FLUka with Geant4 Geometry [1]

FLUGG is an extension of FLUKA that allows to

- Define the geometry, material assignments, evt magnetic field in the Geant4[2] format
- *navigate* in the geometry calling the Geant4 geometry classes

FLUGG is available as a tar file from the FLUKA web page

Presently updated to Geant4 version 6

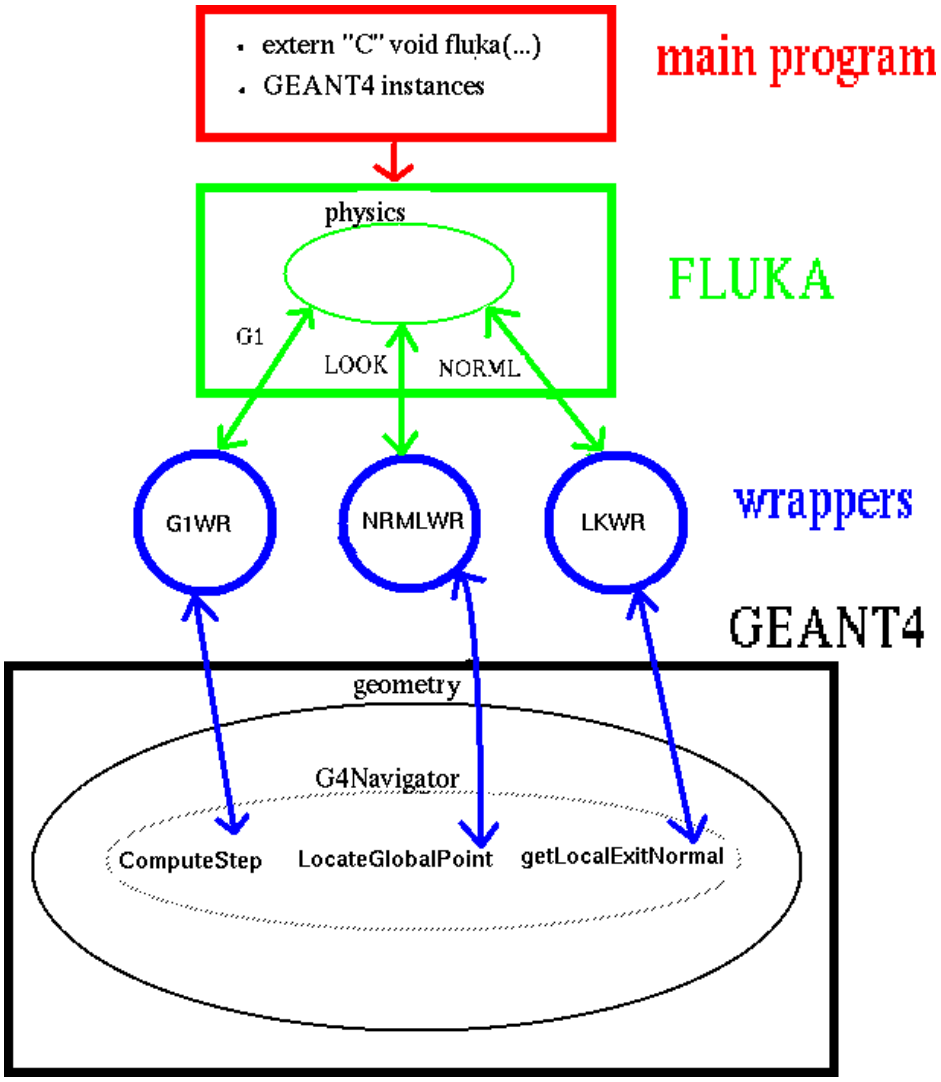
WARNING : No geometry debugger (not possible)

IMPORTANT NOTE : Only the *navigation* is performed by G4, the *tracking* (multiple scattering, approach to boundaries etc) is performed by FLUKA

[1] ATL-SOFT-98-039,ATL-SOFT-99-004

[2] http://geant4.web.cern.ch/geant4/

The general structure of FLUGG



The general structure of FLUGG - in words

The Installation —GDGprocedure prepares Libraries with the G4 geometry classes and the Flugg "wrappers"

The User prepares the Detector Construction and a C++ main from template

The application is built from Flugg + Fluka lib

The C++ main calls Goemetry initialization and FLUKA "real" main

The FLUKA "real" main reads datacards and performs a "standard" run

Calls to Geometry routines are redirected through FLUGG wrappers to G4 geometry methods

Output of results is the standard FLUKA one

What is needed

FLUKA Distribution	www.fluka.org
FLUGG tar file	www.fluka.org
CLHEP libraries	http://proj-clhep.web.cern.ch/proj-clhep/
GEANT4 distribution.	

WARNING: the clhep version must be compatible with the g4 version in flugg.

WARNING: Be careful to compiler "consistency" among libraries.

How to Install

- CLHEP

If not already system-wide, download the distribution and follow the instructions on the web site:

```
cd xxxx
tar -xzvf clhep-1.8.0.0.tgz
cd CLHEP
./install
make install prefix=xxxx/CLHEP
```

make a logical link

CLHEP/lib/libCLHEP.a → CLHEP/lib/libCLHEP-g++.1.8.0.0.a

- FLUKA

.. You already know • GEANT4

download and un-tar

How to Install - II

- FLUGG

>>> Un-tar the distribution. It creates a ./flugg directory

>>> cd flugg

>>> ./Configure This script collects the informations about operating system and installation paths, in order to set environmental variables:

  - FLUGGINSTALL : path to the flugg installation
  - FLUPRO : path to the FLUKA installation
  - CLHEP_BASE_DIR : path to the CLHEP installation
  - G4SYSTEM : operating system
  - G4INSTALL : path to G4 installation
  - G4GEOMETRY_DEBUG, G4LIB_BUILD_SHARED debug and libary options

>>> Depending on shell : '. ./configure.sh' or 'source ./configure.csh'

>>> .Install

>>> cd source

How to Install - II

>>> make

>>> ..and get G4 and Wrapper libraries in $FLUGGINSTALL/lib

How to Build an Application

- Look at the examples in $FLUGGINSTALL/examples/FluggEx
- Set the environment through configure.sh or configure.csh'
- Create application directory mydir
- cp $FLUGGINSTALL/examples/FluggEx/emptyEx/mainFLUGG.cc $mydir/mainMYAPP.cc
- cp $FLUGGINSTALL/examples/FluggEx/emptyEx/GNUmakefile $mydir/.
- edit GNUmakefile and change the application name
- Prepare your geometry/material/magnetic field in G4 style: $mydir/src/MyDetectorConstruction.cc $mydir/include/MyDetectorConstruction.hh
- If needed, place FLUKA user routines (FORTRAN), in $mydir/for/
- make
- your binary is $FLUGGINSTALL/bin/$G4SYSTEM/mainMYAPP

INITIALIZATION

Fluka Physics and FLUKA users need to identify the geometry volumes, that means to have a correspondence table between volumes "à la Geant4" and regions "à la FLUKA"

This is performed by the Initialization Wrapper.

for this reason, a first, dummy run is needed to finalize the input (and the user routines)[3]

[3] see next slides

INITIALIZATION - II

During initialization: (let myinput.inp be the input file)

- A number is assigned to each Logical Volume (replicas have the same number). This number is the "region number" as seen by FLUKA.
- If present, material definitions in MyDetector Construction are translated into MATERIAL cards
- If present, assignment of materials to volumes are translated into ASSIGNMAT cards
- If magnetic field is defined, a MAGFIELD card is prepared.
- FLUKA CARDS are formatted and output to an auxiliary file: myinput001_flukaMat.inp
- Volume - to - region number correspondences and are listed in myinput001_Volumes_index.inp

How to Run an Application

- Prepare a standard FLUKA input myinput.inp
  with the GEOEND card **immediately after** *the GEOBEGIN*
  without MATERIAL and ASSIGNMAT cards
  with a STOP card after the GEOEND card
- Run FLUKA a first time for initialization
  \$FLUPRO/flutil/rfluka –M1 –N0
  –e \$FLUGGINSTALL/bin/\$G4SYSTEM/mainMYAPP myinput
- Paste myinput001_flukaMat.inp into myinput.inp
- Add any other needed card, referring to myinput001_flukaMat.inp and myinput001_Volumes_index.inp for indexing.
- Move the STOP card to the end
- Possibly finalize/modify user routines, and *make* again
- Prepare a standard PEMF file mypemf.pemf

How to Run an Application

- **run !**

  $FLUPRO/flutil/rfluka –M1 –N0 –p mypemf
  –e $FLUGGINSTALL/bin/$G4SYSTEM/mainMYAPP myinput

A special user routine for replicas

All Replicas of a given volume are idefied by the same *region number*. A special wrapper can be called to get *the complete geometry tree*

DIMENSION IND(15), IREP(15)

CALL RGRPWR(MREG,LATCLL,IRG4,IND,IREP,IDEPTH)

IN:

MREG = fluka region number

LATCLL = lattice index == pointer to geometry (Lt1trk or Lt2trk in common TRACKR, latcll in the musrbr.f user routine)

OUT:

IRG4: region number found by wrapper, MUST BE = MREG

IDEPTH = depth of the present volume in the geometry tree

IND(1:IDEPTH): volume or mother volume index at each level

IREP(1:IDEPTH): volume or mother volume replication nb. at each level

Magnetic Field, the FLDWR wrapper

Magnetic field isdefined through G4 classes

- The flag for magnetic field is set in the ASSIGNMAT cards produced at initialization time
- A MGNFIELD card is also provided **to be customized**
- The user must provide a magfld.f routine (in $mydir/for) containing
  CALL FLDWR (X, Y, Z, BTX, BTY, BTZ, B, NREG, IDISC)
  this wrapper takes care of the interface to the mag. field definition.

Magnetic field defined otherwise

The user can provide its own magnetic field routine, or use the uniform magnetic field option, as for a standard FLUKA run. In this case, flagging in ASSIGNMAT must be done by hand.