Running Geant4

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Slides courtesy of SLAC GEANT4 Team

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GEANT4 at TUNL

- Installed in /usr/local/geant4/ (ver. geant4-09-02)
- GEANT4 Environment variables should be set by default upon logging on. (To check those variables, issua the command: 'printenv | grep G4'. For example, verify the followings
  - ✓ G4INSTALL=/usr/local/geant4
  - ✓ G4WORKDIR should be your 'geant4' dir in your home dir.
- GEANT4 is not installed on all the TUNL computers. (we've picked up four computers with geant4 installed. See the next slide)
- Other related software/library also available at tunl: c++ compiler, CLHEP, GNU make, GEANT4 visualization softwares

Running GEANT4 during tutorial

- Useful info posted on the course web page: http://www.tunl.duke.edu/~tajima/geant4
  - software requirements
  - how to verify software installation
- Log onto one of the following TUNL computers from your laptop using 'ssh'
  - ackbar.tunl.duke.edu
  - obiwan.tunl.duke.edu
  - positron.tunl.duke.edu
  - storm.tunl.duke.edu

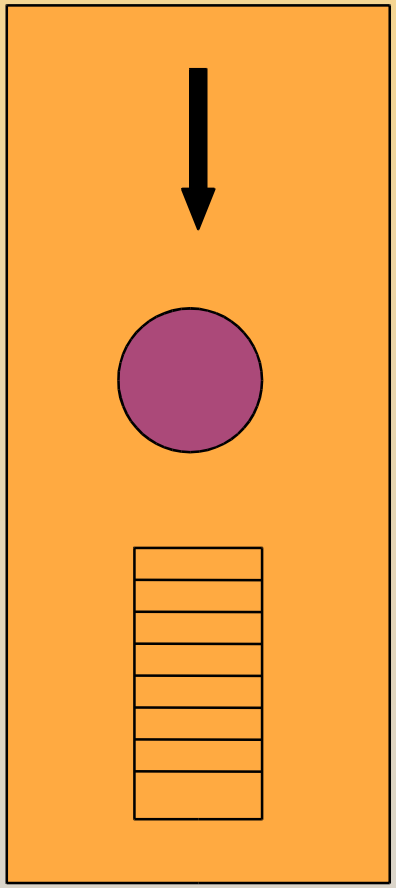
Novice Example Programs

- Available at /usr/local/geant4/examples/novice
- Trivial detector with non-interacting particles
- Complex detector with full physics

- One can make use of the online resources such as Cross Reference (LXR) and Software Reference Manual to understand the geant4 code.
- Reminder: all the geant4 resources are at http://cern.ch/geant4

Novice Example N01

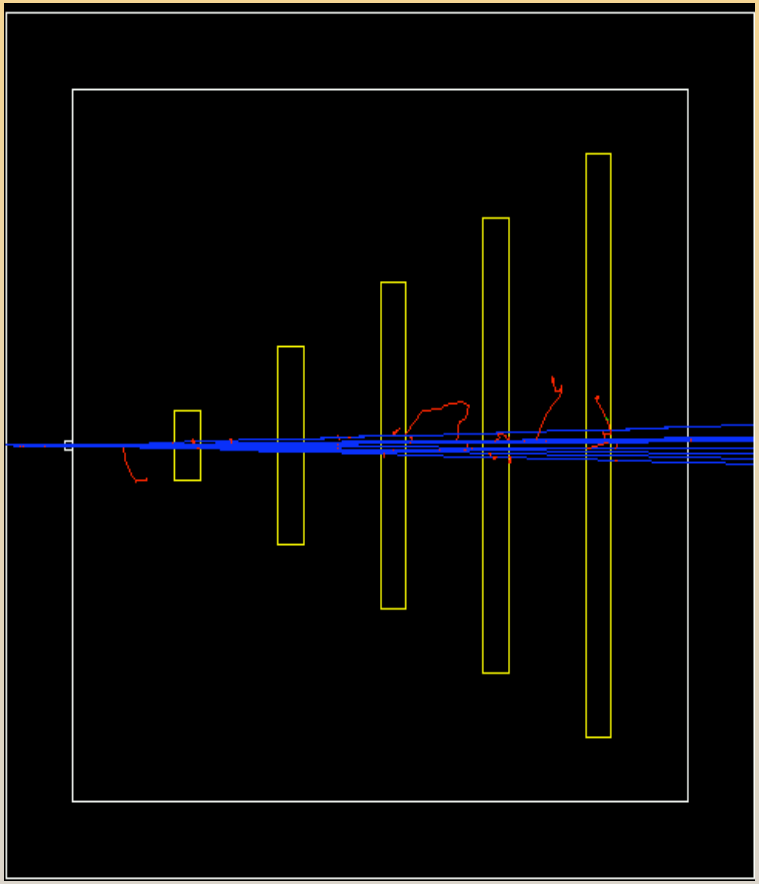
- Fixed geometry: Ar gas mother volume with Al cylinder and Pb block with Al slices
- Incident particle is a geantino – no physics interactions
- No magnetic field and only the transportation process is enabled
- Hard coded batch job and verbosity



Slide from SLAC Geant4 tutorial course in '06

Novice Example N02

- Pb target, Xe gas chambers (parameterized volumes)
- All EM processes + decay included for γ, 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



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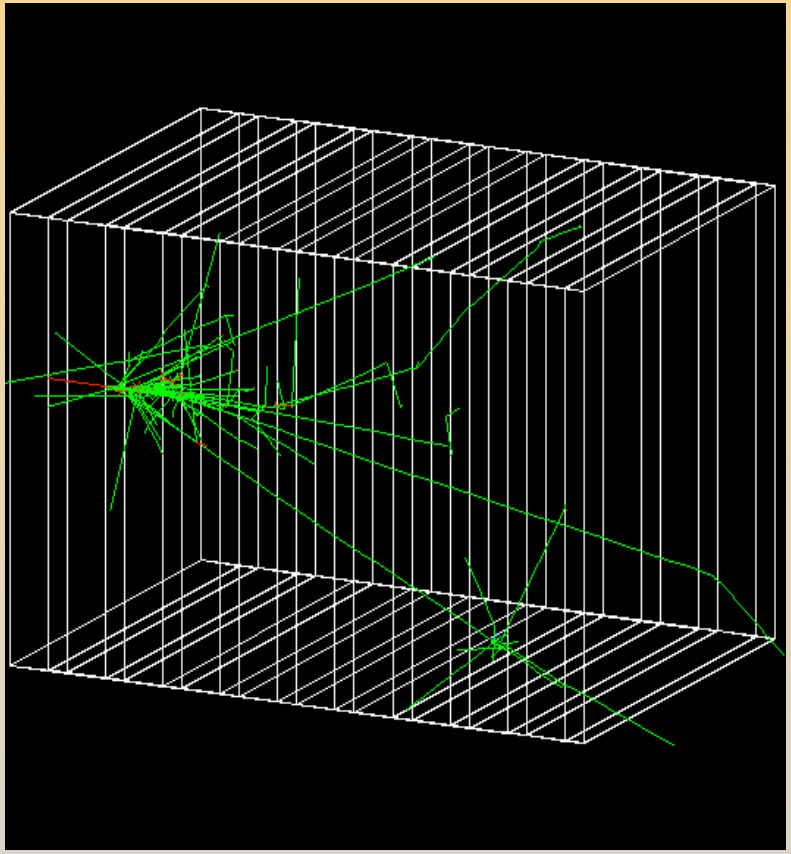
Novice Example N03

- 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- (use for shower studies)
- Detector response: E deposit, track length in absorber and gap
- Visualization tutorial
- Random number seed handling



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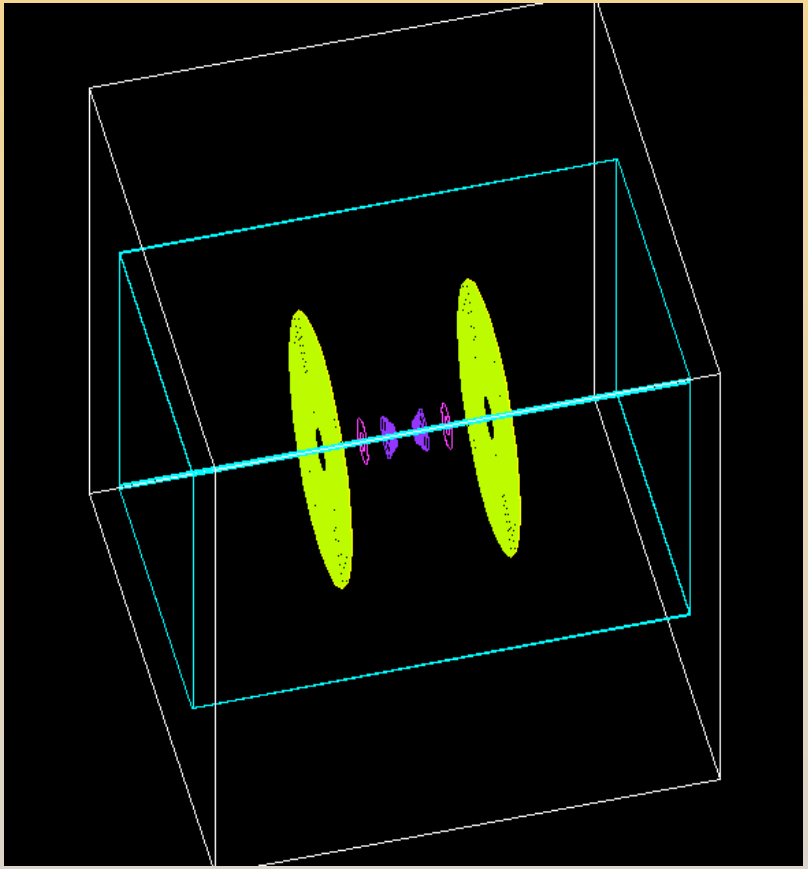
Novice Example N04

- Simplified collider detector
  - all kinds of volume definitions
- Magnetic field
- PYTHIA primary event generator
  - Higgs decay by Z0, lepton pairs
- Full set of EM + hadronic processes
  - Should use updated hadronic physics lists
- Event filtering by using stacking mechanism



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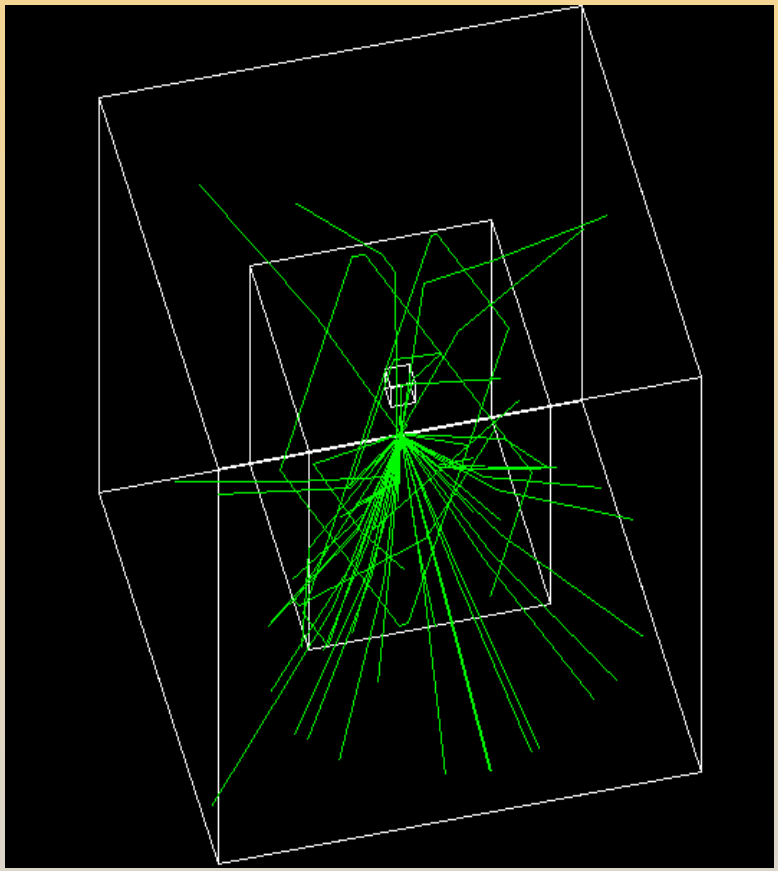
Novice Example N05

- 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



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