

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*

Goniophotometry of LED Luminaires



Illuminating
ENGINEERING SOCIETY

IES LM-79-08

Approved Method: **Electrical and
Photometric Measurements
of Solid-State Lighting
Products**

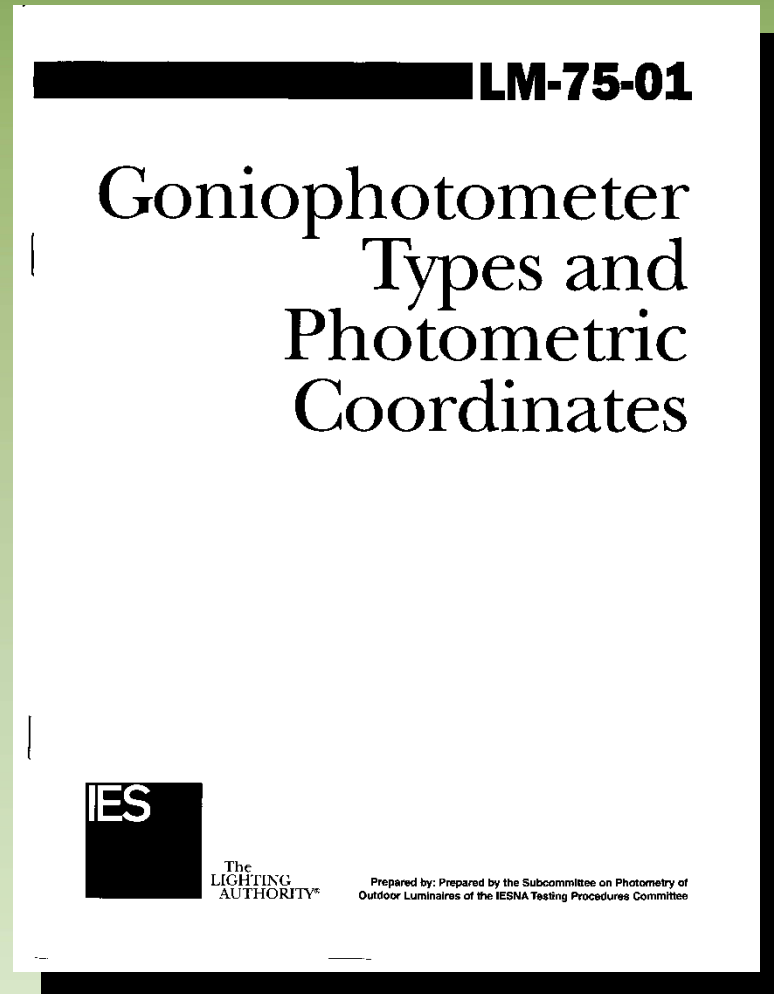
Goniophotometry of LED Luminaires



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

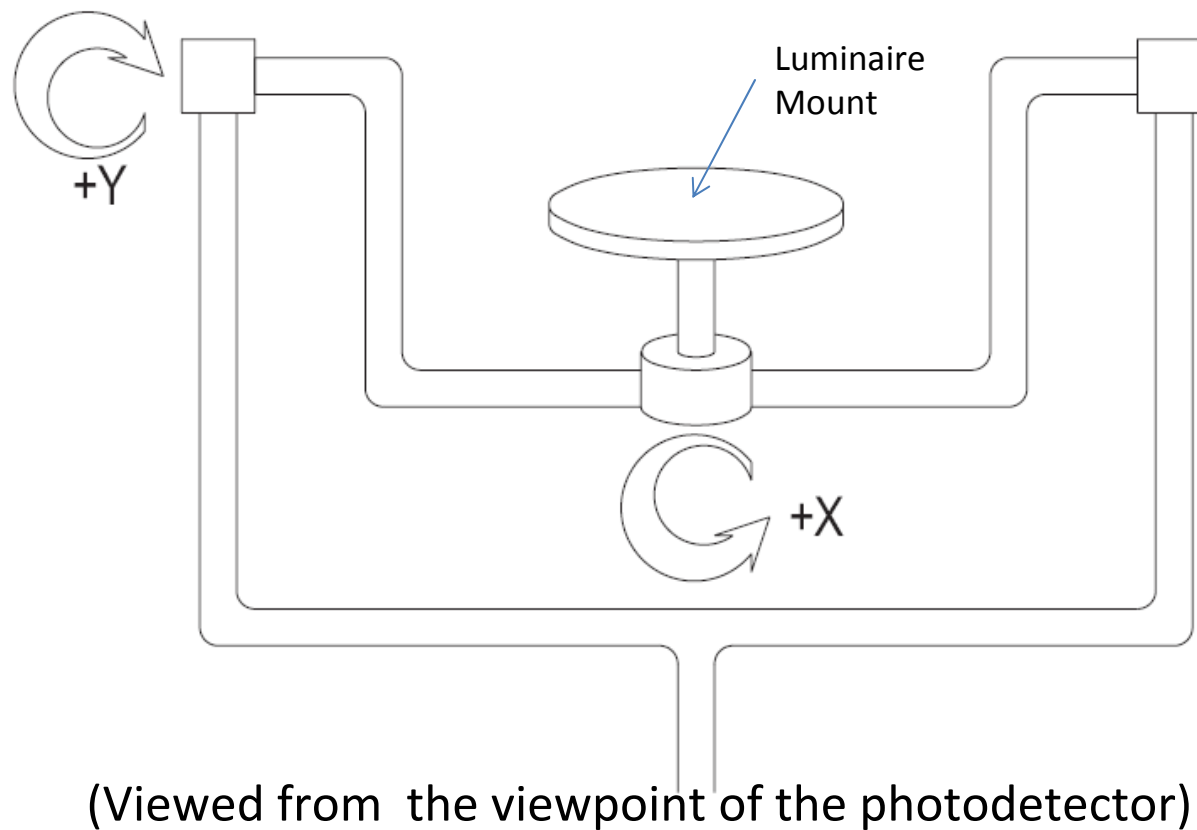
From ANSI/IESNA RP-16-05

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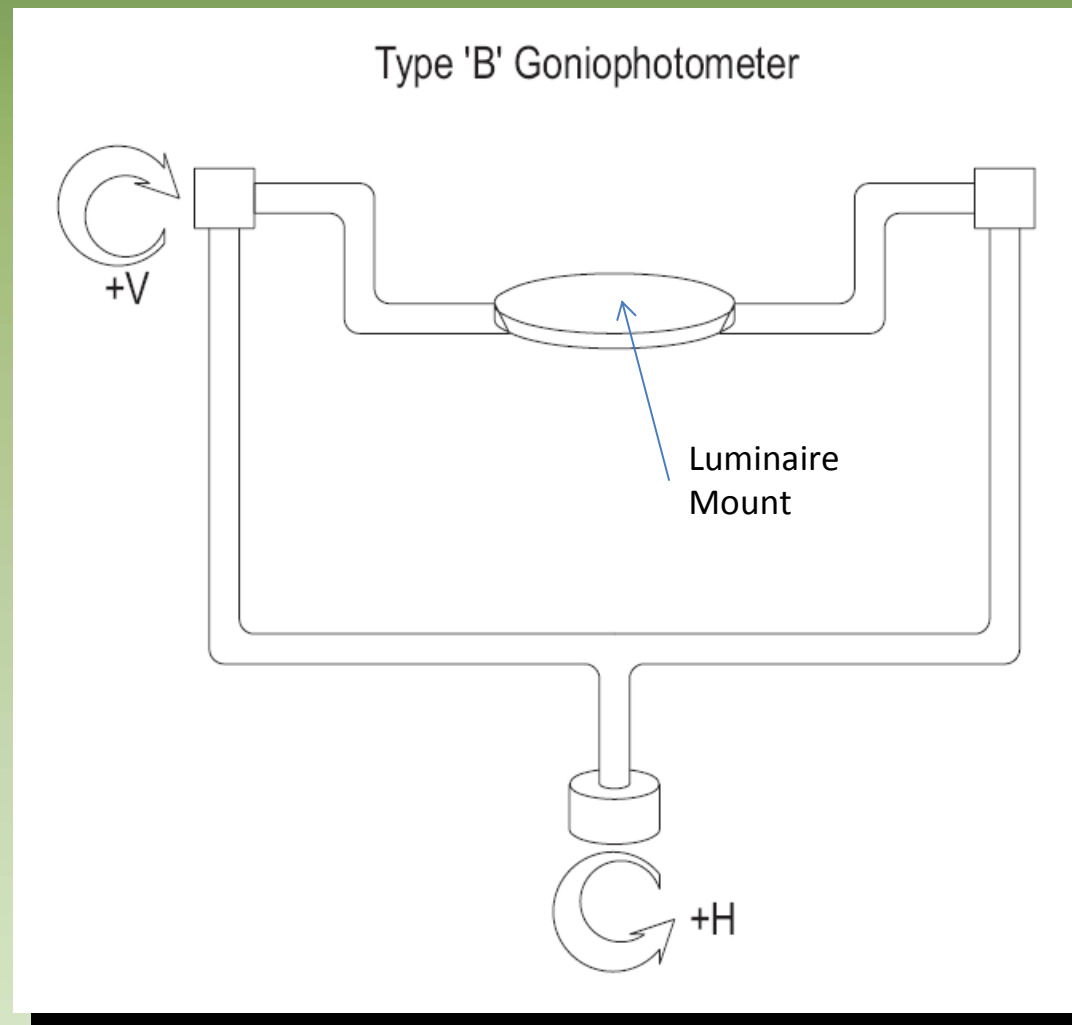


Goniophotometry of LED Luminaires

Type 'A' Goniophotometer



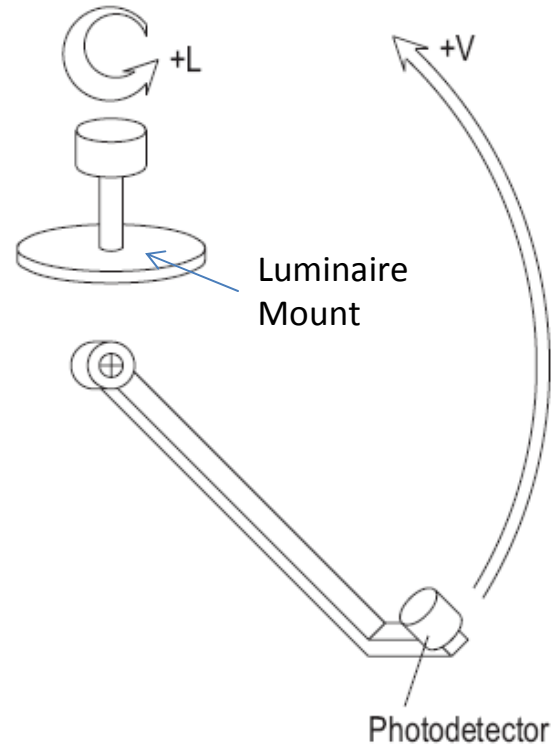
Goniophotometry of LED Luminaires



(Viewed from the viewpoint of the photodetector)

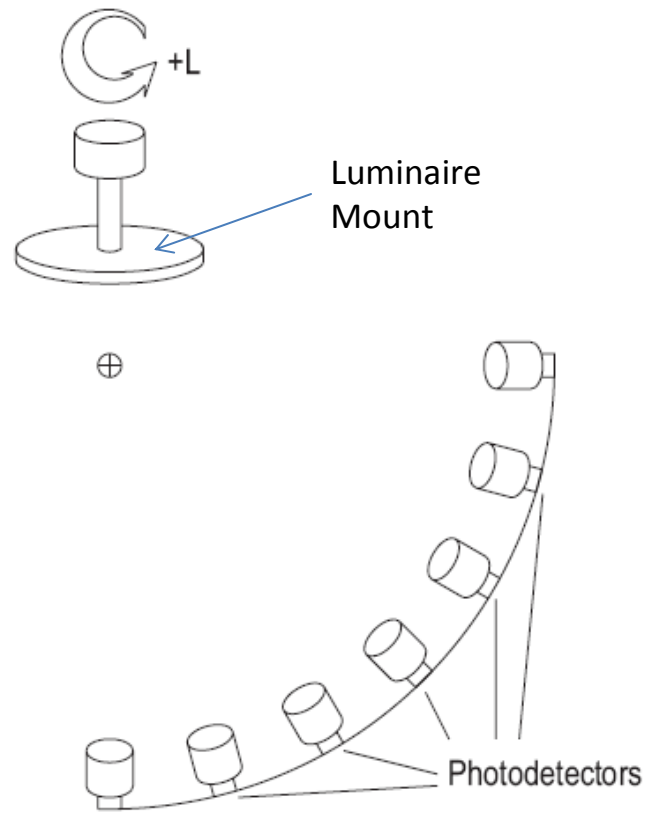
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Type 'C' Boom Goniophotometer



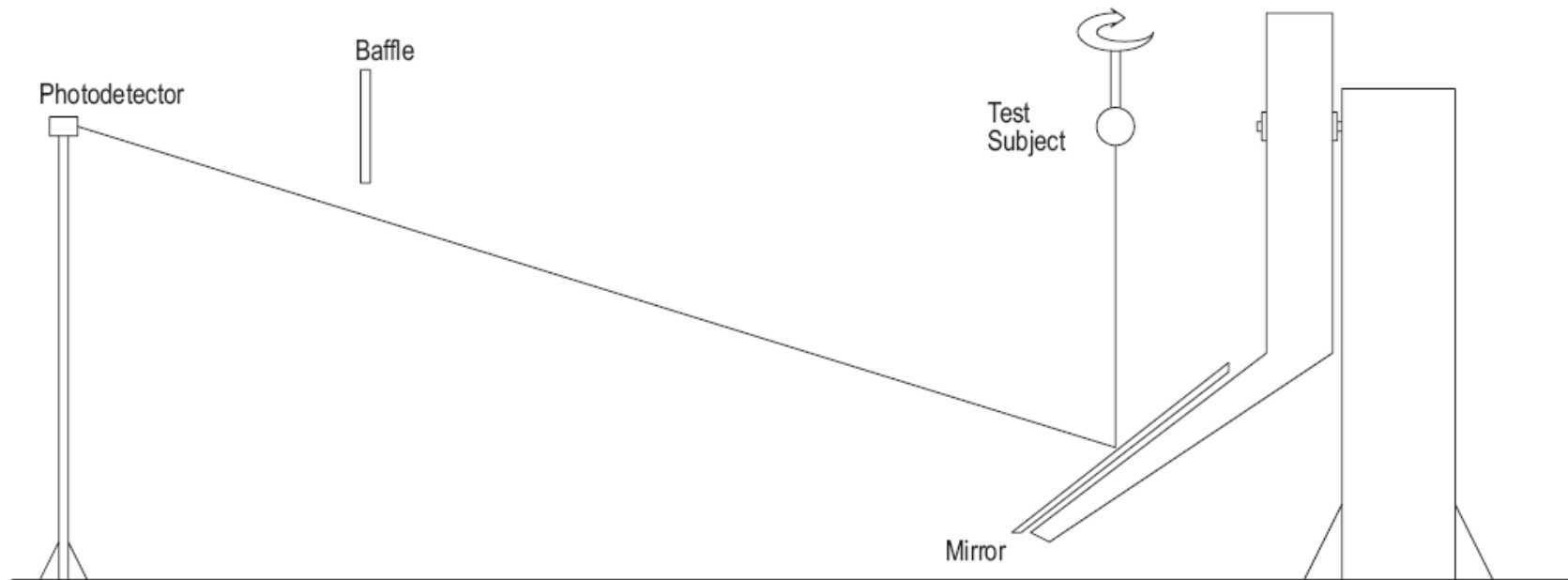
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Type 'C' Multi-Cell Goniophotometer

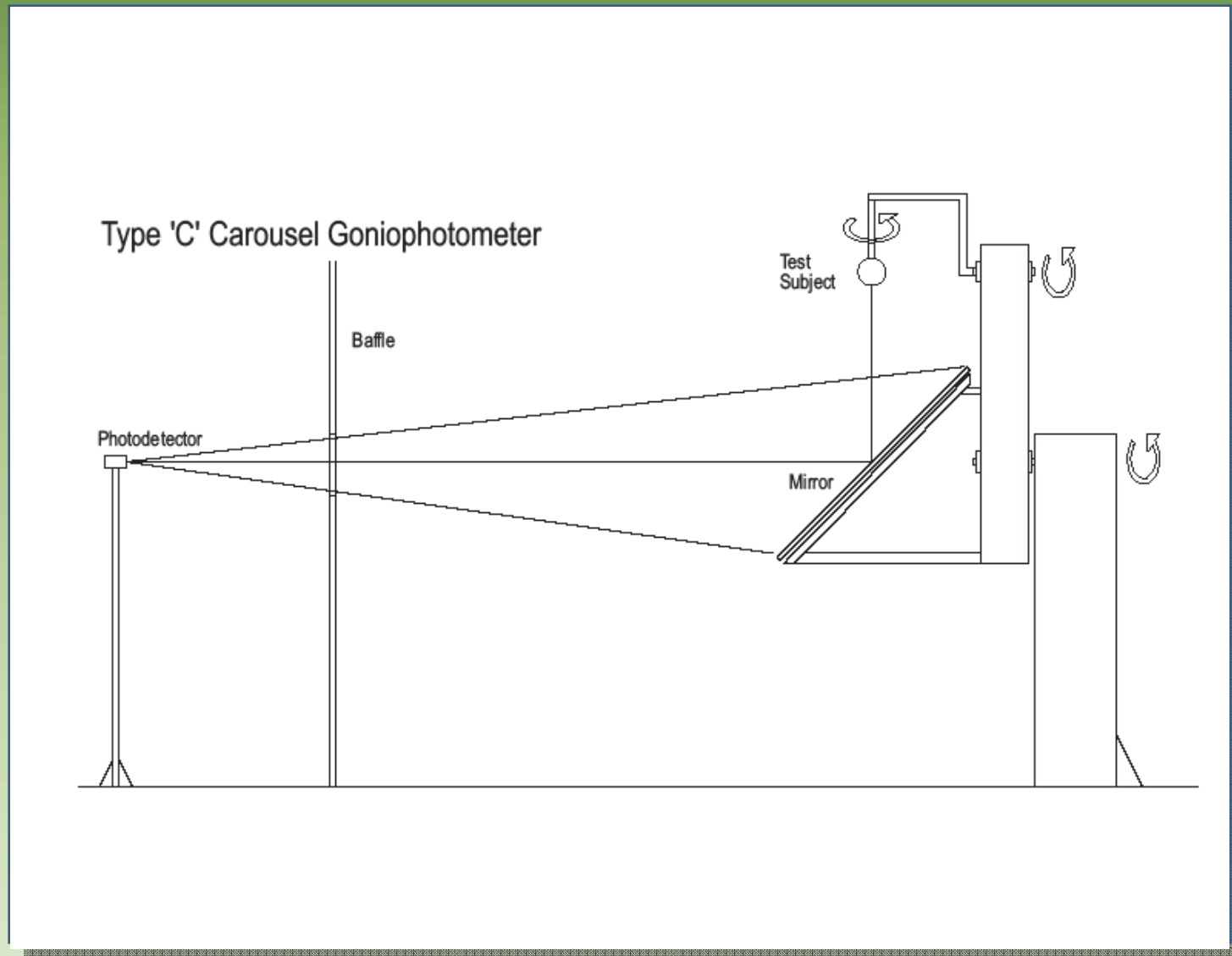


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Type 'C' Swinging Mirror Goniophotometer



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Goniophotometry of LED Luminaires

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.

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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 luminaire 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

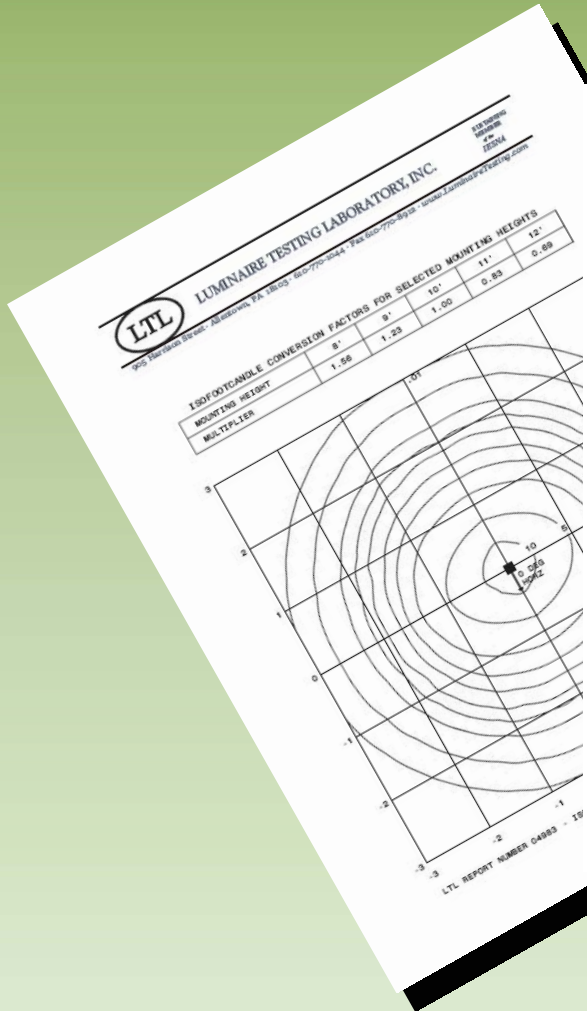
- Typically performed for luminaires using conventional sources
- Luminaire test is referenced to the luminous flux measured from the “bare” lamp(s)
- cd per rated lumens
- Includes luminaire efficiency
- Normalizes ballast factor, lamp age

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)

Goniophotometry of LED Luminaires

Photometric Data



LTL LUMINAIRE TESTING LABORATORY, INC.
 905 Harrison Street - Allentown, PA 18103 • Tel: 610-770-8932 • Fax: 610-770-8933 • www.LuminaireTesting.com
 Date: 02-28-2008

LTL Number: 12824
 Prepared For: Luminaire Testing Laboratory, Inc.
 Luminaire: Formed steel housing with aluminum heatsink, clear plastic enclosure.
 Lamp: Nine white LEDs
 Power Supply: One unmarked electronic LED power supply.
 Luminaire Efficacy: 24.7 Lumens/Watt

Lamp Arc Voltage	Lamp Current	Lamp Watts	Frequency
120.0VAC	0.0974A	11.34W	60.0 Hz

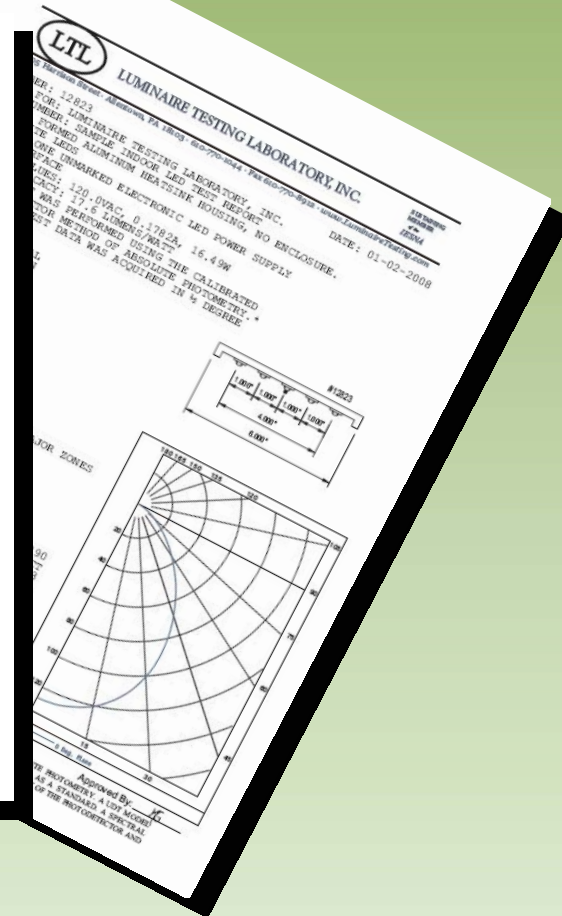
Radiant Flux mW	Luminous Flux lumen	Corr. Color Temperature K	Color Rend. Index Ra
921.102	280.531	4791	77.3

Chroma x	Chroma y	Chroma u	Chroma v
0.349	0.392	0.2191	0.3194

Wavelength in nm	Spectral Flux in mW/nm	Wavelength in nm	Spectral Flux in mW/nm
350	0.0210	810	3.867
360	0.0172	820	3.589
370	0.0192	830	3.1105
380	0.0182	840	2.669
390	0.0208	850	2.288
400	0.0228	860	1.9139
410	0.0405	870	1.5867
420	0.1244	880	1.3158
430	0.4777	890	1.0815
440	1.6595	900	0.8836
450	5.2515	910	0.7100
460	8.4329	920	0.5770
470	5.1160	930	0.4632
480	2.8241	940	0.3696
490	1.5782	950	0.3096
500	1.2124	960	0.2423
510	1.5096	970	0.1907
520	2.2697	980	0.1534
530	3.1722	990	0.1257
540	3.8563	800	0.1063
550	4.5473	810	0.1012
560	4.8861	820	0.0730
570	4.9965	830	0.0517
580	4.9083	840	0.0332
590	4.7133	850	0.0210
600	4.4045		

Chromaticity Diagram CIE 1931, 2 degree

Spectral Flux (mW/nm) vs Wavelength (nm)

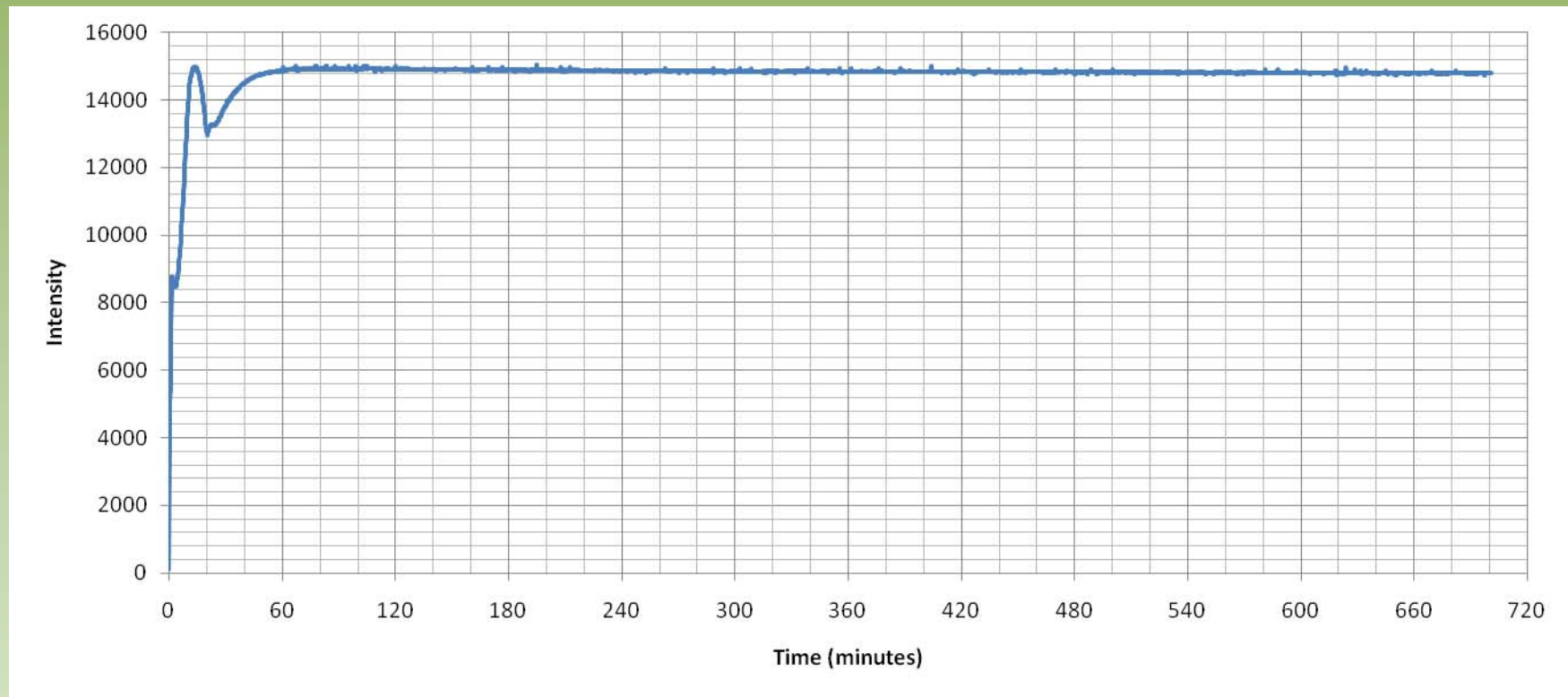


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IESNA:LM-63-2002
[TEST] 99999
[TESTLAB] LUMINAIRE TESTING LABORATORY, INC.
[ISSUE DATE] 12-23-2008
[MANUFAC] LTL INC.
[LUMCAT] COPPER NICHE LIGHT
[LUMINAIRE] EXTRUDED COPPER AND CAST BRONZE HOUSING, FORMED SPECULAR
[MORE] ALUMINUM REFLECTOR, NO ENCLOSURE.
[LAMP] ONE FROSTED VBU 10 WATT T3-1/4 XELOGEN LAMP RATED AT 90
[MORE] LUMENS.
[LAMPCAT] WB1210XF
[OTHER] MOUNTING: BRACKET
TILT=NONE
1 90 1.0 361 9 1 1 -0.188 -0.188 0.000
1.0 1 8.6
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5
10.0 10.5 11.0 11.5 12.0 12.5 13.0 13.5 14.0 14.5 15.0 15.5 16.0 16.5 17.0
17.5 18.0 18.5 19.0 19.5 20.0 20.5 21.0 21.5 22.0 22.5 23.0 23.5 24.0 24.5
25.0 25.5 26.0 26.5 27.0 27.5 28.0 28.5 29.0 29.5 30.0 30.5 31.0 31.5 32.0
32.5 33.0 33.5 34.0 34.5 35.0 35.5 36.0 36.5 37.0 37.5 38.0 38.5 39.0 39.5
40.0 40.5 41.0 41.5 42.0 42.5 43.0 43.5 44.0 44.5 45.0 45.5 46.0 46.5 47.0
47.5 48.0 48.5 49.0 49.5 50.0 50.5 51.0 51.5 52.0 52.5 53.0 53.5 54.0 54.5
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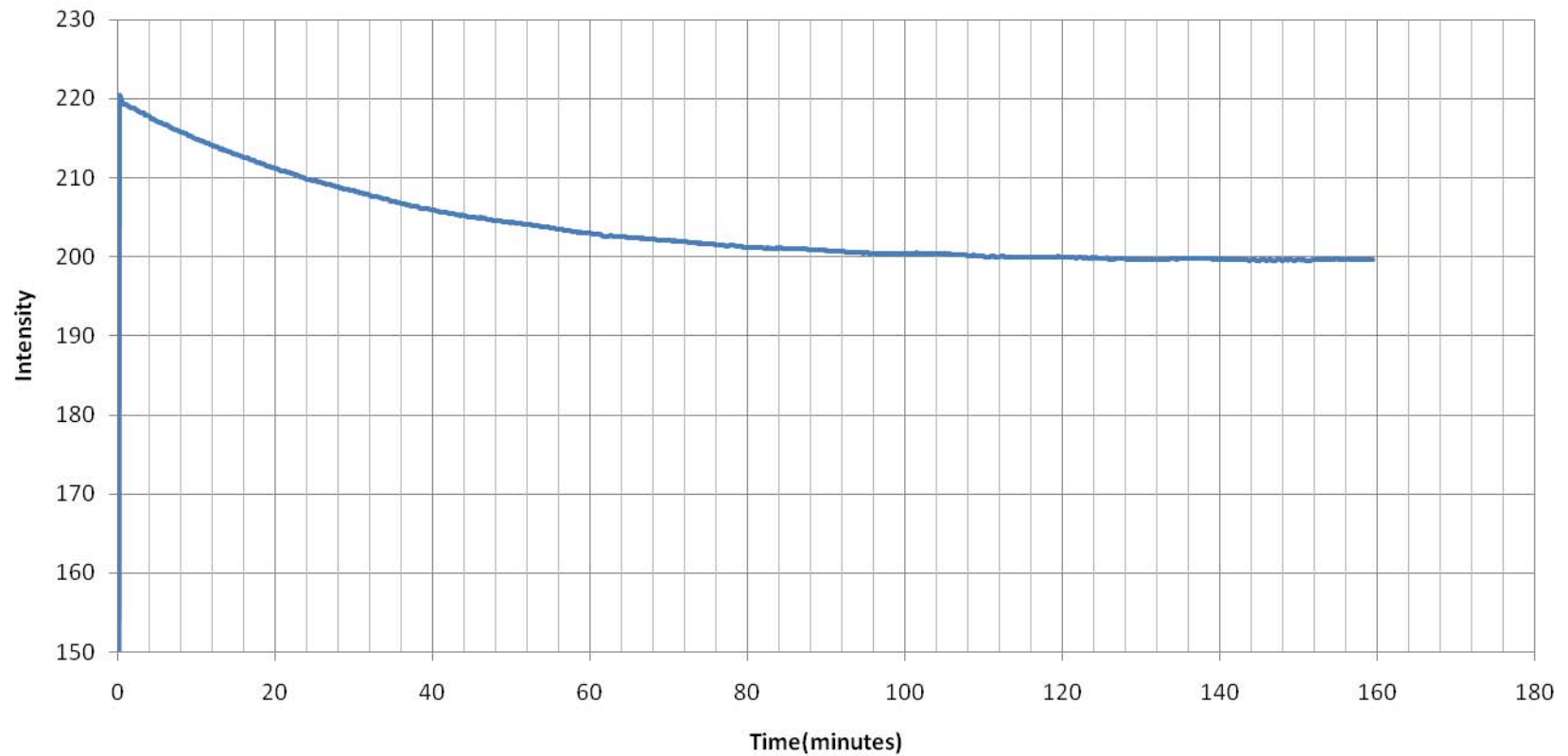

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Stabilization of a typical 1 Lamp 32W CFL Luminaire

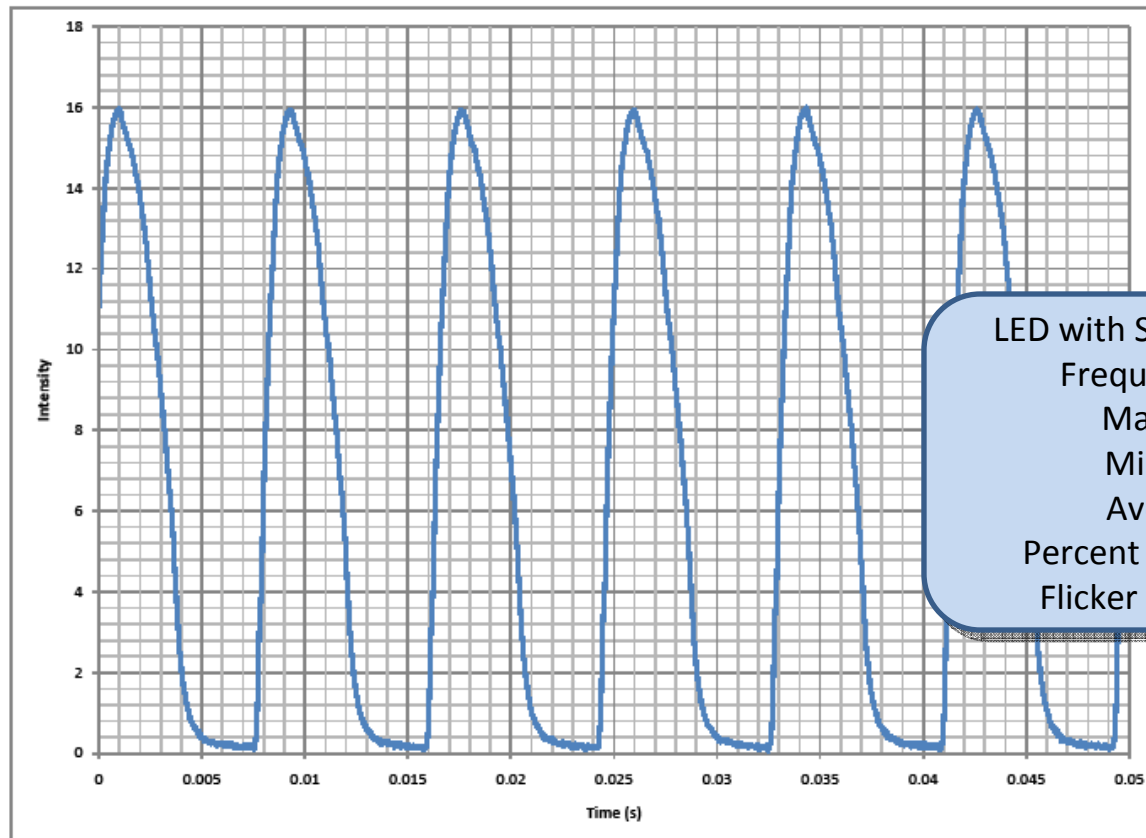


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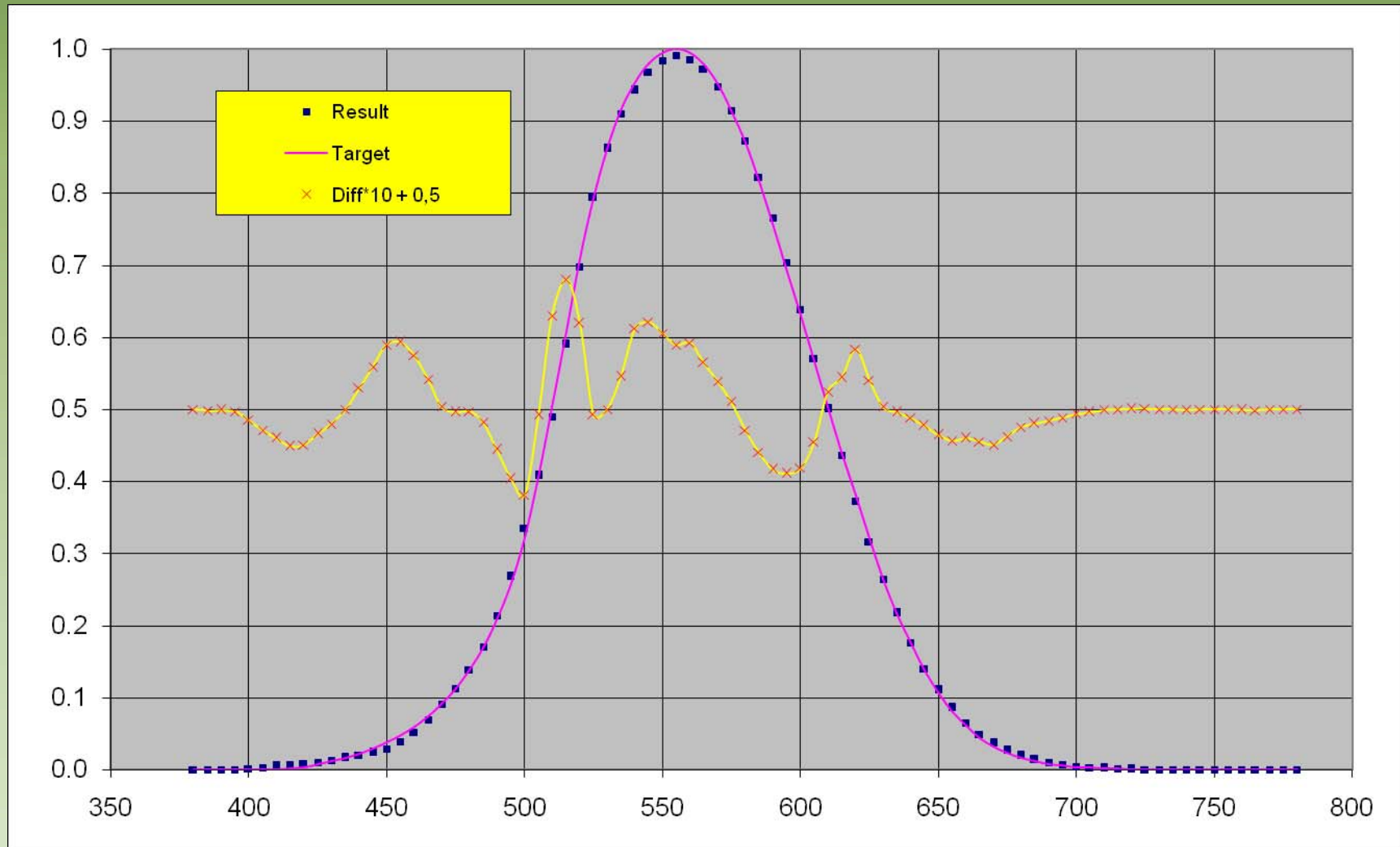
Stabilization of a typical High-Power LED Luminaire



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

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

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Thank You!

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