Desktop Radiance

User Manual

Lawrence Berkeley National Laboratory
Environmental Energy Technologies Division
Building Technologies Department

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Desktop Radiance

Introduction

Desktop Radiance is a design tool that facilitates the design and analysis of buildings to optimize the efficiency of daylighting systems and lighting technologies. Desktop Radiance is a plug-in module that works with other popular computer aided design (CAD) tools to provide the user interaction and 3-d modeling capabilities. Desktop Radiance relies upon the popular *Radiance Synthetic Imaging System* to provide its renderings and analytical results.

The first step in the process of performing a daylighting analysis is the creation of a 3D model in a Graphic Editor program, such as AutoCAD (See **Setting Up A Drawing**). The 3D model can then be detailed appropriately using the Desktop Radiance library of materials, glazings, luminaires and furnishings. Once the model is complete, you then define the analysis parameters such as camera views or reference point calculations, building orientation and zone of interest. Then you set up a rendering or point calculation using the simulation menu commands that initiate the export of the geometry and analysis parameters. See the **Simulation Manager** for more information about starting your simulations and **Image Analyzer** for more information about analyzing your results.

This document is not intended to be a comprehensive discussion of the appropriate modeling techniques for daylighting design. It is assumed that you are familiar with daylighting design and fairly familiar with general 3-d modeling and AutoCAD in particular. You may wish to browse the Quick-start Tutorial for a brief introduction to the various 3-d geometric primitives and how they can be assembled into a model of a simple office space.

This document is organized according to the menu structure of Desktop Radiance as found in Version 1.0 as of April 1, 2000. It is also available through the on-line, context-sensitive help system for Desktop Radiance.

Graphic Editor

Introduction

The Graphic Editor (AutoCAD for this document) is where you create the 3-D representation of the geometry of the space you are designing. All of the AutoCAD native commands are available for this purpose. Desktop Radiance adds the "Radiance" menu item to the AutoCAD menubar.

Figure 1. The Main Radiance Pulldown Menu

It is from this menu that all Desktop Radiance commands are accessed. In most cases, you first select the command, and then follow the prompts to provide the requested information such as selecting the surfaces onto which you wish to perform some action. In some cases the command leads to a dialog box which requires your input. The following pages will explain each Radiance menu item in detail.

Setting Up A Drawing

The best way to get started with modeling your building is to set up your drawing units. AutoCAD and Radiance are both "unitless" modeling systems. This means the "size" of a unit of distance is defined by the user and implemented as a convention. Sometimes a scaling factor is also used which causes the unit to be proportionately larger or smaller than its base unit size. These settings for your drawing can be defined in the Preferences Dialog Box see Preferences(p.22). Once you have set up the units you are ready to start modeling and making attachments

from the Radiance menu. Below we will discuss each menu item in turn starting with the Materials menu item.

Materials

Materials can be attached to any surface in your graphic editor 3-D model. Radiance is equipped with an extensive library of materials. You can also create your own materials using the Materials Editor that can be reached through the Library Manager. For more information on materials and creating your own materials see the **Library Manager** and the **Material Editor.**

Attach materials

The Materials Library dialog box(*Figure 2*) contains the database of available materials that can be attached to surfaces in your drawing.

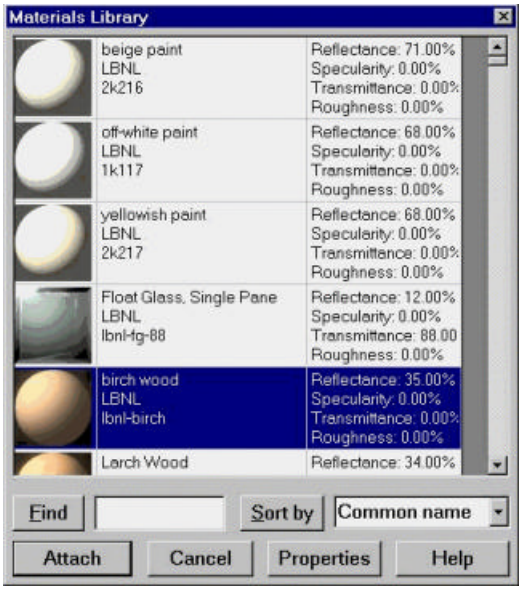

Figure 2. The Materials Library Dialog Box

To access the Materials Library Dialog Box, first use the menu command Radiance→Materials→Attach Material, then when prompted select the surface or surfaces that you want to attach a material to. After selecting surfaces you then press <enter> (this implies, no more surfaces to select) and the Materials Library Dialog Box will appear.

Scroll through the list and choose a material. After selecting a material, click the ATTACH button at the bottom of the Materials Library dialog box. Doing so brings back the AutoCAD window and associates the material to the selected surface. In AutoCAD, the surface will not change appearance; in other words, the line color will not change. Repeat the process for other surfaces in your model. Only one material can be attached to each plane or surface. In other words, two materials cannot be attached to the front and back of a surface.

You can sort the material library to make it easier to find a specific material. The Materials Library can be sorted by the common name of the material, its manufacturer, the manufacturer's product code, the source of the data (the person or company that entered it into the database), or by the material's reflectance,

transmittance, specularity, or roughness. To sort the materials, select the desired property in the drop-down list box next to the “SORT BY” button. Then click “SORT BY”. You can click again to reverse the sort order.

Alternatively, you may search for a material by using the FIND function of the Materials Library. Type the first few characters of the name of the material or any field in the materials library in the edit box adjacent to the FIND button. Click on the “FIND” button and it will find the first occurrence of the material that matches the sequence of characters you have entered. Click on “FIND” again to find the next occurrence.

Detach Materials

To detach a material from an object click on Radiance→Materials→Detach Material. Then select the object from which you want the material detached.

This tool can be used in conjunction with the “Show all attached materials” function making it possible to select and detach all the materials in a drawing at one time. To do this go to Radiance→Materials→Show All Attached Materials. When all surfaces are selected go to Radiance→Materials→Detach Material. At the prompt it will ask you to select surfaces to detach materials. Type the letter P for the previous selection set, all surfaces with materials will be selected and highlighted, then hit <enter>. All materials will be detached.

Show All Attached Materials

This function selects all objects that have a material attached to them. To use this function go to Radiance→Materials→Show All Attached Materials. The surfaces with attached materials will become selected and displayed with dashed lines in the Graphic Editor window.

Show Material Properties

This function allows you to view detailed information about a specific material.

For more information on how to use the Material Properties Dialog Box(*Figure 14*) or to create new materials see **Material Properties** (p.16) or the **Library Manager**.

Luminaires

Place Luminaire

The Luminaires Library dialog box contains the database of available luminaires.

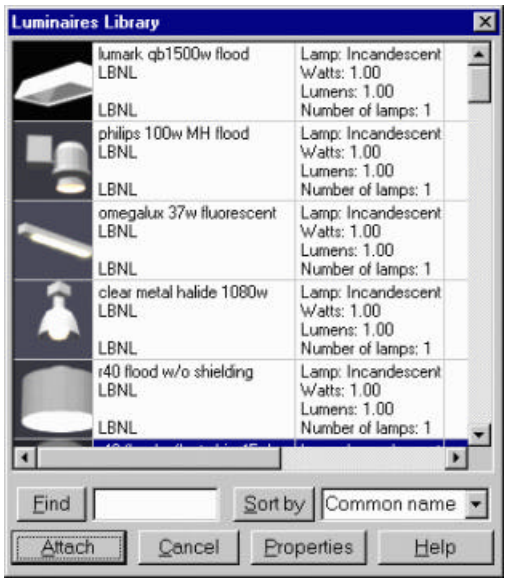

Figure 3. The Luminaire Library Dialog Box

Modeling Tip:

It is usually easiest if you display an axonometric view to position the luminaire into your drawing at the correct height. Use the appropriate "snapping" method. Then in plan view you can move the luminaire to the correct horizontal position.

To access the Luminaires Library Dialog Box select Radiance→Luminaires→Place Luminaires and the Luminaires Library Dialog Box will appear(*Figure 3*).

Scroll through the list and select a luminaire to place in your drawing. Next, click the ATTACH button at the bottom of the Luminaires Library dialog box. Doing so brings back the AutoCAD window. Select an insertion point for the luminaire and then choose a rotation angle. Repeat the process for other luminaires.

You can sort the luminaire library to make it easier to find a specific luminaire. You may sort the luminaire library by the common name of the luminaire, its manufacturer, the manufacturer's product code, the source of the data (the person or company that entered it into the database), the luminaire's lamp type, dimming level (watts), dimming level (lumens), or number of lamps. To sort the luminaires, select the desired property in the drop-down list box next to the "SORT BY" button. Then click "SORT BY". You can click again to reverse the sort order.

Alternatively, you may search for a luminaire by using the FIND function of the Luminaire Library. Type the name of the luminaire or a sequence of characters matching any other field in the luminaire library in the edit box adjacent to the FIND button. Click on the "FIND" button and it will find the first occurrence of the luminaire that matches the sequence of characters you have entered. Click on "FIND" again to find the next occurrence.

Delete Luminaire

To delete a luminaire from your drawing go to Radiance→Luminaires→Delete Luminaire. Then select the luminaire that you want deleted. The AutoCAD erase command also works.

Show Luminaire Aiming

This function allows you to see the direction that a luminaire is aimed. To use this tool, go to Radiance→Luminaires→Show Luminaire Aiming. Select a luminaire as prompted by the command line. A red arrow will appear that shows the direction

that the luminaire is pointing. To change the luminaire aiming, use the standard object rotation commands of the Graphic Editor.

In AutoCAD, the best way to aim a luminaire is through a series of rotations about the Z-Axis of the user coordinate system (UCS). First rotate your UCS such that the z-axis is parallel to the axis on which you would like to rotate the luminaire, for example "UCS, X, 90" will rotate the UCS about the x-axis of the current UCS by 90 degrees. Then type the "rotate" command and select a point on the surface of the luminaire.

Brightness

Not yet available.

Show All Luminaires

This function selects all luminaires in your drawing. To access this function go to Radiance→Luminaires→Show All Luminaires. All luminaires will become selected. This tool can be used in conjunction with "Delete Luminaire" to delete all the luminaires in your drawing at one time.

Show Luminaire Properties

This function allows you to view detailed information about a specific luminaire.

For more information on how to use the Luminaire Properties dialog box see the **Luminaire Properties** dialog box (p.18).

Glazings

Attach glazing

The Glazings Library dialog box contains the database of available glazings that can be attached to surfaces in your drawing(*Figure 4*). The Desktop Radiance Glazing database is based on glazing data from a program called Optics 5. Optics 5 uses data from the NFRC. For more on Optics 5, see http://windows.lbl.gov/Materials/optics5/.

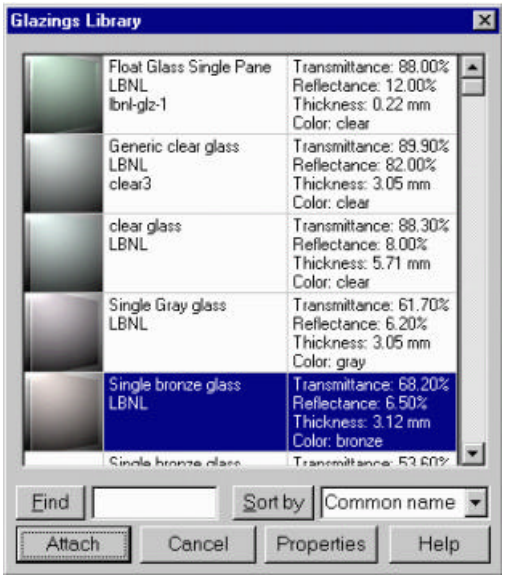

Figure 4. The Glazings Library Dialog Box

To access the Glazings Library Dialog Box go to Radiance→Glazings→Attach Glazing. The command line prompts you to select the surfaces that the glazing will be attached to. After selecting surfaces you then press <enter> (no more surfaces to select) and the Glazings Library Dialog Box will appear. Scroll through the list and select a glazing to attach to the selected window(s) in your drawing. Next, click the ATTACH button at the bottom of the Glazings library dialog box. Doing so brings back the AutoCAD window and associates the glazing to the selected window. Repeat the process for other windows. For double paned windows, do not make two layers of glass. This will result in incorrect light calculations.

You can sort the database to make it more convenient to find a specific glazing. You may sort the glazings library by the common name of the glazing, its manufacturer, the manufacturer's product code, the source of the data (the person or company that entered it into the database), or by the reflectance, transmittance, or thickness. To sort the glazings, select the desired property in the drop-down list box next to the "SORT BY" button. Then click "SORT BY". You can click again to reverse the sort order.

Alternatively, you may search for a glazing using the FIND function of the Glazings Library Dialog Box. Type the name of the glazing or a sequence of characters matching any other field in the glazing library in the edit box adjacent to the FIND button. Click on the "FIND" button and it will find the first occurrence of the glazing that matches the sequence of characters you have entered. Click on "FIND" again to find next occurrence.

Detach Glazing

To detach a glazing from an object click on Radiance→Glazings→Detach Glazing. Then select the object from which you want the glazing detached. This tool can be used in conjunction with the "Show all attached glazings" function making it possible to select and detach all the glazings in a drawing at one time. To do this go to Radiance→Glazings→Show All Attached Glazing. When all windows are selected go to Radiance→Glazings→Detach Glazing. At the prompt it will ask you to select glazings to detach. Type the letter P for the previous selection set, all

glazings will be selected and highlighted, then hit <enter>. All glazings will be detached.

Show All Attached Glazing

This function selects all objects/surfaces that have a glazing attached to them. To use this function go to Radiance→Glazings→Show All Attached Glazings. The objects with glazings attached will become selected.

Show Glazing Properties

This function allows you to view and edit detailed information about a specific glazing.

For more on how to use the Glazing Properties dialog box *(Figure 16)* see **Glazing Properties** (p.17).

Furnishings

Place Furnishing

The Furnishings Library dialog box contains the database of available furnishings that can be placed in your drawing(*Figure 5*).

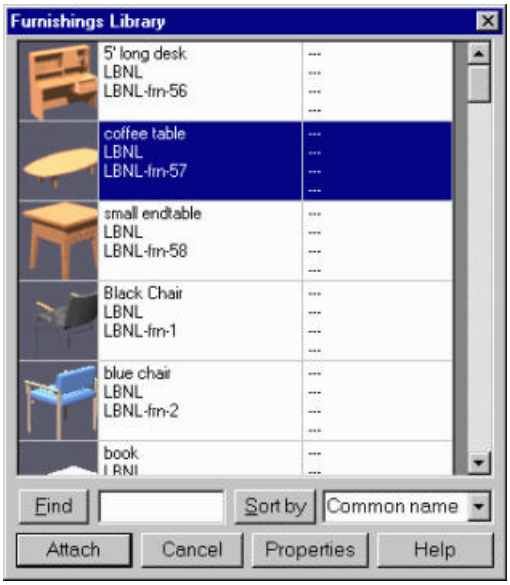

Figure 5. The Furnishings Library Dialog Box

Modeling Tip:

It is usually easiest if you display an axonometric view to position the furnishing into your drawing at the correct height. Use the appropriate "snapping" method. Then in plan view you can move the furnishing to the correct horizontal position.

To access the Furnishings Library Dialog Box go to Radiance→Furnishings→Place Furnishing. Scroll through the list and select a furnishing to place in your drawing. Next, click the ATTACH button at the bottom of the Furnishing library dialog box. Doing so brings back the AutoCAD window. Select an insertion point and rotation angle for the furnishing as indicated by the AutoCAD command prompt. Repeat the process for other furnishings.

You can sort the database to make it more convenient to find a specific furnishing. You may sort the furnishing library by the common name of the furnishing, its manufacturer, the manufacturer's product code, or by the source of the data (the person or company that entered it into the database). To sort the furnishings, select the desired property in the drop-down list box next to the "SORT BY" button. Then click "SORT BY". You can click again to reverse the sort order. You can move, copy and array these furnishings to create a furnishing plan suitable for the model.

Alternatively you may search for a furnishing using the FIND function of the Furnishings Library Dialog Box. Type the name of the furnishing or a sequence of characters matching any other field in the furnishing library in the edit box adjacent to the FIND button. Click on the FIND button and it will find the first occurrence of the furnishing that matches the sequence of characters you have entered. Click on FIND again to find next occurrence.

Delete Furnishing

To delete a furnishing from your drawing, click on Radiance→Furnishings→Delete Furnishing. Then select the furnishing that you want deleted. The AutoCAD erase command also deletes furnishings.

Show All Furnishings

This function selects all furnishings in your drawing. To use this function go to Radiance→Furnishings→Show All Furnishings. This tool can be used in conjunction with "Delete Furnishing" to delete all furnishings in a drawing at once.

Show Furnishing Properties

This function allows you to view and edit detailed information about a specific furnishing.

For more on how to use the Furnishing Properties dialog box (Figure 15) see **Furnishing Properties** (p.17).

Analysis

Desktop Radiance is equipped with several tools to allow for accurate lighting analysis of buildings to fit the needs of the designer.

Define Zone

Use the Define Zone function to create a 3-dimensional box for the simulation to focus on.

To define a zone, go to Radiance→Analysis→Define Zone. The Zone Dialog Box will appear(*Figure 6*).

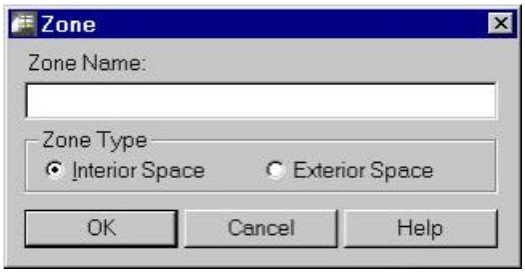

Figure 6. The Zone Dialog Box

Type in a name for the zone being created and select interior or exterior space. An interior zone means that simulations will be from an enclosed interior space. An exterior zone means the simulation is from the outside. If no zone is defined, the default will be an interior zone the size of the scene bounding cube of the model. A zone is an optional component of your model. Use of a zone is recommended when the size of the room you are simulating is less than half the size of the entire building model. The zone is used by Radiance to adjust certain calculation parameters to ensure an accurate simulation.

Define Orientation

This function allows you to define the direction of the north arrow of your model.

To use this tool, go to Radiance→Analysis→Define Orientation. You are then prompted to enter a name for the North Arrow, then you are asked to pick an insertion point and a rotation angle. The "Define Orientation" function is best used in the plan view.

Note: The North Arrow icon may appear too large or too small if the units have not been set up for your drawing. For more on how to adjust this see **Preferences**.

Figure 7. The AutoCAD North Arrow

Multiple north arrows are possible in one drawing to allow for parametric studies.

The default orientation, if none is defined, is with north pointing up and West to the right, in plan view.

Define camera position

The define camera position function allows you to create and position a new camera. To use this tool, go to Radiance→Analysis→Define Camera Position. The Camera Properties Dialog Box then appears(*Figure 8*) .

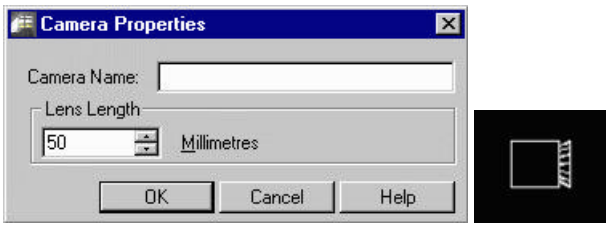

Figure 8. The Camera Properties Dialog Box and the camera icon

Enter a name for the camera and set the lens length. The lens length determines how long the zoom lens is. Smaller numbers make the lens shorter and therefore give a wider, farther away view. Conversely, larger numbers make the lens longer and will therefore give a narrower, closer view. After clicking OK you are brought back to the Graphic Editor window and prompted to give an insertion point, a rotation angle, and the height above the insertion point for the origin of the camera's view. If you enter a camera name that has already been used in the project, scenarios which use this camera will be changed to the new view parameters. The camera icon will then appear in your drawing at the insertion point. If the icon is either too small or too large, this can be adjusted in the preferences dialog box which can be accessed through the Radiance pulldown menu. For more on this, see **Preferences**(p.22).

To change the view of a camera first type **view**¿ **r**¿ and then type the name of the camera¿ . The view of the camera will then appear with an outline representing the camera lens. Type **dview**¿ . Several commands will appear at the command prompt that allow you to adjust your viewpoint in different ways. Consult the AutoCAD help section for detailed information on using these commands. Typically the Target and Zoom commands are very useful. Zoom allows you to zoom forwards and back. Target allows you to move your viewpoint target in all directions. Using these tools is difficult because your wireframe scene disappears while you make adjustments. After editing your camera view, hit enter at the dview prompt. Your new view will appear in wireframe. If you are satisfied with the view, you must save it with the ddview command. If you are unsatisfied with the new view you must return to the original view you started editing and then begin using the dview commands again. Once you are satisfied with the new view, type **ddview¿ ,** to save the new view. Click on New and then enter the same name as the camera view that you were originally editing. Entering the same name will allow you to select the original camera icon when starting a simulation, but with the updated view. Entering a new name will mean that you have to select the view name in the camera simulation setup dialog box because there won't be a picture of a camera representing your new view.

The camera view can also be changed more easily and quickly but not permanently in the ***rview*** program when you start a simulation. This is useful for checking your geometry or to find an ideal view.

Define Animation Path

Calculation of an Animation Path is not yet available on version 1.0 of Desktop Radiance. However, you can set up camera paths that will create individual cameras for single frame renderings.

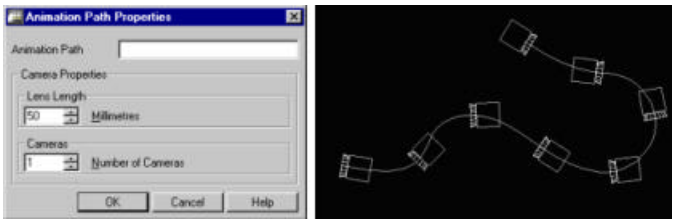

Figure 9. The Animation Path Properties Dialog Box and an animation path

Define Reference Point

Use Define Reference Point to place a light sensor at one specific point. The light sensor is used to find light value readings. To use this tool, go to Radiance→Analysis→Define Reference Point. You are then prompted at the command line to enter a name for the reference point, an insertion point, a rotation angle, and a reference point height.

Figure 10. A Reference Point Sensor

When inserting a reference point…preferences.

Define Reference Grid

Use Define Reference Grid to create a plane within the model where light values can be taken. To define a reference grid go to Radiance→Analysis→Define Reference Grid. You are then prompted to enter a name for the reference grid, the number of rows in the grid (Y-axis), the number of columns in the grid (X-axis), and the first and second corners of the grid. If you are in a perspective view when defining the corners of the grid, the box being defined will not appear to fit the plane in perspective until after you have selected both corners.

The reference grid can be moved to the correct height by using standard graphic editor commands if necessary.

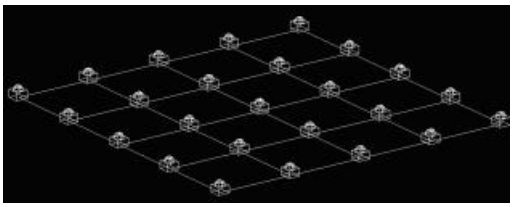

Figure 11. A Reference Grid of Sensors

Simulation

The simulation process can begin when all the Radiance attachments and settings are ready to create a picture or calculate a point or grid quantity of your model. This process begins by selecting a camera, reference point, or reference grid to simulate.

Then the scenario or simulation needs to be named and you choose the location, date, and time that the scenario should portray. These parameters then become part of a single scenario.

When a simulation is done, it can be viewed first in the **Interactive Rendering*(rview)*** and then in the **Image Analyzer**.

Camera

This function allows you to begin a Radiance simulation of your drawing.

To access this tool, go to Radiance→Simulation→Camera. Then you are prompted to select a camera in your drawing. Then a window may appear that asks you to enter a scenario name(*Figure 12*).

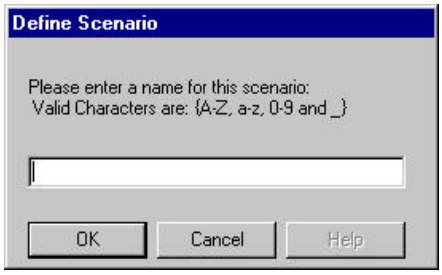

Figure 12. Each scenario must have a unique name.

After entering a name and clicking OK, the command line prompts you to "select objects". These will be the objects included in the simulation. If you want all objects included, type "all". Otherwise, select in your drawing the objects to include and press enter. For more on defining scenarios see **Define Scenario**.

In some cases a dialog box with the heading Define Project may appear. For information on this see **Define Project**.

The computer will then synchronize the database and the Camera Simulation Setup Dialog Box will appear(Figure 13). Synchronizing can sometimes take several minutes to complete for large models as the selected library items are copied to your project directory. For more on simulating your model see Simulation Manager.

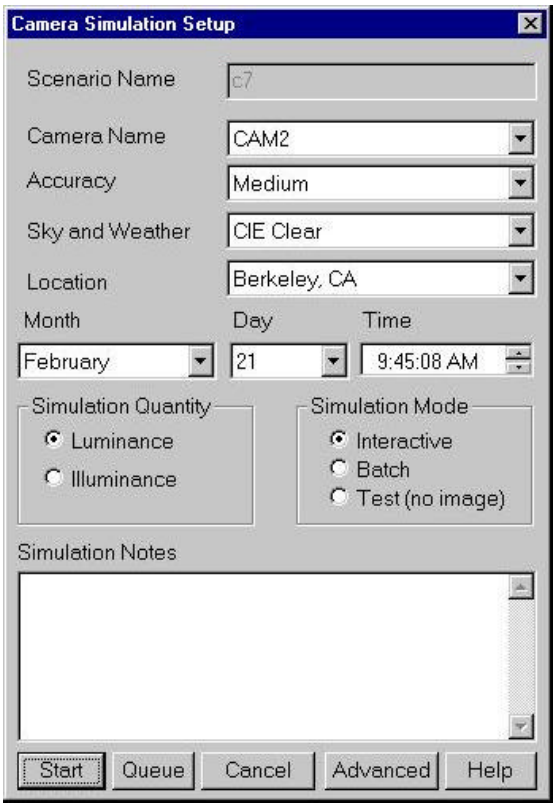

Figure 13. The Camera Simulation Setup Dialog Box.

Reference Point

This tool runs a simulation of a light sensor in your model. It produces a luminance value at the sensor for the scenario you have defined. To use this tool go to Radiance→Simulation→Reference Point.

To place a sensor see **Define Reference Point** (p.13).

Reference Grid

This tool runs a simulation of a grid of light sensors in your model. It produces an array of luminance values for the sensors in the scenario you have defined. To use this tool go to Radiance→Simulation→Reference Grid.

To define a reference grid see **Define Reference Grid** p.13).

Tools

The Radiance tools menu items consist of utilities that assist in the management of your drawing model and the corresponding Radiance project files.

Show All Attachments

This function highlights and selects all luminaires, furnishings, and surfaces with materials or glazings attached to them. To access this tool go to

Radiance→Tools→Show All Attachments. All Radiance attachments will become selected.

Show All Unattached

This function selects and highlights all the objects and surfaces in the drawing that do not have a material or glazing attached to them. To use this tool go to Radiance→Tools→Show All Unattached. Objects and surfaces without Radiance attachments will become selected.

Show Properties

This function allows you to view specific properties of Radiance elements including Furnishings, Materials, Glazings, and Luminaires.

To access this function, go to Radiance→Tools→Show Properties. Then select a material, glazing, furnishing, or luminaire in your drawing.

Material Properties

To access the Material Properties dialog box(Figure 14) go to Radiance→Tools→Show Properties and then select a material in your drawing.

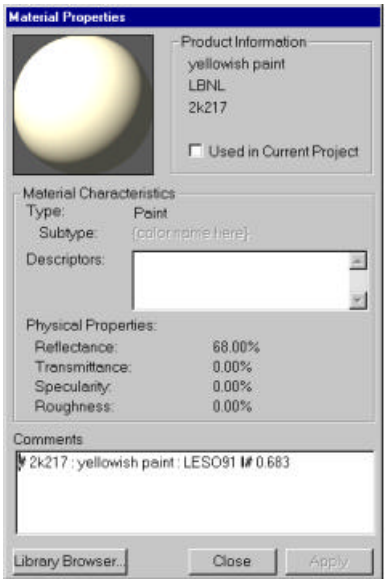

Figure 14. The Material Properties Dialog Box.

When attaching a new material, the Material Properties dialog can also be accessed by clicking on the PROPERTIES button at the bottom of the Materials Library dialog box.

You can change certain properties (comments) of a material in the Material Properties dialog box. This is done by adding inputs and clicking apply.

To create new materials you can go through either the Material Properties Dialog Box or through the Library Browser (see **Library Manager**).

Furnishing Properties

To access the Furnishing Properties dialog box(Figure 15) go to Radiance→Tools→Show Properties and then select a furnishing in your drawing.

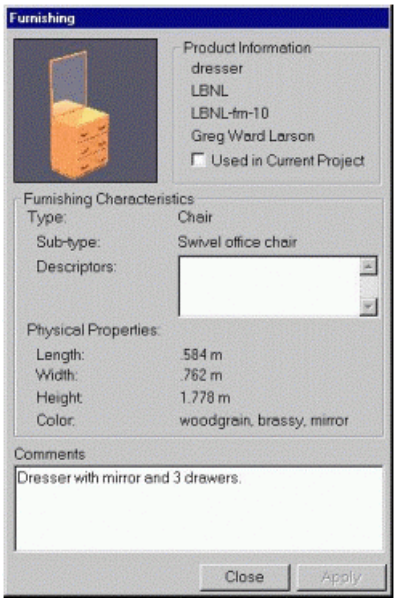

Figure 15. The Furnishing Properties Dialog Box.

The Furnishing Properties dialog can be accessed from the Furnishings Library dialog box when placing a new furnishing or from the Library Browser. In the Furnishings Library dialog box highlight a furnishing and click on the PROPERTIES button.

You can change certain properties (comments) of a furnishing in the Furnishing Properties dialog box. This is done by adding inputs and clicking apply. This doesn't work yet. APPLY is grayed out and clicking CLOSE closes without saving edits.

Glazing Properties

To access the Glazing Properties dialog box(Figure 16) go to Radiance→Tools→Show Properties and then select a glazing in your drawing.

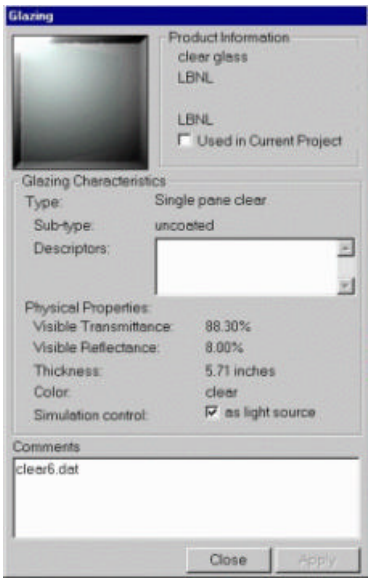

Figure 16. The Glazing Properties Dialog Box.

The Glazing Properties dialog can be accessed from the Glazing Library dialog box when placing a new glazing. In the Glazing Library dialog box select a glazing and click on the PROPERTIES button at the bottom of the Luminaire Library dialog box.

The Simulation Control check box allows you to turn on and off the window as a light source. Unchecking this box will ignore all daylight that would be coming in through this glazing. For more information on this subject, see the Radiance Reference Manual.

You can change certain properties (comments) of a glazing in the Glazing Properties dialog box. This is done by adding inputs and clicking apply.

Luminaire Properties

To access the Luminaire Properties dialog box(Figure 17) go to Radiance→Tools→Show Properties and then select a luminaire in your drawing.

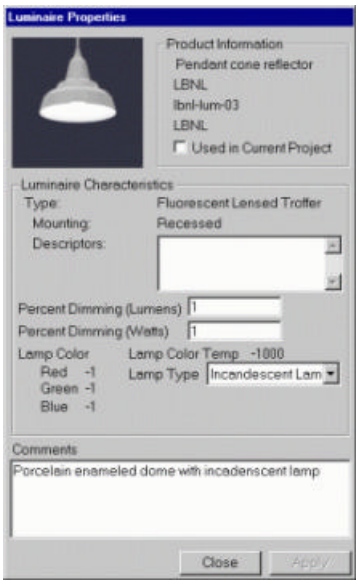

Figure 17. The Luminaire Properties Dialog Box.

When placing a new luminaire, the Luminaire Properties dialog can be accessed by clicking on the PROPERTIES button at the bottom of the Luminaire Library dialog box.

You can change certain properties (comments) of a luminaire in the Luminaire Properties dialog box. This is done by adding inputs and clicking apply. This doesn't work yet. APPLY is grayed out and clicking CLOSE closes without saving edits.

Detach All

This function detaches all materials, glazings, furnishings, and luminaires from objects and surfaces in the model.

To use this tool go to Radiance→Tools→Detach All. All objects with Radiance attachments will be selected automatically and a window appears to confirm that you want to detach all Radiance materials and glazings. This restores your drawing to the state it was in before the use of any Desktop Radiance commands.

Adjust Surface Normals

This command is used to check and adjust the orientation of surfaces in your model. In general, the orientation of surfaces is not important for Radiance as it is with other lighting analysis tools. However, to calculate the distribution of daylight with glazings to be treated as a "light source", it is necessary to have the glazing surface correctly oriented. Material surfaces do not need correct surface normal orientation. To use this function, go to Radiance→Tools→Adjust Surface Normals. Then, as you are prompted, select the glazing surface in your drawing. A red arrow will appear within the window. A correctly oriented surface normal for a window or skylight should be pointing in the direction of daylight travel from brightest to dimmest regions. The command line asks you if you want to flip the surface normal. Type "N" if the arrow is pointing in the correct direction and "Y" if you want to

switch it. If the direction of the surface normal is not as you expected and cannot be reversed with this tool, then the window surface needs to be recreated.

If the red surface normal arrow does not appear it may be that you are checking an object that Desktop Radiance can't figure the front/back of, for example an exploded ACIS solid. The surfaces of an exploded ACIS solid will have normals pointing outwards. If the surface normal you are checking is not that of a surface of an exploded ACIS object and you don't see the red surface normal arrow, see **Preferences**(p.22).

Use the **Right Hand Rule** to correctly orient glazing surfaces: Imagine placing your right hand against the wall with the window, with your thumb pointing in the direction that the light travels. Your four other fingers now curl in the direction that the vertices should be created to obtain a properly oriented surface.

Material Map

The Material Map function associates a surface with a specific layer or line color in your graphic editor program or the specified Desktop Radiance material. To use the material map tool go to Radiance→Tools→Material Map and then the Material Map dialog box will appear(*Figure 18*).

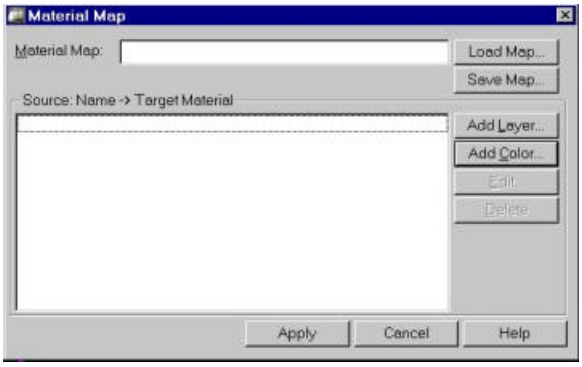

Figure 18. The Material Map Dialog Box

To attach a material to all surfaces in a particular layer, click on ADD LAYER. The Material Layer Assignment Dialog Box will appear(Figure 19).

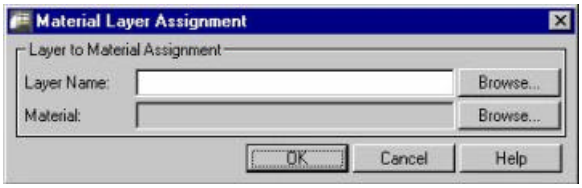

Figure 19. The Material Layer Assignment Dialog Box

Click on layer name→BROWSE to select a layer, from the Current Drawing Layers Dialog Box(Figure 20) that the material will be associated with.

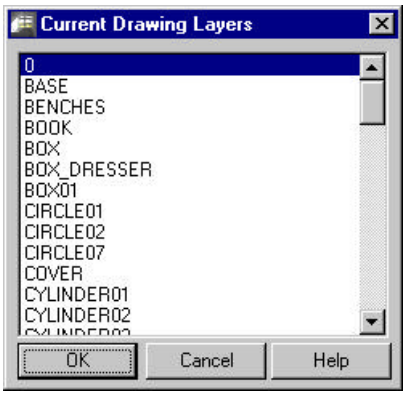

Figure 20. The Current Drawing Layers Dialog Box

Then click on material→BROWSE and select a material to be associated with the layer.

To attach a material to all surfaces with a particular color, go to Radiance→Tools→Material Map to get to the Material Map Dialog Box(*Figure 18*). Click on ADD COLOR.

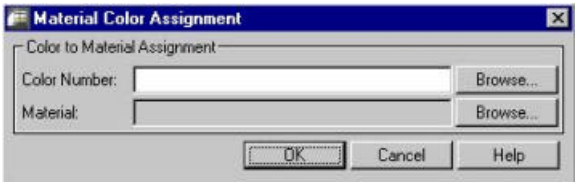

Figure 21. The Material Color Assignment Dialog Box

In the Material Layer Assignment Dialog Box that will appear next(Figure 21), enter either the color number or click on color number→BROWSE to find the correct color. After finding a color click on material→BROWSE to find the material to be associated with the color.

After associating a layer or color with a material through the Material Map tool, new objects created in that layer or color are not automatically associated with the material. The layer or color must be re-associated with the material for all new objects of that layer or color to be included.

Library Manager

This tool allows you to easily keep track of all available Radiance libraries, these include Furnishings, Glazings, Materials, and Luminaires (see **Library Manager**).

Future Plans for the Library Manager:

The Library Manager is still rapidly changing and developing.

Material Editor

This tool allows you to edit existing materials and create new materials altogether. To use the Material Editor see **Material Editor**.

Simulation Manager

The simulation manager keeps track of your simulation scenarios For more information on using this tool (see **Simulation Manager**).

Image Analyzer

The Image Analyzer allows you to further analyze the lighting performance of your model. For more information (see **Image Analyzer**).

Preferences

The General Preferences Dialog Box(Figure 22) is used to set the units (metric or imperial), unit size (meters, inches, etc.) of a drawing, and drawing "scale" for appropriate sizing of the Desktop Radiance library items. To use this tool go to Radiance→Preferences. There is an important relationship between the settings here and the units format of your graphic editor program. The most important relationship is that if the units display in your graphic editor are "Architectural", then you will want to choose "Imperial" and "Inches" in the Desktop Radiance General Preferences Dialog Box(Figure 22). See the note on **Setting Up A Drawing**(p. 3) for more explanation.

Sometimes when attaching or inserting a Radiance entity into your drawing, it will appear much smaller or much larger than you want it to be. This includes objects such as furnishings, luminaires, cameras, north arrows, and surface normal arrows. To fix this problem use the General Preferences tab dialog box. Before attaching the Radiance entity into your drawing, change the Symbol Scale value. To make an object larger, make the symbol scale value larger. To make an object smaller, make the symbol scale value smaller. For example, changing the value from 1 to 10 would make the object ten times as big as before. Whereas, to make an object smaller, changing the value from 1 to 0.1 would make the object one tenth as big as it was before. After changing the symbol scale value, then attach or insert the Radiance entity to your drawing.

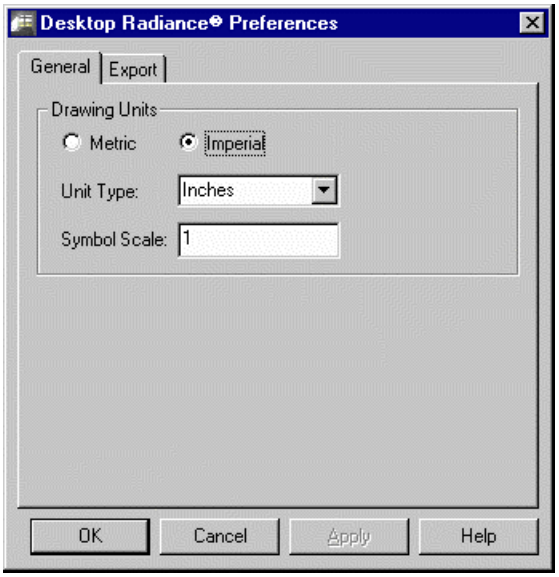

Figure 22. General Preferencs Dialog Box

The Desktop Radiance Export Preferences Dialog Box*(Figure 23)* determines which entity types will be exported from your graphic editor for the simulation.

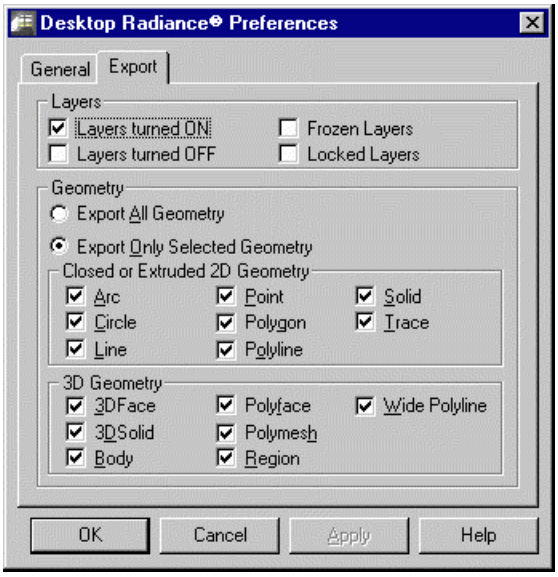

Figure 23. The Export Preferences Dialog Box

The layers options refer to the various layer settings in your Graphic Editor program. The Geometry option determines whether you want all geometry to be exported automatically for simulations or if you want to select particular Geometry yourself. Closed or Extruded 2D Geometry and 3D Geometry refer to types of geometry that can be included in simulations.

Library Manager

Introduction

The Library Manager is a collection of tools related to the maintanance of the Desktop Radiance Materials, Luminaires, Glazings, and Furnishings. As of version 1.0, its features are limited to the library browser and material editor. This Library Browser allows you to view detailed information about Radiance Furnishings, Glazings, Luminaires, and Materials. The Material Editor allows you to create new Radiance materials.

To reach the Library Browser from inside the Graphic Editor, go to Radiance→Tools→Library Manager. Select the appropriate tab for Furnishings, Glazings, Luminaires, or Materials.

The current state of the Library Browser does not include all future functionality. Future version will have the ability to manage project specific libaray items and to move items between a project database and the main library.

Material Library Browser

The Material Library Browser*(Figure 24)* allows you to view all the available materials and their properties. You can search for items in the Material Library by scrolling through the list. When an item has been highlighted the properties can be viewed by clicking PROPERTIES. Materials may be found by using the "Find" Command. Type the common name or a fragment of the common name in the white box next to the FIND button. Then click on the FIND button. It will find the first occurrence of the item. Click on FIND again to find the next occurrence.

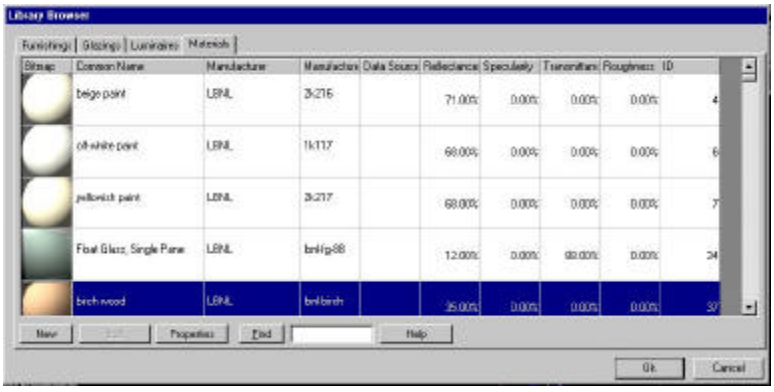

Figure 24. The Material Library Browser

Material Editor

In addition to the predefined Desktop Radiance materials, custom materials may be created in the Material Editor. Currently only reflective materials can be created. It is also not yet possible to "edit" existing materials in the library. To enter the Material Editor*(Figure 24)* from Desktop Radiance, go to Radiance→Tools→Library Manager and select the Materials tab to bring the Material Library to the foreground(Figure 25). Material Editor may also be opened by double clicking on the "Material Editor" icon created by the install program in the Desktop Radiance directory. Once in the Material Library Browser, click on the NEW button and enter a new material name when prompted. For every custom material that you create, the Material Editor needs to know the material type, Red, Green, and Blue values and Specularity and Roughness values. You may optionally specify information about the manufacturer of this material from the "manufacturer" button.

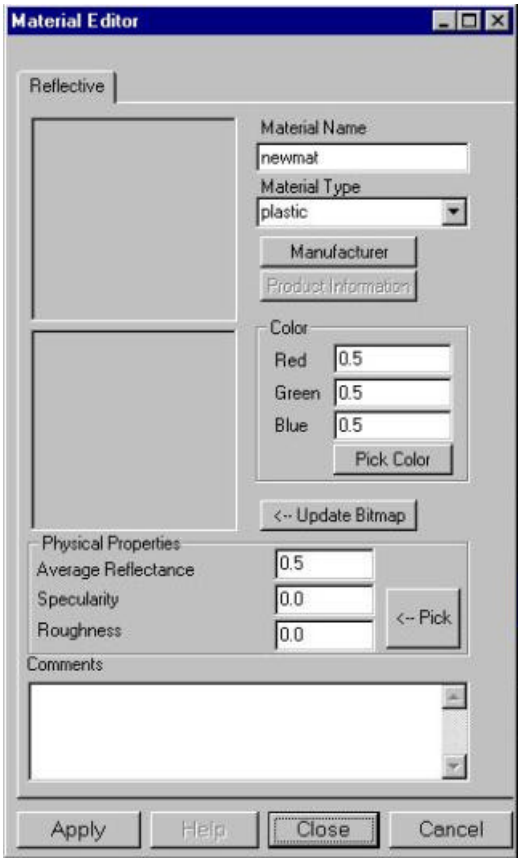

Figure 25. Material Editor

Material Type

To set material type, use the pull down menu located below the Material Name field. Currently only plastic and metal may be created. Plastic includes all opaque materials which have colored diffuse reflections but uncolored specular (shiny) components. Plastic materials include formica, tile, glossy paint, and any similar surfaces. Materials that have colored specular highlights are appropriately modeled

as "metal". Metal materials include bronze, gold, copper, aluminum, and similar surfaces. (More on this in **Physical Properties**)

Manufacturer

Next, if applicable, click on the MANUFACTURER button to bring up the Manufacturer Contact Information Dialog box*(*Figure 26*)*. This information is not required. To save manufacturer information and return to Material Editor, close by clicking on APPLY. You man specify a new manufacturer by selecting "NEW" from the pop-up list of manufacturers.

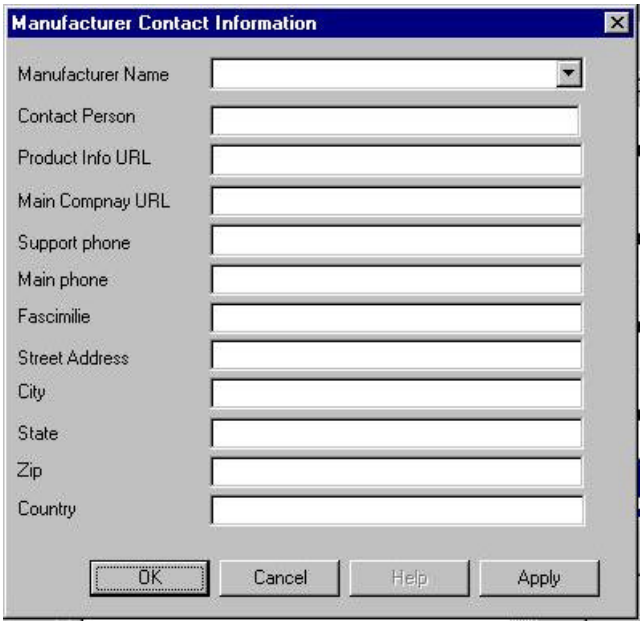

Figure 26. Manufacturer Contact Information dialog box

Color

The range of values for Red, Green, and Blue is generally between 0.0-1.0, with 0.0 being the perfect absorber (black) and 1.0 being the perfect diffuser (white). Radiance RGB values are not comparable to other RGB formats. The RGB may be thought of as a three-point sample of the radiometric spectral content of the material. While it is physically possible to have one of the components greater than one (such as fluorescent materials) the reflective average should not be allowed to exceed 1.0. (see Physical Properties, below). Click the "Pick Color" button to display the standard windows color palette (*Figure 27*). Click "Define Custom Colors" to display the HSV color picker. This standard color picker may be used to approximate the color of your surface. Click "add" to add this color to your palette. Select this color on the left hand side of the color picker and then click OK. The RGB and average reflectance of the color you have created will then be displayed. If the average reflectance is incorrect, the value may be changed and the resulting RGB values will be updated.

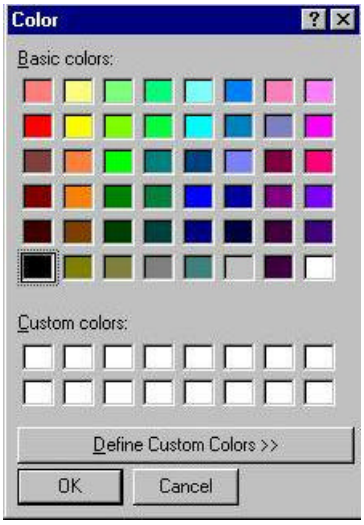

Figure 27. Color Picker

Physical Properties

The Average Reflectance displays the total, hemispherical average photopic reflectance. A plastic*(Figure 28)* or metal*(Figure 29)* "swatch" will appear, depending on which has been selected as the Material Type, to help you find the desired specularity and roughness combination. The reasonable range for specularity is between 0.0 and .07, with 0.0 being a matte surface and .07 being satin. For roughness, the reasonable range is between 0.0 and 0.2, with 0.0 being polished and 0.2 a low gloss. Both of these parameters may be selected from the "Pick" putton adjacent to the Specularity and Roughness values. Select the sphere which most closely resembles your material and click Ok. The selected Specularity and Roughness values will be displayed in the Material Editor dialog box.

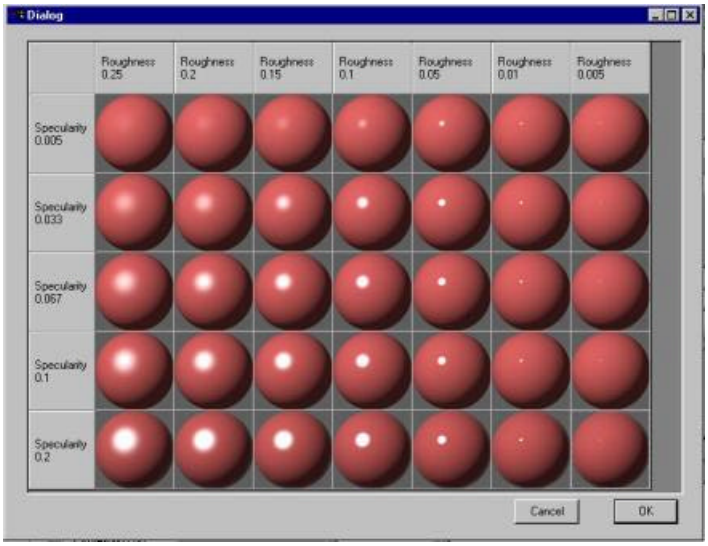

Figure 28. Plastic specularity and roughness samples

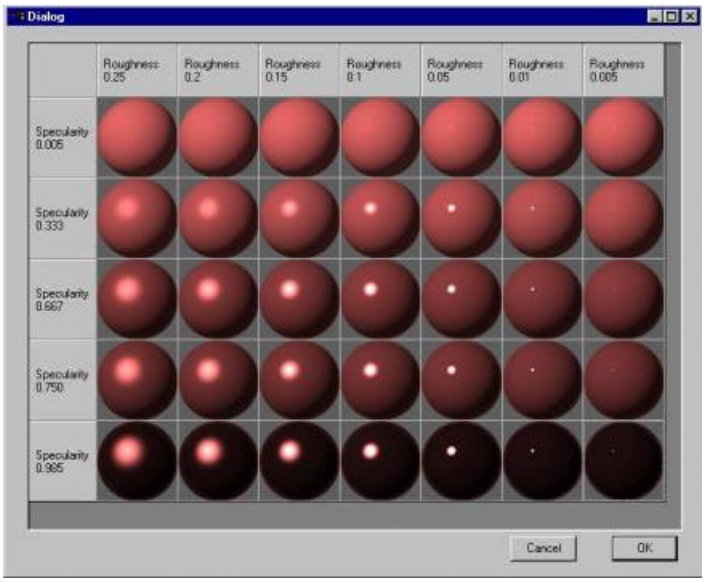

Figure 29. Metal specularity and roughness samples

After the Red, Green, Blue, Specularity, and Roughness of the new material is defined, click on the UPDATE BITMAP button to begin creating the bitmap. The Editor will make the image in the background and display it*(Figure 30)*.

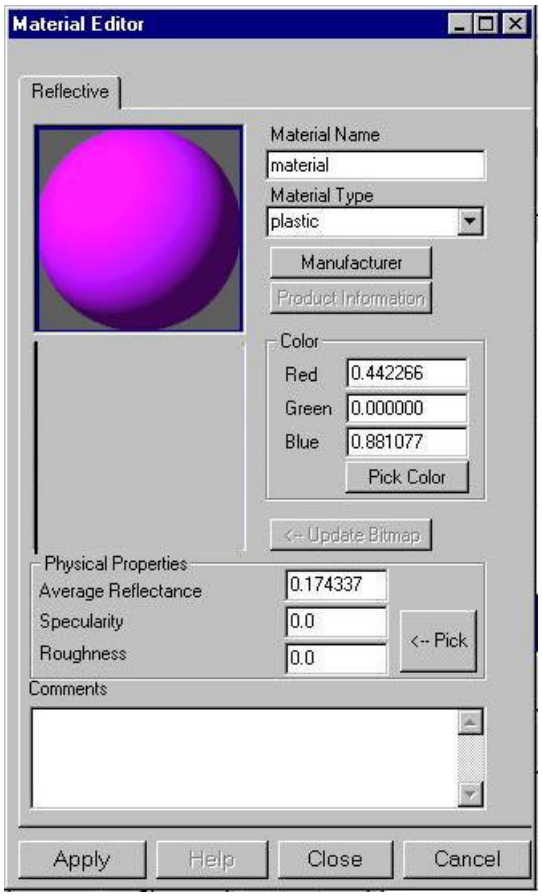

Figure 30. A new material type displayed

You may display two bitmaps at once to compare them side by side. The newer materil will appear in the upper window. Either one may be selected to display its properties. When you are satisfied with the new material, click APPLY to save the selected material into the database.

Glazing Library Browser

The Glazing Library Browser allows you to view all the available glazings and their properties. The Glazing Library Browser*(Figure 31)* allows you to view all the available glazings and their properties. You can search for items in the Glazing Library by scrolling through the list. When an item has been highlighted the properties can be viewed by clicking PROPERTIES. Glazings may be found by using the "Find" Command. Type the common name or a fragment of the common name in the white box next to the FIND button. Then click on the FIND button. It will find the first occurrence of the item. Click on FIND again to find the next occurrence.

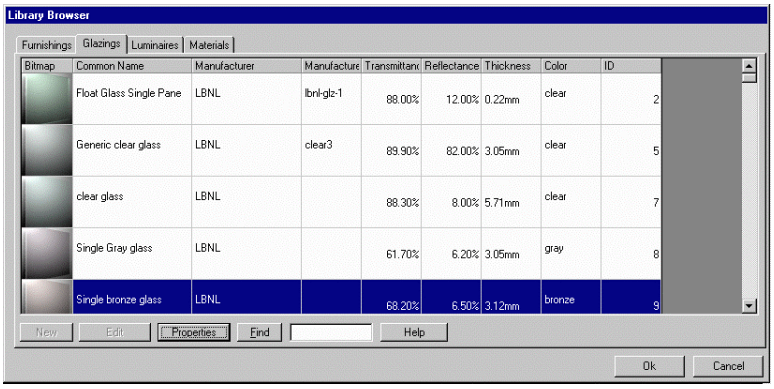

Figure 31. The Glazing Library Browser

Furnishing Library Browser

The Furnishing Library Browser allows you to view all available furnishings and their properties. The Furnishing Library Browser*(Figure 32)* allows you to view all the available furnishings and their properties. You can search for items in the Furnishing Library by scrolling through the list. When an item has been highlighted the properties can be viewed by clicking PROPERTIES. Furnishings may be found by using the "Find" Command. Type the common name or a fragment of the common name in the white box next to the FIND button. Then click on the FIND button. It will find the first occurrence of the item. Click on FIND again to find the next occurrence.

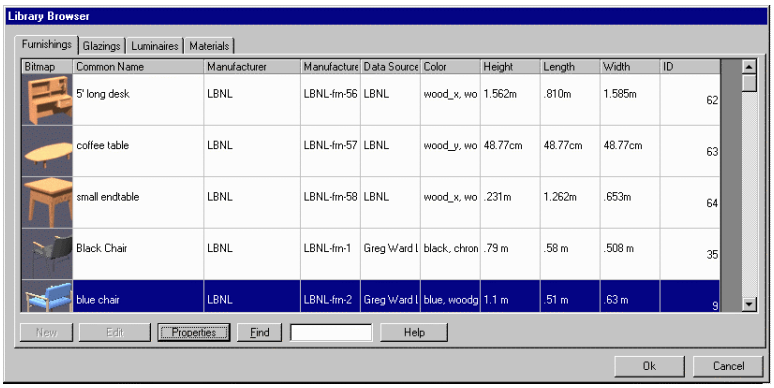

Figure 32. The Furnishing Library Browser

Luminaire Library Browser

The Luminaire Library Browser allows you to view all available luminaires and their properties. The Luminaire Library Browser*(Figure 33)* allows you to view all the available luminaires and their properties. You can search for items in the Luminaire Library by scrolling through the list. When an item has been highlighted the properties can be viewed by clicking PROPERTIES. Luminaires may be found by using the "Find" Command. Type the common name or a fragment of the common name in the white box next to the FIND button. Then click on the FIND button. It will find the first occurrence of the item. Click on FIND again to find the next occurrence

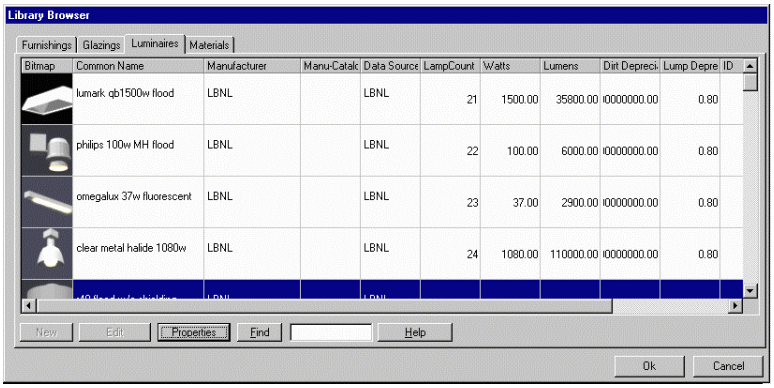

Figure 33. The Luminaires Library Browser.

Simulation Manager

Introduction

The Simulation Manager is the component of Desktop Radiance in which you simulate and render the model you have created in the graphic editor. After attaching Radiance entities to your drawing, for example: materials, luminaires, furnishings, glazings, cameras, etc., you are ready to begin the simulation process. The simulation process involves the calculation of light in your model. These calculations depend on the properties of the Radiance attachments, location/time and day settings, and accuracy parameters.

The simulation manager dialog box*(Figure 40)* allows you to keep track of all your simulations for a project. Each simulation and its associated properties and settings is called a "scenario". After completing a simulation, the interactive rendering or ***rview*** tools allow you to preview your model. Rview allows for adjustments to viewpoint location. The advanced dialog boxes of simulation setup provide a user-friendly means of adjusting light and shadow specifications, and other parameters that can create more accurate images, faster rendering images or a combination of these two factors. Through the use of the rview tools and then with the **Image Analyzer**, you can create an image that best fits your design needs and objectives.

Simulation Setup

The Camera Simulation Setup dialog box*(Figure 34)* allows you to define the base parameters for your simulation. The Camera Simulation Setup dialog box is accessed by beginning a simulation. Go to
Radiance→Simulation→Camera/Reference Grid/Reference Point

Then you will be prompted to select a Camera/Reference Grid/Reference Point <enter>. A dialog box will appear that asks for a scenario name. Enter a name which is unique for this project and click OK. Then, as prompted, select objects to be included in the simulation or type all. <enter>. The Camera Simulation Setup Box will then appear.

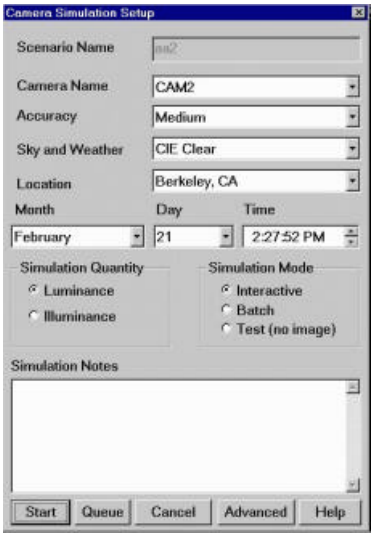

Figure 34. The Camera Simulation Setup Box

The Scenario Name box tells you the name of this particular scenario. It is the name previously entered in the Define Scenario Dialog Box. The scenario name is uneditable in the Camera Simulation Setup Box.

The camera name box allows you to choose the camera or view that you would like to simulate for this scenario. It automatically selects the camera selected previously in the process but others can be chosen from the pulldown menu. To create new saved views of your model in autocad, go to View→Named Views or type **ddview**. The dialog box that appears allows you to save the current view as a saved named view that can be accessed from the Camera Simulation Setup Box for simulation.

The accuracy box allows you to select the accuracy. For Version 1.02, only a Medium level of accuracy is available. However, this setting can be overwritten by changing the parameters under the "**Advanced**" dialog box.

The Sky and Weather box allow you to choose the sky conditions for your model. You can choose from CIE Clear, Overcast, Intermediate, and Uniform. Clear will have sharp patches of light and quite a bit of bright diffuse light. Overcast will have shadows, dimmer diffuse light, and some light specular highlights. Intermediate has sharp patches of light but the dim diffuse light of an overcast rendering. Uniform will have shadows and dimmer diffuse light than overcast with very faint specular highlights. For more information, consult the CIE Handbook.

To render with no sky or to turn the sky off, select a date and time that is at night.

The location box allows you to choose the location, more specifically the latitude and longitude, for the simulation. There are a few predefined locations. You can also define new locations by selecting "New…" from the pulldown menu. This will bring you to the Add New Location dialog box*(Figure 35, p. 33)*. For more on adding a new location see **Add New Location.**

The date, and time boxes allow you to define such factors for your scenario.

In the Camera Simulation Setup Box there is also a Simulation Quantity choice of Luminance or Illuminance. This setting determines what kind of information your image will contain. Luminance is the amount of light leaving a surface from a specific direction and includes the final surface reflectance. It closely resembles what the eye sees. Illuminance, alternatively, represents the total amount of light reaching a surface from all directions. Illuminance does not include the reflectance of the surface where the illuminance is being measured. The "illuminance"

simulation quantity setting changes the Radiance computation so that the final surface reflectance is not included in the determination of the brightness of each pixel of the image.

The Simulation Mode box gives you choices of interactive, batch, or test. The interactive mode will allow you to experiment with exposure, ambient light and other settings in the interactive rendering program, ***rview***. After finding ideal settings for your building in *rview*, then you can make these setting changes using the ADVANCED button on the Camera Simulation Setup Box. Then, instead of rendering in the interactive mode, render in batch mode. The Batch Mode will give more accurate simulation than in the *rview* Interactive Mode. The higher accuracy of a batch mode simulation will also increase the simulating time. After a batch mode simulation is finished, the image will not automatically appear. Click on DISPLAY/ANALYZE in the Simulation Manager(Figure 40, p. 39) to view the image. The Test Mode allows you to get a quick simple rendering of your building. This can be useful for quickly seeing the aiming of a camera. Like the Batch Mode, no image will appear until you click on DISPLAY/ANALYZE. No adjustments can be made to the image for it will appear in the image analyzer - Winimage, not *rview*.

After making any changes to the Camera Simulation SetUp Box you have several commands to choose from. START will begin the simulation. The QUEUE command is currently unavilable. CANCEL will close the Camera Simulation Setup Box and not save your changes. ADVANCED leads you to four dialog boxes*(Figure 36,* Figure 37, *Figure 38, and* Figure 39, *pgs. 35-38)*.

Add New Location

To add a new location, enter all the requested information, click OK and you will have created a new location which is added to the main Desktop Radiance database and can be accessed by other projects.

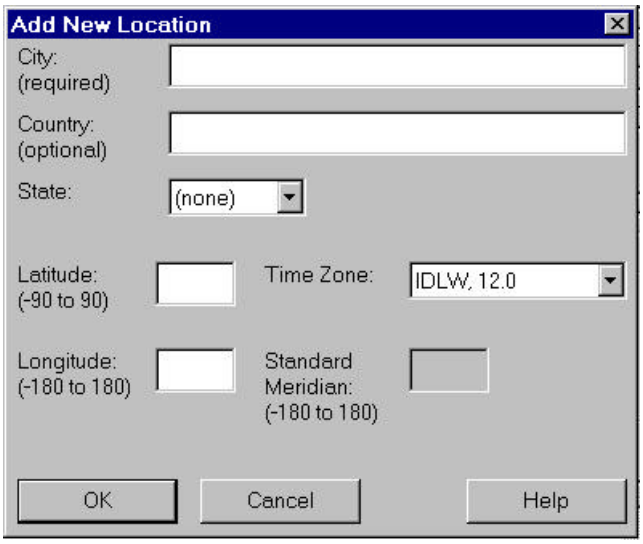

Figure 35. The Add New Location Dialog Box

The "City" field is required, however it does not have to be a real city. The latitude is an angular measurement that defines where your location is relative to the equator. The latitude of the equator is equal to 0. The latitude of the North and South poles is 90 and –90, respectively. The number you would enter for the latitude of your location is between 90 and –90. It should be entered in decimal form. From 0 to 90 is in the northern hemisphere and from 0 to –90 is in the southern hemisphere. So,

for example, the approximate latitude of Athens, Greece would be Lat 37.9. This number means that Athens is 37.9 degrees north of the equator.

The longitude is an angular measurement that defines your location relative to the standard meridian in Greenwich, England. The longitude of the Greenwich Meridian is equal to zero. The number you would enter for the longitude of your location is between –180 and 180. Longitudes west of Greenwich are positive and those east of Greenwich are negative. Like the latitude, the longitude should also be entered in decimal form. Using Athens, Greece as an example again…Athens has a longitude of –23.7. This number means that Athens is 23.7 degrees east of Greenwich, England.

The Time Zone allows you to give the name of the time zone that your location is in, for example Pacific Standard Time, or PST. If you don't know which Time Zone you should be using or if yours is not listed, chose "Other…" from the bottom of the list and then fill in the Standard Meridian field.

Standard Meridian is the longitude of the middle of your time zone. To find it you calculate the difference in time between the new location and the Greenwhich, England timezone and multiply that number by 15. In equation form, the standard meridian looks like this: (GMT)-(your time)*15)=Standard Meridian. For Athens-Greece, it's -2*15, so the Standard Meridian is -30. Hint: Standard meridian is always an interger, multiple by 15.

If you don't know the time difference between your time zone and Greenwich Mean Time, there are many resources on the internet.

The following website allows you to easily find the latitude and longitude of your location within the United States:

http://www.census.gov/cgi-bin/gazetteer

If your location is not in the United States then you can visit the following website to find the latitude and longitude of your location, click on the "Access GEOnet" button:

http://www.nima.mil/gns/html/

Advanced Calculation Properties

The Advanced Calculation Properties dialog boxes(Figure 36, Figure 37, Figure 38, and Figure 39) are a series of settings under the main categories of Analysis, Lighting, Geometry, and Rendering. They are most commonly used in the final steps of creating a highly accurate, high quality rendering. To access these dialog boxes select ADVANCED on the Simulation Setup dialog box. Many of these settings are also found in the interactive rendering program, *rview*. The settings in rview are intended to allow the user to quickly and easily test different values and settings. When ideal settings are found, then the user can make the changes in the Advanced Calculation Properties dialog boxes which will save the setting with the scenario. After making changes in the Advaned Calculation Properties dialog boxes a high quality batch mode simulation can be made by selecting batch on the simulation setup dialog box.

The Advanced Calculation Parameters Analysis dialog box(Figure 36) includes settings that can help with the analysis of images created in a Radiance simulations.

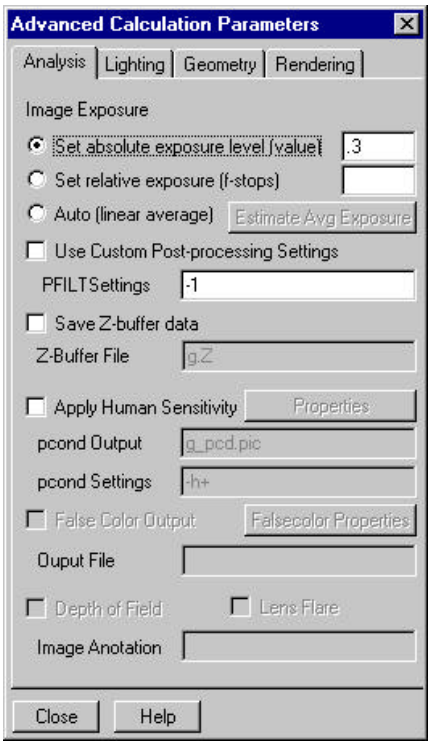

Figure 36. Advanced Calculation Parameters "Analysis" Dialog Box

The settings in the Image Exposure section affect how light/dark your image will be. By selecting Auto (linear average), the exposure will automatically be set to 1. This is a good exposure starting point. If you have a specific value or you want the image to be darker or lighter than usual, then use the absolute settings or the relative f-stop settings.

The "Use Custom Post-processing Settings" checkbox refers to whether you are using a PFILT setting other than the default. If you are using a different value then this box should be checked.

The Save Z-buffer data check box applies to animations only.

The Advanced Calculation Parameters Lighting dialog box(Figure 37) refers to settings that have to do with how light will act within your model.

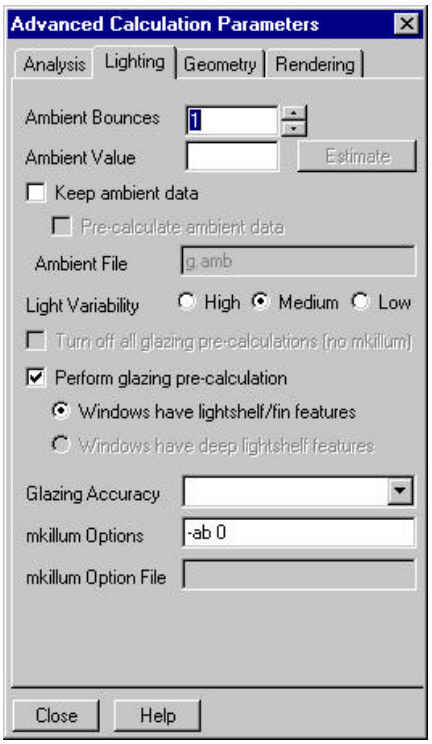

Figure 37. Advanced Calculation Parameters "Lighting" Dialog Box

Ambient bounces sets the number of times light will bounce from surface to surface. The lower the number, the faster the calculation. A reasonable number to use is anywhere between 1 and 5. For a batch mode rendering, 1 ambient bounce works well.

Ambient Value affects how generally light or dark the image is.

The Advanced Calculation Parameters Geometry dialog box(Figure 38) deals with certain Graphic Editor related settings, many of which are also found directly within the Radiance pulldown menu.

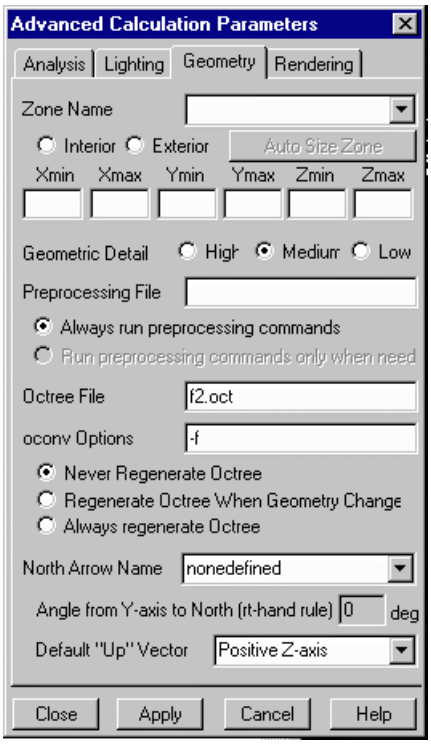

Figure 38. Advanced Calculation Parameters "Geometry" Dialog Box

This dialog box allows you to define a zone. A zone is a volume of space that indicates an area where the simulation should focus on. To define a zone begin by entering a name for the zone. Then select the zone to be either interior or exterior. Interior means that you will be looking at the space from within the space. Exterior means that you will be looking at the space from outside the space.

The 6 point definition boxes are for defining a rectangular volume aligned parallel to the xyz axes.

The Advanced Calculation Parameters Rendering Dialog Box(Figure 39) determines the pictorial quality of the simulation image rendering from your Radiance model.

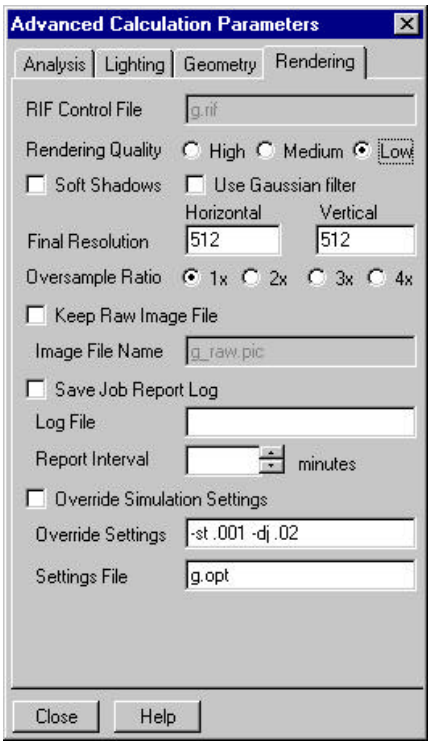

Figure 39. Advanced Calculation Parameters "Rendering" Dialog Box

The RIF Control File box shows the name of the file that you are dealing with. This box will already be set and can't be changed here.

Rendering quality sets the quality of the simulation. With the soft shadows box checked, there will be no sharp shadows and rendering time will be longer.

Final resolution determines the sharpness of the rendered image. The horizontal and vertical boxes should have numbers that are exponentials of 2. For a high quality rendering choose 1024 horizontal and 1024 vertical. For a lower quality rendering 512 x 512 will do fine.

Oversample Ratio is what affects jagged lines. By increasing this value, lines will become smoother. Although, increasing this value greatly increases rendering time. Increasing the oversample from 1x to 2x will increase rendering time by 4 times.

High Quality Renderings

Before creating a high quality rendering, it is best to validate your scenario in the interactive rendering program ***rview***. To do this, simply render your image in the Interactive Mode. This is the default mode setting in the Simulation Setup Dialog Box. Once you are satisfied with the geometry, views, materials, and all other aspects of your model, then it is time to start a high quality rendering. In the Simulation Manager dialog box select the scenario that you would like to create a high quality rendering of and give it a new name as indicated. Once the Simulation Setup Dialog Box appears select Batch as the mode choice. A batch rendering will render the image of your model at a far greater resolution than your monitor resolution. Then click the ADVANCED button in the Simulation Setup dialog box and select the RENDERING tab. First select High or Medium quality for your rendering. Then enter the final resolution that you would like. A good recommended final resolution for high quality renderings is 1024 x 1024. Last,

select the amount of over sampling that you would like. Over sampling reduces the "jaggies". Although be careful with this setting, each incremental increase of over sampling can quadruple your rendering time. A fairly high quality rendering can also be created without increasing the oversampling ratio or with different variations on the above mentioned settings in the Advanced Calculation dialog boxes.

Simulation Manager

The Simulation Manager allows you to keep track of all the scenarios you have created. To access the simulation manager go to Radiance→Tools→Simulation Manager.

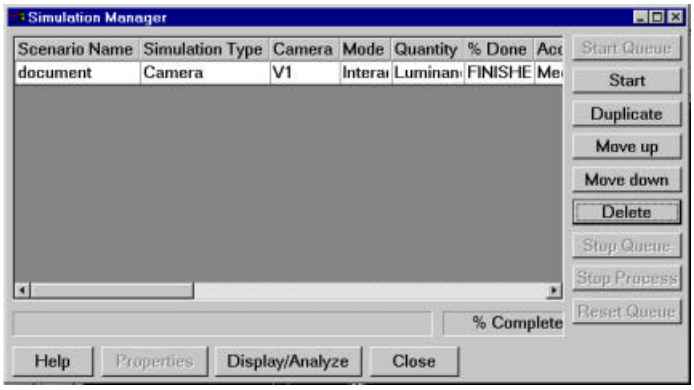

Figure 40. The Simulation Manager dialog box

The START button will begin a simulation that you have highlighted from the list. The DUPLICATE button allows you to duplicate a highlighted scenario and change settings on the Simulation Setup Dialog Box. MOVE UP and MOVE DOWN will change the order of the scenarios. DELETE will delete the highlighted scenario. CLOSE closes the Simulation Manager dialog box.

Define Project

A project folder is created when you start a simulation in Desktop Radiance. The project folder name is the same as the AutoCAD drawing name, and the default location is the Desktop Radiance install path e.g., C:\Program Files\Desktop Radiance. This is similar to how MSWord defaults to a directory called personal for saving word documents. If you chose to save the autocad drawing in a different location, for example the first level of C: drive, then the project folder will be created on the first level of C: drive also.

If the drawing which you want to start the simulation and rendering of is sharing the name of another project and/or drawing, you will be prompted with the Open Project Dialog box (Figure 41, p. 40). If Use Existing is selected, the information in the existing project folder will be used and new information added to the existing project database. Information will not be overwritten, but if significant changes have been made, overwriting the project may be recommanded. If New is selected, you may be prompted by another dialog box to locate and create the new directory (Figure 42, p. 40).

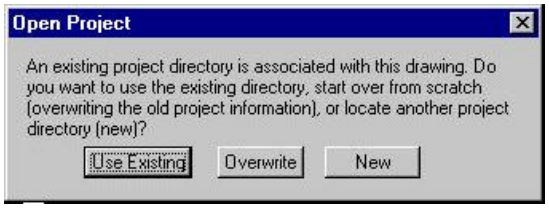

Figure 41. The Open Project dialog box

When the project folder or database files have been deleted, the following dialog boxes will appear. They appear after attempting to start a simulation. They first inform you that the project database cannot be found(Figure 42, p.40). Then an open file dialog box will appear. At this point, either find the database file called dradproj.mdb if it still exists or click OPEN to create a new one.

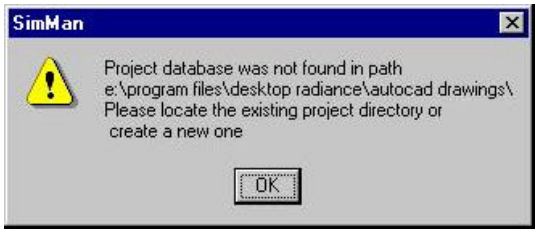

Figure 42. The Locate Project dialog box

This will bring up the Create New Project File dialog box(Figure 43, p.40). Selecting Yes will create a new project folder with the given name.

Figure 43. The Create New Project File dialog box

Reference Point Analysis

When simulating a reference point, the Reference Point Properties dialog box (*Figure* 44, p. 41) can be accessed by first simulating by reference point and then by clicking on the DISPLAY/ANALYZE button in the Simulation Manager(Figure 40, p. 39).

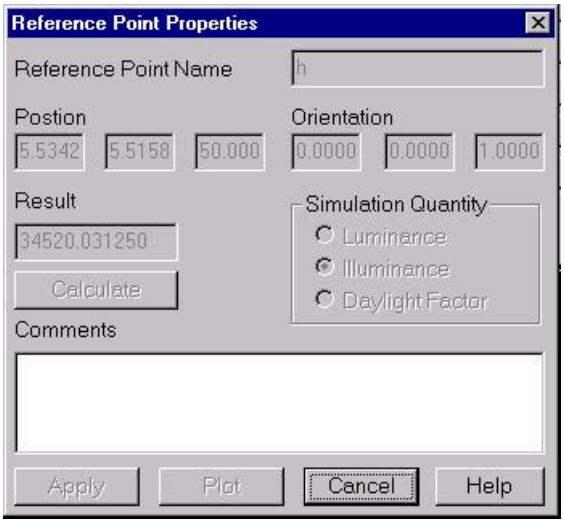

Figure 44. The Reference Point Properties dialog box

Workplane Grid Analysis

When simulating a reference grid or doing a workplane analysis, the Workplane Grid dialog box (Figure 45, p. 41) can be accessed by first simulating by reference grid and then by clicking on DISPLAY/ANALYZE in the Simulation Manager (*Figure 40, p. 39*) .

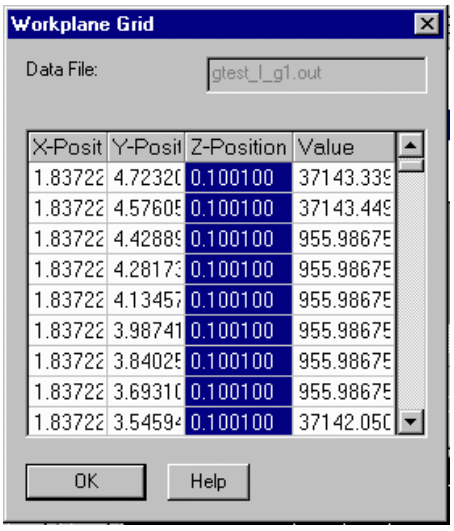

Figure 45. The Workplane Grid dialog box

Define Scenario

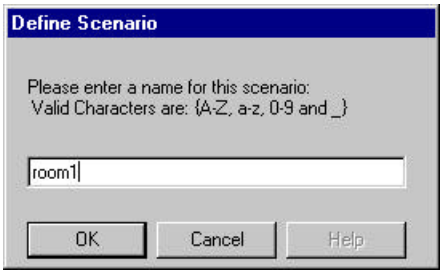

Figure 46. The Define Scenario Dialog box

Every scenario needs to have a unique name. The name given becomes the prefix of files created by the simulation manager. For example, for a scenerio named room1, the files created will have names such as room1_sky.rad and room1.rif.

Image Analyzer

Introduction

The Image Analyzer*(Figure 47)*, also known as ***winimage***, may be opened from within Desktop Radiance starting from Radiance→Tools→Image Analyzer, or by double clicking on the Image Analyzer icon created by the install program.

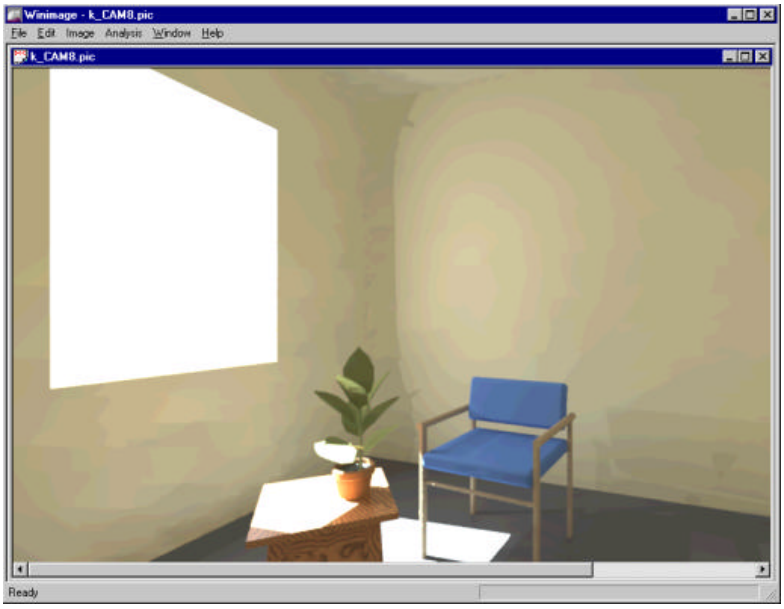

Figure 47. The Image Analyzer Dialog Box

The Image Analyzer displays and allows for analysis of Radiance images. Radiance images are saved with the default extension .pic. You may also convert images (save as) so they can be read by other imaging, paint, or presentation programs. All commands operating within winimage, with the exception of redraw, will result in a new image file being created.

The file naming convention in winimage is adding "_" and an abbreviation of the executed command, i .e. "fls" for falsecolor. Thus, if falsecolor is performed on drawing.pic, the resulting falsecolor image will be drawing_fls.pic. If an annotation is performed on drawing_fls.pic, then the resulting image will be drawing_fls_ann.pic. The original drawing.pic is **not** overwritten. However, if

falsecolor is performed on the same image twice, the second version will overwrite the earlier one.

The Radiance RGBE Format

A main advantage of the Radiance Synthetic Imaging System is the high dynamic range provided by its RGBE image file format. It allows for storing real-world luminance and illuminance values across 77 orders of magnitude with 1% accuracy.

Images can contain either scalar data (which lacks the high dynamic range), or luminance/illuminance values. It is important to distinguish between those two formats because scalar images are not appropriate for analysis as they lack the real-world high dynamic range values.

File

Open

Image Analyzer will open Radiance created images for viewing and analysis only. It will not open pictures or images saved in other formats.

Save As

A Radiance image may be saved as a pic, gif, tiff, pct (mac pict file), eps, or bmp. The saved image, if in a format other than Radiance's .pic, will not be openable by winimage again.

Image

The functions available under the Image menu result in new images which preserve the real-world, high dynamic range of the original image. Such images are suitable for later manipulations with functions under the analysis menu.

Redraw

Image Analyzer→Image→Redraw, this function redraws/regenerates your image. It does not create a new drawing.

Exposure

Image Analyzer→Image→Exposure, this tool adjusts the exposure level of the selected image, region, or point with a linear function with clamping. The adjusted image will be given a name and saved as a new .pic file automatically as it is being displayed. This is similar to how a camera works and can only partially compensate for regions of the image which are too bright or too dark. The sky outside of the windows, for example, will appear completely white if the image is exposed for the interior surfaces. To make the image darker by picking a point or region, select a point or region that is bright. To make the image lighter, choose a point or region that is one of the darker areas.

Image

Image Analyzer→Image→Exposure→Image, this tool adjusts the exposure by averaging all pixels of an image.

Region

Image Analyzer→Image→Exposure→Region, then select the region by clicking and dragging. The enclosed pixels will be averaged and the resulting value used to determine the appropriate exposure. If the image has a washed-out or brightly lit window and a room's interior, the window may be selected for exposing. The resulting new image will be of a dimmer interior and a window which seems less bright.

Point

Image Analyzer→Image→Exposure→Point, then select a point on the image with the cursor. The image will be adjusted with the selected point as the exposure set point.

Rotate

Image Analyzer→Image→Rotate, then select either 90 degrees clockwise or 180 degrees. A rotated image will appear.

Flip

Image Analyzer→Image→Flip, this function will flip (mirror) the image horizontally or vertically.

Analysis

The functions available under the analysis menu result in new images which lose the real-world luminance and illuminance values, i.e. they become unsuitable for further manipulations under the analysis menu.

Human Sensitivity

This tool is similar to an exposure adjustment but uses a variety of nonlinear and linear filters to mimic human visual perception. This tool compresses the dynamic range so that most of the details in a high-contrast image may be displayed simultaneously, similar to the visual experience one may have in the actual space. (See also **Pcond**).

Image

Image Analyzer→Analysis→Human Sensitivity→Image. The human sensitivity tool will consider the entire image *(Figure 48, left)* to determine the appropriate perceptual exposure setting. The resulting new image *(Figure 48, right)* may take a few minutes to complete, especially for wide-angle views.

Figure 48. Image before (left) and after (right) running Human Sensitivity

False Color

Figure 49. The Falsecolor Dialog Box

Image Analyzer→Analysis→Falsecolor brings up the Falsecolor Dialog Box (Figure 49). When applied to a luminance image, falsecolor outputs (Metric) candela/m^2 or (English) footlamberts. When applied to an illuminance image, falsecolor outputs lux or footcandle. The number of divisions sets the number of intermediate, equally spaced values between zero and the maxium value that will be displayed on the legend. Show pixel extrema, if selected, will cause falscolor to annotate the image pixel with the max and min luminance or illuminance values *(Figure 50)*.

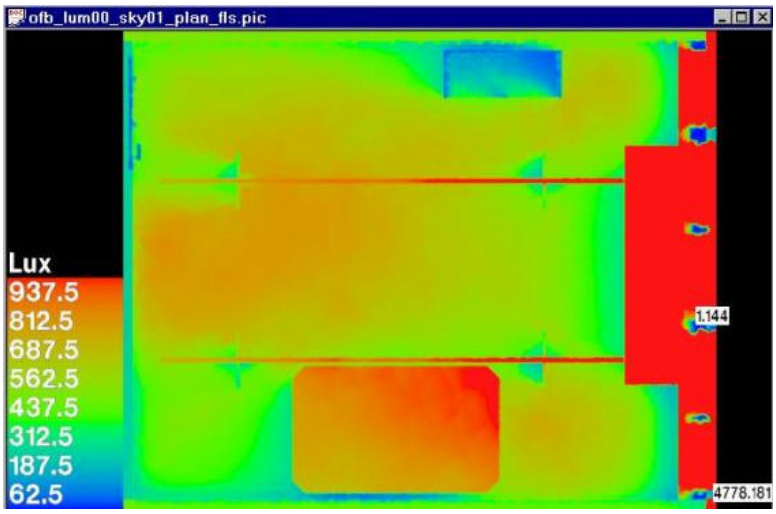

Figure 50. Falsecolor image with Show Pixel Extreme selected

Iso Contour

Image Analyzer→Analysis→Iso Contour brings up the Iso Contour Dialog box *(Figure 51)*.

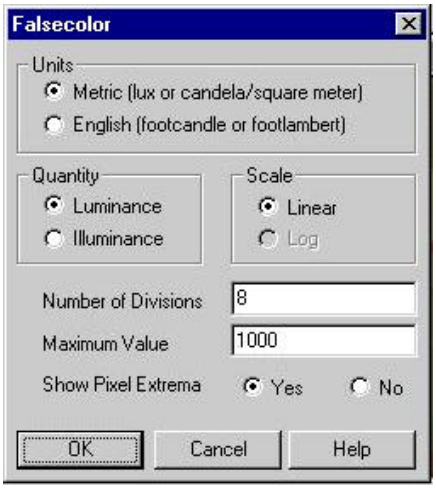

Figure 51. The Iso Contour Dialog box

Iso contour is similar to falscolor. Both output images with quantitative measurements. Iso contour draws demarcation lines in equal steps, according to number of divisions specified, between zero and the maxium value. Unlike falsecolor, the resulting image will contain colored lines of equal value overlayed upon the true color luminance or illuminance image *(Figure 52)*.

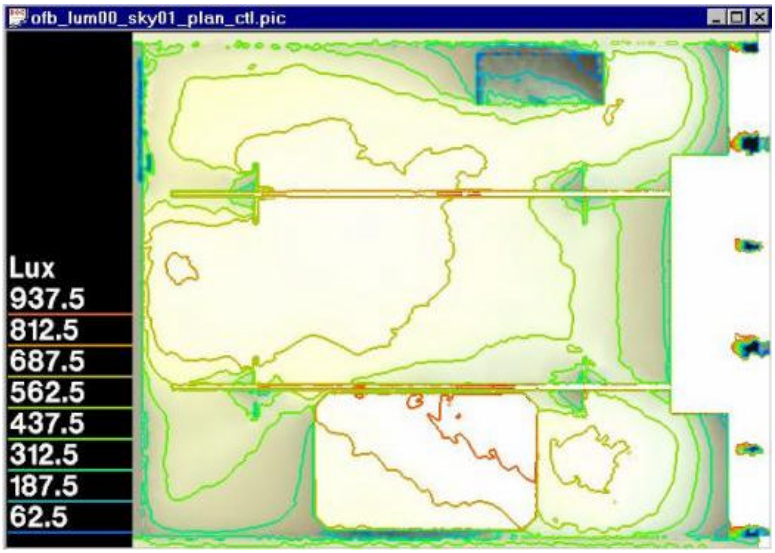

Figure 52. Iso Contour image

Annotate

Image Analyzer→Analysis→Annotate brings up the annotate dialog box. This tool places text on image. Type the annotation text in dialog box, press ok, and an updated image with appear with overlay text.

Window

New Window

Image Analyzer→Window→New Window opens another window of the same image. This allows different parts of the image to be viewed simultaneously, or for different analyses to be performed and compared side by side.

Cascade

Image Analyzer→Window→Cascade displays all open images in a cascading fashion.

Tile

Image Analyzer→Window→Tile tiles all open drawings.

Arrange Icons

Image Analyzer→Window→Arrange Icons lines up minimized image icons at the bottom of the winimage window.

Interactive Rendering (*rview*)

Introduction

Desktop Radiance allows for real time, interactive rendering. The image pixels refine on the screen and start to give you an idea of what the scene will look like. *Rview* is not meant to be a high resolution rendering tool but more for deciding viewpoints and validating scene geometry (make sure window normals are correct, furniture not floating in midair, walls meet, etc). The *rview* interactive rendering is the default mode for simulation. To produce high quality images, select Batch mode in the Camera Simulation Setup box.

Figure 53. The rview window during rendering (right) and after rendering (right).

File

Append View to rif file

This function saves the view information as text into a specified .rif file in the project directory. A rif file is not an image and cannot be opened in the Image Analyzer or rview. But the view information saved within a .RIF file may be used in a later rendering or simulation.

Append View to view file

This function saves the view information into a .vf file in the project directory. A .vf file is a text file and cannot be opened in the Image Analyzer Program.

Load view from rif file

This function allows you to select and load into *rview* a view previously saved in the rif file.

Load view from view file

This function allows you to choose and load a vf file into rview.

Save Image

Saves the image as a .pic file. This type of file can be opened in the Image Analyzer program.

Save Image As

Allows you to save an image as a .pic file. A pic file can be opened in the Image Analyzer. The default location for a pic file is in the project file of your drawing.

Save Log File As

View Log File

The log file is created after you trace a ray in *rview.* The log file records all rays traced and all data associated with the ray.

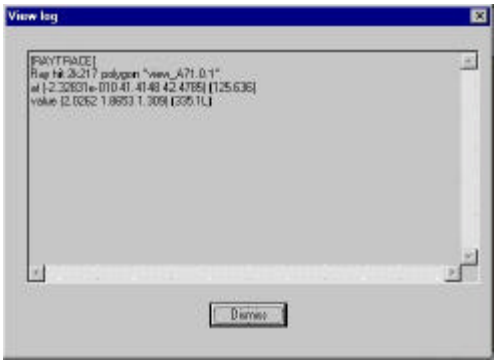

Figure 54. The View Log dialog box

Exit

Upon exiting *rview,* it will ask if you want to save the image. If you click YES you will be able to save the image as the default name given in the default location or as another name in a location you choose. Clicking NO will close *rview* and not save the image.

View

This menu allows you to display or hide the *rview* tools. The Toolbars include: the command bar, the roll/pitch bar, the status bar, the main toolbar, and the yaw/translate bar. If they are not already there, they can be turned on through the

rview→View pull down menu on the *rview* screen. All the toolbars except the Status bar can be rearranged on the *rview* dialog borders.

Figure 55. The rview window with all command bars visible

Command Bar

This is a small edit box which allows you to access some of the legacy features of *rview*.

Figure 56. The Command Bar edit box

You can type in commands for *rview* and press <enter>. The available commands can be found under the *rview*→Help→Commands pull down menu and they are:

Figure 57. The available commands that can be used on the command bar in rview.

Roll/Pitch Bar

These sliders control the rotation of the camera in *rview* to the right, left, up, and down. Roll adjusts rotation to the right or left around a horizontal axis perpendicular to the view plane, of the current view. Moving the slider up will roll the camera to the right, moving it down will roll the camera to the left. Pitch adjusts rotation up and down around a horizontal axis parallel to the view plane. Moving the slider up will rotate the camera forward/up and moving the slider down will rotate the camera forward/down.

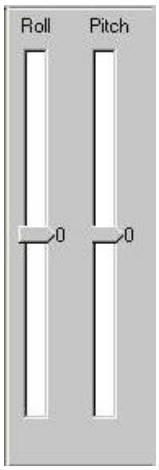

Figure 58. The Roll Pitch Bar

Status Bar

This is found near the bottom of the *rview* screen. The status bar indicates the progress of the rendering. When the rendering process is finished the status bar will display "Ready".

Figure 59. The Rview Status Bar

Tool Bar

The main toolbar contains six different tools *(Figure 60)* that are useful in formatting your ***rview*** screen to best fit your needs and analysis objectives.

Figure 60. The main toolbar in rview

"E" adjusts the exposure. This effects how light or dark your rview image is. For more on this see **Exposure**, p. 55.

"F" allows you to frame an area of the *rview* image for refinement. For more on this see **Frame**,p. 56.

"N" redraws or regenerates the *rview* image. This is sometimes necessary if you have changed several parameters or settings in *rview.* For more on this see **Redraws** a New image**,** p.56**.**

P

"P" allows you to adjust certain image parameters in rview. For more on this see **rview Parameters Dialog** box, p. 56.

T

"T" allows you to ray trace. For more on this see **Ray Tracing**, p. 61.

V

"V" allows you to adjust and set the *rview* view. For more on this see **Set View**, p. 62.

Yaw and Translate Bar

The Yaw tool turns the view about the Z axis to the right or left. Adjusting the Yaw slider to a smaller number makes it turn left, and a larger number turns the camera to the right.

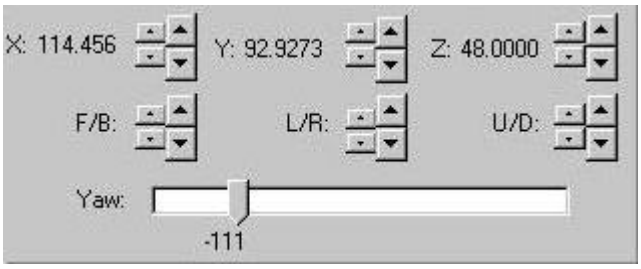

Figure 61. The Yaw and Translate Bar

The X,Y, and Z spinners move your viewpoint position along the X, Y, and Z axes. The larger spinners move the viewpoint in larger increments. The smaller spinners move the viewpoint in smaller increments. To adjust the increments that these spinners set with see **GUI Increments**, p. 55.

The spinners labeled F/B, L/R, and U/D move the viewpoint from it's relative position and angle, as opposed to along an axis which the X,Y, and Z spinners do.

The F/B spinners move the viewpoint forwards and backwards.The up pointing spinners move the viewpoint forwards. The down pointing spinners move the viewpoint backwards.

The L/R spinners move the viewpoint to the left and right. The spinner pointing up moves the viewpoint to the left. The spinner pointing down moves the viewpoint to the right.

The U/D spinners move the viewpoint up and down. The spinner pointing up moves the viewpoint up. The spinner pointing down moves the viewpoint down.

Set

This menu item allows you to turn on and off certain features of *rview.* SET also provides another way of accessing some commands that are found on the main *rview* toolbar.

Backface Visibility

This tool turns on and off the walls whose surface normal is pointing away from your viewpoint.

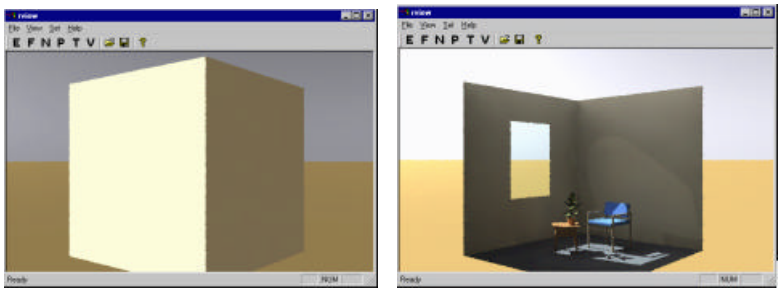

Figure 62. Without backface visibility (left) and with (right).

This tool is useful when you wish to see through the near side of a building. With one camera on the outside both the inside and outside of a building can be easily viewed instantaneously in *rview.* For this tool to work, the surface normals of the wall surfaces must be oriented toward the inside of the building. What this tool in essence does is turn off the wall surfaces whose surface normal is pointing away from the viewpoint. For more information on orienting surface normals see **Adjust Normal Orientation** in the Graphic Editor section**.**

Greyscale

This tool renders the image in black, white, and graytones.

Irradiance

If selected, *rview* simulates and calculates the Illuminance in the model. Reflectance of materials is not taken into account. The amount of light that reaches each surface in your model is measured and displayed.

Figure 63. An irradiance image

GUI Increments

The GUI increments are the increments that the sliders and spinners of *rview* tools are setup with. This tool allows you to adjust the increments that spinners and sliders are set for. The major spinners and sliders are meant to be set with relatively large increments. These allow you to move the view in large segments at a time. The minor spinners and sliders are meant to be set with relatively small increments. These allow you to fine tune the position of your view once you have moved the majority of the distance with the major spinners and sliders.

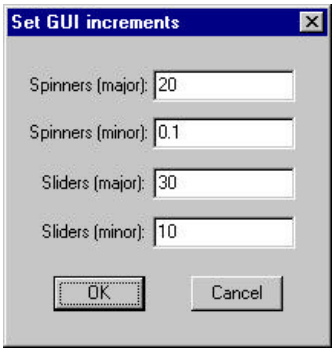

Figure 64. The Set GUI increments dialog box

Exposure

E When using the exposure tool, the higher the setting, the brighter the image will be. When “Relative Mode” is selected, the exposure will be set relative to your choice of either a point that you select in the image or relative to the average value in the image.

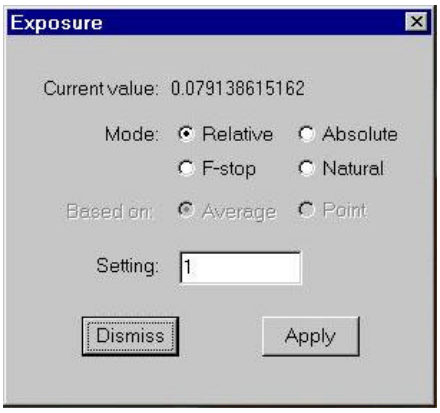

Figure 65. The rview Exposure tool

Frame

F This tool allows you to frame a section of an image for refinement. After clicking on "F" you are prompted to select an area for refinement. Use the cursor to drag a box around an area of the image. To select the entire image, draw a box around the entire ***rview*** window. There is no frame all command as in previous Unix versions of *rview.*

Redraws a New image

N This tool redraws/regenerates a new image. This is sometimes necessary if the image has been corrupted by other dialog boxes, or if you have significantly changed your calculation parameters and want to start over.

rview Parameters Dialog box

P The ***rview*** parameters define the level of accuracy for the simulated image. The settings in this dialog box will determine if your model will simulate an image quickly or more slowly to a high level of accuracy. In the *rview* parameters dialog box you can manipulate things such as the number of ambient bounces that should take place. For information on choosing recommended values for ***rview*** parameter settings see the Desktop Radiance User Manual→Tips and Techniques→Setting Rendering Options. This table will give you minimum, maximum, fast, and accurate values. In addition it tells you particular settings that can greatly affect the rendering time of your model.

Ambient Parameter Tab

The Set Parameters→**Ambient** dialog box*(Figure 66)* below sets the parameters for the ambient light in the scene. To access the Ambient Parameters dialog box go to rview→Set→Parameters and click on the AMBIENT tab.

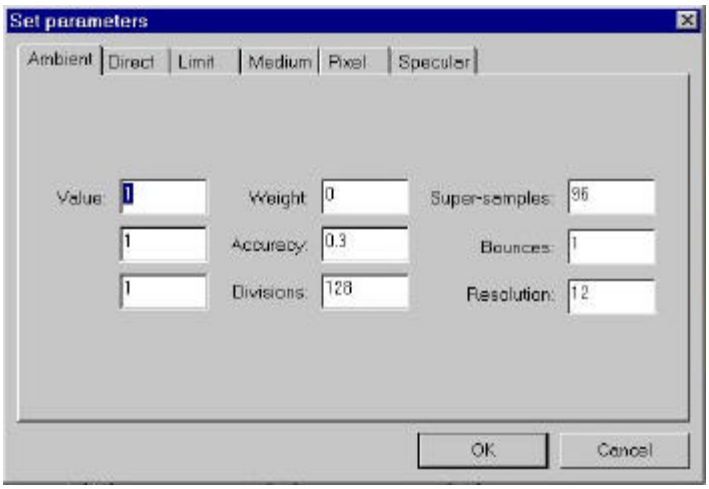

Figure 66. The Ambient Tab in the Parameter Dialog Box

Value: three boxes representing red (top), green (middle), and blue (bottom). Increasing these values evenly can make the scene darker, decreasing them will make it lighter.

Weight: the average weight of the indirect light. As new indirect lights are computed the average value will be modified. For a scene that includes indoor and outdoor spaces, a value of zero is appropriate and is the default.

Accuracy: the accuracy of the ambiently lit areas of the model. The smaller the number, the smoother the rendering. A value of zero is very accurate. A value of 0.3 is a reasonable level to begin with. The range of possible values that can be entered is between 0 and 0.5. Lower numbers are more accurate.

Divisions: the number of divisions in the ambient light. A value of zero implies no indirect calculation. A reasonable value to begin with is 128. The range of possible values that can be entered is between 0 and 4096. Higher numbers are more accurate.

Super-samples: applied to ambient divisions that show a big difference in value from one to the other. A reasonable value to begin with is 96. The range of possible values that can be entered is between 0 and 1024. Higher numbers are more accurate

Bounces: the maximum number of diffuse bounces that will be computed by the indirect calculation. To have no indirect calculation, enter a value of zero. For a medium quality rendering, a value of 2 or 3 is reasonable. The range of possible values that can be entered is between 0 and 8. Higher numbers are more accurate. If your *rview* rendering first appears very flat and shadowless, a low value for the ambient bounces setting is usually the cause.

Resolution: the rendering of the ambient light areas of the model. A value of zero means that there is an unlimited amount of resolution. A reasonable value to begin with is 12.

Direct Parameters Tab

The Set Parameters→**Direct** Dialog Box *(Figure 67)* sets the parameters for the direct light in the scene. To access the Direct Parameters dialog box, go to rview→Set→Parameters and click on the DIRECT tab.

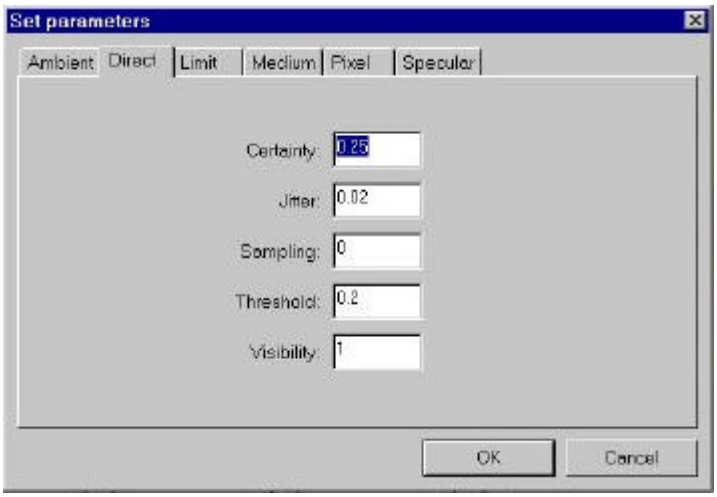

Figure 67. The Direct Parameters Dialog Box

Direct-Certainty: value of one guarantees that the absolute accuracy of the direct calculation will be equal to or better than that given in the *Direct® Threshold value*. A value of zero insures that all shadow lines resulting in a contrast change greater than the specified *Direct® Threshold value* will be calculated. A reasonable value to begin with is 0.25. The range of possible values that can be entered is between 0 and 1. Higher numbers are more accurate.

Direct-Jitter: controls the smoothness and accuracy of penumbras or soft shadows. A value of zero means that shadows will be rendered without penumbras and a value of 1.0 will maximally sample large area sources to provide the smoothest possible penumbras.

If direct jitter is greater than 0.0 then pixel sampling must be 1.0. A good value to use for direct jitter is .67 when smooth shadows are desired. This parameter can greatly increase rendering time so use with caution. A reasonable value to begin with is 0.02. The range of possible values that can be entered is between 0 and 1. Higher numbers are more accurate.

Direct-Sampling: subdivides a light source until the width of each sample area divided by the distance to the illuminated point is below this ratio. This assures accuracy in regions close to large area sources at a slight computational expense. A value of zero turns source subdivision off, sending at most one shadow ray to each light source. Large area sources are subdivided into at most 64 patches which can lead to "hot spots" on immediately adjacent surfaces.

Direct-Threshold: minimum light value that a light source must have to be tested for shadows. A value of zero means all light sources will be tested for shadows. A reasonable value to begin with is 0.2. The range of possible values that can be entered is between 0 and 1. Lower numbers are more accurate.

Direct-Visibility: allows you to make light sources appear black when looked at directly, but light output will still be taken into account for the simulation and analysis. A value of zero will turn off the light source visibility. Any number greater than zero will turn it on.

Limit Parameters Tab

To access the Limit Parameters dialog box*(Figure 68)*, go to *rview*→Set→Parameters and click on the LIMIT tab.

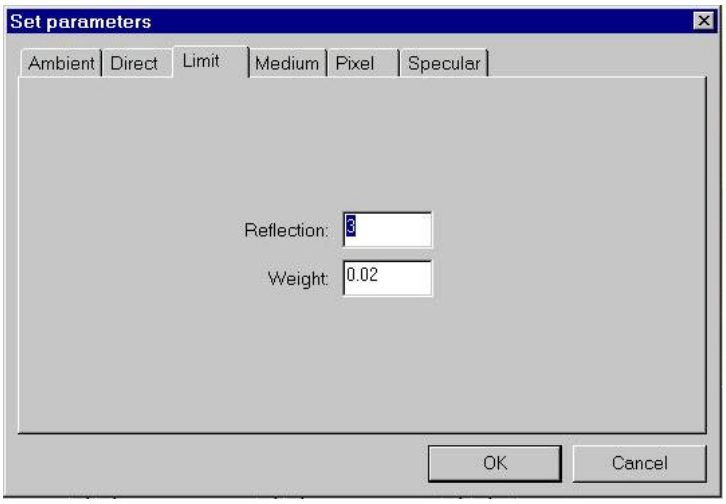

Figure 68. The Limit Parameters Dialog Box

Limit-Reflection: defines the maximum number of specularly reflected and refracted rays that can be spawned for each initial view ray. A reasonable value to begin with is 3. The possible range of values that can be entered is between 0 and 16. Higher numbers are more accurate.

Limit-Weight: the weight function stops the generation of specular rays when the potential contribution is less than the specified minimum value. If the amount measured is less then the specified minimum weight, additional rays will not be traced. A reasonable value to begin with is 0.02. The possible range of values that can be entered is between 0 and 0.05. Lower numbers are more accurate.

Medium Parameters Tab

Parameters in the Medium tab affect the way light is traced through "participating media" such as mist or fog. Volumes of participating media must be modeled with the appropriate Radiance material. Such materials are not yet available in Desktop Radiance.

To access the Medium Parameters dialog box*(Figure 69)*, go to *rview*→Set→Parameters and click on the MEDIUM tab.

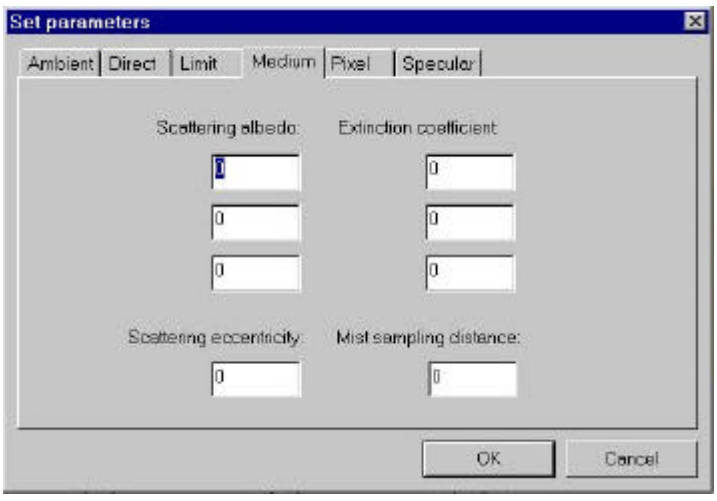

Figure 69. The Medium Parameters Dialog Box

Scattering Albedo: determines whether light from a medium is absorbed or scattered. From top to bottom the boxes stand for Red light, Green light, Blue light. Only values between 0 and 1 can be entered. A zero will cause all light not transmitted by a medium to be absorbed. A one will result in all light not transmitted to be scattered elsewhere.

Extinction Coefficient: refers to the distance that light will be scattered or absorbed. The three boxes from top to bottom stand for red light, green light, blue light.

Scattering Eccentricity: defines how much light scattering will tend towards the forward direction. Only values between 0 and 1 can be entered. A value of one will result in the most forward tending light scattering.

Mist Sampling Distance: defines the distance between samples taken during a source scattering. A value of zero means that only one sample will be taken.

Pixel Parameters Tab

To access the Pixel Parameters dialog box*(Figure 70)*, go to *rview*→Set→Parameters and click on the PIXEL tab.

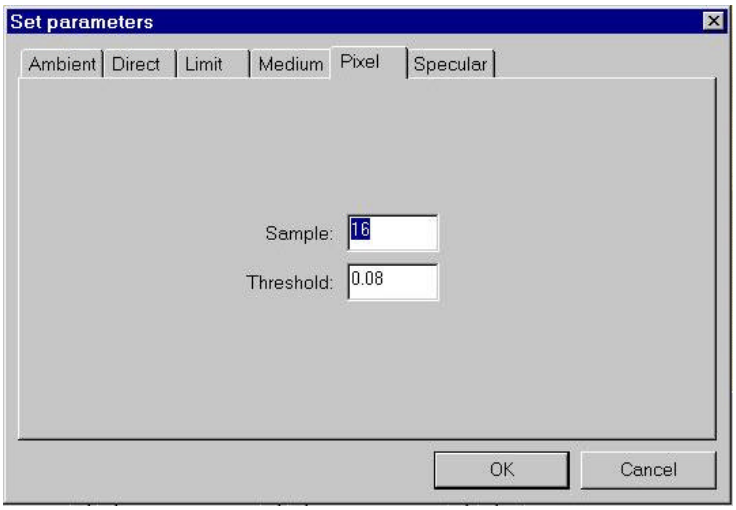

Figure 70. The Pixel Parameters Dialog Box

Sample: defines the amount of space in pixels that can be used for subdivisions on the image plane. A reasonable value to begin with is 16. The range of values that can be entered is between 1 and 16. Lower numbers are more accurate.

Threshold: if two adjacent pixel samples differ by more than this amount, a third sample will be taken. A reasonable value to begin with is 0.08. The range of values that can be entered is between 0 and 1. Lower numbers are more accurate.

Specular Parameter Tab

To access the Specular Parameters dialog box*(Figure 71)*, go to *rview*→Set→Parameters and click on the SPECULAR tab.

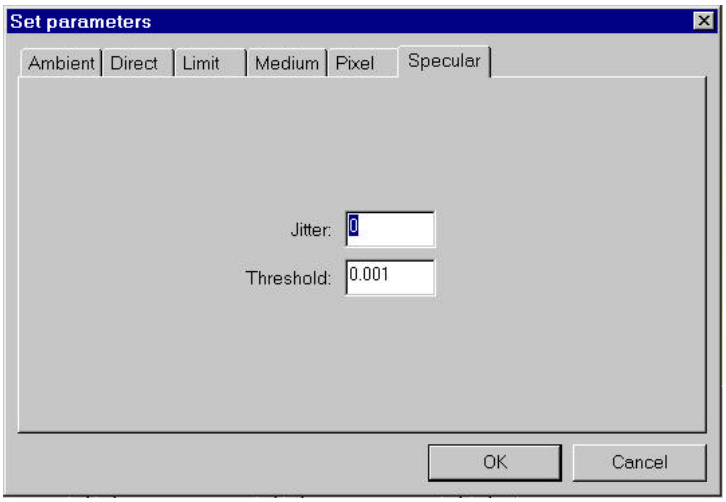

Figure 71. The Specular Parameters Dialog Box

Jitter: the amount that specular semi-highlights will be sampled. A value of zero will turn off specular sampling causing all light reflections to appear sharp. A value of one will make all specular reflections fully sampled allowing for soft reflections. A reasonable value to begin with is 0. The range of values that can be entered is between 0 and 1. Higher numbers are more accurate. Changes in this value have no effect on rendering time.

Threshold: the minimum specularity of materials under which specular sampling is not performed. A value of zero means specular sampling will always take place. A value of one means specular sampling will not take place at all. Values between 0 and 1 will selectively allow specular sampling, for those materials whose specularity is above the specified value. A reasonable value to begin with is 0.001. The range of values that can be entered is between 0 and 1. Lower numbers are more accurate.

Ray Tracing

T You select a point to find the level of luminance or illuminance, depending on the calculation quantity(set→irradiance or set→radiance), in your model at that point.

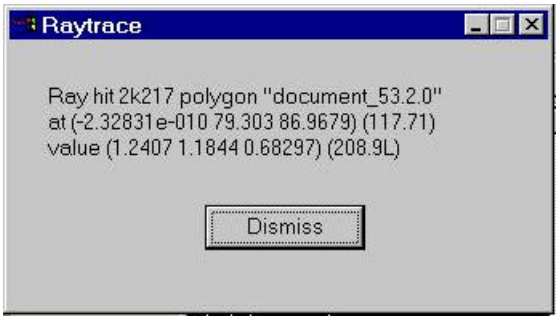

Figure 72. The Raytrace information dialog box

The first line of output provides the name of the material (e.g. 2k217) associated with the surface that the traced ray struck in the model followed by the surface type (e.g. polygon) followed by the surface identifier (e.g. document_53.2.0).

The second line of output provides the location in space that the ray struck (x, y, z coordinates)(e.g. -2.32832 e-010, 79.303, 86.9679) followed by the length of the ray from the
camera position to that point (e.g. 117.71) in the units of your model.

The third line of output provides the computed luminance or illuminance value, first in red, green and blue spectral quantities, then in average luminance or illuminance quantity.

If your calculation quantity is set to illuminance, this value will report the illuminance in Lux. If your calculation quantity is set to luminance, this value will report the luminance in nits or candelas per square meter. These units are always displayed in SI units, regardless of the units specified in the preferences dialog box.

Set View

V The Set View Dialog Box*(Figure 73)* sets specifications for the view or camera. The settings to specify include: Type, Size, Viewpoint, Clipping Plane, Direction, Up, and Offset.

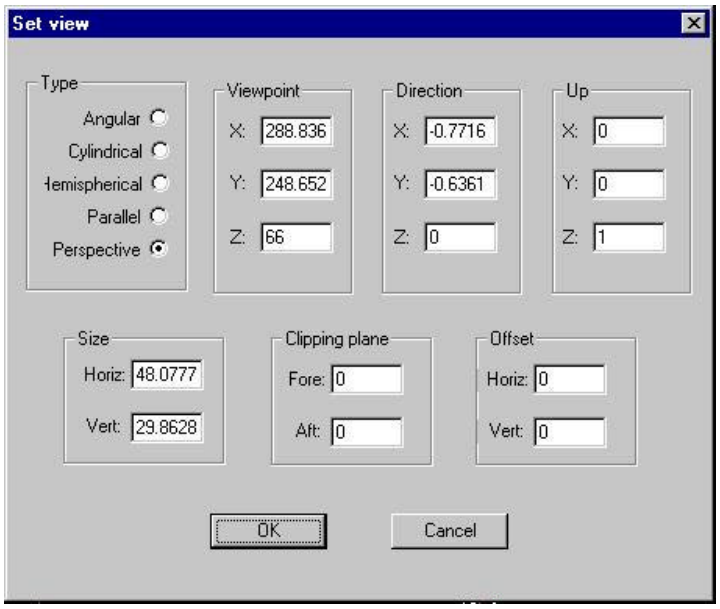

Figure 73. The Set View Dialog Box

Type:

Angular allows for a fisheye view of the model with a horizontal and vertical view size of up to 360 degrees.

Cylindrical gives a view of the model projected onto a horizontal cylinder as is used with quicktime VR applications.

Hemispherical fisheye views of the model with view size up to 180 degrees.

Parallel gives a flat elevation, section, or plan view of the model. View size is then interpreted in world units instead of degrees.

Perspective is a standard perspective view of the model from your viewpoint and allows for a view size of up to 179 degrees.

Size:

Horizontal sets the view angle for a perspective or fisheye view. For a parallel view it sets the width of the view in *world units.*

Vertical sets the height of the view window.

Viewpoint:

The *X,Y,Z* coordinates determine the focal point for a perspective view or the center point of a parallel projection image.

Clipping Plane:

This is a plane, perpendicular to your view direction, that cuts through and hides a portion of the image of your model. *Fore* and *Aft* refer to whether what is in front of or behind the plane, respectively, is hidden. The value that is entered in these boxes determines the distance from your viewpoint that the clipping plane is situated. If your image is in a fisheye view then the clipping plane is a clipping sphere and the value entered is the radius of the sphere. The center of the sphere being your viewpoint.

This tool is useful for viewing the inside of buildings by slicing off a wall on one side. A similar effect can be achieved with backface visibility.

Direction:

This tool defines the direction of the *view vector* that creates the view. The X,Y,Z boxes define a point that the view vector will pass through.

Up:

Up is defined by XYZ vectors, with the direction which appears to be the top of the computer screen being up. For example, for a view seen by a person standing and looking straight towards the horizon, the up is along the Z axis, and is defined by X=0 Y=0 Z=1.

Offset:

This tool offsets the view projection up, down, right, and left. A positive Horiz refers to a right offset. A positive Vert refers to a vertical offset.

Help

Commands

This menu item provides you with commands that can be used in the *rview* Command Bar. For more information and to view the commands, see **Command Bar**(p. 51)**.**

Defaults

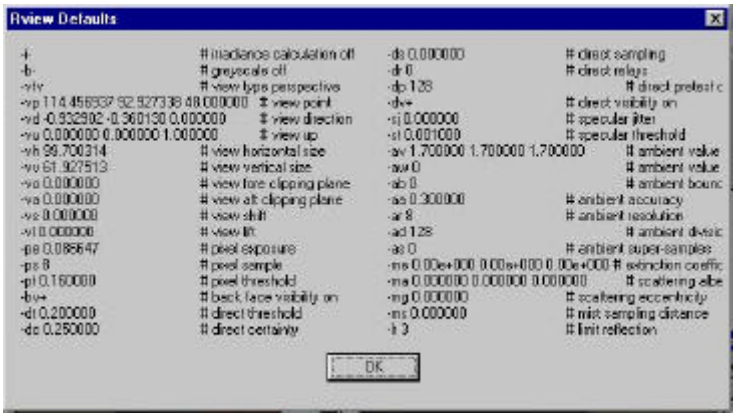

Figure 74. The Rview Defaults dialog box