



Installation Steps for GEANT4

Gourav Rana, Chanchal Sharma, Kavita Lalwani, EHEP group
Department of Physics, MNIT Jaipur

• STEP 1 : Installation of Essential Libraries

- Open the terminal (ctrl +alt+t)
- Update and upgrade ubuntu software :
\$ sudo apt update
\$ sudo apt upgrade -y
- Install the following required libraries using command :
\$ sudo apt install build-essential g++ libexpat1-dev libxmu-dev libxmu-headers cmake
cmake-curses-gui qt5-default libxaw7-dev libxaw7 mesa-common-dev libglu1-mesa-dev
Xerces-c++ libx11-dev
- **cmake: Higher version of cmake is recommended to install (Do not skip this step)**

Follow the below steps to install cmake

<https://github.com/Kitware/CMake/releases/download/v3.14.0-rc2/cmake-3.14.0-rc2.tar.gz>

```
tar -zxvf cmake-3.14.0-rc2.tar.gz
```

```
cd cmake-3.14.0-rc2  
./configure  
make  
sudo make install
```

• STEP 2 : Installation of Geant4

The latest version of Geant4 can be downloaded from the given website
<https://geant4.web.cern.ch/support/download>

- Unpack the Geant4 source package **geant4.10.05.tar.gz** to a location of your choice.
For illustration *only*, this guide will assume it's been unpacked in a directory named **/Geant4**, so that the Geant4 source package sits in a subdirectory **/Geant4/geant4.10.05**
- Open the terminal (ctrl+alt+t)
- Create directories Geant4, geant4.10.05-build
\$ mkdir Geant4
\$ cd Geant4
\$ mkdir geant4.10.05-build

```
$ ls
```

We will see two directories

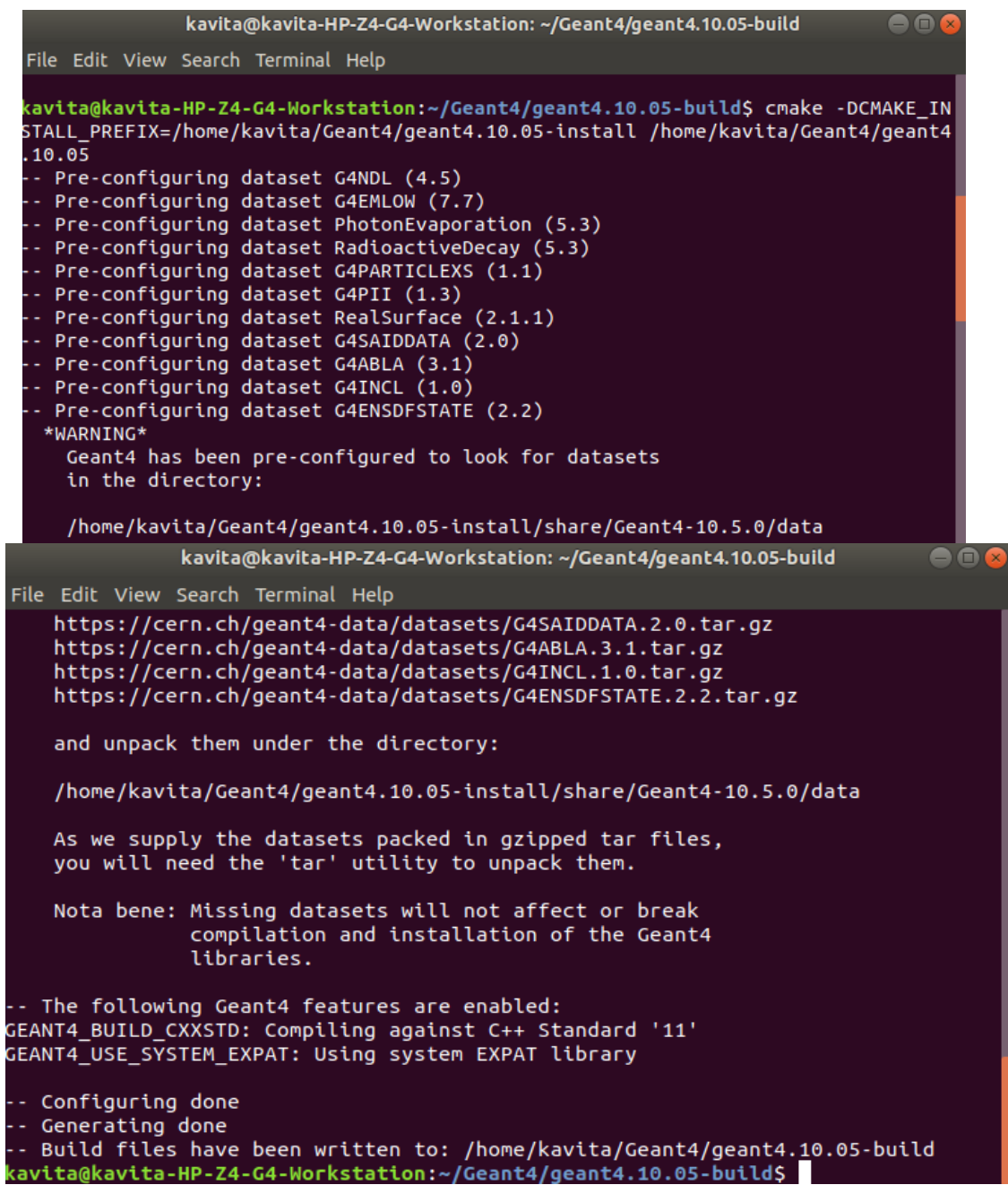
```
geant4.10.05  geant4.10.05-build
```

- `$ cd Geant4/geant4.10.05-build`
- To configure the build, change into the build directory and run CMake:

```
=====
$ cmake -DCMAKE_INSTALL_PREFIX=/home/user/Geant4/geant4.10.05-install
<space> /home/user/Geant4/geant4.10.05
=====
```

Here, the CMake Variable **CMAKE_INSTALL_PREFIX** is used to set the *install directory*, the directory under which the Geant4 libraries, headers and support files will be installed.

You will see output:



```
kavita@kavita-HP-Z4-G4-Workstation: ~/Geant4/geant4.10.05-build
File Edit View Search Terminal Help

kavita@kavita-HP-Z4-G4-Workstation:~/Geant4/geant4.10.05-build$ cmake -DCMAKE_IN
STALL_PREFIX=/home/kavita/Geant4/geant4.10.05-install /home/kavita/Geant4/geant4
.10.05
-- Pre-configuring dataset G4NDL (4.5)
-- Pre-configuring dataset G4EMLOW (7.7)
-- Pre-configuring dataset PhotonEvaporation (5.3)
-- Pre-configuring dataset RadioactiveDecay (5.3)
-- Pre-configuring dataset G4PARTICLEXS (1.1)
-- Pre-configuring dataset G4PII (1.3)
-- Pre-configuring dataset RealSurface (2.1.1)
-- Pre-configuring dataset G4SAIDDATA (2.0)
-- Pre-configuring dataset G4ABLA (3.1)
-- Pre-configuring dataset G4INCL (1.0)
-- Pre-configuring dataset G4ENSDFSTATE (2.2)
*WARNING*
  Geant4 has been pre-configured to look for datasets
  in the directory:

  /home/kavita/Geant4/geant4.10.05-install/share/Geant4-10.5.0/data

kavita@kavita-HP-Z4-G4-Workstation: ~/Geant4/geant4.10.05-build
File Edit View Search Terminal Help

https://cern.ch/geant4-data/datasets/G4SAIDDATA.2.0.tar.gz
https://cern.ch/geant4-data/datasets/G4ABLA.3.1.tar.gz
https://cern.ch/geant4-data/datasets/G4INCL.1.0.tar.gz
https://cern.ch/geant4-data/datasets/G4ENSDFSTATE.2.2.tar.gz

and unpack them under the directory:

/home/kavita/Geant4/geant4.10.05-install/share/Geant4-10.5.0/data

As we supply the datasets packed in gzipped tar files,
you will need the 'tar' utility to unpack them.

Nota bene: Missing datasets will not affect or break
           compilation and installation of the Geant4
           libraries.

-- The following Geant4 features are enabled:
GEANT4_BUILD_CXXSTD: Compiling against C++ Standard '11'
GEANT4_USE_SYSTEM_EXPAT: Using system EXPAT library

-- Configuring done
-- Generating done
-- Build files have been written to: /home/kavita/Geant4/geant4.10.05-build
kavita@kavita-HP-Z4-G4-Workstation:~/Geant4/geant4.10.05-build$
```

- Now switch on the data using command :

```
=====
$ cmake -DGEANT4_INSTALL_DATA=ON .
=====
```

On executing the CMake command, it will run to configure the build and generate Unix Makefiles to perform the actual build.

We will see output:

```
kavita@kavita-HP-Z4-G4-Workstation:~/Geant4/geant4.10.05-build$ cmake -DGEANT4_I
NSTALL_DATA=ON .
-- Configuring download of missing dataset G4NDL (4.5)
-- Configuring download of missing dataset G4EMLOW (7.7)
-- Configuring download of missing dataset PhotonEvaporation (5.3)
-- Configuring download of missing dataset RadioactiveDecay (5.3)
-- Configuring download of missing dataset G4PARTICLEXS (1.1)
-- Configuring download of missing dataset G4PII (1.3)
-- Configuring download of missing dataset RealSurface (2.1.1)
-- Configuring download of missing dataset G4SAIDDATA (2.0)
-- Configuring download of missing dataset G4ABLA (3.1)
-- Configuring download of missing dataset G4INCL (1.0)
-- Configuring download of missing dataset G4ENSDFSTATE (2.2)
-- The following Geant4 features are enabled:
GEANT4_BUILD_CXXSTD: Compiling against C++ Standard '11'
GEANT4_USE_SYSTEM_EXPAT: Using system EXPAT library

-- Configuring done
-- Generating done
-- Build files have been written to: /home/kavita/Geant4/geant4.10.05-build
kavita@kavita-HP-Z4-G4-Workstation:~/Geant4/geant4.10.05-build$
```

Now switch on the open GL driver for visulization and required packages for Geant4 using below command:

```
=====
```

```
$ cmake -DGEANT4_USE_QT=ON .
$ cmake -DGEANT4_USE_OPENGL_X11=ON .
$ cmake -DGEANT4_INSTALL_DATA=ON .
$ cmake -DGEANT4_USE_RAYTRACER_X11=ON .
$ cmake -DGEANT4_USE_GDML=ON .
$ cmake -DGEANT4_INSTALL_EXAMPLES=ON . [Don't forget to use "dot"(.)]
```

OR

```
$ cmake -DGEANT4_USE_QT=ON -DGEANT4_USE_OPENGL_X11=ON
-DGEANT4_INSTALL_DATA=ON -DGEANT4_USE_RAYTRACER_X11=ON
-DGEANT4_USE_GDML=ON -DGEANT4_INSTALL_EXAMPLES=ON .
```

[Don't forget to use "dot"(.)]

```
=====
```

You will see output

```
kavita@kavita-HP-Z4-G4-Workstation:~/Geant4/geant4.10.05-build$ cmake -DGEANT4_
USE_QT=ON -DGEANT4_USE_OPENGL_X11=ON -DGEANT4_INSTALL_DATA=ON -DGEANT4_USE_RAYTR
ACER_X11=ON -DGEANT4_USE_GDML=ON -DGEANT4_INSTALL_EXAMPLES=ON .
-- Found XercesC: /usr/lib/x86_64-linux-gnu/libxerces-c.so
-- Found OpenGL: /usr/lib/x86_64-linux-gnu/libOpenGL.so
-- Looking for XOpenDisplay in /usr/lib/x86_64-linux-gnu/libX11.so;/usr/lib/x86_
64-linux-gnu/libXext.so
-- Looking for XOpenDisplay in /usr/lib/x86_64-linux-gnu/libX11.so;/usr/lib/x86_
64-linux-gnu/libXext.so - found
-- Looking for gethostbyname
-- Looking for gethostbyname - found
-- Looking for connect
-- Looking for connect - found
-- Looking for remove
-- Looking for remove - found
-- Looking for shmatt
-- Looking for shmatt - found
-- Looking for IceConnectionNumber in ICE
-- Looking for IceConnectionNumber in ICE - found
-- Found X11: /usr/lib/x86_64-linux-gnu/libX11.so
-- Configuring download of missing dataset G4NDL (4.5)
-- Configuring download of missing dataset G4EMLOW (7.7)
```

```
kavita@kavita-HP-Z4-G4-Workstation: ~/Geant4/geant4.10.05-build
File Edit View Search Terminal Help
-- Found X11: /usr/lib/x86_64-linux-gnu/libX11.so
-- Configuring download of missing dataset G4NDL (4.5)
-- Configuring download of missing dataset G4EMLOW (7.7)
-- Configuring download of missing dataset PhotonEvaporation (5.3)
-- Configuring download of missing dataset RadioactiveDecay (5.3)
-- Configuring download of missing dataset G4PARTICLEXS (1.1)
-- Configuring download of missing dataset G4PII (1.3)
-- Configuring download of missing dataset RealSurface (2.1.1)
-- Configuring download of missing dataset G4SAIDDATA (2.0)
-- Configuring download of missing dataset G4ABLA (3.1)
-- Configuring download of missing dataset G4INCL (1.0)
-- Configuring download of missing dataset G4ENSDFSTATE (2.2)
-- The following Geant4 features are enabled:
GEANT4_BUILD_CXXSTD: Compiling against C++ Standard '11'
GEANT4_USE_SYSTEM_EXPAT: Using system EXPAT library
GEANT4_USE_GDML: Building Geant4 with GDML support
GEANT4_USE_QT: Build Geant4 with Qt support
GEANT4_USE_RAYTRACER_X11: Build RayTracer driver with X11 support
GEANT4_USE_OPENGL_X11: Build Geant4 OpenGL driver with X11 support
-- Configuring done
-- Generating done
-- Build files have been written to: /home/kavita/Geant4/geant4.10.05-build
kavita@kavita-HP-Z4-G4-Workstation:~/Geant4/geant4.10.05-build$
```

- After the configuration has run, CMake will have generated Unix Makefiles for building Geant4. To run the build, simply execute make in the build directory

```
=====
$ make -jN (N= no. of cores of CPU, N = 8 for my case )
```

```
=====
kavita@kavita-HP-Z4-G4-Workstation: ~/Geant4/geant4.10.05-build
File Edit View Search Terminal Help
rc/G4OpenGLQtViewer.cc.o
[100%] Building CXX object source/visualization/OpenGL/CMakeFiles/G4OpenGL.dir/s
rc/G4OpenGLStoredQt.cc.o
[100%] Building CXX object source/visualization/OpenGL/CMakeFiles/G4OpenGL.dir/s
rc/G4OpenGLStoredQtSceneHandler.cc.o
[100%] Linking CXX shared library ../../BuildProducts/lib/libG4RayTracer.so
[100%] Building CXX object source/visualization/OpenGL/CMakeFiles/G4OpenGL.dir/s
rc/G4OpenGLStoredQtViewer.cc.o
[100%] Building CXX object source/visualization/OpenGL/CMakeFiles/G4OpenGL.dir/i
nclude/moc_G4OpenGLQtExportDialog.cpp.o
[100%] Building CXX object source/visualization/OpenGL/CMakeFiles/G4OpenGL.dir/i
nclude/moc_G4OpenGLQtMovieDialog.cpp.o
[100%] Built target G4RayTracer
[100%] Building CXX object source/visualization/OpenGL/CMakeFiles/G4OpenGL.dir/i
nclude/moc_G4OpenGLQtViewer.cpp.o
[100%] Linking CXX shared library ../../BuildProducts/lib/libG4visHepRep.so
[100%] Built target G4visHepRep
[100%] Linking CXX shared library ../../BuildProducts/lib/libG4physicslists.so
[100%] Built target G4physicslists
[100%] Linking CXX shared library ../../BuildProducts/lib/libG4GMocren.so
[100%] Built target G4GMocren
[100%] Linking CXX shared library ../../BuildProducts/lib/libG4OpenGL.so
[100%] Built target G4OpenGL
kavita@kavita-HP-Z4-G4-Workstation: ~/Geant4/geant4.10.05-build$
```

- Once the build has completed, you can install Geant4 to the directory you specified earlier in CMAKE_INSTALL_PREFIX by running:

```
=====
$ make install
=====
```

```
kavita@kavita-HP-Z4-G4-Workstation: ~/Geant4/geant4.10.05-build
File Edit View Search Terminal Help
toredXViewer.hh
-- Installing: /home/kavita/Geant4/geant4.10.05-install/include/Geant4/G4OpenGLX
Viewer.hh
-- Installing: /home/kavita/Geant4/geant4.10.05-install/include/Geant4/G4OpenGLI
mmediateQt.hh
-- Installing: /home/kavita/Geant4/geant4.10.05-install/include/Geant4/G4OpenGLI
mmediateQtViewer.hh
-- Installing: /home/kavita/Geant4/geant4.10.05-install/include/Geant4/G4OpenGLQ
t.hh
-- Installing: /home/kavita/Geant4/geant4.10.05-install/include/Geant4/G4OpenGLQ
tExportDialog.hh
-- Installing: /home/kavita/Geant4/geant4.10.05-install/include/Geant4/G4OpenGLQ
tMovieDialog.hh
-- Installing: /home/kavita/Geant4/geant4.10.05-install/include/Geant4/G4OpenGLV
boDrawer.hh
-- Installing: /home/kavita/Geant4/geant4.10.05-install/include/Geant4/G4OpenGLQ
tViewer.hh
-- Installing: /home/kavita/Geant4/geant4.10.05-install/include/Geant4/G4OpenGLS
toredQt.hh
-- Installing: /home/kavita/Geant4/geant4.10.05-install/include/Geant4/G4OpenGLS
toredQtSceneHandler.hh
-- Installing: /home/kavita/Geant4/geant4.10.05-install/include/Geant4/G4OpenGLS
toredQtViewer.hh
kavita@kavita-HP-Z4-G4-Workstation: ~/Geant4/geant4.10.05-build$
```


- Now we can see a directory with the name **geant4.10.05-install** inside the **Geant4** directory.

STEP-3 : Set environment variables in .bashrc

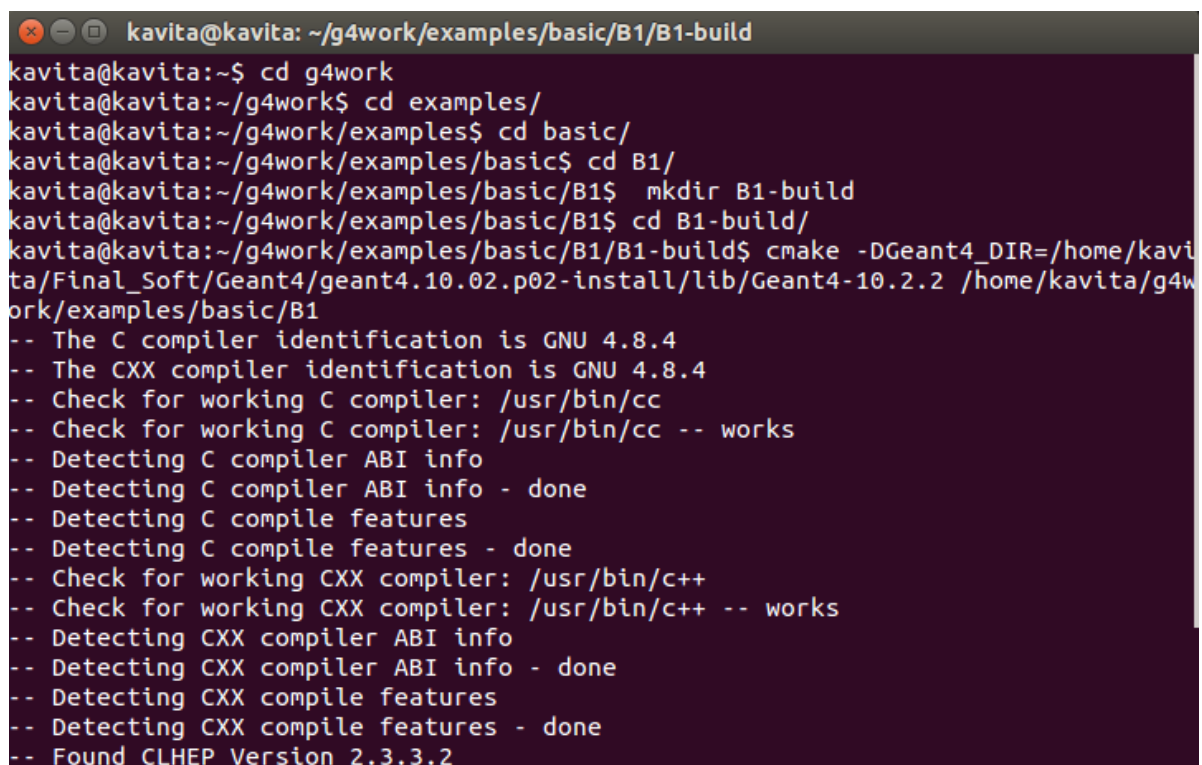
- Open bashrc and add the below line in **bashrc**

```
=====
source <space> /home/user/Geant4/geant4.10.05-install/bin/geant4.sh
=====
```

• STEP 4- Running Example in Geant4 :

- Open the Terminal(ctrl+alt+t)
- create directory where you want to run example
\$ mkdir working dir. (Example)
- Copy the examples from *home/user/Geant4/geant4.10.05* to **Example** directory (working directory) Note: here we have copied folder B1 from basic example.
- Go to the working directory
\$ cd Example
\$ cd basic
\$ cd B1
\$ mkdir B1-build
\$ cd B1-build
- compile example using command
\$ cmake -DGeant4_DIR=/home/user/geant4-install/lib/Geant4-G4VERSION <space>
/home/user/Example/B1

You will see the output

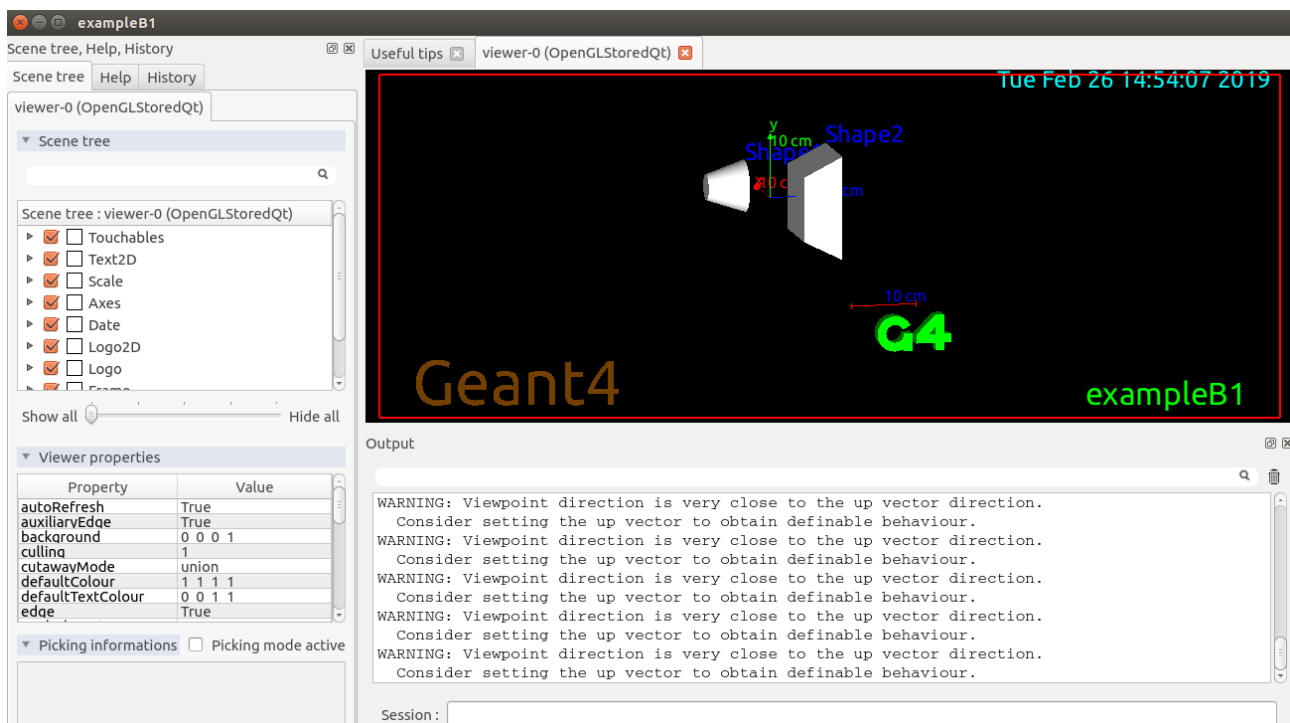


```
kavita@kavita: ~/g4work/examples/basic/B1/B1-build
kavita@kavita:~$ cd g4work
kavita@kavita:~/g4work$ cd examples/
kavita@kavita:~/g4work/examples$ cd basic/
kavita@kavita:~/g4work/examples/basic$ cd B1/
kavita@kavita:~/g4work/examples/basic/B1$ mkdir B1-build
kavita@kavita:~/g4work/examples/basic/B1$ cd B1-build/
kavita@kavita:~/g4work/examples/basic/B1/B1-build$ cmake -DGeant4_DIR=/home/kavita/Final_Soft/Geant4/geant4.10.02.p02-install/lib/Geant4-10.2.2 /home/kavita/g4work/examples/basic/B1
-- The C compiler identification is GNU 4.8.4
-- The CXX compiler identification is GNU 4.8.4
-- 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
-- Check for working CXX compiler: /usr/bin/c++
-- Check for working CXX compiler: /usr/bin/c++ -- works
-- Detecting CXX compiler ABI info
-- Detecting CXX compiler ABI info - done
-- Detecting CXX compile features
-- Detecting CXX compile features - done
-- Found CLHEP Version 2.3.3.2
```

- Use Command :
\$ make -jN (N is number of core in computer)

```
kavita@kavita: ~/g4work/examples/basic/B1/B1-build
-- Detecting CXX compiler ABI info - done
-- Detecting CXX compile features
-- Detecting CXX compile features - done
-- Found CLHEP Version 2.3.3.2
-- Found CLHEP: /lib/libCLHEP.so (Required is at least version "2.3.3.2")
-- Configuring done
-- Generating done
-- Build files have been written to: /home/kavita/g4work/examples/basic/B1/B1-build
kavita@kavita:~/g4work/examples/basic/B1/B1-build$ make -j4
Scanning dependencies of target exampleB1
[ 12%] Building CXX object CMakeFiles/exampleB1.dir/exampleB1.cc.o
[ 25%] Building CXX object CMakeFiles/exampleB1.dir/src/B1ActionInitialization.c
c.o
[ 37%] Building CXX object CMakeFiles/exampleB1.dir/src/B1DetectorConstruction.c
c.o
[ 50%] Building CXX object CMakeFiles/exampleB1.dir/src/B1EventAction.cc.o
[ 62%] Building CXX object CMakeFiles/exampleB1.dir/src/B1PrimaryGeneratorAction
.cc.o
[ 75%] Building CXX object CMakeFiles/exampleB1.dir/src/B1RunAction.cc.o
[ 87%] Building CXX object CMakeFiles/exampleB1.dir/src/B1SteppingAction.cc.o
[100%] Linking CXX executable exampleB1
[100%] Built target exampleB1
kavita@kavita:~/g4work/examples/basic/B1/B1-build$
```

- Use Command : `$./exampleB1`



Note :- This installation has been tested on Ubuntu 14/16/18.

Reference :

<http://geant4-userdoc.web.cern.ch/geant4-userdoc/UsersGuides/InstallationGuide/html/installguide.html>