Geant4 Installation/Usage on Linux

(Ubuntu 16.04 Recommended)

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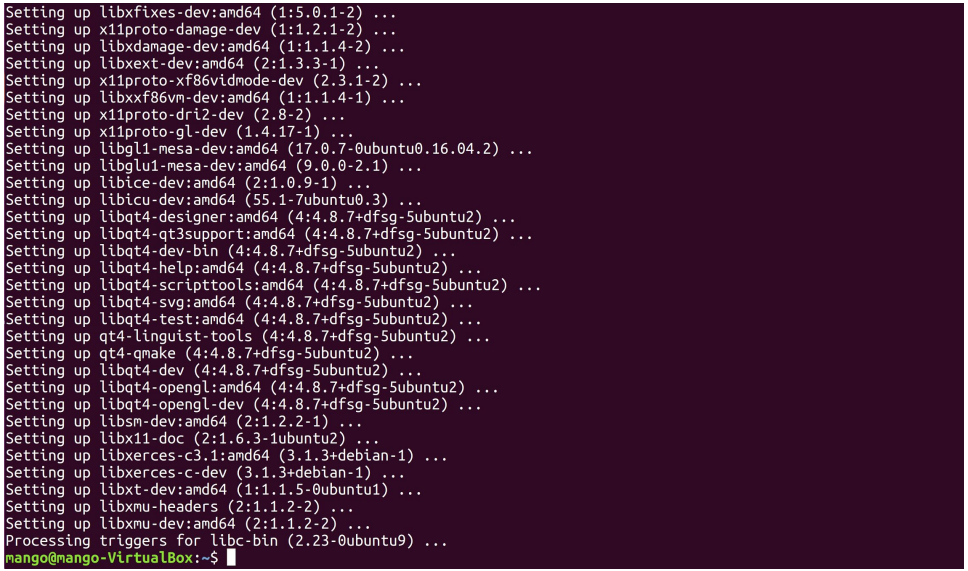
Background

- Geant4 is a simulation program that can be used to model the passage of particles through matter
- Covers physics processes such as: electromagnetic, hadronic, decay, optical
  - Long and short-lived particles
  - Energy ranging from tens of eV to trillions of eV
- It is used in high energy physics (ATLAS, ALICE, Fermilab, etc.), space and radiation, and medicine

Installation (on Linux)

- Installing dependencies for Geant4
  - **sudo apt-get update**
  - **sudo apt-get upgrade**
  - **sudo apt-get install libx11-dev libxmu-dev mesa-common-dev libglu1-mesa-dev -y libqt4-dev libxerces-c-dev cmake**



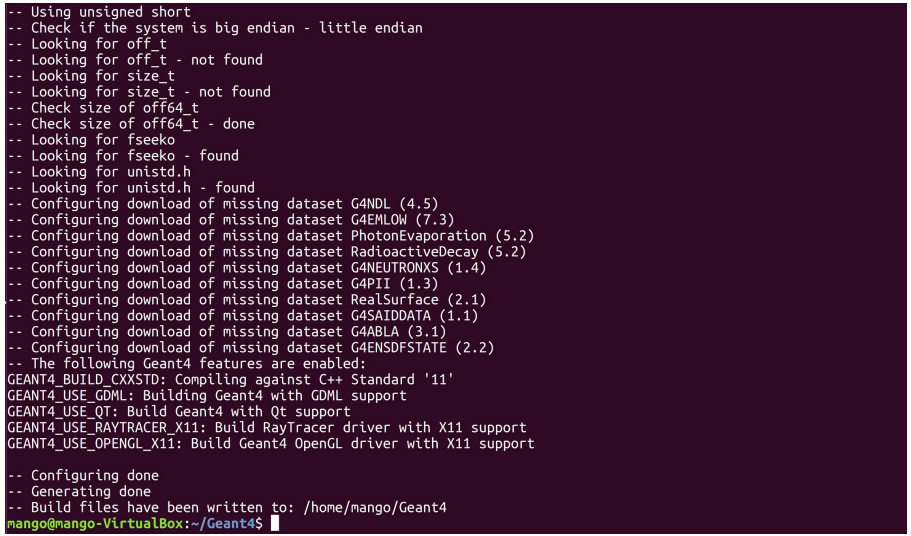
Installation (on Linux)

- Installing Geant4:
  - Download source file from http://geant4.web.cern.ch/geant4/support/download.shtml
  - Make a Geant4 directory (**`mkdir Geant4`**)
    - Moving the Geant4 package from Downloads to the Geant4 folder: **`mv -v ~/path/Downloads/geant4.10.04.tar.gz ~/path/Geant4`**
  - Unpack source file in Geant4 directory (**`tar -xvf geant4.10.04.tar.gz`**)

    - If the Geant4 version changes, change the terminal commands to match the downloaded version of Geant4 (ex: geant4.10.03.p03, geant4.10.05)
  - Make a geant4-install and geant4-build directory inside Geant4 directory: **`mkdir geant4-install`** and **`mkdir geant4-build`** (should have geant4.10.04, geant4-install, and geant4-build directories)

Installation (on Linux)

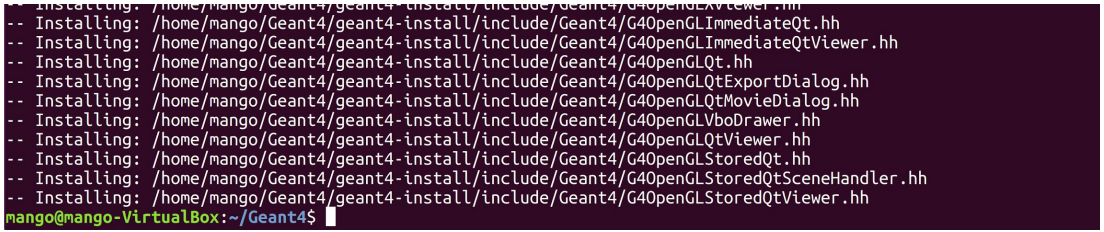
- Installing Geant4:
  - In the geant4-build directory (**`cd geant4-build`**): **`cmake -DCMAKE_INSTALL_PREFIX=~/path/Geant4/geant4-install -DGEANT4_INSTALL_DATA=ON -DGEANT4_USE_GDML=ON -DGEANT4_USE_QT=ON -DGEANT4_USE_OPENGL_X11=ON -DGEANT4_USE_RAYTRACER_X11=ON -DGEANT4_USE_SYSTEM_EXPAT=OFF ~/path/Geant4/geant4.10.04`**
    - When using additional flags (from section 2.3.1 of the Geant4 Installation Guide), you have to run **`cmake`**, **`make`**, and **`make install`** again



Installation (on Linux)

- Installing Geant4:
  - **`make`** (takes a very long time to complete)

  - **`make install`**



  - I tested these instructions using a Linux virtual machine (VirtualBox VM)

Sourcing geant4.sh

- Always do this before running Geant4 in a new terminal
  - Look in directory: **`cd path/Geant4/geant4-install/bin`**
  - In terminal, type: **`source geant4.sh`**
- Adding source geant4.sh to .profile
  - In home directory terminal, type: **`emacs .profile`** (emacs is a text editor)
  - Add this line to the end of .profile: **`alias alias_name = “cd ~/path/geant4.10.04-install/bin; source geant4.sh; cd ~/path/Geant4”`**
    - This will source geant4.sh and leave you in your Geant4 directory
- To use:
  - When you first open terminal (in home directory), type **`source .profile`**
  - Then, you can type **`alias_name`**

Compiling and Running Example B1 (all examples)

- Move B1 to Geant4 directory (**`mv -v ~/path/Geant4/geant4.10.04/examples/basic/B1 ~/path/Geant4`**)
- **`cd path/B1`**
- **`mkdir build`**
- **`cd build`**
- **`cmake ..`**
  - If encountering an error, source geant4.sh

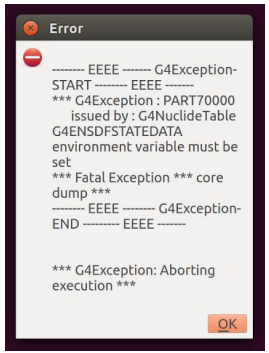
```
etsai@etsai-XPS-15-9550:~/Workspace/Geant4/B1/build$ cmake ..
-- The C compiler identification is GNU 5.4.0
-- The CXX compiler identification is GNU 5.4.0
-- Check for working C compiler: /usr/bin/cc
-- Check for working C compiler: /usr/bin/cc -- works
-- Detecting C compiler ABI info
-- Detecting C compiler ABI info - done
-- Detecting C compile features
-- Detecting C compile features - done
-- 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
-- Configuring done
-- Generating done
-- Build files have been written to: /home/etsai/Workspace/Geant4/B1/build
etsai@etsai-XPS-15-9550:~/Workspace/Geant4/B1/build$
```

Compiling and Running Example B1 (all examples)

- **make**

```
etsai@etsai-XPS-15-9550:~/Workspace/Geant4/B1/build$ make
Scanning dependencies of target exampleB1
[ 12%] Building CXX object CMakeFiles/exampleB1.dir/exampleB1.cc.o
[ 25%] Building CXX object CMakeFiles/exampleB1.dir/src/B1PrimaryGeneratorAction.cc.o
[ 37%] Building CXX object CMakeFiles/exampleB1.dir/src/B1DetectorConstruction.cc.o
[ 50%] Building CXX object CMakeFiles/exampleB1.dir/src/B1EventAction.cc.o
[ 62%] Building CXX object CMakeFiles/exampleB1.dir/src/B1SteppingAction.cc.o
[ 75%] Building CXX object CMakeFiles/exampleB1.dir/src/B1ActionInitialization.cc.o
[ 87%] Building CXX object CMakeFiles/exampleB1.dir/src/B1RunAction.cc.o
[100%] Linking CXX executable exampleB1
[100%] Built target exampleB1
etsai@etsai-XPS-15-9550:~/Workspace/Geant4/B1/build$
```

- How to run examples: **./exampleB1**
  - If encountering this error when trying to run executables, fix by sourcing geant4.sh



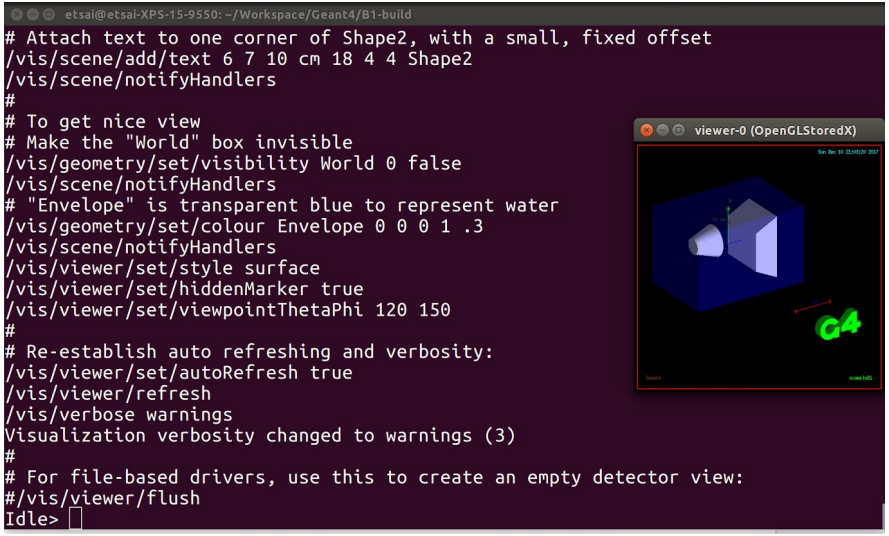
- After making changes to an example, run **cmake** and **make** again to implement the changes

Other Helpful Sources

- Geant4 Installation Guide: http://geant4.web.cern.ch/geant4/UserDocumentation/UsersGuides/InstallationGuide/fo/BookInstalGuide.pdf
- Geant4 Forum: http://hypernews.slac.stanford.edu/HyperNews/geant4/cindex

Tutorials

- Geant4: http://geant4.cern.ch/support/training.shtml
- How to use the visualizer: http://geant4.slac.stanford.edu/Presentations/vis/G4OpenGLTutorial/G4OpenGLTutorial.html
- B1: http://geant4.web.cern.ch/geant4/UserDocumentation/Doxygen/examples_doc/html/ExampleB1.html



Sources

- http://geant4.web.cern.ch/geant4/applications/index.shtml
- https://web.fnal.gov/project/Geant4/SitePages/Home.aspx
- https://kkandyli.wordpress.com/2017/01/25/installation-guide-of-geant4/