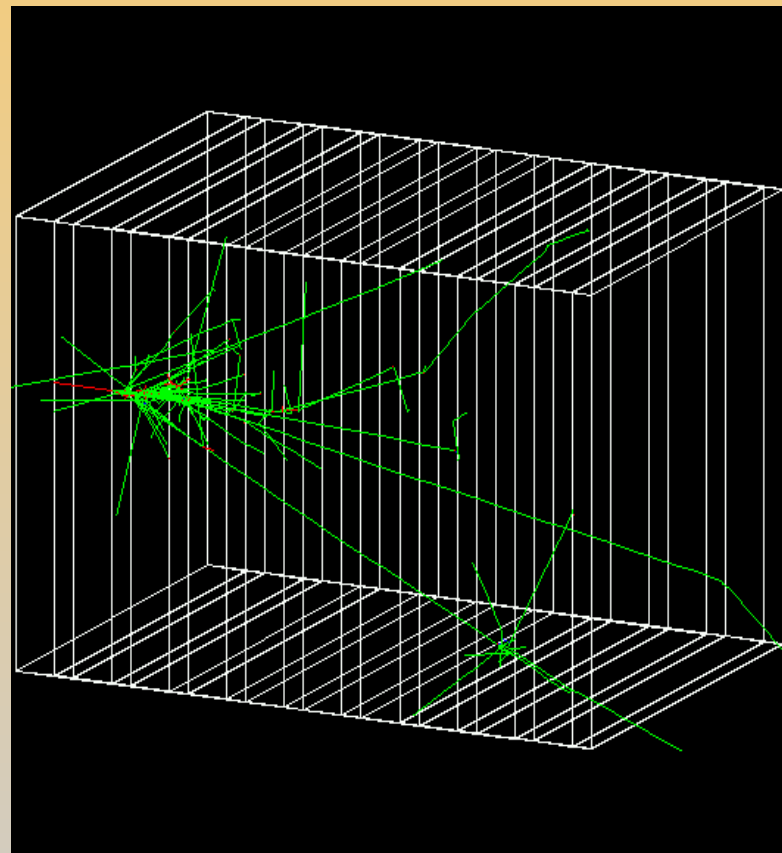




Novice Example N03

- Sampling calorimeter with layers of Pb absorber and liquid Ar detection gaps (replicas)
- Exhaustive material definitions
- Command interface
- Randomization of incident beam

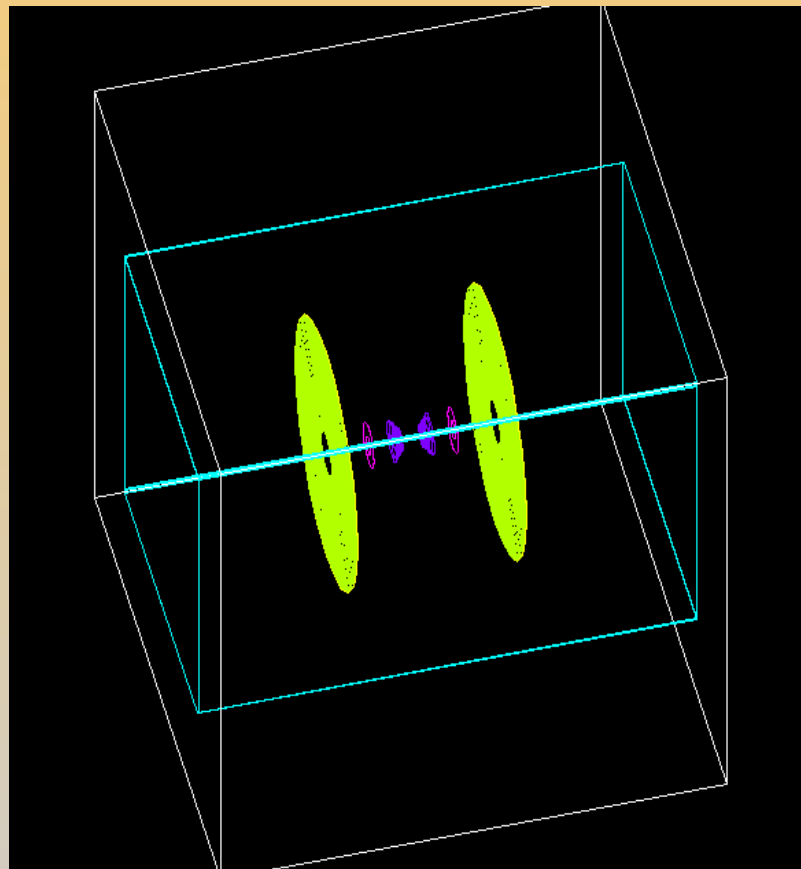
- All EM processes + decay, with separate production cuts for γ , e^+ , e^- (use for shower studies)
- Detector response: E deposit, track length in absorber and gap
- Visualization tutorial
- Random number seed handling





Novice Example N04

- Simplified collider detector
 - all kinds of volume definitions
- Magnetic field
- PYTHIA primary event generator
 - Higgs decay by Z^0 , lepton pairs
- Full set of EM + hadronic processes
 - Should use updated hadronic physics lists
- Event filtering by using stacking mechanism





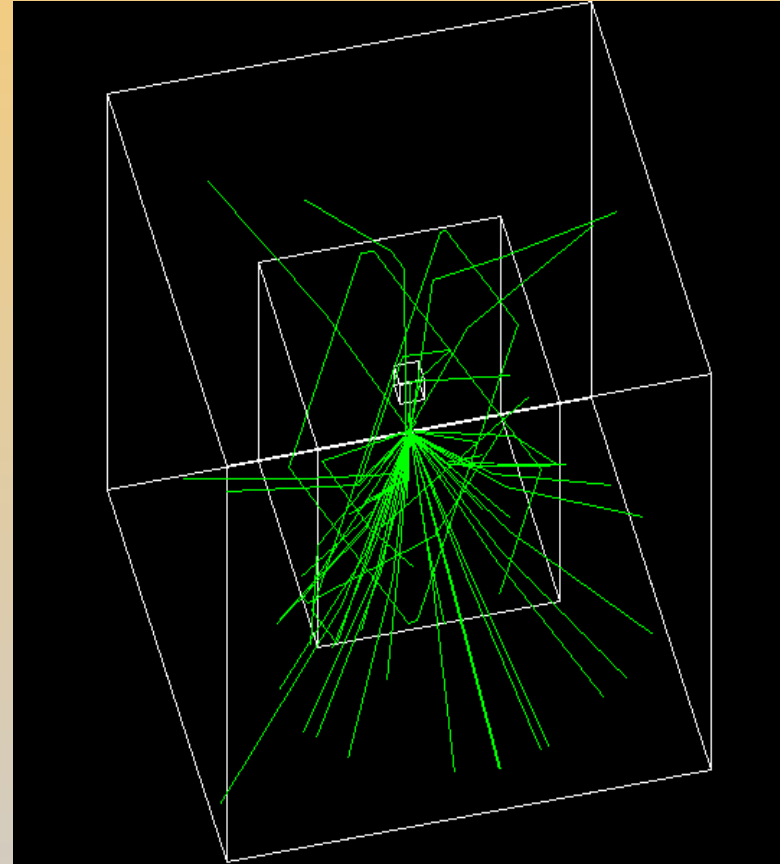
Novice Example N05

- Fast simulation with parameterized showers
 - EM showers (derived from `G4VFastSimulationModel`)
 - Pion showers (for illustration only – not used)
- EM physics only
 - Use of `G4FastSimulationManagerProcess`
- Simplified collider detector geometry
 - Drift chamber
 - EM, hadronic calorimeter
 - Ghost volume



Novice Example N06

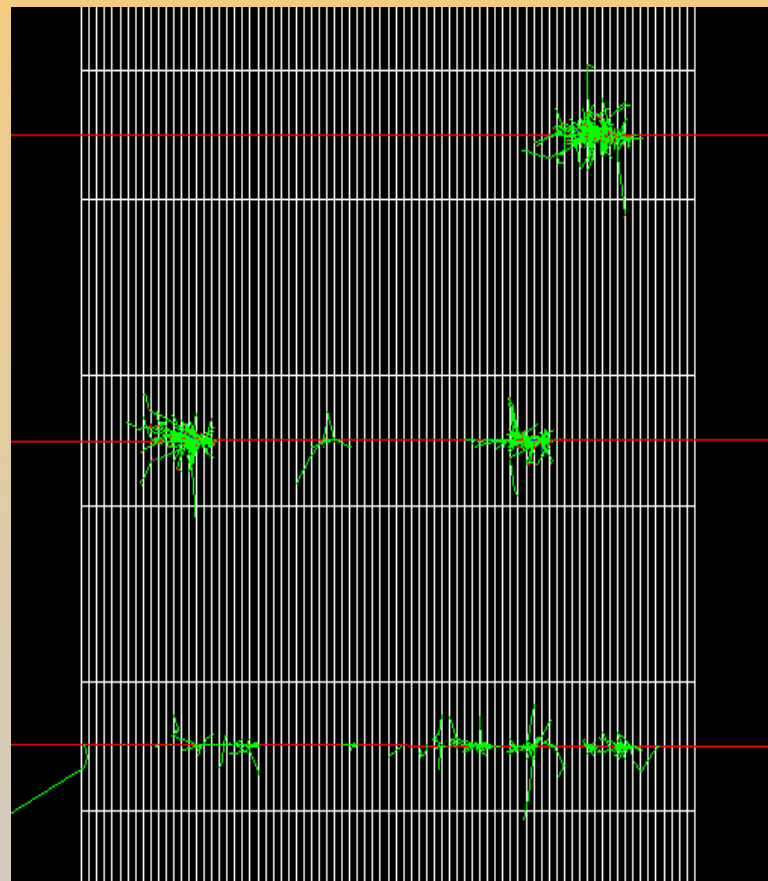
- Water Cerenkov detector with air “bubble”
- Materials
 - Specification of optical properties
 - Specification of scintillation spectra
- Physics
 - Optical processes
 - Generation of Cerenkov radiation, energy loss collected to produce scintillation





Novice Example N07

- 3 simplified sandwich calorimeters (Pb, Al, Ar)
- Run-based (as opposed to event-based) hit accumulation
- Changing geometries without re-building world
- Setting different secondary production cuts for each calorimeter using G4Region





LXR Code Browser

- URL: <http://www-geant4.kek.jp/LXR/>
- Search entire Geant4 source tree by
 - filename (e.g. G4Track.hh)
 - text
 - identifier
- Results: a source file fully hyper-linked to classes and methods
 - tells where classes and methods are defined
 - also where they are referenced



HyperNews User Forum

- URL: <http://geant4-hn.slac.stanford.edu:5090/Geant4-HyperNews/index>
- See also top of Geant4 home page
- Discuss problems with other users, post questions for experts, etc.
- 18 forums roughly based on Geant4 categories
- 3 forums for specific application areas
- New forums may be requested by users
- To join: click on “Membership” at bottom of page and fill out form



Summary

- **Installation and Application Developers Guides** tell you how to get started building and running a simulation
- There are 7 **novice examples** ranging from very easy to complex
 - Can use these as templates for your application
- A **cross reference browser (LXR)** is available for studying source code
- A **user forum** is available for sharing ideas, asking questions