

VIII Seminario sul Software per la Fisica Nucleare, Subnucleare e Applicata

Hotel Porto Conte, Alghero
6-10 June 2011

How to install Geant 4

Geant 4 tutorial course

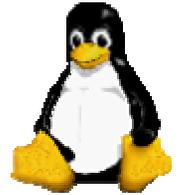


Outline

- Supported platforms & compilers
- External software packages and tools
- Working area and installation area
- Where to download the packages
- CLHEP installation
- Toolkit installation (*release 9.4.p01*)
 - Configuring the environment manually
 - Using the *Configure* installation script

Supported platforms & compilers

- Linux systems
 - Scientific Linux CERN SLC5, g++ gcc 4.1.2
 - G4SYSTEM: Linux-g++
- MacOSX systems
 - MacOSX Darwin 10.6 and g++ gcc 4.2.1
 - G4SYSTEM: Darwin-g++
- Windows systems
 - Win/XP & Cygwin32, MSVC++ 9.0 .NET
 - G4SYSTEM: WIN32-VC
- UNIX systems *(configured but no longer supported)*
 - SUN-SunOS v.5.8, CC v.5.5
 - G4SYSTEM: SUN-CC



Required software

- A **UNIX shell** and related basic UNIX commands
- **C++ compiler**
 - **gcc** is usually installed on your Linux. If not, you need to install it (*not shown here*)
- **CLHEP** library (library for high energy physics)
- The Geant4 **data files**
- The **Geant4** toolkit source code

External software packages I

Visualization/GUI tools (optional):

- X Windows
- OpenGL or MesaGL
- VRML browser
- DAWN (PostScript renderer)
- Open Inventor or HEP Inventor
- WIRED4 JAS Plug-In (HepRep browser)
 - Uses the HepRep built-in graphics driver
- Qt graphics toolkit
- Open Scientist
 - interactive environment, including GUI
- Momo
 - a Java-based GUI environment, GGE, GPE ...

Alternatively, you can produce an ascii file for VRML or DAWN

External software packages II

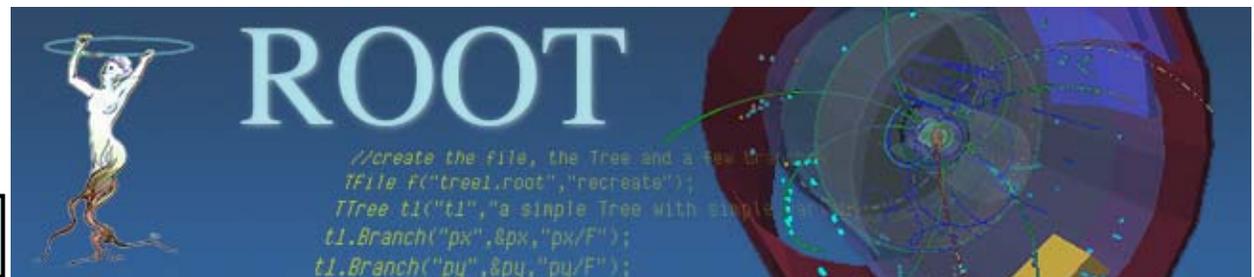
Software for analysis and histogramming (optional):

- AIDA (Abstract Interfaces for Data Analysis)
 - iAIDA (an implementation of AIDA in C++)
 - JAS (Java Analysis Studio)
 - Open Scientist (Interactive Analysis Environment)
 - rAIDA (a Root implementation of AIDA)

<p>AIDA</p> <ul style="list-style-type: none">• Home• Documentation• Source Code• Download• Release Notes• AIDA Compliant Tools• History• Mailing Lists	<h3>AIDA -- Abstract Interfaces for Data Analysis</h3> <h4>Recent News</h4> <ul style="list-style-type: none">• September 2005 - AIDA Workshop in St Malo, France.• October 2003 - AIDA 3.2.1 is has been released to patch version 3.2.0. The documentation has been updated. Check the release notes for an overview of the new features.• September 2003 - AIDA 3.2 is now released with updated documentation. Check the release notes for an overview of the new features.• June 2003 - AIDA Workshop at CERN.
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<http://aida.freehep.org/>

- ROOT (a data analysis framework)



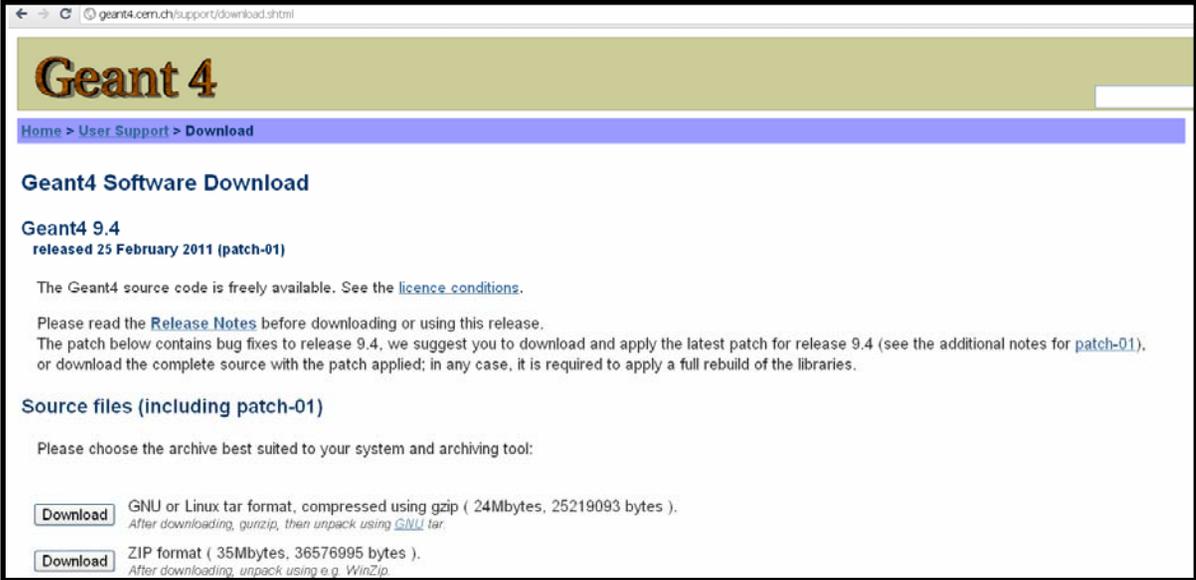
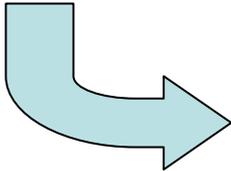
<http://root.cern.ch/>

Working area & installation area

- Why two different areas ?
 - To allow centralized installation of the Geant4 kernel libraries and related sources in a multi-user environment
 - To decouple user-developed code and applications from the kernel
 - To allow an easy integration of the Geant4 software in an existing software framework
 - To allow multiple installations of the kernel and user code
- Working and Installation area can be the same
- Are controlled by two environment variables
 - **G4WORKDIR** and **G4INSTALL**

Where to download the packages

- **Geant4**



Geant4

Home > User Support > Download

Geant4 Software Download

Geant4 9.4
released 25 February 2011 (patch-01)

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 9.4, we suggest you to download and apply the latest patch for release 9.4 (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 (including patch-01)

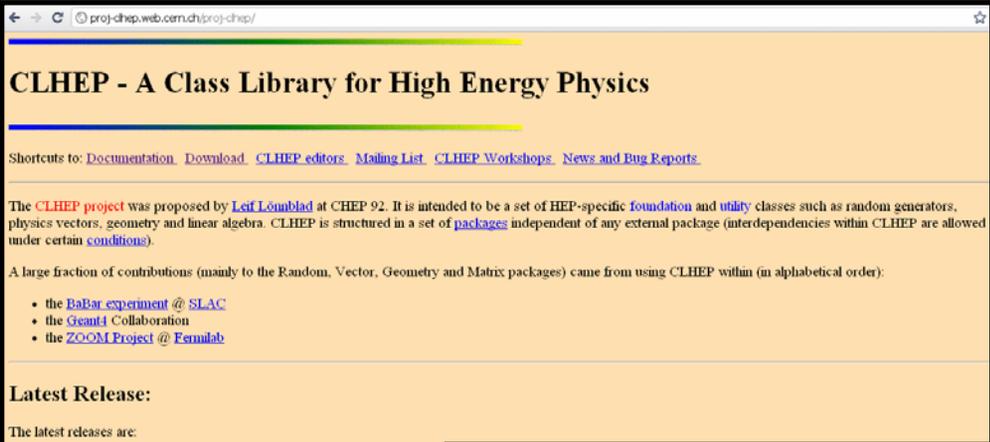
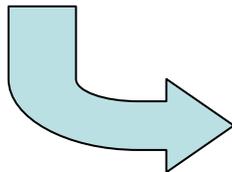
Please choose the archive best suited to your system and archiving tool:

Download GNU or Linux tar format, compressed using gzip (24Mbytes, 25219093 bytes).
After downloading, gunzip, then unpack using GNU tar.

Download ZIP format (35Mbytes, 36576995 bytes).
After downloading, unpack using e.g. WinZip.

<http://geant4.cern.ch/support/download.shtml>

- **CLHEP**



CLHEP - A Class Library for High Energy Physics

Shortcuts to: [Documentation](#), [Download](#), [CLHEP editors](#), [Mailing List](#), [CLHEP Workshops](#), [News and Bug Reports](#)

The **CLHEP project** was proposed by [Leif Lönnblad](#) at CHEP 92. It is intended to be a set of HEP-specific **foundation** and **utility** classes such as random generators, physics vectors, geometry and linear algebra. CLHEP is structured in a set of **packages** independent of any external package (interdependencies within CLHEP are allowed under certain **conditions**).

A large fraction of contributions (mainly to the Random, Vector, Geometry and Matrix packages) came from using CLHEP within (in alphabetical order):

- the [BaBar experiment @ SLAC](#)
- the [Geant4 Collaboration](#)
- the [ZOOM Project @ Fermilab](#)

Latest Release:

The latest releases are:

- 2.1.0.1, released on November 11th, 2010.
- 1.9.4.7/2.0.4.7, released on July 2nd, 2010.

<http://proj-clhep.web.cern.ch>

Downloading Geant4 and data files

Source files (including patch-01)

Please choose the archive best suited to your system and archiving tool:

- [Download](#) GNU or Linux tar format, compressed using gzip (24Mbytes, 25219093 bytes).
After downloading, gunzip, then unpack using [GNU tar](#).
- [Download](#) ZIP format (35Mbytes, 36576995 bytes).
After downloading, unpack using e.g. WinZip.

Pre-compiled Libraries

These are compiled with Geant4 default settings and optimization turned on. Please choose according to your system/compiler:

- [Download](#) compiled using gcc 4.1.2 on Scientific Linux CERN 5 (SLC5, based on Redhat Linux Enterprise 5), 64 bits - (19Mbytes, 19786342 bytes)
- [Download](#) compiled using gcc 4.2.1 on Mac (MacOSX 10.6), 64 bits - (16Mbytes, 17225770 bytes)
- [Download](#) compiled using VC++ 9.0 on Windows/XP, 32 bits - (65Mbytes, 67691006 bytes)

**Geant4 source
or
pre-compiled
libraries**

data files

Data files (*)

For specific, optional physics processes some of the following files are required. The file format is compatible with Unix, GNU, and Windows utilities.

- [Download](#) Neutron data files with thermal cross sections - version 3.14 (56Mbytes, 58794491 bytes) **NEW**
- [Download](#) Neutron data files without thermal cross sections - version 0.2 (12Mbytes, 12465281 bytes)
- [Download](#) Data files for low energy electromagnetic processes - version 6.19 (14Mbytes, 14396144 bytes) **NEW**
- [Download](#) Data files for photon evaporation - version 2.1 (7.2Mbytes, 7504003 bytes) **NEW**
- [Download](#) Data files for radioactive decay hadronic processes - version 3.3 (715Kbytes, 732628 bytes) **NEW**
- [Download](#) Data files for nuclear shell effects in INCL/ABLA hadronic model - version 3.0 (54Kbytes, 54909 bytes)
- [Download](#) Data files for evaluated neutron cross sections on natural composition of elements - version 1.0 (1.1Mbytes, 1186619 bytes) **NEW**
- [Download](#) Data files for shell ionisation cross sections - version 1.2 (3.1Mbytes, 3246159 bytes) **NEW**
- [Download](#) Data files for measured optical surface reflectance - version 1.0 (1.2Mbytes, 1257863 bytes)

Downloading CLHEP

Source code or pre-compiled libraries

CLHEP -- A Class library with High Energy Physics

Download Page

Shortcuts to: [Documentation](#) [Download](#) [Mailing List](#) [News and Bug Reports](#)

Release	Source	ChangeLog	Distribution Kits (supported platforms and other distributions)
2.1.0.1	clhep-2.1.0.1.tgz	ChangeLog for 2.1.0.1	i386-mac106-gcc42-opt i686-sl5-gcc41-opt i686-sl5-gcc43-opt i686-winxp-vc9-opt slc4_amd64_gcc34 slc4_ia32_gcc34 win32_vc71 x86_64-mac106-gcc42-opt x86_64-sl5-gcc41-opt x86_64-sl5-gcc43-opt x86_64-sl5-gcc45-opt

Installing CLHEP

- Create a directory for the installation procedure (ex.:clhep)

```
[geant4-tutorial] ~ >  
[geant4-tutorial] ~ >  
[geant4-tutorial] ~ >  
[geant4-tutorial] ~ >  
[geant4-tutorial] ~ > mkdir clhep  
[geant4-tutorial] ~ > cd clhep  
[geant4-tutorial] ~/clhep > █
```

- Move the downloaded tar-ball into this directory

```
[geant4-tutorial] ~/clhep >  
[geant4-tutorial] ~/clhep >  
[geant4-tutorial] ~/clhep >  
[geant4-tutorial] ~/clhep > mv ~/Desktop/clhep-2.0.3.2-src.tgz .  
[geant4-tutorial] ~/clhep > ls  
clhep-2.0.3.2-src.tgz  
[geant4-tutorial] ~/clhep > █
```

- Unzip the extract tar-ball into this directory

```
[geant4-tutorial] ~/clhep >  
[geant4-tutorial] ~/clhep >  
[geant4-tutorial] ~/clhep >  
[geant4-tutorial] ~/clhep > tar xzvf clhep-2.0.3.2-src.tgz  
2.0.3.2/  
2.0.3.2/CLHEP/  
2.0.3.2/CLHEP/CVS/  
2.0.3.2/CLHEP/CVS/Root  
2.0.3.2/CLHEP/CVS/Repository  
2.0.3.2/CLHEP/CVS/Entries  
2.0.3.2/CLHEP/CVS/Template  
2.0.3.2/CLHEP/CVS/Tag
```

- The extracted CLHEP package can be found in the subdirectory "2.0.3.2/CLHEP". Have a look at the content:

```
[geant4-tutorial] ~/clhep >
[geant4-tutorial] ~/clhep >
[geant4-tutorial] ~/clhep > ls
2.0.3.2 clhep-2.0.3.2-src.tgz
[geant4-tutorial] ~/clhep > ls 2.0.3.2/CLHEP
aclocal.m4          Evaluator          Matrix
autom4te.cache     Exceptions         missing
bootstrap          GenericFunctions  Random
build-clheplib.in  Geometry          RandomObjects
Cast               getObjectList.in  README
ChangeLog          HepMC              ReadMe.cygwin-VC71
clhep-config.in    HepPDT            RefCount
compilers.txt      INSTALL           setup.cygwin-VC71
config.guess       install-sh        StdHep
config.sub         makeBinaryTar.in Units
configure          Makefile.am       Utilities
configure.in       Makefile.in       Vector
CVS                makeSourceDist.in
[geant4-tutorial] ~/clhep > █
```

Have a look in the "INSTALL" file: It contains more details on the installation procedure

- Create two directories (inside our "clhep" directory), which are used for building and installing the package:

```
[geant4-tutorial] ~/clhep >
[geant4-tutorial] ~/clhep > mkdir build
[geant4-tutorial] ~/clhep > mkdir install
[geant4-tutorial] ~/clhep > ls
2.0.3.2 build clhep-2.0.3.2-src.tgz install
[geant4-tutorial] ~/clhep > cd build
[geant4-tutorial] ~/clhep/build > █
```

NOTE: The package will be finally installed in the directory "~/clhep/install"

- Inside the “build” directory, call the CLHEP configure script (which is contained in the “2.0.3.2/CLHEP” directory).

NOTE: As argument you need to specify the directory, where CLHEP should be installed. Thus the full command to be called is: `../2.0.3.2/CLHEP/configure --prefix=/home/geant4-tutorial/clhep/install`

```
[geant4-tutorial] ~/clhep/build >
[geant4-tutorial] ~/clhep/build > ../2.0.3.2/CLHEP/configure --prefix
x=/home/geant4-tutorial/clhep/install
checking build system type... i686-pc-linux-gnu
checking host system type... i686-pc-linux-gnu
checking target system type... i686-pc-linux-gnu
checking for a BSD-compatible install... /usr/bin/install
checking whether build environment is sane... yes
checking for gawk... gawk
checking whether make sets $(MAKE)... yes
checking for a BSD-compatible install... /usr/bin/install -c
checking whether ln -s works... yes
checking for ranlib... ranlib
```

Adapt prefix path according to your own installation directory!

- The `configure` script checks for required programs and libraries, and creates some files, e.g. makefiles, and directories:

```
[geant4-tutorial] ~/clhep/build >
[geant4-tutorial] ~/clhep/build >
[geant4-tutorial] ~/clhep/build >
[geant4-tutorial] ~/clhep/build > ls
build-clheplib  Evaluator          makeBinaryTar      RandomObjects
Cast           Exceptions         Makefile           RefCount
clhep-config   GenericFunctions  makeSourceDist    Units
config.log     Geometry          Matrix             Vector
config.status  getObjectList     Random
[geant4-tutorial] ~/clhep/build > █
```

- If no error occurred in the configure process, one can start to build the CLHEP package using the “make” command:

```
[geant4-tutorial] ~/clhep/build >
[geant4-tutorial] ~/clhep/build > make
Making all in Units
make[1]: Entering directory `/home/geant4-tutorial/clhep/build/Units'
Making all in Units
make[2]: Entering directory `/home/geant4-tutorial/clhep/build/Units/Units'
make all-am
make[3]: Entering directory `/home/geant4-tutorial/clhep/build/Units/Units'
make[3]: Für das Ziel »all-am« ist nichts zu tun.
make[3]: Leaving directory `/home/geant4-tutorial/clhep/build/Units/Units'
make[2]: Leaving directory `/home/geant4-tutorial/clhep/build/Units/Units'
Making all in .
make[2]: Entering directory `/home/geant4-tutorial/clhep/build/Units'
/home/geant4-tutorial/clhep/2.0.3.2/CLHEP/Units/autotools/install-sh -d /home/
geant4-tutorial/clhep/build/Units/CLHEP;
make[3]: Entering directory `/home/geant4-tutorial/clhep/build/Units/Units'
install headers in /home/geant4-tutorial/clhep/build/Units/CLHEP/Units
make[3]: Leaving directory `/home/geant4-tutorial/clhep/build/Units/Units'
make[2]: Leaving directory `/home/geant4-tutorial/clhep/build/Units'
```

This may take a while...

Only the initial and last output messages of the make command are shown

```
liblist=`./getObjectList -static Units Vector Evaluator GenericFunct
ions Geometry Random Matrix RandomObjects RefCount Cast Exceptions`;
\
ar cru libCLHEP-2.0.3.2.a $liblist; ranlib libCLHEP-2.0.3.2.a
rm -f libCLHEP-2.0.3.2.so
liblist=`./getObjectList -shared Units Vector Evaluator Ge
ions Geometry Random Matrix RandomObjects RefCount Cast Ex
\
g++ -O -ansi -pedantic -Wall -D_GNU_SOURCE -g -O2 -o lib
3.2.so -shared -Wl,-soname,libCLHEP-2.0.3.2.so $liblist -o libCLHEP-
2.0.3.2.so
make[1]: Leaving directory `/home/geant4-tutorial/clhep/build'
[geant4-tutorial] ~/clhep/build >
```

*Compiling was successful if
“make” does not exit with error
messages...*

- Once the package was compiled successfully, CLHEP can be installed using the “**make install**” command:

```
[geant4-tutorial] ~/clhep/build >
[geant4-tutorial] ~/clhep/build > make install
Making install in Units
make[1]: Entering directory `/home/geant4-tutorial/clhep/build/Units'
Making install in Units
make[2]: Entering directory `/home/geant4-tutorial/clhep/build/Units/Units'
make[3]: Entering directory `/home/geant4-tutorial/clhep/build/Units/Units'
make[3]: Für das Ziel »install-exec-am« ist nichts zu tun.
test -z "/home/geant4-tutorial/clhep/install/include/CLHEP/Units" || mkdir -p -- "/home/geant4-tutorial/clhep/install/include/CLHEP/Units"
/usr/bin/install -c -m 644 `../../../../2.0.3.2/CLHEP/Units/Units/GlobalPhysicalConstants.h` '/home/geant4-tutorial/clhep/install/include/CLHEP/Units/GlobalPhysicalConstants.h'
/usr/bin/install -c -m 644 `../../../../2.0.3.2/CLHEP/Units/Units/GlobalSystemOfUnits.h` '/home/geant4-tutorial/clhep/install/include/CLHEP/Units/GlobalSystemOfUnits.h'
/usr/bin/install -c -m 644 `../../../../2.0.3.2/CLHEP/Units/Units/PhysicalConstants.h` '/home/geant4-tutorial/clhep/install/include/CLHEP/Units/PhysicalConstants.h'
```

- The CLHEP libraries are now installed in the directory “**~/clhep/install**”
(NOTE: We specified the installation directory in the configure process; see the previous slides)

```
[geant4-tutorial] ~/clhep/install >
[geant4-tutorial] ~/clhep/install >
[geant4-tutorial] ~/clhep/install >
[geant4-tutorial] ~/clhep/install >
[geant4-tutorial] ~/clhep/install > ls
bin include lib
[geant4-tutorial] ~/clhep/install > █
```

Congratulations!

- What do the subdirectories in “~/clhep/install” contain?
 - **include**: Contains (in a defined directory tree structure) the C++ header files of CLHEP
 - **lib**: Contains the (static and shared) CLHEP libraries
 - **bin**: Contains configure scripts and the very useful “clhep-config” script
- Finally, to save some disk space, you can remove the “build” directory, as well as the tar-ball and the source package

```
[geant4-tutorial] ~/clhep > du -sh *
27M    2.0.3.2
93M    build
4,9M   clhep-2.0.3.2-src.tgz
53M    install
[geant4-tutorial] ~/clhep > rm -r 2.0.3.2 build clhep-2.0.3.2-src.tgz
[geant4-tutorial] ~/clhep > █
```

Installing Geant4 manually

- Identify the system used for the installation
 - G4SYSTEM
- Identify the area of installation (i.e. path where the source code and the kernel libraries should be based)
 - G4INSTALL
 - Optionally, specify a different path for the kernel libraries and/or the temporary object files
 - G4LIB, G4TMP
 - Optionally, specify a different path for exporting of source header files
 - G4INCLUDE
- Specify the path of installation of CLHEP
 - CLHEP_BASE_DIR

- Specify all the optional environment variables you need
 - G4WORKDIR
 - G4DEBUG
 - ...

This part is not covered here. For a detailed guide:

<http://geant4.web.cern.ch/geant4/UserDocumentation/UsersGuides/InstallationGuide/html/>

Geant4 Installation Guide

For setting up Geant4 in your computing environment

Geant4 Collaboration

Version: geant4 9.4
17 December, 2010

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2.3. Installing Geant4 Manually

Before proceeding with the installation, some key environment variables must be defined in your user environment in order to specify where all software components are to be placed and to set some compilation options. A complete reference to all environment variables in Geant4 is available in section *Appendix - Makefiles and Environment Variables* of the [Geant4 User's Guide for Application Developers](#).

2.3.1. Required Environment Variables

G4SYSTEM:

set to one of the flavors listed in section 1.1 to specify the kind of architecture and compiler used

G4INSTALL:

path where the Geant4 toolkit tree is installed (ex. \$HOME/geant4)

CLHEP_BASE_DIR:

Installing Geant4 **with the *Configure* script**

- Create a directory for the installation (for example in your home directory) and move the downloaded Geant4 tar-ball and all data tar-balls into this directory (Here: the browser downloaded the tar- balls to the Desktop):

```
[geant4-tutorial] ~ >  
[geant4-tutorial] ~ > mkdir geant4  
[geant4-tutorial] ~ > cd geant4  
[geant4-tutorial] ~/geant4 >  
[geant4-tutorial] ~/geant4 > cp ../Desktop/*.tar.gz .  
[geant4-tutorial] ~/geant4 > cp ../Desktop/*.gtar.gz .  
[geant4-tutorial] ~/geant4 > ls  
G4ABLA.3.0.tar.gz      G4RadioactiveDecay.3.2.tar.gz  
G4EMLOW.5.1.tar.gz   geant4.9.1.p01.gtar.gz  
G4NDL.3.12.tar.gz    PhotonEvaporation.2.0.tar.gz  
[geant4-tutorial] ~/geant4 > █
```

- Unzip and extract all tar-balls:

```
[geant4-tutorial] ~/geant4 >  
[geant4-tutorial] ~/geant4 > tar xzf geant4.9.1.p01.gtar.gz  
[geant4-tutorial] ~/geant4 > tar xzf G4ABLA.3.0.tar.gz  
[geant4-tutorial] ~/geant4 > tar xzf G4EMLOW.5.1.tar.gz  
[geant4-tutorial] ~/geant4 > tar xzf G4NDL.3.12.tar.gz  
[geant4-tutorial] ~/geant4 > tar xzf G4RadioactiveDecay.3.2.tar.gz  
[geant4-tutorial] ~/geant4 > tar xzf PhotonEvaporation.2.0.tar.gz  
[geant4-tutorial] ~/geant4 > ls  
G4ABLA3.0      G4RadioactiveDecay.3.2.tar.gz  
G4ABLA.3.0.tar.gz  geant4.9.1.p01  
G4EMLOW5.1     geant4.9.1.p01.gtar.gz  
G4EMLOW.5.1.tar.gz PhotonEvaporation2.0  
G4NDL3.12     PhotonEvaporation.2.0.tar.gz  
G4NDL.3.12.tar.gz RadioactiveDecay3.2  
[geant4-tutorial] ~/geant4 > █
```

- We would like Geant4 to be installed in “~/geant4/install” (it is convenient to install Geant4 in a separate directory outside the source tree). Thus we have to create this directory:

```
[geant4-tutorial] ~/geant4 >  
[geant4-tutorial] ~/geant4 > mkdir install  
[geant4-tutorial] ~/geant4 > █
```

- But wait: Where do we install newer versions of Geant4 if we still want to keep the old version? It's better to create a further subdirectory inside “install” indicating the Geant4 version:

```
[geant4-tutorial] ~/geant4 >  
[geant4-tutorial] ~/geant4 > mkdir -p install/9.1.p01  
[geant4-tutorial] ~/geant4 > █
```

Our installation directory is thus: “~/geant4/install/9.1.p01”
If we want to install further geant4 versions, we just create more subdirectories inside “install” without mixing up packages

- The Geant4 package we want to build and install is contained in the extracted directory “~/geant4/geant4.9.1.p01”. In this direc. one can find a script called “**Configure**”:

```
[geant4-tutorial] ~/geant4 >  
[geant4-tutorial] ~/geant4 >  
[geant4-tutorial] ~/geant4 > cd geant4.9.1.p01  
[geant4-tutorial] ~/geant4/geant4.9.1.p01 > ls  
config      environments  LICENSE      source  
Configure   examples     ReleaseNotes  
[geant4-tutorial] ~/geant4/geant4.9.1.p01 > █
```

- The “**Configure**” script can now be used to build the libraries and to perform the installation.
 - After invoking the script, you are inquired for some information
 - This procedure will be partly explained in the following (only the most important items are covered)
 - Have a look on the Geant4 webpage for more details

- To start the build process, execute “./Configure -build” inside the “geant4.9.1.p01” directory. Initially you get some general information

```
[geant4-tutorial] ~/geant4/geant4.9.1.p01 >
[geant4-tutorial] ~/geant4/geant4.9.1.p01 >
[geant4-tutorial] ~/geant4/geant4.9.1.p01 >
[geant4-tutorial] ~/geant4/geant4.9.1.p01 >
[geant4-tutorial] ~/geant4/geant4.9.1.p01 > ./Configure -build

--- Geant4 Toolkit Build ---

This installation shell script will examine your system and ask you questions
to determine how the Geant4 Toolkit should be installed.  If you get stuck on
a question, you may use a ! shell escape to start a subshell or execute a
command.  Many of the questions will have default answers in square brackets;
typing carriage return will set the default.

On AFS it is allowed to specify either absolute or relative
paths (i.e. starting with the ~username construct).

[Type carriage return to continue] █

and you will be prompted again.

Running 'Configure -d' will bypass nearly all the questions and
use the computed defaults (or answers saved in a configuration
previously generated).

Type 'Configure -h' for a list of options.

You may also start interactively and then answer '& -d' at any prompt to turn
on the non-interactive behaviour for the rest of the execution.

Much effort has been spent to [Type carriage return to continue]
Unix system. If despite that you can't run configure for some reason, you will
have to set the proper environment variables by hand and follow the "manual"
installation as specified in the Geant4 Installation Guide.

[Type carriage return to continue] █
```

l variables and backticks
to the words in the
arguments given to a
at the whole default line.
confirm. If there is an
or will remain unchanged

- As the next step the “Configure” script tries to determine your system and compiler. In our case it recognizes them correctly, so we accept the default values:

```
Definition of G4SYSTEM variable is Linux-g++.
That stands for:

1) OS           : Linux
2) Compiler     : g++

To modify default settings, select number above (e.g. 2)
[Press [Enter] for default settings] █
```

- We aim for a local installation and we do not care about portability, thus we accept the default ('n') in the next step:

```
I can set things up so that your shell scripts and binaries are more portable,
at what may be a noticeable cost in performance.  In particular, if you
ask to be portable, the following happens:

    1) Shell scripts will rely on the PATH variable rather than using
       the paths derived above.
    2) ~username interpretations will be done at run time rather than
       by Configure.

Do you expect to run these scripts and binaries on multiple machines? [n] █
```

- Then we have to specify the source path and our install directory:

```
Where is Geant4 source installed?
[/home/geant4-tutorial/geant4/geant4.9.1.p01]

Specify the path where Geant4 libraries and source files should be
installed.
[/home/geant4-tutorial/geant4/geant4.9.1.p01] /home/geant4-tutorial/geant4/install
/9.1.p01 █
```

It is correct, so hit enter

Specify install directory (full path)

- Then you are asked if you want to put all header files in one directory:as you prefer....
- We then have to specify the path to the data directories (*Note: We stored the data directories directly in “~/geant4”; actually you could also store them in a dedicated directory like “~/geant4/data”*)

```
Please, specify default directory where ALL the Geant4 data is installed:

G4LEVELGAMMADATA:          /home/geant4-tutorial/geant4/geant4.9.1.p01/data/P
hotonEvaporation2.0

G4RADIOACTIVEDATA:        /home/geant4-tutorial/geant4/geant4.9.1.p01/data/R
radioactiveDecay3.2

G4LEDDATA:                 /home/geant4-tutorial/geant4/geant4.9.1.p01/data/G
4EML0W5.1

G4NEUTRONHPDATA:         /home/geant4-tutorial/geant4/geant4.9.1.p01/data/G
4NDL3.12

G4ABLADATA:               /home/geant4-tutorial/geant4/geant4.9.1.p01/data/G
4ABLA3.0

You will be asked about customizing these next.
[/home/geant4-tutorial/geant4/geant4.9.1.p01/data] /home/geant4-tutorial/geant4
```

Specify the full path of the data directories

- In the next step, you can change the individual paths to the data directories if they are wrong, e.g. because you use a different version of data files.

- Then, you need to specify the path of the CLHEP installation. After you entered the directory (full path!) the script shows you the following:

```
[/usr] /home/geant4-tutorial/clhep/install

You can customize paths and library name of you CLHEP installation:

1) CLHEP_INCLUDE_DIR:      /home/geant4-tutorial/clhep/install/include
2) CLHEP_LIB_DIR:         /home/geant4-tutorial/clhep/install/lib
3) CLHEP_LIB:             CLHEP
To modify default settings, select number above (e.g. 2)
[Press [Enter] for default settings] █
```

The dir. and the library name are correct, so we hit enter

- The next steps are to determine, if one wants static and/or shared libraries, and several questions concerning the visualization setup: take the defaults if you are not sure (*more details in the DEMO...*)
- Finally you will see:

```
End of configuration phase.

Creating configuration setup file...

WARNING: the generated configuration file
can be edited if necessary!
You can introduce any change to the configuration file
/home/geant4-tutorial/geant4/geant4.9.1.p01/.config/bin/Linux-g++/config.sh b
efore the final installation.
To do so, use a shell escape now (e.g. !vi /home/geant4-tutorial/geant4/geant
4.9.1.p01/.config/bin/Linux-g++/config.sh).

Press [Enter] to start installation or use a shell escape to edit config.sh:█
```

Hit enter to start the build process if you don't want to modify the settings

- It may take a while until the libraries are built...
- Once the build process is finished, install the package by executing: `./Configure -install`
- Finally Geant4 is installed in the directory:
- `~/geant4/install/9.1.p01`
- Once the installation is complete, `Configure` can be used to generate shell scripts for configuring the user environment to build a Geant4 application according to the current installation

`./Configure`

- Generates `env[.sh/.csh]` scripts in the user's current directory
- Scripts must be sourced each time a new shell/terminal is opened
 - Execute: `source env.sh`

Now you are ready to compile and run an application!!!