

# CMS Visualisation



- IGUANA:
  - architecture and features
  - web GUI
  - Qt/ROOT integration
  - Desiderata for QT/Root

Giulio Eulisse on behalf of the IGUANA team  
Northeastern University, Boston, U.S.A.

# IGUANA

## Open Source components

Python

QT

HippoDraw

COIN

## CMS Software

Offline

Online

Data Quality Monitoring

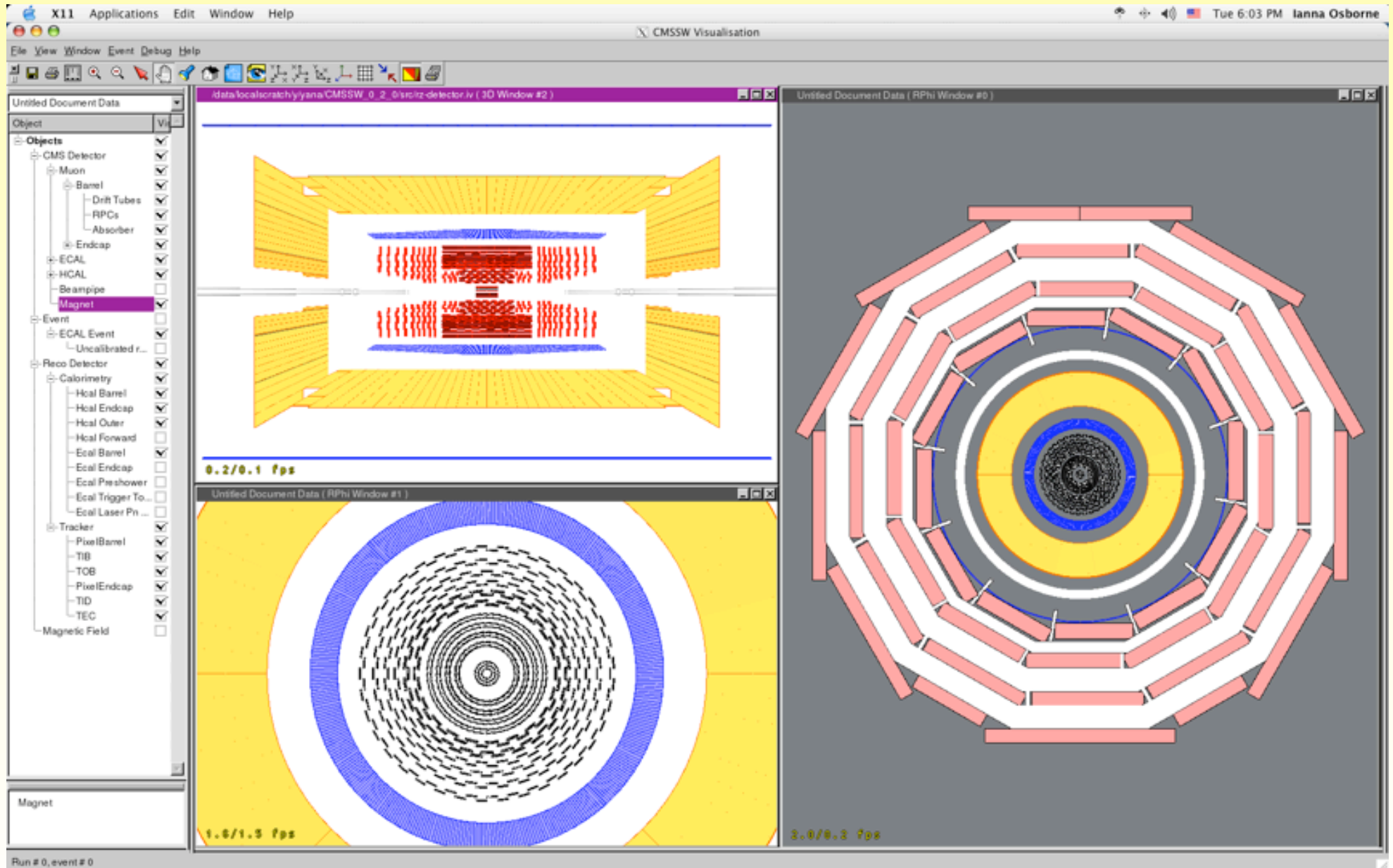
## HEP Software

Geant4

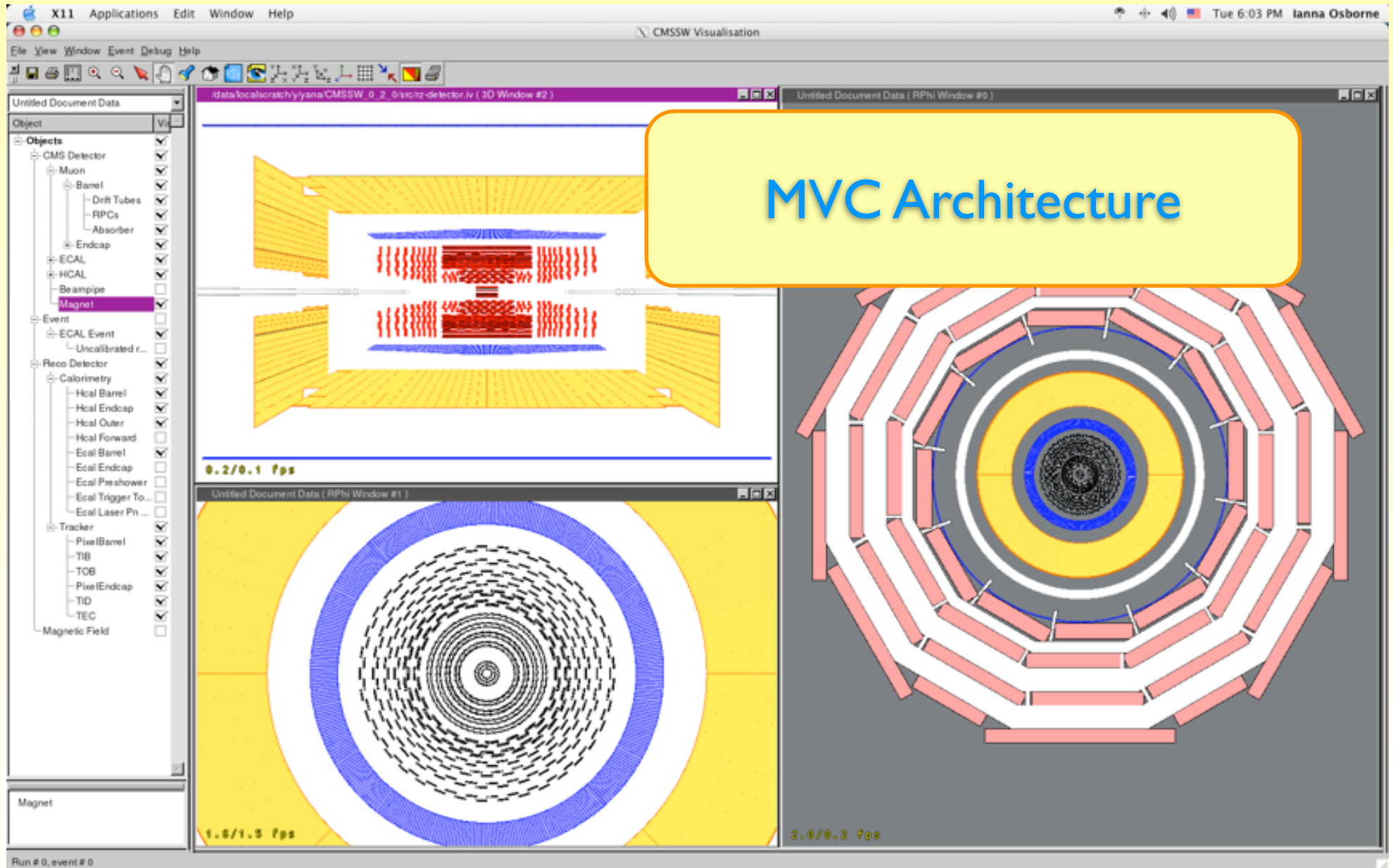
ROOT

SEAL

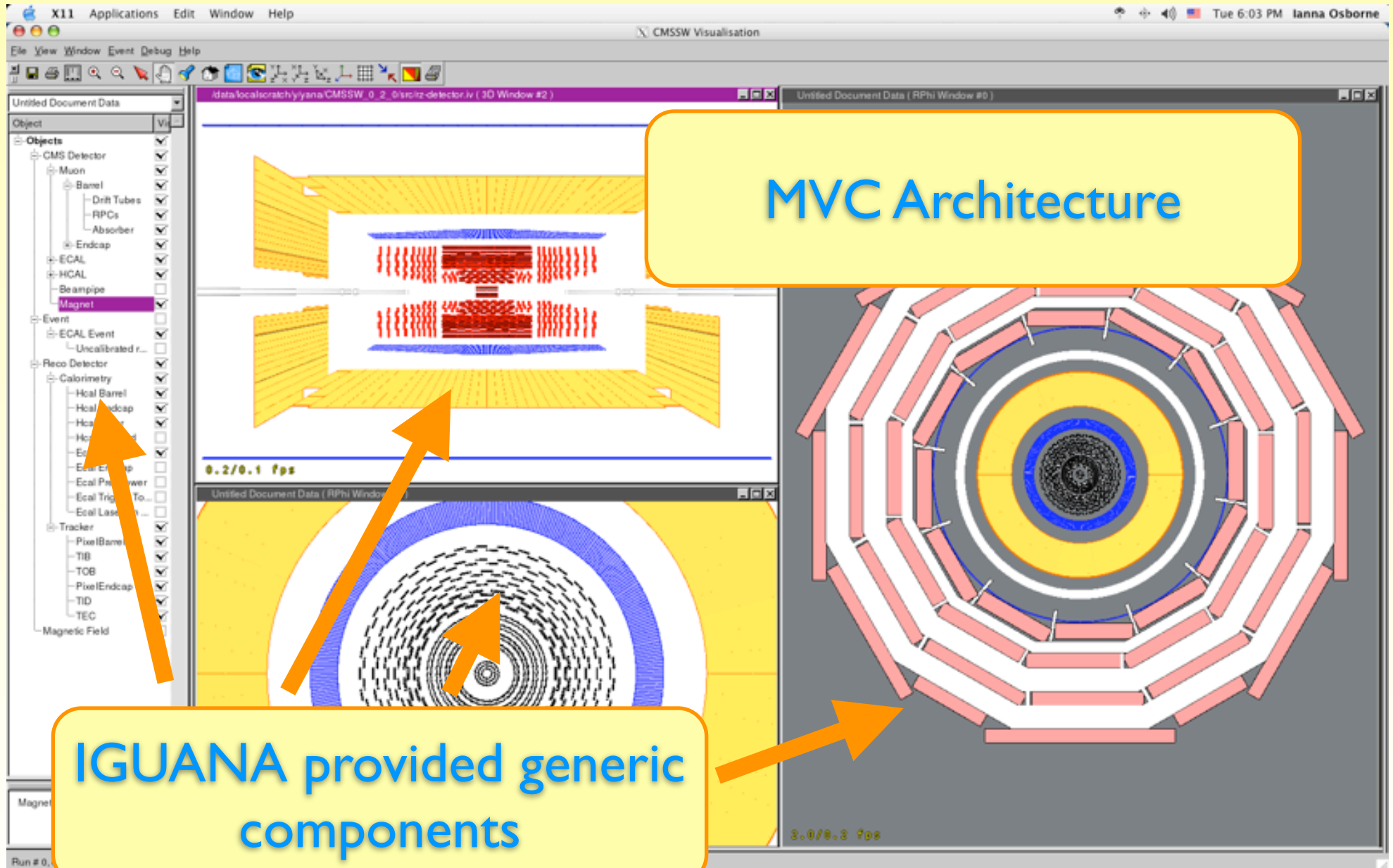
# IGUANA Features



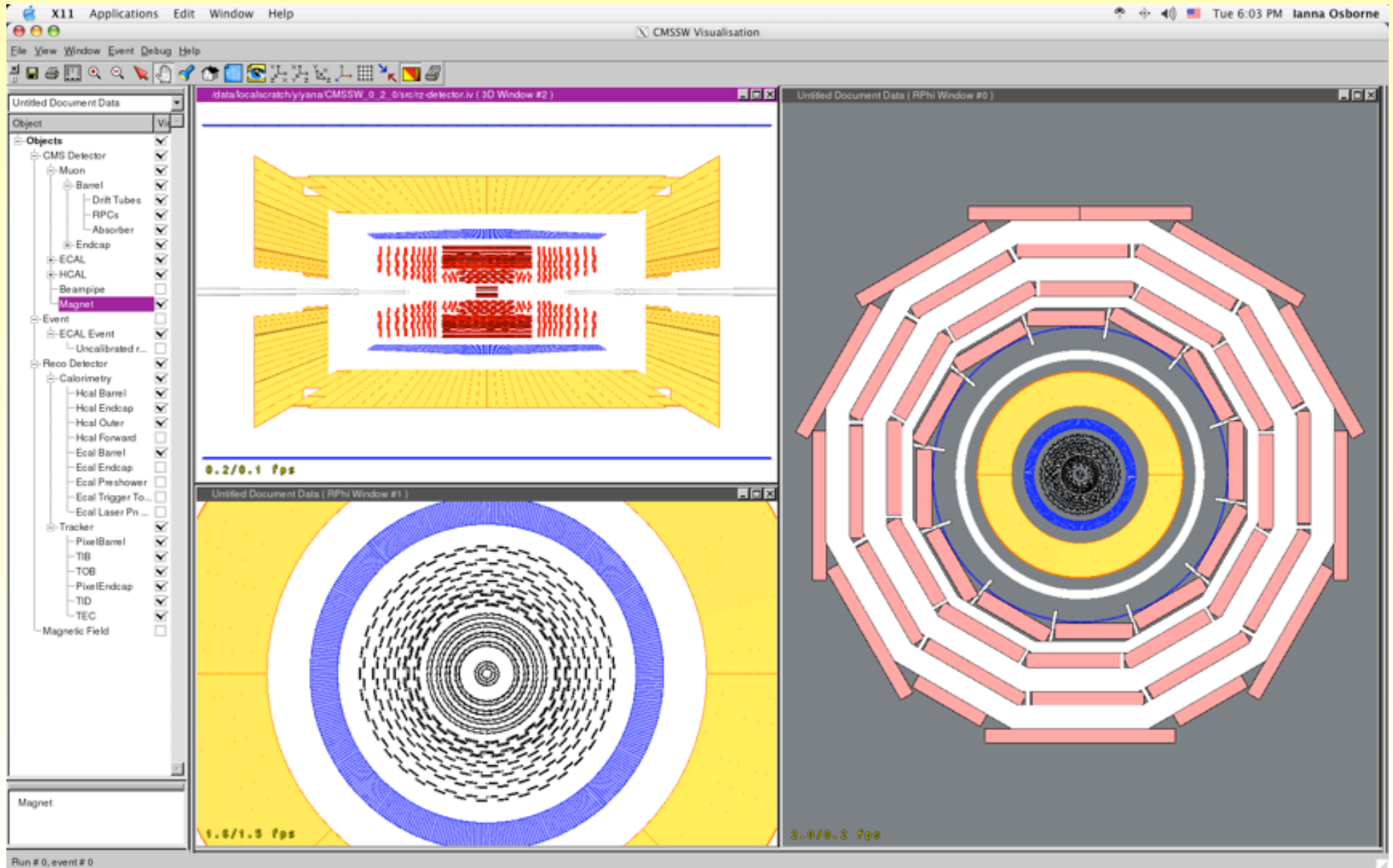
# IGUANA Features



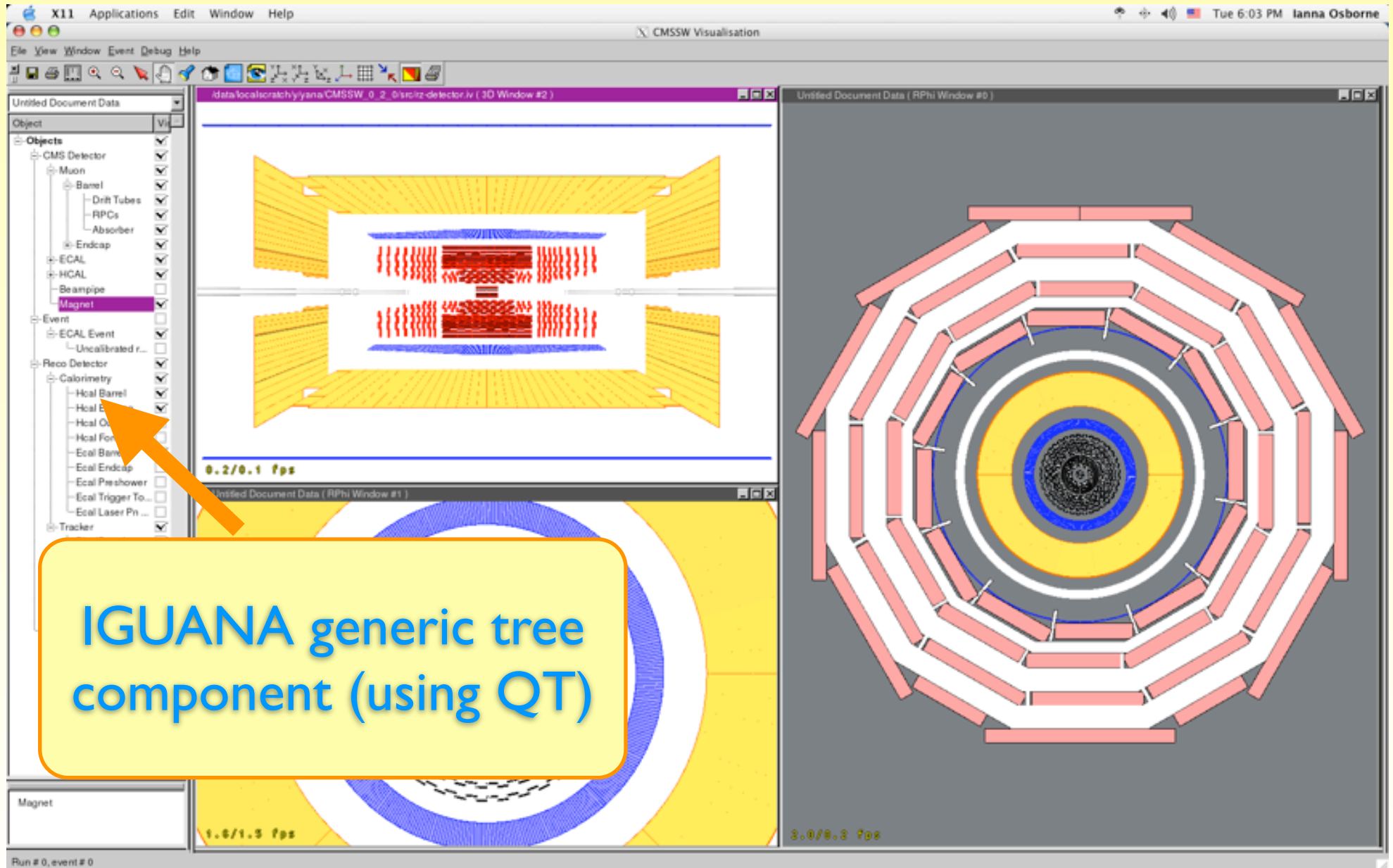
# IGUANA Features



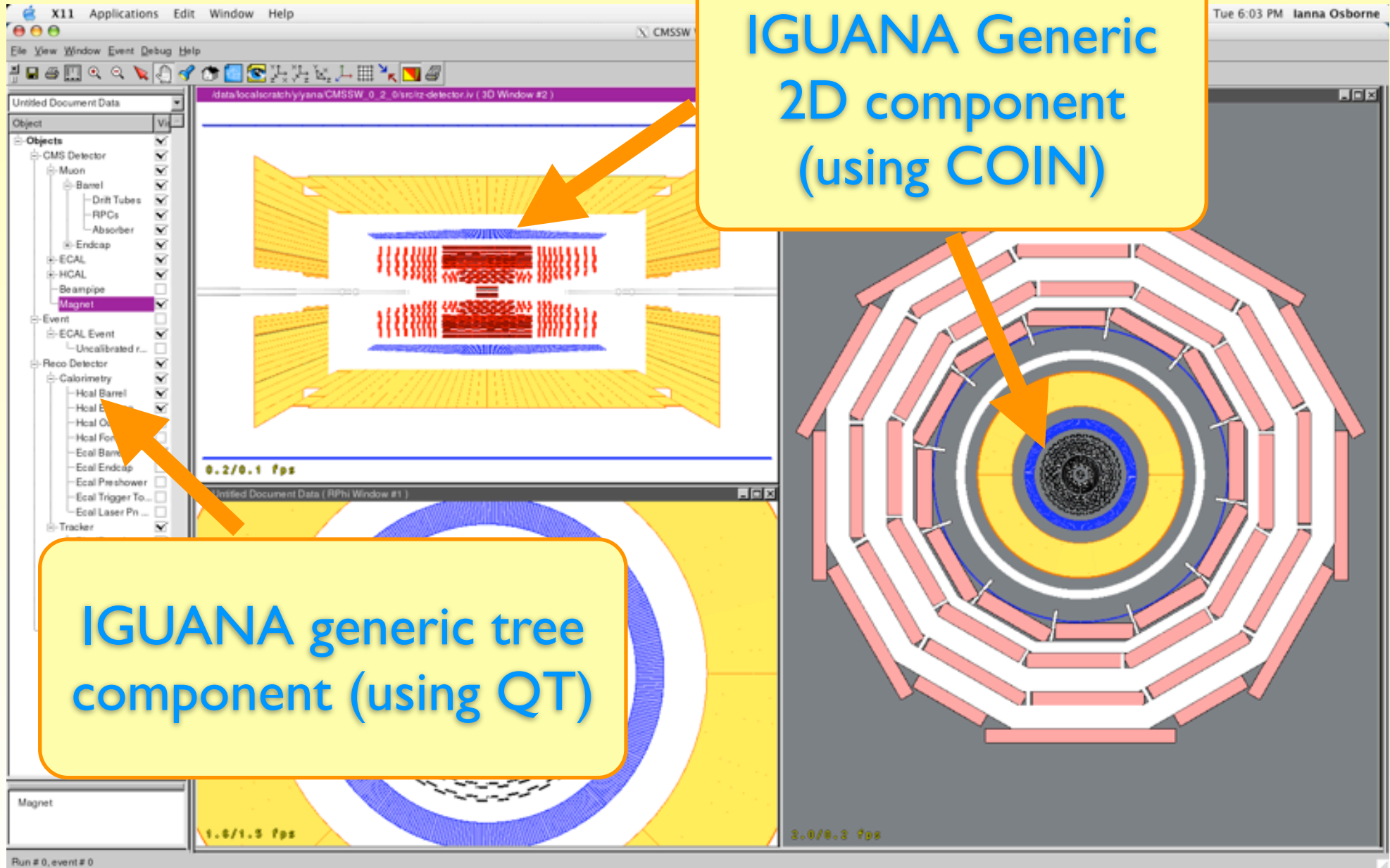
# IGUANA Features



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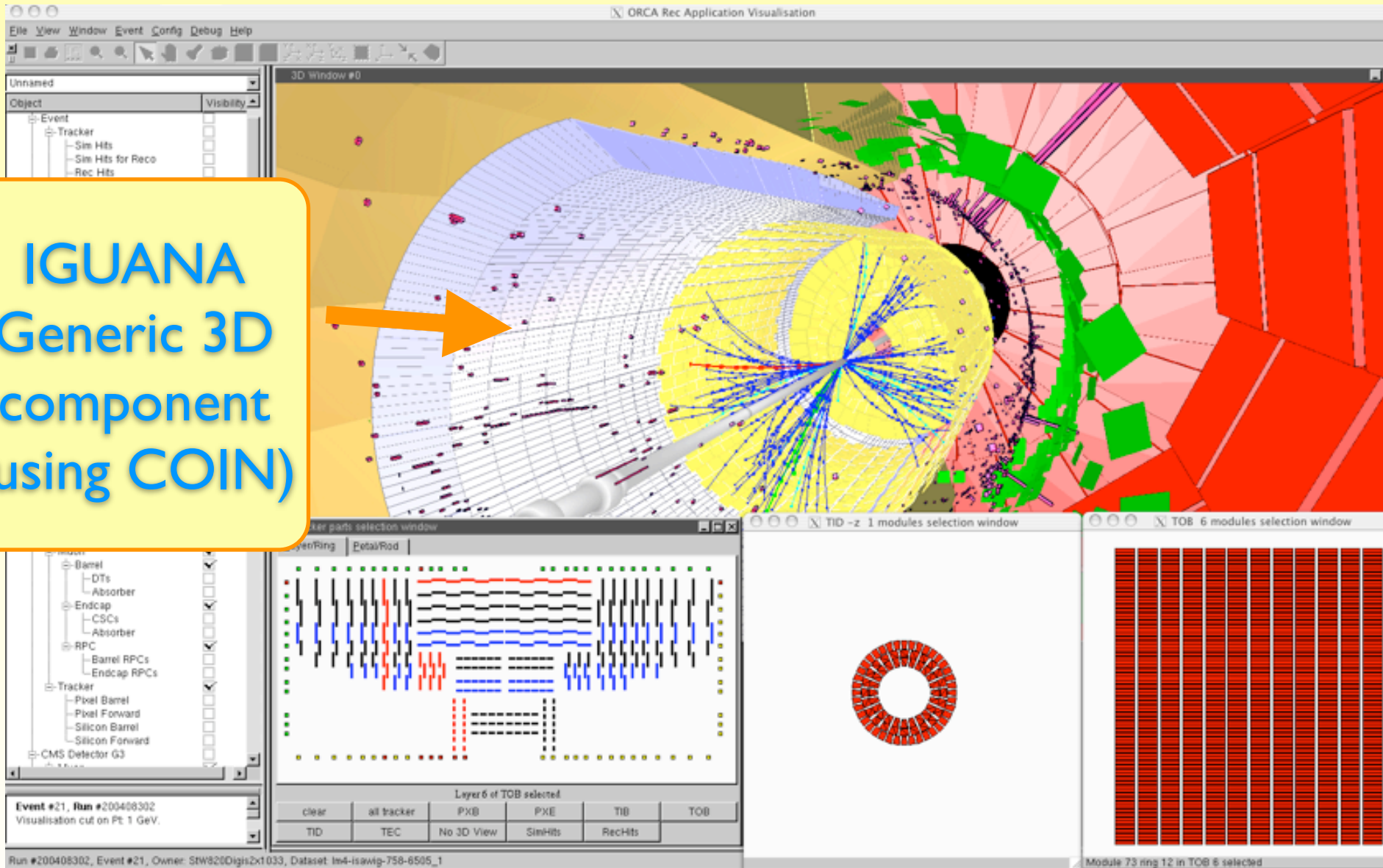




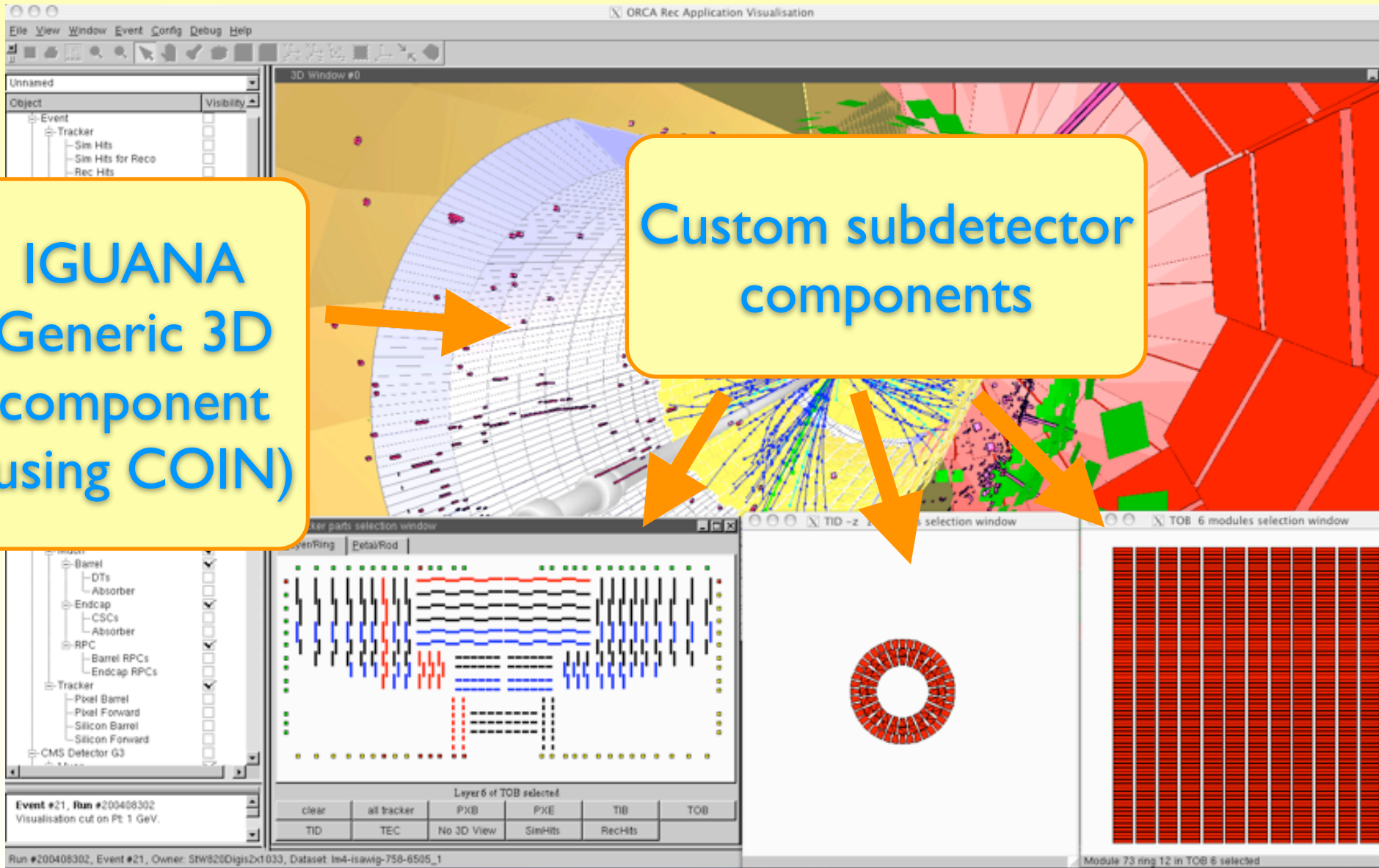


# IGUANA Features

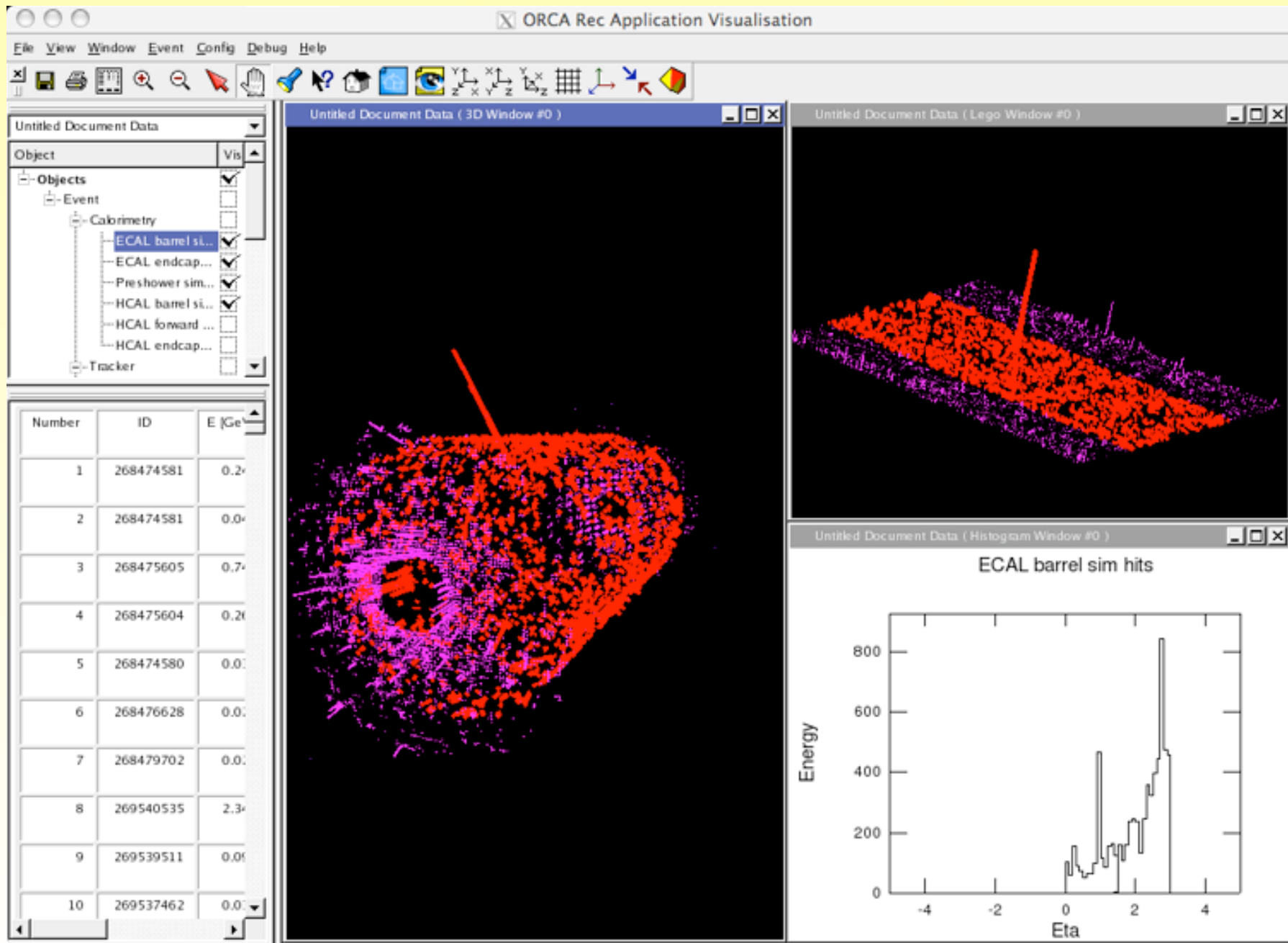
IGUANA  
Generic 3D  
component  
(using COIN)



# IGUANA Features

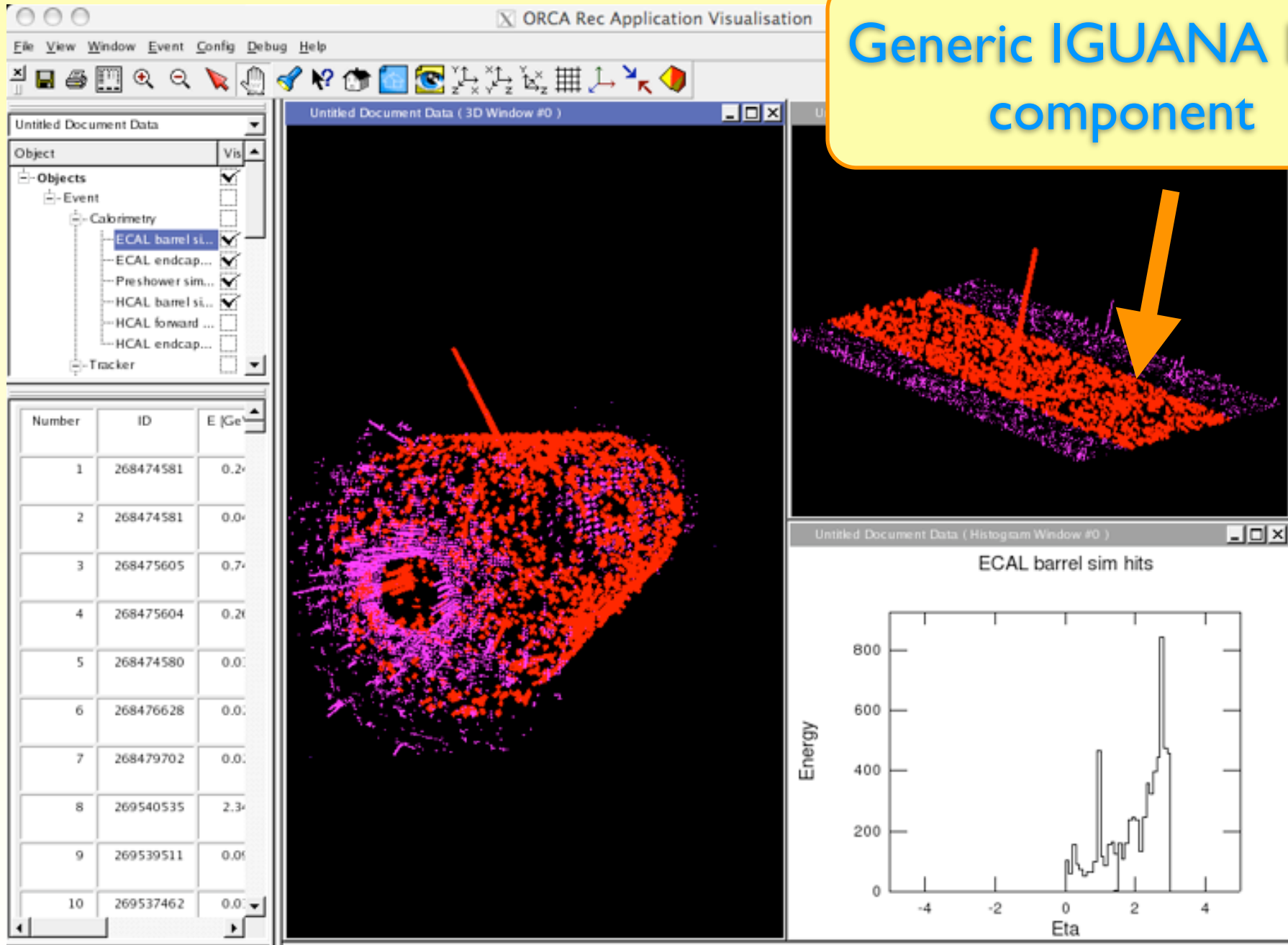


# IGUANA Features

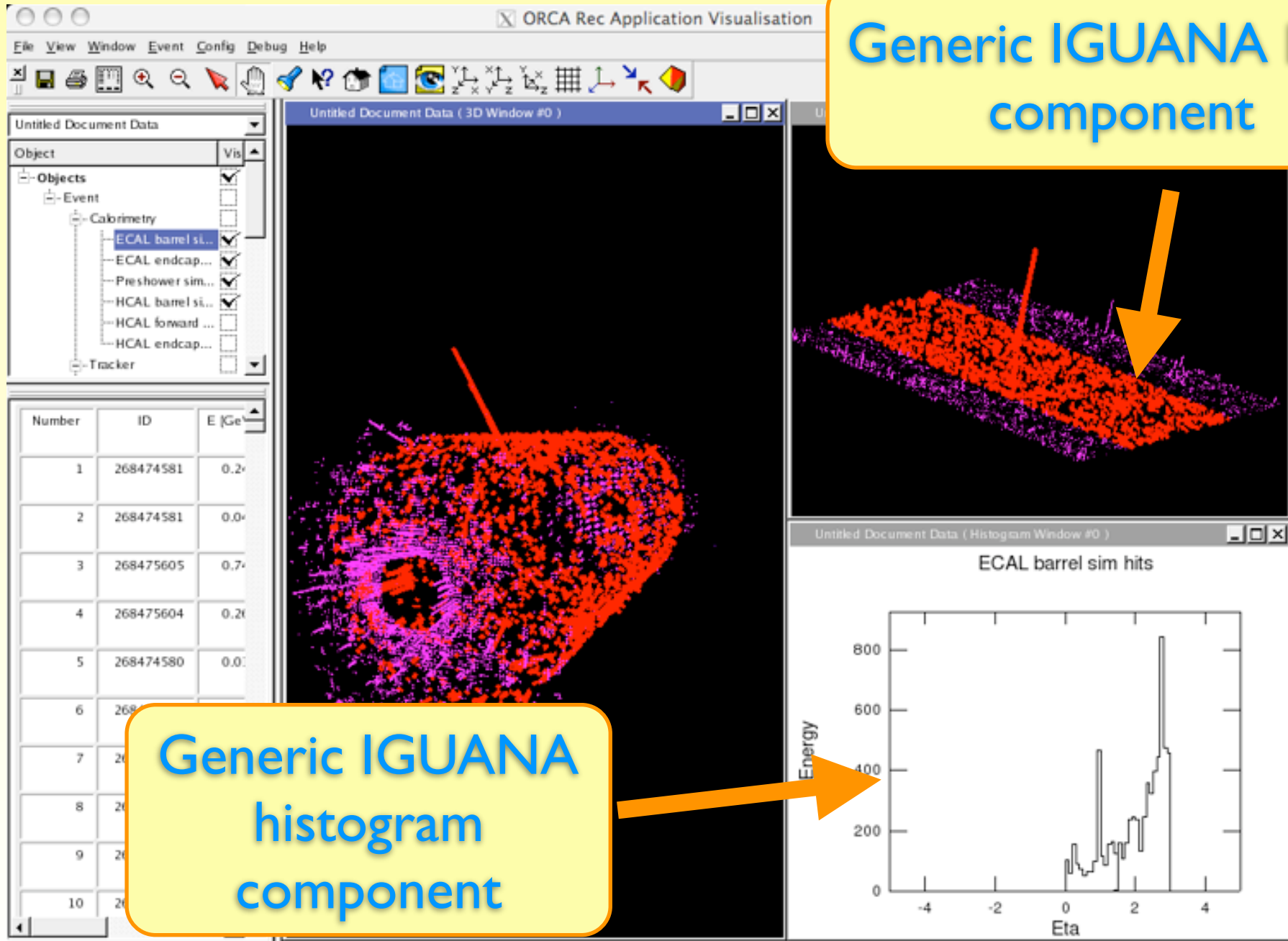


# IGUANA Features

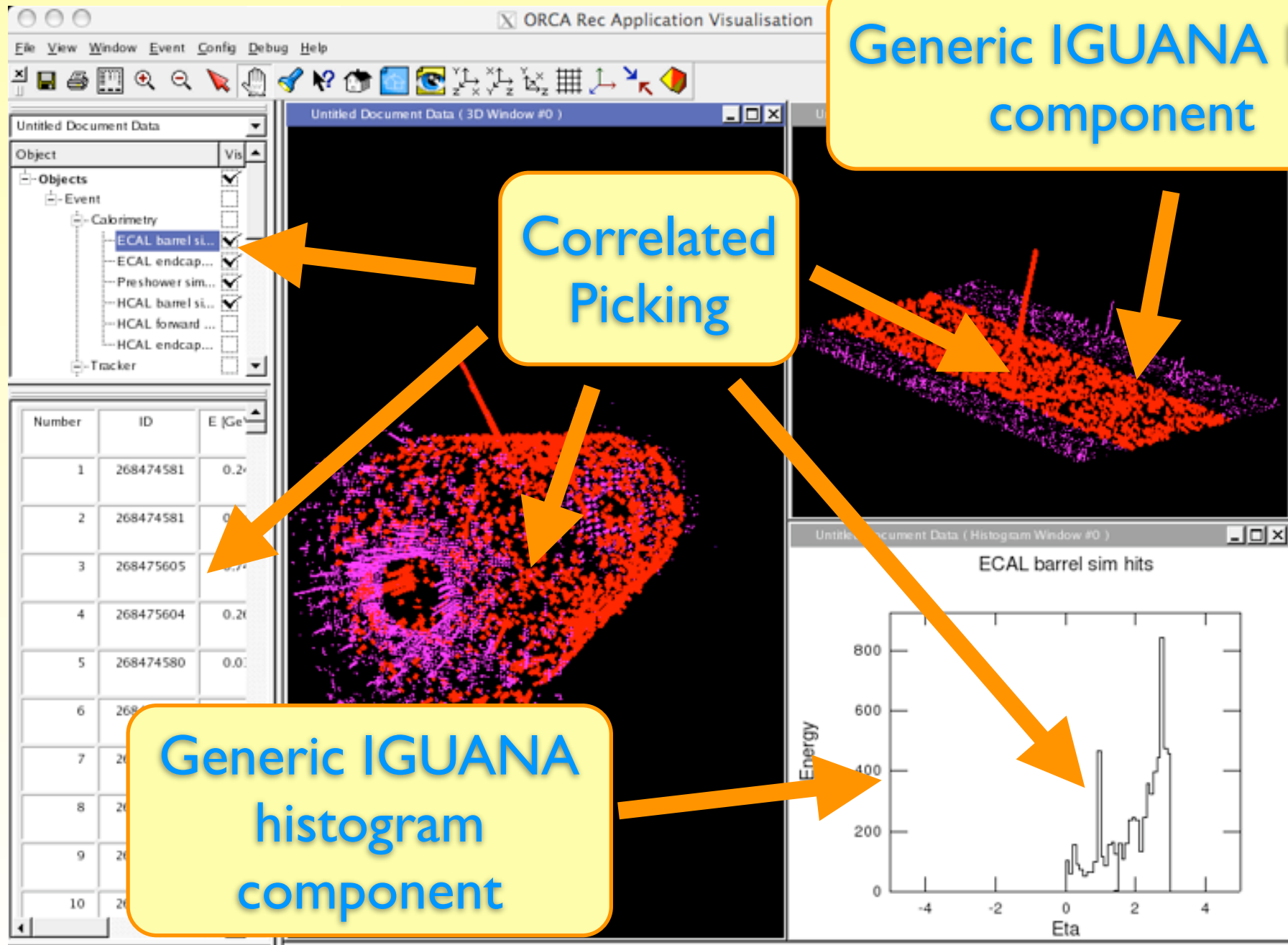
Generic IGUANA Lego component



# IGUANA Features

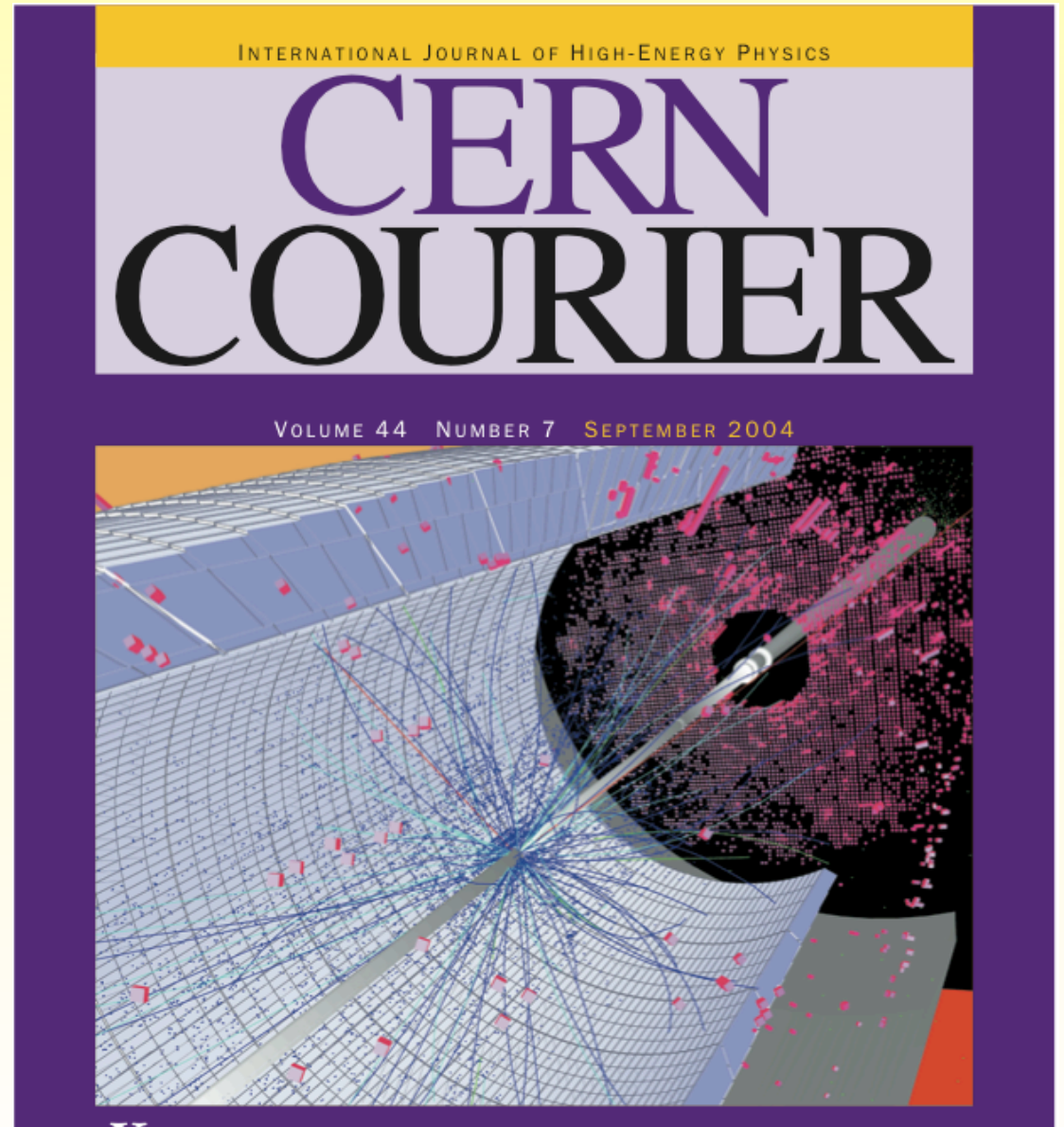


# IGUANA Features



# Multiple printing formats

- Publishing quality  
PDF/EPS/Vector PS
- JPG/PNG/GIF/RGB
- RGB Movies

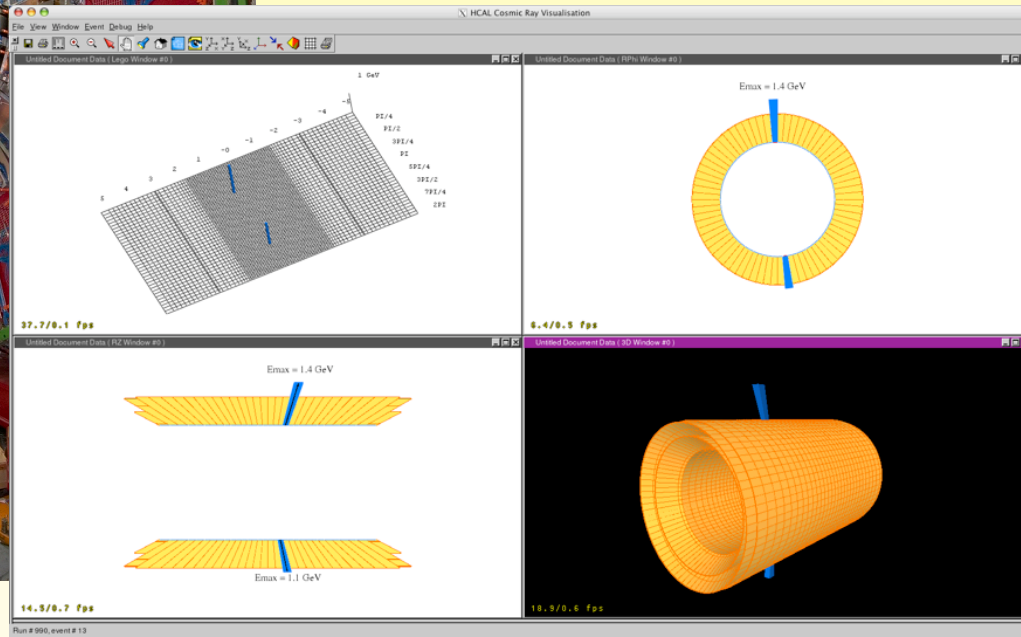
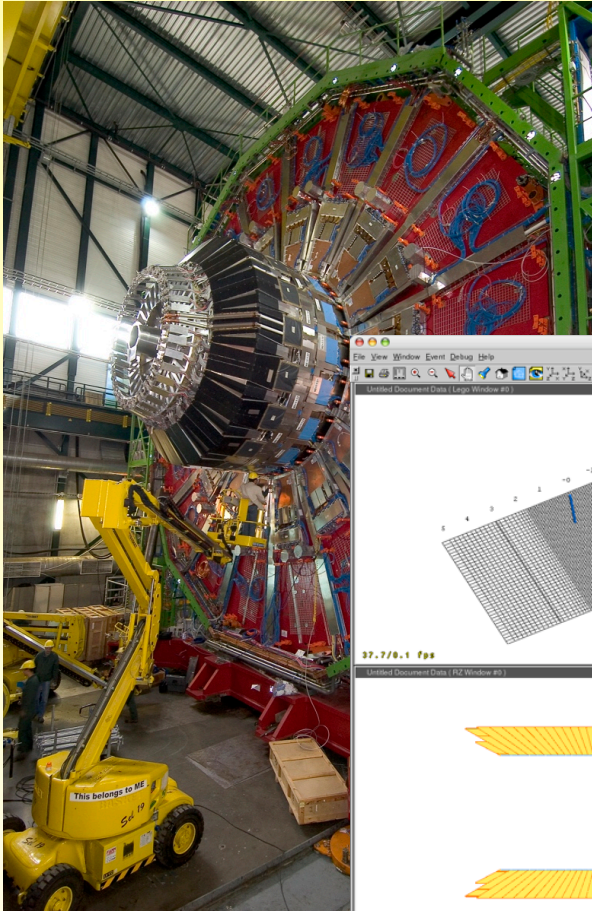




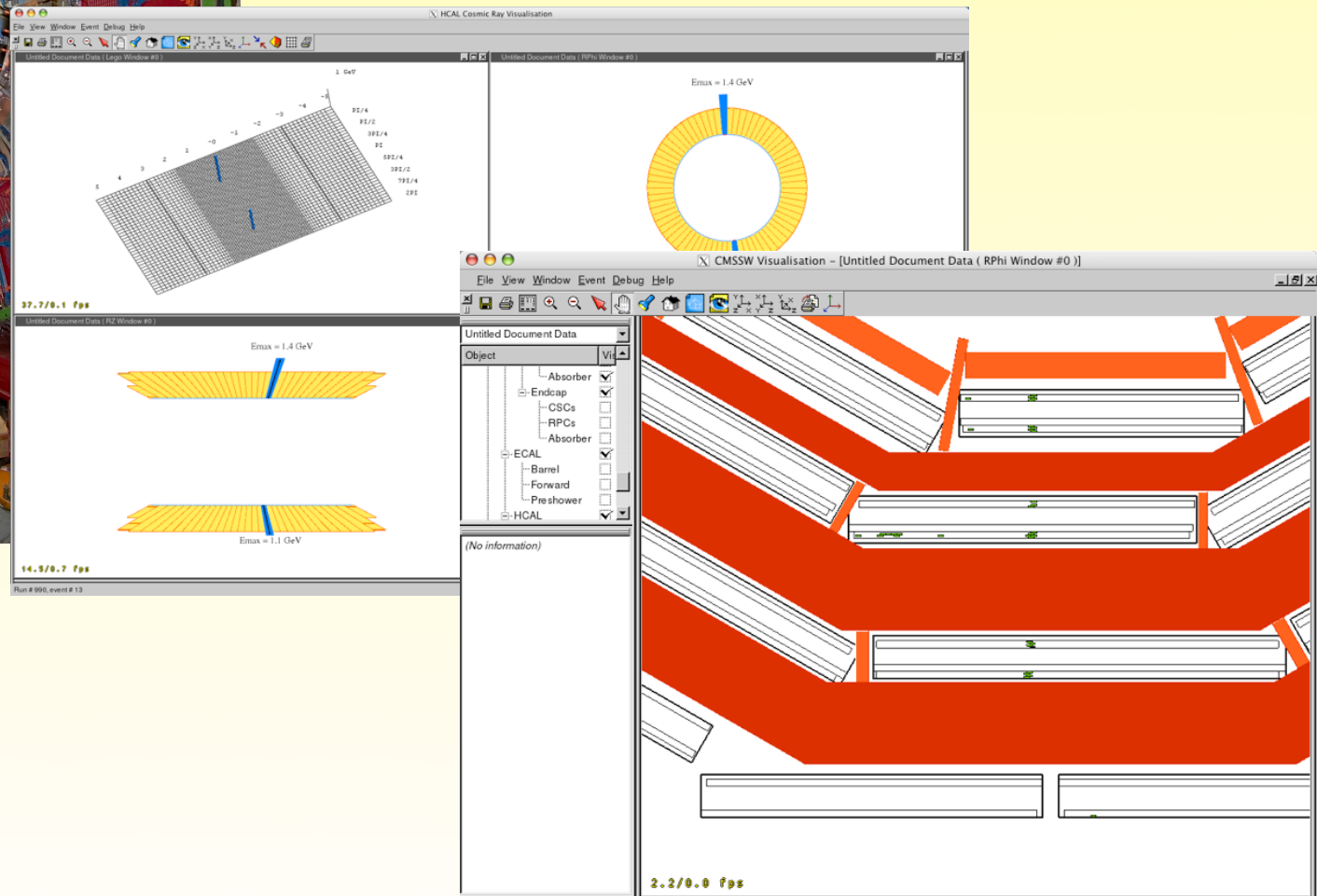
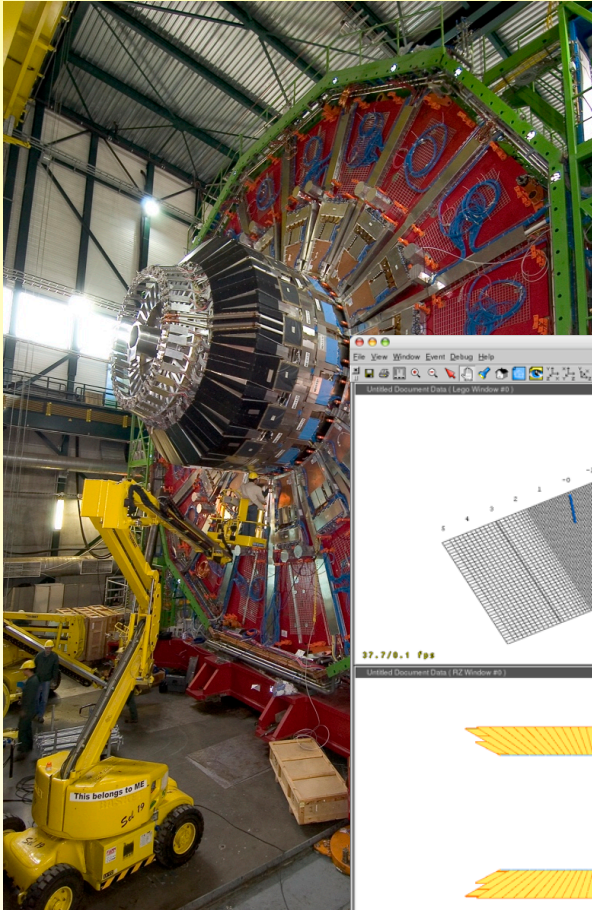


# CMS

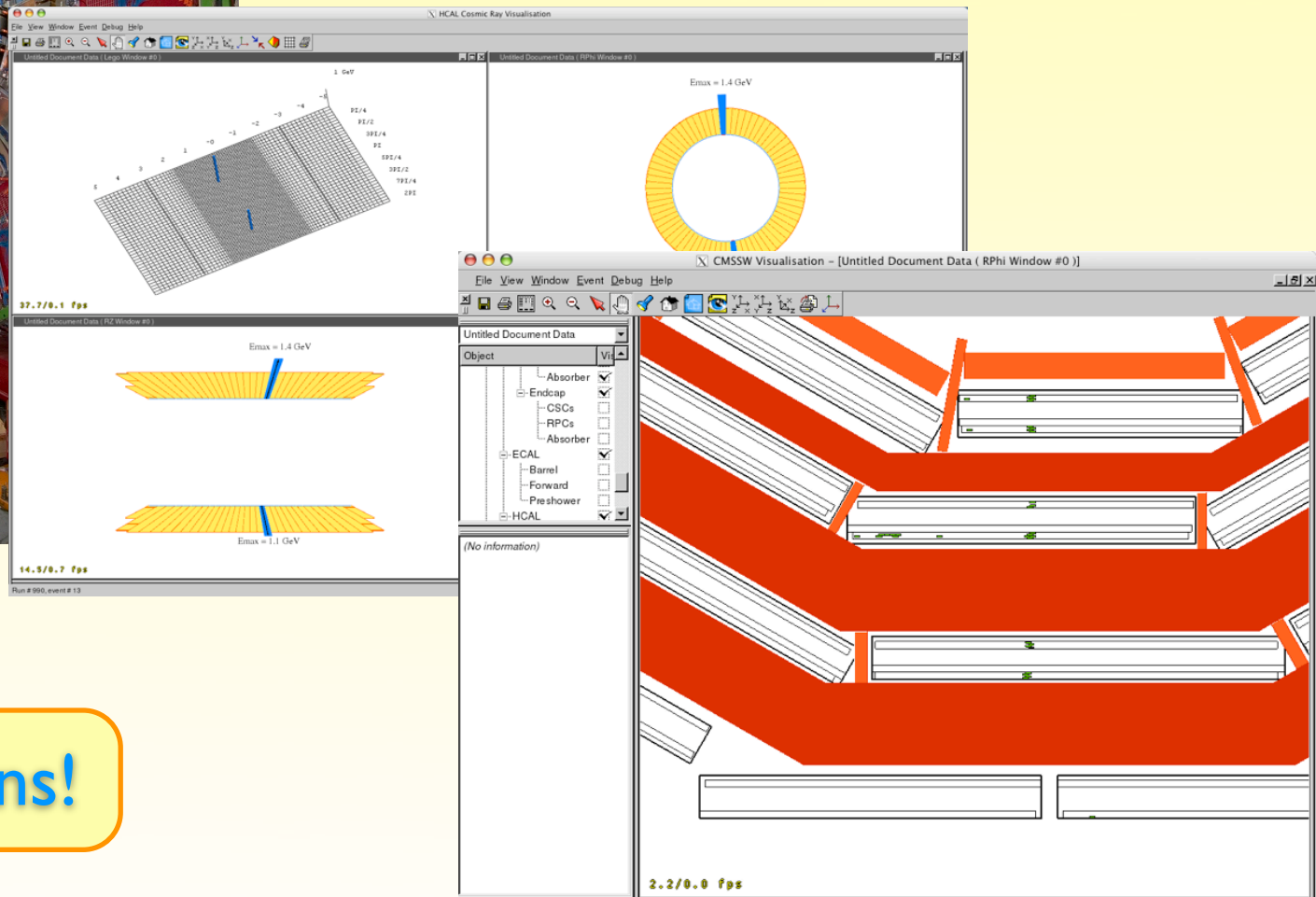
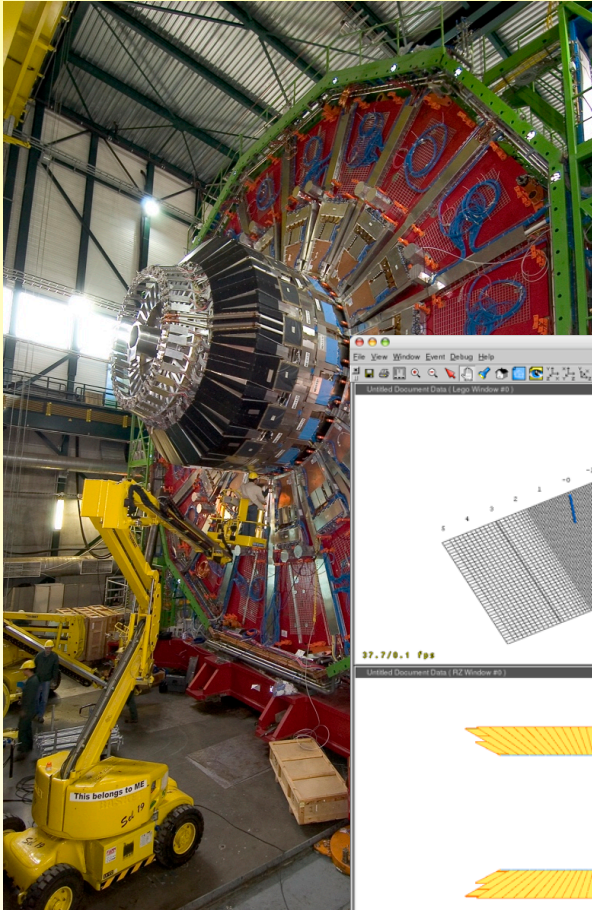
# CMS



# CMS

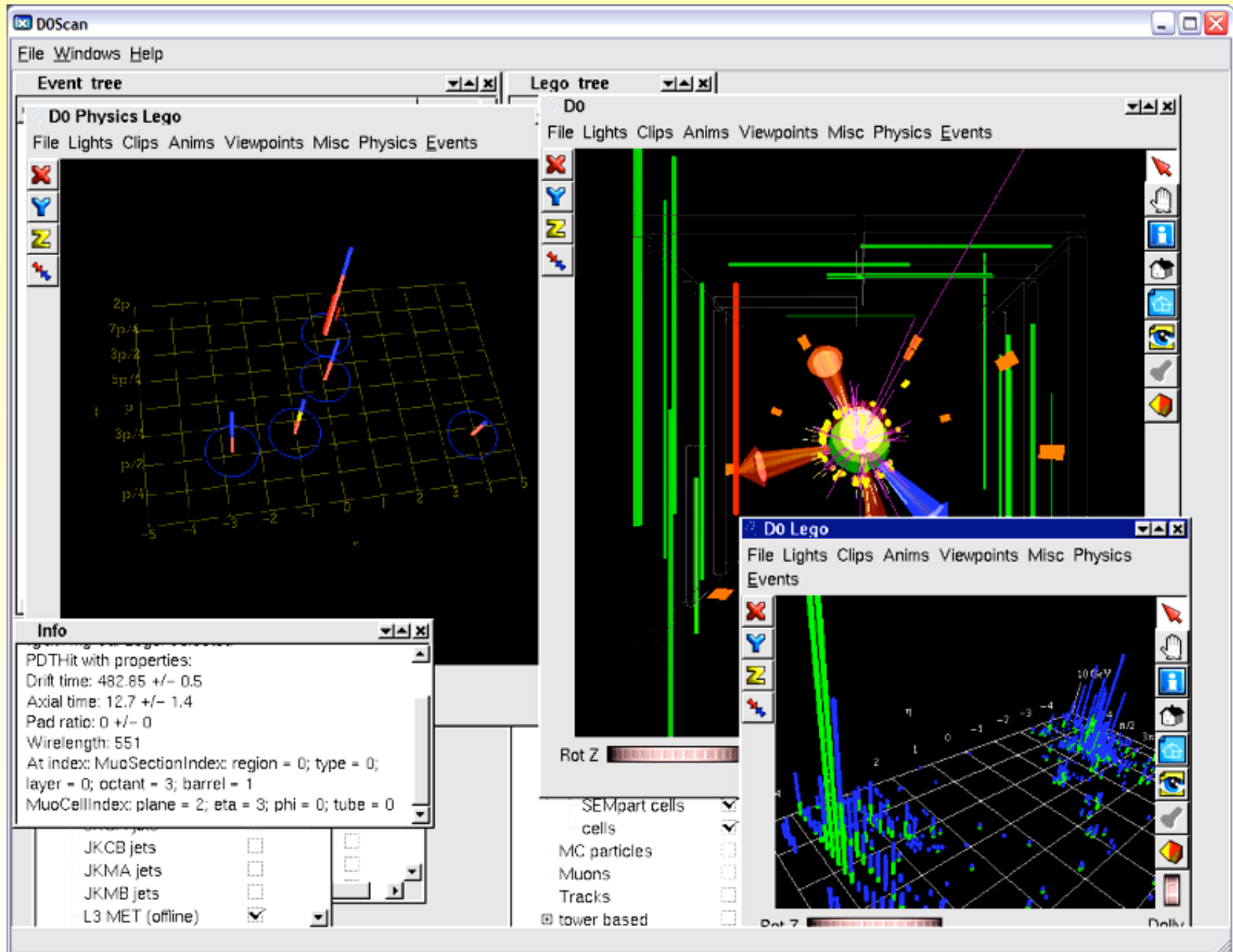


# CMS



Real muons!

# D0



# Custom sub-detectors views

# Custom sub-detectors views

The screenshot displays the IGUANA software interface for visualizing CMS detector components and simulation results. The main window shows a 3D perspective view of the detector with a yellow and orange color scheme. A central window titled 'unnamed' displays a visualization of simulation hits (SimHits) as vertical lines and horizontal bars in various colors (blue, red, black). Below this window are buttons for 'draw SimHits' and 'clear'. To the right, a 'CMS Detector and Event\_tree' panel shows a hierarchical tree of detector components with checkboxes for visibility. The 'TrackerSelection' component is currently selected. Below the tree is another panel with checkboxes for 'Magnet', 'Muon barrel', 'Absorber', 'DT (1st level of details)', 'DT (2nd level of details)', and 'DT (all)'. At the bottom right, a 'CMS Detector and Event\_info' panel displays event details: 'Center position of the module -0.728724 -0.827992 -0.804704', 'single module', and 'silicon barrel'. In the bottom left corner, the text 'Run #1; Event #1' is visible. The interface also includes a menu bar (File, Windows, Help) and a toolbar with navigation icons.

Object	Visibility
CMS Detector and Event	<input checked="" type="checkbox"/>
Detector	<input checked="" type="checkbox"/>
CustomTracker	<input checked="" type="checkbox"/>
TrackerSelection	<input checked="" type="checkbox"/>
ECAL	<input checked="" type="checkbox"/>

Magnet	<input type="checkbox"/>
Muon barrel	<input checked="" type="checkbox"/>
Absorber	<input type="checkbox"/>
DT (1st level of details)	<input type="checkbox"/>
DT (2nd level of details)	<input type="checkbox"/>
DT (all)	<input type="checkbox"/>

Center position of the module -0.728724  
-0.827992 -0.804704  
single module  
silicon barrel

# Custom sub-detectors views

The image displays the IGUANA software interface, which is used for visualizing and analyzing detector data. The main window shows a 3D perspective view of the CMS detector structure, with a color-coded simulation of particle hits. Overlaid on this are several smaller windows:

- Object Visibility Panel:** A tree view showing the hierarchy of objects. The 'TrackerSelection' object is highlighted, indicating it is the current view.
- Tracker Selection View:** A 2D plot showing the distribution of hits in the tracker region, with a central region highlighted in red.
- SimHits View:** A plot showing the raw simulation hits, with a central region highlighted in red.
- Detector Info Panel:** A panel showing the center position of the module (0.674714, -1.26345) and the type of module (silicon forward).

The interface also includes a menu bar (File, Windows, Help) and a status bar at the bottom indicating 'Run #1; Event #1'.



# Custom sub-detectors views

The image displays the IGUANA software interface for visualizing CMS detector components. It features several overlapping windows:

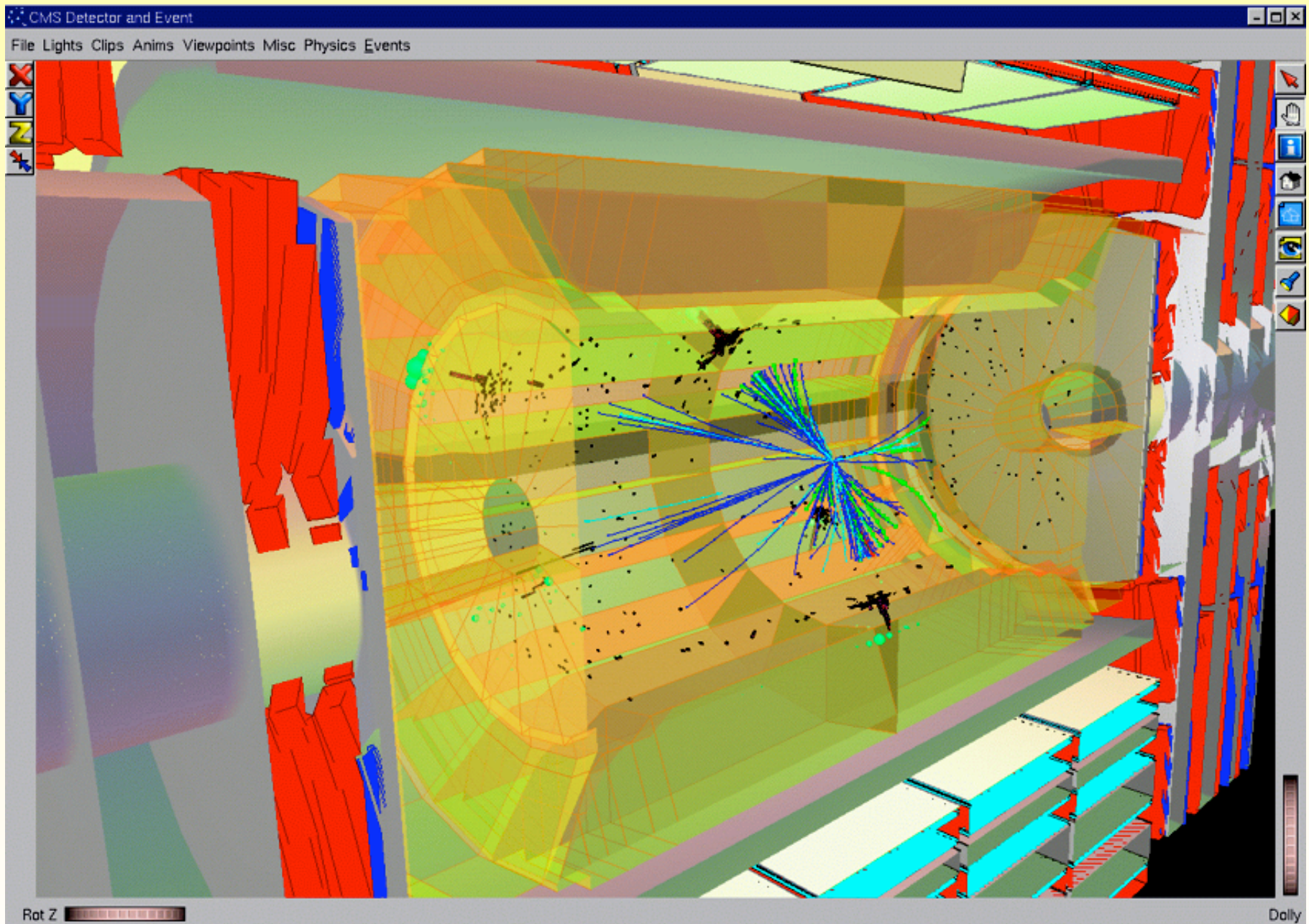
- 3D View (Left):** Shows a 3D reconstruction of the detector with a yellow and orange color scheme. A circular inset at the bottom left shows a top-down view of the detector's cross-section.
- 3D View (Center):** Shows a different 3D view of the detector, possibly a different sub-detector or a zoomed-in section. A circular inset at the bottom right shows a top-down view of this sub-detector.
- Tree View (Top Right):** A hierarchical tree structure showing the detector components. The 'TrackerSelection' sub-detector is highlighted in blue.
- Data Table (Middle Right):** A table with multiple columns, likely representing detector hit data. The 'TrackerSelection' sub-detector is highlighted in blue.
- Control Panel (Bottom Right):** A panel with buttons for 'draw SimHits' and 'clear', and a list of detector components with checkboxes: Magnet, Muon barrel, Absorber, DT (1st level of ...), and DT (2nd level of ...).
- Info Window (Bottom Right):** A window titled 'CMS Detector and Event\_info' displaying the following text:

```
silicon forward  
Center position of the module0.053101  
0.674714 -1.26345  
single module  
silicon forward
```

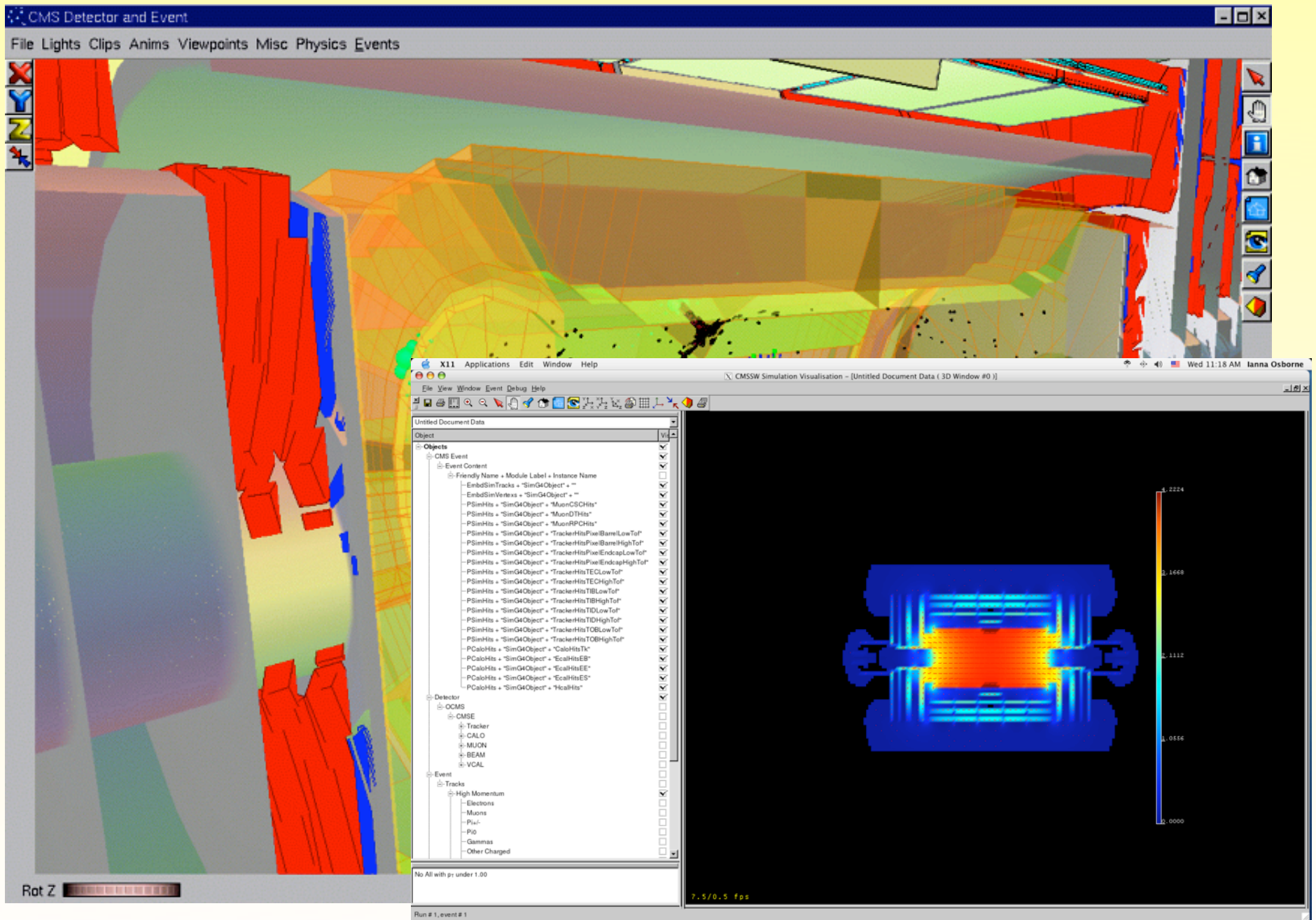
A yellow callout box with the text "Correlated picking" is positioned over the 3D views and the data table, indicating the process of selecting related data points across different views.

# Geant4 visualization

# Geant4 visualization



# Geant4 visualization



# IGUANA on the WEB



Cosmic tests visualization

http://pccmscr13.cern.ch:8080/Cosmics/getPage

Firefox Help Firefox Support Plug-in FAQ Apple Hot News

**Tree Browser**

- Reco Detector ✓
- Calorimetry ✓
  - Ecal Laser Pn Diode ✓
  - Ecal Trigger Tower ✓
  - Ecal Preshower ✓
  - Ecal Endcap ✓
  - Ecal Barrel ✓
  - Hcal Forward ✓
  - Hcal Outer ✓
  - Hcal Endcap ✓
  - Hcal Barrel ✓
- Event ✓
  - HCAL Event ✓
  - Hcal Barrel and Endcap RecHits ✓
  - CMS Detector ✗

**3D Toolbar**

**Event Toolbar**

**R-Z Window**

**Lego Window**

**R-Phi Window**

# IGUANA on the WEB



Cosmic tests visualization

http://pccmscr13.cern.ch:8080/Cosmics/getPage

Firefox Help Firefox Support Plug-in FAQ Apple Hot News

**Tree Browser**

- Reco Detector ✓
- Calorimetry ✓
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  - Ecal Endcap ✓
  - Ecal Barrel ✓
  - Hcal Forward ✓
  - Hcal Outer ✓
  - Hcal Endcap ✓
  - Hcal Barrel ✓
- Event ✓
  - HCAL Event ✓
  - Hcal Barrel and Endcap RecHits ✓
  - CMS Detector ✗

**3D Toolbar**

**Event Toolbar**

**R-Z Window**

**Lego Window**

**R-Phi Window**


AJAX  
enabled GUI

# IGUANA on the WEB

http://pccms226.cern.ch:36413/Mantis/getPage

http://pccms226.cern.ch:36413/Mantis/ge ~ Q- yahoo mail

GMail sunrise mobile portal Giornali Geek Apple Linux Notizie Programming CMS Misc Blogs APROM Clarens Geneve




CMS Interactive Web Interface (powered by IGUANA)


**Tree browser**

- / ✓
- Event ✗
- + Hits ✓
- Tracks ✓
- + Low Momentum ✓
- High Momentum ✓
- + All ✓
- + Other Neutral ✗
- + Other Charged ✗
- + Gammas ✗
- + P10 ✗
- + Pi+/- ✗
- + Muons ✗
- + Electrons ✗
- Detector ✓
- OCMS ✗
- CMSE ✗
- + VCAL ✗
- + BEAM ✗
- + MUON ✗
- + CALO ✗
- TRAK ✗
- PXL ✗
- + PXS ✓
- + PFXM ✓
- + PFXL ✗
- + PBXS ✓
- + PBXL ✓
- SVTX ✗
- + GBSC ✗
- + TGBX ✓
- + GFB0 ✓
- + GFSC ✗
- + TGFA ✗
- + TGFX ✗

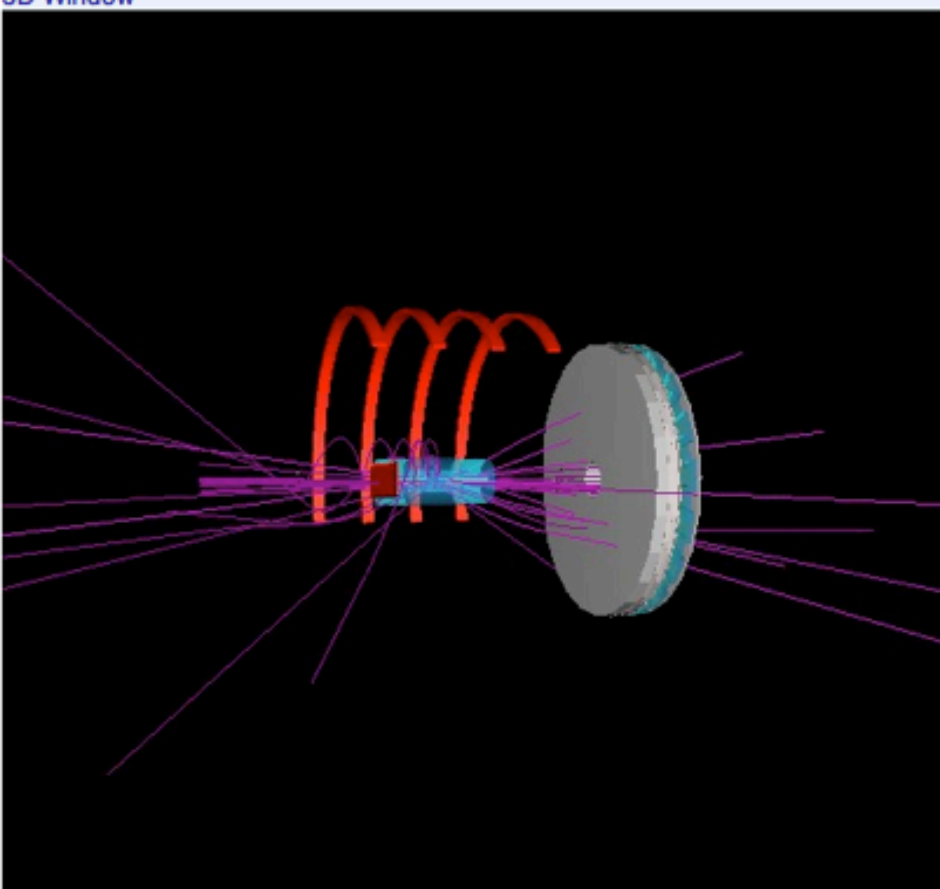
**3D Toolbar**



**Event Toolbar**



**3D Window**

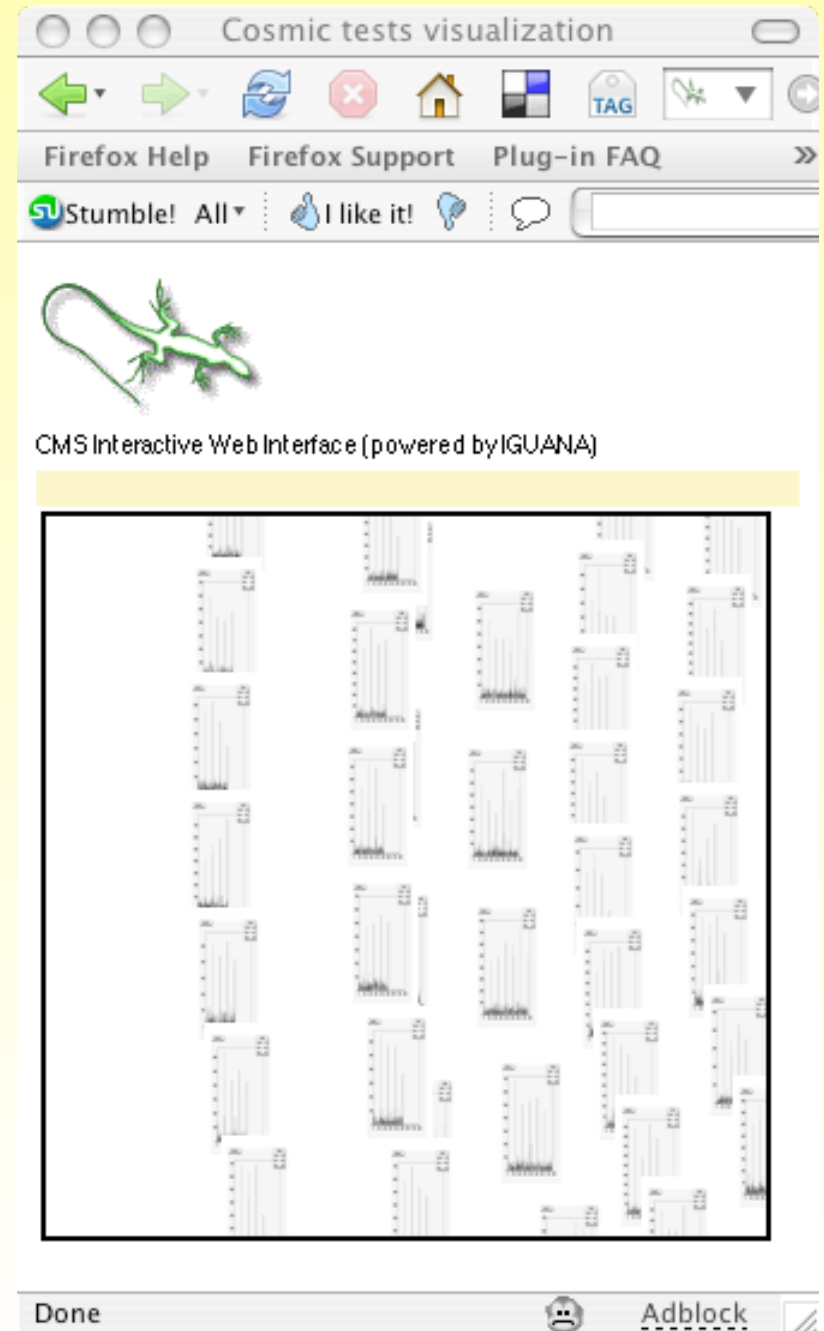
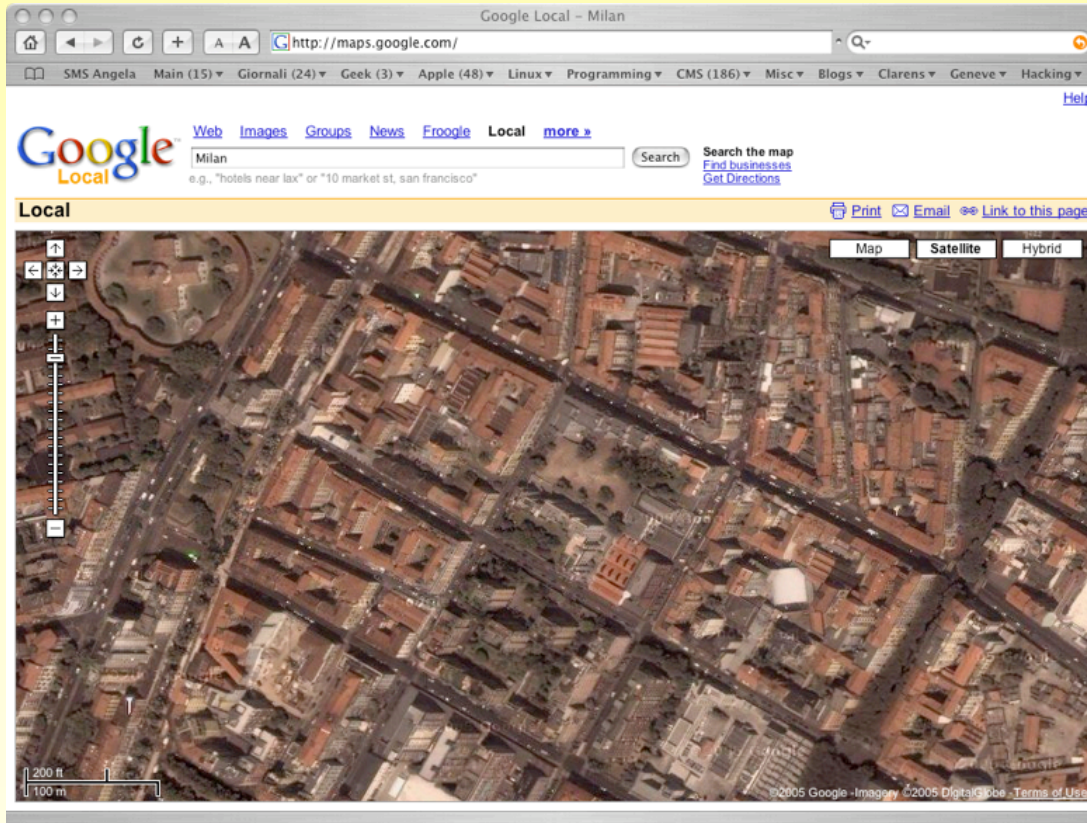


There was one error opening the page. For more information, choose Activity from the Window menu.





# IGUANA on the WEB

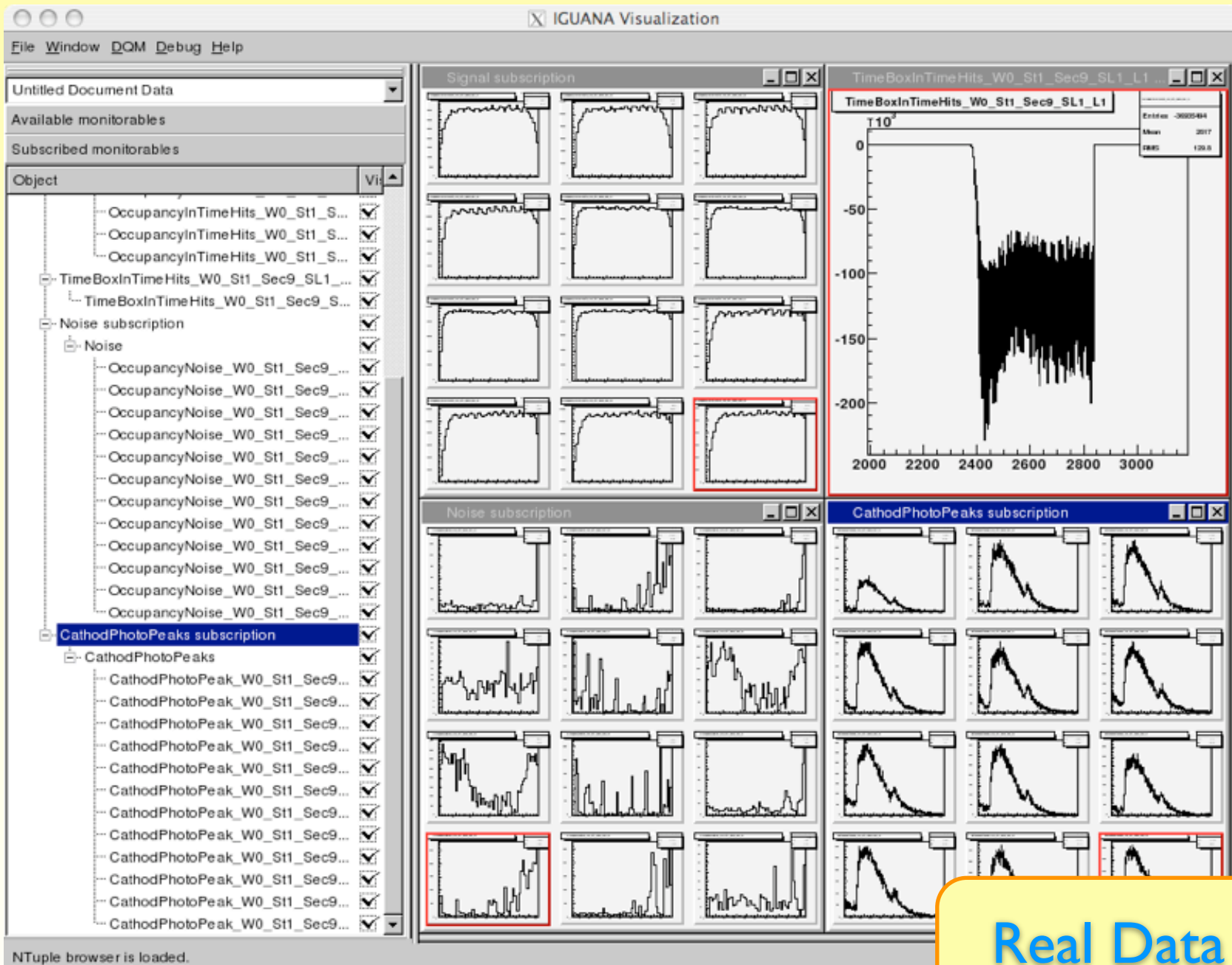


In collaboration with Giuseppe Zito  
and Maria Mennea

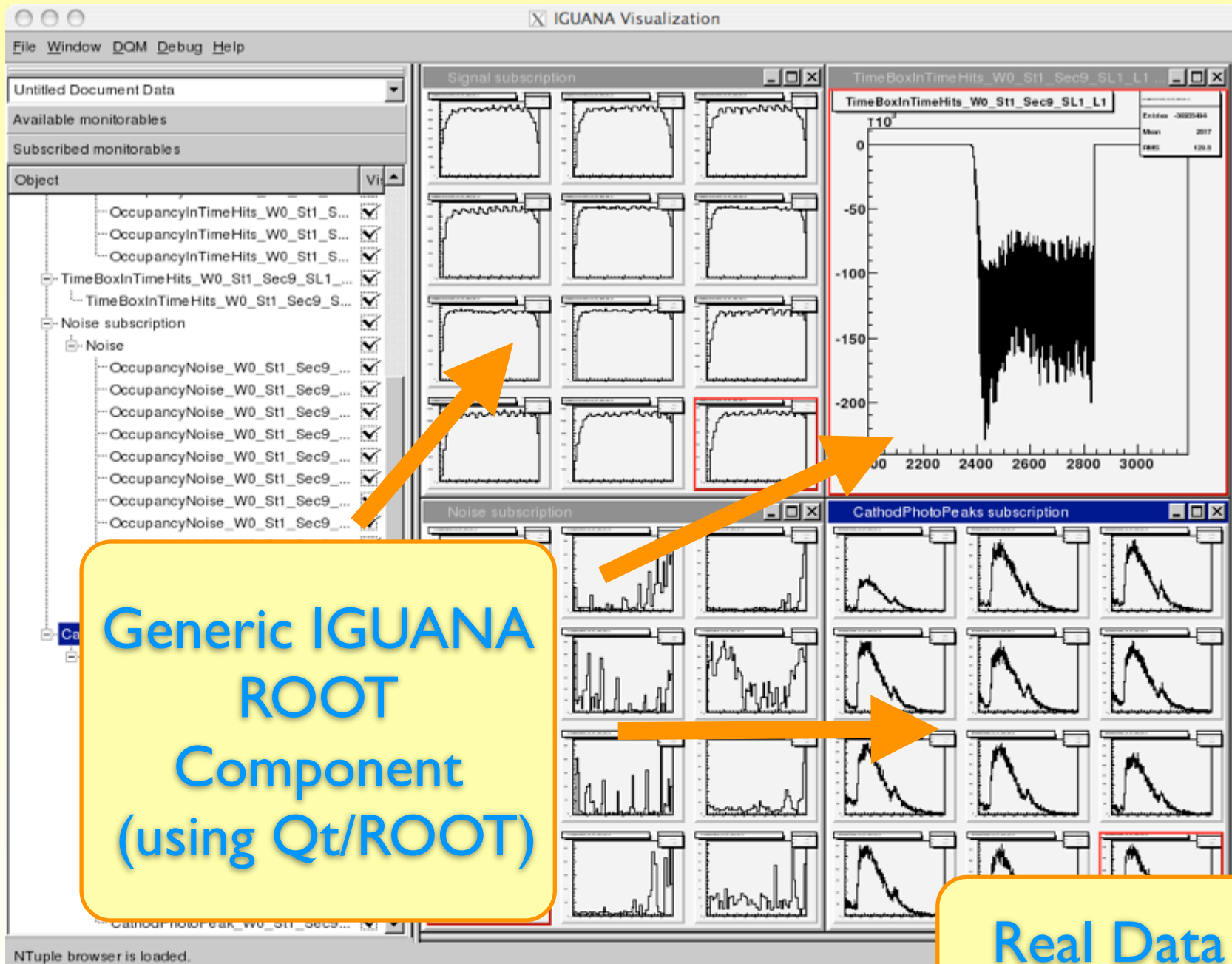
Tracker monitoring  
histograms

...and yes, “we do ROOT too”...

- Uses QT/Root (thanks to Valeri Fine)
- Works in multithreaded environment (using a giant QT lock)
- Provides the ability of layout-ing histograms using an XML file (thanks to Andrea Carboni)



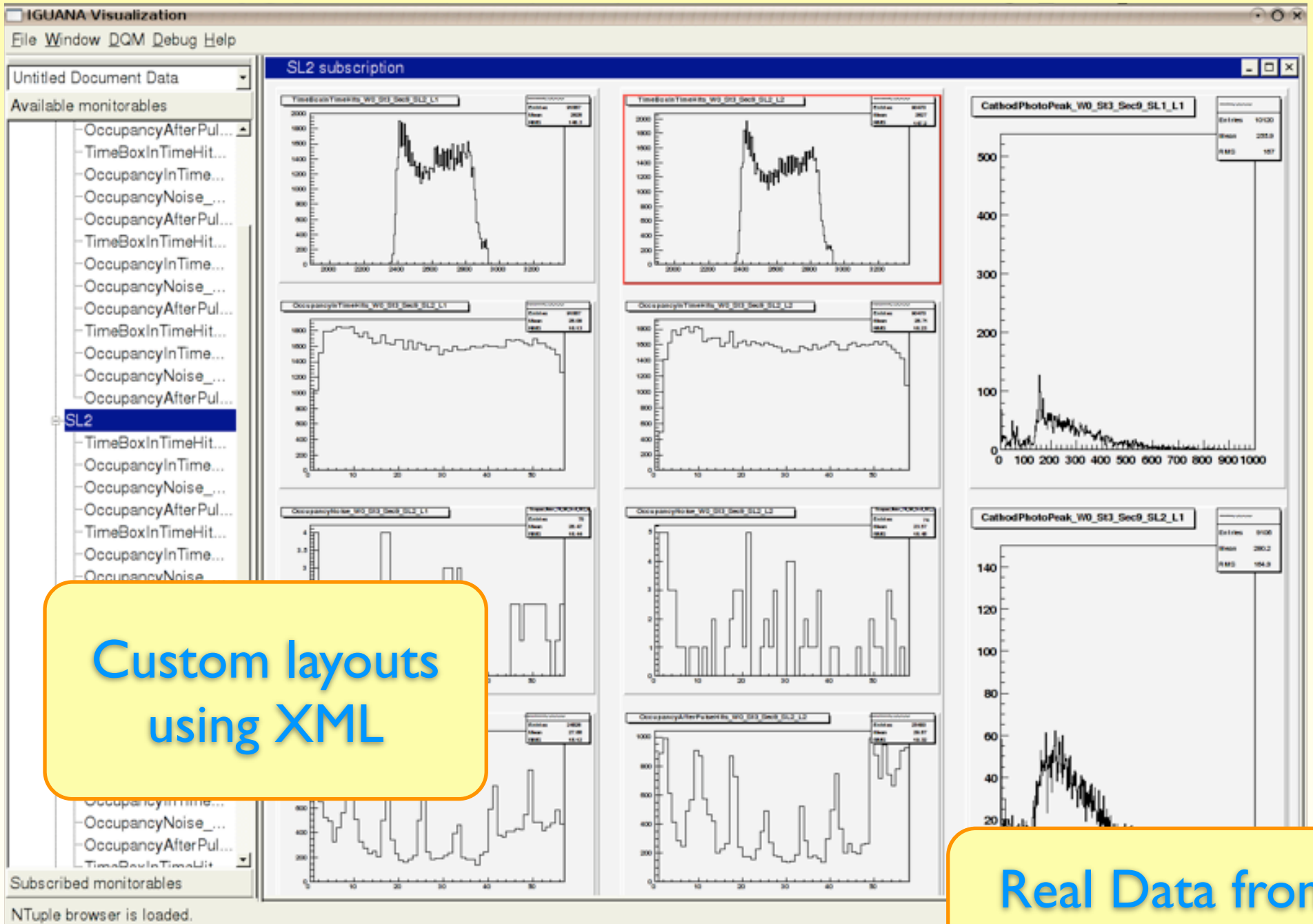
Real Data from  
CMS DT



**Generic IGUANA  
ROOT  
Component  
(using Qt/ROOT)**

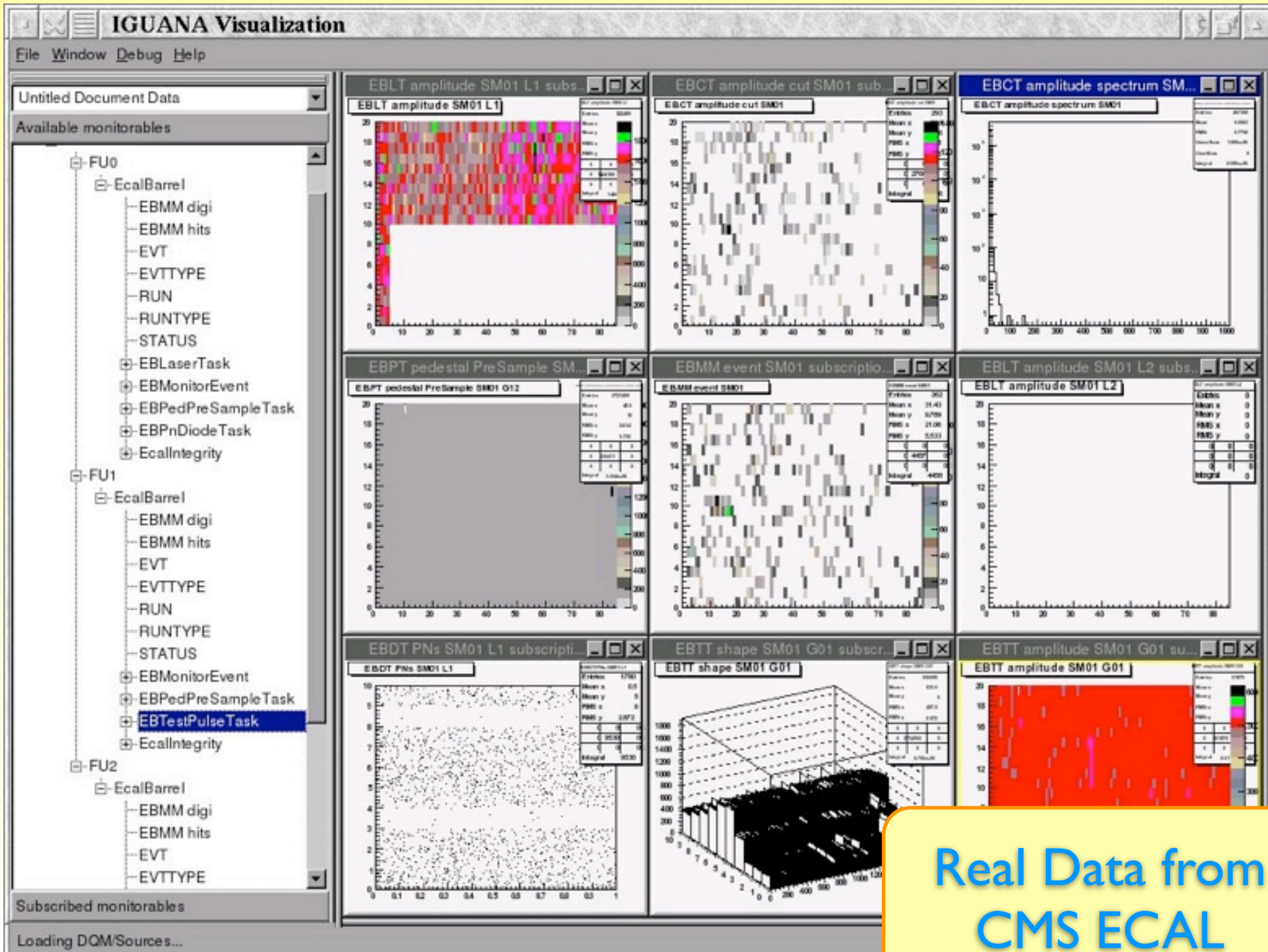
**Real Data from  
CMS DT**





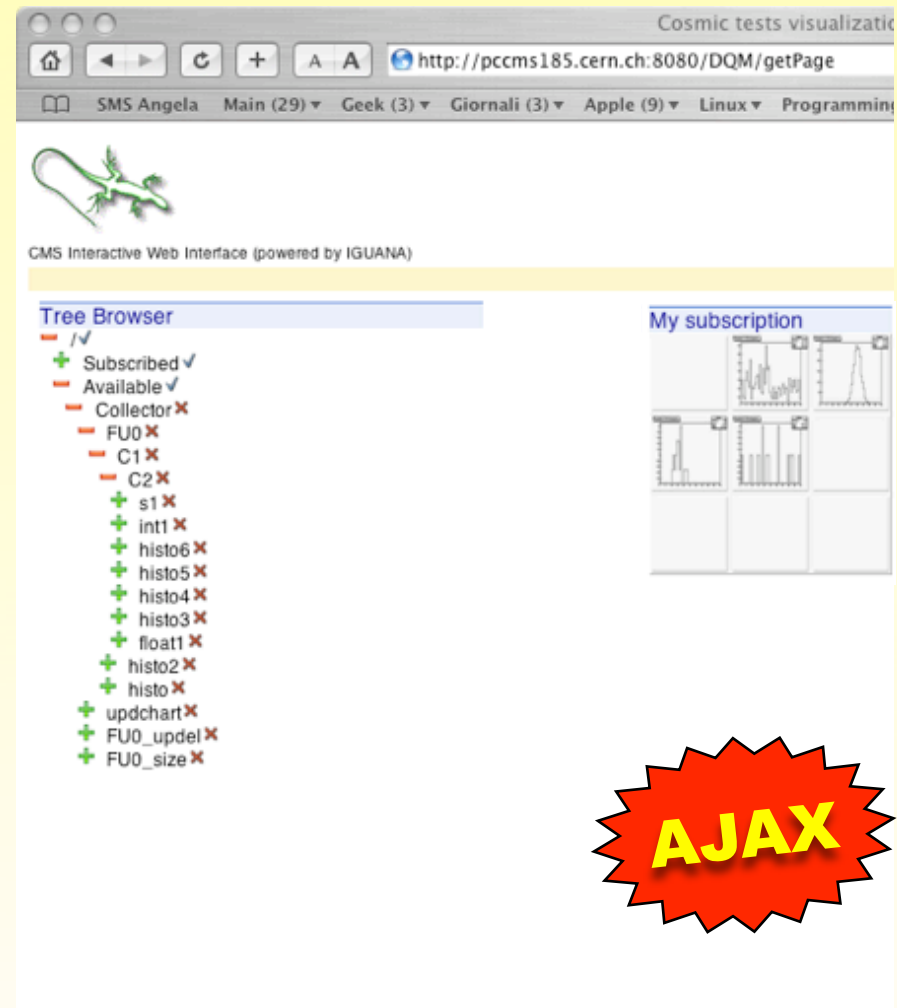
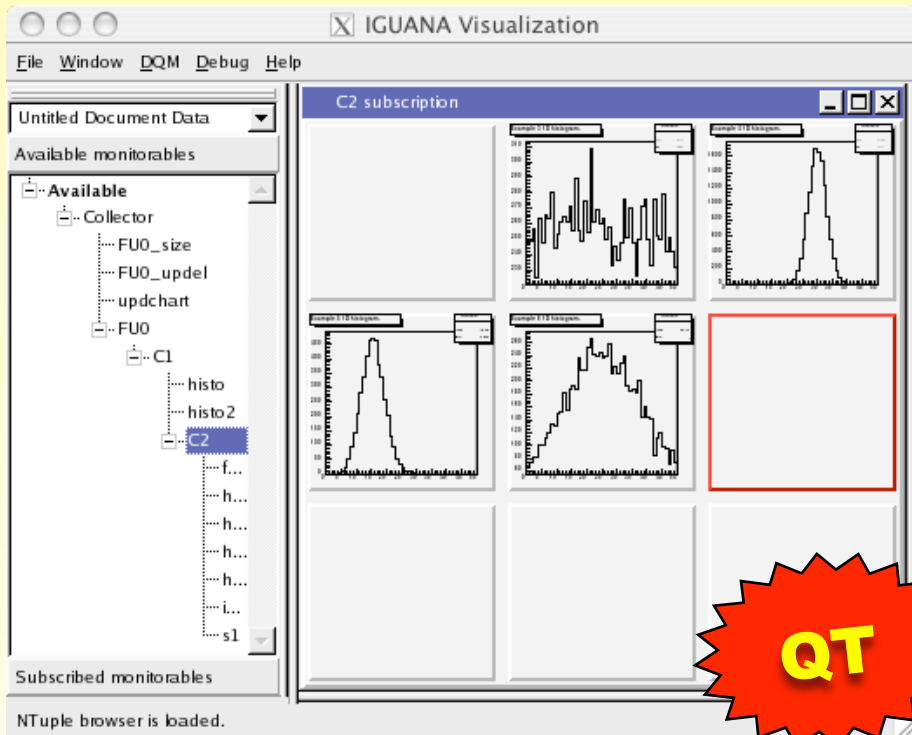
Custom layouts  
using XML

Real Data from  
CMS DT



Courtesy of Giuseppe Della Ricca

# Works on the web as well



The two applications share all the backend code. Only the GUI layer is different



# Desiderata

- After initial problems due to dead lock in Qt/Root, now everything works fine
- Port to QT4
- Ability to draw directly to a QPixmap (yes, I know I can create a dummy QWidget, I just don't like it)
- QT-ification of popup menus and ROOT panels?

...getting ready for data taking...



ROC @ FNAL

Courtesy of Alan Stone