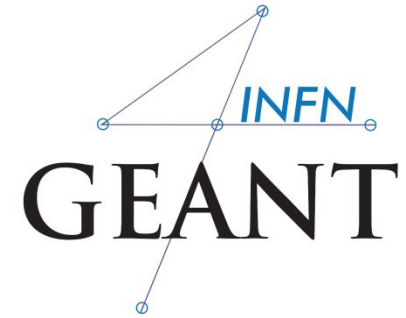




Compiling GEANT4

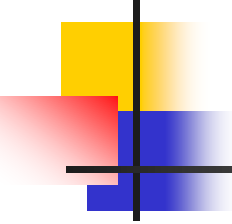
Luciano Pandola

INFN – Laboratori Nazionali del Sud

`pandola@lns.infn.it`

A lot of material by J. Pipek

XIII International Geant4 School
Prague, July 27th- 31st, 2026



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

<https://geant4-userdoc.web.cern.ch/UsersGuides/InstallationGuide/html/index.html>

[http://www.roma1.infn.it/~mancinit/?action=3Teaching/
Suggestions_on_Geant4_installation](http://www.roma1.infn.it/~mancinit/?action=3Teaching/Suggestions_on_Geant4_installation)

1) Supported platforms and requirements

Virtual Machine:
Alma 9 with gcc 11.5.0

■ Operating system

- “recent” Linux (e.g. Alma9, Ubuntu Linux 22.04LTS or 24.04), best support
- macOS 26(Tahoe) 15 (Sequoia), 14 (Sonoma)
- Windows 11 (not recommended)

■ Compilers

- C++17 compliance
- such as GCC 11+, clang 16+, Visual Studio 2022

■ CMake (configuration generation tool) 3.16+

■ System libraries (as development packages):

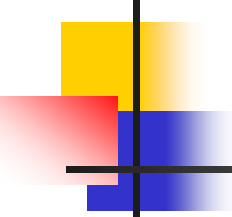
- expat, zlib

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

Pre-requirement: CMake intallation

The VM has CMake installed

- Geant4 build is configured by **CMake** (version >3.16)
- 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 **3.16+** is not available:
 1. [download](http://www.cmake.org/) 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](#)



Pre-requirements: optional libraries

- **X11** for simple graphical user interface and ray-tracing
- **OpenGL** for visualization
- **Qt6** for graphical user interface
- **ROOT** for data analysis (even inside Geant4)

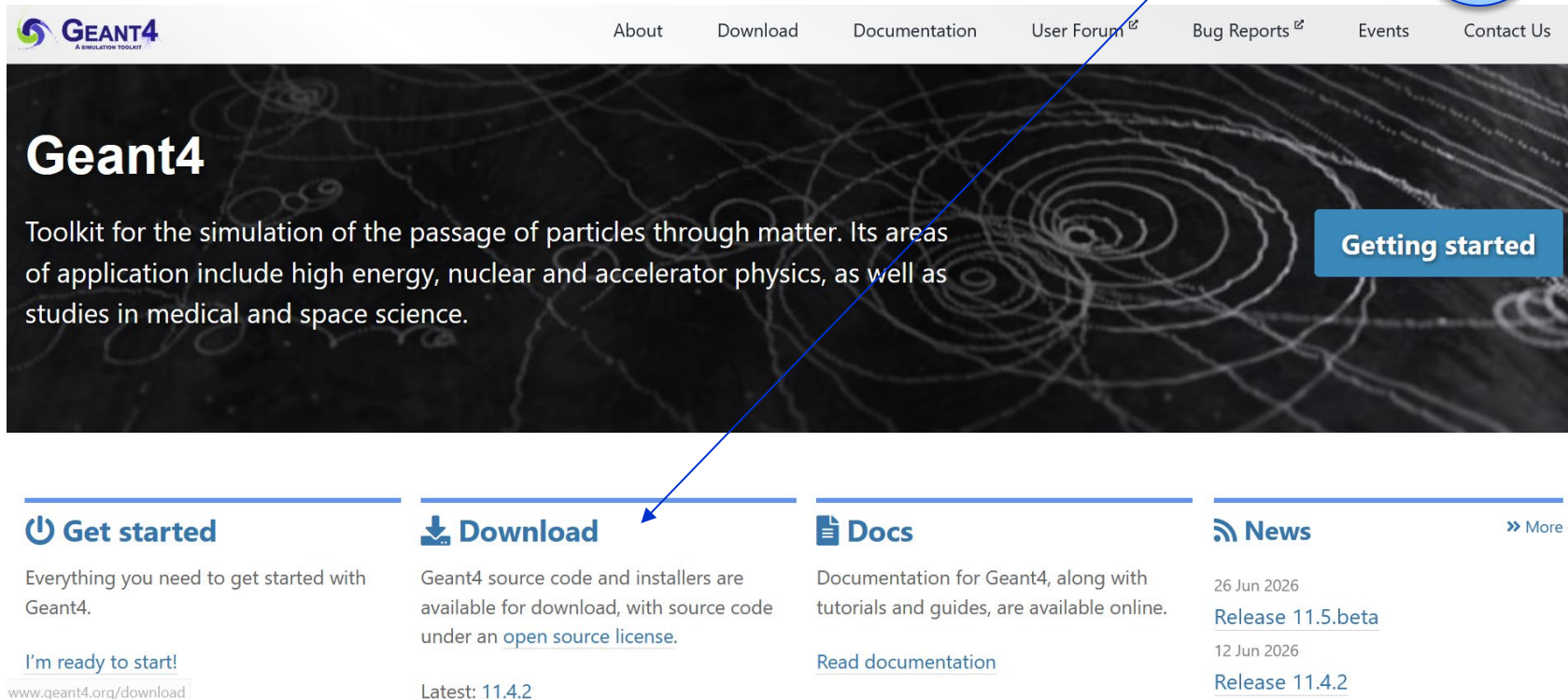
Less frequently used libraries/tools:

Xerces-C, VTK, ToolsSG, OpenInventor, Motif, RayTracer X11, ...

2) Download

- Go to the Geant4 webpage:
<http://geant4.org>

Click
here



The screenshot shows the GEANT4 website homepage. The header includes the GEANT4 logo and navigation links: About, Download, Documentation, User Forum, Bug Reports, Events, and Contact Us. The main banner features the text "Geant4" and a description: "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." A blue button labeled "Getting started" is on the right. Below the banner, there are four columns: "Get started" with a link to "I'm ready to start!" and the URL "www.geant4.org/download"; "Download" with a link to "Geant4 source code and installers" and the text "Latest: 11.4.2"; "Docs" with a link to "Read documentation"; and "News" with links to "Release 11.5.beta" and "Release 11.4.2". A blue arrow points from the "Click here" cloud to the "Download" link in the footer.

GEANT4
A SIMULATION TOOLKIT

About Download Documentation User Forum Bug Reports Events Contact Us

Geant4

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.

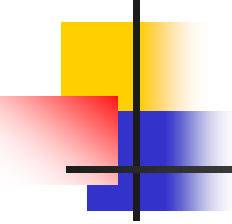
Getting started

Get started
Everything you need to get started with Geant4.
[I'm ready to start!](#)
www.geant4.org/download

Download
Geant4 source code and installers are available for download, with source code under an [open source license](#).
Latest: 11.4.2

Docs
Documentation for Geant4, along with tutorials and guides, are available online.
[Read documentation](#)

News [» More](#)
26 Jun 2026
[Release 11.5.beta](#)
12 Jun 2026
[Release 11.4.2](#)



... download **GEANT4**

A SIMULATION TOOLKIT

<http://www.geant4.org/geant4/support/download>

Download Geant4-11.4.2

First released 17 Jun 2026

[Old releases](#)

License

See the [license conditions](#).

RELEASE NOTES

See:

[Main Release Notes](#) - [Patch-1](#) - [Patch-2](#) -

Source code

Source code is freely available from [CERN GitLab](#) or through [GitHub](#).

Source code can also be browsed through the [LXR source code browser](#).

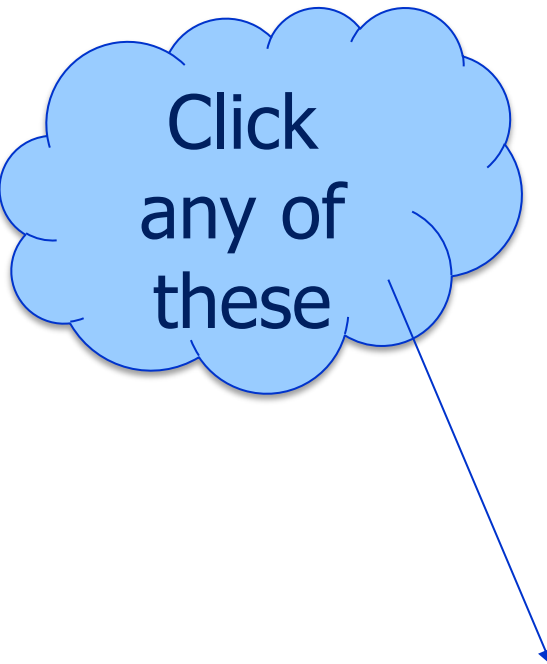
Download zip

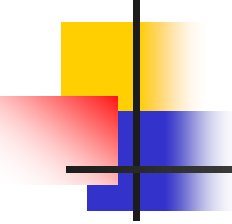
Download tar.gz

Download tar.bz2

Download tar

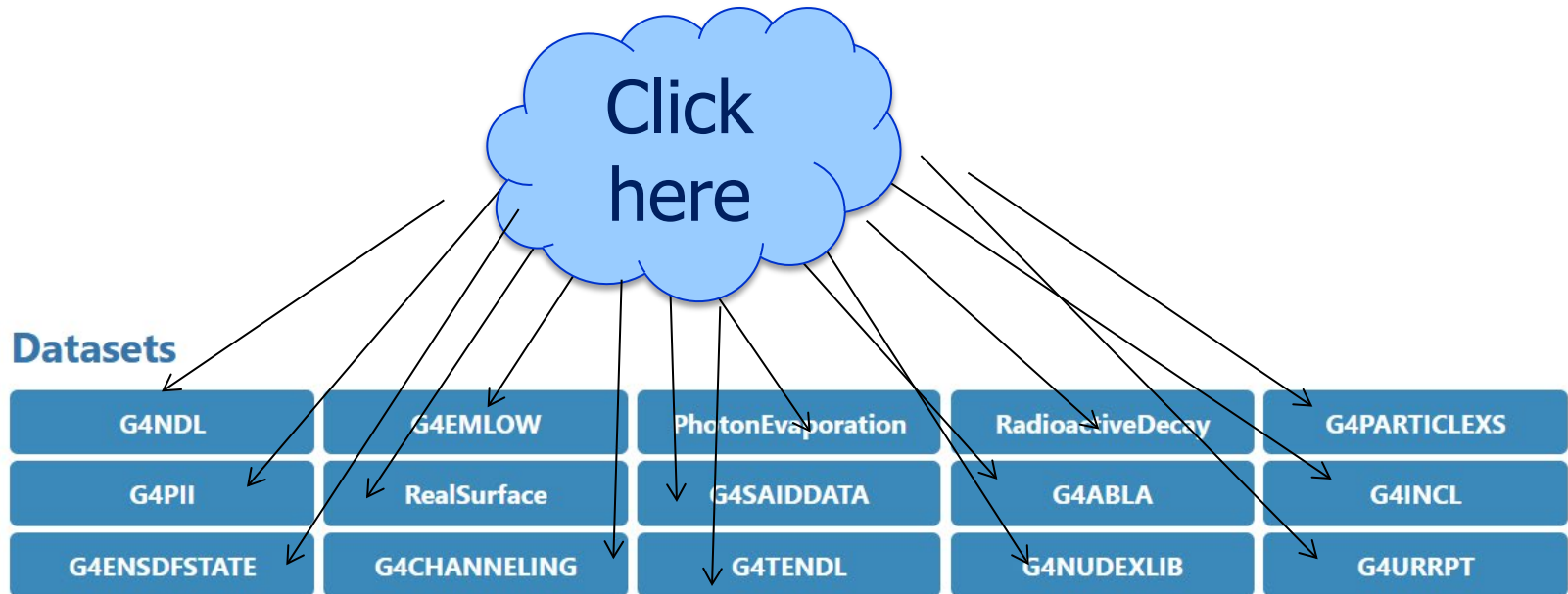
Click
any of
these



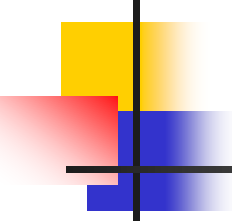


Download data (optional)

Option 1: download manually (slow connections)



Option 2: use CMake to download data automatically (preferred)



Pre-3) Directory nomenclature

Source directory: where you **unpack the source**

/usr/local/geant4/geant4-v11.4.2

VM

Build directory: where you run CMake and build Geant4 (“**working directory**”)

/usr/local/geant4/geant4-v11.4.2-build

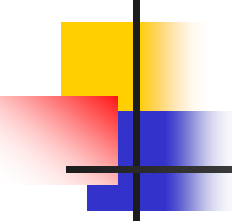
VM

Installation directory: where you **install** Geant4 to and which the applications compile against

/usr/local/geant4/geant4-v11.4.2-install

VM

Only the **installation dir** is necessary to compile & run user apps.



3) Configuration with CMake

- Extract the package into **source directory**

```
tar xzf geant4-v11.4.tar.gz
```

- Create the **build directory**

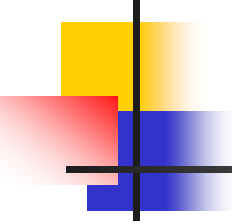
```
mkdir geant4-build
```

Choose name
to your liking

- **Run CMake** in the **build directory**

```
cd geant4-build
```

```
cmake [options...] [source code]
```



CMake configuration options

Install directory

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`
- `-DCMAKE_BUILD_TYPE=Release/Debug/RelWithDebInfo`
- `-DCMAKE_CXX_STANDARD=17 (20/23)`

Running CMake

- CMake configures the build and generates Unix **Makefiles** to perform the actual build:

```
cmake -DGEANT4_INSTALL_DATA=ON -DGEANT4_BUILD_MULTITHREADED=OFF  
-DCMAKE_INSTALL_PREFIX=/usr/local/geant4/geant4-v11.4.2-install  
/usr/local/geant4/geant4-v11.4.2
```

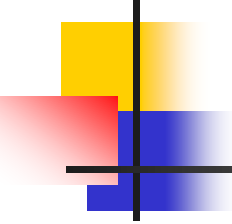
```
-- The C compiler identification is GNU 11.5.0  
-- The CXX compiler identification is GNU 11.5.0  
-- Check for working C compiler: /usr/bin/cc  
-- Check for working C compiler: /usr/bin/cc - works  
-- Detecting C compiler ABI info  
-- Detecting C compiler ABI info - done  
-- Detecting C compile features  
-- Detecting C compile features - done  
...(~50 lines)...  
-- Configuring done  
-- Generating done  
-- Build files have been written to:  
/usr/local/geant4/geant4-v11.4.2-build
```

If you see that, you are
successful !!!



If you see **errors** at this
point, carefully **check the**
messages output by CMake





(Random) installation notes

- Windows: See the installation guide (and good luck!)

<https://geant4-userdoc.web.cern.ch/geant4-userdoc/UsersGuides/InstallationGuide/html/installguide.html#on-windows-platforms>

- Binary packages: Installation without compiling Geant4 is **possible** (but **not recommended**)
- Data packages: If you haven't used CMake to download them, **unpack the downloaded files** in the **share/Geant4/data/** sub-directory of your installation

4) Compile

- Run **make** (and get a cup of coffee)



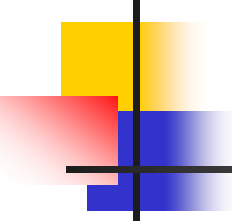
make -j2

Tip: If you have a **multi-core machine**, you can run the compilation in parallel using multiple jobs. Just add the **-jN** parameter, where N is the **number of cores**

```
Scanning dependencies of target G4ENSDFSTATE
Scanning dependencies of target G4NDL
[ 0%] Creating directories for 'G4ENSDFSTATE'
[ 0%] Creating directories for 'G4NDL'
[ 0%] Performing download step (download, verify and extract) for 'G4NDL'
...(4029 lines, ~1 hour of execution)
[100%] Built target G4visXXX
[100%] Building CXX object
source/visualization/gMocren/CMakeFiles/G4GMocren.dir/src/G4GMocrenIO.cc.o
[100%] Building CXX object
source/visualization/gMocren/CMakeFiles/G4GMocren.dir/src/G4GMocrenMesseng
er.cc.o
[100%] Linking CXX shared library
../../BuildProducts/lib64/libG4GMocren.so
[100%] Built target G4GMocren
```



If you see that, you are
successful !!!

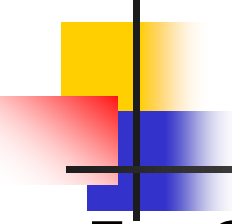


... and install

- Run **make install** (this takes much less time)

make install

```
[ 0%] Built target G4ENSDFSTATE
[ 0%] Built target G4NDL
[ 0%] Built target PhotonEvaporation
[ 0%] Built target RadioactiveDecay
[ 0%] Built target G4ABLA
...(42830 lines, ~2 minute of execution)
-- Installing: /usr/local/geant4/geant4-v11.4.2-
install/include/Geant4/G4VModelCommand.hh
-- Installing: /usr/local/geant4/geant4-v11.4.2-
install/include/Geant4/G4VModelFactory.hh
-- Installing: /usr/local/geant4/geant4-v11.4.2-
install/include/Geant4/G4VTrajectoryModel.hh
-- Installing: /usr/local/geant4/geant4-v11.4.2-
install/include/Geant4/G4VisTrajContext.hh
-- Installing: /usr/local/geant4/geant4-v11.4.2-
install/include/Geant4/G4VisTrajContext.icc
```

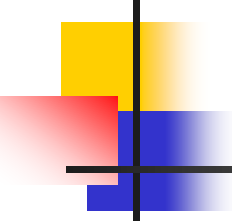


5) Set-up your environment

- For Geant4 to work properly, a few **environmental variables** should be set
 - They are needed to locate at run-time dynamic libraries, data files and executables

```
GEANT4_DATA_DIR=/usr/local/geant4/geant4-v11.4.2-install/share/Geant4/data
LD_LIBRARY_PATH="...:/usr/local/geant4/geant4-v11.4.2-install/lib64"
PATH="...:/usr/local/geant4/geant4-v11.4.2-install/bin"
```

- To set them up properly in your shell, **run the script** in Geant4 installation directory:
`source /usr/local/geant4/geant4-v11.4.2-install/bin/geant4.(c)sh`
- You can put this line your **~/ .bashrc file** (or similar for other shells)



Quick test

- Check for the presence of Geant4

```
geant4-config --prefix
```

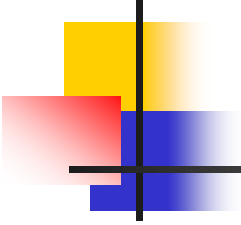
```
/usr/local/geant4/geant4-v11.4.2-install
```

```
geant4-config --version
```

```
11.4.2
```

```
geant4-config --features
```

```
Known Features:
staticlibs[no]
multithreading[no]
smartstack[no]
php_as_hp[no]
clhep[yes]
expat[no]
zlib[yes]
gdml[no]
ptl[yes]
usolids[no]
freetype[no]
hdf5[no]
g3tog4[no]
qt[yes]
motif[no]
raytracer-x11[no]
opengl-x11[yes]
openinventor[no]
vtk[no]
```



Your **GEANT4** is ready now

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