Hands-on Work 1

Geant4 Tutorial @ Japan 2007
Geant4 Collaboration

KEK/CRC

Hand-on Work -1

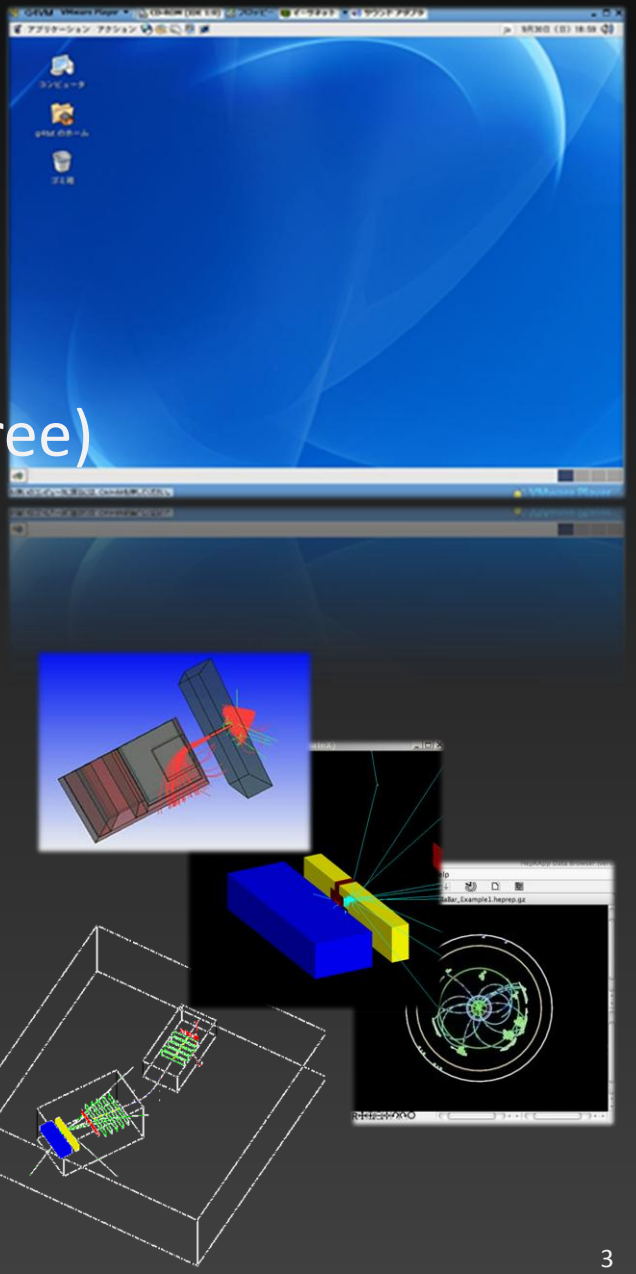
How is your installation ?

Playing with novice examples : N01, N03,…

Your Installation

Windows XP/Vista users

- *http://www-geant4.kek.jp/g4users/g4tut07/install-win.html*
- Virtual machine on VMware Player (Free)
  - ✓ Scientific Linux 4.5
  - ✓ user name: g4tut, password: $g4tut$
- Pre-installed packages
  - ✓ CLHEP, ROOT, gLite
  - ✓ Geant4
    - – pre-build library
    - – data files
    - – examples
  - ✓ Geant4 visualization tools
    - – DAWN, VRML view, WIRED3



Practical installation guide for Linux

http://www-geant4.kek.jp/g4users/g4tut07/install-liux.html

- If you will install Geant4 and its related packages by yourself, follow the procedures described here.
  - ✓ CLHEP, Geant4, Visualization tools, ROOT

Another useful guide

http://geant4.slac.stanford.edu/installation/

LET'S PLAY WITH EXAMPLES

Novice example N01

Let's start with this example as warm-up

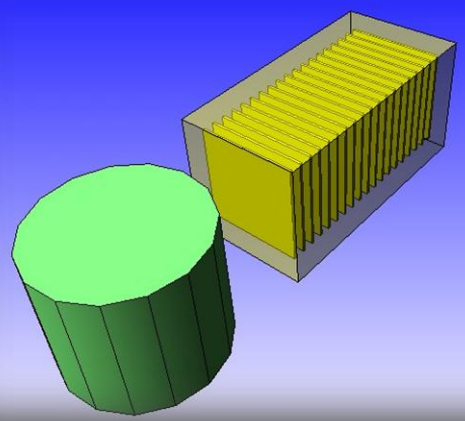
Fixed geometry

- *Ar* gas mother volume with *Al cylinder* and Pb block with Al slices

Incident particle is a *geantino*

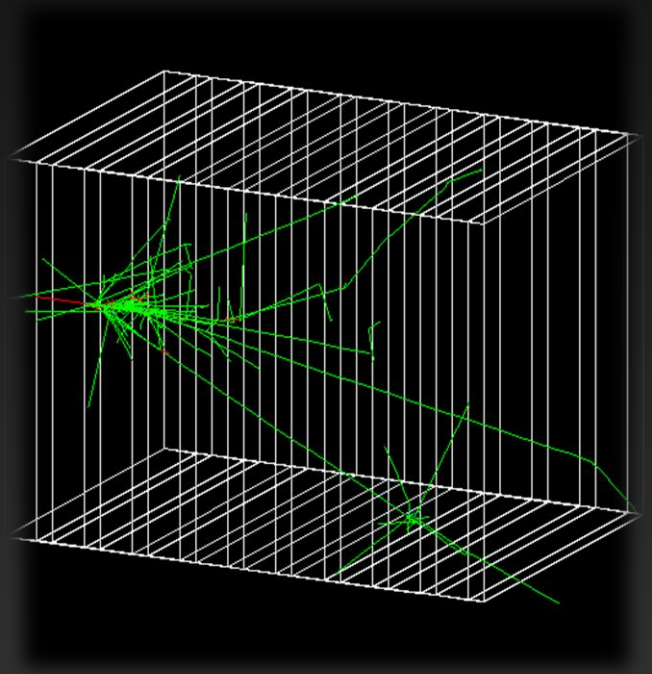
- no physics interactions
- only the transportation process is enabled

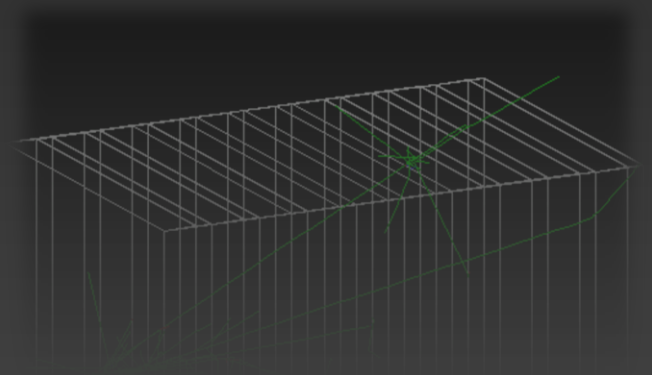
Hard coded batch job and verbosity



Novice Example N03

Let's play with this example.





- Sampling calorimeter with layers of Pb absorber and liquid Ar detection gaps (replicas)
- Exhaustive material definitions
- Command interface
- Randomization of incident beam
- All EM processes + decay, with separate production cuts for γ, e+, e-
- Detector response: E deposit, track length in absorber and gap
- Visualization tutorial
- Random number seed handling

Novie Example N02

Pb target, Xe gas chambers (parameterized volumes)

All EM processes + decay including charged leptons and charged hadrons

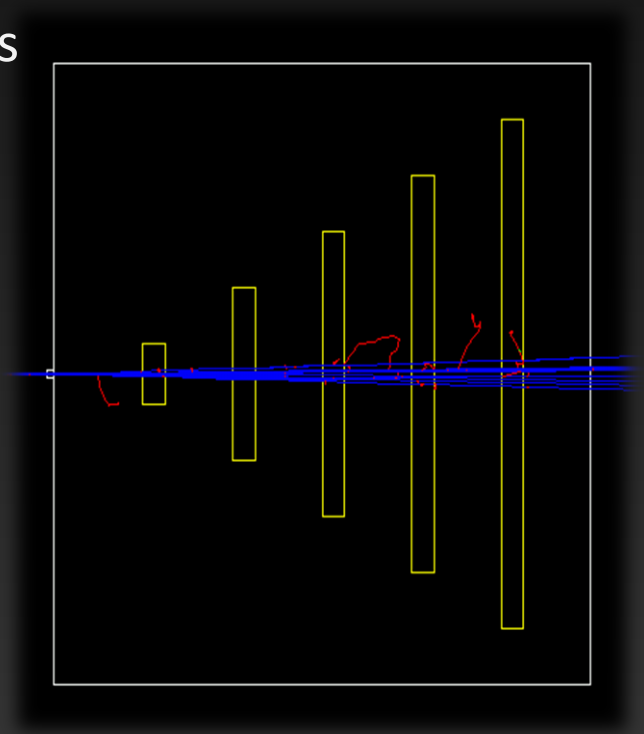
Detector response

- Trajectories and chamber hit collections may be stored

Visualization of detector and event

Command interface introduced

- Can change target, chamber materials, magnetic field, incident particle type, momentum, etc. at run time



Novie Example N04

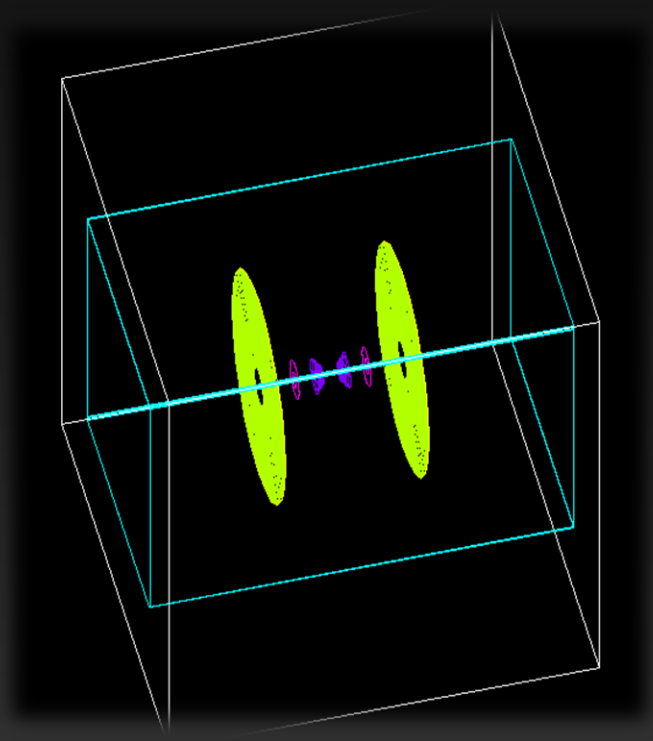
Simplified collider detector
- all kinds of volume definitions

Magnetic field

PYTHIA primary event generator
- Higgs decay by Z0, lepton pairs

Packaged physics list (QGSP)

Event filtering by using stacking mechanism



Novice Example N05

Fast simulation with *parameterized showers*

- EM showers (derived from G4VFastSimulationModel)
- Pion showers (for illustration only – not used)

EM physics only

- Use of G4FastSimulationManagerProcess

Simplified collider detector geometry

- Drift chamber
- EM, hadronic calorimeter
- *Ghost volume*

Novice Example N06

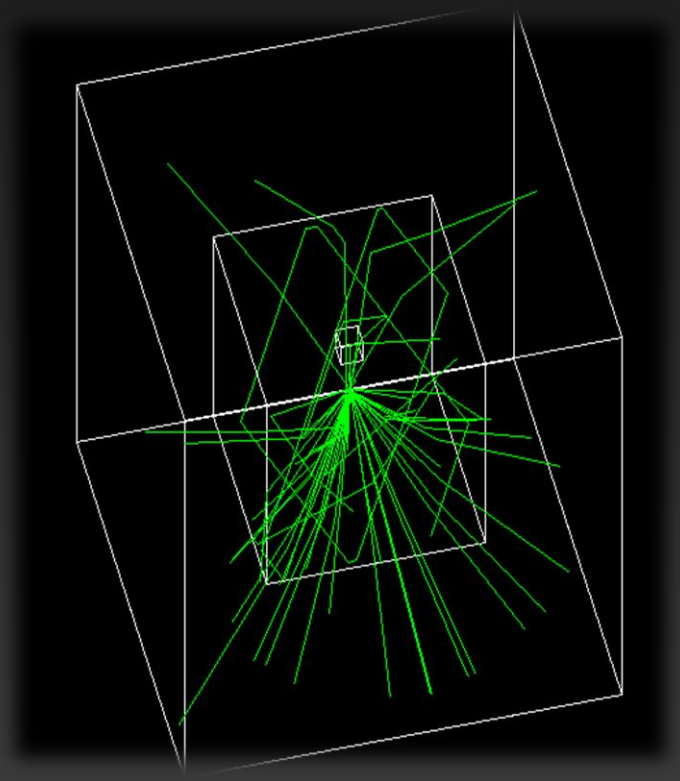
Water Cerenkov detector with air “bubble”

Materials

- Specification of optical properties
- Specification of scintillation spectra

Physics

- *Optical processes*
- Generation of Cerenkov radiation, energy loss collected to produce scintillation



Novice Example N07

3 simplified sandwich calorimeters (Pb, Al, Ar)

Cylindrical ghost volume for scoring

Run-based (as opposed to event-based) hit accumulation

Changing geometries without rebuilding world

Setting different secondary production cuts for each calorimeter using G4Region