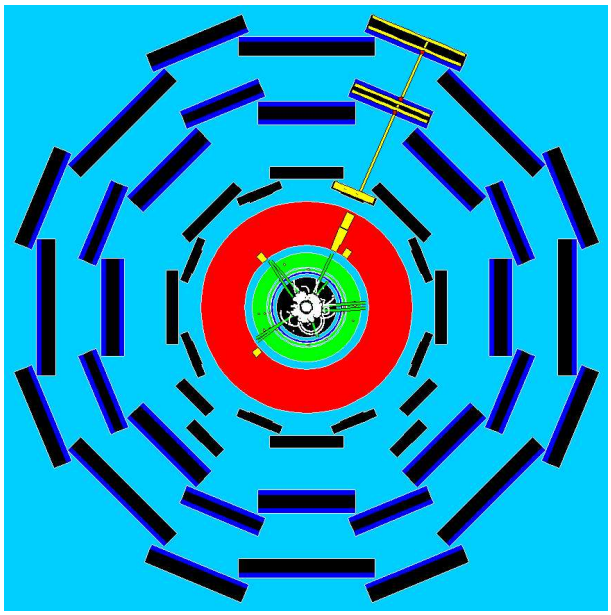
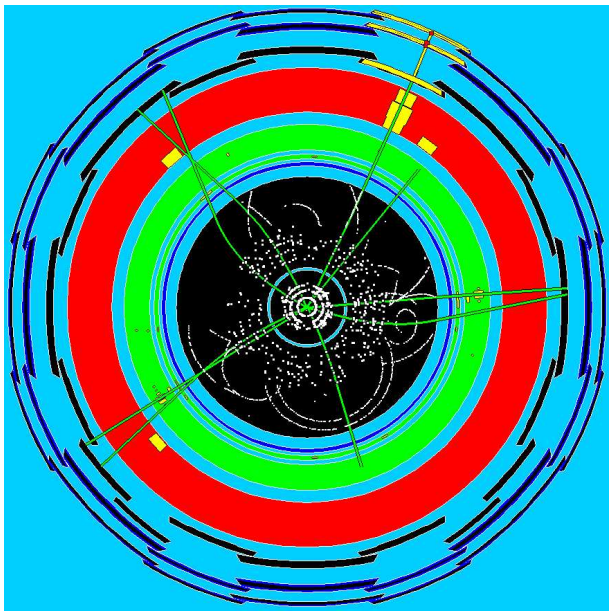
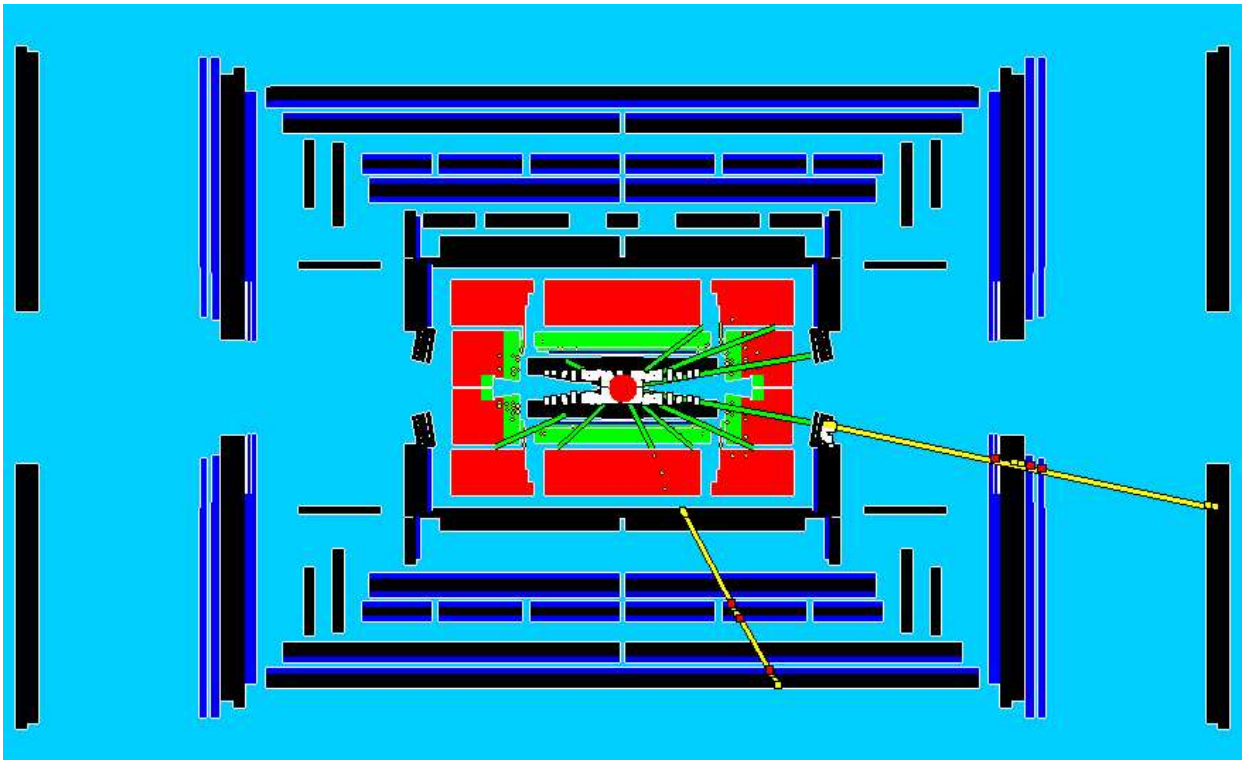
Atlantis Start-up Guide (V1.3)







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1 Introduction

Atlantis is an event display for the ATLAS experiment at CERN's Large Hadron Collider. The primary goals of the program are the visual investigation and the understanding of the physics of complete events. Secondary goals are to help develop reconstruction and analysis algorithms, to facilitate debugging during commisioning and to create pictures and animations for publications, presentations and exhibitions.

Three leading principles form the base of Atlantis development:

1. Atlantis is fast.
2. Atlantis is used intuitively.
3. Atlantis is used for complete ATLAS events.

1.1 Website and E-mail

The Atlantis website has url "`www.cern.ch/atlantis`" and the e-amail address of the Atlantis support team is "`Atlantis.Support@cern.ch`".

2 Getting Started

2.1 Obtaining Atlantis

Atlantis is available in (frozen) distribution versions from ATLAS software releases and in development versions from CVS.

2.1.1 Distribution versions

Distribution versions are obtained via CERN AFS directories, e.g. (for software release 11.0.3, revision 09-04-59):

```
/afs/cern.ch/atlas/software/dist/11.0.3/graphics/AtlantisJava/AtlantisJava-09-04-59
```

and contain the following files and directories (after removal of irrelevant ones):

- atlantis.jar
- configuration/
- events/
- geometry/
- help/
- img/
- lib/
- InteractiveServer.py

2.1.2 Development versions

Development versions are fetched from CVS and compiled using Ant. Directions are given on the Atlantis website and in Appendix A of this document.

2.2 Starting Atlantis

Since November 17, 2005, Atlantis is distributed as external package with ATLAS software releases. It is available in two flavours: the "full" version with all options and the "beginner's" version with a limited set of GUI options. The executables are started by executing commands "`atlantis`" and "`atlantis_beginner`" respectively.

If Atlantis was obtained from CVS, it is started by executing command "`java -jar atlantis.jar`" in the folder in which file `atlantis.jar` resides.

You may wish to add this command with an alias `atlantis` to your shell configuration file.

2.2.1 Startup tags and switches

The general command to run Atlantis is (replace *JAVA-version*, *directory/* and *tag* by appropriate values in the command line):

JAVA-version`/bin/java -jar` *directory/*`atlantis.jar` *tag*

The tag is used to indicate normal events (no tag), Fast Simulation events (tag=`Fast`) or Combined Test Beam events (tag=`TB`). E.g. for Fast Simulation events:

```
/usr/java/j2re-1.4.2_06/bin/java -jar atlantis.jar Fast
```

N.B.: Note that Atlantis runs stand-alone (i.e. outside the ATLAS software framework), it only requires JAVA version 1.4 or higher to run. However, JAVA version 1.5 is preferred.

3 The Atlantis windows

When Atlantis starts, two windows appear, as shown in figure 1. On the left is the display area or Canvas, which may show different views of the events of interest. On the right is the Control Window, which is divided into five logical sections. These sections are, from top to bottom:

1. **Menu** – Provides functionality for I/O, program customization and the help-system
2. **Canvas Control** – Provides functionality for Canvas window management (copy, zoom, pop-up menus, etc.) in the display area or Canvas.
3. **Interaction Control** – Provides functionality for user interaction with the program (pick, zoom, transformations, projections).
4. **Parameter Control** – Provides functionality for viewing and changing various parameters (data selection, cuts, detector, subdetector systems, projections).
5. **Output Display** – Displays output of the program (picking output, cuts summary, etc.).

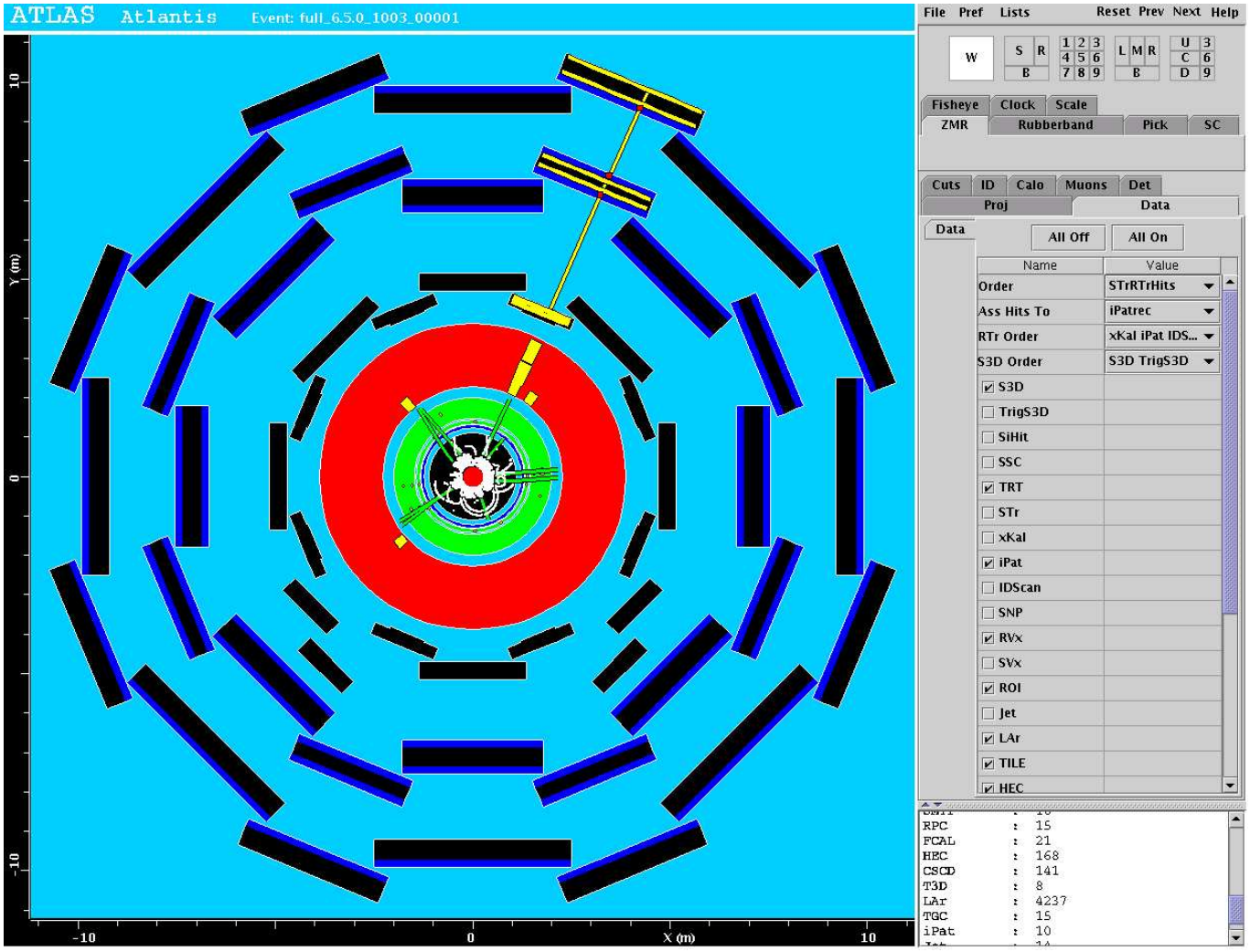

Figure 1: The two startup windows of Atlantis, Canvas (left) and Control Window (right).

4 Menu

4.1 Getting Help

Online documentation is available via option "Online Help System" of the "Help" menu item in the top right corner of the Control Window. If this option is selected, a pop-up help window will be displayed in which you may browse all help pages. With the Search tab in the Atlantis Online Help window you may search for words in the full help text. The Index tab is not used yet.

Figure 2: The Menu of the Control Window.

4.2 Exiting Atlantis

The "File" menu item of the Control Window has an option "Exit" to stop the Atlantis program.

4.3 Reading Events

The "File" menu item is used to perform operations on event files and to exit Atlantis. Note that event files are expected to be in XML format (which may also be zipped). The event files can be on your local machine, available via URL or obtained from a server for which an Athena job has been set up. The event files are made from Athena, using the correct JiveXML job options. Details can be found on url

`http://www.hep.ucl.ac.uk/atlas/JiveXML/JiveXML.shtml`

When using a zip-file (or ordered events in an event folder) the "Prev" and "Next" menu items allow to view the previous and next events respectively.

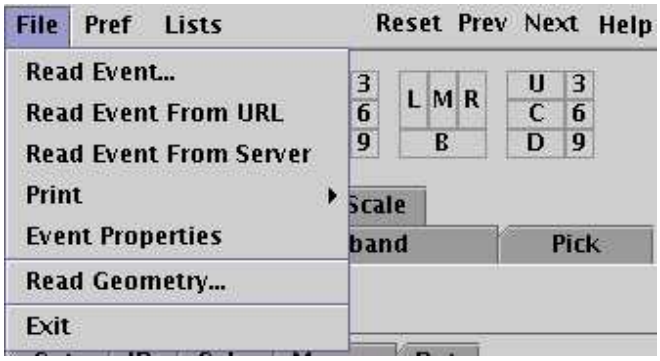

Figure 3: The options of the "File" menu item of the Control Window.

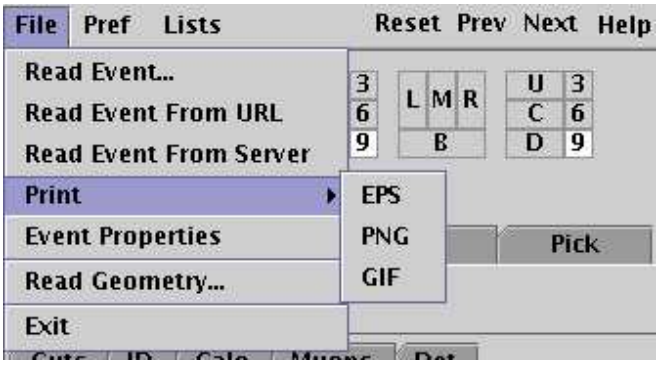

Figure 4: The print options of the "File" menu item of the Control Window.

4.4 Printing

The "Print" option of the "File" menu item shows the output formats from which you may choose to save the pictures shown on the Canvas.

1. **EPS** – Encapsulated PostScript. Vector graphics format for posters, publications, etc.
2. **PNG** – Portable Network Graphics. A compressed bitmap format to be used in Powerpoint presentations, etc.

3. **GIF** – Graphics Interchange Format. Another compressed bitmap format.

5 Canvas Control

In the Canvas Control part of the Control Window the different layouts of the Canvas with canvas subwindows are shown in boxes.

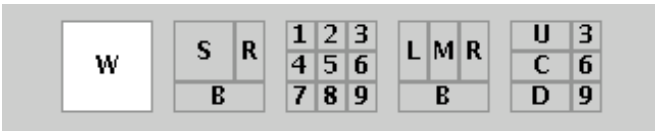

Figure 5: Boxes of Canvas Control with square option selected.

Figure 6: Boxes of Canvas Control with landscape option selected.

Canvas Control provides functionality for different kinds of operations on the canvas subwindows in the boxes:

1. **Making a canvas subwindow current**
   The current canvas subwindow corresponds to the box with the white background. Clicking with the left mouse button into another box will select the corresponding canvas subwindow to become current. If this is not visible on the Canvas it will become visible.

2. **Copying the content of one canvas subwindow into another**
   You can copy the content (picture) of one canvas subwindow into another by dragging and dropping it into another one. While you are dragging, the cursor will change to let you know that you are dragging. You can copy canvas subwindows even if they are not current. After the copy finishes the target canvas subwindow will become current.

3. **Zooming a region of one canvas subwindow into another**
   Canvas Control contributes to the process of zooming with a rubber band, however you cannot perform a zoom by using Canvas Control only.

4. **Accessing the pop-up canvas subwindow menu**
   The pop-up canvas subwindow menu can be accessed by rightclicking with the mouse in the corresponding box. The corresponding canvas subwindow will become selected.

6 Interaction Control

It is very important to understand how interactions work, so you may use the full power of each. There are two sets of interactions, the interactions that are sensible for all projections (global interactions) and the interactions which are only sensible for some specific projections (projection dependent interactions). As a consequence, each projection has a specific set of associated interactions represented by the set of tabs in the Control Window.

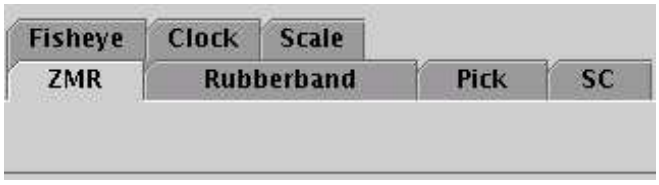

Figure 7: Interaction Control of the Control Window.

6.1 Global Interactions

Interactions that are available in all projections:

1. **ZMR** – Zoom, move and/or rotate a picture in a canvas subwindow.
2. **Rubberband** – Different kinds of rubberband selections.
3. **Pick** – Used to pick an object in one projection and find it in another. Also used to display information about hits, tracks or detectors.
4. **SC** – Synchronised cursors, used to see the same cursor position in different projections.

6.2 Projection Dependent Interactions

Interactions that perform operations which only make sense in specific projections:

1. **Fisheye** – Available in Y/X, ρ/Z, ϕ/ρ, ϕ/Z, X$'$/Z, Y$'$/Z and 3D.
2. **Clock** – Available in Y/X only.
3. **Skew** – Available in ρ/Z, ϕ/ρ and ϕ/Z.
4. **Scale** – Available in Y/X, ϕ/η, ρ/Z, ϕ/ρ, ϕ/Z, X$'$/Z, Y$'$/Z and 3D.

6.3 Modifier Keys

Modifier keys are combinations of a keyboard key and a mouse key that are used to generate pop-up menus or to perform interactions. Generally a keyboard key is kept pressed and during this pressing, a mouse key is clicked (e.g. to get a pop-up menu) or kept pressed (e.g. zooming).

Modifier keys are used to perform specific function for a specific interaction. A list of modifier keys of the currently selected interaction is shown in a pop-up window when clicking on "Mouse Modifier" of the "Help" menu item in the Control Window.

Modifier Key	Action
right-click	Move to last picked item
I + right-click	Interaction List Menu pops up
P + right-click	Projection Menu pops up
W + right-click	Canvas Window Menu pops up
left-click	Pick item
A + left-click	Add to current list
C + left-click	Clear highlighting
H + left-click	Highlight
M + left-click	Hits in same module
N + left-click	Navigate
S + left-click	Select this muon sector

Figure 8: Modifier keys pop-up window.

7 Parameter Control

Atlantis has many parameters. For convenience these parameters are combined into a number of groups: projections, data, cuts, detector, inner detector, calorimeters, muon system.

Figure 9: Parameter Control of the Control Window.

7.1 Projections

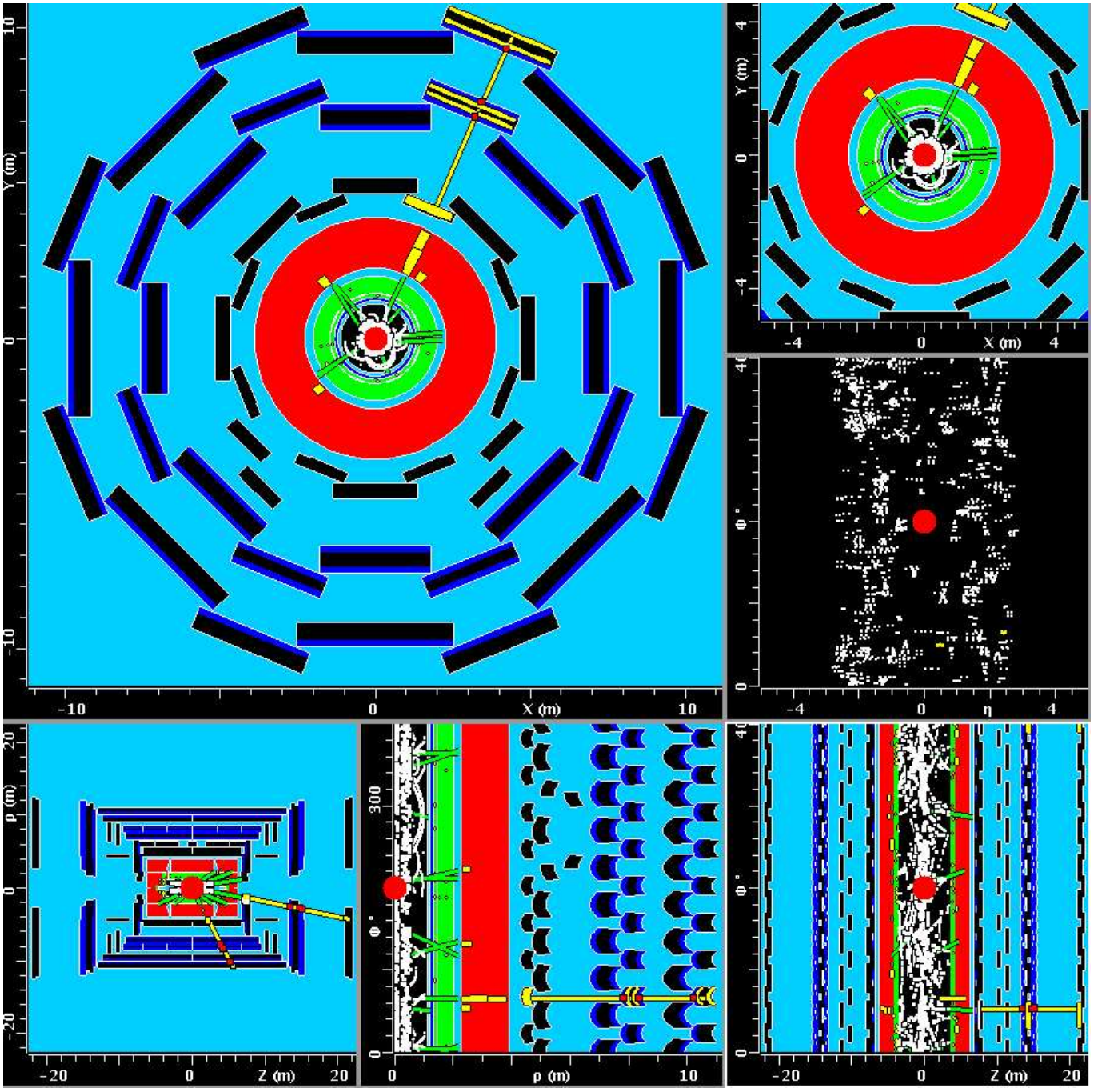

Figure 9: Subwindows on Canvas showing different projections, top left Y/X, top right Y/X with fisheye, middle right ϕ/η (V-plot), bottom left ρ/Z, bottom center phi/ρ, bottom right phi/Z.

The projections that are available in Atlantis are data oriented, that is, they are adapted to the cylindrical structure of helices and of the ATLAS detector. The following projections are available:

1. The Y/X projection: looking along the beam axis.
2. The X′/Z projection: looking perpendicular to the beam axis. The angle around the axis may be changed.
3. The Y′/Z projection: looking perpendicular to the beam axis and perpendicular to X′/Z. The angle around the axis may be changed.
4. The ρ/Z projection: non-linear projection, which is intuitively understandable.
5. The ϕ/ρ projection: non-linear projection.
6. The ϕ/Z projection: non-linear projection.
7. The ϕ/η projection: non-linear projection of which the V-plot is a special case.

7.1.1 The V-plot (ϕ/η projection)

Calorimeter data from a single sampling are best shown in ϕ/η-projection, where the energy deposits may be shown through Lego towers or other methods. There are also methods to show several samplings superimposed.

Data from 3D tracking chambers may be shown in this projection with optimal separation of tracks. However one faces the problem, that charge, track momentum and the distance of hits from the beam axis cannot be recognized.

One way out is the V-plot, which preserves all the features of the ϕ/η-projection. It may be applied to both tracks and hits. The latter without using any hit to track association.

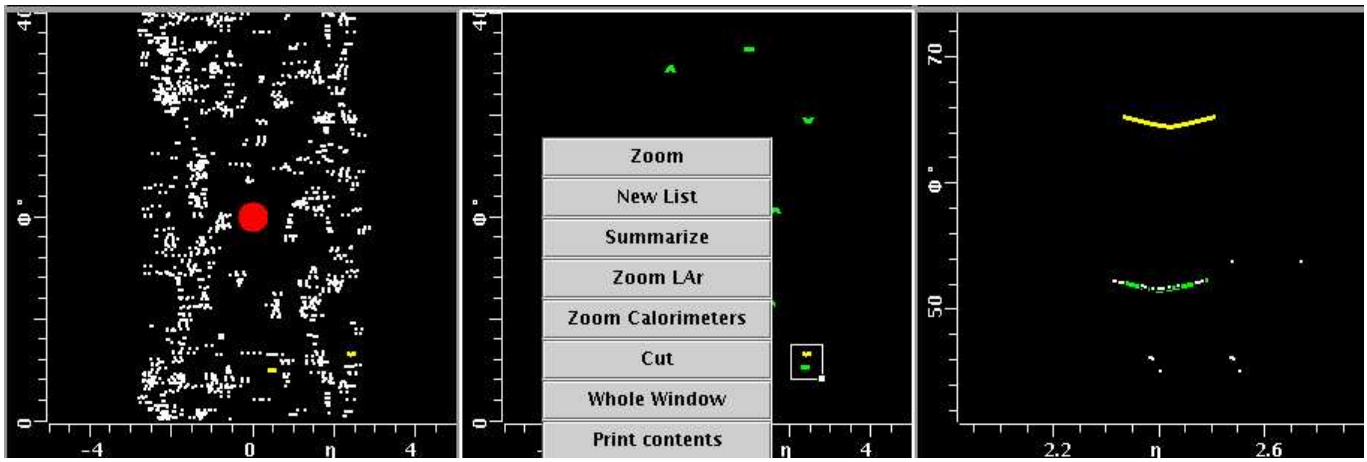

Figure 10: V-plot, left phi/η, center phi/η with S3D hits removed and making selection via rubberband, right the selected area.

For a point in space (with coordinates ϕ, η, ρ) a pair of points is displayed on the V-plot picture. In the case of particles moving in a solenoidal field the two displayed points get the same ϕ as vertical position and get two different horizontal positions namely $\eta \pm k \times (\rho_{max} - \rho)$. The value of the parameter k (Gradient) is set by default but may be changed interactively. The parameter ρ_{max} is set automatically depending on the selected view. As k and ρ_{max} are known, ϕ, η and ρ may be recalculated from the coordinates of a pair of displayed points, which means that the V-plot is a true 3-dimensional image.

The position ZVTx of the primary vertex along the beam axis must be known to calculate η.

The following rules apply to interpret the V-plot:

1. Helices transform into a V like pattern.
2. For helices pointing to the origin with not too low P_t the arms of the V's are straight.
3. For helices not pointing to the origin the arms of the V's are curved:
   - with the same sign of curvature for tracks separated from the origin in z,
   - with opposite sign of curvature for tracks separated in ρ.
4. Positive tracks give V's pointing down.
5. Negative tracks give V's pointing up.
6. The gradient of the V arms is proportional to $1/P_t$:
   - high P_t tracks give V's with large opening angle,
   - low P_t tracks give V's with small opening angle.

7.2 Data and Cuts

Selecting the "Data" tab of the Parameter Control in the Control Window allows the selection of which data objects are displayed. It also allows setting the order in which tracks, hits and truth information is displayed on top of each other.

Selecting the "Cuts" tab allows setting cuts on the individual data-objects, thus displaying only those objects that satisfy the selected cuts.

7.3 Detector

The ATLAS detector is divided into the following subsystems:

1. Inner Detector (with tab ID)
2. Calorimeters (with tab Calo)
3. Muon System (with tab Muons)

The data and parameters are described under these tabs. It is in this section that the coloring of hits and tracks can be changed such that the coloring represents the corresponding associations.

The Atlantis projections (except the ϕ/η-projection) are chosen in such a way that detector volumes do not overlap. Therefore, one can replace transparent wire frame images by filled areas surrounded by frames, which are easier to perceive intuitively. The fill colors of the various detectors and of the background may be modified. Note that small points, lines or cells are better distinguished from background with high intensity contrast. With the value of b between 0.5 and 1, the intensity I of colors can be very roughly estimated by:

$$I = 4 \times I_{green} + 2 \times I_{red} + b \times I_{blue}$$

When printing on normal quality color printers it is advisable to avoid muted colors for areas onto which small objects are drawn. Therefore printed files have their own color set, which takes this into account. Print colors may therefore be different from display colors.

8 Interactive Athena

Athena can be accessed interactively from Atlantis via the interactive dialog window. Thus the user is able to steer the Athena framework directly from the Atlantis display and perform various actions as if the commands were typed on the Athena interactive prompt directly. E.g. changing/querying the values of the job options, executing the methods of Athena algtools/algorithms, directing Athena to process the next event and eventually getting the XML event data.

See the online documentation for more information. The documentation is available from the Atlantis program itself and from links on the Documentation page of the Atlantis website.

9 How to proceed further?

The basic Atlantis elements described in this document merely start to describe the functionality of the package. In order to master the complete package a detailed online documentation is available with the package. A pop-up menu is started via the "Online Help System" option of the "Help" menu item of the Control Window.
The complete online documentation is also available as one PDF document on the Atlantis website. Furthermore, the website contains information from the tutorials given at CERN.

In case of problems, it is recommended to send a message to the Atlantis support team which generally generates a reply within 24 hours.

The Atlantis website has url "`www.cern.ch/atlantis`" and the e-amail address of the Atlantis support team is "`Atlantis.Support@cern.ch`".

10 Appendix A: Atlantis from CVS

If Ant and JAVA (JDK) have been installed correctly on your machine (including the definition of the environment variables `ANT_HOME` and `JAVA_HOME`), you may fetch Atlantis from CVS and run it:

```
mkdir <atlantis CVS directory>
cd <atlantis CVS directory>
cvs -d :kserver:atlas-sw.cern.ch/atlascvs checkout offline/graphics/AtlantisJava
cd offline/graphics/AtlantisJava/ant
ant -DtargetDir=<target directory> all
cd <target directory>
java -jar atlantis.jar
```

First a local subdirectory is created that is used for the Atlantis CVS files. A local target directory (relative to the current directory or absolute) is given as argument to the Ant command to copy the Atlantis files to.

11 Appendix B: Links

Ant	`http://ant.apache.org/`
Atlantis	`www.cern.ch/atlantis`
JAVA	`http://java.sun.com/j2se/1.5.0/download.jsp`