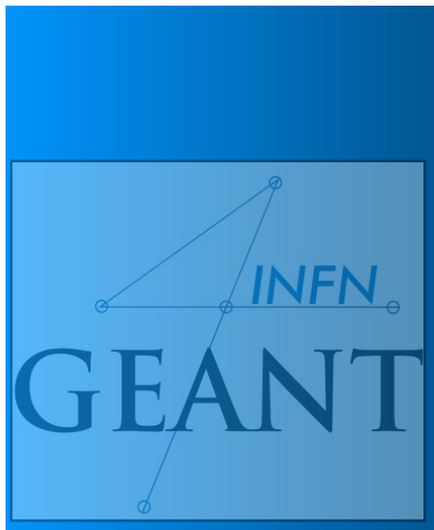
VIII International Geant4 School
Belgrade-Serbia
18-22 November 2019



G4 Installation

Giada Petringa

Laboratori Nazionali del Sud (LNS)
Istituto Nazionale di Fisica Nucleare (INFN)

Installation process

1) Check that you meet all the requirements

2) Download Geant4 source code

3) Configure the build using CMake

4) Make & install

5) Configure your environment to use Geant4

Geant4 web site

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

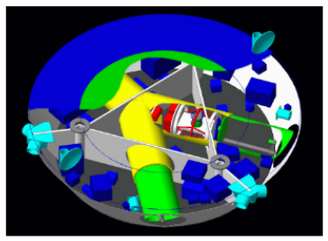
Overview

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

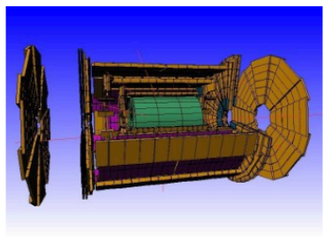
A sampling of applications, technology transfer and other uses of Geant4

User Support



Getting started, guides and information for users and developers

Publications



Validation of Geant4, results from experiments and publications

Collaboration

Who we are: collaborating institutions, members, organization and legal information

printer-friendly version

News

- *12 Mar 2018*
  2018 planned developments
- *6 Mar 2018*
  Patch-01 to **release 10.4** is available from the Download area.
- *20 Oct 2017*
  Patch-03 to release 10.3 is available from the source archive area.

Events

- Geant4 Beginners Course, at TUM University, Munich (Germany), **16-20 April, 2018**.
- Geant4 tutorial at Universite Paris-Saclay/LAL, Orsay (France), **14-18 May 2018**.
- Geant4 Course at the 15th Seminar on Software for Nuclear, Sub-nuclear and Applied Physics, Porto Conte, Alghero (Italy), **27 May - 1 June, 2018**.

Geant4 web site

Istituto Nazionale di Fisica Nucleare

Collaborator Login

GEANT4 A SIMULATION TOOLKIT

Download | User Forum
Contact Us | Gallery

User Support

Submitted by Anonymous (not verified) on Wed, 06/28/2017 - 11:23

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]
   b. Installation Guide: [pdf]
   c. Application Developers [pdf]
   d. Toolkit Developers Guide [pdf]
   e. Physics Reference Manual [pdf]
   f. Physics List Guide [pdf]
9. Examples
10. User Aids
    a. Tips for improving CPU performance
11. Contact Coordinators & Contact Persons

Related Links

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

Getting Started

OS/Software Prerequisites

The following source/software *must* be present to build Geant4:

- Geant4 Toolkit Source Code.
- C++ Compiler and Standard Library supporting the C++11 Standard:
  - Linux: GNU Compiler Collection 4.8.5 or higher.
    - It is strongly recommended to use the GCC compiler supplied by the package management system of your distribution unless this does not meet the minimum version requirement.
  - macOS: Apple Clang (Xcode) 8 or higher.
    - The command line tools must also be installed by running `xcode-select --install` from the terminal.
  - Windows: Visual Studio 2015, Community version or higher.

The compiler and standard library need to support at least the following features of the C++11 Standard:

- Template aliases, as defined in N2258.
- Automatic type deduction, as defined in N1984.
- Delegating constructors, as defined in N1986.
- Enum forward declarations, as defined in N2764.
- Explicit conversion operators, as defined in N2437.
- Override control final keyword, as defined in N2928, N3206 and N3272.
- Lambda functions, as defined in N2927.
- Null pointer, as defined in N2431.
- Override control override keyword, as defined in N2928, N3206 and N3272.
- Range-based for, as defined in N2930.

```
      Technical Notes
                              ---------------

  o Tested platforms:
    + Linux, gcc-4.8.5.
      Tested on 64 bit architectures (Intel or AMD) with CERN CentOS
      Linux 7 (CC7) (based on CentOS Linux 7).
      Versions of Geant4 have also been compiled successfully on
other
      Linux distributions, Ubuntu, Debian, Suse or other RedHat
systems.
    + MacOSX 10.14, clang-6.0 (Apple LLVM/Clang-10.0.1)
    + Windows/10 with Visual C++ 14.11 (Visual Studio 2017)

  o More verified configurations:
    + Linux, gcc-4.9.3/5.4.0/6.3.0/7.3.0/8.2.0/9.1.0, clang-5.0/7.0.
    + Linux, Intel-icc 19.0.
    + MacOSX 10.12/13 with clang-3.9/4.0

  o External dependencies
    + CLHEP-2.4.1.2, suggested for external installation of the
CLHEP library.
    + VecGeom-1.1.2, for optional use of the VecGeom geometry
primitives.

  o New data sets:
    + G4PARTICLEXS-2.0.

 Please refer to the Geant4 User Documentation:
   http://cern.ch/geant4/support/userdocuments.shtml
 for further information about using Geant4.
```

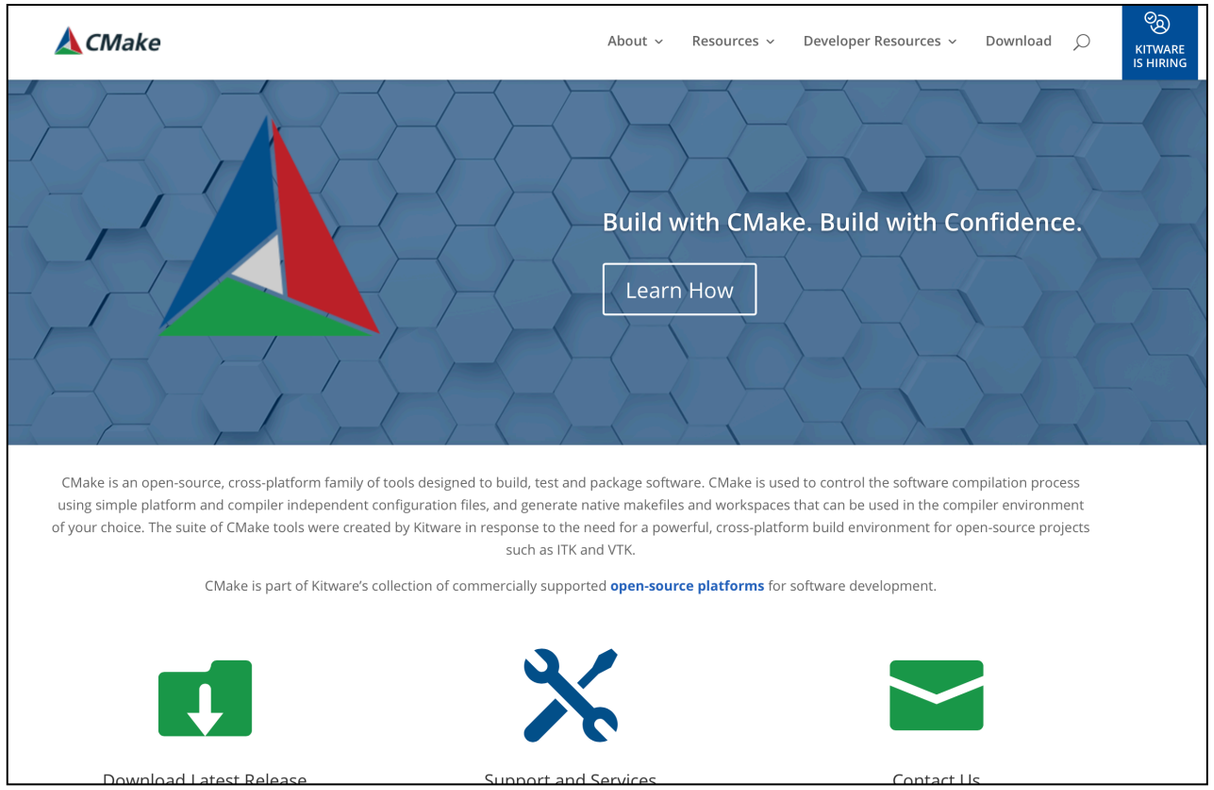
Supported platform & requirements

- **Operating system**
  - "recent" Linux (e.g. CentOS 7), best support
  - macOS 10.10+
  - Windows 7+ (limited support, not recommended)
- **Compilers**
  - C++11 compliance
  - such as GCC 4.8.5+, clang 3.6+, Visual C++ 14.0 (2015)
- **CMake** (configuration generation tool) 3.3+
- **System libraries** (as development packages):
  - expat, xerces-c

These may or may not be necessary. Just keep this in mind when compilation fails.

Cmake

Geant4 uses CMake to configure a build system for compiling and installing the toolkit headers, libraries and support tools. This document covers the basics of using CMake to build and install Geant4 together with an overview of the most commonly used advanced features.



Cmake installation

- Depending on the OS installation, CMake may not be installed by default. In that case you have to install it:
  - **Linux**: it is recommended to use the CMake provided by the package management system of your distribution.

    If version 3.3+ is not available:

    1. download the latest version *(http://www.cmake.org/)*
    2. unzip the tar-ball
    3. **./bootstrap, make, make install**

  - **macOS**: install it using the Darwin64 dmg installerpackage
  - **Windows**: install it using the Win64/32 exe installerpackage

Note: You may also want to install **ccmake** and/or **cmake-gui** tools for user-friendly configuration

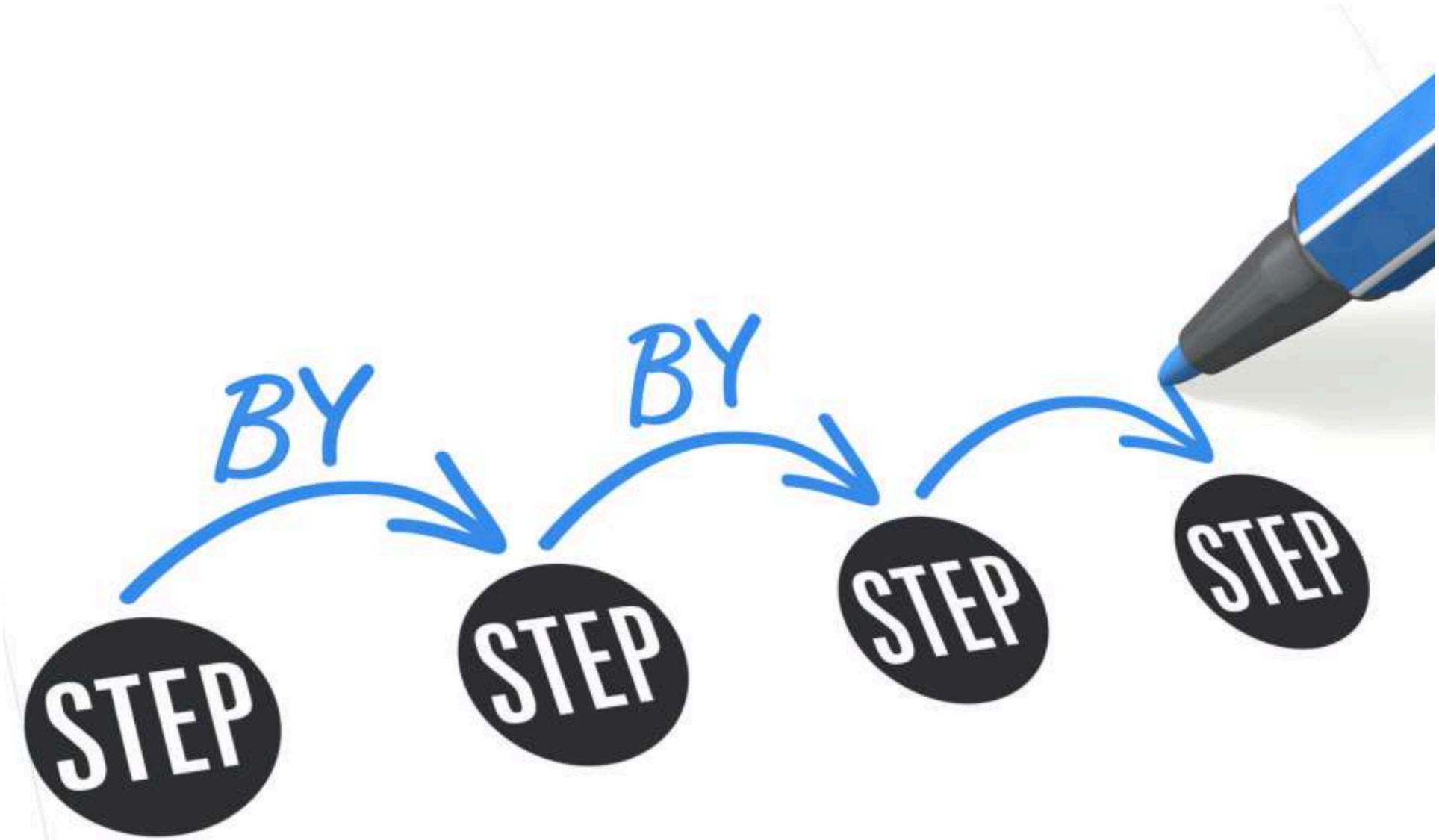
Optional libraries

- **X11** for simple graphical user interface and ray-tracing
- **OpenGL** for visualization
- **Qt4** or **Qt5** for graphical user interface
- **ROOT** for data analysis (even inside Geant4)

Less frequently used libraries/tools:

Motif, OpenInventor, DAWN, RayTracer X11, HepRApp, WIRED JAS Plug-in, AIDA, VRML browser, (external) CLHEP, Wt...

and now…. we can proceed with the Geant4 installation



Download the code

Istituto Nazionale di Fisica Nucleare

Collaborator Login

GEANT4 A SIMULATION TOOLKIT

Download | User Forum
Contact Us | Gallery

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.

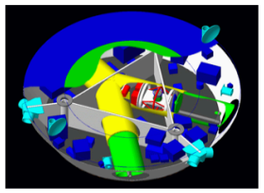
News

- *12 Mar 2018*
  2018 planned developments
- *6 Mar 2018*
  Patch-01 to **release 10.4** is available from the Download area

Applications

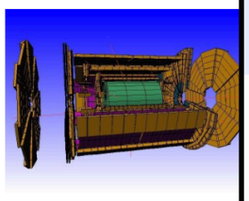
A sampling of applications, technology transfer and other uses of Geant4

User Support



Getting started, guides and information for users and developers

Publications



Validation of Geant4, results from experiment and publications

printer-friendly version

Events

- Geant4 Beginners Course, at TUM University, Munich (Germany), **16-20 April, 2018**.
- Geant4 tutorial at Universite Paris-Saclay/LAL, Orsay (France), **14-18 May 2018**.
- Geant4 Course at the 15th Seminar on Software for Nuclear, Sub-nuclear and Applied Physics
- Geant4 Tutorial, at the University of Texas MD Anderson Cancer Center, Houston (USA), **25**
- Geant4 Short Course at the African School of Physics 2018, University of Namibia, Windhoe

Collaborator Login

GEANT4 A SIMULATION TOOLKIT

Download | User Forum
Contact Us | Gallery

Software Download

Geant4 10.4 Software Download

Geant4 10.4

first released 8 December 2017 (patch-01, released 28 January 2018)

The Geant4 source code is freely available. See the licence conditions.

Please read the **Release Notes** before downloading or using this release.
The patch below contains bug fixes to release 10.4, we suggest you to download and apply the latest patch for release 10.4 (see the additional notes for patch-01), or download the complete source with the patch applied; in any case, it is required to apply a full rebuild of the libraries.

Source files

Please choose the archive best suited to your system and archiving tool:

Download	GNU or Linux tar format, compressed using gzip (33.2Mb, 34842016 bytes) *After downloading, gunzip, then unpack using GNU tar.*
Download	ZIP format (46.9Mb, 49134809 bytes) *After downloading, unpack using e.g. WinZip.*

Data files (*)

For specific, optional physics processes some of the following files are required. The file format is compatible with Unix, GNU, and Windows utilities.

Download	G4NDL4.5, Neutron data files with thermal cross-sections - version 4.5 (402.2Mb, 421710294 bytes)
Download	G4EMLOW7.3, data files for low energy electromagnetic processes - version 7.3 (71.4Mb, 74875087 bytes)

Related Links

- **Previous Releases** of Geant4 (since release 9.6).
- LXR source code browser.
- GitHub
- GitLab @ CERN.

Data files (*)

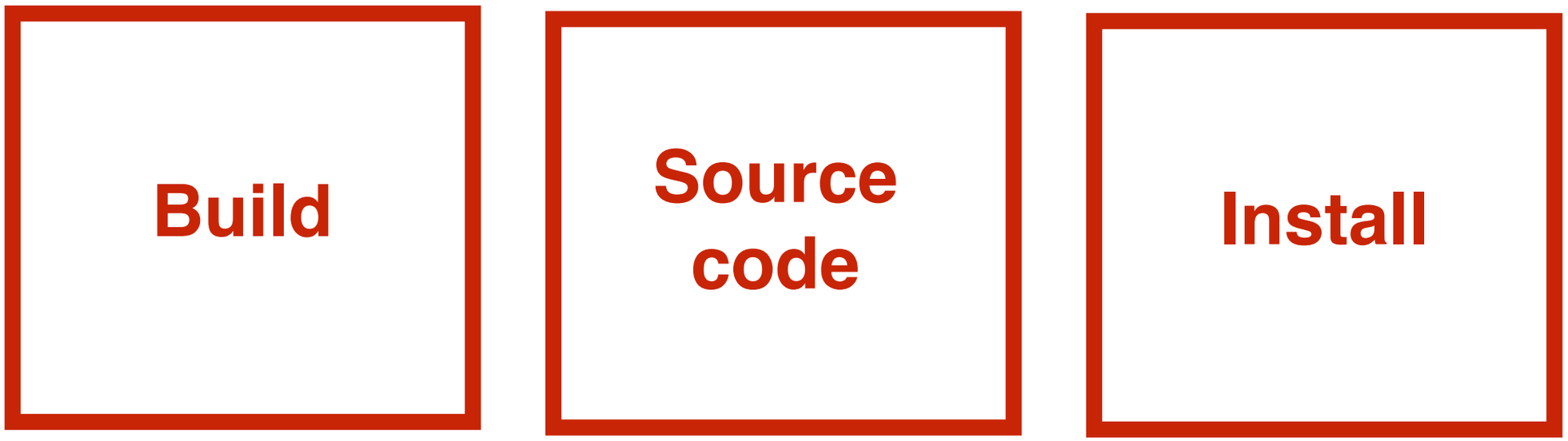
For specific, optional physics processes some of the following files are required. The file format is compatible with Unix, GNU, and Windows utilities.

Download	G4NDL4.5, Neutron data files with thermal cross-sections - version 4.5 (402.2Mb, 421710294 bytes)
Download	G4EMLOW7.3, data files for low energy electromagnetic processes - version 7.3 (71.4Mb, 74875087 bytes) NEW
Download	G4PhotonEvaporation5.2, data files for photon evaporation - version 5.2 (9.6Mb, 10084513 bytes) NEW
Download	G4RadioactiveDecay5.2, data files for radioactive decay hadronic processes - version 5.2 (1.0Mb, 1057501 bytes) NEW
Download	G4SAIDDATA1.1, data files from evaluated cross-sections in SAID data-base - version 1.1 (25.2kb, 25800 bytes)
Download	G4NEUTRONXS1.4, data files for evaluated neutron cross-sections on natural composition of elements - version 1.4 (2.1Mb, 2249001 bytes)
Download	G4ABLA3.1, data files for nuclear shell effects in INCL/ABLA hadronic mode - version 3.1 (104.8kb, 107286 bytes) NEW
Download	G4PII1.3, data files for shell ionisation cross-sections - version 1.3 (4.1Mb, 4293607 bytes)
Download	G4ENSDFSTATE2.2, data files for nuclides properties - version 2.2 (283.8kb, 290632 bytes) NEW
Download	G4RealSurface2.1, Optional data files for measured optical surface reflectance - version 2.1 (126.0Mb, 132130413 bytes) NEW
Download	G4TENDL1.3.2, Optional data files for incident particles - version 1.3.2 (558.0Mb, 585100935 bytes) NEW

- Low Energy Nuclear Data (LEND) files can be downloaded from: ftp://gdo-nuclear.uclnl.org/

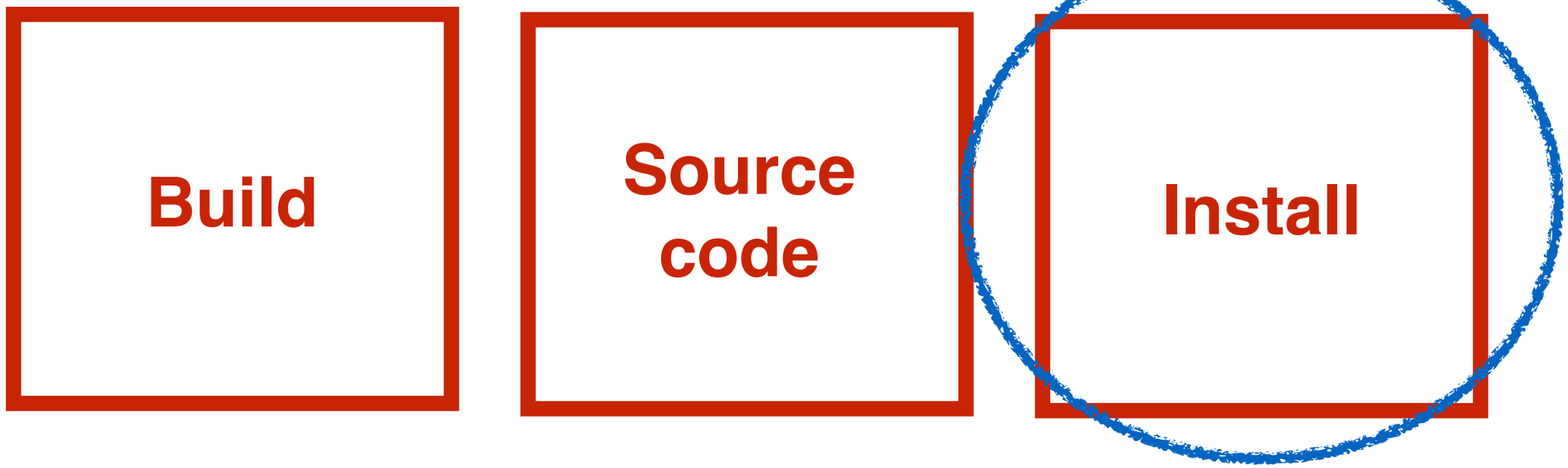
Create the "envirorment"

Geant4 folder



Create the "envirorment"

Geant4 folder



G4 installation: main command

set the *install directory*

the directory under which the Geant4 libraries, headers and support files will be installed.

the additional external data libraries are automatically downloaded

```
$ cmake -DCMAKE_INSTALL_PREFIX=/home/user/Desktop/
Geant4/geant4.10.05.p01 —install -DGEANT4_INSTALL_DATA=ON
-DGEANT4_USE_OPENGL_X11=ON -DGEANT4_USE_QT=ON
/home/user/Desktop/Geant4/geant4.10.05.p01
```

build the X11 OpenGL visualization driver

build the Qt visualization driver

Other options

Important options:

-DCMAKE_INSTALL_PREFIX= … installation_path

-DGEANT4_INSTALL_DATA=ON/OFF

-DGEANT4_BUILD_MULTITHREADED=ON/OFF

Further options:

-DGEANT4_USE_OPENGL_X11=ON/OFF

-DGEANT4_USE_QT=ON/OFF

……

Other options

Geant4 Installation Guide

10.5

Search docs

Getting Started

Building and Installing

On Unix Platforms

On Windows Platforms

Geant4 Build Options

Standard Options

Advanced Options

Options for Changing the Compiler and Build Flags

Postinstall Setup

How to Use the Geant4 Toolkit Libraries

How to Make an Executable Program

CMake for Geant4 Developers

Advanced Options

Most installs should never need to touch these options, and are primarily to give advanced users more control over the build, enable experimental features, and to help CMake locate needed software packages. Advanced options and variables can be set like the standard ones listed earlier using `-D` arguments to `cmake`. In CMake's curses and GUI interfaces these options can be displayed by pressing `t` in `ccmake`, or clicking the 'advanced' check box in the CMake GUI.

In the list below, we only list those options most relevent for Geant4. Many additional core CMake variables are available, for which you should consult the Reference Documentation section of the main CMake documentation , and specifically the sections on Variables. The following list is presented in semi-alphabetical order, with grouping by task where appropriate.

- `BUILD_SHARED_LIBS : (DEFAULT : ON)`
  - If set to `ON` build Geant4 shared libraries.
- `BUILD_STATIC_LIBS : (DEFAULT : OFF)`
  - If set to `ON`, build Geant4 static libraries.
- `CMAKE_INSTALL_BINDIR : (DEFAULT : bin)`
  - Installation directory for Geant4 Toolkit executables. It can be supplied as a path relative to `CMAKE_INSTALL_PREFIX` or as an absolute path.
- `CMAKE_INSTALL_INCLUDEDIR : (DEFAULT : include)`
  - Installation directory for Geant4 C/C++ headers. It can be supplied as a path relative to `CMAKE_INSTALL_PREFIX` or as an absolute path. The headers will always be installed in a subdirectory of `CMAKE_INSTALL_INCLUDEDIR` named `Geant4`.
- `CMAKE_INSTALL_LIBDIR : (DEFAULT : lib(+?SUFFIX))`
  - Installation directory for object code libraries. It can be supplied as a path relative to `CMAKE_INSTALL_PREFIX`, or an absolute path. When the default is used, `SUFFIX` will be set to `64` on 64bit Linux platforms apart from Debian systems.
- `CMAKE_INSTALL_DATAROOTDIR : (DEFAULT : share)`

Compiling

Start the Geant4 installation

$ make -jN

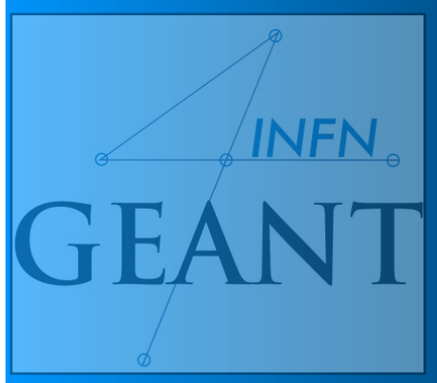
$ make install

and wait....

```
[  0%] Built target G4EMLOW
[  0%] Built target G4NDL
[  1%] [  1%] Built target G4NEUTRONXS
[  1%] [  1%] [  1%] [  1%] Built target RealSurface
[  2%] Built target RadioactiveDecay
Built target G4PII
Built target PhotonEvaporation
Built target G4SAIDDATA
Built target G4zlib
[  4%] Built target G4global
make[2]: *** Pas de règle pour fabriquer la cible « /usr/lib/x86_64-linux-gnu/libGL.so », nécessaire pour « outputs/library/Linux-g++/libG4gl2ps
.so ». Arrêt.
make[1]: *** [source/visualization/externals/gl2ps/CMakeFiles/G4gl2ps.dir/all] Erreur 2
make[1]: *** Attente des tâches non terminées....
Scanning dependencies of target G4intercoms
[  4%] [  4%] [  4%] [  4%] [  4%] Building CXX object source/intercoms/CMakeFiles/G4intercoms.dir/src/G4UIaliasList.cc.o
[  4%] [  4%] [  4%] Building CXX object source/intercoms/CMakeFiles/G4intercoms.dir/src/G4UIcmdWith3Vector.cc.o
[  4%] [  4%] Building CXX object source/intercoms/CMakeFiles/G4intercoms.dir/src/G4UIcmdWith3VectorAndUnit.cc.o
Building CXX object source/intercoms/CMakeFiles/G4intercoms.dir/src/G4UIbatch.cc.o
Building CXX object source/intercoms/CMakeFiles/G4intercoms.dir/src/G4UIcmdWithABool.cc.o
Building CXX object source/intercoms/CMakeFiles/G4intercoms.dir/src/G4UIcmdWithADoubleAndUnit.cc.o
[  4%] Building CXX object source/intercoms/CMakeFiles/G4intercoms.dir/src/G4UIcmdWithADouble.cc.o
[  4%] Building CXX object source/intercoms/CMakeFiles/G4intercoms.dir/src/G4UIcmdWithAString.cc.o
Building CXX object source/intercoms/CMakeFiles/G4intercoms.dir/src/G4UIcmdWithoutParameter.cc.o
[  4%] Building CXX object source/intercoms/CMakeFiles/G4intercoms.dir/src/G4UIcmdWithAnInteger.cc.o
[  4%] [  4%] Building CXX object source/intercoms/CMakeFiles/G4intercoms.dir/src/G4UIcommand.cc.o
Building CXX object source/intercoms/CMakeFiles/G4intercoms.dir/src/G4UIcommandTree.cc.o
Building CXX object source/intercoms/CMakeFiles/G4intercoms.dir/src/G4UIcontrolMessenger.cc.o
Building CXX object source/intercoms/CMakeFiles/G4intercoms.dir/src/G4UImanager.cc.o
Building CXX object source/intercoms/CMakeFiles/G4intercoms.dir/src/G4UIdirectory.cc.o
Building CXX object source/intercoms/CMakeFiles/G4intercoms.dir/src/G4UImessenger.cc.o
[  5%] Building CXX object source/intercoms/CMakeFiles/G4intercoms.dir/src/G4UIparameter.cc.o
[  5%] Building CXX object source/intercoms/CMakeFiles/G4intercoms.dir/src/G4UIsession.cc.o
/home/beilla/Software/geant4/geant4.9.6.p03/source/intercoms/src/G4UIcontrolMessenger.cc: In member function ‘virtual void G4UIcontrolMessenger:
:SetNewValue(G4UIcommand*, G4String)’:
/home/beilla/Software/geant4/geant4.9.6.p03/source/intercoms/src/G4UIcontrolMessenger.cc:328:21: warning: ignoring return value of ‘int system(c
onst char*)’, declared with attribute warn_unused_result [-Wunused-result]
     system(newValue);
                     ^
[  5%] Building CXX object source/intercoms/CMakeFiles/G4intercoms.dir/src/G4UnitsMessenger.cc.o
[  5%] Building CXX object source/intercoms/CMakeFiles/G4intercoms.dir/src/G4VGlobalFastSimulationManager.cc.o
[  5%] [  5%] Building CXX object source/intercoms/CMakeFiles/G4intercoms.dir/src/G4GenericMessenger.cc.o
Building CXX object source/intercoms/CMakeFiles/G4intercoms.dir/src/G4AnyType.cc.o
Linking CXX shared library ../../outputs/library/Linux-g++/libG4intercoms.so
```

each time you open a new shell remember to source the `geant4.sh` script before executing an application !!!

VIII International Geant4 School
Belgrade-Serbia
18-22 November 2019



Build a Geant4 application

=====> Ruhani Khanna