http://geant4.org

GEANT4 GEOMETRY HANDS ON

KIT Tutorial, October 25-26, 2011, Karlsruhe

Setup

- We assume your Vmware or VirtualBox virtual machine is correctly set up
  - See details at http://geant4.in2p3.fr
- Download exercices
  - http://geant4.in2p3.fr
  - Go to Tutorials & teachings
  - Search for today's tutorial
  - Download Geometry Hands On
  - Save this file on your desktop
  - Under your Linux VMware machine:
    - Make sure file sharing is enabled and that your exchange directory has been defined (see Geant4 VMware web page for details)
    - Your exchange directory is `/mnt/hgfs/Desktop`
    - Open a terminal
      - `cp /mnt/hgfs/Desktop/gzgeometry-tar.gz .`
      - `tar -zxvf gzgeometry-tar.gz`
      - `cd geometry`
      - `cd jour1a`

jour1a

- Geometry
  - A space shuttle is modelled by an Al cylinder
  - Inside, the shuttle has a floor in Al
  - The shuttle is placed in the « World » : a box as small as possible
- How to start ?
  - Go to jour1a
  - Read the code
    - jour1a.cc (main)
    - 2 classes: DetectorConstruction and PrimaryGeneratorAction
    - You may use `snavigator &`
- Compile and generate executable
  - `gmake`

Run jour1a in interactive mode


```
% $G4WORKDIR/bin/$G4SYSTEM/jour1a
....
Idle> type your commands: example :

Idle> /run/beamOn 1
Idle> /gun/direction 1 1 0
Idle> /run/beamOn 1
Idle> /gun/position -2.4 0 0 m
Idle> /run/beamOn 1
....
Idle> exit
```

Let's start to interact with Geant4

- Try to understand what is printed
- Try to play with
  - `/gun/direction`
  - `/gun/position`

  in order to determine x, y and z axis
    - x is red
    - y is green
    - z is blue
- read the vis.mac macro file
- Try some visualisation commands

Exercice 1

- Model an astronaut as a pyramid with a square base
  - height = 50 cm, bases = 60 cm (bottom), 40 cm (top)
  - material : water
  - place it on the floor

- Hints
  - materials: see User's Guide for Application Developer (section 2.3)
  - geometry:
    - http://geant4.web.cern.ch/geant4/G4UsersDocuments/UsersGuides/ForApplicationDeveloper/html/GettingStarted/geometryDef.html
    - `$G4INSTALL/examples/novice/N03/src/ExN03DetectorConstruction.cc`
  - placement with rotation: see placement of floor

- Answer : see jour1b

Exercice 2

- Enlarge dimensions of space around the shuttle and place a second shuttle
  - Use rotation

- Answer
  - see DetectorConstruction.cc2 in jour1b

```
cd src
mv DetectorConstruction.cc DetectorConstruction.cc1
mv DetectorConstruction.cc2 DetectorConstruction.cc
cd ..
gmake clean
gmake
```

Exercice 3

- The parameters that are used for the description of the geometry are local variables of the `ConstructVolumes()` method
  - cabinRadius, cabinLength, …
- Define these variables as private data members of the DetectorConstruction class
- Initialise them in the class constructor and put computed variables in the ConstructVolumes() method
- Write corresponding Get/Set public accessors
- Update the `PrintParameters()` method in order to print the dimensions of the geometrical components : World, Spacecraft, Floor, Astronaut.
- Answer : see jour1c
  - Method `UpdateGeometry()` to force geometry reconstruction
  - Display of units in `PrintParameters()`

Exercice 4

- Try to shoot other particles using UI commands
  - e-
  - e+
  - gamma
  - proton
- Change their energy
- Change their direction
- Read PrimaryGeneratorAction class
  - This is whre you describe how to shoot primary particles
- Read PhysicsList class
  - This is where the Physics is « hidden »