

Gate 8.0 安装流程（Linux Ubuntu）

相关链接：

官方 wiki: <https://opengate.readthedocs.io/en/latest/>

Gate 官网: <http://www.opengatecollaboration.org/GATE80>

首先打开官网找到对应安装的版本。此处以 Gate 8.0 为例。



官网上就会提示需要先安装一些必要的软件，而有的软件是可选择安装的。

GATE 8.0

Release Date: 20/4/2017

README

Release Notes

Required dependencies:

- geant4 10.3
- root 5.14 to last version
- gcc 4.8 to 6.2
- cmake minimal version 3.3 (with SSL support)

必装

Optional dependencies:

- Imf 3.0
- RTK 1.2

选装

File:

Attachment

Size

gate_v8.0.tar.gz

2.37 MB

其实最主要的就是 **Geant4** 和 **ROOT**。大多数 Linux 系统里都包含 **gcc** 和 **cmake**，就算没有装起来也比较简单。需要先把必装的软件装好后才可以下载最下方的 **gate_8.0.tar.gz** 安装。

从易到难，我们先检查是否需要安装 **gcc** 和 **cmake** 再安装 **Geant4** 和 **ROOT**。

一、检查是否已经有对应版本的 gcc 和 cmake

输入 **gcc --version** 和 **cmake --version** 查看 **gcc** 版本。如果能成功显示满足最低要求的版本则跳过此步骤。

```
ang@ang-VirtualBox:~$ gcc --version
gcc (Ubuntu 7.3.0-16ubuntu3) 7.3.0
Copyright (C) 2017 Free Software Foundation, Inc.
This is free software; see the source for copying conditions. There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

ang@ang-VirtualBox:~$ cmake --version
cmake version 3.10.2

CMake suite maintained and supported by Kitware (kitware.com/cmake).
ang@ang-VirtualBox:~$
```

可见我电脑上的 **gcc** 为版本 7.3.0，不在[4.8-6.2]的区间内，不过只要不低于版本就行。而 **cmake** 也满足了最低版本的要求。

如果版本不满足要求或者提示没有找到 gcc/cmake 指令则需要更新/安装 gcc/cmake。

安装 gcc, g++, make 等多个软件: **sudo apt-get install build-essential**

安装 cmake: **sudo apt-get install cmake**

其他安装方式可参考链接:

安装 gcc: https://blog.csdn.net/qq_43504064/article/details/101010507

安装 cmake: <https://blog.csdn.net/zzy0006/article/details/88625007>

二、安装必要的包（主要为 Geant4 安装准备）

官方 wiki 链接: https://opengate.readthedocs.io/en/latest/package_requirements.html#package-requirements-label 上面说明不同系统版本不太一样（主要看系统，和 Gate 版本关系不太大，如果担心可以都装一下试试）。

在终端键入:

更新 apt: **sudo apt-get update**

如果你是 Ubuntu 18.04.2 LTS (for GATE v8.2 w/ Geant4 10.5 p01)

键入安装推荐的包: **sudo apt-get install cmake cmake-curses-gui build-essential libqt4-opengl-dev qt4-qmake libqt4-dev libx11-dev libxmu-dev libxpm-dev libxft-dev**

其中必须的包: cmake-curses-gui libqt5-default libxmu-dev

如果你是 Ubuntu 16.04.2 LTS (for GATE v8.0 w/ Geant4 10.3 p01) and Ubuntu 16.04 LTS (for GATE v7.2 w/ Geant4 10.2 p01)

键入安装必要的包: **sudo apt-get install cmake cmake-curses-gui build-essential libqt4-opengl-dev qt4-qmake libqt4-dev libx11-dev libxmu-dev libxpm-dev libxft-dev**

编译 Gate/Geant4 时想要 GATE_USE_OPTICAL 还需安装: **sudo apt-get install libxml2-dev**

如果你是 Ubuntu 14.04.3 LTS (for GATE v7.1 w/ Geant4 10.1 p02) and Ubuntu 12.04.5 LTS (for GATE v7.0 w/ Geant4 9.6 p04)

键入安装必要的包: **sudo apt-get install cmake cmake-curses-gui build-essential libqt4-opengl libqt4-opengl-dev libqt4-core qt4-qmake libqt4-dev libX11-dev libxmu-dev**

注意: 如果出现安装问题，如存在依赖关系、包的版本不对，建议把提示的依赖库加上；按照要求在库的后面备注版本号如（xxx 库=1.2.5.7）；如果还不能解决就百度一下（不要抱太大的希望）；最后还没解决就换一个系统吧，Ubuntu16.04 更稳定一些。

在安装前最好专门建立一个文件夹来放 Gate 和 Gate 所需要的其他软件（ROOT、Geant4 等）



三、安装 ROOT

Gate 的官方 wiki: https://opengate.readthedocs.io/en/latest/compilation_instructions.html#compilation-instructions-label

ROOT 建议在官网（<https://root.cern.ch/downloading-root>）上下载对应系统版本的二进制文件。

Binary distributions

Platform	Files	Size
CentOS Cern 7 gcc4.8	root_v6.18.04.Linux-centos7-x86_64-gcc4.8.tar.gz	137M
Linux fedora29 gcc8.3	root_v6.18.04.Linux-fedora29-x86_64-gcc8.3.tar.gz	155M
Linux fedora30 gcc9.2	root_v6.18.04.Linux-fedora30-x86_64-gcc9.2.tar.gz	158M
Ubuntu 14 gcc4.8	root_v6.18.04.Linux-ubuntu14-x86_64-gcc4.8.tar.gz	137M
Ubuntu 16 gcc5.4	root_v6.18.04.Linux-ubuntu16-x86_64-gcc5.4.tar.gz	144M
Ubuntu 18 gcc7.4	root_v6.18.04.Linux-ubuntu18-x86_64-gcc7.4.tar.gz	154M

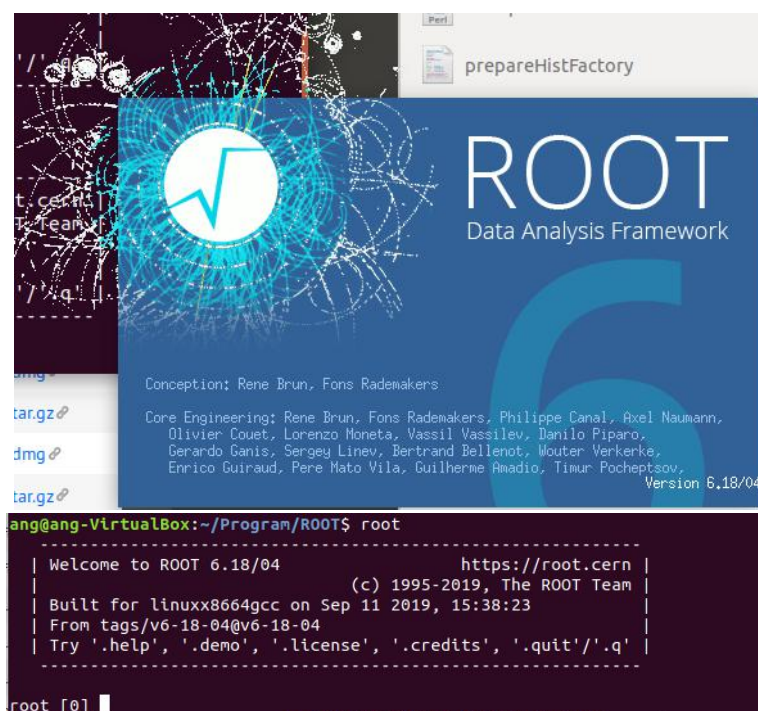
下载好后解压: `tar -xzf root_v6.xx.xx.Linux-ubuntu14-x86_64-gcc4.8.tar.gz`

删除压缩文件: `mv root root_v6.xx`

添加 source: `source /你解压的文件夹/bin/thisroot.sh`

注意: source 之后仅在当前终端下有效!!! 如果切换终端, 需要重新 source

验证直接输入: `root`



即安装成功。

四、安装 Geant4

Gate 的官方 wiki: https://opengate.readthedocs.io/en/latest/compilation_instructions.html#compilation-instructions-label

关于 CLHEP: 在 Gate 7.0 版本之后, 就可以用 Geant4 集成的 CLHEP。不需要额外的安装。但是要在 cmake 配置时把 GEANT4_USE_SYSTEM_CLHEP 设成 OFF。如果想手动安装则需要安装对应 Geant4 正确的版本, 不推荐。详细说明参考上面的链接。

注意版本: Geant4 的版本直接关系到 Gate 的安装能否成功, 因此需要查看想要安装的 Gate 版本需要哪个版本的 Geant4。这里 Gate 8.0 需要 10.3 版本的 Geant4。

在官网下载对应版本的源代码, 最新版本 <http://geant4.web.cern.ch/node/1765> 链接

Geant4 10.5 Software Download

Submitted by Gabriele Cosmo on Fri, 12/07/2018 - 15:29

Geant4 10.5

first released 7 December 2018 (patch-01, released 17 April 2019)

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 10.5, we suggest you to download and apply the latest patch for release 10.5 (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 (32.8Mb, 34413415 bytes) <small>After downloading, gunzip, then unpack using GNU tar</small>
Download	ZIP format (46.5Mb, 48749891 bytes) <small>After downloading, unpack using e.g. WinZip.</small>

Related Links

- [Previous Releases](#) of Geant4 (since release 10.0)
- [LXR source code browser](#)
 - [GitHub](#)
 - [GitLab @ CERN](#)

老版本链接

最新版本源代码

解压: **tar -xzf geant4.10.03.tar.gz**

在文件夹下新建两个文件夹用于编译和安装: **mkdir geant4.10.03-build; mkdir geant4.10.03-install**



然后移动到 build 文件夹: **mkdir geant4.10.03-build**

用 cmake 配置 cmake 参数: **ccmake ../geant4.10.03**

可以看到下图

```
Page 0 of 1
EMPTY CACHE:
Press [enter] to edit option                               CMake Version 3.5.1
Press [c] to configure
Press [h] for help                                         Press [q] to quit without generating
Press [t] to toggle advanced mode (Currently Off)
```

然后按 **c** 即可配置，会显示配置输出的信息:

```
WARNING*
Geant4 has been pre-configured to look for datasets
in the directory:

/usr/local/share/Geant4-10.0.4/data

but the following datasets are NOT present on disk at
that location:

CMake produced the following output
Press [e] to exit help                                     CMake Version 3.5.1
```

按 **e** 返回


```
Page 1 of 1
CMAKE_BUILD_TYPE                *Release
CMAKE_INSTALL_PREFIX            */usr/local
GEANT4_BUILD_MULTITHREADED      *OFF
GEANT4_INSTALL_DATA             *OFF
GEANT4_INSTALL_DATADIR         *
GEANT4_USE_G3TOG4               *OFF
GEANT4_USE_GDML                 *OFF
GEANT4_USE_INVENTOR             *OFF
GEANT4_USE_OPENGL_X11          *OFF
GEANT4_USE_QT                   *OFF
GEANT4_USE_RAYTRACER_X11       *OFF
GEANT4_USE_SYSTEM_CLHEP        *OFF
GEANT4_USE_SYSTEM_EXPAT        *ON
GEANT4_USE_SYSTEM_ZLIB         *OFF
GEANT4_USE_XM                   *OFF

CMAKE_BUILD TYPE: Choose the type of build, options are: None Release TestReleas
Press [enter] to edit option
Press [c] to configure
Press [h] for help
Press [t] to toggle advanced mode (Currently Off)
```

建议按照如下配置。第四行 DATA 是强制要选，会自动下载 Geant4 的 DATA，倒数第 5 行 CLHEP 如果没有安装则不选（有的安装过程会让你提前安装）。

```
Page 1 of 1
CMAKE_BUILD_TYPE                Release
CMAKE_INSTALL_PREFIX            ../geant4.10.00-install
GEANT4_BUILD_MULTITHREADED      ON
GEANT4_INSTALL_DATA             ON
GEANT4_INSTALL_DATADIR
GEANT4_USE_G3TOG4               OFF
GEANT4_USE_GDML                 OFF
GEANT4_USE_INVENTOR             OFF
GEANT4_USE_OPENGL_X11          ON
GEANT4_USE_QT                   ON
GEANT4_USE_RAYTRACER_X11       OFF
GEANT4_USE_SYSTEM_CLHEP        OFF
GEANT4_USE_SYSTEM_EXPAT        ON
GEANT4_USE_SYSTEM_ZLIB         OFF
GEANT4_USE_XM                   OFF
QT_QMAKE_EXECUTABLE            /usr/bin/qmake

GEANT4 USE SYSTEM CLHEP: Use system CLHEP library
Press [enter] to edit option
Press [c] to configure
Press [h] for help
Press [t] to toggle advanced mode (Currently Off)
```

第二行为编译生成的路径（最好改成绝对路径，否则可能配置出错，右键文件夹->属性）。第三行为多线程，第 9 行选 No 则需要安装 libxml2-dev（前面提到）

配置好后再按一次 **c** 重配置。随后按 **g** 生成并自动退出 ccmake。

随后在终端（目录还在 xxx-build）输入：**make -jN**（N 为电脑处理器的数量，比如 4 核的 CPU 输入-j4）这个过程时间较长。

下一步：**make install**

最后更新环境变量：**source ../geant4.10.10-install/bin/geant4.sh**

五、安装 Gate 8.0

Gate 的官方 wiki: https://opengate.readthedocs.io/en/latest/compilation_instructions.html#compilation-instructions-label
如果要安装 ECAT7、ITK、LMF 等可选包需要在安装 GATE 之前安装。具体方法参照上面的链接（普通玩家一般不用这些功能）。

先从 Gate 官网下载 Gate 8.0。 <http://www.opengatecollaboration.org/node/90>

GATE 8.0

Release Date: 20/4/2017

README

Release Notes


Required dependencies:

- geant4 10.3
- root 5.14 to last version
- gcc 4.8 to 6.2
- cmake minimal version 3.3 (with SSL support)

Optional dependencies:

- Imf 3.0
- RTK 1.2

File:

Attachment	Size
 gate_v8.0.tar.gz	2.37 MB

整个过程与 Geant4 类似。

解压: **tar -xzf Gate-8.2.tar.gz**

新建文件夹: **mkdir gate_v8.0-build; mkdir gate_v8.0-install**



注意, 如果前面的 source 没有在当前终端下, 这一步会出现问题!!!

所以最好在**当前终端**下再 source 一次:

source /你解压的文件夹/bin/thisroot.sh

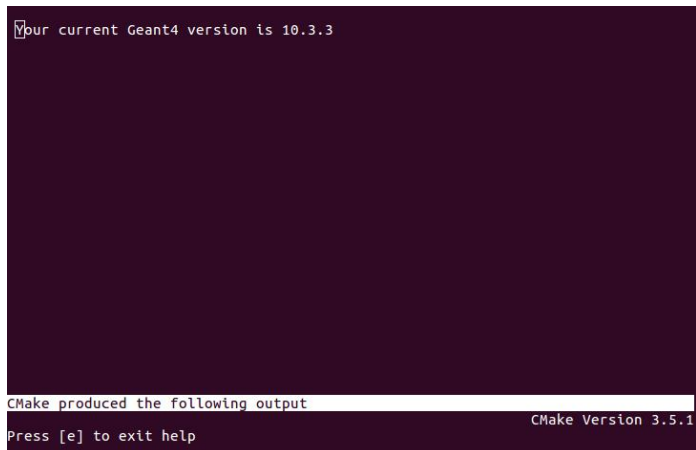
source /你解压的文件夹/geant4.10.10-install/bin/geant4.sh

然后移动到 xx-build 目录: **cd gate_v8.0-build**

配置 cmake: **ccmake ../gate_v8.0** 显示如下



按 **c** 配置



按 **e** 返回,

```
Page 1 of 1
BUILD_TESTING OFF
CMAKE_BACKWARDS_COMPATIBILITY 2.4
CMAKE_BUILD_TYPE Release
CMAKE_INSTALL_PREFIX /usr/local
EXECUTABLE_OUTPUT_PATH
GATE_DOWNLOAD_BENCHMARKS_DATA OFF
GATE_USE_DAVIS OFF
GATE_USE_ECAT7 OFF
GATE_USE_GEANT4_UIVIS ON
GATE_USE_GPU OFF
GATE_USE_ITK OFF
GATE_USE_LMF OFF
GATE_USE_OPTICAL OFF
GATE_USE_RTK OFF
GATE_USE_STDC11 ON
GATE_USE_SYSTEM_CLHEP OFF
Geant4_DIR /home/ang/Program/Geant4/geant4.10.03-install
LIBRARY_OUTPUT_PATH
ROOTCINT_EXECUTABLE /home/ang/Program/ROOT/root/bin/rootcint

BUILD_TESTING: Build the testing tree.
Press [enter] to edit option CMake Version 3.5.1
Press [c] to configure Press [g] to generate and exit
Press [h] for help Press [q] to quit without generating
Press [t] to toggle advanced mode (Currently Off)
```

修改安装路径，即第四行 CMAKE_INSTALL_PREFIX。其他的默认。如果你安装了附加包如 ECAT7、ITK、LMF 等，可以把 OFF 改成 ON，不过本例程没有说明，即默认 OFF。

```
Page 1 of 1
BUILD_TESTING OFF
CMAKE_BACKWARDS_COMPATIBILITY 2.4
CMAKE_BUILD_TYPE Release
CMAKE_INSTALL_PREFIX /home/ang/Program/Gate/gate_v8.0-install
EXECUTABLE_OUTPUT_PATH
GATE_DOWNLOAD_BENCHMARKS_DATA OFF
GATE_USE_DAVIS OFF
GATE_USE_ECAT7 OFF
GATE_USE_GEANT4_UIVIS ON
GATE_USE_GPU OFF
GATE_USE_ITK OFF
GATE_USE_LMF OFF
GATE_USE_OPTICAL OFF
GATE_USE_RTK OFF
GATE_USE_STDC11 ON
GATE_USE_SYSTEM_CLHEP OFF
Geant4_DIR /home/ang/Program/Geant4/geant4.10.03-install
LIBRARY_OUTPUT_PATH
ROOTCINT_EXECUTABLE /home/ang/Program/ROOT/root/bin/rootcint

BUILD_TESTING: Build the testing tree.
Press [enter] to edit option CMake Version 3.5.1
Press [c] to configure Press [g] to generate and exit
Press [h] for help Press [q] to quit without generating
Press [t] to toggle advanced mode (Currently Off)
```

如果倒数第三行的 Geant4_DIR 和最后一行的 ROOTCINT_EXECUTABLE 路径和你安装的路径不匹配，则可手动修改（主要原因可能是前面 source 出了问题）。

最后按 **c** 配置按 **g** 生成。

安装：make -jN（N 为电脑处理器的数量，比如 4 核的 CPU 输入-j4）

然后：make install

六、配置环境变量

万里长征最后一步了!!!

Gate 的官方 wiki: https://opengate.readthedocs.io/en/latest/compilation_instructions.html#compilation-instructions-label

在/你解压 Gate 的文件夹/gate_v8.0-install/bin/目录下新建一个文件用于配置环境变量：gate_env.sh。

在里面加入如下内容，并保存：

```
#!/bin/sh
```

```
source /你安装的文件夹/root_v6.XX/bin/thisroot.sh
```

```
source /你安装的文件夹/geant4.10.05-install/bin/geant4.sh
```

```
export PATH=$PATH:/你安装的文件夹/gate_v8.2-install/bin
```

```
# the following lines only if you are using an external CLHEP library (and similar for ITK, if you enabled it):
```

```
#export PATH=$PATH:/你安装的文件夹/2.3.4.3/CLHEP/bin
```

```
#export PATH=$PATH:/ 你安装的文件夹/2.3.4.3/-install/bin:/PATH_TO/2.3.4.3-install/include
```

```
#export LD_LIBRARY_PATH=$LD_LIBRARY_PATH:/你安装的文件夹/2.3.4.3/CLHEP/lib
```

其实就是把之前配置的 ROOT 和 Geant4 的环境变量还有 Gate 的环境变量用一个文件写出来。
由于没有装 CLHEP（Geant4 集成的），所以最后三行注释了。

把它 source 一下：`source /路径/gate_env.sh`

你就可以在当前终端输入：`Gate`

```
ang@ang-gate:~/Program/Gate/gate_v8.0/benchmarks/benchPET$ Gate
[G4]
[G4] *****
[G4] Geant4 version Name: geant4-10-03-patch-03 [MT] (20-October-2017)
[G4] Copyright : Geant4 Collaboration
[G4] Reference : NIM A 506 (2003), 250-303
[G4] WWW : http://cern.ch/geant4
[G4] *****
[G4]
[G4] ### WARNING: G4EmProcessOptions class is obsolete and will be removed in the next public release
      Please, try to use G4EmParameters class and/or UI interface to EM parameters
[Core-0] Initialization of geometry
[Core-0] Initialization of physics
[G4] ### WARNING: G4EmProcessOptions class is obsolete and will be removed in the next public release
      Please, try to use G4EmParameters class and/or UI interface to EM parameters
[Core-0] Initialization of actors
[Core-0]
[Core-0] *****
[Core-0] GATE version name: gate_v8.0
[Core-0] Copyright : OpenGATE Collaboration
[Core-0] Reference : Phys. Med. Biol. 49 (2004) 4543-4561
[Core-0] Reference : Phys. Med. Biol. 56 (2011) 881-901
[Core-0] WWW : http://www.opengatecollaboration.org
[Core-0] *****
[Core-0]
[Core-0] You are using Geant4 version 10.3.3
PreInit>
```

你不想每次打开终端/打开电脑都要重新 source 一下 `gate_env.sh`，这样太麻烦。因此要把这句话写在 `~/.bashrc` 中。

用一个你喜欢的编辑器打开：`gedit ~/.bashrc`

在最后加上 `source /路径/gate_env.sh`

保存关闭

`~/.bashrc` 可以在被配置用户打开终端前自动执行（`source ~/.bashrc`）

关于 `~/.bashrc` 的说明可参考链接：<https://www.jianshu.com/p/35ad1b375e50>

七、验证你的安装

为了保证你今后使用 Gate 的正确性，最好在安装完成后验证一下。在你解压的 Gate 文件夹里面包含了用于验证的 benchmark 文件。

打开一个新的终端

移动到 benchmark 目录：`cd /解压 Gate 的目录/解压的文件（不是 xx-build 和 xx-install）/benchmarks/benchPET`

输入：`ls`

如果目录下有 `benchmarkPET.root` 先删除：`rm benchmarkPET.root`

```
ang@ang-gate:~/Program/Gate/gate_v8.0/benchmarks/benchPET$ ls
benchmarkPET.C          benchmarkPET.gif.md5    benchPET.pdf.md5      phantom.mac    visu.mac
benchmarkPET-FGATE.gif.md5 benchmarkPET.root       camera.mac            physics.mac
benchmarkPET-GATE-Reference.gif.md5 benchPET.mac           digitizer.mac         sources.mac
ang@ang-gate:~/Program/Gate/gate_v8.0/benchmarks/benchPET$ rm benchmarkPET.root
ang@ang-gate:~/Program/Gate/gate_v8.0/benchmarks/benchPET$
```

运行：`Gate benchPET.mac`（让程序飞一会）


```

msc: for e+ SubType= 10
RangeFactor= 0.04, stepInitType: 3, latDisplacement: 1, skin= 1, geomFactor= 2.5
===== EH models for the G4Region DefaultRegionForTheWorld =====
UrbanMsc : Emin= 0 eV Emax= 100 TeV Table with 84 bins Emin= 100 eV Emax=
100 TeV

ElectronIonisation: for e+ SubType= 2
dE/dx and range tables from 100 eV to 100 TeV in 84 bins
Lambda tables from threshold to 100 TeV, 7 bins per decade, spline: 1
finalRange(mm)= 1, dRoverRange= 0.2, integral: 1, fluct: 1, linLossLimit= 0.01
===== EH models for the G4Region DefaultRegionForTheWorld =====
MollerBhabha : Emin= 0 eV Emax= 100 TeV

### === Deexcitation model UatomDeexcitation is activated for 11 regions:
DefaultRegionForTheWorld 1 1 1
cylindricalPET 1 1 1
head 1 1 1
endshielding 1 1 1
septa 1 1 1
module 1 1 1
block 1 1 1
crystal 1 1 1
LSO 1 1 1
BGO 1 1 1
NEMACylinder 1 1 1

### === G4UatomicDeexcitation::InitialiseForNewRun()
### === Auger cascade flag: 0
### === Ignore cuts flag: 0
### === PIXE model for hadrons: Empirical
### === PIXE model for e+: Livermore

```

过了大约 1 分钟后按: **Ctrl+z** 终止程序。可以看到程序生成了一个 benchmarkPET.root 文件

然后运行: root

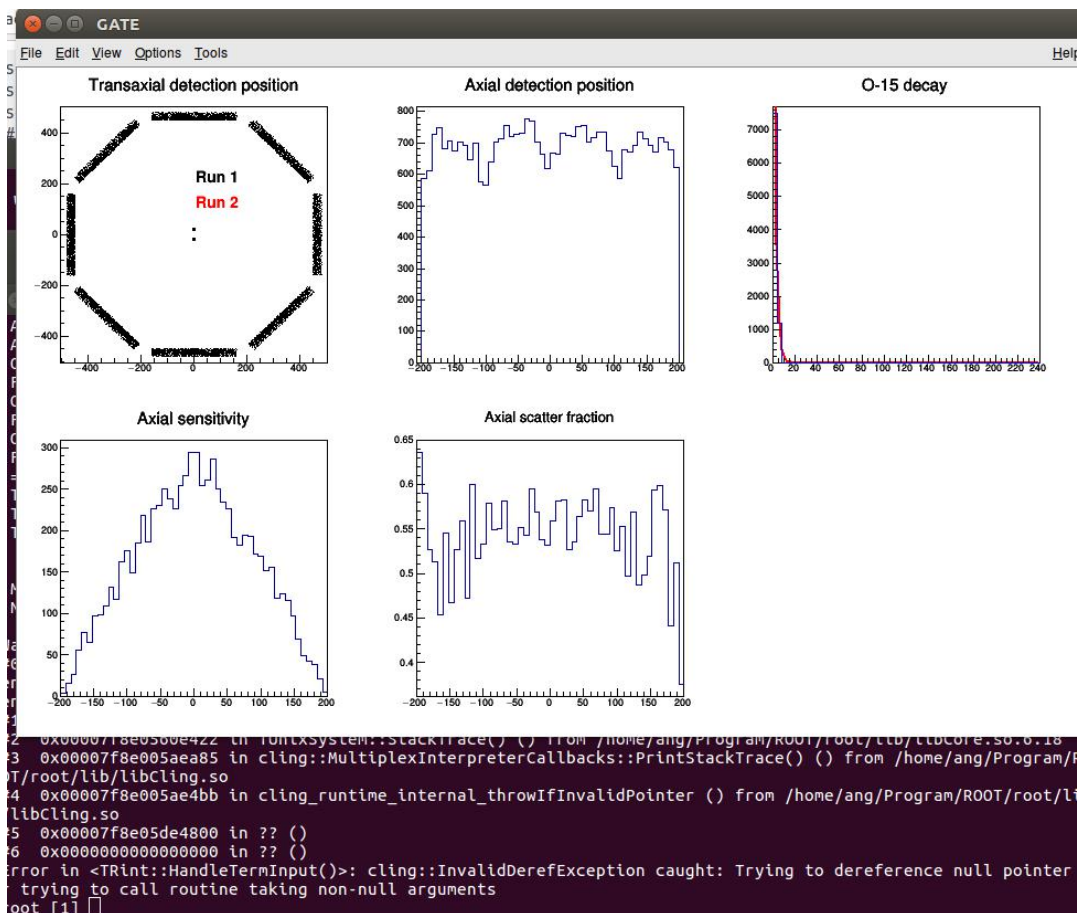
```

ang@ang-gate:~/Program/Gate/gate_v8.0/benchmarks/benchPET$ root
-----
| Welcome to ROOT 6.18/04                               https://root.cern |
|                                                         (c) 1995-2019, The ROOT Team |
| Built for linuxx8664gcc on Sep 11 2019, 15:38:23      |
| From tags/v6-18-04@v6-18-04                          |
| Try '.help', '.demo', '.license', '.credits', '.quit'/.q' |
|-----|

root [0] .x benchmarkPET.C

```

输入: .x benchmartPET.C 即可看到如下结果



恭喜你成功正确地完成了 **Gate** 最基本组件的安装！
接下来可以放心使用 **Gate** 的基本功能