Gallery Lighting with LEDs

TH vs LED Heade

MR16 Tungsten-halogen

MR16 Phillips LED 3000

TH vs LED

MR16 Tungsten-halogen

MR16 Phillips LED 3000

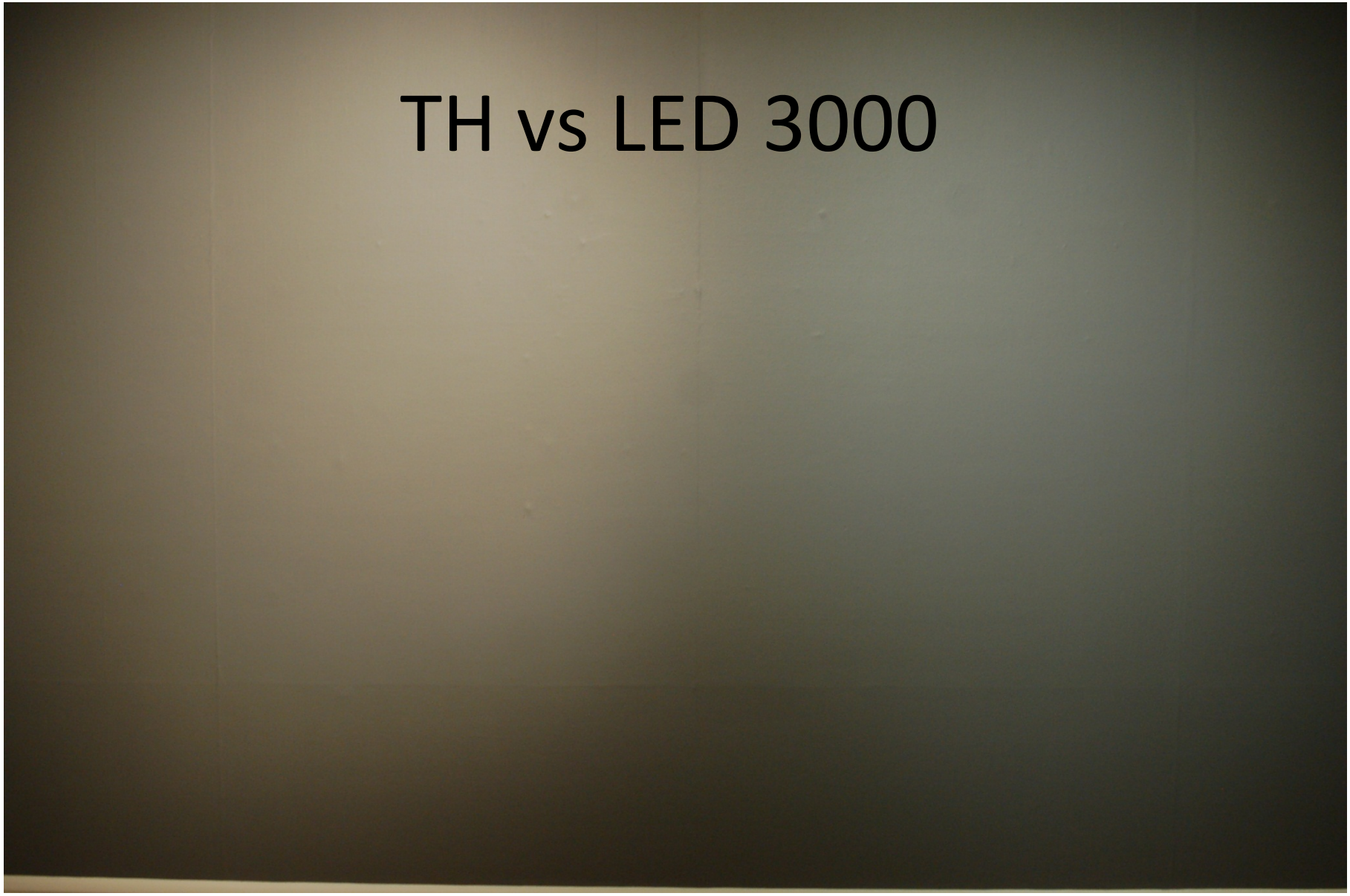
TH vs LED Print

MR16 Tungsten-halogen

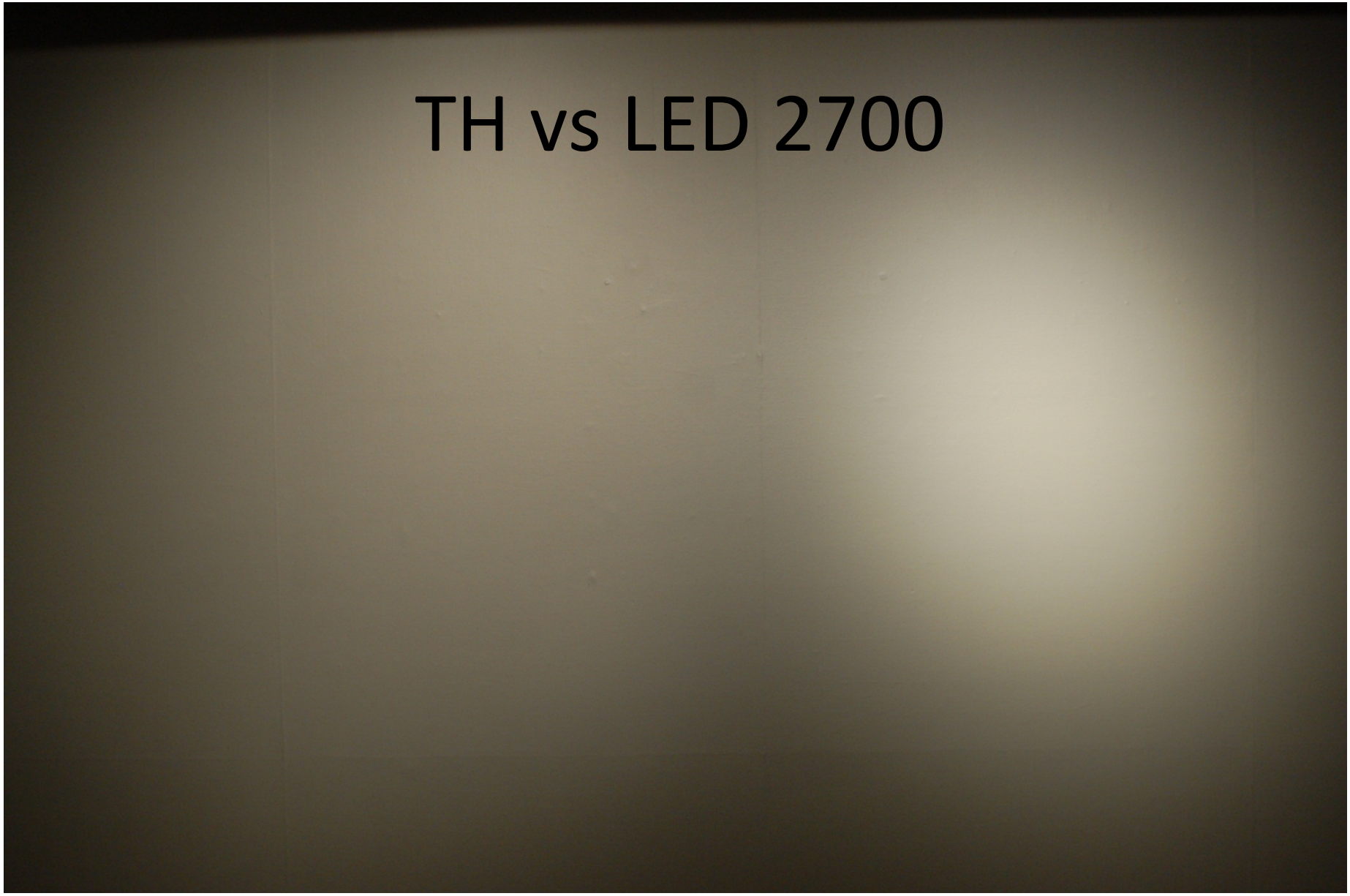
MR16 Phillips 3000LED

Figure 2. Mockup of four LED lamp types (left wall) in the Barker Gallery. The Cree PAR38 ("LRP38") lamp is on the far left, nearest the viewer. The incumbent halogen lamp is projected on the far wall. There were no screens, louvers, or lenses in place to modify the projected beams in the track heads for this test. Notice the difference in color and beam edge among the different lamps.

From N. Miller, *Demonstration of LED Retrofit Lamps at the Jordan Schnitzer Museum of Art,* Final report prepared in support of the U.S. DOE Solid State Lighting Technology Demonstration GATEWAY Program September 2011. http://www.connectingtocollections.org/wp-content/uploads/2011/08/Jordan_Schnitzer_Museum_Gateway_report_final.pdf

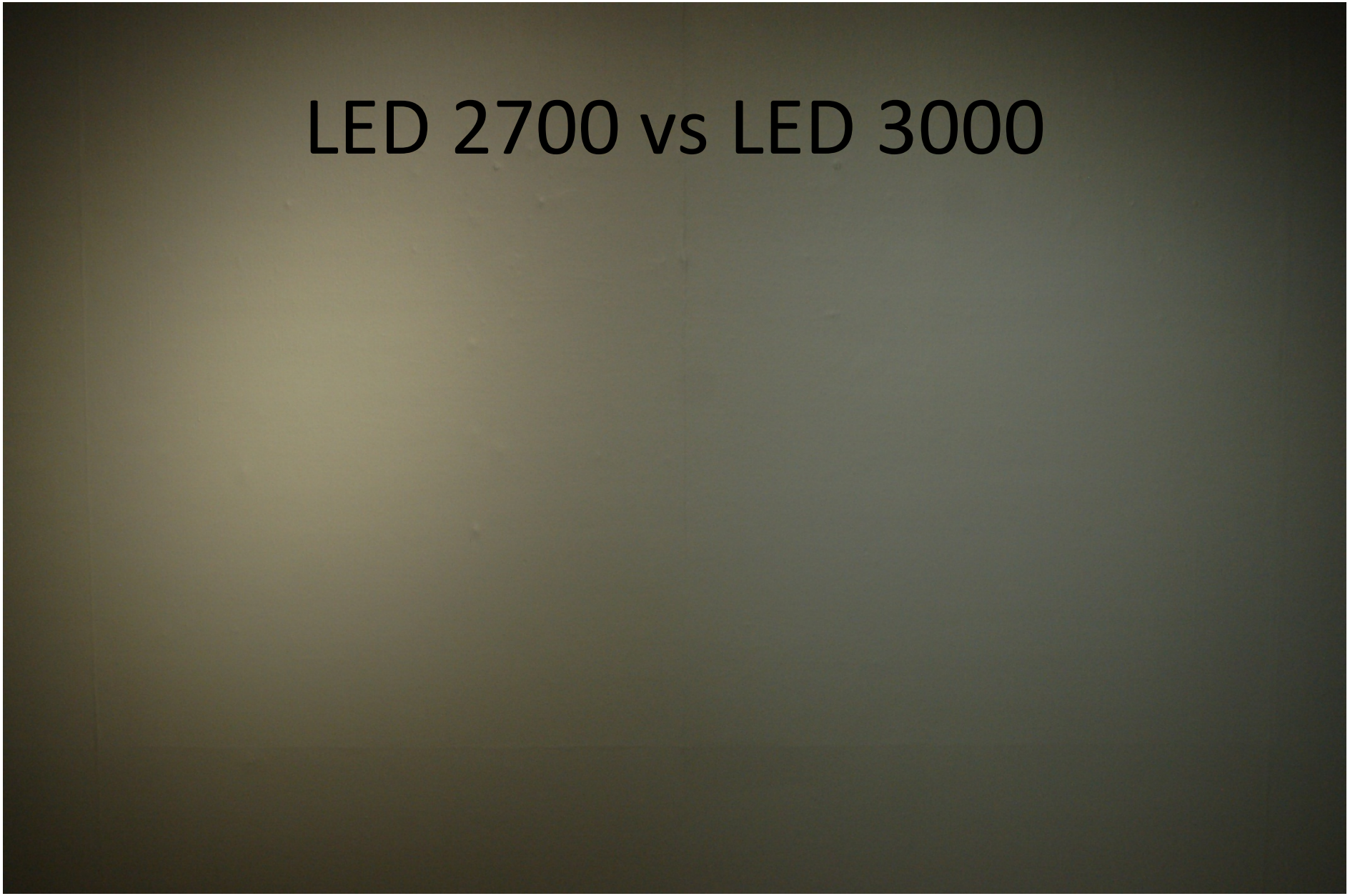


PAR 30 Tungsten-halogen wide flood vs PAR 20 LED 3000 wide flood



PAR 30 Tunsten-halogen wide flood vs PAR 20 LED 2700 narrow flood

LED 2700 vs LED 3000



PAR 20 LED 2700 narrow flood vs PAR 20 LED 3000 wide flood

Information found on product packaging

Some definitions:

Life L70 = how long it takes before the light dims to 70% of the original intensity

CBCP = Center beam candle power

PAR 30 replacement bulb

PAR 20 replacement bulb

www.sylvania.com/ledr

ULTRA LED Retrofit PAR20 Lamps

Dimmable

Key Features & Benefits

- 8W LED lamp designed as replacement of 50W halogen PAR20 lamps
- Dimmable 10%–100%*
- 50,000 hours life at 70% lumen maintenance
- Suitable for indoor and outdoor use
- Available in 3000K CCT with 85 CRI (2700K targeted for Fall 2010)
- Power factor 0.95
- Reduces energy consumption up to 84%
- Lasts 20 times longer than halogen lamps
- No warm-up time, instant-on with full light output and stable color
- Mercury free and RoHS compliant
- UV and IR free

Product literature available online

SYLVANIA

lighting facts[CM]

A Program of the U.S. DOE

Light Output (Lumens)	350
Watts	8
Lumens per Watt (Efficacy)	44
Color Accuracy Color Rendering Index (CRI)	85

Light Color — **3000 (Bright White)**
Correlated Color Temperature (CCT)

Warm White | Bright White | Daylight

2700K 3000K 4500K 6500K

All results are according to IESNA LM-79-2008: *Approved Method for the Electrical and Photometric Testing of Solid-State Lighting*. The U.S. Department of Energy (DOE) verifies product test data and results.

Visit www.lightingfacts.com for the *Label Reference Guide*.

Registration Number: 5BZT-HGZ51Y
Model Number: LED8PAR20/DIM/830/NFL25
Type: Replacement lamps

Ordering Guide

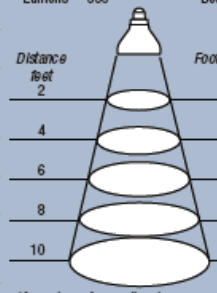
LED	8	PAR20	/	DIM	/	830	/	NFL	25
LED Lamps and Retrofits	Wattage: 8	Lamp Type: PAR20		Dimmable		CRI, CCT: 830: 80+ CRI, 3000K CCT		Beam Type: NFL: Narrow Flood	Beam Angle: 25°

Illuminance Cone Diagrams

Similar Halogen	50PAR20
Watts (W)	50
Avg. Rated Life (hrs)	2,500
Lumens	550
CBCP (cd)	1200
Beam Angle	30°

LED8PAR20/DIM/830/NFL25

Wattage 8 — CBCP (cd) 1260
Lumens 350 — Beam Angle 25



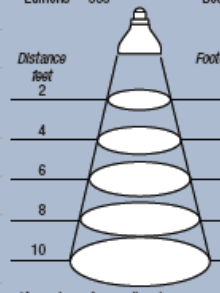
Distance feet	Footcandles*	Diameter feet
2	315	0.9
4	79	1.8
6	35	2.7
8	20	3.5
10	13	4.4

*Approximate footcandle values at center of beam

Similar Halogen	50PAR20
Watts (W)	50
Avg. Rated Life (hrs)	2,500
Lumens	550
CBCP (cd)	900
Beam Angle	40°

LED8PAR20/DIM/830/FL36

Wattage 8 — CBCP (cd) 713
Lumens 350 — Beam Angle 36



Distance feet	Footcandles*	Diameter feet
2	178	1.3
4	45	2.6
6	20	3.9
8	11	5.2
10	7	6.5

*Approximate footcandle values at center of beam

Energy Savings

Basic Product Description	LED Life (hrs.)	Similar Halogen	Halogen Life (hrs.)	Watts Saved	Energy Savings*	LED Life vs. Halogen
LED8PAR20/DIM	50,000	50PAR20	2,500	42	$231	20x

*Energy savings over life of lamp calculated at $0.11/kWh

Product literature available online

LED RETROFITS LIMITED WARRANTY

OSRAM SYLVANIA Products Inc. ("OSPI") is pleased to provide a limited warranty for use for use in industrial or commercial applications for the LED retrofit products listed below ("LED Retrofits").

LED RETROFITS	Warranty Period	
LED A19 Ultra Family	36 months- 8,760 hours	60 months – 4,360 hours
LED PAR16 Ultra Family	36 months- 8,760 hours	60 months – 4,360 hours
LED PAR20 Ultra Family	36 months- 8,760 hours	60 months – 4,360 hours
LED PAR30 Ultra Family	36 months- 8,760 hours	60 months – 4,360 hours
LED PAR38 Ultra Family	36 months- 8,760 hours	60 months – 4,360 hours
LED MR16 Ultra Family	36 months- 8,760 hours	60 months – 4,360 hours
LED B10 Candle Elique Family	36 months- 8,760 hours	60 months – 4,360 hours
LED G25 Ultra Family	36 months- 8,760 hours	60 months – 4,360 hours

REPLACEMENT OF PRODUCT, LIMITS OF LIABILITY

OSPI liability for any warranty remedy shall be limited to repair, replacement, or issue of credit against a future OSPI post top retrofit purchase, at the sole discretion of OSPI. Unit credit is calculated as follows:

$$\frac{\text{Purchase Price (\$) x Unexpired warranty period (months)}}{\text{Warranty period (months)}}$$

Excerpts from the OSRAM Sylvania Limited Warranty

OnSpeX™
Consumer Product Evaluation

PHOTOMETRIC TESTING & EVALUATION TO IES LM-79-08

Sample Tested
EnduraLED MR16 2700K P

Prepared for:

Anne Ye

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Philips Innovation Campus Shanghai
No.2 Building
No.9, Lane 888, Tian Lin Road, 200233, Shanghai, Chi

Phone: +86-21-2412 8569
Fax: +86-21-5445 1520

Technical Report Number
30013197

January 12, 2010

Prepared by:
Clayton Magerfleisch, Project Technician

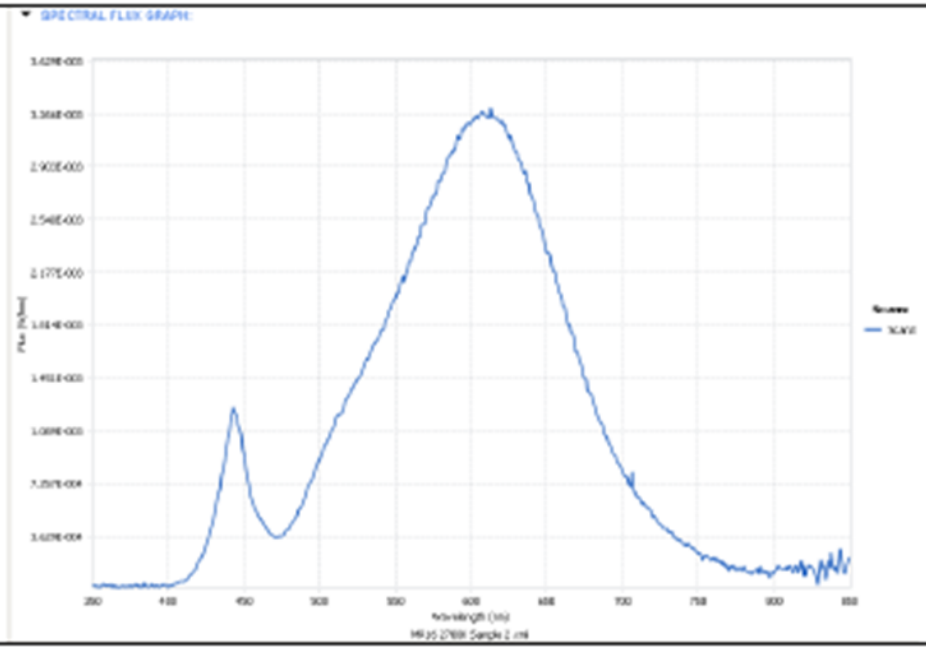
Approved by:
Bryan Cubitt, Technical Team

2210 Justin Trail
Alpharetta, Georgia 30004
www.onspex.com

Confidential

Spectral Flux

The following graph shows the spectral response curve of the radiant flux for the sample:



Spectral response of the Radiant Flux
(350nm to 850nm – calibrated range of the Spectroradiometer).

Product literature available through manufacturer

Light Sources | SPD Curves | National Gallery, London

research.ng-london.org.uk/scientific/spd/

THE NATIONAL GALLERY

Home | SPD Curves | Proportional | Rel. Exposure | Information

Spectral Power Distribution (SPD) Curves

For more information about the project in general contact Joseph Padfield.

Measuring and working with different light sources within the National Gallery:

Comparing Spectral Power Distribution (SPD) curves

This web site has been set up to allow users to examine and compare the Spectral Power Distribution (SPD) curves of a number of different light sources and begin to discuss the relative proportions of these SPDs. The curves and relative proportions can been seen here and here or accessed via the appropriate links at the top of the page. If you would like to contribute data to this project or would like to recommend other sources of information please contact Joseph Padfield.

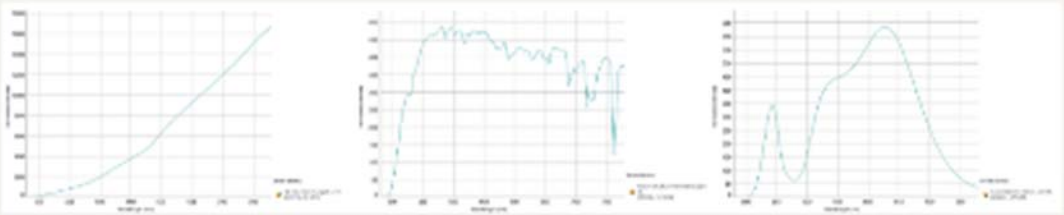
Further details, including descriptions of the equipment and calculations used, along with additional links can be found on the Information page.

Measuring light levels in museums and galleries

Many of the materials used to make up works of art can degrade over time as a result of exposure to light, but we need this light to be able to actually see them. A balance must therefore be established between ensuring there is enough light for people to see, while minimising any long term degradation. Within museums and galleries these light, or Lux levels have been monitored and recorded for many years. Lux levels represent a measure of the brightness, of a given light, as perceived by the human eye, but it does not establish the colour quality of a light, or accurately record the intensity of the light that the human eye is less sensitive to. When examining a single type of light source, for example tungsten halogen, Lux levels allow for a good comparison, however when many different types of light need to be compared then it is better to consider the entire range of light produced or the SPD.

What is the Spectral Power Distribution (SPD) of a light?

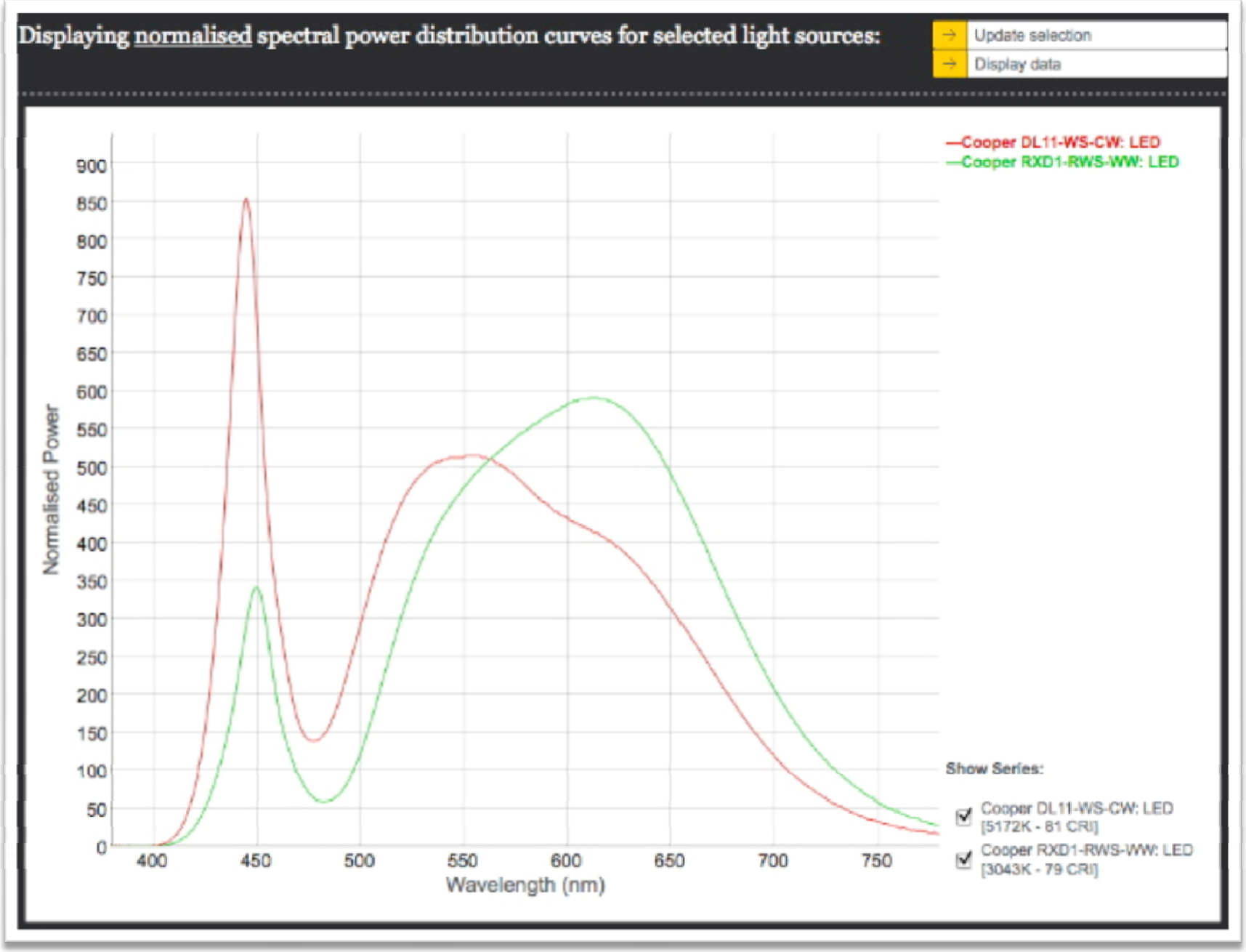
"In color science and radiometry, a spectral power distribution (SPD) describes the power per unit area per unit wavelength of an illumination (radiant exitance), or more generally, the per-wavelength contribution to any radiometric quantity (radiant energy, radiant flux, radiant intensity, radiance, irradiance, radiant exitance, or radiosity)." Wikipedia



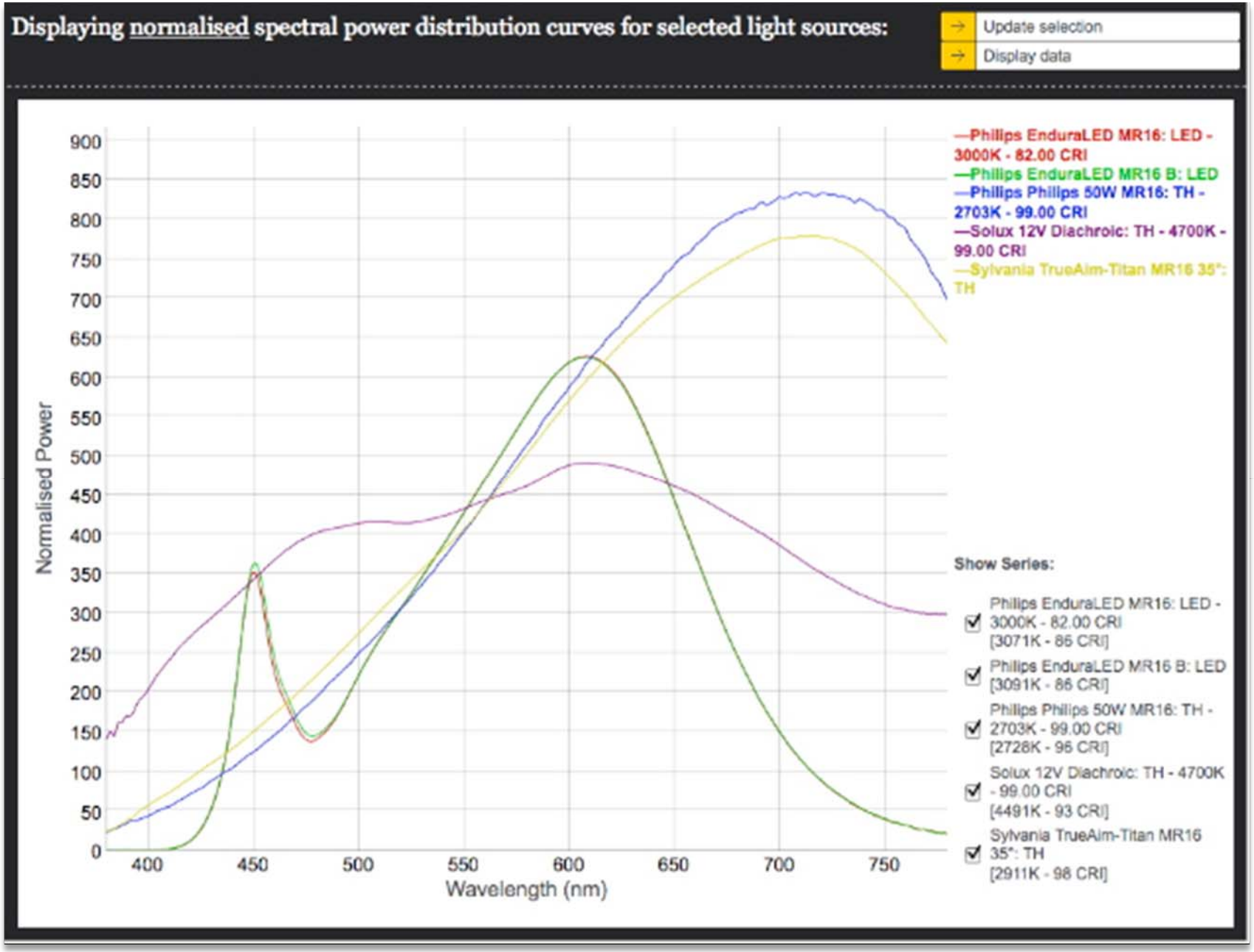
Example spectral power distribution (SPD) curves, standard tungsten, filtered daylight and a LED based source.

This site was developed and is maintained by: Joseph Padfield, The National Gallery Scientific Department.

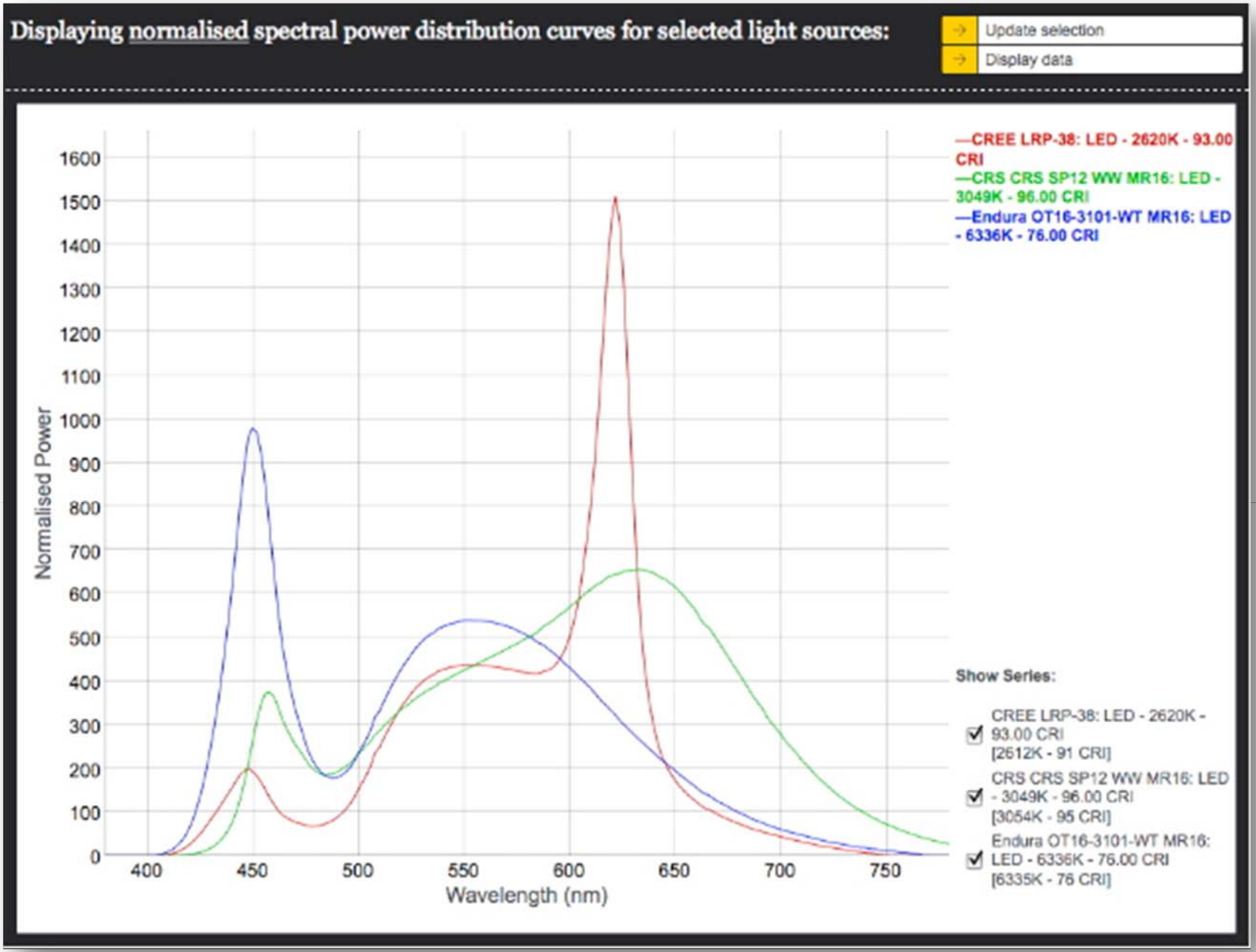
http://research.ng-london.org.uk/scientific/spd/



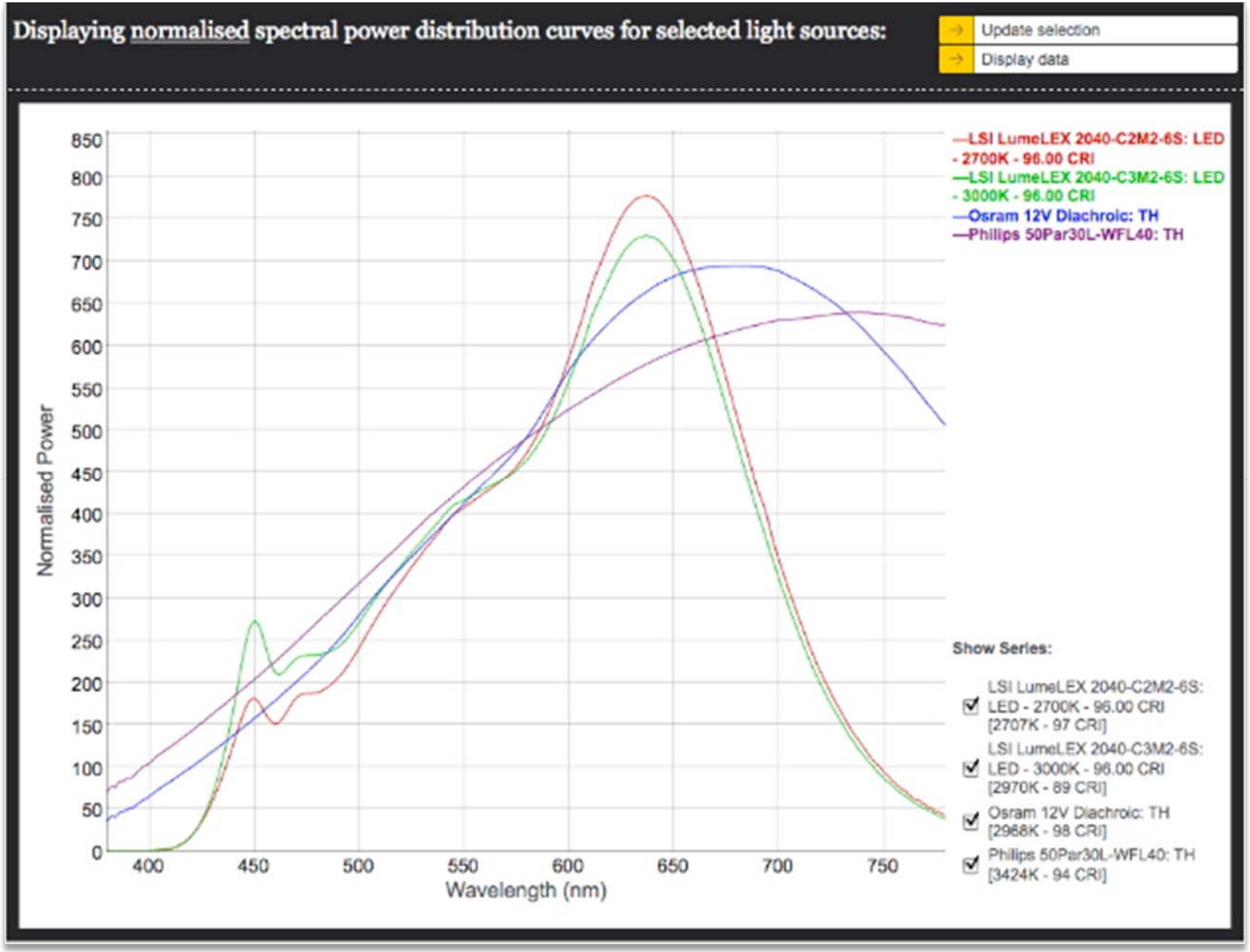
Two different Cooper LEDs. Cooper are specialty-built, not retrofit.



Tungsten-Halogen MR16 vs LED and Solux (a halogen lamp)



Cree and Endura LEDs. Both of these are replacement LEDs.



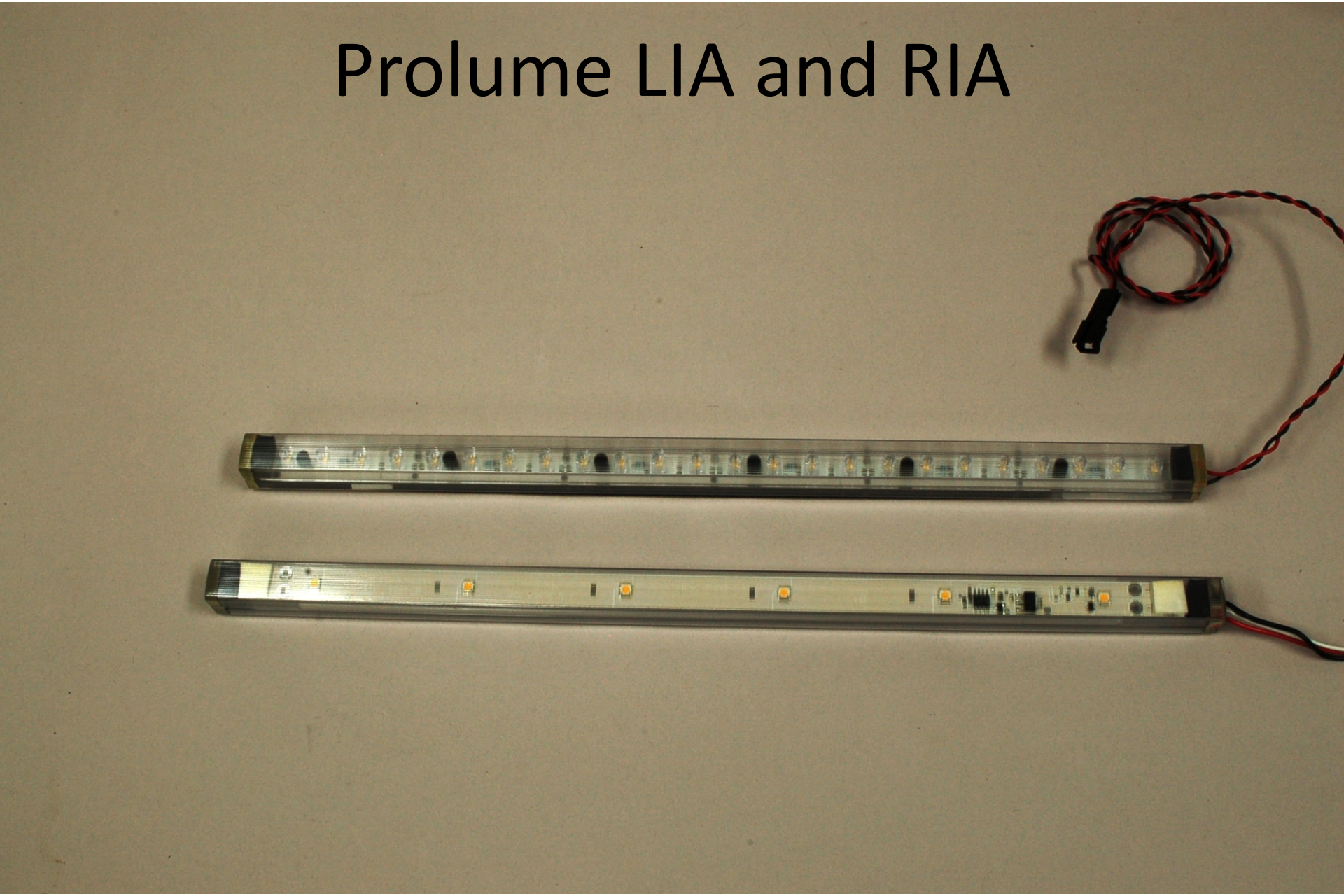
LSI Xicato specialty lamps vs tungsten-halogen

PROLUME SERIES LIA GALLERY

SHELBURNE MUSEUM VARIETY UNIT – TOY SHOP and DOLL EXHIBITION

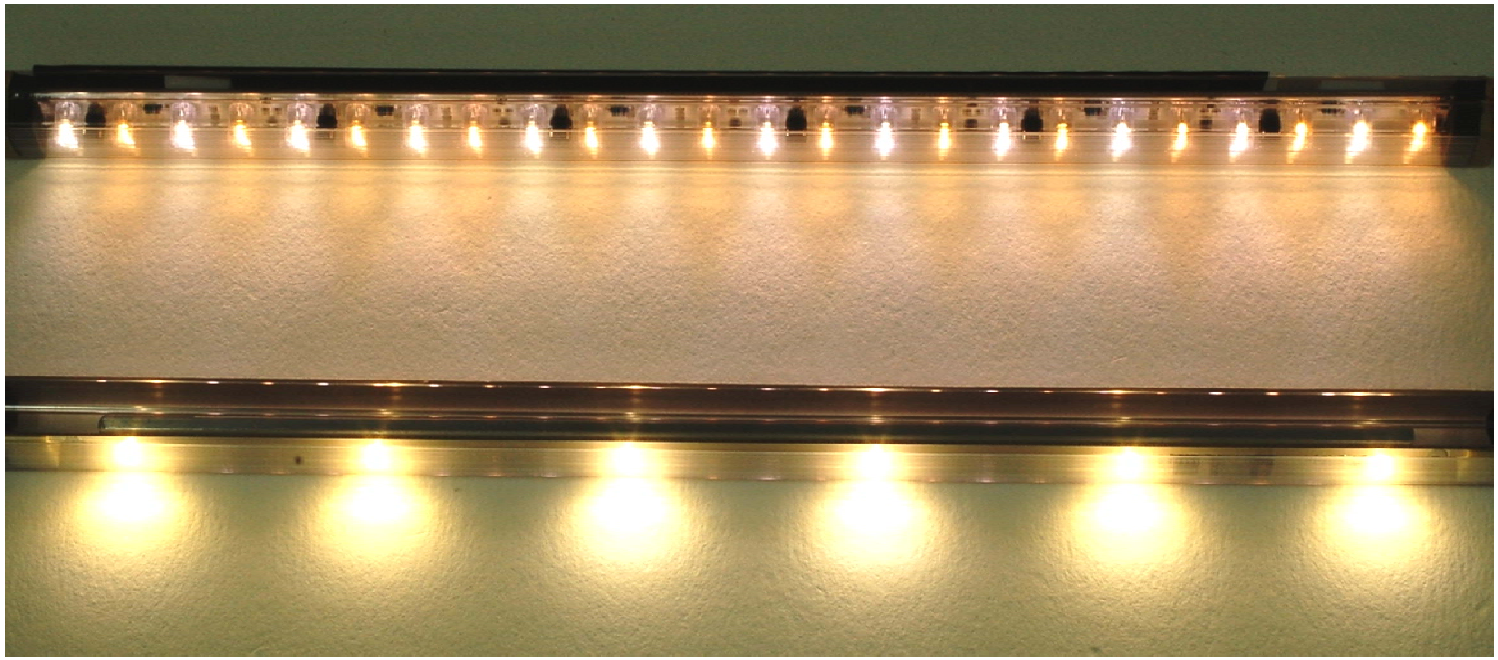
PROLUME

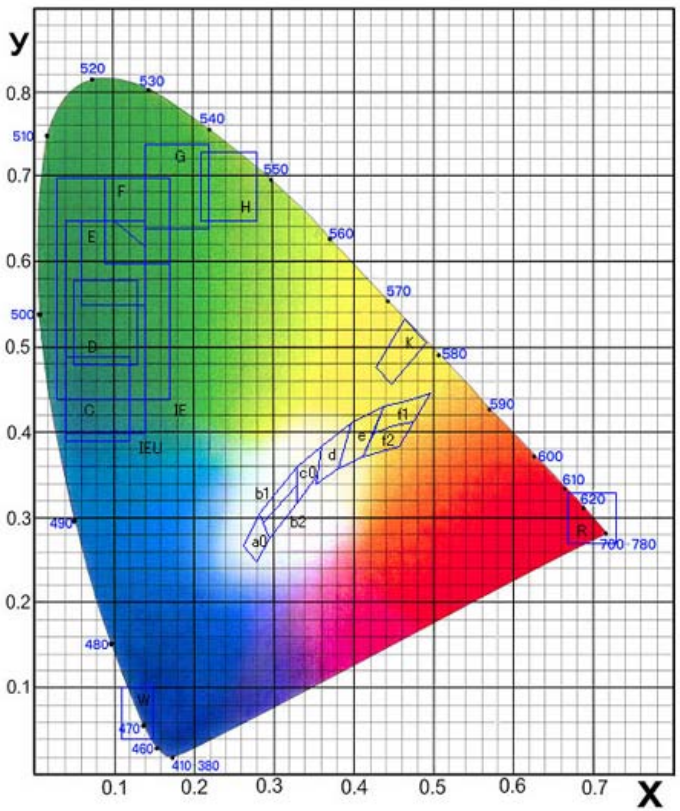
Prolume LIA and RIA



LIA

RIA




y
x
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0.4
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0.6
0.7
0.8
520
530
540
550
560
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580
590
600
610
620
780
510
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490
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470
460
410
380
G
F
H
E
D
C
IE
IEU
K
f1
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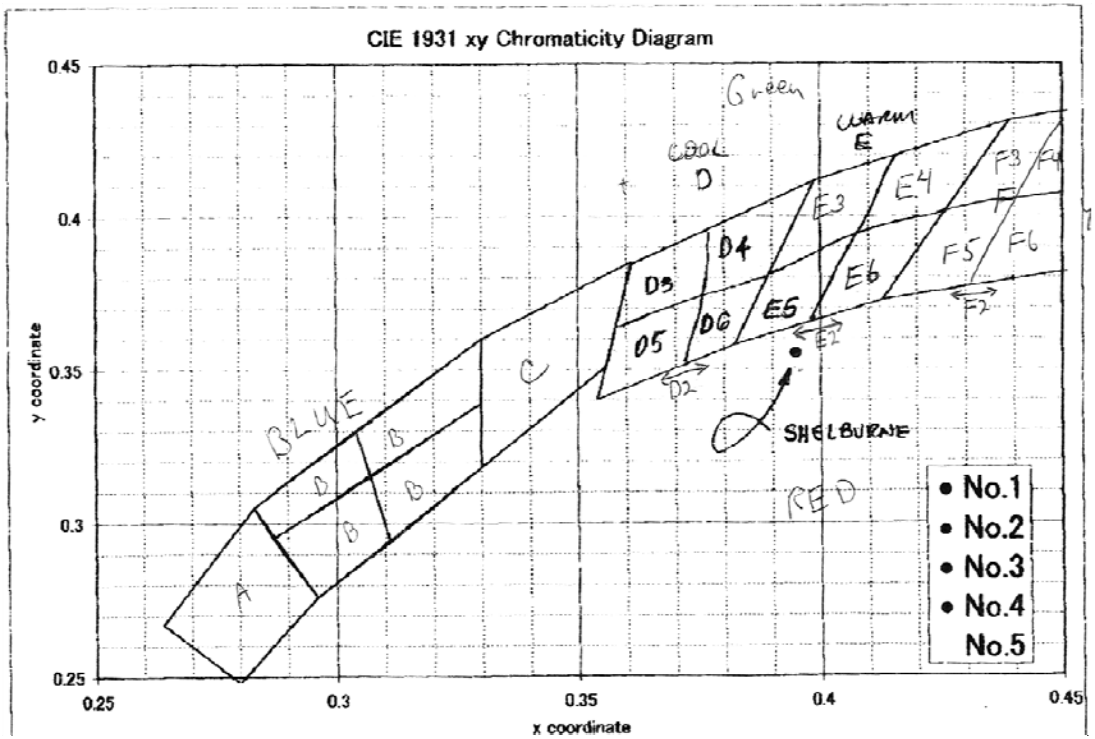
e
d
c0
b1
b2
a0
R
W

D↑
E↑
F↑
E+F↑


CIE 1931 xy Chromaticity Diagram
y coordinate
x coordinate
0.25
0.3
0.35
0.4
0.45
Green
COOL
D
WARM
E
E3
E4
E6
F3
F4
F5
F6
D3
D4
D5
D6
E5
D2
E2
F2
C
BLUE
B
A
SHELBURNE
RED
No.1
No.2
No.3
No.4
No.5

Miniature Millinery Shop

Old Tungsten Lighting

New LED Lighting

Guidelines for Selecting Solid-State Lighting for Museums

James R. Druzik and Stefan W. Michalski

September 2011

Canadian Conservation Institute
The Getty Conservation Institute

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