

## **Description of theoretical and practical lessons on the Monte Carlo Geant4 code and prerequisites for the course**

Lessons on Geant4 consist of a theoretical part on the capabilities of the code and practice exercises with the computer. Purpose of the lessons is to provide a basic understanding of the main features and tools available in Geant4 toolkit, including a description of geometry and physical processes. The course wants to make the participants able to install Geant4 and to implement and run user applications, simple but comprehensive, based on Geant4. Lessons will be divided over 5 days (from Monday to Friday) and will include approximately 6 hours of lectures and 8 hours of practical exercises at the computer, on Linux platform. The teachers will be two members of the Geant4 International Collaboration.

### **Geant4**

Geant4 (<http://geant4.cern.ch/>) is a software toolkit, written in C ++, for simulating the tracking of particles in the matter with the Monte Carlo approach. The software is developed and maintained by an International Collaboration (<http://geant4.cern.ch/collaboration/index.shtml>) of scientists belonging to different institutions, including INFN. Geant4 can be used for applications in high energy physics, astrophysics, medical physics, particle astrophysics and nuclear physics. The software provides all the tools needed to a complete Monte Carlo simulation of the experimental set-up, including modeling of geometry, detector response, event management and user interface. In Geant4 there is a wide range of physical models capable of describing interactions of particles with matter; there are several alternative models, which can be chosen by the user for many physical processes. Geant4 source code and libraries are freely available, along with manuals, from the Geant4 home page.

### **Prerequisites**

Participants must have their own laptop, equipped for supporting ssh connections to a Linux machine with graphical windows. Wi-Fi connection will be available for the participants.

Each student can choose between two methods for using the Geant4 toolkit. We suggest to try to use the first one and, in case of problem, switch on the second one:

#### **1. *recommended:***

work with a pre-configured Virtual Machine (VM), developed with the VMware tool. In this VM a Linux operating system has been already pre-installed with an installation of the Geant4 toolkit. Additional graphical libraries (Qt and Xm) have been also installed in order to facilitate the practical session of the course.

You can download a compressed version of the VM (vm\_alghero2013.zip) going to a url which will be provided during the first lesson.

To run the Virtual Machine, it is necessary to install VMware Player that is the easiest way to run multiple operating systems at the same time on your PC (it is suggested to download and install it before the first lesson).

VMware Player program installer is available at:

[https://my.vmware.com/web/vmware/free#desktop\\_end\\_user\\_computing/vmware\\_player/5\\_0](https://my.vmware.com/web/vmware/free#desktop_end_user_computing/vmware_player/5_0)

You can choose the version compatible with your operating systems.

Once you download that, you can uncompress vm\_alghero2013.zip with the following software:

- **WinZip:** a trial Version is available here at <http://www.winzip.com/win/it/index.htm> (Only for Windows Operating system)
- **7-Zip** Open source software:
  - It is possible to download it at <http://www.7-zip.org/download.html> , for both the Linux operating system that Windows.
 or
  - It is possible to install it directly via “Add/remove software” in your in your Linux packages administration.

The command line for to extract `vm_alghero2013.zip` by terminal Linux is:

```
7z x vm_alghero2013.zip
```

Once you have downloaded the VM, you can open that and login as:

Username: *user*

Password: *user*

For the practical session of the Geant4 course with suggest to work with the pre-configured “*user*”, avoiding to use “*root*”.

In case, for future modification of the VM, you may need to login as “*root*” user, you can use the following password: *scilinux5.8*

## 2. *alternative:*

work with SSH Secure Shell (or putty) and Xming-mesa (both freeware), to connect remotely to computers where the toolkit Geant4 has already been installed.

Xming-mesa program installer is available at:

[http://geant4.lngs.infn.it/corso\\_infn/Xming-mesa.exe](http://geant4.lngs.infn.it/corso_infn/Xming-mesa.exe)

Additional fonts (necessary only if you want to use emacs as text editor) can be downloaded from here:

[http://geant4.lngs.infn.it/corso\\_infn/Xming-fonts-7-5-0-8-setup.exe](http://geant4.lngs.infn.it/corso_infn/Xming-fonts-7-5-0-8-setup.exe)

(documentation is at: <http://www.straightrunning.com/XmingNotes/> ).

SSH Secure Shell program is available at:

<http://software.dartmouth.edu/Windows/Connectivity/SSHSecureShell.zip>

Xming server must be launched before starting the SSH connection. To configure the SSH connection with graphics windows, just open menu Edit->Settings->Tunneling SSH Secure Client, select “Tunnel X11 connections” option and click OK.

Moreover, we invite participants who are interested on working with the toolkit Geant4 to directly install the toolkit on their own operative system (Linux or Mac). We will give you all the necessary support to fix eventual installation problems.

Presentations and other teaching materials (including Geant4 installation code) will be available online in the website of the Seminar for long time, so participants can come back on them also after the end of the Course.