FLUKA - Basics

7th FLUKA Course

NEA Paris, Sept.29-Oct.3, 2008

How to download and install Fluka

Two ways of downloading the FLUKA software:

- From the FLUKA website http://www.fluka.org
- From NEA databank http://www.nea.fr through the liaison officer from your institute

It is mandatory to be registered as FLUKA user. Follow the following link:

http://www.fluka.org/download.html

After registration (or using your user-id and password) normally you can then proceed in downloading the latest official release version.

Before continuing we just need to find out one more thing, the '**shell**' you're using on your computer (mostly **bash** or **tcsh**). For this purpose please issue the following command in a terminal window:

```
echo $SHELL
```

You will then get as a results the current shell which is used on your computer, *i.e.*, one of the following:

```
/bin/bash
/bin/tcsh
```

How to download and install Fluka

First identify the location of the FLUKA distribution file: fluka2008.3-linuxAA.tar.gz.

Depending on the OS and the method you used most probably will be located in one of the following directories:

```
        /media/FLUKA/Software              # in case you are using the USB stick
or      $HOME                              # if you downloaded from the web
        $HOME/Desktop                      # -//- depending on your browser
```

We will create a directory FLUKA under your home directory to install FLUKA.

The following commands issued from a terminal/console window will perform the entire installation.

```
        cd                                 # change directory to your home
        mkdir FLUKA                        # create a directory called FLUKA
        cd FLUKA                           # change to the FLUKA directory
        tar xzf /media/disk/Software/fluka2008.3-linuxAA.tar.gz
                                           # expand the FLUKA package
        export FLUPRO=$HOME/FLUKA          # set FLUPRO in bash shell or similar
or      setenv FLUPRO $HOME/FLUKA          # set FLUPRO  in tcsh shell or similar
        make                                # compile FLUKA
```

Persistent settings

The only thing left to do is to make these settings persistent on your computer, *i.e.*, you don’t have to set the environment variable again when you open a new terminal or log into your computer. We will thus add the following lines into your shell configuration file in your main directory.

bash users:

```
cd
emacs [or any editor] .bashrc
```

“go to the end of the document and add the following”

```
export FLUPRO=${HOME}/FLUKA
export PATH=${PATH}:$FLUPRO:$FLUPRO/flutil
```

tcsh users:

```
cd
emacs [or any editor] .tcshrc
```

“go to the end of the document and add the following”

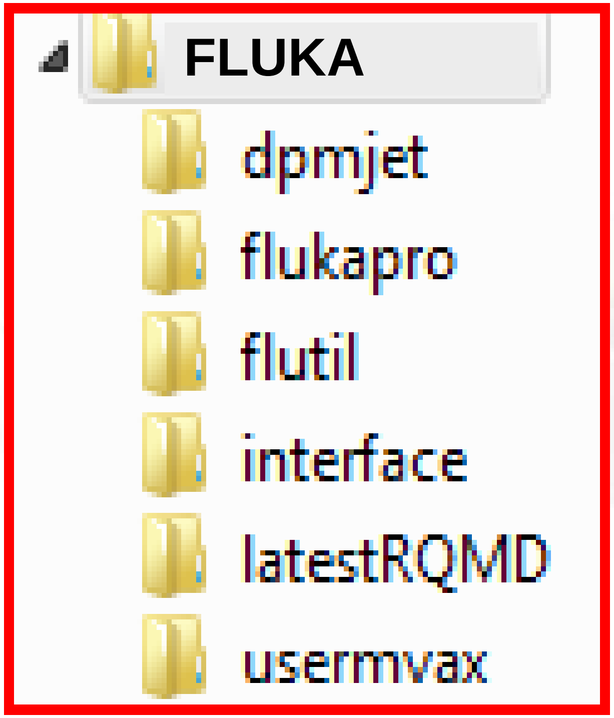
```
setenv FLUPRO ${HOME}/FLUKA
setenv PATH ${PATH}:$FLUPRO:$FLUPRO/flutil
```

The changes will be activated on the next login or if you type the command

```
source .bashrc
source .tcshrc
```

FLUKA directory structure

The tar command will create the following directory structure in your fluka installation directory: ~/FLUKA



FLUKA	Root directory of FLUKA
dpmjet	DPMJET data files
flukapro	All FLUKA commons
flutil	Utility programs and scripts
interface	Interface libraries to DPMJET
latestRQMD	Interface libraries to rQMD
usermvax	Fortran user routines

FLUKA release: main directory $FLUPRO

Main Library:

libflukahp.a (object collection)

Physics data files:

sigmapi.bin
elasct.bin
brems_fin.bin
cohff.bin
gxsect.bin
neuxsc-ind_260.bin
neuxsc-ind_72.bin
nuclear.bin
fluodt.dat
e6r1nds3.fyi
jef2.fyi
jendl3.fyi
xnloan.dat

Basic Scripts: (in $FLUPRO/flutil)

rfluka
lfluka
fff

Random Number seed

random.dat

Important Directories

flukapro/	all fluka commons
usermvax/	user routines
flutil/	general utilities

What’s inside the physics data files:

sigmapi.bin: pion-N double-diff. cross sections
elasct.bin: elastic scattering cross sections
brems_fin.bin: bremsstrahlung cross sections
cohff.bin: atomic form factor tabulations
gxsect.bin photon cross sections
neuxsc-ind_260.bin: low energy neutron multi-group cross sections
nuclear.bin: nuclear masses, mass excesses, levels, and many other nuclear data for evaporation, pre-equilibrium, Fermi break up and photonuclear cross sections, gamma and beta databases
fluodt.dat: Fluorescence data (photoelectric effect)
e6r1nds3.fyi:
jef2.fyi: Fission products (for neutrons with E<20MeV)
jendl3.fyi:
xnloan.dat:

WARNING: Never mix files from different FLUKA distributions

Available Documentation

- fluka2008.manual ASCII version of the manual (easy to edit)
- FM.pdf current version of the FLUKA manual
- CERN-2005-10.pdf official reference for FLUKA

- or navigate the manual, online version (http://www.fluka.org)

- or (when using FLAIR) press F1 to get an interactive manual (which can be also called on prompt level by typing ‘*fm*’)

- or (at a further stage) the FAQ available at: http://www.fluka.org/fluka.php?id=faq

- or (at a further stage) the archive of fluka-discuss: http://www.fluka.org/MailingList.html

Input example

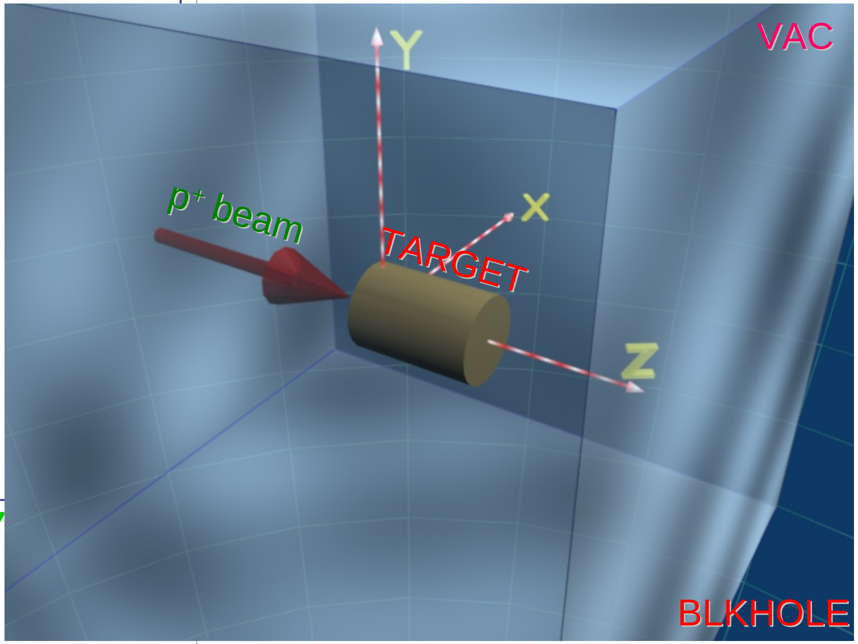
- FLUKA is driven by the user almost completely by means of an input file (.inp) which contains directives issued in the form of DATA CARDS
- The standard release provides a simple case to test the installation: example.inp *(Production of particles in p-Be collisions with a 50 GeV/c proton beam.)*
- A different example is used along this course, which will be varied in different ways for didactic reasons
- We will start with a minimum input file and after each lecture we will enhance our example with more and more functionality
- It is strongly recommended that for every exercise you create a subdirectory *i.e.,* ex1, ex2, ex3 where all the necessary input and output file will be stored
- For better clarity before starting a new exercise you will get the solution of the previous one, to be picked up at the course website: http://www.cern.ch/fluka-course/nea2008

A Simple Example

```
TITLE
FLUKA Course Exercise
*23456789 123456789  123456789 123456789 123456789 123456789 123456789 123456789
DEFAULTS                                                              NEW-DEFA
BEAM              -3.5     -0.082425        -1.7         0.0         0.0      1.0PROTON
BEAMPOS            0.0           0.0         0.1         0.0         0.0       0.0

*23456789 123456789  123456789 123456789 123456789 123456789 123456789 123456789
GEOBEGIN                                                              COMBNAME
        0    0          Cylindrical Target
SPH BLK    0.0  0.0  0.0  10000.
* vacuum box
RPP VOI    -1000. 1000. -1000. 1000. -1000. 1000.
* Lead target
RCC TARG  0.0 0.0 0.0 0.0 0.0 10. 5.
  END
* Regions
* Black Hole
BLKHOLE   5   +BLK -VOI
* Void around
VAC       5   +VOI -TARG
* Target
TARGET    5   +TARG
END
GEOEND
*23456789     123456789  123456789 123456789 123456789 1234567
ASSIGNMA BLCKHOLE  BLKHOLE
ASSIGNMA    VACUUM        VAC
ASSIGNMA       LEAD     TARGET
*
RANDOMIZ           1.0
START             10.0          0.0
STOP
```

Geometry embedded in the data card (useful for simple problems)



Prepare the working space

- Do not run inside the $FLUPRO directories, therefore:
- Go to your home directory and create a subdirectory named work:

```
cd
mkdir work
```

- Change to the work subdirectory and create a new one named: ex1

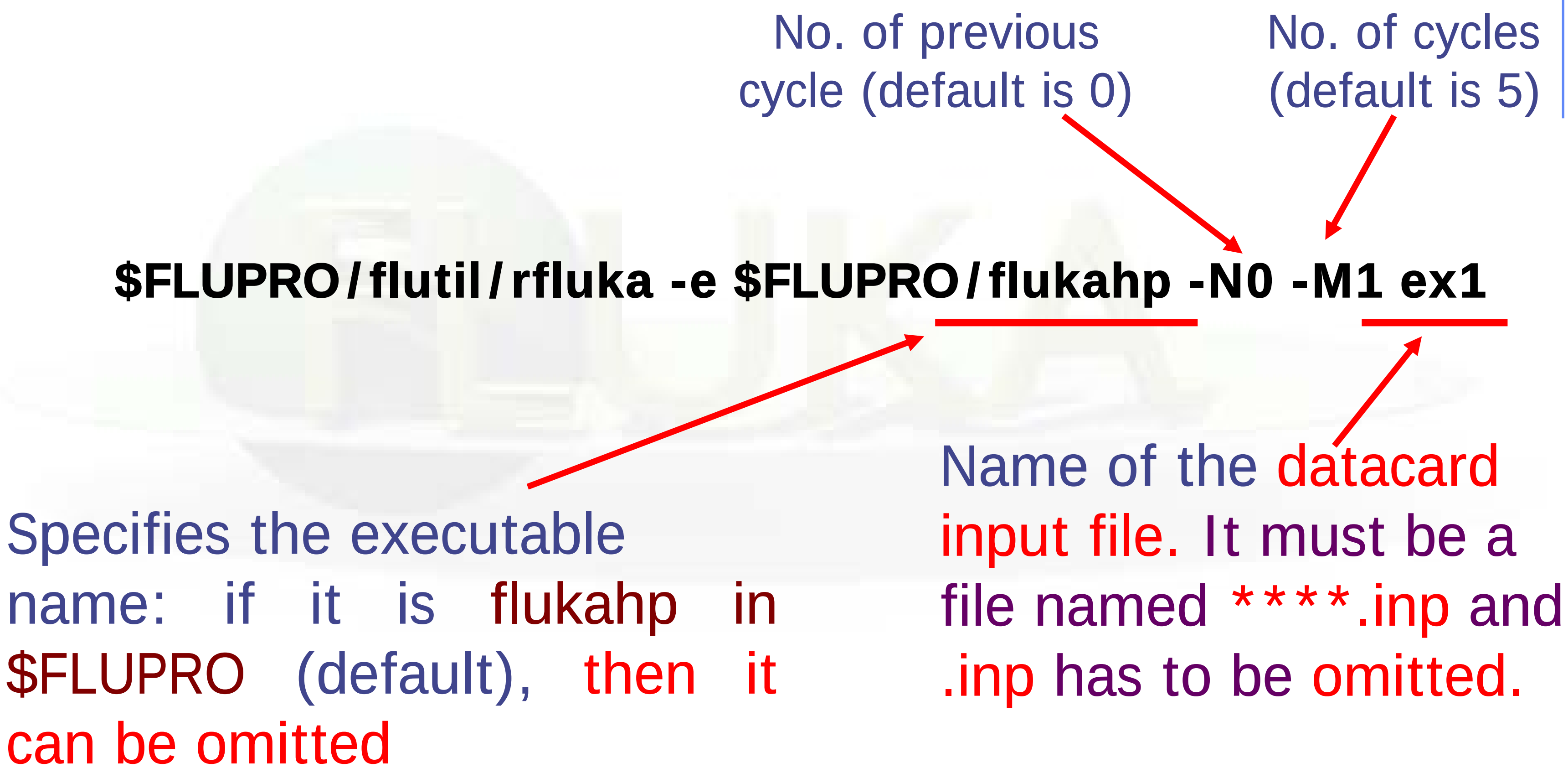
```
cd work
mkdir ex1
cd ex1
```

- Get the source example file from the course website (copy all the ex1.inp file to your subdirectory: ~/work/ex1)

  http://www.cern.ch/fluka-course/nea2008

Now let’s test the installation

Soon after you have created your standard FLUKA we can run the first example:



No. of previous cycle (default is 0)

No. of cycles (default is 5)

```
$FLUPRO/flutil/rfluka -e $FLUPRO/flukahp -N0 -M1 ex1
```

Specifies the executable name: if it is flukahp in $FLUPRO (default), then it can be omitted

Name of the datacard input file. It must be a file named ****.inp and .inp has to be omitted.

What rfluka does:

It creates a temporary subdirectory: $PWD/fluka_nnnn
($PWD means the current directory)
where nnnn is the system process-id assigned to FLUKA. There all necessary assignments are defined and output files are written.

elasct.bin	→	$FLUPRO/ elasct.bin
fluodt.dat	→	$FLUPRO/ fluodt.dat
fort.1	→	../ranex_1001
fort.11	→	ex_1001.out
fort.12	→	libec_thihecufealw_10t.pemf
fort.15	→	ex_1001.err
fort.16	→	“geometry scratch”
fort.2	→	ranex_1002
neuxsc.bin	→	$FLUPRO/ neuxsc-ind_260.bin
nuclear.bin	→	$FLUPRO/ nuclear.bin
sigmapi.bin	→	$FLUPRO/ sigmapi.bin
xnloan.dat	→	$FLUPRO/ xnloan.dat

At the end of the FLUKA run:

If everything is OK the temporary directory disappears
and the relevant results are copied in the start directory:

```
Removing links

Removing temporary files

Saving output and random number seed
```

by default you have ex100n.log, ex100n.out, ex100n.err and ranex100m (seed for cycle m = n+1)

```
Saving additional files generated
    Moving fort.33 to /home/student/work/ex1001_fort.33
    Moving fort.47 to /home/student/work/ex1001_fort.47
    Moving fort.48 to /home/student/work/ex1001_fort.48
    Moving fort.49 to /home/student/work/ex1001_fort.49
    Moving fort.50 to /home/student/work/ex1001_fort.50
```

Additional files resulting from the scoring required by the user

```
End of FLUKA run
```

Checking FLUKA during the run

Look in the temporary directory:

a) Initialization phase ends when the *.err file is opened.

b) Inside *.err file and (at the end of *.out file) the progress in the number of events is given in the line immediately following the one which starts by "NEXT SEEDS":

```
NEXT SEEDS:  C8888D      0      0      0      0      0 33B49B1      0      0      0
          1                    9                    9           0.0000000E+00
1.0000000E+30                  0
 NEXT SEEDS:  C88894      0      0      0      0      0 33B49B1      0      0      0
          2                    8                    8           5.0010681E-03         1.0000000E+30
0
 NEXT SEEDS:  C8889A      0      0      0      0      0 33B49B1      0      0      0
          3                    7                    7           3.3340454E-03         1.0000000E+30
0
 .....
```

EVENTS ALREADY COMPLETED

EVENTS TO BE COMPLETED

AVERAGE CPU TIME CONSUMED PER EVENT

Tips & Tricks

How to make a “clean” stop of FLUKA run

- Here “clean” means performing CLOSE of all files and removing the temporary directory and files.
- In the temporary run (*fluka_XXXX*) directory:

	touch fluka.stop	To stop the present cycle
or	touch **r**fluka.stop	To stop this and all remaining cycles

- The clean stop will occur at the next CPU-time check, *i.e.*, at the same time when printing the random number calls : see START card instructions (5th parameter) for the frequency of these checks!!
- If the check is never performed it means that the program has entered an infinite loop (probably a fault in user code)