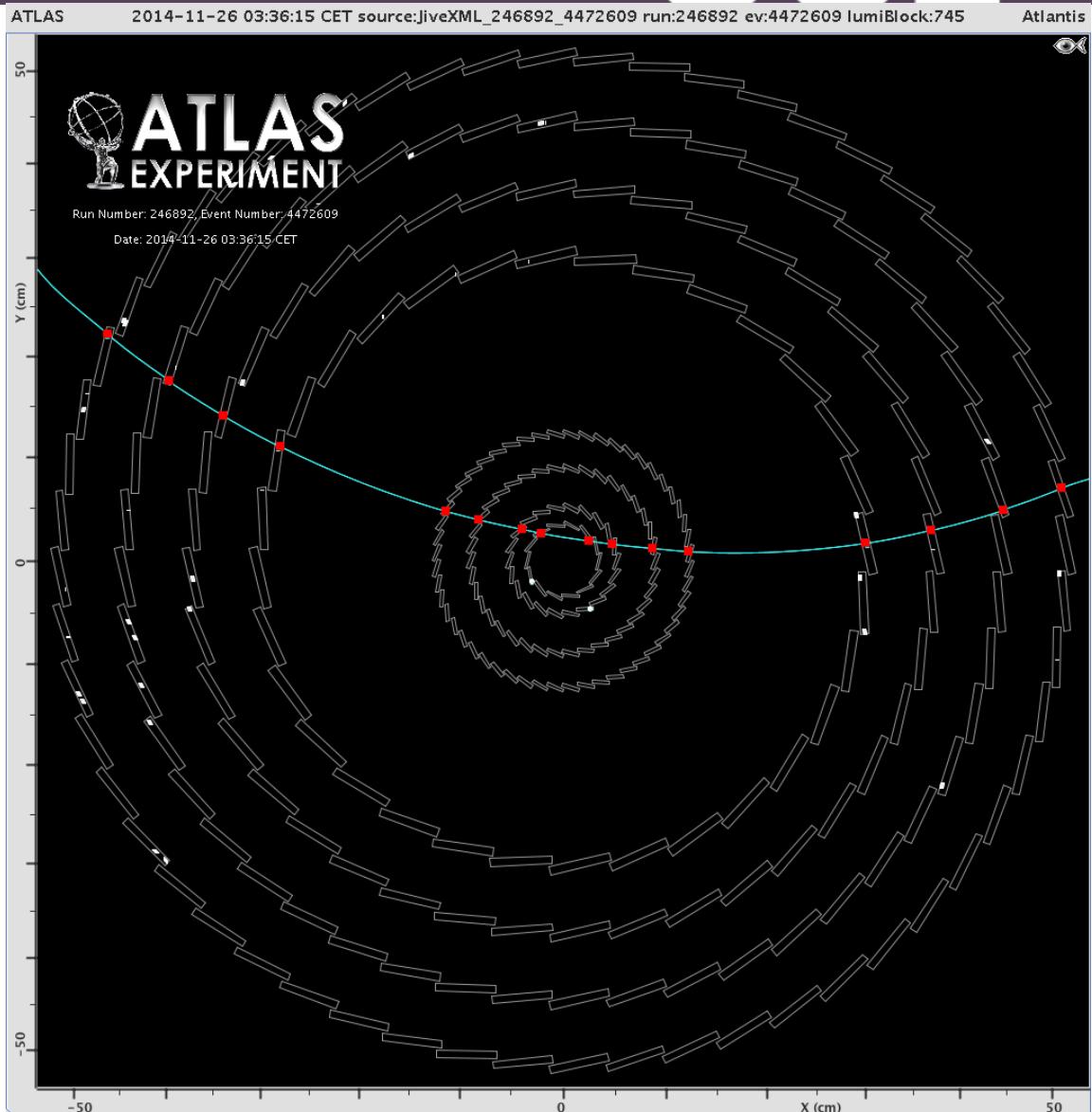


Atlantis Event Display Basics

ATLAS Software Tutorial
25 October 2019

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UCL



What is Atlantis?

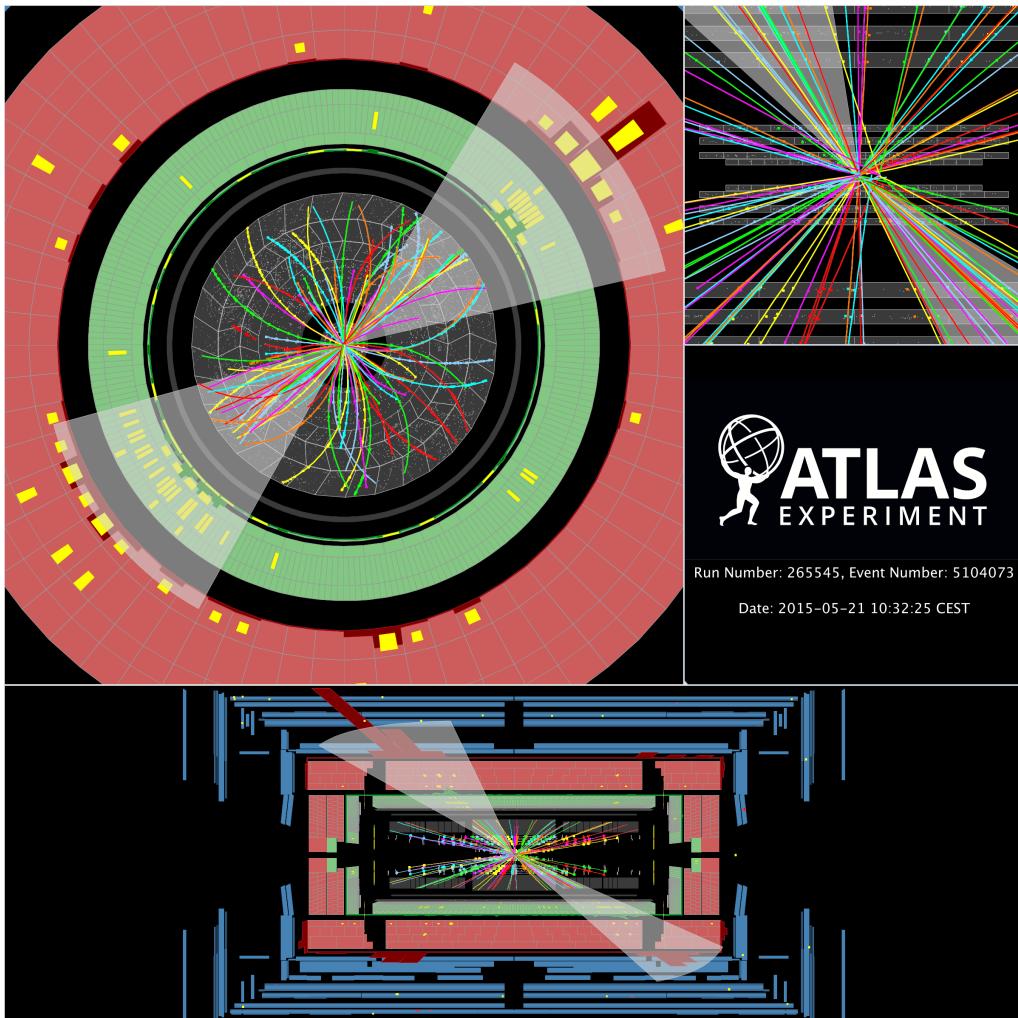
Atlantis provides a graphical representation of what is happening in an event. It aims to display complete ATLAS events in an intuitive way, so the user can make fast and correct conclusions about the underlying physics processes.

Within ATLAS it is used for:

- Monitoring data taking in the control room
- Creating images for publications
- Analysis of individual events

Outside ATLAS it is used for:

- Outreach
- Master classes



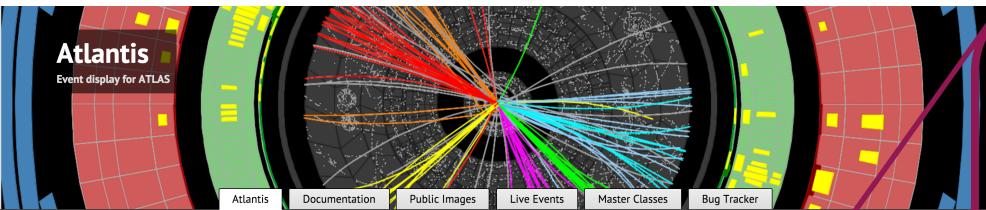
Structure of Atlantis

- The Atlantis application consists of two programs:
 - The **event viewer**, Atlantis, which runs locally
 - The **event file generator**, JiveXML, running inside Athena
- In this session we will focus on the event viewer only
- JiveXML packages can convert RAW/ESD/AOD/xAOD events into single-event XML files.
- These XML files are then read by the viewer.
- The level of detail available in the viewer depends on the input format
- Instructions on how to run JiveXML on a given set of run/event numbers can be found on our TWiki: <https://twiki.cern.ch/twiki/bin/viewauth/AtlasComputing/Atlantis>
- For this tutorial just download the zip file from indico

Getting Atlantis up and running on your laptop

- Atlantis can be started in a few ways:
 1. From <http://atlantis.web.cern.ch/atlantis/>
 - a. Starting it directly using Java WebStart
 - b. Downloading as a .zip/.tgz archive.
 2. Directly from the Athena environment by typing `atlantis` (not recommended unless you have Athena installed locally)
 3. Typing `localSetupAtlantis` from within cvfms
 - » `export ATLAS_LOCAL_ROOT_BASE=/cvmfs/atlas.cern.ch/repo/ATLASLocalRootBase`
 - » `source /cvmfs/atlas.cern.ch/repo/ATLASLocalRootBase/user/atlasLocalSetup.sh`
 - » `localSetupAtlantis`
 - » `runAtlantis`
- We are going to use the development version from the website today, **AtlantisJava-09-16-06-07**

atlantis.web.cern.ch/atlantis



About Atlantis

Atlantis is an event display for the ATLAS experiment at CERN's Large Hadron Collider.

Atlantis provides a graphical representation of what is happening in an event. It aims to display complete ATLAS events in an intuitive way, providing the user with the tools necessary to make fast and correct conclusions about the underlying physics processes.

Documentation

- ATLAS Atlantis TWiki
- Event picking on the grid

Download

- Development version: AtlantisJava-09-16-06-07
The development version contains all the latest features, but possibly also some bugs.
 - Download as ZIP archive
 - Download as TGZ archive
 - Web Start
- Production version: AtlantisJava-09-16-05-23
The production version is the stable release.
 - Download as ZIP archive
 - Download as TGZ archive
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- Older versions

Download

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Production version: AtlantisJava-09-16-05-23

The production version is the stable release.

- Download as ZIP archive
- Download as TGZ archive
- Web Start

Either download the .zip/.tgz,

- unzip
- Go into the AtlantisJava-09-16-06-07 directory
- type “java -jar atlantis.jar” on the command line or
- double click on “atlantis.jar”

Or click on “Web Start”

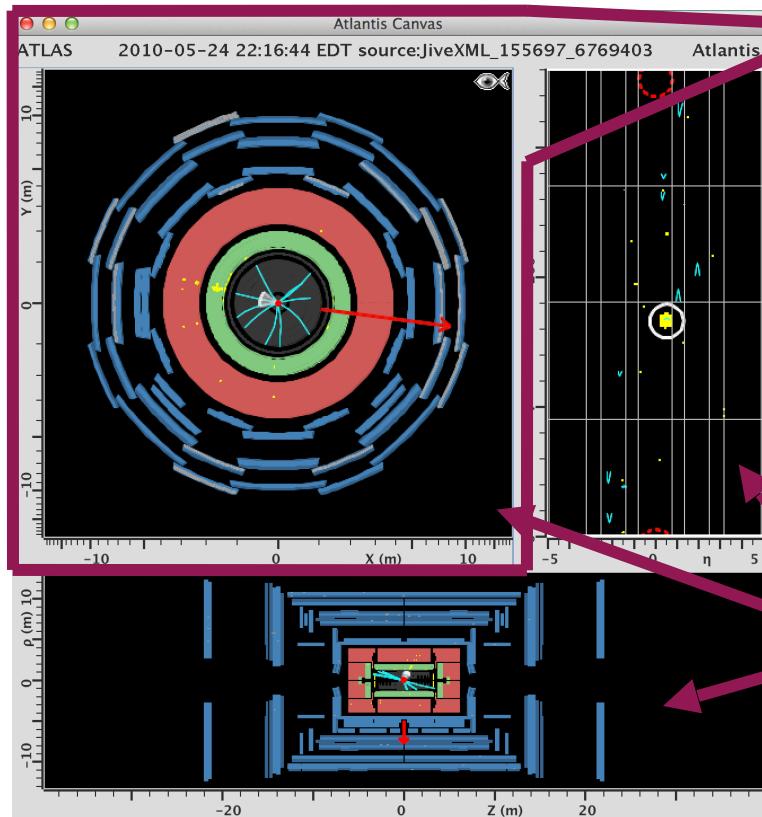
If you have any problems with this let one of us know and we will help you get it up and running!

Using Java Web Start

- You will probably have to change some security settings...
 - ... but the details depend on your Java version and OS.
- The latest Web Start version is signed with a CERN certificate...
 - ... but you will have to tell Java to trust the CERN CA.
- Download the two .crt files from
 - <https://cafies.cern.ch/cafies/certificates/Cern.aspx>
 - Import these (as “Signer CA”) using the Java control panel.
- Alternatively you may be able to lower the security level so it will let you
 - click through to run applications from unknown sources...
 - ... or add http://www.cern.ch/ to the “Exception site list”.
- Extra step for Mac users:
 - In System Preferences, go to “Security & Privacy”
 - ... and select the “General” tab. Under “Allow apps downloaded from:”
 - ... select, “Anywhere”. (Though obviously don’t trust all apps...)

User interface basics

Now that you have Atlantis up you should see two panels:



Canvas

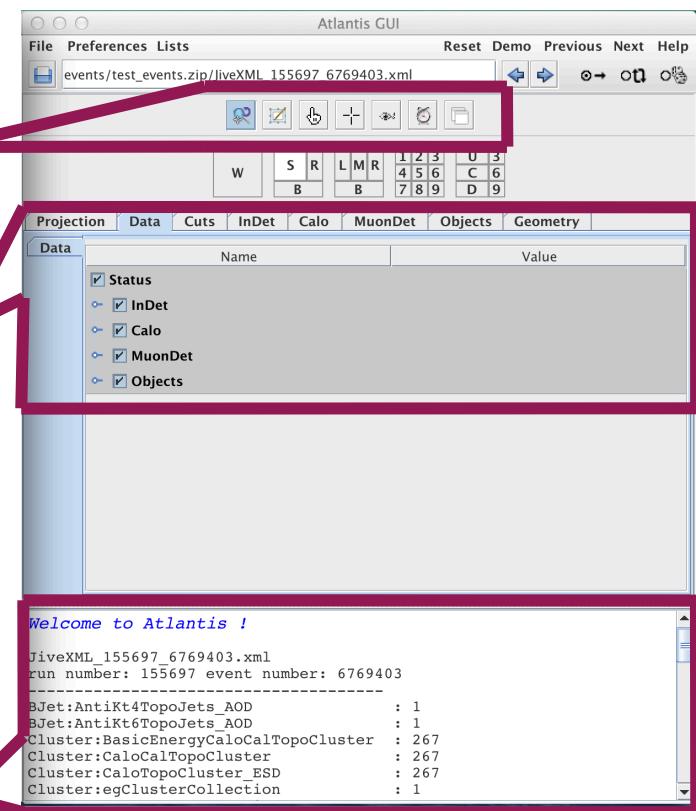
A window

Interaction tools

Tabs contain settings and cuts

Projections
(yx , ρz and
 $\varphi \eta$)

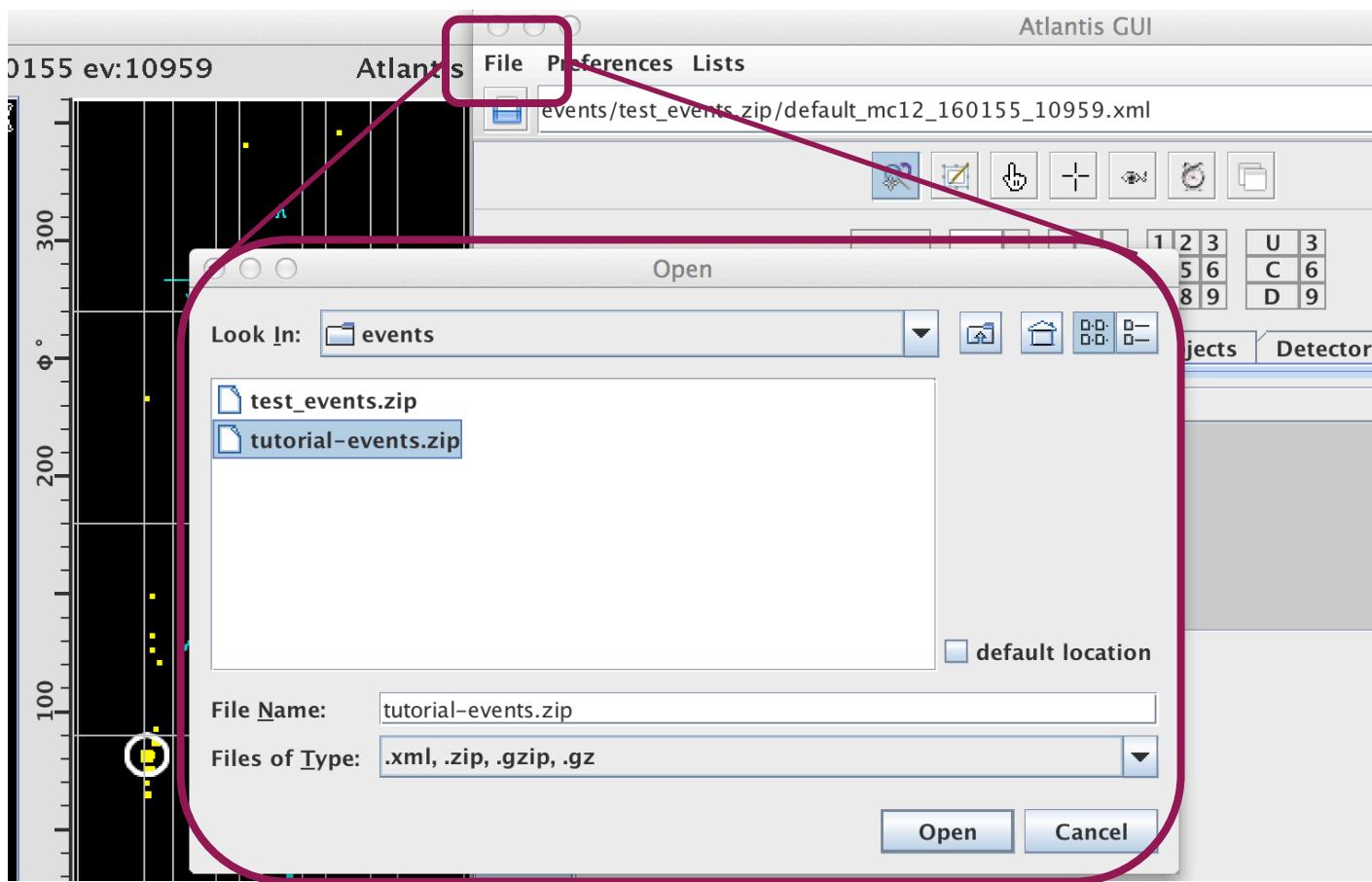
Information window



GUI

Loading events

- If you haven't already, download the tutorial-events.zip from the indico page
- File → Read Event Locally
- Select the file....

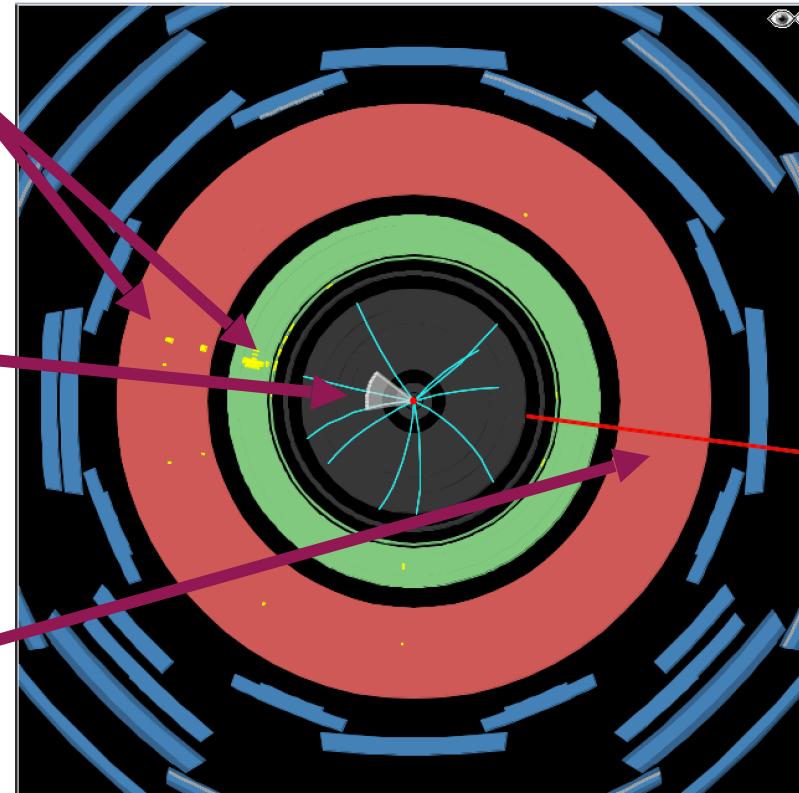


Looking at our first event

Calorimeter energy deposits (**hadronic**, **electromagnetic**)

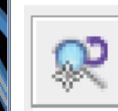
Jet with a single track

Direction of the missing energy



Transverse view, endcap detectors hidden

Here you can use:



The zoom tool:
lets you zoom in on
the interaction point.
The point you click
stays under the
mouse, drag it in or
out to zoom



The rubberband tool:
Lets you select an
area on the canvas,
you can then select
to zoom in on this
area

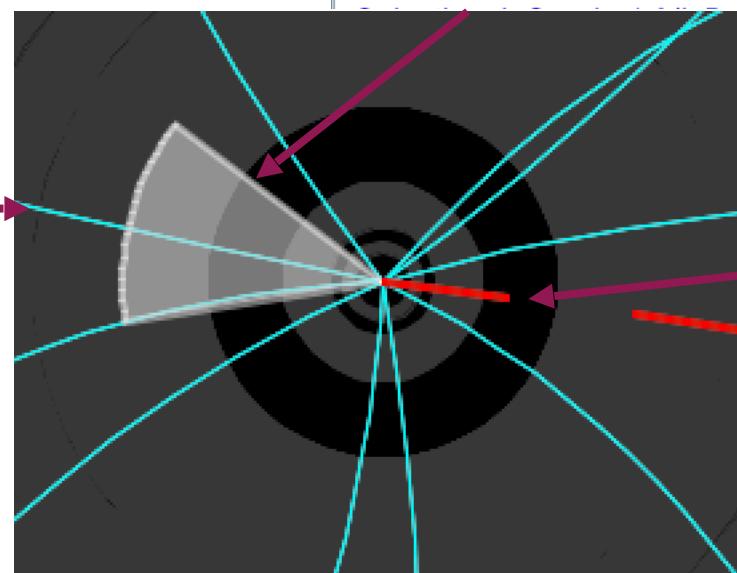
Looking at our first event

Now select the picking tool and look at the details of some of the objects we can see by clicking on them



Jet (id: 0 index: 0)
storegate key: AntiKt4TopoJets
 $ET = 36.481 \text{ GeV}$
 $E = 41.241 \text{ GeV}$
 $\eta = 0.505$
 $\Phi = 166.090^\circ (2.899 \text{ rad})$

InDetTrack (id: 35 index: 35)
storegate key: Tracks
numHits = 44
 $d0 = -0.062 \pm 0.002 \text{ cm}$
 $z0 = -8.372 \pm 0.011 \text{ cm}$
 $|z_0 - z_{\text{Vtx}}| = 0.019 \text{ cm}$
 $\phi_{\text{t0}} = 169.044 \pm 0.017^\circ (2.950 \pm 0.000 \text{ rad})$
 $\eta = 0.536 \pm 0.001$
 $tL = 0.562 \pm 0.001$
 $pT = 10.07 \text{ GeV} \pm 0.144 \text{ GeV}$
 $p = 11.55 \text{ GeV}$
 $\chi^2/\text{numDoF} = 0.6738268$
numPixelHits = 2
numSCTHits = 10
numTRTHits = 32



ETM_{is}
storegate key: MET_RefFinal
Sum- $ET = 144.899 \text{ GeV}$
 $ET\text{-}Mis = 38.592 \text{ GeV}$
 $ETx\text{-}Mis = 38.265 \text{ GeV}$
 $ETy\text{-}Mis = -5.017 \text{ GeV}$
 $\Phi = 352.531^\circ (6.153 \text{ rad})$

We have a 36 GeV jet balancing the missing E_T , containing one track of only 10 GeV. What could this be?

Applying cuts, displaying/hiding data types

Continue to the next event and reset the view:



Let's look at the hits in the inner detector

Data		Name
<input checked="" type="checkbox"/>	InDet	
<input type="checkbox"/>	Track Collections	
<input type="checkbox"/>	Segment Collections	
<input checked="" type="checkbox"/>	SpacePoint	
<input type="checkbox"/>	SCT_Cluster	
<input type="checkbox"/>	PixelCluster	
<input type="checkbox"/>	TrigSiSpacePoint	
<input type="checkbox"/>	PixelRDO	
<input type="checkbox"/>	SiClusterRDO	
<input checked="" type="checkbox"/>	TRT_DriftCircle	
<input type="checkbox"/>	SimChargedTrack	
<input type="checkbox"/>	SimVertex	
<input checked="" type="checkbox"/>	RecVertex	

Try raising the track p_T cut from 1 to 5 GeV:

Projection	Data	Cuts	InDet	Calo	MuonDet	Objects	Geometry
InDet			<input checked="" type="checkbox"/> Pt				> 1.0 GeV
Calo							< 2.5 mm
MuonDet			<input checked="" type="checkbox"/> d0				< 20.0 cm
Objects							
ATLAS			<input checked="" type="checkbox"/> z0				

Global settings (blue) apply to all windows
 Local settings (black) only apply to the selected window
 Right click on any setting to switch to local/global

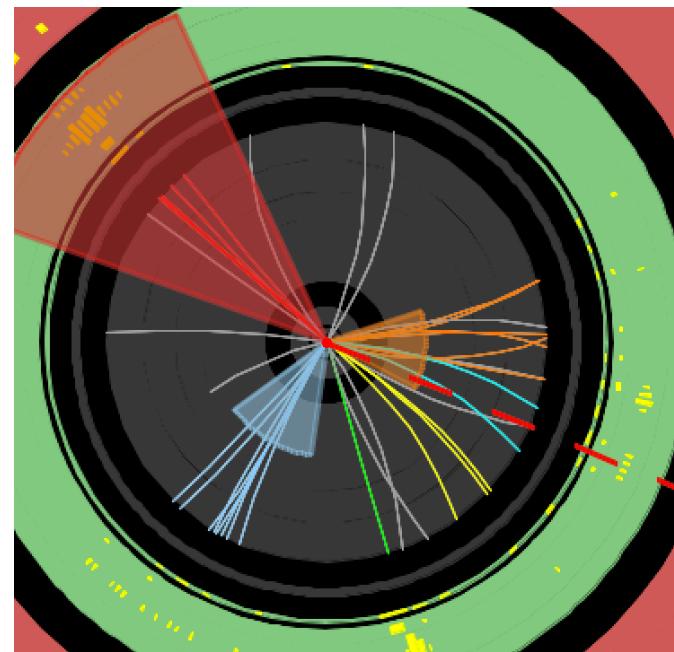
Now use the cuts panel, zoom and pick events to find out what particles you see in the event

Associations

Atlantis also knows about associations between objects, for example the tracks that are associated to a jet

Give each jet a different colour (colour by index)...

Projection		Data	Cuts	InDet	Calo	MuonDet	Objects	Geometry
Jet		Name	Value					
ETMis		AntiKt4TopoJets						
BJet		Index						
Electron	Color Function	8						
Muon	Constant Color							
Photon	Line Width	3						
TauJet	Scale	1.0						
Comp.Part.								



...then colour the tracks by associated object

Projection		Data	Cuts	InDet	Calo	MuonDet	Objects	Geometry
Track		Zoom Next Track						
Segment	Name	Value						
SpacePoint	Tracks							
PixelCluster	Color Function	Objects						
SCT_Cluster	Constant Color	25						
TrigSiSpacePoint								
PixelRDO								
SiClusterRDO								

Associations work the same for hits and tracks, try colouring the hits by tracks

Mouse modifiers

Mouse modifiers are keys you hold down to change the default behavior of an interaction tool

For example: hold down the ‘M’ key when using the Zoom tool to change it from zooming to moving, or ‘R’ to rotate the detector

The modifier keys for the currently active interaction can be shown if you select modifier keys from the help menu

If you change to the pick interaction, you will see that holding the ‘M’ key will allow you to calculate the invariant mass of tracks

	Key	Action
	I + Right	Interaction Manager pops up
	O + Right	Output of pointer position
	W + Right	Window Menu pops up
	Right	Interaction Menu pops up
	C	Modify Central Point
	F	Fast Zoom
	H	Horizontal Zoom
	M	Move (pan)
	R	Rotate
	V	Vertical Zoom
	Z	Zoom
		Zoom

Lists

Lists are collections of objects in Atlantis that you are able to select yourself

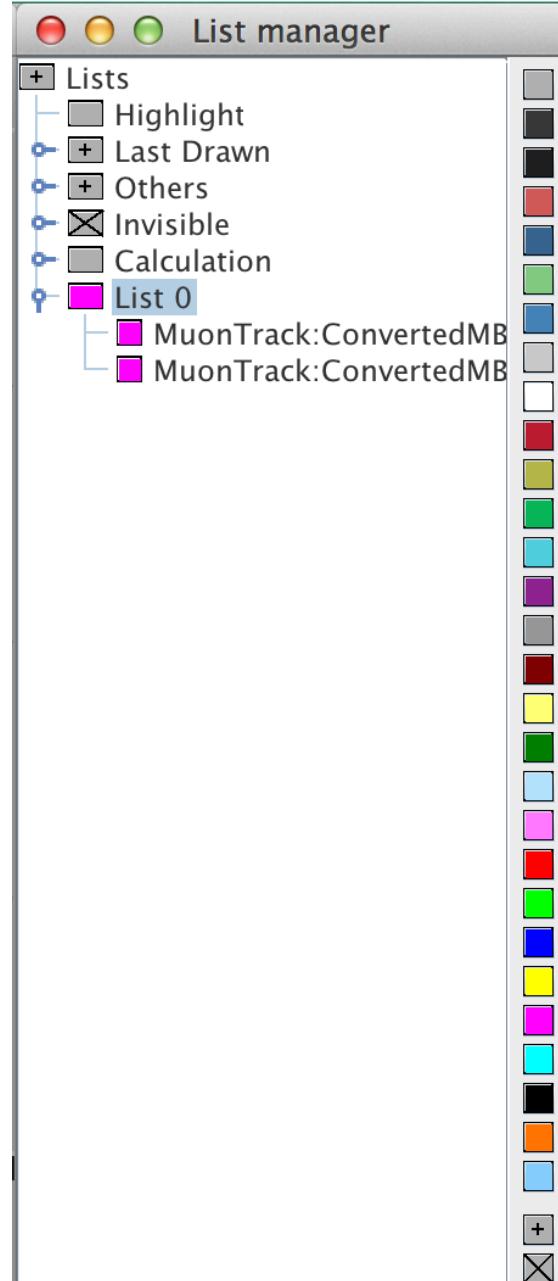
The list manager can be found by clicking on ‘lists’ at the top of the GUI

Objects can be added by

- highlighting using the picking tool and then moving from the “Highlight” list to a new list
- Selecting “new list” when using the rubberband tool

Lists can be used to:

1. change colours → click on the list’s box, and then on a colour from the RHS
- work out invariant masses → right click on the list and click “summarize”
1. hide objects → drag objects into the “Invisible” list or colour the list with the X button



Hands-on session

Now it is time for you to explore the rest of the events on your own

In the events we have given you, you can find:

- Single W and Z bosons
- WZ and $W\gamma$ events
- Top quark pair events
- Leptonic Higgs decay

We will be walking around the room to help, **do not hesitate to ask questions**

More information

If you want to learn more about Atlantis:

- Go to our website atlantis.web.cern.ch
- Sign up for the hypernews hn-atlas-AtlantisDisplay@cern.ch
- Check out <http://atlas-live.cern.ch> and go to “Collaboration site” to download XML files of the most recent collisions