iTool User's Guide

IDL Version 6.0
July, 2003 Edition

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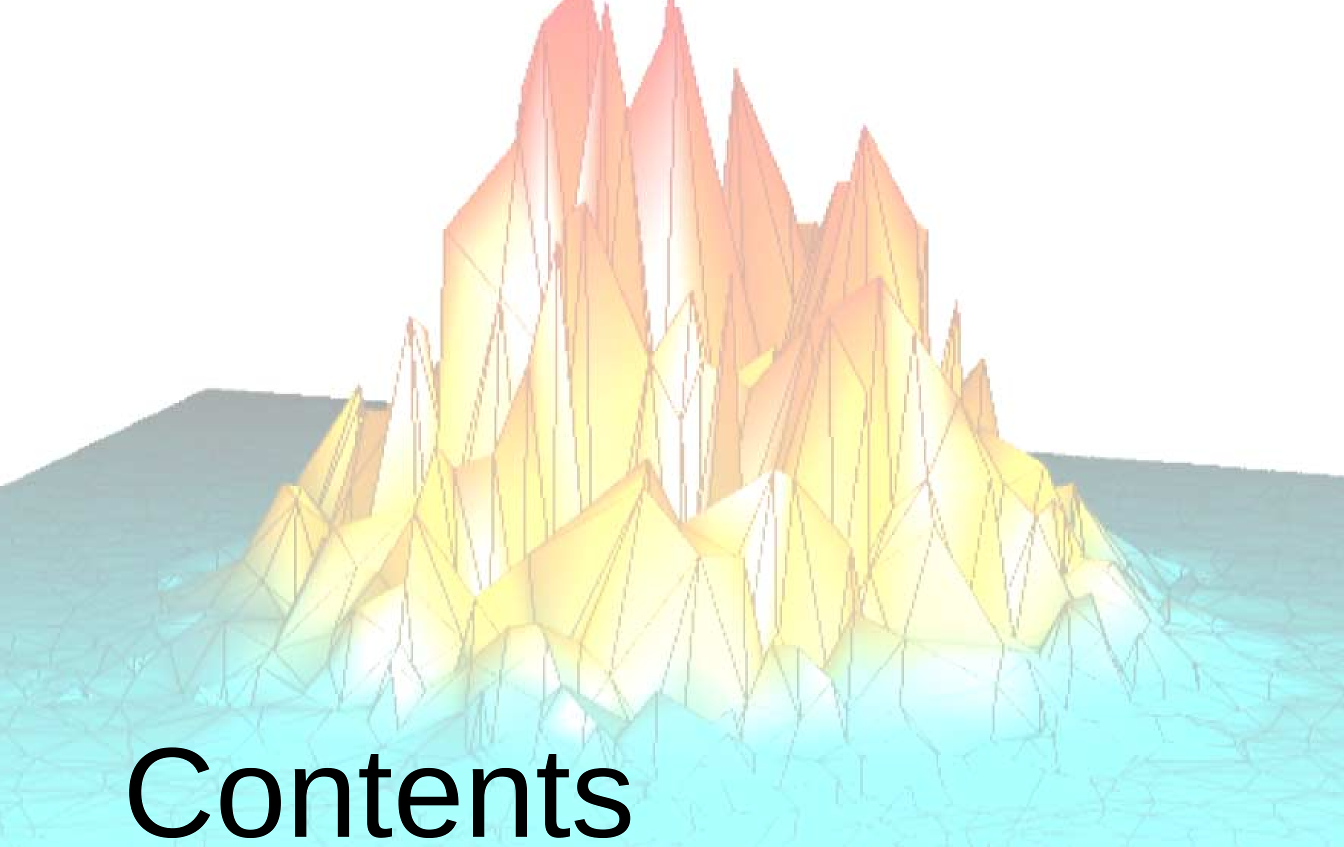

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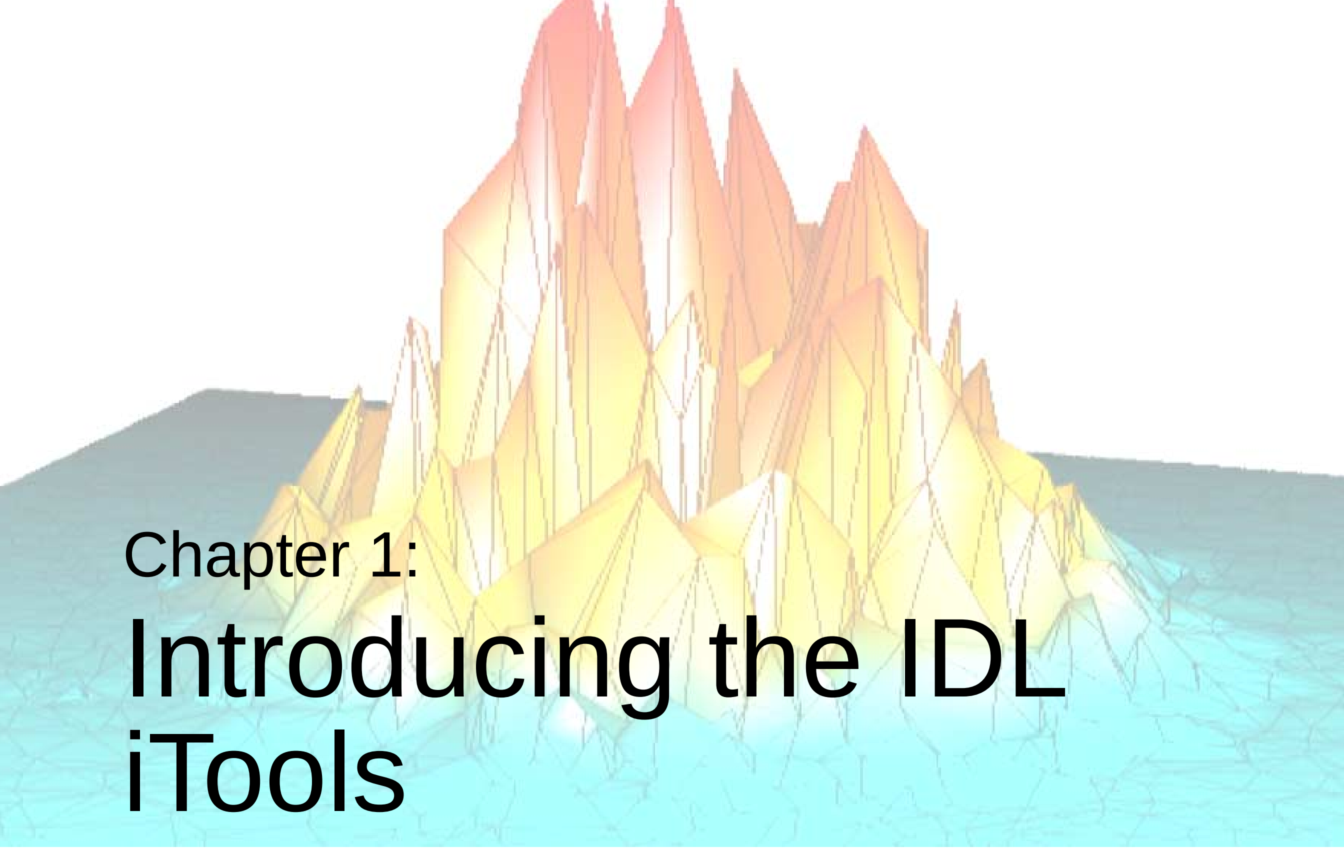


Chapter 1: Introducing the IDL iTools

This chapter introduces you to the new IDL iTools and aids in using this guide.

Introducing the iTools

The new IDL Intelligent Tools (iTools) are a set of interactive utilities that combine data analysis and visualization with the task of producing presentation quality graphics. Based on the IDL Object Graphics system, the iTools are designed to help you get the most out of your data with minimal effort. They allow you to continue to benefit from the control of a programming language, while enjoying the convenience of a point-and-click environment.

In IDL 6.0, five pre-built iTools are exposed for immediate interactive use. Each of these five tools is designed around a specific data or visualization type, including:

- Two and three dimensional plots (line, scatter, polar, and histogram style)
- Surface representations
- Contour maps
- Image displays
- Volume visualizations

The iTools are built upon a new object-oriented framework, or set of object classes, that serve as the building blocks for the interface and functionality of the Intelligent Tools. IDL programmers can easily use this framework to create custom data analysis and visualization environments. Such custom Intelligent Tools may be called from within a larger IDL application, or they may serve as the foundation for a complete application in themselves.

A Single Tool with Many Faces

What sets the Intelligent Tools apart from precursors such as the Live Tools (now obsolete with IDL 6.0) — and what gives them their optimal power, flexibility, and extensibility — is the cohesive, open architecture of the Intelligent Tools system. The iTools system is actually comprised of a single tool, which adapts to handle the data that you pass to it. The plot, surface, image, contour, and volume tools are simply shortcut configurations, which facilitate ad hoc data analysis and visualization. Each tool encapsulates the functionality (data operations, display manipulations, and visualization types) required to handle its data or visualization type. However, you are not constrained to work with a single data or visualization type. Instead, using the Intelligent Tools system, you may start by bringing up a surface plot in a surface tool and then import scattered point data into the same plot to see the relationship between two datasets. Or, you may start with an image display, overlay contours from another dataset, and map both the image and contours onto a three-dimensional surface representation of a third dataset. By throwing new data into an iTool, it is easy to end up with a hybrid tool that can handle complex, composite visualizations.

Of course, you have always been able to create these kinds of powerful, composite visualizations in IDL to reveal important relationships and trends in data. The main enhancements the new iTools provide are more mouse interactivity, WYSIWYG (What-You-See-Is-What-You-Get) printing, built-in analysis, undo-redo capabilities, layout control, and better-looking plots. These robust, pre-built tools reduce the amount of programming IDL users must do to create interactive visualizations. At the same time, the iTools integrate seamlessly with the IDL Command Line, user interface controls, and custom algorithms. In this way, the iTools maintain and enhance the control and flexibility IDL users rely on for data exploration, algorithm design, and rapid application development.

Foundation for the Future

As you will discover, the iTools are compelling new tools to add to your arsenal. They complement the strong foundation that IDL has maintained over the course of its evolution. This foundation has made possible countless valuable user-written applications across many disciplines and industries. However, the iTools also represent the start of a new, updated display paradigm for IDL. While the iTools system in IDL 6.0 is a powerful and flexible environment that will allow you to immediately accelerate your data interpretation and reporting, it is only the beginning. We will continue to build on this new technology in future releases. You can look forward to more functionality, flexibility, and optimization as the iTools system continues to grow.

We look forward to members of the IDL community building on the iTools system as well. The iTools source code is included in the IDL distribution to allow you to:

- extend the pre-built tools with your own operations, manipulations, visualization types, and GUI controls,
- create your own custom tools based on the iTools component framework,
- share your inventions with others in the IDL community via the RSI User-Contributed Library (www.RSInc.com/codebank) or other avenues of collaboration and distribution.

Note

For more information on building your own iTools or building hybrid iTools, see the *iTool Developer's Guide*.

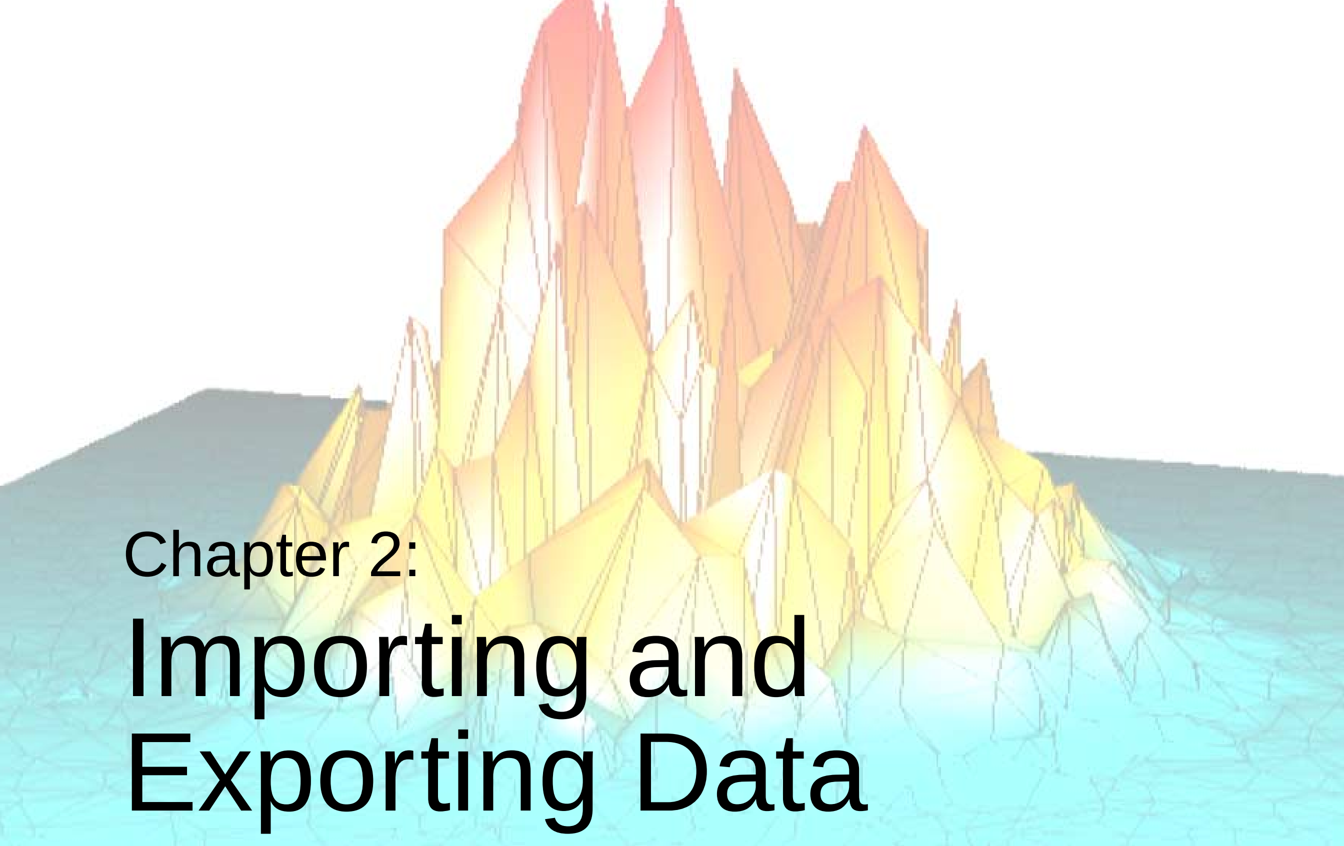
Tips and instructions for using this Guide are detailed in the following section.

Using this Guide

The iTool User Guide can show you important iTool functionality such as how to start the iTools, how to import data into an iTool, how to export data out of an iTool, the general layout of the iTools, and how to perform common iTool tasks.

This User Guide is organized to help you make the most of the IDL iTools. The User Guide contains the following chapters:

- Chapter 2, "Importing and Exporting Data" - This chapter introduces you to bringing data into the iTools as well as exporting data.
- Chapter 3, "iTool Common Tasks" - Many iTool tasks are common to each tool. These tasks are described in this chapter.
- Chapter 4, "Working with Images" - This chapter describes the iImage tool and gives you insight into unique image visualization and manipulation tasks.
- Chapter 7, "Working with Plots" - This chapter describes the iPlot tool and gives you insight into unique plotting and plot manipulation tasks.
- Chapter 5, "Working with Surfaces" - This chapter describes the iSurface tool and gives you insight into unique surfacing and surface manipulation tasks.
- Chapter 6, "Working with Contours" - This chapter describes the iContour tool and gives you insight into unique contouring and contour manipulation tasks.
- Chapter 8, "Working with Volumes" - This chapter describes the iVolume tool and gives you insight into unique volume visualization and volume manipulation tasks.
- Appendix A, "iTools Interface Reference" - This appendix gives you a detailed look at the iTool interface and its components.
- Appendix B, "Property Controls" - This appendix describes the iTool controls used to set properties in the iTool property sheets.
- Appendix C, "Operations Properties" - This appendix describes the properties of the iTools found in the Operations Browser of each iTool.
- Appendix D, "Visualization Properties" - describes the properties of the iTools found in the Visualization Browser of each iTool.



Chapter 2: Importing and Exporting Data

This chapter describes how to access data using the iTool.

About the iTools Data Manager

All data used by any iTool is first loaded into the iTools *data manager*, which keeps track of which data items are associated with an iTool visualization. The process of loading data into the data manager is entirely automatic if you specify data when launching an iTool at the IDL command line or if you open a data file using the **Open** command from the iTool's **File** menu. In these cases, the iTool will import the data in the specified file or variable and create a visualization of the default type for the selected data and the iTool you are using.

If you want more control over the process of creating a visualization, you can load data into the data manager manually, either from a data file or from one or more variables that exist in your current IDL session. Once a data item is placed in the data manager, it is available to all iTools until it is removed. The methods of placing data into the data manager are described throughout this chapter.

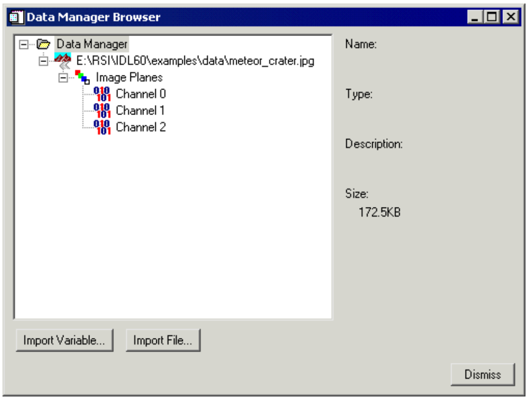


Figure 2-1: The iTools Data Manager

The data manager dialog provides a convenient and structured environment in which to import and view files and variables. Any data which is placed in the iTools system is stored in this repository. This chapter outlines the ways you can import data into the data manager as well as ways to export data out of the data manager into a file on your computer or a variable in the current IDL session.

The IDL iTools support several data types. Data import and export capabilities within each iTool allow you to access these various types of data. Standard file readers are provided in the IDL iTools to import data stored in binary formats, ASCII files, and several image file types.

Note

You can also create file readers for other data types besides those provided in IDL 6.0. For more information on creating file readers and creating your own iTools, see Chapter 8, “Creating a File Reader” in the *iTool Developer’s Guide* manual.

Data Manager Utilities

Within the data manager you can perform important tasks such as removing, renaming, copying, and importing data.

- **Deleting data** — Unused or outdated data items can be manually removed from the data manager by selecting and right-clicking to choose the **Delete** option.
- **Renaming data** — Data items can be renamed at any time by selecting and right-clicking to chose the **Rename** option.
- **Duplicating data** — Data items can be copied at any time by selecting and right-clicking to chose the **Duplicate** option.
- **Importing data** — Importing data into the data manager is described in this chapter in the sections which follow.

About the Parameter Editor

Every iTool requires that data be assigned to one or more *parameters* before a visualization can be created and displayed. If you specify data when launching an iTool at the IDL command line or if you open a data file using the **Open** command on an iTool's **File** menu, the iTool will attempt to assign the specified data to the correct parameters for the visualization you are creating.

If you have already created a visualization, you can change the data associated with one or more visualization parameters using the Parameter Editor. To display the Parameter Editor, select your visualization, then select **Edit** → **Parameters...**.

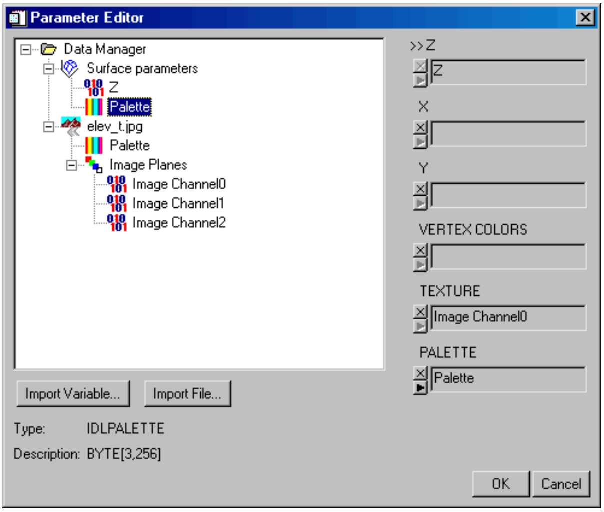


Figure 2-2: Parameter Editor

Similarly, if you choose to create a visualization by selecting **Visualization** from the iTool's **Insert** menu, you will have the chance to select data for each parameter used by the visualization manually. (The Insert Visualization dialog contains all of the fields shown in the Parameter Editor, and additionally allows you to select a visualization type. See "Using Insert Visualization" on page 23 for details.)

To associate data with a visualization's parameters using the Parameter Editor:

1. Select **Edit** → **Parameters**.
2. Do one of the following:

- Select an item already in the Visualization Tree.
- Click **Import File** to import a file into the Visualization Tree, and select the file.
- Click **Import Variable** to import a variable into the Visualization Tree, and select the variable.

3. Assign the item to the appropriate input variable by clicking the **Assign Data** button beside the input variable field. To remove an item from an input variable field, click the **Clear** button. Also, if you double-click on an item in the tree, it will move to the field of your selected parameter.
4. Click **OK** to close the Parameter Editor.

Data Import Methods

Data items in the data manager are available to all iTools until it they are removed. There are five ways to bring data into the iTool data manager:

- Using the Insert Visualization dialog (**Insert** → **Visualization**)
- Using the Data Import Wizard (**File** → **Import**)
- By opening a data file directly (**File** → **Open**)
- Using the Data Manager dialog (**Window** → **Data Manager**)
- At the Command Line of IDL (for example, `iPlot, indgen(20)`)

These methods are described in the following sections.

Using Insert Visualization

One simple method to import data into the data manager is to use the **Insert** → **Visualization** feature from the iTool window. To use this method, select Insert Visualization from your iTool window.

To access data using **Insert** → **Visualization** from your tool:

1. Start an iTool.
2. Select **Insert** → **Visualization** and the **Insert Visualization** Dialog appears

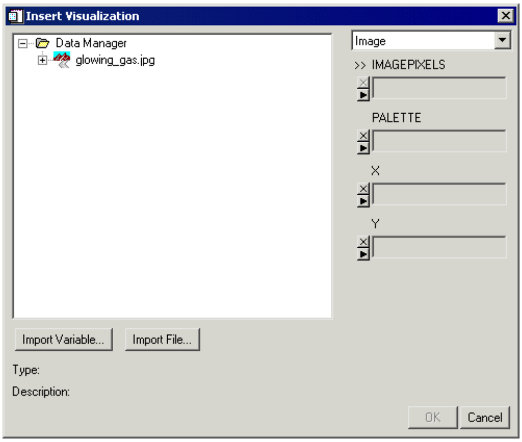


Figure 2-3: Insert Visualization Dialog With Image Visualization Type Selected

The **Insert Visualization** dialog contains the following items:

- **Visualization Tree** — This area shows the tree structure of imported data and/or variables available for visualization.
- **Visualization Type Drop-down Menu** — This menu allows you to select the visualization type to use with the selected data.
- **Input Parameters** — These are the input parameters for the visualization type selected in the Visualization Type Drop-down Menu. These input variables will change per visualization type.
- **Import Variable** — gives you the ability to select a variable to import into the data manager via the **Insert Visualization** Browser. For more

information on importing a variable into your data manager, see "Importing a Variable" on page 42.

- **Import File** — gives you the ability to select data from a file to import into the data manager via the **Insert Visualization** Browser.

3. Next, assign data in the dialog to the parameters of the visualization being inserted.
4. Select the visualization type from the visualization type drop-down menu.
5. Now click **OK** to finish inserting the visualization.

Note

The **OK** button on the insert visualization dialog is disabled until all required parameters have associated data.

The Insert Visualization feature can display your data file according to its file type. For an explanation of the handling of various file types see the following sections:

- For Image Data see "Importing Image Data" on page 33.
- For ASCII Data see "Importing ASCII Data" on page 34.
- For Binary Data see "Importing Binary Data" on page 38.

Using the Data Import Wizard

Another option when importing data into the data manager is to use the Data Import Wizard. The Data Import Wizard matches your visualization parameters automatically rather than needing you to match them individually as in the parameter editor. Here is an example of how to import a JPEG image file using the Data Import Wizard and display the image:

1. From an iTool window (in this example iImage since our data is image data) select **File** → **Import**.

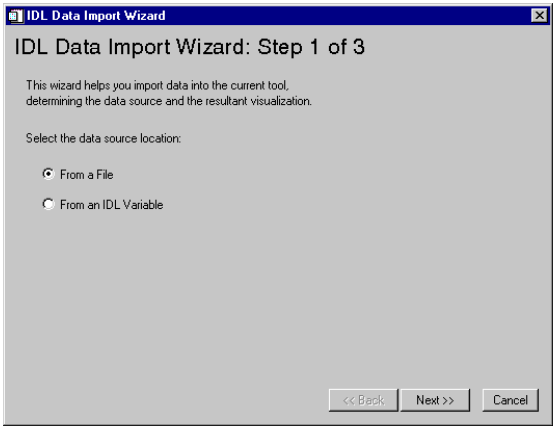


Figure 2-4: The IDL Data Import Wizard, Showing Step 1 of 3

The **IDL Data Import Wizard: Step 1 of 3** dialog contains the following items:

- **From a File** — gives you the ability to select data from a file to import into the data manager.
- **From an IDL Variable** — gives you the ability to select a variable to import into the data manager. For more information on importing a variable into your data manager, see “Importing a Variable” on page 42.

2. Select **From a File** and click **Next**.

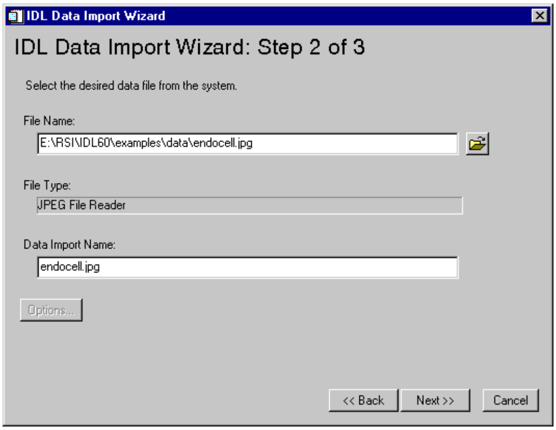


Figure 2-5: The IDL Data Import Wizard, Showing Step 2 of 3

The **IDL Data Import Wizard: Step 2 of 3** dialog contains the following items:

- **File Name** — used to show the name and path of the file you chose from the **File Open** button.
- **File Open** button — used to show the **Please Select a File for Reading** dialog.
- **Data Import Name** — used to name or rename (if desired) a selected file to import.
- **Options** — TBD.

3. In the **File Name** field, type the path to the desired file, or click the **File Open** button just to the right of the **File Name** field to search the directory

structure for the desired file. Select a file in the `examples/data` directory named `endocell.jpg`. Click **Next**.

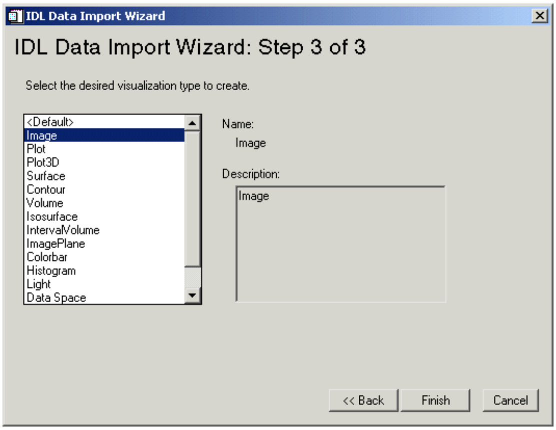


Figure 2-6: The IDL Data Import Wizard, Showing Step 3 of 3

The **IDL Data Import Wizard: Step 3 of 3** dialog contains the following items:

- **Select the desired visualization to create** — used to select the type of visualization to create based upon the data type to be visualized.
- **Name** — displays the visualization type name.
- **Description** — shows the visualization type.

4. Select **Image** as the desired visualization to create since we have a JPEG image.

5. Click **Finish** and the visualization appears in the iTool window:

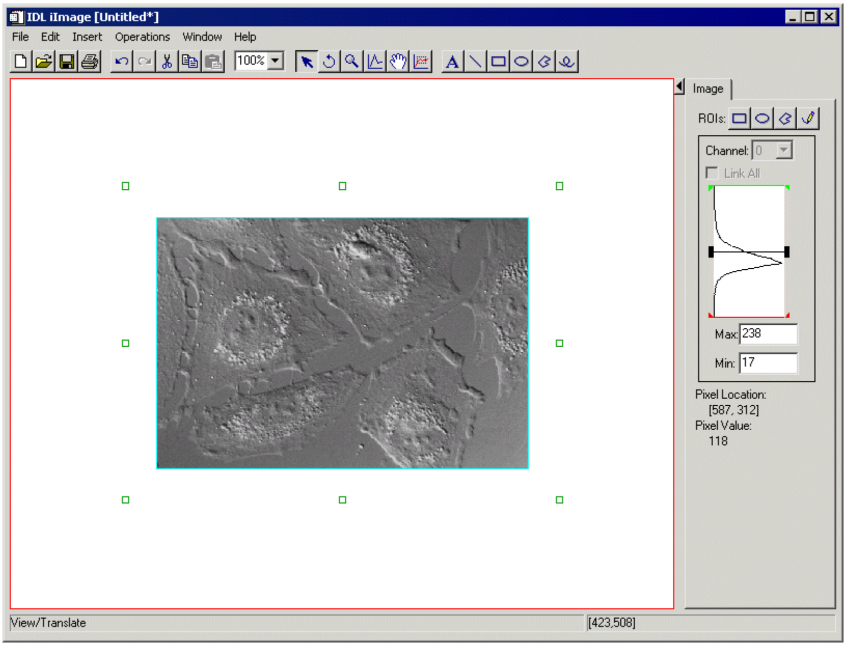


Figure 2-7: JPEG Image Visualized Using the Data Import Wizard

Note

This example shows a JPEG image visualized using the iImage tool. The iImage tool has unique features such as the tab to the right of the image pane which shows you pixel location and pixel value. For more information on the iImage tool and its functions and features, see Chapter 4, "Working with Images".

The Data Import Wizard can visualize your data file according to its file type. For an explanation of the handling of various file types see the following sections:

- For Image Data see "Importing Image Data" on page 33
- For ASCII Data see "Importing ASCII Data" on page 34
- For Binary Data see "Importing Binary Data" on page 38

Using File Open

Yet another method to import data into your data manager is to use **File** → **Open** to import data if you already know your data type. Using **File** → **Open** will also match your parameters automatically.

To access data using **File** → **Open** from your tool:

1. Start your desired iTool (depending upon your data type) at the IDL command line.
2. Select **File** → **Open** or the File Open icon at the top left of your iTool window, and the File Open Dialog appears.

Figure 2-8: The Open Dialog From Which to Choose Data

3. Select the desired file from your directory structure.
4. The iTool will visualize your data file according to its file type, or, if the data is binary or ASCII, will prompt you with a template to read the file into the data manager. For an explanation of the handling of various file types see the following sections:

- For Image Data see "Importing Image Data" on page 33
- For ASCII Data see "Importing ASCII Data" on page 34
- For Binary Data see "Importing Binary Data" on page 38.

Using the Data Manager Dialog

The most direct way to import data into an iTool is from the data manager.

Here is an example of how to import a JPEG image file using the data manager and display the image:

1. From an iTool window select **Window** → **Data Manager**.

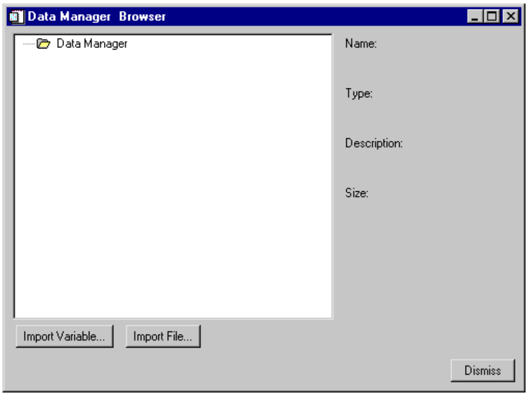


Figure 2-9: The iTools Data Manager

The **Data Manager Browser** appears. This browser shows you any imported data in the window to the left of the browsers (here it is shown empty). Also any selected data displays its name, type, description, and size in the appropriate fields on the right. At the bottom of the browser are the options to import a variable, import a file or dismiss the browser. You can also perform such options as deleting, duplicating, and renaming your data items by right-clicking on them in the Data Manager and then selecting from **Delete**, **Duplicate**, or **Rename**.

Importing From a File

You can import a file into an existing visualization within the iTools.

1. From your iTool window, select **Insert** → **Visualization**.
2. Select **Import File** and the **File Import** dialog appears.

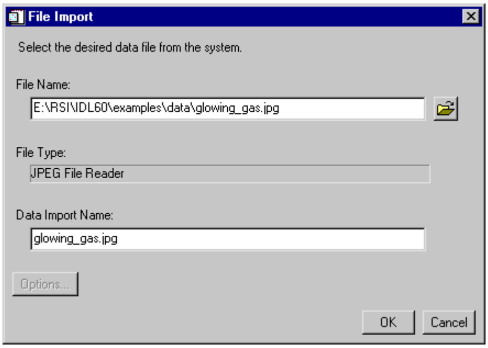


Figure 2-10: The File Import Dialog with JPEG File Selected

The **File Import** dialog contains the following items:

- **File Name** — used to show the name and path of the file you chose from the **File Open** button.
- **File Open** button  — used to show the **Please Select a File for Reading** dialog.
- **File Type** — used to show the file format type of the selected file (if any).
- **Data Import Name** — used to name or rename (if desired) a selected file to import.

3. In the **File Name** field, type the path to the desired file, or click the **File Open** button  just to the right of the **File Name** field to search the directory structure for the desired file. Select a file in the `examples/data` directory or any other data files you wish to visualize.
4. Click **OK** to dismiss the **File Import** dialog.
5. Select the visualization type from the drop-down list at the top-right of the **Insert Visualization** dialog.
6. From the **Insert Visualization** dialog, expand the tree of the file you wish to see.
7. In this example of image data, select **Image Planes** and then click the small arrow next to **IMAGEPIXELS**.
8. Select **Palette** from the files tree and then click the little arrow next to **PALETTE**. (This is optional and in this particular example we have no palette)

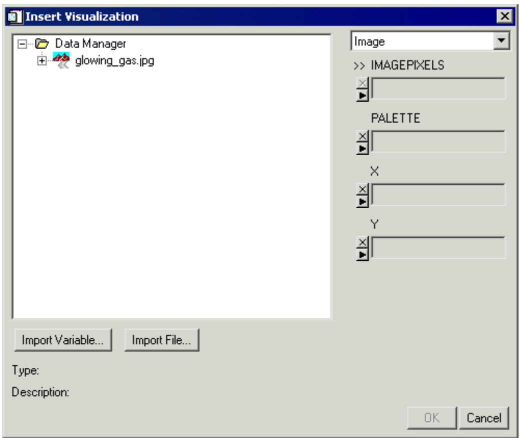


Figure 2-11: The Insert Visualization Dialog

9. Click **OK** and your data will then be visualized according to your selections, or, in the case of binary and ASCII data, you will be prompted by a template for more information about your data.

Importing Image Data

Image data of many common file formats can be visualized by IDL iTools. Common image file formats accepted are:

- BMP
- DICOM
- JPEG
- PICT
- PNG
- TIFF

Note

You can also use the iTool's export and export variable features to export image data and variables. For more information on exporting, see "Exporting Data" on page 44.

You may import common image files into the IDL iTools using any of the previously described methods. For information on these methods, see "Data Import Methods" on page 22. This section also shows examples of importing image data.

Note

For more information on the iImage tool and its functions and features, see Chapter 4, "Working with Images".

Importing ASCII Data

When you open a file containing ASCII data, you must specify the format of the file before the iTool can read the data and place it into the data manager. The iTool opens the **ASCII Template** dialog to allow you to specify the format of the ASCII data.

Note

You can also use the iTool's export and export variable features to export ASCII data and variables. For more information on exporting, see "Exporting Data" on page 44.

Here is an example of opening an ASCII file using the ASCII Template as well as information on the ASCII template's layout:

1. From the iTool window open an example file named `sine_waves.txt` from the `examples\data` subdirectory of your IDL distribution. You can open the file either by selecting **File** → **Open** or by clicking the **Import File** button in the Data Manager or Insert Visualization dialog.
2. The ASCII Template window is displayed:

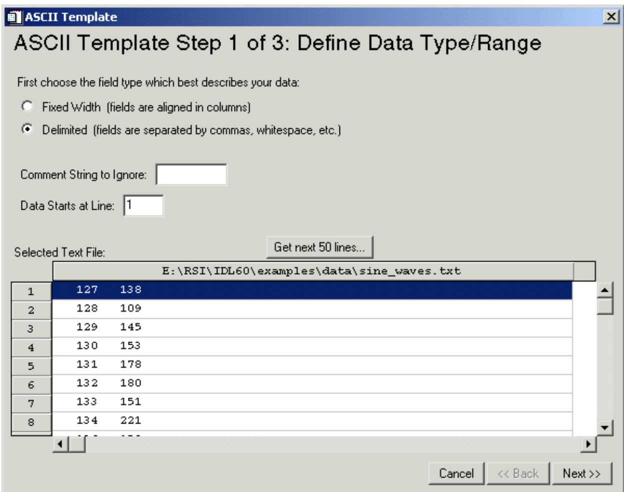


Figure 2-12: The ASCII Template Step 1, Defining Data Type and Range

The first step of the **ASCII Template** contains the following items:

- **Field Type** — Select the field type which best describes your data. Choose from fixed width or delimited.
- **Comment Strings to Ignore** — Allows you to note any comment strings you wish to be ignored.
- **Data Starts at Line** — Allows you to specify from which line data should first be read.
- **Selected Text File** — Shows the real data from the selected text file. The option is also given to **Get next 50 Lines**.

3. Choose the field type. Here it is delimited by white space.
4. There are no comment strings to ignore here, and the line upon which to begin your data is 1. Now select **Next**.

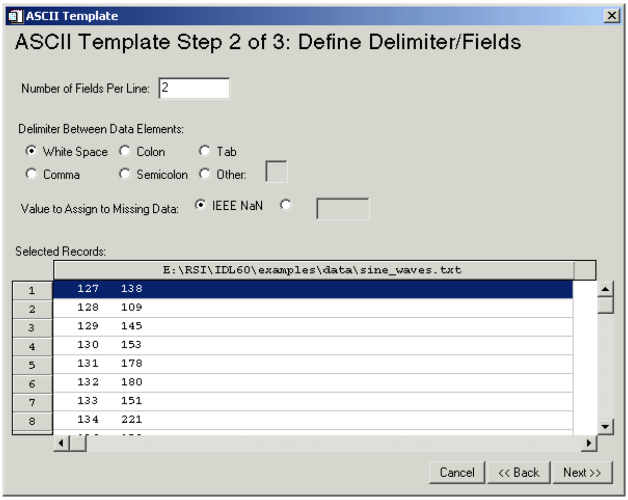


Figure 2-13: The ASCII Template Step 2, Defining Delimeters/Fields

The second step of the **ASCII Template** contains the following items:

- **Number of Fields Per Line** — Allows you to specify how many fields should appear per line.
- **Delimiter Between Data Elements** — Allows you to select the delimeter type between data elements.
- **Value to Assign to Missing Data** — Allows you to choose a value to assign any missing data.

- **Selected Records** — Shows the data itself in its desired column-delimited format.

5. Next, enter the **Number of Fields Per Line** as two, and the **Delimiter Between Data Elements** should be set to **White Space**. Click **Next**.

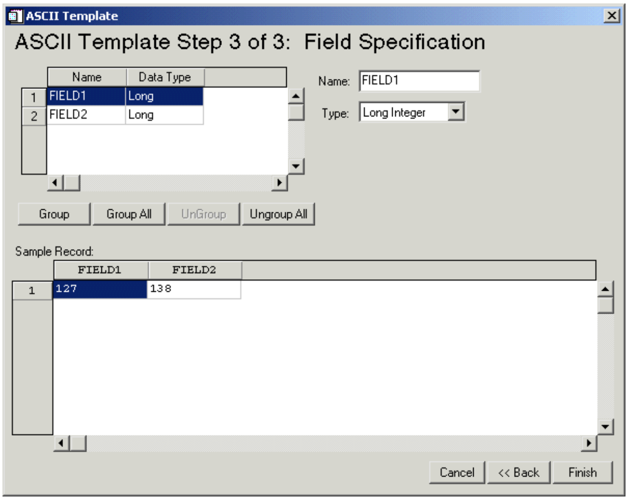


Figure 2-14: ASCII Template Step 3, Field Specifications

The third step of the **ASCII Template** contains the following items:

- **Name** — Allows you to name your fields. Default values are **Field1**, **Field2**, and so on. You can enter the name into the **Name** field to the right.
- **Data Type** — Allows you to set the data type for your fields. You can enter the type by selecting it from the **Type** drop-down menu.
- **Grouping** — Allows you the option of joining fields to be manipulated or displayed as a group. You can group certain fields, group all, ungroup certain fields and ungroup all. The default is no grouping.
- **Sample Record** — Shows you a sample of the configuration you have set.

6. Next, at step three, the defaults are all correct for the data to visualize. Click **Finish** and the data is plotted:

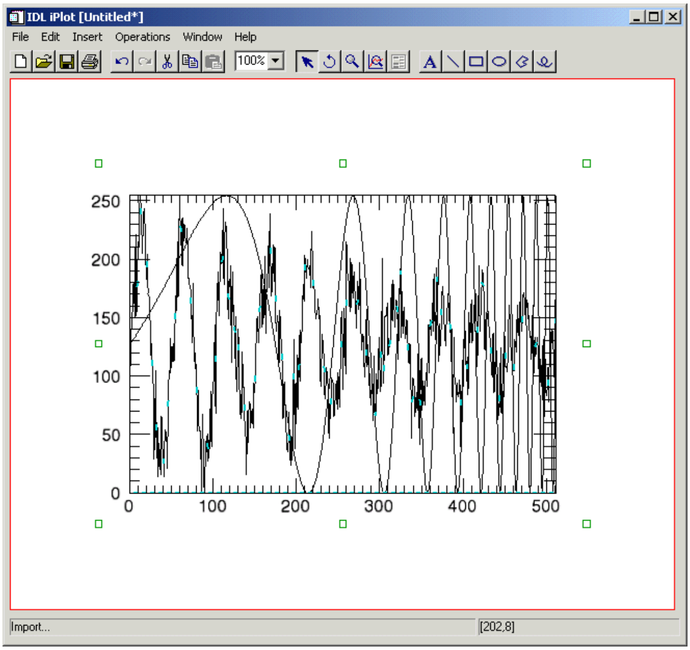


Figure 2-15: ASCII Data Plotted Using the ASCII Template

For more information on using the ASCII file reader, see “ASCII_TEMPLATE” in the *IDL Reference Guide* manual.

For more information on plotting and plot functions, see Chapter 7, “Working with Plots”.

Importing Binary Data

When you open a file containing binary data that is not of a format recognized by any other file reader available to your iTool, you must specify the format of the file before the iTool can read the data and place it into the data manager. The iTool opens the **Binary Template** dialog to allow you to specify the format of the binary data.

Note

If the file contains binary data of a recognized format, such as TIFF or JPEG, the iTool will automatically choose the correct file reader to read the binary data.

Note

You can also use the iTool's export and export variable features to export binary data and variables. For more information on exporting, see "Exporting Data" on page 44.

Here is an example of opening a binary file using the Binary Template as well as information on the binary template's layout:

1. From the iTool window open an example file nanamed `damp_sn.dat` from the `examples\data` subdirectory of your IDL distribution. You can open the file either by selecting **File** → **Open** or by clicking the **Import File** button in the Data Manager or Insert Visualization dialog. This is a data file containing a damped sine wave with severe high frequency noise.
2. The Binary Template window is then displayed.

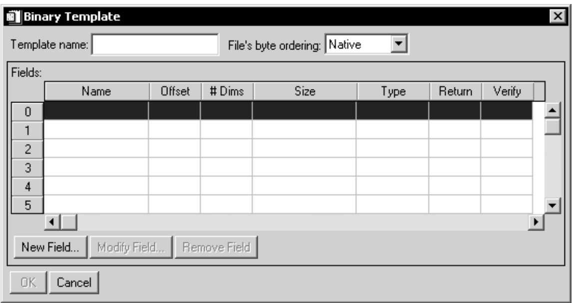


Figure 2-16: The Binary Template

The **Template Name** is optional, and can be any string.

The byte order in the file is selected using the using the **File's byte ordering:** pull-down menu. The choices are:

- **Native** — The type of storage method that is native to the machine you are currently running. Little Endian for Intel microprocessor-based machines and Big Endian for Motorola microprocessor-based machines. No byte swapping will be performed.
- **Little Endian** — A method of storing numbers so that the least significant byte appears first in the number. Specify this if the original file was created on a machine that uses an Intel microprocessor.
- **Big Endian** — A method of storing numbers so that the most significant byte appears first in the number. Specify this if the original file was created on a machine that uses a Motorola microprocessor.

3. From this template, click **New Field**.

   The **New Field** dialog contains the following items:

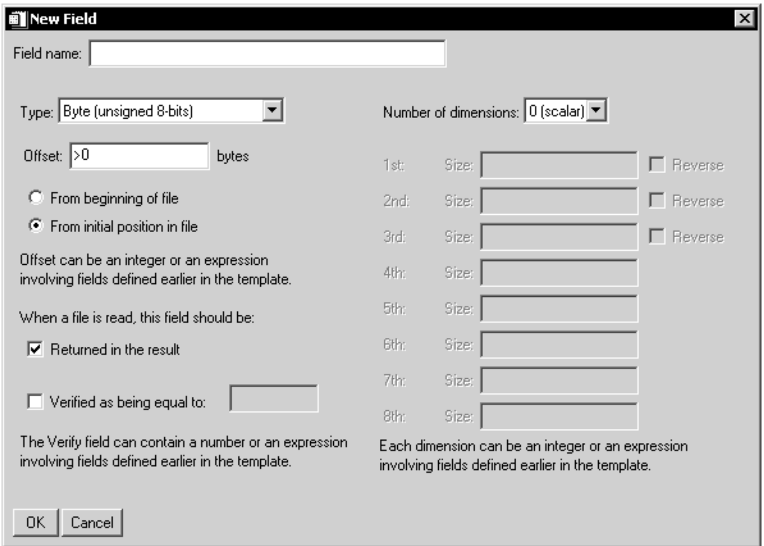


Figure 2-17: Defining a New Field in the Binary Template

- The **Field Name** can be any string.
- The **Type** of each Template-specified field is selected from a droplist that offers the following IDL types: byte, integer, long, float, double, complex,

dcomplex, uint, ulong, long64 and ulong64. Strings are read as an array of bytes for later conversion to type STRING.

- **Offsets** can be specified using integer values, field names, or any valid IDL expression. An *absolute integer offset* specifies a fixed location (in bytes) from the beginning of the file (or the initial file position for an externally opened file). A r*elative integer offset* specifies a position relative to the current file position pointer after the previous field (if any) is read. Relative offsets are shown in the binary template user interface with a preceding > or < character, to indicate a positive (>) or negative (<) byte offset. *Expressions* can include the names of fields that will be read *before* the current field — that is, the field number of the referenced field must be lower than the field number of the field being defined.
- The **Verify** field can contain an integer, field name, or any valid IDL expression. Only scalar fields can be verified.
- The **Number of Dimensions** of a field can be set via a droplist of values 0 (scalar) to 8 (which is the maximum number of dimensions that an IDL variable can have.) The size of each dimension can be an integer, field name, or any valid IDL expression. Any of the first three dimensions of array data can also be specified to be reversed in order.

Click **OK** to create the new field definition, and repeat to define all necessary fields.

Note

If the iTool is running in the IDL Virtual Machine, the **Offsets**, **Verify,** and **Size** fields can contain integers or field names, but *not* an IDL expression. For additional information on the binary template, see “BINARY_TEMPLATE” in the *IDL Reference Guide* manual.

4. In this example, name the field “dampsn”. The type is Byte data. The number of dimensions is 1 and the dimension size is 512.

5. Click **OK** and then **OK** again to close the **Binary Template** dialog. The Plot appears in the iTool window.

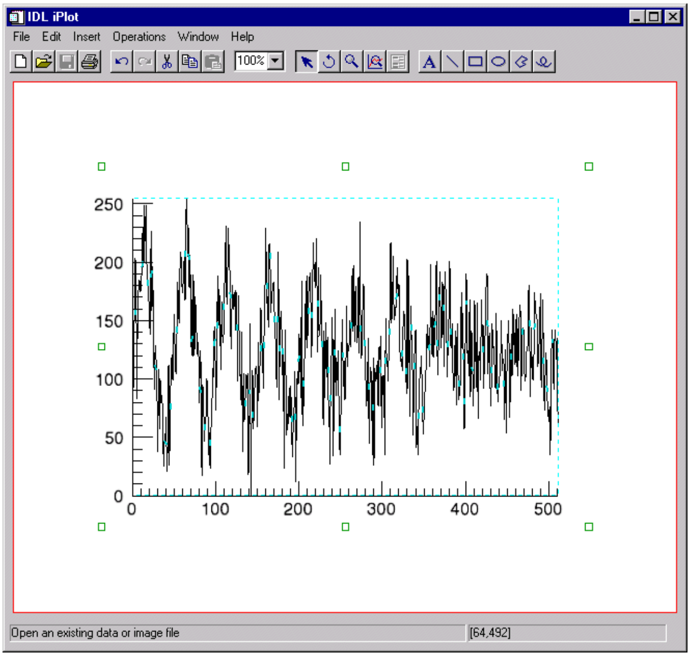


Figure 2-18: Binary Data File Displayed in the iTool Window

For more information on the binary file reader, see "BINARY_TEMPLATE" in the *IDL Reference Guide* manual.

For more information on plotting and plot functions, see Chapter 7, "Working with Plots".

Importing a Variable

Variables in your current IDL session can be imported into the data manager to be visualized in an iTool. Once you have entered variables into the IDL session at the command line, you can import a variable directly from the **Data Manager** dialog, or by using **File** → **Import**.

Note

If you specify a variable as a parameter to the iTool at the IDL command line, the variable is automatically imported into the data manager.

The following is an example of importing a variable using the **Data Manager** dialog:

1. From the **Data Manager** dialog, select **Import Variable**. The **IDL Variable Browser** appears.

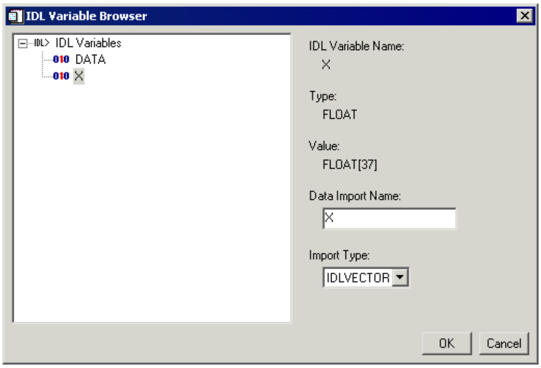


Figure 2-19: The IDL Variable Browser

From the **IDL Variable Browser** you can select available variables which you have entered at the Command Line and click **OK** to add them to your Data Manager as available variables.

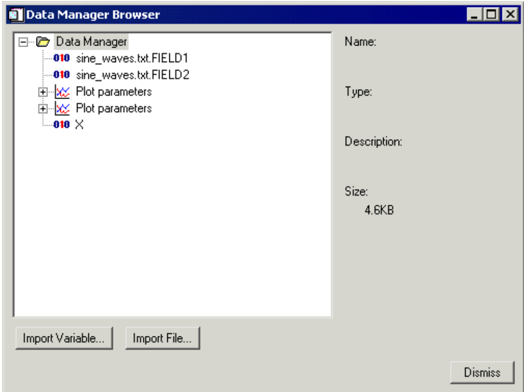


Figure 2-20: Imported Variable with Imported Files

Exporting Data

You can export data from an iTool to a data file or back to the current IDL session:

- Exporting Data to a File (following)
- Exporting Data to the IDL Session (page 46)

Exporting Data to a File

You can export the contents of an entire iTool window into a single image or data file using the IDL Data Export Wizard.

For example, to export a file:

1. Select **File** → **Export**. The **IDL Data Export Wizard** appears.

Figure 2-21: The IDL Data Export Wizard, Showing Step 1 of 3

2. The first step asks you to choose to export the data to either a file or an IDL variable. Select **File** and then **Next**.

Note

For more information on exporting data to an IDL variable, see the following section, "Exporting Data to the IDL Session" on page 46.

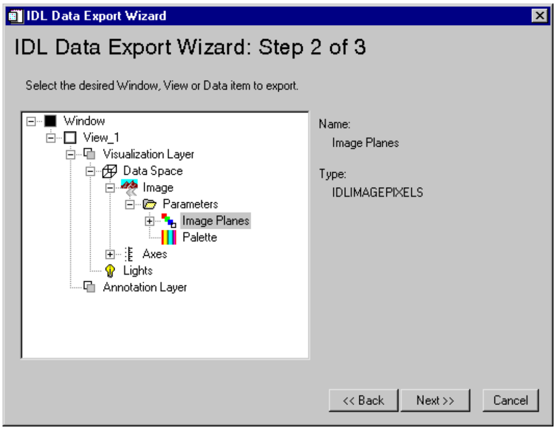


Figure 2-22: The IDL Data Export Wizard, Showing Step 2 of 3

3. From the next screen, select the data which you wish to export. Notice that only the Window level or View level can be exported. Click **Next**.

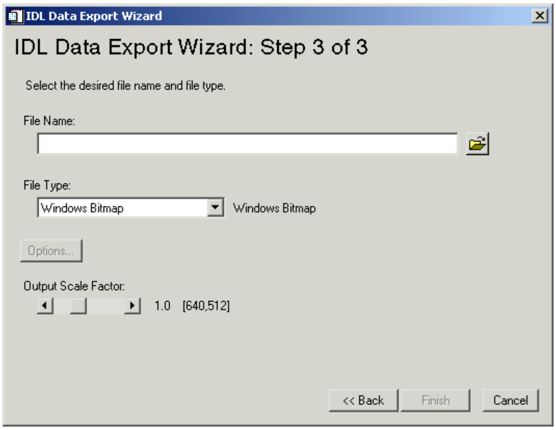


Figure 2-23: The IDL Data Export Wizard, Showing Step 3 of 3

4. You are now prompted for selection of the destination and file type. After entering a desired filename, extension, and destination, click **Finish**. The file is then exported.

Exporting Data to the IDL Session

You can export data from an iTool into a single variable using the IDL Data Export Wizard.

For example, to export data to an IDL variable:

1. Select **File** → **Export**. The **IDL Data Export Wizard** appears.

Figure 2-24: The IDL Data Export Wizard, Exporting a Variable Step 1 of 3

2. Select **To an IDL Variable**.

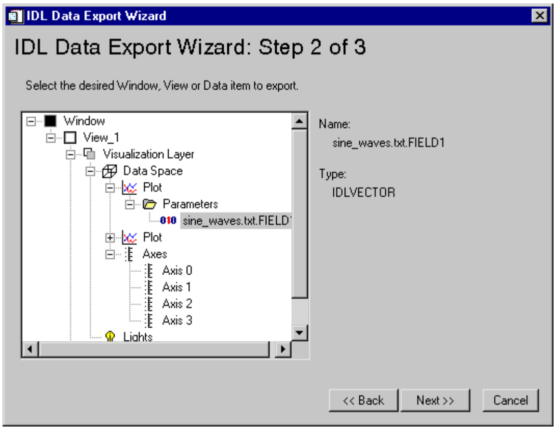


Figure 2-25: The IDL Data Export Wizard, Exporting a Variable Step 2 of 3

3. From the next screen, select the data which you wish to export. Notice that only data items can be exported as variables. Click **Next**.

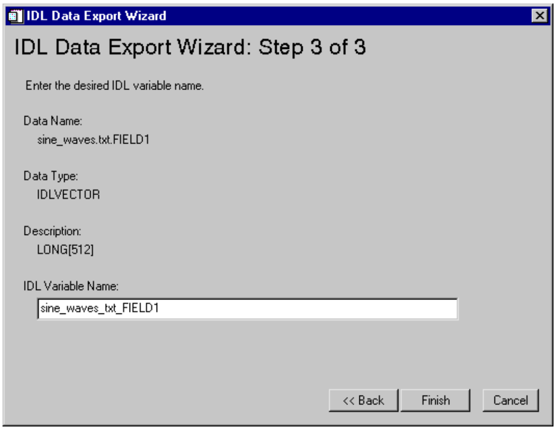


Figure 2-26: The IDL Data Export Wizard, Exporting a Variable Step 3 of 3

4. The final screen and step allow you to name your variable as you wish. A default name also appears as representative of the data item. Name your variable and click **Finish**.
5. The variable will now appear in the data manager.

Exporting via Context Menu

An alternate way to export a variable to IDL is to select the variable within the Visualization browser and right-click to choose **Export to IDL**. For more information on the Visualization browser, see Appendix D, "Visualization Properties".

Unknown Data

If you supply data in a format not recognized by the current iTool, the **Create Visualization** dialog allows you to specify how the data is to be used.

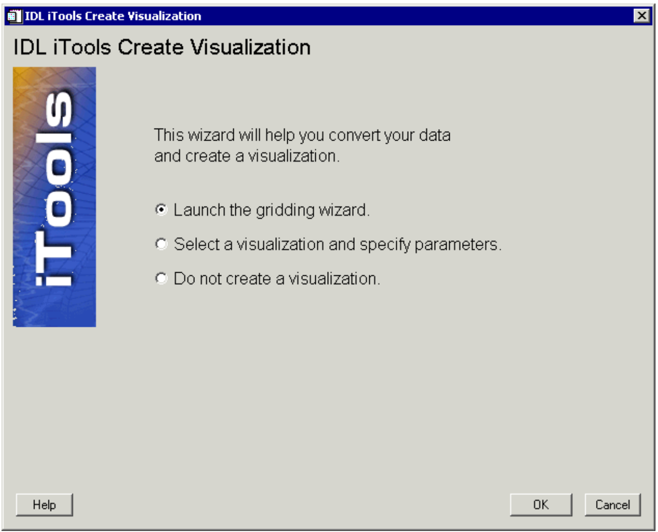


Figure 2-27: The iTools Create Visualization Dialog

You will see this dialog if the data you supply when launching an iTool from the IDL command line does not match a known data organization for the selected tool, or if you open an ASCII text file containing data that appears to be irregularly gridded.

The **Create Visualization** dialog contains the following choices:

- **Launch the gridding wizard**

  This option lets you transform irregularly-gridded data into regularly-gridded data using IDL's gridding routines. The resulting regularly-gridded data will be displayed by the iTool. See "Gridding Wizard" on page 50 for details.

- **Select a visualization and specify parameters**

  This option lets you manually specify how the data should be assigned to a selected visualization's parameters.

- **Do not create a visualization**

Gridding Wizard

The iTools Gridding Wizard allows you to convert irregularly-gridded data into regularly-gridded data using a variety of methods. The gridding wizard processes your irregularly-gridded data in three steps.

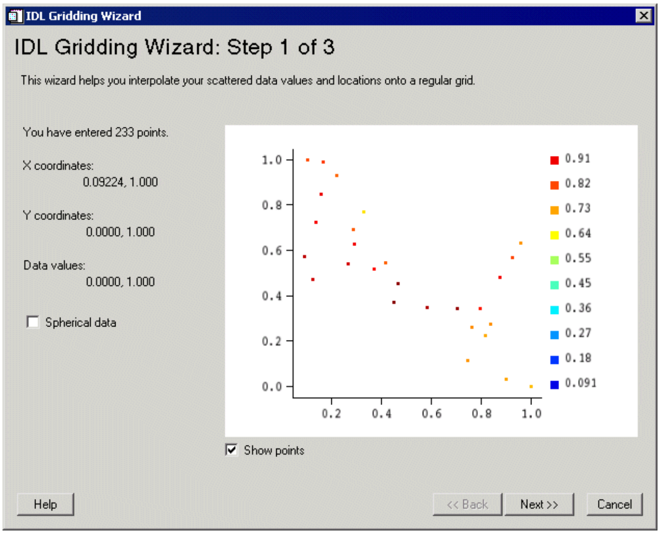


Figure 2-28: The IDL Gridding Wizard Step 1 of 3

The **IDL Gridding Wizard Step 1 of 3** dialog contains the following items:

- **Number of points entered**
- **X Coordinates —** The X coordinate range
- **Y Coordinates —** The Y coordinate range
- **Data values —** The data minimum and maximum values
- **Spherical data checkbox —** Check this box if the data is spherical
- **Coordinate diagram** — Shows coordinates of grid data
- **Show points checkbox** — Select to show all points (default = checked)
- **Help** — Obtain help on this dialog
- **Back** — Return to previous step
- **Next** — Proceed to Step 2 of 3
- **Cancel** — Dismiss the Gridding Wizard

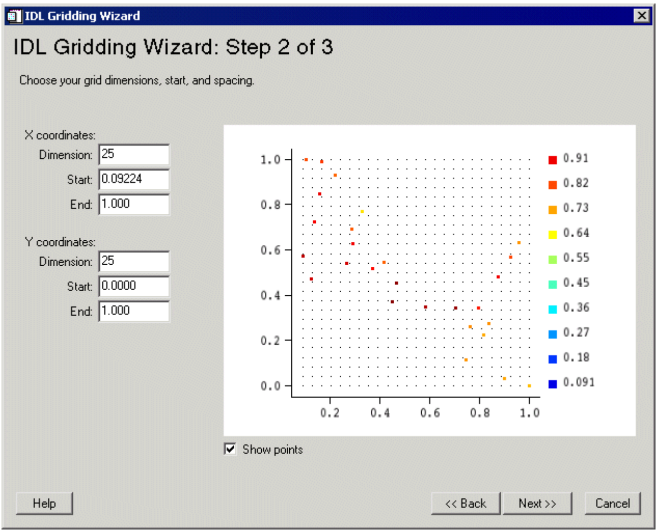


Figure 2-29: The IDL Gridding Wizard Step 2 of 3

The **IDL Gridding Wizard Step 2 of 3** dialog contains the following items:

- **X Coordinates** — modify dimension, start or end
- **Y Coordinates** — modify dimension, start or end
- **Coordinate diagram** — Shows coordinates of grid data
- **Show points checkbox** — Select to show all points (default = checked)
- **Help** — Obtain help on this dialog
- **Back** — Return to previous step
- **Next** — Proceed to Step 3 of 3
- **Cancel** — Dismiss the Gridding Wizard

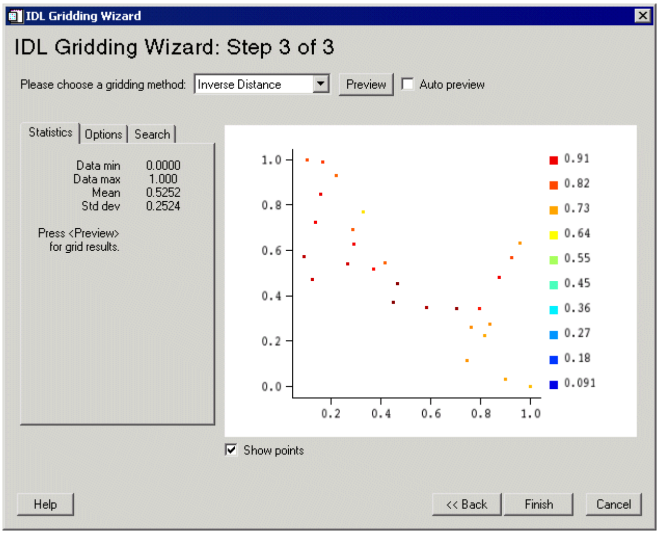


Figure 2-30: The IDL Gridding Wizard Step 3 of 3

The **IDL Gridding Wizard Step 3 of 3** dialog contains the following items:

- **Choose gridding method** — Choose from pull-down list of methods. See "GRIDDATA" in the *IDL Reference Guide* manual for a discussion of the gridding methods.
- **Preview** — Click to preview selected method and data
- **Auto preview** — Checkbox to turn auto preview on (default = off)
- **Statistics tab** — Shows data statistics
- **Options tab** — Set options for missing values, smoothing, weighting, and anistropy between axes
- **Search tab** — Set options for using search ellipse
- **Coordinate diagram** — Shows coordinates of grid data
- **Show points checkbox** — Select to show all points (default = checked)
- **Help** — Obtain help on this dialog
- **Back** — Return to previous step
- **Finish** — Dismiss the Gridding Wizard with data gridded

- **Cancel** — Dismiss the Gridding Wizard

Chapter 3: iTool Common Tasks

This chapter describes the following common tasks that can be performed with all of the IDL Intelligent Tools:

Introduction

The Standard IDL Intelligent Tools supplied in the IDL 6.0 distribution comprise five distinct tools: iImage, iPlot, iSurface, iContour, and iVolume. Each tool performs a specific set of tasks related to the type of data it is designed to use. In addition to these specific tasks, all five tools have a number of tasks they perform in common. This chapter describes only those common tasks; for information about specific tasks performed by the individual iTools, refer to the chapters describing those tools.

The common iTool tasks include selecting objects, retracing steps with the Undo/Redo commands, and manipulating data. All iTools share a common interface for setting properties, browsing the available operations and visualizations, adjusting the window layout, and ending the iTool session.

Note

This chapter describes only the Standard IDL iTools, those iTools supplied in the IDL 6.0 distribution. Other iTools written by users and third-party developers share a common interface with the RSI iTools because the iTools framework is used to create all iTools. However, the specific functionality of such iTools may be different from the functionality of the RSI iTools described here.

Selection of Objects

iTool elements such as axes and annotations have objects associated with them. These objects have their own associated *properties* — such as color, line style, size, and so on. There are two ways to select objects in IDL iTools:

- With the Select arrow
- From the Visualization Browser

To select an object or group of objects with the Select arrow:

1. If necessary, click the Select button  on the toolbar to enter Select mode.
2. Position the arrow mouse pointer over the object and click. A selection box appears around the object.
3. To select additional objects, hold down the SHIFT key while clicking them.

To select an object or group of objects from the Visualization Browser:

1. Select **Window** → **Visualization Browser**.
2. Click the name of the object in the Visualization Browser list. A selection box or selection highlight appears on that object in the iTool window.
3. To select additional objects, hold down the SHIFT key while selecting the names of additional objects in the Visualization Browser list.

Select All

Select All selects all objects (visualizations, annotations, legends, etc.) displayed in the iTool window.

To select all objects:

1. Select **Edit** → **Select All**. All displayed objects are selected.
2. CTRL + click to deselect any objects that you do not want to include.

Undo/Redo

Any action performed in an iTool window can be undone or redone. The Undo and Redo mechanism provides a useful way of retracing and repeating steps that have been performed in the iTool window.

Note

Operations which cannot be undone are: Open, Save, Export, Export variable, Print, Exit, and window moving and resizing.

To undo the most recent action, do one of the following:

- Select **Edit** → **Undo**.

or

- Click .

To undo multiple actions, simply repeat these commands. When no more actions remain to be undone, the Undo menu item or toolbar button is no longer active.

To repeat actions that have been undone, do one of the following:

- Select **Edit** → **Redo**.

or

- Click .or

Tip

Look at the text following the Undo or Redo menu item, or hover the mouse pointer over the Undo or Redo button on the toolbar to display the tooltip, to identify the action that will be undone or redone.

Common Manipulation Tasks

All iTools have the following manipulation tasks in common: translating, scaling, zooming, rotating, transforming, and filtering.

Translating

Translation moves an object or group of objects in a specified direction. When an object is selected, a bounding box appears around the object.

To translate a selected object to another location:

1. Position the pointer inside the bounding box. The mouse pointer changes to the translation pointer ✥ .
2. Drag in the desired direction. The entire object moves to the new location.

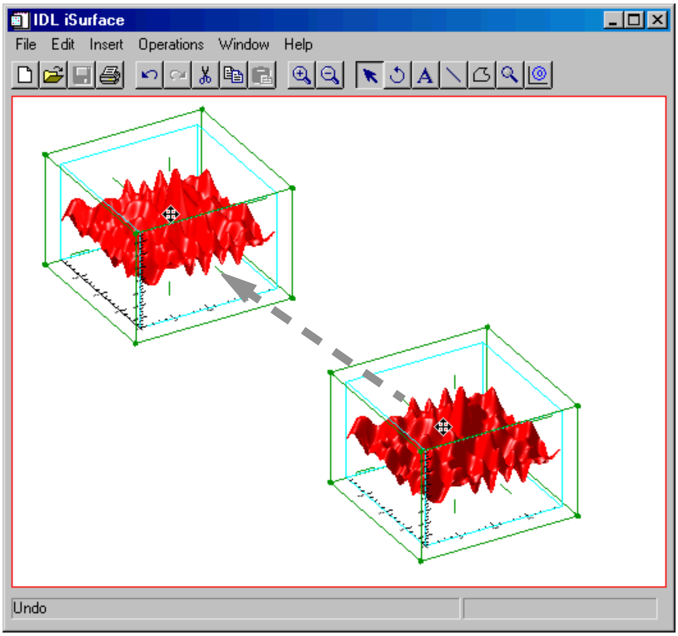


Figure 3-1: Translating Objects

Note

For information on creating a surface visualization which you can translate such as the one shown in the previous figure, see Chapter 5, “Working with Surfaces”.

Scaling

Two types of scaling are possible: constrained scaling and unconstrained scaling.

Constrained Scaling

Constrained scaling permits scaling of only one dimension while preserving the other dimensions.

Constrained Scaling of 2-D Objects

To scale one dimension of a 2-D object, click on the object so that eight small selection-boxes appear at each corner of the object and also midway along each side of the object. Then position the mouse onto one of these boxes so that the mouse pointer changes to a four-headed arrow pointer (see the following figure). Drag the mouse in the desired direction to scale the object in the selected dimension.

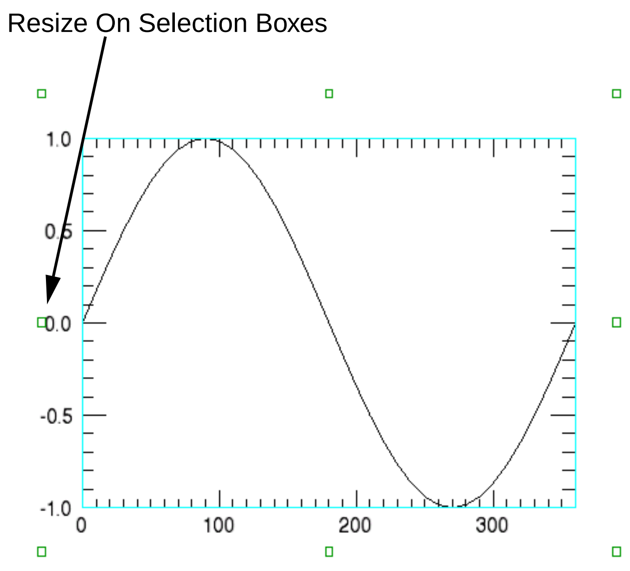


Figure 3-2: Resizing a 2-D Plot

Constrained Scaling of 3-D Objects

Two types of constrained scaling are available for 3-D objects: multiple-axis scaling and single-axis scaling.

The multiple-axis scaling mouse pointer for 3-D objects is a three-headed arrow displayed when the mouse pointer is positioned over a corner of a 3-D object's data space. Dragging the constrained scaling pointer scales the object a fixed distance along all axes in the direction of the drag.

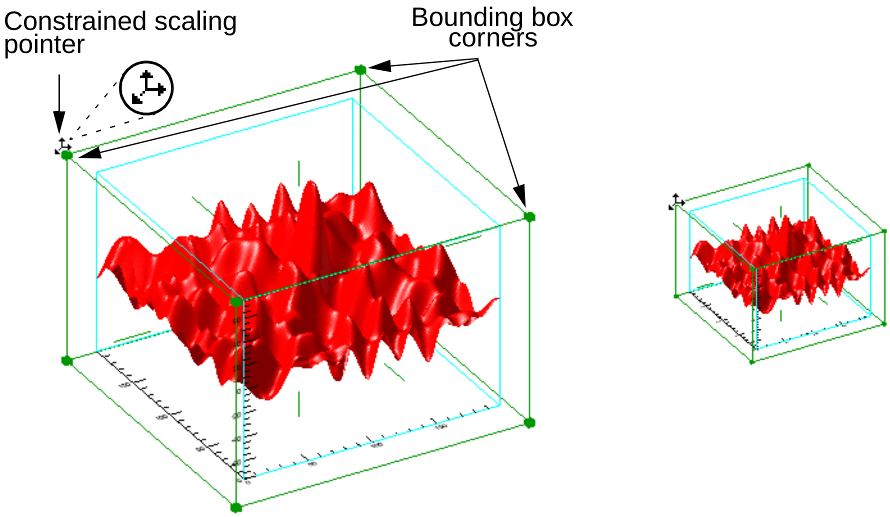


Figure 3-3: Constrained Scaling

The single-axis scaling pointer for 3-D objects is a two-headed arrow ↕, displayed when the pointer is positioned over an axis “whisker” in a 3-D image. Dragging an axis “whisker” scales the object only in the direction of the arrows.

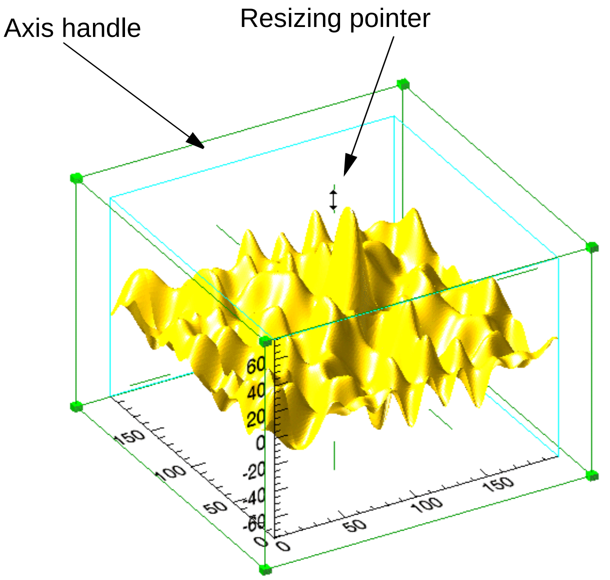


Figure 3-4: Resizing a 3-D Surface

Unconstrained Scaling

Unconstrained scaling allows you to scale all dimensions of an object at once from any point within the object. Unconstrained scaling is different for 2-D and 3_D objects.

Unconstrained Scaling of 2-D Objects

Unconstrained scaling of 2-D objects occurs when a corner of the data set bounding box is dragged. The mouse pointer changes to an unconstrained scaling pointer ⤧, and the object is scaled in the direction of the drag.

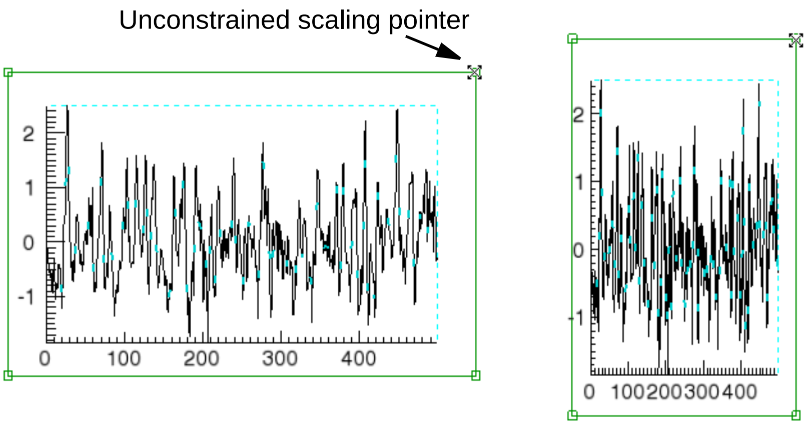


Figure 3-5: Unconstrained Scaling of a 2-D Plot

Unconstrained Scaling of 3-D Objects

Unconstrained scaling of 3-D objects occurs when a single side of the data set bounding box is dragged. The mouse pointer changes to an unconstrained scaling pointer, and the object is scaled along the dimensions of the selected side.

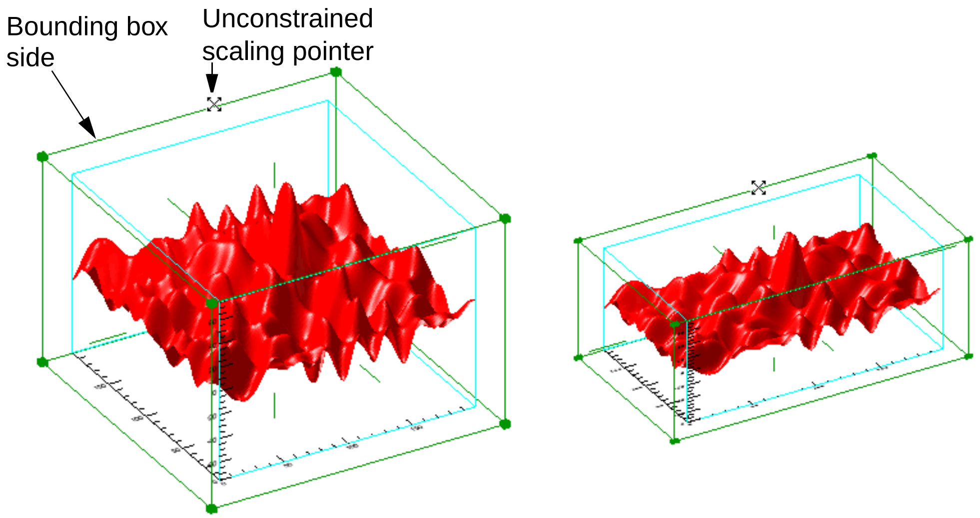


Figure 3-6: Unconstrained Scaling of a 3-D Surface

Zooming

Two types of zooming are available in all iTools: **Canvas Zoom**, which increases or decreases the magnification of the entire display canvas by a specified percentage, and **View Zoom**, which zooms in or out on a specific portion of the display area.

Canvas Zoom

Canvas Zoom increases or decreases magnification of the entire iTool window without moving the observer's "eye."

To zoom in or out with Canvas Zoom:

1. Click the browse button and select a percentage from the list.

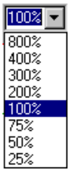


Figure 3-7: Canvas Zoom List

- To increase magnification, choose a percentage greater than **100%**.
- To decrease magnification, choose a percentage less than **100%**.
- To specify an arbitrary percentage, edit the number in the zoom text box.

2. Select **100%** to return to the default magnification.

View Zoom

View Zoom increases or decreases magnification at a specific point in the iTool window. This is similar to moving the observer's "eye" closer to or farther away from the object. Clicking with the mouse specifies the point of interest, and dragging the mouse makes it possible to zoom in or out.

To zoom in or out in Zoom mode:

1. Click Zoom on the toolbar to enter Zoom mode.
2. Position the mouse pointer on the viewplane. The pointer changes to a zoom pointer .
3. Do either of the following:
   - Drag the zoom pointer toward the top of the iTool window to enlarge the display.
   - Drag the zoom pointer toward the bottom of the iTool window to make the display smaller.
4. Click on the arrow Select button to leave Zoom mode and return to Select mode. The mouse pointer changes to an arrow pointer. In Select mode, dragging the arrow pointer positions the zoomed image.

Rotating

The iTools provide a number of ways to rotate graphical objects. 3-D objects can be rotated freely or along an axis using the mouse. In addition, both 2-D and 3-D objects can be rotated left or right in 90-degree increments, or they can be rotated by a specified number of degrees. These tools rotate the entire data space.

Mouse Rotation

To rotate a 3-D object with the mouse:

1. Select the object in the iTool window.
2. Click Rotate on the toolbar to enter Rotate mode. The rotation sphere, consisting of circular x-, y-, and z-dimension axes, is displayed around the object, as illustrated in Figure 3-8 and Figure 3-9:
3. 3-D objects can be constrained to rotate only along one of the three displayed axes, or they can be rotated freely.
   - To rotate an object along an axis, position the mouse pointer on the axis. The constrained rotation pointer is displayed. Drag in the desired direction to rotate the object along the selected axis.

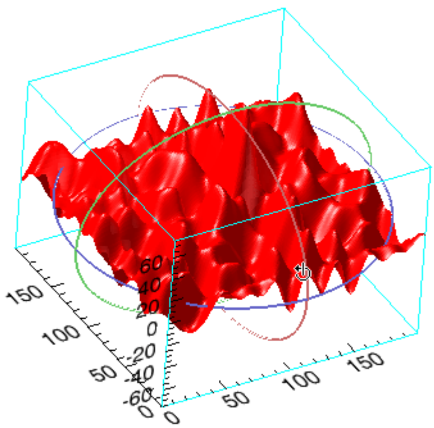


Figure 3-8: Rotating a 3-D Object

- To rotate an object freely, position the mouse pointer anywhere on the object.The free rotation pointer is displayed. Drag in any direction to rotate the object in that direction.

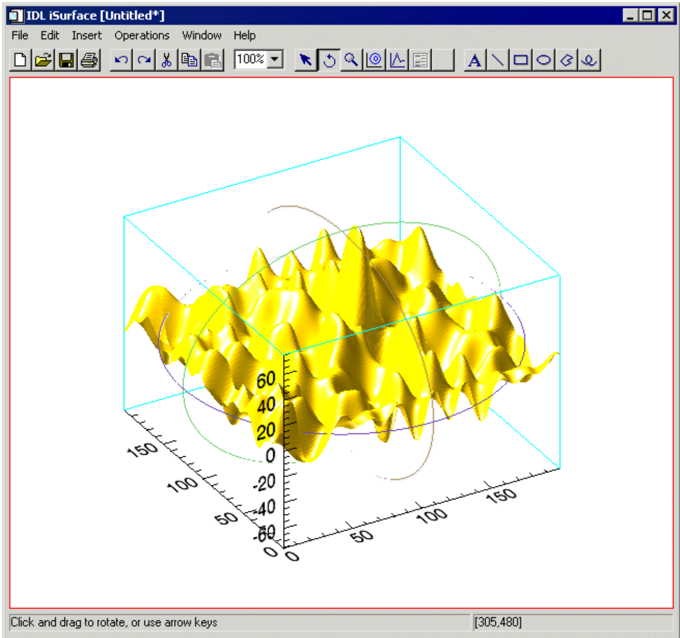


Figure 3-9: Free Rotation

4. Click or select **Edit** → **Undo** to undo the rotation, or click to leave rotate mode.

Rotate Left and Rotate Right

To rotate a selected 2-D or 3-D object 90° left or right, select **Operations** → **Rotate** → **Rotate Left** or **Operations** → **Rotate** → **Rotate Right**.

Note

For three-dimensional objects, the rotation is about the Z axis.

Rotate by Specified Angle

To rotate a selected 2-D or 3-D object a specific number of degrees, select **Operations** → **Rotate** → **Rotate by Angle**, specify the number of degrees in the Rotate Angle dialog, and click **OK**.

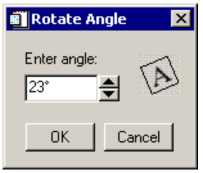


Figure 3-10: Rotate Angle Dialog

Transforming

Three types of transforms are common to all iTools: Resample, Rotate Data and Scale Data.

Resample

The **Resample** transform resamples the selected data. Resampling operation properties include factors for each dimension of the data, as well as the interpolation method to be used.

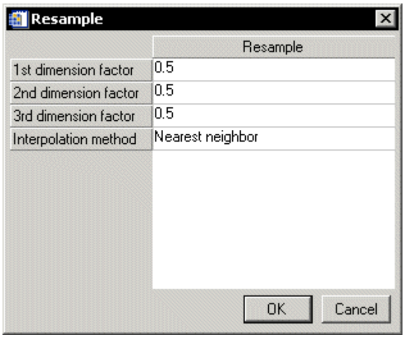


Figure 3-11: Resample Dialog

For example, if the X, Y, or Z value of a visualization needs to be different from the original data value, you can resample the data to adjust the X, Y, or Z value by the specified resample factor. Or, if the default interpolation method produces undesirable artifacts in the visualization of the data, the data can be resampled with a different interpolation method.

To resample data:

1. Select one or more objects in the iTool window for resampling.
2. Select **Operation** → **Transform** → **Resample**.
3. Use the property sheet that appears to specify the resampling factor in each dimension, along with the interpolation method. See "Resample Properties" on page 258 for details.
4. Click **OK** to resample the data, or **Cancel** to abort the operation.

Note

For more information on the iTool's Operations Browser, see Appendix C, "Operations Properties".

Rotate Data

The Rotate Data transform makes it possible to rotate the data within the visualization by a specified number of degrees without affecting the rest of the data space (graphical objects and axes).

To rotate data:

1. Select the visualization.
2. Select **Operation** → **Transform** → **Rotate Data**. The Rotate Angle dialog is displayed.

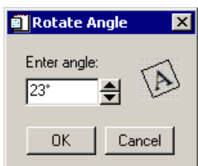


Figure 3-12: Rotate Angle Dialog

3. Specify the number of degrees to rotate by clicking the up-down control, or by editing the text.
4. Click OK.

Scale Data

The Scale Data transform makes it possible to scale the data within an object by a specified scale factor.

To scale data:

1. Select one or more objects which contain the data to be scaled.
2. Select **Operations** → **Scale Data**. The Scale Factor dialog appears.

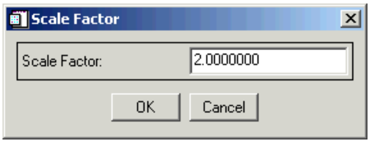


Figure 3-13: Scale Factor Dialog

3. Change the scale factor, if necessary, by editing the number in the Scale Factor text box, and click **OK** to scale the selected object(s) and close the Scale Factor dialog, or **Cancel** to close the Scale Factor dialog without scaling the object(s).

Filtering

Three types of filters are common to all iTools: Smooth filtering, Median Filtering, and Convolution.

Smooth Filter

To remove unwanted noise from data, apply the Smooth filter to the data.

To apply the Smooth filter:

1. Select the data that you want to smooth.
2. Select **Operations** → **Filter** → **Smooth**.

Median Filter

Median smoothing replaces each point with the *median* (a value in an ordered set of values with an equal number of values above and below it) of the one- or two-dimensional neighborhood of a given width. It is similar to smoothing with a boxcar or average filter but does not blur edges larger than the neighborhood. Median filtering is effective in removing "salt and pepper" noise, (isolated high or low values).

To apply the Median filter:

1. Select the data that you want to smooth.
2. Select **Operations** → **Filter** → **Median**.

Convolution Filter

To convolve data:

1. Select the data to be convolved.
2. Select **Operations** → **Filter** → **Convolution**. The Convolution Kernel Editor window is displayed.

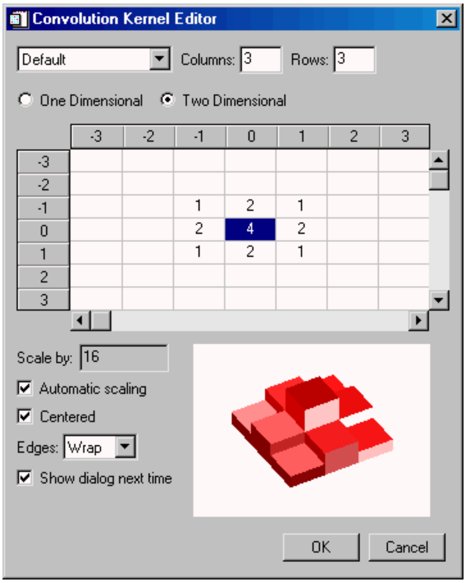


Figure 3-14: Convolution Kernel Editor

3. Change Convolution Kernel Editor settings as necessary by modifying any of the following:
   - Select a filter type from the list. The default filter is named **Default**.
   - Edit the number of **Columns** and **Rows**, if necessary.
   - Choose between a **One Dimensional** and a **Two Dimensional** convolution.
   - Scaling is automatic by default. To choose a different scaling factor, clear the **Automatic scaling** check box and enter a new factor in the **Scale by** text box.
   - Position is **Centered** by default. Clear the check box to turn centering off.
   - Edges **Wrap** by default. To choose a different edge format, select **Zero** or **Repeat** from the list.
   - If **Show dialog next time** is selected, the Convolution Kernel Editor window will be displayed the next time the Convolution filter is selected. Clear the check box to apply the filter without displaying the dialog.
4. Click **OK** to apply the filter with the current settings and close the Convolution Kernel Editor window, or click **Cancel** to close the window without applying the filter.

Morphing

Mathematical morphology is a method of processing digital images on the basis of shape. Six morphing options are available for use in iTools: dilate, erode, morph open, morph close, morph gradient, and morph tophat.

Morphing Option	Description
Dilate	**Dilate** is commonly known as “fill”, “expand”, or “grow.” It can be used to fill “holes” of a size equal to or smaller than the structuring element.
Erode	**Erode** does to the background what dilation does to the foreground. Given an image and a structuring element, erode can be used to remove islands smaller than the structuring element.

Table 3-1: Morph Menu Options

Morphing Option	Description
Morph open	**Morph open** is simply an erosion operation followed by a dilation operation. Applying morph open more than once produces no further effect.
Morph close	**Morph close** is simply a dilation operation followed by an erosion operation. Applying morph close more than once produces no further effect.
Morph gradient	**Morph gradient** is the subtraction of an eroded version of the original image from a dilated version of the original image.
Morph tophat	**Morph tophat** is implemented by first applying the opening operator to the original image, then subtracting the result from the original image. Applying tophat shows the bright peaks within the image.

Table 3-1: Morph Menu Options

To apply a morphology option:

1. Select the object to be morphed.
2. Select **Operations** → **Morph** → *<option>*.

Legends

Legends identify the visualizations displayed in the iTool window. For example, a legend displayed in an iPlot window can include a description of each plot line in a plot. Or a legend can be displayed in an iSurface window to identify surfaces and contour levels displayed on those surfaces.

To insert a legend for a surface or contour:

1. Select specific items to include in the legend, or click in an empty area of the iSurface window dataspace to select the dataspace and include all items in the legend.
2. Select **Insert** → **Legend**.

To add to a legend:

1. Select the legend by clicking the legend border.
2. Click Add to Legend in the Manipulator toolbar.
3. Click the item in the iTool window to add to the legend.

Each legend entry consists of a sample and a label. For example, in Figure 3-15, the sample for the first entry is an unbroken line of thickness 1, and the label is Noisy Sine Plot. The sample for the second is a broken blue line of thickness 2, and the label is Clean Sine Plot.

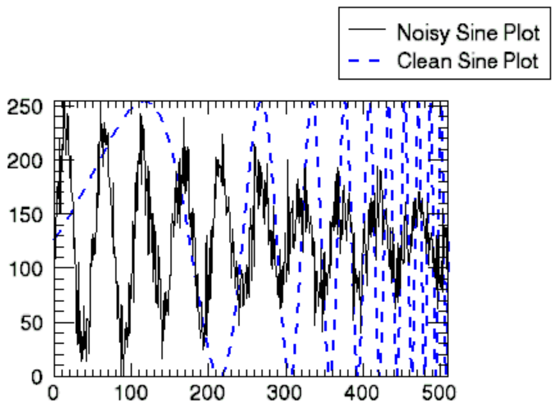


Figure 3-15: Legend for Two Plot Lines

Tip

To alter your legend's properties such as in the example shown previously, display the property sheet. To do this, double-click the border of the legend box.

Annotations

The following types of annotations can be added to iTool visualizations:

Annotation Type	Description
Text	Single lines or multiple lines of text can be added to a visualization to provide a label or description.
Line	Straight line annotations can be added to a visualization to link labels to objects or to identify an object.
Rectangle	Rectangular annotations can be added to a visualization to identify rectangular areas.
Oval	Oval annotations can be added to a visualization to identify circular areas.
Polygon	Polygon annotations can be added to a visualization to identify areas bounded by a multi-sided polygon.
Freehand	Freehand annotations can be added to a visualization to identify an area.

Table 3-2: Types of Annotations

Note

Annotations are 2D in nature and are defined in their own data space. They are most useful for adding notes to a data visualization for which the orientation has been finalized.

Text Annotations

To add a text annotation:

1. Click the Text Annotation button  on the toolbar.
2. Click anywhere on the canvas. A text insertion bar appears where you click.
3. Type the annotation text.
    - To add a new line, press CTRL + ENTER.
    - To add superscript characters, press CTRL + U.

- To add subscript characters, press CTRL + D.
- To return to normal characters, press CTRL + N.

Note

For information on how to embed these and other formatting commands from the Text Annotation property sheet, refer to “Text Annotation Properties” in Appendix D.

4. Press ENTER. A bounding box appears around the annotation text.
   - To position the annotation, position the mouse pointer within the bounding box so that it changes to a translation pointer ✥. Click and drag the annotation to the desired location.
   - To display and modify text annotation properties such as font, text color and transparency, double-click the bounding box or inside the bounding box.

Line Annotations

To add a line annotation:

1. Click the Line Annotation button on the toolbar.
2. Click in an empty part of the canvas and, without releasing the mouse button, drag to draw a line of the desired length.
   - To constrain in the direction that you are drawing, hold down the SHIFT key while drawing.
   - To draw the line from the center, hold down the CTRL key while drawing.
3. Release the mouse button. Selection handles appear at both ends of the line annotation.
   - To position the line annotation, position the mouse pointer over the selected line so that it changes to a translation pointer ✥. Click and drag the annotation to the desired location.
   - To resize the line annotation, position the mouse pointer over the selection handle at one end of the line so that it changes to a resize pointer ↕. Click and drag the selection handle to obtain the desired line length.
   - To display and modify line annotation properties such as line thickness and arrow style, double click the annotation.

Rectangle Annotations

To add a rectangle annotation:

1. Click the Rectangle Annotation button on the toolbar.
2. Click in an empty part of the canvas and, without releasing the mouse button, drag to draw a rectangle of the desired size.
    - To constrain the rectangle to a square, hold down the SHIFT key while drawing.
    - To draw the rectangle from the center, hold down the CTRL key while drawing.
3. Release the mouse button. Selection handles appear at the corners and sides of the rectangle annotation.
    - To position the rectangle annotation, position the mouse pointer inside the selected rectangle so that it changes to a translation pointer . Click and drag the annotation to the desired location.
    - To resize the rectangle annotation, position the mouse pointer over the selection handle on one side of the rectangle so that it changes to a resize pointer . Click and drag the selection handle to obtain the desired shape.
    - To scale the rectangle annotation, position the mouse pointer over the selection handle at one corner of the rectangle so that it changes to an unconstrained scaling pointer . Click and drag the selection handle to obtain the desired scaling.
    - To display and modify rectangle annotation properties such as background color and transparency, double click the annotation.

Oval Annotations

To add an oval annotation:

1. Click the Oval Annotation button on the toolbar.
2. Click in an empty part of the canvas and, without releasing the mouse button, drag to draw a circular annotation of the desired size.
    - To constrain the oval to a circle, hold down the SHIFT key while drawing.
    - To draw the oval from the center, hold down the CTRL key while drawing.
3. Release the mouse button. Selection handles appear at the corners and sides of the oval annotation.

- To position the oval annotation, position the mouse pointer inside the selected oval so that it changes to a translation pointer. Click and drag the annotation to the desired location.
- To resize the oval annotation, position the mouse pointer over the selection handle on one side of the oval so that it changes to a resize pointer. Click and drag the selection handle to obtain the desired shape.
- To scale the oval annotation, position the mouse pointer over the selection handle at one corner of the oval so that it changes to an unconstrained scaling pointer. Click and drag the selection handle to obtain the desired scaling.
- To display and modify oval annotation properties such as background color and transparency, double click the annotation.

Polygon Annotations

To add a polygon annotation:

1. Click the Polygon Annotation button on the toolbar.
2. Click in an empty part of the canvas to specify the first point of the polygon.
3. Click again to specify the second point of the polygon. A line is drawn to connect the first and second points.
4. Click to specify the third and each consecutive point of the polygon. Lines are drawn to connect each subsequent point, forming a multi-sided shape.

Tip

To remove the last point, press the ESC key.

5. Double-click to specify the last point of the polygon. Selection boxes appear at the corners and sides of the newly-created annotation.
   - To position the polygon annotation, position the mouse pointer inside the selected polygon so that it changes to a translation pointer. Click and drag the annotation to the desired location.
   - To resize the polygon annotation, position the mouse pointer over the selection handle on one side of the polygon so that it changes to a resize pointer. Click and drag the selection handle to obtain the desired shape.
   - To scale the polygon annotation, position the mouse pointer over the selection handle at one corner of the polygon so that it changes to an

unconstrained scaling pointer . Click and drag the selection handle to obtain the desired scaling.

- To display and modify polygon annotation properties such as background color and transparency, double click the annotation.

Freehand Annotations

To add a freehand annotation:

1. Click the Freehand Annotation button in the toolbar.
2. Click in an empty part of the canvas and, without releasing the mouse button, drag to draw a freehand shape.
3. Release the mouse button. Selection handles appear at the corners and sides of the selected freehand annotation.
   - To position the freehand annotation, position the mouse pointer inside the selected freehand shape so that it changes to a translation pointer . Click and drag the annotation to the desired location.
   - To resize the freehand annotation, position the mouse pointer over the selection handle on one side of the freehand shape so that it changes to a resize pointer . Click and drag the selection handle to obtain the desired shape.
   - To scale the freehand annotation, position the mouse pointer over the selection handle at one corner of the freehand shape so that it changes to an unconstrained scaling pointer . Click and drag the selection handle to obtain the desired scaling.
   - To display and modify rectangle annotation properties such as background color and transparency, double click the annotation.

Additional Axes

By default, X, Y and (for 3-D data spaces) Z axes are displayed in the iTool window. The display of these axes is controlled by property sheets for the axes container and for individual axes (see “Axes” in Appendix D). Additional X, Y or Z axes can be added to most data spaces to make it easier to identify characteristics.

To add an additional axis to your data space:

1. Select the data space.
2. Select **Insert** → **Axis**.
3. Choose from the following options:
   - X axis
   - Y axis
   - Z axis

Use the mouse to position the new axis, and double-click the axis to display the axis property sheet.

Note

For a 3D visualization, you can use the **Shift + Ctrl** to translate an axis in the opposite direction. This will be shown in the Status message when an axis is selected for translation. You can also use the arrow keys to change axes placement direction.

Rendering Translucent Objects

In many places in iTools, you can set the transparency of an object to make it appear totally opaque, transparent, or translucent. An isosurface is an example of such an object. The text objects can also be made partially transparent so that you can see through the labels on a complex plot and still see both the labels and the data beneath the label. In most situations consisting of several opaque objects representing data and some translucent text labeling, the translucent rendering works well.

However, translucent rendering does not always work well in more complex situations. The reason for this is that translucent objects must be strictly rendered from the back (far from the viewer) towards the front, or closer to the viewer. IDL accomplishes translucent rendering by blending the pixels already drawn on the device with the pixels that are drawn to represent a translucent object. Therefore, it is important that the objects that are positioned behind the translucent object be rendered before the translucent object. If the ordering is not correct, then you will not be able to see the objects behind the translucent object.

For most cases in iTools, the ordering issue is not a problem. If you encounter such a problem, the **Bring to Front** (and related) operations in the tools may help you improve the appearance of translucent objects. But in some cases the ordering can not be easily accomplished. For example, a complex isosurface rendered as a translucent object does not always look correct from all viewing angles. An isosurface is composed of a large number of triangles stored in an IDLgrPolygon object. The triangles are always drawn in the same order, the order in which they are stored in the object.

So, as the viewing angle changes, the apparent back-to-front ordering of the triangles also changes. In some cases, the triangles closest to the viewer draw first and end up blocking the view of other triangles drawn later and behind them that should be visible through the translucent triangles drawn first.

Transparency should be used with care with objects like complex isosurfaces, keeping in mind that the rendering of the objects may not appear completely correct.

Property Sheets

Most iTool visualizations and operations have attributes or *properties* that can be modified to change their characteristics. These properties are organized into *property sheets* for each operation and visualization type. For example, the skin of a surface visualization has a gold color by default. To change this color, modify the surface color property in the surface visualization property sheet.

Visualization Property Sheets

Visualization property sheets can be displayed from the Visualization Browser or from the iTool window.

To display a visualization's property sheet from the Visualization Browser:

1. Select **Window** → **Visualization Browser**.
2. Select the name of the object in the Visualization Browser list. The object's properties are displayed in the right-hand pane of the Visualization Browser window (the small arrows at the top-left of the Browser window will allow you to display both panes).

To display a visualization's property sheet from the iTool window:

1. Click to select the object in the iTool window.
2. Do one of the following to display the property sheet for the selected visualization:
   - Double-click the visualization in the iTool window.
   - Select **Edit** → **Properties**.
   - Right-click to display the Context Menu, and select the **Properties** menu item.

Note

For detailed information on Visualization Browser properties, see Appendix D, "Visualization Properties".

Operations Property Sheets

Operations property sheets can only be displayed from the Operations Browser. To display an operations property sheet:

1. Select **Operations** → **Operations Browser**.
2. Select the name of the operation in the Operations Browser list. The operation properties are displayed in the right-hand pane of the Operations Browser window (the small arrows at the top-left of the Browser window will allow you to display both panes).

Note

For detailed information on Operations Browser properties, see Appendix C, "Operations Properties".

The Visualization Browser

The Visualization Browser provides access to *visualizations* (objects displayed in the iTool window) and the properties of those visualizations. When the Visualization Browser is displayed, you can select graphical objects from a nested list and display the property sheets for those objects. For example, if a surface visualization is displayed and you would like to change the appearance of the X axis in that visualization, you can select the axis in the Visualization Browser (Figure 3-16), display the property sheet for that axis (Figure 3-17), and modify the properties to change the appearance of the axis.

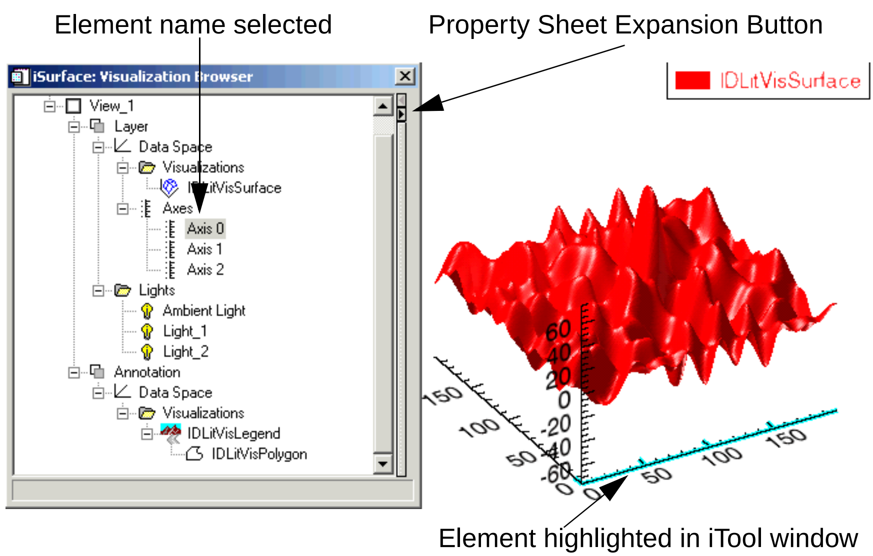


Figure 3-16: Visualization Browser with Axis 0 Selected

To select an object with the visualization browser:

1. Select **Window** → **Visualization Browser**.
2. Select the name of the object in the list. The element is highlighted in the iTool window.
   - To expand a list item, click the + icon .
   - To collapse an expanded list item, click the - icon .

3. To display the property sheet for the object, click the expansion button to the right of the list or double-click the property.

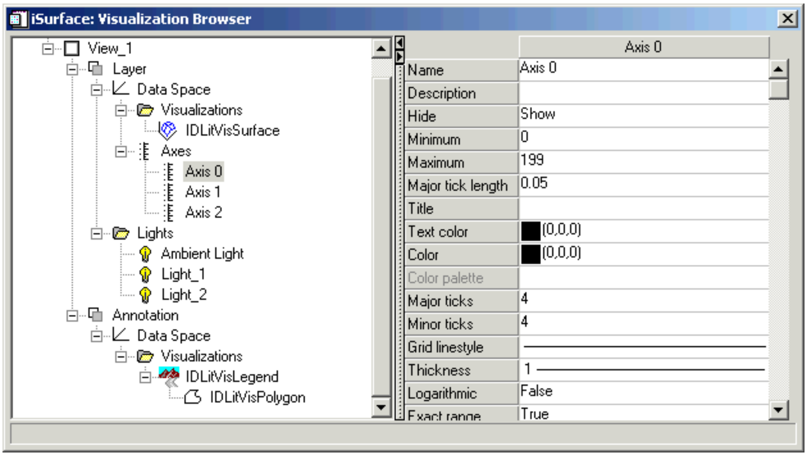


Figure 3-17: Visualization Browser with Property Sheet Displayed

4. To change a property setting, click in the settings column.
   - If a drop-down button appears in the settings column, click the button to choose a new setting from the list of options, activate a slider to change the setting value, display a selection dialog or list, or display an Edit button providing access to a user-defined property control.
   - If the text is editable, edit the text to change the setting.

   See Appendix B, "Property Controls" for a detailed description of the types of property settings included in property sheets.

5. Click the Close button to close the Visualization Browser.

Note

Properties of standard graphical objects are described in detail in Appendix D, "Visualization Properties" and in the "IDL Commands" chapter of the *IDL Reference Guide*.

The Preferences Browser

The Preferences Browser provides a means of setting *preferences*, or default properties, for the visualizations, annotations, and file readers and writers used by all iTools. For example, if you prefer the projection of contours displayed on surfaces to be three-dimensional rather than planar, you can change the default property for projecting contours from **Planar** to **Three-D** in the Preferences Browser, as shown in Figure 3-18.

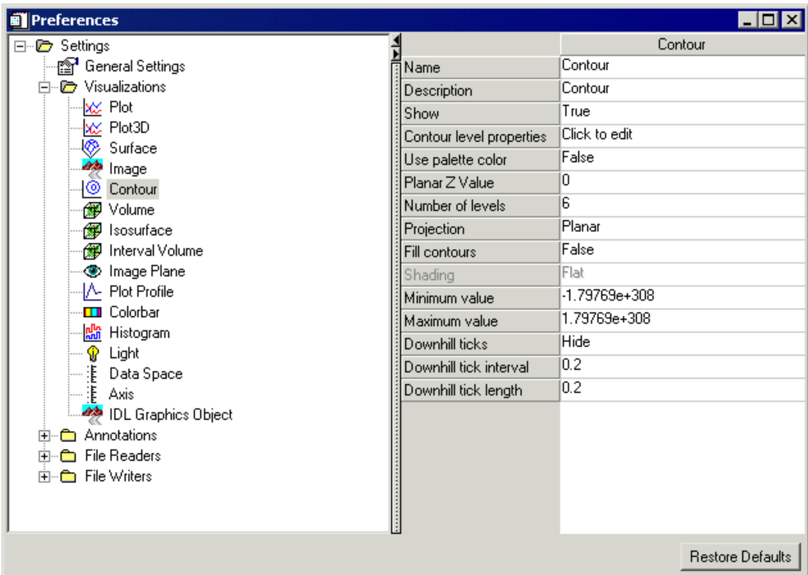
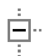


Figure 3-18: Preferences Browser with Contour Projection Properties Displayed

For more information on the property sheets displayed in the right-hand pane of the Preferences Browser, see Appendix D, "Visualization Properties".

The Preferences Browser displays a nested list of visualizations, annotations, file readers, and file writers available for all iTools in the left-hand pane, and a property sheet for the currently selected item in the right-hand pane.

- To expand a list item, click the + icon .
- To collapse an expanded list item, click the - icon .

To change the properties of a a visualization, annotation, file reader, or file writer from the Preferences Browser:

1. Select **File** → **Preferences**.
2. Select the name of the visualization, annotation, file reader, or file writer in the list. A list of properties and the current property settings appears in the right-hand pane of the Preferences Browser window.
3. Locate the property you want to change in the list, and click in the settings column.
   - If a drop-down button appears in the settings column, click the button to choose a new setting from the list of options, activate a slider to change the setting value, display a selection dialog or list, or display an Edit button providing access to a user-defined property control.
   - If the text is editable, edit the text to change the setting.

   See Appendix B, “Property Controls” for a detailed description of the types of property settings included in property sheets.
4. Click the Close button to close the Preferences Browser.

Note

Changes to preferences are saved between iTool sessions. When the Preferences browser is closed, preferences are saved in their current state.

General Settings

The first option on the Preferences Browser is the General Settings option. Settings listed here will be applicable to all iTools if altered. The properties listed here are:

Property	Control Type: Values
Unlimited Buffer	Boolean: Set to determine buffer size as limited or unlimited: • **True** • **False** Default = **True**

Table 3-3: General Settings Properties

Property	Control Type: Values
Zoom on Window Resize	Boolean: Set to determine if iTool data resizes upon window resizing: • **True** • **False** Default = **False**
Change directory on open	Boolean: Set to be prompted to change directory upon open: • **True** • **False** Default = **True**

Table 3-3: General Settings Properties (Continued)

Note

The **Restore Defaults** button at the bottom of the Preferences Browser restores all default settings immediately.

Visualizations

Select this folder to edit visualization preferences and properties for various object types. For detailed information on visualization properties, see Appendix D, "Visualization Properties".

Operations

Select this folder to edit operation preferences and properties for various object types. For detailed information on operation properties, see Appendix C, "Operations Properties".

File Readers

Select this folder to edit file reader preferences and properties. Available file reader types and their editable properties are listed in the following tables. For more information on reading in data of various types, see Chapter 2, "Importing and Exporting Data".

iTools State

The iTools State File Reader properties are:

Property	Control Type: Values
None	The iTools State File Reader has no configurable properties other than Name and Description.

Table 3-4: iTools State File Reader Properties

Windows Bitmap

The Windows Bitmap File Reader properties are:

Property	Control Type: Values
None	The Windows Bitmap File Reader has no configurable properties other than Name and Description.

Table 3-5: Windows Bitmap File Reader Properties

Joint Photographic Experts Group

The Joint Photographic Experts Group File Reader properties are:

Property	Control Type: Values
None	The Joint Photographic Experts Group File Reader has no configurable properties other than Name and Description.

Table 3-6: Joint Photographic Experts File Reader Properties

Macintosh PICT

The Macintosh PICT File Reader properties are:

Property	Control Type: Values
None	The Macintosh PICT File Reader has no configurable properties other than Name and Description.

Table 3-7: Macintosh PICT File Reader Properties

Portable Network Graphics

The Portable Network Graphics File Reader properties are:

Property	Control Type: Values
None	The Portable Network Graphics File Reader has no configurable properties other than Name and Description.

Table 3-8: Portable Network Graphics File Reader Properties

Tag Image File Format

The Tag Image File Format File Reader properties are:

Property	Control Type: Values
Image index	Number: Level at which to begin image index. Edit the number to change the value. Default = `0`
Image Stacking	String List: Image stacking method. Select a method from the list. Choose between these values: • **+X** • **-X** • **+Y** • **-Y** • **+Z** • **-Z** Default = **Read Single Image**

Table 3-9: Tag Image File Format File Reader Properties

DICOM Image

The DICOM Image File Reader properties are:

Property	Control Type: Values
None	The DICOM Image File Reader has no configurable properties other than Name and Description.

Table 3-10: DICOM Image File Reader Properties

Windows Waveform Audio Stream

The Windows Waveform Audio Stream File Reader properties are:

Property	Control Type: Values
None	The Windows Waveform Audio Stream File Reader has no configurable properties other than Name and Description.

Table 3-11: Windows Waveform Audio Stream File Reader Properties

ASCII text

The ASCII text File Reader properties are:

Property	Control Type: Values
None	The ASCII text File Reader has no configurable properties other than Name and Description.

Table 3-12: ASCII Text File Reader Properties

Binary data

The Binary data File Reader properties are:

Property	Control Type: Values
None	The Binary data Graphics File Reader has no configurable properties other than Name and Description.

Table 3-13: Binary Data File Reader Properties

File Writers

Select this folder to edit file write preferences and properties. Available file writer types and their editable properties are shown in the following tables. For more information on writing data of various types, see Chapter 2, “Importing and Exporting Data”.

iTools State

The iTools State File Writer properties are:

Property	Control Type: Values
None	The iTool State File Writer has no configurable properties other than Name and Description.

Table 3-14: iTools State File Writer Properties

Windows Bitmap

The Windows Bitmap File Writer properties are:

Property	Control Type: Values
Bit depth	String List: Bit depth in bits. Select a depth from the list. Choose between these values: • **Automatic** • **8 bit** • **24 bit** Default = **Automatic**

Table 3-15: Windows Bitmap File Writer Properties

Joint Photographic Experts Group

The Joint Photographic Experts Group File Writer properties are:

Property	Control Type: Values
Bit depth	String List: Bit depth in bits. Select a depth from the list. Choose between these values: • **Automatic** • **8 bit** • **24 bit** Default = **Automatic**
Quality	Number: Factor from 0 - 100 determining the level of quality. Move slider to change the level. Default = 75

Table 3-16: Joint Photographic Experts Group File Writer Properties

Macintosh PICT

The Macintosh PICT File Writer properties are:

Property	Control Type: Values
None	The Macintosh PICT File Writer has no configurable properties other than Name and Description.

Table 3-17: Macintosh PICT File Writer Properties

Portable Network Graphics

The Portable Network Graphics File Writer properties are:

Property	Control Type: Values
Bit depth	String List: Bit depth in bits. Select a depth from the list. Choose between these values: • **Automatic** • **8 bit** • **24 bit** Default = **Automatic**

Table 3-18: Portable Network Graphics File Writer Properties

Tag Image File Format

The Tag Image File Format File Writer properties are:

Property	Control Type: Values
Bit depth	String List: Bit depth in bits. Select a depth from the list. Choose between these values: • **Automatic** • **8 bit** • **24 bit** Default = **Automatic**
Compression	String List: Compression type. Select a type from the list. Choose between these values: • **None** • **Packbits** • **JPEG** Default = **None**

Table 3-19: Tag Image File Format File Writer Properties

ASCII text

The ASCII text File Writer properties are:

Property	Control Type: Values
Separator	Enter a value. Default = None
Use default format	Boolean: Use default format? Choose **True** or **False**. Default = **True**
Format string	Number: Enter a number to change the value. Default = `G9.2`

Table 3-20: ASCII Text File Writer Properties

Binary data

The Binary data File Writer properties are:

Property	Control Type: Values
Byte ordering	String List: Byte ordering type. Select from the list. Choose between these values: • **Native** • **Little endian** • **Big endian** Default = **Native**

Table 3-21: Binary Data File Writer Properties

The Operations Browser

The Operations Browser provides a quick way to display and modify the properties for a given iTool *operation* (task performed on iTool data) before that operation is performed. For example, to display the properties of the Convolution filter, select the name of the filter in the left-hand pane of the Operations Browser (see Figure 3-19), and modify the Scale factor property value in the right-hand pane to change the default scale factor for convolution.

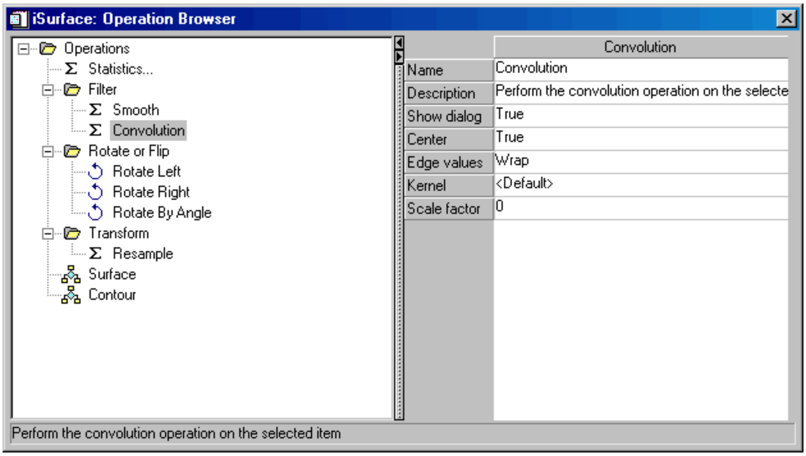
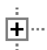
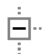


Figure 3-19: Operations Browser with Convolution Filter Properties Displayed

The Operations Browser displays a nested list of operations available in the current iTool in the left-hand pane, and a property sheet for the currently selected operation in the right-hand pane.

- To expand a list item, click the + icon .
- To collapse an expanded list item, click the - icon .

To change the properties of an operation from the Operations Browser:

1. Select **Operations** → **Operations Browser**.
2. Select the name of the operation in the list. A list of properties and the property settings appears in the right-hand pane of the Operations Browser window.
3. Locate the property you want to change in the list, and click in the settings column.

- If a drop-down button appears in the settings column, click the button to choose a new setting from the list of options, activate a slider to change the setting value, display a selection dialog or list, or display an Edit button providing access to a user-defined property control.
- If the text is editable, edit the text to change the setting.

  See Appendix B, "Property Controls" for a detailed description of the types of property settings included in property sheets.

4. Click the Close button to close the Operations Browser.

Note

Properties of standard iTool operations are described in Appendix C, "Operations Properties" and in the "IDL Commands" chapter of the *IDL Reference Guide*.

Window Layouts

You can change the minimum size of the canvas displayed in the iTool window, display multiple views in the iTool window, or select a preset arrangement of views, with the Window Layout dialog.

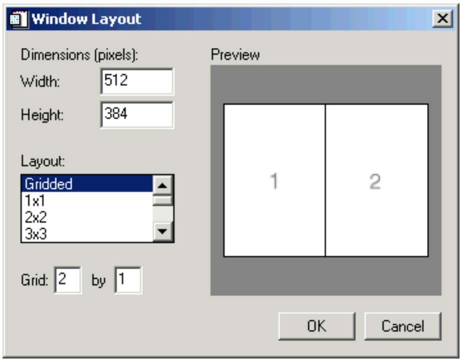


Figure 3-20: Window Layout Tool

Note

If you are in Freeform mode, canvas size can also be changed interactively by dragging the corners or sides of the iTool window.

To change the minimum size of the canvas displayed in the iTool window:

1. Select **Window** → **Layout**.
2. Edit the pixel values in the **Width** and **Height** text boxes. (Default = Width 512, Height 384.) A preview of the shape of the new canvas size is displayed in the Preview window.
3. Click **OK** to apply the changes, or **Cancel** to close the window without applying changes.

To change the number of views displayed:

1. Select **Window** → **Layout**.
2. Select **Gridded** from the Layout list.
3. Edit the number of columns and rows in the Grid text boxes. (Default = 1 by 1.)

4. Click **OK** to apply the changes, or **Cancel** to close the window without applying changes.

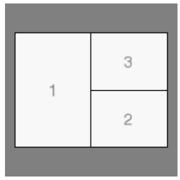
To select a preset arrangement of views:

1. Select **Window** → **Layout**.
2. Select from the following arrangements in the Layout list:

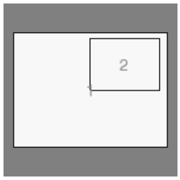
1 x 1

Gridded

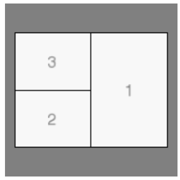
Trio Left



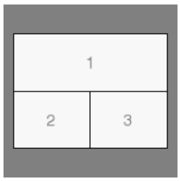
Inset



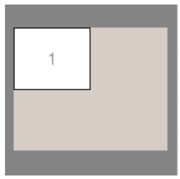
Trio Right



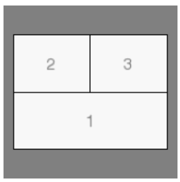
Trio Top



Freeform



Trio Bottom



3. Click **OK** to apply the changes, or **Cancel** to close the window without applying changes.

File Operations

File operations are provided in the iTools to allow you to open files, save files, import variables and files, export variables, or export the contents of the iTool window as an image file. Printing and exiting the iTool are additional file operations.

Opening Files

Data files, text files, and previously saved iTools State (`*.isv`) files can be opened with **File** → **Open**. For more information on opening files, see "Using File Open" on page 29.

Importing Variables and Files

IDL variables and files can be imported into the current iTool with **File** → **Import**. The IDL Data Import Wizard offers you the choice of importing a variable or a file, and then asks you to identify the location of the data source and the type of visualization to be created with the data.

Import a Variable

The Data Import Wizard can import an IDL variable created at the IDL command line or exported from an iTool session into the current iTool. For more information on importing variables, see "Importing a Variable" on page 42.

Import a File

The Data Import Wizard can import text files, data files, or image files into the current iTool. For more information on importing files, see "Importing ASCII Data" on page 34, "Importing Binary Data" on page 38, or "Importing Image Data" on page 33.

Saving Files

The current state of the iTool can be saved as an iTools State (`*.isv`) file. Whenever you close an iTool window, you will be prompted to save the current state as an `*.isv` file so that you can return to the current state of the data later when you open the `*.isv` file. Other IDL users running IDL 6.0 for Windows, UNIX or Mac OS X can open `*.isv` files.

Save

File → **Save** saves the state of the current iTool to a file. If the file has already been saved, it will be saved under the same filename it was previously saved under. If the state has not been previously saved and has no filename, enter a filename. The saved file can be opened by IDL on either the Windows or the UNIX platform.

Save As...

File → **Save As** also saves the state of the current iTool to a file, but it prompts you to enter a filename even if the file has been saved previously. Use **Save As** to save an existing iTools State file under a different name.

Exporting Variables and Files

Data items created within the current iTool can be exported as IDL Variables, and the contents of the current iTool window can be exported as an image file. Select **File** → **Export**, and follow the instructions in the IDL Data Export Wizard.

Export as a Variable

Data from the currently selected object can be exported as a variable from the IDL Data Export Wizard to the main IDL program.

For more information, see "Exporting Data to the IDL Session" on page 46.

Export as a File

The contents of the current window can be exported from the IDL Data Export Wizard as an image file.

For more information, see "Exporting Data to a File" on page 44.

Printing

File → **Print** sends the current view of the contents of the graphics window to the specified printer via the standard Windows or Motif printer dialog. If the contents have been modified in the current view, they will appear modified in the printer output.

To print the contents of the graphics window:

1. **Select File** → **Print**. The standard Windows or Motif printer dialog appears.
2. Select the desired printer and printer properties from the printer dialog.

3. Click **Print**. The contents of the graphics window are sent to the chosen printer, with the chosen options.

Exiting the iTool

Clicking the Close button on the iTool window will close the selected window. **File** → **Exit** also closes the iTool window. You will be prompted to save any changes to the current state (see **File** → **Save** above for details). All visualizations and views within the window are removed from memory.

Additional Operations

The Histogram, Statistics, and Console tools display additional information about data displayed in the iTool windows, and about operations performed with the iTools.

Plotting a Histogram

Histogram displays a histogram plot of the data currently selected in the iTool window. The Histogram plot appears in a separate iPlot window.

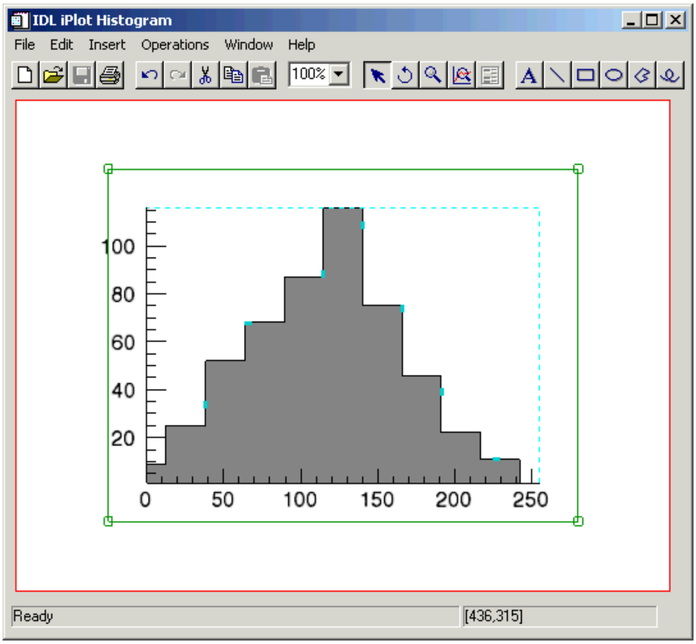


Figure 3-21: Histogram Plot

To display a histogram plot:

1. Select an object or group of objects in the iTool window.
2. Select **Operations** → **Histogram**.

Displaying Statistics

The Statistics dialog displays all available statistical information pertaining to the object or objects currently selected in the iTool window.

To display the Statistics dialog:

1. Select an object or a group of objects in the iTools window.
2. Select **Operations** → **Statistics**. The Statistics window is displayed.

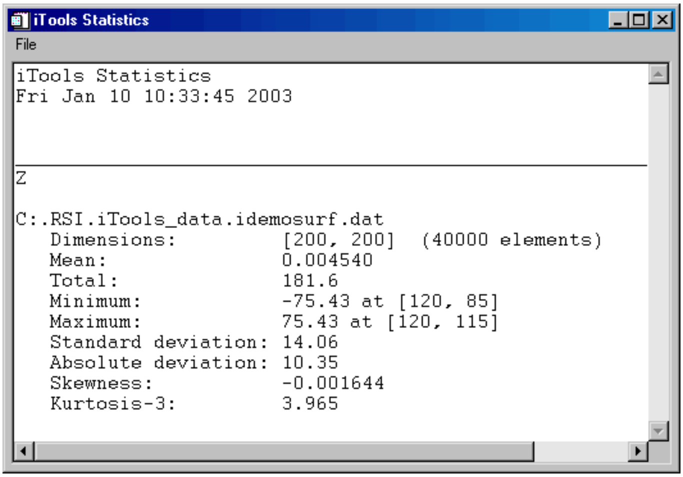


Figure 3-22: The iTools Statistics Window

The information displayed in the Statistics window varies depending upon the type of objects selected.

- For scalars, the name of the variable and its value are displayed in the Statistics window.
- For arrays, the following information is displayed:
    - Name
    - Maximum & location
    - Dimensions
    - Standard deviation
    - Mean

- Variance
- Absolute deviation
- Total
- Skewness
- Minimum & location
- Kurtosis - 3

The information in the Statistics window can be edited (by selecting **Edit**), printed, or saved as a file.

- On Windows platforms, the standard Windows editing context menu containing Cut, Copy, Paste and Delete commands can be displayed by right-clicking anywhere in the Statistics window.
- On UNIX platforms, use the left or right mouse buttons to cut, copy or paste.

To save the text as an ASCII file:

1. Select **File** → **Save As**.
2. Enter a filename. If the filename already exists, you will be asked if you want to replace the file.
3. Select **Cancel** to return to the Statistics window without saving the file.

To print the text, select **File** → **Print**. The standard Windows or Motif printer dialog is displayed.

To close the Statistics window, select **File** → **Close**.

Resetting Dataspace Ranges

You can reset the ranges of your dataspace to accommodate all your contained visualizations. When you reset your ranges, the following properties of the dataspace are reset to a value of True:

- Automatic X range updates
- Automatic Y range updates
- Automatic Z range updates

To reset the ranges of your dataspace, select **Operations** → **Dataspace** → **Reset Ranges**.

Recording a Message Log

Use **Console** to record a log of Status Bar information for each action performed with the current iTool.

To use **Console**:

1. Select **Window** → **Console**. A blank Message Log dialog appears.

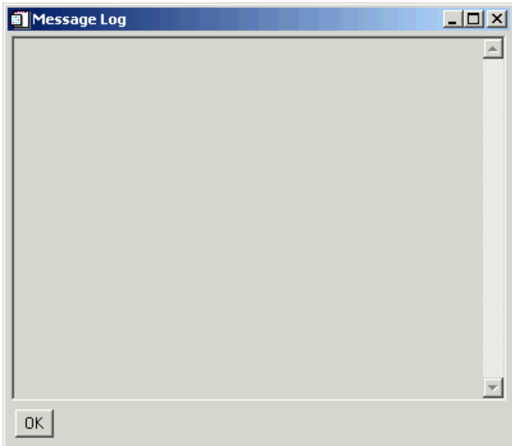


Figure 3-23: Blank Message Log Dialog

2. As actions are performed in the iTool window, the Status Bar message associated with each action is recorded in the Message Log along with the date and time of the action. These messages can be selected and cut, copied or pasted:
   - In Windows, the standard Windows editing context menu containing **Cut**, **Copy**, **Paste** and **Delete** commands can be displayed by right-clicking anywhere in the Message Log dialog.

- In UNIX or Mac OS X, use the left or right mouse buttons to cut, copy or paste.

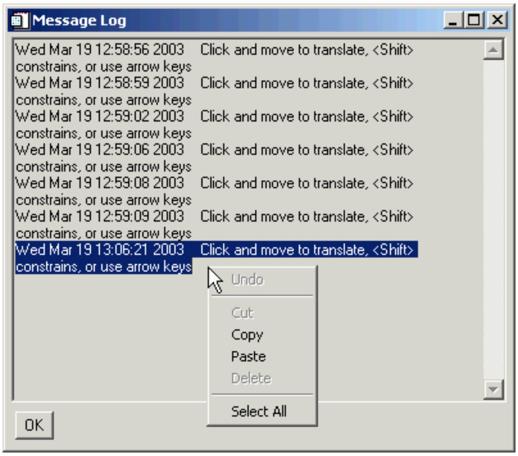


Figure 3-24: Message Log Dialog with Context Menu

3. Click **OK** to close the Message Log dialog and stop recording messages.

Chapter 4:
Working with Images

This chapter describes how to use the Image iTool.

Introduction

The IDL iImage tool displays your data in image form. The iImage tool then allows you great flexibility in manipulating and visualizing image data. To use iImage, from the IDL Command Line, type `iImage`. An empty iImage tool appears. You can then import image data using any of several data import methods. For more information importing image data see Chapter 2, “Importing and Exporting Data”.

Note

For more information on accepted arguments and keywords, see “IIMAGE” in the *IDL Reference Guide* manual.

The iImage tool can be launched in many different ways:

- At the IDL Command Line without arguments or keywords
- At the IDL Command Line with arguments or keywords
- Through the **File** → **New** → **Visualization** → **iImage** menu option in the IDL Development Environment
- Through the **File** → **New** → **iImage** menu option in an iTool

Common image file formats accepted are:

- BMP
- DICOM
- JPEG
- PICT
- PNG
- TIFF

Colors in the iImage Tool

The iImage tool allows you flexibility with colors and your visualization. RGB images contain their own color information while indexed images have their own color information which is separate from the image itself. Binary and greyscale images do not contain any color information. Color information can be modified for indexed, binary, and greyscale images.

In order to modify color attributes for indexed, binary, and greyscale images, you can highlight the image data by clicking once on the visualization and then double-clicking on it to bring up the Visualization Browser.

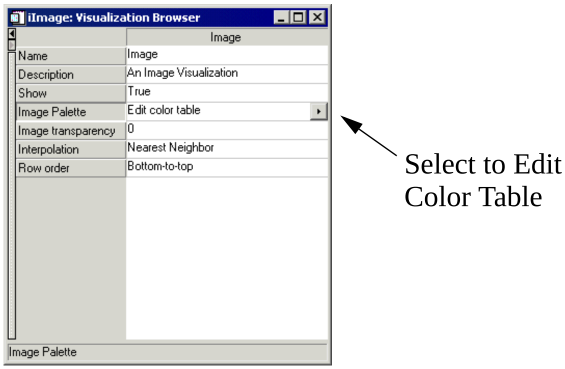


Figure 4-1: The Visualization Browser in the iImage Tool

From the Visualization Browser you can select **Image Palette** → **Edit Color Table** → **Edit**.

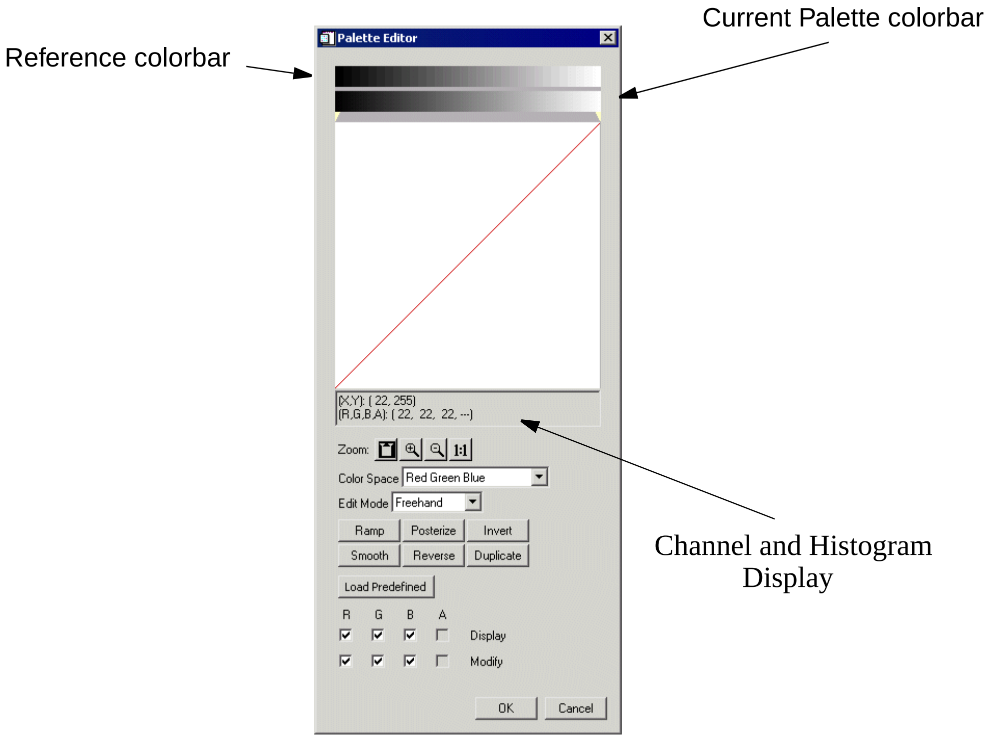


Figure 4-2: The iImage Tool's Palette Editor

The Palette Editor contains these items:

- **Current Palette colorbar and Reference colorbar** — Shows a colorbar containing a display of the current palette and displays it below the reference colorbar.
- **Channel and Histogram Display** — The palette channel vectors are displayed; the red channel is displayed in red, the Green channel in green, the Blue channel in blue, and the optional Alpha channel in purple. The optional Histogram vector is displayed in Cyan. An area with a white background represents the current selection, with gray background representing the area outside of the current selection. Yellow drag handles are an additional indicator of the selection endpoints. These selection endpoints represent the range for some editing operations. In addition,

cursor X,Y values and channel pixel values at the cursor location are displayed in a status area below the graphics area.

- **Zoom Options** — The available buttons for zooming are from left to right:

Zoom Current	Zooms to show the current selection.
Zoom In	Zooms in 50% (factor of 2)
Zoom Out	Zooms out 100% (factor of 2)
Zoom Return	Returns the display to the full palette.

Table 4-1:

- **Color Space** — A droplist allows selection of RGB, HSV or HLS color spaces. RGB is the default color space.

Note

Regardless of the color space in use, the color vectors retrieved with the GET_VALUE keyword to WIDGET_CONTROL are always in the RGB color space.

- **Editing Mode** — A droplist allows selection of the editing mode. Freehand is the default editing mode. The droplist options are:

Freehand	The user can click and drag in the graphics area to draw a new curve. Editable channel vectors will be modified to use the new curve for that part of the X range within the selection that was drawn in Freehand mode.
Line Segment	A click, drag and release operation defines the start point and end point of a line segment. Editable channel vectors will be modified to use the new curve for that part of the X range within the selection that was drawn in Line Segment mode.

Table 4-2: Editing Mode Droplist Options

Barrel Shift	Click and drag operations in the horizontal direction cause the editable curves to be shifted right or left, with the portion which is shifted off the end of selection area wrapping around to appear on the other side of the selection area. Only the horizontal component of drag movement is used.
Slide	Click and drag operations in the horizontal direction cause the editable curves to be shifted right or left. Unlike the Barrel Shift mode, the portion of the curves shifted off the end of the selection area does not wrap around. Only the horizontal component of drag movement is used.
Stretch	Click and drag operations in the horizontal direction cause the editable curves to be compressed or expanded. Only the horizontal component of drag movement is used.

Table 4-2: Editing Mode Droplist Options

Note

Unless noted previously, editing operations apply only to the channel vectors currently selected for editing and apply only to the portion of the vectors within the selection indicators.

- **Editing Operations** — The buttons that provide editing operations but do not require cursor input are:

Ramp	Causes the selected part of the editable curves to be replaced with a linear ramp from 0 to 255.
Smooth	Causes the selected part of the editable curves to be smoothed.
Posterize	Causes the selected part of the editable curves to be replaced with a series of steps.

Table 4-3: Editing Operations

Reverse	Causes the selected part of the editable curves to be reversed in the horizontal direction.
Invert	Causes the selected part of the editable curves to be flipped in the vertical direction.
Duplicate	Causes the selected part of the editable curves to be compressed by 50% and duplicated to produce two contiguous copies of the channel vectors within the initial selection.
Load PreDefined	Leads to additional choices of pre-defined palettes. Loading a pre-defined palette replaces only the selected portion of the editable color channels, limited by the settings of the selection endpoints and editable checkboxes. This allows loading only a single channel or only a portion of a pre-defined palette.

Table 4-3: Editing Operations

- **Channel Display and Edit** — A row of checkboxes allows the user to indicate which channels of Red, Green, Blue and the optional Alpha channel should be displayed. A second row of checkboxes allows the user to indicate which channels should be edited by the current editing operation. The checkboxes for the Alpha channel will be sensitive only if an Alpha channel is loaded relative to the color table.

Displaying Images

The iImage tool's primary design is to visualize image data, though the tool is capable of much more once the data is displayed. The iImage tool also allows you to manipulate and edit the displays. The first task is to display the image data.

Your options for calling the iImage tool are:

- At the IDL Command Line without arguments or keywords
- At the IDL Command Line with arguments or keywords

Note

Arguments and keywords are accepted at the IDL Command Line for the iImage tool, for more information on accepted arguments and keywords, see "IIMAGE" in the *IDL Reference Guide* manual.

- Through the **File** → **New** → **Visualization** → **iImage** menu option in the IDL Development Environment
- Through the **File** → **New** → **iImage** menu option in an iTool

To visualize image data in the iImage tool:

1. Image data can be loaded into the data manager. You may do this using any of the previously described methods in "Data Import Methods" in Chapter 2, *Importing and Exporting Data*.
2. Image data of any supported type can also be directly visualized into the iImage tool using **File** → **Open** or the File Open icon at the top left of your iImage window, and the File Open Dialog appears.

Figure 4-3: The Open Dialog From Which to Choose Data

3. Select the desired image file from your directory structure. For example here we will visualize an `examples/data` file named `meteor_crater.jpg`. Select the file name and click **Open**.

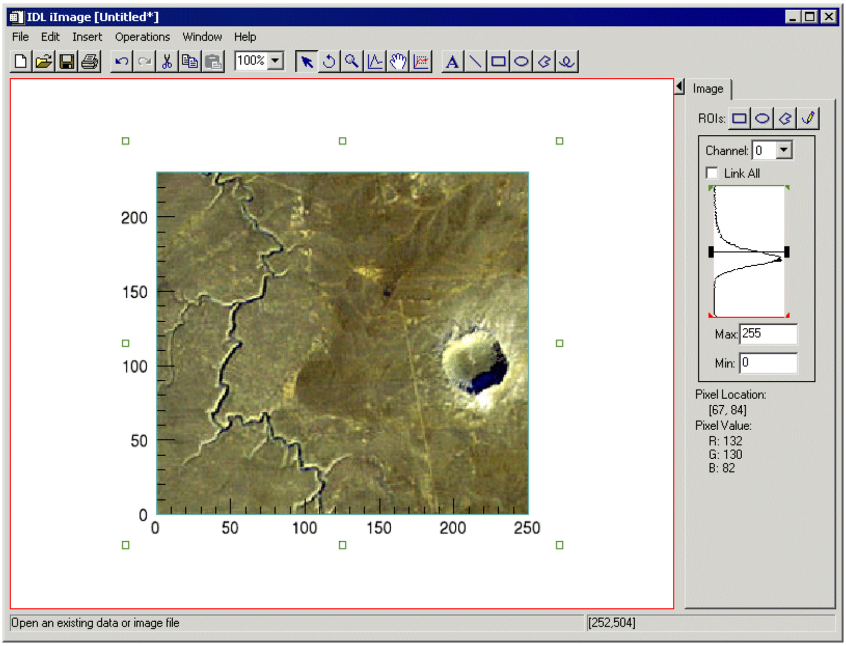


Figure 4-4: A JPEG File Visualized Using the iImage Tool

Note

The `examples/data` directory of your IDL 6.0 distribution contains a text file named `index.txt`. This file lists all data files available in the example directory and also lists their dimensions and values.

Displaying Multiple Images

You can use the window layout console to provide for multiple image display within your window. To add another image to the view of the image you just visualized:

1. From the iImage window displaying the meteor crater JPEG image, select **Window** → **Layout**.

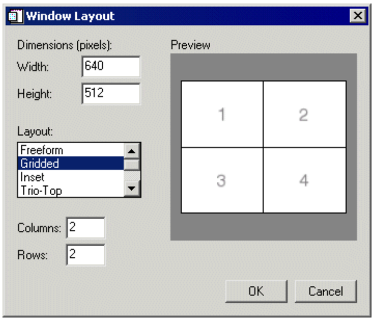


Figure 4-5: The Window Layout Dialog

The Window Layout dialog contains these items:

- **Dimensions** — Allows you to enter specific window dimensions if desired, also reflects default window dimensions for selected views.
- **Layout** — Allows you to pick from a scroll-down list of layout options and grids.
- **Preview** — Gives you a visual preview of the selected layout.

For more information on working with window layouts, see "Window Layouts" in Chapter 3, *iTool Common Tasks*.

2. Select a layout, in this case select **Gridded** and then enter 2 and 2 for **Columns** and **Rows** and then **OK**.

3. The window now displays a two by two arrangement of views. You will notice the original meteor crater image is shifted to the top-left viewpane. Select and highlight the top-right viewpane.
4. Select **File** → **Open** or the File Open icon at the top left of your iImage window, and from the **File Open** Dialog select the `examples/data` image named `marsglobe.jpg` and click **Open**.
5. The second image of the planet Mars now appears in the top-right viewpane.

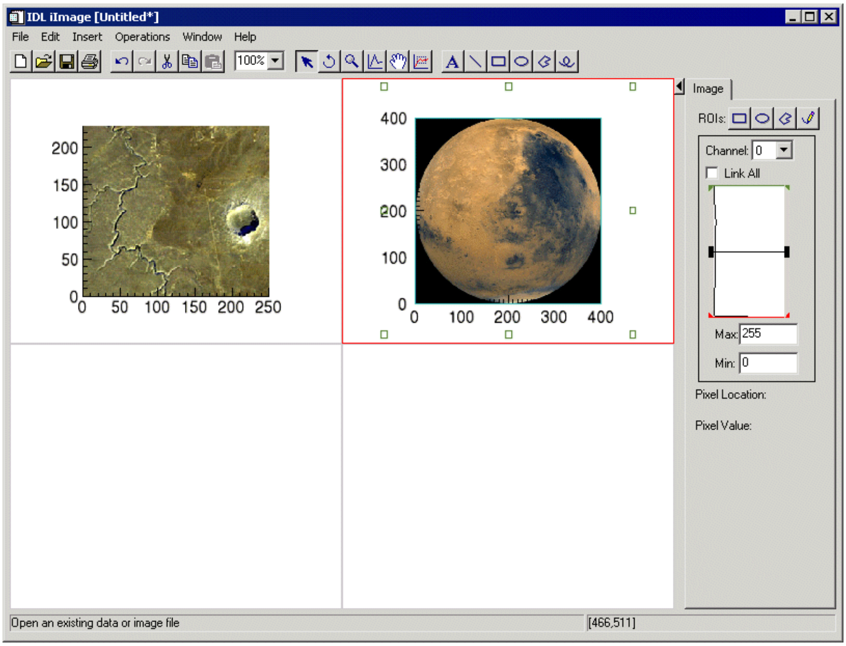


Figure 4-6: Displaying Multiple Images in iImage

Image Properties

The iImage window is a self-contained image display and manipulation device. You can import, export, modify, and manipulate image data. For more information on the basic iImage interface and its layout, see Appendix A, “iTools Interface Reference”.

Modifying Properties

By selecting **Edit** → **Properties** from the iImage tool, you may modify your image properties. You may modify your image’s name, description, background color, transparency as well as the projection and stretch properties. For more information on editing properties in the iTools, see Appendix D, “Visualization Properties”.

Adding a Colorbar

You can add a colorbar to your visualized image which will show on a color scale the minimum to maximum values of data in the visualization. To add a colorbar, click on the image data and then from the iImage window, select **Insert** → **Colorbar**. A colorbar will be placed in the visualization window. This colorbar can be resized and moved around the data space. You can also double-click on the colorbar to invoke the Visualization Browser which will allow you to change the values for the colorbar.

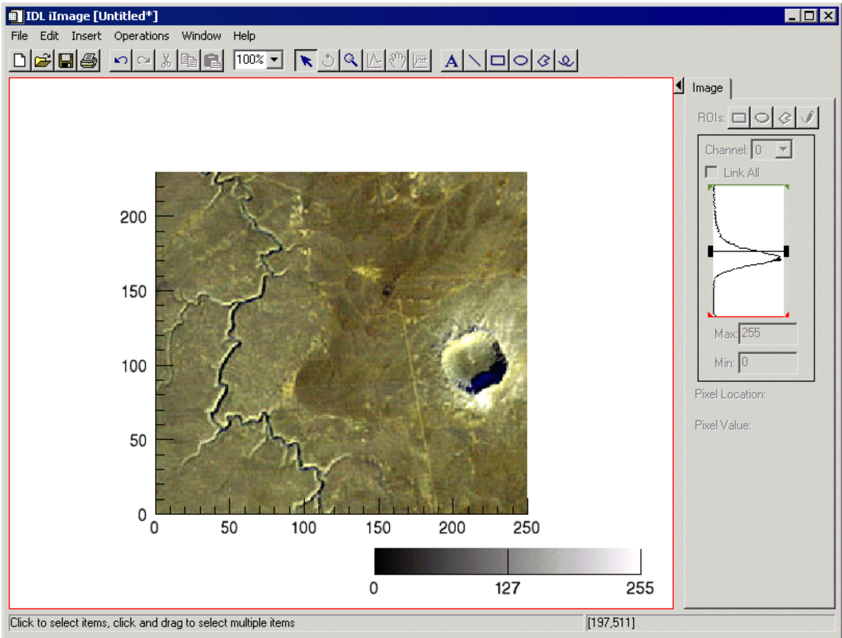


Figure 4-7: Image With Inserted Colorbar

Adding Axes

You can add X and Y axes to your image data by selecting **Insert** → **Axis** from the iTool window. From here you can select **X Axis** or **Y Axis**. By double-clicking on the axis itself after it is added you can modify axis properties.

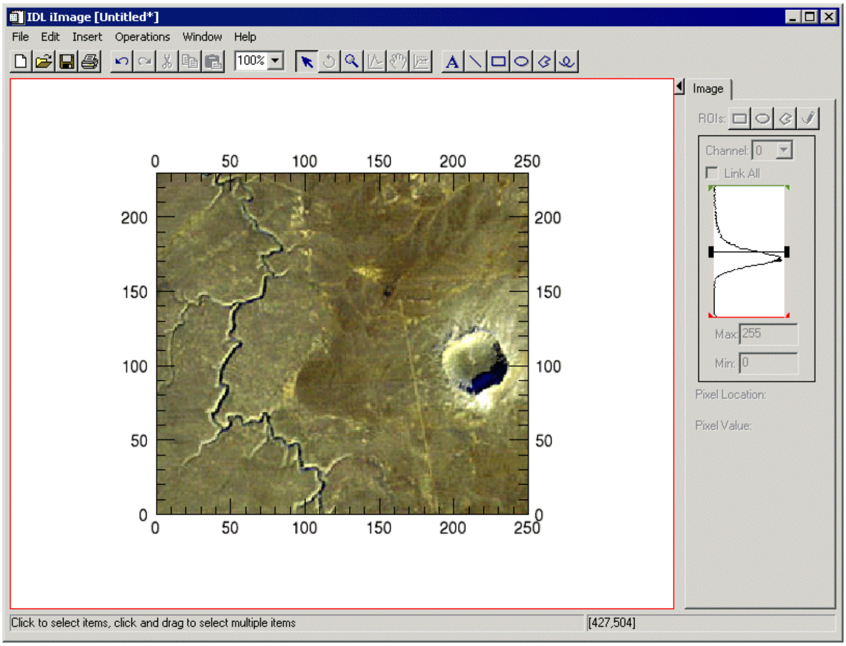


Figure 4-8: Image in iImage with Axes Inserted and Placed

Modifying Image Brightness

The Data Window on the iImage tool allows you to adjust and manipulate the image brightness by changing the RGA or indexed channel values. For indexed color images, Channel 0 represents the image data values. For RGBA images, Channel 0 represents the red values, Channel 1 represents the green values and Channel 2 represents the blue values. Within each channel is a red bar representing minimum values and a green bar representing maximum values. You can click on each bar in each channel (which are tabbed) to manipulate these values.

Resampling an Image

Resampling re-imports the selected image data using parameters specified in the Resample properties. Resampling parameters include factors for adjusting the X, Y, or Z dimensions of the data, as well as the interpolation method to be used.

To resample image data:

1. Select one or more images in the iImage window for resampling.
2. If necessary, use the Operations Browser to set the desired parameters through the Resample properties. See “Resample Properties” on page 258 for details.
3. Select **Operation** → **Transform** → **Resample**.

Filtering an Image

There are five types of filters available in the iImage.

Smoothing an Image

The smooth filter removes unwanted noise from an image using a weighted average.

To apply the smooth filter to an image:

1. Select the image.
2. Select **Operations** → **Filter** → **Smooth**.

Convolving an Image

To convolve an image:

1. Select the image to be convolved.
2. Select **Operations** → **Filter** → **Convolution**.

For more details on the convolution filter, see "Convolution Filter" on page 71 in Chapter 3, *iTool Common Tasks*.

Applying a Median Filter

The median filter replaces each point with the *median* (a value in an ordered set of values with an equal number of values above and below it) of the one- or two-dimensional neighborhood of a given width.

To apply the smooth filter to an image:

1. Select the image.
2. Select **Operations** → **Filter** → **Median**.

For more details on the median filter, see "Median Filter" on page 71 in Chapter 3, *iTool Common Tasks*.

Applying a Roberts Filter

The Roberts filter uses the Roberts edge enhancement operator to detect edges within the image.

To apply the smooth filter to an image:

1. Select the image.
2. Select **Operations** → **Filter** → **Roberts**.

Applying a Sobel Filter

The Sobel filter uses the Sobel edge enhancement operator to detect edges within the image.

To apply the smooth filter to an image:

1. Select the image.
2. Select **Operations** → **Filter** → **Sobel**.

Morphing an Image

Mathematical morphology is a method of processing digital images on the basis of shape. Six morphing options are available for use in iImage: dilate, erode, morph open, morph close, morph gradient, and morph tophat. For more information on morphing, see "Morphing" on page 72 in Chapter 3, *iTool Common Tasks*. To morph your image, select **Operations** → **Morph** → <*option*>.

Contouring an Image

You can also insert contouring into your visualized image in iTool by selecting **Operations** → **Contour**. The following figure shows contouring added to the image of a meteor surface.

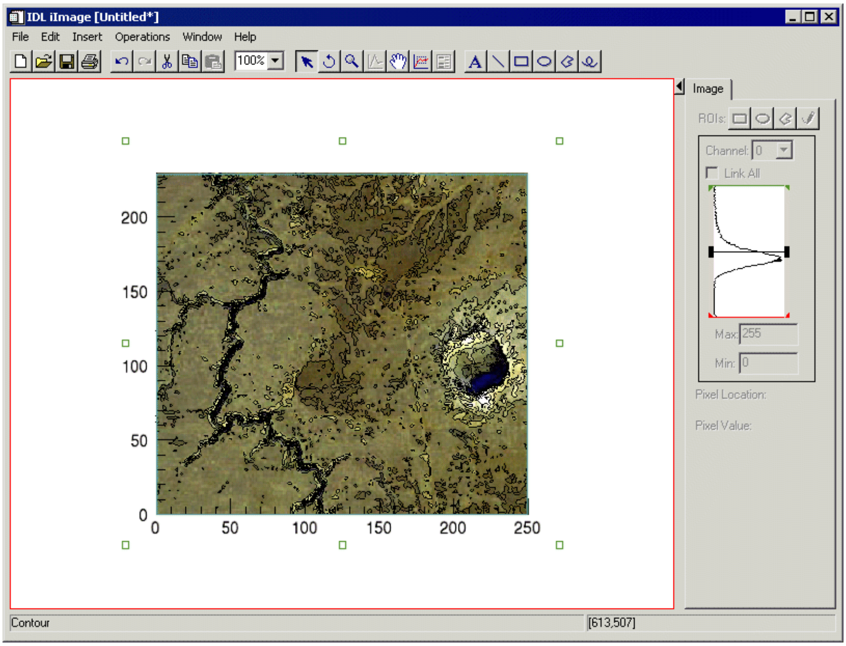


Figure 4-9: A Contoured Image in iImage

You can highlight and double-click your contoured image data, invoking the Visualization Browser which allows you to edit Contour Level properties and Contour Level color table data. For more information on these edit options, see "Contour" in Appendix D, *Visualization Properties*.

Surfacing an Image

You can also insert a surface or your image data into your visualized image in iTool by selecting **Operations** → **Surface**. This causes the image display to become three-dimensional. The following figure shows a surface added to the image of a meteor surface.

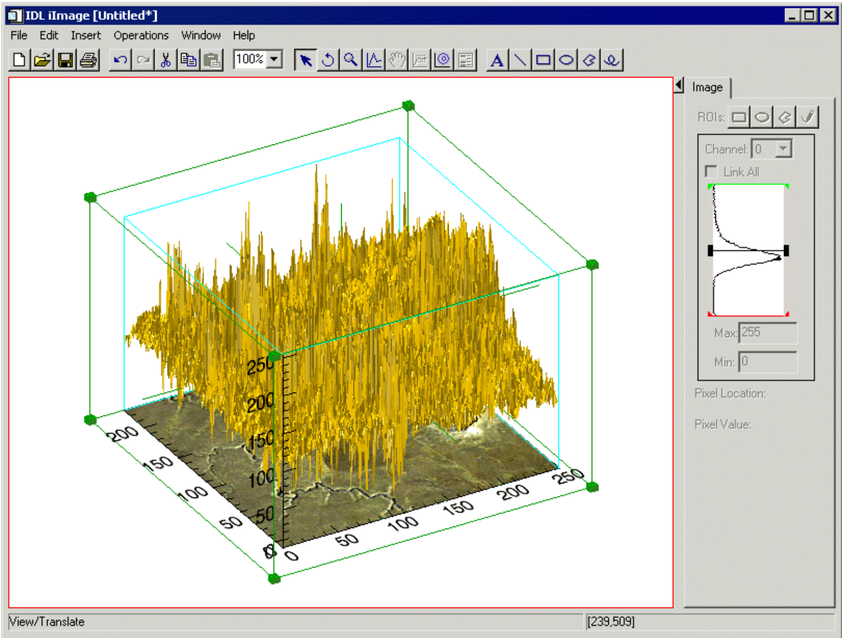


Figure 4-10: Image Data Shown as a Surface

You can highlight and double-click your surfaced image data, invoking the Visualization Browser which allows you to edit surface properties. For more information on these edit options, see "Surface" in Appendix D, *Visualization Properties*.

Manipulating the Image Display

The iImage tool allows you many options to manipulate your existing image displays. Once you have visualized your image, you may rotate, flip, translate, scale, and zoom as well as modify image properties, scroll, and select image ROIs. The following options are available for manipulating images.

For more information on tasks which are common to iImage as well as other iTools, see Chapter 3, “iTool Common Tasks”.

Rotating an Image

Rotating makes it possible to rotate the image within the visualization by a specified number of degrees. To rotate your image, select **Operations → Transform → Rotate Data**. For more information about rotating, see “Rotate Data” on page 69 in Chapter 3, *iTool Common Tasks*.

Scaling an Image and Byte Scaling an Image

It is possible to scale the data within an image by a specified scale factor. To scale your image, select **Operations → Transform → Scale Data**. For more information on scaling data, see “Scale Data” on page 70 in Chapter 3, *iTool Common Tasks*.

To scale the image data to bytes, select **Operations → Transform → Byte Scale**.

Inverting an Image

You can also invert the data associated with your image, or with each channel of an RGB or RGBA image. If the data is byte data, the inversion occurs relative to the maximum byte value (255). Otherwise, the inversion occurs relative to the maximum data value per channel. To invert your image, select **Operations → Transform → Invert Image**.

Flipping an Image

You can flip your image within the data space either horizontally or vertically. These operations flip the actual data associated with the image. To flip your data, select **Operations → Flip → Flip Horizontal** or **Operations → Flip → Flip Vertical**.

View Zoom

View Zoom allows you to zoom in or out on a specific area of the image display area. To zoom in or out in View Zoom mode click Zoom on the toolbar. For more information on working with View Zoom, see "Common Manipulation Tasks" in Chapter 3, *"iTool Common Tasks"*.

Canvas Zoom

Canvas Zoom allows you to increase or decrease the magnification of the entire display canvas (which may contain multiple views, depending on the layout) by a specified percentage. Canvas Zoom is available by selecting the pull-down percentage list from the top of the tool just under the Help menu. For more information on working with Canvas Zoom, see "Common Manipulation Tasks" in Chapter 3, *"iTool Common Tasks"*.

Image ROIs

Regions of interest may be drawn on images in order to highlight specific areas of interest. ROI buttons exist on the iImage tool toolbar. Freehand, rectangular and line options are available by simply selecting the desired button from the ROI Toolbar on the iImage pane.

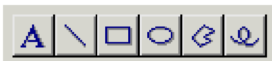


Figure 4-11: The Annotation Toolbar Including ROIs

Region Growing

The iImage region growing function lets you apply a region growing algorithm to the currently selected ROI. A new ROI is then created and displayed. To apply region growing to your ROI, select **Operations** → **Region Grow**.

Adding Annotations

Annotations can be added to label or describe image visualizations displayed in the iImage tool.

The following types of annotations can be added to iImage displays:

Image Annotation Type	Description
Text	Single lines or multiple lines of text can be added to a visualization to provide a label or description.
Line	Straight line annotations can be added to a visualization to link labels to objects or to identify an object.
Rectangle	Rectangular annotations can be added to a visualization to identify rectangular areas.
Oval	Oval annotations can be added to a visualization to identify circular areas.
Polygon	Polygon annotations can be added to a visualization to identify areas bounded by a multi-sided polygon.
Freehand	Freehand annotations can be added to a visualization to identify an area.

Table 4-4: Types of Image Annotations

For more information on creating and using annotations, see "Annotations" in Chapter 3, *"iTool Common Tasks"*.

Line Profiles

You can plot image pixel values along a selected line. To extract a line profile of part of your surface visualization in an iPlot window:

1. Click on the **Line Profile** icon on the iImage window toolbar.
2. use the mouse to position the jagged-edge line profile tool over the place which you wish your line profile to begin.
3. Drag to the ending point of your line profile.
4. A new plot window appears showing a plot of the image pixel values that fall along that line.

Once a line profile has been drawn, it will remain until deleted. The line may be translated (or its endpoints moved individually) by switching back to the arrows. If it is translated or edited, the profile plot will automatically update.

Panning

To pan an image, select the Pan tool button on the toolbar and then click on the image and drag until the desired dataspace range is visible. Panning causes the extents of the current dataspace to be shifted left, right, up, or down.

Selecting the Data Range

Your data range can be manipulated in several ways. First, enter into the Data Range tool mode by clicking on the Data Range button on the toolbar. You can then manipulate your data range in the following ways:

- Clicking and dragging a selection box within the view. The selected range becomes the new data range.
- Panning in one direction or another along a single axis by clicking on the arrow manipulators.
- Zooming in or out by clicking on one of the plus or minus symbols. When isotropic scaling is in effect (the default for the iImage tool), these symbols appear at the axis origin, and will impact both the X and Y ranges simultaneously.

Note

Images are clipped to fit within newly selected data ranges.

iImage Tool Operations

The iImage tool provides the following operations:

Viewing a Histogram

A histogram is a density plot showing a distribution of data values. The widths or heights of these bars represent data values. To view a histogram of image data, use the iTool's histogram feature by selecting **Operations** → **Histogram**. For information on histogram creation, see "Plotting a Histogram" in Chapter 3, *iTool Common Tasks*.

Viewing Image Statistics

To view statistics for image data, use the iTool's statistics feature by selecting **Operations** → **Statistics**. For information on viewing statistics, see "Displaying Statistics" in Chapter 3, *iTool Common Tasks*.

Resetting Dataspace Ranges

You can reset the ranges of your dataspace to accommodate all your contained visualizations. When you reset your ranges, the following properties of the dataspace are reset to a value of True:

- Automatic X range updates
- Automatic Y range updates
- Automatic Z range updates

To reset the ranges of your dataspace, select **Operations** → **Dataspace** → **Reset Ranges**.

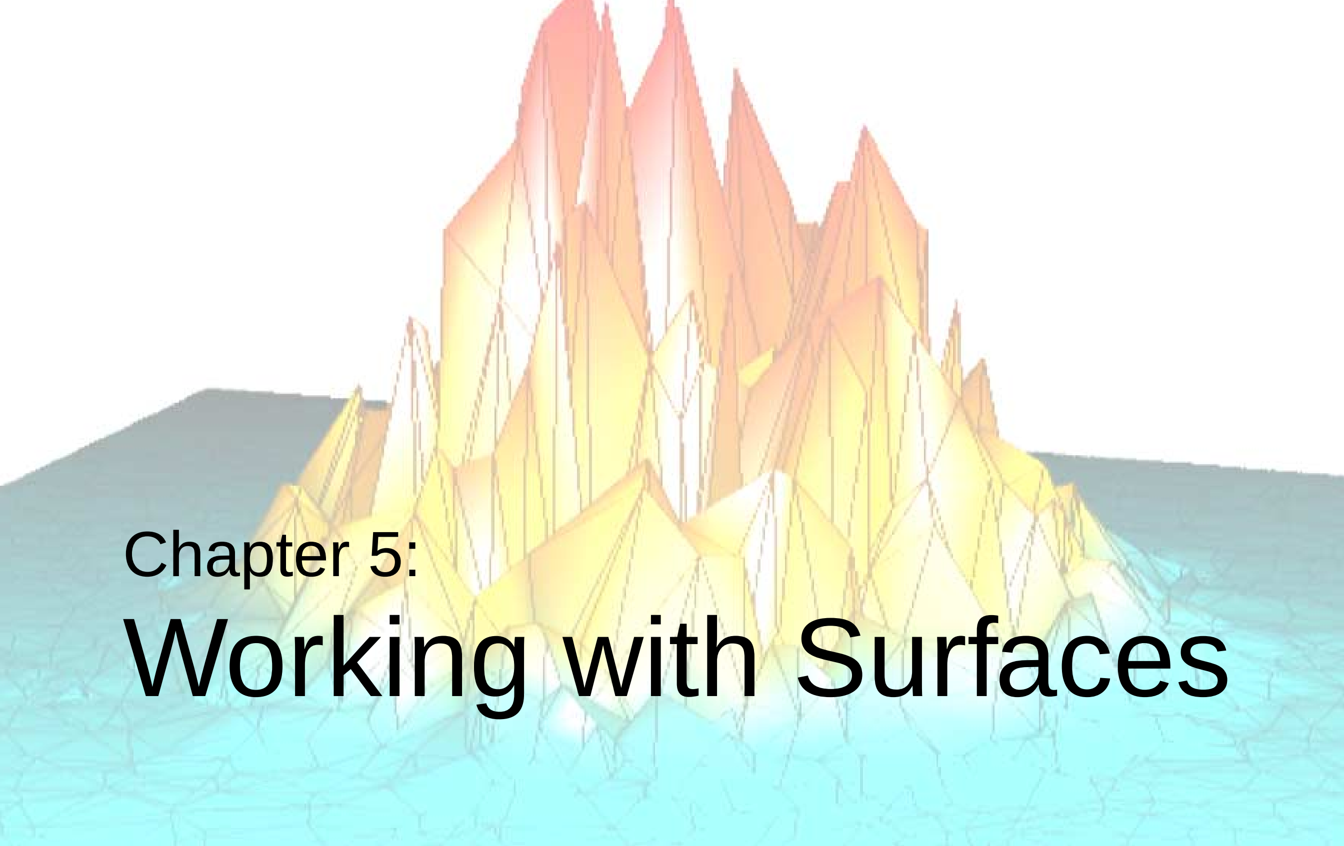
Note

You can turn automatic range updates on and off in the Visualization Browser. For more information, see Appendix D, "Visualization Properties".

Dataspace Pixel Scaling

Pixel scaling resets the data ranges of your dataspace so that one display pixel will correspond to a given number of image pixels. The number of image pixels per display pixel can be set as a property of this operation via the Operations Browser.

The default value is 1. To pixel scale your dataspace, select **Operations** → **Dataspace** → **Pixel Scale**.



Chapter 5: Working with Surfaces

This chapter describes how to work with surfaces in the iSurface tool.

Introduction

The IDL iSurface tool provides interactive access to surface data. You can visualize surfaces and then modify and manipulate those surfaces in the ways that you need. The following sections describe how surfaces can be displayed, modified, and manipulated in iSurface.

To use iSurface from the IDL Command Line, type iSurface. An empty iSurface tool appears. You can then import surface data using any of several data import methods. For more information on importing surface data, see Chapter 2, "Importing and Exporting Data".

Note

For more information on accepted arguments, see "ISURFACE" in the *IDL Reference Guide* manual.

The iSurface tool can be launched in the following ways:

- At the IDL Command Line without arguments or keywords
- At the IDL Command Line with arguments and keywords
- Through the **File** → **New** → **Visualization** → **iSurface** menu option in the IDL Development Environment
- Through the **File** → **New** → **iSurface** menu option in an existing iTool

Displaying Surfaces

Three-dimensional visualizations of surfaces can be displayed in the iSurface window.

To open an iSurface window, do one of the following:

- At the IDL command line, enter `ISURFACE`.
- From an iTool window, select **File** → **New**, and select **iSurface**.

Surface data can be displayed by specifying data parameters at the IDL command line, or by importing a binary or ASCII text file containing surface data.

To import a file containing surface data into the iSurface tool:

1. Select **File** → **Open** from the iSurface tool, and locate the file to open. For example from your IDL `examples/data` directory select `idemosurf.dat`.
2. Double-click the filename, or select the filename and click **Open** to open the surface data file. You will be prompted to enter information regarding your file type (for example, ASCII or binary). For more information on entering this information and on importing data, see Chapter 2, “Importing and Exporting Data”. In this example, enter *demosurface* for your template name and then select **New Field** and specify *demosurface* as the **Field Name** and specify it as a two-dimensional 200 by 200 Floating type.

3. Then select **OK** and **OK** to dismiss and visualize.

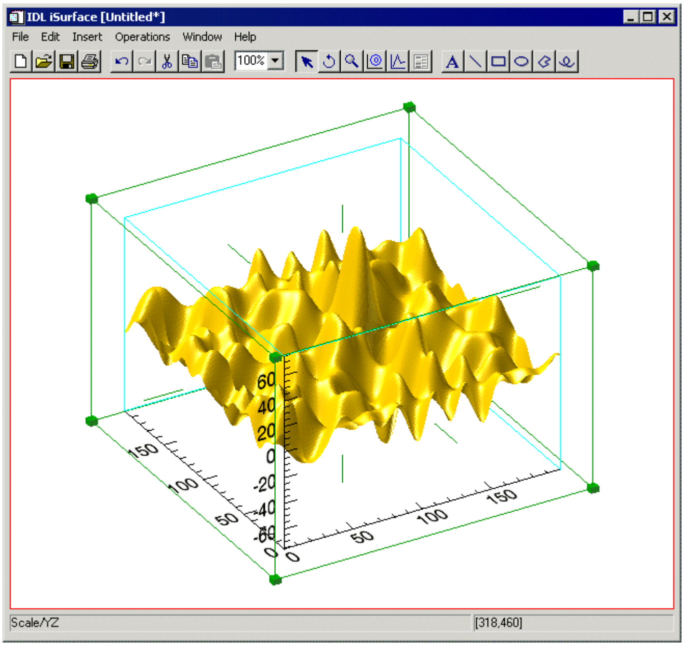


Figure 5-1: Surface Data Visualized in iSurface

Surface Properties

Surfaces have attributes or *properties* that can be modified to change their characteristics. These properties are organized into *property sheets* for each operation and visualization type. For example, the skin of a surface visualization has a gold color by default. To change this color, modify the surface color property in the surface visualization property sheet.

To display the property sheet for a surface, do one of the following:

- Double-click the surface in the iTool window.
- Select the surface, and select **Edit** → **Properties**.
- Display the Visualization Browser, and double-click the entry for the surface.

For more information, see "Property Sheets" on page 83 in Chapter 3, *iTool Common Tasks*.

The Visualization Browser

The Visualization Browser provides a nested list of all visualizations displayed in the iSurface window. From the Visualization Browser, you can select visualizations and display property sheets for those visualizations.

To display the Visualization Browser:

1. Select **Window** → **Visualization Browser**.
2. Do either of the following:
    - Click an item to select it in the Visualization Browser.
    - Double-click an item in the iTool window to display its property sheet.

For more information, see "The Visualization Browser" on page 85 in Chapter 3, *iTool Common Tasks* and Appendix D, "Visualization Properties".

The Operations Browser

The Operations Browser provides a nested list of all operations available from the iSurface Operations menu. From the Operations Browser, you can display property sheets for each of the items in the iSurface Operations menu.

To display the Operations Browser:

1. Select **Operations** → **Operations Browser**.

2. Click an item to display its property sheet.

For more information, see “The Operations Browser” on page 97 in Chapter 3, *iTool Common Tasks* and Appendix C, “Operations Properties”.

Adding a Colorbar

If you have added vertex coloring or texture to your surface visualization, you can add a colorbar which will show on a color scale the minimum to maximum values of data in the visualization. To add a colorbar, click on the surface data and then from the iSurface window, select **Insert** → **Colorbar**. A colorbar will be placed in the visualization window. This colorbar can be resized and moved around the data space. You can also double-click on the colorbar to invoke the Visualization Browser which will allow you to change the values for the colorbar. For more information on the colorbar, see "Colorbar" in Appendix D, *Visualization Properties*.

Adding a Light

Adding a light to your surface display allows you to highlight various parts of the surface. To add a light to your surface display, select **Insert** → **Light**. you can click on the light bulb which appears and drag it around the display area to manipulate the lighting. You can also adjust the lighting settings using the Visualization Browser by double-clicking on the light bulb.

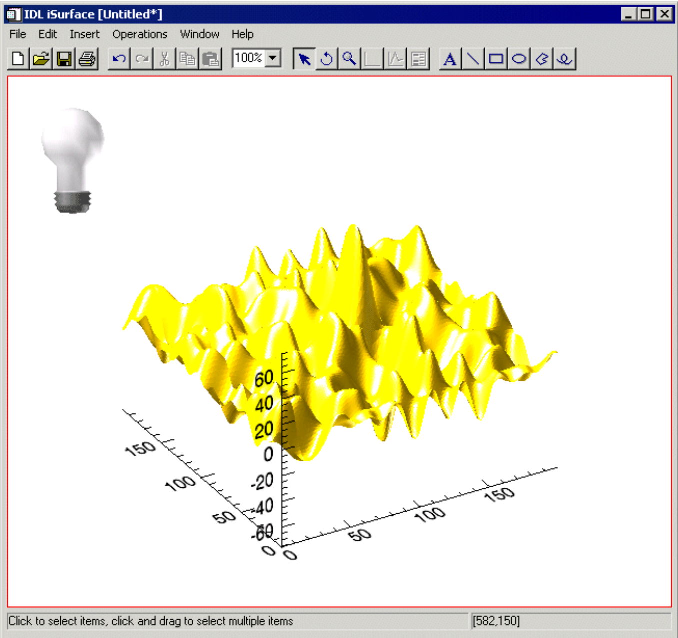


Figure 5-2: Inserting Light into a Surface Display

Adding a Legend

Legends identify the visualizations displayed in the iTool window. Legends can be displayed in the iSurface window to identify surfaces and contours on those surfaces.

To insert a legend for a surface or contour:

1. Select specific items to include in the legend, or click in an empty area of the iSurface dataspace to deselect and include all dataspace items in the legend.
2. Select **Insert** → **Legend**.

To add to a legend:

1. Select the legend by clicking the legend border.
2. Click Add to Legend in the Manipulator toolbar.
3. Click the item in the iTool window to add to the legend.

For more information, see "Legends" on page 74 in Chapter 3, *iTool Common Tasks*.

Adding Axes

By default, surfaces are displayed with X, Y and Z axes. The display of these axes is controlled by property sheets for the axes container and for individual axes (see “Axes” in Appendix D). Additional X, Y or Z axes can be added to a surface visualization to make it easier to identify surface characteristics.

To add an axis to your surface visualization:

1. Select the surface.
2. Select **Insert** → **Axis**.
3. Choose from the following options:
    - **X axis**
    - **Y axis**
    - **Z axis**

Use the mouse to position the new axis, and double-click the axis to display the axis property sheet.

For more information on adding axes, see “Additional Axes” on page 81 in Chapter 3, *iTool Common Tasks*.

Imaging a Surface

You can insert an image of your surface data by using **Operations** → **Image**. An image visualization of your original surface data is then displayed with your original surface visualization.

For example at the IDL command line enter:

1. `iSurface, DIST (10)`
2. Now select **Operations** → **Image**

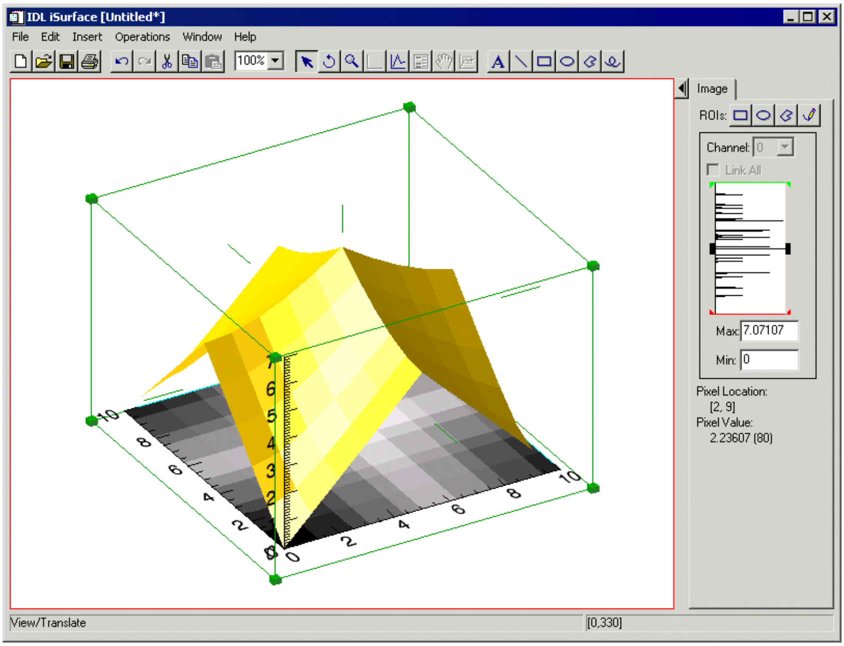


Figure 5-3: Surface Visualization with Image Added

Contouring a Surface

Contour lines can be drawn directly on a surface to provide information about the levels of the surface, such as elevation. Two types of contours can be applied: multiple-level contour operations that apply to the surface in general, and single-level contour objects applied at a specific location on the surface.

To add contour lines to a surface:

1. Select the surface in the iTools window. For example, select the `isurfdemo.dat` surface data previously visualized.
2. Select **Operations** → **Contour**. Contour lines will be applied to the surface at the interval specified in the contour properties page.

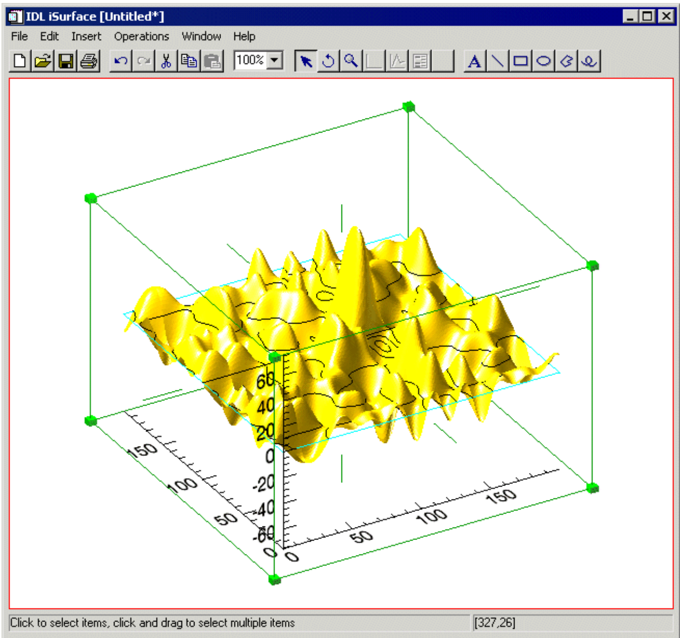


Figure 5-4: Surface with Contours Added

3. To adjust the properties of the contour, double-click the contour in the iTool window or in the Visualization Browser to display the Contour property sheet. For information on the contour properties, see "Contour" in Appendix D, *Visualization Properties*.

To insert a contour object at a specific location on a surface:

1. Select a surface in the iSurface window.
2. Click the Surface Contour button  in the Manipulator toolbar.
3. Click the level on the surface at which you would like the contour to appear. Contour lines are displayed on the surface at that level.
4. To adjust the properties of the contour object, double-click the contour object in the iTool window or in the Visualization Browser to display the Contour property sheet. For information on the contour properties, see "Contour" in Appendix D, *Visualization Properties*.

Resampling a Surface

Once surface data has been imported into the iSurface window, that data can be re-imported using different import parameters by *resampling* the data. See “Resample” in Chapter 3, *iTool Common Tasks* for details.

To resample a surface:

1. Select a surface in the iSurface window. For example, select the `isurfdemo.dat` surfaced data.
2. Select **Operations** → **Transform** → **Resample**.

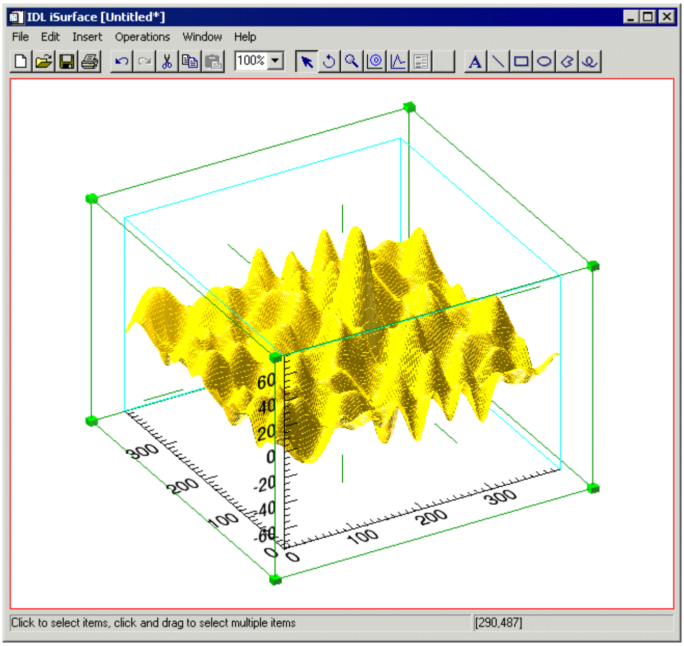


Figure 5-5: Resampled Surface in iSurface

Filtering a Surface

Two types of filters are available in the iSurface tool: smooth filtering and convolution filtering.

Smoothing a Surface

The smooth filter removes unwanted noise from a surface.

To apply the smooth filter to a surface:

1. Select the surface.
2. Select **Operations** → **Filter** → **Smooth**.

For details on using the smooth filter, see “Smooth Filter” on page 70 in Chapter 3, *iTool Common Tasks*.

Convolving a Surface

To convolve a surface:

1. Select the surface to be convolved.
2. Select **Operations** → **Filter** → **Convolution**.

For details on using the convolution filter, see “Convolution Filter” on page 71 in Chapter 3, *iTool Common Tasks*.

Median a Surface

The median filter replaces each point with the *median* (a value in an ordered set of values with an equal number of values above and below it) of the one- or two-dimensional neighborhood of a given width.

to median a surface:

1. Select the surface.
2. Select **Operations** → **Filter** → **Median**.

For details about using the median filter, see “Median Filter” on page 71 in Chapter 3, *iTool Common Tasks*.

Adding a Texture Map

An image file can be imported into a surface visualization to serve as a *texture map*: an image projected onto the surface skin in place of the default red skin.

To add a texture map to a surface:

1. Select the surface.
2. Select **Edit** → **Parameters** to open the Parameter Editor.
3. Click **Import File** to import the image file to be used as a texture map into the Data Manager.
4. Find the image file in the list of files in the Data Manager tree and select either a specific image channel to import, or select **Image Planes** to import all channels of the image.
5. Click the **Assign Data** button under TEXTURE. The name of the data to import appears in the TEXTURE field.

Figure 5-6: TEXTURE Field in Parameter Editor

6. Click **OK**. The Parameter Editor window closes, and the texture map appears on the surface.

Manipulating Surface Displays

The iSurface tool provides options for manipulating surface data. You can rotate as well as scale surfaces. These manipulations are described in the following sections.

Rotating a Surface

Rotation tools are provided in the iSurface tool to make it easier to see all aspects of a 3-D surface visualization. Surfaces can be rotated freely or along an axis with the mouse, and they can be rotated in fixed or arbitrary increments from the Operations menu.

To rotate a surface freely or along an axis with the mouse:

1. Select the surface in the iSurface window.
2. Click Rotate on the Manipulator toolbar. The rotation sphere is displayed around the surface.

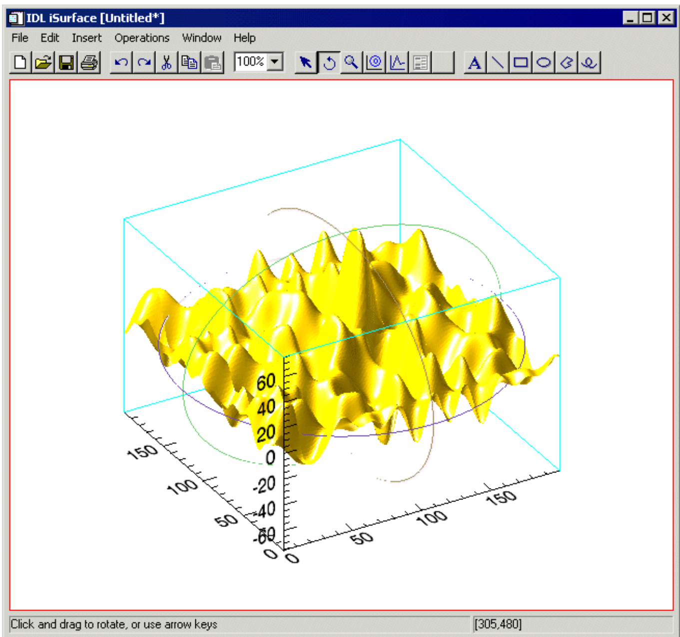


Figure 5-7: Surface with Rotation Sphere Displayed

- To rotate the surface freely, position the mouse pointer over the surface so that it changes to a free rotation pointer . Click and drag to rotate the surface in the desired direction.
- To rotate the surface along an axis, position the mouse pointer over an axis so that it changes to an axis rotation pointer . Click and drag to rotate the surface along the axis in the desired direction.

To rotate a surface in 90° increments left or right from the Operations menu:

1. Select the surface in the iTool window.
2. Select **Operations** → **Rotate** → **Rotate Left** or **Operations** → **Rotate** → **Rotate Right**.

To rotate a surface an arbitrary number of degrees from the Operations menu:

1. Select the surface in the iTool window.
2. Select **Operations** → **Rotate** → **Rotate by Angle**.
3. In the Rotate Angle dialog, enter the desired number of degrees to rotate the surface.

For more information, see “Rotating” on page 66 in Chapter 3, *iTool Common Tasks*.

Scaling a Surface

Surfaces can be scaled freely, or scaling can be constrained to one or more dimensions.

To scale a surface freely:

1. Select the surface in the iTool window.
2. Position the mouse pointer over a side of the data set bounding box so that it changes to an unconstrained scaling pointer .
3. Click and drag to scale all points of the surface in the desired direction.

To constrain scaling of a surface:

1. Select the surface in the iTool window.

2. Position the mouse pointer over an axis “whisker” to scale along only one axis, or over a corner of the bounding box for multi-axis scaling.

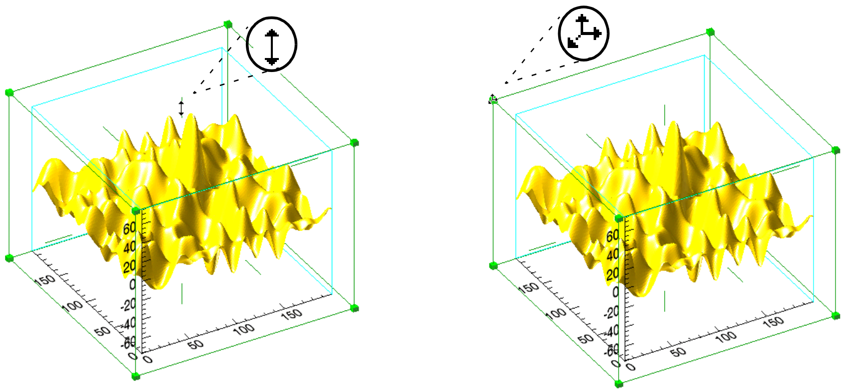


Figure 5-8: Constrained Single-Axis (left) and Multi-Axis (right) Scaling

3. Click and drag to scale in the desired direction.

For more information, see “Scaling” on page 60 in Chapter 3, *iTool Common Tasks*.

Adding Annotations

Annotations can be added to label or describe surface visualizations displayed in the iSurface tool.

The following types of annotations can be added to iSurface displays:

Plot Annotation Type	Description
Text	Single lines or multiple lines of text can be added to a visualization to provide a label or description.
Line	Straight line annotations can be added to a visualization to link labels to objects or to identify an object.

Table 5-1: Types of Surface Annotations

Plot Annotation Type	Description
Rectangle	Rectangular annotations can be added to a visualization to identify rectangular areas.
Oval	Oval annotations can be added to a visualization to identify elliptical areas.
Polygon	Polygon annotations can be added to a visualization to identify areas bounded by a polygon.
Freehand	Freehand annotations can be added to a visualization to identify an area.

Table 5-1: Types of Surface Annotations (Continued)

For more information on creating and using annotations, see "Annotations" in Chapter 3, "*iTool Common Tasks*".

View Zoom

View Zoom allows you to zoom in or out on a specific area of the surface display area. To zoom in or out in View Zoom mode click Zoom  on the toolbar. For more information on working with View Zoom, see "Common Manipulation Tasks" in Chapter 3, "*iTool Common Tasks*".

Canvas Zoom

Canvas Zoom allows you to increase or decrease the magnification of the entire display canvas (which may contain multiple views, depending on the layout) by a specified percentage. Canvas Zoom is available by selecting the pull-down percentage list from the top of the tool just under the Help menu. For more information on working with Canvas Zoom, see "Common Manipulation Tasks" in Chapter 3, "*iTool Common Tasks*".

Extracting a Line Profile

To extract a line profile of part of your surface visualization in an iPlot window:

1. Click on the **Line Profile** icon on the iSurface window toolbar.

2. use the mouse to position the jagged-edge line profile tool over the place which you wish your line profile to begin.
3. Drag to the ending point of your line profile.
4. The profile plot appears in an iPlot window.

Once a line profile has been drawn, it will remain until deleted. The line may be translated (or its endpoints moved individually) by switching back to the arrows. If it is translated or edited, the profile plot will automatically update.

iSurface Tool Operations

The iSurface tool provides the following operations:

Viewing a Histogram Plot

To display a histogram plot of your surface:

1. Select the surface.
2. Select **Operations** → **Histogram**.

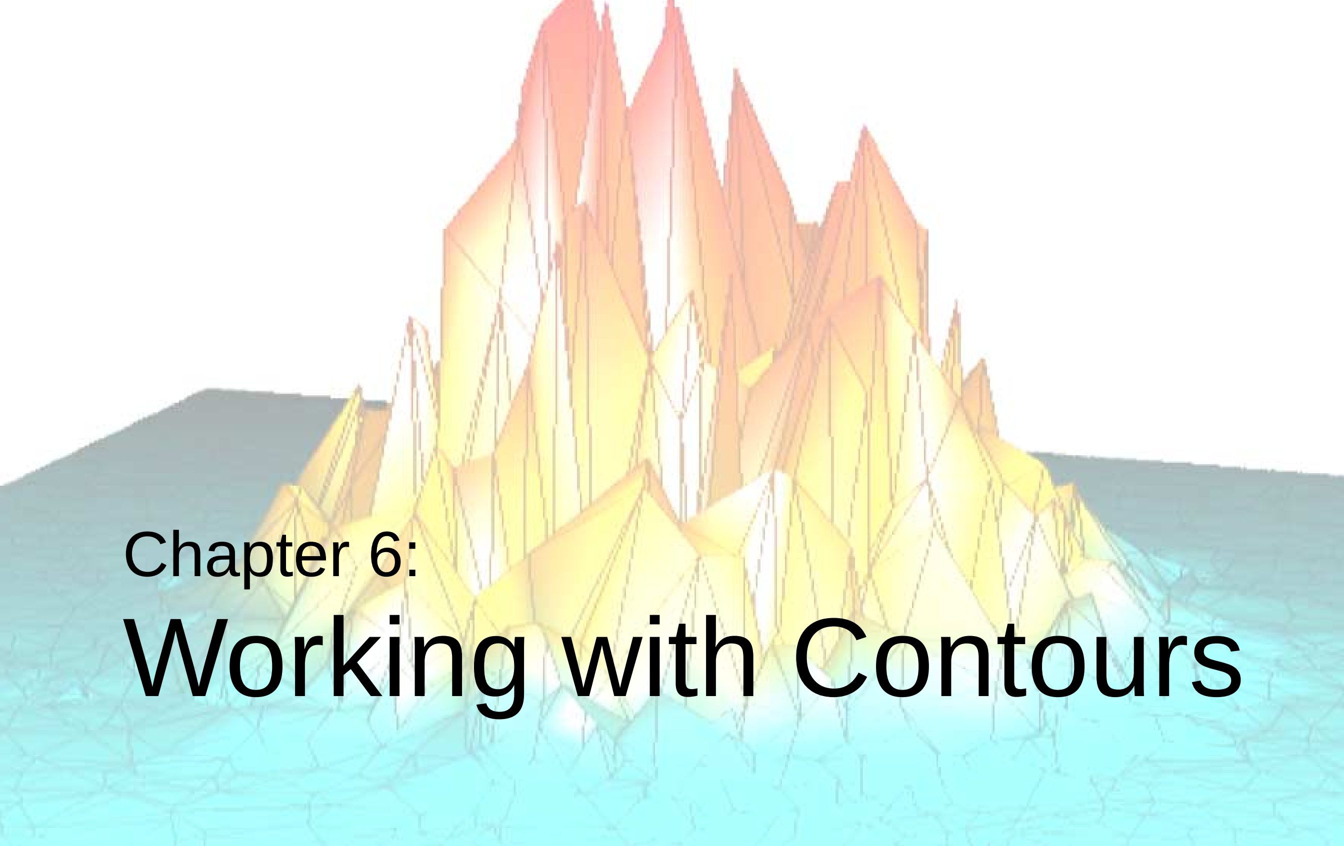
For more information, see “Plotting a Histogram” on page 104 in Chapter 3, *iTool Common Tasks*.

Viewing Statistics

To display the Statistics dialog:

1. Select an object or a group of objects in the iTools window.
2. Select **Operations** → **Statistics**. The Statistics window displays the statistics for the selected object(s).

For more information, see “Displaying Statistics” on page 105 in Chapter 3, *iTool Common Tasks*.



Chapter 6: Working with Contours

This chapter describes how to work with contours in the iContour tool.

Introduction

The IDL iContour tool allows you interactive access to contour data. You may visualize contours and then modify and manipulate those contours in the ways that you need.

The IDL iContour tool displays your data as contours and allows you great flexibility in manipulating and visualizing these contours. The iContour tool can be used for irregular or regular grid data. Irregularly-grid data arranged as three fields (three one-dimensional vectors) are gridded by a Gridding Wizard if this data is imported into the iTool. Regular grid data arranged as a two-dimensional array is directly imported.

To use iContour from the IDL Command Line, type iContour. An empty iContour tool appears. You can then import contour data using any of several data import methods. For more information on importing contour data, see Chapter 2, "Importing and Exporting Data".

Note

For more information on accepted arguments and keywords, see "ICONTOUR" in the *IDL Reference Guide* manual.

The iContour tool can be launched in the following ways:

- At the IDL Command Line without arguments or keywords
- At the IDL Command Line with arguments and keywords
- Through the **File** → **New** → **Visualization** → **iContour** menu option in the IDL Development Environment
- Through the **File** → **New** → **iContour** menu option in an existing iTool

Displaying Contours

The iContour tool's primary purpose is to display contours, though the tool is capable of much more once the data is displayed. The iContour tool can display regular-grid data or irregular-grid data. Gridding is the creation of uniformly-spaced planar data from data points. These points may initially be irregular.

Displaying Regular-grid Data

Regular-grid data points are presented by two-dimensional arrays. The following example shows one way of importing and displaying this type of data into the iContour tool. The 248 by 248 two-dimensional array contained within the `convec.dat` binary file in the `examples/data` directory is imported into IDL with the READ_BINARY function. The iContour tool then displays this data as contours.

At the IDL Command Line, enter:

```
file = FILEPATH('convec.dat', SUBDIRECTORY = ['examples', 'data'])
data = READ_BINARY(file, DATA_DIMS = [248, 248])
iContour, data
```

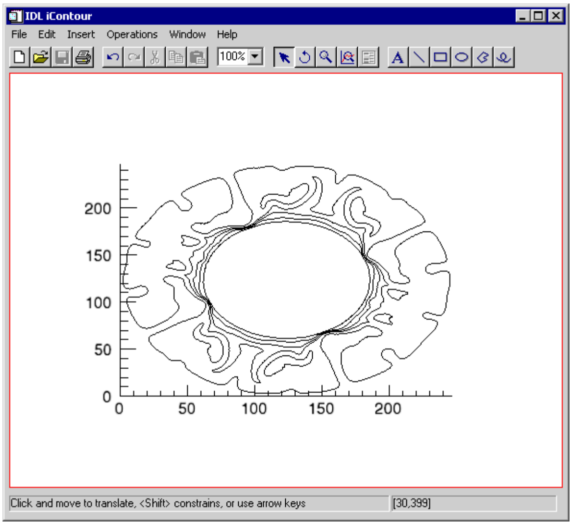


Figure 6-1: Earth Convection Contours in the iContour Tool

Note

The `examples/data` directory of your IDL 6.0 distribution contains a text file named `index.txt`. This file lists all data files available in the example directory and also lists their dimensions and values.

Displaying Irregular-grid Data

Irregular-grid data points are presented by three one-dimensional vectors, usually known as fields. The following example shows one way of importing and displaying this type of data into the iContour tool. The three fields contained within the `irreg_grid1.txt` ASCII file in the `examples/data` directory is imported into IDL with the **File** → **Open** option in the iContour tool. This option uses the ASCII Template wizard to import the data, which is then gridded into contour data with the Gridding Wizard. The iContour tool then displays this data as contours.

1. At the IDL Command Line, enter:

   ```
   ICONTOUR
   ```

2. Select **File** → **Open** from the pulldown menus of the empty iContour tool. The Open dialog will appear.

3. Use the Open dialog to find and select the `irreg_grid1.txt` file in the `example/data` directory. The ASCII Template wizard will appear.

   The `irreg_grid1` file contains three columns of data points. These columns represent the *x*-locations, *y*-locations, and the elevation (respectively) of this data. These columns are specified as three fields (vectors) of data with the ASCII Template wizard.

4. Click **Next** on the first and second step of the wizard, then click **Finish** on the third (last) step of the wizard. The **IDL iTools Create Visualization** dialog will appear.

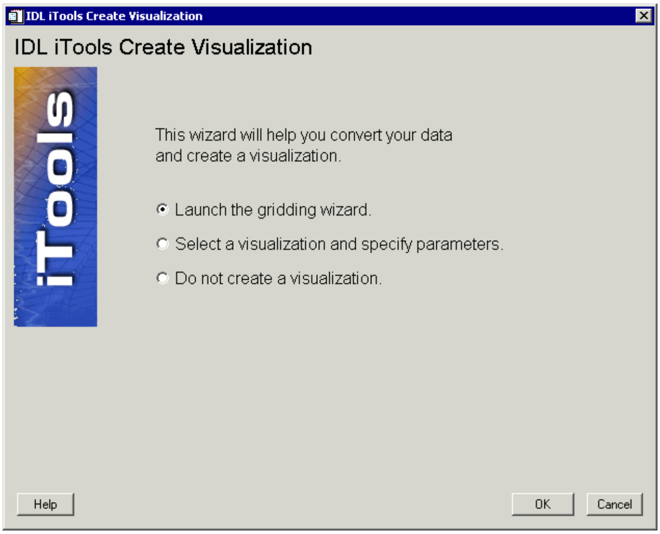


Figure 6-2: The iTools Create Visualization Dialog

The **IDL iTools Create Visualization** dialog contains the following choices:

- **Launch the gridding wizard**
- **Select a visualization and specify parameters**
- **Do not create a visualization**

5. Select the **Launch the gridding wizard** radio button, then click **OK**. The **IDL Gridding Wizard Step 1 of 3** dialog will appear.

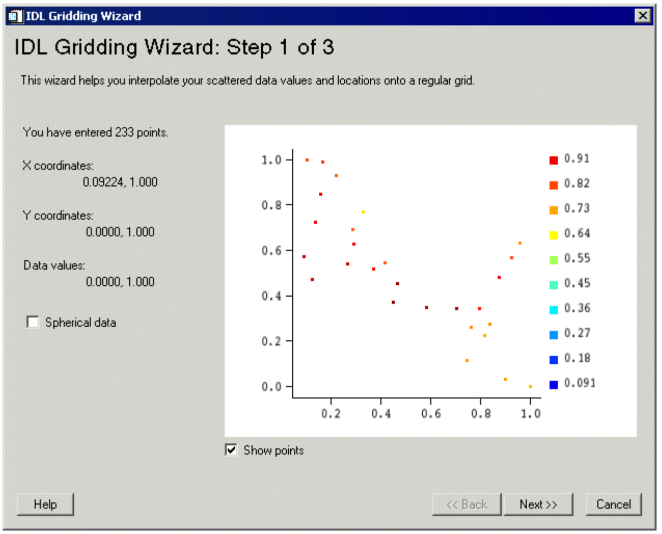


Figure 6-3: The IDL Gridding Wizard Step 1 of 3

The Gridding Wizard allows you to specify the method of gridding while showing you the possible results for that method. The **IDL Gridding Wizard Step 1 of 3** dialog contains the following items:

- **Number of points entered**
- **X Coordinates —** X coordinate range
- **Y Coordinates —** Y coordinate range
- **Data values**
- **Spherical data checkbox —** Check to make data spherical
- **Coordinate diagram** — Shows coordinates of grid data
- **Show points checkbox** — Select to show all points (default = checked)
- **Help** — Obtain help on this dialog
- **Back** — Return to previous step
- **Next** — Proceed to Step 2 of 3

- **Cancel** — Dismiss the Gridding Wizard

6. In the Gridding Wizard Step 1, click **Next** to accept the interpolation of data values and locations. The **IDL Gridding Wizard Step 2 of 3** dialog will appear.

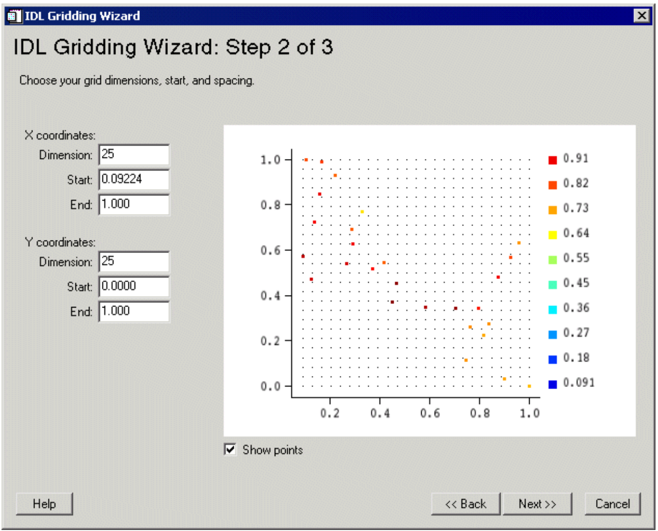


Figure 6-4: The IDL Gridding Wizard Step 2 of 3

The **IDL Gridding Wizard Step 2 of 3** dialog contains the following items:

- **X Coordinates** — modify dimension, start or end
- **Y Coordinates** — modify dimension, start or end
- **Coordinate diagram** — Shows coordinates of grid data
- **Show points checkbox** — Select to show all points (default = checked)
- **Help** — Obtain help on this dialog
- **Back** — Return to previous step
- **Next** — Proceed to Step 3 of 3
- **Cancel** — Dismiss the Gridding Wizard

7. At Step 2, click **Next** to accept the dimensions, start and spacing. The **IDL Gridding Wizard Step 3 of 3** dialog will appear.

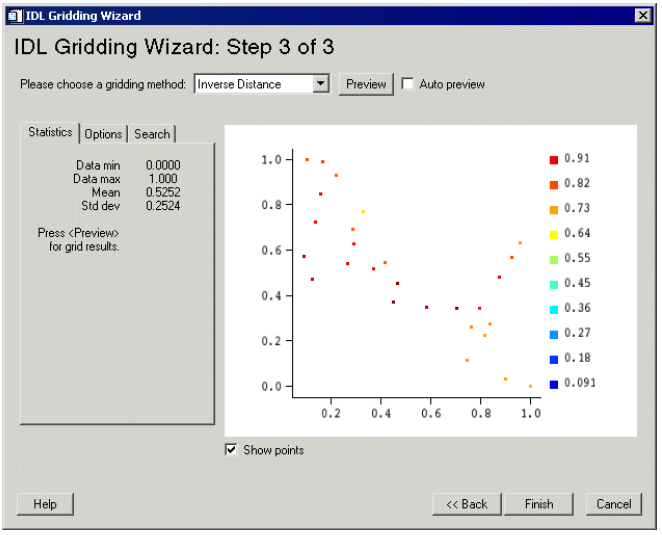


Figure 6-5: The IDL Gridding Wizard Step 3 of 3

The **IDL Gridding Wizard Step 3 of 3** dialog contains the following items:

- **Choose gridding method** — Choose from pull-down list of methods
- **Preview** — Click to preview selected method and data
- **Auto preview** — Checkbox to turn auto preview on (default = off)
- **Statistics tab** — Shows data statistics
- **Options tab** — Set options for missing values, smoothing, weighting, and anistropy between axes
- **Search tab** — Set options for using search ellipse
- **Coordinate diagram** — Shows coordinates of grid data
- **Show points checkbox** — Select to show all points (default = checked)
- **Help** — Obtain help on this dialog
- **Back** — Return to previous step
- **Finish** — Dismiss the Gridding Wizard with data gridded

- **Cancel** — Dismiss the Gridding Wizard

8. At Step 3, select **Inverse Distance** as the gridding method and click **Finish** to display the surface.
9. The resulting contours are displayed in the iContour tool.

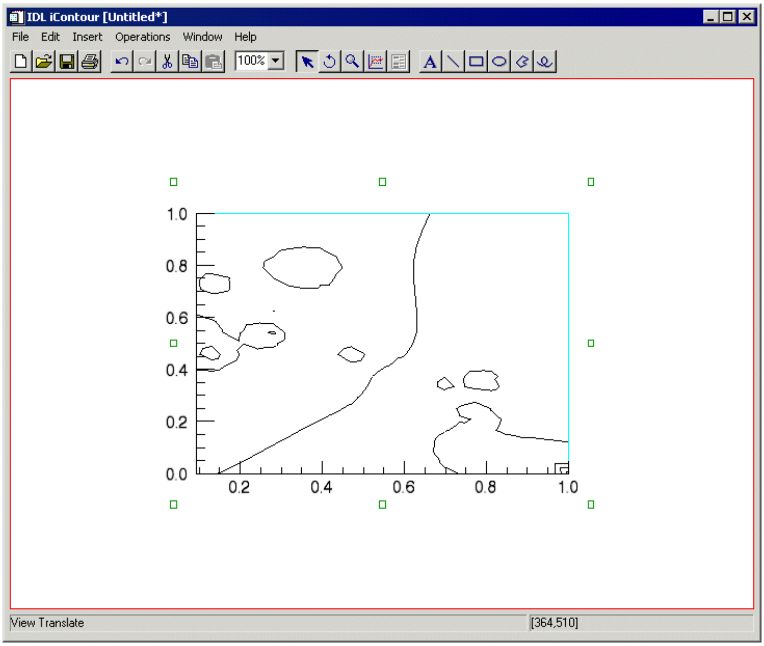


Figure 6-6: Irregular-grid Elevation Contours in the iContour Tool

Contour Properties

The iContour window is a self-contained contour display and manipulation device. You can import and export contour data, and modify and manipulate contours. For more information on the basic iContour interface and its layout, see Appendix A, “iTools Interface Reference”.

With the contour selected, the **Edit** → **Properties...** option allows access to the contour property sheet. You can change many contour properties through this sheet including contour labels, colors, and fill values.

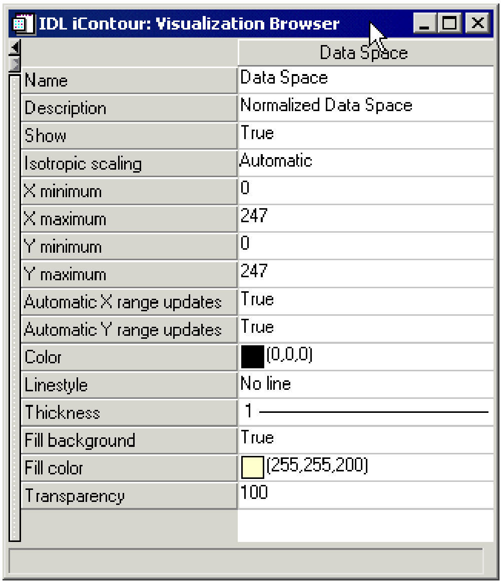


Figure 6-7: Contour Property Sheet

The following examples show how to modify some contour properties. These examples are performed on the contours imported by using the following steps:

1. At the IDL Command Line, enter:

```
ICONTOUR
```

2. Select **File** → **Open** from the pulldown menus of the empty iContour tool. The Open dialog will appear.

3. Use the Open dialog to find and select the `convec.dat` file in the `example/data` directory. The Binary Template wizard will appear.
4. In the Binary Template dialog, click **New Field**, and enter the following information in the New Field dialog:
    - **Field name**: `data` (or a name of your choosing)
    - **Type**: `byte`
    - **Number of dimensions**: `2`
    - **1st dimension Size**: `248`
    - **2nd dimension Size**: `248`
5. Click **OK** to close the New Field dialog and the Binary Template dialog, and the contours are displayed in the tool.

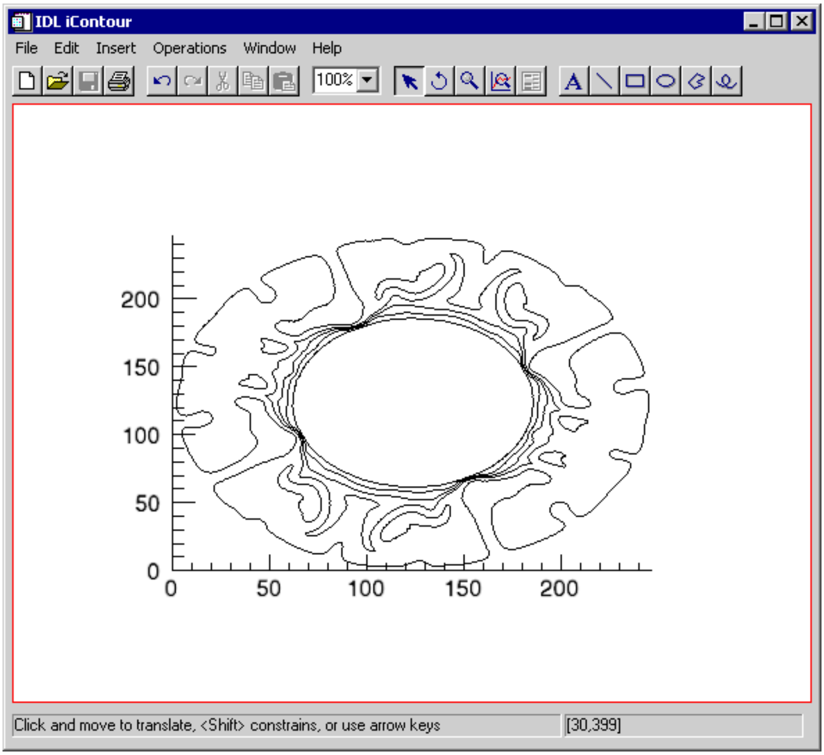


Figure 6-8: Earth Convection Contours in the iContour Tool

Labelling Contours

Each contour level line has its own properties. You can access these properties through **Contour level properties** in the contour property sheet by clicking **Contour level properties**, clicking on the arrow button, and then clicking **Edit...** The Contour Levels property sheet will appear.

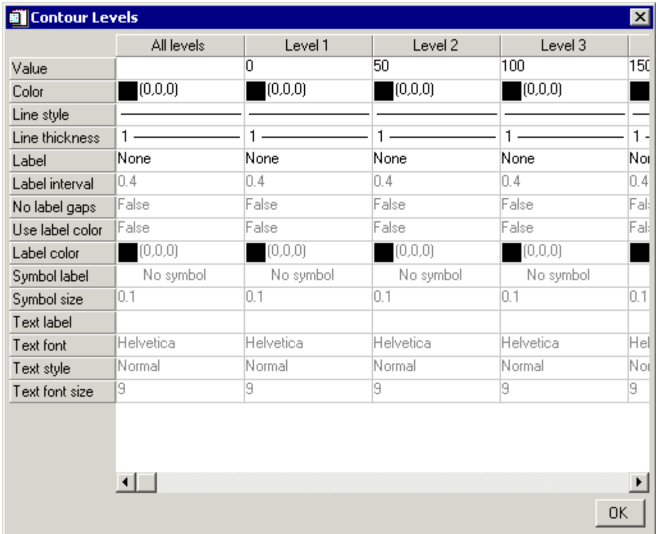


Figure 6-9: Contour Levels Property Sheet

The first column of the Contour Levels property sheet contains the property values for all the levels. In this column, change the **Label** setting from `None` to `Value`. The value of each contour line appears as labels in the iContour display.

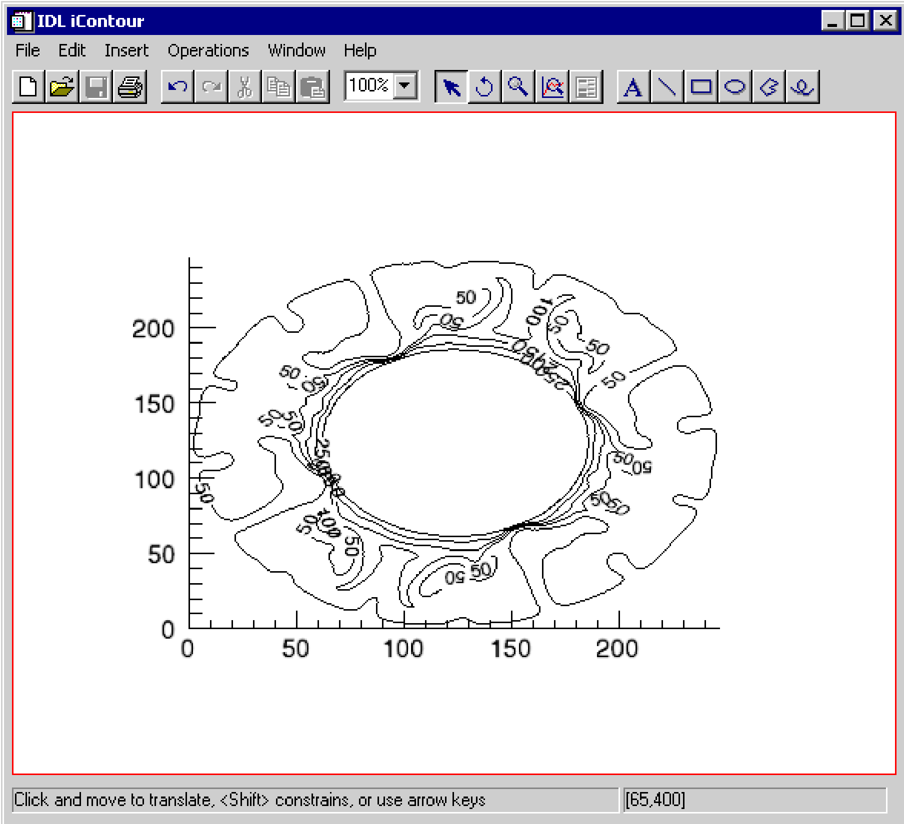


Figure 6-10: Labelled Contour Levels

Changing the Contour Colors

The columns after the first one are for each individual contour level. In each level column, change the Color setting from black to a different color making sure to use a different color for each level. When a level color is changed in the property sheet, that level is updated in the iContour display.

The resulting display contains a different color contour for each level.

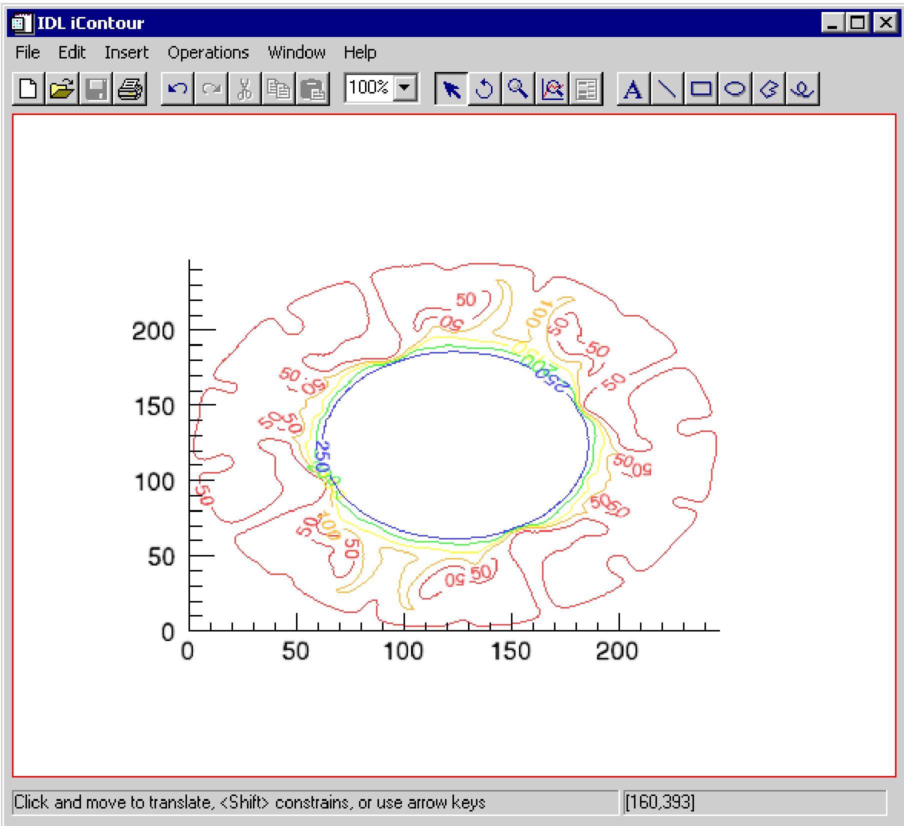


Figure 6-11: Color Contour Levels

After changing the colors of each level, click **OK** in the Contour Levels property sheet. The Contour Labels property sheet will go away.

Filling Contours

The Fill contours setting in the original contour property sheet controls whether the contour levels are filled or not. Change the **Fill contours** setting to `True`.

Note

You must also change the **Use palette color** setting to `True` as well before colors can be used. After that, you can choose or set your own color scheme from the **Levels Color Table** → **Edit color table** function.

The contour colors are now more distinctive.

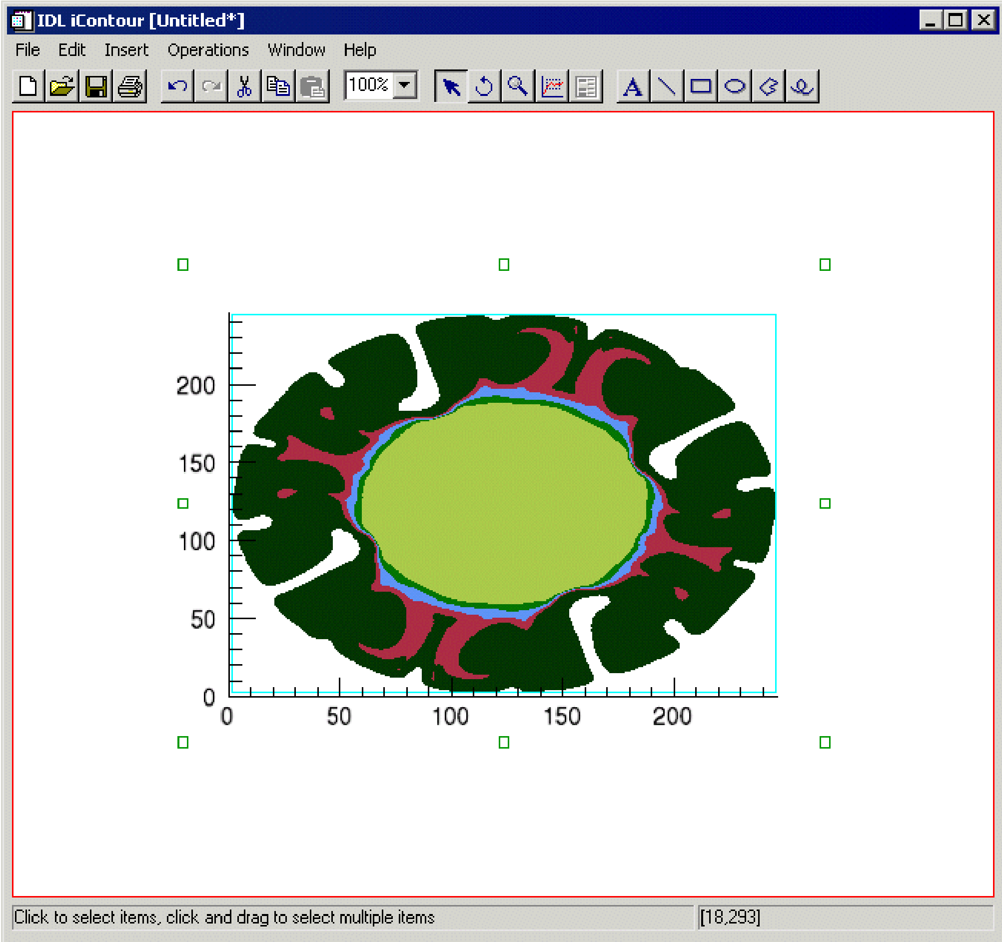


Figure 6-12: Filled Contour Levels Using the Predefined Blue Waves Scheme

Even more detail can be added by increasing the number of levels in the contour display. Change the **Number of levels** from `6` to `20`.

The color set for each of the original seven levels is repeated every set of seven within the 20 new levels.

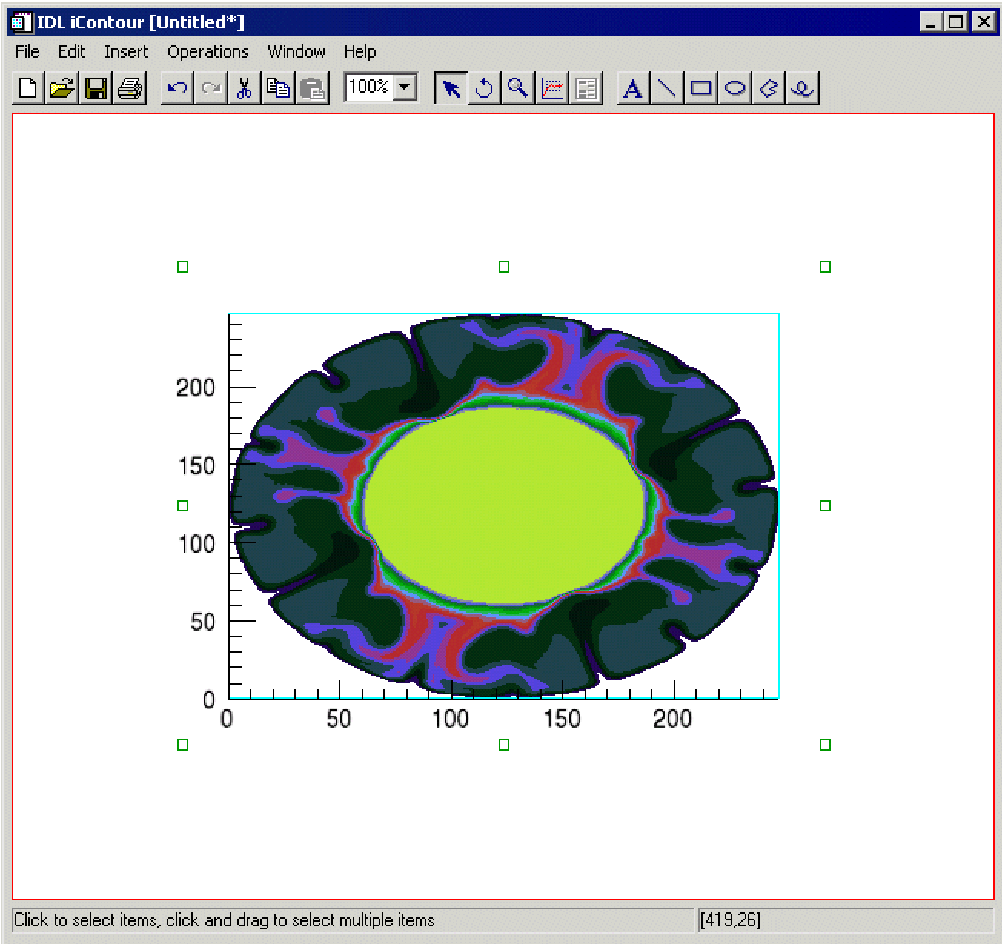


Figure 6-13: 20 Filled Contour Levels Reset at 20 Levels

Adding a Colorbar

You can add a colorbar to your visualized contour which will show on a color scale the minimum to maximum values of data in the visualization. To add a colorbar, click on the contour data and then from the iContour window, select **Insert** → **Colorbar**. A colorbar will be placed in the visualization window.

Note

Be sure that the **Use palette color** setting in the Visualization Browser is `True` so that colors can be used. After that, you can choose or set your own color scheme from the **Levels Color Table** → **Edit color table** function.

This colorbar can be resized and moved around the data space. You can also double-click on the colorbar to invoke the Visualization Browser which will allow you to change the values for the colorbar and edit color tables. For more information on the colorbar, see "Colorbar" in Appendix D, *Visualization Properties*.

Adding a Legend

You can add a legend to your contour which shows the levels of the contour in their increments. To add a legend, select **Insert** → **Legend** from the iContour tool window.

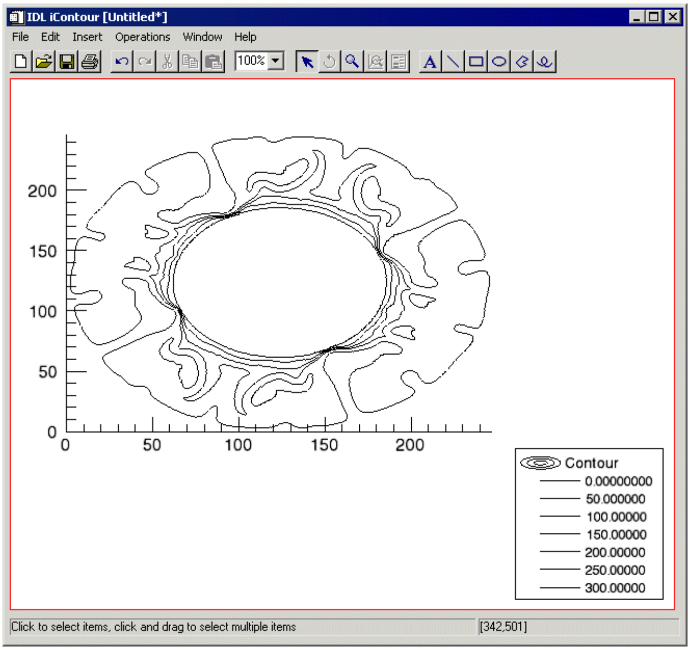


Figure 6-14: A Contour With Legend Added Showing Levels

Once you have placed a legend on your contour can edit the legend settings such as the title and level increments as well as the color options on the legend. Double-clicking on the legend itself will show you the Visualization Browser. For more information on the options available, see “Legend Properties” in Appendix D, *Visualization Properties*.

Adding Axes

You can also add axes to your contour as visual aids for reading contour data. Although axes are added to two-and three dimensional contour data there are advantages to adding additional axes. For example in the figure which follows, additional axes have been added in order to create a box-style contour showing the tick marks and increments on all sides of the image. You can add X, Y and Z axes depending on your contour and needs. To insert axes, select **Insert** → **Axis** and then select **X Axis**, **Y Axis**, or **Z Axis** or from the Visualization Browser, select the **Axes** group and then set **Style** to **Box Axes**.

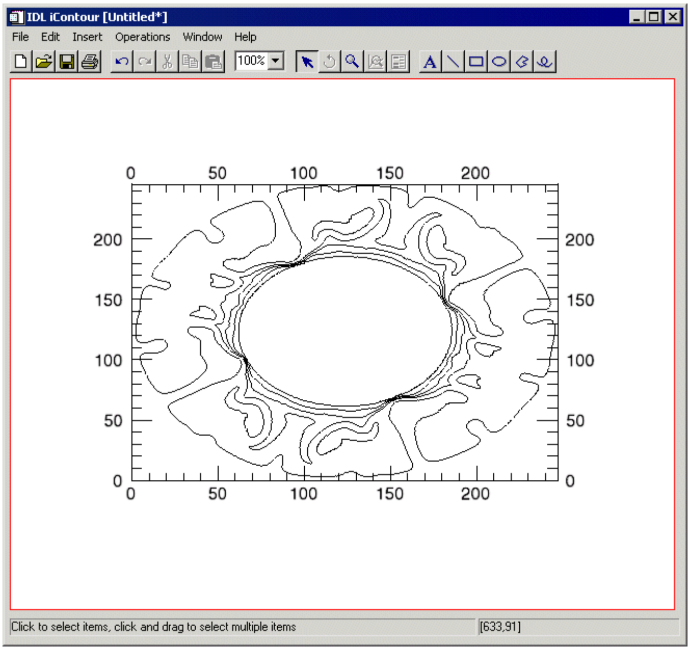


Figure 6-15: A Contour With Axes Added and Altered in Box-Style

Once you have placed an axis on your contour you can edit the axis settings by changing the title and increments as well as the color options on the axis. Double-clicking on the axis itself will show you the Visualization Browser.

Filtering a Contour

The iContour tool allows you to modify your contour data in the following ways:

Contour Smoothing

Within the iContour tool, contours can also be smoothed to refine edges or compensate for random noise in the data. To smooth your data from the iContour window, select **Operations** → **Filter** → **Smooth**

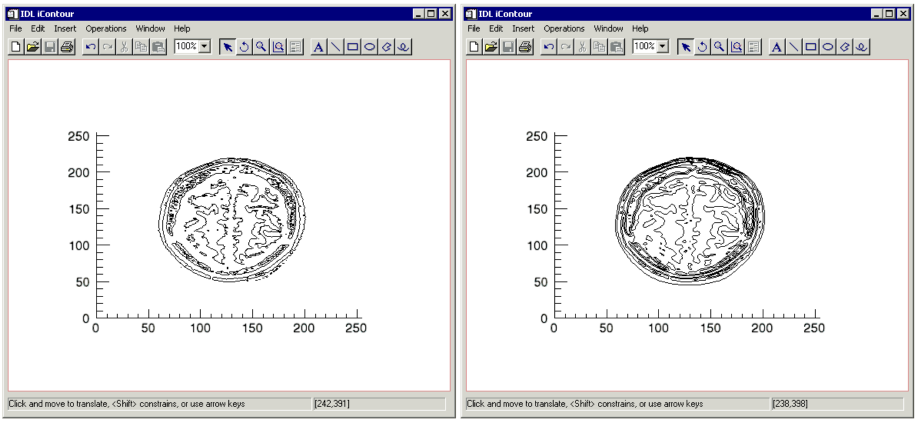


Figure 6-16: Brain MRI Data (left) and Smoothed Data (right)

Note

The previous figure shows brain MRI data taken from the IDL `examples\data` directory in a file named `mr_brian.dcm`.

Note

The window's default size is three, however this can be changed via the operations browser. For more information on smoothing properties, see "Smooth Properties" in Appendix C, *"Operations Properties"*.

Contour Convolution

You can also use iContour convolution feature by selecting **Operations** → **Filter** → **Convolution**. By selecting this, the **Convolution Editor** appears:

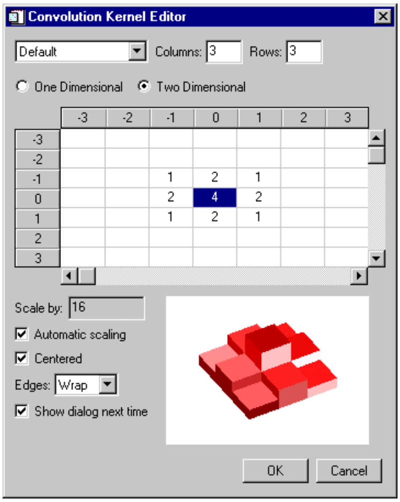


Figure 6-17: Default Convolution Editor Dialog

From this dialog, you can select the desired convolution type from a drop-down list or you may manipulate the columns and rows and scale factor and details manually.

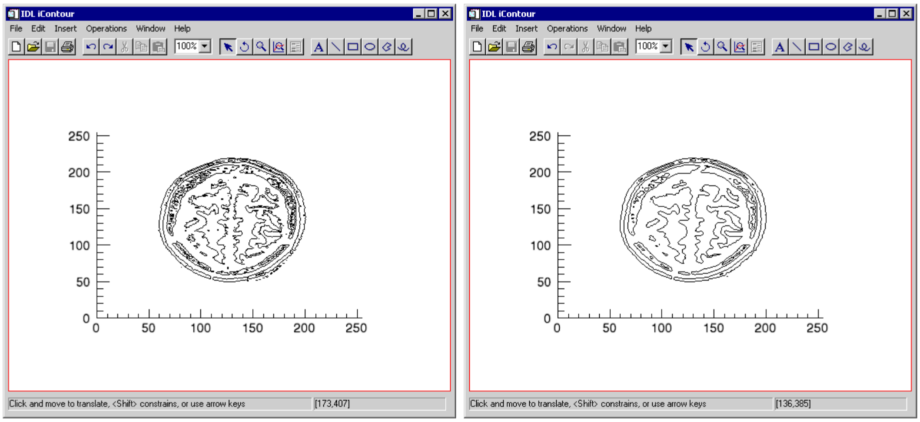


Figure 6-18: Brain MRI Data (left) and Convolved (right) Using the Default Gaussian Convolution

For more information on convolution properties, see *"Convolution Properties"* in Appendix C, *"Operations Properties"*.

Manipulating the Contour Display

The iContour tool allows you many options to manipulate your existing plot displays. Once you have visualized your contours, you may rotate, flip, translate, scale, and zoom as well as modify contour properties, scroll, and select contour ROIs. The following options are available for manipulating contours.

Translating

Translation moves an object or group of objects in a specific direction. When an object is selected, a bounding box appears around the object. For information on translating objects, see “Common Manipulation Tasks” in Chapter 3, “*iTool Common Tasks*”.

View Zoom

View Zoom allows you to zoom in or out on a specific area of the contour display area. To zoom in or out in View Zoom mode click Zoom  on the toolbar. For more information on working with View Zoom, see “Common Manipulation Tasks” in Chapter 3, “*iTool Common Tasks*”.

Flipping a Contour

You can flip your contour within the data space either horizontally or vertically. These operations flip the actual data associated with the contour. To flip your data, select **Operations** → **Flip** → **Flip Horizontal** or **Operations** → **Flip** → **Flip Vertical**.

Canvas Zoom

Canvas Zoom allows you to increase or decrease the magnification of the entire display canvas (which may contain multiple views, depending on the layout) by a specified percentage. Canvas Zoom is available by selecting the pull-down percentage list from the top of the tool just under the Help menu. For more information on working with Canvas Zoom, see “Common Manipulation Tasks” in Chapter 3, “*iTool Common Tasks*”.

Scaling a Contour Display

The iContour tool allows you to scale your contour data by selecting **Operations** → **Transform** → **Scale Data**. You can scale your data by a factor which you provide in the **Scale Factor** dialog.

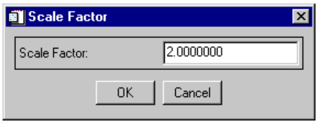


Figure 6-19: Setting the Contour Scale Factor

Once you have set the scale factor, select **OK** and the scaling takes place.

You may zoom in and out from your plot using either the Zoom In and Zoom Out buttons on the iPlot toolbar, or by selecting **Window** → **Zoom** In or **Window** → **Zoom Out**.

Adding Annotations

The following types of annotations can be added to iContour displays:

Plot Annotation Type	Description
Text	Single lines or multiple lines of text can be added to a visualization to provide a label or description.
Line	Straight line annotations can be added to a visualization to link labels to objects or to identify an object.
Rectangle	Rectangular annotations can be added to a visualization to identify rectangular areas.
Oval	Oval annotations can be added to a visualization to identify oval areas.

Table 6-1: Types of Contour Annotations

Plot Annotation Type	Description
Polygon	Polygon annotations can be added to a visualization to identify areas bounded by a polygon.
Freehand	Freehand annotations can be added to a visualization to identify an area.

Table 6-1: Types of Contour Annotations

For more information on creating and using annotations, see "Annotations" in Chapter 3, "*iTool Common Tasks*".

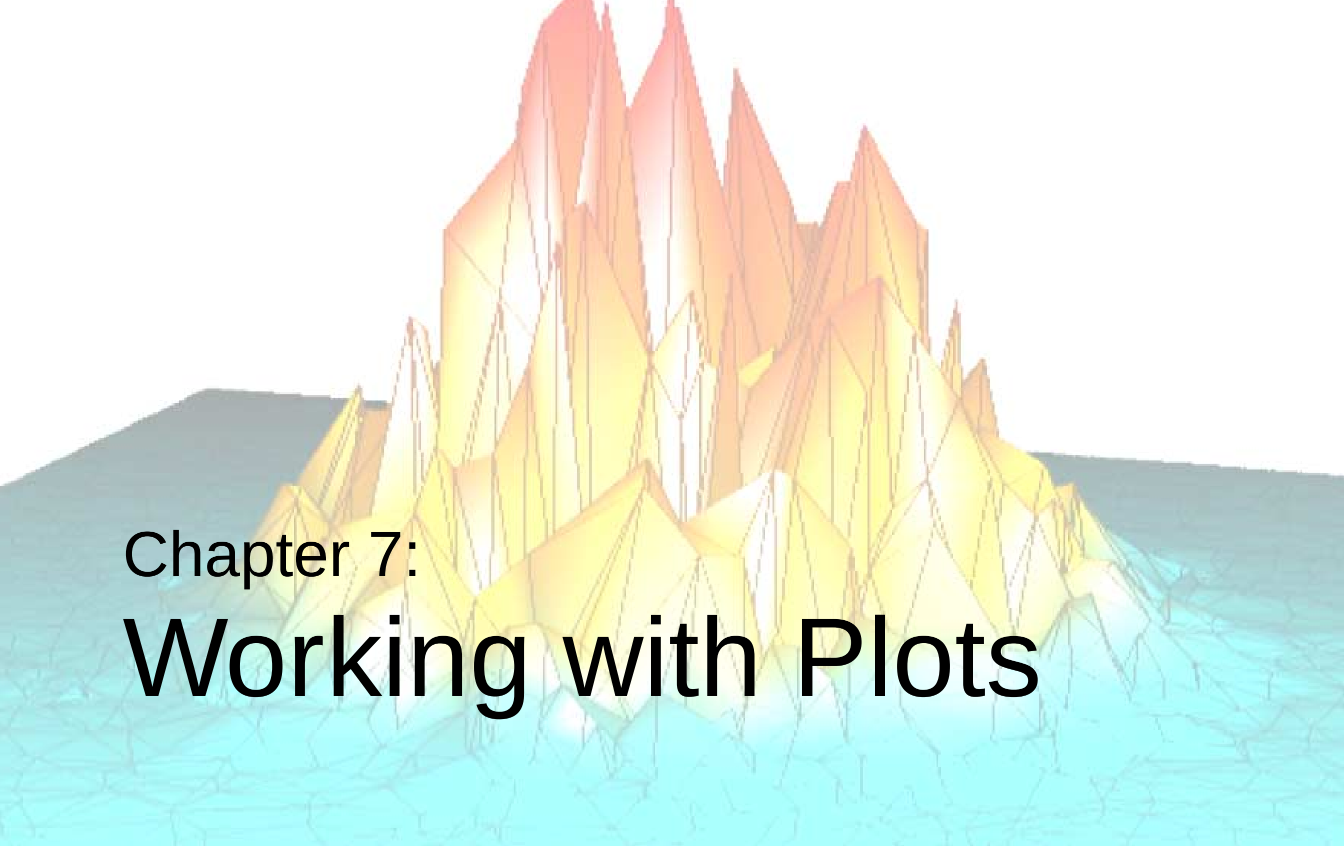
iContour Tool Operations

Viewing a Histogram

A density histogram is a density plot showing the distribution of data values. The X-axis represents data values and the Y-axis represents density or frequency. Another type of histogram is a style plot histogram. To view a density histogram of contour data, use the iTool's histogram feature by selecting **Operations** → **Histogram**. For information on histogram creation, see "Plotting a Histogram" in Chapter 3, *iTool Common Tasks*.

Viewing Statistics

To view statistics for contour data, use the iTool's statistics feature by selecting **Operations** → **Statistics**. For information on viewing statistics, see "Displaying Statistics" in Chapter 3, *iTool Common Tasks*.



Chapter 7: Working with Plots

This chapter describes plotting tasks and the iPlot tool.

Introduction

The IDL iPlot tool displays your data in plot form. The iPlot tool then allows you great flexibility in manipulating and visualizing plot data. iPlot can be used for any type of two- or three-dimensional plot, including scatter plots, line plots, polar plots, and histogram plots. To use iPlot, from the IDL Command Line, type `iPlot`. An empty iPlot tool appears. You can then import plot data using any of several data import methods. For more information importing plot data see Chapter 2, “Importing and Exporting Data”.

Note

For more information on accepted arguments, see “IPLOT” in the *IDL Reference Guide* manual.

The iPlot tool can be launched in many different ways:

- At the IDL Command Line without arguments or keywords
- At the IDL Command Line with arguments or keywords
- Through the **File** → **New** → **Visualization** → **iPlot** menu option in the IDL Development Environment
- Through the **File** → **New** → **iPlot** menu option in an iTool

Displaying Two-Dimensional Plots

The iPlot tool's primary design is to display plot data, though the tool is capable of much more once the data is plotted. The iPlot tool can display multiple types of plots and allows you to manipulate and edit the displays.

The first task is to display plot data. Here is a simple example of how to display a plot.

At the IDL command line, enter:

```
iPlot, RANDOMU(seed, 20)
```

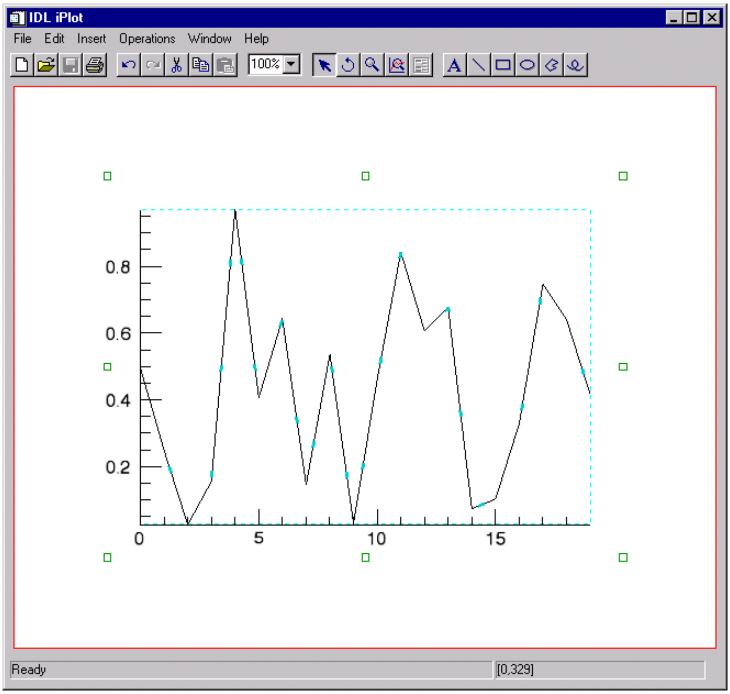


Figure 7-1: A Simple 2D Plot Using the iPlot Tool

Note

The `examples/data` directory of your IDL 6.0 distribution contains a text file named `index.txt`. This file lists all data files available in the example directory and also lists their dimensions and values.

Displaying Three-Dimensional Plots

iPlot can display multiple types of plots and allows you to manipulate and edit the displays. You can also display three-dimensional plots. Here is a simple example of how to display a 3D plot.

At the IDL command line, enter:

```
iPlot, FINDGEN(20), FINDGEN(20), RANDOMU(seed, 20)
```

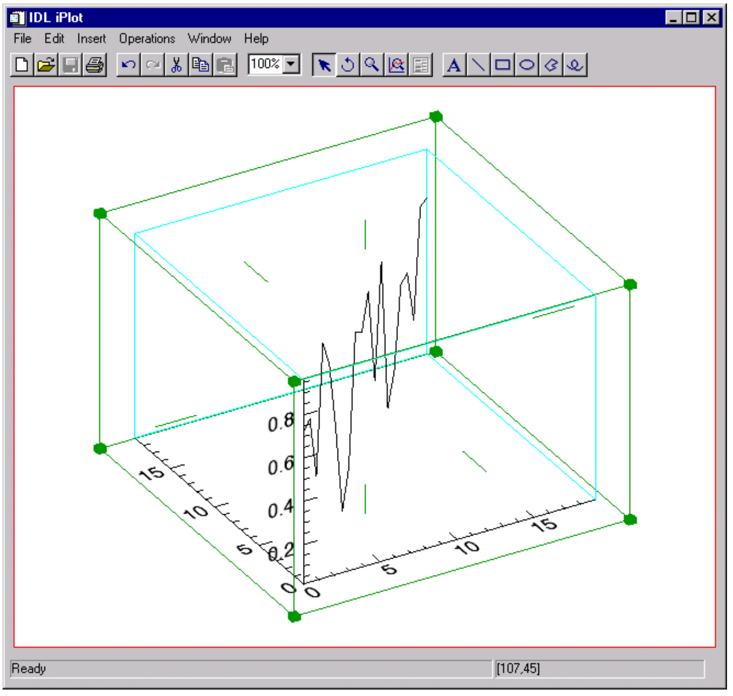


Figure 7-2: A Simple 3D Plot Using the iPlot Tool

Displaying Polar Plots

iPlot can display multiple types of plots and allows you to manipulate and edit the displays. You can also display polar plots. Here is a simple example of how to display a polar plot.

At the IDL command line, enter:

```
iPlot, FINDGEN(20), FINDGEN(20), /POLAR
```

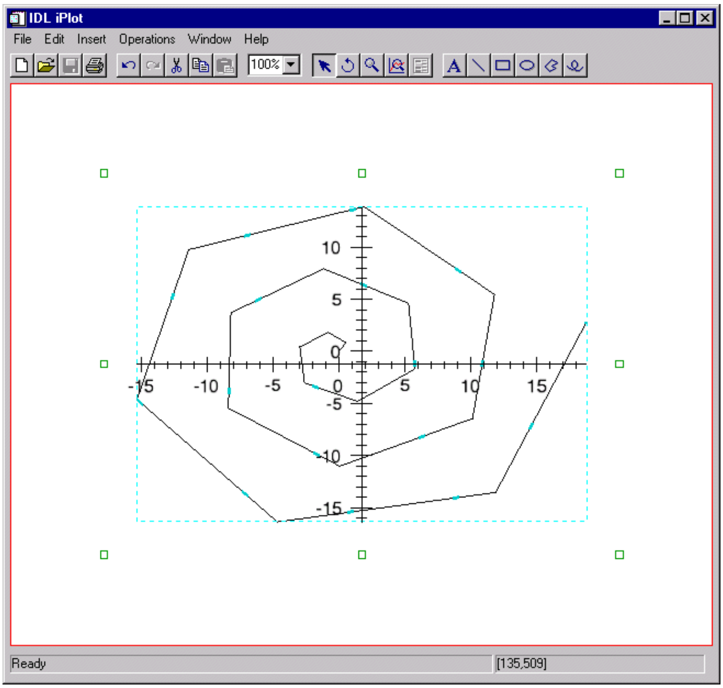


Figure 7-3: A Simple Polar Plot Using the iPlot Tool

Note

The `examples/data` directory of your IDL 6.0 distribution contains a text file named `index.txt`. This file lists all data files available in the example directory and also lists their dimensions and values.

Overplotting

Once you have plotted data, you may overplot new plot data in the original iPlot window. Overplotting is the process of plotting new data over the top of original data or datasets for the purpose of analyzing or comparing more than one dataset at a time.

For example, in order to overplot cosine data onto a plot of sine wave data follow these steps:

1. Create a variable named “theory” to contain sine wave data to be plotted:

```
theory = SIN(2.0*FINDGEN(200)*!PI/25.0)*EXP(-0.02*FINDGEN(200))
```

2. Plot theory using iPlot:

```
iPlot, theory
```

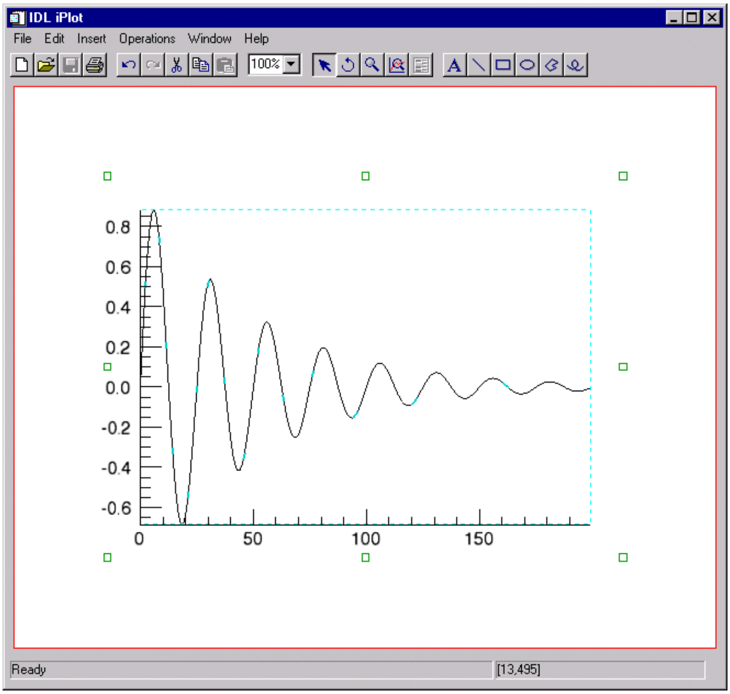


Figure 7-4: Sin Wave Data Plotted

3. Create a variable named “newtheory” which stores cosine data to be used for overplotting:

```
newtheory = COS(2.0*FINDGEN(200)*!PI/25.0)*EXP(-0.02*FINDGEN(200))
```

4. Now overplot the new cosine data onto your original plot:

```
iPlot, newtheory, /OVERPLOT
```

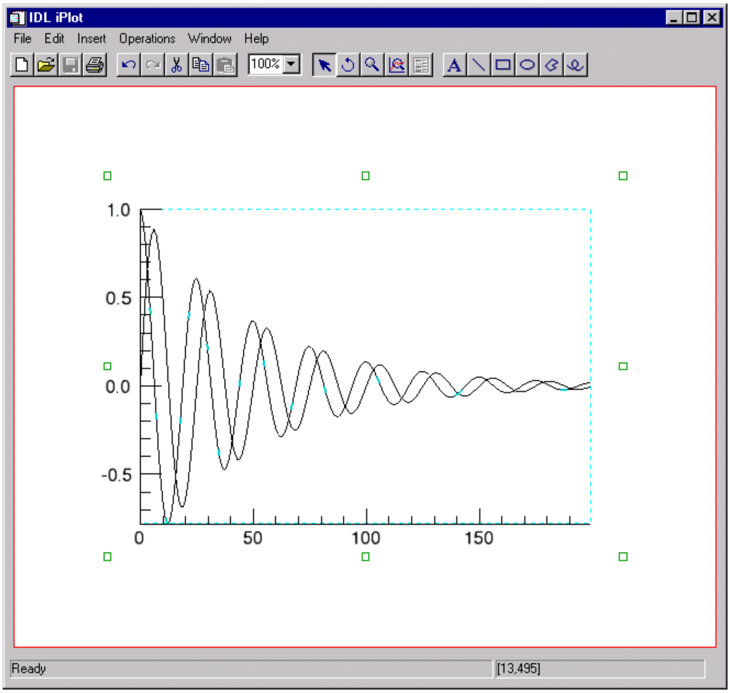


Figure 7-5: Cosine Data Overplotted on Sine Data

Plot Properties

The iPlot window is a self-contained plot display and manipulation device. You can import and export plot data, and modify and manipulate plot data. For more information on the basic iPlot interface and its layout, see Appendix A, “iTools Interface Reference”.

Modifying Properties

By selecting **Edit** → **Properties** from the iPlot tool, you may modify your plot properties. You may modify your plot’s name, description, fill type and fill color, opacity as well as the show/hide properties and the line color, style and thickness. For more information on editing properties in the iTools, see Appendix D, “Visualization Properties”.

Adding Legends

A legend is text that describes aspects of a visualization. For example, a legend might show the plot line or plot points. If multiple plots are present the legend may show which colors and linestyles represent which plots. An inserted legend will include items selected at the time of insertion. If no specific dataset is selected, the legend will include all datasets in the plot.

To add a legend to your plot, select **Insert** → **Legend**.

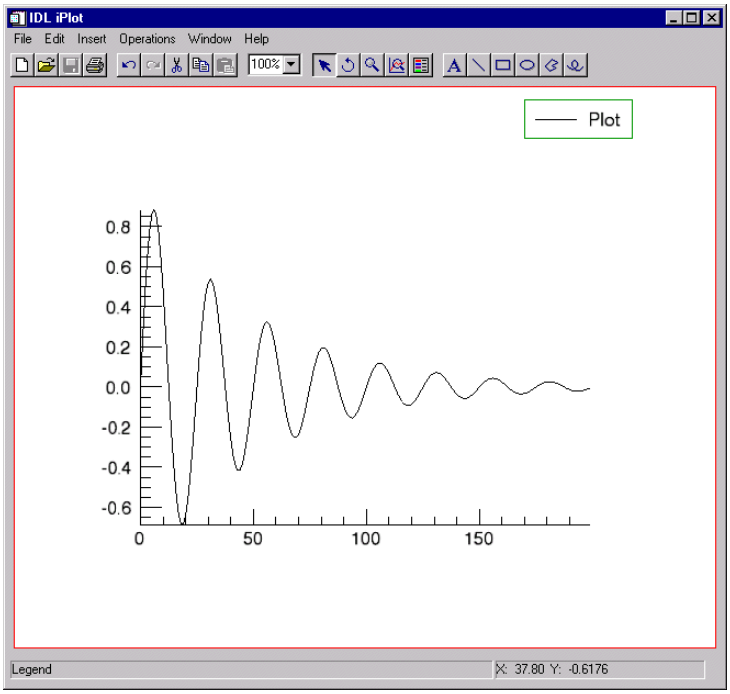


Figure 7-6: A Simple Sine Plot with Default Legend Added

You can add new information to your existing legend or you can also use the **Insert** → **Legend** option can be used over again to add more legends. For example, in the `theory` plot with `newtheory` overplot displayed in the previous section, you can add a legend for each plot:

1. Select the `newtheory` plot by clicking once on the line.

2. Select **Insert** → **Legend**. A new legend appears on top of the previous legend (this new legend can be selected and repositioned).

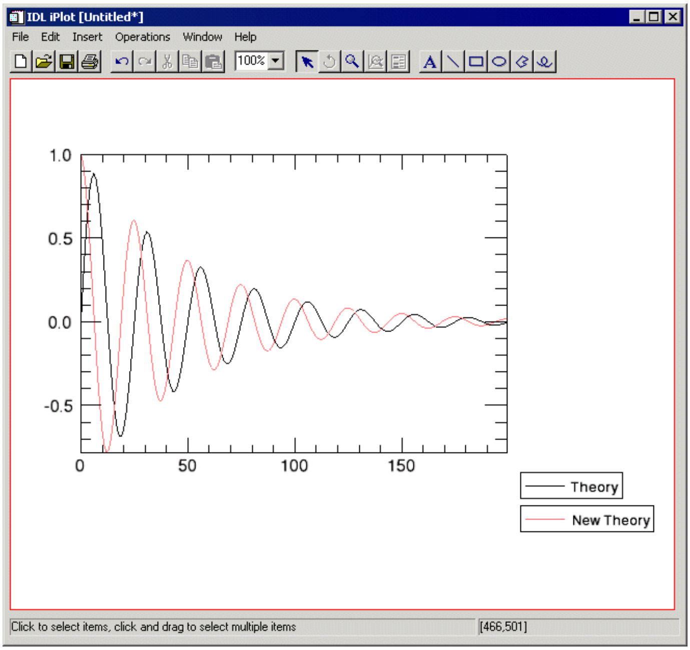


Figure 7-7: Plot and Overplot in iPlot with Legend Added for Each

You can double-click on the legend to bring up a property sheet to alter its settings. Through the property sheet, you can also access the Visualization Browser, which can be used to navigate through other legends and objects within the visualization. In the previous example the names of the legends have been altered to reflect the data names. For more information editing settings in the Visualization Browsers, see "The Visualization Browser" in Appendix D, *"Visualization Properties"*.

Adding a Colorbar

You can add a colorbar to your visualized plot which will show on a color scale the minimum to maximum values of data in the visualization. To add a colorbar, first double-click on the plot to bring up the Visualization Browser. Then set the vertex coloring to `True`. Now you can click on the plot data and then from the iPlot window, select **Insert** → **Colorbar**. A colorbar will be placed in the visualization window. This colorbar can be resized and moved around the data space. You can also double-click on the colorbar to invoke the Visualization Browser which will allow you to change the values for the colorbar. For more information on the colorbar, see "Colorbar" in Appendix D, *Visualization Properties*.

Adding Error Bars

Error bars are used to show uncertainty in data values. These uncertainties may be caused by measurement errors or instrument noise, and are usually specified in terms of standard deviations away from the data value.

For example, to create a 2D plot with asymmetric error bars on the X and Y axes, follow these steps:

1. To set asymmetric error bars for X and Y with X bars initially hidden, enter:

```
err = FLTARR(2,10)
err[0, *] = FINDGEN(10)/10.
err[1, *] = FLTARR(10) + 0.5
```

2. Plot the error bars in the iPlot window:

```
iPlot, FINDGEN(10), COLOR = [255, 0, 255],$
   ERRORBAR_COLOR = [255, 0, 0], $
   ERRORBAR_CAPSIZE = 0.25, X_ERRORBARS = 0, $
   XERROR = err, YERROR = err
```

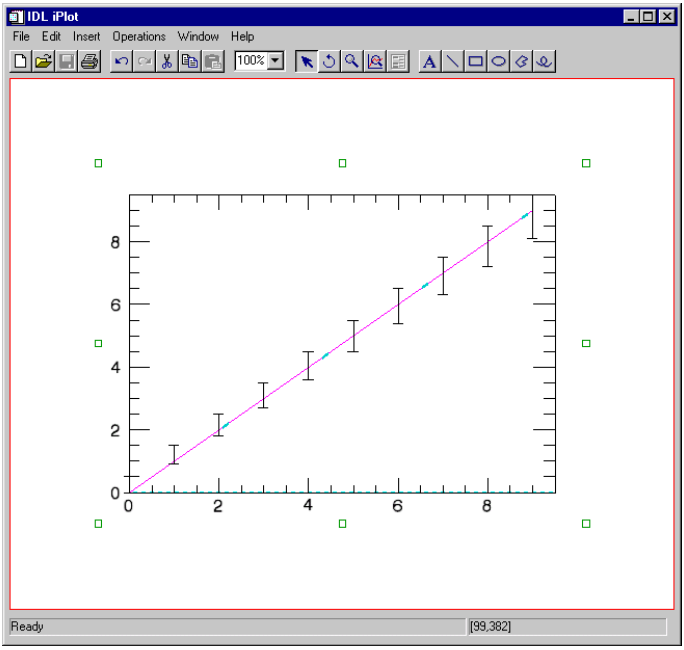


Figure 7-8: 2D Plot with Error Bars

Also, to create a 3D plot with asymmetric error bars on the X, Y and Z axes:

1. To set asymmetric error bars for a 3D plot, enter:

```
nVerts = 30
x = FINDGEN(nVerts)/10.
y = (SIN(x*2) + 1.)*25.
z = x
err = FLTARR(2, nVerts)
err[0, *] = RANDOMU(seed, nVerts)
err[1, *] = RANDOMU(seed, nVerts)
```

2. Plot the error bars in the iPlot window with 3D plot and name the plot “3D Plot with Error Bars”:

```
iPlot, x, y, z, COLOR = [0, 0, 255], $
   THICK = 2, ERRORBAR_COLOR = [255, 0, 0], $
   XERROR = err/2., YERROR = err*5., ZERROR = err, $
   NAME = '3D Plot with Error Bars'
```

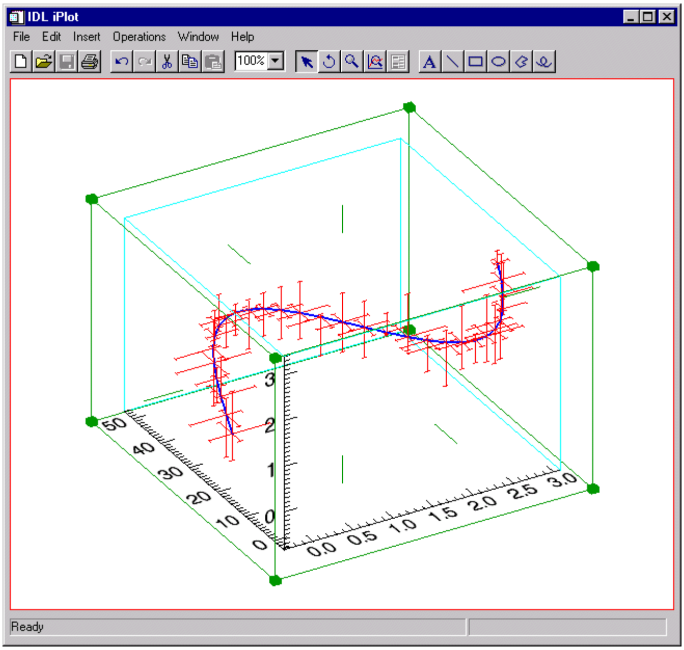


Figure 7-9: 3D Plot with Error Bars and Name

For more information on error bar properties, see “Plot” in Appendix D, *“Visualization Properties”*.

Curve Fitting

Curve fitting is the process of finding various ways to fit a curve to a series of data points which best represents all points. More specifically, since data, such as plot data, is often given as values along a continuum, you may wish at times to give estimates at points between values. Curve fitting allows you to find intermediate estimates for these values.

For example, to fit a curve to the damped sine plot we have already created:

1. Select **Operations** → **Filter** → **Curve Fitting.**
2. The Curve Fitting dialog appears.

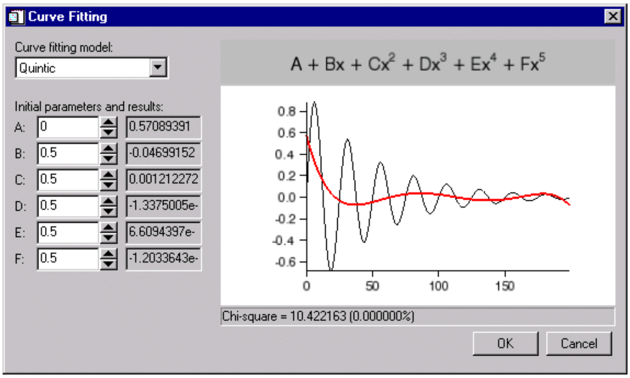


Figure 7-10: The Curve Fit Dialog with Curve Fitting Model Choices

The Curve Fitting dialog contains the following fields:

- **Curve fitting model -** used to select the type of model used to try to fit a curve to the data.
- **Initial parameters and results -** used to specify the initial values of the parameters of the model used to fit a curve to the data and to display the resulting values of these parameters for the model selected in the **Curve fitting model** drop-down list. The initial values are specified in the text boxes on the left side and the results are shown in the labels on the right side.
- Equation of the model - shows the equation of the model used to try to fit a curve to the data. This model is selected from the **Curve fitting model**.

- Display of resulting fit - graphically shows how well the model specified by the **Curve fitting model** drop-down menu and the **Initial parameters** text boxes fits the data.
- Chi-square value - shows the resulting chi-square value, which is a measure of goodness-of-fit.

You can use this dialog to determine what type of model would best fit your data by changing the **Curve fitting model** drop-down menu setting and the **Initial parameters** text boxes values.

3. Select the desired curve fit from the **Curve fitting model** drop-down list. You can also set initial parameters if desired.

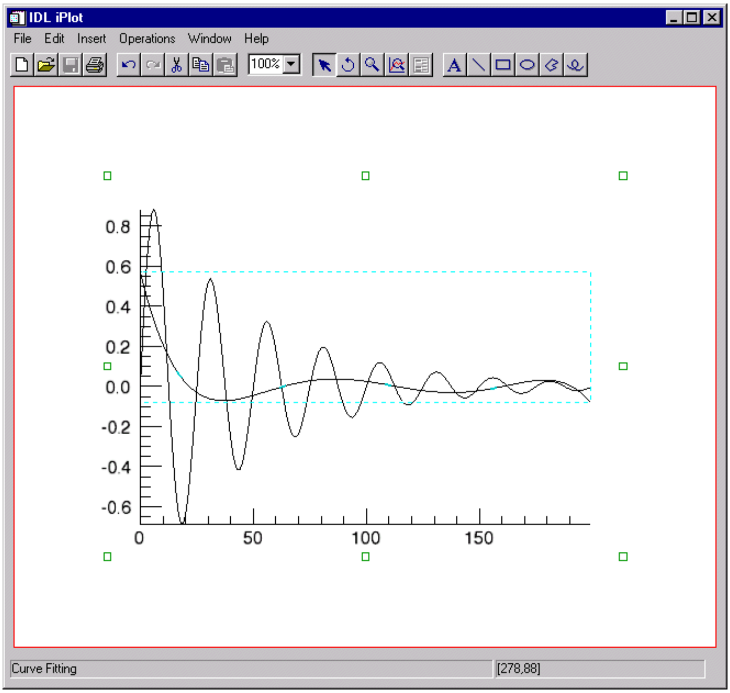


Figure 7-11: A Quintic Curve Fit to a Sin Wave Plot

The new curve created by the curve fitting operation is added to the Data Manager.

Filtering a Plot

The iPlot tool allows you to modify your plot data in the following ways:

Plot Smoothing

Within the iPlot tool, plots can also be smoothed to soften edges or compensate for random noise in the plot. To smooth your plot from the iPlot window, select **Operations → Filter → Smooth**

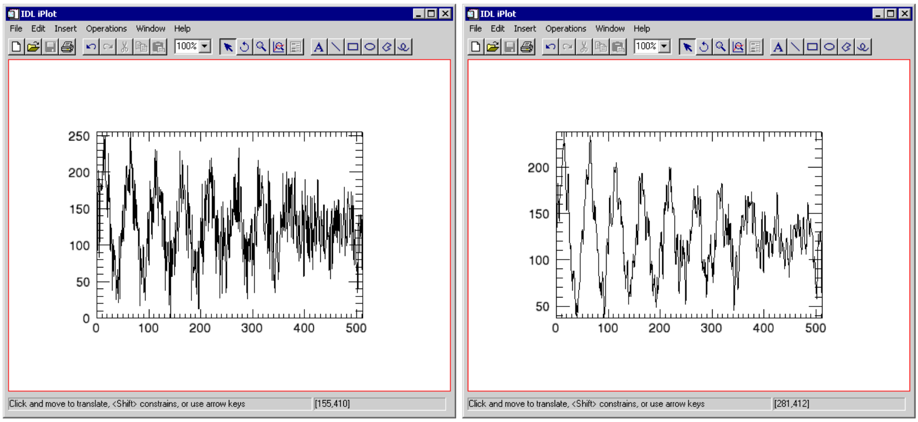


Figure 7-12: Damped Sine Plotted Data (left) and Smoothed Data (right)

Note

The example shown in the previous figures is taken from example data available in the `examples\data` directory of your IDL installation. The data is contained in a file called `damp_sn.dat`.

Note

The window's default size is three, however this can be changed via the operations browser. For more information on smoothing properties, see "Smooth Properties" in Appendix C, *"Operations Properties"*.

Plot Convolution

You can also use iPlots convolution feature by selecting **Operations** → **Filter** → **Convolution**. By selecting this, the **Convolution Editor** appears:

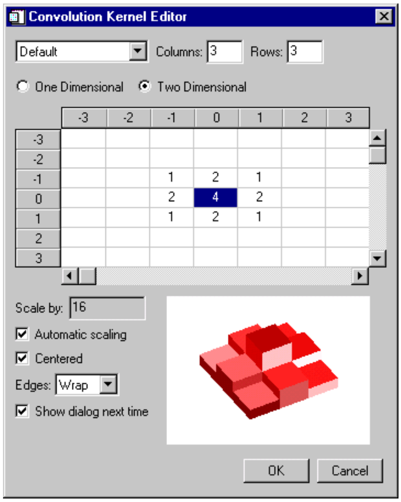


Figure 7-13: Default Convolution Editor Dialog

From this dialog, you can select the desired convolution type from a drop-down list or you can manually manipulate the columns, rows, scale factor, and details.

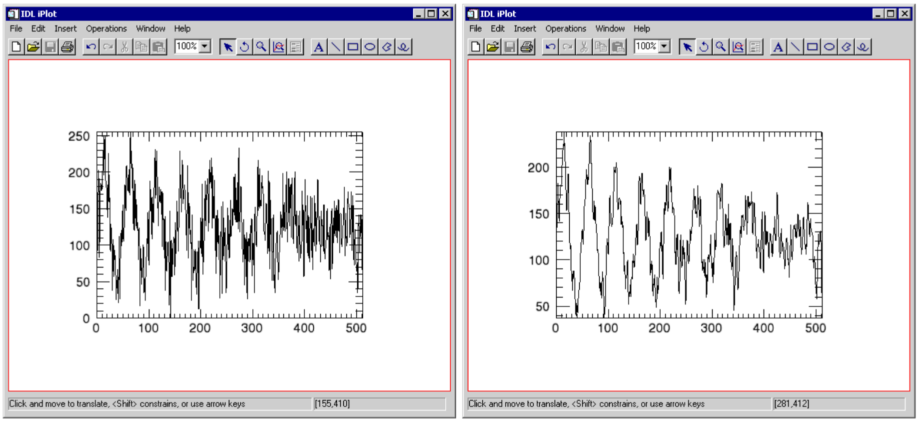


Figure 7-14: Sine Wave Plotted (left) and Convolved (right) Using Line Vertical Convolution

For more information on convolution properties, see *"Convolution Properties"* in Appendix C, *"Operations Properties"*.

Plot Median

The median filter replaces each point with the *median* (a value in an ordered set of values with an equal number of values above and below it) of the one- or two-dimensional neighborhood of a given width.

To apply the smooth filter to an image:

1. Select the plot.
2. Select **Operations** → **Filter** → **Median**.

For more details on the median filter, see "Median Filter" on page 71 in Chapter 3, *iTool Common Tasks*.

Manipulating the Plot Display

The iPlot tool allows you many options to manipulate your existing plot displays. Once you have visualized your plot data, you may rotate, flip, translate, scale, and zoom as well as modify plot properties, scroll, and select plot ROIs. The following options are available for manipulating plots.

Translating

Translation moves an object or group of objects in a specific direction. When an object is selected, a bounding box appears around the object. For information on translating objects, see "Common Manipulation Tasks" in Chapter 3, *"iTool Common Tasks"*.

Adding Annotations

The following types of annotations can be added to iPlot displays:

Plot Annotation Type	Description
Text	Single lines or multiple lines of text can be added to a visualization to provide a label or description.
Line	Straight line annotations can be added to a visualization to link labels to objects or to identify an object.
Rectangle	Rectangular annotations can be added to a visualization to identify rectangular areas.
Oval	Oval annotations can be added to a visualization to identify elliptical areas.
Polygon	Polygon annotations can be added to a visualization to identify areas bounded by a multi-sided polygon.
Freehand	Freehand annotations can be added to a visualization to identify an area.

Table 7-1: Types of Plot Annotations

For more information on creating and using annotations, see "Annotations" in Chapter 3, "*iTool Common Tasks*".

View Zoom

View Zoom allows you to zoom in or out on a specific area of the plot display area. To zoom in or out in View Zoom mode click Zoom on the toolbar. For more information on working with View Zoom, see "Common Manipulation Tasks" in Chapter 3, "*iTool Common Tasks*".

Canvas Zoom

Canvas Zoom allows you to increase or decrease the magnification of the entire display canvas (which may contain multiple views, depending on the layout) by a specified percentage. Canvas Zoom is available by selecting the pull-down percentage list from the top of the tool just under the Help menu. For more information on working with Canvas Zoom, see "Common Manipulation Tasks" in Chapter 3, "*iTool Common Tasks*".

Selecting the Data Range

In a two-dimensional plot, your data range can be manipulated in several ways. First, enter into the Data Range tool mode by clicking on the Data Range button on the toolbar. You can then manipulate your data range in the following ways:

- Clicking and dragging a selection box within the view. The selected range becomes the new data range.
- Panning in one direction or another along a single axis by clicking on the arrow manipulators.
- Zooming in or out by clicking on one of the plus or minus symbols. When isotropic scaling is in effect (the default for the iPlot tool), these symbols appear at the axis origin, and will impact both the X and Y ranges simultaneously.

Note

Plots are clipped to fit within newly selected data ranges.

iPlot Tool Operations

The iPlot tool allows you many operations for your existing plot displays. Once you have visualized your plot data, you can scale and filter as well as creating a histogram or viewing statistics for your plot. The following operations are available for plots.

Scaling a Plot Display

iPlot allows you to scale your plotted data by selecting **Operations** → **Transform** → **Scale Data**. You can scale your data by a factor which you provide in the **Scale Factor** dialog.

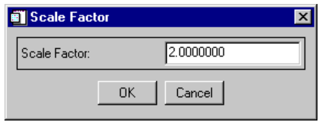


Figure 7-15: Setting the Plot Scale Factor

Once you have set the scale factor, select **OK** and the scaling takes place.

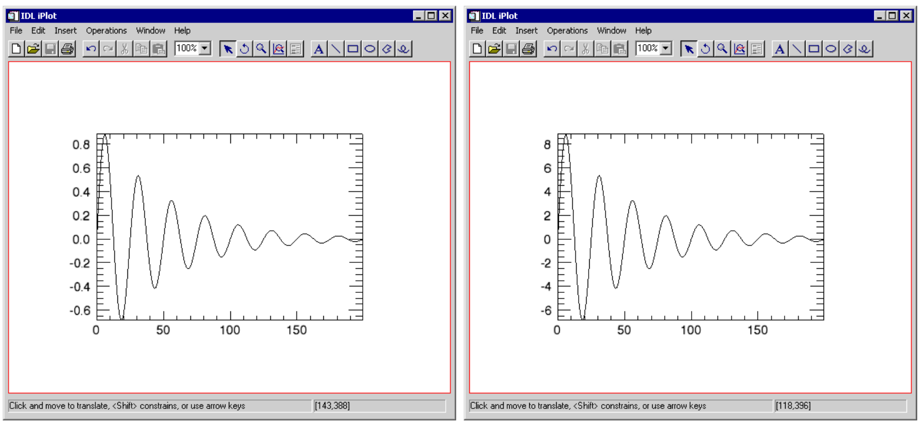


Figure 7-16: Sine Wave Plot with Scale Factor of 2 (left) and Adjusted to Scale Factor of 10 (right)

Viewing a Histogram

A density histogram is a plot consisting of either horizontal or vertical bars. The widths or heights of these bars represent data values. Another type of histogram is a style plot histogram which plots different data sets side-by-side using differently styled points or bars to represent the data. To view a density histogram of plot data, use the iTool's histogram feature by selecting **Operations** → **Histogram**. For information on histogram creation, see "Plotting a Histogram" in Chapter 3, *iTool Common Tasks*.

Viewing Statistics

To view statistics for plot data, use the iTool's statistics feature by selecting **Operations** → **Statistics**. For information on viewing statistics, see "Displaying Statistics" in Chapter 3, *iTool Common Tasks*.

Chapter 8:

Working with Volumes

This chapter describes how to use the iVolume tool.

Introduction

The IDL iVolume tool displays your data in volume form. The iVolume tool then allows you great flexibility in manipulating and visualizing volume data. To use iVolume, from the IDL Command Line, type `iVolume`. An empty iVolume tool appears. You can then import volume data using any of several data import methods. For more information importing volume data see Chapter 2, "Importing and Exporting Data".

Note

For more information on accepted arguments, see "IVOLUME" in the *IDL Reference Guide* manual.

The iVolume tool can be launch in many different ways:

- At the IDL Command Line without arguments or keywords
- At the IDL Command Line with arguments or keywords
- Through the **File** → **New** → **Visualization** → **iVolume** menu option in the IDL Development Environment
- Through the **File** → **New** → **iVolume** menu option in an iTool

Note

The iVolume tool continues to be updated in IDL 6.0. This chapter will be written to accommodate additional iVolume functionality and this chapter reflects only current configuration.

Displaying Volumes

The iVolume tool's primary purpose is to visualize volume data, though the tool is capable of much more once the data is displayed. The iVolume tool also allows you to manipulate and edit the displays. The first task is to display the volume data.

Before displaying, volume data must be loaded into the tool. Here is a simple example of one way to load in some data.

At the IDL command line, enter:

```
file = FILEPATH('head.dat', $
   SUBDIRECTORY = ['examples', 'data'])
data = READ_BINARY(file, DATA_DIMS = [80, 100, 57])
IVOLUME, data
```

Note

The `examples/data` directory of your IDL 6.0 distribution contains a text file named `index.txt`. This file lists all data files available in the example directory and also lists their dimensions and values.

Multi-Channel Volumes

The data in the previous example is a single-channel volume which is volume data specified in a single parameter. This is the simplest and most common way to display volume data. The iVolume tool also supports two-channel and four-channel volume rendering. Two-channel rendering allows you to combine or blend two volume arrays together. Four-channel rendering is useful when your volume data is composed of a volume array for each of the red, green, blue, and alpha display channels. Note that the dimensions of all the volume arrays used in multi-channel volume rendering must be the same.

In the following example, the second volume array of a two-channel volume is used as a mask to cut out a portion of the volume to create a hole. With the `head.dat` data already loaded from the `examples/data` directory, a mask volume is created and displays the result:

```
mask = BYTARR(80, 100, 57)
mask[*] = 255
mask[30:50, *, 20:30] = 0
IVOLUME, data, mask
```

A rectangular hole through the middle of the head is created, making portions of the inside more visible.

The following is an example of a four-channel volume:

```
red = BYTARR(20,20,20)
green = BYTARR(20,20,20)
blue = BYTARR(20,20,20)
alpha = BYTARR(20,20,20)

red[10:*,*,*]=255
green[*,10:*,*]=255
blue[*,*,10:*]=255
alpha[*] = 128
IVOLUME, red, green, blue, alpha
```

Rendering Volumes

Volume data does not automatically appear in the tool window since volume rendering can be a time consuming operation. To render the volume, click the **Render** button on the tool. Auto-render is available but not set by default since it can slow down your iTool session if you have simultaneous operations.

Note

Volume data is only rendered if the volume dataspace is selected. Thus, if you have multiple volumes in your dataspace, auto-render must be turned on in order to render both simultaneously.

The data loaded earlier can be displayed by clicking the **Render** button.

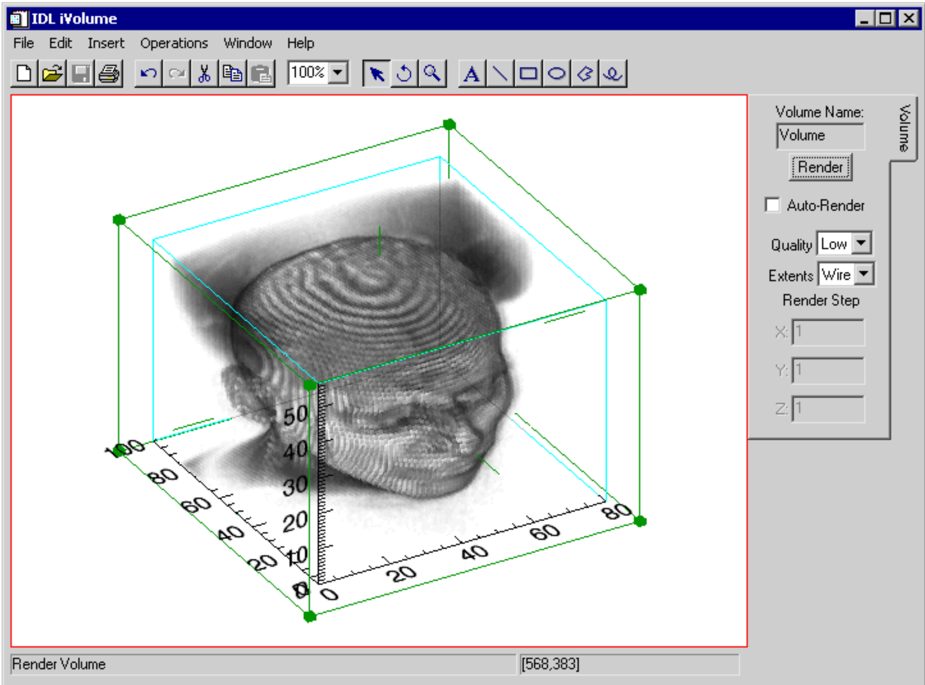


Figure 8-1: Rendered MRI Head Volume Data

Rendering Quality

The volume can be rendered in two quality modes:

- **Low** — Done with a stack of 2D texture-mapped semi-transparent polygons. The polygons are oriented so that the flat sides face the viewer as directly as possible. On most systems, Low-quality mode renders faster than High-quality mode, but not as accurately.
- **High** — Done with the IDLgrVolume ray-casting volume renderer. This quality mode is CPU-intensive and will usually take much longer than the Low-quality mode.

Extents

Since the volume is not always rendered, iVolume draws wireframe volume extents to help you locate and select the volume. You can select the volume by selecting on the extents, without rendering the volume. By default, iVolume draws a translucent solid cube with internal extents. You can also select a wire frame, or no extents within the visualization browser.

Note

Use caution when turning off extents. If extents are turned off and Auto-Render is also off, you may need to use the Visualization Browser to select the volume again.

Volume Properties

The iVolume window is a self-contained volume display and manipulation device. You can import and export volume data, and modify and manipulate volume data. For more information on the basic iVolume interface and its layout, see Appendix A, "iTools Interface Reference".

Modifying Properties

By selecting **Edit** → **Properties** from the iVolume tool, you may modify your volume properties. You may modify your volume's name, description as well as the show/hide properties and the line color, style and thickness. For more information on editing properties in the iTools, see Appendix D, "Visualization Properties".

Adding a Colorbar

You can add a colorbar to your visualized volume which will show on a color scale the minimum to maximum values of data in the visualization. To add a colorbar, click on the volume visualization and then from the iVolume window, select **Insert** → **Colorbar**. A colorbar will be placed in the visualization window. This colorbar can be resized and moved around the data space. You can also double-click on the colorbar to invoke the Visualization Browser which will allow you to change the properties for the colorbar.

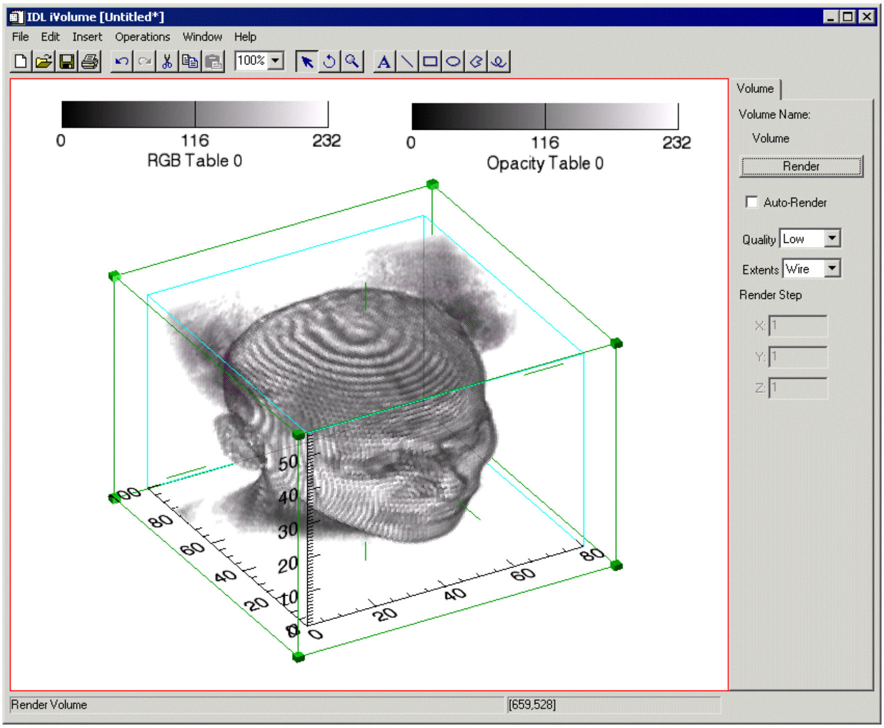


Figure 8-2: Rendered Volume with Colorbar Added

Adding Axes

By default, volumes are displayed with X, Y and Z axes. The display of these axes is controlled by property sheets for the axes container and for individual axes (see "Axes" in Appendix D). Additional X, Y or Z axes can be added to a volume visualization to make it easier to identify volume characteristics.

To add an axis to your volume visualization:

1. Select the volume.
2. Select **Insert** → **Axis**.
3. Choose from the following options:
   - **X axis**
   - **Y axis**
   - **Z axis**

Use the mouse to position the new axis, and double-click the axis to display the axis property sheet.

For more information on adding axes, see "Additional Axes" on page 81 in Chapter 3, *iTool Common Tasks*.

Resampling Volumes

Resampling re-imports the selected volume data using parameters specified in the Resample properties. Resampling parameters include factors for adjusting the X, Y, or Z dimensions of the data, as well as the interpolation method to be used.

To resample volume data:

1. Select one or more volumes in the iVolume window for resampling.
2. If necessary, use the Operations Browser to set the desired parameters through the Resample properties. See "Resample Properties" on page 258 for details.
3. Select **Operation** → **Transform** → **Resample**.

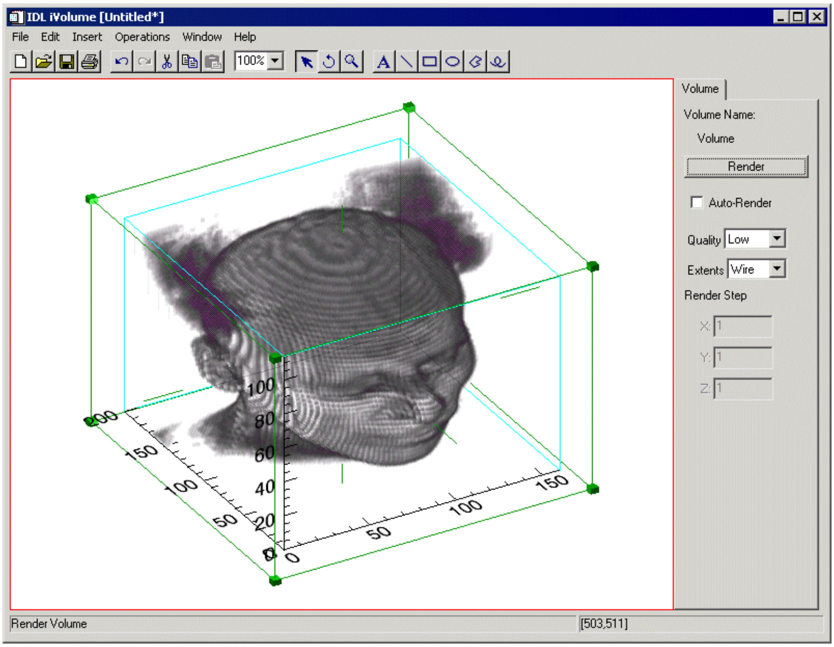


Figure 8-3: Resampled and Rendered Volume

Showing an Image Plane

An image plane is a visualization of a slice of the volume. An image plane can be dragged and rotated within the volume. To show an image plane for a portion of volume data, first be sure your volume is selected and then choose **Operations** → **Volume** → **Image Plane**. An image plane appears showing a cross-section of your volume data. You can change the orientation of an image plane by double-clicking on the image plane to bring up the property browser. You can also click on the edge of the plane and move it to various other points in the volume data.

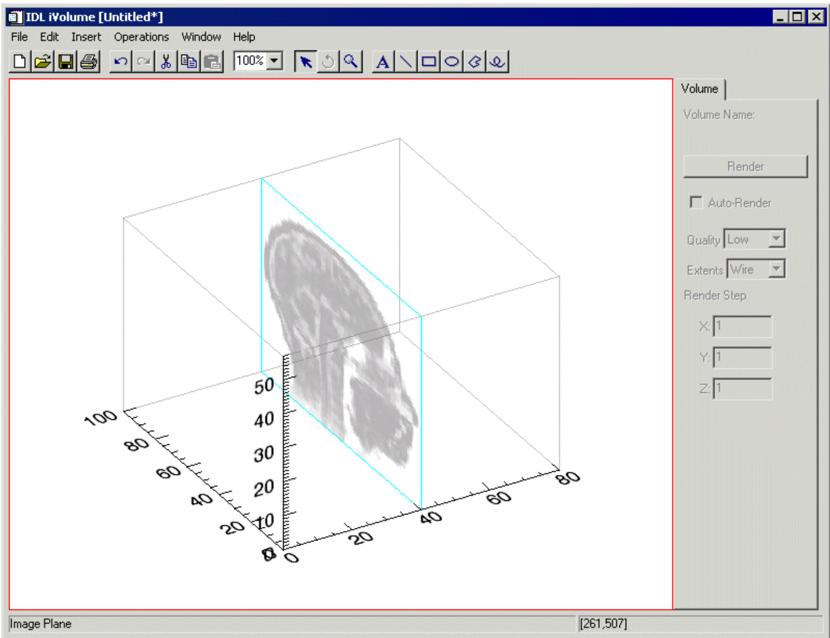


Figure 8-4: Image Plane of a Rendered Volume

Viewing the Image Plane in iImage

Image plane data is available in Data Manager and can be utilized in the iImage tool for closer image analysis. The image plane image data is always a 4-channel RGBA truecolor image. To view your image plane in iImage, from the iVolume tool select **Operations** → **Image Plane** → **Launch iImage**.

Extracting an IsoSurface

An isosurface is a set of polygons drawn in the volume to represent a surface that has a specific constant value (the isovalue). An isosurface cannot be translated, scaled, or rotated relative to the volume but does move with the volume.

To create an isosurface, select **Operations** → **Volume** → **Isosurface** and iVolume displays a dialog allowing you to specify the isovalue. If the volume is multi-channel, you can select a channel and set its isovalue.

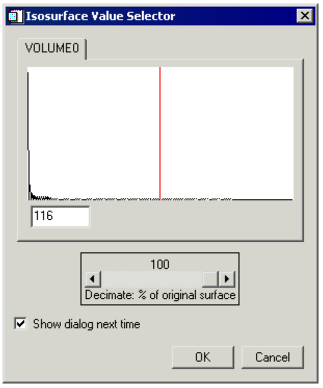


Figure 8-5: Isosurface Value Selector for iVolume

You will then create an isosurface for that channel by selecting **OK**.

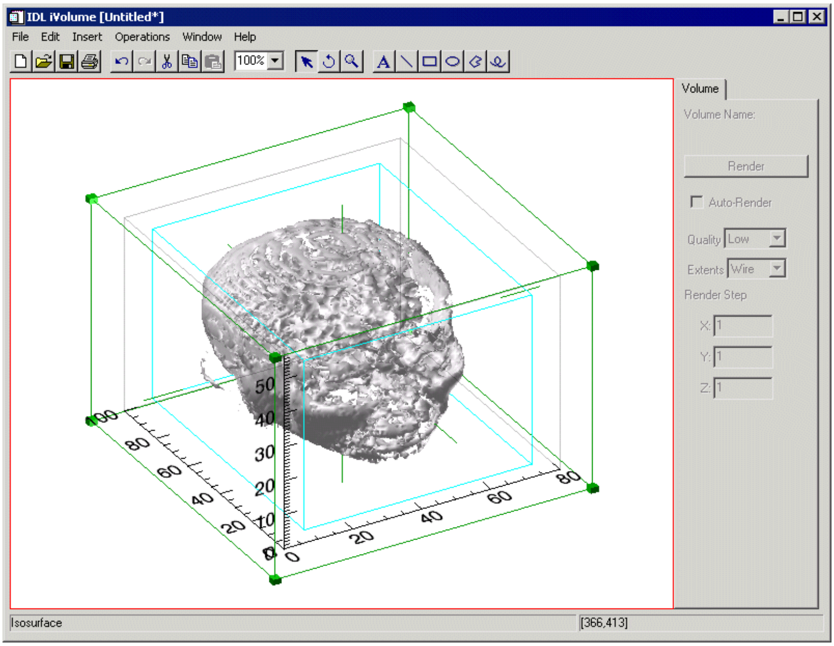


Figure 8-6: Isosurfaced Rendered Volume

Note

Isosurfaces often contain a large number of polygons, which may degrade iVolume's display performance. When selecting the isovalue, you can also specify a decimation percentage to reduce the number of polygons in the resulting isosurface. This decimation step requires additional time, but the resulting isosurface will contain fewer triangles and will draw faster.

Extracting an Interval Volume

An interval volume is a set of tetrahedra that span a space between two isovalues within a volume. Since a tetrahedral mesh is a solid, iVolume displays the outer surface of the mesh as a set of polygons. This surface cannot be translated, scaled, or rotated relative to the volume but does move with the volume.

To create an interval volume, select **Operations** → **Volume** → **Interval Volume** and a dialog appears allowing you to set two isovalues.

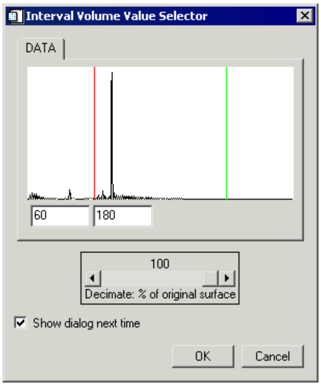


Figure 8-7: Interval Volume Value Selector for iVolume

If the volume is multi-channel, you can select a channel for setting the isovalues and then create an interval volume for that channel by selecting **OK**.

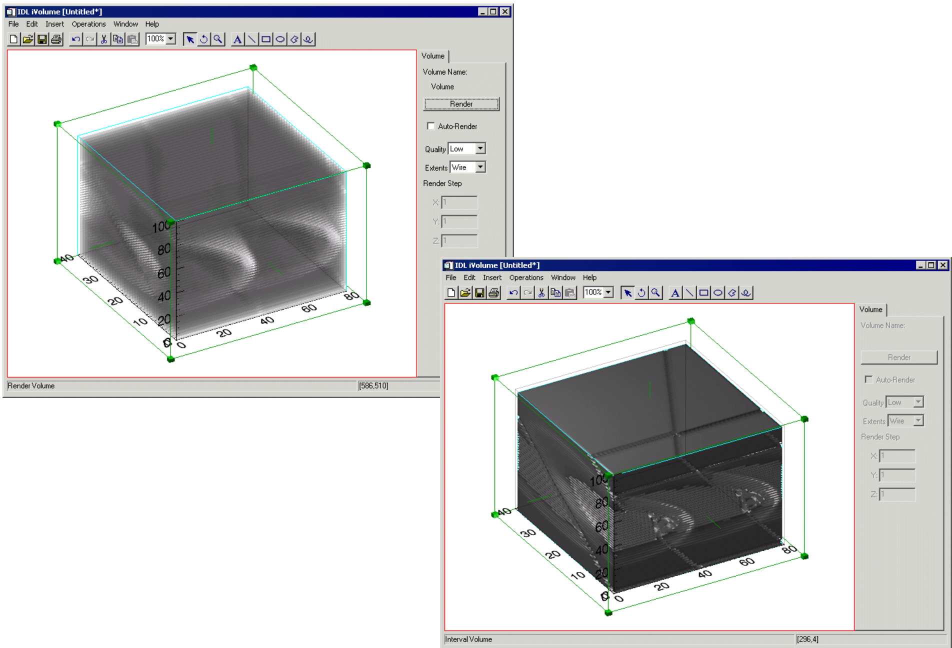


Figure 8-8: Original Volume Visualization and Interval Volume

Note

Vertex colors are not persevered during decimation.

Note

Interval volume surfaces often contain a large number of polygons. These can degrade iVolume’s display performance. When selecting isovalues, you can specify a decimation percentage to reduce the number of polygons in the resulting surface. This decimation step requires additional time, but the resulting surface will contain fewer triangles and will draw faster.

Manipulating the Volume Display

The iVolume tool allows you many options to manipulate your existing volume displays. Once you have visualized your volume data, you may rotate, translate, scroll, and zoom as well as modify volume properties. The following options are available for manipulating volumes.

Rotating a Volume

Rotating makes it possible to rotate the volume within the visualization without affecting the rest of the data space (graphical objects and axes). To rotate your volume, from the toolbar on the iVolume window, select the **Rotate** button. For more information about rotating, see "Rotate Data" on page 69 in Chapter 3, *iTool Common Tasks*.

Scaling a Volume

It is possible to scale the data within a volume by a specified scale factor. To scale your volume, select **Operations** → **Transform** → **Scale Data**. For more information on scaling data, see "Scale Data" on page 70 in Chapter 3, *iTool Common Tasks*.

View Zoom

View Zoom allows you to zoom in or out on a specific area of the volume display area. To zoom in or out in View Zoom mode click Zoom  on the toolbar. For more information on working with View Zoom, see "Common Manipulation Tasks" in Chapter 3, "*iTool Common Tasks*".

Canvas Zoom

Canvas Zoom allows you to increase or decrease the magnification of the entire display canvas (which may contain multiple views, depending on the layout) by a specified percentage. Canvas Zoom is available by selecting the pull-down percentage list from the top of the tool just under the Help menu. For more information on working with Canvas Zoom, see "Common Manipulation Tasks" in Chapter 3, "*iTool Common Tasks*".

Morphing a Volume

Mathematical morphology is a method of processing digital images on the basis of shape. Six morphing options are available for use in iVolume: dilate, erode, morph open, morph close, morph gradient, and morph tophat. For more information on morphing, see “Morphing” on page 72 in Chapter 3, *iTool Common Tasks*. To morph your image, select **Operations** → **Morph** → <*option*>.

Adding Annotations

Annotations can be added to label or describe volume visualizations displayed in the iVolume tool.

The following types of annotations can be added to iVolume displays:

Plot Annotation Type	Description
Text	Single lines or multiple lines of text can be added to a visualization to provide a label or description.
Line	Straight line annotations can be added to a visualization to link labels to objects or to identify an object.
Rectangle	Rectangular annotations can be added to a visualization to identify rectangular areas.
Oval	Oval annotations can be added to a visualization to identify circular areas.
Polygon	Polygon annotations can be added to a visualization to identify areas bounded by a multi-sided polygon.
Freehand	Freehand annotations can be added to a visualization to identify an area.

Table 8-1: Types of Volume Annotations

For more information on creating and using annotations, see “Annotations” in Chapter 3, “*iTool Common Tasks*”.

iVolume Tool Operations

The iVolume tool allows you operations for your existing volume displays. Once you have visualized your volume data, you can scale and filter as well as creating a histogram or viewing statistics for your volume. The following operations are available for volumes.

Viewing a Histogram

A density histogram is a plot consisting of either horizontal or vertical bars. The widths or heights of these bars represent data values. Another type of histogram is a style plot histogram which plots different data sets side-by-side using differently styled points or bars to represent the data. To view a density histogram of volume data, use the iTool's histogram feature by selecting **Operations** → **Histogram**. For information on histogram creation, see "Plotting a Histogram" in Chapter 3, *iTool Common Tasks*.

Viewing Statistics

To view statistics for volume data, use the iTool's statistics feature by selecting **Operations** → **Statistics**. For information on viewing statistics, see "Displaying Statistics" in Chapter 3, *iTool Common Tasks*.

Smoothing a Volume

Within the iVolume tool, plots can also be smoothed to soften edges or compensate for random noise in the volume.

To apply the smooth filter to a volume:

1. Select the volume.
2. Select **Operations** → **Filter** → **Smooth**.

Appendix A: iTools Interface Reference

This appendix describes the following common features of the IDL Intelligent Tools interface:

Introduction

The Standard IDL Intelligent Tools comprise five distinct tools: iImage, iPlot, iSurface, iContour, and iVolume. Each tool has a specific set of functions related to the type of data it is designed to use. In addition to these specific tasks, all four tools have a number of functions in common. This appendix describes those functions that all iTools have in common; for information about the functions unique to the individual iTools, refer to the chapters describing those tools.

This appendix is an overview of these menu items and toolbar buttons that are common to all iTools:

Menu Bar Items

The following menus appear on the iTool menu bar:

- File Menu
- Edit Menu
- Insert Menu
- Operations Menu
- Window Menu
- Help Menu

Toolbar Items

The following toolbars appear at the top of each iTool window:

- The File toolbar, containing the New, Open, Save, and Print buttons.
- The Edit toolbar, containing the Undo, Redo, Cut, Copy, and Paste buttons.
- The Manipulator toolbar, containing the Select, Rotate, and View Zoom buttons, as well as the Canvas Zoom drop-down list.
- The Annotation toolbar, containing the Text and line buttons as well as the Line, Rectangle, Oval, Polygon, and Freehand Region of Interest buttons.

File Menu

The File menu contains tools for creating, opening, printing and saving files, as well as tools for importing and exporting data and images. The file menu items are common to all standard iTools.

Menu Selection	Function
New	Creates a new iTool of the specified type. Options: **iImage**, **iPlot**, **iSurface**, **iContour**, **iVolume**.
Open...	Opens a file for import into the current iTool. If this is a data file, such as an image file, ASCII file, or binary file, a new data object will be created and, if applicable, a new visualization will be created.
Import...	Imports an IDL variable or file to the current iTool. See "Data Import Methods" on page 22 for details.
Export...	Exports the data from the currently-selected object to the IDL main program level, or exports the current window to an image file.
Save	Saves the state of the current iTool to a file. If the state has not been previously saved and has no filename, enter a filename.
Save As...	Prompts you to enter a filename, and then saves the state of the current iTool.
Print Preview...	Shows a preview of the visualization to print and allows you to reorient (Portrait or Landscape) as well as Center, Print, Close or change printer Setup.
Print...	Prints the entire contents of the graphics window.
Preferences...	Displays the Preferences Browser. See "The Preferences Browser" on page 87 for details.
Exit	Exits the iTool window, closing all visualizations and views within the window and removing them from memory.

Table 8-2: The File Menu

Edit Menu

The Edit menu contains tools for editing and deleting data within the tool, retracing your steps with the Undo/Redo commands, and displaying properties for selected objects. The Edit menu items are common to all standard iTools.

Menu Selection	Function
Undo	Nullifies the previous operation and restores the iTool to its state before that operation. The name of the previous operation appears after Undo. Note - Operations such as open, save, export, export variable, print, exit, and window moving and resizing cannot be undone.
Redo	Nullifies the previous Undo command and restores the iTool to its state before the Undo command was issued. Any action that can be undone can also be redone.
Cut	Deletes the selected item(s) and places a copy on the local clipboard.
Copy	Copies the selected item to the local clipboard. If a view is copied, then a bitmap copy of that view (not the entire Window) is also put on the System clipboard.
Paste	Pastes the current local clipboard contents into the selected view. If a view is pasted, it is added to the current Window layout and becomes the currently-selected view.
Paste Special	Pastes the current local clipboard contents into the selected view, and makes a reference to all contained data.
Delete	Deletes the currently-selected item(s), without putting a copy on the local or system clipboards. Deletion can be reversed with Undo.
Select All	Selects all items in the current view.
Grouping	Select **Group** to add all selected objects to a group, **Ungroup** to remove them from the group.

Table 8-3: The Edit Menu

Menu Selection	Function
Order	Change the display order of the selected object(s).Choose from these options: • **Bring to Front**: Move selected object(s) to the top display level. • **Send to Back**: Move selected object(s) to the bottom display level. • **Bring Forward**: Move selected object(s) up one display level. • **Send Backward**: Move selected object(s) down one display level.
Parameters...	Displays the Parameter Editor. See “About the Parameter Editor” on page 20 for details.
Properties...	Brings up the property sheet for the currently-selected item(s). If only the view is selected, the property sheet for the view layer is presented. Only one property sheet may be displayed at a time. If a different item or view is selected, the contents of the property sheet change to the properties of the new item or view. For grouped items, a single property sheet with the intersection of the properties is displayed. When the property values are not the same for the grouped items, those properties are set to undefined or default. Setting a property for a grouped item sets that property for all items in the group.

Table 8-3: The Edit Menu (Continued)

Insert Menu

The Insert menu contains tools for adding visualization elements to the displayed data. Contents of the Insert menu vary from iTool to iTool.

Menu Selection	Function
Visualization	Inserts a new visualization into the current window. See "Using Insert Visualization" on page 23 for details.
View	Inserts a new view into the current window. • If the window is currently locked, this menu item will be grayed out. • If the window is not locked, the new view is added to the layout in the appropriate location, depending upon the currently active layout.
Light	Inserts a new light into the current window. See "Lights" in Appendix D for details.
Axis	Inserts a new axis. Choose from these options: • X: inserts an additional X axis • Y: inserts an additional Y axis • Z: inserts an additional Z axis See "Additional Axes" on page 81 for details.
Legend	Inserts a legend for the data set or for the selected visualization(s) into the current window. See "Legends" on page 74 for details.
Colorbar	Inserts a colorbar for the selected item. Note - Only available for indexed color images.
{Additional items vary depending on the iTool selected.} For example:	
Insert Dataspace	Inserts dataspace. (useful when overplotting such as in iPlot)

Table 8-4: The Insert Menu

Operations Menu

The Operations menu contains commands for performing operations on the selected data. Contents of the Operations menu vary from iTool to iTool.

Menu Selection	Function
Operations Browser	Displays a hierarchical nested list of all tools in the menus and toolbars. See "The Operations Browser" on page 97 for details.
Statistics	Computes the statistical properties of the selected item(s), and displays the results in a separate dialog. See "Displaying Statistics" on page 105 for details.
Histogram	Displays a histogram plot of the selected data. See "Plotting a Histogram" on page 104 for details.
Filter	Choose from these options: • Smooth • Median • Convolution See "Filtering" on page 70 for details. {Additional filters vary depending on the iTool selected.}

Table 8-5: The Operations Menu

Menu Selection	Function
Morph	Choose from the following options: • **Dilate** is commonly known as “fill”, “expand”, or “grow.” It can be used to fill “holes” of a size equal to or smaller than the structuring element. • **Erode** does to the background what dilation does to the foreground. Given an image and a structuring element, erode can be used to remove islands smaller than the structuring element. • **Morph open** is simply an erosion operation followed by a dilation operation. Applying morph open more than once produces no further effect. • **Morph close** is simply a dilation operation followed by an erosion operation. Applying morph close more than once produces no further effect. • **Morph gradient** is the subtraction of an eroded version of the original image from a dilated version of the original image. • **Morph tophat** is implemented by first applying the opening operator to the original image, then subtracting the result from the original image. Applying tophat shows the bright peaks within the image. See “Morphing” on page 72 for details.
Rotate	
Rotate Left	Rotate the selected data space left 90°.
Rotate Right	Rotate the selected data space right 90°.
Rotate by Angle	Specify the number of degrees to rotate the selected data space.

Table 8-5: The Operations Menu (Continued)

Menu Selection	Function
Transform	• Resample: Resample the selected data using parameters specified in Resample property settings. • Rotate Data: Rotate the data within the visualization by a specified number of degrees without affecting the rest of the data space. • Scale Data: Scale the selected object by a specified scale factor. See "Transforming" on page 68 for details. {Additional transformations vary depending on the iTool selected.}
{Additional items vary depending on the iTool selected.}	

Table 8-5: The Operations Menu (Continued)

Window Menu

The Window menu contains commands for displaying the Data, Operations and Visualization browsers, for zooming in and out of the display, for modifying the window layout, and for displaying a log of system messages. The Window menu items are common to all iTools.

Menu Selection	Function
Data Manager	Displays the Data Manager for the current iTool. See "About the iTools Data Manager" on page 18 for details.
Visualization Browser	Displays a hierarchical nested list of all visualization elements in the display area. See "The Visualization Browser" on page 85 for details.
Zoom on Resize	If this menu item is checked, views will be resized whenever a visualization is zoomed in any way. • by default, the view will not be resized if zoom is performed.
Layout...	Displays the window layout dialog, which allows the user to change the current view layout and the window dimensions.
Console...	Displays the Message Log dialog containing all system messages and error logs. • The Message Log dialog is a simple uneditable text box. • To close the dialog, click **OK** or the Close button.

Table 8-6: The Window Menu

Help Menu

The Help menu contains commands for displaying online help and information about the iTools. The Help menu items are common to all iTools.

Menu Selection	Function
Help on iTools	Displays help for the iTools system.
Help on the iTools Data Manager	Displays help on the Data manager.
Help on the iTools Parameter Editor	Displays help on the Parameter Editor
Help on Selected Item	Displays help for the item selected in the iTool visualization or browser window.
Help on this iTool	Displays help for the current iTool.
About iTools	Displays a dialog describing the iTools and giving the version number.

Table 8-7: The Help Menu

Note

In the Operations and Preferences browser windows, help for the selected item is also available on the context menu.

File Toolbar

The File toolbar contains the following buttons:

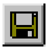
Button	Tool Name	Function
	New	Creates a new iTool of the same type as the current tool with no data or visualizations.
	Open	Opens a file for import into the current iTool. If this is a data file, such as an image file, ASCII file, or binary file, a new data object will be created and, if applicable, a new visualization will be created.
	Save	Saves the state of the current iTool to a file. If the state has not been previously saved and has no filename, enter a filename. The saved file is cross-platform.
	Print	Prints the entire contents of the graphics window.

Table 8-8: File Toolbar Buttons

Edit Toolbar

The Edit Toolbar contains the following buttons:

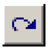
Button	Tool Name	Function
	Undo	Nullifies the previous operation and restores the iTool to its state before that operation. Note - Operations such as open, save, export, export variable, print, exit, and window moving and resizing cannot be undone.
	Redo	Nullifies the previous Undo command and restores the iTool to its state before the Undo command was issued. Any action that can be undone can also be redone.
	Cut	Deletes the selected item(s) and places a copy on the local clipboard. If the window layout is locked, you will be asked if a copy of the view should be placed on the System clipboard.
	Copy	Copies the selected item to the local clipboard. If a view is copied, then a bitmap copy of that view (not the entire Window) is also put on the System clipboard.
	Paste	Pastes the current local clipboard contents into the selected view. If a view is pasted, it is added to the current Window layout and becomes the currently-selected view.

Table 8-9: Edit Toolbar Buttons

Manipulator Toolbar

The Manipulator Toolbar contains the following buttons:

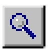
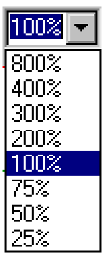
Button	Tool Name	Function
	Select	Click to enter select mode. The arrow pointer is displayed, and objects can be selected in the display area. Click to select an object; a selection box appears around the current selection.
	Rotate	Click to enter rotate mode. A rotation sphere appears around the currently selected object. • Position the mouse pointer on an axis, and the axis rotation pointer is displayed. Drag in the desired direction to rotate the object along the axis. • Position the mouse pointer anywhere on the selected object, and the free rotation pointer is displayed. Drag in the desired direction to rotate the object freely.
	View Zoom	Click to enter zoom mode. The zoom cursor is displayed, and dragging the mouse closer to or farther from the center of the canvas decreases or increases magnification at the initial point of clicking.
	Canvas Zoom	Click  to select a magnification percentage for the entire canvas, or type a percentage in the text box and press ENTER.

Table 8-10: Manipulator Toolbar Buttons

Annotation Toolbar

The Annotation Toolbar contains the following buttons:

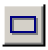
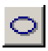
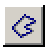
Button	Tool Name	Function
	Text	Click to enter text annotation mode. The insert pointer is displayed, and text can be entered from the keyboard.
	Line	Click to enter line annotation mode. The crosshairs pointer is displayed. Click at the starting point for the line and drag in the desired direction. Release the mouse button to terminate the line.
	Rectangle	Click to enter rectangle annotation mode.
	Oval	Click to enter oval annotation mode.
	Polygon	Click to create a polygon annotation. Click to define vertices, double-click to complete polygon.
	Freehand	Click to enter freehand annotation mode. The cross-hairs pointer is displayed. Click at a starting point and drag to create the desired shape. Release the mouse button to complete the polygon.

Table 8-11: Annotation Toolbar Buttons

Context Menu

Right-clicking on the visualization window brings up a context menu at that location. The context menu is common to all iTools, and it contains the following menu items:

Menu Selection	Description
Cut	Deletes the selected item(s) and places a copy on the local clipboard. If the window layout is locked, you will be asked if a copy of the view should be placed on the System clipboard.
Copy	Copies the selected item to the local clipboard. If a view is copied, then a bitmap copy of that view (not the entire Window) is also put on the System clipboard.
Paste	Pastes the current local clipboard contents into the selected view. If a view is pasted, it is added to the current Window layout and becomes the currently-selected view.
Delete	Deletes the currently-selected item(s), without putting a copy on the local or system clipboards. Deletion can be reversed with Undo.
Grouping:	Grouping gives you the advantage of allowing desired items to operate together and be manipulated as a single unit.
Group	Groups the currently-selected items into a single unit.
Ungroup	If the selected item is currently a group, then it is ungrouped. Note - You cannot group items across separate visualization and annotation layers.
Order:	

Table 8-12: The Context Menu

Menu Selection	Description
Bring To Front	Brings the selected item(s) to the front of the graphics hierarchy.
Send To Back	Sends the selected item(s) to the back of the graphics hierarchy.
Bring Forward	Bring the selected item(s) forward one position in the graphics hierarchy.
Send Backward	Send the selected item(s) back one position in the graphics hierarchy.
Export to IDL	Exports the currently-selected item(s) to your IDL session.
Parameters...	Brings up the parameter editor for the currently-selected item(s).
Properties…	Brings up the property sheet for the currently-selected item(s). If only the view is selected, the property sheet for the view layer is presented. Only one property sheet may be displayed at a time. If a different item or view is selected, the contents of the property sheet change to the properties of the new item or view. For grouped items, a single property sheet with the intersection of the properties is displayed. When the property values are not the same for the grouped items, those properties are set to undefined or default. Setting a property for a grouped item sets that property for all items in the group.

Table 8-12: The Context Menu (Continued)

Appendix B: Property Controls

The following user interface controls are used in iTool property sheets. The general function of these controls is described here. Refer to the individual property descriptions in Appendix C, “Operations Properties” and Appendix D, “Visualization Properties” for specific information on how to set individual property controls.

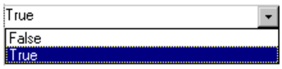
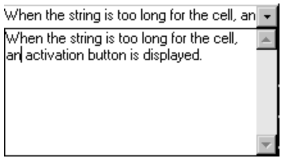
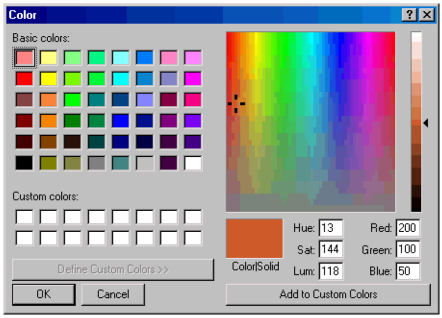
Control Type	Function
Boolean	 Click the browse button  to expand the list. Select either of the two choices (**Show** or **Hide**, **True** or **False**, etc.) from the list.
Number	If the number is editable, type in a new value. You may be restricted to whole numbers or a range of numbers.  If a slider is displayed, slide to select a new value.
String	 Enter a string in the text box. If the string exceeds the length of the text box, a browse button is provided to expand the text box.

Table 8-13: Controls Used in Property Sheets

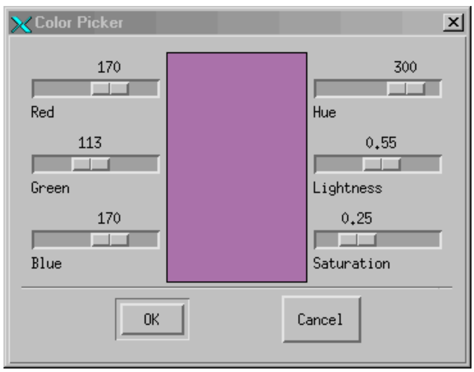
<table>
<tr><th>Control Type</th><th>Function</th></tr>
<tr><td>Color</td><td>
Select a color from the palette displayed in the color selector:

Or click **Custom Color** (UNIX users right-click the color bar at the bottom of the window) to specify RGB or HSL values:



Windows Color Picker

Windows users: enter Hue, Sat, Lum or Red, Green, Blue values and click OK to apply the new values. Click Add to Custom Colors to save your values.



UNIX Color Picker

UNIX users: drag the Red, Green, Blue or Hue, Lightness, Saturation sliders to change values, and click OK to apply the new values.
</td></tr>
</table>

Table 8-13: Controls Used in Property Sheets (Continued)

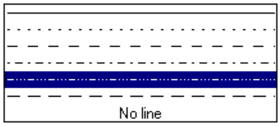
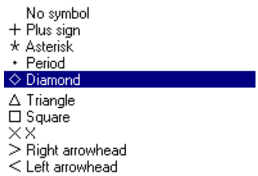
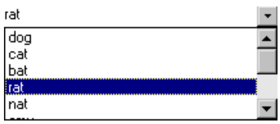
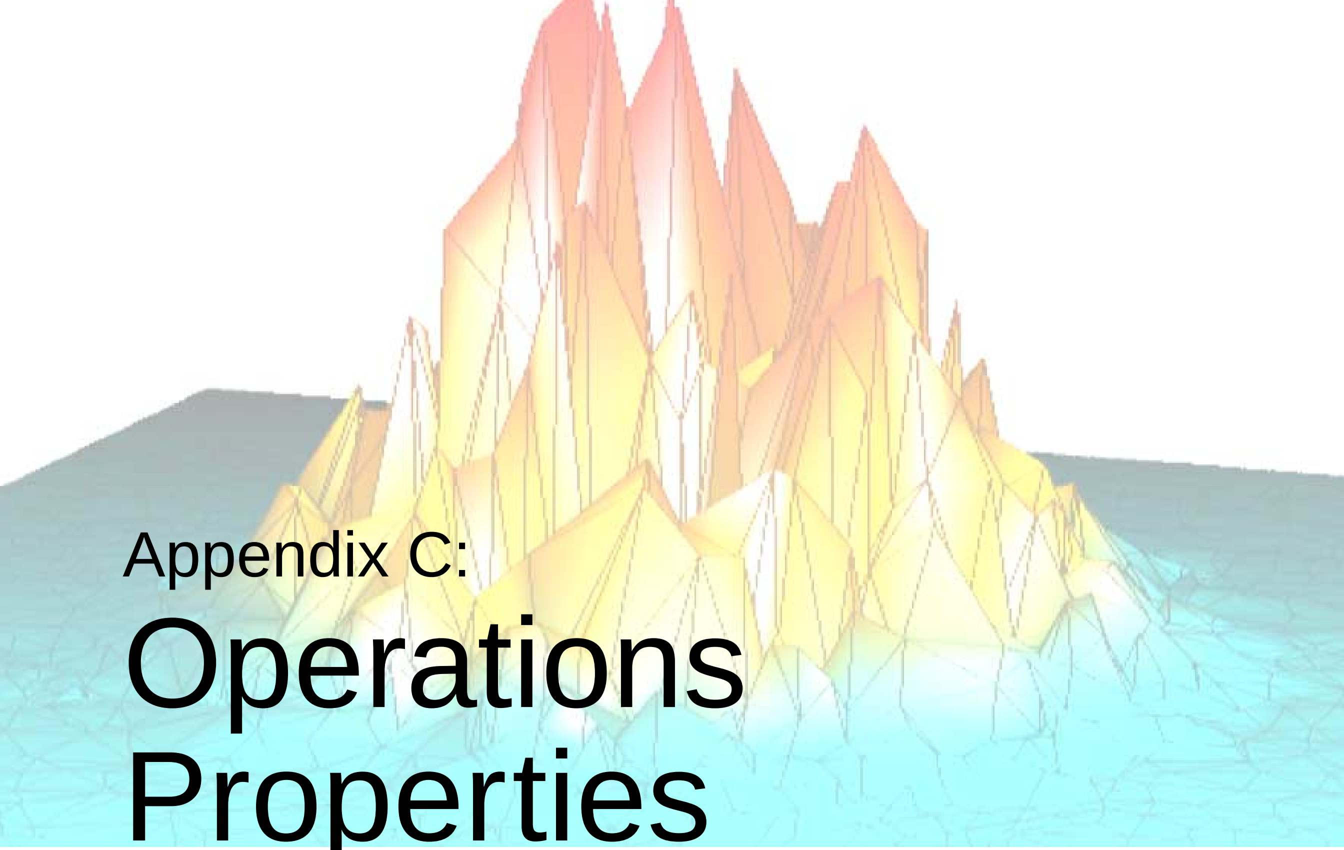
Control Type	Function	
Line Style		Select a line style from the list. To make the line invisible, select **No Line**.
Line Thickness		Select a line thickness from the list. Numbers indicate line thickness in pixels. Use the scroll bar to display additional items.
Symbol		Select a symbol to appear at regular intervals on the selected line from the list. To remove a symbol from a line, select **No Symbol**. Use the scroll bar to display additional items.
String List		Select an item from the list. Use the scroll bar to display additional items.
User Defined		Click the **Edit** button to display the user-defined property control.

Table 8-13: Controls Used in Property Sheets (Continued)



Appendix C: Operations Properties

This appendix describes the following properties of the IDL Intelligent Tools interface found in the Operations Browser of each iTool:

The Operations Browser

The Operations Browser provides a hierarchical tree view of the tools and operations available from the iTool Operations menu. The Operations Browser is used to set properties for operations and tools used in the iTool window. See "The Operations Browser" on page 97 for details on how to display and use the Operations Browser.

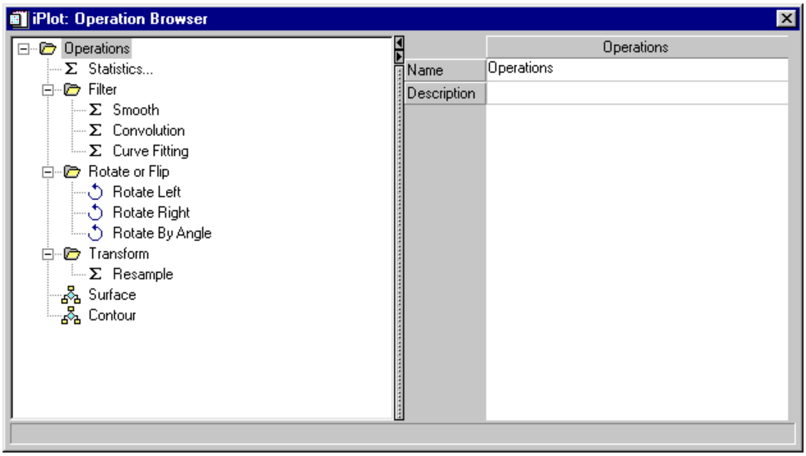


Figure 8-9: The Operations Browser

The property sheet for each operation displayed in the Operations Browser contains the Name and Description properties described in the following table. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, "Property Controls"

Property	Control Type: Options
Name	String: Name assigned to this statistics dialog. Edit the text to change the name.
Description	String: Description of this statistics function. Edit the text to change the description.

Table 8-14: Statistics Operation Properties

Statistics Properties

The Statistics tool displays statistical information relating to the currently selected object or group of objects. The Statistics tool appears in the Operation Browser for all iTools. See "Displaying Statistics" on page 105 for details on how to use the Statistics tool.

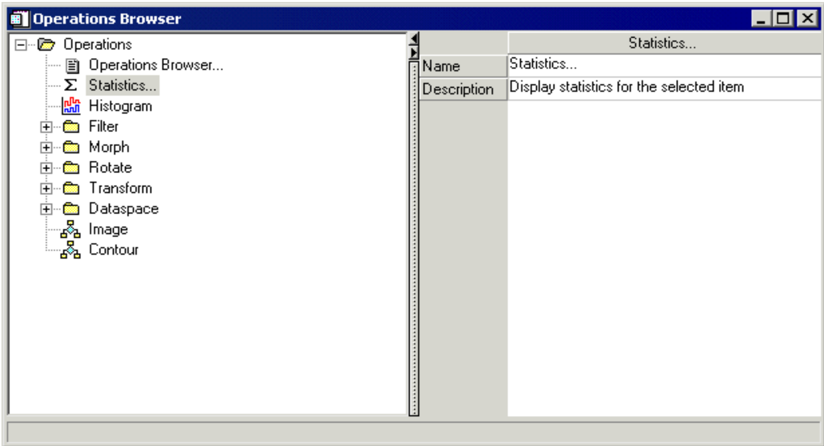


Figure 8-10: Statistics Properties in the Operations Browser

Statistics has no properties that can be configured other than Name and Description.

Histogram Properties

The Histogram tool displays a histogram plot of the data selected in the iTool window. The Histogram tool appears in the Operation Browser for all iTools. See "Plotting a Histogram" on page 104 for details on how to use the Histogram tool.

Histogram has no configurable properties other than Name and Description.

Filter Properties

The following properties control the iTool filters.

Smooth Properties

The Smooth filter reduces noise within an image by applying low pass filters. Smooth filter properties appear on the Operations Browser for all iTools. See "Smooth Filter" on page 70 for details on applying the smooth filter.

For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, "Property Controls".

Property	Control Type: Options
WIDTH	Number: Width of the smooth window. Enter a whole number between `1` (no smoothing) and the width of the data. Default = `3`

Table 8-15: Smooth Filter Properties

Median Properties

Median smoothing replaces each point with the *median* (a value in an ordered set of values with an equal number of values above and below it) of the one- or two-dimensional neighborhood of a given width. See "Median Filter" on page 71 for details on applying the median filter.

For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, "Property Controls".

Property	Control Type: Options
WIDTH	Number: Width of the smooth window. Enter a whole number between `1` (no smoothing) and the width of the data. Default = `3`

Table 8-16: Median Filter Properties

Property	Control Type: Options
Even Average	Boolean: If set to true and the Width property is set to an even number, the operation will return the average of the two middle numbers.

Table 8-16: Median Filter Properties

Convolution Properties

Convolution smooths data by using a weighted moving average. Convolution filter properties appear on the Operations Browser for all iTools. See "Convolution Filter" on page 71 for details on applying convolution.

For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, "Property Controls".

Property	Control Type: Options
Show dialog	Boolean: Display the Convolution Kernel Editor dialog when the Convolution filter is selected from the **Operations** → **Filter** menu. Choose **True** to display the dialog, or **False** to apply the Convolution filter without displaying the dialog. Default = **True**
Kernel	User Defined: Display the Convolution Kernel Editor dialog. Click **Edit** to display the dialog. Default = `<Default>`

Table 8-17: Convolution Filter Properties

Roberts Filter Properties

Roberts filter appears on the Operations Browser for the iImage tool only. Roberts filter has no configurable properties other than Name and Description. For more information on the Roberts filter, see "ROBERTS" in the *IDL Reference Guide* manual.

Sobel Filter Properties

Sobel filter appears on the Operations Browser for the iImage tool only. Sobel filter has no configurable properties other than Name and Description. For more information on the Sobel filter, see "SOBEL" in the *IDL Reference Guide* manual.

Curve Fitting Properties

Curve Fitting Properties appear on the Operations Browser for the iPlot tool only. Curve Fitting has no configurable properties other than Name and Description. For more information on curve fitting a plot, see "Curve Fitting" in Chapter 7, *Working with Plots*.

Morphing Properties

The following properties control the iTool morphing filters.

Mathematical morphology is a method of processing digital images on the basis of shape. Six morphing options are available for use in iTools: dilate, erode, morph open, morph close, morph gradient, and morph tophat. All six options share the same properties. See “Morphing” on page 72 for details on morphing data.

For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, “Property Controls”.

Property	Control Type: Options
Structure Shape	String List: The shape of the structuring element used in the morph operation. Choose from these values: • **Square**: • **Circle**: Default = **Square**
Structure Width	Number: The width of the structuring element. Default = 3

Table 8-18: Morphological Filter Properties

Rotate Properties

The following properties control the iTool Rotate tools. Rotate properties appear on the Operations Browser for all iTools (for iImage it is Rotate or Flip).

Rotate Left Properties

Rotate Left has no configurable properties other than Name and Description.

Rotate Right Properties

Rotate Right has no configurable properties other than Name and Description.

Rotate By Angle Properties

Rotate by Angle has no configurable properties other than Name and Description.

Flip Horizontal

Flip Horizontal has no configurable properties other than Name and Description.

Flip Vertical

Flip Vertical has no configurable properties other than Name and Description.

Transform Properties

The following properties control the iTool Transform tools.

Resample Properties

The Resample transform resamples the selected data using the resamping factors and method specified in these properties. Resample Transform properties appear on the Operations Browser for all iTools. See “Resample” on page 68 for details on how to resample data.

For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, “Property Controls”.

Property	Control Type: Options
1st dimension factor	Number: The resampling factor for the first dimension (X). Edit the number to change the value. Default = 2
2nd dimension factor	Number: The resampling factor for the second dimension (Y). Edit the number to change the value. Default = 2
3rd dimension factor	Number: The resampling factor for the third dimension (Z). Edit the number to change the value. Default = 2
Interpolation method	String List: Method of interpolation to use in resampling. Select a method from the list. Choose from these values: • **Nearest neighbor**: Assign the value of the nearest pixel to the pixel in the output image. Fastest method, but may cause jagged edges. • **Linear**: Surveys the two closest pixels, drawing a line between them and designating a value along that line as the output pixel value. • **Cubic**: Use cubic polynomial waveforms instead of linear waveforms. Most accurate method, but may require more processing time. Default = **Nearest neighbor**

Table 8-19: Resample Transform Properties

Rotate Data Properties

The Rotate Data operation allows you to rotate the data within the visualization by a specified number of degrees without affecting the rest of the data space (graphical objects and axes). See "Rotate Data" on page 69 for details on using the Rotate Data operation.

The following properties control the Rotate Data tool. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, "Property Controls".

Property	Control Type: Options
Angle	Number: The angle of rotation in degrees clockwise. Default = `0`
X center offset	Number: X subscript of the center of rotation. Default = `0`
Y center offset	Number: Y subscript of the center of rotation. Default = `0`
Magnification	Number: Magnification factor. Default = `1`
Interpolation method	String List: Method of interpolation to use when rotating. Select a method from the list. Choose from these values: • **Nearest neighbor**: Assign the value of the nearest pixel to the pixel in the output image. Fastest method, but may cause jagged edges. • **Linear**: Surveys the two closest pixels, drawing a line between them and designating a value along that line as the output pixel value. • **Cubic**: Use cubic polynomial waveforms instead of linear waveforms. Most accurate method, but may require more processing time. Default = **Nearest neighbor**
Extrapolate missing	Boolean: Extrapolate the value of a missing pixel from the the value of nearby pixels. Default = **True**

Table 8-20: Rotate Data Properties

Property	Control Type: Options
Missing value	Number: A value to be substituted for pixels in the rotated image that fall outside the bounds of the unrotated image. This property is only used if the Extrapolate missing property is set to false. Default = `0`
Pivot	Boolean: If set to true, the image will be rotated around the point defined by the X center offset and Y center offset. If set to false, the image will be rotated around its center. Default = **False**

Table 8-20: Rotate Data Properties

Scale Data Properties

The Scale Data operation scales the selected objects by a specified scale factor. Scale Data properties appear on the Operations Browser for all iTools. See “Scale Data” on page 70 for details on using the Scale Data operation.

The following properties control the Scale Data tool. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, “Property Controls”.

Property	Control Type: Options
Scale Factor	Number: Scale the selected data by this factor. Edit the number to change the factor that appears in the Scale Factor dialog. Scale Factor may be positive or negative. Default = `2`

Table 8-21: Scale Data Properties

Invert Image Properties

Invert Image Transform properties appear on the Operations Browser for iImage only. The operation has no unique properties.

Byte Scale Properties

Byte Scale properties appear on the Operations Browser for iImage only. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, “Property Controls”.

Property	Control Type: Options
Automatic Min/Max	Boolean: Automatically compute minimum and maximum values? Choose **True** or **False**. Default = **True**
Minimum cutoff	Number: Minimum value of array to be considered. Edit the number to change the value. Default = `0`
Maximum cutoff	Number: Maximum value of array to be considered. Edit the number to change the value. Default = `255`
Bottom byte	Number: Minimum value of scaled result. Edit the number to change the value. Range = `0-255`. Default = `0`
Top byte	Number: Maximum value of scaled result. Edit the number to change the value. Range = `0-255`. Default = `255`

Table 8-22: Byte Scale Transform Properties

Dataspace Operation Properties

Reset Ranges Properties

The Reset Ranges operation has no unique properties.

Pixel Scale Properties

The Pixel Scale operation appears in the Operations browser for iImage only. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, “Property Controls”.

Property	Control Type: Options
Pixel scale	Number: The number of pixels that should be used to render each pixel in the original image. Default = `1`

Table 8-23: Pixel Scale Properties

Region Grow Properties

Region growing expands a selected area to include nearby pixels that fall within a threshold range of the current selection. See "REGION_GROW" in the *IDL Reference Guide* manual for additional details. For a description of how a particular control is used, refer to Appendix B, "Property Controls".

<table>
<tr><th>Property</th><th>Control Type: Options</th></tr>
<tr><td>Region grow method</td><td>String List: The method used to select pixels that are similar to the current selection. Choose from these values:
By threshold: The expanded region includes neighboring pixels that fall within the range defined by the Threshold minimum and Threshold maximum values.
By standard deviation: The expanded region includes neighboring pixels that fall within the range of the mean of the region's pixel values plus or minus the given multiplier times the sample standard deviation as follows:
<code>Mean +/- StdDevMultiplier * StdDev</code>
where <code>Mean</code> is the mean value of the selected pixels, <code>StdDevMultiplier</code> is the value specified by the Standard Deviation Multiplier property, and <code>StdDev</code> is the standard deviation of the selected pixels.
Default = By threshold</td></tr>
<tr><td>Pixel search method</td><td>String List: Specifies which pixels should be considered during region growing. 4-neighbor searching searches only the neighbors that are exactly one unit in distance from the current pixel; 8-neighbor searching searches all neighboring pixels.
Choose from these values:
4-neighbor:
8-neighbor:
Default = 4-neighbor</td></tr>
</table>

Table 8-24: Region Grow Operation Properties

Property	Control Type: Options
Threshold to use	String List: Specifies the threshold values to use. Choose from these values: • **Source ROI/Image threshold**: Base the threshold values on the pixel values in the currently selected region. • **Explicit**: Specify the threshold values using the Threshold minimum and Threshold maximum properties. Default = **Source ROI/Image threshold**
Threshold minimum	Number: The explicitly specified minimum threshold value. Default = `0`
Threshold maximum	Number: The explicitly specified maximum threshold value. Default = `256`
Standard deviation multiplier	Number: The number of standard deviations to use if the region growing method is By standard deviation. Default = `1`
For an RGB(A) image use	String List: If the image has separate color channels, use the selected channel when growing the region. Choose from these values: • **Luminosity**: Luminosity values • **Red Channel**: Red values • **Green Channel**: Green values • **Blue Channel**: Blue values • **Alpha Channel**: Transparency values. Default = **Luminosity**

Table 8-24: Region Grow Operation Properties (Continued)

Surface Properties

Surface Properties appear on the Operations Browser for iImage and iContour only. Surface has no configurable properties other than Name and Description.

Contour Properties

Contour Properties appear on the Operations Browser for iImage and iSurface only. Contour has no configurable properties other than Name and Description.

Image Properties

Image Properties appear on the Operations Browser for iSurface and iContour only. Image has no configurable properties other than Name and Description.

Volume Properties

Volume Properties appear on the Operation Browser for the iVolume tool only.

Image Plane

Image Plane has no configurable properties other than Name and Description.

Isosurface

For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, "Property Controls".

Property	Control Type: Options
Show Dialog	Boolean: Display the Isosurface Value Selector dialog when Isosurface is selected from the **Operations** → **Volume** menu. Choose **True** to display the dialog, or **False** to apply the isosurface without displaying the dialog. Default = **True**

Table 8-25: Isosurface Properties

Render Volume

Render Volume has no configurable properties other than Name and Description.

Interval Volume

For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, "Property Controls".

Property	Control Type: Options
Show Dialog	Boolean: Display the Isosurface Value Selector dialog when Isosurface is selected from the **Operations** → **Volume** menu. Choose **True** to display the dialog, or **False** to apply the isosurface without displaying the dialog. Default = **True**

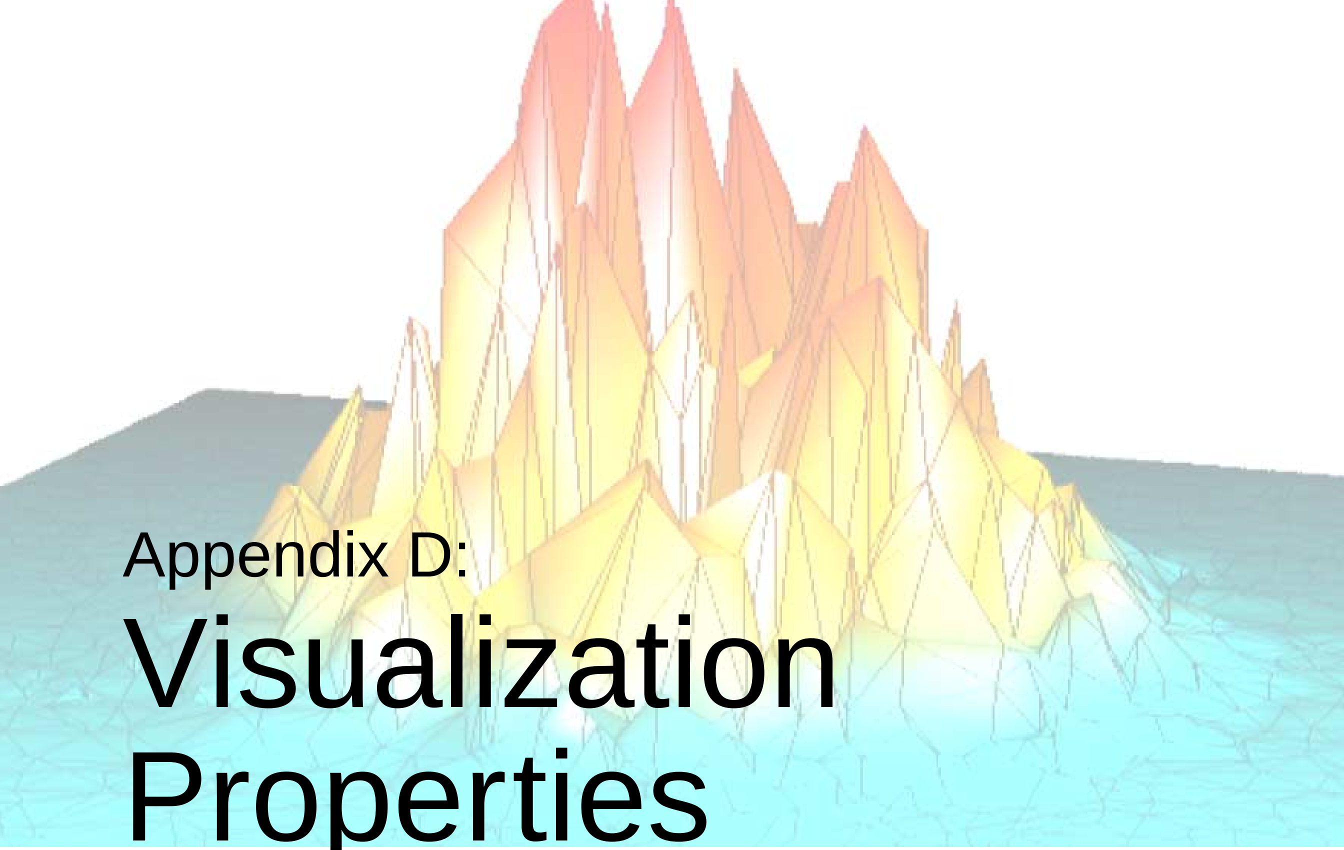
Table 8-26: Interval Volume Properties

Image Plane Properties

Image Plane Properties appear on the Operation Browser for the iVolume tool only.

Launch iImage

Launch iImage has no configurable properties other than Name and Description.



Appendix D: Visualization Properties

This appendix describes the following visualization properties of the IDL Intelligent Tools interface found in the Visualization Browser of each iTool:

Introduction

The IDL Intelligent Tools comprise five distinct tools: iImage, iPlot, iSurface, iContour, and iVolume. Each tool has a specific set of functions related to the type of data it is designed to use. In addition to these specific tasks, all five tools have a number of functions in common.

This appendix describes those functions that all iTools have in common; for information about the functions unique to the individual iTools, refer to

- Chapter 4, “Working with Images”
- Chapter 5, “Working with Surfaces”
- Chapter 6, “Working with Contours”
- Chapter 7, “Working with Plots”
- Chapter 8, “Working with Volumes”

This appendix is an overview of the menu items and toolbar buttons that are common to all iTools.

The Visualization Browser

The Visualization Browser provides a hierarchical tree view of all objects displayed in the iTool window. The Visualization Browser is used to select objects and to display the property sheets for selected objects. See "The Visualization Browser" on page 85 for details on how to display and use the Visualization Browser.

The Visualization Browser displays a list of the contents of the iTool window in the left pane. The property sheet for the object currently selected in the left pane can be displayed in the right pane of the Visualization Browser window by clicking on the small arrows to the top-right of the left pane and top-left of the right pane (in the middle if both are displayed). For example, to display the properties of the current window, select Window in the left pane of the Visualization Browser as shown in the following figure.

Window Properties

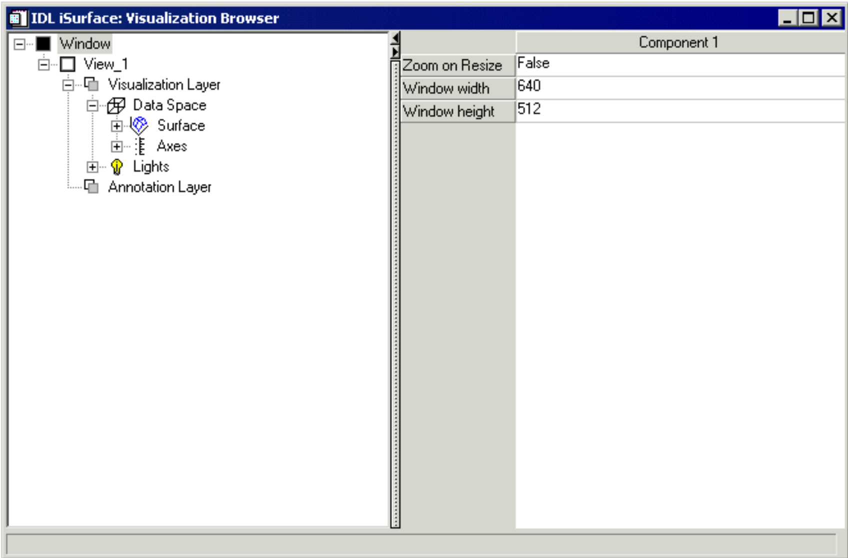


Figure 8-11: The Visualization Browser with Window Properties Displayed

These properties control the display of the iTool window. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, "Property Controls".

Property	Control Type: Values
Zoom on Resize	Boolean: Zoom visualization upon resize of window? Choose **True** or **False**. Default = **False**
Window Width	Number: Width of the current iTool window in pixels. Edit the number to change the value. Default = `640` Note - The minimum width of the window correlates to the width of the menubar.

Table 8-27: iTool Window Properties

Property	Control Type: Values
Window Height	Number: Height of the current iTool window in pixels. Edit the number to change the value. Default = `512` `Minimum = 100`

Table 8-27: iTool Window Properties

All property sheets displayed in the Visualization Browser, with the exception of the Window property sheet displayed above, include the Name, Description, and Show properties described in the following table:

Property	Control Type: Values
Name	String: Name assigned to this view. Edit the text to change the name.
Description	String: Description of this view. Edit the text to change the description.
Show	Boolean: Show this view? Choose **True** or **False**. Default = **True**

Table 8-28: Name and Description Properties

View Properties

Each iTool window contains at least one view. If multiple views have been created from the Window Layout dialog, each view will be listed separately.

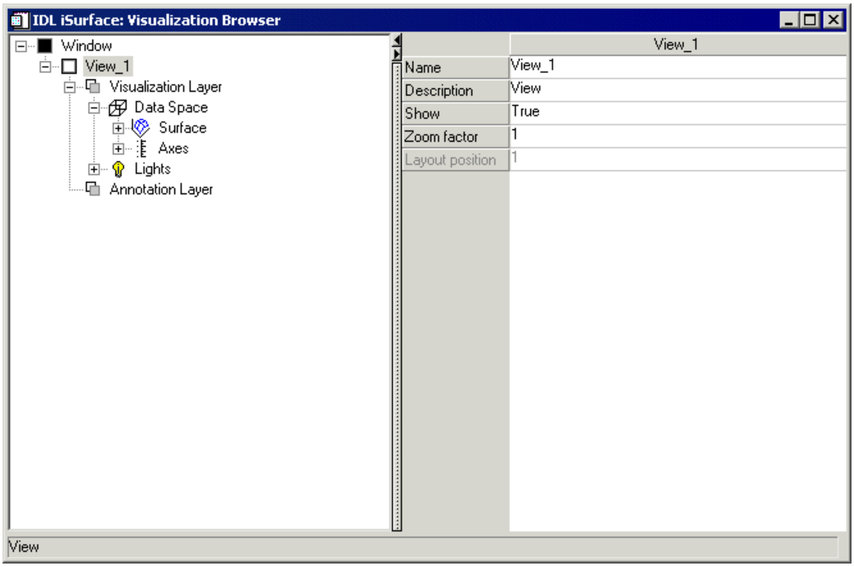


Figure 8-12: Visualization Browser with View Properties Displayed

These properties control the display of the view or views contained in the iTool window. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, "Property Controls"

Property	Control Type: Values
Zoom Factor	Number: Increase or decrease magnification of the view by this factor. Edit the number to change the value. Default = `1`
Layout Position	Displays the currently-selected layout view

Table 8-29: View Properties

Visualization Layer Properties

The Visualization Layer contains the data space and, for three-dimensional objects, the lights, associated with a visualization.

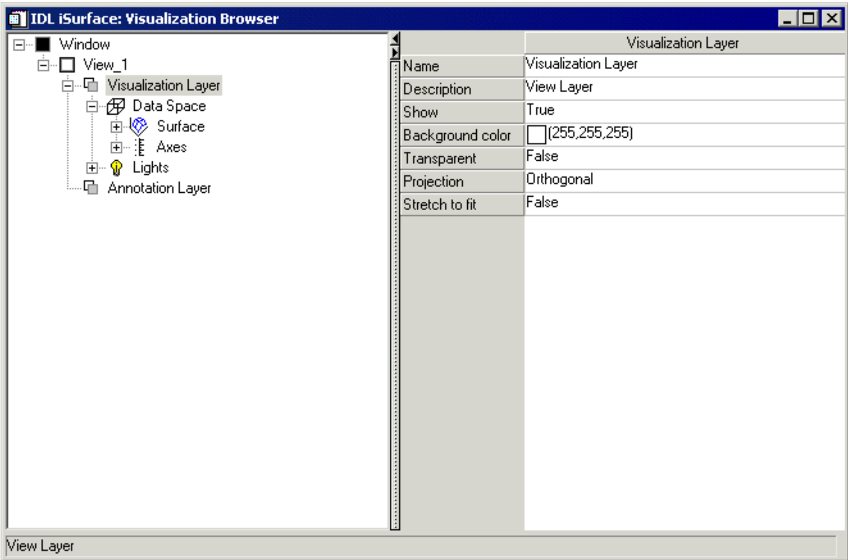


Figure 8-13: Visualization Browser with Visualization Layer Properties Displayed

These properties control the visualization of the data space. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, "Property Controls".

Property	Control Type: Values
Background Color	Color: Visualization layer background color. Transparent must be set to **False**. Click to choose from the default color palette, or specify RGB values. Default = `[255, 255, 255]` (white)
Transparent	Boolean: Make visualization layer transparent? Choose **True** or **False**. Default = **True**

Table 8-30: Visualization Layer Properties

Property	Control Type: Values
Projection	String List: Projection method for displaying the visualization layer. Select a method from the list. Choose from these values: • **Orthogonal**: Orthographic projection (objects are projected onto the visualization layer along lines perpendicular to the view plane) • **Perspective**: Objects are projected onto the visualization layer along perspective lines that converge in the distance. Default = **Orthogonal**
Stretch to Fit	Boolean: Stretch visualization layer to fit window? Choose **True** or **False**. Default = **False**

Table 8-30: Visualization Layer Properties (Continued)

Data Space Properties

The data space contains the data type(s) displayed within the visualization, plus the axes associated with the data.

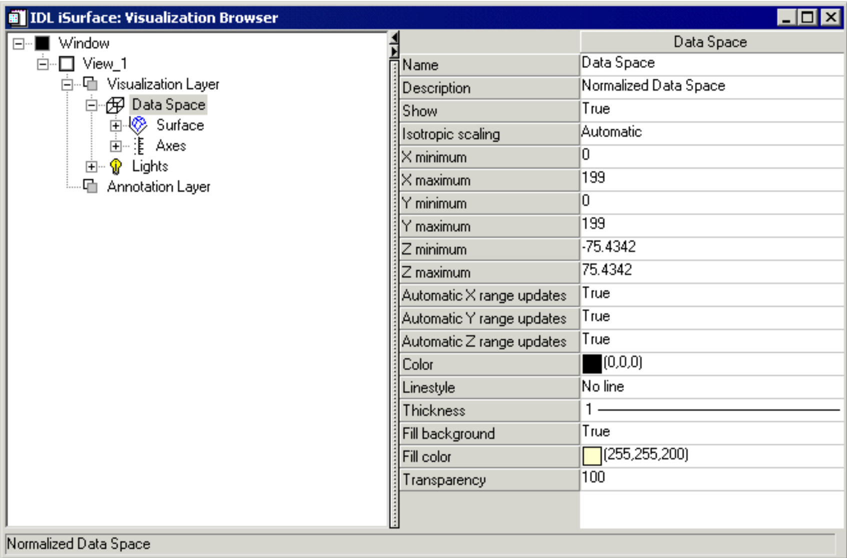


Figure 8-14: Visualization Browser with Data Space Properties Displayed

These properties control the visualization of the data space. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, "Property Controls".

Property	Control Type: Values
Isotropic scaling	Scaling method. Select a method from the list. Choose between these values: • **Automatic**: automatic scaling • **Isotropic**: isotropic scaling • **Nonisotropic**: nonisotropic scaling Default = **Automatic**

Table 8-31: Data Space Properties

Property	Control Type: Values
X Minimum	String: Minimum value for X coordinate of data set.
X Maximum	String: Maximum value for X coordinate of data set.
Y Minimum	String: Minimum value for Y coordinate of data set.
Y Maximum	String: Maximum value for Y coordinate of data set.
Z Minimum	String: Minimum value for Z coordinate of 3-D data set.
Z Maximum	String: Maximum value for Z coordinate of 3-D data set.
Automatic X range updates	Boolean: Automatically updates the range of X values. Choose **True** or **False**. Default = **True**
Automatic Y range updates	Boolean: Automatically updates the range of Y values. Choose **True** or **False**. Default = **True**
Automatic Z range updates	Boolean: Automatically updates the range of Z values. Choose **True** or **False**. Default = **True**
Color	Color: Data space bounding box border color. Border Style must not be **No line**. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Linestyle	Line Style: Data set bounding box border line style. Select a line style from the list. Default = **No line**
Thickness	Line Thickness: Data set bounding box border line thickness. Select a thickness from the list. Default = **1**.
Fill Background	Boolean: Fills data space background with background color. Choose **True** or **False**. Default = **True**
Fill Color	Color: Data space background color. Fill Background must be set to **True**. Click to choose from the default color palette, or specify RGB values. Default = `[255, 255, 200]` (cream)
Transparency	Number: Transparency of data space background from 0% to 100%. Fill Background must be set to **True**. Move slider to select a new percentage. Default = `100`

Table 8-31: Data Space Properties (Continued)

Visualization Type Properties

Five types of visualizations can be displayed in iTool windows: images, plots, surfaces, contours, or volumes. Each data type has its own property sheet, which can be displayed in the Visualization Browser.

Image

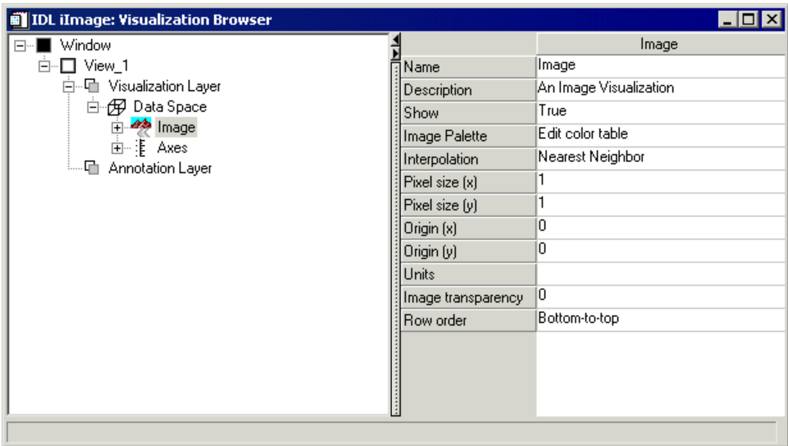


Figure 8-15: Visualization Browser with Image Properties Displayed

These properties control image object visualizations. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, "Property Controls".

Property	Control Type: Values
Image Palette	User Defined: By selecting **Edit Color** → **Table Edit** access the color table to manipulate plot color values

Table 8-32: Image Properties

Property	Control Type: Values
Interpolation	String List: Method used for interpolating the image. Select a method from the list. Choose from these values: • **Nearest Neighbor**: Assign the value of the nearest pixel to the pixel in the output image. Fastest method, but may cause jagged edges. • **Bilinear**: Create a weighted average based on the nearness and brightness of the closest 4 pixels, and assign that value to the pixel in the output image. Default = **Nearest Neighbor**
Pixel size (x)	Number: Pixel size for x value. Default = `1`
Pixel size (y)	Number: Pixel size for y value. Default = `1`
Origin (x)	Number: Origin point for x value. Default = `0`
Origin (y)	Number: Origin point for y value. Default = `0`
Units	Number: Number of units. Default = None
Image transparency	Number: Transparency of the image, 0% - 100%. Move the slider to change the value. Default = `0` (no transparency) Note - The transparency is changed by adding an alpha channel to the image. If your image has an alpha channel then the Transparency property is ignored.
Row Order	String List: Select an order from the list. Choose from these values: • **Bottom-to-top** • **Top-to-bottom** Default = **Bottom-to-top**

Table 8-32: Image Properties (Continued)

Plot

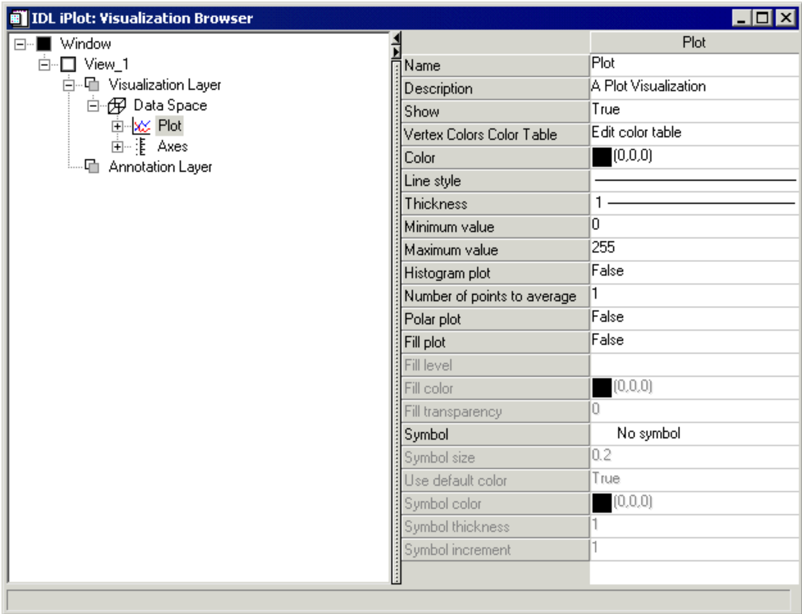


Figure 8-16: Visualization Browser with Plot Properties Displayed

These properties control plot object visualizations. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, “Property Controls”.

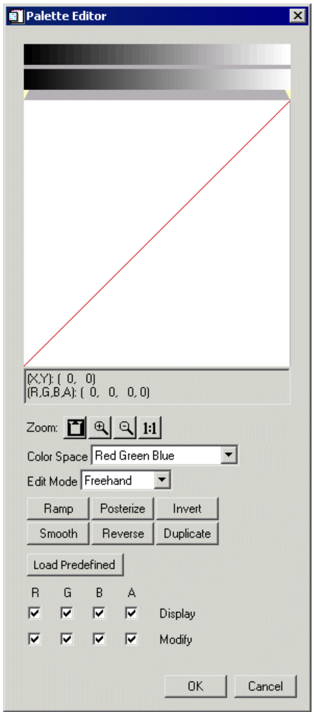
Property	Control Type: Values
Vertex Colors Color Table	User Defined: By selecting **Edit Color** → **Table Edit** access the color table to manipulate plot color values 
Color	Color: Color for the plot line. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Line style	Line Style: Style for the plot line. Select a style from the list. Default = ———— (solid line)
Thickness	Line Thickness: Thickness for the plot line. Select a thickness from the list. Default = `1`
Minimum value	Number: Minimum value to include in the plot. Edit the number to change the value.

Table 8-33: Plot Properties

Property	Control Type: Values
Maximum value	Number: Maximum value to display in the plot. Edit the number to change the value.
Histogram plot	Boolean: Display plot as a histogram? Choose **True** or **False**. Default = **False**
Number of points to average	Number: Number of points to average when drawing the plot. Edit to change the value. Default = `1`
Polar plot	Boolean: Display plot as a polar plot? Choose **True** or **False**. Default = **False**
Fill plot	Boolean: Fill between plot lines? Choose **True** or **False**. Default = **False**
Fill level	Number: Level at which to begin the plot fill. Edit the number to change the value. Default = `0`
Fill color	Color: Color for the plot fill. Fill transparency must be less than 100%. Click to choose from the default color palette, or specify RGB values. Default = `[255, 255, 255]` (white)
Fill transparency	Number: Transparency of the plot fill from 0% to 100%. Move the slider to change the value. Default = `0`
Symbol	Symbol: Symbol to appear at regular intervals on the plot line. Choose a symbol from the list. Default = **No symbol**
Symbol size	Number: Factor from 0 - 1 determining the size of the selected symbol. Move slider to change the size. Default = `0.2`
Use default color	Boolean: Activate Symbol color property. Choose **True** or **False**. Default = **False**
Symbol color	Color: Color for the selected symbol. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Symbol thickness	Number: Line thickness from 1 - 9.9 for the selected symbol. Move slider to change the thickness. Default = `1`.

Table 8-33: Plot Properties (Continued)

Property	Control Type: Values
Symbol increment	Number: Interval at which symbols will be displayed on the plot line. Influenced by Number of points to average (above). Edit to change the value. Default = `1`

Table 8-33: Plot Properties (Continued)

Plot 3D

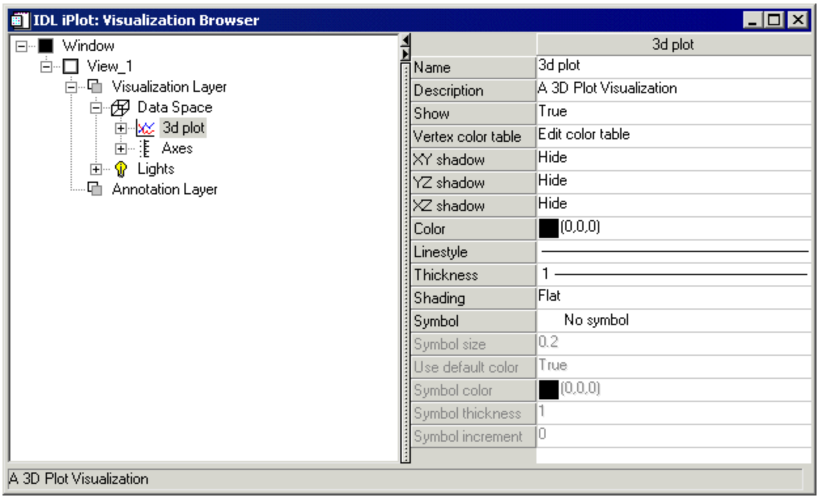


Figure 8-17: Visualization Browser with 3D Plot Properties Displayed

These properties control three-dimensional plot object visualizations. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, “Property Controls”.

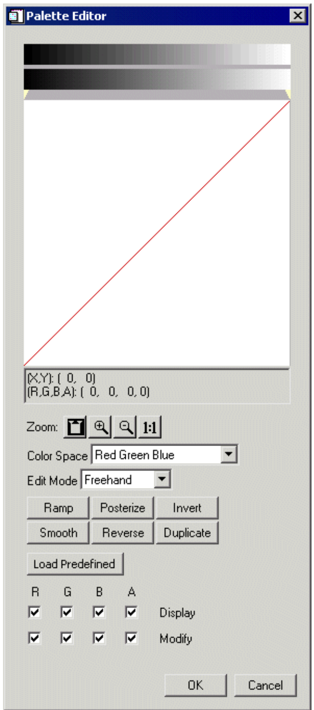
Property	Control Type: Values
Vertex color table	User Defined: By selecting **Edit Color** → **Table Edit** access the color table to manipulate plot color values 
XY Shadow	Boolean: Show XY shadow? Choose Hide or Show. Default = **Hide**
YZ Shadow	Boolean: Show YZ shadow? Choose Hide or Show. Default = **Hide**
XZ Shadow	Boolean: Show XZ shadow? Choose Hide or Show. Default = **Hide**

Table 8-34: Plot 3D Properties

Property	Control Type: Values
Color	Color: Color for the plot line. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Line style	Line Style: Style for the plot line. Select a style from the list. Default = ——————— (solid line)
Thickness	Line Thickness: Thickness for the plot line. Select a thickness from the list. Default = `1`
Shading	String List: Shading method. Select a method from the list. Choose between these values: • **Flat**: Flat shading • **Gouraud**: Gouraud shading Default = **Flat**
Symbol	Symbol: Symbol to appear at regular intervals on the plot line. Choose a symbol from the list. Default = **No symbol**
Symbol size	Number: Factor from 0 - 1 determining the size of the selected symbol. Move slider to change the size. Default = `0.2`
Use default color	Boolean: Activate Symbol color property. Choose **True** or **False**. Default = **False**
Symbol color	Color: Color for the selected symbol. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Symbol thickness	Number: Line thickness from 1 - 9.9 for the selected symbol. Move slider to change the thickness. Default = `1`.
Symbol increment	Number: Interval at which symbols will be displayed on the plot line. Influenced by Number of points to average (above). Edit to change the value. Default = `1`

Table 8-34: Plot 3D Properties (Continued)

Surface

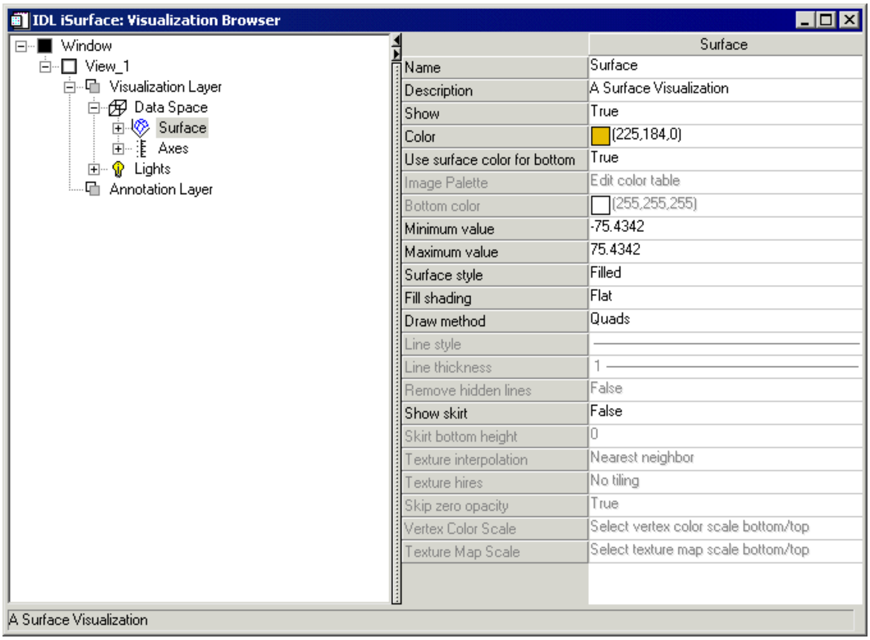


Figure 8-18: Visualization Browser with Surface Properties Displayed

These properties control surface object visualizations. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, "Property Controls".

Property	Control Type: Values
Color	Color: Color of the surface visualization. Click to choose from the default color palette, or specify RGB values. Default = `[255,184,0]` (gold)
Use surface color for bottom	Boolean: Display a color for the bottom of the surface. Choose **True** or **False**. Default = **False**

Table 8-35: Surface Properties

Property	Control Type: Values
Image palette	User Defined: By selecting **Edit Color** → **Table Edit** access the color table to manipulate surface color values
Bottom color	Color: Color to be used for the bottom of the surface. Click to choose from the default color palette, or specify RGB values. Default = `[255,255,255]` (white)
Minimum value	Number: Minimum value to display in the surface. Edit the number to change the value.
Maximum value	Number: Maximum value to display in the surface. Edit the number to change the value.
Surface style	String List: Style used for rendering the surface. Select a style from the list. Choose from these values: • **Points**: Data points in the surface are rendered as points. • **Wire mesh**: Data points in the surface are connected with lines, forming a mesh. • **Filled**: Data points in the surface are connected with filled quadrangles or triangles, forming a solid surface. • **Ruled XZ**: Data points in the surface are connected with horizontal (Z-direction) lines, forming a grid. • **Ruled YZ**: Data points in the surface are connected with vertical (Y-direction) lines, forming a grid. • **Lego**: Stacked histogram-style plot in which each data value is rendered as an outline box covering the XY extent of the cell and with a height proportional to the Z value. • **Lego filled**: Same as Lego, but the boxes are filled. Default = **Filled**

Table 8-35: Surface Properties (Continued)

Property	Control Type: Values
Fill shading	String List: Method used for shading the surface polygons. Select a shading method from the list. Choose from these values: • **Flat**: Shades polygons with a uniform fill. • **Gouraud**: Interpolates intensities from each vertex along each edge. Then, when the polygons are converted, interpolates the shading along each scan line from the edge intensities. Results in a more natural appearance. Default = **Flat**
Draw method	String List: Method used for drawing the surface. Select a method from the list. Choose from these values: • **Quads**: Draw a surface composed of quadrangles. • **Triangles**: Draw a surface composed of triangles. Default = **Quads**
Line style	Line Style: Style of lines used for constructing the surface. Select a style from the list. Default = ——————— (solid line)
Line thickness	Line Thickness: Thickness of lines used for constructing the surface. Select a thickness from the list. Default = `1`
Remove hidden lines	Boolean: Hide lines that show through the surface mesh or grid. Choose **True** or **False**. Default = **False**
Show skirt	Boolean: Display the edges of the surface as a filled skirt? Choose **True** or **False**. Default = **False**
Skirt bottom height	Number: Set bottom of displayed skirt to this height. Edit the number to change the value. Default = `0`

Table 8-35: Surface Properties (Continued)

Property	Control Type: Values
Texture interpolation	String List: Method used for interpolating selected texture map. Select a method from the list. Choose from these values: • **Nearest Neighbor**: Assign the value of the nearest pixel to the pixel in the output image. Fastest method, but may cause jagged edges. • **Bilinear**: Create a weighted average based on the nearness and brightness of the closest 4 pixels, and assign that value to the pixel in the output image. Default = **Nearest Neighbor**
Texture hires	String List: Method used for tiling the selected high-resolution texture map. Select a tiling method from the list. Choose from these values: • **No tiling**: Do not use tiling • **LOD tiling**: Use Level Of Detail tiling • **Tiling**: Use tiling Default = **No tiling**
Skip zero opacity	Boolean: Skip zero opacity for surface? Choose **True** or **False**. Default = **True**
Vertex Color Scale	User Defined: Select vertex color scale bottom/top.
Texture Map Scale	User Defined: Select texture map scale bottom/top.

Table 8-35: Surface Properties (Continued)

Contour

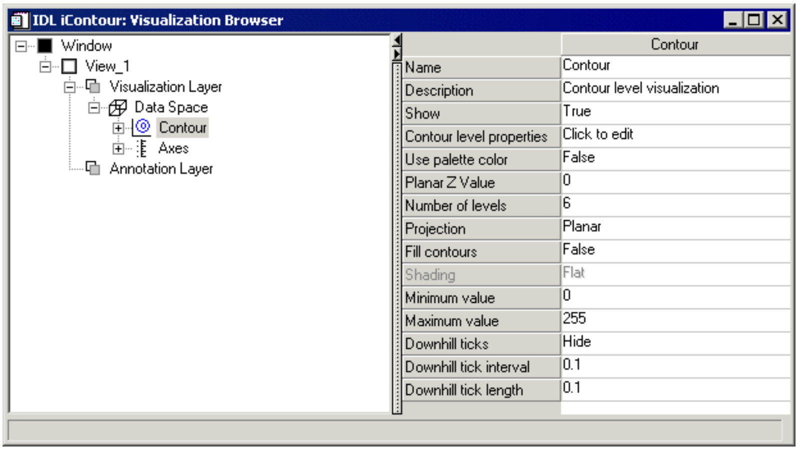


Figure 8-19: Visualization Browser with Contour Properties Displayed

These properties control contour object visualizations. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, “Property Controls”.

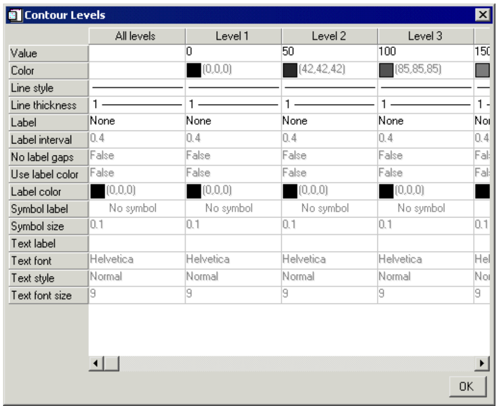
Property	Control Type: Values
Contour level properties	User Defined: Click to edit individual or all contour level properties. Click and **Edit...** to display Contour Levels window. 
Use palette color	Boolean: Use palette color? Choose **True** or **False**. Default = **False**
Planar Z Value	Number: Z value of plane on which to project contours. Edit the number to change the value. Default = `0`
Number of levels	Number: Number of contour levels to display. Edit the number to change the value. Default = `5`
Projection	String List: Method of projection. Select a method from the list. Choose from these values: • **Three-D**: Project in three dimensions • **Planar**: Project onto a plane Default = **Planar**
Fill contours	Boolean: Fill space between contours? Choose **True** or **False**. Default = **False**

Table 8-36: Contour Properties

Property	Control Type: Values
Shading	String List: Shading method. Select a method from the list. Choose between these values: • **Flat**: Flat shading • **Gouraud**: Gouraud shading Default = **Flat**
Minimum value	Number: Minimum value to display in the contour. Edit number to change value. No default value.
Maximum value	Number: Maximum value to display in the contour.Edit number to change value. No default value.
Downhill ticks	Boolean: Show downhill ticks? Choose **Hide** or **Show**. Default = **Hide**
Downhill tick interval	Number: Distance between downhill tick marks. Edit number to change value. Default = `0.2`
Downhill tick length	Number: Length of downhill tick marks. Edit number to change value. Default = `0.2`

Table 8-36: Contour Properties (Continued)

Volume

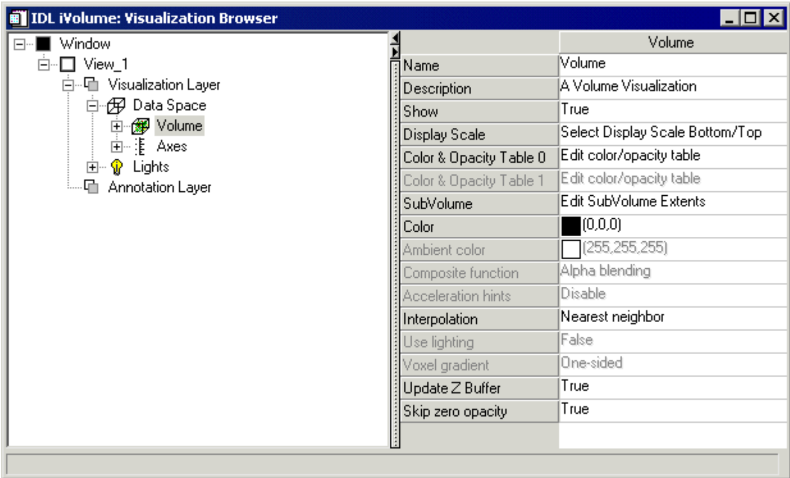


Figure 8-20: Visualization Browser with Volume Properties Displayed

These properties control volume object visualizations. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, "Property Controls".

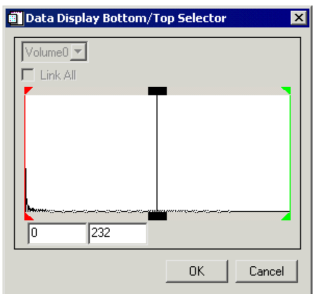
Property	Control Type: Values
Display Scale	Set the display scale for the selected volume. **Select Display Scale Bottom/Top → Edit** 

Table 8-37: Volume Properties

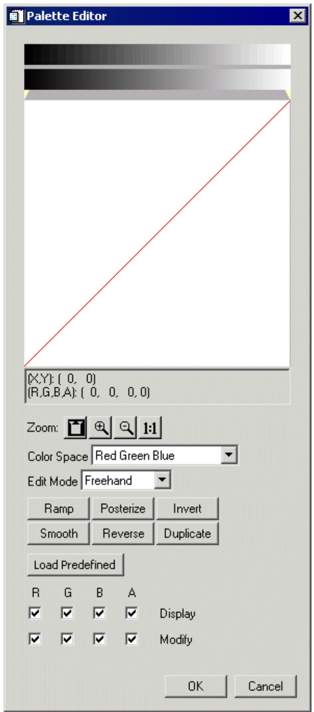
Property	Control Type: Values
Color & Opacity Table 0	Color: By selecting **Edit Color** → **Table Edit** access the color table to manipulate plot color values  Note **-** To edit the opacity only in the editor, uncheck the **R**, **G**, and **B** boxes in both the **Modify** and **Display** rows. Edit the remaining line by clicking on and dragging the line in the window. Click **OK** when finished.
Color & Opacity Table 1	Color: By selecting **Edit Color** → **Table Edit** access the color table to manipulate plot color values.

Table 8-37: Volume Properties (Continued)

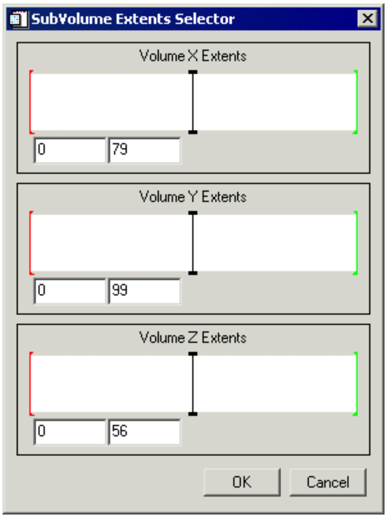
Property	Control Type: Values
SubVolume	String: Edit SubVolume Extents. 
Color	Color: Color for the volume. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Ambient color	String: Choose from default color palette, or specify RGB values. Default = `[255, 255, 255]` (white)
Composite function	String: Choose composite function. Default = **Alpha Blending**
Acceleration hints	Boolean: Use acceleration hints? Choose **Enable** or **Disable**. Default = **Disable**
Interpolation	String List: Set interpolation type. Choose between these values: • **Nearest neighbor** • **Trilinear** Default = **Nearest neighbor**
Use lighting	Boolean: Use lighting? Choose **True** or **False**. Default = **False**

Table 8-37: Volume Properties (Continued)

Property	Control Type: Values
Voxel gradient	Color: Color of the volume. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Update Z Buffer	Boolean: Update Z Buffer? Choose **True** or **False**. Default = **True**
Skip zero opacity	Boolean: Skip zero opacity? Choose **True** or **False**. Default = **True**

Table 8-37: Volume Properties (Continued)

Isosurface

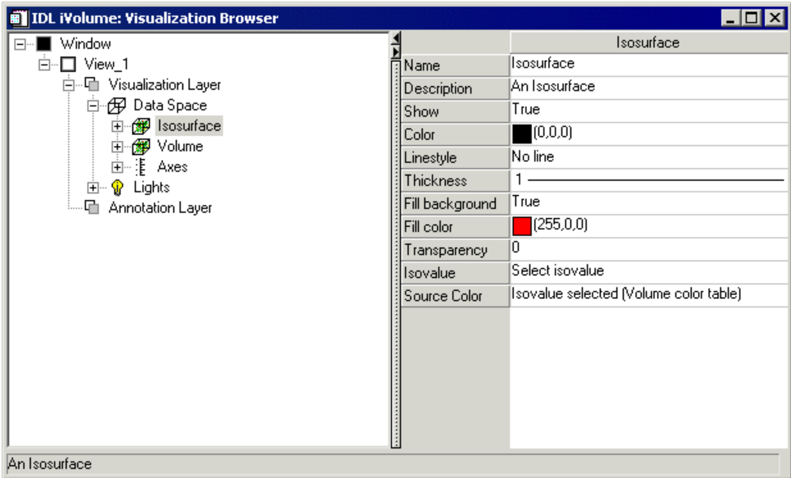


Figure 8-21: Visualization Browser with Isosurface Properties Displayed

These properties control Isosurface object visualizations. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, "Property Controls"

Property	Control Type: Values
Color	Color: Color to be used for the isosurface lines in this visualization. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Linestyle	Line Style: Style of the isosurface lines. Select a line style from the list. Default = No line
Thickness	Line Thickness: Thickness of the isosurface lines in points. Select a thickness from the list. Default = `1`

Table 8-38: Isosurface Properties

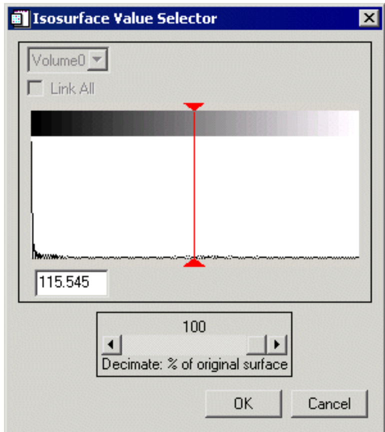
Property	Control Type: Values
Fill background	Boolean: Fill background? Choose **True** or **False**. Default = **True**
Fill color	Color: Color to fill. Click to choose from the default color palette, or specify RGB values. Default = `[255,0,0]` (red)
Transparency	Number: Level of transparency. Default = `0`
Isovalue	String: Edit isovalue. 
Source color	String List: Choose from the following: • **Isovalue selected (Volume color table)** • **User selected (Fill Color Property)** Default = **Isovalue selected (Volume color table)**

Table 8-38: Isosurface Properties

Interval Volume

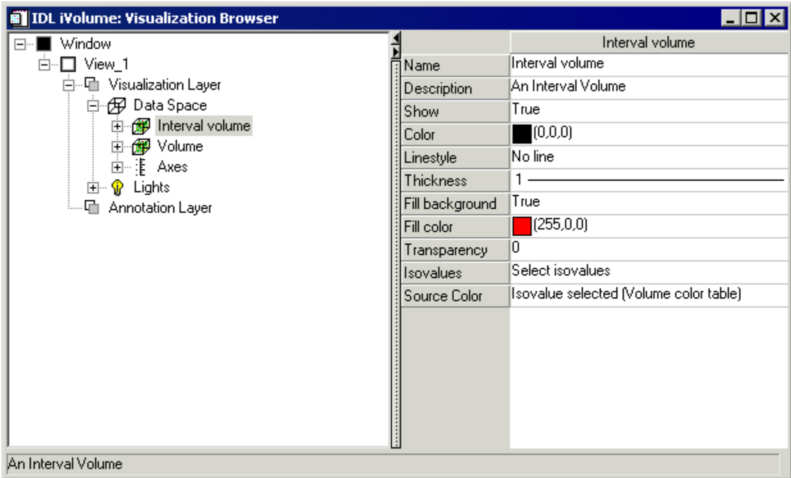


Figure 8-22: Visualization Browser with Interval Volume Properties Displayed

These properties control interval volume object visualizations. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, "Property Controls"

Property	Control Type: Values
Color	Color: Color to be used for the interval volume lines in this visualization. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Linestyle	Line Style: Style of the interval volume lines. Select a line style from the list. Default = No line
Thickness	Line Thickness: Thickness of the interval volume lines in points. Select a thickness from the list. Default = `1`

Table 8-39: Interval Volume Container Properties

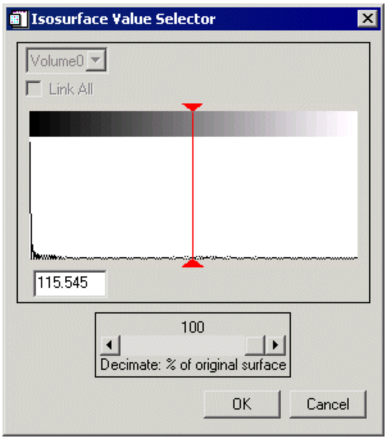
Property	Control Type: Values
Fill background	Boolean: Fill background? Choose **True** or **False**. Default = **True**
Fill color	Color: Color to fill. Click to choose from the default color palette, or specify RGB values. Default = `[255,0,0]` (red)
Transparency	Number: Level of transparency. Default = `0`
Isovalues	String: Edit isovalue. 
Source Color	String List: Set source color. Choose from the following: • **Isovalue selected (Volume color table)** • **User selected (Fill Color Property)** Default = **Isovalue selected (Volume color table)**

Table 8-39: Interval Volume Container Properties

Image Plane

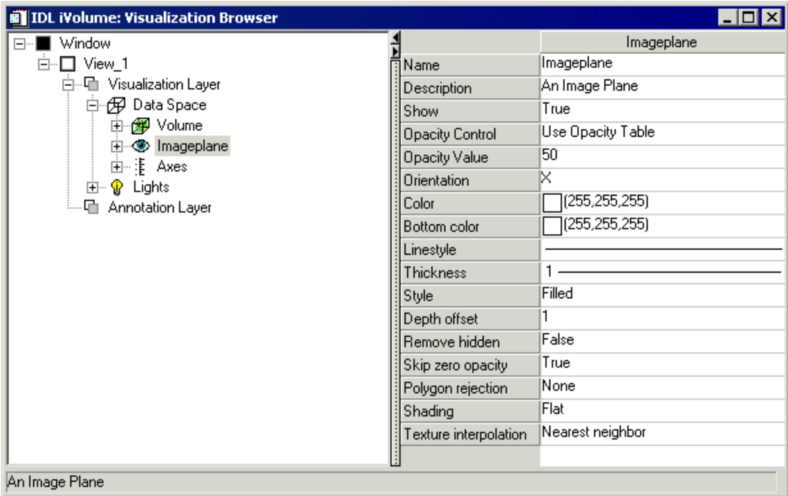


Figure 8-23: Visualization Browser with Image Plane Properties Displayed

These properties control image plane object visualizations. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, "Property Controls".

Property	Control Type: Values
Opacity Control	String List: Set opacity. Choose from the following: • **Use Opacity Table** • **Opaque** • **Opacity Value** Default = **Use Opacity Table**
Opacity Value	Number: Factor from 0 - 100 determining the level of opacity. Move slider to change the size. Default = `50`

Table 8-40: Image Plane Container Properties

Property	Control Type: Values
Orientation	Set orientation. Default = **X**
Color	Color: Color to be used for the image plane lines in this visualization. Click to choose from the default color palette, or specify RGB values. Default = `[255, 255, 255]` (white)
Bottom color	Color: Color to be used for the image plane bottom color in this visualization. Click to choose from the default color palette, or specify RGB values. Default = `[255, 255, 255]` (white)
Linestyle	Line Style: Style of lines used for constructing the surface. Select a style from the list. Default = ———————— (solid line)
Thickness	Line Thickness: Thickness of lines used for constructing the surface. Select a thickness from the list. Default = `1`
Style	Style: Style of lines used. Choose from the following: • **Points** • **Lines** • **Filled** Default = **Filled**
Depth offset	Number: Set depth offset value. Enter value. Default = `1`
Remove hidden	Boolean: Remove hidden? Choose **True** or **False**. Default = **False**
Skip zero opacity	Boolean: Skip zero opacity? Choose **True** or **False**. Default = **True**

Table 8-40: Image Plane Container Properties

Property	Control Type: Values
Polygon rejection	String List: Set polygon rejection color. Choose from the following: • **None** • **Normals point away** • **Normals point toward** Default = **None**
Shading	String List: Shading method. Select a method from the list. Choose between these values: • **Flat**: Flat shading • **Gouraud**: Gouraud shading Default = **Flat**
Texture interpolation	String List: Set texture interpolation type. Choose between these values: • **Nearest neighbor** • **Bilinear** Default = **Nearest neighbor**

Table 8-40: Image Plane Container Properties

Colorbar

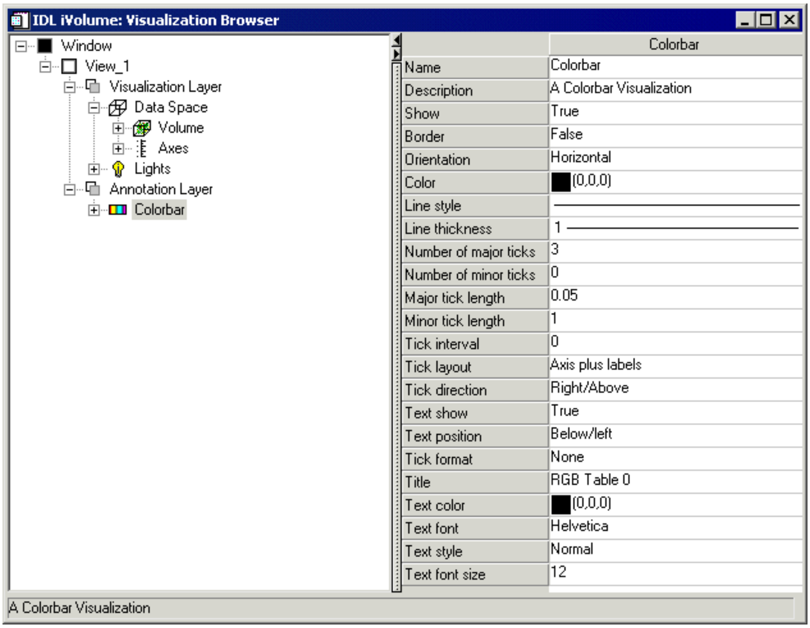


Figure 8-24: Visualization Browser with Colorbar Properties Displayed

These properties control colorbar object visualizations. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, "Property Controls"

Property	Control Type: Values
Border	Boolean: Set border on or off. Choose **True** or **False**. Default = **False**
Orientation	Boolean: Set orientation of colorbar. Choose **Horizontal** or **Vertical**. Default = **Horizontal**

Table 8-41: Colorbar Container Properties

Property	Control Type: Values
Color	Color: Color to be used for the colorbar in this visualization. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Line style	Line Style: Style of the colorbar lines. Select a line style from the list. Default = ———— (solid line)
Line thickness	Line Thickness: Thickness of the colorbar lines in points. Select a thickness from the list. Default = `1`
Number of major ticks	Number: Set number of major tick marks. Enter value. Default = `3`
Number of minor ticks	Number: Set number of minor tick marks. Enter value. Default = `0`
Major tick length	Number: Factor from 0 - 1 determining major tick length. Move slider to change the size. Default = .05
Minor tick length	Number: Factor from 0 - 1 determining minor tick length. Move slider to change the size. Default = 1
Tick interval	Number: Set tick interval. Enter value. Default = `0`
Tick layout	String List: Set tick layout type. Choose between these values: • **Axis plus labels** • **Labels only** • **Box style** Default = **Axis plus labels**
Tick direction	String List: Set tick direction. Choose between these values: • **Right/Above** • **Left/Below** Default = **Right/Above**

Table 8-41: Colorbar Container Properties

Property	Control Type: Values
Text show	Boolean: Set text to show or not show. Choose **True** or **False**. Default = **True** (show)
Text position	String List: Set text position. Choose between these values: • **Below/left** • **Above/right** Default = **Below/left**

Table 8-41: Colorbar Container Properties

Property	Control Type: Values
Tick format	String List: Set tick format type. Choose from these values: • **None** • **Use Tick Format Code** • **Year** • **Month(I)/Year** • **Month(A)/Year** • **Month(A);Year** • **Month(I)/Day/Year** • **Year/Month(I)/Day** • **Month(I)/Day/Year;Hour:Min:Sec** • **Year/Month(I)/Day;Hour:Min:Sec** • **Month(A)** • **Month(I)/Day** • **Month(A);Day** • **Day** • **Day;Hour:Min:Sec** • **Hour** • **Hour:Min** • **Hour:Min:Sec** • **Hour:Min:Sec.00** • **Min** • **Min:Sec** • **Min:Sec.00** • **Sec** • **Sec.00** Default = **None**
Title	Title: Enter title for colorbar. Default = **RGB Table 0**

Table 8-41: Colorbar Container Properties

Property	Control Type: Values
Text color	Color: Color to be used for the legend text. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Text font	String List: Font used for legend text. Select a font from the list. Choose from these values: • **Helvetica** • **Courier** • **Times** • **Symbol** • **Hershey** Default = **Helvetica**
Text style	String List: Style used for legend text. Select a style from the list. Choose from these values: • **Normal** • **Bold** • **Italic** • **Bold italic** Default = **Normal**
Text font size	Number: Font size in points for the legend text. Edit the number to change the size. Default = `12`

Table 8-41: Colorbar Container Properties

Histogram

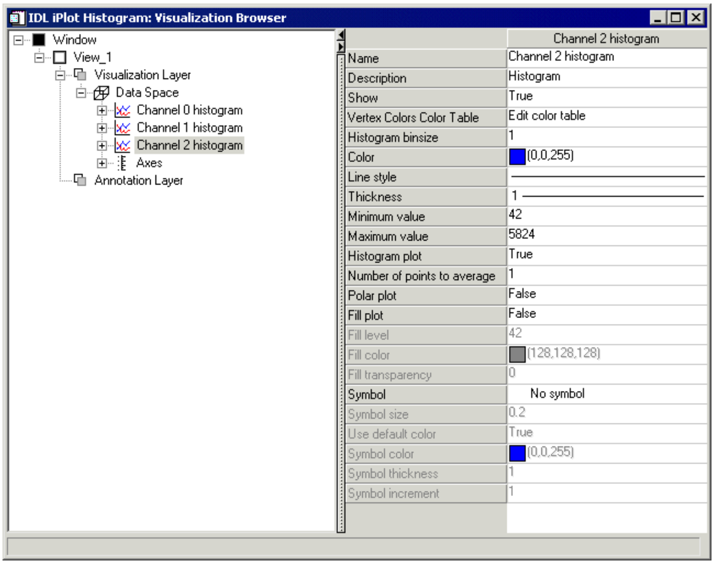


Figure 8-25: Visualization Browser with Histogram Properties Displayed

These properties control histogram object visualizations. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, “Property Controls”

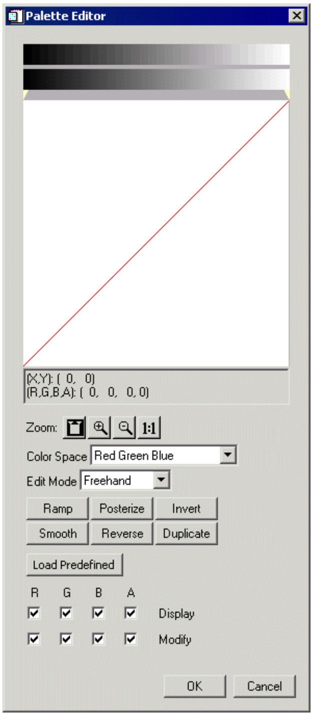
Property	Control Type: Values
Vertex Colors Color Table	Color: By selecting **Edit Color** → **Table Edit** access the color table to manipulate plot color values 
Histogram binsize	Number: Set histogram binsize. Default = `1`
Color	Color: Color to be used for the plot lines. RGB values are assigned or you may edit your color. Default = **varies**
Line style	Line Style: Style of the colorbar lines. Select a line style from the list. Default = ———————— (solid line)

Table 8-42: Histogram Container Properties

Property	Control Type: Values
Thickness	Line Thickness: Thickness of the colorbar lines in points. Select a thickness from the list. Default = `1`
Minimum value	Number: Minimum histogram value. Enter a number. Default = **varies**
Maximum value	Number: Maximum histogram value. Enter a number. Default = **varies**
Histogram plot	Boolean: Set histogram to show or not show. Choose **True** or **False**. Default = **True** (show)
Number of points to average	Number: Number of points in plot to be averaged. Enter a number. Default = `1`
Polar plot	Boolean: Set histogram to show or not show as a polar plot. Choose **True** or **False**. Default = **False** (hide)
Fill plot	Boolean: Set histogram to show or not show as a filled plot. Choose **True** or **False**. Default = **False** (hide)
Fill level	Number: Level to fill if fill plot is selected. Enter a number. Default = **varies**
Fill color	Color: Color to be used for fill plot if selected. Default = `[128, 128, 128]` (grey)
Fill transparency	Number: Value of transparency if fill plot is selected. Enter a number. Default = `0`

Table 8-42: Histogram Container Properties

Property	Control Type: Values
Symbol	String List: Font used for legend text. Select a font from the list. Choose from the list of symbols. Default = **No symbol**
Symbol size	Number: Value for symbol size in points if fill symbol is selected. Enter a number. Default = `0.2`
Use default color	Boolean: Set to use default color for symbols. Choose **True** or **False**. Default = **True** (use default color)
Symbol color	Color: Color to be used for symbols if default color is set to False. Enter a value. Default = **varies**
Symbol thickness	Number: Value for symbol thickness in points if symbol is selected. Enter a number. Default = `1`
Symbol increment	Number: Value for symbol increments if fill symbol is selected. Enter a number. Default = `1`

Table 8-42: Histogram Container Properties

Axes

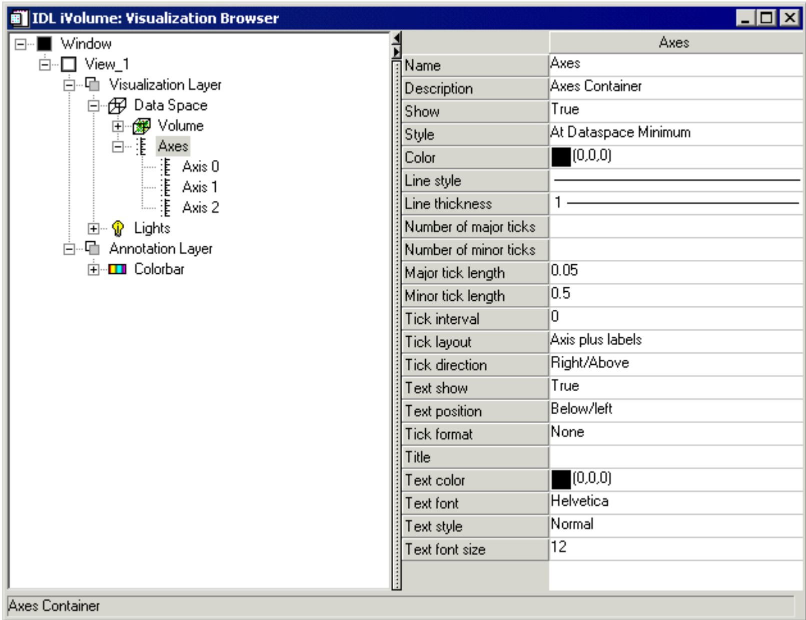


Figure 8-26: Visualization Browser with Axis Properties Displayed

These properties control axis object visualizations. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, “Property Controls”

The following table contains the properties that control the Container for the visualization axes.

Property	Control Type: Values
Style	String List: Select display style for axes. Choose from these values: • **None**: Do not display axes. • **At Dataspace Minimum**: Display 2 axes for 2-D visualization, 3 axes for 3-D visualization. • **Box Axes**: Display 4 axes for 2-D visualization, 12 axes for 3-D visualization. • **Crosshairs**: Display crosshair style axes. Default = **At Dataspace Minimum**
Color	Color: Color to be used for the axis lines in this visualization. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Line style	Line Style: Style of the axis tick lines. Select a line style from the list. Default = ———— (solid line)
Line thickness	Line Thickness: Thickness of the axis tick lines. Select a thickness from the list. Default = `1`
Number of major ticks	Number: Set number of major tick marks. Enter value. Default = `0`
Number of minor ticks	Number: Set number of minor tick marks. Enter value. Default = `0`
Major Tick Length	Number: Normalized length of major tick marks for all axes from 0 (no ticks) to 1 (major tick marks span the visualization). Move the slider to change the value. Default = `0.05`.

Table 8-43: Axes Container Properties

Property	Control Type: Values
Minor tick length	Number: Relative length of minor tick marks for all axes from -1 (minor tick marks extend the length of major tick marks on left side of axes) to 1 (minor tick marks extend same length as major tick marks on right side of axes). Move the slider to change the value. Default = `0.5` (Minor tick marks extend one-half the length of major tick marks on right side of axes).
Tick interval	Number: Interval between ticks. Edit the number to change the value. Default = `0`
Tick layout	String List: Select layout style for major and minor tick visualization on all axes. Choose from these values: • **Axis plus labels**: Display tick labels and marks. • **Labels only**: Display tick labels only (no tick marks). • **Box style**: Display tick labels and marks, with labels enclosed in boxes. Default = **Axis plus labels**
Tick direction	String List: Select a direction for tick marks. Choose from these values: • **Right/Above**: Place tick marks to the right of or above the axis line. • **Left/Below**: Place text to the left of or below the axis line. Default = **Right/Above**
Text show	Boolean: Set text to show or not show. Choose **True** or **False**. Default = **True** (show)
Text position	String List: Select a position for tick and label text. Choose from these values: • **Below/left**: Place text below or to the left of the axis line. • **Above/right**: Place text above or to the right of the axis line. Default = **Below/left**

Table 8-43: Axes Container Properties

Property	Control Type: Values
Tick format	String List: Choose a format code or time interval to use for each tick interval. Choose from these: • **None** • **Use Tick Format Code** • **Year** • **Month(I)/Year** • **Month(A)/Year** • **Month(A);Year** • **Month(I)/Day/Year** • **Year/Month(I)/Day** • **Month(I)/Day/Year;Hour:Min:Sec** • **Year/Month(I)/Day;Hour:Min:Sec** • **Month(A)** • **Month(I)/Day** • **Month(A);Day** • **Day** • **Day;Hour:Min:Sec** • **Hour** • **Hour:Min** • **Hour:Min:Sec** • **Hour:Min:Sec.00** • **Min** • **Min:Sec** • **Min:Sec.00** • **Sec** • **Sec.00** Default = **None**
Title	String: Title to apply to all axes for this visualization. Enter title text for the axes. No default value.

Table 8-43: Axes Container Properties

Property	Control Type: Values
Text color	Color: Color to be used for the text. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Text font	String List: Font used for tick and label text. Select a font from the list. Choose from these values: • **Helvetica** • **Courier** • **Times** • **Symbol** • **Hershey** Default = **Helvetica**
Text style	String List: Style used for tick and label text. Select a style from the list. Choose from these values: • **Normal** • **Bold** • **Italic** • **Bold italic** Default = **Normal**
Text font size	Number: Font size in points for the tick and label text. Edit the number to change the size. Default = `12`

Table 8-43: Axes Container Properties

This table contains the properties that control axis visualization X, Y, or (for three-dimensional visualizations) Z. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, “Property Controls”.

Property	Control Type: Values
Color	Color: Color to be used for the axis line. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Line style	Line Style: Style of the axis tick lines. Select a line style from the list. Default = ———— (solid line)
Line thickness	Line Thickness: Thickness of the axis tick lines in points. Select a thickness from the list. Default = `1`
Number of major ticks	Number: Number of major ticks marks to display along the axis. Edit the number to change the value. Default = 5
Number of minor ticks	Number: Number of minor ticks to display between major ticks. Edit the number to change the value. Default = 3
Major tick length	Number: Normalized length of major tick marks for this axis from 0 (no ticks) to 1 (major tick marks span the visualization). Move the slider to change the value. Default = `0.05`
Minor tick length	Number: Relative length of minor tick marks for this axis from -1 (minor tick marks extend the length of major tick marks on left side of axis) to 1 (minor tick marks extend same length as major tick marks on right side of axis). Move the slider to change the value. Default = `0.5` (Minor tick marks extend one-half the length of major tick marks on right side of axis).
Tick interval	Number: Interval between major tick marks. Edit the number to change the value. Default = `0` (use the default interval for the specified range)

Table 8-44: Property Settings for Individual Axes

Property	Control Type: Values
Tick layout	String List: Select layout style for major and minor tick visualization. Choose from these values: • **Axis plus labels**: Display tick labels and marks. • **Labels only**: Display tick labels only (no tick marks). • **Box style**: Display tick labels and marks, with labels enclosed in boxes. Default = **Axis plus labels**
Tick direction	String List: Select a direction for tick marks. Choose from these values: • **Right/Above**: Place tick marks to the right of or above the axis line. • **Left/Below**: Place text to the left of or below the axis line. Default = **Right/Above**
Text show	Boolean: Show tick and label text? Choose **True** or **False**. Default = **True**.
Text position	String List: Select a position for tick and label text. Choose from these values: • **Below/left**: Place text below or to the left of the axis line. • **Above/right**: Place text above or to the right of the axis line. Default = **Below/left**

Table 8-44: Property Settings for Individual Axes (Continued)

Property	Control Type: Values
Tick format	String List: Choose a format code or time interval to use for each tick interval. Choose from these: • **None** • **Use Tick Format Code** • **Year** • **Month(I)/Year** • **Month(A)/Year** • **Month(A);Year** • **Month(I)/Day/Year** • **Year/Month(I)/Day** • **Month(I)/Day/Year;Hour:Min:Sec** • **Year/Month(I)/Day;Hour:Min:Sec** • **Month(A)** • **Month(I)/Day** • **Month(A);Day** • **Day** • **Day;Hour:Min:Sec** • **Hour** • **Hour:Min** • **Hour:Min:Sec** • **Hour:Min:Sec.00** • **Min** • **Min:Sec** • **Min:Sec.00** • **Sec** • **Sec.00** Default = **None**
Title	String: Title to apply to this axis. Enter title text for the axes. No default value.

Table 8-44: Property Settings for Individual Axes (Continued)

Property	Control Type: Values
Text color	Color: Color to be used for the text. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Text font	String List: Font used for tick and label text. Select a font from the list. Choose from these values: • **Helvetica** • **Courier** • **Times** • **Symbol** • **Hershey** Default = **Helvetica**
Text style	String List: Style used for tick and label text. Select a style from the list. Choose from these values: • **Normal** • **Bold** • **Italic** • **Bold italic** Default = **Normal**
Text font size	Number: Font size in points for the tick and label text. Edit the number to change the size. Default = `12`

Table 8-44: Property Settings for Individual Axes (Continued)

Lights

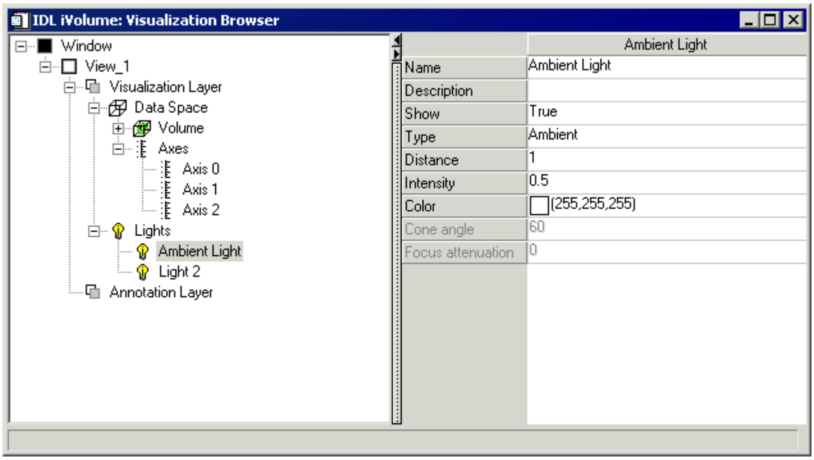


Figure 8-27: Visualization Browser with Light Properties Displayed

Lights properties control the lighting of the data space. These properties are available only for 3-D Surface and Volume visualizations.

Three types of lights can be configured through the Lights properties: Ambient Light, Light 1 (from above), and Light 2 (from below). Each type of light has the same set of properties, as described in Table 8-45.

For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, "Property Controls".

Property	Control Type: Values
Type	String List: Type of light source for this light. Select a type of light from the list. Choose from these options: • **Ambient**: Universal light source with no direction or position. An ambient light illuminates every surface in the scene equally, which means that no edges are made visible by contrast. Ambient light controls the overall brightness and color of the scene. • **Positional**: Supplies divergent light rays so that the edges of surfaces can be made visible by contrast. A positional light source can be located anywhere in the scene. • **Directional**: Supplies parallel light rays from a light source located at an infinite distance from scene. • **Spotlight**: Illuminates only a specific area defined by the light's position, direction, and the *cone angle* (angle the spotlight covers). Default = **Positional**
Distance	Number: Distance of the light source from the visualization from -1 (in front of the visualization) to 1 (behind the visualization). Move the slider to change the value. Default = **-1** for Ambient Light and Light 1, **1** for Light 2
Intensity	Number: Intensity of this light from 0 (no light) to 1 (bright light). Move the slider to change the value. Default = **0.5** for Ambient Light, **0.8** for Light 1 and Light 2
Color	Color: Color of this light. Click to choose from the default color palette, or specify RGB values. Default = `[255,255,255]` (white)
Cone angle	Number: Angle the spotlight covers from 0º to 180º. Active only when **Spotlight** type is selected. Move the slider to change the value. Default = 60

Table 8-45: Property Settings for Lights

Property	Control Type: Values
Focus attenuation	Number: Floating-point value from 0 to 128 that attenuates the intensity of spotlights as the distance from the center of the cone of coverage increases. This factor is used as an exponent to the cosine of the angle between the direction of the spotlight and the direction from the light to the vertex being lighted. Active only when **Spotlight** type is selected. Move the slider to change the value. Default = **0**

Table 8-45: Property Settings for Lights (Continued)

Polygonal ROI

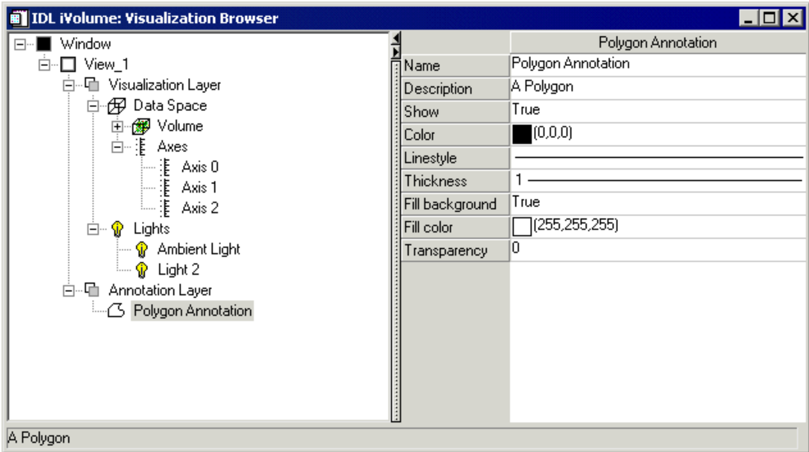


Figure 8-28: Visualization Browser with Polygon ROI Properties Displayed

These properties control polygonal ROI object visualizations. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, "Property Controls"

Property	Control Type: Values
Color	Color: Color to be used for the line. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Linestyle	Line Style: Style of the polygon lines. Select a line style from the list. Default = ———— (solid line)
Thickness	Line Thickness: Thickness of the polygon lines in points. Select a thickness from the list. Default = `1`
Fill background	Boolean: Fill background? Choose **True** or **False**. Default = **True**

Table 8-46: Property Settings for Polygonal ROI

Property	Control Type: Values
Fill color	Color: Color to fill. Click to choose from the default color palette, or specify RGB values. Default = `[255,255, 255]` (white)
Transparency	Number: Level of transparency. Default = `0`

Table 8-46: Property Settings for Polygonal ROI

IDL Graphics Objects

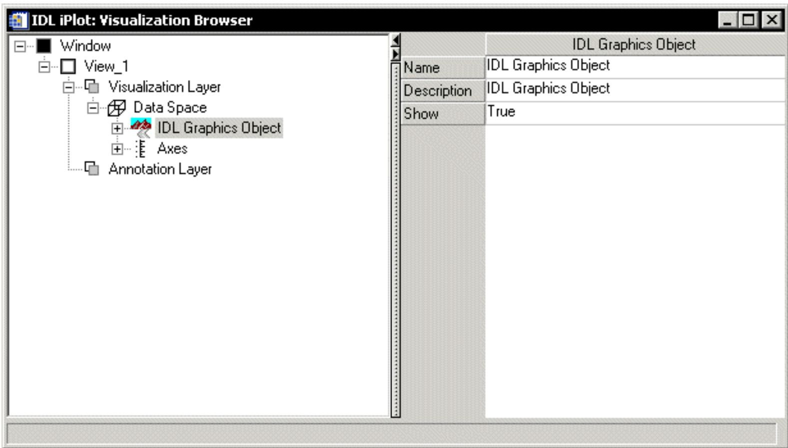


Figure 8-29: Visualization Browser with IDL Graphics Object Properties Displayed.

You can import an IDL graphics object into an iTool and display it directly by selecting the “IDL Graphics Object” visualization type. The properties available will depend on the type of graphics object. See the properties listing for the specific graphics object in the *IDL Reference Guide* for details.

Note

The behavior of IDL graphics objects imported into an iTool may not be the same as that of the corresponding iTool visualization. While importing an existing graphics object into an iTool will often work, you will generally obtain better results using an iTool visualization type.

Tip

In order to display properties for a generic IDL graphics object in the iTool property sheet interface, the graphics object must have been created with the REGISTER_PROPERTIES keyword set. If no properties are registered, only the three standard iTool properties (Name, Description, and Show) will be present, as displayed in the previous figure.

2D Annotation Layer Properties

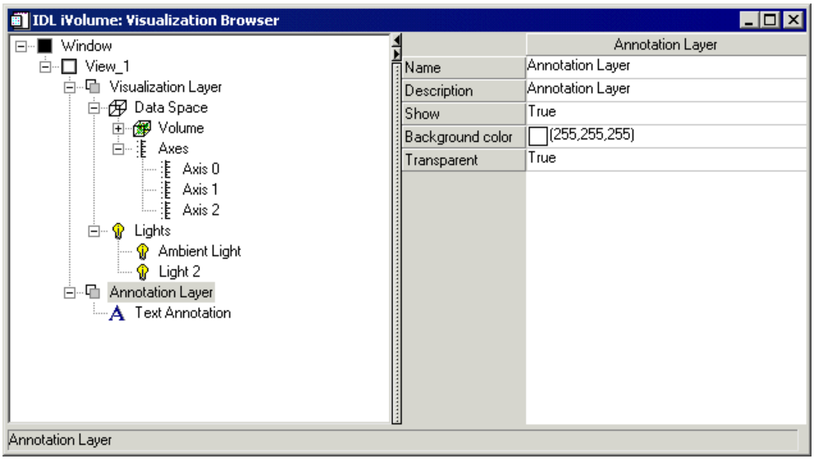


Figure 8-30: Visualization Browser with Annotation Properties Displayed

The following types of annotations can be added to iTool visualizations: Text, Line, Line Profile, Rectangle, Oval, Polygon, and Freehand annotations. The following table contains properties that control the Annotation layer. Subsequent tables describe the properties specific to each type of annotation.

Property	Control Type: Values
Background color	Color: Color to be used for the Annotation Layer background. For background to display, Transparent property must be set to **False**. Click to choose from the default color palette, or specify RGB values. Default = `[255,255,255]` (white)
Transparent	Boolean: Make the annotation layer transparent? Choose **True** or **False**. Default = **True**.

Table 8-47: Annotation Layer Properties

Text Annotation Properties

These properties control text annotation visualizations. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, “Property Controls”.

Property	Control Type: Values
Text string	String: Text that appears in the annotation. Edit to change the text, or to add formatting commands such as the following: • !C: Add new line. • !U: Add superscript characters. • !D: Add subscript characters. • !N: Return to normal characters. For a complete list of embedded text formatting commands, refer to “Embedded Formatting Commands” in Appendix H of the *IDL Reference Guide*. No default value.
Horizontal alignment	String List: Horizontal alignment of multiple lines within text box. Choose from these values: • **Left**: Align text along the left border of the text box. • **Center**: Align text in the center of the text box. • **Right**: Align text along the right border of the text box. Default = **Left**
Color	Color: Color to be used for the text. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Fill background	Boolean: Fill the background of the text with the background color? Choose **True** or **False**. Default = **False**
Transparency	Number: Transparency of the text annotation from 0% to 100%. Move the slider to change the value. Default = **0**

Table 8-48: Text Annotation Properties

Property	Control Type: Values
Text font	String List: Font used for text annotation. Select a font from the list. Choose from these values: • **Helvetica** • **Courier** • **Times** • **Symbol** • **Hershey** Default = **Helvetica**
Text style	String List: Style used for text annotation. Select a style from the list. Choose from these values: • **Normal** • **Bold** • **Italic** • **Bold italic** Default = **Normal**
Text font size	Number: Font size in points for the text annotation. Edit the number to change the size. Default = `12`

Table 8-48: Text Annotation Properties (Continued)

Line Annotation Properties

These properties control line annotation visualizations. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, "Property Controls".

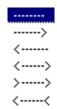
Property	Control Type: Values
Color	Color: Color to be used for the line. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Linestyle	Line Style: Style of the line annotation. Select a line style from the list. Default = ———— (solid line)
Thickness	Line Thickness: Thickness of the line annotation in points. Select a thickness from the list. Default = `1`
Arrow style	Arrow Style Selector: Select an arrow style from the list. Choose from these values:  Default = -------- (no arrow)
Arrowhead size	Number: Size of arrowhead in normalized units. Arrow style must be selected for arrowhead to display. Move the slider to change the value. Default = `0.05`

Table 8-49: Line Annotation Properties

Line Profile Annotation Properties

These properties control line profile annotation visualizations. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, "Property Controls"

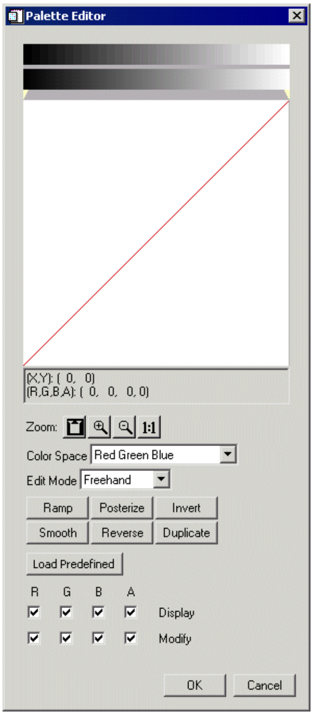
Property	Control Type: Values
Vertex Colors Color Table	User Defined: By selecting **Edit Color** → **Table Edit** access the color table to manipulate plot color values 
Color	Color: Color to be used for the line. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Line style	Line Style: Style of the line profile annotation. Select a line style from the list. Default = ———— (solid line)

Table 8-50: Line Profile Annotation Properties

Property	Control Type: Values
Thickness	Line Thickness: Thickness of the line profile annotation in points. Select a thickness from the list. Default = `1`
Minimum value	Number: Minimum value for line profile. Edit number to change value. No default value.
Maximum value	Number: Maximum value for line profile.Edit number to change value. No default value.
Histogram plot	Boolean: Show line profile as a histogram plot? Choose **True** or **False**. Default = **False**
Number of points to average	Number: Set number of points to average. Enter a value. Default = `1`
Polar plot	Boolean: Show line profile as a polar plot? Choose **True** or **False**. Default = **False**
Fill plot	Boolean: Fill plot? Choose **True** or **False**. Default = **False**
Fill level	Number: Set level to fill. Enter value. Default = `71`
Fill color	Color: Color used for fill. For color to display, Fill Plot property must be set to **True**. Click to choose from the default color palette, or specify RGB values. Default = `[255,255,255]` (white)
Fill transparency	Number: Transparency of the plot fill from 0% to 100%. Move the slider to change the value. Default = `0`
Symbol	Symbol: Symbol to appear at regular intervals on the plot line. Choose a symbol from the list. Default = **No symbol**
Symbol size	Number: Factor from 0 - 1 determining the size of the selected symbol. Move slider to change the size. Default = `0.2`

Table 8-50: Line Profile Annotation Properties

Property	Control Type: Values
Use default color	Boolean: Activate Symbol color property. Choose **True** or **False**. Default = **False**
Symbol color	Color: Color for the selected symbol. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Symbol thickness	Number: Line thickness from 1 - 9.9 for the selected symbol. Move slider to change the thickness. Default = `1`.
Symbol increment	Number: Interval at which symbols will be displayed on the plot line. Influenced by Number of points to average (above). Edit to change the value. Default = `1`

Table 8-50: Line Profile Annotation Properties

Rectangle Annotation Properties

These properties control rectangle annotation visualizations. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, "Property Controls".

Property	Control Type: Values
Color	Color: Color to be used for the rectangle outline. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Linestyle	Line Style: Style of the rectangle outline. Select a line style from the list. Default = ———————— (solid line)
Thickness	Line Thickness: Thickness of the rectangle outline in points. Select a thickness from the list. Default = `1`
Fill background	Boolean: Fill rectangle background? Choose **True** or **False**. Default = **True**
Fill color	Color: Color to be used for the background. For background color to display, Fill Background property must be set to **True**. Click to choose from the default color palette, or specify RGB values. Default = `[255,255,255]` (white)
Transparency	Number: Transparency of the rectangle background fill from 0% to 100%. Move the slider to change the value. Default = **0**

Table 8-51: Rectangle Annotation Properties

Oval Annotation Properties

These properties control oval annotation visualizations. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, "Property Controls".

Property	Control Type: Values
Color	Color: Color to be used for the oval outline. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Linestyle	Line Style: Style of the oval outline. Select a line style from the list. Default = ———— (solid line)
Thickness	Line Thickness: Thickness of the oval outline in points. Select a thickness from the list. Default = `1`
Fill background	Boolean: Fill oval background? Choose **True** or **False**. Default = **True**
Fill color	Color: Color to be used for the background. For background color to display, Fill Background property must be set to **True**. Click to choose from the default color palette, or specify RGB values. Default = `[255,255,255]` (white)
Transparency	Number: Transparency of the oval background fill from 0% to 100%. Move the slider to change the value. Default = **0**

Table 8-52: Oval Annotation Properties

Polygon Annotation Properties

These properties control polygon annotation visualizations. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, "Property Controls".

Property	Control Type: Values
Color	Color: Color to be used for the polygon outline. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Linestyle	Line Style: Style of the polygon outline. Select a line style from the list. Default = ——————— (solid line)
Thickness	Line Thickness: Thickness of the polygon outline in points. Select a thickness from the list. Default = `1`
Fill background	Boolean: Fill polygon background? Choose **True** or **False**. Default = **True**
Fill color	Color: Color to be used for the background. For background color to display, Fill Background property must be set to **True**. Click to choose from the default color palette, or specify RGB values. Default = `[255,255,255]` (white)
Transparency	Number: Transparency of the polygon background fill from 0% to 100%. Move the slider to change the value. Default = **0**

Table 8-53: Polygon Annotation Properties

Freehand Annotation Properties

These properties control freehand annotation visualizations. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, “Property Controls”.

Property	Control Type: Values
Color	Color: Color to be used for the freehand shape outline. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Linestyle	Line Style: Style of the freehand shape outline. Select a line style from the list. Default = ———— (solid line)
Thickness	Line Thickness: Thickness of the freehand shape outline in points. Select a thickness from the list. Default = `1`
Fill background	Boolean: Fill freehand shape background. Choose **True** or **False**. Default = **True**
Fill color	Color: Color to be used for the background. For background color to display, Fill Background property must be set to **True**. Click to choose from the default color palette, or specify RGB values. Default = `[255,255,255]` (white)
Transparency	Number: Transparency of the freehand background fill from 0% to 100%. Move the slider to change the value. Default = **0**

Table 8-54: Freehand Annotation Properties

Legend Properties

These properties control legend annotations. For each property, the type of control and the values that can be assigned are listed. For a description of how a particular control is used, refer to Appendix B, "Property Controls".

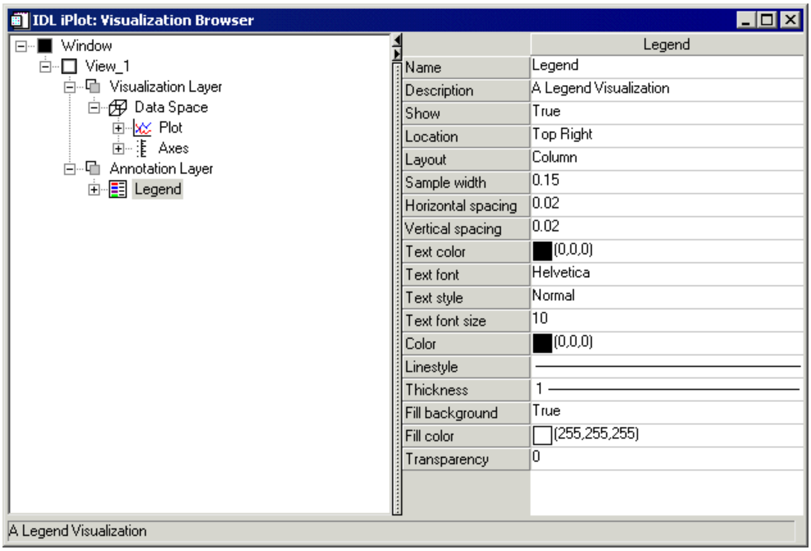


Figure 8-31: Visualization Browser with Legend Properties Displayed

Note

This section discusses the properties of the legend container, which can contain multiple legend items of different types. The individual legend types are described in:

"Legend Contour Items" on page 347
"Legend Contour Level Items" on page 348
"Legend Plot Items" on page 349
"Legend Surface Items" on page 350

Property	Control Type: Values
Location	String List: Position of the legend within the iTool window. Select a location from the list. Choose from these values: • **Top Right** • **User Specified** • **Top Left** • **Top Center** • **Bottom Left** • **Bottom Center** • **Bottom Right** Default = **Top Right**
Layout	String List: Arrange the legend elements in columns or rows. Select a layout from the list. Choose from these values: • **Columns** • **Rows** Default = **Columns**
Sample width	Number: Width in normalized units of the element sample that appears in the legend box. Range = `0.0` to `0.5`. Move the slider to change the value. Default = `0.15`
Horizontal spacing	Number: Space in normalized units between samples and text in the legend box. Range = `0.0` to `0.25`. Move the slider to change the value. Default = `0.02`
Vertical spacing	Number: Space in normalized units between lines in the legend box. Move the slider to change the value. Default = `0.02`
Text color	Color: Color to be used for the legend text. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)

Table 8-55: Legend Properties

Property	Control Type: Values
Text font	String List: Font used for legend text. Select a font from the list. Choose from these values: • **Helvetica** • **Courier** • **Times** • **Symbol** • **Hershey** Default = **Helvetica**
Text style	String List: Style used for legend text. Select a style from the list. Choose from these values: • **Normal** • **Bold** • **Italic** • **Bold italic** Default = **Normal**
Text font size	Number: Font size in points for the legend text. Edit the number to change the size. Default = `10`
Color	Color: Color to use for the legend border. Legend object must be deselected for border attributes to be visible. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Linestyle	Line Style: Style of the legend border. Select a line style from the list. Default = ———————— (solid line)
Thickness	Line Thickness: Thickness of the legend border in points. Select a thickness from the list. Default = `1`
Fill background	Boolean: Fill legend background? Choose **True** or **False**. Default = **True**

Table 8-55: Legend Properties (Continued)

Property	Control Type: Values
Fill color	Color: Color to be used for the background. For background color to display, Fill Background property must be set to **True**. Click to choose from the default color palette, or specify RGB values. Default = `[255,255,255]` (white)
Transparency	Number: Transparency of the background fill from 0% to 100% Move the slider to change the value. Default = **`0%`**

Table 8-55: Legend Properties (Continued)

Legend Contour Items

The following are properties of the top-level Contour legend item. For a description of how a particular control is used, refer to Appendix B, "Property Controls".

Property	Control Type: Values
Show Levels	Boolean: Show contour levels in the legend. Choose **True** or **False**. Default = **True**
Text	String: Text that labels the contour object in the legend.
Text color	Color: Color to be used for the legend text. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Text font	String List: Font used for legend text. Select a font from the list. Choose from these values: • **Helvetica** • **Courier** • **Times** • **Symbol** • **Hershey** Default = **Helvetica**
Text style	String List: Style used for legend text. Select a style from the list. Choose from these values: • **Normal** • **Bold** • **Italic** • **Bold italic** Default = **Normal**
Text font size	Number: Font size in points for the legend text. Edit the number to change the size. Default = `12`

Table 8-56: Contour Legend Properties

Legend Contour Level Items

The following are properties of individual Contour level legend items. For a description of how a particular control is used, refer to Appendix B, “Property Controls”

Property	Control Type: Values
Text	String: Text that labels the contour object in the legend.
Text color	Color: Color to be used for the legend text. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Text font	String List: Font used for legend text. Select a font from the list. Choose from these values: • **Helvetica** • **Courier** • **Times** • **Symbol** • **Hershey** Default = **Helvetica**
Text style	String List: Style used for legend text. Select a style from the list. Choose from these values: • **Normal** • **Bold** • **Italic** • **Bold italic** Default = **Normal**
Text font size	Number: Font size in points for the legend text. Edit the number to change the size. Default = `12`

Table 8-57: Contour Level Legend Properties

Legend Plot Items

The following are properties of Plot legend items. For a description of how a particular control is used, refer to Appendix B, “Property Controls”.

Property	Control Type: Values
Text	String: Text that labels the plot object in the legend.
Text color	Color: Color to be used for the legend text. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Text font	String List: Font used for legend text. Select a font from the list. Choose from these values: • **Helvetica** • **Courier** • **Times** • **Symbol** • **Hershey** Default = **Helvetica**
Text style	String List: Style used for legend text. Select a style from the list. Choose from these values: • **Normal** • **Bold** • **Italic** • **Bold italic** Default = **Normal**
Text font size	Number: Font size in points for the legend text. Edit the number to change the size. Default = `12`

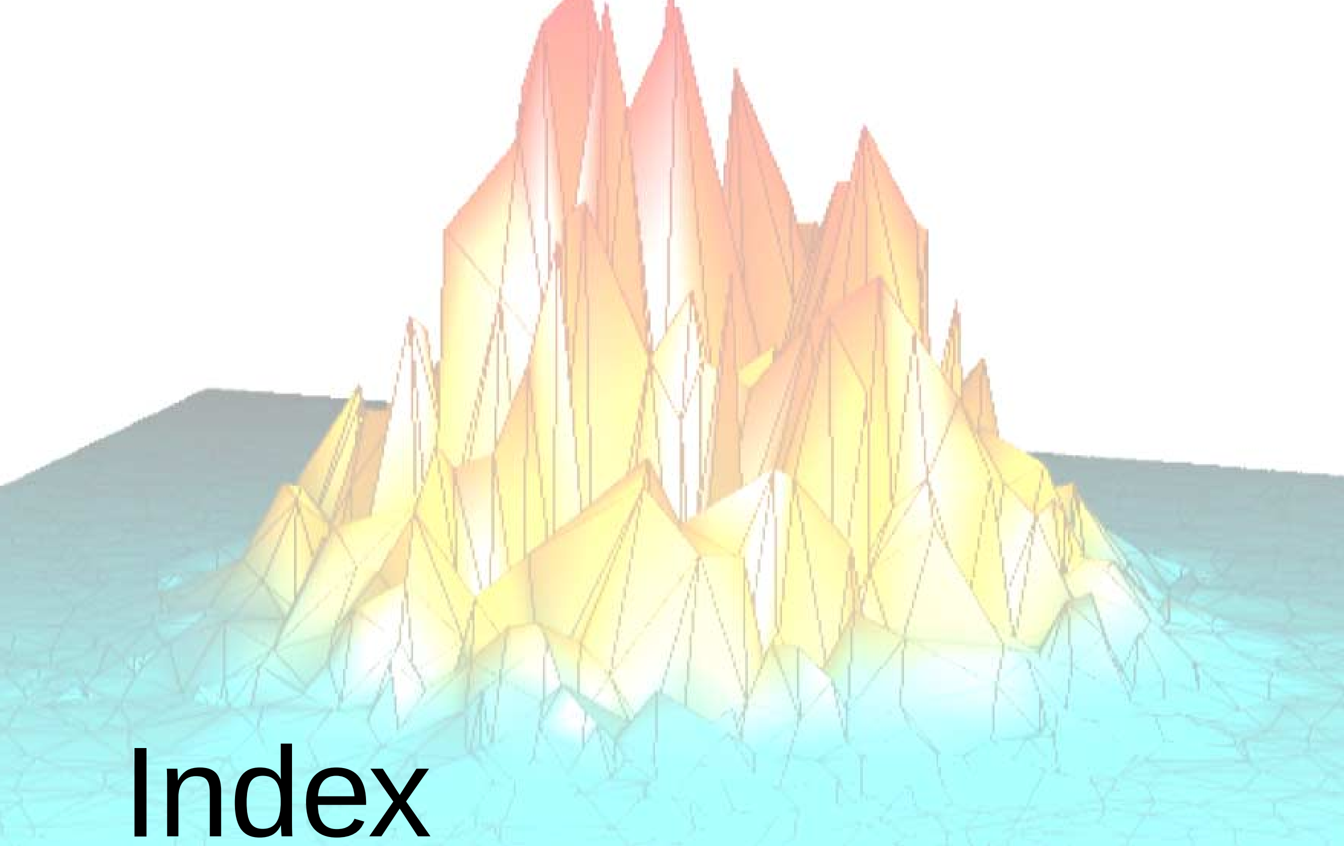
Table 8-58: Plot Legend Properties

Legend Surface Items

The following are properties of individual Surface legend items. For a description of how a particular control is used, refer to Appendix B, “Property Controls”.

Property	Control Type: Values
Text	String: Text that labels the surface object in the legend.
Text color	Color: Color to be used for the legend text. Click to choose from the default color palette, or specify RGB values. Default = `[0,0,0]` (black)
Text font	String List: Font used for legend text. Select a font from the list. Choose from these values: • **Helvetica** • **Courier** • **Times** • **Symbol** • **Hershey** Default = **Helvetica**
Text style	String List: Style used for legend text. Select a style from the list. Choose from these values: • **Normal** • **Bold** • **Italic** • **Bold italic** Default = **Normal**
Text font size	Number: Font size in points for the legend text. Edit the number to change the size. Default = `12`

Table 8-59: Surface Legend Properties



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