Geant4 Documentation

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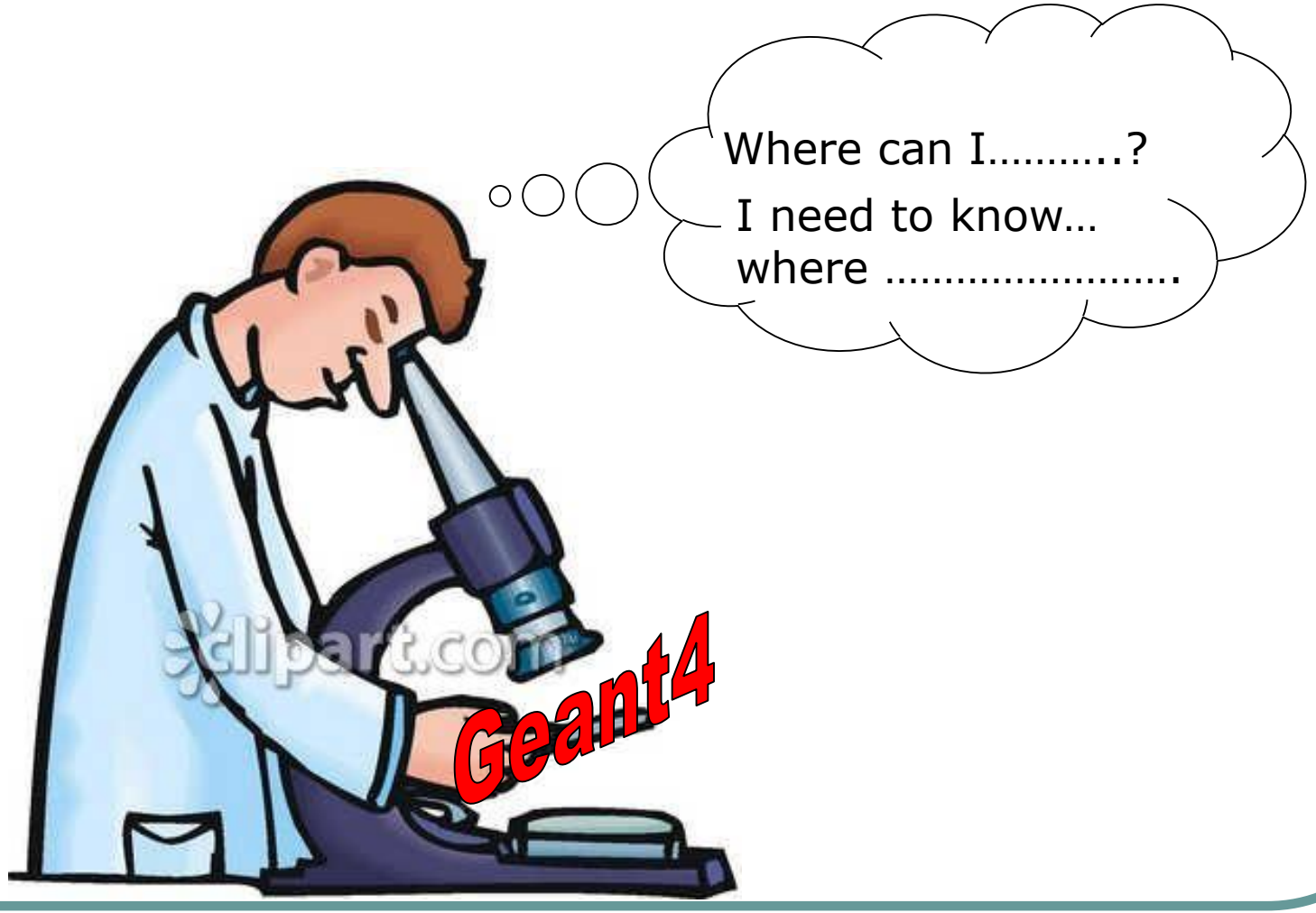
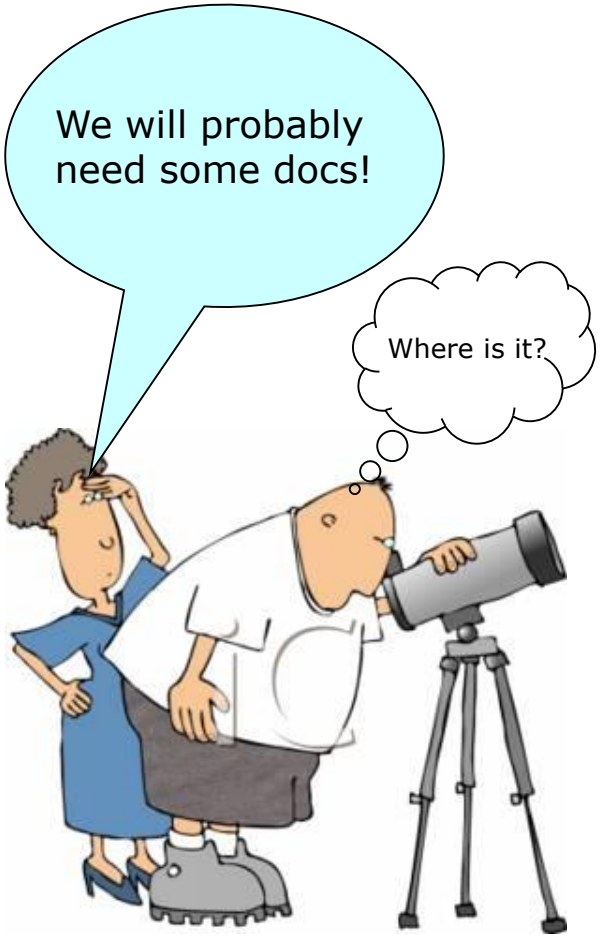
WS 2020/21

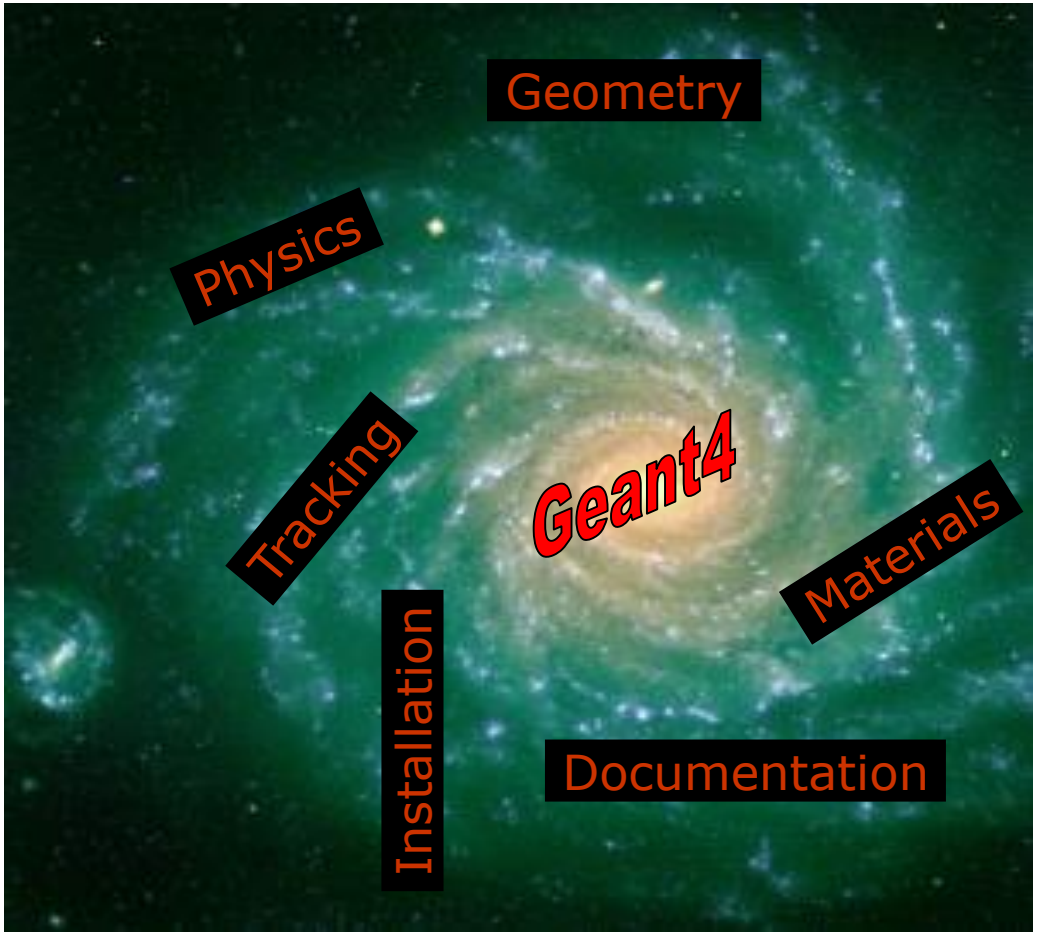
I will make it!!!

But where can I find …?



I will make it!!!





Overview

- User Documentation
- Getting help
  - FAQ
  - Geant4 HyperNews
  - Code documentation
  - Physics documentation
  - Working group and Geant4 related pages
  - Training courses material
- Examples
- Mailing List

GEANT4
A SIMULATION TOOLKIT

Download | User Forum
Contact Us | Bug Reports

Geant4

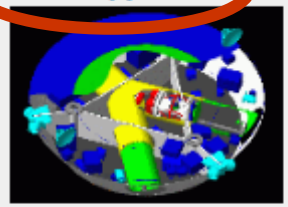
Overview

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 three main reference papers for Geant4 are published in Nuclear Instruments and Methods in Physics Research A 506 (2003) 250-303, IEEE Transactions on Nuclear Science 53 No. 1 (2006) 270-278 and Nuclear Instruments and Methods in Physics Research A 835 (2016) 186-225.

Applications

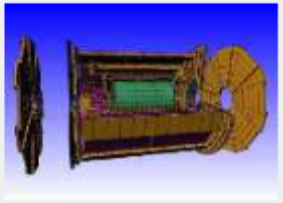
A sampling of applications, technology transfer and other uses of Geant4

User Support



Getting started, guides and information for users and developers

Publications



Validation of Geant4, results from experiments and publications

Collaboration

W

News

2020-06-26
Release 10.7-BETA is available from the BETA Download area.

2020-05-29
Patch-02 to release **10.6** is available from the download

nts.

Geant4 home page
http://geant4.cern.ch
or
http://geant4.org

User Support

1. Getting started
2. Training courses and materials
3. Source code

   a. Download page
   b. LXR code browser
   c. doxygen documentation
   d. GitHub
   e. GitLab @ CERN

4. Frequently Asked Questions (FAQ)
5. Bug reports and fixes
6. User requirements tracker
7. User Forum
8. Documentation

   a. Introduction to Geant4 [pdf] [epub] [kindle]
   b. Installation Guide [pdf] [epub] [kindle]

Related Links

- Object Oriented Analysis & Design
- Archive of previous releases
- Mailing list subscription
- User requirements document (pdf)
- Technical Forum

User Documentation

- Documentation (link to page with pdf version below)
  - Introduction to Geant4
  - Installation Guide
  - Application Developers Guide
  - Toolkit Developers Guide
  - Physics Reference Manual
  - Physics List Guide
  - Code Cross Reference – LXR
  - Classes and Members Reference Guide – Doxygen

Installation Manual

Links

URL: (html/pdf)

https://geant4-userdoc.web.cern.ch/geant4-userdoc/UsersGuides/InstallationGuide/html/index.html
https://geant4-userdoc.web.cern.ch/geant4-userdoc/UsersGuides/InstallationGuide/fo/Geant4InstallationGuide.pdf

- step by step instructions how to install Geant4 from source code
- maybe other software is required
  - Compiler, CLHEP, etc.
- installation choices
- details on environment variables

Application Developers Guide

Links

URL: (html/pdf)

https://geant4-userdoc.web.cern.ch/geant4-userdoc/UsersGuides/ForApplicationDeveloper/html/index.html
https://geant4-userdoc.web.cern.ch/geant4-userdoc/UsersGuides/ForApplicationDeveloper/fo/BookForApplicationDevelopers.pdf

- Guide for users developing an application based on Geant4 toolkit
  - Does not cover design or details of Geant4 classes
  - No description of physics models
- Introduces users to Geant4 toolkit
- How to set up and run simulation

- Contents
  - Getting started
  - Toolkit fundamentals
  - Detector Definition and Response
  - Tracking and Physics
  - User Actions
  - Control
  - Visualization
  - Analysis
  - Examples

Toolkit Developers Guide

Links

URL: (html/pdf)

https://geant4-userdoc.web.cern.ch/geant4-userdoc/UsersGuides/ForToolkitDeveloper/html/index.html
https://geant4-userdoc.web.cern.ch/geant4-userdoc/UsersGuides/ForToolkitDeveloper/fo/BookForToolkitDevelopers.pdf

- More details on Geant4 classes
  - Object oriented design
  - Explaining design choices
  - Algorithms
- How to extend Geant4 functionality

- Contents
  - Introduction
  - Design and Function of Geant4 Categories
    - …
  - Extending Toolkit Functionality
    - …

Physics Reference Manual

Link

URL: (html/pdf)

https://geant4-userdoc.web.cern.ch/geant4-userdoc/UsersGuides/PhysicsReferenceManual/html/index.html
https://geant4-userdoc.web.cern.ch/geant4-userdoc/UsersGuides/PhysicsReferenceManual/fo/PhysicsReferenceManual.pdf

- Detailed explanations of the physics implemented in the Geant4 toolkit
- Theoretical formulation, model, parameterization, or data underlying the physics interactions included in Geant4
- Probability of the occurrence of an interaction
  - and the sampling mechanisms required to simulate it
- Reference for toolkit users and developers who wish to consult the underlying physics

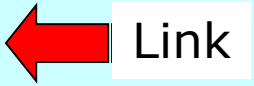
Getting Help

- FAQ
- Geant4 Forum
- Code documentation
- Physics Lists
- Working group and Geant4 related pages
- Training courses material

Getting Help—FAQ

- Frequently asked questions (FAQ)

  https://geant4-userdoc.web.cern.ch/geant4-userdoc/UsersGuides/FAQ/html/index.html

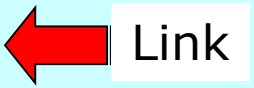


- First place to look for help
- Solutions to several problems or questions
  - Installation
  - Run Time Problems
  - Geometry
  - …

Getting help—Forum

- Geant4 Forum at

  https://geant4-forum.web.cern.ch/



- 10 categories
- Open for all to read postings
- Only members may create postings
  - To join, click on “Sign up”
  - Create new account with CERN SSO
  - At “Sign in with your organization or institution account” choose “RWTH Aachen University”

Sign Up | Log In

all categories | Latest | Top | Categories

Category	Topics	Latest
News Announcements of simulation related software/packages or tools, together with Conferences, Workshops or Events of interest to the community.	1	
Forum Issues This is an announcement and test area for the Geant4 forum. Forum-wide announcements will appear here from time to time. Please post here questions concerning general forum operation, including sign-up, requests for new fora or problems with access or posting. You may use this area to test-post.	8	
Getting Started This category covers Geant4 installation, using its example applications, and the toolkit documentation. Before you post, see if your question is answered in Geant4's Installation and Application Developers' Guides. Also check the archived discussion at installation/configuration and examples/docum…	236	
Geometry, Fields and Transportation This category covers the construction of an experiment setup, including its geometry, materials, fields and particle transportation. HyperNews posts in these categories are archived at geometry, fields and transportation.	131	
Physics Lists	54	

Latest		
Error running visualization Recording, Visualizing and Persisting Data	2 3h
Clone master UI manager commands in worker threads Applications	2 4h
Importance biasing change the results Particles, Track, Event, Run and Biasing	0 5h
Error Running ChargeExchangeMC Geant4 Advanced Example Getting Started	4 20h
Charge exchange model (G4ChargeExchange) for 7Li(p,n)7Be reaction at lower energy region Physics Processes, Models and Cross Sections	4 3d
Implementation of a new G4VDiscreteProcess - energy dependence of the cross section along step Physics Processes, Models and Cross Sections	0 4d

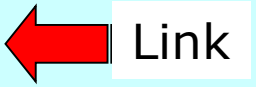
Getting Help—Code Documentation

- LXR Code Browser
  - https://geant4.kek.jp/LXR/  Link
- Doxygen Code Documentation
  - https://geant4.kek.jp/Reference/  Link

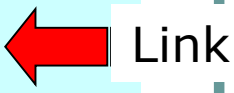
  - Details on the interface of important Geant4 classes
  - All classes and methods needed by or available to the user
  - Internal classes are not documented here

Getting Help—Working Group Pages, Geant4 Related Pages

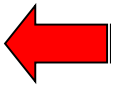
- Working group web pages
  - Within Geant4 collaboration page
  - details on current work and plans
  - Additional information
  - Validation
  - Papers



- Geant4 related web pages
  https://geant4.web.cern.ch/collaboration/geant4_related_sites
  - Pages of collaborating Labs / Institutions
  - Pages of tools based on Geant4



Getting Help—Training Courses

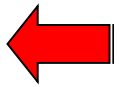
- Training material used in courses
  https://geant4.web.cern.ch/support/training_courses  Link
- Scope and depth on individual topics varies

Geant4 Examples

- Basic examples
  - basic Geant4 features
  - five examples: B1–B5
  - each showing several aspects
- Extended examples
  - about 20 groups of examples
  - demonstrate use of specific features
- Advanced examples
  - complete applications
  - may depend on additional external software

Geant4 ‘Announce’ Mailing List

- Announcements of general interest to users
  - new releases or patches
  - Workshops
  - Tutorials
- To subscribe, follow link in user support page, right side panel, or
  https://geant4.web.cern.ch/support/mailing_list_subscription



Summary

- Geant4 offers a wide set of documentation
  - Book style manuals
  - Additional information in Geant4 web
    - Much linked from “user support”
    - Additional pages under “collaboration”
  - Examples show how to use Geant4 for wide range of applications
- Direct questions can be put to forum
  - Developers watch topics

Exercises/Training:

1. **Geant**
   1. What is the latest version of the Geant simulation toolkit?
   2. What is the latest release of the simulation toolkit?
2. **Using the Framework**
   - Try to have a look at section 2.1 “How to Define the main() Program” of the “Book for Application Developers”.
   1. What are the three mandatory User Classes?
   2. What are optional user classes?
3. **Solids and Materials**
   1. What are the predefined solids (geometry) in Geant4?
   2. Where would you look to have an idea on the predefined Materials in Geant4? (The so-called NIST database)
4. **C++ Classes**
   1. What are the arguments of the constructor of **G4PVPlacement**?
   2. What are the arguments of the class **G4Box** to implement a solid box in Geant4?