

# Demo: Geant4 installation on a Linux PC

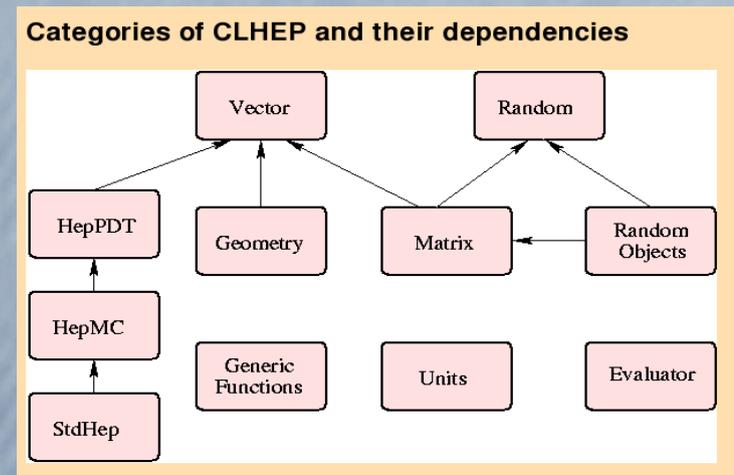
**Anton Lechner, CERN**

**Geant4 Training Course**  
Oak Ridge National Laboratory  
May 19<sup>th</sup>, 2008

*I. Downloading  
packages from the web*

# What do I need?

- A **C++ compiler**
  - **gcc** is usually installed by default on your Linux PC
  - If not, you need to install it (*not shown here*)
- The **CLHEP** package
  - Libraries for high energy physics
- The **Geant4 data files**
- The **Geant4** package



# Where to download the packages?

- CLHEP:
  - [CLHEP webpage](#)
- Geant4 (source and data files):
  - [Geant4 webpage](#) (download area)

## Downloading

- Installation Guide for compilation from sources [for the 1.8 and 1.9 and 2.0](#) series. You will also find source code tarballs for 1.9 and 2.0 there.
- Latest source code: [1.9.3.2](#) and [2.0.3.2](#)
- Precompiled binary distribution kits [for the 1.8 and 1.9 and 2.0](#) series.
- Links to the [ChangeLog for 1.9](#) and [ChangeLog for 2.0](#) series. Change Log [for the 1.8](#) series.

## CLHEP - A Class Library for High Energy Physics

Last modified: Wed Nov 15 23:41:53 CET 2006

Shortcuts to: [Documentation](#) [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 **foundations** such as random generators, physics vectors, geometry and linear algebra. CLHEP is structured in a set of **packages** external package (interdependencies within CLHEP are allowed under certain [conditions](#)).

A large fraction of the more recent additions (mainly to the Random, Vector, Geometry and Matrix packages) came within (in alphabetical order)

- the [BaBar experiment](#) at [SLAC](#),
- the [GEANT-4](#) collaboration
- the [ZOOM Project](#) at [Fermilab](#)

### Latest Release:

The latest release is [1.9.3.2](#) and [2.0.3.2](#), released on October 18, 2007.  
Note that HepPDT, HepMC, and StdHep are no longer being built.

## Geant 4

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### Geant4 Software Download

#### Geant4 9.1

released 5 February 2008 (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 9.1, we suggest you to download and apply the patch for release 9.1 (see the [additional notes](#)), 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 ( 17Mbytes, 17546171 bytes ).  
*After downloading, gunzip, then unpack using GNU tar.*

[Download](#) Unix tar format, compressed using gzip ( 17Mbytes, 17528409 bytes ).  
*After downloading, gunzip, then unpack using tar, not GNU tar!*

[Download](#) ZIP format ( 27Mbytes, 28036577 bytes ).  
*After downloading, unpack using e.g. WinZip.*

#### Related Links

- [Previous Releases of Geant4](#) (since release 6.0).
- [LXR source code browser](#).
- [Full history of Geant4 releases](#) (RD44 pages).
- [Installation Guide tutorials](#) for Linux and Windows.
- [Windows CygWin installation note](#).

# Using pre-compiled libraries

- **Pre-compiled libraries** are available for both **CLHEP** and **Geant4** (for supported platforms):

You may use them if you work on a supported platform

## 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 3.4.6 on Scientific Linux CERN 4 (SLC4, based on Redhat Linux Enterprise 4) - ( 14Mbytes, 14709994 bytes )
- [Download](#) compiled using CC 5.5 on SUN (SunOS 5.8) - ( 40Mbytes, 41863538 bytes )
- [Download](#) compiled using VC++ 8.0 on Windows/XP - ( 53Mbytes, 55368135 bytes )

These libraries were built using [CLHEP version 2.0.3.2](#). Please refer to the [Release Notes](#) for platform specific notes on CLHEP.

## CLHEP -- A Class library for High Energy Physics

### CLHEP-1.9 Distribution Kits (Precompiled libraries)

Linux Debian testing/unstable	<a href="#">CLHEP 1.9.3.1</a>	Thanks to James Ferrando for providing these.
Mac OS X 10.4 (Tiger) (build on PowerPC)	<a href="#">CLHEP 1.9.3.1 for gcc 4.0</a> <a href="#">CLHEP 1.9.2.3 for gcc 4.0</a> <a href="#">CLHEP 1.9.2.2 for gcc 4.0</a> <a href="#">CLHEP 1.9.2.1 for gcc 4.0</a>	
Mac OS X 10.3 (Jaguar)	<a href="#">CLHEP 1.9.2.0 for gcc 3.3.1</a> <a href="#">CLHEP 1.9.1.2 for gcc 3.3.1</a> <a href="#">CLHEP 1.9.1.1 for gcc 3.3.1</a>	
Scientific Linux 4 on AMD64 architecture	<a href="#">CLHEP 1.9.3.1 for gcc 3.4</a> <a href="#">CLHEP 1.9.2.3 for gcc 3.4.5</a>	
Scientific Linux 4 on IA32 architecture	<a href="#">CLHEP 1.9.3.1 for gcc 3.4</a> <a href="#">CLHEP 1.9.2.3 for gcc 3.4.5</a>	
Scientific Linux 3 on AMD64 architecture	<a href="#">CLHEP 1.9.2.1 for gcc 3.2.3</a>	<a href="#">CLHEP 1.9.2.3 for gcc 3.4.4</a> <a href="#">CLHEP 1.9.2.2 for gcc 3.4.4</a>

In the demo we build the libraries by our own

# Downloading Geant4 source and data files

## Source files

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

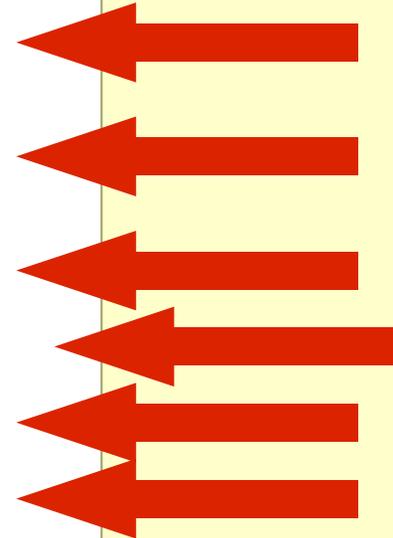
- [Download](#) GNU or Linux tar format, compressed using gzip ( 17Mbytes, 17546171 bytes ).  
*After downloading, gunzip, then unpack using [GNU tar](#).*
- [Download](#) Unix tar format, compressed using gzip ( 17Mbytes, 17528409 bytes ).  
*After downloading, gunzip, then unpack using tar, not GNU tar!*
- [Download](#) ZIP format ( 27Mbytes, 28036577 bytes ).  
*After downloading, unpack using e.g. WinZip.*

[Installation note.](#)

## 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 3.12 ( 52Mbytes, 54904967 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 5.1 ( 7.9Mbytes, 8287134 bytes ) **NEW**
- [Download](#) Data files for photon evaporation - version 2.0 ( 7.2Mbytes, 7506068 bytes )
- [Download](#) Data files for radioactive decay hadronic processes - version 3.2 ( 743Kbytes, 761070 bytes )
- [Download](#) Data files for nuclear shell effects in INCL/ABLA hadronic model - version 3.0 ( 54Kbytes, 54909 bytes ) **NEW**



# Downloading CLHEP

## Downloading

- Installation Guide for compilation from sources [for the 1.8](#) and [1.9 and 2.0](#) series. You will also find source code tarballs for 1.9 and 2.0 there.
- Latest source code: [1.9.3.2](#) and [2.0.3.2](#)
- Precompiled binary distribution kits [for the 1.8](#) and [1.9 and 2.0](#) series.
- Links to the [ChangeLog for 1.9](#) and [ChangeLog for 1.8](#) series.  
Change Log [for the 1.8](#) series.

Now we are  
ready to start!

**NOTE: CLHEP must be installed first**

## *II. Installing CLHEP*

# CLHEP installation procedure

- The following slides cover the **build and installation procedures** for the CLHEP package on Linux
  - Version 2.0.3.2 is considered
  - Local installation (in directory “~/clhep/install”)
  - System: Linux SuSE 10.1 (Similar for other flavours)
- Where can I find additional information?
  - [CLHEP webpage](#)
  - [Tutorial on Geant4 webpage \(for Linux\)](#)
  - [Tutorial on Geant4 webpage \(for Windows\)](#)

- Create a directory for the installation procedure (for example in your home directory):

```
[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 (Here: the browser downloaded the tar-ball to the Desktop):

```
[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 and extract the tar-ball:

```
[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
```

Output only partially shown...

- 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        StdHen
config.sub         makesourceDist.in
configure
configure.in
CVS
[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 --prefi
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/i
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!

Output is only partially shown...

- 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'
liblist=
ions Geometry Random Matrix RandomObjects RefCount Last Exceptions`;
\
ar cru libCLHEP-2.0.3.2.a $liblist; ranlib libCLHEP-2.0.3.2.a
rm -f libCLHEP-2.0.3.2.a
liblist=
ions Geom
\
g++ -O -ansi -pedantic -Wall -D_GNU_SOURCE -g -O2 -o libCLHEP-2.0.
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 >
```

This may take a while...

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

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'
```

Output only partially shown...

- 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

→ “clhep-config” can be used to retrieve compiler flags (you can include the command into your makefile!):

```
[geant4-tutorial] ~/clhep/install >
[geant4-tutorial] ~/clhep/install >
[geant4-tutorial] ~/clhep/install > clhep-config
Usage: clhep-config [OPTION]

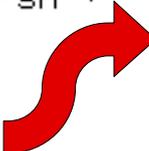
Known values for OPTION are:

--prefix          show installation prefix
--cxx             print C++ compilation command
--cc              print C compilation command
--cpp             print pre-processor commands
--include         print include path
--ldflags         print linker flags
--libs            print libraries to link against
--help           display this help and exit
--version         output version information

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

- 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 > █
```



**Installation: 53 Mb**

## *III. Installing Geant4*

# Geant4 installation procedure

- The following slides cover the **build and installation procedures** for the Geant4 package on Linux
  - Version 9.1.p01 is considered
  - Local installation (in dir. “~/geant4/install/9.1.p01”)
  - System: Linux SuSE 10.1 (Similar for other flavours)
- Where can I find additional information?
  - [Geant4 installation guide](#)
  - [Tutorial on Geant4 webpage \(for Linux\)](#)
  - [Tutorial on Geant4 webpage \(for Windows\)](#)

## Geant4 Installation Guides

The following guides present a step by step procedure to install Geant4 for single-user operation on three operating systems: Linux, Mac and Windows.

### Currently available guides:

Latest Geant4 Release: 4.9.0

- [Installing Geant4.9.0 on Linux](#)
- [Installing Geant4.9.0 on Macintosh OSX](#)
- [Installing Geant4.9.0 on Windows using Microsoft Visual C++ and Cygwin](#)

Previous Geant4 Releases:

4.8.3

- [Installing Geant4.8.3 on Linux](#)
- [Installing Geant4.8.3 on Macintosh OSX](#)
- [Installing Geant4.8.3 on Windows using Microsoft Visual C++ and Cygwin](#)

4.8.2.p01

- [Installing Geant4.8.2.p01 on Linux](#)
- [Installing Geant4.8.2.p01 on Macintosh OSX](#)
- [Installing Geant4.8.2.p01 on Windows using Microsoft Visual C++ and Cygwin](#)

4.8.0

- 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.
  - x After invoking the script, you are inquired for some information
  - x This procedure will be partly explained in the following (*only the most important items are covered*)
  - x Have a look on the Geant4 webpage for more details ([Link](#))

Chapter 2. Installation Procedures

[Previous](#) [Next](#)

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## Chapter 2. Installation Procedures

Before installing Geant4, the required software listed in [Section 1.2](#) (and [Section 1.3](#) in the case of graphics drivers) of this Installation Guide must already be installed on your system.

In this section, a short tutorial on how to install the toolkit's kernel libraries is given. The installation of the Geant4 kernel libraries and the proper configuration of the environment can be achieved either manually (by setting the proper environment variables) or through the `configure` shell script, which will allow the installation of just the necessary source code and libraries in a specified installation area.

*Step-by-Step* guides for the installation are also available. See [Appendix - Step-by-Step Installation Guides](#) of *Geant4 User's Guide - For Application Developers*.

### 2.1. Using the `configure` Script for installation

A shell script is provided for building the libraries and to allow easy installation in a specified area. The `configure` shell script is placed in the top directory tree of the distribution (`geant4/Configure`) and allows the user or system administrator to install the Geant4 toolkit in a semi-automatic way. Some knowledge of the

- 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] █

...ing ... will ... 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 on making Geant4 work on a wide range of Unix systems. If despite this you 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] █

- 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's correct, so we hit enter

↙ Specify install direct. (full path)

- You are then 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”, but avoid putting them into the source tree if you intend to remove the “~/geant4/geant4.9.1.p01” directory after installation*)

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

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

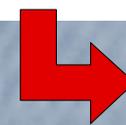
G4RADIOACTIVEDATA:        /home/geant4-tutorial/geant4/geant4.9.1.p01/data/R
radioactiveDecay3.2

G4LEDATA:                 /home/geant4-tutorial/geant4/geant4.9.1.p01/data/G
4EMLOW5.1

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 to the data directories

- In the next step, you can change the individual pathes 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 (which was `~/clhep/install`). 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: **These steps are not covered here** (just take the defaults if you are not sure).
- 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`
- NOTE: To set up your environment, you can use the `env.sh/env.csh` script (depending which shell you use), which are located in the directory:  
`~/geant4/install/9.1.p01/src/geant4/.config/bin/Linux-g++`
  - Execute:  
`source ~/geant4/install/9.1.p01/src/geant4/.config/bin/Linux-g++/env.sh`