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RadianceIES
Daylight Modelling

RadianceIES Daylight Modelling

If we consider the different types of simulation available in more detail:

LUMINANCE is used to generate a photo-realistic image or which can then be used to analyse glare.
It is the apparent brightness of a surface or object, as seen by the human eye.

– Standard Image, has an option where you can select **analyse glare** from the glare drop-down menu to show glare sources and generate glare metrics
– **Daylight Glare Probability:** Glare is caused by either or both of the following: excessive luminance values in the field of view, or luminance contrasts that are too high. Windows can have a high luminance compared with other luminance 'sources and/or surfaces in a room. This gives a strong contrast from inside to outside, potentially causing glare.

ILLUMINANCE is used to determine LUX levels or Daylight Factors – it measures light incident on a surface/plane.

– Standard Image creates a standard perspective view
– WP View Image.
– WP Zone Image creates a working plane Illuminance image, a notional working plane is specified by the user.
– WP Zone Data creates a grid of Lux values – the results are displayed in WP Grid tab ; this option uses rtrace method
– WP Zone Data (Dynamic) creates a grid of Lux values – the results are displayed in WP Grid tab; this option uses Daylight Coefficient (rcontrib) method with hard-wired dynamic parameters settings. Remember that this requires the quality to be set to Dynamic Quality

Sky Type Selection

There are a number of different sky types in Radiance, but two are of particular importance:
– The Sunny sky is used to provide a worst case scenario for glare analysis (luminance images).
– The CIE Overcast Sky is used to give the worst case scenario (in design terms) for illuminance, and can also be used for glare analysis.
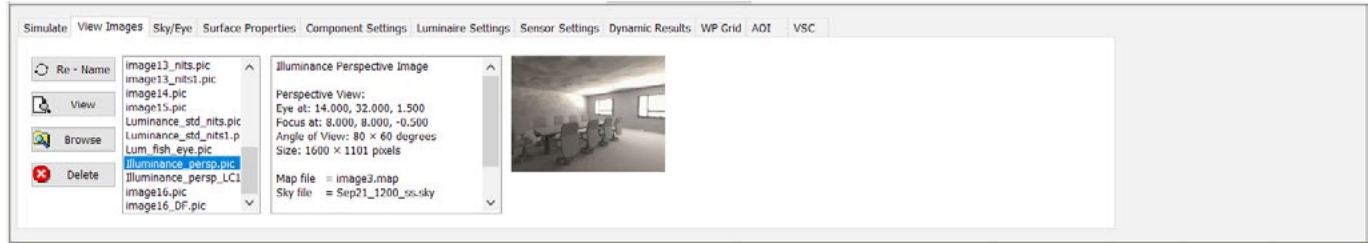
Note that the CIE Overcast Sky does not have a fixed brightness (usually quoted as 10,000 Lux), as the zenith brightness of the CIE Overcast Sky varies by Site Latitude, by season and by the time of the day. If you want to run a simulation using this fixed sky brightness, use the10 Lux CIE Overcast Sky.

When using the CIE Overcast Sky it is possible to generate Daylight Factors. This value (expressed as a percentage) is the ratio of measured illuminance to a theoretical maximum on an unobstructed plane. This ratio is constant whatever the date/time of simulation, thus only one simulation is required to generate this data.

Location

The location of the building is very important when running daylighting calculations. The orientation of the building will determine where the sun is at a certain time of day. This is particularly important when running Luminance images to determine glare occurrence.

View Images

The view images tab will list an image for each simulation you run. It will give a description of the settings used, and a thumbnail of the final image. You can re-name each image as required, and delete any you do not need.

Double click on the image name to open the image in the Radiance picture viewer.

By clicking anywhere on an image the luminance/illuminance at that point is displayed. These values can be removed by right clicking the value. Luminance/illuminance levels can be shown as contours to aid analysis of the image.

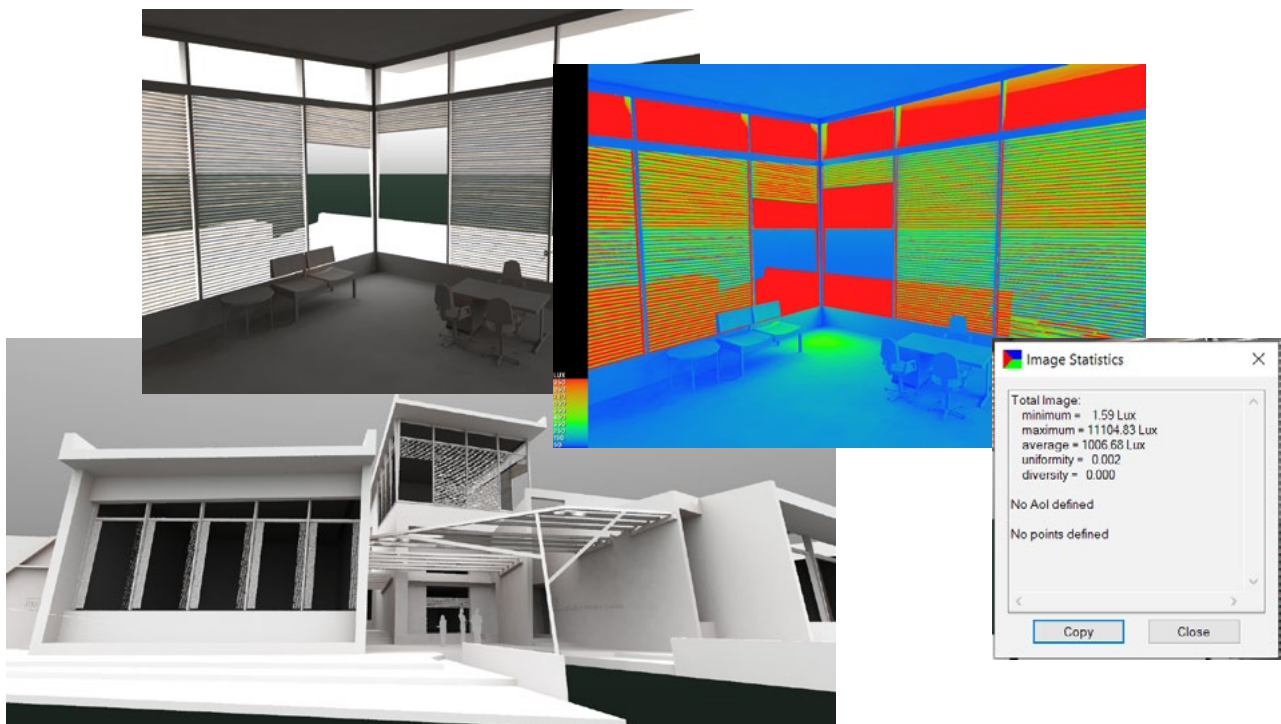**The toolbars are similar for both Luminance and Illuminance:**

–   You can open, save, copy and print the image file.

–   You can display the summary information for the current image

–   You can adjust the image exposure from -5 (under exposed) to +5 (over exposed)

Illuminance images are displayed in lux on opening, but this can be changed to daylight factor / footcandles /.

–   For an image in plan view, a grid can be turned on, showing the lux values at designated intervals. Clicking on show grid, will overlay the values at each point on the image, in a selection of colours.

Using this dialogue you can show/hide the area of interest (AoI). The area of interest enables the user to analyse a specific section of the image and thus, omit the part of the image that they are not interested in.

–   Lux Contours can be shown, for example in false colour

–   A colour overlay can be generated to show areas above/below a threshold for plan or working plane images.

–   Daylight Factors can be shown for plan images that were simulated using a CIE clear sky. You can generate a rendered image or tabular text, or show a polyline for a set threshold.

–   Statistics: displays a pop-up window showing various statistics such as total average Lux, % threshold and the spot Lux value for each defined point, etc.

Luminance images can also be used to analyse glare sources, at different times/ dates, with or without numerical data:
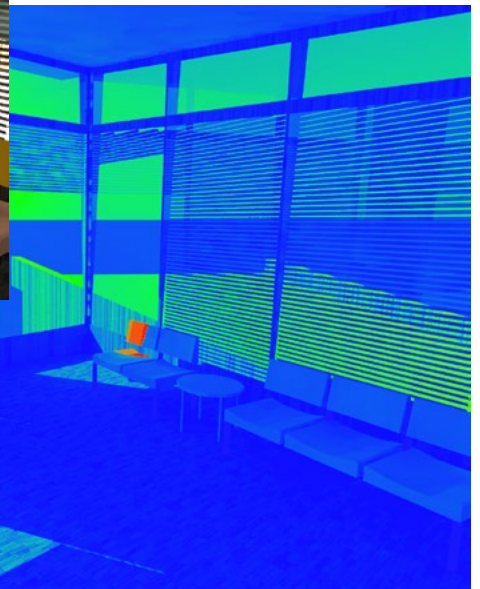
– Glare sources can be identified – they are displayed as a red circle with the intensity of the source at the centre (luminance = nits).

– Indices: displays a window showing the "GUTH Visual Comfort Probability" (% of people who would be satisfied) and the "CIE Glare Index" for the analysed glare angles.

– Analyse glare: this analysis will run when activated here. The status bar at the bottom of picture viewer window shows the "Glare threshold" for a luminance image (this is the default value calculated as 7 times the average luminance).

– Re-analyse Glare: lets you modify the glare parameters and repeat the glare analysis. When the glare threshold is set to "0" the program will calculate the threshold as 7 times the average luminance. *https://help.iesve.com/ve2019/radiance_picture_viewer.htm#*

– You can perform a daylight glare probability analysis from a standard luminance image if you had manually set its view type to be hemispherical fisheye.
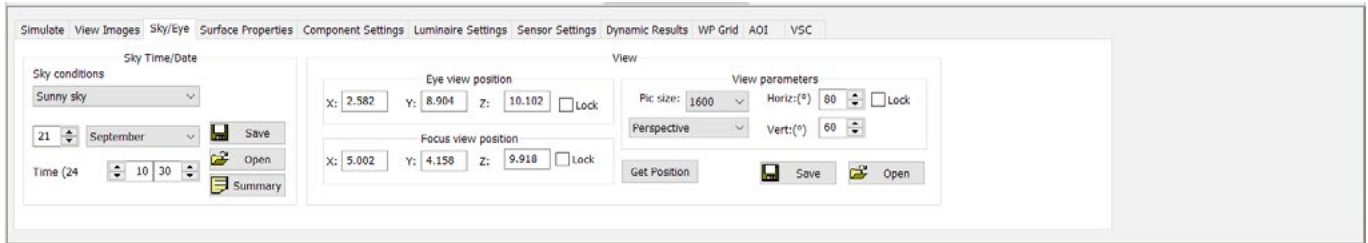
Glare indices summary

Glare Threshold = 448.91 cd/m²   resolution = 250   Sep21_1030_ss.sky

Angle	60	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
GVCP	73.91	73.74	75.15	78.74	79.79	83.74	86.60	89.24	92.16	93.44	93.71	91.33	90.72

Guth Visual Comfort Probability   Copy   Save   -ve angles to Right, +ve angles to Left   Close

Sky/Eye

The SKY/EYE tab lets you select the sky type and choose your point of view to generate images.

The first section for Sky Time/Data is where you choose the sky type for your simulation – remembering that this may be dictated by regulations if you are doing a compliance simulation: the most frequently used sky conditions are:

- A Sunny Sky is used for Glare Analysis.
- A CIE Overcast sky is used to produce lux levels and daylight factors, and to check glare.

After choosing your sky type, set the time and date for the simulation. RadianceIES can perform analyses for any given date/time, so the biggest problem is deciding when to simulate: this is sometimes stipulated by regulations.

The obvious design days are the equinoxes, mid-summer and mid-winter. These will give average, maximum and minimum levels of daylight. As well as varying seasonally, daylight also varies daily. East facing rooms will get sunlight in the morning and West facing in the afternoon. The use of Daylight Factors can be useful for reducing the number of simulations. Daylight factor is run for the equinoxes in March and September. Often you are presenting the worst case scenario, i.e. the minimum Lux, or the maximum glare.

Choose your point of view: this can be done by either double right-clicking the mouse on the new Eye/Focus position and choosing Set Eye/Focus Position option; or by changing the x, y and z values; or by clicking on **get position**.

You can move around the model in that view using W (zoom in), S (zoom out), A (left), D (right), E (up) and C (down) keys on your keyboard. Once the required view is set up just close the Model Viewer mode.

- The default view is to add 10% to the bounding box of the model and set the focus position to the centre of the model. If a zone is selected, then the eye and focus position change to inside the zone.

  The "Lock" selectors can be used to maintain a fixed eye/focus position.
- The "Eye view position" is the point from which the image is taken (i.e. where a camera would be placed).
- The "Focus view position" sets the point towards which the camera would be directed.
- They eye and focus positions are easier to set up when the model is in plan view.
- Illuminance and Luminance simulation types will permit an external view of the building (eg. Luminance standard image).
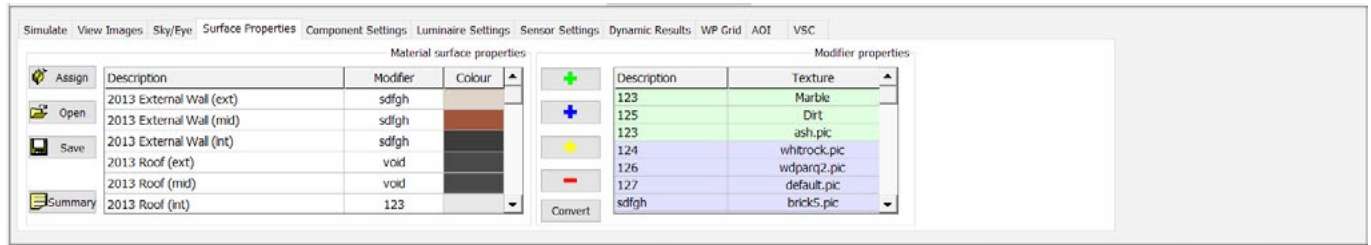
The view parameters let you set the size of the final image generated, and choose between different types of views: perspective; plan; hemispherical fisheye and angular fisheye.

You can change the angle of the view, or the horizontal and vertical extents of a plan view.

- Perspective is best when calculating glare occurrence and for visualising a space. You can define both the eye and the focus position for this view.
- Plan views enable daylight factors and lux levels to be displayed at working plane height using a grid layout.
  When selecting a plan view, if you are at the highest level, viewing the entire model, you can click on the space in which you are interested and the plan view will be limited to that space. You can adjust the height thereafter by typing in a z co-ordinate. There is no focus position, and the horizontal and vertical dimensions are set in metres: the default will add 0.5m to the bounds of the space, and if it has a complex shape, the generated image will include other space(s).
- The hemispherical fish-eye view has a maximum angle of 180°.
- The angular fish-eye has a maximum angle of 360°.

The selected view position and parameters can be saved and later opened.

Surface Properties

RadianceIES is linked to the Apache constructions database (APcdb) for glazing transmission values and surface reflectance values. To view or edit a material, double-click on its description, modifier, or colour, and this will open the project construction in (APcdb), where you can select from the list of materials or manually adjust the RGB values.

The "Type" can be either "plastic" or "metal". These both have the same set of parameters.
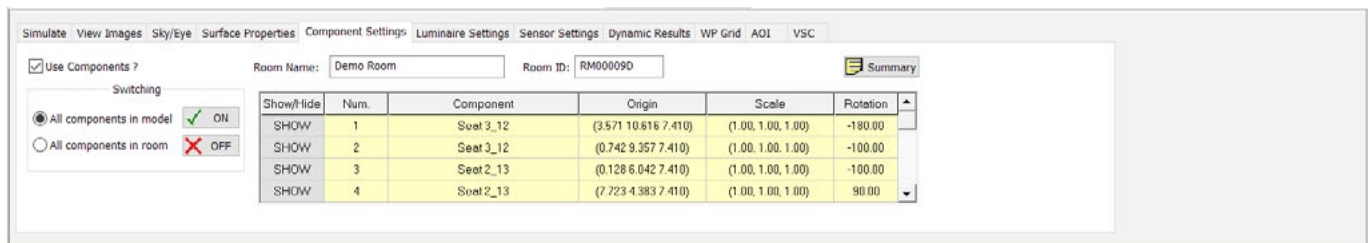
You can use a custom colour to pick and RGB colour.

If a glass material is selected a different set of pre-defined options is displayed. There is a button on the construction material page which you can use to calculate the transmissivity.

The "Type" has a choice of three possible options - "glass", "trans" or "dielectric". These all have different parameters.
https://help.iesve.com/ve2019/surface_properties.htm# and *https://help.iesve.com/ve2019/materials_in_radiance.htm#*

Component Settings

The COMPONENT SETTINGS tab determines whether or not components will be shown in RadianceIES

Components are created using the Component Modeller and assigned to zones in ModelIT.

The "Use Components" switch is used to activate the use of components. The options available in the "Switching" allow for quick selection of default scenarios e.g. all components OFF, only components in a selected room ON.

A list of all components placed in the model will be displayed and you can choose to switch all, none or some of them on. Individual components can be switched ON or OFF using the button to the left of each component description.

Luminaire Settings

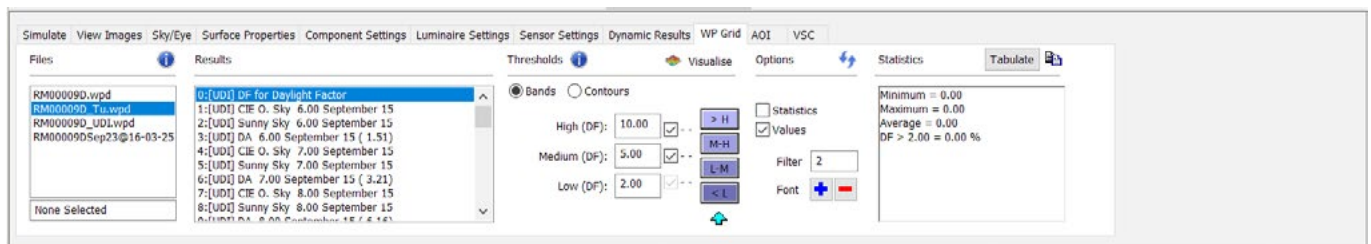The LUMINAIRE SETTINGS tab is used to activate the use of luminaires

Luminaire properties are defined using the LightPro application.

The "Use Luminaires?" switch is used to activate the use of luminaires; the "Daylight off?" switch is then available. The options available in the "Switching" allow for quick selection of default scenarios e.g. all lights ON, only lights in a selected room ON. When a zone with lights is selected, the list is updated.

Individual lights can be switched ON or OFF using the button to the left of each luminaire description. The luminaire positions are also drawn in the canvas window. The "Summary" button generates a window detailing what luminaires are defined in the model and the status of each.

Working Plane (WP) Grid

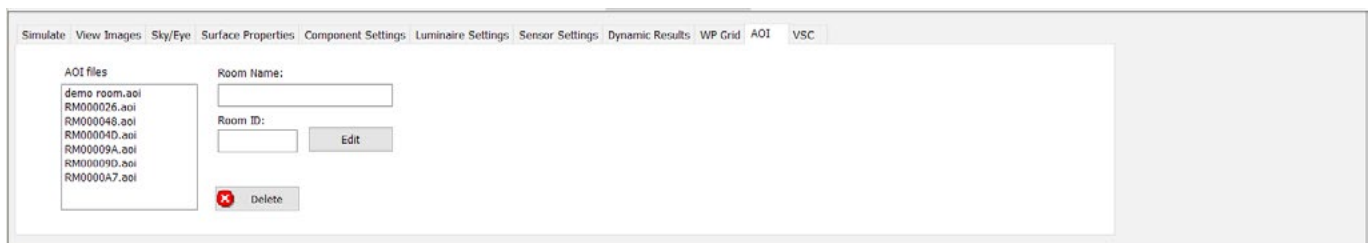The WP Grid tab is used with a WP Illuminance simulation.

Once the WP simulation is complete, use the parameters on this tab for a quick visual analysis of what areas fall within prescribed parameters. The results can be tabulated and statistics drawn as desired.

This tab is also used for the analysis of Advanced Simulations, as discussed in the section on Climate Based Daylight Modelling (CBDM).

Area of Interest (AOI)

The AOI tab is used to list the saved Area of Interest outlines.

This tab has a list of saved AoI outlines that have been saved for this project. They can all be loaded in the relevant Illuminance image to ensure consistent results from the evaluation of the same area within each image. This allows a statistical review with numerical calculations for the average, minimum, and mean within the defined area.

A threshold value can also be generated within the AoI.

https://help.iesve.com/ve2019/area_of_interest.htm#

Daylight Glare Probablity

The Daylight Glare Probability metric is used to evaluate glare from a hemispherical fish-eye Radiance luminance image. If you select the glare option from the luminance drop-down on the Simulation tab, then the simulation will automatically generate a regular luminance image, and a second image to display the glare sources (the glare file) and also a data file with the glare metrics.

*Note: you could also access this by selecting **Daylight Glare Probability** from the drop-down **Glare** menu when viewing a hemispherical fish-eye Radiance luminance image. If you do it on an existing glare file, it will overwrite an existing DGP file linked to the parent image, and also the "glare data" file.*

The glare image shows the areas of glare in yellow and also displays the calculated DGP value.

The DGP is shown as a percentage of people who would be satisfied and the following ranges are displayed on the bottom of the image.

Imperceptible	less than 35%
Perceptible	35% - 40%
Disturbing	40% - 45%
Intolerable	greater than 45%

If the "glare data" file does not exist (deleted by user) or cannot be parsed, then a DGP value of -1.0 is shown with the label "unknown", the analysis should be rerun manually.)

You cannot delete the parent Luminance image unless you also accept the option to delete the glare image, and you cannot re-name the glare file, but if you re-name the parent luminance file, the glare file name will be automatically updated.

This section online offers some more information on Daylight Glare Probability
https://help.iesve.com/ve2019/daylight_glare_probability.htm#