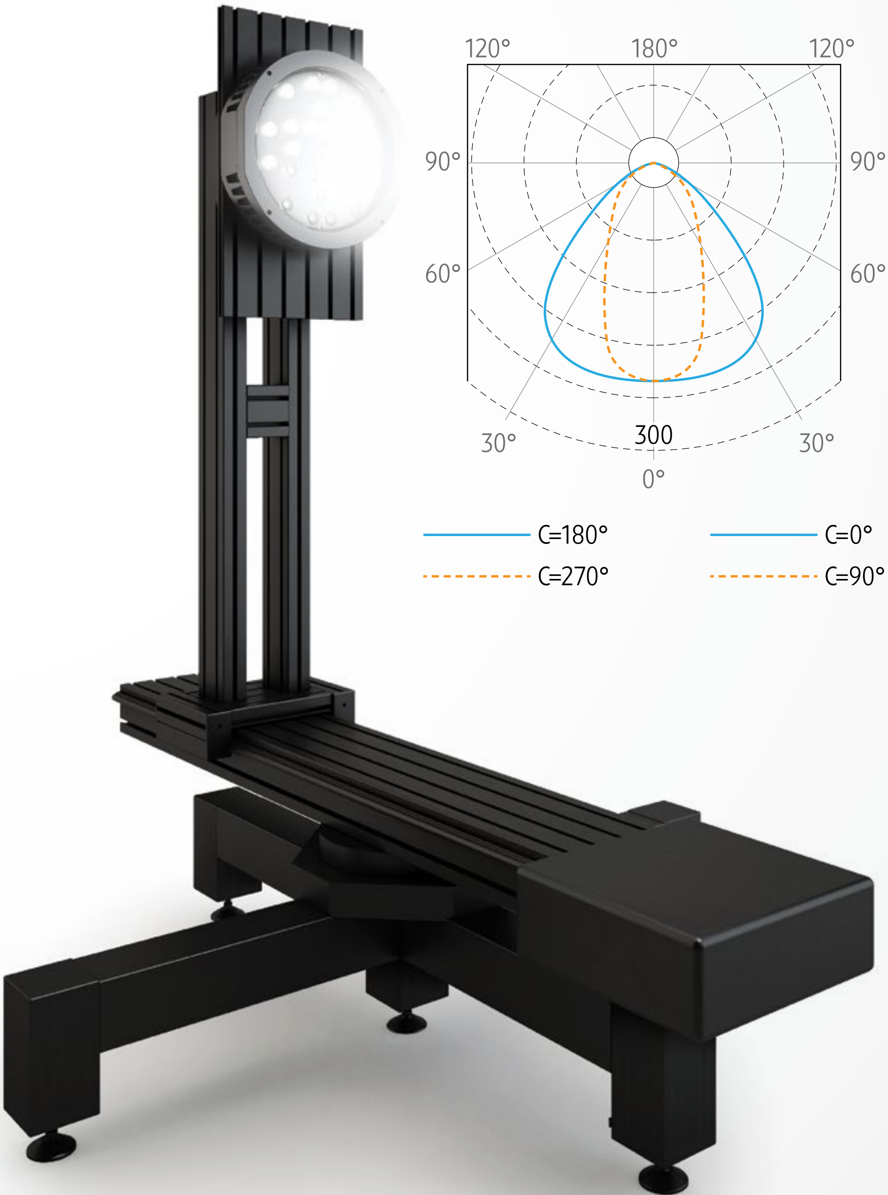
peo PHOTONICS

Touch the technology

GL **GONIO SPECTROMETER**

Introducing the latest innovation from GL Optic.



ENTER THE WORLD OF THE GONIOSPECTROMETER

GL Optic's latest innovative product combines the functionality of a goniophotometer with the features of a spectroradiometer to measure brightness and to check angle dependence luminous intensity.

MEETING THE DEMANDS OF THE MARKET

Traditional goniometers use a photometer as a measuring probe. However, contemporary SSL (Solid State Lighting) such as LED and/or OLED lamps and luminaires require the use of spectroradiometers. This is because LEDs are narrow -banded sources and simple systems based on photodiodes can cause additional errors (due to the LED spectral curve which is limited to a small spectral range).

WHAT DOES A GONIOSPECTROMETER MEASURE?

Use a goniospectrometer to check the angle dependence luminous intensity along with colorimetric values like color, color temperature and CRI.

GL OPTIC Light measurement solutions office@gloptic.com | www.gloptic.com

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GL **GONIO SPECTROMETER**

Effectively measure LED-based luminaires using the latest innovative product from GL Optic.

The GL GONIO SPECTROMETER is GL Optic's latest solution for the measurement of SSL source and luminaries. Up until now, goniophotometers were the only comparable product available on market, used to measure brightness with a photo-detector.

LED-based luminaries, on the other hand, need to be measured using a goniospectrometer to check the angle dependence luminous intensity along with colorimetric values like color, color temperature and CRI.

STANDARD GONIOMETER SYSTEM INCLUDES:

- C type goniometer in C-γ coordinate
- Class A laboratory photometer
- Current or power sources and power meter
- Optical axis in horizontal direction
- Angular luminous intensity measurements
- Luminous flux measurements
- EULUMDAT file generation

THE GL GONIO SPECTROMETER SYSTEM FEATURES:

- GL SPECTIS series spectrometer
- Spectrometric measurement software

This setup conforms to goniospectrometric measurement on four C planes at γ angles in 10° steps according to the IES LM-70-08 standard:

- Angular color measurements
- Spectrometric and colorimetric measurements.

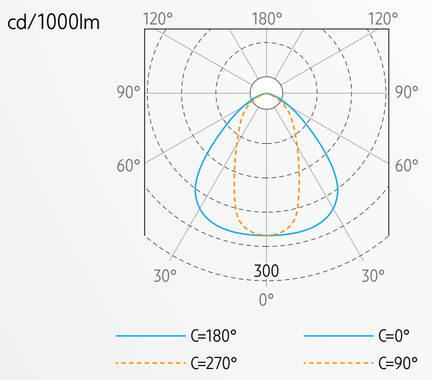

Fig. Example of Luminous intensity chart.

The chart presents the spatial distribution of the luminous intensity of the fixture on two planes:

- On a vertical plane passing through the longitudinal axis of the fixture, plane C90° – C270°
- On a plane perpendicular to the axis of the fixture, plane C0° – C180°

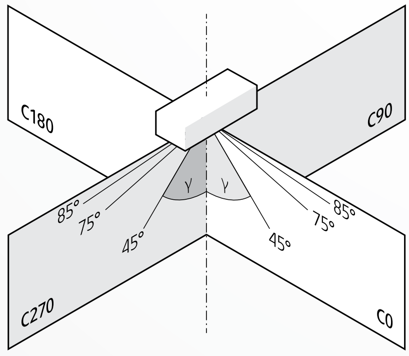

Fig. Partition of the fixture by planes C0° – C180°, C90° – C270° and the γ-angle.

In the case of a fixture with non-symmetrical coverage, luminous intensity values are provided on plane C, at angles in 30° or even 15° increments. The luminous intensity chart provides basic information about the shape of the spatial distribution of the fixture's luminous intensity.

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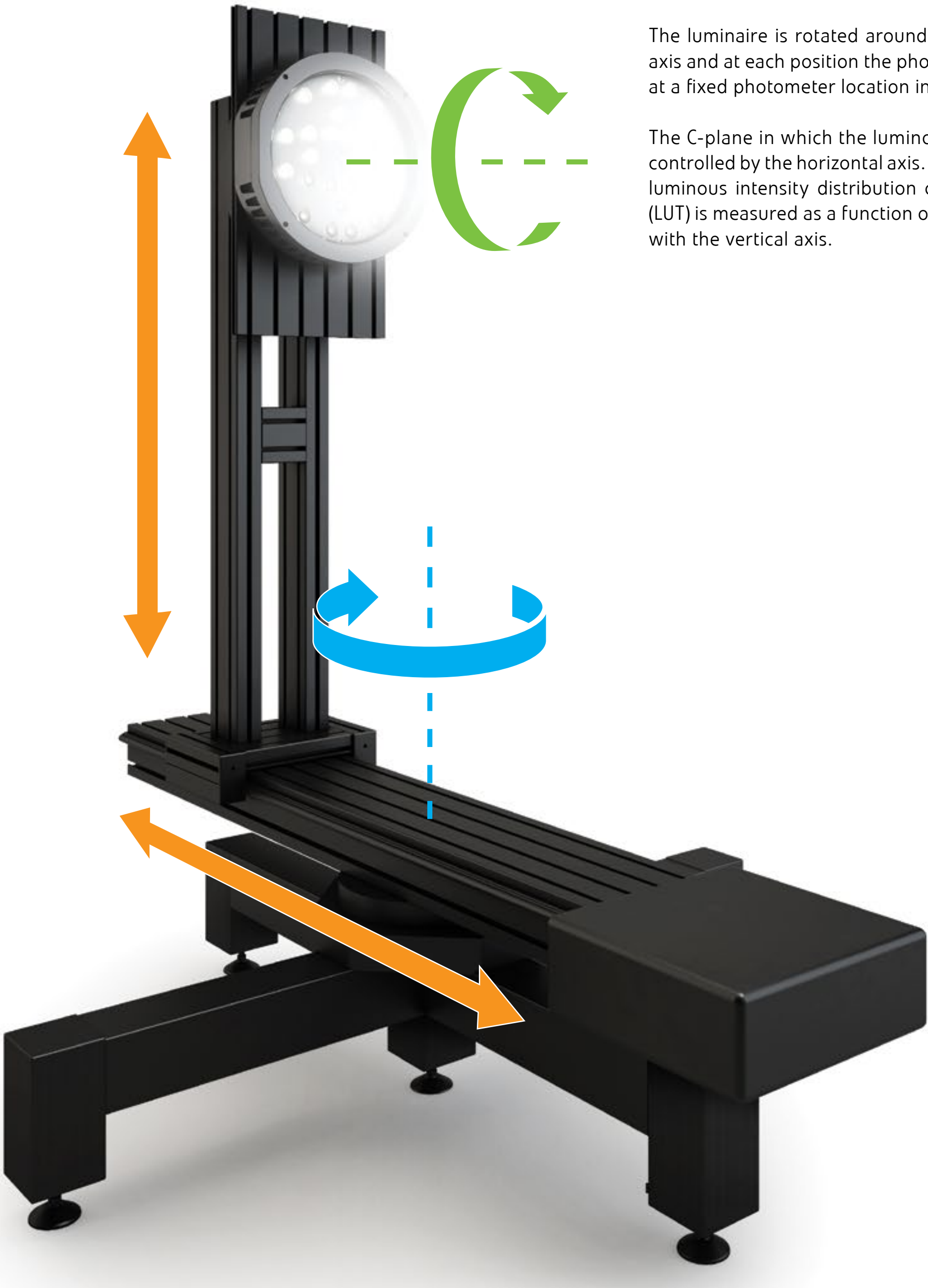

GONIOMETRIC MEASUREMENT PRINCIPLE

The luminaire is rotated around the horizontal and vertical axis and at each position the photometric signal is measured at a fixed photometer location in the far field of radiation.

The C-plane in which the luminous intensity is measured is controlled by the horizontal axis. In each C-plane, the angular luminous intensity distribution of the luminaire under test (LUT) is measured as a function of γ angle by turning the LUT with the vertical axis.

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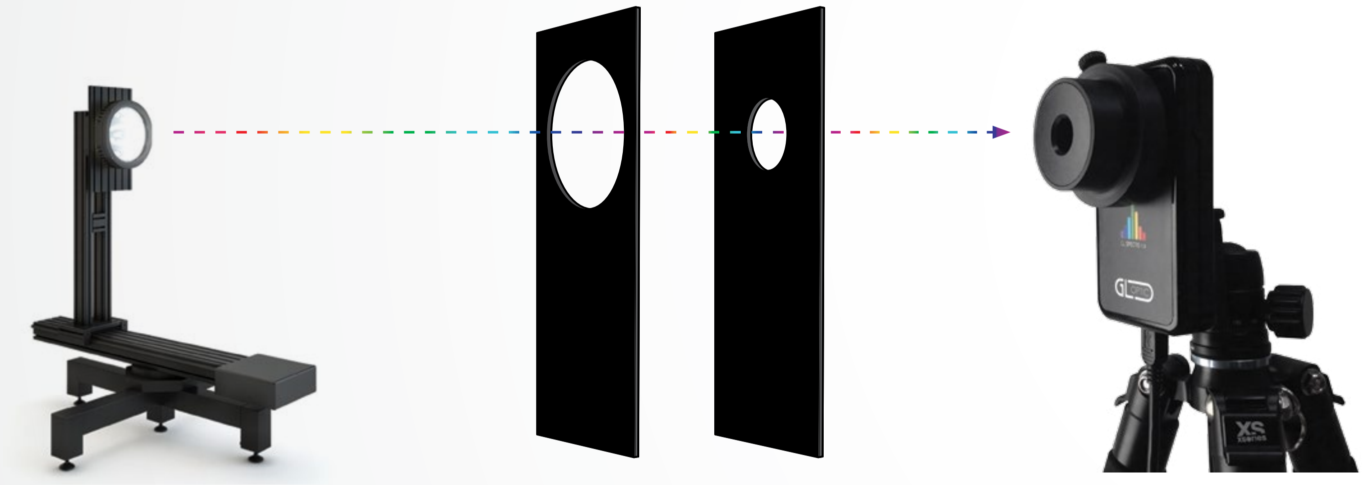
USING A GL GONIO SPECTROMETER

Effectively measure LED-based luminaires using the latest innovative product from GL Optic.

Goniometric data is crucial for the full characterization of luminaires, in particular for the measurement of luminous distribution curves or polar diagrams which present light intensity depending on angle. This information is key in preparing light design or when we need to know what the spatial distribution of light is.



GL **GONIO SYSTEM** — OPTIONAL BAFFLES AVAILABLE — GL **SPECTIS 1.0**

WHAT IS A GONIOSPECTROMETER SYSTEM?

A goniospectrometer system consists of a goniometer and a spectroradiometer.
The goniometer is an instrument which features a turning device and is used for the measurement of luminous flux and the luminous intensity distribution (in accordance with EN 13032-1) of a luminaire.
The spectroradiometer is placed at a certain distance from the luminaire and conducts a set of measurements while the goniometer arm moves the luminaire.

WHY COMBINE A GONIOMETER WITH A SPECTROMETER?

When using a spectrometer as a detector together with a goniometer, the spatial color uniformity of a luminaire can be measured. The goniospectrometer measures color coordinates, correlated color temperatures and color rendering indices as a function of observation angle, and the goniospectrometer software further analyzes the SDCM value corresponding to the MacAdam ellipse within which the color coordinates from different directions are located. With a high precision spectrometer, the luminous intensity distribution, luminous flux and luminous efficacy of a luminaire can be measured as well.

HOW DOES A GONIOMETER SYSTEM WORK?

Luminous intensity can be obtained through illuminance (far-field) or luminance (near-field) measurements at a fixed distance from a luminaire rotated in various directions. With sufficient angular step and range, the luminous flux of a luminaire can be reliably calculated by summing up all the luminous intensities from each measurement direction.
From the measured luminous intensity distribution, various lighting application figures like transversal/longitudinal isolux curves or cone diagrams can be analyzed and illustrated.

WHY DO LED-BASED LUMINARIES REQUIRE ADDITIONAL SPECTRAL PROFILING?

With a goniospectrometer system, spatial distribution of all relevant photometric quantities (E, I, CCT, CRI, peak wavelength,...) are possible at the same time. This pertains not only to the light intensity, but also to colorimetric values.
It is important to note that the CRI index can only be measured with a spectroradiometer. The luminous flux is obtained by numerical integration.

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THE GONIOMETER TYPES: A / B / C

The luminous intensity distribution of lamps and luminaires is measured on different planes. The number of distribution curves for luminous intensity and the selection of specific measuring planes depend on the light source and the goniophotometer type have an effect on the number of luminous intensity distribution curves, as well as the selection of measuring planes.

CIE Publication no. 70 differentiates between the 1, 2, and 3 goniometer type.
These goniometer types are also frequently referred by their measuring planes: A, B or C.

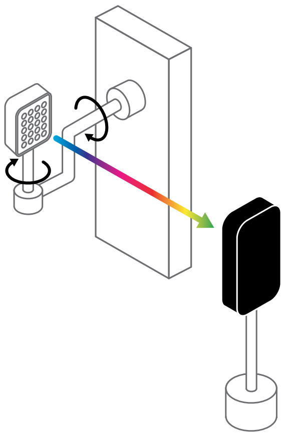

Fig. Goniometer types A

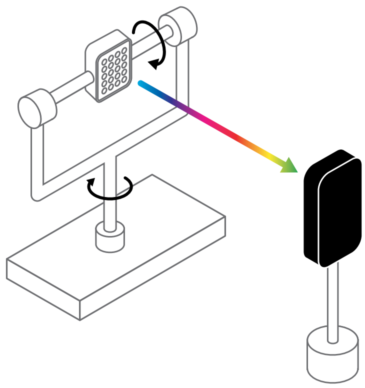

Fig. Goniometer types B

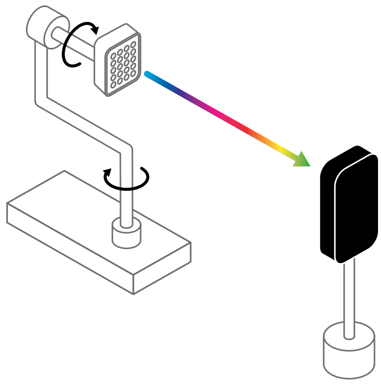

Fig. Goniometer types C

THE GL GONIO SYSTEM IS A TYPE C

It is a highly specialized instrument featuring a fixed vertical axis and moving horizontal axis. Measurements are made on the C-plane or on conical surfaces.
This type is recommended by international standards for general lighting systems.

STRAIGHTFORWARD MEASUREMENT IN TERMS OF BURNING POSITION

Traditional light sources like fluorescent tubes or sodium lamps had very specific requirements in terms of burning position. Any change in the position resulted in a significant drop of luminous flux emission. A goniometric measurement of solid state light sources (LEDs, OLEDs) is more straightforward as far as burning position is concerned. SSL luminaires may have a small effect as the thermal management can change a bit. The magnitude of the effect depends on the shape and type of the SSL luminaire heat sink, as well as the type of goniometer. This is the reason why a Type C Gamma Goniometer system is the best solution for LED based lighting.

WHAT IS A SUITABLE DETECTOR?

Luminous intensity measurements are typically taken with a broadband photometer / tristimulus colorimeter which has high sensitivity and can quickly measure the low light levels. The photometer needs to have a good match with the photopic spectral sensitivity V(λ) of CIE1924 standard human eye as described by the spectral quality factor f1´. The laboratory class L photometer (f1´< 1.5 %) and the class A photometer (f1´< 3%) are generally considered as sufficient in terms of performance for goniometric measurements. However, the f1´value does not provide the actual luminous intensity measurement errors caused by a spectral mismatch, because it depends on the spectrum of the light source to be measured and the spectral shape of the mismatch.

Contemporary SSL (Solid State Lighting) such as LED and/or OLED lamps and luminaires require the use of spectroradiometers. This is because LEDs are narrow-banded sources and simple systems based on photodiodes can cause additional errors (due to the LED spectral curve which is limited to a small spectral range).

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HOW DO YOU CHOOSE THE OPTIMAL GONIOMETER?

The dimensions and luminous area, shape of a luminaire and required accuracy determine the size of the goniometer. The instrument needs to be adjustable to position the photometric center of luminaires with varying thicknesses (distance from its back surface to the photometric center) to the turning axes.

For measurement of luminaires with an upward radiation, the maximum γ angle of the goniometer and luminaire mounting should be such that the dead angle is minimized and the total radiation angular range is covered.

TECHNICAL DATA SHEET

PRODUCT	GLG-1-20	GLG-6-70	GLG-20-150
Application area	Small LED sources, retrofit lamps (E14,E27,etc)	up to medium sized SSL sources	up to large luminaires
Height, Width, Length, Weight	300 mm, 300 mm (stand), 300 mm (stand), appr.4 kg	700 mm, 700 mm (stand), 700 mm (stand), appr. 25 kg	1240 mm, 1500 mm (stand), 1500 mm (stand), appr. 70kg
LUT Photometric center positioning	adjustable within 150 mm (vertical axis)	adjustable within 300 mm (vertical axis)	adjustable within 575 mm (vertical axis)
Max. dimension of the LUT*	0.2 m	0.7 m	1.5 m
Max. mass of the LUT# (in installed status)	1.5 kg	6 kg	20 kg
Minimum space for installation (w x h x l)	table installation 0.4 m x 0.4 m x 1.2 m	goniometer onto table or floor, photometer in tripod 0.7 m x 0.7 m x 5 m	floor installation 2.5 m x 2.5 m x 9 m
Measuring instruments	**TURNING DEVICE (GONIOMETER)** • Rotary stages equipped with stepper motors – Reproducibility 0.01° (both axes) – Positioning accuracy 0.01° (both axes) – Worm gear drive system – Deep groove ball bearings • Motion controller – 2 axis controller – RS-232 interface **PHOTOMETER** • Electronic unit: – RS232 interface – Measurement range 0.0005 – 100 000 lx • Photometer head: – class A, f1'< 3% (meets the DIN-5032 requirements) – Entrance aperture: 8 mm (no diffuser!) • EULUMDAT – files (F_V / LOR) F_V = $\mathbf{F_V}$ **SPECTROMETRIC DEVICE:** • GL SPECTIS 1.0; 5.0 or 6.0 • Goniospectrometric measurements – Angular color uniformity measurement (IES LM-79-08) – Average color quantities (CCT, CRI, SDCM) **AC POWER METER:** • Automatic / Manual measurement of electrical input power and supply voltage **AC POWER SUPPLY** • Maximum output power 500 W and 1000 W • Stable AC power for luminaires under measurements		

*LUT - Light source under test

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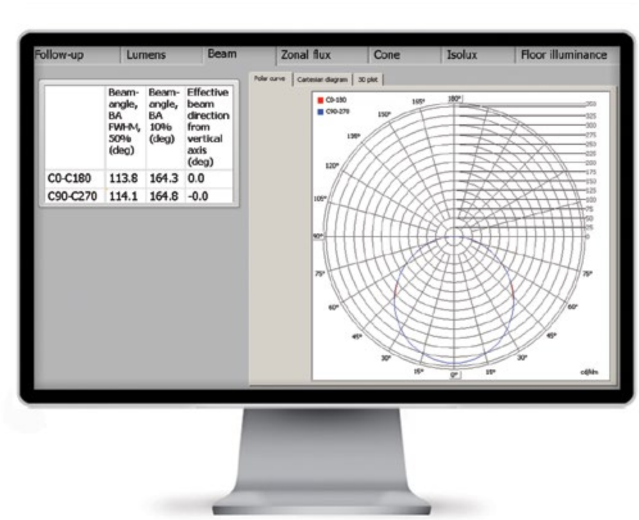
PEO PHOTONICS

BASIC GONIOMETER SOFTWARE

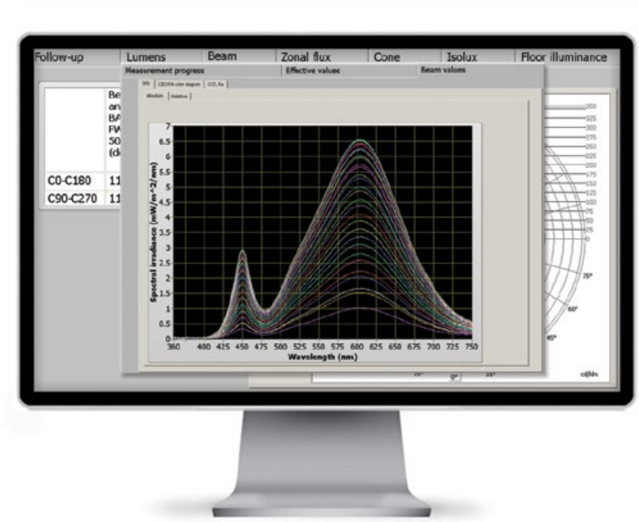


FEATURES

- Test report (pdf)
- Beam angles
  (Full width at 50% and 10% from the maximum)
  are calculated for two perpendicular C planes
  (C0° – 180° and C90° – 270°)
- Isolux curves (longitudinal)
- Floor illuminance
- Cumulative flux
- Cone angle presentation at different distances
  (beam width in angle and in meters,
  illuminance in the center and edge of the cone)
- Opening of data from an existing EULUMDAT file
  (analyses the parameters in the list above)
- Symmetric beam measurement

GONIO SPECTROMETRIC SOFTWARE

Goniospectrometric measurement in four C planes at γ angles by 10° steps according to the IES LM-79-08 standard.



FEATURES

- Plot of spectrum, color coordinates (xy, u'v'),
  color temperature CCT, and color rendering indices (Ra)
  as function of angle
- Calculation of effective color coordinates,
  color temperature and color rendering indices (Ra, R1-14)
- Calculation of maximum color change over the angular
  space in SDCM/MacAdam ellipse units
- Measurement of total radiant flux (optical Watts),
  thermal power, wall-plug efficiency,
  luminous efficacy of radiation spectrum (LER),
  total spectral radiant flux (W/nm)
- Print or save results to a PDF report

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