



WIRED User Manual v.4.0

User Manual

Table of Contents

| | |
|----------------------------------|----|
| 1 WIRED 4 User Manual | |
| 1.1 User Manual | 1 |
| 1.2 Introduction | 2 |
| 1.3 Installation | 4 |
| 1.4 JAS 3 | 7 |
| 1.5 Environment | 9 |
| 1.6 Commands | 11 |
| 1.7 Data Access | 12 |
| 1.8 Projections | 13 |
| 1.9 Interactivity | 19 |
| 1.10 Output | 27 |
| 1.11 Comparison to WIRED 3 | 1 |
| 1.12 Feedback | 2 |
| 1.13 Appendix A: BaBar | 3 |
| 1.14 Appendix B: GLAST | 7 |
| 1.15 Appendix C: Linear Collider | 9 |
| 1.16 Appendix D: GEANT4 | 10 |
| 1.17 Appendix E: History | 11 |
| 1.18 References | 12 |
| 1.19 Epilogue | 13 |

1.1 User Manual

WIRED 4 User Manual

This manual explains how to use WIRED 4 and its associated plugin modules inside JAS 3. It covers subjects ranging from installation and setup through data access to interactivity and producing output plots. Experiment specific notes are written up in appendices.

1.2 Introduction

Introduction

WIRED [1] is an event display system which allows users to visualize single event data on any platform using JAS 3 (Java Analysis Studio). Events can be browsed by WIRED from any source that can provide data in the HepRep standard [2]. Data can be particle physics events, detector geometries, or any other hierarchical graphics information. HepRep data can be supplied to WIRED in XML format from files, converted from some other format on the fly, or by using communication mechanisms such as CORBA or RMI.

WIRED 4 is an experiment independent plugin module for JAS 3. It is written in pure Java and runs on any platform that runs Java and JAS 3 [3]. These platforms include the whole range of Windows operating systems (95, 98, ME, 2000, NT and XP), MacOS X, Linux and other Unix systems. WIRED 4 handles data in the HepRep standard. To supply WIRED 4 with the necessary HepRep you need other plugin modules, some of which may be experiment specific. To handle HepRep XML files you need to install the HepRep plugin, see [installation](#). See the appendix for your experiment (BaBar, GLAST, Linear Collider, Geant4) to see what plugins to load into JAS.

The WIRED 4 system takes HepRep data, runs it through some projection and displays it on the screen. The following features are currently available in WIRED 4:

- **Data Access**
 - Access HepRep 2 data.
 - Access HepRep 1 data via converter.
 - Browse multiple events in XML format in either plain files, zip files or gzipped files.
- **Interactivity**
 - Selection of multiple euclidian and non-euclidian projections: Parallel, FishEye, RhoZ, etc.
 - Interactive scaling, translation and rotation, including feedback.
 - Interactive changes to settings such as projections, global variables, etc...
 - Advanced picking of pre-selected objects and showing physics (and non-physics) information from the HepRep data.
 - 3D translations using picking, for instance to select a calorimeter hit and center it for rotation.
 - Tree representation of HepRep data to control the detector and or event visibility.
 - Almost all interactive commands can be undone and redone.
- **Output**
 - Layering of Hits on Tracks on Geometry, making all visible at any time.
 - Change of quality settings for both display and file output.
 - Low quality output in bitmap graphics formats, such as PNG and GIF.

- High quality output in vector graphics formats, such as PostScript, PDF, EMF, SVG, Macromedia Flash and others.
- Copy on the Windows platform to the clipboard (in EMF format) for pasting in PowerPoint or Word.

Among the features on the list for post version 4.0 are:

- Interactive cuts on physics (and non physics) information, so users can for instance hide all tracks below a certain energy.
- Scripting to allow users to run small programs to manipulate the HepRep data.
- Labeling of objects on the screen.
- Interactive 3D translations using orthogonal views.
- Full implementation to save the state of the application.
- Use of the plugin to create histograms in JAS 3.
- Other user requests.

1.3 Installation

Installation of JAS 3 and WIRED 4

Users are encouraged to install JAS 3 and WIRED 4 on their local machines. This has the advantage that the local CPU and memory is used for running these programs and no usage is made of remote XWindows in the case of Unix.

Before you can install WIRED 4 you need to have JAS 3 installed. You need at least version 0.8.1 of JAS 3. If JAS 3 is not yet installed, do so now, by following the instructions from the JAS 3 website at:

<http://jas.freehep.org/jas3/index.html>.

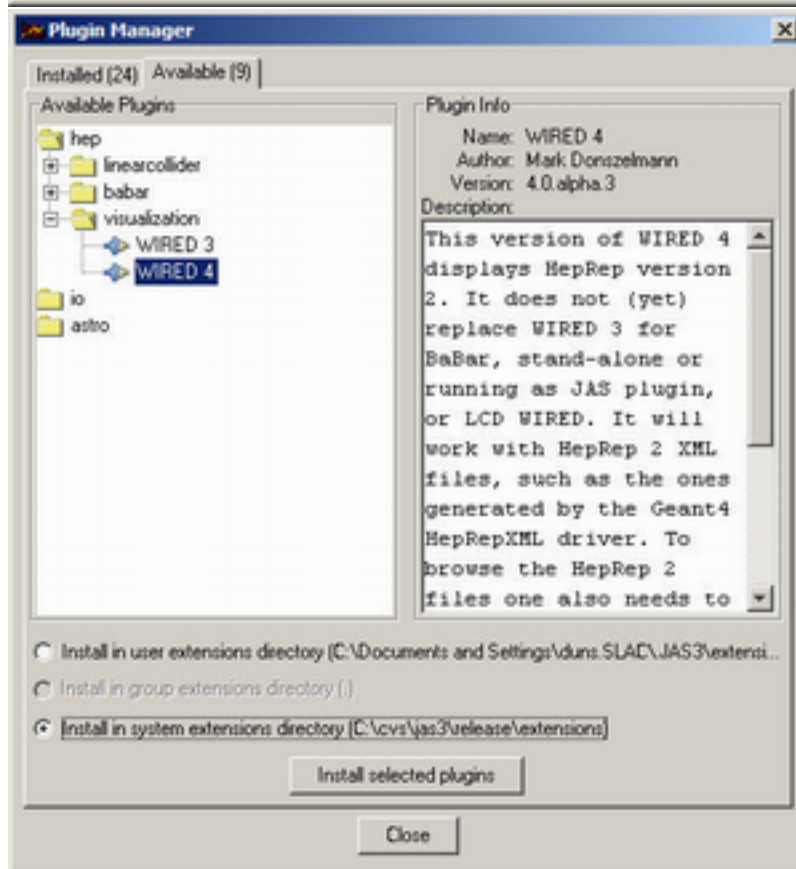
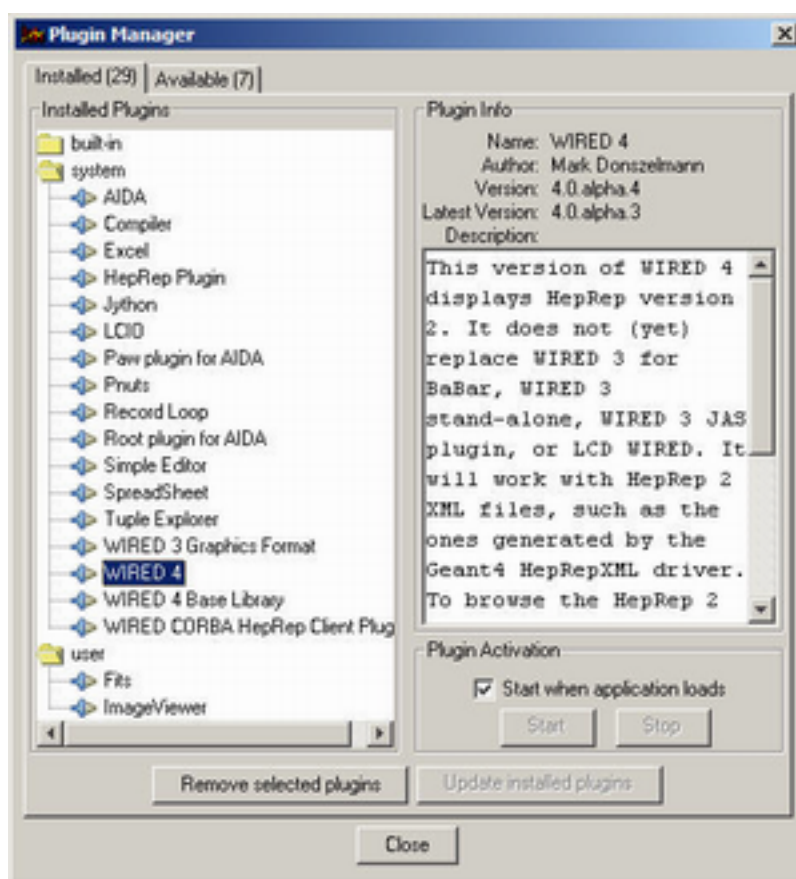
To verify the version number of JAS 3 select **Help->About** from the menu.

To run WIRED 4 you need at least the following three plugin modules:

1. **WIRED 4**
2. **WIRED 4 Base Library**
3. **HepRep**

Launch JAS 3 and select **View->Plugin Manager** from the menu. On the **Installed** tab you may find **WIRED 4** listed under either **system** or **user**. If this is the case, WIRED 4 is already installed, but you still may want to upgrade to the latest version.

If you do not find WIRED 4 here, go to the **Available** tab (you need to be connected to the internet at this time) and look under **hep/visualization**. You should find WIRED 4 here. You need to install both the **WIRED 4 Base Library** and **WIRED 4**, by selecting the first one with a click and the second one with a shift-click. Then select either to install them in the **User extensions directory** or in the **System extensions directory**, it does not matter, but you may not have write permission in the System area. Once selected, click **Install selected plugins**, which will download the plugins and install them. Progress will be shown. You may check that WIRED 4 is installed, as it should appear now under the **Installed** tab.



To view HepRep data you also need to install the HepRep plugin. You need at least version 1.3 of this plugin. Again you can check if the HepRep plugin is installed by looking under the **Installed** tab. If not, it should be under the **Available** tab under **hep/visualization**.

Any plugin can be updated if newer versions are available, and plugins can also be removed.

To get rid of the plugin manager, push the **Close** button.

The following plugin modules are part of or related to WIRED 4:

- **WIRED 4:** The main WIRED Event Display plugin.
- **WIRED 4 Base Library:** The base library for WIRED 4, which is also used by other graphics visualization plugins such as the FITS plugin.
- **HepRep:** The HepRep2 XML file reader, the HepRep1 to HepRep2 converter and the HepRep1 and HepRep2 interface standards.
- **WIRED CORBA HepRep Client Plugin:** The CORBA client which connects to HepEventServers [4] to retrieve HepRep1 or HepRep2 data using CORBA. This client can also handle JProcMan [5] lookups. This plugin is useful for GLAST and BaBar.
- **WIRED 3 Graphics Format:** A converter plugin from the WIRED3 graphics format to HepRep2. This plugin is only useful for BaBar, where the geometry description in in WIRED3 Graphics Format. The geometry of BaBar is included in this plugin, so the plugin is rather large.

1.4 JAS 3

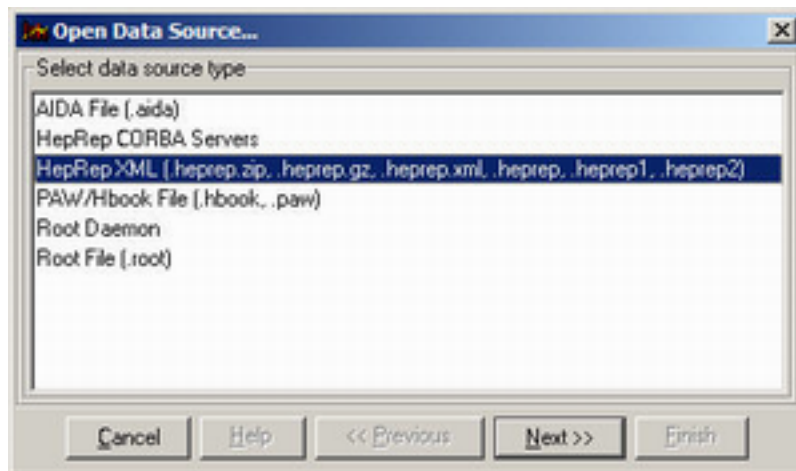
JAS 3

JAS 3 provides an Analysis Studio for the user. It is based on the FreeHEP Java Library [6]. It handles installation and interaction of plugin modules. Different plugin modules can be loaded into JAS 3 to do analysis on multiple events and view histograms, or to browse datasets and view events one by one using WIRED 4. JAS 3 comes with a set of default plugin modules installed. You have already installed the extra WIRED 4 and HepRep plugin modules, so you should be ready to browse and view events.

To get started, you may download some sample HepRep files from the WIRED 4 HepRep download area and store them on some accessible area. The HepRep examples can be found at:

<http://wired4.freehep.org/heprep/examples>.

HepRep files can be opened in JAS by selecting **Open DataSource...** from the **File** menu. This will open the DataSource wizard and allow you to select from a set of HepRep (and non-HepRep datasources). You should be able to select HepRep XML, and if you installed the **WIRED CORBA HepRep Client Plugin** you can also select events from CORBA servers.







Note: If this option is not available, the HepRep plugin is not installed. Open the Plugin Manager and try to see what went wrong.


Select Next in the wizard and browse to one of the downloaded HepRep files and open it. The toolbar now expands by showing you the current dataset and a set of buttons to browse through the event set.

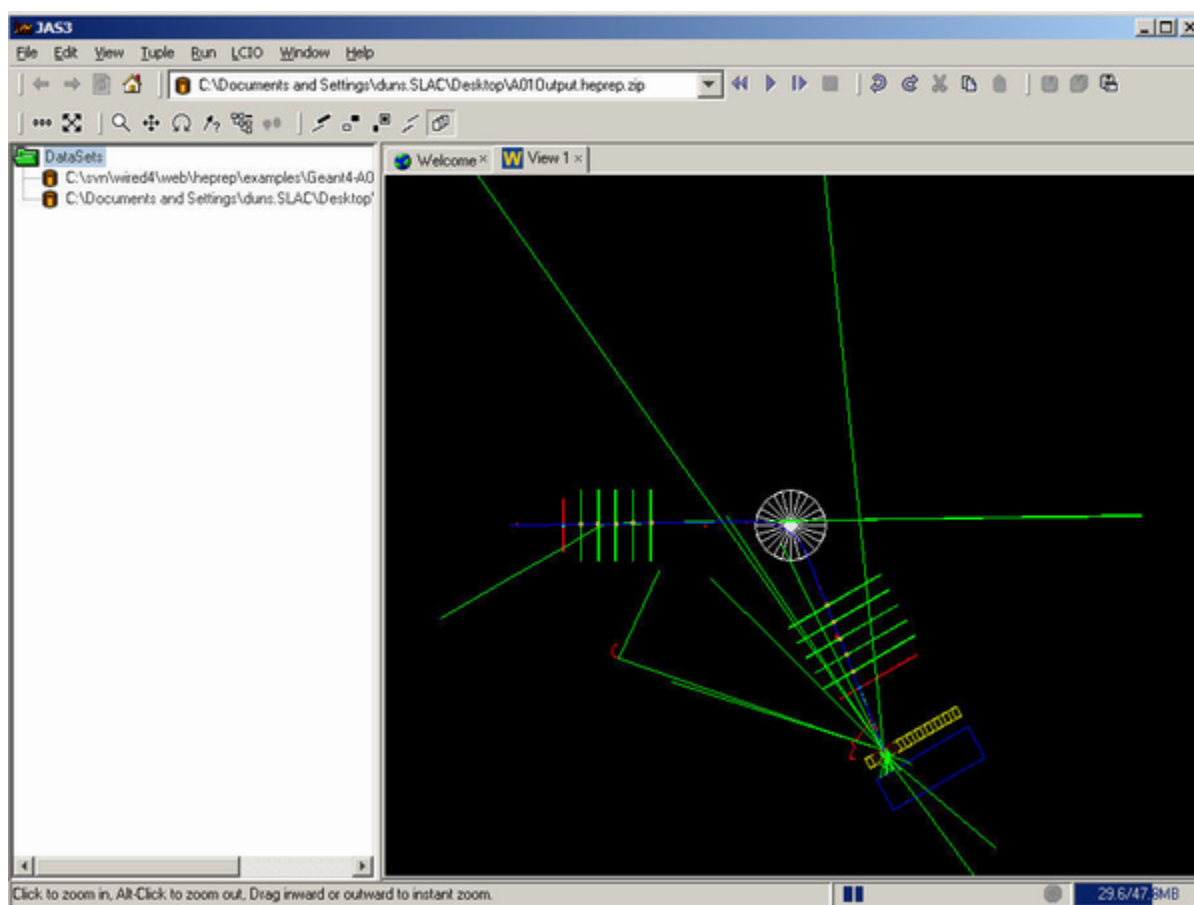


The dataset is now open, and you are situated just before the first event. To navigate through your event set you have the following four buttons available:

-  Rewind to the start of the dataset and set the pointer just before the first event.
-  Run through all events (not useful for Event Display).
-  Go to next event.
-  Stop processing (only available while loading a next event).

You may also select any of these options and more from the **Run** menu.

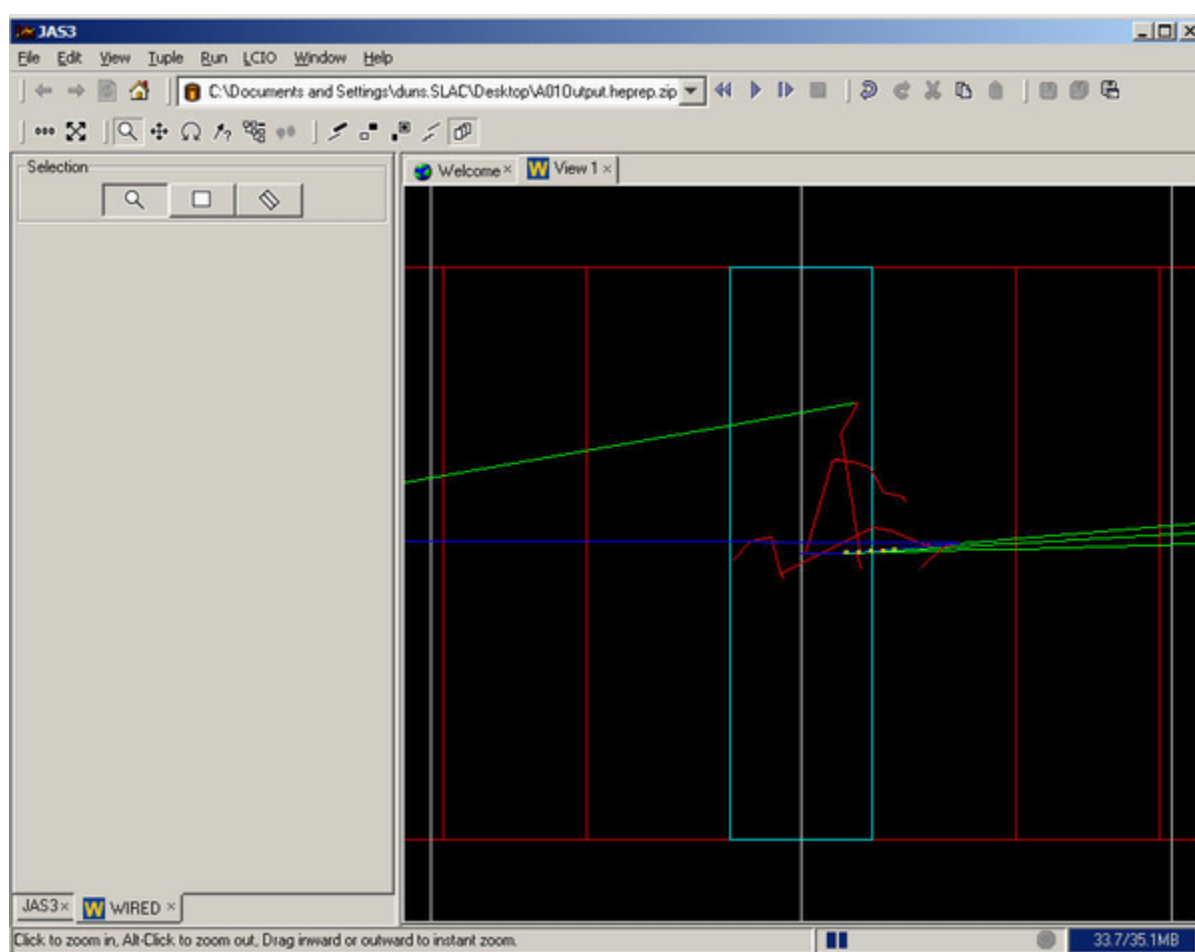
You could navigate to the first event now, but it would not show since you have not yet opened any WIRED view. To open a WIRED view, select **New->Wired4 View** from the **File** menu. If you click on Next event  now, then the first event of your dataset will show. The next picture show the first event out of the A01 Geant4 example dataset.



1.5 Environment

The JAS 3 and WIRED 4 environment

Before we go on and explore events, let us look at the JAS3 and WIRED 4 environment. As JAS 3 is a plugin based system, menus, toolbars and windows can be added by different plugins as they are installed, loaded and started. Your JAS 3 may thus look a little different than the one shown here.



At the top we have a menubar, where we see the standard set of menus. We can also see that the LCIO plugin has added its own menu. Unless you are working with LCIO you probably will not have this menu. Just below the menubar we find the toolbar. If we have a dataset open, it will show this dataset by name. If the dataset is browsable there will be a set of buttons to browse it. If you have executed commands which can be undone/redone a small toolbar will be available to undo the command. If you are looking at an event, you will also have buttons to Copy and Save As. Somewhere on the toolbar there will be buttons for interaction with JAS. These buttons will be explained later on. The toolbar buttons

will be enabled or disabled depending on the availability of certain functions. Tooltips will show what each button is useful for.

The rest of the main window is split into two panels. On the right, the views, which are tabbed, so you can switch from one to the other, or to panels with output from other plugins such as histograms. On the left, the tabbed control panel, where you can find the main tree with DataSets, Histograms and the WIRED 4 control panel. This control panel is used to show extra information and let the user choose more advanced functionality.

All the way at the bottom-left is the status bar, which shows messages to inform the user what has happened, or what the next step is he can perform. At the bottom right is the progress bar, to show what JAS is doing and the memory usage.



1.6 Commands

Commands

Most commands are available from the menus, the toolbar and from the popup-menu. The popup menu is specific to the view and can be popped up with a right-click on the mouse. On the Macintosh ctrl-click will show the menu.

Most of the commands that change the view can be undone. Once undone, the command can again be redone. A whole sequence of commands can be undone one after another. The sequence is broken if a command is executed which cannot be undone. Then, unfortunately, there is no further way back. The tooltip on the undo/redone button will show the next command it will undo/redone and the status bar will also show information about the command.

Undo / Redo functionality is available from the Edit menu and from the toolbar:

-  Undo
-  Redo

1.7 Data Access

Accessing Data using the HepRep plugin

The backbone of WIRED 4 is the HepRep2 standard. In principle this is the only "format" that WIRED 4 accepts. However, additional plugin modules make HepRep1 and older formats also available to WIRED 4. If you were to write a plugin module to make your data accessible in HepRep format, HepRep2 would be the better choice.

The HepRep2 format stores information such as points in a tree structure. Special drawing attributes are attached to the tree to show how to represent the points (as symbols, as lines, as polygons, cylinders, etc). With this information WIRED 4 can do a projection and make a drawing on the screen. Additional information of any type, including physics attributes, can be attached. This information can be shown on the screen in picking mode, or be used in future for cuts.

File Access

HepRep2 data can be read from files, either in the form of XML HepRep (.heprep) or in the form of Binary HepRep (.bheprep). XML files tend to be fairly large while Binary HepRep files are quite a bit smaller and faster to parse. Both XML HepRep and Binary HepRep files can be compressed using gzip format (.gz extension). However, to allow multiple events to be stored in one file, HepRep2 uses the zip format (.zip extension), which allows semi-random access to the events and compression at the same time. The HepRep plugin handles all these different file combinations.

HepRep1 files can also be read. The same applies for compression and multi-event handling as for HepRep2, but no Binary HepRep exists for HepRep1. HepRep1 data, once read in, is converted on the fly to HepRep2 data.

HepRep files can be opened by selecting **Open Data Source...** from the **File** menu and selecting the **HepRep XML** wizard.

CORBA Access

HepRep data can also be accessed using the WIRED CORBA HepRep Client Plugin. This plugin is a client of the HepEventServer and JProcMan systems and needs to be separately installed.

HepRep CORBA connections can be created by selecting **Open Data Source...** from the **File** menu and selecting the **HepRep CORBA Servers** wizard. [Appendix A: BaBar](#) and [Appendix B: GLAST](#) explain how to select data from a CORBA server.

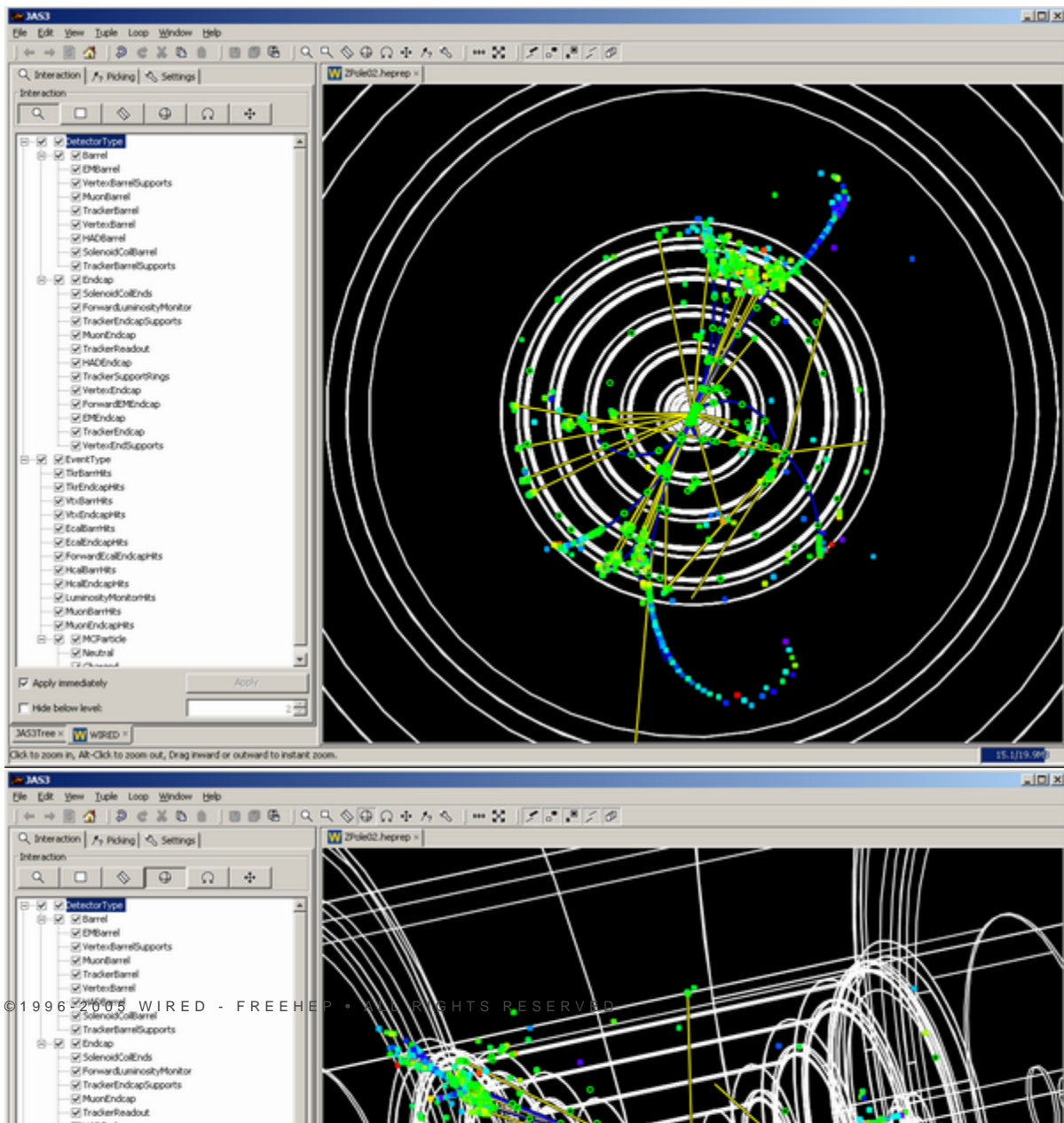
1.8 Projections

Projections

To show HepRep data WIRED 4 uses projections to make that data visible on the screen. One can use a single projection or concatenate projections together to form new composite projections. A set of standard projections is available. New views are currently created with a Parallel projection. The projection can be changed from the popup menu.

Parallel

A Parallel projection transforms 3D space onto 2D space, which can be subsequently used for viewing. This projection allows the user to Scale, Translate and Rotate the HepRep data to any point of view. Parallel projections can be created with any of the following initial viewpoints: XY, ZX, ZY, XZ and YZ.

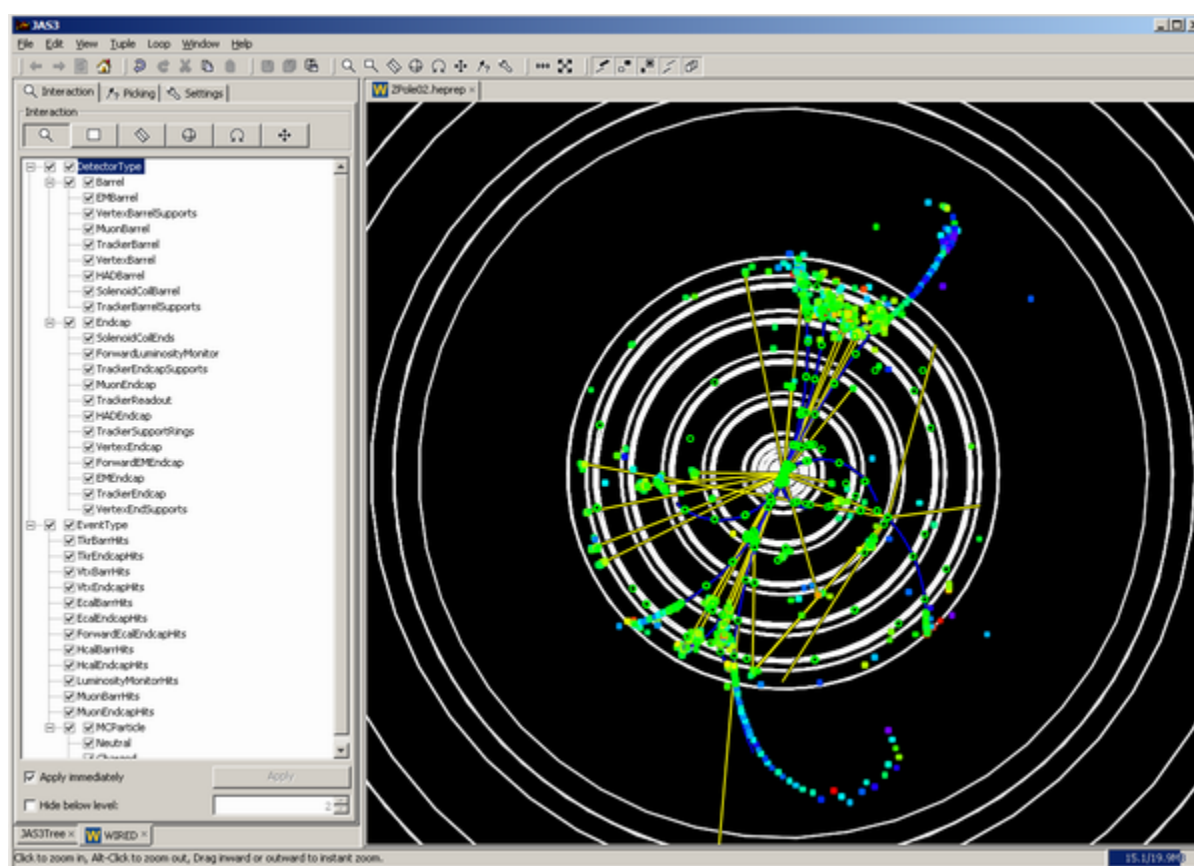


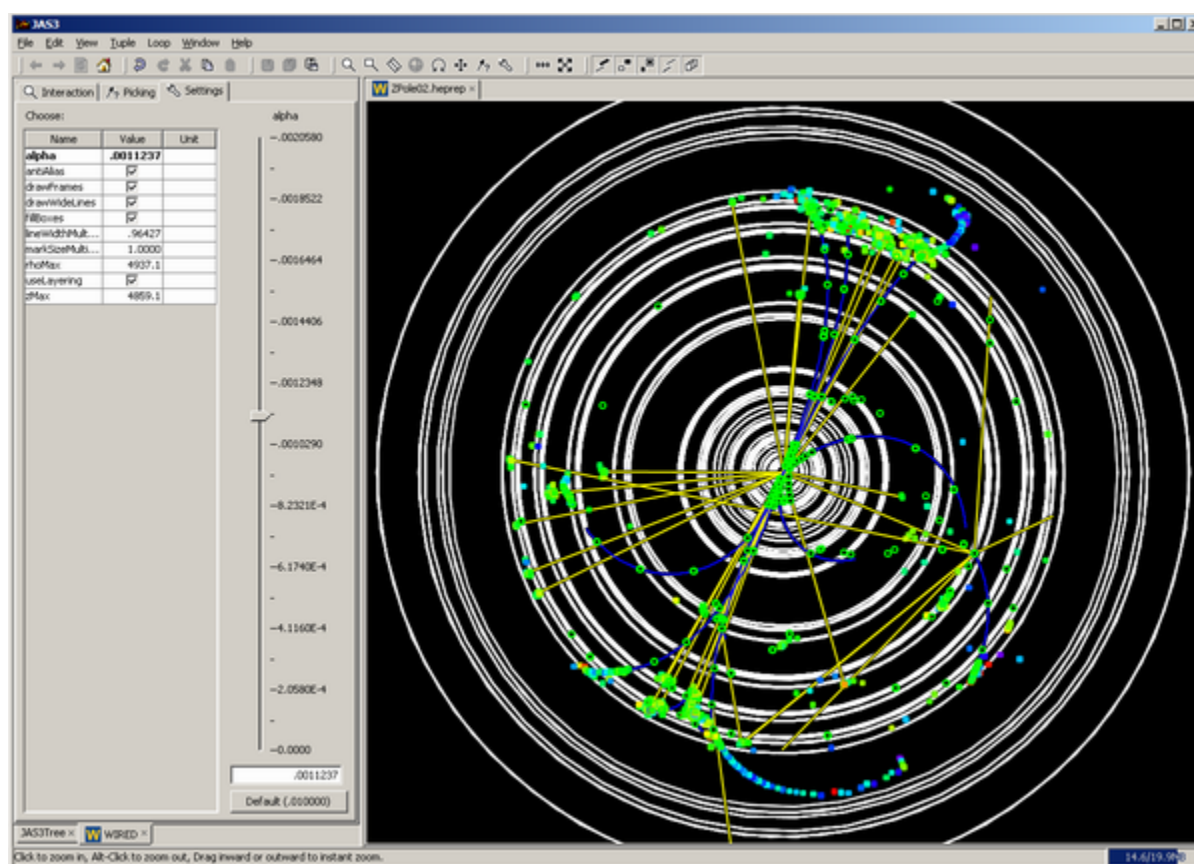
Flat

The Flat projection does the same as the Parallel projection, with the exception that Rotation is only possible in the Z-plane. This projection is normally used to Scale and Translate the result of other projections which have no more depth (Z) value, such as the YX-FishEye or the RhoZ projections.

YX-FishEye

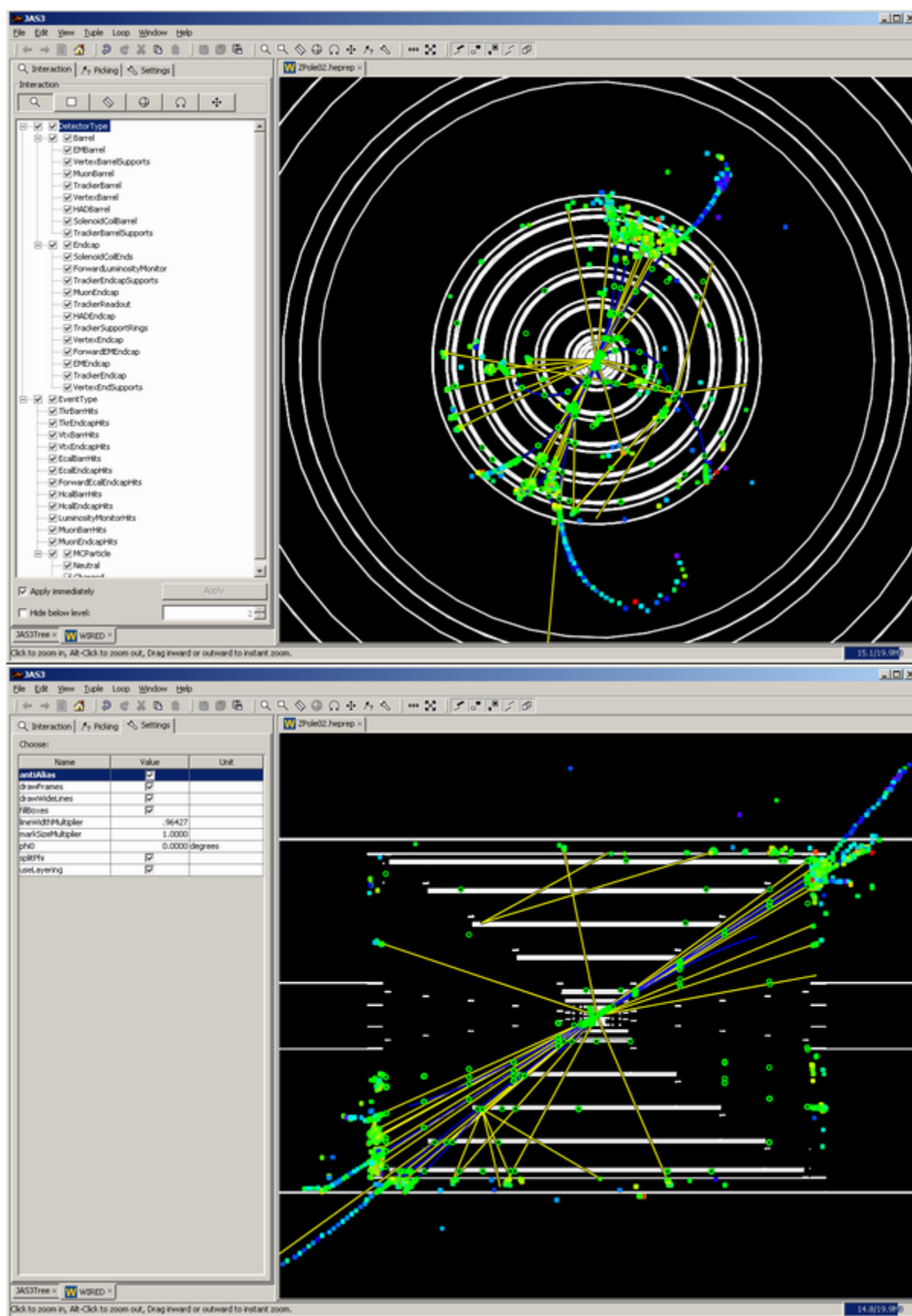
The YX-FishEye projection looks at the 3D space in the form of a fish eye. The inner parts are blown up, while the outer parts are squeezed. The projection leaves straight tracks through the center straight, but it does deform the curved tracks. The idea behind this projection is to show detail of the inner detectors while not losing the context of the outer detectors. This projection works well for YX-cuts of cylindrical detectors. The Settings control panel allows you to modify parameters of this projection to change the distortion factor.





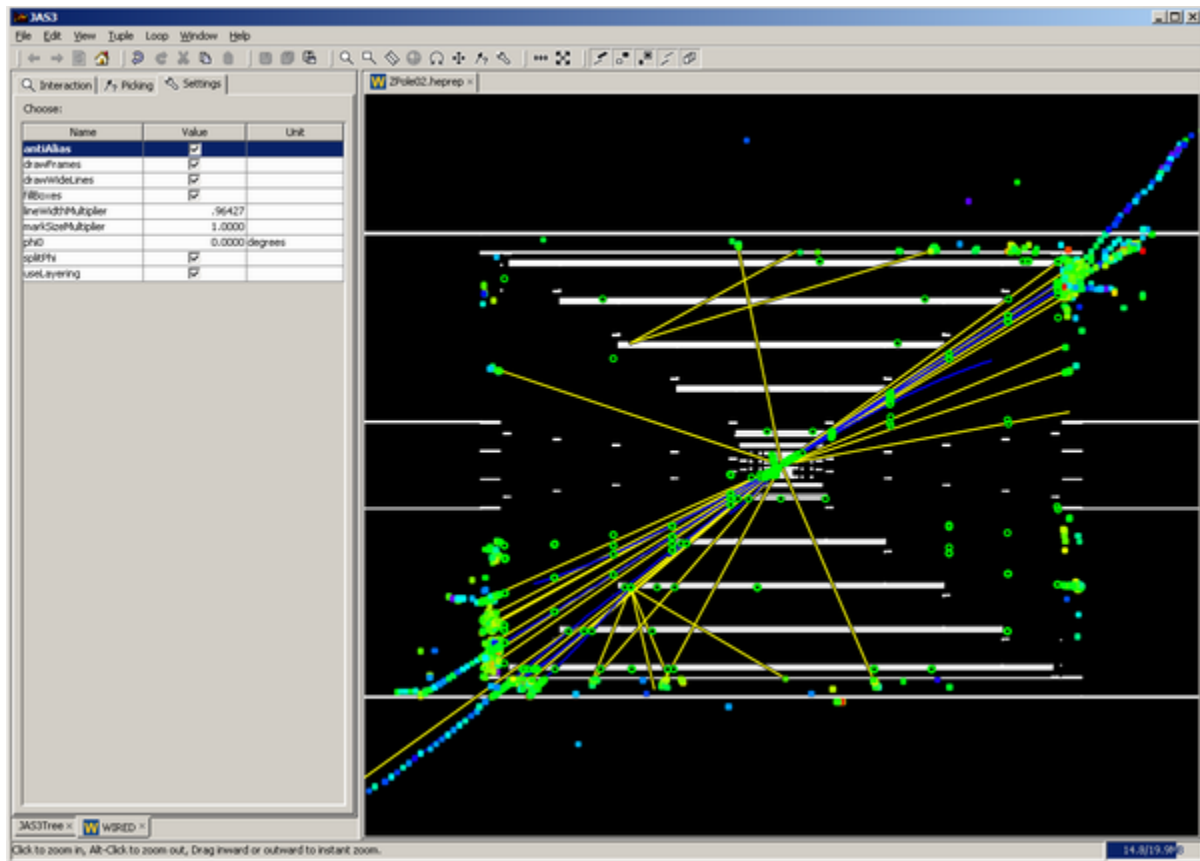
RhoZ

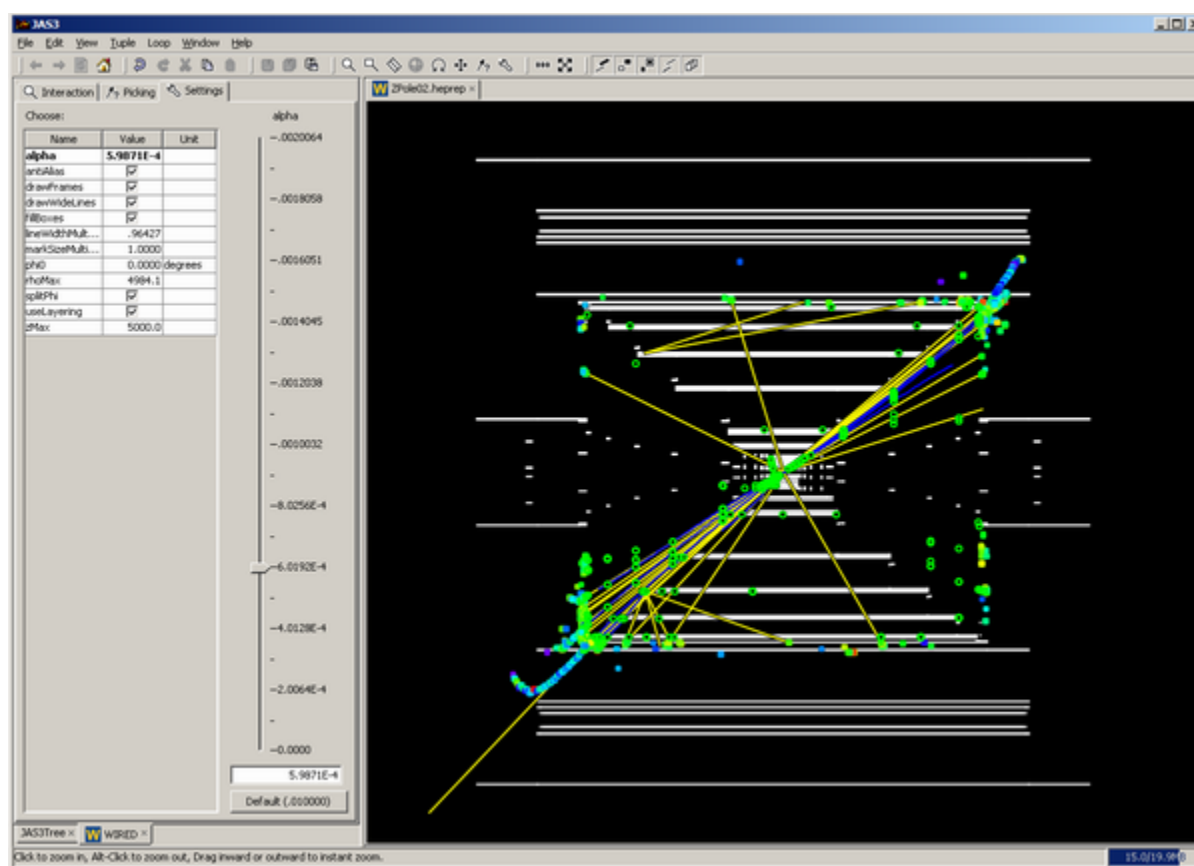
The RhoZ projection cuts a detector into two halves along the Z-axis and projects either half onto the screen. The idea behind this projection is that it is strictly orthogonal with the YX-projection. A YZ or XZ projection would be orthogonal as well, but tracks coming out of the screen would not be visible. This projection works well for the "side view" of cylindrical detectors. The Settings control panel allows you to modify parameters of this projection to change the cutting angle or to not cut the detector at all.



RhoZ-FishEye

This projection is a composition of a RhoZ and a FishEye. The detector is cut into two halves along the Z-axis, projected onto two halves of the screen, then the center is blown up, while outer parts are squeezed using a rectangular fish eye projection.





1.9 Interactivity

Interactivity

In general the available interactive functionality depends on the chosen projection and type of data being viewed. Most projections provide Scaling and Translation.

If you have a mouse with a mousewheel it will zoom in or out. Scroll down will bring the picture closer to you while scroll up will push it away.

Some interactivity can be achieved by direct actions, other functionality depends on the interactivity mode being used. Only one mode can be active at a time. This mode is shown by the button being selected from the toolbar, the control panel being shown and the cursor shape while moving the mouse over the view.

Direct Actions

Direct actions will result in an immediate change.



Reset

Reset is a direct action. It will put the view back into its original state of the projection.



Fit to Window

Fit to Window is a direct action. It will measure the bounding box of the event/geometry in its currently visible state and will Scale and Translate to fit it within the boundaries of the window. The Scaling is uniform. The Translation will center the result.

Interactivity Modes


Of the modes described below only one can be active at a time. The active mode is shown by the corresponding button being depressed, the corresponding menu item in the popup menu being flagged, the corresponding control panel being shown. Any mouse interaction started may be interrupted by pressing the **Esc** key.





Scaling

Scaling will allow you to enlarge or shrink the picture you are currently seeing. You can also zoom into a region on the screen. When you select the Scaling mode, the control panel will show you a choice of

three sub-modes in its **Selection** box:

- 

The direct scaling mode scales along the center of the screen. When you drag the left-mouse button in the view towards the center the image will shrink, while when you drag it outwards it will enlarge. Feedback is shown in the form of a circle around the center. This is also the mode which is continuously connected to the mousewheel and works even if another interaction mode is active. If you click the mousebutton the view will be scaled up by some standard amount. If you alt-click the mousebutton the scaled down by some standard amount.
- 

The rectangle scaling mode allows you to zoom into a rectangle. When you drag the left-mouse button a fixed ratio rectangle will appear. When released this rectangle will be centered (Translated) and enlarged to fill the view. The view will not be distorted. If, while dragging, you press the shift key, you can select an arbitrary sized rectangle. When released this will be centered and fill the view, however, now the result will be scaled non-uniformly to fill the view. If you click the mousebutton, the position of the click will be centered and scaled up by some standard amount. Alt-click will produce the opposite result.
- 

The rotated rectangle scaling mode allows you to zoom into a rotated rectangle. This mode is useful for zooming into tracks at arbitrary angles. When you drag the left-mouse button you will see a line appearing. Drag the line along the track. Now release. You will see a straight or skewed rectangle, along the line just drawn. The ration is fixed, however you have the choice between a straight rectangle, a X-skewed or a Y-skewed rectangle. Click to select one of the three. The picture will now center, rotate, de-skew (if necessary) and scale to fit the view. Deformation of the picture will happen, if you de-skew. While selecting the final rectangle you may either press the shift key to remove the ratio constraint (the result will deform while scaling) or the ctrl key to remove both ratio constraint and angle (the result will most likely deform, but you can select an arbitrary parallelogram. If you click (before dragging) allows you to define the rotated rectangle by selecting three points (start center line - end center line - corner point).



Translation

Translation allows you to move the picture anywhere inside the view. Translation (apart from incurred by any of the scaling modes) will only work in direct mode. The control panel will give you no other choice.



When you drag the left-mouse button the picture underneath will follow until you release the mouse button. If you click, the clicked point will be centered. If you alt-click the center will move to the clicked point.

Translations like these will only have an affect on the currently viewed angle. So, if you click on a calorimeter cluster, the cluster will move to the center of the screen, however if you go on to rotate the cluster, you will find that the model is not centered along the screen's Z-axis. In fact what will most likely happen is that the model will float out of the viewable area while you rotate. To select a proper rotation point a 3D translation mode will be added in the near future.



Rotation


The rotation modes are both immediate. From the **Selection** box you may choose between:

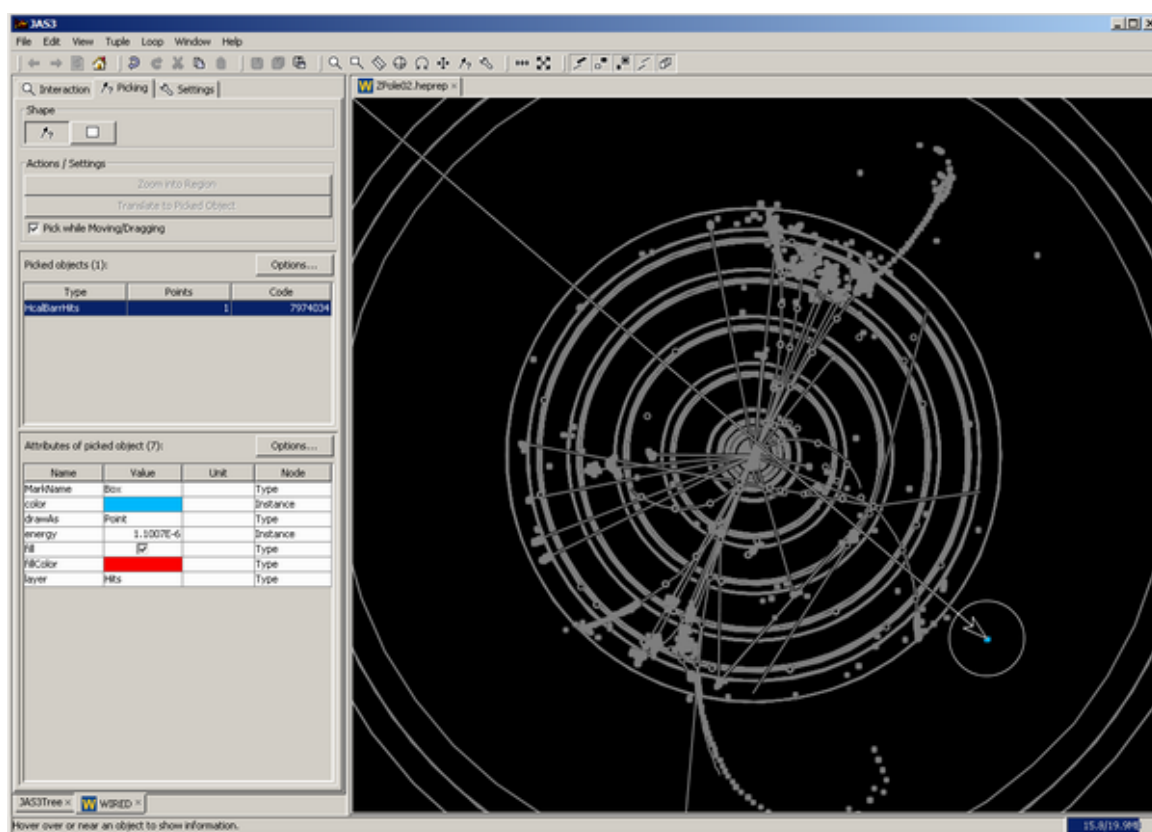
-  Rotate in the screen's Z-plane. When you drag the left-mouse button the picture will rotate over the center of the view. Clicking has no function.
-  Rotate in 3D using a virtual ball. When you drag the left-mouse button the picture will rotate as if captured by a ball which you roll to any side. Although it is possible by small circular movements to rotate the picture in the screen's Z-plane, the option above is easier. By holding down the shift key while dragging rotation will be limited to the screen's Y-axis, while the ctrl key will limit rotation to the screen's X-axis. Clicking has no function.




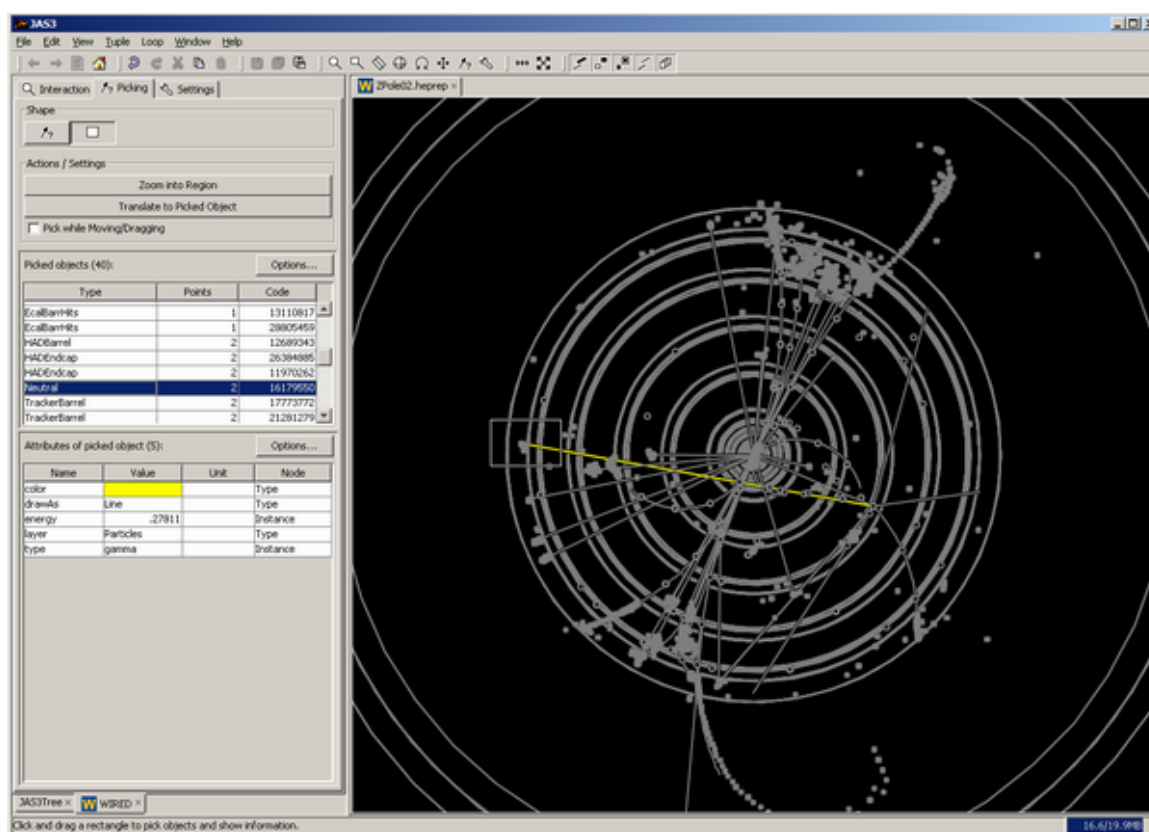
Picking

Picking allows the user to show information attached to the objects shown in the view. This attributes can be physics values or other relevant information. When you select the picking mode the control panel will allow you to select from different sub-modes:

-  Direct picking of the object nearest to the mouse. As you hover the mouse over the view, an arrow will appear from the furthest corner, pointing to the object nearest to the cursor. A circle is drawn around the object, with a radius large enough to include the cursor. As you move the mouse, the arrow may move to nearer objects. If you click, the position gets fixed, the circle disappears, until you click again to release the point. The selected object is shown in the control panel, see below.



- 
 Selecting all objects within a rectangular shape. In this mode you need to drag the left-mouse button to create a rectangle, which surrounds the objects you would like to pick. When you release, the objects inside the rectangle will be selected. The non-selected objects will dim their colors to gray, so that the selected objects highlight. If objects, such as tracks, extend outside the rectangle boundaries, they will also highlight there. In the control panel you may now select the action **Zoom into region** to center and scale the view to only show the selected objects.



The control panel will show a table of picked objects, which update as you change your pick of the view. If only a single object is picked, its attributes will show in the attributes table. If multiple objects are picked, then you can select one object from the picked table to show its attributes. Doing so will cause the view to only highlight that single picked object.

The **Options...** button in the **Picked objects** table allows you to restrict the picking to certain layers and to certain HepRepTypes. The layers are shown in a list, with a checkbox if this layer is used in the picking. The HepRepTypes are shown in a tree, where checkboxes mark if types are used in picking.

The **Options...** button in the **Attributes of picked object** table allow you to limit the display of attributes to certain categories. The categories are shown in a list, with a checkbox if attributes of a category are shown.



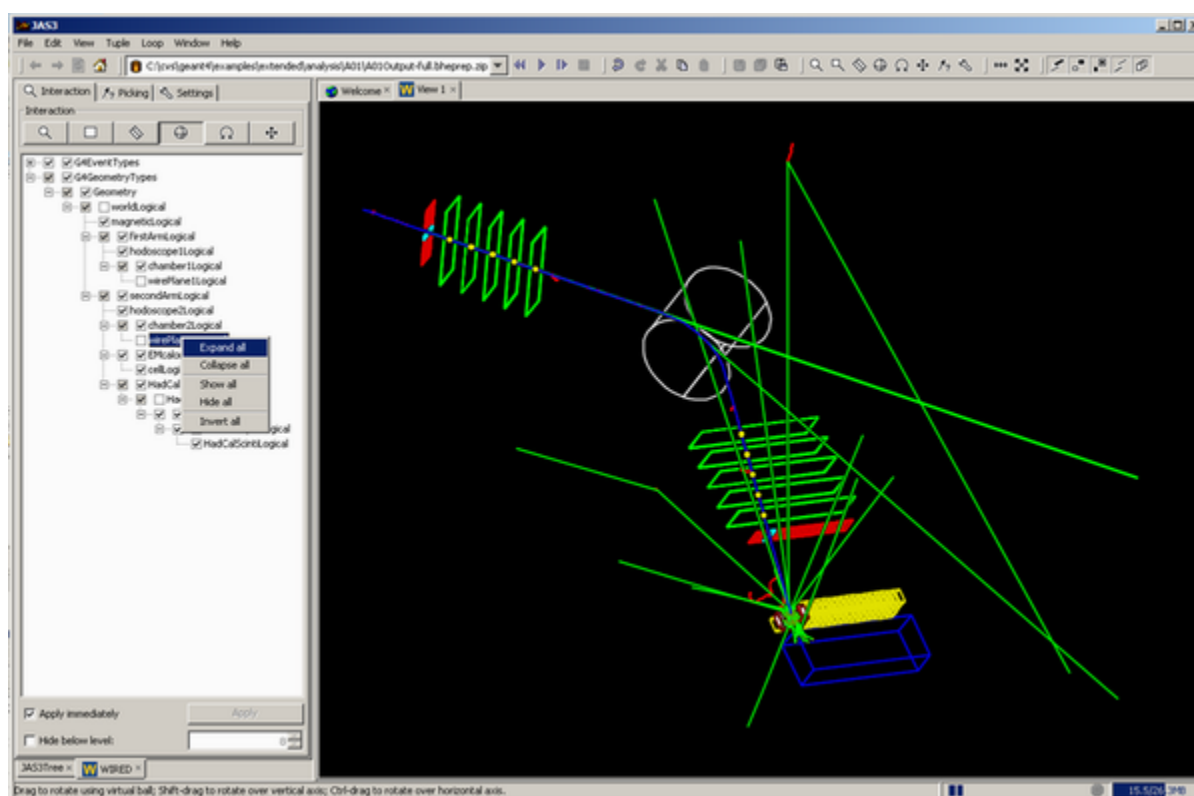
Tree Selection

In tree selection mode, the control panel shows a tree of HepRepTypes. If you expand the tree you will find familiar names of your event and geometry. You can toggle the visibility of certain object types, by clicking on the right-most checkbox. The left most checkbox only exist if the object in the tree is a folder. It shows three states:

- **Off**, when all sub folders and sub nodes are invisible, or when this folder was made invisible by the user.
- **Checked in gray**, when some of the sub folders and sub nodes are visible.
- **Checked in white**, when all of the sub folders and sub nodes are visible.

This checkbox may change state depending on the state of other checkboxes. By clicking, it will either switch off or checked (in one of the two conditions depending on the sub-nodes). It allows you to hide whole subtrees at once.

The tree also has a popup menu to allow you to execute actions such as "Expand all", "Collapse all", "Show all", "Hide all" and "Invert All" for the node you clicked on when selecting the popup menu AND all nodes below that one.



Below the tree there are several other options available:

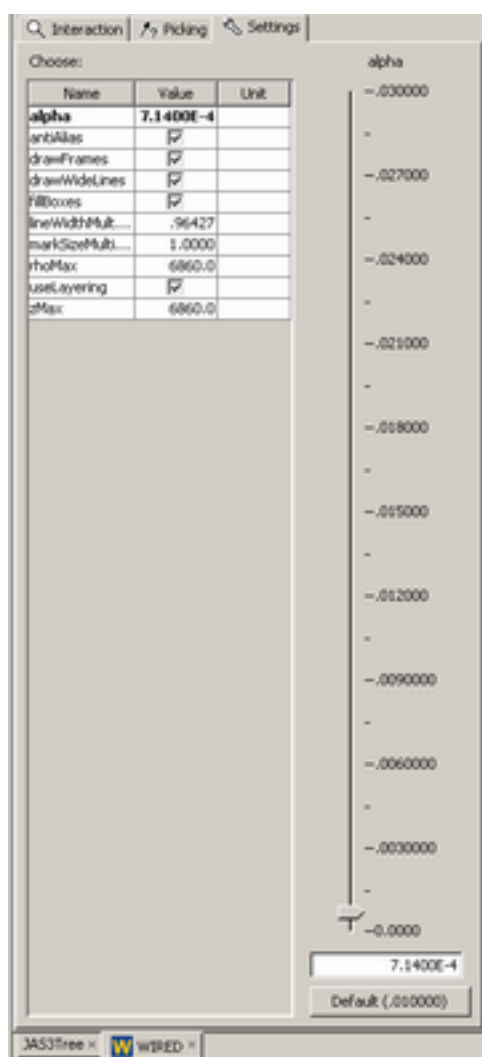
- By switching off the **Apply immediately** checkbox the user can make changes in the tree without applying them until he pushes the **Apply** button.
- By switching on the **Hide below level** checkbox the user can ignore certain depth of the tree, set by the level number. The result is reflected immediately in the tree, by dimming out useless checkboxes. The view will react immediately if **Apply immediately** is checked.

The tree is associated to the selected view.



Settings

The Settings panel allows you to change and control general settings and settings of the projection(s). Any variable may be selected from the table. For numeric variables a slider appears and a value box. You may use either to make changes to the variable. Variables can be coupled so that their maximum and minimum value may depend on another variable, or a variable may only be active after switching on a different variable.



Quality Settings

The quality settings allow the user to make the picture show better on the screen. The default settings are the best for performance, but for screen, printer and file output it may be worthwhile to switch some of these options on.



Draw Thick lines

This option will draw lines in the thickness given by the HepRep data. Especially for online presentations this may give better viewable results. When this option is off, the lines are drawn in single unit width, which gives the best interactive performance.



Fill Boxes

This option will fill symbols (hits) and some polygons (calorimeter hits) when the fill flag is switched on

the HepRep data. When this option is off, all filled objects are drawn only by a surrounding line, which gives the best interactive performance.



Draw Frames

To show colored objects (hits) on top of other colored objects (tracks) it is sometimes useful to draw a thin (black) frame around them. This option will draw such a frame if the HepRep data contains information for it. The loss in performance can be dramatic, as the number of drawn objects multiplies by two and all frames are filled objects.



Anti-Alias

To smoothen curved lines and lines with non-trivial angles, you can switch on anti-aliasing, which blends the jagged edges due to pixelation into the background by choosing mid-tones between the line color and the background color. As this is a pixel-by-pixel operation it can be quite a performance loss. Future versions of Java may use hardware acceleration if available.



Use Layering

All objects are drawn in layers: hits on top of tracks on top of calorimeter hits on top of geometry. The layering may cause certain objects to disappear, when data has not been correctly layered. If you switch off layering these hidden objects may suddenly appear. There is no performance loss for having layering switched on.

1.10 Output

Output

You can use the plots you have created in other documents or programs. To do so you can use either the **Copy-Paste** or the **Save As** functionality built into JAS 3 and WIRED 4. You can use these two buttons on the toolbar:

-  Copy
-  Save As...

and printing from the menu:

-  Print

Copy - Paste

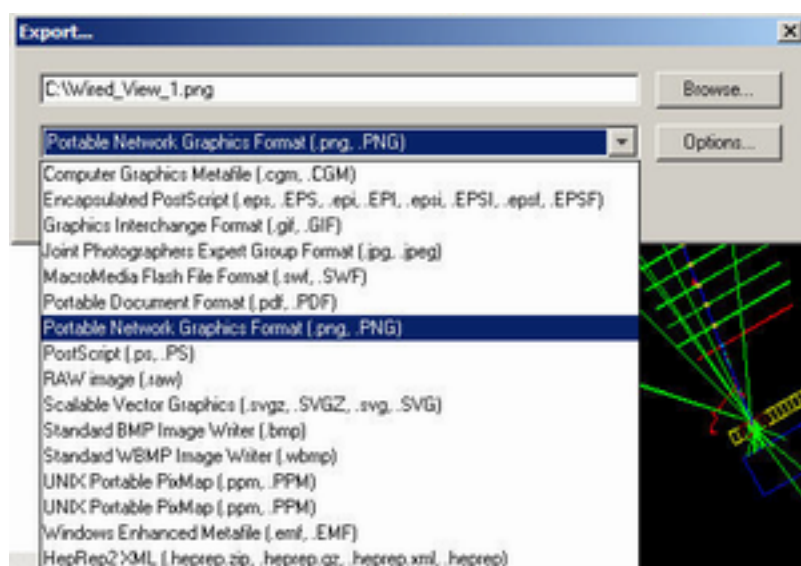
This method is recommended on Windows platforms, since it uses the Windows Enhanced Metafile Format (EMF) internally, which will not work on other platforms. On other platforms copy-paste will copy a bitmap graphics, rather than a vector graphics, so use save as instead.

On Windows select **Copy** from the **Edit** menu. You may now paste the clipboard contents into programs such as PowerPoint and Word.

Note: The EMF format is supported on Windows NT/2000/ME/XP only. Earlier versions of Windows (95/98) have immature versions of EMF which may even destabilize your system.

Save as Vector Graphics or Bitmap formats

You can also save your output in a variety of formats. Select **Save As...** from the **File** menu and a dialog will pop up. You can select an output filename, a format and then click on **Ok** to export the file. The **Options...** button, when available, lets you change options specific for each graphics format.



The following formats are Vector Graphics formats. They can be resized without losing information.

- **CGM:** Computer Graphics Metafile, not very much in use, but can be read by PowerPoint and Word.
- **EMF:** Windows Enhanced Metafile Format, can be imported into Microsoft products (PowerPoint, Word...).
- **EPS and PS:** Encapsulated PostScript and PostScript, for usage with LaTeX and FrameMaker. PostScript supports multiple pages.
- **PDF:** Portable Document Format, for electronic distribution, supports multiple pages.
- **SVG:** Scalable Vector Graphics, for usage with viewer on the World-Wide Web.
- **SWF:** Macromedia Flash File Format, for usage with viewer on the World-Wide Web. Can be used in animations.

The following bitmap formats are available by default in Java. Bitmap formats can be resized, but this results most of the time in a loss of information.

- **GIF:** Graphics Interchange Format, bitmap format of the World-Wide Web, limited to 256 colors.
- **JPG:** Joint Photographers Expert Group format, useful for photographs and not much for line drawings.
- **PNG:** Portable Network Graphics, replacement bitmap format for GIF. No limitations on the colors.
- **RAW:** If you really want big files without compression. For conversion to something else...
- **PPM:** UNIX Portable PixMap format, for usage with the NetPBM package to convert to other formats. Output fairly big.




If you also have the **Java Advanced Imaging library** installed you may also export to the following bitmap formats:

- **BMP, WBMP:** Windows Bitmap Format, for usage with some Windows tools.

On top of these output formats you can save the HepRep data in HepRep2 XML format. You cannot save into HepRep1 XML format, since there is currently no converter to convert HepRep2 back into HepRep1.

Printing

Views can be printed using the JAS 3 print functionality. The following options are available from the **File** menu:

-  Print Setup... - will allow you to setup the printer.
-  Print - will print the view to the default printer (setup under Print Setup...)
-  Print Preview - will show you what the printout will look like and print is subsequently.

1.11 Comparison to WIRED 3

Comparison to WIRED 3

A lot of the features of WIRED 3 [7] have been augmented in WIRED 4. Below a comprehensive list of the main differences:

- WIRED 4 runs as a plugin in JAS 3 as opposed to WIRED 3 which runs as a stand-alone program. This has the advantage that a lot of the base functionality of JAS 3, most of which is part of the FreeHEP library, comes for free. Such features include: output to graphics formats, copy-and-paste, setting of preferences, services and plugin modules, automatic updates of modules, etc. Integration in JAS 3 also means that some functionality sits deeper in JAS than in WIRED. For instance, access to data is arranged using a standard record loop, datasets can be opened using wizards, etc.
- The interactivity modes of WIRED 4 give better feedback and are more useful to the user than the ones in WIRED 3. All the interactivity modes of WIRED 3, direct zoom, direct translation and direct rotation are all available in WIRED 4. On top of these modes, you can now select a region and zoom into that region. You can also easily select regions along a track and zoom into those.
- The picking mode of WIRED 4 shows information in an easier way than WIRED 3. The latter would pop up boxes all over the screen, while WIRED 4 places information neatly in a control panel on the side. The interaction in WIRED 4 works both ways. You pick in the view and it shows in the control panel, or you select in the control panel and it highlights in the view. WIRED 3 does not have this capability.
- WIRED 4 is extensible: new projections, representations and scripts can be created and added to WIRED 4. These features and how to write your own extension modules will be documented in the JAS 3/WIRED 4 developers manual, which is currently being written.
- WIRED 4 uses HepRep 2 as its base format but can handle HepRep 1 using a converter plugin.
- WIRED 4 contains far fewer classes than WIRED 3. This makes WIRED 4 more maintainable, which reflects in a quicker response to user requests and bug fixes.

There are a few features not included in this first release of WIRED 4:

- The tree only shows HepRepTypes and not HepRepInstances.
- Cuts as implemented in the latest version of WIRED 3 are not yet available.
- There is no way to show labels in this version.
- The state of the application is only partially saved.

But, we are working on it...

1.12 Feedback

FeedBack

Your feedback is very useful and welcome. If you have problems using WIRED 4 or think of good ways to extend its functionality, please use our **discussion forum** at:

<http://forum.freehep.org/>

WIRED 4 keeps a database of **bugs, issues and further improvements**, which can be found at:

<http://bugs.freehep.org/>

WIRED 4 is OpenSource, so please feel free to download the source code from:

<http://wired4.freehep.org/SourceDistributions.html>

1.13 Appendix A: BaBar

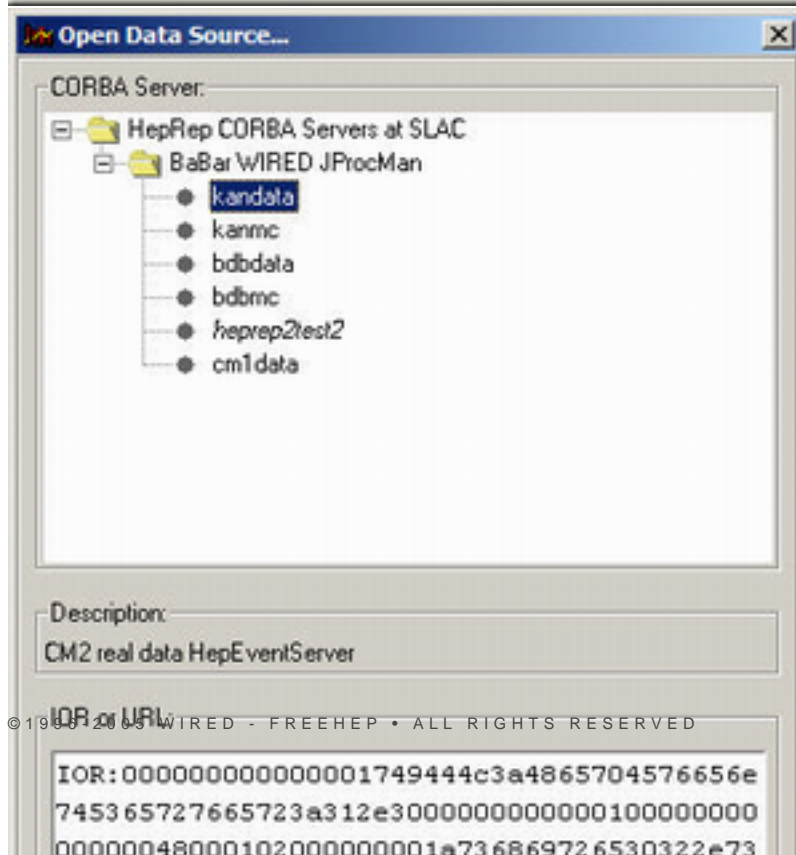
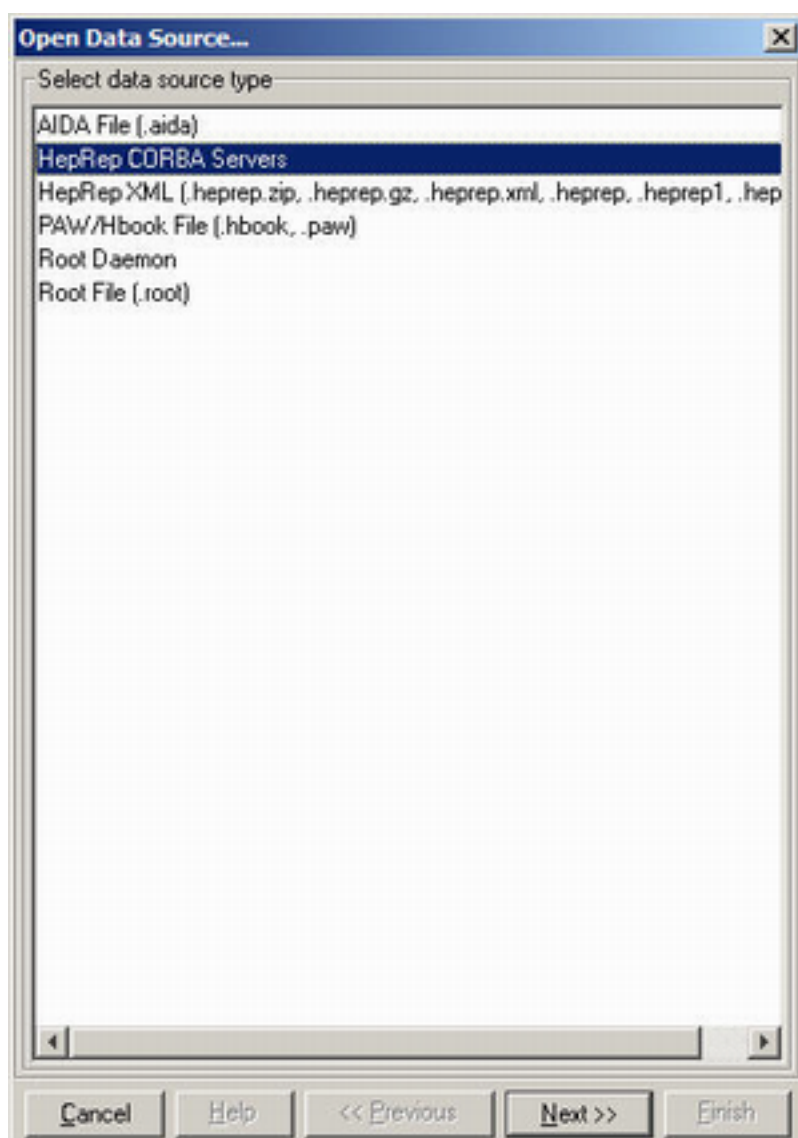
Appendix A: BaBar and WIRED 4

BaBar geometry is included in a separate plugin under the name **WIRED 3 Graphics Format**. If this plugin is loaded, any BaBar event will automatically also show the BaBar geometry.

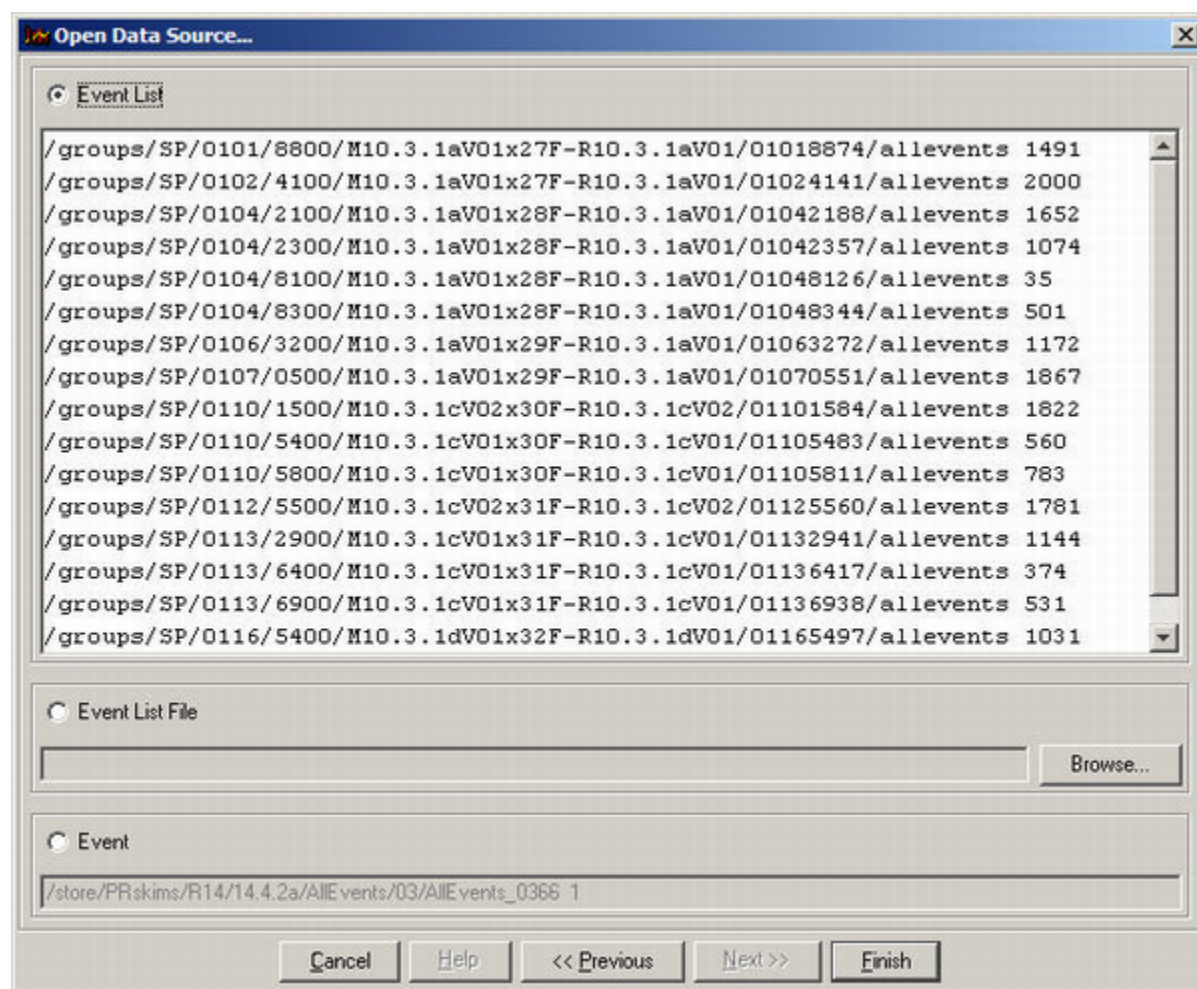
BaBar events are made accessible via a CORBA server. To see these events you need the **WIRED CORBA HepRep Client Plugin** installed, see the installation instructions.

To select a CORBA server of BaBar, choose **Open Data Source...** from the **File** menu and select the **HepRep CORBA Servers** wizard and click on **Next**.

You are now connected to a tree of servers, which will initially only show you the folder **HepRep CORBA Servers at SLAC**. Open this folder and the next one which says **BaBar WIRED JProcMan**. A list of servers will now show. As you select one of them, the description field will change, explaining what this server contains. Servers which show up in italics may have a problem. The description field will tell you their status. You can now select the server you want and click on **Finish**. Your data source is now open for browsing.



If you wish to connect to a server which is not in the list, for instance your own server, you can paste the IOR into the **IOR or URL** field and click **Add to List**. You may give it a different name than **New Node** of course. New servers are added to the top-level, and only visible to you. You can then select the new server, see its status/description and click **Finish** to open the dataset for browsing.



Instead of clicking on **Finish**, you may select **Next**, which allows you to use a prepared event list. You will see a default event in the **Event** box at the bottom. This default event is suggested by the server. If you click on **Finish** now, it will be no different than if you clicked on **Finish** in the previous window. However, you can also use your own event list, by pasting the full list into the **EventList** box at the top, or by giving the filename of the **Event List File** box in the center. When you click **Finish**, make sure the correct box is selected.

The BaBar event ID consist of three parts, though the first two are enough to identify the event:

| | | |
|----------------|---------------|-------|
| CollectionName | OrdinalNumber | HexID |
|----------------|---------------|-------|

- The **CollectionName** refers to the name of a collection.
- The **HexID** (referred to within BaBar as the real EventID) is the most persistent form of event id. It encodes the time that the event was detected by the BaBar online. A given event may then appear in

one or more event collections (a raw form of the event, a later reconstruction collection, a re-reconstruction collection, and so forth). Thus to uniquely identify a particular reconstruction version of an event, one needs both the `CollectionName` and the `HexID`.

- The **OrdinalNumber** is just the ordinal position at which this event appears in the given collection. Thus the event from some particular collision may appear as ordinal number 505 in one collection, ordinal number 101 in some more refined collection, etc.

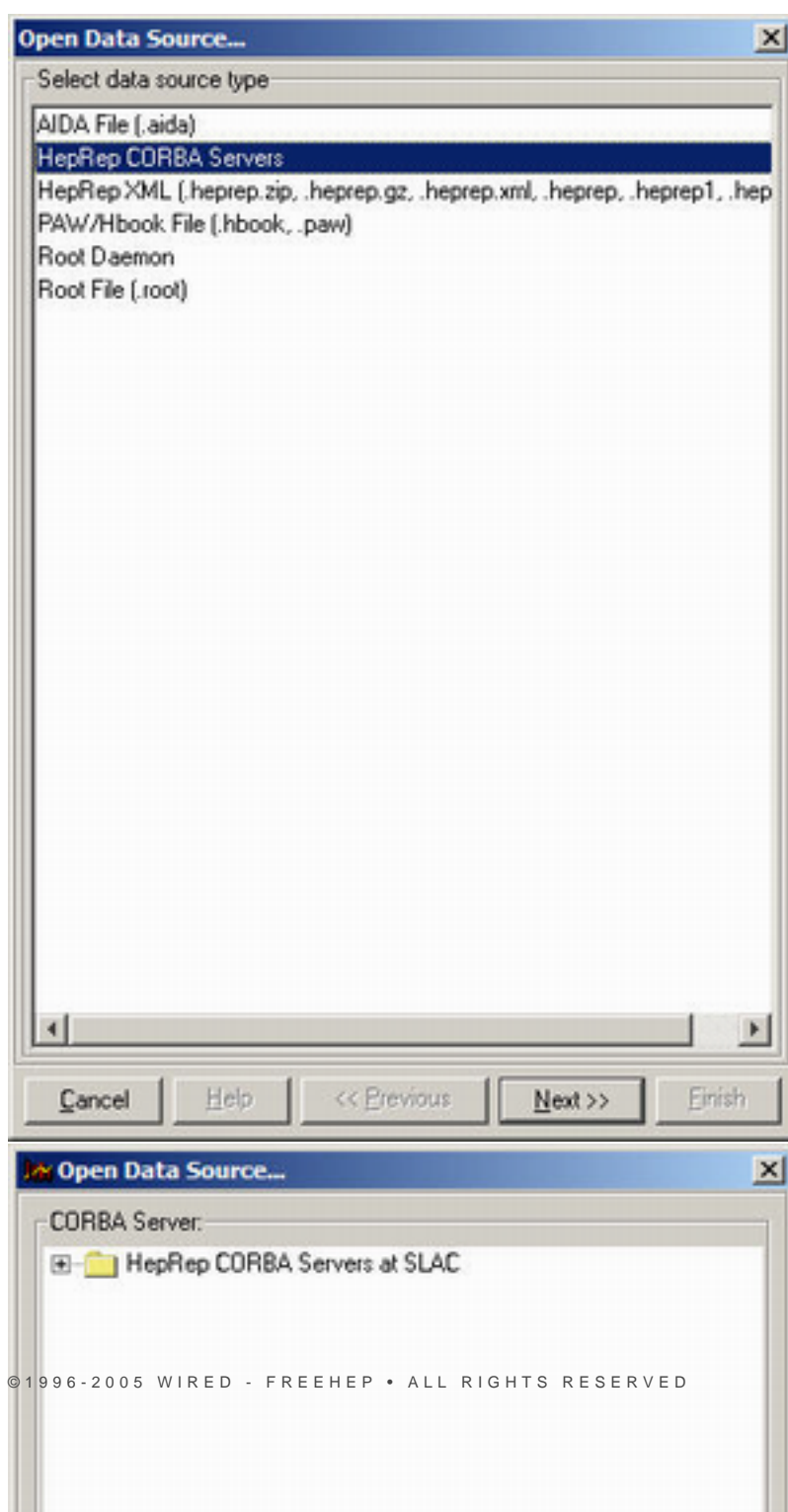
You can use the following in an event list:

- `CollectionName OrdinalNumber`: The fastest way, since the database allows random access by this method.
- `CollectionName HexID`: Slower in practice, since the WIRED server has to actually start at the head of the collection and read through the tag part of every event until it finds a match for this `HexID`.

1.14 Appendix B: GLAST

Appendix B: GLAST and WIRED 4

GLAST events can be accessed using from HepRep XML files or from a GAUDI server, which includes a HepEventServer. To access this HepEventServer select **Open Data Source...** from the **File** menu and select the **HepRep CORBA Servers** wizard.



Paste the IOR from your HepEventServer in the **IOR or URL** field and click **Add to List**. You may give it a different name than **New Node** of course. New servers are added to the top-level, and only visible to you. You can then select the new server, see its status/description and click **Finish** to open the dataset for browsing.

1.15 Appendix C: Linear Collider

Appendix C: Linear Collider and WIRED 4

LCIO files can be read and converted into HepRep 2 data by installing either the **LCIO** plugin or the **org.lcsim** plugin.

The LCIO plugin is available in the Plugin Manager of JAS 3 under **hep/linearcollider/lcio**.

The **org.lcsim** is available in the Plugin Manager of JAS 3 under **hep/linearcollider**.

Once either is installed, LCIO files can be opened and browsed, just like HepRep XML files. If you install both JAS will ask you to choose the plugin to use when opening the files.

1.16 Appendix D: GEANT4

Appendix D: GEANT4 and WIRED 4

From GEANT4 [8] you can produce HepRep1 or HepRep2 XML files. The standard GEANT4 distribution comes with a visualization driver for HepReps.

To select the HepRep2 driver you need to issue the following commands from the GEANT4 command line:

```
/vis/scene/create filename.heprep.zip  
/vis/open HepRepXML
```

This will open a file with name filename.heprep.zip and put multiple events in it. To store events (and geometry) in this file, you should issue a run command:

```
/run/beamOn 20
```

which will write 20 events and geometry.

To only write a geometry:

```
/vis/viewer/flush
```

More information on the HepRep drivers can be found in the README in the src/visualization/HepRep directory of the Geant4 distribution.

1.17 Appendix E: History

Appendix E: History of WIRED

WIRED which stands for World-Wide Web Interactive Remote Event Display was initially developed in 1996 at CERN as an Applet to show the usefulness of the Java language in High Energy Physics. The applet showed the DELPHI detector of LEP and was presented at the HepVis 1996 workshop at CERN.

The core of the Applet was rewritten for WIRED 1 which was adopted by the CHORUS and DELPHI experiments for further event display usage. This version was presented at CHEP'97 in Berlin, Germany.

As research and development at CERN continued for the ATLAS experiment, WIRED 2 was developed to cope with large events and special projections. Some of the work of WIRED 2 was generalized and moved into the Java FreeHEP Library on top of which WIRED 3 and WIRED 4 were built. The Atlantis event display for ATLAS was built from the WIRED 2 prototype.

In the meantime WIRED 3 was created, based mainly on WIRED 1, to support the BaBar experiment at SLAC, which became one of the main users of WIRED. An integration was started with JAS 2, which resulted in a plugin module of WIRED 3 specific for the Linear Collider Study at SLAC. This version was presented at CHEP'2000 in Padova, Italy.

WIRED 4 combines some of the work done in WIRED 2 with a lot of the functionality in WIRED 3. WIRED 4 was presented at Computing in High Energy Physics, CHEP2004, in Interlaken, Switzerland.

1.18 References

References

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1.19 Epilogue

Epilogue

Author: Mark Donszelmann

Version: \$Id: Epilogue.xml 2182 2005-08-03 19:24:22Z duns \$

WIRED 4 Version: 4.0