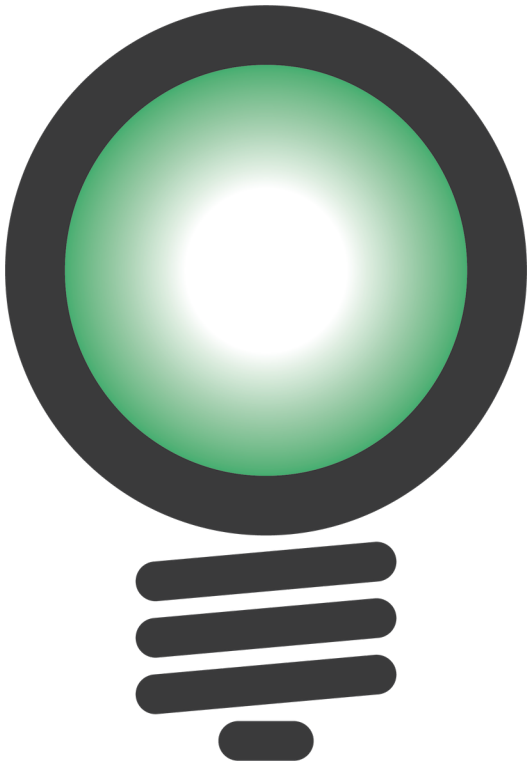

4.1

Brotens.com: Marcello Brocato and Ecleti - Roberto Panetta - We Make Software

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1. What's

1.1. Generalities

Illuminando is a Cocoa Mac OS application specialized to perform lighting calculations.

Illuminando works in metric or imperial units, runs on Apple computers running Mac OS, fully respecting the specific technology and implements OpenGL for rendering also with textures.

The simplicity of use and the interface modeler should not be fooled; Illuminando is a 'easy to use' CAD that uses some tools in order to obtain a simple and effective input to create the scene and perform subsequent calculations. Applying the "sources", the set will be complete, let's start calculations and wait for the results. Verifications may proceeds both visually (on the virtual space generated by the Application) and technically (through plan projections, iso-vales curves, color-scale map,...).

Illuminando has some implementable internal databases containing:

- geographic/territorial information of some cities;
- lighting sources catalogues and linked multi-currency prices files;
- electrical wires catalogue and linked multi-currency prices files;
- special pieces catalogue and linked multi-currency prices files;

Iluminando can generate morphologically defined parametric objects (vaults, quadric surfaces, domes, etc..) or more complex through the use of primitives (cubes, spheres, cones, etc..) in order to simplify the design procedures or can import from DXF 3D or PDF 2D files.

The working window projects objects within a three-dimensional space that displays the axial reference system and a plane of virtual modeling. The rationalization and intuitiveness of the available commands allow the acquisition of the graphics tools provided by the Application, minimizing the learning curve. Moreover, UNDO and REDO command allow the possibility of control in security in the working progress.

Powerful LAYER and VIEW management, intelligent PASTING options (the Application allows to copy the attributes of an object and paste only those that is possible to transfer on an object with different characteristics), RESHAPE, MOVE, ROTATE, MIRROR, SCALE, OFFSET, rectangular and polar ARRAY, EXPLODE, JOIN, DIVIDE, EXTRUDE commands, online HELP for the execution of commands: these are some of the possibilities offered by Illuminando.

The light sources, calculated as volumetric sources, are managed entirely by the Application, which allows you to import, display, edit and format IESNA LM-63 (ASCII text files normally used by manufacturers of lighting fixtures-North Americans), EULUMDAT (formed by European standards) and even drawings PDF or DXF (the Application converts drawings into photometry!) data files; photometric solids are summarized in 36 azimuthal C-curves and 180 zenithal gamma-angles, while the color of the lamps is given by the color temperature or real color.

Illuminando is the only software that is able to handle linear sources (ex. strip led) called 'polyline-source' that can be segment by segment oriented.

Illuminando can export to RTF a complete list, formatted according to user needs, of the installed products and special items, full of economic computing and electrical power.

Illuminando provides users with powerful tools for design optimization: a window of pre-project for rectangular rooms, L or cutted-corner, with the CIE method, the correct number of sources to achieve a certain value of illuminance on the working surface.

Illuminando has an utility for the road projects and road optimization: given the width of the street, through the choice of a variety of sources, distance and height of the poles, brackets, inclination, ..., the application builds a database for each configuration with all the performed simulations. Through the use

of filters you can choose from all the simulations carried out those that meet the parameters of law, the minimum installed capacity per kilometer, the configuration with maximum average luminance, ...

Illuminando has a utility for the area projects: given the rectangular dimension of the area and the layout of the illumination plant the application builds the model to light.

Illuminando has a tool to view spectral bulb data saved in XML format (according to IES TM-27-14 IES Standard Format for the Electronic Transfer of Spectral Data) or CSV format and to compare the color of two sources calculating their 'distance'.

Illuminando has a tool to evaluate the maintenance factor of led fixtures.

1.2. The Method

After creating or importing the scene, the method used for calculations is the radiance one.

The objects of the scene to calculate are divided into finite elements, which assess the amount of direct illumination due to natural sources (sun and sky) and/or artificial. The method involves the calculation of multiple reflections (for the interior) until the complete redistribution of the illuminance (unless the user do not stop the calculation). In the event that the calculation has been interrupted, the user can resume from where it was suspended to take it to completion.

The information available when calculation is done is both visual (screen image) and numerical for the required verifications. The final real view is built in real colors or in color-scale.

1.3. Video output

The individual surfaces of the object subjected to calculation are editable and can be projected on a plane and presented with the actual colors on both faces. Furthermore, the entire scene appears on the screen and can be modified in real time, because the Application keeps all lighting information previously calculated.

This means that the calculation time is long, but still proportional to the complexity of the scene and the number of the arranged light sources but, by counterpart, once completed, allow a total control of the scene, in real time and from whatever point of view we choose.

Illuminando has also a tool section, which shifts the normal plane of the lens (the plane of the screen) forward or backward from the observer cutting, always in real time, the scene to verify the illuminament of interior spaces that are not visible.

1.4. Numerical output

The outputs of numerical type can be plotted on the surfaces projected on the plane and shown in iso-value curves:

- Illuminament horizontal, vertical X+, Y+, X-, Y-, semi-cylindrical , hemispherical and in camera direction;
- Luminance;
- Daylight coefficient, Useful Daylight Illuminance, Shadow factor;
- Lighting pollution;
- RGB;
- Contrast Rendering Factor (C.R.F.);
- Glare indexes (TI, G, U.G.R., C.G.I. and G.R.);

The displayed curves can be represented in color overlaying the view, print directly, pasted to the clipboard or saved in one of the allowed export formats (DXF, PDF, JPG).

1.5. What's the use

It is clear that, after this introduction, the use of Illuminando is wide but targeted on well defined problems. Illuminando is a flexible, fast and simple tool to address and solve problems related to various professional activities as well as to different purposes of practical application.

It is also a powerful and intuitive verification tool to assess the compliance of systems to specific laws. Finally, it allows the economic computation of the entire plan, including lighting fixtures, electrical wiring and special pieces selected from a user-implementable database in more currencies.

Illuminando is, therefore, the ideal tool for:

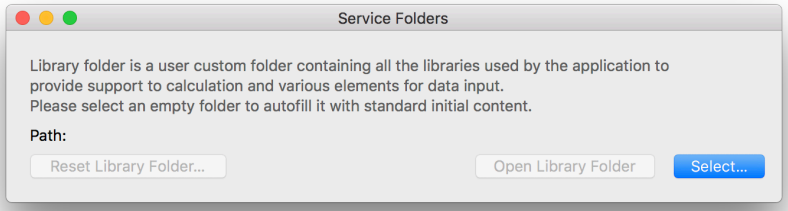
- dimensioning and color-choice for the lighting sources;
- exterior - road, tunnel, urban landscapes, stadium, monuments, etc.;
- interior - showroom, auditorium, showcases, etc.;
- optimization and choice of glazed surfaces;
- choice of the plaster based of the real color lighting effect;
- study of the shadows, owned and brought;
- calculate the real lighting pollution in presence of obstructions;
- checks and controls for television and glare.

1.6. Who needs it

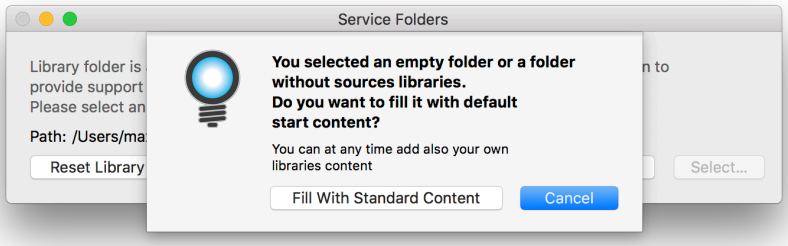
Illuminando is a Macintosh Application dedicated to professionals working in the industry, architects, engineers, designers, builders, and their professional needs. To large industries that design lighting, institutions that determine the sites of application, the engineers charged in audits of facilities and verification of compliance of plant.

2. Getting started

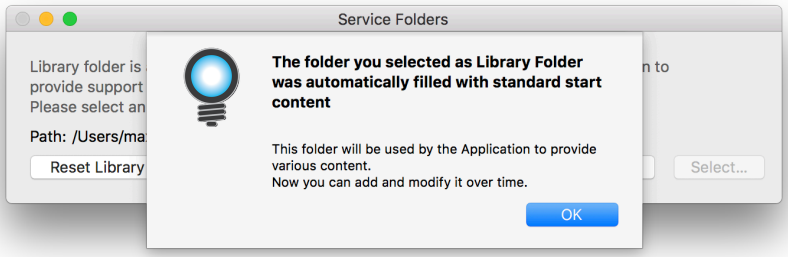
At the beginning Illuminando asks for selecting or creating some folders in which the application will save all the libraries and support files for exported reports:



If an empty folder was selected/created as library folder Illuminando asks if the user wants to fill it with the default content:



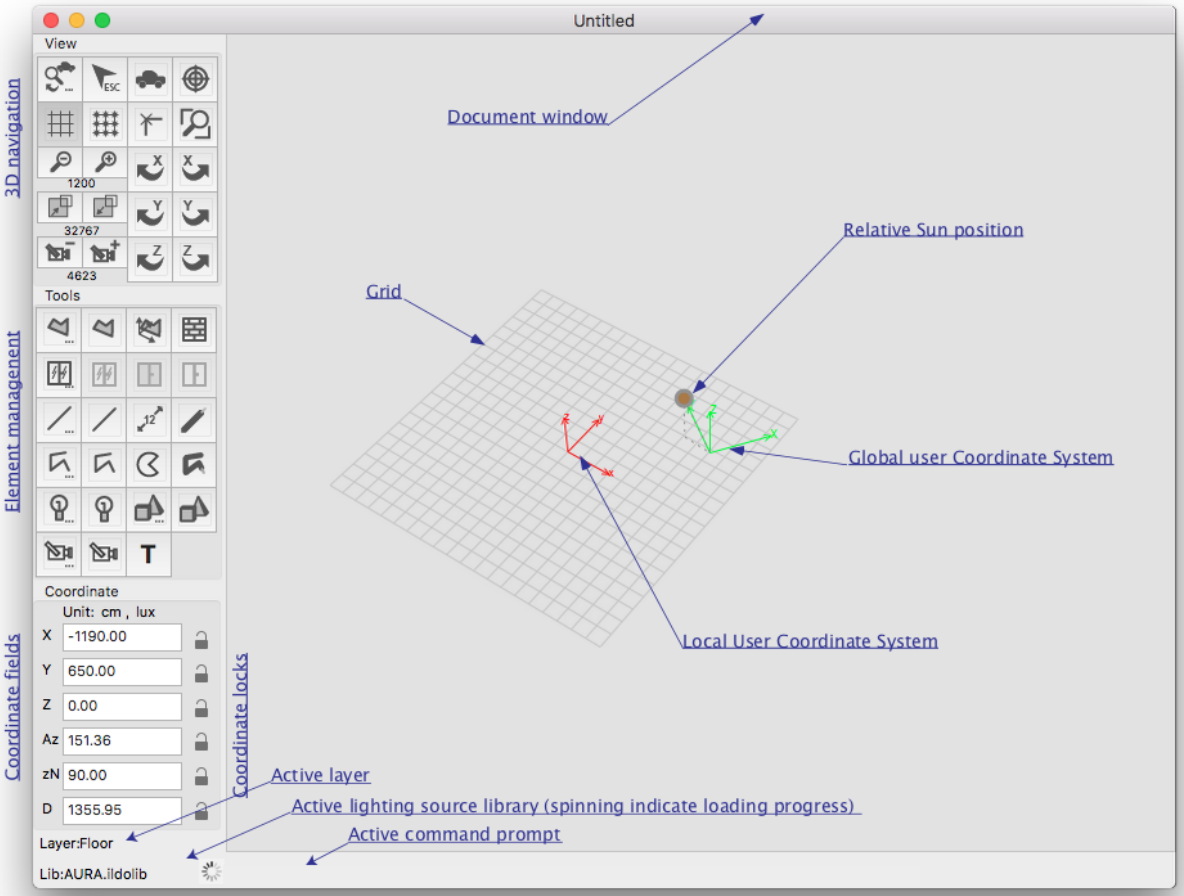
Then the installation procedure for the libraries folder will end:



Finally Illuminando presents the window that permits to start working (see paragraph 3 Workspace).

3. Workspace

At the beginning, the Application shows the scene in 3D mode view. Following default settings, may be visible:



- Global Coordinate System with the axis X-Y-Z in green color (always visible);
- Active Coordinate System with the axis x-y-z in red color;
- The graphic grid of the Active Coordinate System at z=0;

3.1. Document Window

For each Document the main window contains the model and some instruments depending on the type of visualization, but for each mode it is possible:

- reposition the window with the title bar;
- redimension the window from the edges and with zoom (green) and collapse (yellow) button in the title bar;
- close the window whit the close (red) button in the title bar.

Visualization mode may be:

1. 3D view
2. Plan view
3. Result view

3.1.1. 3D View mode

This is the mode in which the software presents a new document and the only one in which is possible to create and edit all drawing elements.

The drawer contains three groups of buttons, a coordinate section and a result visualization section:

The Tool group contains:

Surface dialog	Surface input	Free surface input	Wall input
Opening dialog	Opening with glass input	Opening opaque input	Opening empty input
Line dialog	Line input	Quote input	Wire input
Polyline dialog	Polyline input	Arc, polygon input	Poly-wire input
Source dialog	Source input	Object dialog	Object input
Camera dialog	Camera input	Text input	-

The View group contains

Setting dialog	Escape (ESC) command	Models link ON/OFF	Center view
Grid ON/OFF	Snap to grid ON/OFF	Snap to points ON/OFF	Zoom window
Zoom out	Zoom in	Rotate X clockwise	Rotate X counterclockwise
Front cut plane forward	Front cut plane back	Rotate Y clockwise	Rotate Y counterclockwise
Camera out	Camera in	Rotate Z clockwise	Rotate Z counterclockwise

View modifications may be done also with the mouse wheel:

1. top, bottom, left and right view movements permits to scroll the 3D view;
2. pressing the ⌥(option) key at the horizontal mouse-wheel moving the software will react with an horizontal view rotation (pitch), and to a vertical mouse-wheel moving a vertical view rotation (yaw) will be linked.
3. pressing the ⌘(command) key the mouse-wheel moving will be linked to a video-plan view rotation (roll);
4. pressing the ⇧(shift) key vertical mouse-wheel movements will be linked to the zoom (Zoom in and out), while horizontal mouse-wheel movement will be linked to the eye position (Camera in and out).

The Coordinate section contains:

- editable field X: reports the current X coordinate of the mouse on the Active Coordinate System in the current units (cm or in);
- lock X-coordinate button (key 'x');
- editable field Y: reports the current Y coordinate of the mouse on the Active Coordinate System in the current units (cm or in);
- lock Y-coordinate button (key 'y');
- editable field Z: reports the current Z coordinate of the mouse on the Active Coordinate System in the current units (cm or in);
- lock Z-coordinate button (key 'z');
- editable field Az: reports the angle in the XY plan in degrees between the traced segment and the Active Coordinate System X axis (azimuth angle);

- lock Azimuth angle button (key 'a');
- field zN: Reports the angle from the XY plan in degrees between the traced segment and the Active Coordinate System X axis (zenith angle)
- lock Zenith angle button (key 'n');
- editable field Distance: reports the length in the current units (cm or in) of the segment traced from the last point;
- lock Distance button (key 'd');

With these edit fields and lockers it is possible to introduce the points with the keyboard (the Z coordinate, if not belong to the design plan, always has to be introduced with the keyboard) keying the value in the current units (cm or inches) in the relative field in the drawer and press 'return' to define the point.

It is possible to lock one or more variables to an assigned value simply pressing the concerning icon or choosing from the keyboard the key to lock ('X', 'Y', 'Z', 'A', 'N', 'D', or 'x', 'y', 'z', 'a', 'n', 'd'): the relative button will be selected.

To unlock all previous locked coordinate it is possible to type '<' key.

In the bottom side of the window there is a status line with the active command prompt, indicating the command sequence to execute.

3.1.1.1. Selection management

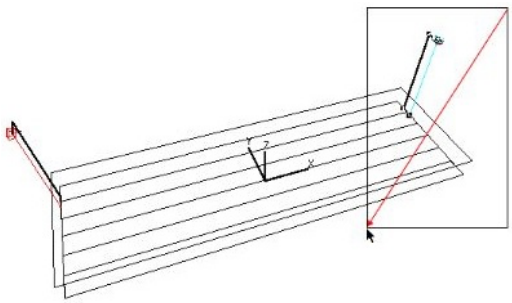
The user enters the selection mode. The command stops every other active command and stands by for another selection set to be created.

Selecting only one element the user will be able to modify its internal parameter by a double-click or by the command 'Edit'->'Info'->..., its geometry by the command 'Edit'->Reshape', and its local Coordinate System by the command 'Coordinate'->'Modify'.

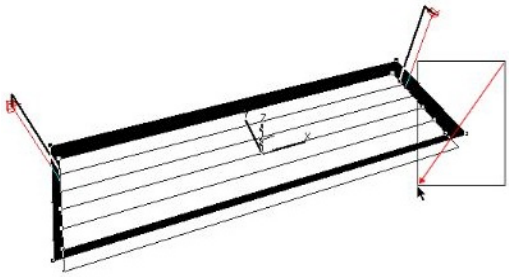
To modify the same parameters on more than one element, the user must modify one element of the group, activate the copy of its parameters (command 'Edit'->'Copy') and then paste the desired parameters to the group (command 'Edit'->'Paste Special...').

Multiple selections proceed holding down the key ⇧(shift key) and selecting or deselecting the desired element: if this is overlapped with others, the user will be able to make more clicks, holding down the key ⇧(shift key), and then will be selected, in order, from the first to the last of the overlapped elements and then all together.

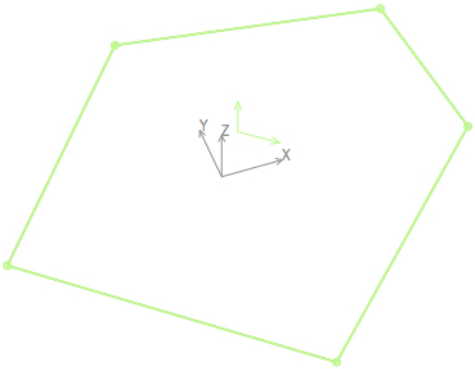
Multiple selection may be done by the 'window selection' simply dragging a rectangle with the mouse that has to totally include the elements we want in the selection.



An option for making a multiple selection is the 'crossing window selection' that consists in creating a dragging mouse rectangle, that intersects the wanted objects, with ⌘(command) key pressed:



Selecting flat surfaces the Application shows the local X and Z ax (highlighted in green), defining the direction of the 'observers':

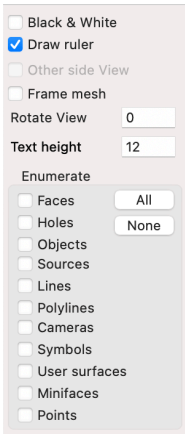


3.1.1.2. *Contextual menu*

The [second mouse button] or the ['ctrl' key + mouse button] sequences enable contextual menu if done on an element (or with an already done selection): this menu permits to enter in the 'Info' dialogue of the element and some specific commands relative to the selected elements.

3.1.2. Plan view mode

In the Plan view mode the drawer contains two group of check box (see the right image):



The first group permits to enumerate the elements contained in the view, the others permit:

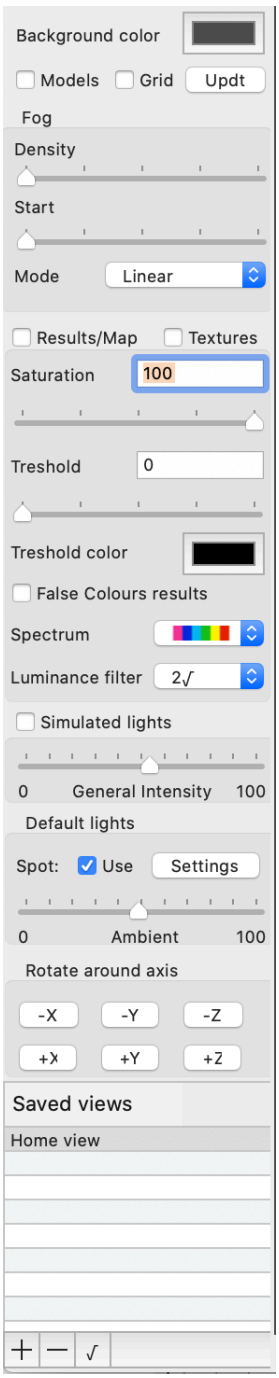
- to draw the plan view in black and white (check box 'Black and White');
- to draw ruler;
- to project selected elements in the opposite side of the first-selected face (check box 'Other side View');
- to draw each finite element frame (check box 'Frame mesh');
- to rotate plan view of a certain angle;
- to fix the plan view text height;
- to enumerate certain kind of elements.

3.1.3. Result view mode

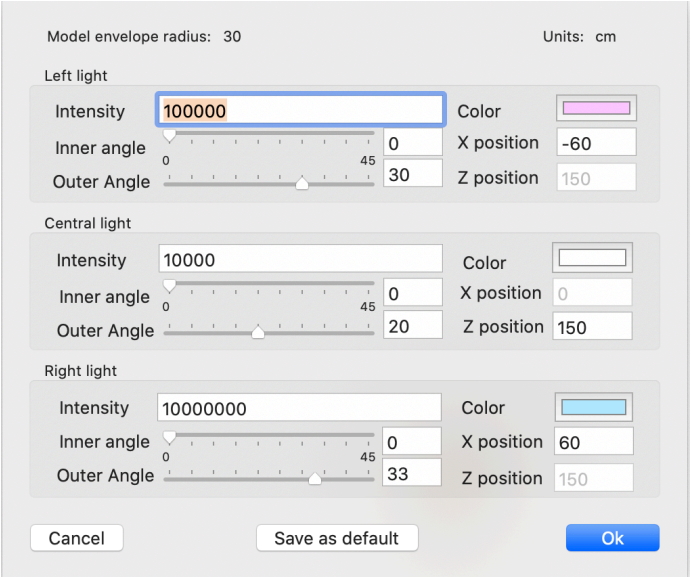
The characteristics of this mode are explained in the § 4.9.2 Command: RESULTS.

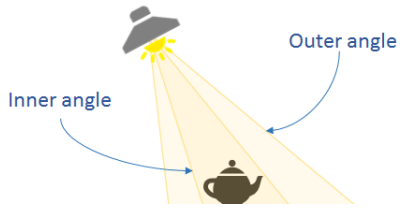
3.2. Scene Kit window

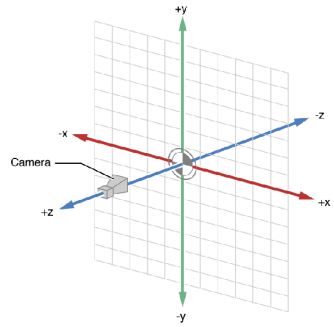
Selecting the menu 'Rendering' Scene Kit window for the active document will be opened: this has a drawer that permit to manage some parameters, following the next table (see right image at next page):



- Background color can be chosen;
- 'Model check-box turn on the visualization of 3D-model linked to sources;
- 'Grid' check-box make visible a reference grid on the XY plan;
- 'Updt' button permits to regenerate the Scene Kit scene after some modification in the model;
- 'Fog' box permits to add opacity to the scene, to make it more realistic, (see 4.9.4.1 Color Mapping):
- 'Result/Map' check-box permits to map the calculation results: this option may be onerous for complex projects, and we suggest to flag it only when the user has chosen the view;
- 'Textures' allow the textures visualization for the whole model;
- 'Saturation' slide and edit field permit to set the maximum lux value mapped in the scene;
- 'Threshold' slide and edit field permit to set the lux value below which the color will be mapped following the next field choice...
- 'Threshold color' (see upward);
- 'False color results' check-box permits to examine the lighting, choosing a Spectrum of color scale and a Luminance Filter (see 4.9.4.1 Color Mapping);
- 'Simulated lights' check-box permits to light the scene with all the lighting source placed in the model but simulating their photometries as cone (see image at right-bottomn); If more than 8 source are placed in the model the user will be prompted to switch in 'Result/Map' mode;
- 'General Intensity' slide permits to calibrate the whole effect of the simulated lights;
- 'Default lights' permits to light the scene with the Ambient light (to calibrate the global brightness of the scene: intensity is controlled by the slide) and three spot lights, whose parameters are controlled through a specific 'Settings' dialogue (see images at the bottom-left of this page):
    - 'Model envelope radius' is the model envelope sphere radius;
    - 'Intensity' permits to calibrate the brightness of the spots;
    - X and Z position permits to adjust the spot position;
    - Inner is the angle, in degrees, of the area fully lit by the spotlight;
    - Outer is the angle, in degrees, of the area partially lit by the spotlight;
    - Color is selectable through the standard Apple color picker;
- 'Saved views' permits:
    - to create a new view (button add);
    - to delete views (it is not possible to delete the first, button delete);
    - to bring as active a previously saved view (button set);
    - to rename existing view, editing it directly in the table.
- Inside the scene it is possible to select and hide elements through a contextual menu that will be presented clicking on them:
    - Hide this permits to hide the selected element;
    - Show all permits to make visible all the elements make hidden with previous commands.



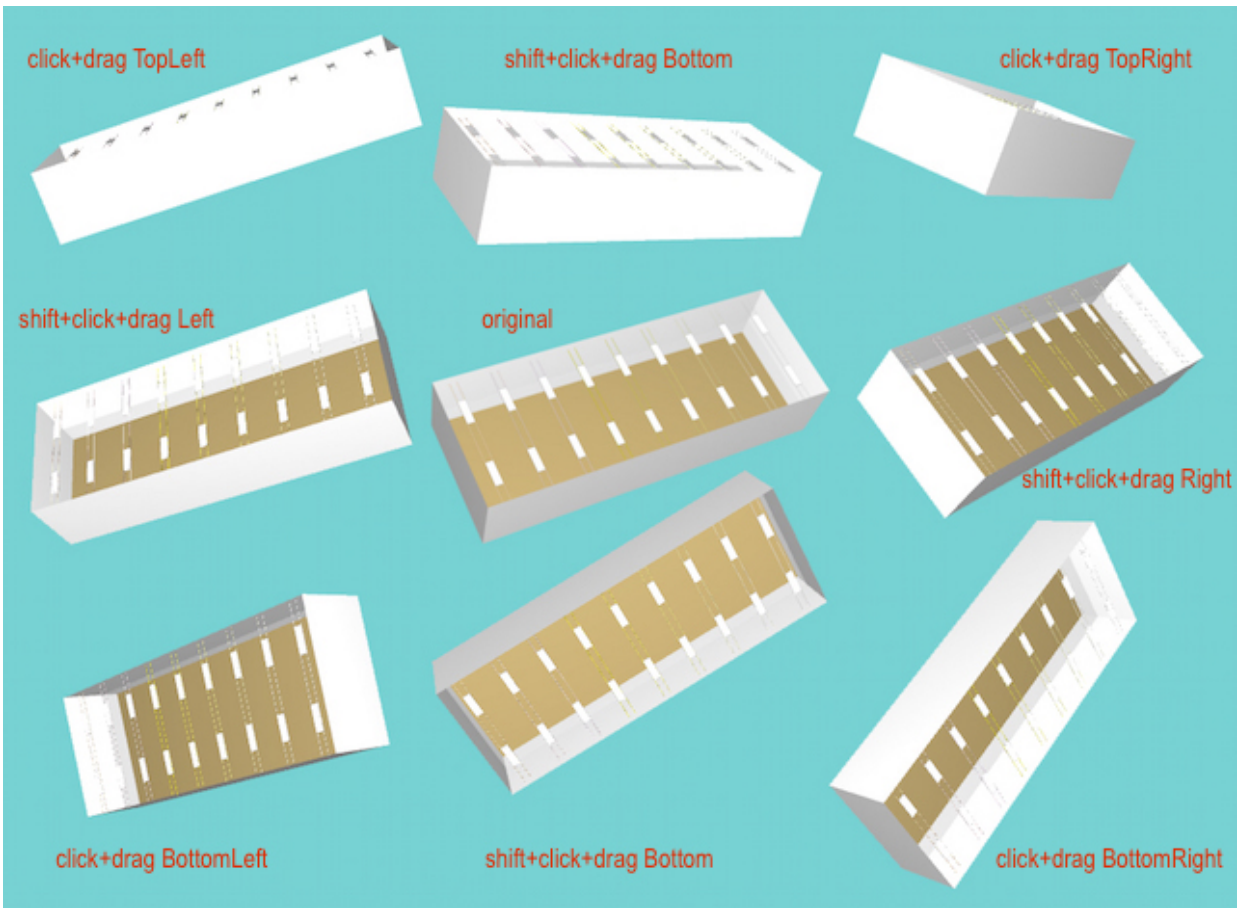




Navigation inside the SceneKit window is simple and proceed through the method of the 'Virtual sphere' using the mouse and the modification keys. To rotate use the procedures described below.

Translation will be done with the ⇧(shift) key pressed and the zoom will be activated with the ⌥(alt) key pressed during the click-drag mouse procedure (using the trackpad it will be possible to zoom also with the 'open/close fingers' gesture).

Finally, 6 buttons are presented, to rotate the view around X, Y and Z model axes: step interval follows the value saved for the main view rotations step (see §4.8.2.2 3D Space section).



With the Scene Kit window in front, the 'View' -> 'Save image for Report as 'Rendering'' menu permits to save the viewed image in the report file as 'Rendering' view (see § 4.2.18.1).

3.3. Mouse and data input

The current position of the cursor is indicated always in the editable fields at the top left: the coordinates follow the Active Coordinate System in the plane Z=0 and in the current units (cm or in). The following keys carry out the procedure used in the generation of points:

- The tabulation key cycles the active field (X -> Y -> Z -> X ->...).
- The 'X', 'Y', 'Z' keys activate and alternatively lock and unlock the field at the relative variables (the 'N' key unlock them); this is particularly useful when you want give coordinates to points 'taken' for alignments known and existing;
- The ⌥(option) key when pressed make sensible the position of the cursor at existing points in the project, the existence is highlighted with a change of the form of the cursor to snap-cursor. Activating the auto-snap procedure it will be possible to snap to existing points without pressing the ⌥(option) key.

Point's introduction is done with a simple click of the mouse or by inserting numeric values in the current units (cm or in) in one or more fields (x, y, z) and pressing the ⏎(return) key.

In practice, if you want to introduce a point at X=100, Y=200 and Z=300, in the Active Coordinate System it is enough to move the cursor until you read in the X fields the value '100' and in the Y field the value '200', introduce in the Z fields the value '300' and press ⏎(return), or introduce in the three fields the desired values and press ⏎(return).

The introduction of the objects is done as in traditional CAD, following the mouse procedure "click-drag-click". Pressing the ⌥(option) key the user can attach tracking ("snap") to existing points: when the cursor passes near existing points the cursor becomes a circular point. The selection/deselection of more objects is done by pressing the ⇧(shift) key. Other kind of selection is the 'window selection' and the 'crossing window selection', described in the 'Menu'->'Edit' section. Pressing the ⌥(option) key holes will be excluded from the selection cycle.

A double-click inside an element region opens the info-dialog of that element.

3.4. Try points

The combination ⌥(alt) + click assigns a 'try point', a particular function of Illuminando for precision input of ties or existing alignments.

The sequence of the procedure is as follows:

1. passing on an existing point the cursor highlights its existence.
2. the combination ⌥(alt) + click takes the real coordinates of the point in the editable fields 'X', 'Y' and 'Z' of the main window.
3. at this point, taking care not to move the cursor, it is possible to:
   - lock one or more coordinates;
   - modify with the keyboard one or more coordinate;
   - move to other fields with the tabulation key;
4. finally, simply accept the present point in the editable fields with another click or by pressing ⏎(return).

Activating the auto-snap procedure it will be possible to snap to existing points without pressing the ⌥(option) key.

3.5. User surfaces

Illuminando permits to define every surface, flatten or curved, as a 'user surface', to simulate audience arrangement or working plane, and to calculate, in addition to the horizontal, also the vertical and semi-cylindrical illuminances, contrast rendering factors C.R.F. and glare indexes C.G.I. and U.G.R., ...

An user plane is a transparent virtual surface, that retains data relative to rays passing through it; measured points are placed in the barycenter of the finite elements of the same surface (defined by the calculation internal grids), and the local X-axis represents the viewing direction.

A user surface can simulate, so, working plane in a factory, desktop in a school, audience in a theater or in a cinema hall,...

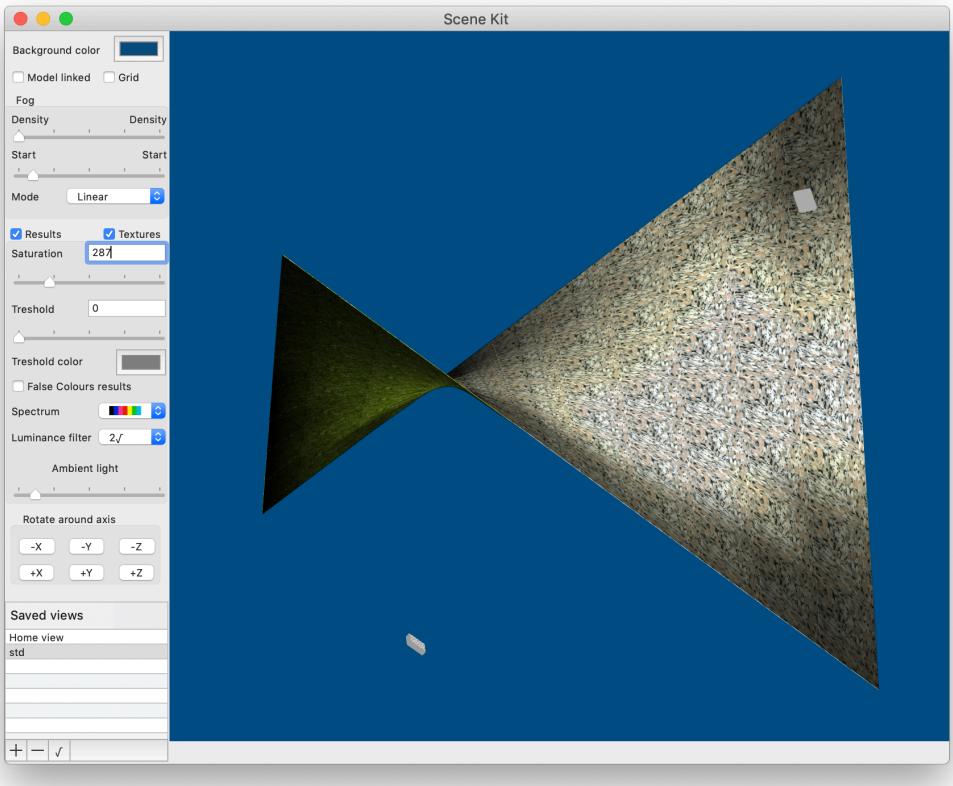
3.6. Textures

Illuminando 3 implements textures for both sides of 'Face' and 'Object' elements.

Textures are bitmapped images that the application loads from the 'Textures' folder inside the library folder (see § 2 Getting started): in this way the user is allowed to add any bitmapped image (jpg, tif, bmp) to the 'Textures' folder, that will be presented in the textures list in the info dialogues.

Texture will be mapped following the x-axis of each element and according to the scale parameter available in the info dialogues.

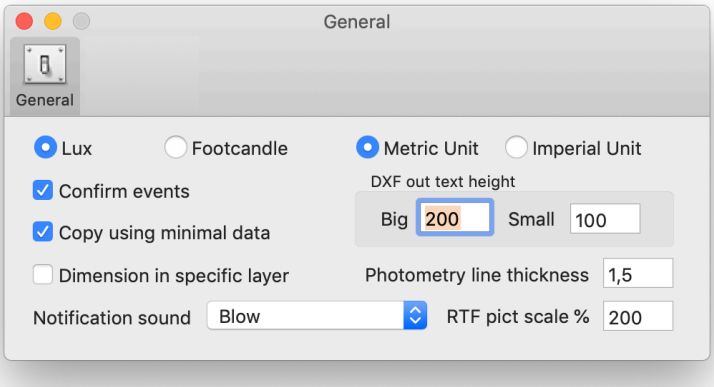
The following image present a 'Stone granite01' textured quadric surface lighted by two projectors:



4. Guide

4.1. Menu Illuminando

4.1.1. Command: PREFERENCES...



With this dialogue, in the 'General' tab it is possible:

- to work with the preferred units: metric (cm, m) or imperial (ft., in);
- to use lux or footcandle to examine illuminances;
- with 'Confirm events', to disable confirm warning events like 'Are you sure to delete...';
- with 'Copy using minimal data', to copy only lux values in the result view while opening a mouse region (not applicable for roads – see 4.9.2 Command: RESULTS);
- 'Dimension in specific layer' permits to force the dimension creation on their specific layer;
- to define the text height for the dxf exportations;
- to set the line thickness for the photometric curves plot;
- to choose the default notification sound;
- to define the scale of the pictures exported in the RTF files.

4.1.2. Command: QUIT

From this menu it is possible to exit the Application.

4.2. Menu File

4.2.1. Command: NEW

This menu permits to create a new working session.

4.2.2. Command: OPEN...

This command permits to open an already-saved Illuminando file through the standard Mac dialog.

It is also possible to open Illuminando projects through Drag & Drop procedures.

4.2.3. Command: OPEN RECENT

This menu presents a list of the last opened files, and it is possible quickly open one of it.

4.2.3.1. Command: CLEAR MENU

This command clears the list of the recent opened files.

4.2.4. Command: IMPORT

Illuminando can import dxf or pdf files.

4.2.4.1. Import DXF

The importation proceed from DXF format (Drawing eXchange Format), tool that allows inserting bidimensional or tridimensional objects from almost all CAD applications in Macintosh and DOS/Windows environments (AutoCAD, ArchiCAD, DomusCAD, Vectorworks, etc.) or from a PDF (only 2D) file.

This command permits to import external objects inside an Illuminando file, choosing:

- the Unity conversion, from the external file to the Illuminando file (may be cm or inches);
- the approximation edge number to import circle or arcs;
- to import the element contained in the external file as a single object of type Illuminando-free: it is important that the drawing must contain only dxf entities of type 3DFACE or POLYLINE, and these last with no more than 4 vertices.

User has to notice that the DXF format contains less information than the ones Illuminando needs to correctly start calculation, so missing information will be assigned by default.

For a correct DXF importation, it is important to notice that:

- if possible, it is better to export DXF files without header, to permit in Illuminando a correct color reading;
- Illuminando imports only dxf ARC , CIRCLE , LINE, POLYLINE, LWPOLYLINE, 3DFACE and INSERT (BLOCK) entities:
  - dxf-lines will be converted to Illuminando-lines;
  - dxf-open polylines will be converted to Illuminando-polylines
  - dxf-closed polylines will be converted to Illuminando-flat surfaces;
  - dxf-3Dfaces will be grouped, converted in free-form objects and saved in separated layer;
  - dxf-block will be converted in an Illuminando-symbol and presented as an oriented circle;
  - dxf-text will be imported without rotation.

4.2.4.2. Import PDF

The importation in PDF, allows inserting bidimensional objects from almost all applications in Macintosh environment.

In this option too, the user has to notice that the PDF format contains less information than the ones needs to correctly start calculation, so missing information will be assigned by default.

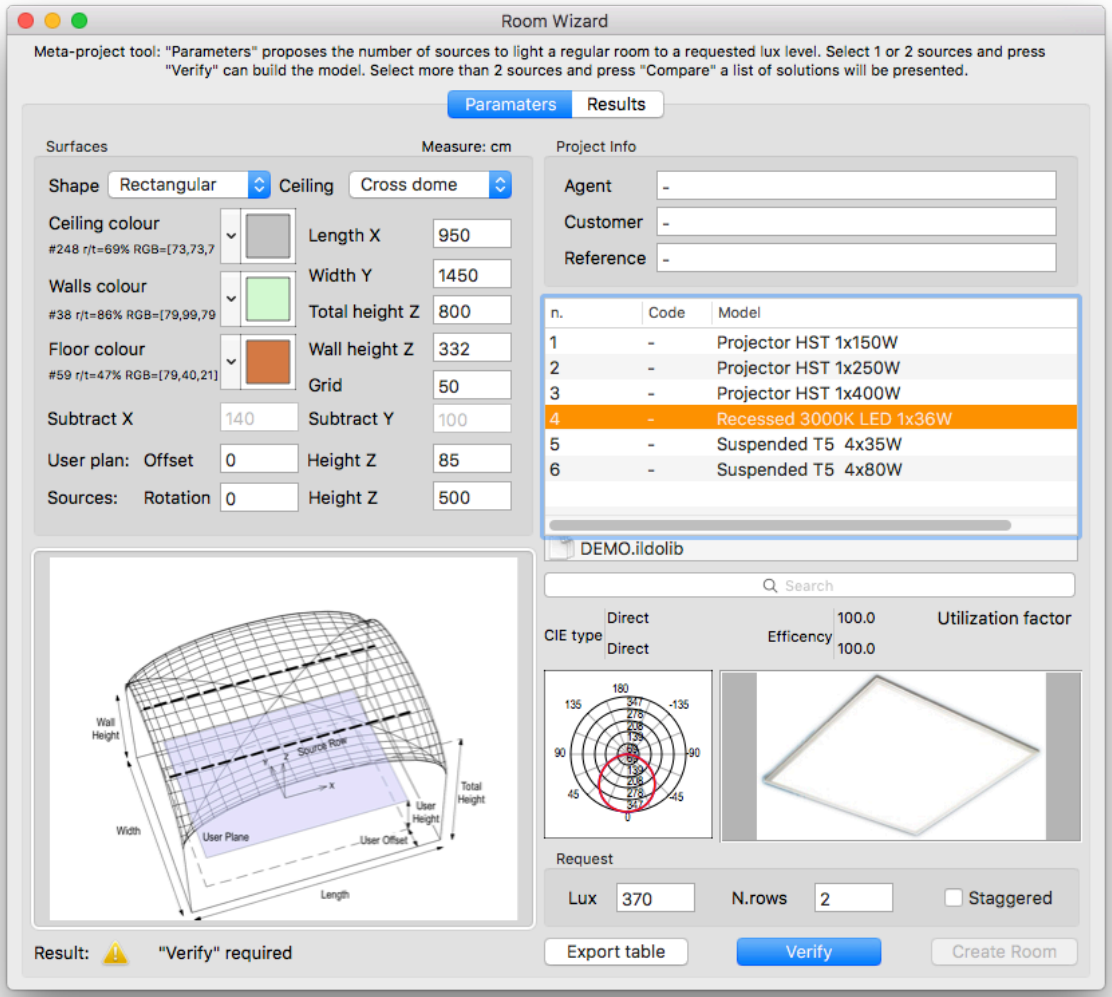
The file will be automatically converted into the Active Coordinate System, placed on the active layer and visualized on the screen.

For a correct PDF importation, it is important to notice that Illuminando imports only arc, circles, lines and open or closed polygons:

- lines will be converted to line;
- open polygons will be converted in polylines, the closed one in faces.

4.2.5. Command: ROOM WIZARD...

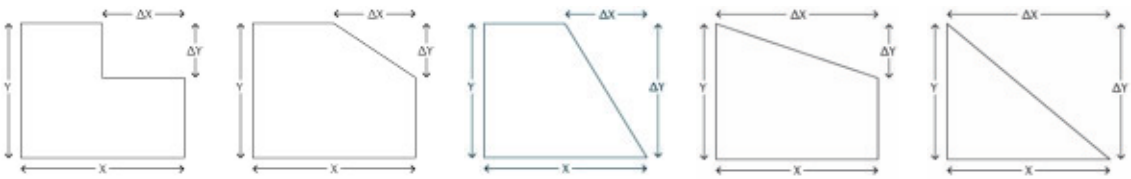
The Room-wizard dialog will be presented:



Room shape may be:

- rectangular with a generic ceiling;
- L shaped, with flat ceiling;
- cutted corner (and triangular for extension) with flat ceiling.

In case of L-shaped or cutted corner will be activated two edit field that permit to 'cut' one room corner, following the next figures, in which X=Length, Y=Width:

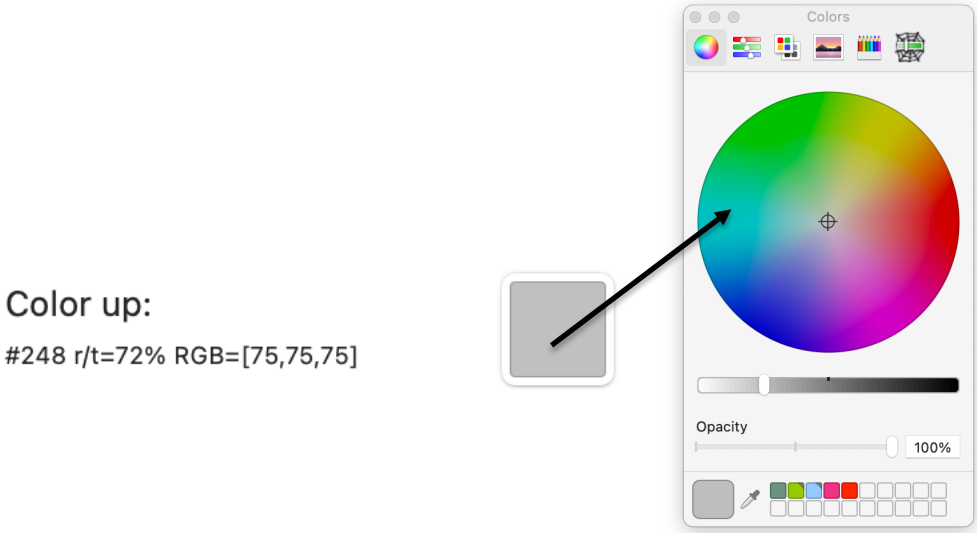


Ceiling of a rectangular room may be:

- flat;
- single slab (along X-axis);
- single slab 90° (along Y-axis);
- double slab (along X-axis);
- double slab 90° (along Y-axis);
- barrel vault (along X-axis);

- barrel vault 90° (along Y-axis);
- cross vault;
- dish vault.

Colors may be chosen through the standard Mac procedure



while in the dialogue is visible the current color with its number (ex. #248), its reflection coefficient (ex. r=72%) and its RGB components in % (ex. RGB { 75, 75, 75}).

The source catalogue may be chosen through the button at the bottom of the source list, containing the code and the name of the active one.

To find some source it is present a find edit field under the source list: typing something inside it the Application will search for the sources whose name contains the typed characters.

4.2.5.1. Selecting one or two ligting sources: Verify option

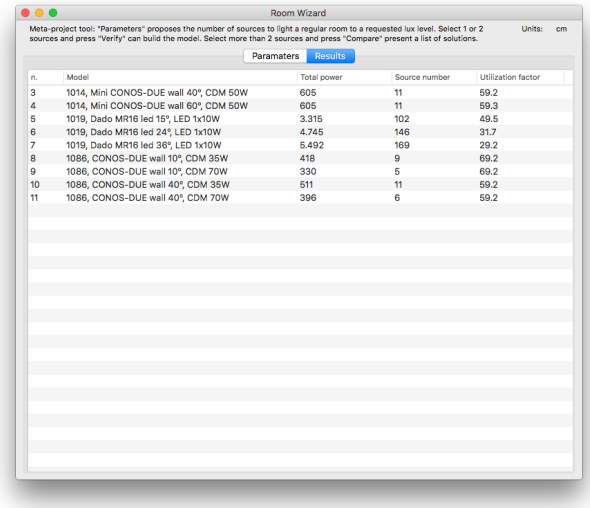
Lighting sources involved in calculation may be of two types (selecting two rows in the source table list by pressing the ⌘ (command) key), and the 'Staggered' check box permits to have such a type of layout.

The procedure start once the user choose the lux level required and press the 'Verify' button: the Application presents the number of fixture needed to reach the required lux level. Then the only parameters it is possible to change without making new calculation are the row number, the layout (standard or staggered) type and the calculation grid.

Pressing the button 'Create room' a new project will start with the values displayed in the dialogue.

4.2.5.2. Selecting more than two lighting sources: Compare option

In case of selecting more than two sources the user can activate the "Compare" tool that permits to evaluate the performances of the selected sources, presented in the second tab of the panel as in the following image:



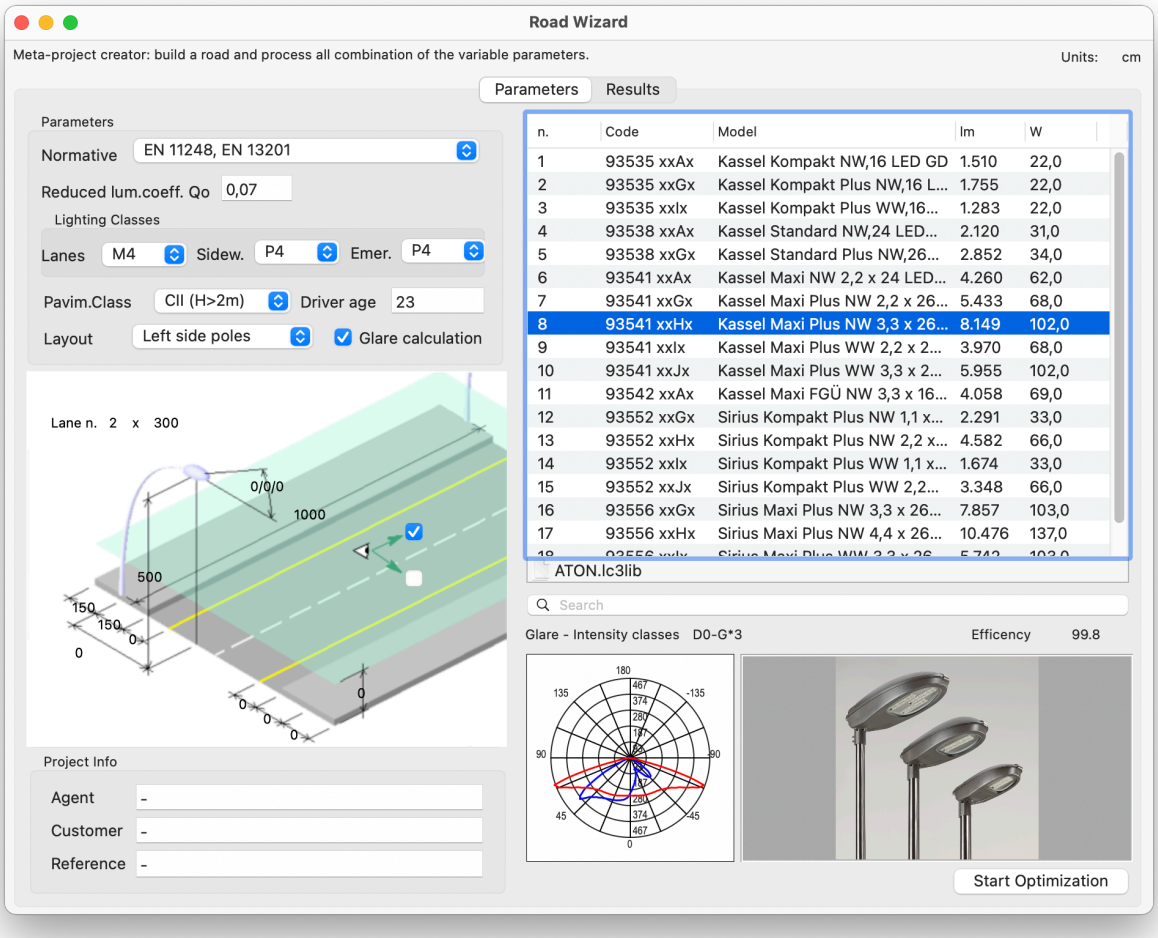
n.	Model	Total power	Source number	Utilization factor
3	1014, Mini CONOS-DUE wall 40°, CDM 50W	605	11	59.2
4	1014, Mini CONOS-DUE wall 60°, CDM 50W	605	11	59.3
5	1019, Dado MR16 led 15°, LED 1x10W	3.315	102	49.5
6	1019, Dado MR16 led 24°, LED 1x10W	4.745	146	31.7
7	1019, Dado MR16 led 36°, LED 1x10W	5.492	169	29.2
8	1086, CONOS-DUE wall 10°, CDM 35W	418	9	69.2
9	1086, CONOS-DUE wall 10°, CDM 70W	330	5	69.2
10	1086, CONOS-DUE wall 40°, CDM 35W	511	11	59.2
11	1086, CONOS-DUE wall 40°, CDM 70W	396	6	59.2

See §5.2

Rectangular room for a tutorial.

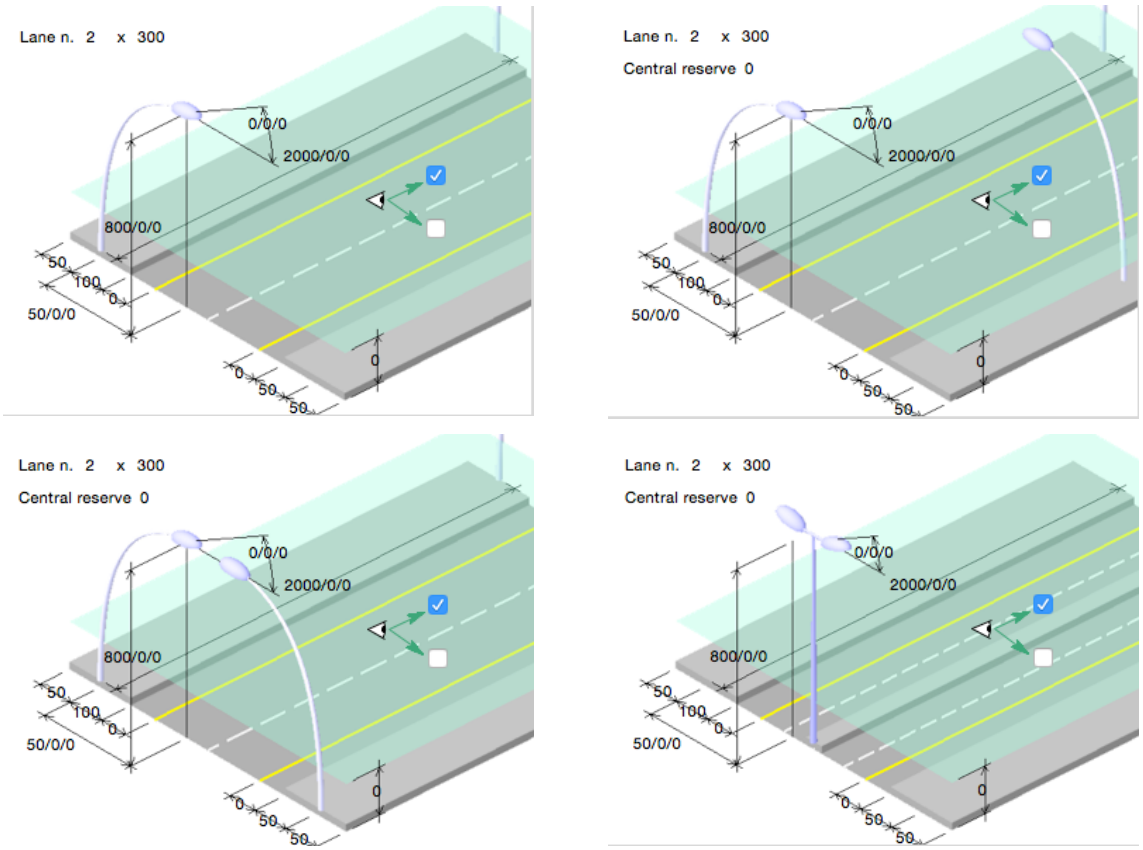
4.2.6. Command: ROAD WIZARD...

It is possible to automatically draw a road section with (in centimeters/inches) lane number and width, pole distance, sources height, luminaire tilt and bracket length, sidewalks size and the position of the pole respect to these, height and orientation X+ of a virtual surface to calculate vertical (X+, Y+, X-, Y-) and semicilindrical (X+) illuminament, and other parameters as the following dialogue divided in two tabs, in which the first ('Parameters') permits to introduce the parameters and the second to analyze the optimization ('Results'):



Sidewalks define the proximity zones and are useful to evaluate the SR parameter.

The "Layout" pop-menu may present a single side road with left-side or right side poles, a staggered pole disposition or a double side with pole in front or centrals:



If the central reserve is present or the chosen layout is “Central pole” the Application will build only the left-side road (for symmetry reasons). The road surface may be of Class I or II, but it is possible to change the proposed reduced luminance coefficient q_0 in the relative edit field.

The calculation grid may be free or may follow the UNI10439, UNI11248/EN13201 or UNI11095 standard. In case of free calculation the user can choose the calculation grid.

The Application permits to introduce the driver age as a parameter in the K multiplier of the veil luminance in the TI glare calculation:

$$0.86 \cdot \left[1+\left(\frac{\text{Driver age}}{66,4}\right)^4 \right]$$

Checking the “Glare calculation” button the complete law calculation will be performed (observer position, TI calculation, ...).

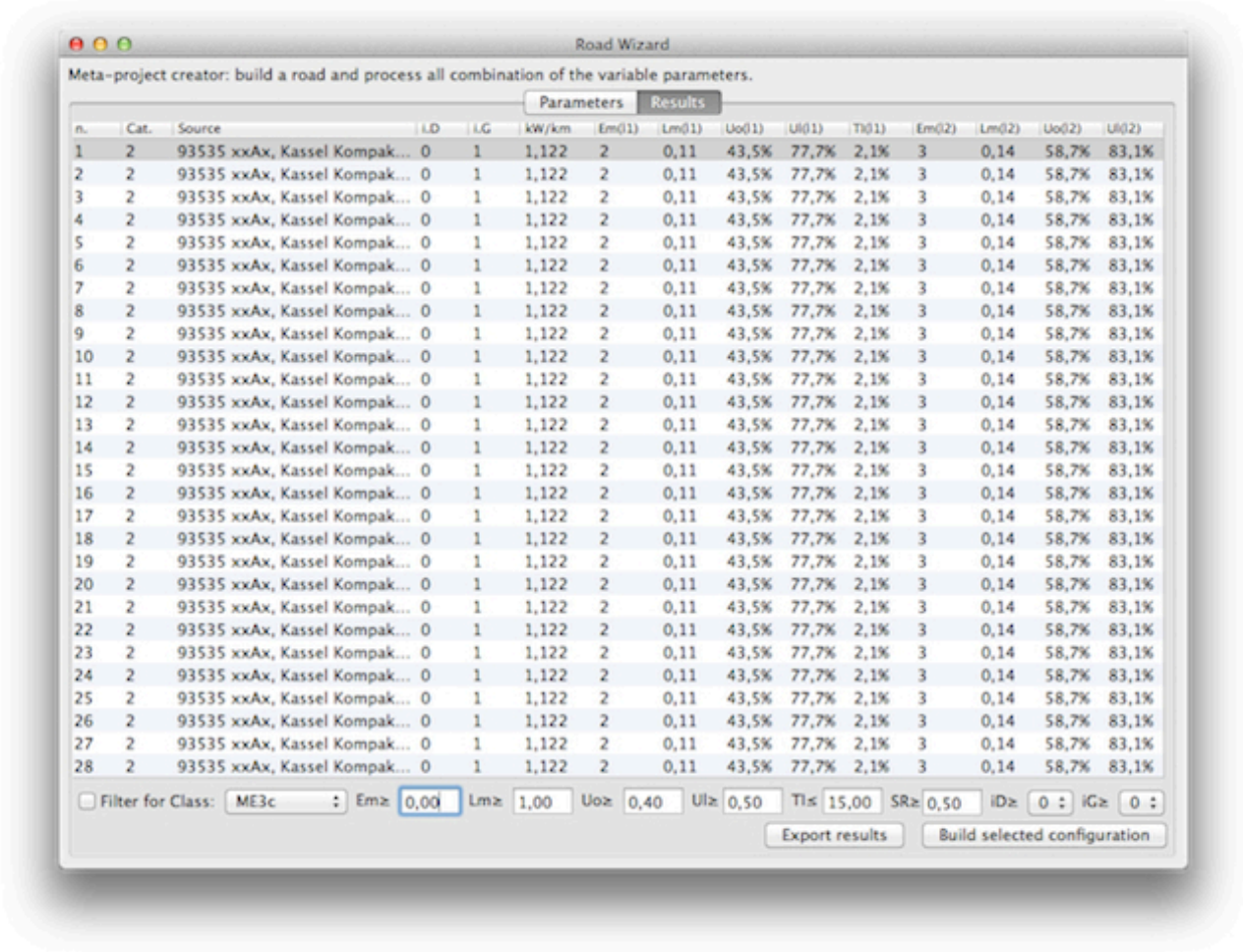
The source catalogue may be chosen through the button at the end of the source list, containing the code and the name of the active one.

To find some source it is present a “find” edit field under the source list: typing something inside it the Application will search for the sources whose name contains the typed characters.

To start the Road Optimization Tool, lighting source multiple selection and some fields permits to select a range of values from a minimum to a maximum with fixed step:

- source model (with a multiple selection by pressing the ⌘(command) key or the ⇧(shift) key)
- pole distance (type: minimum/maximum/step)
- source height (type: minimum/maximum/step)
- luminaire tilt (type: minimum/maximum/step)
- arm length (type: minimum/maximum/step)

Finally the Application start to calculate all the possible combination of layout (each model at each source heights at each pole distances at each arm and for each tilt) presenting the results in the second tab:



n.	Cat.	Source	i.D	i.G	kW/km	Em(i1)	Lm(i1)	Uo(i1)	Ul(i1)	TI(i1)	Em(i2)	Lm(i2)	Uo(i2)	Ul(i2)
1	2	93535 xxAx, Kassel Kompak...	0	1	1,122	2	0,11	43,5%	77,7%	2,1%	3	0,14	58,7%	83,1%
2	2	93535 xxAx, Kassel Kompak...	0	1	1,122	2	0,11	43,5%	77,7%	2,1%	3	0,14	58,7%	83,1%
3	2	93535 xxAx, Kassel Kompak...	0	1	1,122	2	0,11	43,5%	77,7%	2,1%	3	0,14	58,7%	83,1%
4	2	93535 xxAx, Kassel Kompak...	0	1	1,122	2	0,11	43,5%	77,7%	2,1%	3	0,14	58,7%	83,1%
5	2	93535 xxAx, Kassel Kompak...	0	1	1,122	2	0,11	43,5%	77,7%	2,1%	3	0,14	58,7%	83,1%
6	2	93535 xxAx, Kassel Kompak...	0	1	1,122	2	0,11	43,5%	77,7%	2,1%	3	0,14	58,7%	83,1%
7	2	93535 xxAx, Kassel Kompak...	0	1	1,122	2	0,11	43,5%	77,7%	2,1%	3	0,14	58,7%	83,1%
8	2	93535 xxAx, Kassel Kompak...	0	1	1,122	2	0,11	43,5%	77,7%	2,1%	3	0,14	58,7%	83,1%
9	2	93535 xxAx, Kassel Kompak...	0	1	1,122	2	0,11	43,5%	77,7%	2,1%	3	0,14	58,7%	83,1%
10	2	93535 xxAx, Kassel Kompak...	0	1	1,122	2	0,11	43,5%	77,7%	2,1%	3	0,14	58,7%	83,1%
11	2	93535 xxAx, Kassel Kompak...	0	1	1,122	2	0,11	43,5%	77,7%	2,1%	3	0,14	58,7%	83,1%
12	2	93535 xxAx, Kassel Kompak...	0	1	1,122	2	0,11	43,5%	77,7%	2,1%	3	0,14	58,7%	83,1%
13	2	93535 xxAx, Kassel Kompak...	0	1	1,122	2	0,11	43,5%	77,7%	2,1%	3	0,14	58,7%	83,1%
14	2	93535 xxAx, Kassel Kompak...	0	1	1,122	2	0,11	43,5%	77,7%	2,1%	3	0,14	58,7%	83,1%
15	2	93535 xxAx, Kassel Kompak...	0	1	1,122	2	0,11	43,5%	77,7%	2,1%	3	0,14	58,7%	83,1%
16	2	93535 xxAx, Kassel Kompak...	0	1	1,122	2	0,11	43,5%	77,7%	2,1%	3	0,14	58,7%	83,1%
17	2	93535 xxAx, Kassel Kompak...	0	1	1,122	2	0,11	43,5%	77,7%	2,1%	3	0,14	58,7%	83,1%
18	2	93535 xxAx, Kassel Kompak...	0	1	1,122	2	0,11	43,5%	77,7%	2,1%	3	0,14	58,7%	83,1%
19	2	93535 xxAx, Kassel Kompak...	0	1	1,122	2	0,11	43,5%	77,7%	2,1%	3	0,14	58,7%	83,1%
20	2	93535 xxAx, Kassel Kompak...	0	1	1,122	2	0,11	43,5%	77,7%	2,1%	3	0,14	58,7%	83,1%
21	2	93535 xxAx, Kassel Kompak...	0	1	1,122	2	0,11	43,5%	77,7%	2,1%	3	0,14	58,7%	83,1%
22	2	93535 xxAx, Kassel Kompak...	0	1	1,122	2	0,11	43,5%	77,7%	2,1%	3	0,14	58,7%	83,1%
23	2	93535 xxAx, Kassel Kompak...	0	1	1,122	2	0,11	43,5%	77,7%	2,1%	3	0,14	58,7%	83,1%
24	2	93535 xxAx, Kassel Kompak...	0	1	1,122	2	0,11	43,5%	77,7%	2,1%	3	0,14	58,7%	83,1%
25	2	93535 xxAx, Kassel Kompak...	0	1	1,122	2	0,11	43,5%	77,7%	2,1%	3	0,14	58,7%	83,1%
26	2	93535 xxAx, Kassel Kompak...	0	1	1,122	2	0,11	43,5%	77,7%	2,1%	3	0,14	58,7%	83,1%
27	2	93535 xxAx, Kassel Kompak...	0	1	1,122	2	0,11	43,5%	77,7%	2,1%	3	0,14	58,7%	83,1%
28	2	93535 xxAx, Kassel Kompak...	0	1	1,122	2	0,11	43,5%	77,7%	2,1%	3	0,14	58,7%	83,1%

The table presents a series of column:

- the number of simulation
- the number of source model in the catalog
- the source name
- the specific power consumption per km/mile
- the pole distance (if input as minimum/maximum/step)
- the source height (if input as minimum/maximum/step)
- the luminaire tilt (if input as minimum/maximum/step)
- the arm length (if input as minimum/maximum/step)
- the medium horizontal illuminament Em
- the medium luminance Lm
- the horizontal luminance uniformity Uo
- the center-road luminance uniformity Ul

and, for each observer "i"

- the longitudinal lane luminance Lm(i)
- the horizontal luminance lane uniformity Uo(i)
- the longitudinal lane luminance uniformity Ul(i)
- the lane glare TI(i)
- the SR(j) and the TI(j) (UNI 11248/2011) parameter connected to every sidewalks
- the intensity indexes D and G relative to the fixture.

It is possible to order the rows by a specific column value by clicking the column header, or reorder the column order dragging the choose one in the new position.

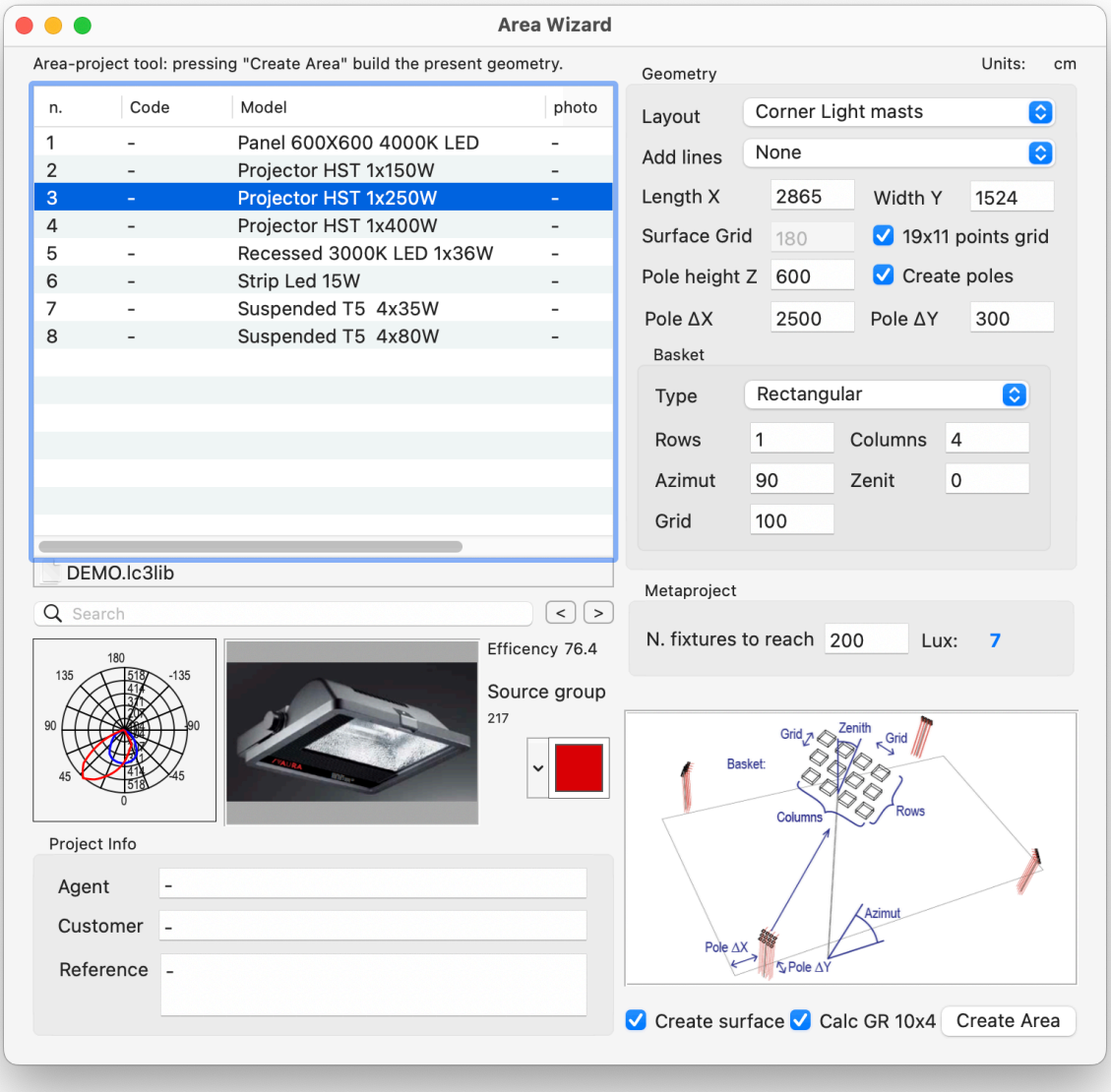
Finally, it is possible to filter the results editing the threshold-values on the bottom of the window and check the relative button: the simulations that not respect these limits will be hidden.

To simplify this procedure is present a 'Class' pop-up menu with the standard road classification that will fill for you the fields.

The 'Export Result' button will save the whole table in a tab-delimited file, while clicking the 'Build selected configuration' button the Application exit the optimization result dialog and will build the chosen configuration.

4.2.7. Command: AREA WIZARD...

An 'area' represents an open zone like a parking, a square,... The 'Area' dialog will be presented:



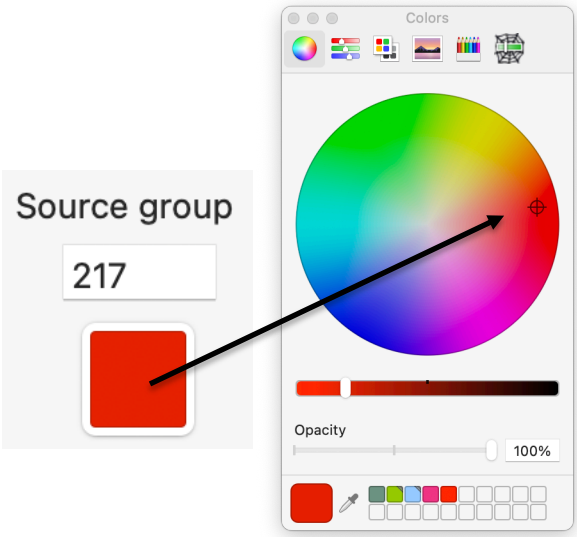
The first section of the dialogue permits to choose the lighting source.

The source catalogue may be chosen through the button at the bottom of the source list, containing the code and the name of the active one.

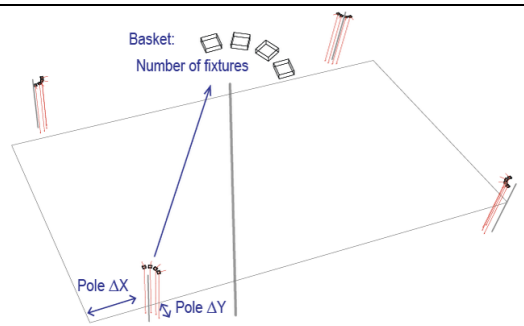
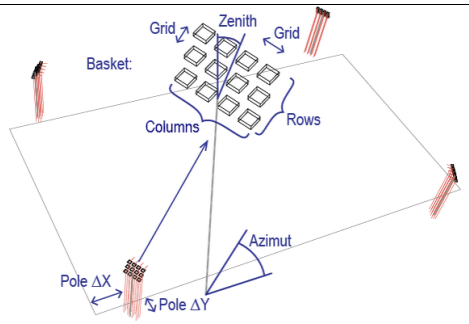
To find some source it is present a find edit field under the source list: typing something inside it the Application will search for the sources whose name contains the typed characters.

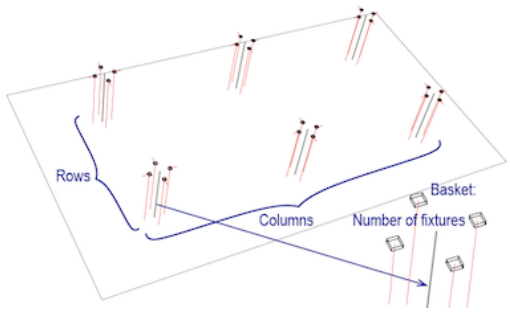
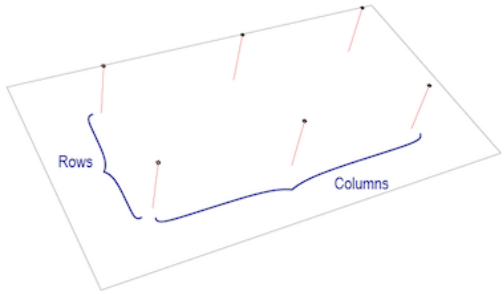
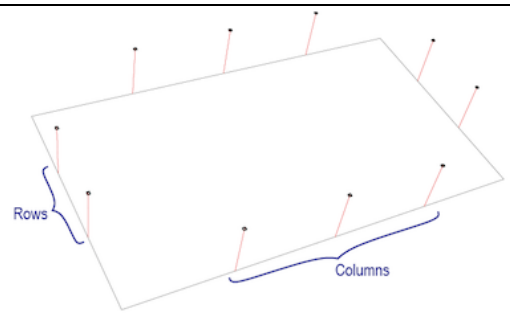
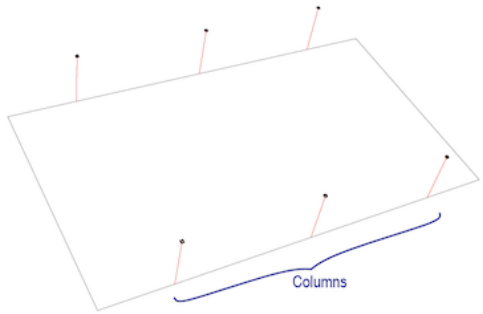
The Application also reports the efficiency of the selected model.

The 'Source Group' button permits to assign the default group to the lighting sources through the standard Mac colour dialogue or through the relative field (in the range of 1-256):



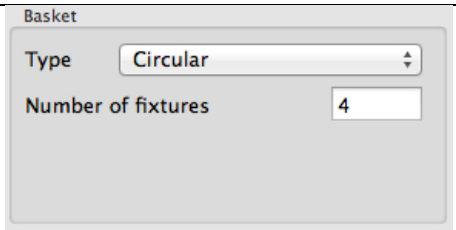
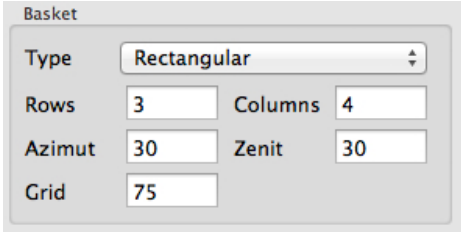
The next section refers to the geometry of the model and in particular (in the near-bottom box are presented the explanation graphics):

1. Corner light masts: light-masts will be placed at the corner of the area and according to the 'Basket' setup it is possible to have a 90° open circular distribution of the fixtures....	
...or a rectangular matrix of 'Rows' x 'Columns' at 'Grid' intervals, oriented in the XY plan following the 'Azimuth' angle and tilted of a 'Zenith' angle;	

2. Distributed light masts: a regular matrix of 'rows' x 'columns' of light-masts will be placed with a 180° open circular distribution of the fixtures at the top;	
3. Distributed poles: a regular matrix of 'rows' x 'columns' of poles with a single fixture will be placed	
4. Perimetral poles: poles with a single fixture will be placed only along the perimeter of the area, in the number of 'row' along the Y edges and 'column' along the X edges	
5. Faced poles: poles with a single fixture will be placed only along the X edges of the area, in the number of 'column'	

- 'Length X', 'Width Y' are the dimensions of the area;
- 'Surface Grid' is the finite elements dimension for the lighting calculation;
- '19x11 point grid' fix the grid to divide the surface in n.19x11 rectangular finite elements;
- 'Pole height Z' is the height of each pole/mast;
- 'Create poles' permits to add the poles in the model;
- 'Pole Rows' and 'Pole Columns' define the pole/masts matrix distribution;
- 'Pole ΔX' and 'Pole ΔY' define the pole distances from the field corners.

The fixture basket may be circular or rectangular, and the available parameters are:

circular basket: - 'Number of fixtures' fix the number of light sources to distribute roundly (180° or 90°) at the top of each mast;	
rectangular basket: - 'Rows' fix the number of rows in the basket; - 'Columns' fix the number of columns in the basket; - 'Azimuth' fix the planar orientation of the basket (angle in the XY plan from the X axis); - 'Zenith' fix the inclination from the vertical of the basket (angle from the Z axis); - 'Grid' fix the distance among fixtures in the basket (Δx and Δy);	

- The 'Add lines' pop-menu permits to add the particular game lines in the plan.
- The 'Metaproject' box use the CIE method to evaluate the number of the selected fixtures to reach a specific illuminament level, in function of the area dimension and the poles height.
- The 'Create surface' check-box permits to include or not the surface creation in the model.
- The 'Calc GR 10x4' check box add an user surface for calculating glare GR in a grid of 10x4 finite elements;

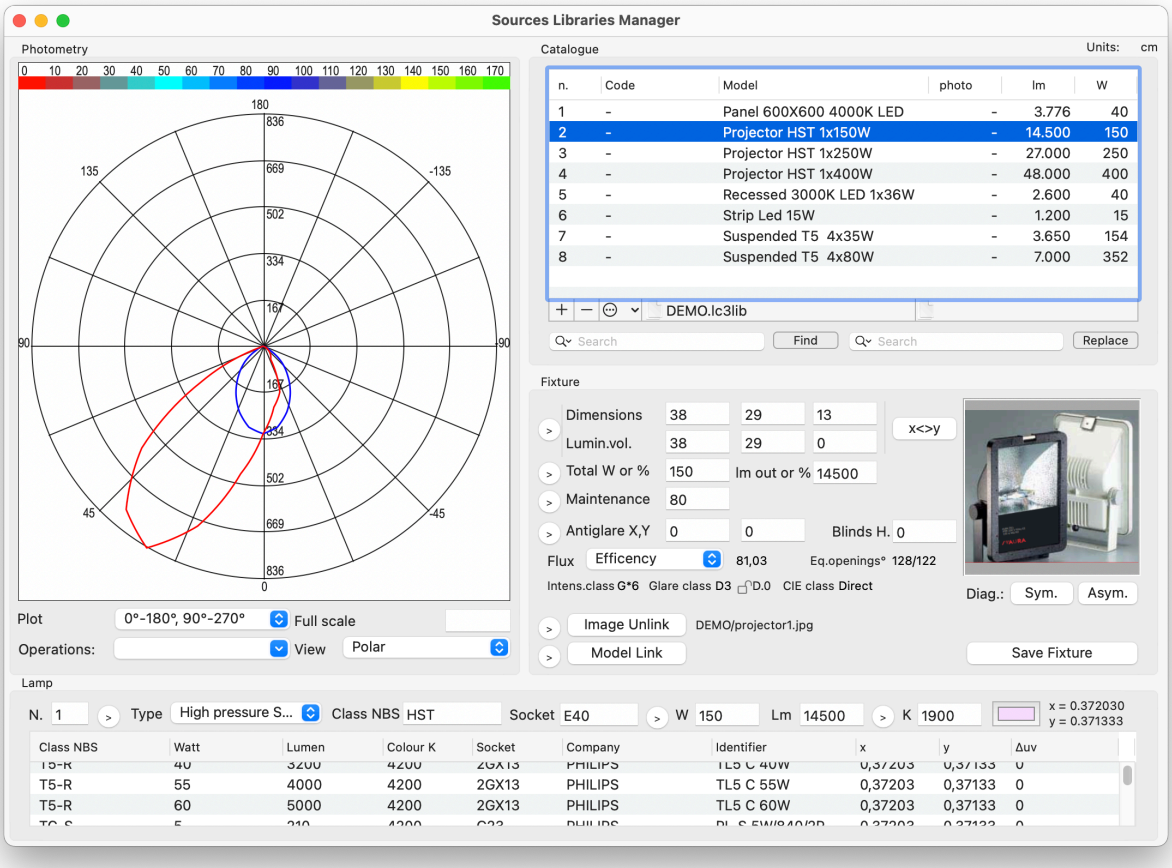
Pressing the button 'Create area' a new project will start with the values displayed in the dialogue and the application shows the scene in 3D mode view.

See §5.1 Open area for a tutorial.

4.2.8. Command: SOURCE LIBRARIES MANAGER

The main window is divided into 4 sections:

- Photometry: permits to navigate and modify the photometric solid
- Catalogue: permits to manage catalogue on disk
- Fixture: permits to modify geometrical, electrical,... characteristic of the fixture
- Lamp: permits to view/select lamps



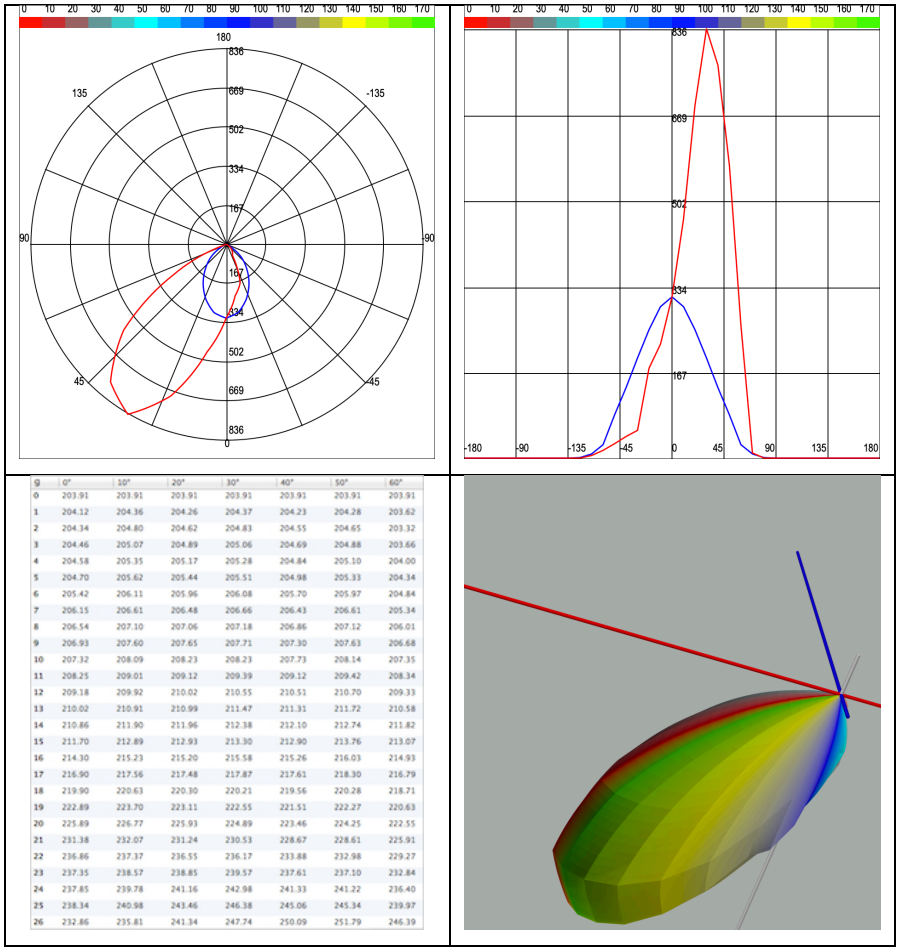
4.2.8.1. *Photometry section*

The view presents the 18 azimuthal sections of the photometry in candle for 1000 lumen with different colors for each curve or the I-table, according to the 'View' pop-up menu. Many options are possible:

- With the pop-up 'Operations' it is possible to modify the active photometry, and in particular it is possible on a single or multiple selection (after all these procedure, to maintain the modified photometry it is necessary to save it with the item 'Save Fixture' in the 'Fixture' section):
  - to correct efficiency of the selected luminaires: permits to evaluate the ratio between the luminaire emitted flux and the total installed one: the user can scale the photometry to balance this value on a more correct one, following the side dialog; value can be entered also as a series of simple operation (without parenthesis or precedence order) like '100*45,12/36'.
  - to rotate the azimuth of the whole photometry at 10° or 90° steps, clockwise or counter-clockwise, for example to overlap the C=0 axis of the imported photometry with the frontal axis of the Illuminando source, if the first does not respect the CIE-standard (this is possible importing IESNA formats);
  - to rotate the zenith of the whole photometry at 90° steps, up and down;

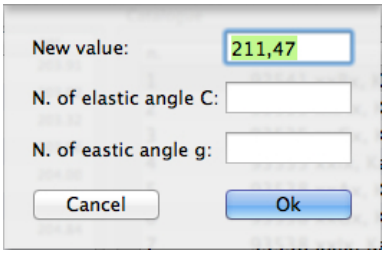
- to mirror the left side of the photometry to the right side and vice-versa, respect to the C=0-180°;
- to reassign the photometry as the average of the left side and the right side, respect to the C=0-180°;
- to reassign the photometry as the average respect of the vertical axis and rotating it 90° in the azimuth;
- to sum the selected photometries (only multiple selection).

- Through the pop-up menu 'Plot' it is possible to choose the section or combination of sections to show;
- The edit field 'Full scale' assign the diagram Y scale ratio: a 0 value let the software to choose the best value;
- The pop-up menu 'View' permits to display the photometry as polar, Cartesian, I-table or 3D view (C-sections are plotted following the C-curves colors).



G	0°	10°	20°	30°	40°	50°	60°
0	203.91	203.91	203.91	203.91	203.91	203.91	203.91
1	204.12	204.36	204.26	204.37	204.23	204.28	203.62
2	204.34	204.80	204.62	204.83	204.55	204.65	203.32
3	204.46	205.07	204.89	205.06	204.69	204.88	203.66
4	204.58	205.35	205.17	205.28	204.84	205.10	204.00
5	204.70	205.62	205.44	205.51	204.98	205.33	204.34
6	205.42	206.11	205.96	206.08	205.70	205.97	204.84
7	206.15	206.61	206.48	206.66	206.43	206.61	205.34
8	206.54	207.10	207.06	207.18	206.86	207.12	206.01
9	206.93	207.60	207.65	207.71	207.30	207.63	206.68
10	207.32	208.09	208.23	208.23	207.73	208.14	207.35
11	208.25	209.01	209.12	209.39	209.12	209.42	208.34
12	209.18	209.92	210.02	210.55	210.51	210.70	209.33
13	210.02	210.91	210.99	211.47	211.31	211.72	210.58
14	210.86	211.90	211.96	212.38	212.10	212.74	211.82
15	211.70	212.89	212.93	213.30	212.90	213.76	213.07
16	214.30	215.23	215.20	215.58	215.26	216.03	214.93
17	216.90	217.56	217.48	217.87	217.61	218.30	216.79
18	219.90	220.63	220.30	220.21	219.56	220.28	218.71
19	222.89	223.70	223.11	222.55	221.51	222.27	220.63
20	225.89	226.77	225.93	224.89	223.46	224.25	222.55
21	231.38	232.07	231.24	230.53	228.67	228.61	225.91
22	236.86	237.37	236.55	236.17	233.88	232.98	229.27
23	237.35	238.57	238.85	239.57	237.61	237.10	232.84
24	237.85	239.78	241.16	242.98	241.33	241.22	236.40
25	238.34	240.98	243.46	246.38	245.06	245.34	239.97
26	232.86	235.81	241.34	247.74	250.09	251.79	246.39

In the I-table view mode the user can modifying a single value by editing the relative field in the list: the Application will answer requiring an interval (called "elastic interval") to smooth the final result following a sine/cosine surface interpolation:



In the 3D view navigation is possible through the standard Mac mode:

- click + drag = rotate;
- right-click + drag = pan;
- alt + click + drag = zoom.

4.2.8.2. Catalogue section

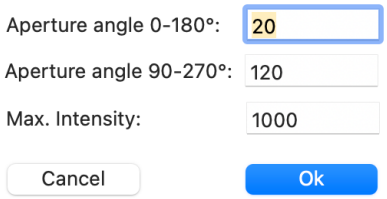
This section presents the active source catalogue and a list of its enclosed luminaries alphabetically ordered: choosing a luminaire, the element identifier will be pasted in the relative edit field that make possible to change its name. If the user wants to save information in the specific "photo" fiald about the optic of the luminaire, it is possible to insert the "#" char followed by the optic description without spaces (for axample, typing "#road_01" the application will present "road_01" in the "photo" column).

It is possible to make multiple continuous (⇧-shift key pressed) or discontinue (⌘-command key pressed) selection for particular modification to the selection set.

Furthermore it is possible to order the list of fixtures alphabetically by clicking the column title. In this section it is possible:

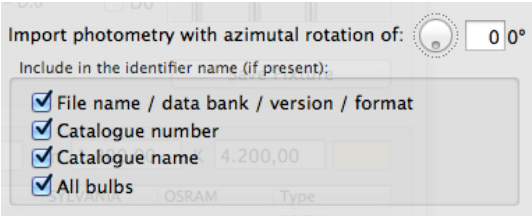
- to add a luminaire copied from the selected ones (button '+' and also available as contextual menu); the program asks for sizing flux and power of the new fixture to a new value of total power, according to the following dialogue:

- to delete the selected luminaires (button '-' and also available as contextual menu);
- to create a new empty Catalogue;
- to open an existing one: the active one is highlighted in the field under-center the source list;
- to merge an existing one into the active catalogue;
- to create a photometry by equivalent openings. The application open a dialogue asking for the needed parameters and will build the relative rectangular: photometry:

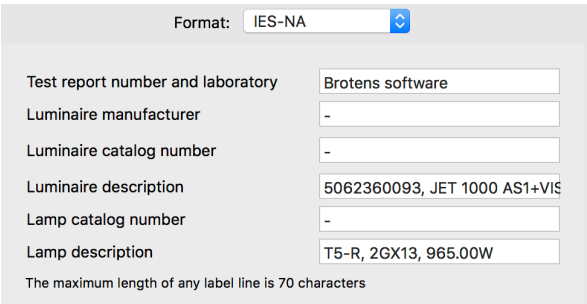


- to import a single photometry, saved in EULUMDAT, IES or TM14 format (see 4.2.8.2.1 Importing photometries);

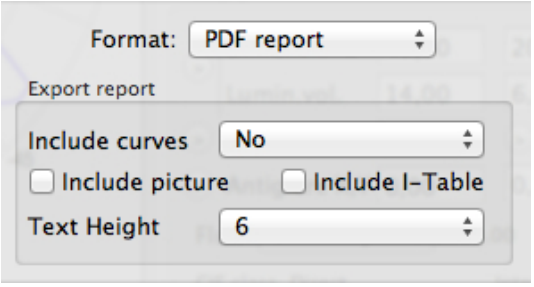
- to import a whole photometry folder included all subfolders, saved in EULUMDAT, IES or TM14 format: in this case the software asks for some options: it is possible to rotate each photometry at 10° step clockwise or counterclockwise, to include in the Illuminando identifier:
  - label the file name, data bank, version and format;
  - the Company luminaire catalog number;
  - the Company luminaire name;
  - to import all the bulbs with which the luminaire is powered (only EULUMDAT format) following the dialogue:



- to save the current catalogue;
- to save a copy of the current catalogue;
- to link a price file to the active catalogue, simply choosing it through the standard Macintosh dialogue: the linked one is highlighted under-left the source list;
- to unlink any price file from the active sources catalogue;
- to join code and model strings in a single label that will replace the model label, far all the selected photometries;
- to swap code and model strings, far all the selected photometries;
- to export all the luminaires in the active catalogue as a simple list of sources in plain text format with tab delimiters, formatted as 'Model' - 'Input flux' (Lamps number x Lamp flux) - 'Output flux' (Luminaire outgoing flux) - 'Efficiency %' (Light Output Ratio);
- to export the selected luminaries as:
  1. IES-NA photometry file, and it is possible to personalize some fields as in the next figure:



  2. EULUMDAT photometry file;
  3. PDF drawing file;
  4. PDF protocol that may include:
     - the longitudinal section (C=0/180) of the luminary's photometry;
     - the longitudinal (C=0/180) and the transversal (C=90/270) section of the luminary's photometry;
     - all the sections of the luminary's photometry;
     - all the numeric fields defining the photometry (I-table);
     - the luminary's picture.



5. Collada (DAE) 3D file (if the 3D view is activated in the 'View' pop-menu);

- to find lighting sources that contain a specific text inside the model name or to replace all the occurrences of a certain text string in the selected sources (once activated the 'Replace' field through the toggle menu inside the 'Find' edit field); moreover, typing '#' followed by a number N the application will cut from the name the first N characters;
- to copy in a single text string the code and the model of the selected source (also available as contextual menu);
- to copy the selected photometries in the Brotens native format for pasting them in another catalogue;
- to paste the previously copied photometries in the active catalogue;
- to copy the active photometry in PDF format;
- to copy the active photometry in PNG format.

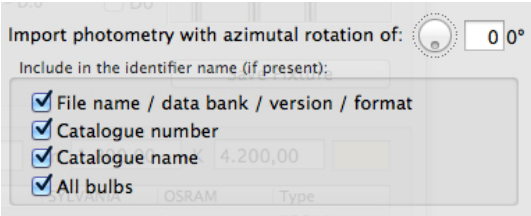
4.2.8.2.1. Importing photometries

Illuminando permits to import photometric data from IES-NA, EULUMDAT, TM14, PDF or DXF files.

The user will be prompted with the following dialogue, to save the photometry rotating it at 10° steps, clockwise or counter-clockwise, with an Illuminando identifier containing or not:

- the file name, data bank, version and format;
- the Company luminaire catalog number;
- the Company luminaire name

...and to import all the bulbs with which the luminaire is powered (EULUMDAT format):



For text files, Illuminando will try for the first time the IES-LM-63 format (to format a file in such a way see Appendix C: IES-NA data interchange format). If this is not a correct filter, the Application reply with an alert and try EULUMDAT filter (to format a file in such a way see 5.10 Appendix D: EULUMDAT data interchange format) and finally the TM-14 filter will be tried.

If the luminaire to import has the possibility to install different bulbs (EULUMDAT formats), the Application will display a dialog for choosing the configuration to present.

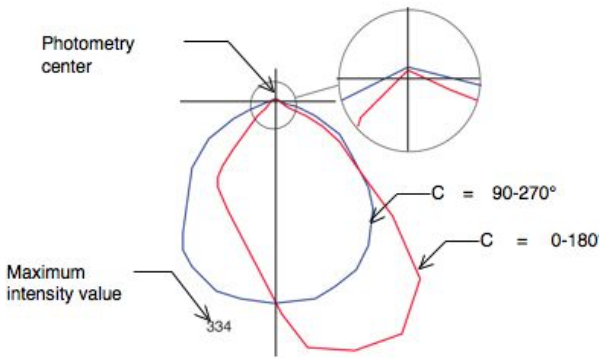
Illuminando can import also PDF or DXF drawing as photometry, that must contain the following information:

- a couple of lines drawn in **BLACK** crossing in the center of the real photometry if drawing a polar diagram or an horizontal black line and (optional) a **YELLOW** line perpendicular in the middle point of the first if drawing a Cartesian diagram;
- a text object indicating the maximum intensity value (optional);

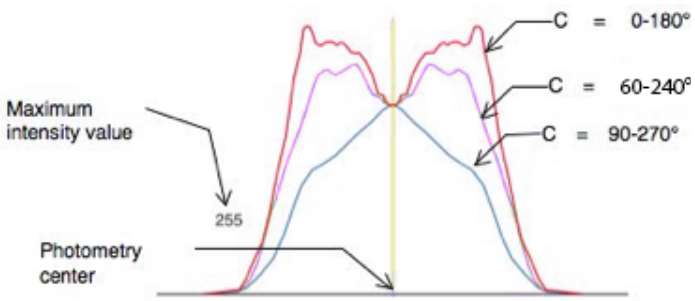
- a polyline or some connected lines drawn in **RED** (or a mainly-red color – ex.: RGB={0.8, 0.1, 0.2}) defining the C=0, C=180 sections and containing the center of photometry;
- a polyline or some connected lines drawn in **BLUE** (or a mainly blue color – ex.: RGB={0.2, 0.1, 0.8}) defining the C=90, C=270 sections and containing the center of photometry (optional but the first to use if the red one is present);
- a polyline or some connected lines drawn in **MAGENTA** (or a mainly magenta color – ex.: RGB={0.8, 0.7, 0.1}) defining the C=60, C=240 sections and containing the center of photometry (optional but the first to use if the red and blue ones are present);
- a polyline or some connected lines drawn in **CYAN** (or a mainly cyan color – ex.: RGB={0.2, 0.7, 0.8}) defining the C= 10, C=190 sections and containing the center of photometry (optional but the first to use if the red, blue and magenta ones are present).
- a polyline or some connected lines drawn in **GREEN** (or a mainly green color – ex.: RGB={0.2, 0.7, 0.2}) defining the C=30, C=210 sections and containing the center of photometry (optional but possible to use only if the other colors are present).

Opening the DXF file, if not present in the file, the Application asks for the maximum intensity in the selected photometry, to bring the drawing to the real scale. Photometry to import may be drawn as polar or Cartesian diagram, following the next indications:

Drawing a polar representation



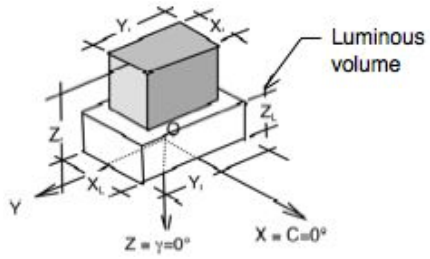
Drawing a Cartesian representation



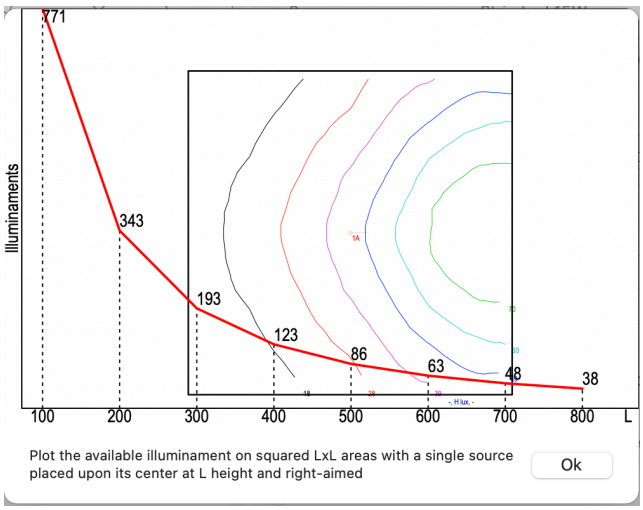
4.2.8.3. Fixture section

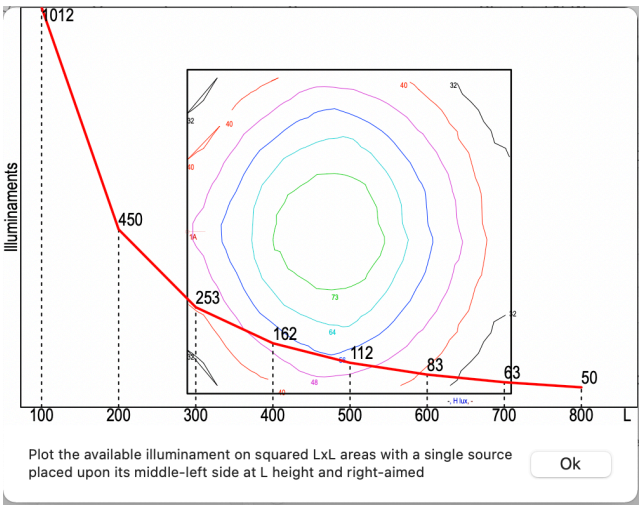
In this section it is possible:

- to save the modified luminaire ('Save fixture' button). The label inserted in the edit field may contain some code characters:
  - a couple of round brackets with a fraction '(1/N)': this case means for the software, in the evaluation exportation, that the fixture is a part of a bigger luminaire composed by N identical parts (es. 'fixture AAA (1/3)'); in the price list the cost of the fixture has to be divided by N and finally in the computation it will be reassembled with the price brought to the original cost;
  - some text included in square brackets '[...]' will be omitted in the report. This opportunity is useful to connect luminous parts (saved as photometries) of the same fixture: the part of the label external to the brackets '[...]' has to be the same, while inside the brackets the part may be evidenced, taking care to highlight with a '+' sign all the secondary parts (es. 'fixture AAA[part 1]', 'fixture AAA[+part 2]', ...).
- to assign dimensions and luminous volume. Luminaire geometry is defined through its "Bounding box" (needed for shadow calculation) and its "Luminous box", both described as box oriented in the Local Coordinate System of the lighting source as in figure:



- Because of the local X-axis in Illuminando is the C=0° axis, for compatibility with the interchange formats it is present the "x <-> y" button, that permits to invert the fixture dimensions along the local axis;
- to assign total power (that take count of electronic parts and of what the luminaire needs to function; it is possible to input this field as an absolute value, es. '120', or as a percentage of the lamps power, es. '20%') and maintenance factor (must be choose on low values 30%÷50% for dusty luminaries and/or rooms, and on better values 70%÷90% for new luminaries and/or clean rooms, not involved in calculations); for poly-sources a zero value let the software calculate this quantity in function of the lenght of the polyline;
- to assign the total flux of the fixture, that take account of the Light Output Ratio of the Luminaire (not involved in calculations); for poly-sources a zero value let the software calculate this quantity in function of the lenght of the polyline;
- to assign blind height and antiglare grids;
- to control emitted flux, and in particular:
    - efficiency;
    - 0°-30° emitted flux;
    - 0°-40° emitted flux;
    - 0°-60° emitted flux;
    - 0°-90° emitted flux (DLOR = downward luminaire output ratio);
    - 90°-120° emitted flux;
    - 90°-130° emitted flux;
    - 90°-150° emitted flux;
    - 90°-180° emitted flux (ULOR = upward luminaire output ratio);
    - 0°-180° emitted flux (total).
- to control equivalent light-cone (those angles in which the intensity decay at 50% of the one measured at gamma=0°) ;
- to control the CIE class (the official CIE classification for the fixture) end Intensity Class D and G;
- to force the assignment at Intensity Class D.0 through the check box (if the bulb or its image is visible from an angle of 85° from the vertical, according to the D.0 definition);
- to link/unlink an image to the fixture, that has to be contained in the 'Picture' folder inside the 'Luminaires' folder (choosing 'Cancel' the user can delete every link to the element);
- to link/unlink a 3D dxf-model to the fixture, that has to be contained in the 'Models' folder inside the 'Luminaires' folder (it is important that the model will have origin O and spatial orientation equal to the Illuminando scheme to have a correct visualization inside SceneKit and with the convention that all the dxf-elements drawn in color #0 represent the luminous parts of the fixture, and in Illuminando will be drawn in the source color);
- to examine illuminament diagram on a standard flat squared LxL horizontal surface with the active source placed in the center of the area ("Sym." button, left picture) or in the left-middle edge ("Asym." button, right picture) at L height. The front red curve represent the available average illuminament as the parameter L changes:





The '>' button, if present, permits to automatically assign the actual value to all the selected elements in the source list of the active Catalog.

4.2.8.4. Bulb section

Bulbs installed in the lighting source will be characterized with the following parameters:

- type of emission spectrum;
- number of installed ones;
- power of the single bulb in Watt;
- conventional bulb name;
- lamp holder type;
- luminous flux of the single bulb in Lumen;
- correlated Color Temperature and RGB color.

It is possible to change the proposed Color Temperature simply editing the new value in its field or clicking right side coloured button.

The main dialogue presents, finally, a list reporting some of the most common commercial lamps, for a quick selection through a double click.

The '>' button, if present, permits to automatically assign the actual value to all the selected elements in the source list of the active Catalog.

The bulb database is contained in the "Lamps.txt" file is a simple text file that can be edited with whatever software but saved as text file.

The file has the following structure:

class NBS	W	Lm	K	Holder	Company	Identifier	x	y	Δuv	Type
T5	35	3650	4000	G5	-	T5 tube	. 3855	. 44017	. 02559	FLIN
…										

The first line is the header; follow the real lamp records, one each row.

Each field in a record is separated by a 'tab' code.

The user has to introduce a new lamp at the correct row, following the last field 'Type' in which:

Identifier	description
FCOM	compact fluorescent
FLIN	linear fluorescent
HALO	halogen
HGVA	mercury vapor
JMET	metal halide

Identifier	description
NAHP	sodium high pressure
NABP	sodium low pressure
INCA	incandescent
LED_	led
XENO	xenon

The operation is to insert a new record as a row inside the correct lamp group, then each field of the record has to be filled:

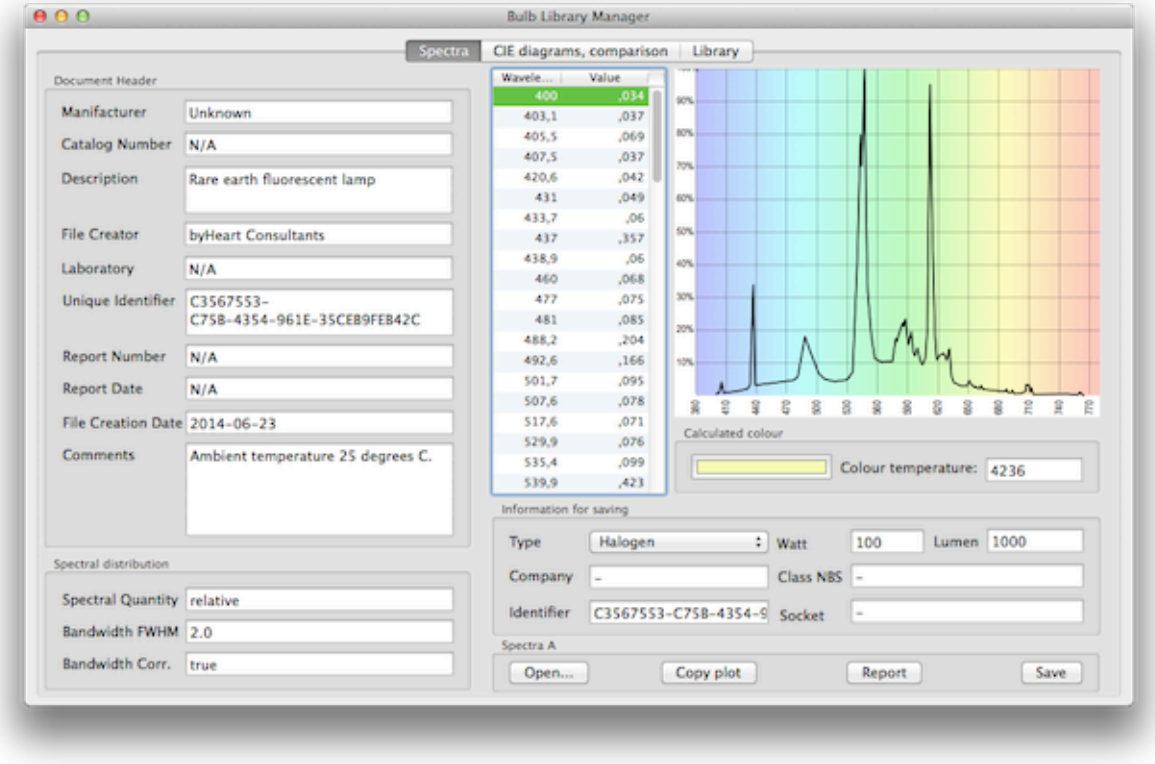
class NBS	standard lamp name;
W	nominal power consumption
Lumen	nominal lumen output
K	Kelvin color temperature of the source
Holder	lampholder
Company	Company
Identifier	Commercial name
x	x-coordinate (CIE 1931)
y	y-coordinate (CIE 1931)
Δuv	distance from the Black Body curve in the CIE 1960 diagram
TYPE	internal identifier for the lamp type (one of the name in the previous table)

Once finished, the user has to save the file as text file with the name "Lamps.txt" in the same directory of the original one.

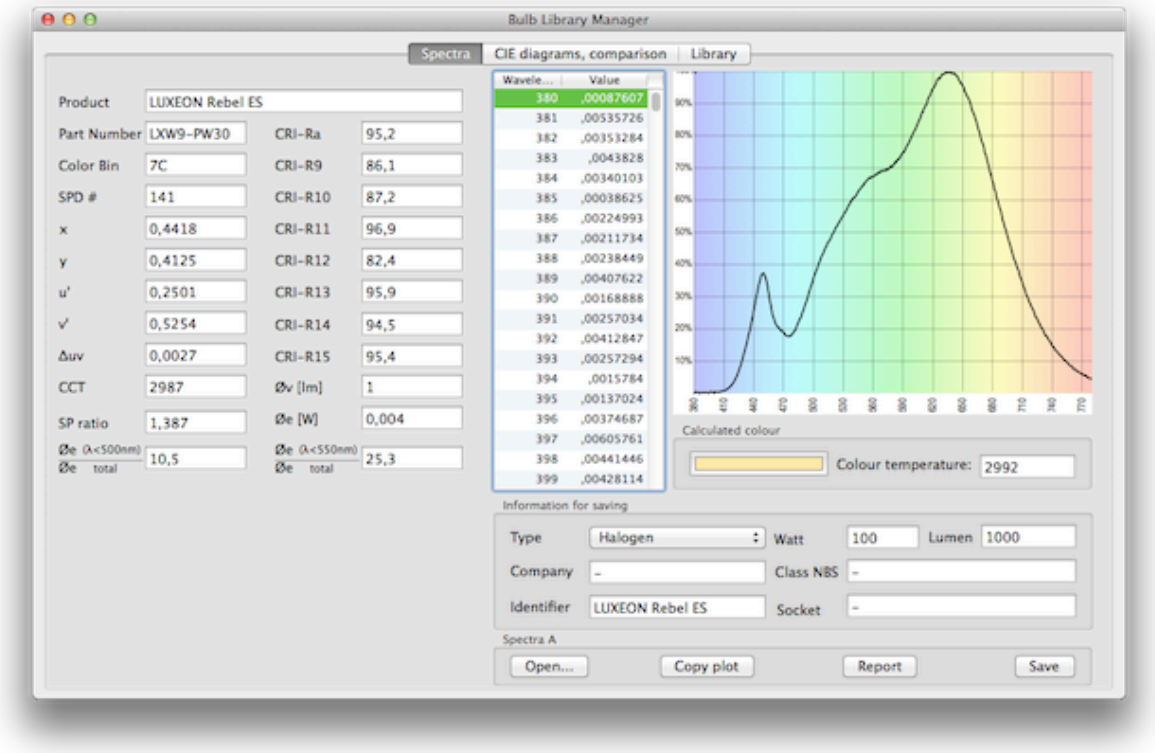
See § 5.4 Manage photometries for a tutorial.

4.2.9. Command: BULB LIBRARY MANAGER

Selecting the command, the Bulb manager dialog will be presented: the first box 'Spectra' permits to open, examine and save spectra data. The following image present an already opened spectra in XML format...



...and another spectra in CSV format:

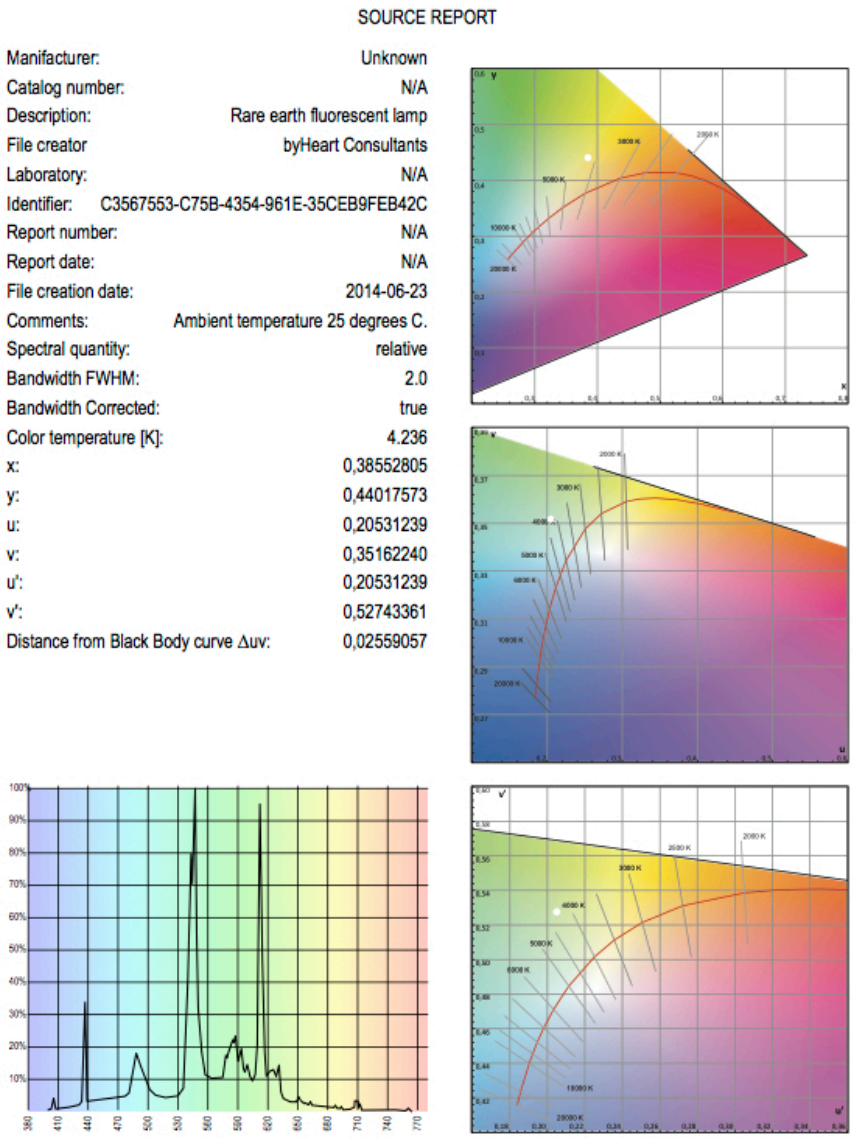


Once opened the application calculate the color and the color temperature of the source and display them at the bottom of the graphic. The method to calculate the real lighting source color is through the opened emission spectra spd(i) weighted by the human visibility curve V(i) to reach the (X, Y, Z) color coordinates, then calculate the (x, y), (u, v) and (u', v') to describe the color point in the CIE 1931, CIE 1960 and CIE 1976 diagrams and finally it is possible to calculate the color temperature cct as function of the (x, y) color coordinates:

$$n = \frac{x - 0.332}{0.1858 - y}; \qquad cct = 449 \cdot n^3 + 3528 \cdot n^2 + 6823.3 \cdot n + 5520.33$$

There are four commands available:

- Open...: permits to open an XML file formatted following the IES TM-27-14 IES Standard Format for the Electronic Transfer of Spectral Data or a CSV file: once opened, the application calculate the spectra color and will round up the color temperature in K;
- Copy plot: permits to copy the graphic in PDF format;
- Report: permits to export the calculated data and the graphics in PDF format, as the in following image:

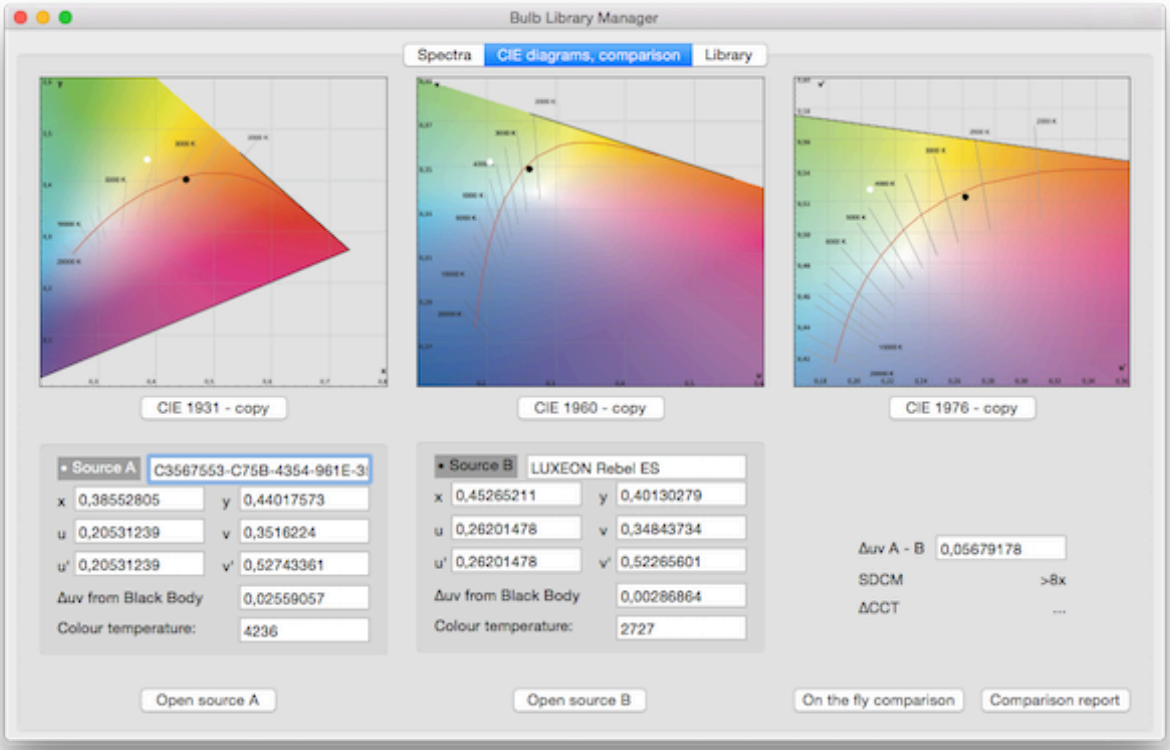


SOURCE REPORT

Manifacturer:	Unknown
Catalog number:	N/A
Description:	Rare earth fluorescent lamp
File creator	byHeart Consultants
Laboratory:	N/A
Identifier:	C3567553-C75B-4354-961E-35CEB9FEB42C
Report number:	N/A
Report date:	N/A
File creation date:	2014-06-23
Comments:	Ambient temperature 25 degrees C.
Spectral quantity:	relative
Bandwidth FWHM:	2.0
Bandwidth Corrected:	true
Color temperature [K]:	4.236
x:	0,38552805
y:	0,44017573
u:	0,20531239
v:	0,35162240
u':	0,20531239
v':	0,52743361
Distance from Black Body curve Δuv:	0,02559057

- Save: permits to save the current spectra in the 'Lamps.txt' library inside the service folder of Brotens applications before saving the user has to fill the Information in the relative box for saving fields.

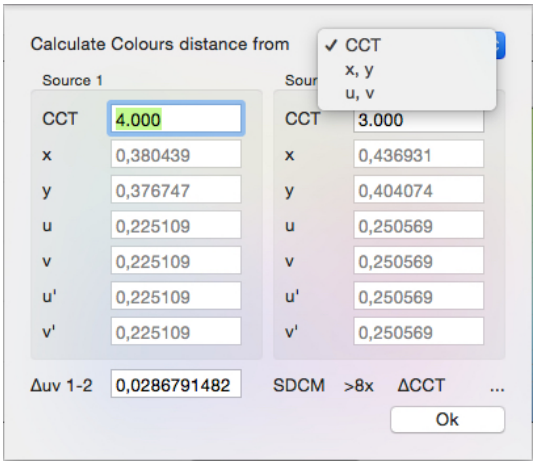
The second box 'CIE diagrams / comparison' of the dialogue permits to examine the CIE 1931, CIE 1960 and CIE 1976 diagrams where the color point of the opened sources is plotted, and to compare two spectra (the following image present the two previous sources already opened as A and B):



There are six commands available:

- CIE 1931 - copy: permits to copy the relative graphic in PDF format;
- CIE 1960 - copy: permits to copy the relative graphic in PDF format;
- CIE 1976 - copy: permits to copy the relative graphic in PDF format;
- Open source A: permits to open an XML file formatted following the IES TM-27-14 IES Standard Format for the Electronic Transfer of Spectral Data or a CSV file;
- Open source B: permits to open an XML file formatted following the IES TM-27-14 IES Standard Format for the Electronic Transfer of Spectral Data or a CSV file;

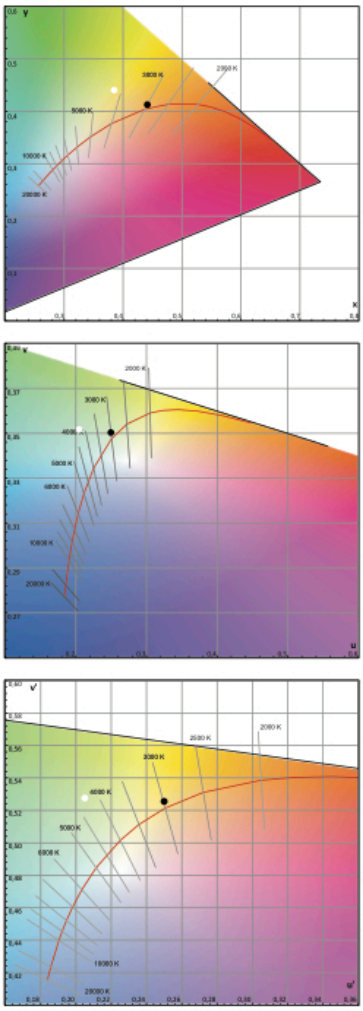
- On the fly comparison, permits to insert manually two color-temperatures (pop menu 'CCT') or two CIE1931-colours (pop menu 'x, y') or two CIE1960-colours (pop menu 'u, v') and compare them as explained later:



- Comparison report: permits to save the calculated data and the graphics in PDF format, as in the following image:

SOURCES COMPARISON

SOURCE A (white)	
Identifier:	T5 linear fluorescent
Color temperature [K]:	4.236
x:	0,38552805
y:	0,44017573
u:	0,20531239
v:	0,35162240
u':	0,20531239
v':	0,52743361
Distance from Black Body curve Δuv:	0,02559057
SOURCE B (black)	
Identifier:	LUXEON Rebel ES
Color temperature [K]:	2.992
x:	0,44178637
y:	0,41250549
u:	0,25007390
v:	0,35024911
u':	0,25007390
v':	0,52537367
Distance from Black Body curve Δuv:	0,00266920
RESULT	
Distance A-B Δuv:	0,04478257



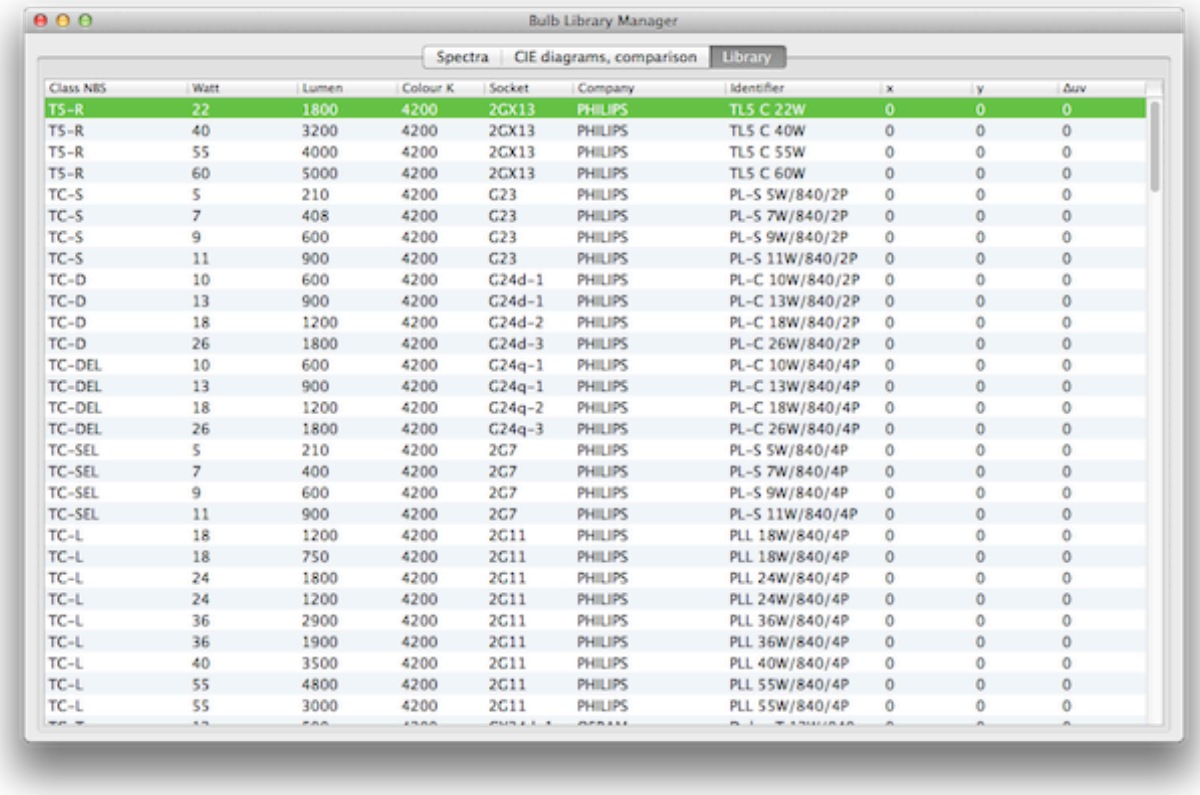
The comparison is presented (following the ANSI_NEMA_ANSLG C78.377-2008 - Specifications for the Chromaticity of Solid State Lighting Products - American National Standard):

- in the 'Δuv A-B' field as the distance of the colors in the CIE 1960 diagram;
- in the 'SDCM' field that present the minimal McAdam ellipse that include this distance;
- in the 'ΔCCT' field that present the color temperature tolerance for the selected McAdam ellipse.

Parameters follow the next table:

Δuv A-B	SDCM	ΔCCT
< .0007	1x	±30K
< .0010	2x	±60K
< .0015	3x	±80K
< .0020	4x	±100K
< .0060	7÷8x	±175K
> .0060	>8x	...

The third box of the dialogue present the bulbs database in the Brotens service folder:



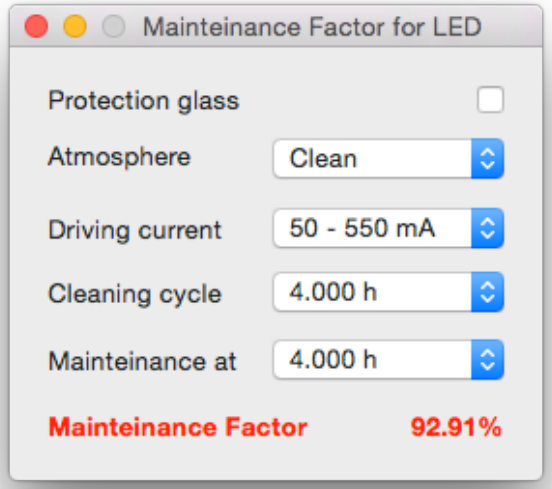
Class NBS	Watt	Lumen	Colour K	Socket	Company	Identifier	x	y	Δuv
T5-R	22	1800	4200	2GX13	PHILIPS	TL5 C 22W	0	0	0
T5-R	40	3200	4200	2GX13	PHILIPS	TL5 C 40W	0	0	0
T5-R	55	4000	4200	2GX13	PHILIPS	TL5 C 55W	0	0	0
T5-R	60	5000	4200	2GX13	PHILIPS	TL5 C 60W	0	0	0
TC-S	5	210	4200	G23	PHILIPS	PL-S 5W/840/2P	0	0	0
TC-S	7	408	4200	G23	PHILIPS	PL-S 7W/840/2P	0	0	0
TC-S	9	600	4200	G23	PHILIPS	PL-S 9W/840/2P	0	0	0
TC-S	11	900	4200	G23	PHILIPS	PL-S 11W/840/2P	0	0	0
TC-D	10	600	4200	G24d-1	PHILIPS	PL-C 10W/840/2P	0	0	0
TC-D	13	900	4200	G24d-1	PHILIPS	PL-C 13W/840/2P	0	0	0
TC-D	18	1200	4200	G24d-2	PHILIPS	PL-C 18W/840/2P	0	0	0
TC-D	26	1800	4200	G24d-3	PHILIPS	PL-C 26W/840/2P	0	0	0
TC-DEL	10	600	4200	G24q-1	PHILIPS	PL-C 10W/840/4P	0	0	0
TC-DEL	13	900	4200	G24q-1	PHILIPS	PL-C 13W/840/4P	0	0	0
TC-DEL	18	1200	4200	G24q-2	PHILIPS	PL-C 18W/840/4P	0	0	0
TC-DEL	26	1800	4200	G24q-3	PHILIPS	PL-C 26W/840/4P	0	0	0
TC-SEL	5	210	4200	2G7	PHILIPS	PL-S 5W/840/4P	0	0	0
TC-SEL	7	400	4200	2G7	PHILIPS	PL-S 7W/840/4P	0	0	0
TC-SEL	9	600	4200	2G7	PHILIPS	PL-S 9W/840/4P	0	0	0
TC-SEL	11	900	4200	2G7	PHILIPS	PL-S 11W/840/4P	0	0	0
TC-L	18	1200	4200	2G11	PHILIPS	PLL 18W/840/4P	0	0	0
TC-L	18	750	4200	2G11	PHILIPS	PLL 18W/840/4P	0	0	0
TC-L	24	1800	4200	2G11	PHILIPS	PLL 24W/840/4P	0	0	0
TC-L	24	1200	4200	2G11	PHILIPS	PLL 24W/840/4P	0	0	0
TC-L	36	2900	4200	2G11	PHILIPS	PLL 36W/840/4P	0	0	0
TC-L	36	1900	4200	2G11	PHILIPS	PLL 36W/840/4P	0	0	0
TC-L	40	3500	4200	2G11	PHILIPS	PLL 40W/840/4P	0	0	0
TC-L	55	4800	4200	2G11	PHILIPS	PLL 55W/840/4P	0	0	0
TC-L	55	3000	4200	2G11	PHILIPS	PLL 55W/840/4P	0	0	0

The bulbs database is contained in the "Lamps.txt" file: it is possible to find the description of this file in the paragraph 'Bulb Manager'.

See § 5.5 Manage spectra data for a tutorial.

4.2.10. Command: MAINTEINANCE FACTOR MANAGER...

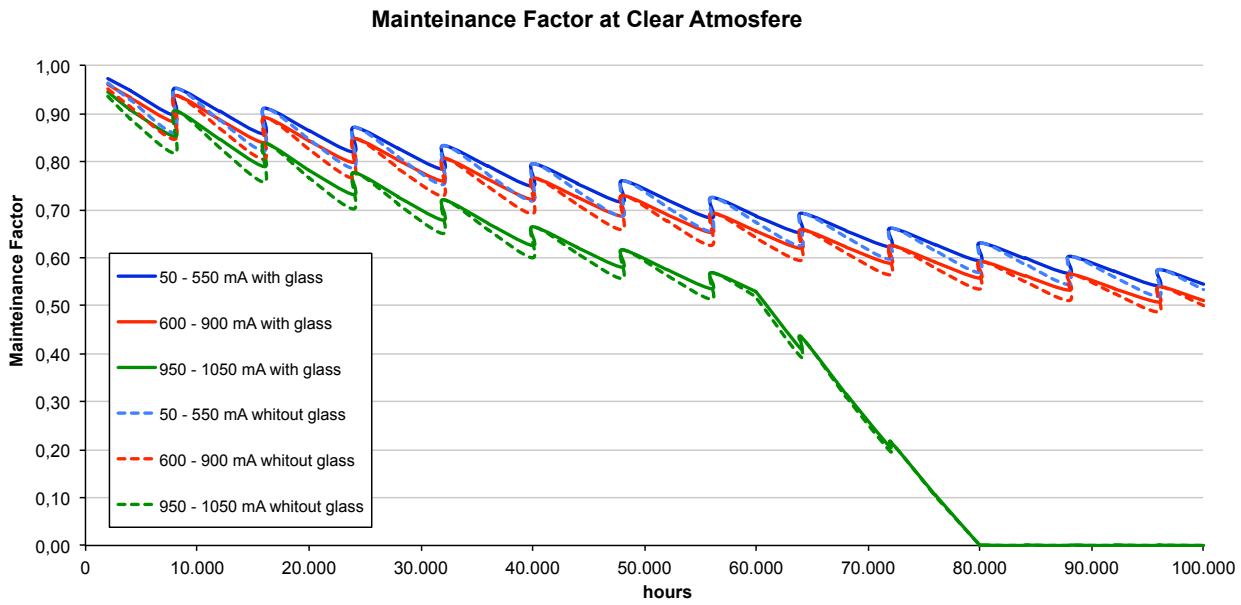
With this tool it is possible to evaluate the maintenance factor for fixtures with led and PMMA lenses:

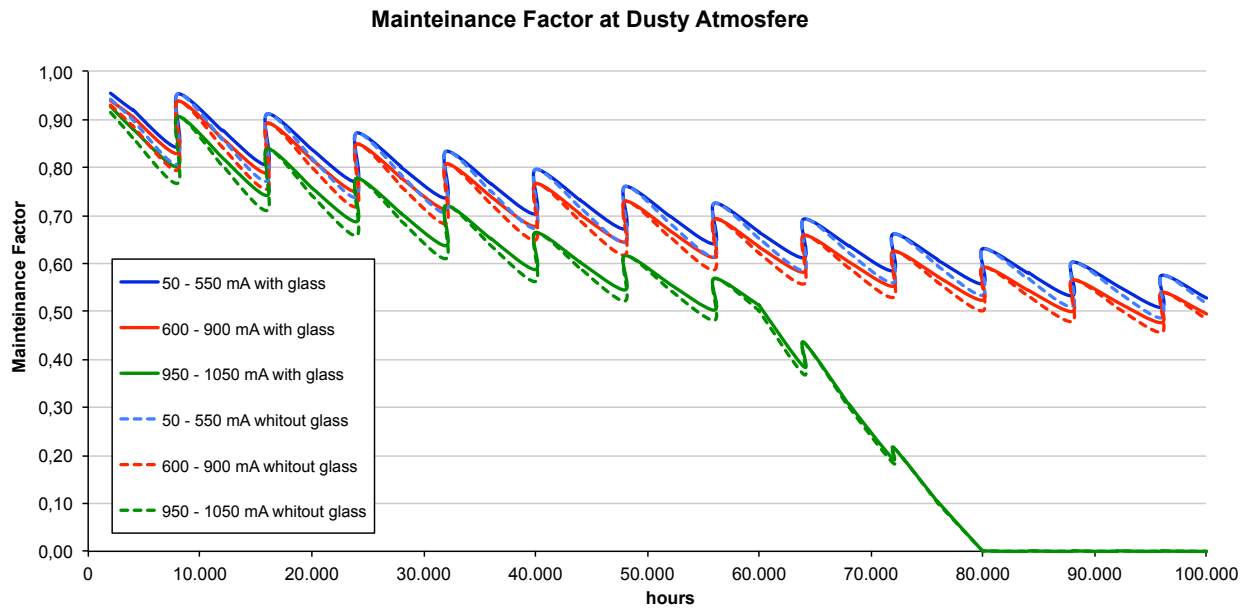


- the 'Protection glass' box checked permit to evaluate M.F. for fixtures in which leds are protected with a glass;
- 'Atmosphere' may be clean or dusty (smog areas, heavy factories,...)
- 'Driving current' may be chosen among:
  - 50-550 mA;
  - 600-900 mA;
  - 95-1050 mA.
- the user has to fix also the cleaning cycle among the following:
  - 4.000 hours;
  - 8.000 hours;
  - 12.000 hours;
  - 16.000 hours;
  - never.

Finally, choosing the time at which the M.F. has to be calculated (from 4.000 to 100.000 hours) the user will read the result (in red in the upper figure).

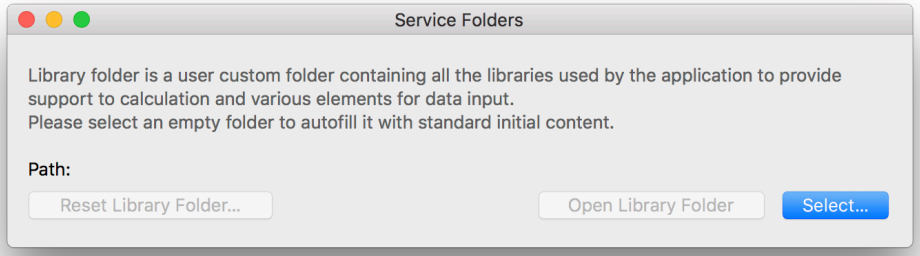
Follows one of the graphics on which the tool is based.



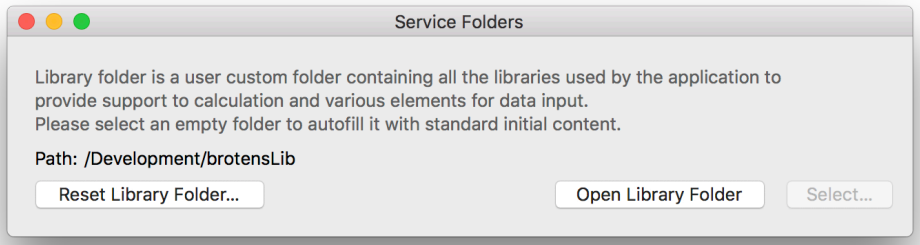


4.2.11. Command: SERVICE FOLDERS...

This command permits to manage the Application service folders. The first time the Application runs the user is prompted for locating these folders:



Once chosen, the Application initialize it. It is possible to reset the service folders in every moment simply choosing this menu and pressing the 'Reset Library Folder...' button:



...or navigating inside it through the button 'Open Library Folder'.

4.2.12. Command: CLOSE

This command permits to close the current project.

4.2.13. Command: SAVE

This command permits to save the current project.

4.2.14. Command: DUPLICATE

This command permits to duplicate the current project.

4.2.15. Command: RENAME

This command permits to rename the current project.

4.2.16. Command: MOVE TO...

This command permits to move to another folder the current project.

4.2.17. Command: REVERT TO...

This command permits to recall the last saved versions.

4.2.18. Command: EXPORT

This command allows the saving of work in different formats for compatibility with other programs of CAD, graphics, text, database, etc... The possibility to exchange information with other applications has the purpose to permit the maximum action freedom for the user in compiling drafts and technical reports, showing the results of the calculations. Available export formats follow.

4.2.18.1. Export TEXT, RTF format

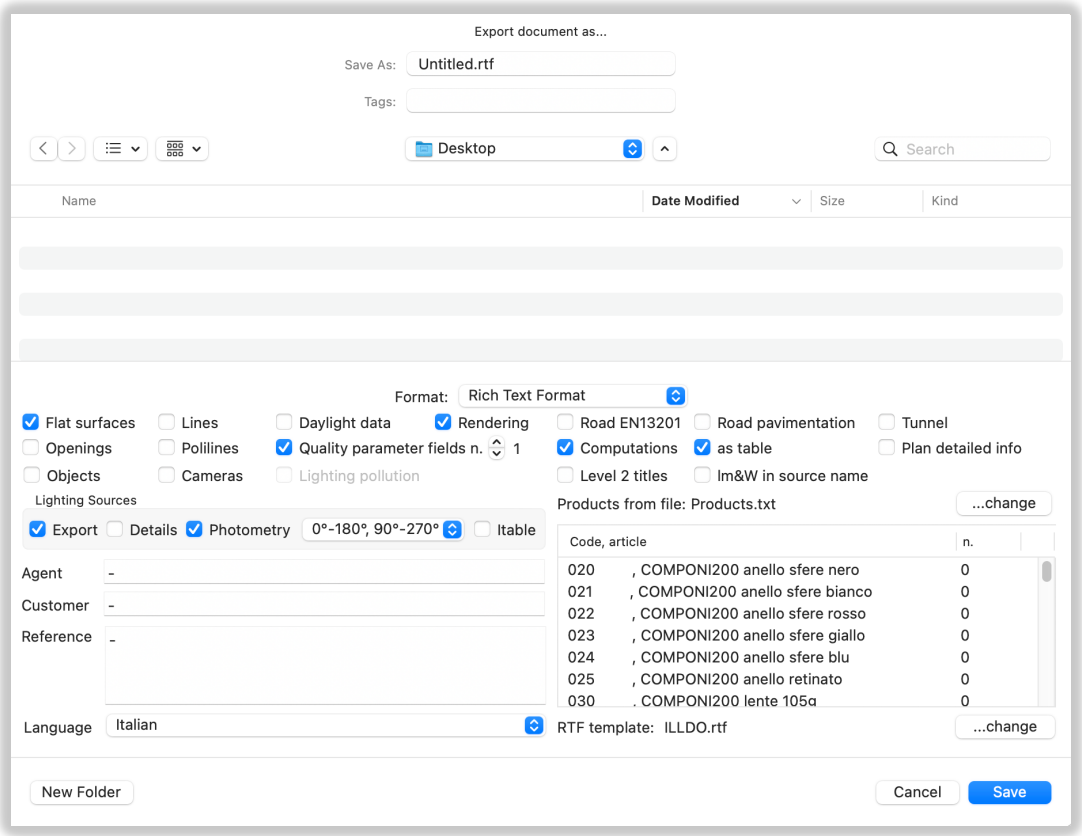
The Application will create a complete calculation report with which it is possible to read numeric results and chromatic and spatial coordinates of all the elements in the project.

If the user has made a selection set, the Application will export information and results only for the selected elements; in the other case the whole project will be registered. If TEXT was selected, the Application will export a TEXT file with tabulation, while for RTF/RTFX (Rich Text Format) export the Application will use a template (one fore each currency and/or customer) created ad formatted by the user. In the example-file are present every styles needed for a correct printing of the report, and the user will be able to change them, leaving the number of tabulations and, if possible, the width of the fields.

In the RTF templates, it is possible to insert some automatic information through some codes (case is relevant):

- #1 = The image saved in the slot 'Cover Design';
- #A = Agent name;
- #D = Actual date;
- #h = Actual time;
- #N = File name (complete directory);
- #C = Customer name;
- #R = Reference and place;

Fields to include in the exportation are selectable by the following dialog:



The other saved drawing slots, 'Layout design', 'Result Design' and 'Rendering' will be inserted in their opportune places inside the report.

Buttons refer to the following dates:

- (List of) Flat Surfaces:

Number, Level, Type of surface, Area, Color of the upper/lower side (number, name, reflection coefficient), Calculation grid;

- (List of) Openings:

Number, Owner Type, Owner Number, Total glass thickness, Extinction coefficient, Color (number, name, transparency coefficient);

- (List of)Lighting Sources:

Number/Reference to the model, Model, Total power and flux with dimming percentage, Number of Lamps, Lamp type, Lamp label, Lamp socket, Lamp power, Lamp luminous flux, Lamp color, Total installed power, Maintenance factor, X/Y position, Installation height, Pointing (x, y, z/azimuth, zenith); if this field is checked will export in the report the last viewed image in the "Project Source" session. If Detailed is active also: Catalogue, Level, anti-glare shader height, anti-glare shader angles, anti-glare grid height, anti-glare grid x,y dimensions. If Photometries is active also photometric diagrams with the curves visibility selected in the relative pop-menu

- (List of) Objects:

Number, Level, Type of surface, Color of the upper/lower side (number, name, reflection coefficient), Large Grid [cm], Calculation grid or number of X-Y divisions if a mesh;

- (List of) Lines:

Number, Level, Total length, Color number (group), Thickness;

- (List of) Polylines:

Number, Level, Total length, Color number (group), Thickness;

- (List of) Cameras:

Number, Position;

- Daylight Data:

Place, Latitude [°,'], Day, Month, Hour, Direct Radiation [W/m^2], Diffuse Radiation [W/m^2], Albedo [%];

- Titles from Level 2:

Start title indentation from level 2;

- Quality parameters:

For each user surface: Number, Minimum horizontal illuminance, Maximum, Mean, Minimum/Mean illuminance ratio, Minimum/Maximum illuminance ratio, Mean/Maximum illuminance ratio; if this field is checked the Application will export in the report the last viewed image in the "Results" session;

- Number of quality fields:

The Application will prepare the number of quality fields relative to some surfaces the user want to insert in the report;

- Plan detailed info: (for the roads)

Road width, sources layout type, sources inter-distance, sources height, source beam, source beam tilt angle, luminaire label, bulb type;

- Road Classification EN13201: (for the roads)

Tables contained in the EN13201;

- Road pavimentation: (for the roads)

The r-values of the reduced luminance coefficients of the road pavimentatioin used in the calculations;

- Computation:

Prizes for each fixture and each special piece, in the currency exportable to the estimation, are saved in the same folder of the source catalog (ex.: “Fixtures”) in a text file with the same name of the catalog and the “.prz” or ".txt" extension (ex.:”Fixtures.txt”). This file must contain the same list of lighting sources as in the Application catalog, and will be filled by the following fields, separated by tabulations:

element description (it must be the same character string with which the Application recognize the element – to export in text format these identifying strings for a whole catalog, see 0

- Command: SOURCE LIBRARIES MANAGER
- price in the first currency (ex.: "English" -> £)
- price in the second currency (ex.: "Italian" -> €)
- price in the third currency (ex.: "German" -> €)
- ...

Description	currency 1	currency 2	currency 3	....	currency n
Fixture #1	10.6	8.44	100.5	...	128.7
Fixture #2	33.6	456.9	345.1	...	789.0
...	...	...	...	...	...
Fixture #m	236.9	16.8	444.8	...	100.5

Only viewed elements will be exported, and in particular:

- for each line and polyline: Number, Group (color), Description, Length, Quantity, Prize, Total;
- for each special piece (to select manually): Number, Image (if saved), Description, Quantity, Prize, Total;
- for each installed lighting source model: Progressive number (1, 2, ...) and local reference (A, B, ...), Image (if saved), Description, Image (if saved), Description, Total power, Quantity, Prize (if saved), Total.

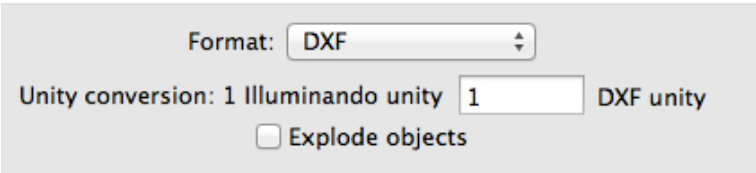
If the option Computation as table is active it is possible to export computation as table with formulas The software, finally, will automatically update the 'Summary.txt' database (saved in the same folder of the Application) filled with the list and the summary data of the RTF, RTFX or TEXT exported projects.

4.2.18.2. Export DXF format

Selecting 'DXF' from the sub-menu the selected element will be saved in DXF format or, if no selection is present, the whole project:

- translating lines in LINE elements;
- faces in POLYLINE elements;
- furniture and free objects will be 'exploded' in 3DFACE elements, each put on a layer whose name is that one of the starting element plus a progressive suffix (Es. starting layer = 'Walls' ; ending layer = 'Walls#o1' ;...); the other object type will be exported as POLYLINE mesh;
- lighting sources will be exported in INSERT (BLOCK) elements schematized as a circle.

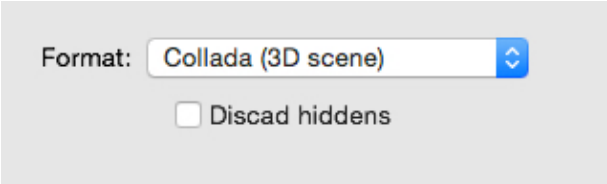
In the result session, the exportation will involve numeric fields and iso-value curves, in the other case the user will be prompted to assign the exportation scale (from centimeters/inches to...):



The 'Explode objects' check-box permits the objects exportable as poly-mesh to be 'exploded' in 3DFACE elements.

4.2.18.3. Export in COLLADA format

If the Scene Kit window is opened, selecting 'Collada (3D scene)' from the sub-menu a .dae object containing the actual scene will be saved.



If the user doesn't want to export all hidden elements the relative check box has to be flagged.

4.2.18.4. Export in JPEG format

Selecting 'JPEG' from the sub-menu, a JPEG image clipped from the screen will be saved.

4.2.18.5. Export in PDF format

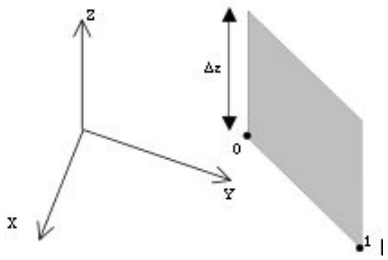
Selecting 'PDF' from the sub-menu, a vectorial PDF file clipped from the screen will be saved.

4.3. Menu Elements

Remember that to exit the command the user must press the 'Escape' key.

4.3.1. Command: WALL

This command permits to introduce a 4-vertices flat surface, starting from a base assigned with two generic space points. The Application asks for two points defining the base needed for the wall extrusion, that goes on, following the selected parameters in the extrusion options, in the Active Coordinate System. For example, assigning for extrusion parameters the vector {0, 0, dz} will create the element in the figure:

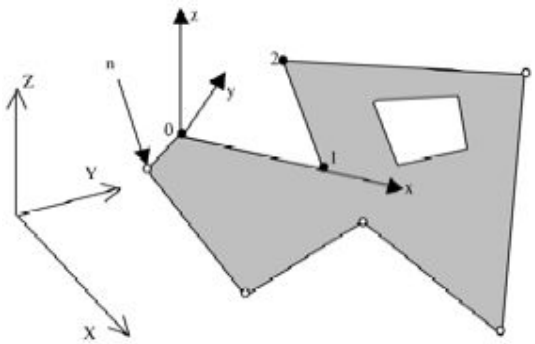


4.3.2. Command: FREE FACE

Permits to draw a flat surface in a generic 3D space plan, assigned y the first three input points. The procedure ask to insert the first three points of the building flat surface as new Coordinate System: next points will refers to the new Coordinate System.

4.3.3. Command: FACE

A flat surface is defined by its polyline contour, and may include openings (hole, glass or different color parts). The element is introduced on the XY plan of the Active Coordinate System, placing points consecutively, no matter if clockwise or counter clockwise: the first and second points define the local x axis direction, while the first and third points define the positive semi-plan for the element, following the figure:



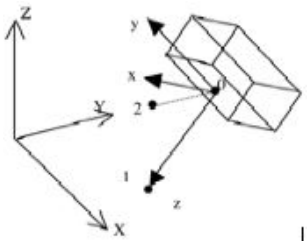
To close the boundary polyline it is possible to make a double click on the last point of the surface (point "n" in the figure) or making a simple click on the polyline's initial point (point "0" in the figure). Closing the surface, the local Coordinate System will be placed in the barycenter of the face.

4.3.4. Command: OPENING

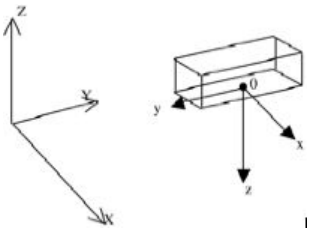
This item is active only if the user selects one (and only one) flat surface inside which it is possible to introduce hole, glasses or different color parts. The Application automatically brings the Active Coordinate System onto the surface's plan, and lets the user introduce the polyline defining the boundary of the opening. The next steps are identical to those taken for introducing flat surfaces, but with a limitation in drawing that does not permit the assignment of points outside the flat surface to which the opening belongs.

4.3.5. Command: LIGHTING SOURCE

This command permits to introduce a lighting source by three points. The procedure asks for the introduction of the source position (barycenter of the luminous opening - point 0 in figure), the pointing axis (Z local axis - point 1 in figure) and the frontal axis of the source (C=0° - point 2 in figure):



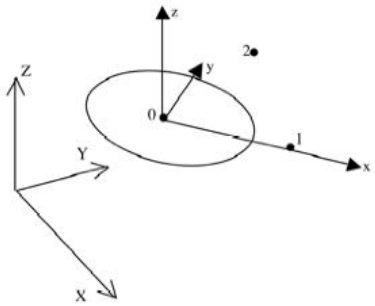
In every moment, during the introduction of the three points needed to assign the position and orientation of the element in the space, it is possible to execute a mouse double click: in this case the orientation procedure will be stopped, end the element placed:



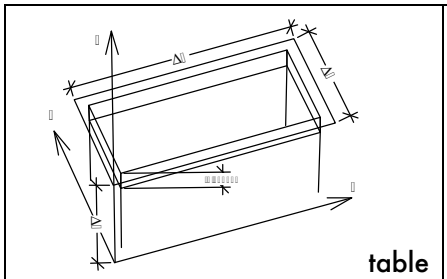
- with the pointing axis oriented to the negative side of the Active Coordinate System Z axis;
- with the frontal axis oriented to the positive side of the Active Coordinate System X axis;
- with the transversal axis parallel to the Active Coordinate System Y axis.

4.3.6. Command: OBJECT

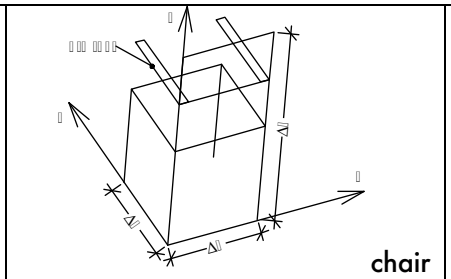
The command permits to introduce an object among those available. The procedure asks for the position of the origin of the object (point 0 in the figures), the direction of the local X axis (point 1 in figure) and the direction of the local Y axis (point 2 in the figures), like in the following figures, in which the local axis for every type of object are drawn.

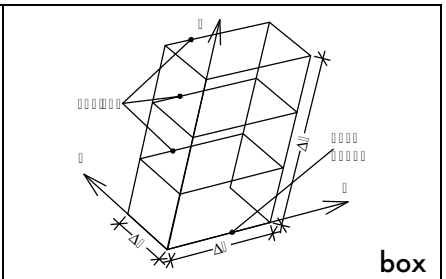


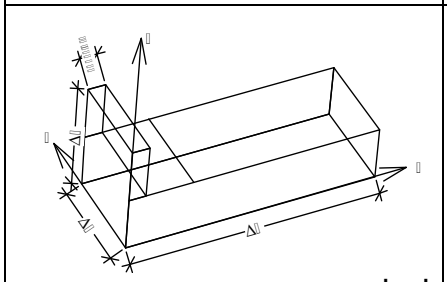
In every moment, during the introduction of those three points needed to assign the position and orientation of the element in the space, it is possible to execute a mouse double click: in this case the orientation procedure will be stopped, and the element placed following the Active Coordinate System. Available objects are displayed in the next figure.

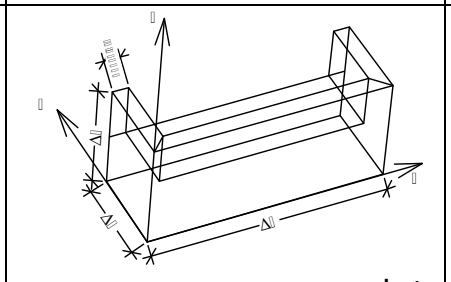


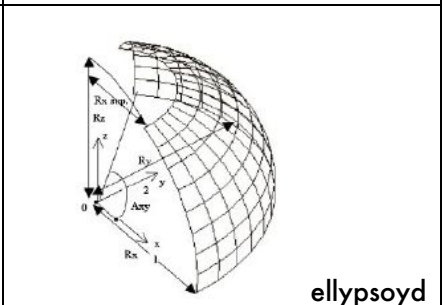
table

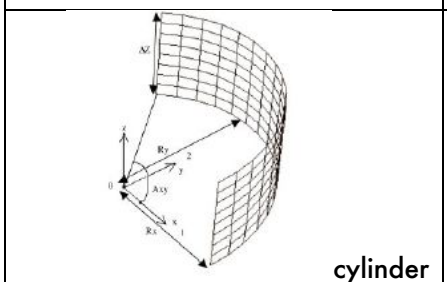

chair

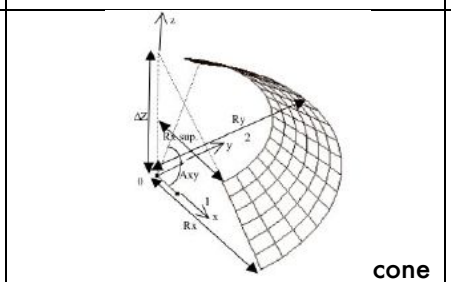

box

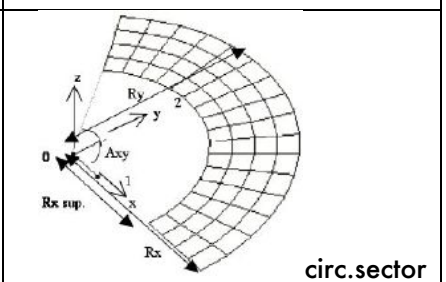

bed

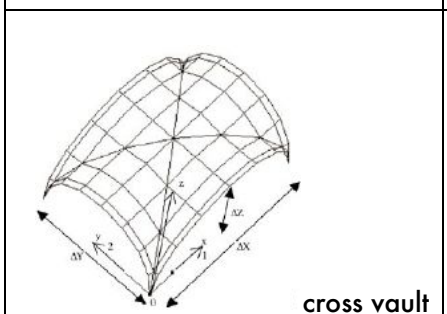

armchair

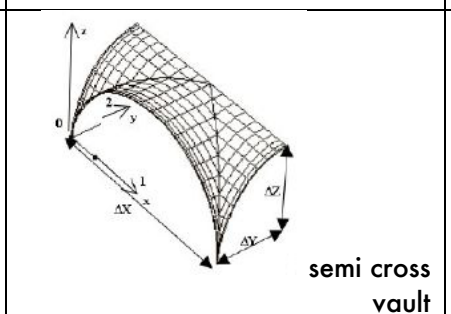

ellypsoyd

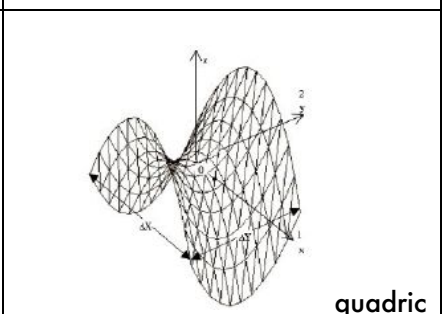

cylinder

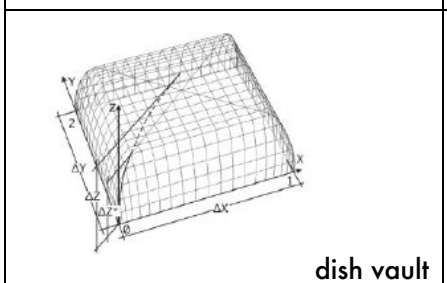

cone

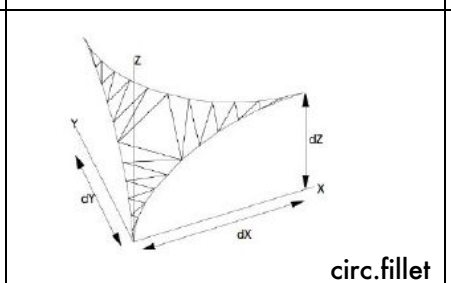

circ.sector

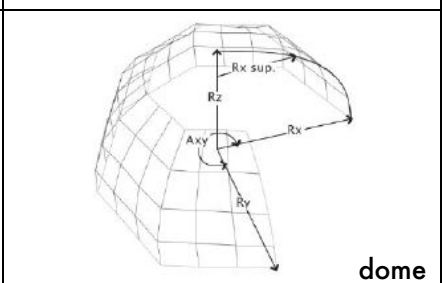

cross vault

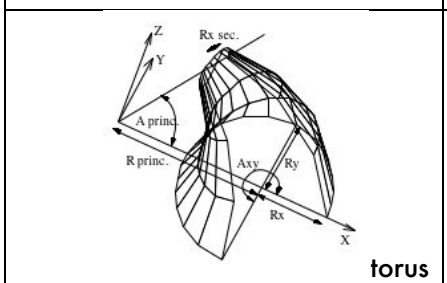

semi cross vault

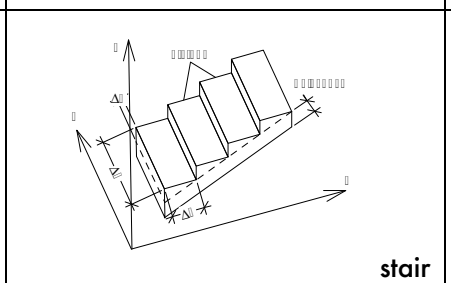

quadric

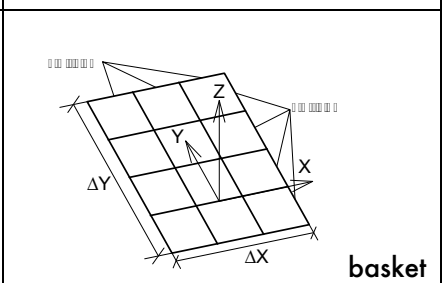

dish vault


circ.fillet


dome

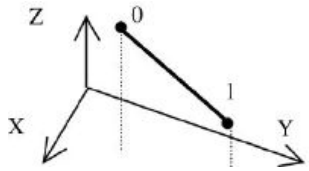

torus


stair


basket

4.3.7. Command: LINE

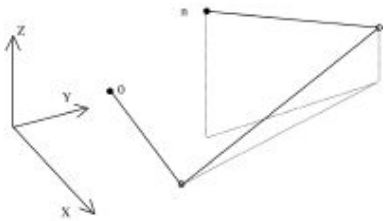
Permits the introduction of a single line. The procedure asks for the introduction of two points laying everywhere in the tridimensional space: the A vertex (point 0 in figure) and the B vertex (point 1 in figure) of the line:



Once the line is drawn its middle point will be visible (is this option is checked in the Preferences) and snappable.

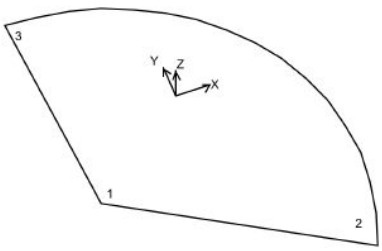
4.3.8. Command: POLYLINE

It is possible to create open polylines: the element is introduced on the XY plan of the Active Coordinate System, placing points consecutively with Z coordinate that may be different from zero. To end the polyline the user has to make a double click:



4.3.9. Command: POLYGON

It is possible to create a polygon that can approximate an arc: the element is introduced on the XY plan of the Active Coordinate System, placing up to three points; the end of the arc may be done by a double-click in every moment: if the information given until this moment are enough to draw the arc, this will be placed.



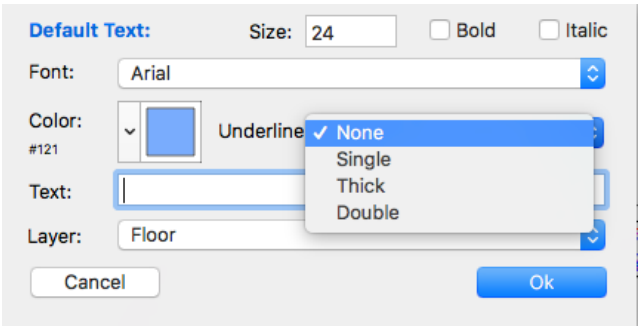
4.3.10. Command: CAMERA

It is possible to introduce up to five (six for roads) cameras (observers). The position of the camera in the drawing will be marked with the symbol: .

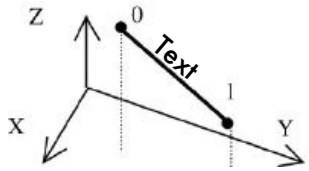
If the user inserts more than 2 observers the 'CRF' = Contrast Rendering Factor wil be no more available for 'user' surfaces.

4.3.11. Command: TEXT

It is possible to introduce text formatted in several ways. The procedure, after opening the format dialogue:



...asks for the introduction of two points laying everywhere in the tridimensional space: the A vertex (point 0 in figure) and the B vertex (point 1 in figure) along the text line:

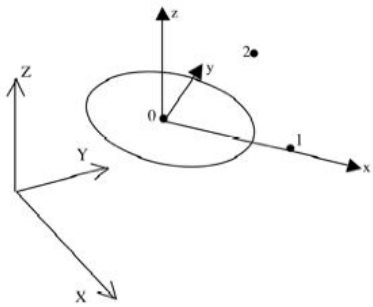


4.3.12. Other commands

At the bottom of this menu the user will find the name of the files contained in the "Models" folder inside the user Libraries folder, as seen in chapter 2 Getting started. Every ".lcdoc" Brotens document the user will put inside the "Models" folder, before starting the application, will be displayed in this menu.

With these menus it is possible to insert a whole Brotens model inside the active one (except camera objects), mainaining layer attributions (new layer will be added to the current drawing if not already present in the list).

Selecting one of these files, the procedure asks for the position of the origin of the model (point 0 in the figures), the direction of the local X axis (point 1 in figure) and the direction of the local Y axis (point 2 in the figures), like in the following figures, in which the local axis for the model to insert are drawn.



In every moment, during the introduction of those three points needed to assign the position and orientation of the model in the space, it is possible to execute a mouse double click: in this case the orientation procedure will be stopped, and the model placed following the Active Coordinate System.

4.4. Menu Edit

4.4.1. Command: UNDO

Permits to revert the last command. This permits to come back in the command sequence.

4.4.2. Command: REDO

Permits to discard the effects of the "Undo" command, going on one step in the command sequence.

4.4.3. Command: INFO

This command allows the user to set the characteristic parameters of every element.

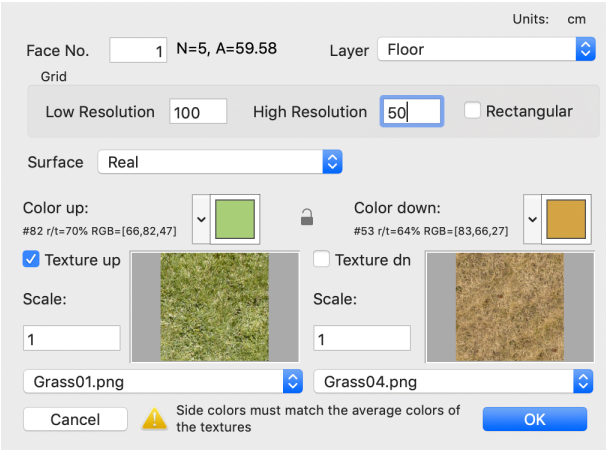
The procedure is different whenever it is present or not a selection set built with a single element.

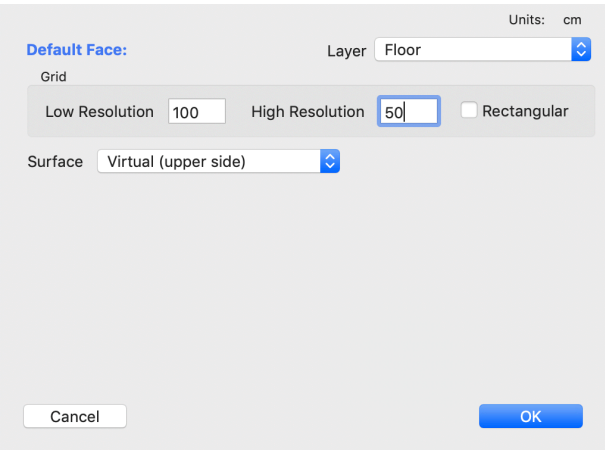
If no element is selected the user will be able to set the default parameters of the future entities to create.

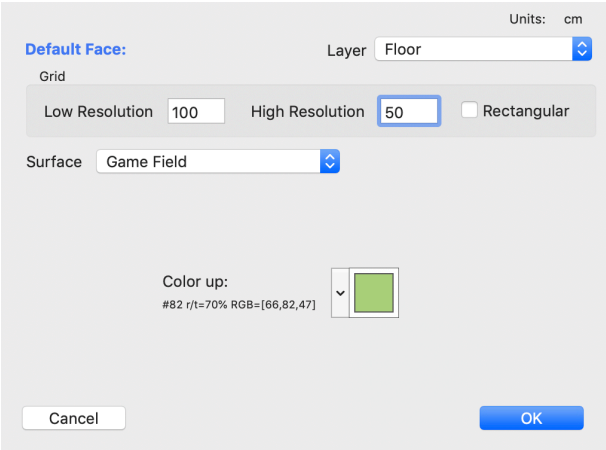
If only one element is selected the user can change its parameters, in the same way as through a contextual menu procedure.

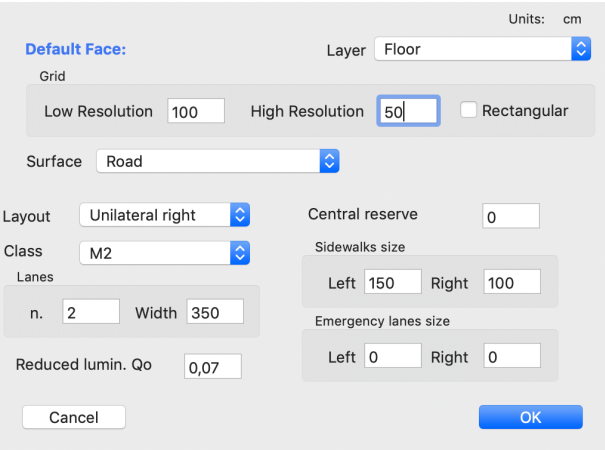
4.4.3.1. selection: Flat Surface

The item opens a dialog in which it is possible to control the characteristic parameters of the flat surfaces: if one is selected the user can change its parameters, with no selection the user can assign the default.









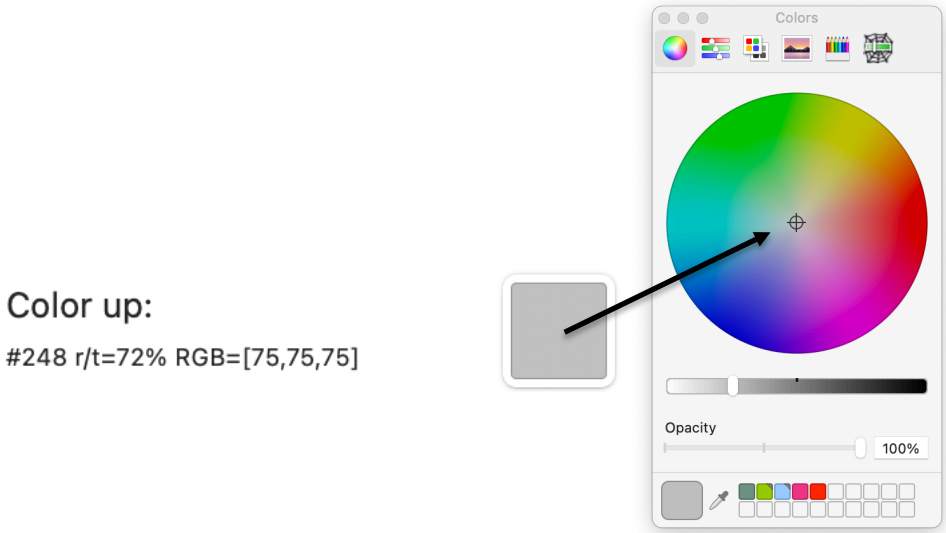
The dialog presents some field, following the type of surface:

- if one element is selected, an edit field to renumber the surface (see fig.1: 'Face No.');
- if one element is selected, a field displaying the number of vertex and the area of the surface (see fig.1: 'N=..., A=...');
- one pop-up menu for setting the layer to which the element belongs;
- two edit fields for defining local calculation grids;
- one button to make the internal grid rectangular: in this case the two 'Grid' edit field refers to the X-size and Y-size of the rectangular grid (for ex. EN13201 calculation);
- one pop-up menu 'Surface' to specify the kind of surface, that may be:
  - real;
  - virtual (side up means that the lighting flows on the local-UCS Z-positive side);
  - virtual (side down means that the lighting flows on the local-UCS Z-negative side);
  - road.
- one or two pop-up menus for setting colors and reflection coefficients of the element;
- one button 🔒/🔓 that permits to link or not the Color and the Texture'of the 'down' side to the one of the 'up' side (if the surface is defined as 'real');
- one or two check box to activate the texture mapping on the face sides (if the surface is defined as 'real');
- one or two pop-up menus for setting the Texture to apply to the 'down' and 'up' side of the element that allow the user to examine the images to be linked (if the surface is defined as 'real');
- one or two edit field to set the scale of the textures (if the surface is defined as 'real');

In case the 'road' type is selected through the 'Surface' pop-up menu, will be enabled:

- one pop-menu for selecting the layout type;
- one pop-menu for selecting the road-class;
- one edit field for defining the central reserve width;
- two edit fields to define the sidewalks width;
- one edit field to define the lane width;
- one edit field to define the number of lanes;
- one edit field to assign the reduced luminance coefficient q0 is different from the class standard;

Colors may be chosen through the standard Mac procedure



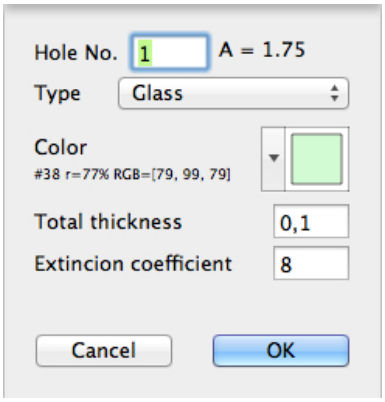
while in the dialogue is visible the current color with its number (ex. #248), its reflection coefficient (ex. r=72%) and its RGB components in % (ex. RGB { 75, 75, 75}).

Textures will be aligned with the x-axis of the face and will be scaled following the 'scale' parameter (Scale=1 map the texture on the whole face).

Finally, please, notice that textures are not involved in calculation, so the user has to match the colors of the face sides with each texture, as the fig.1 shows.

4.4.3.2. selection: OPENING

The item opens a dialog in which it is possible to control the characteristic parameters of the openings: if one is selected the user can change its parameters, with no selection the user can assign the default.



Are presents:

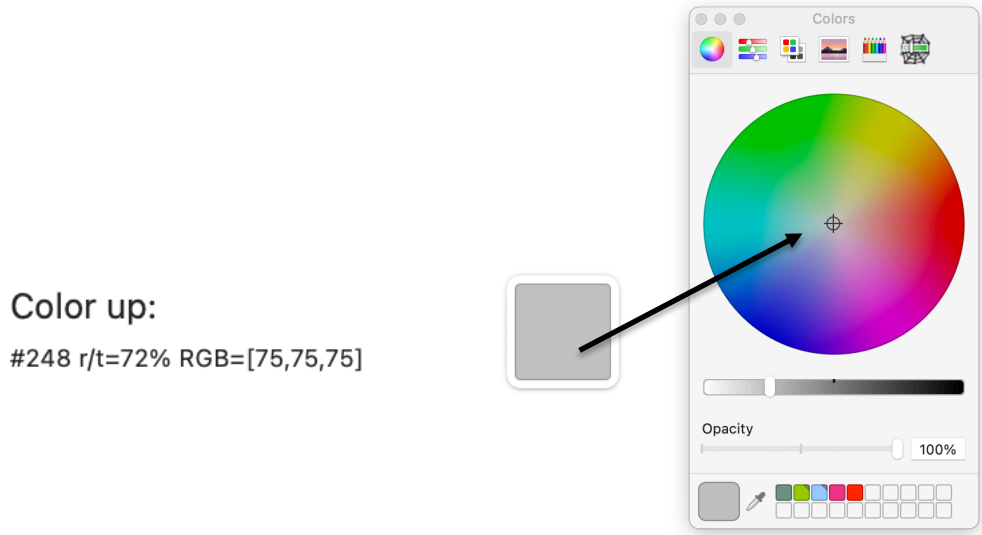
- an edit field to renumber the hole (if one is selected: Hole No. ...);
- a pop-up menu for selecting the type of the opening, that may be:
  - Empty, a simple hole in a wall;
  - Glass, a window type;
  - Opaque, to define in the surface a different color area, that always will follow the internal finite element grid;
  - Emissive, to define an emitting surface to simulate, for example, a shop window;
- an edit field (only "glass" type) for entering the value of the extinction coefficient K [m-1/ft-1] of the Bouguer Law, based on the assumption that the radiation absorbed by a glass is proportional to its intensity and to the path of the radiation inside the glass L/cosØ, with L=glass thickness:

$$\frac{I_{transmitted}}{I_{incident}} = EXP\left(-\frac{K \cdot L}{\cos Ø}\right)$$

The K coefficient may vary from approximately $4m^{-1}$ ($1{,}22ft^{-1}$) for “water white” glass (which appears white when viewed on the edge) to approximately $32m^{-1}$ ($9{,}75ft^{-1}$) for poor (greenish cast of edge) glass;

- an edit field containing the illuminament in lux of the emitting surface (only "emitting" type), that will spread light in Lambertian mode with the assigned color;
- an edit field for introducing the total thickness of the glass in millimeters (only "glass" type), computed without eventual cavities among glasses;
- a pop-up menu for selecting the color (not present for the "empty" type);

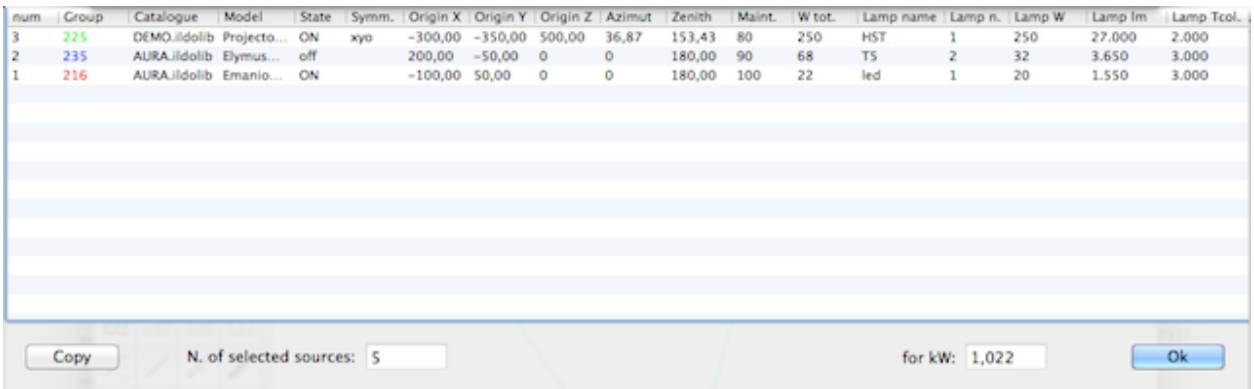
Colors may be chosen through the standard Mac procedure



while in the dialogue is visible the current color with its number (ex. #248), its reflection coefficient (ex. r=72%) and its RGB components in % (ex. RGB { 75, 75, 75}).

4.4.3.3. selection: LIGHTING SOURCE

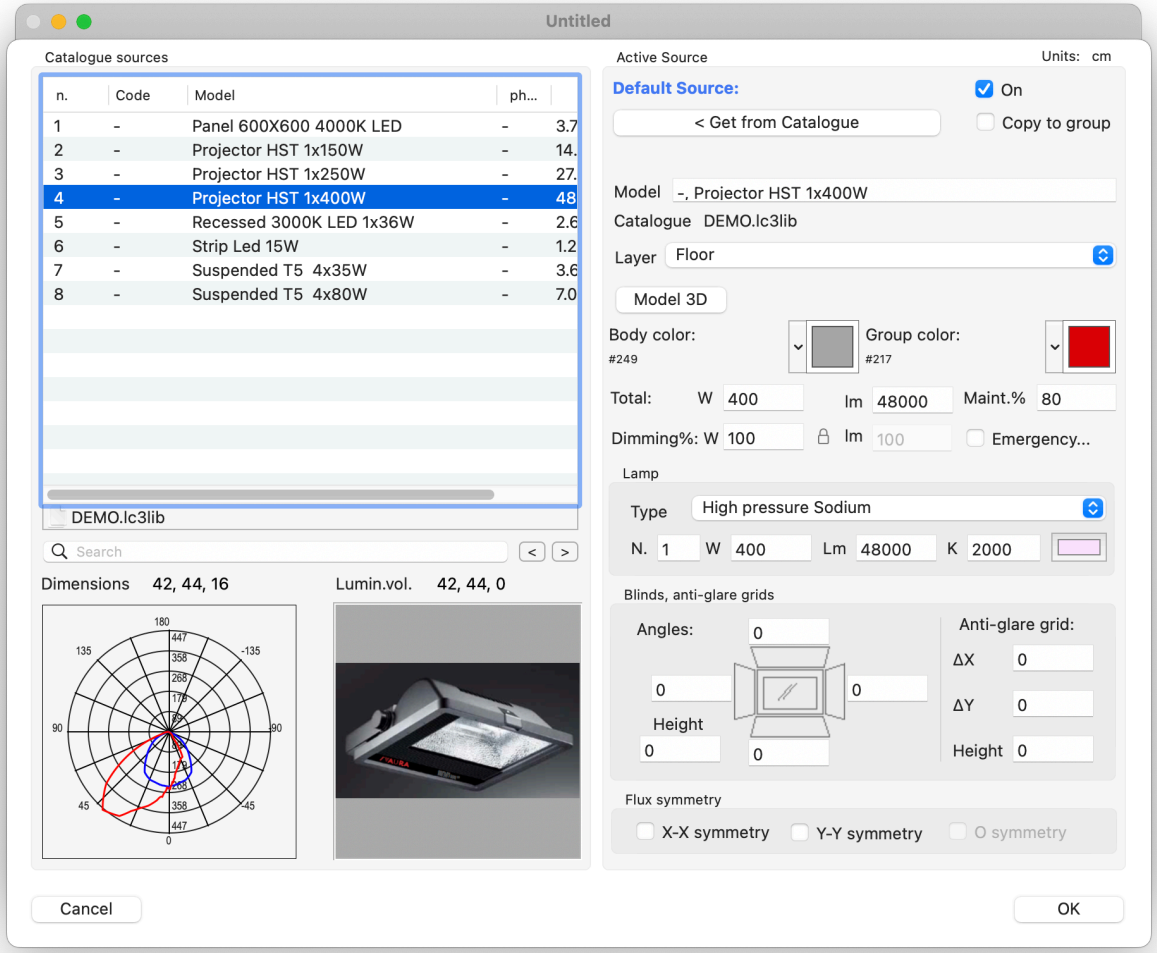
Selecting this item, if the selection contains more than one lighting source the application opens a dialog:



num	Group	Catalogue	Model	State	Symm.	Origin X	Origin Y	Origin Z	Azimut	Zenith	Maint.	W tot.	Lamp name	Lamp n.	Lamp W	Lamp lm	Lamp Tcol.
3	225	DEMO.ildolib	Projecto...	ON	xyo	-300,00	-350,00	500,00	36,87	153,43	80	250	HST	1	250	27.000	2.000
2	235	AURA.ildolib	Elymus...	off		200,00	-50,00	0	0	180,00	90	68	T5	2	32	3.650	3.000
1	216	AURA.ildolib	Emanio...	ON		-100,00	50,00	0	0	180,00	100	22	led	1	20	1.550	3.000

... in which a list of the source is presented, and the user can copy it and modify some parameters; double-clicking on the column header the whole column will be modified.

If only one source is selected the user can choose its characteristics, if no selection is done, the user can choose the default source:



In the dialog are presents two sections:

4.4.3.3.1. Catalogue sources section:

Contains:

- the list of the codes and the models of the luminaires in the open source catalogue in which, if present, is highlighted the selected luminaire; in the bottom of this list a button (with the name of the actual catalogue) to open another one;
- a 'search' edit field, to look for some text in the open catalogue; the dimension of the luminaire bounding box and the its luminous volume, that is the spatial encumbrance of the luminous zone of the luminaire;
- the photometry of the active luminaire in the list;
- the image of the active luminaire in the list.

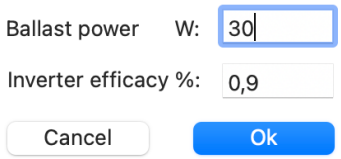
The user can copy a specified source name using a contextual menu ('ctrl'+click on a row).

4.4.3.3.2. Active Source section:

Contains:

- a button 'Get from Catalogue' to load the active luminaire in the list and assign it to the selected (or to the default) lighting source ;
- a 'Copy to group' check box to propagate the choice to the group of the selected source;
- an edit field "Source n." that permits to renumber the source in the project. (if a source is selected);

- a check button ("on") to include or exclude the source in the calculation;
- the position (in x,y,z coordinates) and the aiming (in azimuth, zenith values) of the selected source (if a source is selected);
- a 'Model' edit field that contain the name of the selected source (if a source is selected) or the name of the active source (if no source are selected);
- the name of the catalogue of the selected/active source;
- a pop-up menu to choose the layer to which the source belongs;
- a button '3D model' to link a DXF model to the selected source. The model to link will have origin and orientation according to Illuminando source Coordinate System;
- two pop-up menus for selecting the colors of the body and group of the lighting source;
- some edit field containing the total power in Watt installed in the lighting source (that is the sum of the power of the lamps, the ballast, ...), the maintenance factor (the cleaning level both of the luminaire and of the room in which it is installed: 0 = very dusty ... 100 = very clean), the dimming percentage in power (W) and in Lumen (linkable through the lock button);
- an "Emergency..." button, in witch it is possible to fix the emergency lighting values based on the installed ballast, following the next dialogue and formula:



$$L_{emerg} = \frac{L_{tot} \times W_{ballast}}{W_{tot} \times \varepsilon_{ballast}}$$

- *L = flux [lumen];*
- *W = power [watt];*
- *ε = efficacy [0-1].*

This section contains also three sub-sections:

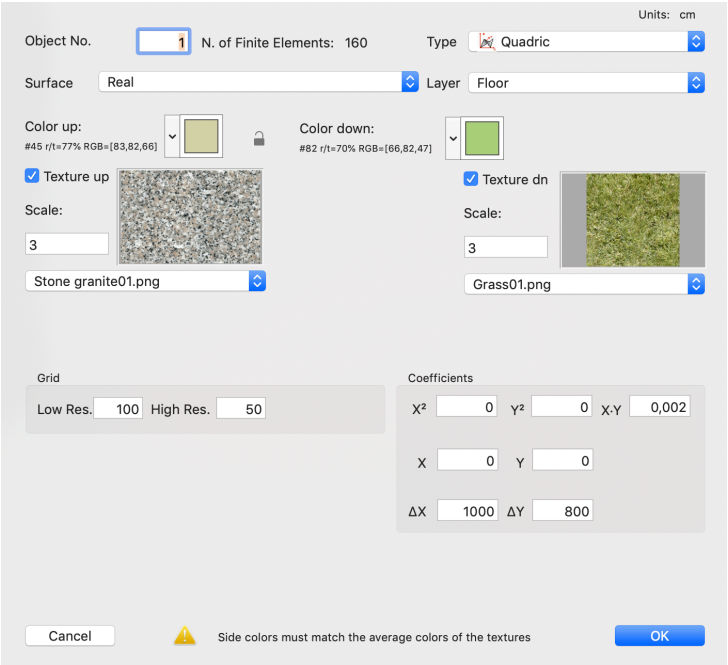
- Lamp sub-section: contains some fields showing the bulb installed in the lighting source and in particular, the number, the type (halogen, fluorescent, ...), the flux in lumen and power in Watt of each lamp, the correlated color temperature in Kelvin degrees and/or the color of the same lamp, selectable through the standard Macintosh Color Manager.
- Blinds, anti-glare grid sub-section: contains four edit field to choose the aiming angles of the side-shader and one edit field to fix the height of the side-shader and three edit fields to fix the xy-size and z-height of an anti-glare frontal grid. ;

Symmetric flux sub-section: contains three check box to make the source position and aiming symmetric along the X, the Y global axis and from the Origin (active only if X and Y symmetry both checked); see 0

- Sources symmetry section.

4.4.3.4. selection: OBJECT

Selecting this item, the Application opens a dialog in which the user can choose the object parameters: if one is selected the user can change its parameters, with no selection the user can assign the default.



Are present:

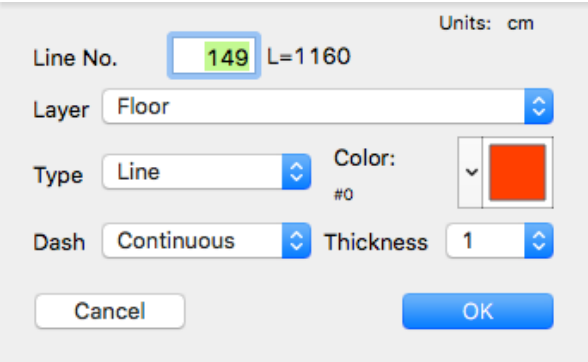
- the edit fields that may vary according to the element selected from the 'Type' pop up menu;
- one pop-up menu for setting the layer to which the element belongs;
- one pop-up menu for choosing the 'Surface' type (real or user);
- one (for user 'Surface' type) or two (for real 'Surface' type) pop-up menus for setting colors and reflection coefficients for both the element sides;
- one button 🔒/🔓 to link or not the color and texture of the back side to the one of the front side.
- one or two check box to activate the texture mapping on the face sides (if the surface is defined as 'real');
- one or two pop-up menus for setting the Texture to apply to the 'down' and 'up' side of the element that allow the user to examine the images to be linked (if the surface is defined as 'real');
- one or two edit field to set the scale of the textures (if the surface is defined as 'real').

Textures will be aligned with the x-axis of each finite element of the object and will be scaled following the 'scale' parameter (Scale=1 map the texture on the whole finite element).

Finally, please, notice that textures are not involved in calculation, so the user has to match the colors of the object sides with each texture, as the figure shows.

4.4.3.5. selection: LINE

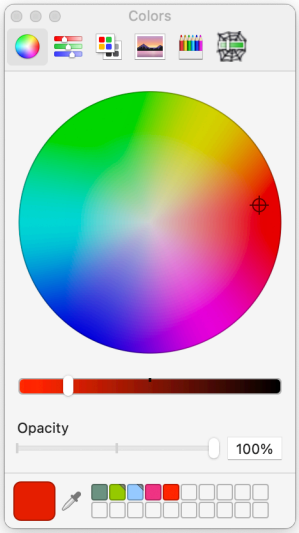
Selecting this item, the Application opens a dialog in which the user can choose the lines parameters if one is selected the user can change its parameters, with no selection the user can assign the default.



Are present:

- a field reporting the line number (possible to change) and its length (if a line is selected);
- a pop-up menu for setting the layer to which the element belongs;
- a pop-up menu to assign the type of line (simple line, wire, quote or road axis);
- a pop-up menu for setting the color of the element;
- a pop-up menu for setting the dash type of the element (not available for 'Quote' type);
- a pop-up menu for setting the thickness of the element (not available for 'Quote' type).

Colors may be chosen through the standard Mac procedure

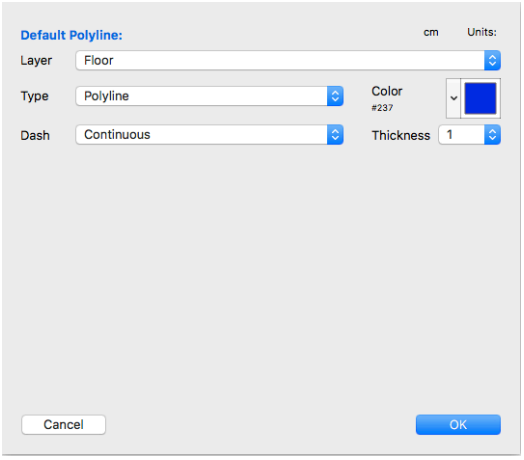


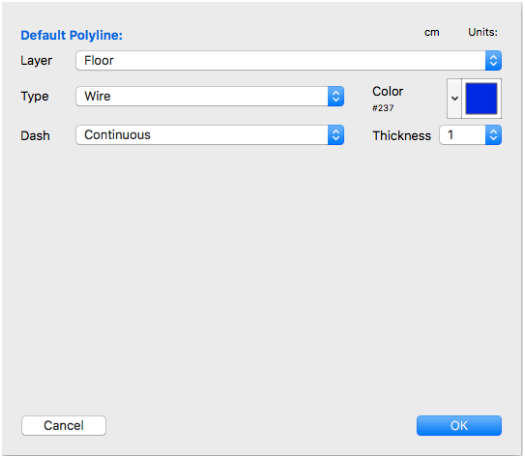
while in the dialogue is visible the current color with its number that assign the element to a group of wires.

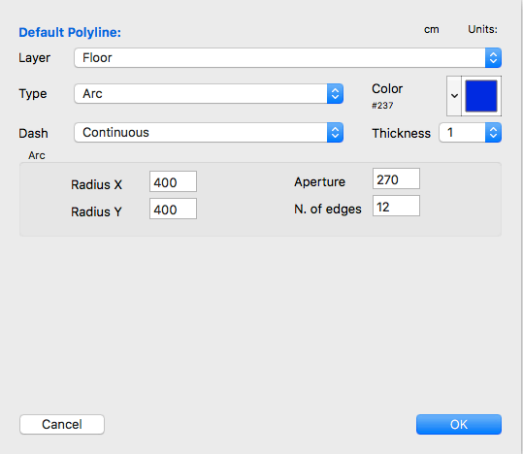
4.4.3.6. selection: POLYLINE

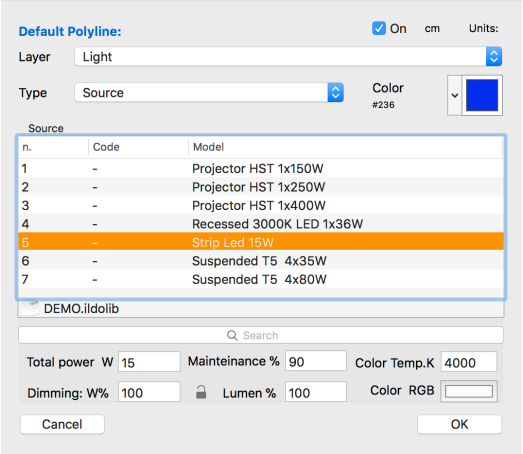
Selecting this item, the Application opens a dialog in which the user can choose the polylines and polygon parameters; if one is selected the user can change its parameters, with no selection the user can assign the default.

The dialogue will change according to the 'Type' pop-menu selection:







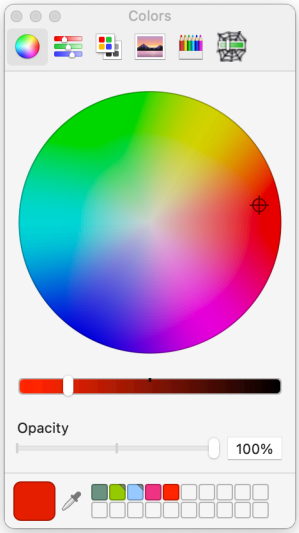


The dialogue presents:

- a field reporting the line number (possible to change) and its length (if a polyline is selected);
- a pop-up menu for setting the layer to which the element belongs;
- a pop-up menu to assign the type of line (simple polyline, wire, arc, source);
- a pop-up menu for setting the color of the element;
- a pop-up menu for setting the dash type of the element;
- a pop-up menu for setting the thickness of the element;
- if type-arc is selected, four edit fields to set the X and Y radius and the aperture in degrees of the enveloping circle and the number of edge to approximate the arc;
- if type-source is selected the element will be converted into a polyline-source, and a list of lighting source that will represent the 'specific' photometry of the linear source ([1]) will be shown: the user will also be able to choose the catalogue from the button under the list, to search a source name, to set total power, mainteinance factor, dimming values and color as color temperature or RGB with the special fields.

[1] *To use these kind of sources the user have to save the photometry as 'specific', per units of length (meter or inch)*

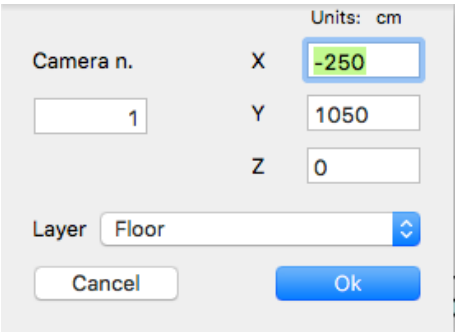
Colors may be chosen through the standard Mac procedure



while in the dialogue is visible the current color with its number that assign the element to a group of wires.

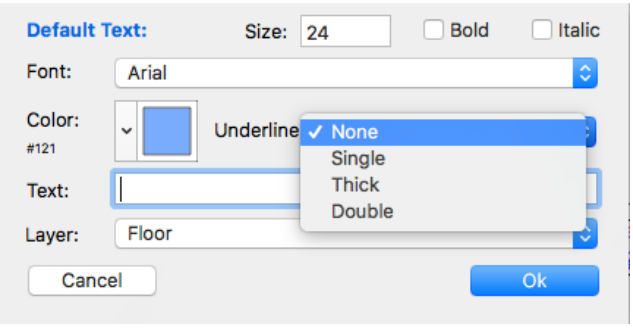
4.4.3.7. selection: CAMERA

A dialog is opened in which the user can edit the number, the position and the layer assigned to the selected observer:



4.4.3.8. selection: TEXT

Selecting this item, the Application opens a dialog in which the user can modify the format for the selected text object:



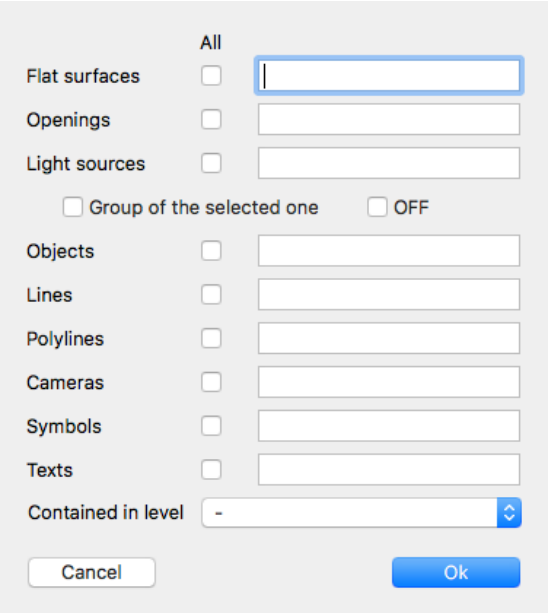
The user will be able to edit the string, to choose the height, bold and italic variations, the font, the underline type and the layer assigned to the text object.

4.4.4. Command: SELECT ALL

Select all entities in the drawing.

4.4.5. Command: SELECT SPECIAL...

Permits to create a new selection set, by choosing the elements to include by its number. The so created selection set may be added to an existent set or it is possible to add a new set to the one just created. In the filtering selection dialog...



...the selection of numerically contiguous elements goes on by a minus sign ('-'), while selecting uncontiguous elements goes on by a comma (',') separation (for example, if the user type '1-3' in the first field, and '1,5,8-21' in the third field, the Application will select flat surfaces from 1 to 3 and lighting sources 1, 5 and from 8 to 21).

It is possible to select all the element types checking the relative check-box.

If a lighting source is selected, it is also possible to select the whole group of sources of the selected one activating the relative button. Finally, it is possible to select all elements belonging to a certain layer.

4.4.6. Command: MOVE

The command is differently applied where the selected element is an opening or a complex selection set. In the latter case all the elements are moved: the Application asks to introduce the initial point of the movement that may occur in all directions in the space, it then asks for the final point.

If the user selects one (and only one) opening, the Application asks to introduce the first and the second point of the movement that can only be inside the boundary.

In the status line, the Application will prompt the user about the procedure to execute in the command.

4.4.7. Command: RESHAPE

The command is applied on a single selection in different modes following the selection of the element.

4.4.7.1. Flat Surface

Selecting the menu, the Application automatically brings the actual reference system onto the surface plane. It is possible to move a vertex simply by clicking on an existing one and moving it to a new position, which will be automatically projected onto the local XY of the same surface.

To add a new vertex just click on an edge of the surface and assign the position of the new vertex, which will automatically be projected onto the local XY of the same surface.

4.4.7.2. Opening

Selecting the menu the Application automatically brings the Actual Coordinate System onto the surface plan to which the opening belongs; It is possible to move a vertex inside the boundary of the owner flat surface simply by clicking onto an existing one and moving it to a new position, which will automatically be projected onto the Local XY plane of the same surface.

To add a new vertex just click onto an edge of the surface and assign the position of the new vertex inside the boundary of the owner flat surface, which will be automatically projected onto the Local XY plane of the same surface.

4.4.7.3. Lighting Source

For a standard source (not a polyline-source) it is possible to reassign:

- the position of the body;
- the pointing direction;
- the direction of the frontal axis;

...of the lighting source.

The procedure is identical for the three cases: it is enough to select the point to be modified and reassign the new position, controlling that the three points a), b) and c) after modification, will not be aligned.

For a polyline-source it is possible to reassign:

- the pointing of each segment: the user has to select the pointing to be modified and reassign the new position that will be adjusted by the Application to make it perpendicular to the segment;
- the shape of the polyline: the user has to convert the polyline-source in a simple polyline or arc, edit and it convert it again in a polyline-source.

4.4.7.4. Line

It is possible to move a vertex simply by clicking on an existing one and moving it to a new position.

4.4.7.5. Polyline

It is possible to move a vertex simply by clicking on an existing one and moving it to a new position.

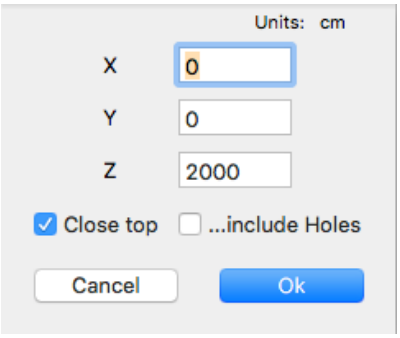
To add a new vertex just click on an edge of the surface and assign the position of the new vertex.

4.4.7.6. Text

It is possible to move a vertex simply by clicking on an existing one and moving it to a new position.

4.4.8. Command: EXTRUSION.../EXTRUDE

If no selection is present the Command permits to define the default extrusion parameters, while if the user has made a selection containing some lines, polylines, flat surfaces and openings the application will apply the command on them.



The openings will be extruded in the Local Coordinate System of the owner surface, while other elements will be extruded in the Active Coordinate System, following the selected parameters in the appropriate dialog on the right.

For the flat selected surfaces it is possible also to build the closing top faces including or not their holes.

4.4.9. Command: DELETE

Allows eliminating all the objects contained in the actual selection set.

4.4.10. Command: DUPLICATE

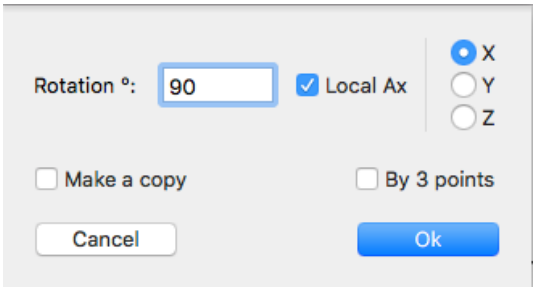
Allows creating a copy of all the objects contained in the actual selection set.

The Application asks to assign the origin point for duplication and the destination point for copying the group.

In the status line, the Application will prompt the user about the procedure to execute in the command.

4.4.11. Command: ROTATE

Allows rotating all of the objects contained in the actual selection set, creating, eventually, a copy following the next dialog:



In the status line, the Application will prompt the user about the procedure to execute in the command.

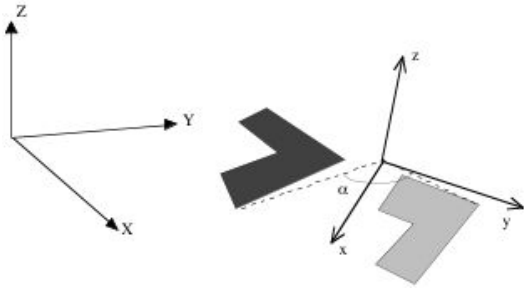
The rotation mode, with or without copy, will be of four types.

4.4.11.1. Rotation relative

Selecting one of the three buttons 'X local', 'Y local' or 'Z local' each element will rotate of the edited value along each local axis.

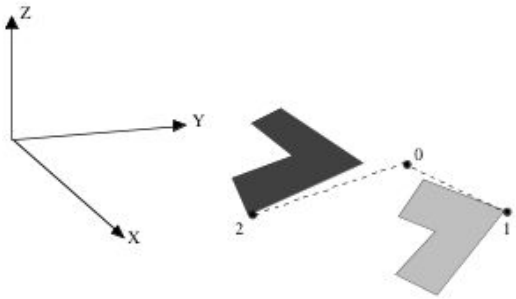
4.4.11.2. Rotation absolute

Just assign an angle rotation 'A' in the edit field, and the objects will be rotated by 'A', following the Z axis normal to the Active Coordinate System (red), whose XY plane is the rotation plane.



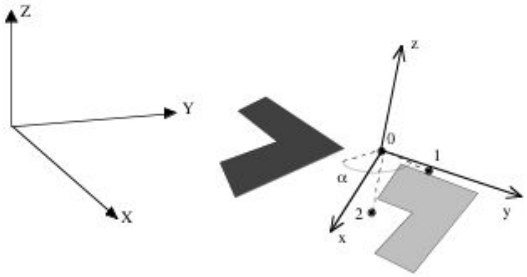
4.4.11.3. Rotation by three points

The Application asks to assign firstly the origin of the Z axis, normal to the rotation plane (point 0 in the figure), then the direction of the axis which will be the origin of rotation, (point 1 in the figure), and finally the final direction of rotation (point 2 in the figure), which, projected onto the rotation plane, describes the total angle of rotation.

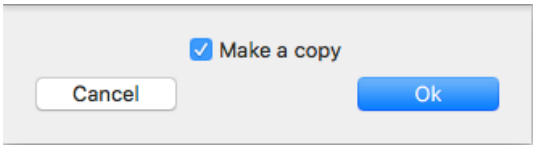


4.4.11.4. Rotation by three points with fixed angle

The procedure is identical to that by three points, except for the fact that total rotation "A" is assigned in the edit field.

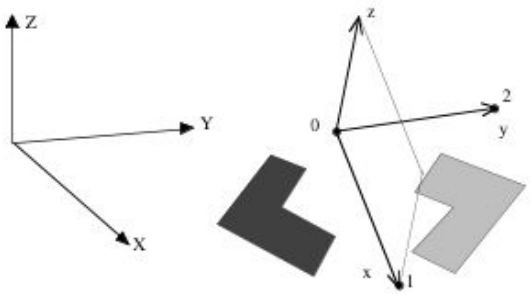


4.4.12. Command: MIRROR



Allows mirroring, with eventual copy, all of the objects of the selection set, respective to the XY plane of a Coordinate System defined by three points, as follows:

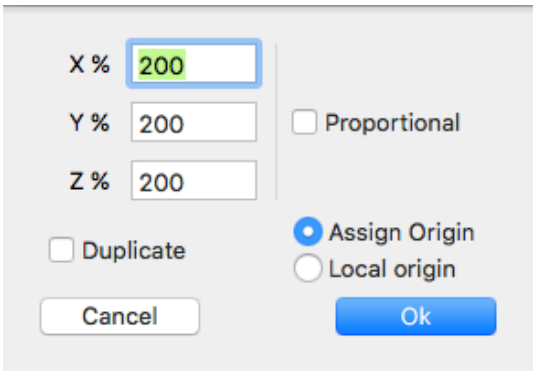
- the first point (point 0 in the figure) is the origin of the Temporary Coordinate System;
- the second point (point 1 in the figure) denotes the x axis of the mirror;
- the third point (point 2 in the figure) defines the normal y at the xz-plane of the mirror.



In the status line, the Application will prompt the user about the procedure to execute in the command.

4.4.13. Command: SCALE

Allows to scale, eventually copying, the selection set in percent at the actual dimensions; the Application asks for the point origin of the scale procedure, if the relative button is checked, otherwise the scaling will proceed for the origin of each selected element. The 'proportional' button permits an uniform scaling.



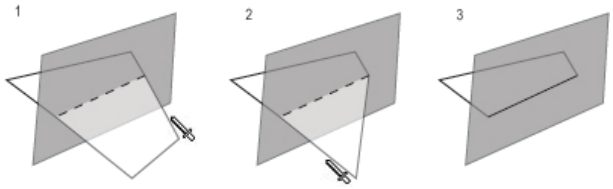
In the status line, the Application will prompt the user about the procedure to execute in the command.

4.4.14. Command: TRIM/EXTEND

The command permits:

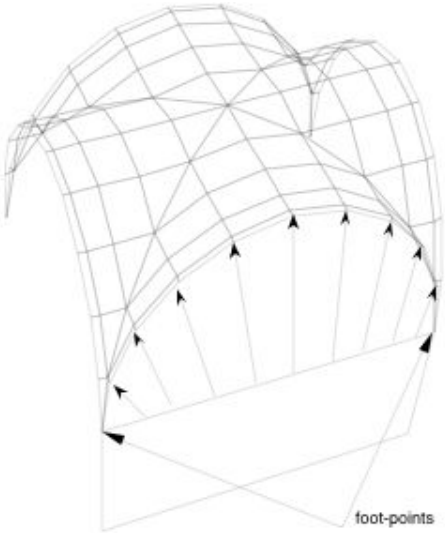
- selecting two lines: to cut or extend them.
- selecting one lines: to trim/extend lines or the external segment of the polylines. The procedure to trim lines and polylines is the following:
  1. select the line or the face on which cutting or extending (the menu highlight);
  2. choose the menu 'Modify' -> 'Trim/Extend';
  3. select the end of the line to cut or to extend. ;
  4. select the end of the line to cut or to extend;
  5. ...

- to trim faces to faces: the procedure is the following:
  1. select the face on which cutting or extending (the menu highlight);
  2. choose the menu 'Modify' -> 'Trim/Extend';
  3. select the end of the line or the edge of the face (near the vertex to move) to cut or to extend ;
  4. select the end of the line or the edge of the face (near the vertex to move) to cut or to extend;
  5. ...

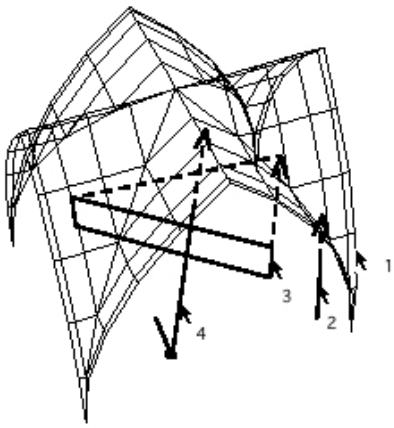


In gray the trimmer surface: the selected vertex will be moved along the edge on the dashed line that represent the intersection of the two faces. Autointersections are controlled.

- to build the 'under-roof' walls: the procedure is the following:
  1. build the under-roof walls with two consecutive points coincident to the 'foot-points' of the object;
  2. select the object and the walls to extend;
  3. select the 'Trim/Extend' command from the menu.



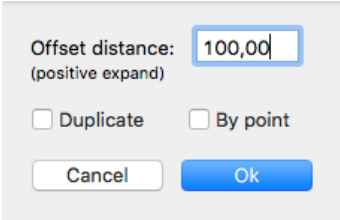
- to trim/extend lines, polylines or edge of flat surfaces on object. An example on the next figure containing the click sequence (1 = trimming object) and the effects on a line (2), the edge of a flat surface (3) and a source aiming (4):



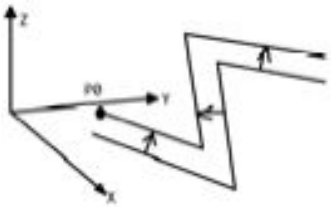
4.4.15. Command: OFFSET

Permits the creation of a parallel-copy of a flat surface, a line or a flat polyline.

The Application ask for an offset distance, positive if the original surface will be enlarged:



The button 'duplicate' if checked permits to leave the original surface and copy the offset one.



4.4.16. Command: EXPLODE

Permits to convert:

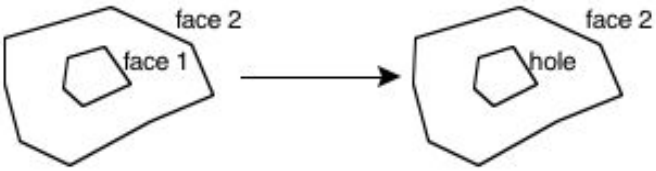
- objects into flat surfaces;
- flat surfaces into polylines;
- polylines into single lines.

Select the objects to explode and run the command.

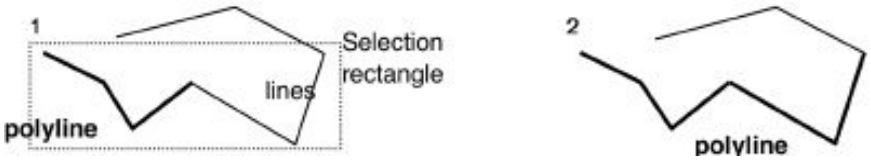
4.4.17. Command: JOIN

Following the selection:

- if two flat surfaces are selected, the command permits to transform the one contained in the other to an hole, empty if the color of the original face is 255, or opaque of the same color of the original face in the other case:



- if faces are not contained une in the other, or selecting more than two faces a new object will be created: the faces will be the Finite Elements of the new object on condition that the face have less than 4 points, otherwise the face wil be not added.
- if only one line is selected, it will be converted in a 3-points polyline, adding the original line middle point;
- if are selected line and/or polylines, the command permits to join more connected lines between them or to an existing and selected polyline:



The user must start from two connected lines or from a polyline and some lines. Selecting only one planar polyline, the next command 'Join' will create a flat surface.

- Selecting two or more objects it is possible to create e new object given by the sum of all the finite elements: the new object wil be no more parametric. The new Finite Elements will keep the color

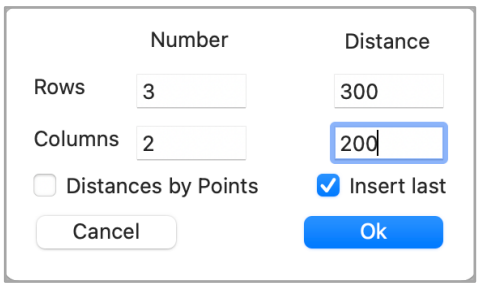
of the original object: to discard these colors it is possible to select the command 4.4.21.1.3 Finite Elements Reset.

4.4.18. Sub-menu: ARRAY

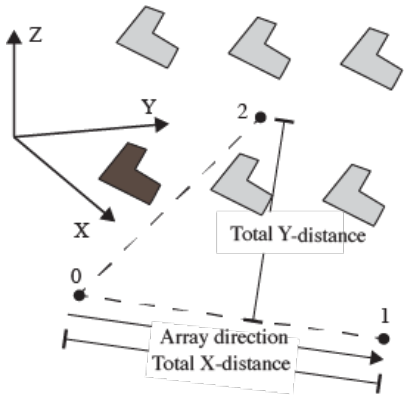
From this menu, it is possible to make multiple copy of a selection set.

4.4.18.1. Command: RECTANGULAR

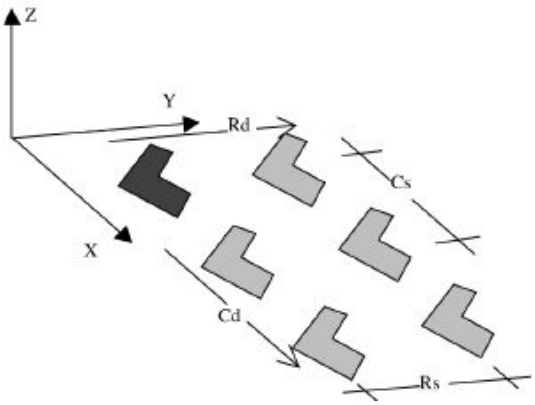
In the actual Coordinate System, a rectangular array of 'Rows Number' x 'Column Number' will be executed at regular intervals.



Checking the '...by Points' box the user will be able to define with 3 mouse clicks (0, 1 and 2 in the next figure) the direction of the array and the total distances, following the drawing:



In this case the 'Total X-distance' will be divided for the 'Column Number' value, and the 'Total Y-distance' will be divided for the 'Row Number' value to obtain the array steps. If the box '...by Points' is no checked the distances between rows and between columns will be assigned from the fields 'Rows Distance' and 'Columns Distance' according to the following scheme:



In this case rows direction will be that one of the local X-axis.

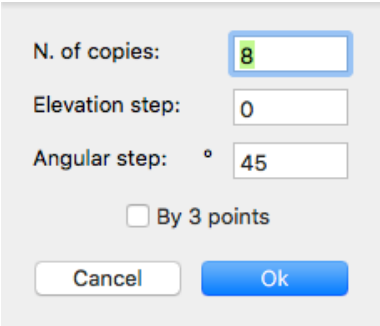
- Rd = row direction;
- Rs = row step distance;
- Cd = column direction;

- Cs = column step distance.

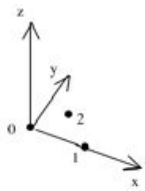
The 'Insert last' check-box permits to add or not the last row and column.

4.4.18.2. Command: POLAR

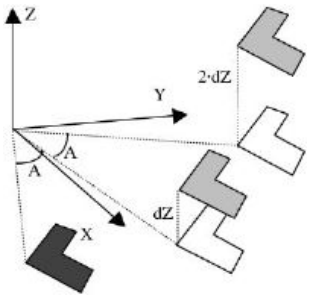
In the actual Coordinate System, a polar array will be executed at regular angle intervals, eventually with a vertical translation relative to the rotation plan.



Once filled the fields, choosing 'Ok' the Application will execute the polar array relative to the actual Coordinate System, while choosing the button '3 points...' the copy will be executed relative to a temporary Coordinate System that the user will assign by three points: the Application asks the position of the new origin (point 0 in figure), the direction of the new local X axis (point 1 in figure) and the side of the positive Y semi plan (point 2 in figure):

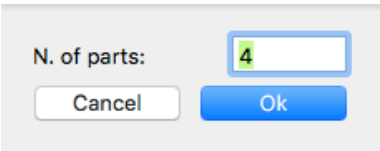


The procedure will follow the next scheme (A = angular step, dZ = elevation step):



4.4.19. Command: DIVIDE

Is useful to divide the selected lines in so many parts how much indicated in the edit field:



4.4.20. Command: RANDOMIZE COLORS

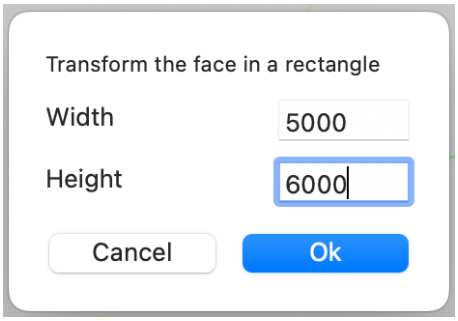
Selecting faces and/or objects, with this command it is possible to automatically assign them a random color (useful to customize book in a library, dresses in a stand...).

4.4.21. Command: OTHER...

4.4.21.1. FACES:

4.4.21.1.1. Command: RECTANGULARIZE...

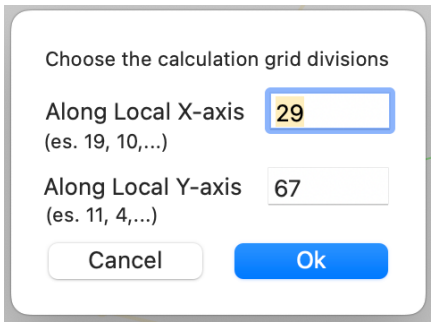
Permits to reshape the selected face as a rectangular one, of width and height given through the following dialogue:



...and the 'width' direction following the local X-axis.

4.4.21.1.2. Command: SET GRID

Permits to divide the selected surface in a fixed number of finite elements, determining the rectangular dimension of each of them as the ratio [surface X-size]/[n.of elememts along X-axis] and [surface Y-size]/[n.of elememts along Y-axis]



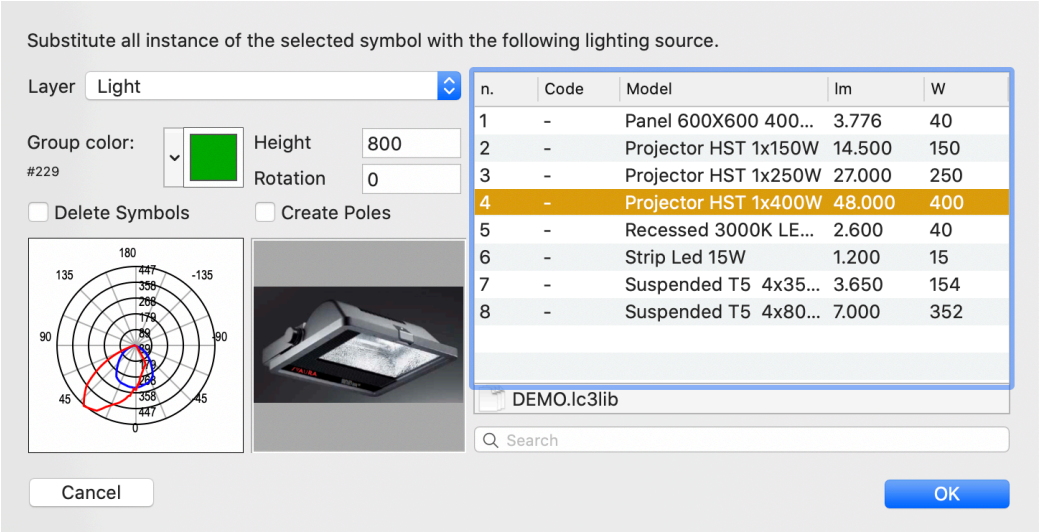
4.4.21.1.3. Command: AIMING SURFACE

Selecting one flat surface, this will be used as a trimming/extending surface for all the light source pointing.

4.4.21.2. SOURCES:

4.4.21.2.1. Command: SYMBOL TO SOURCE

Selecting a symbol imported from a DXF file, is possible to insert for each instances of that symbol a luminous source, with the options defined by the following dialogue:

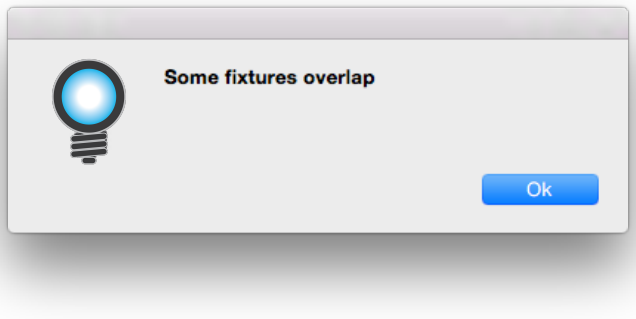


...in which it is possible:

- to open another source catalogue (button under the list 'n./Model');
- to select the lighting source from the active catalogue (list 'n./Model');
- to search for a specific model in the list ('Search' edit field);
- to set layer in which all the sources will be insert (pop-menu 'Layer');
- to set the common group for all the sources to insert through the color box or the edit field ('Group color');
- to set the common height for all the sources to insert (edit field 'Height');
- to set the pointing-ax rotation for all the lighting sources to insert (edit field 'Rotation');
- to delete all symbols at the end of the procedure;
- to add a pole for each fixture.

4.4.21.2.2. Command: CHECK OVERLAPPING

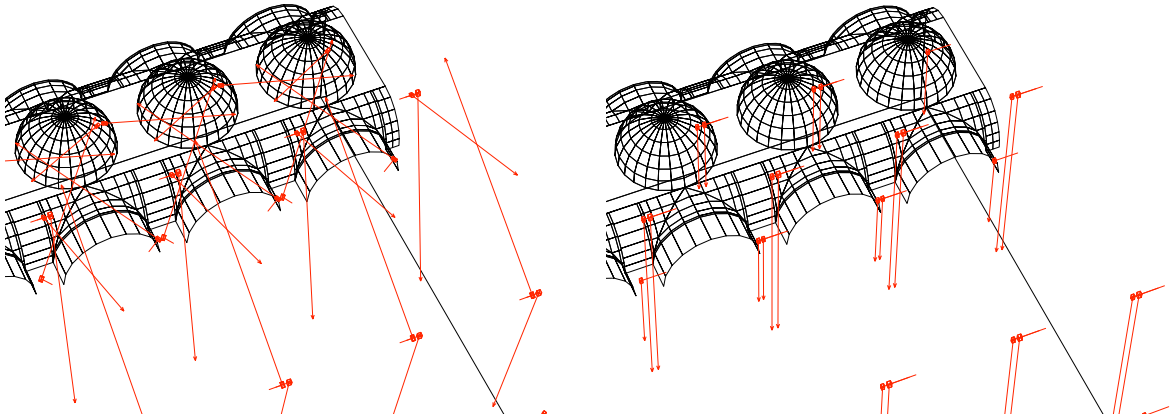
The comman is useful to find doubled lighting sources (sources with the same position and pointing) to avoid calculation error. In case of doubled sources the application prompt:



...and select the doubled elements.

4.4.21.2.3. Command: RESET AIMING

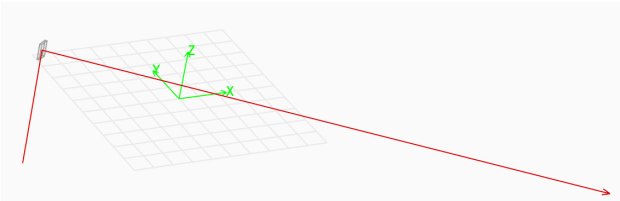
This command permits to reset pointing to global negative Z-axis and pointing rotation to global positive X-axis, following the next figure:



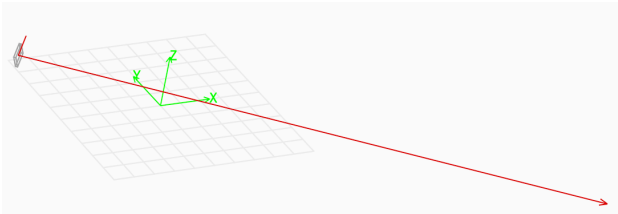
4.4.21.2.4. Command: VERTICALIZE X-AXIS

Permits to reshape in vertical the x-axis of the selected sources, following the next figures:

Before the command…



After the command…

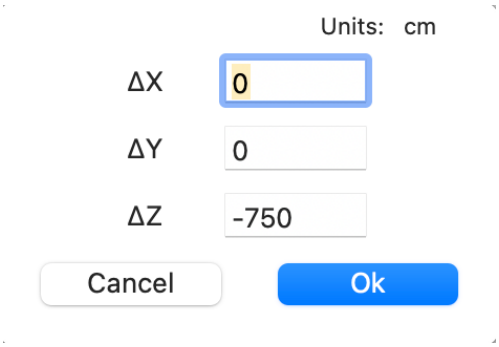


4.4.21.2.5. Command: RESET DIMMING

Permits to reset to 100% both the W and Lm dimming of the selected sources.

4.4.21.2.6. Command: MOVE SOURCE ORIGIN

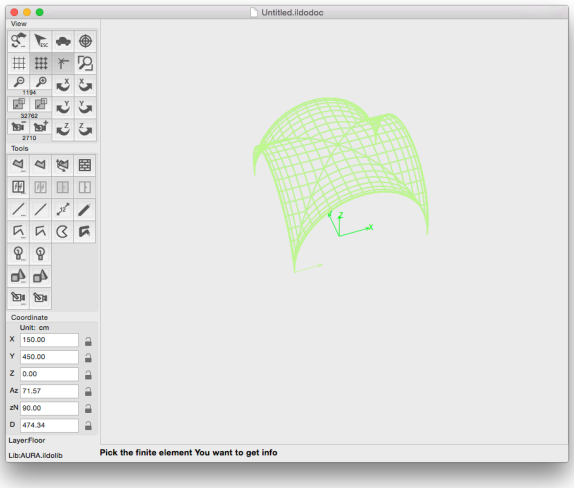
This command permits to make relative displacements of the source position, whitout changing aiming point and x-axis direction of it:



4.4.21.1. OBJECTS:

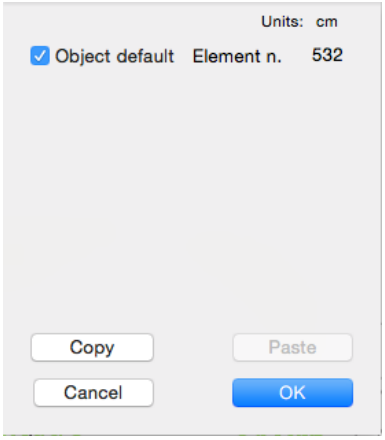
4.4.21.1.1. Finite Element Info

This command is active once the user has selected an object: it permits to modify the characteristics of some finite element of this object. Selecting the object and then the command, the application ask to pick the finite element to modify:

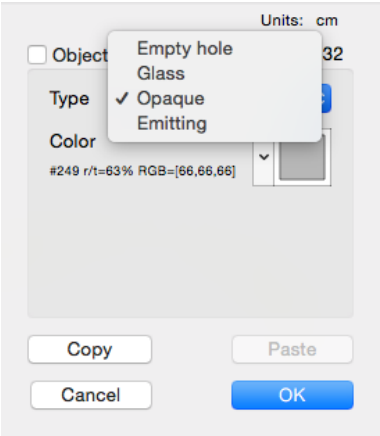


Picking follows the standard procedure: simple-click select the first Finite Element, ⇧(shift)-click permits to highlight one by one all elements founded under the click. Once presented the right one a simple-click permits to confirm it as selection, and the Finite Element Info dialogue opens displaying:

...the parameters as the object default (box checked)



...the parameters to assign (box unchecked)

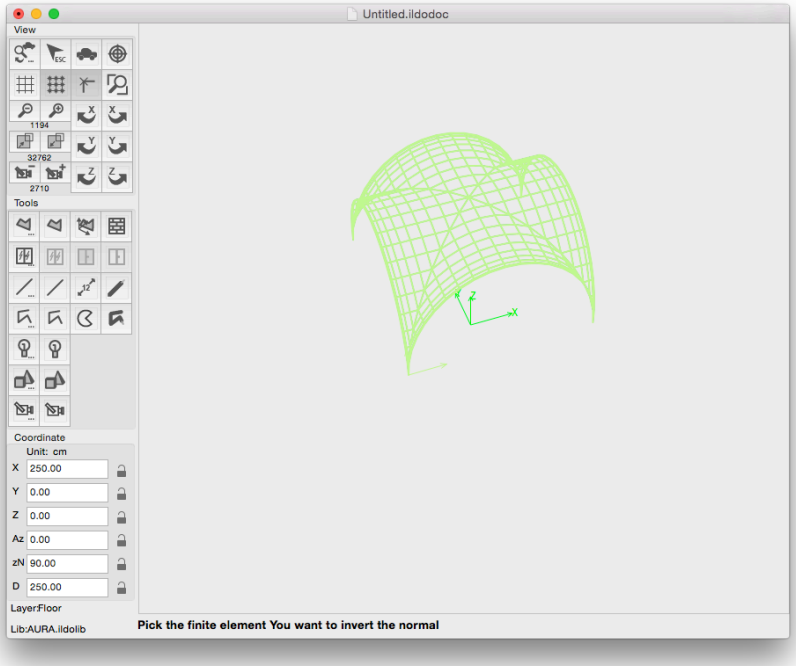


It is possible to transform the selected Finite Element in a hole with all its characteristics (see 4.4.3.2 selection: OPENING) and to copy'the selected parameters (button 'Copy') for pasting them to other Finite Elements to select later (button 'Paste'). The application continue asking for another Finite Element: to end the command the user has to press the 'ESC' key.

If the Scele Kit window (see § 3.2 Scene Kit window) is opened it will be updated following this dialogue. WARNING: all modification will be lost modifying the object parameters or changing the calculation resolution (from the 'High resolution' command).

4.4.21.1.2. Finite Element Invert Normal

This command is active once the user has selected an object: it permits to invert the orientation of some finite element of this object. Selecting the object and then the command, the application ask to pick the finite element to invert its normal:



Picking follows the standard procedure: simple-click select the first Finite Element, ⇧(shift)-click permits to highlight one by one all elements founded under the click. Once presented the right one a simple-click permits to confirm it as selection and the application display in the command line its internal number and continue asking for another Finite Element: to end the command the user has to press the 'ESC' key.

If the Scele Kit window (see § 3.2 Scene Kit window) is opened it will be updated following this dialogue.

4.4.21.1.3. Finite Elements Reset

Permits to discard all the particular characteristics previous saved through the 4.4.21.1.1 Finite Element Info paragraph for the single finite element in the selected object.

4.4.21.2. ALL ELEMENTS:

4.4.21.2.1. Command: ASSIGN AS DEFAULT

Assign the parameters of selected element as default.

4.4.21.2.2. Command: ASSIGN TO CURRENT LAYER

Assign to the current layer the selected elements.

4.4.22. Command: CUT

Works only in the selected edit field, in the standard Macintosh mode.

4.4.23. Command: COPY

If an edit-field is selected the command works in the standard Macintosh mode.

With the main view actived (by clicking on it, no edit field selected) the procedure is different if there is present or not a selection set:

- if no element has been selected the content of the view will be inserted into the clipboard in PDF: this allows to transfer information between Brotens software and the other programs;
- if one element is selected, the application will copy into the clipboard the element parameters enabling to transfer them through the paste command applied to a selection set;

- if more than one element is selected, they will be copied into the clipboard for pasting them afterward.

4.4.24. Command: PASTE

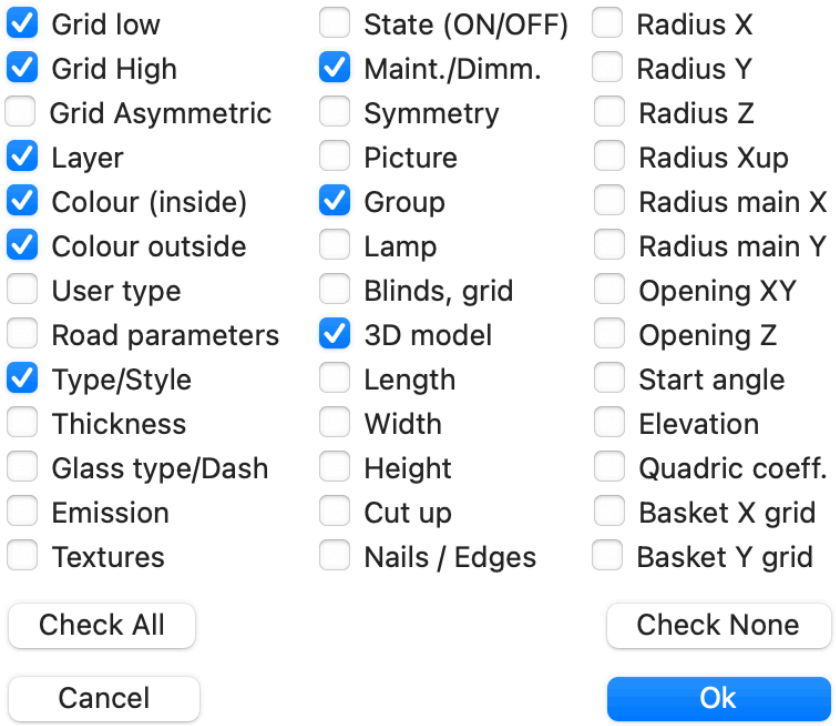
If the clipbord contains parameter to transfer (see previous paragraph) the command permits to transfer those parameters flagged in the 'Paste Special' dialog from a source-element to a destination-selection set.

The destination group may be also formed by objects of different type than the source-element: the Application recognizes the attributes to paste among heterogeneous elements (example: colors among flat surfaces, objects, lines and lighting sources) and permits to transfer them.

If the clipboard contains Brotens elements from a previous 'copy' command, they will be inserted in the model in the active User Coordinate System.

4.4.25. Command: PASTE SPECIAL...

The Application permits to choose data to transfer before pasting them to the selection set (see the figure):



A dialog is shown, in which the user will be able to select those parameters to transfer in the next paste operation.

Checking the relative button, the Application will remember to 'paste' to the destination-set the selected parameter.

Two other buttons permit to select or unselect all check boxes.

4.5. Menu Coordinate

The menu permits to enter the Active Coordinate System modification section. The triad of the Global Coordinate System is always visible in green color: if the Active System is the Global one, the "Global" item will be marked with "√"; if the Active System is a Local Coordinate System of an element in the scene, the "Local" item will be marked; in the other cases both the menus will be unmarked.

4.5.1. Command: LOCAL

For a selection set built with a single element of type Plan, Opening, Lighting source or Object, it is possible to attach the Active Coordinate System to the local one of the selected element. Switching from the Global System to a Local System is highlighted by a mark "√" in the menu and by the presence of the red triad in the visualized space.

4.5.2. Command: GLOBAL

It is always possible to make the Active one the Global Coordinate System; the Application puts a mark "√" in this menu item and eliminates the red triad from the video.

4.5.3. Command: LOCAL ON THE FLY

Permits to switch from the active to another Local Coordinate System of the element pointed my the mouse, without selecting it. The command is useful, for example, to switch to another Coordinate System while aiming a source.

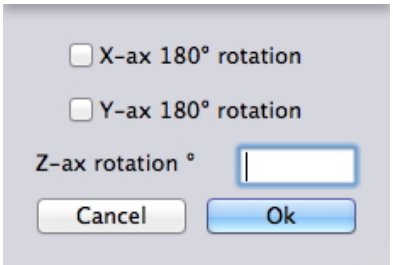
4.5.4. Command: MODIFY

The command may be used in two different modes, in the case where there is active a Local Coordinate System of a Flat Surface or not.

4.5.4.1. Is active the Local System of a Flat Surface

This is case in which a single element is selected end the user chooses the command "User" from the menu "Coordinates".

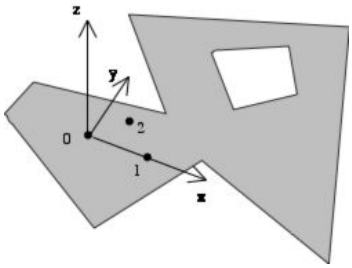
The Application presents a dialog for modifying the Local Coordinate System of the element, in which it is possible to rotate end eventually to move the System only on the plan of the same Surface:



For a Flat surface the System may be:

- rotated on a generic angle around the Z axis of the local Coordinate System (or Systems);
- rotated 180° around the local X axis (inverting the positive semi-space viewed from the surface);
- rotated 180° around the local Y axis (inverting the positive semi-space viewed from the surface).

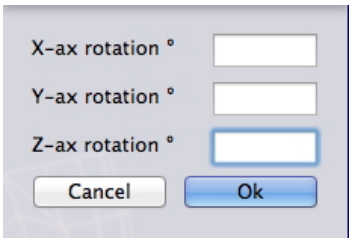
In this last case the Application asks the position of the new origin (point 0 in figure), the direction of the new local X axis (point 1 in figure) and the side of the positive Y semi plan (point 2 in figure):



In every moment, during the introduction of the three points needed to assign the position and orientation of the new Coordinate System in the space, it is possible to execute a mouse double click: in this case the orientation procedure will be stopped, and the new Coordinate System is simply translated to the first introduced point.

4.5.4.2. *Is active a generic Coordinate System*

The Application presents a dialog to modify the Active Coordinate System:



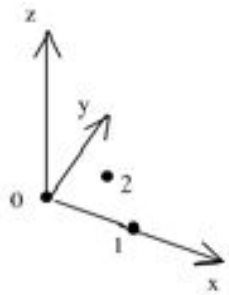
The System may be:

- rotated on a generic angle around a generic axis;

In the last case, the Application asks for the position of the new origin, the direction of the new X axis and the side of the semi plan of the positive Y, similar to the previous paragraph.

4.5.5. Command: BY 3 POINTS...

Permits to reach quickly the procedure to reassign the Coordinate System by three points: the Application asks the position of the new origin (point 0 in figure), the direction of the new local X axis (point 1 in figure) and the side of the positive Y semi plan (point 2 in figure):



4.5.6. Command: ROTATE X

Permits to reach quickly the procedure to rotate of 180° along the X-axis of the Coordinate System; if it is active the Local Coordinate System of a face or a polyline-source, the rotation will be of 90°. Pressing ⌥(option) key while choosing the command the rotation will be done in the opposite side.

4.5.7. Command: ROTATE Y

Permits to reach quickly the procedure to rotate of 180°along the Y-axis of the Coordinate System; if it is active the Local Coordinate System of a face, the rotation will be of 90°. Pressing ⌥(option) key while choosing the command the rotation will be done in the opposite side.

4.5.8. Command: ROTATE Z

Permits to reach quickly the procedure to rotate along Z-axis the Coordinate System (also for the Local Coordinate System of a face) that will always be of 90°. Pressing ⌥(option) key while choosing the command the rotation will be done in the opposite side.

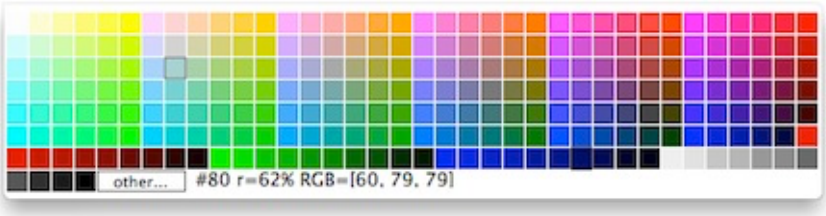
4.5.9. Command: ASSIGN NEW ORIGIN

The command works differently if some flat surfaces are selected or not: in the first case the software will automatically move the origin of the selected faces each in the barycenter of their points, otherwise the user will be prompted to introduce a point that will be the new global origin.

4.6. Menu Options

4.6.1. Command: COLORS

Colors, always based on 256 tones, are presented in a palette like the following one:

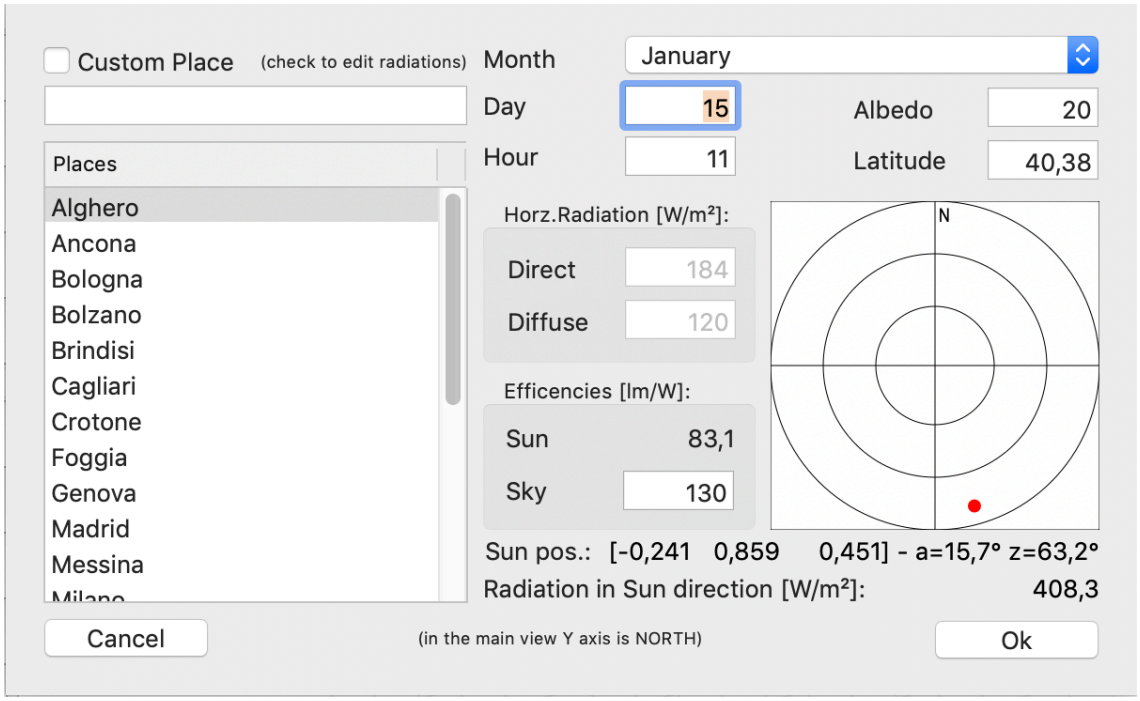


in which is visible the original color (blue framed) and the active color (black framed) with its number (ex. #80), its reflection coefficient (ex. r=62%) and its RGB components in % (ex. RGB { 60, 79, 79 }).

The 'other' field permits to assign the color through the standard Mac dialogue. If there is a selection set, choosing a color from the palette the user will assign that color to all the object of the selection to both the side of the surface. Sources will be assigned to the relative color group. Without selection it is possible to assign the color for the background of the window.

4.6.2. Command: PLACE...

This command assigns the place and the hour of the lighting simulation through a dialog:



Selecting the reference city, the Application suggests the latitude and the direct and diffuse radiation on an horizontal plane: all of these values may be modified once the 'Custom Place' box will be checked.

Other parameters assigned are the month, the day and the hour of the simulation and the albedo (medium reflectivity of the external ambient). Introducing the values, the user will be able to check the Sun position in the sky: the Application will update the polar diagram near the button with the new position.

4.6.3. Command: EDIT PLACES...

The command opens the 'cities' database, a text file with tabulations. The Application simulates the radiation function as symmetrical curves, being the hour 12:00 on the symmetry axis: to explain, radiation at 11:00 'o clock is equal to 13:00, that one at 10:00 'o clock is equal to 14:00, and so on:

city #1 name					
city #1 latitude					
January					
I_{direct}(h12:00)	I_{direct}(h13:00)	I_{direct}(h14:00)	I_{direct}(h15:00)	...	I_{direct}(h ##:##)
$I_{diffuse}$(h12:00)	$I_{diffuse}$(h13:00)	$I_{diffuse}$(h14:00)	$I_{diffuse}$(h15:00)	...	$I_{diffuse}$(h ##:##)
February					
...					
city #2 name					
city #2 latitude					
...					

For every cities it is necessary to input the following fields, where with I_{direct}(h ##:##) e $I_{diffuse}$(h ##:##) are indicated the direct and diffuse radiation [W/m^2] on the horizontal plane at hour x.

4.6.4. Command: HIGH RESOLUTION

The command permits the regeneration of the whole project alternatively with large and small grids for every element. The "High Resolution" mode is highlighted in the menu item. The Application informs, before to confirm the operation, that may be onerous in terms of calculation timing.

4.6.5. Command: REMOVE UNUSED POINTS

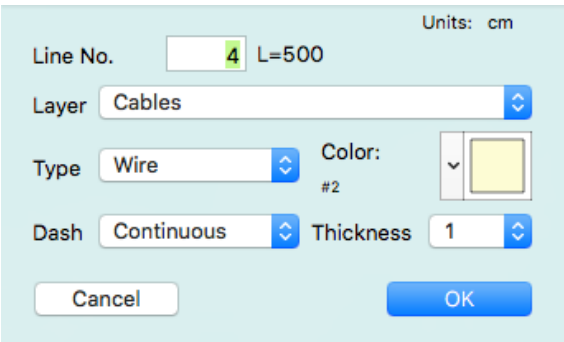
The Application executes an internal database check, deleting redundant information and entities.

4.6.6. Command: OPTIMIZE WIRES

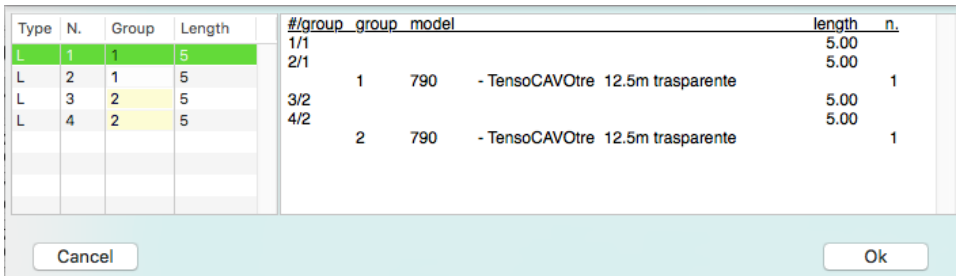
This procedure permits to optimize cable length, if in the project are present lines or polylines defined as wires.

Optimization is based on the standard cable lengths saved in the 'Wires.txt' file described in the 5.11 Appendix D: "Wires.txt" file structure.

Using the color field as a group in the line/polyline info dialogue:



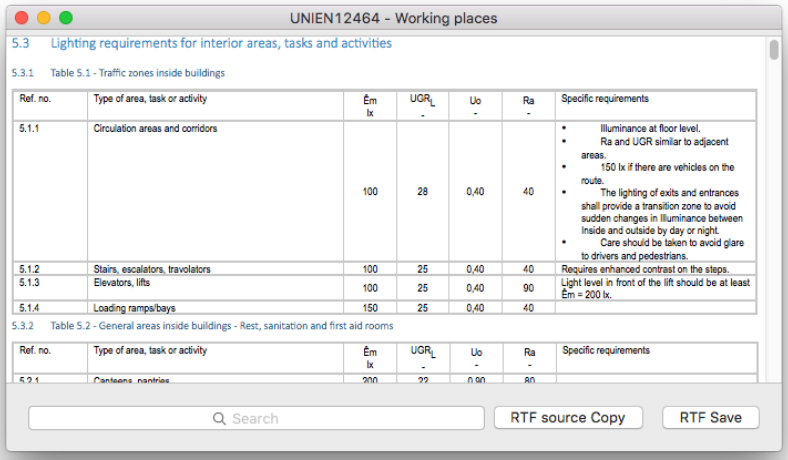
the user can choose the reel assignement for each wire, then selecting the command the application presents the wires optimization dialogue:



Modifying the values in the 'Group' column and pressing 'return' the user is able to examine the actual wires-cutting optimization.

4.6.7. Command: UNI 11248 - EN 13201 ROAD CLASSIFICATION

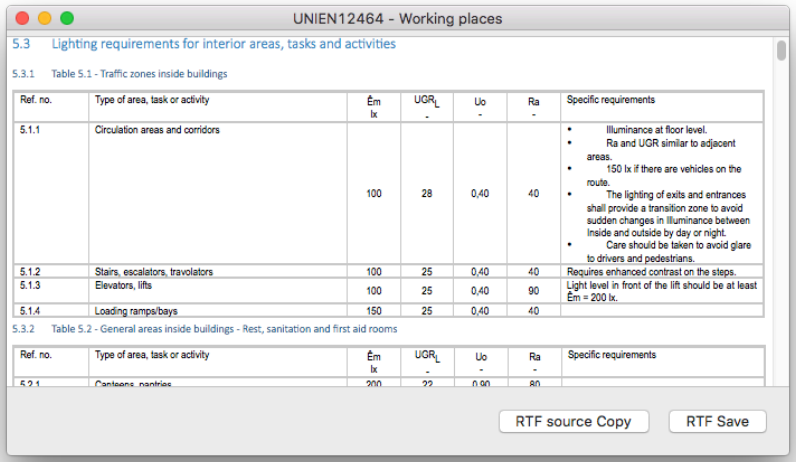
Selecting this command the applicatione present the UNI 11248 - EN 13201 tables:



...and it is possible to 'Search' for a text (typing 'return' the application find the next recurrence of the inserted string), to 'Copy' the document as an RTF source or 'Save' it in RTF.

4.6.8. Command: UNI EN12464 WORKING PLACES

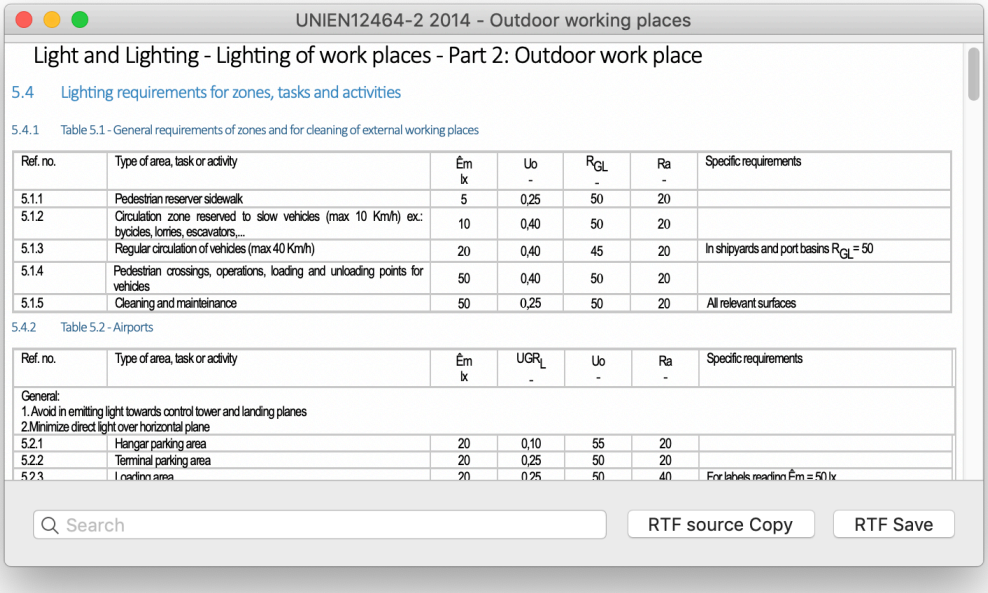
Selecting this command the applicatione present the UNI EN 12464 tables:



...and it is possible to copy the document as an RTF source or save it in RTF.

4.6.9. Command: UNI EN12464-2 2014 OUTDOOR WORKING PLACES

Selecting this command the applicatione present the UNI EN 12464-2 2014 tables:



Light and Lighting - Lighting of work places - Part 2: Outdoor work place

5.4 Lighting requirements for zones, tasks and activities

5.4.1 Table 5.1 - General requirements of zones and for cleaning of external working places

Ref. no.	Type of area, task or activity	Êm lx	Uo -	R_{GL} -	Ra -	Specific requirements
5.1.1	Pedestrian reserver sidewalk	5	0,25	50	20	
5.1.2	Circulation zone reserved to slow vehicles (max 10 Km/h) ex.: bycicles, lorries, escavators,...	10	0,40	50	20	
5.1.3	Regular circulation of vehicles (max 40 Km/h)	20	0,40	45	20	In shipyards and port basins R_{GL} = 50
5.1.4	Pedestrian crossings, operations, loading and unloading points for vehicles	50	0,40	50	20	
5.1.5	Cleaning and mainteinance	50	0,25	50	20	All relevant surfaces

5.4.2 Table 5.2 - Airports

Ref. no.	Type of area, task or activity	Êm lx	UGR_L -	Uo -	Ra -	Specific requirements
General: 1. Avoid in emitting light towards control tower and landing planes 2.Minimize direct light over horizontal plane						
5.2.1	Hangar parking area	20	0,10	55	20	
5.2.2	Terminal parking area	20	0,25	50	20	
5.2.3	Loading area	20	0,25	50	40	For labels reading Êm = 50 lx

...and it is possible to copy the document as an RTF source or save it in RTF.

4.6.10. Command: UNI EN12193 & SPORT

Selecting this command the applicatione present the UNI EN 12193 and other rules tables:

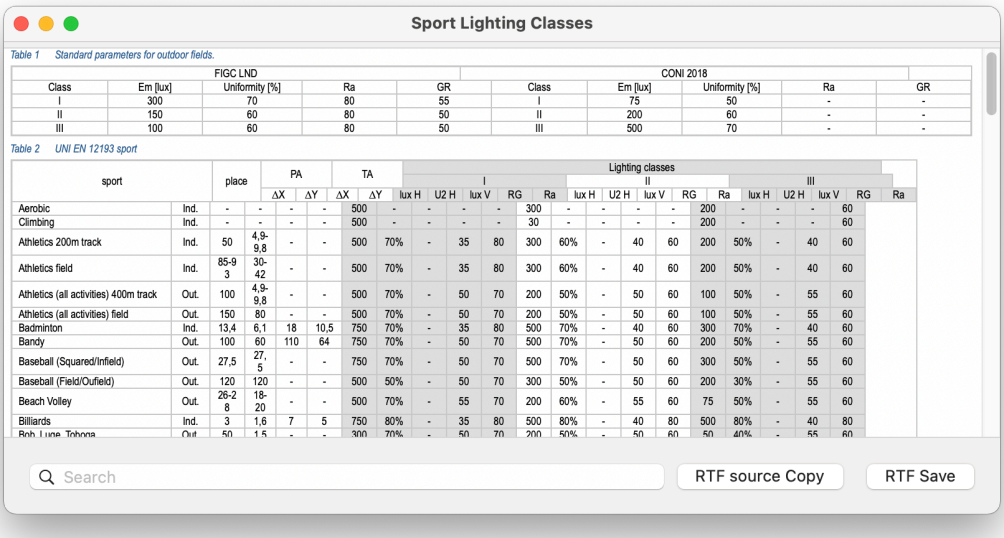


Table 1 Standard parameters for outdoor fields.

FIGC LND					CONI 2018				
Class	Em [lux]	Uniformity [%]	Ra	GR	Class	Em [lux]	Uniformity [%]	Ra	GR
I	300	70	80	55	I	75	50	-	-
II	150	60	80	50	II	200	60	-	-
III	100	60	80	50	III	500	70	-	-

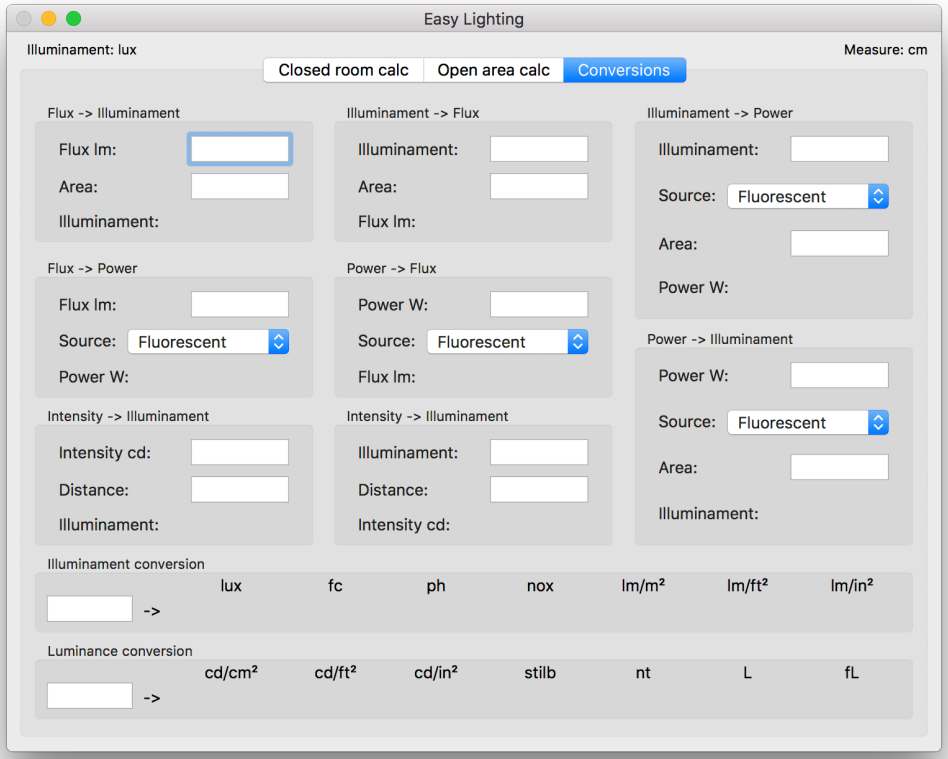
Table 2 UNI EN 12193 sport

sport		place	PA		TA		Lighting classes														
							I					II					III				
			ΔX	ΔY	ΔX	ΔY	lux H	U2 H	lux V	RG	Ra	lux H	U2 H	lux V	RG	Ra	lux H	U2 H	lux V	RG	Ra
Aerobic	Ind.	-	-	-	-	500	-	-	-	-	300	-	-	-	-	200	-	-	-	60	
Climbing	Ind.	-	-	-	-	500	-	-	-	-	30	-	-	-	-	200	-	-	-	60	
Athletics 200m track	Ind.	50	4,9-9,8	-	-	500	70%	-	35	80	300	60%	-	40	60	200	50%	-	40	60	
Athletics field	Ind.	85-93	30-42	-	-	500	70%	-	35	80	300	60%	-	40	60	200	50%	-	40	60	
Athletics (all activities) 400m track	Out.	100	4,9-9,8	-	-	500	70%	-	50	70	200	50%	-	50	60	100	50%	-	55	60	
Athletics (all activities) field	Out.	150	80	-	-	500	70%	-	50	70	200	50%	-	50	60	100	50%	-	55	60	
Badminton	Ind.	13,4	6,1	18	10,5	750	70%	-	35	80	500	70%	-	40	60	300	70%	-	40	60	
Bandy	Out.	100	60	110	64	750	70%	-	50	70	500	70%	-	50	60	200	50%	-	55	60	
Baseball (Squared/Infield)	Out.	27,5	27,5	-	-	750	70%	-	50	70	500	70%	-	50	60	300	50%	-	55	60	
Baseball (Field/Oufield)	Out.	120	120	-	-	500	50%	-	50	70	300	50%	-	50	60	200	30%	-	55	60	
Beach Volley	Out.	26-28	18-20	-	-	500	70%	-	55	70	200	60%	-	55	60	75	50%	-	55	60	
Billiards	Ind.	3	1,6	7	5	750	80%	-	35	80	500	80%	-	40	80	500	80%	-	40	80	
Bob, Luge, Tobogg	Out.	50	1,5	-	-	300	70%	-	50	70	200	50%	-	50	60	50	40%	-	55	60	

...and it is possible to copy the document as an RTF source or save it in RTF.

4.6.1. Command: CONVERSIONS

EasyLighting presents in the third tab of the window a tool that permits to resolve some lightig conversion: the use is trivial, and are present both direct and inverse solutions:



Symbols in the following paragraphs are relative to:

E .....Illuminant

Ø ..... Flux

I ..... Intensity

P .....Power

η .....Luminous Efficency

A.....Area

D.....Distance

4.6.1.1. *Flux ⇒ Illuminant*

$$E = \frac{Ø}{A}$$

4.6.1.2. *Illuminant ⇒ Flux*

$$Ø = E \cdot A$$

4.6.1.3. *Flux ⇒ Power*

$$P = \frac{Ø}{\eta}$$

4.6.1.4. Power ⇒ Flux

$$\emptyset = \eta \cdot P$$

4.6.1.5. Intensity ⇒ Illuminament

$$E = \frac{I}{D^2}$$

4.6.1.6. Illuminament ⇒ Intensity

$$I = E \cdot D^2$$

4.6.1.7. Illuminament ⇒ Power

$$P = \frac{E \cdot A}{\eta}$$

4.6.1.8. Power ⇒ Illuminament

$$E = \frac{P \cdot \eta}{A}$$

4.6.1.9. Illuminament conversion

The application allow to convert illuminament values from the actual units to other units.

4.6.1.10. Luminance conversion

The application allow to convert luminance values from the actual units to other units.

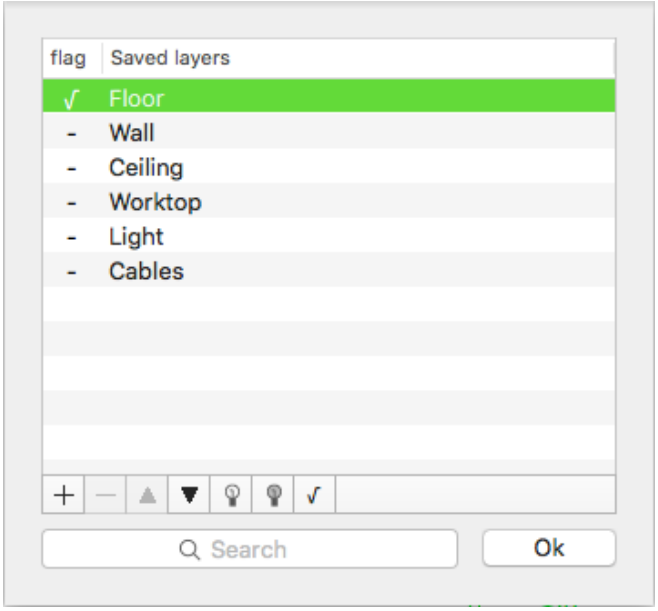
4.7. Menu Layers

From this menu the user can show/hide or make active layers (virtual spaces in which elements are drawn). Layers are a powerful working tool, because they can simplify the scene, temporarily hiding unimportant parts, deleting whole groups of objects and allowing the user to include or exclude from the calculation other objects.

To make a layer the active one simply select it in the menu list, while to show or hide a single layer the user has to select the item while holding down the ⌥(option) key.

4.7.1. Command: SETTINGS...

Permits to manage layers:



It is possible:

- to add a new layer (button +);
- to delete selected layers (button −): the user will be prompted to delete all the elements contained in these layers;
- to bring layer upward in the list (button ▲);
- to bring layer downward in the list (button ▼);
- to show the selected layers (button): the layer will be flagged with a '-' sign;
- to hide the selected layers (button): the layer will be unflagged;
- to make the active one the selected layer (button √): the layer will be flagged with a '√' sign;
- to select all layers whose name contains the text edited in the search field.

4.8. Menu View

4.8.1. Command: RENDERING

Will be opened a new window for the current document in SceneKit mode: the way to navigate within the model is different than the 'normal' mode, and it is called the 'virtual sphere' mode.

The alternate selection of the command marks with '√' and unmark the item.

For the management of this window refer to § 3.2Scene Kit window Scene Kit window.

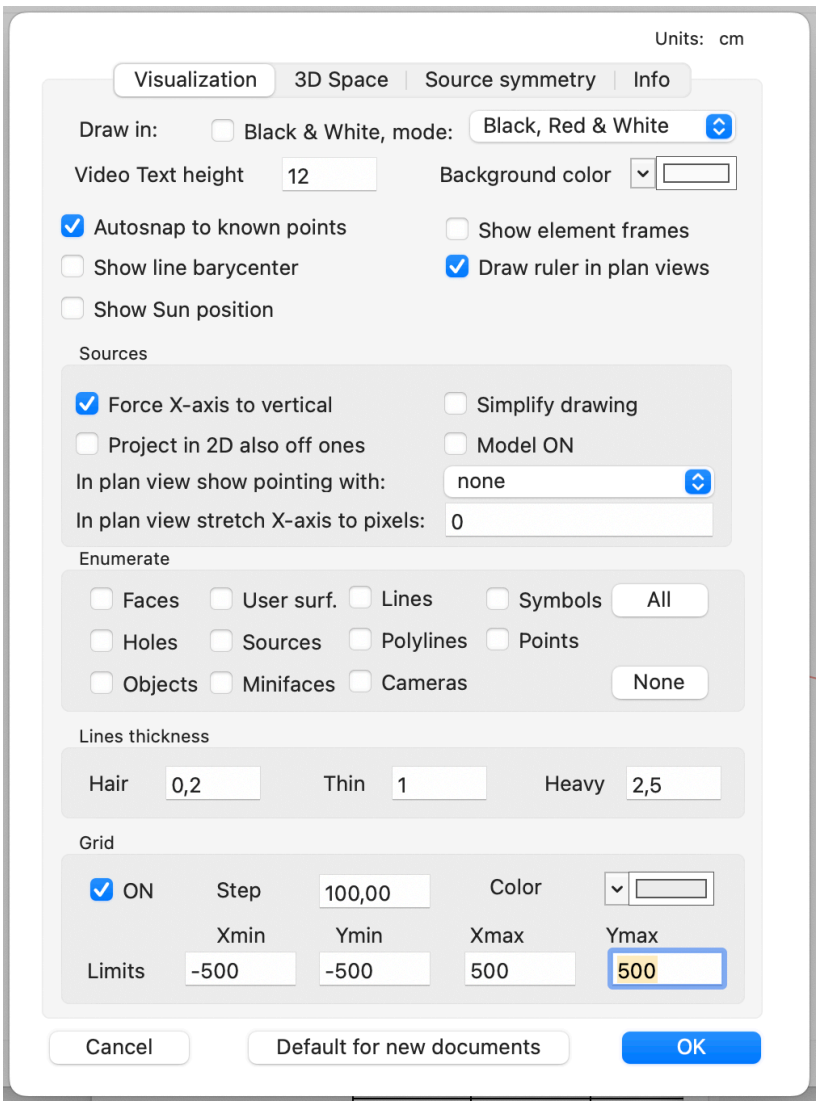
.

4.8.2. Command: VIEW SETTINGS...

The command opens a dialogue that allows the user to modify some parameters of the active document and eventually saving them as default (button 'Default for new documents): it is divided into four tabs:.

4.8.2.1. Visualization section

The section permits to manage some general parameter of the document:

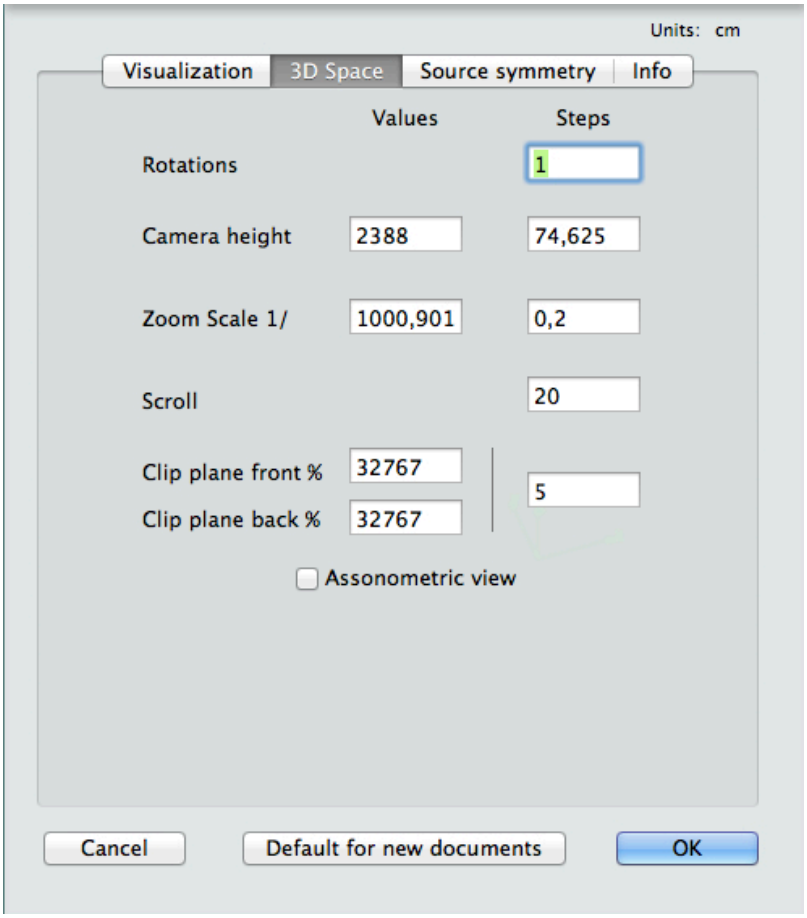


- to view the scene in black and white mode or in black-red-white mode;
- to select the text height in the screen;
- to select the background color;
- in plan view, to show sources pointing coordinates or angles or none;

- in plan view, for those source with no zenital tilt, to stretch their X-axis to a fixed length;
- to work in auto-snap to known points in creating or modifying element sessions;
- to show the line barycenter, for an easy snap to them;
- to project in 2D view also the shut-off lighting sources;
- to show the finite-element frames in the 2D views;
- to simplify sources shape as a circle for faster navigation;
- to draw the real shape of the fixtures (if thay are linked to a 3D dxf file);
- to show the Sun position (in scale).
- to enumerate elements, points,...
- to choose the thickness of the line with which Illuminando renders the scene;
- to define the virtual grid color, divisions, limits and visualization.

4.8.2.2. 3D Space section

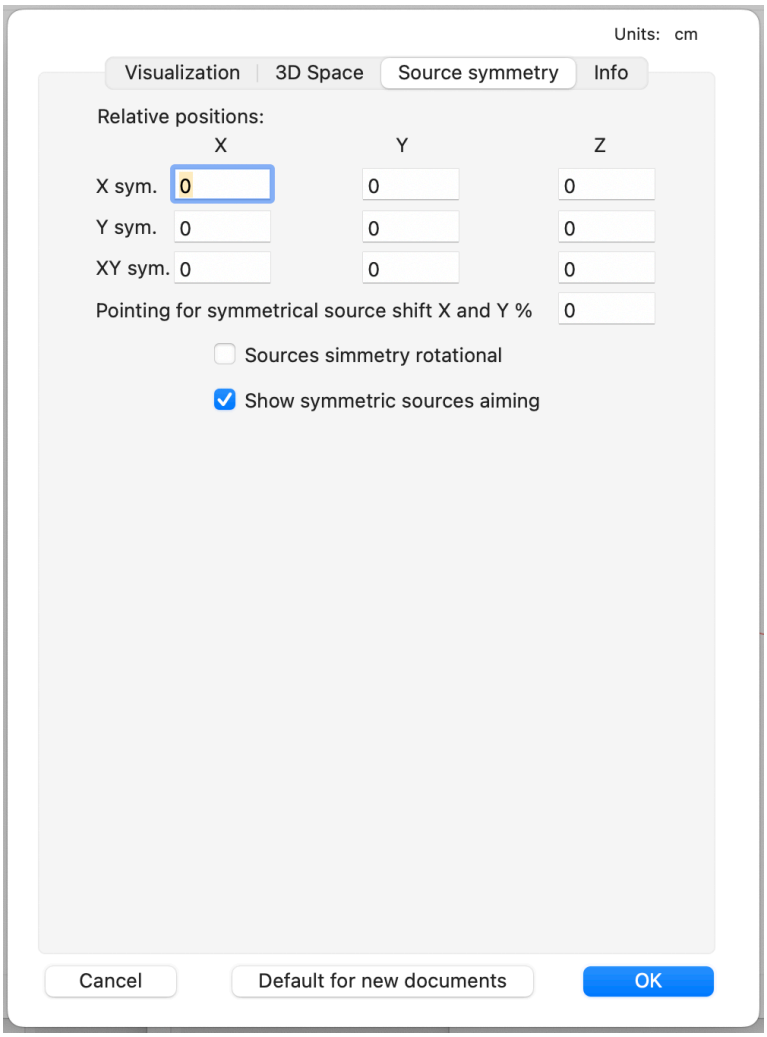
The section permits the setting of the tridimensional visualization parameters:



- values and steps for every movement of the view (rotations, zoom, camera, scroll);
- switch between assonometric /perspective view.

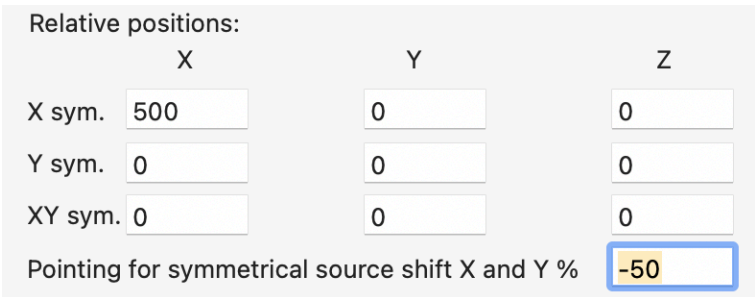
4.8.2.3. Sources symmetry section

This section permits to manage sources symmetry options:



and in particular:

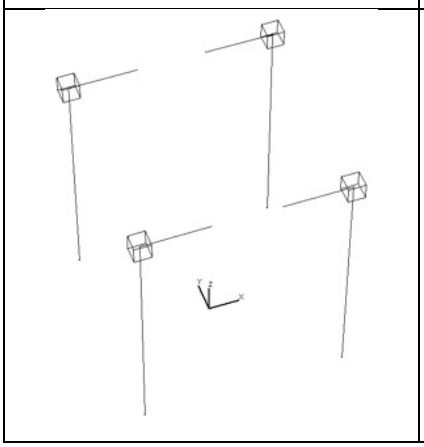
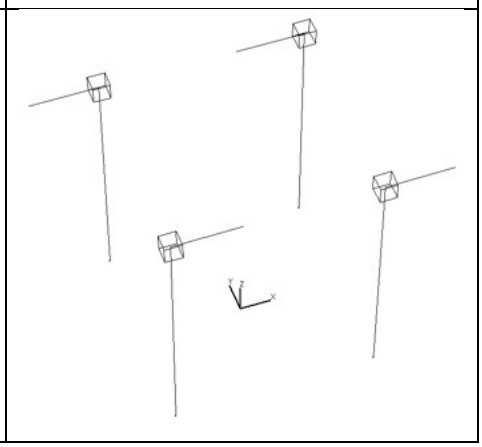
- Nine fields are present, that permit to translate in an independent way the X-symmetrized sources, the Y-symmetrized source and the XY-symmetrized ones;
- A field that permits to shift the simmetrical source pointing as a percentage of its relative position: for example, following the next image:



... the X-coordinate of the pointing of the X-symmetrical source will be shifted of -250cm from the standard X-symmetrical position.

the 'Rotational symmetry' is useful to force the y-axis rotation (better configuration for road project) in the symmetric source option: its flag handle the scene according the following scheme (see 0

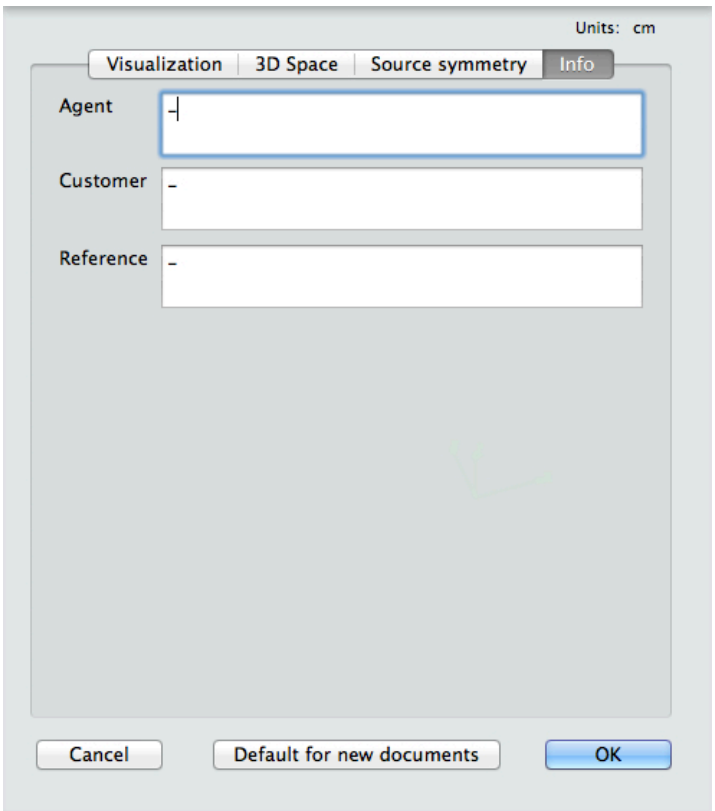
- Sources symmetry section):

X-X and Y-Y standard symmetry:	X-X and Y-Y "rotational" symmetry:
	

- The 'Show symmetric source aiming' permits to semplificate the view: in case of large number of symmetrical fixtures their aiming vectors may be obscured.

4.8.2.4. Info Section

The section permits to assign the general info for the document:

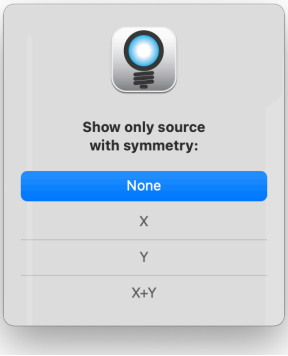


4.8.3. Command: PLAN VIEW

This command allows you to project all selected elements in the Local Coordinate System of the first-selected element (flat surface or object). In a quoted plan view will be visible on the 1st selected element L.C.S., for the each selected elements:

- for each flat surface: its planar projection;
- for each object: its planar projection;

- for each lighting source: its progressive number, a letter for model reference and the pointing vector;
- for each line and polyline: its progressive number and a number for color/group reference;
- for each camera: its position.
- with a [Basket object + symmetrized sources] selection the application will ask what simmetrization has to be presented:



The alternate selection of the command marks with "√" and unmark the item.

4.8.4. Command: OTHER SIDE VIEW

Only in 2D view, permits to invert the side of the 2D projection: this means the back-side of the flat surface and the 'internal' side of the object.

The alternate selection of the command marks with "√" and unmark the item.

4.8.5. Command: ROTATED VIEW

Only in 2D view, permits to rotate of the 2D projection.

The alternate selection of the command marks with "√" and unmark the item.

4.8.6. Command: BLACK & WHITE

Permits to switch from a color representation to a black and white (or black, red and white, following the relative Preference in the dialog setting) one and vice-versa. This selection checks with a "√" or uncheck the menu.

4.8.7. Command: ZOOM IN

The command executes one-step zoom in; the step is fixed in the '3D Space section' dialog, at the item 'steps' as the button 'Zoom in' of the 'View' palette does.

4.8.8. Command: ZOOM OUT

The command executes one-step zoom out; the step is fixed in the '3D Space section' dialog, at the item 'steps', at the item 'steps' as the button 'Zoom out' of the 'View' palette does.

4.8.9. Command: ZOOM WINDOW

Through the procedure click-click it is possible to create a rectangle that will point to the area to zoom in, as happens with the button 'Zoom window'.

4.8.10. Command: CENTER VIEW

Is useful to center the view, as happens with the button 'Center View'.

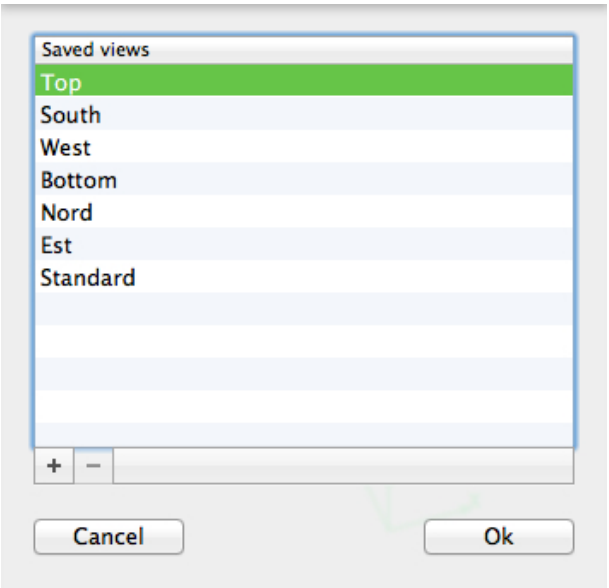
4.8.11. Command: ZOOM SCALE

This menu permits to bring the actual plan view to one of the selectable values.

4.8.12. Sub-Menu: VIEWS

4.8.12.1. Command SETTINGS

Trough these command the Application enters the view manager:



The dialogue permits:

- to create a new view (button +);
- to delete some previously saved view (it is not possible to delete the first seven ones, button −) ;
- to rename existing view, editing it directly in the table.

The dialogue presents the name of every saved view in the last part of the list, and it is possible to make one of them active simply choosing it in the list.

4.8.12.2. Other Command

It is possible to select directly some predefined views (Top, South, West, Bottom, North, East) or others previously saved. Selecting one of the saved view through its menus with the ⌥(option) key pressed permits to reassign the active view to the saved one.

4.8.12.3. Command: SAVE IMAGE FOR...

Permits to save the actual scene for the three types of view:

- Cover Design (3D scene)
- Layout design (2D projection scene)
- Result Design (examine result scene)
- Rendering (if the OpenGL scene is opened and frontmost)

...to export in the eventual rtf report (see 4.2.18.1 Export TEXT, RTF format).

4.8.12.4. Command: COPY VIEW

The command permits to save the perspective view parameters (scene rotation, point of view placement, zoom and frontal section) for a following operation of view restoring through the command "Paste view".

4.8.12.5. Command: PASTE VIEW

The command permits to restore the perspective view parameters (scene rotation, point of view placement, zoom and frontal section) previously saved through the command "Copy view".

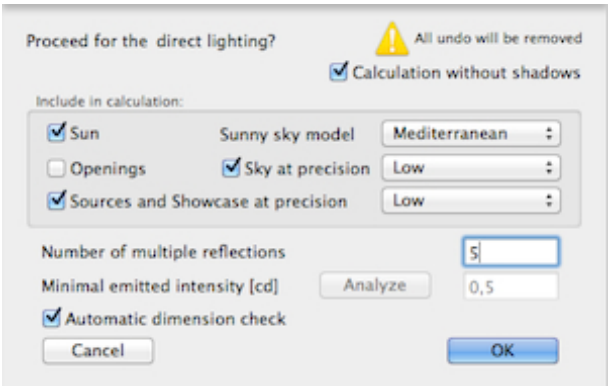
4.9. Menu Lighting

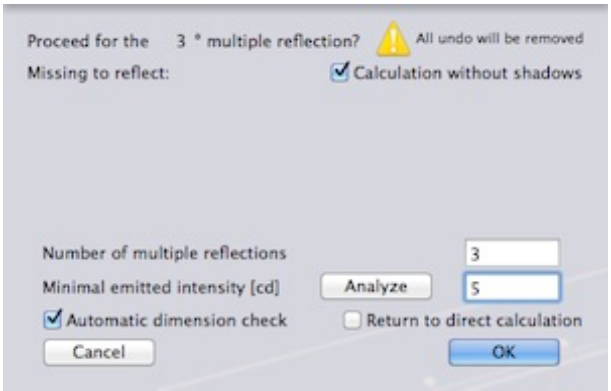
This section includes the necessary operations for lighting calculation and for the analysis of results. The analysis will be available only for the visible objects on the screen; in other words, there will be excluded from calculation those elements belonging to hidden layers.

4.9.1. Command: CALCUL

The Application shows a dialog: when the calculation has been started for the first time, it is possible to choose sources to include and some other useful parameters for a right analysis.

There are two different possibilities: if it is the first time that the calculation goes on (left side dialog) or if the procedure has been initialized (right side dialog):





The Application gives information on the state of the calculation procedure (computed only Direct, nth multiple reflection, ...).

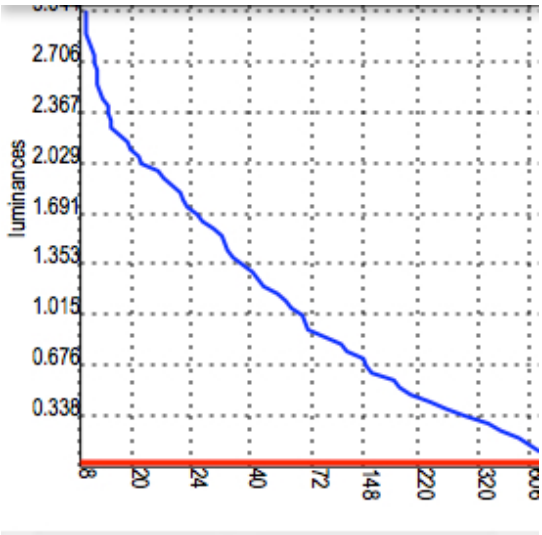
For still not initialized calculation, the Application asks what to include, and in particular:

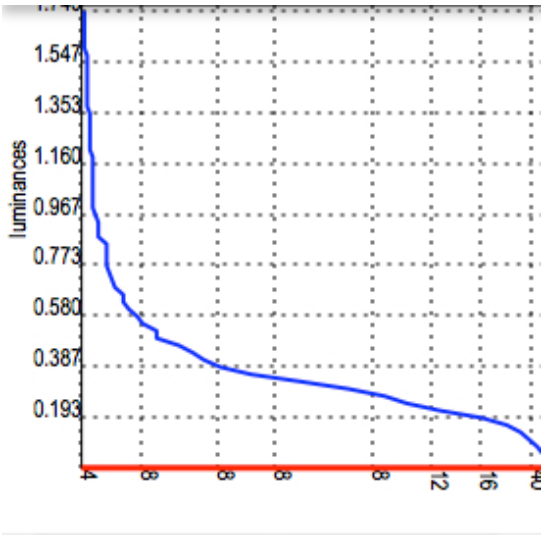
- Sun direct will be computed;
- Sky model, that may be CIE-model or Mediterranean-model;
- Sky at low, medium or high precision (in exclusion with the button "Openings"): this option must be selected in the case where the user has to execute diffuse lighting calculation on models not completely closed with surfaces or for where it will be interested in lighting distribution also on the external faces (example: stadium, rooms with windows and very reflective surfaces outside, ...). The precision in calculation is affected by the number of divisions of the sky vault with which the Application builds the integrals, that are, in the order 25, 49 or 145 points;
- Openings (in exclusion with the button "Sky"): the button is active only if openings are present in the project: the calculation will include only the integrals on transparent surfaces, computed at the precision given at the appropriate flat surface internal grid;
- Sources at low, medium or high precision: artificial lighting sources will be computed. The precision in calculation involves the volumetric schematization adopted for the sources: low = point light, medium = steps of 40 cm distributed luminance, high = steps of 20 cm distributed luminance.

Calculation will go on, moreover, for the number of total reflections given in the edit field 'Reflection number'. For example, to initiate the calculation with direct only '0' must be keyed to initiate the calculation with the direct and one multiple reflection 1 or more must be keyed. After the direct calculation, inside every group of multiple reflection the user ask to execute, to accelerate them (against some precision loss), it is possible to set a 'Minimum luminance' threshold, below which the relative source-finite element will not be considered. To have an idea of the number of finite elements that will be

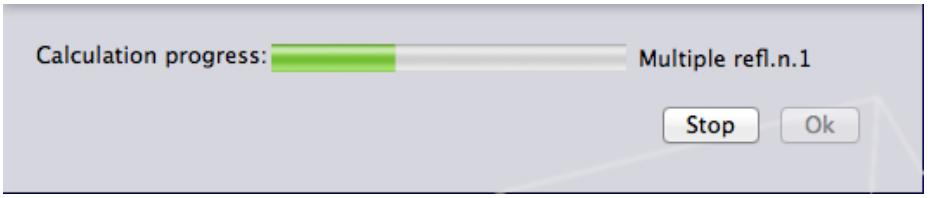
excluded changing this threshold, it is possible to enter, through the button 'Analyze', a dialogue in which these control parameters are presented.

Following graphics reporting the number of elements involved (x-axis) in calculation in function of a luminance threshold in the first and in the third multiple reflection.

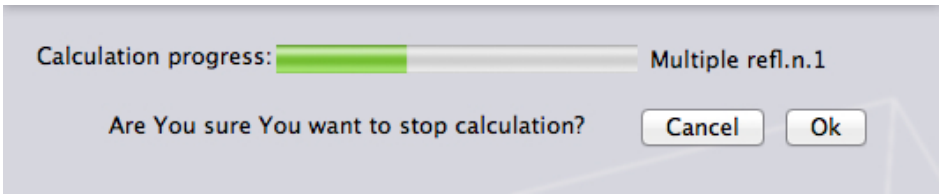




Once the calculation started, the following the dialog: ...



permits to break it by clicking the 'Stop' button or by typing the 'esc' key: after the user reply to confirm breaking the calculation...

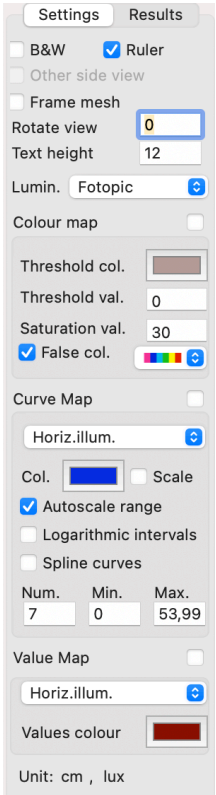


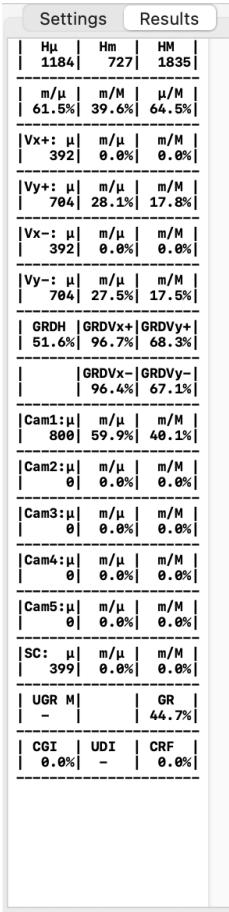
the Application stops it. To start again from the direct, in whatever step of calculation, it is possible to check the 'Return to direct calculation' box. Finally with the 'Calculation without shadows' check box the user is allowed to execute very fast calculation, but without computing shadows: turning on this feature may bring to high approximations, so a reasonable use is suggested.

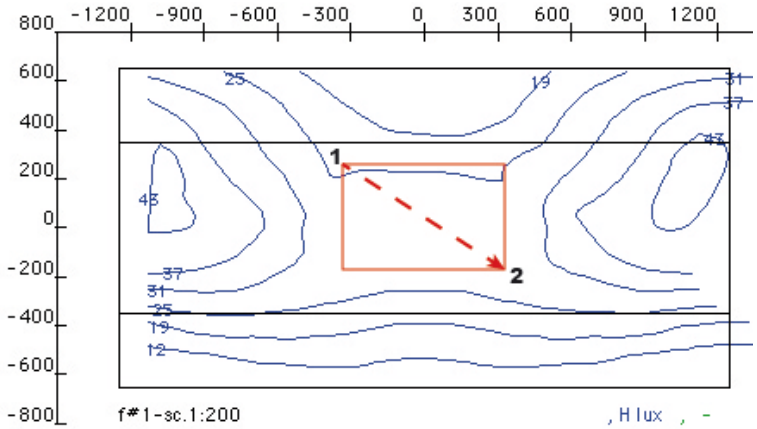
4.9.2. Command: RESULTS

After selecting only one element, this command lets you enter a section for calculation testing. The drawer changes the layout: it is divided into two tabs, as shown on the right.

The 'Setting' tab permits to assign parameters, while the 'Results' tab permits to examine and edit the results (an example is presented). For the explanation of the available options see 4.9.4 Command: RESULT SETTINGS.
In the main view the user may open a 'zone' with a mouse click-drag-release procedure:







Once the area (in the figure, the red rectangle) is drawn a list of values appear in the drawer at the 'results' tab, reporting the illuminaments, uniformities, luminances,... of the selected zone: the user can copy them. This will take place in different ways, depending on the type of the chosen element: if this is a flat surface, it is possible to select also other elements to project on the plan of the surface. At this point the clipboard will be automatically filled with the presented text results, in a minimal format if the user selected this option in the Preferences.

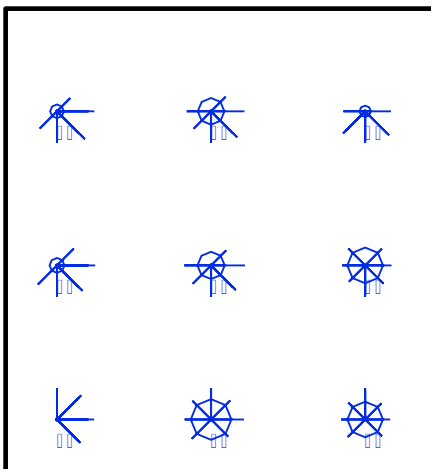
Selecting a single 'table' or 'box with shelves' object the dragging operation will display the average illuminament on the table surface or the average, minimum and maximum illuminaments on the box horizontal shelves.

Results may be examined in color mapping, in iso-value curves, in numeric values or in mixed mode.

Inside this section, unusable menus, rotation and camera buttons and section scroll bar will be hidden.

A particular case is the U.G.R. or G.R. plot choice:

- selecting the curve mapping (see the side image) the application will present a star-shaped plot in which each segment is proportional to the U.G.R./G.R. value in that direction (from the local x-axis at 45° steps). Furthermore, the value of the maximum and a circle representing the average U.G.R./G.R. in that point are plotted;
- selecting the value mapping the average U.G.R./G.R. in that point will be plotted.



To draw the view in black&white check the button 'B&W', and for drawing or not the ruler there is another check-box, to rotate the plan view of a certain degree use the 'Rotate view' edit field.

To examine the other side of the surface it is necessary to select from the 'Settings' tab or through the dialogue in the 'Lighting'->'Settings' menu the item 'Other side view' check-box.

In the same way, for the visualization in finite elements we have to select from the 'Frame mesh' check-box.

From the 'File'->'Export' menu it will be possible to save the results, for the visible side of the surface, in a file:

- JPEG (bitmapped) for color visualization;
- PDF (vectorial) for curves and numeric fields mapping;
- DXF 2D for curves and numeric fields mapping.

From the 'Edit'->'Copy' menu the result for the visible side of the surface will be transferred to the clipboard.

According to the selected element, the left side edit field permits to examine and copy all available results. Labels conform to the following:

- 'H...' = Horizontal illuminament, 'V...' = Vertical illuminament, 'S' = semicylindrical illuminament, 'Cam' = Camera direction illuminament, 'l...' = luminance, 'UGR' = Uniform Glare Ratio, 'CGI' = Contrast Glare Index, 'GR' = Glare Ratio, 'CRF' = Contrast Rendering Factor ([2]), 'DLF' = Daylight factor, 'UDI' = Useful Daylight Illuminance ([3]), 'SHF' = Shadow Factor ([4]), 'GRD...' = Gradient ([5]);
- 'x+' = value from x axis positive direcion, 'y+' = value from y axis positive direction, 'x-' = value from x axis negative direcion, 'y-' = value from y axis negative direction;
- 'm' = minimum, 'μ' = average, 'M' = maximum value.

4.9.2.1. Selecting Furniture

The Application replies with no results.

4.9.2.2. Selecting a Flat Surface

The Application presents a projection orthogonal to the plan of the surface. Creating on video a rectangular region (click-drag-release mouse operation) it is possible to select those finite elements of the surface also partially belonging to the region. For these elements, the Application presents an analysis of the result in the status line. Switching back to the standard perspective view if the 'Curve map' button is checked the iso-values curves will be plotted in 3d.

4.9.2.3. Selecting an Object

The Application presents a central-type projection eventually with unified radius for the object. Creating on video rectangular region (click-drag-release mouse operation) it is possible to select those finite elements of the surface belonging to the region. For these elements, the Application presents an analysis of the result in the status line.

---

[2] *Available only if the usere inserted less than 3 observers in the model.*

[3] *Useful Daylight Illuminance (UDI) is a modification of Daylight Autonomy conceived by Mardaljevic and Nabil in 2005. This metric bins hourly time values based upon three illumination ranges, 0-100 lux, 100-2000 lux, and over 2000 lux. It provides full credit only to values between 100 lux and 2,000 lux suggesting that horizontal illumination values outside of this range are not useful.*

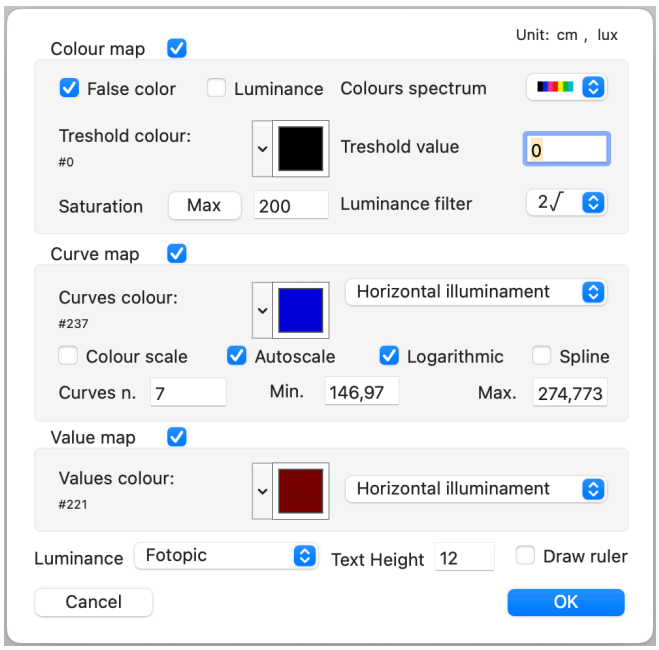
[4] *Percentage of shadowed / total surface, useful for evaluating building facade shadowing.*

[5] *Maximum slope of the illuminament surface sectioned along X and Y direction in the selected point.*

4.9.3. Command: OTHER SIDE

Active only in the result analysis mode, it permits to show the back-side of the surface. The mark "√" in the menu advises that the user look at the back-side of the element.

4.9.4. Command: RESULT SETTINGS



With Illuminando it is possible to examine results in very many ways, available both on video and in the bitmapped, numeric or vectorial exportation.

It is possible to obtain information, depending from the type of the selected element, on:

- horizontal illum.: horizontal illuminance in lux (for "horizontal" we mean "normal to the surface");
- emi-cylindrical illum.: Semi-cylindrical illuminance (parallel to the surface, direction of the local X-axis direction - only user surfaces);
- hemispherical illum.: Hemispherical illuminance (parallel to the surface - only road surfaces);
- vertical X+, Y+, X-, Y- light.: four Vertical illuminance in lux (for "vertical" we mean "parallel to the surface, in the direction of the local X-axis and Y-axis, positive and negative sides" - only user surfaces) average and uniformity as minimum/average and minimum/maximum ratio;
- Gradient H (horizontal...), Vx+, Vy+, Vx-, Vy- (vertical...): slope of the illuminament surface sectioned along X and Y direction in the selected point (see note 5 at pag.105);
- camera N: the illuminament in the camera direction (only user surfaces) average and uniformity as minimum/average and minimum/maximum ratio;
- Luminance: luminance in cd/m^2 (only not-user surfaces);
- Luminance observer 1...6: luminance in cd/m^2 or cd/ft^2 in the direction of the observer 1, ... (only road surfaces);
- U.G.R.: Unified Glare Ratio (only user surfaces) mapped in 8 directions;
- G.R.: Glare Ratio (only user surfaces) mapped in 8 directions;
- C.R.F.: Contrast Rendering Factor (only user surfaces);
- C.G.I.: Contrast Glare Index (only user surfaces);
- Daylight Factor: if calculation goes on only for sky radiation (only 'normal' surfaces) average, minimum and maximum;
- UDI: Useful Daylight Illuminance (see note 3 at pag.105 - available only if calculation proceeded with holes and/or sky vault option enabled);
- SHF: Shadow Factor (see note 5 at pag.105 - only not-user surfaces).

The results viewed on the screen may be copied in the clipboard or exported in all available formats that are bitmapped, vectorial or numeric.

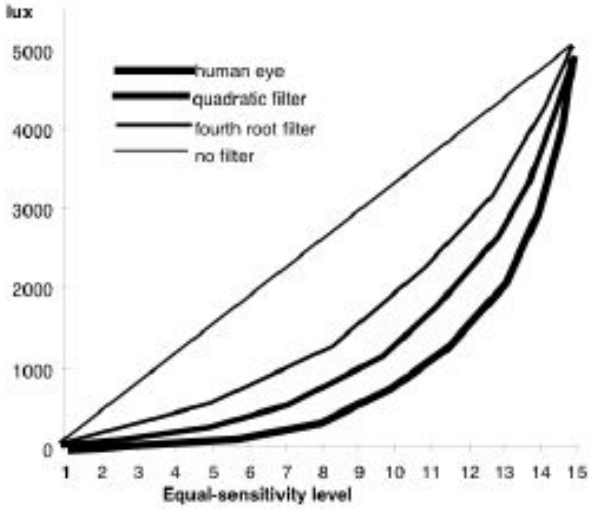
The dialog is divided into three sections: the upper side is relative to the color visualization, the central one to iso-value curves and the lower to the numeric fields mapping.

4.9.4.1. Color Mapping

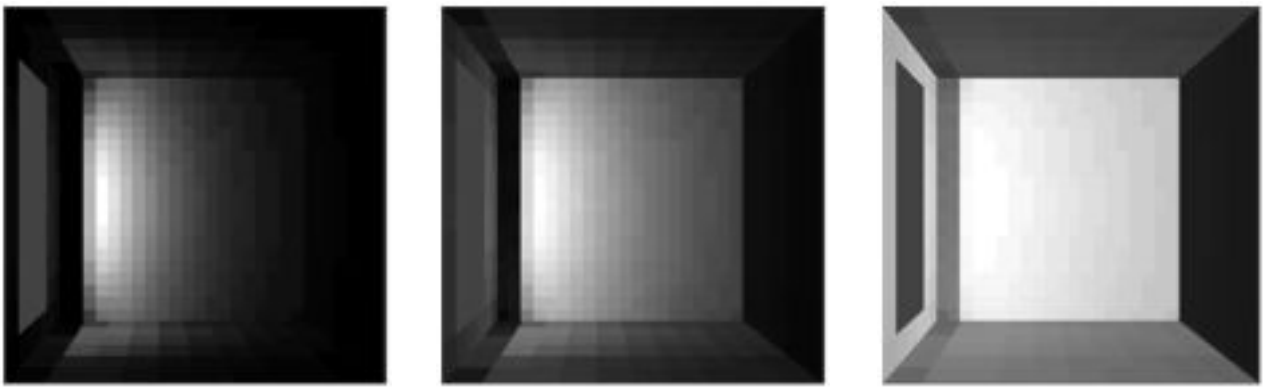
By selecting "Color mapping (horizontal)" button the user can examine the horizontal (on the surface) lighting. At 8-colors (button "False"), eventually mapping luminances ("Luminance" check-box), it is possible to choose the spectrum to plot results among three ones.

At real-color visualization (button "True") for the single finite elements is possible to apply to the view a "Filter" to simulate a luminous sensation less or more similar to the human eye sensitivity.

Luminance may be mapped in a linear (filter "none"), quadratic (filter "2") or fourth-root (filter "4") way, according to the following scheme:



The following figure shows luminous sensation filters in a day lighted room: 1=none, 2=quadratic, 3=human eye:



With the value contained in the "Threshold" edit field it is possible to create an "high-pass" filter, to emphasize (by a color selectable from the pop-up menu "Color" near this edit field) those finite elements that are in a lower lighting condition then the fixed threshold.

In this mode the chromatic effect in the video scene is "proportional" to the real effect according to an input value in the "Saturation" edit field. Lower saturation values make the scene lighter, higher values permit a better mapping on higher lighting values. With the "Max" button the Application suggests as saturation, the maximum lighting value found in the project. The Saturation field, finally, may be considered as the aperture of a camera.

4.9.4.2. Curve mapping

Curve mapping may be executed in the modes proposed by the Application, according to the type of the selected element (user surface or not) and to the type of calculation (only sky diffuse radiation or other).

The “Curve color” pop-up menu permits to choose the color for the curves to plot, while selecting "Colour scale" every curve will be plotted following the spectrum colour scale of the paragraph 4.9.4.1. The user can choose the first curve (field “Min.”), the last one (field “Max.”) and the number of curves to plot (field “Curve num.”), while it is possible to plot curves at “logarithmic intervals” checking the appropriate button. The “Auto range” button optimizes the plot from the minimum to the maximum value available in the selected element.

The “Spline” fields permit to choose the type of interpolation for the curves to plot.

Once cheched the "Curve Map" box for a flat surface, the user will have the actual 2D map plotted also in 3D: uncheck the box in the "Result Setting" dialogue to release this option.

4.9.4.3. Values mapping

Values mapping may be executed in the modes proposed by the Application, according to the type of the selected element (user surface or not) and to the type of calculation (only sky diffuse radiation or other).

The “Color” pop-up menu permits to choose the color for the values to plot.

4.9.4.4. Others

At the end of the dialogue there is the pop-up menu "Luminance" that permits to switch from the standard photopic calculation of the luminance to the unified (MOVE modified) one. This take count of the mesopic vision due to:

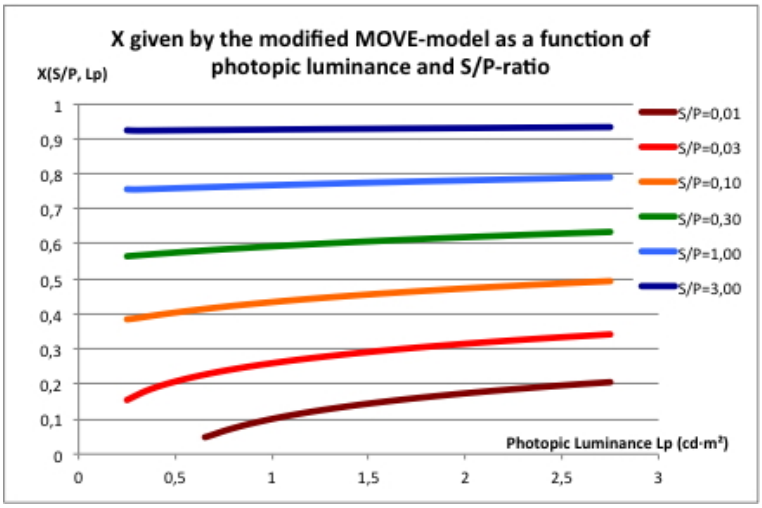
- the luminance field L (linearly interpolated from scotopic L≤0,25 to photopic L≥3,00 cd·m^{-2}) ;
- the lamp type, color and power (Scotopic/Photopic lamp parameter).

The Unified Luminance L is calculated as follow:

$$L = \left[\frac{XP}{683} + \frac{(1-X)S}{1700}\right] \cdot \frac{683}{X+0.402(1-X)}$$

...where

- X is the MOVE parameter defined through the next graphic:



- S and P are the Scotopic and Photopic parameters whose ratio is function of the lamp type, color and power: this parameter is calculated as the average of all the lamp present in the project.

Finally, there is a field "Text Height " permits to choose the height of the text in the visualization.

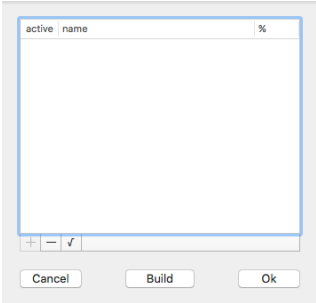
4.9.5. Command: CONFIGURATIONS

With the tool 'Configurations' the application permits to study different solution for lighting one scene with artificial sources or combine some calculation to build a new one.

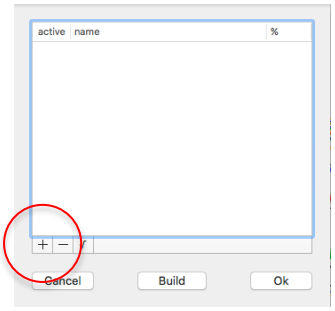
It is important to remember that configurations have to be compliant one each other, in the sense that the only differences between them may be:

- modifying lighting sources (move, add, delete, reshape, change layer,...)
- hiding, showing layers
- changing elements colors

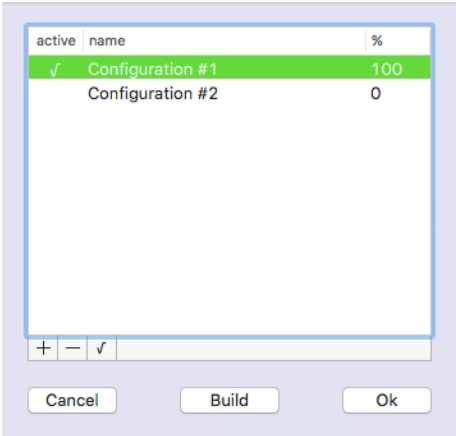
Calculation not done



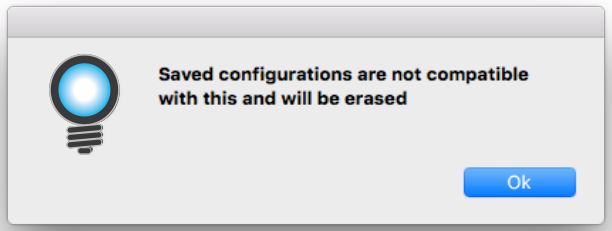
Calculation done



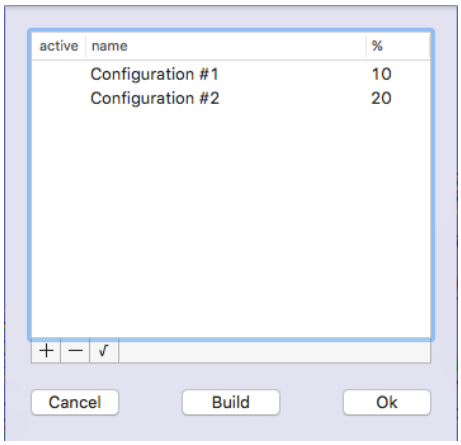
- It will be possible to save the configuration through the '+' button once the calculation will be done;
- the '-' button permits to delete the selected configurations;
- the '√' button makes the selected configuration the active one, like in the following image:



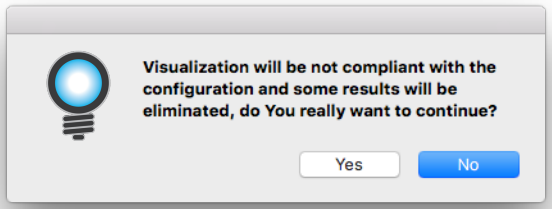
If the configuration we're going to save is not compliant with the saved ones the application will reply deleting the saved configurations:



For combining more configurations into a new one the user has to fix the 'weight' of the single configuration in the '%' column and then press the 'Build' button:

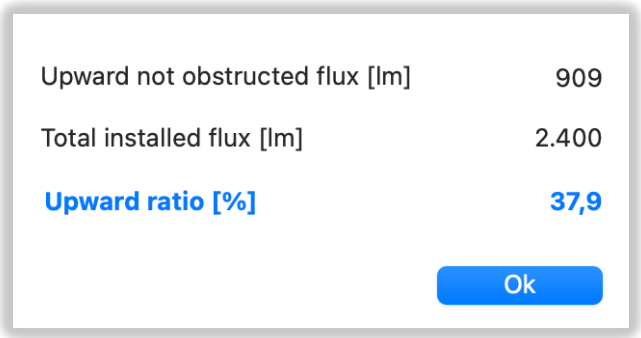


an alert will inform the user that the actual scene will be not compliant with the configuration to build and some results will be eliminated:



4.9.6. Command: LIGHTING POLLUTION

The application calculates the upward flux (the flux emitted by all lighting sources to the sky vault considering obstructions), and will divide this for the total flux (the flux emitted by all lighting sources) to obtain the project Upward ratio. The result will be presented in the following panel:



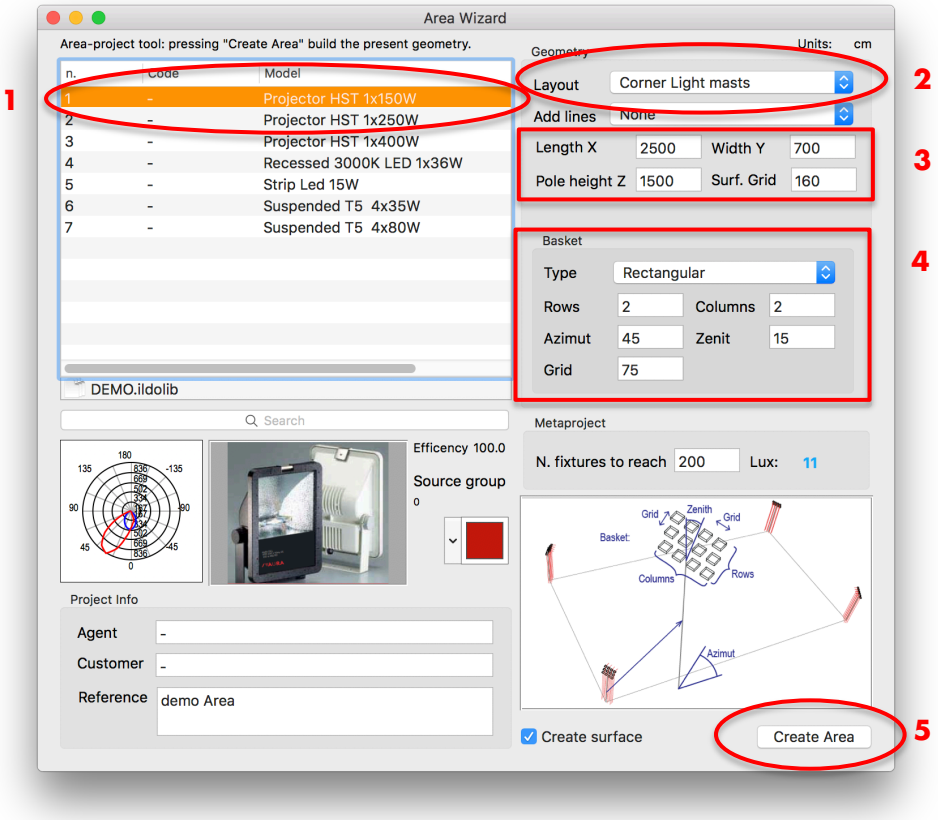
5. Tutorials

5.1. Open area

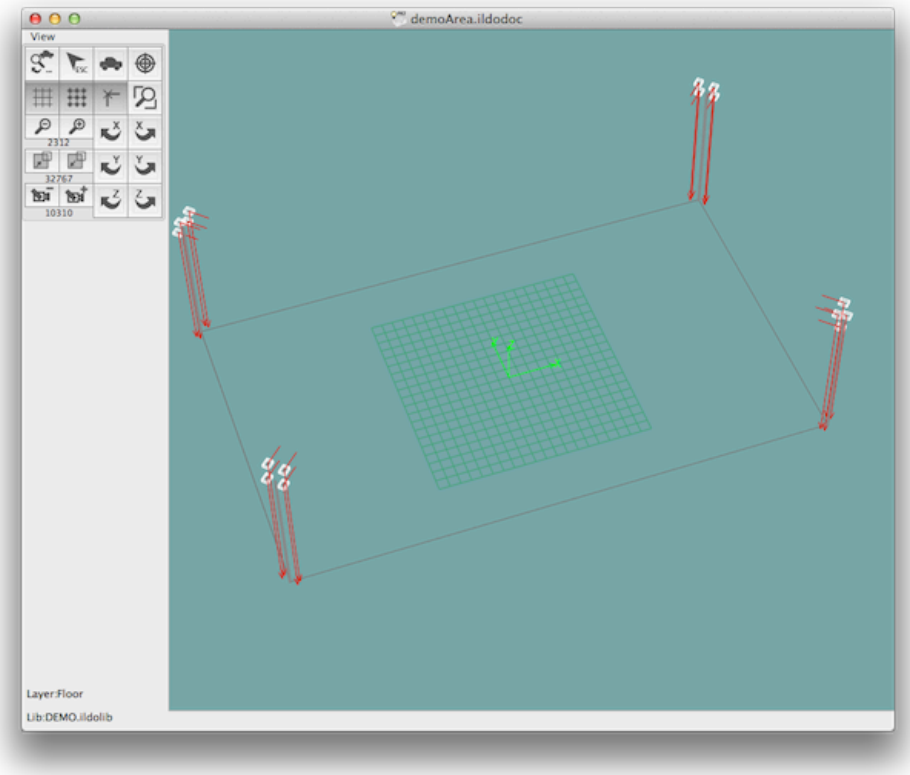
This tutorial permits to build a simple open area.

5.1.1. Building the area

1. The first step consist in opening from the menu "File" the item "Area Wizard" that will open the standard dialog; navigate in the "Luminaires" folder to choose "DEMO.illdolib" catalogue in which select the "Projector, HST 1x150W" luminaire (point 1):

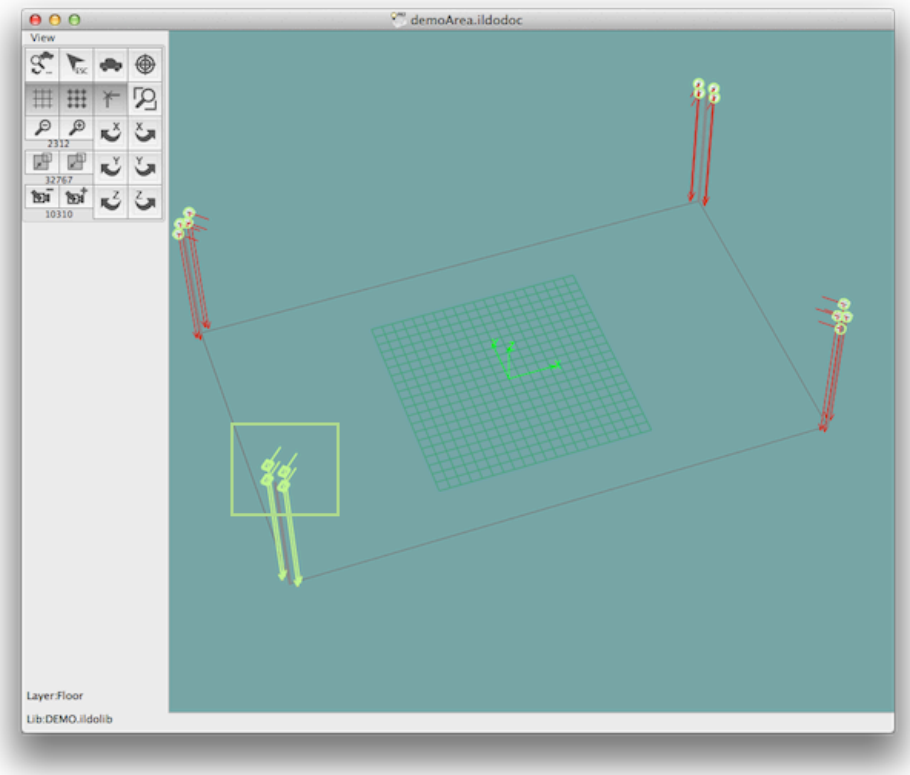


2. Then let's choose the layout as "Corner light mast" (point 2) and the area dimension and grid and the pole height (point 3);
3. As basket let's choose a rectangular one and fix its parameters following the upper image (point 4);
4. When finished press the "Create Area" button and the Application will build the requested area.

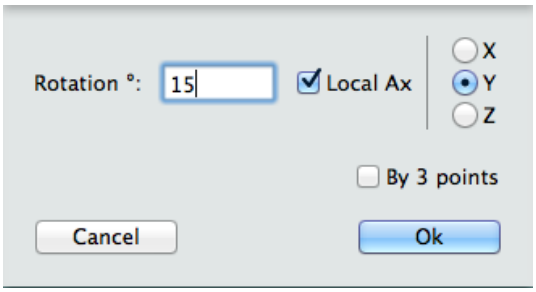


5.1.2. Aiming sources

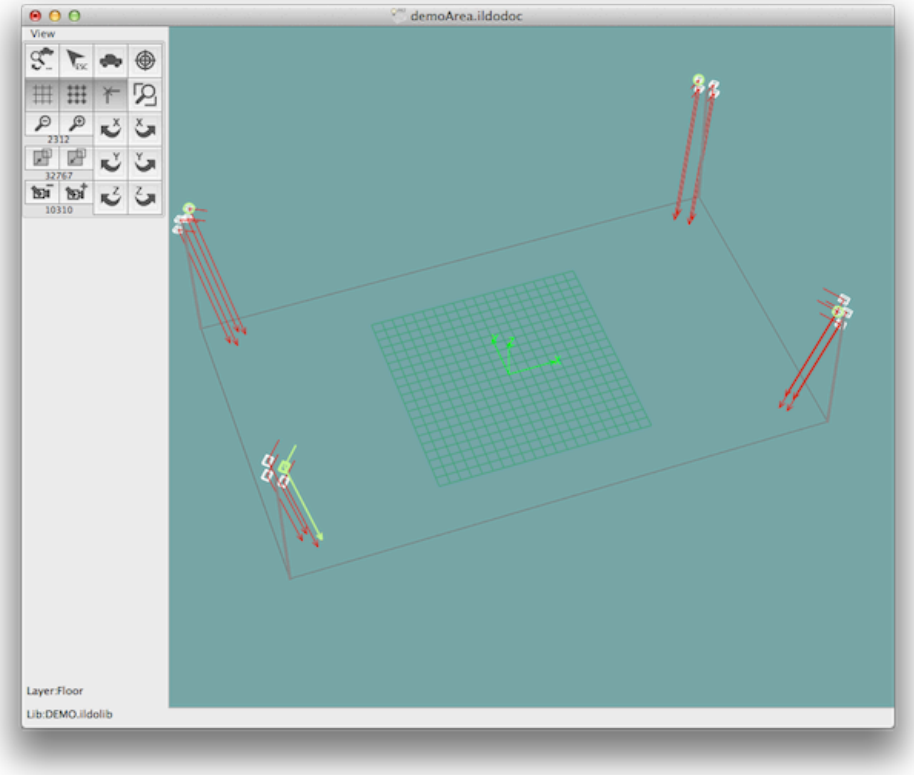
Select all the source opening with the mouse a rectangle, as the next image propose:



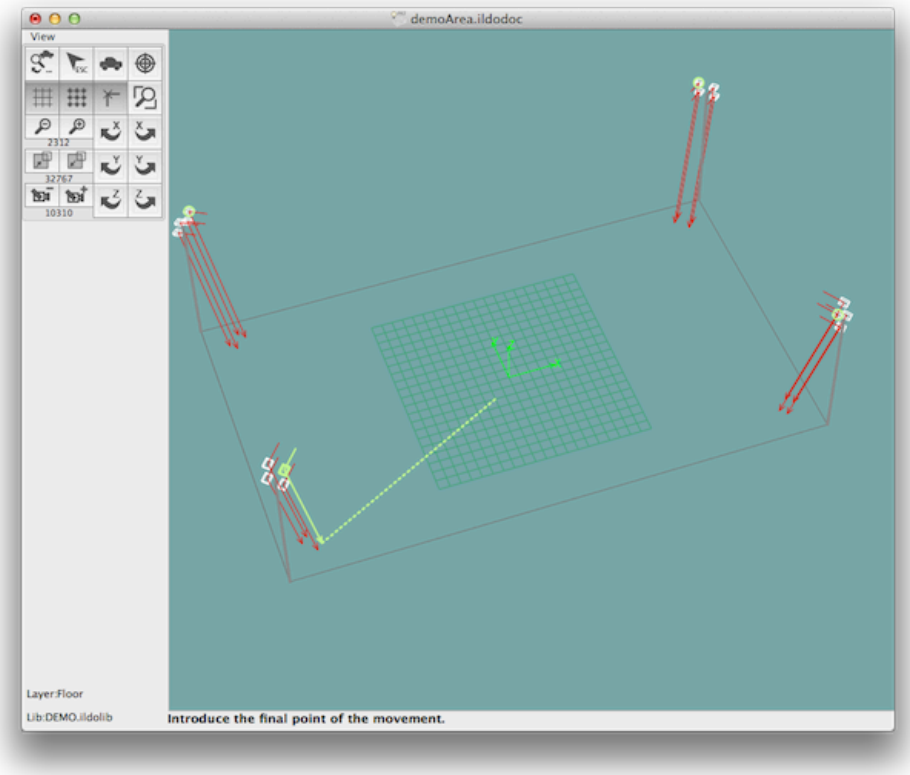
Please, notice that the sources are created as symmetric both for X and Y axis. Then select the command 'Edit'-'Rotate', and in the relative dialogue set the parameters following the next image:



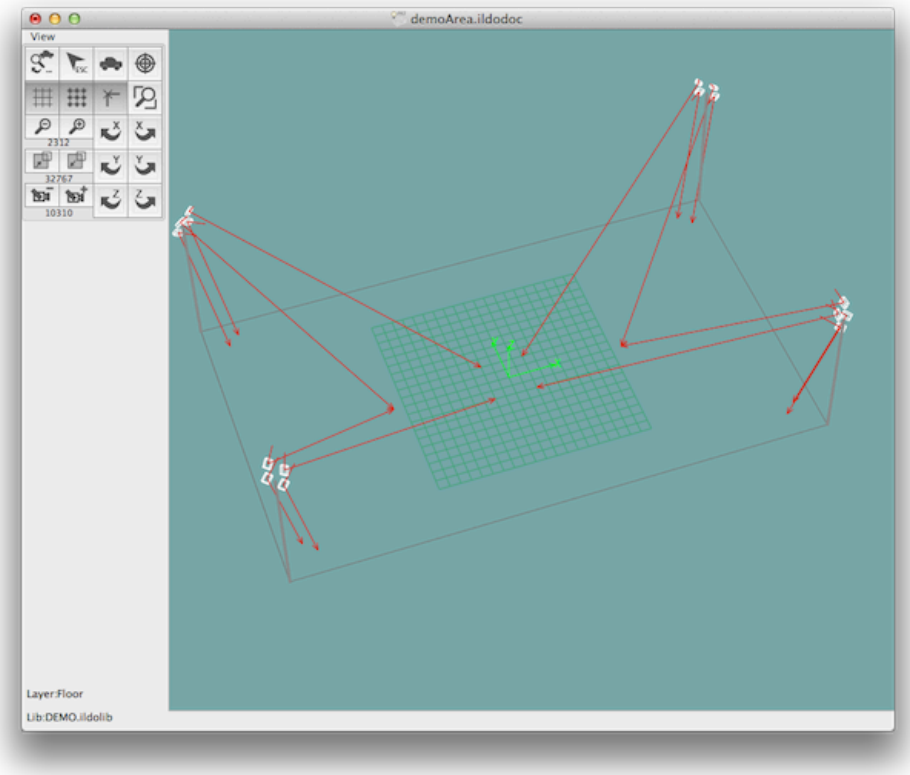
All the sources were tilted of 15°. Now select the top-right source, as the next image propose:



... and select the command 'Edit'-'Reshape' to manually orient this source. At the prompt 'Pick the source origin or the axis to modify' pick with the mouse near the arrow head (the pointing vector): if the operation succeed, the source pointing will follow the mouse, as the following image shows:

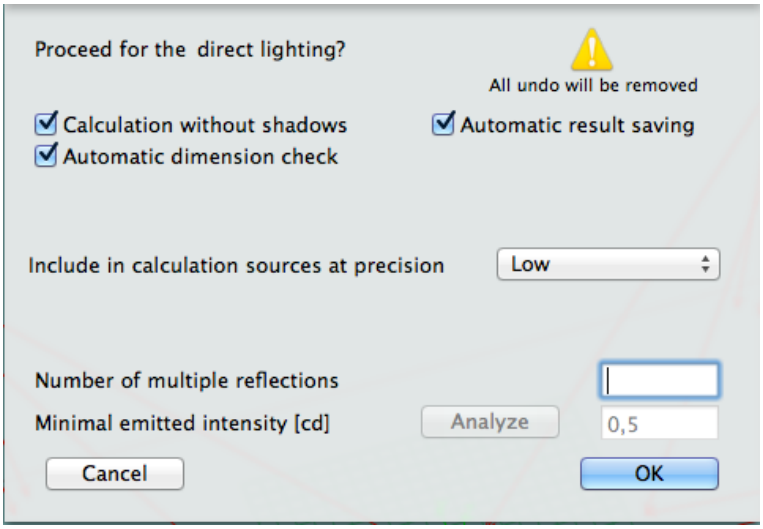


Try to click as the previous image propose, then make a similar operation on the top-left source and You'll reach the final configuration:

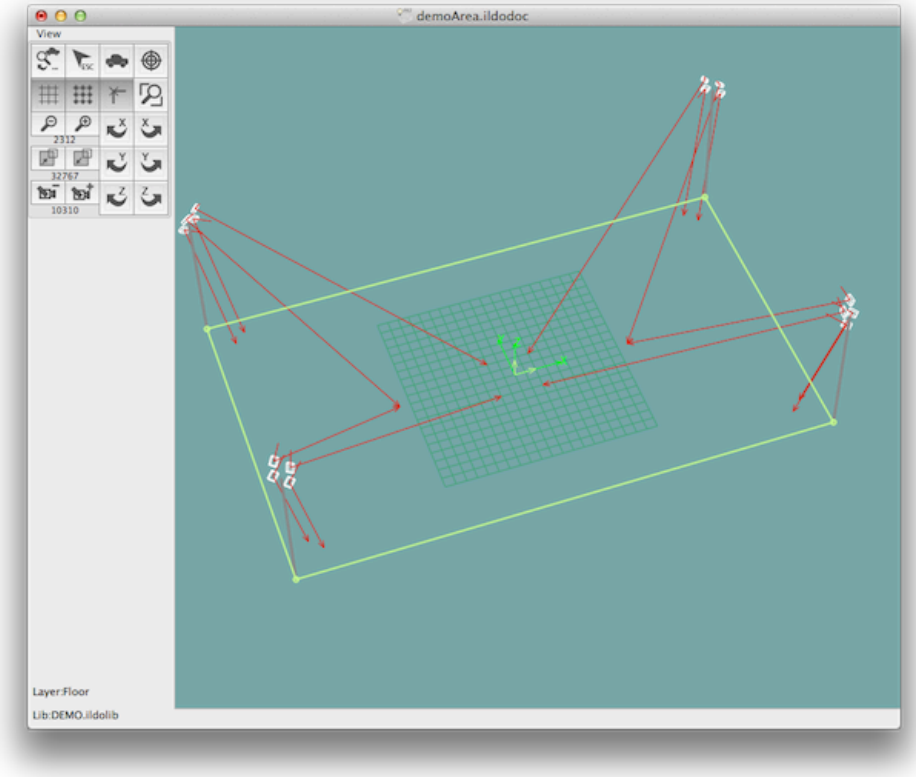


5.1.3. Starting calculation

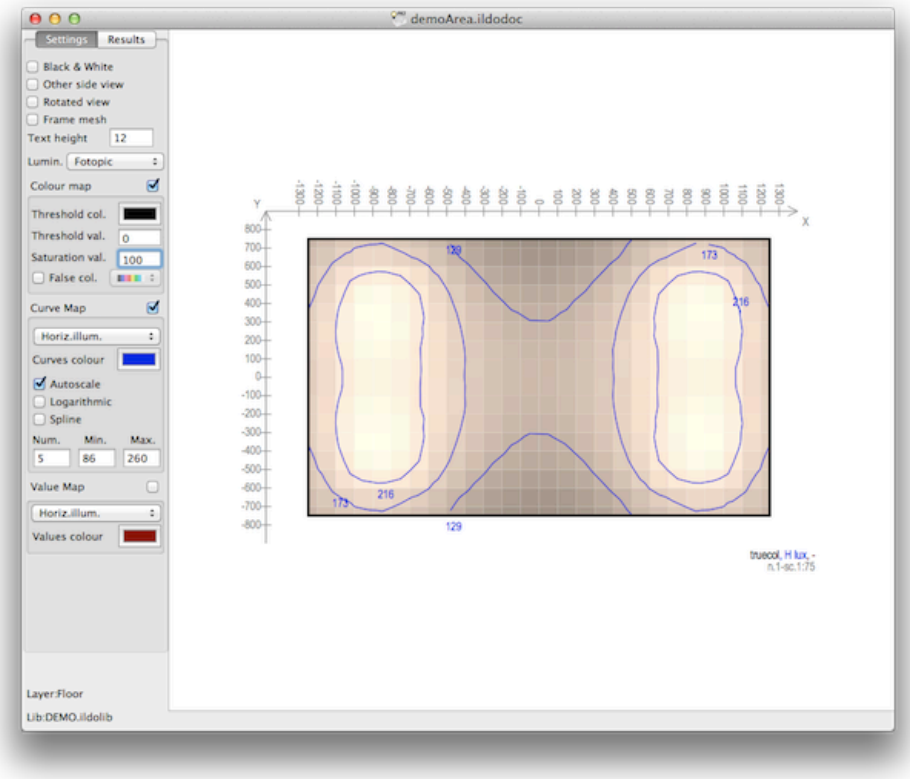
Select in the menu "Lighting" the item "Calcul...", erase the content of the "Number of multiple reflections" edit field and then pushing the button "Ok"...



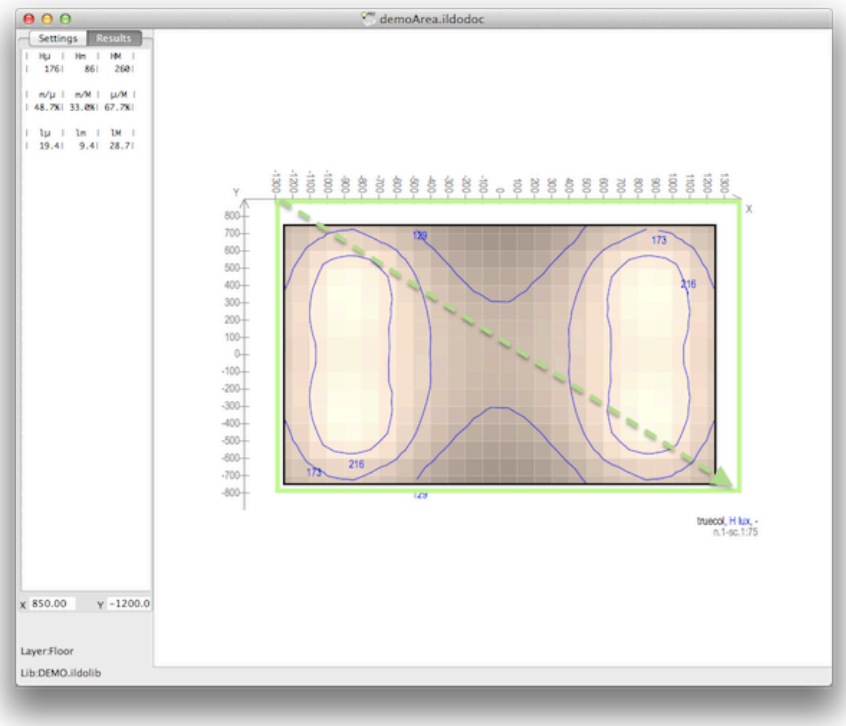
...the software will compute the direct lighting calculation. To examine the results at this first step, select the surface and choose the menu "Lighting"->"Results":



Zooming to a scale of 1/75 (menu "View" "Zoom scale" "1/75"), typing 100 in the "Saturation val." edit field and choosing "Color Map" + "Curve Map" + "Autoscale" + Curves "Num."=5, You will see the following view:



In which is presented the flat surface n.1 in true color and isolux curves. You can change the show results mode in some other way through the drawer settings (see 4.9.4 Command: RESULT SETTINGS) Opening with the mouse a rectangle inside the surface or simply making a click somewhere, the partial result values will be presented: opening a rectangle from the top-left corner 1 to the bottom-right one 2 of the projected surface, the information on the whole surface will be presented:

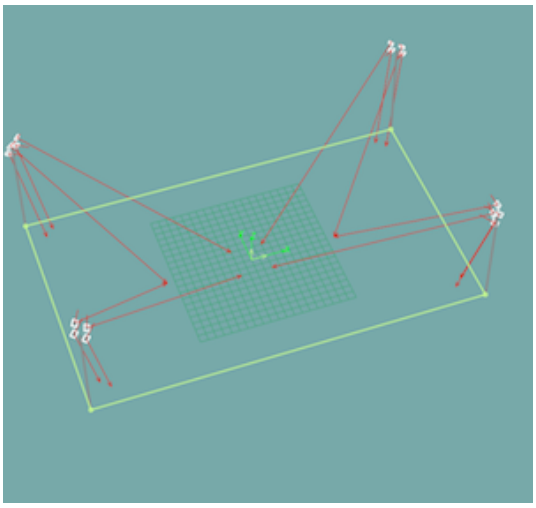


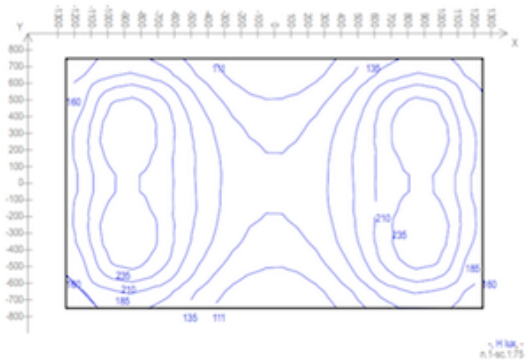
In the left drawer will be presented the values relative to the selected zone.

5.1.4. Preparing the report

For this, we have to choose the picture we want to show in the first page (menu "View"->"Save Image for Report as 'Cover design'"), in the "Installation of the fixtures" paragraph (menu "View"->"Save Image for Report as 'Layout design'") and in the "Result on worktop" paragraph (menu "View"->"Save Image for Report as 'Result design'").

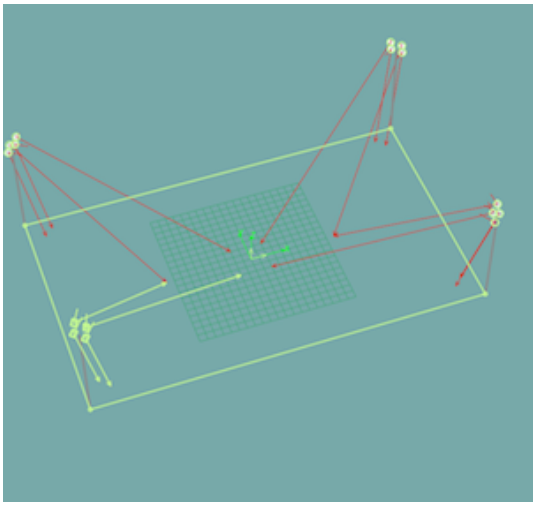
The procedure is simple. To export the 'Result design' picture we have to select for first the surface whose results we want to represent and then all the elements we want to project on it: then choose the "Lighting"->"Result" menu, and finally select the visualization option we want to view in the report page. Follows an example:

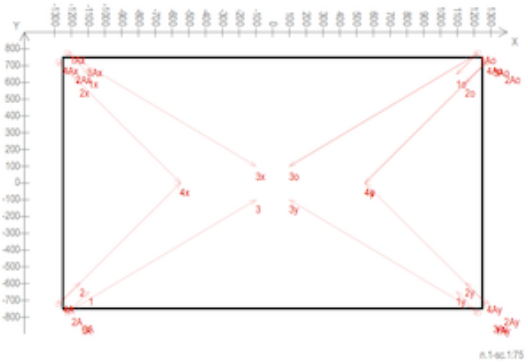




To save in the 'Result design' picture-slot select the menu command 'View'->'Save Image for Report as Result design'. Come back to the 3D general view by selecting "Lighting"->"Result" menu again.

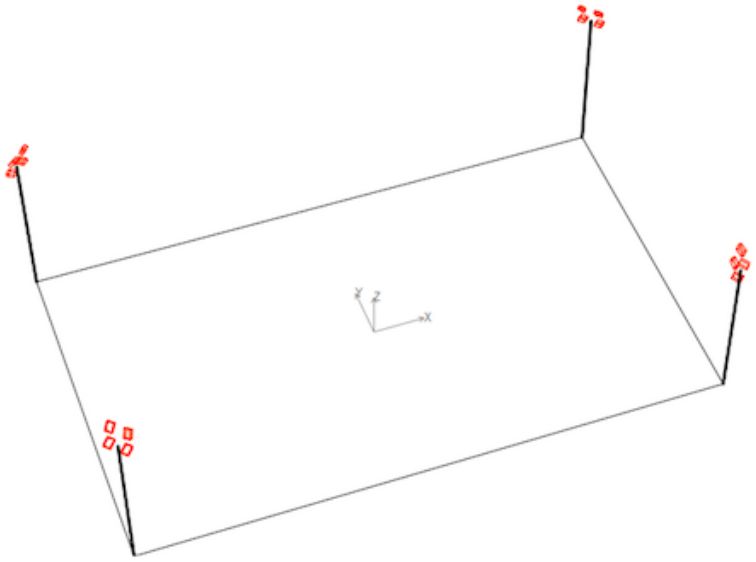
To export the 'Layout design' we have to select for first the surface we want to use as reference plan and then all the elements we want to project on it to create an installation layout. Follows an example in which the view is plotted in black+red+white (managing from the left drawer). Then choose the "View"->"Plan View" menu and adjust the view by centering and zooming (better in scale) it.



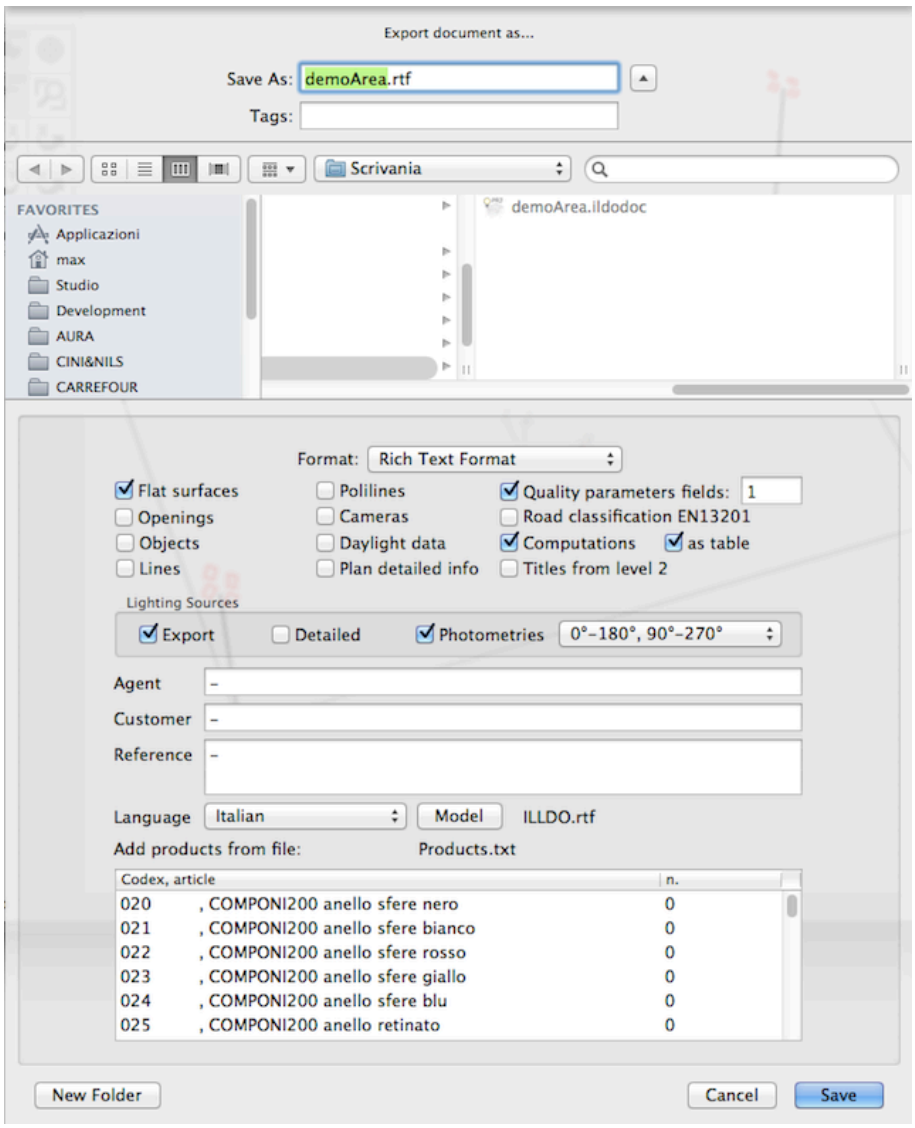


To save in the 'Layout design' picture-slot select the menu command 'View'>'Save Image for Report as Layout design'. Come back to the 3D general view by selecting "View"->"Plan View" menu again.

To export the 'Cover design' simply adjust the last 3D general view to your preferences. In the following picture the view is plotted in black+red+white and the 3D-model linking on.



To save in the 'Cover design' picture-slot select the menu command 'View'->'Save Image for Report as Cover design'. Then select the "File"->"Export" menu and set your preferences. Pressing the "Ok" button the software will ask to save the report file: select the "RTF" or "RTFD" format in the pop-menu and choose the exportation preferences. Follows an example:



Then let's open the saved file to add some picture in: (follow the opened pages).

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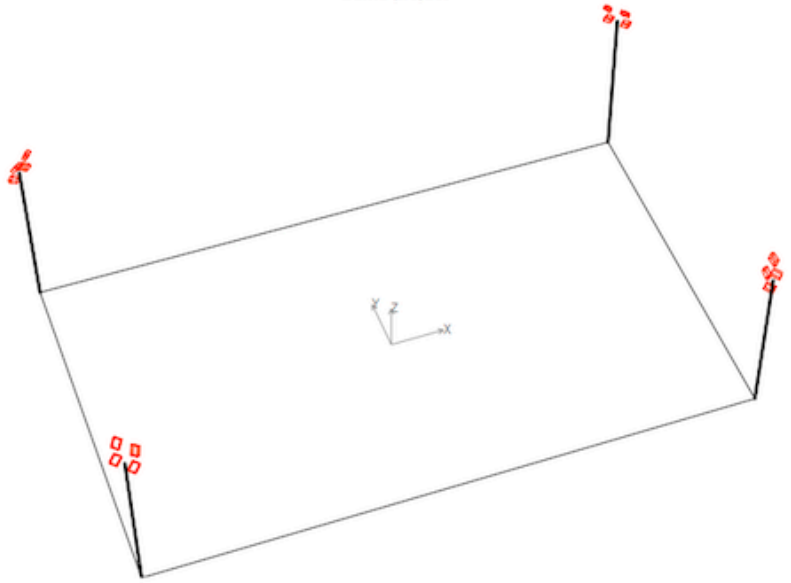
Rif.Progetto:demoArea.rtf del 03/05/14 Committente:-

Demo project



1 Lighting software: Illuminando

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Rif.Progetto:demoArea.rtf del 03/05/14 Committente:-

INFORMAZIONI SUL MODELLO

DIMENSIONI DEL MODELLO (X, Y, Z): 25.00 x 15.00 x 0.00 m

1.1. SUPERFICI PIANE

n.	Livello	Superficie	Area [m2]	Colore superiore-inferiore	Griglia [cm]
1	Floor	reale	375.0	grigio medio 35%	100

1.2. APPARECCHI ILLUMINANTI

n./rif.	Codice - Modello	Lam.	Sorgente	Modello	Attacco	W	lm	K	W tot.	Man.	Posizione (x,y)	H install.	Puntam.(x,y,z)	az.,zen.
1A	Projector, HST 1x150W	1	Sodio alta press.	HST	E40	150	14500	1900	150	80	-1223, -777	700	-1095,-648,24	45,165
1Ax	Projector, HST 1x150W	1	Sodio alta press.	HST	E40	150	14500	1900	150	80	-1223, 777	700	-1095,648,24	315,173
1Ay	Projector, HST 1x150W	1	Sodio alta press.	HST	E40	150	14500	1900	150	80	1223, -777	700	1095,-648,24	135,173
1Ao	Projector, HST 1x150W	1	Sodio alta press.	HST	E40	150	14500	1900	150	80	1223, 777	700	1095,648,24	225,173
2A	Projector, HST 1x150W	1	Sodio alta press.	HST	E40	150	14500	1900	150	80	-1277, -723	700	-1148,-595,24	45,165
2Ax	Projector, HST 1x150W	1	Sodio alta press.	HST	E40	150	14500	1900	150	80	-1277, 723	700	-1148,595,24	315,173
2Ay	Projector, HST 1x150W	1	Sodio alta press.	HST	E40	150	14500	1900	150	80	1277, -723	700	1148,-595,24	135,173
2Ao	Projector, HST 1x150W	1	Sodio alta press.	HST	E40	150	14500	1900	150	80	1277, 723	700	1148,595,24	225,173
3A	Projector, HST 1x150W	1	Sodio alta press.	HST	E40	150	14500	1900	150	80	-1210, -763	772	-100,-100,0	31,121
3Ax	Projector, HST 1x150W	1	Sodio alta press.	HST	E40	150	14500	1900	150	80	-1210, 763	772	-100,100,0	330,124
3Ay	Projector, HST 1x150W	1	Sodio alta press.	HST	E40	150	14500	1900	150	80	1210, -763	772	100,-100,0	150,124
3Ao	Projector, HST 1x150W	1	Sodio alta press.	HST	E40	150	14500	1900	150	80	1210, 763	772	100,100,0	210,124
4A	Projector, HST 1x150W	1	Sodio alta press.	HST	E40	150	14500	1900	150	80	-1263, -710	772	-550,0,0	45,128
4Ax	Projector, HST 1x150W	1	Sodio alta press.	HST	E40	150	14500	1900	150	80	-1263, 710	772	-550,-0,0	315,131
4Ay	Projector, HST 1x150W	1	Sodio alta press.	HST	E40	150	14500	1900	150	80	1263, -710	772	550,0,0	135,131
4Ao	Projector, HST 1x150W	1	Sodio alta press.	HST	E40	150	14500	1900	150	80	1263, 710	772	550,-0,0	225,131

2 Lighting software: Illuminando

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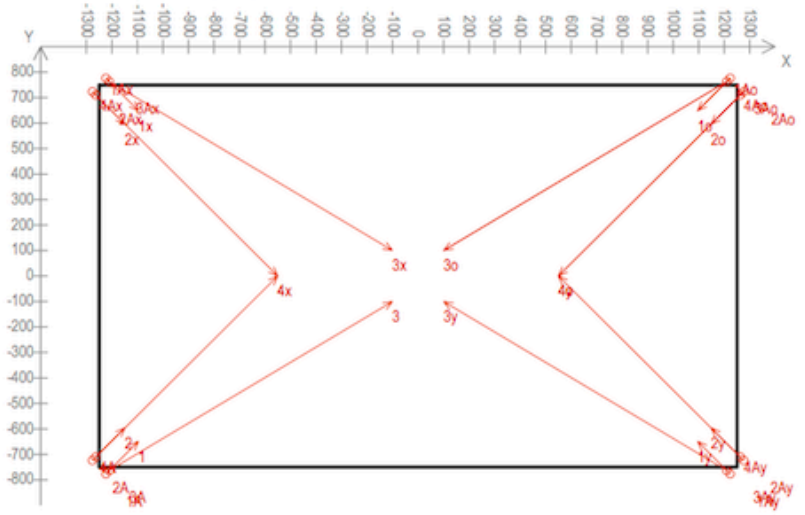
Rif.Progetto:demoArea.rtf del 03/05/14 Committente:-

1.2.1. INSTALLAZIONE DEGLI APPARECCHI (n./rif.)



3 Lighting software: Illuminando

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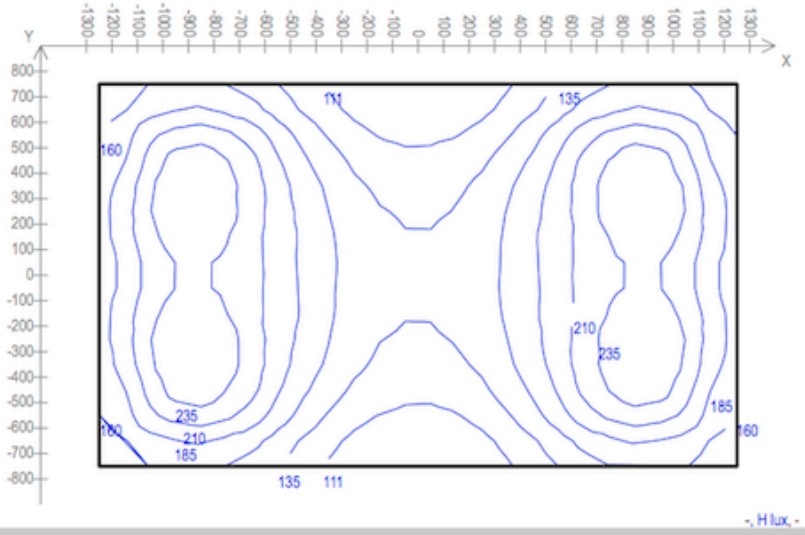
Rif.Progetto:demoArea.rtf del 03/05/14 Committente:-

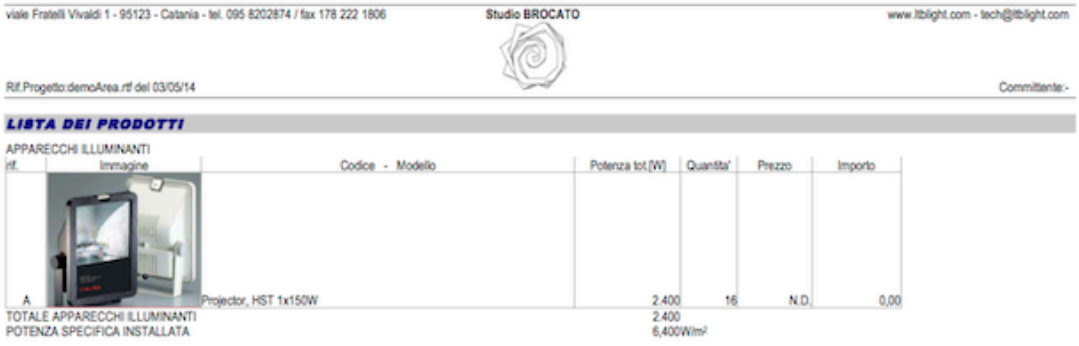
RISULTATI SUI PIANI DI LAVORO

Piano	Valore Medio lux	Valore Minimo lux	Valore Massimo lux	Min/Medio	Min/Max	Medio/Max
1 - H=0	176	86	260	48,86%	33,08%	67,69%

1.3. ISOVALORI SUI PIANI DI LAVORO



4 Lighting software: Illuminando



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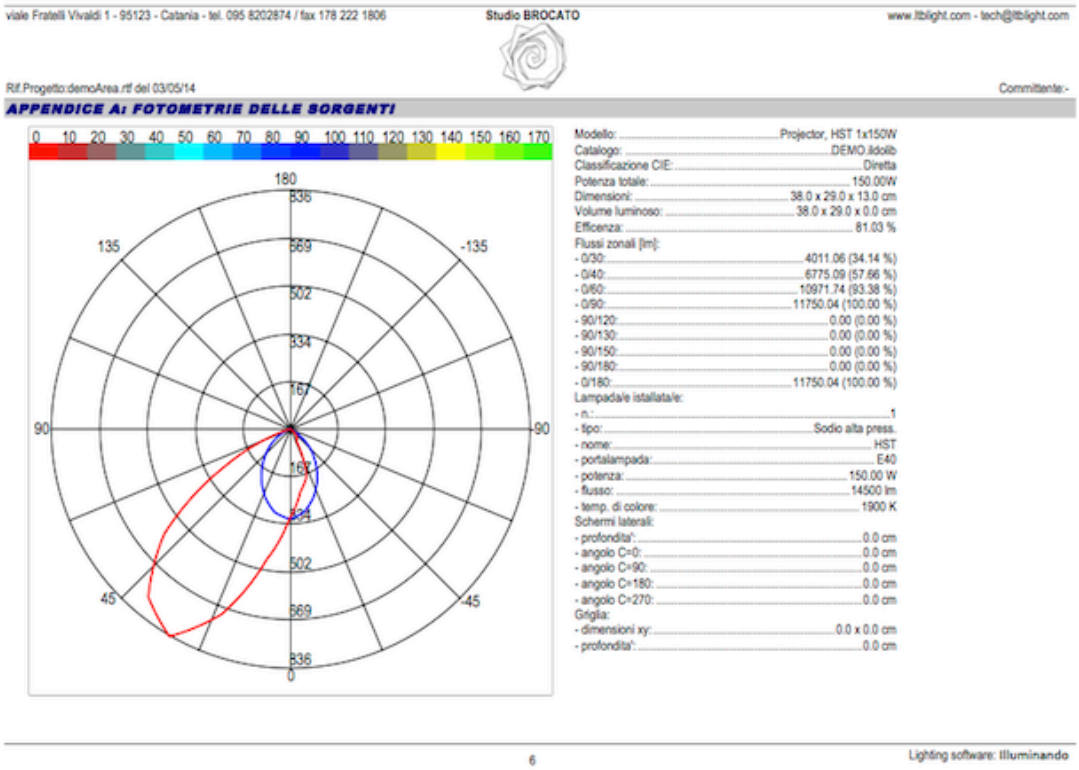
Rif.Progetto:demoArea.rtf del 03/05/14 Committente:-

LISTA DEI PRODOTTI

APPARECCHI ILLUMINANTI

rif.	Immagine	Codice - Modello	Potenza tot.[W]	Quantita'	Prezzo	Importo
A		Projector, HST 1x150W	2.400	16	N.D.	0,00
TOTALE APPARECCHI ILLUMINANTI			2.400			
POTENZA SPECIFICA INSTALLATA			6,400W/m²			

5 Lighting software: Illuminando



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Rif.Progetto:demoArea.rtf del 03/05/14 Committente:-

APPENDICE A: FOTOMETRIE DELLE SORGENTI

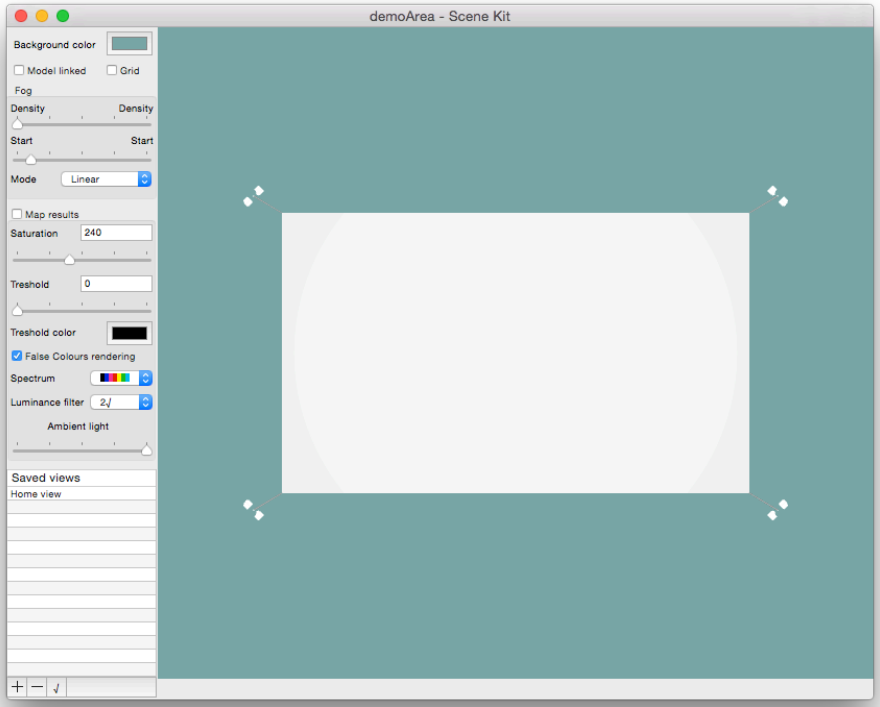
Modello: Projector, HST 1x150W
Catalogo: DEMO.ildolib
Classificazione CIE: Diretta
Potenza totale: 150.00W
Dimensioni: 38.0 x 29.0 x 13.0 cm
Volume luminoso: 38.0 x 29.0 x 0.0 cm
Efficenza: 81.03 %
Flussi zonali [lm]:
- 0/30: 4011.06 (34.14 %)
- 0/40: 6775.09 (57.66 %)
- 0/60: 10971.74 (93.38 %)
- 0/90: 11750.04 (100.00 %)
- 90/120: 0.00 (0.00 %)
- 90/130: 0.00 (0.00 %)
- 90/150: 0.00 (0.00 %)
- 90/180: 0.00 (0.00 %)
- 0/180: 11750.04 (100.00 %)
Lampada/e istallata/e:
- n.: 1
- tipo: Sodio alta press.
- nome: HST
- portalampada: E40
- potenza: 150.00 W
- flusso: 14500 lm
- temp. di colore: 1900 K
Schermi laterali:
- profondita': 0.0 cm
- angolo C=0: 0.0 cm
- angolo C=90: 0.0 cm
- angolo C=180: 0.0 cm
- angolo C=270: 0.0 cm
Griglia:
- dimensioni xy: 0.0 x 0.0 cm
- profondita': 0.0 cm

6 Lighting software: Illuminando

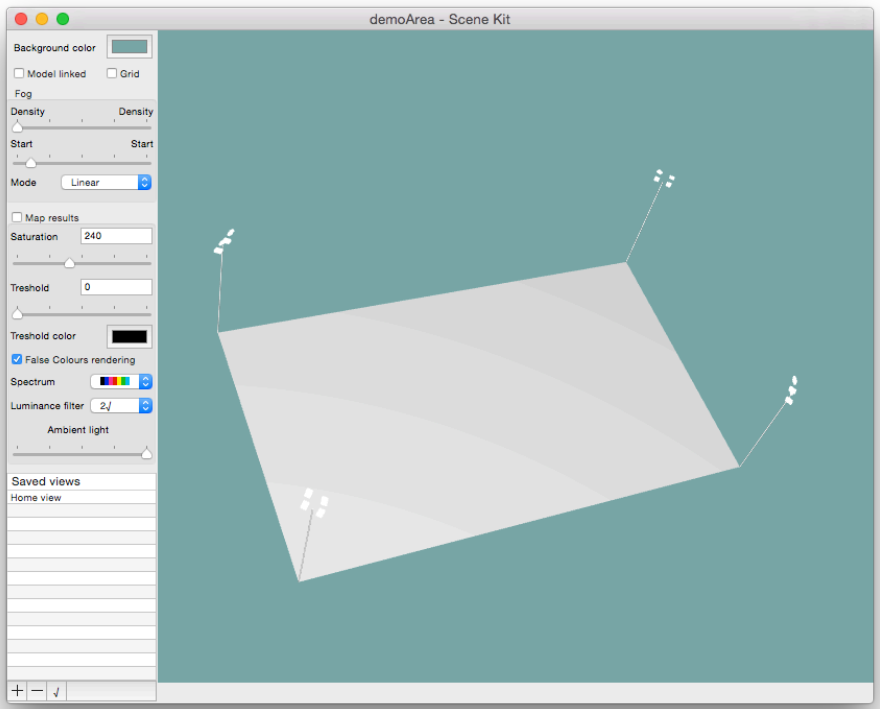
The first operation is to the file in a native format.

Then, scroll the document to see if each picture is contained in the relative page (it is possible to resize them) and to update fields (the table with the Product List at the end of document contains some formulas: it is possible to view and modify them with specific commands inside each word processor).

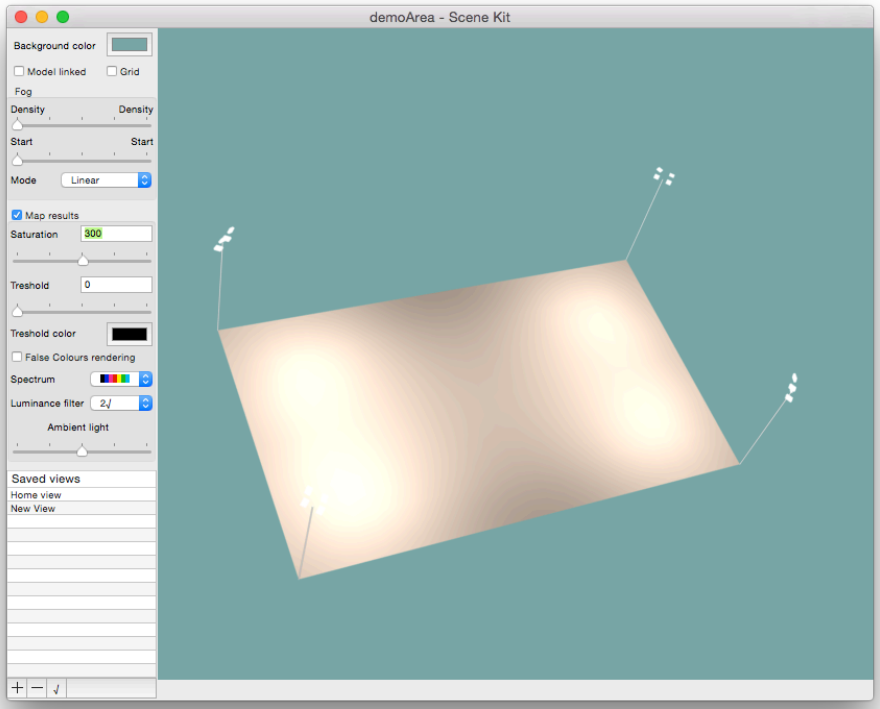
Now we can paste into the document some rendered image. Come to Illuminando and, from the 3D general view, select the command "View"->"Rendering": you'll se something like this:



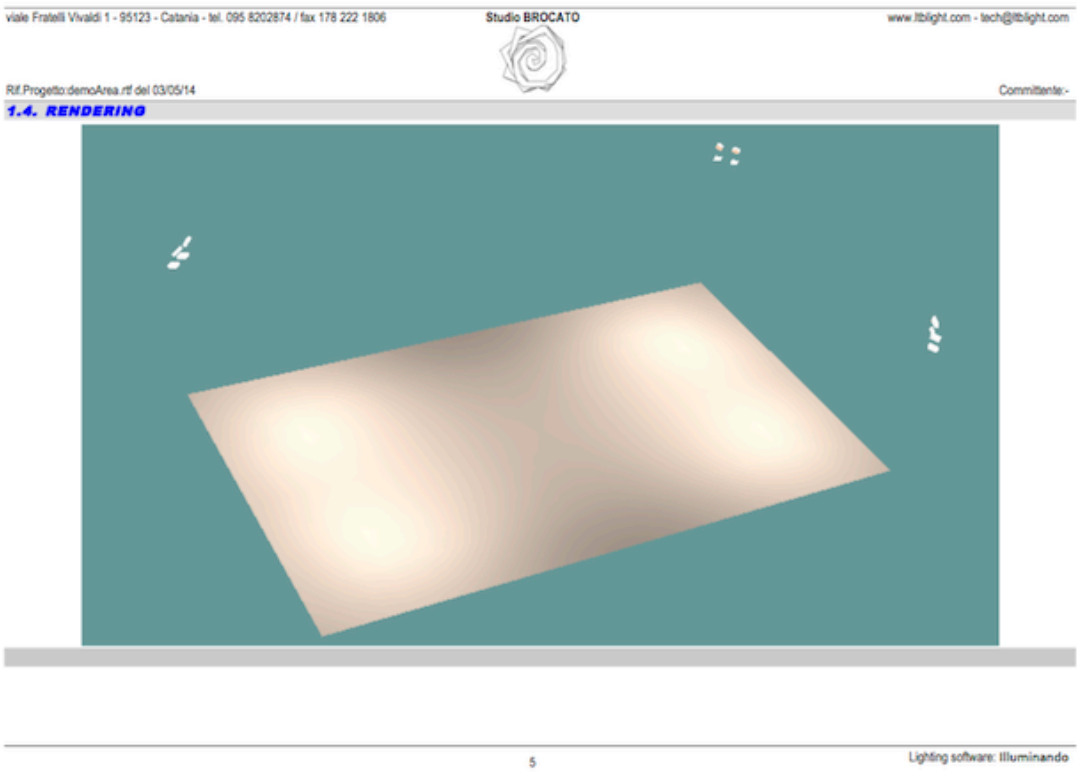
Now with the 'Virtual sphere' mouse-method rotate (click-drag procedure), zoom (mouse wheel) and drag (right-button + click-drag procedure) the view to make it similar to the one presented in the next figure:



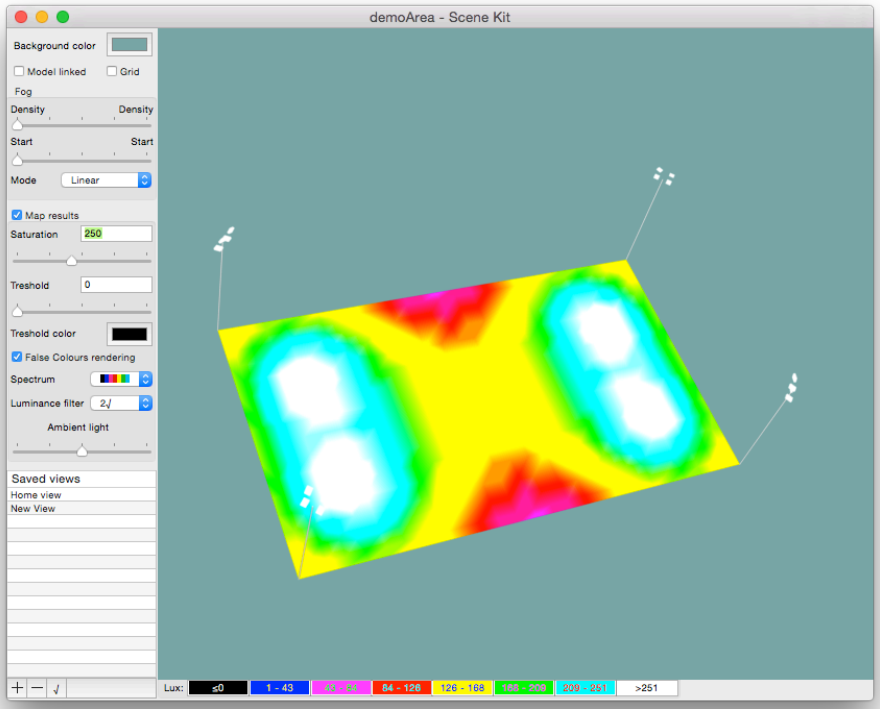
Save the view with the + button down in the drawer. Now, following the next figure, set parameters:



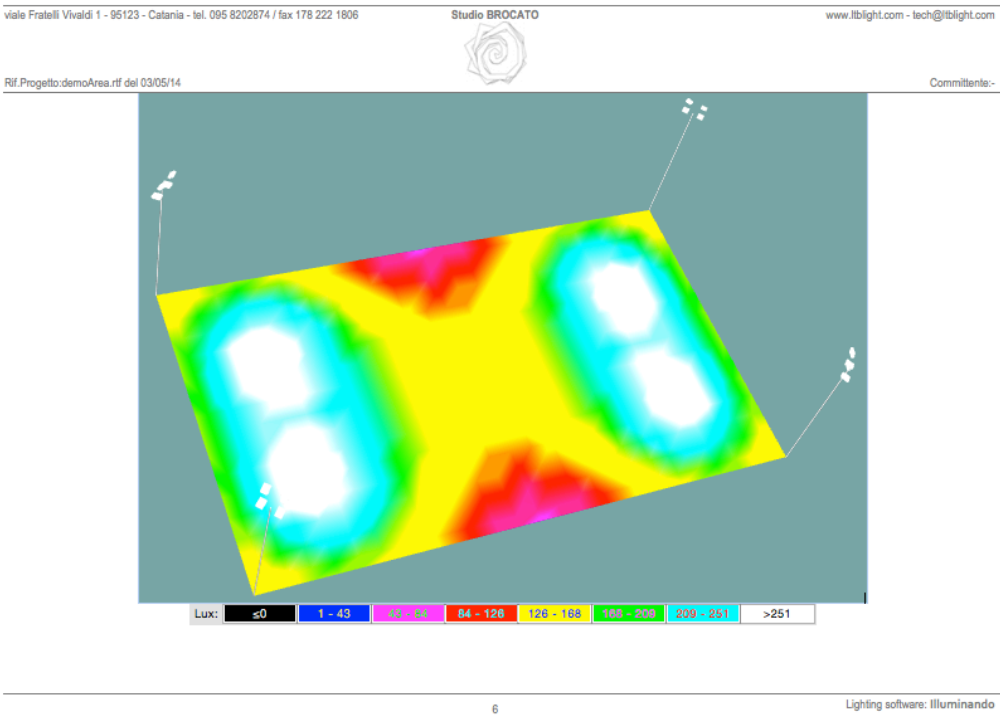
Copy the image in the clipboard and go to page 4 of the report. Put the insertion point after the image, press Return, type "RENDERING", press Return again, then paste the clipboard content. After resizing the pasted image in the report file you will see a new page:



Activate the Result tab and adjust the "Saturation" at the value of 250 lux and check the "False Colors rendering" box, to see the following imagine:



Copy the image in the clipboard and go to page 5 of the report. Put the insertion point after the image pasted before, press Return and paste the clipboard content (You can also hard-copy the color-scale at the bottom of the window and paste it in the report, like in the next figure):



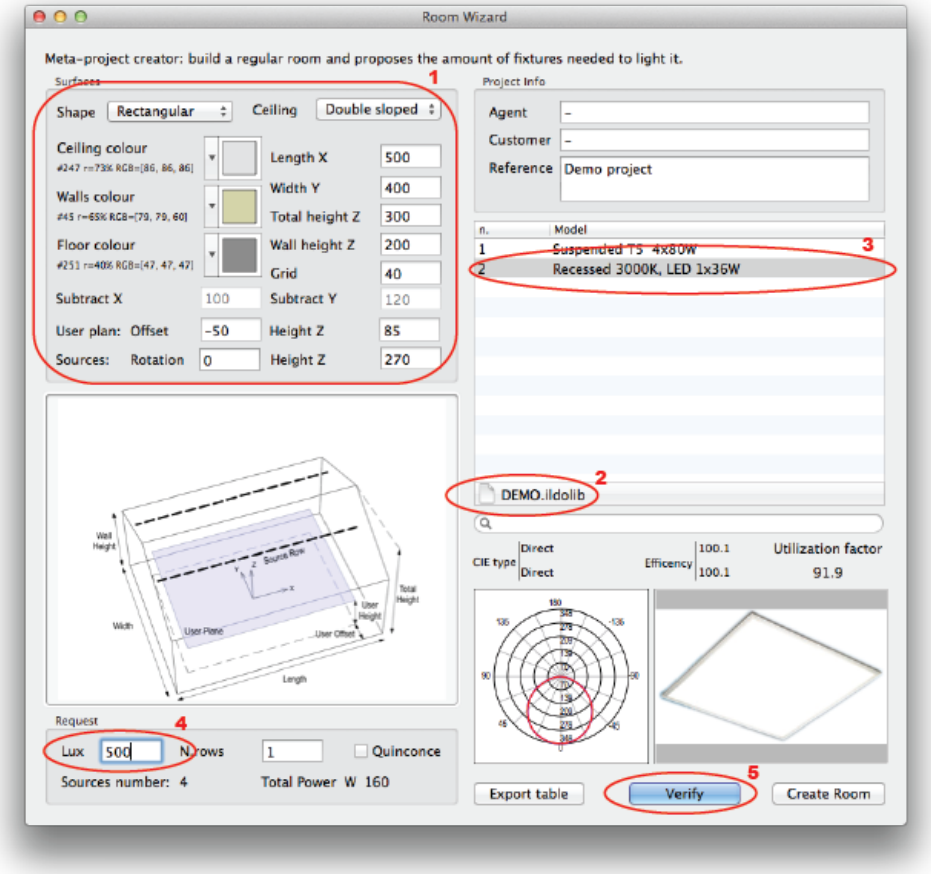
Save the file and this is all!

5.2. Rectangular room

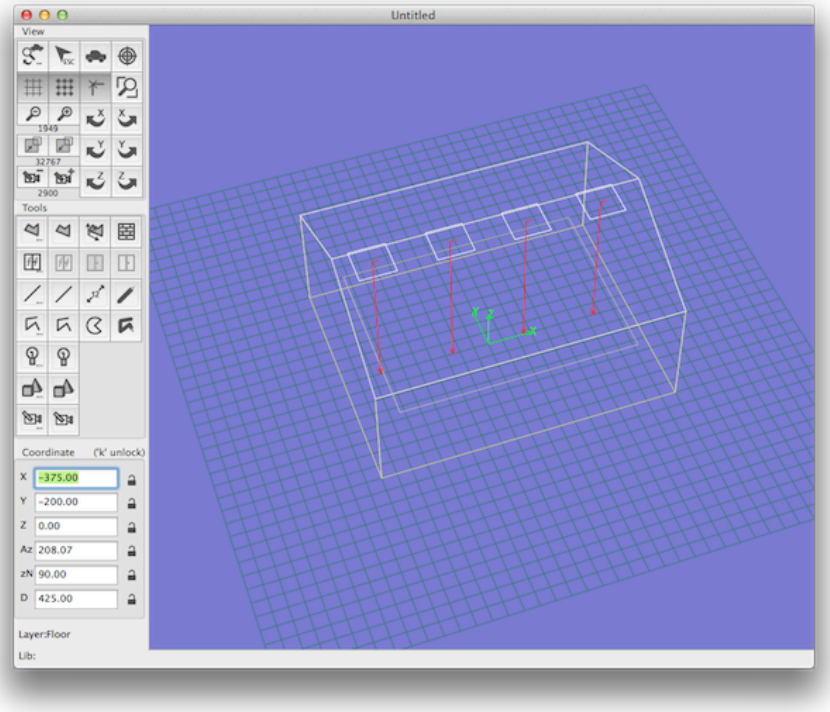
This tutorial permits to build a simple rectangular room and to choose an efficient lighting solution.

5.2.1. Building the room.

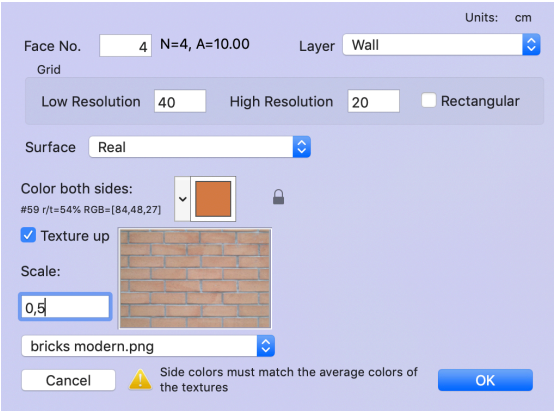
1. The first step consist in opening from the menu "File" the item "Room Wizard" that will open the standard dialog; let's choose the room parameters and the surface color following the scheme at point 1:



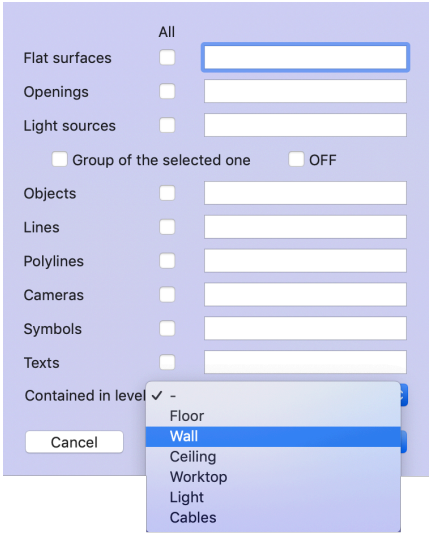
2. Then navigate in the "Luminaires" folder to choose "DEMO.ildolib" catalogue (point 2) in which select the "Recessed 3000K, LED 1x36W" luminaire (point 3).
3. In the "Lux" edit field everything is ok, press the "Create room" button and the Application will build the room to start calculations.



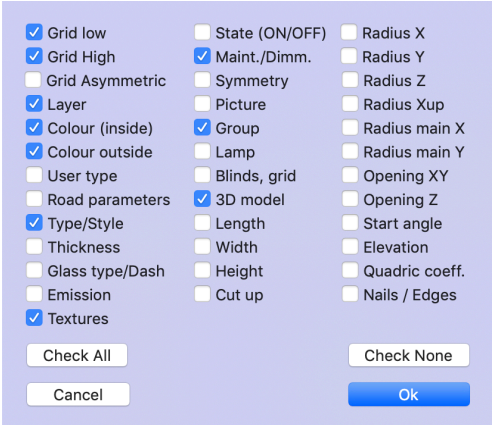
Select a wall and assign colour and texture following the next image (scale texture to 0,5):



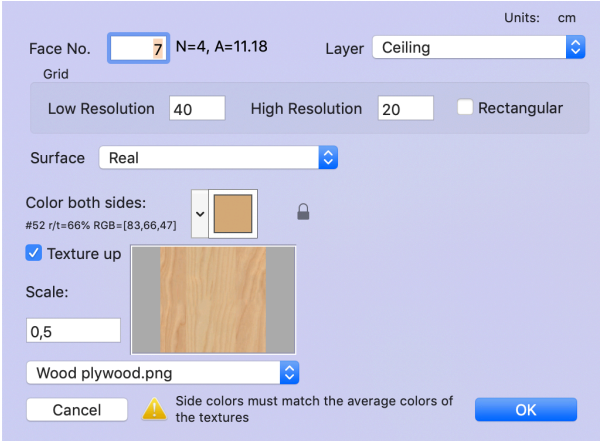
Accept the dialogue, copy the wall characteristic (Menu 'Edit'->'Copy') and select all the other walls through the Menu 'Edit'->'Select special...':



Accept the dialogue and paste texture to the selected element through the Menu 'Edit'->'Paste special...' (control to check the 'Textures' box):



Do the same procedure for one of the roof face, with the following texture and scale:

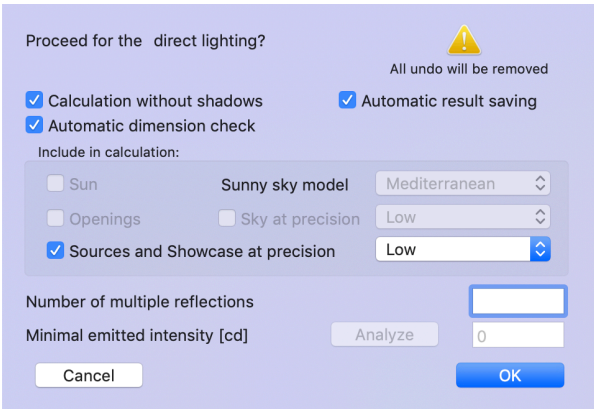


Accept the dialogue, copy the wall characteristic (Menu 'Edit'->'Copy'), select all the other roof face and paste the texture characteristic with the Menu 'Edit'->'Paste'.

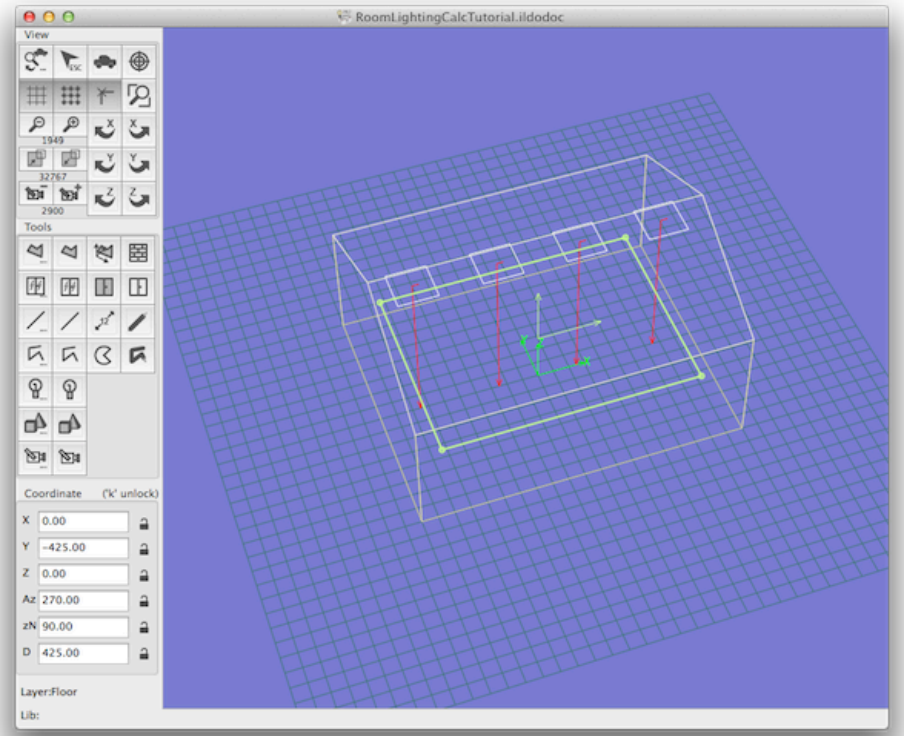
Now the room is ready for calculation.

5.2.2. Starting calculation

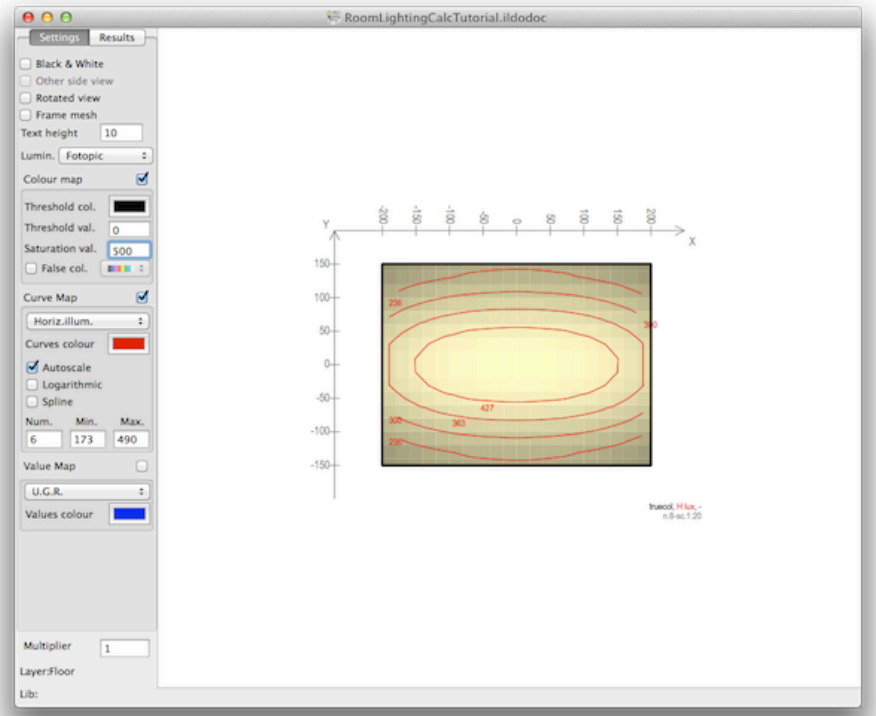
Select in the menu "Lighting" the item "Calcul...", erase the content of the "Number of multiple reflections" edit field and then pushing the button "Ok"...



...the software will compute the direct lighting calculation. To examine the results at this first step, select the user surface and choose the menu "Lighting"->"Results":

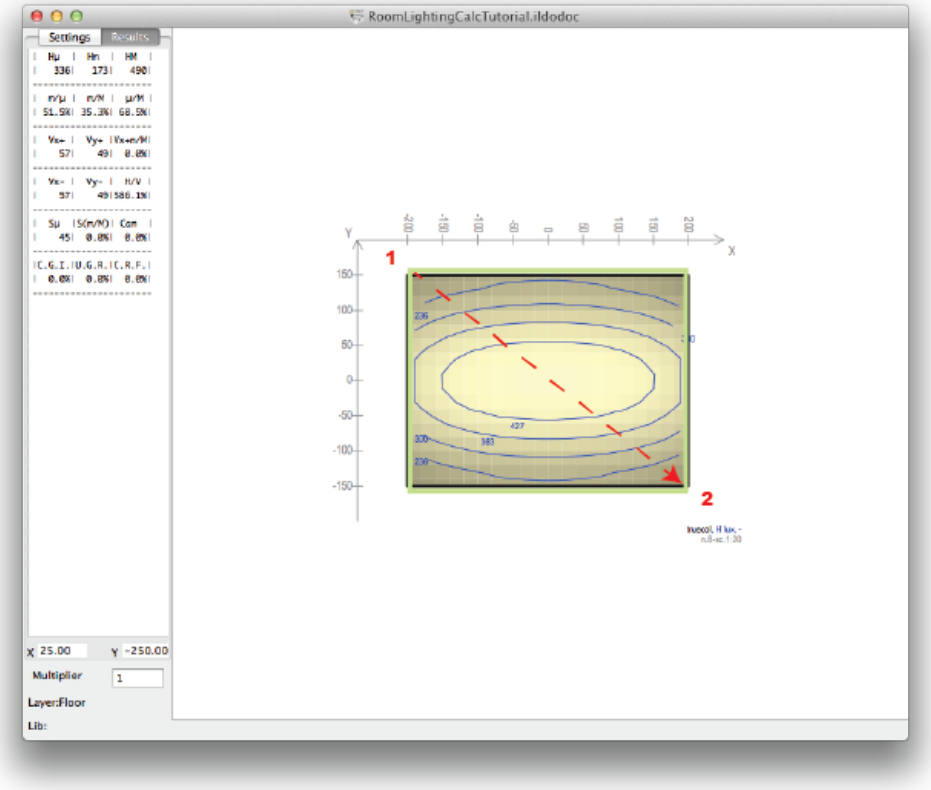


Zooming to a scale of 1/20 (menu "View" "Zoom scale" "1/20"), typing 500 in the "Saturation val." edit field and choosing "Color Map" + "Curve Map" + "Autoscale", You will see the following view:

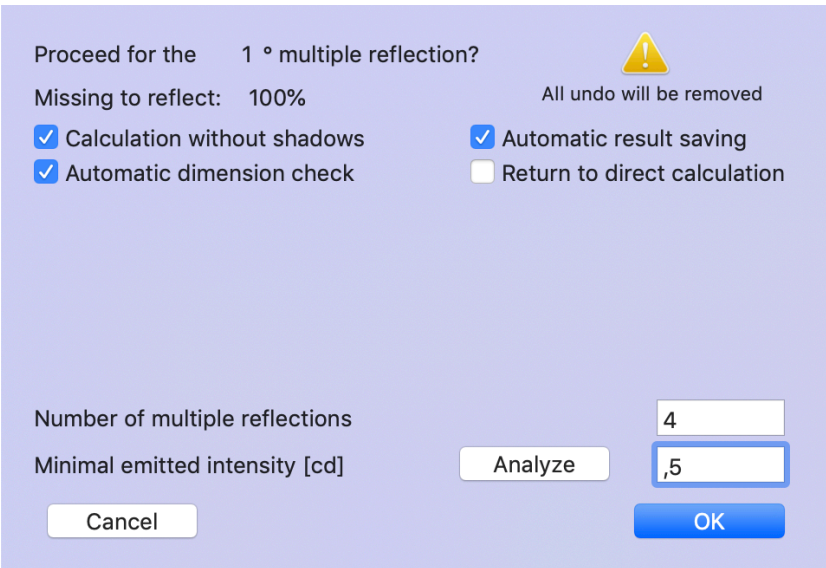


In which is presented the flat surface n.8 in true color and isolux curves. You can change the show results mode in some other way through the drawer settings (see menu "Lighting"->"Settings...").

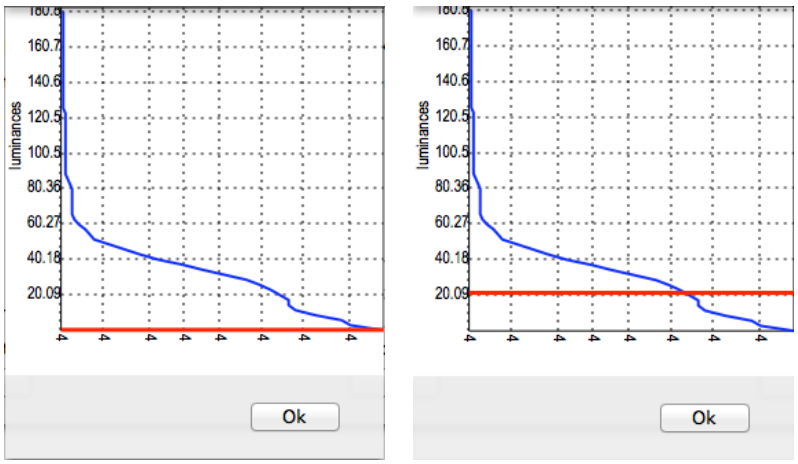
Opening with the mouse a rectangle inside the surface or simply making a click somewhere, the partial result values will be presented: opening a rectangle from the top-left corner 1 to the bottom-right one 2 of the projected surface, the information on the whole surface will be presented:



In the left drawer will be presented the values relative to the selected zone. Then we can go on in multiple reflections: choose "Lighting"->"Calcul..." from the menu:

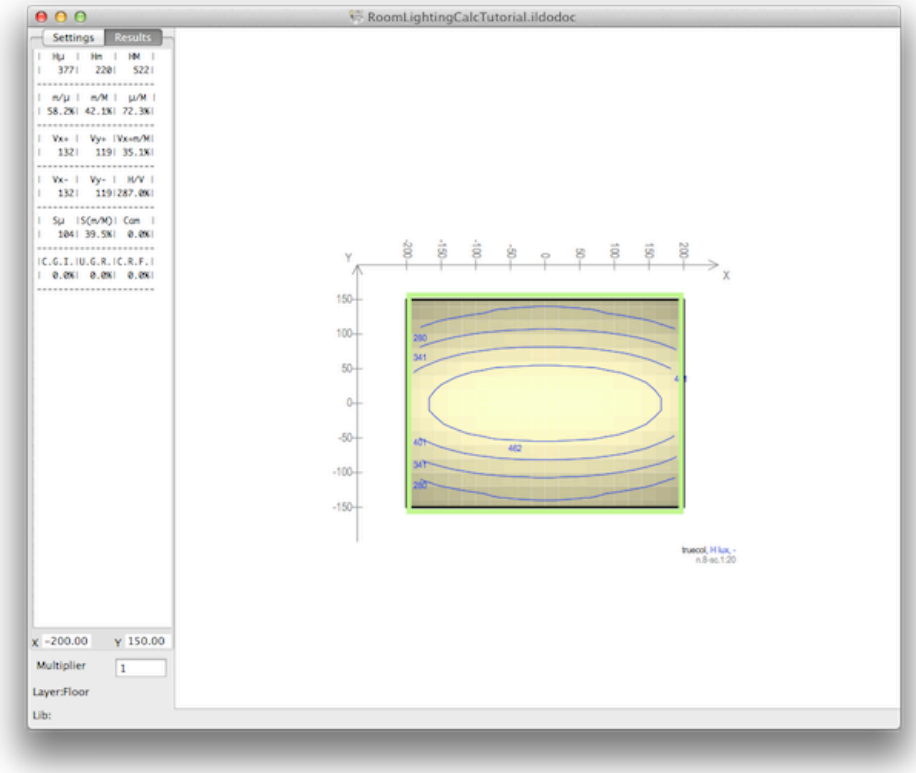


We have the 100% of interreflection to redistribute and we can look for the best value to cut the reflections at the first step: choose "Analyze":



...and with the mouse bring the horizontal red line near the knee between 40.18 and 60.27: pressing "OK" the luminance threshold will be fixed. For now, it is better to do 4 multiple reflection, and put 0.5 as the minimum emitted intensity, as presented in the upper dialogue. Pressing "Ok" other 4 reflections will be done with this threshold.

And now, let's examine again the result: select the user surface and select the menu "Lighting" "Results". Open a rectangle that include the whole surface and read the results:



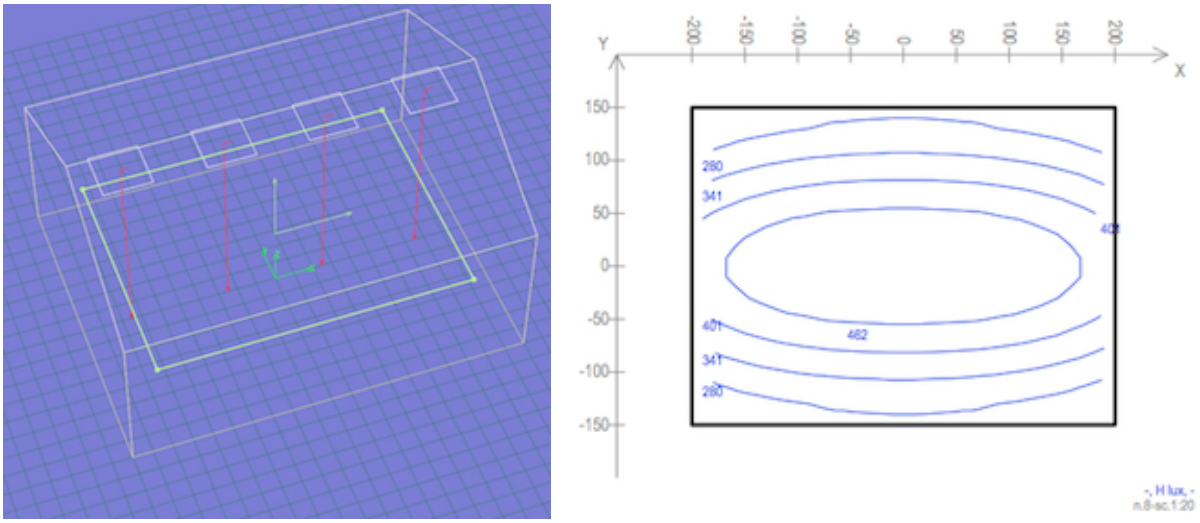
We can go on in multiple reflections or stop calculation accepting the results.

5.2.3. Preparing the report

For this, we have to choose the picture we want to show in the first page (menu "View"->"Save Image for Report as 'Cover design'"), in the "Installation of the fixtures" paragraph (menu "View"->"Save Image for Report as 'Layout design'") and in the "Result on worktop" paragraph (menu "View"->"Save Image for Report as 'Result design'").

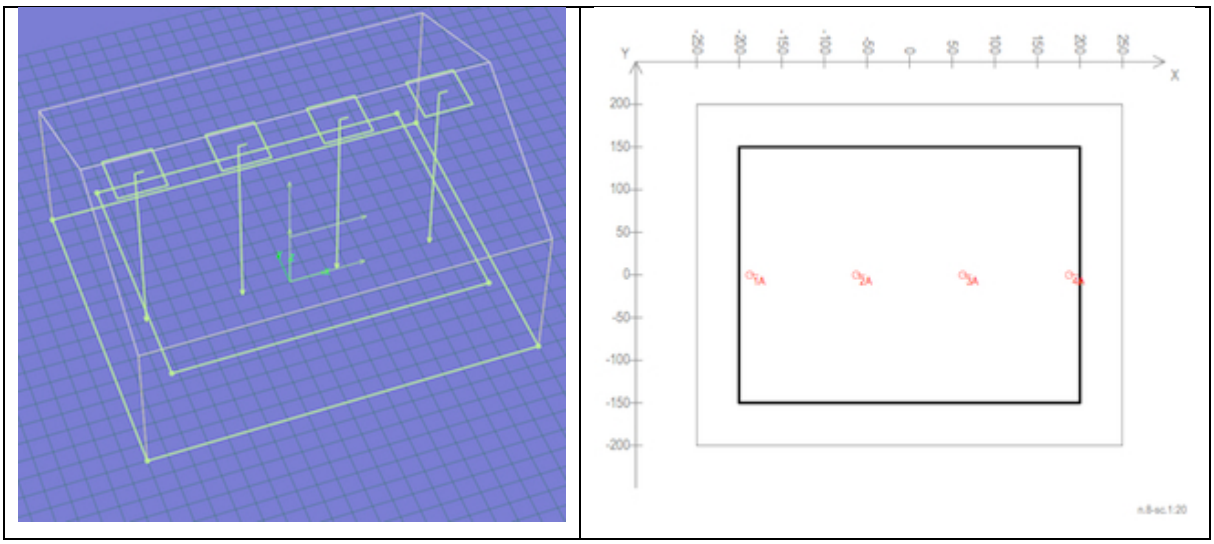
The procedure is simple.

To export the 'Result design' picture we have to select for first the surface whose results we want to represent and then all the elements we want to project on it: then choose the "Lighting"->"Result" menu, and finally select the visualization option we want to view in the report page. Follows an example:



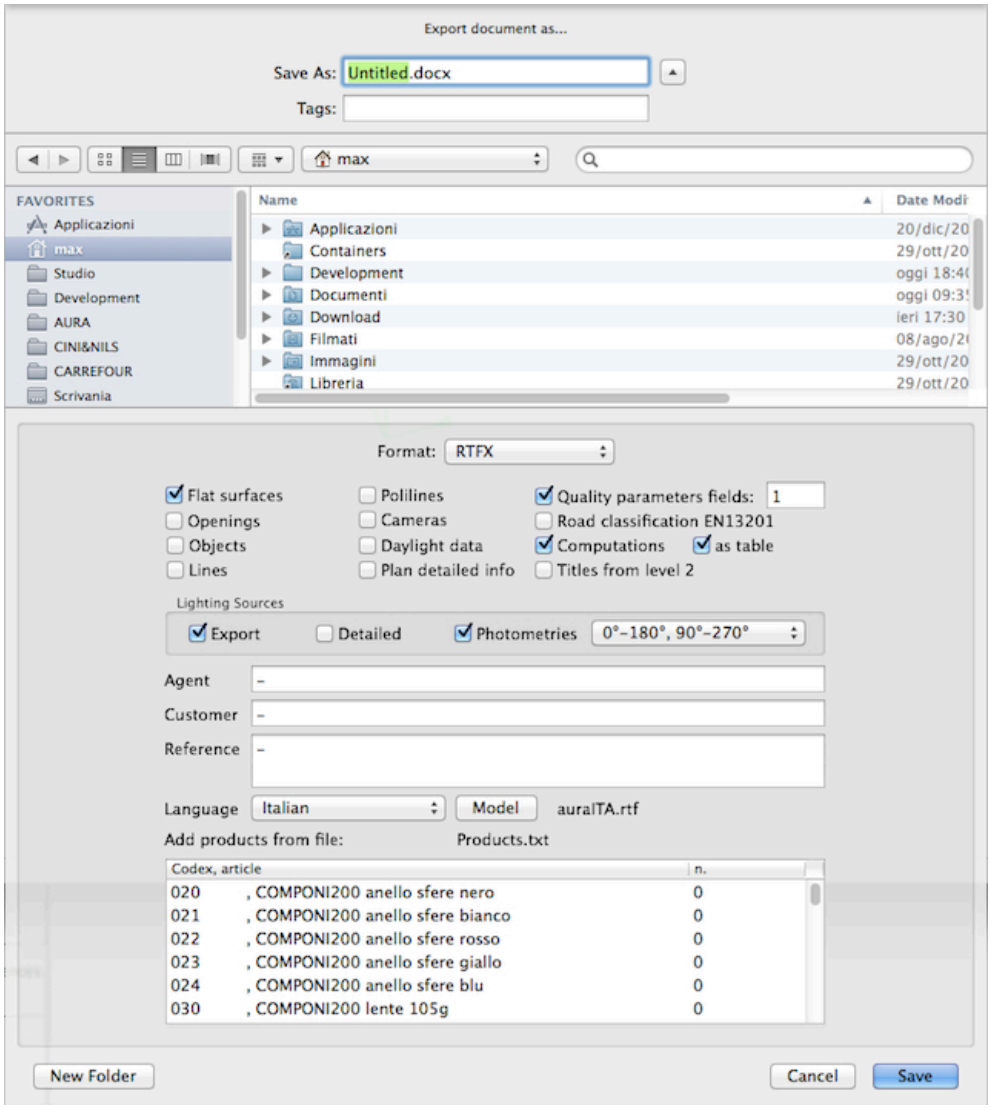
To save in the 'Result design' picture-slot select the menu command 'View'->'Save Image for Report as Result design'. Come back to the 3D general view by selecting "Lighting"->"Result" menu again.

To export the 'Layout design' we have to select for first the surface we want to use as reference plan and then all the elements we want to project on it to create an installation layout. Follows an example in which the view is plotted in black+red+white (managing from the left drawer). Then choose the "View"->"Plan View" menu and adjust the view by centering and zooming (better in scale) it.

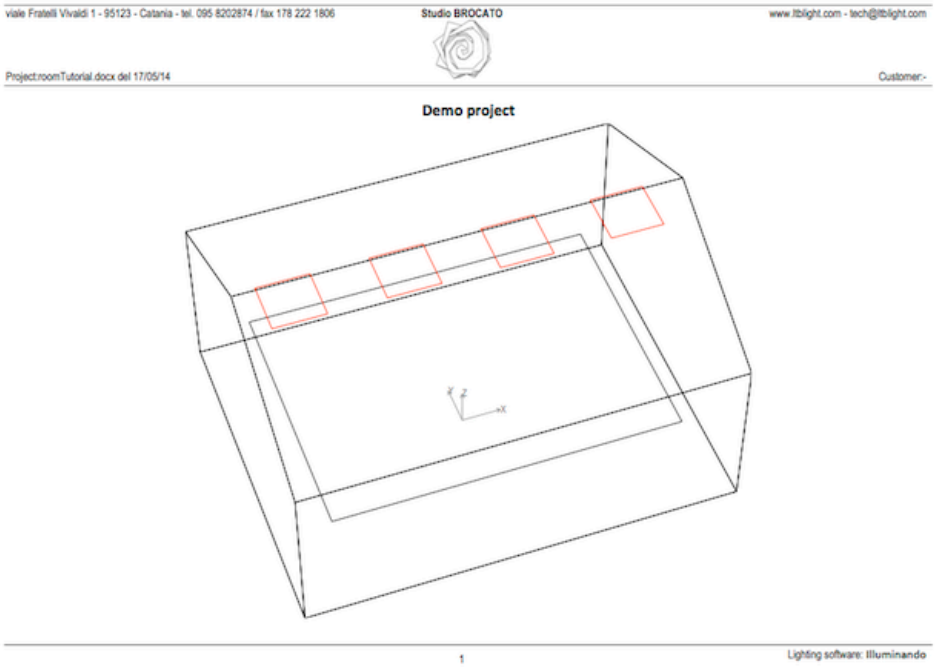


To save in the 'Layout design' picture-slot select the menu command 'View'>'Save Image for Report as Layout design'. Come back to the 3D general view by selecting "View"->"Plan View" menu again. To export the 'Cover design' simply adjust the last 3D general view to your preferences. In the following picture the view is plotted in black+red+white and the 3D-model linking on.

To save in the 'Cover design' picture-slot select the menu command 'View'->'Save Image for Report as Cover design'. Then select the "File"->"Export" menu and set your preferences. Pressing the "Ok" button the software will ask to save the report file: select the "RTF" or "RTFD" format in the pop-menu and choose the exportation preferences. Follows an example:



Then let's open the saved file to add some picture in: (follow the opened pages).



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Project:roomTutorial.docx del 17/05/14 Customer:-

INFORMATION ABOUT THE ROOM

ROOM DIMENSIONS (X, Y, Z): 5.00 x 4.00 x 3.00 m

1.1. FLAT SURFACES

n.	Level	Surface	Area [m2]	Colour upper-lower	Grid [cm]
1	Floor	real	20.0	medium gray 40%	40
2	Wall	real	10.0	pink 65%	40
3	Wall	real	10.0	pink 65%	40
4	Wall	real	10.0	pink 65%	40
5	Wall	real	10.0	pink 65%	40
6	Ceiling	real	11.2	white 73%	40
7	Ceiling	real	11.2	white 73%	40
8	Worktop	virtual	12.0	-	20

1.2. LIGHT FITTINGS

n./ref.	Code - Model	Bulb	Source	Model	Socket	W	lm	K	W tot.	B.F.	Position (x,y)	H inst.	Pointing (x,y,z)	az.,zen.
1A	Recessed 3000K, LED 1x36W	1	Led	led	-	36.0	2600.0	4000	40.0	90	-188, 0	270	-188,0,0	0,180
2A	Recessed 3000K, LED 1x36W	1	Led	led	-	36.0	2600.0	4000	40.0	90	-62, 0	270	-62,0,0	0,180
3A	Recessed 3000K, LED 1x36W	1	Led	led	-	36.0	2600.0	4000	40.0	90	62, 0	270	62,0,0	0,180
4A	Recessed 3000K, LED 1x36W	1	Led	led	-	36.0	2600.0	4000	40.0	90	188, 0	270	188,0,0	0,180

2 Lighting software: Illuminando

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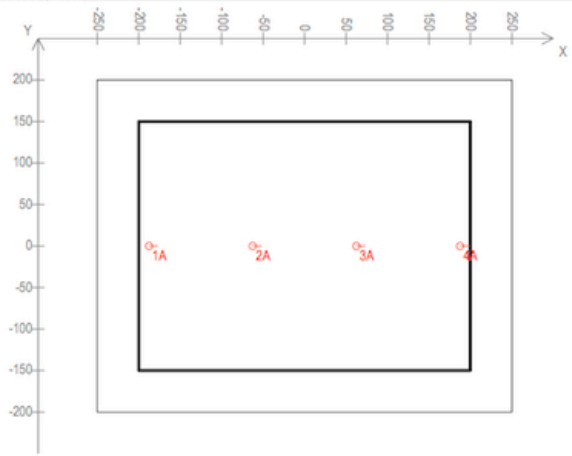
Project:roomTutorial.docx del 17/05/14 Customer:-

1.2.1. INSTALLING FITTINGS (n./ref.)



n.8-sc.1:20

3 Lighting software: Illuminando

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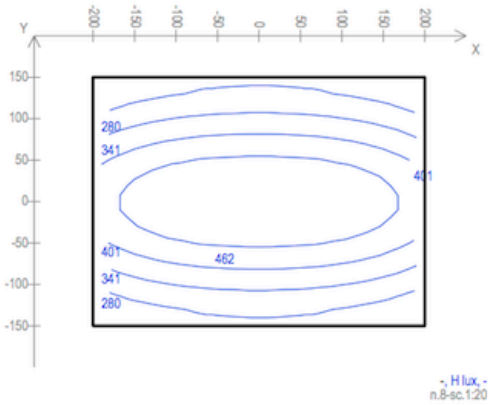
Project:roomTutorial.docx del 17/05/14 Customer:-

RESULTS ON WORKTOPS

Top	Mean Value lux	Minimum Value lux	Maximum Value lux	Min/Mean	Min/Max	Mean/Max
8 - H=85	377	220	522	58,36%	42,15%	72,22%

1.3. ISOVALUES ON WORKTOPS



4 Lighting software: Illuminando

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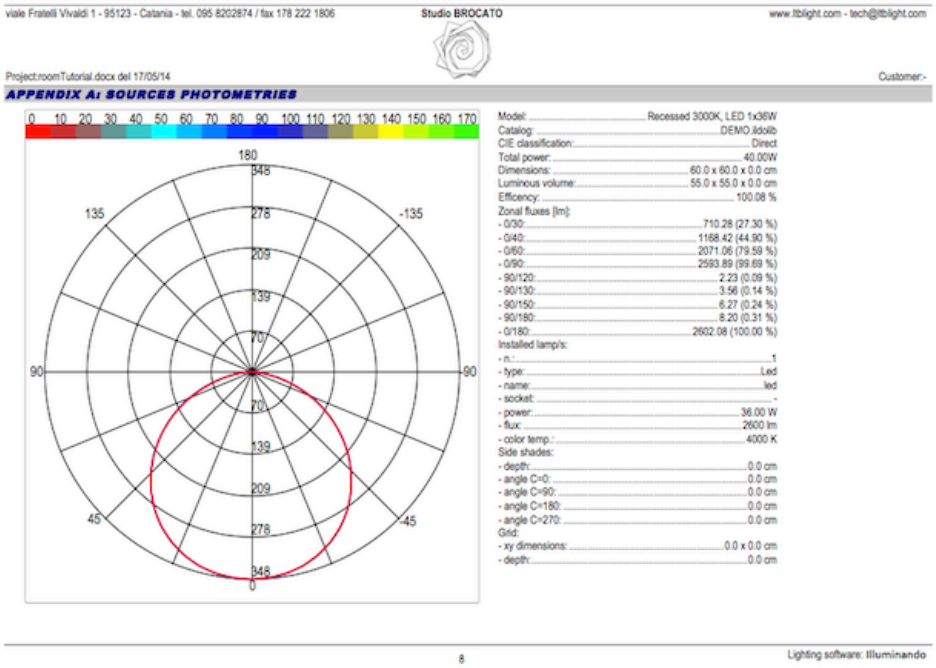
Project:roomTutorial.docx del 17/05/14 Customer:-

PRODUCT LIST

LIGHT FITTINGS

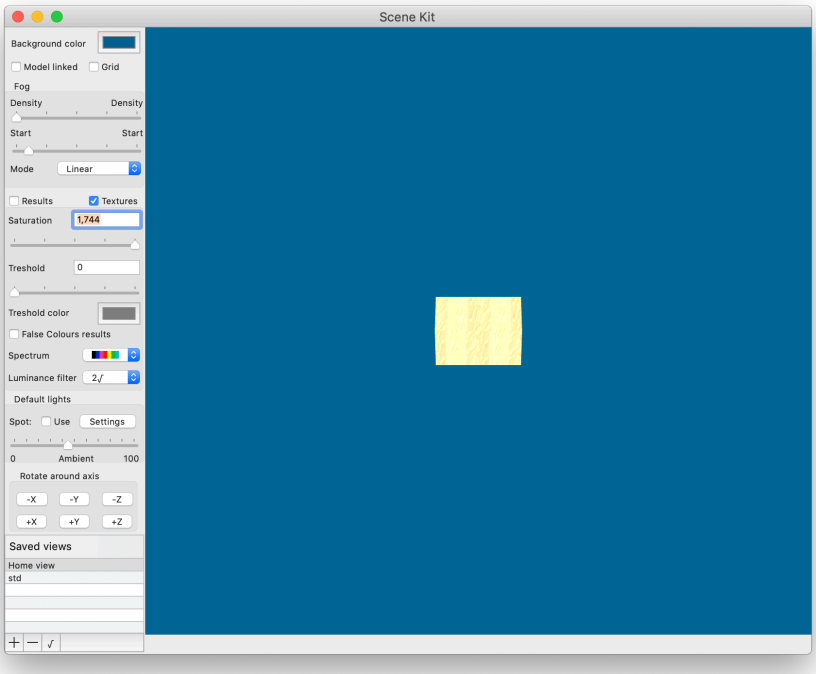
ref.	Image	Code - Model	Tot.Power [W]	Quantity	Prize	Amount
A		Recessed 3000K, LED 1x36W	160	4	N.D.	0,00
TOTAL LIGHT FITTINGS			160			
SPECIFIC INSTALLED POWER			8,000W/m²			

7 Lighting software: Illuminando

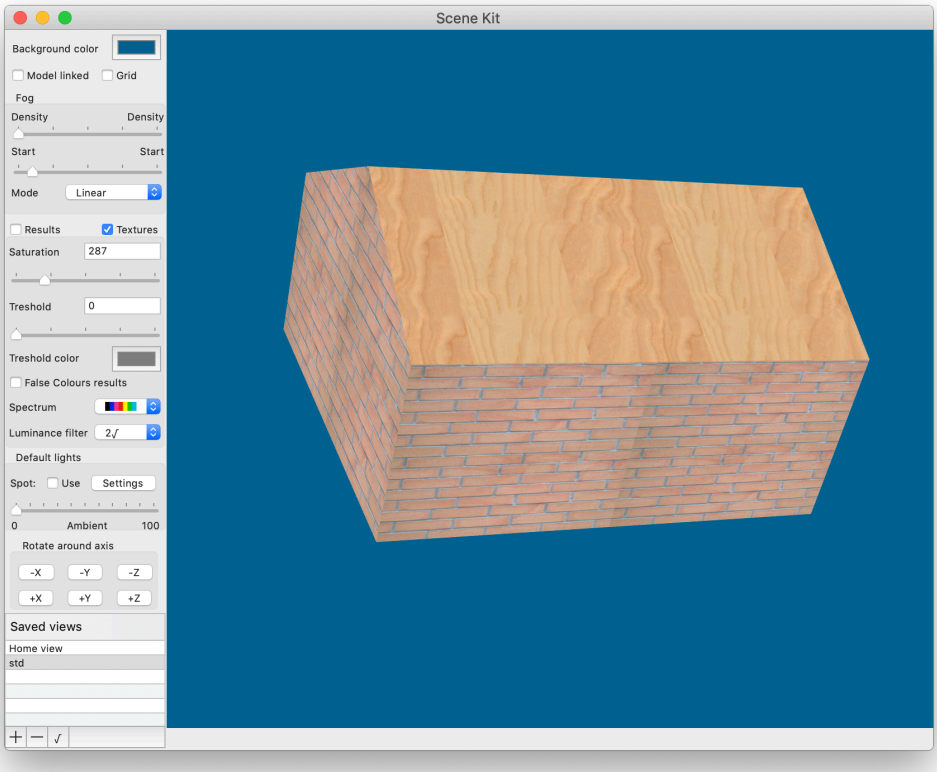


The first operation is to save the file in a native format.

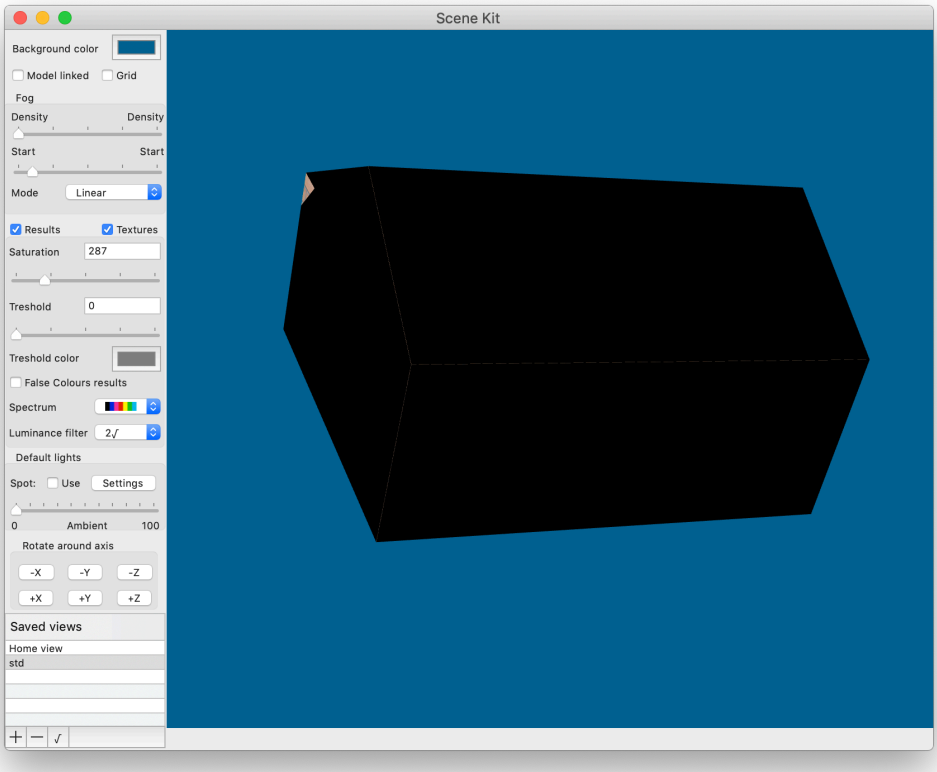
Then, scroll the document to see if each picture is contained in the relative page (it is possible to resize them) and to update fields (the table with the Product List at the end of document contains some formulas: it is possible to view and modify them with specific commands inside each word processor). Now we can paste into the document some rendered image. Come to Illuminando and, from the 3D general view, select the command "View"->"Rendering". You'll se something like this:



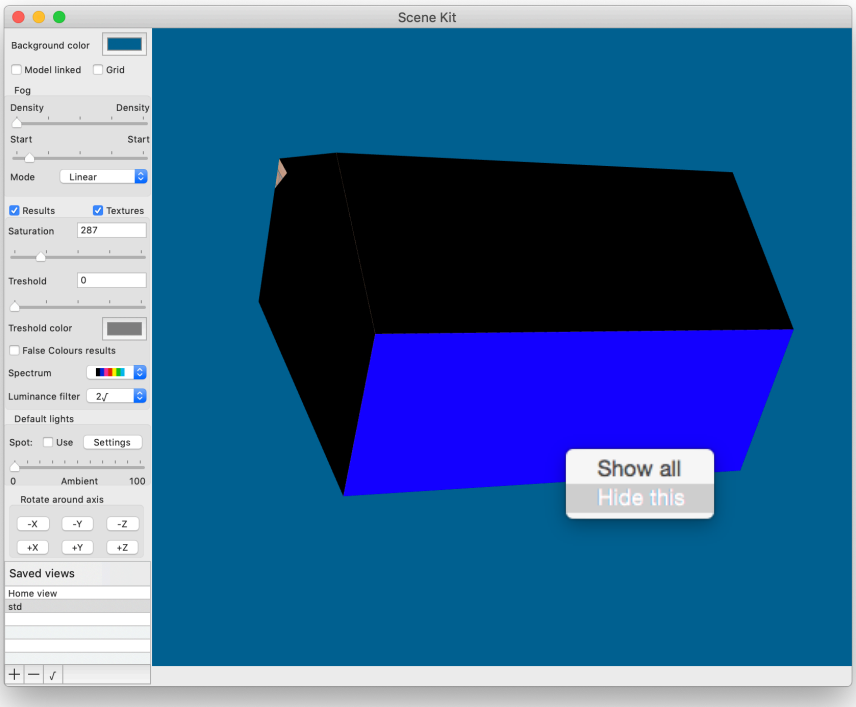
Eventually, turn off the 'Grid', put the 'Ambient light' at 0% and with the view buttons and the 'Virtual sphere' mouse-method rotate (click-drag procedure), zoom (mouse wheel) and drag (right-button + click-drag procedure) the view until You see something like the following figure:



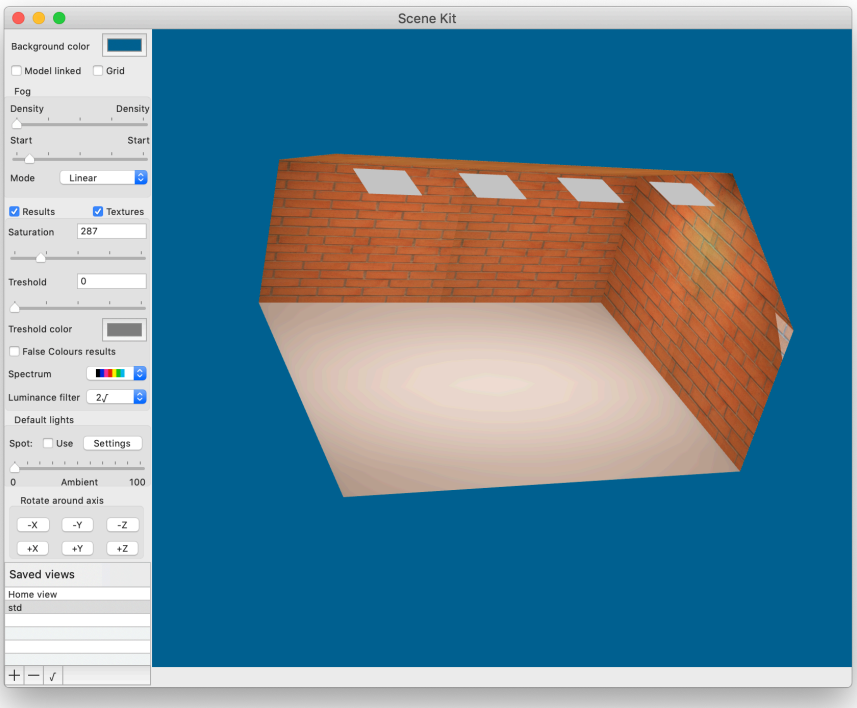
Save the view with the '+' button down in the drawer and give it 'std' as name. Activate 'Map results' and uncheck 'False color rendering' option, then You'll see something like this:



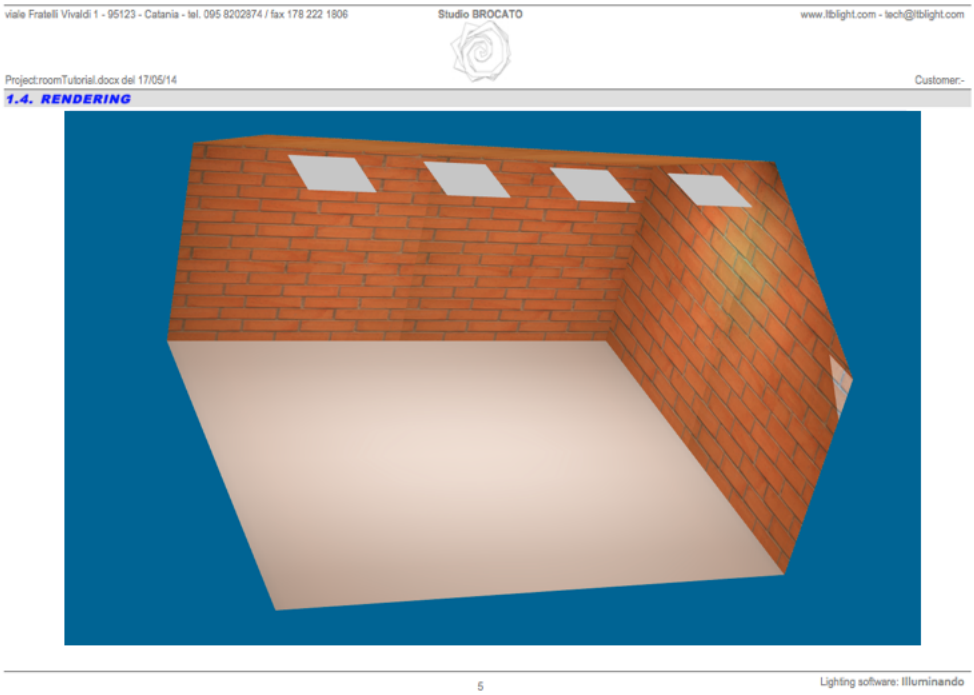
Select the front most wall (it will start blinking) and with the contextual menu select 'Hide this':



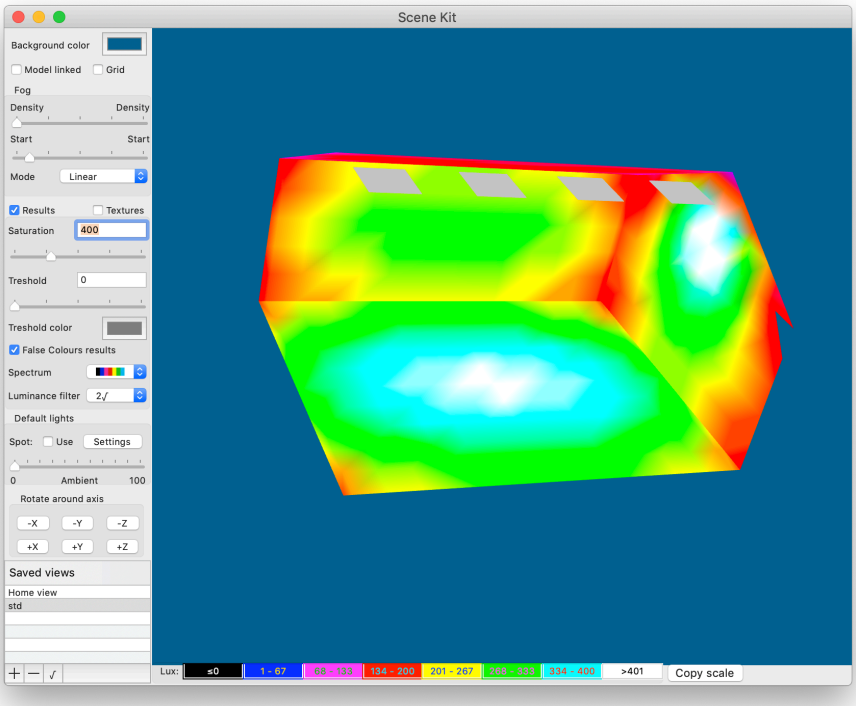
Do the same procedure with the other front most wall and roof:



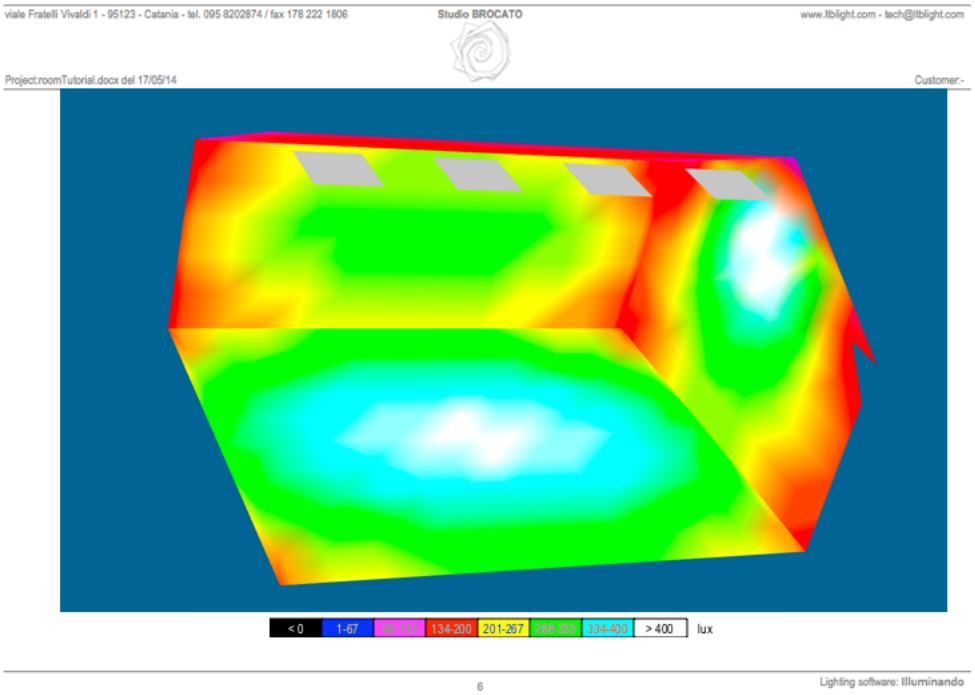
Now adjust the "Saturation" at the value of 300 lux, copy the image in the clipboard and go to page 4 of the report. Put the insertion point after the image, press Return, type "RENDERING", press Return again, then paste the clipboard content. After resizing and cropping the pasted image in the report file you will see a new page:



Come back to Illuminando, check the "False Colors rendering" box, hide the three front most surfaces (like before) and You'll have the following:



Copy the image in the clipboard and go to page 5 of the report. Put the insertion point after the image pasted before, press Return and paste the clipboard content (You can also hard-copy the color-scale at the bottom of the window and paste it in the report, like in the next figure):



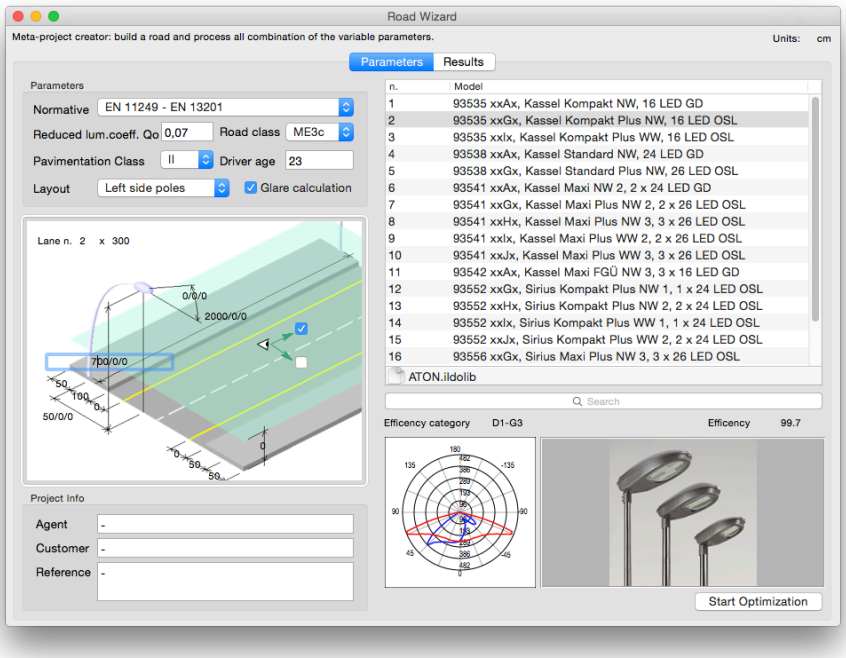
Save the file and this is all!

5.3. Road

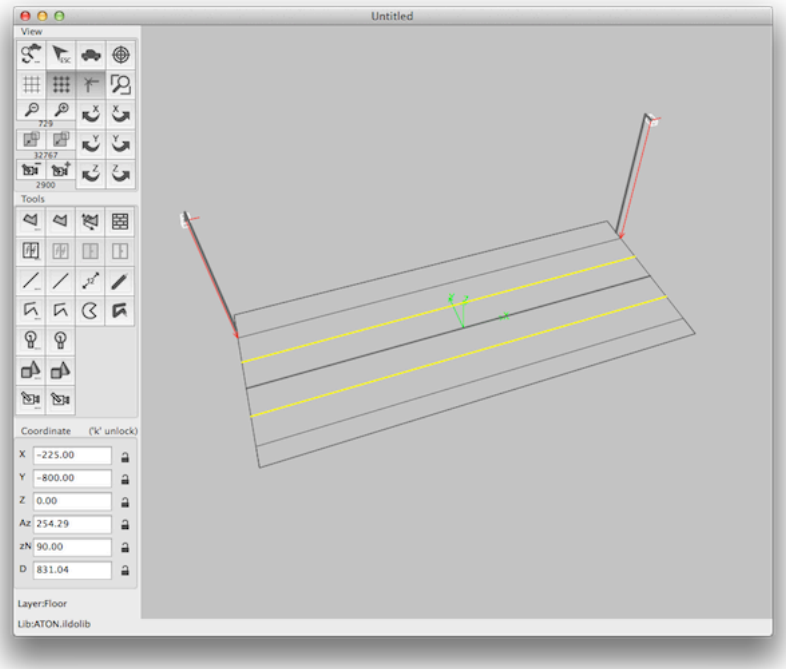
This tutorial permits to build a road and to choose an efficient lighting solution.

5.3.1. Building the road with the road tool.

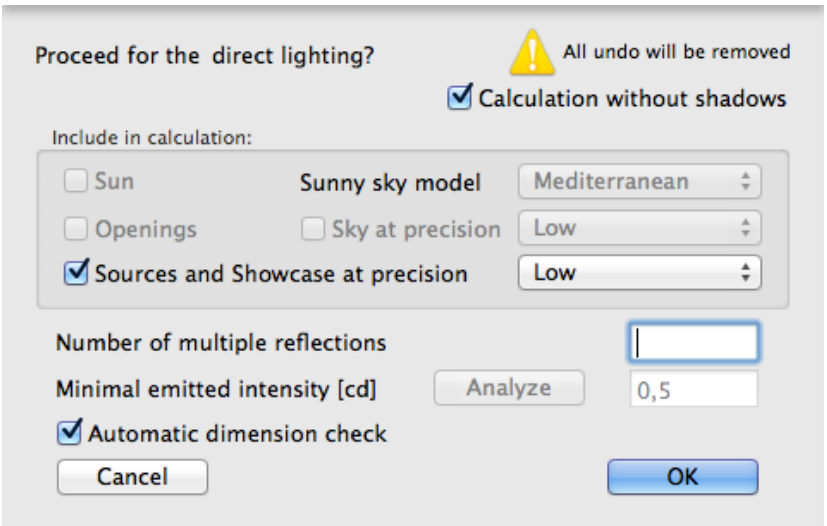
1. The first step consist in opening from the menu "File" the item "Road Wizard..." that will open the road tool, choosing the "ATON.ildolib" catalogue and the fixture n.2 and then set the parameters like in the following figure:



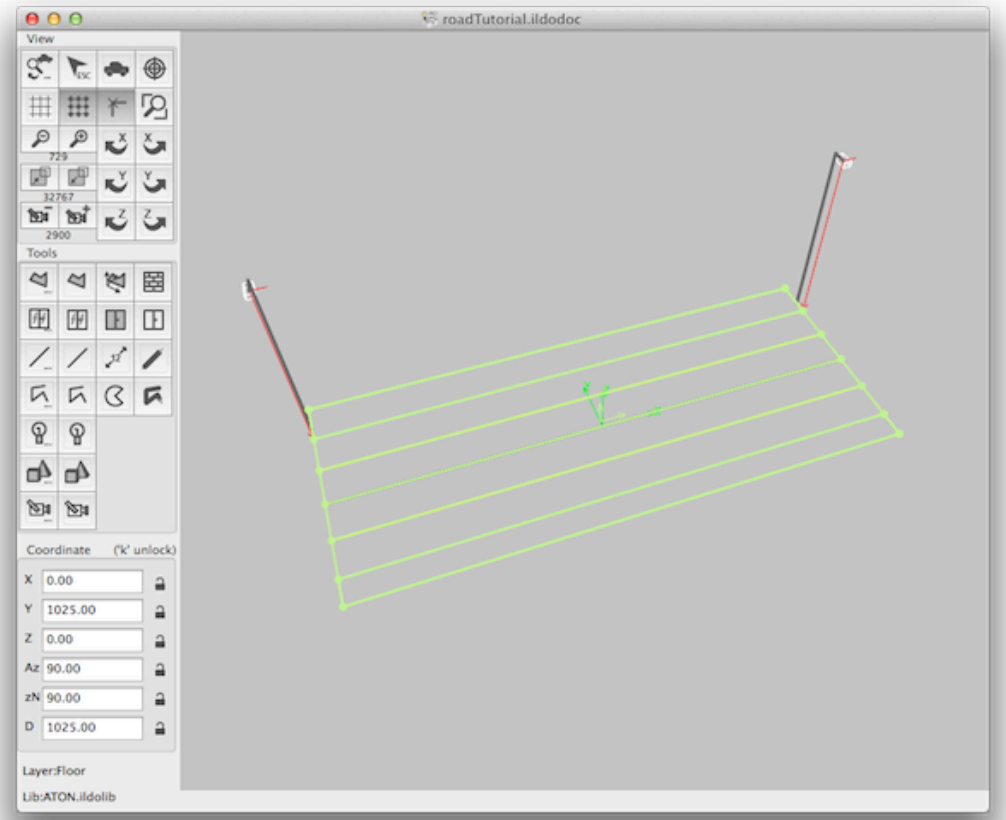
2. Pressing the "Start optimization" button the software will create the model for the selected configuration:



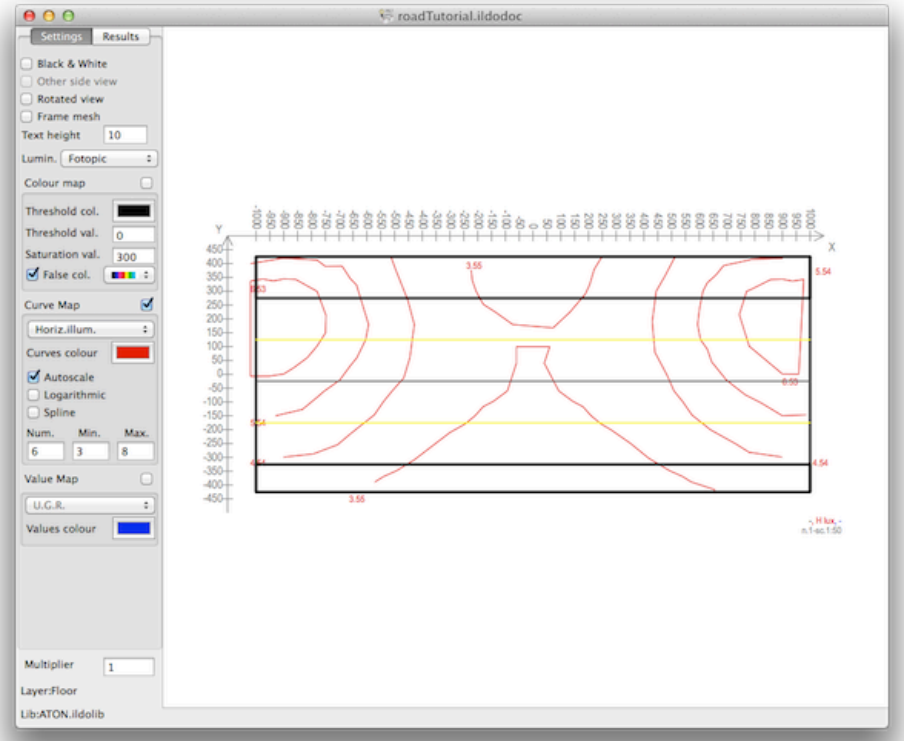
We can start calculation: choose "Lighting" - "Calcul" and accept the following options:



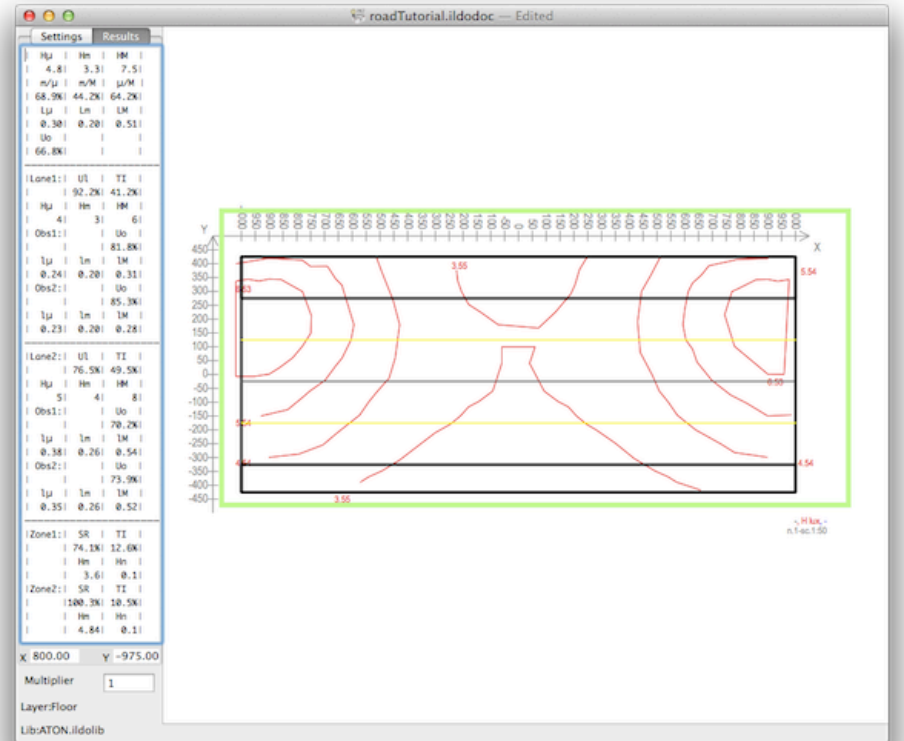
Select the road surface and the lines on it with a crossing window selection...



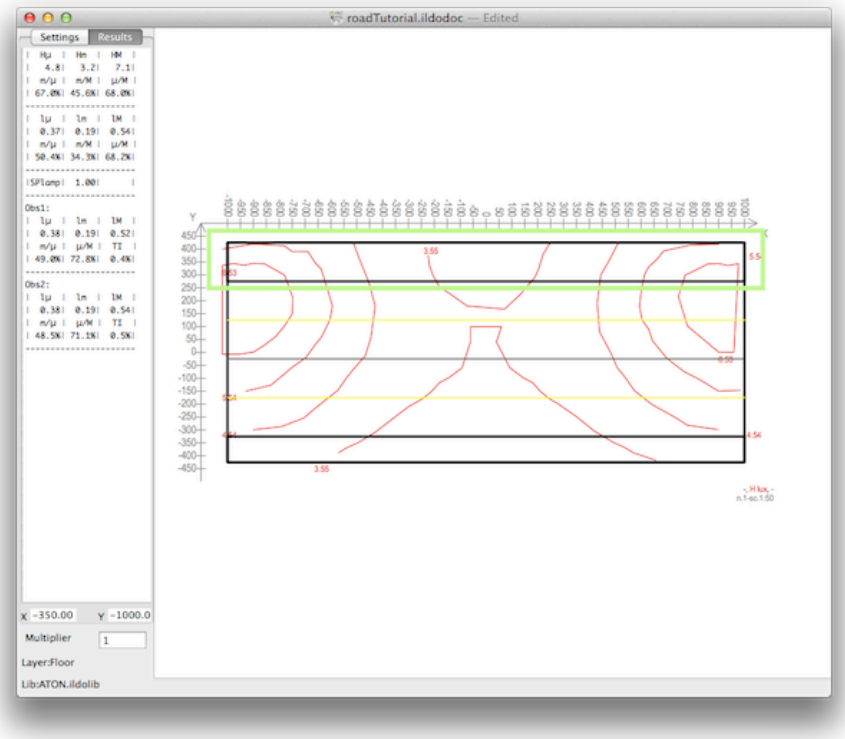
...choose "Lighting" - "Result..." and put the view in scale 1:50 accepting the following parameters:



Opening with the mouse a rectangle that contains the whole face (light green one), You'll se the global results:

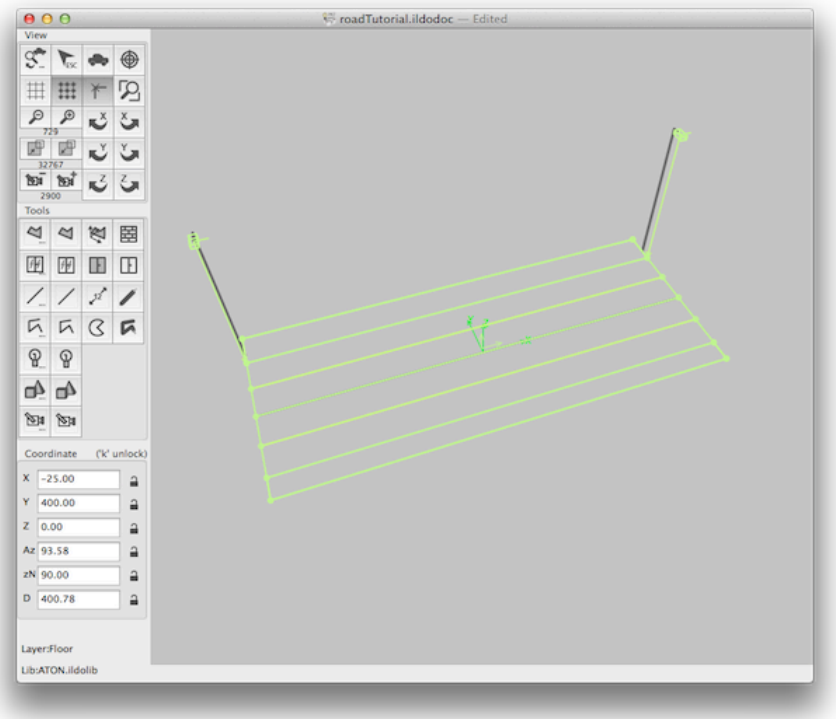


You can investigate what's happened in several zones dragging some rectangle inside the surface: the drawer will present the results for that zone:

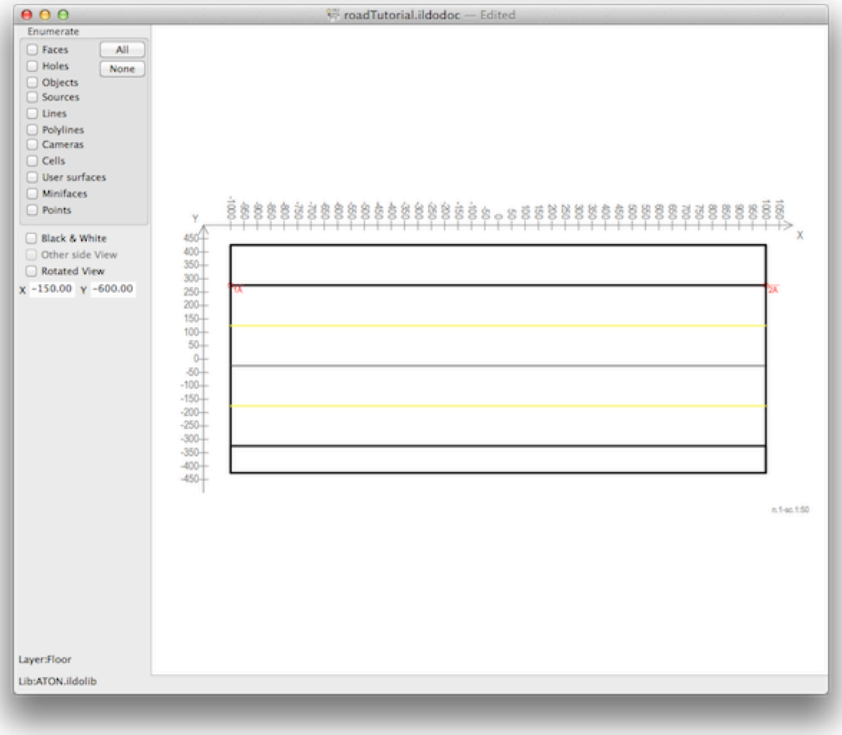


Now we'll export the report. Scroll a little the view to make the light-green selection rectangle disappear and choose the menu "View"-"Save image for report as “Result Design” to include this view in the report.

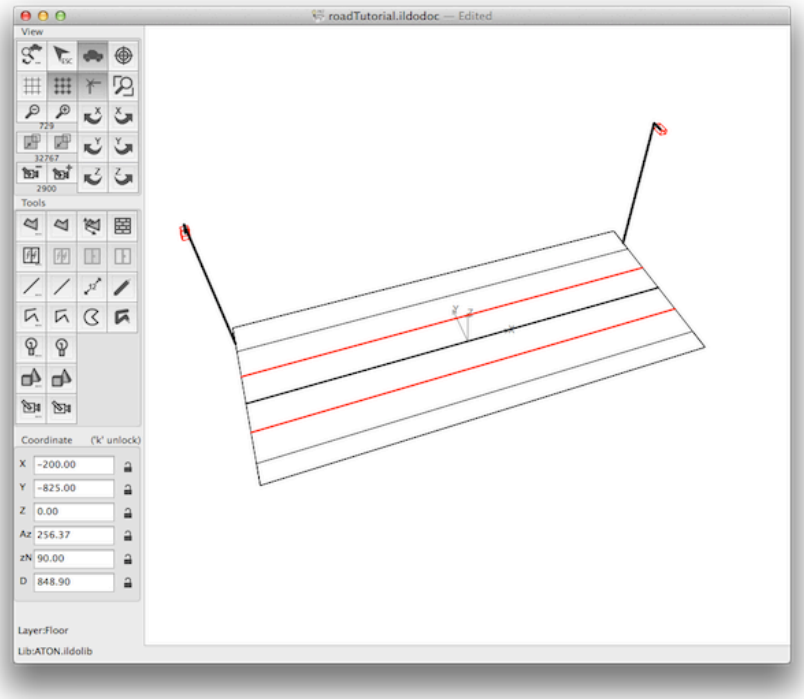
Return to the main view choosing again "Lighting" - "Results" from the menu, add to the selection set the two red luminaires...



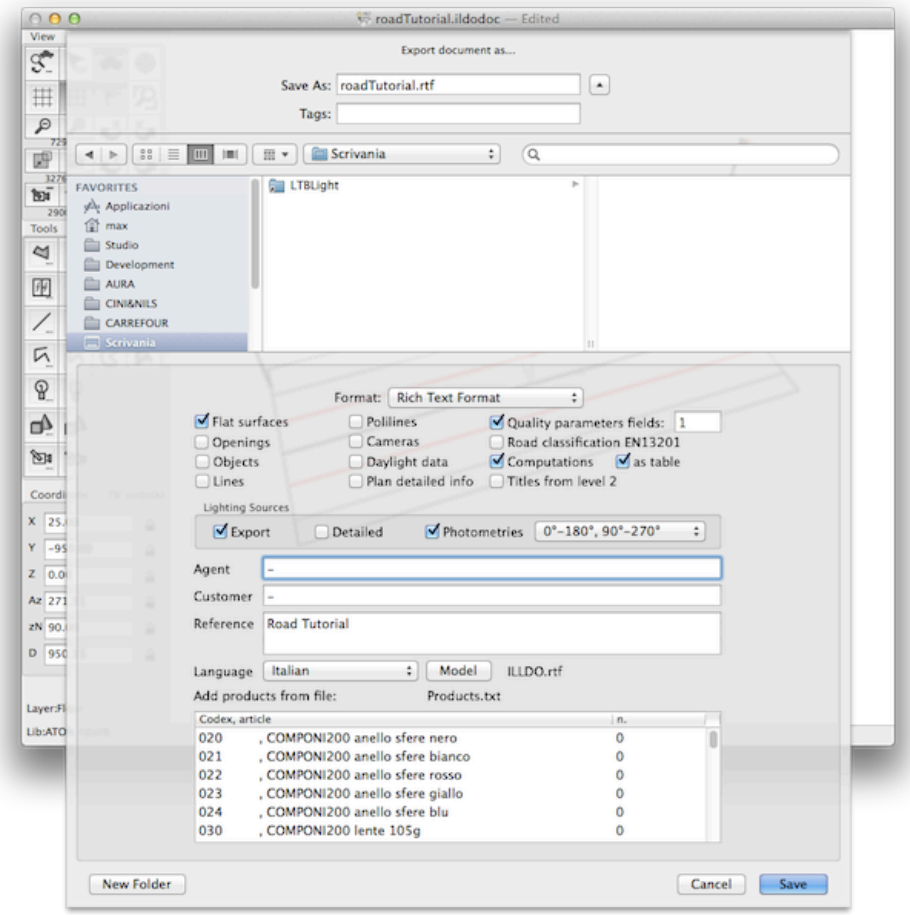
...and choose "View" - "Plan view" from the menu. You will see the following figure that represent the project layout and then choose the menu "View"-"Save image for report as “Layout Design" to include this view in the report:



Come back to the main view choosing again "View" - "Plan view" from the menu and force the display in black/red/white by choosing "View" - "Black/White" from the menu, and from the drawer turn off the "grid visualization" (the icon must be unhighlighted) and turn ON the "3D models linking" (the icon must be highlighted). You will see:



Choose the menu "View"-"Save image for report as 'Cover Design'"; to include this view in the report. Now choose "File" - "Export..." with RTF or RTFD format...



...and accept the previous parameters in the dialogue.

Press 'Save' and go on. Find the file just now created and open it with a word processor. Follow the opened pages:

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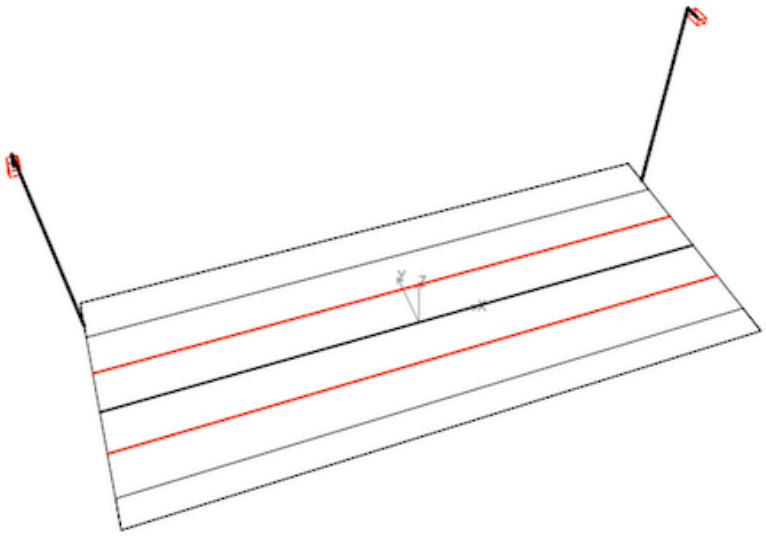
Rif.Progetto:roadTutorial.rtf del 20/11/13 Committente:-

Road Tutorial



1 Lighting software: LetThereBeLight

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Rif.Progetto:roadTutorial.rtf del 20/11/13 Committente:-

INFORMAZIONI SUL MODELLO

DIMENSIONI DEL MODELLO (X, Y, Z): 20.00 x 8.50 x 0.00 m

1.1. SUPERFICI PIANE

n.	Livello	Superficie	Area [m2]	Colore superiore-inferiore	Griglia [cm]
1	Floor	strada CLI	170.0	-	120

1.2. APPARECCHI ILLUMINANTI

n./rif.	Codice - Modello	Lam.	Sorgente	Modello	Attacco	W	lm	K	W tot.	Man.	Posizione (x,y)	H install.	Puntam.(x,y,z)	az.,zen.
1A	93535 xxGx, Kassel Kompakt Plus NW,...	1	Led	LED	-	22.0	1755.0	5000	22.0	80	-1000, 300	700	-1000,300,0	0,180
2A	93535 xxGx, Kassel Kompakt Plus NW,...	1	Led	LED	-	22.0	1755.0	5000	22.0	80	1000, 300	700	1000,300,0	0,180
3A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	3000, 300	700	3000,300,0	0,180
4A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	5000, 300	700	5000,300,0	0,180
5A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	7000, 300	700	7000,300,0	0,180
6A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	9000, 300	700	9000,300,0	0,180
7A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	11000, 300	700	11000,300,0	0,180
8A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	13000, 300	700	13000,300,0	0,180
9A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	15000, 300	700	15000,300,0	0,180
10A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	17000, 300	700	17000,300,0	0,180
11A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	19000, 300	700	19000,300,0	0,180
12A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	21000, 300	700	21000,300,0	0,180
13A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	23000, 300	700	23000,300,0	0,180
14A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	25000, 300	700	25000,300,0	0,180
15A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	27000, 300	700	27000,300,0	0,180
16A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	29000, 300	700	29000,300,0	0,180
17A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	31000, 300	700	31000,300,0	0,180
18A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	33000, 300	700	33000,300,0	0,180
19A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	35000, 300	700	35000,300,0	0,180
20A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	37000, 300	700	37000,300,0	0,180
21A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	39000, 300	700	39000,300,0	0,180
22A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	41000, 300	700	41000,300,0	0,180
23A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	43000, 300	700	43000,300,0	0,180
24A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	45000, 300	700	45000,300,0	0,180
25A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	47000, 300	700	47000,300,0	0,180
26A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	49000, 300	700	49000,300,0	0,180
27A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	51000, 300	700	51000,300,0	0,180
28A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	-3000, 300	700	-3000,300,0	0,180
29A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	-5000, 300	700	-5000,300,0	0,180

2 Lighting software: LetThereBeLight

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Rif.Progetto:roadTutorial.rtf del 20/11/13 Committente:-

INFORMAZIONI SUL MODELLO

DIMENSIONI DEL MODELLO (X, Y, Z): 20.00 x 8.50 x 0.00 m

1.1. SUPERFICI PIANE

n.	Livello	Superficie	Area [m2]	Colore superiore-inferiore	Griglia [cm]
1	Floor	strada CLI	170.0	-	120

1.2. APPARECCHI ILLUMINANTI

n./rif.	Codice - Modello	Lam.	Sorgente	Modello	Attacco	W	lm	K	W tot.	Man.	Posizione (x,y)	H install.	Puntam.(x,y,z)	az.,zen.
1A	93535 xxGx, Kassel Kompakt Plus NW,...	1	Led	LED	-	22.0	1755.0	5000	22.0	80	-1000, 300	700	-1000,300,0	0,180
2A	93535 xxGx, Kassel Kompakt Plus NW,...	1	Led	LED	-	22.0	1755.0	5000	22.0	80	1000, 300	700	1000,300,0	0,180
3A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	3000, 300	700	3000,300,0	0,180
4A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	5000, 300	700	5000,300,0	0,180
5A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	7000, 300	700	7000,300,0	0,180
6A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	9000, 300	700	9000,300,0	0,180
7A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	11000, 300	700	11000,300,0	0,180
8A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	13000, 300	700	13000,300,0	0,180
9A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	15000, 300	700	15000,300,0	0,180
10A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	17000, 300	700	17000,300,0	0,180
11A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	19000, 300	700	19000,300,0	0,180
12A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	21000, 300	700	21000,300,0	0,180
13A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	23000, 300	700	23000,300,0	0,180
14A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	25000, 300	700	25000,300,0	0,180
15A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	27000, 300	700	27000,300,0	0,180
16A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	29000, 300	700	29000,300,0	0,180
17A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	31000, 300	700	31000,300,0	0,180
18A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	33000, 300	700	33000,300,0	0,180
19A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	35000, 300	700	35000,300,0	0,180
20A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	37000, 300	700	37000,300,0	0,180
21A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	39000, 300	700	39000,300,0	0,180
22A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	41000, 300	700	41000,300,0	0,180
23A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	43000, 300	700	43000,300,0	0,180
24A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	45000, 300	700	45000,300,0	0,180
25A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	47000, 300	700	47000,300,0	0,180
26A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	49000, 300	700	49000,300,0	0,180
27A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	51000, 300	700	51000,300,0	0,180
28A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	-3000, 300	700	-3000,300,0	0,180
29A	93535 xxGx, Kassel Kompakt Plus NW,... (off)	1	Led	LED	-	22.0	1755.0	5000	22.0	80	-5000, 300	700	-5000,300,0	0,180

2 Lighting software: LetThereBeLight

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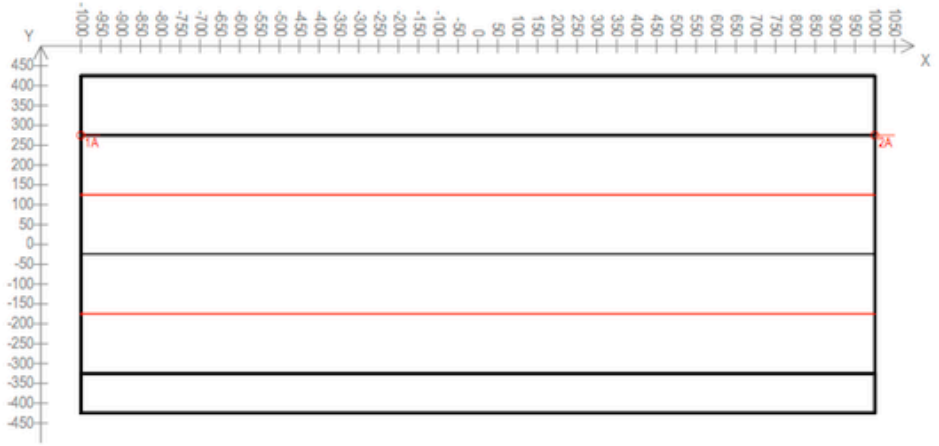
Rif.Progetto:roadTutorial.rtf del 20/11/13 Committente:-

1.2.1. INSTALLAZIONE DEGLI APPARECCHI (n./rif.)



n.1-sc.1:50

3 Lighting software: LetThereBeLight

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RISULTATI SUI PIANI DI LAVORO

Piano	Valore Medio lux	Valore Minimo lux	Valore Massimo lux	Min/Medio	Min/Max	Medio/Max
Road class ME3c						
illuminaments	Em=4.8 lux	3.3 lux	7.5 lux	68.9%	44.2%	64.2%
luminances	Lm=0.30 cd/m2l	0.20 cd/m2	0.51 cd/m2	Uo=0.7%	-	Ul=88.5%
laneID 1						
illuminaments	Em=4.5 lux	3.3 lux	6.1 lux	Ul=92.2%	Tl=41.2%	
luminances						
observerID 1	Lm=0.24 cd/m2	0.20 cd/m2	0.31 cd/m2	Uo=81.8%!		
observerID 2	Lm=0.23 cd/m2	0.20 cd/m2	0.28 cd/m2	Uo=85.3%!		
laneID 2						
illuminaments	Em=5.2 lux	3.5 lux	7.5 lux	Ul=76.5%	Tl=49.5%	
luminances						
observerID 1	Lm=0.38 cd/m2	0.26 cd/m2	0.54 cd/m2	Uo=70.2%!		
observerID 2	Lm=0.35 cd/m2	0.26 cd/m2	0.52 cd/m2	Uo=73.9%!		
zone ID 1						
illuminaments	Em=3.6 lux	3.3 lux	SR=74.1%	Tl=0.0%		
zone ID 2						
illuminaments	Em=4.8 lux	3.5 lux	SR=100.3%	Tl=0.0%		

4 Lighting software: LetThereBeLight

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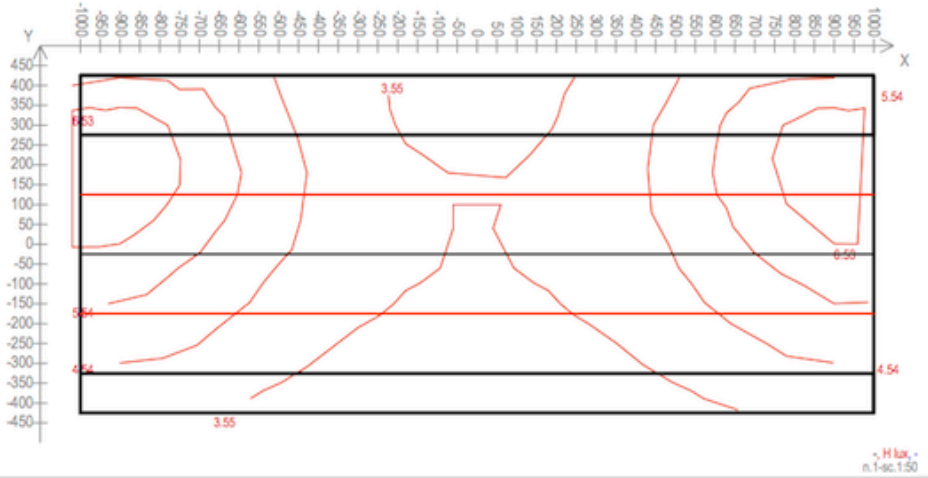
Rif.Progetto:roadTutorial.rtf del 20/11/13 Committente:-

1.3. ISOVALORI SUI PIANI DI LAVORO



5 Lighting software: LetThereBeLight

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Rif.Progetto:roadTutorial.rtf del 20/11/13 Committente:-

LISTA DEI PRODOTTI

APPARECCHI ILLUMINANTI

rif.	Immagine	Codice - Modello	Potenza tot.[W]	Quantita'	Prezzo	Importo
A		93535 xxGx, Kassel Kompakt Plus NW, 16 LED OSL	44	2	N.D.	0,00
TOTALE APPARECCHI ILLUMINANTI			44			
POTENZA SPECIFICA INSTALLATA			0,259W/m²			

6 Lighting software: LetThereBeLight

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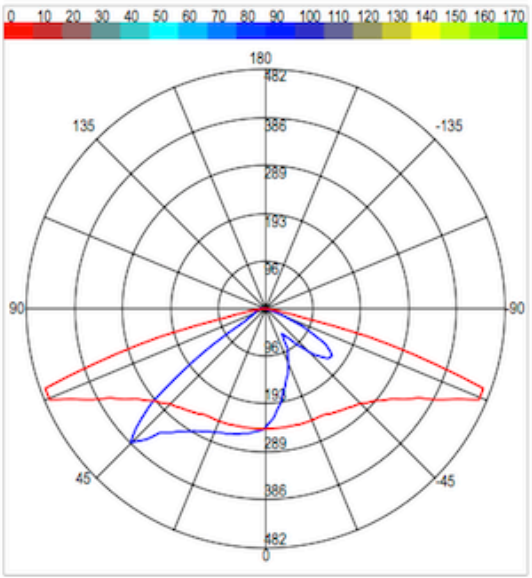
Rif.Progetto:roadTutorial.rtf del 20/11/13 Committente:-

APPENDICE A: FOTOMETRIE DELLE SORGENTI

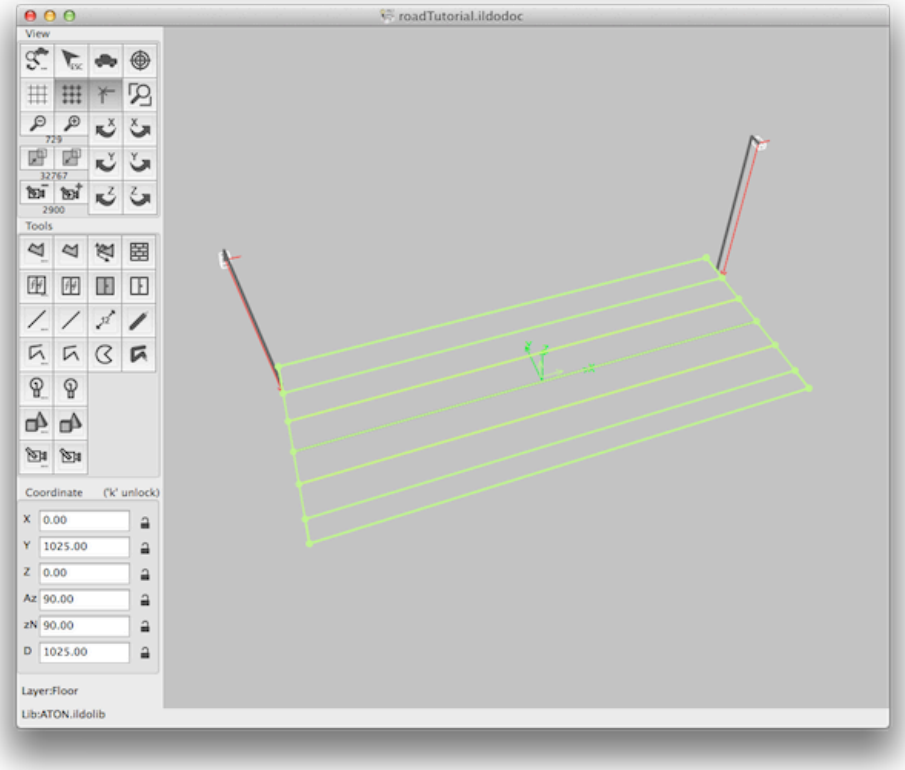


Modello: ..... 93535 xxGx, Kassel Kompakt Plus NW, 16 LED OSL
Catalogo: ..... ATON.ildolib
Classificazione CIE: ..... Diretta
Semi-Diretta 22.00W
Dimensioni: ..... 27.5 x 57.0 x 17.5 cm
Volume luminoso: ..... 6.0 x 18.0 x 0.0 cm
Efficenza: ..... 99.71 %
Flussi zonali [lm]:
- 0/30: ..... 334.40 (19.11 %)
- 0/40: ..... 576.17 (32.92 %)
- 0/60: ..... 1285.19 (73.44 %)
- 0/90: ..... 1749.01 (99.94 %)
- 90/120: ..... 0.97 (0.06 %)
- 90/130: ..... 0.97 (0.06 %)
- 90/150: ..... 0.97 (0.06 %)
- 90/180: ..... 0.97 (0.06 %)
- 0/180: ..... 1749.99 (100.00 %)
Lampada/e istallata/e:
- n.: 1
- tipo: ..... Led
- nome: ..... LED
- portalampada: ..... -
- potenza: ..... 22.00 W
- flusso: ..... 1755 lm
- temp. di colore: ..... 5000 K
Schermi laterali:
- profondita': ..... 27.5 cm
- angolo C=0: ..... 0.0 cm
- angolo C=90: ..... 0.0 cm
- angolo C=180: ..... 0.0 cm
- angolo C=270: ..... 0.0 cm
Griglia:
- dimensioni xy: ..... 0.0 x 0.0 cm
- profondita': ..... 0.0 cm

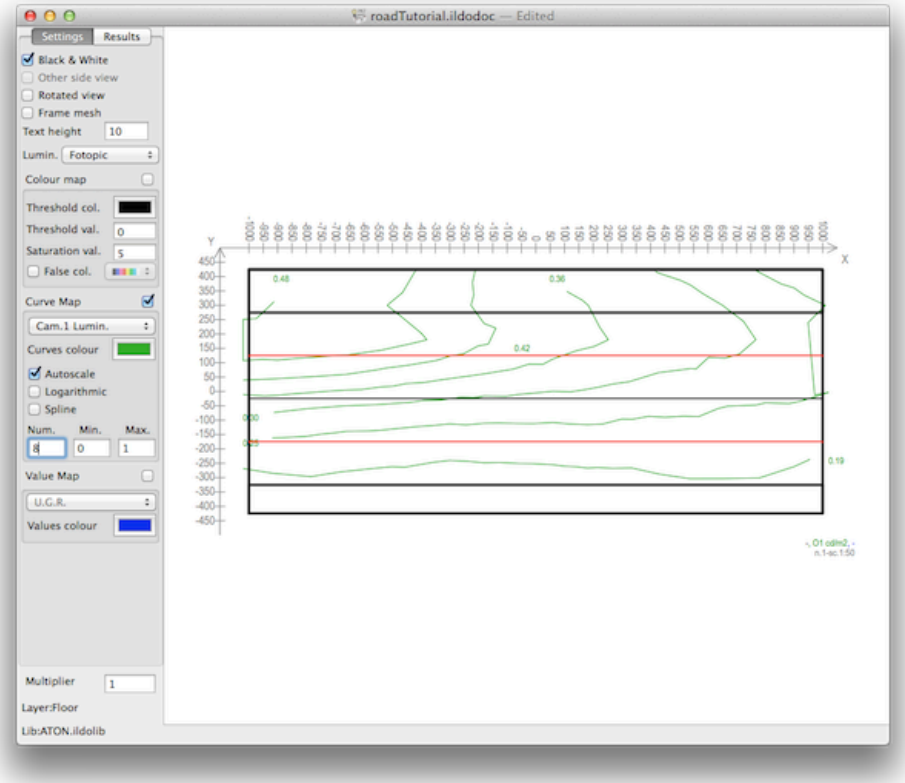
7 Lighting software: LetThereBeLight

Save the file in a native format and let's add some other results map for the road surface.

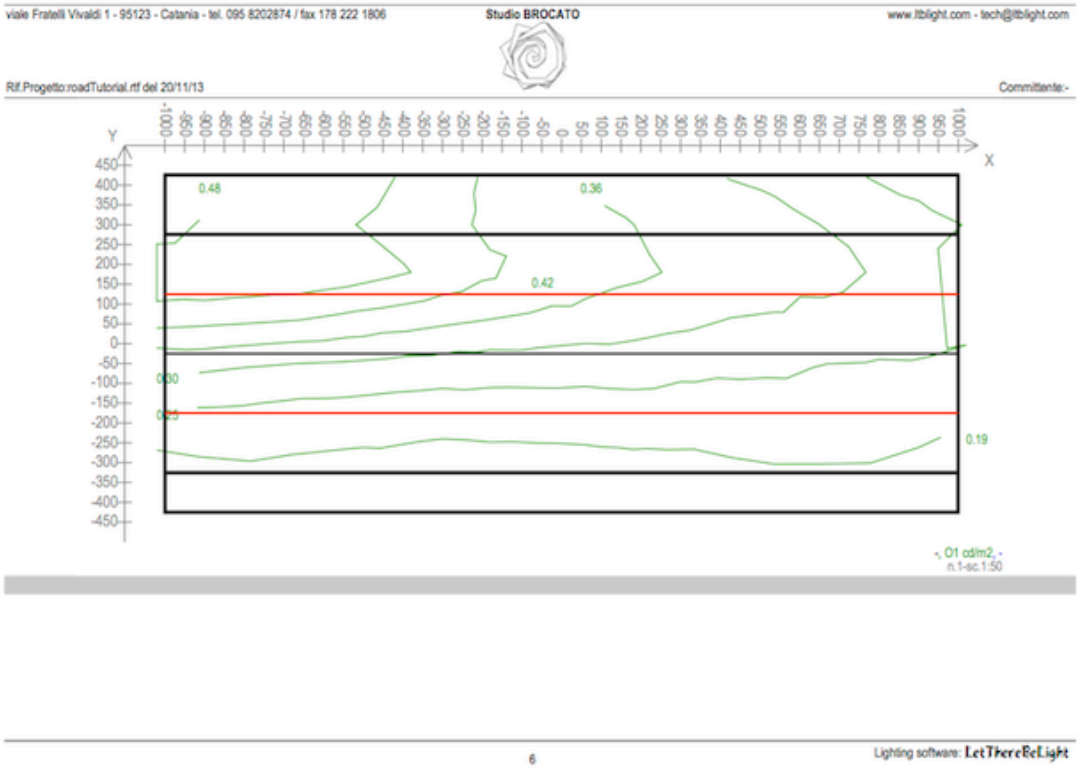
Select again the surface and the lines...



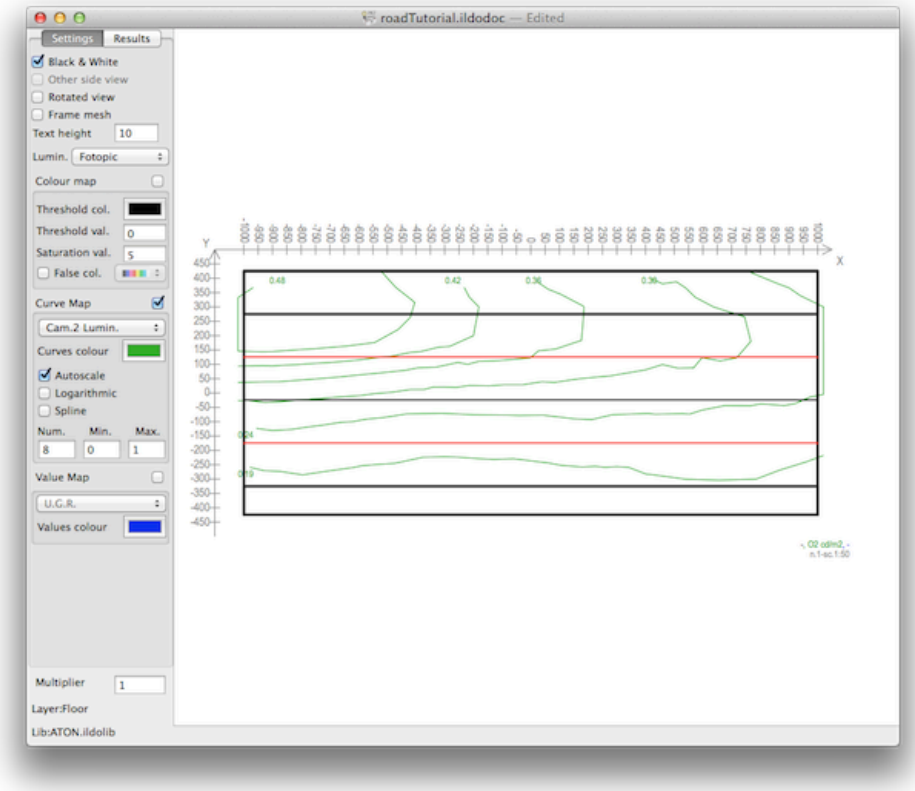
...and choose "Lighting" - "Results" from the menu. Then set the parameters in the drawer as follows (Curve map: Camera 1 Luminance; Autoscale; n.curves: 8):



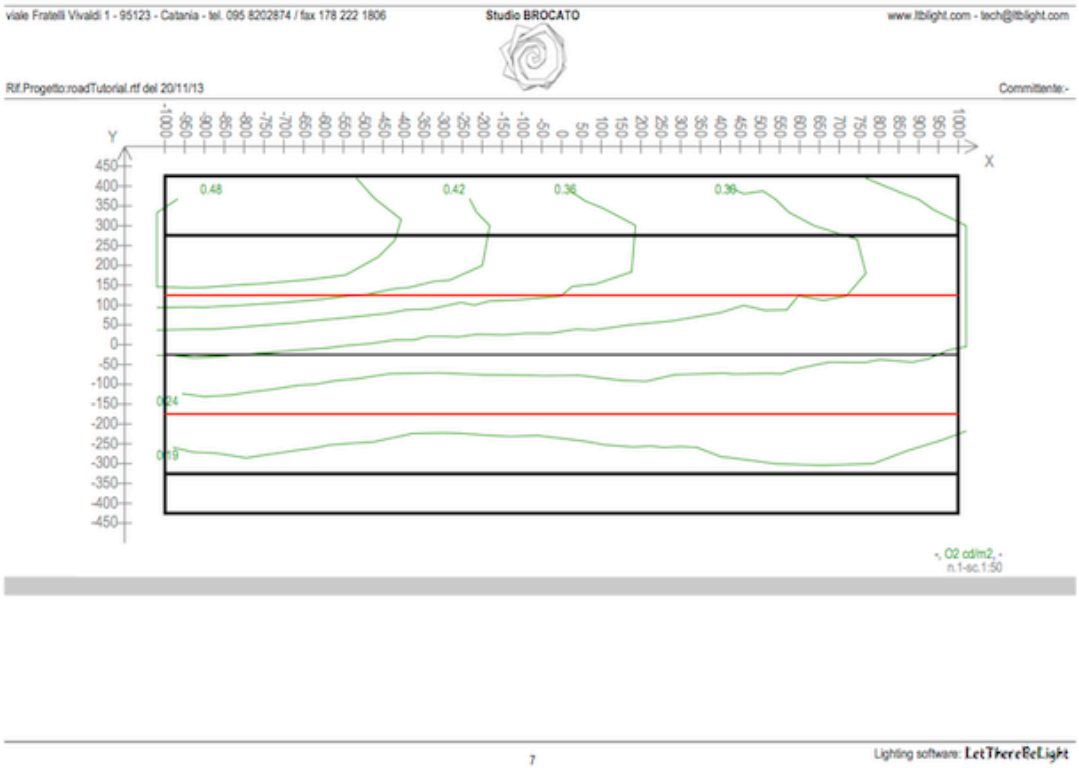
Click somewhere on the view and copy it, than go to the report file at pag.5, place the cursor after the image, press 'return' and paste the copied image. The report file will have a page more:



Set the parameters in the drawer as follows (Curve map: Camera 2 Luminance; Autoscale; n.curves: 8):



Click somewhere on the view and copy it, than go to the report file at pag.6 (the new added one), place the cursor after the image, press 'return' and paste the copied image. The report file will have a page more:



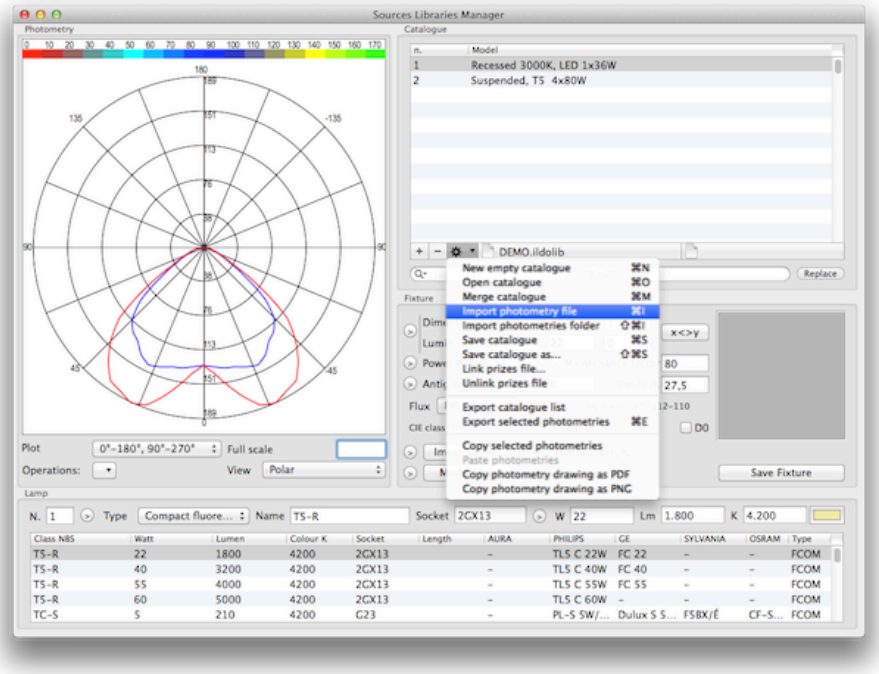
Save the file and this is all.

5.4. Manage photometries

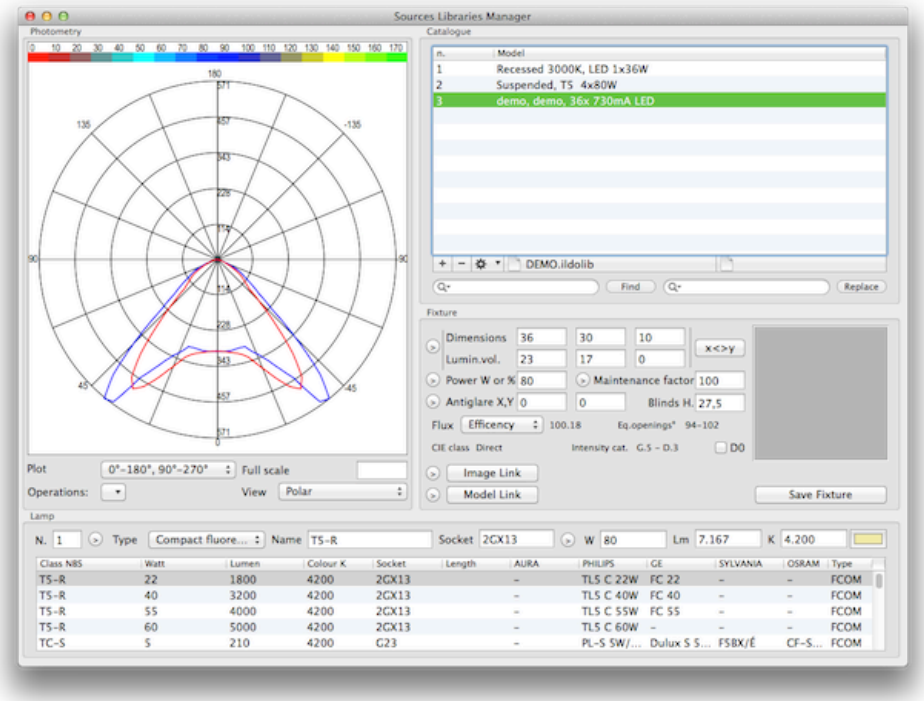
This tutorial permits to import a photometric file, to do some manipulations on it and to export a full report.

5.4.1. Import, correct and save a photometric file.

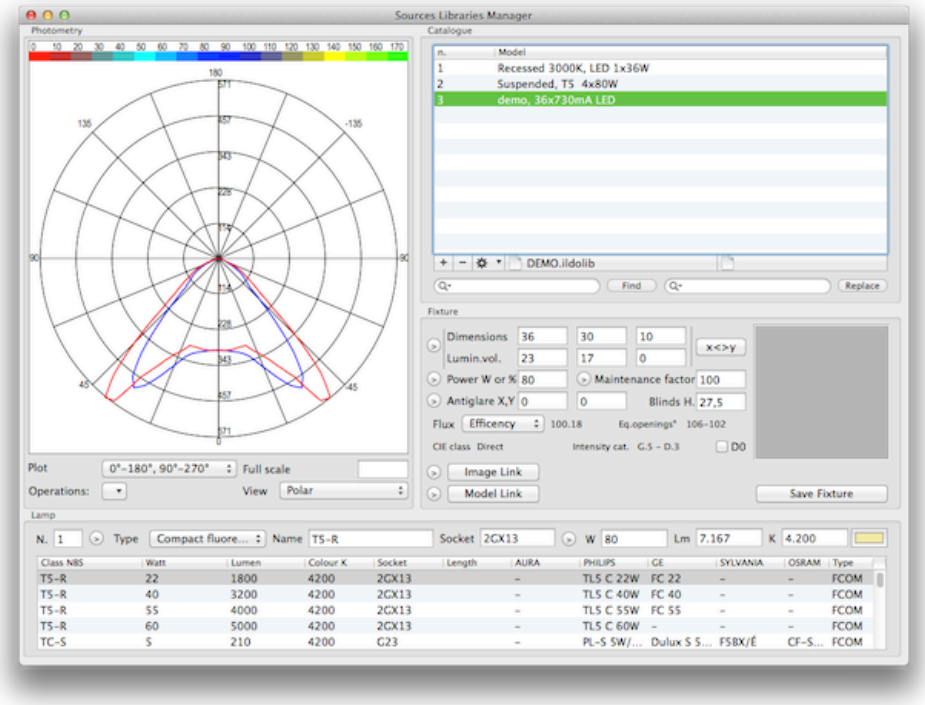
1. The first step consist in importing the 'demo.ldt' file from the catalogue pop-menu:



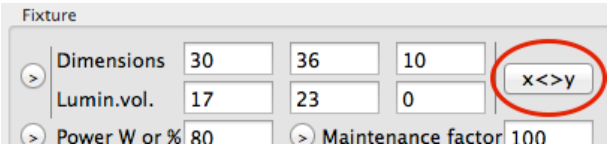
2. Let's correct the name in 'demo. 36x750mA LED' simply with a double-click on the table row to enter the edit mode.



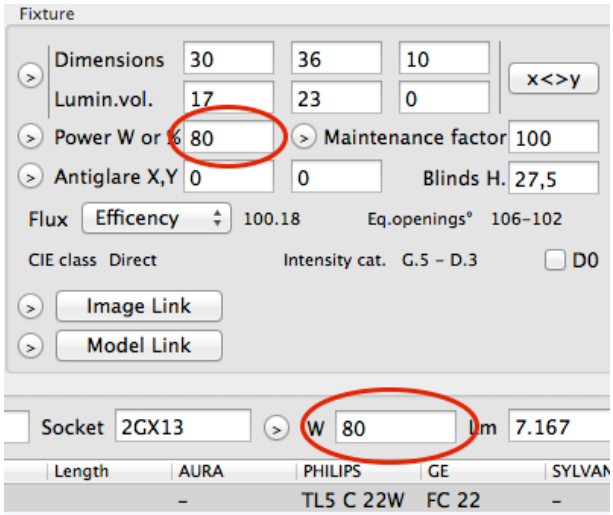
3. Now let's rotate the photometry 90° azimuth to make the plan of the maximum emission (in the previous image, the plan of the blue curve, C=90°/270°) the main plan (C=0°-180°): from the 'Operation' pop-menu 'Rotate +90° azimuth'.



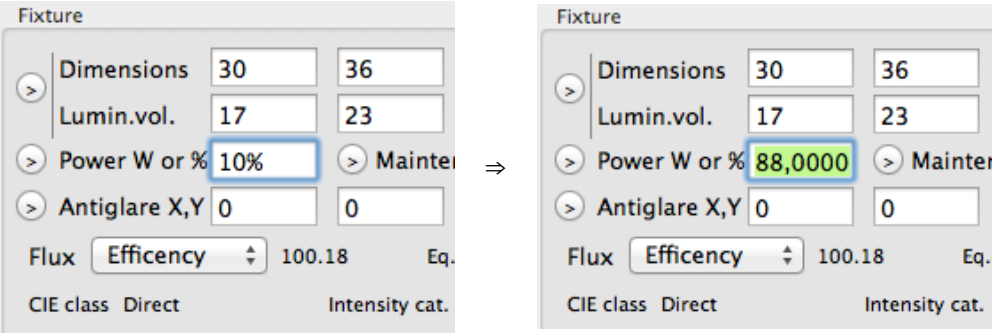
4. For coherence we need to rotate also the geometry 90° azimuth, through the 'x<>y' button in the fixture box:



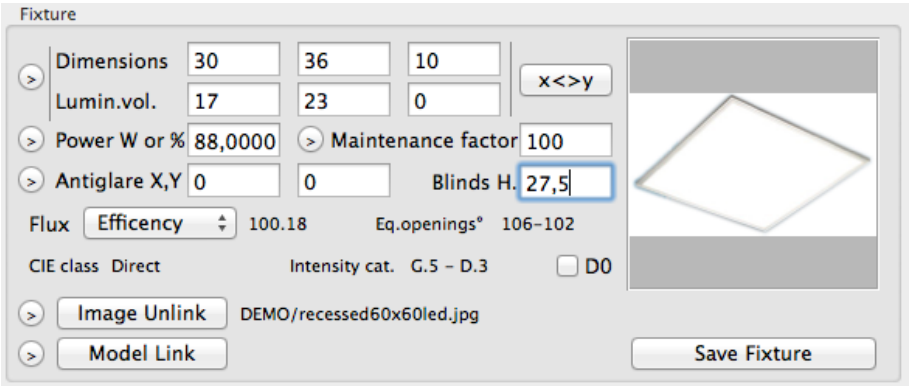
5. Now we have to notice that the total power is equal to the lamp power:



6. This may be or may be not an error, but for now we assume that this is the inconsistence of the EULUMDAT file, so let's correct the total power adding a 10% of power due to the ballast consumption: type '10%' in the 'Power W or %' edit field in the Fixture box and press return, to let the application calculate the real total consumption:



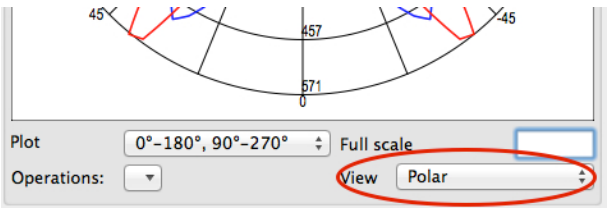
7. Select an image to link to this photometry by clicking the 'Image Link' button in the fixture box, and select the 'recessed60x60led.jpg' one in the folder suggested by the application. The button will change in 'Image Unlink' (this button now will be used to discard actual link) and the image box will be filled with the selected picture:

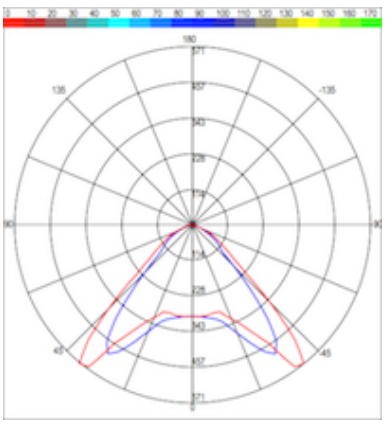


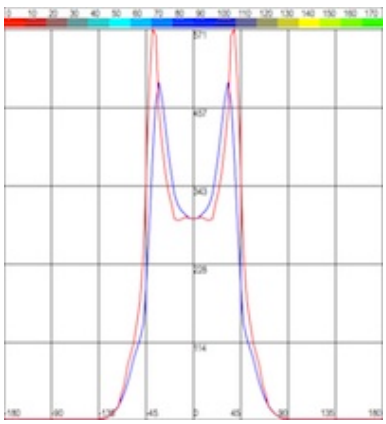
8. At this point we can save the fixture in the open catalogue simply clicking the 'Save Fixture' button: remember that until now the active catalogue was not updated on disk, so we have to select the 'Save catalogue' pop-menu to make permanent the modifications.

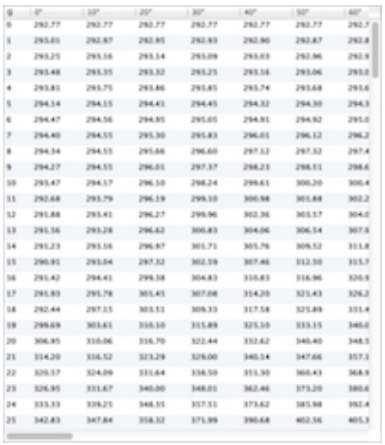
5.4.2. Examine photometry

1. The user is able to choose the photometry representation through the 'View' pop-menu among the polar, Cartesian or table view:

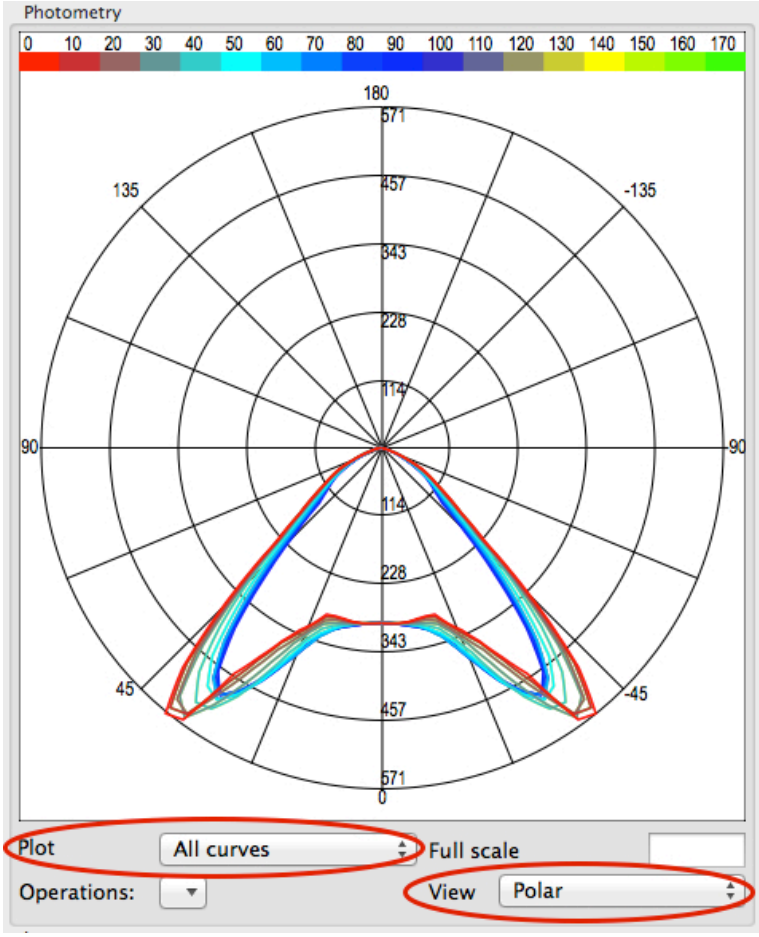




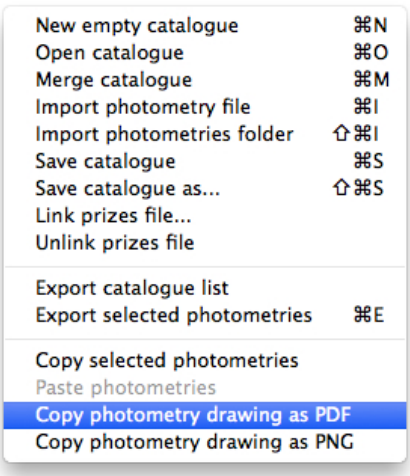




2. Is it also possible to plot a single curve, both the C=0°/C=180° and C=90°/C=270° curves or all the C-curves through the 'Plot' pop-menu: let's select 'All curves' from the 'Plot' pop-menu and 'Polar' from the 'View' pop-menu, and the Photometry box will present the following diagram...

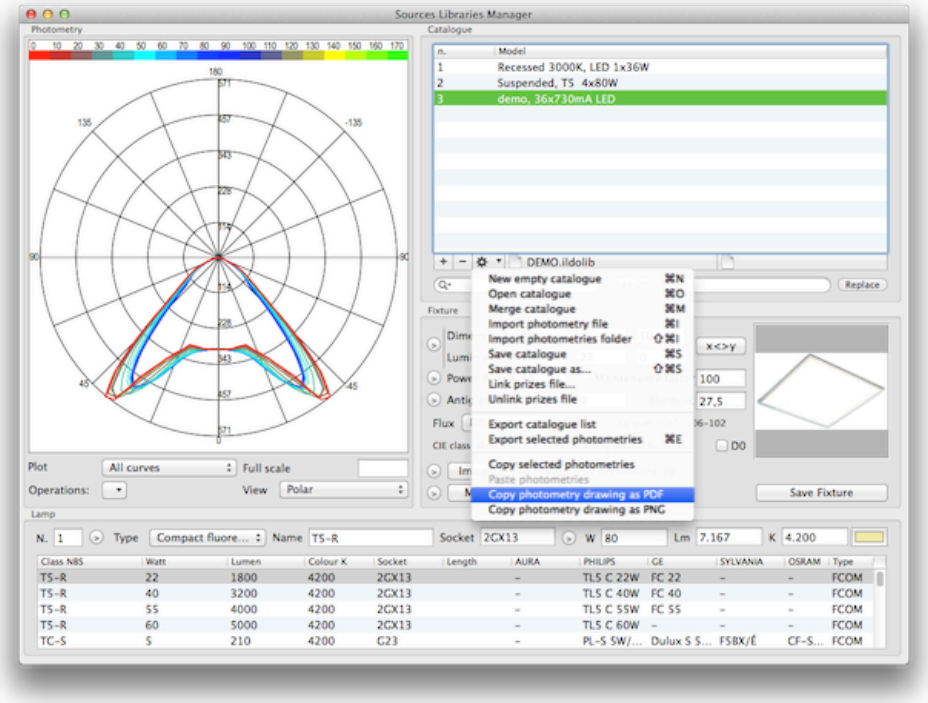


3. ...that may be copied in the pasteboard with the 'Copy photometry as PDF/PNG' commands in the 'Catalogue' pop-menu:

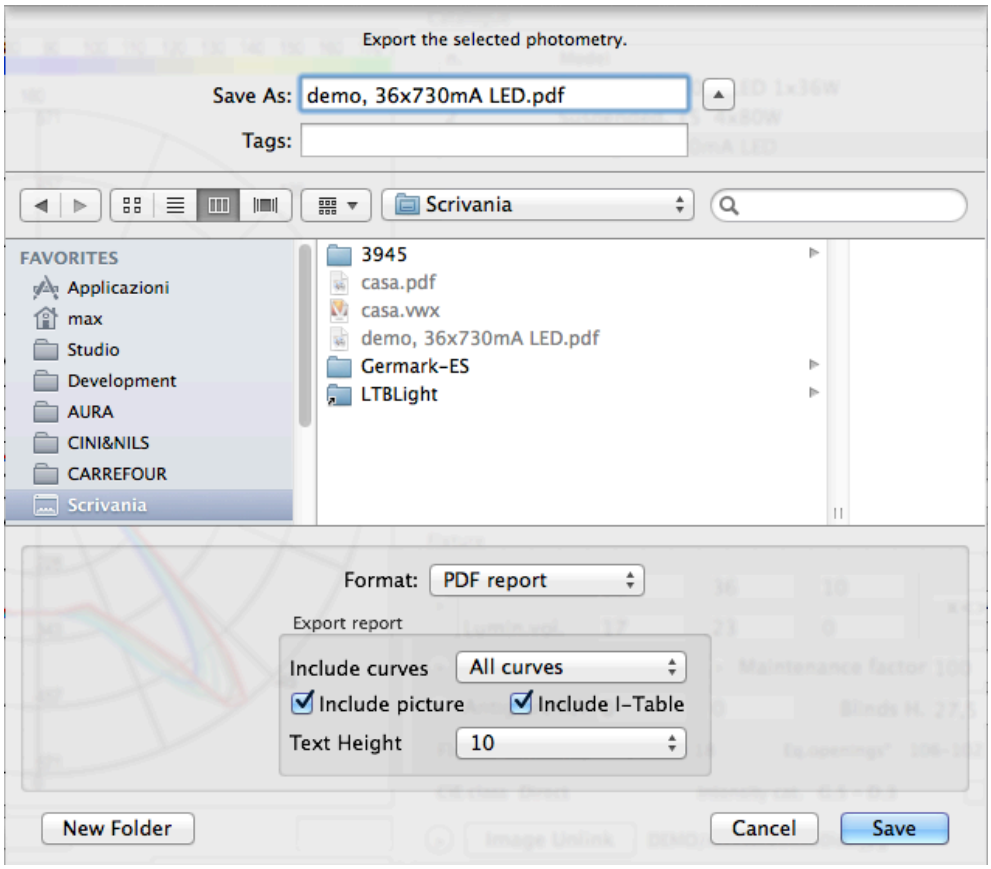


5.4.3. Export photometry protocol.

1. It is possible to export in PDF the total report for the selected photometry, through the 'Export selected photometries' command in the Catalogue pop-menu:



2. Then select 'PDF report' as Format and the parameters following the next image:



3. The saved report will contain one page with the photometry summary, 12 pages presenting the I-table and one page with the planar representation of the photometric solid:
   - photometry summary:

LIGHTING SOURCE PROTOCOL

Model:	demo, 36x730mA LED
Catalog:	DEMO.ildolib
CIE classification:	Direct
Total power:	88.00W
Dimensions:	30.0 x 36.0 x 10.0 cm
Luminous volume:	17.0 x 23.0 x 0.0 cm
Efficency:	100 %
Zonal fluxes [lm]:	
- 0/30:	2102.17 (29.28 %)
- 0/40:	4377.81 (60.97 %)
- 0/60:	6692.01 (93.20 %)
- 0/90:	7179.99 (100.00 %)
- 90/120:	0.00 (0.00 %)
- 90/130:	0.00 (0.00 %)
- 90/150:	0.00 (0.00 %)
- 90/180:	0.00 (0.00 %)
- 0/180:	7179.99 (100.00 %)
Installed lamp/s:	
- n.:	1
- type:	Fluorescent comp.
- name:	T5-R
- socket:	2GX13
- power:	80.00 W
- flux:	7167 lm
- color temp.:	4200 K
Side shades:	
- depth:	27.5 cm
- angle C=0:	0.0 cm
- angle C=90:	0.0 cm
- angle C=180:	0.0 cm
- angle C=270:	0.0 cm
Grid:	
- xy dimensions:	0.0 x 0.0 cm
- depth:	0.0 cm

- 1 -

   - I-table:

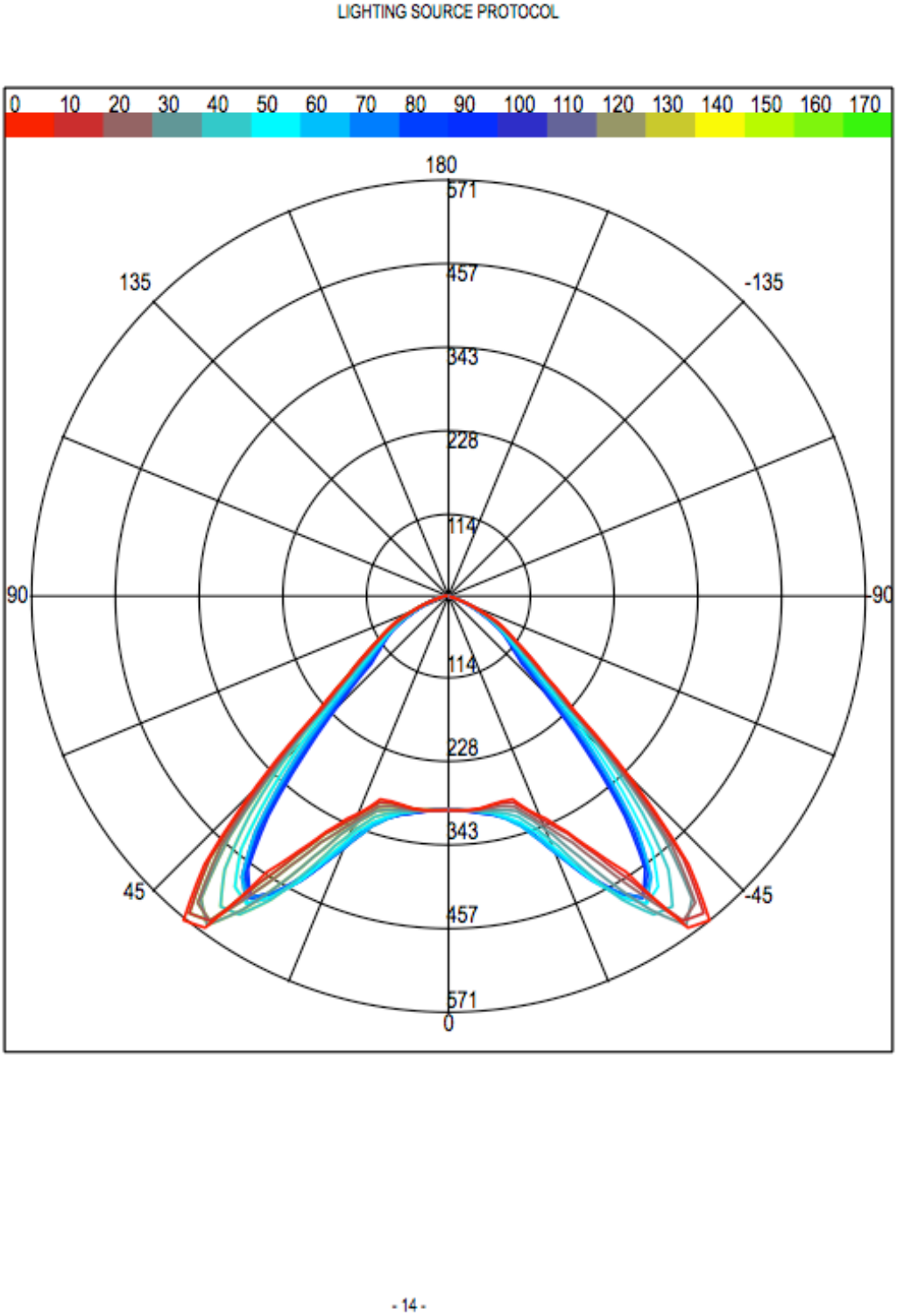
LIGHTING SOURCE PROTOCOL

	C											
gamma	0	10	20	30	40	50	60	70	80	90	100	110
0	292.8	292.8	292.8	292.8	292.8	292.8	292.8	292.8	292.8	292.8	292.8	292.8
1	293.0	293.0	293.0	292.9	292.9	292.9	292.9	292.8	293.0	292.9	293.0	292.8
2	293.2	293.2	293.1	293.1	293.0	293.0	292.9	292.9	293.3	293.1	293.3	292.9
3	293.5	293.3	293.3	293.3	293.2	293.1	293.0	293.0	293.5	293.3	293.5	293.0
4	293.8	293.8	293.9	293.9	293.7	293.7	293.7	293.8	294.5	294.3	294.5	293.8
5	294.1	294.2	294.4	294.5	294.3	294.3	294.3	294.6	295.4	295.4	295.4	294.6
6	294.5	294.6	295.0	295.1	294.9	294.9	295.0	295.4	296.3	296.4	296.3	295.4
7	294.4	294.6	295.3	295.8	296.0	296.1	296.2	296.7	297.8	297.9	297.8	296.7
8	294.3	294.6	295.7	296.6	297.1	297.3	297.4	298.1	299.4	299.3	299.4	298.1
9	294.3	294.5	296.0	297.4	298.2	298.5	298.6	299.4	300.9	300.7	300.9	299.4
10	293.5	294.2	296.1	298.2	299.6	300.2	300.4	301.4	302.7	302.3	302.7	301.4
11	292.7	293.8	296.2	299.1	301.0	301.9	302.2	303.3	304.5	304.0	304.5	303.3
12	291.9	293.4	296.3	300.0	302.4	303.6	304.0	305.2	306.3	305.6	306.3	305.2
13	291.6	293.3	296.6	300.8	304.1	306.5	307.9	308.5	309.0	308.3	309.0	308.5
14	291.2	293.2	297.0	301.7	305.8	309.5	311.8	311.8	311.8	311.0	311.8	311.8
15	290.9	293.0	297.3	302.6	307.5	312.5	315.7	315.2	314.6	313.7	314.6	315.2
16	291.4	294.4	299.4	304.8	310.8	317.0	321.0	320.4	319.2	318.3	319.2	320.4
17	291.9	295.8	301.4	307.1	314.2	321.4	326.2	325.5	323.8	322.9	323.8	325.5
18	292.4	297.2	303.5	309.3	317.6	325.9	331.5	330.7	328.5	327.6	328.5	330.7
19	299.7	303.6	310.1	315.9	325.1	333.1	340.0	340.2	338.2	337.1	338.2	340.2
20	306.9	310.1	316.7	322.4	332.6	340.4	348.6	349.7	348.0	346.5	348.0	349.7
21	314.2	316.5	323.3	329.0	340.1	347.7	357.1	359.2	357.8	356.0	357.8	359.2
22	320.6	324.1	331.6	338.5	351.3	360.4	368.9	371.1	370.0	367.0	370.0	371.1
23	326.9	331.7	340.0	348.0	362.5	373.2	380.7	382.9	382.3	378.0	382.3	382.9
24	333.3	339.2	348.3	357.5	373.6	386.0	392.5	394.8	394.5	389.0	394.5	394.8
25	342.8	347.8	358.3	372.0	390.7	402.6	405.3	407.9	408.6	402.4	408.6	407.9
26	352.3	356.4	368.3	386.5	407.7	419.1	418.2	421.0	422.7	415.8	422.7	421.0
27	361.8	365.0	378.3	401.0	424.8	435.7	431.1	434.1	436.8	429.2	436.8	434.1
28	375.3	379.6	394.1	419.2	443.1	448.5	445.9	445.1	448.3	442.3	448.3	445.1
29	388.8	394.3	410.0	437.4	461.5	461.4	460.7	456.2	459.7	455.4	459.7	456.2
30	402.3	408.9	425.8	455.6	479.8	474.2	475.5	467.2	471.2	468.5	471.2	467.2
31	418.2	428.1	445.4	474.4	493.1	483.4	484.0	475.5	478.3	476.3	478.3	475.5
32	434.1	447.4	464.9	493.3	506.4	492.7	492.5	483.7	485.4	484.2	485.4	483.7
33	450.0	466.6	484.4	512.1	519.6	501.9	501.1	491.9	492.5	492.1	492.5	491.9
34	487.1	494.2	506.2	526.9	521.5	498.5	492.6	486.4	484.3	481.9	484.3	486.4
35	524.1	521.8	527.9	541.7	523.3	495.1	484.1	480.9	476.2	471.8	476.2	480.9
36	561.1	549.4	549.7	556.5	525.1	491.7	475.6	475.4	468.1	461.7	468.1	475.4
37	564.4	552.4	546.5	548.7	510.6	476.5	455.7	454.5	445.7	436.7	445.7	454.5
38	567.6	555.4	543.3	540.8	496.1	461.4	435.7	433.6	423.3	411.7	423.3	433.6
39	570.8	558.4	540.1	533.0	481.6	446.2	415.8	412.8	400.9	386.7	400.9	412.8
40	545.2	533.3	513.5	503.2	454.6	417.0	386.4	382.1	367.6	353.4	367.6	382.1
41	519.6	508.2	487.0	473.3	427.6	387.7	357.1	351.4	334.4	320.1	334.4	351.4
42	494.0	483.2	460.5	443.5	400.6	358.5	327.8	320.7	301.2	286.8	301.2	320.7
43	451.3	439.6	419.0	403.7	368.2	328.8	300.1	291.2	273.0	258.0	273.0	291.2
44	408.6	396.1	377.5	363.8	335.9	299.1	272.3	261.6	244.9	229.3	244.9	261.6
45	365.9	352.6	336.0	324.0	303.6	269.4	244.5	232.1	216.7	200.5	216.7	232.1
46	323.2	311.5	298.3	287.3	271.7	244.3	220.9	209.3	195.0	179.7	195.0	209.3
47	280.5	270.4	260.7	250.6	239.7	219.1	197.2	186.6	173.2	158.9	173.2	186.6
48	237.9	229.3	223.0	214.0	207.7	194.0	173.5	163.9	151.5	138.1	151.5	163.9
49	216.3	210.9	204.7	196.8	190.9	178.6	161.1	152.1	142.7	131.2	142.7	152.1
50	194.7	192.5	186.5	179.6	174.1	163.3	148.6	140.2	133.8	124.3	133.8	140.2
51	173.1	174.1	168.3	162.4	157.3	147.9	136.1	128.4	125.0	117.5	125.0	128.4

- 2 -

...follows 11 pages

- ... planar representation of the photometric solid:



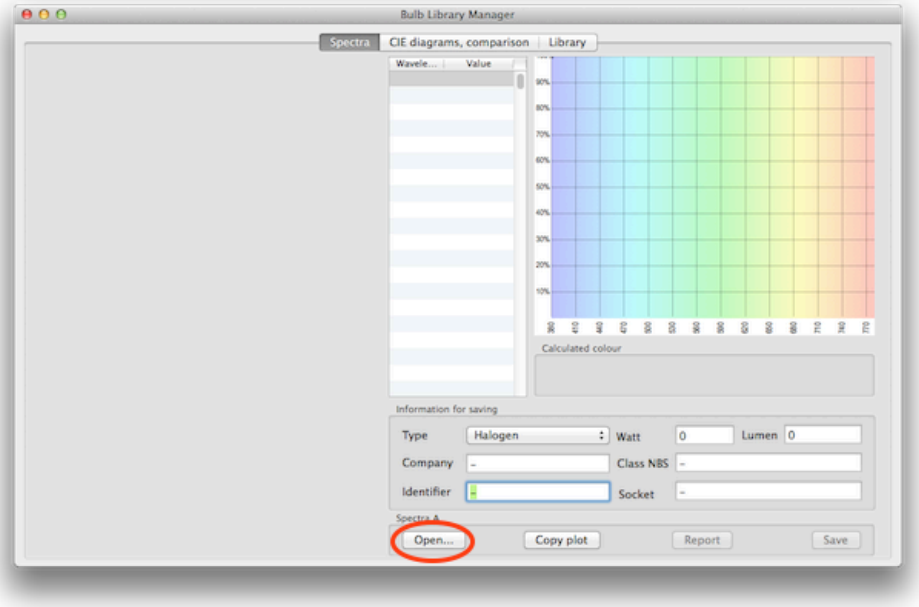
That's all!

5.5. Manage spectra data

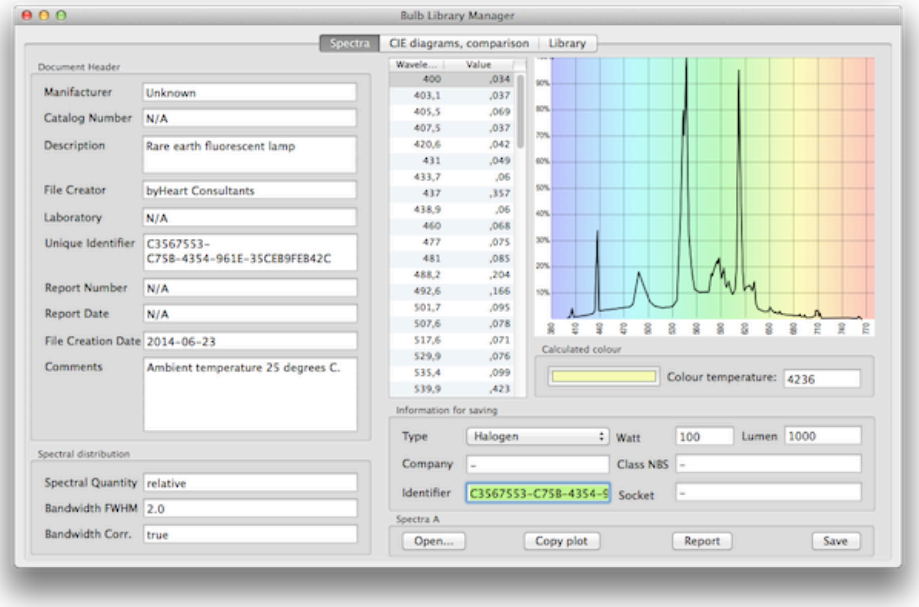
This tutorial permits to open, examine and save in the 'Lamps.txt' file an XML file formatted following IES TM-27-14 IES Standard Format for the Electronic Transfer of Spectral Data or CSV format.

5.5.1. Open the data.

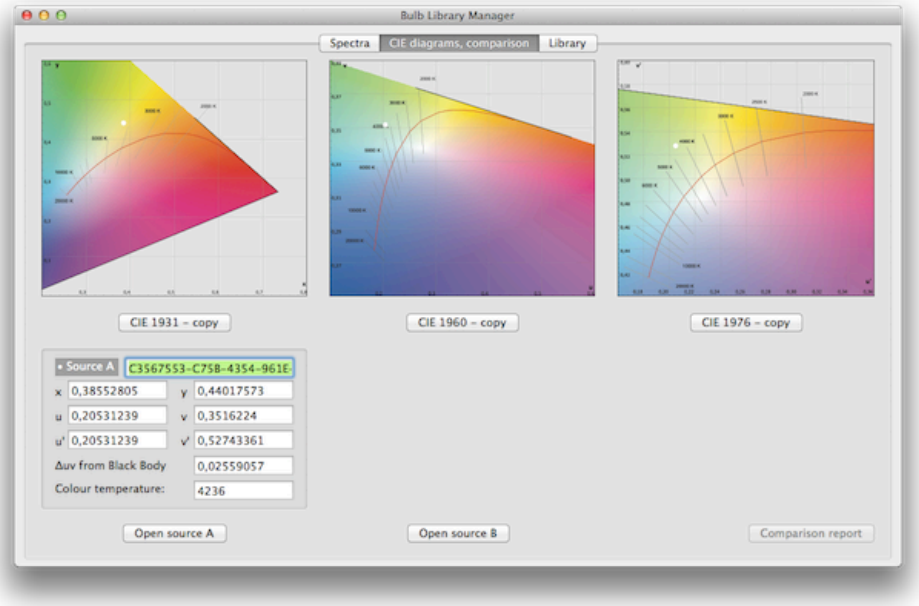
1. The first step consist in selecting (from the menu "File" or from the button) the "Open" command:



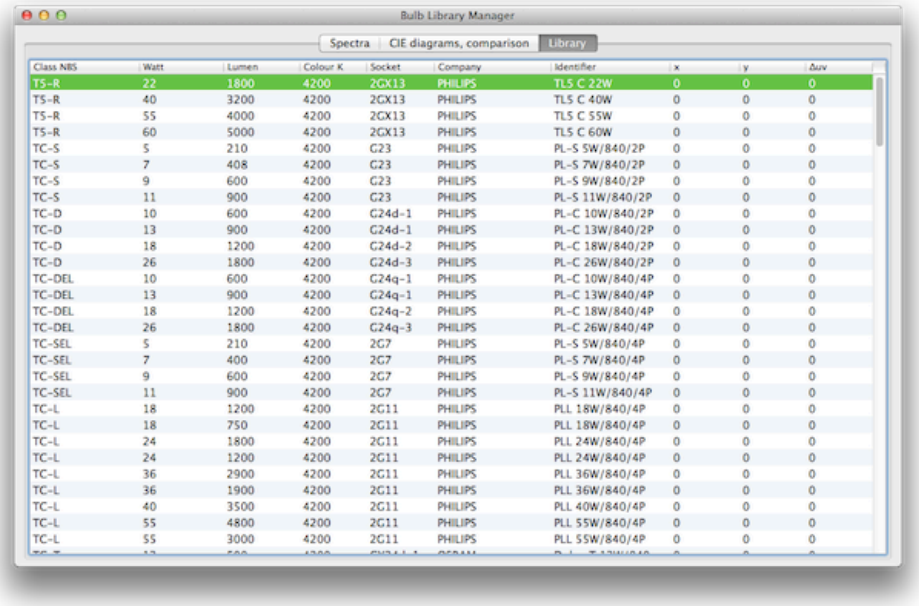
2. navigate in the Brotens library folder to find and open the file "demo spectra.spdx"; the window will present the data:



3. go to the 'CIE diagrams / comparison' tab and examine the color position in the CIE diagrams:

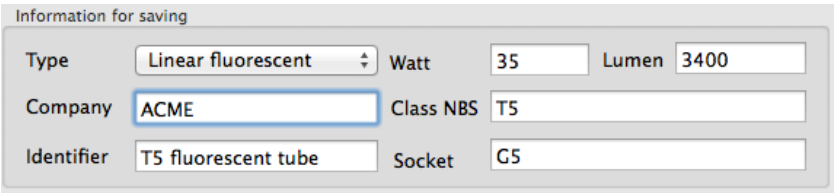


4. In the "Library" tab is still present the "Lamps.txt" file with the list of the lamps;

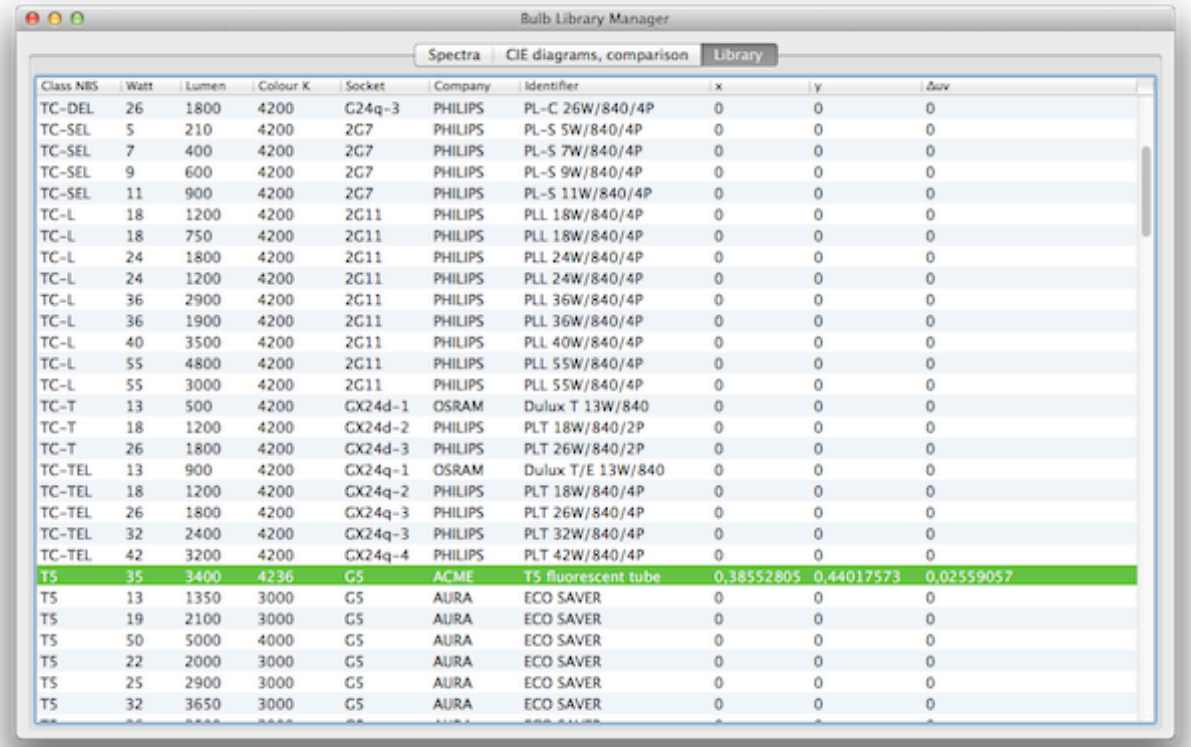


Class NBS	Watt	Lumen	Colour K	Socket	Company	Identifier	x	y	Δuv
T5-R	22	1800	4200	2GX13	PHILIPS	TL5 C 22W	0	0	0
T5-R	40	3200	4200	2GX13	PHILIPS	TL5 C 40W	0	0	0
T5-R	55	4000	4200	2GX13	PHILIPS	TL5 C 55W	0	0	0
T5-R	60	5000	4200	2GX13	PHILIPS	TL5 C 60W	0	0	0
TC-S	5	210	4200	G23	PHILIPS	PL-S 5W/840/2P	0	0	0
TC-S	7	408	4200	G23	PHILIPS	PL-S 7W/840/2P	0	0	0
TC-S	9	600	4200	G23	PHILIPS	PL-S 9W/840/2P	0	0	0
TC-S	11	900	4200	G23	PHILIPS	PL-S 11W/840/2P	0	0	0
TC-D	10	600	4200	G24d-1	PHILIPS	PL-C 10W/840/2P	0	0	0
TC-D	13	900	4200	G24d-1	PHILIPS	PL-C 13W/840/2P	0	0	0
TC-D	18	1200	4200	G24d-2	PHILIPS	PL-C 18W/840/2P	0	0	0
TC-D	26	1800	4200	G24d-3	PHILIPS	PL-C 26W/840/2P	0	0	0
TC-DEL	10	600	4200	G24q-1	PHILIPS	PL-C 10W/840/4P	0	0	0
TC-DEL	13	900	4200	G24q-1	PHILIPS	PL-C 13W/840/4P	0	0	0
TC-DEL	18	1200	4200	G24q-2	PHILIPS	PL-C 18W/840/4P	0	0	0
TC-DEL	26	1800	4200	G24q-3	PHILIPS	PL-C 26W/840/4P	0	0	0
TC-SEL	5	210	4200	2G7	PHILIPS	PL-S 5W/840/4P	0	0	0
TC-SEL	7	400	4200	2G7	PHILIPS	PL-S 7W/840/4P	0	0	0
TC-SEL	9	600	4200	2G7	PHILIPS	PL-S 9W/840/4P	0	0	0
TC-SEL	11	900	4200	2G7	PHILIPS	PL-S 11W/840/4P	0	0	0
TC-L	18	1200	4200	2G11	PHILIPS	PLL 18W/840/4P	0	0	0
TC-L	18	750	4200	2G11	PHILIPS	PLL 18W/840/4P	0	0	0
TC-L	24	1800	4200	2G11	PHILIPS	PLL 24W/840/4P	0	0	0
TC-L	24	1200	4200	2G11	PHILIPS	PLL 24W/840/4P	0	0	0
TC-L	36	2900	4200	2G11	PHILIPS	PLL 36W/840/4P	0	0	0
TC-L	36	1900	4200	2G11	PHILIPS	PLL 36W/840/4P	0	0	0
TC-L	40	3500	4200	2G11	PHILIPS	PLL 40W/840/4P	0	0	0
TC-L	55	4800	4200	2G11	PHILIPS	PLL 55W/840/4P	0	0	0
TC-L	55	3000	4200	2G11	PHILIPS	PLL 55W/840/4P	0	0	0

5. Now we want to save the spectra data as a bulb in the "Lamps.txt" Library: come back to the "Spectra" tab and fill the "Information for saving" fields as follow:



6. Select (from the menu "File" or from the button) the "Save spectra" and the spectra data will be saved as a bulb in the "Lamps.txt" Library: come back to the "Library" tab to see the result:



Class NBS	Watt	Lumen	Colour K	Socket	Company	Identifier	x	y	Δuv
TC-DEL	26	1800	4200	G24q-3	PHILIPS	PL-C 26W/840/4P	0	0	0
TC-SEL	5	210	4200	2G7	PHILIPS	PL-S 5W/840/4P	0	0	0
TC-SEL	7	400	4200	2G7	PHILIPS	PL-S 7W/840/4P	0	0	0
TC-SEL	9	600	4200	2G7	PHILIPS	PL-S 9W/840/4P	0	0	0
TC-SEL	11	900	4200	2G7	PHILIPS	PL-S 11W/840/4P	0	0	0
TC-L	18	1200	4200	2G11	PHILIPS	PLL 18W/840/4P	0	0	0
TC-L	18	750	4200	2G11	PHILIPS	PLL 18W/840/4P	0	0	0
TC-L	24	1800	4200	2G11	PHILIPS	PLL 24W/840/4P	0	0	0
TC-L	24	1200	4200	2G11	PHILIPS	PLL 24W/840/4P	0	0	0
TC-L	36	2900	4200	2G11	PHILIPS	PLL 36W/840/4P	0	0	0
TC-L	36	1900	4200	2G11	PHILIPS	PLL 36W/840/4P	0	0	0
TC-L	40	3500	4200	2G11	PHILIPS	PLL 40W/840/4P	0	0	0
TC-L	55	4800	4200	2G11	PHILIPS	PLL 55W/840/4P	0	0	0
TC-L	55	3000	4200	2G11	PHILIPS	PLL 55W/840/4P	0	0	0
TC-T	13	500	4200	GX24d-1	OSRAM	Dulux T 13W/840	0	0	0
TC-T	18	1200	4200	GX24d-2	PHILIPS	PLT 18W/840/2P	0	0	0
TC-T	26	1800	4200	GX24d-3	PHILIPS	PLT 26W/840/2P	0	0	0
TC-TEL	13	900	4200	GX24q-1	OSRAM	Dulux T/E 13W/840	0	0	0
TC-TEL	18	1200	4200	GX24q-2	PHILIPS	PLT 18W/840/4P	0	0	0
TC-TEL	26	1800	4200	GX24q-3	PHILIPS	PLT 26W/840/4P	0	0	0
TC-TEL	32	2400	4200	GX24q-3	PHILIPS	PLT 32W/840/4P	0	0	0
TC-TEL	42	3200	4200	GX24q-4	PHILIPS	PLT 42W/840/4P	0	0	0
T5	35	3400	4236	G5	ACME	T5 fluorescent tube	0,38552805	0,44017573	0,02559057
T5	13	1350	3000	G5	AURA	ECO SAVER	0	0	0
T5	19	2100	3000	G5	AURA	ECO SAVER	0	0	0
T5	50	5000	4000	G5	AURA	ECO SAVER	0	0	0
T5	22	2000	3000	G5	AURA	ECO SAVER	0	0	0
T5	25	2900	3000	G5	AURA	ECO SAVER	0	0	0
T5	32	3650	3000	G5	AURA	ECO SAVER	0	0	0

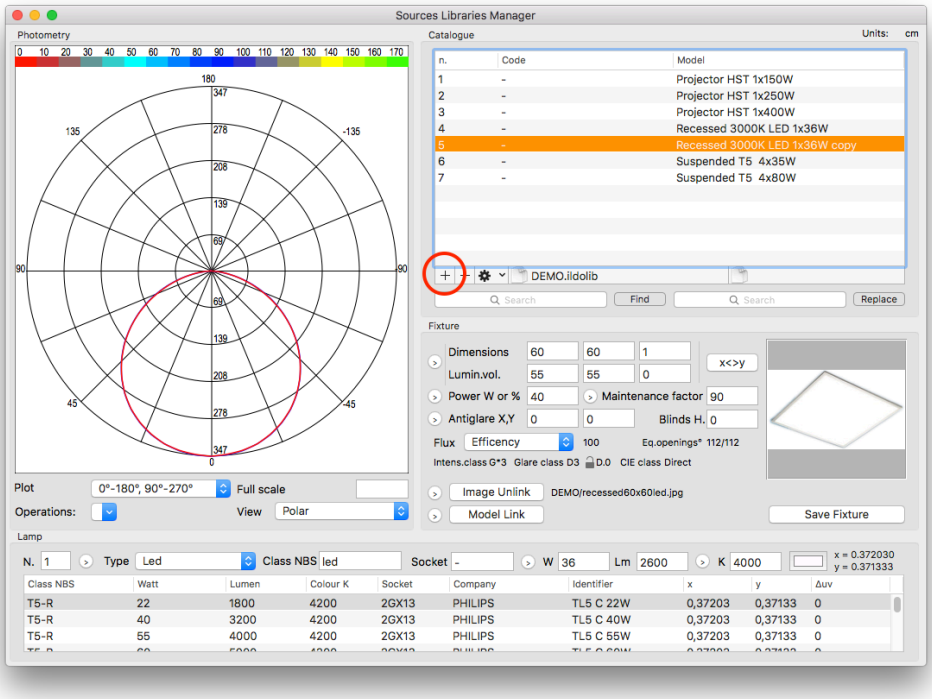
That's all!

5.6. Using polyline-sources

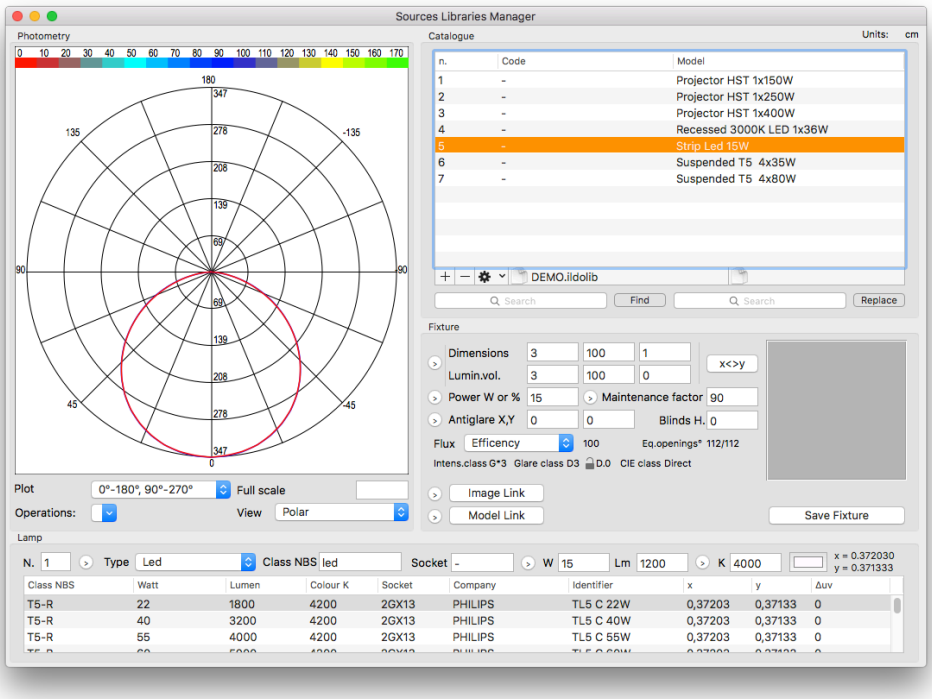
This tutorial permits to understand the use of polyline-sources to simulate a strip-led source.

5.6.1. Creating and saving a 'specific' photometry

Open the Sources Library Manager, load the Demo.ildolib library and duplicate the 'Recessed 3000K LED 1x36W' model:

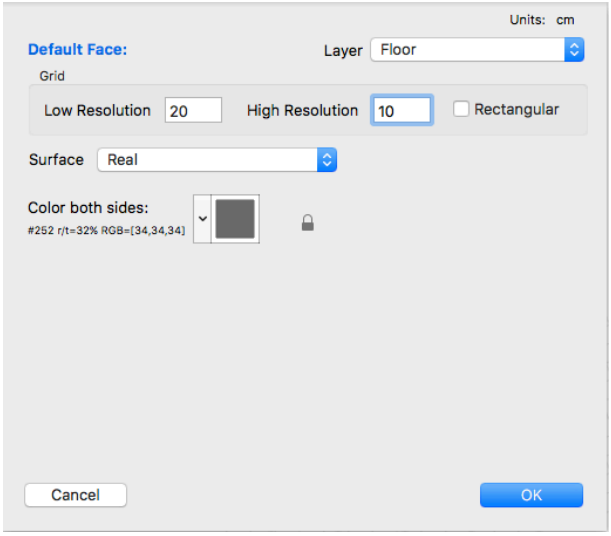


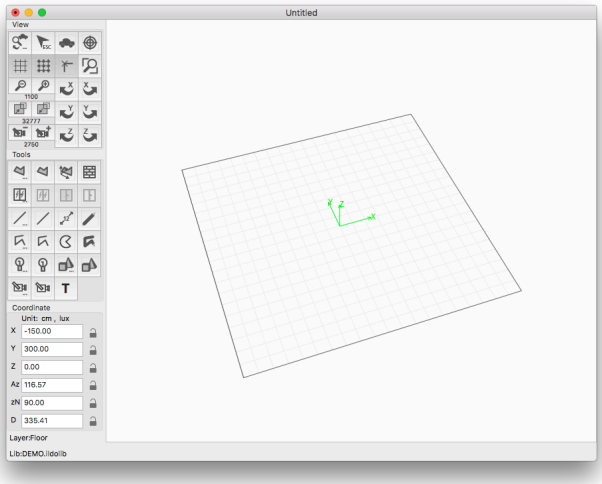
Rename it 'Strip Led 15W', change parameters following the next figure and save the catalogue:



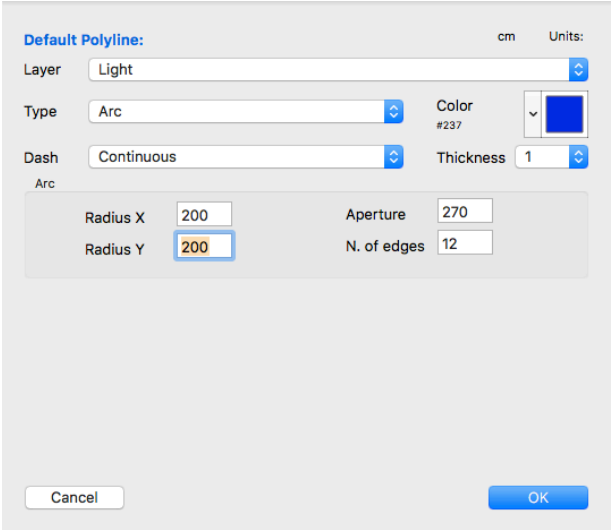
5.6.2. Buliding the model

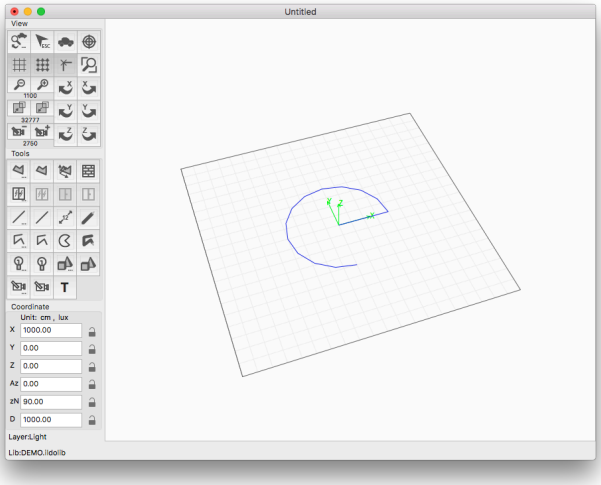
Create a squared face with the following characteristics:



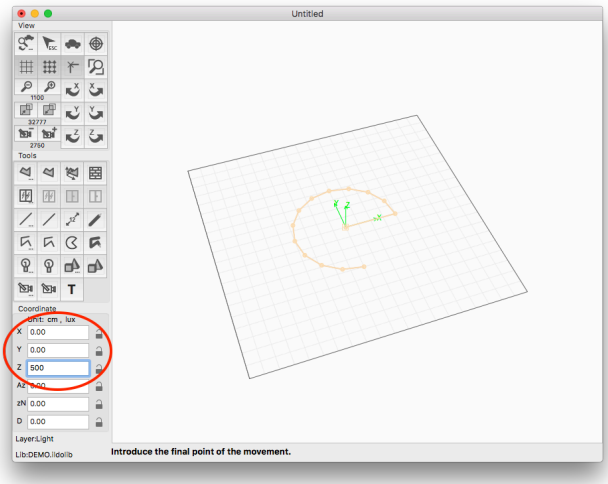


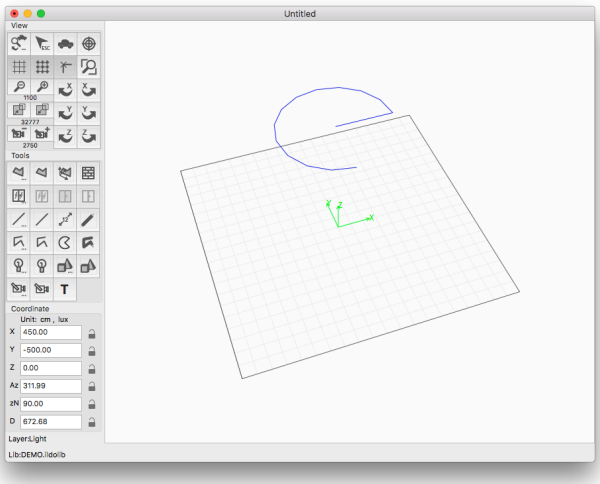
Create a polyline-arc with the following parameters and place it at (0,0,0):



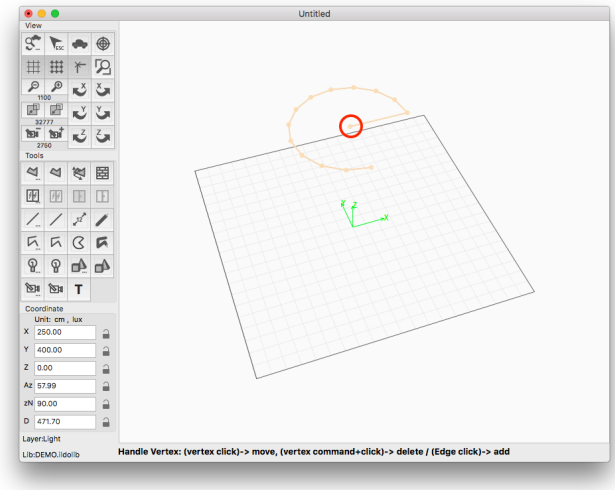


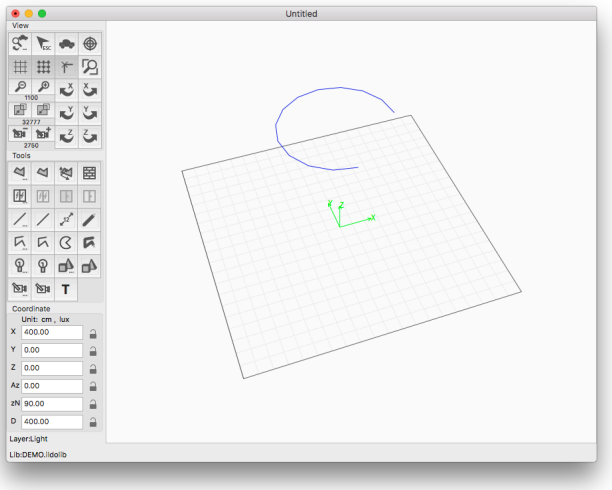
Now select the polyline-arc and move it at (0,0,500):



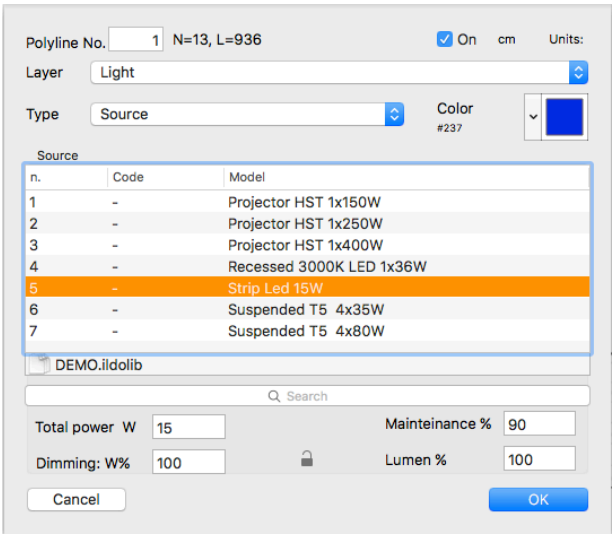


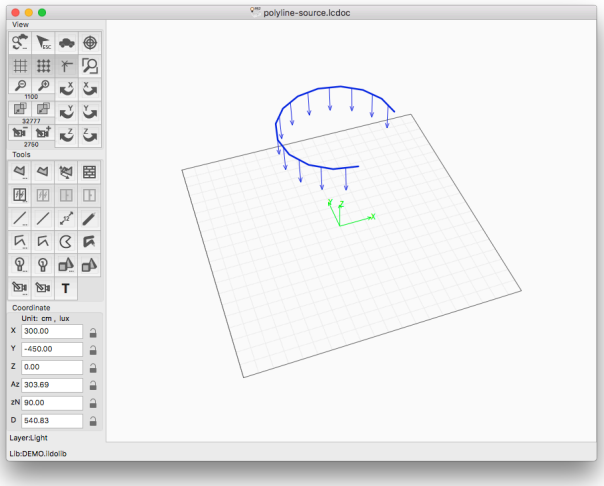
Select the polyline-arc, choose 'Reshape' from the 'Edit' menu and ⌘(command)+click on the center vertex to delete it (first image), pres 'Esc' key and the scene will be presented following the second image:



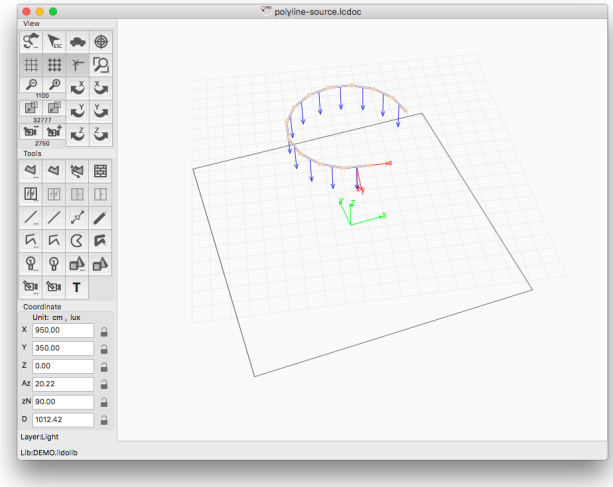


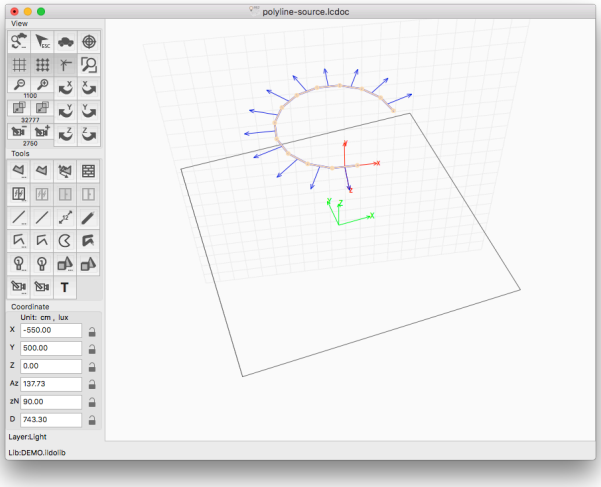
Select the polyline-arc again, choose 'Info' from the 'Edit' menu and change the type in 'Source' selecting the 'Strip Led 15W' model for it; the scene will be update according to the second image:





Select the polyline-arc again, choose 'Local' from the 'Coordinate' menu (first image) and then with the ⌥(option) key pressed select 'Rotate X' from the 'Coordinate' menu (second image); in this way we changed the orientation of the emitted flux according the curvature of the strip-led source:

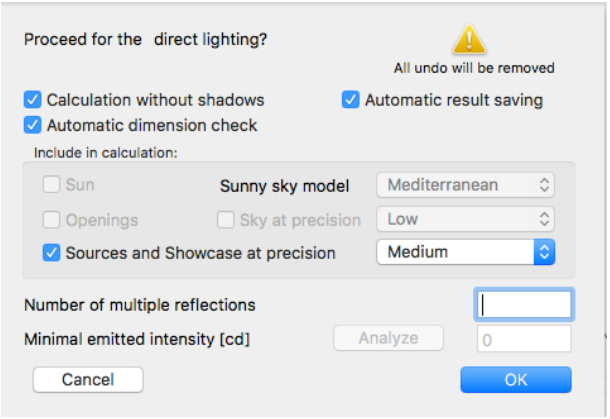




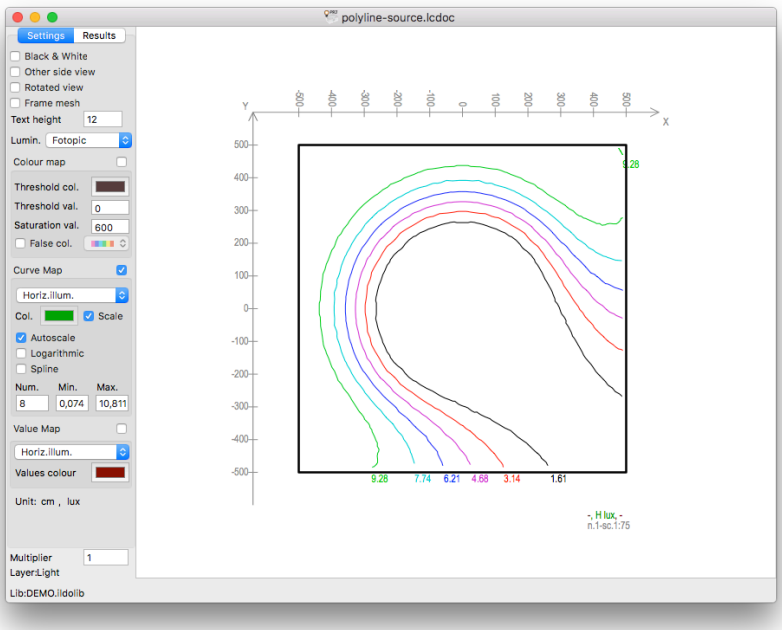
Choose 'Global' from the 'Coordinate' menu and we're ready to start calculation.

5.6.3. Calculation and results

Choose 'Calc' from the 'Lighting' menu and set parameters following the next dialogue:

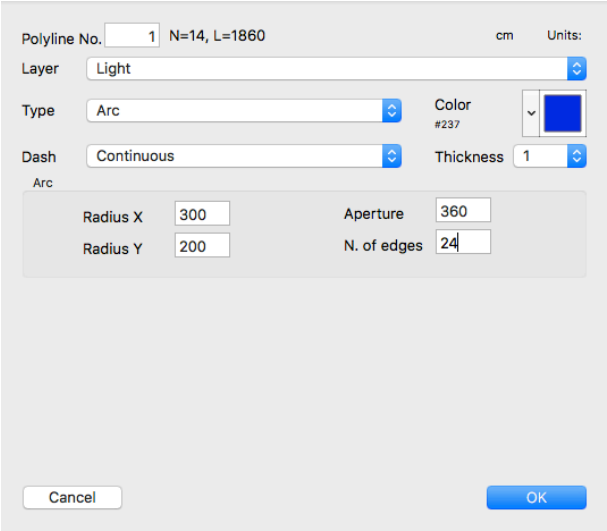


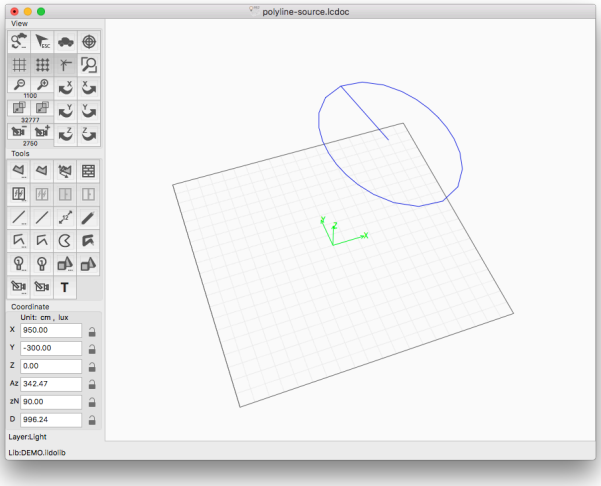
Select the face, choose 'Results' from the 'Lighting' menu and set the parameters following the next image:



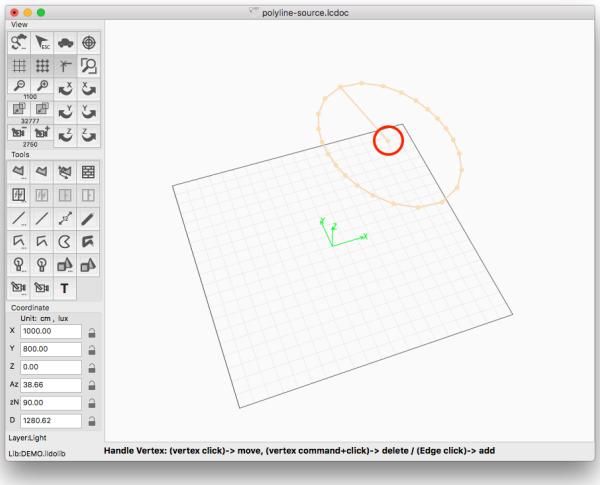
5.6.4. Change the shape of the polyline-source

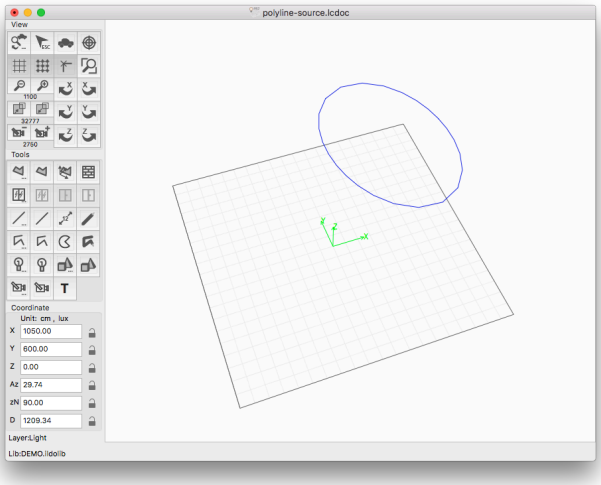
Choose 'Results' again from the 'Lighting' menu, select the polyline-source and choose 'Info' from the 'Edit' menu and set its parameters according to the next left image, accept to discard results and the scene will change according the next right image:



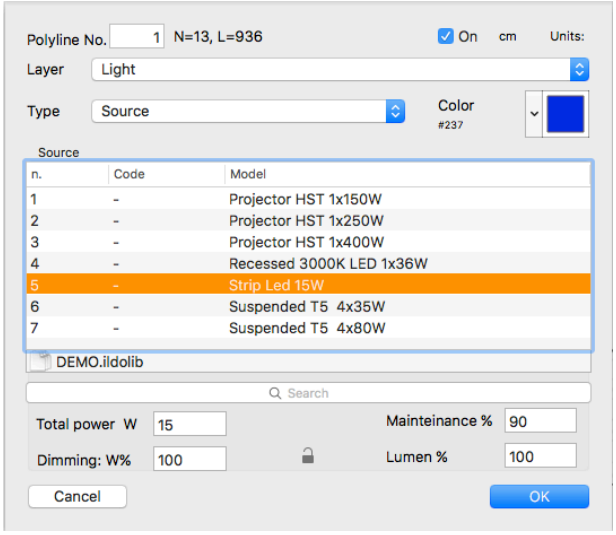


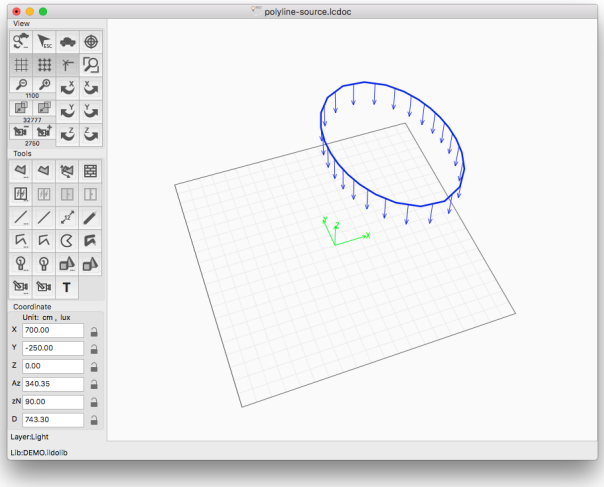
Select the polyline-arc, choose 'Reshape' from the 'Edit' menu and ⌘(command)+click on the center vertex to delete it (first image), pres 'Esc' key and the scene will be presented following the second image:



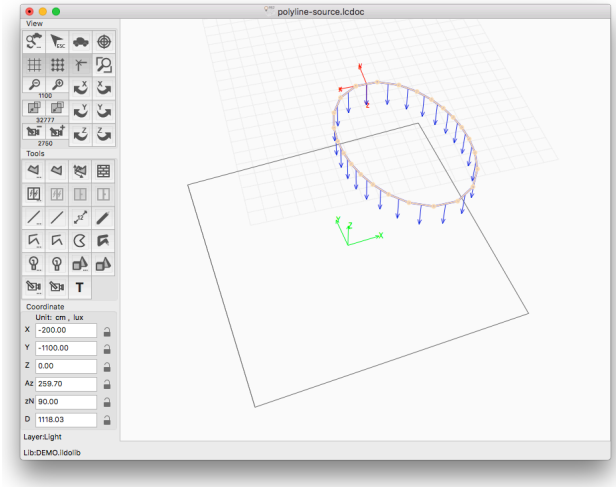


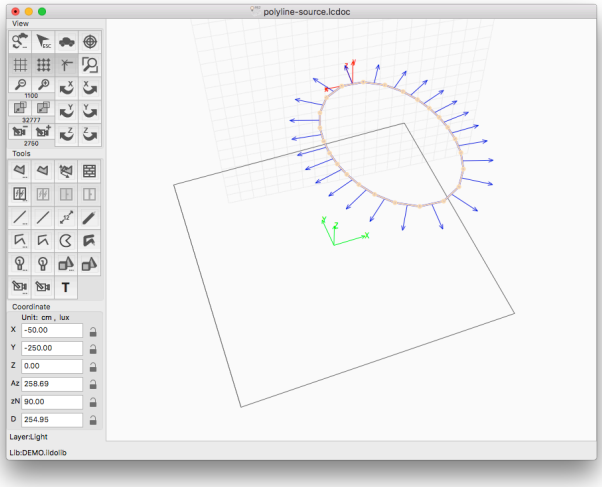
Select the polyline-arc again, choose 'Info' from the 'Edit' menu and change the type in 'Source' selecting the 'Strip Led 15W' model for it; the scene will be update according to the second image:



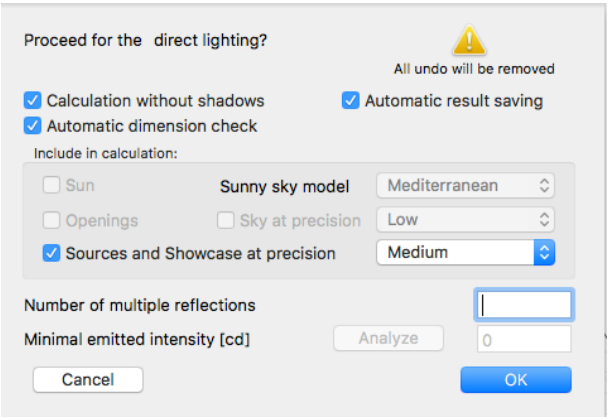


Select the polyline-arc again, choose 'Local' from the 'Coordinate' menu (first image) and then with the ⌥(option) key pressed select 'Rotate X' from the 'Coordinate' menu (second image); in this way we changed the orientation of the emitted flux according the curvature of the strip-led source:

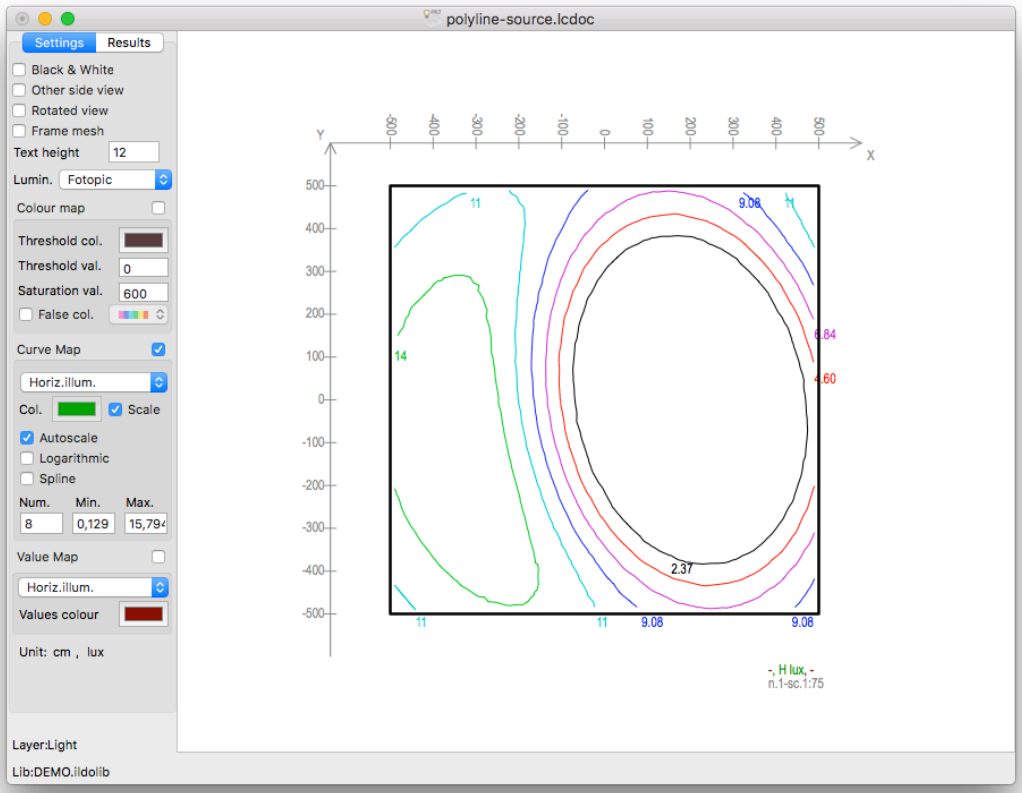




Choose 'Global' from the 'Coordinate' menu and 'Calc' from the 'Lighting' menu setting parameters following the next dialogue:

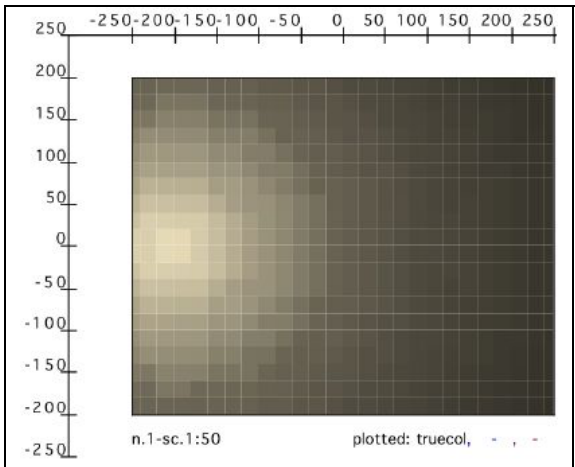
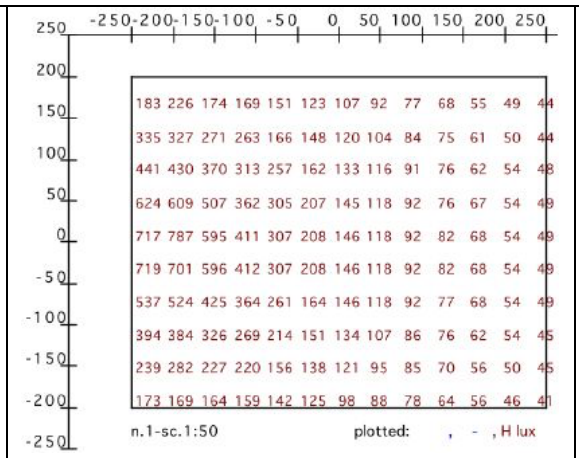
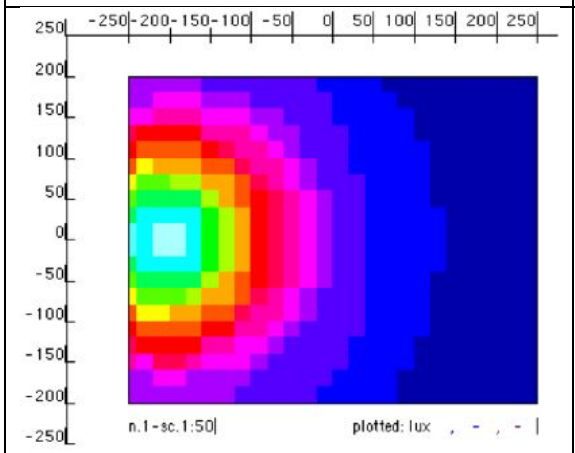
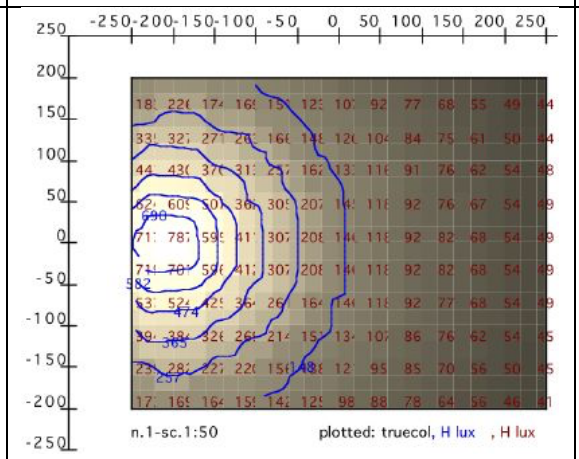
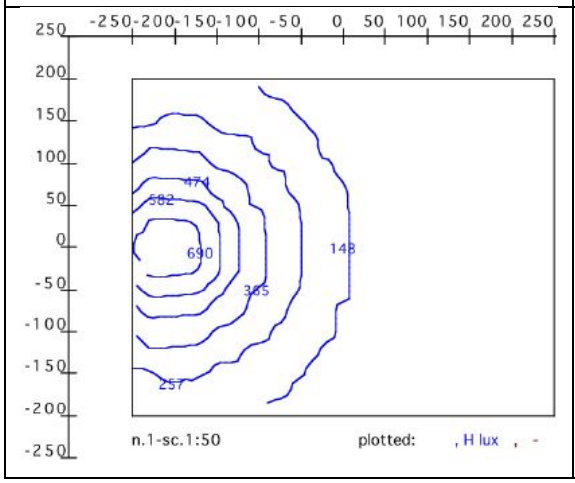


Select the face, choose 'Results' from the 'Lighting' menu and set the parameters following the next image:


polyline-source.lcdoc
Settings
Results
Black & White
Other side view
Rotated view
Frame mesh
Text height
12
Lumin.
Fotopic
Colour map
Threshold col.
Threshold val.
0
Saturation val.
600
False col.
Curve Map
Horiz.illum.
Col.
Scale
Autoscale
Logarithmic
Spline
Num.
Min.
Max.
8
0,129
15,794
Value Map
Horiz.illum.
Values colour
Unit: cm , lux
Layer:Light
Lib:DEMO.ildolib
Y
X
-500
-400
-300
-200
-100
0
100
200
300
400
500
11
9.08
14
6.84
4.60
2.37
-, H lux, -
n.1-sc.1:75

That's all!

5.7. Appendix A: Analysis results

	Real color		Values
	False color		Overlapped
	Curves		

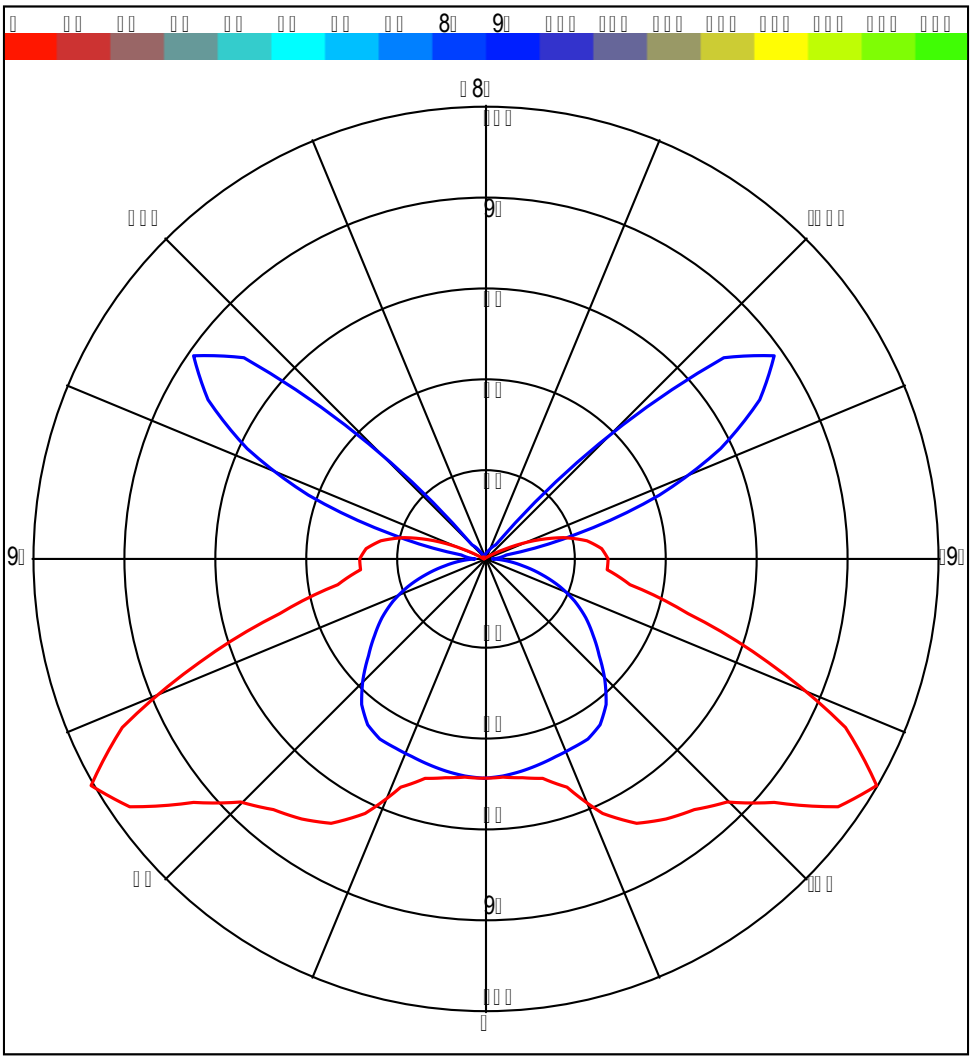
5.8. Appendix B: Luminaire protocol

[illegible]

	C										
gamma	0	10	20	30	40	50	60	70	80	90	100	110
0d	54.2	54.2	54.2	54.2	54.2	54.2	54.2	54.2	54.2	54.2	54.2	54.2
1d	54.1	54.1	54.1	54.1	54.1	54.1	54.1	54.1	54.1	54.1	54.1	54.1
2d	54.1	54.1	54.1	54.1	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0
3d	54.1	54.1	54.1	54.0	54.0	54.0	54.0	53.9	53.9	54.0	53.9	53.9
4d	54.1	54.1	54.0	54.0	53.9	53.9	53.9	53.9	53.9	53.9	53.9	53.9
5d	54.1	54.1	54.0	53.9	53.8	53.8	53.8	53.8	53.8	53.8	53.8	53.8
6d	54.2	54.2	54.1	54.0	53.8	53.8	53.7	53.7	53.7	53.7	53.7	53.7
7d	54.4	54.3	54.2	54.0	53.8	53.8	53.7	53.6	53.6	53.6	53.6	53.6
8d	54.6	54.4	54.3	54.0	53.8	53.8	53.6	53.5	53.5	53.5	53.5	53.5
9d	54.7	54.5	54.4	54.1	53.7	53.7	53.5	53.4	53.3	53.3	53.3	53.4
10d	54.9	54.7	54.5	54.1	53.7	53.7	53.5	53.2	53.2	53.2	53.2	53.2
11d	55.1	54.9	54.7	54.2	53.8	53.8	53.5	53.1	53.1	53.1	53.1	53.1
12d	55.4	55.1	54.8	54.4	53.9	53.9	53.5	53.0	53.0	53.0	53.0	53.0
13d	55.6	55.3	55.0	54.5	54.0	54.0	53.4	52.9	52.9	52.8	52.9	52.9
14d	55.9	55.5	55.2	54.6	54.0	54.0	53.4	52.8	52.8	52.7	52.8	52.8
15d	56.1	55.7	55.4	54.8	54.1	54.1	53.4	52.7	52.6	52.6	52.6	52.7
16d	56.9	56.4	55.8	55.0	54.2	54.2	53.4	52.6	52.5	52.4	52.5	52.6
17d	57.7	57.0	56.3	55.3	54.3	54.3	53.4	52.6	52.4	52.3	52.4	52.6
18d	58.4	57.6	56.8	55.6	54.4	54.4	53.4	52.5	52.3	52.2	52.3	52.5
19d	59.2	58.2	57.2	55.8	54.5	54.5	53.4	52.4	52.2	52.1	52.2	52.4
20d	60.0	58.8	57.7	56.1	54.5	54.5	53.4	52.3	52.1	51.9	52.1	52.3
21d	61.9	60.5	59.1	57.0	54.8	54.8	53.6	52.3	52.1	51.9	52.1	52.3
22d	63.7	62.1	60.5	57.8	55.2	55.2	53.7	52.2	52.0	51.8	52.0	52.2
23d	65.6	63.8	61.9	58.7	55.5	55.5	53.8	52.2	52.0	51.7	52.0	52.2
24d	67.5	65.4	63.4	59.6	55.8	55.8	54.0	52.2	51.9	51.6	51.9	52.2
25d	69.3	67.1	64.8	60.4	56.1	56.1	54.1	52.1	51.8	51.5	51.8	52.1
26d	70.6	68.3	66.0	61.4	56.9	56.9	54.5	52.2	51.8	51.5	51.8	52.2
27d	71.8	69.5	67.2	62.4	57.7	57.7	55.0	52.2	51.9	51.5	51.9	52.2
28d	73.0	70.7	68.4	63.4	58.5	58.5	55.4	52.3	51.9	51.4	51.9	52.3
29d	74.2	71.9	69.6	64.4	59.3	59.3	55.8	52.3	51.9	51.4	51.9	52.3
30d	75.4	73.1	70.8	65.4	60.1	60.1	56.2	52.4	51.9	51.4	51.9	52.4
31d	76.0	73.6	71.2	66.0	60.7	60.7	56.6	52.4	51.7	51.1	51.7	52.4
32d	76.6	74.1	71.7	66.5	61.4	61.4	56.9	52.4	51.6	50.8	51.6	52.4
33d	77.2	74.7	72.1	67.1	62.0	62.0	57.2	52.5	51.5	50.5	51.5	52.5
34d	77.8	75.2	72.6	67.6	62.6	62.6	57.6	52.5	51.4	50.3	51.4	52.5
35d	78.4	75.7	73.0	68.2	63.3	63.3	57.9	52.5	51.2	50.0	51.2	52.5
36d	78.9	76.1	73.4	68.4	63.4	63.4	57.9	52.3	50.9	49.4	50.9	52.3
37d	79.4	76.6	73.8	68.6	63.5	63.5	57.8	52.2	50.5	48.8	50.5	52.2
38d	79.8	77.0	74.1	68.9	63.6	63.6	57.8	52.0	50.1	48.2	50.1	52.0
39d	80.3	77.4	74.5	69.1	63.7	63.7	57.8	51.9	49.7	47.5	49.7	51.9
40d	80.8	77.8	74.8	69.3	63.8	63.8	57.7	51.7	49.3	46.9	49.3	51.7
41d	81.6	78.5	75.4	69.6	63.9	63.9	57.6	51.3	48.6	46.0	48.6	51.3
42d	82.4	79.2	76.0	70.0	64.0	64.0	57.4	50.9	48.0	45.0	48.0	50.9
43d	83.3	79.9	76.5	70.3	64.1	64.1	57.3	50.5	47.3	44.1	47.3	50.5
44d	84.1	80.6	77.1	70.6	64.2	64.2	57.1	50.1	46.6	43.2	46.6	50.1
45d	84.9	81.3	77.6	70.9	64.2	64.2	57.0	49.7	46.0	42.2	46.0	49.7
46d	86.6	82.6	78.5	71.4	64.3	64.3	56.7	49.1	45.2	41.2	45.2	49.1
47d	88.3	83.9	79.4	71.9	64.4	64.4	56.5	48.5	44.3	40.2	44.3	48.5
48d	90.1	85.2	80.4	72.4	64.5	64.5	56.2	47.9	43.5	39.2	43.5	47.9
49d	91.8	86.5	81.3	72.9	64.6	64.6	56.0	47.3	42.7	38.2	42.7	47.3
50d	93.5	87.9	82.2	73.4	64.7	64.7	55.7	46.7	41.9	37.2	41.9	46.7
51d	96.2	89.8	83.4	74.2	65.0	65.0	55.5	46.0	41.2	36.3	41.2	46.0

[illegible]

...follows all other fields



5.9. Appendix C: IES-NA data interchange format

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Synopsis: The IESNA LM-63 photometric data file is an ASCII text file commonly used by North American lighting fixture manufacturers to distribute photometric information about their products. ...

The Standard File Format IES ... is an ACII text file. There are three revisions, based on LM-63-1986, LM-63-1991, and LM-63-1995.

5.9.1. IES LM-63-1986

The file format specification for the LM-63-1986 variant is:

Id	Description
01	{label line 1}
02	{label line 2}
03	...
04	{label line n}
05	TILT={file-spec} or {INCLUDE} or {NONE}
06	{lamp-to-luminaire geometry}
07	{# of pairs of angles and multiplying factors}
08	{angles}
09	{multiplying factors}
10	{# of lamps} {lumens per lamp} {candela multiplier} {# of vertical angles} {# of horizontal angles} {photometric type} {units type} {width} {length} {height}
11	{ballast factor} {ballast-lamp photometric factor} {input watts}
12	{vertical angles}
13	{horizontal angles}
14	{candela values for all vertical angles at first horizontal angle}
15	{candela values for all vertical angles at second horizontal angle}
16	...
17	{candela values for all vertical angles at nth horizontal angle}

A detailed description of each line is presented in the following sections.

5.9.2. IES LM-63-1991

The file format specification for the LM-63-1991 variant is:

Id	Description
00	IESNA91
01	{Keyword [TEST]}
02	{Keyword [MANUFAC]}
03	...

04 {Keyword n}

05 TILT={file-spec} or {INCLUDE} or {NONE}

06 {lamp-to-luminaire geometry}

07 {# of pairs of angles and multiplying factors}

08 {angles}

09 {multiplying factors}

10 vertical angles} {# of horizontal angles} {photometric type} {units type} {width} {length} {height}

11 {ballast factor} {ballast-lamp photometric factor} {input watts}

12 {vertical angles}

13 {horizontal angles}

14 {candela values for all vertical angles at first horizontal angle}

15 {candela values for all vertical angles at second horizontal angle}

16 ...

17 {candela values for all vertical angles at nth horizontal angle}

The changes between LM-63-1986 and LM-63-1991 are:

- Identifier line 00 ("IESNA91") was added to distinguish the file from LM-63-1986 photometric data files.
- The free-form label lines (identifiers 01 through 04) were replaced with lines that begin with user-defined keywords.

A detailed description of each line is presented in the following sections.

5.9.3. IES LM-63-1995

The file format specification for the LM-63-1995 variant is:

Id Description

00 IESNA:LM-63-1995

01 {Keyword 1}

02 {Keyword 2}

03 ...

04 {Keyword n}

05 TILT={file-spec} or {INCLUDE} or {NONE}

06 {lamp-to-luminaire geometry}

07 {# of pairs of angles and multiplying factors}

08 {angles}

09 {multiplying factors}

10 {# of lamps} {lumens per lamp} {candela multiplier} {# of vertical angles} {# of horizontal angles} {photometric type} {units type} {width} {length} {height}

11 {ballast factor} {future use} {input watts}

12 {vertical angles}

13 {horizontal angles}

14 {candela values for all vertical angles at first horizontal angle}

15 {candela values for all vertical angles at second horizontal angle}

16 .. .

17 {candela values for all vertical angles at nth horizontal angle}

The changes between LM-63-1991 and LM-63-1995 are:

- Identifier line 00 was changed to "IESNA:LM-63-1995") to distinguish the file from LM-63-1986 and LM-63-1991 photometric data files and other (future) IESNA standard file formats.
- The number of predefined keywords was expanded and new features (such as support for near-field photometric data) introduced via the keyword mechanism.
- The {ballast-lamp photometric factor} was changed to {future use}.

A detailed description of each line is presented in the following sections.

5.9.4. IES Standard File Format - Detailed Description

All lines shall be terminated with a {CR}{LF} pair. (This is the text file convention for MS-DOS programming environments).

An "identifier line" as presented in Section 2, "IES Standard File Format - Specification," may be consist of one or more ASCII text lines in the photometric data file. Multiple lines are typically present when the space needed to represent the values in the identifier line exceeds the allowable line length.

The maximum length of any label / keyword line (including the {CR}{LF} terminating pair) is 82 characters. The maximum length of any other line (including the {CR}{LF} terminating pair) is 132 characters.

5.9.4.1. File Format Identifier (Identifier Line 00)

IES LM-63-1991 and LM-63-1995 photometric data files begin with a unique file format identifier line, namely "IESNA91" or "IESNA:LM-63-1995". IES LM-63-1986 does not have a file format identifier line.

5.9.4.2. Label Lines / Keywords (Identifier Lines 01 Through 04)

Label lines contain descriptive text about the luminaire, the lamp(s) used, and other descriptive comments. Keywords, which were introduced in LM-63-1991, require that each label line begins with a defined IES keyword in square brackets. For example:

[TEST] ABC1234 ABC Laboratories

The keywords [TEST] and [MANUFAC] are required in LM-63-1991, but not in LM-63-1995. (Label lines are optional in LM-63-1986 and LM-63-1995.) The following keywords are a suggested minimum for LM-63-1995:

[TEST] Test report number and laboratory

[MANUFAC] Luminaire manufacturer

[LUMCAT] Luminaire catalog number

[LUMINAIRE] Luminaire description

[LAMPCAT] Lamp catalog number

[LAMP] Lamp description

LM-63-1995 presents a list of predefined keywords that identify test-related data, luminaire product information, luminaire characteristics, and miscellaneous information. User-defined keywords are also permitted.

Details regarding the syntax of user-defined keywords are presented in IES LM-63-1995. The accompanying IES Standard File parser reads and stores, but does not interpret, keyword lines.

5.9.4.3. TILT= (Identifier Line 05)

The lamp output may vary as a function of the luminaire tilt angle. If so, then the photometric data file may provide photometric data multipliers for various tilt angles. The "TILT=" line uniquely delimits the end of label / keyword lines in the photometric data file.

There are three variants of this line:

- "TILT=NONE": The lamp output (presumably) does not vary as a function of the luminaire If TILT=NONE is present, the identifier lines 06 {lamp-to-luminaire geometry}, 07 {# of pairs of angles and multiplying factors} 08 {angles}, 09 {multiplying factors} are not present in the photometric data file.
- "TILT=INCLUDE": The lamp output varies as a function of the luminaire tilt angle. If TILT=INCLUDE is present, the identifier lines 06 {lamp-to-luminaire geometry}, 07 {# of pairs of angles and multiplying factors} 08 {angles}, 09 {multiplying factors} are present in the photometric data file.
- "TILT={filename}": The lamp output varies as a function of the luminaire tilt angle. If TILT={filename} is present (where "filename" is the name of a valid TILT photometric data file), the identifier lines 06 {lamp-to-luminaire geometry}, 07 {# of pairs of angles and multiplying factors} 08 {angles}, 09 {multiplying factors} are present in the identified and separate TILT photometric data file.

5.9.4.4. Lamp-to-Luminaire Geometry (Identifier Line 06)

This integer value indicates the orientation of the lamp within the luminaire as follows:

1. Lamp base is either vertical base up or vertical base down when the luminaire is aimed straight down.
2. Lamp is horizontal and remains horizontal when the luminaire is aimed straight down or rotated about the zero-degree horizontal plane.
3. Lamp is horizontal when the luminaire is pointed straight down, but does not remains horizontal when the luminaire is rotated about the zero-degree horizontal plane.

The lamp-to-luminaire geometry line is absent if TILT=NONE.

5.9.4.5. Number of Pairs of TILT Angles and Multiplying Factors (Identifier Line 07)

This integer value indicates the total number of lamp tilt angles and their corresponding candela multiplying factors. It is absent if TILT=NONE.

5.9.4.6. TILT Angles (Identifier Line 08)

This line enumerates the (floating point) lamp tilt angles. It is absent if TILT=NONE.

5.9.4.7. TILT Multiplying Factors (Identifier Line 09)

This line enumerates the (floating point) candela multiplying factors for the corresponding lamp tilt angles. It is absent if TILT=NONE.

5.9.4.8. Number of Lamps (Identifier Line 10)

This integer value indicates the total number of lamps in the luminaire.

5.9.4.9. Lumens Per Lamp (Identifier Line 10)

This floating point value indicates the rated lumens per lamp on which the photometric test was based. (This value is obtained from the lamp manufacturer's published technical data for the lamp, and does not represent the actual lumens emitted by the test lamp).

If the luminaire has two or more lamps with different rated lumens per lamp, this value represents the average lumens per lamp for the luminaire. In the (very rare) cases of absolute photometry, this value is -1.

5.9.4.10. Candela Multiplier (Identifier Line 10)

This floating point value indicates a multiplying factor that is to be applied to all candela values in the photometric data file (identifier lines 14 through 17).

5.9.4.11. Number of Vertical Angles (Identifier Line 10)

This integer value indicates the total number of vertical angles in the photometric data (identifier lines 14 through 17).

5.9.4.12. Number of Horizontal Angles (Identifier Line 10)

This integer value indicates the total number of horizontal angles in the photometric data (identifier lines 14 through 17).

5.9.4.13. Photometric Type (Identifier Line 10)

This integer value indicates the type of photometric web used for the photometric measurements as follows:

1. Type C photometry
2. Type B photometry
3. Type A photometry

Luminaries are photometered by locating the luminaire at the center of an imaginary sphere and measuring the light intensity (candela) values at grid points (the "photometric web') on the sphere's surface. The orientation of the luminary's axes relative to that of the sphere determines the photometric type.

Type C photometry is normally used for architectural and roadway luminaries. The polar axis of the photometric web coincides with the vertical axis of the luminaire, and the 0-180 degree photometric plane coincides with the luminary's major axis (length).

Type B photometry is normally used for adjustable outdoor area and sports lighting luminaries. The polar axis of the luminaire coincides with the minor axis (width) of the luminaire, and the 0-180 degree photometric plane coincides with the luminary's vertical axis.

Type A photometry is normally used for automotive headlights and signal lights. The polar axis of the luminaire coincides with the major axis (length) of the luminaire, and the 0-180 degree photometric plane coincides with the luminary's vertical axis.

It is important to note that these photometric types are *not* clearly defined in IES LM-63. All three versions refer the reader to the IES Lighting Handbook for descriptions of Type A and Type B photometry, and to CIE 27-1973 ("Photometry of Luminaries for Street Lighting") and CIE 43-1979 ("Photometry of Floodlights") for a description of Type C photometry. It then says that "Type C is the form in common use in the United States (although it was formerly referred to as Type A)."

This is in contrast to CIE Publication 102-1993, "Recommended File format for Electronic Transfer of Luminaire Photometric Data," which clearly and unambiguously defines three types of photometry: A (alpha), B (beta), and C (gamma). The diagrams in CIE 102-1993 leave no doubt as to how their photometric webs are oriented with respect to the luminaire. Unfortunately, the IES LM-63 Type A photometry is equivalent to the CIE 102-1993 Type C photometry, and the IES LM-63 Type C photometry is equivalent to the CIE 102-1993 Type A photometry.

5.9.4.14. Units Type (Identifier Line 10)

This integer value indicates the units used for the dimensions of the luminous opening in the luminaire as follows:

1. Feet
2. Meters

5.9.4.15. Luminous Opening Dimensions (Identifier Line 10)

While the term "luminous opening" is somewhat ambiguous for many architectural luminaries and other light sources, it is useful in calculating average luminaire luminances and modeling the luminaries as homogeneous area light sources.

5.9.4.15.1. Luminaire Width

This floating point value indicates the distance across the luminous opening of the luminaire as measured along the 90-270 degree photometric plane.

5.9.4.15.2. Luminaire Length

This floating point value indicates the distance across the luminous opening of the luminaire as measured along the 0-180 degree photometric plane.

5.9.4.15.3. Luminaire Height

This floating point value indicates the average height of the luminous opening of the luminaire as measured along the vertical axis.

5.9.4.15.4. Nonrectangular Luminous Openings

The luminous opening is normally considered to be rectangular. However, other predefined shapes can be modeled by specifying one or more of the above dimensions as zero or negative floating point numbers as follows:

Width	Length	Height	Description
0	0	0	Point
w	l	h	rectangular (default)
-d	0	0	Circular (where d = diameter of circle)
-d	0	-d	Sphere (where d = diameter of circle)
-d	0	h	Vertical cylinder (d = diameter of cylinder)
0	l	-d	Horizontal cylinder oriented along lum.length
w	0	-d	Horizontal cylinder oriented along lum.width
-w	l	h	Ellipse oriented along luminaire length
w	-l	h	Ellipse oriented along luminaire width
-w	l	-h	Ellipsoid oriented along luminaire length
w	-l	-h	Ellipsoid oriented along luminaire width

See 5.9.3 IES LM-63-1995 IES for detailed descriptions and diagrams.

5.9.4.16. Ballast Factor (Identifier Line 11)

This floating point value indicates the ratio of the lamp lumens when operated on a commercially-available ballast, to the rated lamp lumens as measured by the lamp manufacturer using a standard (reference) ballast.

All candela values in the photometric data file (identifier lines 14 through 17) must be multiplied by the ballast factor before the candela values are used in an application program.

5.9.4.17. Ballast-Lamp Photometric Factor / Future Use (Identifier Line 11)

In LM-63-1986 and LM-63-1991, this floating point value indicates the ratio of the lamp lumen output using the given ballast and lamp type used to generate a photometric report, to the lumen output of the same luminaire with the ballast and lamp type used for photometric testing.

In LM-63-1995, it was recognized that most lighting manufacturers incorporate the ballast-lamp photometric factor in the preceding ballast factor and set the ballast-lamp photometric factor to unity.

Consequently, the ballast-lamp photometric factor was designated as being for future use and the value set to unity to be compatible with previous releases of LM-63.

All candela values in the photometric data file (identifier lines 14 through 17) must be multiplied by the ballast-lamp photometric factor before the candela values are used in an application program.

5.9.4.18. Input Watts (Identifier Line 11)

This floating point value indicates the total power (measured in watts) consumed by the luminaire, as measured during the photometric test (the input watts value is *not* adjusted by the ballast factor or ballast-lamp photometric factor, even though the power consumption of a luminaire may change if the measured candela values are modified).

5.9.4.19. Vertical Angles (Identifier Line 12)

This line enumerates the (floating point) vertical angles. For Type C photometry, the first vertical angle will be either 0 or 90 degrees, and the last vertical angle will be either 90 or 180 degrees.

For Type A or B photometry, the first vertical angle will be either -90 or 0 degrees, and the last vertical angle will be 90 degrees.

5.9.4.20. Horizontal Angles (Identifier Line 13)

This line enumerates the (floating point) horizontal angles.

For Type C photometry, the first value is (almost) always 0 degrees, and the last value is one of the following:

0° There is only one horizontal angle, implying that the luminaire is laterally symmetric in all photometric planes;

90° The luminaire is assumed to be symmetric in each quadrant;

180° The luminaire is assumed to be bilaterally symmetric about the 0-180 degree photometric plane;

360° The luminaire is assumed to exhibit no lateral symmetry ([6]).

A luminaire that is bilaterally symmetric about the 90-270 degree photometric plane will have a first value of 90 degrees and a last value of 270 degrees.

For Type A or B photometry where the luminaire is laterally symmetric about a vertical reference plane, the first horizontal angle will be 0 degrees, and the last horizontal angle will be 90 degrees.

[6] *This is an error in the draft IES LM-63-1995 standard, because the 360-degree plane is coincident with the 0-degree plane. It should read "greater than 180 degrees and less than 360 degrees"*

For Type A or B photometry where the luminaire is not laterally symmetric about a vertical reference plane, the first horizontal angle will be -90 degrees, and the last horizontal angle will be 90 degrees.

5.9.4.21. Candela Values (Identifier Lines 14 Through 17)

These lines enumerate the (floating point) candela values. There is one line for each corresponding horizontal angle, and one candela value for each corresponding vertical angle.

5.9.5. IES Standard File Example

The following is an example of an IES LM-63-1995 photometric data file:

The following is an example of an IES LM-63-1995 photometric data file:

```
IESNA:LM-63-1995
[TEST]            ABC1234 ABC Laboratories
[MANUFAC]         Aardvark Lighting Inc.
[LUMCAT]          SKYVIEW 123-XYZ-abs-400
[LUMINAIRE]       Wide beam flood to be used without tilt
[LAMPCAT]         MH-400-CLEAR
[LAMP]            Metal Halide 400 watt
[BALLASTCAT]      Global 16G6031-17R
[BALLAST]         400W 277V MH
[MAINTCAT]        4
[OTHER]           This luminaire is useful as an indirect flood
[MORE]            and to reduce light pollution in down light
[MORE]            applications.
[SEARCH]          POLLUTION SPORTS INDIRECT
[BLOCK]
[LUMCAT]          TENNISVIEW 123-XYZ-abc-400
[LUMINAIRE]       Wide beam flood for indirect applications.
[ENDBLOCK]
TILT=INCLUDE
1
13
0 15 30 45 60 75 90 105 120 135 150 165 180
1.0 .95 .94 .90 .88 .87 .98 .87 .88 .90 .94 .95 1.0
1 50000 1 5 3 1 1 .5 .6 0
1.0 1.0 495
0 22.5 45 67.5 90
0 45 90
10000 50000 25000 10000 5000
10000 35000 16000 8000 3000
10000 20000 10000 5000 1000
```

5.10. Appendix D: EULUMDAT data interchange format

of: Zumtobel Licht's COPHOS Development Team, http://www.cophos.co.at

Synopsis: Proposal for a data format for exchange of luminaire data (interior, exterior, and/or road lighting luminaries) under the operating systems ms-dos 2.xx/3.xx under condition of unequivocal coordination between luminaire and data set...

NOTE: Each of the following fields is an ASCII string that is terminated with an MS-DOS 'CR+LF' pair.

N.	Description	N.character
1	Company ident./data bank/version/format identif.	max. 78
2	Ityp = Type indicator: 1 ... point source with symmetry about the vert.axis 2 ... linear luminaire 3 ... point source with any other symmetry (only linear luminaries, Ityp = 2, are being subdivided in longitudinal and transverse directions)	1
3	Isym = Symmetry indicator: 0 ... no symmetry 1 ... symmetry about the vertical axis 2 ... symmetry to plane C0-C180 3 ... symmetry to plane C90-C270 4 ... symmetry to plane C0-C180 and C90-C270	1
4	Mc = Number of C-planes between 0° e 360° (usually 24 for interior, 36 for road luminaries)	2
5	Dc = Distance between C-planes (Dc = 0 for non-equidistantly available C-planes)	5
6	Ng = Number of luminous intensities in each C-plane (usually 19 or 37)	2
7	Dg = Distance between luminous intensities per C-plane (Dg = 0 for non-equidistantly available luminous intensities in C-planes)	5
8	Measurement report number	max. 78
9	Luminaire name	max. 78
10	Luminaire number	max. 78
11	File name	8
12	Date/user	max. 78
13	Length/diameter of luminaire (mm)	4
14	Width of luminaire b (mm) (b = 0 for circular luminaire)	4
15	Height of luminaire (mm)	4
16	Length/diameter of luminous area (mm)	4
17	b1 = Width of luminous area (mm) (b1 = 0 for circular luminous area of luminaire)	4
18	Height of luminous area C0-plane (mm)	4
19	Height of luminous area C90-plane (mm)	4
20	Height of luminous area C180-plane (mm)	4
21	Height of luminous area C270-plane (mm)	4
22	DFF = Downward flux fraction (%)	4
23	LORL = Light output ratio luminaire (%)	4
24	Conversion factor for luminous intensities (depending on measurement)	6
25	Tilt of luminaire during measurement (road lighting luminaries)	6
26	n = Number of standard sets of lamps (optional, extendable on company-specific basis)	4
26a	Number of lamps	n * 4
26b	Type of lamps	n * 24
26c	Total luminous flux of lamps (lm)	n * 12

26d	Color appearance / color temperature of lamps	n * 16
26e	Color rendering group / color rendering index	n * 6
26f	Wattage including ballast (W)	n * 8
27	DR = Direct ratios for room indices 0.6÷5 (for determination of luminaire numbers according to utilization factor method)	10 * 7
28	Angles C (beginning with 0°)	Mc * 6
29	Angles G (beginning with 0°)	Ng * 6
30	Luminous intensity distribution (cd/klm) (Mc2-Mc1+1)*Ng*6 with: Isym = 0: Mc1 = 1 Mc2 = Mc Isym = 1: Mc1 = 1 Mc2 = 1 Isym = 2: Mc1 = 1 Mc2 = Mc/2+1 Isym = 3: Mc1 = 3*Mc/4+1 Mc2 = Mc1+Mc/2 Isym = 4: Mc1 = 1 Mc2 = Mc/4+1	

5.10.1. EULUMDAT Standard File Example

The following is an example of an EULUMDAT photometric data file (the file is splitted into 4 columns for clarity):

```
LED                 0.86265             0.0                 3432.3
2                   0.88517             3.0                 1260.4
1                   0.91294             6.0                 478.3
24                  0.92490             9.0                 254.6
15                  0.93917             12.0                174.4
31                  0.94937             15.0                137.3
3.0                 0.95872             18.0                117.1
LED00004            0.96163             21.0                103.7
Ipotesi 2S MH-T     0.96680             24.0                87.5
--                  0                   27.0                74.5
LED00004            15                  30.0                67.3
21.12.90/Lue        30                  33.0                61.6
300                 45                  36.0                55.6
180                 60                  39.0                38.2
160                 75                  42.0                12.4
244                 90                  45.0                4.2
146                 105                 48.0                2.2
0                   120                 51.0                2.0
0                   135                 54.0                1.9
0                   150                 57.0                1.9
0                   165                 60.0                0.3
100                 180                 63.0                0.0
51.9                195                 66.0                0.0
1.0                 210                 69.0                0.0
0.0                 225                 72.0                0.0
1                   240                 75.0                0.2
1                   255                 78.0                0.0
CDM-T 70W/83        270                 81.0                0.0
6200.0              285                 84.0                0.0
-                   300                 87.0
-                   315                 90.0
0.0                 330                 7296.4
0.83282             345                 6035.9
```

5.11. Appendix D: "Wires.txt" file structure

In this file, a text tab-formatted one, wire information are saved following the next scheme:

PRODUCT	PICTURE	MAX.LENGTH	TOLERANCE	EURO Exp	EURO Ita	EURO Ger	EURO Fra	EURO Spa	EURO Ned	EURO Aus	EURO Bel	FS Swz	DKK Den	EURO Gre	GBP Uk
AAA	AAA.jpg	12,5	12,5	68	68	68	68	68	68	68	68	68	68	68	68
BBB	BBB.jpg	20	3	107	107	107	107	107	107	107	107	107	107	107	107

The "MAX LENGTH" column describe the lenght of the cable-reel, while the "TOLERANCE" column inform about swarf or rounding in cable cutting. Next columns has to be filled with the reel prize in several currencies.