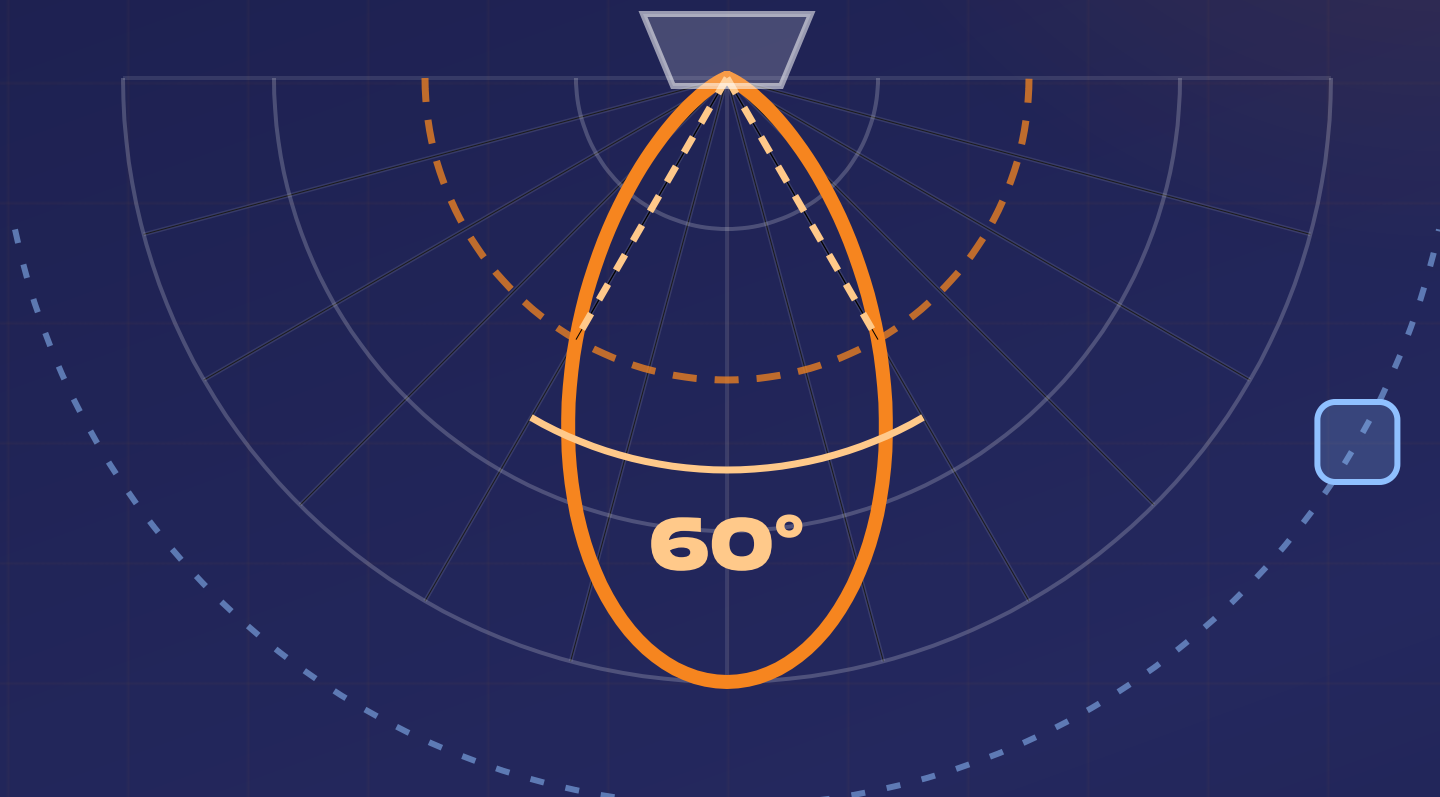




A drawn example distribution, with the half-peak ring marked.

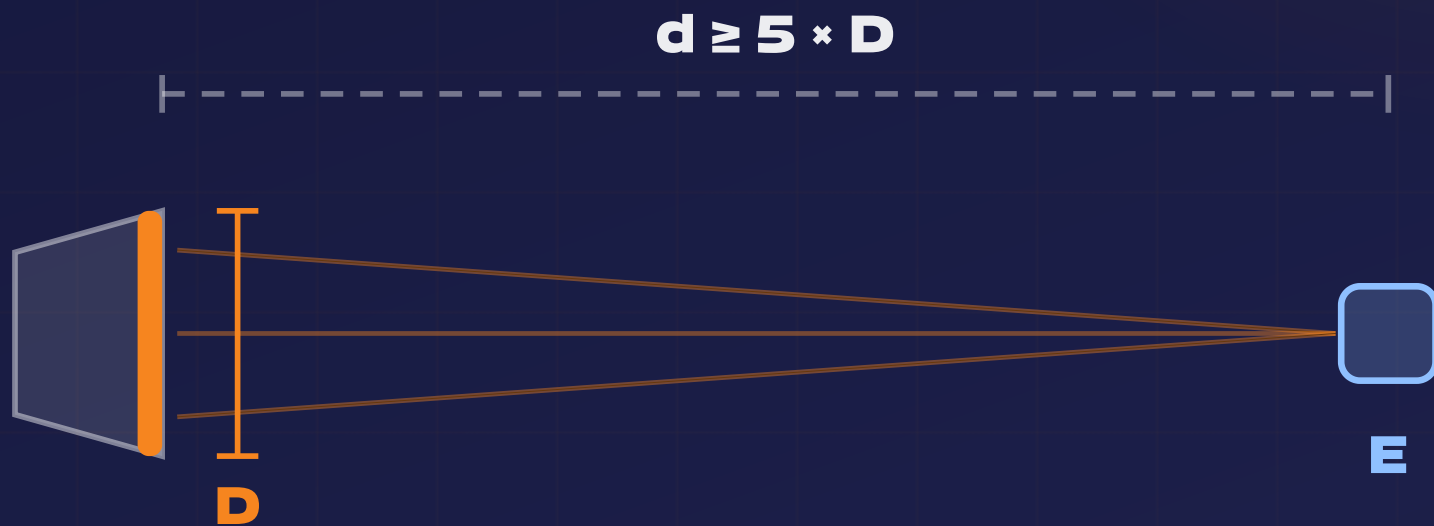
NLC Academy | Episode 16

The brochure sells lumens. The design runs on candela.

A photometric file is not a brochure. It is a measured map of luminous intensity at every angle around the fixture: a goniophotometer makes it, DIALux reads it. This episode: how the measurement is actually taken, what the file really contains, and exactly where the model stops matching the room.

The instrument

It measures lux. **Candela is calculated.**



- 1** The detector reads illuminance at a known distance; intensity is derived, $I = E \times d^2$. No instrument reads candela directly. [3][4]
- 2** That inversion only holds in the far field. A common rule of thumb is $d \geq 5 \times D$, where D is the largest luminous dimension; narrow or spatially complex distributions may require a longer distance. [3][4]

On the rule of thumb, a 0.6 m opening needs 3 m and a 2 m linear needs 10 m. Mirror goniophotometers fold that path into a shorter room. [2]



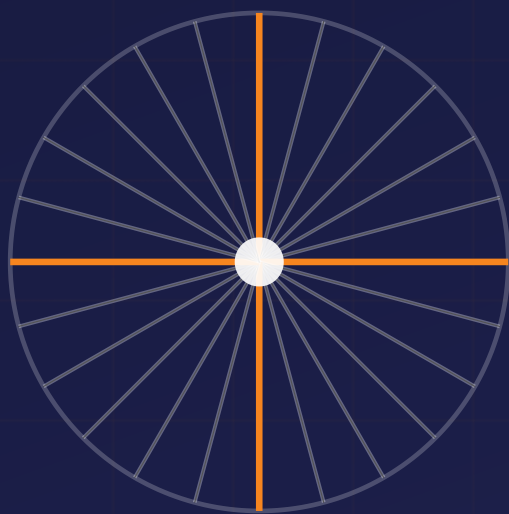
A full-field goniophotometer. The luminaire mounts at the centre of the rotating arm; the detector sweeps the angles around it.

Machine photo:
EVERFINE GO-R5000

Ask for the photometric distance and the aperture together.
One without the other tells you nothing.

The scan

A file is a grid: **C planes × γ steps.**



C 0°-360°



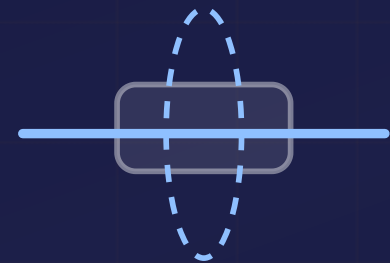
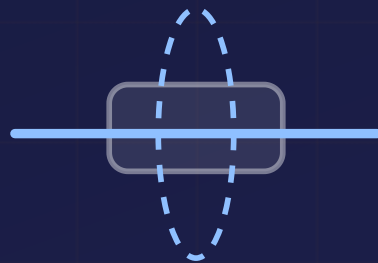
γ 0°-180°

- 1** C selects the vertical plane you are cutting through the distribution; γ is the angle within that plane, measured from straight down. [2][3]
- 2** One common scan: 24 C planes at 15° and 181 γ steps at 1° = 4,344 points. Narrow or complex beams may require finer angular increments. [2]

A symmetric downlight needs few planes. **An asymmetric road optic needs many**, and a coarse grid hides exactly the detail you are buying.

The geometry

Three coordinate systems, **one number in the file.**



Type C

photometric type 1

Vertical polar axis.
General interior and exterior luminaires: downlights, panels, street lighting, high bay. [2][3]

Type B

photometric type 2

Horizontal polar axis.
Floodlights and sports projectors, where aiming is described in two tilt angles. [2]

Type A

photometric type 3

Horizontal polar axis, the automotive and signalling convention. Rare in architectural work. [2]

Any goniophotometer can produce any system, and A and B convert to C. **The real failure is a file that DECLARES the wrong type [2]**, so the software reads a good measurement in the wrong frame.

The file

The first numeric record after TILT= has ten ordered fields.

```

IES:LM-63-2019
[TEST] TR-2026-0416
[TESTLAB] accredited photometric lab
[ISSUEDATE] 2026-04-16
[MANUFAC] example manufacturer
TILT=NONE
1 -1 1 1.0 181 24 2 1 3 2 0.6 0.6 0.12
1.0 1.0 38.5
0 1 2 3 ... 180
0 15 30 ... 345
<candela values>
  
```

- 1** Lumens per lamp of -1 is the absolute-photometry flag: measured as it ships. On an LED file, expect it. [1][4]
- 2** The two counts fix resolution: γ steps first, then C planes. Multiply them to see how detailed the measurement is. [1]
- 3** Photometric type: 1 = Type C, 2 = Type B, 3 = Type A. One digit decides how every angle below is read. [1]

Example header, not a real product file. The first numeric record holds these ten luminaire fields in order: lamps, lumens per lamp, candela multiplier, γ count, C count, photometric coordinate type, units type, opening width, length, height. The next three values are ballast factor, future use and input watts. [1]

The method

Absolute or relative: **LED settled the argument.**



×



shape



cd + lm

1 test



Relative photometry

Two separate measurements combined: a lamp's flux from its own test, and the distribution shape from the luminaire. It worked because you could take the lamp out. [1]

Absolute photometry

One measurement of the finished product, flux and distribution together. LM-79-24 is built around it, because in an LED luminaire the source, optic, thermal path and driver are one system that cannot be separated. [4]

If an LED file still declares a positive lumens-per-lamp value,
ask what was actually measured.

The containers

IES, LDT, XML: same measurement, three wrappers.



.ies

.ldt

.xml

.ies

ANSI/IES LM-63-19

The North American text format, maintained by the IES, revised 2019. [1]

.ldt

EULUMDAT, 1990

Proposed by Axel Stockmar in 1990 and used across Europe, but with no standards body and no official specification. [8]

.xml

ANSI/IES TM-33-23

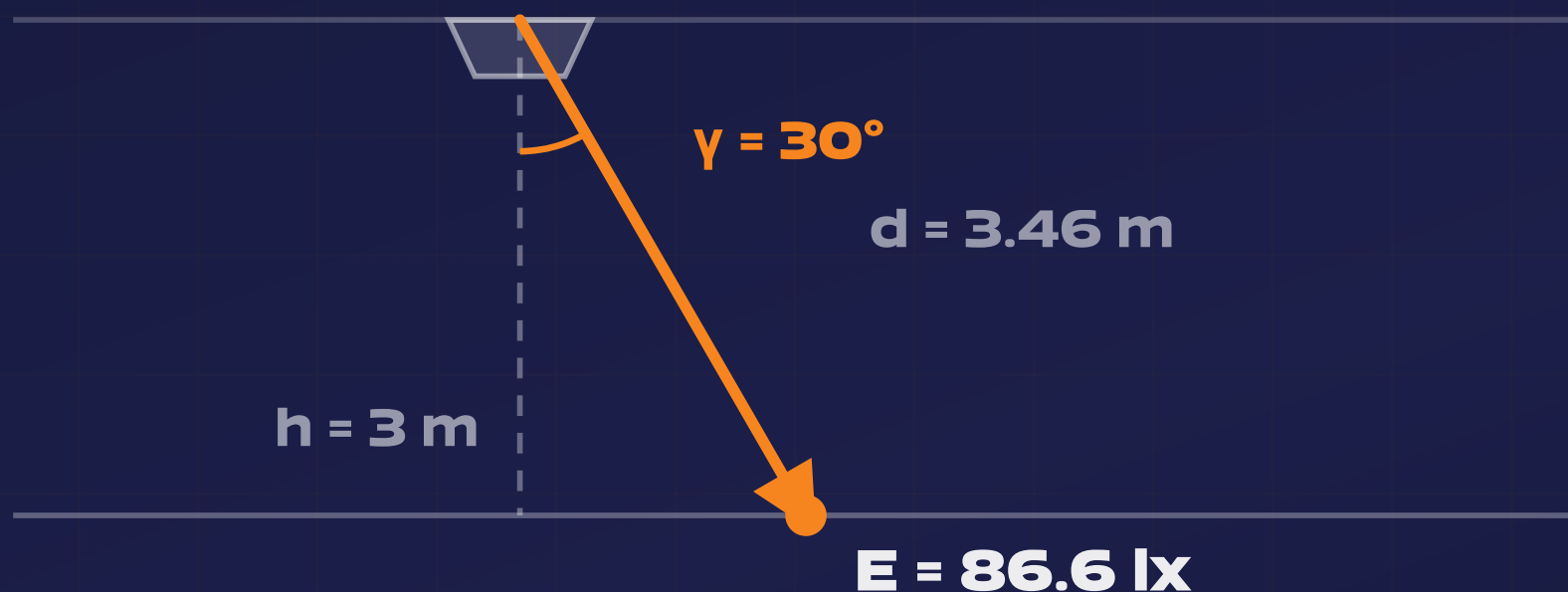
The XML successor, able to carry spectra and radiant or PAR distributions that a fixed-field text line cannot. [7]

The container is a transport question. **Ask instead who measured it, to which method, and under what accreditation.** [4][17]

The calculation

From candela in the file to lux on the desk.

Worked example



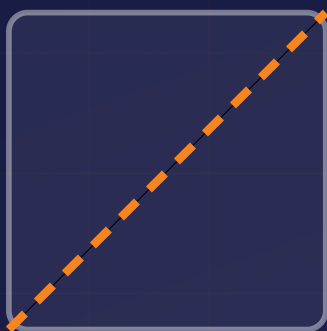
- 1** Direct light at a point:
 $E = I(\gamma) \times \cos^3\gamma / h^2$. Here
 $I = 1200 \text{ cd}$ at 30° , $h = 3 \text{ m}$, so
 $E = 86.6 \text{ lx}$ before any bounce.
- 2** The engine then adds interreflection from every surface you typed a reflectance into. DIALux evo has a free tier; using luminaires from non-member manufacturers may require a paid plan. [14]

DIALux closely matched the CIE 171 analytical test cases. **In practice, discrepancies are often dominated by inputs and measurement conditions**, although near-field and modelling limitations can also matter. [10][11]

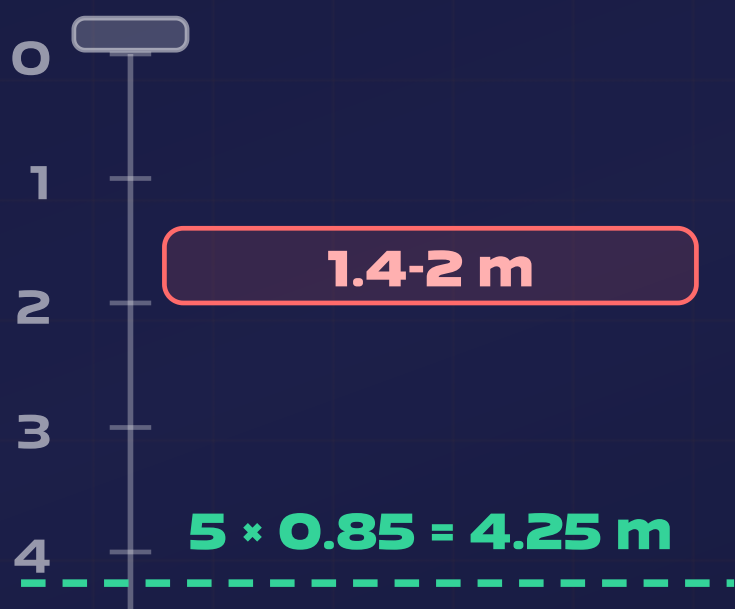
The limit

A file treats your luminaire as a single point.

600 × 600 mm



0.85 m



- 1 The far-field data behind every photometric file assumes the fixture is small against the distance. For indoor lighting that assumption "is generally not met". [9]
- 2 A 600 × 600 mm panel has a 0.85 m diagonal, so the five-times rule wants 4.25 m. Your work plane sits at 1.4-2 m. [9]

Near-field data, the luminaire split into many emitting points, **gives a better UGR for non-uniform luminaires** [9]. For big soft sources close overhead, treat the number as an estimate.

The gap

Why the site reading **may not match the report.**

$$\begin{array}{|c|} \hline \text{LLMF} \\ \hline \text{lamp lumen} \end{array} \times \begin{array}{|c|} \hline \text{LSF} \\ \hline \text{survival} \end{array} \times \begin{array}{|c|} \hline \text{LMF} \\ \hline \text{luminaire} \end{array} \times \begin{array}{|c|} \hline \text{RSMF} \\ \hline \text{surfaces} \end{array} = \text{MF}$$

- 1 The calculation targets MAINTAINED illuminance. The maintenance factor is a product of four factors. For LED luminaires, product-level lumen maintenance is measured under LM-84 and projected under TM-28. [5][6][12][13]
- 2 Real reflectances differ from the modelled ones: paint batch, furniture, a dark floor nobody put in.
- 3 The luminaire in the room is not the sample in the report; production tolerance, drive current and ambient all move output. [4]
- 4 The meter and the method: class, calibration, grid, stabilisation time, daylight exclusion.

Factors per CIE 97:2005. EN 12464-1 requires measurement uncertainty to be accounted for, and sets no pass/fail percentage. [12][13]

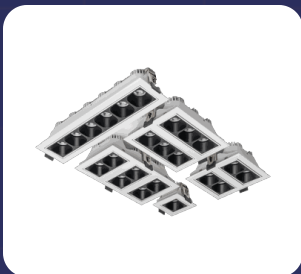
Agree the verification method in the contract: **grid, meter class, stabilisation, daylight exclusion and the maintenance factor you both assumed.**

From the NLC range

Four distributions, **four different files.**

MINI

Recessed spot



15° / 24° / 36°

5-30 W

CRI >90

Three beam options mean three photometric files, not one.

LUXO

COB recessed downlight



15°-80°

12-40 W

CRI >90

A range that wide is a family of files, one per optic.

STONY

High bay luminaire



60° / 90°

100-240 W

IP65

Rotationally symmetric: few C planes carry it.

COMET

LED street light



All types

50-300 W

IP66

Asymmetric road optics: the C-plane grid is the whole story.

Beam, wattage and optic rows quoted from each product's own catalogue page, read 2026-08-24. [16]

NLC is building its photometric library. **IES and LDT files for specific products are available on request** for your DIALux or Relux model. [15]

Before you accept a file

Five checks, **one screenful.**

photometric type

Does it match the product? A downlight or street light should read 1, Type C. [1][2]

lumens per lamp

On an LED file, expect -1, and check the total flux against the LM-79 report. [1][4]

candela multiplier

Should be 1.0. Anything else means the candela values were scaled: ask why, and from what. [1]

units + opening

Units type and the luminous opening dimensions must be sane and non-zero, or glare and near-field results go with them. [1]

who tested it

A named laboratory with an accreditation scope that actually covers the test, not just a logo. [4][17]

It is a plain-text file. These checks are visible near the top: in the keyword header and the first numeric record. [1]

The sources

Every claim on these slides, sourced.

- | | |
|--------------------------|----------------------------|
| [1] ANSI/IES LM-63-19 | [10] CIE 171:2006 |
| [2] ANSI/IES LM-75-19 | [11] Mangkuto 2016, LEUKOS |
| [3] CIE 121-1996 | [12] CIE 97:2005 |
| [4] ANSI/IES LM-79-24 | [13] BS EN 12464-1:2021 |
| [5] ANSI/IES LM-84-20+E1 | [14] DIAL GmbH, DIALux |
| [6] ANSI/IES TM-28-20 | [15] NLC design resources |
| [7] ANSI/IES TM-33-23 | [16] NLC catalogue |
| [8] EULUMDAT, 1990 | [17] ISO/IEC 17025:2017 |
| [9] Simonot et al. 2022 | |

Standards cited in their current active revisions. Full titles, DOIs, URLs and access dates ship in the episode reference document, linked from the article.

PRACTICAL LIGHTING ENGINEERING

**Save this. Send it to a
colleague.**



Read the full episode article

<https://nlc.com.sa/academy/dialux-and-goniophotometers.html>



Next episode
Conventional Lights