

# Goniophotometry Report

1\_PHOT\_NINETY-NINE-2125lmChip-3000K-58Deg\_2303  
www.factorylux.com



Tested Light Source - 1\_PHOT\_NINETY-NINE-2125lmChip-3000K-58Deg\_2303

## Laboratory and Equipment

Laboratory Owner and Location  
Goniospectrometer System and Type  
Spectrometer Manufacturer and Model

Factorylux, Greenhill Mills, Hebden Bridge, HX7 5QF, UK  
BaseSpion – Type C, horizontal  
Ibsen Photonics, Denmark – Freedom VIS (Custom Viso)

## Measurement Conditions

Number of C-planes and Resolution  
 $\gamma$  (gamma)-Resolution  
Test Distance  
Input Power, Power and Displ. Factors  
Input RMS Voltage and Current  
Frequency of Input Power

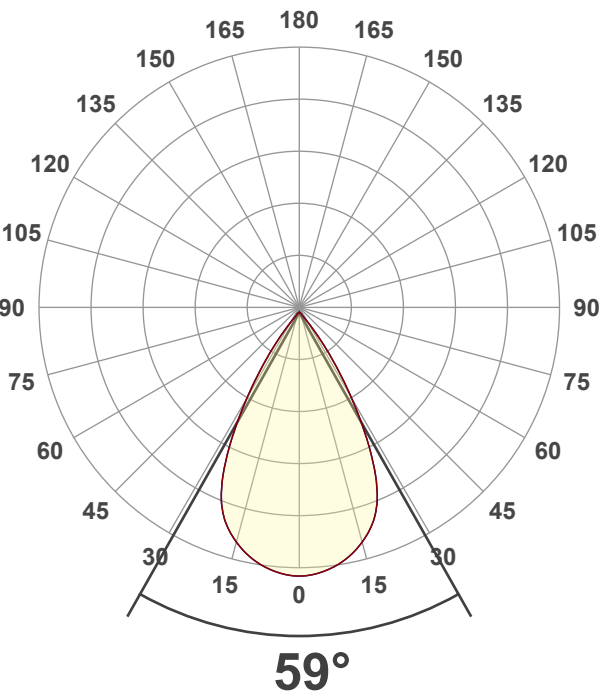
32 planes – 11.25°  
2.5°  
1.50 m  
15.9 W – PF 0.98 – DPF 0.98  
243 V – 0.067 A  
50 Hz

## Main Light Measurement Results

Output  
Efficiency  
Peak Intensity and Beam Angle  
Color Rendering Index

1540 lm  
97 lm/W  
1767 cd – 59°  
CRI 92.6

## Light Intensity Distribution



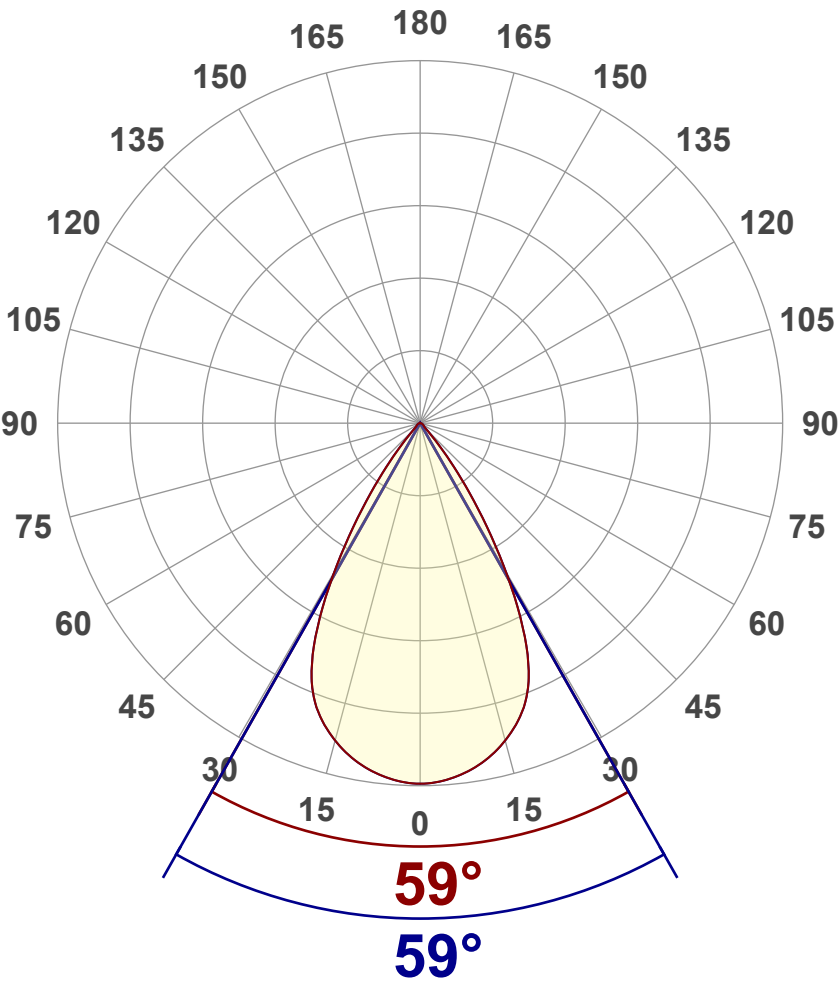
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Luminous Intensity diagram

Unit: 0-100% of peak intensity



Main Values

|                      |         |
|----------------------|---------|
| Output (total Lumen) | 1540 lm |
| Peak Intensity       | 1767 cd |
| Beam Angle (50%)     | 59°     |
| Beam Angle (90%)     | 59°     |
| Beam Angle (10%)     | 59°     |

Cut-off Angle

|              |       |
|--------------|-------|
| Average 2,5% | 90.7° |
|--------------|-------|

Field Angle

|             |       |
|-------------|-------|
| Average 10% | 79.3° |
|-------------|-------|

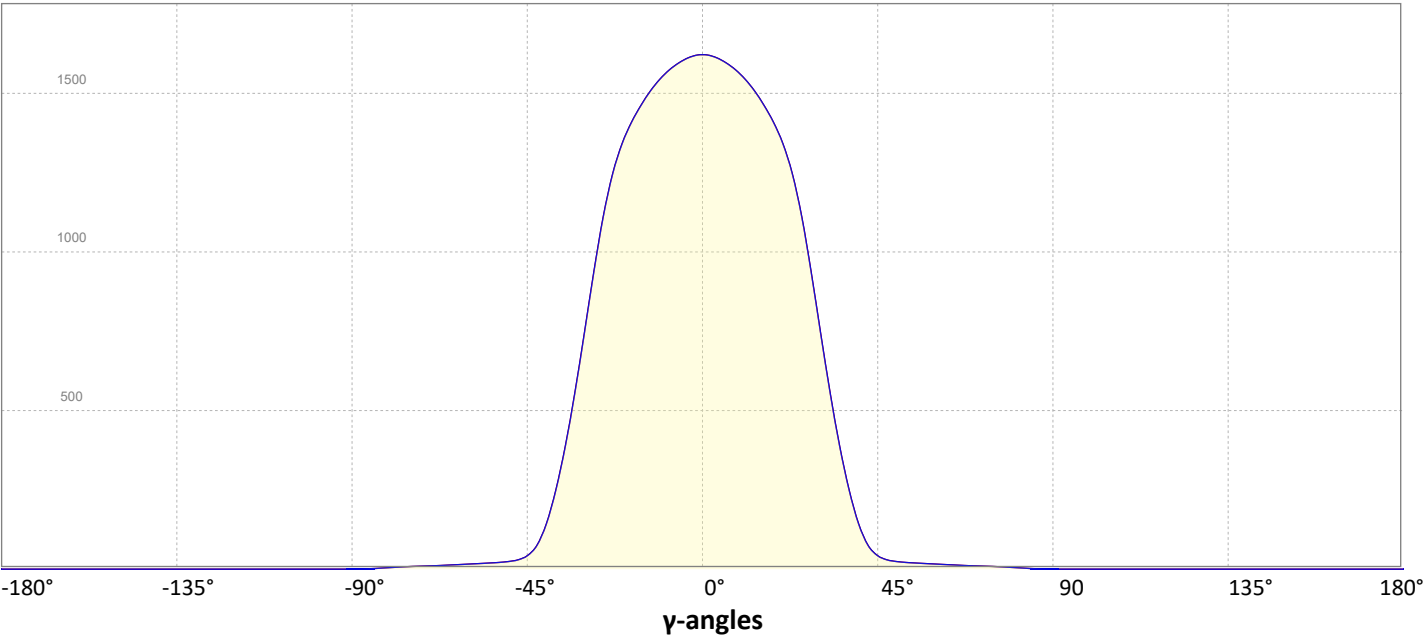
Intensity Ratio

|              |       |
|--------------|-------|
| In 120° cone | 98.3% |
| In 90° cone  | 96.2% |

C000-C180

C090-C270

Linear distribution diagram - Intensity (candela) vs γ-angle

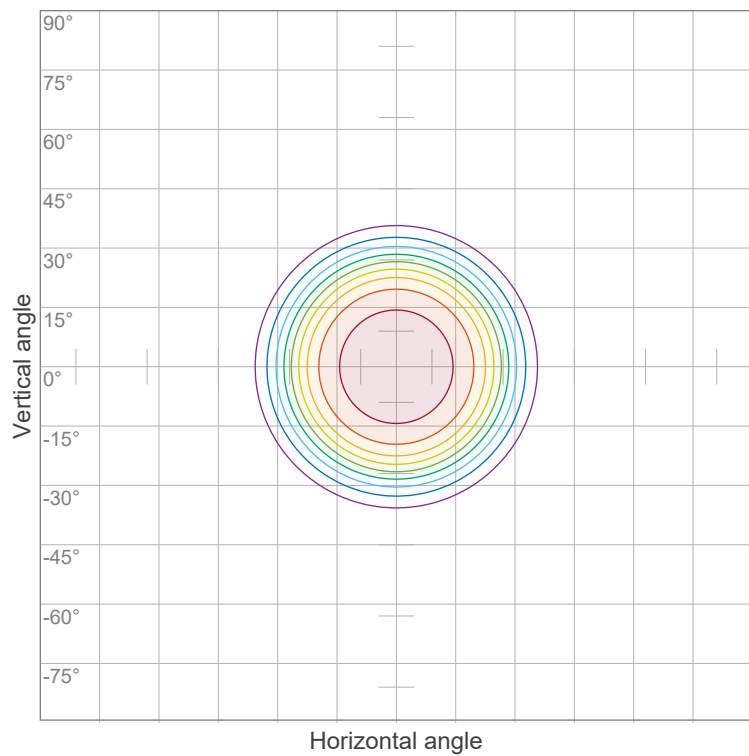


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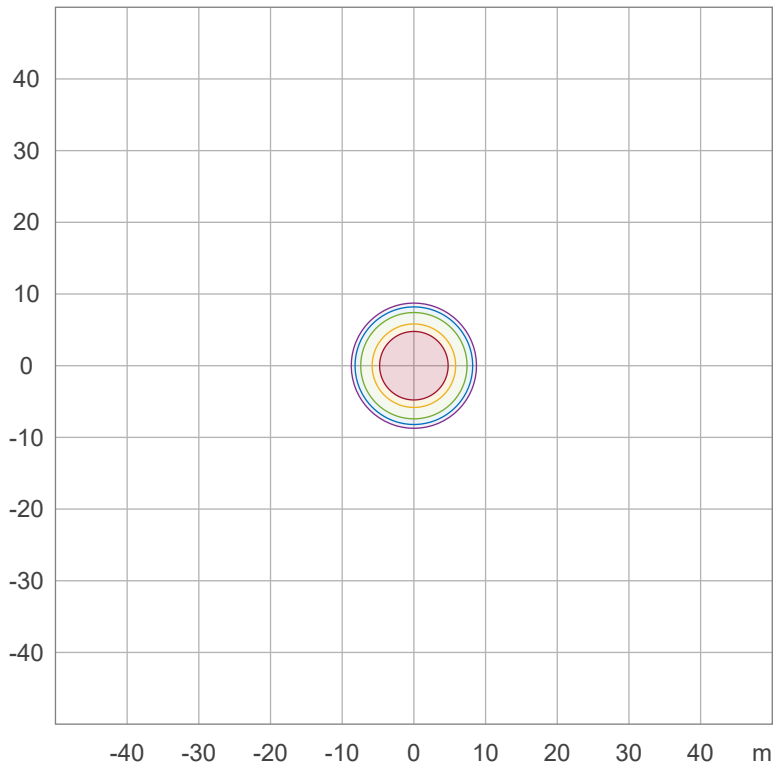
## Iso-intensity Diagram (Iso-candela)



|      |           |
|------|-----------|
| 90 % | 1589.9 cd |
| 80 % | 1413.3 cd |
| 70 % | 1236.6 cd |
| 60 % | 1060.0 cd |
| 50 % | 883.3 cd  |
| 40 % | 706.6 cd  |
| 30 % | 530.0 cd  |
| 20 % | 353.3 cd  |
| 10 % | 176.7 cd  |

Peak intensity: 1766.6 cd  
Number of c-planes: 32

## Iso-illuminance Diagram (Iso-lux)



|        |        |
|--------|--------|
| 50.0 % | 8.8 lx |
| 30.0 % | 5.3 lx |
| 10.0 % | 1.8 lx |
| 5.0 %  | 0.9 lx |
| 3.0 %  | 0.5 lx |

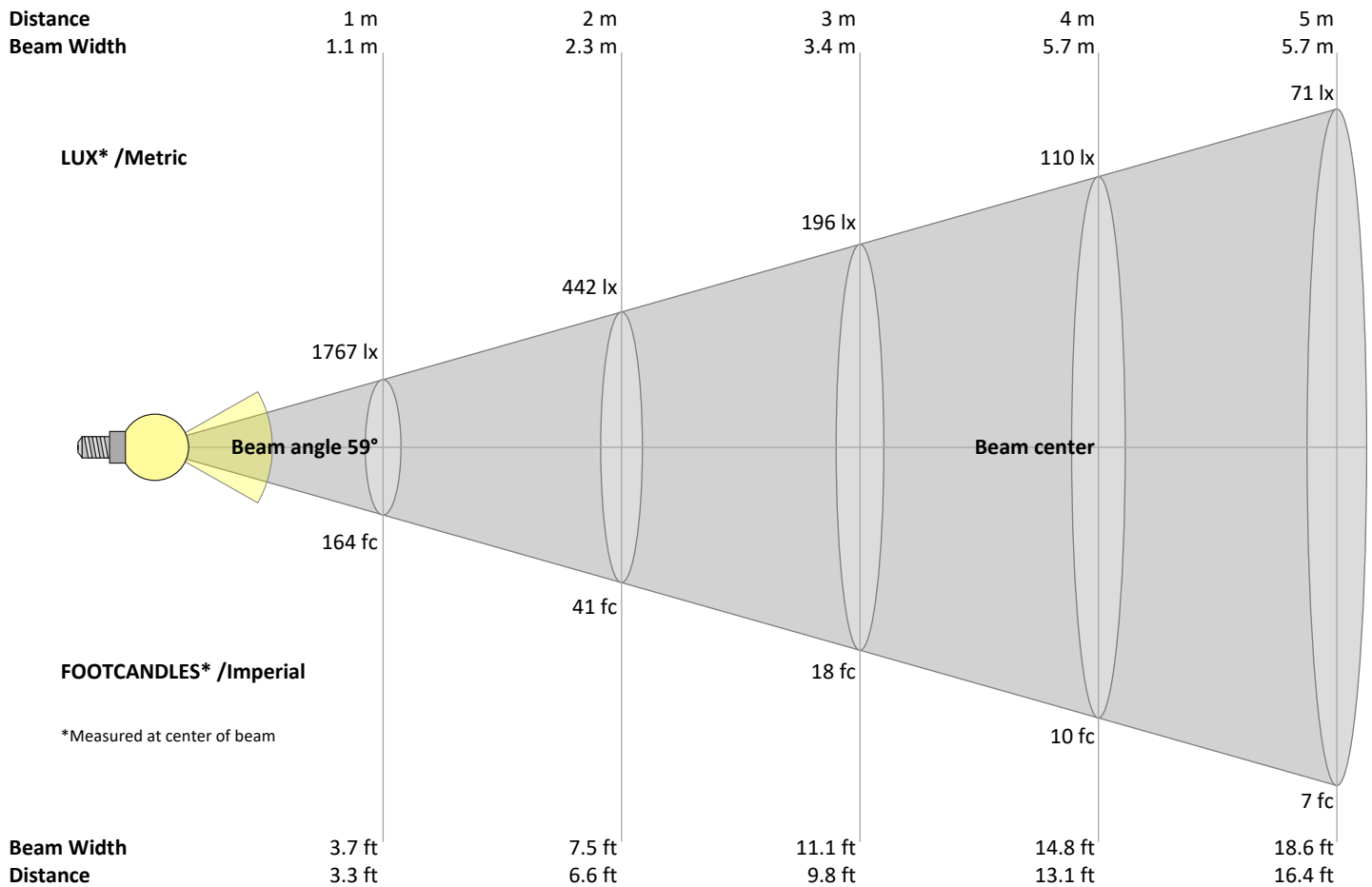
Peak illuminance: 17.7 lx  
Mounting height: 10.0 m  
Number of c-planes: 32

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## Beam Details



### Beam intensities from 1 – 20 m

| 1     | 2   | 3    | 4    | 5    | 6    | 7   | 8    | 9    | 10   | 11   | 12   | 13   | 14   | 15   | 16   | 17   | 18   | 19   | 20   | m   |
|-------|-----|------|------|------|------|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|
| 3.3   | 6.6 | 9.8  | 13.1 | 16.4 | 19.7 | 23  | 26.2 | 29.5 | 32.8 | 36.1 | 39.4 | 42.7 | 45.9 | 49.2 | 52.5 | 55.8 | 59.1 | 62.3 | 65.6 | ft  |
| 1767  | 442 | 196  | 110  | 71   | 49   | 36  | 28   | 22   | 18   | 15   | 12   | 10   | 9    | 8    | 7    | 6    | 5    | 5    | 4    | lux |
| 164.1 | 41  | 18.2 | 10.3 | 6.6  | 4.6  | 3.3 | 2.6  | 2    | 1.6  | 1.4  | 1.1  | 1    | 0.8  | 0.7  | 0.6  | 0.6  | 0.5  | 0.5  | 0.4  | fc  |

### Intensities in 0° c-plane

| 0°   | 2°   | 4°   | 6°   | 8°   | 10°  | 12°  | 14°  | 16°  | 18°  | 20°  | 22°  | 24°  | 26°  | 28°  | 30° | 32° | 34° | 36° | 38° | γ        |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|----------|
| 1767 | 1763 | 1754 | 1740 | 1720 | 1696 | 1666 | 1630 | 1589 | 1541 | 1482 | 1404 | 1302 | 1171 | 1013 | 840 | 671 | 514 | 375 | 256 | cd       |
| 100% | 100% | 99%  | 98%  | 97%  | 96%  | 94%  | 92%  | 90%  | 87%  | 84%  | 79%  | 74%  | 66%  | 57%  | 48% | 38% | 29% | 21% | 14% | of 0°val |

### Intensities in 90° c-plane

| 0°   | 2°   | 4°   | 6°   | 8°   | 10°  | 12°  | 14°  | 16°  | 18°  | 20°  | 22°  | 24°  | 26°  | 28°  | 30° | 32° | 34° | 36° | 38° | γ        |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|----------|
| 1767 | 1763 | 1754 | 1740 | 1720 | 1696 | 1666 | 1630 | 1589 | 1541 | 1482 | 1404 | 1302 | 1171 | 1013 | 840 | 671 | 514 | 375 | 256 | cd       |
| 100% | 100% | 99%  | 98%  | 97%  | 96%  | 94%  | 92%  | 90%  | 87%  | 84%  | 79%  | 74%  | 66%  | 57%  | 48% | 38% | 29% | 21% | 14% | of 0°val |

### Intensities in 180° c-plane

| 0°   | 2°   | 4°   | 6°   | 8°   | 10°  | 12°  | 14°  | 16°  | 18°  | 20°  | 22°  | 24°  | 26°  | 28°  | 30° | 32° | 34° | 36° | 38° | γ        |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|----------|
| 1767 | 1763 | 1754 | 1740 | 1720 | 1696 | 1666 | 1630 | 1589 | 1541 | 1482 | 1404 | 1302 | 1171 | 1013 | 840 | 671 | 514 | 375 | 256 | cd       |
| 100% | 100% | 99%  | 98%  | 97%  | 96%  | 94%  | 92%  | 90%  | 87%  | 84%  | 79%  | 74%  | 66%  | 57%  | 48% | 38% | 29% | 21% | 14% | of 0°val |

### Intensities in 270° c-plane

| 0°   | 2°   | 4°   | 6°   | 8°   | 10°  | 12°  | 14°  | 16°  | 18°  | 20°  | 22°  | 24°  | 26°  | 28°  | 30° | 32° | 34° | 36° | 38° | γ        |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|----------|
| 1767 | 1763 | 1754 | 1740 | 1720 | 1696 | 1666 | 1630 | 1589 | 1541 | 1482 | 1404 | 1302 | 1171 | 1013 | 840 | 671 | 514 | 375 | 256 | cd       |
| 100% | 100% | 99%  | 98%  | 97%  | 96%  | 94%  | 92%  | 90%  | 87%  | 84%  | 79%  | 74%  | 66%  | 57%  | 48% | 38% | 29% | 21% | 14% | of 0°val |

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Light Planning – UGR table

Uncorrected, comprehensive UGR table according to 117-1995

| Reflectances   |           |  |      |      |      |      |  |      |      |      |      |
|--|-----------|--|------|------|------|------|--|------|------|------|------|
|  | ρ Ceiling | 70   | 70   | 50   | 50   | 30   | 70   | 70   | 50   | 50   | 30   |
|  | ρ Walls   | 50   | 30   | 50   | 30   | 30   | 50   | 30   | 50   | 30   | 30   |
|  | ρ Floor   | 20   | 20   | 20   | 20   | 20   | 20   | 20   | 20   | 20   | 20   |
| Room size  |           |  |      |      |      |      |  |      |      |      |      |
| H = mounting height<br>above eye level                               |           | Viewed Crosswise                                   |      |      |      |      | Viewed Endwise                                   |      |      |      |      |
| X  | Y         | (Viewing direction orthogonal to lamp length axis) |      |      |      |      | (Viewing direction parallel to lamp length axis) |      |      |      |      |
| 2H   | 2H        | 20.1   | 20.8 | 20.2 | 21.0 | 21.2 | 20.1   | 20.8 | 20.2 | 21.0 | 21.2 |
|  | 3H        | 20.0   | 20.8 | 20.4 | 21.0 | 21.2 | 20.0   | 20.8 | 20.4 | 21.0 | 21.2 |
|  | 4H        | 20.1   | 20.8 | 20.5 | 21.0 | 21.3 | 20.1   | 20.8 | 20.5 | 21.0 | 21.3 |
|  | 6H        | 20.2   | 20.8 | 20.5 | 21.1 | 21.4 | 20.2   | 20.8 | 20.5 | 21.1 | 21.4 |
|  | 8H        | 20.2   | 20.8 | 20.5 | 21.1 | 21.5 | 20.2   | 20.8 | 20.5 | 21.1 | 21.5 |
|  | 12H       | 20.1   | 20.7 | 20.5 | 21.1 | 21.5 | 20.1   | 20.7 | 20.5 | 21.1 | 21.5 |
| 4H   | 2H        | 19.8   | 20.6 | 20.2 | 20.8 | 21.0 | 19.8   | 20.6 | 20.2 | 20.8 | 21.0 |
|  | 3H        | 20.0   | 20.6 | 20.3 | 20.9 | 21.3 | 20.0   | 20.6 | 20.3 | 20.9 | 21.3 |
|  | 4H        | 20.1   | 20.6 | 20.5 | 21.0 | 21.5 | 20.1   | 20.6 | 20.5 | 21.0 | 21.5 |
|  | 6H        | 20.2   | 20.8 | 20.7 | 21.1 | 21.4 | 20.2   | 20.8 | 20.7 | 21.1 | 21.4 |
|  | 8H        | 20.2   | 20.7 | 20.7 | 21.1 | 21.4 | 20.2   | 20.7 | 20.7 | 21.1 | 21.4 |
|  | 12H       | 20.2   | 20.6 | 20.7 | 21.0 | 21.5 | 20.2   | 20.6 | 20.7 | 21.0 | 21.5 |
| 8H   | 4H        | 20.0   | 20.6 | 20.6 | 20.9 | 21.3 | 20.0   | 20.6 | 20.6 | 20.9 | 21.3 |
|  | 6H        | 20.3   | 20.6 | 20.8 | 21.1 | 21.6 | 20.3   | 20.6 | 20.8 | 21.1 | 21.6 |
|  | 8H        | 20.4   | 20.6 | 20.9 | 21.2 | 21.8 | 20.4   | 20.6 | 20.9 | 21.2 | 21.8 |
|  | 12H       | 20.4   | 20.6 | 21.0 | 21.1 | 21.7 | 20.4   | 20.6 | 21.0 | 21.1 | 21.7 |
| 12H  | 4H        | 20.0   | 20.4 | 20.5 | 20.8 | 21.3 | 20.0   | 20.4 | 20.5 | 20.8 | 21.3 |
|  | 6H        | 20.3   | 20.6 | 20.8 | 21.1 | 21.7 | 20.3   | 20.6 | 20.8 | 21.1 | 21.7 |
|  | 8H        | 20.3   | 20.6 | 20.9 | 21.1 | 21.7 | 20.3   | 20.6 | 20.9 | 21.1 | 21.7 |
| Variations with the observer position for the luminaire spacings, S: |           |  |      |      |      |      |  |      |      |      |      |
| S = 1.0H   |           | 4.7 / -3.7   |      |      |      |      | 4.7 / -3.7                                       |      |      |      |      |
| S = 1.5H   |           | 7.2 / -3.9   |      |      |      |      | 7.2 / -3.9                                       |      |      |      |      |
| S = 2.0H   |           | 9.2 / -4.2   |      |      |      |      | 9.2 / -4.2                                       |      |      |      |      |

Coefficients of Utilization

|                     |     |                          |     |     |  |     |     |     |     |     |     |     |     |     |     |     |     |     |
|---------------------|-----|--------------------------|-----|-----|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Ceiling reflectance | 80  |                          |     | 70  |  |     | 50  |     |     | 30  |     |     | 10  |     |     | 0   |     |     |
| Wall reflectance    | 70  | 50                       | 30  | 10  | 70   | 50  | 30  | 10  | 50  | 30  | 10  | 50  | 30  | 10  | 50  | 30  | 10  | 0   |
| Floor reflectance   | 20  | 20                       | 20  | 20  | 20   | 20  | 20  | 20  | 20  | 20  | 20  | 20  | 20  | 20  | 20  | 20  | 20  | 0   |
| RCR                 |     | (RCR: Room Cavity Ratio) |     |     | Room Values are expressed as percentage of Lumen delivered to the task surface |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 0                   | 119 | 119                      | 119 | 119 | 116  | 116 | 116 | 116 | 111 | 111 | 111 | 106 | 106 | 106 | 102 | 102 | 102 | 100 |
| 1                   | 113 | 111                      | 108 | 106 | 111  | 109 | 106 | 104 | 104 | 103 | 101 | 101 | 99  | 98  | 97  | 96  | 95  | 93  |
| 2                   | 108 | 103                      | 99  | 96  | 106  | 101 | 98  | 95  | 98  | 95  | 93  | 95  | 93  | 91  | 92  | 90  | 89  | 87  |
| 3                   | 103 | 96                       | 91  | 87  | 101  | 95  | 90  | 87  | 92  | 88  | 85  | 90  | 87  | 84  | 88  | 85  | 83  | 81  |
| 4                   | 98  | 90                       | 85  | 80  | 96   | 89  | 84  | 80  | 87  | 82  | 79  | 85  | 81  | 78  | 83  | 80  | 77  | 76  |
| 5                   | 93  | 85                       | 79  | 75  | 91   | 84  | 78  | 74  | 82  | 77  | 74  | 80  | 76  | 73  | 79  | 75  | 72  | 71  |
| 6                   | 88  | 80                       | 74  | 69  | 87   | 79  | 73  | 69  | 77  | 72  | 69  | 76  | 72  | 68  | 75  | 71  | 68  | 66  |
| 7                   | 84  | 75                       | 69  | 65  | 83   | 74  | 69  | 65  | 73  | 68  | 64  | 72  | 67  | 64  | 71  | 67  | 64  | 62  |
| 8                   | 80  | 71                       | 65  | 61  | 79   | 70  | 65  | 61  | 69  | 64  | 61  | 68  | 64  | 60  | 67  | 63  | 60  | 59  |
| 9                   | 76  | 67                       | 61  | 57  | 75   | 66  | 61  | 57  | 66  | 61  | 57  | 65  | 60  | 57  | 64  | 60  | 57  | 55  |
| 10                  | 73  | 63                       | 58  | 54  | 72   | 63  | 58  | 54  | 62  | 57  | 54  | 61  | 57  | 54  | 61  | 57  | 53  | 52  |

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## Zonal Lumen Summary

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## Outdoor Light Planning

### Lumen per Zone

| Zone (γ) | Lumen   | % Total |
|----------|---------|---------|
| 0-10°    | 165 lm  | 10.7%   |
| 10-20°   | 451 lm  | 29.3%   |
| 20-30°   | 551 lm  | 35.8%   |
| 30-40°   | 280 lm  | 18.2%   |
| 40-50°   | 47 lm   | 3.1%    |
| 50-60°   | 19 lm   | 1.2%    |
| 60-70°   | 14 lm   | 0.9%    |
| 70-80°   | 9 lm    | 0.6%    |
| 80-90°   | 2 lm    | 0.2%    |
| 90-100°  | 0 lm    | 0.0%    |
| 100-110° | 0 lm    | 0.0%    |
| 110-120° | 0 lm    | 0.0%    |
| 120-130° | 0 lm    | 0.0%    |
| 130-140° | 0 lm    | 0.0%    |
| 140-150° | 0 lm    | 0.0%    |
| 150-160° | 0 lm    | 0.0%    |
| 160-170° | 0 lm    | 0.0%    |
| 170-180° | 0 lm    | 0.0%    |
| Total    | 1540 lm | 100.0%  |

### Zonal Lumen summary

| Zone (γ) | Lumen   | % Total |
|----------|---------|---------|
| 0-30°    | 1168 lm | 75.8%   |
| 0-40°    | 1448 lm | 94.1%   |
| 0-60°    | 1515 lm | 98.3%   |
| 60-90°   | 25 lm   | 1.7%    |
| 70-100°  | 12 lm   | 0.8%    |
| 90-120°  | 0 lm    | 0.0%    |
| 0-90°    | 1540 lm | 100.0%  |
| 90-180°  | 0 lm    | 0.0%    |
| 0-180°   | 1540 lm | 100.0%  |

### BUG rating

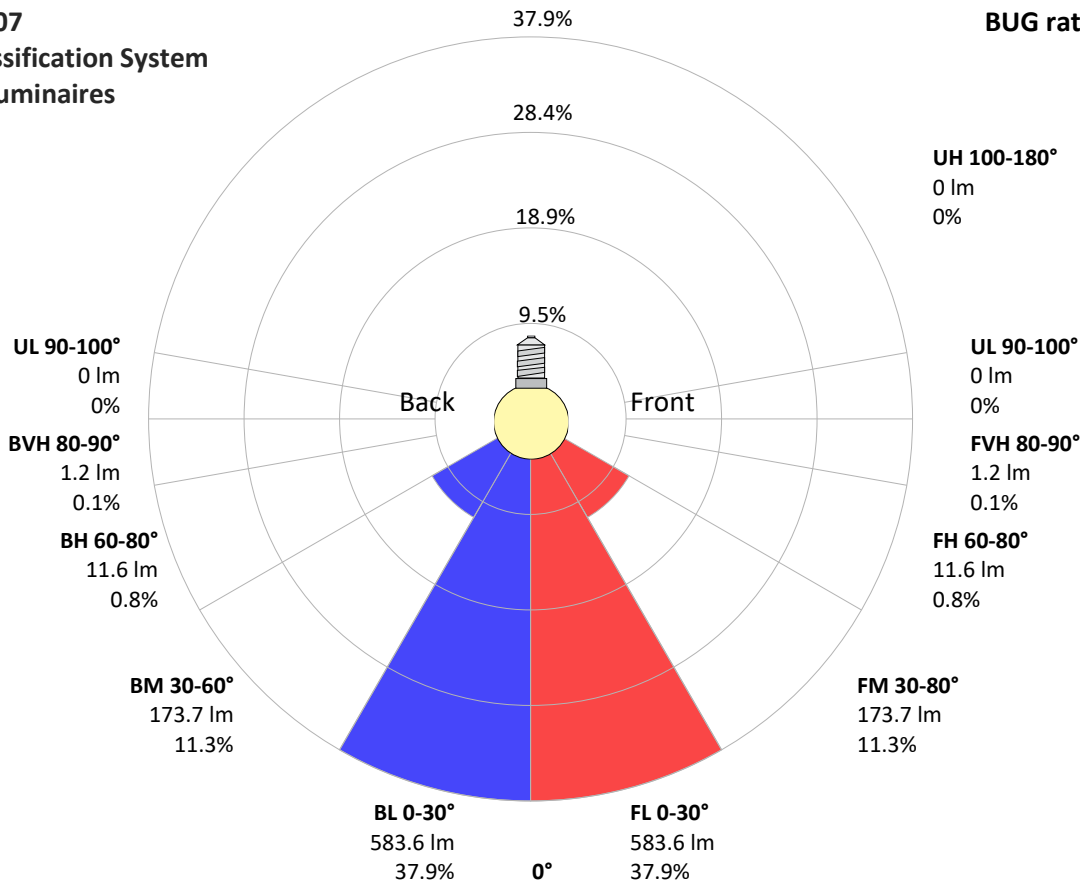
|                      | Lumen  | % Total |
|----------------------|--------|---------|
| <b>Forward light</b> |        |         |
| Low(0-30°)           | 584 lm | 37.9%   |
| Medium(30-60°)       | 174 lm | 11.3%   |
| High(60-80°)         | 12 lm  | 0.8%    |
| Very high(80-90°)    | 1 lm   | 0.1%    |
| <b>Back light</b>    |        |         |
| Low(0-30°)           | 584 lm | 37.9%   |
| Medium(30-60°)       | 174 lm | 11.3%   |
| High(60-80°)         | 12 lm  | 0.8%    |
| Very high(80-90°)    | 1 lm   | 0.1%    |
| <b>Uplight</b>       |        |         |
| Low(90-100°)         | 0 lm   | 0.0%    |
| High(100-180°)       | 0 lm   | 0.0%    |

### Intensity peaks

|                |         |
|----------------|---------|
| Max intensity  | 1767 cd |
| Intensity, 90° | 0 cd    |
| Intensity, 0°  | 1767 cd |

## IESNA TM-15-07 Luminaire Classification System For Outdoor Luminaires

BUG rating B2 U1 G0



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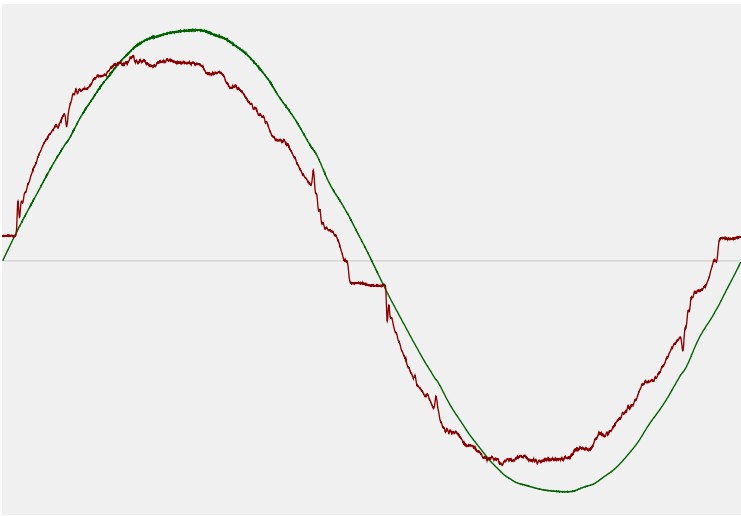


## Power Details

### Input Power

|   |          |
|---|----------|
| Power feed to light source                          | 15.9 W   |
| Frequency of input power                            | 50 Hz    |
| RMS Input voltage feed, $V_{RMS}$                   | 243 V    |
| RMS Input current feed, $I_{RMS}$                   | 0.067 A  |
| Volt-Ampere or apparent power = $V_{RMS} * I_{RMS}$ | 16.19 VA |
| Displacement factor of AC power feed                | 0.98     |
| Power factor of AC current feed                     | 0.98     |
| Total harmonic distortion of the current            | 6.25%    |
| Total harmonic distortion of the voltage            | 1.07%    |

### Input Power Curve



### Efficiency

|                           |         |
|---------------------------|---------|
| Radiated power efficiency | 35.4%   |
| <div><div></div></div>    |         |
| Lumen efficiency          | 97 lm/W |
| <div><div></div></div>    |         |



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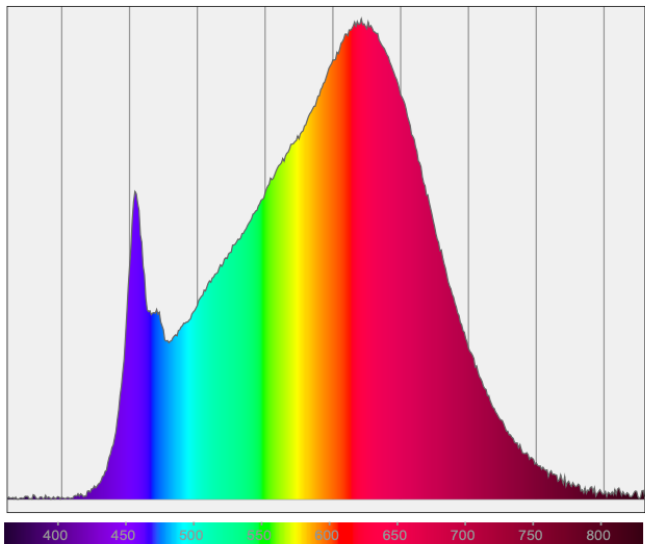
1\_PHOT\_NINETY-NINE-2125lmChip-3000K-58Deg\_2303  
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## Color Measurements

|                              |   |
|------------------------------|---|
| Correlated Color Temperature | CCT = 3000 K                              |
| Color Rendering TM30-18      | R <sub>f</sub> 91.0 — R <sub>g</sub> 97.7 |
| Color Shift, CIE duv         | Duv ±0.0003                               |

## Spectral distribution



## Color details

|   |   |                                     |                         |
|---|---|-------------------------------------|-------------------------|
| Correlated Color Temperature              | CCT = 3000 K                              | Color coordinates CIE 1931          | (x;y) = (0.437;0.404)   |
| Color Rendering Index                     | CRI 94.1                                  | Color coordinate CIEs 1960          | (u;v) = (0.251;0.348)   |
| Color Rendering Index, R9 (red component) | R9 = 68.6                                 | Color deviation from BBL            | Duv = ±0.0003           |
| Color Rendering TM30-18                   | R <sub>f</sub> 91.0 — R <sub>g</sub> 97.7 | Color coordinate CIEs 1976 (CIELUV) | (u';v') = (0.251;0.251) |
| Color Quality Scale                       | CQS = 91.8                                |                                     |                         |

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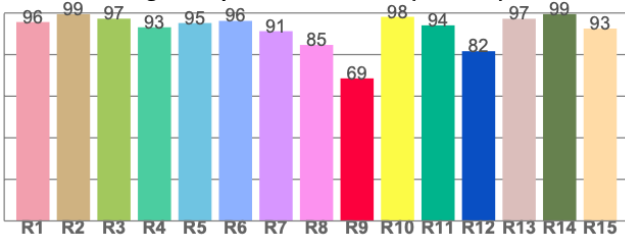
CIE 1931



CIE 1931 – zoomed on Planckian locus



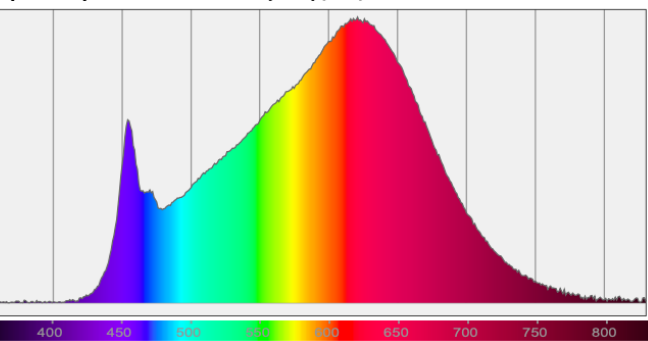
Color Rendering Index per reference color (CIE 1995)



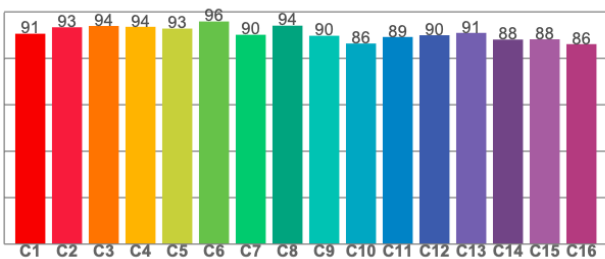
CRI R values, only R1-R8 are used to calculate final CRI value

| R1   | R2   | R3   | R4   | R5   | R6   | R7   | R8   | R9   | R10  | R11  | R12  | R13  | R14  | R15  |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 95.7 | 99.5 | 97.3 | 93.1 | 95.2 | 96.2 | 91.3 | 84.6 | 68.6 | 98.2 | 94.1 | 81.6 | 97.2 | 99.5 | 92.5 |

Spectral power distribution (SPD) / W/nm – 0-100%



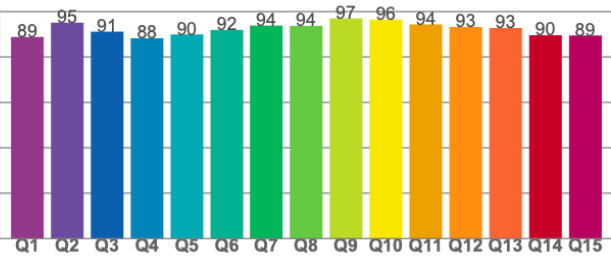
TM30-18 Rf-values per hue bin



TM30 C values, 16 binned values out of total of 99 C values

| C1   | C2   | C3   | C4   | C5   | C6   | C7   | C8   | C9   | C10  | C11  | C12  | C13  | C14  | C15  | C16  |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 90.6 | 93.4 | 93.9 | 93.6 | 92.8 | 95.9 | 90.1 | 94.0 | 89.7 | 86.4 | 89.2 | 89.9 | 90.9 | 88.1 | 88.2 | 86.1 |

Color Quality Scale by reference color



CQS Q values

| Q1   | Q2   | Q3   | Q4   | Q5   | Q6   | Q7   | Q8   | Q9   | Q10  | Q11  | Q12  | Q13  | Q14  | Q15  |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 88.8 | 95.1 | 91.2 | 88.2 | 89.9 | 91.9 | 93.8 | 93.7 | 97.0 | 96.5 | 94.4 | 93.2 | 92.8 | 89.6 | 89.5 |