Goniophotometry of LED Luminaires

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Goniophotometry of LED Luminaires

Luminaire (Light Fixture) – A complete lighting unit consisting of a lamp(s) and ballast(s) (when applicable) together with the parts designed to distribute the light, to position and protect the lamps, and to connect the lamps to the power supply.

From ANSI/IESNA RP-16-05, *Nomenclature and Definitions for Illuminating Engineering*

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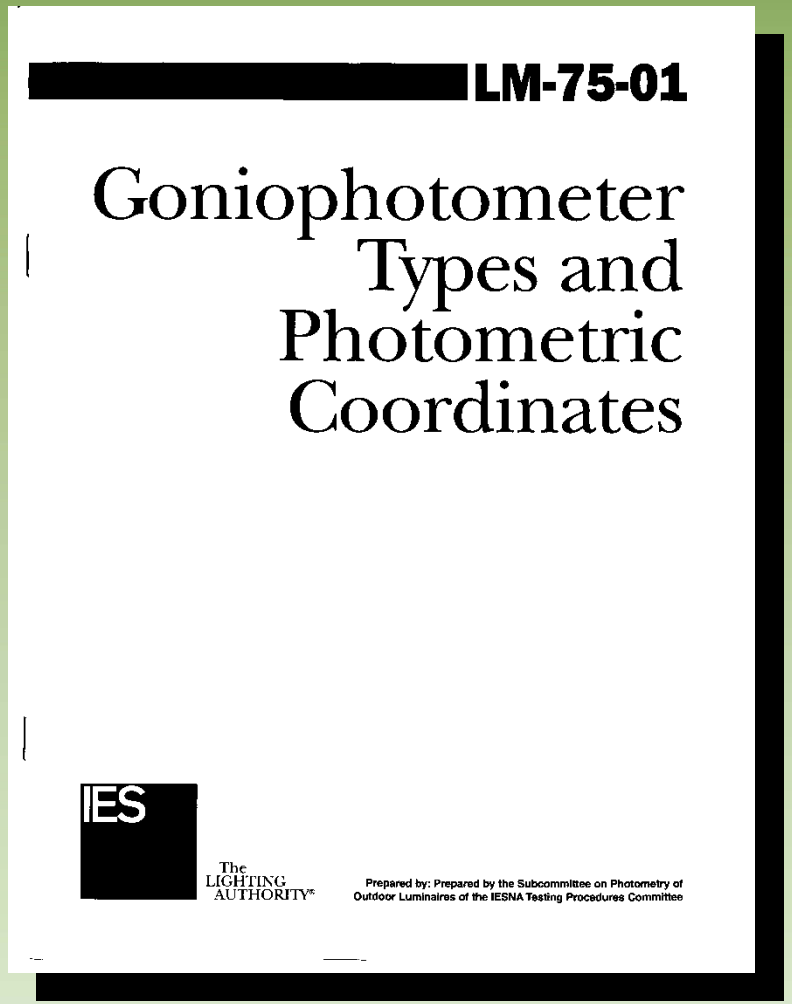
Goniophotometer:

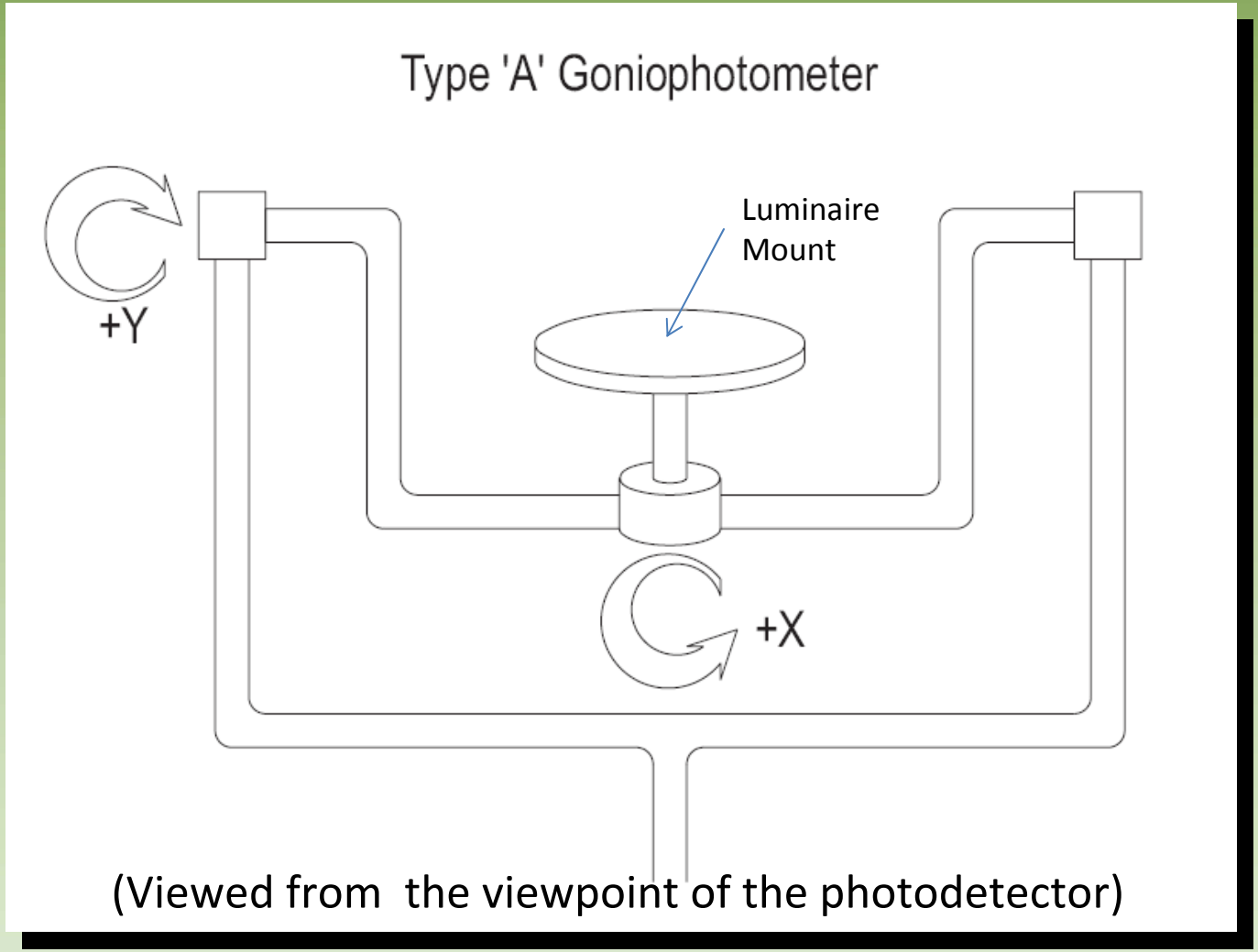
A photometer for measuring the directional light distribution characteristics of sources, luminaires, media, and surfaces.

From ANSI/IESNA RP-16-05

Goniophotometry of LED Luminaires



Goniophotometry of LED Luminaires



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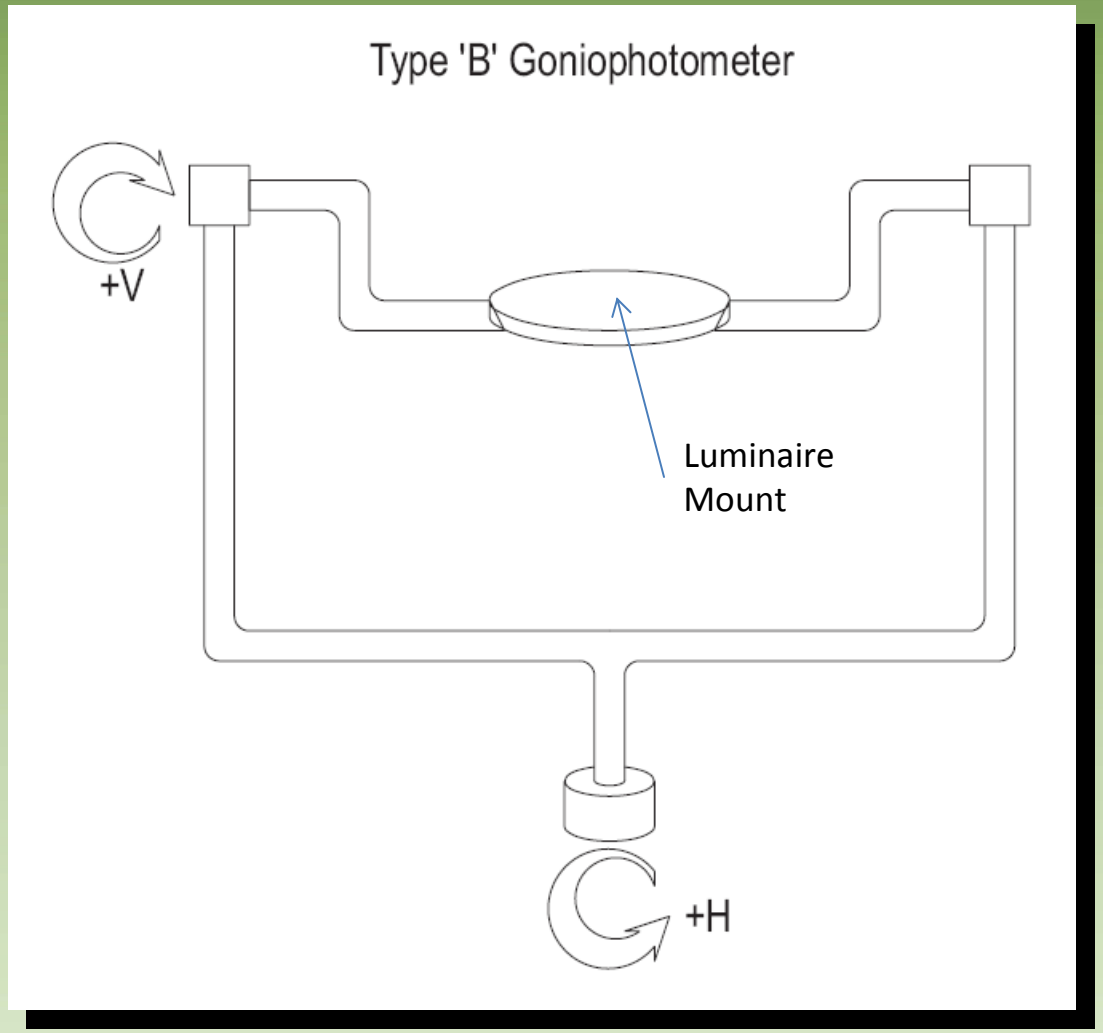

(Viewed from the viewpoint of the photodetector)

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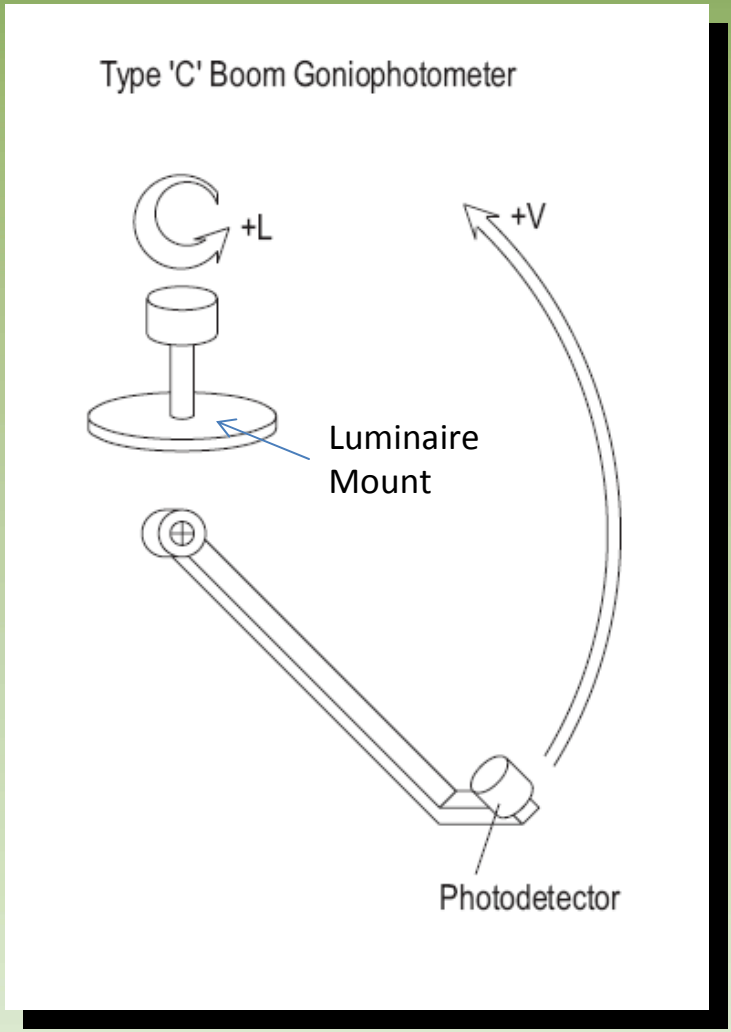

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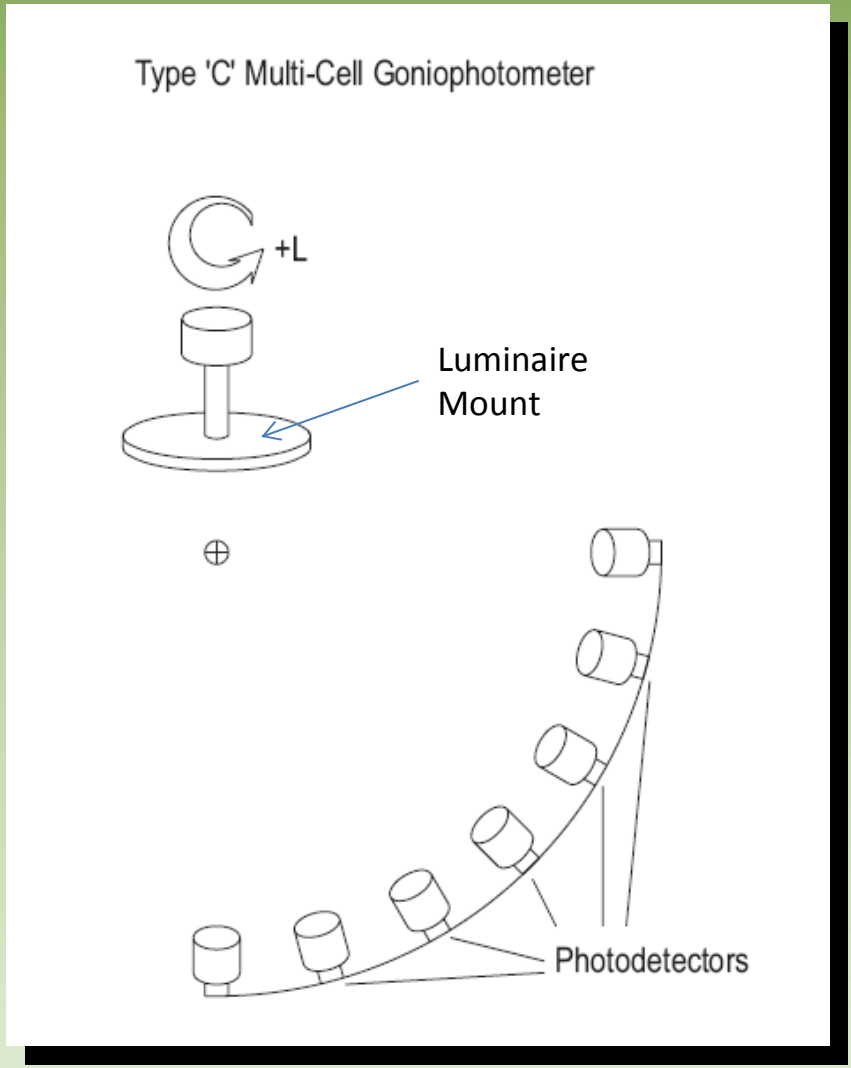

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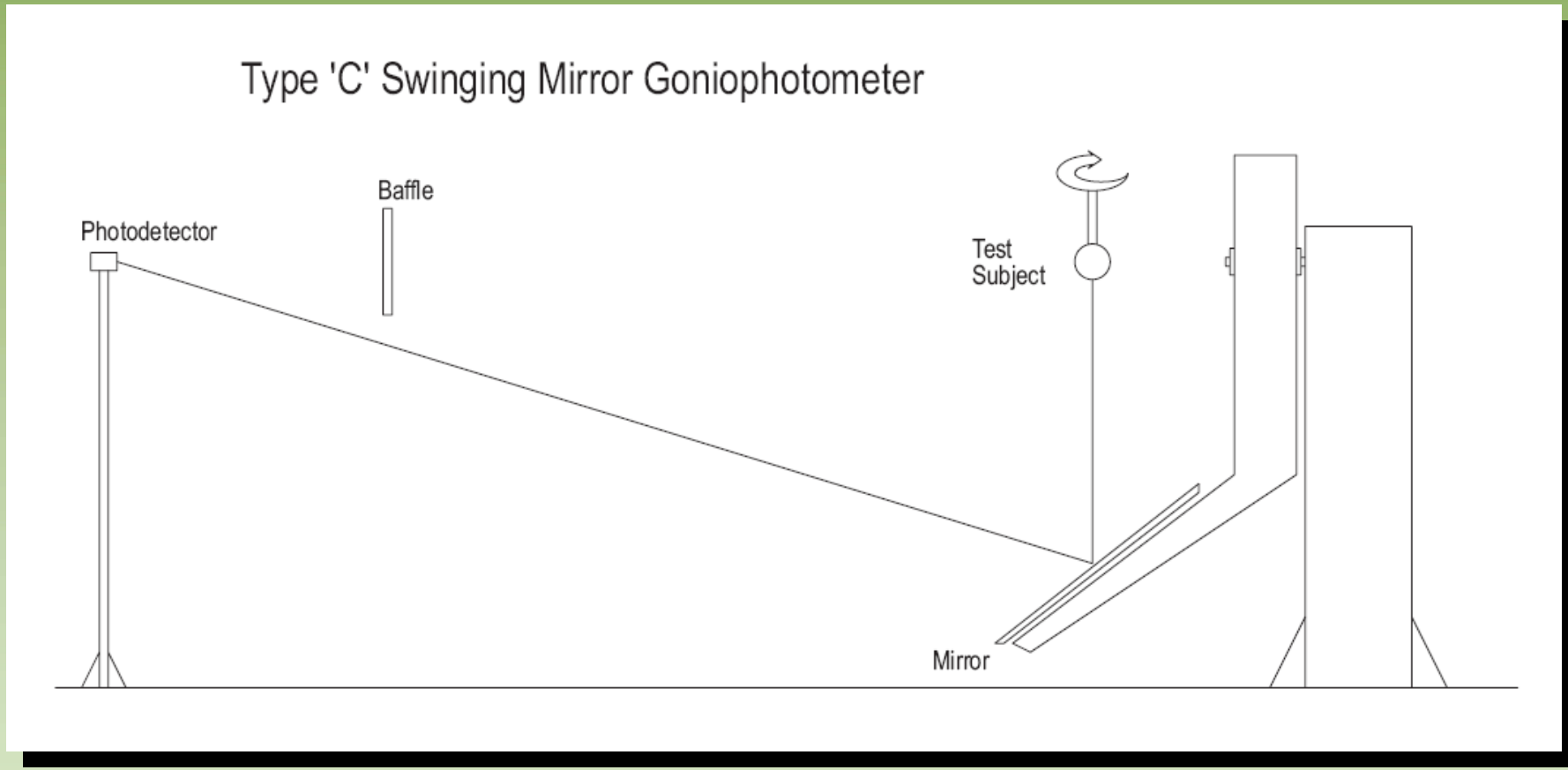

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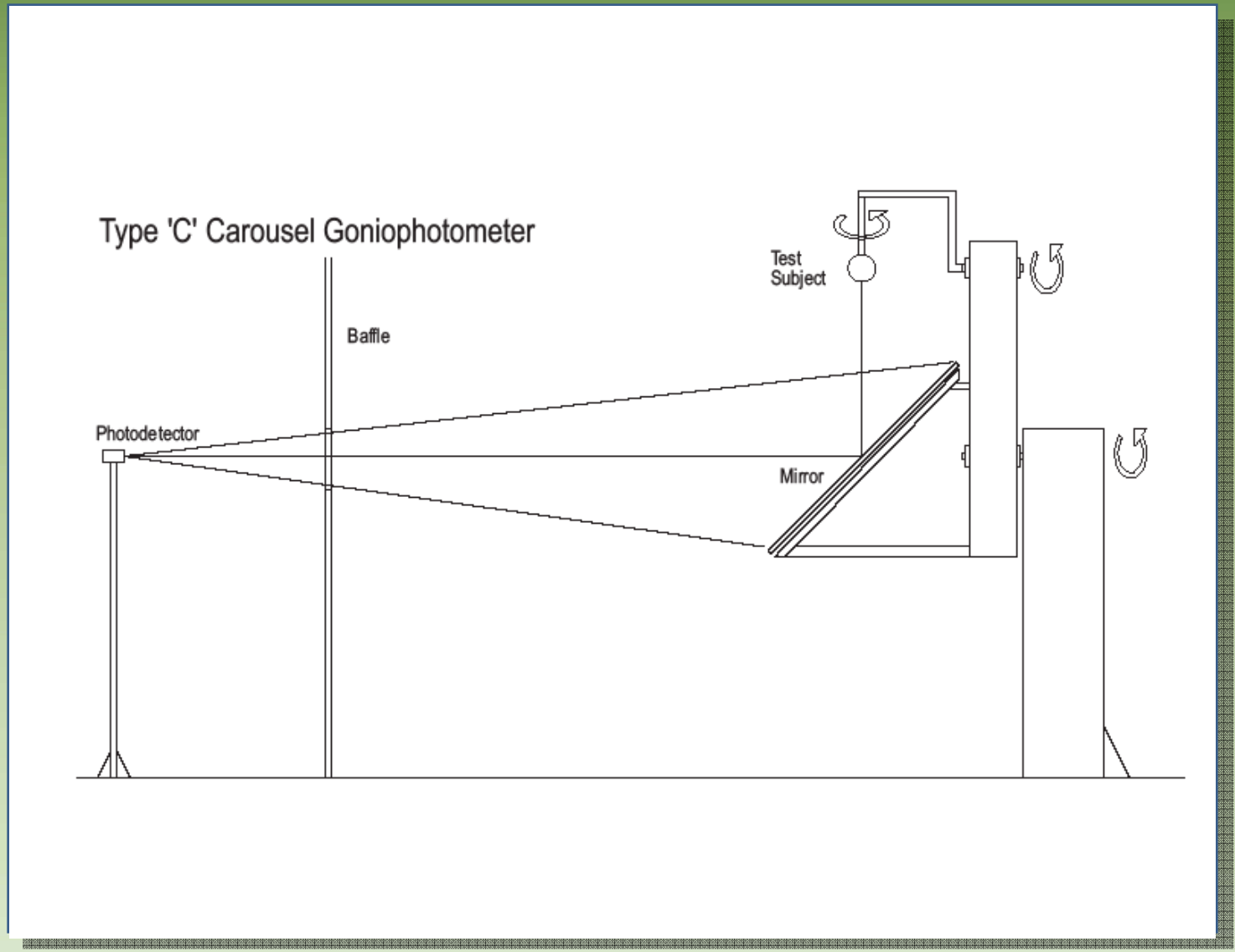

Relative Photometry

Luminaires that use conventional lighting sources are usually tested using relative photometry.

- The luminaire is measured.
- The lamp(s) and ballast(s) are removed and measured.
- Luminaire Efficiency can then be calculated
- The luminous intensity distribution is scaled to candela per rated lumen.

Relative Photometry

Why not use relative photometry for SSL luminaires?

- The LED devices are usually difficult to remove from the luminaire.
- Many LED devices will not operate properly without the heat-sinking that the luminaire provides.
- The thermal environment that the LED devices experience within the luminare is often radically different from the thermal environment it will experience in its “bare lamp” configuration.

Goniophotometry of LED Luminaires

Relative vs. Absolute Photometry

Relative

- Typically performed for luminaires using conventional sources
- Luminaire test is referenced to the luminous flux measured from the “bare” lamp(s)
- cd per rated lumens
- Includes luminaire efficiency
- Normalizes ballast factor, lamp age

Absolute

- Typically performed for luminaires using LEDs
- Luminaire test is referenced to a calibrated standard lamp
- Absolute luminous intensity (cd)
- No luminaire efficiency
- Total luminous flux
- Used to calculate absolute luminaire efficacy (lumens per watt)

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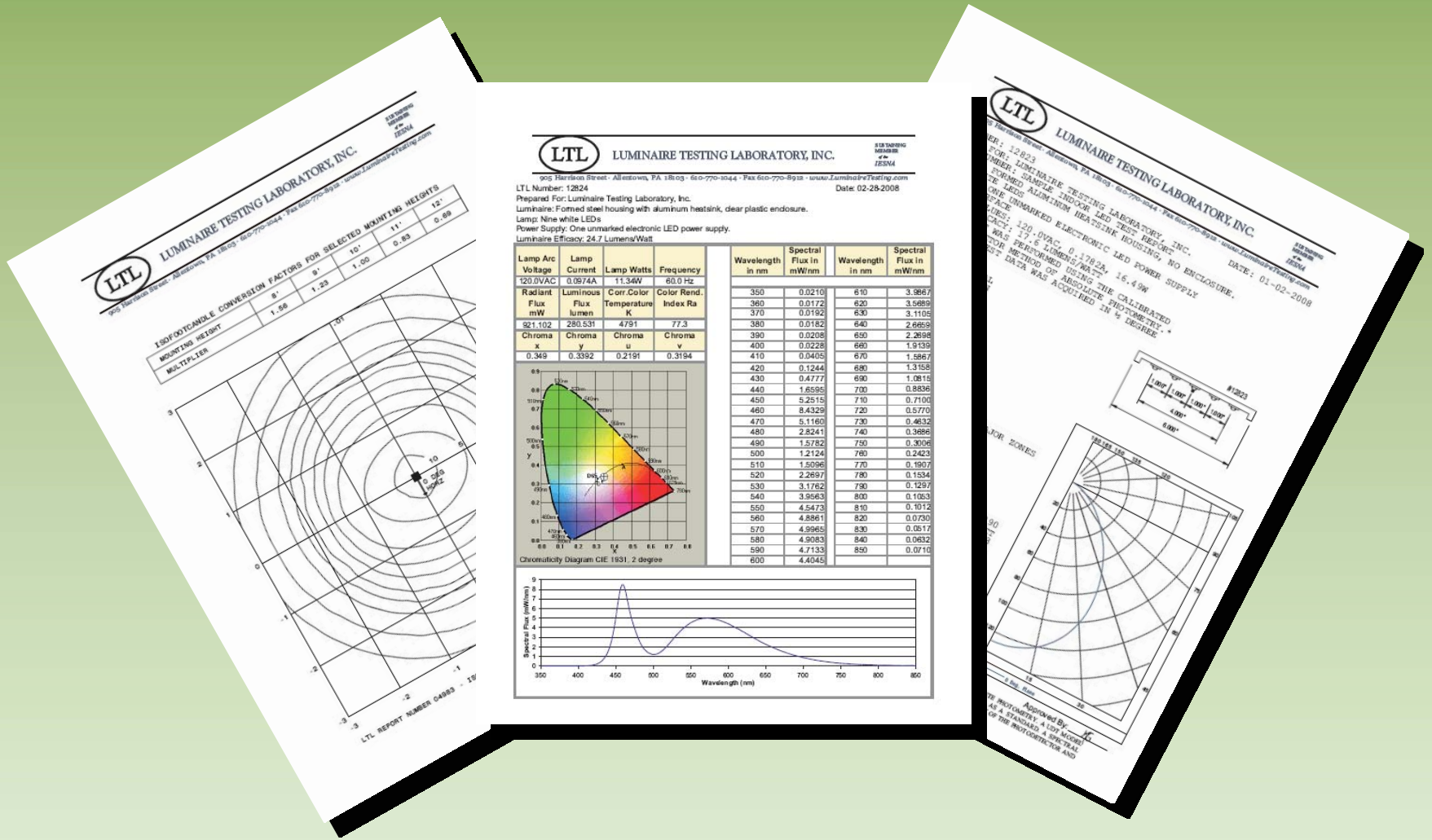
Photometric Data



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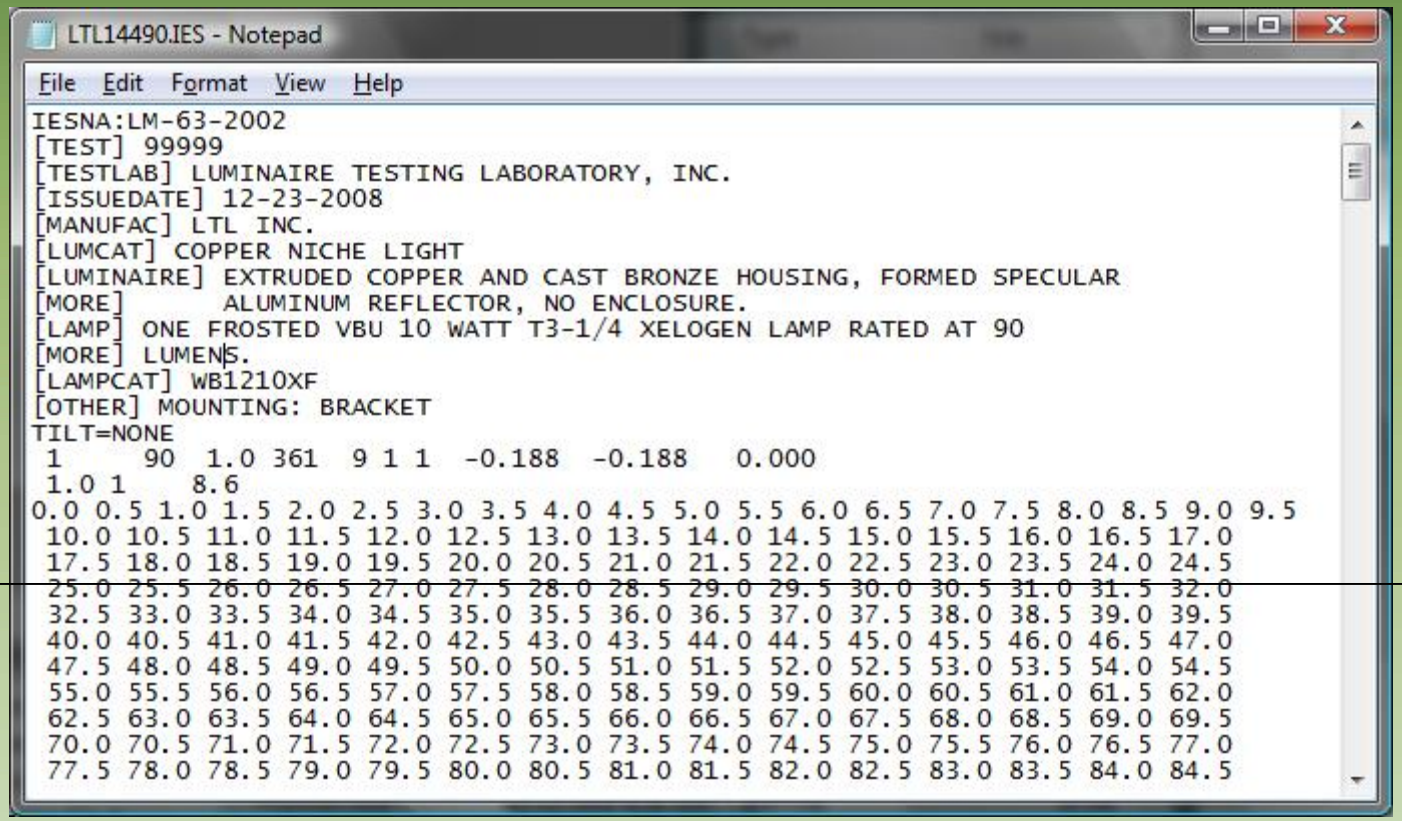

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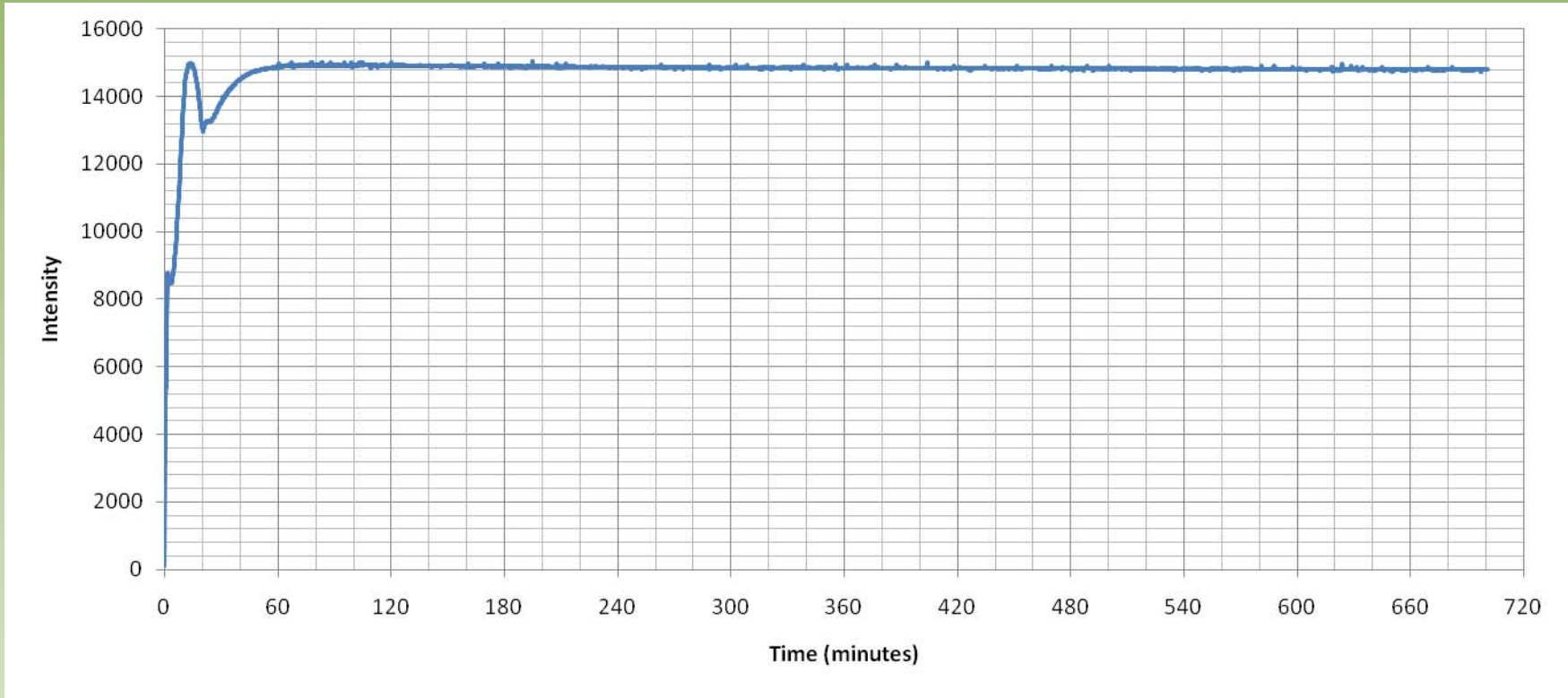
Stabilization of a typical 1 Lamp 32W CFL Luminaire



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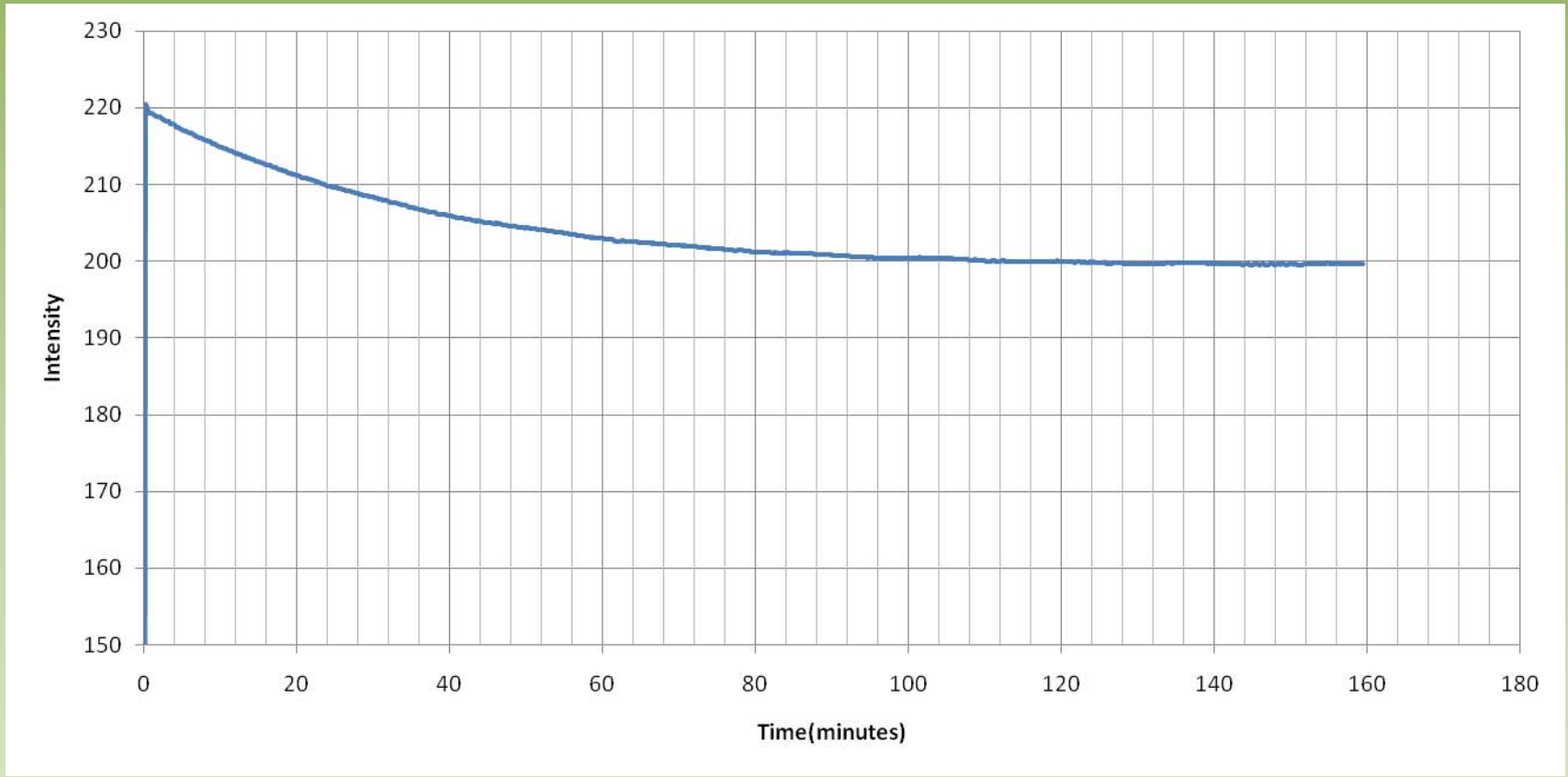
Stabilization of a typical High-Power LED Luminaire



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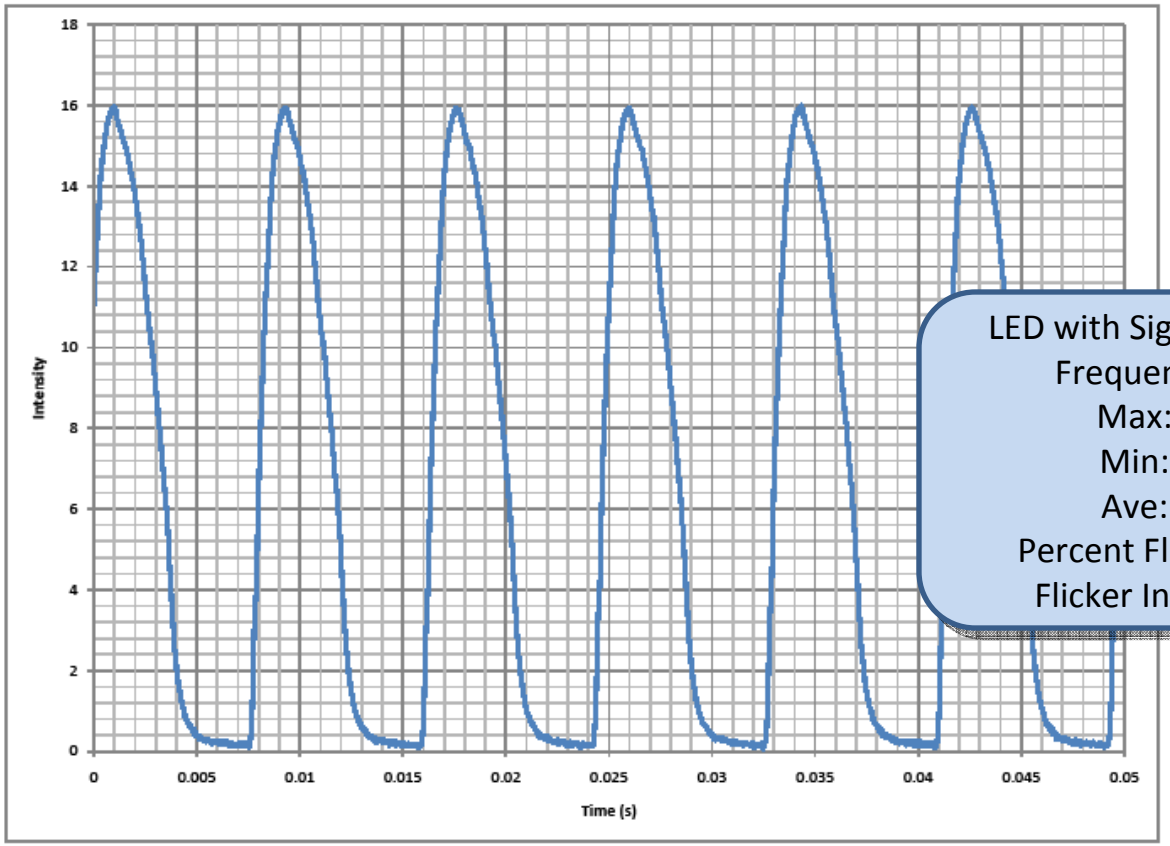

LED with Significant Flicker
Frequency: 120Hz
Max: 15.996
Min: 0.0555
Ave: 6.3026
Percent Flicker: 99.309
Flicker Index: 0.4498

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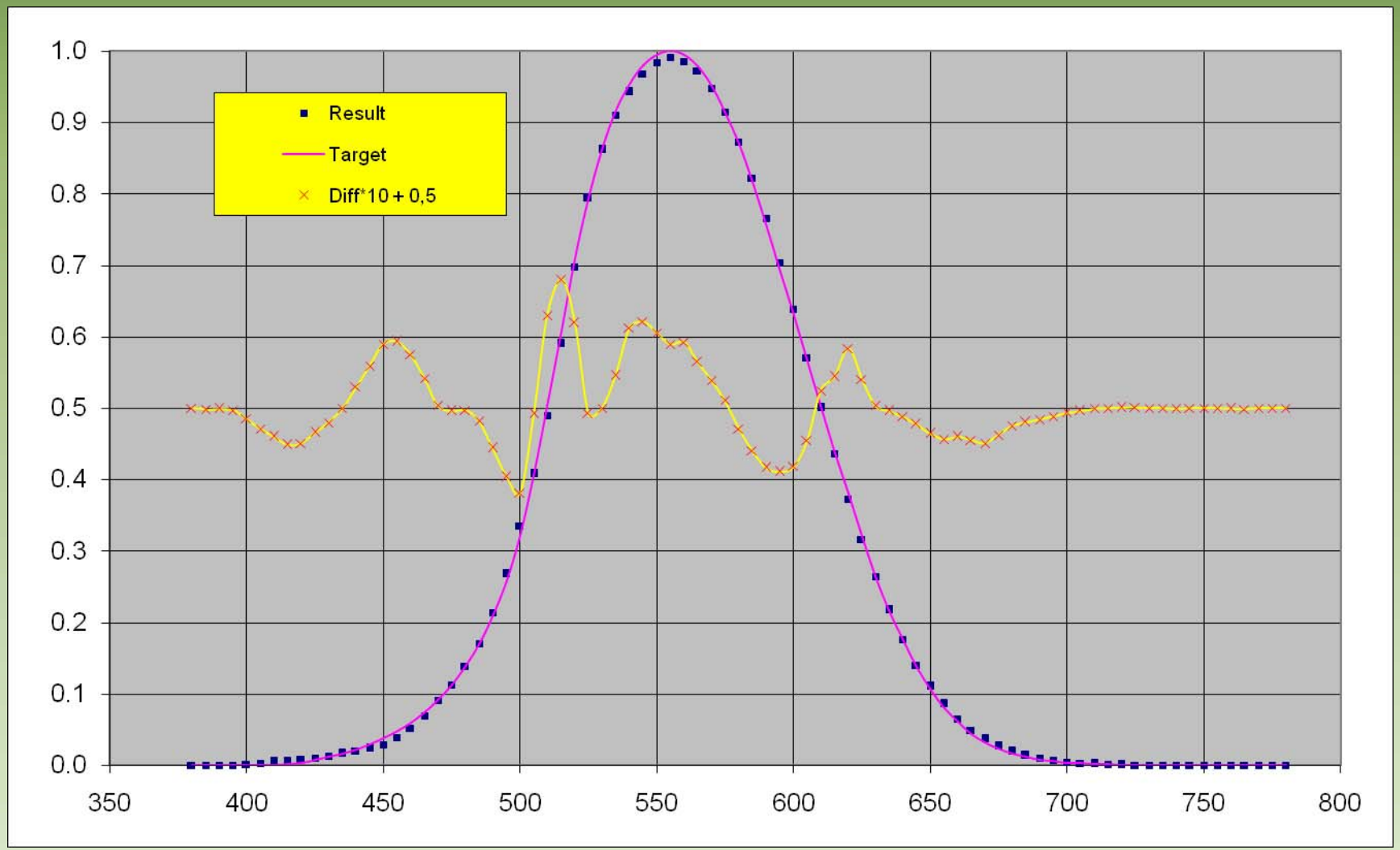

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Spectral Mismatch Correction Factor (from IES LM-79-08)

$$F = \frac{\int_\lambda S_{\mathrm{REF}}(\lambda)\, s_{\mathrm{rel}}(\lambda)\, \mathrm{d}\lambda \int_\lambda S_{\mathrm{TEST}}(\lambda)\, V(\lambda)\, \mathrm{d}\lambda}{\int_\lambda S_{\mathrm{REF}}(\lambda)\, V(\lambda)\, \mathrm{d}\lambda \int_\lambda S_{\mathrm{TEST}}(\lambda)\, s_{\mathrm{rel}}(\lambda)\, \mathrm{d}\lambda}$$

Thank You!

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