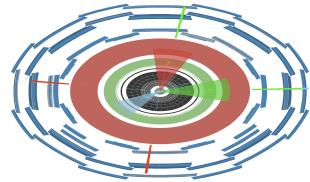


The ATLANTIS Tutorial

Stephen Bieniek, Eric Jansen and Juergen Thomas



ATLANTIS EVENT DISPLAY FOR ATLAS



Loading Atlantis

The easiest way to use Atlantis is from the webstart, found here:

<http://www.hep.ucl.ac.uk/atlas/atlantis/?q=download>

Click on the “Webstart” option, for
Temporary: Tutorial version:
AtlantisJava-09-16-02-06

Alternatively you can download it directly
to your laptop by clicking on the Download
option, or from a terminal:

```
$ wget https://atlantis.web.cern.ch/  
atlas/download/  
AtlantisJava-09-16-02-06.tgz
```

Then:

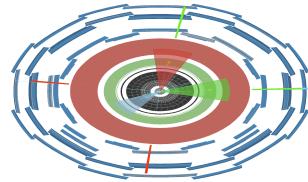
```
$ tar xzf AtlantisJava-09-16-02-06.tgz  
$ cd AtlantisJava-09-16-02-06  
$ java -jar atlantis.jar
```

The screenshot shows the ATLANTIS EVENT DISPLAY FOR ATLAS website. At the top, there's a logo of the ATLAS detector and the title "ATLANTIS EVENT DISPLAY FOR ATLAS". Below the title are several navigation links: Home, Announcements, ATLAS Live, Atlantis in news, Introduction, Documentation, Download, Install, JiveXML, and Contact us. The main content area has several sections: "SVNWeb links" (listing various XML files like AtlantisJava, AnalysisJiveXML, CaloJiveXML, etc.), "Other links" (listing forums, twikis, and groups), and "Atlantis downloads" (listing production, development, and old versions). A specific section for the temporary tutorial version is highlighted with a red box and a red arrow pointing to the "Webstart" link. This section also lists the download links for AtlantisJava-09-16-02-06.tgz and AtlantisJava-09-16-02-06.zip. To the right, there are sections for "Specific configurations" (listing various ACR types) and "Picture database" (listing event types like LHC start up beam events, Black hole, etc.).

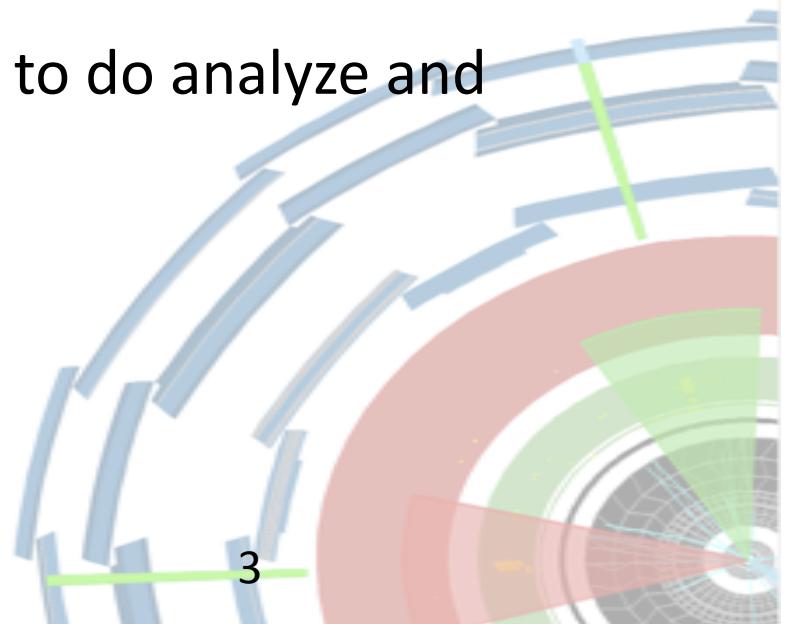
Temporary: tutorial version: AtlantisJava-09-16-02-06

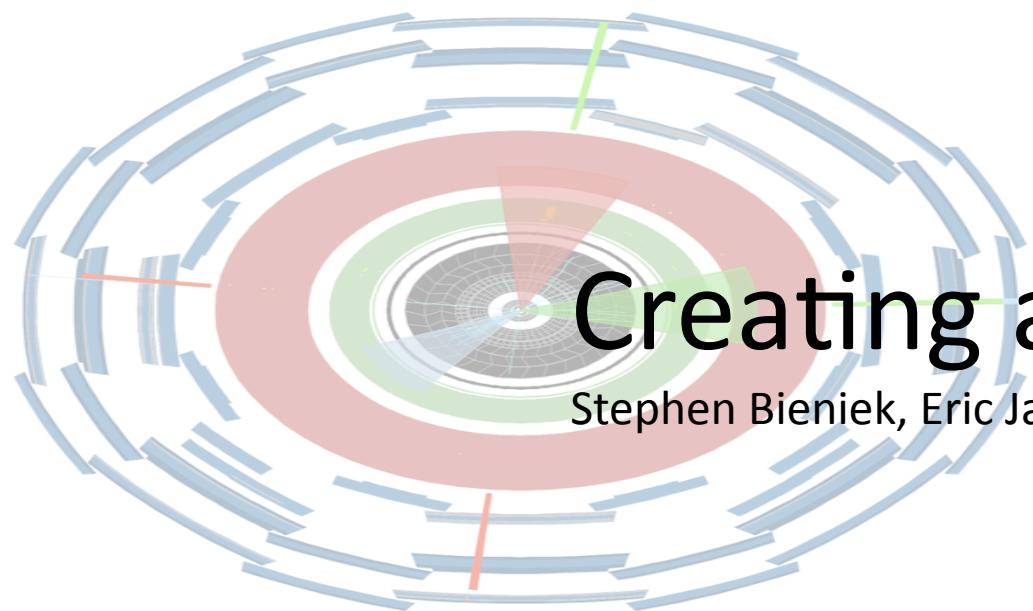
- Download: [AtlantisJava-09-16-02-06.tgz](https://atlantis.web.cern.ch/atlas/download/AtlantisJava-09-16-02-06.tgz), [AtlantisJava-09-16-02-06.zip](https://atlantis.web.cern.ch/atlas/download/AtlantisJava-09-16-02-06.zip)
- Webstart





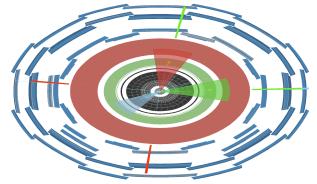
- 1) Introductory Atlantis Session: Creating an event display
- 2) Getting Data into Atlantis
- 3) Advanced Atlantis Session: How to do analyze and event with Atlantis.





Creating an event display

Stephen Bieniek, Eric Jansen and Juergen Thomas



1) An overview of ATLANTIS: ATLANTIS

ATLA_S eveNT dISplay

Atlantis provides a graphical representation of events to allow an intuitive understanding of what's going on. The mission statement so to speak is:

“Try to put data from the ATLAS detector into the human brain in an intuitive way, so the human may make fast and correct conclusions. This is largely accomplished by using dataoriented projections.” - *Hans Drevermann*

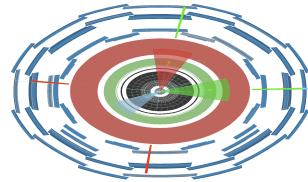
The current team is:

*Tom McLaughlan, Juergen Thomas, Peter Watkins (Birmingham, UK) Peter Klok (Nijmegen, NL)
Nikos Konstantinidis, Eric Jansen, Adam Davison, Stephen Bieniek, Ben Waugh (UCL, UK)*

To contact our team with and questions or problems, email us on:

hn-atlas-AtlantisDisplay@cern.ch

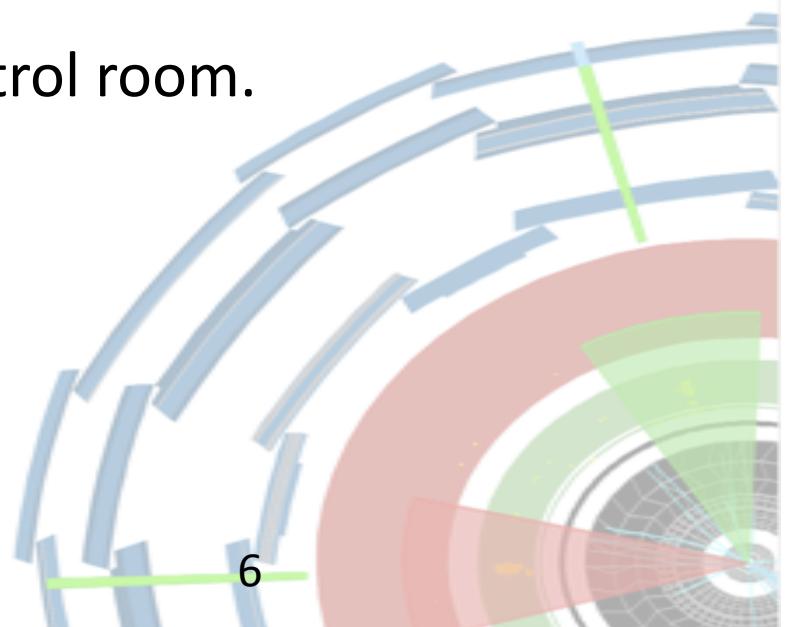


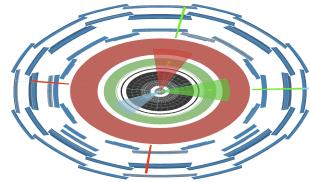


2) An overview of ATLANTIS:
What ATLANTIS is used for

ATLANTIS is used for 4 main tasks:

- 1) Creating event displays for publication:
- 2) Analysis of an individual event
- 3) Detector calibration
- 4) Monitoring the run in the control room.



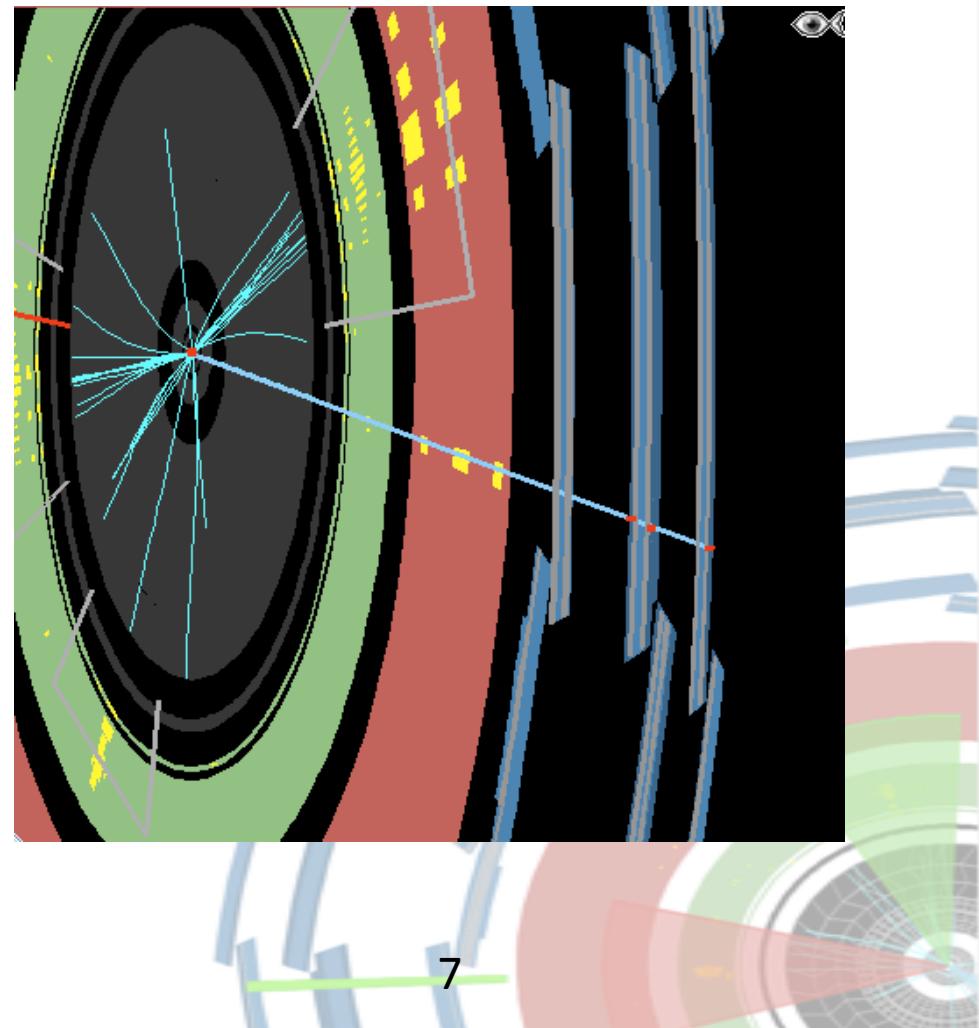


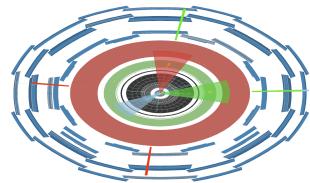
2) An overview of ATLANTIS: Analysis of an individual event

This will be covered in the second half of this tutorial.

By eye we can see clearly an electron and a muon in this event:

- 1) The electron is identified by its single track depositing all its energy in the Lar.
- 2) The muon is given away from the clear hits in the muon detectors. The 3 equal hits in the TILE are also a strong indication that this is a real muon, not a pion that punched through.



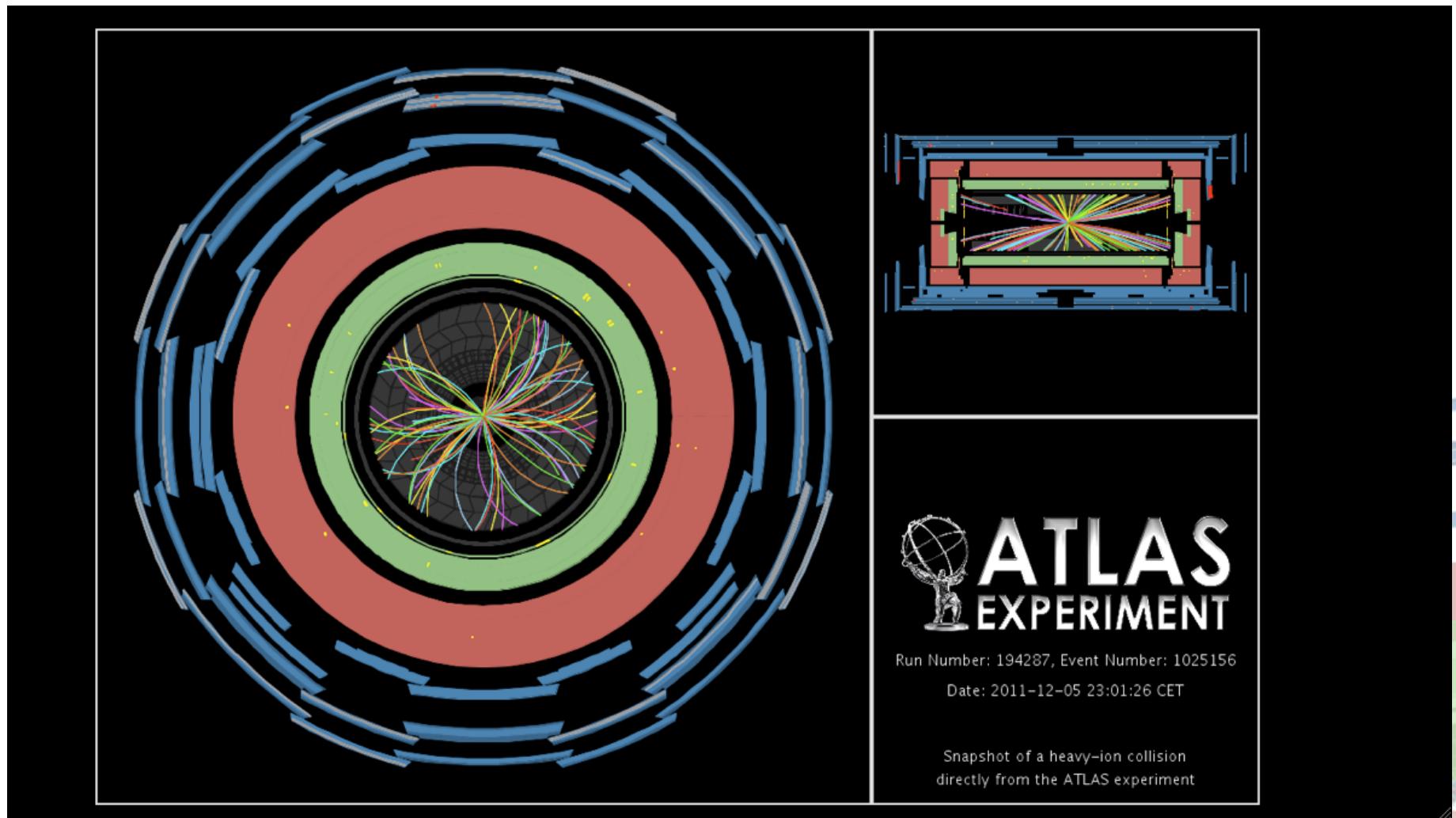


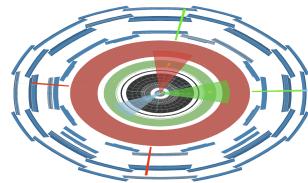
ATLANTIS EVENT DISPLAY FOR ATLAS



2) An overview of ATLANTIS: Monitoring in the control room

There are two screens in the ATLAS control room showing live events. Live (when available) events can be seen by the public here: <http://atlas-live.cern.ch/>



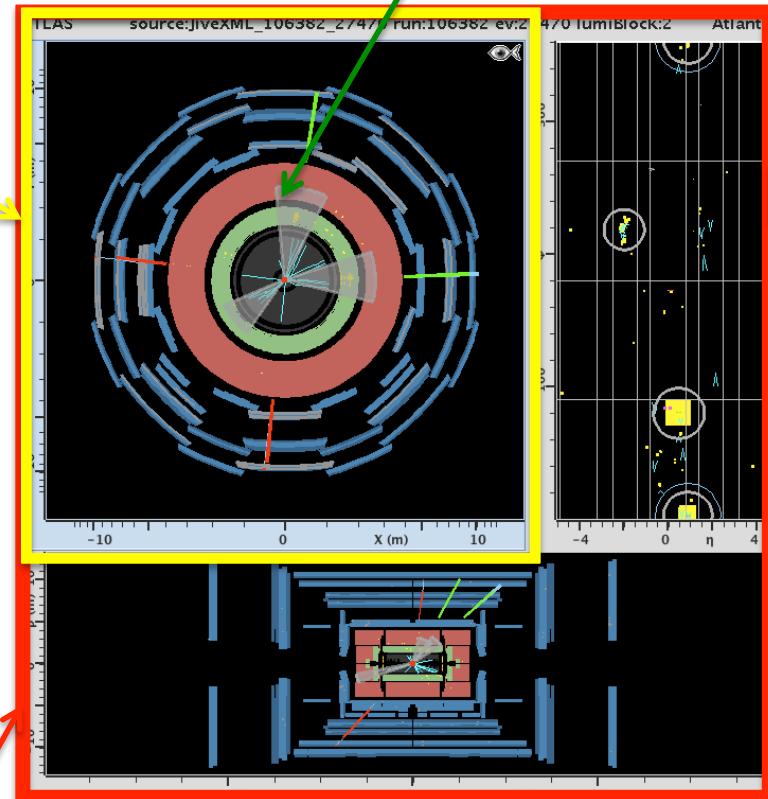


ATLANTIS EVENT DISPLAY FOR ATLAS



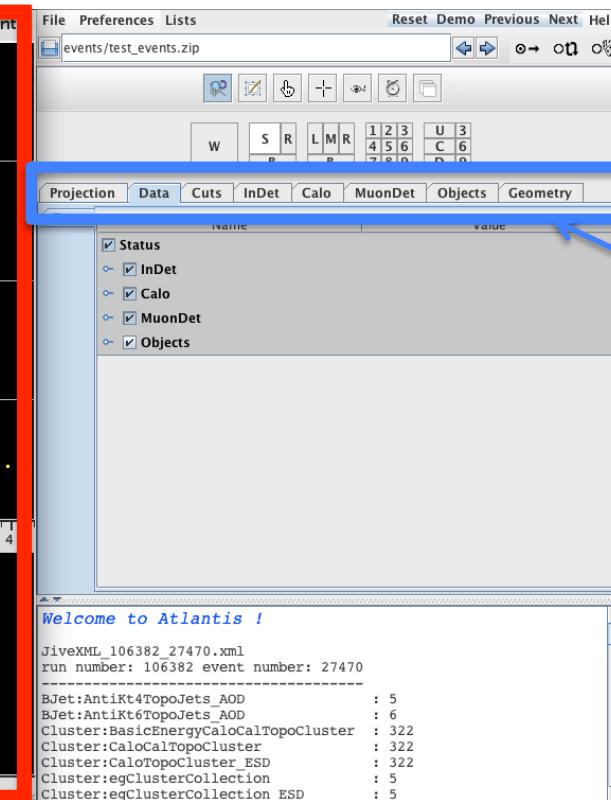
2) An overview of ATLANTIS: The GUI

A window
(contains a
projection)

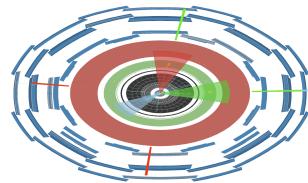


The canvas, shows the
event display

A projection, shows information
about the event



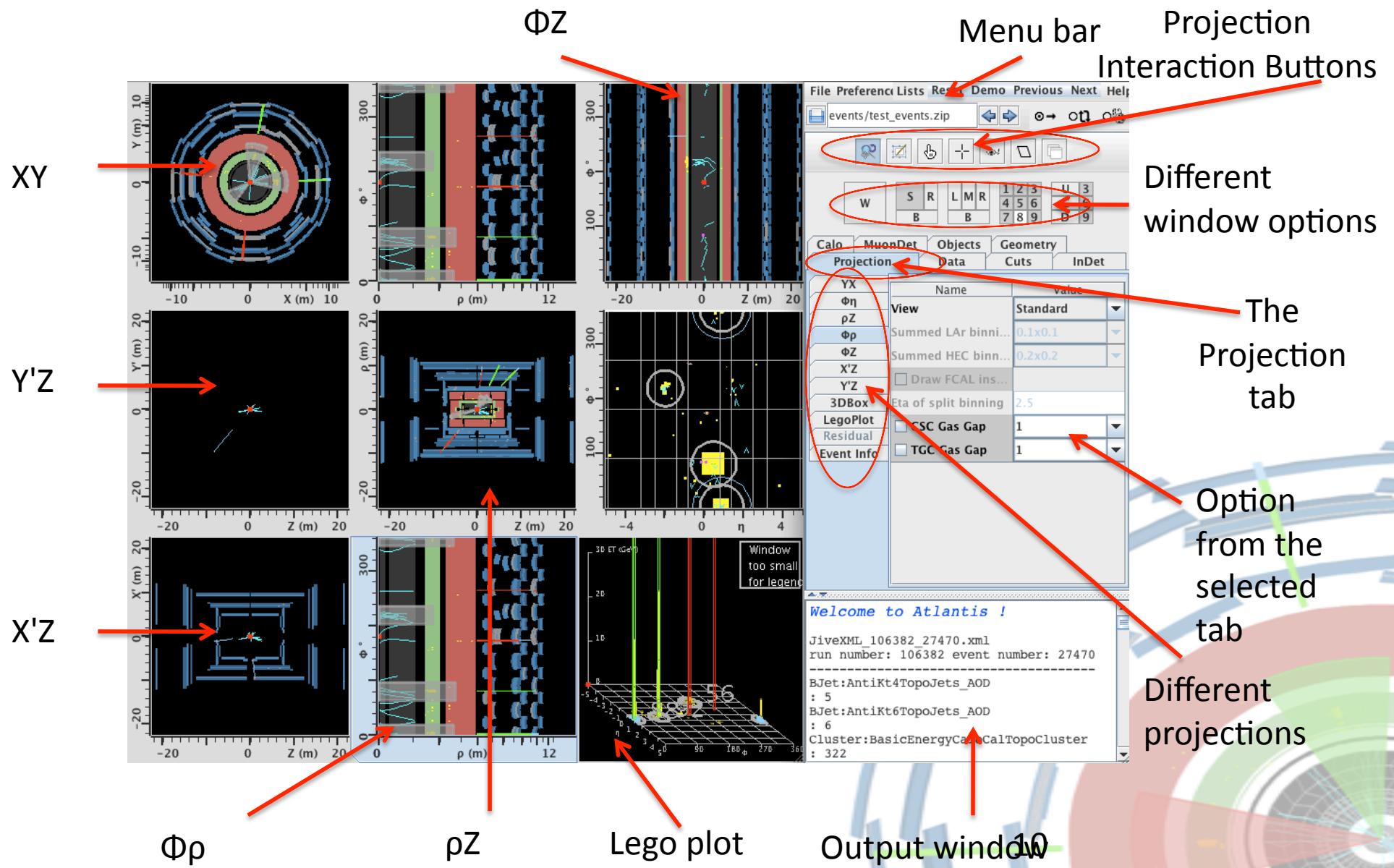
The tabs, how
the different
event display
controls are
organized

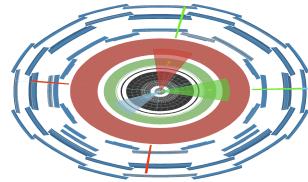


ATLANTIS EVENT DISPLAY FOR ATLAS



2) An overview of ATLANTIS: Projections





ATLANTIS EVENT DISPLAY FOR ATLAS



2) An overview of ATLANTIS: Objects

Electron

Object Tab

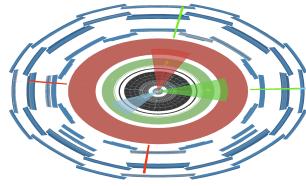
Different Objects

Muon

Jet

11

The image shows a screenshot of the ATLANTIS event display software. On the left, a circular event display visualization shows several particles: an electron (green arrow), a muon (red arrow), and a jet (blue arrow). These particles are highlighted with red circles. On the right, the software's configuration interface is shown, featuring a tabbed panel labeled "Objects". This panel contains settings for different particle types, such as Jet, ETMis, BJet, Electron, Muon, Photon, Taujet, and CompPart. The "CompPart" tab is currently selected. The interface also includes tabs for Calo, MuonDet, Geometry, Data, Cuts, and InDet. A status bar at the bottom displays the message "Welcome to Atlantis!" and the file path "JiveXML_106382_27470.xml". A page number "11" is visible in the bottom right corner.



ATLANTIS EVENT DISPLAY FOR ATLAS



The "Data" tab allows you to control what information from the event file is shown in ATLANTIS. If a data type is shown in blue, the option will be applied to all projections. If it is in black, then the option will be applied to only the current, 'local', projection. This can be changed by right/alternative clicking on the date type and selecting the new option

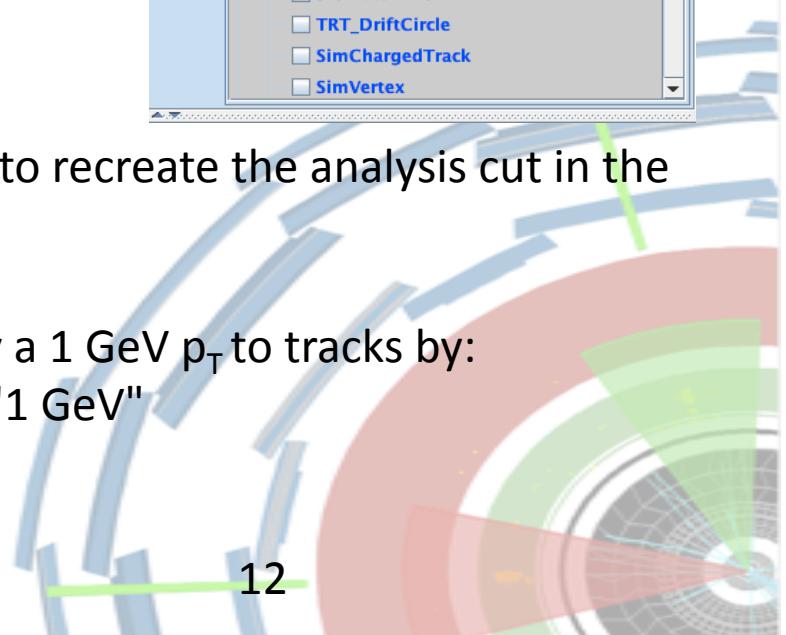
This screenshot shows the ATLANTIS software interface with the "Data" tab selected. The top menu bar includes File, Preferences, Lists, Reset, Demo, Previous, Next, and Help. Below the menu is a toolbar with various icons. A navigation panel on the left shows a grid layout (W, S, R, L, M, R, U) with sub-sections B, 1, 2, 3, 4, 5, 6, 7, 8, 9, C, D, and 3, 6, 9. The main panel has tabs for Calo, MuonDet, Objects, Geometry, Projection, Data, Cuts, and InDet. The "Cuts" tab is highlighted with a red circle. On the left, a sidebar lists categories like InDet, Calo, MuonDet, Objects, and ATLAS, each with a list of selection checkboxes. One checkbox under "InDet" is checked and highlighted with a red circle, while others are in blue.

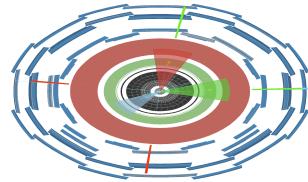
2) An overview of ATLANTIS: Data and Cuts tab

This screenshot shows the ATLANTIS software interface with the "Cuts" tab selected. The top menu bar includes File, Preferences, Lists, Reset, Demo, Previous, Next, and Help. Below the menu is a toolbar with various icons. A navigation panel on the left shows a grid layout (W, S, R, L, M, R, U) with sub-sections B, 1, 2, 3, 4, 5, 6, 7, 8, 9, C, D, and 3, 6, 9. The main panel has tabs for Calo, MuonDet, Objects, Geometry, Projection, Data, Cuts, and InDet. The "Cuts" tab is highlighted with a red circle. A detailed table titled "Status" is displayed, listing various particle types and their selection status. Many checkboxes are checked and highlighted in blue, indicating they apply to all projections. Some checkboxes are in black, indicating they apply only to the local projection.

The "Cuts" tab allows you to recreate the analysis cut in the displayed event.

For instance, we can apply a 1 GeV p_T to tracks by:
Cuts -> InDet -> Pt > "1 GeV"

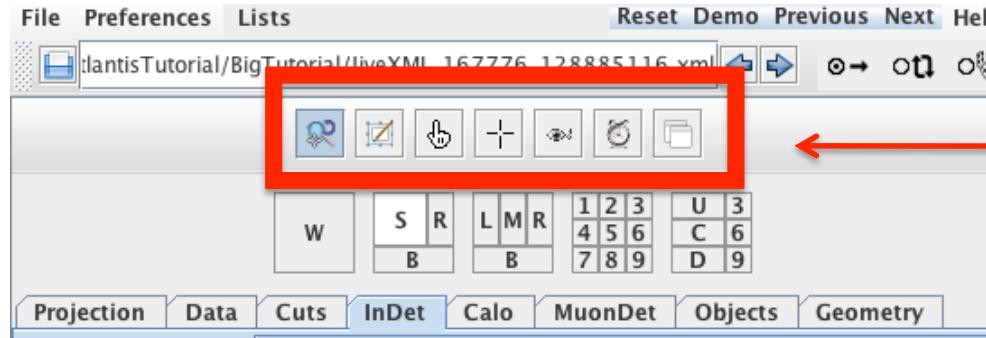




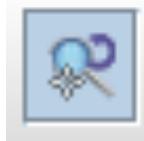
ATLANTIS EVENT DISPLAY FOR ATLAS



2) An overview of ATLANTIS: Projection Interactions



The tools to interact with the Canvas can be found at the top of the GUI



The Zoom/Move/Rotate Tool

This tool allows control more directly as the canvas shows the user. By default **Zoom** is selected. By holding down **M** or **R** while clicking on the canvas activates the Move or Rotate mode respectively.



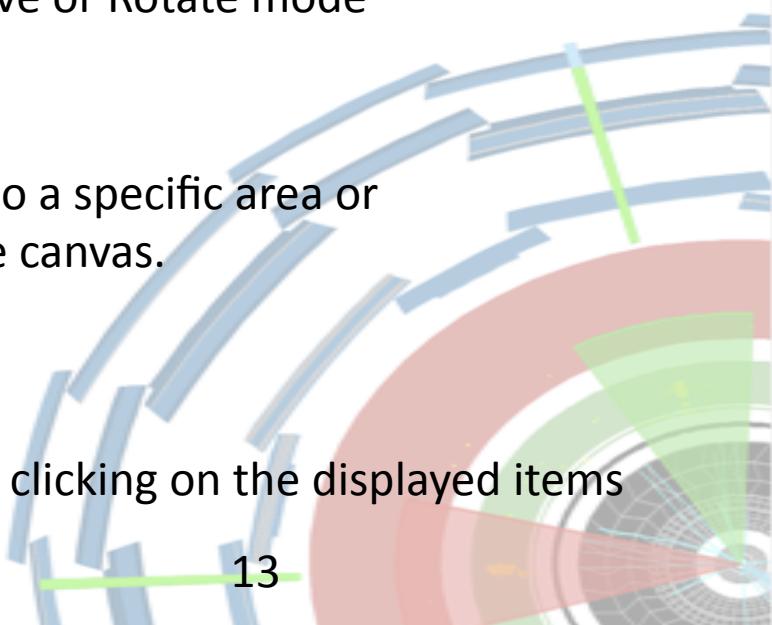
The Rubber Band Tool

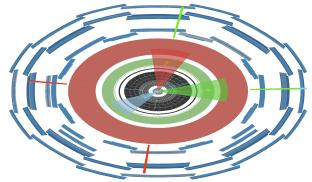
This is a tool that lets the user zoom into a specific area or select multiple objects displayed on the canvas.



The Event Pick Tool

This tool gives you event information by clicking on the displayed items on the canvas

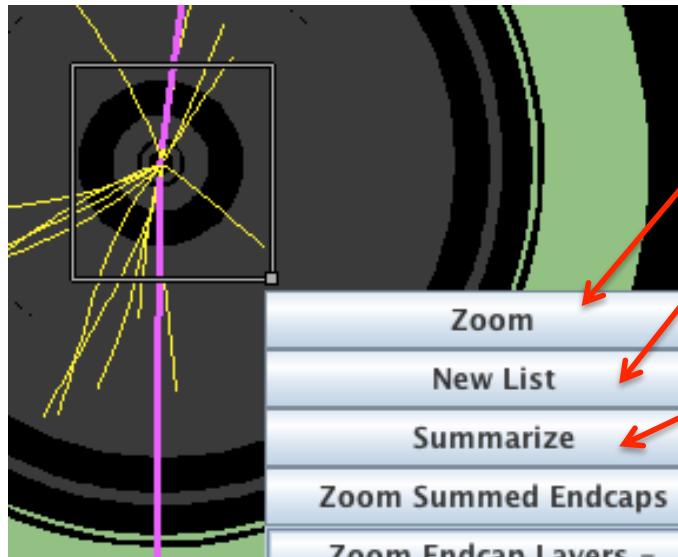




ATLANTIS EVENT DISPLAY FOR ATLAS



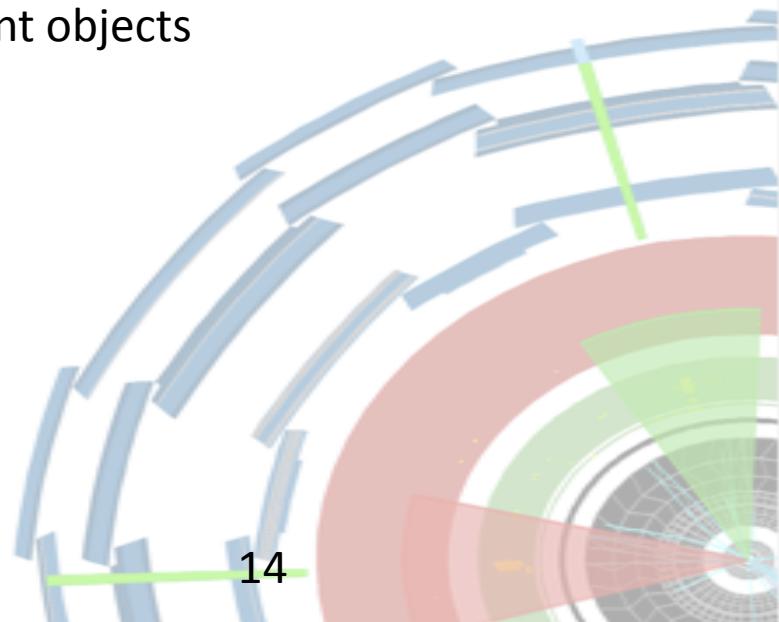
2) An overview of ATLANTIS: The rubber band tool

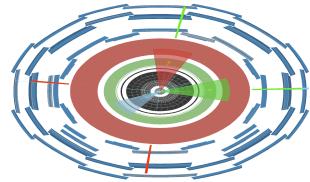


Zoom: as used earlier

Creates a 'list' of event objects within the selected area

Calculates the invariant mass and energy of the the combined event objects



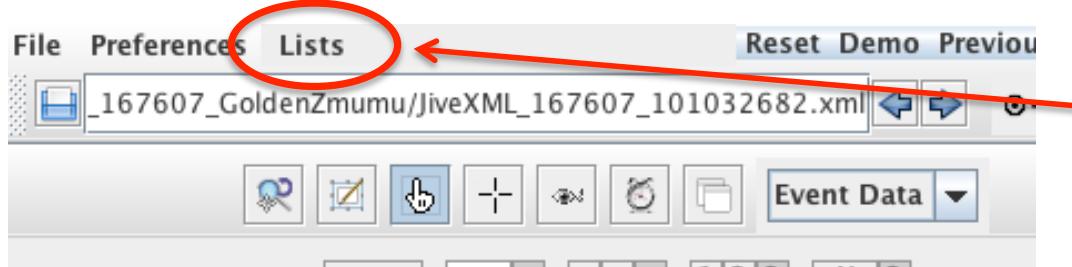


ATLANTIS EVENT DISPLAY FOR ATLAS



2) An overview of ATLANTIS: The List manager

The List Manager allows the user to keep track of, analyze and color event objects.



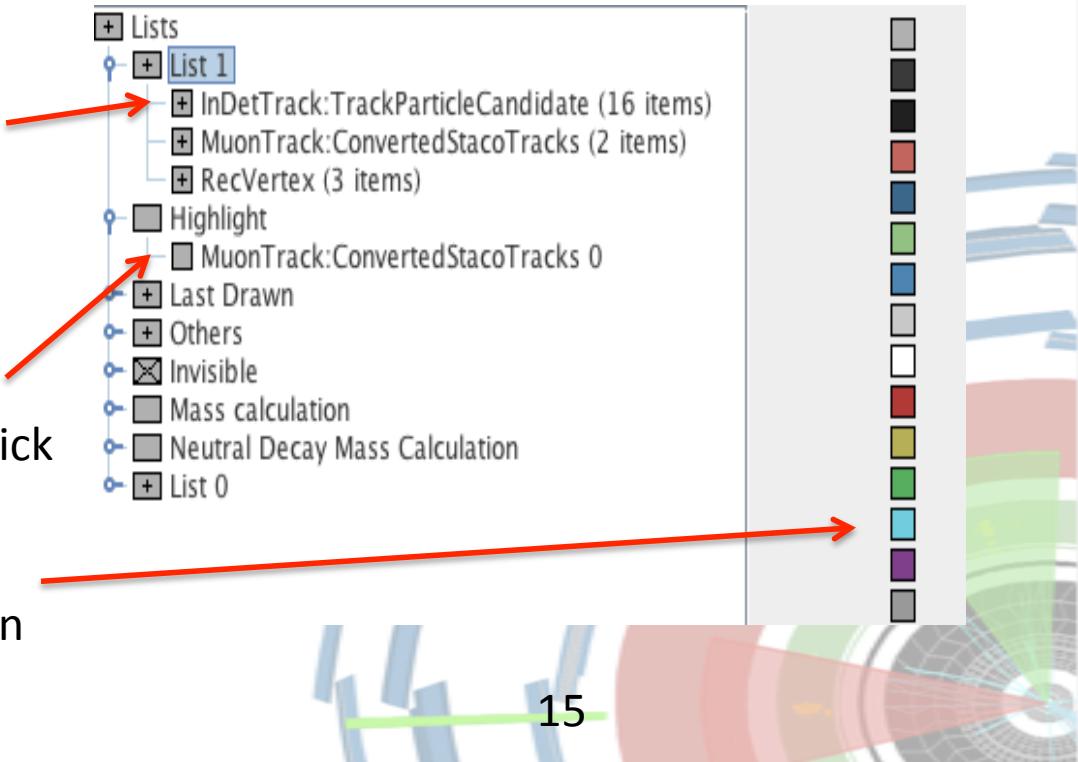
The list manager can be viewed by clicking on the 'Lists' option in the tool bar.

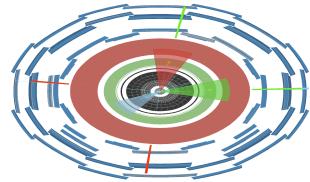
The list manager (right)

Event objects selected from the rubber band tool are contained in a single list.
Multiple event objects of the same type are grouped together but can be expanded.

Highlighted object are chosen with the pick tool.

Available options to color event objects in a list of highlighted object.





ATLANTIS EVENT DISPLAY FOR ATLAS



In the lists manager right click on the 'Lists' box at the top and select 'New Child'. This will create a new list which we will use to keep track of our muons.

Using the pick tool select the two items, then click and drag item from the 'Highlight' list to the new list you have created.

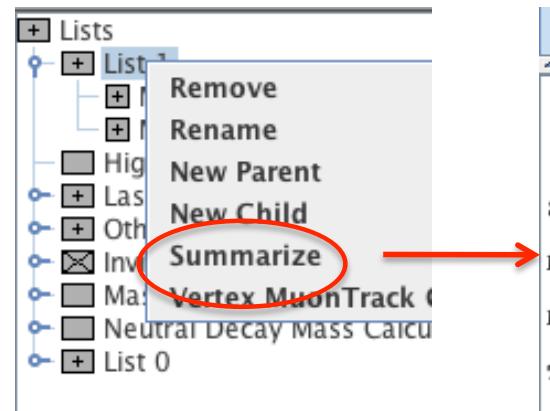
Right click on the List name and select summarize to view reconstructed invariant mass of the two objects.

2) An overview of ATLANTIS: The List manager: Calculating the invariant mass

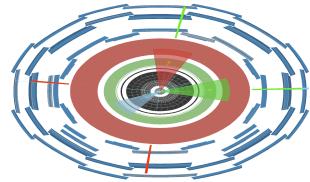
The screenshot shows the ATLANTIS software interface. At the top, there's a 'Lists' manager window with a tree view of list items. A red circle highlights the 'New Child' option under the root 'Lists' node. Below it, another 'Lists' manager window shows a list named 'List 1' containing 'Highlight' and other items. To the right is a 3D event display showing particle tracks and energy deposits in a calorimeter. In the bottom right corner of the display, there's a small inset showing a zoomed-in view of a muon track.

Lists

- + Lists
 - + Lists
 - + List 1
 - + MuonTrack:ConvertedStacoTracks 1
 - + MuonTrack:ConvertedStacoTracks 0
 - Highlight
 - Last Drawn
 - Others
 - Reset
 - New Child
 - + Last Drawn
 - Others
 - Invisible
 - Mass calculation
 - Neutral Decay Mass Calc
 - List 0

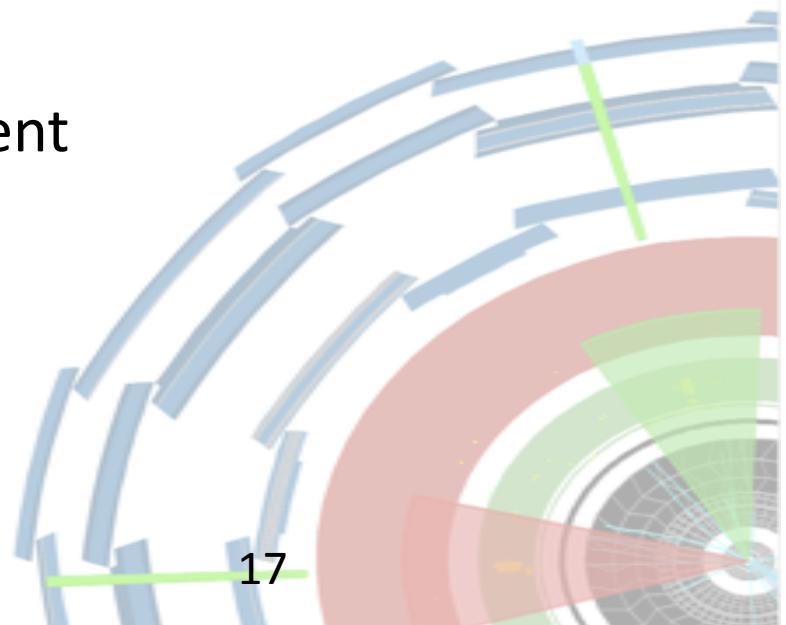


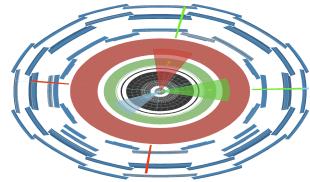
	ET	E	M
MuonTrack:ConvertedStacoTracks 1	48.4	49.1	0.140
MuonTrack:ConvertedStacoTracks 0	48.6	49.0	0.140
Total	5.1	98.1	97.930



2) An overview of ATLANTIS:
Making a public image

- 1) No numbers
- 2) Must contain the information about the event number, run number and the ATLAS logo.
- 3) Need approval of ATLAS Management





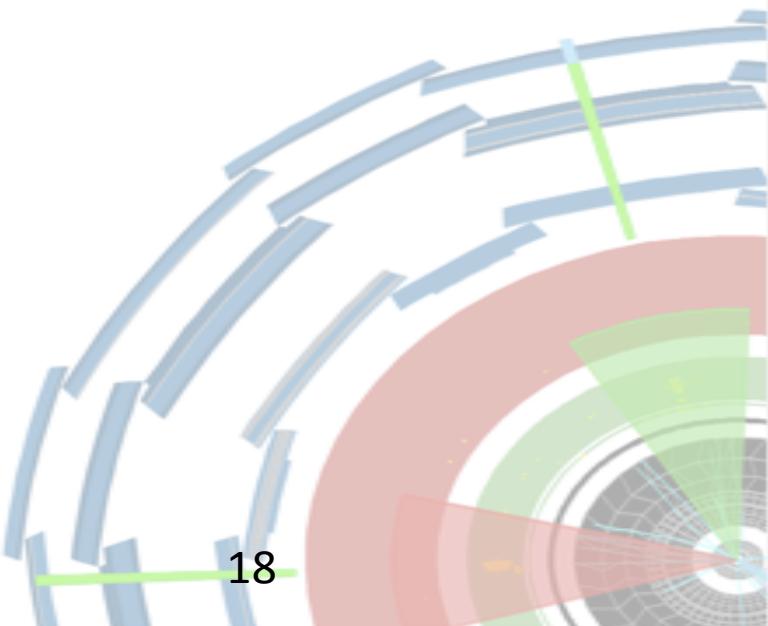
ATLANTIS
EVENT DISPLAY FOR ATLAS

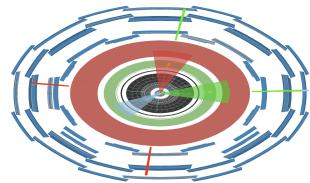


3) Practical Sessions:

Run number: 182796

Event Number: 74566644



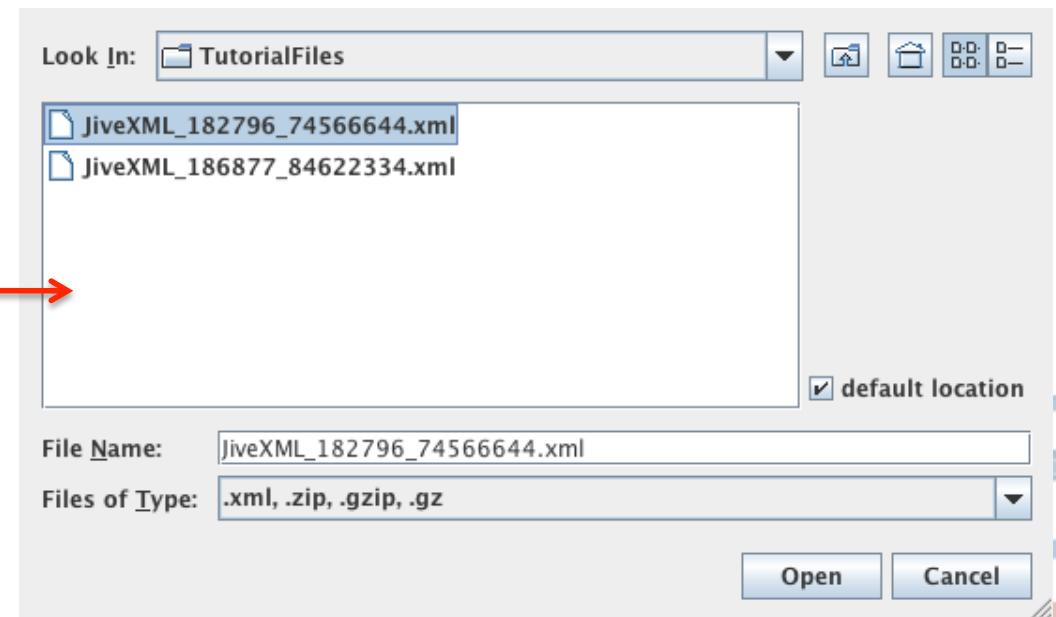
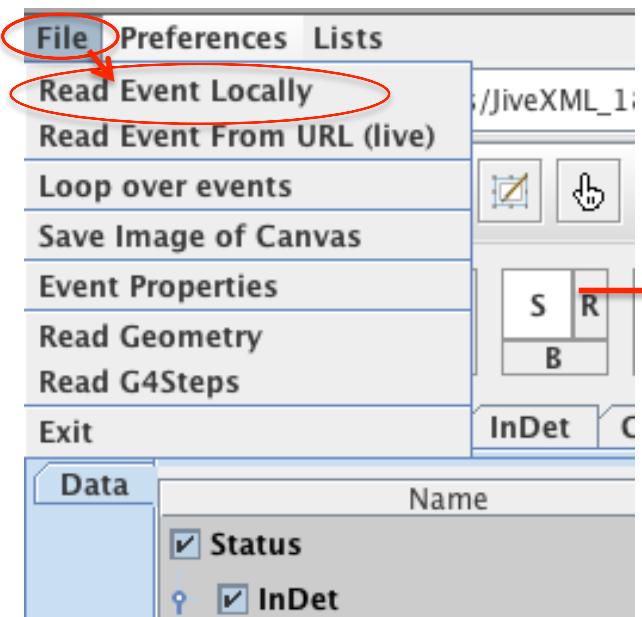


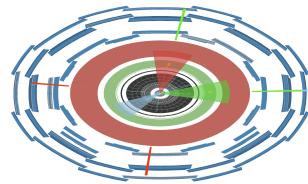
ATLANTIS EVENT DISPLAY FOR ATLAS



3) Practical Sessions:
Run number: 182796
Event Number: 74566644

Download the three events from the twiki page, and load JiveXML_182796_74566644.xml.





ATLANTIS EVENT DISPLAY FOR ATLAS

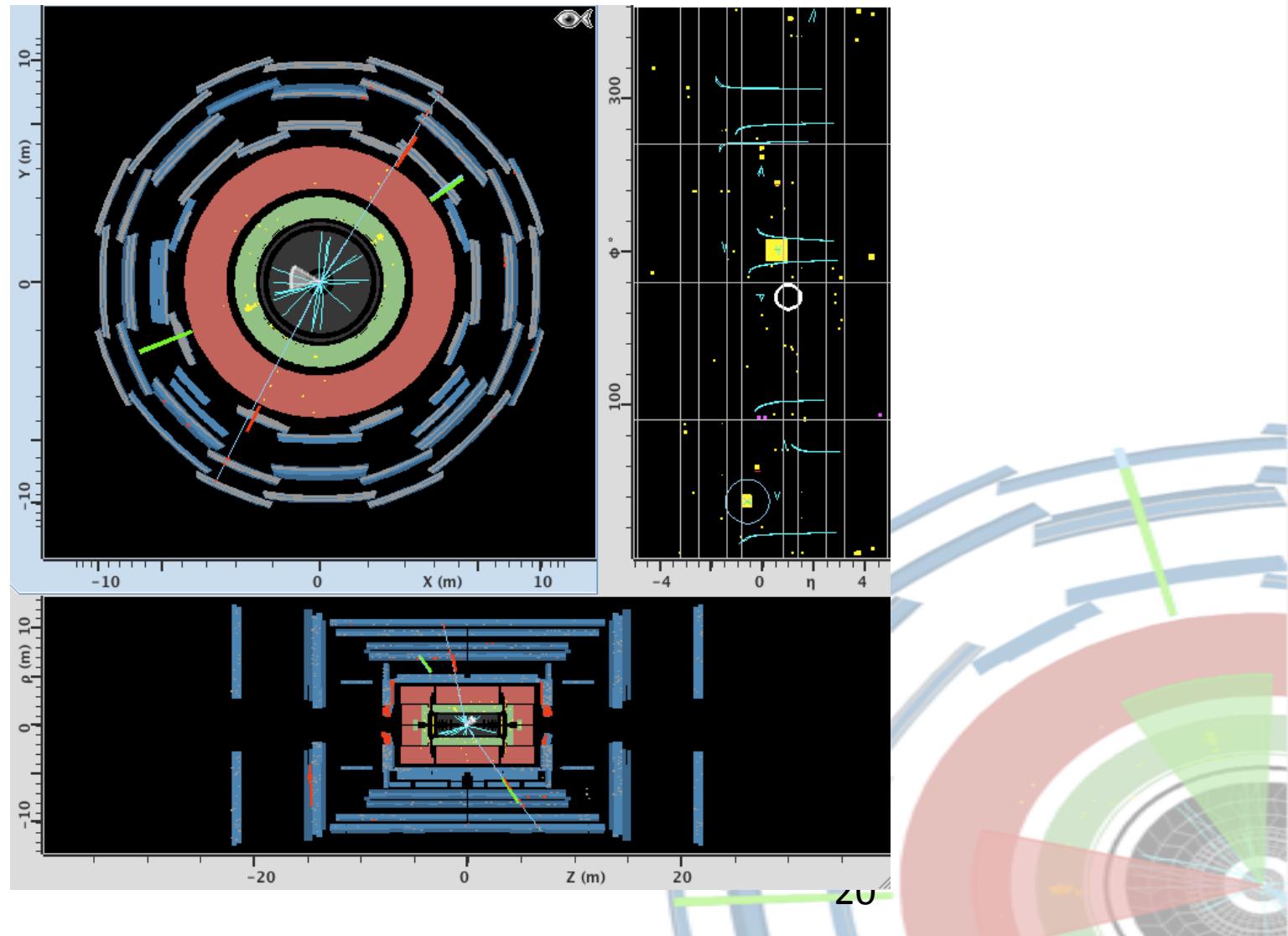


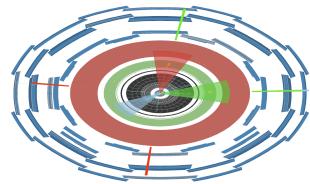
3) Practical Sessions:

Run number: 182796

Event Number: 74566644

You should now have an image up like this:





ATLANTIS EVENT DISPLAY FOR ATLAS

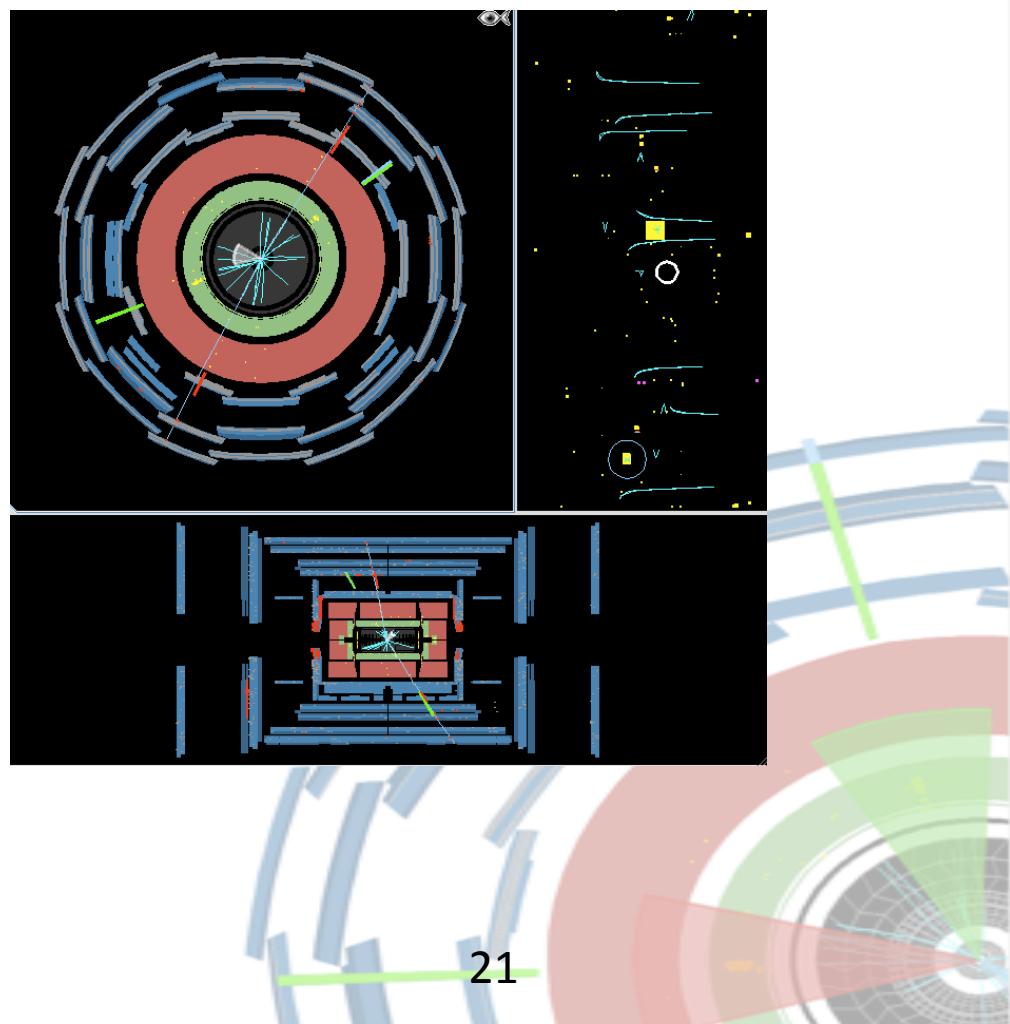
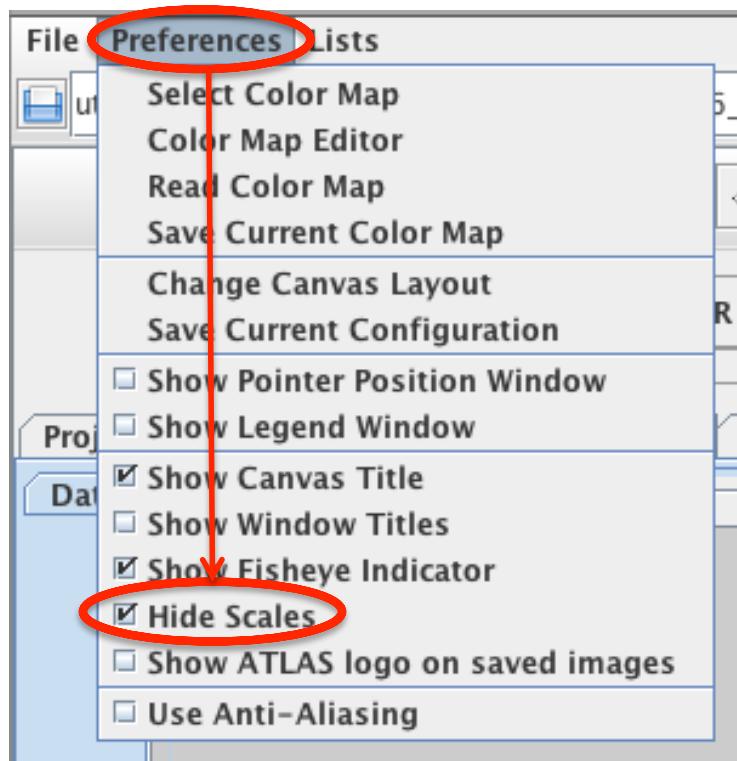


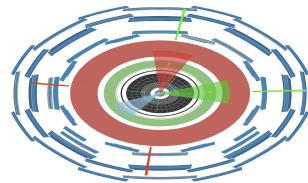
3) Practical Sessions:

Run number: 182796

Event Number: 74566644

To remove numbers from the event, we select the hide scale option.





ATLANTIS EVENT DISPLAY FOR ATLAS

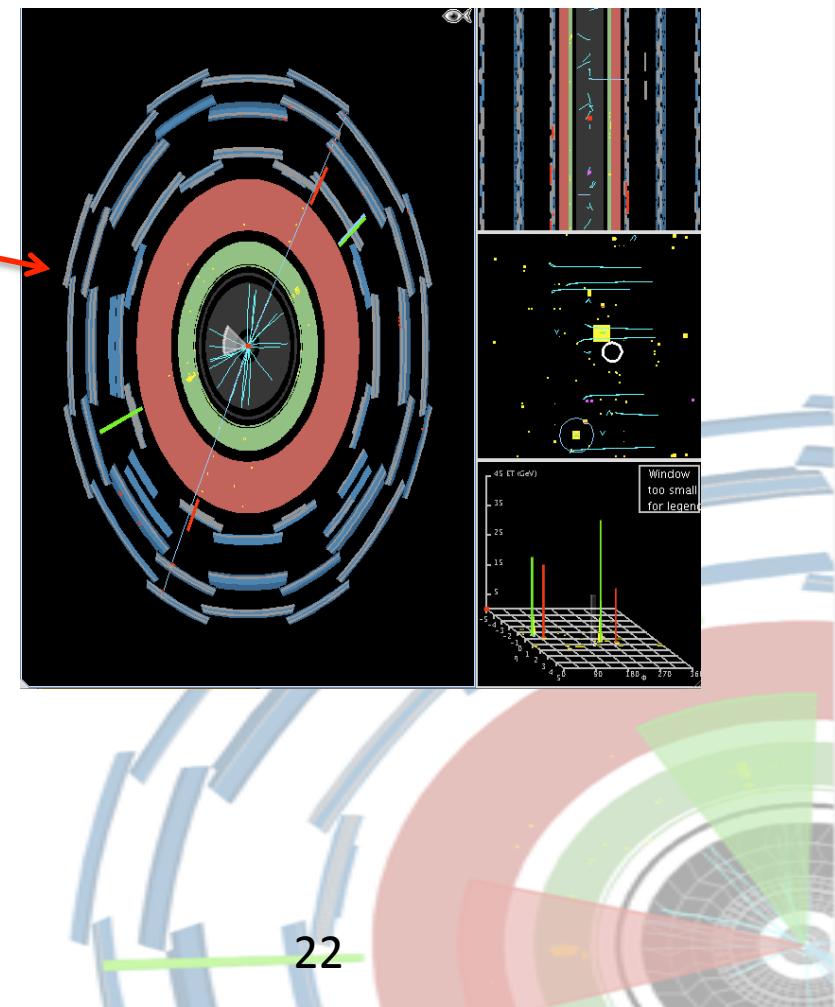
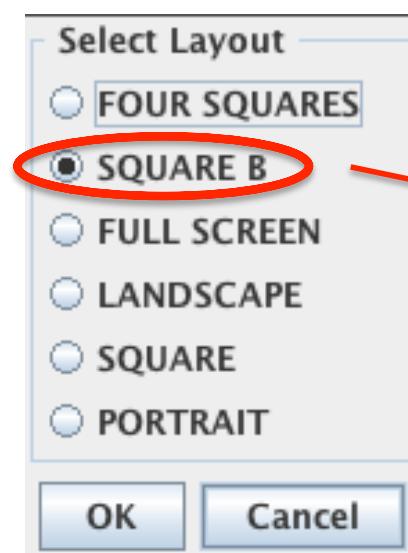
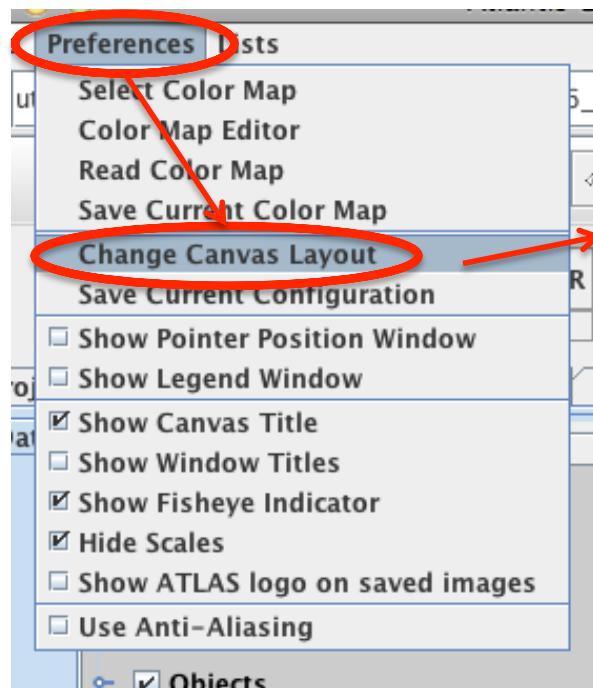


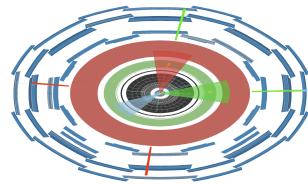
3) Practical Sessions:

Run number: 182796

Event Number: 74566644

By changing the canvas layout, we can the projections in a different order.





ATLANTIS EVENT DISPLAY FOR ATLAS

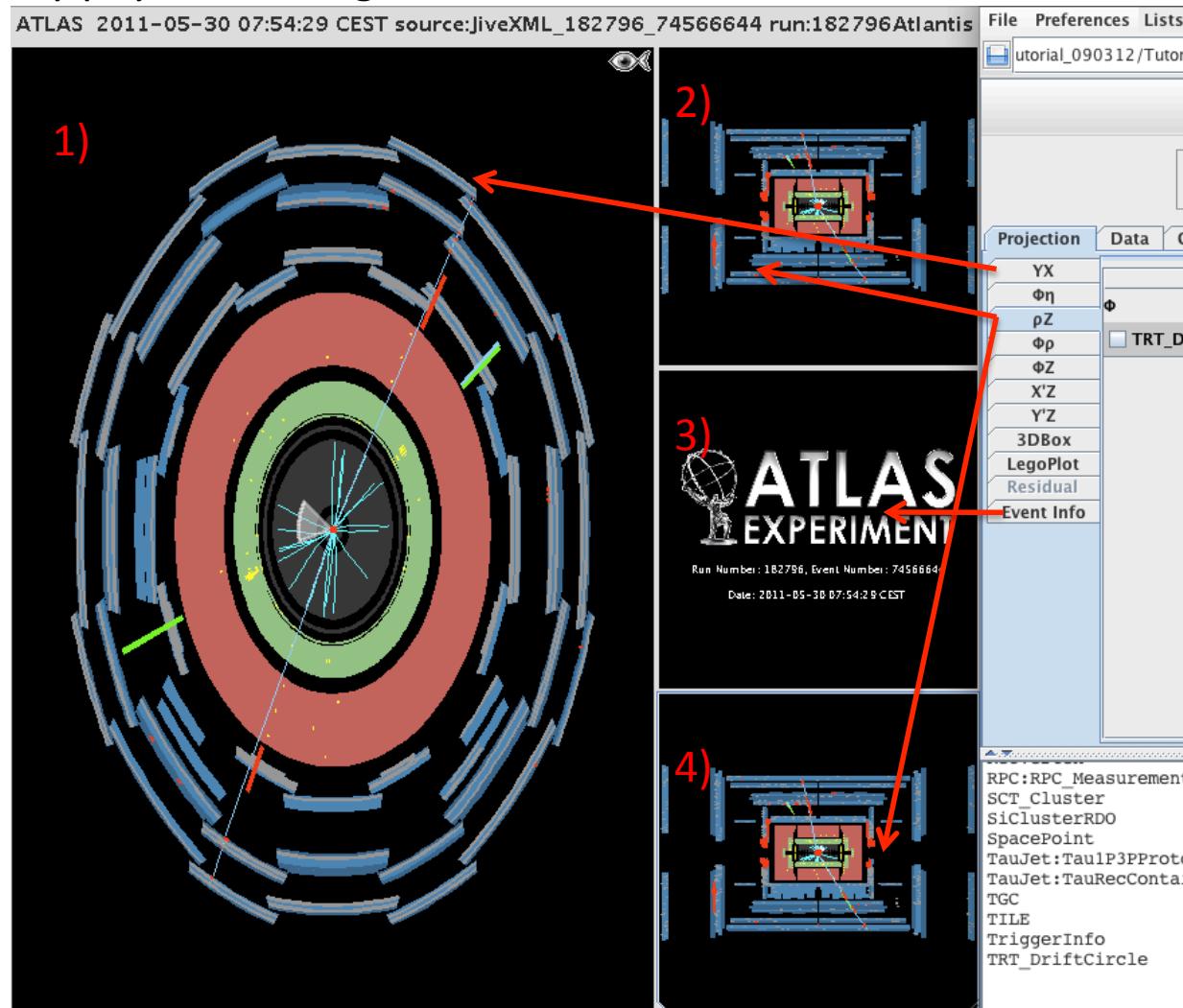


3) Practical Sessions:

Run number: 182796

Event Number: 74566644

We now decided which projections to show. In general the point is to convey the key physics message of an event.

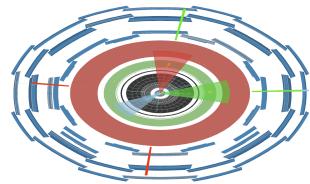


To change the projection, click on a window on the canvas then select which projection you want in the 'projection' tab

1,2) Shows the layout the event

3) Shows event info to meet ATLAS requirements

4) When zoomed in shows the different vertices. Shows the leptons come from the primary vertex



ATLANTIS EVENT DISPLAY FOR ATLAS

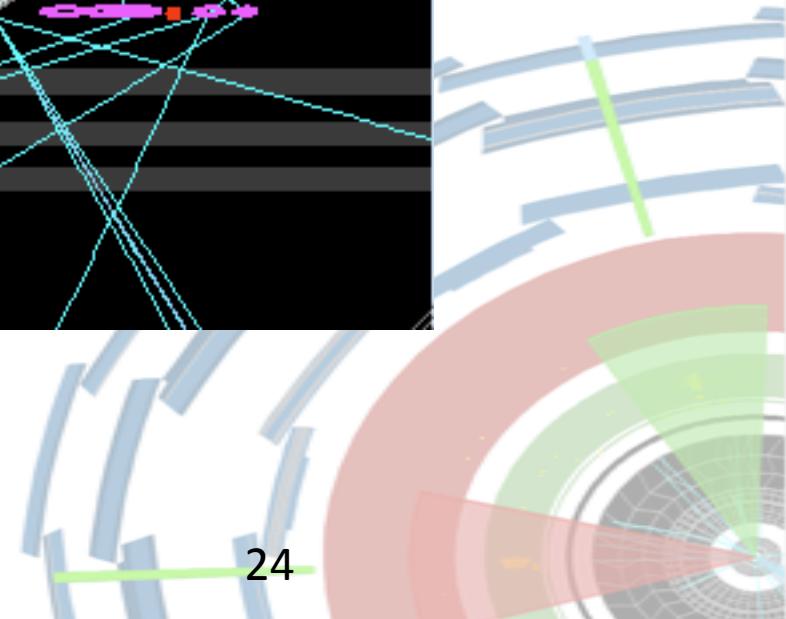
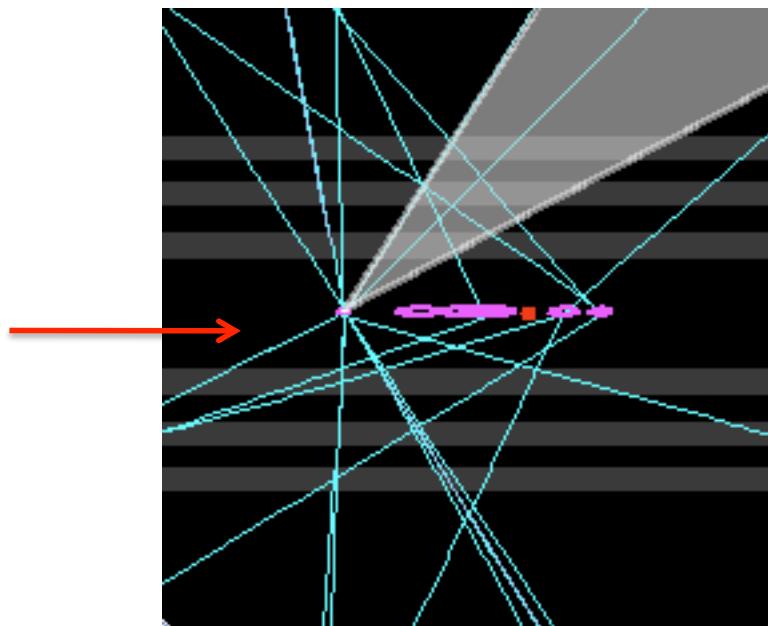
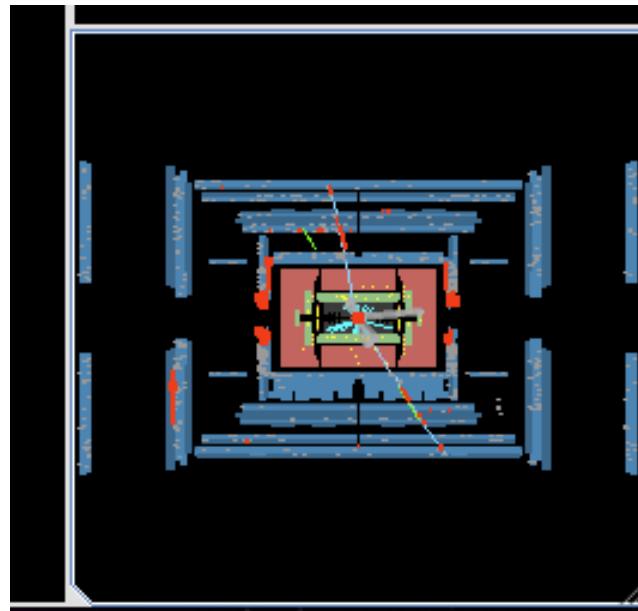


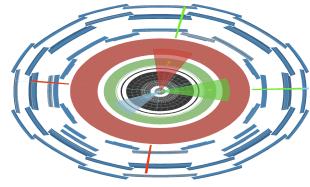
3) Practical Sessions:

Run number: 182796

Event Number: 74566644

On projection 4), select the Z/M/R tool. Click on the center of the image and drag out. Once you can make out the different vertices, hold down 'M' and click and drag on the image to center the primary vertex.





ATLANTIS EVENT DISPLAY FOR ATLAS



3) Practical Sessions:

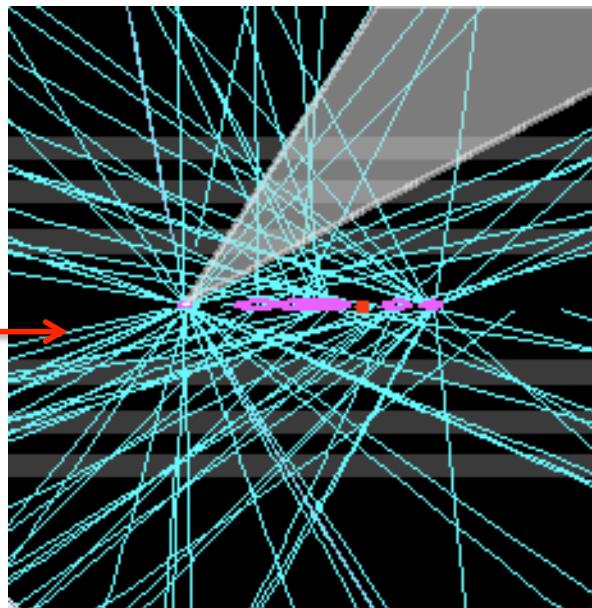
Run number: 182796

Event Number: 74566644

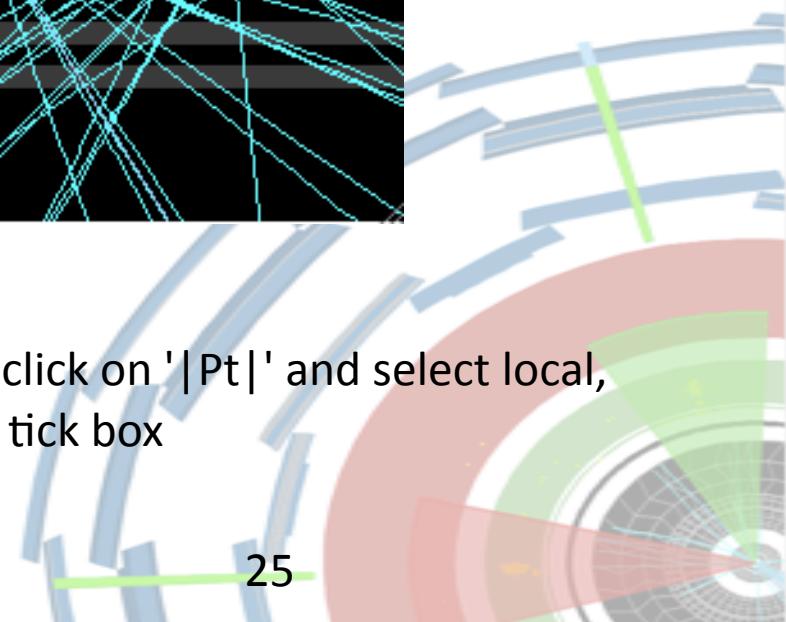
To better show pile up we can remove the p_T cut on the tracks. After this we'll highlight the muons to show everything comes from a single vertex.

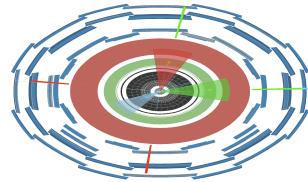
The screenshot shows the 'Cuts' configuration window in the ATLANTIS software. The left sidebar lists categories: Calo, MuonDet, Objects, Geometry, InDet, Projection, Data, and Cuts. The 'InDet' category is selected, indicated by a red arrow. The 'Cuts' tab is also selected, indicated by another red arrow. The main table lists various cuts with their current values and options to set them locally or globally. The '|Pt|' cut is highlighted with a red circle, showing its current value of 1.0 GeV and a checked 'Set Local' checkbox. Other cuts listed include |z0|, |d0 Loose|, |z0-zVtx|, Layer, Number P..., Number S..., Number T..., |Sim. Partic..., Sim. Partic..., Sim. Particle Ty..., and SimVertex.

Name	Value
Pt	1.0 GeV
<input checked="" type="checkbox"/> Set Local	
z0	< 2.5 mm
<input checked="" type="checkbox"/> d0 Loose	< 20.0 cm
z0-zVtx	< 2.0 cm
Layer	< 2.5 mm
Number P...	> 0
Number S...	>= 2
Number T...	>= 7
Sim. Partic...	>= 15
Sim. Partic...	< 40
Sim. Particle Ty...	= 0
SimVertex	charged hadr... = 0



Turning off the track cut locally: Cuts -> InDet -> right click on '| Pt |' and select local, then deselect the '| Pt |' tick box





ATLANTIS EVENT DISPLAY FOR ATLAS



3) Practical Sessions:

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Grey jets are boring. To change there color:

Objects -> Jet -> Color Function -> Index.

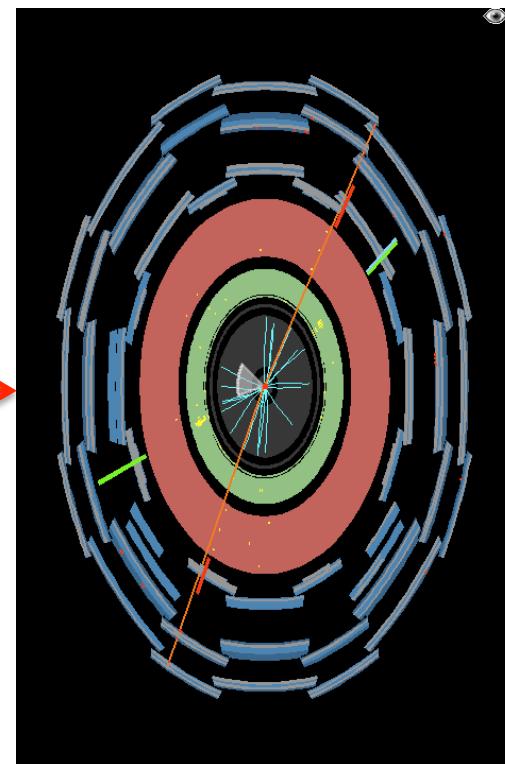
The default muon track collection doesn't attach to a vertex, we can change collection by:

MuonDet -> Track -> Track Collection -> StacoTrackParticle

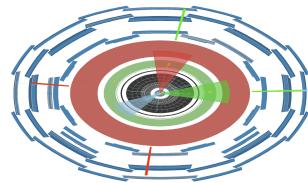
To make the muons stand out more, we can increase there line width:

MuonDet -> Trac -> Line Width -> 2

Screenshot of the ATLANTIS configuration interface showing the 'Objects' tab selected. The 'Jet' section is highlighted with a red circle. The 'Color Function' dropdown is set to 'Constant'. The 'Constant Color' dropdown is set to 'Index'. The 'Line Width' dropdown is set to 'Collection'. The 'Scale' input is set to 1.0. The 'Inner draw radius' input is set to 0.0.



Screenshot of the ATLANTIS configuration interface showing the 'Track' tab selected. The 'Track Collections' dropdown is set to 'StacoTrac...'. The 'Color Function' dropdown is set to 'ConvertedMuld'. The 'Constant Color' dropdown is set to 'StacoTrackPart...'. The 'Unconnected' dropdown is set to 'All'. The 'Line Width' dropdown is set to 2. The 'Drawn As' dropdown is set to 'Polyline'.



ATLANTIS EVENT DISPLAY FOR ATLAS



3) Practical Sessions:

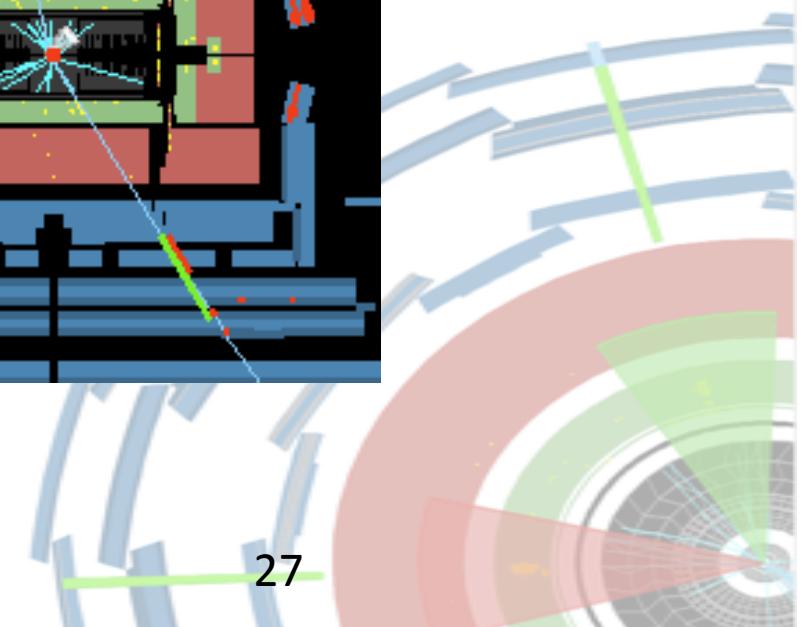
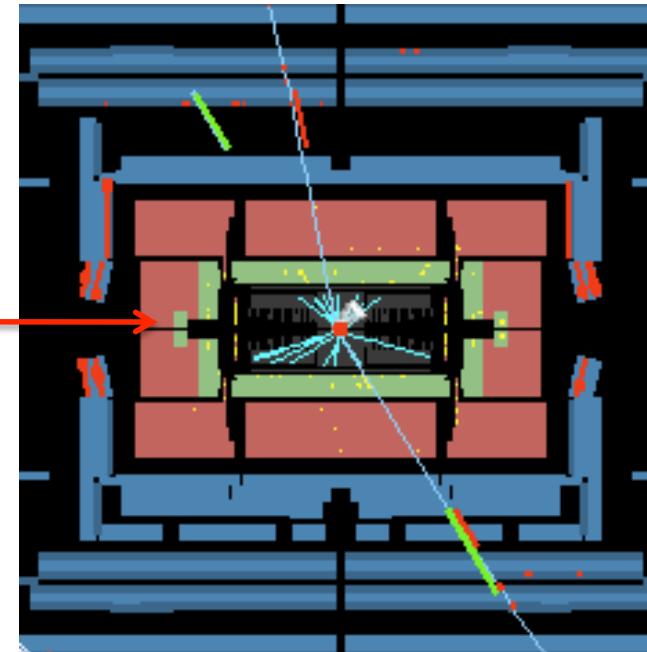
Run number: 182796

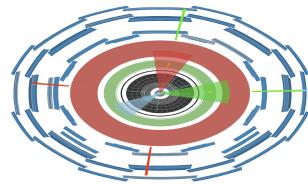
Event Number: 74566644

In window 2, the top right ρZ view, the entire muon system doesn't add much information to the event. Using the Z/M/R tool, zoom in. Also the image looks a bit cluttered with all the MDT hits. These can be removed by:

Data -> MuonDet -> Deselect 'MDT'

The screenshot shows the ATLANTIS software interface with the 'Data' tab selected in the top navigation bar. The main panel displays a tree view of data collections. Under the 'MuonDet' node, the 'MDT' checkbox is highlighted with a red circle. A red arrow points from this highlighted checkbox to a corresponding red arrow pointing at the 'MDT' collection in the central event display window.





ATLANTIS EVENT DISPLAY FOR ATLAS



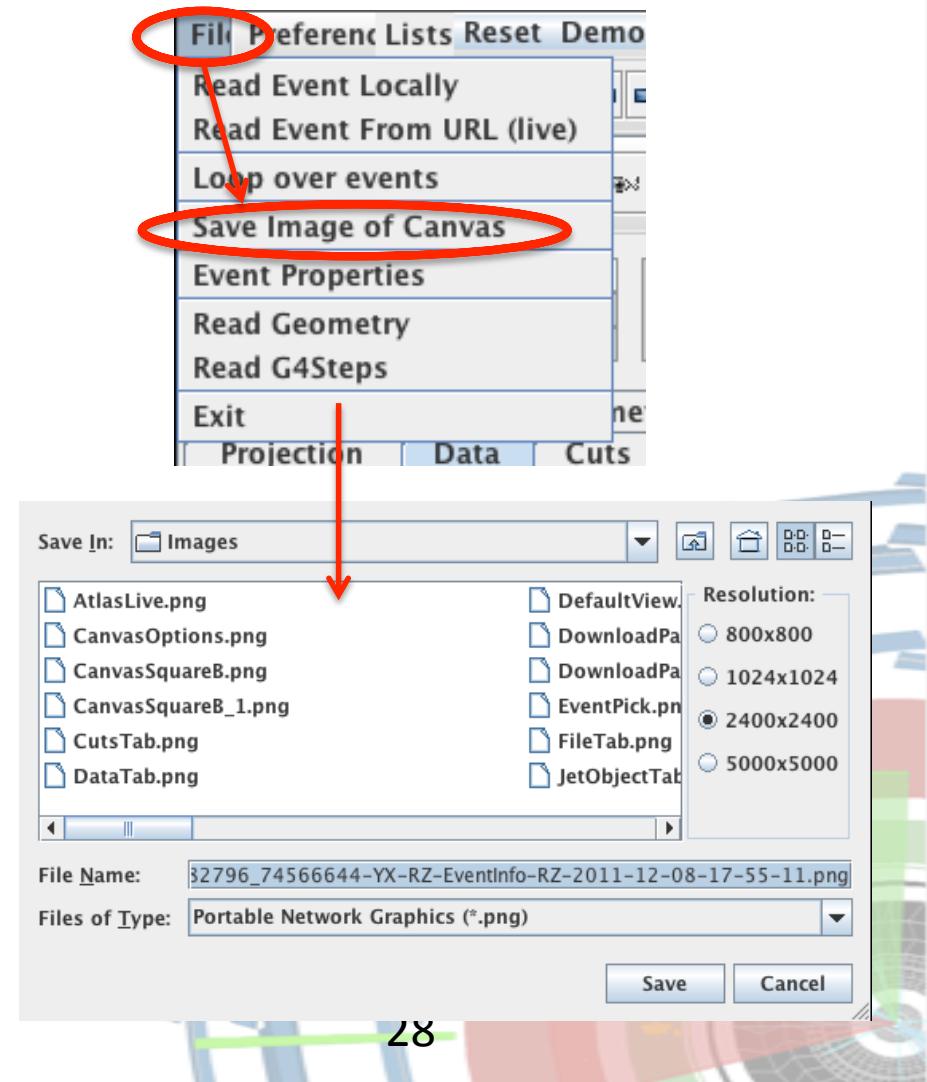
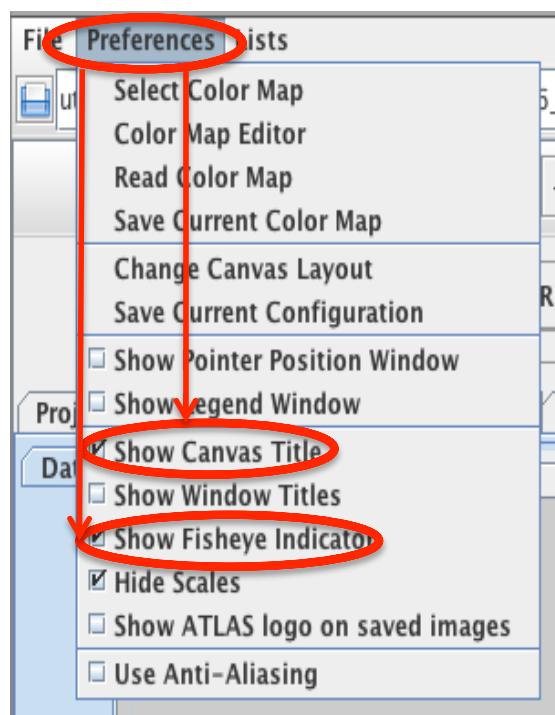
3) Practical Sessions:

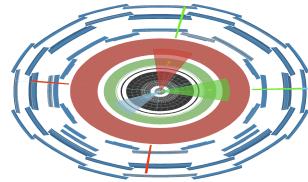
Run number: 182796

Event Number: 74566644

Now for the final touches, and saving the image. First remove the fish eye indicator, and the canvas title bar. This is done in preferences. To save the image:

File -> Save Image of Canvas





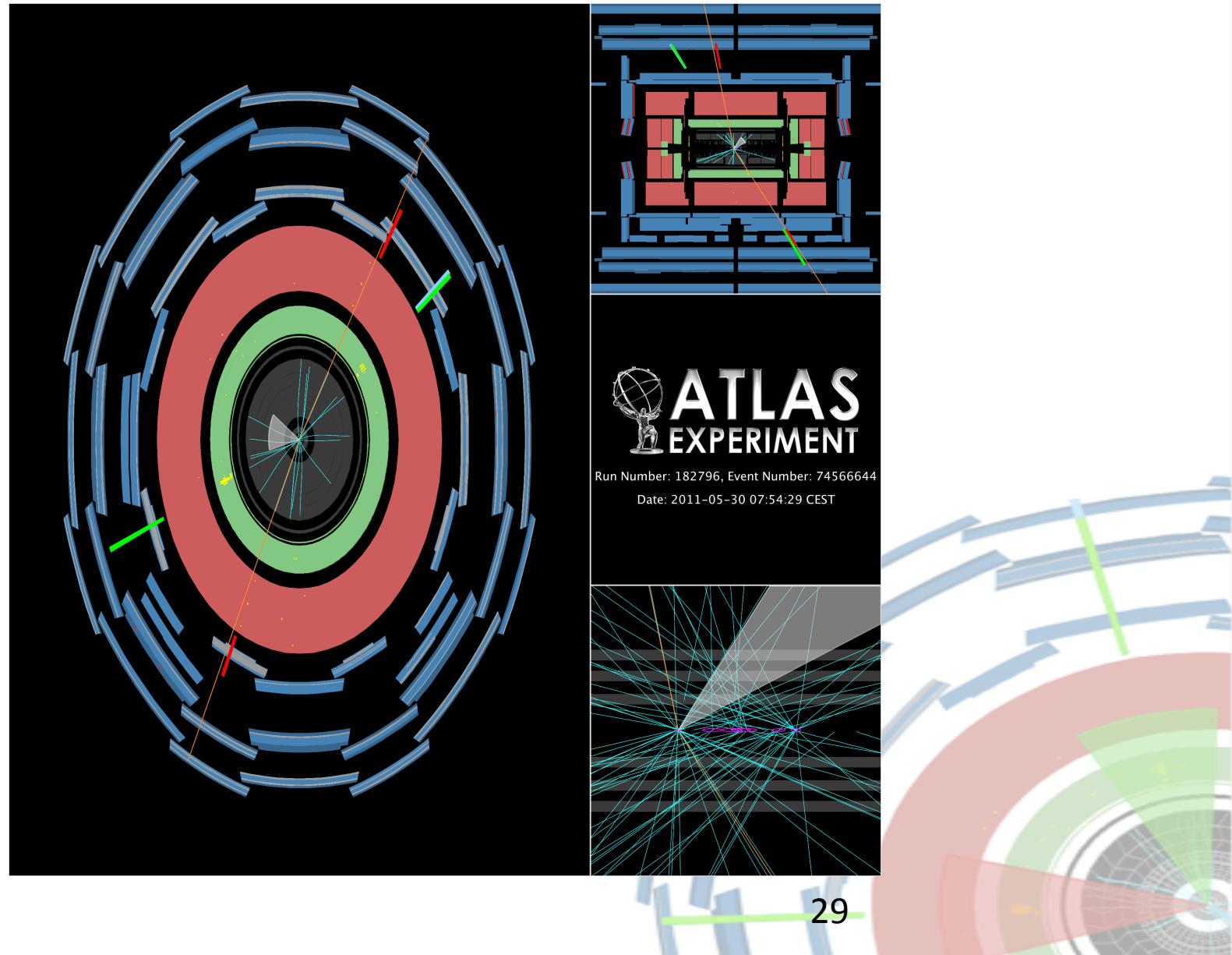
ATLANTIS EVENT DISPLAY FOR ATLAS

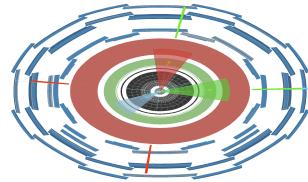


3) Practical Sessions:

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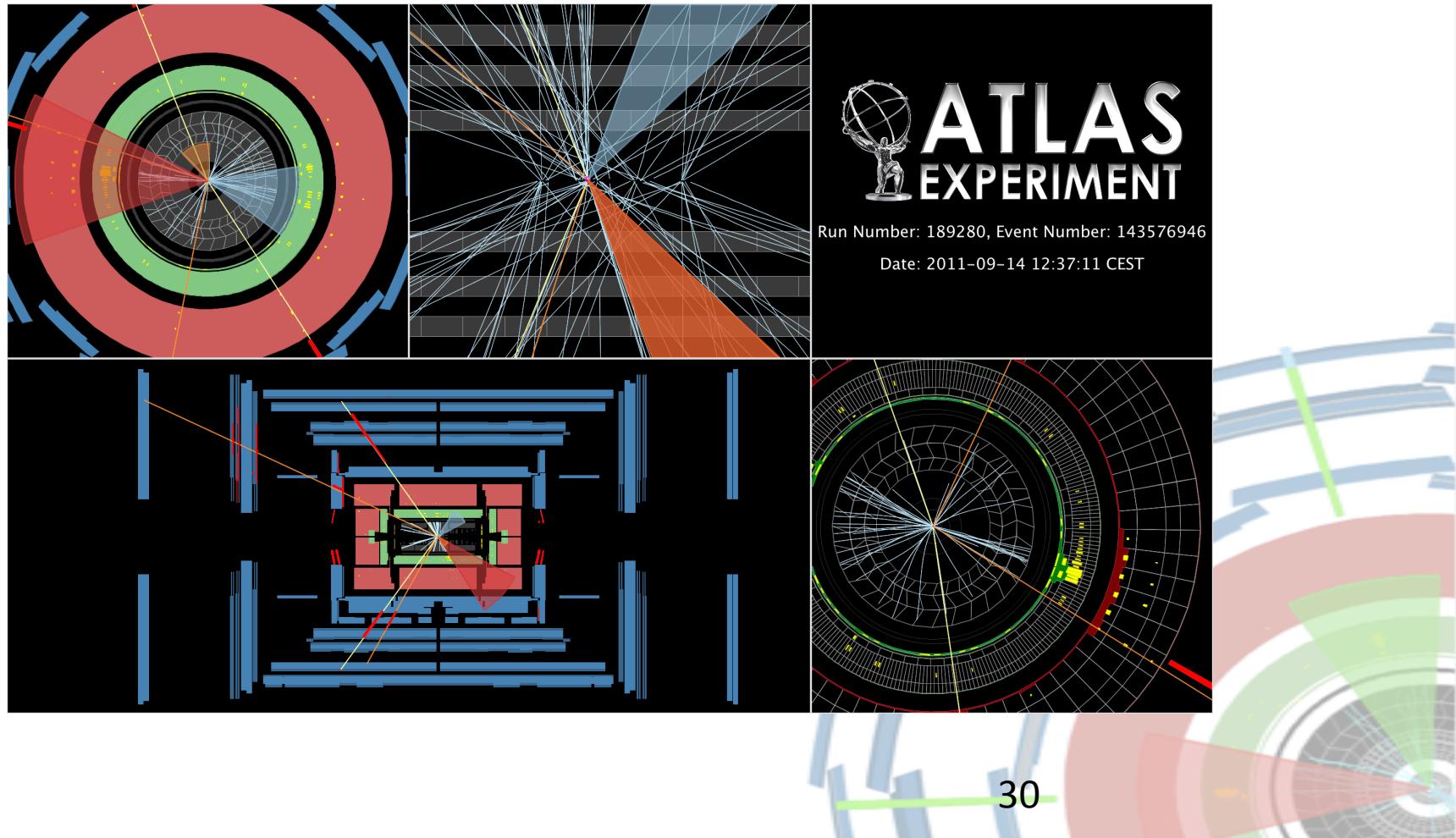
ATLANTIS EVENT DISPLAY FOR ATLAS

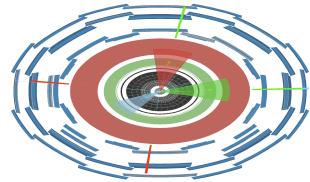


3) Practical Sessions:

Run number: 189280
Event Number: 143576946

For this event, you have the final image from the start. Other then the hints provided on the next slide its up to you to recreate the image.





3) Practical Sessions:

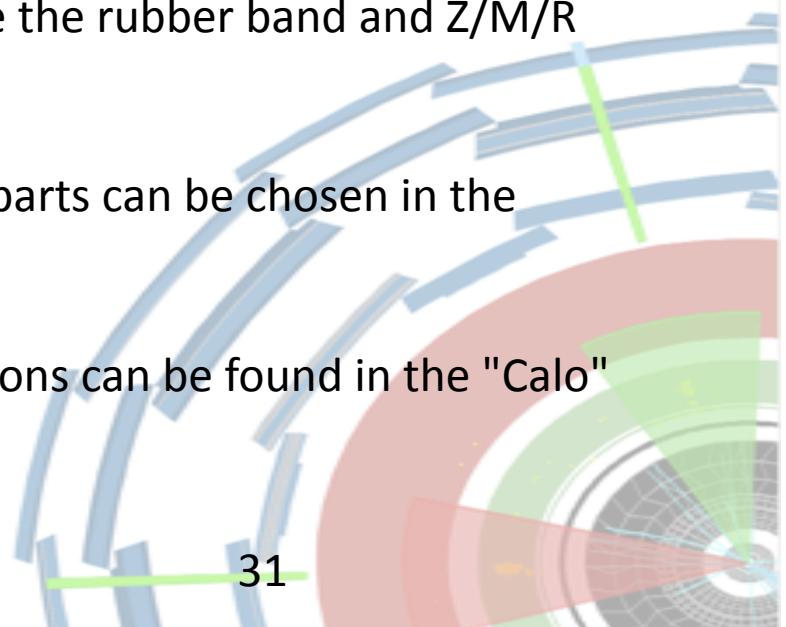
Run number: 189280
Event Number: 143576946

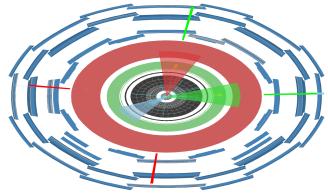
Hints about how to recreate the image.

- 1) The canvas layout is full screen. Different windows can be shown by clicking on the different layout shown here:



- 2) To find the two muons coming from the Z and color them separately you'll need to create a list.
- 3) To view the different parts of the detector use the rubber band and Z/M/R tool.
- 4) The colours of the back ground and detector parts can be chosen in the Geometry tab.
- 5) The green and red calorimeter histogram options can be found in the "Calo" tab.





3) Practical Sessions:

Run number: 186877

Event Number: 84622334

For this event, you have no guide lines. Its up to you to decide what looks best.
Remember to focus on the physics the image is trying to show.

