Visualization in MaGe/Geant4

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Max-Planck-Institute for Physics

MaGe Workshop 2010, Munich

January 18, 2010

Visualization in MaGe/Geant4, or Ways to see what you do in MaGe/Geant4

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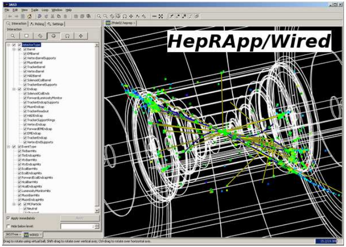
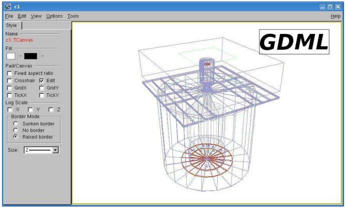
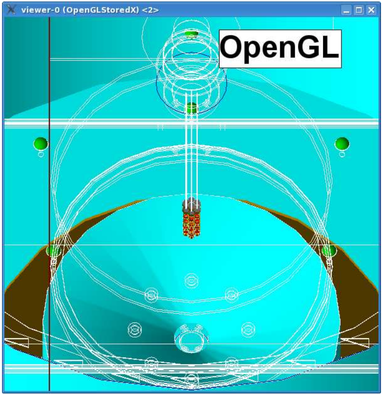
Examples


HepRApp/Wired


c1
File Edit View Options Tools Help
GDML


viewer-0 (OpenGLStoredX) <2>
OpenGL

Outline

- Motivation

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- General visualization commands

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- Examples of command sequences

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- General visualization commands
- Examples of command sequences
- More detailed information on:
  - GDML
  - HepRep/HepRApp/Wired
  - OpenGL
  - Extra features of OpenGL

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- Even for more interesting things (not really useful but nice). Later on this...

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  - /vis/viewer/set/style wireframe
  - /vis/viewer/set/viewpointThetaPhi 70 20
- Declare what data should be added to the scene (default is to just add full set of detector volumes)
  - /vis/scene/add/trajectories
  - /vis/scene/add/hits

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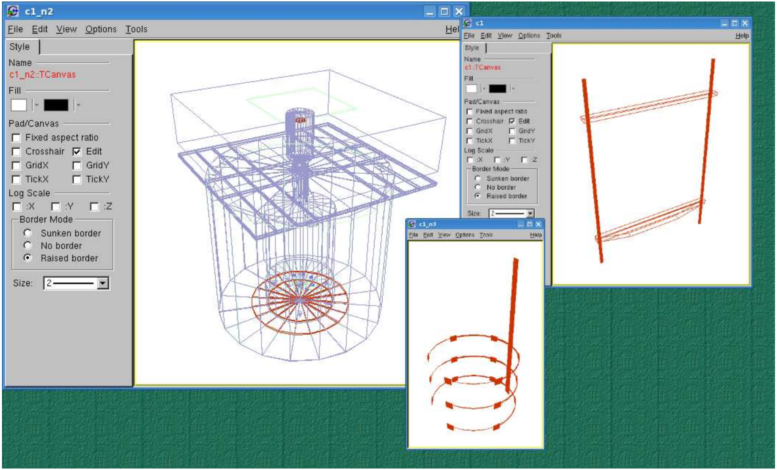
⋆ If using an external viewer, such as for HepRepFile:
  - import the .heprep file into HepRApp/Wired, set camera parameters, drawing style, etc., view the visualization

Example Visualization Command Sequences

- Visualize a detector in OpenGL (Linux or Mac)
  - /vis/open OGLIX
  - /vis/drawVolume
- Visualize trajectories and hits for 10 events using HepRep/HepRApp
  - /vis/open HepRepFile
  - /vis/drawVolume
  - /vis/scene/add/trajectories
  - /vis/scene/add/hits
  - /run/beamOn 10

GDML (Geometry Description Markup Language)



GDML3.0 + ASCIITree + ROOT example sequence

- Open ASCIITree driver and create geometry tree
  - /vis/open ATree
  - /vis/ASCIITree/verbose 1
  - /vis/drawTree
- Set up GDML format: filename, output format and levels to modularize (see GDML manual):
  - /MG/geometry/GDML/outputName GerdaArray
  - /MG/geometry/GDML/outputFormat false
  - /MG/geometry/GDML/modularizeLevels 0 1 2
- Dump geometry to files
  - /MG/geometry/GDML/write
- Import geometry into ROOT
  - `gSystem->Load("libGeom");`
  - `gSystem->Load("libGdml");`
  - `TGeoManager::Import("GerdaArray.gdml");`
  - `gGeoManager->GetTopVolume()->Draw();`

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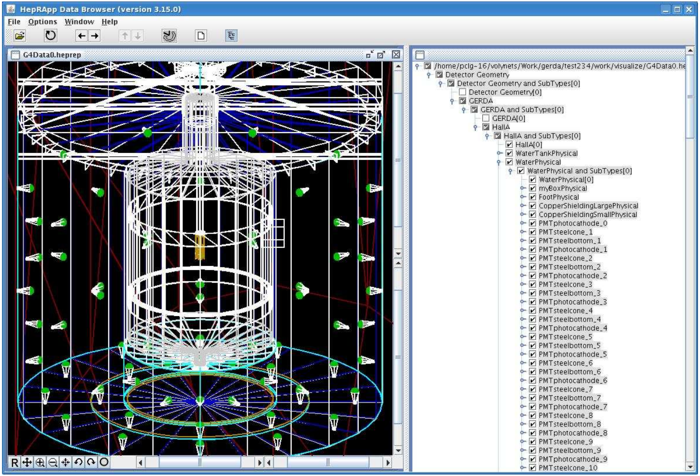
Disadvantages:

- GDML is included in Geant4.9.2 and later releases so there appeared number of incompatibilities in MaGe (way of reading/writing files was changed) - to be discussed during the Computing Session
- Creating geometry for older releases of GDML (version $<= 2.10$) does not mean that it will be read by Geant4-GDML

HepRApp/Wired (HepRep)



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- Many visual options;
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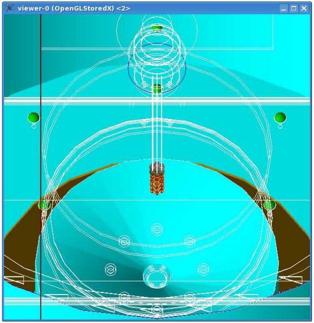
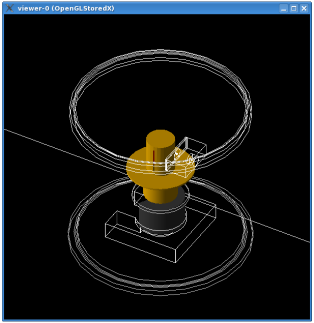
Disadvantages:

- Rather slow when rotating a complicated geometry;
- Not a better way of making high-quality pictures (i.e. for Posters or Technical Design Report)

OpenGL





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- Gives extra possibilities. See next slide...

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See the movie about GERDA...

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- Put some loop to MaGe/Geant4 macro at the very end: *RunGerda.mac:*
  - /control/loop movie.loop phi 0 100 5
    loop over $\phi = 0..100$ *with step* 5 *degrees*

  movie.loop:
  - /vis/viewer/set/viewpointThetaPhi 30 {phi}
  - /vis/ogl/printEPS

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  movie.loop:
  - /vis/viewer/set/viewpointThetaPhi 30 {phi}
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- Convert all *.eps* to *.yuv* files, create conversion macro for *mpeg2encode* and encode pictures to video file. See the reference for details.

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See slowed down motion of the particles (for free!)...

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- Each method has Advantages and Disadvantages
- There are other also good ways not covered in this presentation (DAWN, RayTracerX etc.). Try them
- If you are a geek* you have much space to fulfil your needs. Just use your imagination

* http://en.wikipedia.org/wiki/Geek

Acknowledgements

Thanks to Joseph Perl from SLAC
(I took his presentations' materials while creating my talk)

References

HepRApp Tutorial
- http://geant4.slac.stanford.edu/Presentations/vis/G4HepRAppTutorial/G4HepRAppTutorial.html

OpenGL Tutorial
- http://geant4.slac.stanford.edu/Presentations/vis/G4OpenGLTutorial/G4OpenGLTutorial.html

GDML manual
- http://gdml.web.cern.ch/GDML/doc/GDMLmanual.pdf

Geant4 Visualization Commands
- http://geant4.slac.stanford.edu/Presentations/vis/G4VisCommands.ppt (and .pdf)

Geant4 Advanced Visualization
- http://geant4.slac.stanford.edu/Presentations/vis/G4VisAdvanced.ppt (and .pdf)

How to Make a Movie
- http://geant4.slac.stanford.edu/Presentations/vis/HowToMakeAMovie.ppt (and .pdf)

Visualization Chapter of the Geant4 User's Guide for Application Developers
- http://geant4.web.cern.ch/geant4/UserDocumentation/UsersGuides/ForApplicationDeveloper/html/

Movies and other useful manuals and tutorials
- http://geant4.slac.stanford.edu/Presentations/vis/