
Short Guide to FLUKA's and Flair's Installation and Setup (in Ubuntu OS)

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Part I

Introduction

This is a short guide to the installation and set up of Flair and FLUKA in Ubuntu systems and, in particular, in versions 18.04, 20.04, or 20.10. To which, there are, essentially, two methods of doing so:

1. Either, one installs the FLUKA package downloaded from CERN's repository [1] following the installation of Flair via terminal.
2. Or, one installs Flair by unpacking (and compiling) the packages downloaded from the official Flair's website [2], and installs FLUKA via packages downloaded from its official website [3].

It's best if you read all the instructions first before simply copy-pasting commands!

1 What is FLUKA?

An integrated Monte Carlo simulation package of particle's transportation and interaction with matter, that is used in many areas spanning from Dosimetry to Nuclear Astrophysics.

2 What is Flair?

A graphical user interface that supports FLUKA, Geant4, PENELOPE and others alike, allowing us to have an easier way of editing parameters of the input files through *cards* and to have a better perception of the experiment geometry through 3D visualization. And, though the term Flair encompasses all of this, the latter can be seen as a complementary function that goes by the more specific name of *flair-geoviewer*.

3 What is assumed?

- That the reader has an account on CERN's website of FLUKA [4] in order to download packages (Method 1).
- And/or, has an account on FLUKA's official website [5] in order to download the package (Method 2).
- Also, the reader has some notions of Linux basic commands - not mandatory but it's unlikely that you don't have them.

Part II

Beware Of Your Versions

Usually this isn't a problem but since there are many packages or utilities on which FLUKA and Flair depend, it is important to check if those dependencies' versions are compatible with the versions of FLUKA and Flair you are trying to install. In particular:

- Ubuntu: At least 18.04.
- Gfortran: At least 7.5 for Flair, whilst FLUKA, in itself, can be used with G77.
- Python3: Which has to be at least 3.6 as a requirement for Flair, albeit FLUKA alone may be used with Python2.
- Gnuplot: Has to be at least 4.0.
- Tcl/tk (Tkinter Toolkit): Has to be at least 8.5.

All of this can be taken care of if everything is updated - and it is specially necessary to be so for Method 1.

4 Updates

Open the terminal...

- Fetch all updates for your repositories:
\$ sudo apt update
- Install the updates:
\$ sudo apt upgrade

You can use apt-get instead.

It is preferable to have at least Gfortran 10.2 installed, given the package offers on FLUKA's website, to wit:

- \$ sudo add-apt-repository ppa:ubuntu-toolchain-r/test
- \$ sudo apt update
- \$ sudo apt install gfortran-10

5 Checking Versions

- To check for *gfortran*, *python3* and *gnu-plot* versions:
\$ <insert name here> --version
- To check for Ubuntu's version:
\$ lsb_release -a
- To check for tcltk version:
\$ tclsh
% info patchlevel
(Ctrl+C to exit)
- To check for Tkinter version:
\$ python3
> > > import tkinter
> > > tkinter.TkVersion
(exit() to exit)

Tkinter is one specific set of python bindings for a tcltk package installed by default with python, so if you can't find it then you ought to reinstall python. Whilst TclTk is non-specific to python.

If FLUKA 32 bits is downloaded, then it requires at least gcc/g77 (version ≥ 3.4) and if FLUKA 64 bits is downloaded, then it requires gcc/gfortran (version ≥ 4.6). But this knowledge is just a formality because in practice, for Flair, you need Gfortran.

5.1 glibc - for Method 2

Assuming you went through the Update section's commands, you can check the glibc (GNU C library) installed version and candidate version by doing:

- \$ apt-cache policy libc6
- If you want to install the candidate version:
\$ apt-get install libc6

Afterwards, check the installed version by the mentioned command or, for Debian based systems (i.e. Ubuntu), using the command:

- 64bit:
\$ /lib/x86_64-linux-gnu/libc.so.6
- 32bit:
\$ /lib/i386-linux-gnu/libc.so.6

After this, if your installed version is the same as your candidate version and you still need/want a more recent version, then you must reinstall Ubuntu to a more recent version.

Part III

Methods

6 Method 1: CERN's FLUKA + Flair via Terminal

6.1 FLUKA

1. Download FLUKA: Download a release from CERN [1]. Each release has physics and/or technical improvements and bug fixes.

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2. Go to the directory where you want FLUKAS's files to be in and create a folder:

```
$ mkdir fluka
```

3. Define the path to fluka

```
$ export FLUPRO=<path to fluka>
```

You can check if the path is working fine by entering:

```
$ cd $FLUPRO
```

4. Define the GNU compiler:

```
$ export FLUFOR=gfortran
```

If it's left undefined, later, the script will check if there's the string "gfor" somewhere in the directory name.

If not, then "g77" is automatically selected (bad idea unless you plan on not using Flair).

5. If you have more than one Gfortran version then you need to specify by doing:

```
$ export GFORFLU=gfortranxx
```

Where xx is the version number.

6. Unpack files from the package you downloaded inside the *fluka* directory defined earlier, akin to the following example:

```
$ tar -xzf fluka-4-1.1.Linux-gfor7.tgz.
```

7. Compile the program using the Makefile:

```
$ make
```

6.2 Flair

1. Install the public repository key:

```
$ sudo wget -q -O - https://cern.ch/flair/download/ubuntu/KEY.gpg | sudo apt-key add -
```

2. Install the repository, where xx.xx is the Ubuntu's version:

```
$ sudo add-apt-repository 'deb [arch=amd64]https://cern.ch/flair/download/ubuntu/xx.xx/'
$ sudo apt install flair
```

3. If by any chance you need to uninstall Flair:

```
$ sudo apt-get purge - -auto-remove flair
```

6.3 Setting Up

Once the previous steps are done, you can now boot up the Flair program through the terminal (\$ Flair) or simply search for it on *Show Applications*.

You might encounter errors, right from the get-go, relative to Flair failing to find the proper programs and, so, you must point them out. To do so, open the Preferences window option, in the bottom right corner:

1. In the left column pick *Fluka*.
2. In the *Fluka Directory* textbox there must a path similar to this: `/home/fluka/fluka4-1.1`.
3. The *rfluka* executable, the program and the *fff* files are found in the *bin* folder: `/home/fluka/fluka4-1.1/bin/`.
4. After selecting the correct files, click Ok and everything is set up.

7 Method 2: FLUKA from the official website + Flair Manually

7.1 FLUKA

Go to FLUKA's official website [3] and download the best suited package (read the *Comment* column!). The process is really straight forward and as such, everything in section 6.1 still hold true except the name of the package you are unpacking which will be something along the lines of: `fluka2021.2-linux-gfor64bit-8.4-AA.tar.gz`.

7.2 Flair

In this method, since we are installing Flair manually you will need to download Flair's interface and geometry viewer. For that:

1. Go to it's website [2] and on the *DEB based systems* section download the corresponding packages, e.g:
 - "flair_3.1-13_ubuntu20.04_all.deb"
 - "flair-geoviewer_3.1-13_ubuntu20.04_amd64.deb"
2. Create a directory where you want flair files to be in and navigate to that directory:

```
$ mkdir flair
$ cd flair
```
3. Copy both .deb files to the directory previously created, similar to:

```
$ cp ~/Downloads/flair_3.1-13_ubuntu20.04_all.deb ~/flair/
```
4. Install both .deb files:

```
$ sudo dpkg -i flair_3.1-13_ubuntu20.04_all.deb
$ sudo apt-get install -f
```
5. Note that the *dpkg -i* command and option, respectively, indicates that you are installing via a .deb format which is a compiled and packaged application. Whilst, the *make* command used in method 1 installs using the Makefile file you get after unpacking the .tar file.
6. If you want you can now remove the copied files from point 3:

```
$ rm -r <name of file>
```
7. To launch:

```
$ flair
```

7.3 Setting Up

Do the same procedure as the one in subsection 6.3.

Part IV

Still Not Working?

If you have installed FLUKA, and Flair, and the latter isn't recognizing FLUKA's files, is it possible you installed Flair via terminal and FLUKA via it's official website ?

My advice is that if you encounter any error - apparently unavoidable - along the way of setting it up, just uninstall flair and fluka and start again (not much of a suggestion, but sometimes we can get too focused in solving errors that we go pass the most efficient solution, that is, starting over) and check if all dependencies are fulfilled, namely:

- Are Gnuplot and Gfortran updated?
- Is Ubuntu 18.04/20.04/20.10 ?
- Is Python3 set correctly ?

If you wish to use only FLUKA and you want to use Python2 you can do so by:

```
$ export PYTHON=<python2 executable name>
```

Part V

Final Remark

Just like any other, this short guide has all of my idiosyncracies in it, and, so, all the solutions I found to effectively solve issues are condensed here.

The intention is merely to refrain people from doing extensive research just to get the whole apparatus up and running. Notwithstanding, it is highly recommended to check the bibliography below in order to have a better grasp of why are things done the way they are, as well as other guides or sources of information in order to have different perspectives.

Worth pointing out that although this guide is specific to the Ubuntu OS, the rationale here presented still hold true and the two described ways of setting up things are similar in other distros and MacOS.

Sporadically, I will do a check up to see if these instructions are still valid, nevertheless, if this guide becomes outdated, or if you spotted an error, or if you have any suggestions or questions, please feel free to contact me and I will do my best to correct them or to give a proper answer.

References

- [1] *CERN's FLUKA*: <https://fluka.cern/>
- [2] *Flair Download*: <https://flair.web.cern.ch/flair/download.html>
- [3] *Fluka Download*: <https://www.fluka.org/fluka.php?id=download>
- [4] *Flair Registration*: <https://fluka.cern/download/registration>
- [5] *Fluka Official Website*: <https://www.fluka.org/>
- [6] *A Concise guide by Kristian Ytre-Hauge*: https://wiki.uib.no/particletherapy/img_auth.php/8/89/Prerequisites_for_installation_of_FLUKA_and_Flair.pdf
- [7] *Software Requirements*: <https://fluka-forum.web.cern.ch/t/software-requirements-of-fluka-and-flair/94>
- [8] *Flair Manual*: <https://flair.web.cern.ch/flair/manual/flair.html>