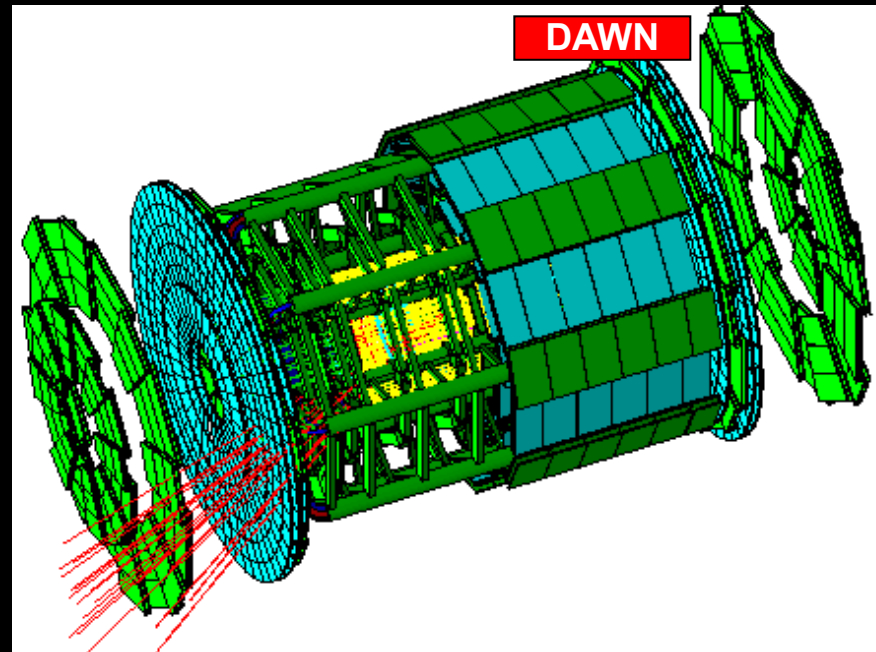
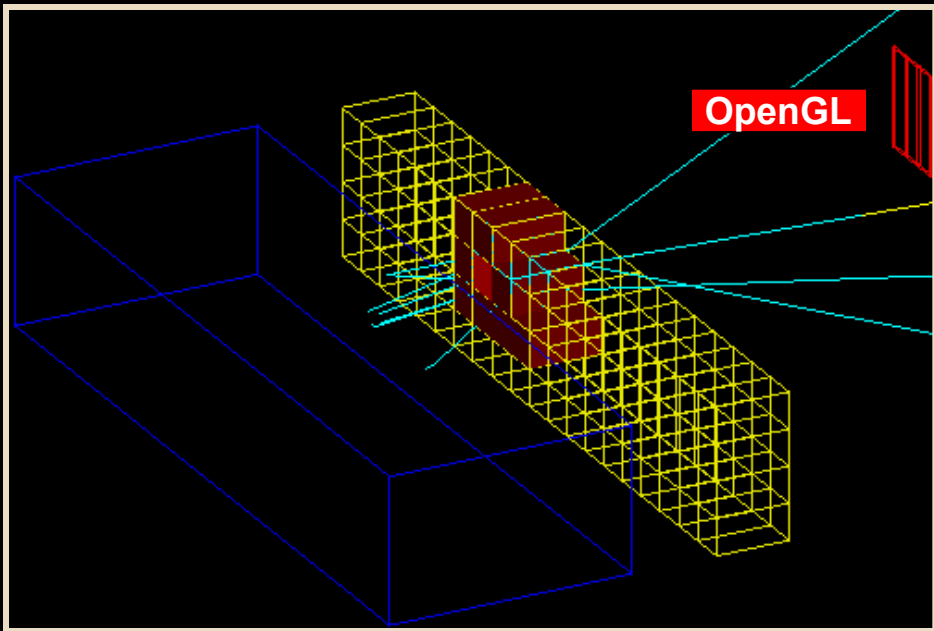
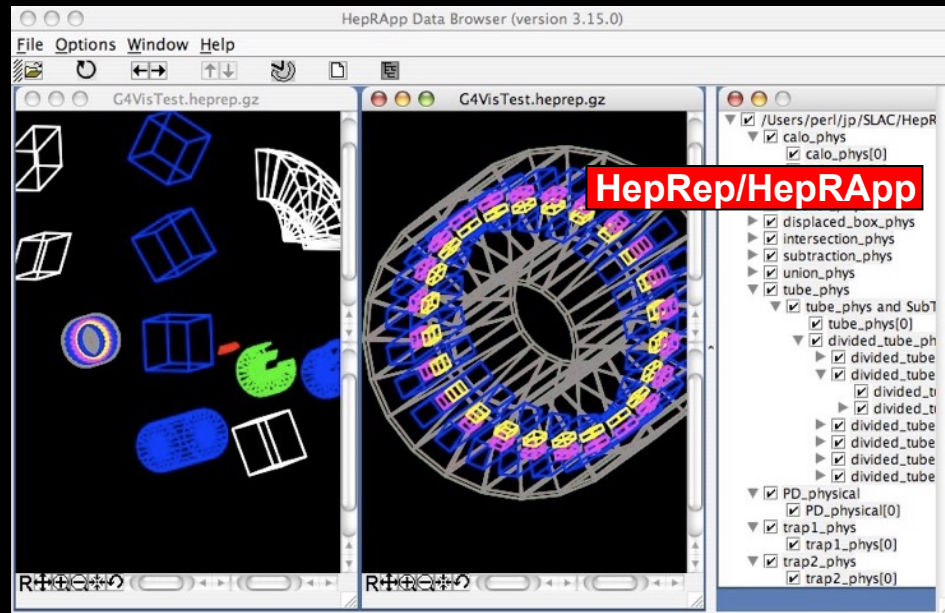


VISUALIZATION

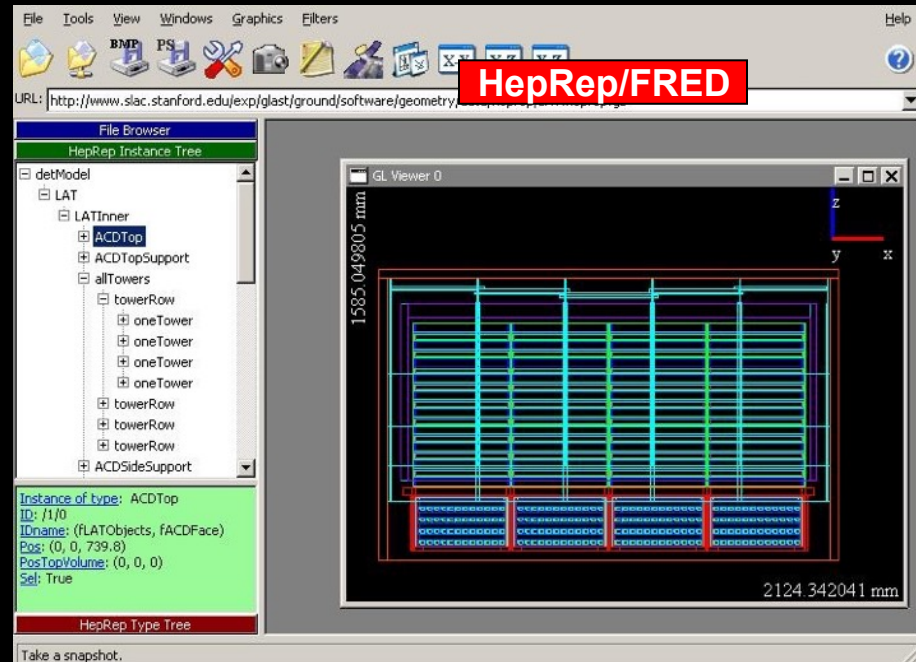
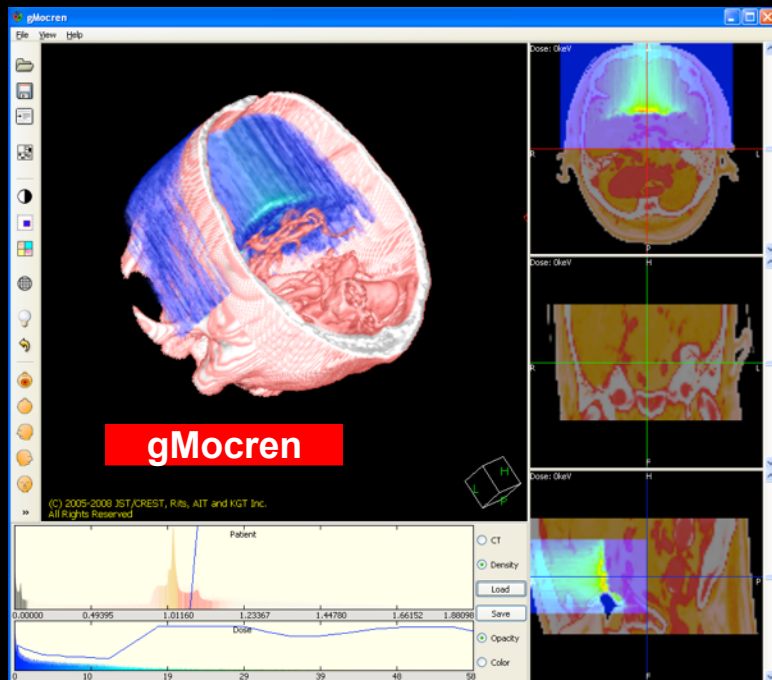
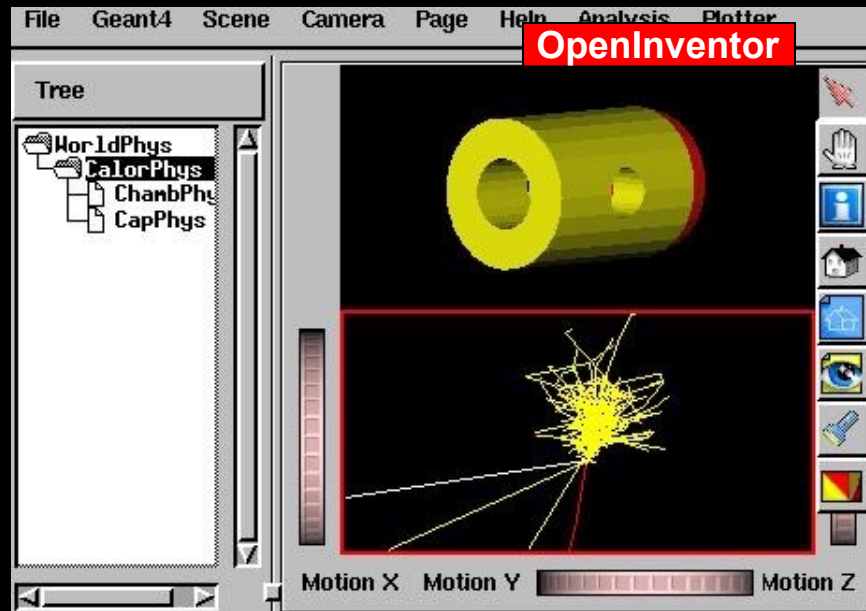
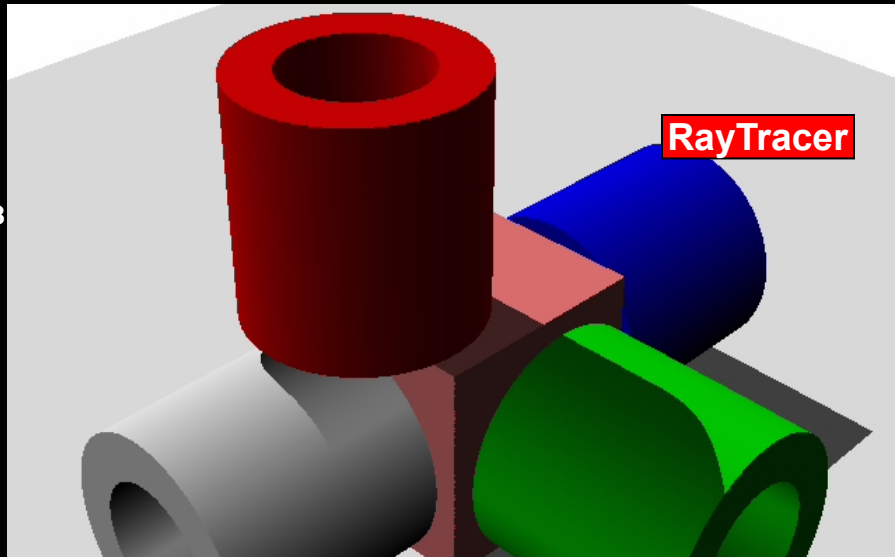
Mihaly Novak

based on material provided by

M. Asai (SLAC) & A. Dotti (SLAC) & J. Perl (SLAC) & L. Garnier (CNRS)

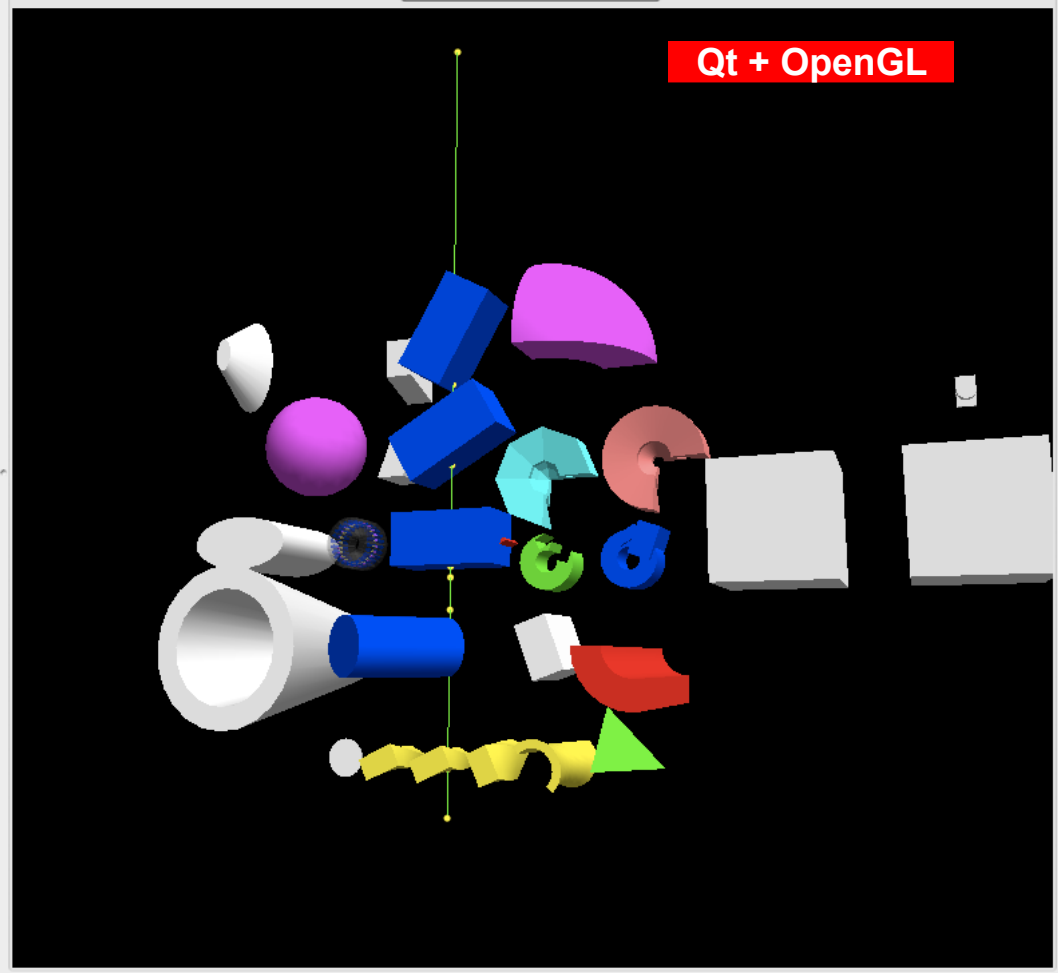


3



viewer-1 (OpenGLStoredQt)

Qt + OpenGL



Vis parameters

Viewer components

Helr:

Search :

- Command
 - ▶ /vis/filtering/
 - ▶ /vis/geometry/
 - ▶ /vis/scene/
 - ▶ /vis/sceneHandler/
 - ▼ /vis/viewer/
 - ▼ /vis/viewer/set/
 - /vis/viewer/set/all
 - /vis/viewer/set/autoRefresh
 - /vis/viewer/set/auxiliaryEd...
 - /vis/viewer/set/background
 - /vis/viewer/set/culling
 - /vis/viewer/set/cutawayMo...
 - /vis/viewer/set/edge
 - /vis/viewer/set/explodeFac...
 - /vis/viewer/set/globalLine...
 - /vis/viewer/set/globalMark...
 - /vis/viewer/set/hiddenEdge
 - /vis/viewer/set/hiddenMar...
 - /vis/viewer/set/lightsMove
 - /vis/viewer/set/lightsTheta...
 - /vis/viewer/set/lightsVector
 - /vis/viewer/set/lineSegme...
 - /vis/viewer/set/picking
 - /vis/viewer/set/projection
 - /vis/viewer/set/sectionPlane
 - /vis/viewer/set/style
 - /vis/viewer/set/targetPoint
 - /vis/viewer/set/unThetaPhi

Command /vis/viewer/set/hiddenMarker
Guidance :
If true, closer objects hide markers.
Otherwise, markers always show.

Parameter : hidden-marker
Parameter type : b
Omittable : True
Default value : 1

Cout

History

Session :

What can be visualized ?

5

- **Simulation data** can be visualized
 - Geometrical components
 - Particle trajectories and tracking steps
 - Hits of particles in the geometry
 - Scored energy, dose, etc.

- Other user defined objects can be visualized
 - Polylines
 - such as coordinate axes
 - 3D Markers
 - such as eye guides
 - Text
 - descriptive character strings
 - comments or titles

- Geant4 visualisation documentation: [Visualisation Documentation](#)

A **variety** of choices

6

Driver	Variant	Hight quality print	Interactive	browse geometry hierarchies	Direct access to G4 kernel	Make movies	Web
OpenGL	X	Green	Green	Red	Green	Green	Red
	Xm	Green	Green	Red	Green	Green	Red
	Qt	Green	Green	Green	Green	Green	Red
	Win32	Green	Green	Red	Green	Green	Red
OpenInventor	Xt	Green	Green	Red	Green	Red	Red
	Win32	Green	Green	Red	Green	Red	Red
DAWN		Green	Red	Red	Red	Red	Red
VRML		Red	Green	Red	Red	Red	Green
HepRep		Red	Green	Green	Red	Red	Red
gMocren		Red	Green	Red	Red	Red	Red
RayTracer		Green	Red	Red	Red	Red	Red
ACSII File		Red	Red	Green	Green	Red	Red

Controlling visualization

7

- Your Geant4 code **stays basically the same** no matter which driver you use
- Visualization is performed either **with commands or from C++ code**
 - For the present tutorial, we confine ourselves to **command-driven** visualization.
- Some visualization drivers work directly **from Geant4**
 - OpenGL
 - OpenInventor
 - RayTracer
 - ASCII Tree
- For other visualization drivers, you first have **Geant4 produce a file**, and then you have that file **rendered by another application** (which may have GUI control)
 - HepRepFile
 - DAWNFILE
 - VRML2FILE
 - gMocrenFile
- You can open **more than one driver at a time**
 - For example, do a quick check in OpenGL, then save the same event for a beautiful DAWN plot

Controlling which drivers are available

8

- Six of the visualization drivers are always included by default (since they require no external libraries):
 - HepRepFile
 - DAWNFILE
 - VRMLFILE
 - RayTracer
 - gMocrenFile
 - ASCIITree
- Other visualization drivers are included only if you request them in your `cmake` options.
- You can also add your own visualization driver
 - Geant4's visualization system is modular.
By creating just three new classes, you can direct Geant4 information to your own visualization system.

Simplest command example

9

- Visualize your geometry in OpenGL
 - `/vis/open OGL`
 - `/vis/drawVolume`
- Most examples come with a **visualization macro**
more complete
 - good starting point

Screenshots on the visualization drivers

10

- Qt with OpenGL
 - ▣ Requires that you install Qt
 - ▣ Visualization driver + user interface
 - ▣ You can customize the interface to control any Geant4 command
- OpenGL
- OpenInventor
- HepRep
- DAWN
- VRML
- RayTracer
- gMocren
- ASCII Tree

1) Qt Driver with OpenGL visualization

11

- Recent developments focused on Qt User Interface and Visualization
- Geant4 **Qt + OpenGL Documentation**
- Demo...

Scene tree, Help, History

Useful tips viewer-0 (OpenGLStoredQt)

Scene tree Help History

viewer-0 (OpenGLStoredQt)

Scene tree

Search bar

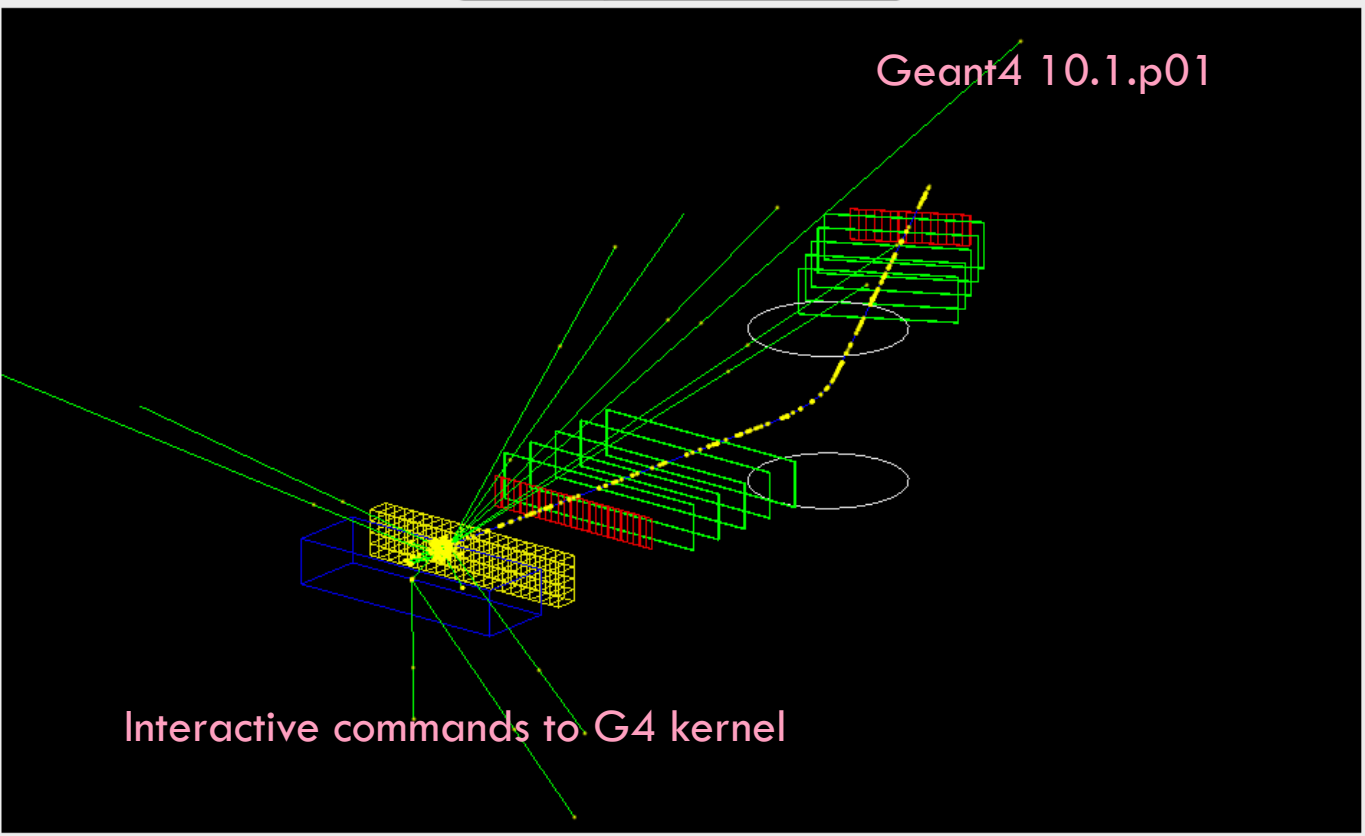
Scene tree : viewer-0 (OpenGLStoredQt)

Touchables

Show all Hide all

Viewer properties

Property	Value
autoRefresh	True
auxiliaryEdge	False
background	0 0 0 1
culling	1
cutawayMode	union
defaultColour	1 1 1 1
defaultTextColour	0 0 1 1
edge	False
explodeFactor	1 1 mm
globalLineWidthScale	1
globalMarkerScale	1
hiddenEdge	False
hiddenMarker	False
lightsMove	object
lightsThetaPhi	54.7356 45 deg
lightsVector	1 1 1
lineSegmentsPerCircle	24
picking	False
projection	orthogonal
rotationStyle	constrainUpDirection
sectionPlane	off



Interactive commands to G4 kernel

Output

```

Drift Chamber 2 has 5 hits.
Layer[0] : time 34.706100916825 (nsec) --- local (x,y) -224.16660513171, -0.21355242280892
Layer[1] : time 36.37640752814 (nsec) --- local (x,y) -251.45832124829, -1.2334283123023
Layer[2] : time 38.046694157875 (nsec) --- local (x,y) -278.6416463582, -2.2065434918955
Layer[3] : time 39.717018612375 (nsec) --- local (x,y) -306.03356668968, -3.1589879612698
Layer[4] : time 41.387329111728 (nsec) --- local (x,y) -333.34494482692, -4.2231537511901
EM Calorimeter has 7 hits. Total Edep is 967.12227158091 (MeV)
Hadron Calorimeter has 0 hits. Total Edep is 0 (MeV)
Run terminated.
Run Summary
Number of events processed : 1
User=0.07s Real=0.09s Sys=0.01s
... write Root file : B5.root - done
WARNING: 1 event has been kept for refreshing and/or reviewing.
"/vis/reviewKeptEvents" to review them.
/control/shell ls

```

Picking informations Picking mode active

Session : [input field]

Scene tree, Help, History

viewer-0 (OpenGLStoredQt)

Scene tree

viewer-0 (OpenGLStoredQt)

Scene tree : viewer-0 (OpenGLStoredQt)

Touchables

Show all Hide all

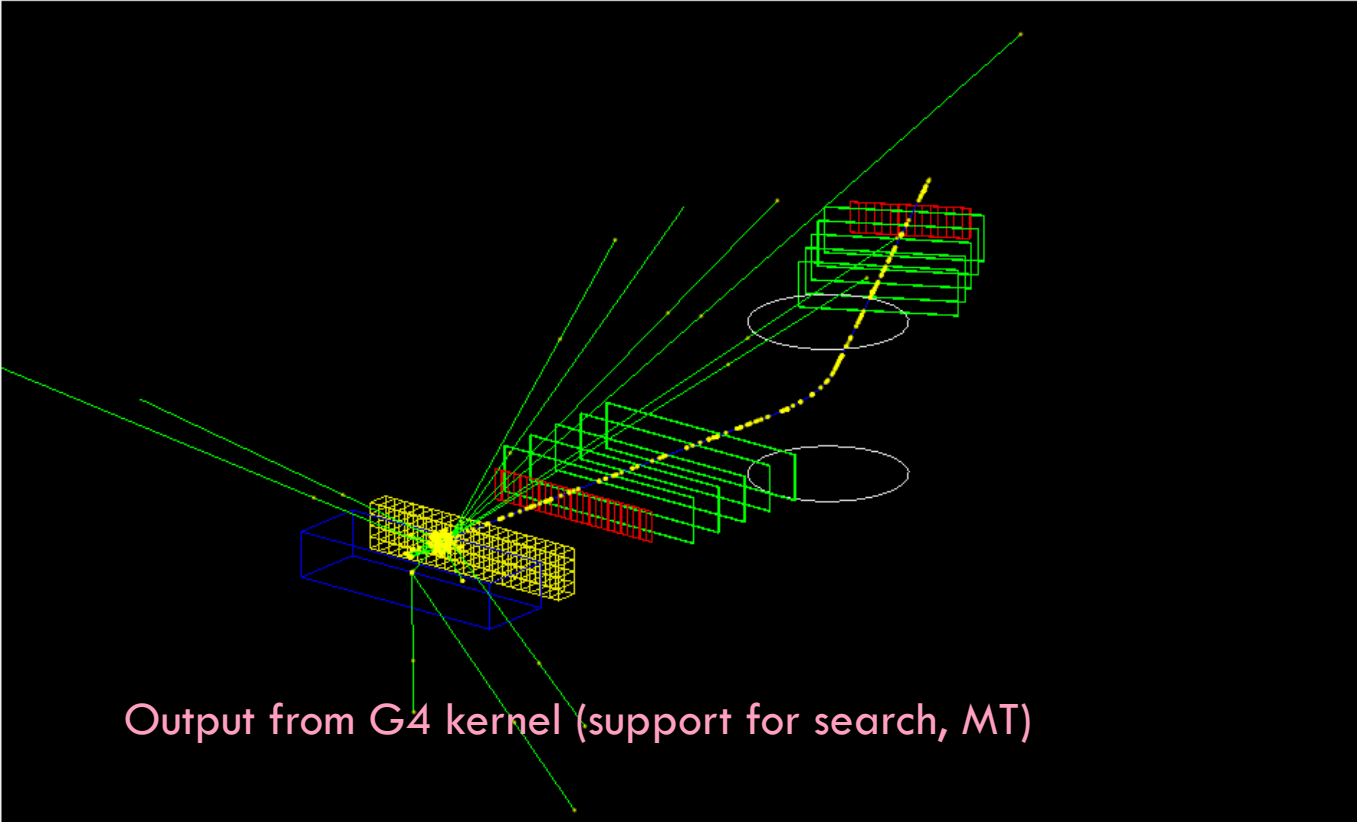
Viewer properties

Property	Value
autoRefresh	True
auxiliaryEdge	False
background	0 0 0 1
culling	1
cutawayMode	union
defaultColour	1 1 1 1
defaultTextColour	0 0 1 1
edge	False
explodeFactor	1 1 mm
globalLineWidthScale	1
globalMarkerScale	1
hiddenEdge	False
hiddenMarker	False
lightsMove	object
lightsThetaPhi	54.7356 45 deg
lightsVector	1 1 1
lineSegmentsPerCircle	24
picking	False
projection	orthogonal
rotationStyle	constrainUpDirection
sectionPlane	off

13

Picking informations Picking mode active

Useful tips viewer-0 (OpenGLStoredQt)



Output from G4 kernel (support for search, MT)

Output

```

Drift Chamber 2 has 5 hits.
Layer[0] : time 34.706100916825 (nsec) --- local (x,y) -224.16660513171, -0.21355242280892
Layer[1] : time 36.37640752814 (nsec) --- local (x,y) -251.45832124829, -1.2334283123023
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... write Root file : B5.root - done
WARNING: 1 event has been kept for refreshing and/or reviewing.
"/vis/reviewKeptEvents" to review them.
/control/shell ls

```

Session :

Scene tree, Help, History

viewer-0 (OpenGLStoredQt)

Scene tree

viewer-0 (OpenGLStoredQt)

Scene tree : viewer-0 (OpenGLStoredQt)

Touchables

Show all Hide all

Viewer properties

Property	Value
autoRefresh	True
auxiliaryEdge	False
background	0 0 0 1
culling	1
cutawayMode	union
defaultColour	1 1 1 1
defaultTextColour	0 0 1 1
edge	False
explodeFactor	1 1 mm
globalLineWidthScale	1
globalMarkerScale	1
hiddenEdge	False
hiddenMarker	False
lightsMove	object
lightsThetaPhi	54.7356 45 deg
lightsVector	1 1 1
lineSegmentsPerCircle	24
picking	False
projection	orthogonal
rotationStyle	constrainUpDirection
sectionPlane	off

14

Picking informations Picking mode active

Useful tips

viewer-0 (OpenGLStoredQt)

Visualization, one tab per viewer
Interactivity with mouse: rotate, zoom, move, pick

Output

```

Drift Chamber 2 has 5 hits.
Layer[0] : time 34.706100916825 (nsec) --- local (x,y) -224.16660513171, -0.21355242280892
Layer[1] : time 36.37640752814 (nsec) --- local (x,y) -251.45832124829, -1.2334283123023
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EM Calorimeter has 7 hits. Total Edep is 967.12227158091 (MeV)
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Run terminated.
Run Summary
Number of events processed : 1
User=0.07s Real=0.09s Sys=0.01s
... write Root file : B5.root - done
WARNING: 1 event has been kept for refreshing and/or reviewing.
"/vis/reviewKeptEvents" to review them.
/control/shell ls

```

Session :

Toolbar and menubar controlled by icons.mac file, add your own without coding

Scene tree, Help, History

viewer-0 (OpenGLStoredQt)

Scene tree

Scene tree : viewer-0 (OpenGLStoredQt)

Touchables

Show all Hide all

Viewer properties

Property	Value
autoRefresh	True
auxiliaryEdge	False
background	0 0 0 1
culling	1
cutawayMode	union
defaultColour	1 1 1 1
defaultTextColour	0 0 1 1
edge	False
explodeFactor	1 1 mm
globalLineWidthScale	1
globalMarkerScale	1
hiddenEdge	False
hiddenMarker	False
lightsMove	object
lightsThetaPhi	54.7356 45 deg
lightsVector	1 1 1
lineSegmentsPerCircle	24
picking	False
projection	orthogonal
rotationStyle	constrainUpDirection
sectionPlane	off

Output

```

Drift Chamber 2 has 5 hits.
Layer[0] : time 34.706100916825 (nsec) --- local (x,y) -224.16660513171, -0.21355242280892
Layer[1] : time 36.37640752814 (nsec) --- local (x,y) -251.45832124829, -1.2334283123023
Layer[2] : time 38.046694157875 (nsec) --- local (x,y) -278.6416463582, -2.2065434918955
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EM Calorimeter has 7 hits. Total Edep is 967.12227158091 (MeV)
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Run Summary
Number of events processed : 1
User=0.07s Real=0.09s Sys=0.01s
... write Root file : B5.root - done
WARNING: 1 event has been kept for refreshing and/or reviewing.
"/vis/reviewKeptEvents" to review them.
/control/shell ls

```

Session :

Scene tree, Help, History
Useful tips viewer-0 (OpenGLStoredQt)

Scene tree Help History

Search :

Command

- ▶ control
- ▶ units
- ▶ process
- ▶ gui
- ▶ geometry
- ▶ tracking
- ▶ event
- ▶ cuts
- ▼ run
 - ▼ particle
 - verbose
 - dumpList
 - addProcManager
 - buildPhysicsTable
 - storePhysicsTable
 - retrievePhysicsTable
 - setStoredInAscii
 - applyCuts
 - dumpCutValues
 - dumpOrderingParam
 - initialize
 - beamOn
 - verbose
 - printProgress
 - numberOfThreads
 - useMaximumLogicalCores
 - pinAffinity
 - eventModulo
 - dumpRegion
 - dumoCouples

Command /run/particle/addProcManager
Guidance : add process manager to specified particle type

	Parameter	Guidance	Type	Ommittable	Default	Range
1	particleType		s	True		

Help tree browser, free text search

Output


```

Drift Chamber 2 has 5 hits.
Layer[0] : time 34.706100916825 (nsec) --- local (x,y) -224.16660513171, -0.21355242280892
Layer[1] : time 36.37640752814 (nsec) --- local (x,y) -251.45832124829, -1.2334283123023
Layer[2] : time 38.046694157875 (nsec) --- local (x,y) -278.6416463582, -2.2065434918955
Layer[3] : time 39.717018612375 (nsec) --- local (x,y) -306.03356668968, -3.1589879612698
Layer[4] : time 41.387329111728 (nsec) --- local (x,y) -333.34494482692, -4.2231537511901
EM Calorimeter has 7 hits. Total Edep is 967.12227158091 (MeV)
Hadron Calorimeter has 0 hits. Total Edep is 0 (MeV)
Run terminated.
Run Summary
Number of events processed : 1
User=0.07s Real=0.09s Sys=0.01s
... write Root file : B5.root - done
WARNING: 1 event has been kept for refreshing and/or reviewing.
"/vis/reviewKeptEvents" to review them.
/control/shell ls
          
```

Session :

Scene tree, Help, History

Scene tree

Help

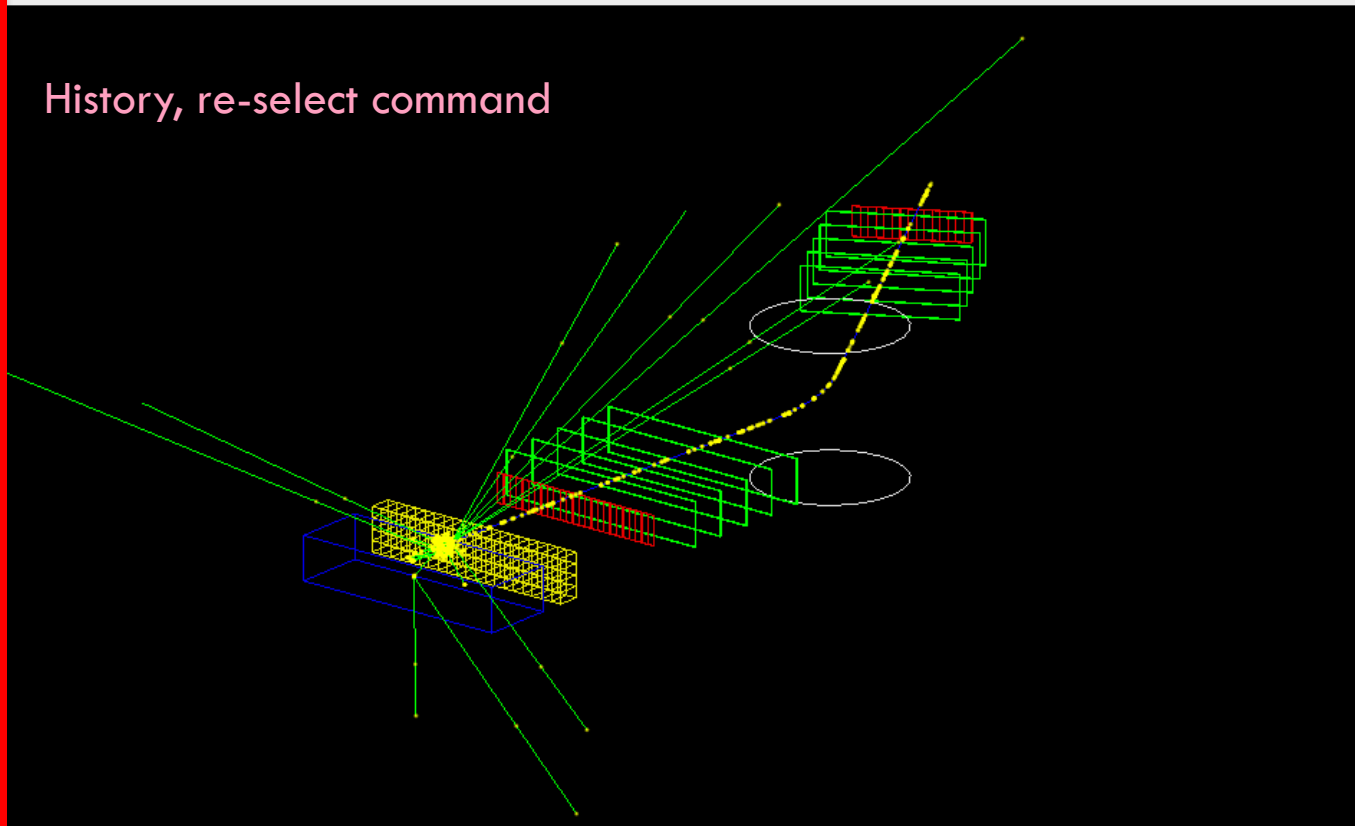
History

```

/run/beamOn 1
/control/shell ls

```

History, re-select command



Output

```

Drift Chamber 2 has 5 hits.
Layer[0] : time 34.706100916825 (nsec) --- local (x,y) -224.16660513171, -0.21355242280892
Layer[1] : time 36.37640752814 (nsec) --- local (x,y) -251.45832124829, -1.2334283123023
Layer[2] : time 38.046694157875 (nsec) --- local (x,y) -278.6416463582, -2.2065434918955
Layer[3] : time 39.717018612375 (nsec) --- local (x,y) -306.03356668968, -3.1589879612698
Layer[4] : time 41.387329111728 (nsec) --- local (x,y) -333.34494482692, -4.2231537511901
EM Calorimeter has 7 hits. Total Edep is 967.12227158091 (MeV)
Hadron Calorimeter has 0 hits. Total Edep is 0 (MeV)
Run terminated.
Run Summary
Number of events processed : 1
User=0.07s Real=0.09s Sys=0.01s
... write Root file : B5.root - done
WARNING: 1 event has been kept for refreshing and/or reviewing.
"/vis/reviewKeptEvents" to review them.
/control/shell ls

```

Session :

Scene tree, Help, History

Scene tree

Help

History

viewer-0 (OpenGLStoredQt)

Scene tree

Scene tree : viewer-0 (OpenGLStoredQt)

- Touchables
 - worldPhysical [0]
 - magneticPhysical [0]
 - firstArmPhysical [0]
 - hodoscope1Physica...
 - hodoscope1Physica...
 - hodoscope1Physica...
 - hodoscope1Physica...
 - hodoscope1Physica...
 - hodoscope1Physica...
 - hodoscope1Physica...

 Show all Hide all

Viewer properties

Property	Value
autoRefresh	True
auxiliaryEdge	False
background	0 0 0 1
culling	1
cutawayMode	union
defaultColour	1 1 1 1
defaultTextColour	0 0 1 1
edge	False
explodeFactor	1 1 mm
globalLineWidthScale	1
globalMarkerScale	1
hiddenEdge	False
hiddenMarker	False
lightsMove	object
lightsThetaPhi	54.7356 45 deg
lightsVector	1 1 1
lineSegmentsPerCircle	24
picking	False
projection	orthogonal
rotationStyle	constrainUpDirection
sectionPlane	off

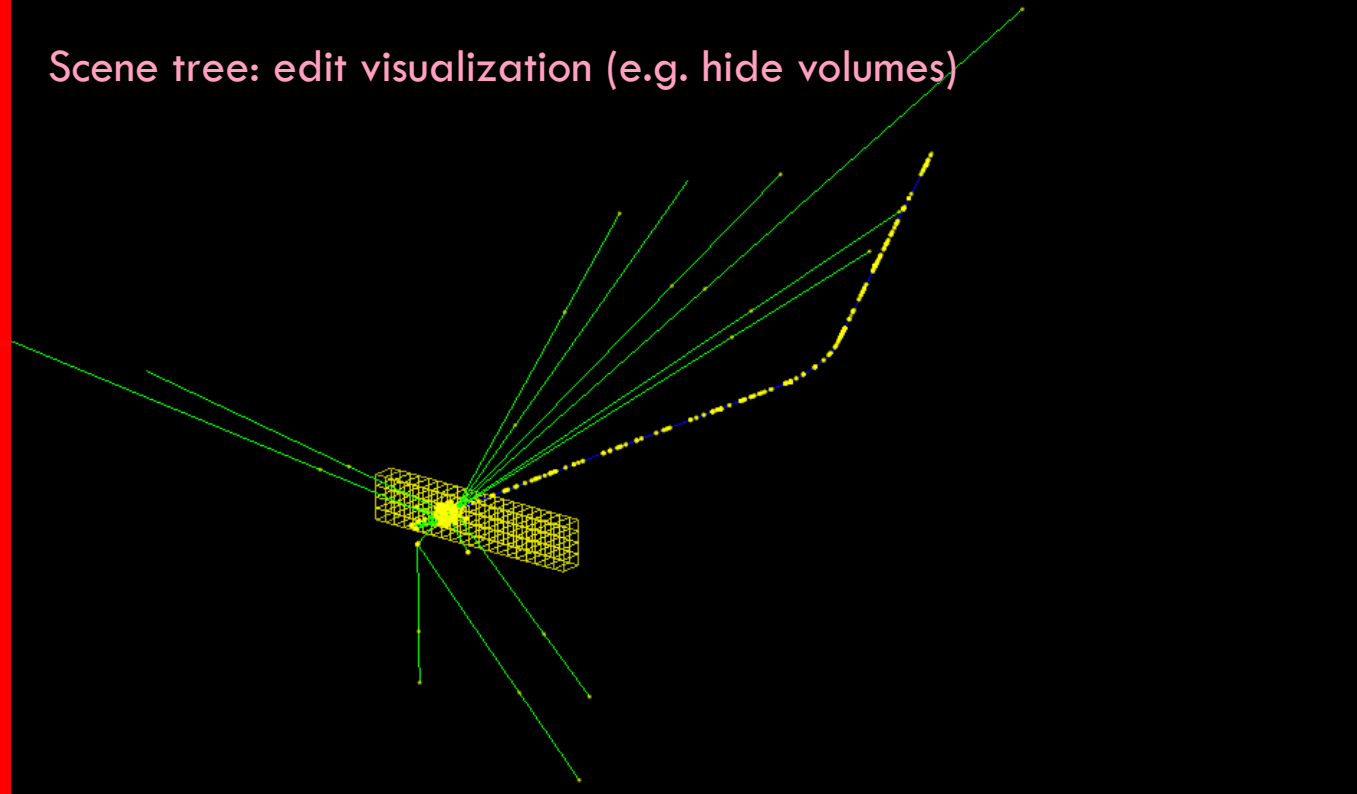
18

 Picking informations Picking mode active

Useful tips

viewer-0 (OpenGLStoredQt)

Scene tree: edit visualization (e.g. hide volumes)



Output

```

Drift Chamber 2 has 5 hits.
Layer[0] : time 34.706100916825 (nsec) --- local (x,y) -224.16660513171, -0.21355242280892
Layer[1] : time 36.37640752814 (nsec) --- local (x,y) -251.45832124829, -1.2334283123023
Layer[2] : time 38.046694157875 (nsec) --- local (x,y) -278.6416463582, -2.2065434918955
Layer[3] : time 39.717018612375 (nsec) --- local (x,y) -306.03356668968, -3.1589879612698
Layer[4] : time 41.387329111728 (nsec) --- local (x,y) -333.34494482692, -4.2231537511901
EM Calorimeter has 7 hits. Total Edep is 967.12227158091 (MeV)
Hadron Calorimeter has 0 hits. Total Edep is 0 (MeV)
Run terminated.
Run Summary
Number of events processed : 1
User=0.07s Real=0.09s Sys=0.01s
... write Root file : B5.root - done
WARNING: 1 event has been kept for refreshing and/or reviewing.
"/vis/reviewKeptEvents" to review them.
/control/shell ls
  
```

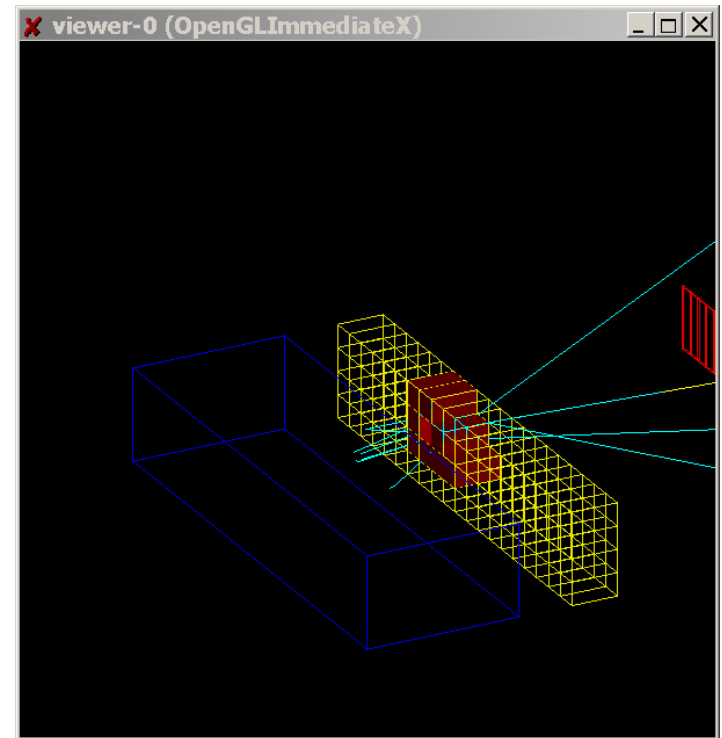
Session :

2) OpenGL

19

- [/vis/open OGL](#)

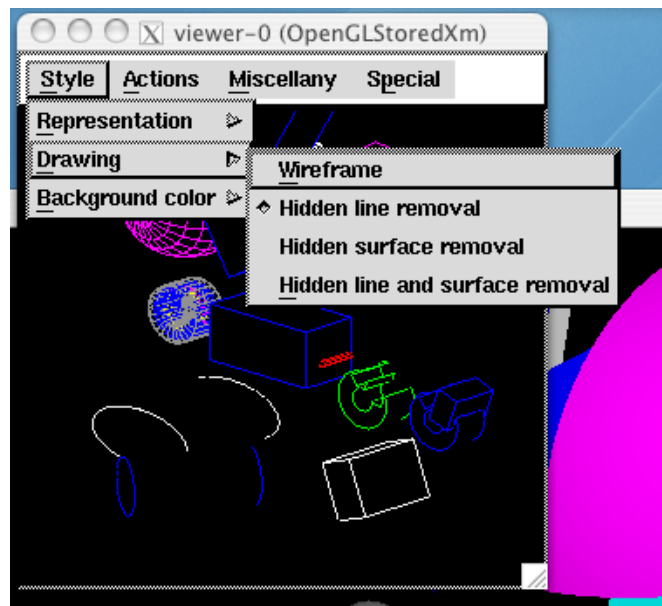
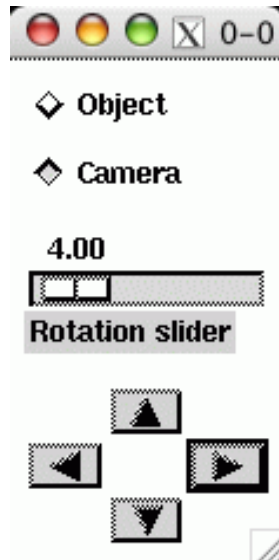
- Features
 - ▣ Control directly from Geant4
 - ▣ Uses GL libraries that are already included on most Linux and Windows systems
 - ▣ Rendered, photorealistic image with some interactive features
 - zoom, rotate, translate
 - ▣ Fast response (can usually exploit full potential of graphics hardware)
 - ▣ Save as pixel graphics or vector EPS
 - ▣ Live movies
 - ▣ Geant4 Documentation: [OpenGL](#)



OpenGL with **Motif Control**

20

- Somewhat obsolete now that Qt can take over this functionality
 - ▣ but still supported
 - ▣ requires that you have Motif and link against this in your Geant4

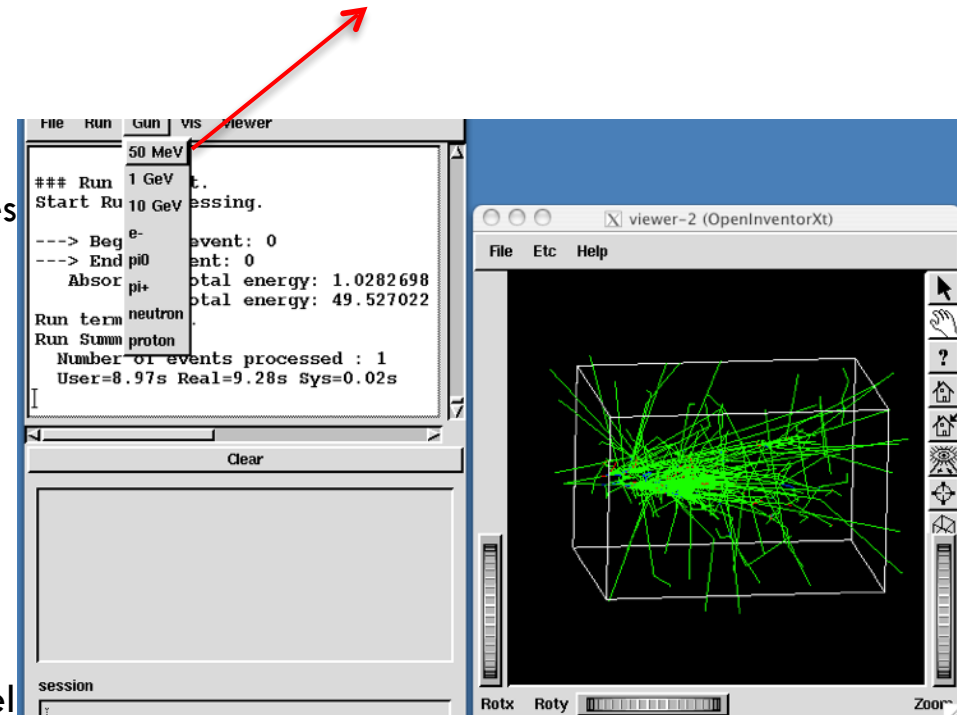


3) OpenInventor

21

- `/vis/open OIX` or `/vis/open IOWin32`
- Features
 - Control from the OpenInventor GUI
 - Requires addition of OpenInventor libraries (freely available for most Linux systems and Windows)
 - Rendered, photorealistic image
 - Many interactive features
 - zoom, rotate, translate
 - click to “see inside” opaque volumes
 - click to show attributes (momentum, etc., dumps to standard output)
 - Fast response (can usually exploit full potential of graphics hardware)
 - Expanded printing ability (vector and pixel graphics)
 - Geant4 Documentation: [OpenInventor](#)

GUI control



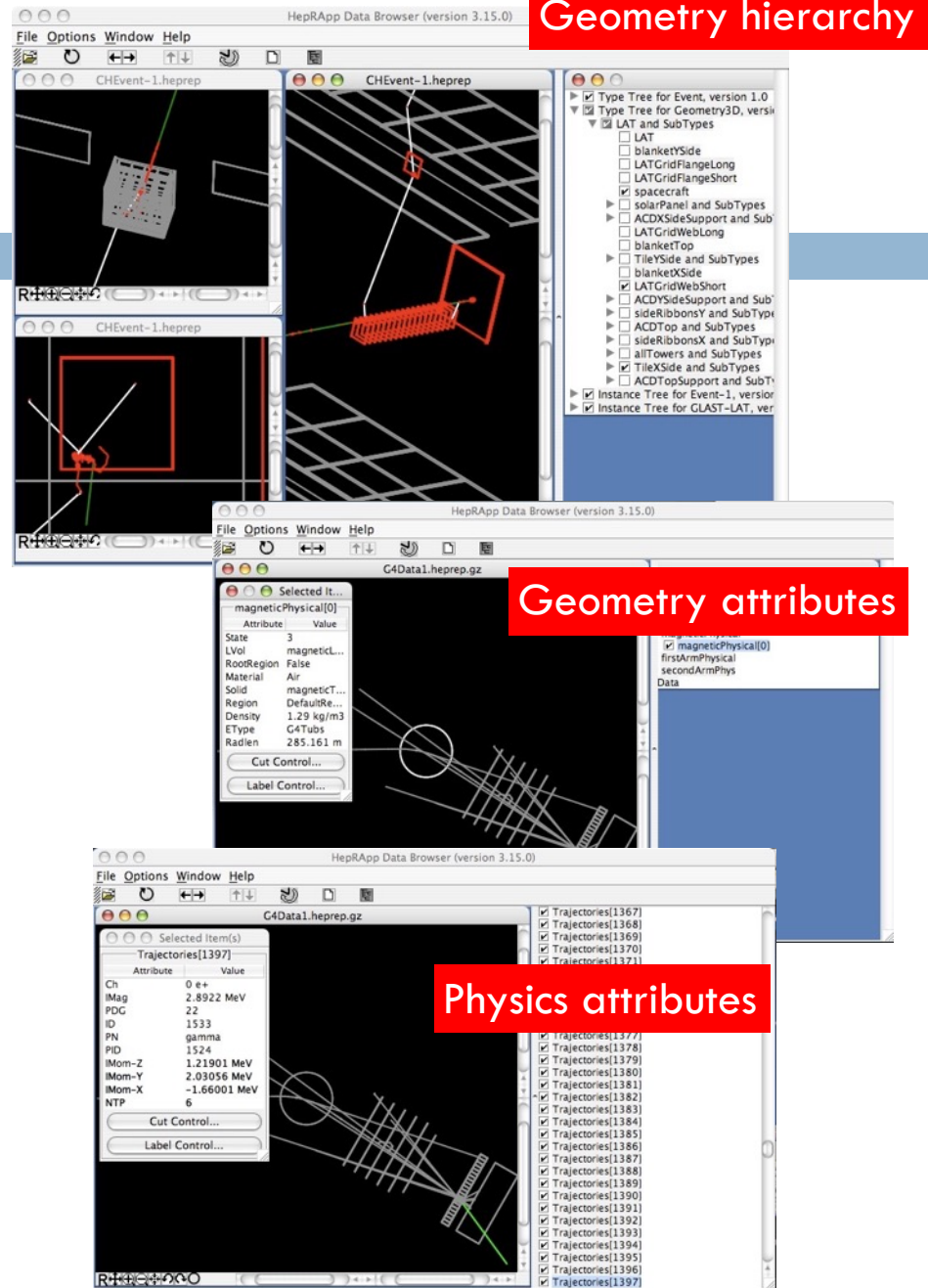
Warning:

OpenScientist (implementing our OI driver) is discontinued, but you could still try to use it

4) HepRep

22

- [/vis/open HepRepFile](#)
- Features
 - The HepRepFile driver creates an XML file in HepRep1 format. This can be viewed with HepRAPP HepRep Browser.
 - The HepRepXML driver creates a HepRep file in HepRep2 format that can be viewed with WIRED4 plugin to JAS3 Analysis System or the FRED event display.
 - Requires one of the above browsers (freely available for all systems)
 - Wireframe or simple area fills (not photorealistic)
 - Many interactive features
 - zoom, rotate, translate
 - click to show attributes (momentum, etc.)
 - special projections (FishEye, etc.)
 - control visibility from hierarchical (tree) view of data
 - Hierarchical view of the geometry
 - HepRAPP and WIRED4 can export to many vector graphic formats (PostScript, PDF, etc.)
 - Geant4 Documentation: [HepRep](#)

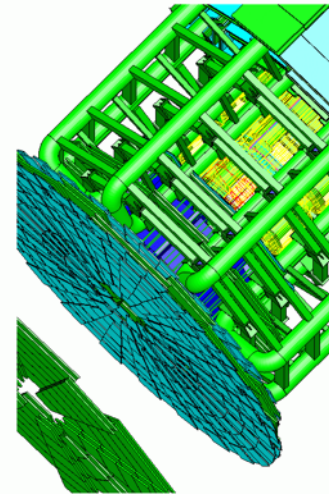
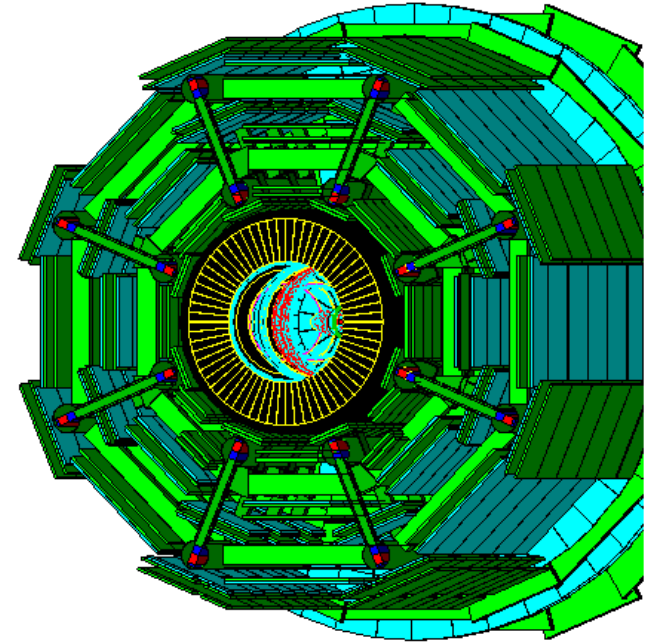


Warning: Issues with recent java versions

5) DAWN

23

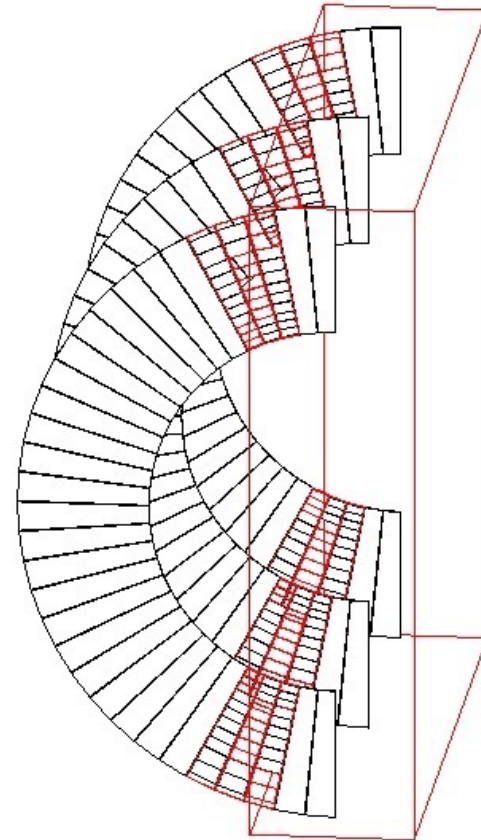
- `/vis/open DAWNFILE`
- Features
 - Create a .prim file
 - Requires DAWN, available for all Linux and Windows systems
 - DAWN creates a rendered, photorealistic PostScript image
 - No interactive features once at PostScript stage
 - Highest quality technical rendering - vector PostScript
 - View or print from your favorite PostScript application
 - DAWN file can serve as input of 2 application programs: DAWNCUT and DAVID
 - Geant4 Documentation: [DAWN](#)



DAWNCUT and DAVID

24

- A standalone program, **DAWNCUT**, can perform a planar cut on a DAWN image
 - DAWNCUT takes as input a .prim file and some cut parameters. Its output is a new .prim file to which the cut has been applied.
- Another standalone program, **DAVID**, can show you any volume overlap errors in your geometry
 - DAVID takes as input a .prim file and outputs a new .prim file in which overlapping volumes have been highlighted.

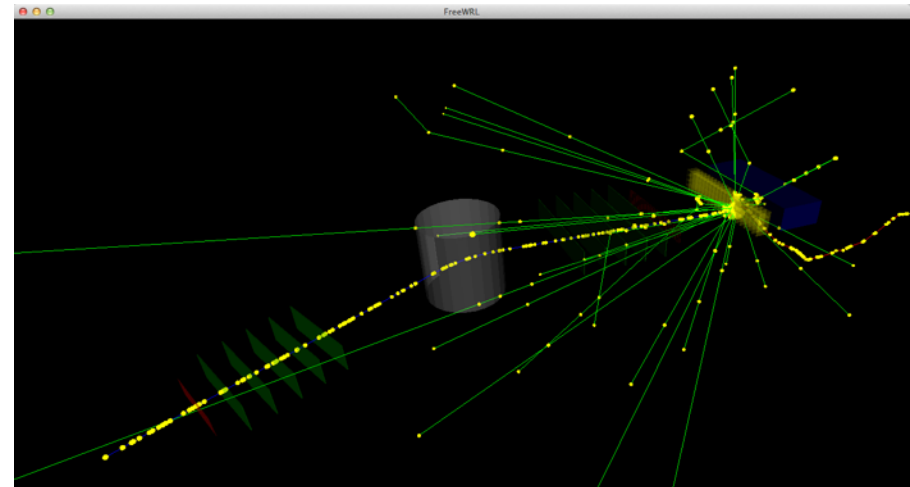


6) VRML

25

- `/vis/open VRML1FILE` or
`/vis/open VRML2FILE`

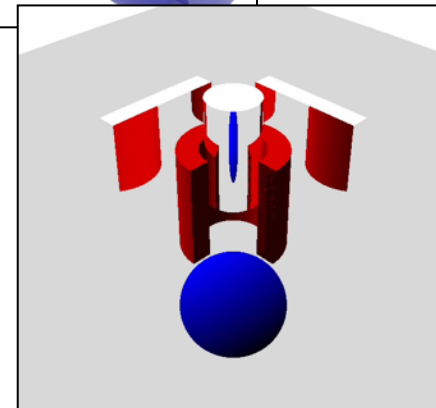
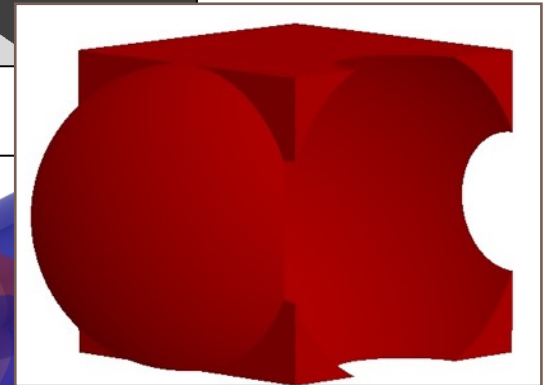
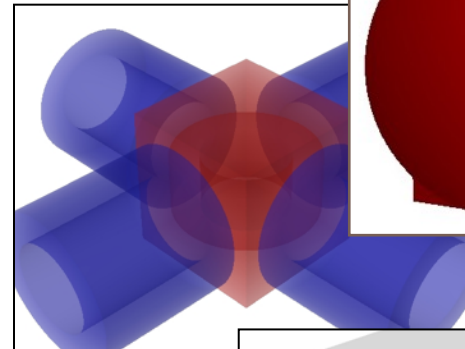
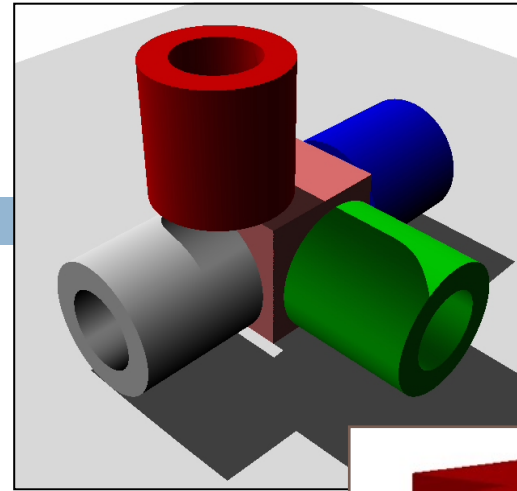
- Features
 - Create a file to view in any VRML browser (some as web browser plug-ins i.e. can be viewed at a remote host)
 - Requires VRML browser (many different choices for different operating systems)
 - [FreeWRL](#)
 - Rendered, photorealistic image with some interactive features
 - zoom, rotate, translate
 - Limited printing ability (pixel graphics, not vector graphics)
 - Geant4 Documentation: [VRML](#)



7) RayTracer

26

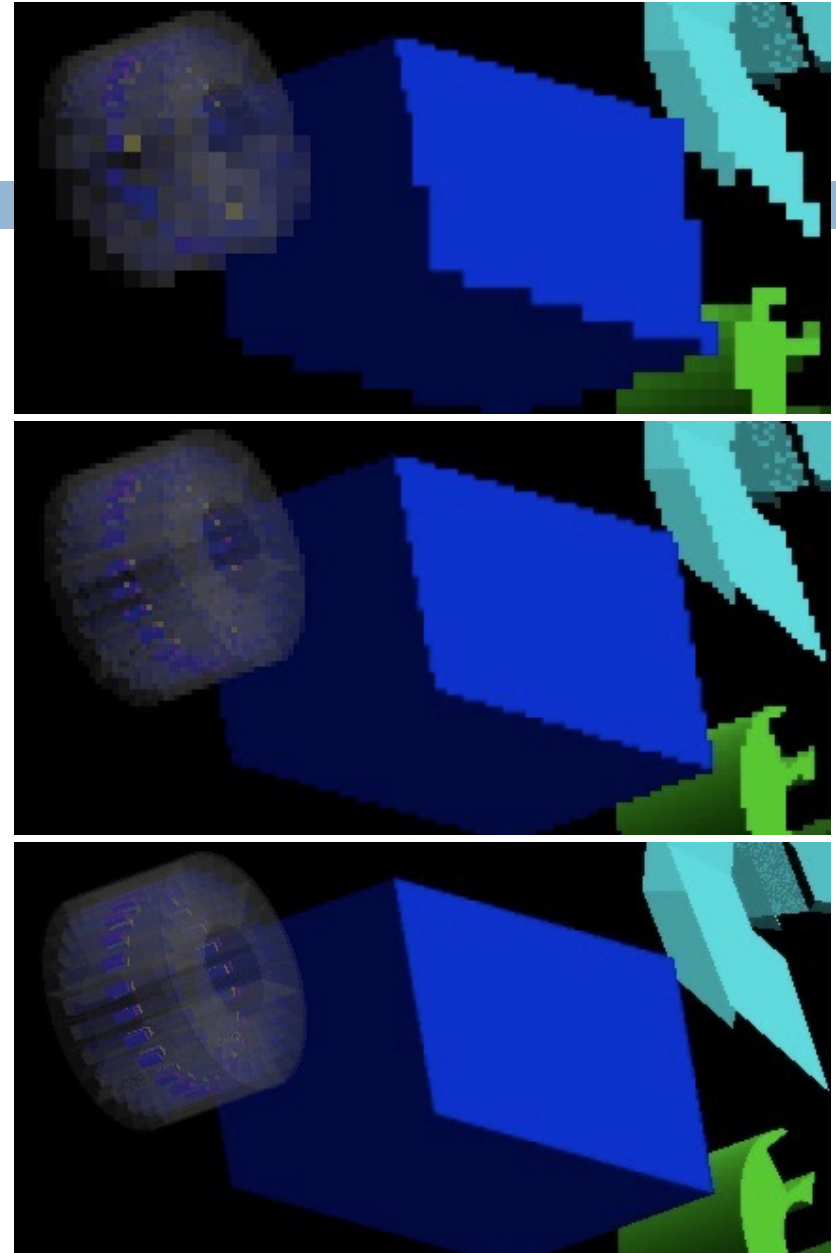
- `/vis/open RayTracer`
- Features
 - Create a jpeg file (and with RayTracerX option, also draws to x window)
 - Forms image by using Geant4's own tracking to follow photons through the detector
 - Can show geometry but not trajectories
 - Can render any geometry that Geant4 can handle (such as Boolean solids) - no other Vis driver can handle every case
 - Supports shadows, transparency and mirrored surfaces
 - Geant4 Documentation: [RayTracer](#)



RayTracerX

27

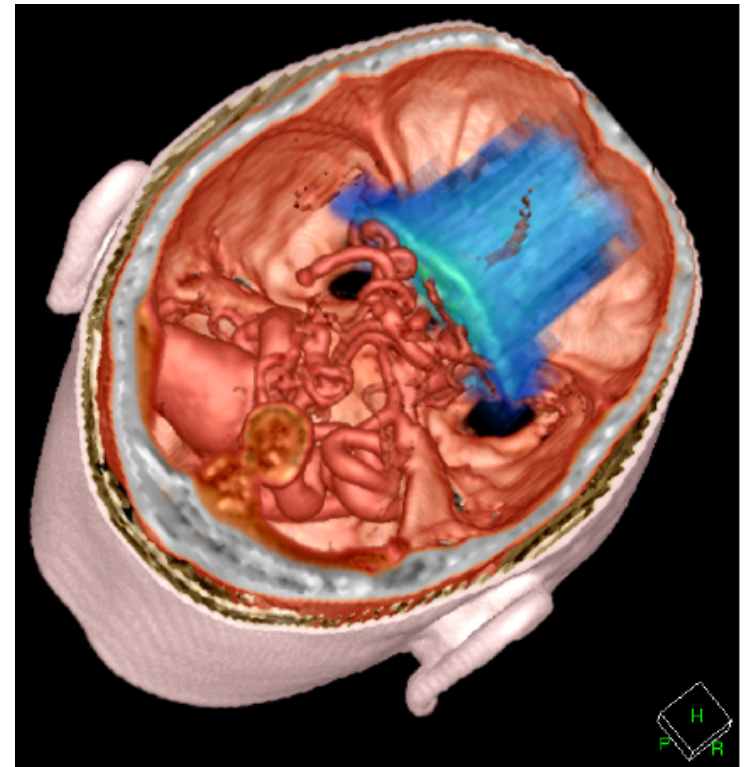
- You have the option of
 - `/vis/open RayTracerX`
- Builds same jpeg file as RayTracer, but simultaneously renders to screen so you can watch as rendering grows progressively smoother
- Means you can abort and retry the rendering with different view parameters without having to wait for the complete refinement of the image



8) gMocren

28

- Great tool available for volume visualization
- From JST/CREST project (Japan) to improve Geant4 for medical physics
- The gMocrenFile driver creates a gdd file then gMocren able to visualize
 - Volume data (including overlay of more than one set)
 - Trajectories
 - Geometry
- Runs on
 - Windows, Linux and Mac
 - Based on a commercial package but offered freely to all Geant4 users
 - <http://geant4.kek.jp/gMocren>
 - Installation is straightforward, follow the Download link on the above page
 - First run gMocren's one-click installer
 - Then, inside <gMocren-dir>/gtk, you will find the one-click installer for gtk
- To export Geant4 visualization to gMocren files
 - `/vis/open gMocrenFile`
 - `/vis/scene/add/psHits`
 - `/vis/viewer/flush`
 - many other options available with `/score/draw ...` commands
- Geant4 Documentation: [gMocren](#)



9) ASCIITree

29

- `/vis/open ATree`
- Features
 - ▣ Text dump of the geometry hierarchy
 - ▣ Not graphical
 - ▣ Control over level of detail to be dumped
 - ▣ Can calculate mass and volume of any hierarchy of volumes
- Geant4 Documentation: **ASCIITree**

```
/vis/viewer/flush
"worldPhysical":0
"magneticPhysical":0
"firstArmPhysical":0
"hodoscope 1 Physical":0
"hodoscope 1 Physical":1 (repeated placement)
"hodoscope 1 Physical":2 (repeated placement)
"hodoscope 1 Physical":3 (repeated placement)
"hodoscope 1 Physical":4 (repeated placement)
```

Can be set to **various levels of detail**

```
/vis/ASCIITree/verbose <verbosity>
```

0: prints physical volume name.

1: prints logical volume name.

2: prints solid name and type.

3: prints volume and density of solid.

4: calculates and prints mass(es) of volume(s) in scene.

By default, shows only daughters of first placement and not repeat replicas.

Add 10 to the above to also show repeated placements and replicas.

ASCIITree: calculate Volume and Mass

30

- At verbosity **level 4**, ASCIITree calculates the **mass** of the complete geometry tree taking into account daughters up to the depth specified for each physical volume.
- The calculation involves subtracting the mass of that part of the mother that is occupied by each daughter and then adding the mass of the daughter, and so on down the hierarchy.

[/vis/ASCIITree/Verbose 4](#)

[/vis/viewer/flush](#)

"HadCalorimeterPhysical":0 / "HadCalorimeterLogical" / "HadCalorimeterBox"(G4Box), 1.8 m³ , 11.35 g/cm³

- "HadCalColumnPhysical":-1 (10 replicas) / "HadCalColumnLogical" / "HadCalColumnBox"(G4Box), 180000 cm³, 11.35 g/cm³
 - "HadCalCellPhysical":-1 (2 replicas) / "HadCalCellLogical" / "HadCalCellBox"(G4Box), 90000 cm³, 11.35 g/cm³
 - "HadCalLayerPhysical":-1 (20 replicas) / "HadCalLayerLogical" / "HadCalLayerBox"(G4Box), 4500 cm³, 11.35 g/cm³
 - "HadCalScintiPhysical":0 / "HadCalScintiLogical" / "HadCalScintiBox"(G4Box), 900 cm³, 1.032 g/cm³
- Calculating mass(es)...
 - Overall volume of "worldPhysical":0, is 2400 m³
 - Mass of tree to unlimited depth is 22260.5 kg

Movies: time development of the event

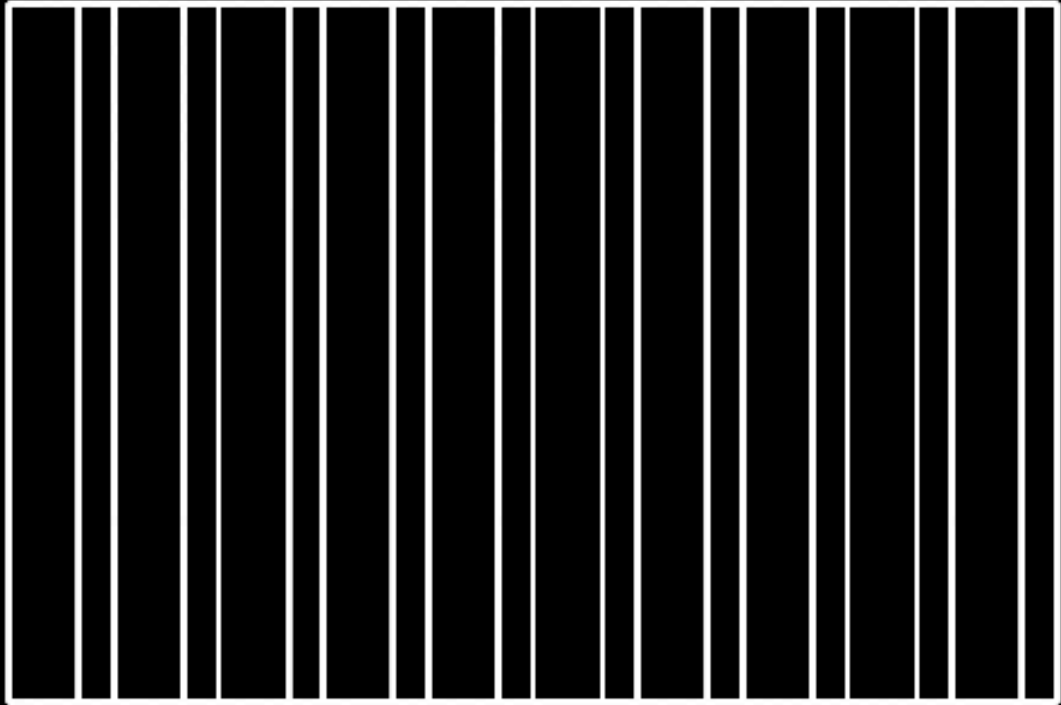
31

- You can make movies that show time development of an event
 - ▣ i.e., a shower in slow motion
- Based on technique of “time-slicing”, breaking trajectories into individual slices, each with a time attribute.
 - ▣ requires newer visualization features, rich trajectory and some extensions to the OpenGL driver
 - ▣ you can run these animations Directly from Geant4, does NOT involve stitching together a movie by hand
- A collection of example movies has been prepared by John Allison:
<http://www.hep.man.ac.uk/u/johna/pub/Geant4/Movies/>
- How-To Presentation:
<http://geant4.slac.stanford.edu/Presentations/vis/HowToMakeAMovie.ppt> <http://geant4.slac.stanford.edu/Presentations/vis/HowToMakeAMovie.pdf>
- Geant4 Documentation: [movies](#)

10 GeV pion

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Mpeg4 encoding with
QuickTime Pro



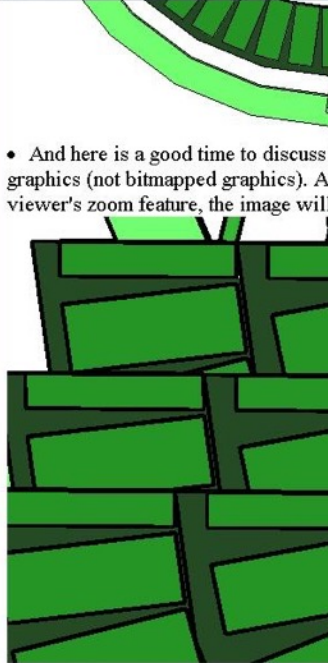
Tutorials and references on the Web !

33

- DAWN
 - <http://geant4.slac.stanford.edu/Presentations/vis/G4DAWNTutorial/G4DAWNTutorial.html>
 - http://geant4.kek.jp/~tanaka/DAWN/About_DAWN.html
 - DAWNCUT
 - http://geant4.kek.jp/~tanaka/DAWN/About_DAWNCUT.html
 - DAVID
 - http://geant4.kek.jp/~tanaka/DAWN/About_DAVID.html
 - And more...
 - <http://geant4.kek.jp/~tanaka/>
- gMocren
 - <http://geant4.kek.jp/gMocren>
- HepRApp
 - <http://www.slac.stanford.edu/~perl/HepRApp>
 - <http://geant4.slac.stanford.edu/Presentations/vis/G4HepRAppTutorial/G4HepRAppTutorial.html>
- OpenGL
 - <http://geant4.slac.stanford.edu/Presentations/vis/G4OpenGLTutorial/G4OpenGLTutorial.html>
- OpenScientist
 - <http://openscientist.lal.in2p3.fr>
- Qt
 - <http://geant4.in2p3.fr/spip.php?rubrique25&lang=en>

Geant4 Vis Tutorial using th

File Edit View Go Bookmarks Tool



- And here is a good time to discuss graphics (not bitmapped graphics). A viewer's zoom feature, the image will

Now that you have some basic fam created during the previous tutorial w file called:

geant4\examples\extended\analysis\A

Orientation Actions

To select from among s right mouse button (Ma

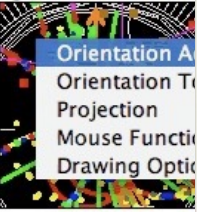
Orientation A

Orientation T

Projection

Mouse Functi

Drawing Opti




Or, if you skipped running Geant4 for

- Run DAWN on this file: dawn g4_01.prim
- Go to the DAWN GUI's page 1 and
- On the same page, change "Camera you can type in a specific number to c new value).
- You should end up with an image a

Geant4 Vis Tutorial

File Edit View Go Bookm




- The output appears as included automatically
- One last command for the detector was drawn command:

```
/vis/viewer/set /run/beamOn 1
```

The detector will then to still see the tracks

viewer-0 (OpenCLStor



Geant4 @ IN2P3 - Geant4 Qt User interface tutorial (based on 4.9.6 version)

http://geant4.in2p3.fr/spip.php?article84&lang=en

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- Publications
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Geant4 Qt User interface tutorial (based on 4.9.6 version)

Geant4 Qt User Interface tutorial (based on 4.9.6 version)

First tutorial : Download/Compilation/Installation/Launch B1

- Step 1: Download Geant4
- Step 2: Compilation and Installation (at 25')
- Step 3: Example (B1) compilation (at 2'06)
- Step 4: Run example (at 2'32)



Second tutorial : User Interface demo

- Step 5: Qt interface
- Step 6: Making movies (at 6'12)
- Step 7: Export high quality pictures (at 8'00)

Summary

35

- Many visualization drivers are available
- The most recent : Qt + OpenGL
 - Visualization
 - GUI interface
- Movies
- Tutorials are available on the Internet

36

Backup

Additional notes on OpenGL

37

- There are actually two OpenGL modes, **OGLS** and **OGLI**
 - **Stored mode**: creates graphical database (display lists). Redrawing is faster because Geant4 only needs to resend parts that have changed. Nothing is lost on simple operations like change of viewing angle.
 - **Immediate mode**: draws only to screen, no “memory”; detector can be redrawn after view changes but event data is lost.
- And if you have Qt and Motif built and configured, even more options:
 - **OGLSX**, **OGLIX**, **OGLSWin32** and **OGLIWin32** are basic OpenGL (stored, immediate, stored for Microsoft Windows, immediate for Microsoft Windows)
 - **OGLSQt** and **OGLIQt** are OpenGL with Qt
 - **OGLSXm** and **OGLIXm** are OpenGL with Motif
- When you just use `/vis/open OGL`,
 - We provide you the most advanced OpenGL that you currently have configured - Qt if you have it, otherwise Motif, otherwise basic OpenGL
 - We give you Stored mode unless starts to use too much memory, in which case we switch to Immediate mode
 - We worry for you about whether you're on Windows or not
- To explicitly specify stored or immediate, but leave other decisions to us:
 - `/vis/open OGLS`
 - `/vis/open OGLI`

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