

Goniophotometry Report

1_PHOT_SKIN+BONES-4300lmChip-3000K-58Deg-HoneycombLouve_2303
www.factorylux.com



Tested Light Source - 1_PHOT_SKIN+BONES-4300lmChip-3000K-58Deg-HoneycombLouve_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
 γ (gamma)-Resolution
Test Distance
Input Power, Power and Displ. Factors
Input RMS Voltage and Current
Frequency of Input Power

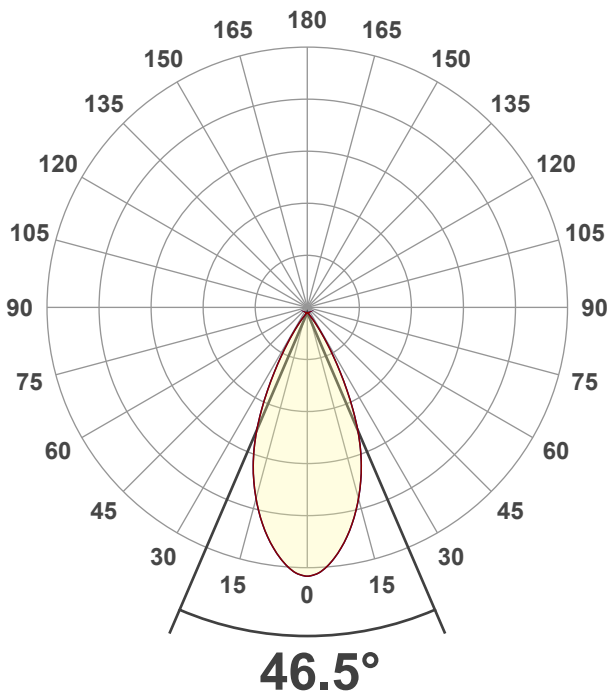
4 planes – 90°
2°
1.50 m
41.3 W – PF 0.97 – DPF 0.97
239 V – 0.179 A
50 Hz

Main Light Measurement Results

Output
Efficiency
Peak Intensity and Beam Angle
Color Rendering Index

2376 lm
57 lm/W
4009 cd – 46.5°
CRI 92.6

Light Intensity Distribution



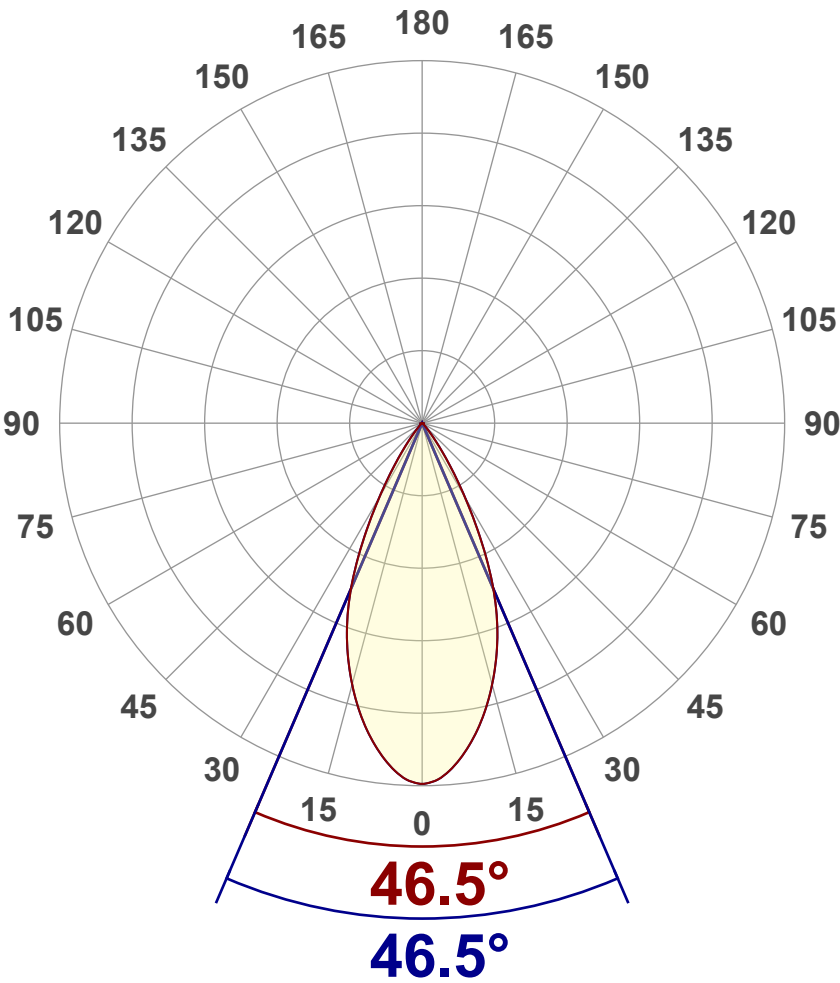
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Luminous Intensity diagram

Unit: 0-100% of peak intensity



Main Values

| | |
|----------------------|---------|
| Output (total Lumen) | 2376 lm |
| Peak Intensity | 4009 cd |
| Beam Angle (50%) | 46.5° |
| Beam Angle (90%) | 46.5° |
| Beam Angle (10%) | 46.5° |

Cut-off Angle

| | |
|--------------|-------|
| Average 2,5% | 81.7° |
|--------------|-------|

Field Angle

| | |
|-------------|-----|
| Average 10% | 70° |
|-------------|-----|

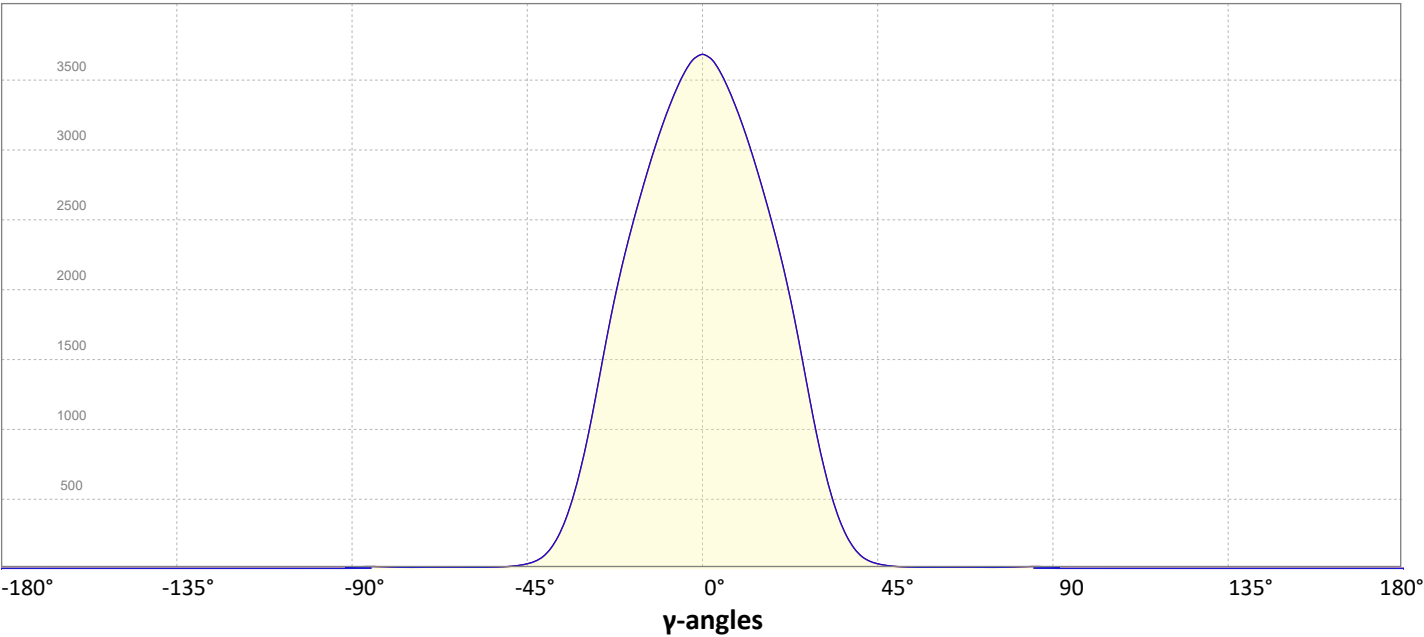
Intensity Ratio

| | |
|--------------|-------|
| In 120° cone | 96.2% |
| In 90° cone | 95.1% |

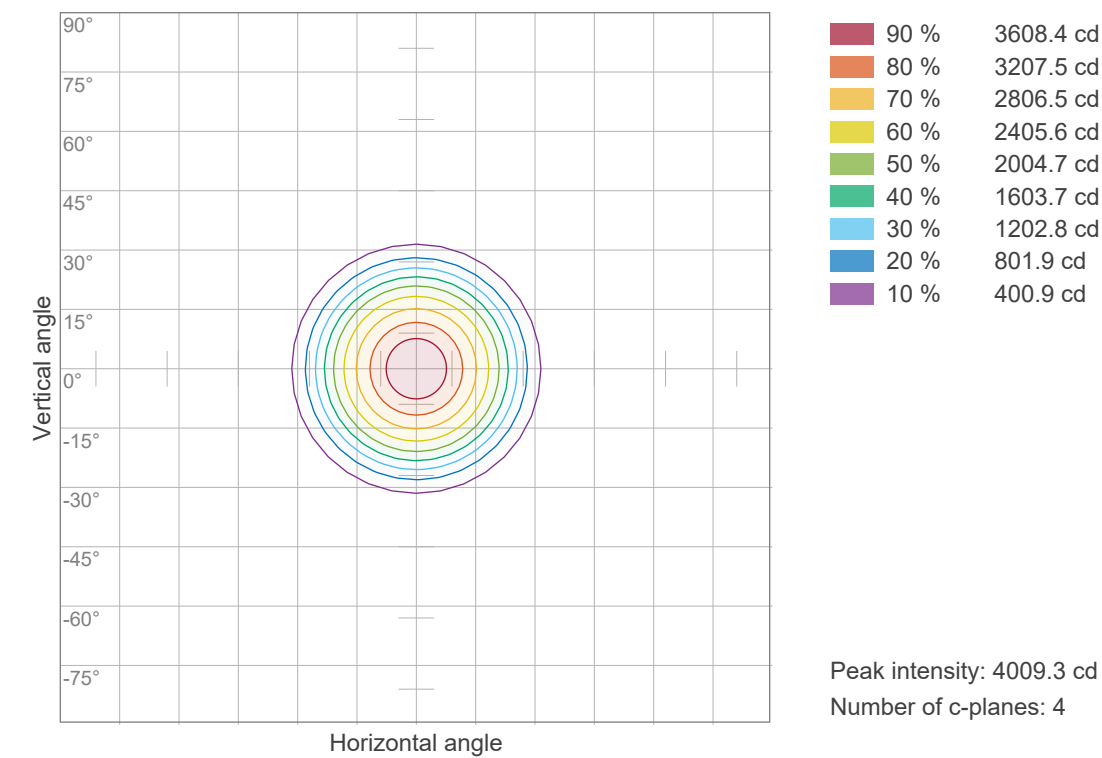
C000-C180

C090-C270

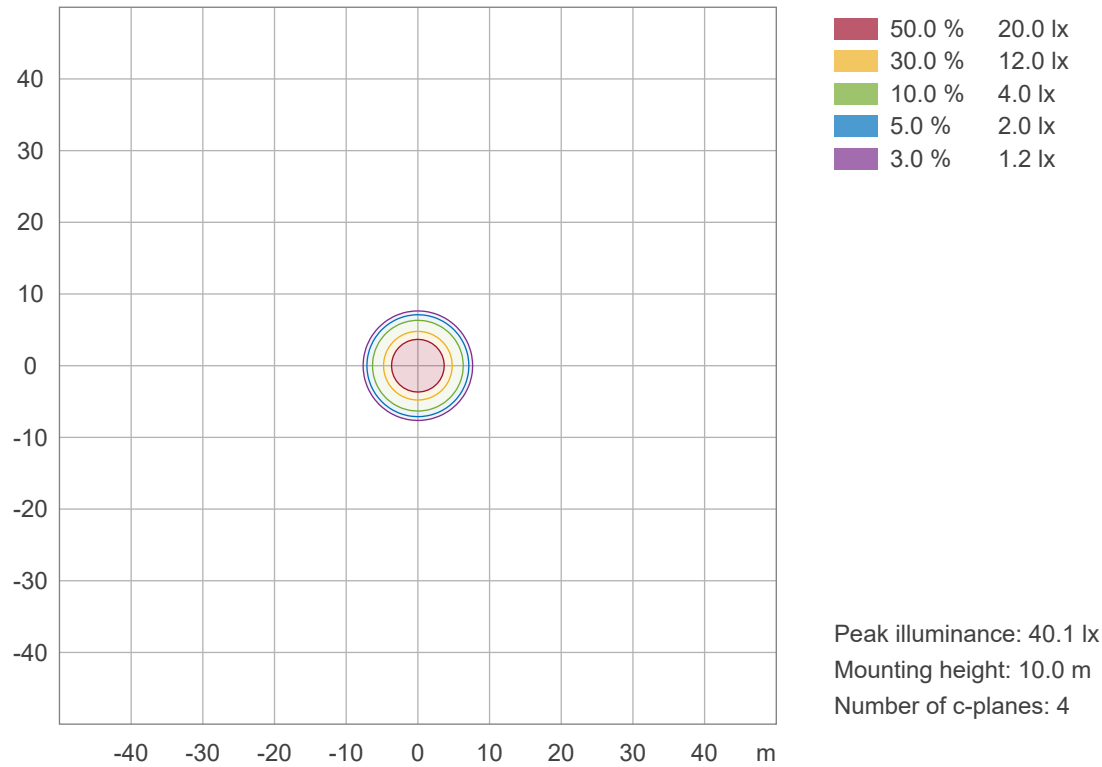
Linear distribution diagram - Intensity (candela) vs γ-angle



Iso-intensity Diagram (Iso-candela)



Iso-illuminance Diagram (Iso-lux)

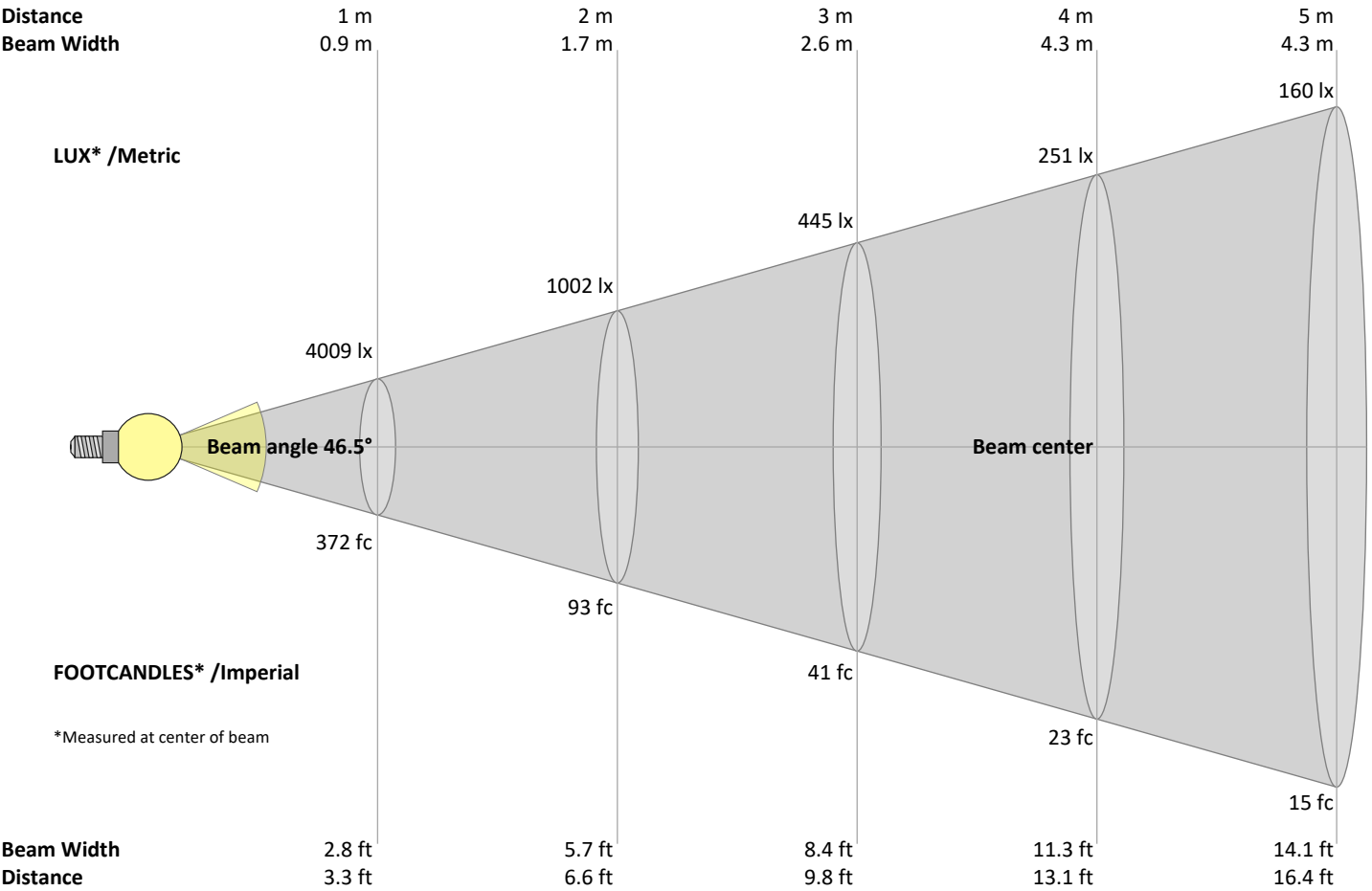


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Beam Details



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 |
| 4009 | 1002 | 445 | 251 | 160 | 111 | 82 | 63 | 49 | 40 | 33 | 28 | 24 | 20 | 18 | 16 | 14 | 12 | 11 | 10 | lux |
| 372.5 | 93.1 | 41.4 | 23.3 | 14.9 | 10.3 | 7.6 | 5.8 | 4.6 | 3.7 | 3.1 | 2.6 | 2.2 | 1.9 | 1.7 | 1.5 | 1.3 | 1.1 | 1 | 0.9 | 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 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|----------|
| 4009 | 3980 | 3902 | 3786 | 3645 | 3485 | 3307 | 3112 | 2903 | 2683 | 2446 | 2184 | 1892 | 1574 | 1253 | 957 | 702 | 492 | 328 | 209 | cd |
| 100% | 99% | 97% | 94% | 91% | 87% | 82% | 78% | 72% | 67% | 61% | 54% | 47% | 39% | 31% | 24% | 18% | 12% | 8% | 5% | 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 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|----------|
| 4009 | 3980 | 3902 | 3786 | 3645 | 3485 | 3307 | 3112 | 2903 | 2683 | 2446 | 2184 | 1892 | 1574 | 1253 | 957 | 702 | 492 | 328 | 209 | cd |
| 100% | 99% | 97% | 94% | 91% | 87% | 82% | 78% | 72% | 67% | 61% | 54% | 47% | 39% | 31% | 24% | 18% | 12% | 8% | 5% | 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 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|----------|
| 4009 | 3980 | 3902 | 3786 | 3645 | 3485 | 3307 | 3112 | 2903 | 2683 | 2446 | 2184 | 1892 | 1574 | 1253 | 957 | 702 | 492 | 328 | 209 | cd |
| 100% | 99% | 97% | 94% | 91% | 87% | 82% | 78% | 72% | 67% | 61% | 54% | 47% | 39% | 31% | 24% | 18% | 12% | 8% | 5% | 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 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|----------|
| 4009 | 3980 | 3902 | 3786 | 3645 | 3485 | 3307 | 3112 | 2903 | 2683 | 2446 | 2184 | 1892 | 1574 | 1253 | 957 | 702 | 492 | 328 | 209 | cd |
| 100% | 99% | 97% | 94% | 91% | 87% | 82% | 78% | 72% | 67% | 61% | 54% | 47% | 39% | 31% | 24% | 18% | 12% | 8% | 5% | of 0°val |

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Light Planning – UGR table

Uncorrected, comprehensive UGR table according to 117-1995

| Reflectances | | | | | | | | | | | |
|-------------------------------------|-----|--|------|------|------|------|--|------|------|------|------|
| p Ceiling | | 70 | 70 | 50 | 50 | 30 | 70 | 70 | 50 | 50 | 30 |
| p Walls | | 50 | 30 | 50 | 30 | 30 | 50 | 30 | 50 | 30 | 30 |
| p Floor | | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Room size | | Viewed Crosswise | | | | | Viewed Endwise | | | | |
| H = mounting height above eye level | | (Viewing direction orthogonal to lamp length axis) | | | | | (Viewing direction parallel to lamp length axis) | | | | |
| X | Y | | | | | | | | | | |
| 2H | 2H | 17.9 | 18.5 | 18.0 | 18.7 | 18.9 | 17.9 | 18.5 | 18.0 | 18.7 | 18.9 |
| | 3H | 17.9 | 18.6 | 18.2 | 18.8 | 19.0 | 17.9 | 18.6 | 18.2 | 18.8 | 19.0 |
| | 4H | 18.0 | 18.7 | 18.4 | 18.9 | 19.2 | 18.0 | 18.7 | 18.4 | 18.9 | 19.2 |
| | 6H | 18.4 | 19.0 | 18.7 | 19.3 | 19.7 | 18.4 | 19.0 | 18.7 | 19.3 | 19.7 |
| | 8H | 18.8 | 19.3 | 19.1 | 19.6 | 20.0 | 18.8 | 19.3 | 19.1 | 19.6 | 20.0 |
| | 12H | 19.2 | 19.8 | 19.6 | 20.1 | 20.6 | 19.2 | 19.8 | 19.6 | 20.1 | 20.6 |
| 4H | 2H | 17.6 | 18.3 | 18.0 | 18.6 | 18.8 | 17.6 | 18.3 | 18.0 | 18.6 | 18.8 |
| | 3H | 17.9 | 18.4 | 18.2 | 18.8 | 19.2 | 17.9 | 18.4 | 18.2 | 18.8 | 19.2 |
| | 4H | 18.1 | 18.6 | 18.5 | 19.0 | 19.5 | 18.1 | 18.6 | 18.5 | 19.0 | 19.5 |
| | 6H | 18.7 | 19.2 | 19.2 | 19.6 | 19.9 | 18.7 | 19.2 | 19.2 | 19.6 | 19.9 |
| | 8H | 19.2 | 19.7 | 19.7 | 20.1 | 20.4 | 19.2 | 19.7 | 19.7 | 20.1 | 20.4 |
| | 12H | 20.0 | 20.4 | 20.5 | 20.8 | 21.2 | 20.0 | 20.4 | 20.5 | 20.8 | 21.2 |
| 8H | 4H | 18.2 | 18.7 | 18.7 | 19.0 | 19.4 | 18.2 | 18.7 | 18.7 | 19.0 | 19.4 |
| | 6H | 19.1 | 19.4 | 19.6 | 19.9 | 20.4 | 19.1 | 19.4 | 19.6 | 19.9 | 20.4 |
| | 8H | 19.9 | 20.2 | 20.4 | 20.7 | 21.3 | 19.9 | 20.2 | 20.4 | 20.7 | 21.3 |
| | 12H | 20.9 | 21.2 | 21.5 | 21.7 | 22.3 | 20.9 | 21.2 | 21.5 | 21.7 | 22.3 |
| 12H | 4H | 18.2 | 18.6 | 18.7 | 19.0 | 19.5 | 18.2 | 18.6 | 18.7 | 19.0 | 19.5 |
| | 6H | 19.3 | 19.5 | 19.8 | 20.1 | 20.7 | 19.3 | 19.5 | 19.8 | 20.1 | 20.7 |
| | 8H | 20.2 | 20.4 | 20.8 | 20.9 | 21.5 | 20.2 | 20.4 | 20.8 | 20.9 | 21.5 |

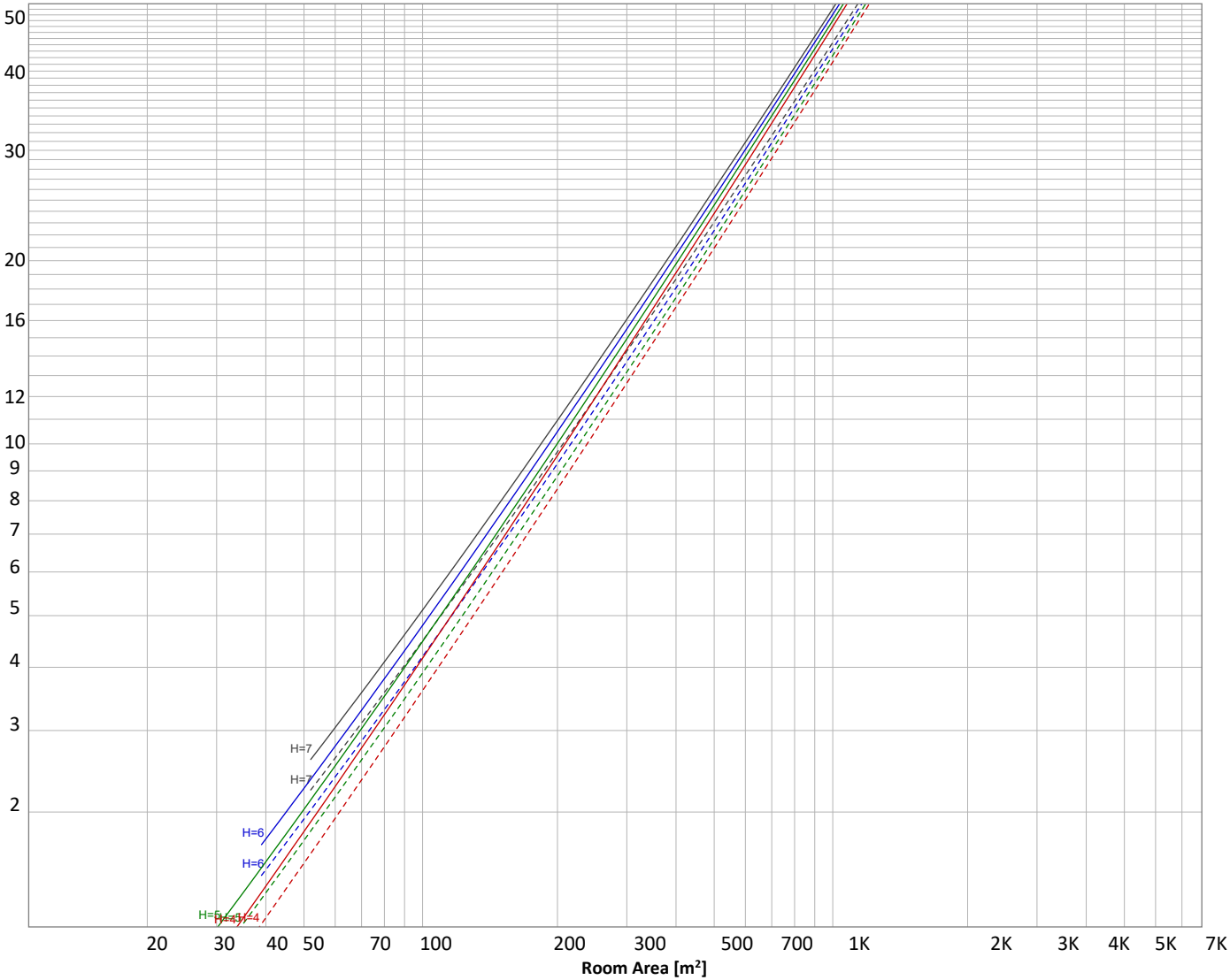
Variations with the observer position for the luminaire spacings, S:

| | | |
|----------|------------|------------|
| S = 1.0H | 2.6 / -0.9 | 2.6 / -0.9 |
| S = 1.5H | 4.7 / -1.0 | 4.7 / -1.0 |
| S = 2.0H | 6.4 / -1.1 | 6.4 / -1.1 |

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 | 110 | 110 | 110 | 105 | 105 | 105 | 101 | 101 | 101 | 98 |
| 1 | 113 | 110 | 108 | 106 | 111 | 108 | 106 | 104 | 104 | 102 | 100 | 100 | 98 | 97 | 96 | 95 | 94 | 92 |
| 2 | 108 | 103 | 100 | 96 | 106 | 102 | 98 | 95 | 98 | 95 | 93 | 95 | 93 | 91 | 92 | 90 | 88 | 87 |
| 3 | 103 | 97 | 93 | 89 | 101 | 96 | 91 | 88 | 93 | 89 | 86 | 90 | 87 | 85 | 88 | 85 | 83 | 82 |
| 4 | 99 | 92 | 87 | 83 | 97 | 90 | 86 | 82 | 88 | 84 | 81 | 86 | 83 | 80 | 84 | 81 | 79 | 77 |
| 5 | 94 | 87 | 81 | 77 | 93 | 86 | 81 | 77 | 84 | 79 | 76 | 82 | 78 | 75 | 80 | 77 | 75 | 73 |
| 6 | 90 | 82 | 77 | 73 | 89 | 81 | 76 | 72 | 80 | 75 | 72 | 78 | 74 | 71 | 77 | 73 | 71 | 69 |
| 7 | 86 | 78 | 73 | 69 | 85 | 77 | 72 | 68 | 76 | 71 | 68 | 75 | 71 | 68 | 73 | 70 | 67 | 66 |
| 8 | 83 | 74 | 69 | 65 | 82 | 74 | 68 | 65 | 72 | 68 | 65 | 71 | 67 | 64 | 70 | 67 | 64 | 63 |
| 9 | 80 | 71 | 65 | 62 | 78 | 70 | 65 | 62 | 69 | 65 | 61 | 68 | 64 | 61 | 67 | 64 | 61 | 60 |
| 10 | 76 | 68 | 62 | 59 | 75 | 67 | 62 | 59 | 66 | 62 | 58 | 65 | 61 | 58 | 65 | 61 | 58 | 57 |

Luminaire budgetary diagram
Uncorrected, comprehensive UGR table according to 117-1995
LAMPS (number of lamps)



| Conditions | | ρ(%) | | | |
|---|----------------|-----------|---------------------|------------------|-------------------|
| H = Room height | Flux = 2376 lm | Line type | Ceiling reflectance | Wall reflectance | Floor reflectance |
| H _{down} = Lamp distance from ceiling = | 0.00 m | ----- | 70 | 50 | 30 |
| H _{work} = Work area height from floor = | 0.00 m | ————— | 50 | 30 | 20 |
| E _{work} = Average lux on work area = | 100 lx | | | | |

Zonal Lumen Summary

| | | | | | | | | |
|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 0°-10° | 10°-20° | 20°-30° | 30°-40° | 40°-50° | 50°-60° | 60°-70° | 70°-80° | 80°-90° |
| 355 lm | 833 lm | 775 lm | 271 lm | 38.2 lm | 13.9 lm | 14.6 lm | 15.4 lm | 20.1 lm |
| 90°-100° | 100°-110° | 110°-120° | 120°-130° | 130°-140° | 140°-150° | 150°-160° | 160°-170° | 170°-180° |
| 7.91 lm | 6.45 lm | 6.05 lm | 5.47 lm | 4.72 lm | 3.83 lm | 2.82 lm | 1.73 lm | 0.582 lm |

Outdoor Light Planning

Lumen per Zone

| Zone (γ) | Lumen | % Total |
|----------|---------|---------|
| 0-10° | 355 lm | 15.0% |
| 10-20° | 833 lm | 35.0% |
| 20-30° | 775 lm | 32.6% |
| 30-40° | 271 lm | 11.4% |
| 40-50° | 38 lm | 1.6% |
| 50-60° | 14 lm | 0.6% |
| 60-70° | 15 lm | 0.6% |
| 70-80° | 15 lm | 0.6% |
| 80-90° | 20 lm | 0.8% |
| 90-100° | 8 lm | 0.3% |
| 100-110° | 6 lm | 0.3% |
| 110-120° | 6 lm | 0.3% |
| 120-130° | 5 lm | 0.2% |
| 130-140° | 5 lm | 0.2% |
| 140-150° | 4 lm | 0.2% |
| 150-160° | 3 lm | 0.1% |
| 160-170° | 2 lm | 0.1% |
| 170-180° | 1 lm | 0.0% |
| Total | 2376 lm | 100.0% |

Intensity peaks

| | |
|----------------|---------|
| Max intensity | 4009 cd |
| Intensity, 90° | 15 cd |
| Intensity, 0° | 4009 cd |

Zonal Lumen summary

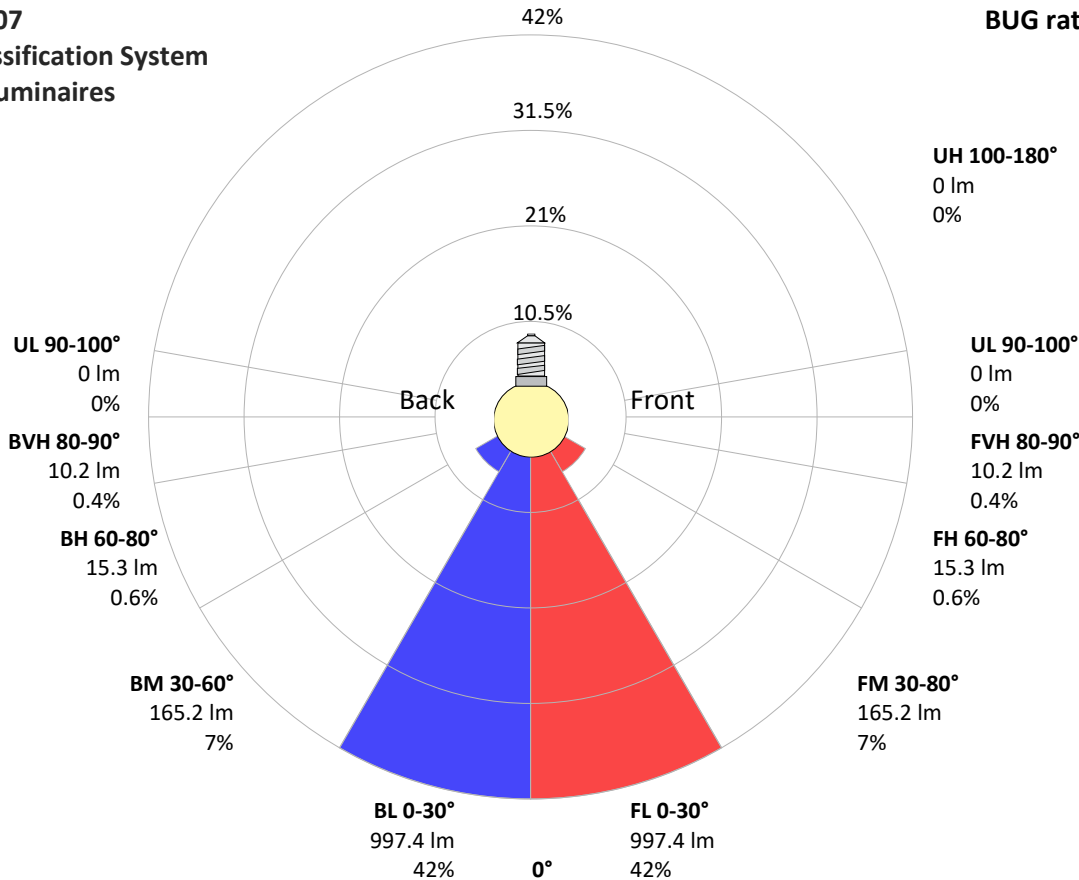
| Zone (γ) | Lumen | % Total |
|----------|---------|---------|
| 0-30° | 1963 lm | 82.6% |
| 0-40° | 2234 lm | 94.0% |
| 0-60° | 2286 lm | 96.2% |
| 60-90° | 50 lm | 2.1% |
| 70-100° | 43 lm | 1.8% |
| 90-120° | 20 lm | 0.9% |
| 0-90° | 2336 lm | 98.3% |
| 90-180° | 40 lm | 1.7% |
| 0-180° | 2376 lm | 100.0% |

BUG rating

| | Lumen | % Total |
|----------------------|--------|---------|
| Forward light | | |
| Low(0-30°) | 997 lm | 42.0% |
| Medium(30-60°) | 165 lm | 7.0% |
| High(60-80°) | 15 lm | 0.6% |
| Very high(80-90°) | 10 lm | 0.4% |
| Back light | | |
| Low(0-30°) | 997 lm | 42.0% |
| Medium(30-60°) | 165 lm | 7.0% |
| High(60-80°) | 15 lm | 0.6% |
| Very high(80-90°) | 10 lm | 0.4% |
| Uplight | | |
| Low(90-100°) | 0 lm | 0.0% |
| High(100-180°) | 0 lm | 0.0% |

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

BUG rating B2 U1 G1



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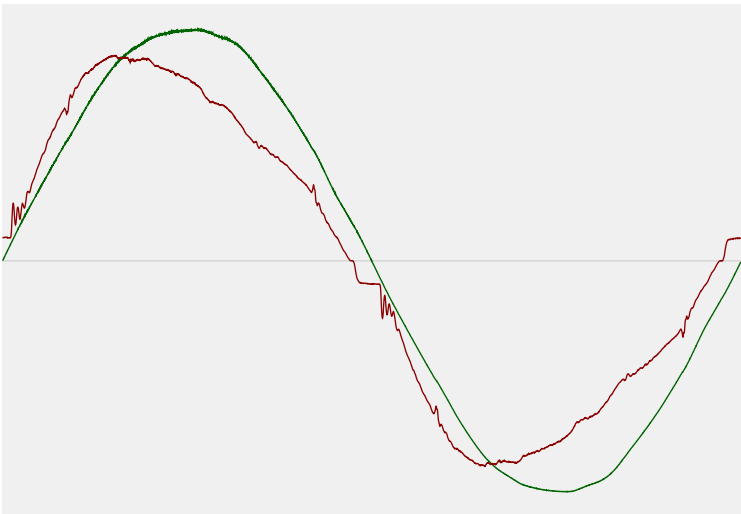


Power Details

Input Power

| | |
|---|----------|
| Power feed to light source | 41.3 W |
| Frequency of input power | 50 Hz |
| RMS Input voltage feed, V_{RMS} | 239 V |
| RMS Input current feed, I_{RMS} | 0.179 A |
| Volt-Ampere or apparent power = $V_{RMS} * I_{RMS}$ | 42.74 VA |
| Displacement factor of AC power feed | 0.97 |
| Power factor of AC current feed | 0.97 |
| Total harmonic distortion of the current | 10.93% |
| Total harmonic distortion of the voltage | 1.21% |

Input Power Curve



Efficiency

| | |
|---------------------------|---------|
| Radiated power efficiency | 20.8% |
| Lumen efficiency | 57 lm/W |

Goniophotometry Report

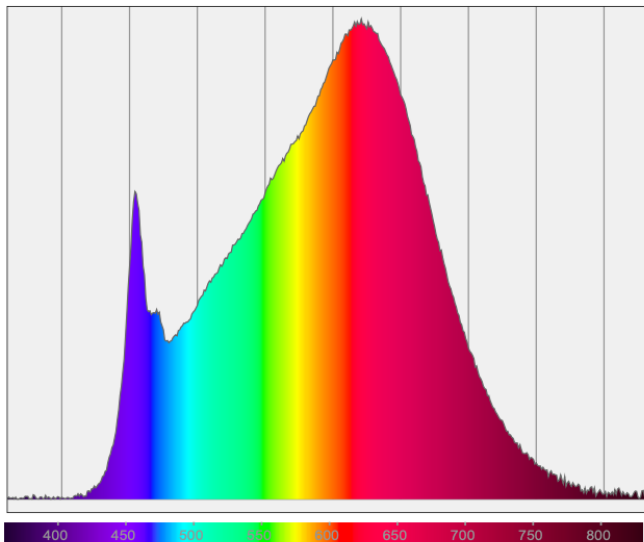
1_PHOT_SKIN+BONES-4300lmChip-3000K-58Deg-HoneycombLouve_2303
www.factorylux.com



Color Measurements

| | |
|------------------------------|---|
| Correlated Color Temperature | CCT = 3000 K |
| Color Rendering TM30-18 | R _f 91.0 — R _g 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 _f 91.0 — R _g 97.7 | Color coordinate CIEs 1976 (CIELUV) | (u';v') = (0.251;0.251) |
| Color Quality Scale | CQS = 91.8 | | |

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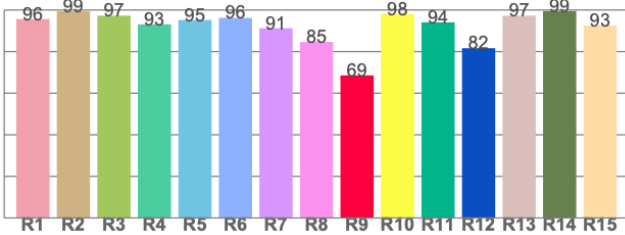
CIE 1931



CIE 1931 – zoomed on Planckian locus



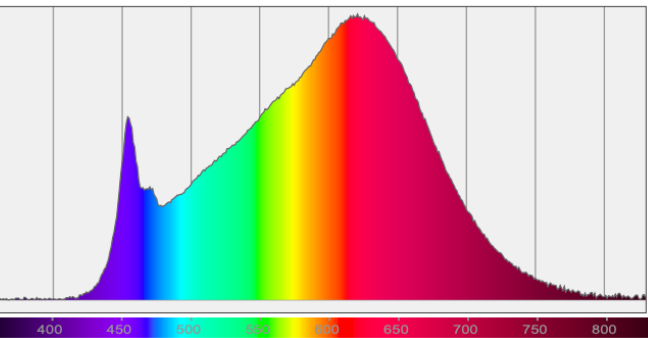
Color Rendering Index per reference color (CIE 1995)



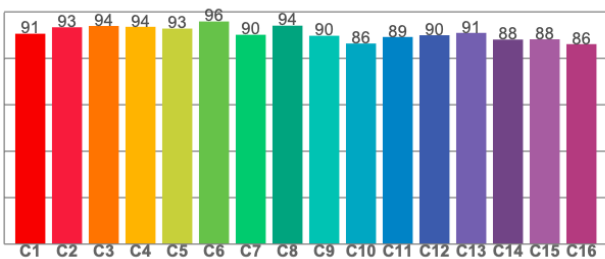
CRI R values, only R1-R8 are used to calculate final CRI value

| 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%



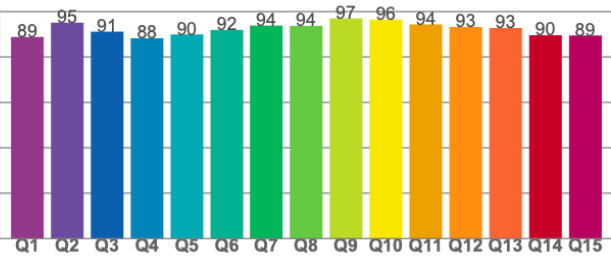
TM30-18 Rf-values per hue bin



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 |