2.2

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

Summary

1. What's

1.1. Generalities

LightingSourceManager is a Cocoa Mac OSX application specialized to manage photometric files.

LightingSourceManager works in metric or imperial units, runs on Apple computers running OSX, fully respecting the specific technology.

The simplicity of use and the interface modeler should not be fooled; LightingSourceManager is really easy to use.

LightingSourceManager has some implementable internal databases containing:

- lighting sources catalogues and linked multi-currency prices files;
- bulb catalogue;

LightingSourceManager 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 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.

LightingSourceManager can export to PDF a complete report for each photometric measurement.

1.2. What's the use

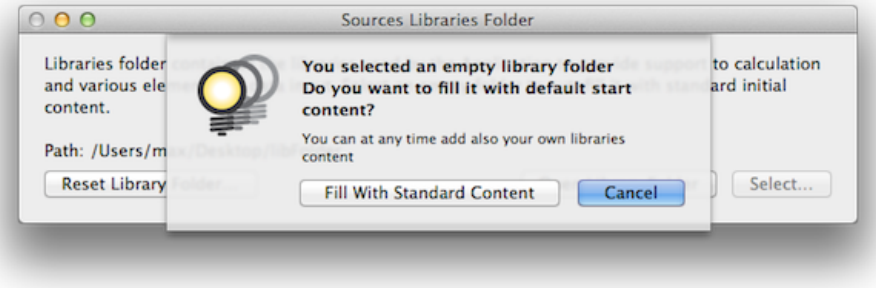
It is clear that, after this introduction, the use of LightingSourceManager is wide but targeted on well-defined problems. LightingSourceManager is a flexible, fast and simple tool to address and solve problems related to various professional activities as well as to different purposes of practical application.

1.3. Who needs it

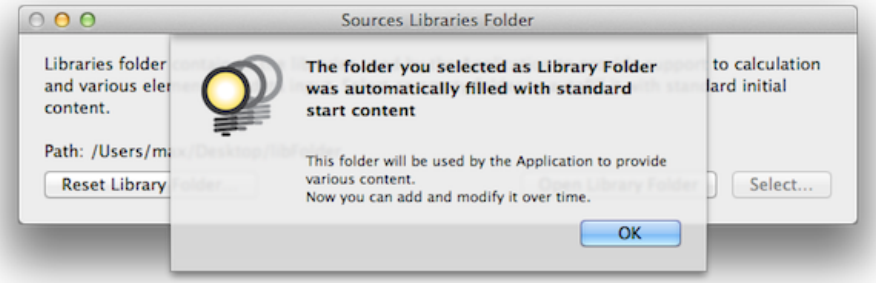
LightingSourceManager is a Macintosh Application dedicated to professionals working in lighting and their professional needs.

2. Getting started

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



Then the installation procedure for the libraries folder will end:

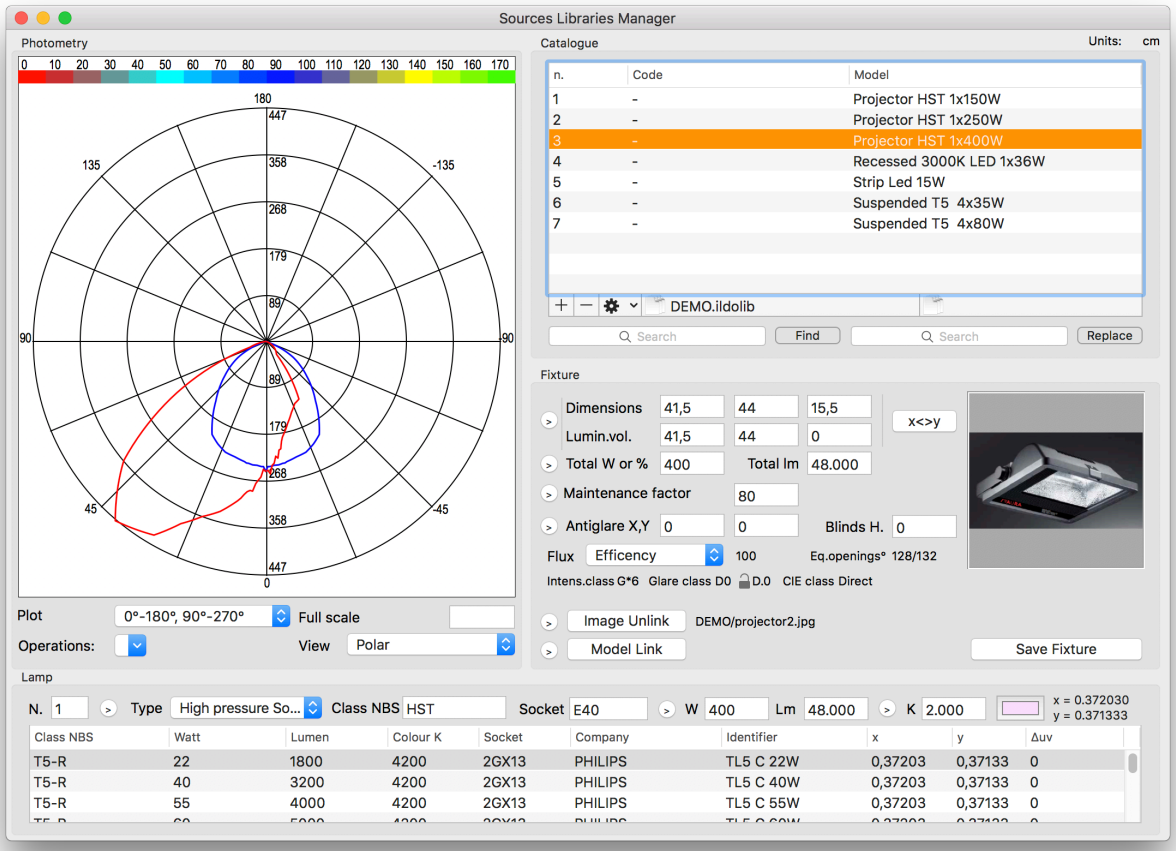


Finally LightingSourceManager presents the window that permits to manage photometric files (see paragraph 3 Workspace).

3. Workspace

The main window is divided into 4 sections:

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



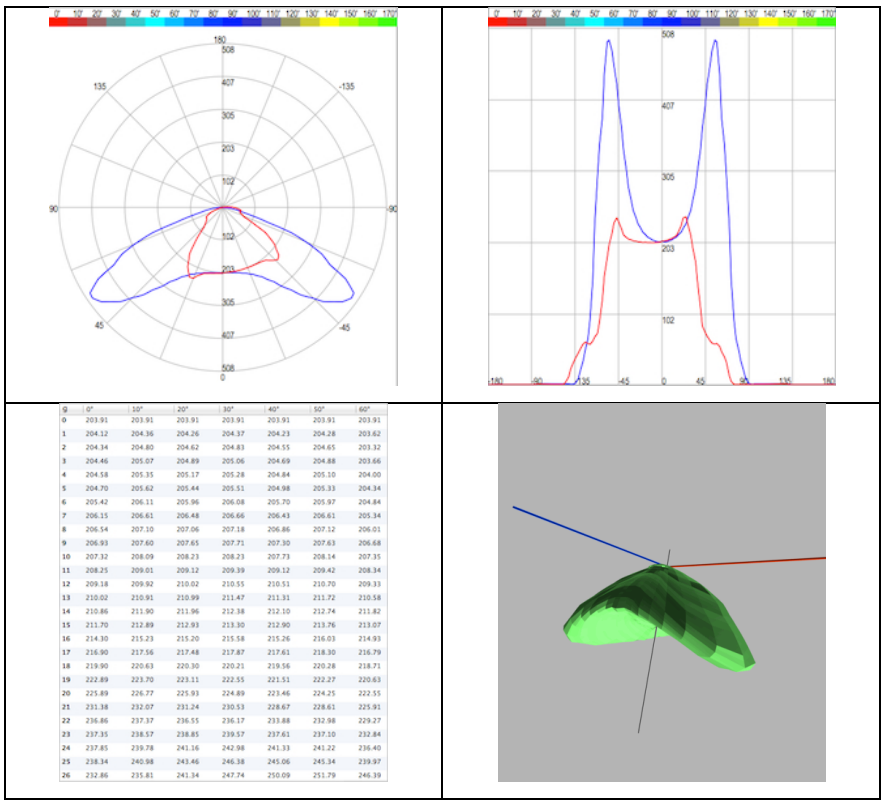
3.1. Photometry section

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.

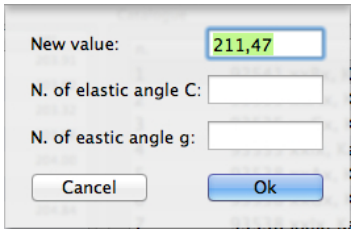
Many options are possible:

- 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 adjust 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 LightingSourceManager 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.



In the I-table view mode the user can modify 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.

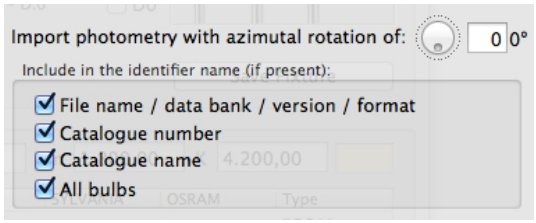
3.2. Catalogue section

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

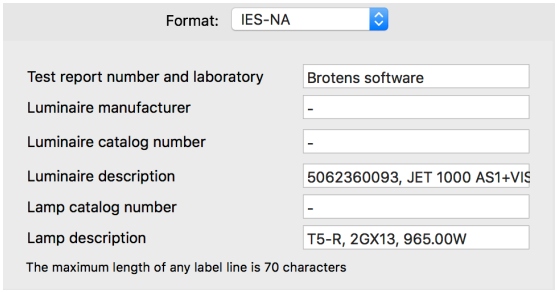
Furthermore it is possible to order the list of fixtures alphabetically by clicking the column title. In this section it is possible:

- 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:

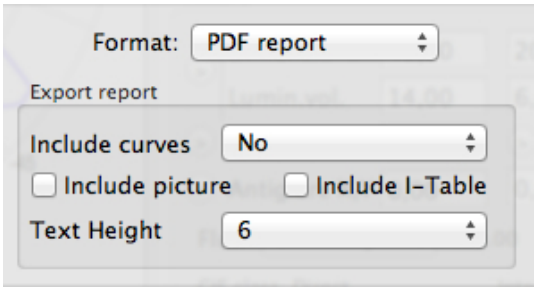
- to delete the selected luminaires (button '-' and also available as contextual menu);
- to create a new empty Catalogue;
- to open an existing one: the active one is highlighted in the field under-center the source list;
- to merge an existing one into the active catalogue;
- to import a single photometry, saved in EULUMDAT, IES or TM14 format (see 3.2.1 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 LightingSourceManager 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 in a single strings that will replace the model string, 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.

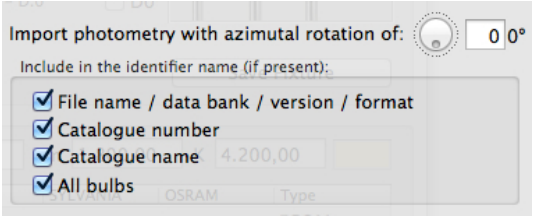
3.2.1. Importing photometries

LightingSourceManager 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 LightingSourceManager 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 (EULUNDAT format):



For text files, LightingSourceManager will try for the first time the IES-LM-63 format and finally the TM-14 filter will be tried.

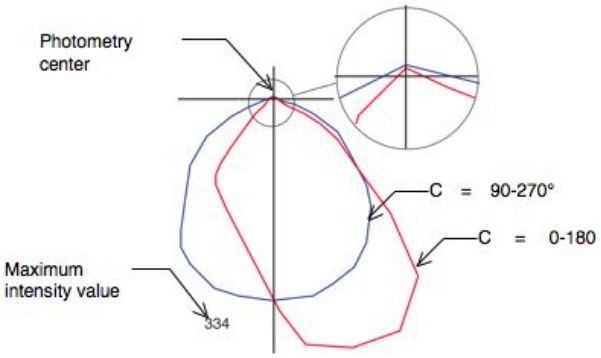
If the luminaire to import has the possibility to install different bulbs (EULUMDAT formats), the Application will display a dialog for choosing the configuration to present.

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

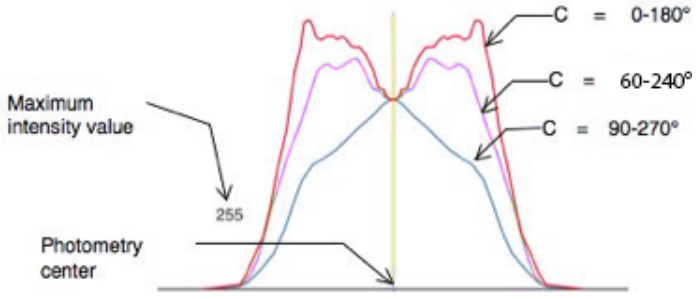
- a couple of lines drawn in **BLACK** crossing in the center of the real photometry if drawing a polar diagram or an horizontal black line and (optional) a **YELLOW** line perpendicular in the middle point of the first if drawing a Cartesian diagram;
- a text object indicating the maximum intensity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



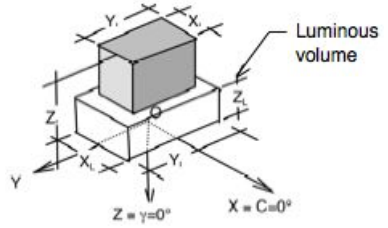
Drawing a Cartesian representation



3.3. Fixture section

In this section it is possible:

- to save the modified luminaire ('Save fixture' button). The label inserted in the edit fileld 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 LightingSourceManager 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);
- to assign the total flux of the fixture, that take account of the Light Output Ratio of the Luminaire;
- 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 LightingSourceManager 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 LightingSourceManager will be drawn in the source color);

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

3.4. 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 colored 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
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:

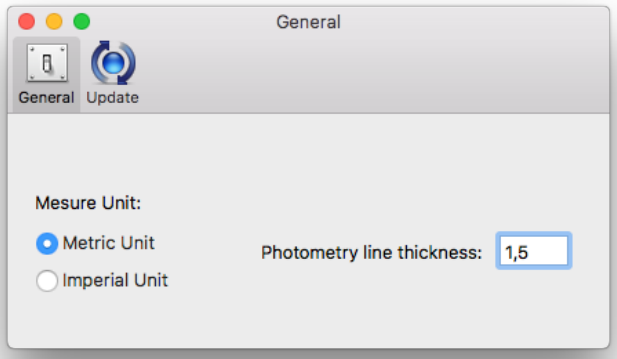
class NBS	standard lamp name;
W	nominal power consumption
Lumen	nominal lumen output
K	Kelvin color temperature of the source
Holder	lampholder
Company	Company
Identifier	Commercial name
x	x-coordinate (CIE 1931)
y	y-coordinate (CIE 1931)
Δuv	distance from the Black Body curve in the CIE 1960 diagram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

4. Guide

4.1. Menu Lighting Source Manage

4.1.1. Command PREFERENCES...



With this dialogue it is possible to work with the preferred units: metric (cm, m) or imperial (ft, in) and to set the line thickness for the photometric curves plot.

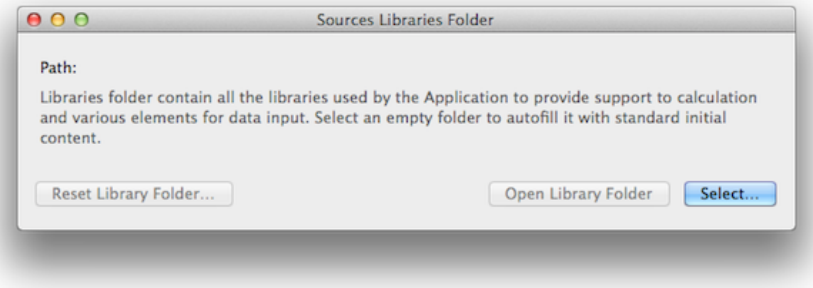
4.1.2. Command QUIT

From this menu it is possible to exit the Application.

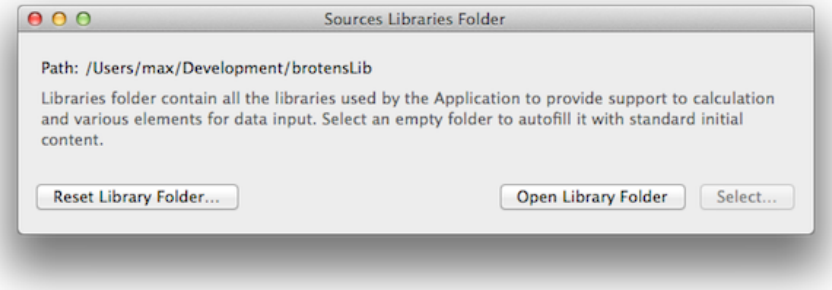
4.2. Menu File

4.2.1. Command: SERVICE FOLDERS...

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



Once chosen, the Application inizialize 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'.

4.3. Menu Edit

Refer to the chapter 3 Workspace.

4.4. Menu Plot

The menu permits to choose how many C-curves are to be plotted.

4.4.1. Command: 0°-180°

These commands permit to plot only the C-curve selected.

4.4.2. Command: ALL CURVES

This command permits to plot all the C-curves.

4.4.3. Command: 0°-180°, 90°-270°

This command permits to plot only these two C-curves.

4.5. Menu Operation

Refer to the chapter 3 Workspace.

4.6. Menu View

Refer to the chapter 3 Workspace.

4.7. Menu View

Refer to the chapter 3 Workspace.

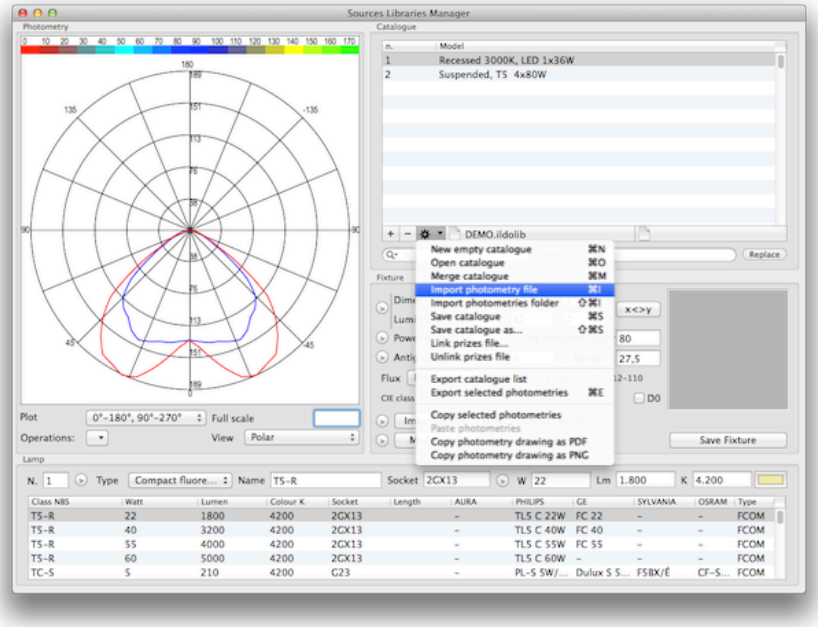
5. Tutorials

5.1. Manage photometries

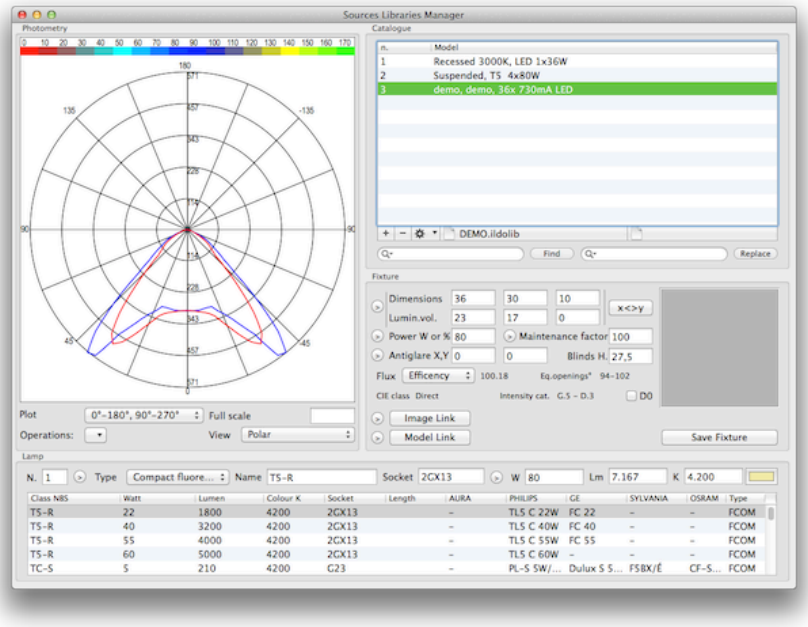
This tutorial permits to import a photometric file, to do some manipulations on it and to export a full report.

5.1.1. Import, correct and save a photometric file.

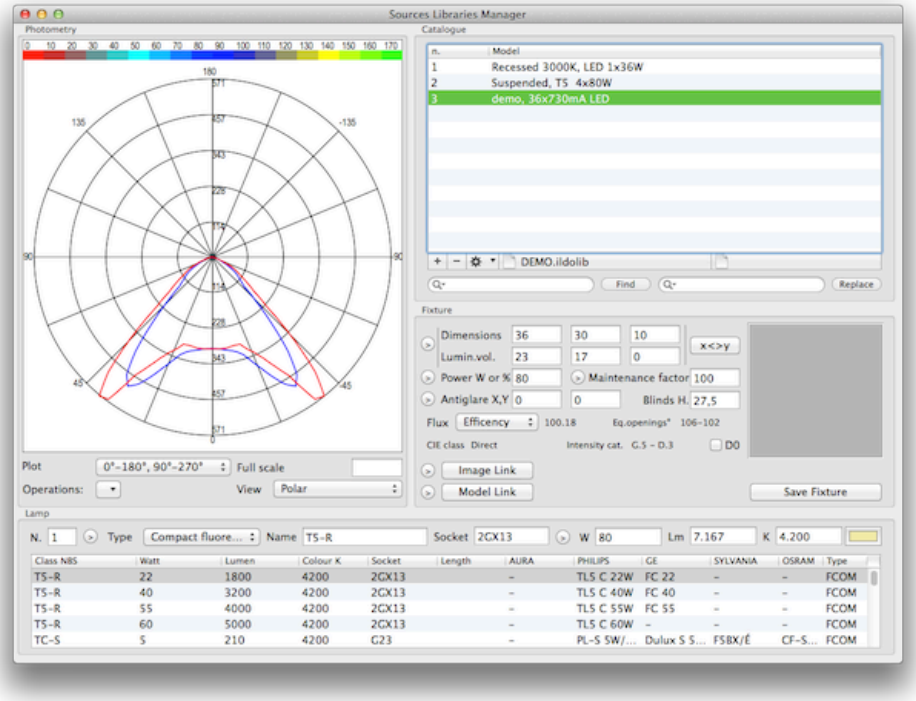
1. The first step consist in importing the 'demo.ldt' file from the catalogue pop-menu:



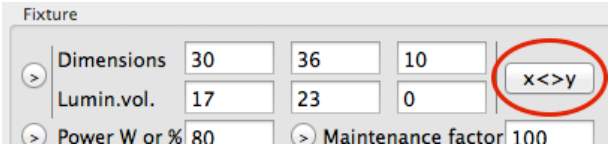
2. Let's correct the name in 'demo. 36x750mA LED' simply with a double-click on the table row to enter the edit mode.



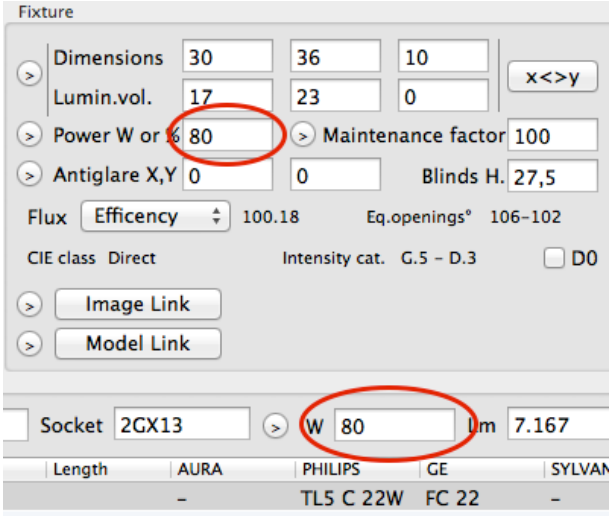
3. Now let's rotate the photometry 90° azimuth to make the plan of the maximum emission (in the previous image, the plan of the blue curve, C=90°/270°) the main plan (C=0°-180°): from the 'Operation' pop-menu 'Rotate +90° azimuth'.



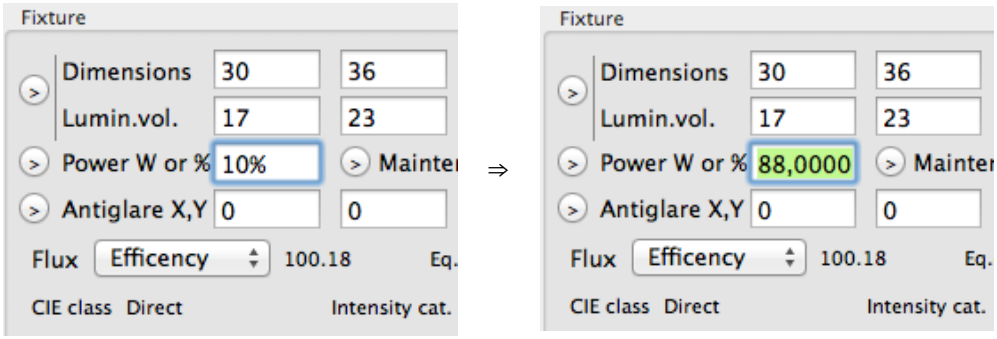
4. For coherence we need to rotate also the geometry 90° azimuth, through the 'x<>y' button in the fixture box:



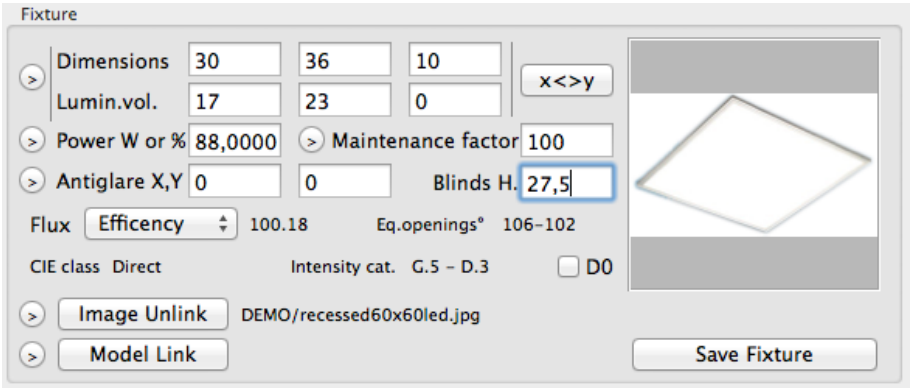
5. Now we have to notice that the total power is equal to the lamp power:



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:



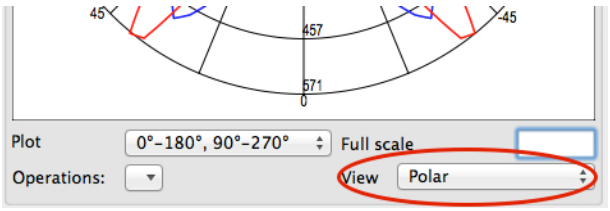
7. Select an image to link to this photometry by clicking the 'Image Link' button in the fixture box, and select the 'recessed60x60led.jpg' one in the folder suggested by the application. The button will change in 'Image Unlink' (this button now will be used to discard actual link) and the image box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

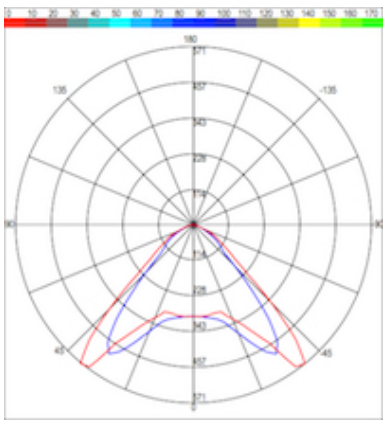


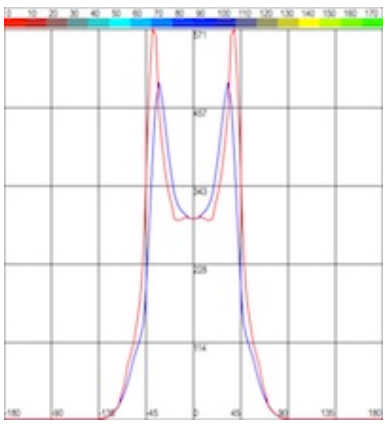
8. At this point we can save the fixture in the open catalogue simply clicking the 'Save Fixture' button: remember that until now the active catalogue was not updated on disk, so we have to select the 'Save catalogue' pop-menu to make permanent the modifications.

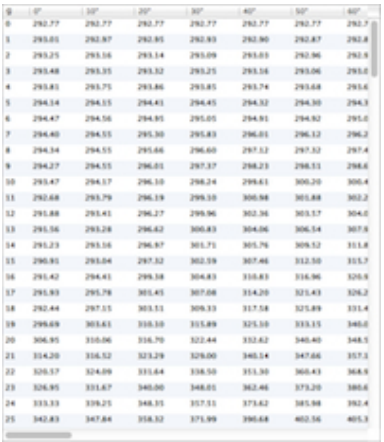
5.1.2. Examine photometry

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

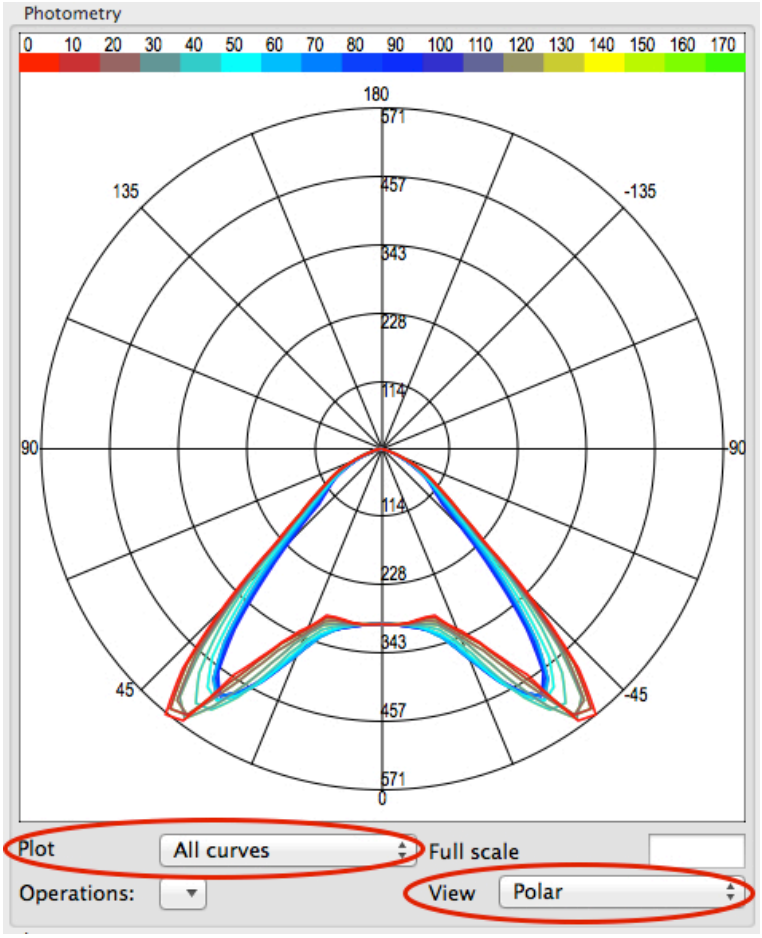




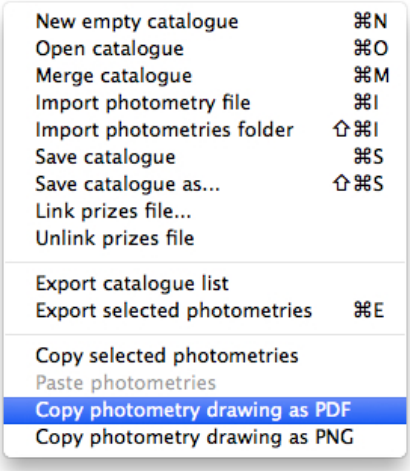




2. Is it also possible to plot a single curve, both the C=0°/C=180° and C=90°/C=270° curves or all the C-curves through the 'Plot' pop-menu: let's select 'All curves' from the 'Plot' pop-menu and 'Polar' from the 'View' pop-menu, and the Photometry box will present the following diagram...

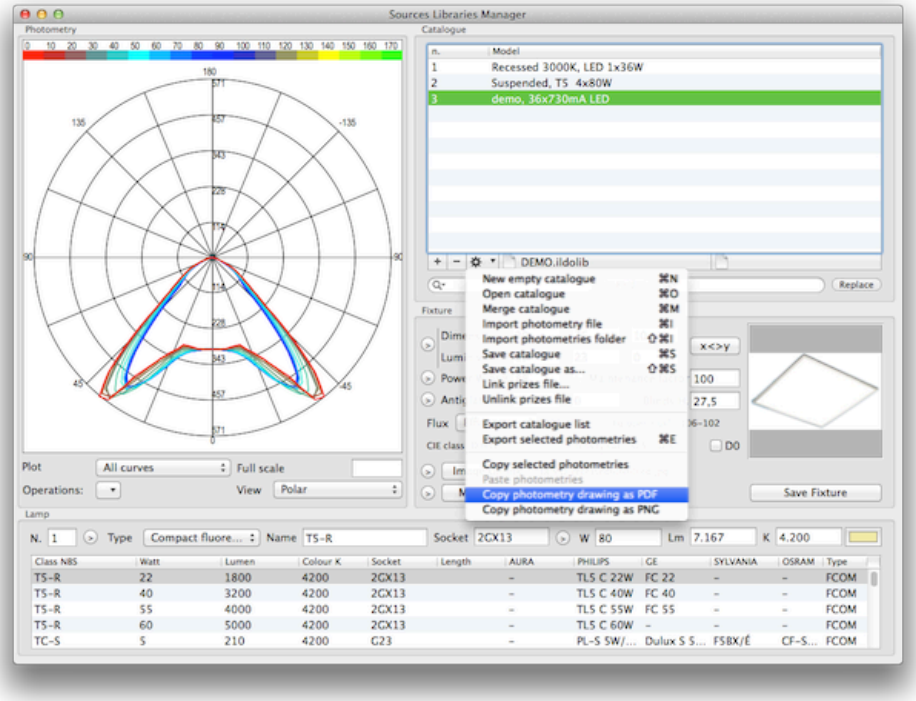


3. ...that may be copied in the pasteboard with the 'Copy photometry as PDF/PNG' commands in the 'Catalogue' pop-menu:

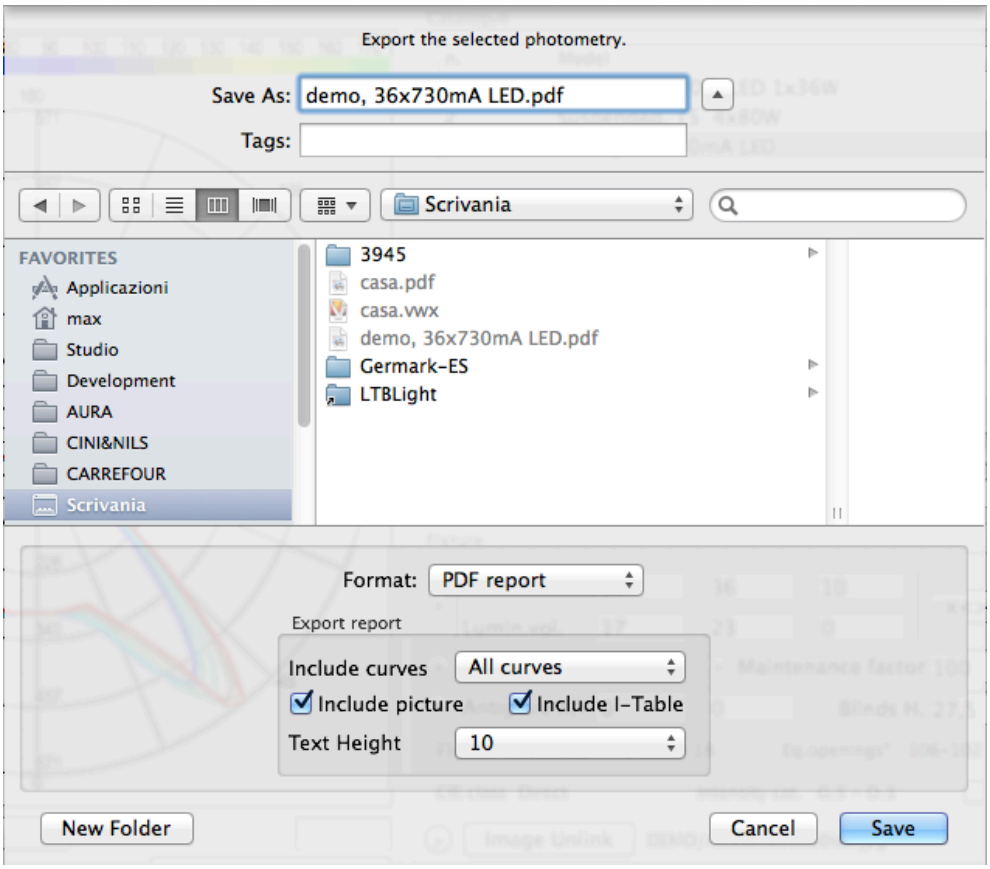


5.1.3. Export photometry protocol.

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:

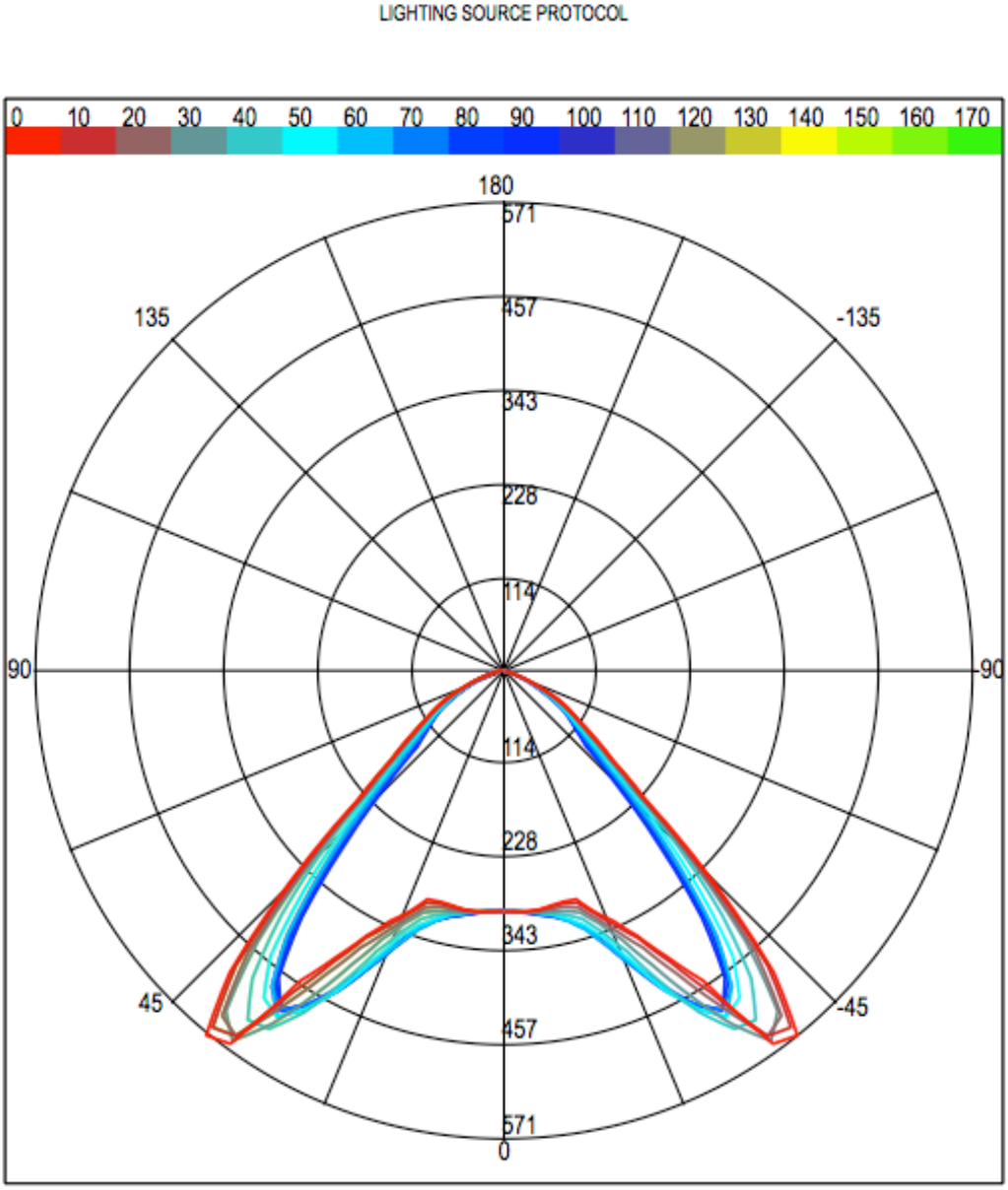
LIGHTING SOURCE PROTOCOL

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


LIGHTING SOURCE PROTOCOL
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170
180
571
457
343
228
114
135
-135
90
90
114
228
343
45
-45
457
571
0

That's all!

6. Appendix A: Luminaire protocol

LIGHTING SOURCE PROTOCOL

Model:	325+316, miniTensoDOMO QUADRETT.arg. + miniTensoCIELI DIFF.
Catalog:	CINI&NILS.ildolib
CIE classification:	Semi-Direct
Total power:	120.00W
Dimensions:	20.2 x 22.5 x 10.0 cm
Luminous volume:	20.2 x 22.5 x 0.0 cm
Efficency:	43 %
Zonal fluxes [lm]:	
- 0/30:	116.10 (11.11 %)
- 0/40:	213.45 (20.42 %)
- 0/60:	481.48 (46.06 %)
- 0/90:	838.16 (80.19 %)
- 90/120:	145.42 (13.91 %)
- 90/130:	186.95 (17.89 %)
- 90/150:	205.22 (19.63 %)
- 90/180:	207.08 (19.81 %)
- 0/180:	1045.24 (100.00 %)
Installed lamp/s:	
- n.:	1
- type:	Halogen
- name:	linear
- socket:	R7s
- power:	120.00 W
- flux:	2450 lm
- color temp.:	3000 K
Side shades:	
- depth:	0.0 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 - Illuminando

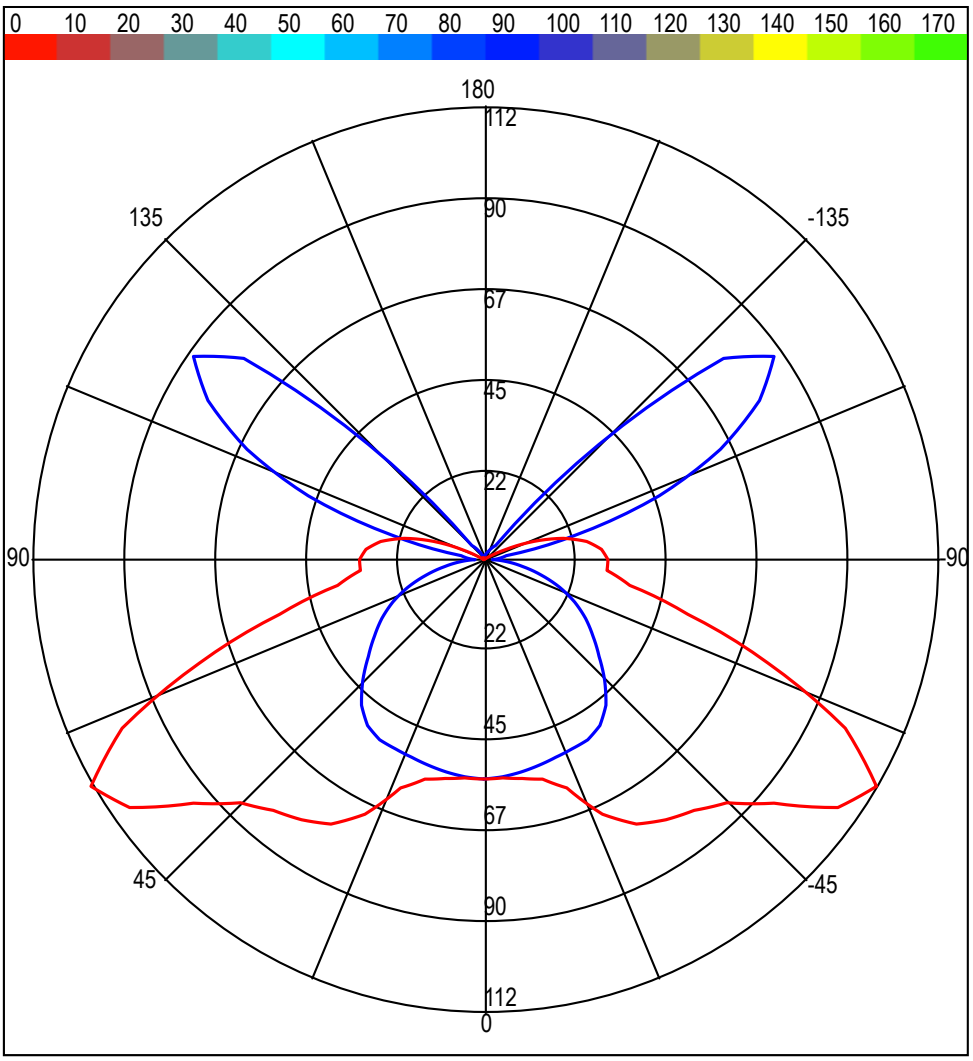
LIGHTING SOURCE PROTOCOL

	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

- 2 - Illuminando

...follows all other fields

LIGHTING SOURCE PROTOCOL



- 14 - Illuminando

7. Appendix B: IES-NA data interchange format

of: (Ian Ashdown, P. Eng. Research & Development Manager - Ledalite Architectural Products Incorporated 9087A - 198th Street - Langley, B.C. - Canada V1M 3B1 - Tel. (604) 888-6811 - Fax. (604) 888-0566 - e mail: iashdown@ledalite.com - URL: http://www.ledalite.com ...

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.

7.1.1. 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.

7.1.2. 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.

7.1.3. 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.

7.1.4. 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.

7.1.4.1. 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.

7.1.4.2. 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 begin 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.

7.1.4.3. 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.

7.1.4.4. 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.

7.1.4.5. 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.

7.1.4.6. TILT Angles (Identifier Line 08)

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

7.1.4.7. 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.

7.1.4.8. Number of Lamps (Identifier Line 10)

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

7.1.4.9. 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.

7.1.4.10. 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).

7.1.4.11. 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).

7.1.4.12. 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).

7.1.4.13. 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 the 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.

7.1.4.14. 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

7.1.4.15. 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.

7.1.4.15.1. 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.

7.1.4.15.2. 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.

7.1.4.15.3. Luminaire Height

This floating-point value indicates the average height of the luminous opening of the luminaire as measured along the vertical axis.

7.1.4.15.4. 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 7.1.3 IES LM-63-1995 IES for detailed descriptions and diagrams.

7.1.4.16. Ballast Factor (Identifier Line 11)

This floating-point value indicates the ratio of the lamp lumens when operated on 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.

7.1.4.17. 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.

7.1.4.18. 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).

7.1.4.19. 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.

7.1.4.20. 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 ([1]).

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.

[1] *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.

7.1.4.21. 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.

7.1.5. 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
```

8. Appendix C: 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	

8.1.1. 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	