TRIUMF

Canada's national laboratory for particle and nuclear physics
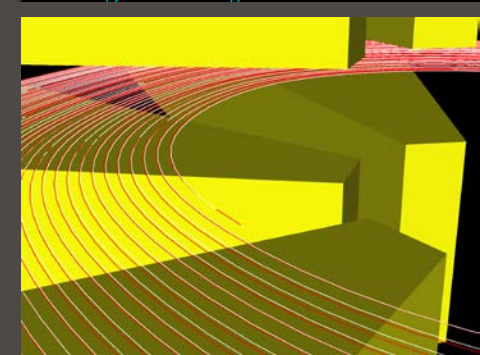Laboratoire national canadien pour la recherche en physique nucléaire
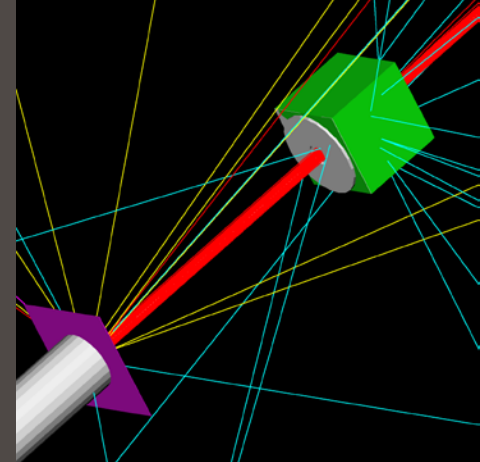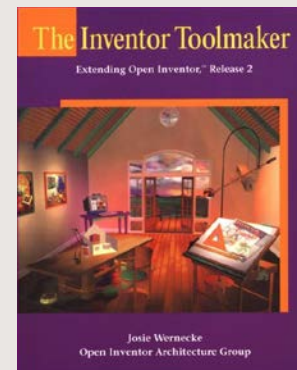et en physique des particules
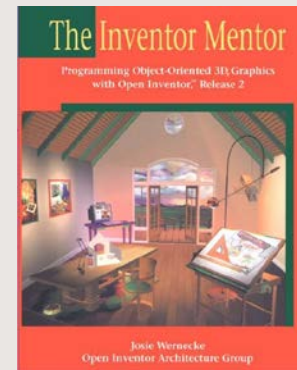
Progress on the Open Inventor Qt Visualization Driver

Frederick Jones, TRIUMF
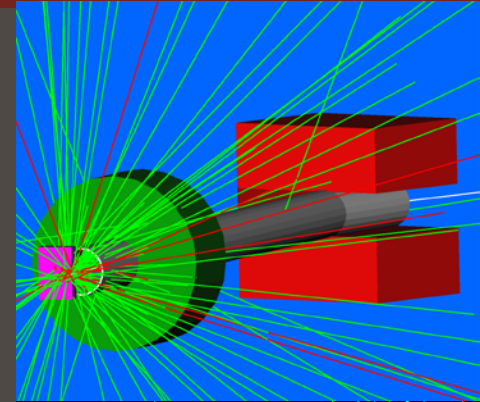
- The Open Inventor (OI) drivers were first developed in 1996-98 principally by J.Kallenbach, G.Barrand and J.Boudreau.

- After Silicon Graphics developed OpenGL, Open Inventor was created both as a higher-level API for OpenGL applications and as an advanced 3D graphical display and management system, using OpenGL as the rendering layer.

- Some advantages of OI over basic OpenGL:
  - OI provides powerful viewers with effective interactive controls and many built-in functions. The view is continuously relocatable via the "Seek" function. Full support for animated displays, transparency, and other effects.
  - Scene graph technology allows great flexibility including overlayed 2D or 3D scenes and information retrieval via picking and mouse-hovering.
  - Multi-platform support. Application code is OS-independent. Works with different GUI toolkits: Xt/Motif, Windows, Qt, through specific libraries SoXt, SoWin, and SoQt. Many common "So" methods for writing event-driven viewer functions.

- The existing G4 drivers are based on SoXt (for Unix and MacOS with XQuartz installed) and SoWin.

- The current effort is to produce a driver based on SoQt, initially for Unix and MacOS, and later for Windows, thus potentially a common OI driver for all our supported platforms.

2

G4VGraphicsSystem   G4VInteractorManager   G4VViewer

G4OpenInventor   G4SoQt   G4OpenInventorViewer

SoQt::Init()

SoQt::MainLoop()

G4OpenInventorQt   G4OpenInventorQtViewer

createViewer()   SoQtExaminerViewer

G4SoQtExaminerViewer
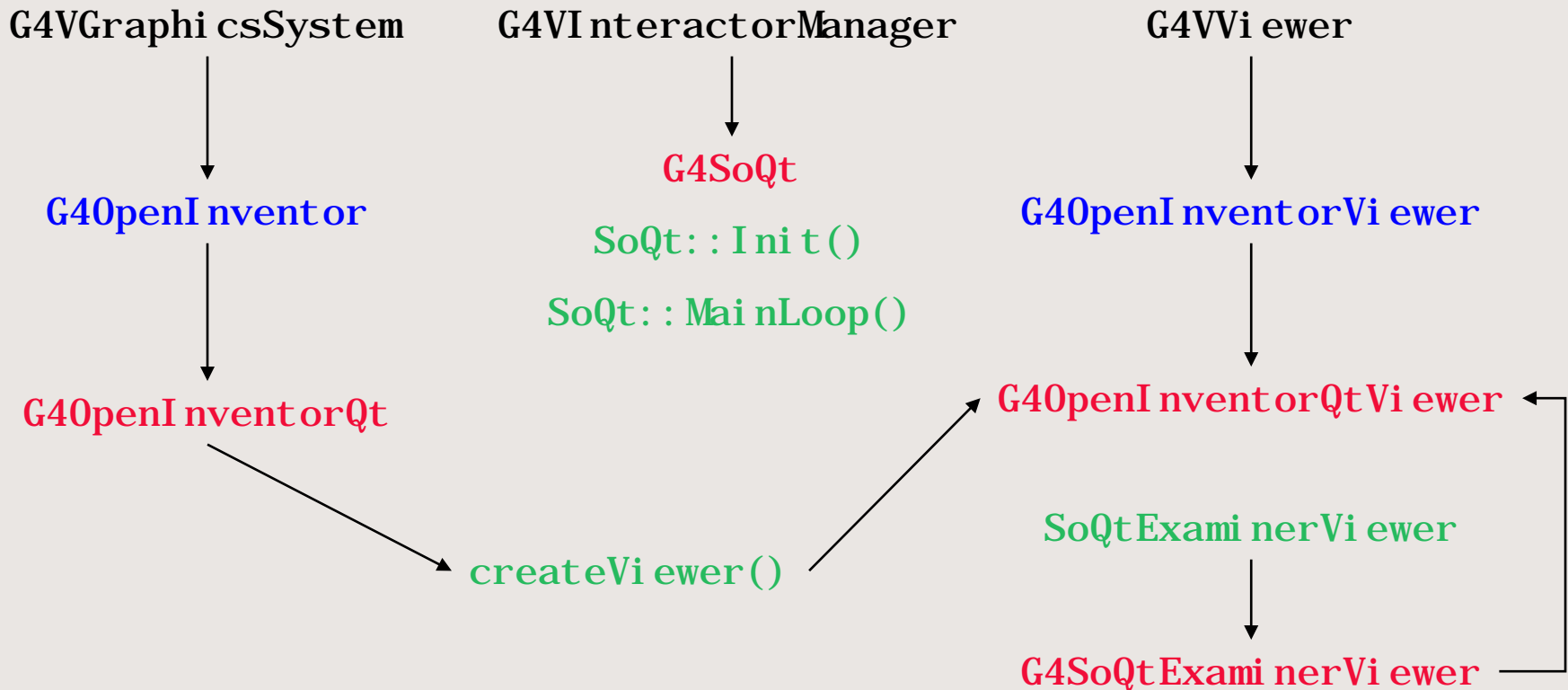
Four new classes are required.
Minimal other changes: register OIQt in G4VisExecutive and make
G4VInteractorManager::secondaryLoop() virtual.

G4SoQtExaminerViewer is the Qt equivalent of G4SoXtExaminerViewer

3

- For our beam physics applications we found the OI viewer to be indispensable because of its interactive controls and ability to easily relocate the view (seek function). But we needed further functionality.

- We started a background project to add the following features:
  - A Bookmark facility to save/restore views and camera parameters, allowing random access to them or sequential "slide shows" of interactive 3D views.
  - Stepwise navigation or animation through the geometry along a trajectory or reference path, with precise view rotations.
  - Superimposed text layer allowing mouse-over readout of solids and trajectories (very useful to obtain specifics of a track).

- The new "extended viewer" Vis Driver (OIXE) was completed in 2015. It relies on the Coin3D implementation of OI which is available for all OS and has been made a requirement for the Vis-OI category.

- Requirement of the current development: the Qt-based driver (OIQt) will contain all the added features of the OIXE driver.

- SoXt to SoQt migration process: Unqualified "So…" calls mostly go over unchanged, but code based on "SoXt…" methods must be rewritten using Qt widgets and event handling. Many new menus, buttons, dialogs and callback functions have been implemented.

4

Extensions to Open Inventor Viewer

Save bookmark

Next bookmark

Previous bookmark
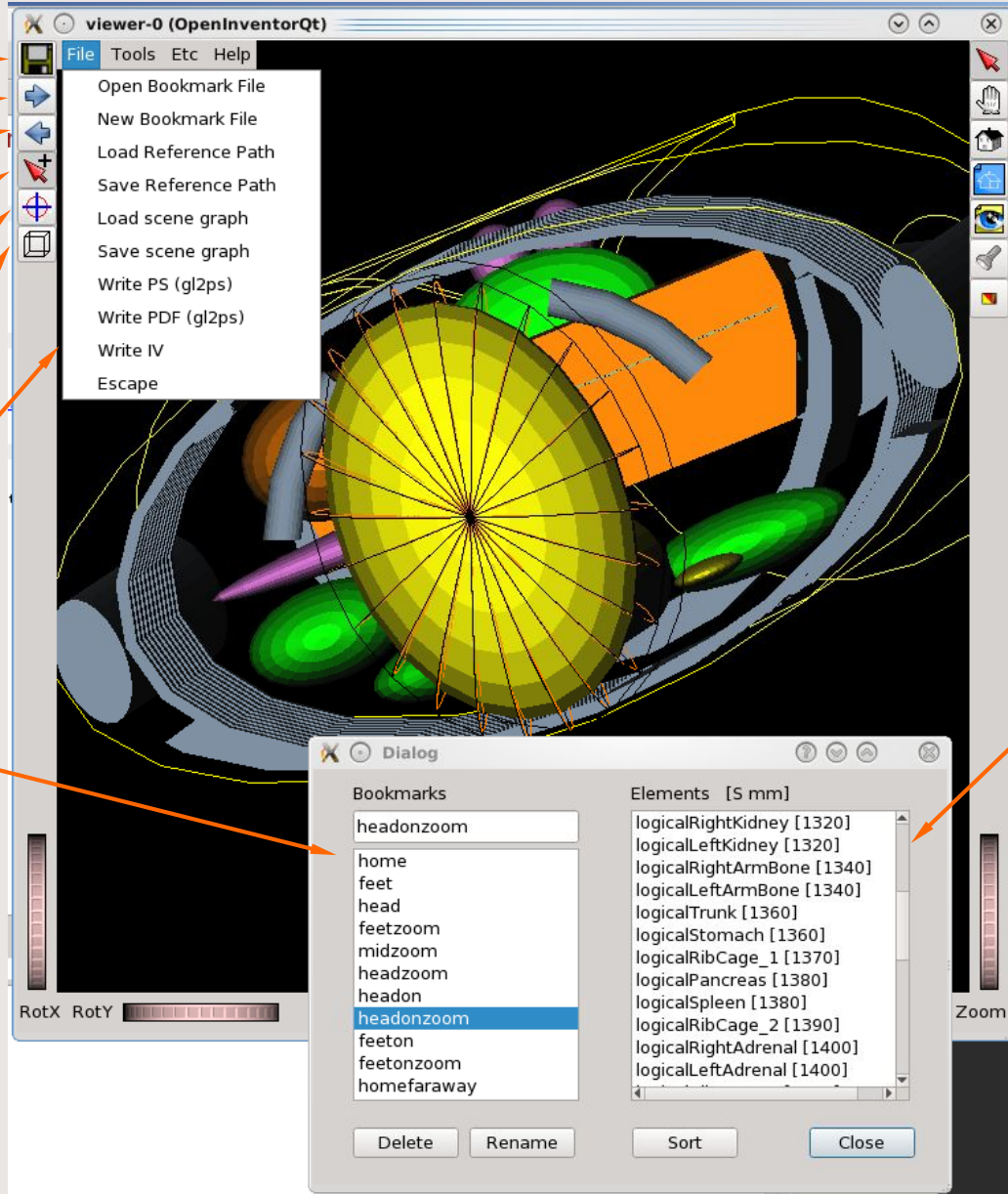
Extended picking & mouse-over display

Pick reference path (trajectory)

Toggle wireframe

Input/Output menu

Bookmark List
Click for random access or use viewer buttons for sequential access

Built-in viewer controls

Element List
Ordered by distance along reference path. Click to navigate to element or use arrow keys to travel between elements and rotate around them.

viewer-0 (OpenInventorQt)

File Tools Etc Help

Open Bookmark File
New Bookmark File
Load Reference Path
Save Reference Path
Load scene graph
Save scene graph
Write PS (gl2ps)
Write PDF (gl2ps)
Write IV
Escape

Dialog

Bookmarks

headonzoom

home
feet
head
feetzoom
midzoom
headzoom
headon
headonzoom
feeton
feetonzoom
homefaraway

Elements [S mm]

logicalRightKidney [1320]
logicalLeftKidney [1320]
logicalRightArmBone [1340]
logicalLeftArmBone [1340]
logicalTrunk [1360]
logicalStomach [1360]
logicalRibCage_1 [1370]
logicalPancreas [1380]
logicalSpleen [1380]
logicalRibCage_2 [1390]
logicalRightAdrenal [1400]
logicalLeftAdrenal [1400]

Delete   Rename   Sort   Close

RotX RotY   Zoom

5

- Phases completed:
  - Corrections to CMake configuration and addition of GEANT4_USE_INVENTOR_QT option.
  - A prototype OIQt viewer (fully functional but no add-ons) was released in Geant4 10.7 Beta.
  - All functions migrated to Qt widgets.
  - All Bookmark functions implemented.
  - Element navigation, rotation, and geometry fly-through.
  - Superimposed scene, extended picking, and mouse-over readouts for volumes and trajectories.
- Phases remaining:
  - Add some viewer I/O functions such as PS and PDF output.
  - Improve layout of the Lists Dialog (Qt Designer).
  - General shake-down to remove glitches and resolve some inter-operability issues (e.g. embedding in the Qt UI).

Special thanks to John Allison for his interest in this project and for essential feedback and support.