Chapter 1 NCSA PolyView Tutorial

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Chapter Overview

This chapter offers a tutorial which introduces some of NCSA PolyView's capabilities.

The tutorial assumes that you are able to work with 4Sight, the SGI window manager, and IRIX, the SGI version of UNIX. If you are unfamiliar with either system, please refer to their respective documentation.

Starting NCSA PolyView

This section describes how to start PolyView using a sample data file. Please refer to Appendix A, "Installing NCSA PolyView," if you need

information on installation procedures.

The following steps explain how to run PolyView using data provided for the tutorial:

1. Begin by moving to the directory that contains PolyView and the tutorial files. If you built the PolyView tar file from anonymous FTP or loaded a directory from source tapes, the directory should be named `src`.

2. Enter an **`ls`** command at the prompt to get a listing of the directory's contents. For this tutorial, you'll work with the HDF Vset file `demo.hdf` and the associated fly file `demo.fly`.

   If `demo.hdf` is missing, run **`make`** again and it will generate the file.

3. Enter **`polyview -hdf demo.hdf -scalar random -fly demo.fly`** at the prompt, where:

   - `polyview` is the name of the program
   - `-hdf demo.hdf` tells the program to read data from the `demo.hdf` file
   - `-scalar random` tells the program to load a vdata called `random` from the file and use it as a set of scalar values
   - `-fly demo.fly` tells the program that the name of the file used to script fly-bys is `demo.fly`.

PolyView reads the file's contents and list the names of vdatas as it loads them.

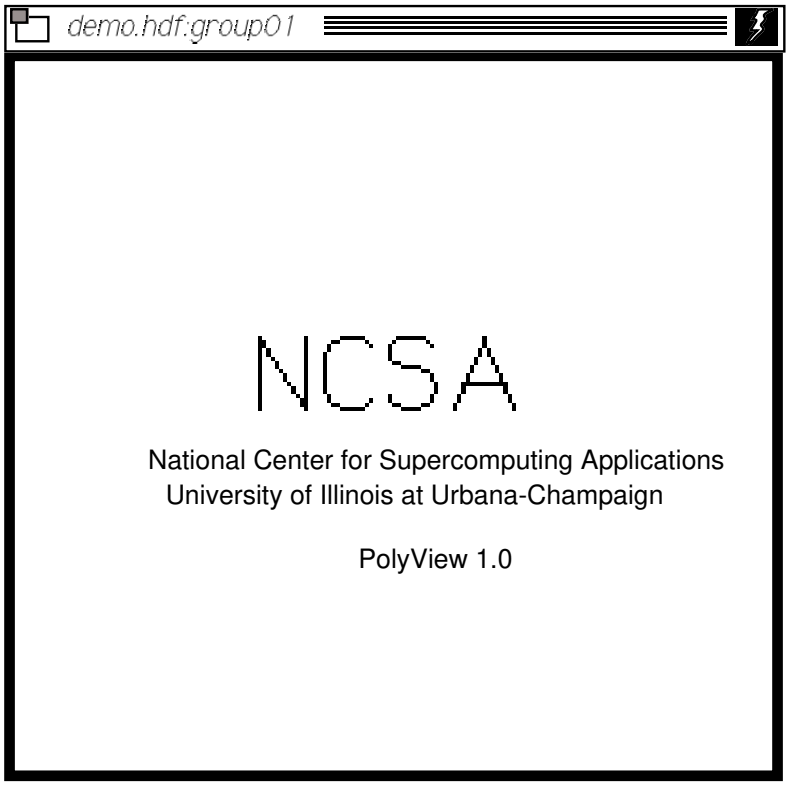
A red outline of the *View window* appears. Moving the mouse allows you to drag the outline to where you want the window to be placed.

4. Click the left button when the window is where you want it. The shaded border and title of the window will appear, but the window will remain empty for now. The file name "demo.hdf" should be visible in the title bar.

A red outline of the *Palette window* appears. Place it the same way you placed the View window.

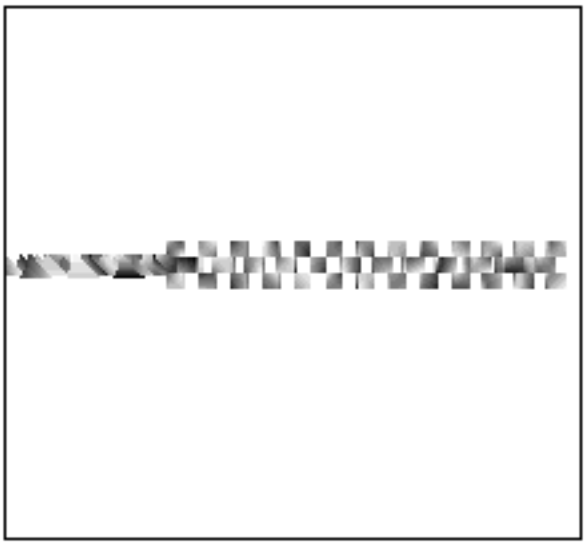
PolyView now fills in the View and Palette windows. Initially, the View window displays a title screen (Figure 1.1). Click the left button within the window to remove this screen.

Figure 1.1 View Window



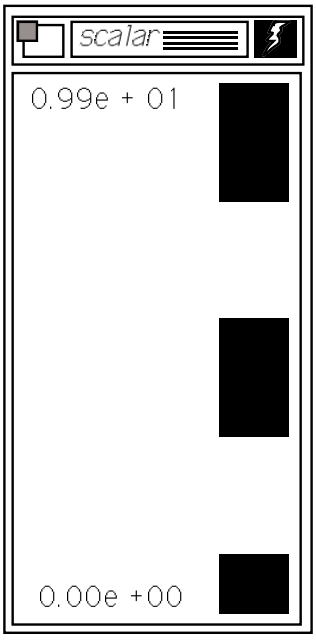
The View window displays the demonstration dataset that PolyView loaded. When the program starts up, the program chooses a default camera location and set of viewing parameters (Figure 1.2).

Figure 1.2 Initial View



The Palette window displays a bar reflecting the current palette (Figure 1.3). The bar is labelled with values corresponding to range of colors in the palette and the image.

Figure 1.3 Palette Window



Getting Around

This section of the tutorial demonstrates how to interact with the data

using the mouse and pop-up menus.

Note that mouse control, menus, and command line parameters all allow you to control viewing parameters. However, this section only focuses on the interactive features of PolyView. For more information on command lines, refer to Chapter 2, “Command References.”

This portion of the tutorial assumes that PolyView is running using the demonstration data, as described in the previous section.

Camera Movement

The initial view of the data is chosen automatically by the program. The view is defined by two things: your *camera* position and the *focus* of the camera’s attention (these are also referred to as the *from* and *at* points, respectively).

The camera position determines where the image in the View window is “taken from.” The camera’s focus determines what the camera is “pointing at” when the image is generated. Try manipulating the camera position and the focus.

Place the cursor arrow in the center of the View window. Move the camera in towards the focus by holding down the left mouse button and pushing the mouse backward. You should see the row of cubes moving closer.

Move the camera back from the focus by holding down the left mouse button again, but this time moving the mouse forward. The row of cubes should move farther away from the camera.

Move the camera around the focus point by holding down the middle mouse button and moving the mouse. Moving the mouse left and right shifts the camera so that the data appears to rotate to the left or right.

Likewise, moving the mouse forward or backward moves the camera, giving the illusion that the data is rotating up or down around the focus point .

Experiment with using the left and middle mouse buttons to maneuver the camera around the data. Try to move the camera to produce views that you are interested in. See if you can position the camera inside the tunnel of cubes or in top, side, front, and isometric views.

Palette Manipulation

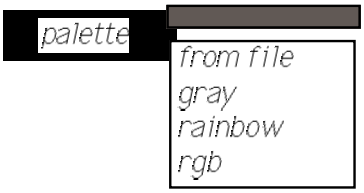
Moving the camera around the data provides fresh perspectives on the data’s geometry. You can gain additional insight into the distribution of scalar values from using features available in the Palette window.

Move the cursor into the Palette window. Note again how the scalar values are mapped to the colors in the palette, with the smallest scalar values corresponding to the lowest palette colors and the largest scalar values corresponding to the highest palette colors.

Hold down the right mouse button. The *palette menu* appears (Figure 1.4). The *palette* menu allows you to change the currently active palette

by selecting a new one from its list. Choose the *gray* palette by moving the cursor over it and releasing the mouse button. The color bar changes to a grey-scale palette. Note that the colors in the image have changed to the corresponding palette.

Figure 1.4 Palette Submenu



With the cursor in the Palette window, hold down the middle mouse button. This action places the Palette window in *fiddle mode*. Moving the mouse forward and backward shifts the colors in the palette up and down the scale. While you shift the palette, watch what effect it has on the data in the View window.

Once again, with the cursor in the Palette window, hold down the middle mouse button. Move the mouse left and right. Observe how the palette in both the Palette and View windows compresses and expands as the mouse moves.

Experiment with the fiddle feature to draw out details in the random scalar values that are displayed as color. Try changing the camera position to see how "fiddling" affects different areas of the data. When you are done, choose rainbow from the palette menu to return the palette to normal.

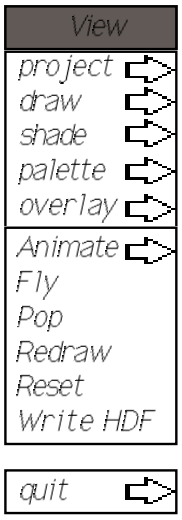
Using the View Menu

Besides manipulating a palette, you can change other image parameters in the *View* menu to make it much easier to understand what is happening to scalar values in an image dataset.

Display the *View* menu (Figure 1.5) by moving the cursor into the View window and holding down the right mouse button.

The *View menu* contains a number of options for changing the appearance of the data. The first five options control display parameters. The next set of menu items allow you to control animation; toggle a flight; pop or redraw a window; reset the window's display parameters; or write the image to an HDF raster image file.

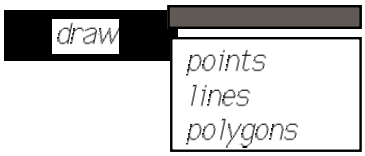
Figure 1.5 View Menu



Drawing Options

PolyView displays polygons, if possible, when the program starts up. Move the cursor to the *draw* submenu and choose the *points* option (Figure 1.6). The data in the View window should change to a set of dots, one at each polygon vertex.

Figure 1.6 Draw Submenu



Displaying images as points is useful for positioning large sets of data. It can be difficult to move the camera interactively while drawing polygons, since they take longer to draw. Try moving the camera and notice how much faster the screen redraws when you choose the *points* option.

Occasionally it is desirable to display 3D data that has no connectivity information associated with it. In these cases, PolyView defaults to drawing points.

Choose *lines* from the *draw* submenu. PolyView redraws the data in wireframe. Like the *points* option, lines display large sets of data more quickly than polygons. In addition, lines have the added benefit of displaying how the points are connected.

Choose *polygons* from the *draw* submenu. The View window again displays filled polygons.

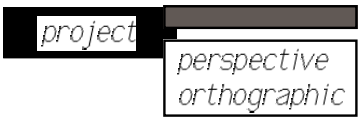
Viewing Projections

Up until this point in the tutorial, the program has drawn all the images using a perspective projection; that is, polygons closest to the camera

appear larger, while more distant objects appear smaller. You can choose different viewing projections from the *project* submenu.

The *project submenu* (Figure 1.7) allows you to change the projection used when drawing the data. Choose the *orthographic* option from this submenu. PolyView uses the orthographic projection to redraw the displayed data. Try moving the camera with this new projection to see how it differs from a perspective projection.

Figure 1.7 Projections Submenu



Choose the *perspective* option from the *project* submenu to restore the view to its initial projection.

Shading Data

At this point, polygons in the image should have a smoothly colored appearance. Colors are interpolated across their surfaces using *gouraud* shading. You can control polygonal shading using the *shade* submenu (Figure 1.8).

Figure 1.8 Shade Submenu

Choose the *constant* option from the *shade* submenu. The polygons in the image lose their smeared appearance and gain constant color values. PolyView averages the color values at the vertices to produce the constant color used in the new image.

Constant shading also makes the outline of individual polygons more apparent.
This shading also has an interesting effect on the data when it is displayed in lines mode. Choose the *lines* option from the *draw* submenu. Notice that the View window now displays the data as a wireframe drawn in white.

Choose the *polygons* option from the *draw* submenu to return to constant shaded polygons. Next choose the *gouraud* option from the *shade* submenu to return the View window to its initial state.

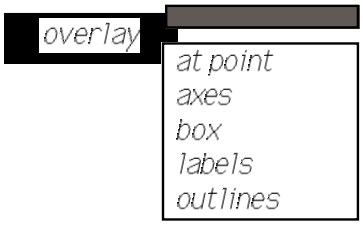
NOTE: Look at the *palette* submenu and note that it is the same menu available from the Palette window. These identical menus let you avoid returning to the Palette window when experimenting with the palette.

Creating Overlays

Thus far, PolyView has only displayed image data in the View window. The program, however, allows you to add other elements to the display to

aid in its understanding. You can choose these options from the *overlay* submenu (Figure 1.9).

Figure 1.9 Overlay Submenu



Begin by selecting the *at point* option from the submenu. A six-pointed, 3D "jack") appears at the center of the scene in the View window. This jack is the focus of the camera's attention. Try moving the camera and notice how the point remains stable in 3D space.

Select the *at point* option again, and notice that the jack has disappeared from the View window. All options in the *overlay* submenu toggle on and off, and work in a similar fashion.

Choose *axes* from the *overlay* submenu. A set of 3D axes appears, with their origin located at the minimal corner of the data (i.e., the point with the smallest x, y, and z coordinates in the dataset). The axes are labelled with the names of the vdatas used to determine each coordinate. In the currently displayed demonstration file, those vdatas/axes are px, py, and pz.

With the axes still displayed, choose the *labels* option from the *overlay* submenu. The labels that were displayed at the end of the axes disappear.

Now choose the *box* option from the *overlay* submenu. The axes disappear and are replaced by a box that contains the entire dataset. This box provides a reference frame for dispersed or poorly connected data, and provides a visual cue for orientation.
While the box is displayed, choose *labels* from the *overlay* submenu. The labels reappears in the scene, this time at the corners of the box where the axes used to end.

Choose *box* again, and the overlay disappears.

Finally choose *outlines,* the last option in the submenu. The View window now displays all of the polygons as outlined in white.

You'll find the outlines option useful when you want to see the original polygonal mesh while still displaying the object as a solid.

Deactivate the outlines by choosing *outlines* again.

Animating Datasets

PolyView animates multiple datasets contained in an HDF Vset file. The *animate* submenu provides animation controls. Using the submenu, you can set the animation running backward or forward for a single frame or

a continuous “movie,” or you can stop the animation sequence once it has started.

NOTE: Because the demonstration file, `demo.hdf`, contains only one frame, animation commands will have no effect in this tutorial.

Taking a Flight

One of the most popular features of PolyView is the *fly file,* which allows examination of image data as it moves the camera and focus through 3D space.

The flight is entirely described by an ASCII file, and is chosen at program startup by specifying the `-fly` switch on the command line. This tutorial uses the `demo.fly` file, which is printed in Appendix B, “Example Fly File.”

Select the *Fly* option from the *View* menu. The flight described by the fly file begins. The camera moves from its initial location, to the end of a row of tetrahedrons, and then continues its flight through the dataset.

Notice that both the camera and the camera’s focus change as the file executes. You can control the camera’s position with `from` statements in the fly file and the camera’s focus with `at` statements.

Open another shell window and display `demo.fly` using an editor such as `vi` or `emacs`. See if you can follow the course of the flight from the statements in the file.

Try changing viewing parameters from the *View* menu during the flight. Note that the flight pauses while you select from the menu and then continues once you select an item.

Select the *Fly* option again to stop the flight. Choosing *Fly* again restarts the flight from the beginning.

Taking Snapshots

Another way you can relay results to others is through still raster images. PolyView can write a still image of any scene from the View window to an HDF 8-bit raster image format file. You may then display, annotate, or make the image into a slide using other NCSA software like NCSA Image, NCSA ImageIP,
NCSA X Image, and NCSA Layout.

Position the camera and select the viewing parameters for an image that you find interesting. Choose the *Write HDF* option from the *View* menu. PolyView creates a file called `ris8.hdf` that contains the image and its associated palette.

Using Other Options

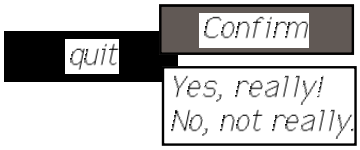
Occasionally, you will use the Pop, Redraw, and Reset options. *Pop* brings the View window to the foreground, on top of all other windows. *Redraw* regenerates the image in the View window in case it gets corrupted. *Reset* returns the camera position and camera focus to their start-up values and resets the viewing parameters.

Exiting NCSA PolyView

You are now at the end of the tutorial. After experimenting further with the program, you may wish to quit. Do so by either pressing the **Esc** key while in the View or Palette windows, or by selecting the *quit* submenu from the *View* menu.

In either case, the *Confirm* submenu (Figure 1.10) confirms any effort to shutdown the program.

Figure 1.10 Confirm Menu



Choosing *Yes, really!* quits the program. *No, not really* leaves PolyView running.