

IGUANA Interactive Graphics Project: Recent Developments

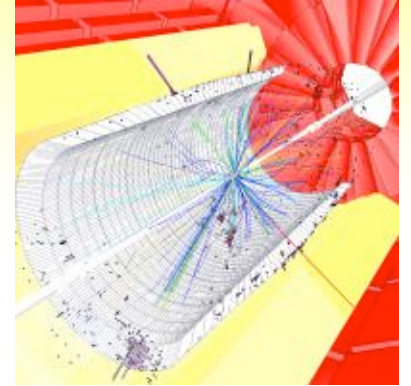
CHEP'04



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What is IGUANA



Interactive Graphics for User ANALysis:

IGUANA defines a **generic** object model and a framework for interactive 2D and 3D visualisation. It provides a number of services and tools to generate and manipulate those objects and to manage user interactions.



Default Views

- **2D**: a 2D view where every object has been sliced by a plane: XY, ZX, or ZY;
- **3D**: the usual 3D view (e.g. generated from G4);
- **Lego**: allows to display the lego plots associated to some of the twigs;
- **Open Inventor**: allows to open an .iv file as a separate twig tree;
- **Python shell**: opens an interactive python shell.



Example

Grab File Edit Capture Window Help

ORCA Rec Application Visualisation

Mon 2:14 PM ianna Osborne

File View Window Event Scripts Config Debug Help

Object

- Event
 - Tracker
 - Sim Tracks Tree
 - CustomTracker
 - Muon
 - Calorimetry
 - Event Info
 - Collections
 - PrincipalVertexFinder
 - PersistentJetFinder
 - CombinatorialTrackFinder**
 - EGBCluster
 - EGSCluster
 - GlobalMuonReconstructor
 - L1Trigger
 - L2MuonReconstructor

CombinatorialTrackFinder

Version: 0.0 Size: 20

Parameters:

Name type (precision) val
TrajectoryBuilder.chiSqua
(+/-0.0001) 30
TrajectoryBuilder.intermed
bool 1 TrajectoryBuilder.m
TrajectoryBuilder.maxCon
TrajectoryBuilder.maxLost
TrajectoryBuilder.maxim
int -1
TrajectoryBuilder.minimum
int 5 mass double (+/-0.00
ptCut double (+/-0.0001) l
seedCleaning bool 1

Components:

Dump:
Name: CombinatorialTrackFinder Version: 0.0 Parameters:
Name type (precision) value
TrajectoryBuilder.chiSqua double (+/-0.0001) 30
TrajectoryBuilder.intermediateCleaning bool 1
TrajectoryBuilder.maxCand int 5
TrajectoryBuilder.maxConsecLostHit int 1
TrajectoryBuilder.maxLostHit int 1
TrajectoryBuilder.maximumNumberOfHits int -1
TrajectoryBuilder.minimumNumberOfHits int 5 mass double
(+/-0.0001) 0.1057 ptCut double (+/-0.0001) 0.9
seedCleaning bool 1 Components: SeedGenerator Name:
GlobalPixelSeedGenerator Version: 1.0 Parameters: Name
type (precision) value originHalfLength double (+/-0.0001)

3D Window #2

3D Window #1

3D Window #4

3D Window #3

3D Window #0

16.0743 fps

8.0/0.0 fps

6.5/0.4 fps

Welcome to IGUANA python shell!

Ctrl-Return to execute typed text
Ctrl-Space on a word to complete it according to python dictionary
Ctrl-Up for previous history item
Ctrl-Down for next history item

Configurable Parameters

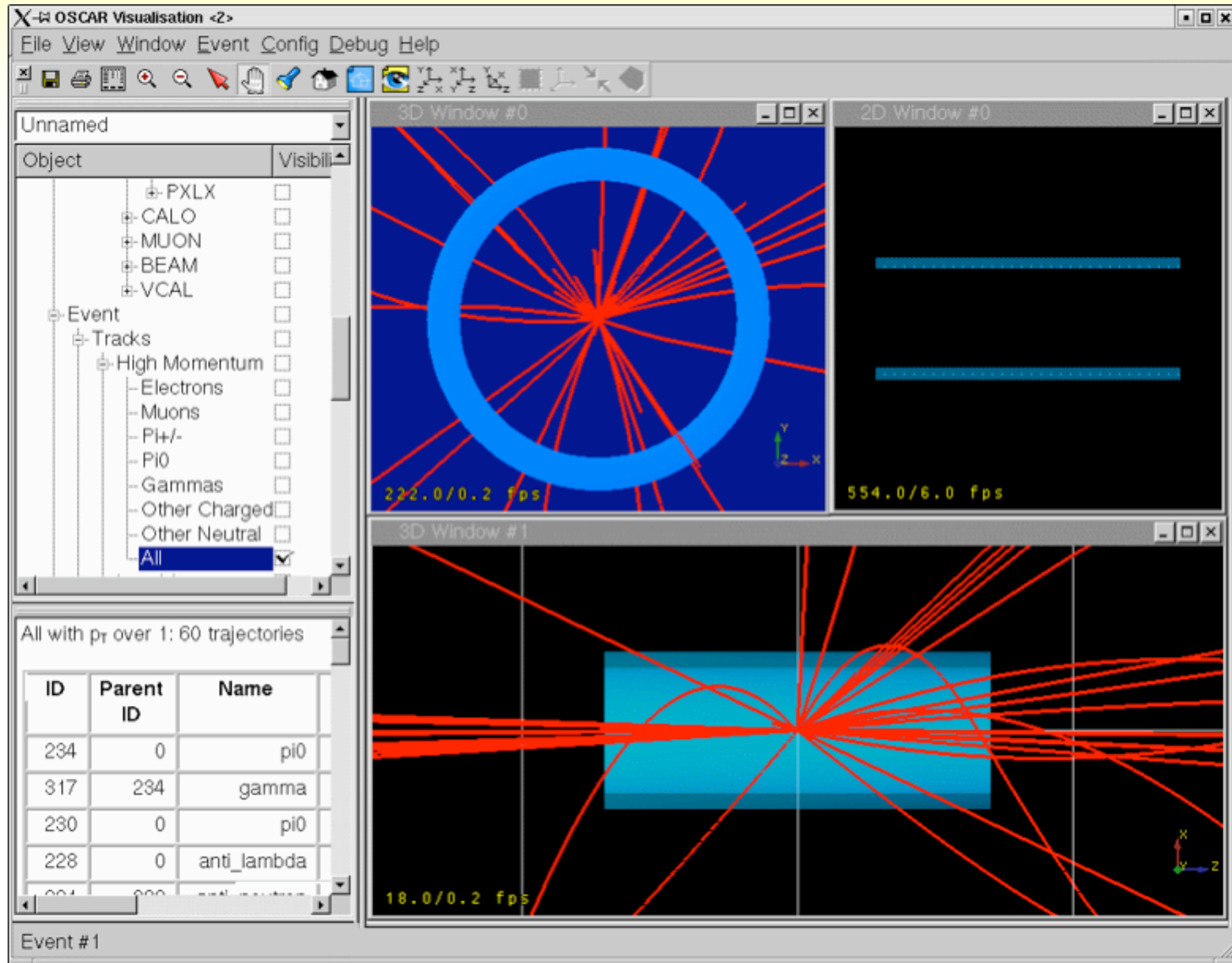
Configurable Parameter	Value
CoreParserLib	true
DDCConfigFile	ORCAConfiguration.xml
DDCParserInstance	true
DataSetPackages	RecCobraModule
DefaultVerbosity	silent
DetMagneticField.constantField	false
EBRY_GeomSource	DDD
EFRY_GeomSource	DDD
EGBCluster.Persistent	false

Help New Edit Refresh OK Cancel

Run #123, Event #20, Owner: SW820Oigs, Dataset: h300eenn



Example



Example

Run #123, Event #3, Owner: SW830DST, Dataset: h30beem

3.5/0.3 fps

7.7/0.1 fps

CombinatorialTrackFinder	
Version: 0.0	Size: 41
Parameters:	
Name type (precision) value	TrajectoryBuilder.chiSquareCut double (+/-0.0001) 30
TrajectoryBuilder.intermediateCleaning	bool 1
TrajectoryBuilder.maxConsec	TrajectoryBuilder.maxConsecLostHit int 1
TrajectoryBuilder.maxLostHit	TrajectoryBuilder.maxLostHit int 1
TrajectoryBuilder.minimumNumberOfHits	int 5
mass	double (+/-0.0001) 0.1057
ptCut	double (+/-0.0001) 0.9
seedCleaning	bool 1
Components:	
Jump:	
Name: CombinatorialTrackFinder Version: 0.0	
Parameters: Name type (precision) value	
trajectoryBuilder.chiSquareCut	double (+/-0.0001) 30
trajectoryBuilder.intermediateCleaning	bool 1
trajectoryBuilder.maxConsec	int 5
trajectoryBuilder.maxConsecLostHit	int 1
trajectoryBuilder.maxLostHit	int 1
trajectoryBuilder.minimumNumberOfHits	int 5
mass	double (+/-0.0001) 0.1057
ptCut	double (+/-0.0001) 0.9
seedCleaning	bool 1
Components: SeedGenerator Name: GlobalPixelSeedGenerator Version: 1.0	
Parameters: Name type (precision) value originHalfLength	
chiSquareCut	double (+/-0.0001) 15
originHalfLength	double (+/-0.0001) 0.1



New Developments

- IGUANA Studio is now an MDI environment
- Control Centre
- Improved printing
- New python scripting environment
- Improved performance
- Initial support for MacOS X



Multi Document Interface

- Fully customizable layout via drag and drop
- Easy framework for embedding own qt widgets in the studio environment
- Design exploits SEAL plugins capabilities
 - Default plugins for 3D, 2D and Lego models
- Context sensitive behaviour (e.g. toolbar buttons change if you are looking at 3d or 2d view)



Typical Visualisation Application

Tool Bar
Tool bar provides short-cuts to most common actions.

Menu Bar
Menu bar hosts loaded services.

Twig Browser
Twig window shows the list of loaded Twigs. They can be selected and made visible.

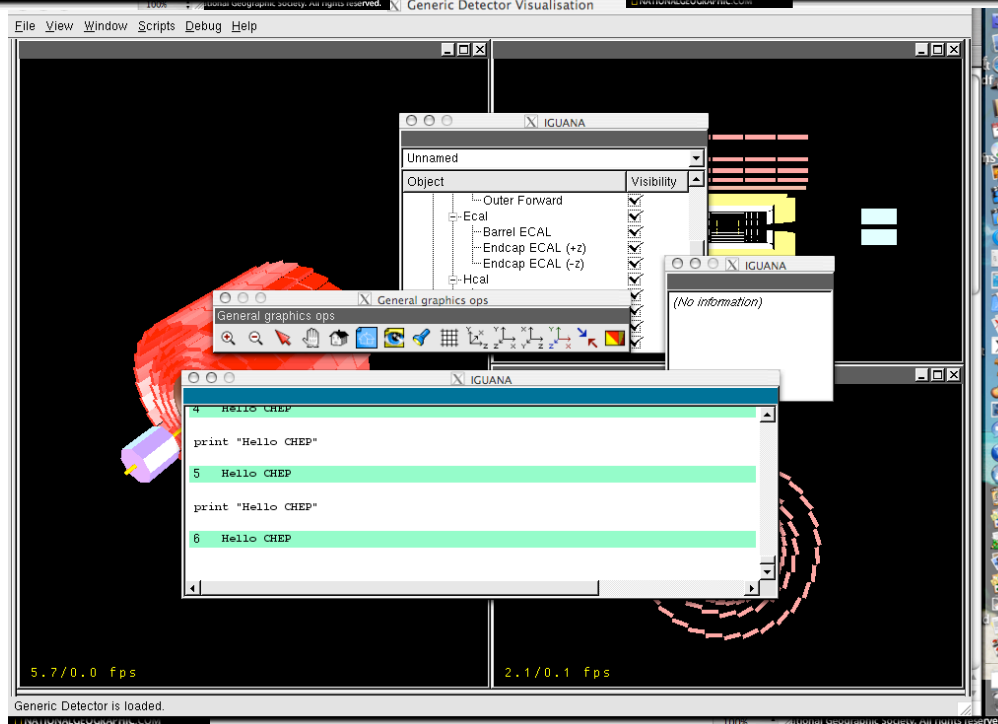
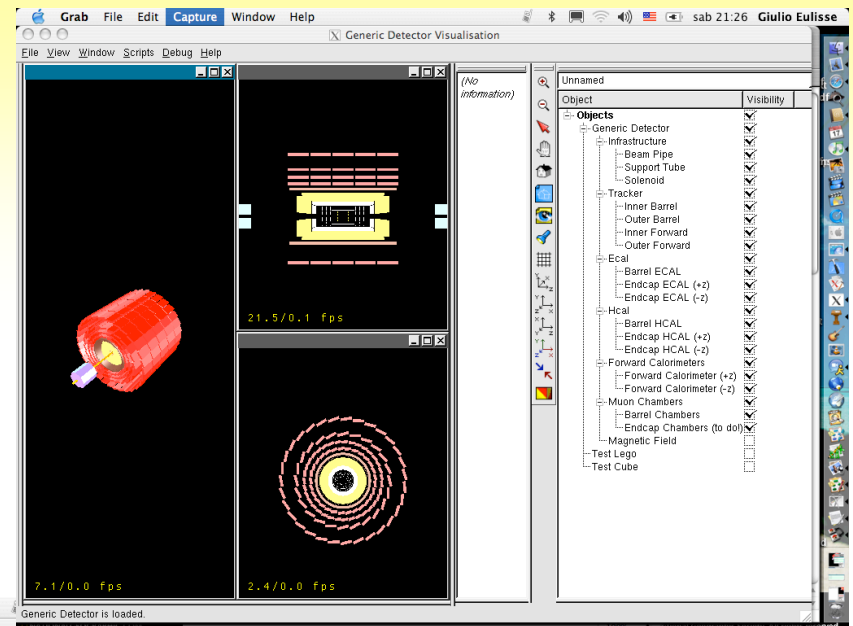
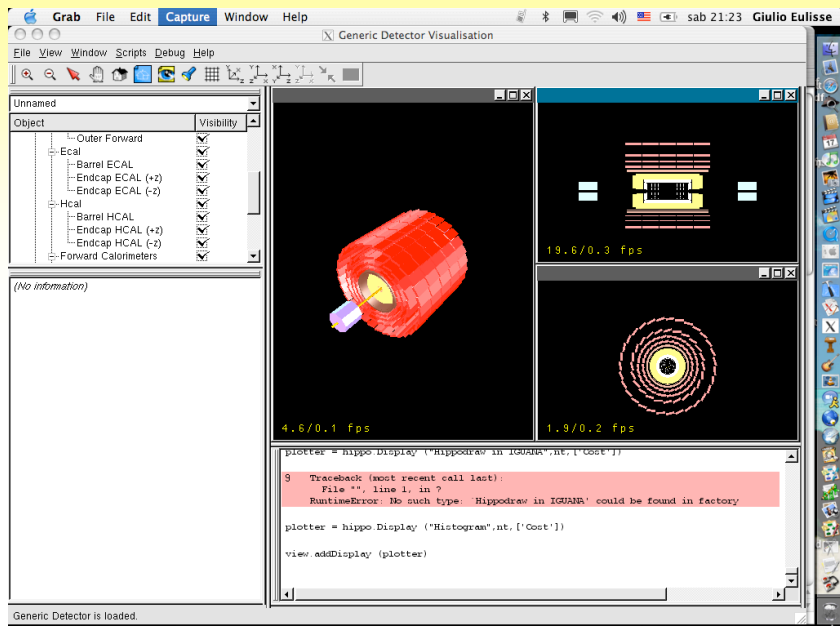
3D Browser
3D representation of visible objects are shown in 3D window.

Text Info
Text info window will show reach text output for selected object.

MDI Workspace
The workspace hosts browsers: 3D, 2D, Lego.

Status Bar
Run #123, Event #2, Owner: SIW830DST, Dataset: h300eemm

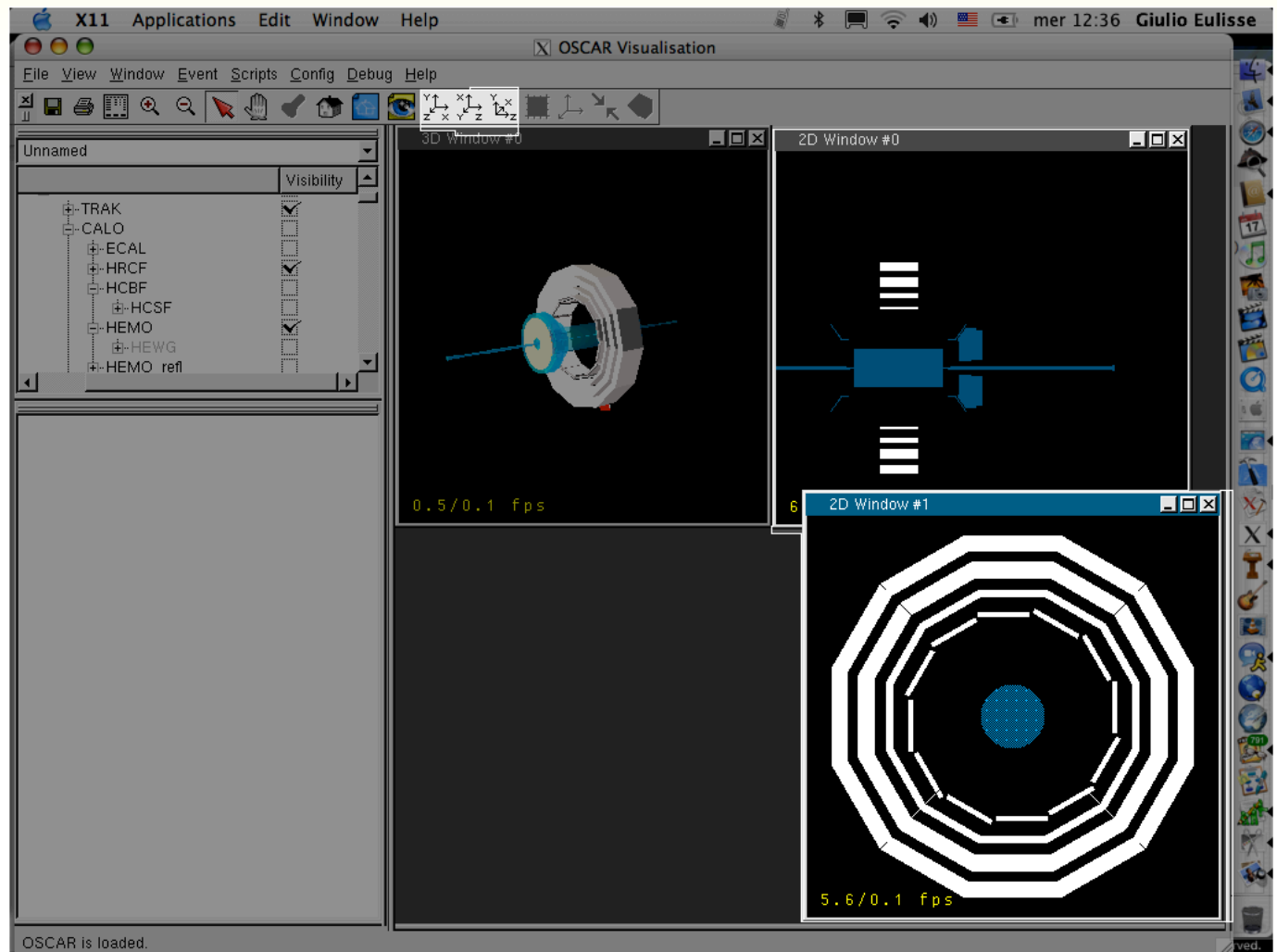




2D Views

Automatically generated from the 3D representation (supporting slicing, layering, projection or custom 2D objects)

The algorithm also supports boolean operations between solids



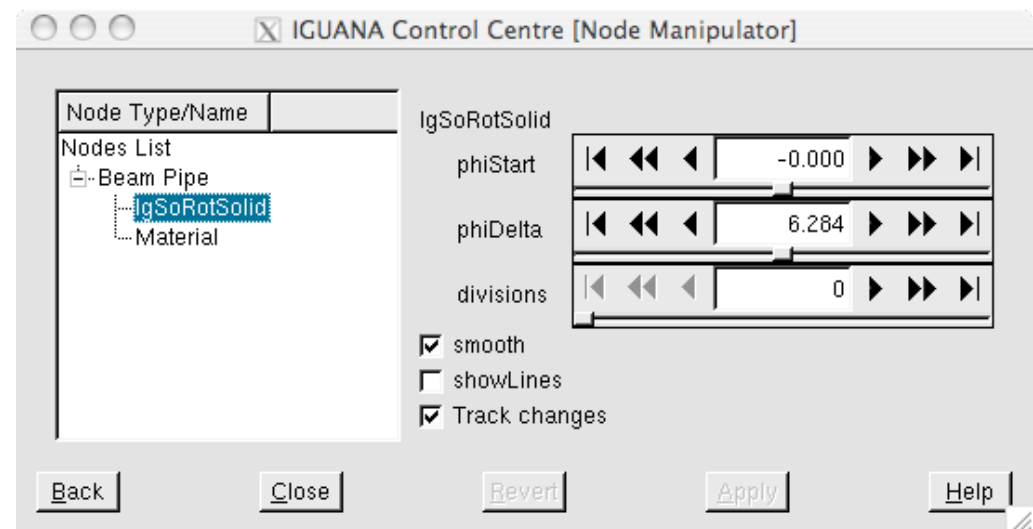
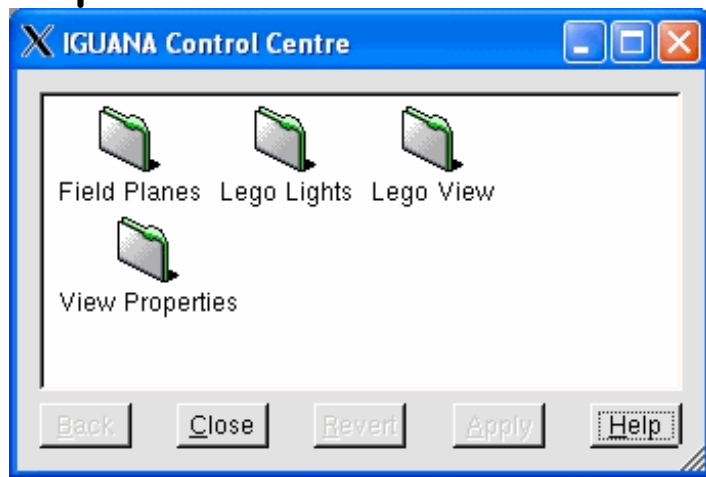
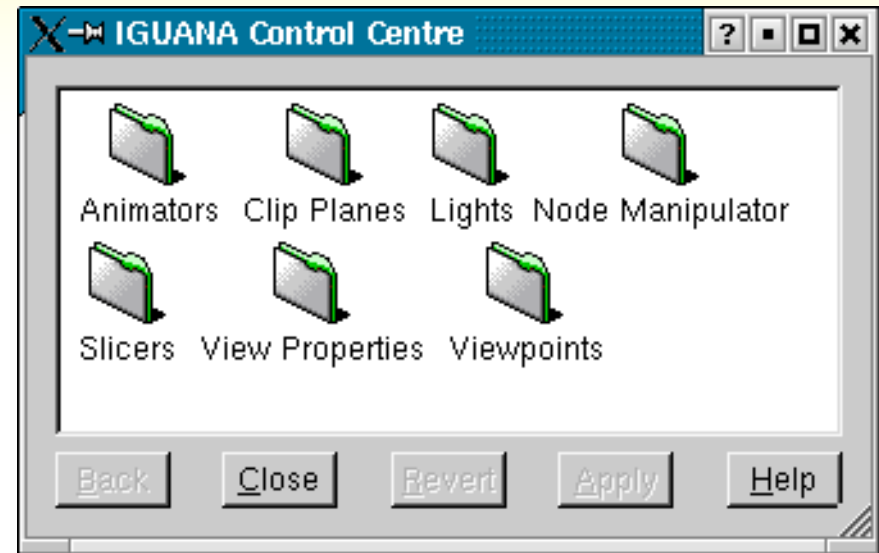
Printing and Vector Postscript

- Multiple output formats:
 - bitmapped:
 - JPEG
 - TIFF
 - vector:
 - eps (level 2,3)
- Publishing quality
- All the improvements contributed back to the gl2ps open source project



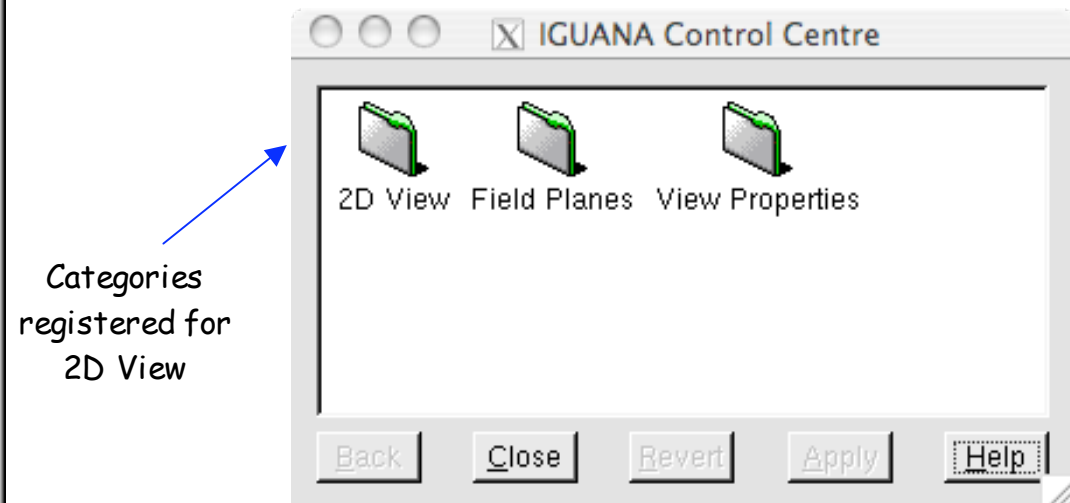
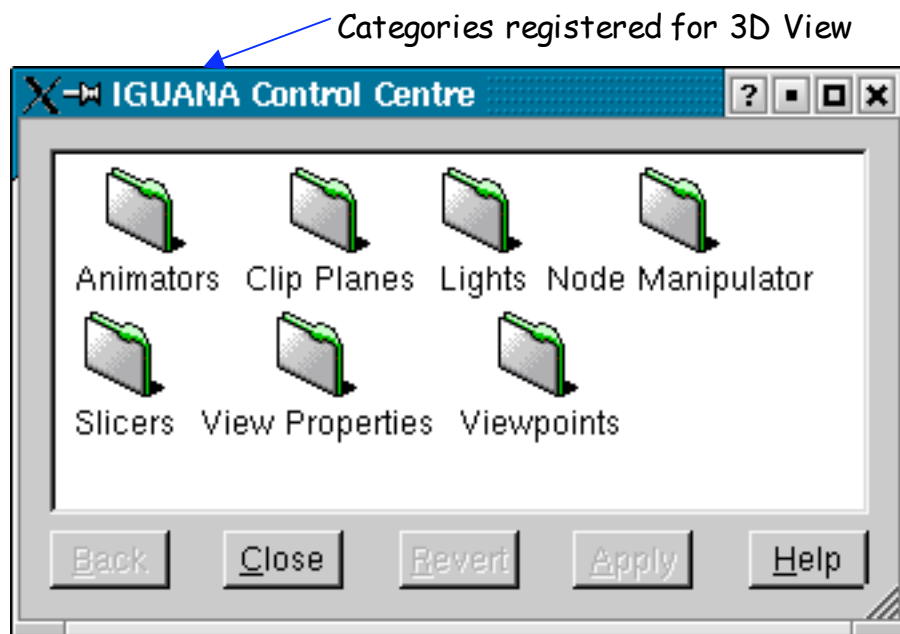
Control Centre

- Modular architecture
- Context sensitive: only see the categories that apply to your view
- Categories provided for modifying any aspects of the Open Inventor models



Control Centre: context sensitive

- Selecting different views (3D, 2D, Lego etc.) will automatically update the control centre for its available categories



3D Node Manipulator Category...

- A category to manipulate the fields of any 3D node.
- Select a node, from twig tree or 3D Browser (in pick/select mode), and open 3D node manipulator category to manipulate that node

Node and its children list

Selected node

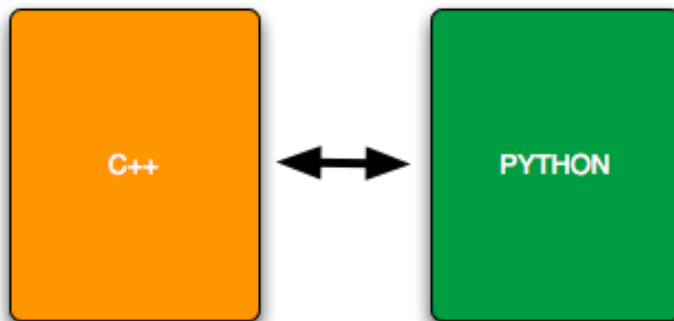
Different controllable fields of selected node

Automatically apply the changes made via GUI



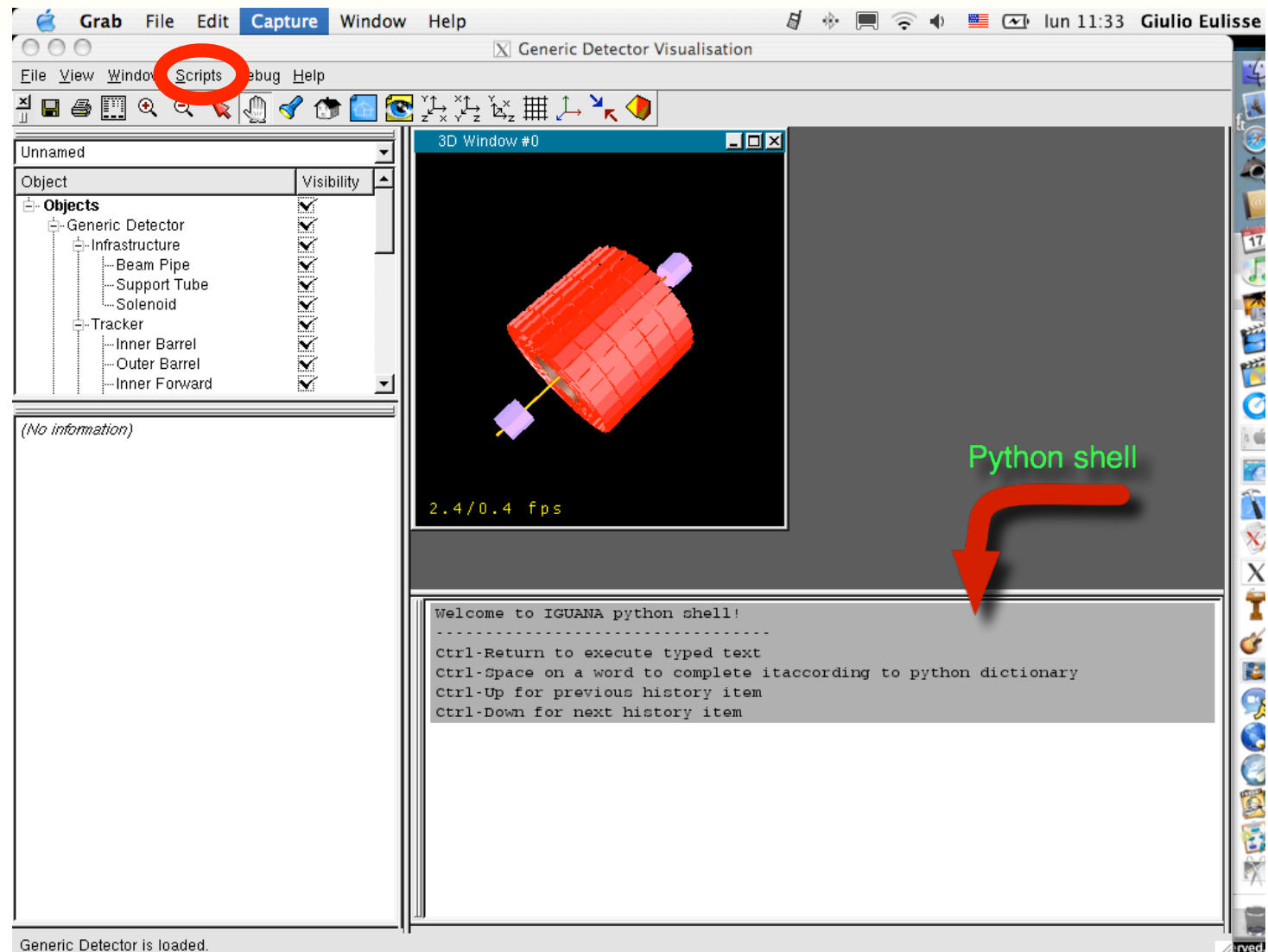
Python Support in IGUANA

- Python is an object-oriented programming language introduced in the beginning of the 90s
- Easy to learn but powerful
- It is currently the selected scripting language of choice for the CMS Application Framework -- COBRA
- Interoperability with C++



Interactive Python Shell

IGUANA provides
a widget for
accessing the
python shell from
the Studio
environment



IGUANA & Python Interoperability

The screenshot displays the IGUANA software interface. The main window is titled "OSCAR Visualisation" and contains a 3D visualization of a detector component, labeled "3D Window #0". The detector is rendered as a blue, elongated, cylindrical shape with a rounded end. The visualization is set against a black background. Below the 3D window, a text area displays the following text:

```
Welcome to IGUANA python shell!  
-----  
Ctrl-Return to execute typed text  
Ctrl-Space on a word to complete it according to python dictionary  
Ctrl-Up for previous history item  
Ctrl-Down for next history item
```

Below the text area, a code editor window is open, showing the following Python code:

```
from PyIgtwigNavigation import *  
  
enableTwig ("/Objects/Detector/OCMS")  
  
enableTwig ("/Objects/Detector/OCMS/CMSE")
```

The interface also includes a menu bar with options: Grab, File, Edit, Capture, Window, Help. A toolbar with various icons is located below the menu bar. On the left side, there is a tree view showing the object hierarchy:

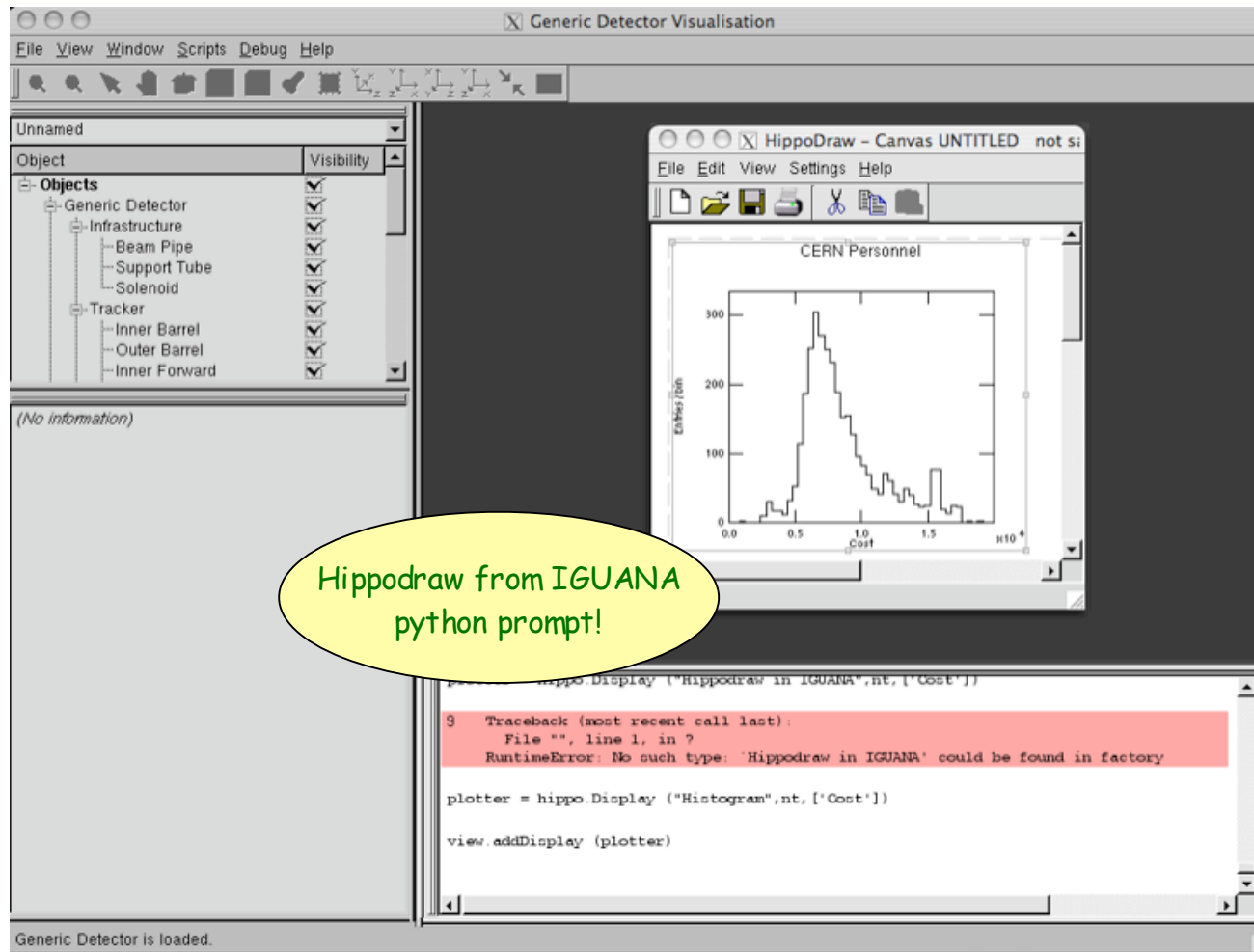
- Unnamed
 - Objects
 - Detector
 - OCMS
 - CMSE
 - Event
 - Tracks
 - High Momentum
 - Electrons
 - Muons
 - Pi+/-

The status bar at the bottom left indicates "OSCAR is loaded." and the system tray at the bottom right shows "rved."



IGUANA, PYTHON and the Others

- Take advantage of the huge number of python libraries.



The screenshot shows the IGUANA software interface. On the left, a tree view under 'Objects' lists components of a 'Generic Detector' such as 'Infrastructure', 'Beam Pipe', 'Support Tube', 'Solenoid', 'Tracker', 'Inner Barrel', 'Outer Barrel', and 'Inner Forward'. A 'HippoDraw - Canvas UNTITLED' window is open, displaying a histogram titled 'CERN Personnel' with 'Cost' on the x-axis and 'Entries/ton' on the y-axis. A yellow callout bubble points to the HippoDraw window with the text 'Hippodraw from IGUANA python prompt!'. Below the HippoDraw window, a Python prompt shows a traceback error: 'RuntimeError: No such type: 'Hippodraw in IGUANA' could be found in factory'. The code in the prompt includes: `plotter = hippo.Display ("Histogram",nt, ['Cost'])` and `view.addDisplay (plotter)`. The status bar at the bottom left indicates 'Generic Detector is loaded.'

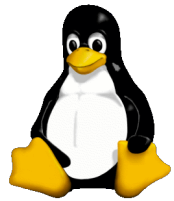


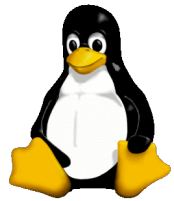


Improved Performance

- New, optimised, Scene Graph organization lead to 10x improvement in ORCA visualization in IGUANACMS
- New base shape for volumes of rotation improves performances and simplifies coding



Available platforms



	Compiles	Works	Binaries
	✓	✓	✓
	✓	✓	✗
	?	?	✗

Future Plans

- Continued maintenance
- Port to SCRAM v1
- More extensive usage of SEAL plugins in the Studio environment
- Extended python support
- Better integration with other python exposed packages, e.g. hippodraw
- PhySh client



More information

<http://iguana.cern.ch>

