

Goniophotometry Report

1_PHOT_SKIN+BONES-4050lmChip-2700K-21Deg_2303
www.factorylux.com



Tested Light Source - 1_PHOT_SKIN+BONES-4050lmChip-2700K-21Deg_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

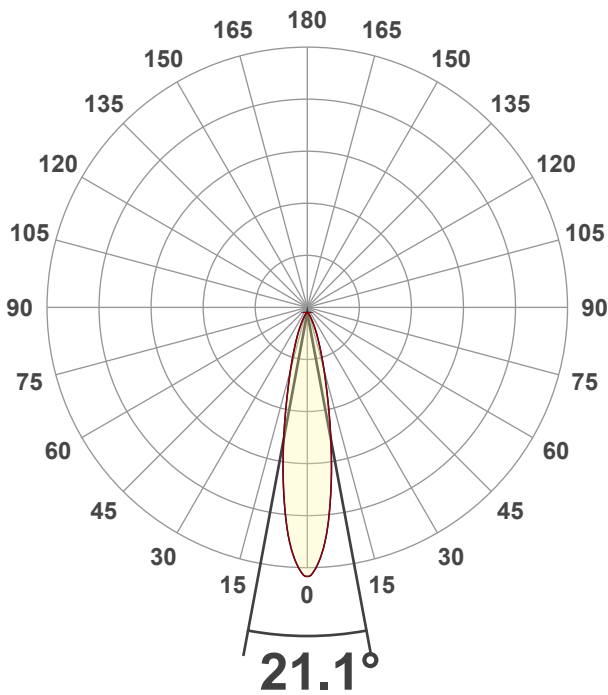
4 planes – 90°
1°
1.50 m
41.4 W – PF 0.97 – DPF 0.97
242 V – 0.177 A
50 Hz

Main Light Measurement Results

Output
Efficiency
Peak Intensity and Beam Angle
Color Rendering Index

3579 lm
86 lm/W
15927 cd – 21.1°
CRI 92.7

Light Intensity Distribution



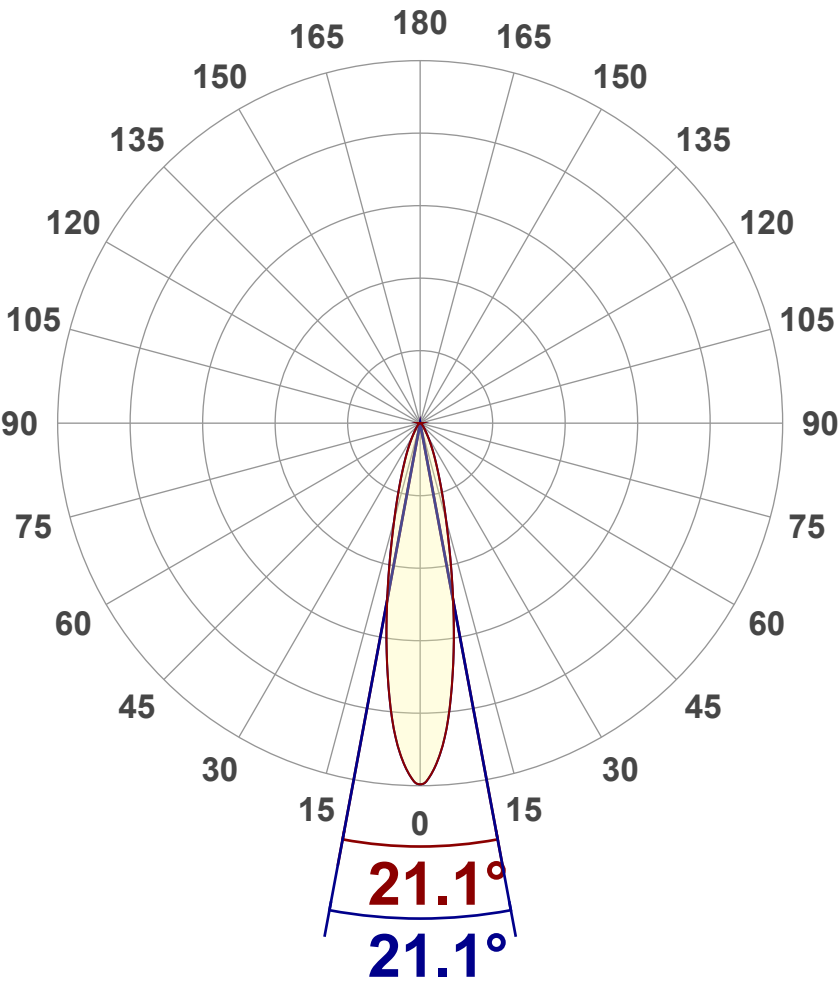
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Luminous Intensity diagram

Unit: 0-100% of peak intensity



Main Values

Output (total Lumen)	3579 lm
Peak Intensity	15927 cd
Beam Angle (50%)	21.1°
Beam Angle (90%)	21.1°
Beam Angle (10%)	21.1°

Cut-off Angle

Average 2,5%	69.8°
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Field Angle

Average 10%	46.4°
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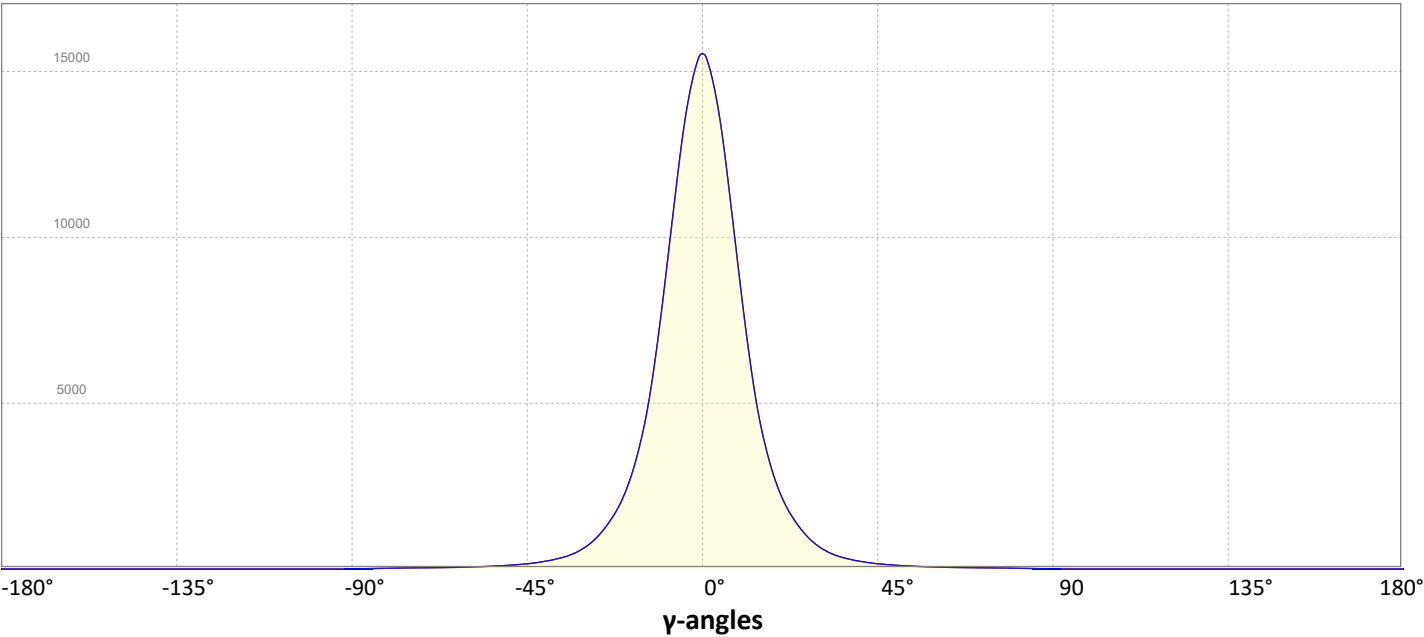
Intensity Ratio

In 120° cone	96.5%
In 90° cone	92.7%

C000-C180

C090-C270

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

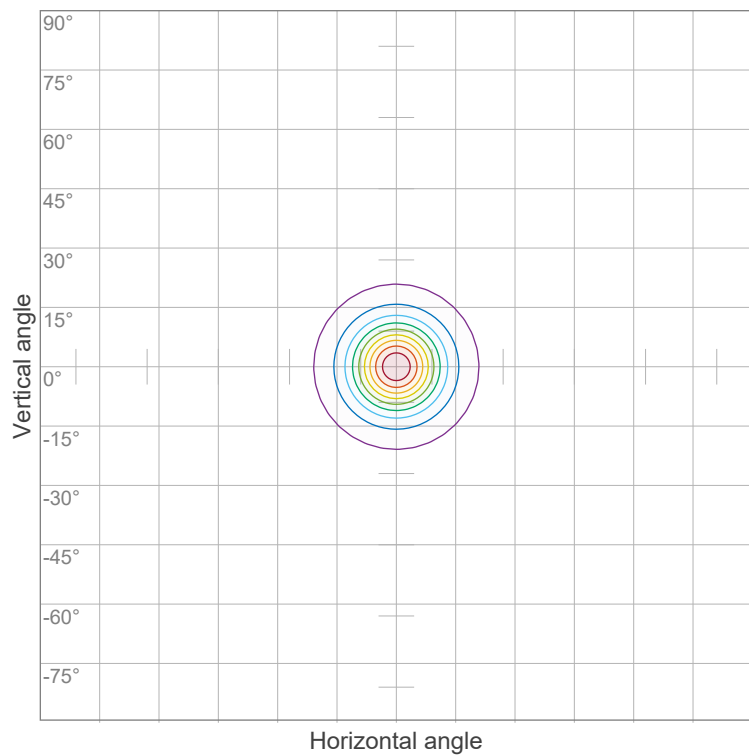


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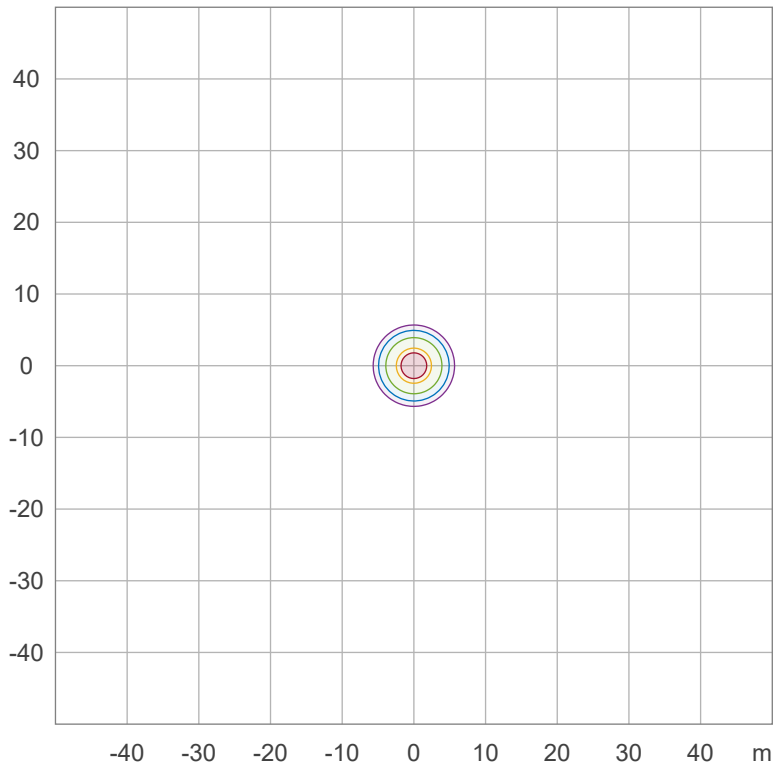
Iso-intensity Diagram (Iso-candela)



90 %	14334.3 cd
80 %	12741.6 cd
70 %	11148.9 cd
60 %	9556.2 cd
50 %	7963.5 cd
40 %	6370.8 cd
30 %	4778.1 cd
20 %	3185.4 cd
10 %	1592.7 cd

Peak intensity: 15927.0 cd
Number of c-planes: 4

Iso-illuminance Diagram (Iso-lux)



50.0 %	79.6 lx
30.0 %	47.8 lx
10.0 %	15.9 lx
5.0 %	8.0 lx
3.0 %	4.8 lx

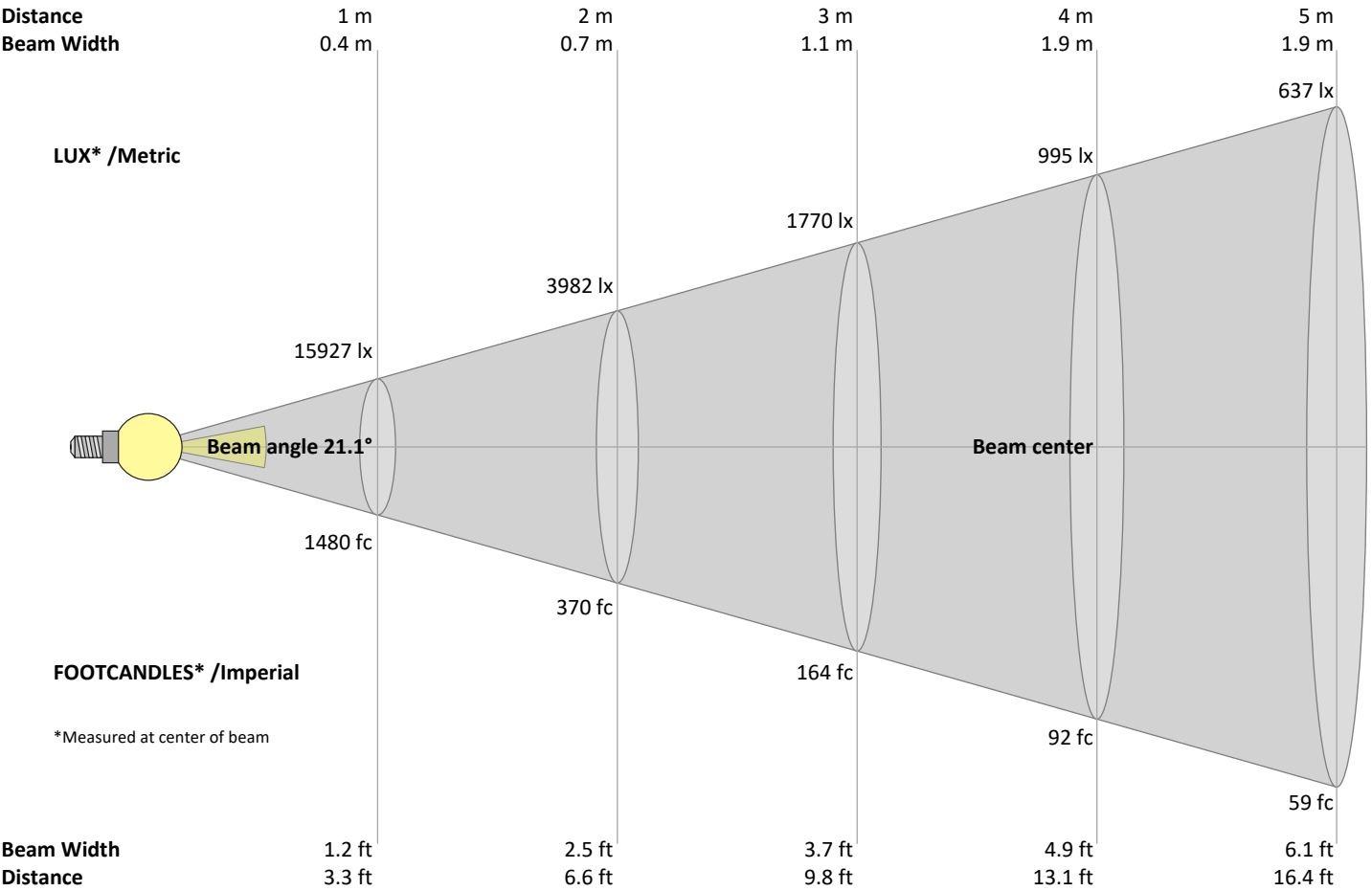
Peak illuminance: 159.3 lx
Mounting height: 10.0 m
Number of c-planes: 4

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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
15927	3982	1770	995	637	442	325	249	197	159	132	111	94	81	71	62	55	49	44	40	lux
1479.7	369.9	164.4	92.5	59.2	41.1	30.2	23.1	18.3	14.8	12.2	10.3	8.8	7.5	6.6	5.8	5.1	4.6	4.1	3.7	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
15.9K	15.4K	14.3K	12.6K	10.6K	8.5K	6.6K	5.1K	3.9K	3.0K	2.3K	1.8K	1.4K	1.1K	0.9K	0.7K	0.5K	0.4K	0.4K	0.3K	cd
100%	97%	90%	79%	66%	53%	42%	32%	24%	19%	15%	11%	9%	7%	6%	4%	3%	3%	2%	2%	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
15.9K	15.4K	14.3K	12.6K	10.6K	8.5K	6.6K	5.1K	3.9K	3.0K	2.3K	1.8K	1.4K	1.1K	0.9K	0.7K	0.5K	0.4K	0.4K	0.3K	cd
100%	97%	90%	79%	66%	53%	42%	32%	24%	19%	15%	11%	9%	7%	6%	4%	3%	3%	2%	2%	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
15.9K	15.4K	14.3K	12.6K	10.6K	8.5K	6.6K	5.1K	3.9K	3.0K	2.3K	1.8K	1.4K	1.1K	0.9K	0.7K	0.5K	0.4K	0.4K	0.3K	cd
100%	97%	90%	79%	66%	53%	42%	32%	24%	19%	15%	11%	9%	7%	6%	4%	3%	3%	2%	2%	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
15.9K	15.4K	14.3K	12.6K	10.6K	8.5K	6.6K	5.1K	3.9K	3.0K	2.3K	1.8K	1.4K	1.1K	0.9K	0.7K	0.5K	0.4K	0.4K	0.3K	cd
100%	97%	90%	79%	66%	53%	42%	32%	24%	19%	15%	11%	9%	7%	6%	4%	3%	3%	2%	2%	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	19.6	20.1	19.6	20.3	20.5	19.6	20.1	19.6	20.3	20.5
	3H	20.1	20.8	20.5	21.0	21.1	20.1	20.8	20.5	21.0	21.1
	4H	20.5	21.2	20.9	21.4	21.6	20.5	21.2	20.9	21.4	21.6
	6H	21.0	21.6	21.3	21.9	22.2	21.0	21.6	21.3	21.9	22.2
	8H	21.2	21.7	21.5	22.1	22.5	21.2	21.7	21.5	22.1	22.5
	12H	21.4	21.9	21.7	22.2	22.7	21.4	21.9	21.7	22.2	22.7
4H	2H	19.6	20.3	20.0	20.5	20.7	19.6	20.3	20.0	20.5	20.7
	3H	20.6	21.1	21.0	21.5	21.9	20.6	21.1	21.0	21.5	21.9
	4H	21.1	21.6	21.6	22.0	22.5	21.1	21.6	21.6	22.0	22.5
	6H	21.8	22.3	22.3	22.6	23.0	21.8	22.3	22.3	22.6	23.0
	8H	22.0	22.5	22.5	22.8	23.2	22.0	22.5	22.5	22.8	23.2
	12H	22.2	22.6	22.7	23.0	23.5	22.2	22.6	22.7	23.0	23.5
8H	4H	21.4	21.8	21.9	22.2	22.5	21.4	21.8	21.9	22.2	22.5
	6H	22.2	22.5	22.7	23.0	23.5	22.2	22.5	22.7	23.0	23.5
	8H	22.6	22.9	23.1	23.4	24.0	22.6	22.9	23.1	23.4	24.0
	12H	22.9	23.1	23.5	23.7	24.3	22.9	23.1	23.5	23.7	24.3
12H	4H	21.4	21.7	21.9	22.1	22.6	21.4	21.7	21.9	22.1	22.6
	6H	22.3	22.5	22.8	23.1	23.7	22.3	22.5	22.8	23.1	23.7
	8H	22.7	22.9	23.3	23.4	24.0	22.7	22.9	23.3	23.4	24.0

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

S = 1.0H	0.8 / -0.5	0.8 / -0.5
S = 1.5H	1.8 / -0.7	1.8 / -0.7
S = 2.0H	2.9 / -1.0	2.9 / -1.0

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	99
1	114	111	109	107	111	109	107	105	105	103	102	101	100	99	98	97	96	94
2	109	105	101	98	107	103	100	97	100	97	95	97	95	93	94	92	91	89
3	105	99	95	91	103	98	94	91	95	92	89	93	90	88	91	88	86	85
4	101	94	90	86	99	93	89	86	91	87	85	89	86	84	87	85	83	81
5	97	90	85	82	96	89	85	81	87	84	81	86	82	80	84	81	79	78
6	94	86	81	78	92	86	81	78	84	80	77	83	79	77	82	78	76	75
7	91	83	78	75	89	82	78	74	81	77	74	80	76	74	79	76	73	72
8	88	80	75	72	87	79	75	72	78	74	71	77	74	71	77	73	71	70
9	85	77	72	69	84	77	72	69	76	72	69	75	71	69	74	71	68	67
10	82	75	70	67	82	74	70	67	74	69	67	73	69	67	72	69	66	65

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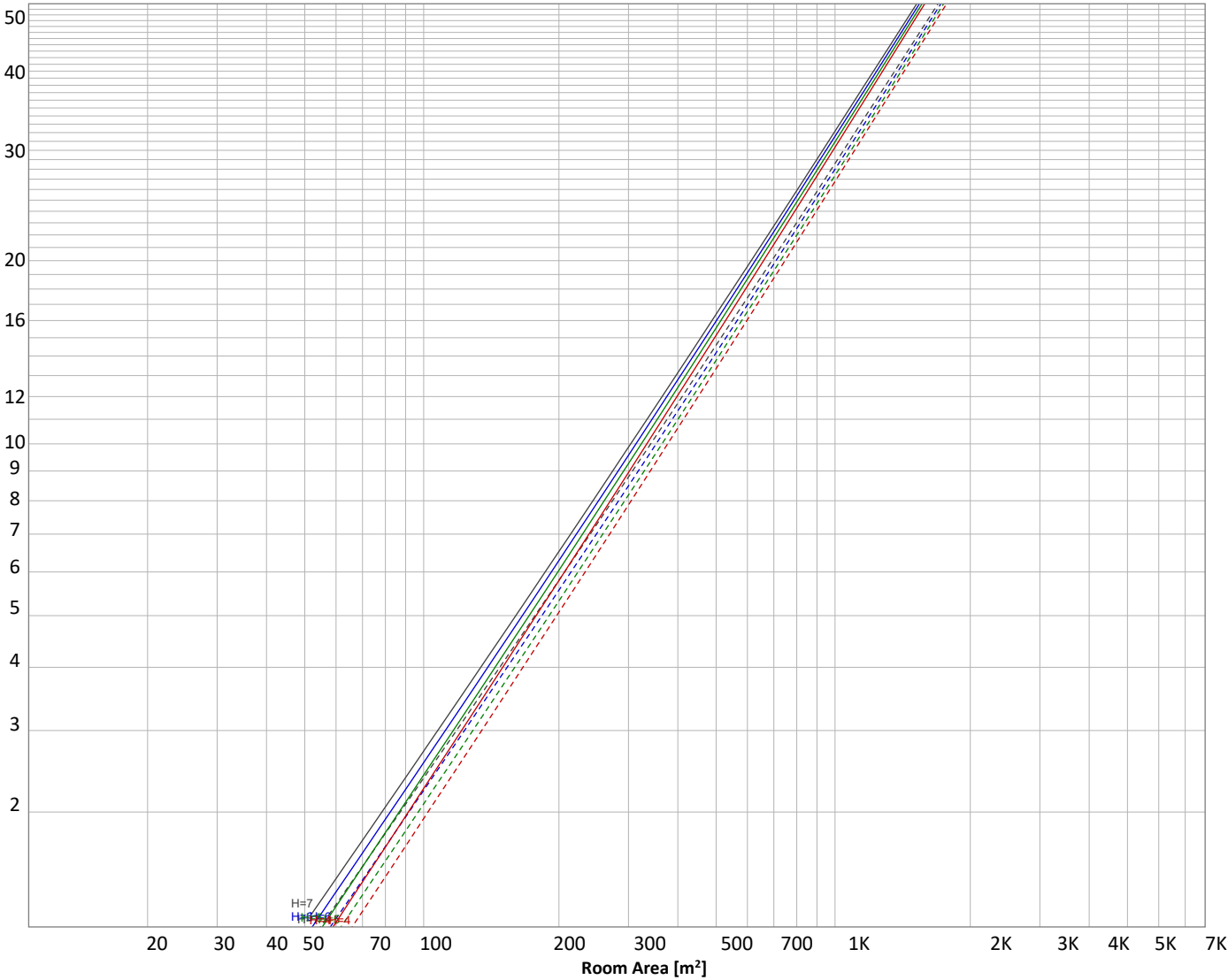
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Luminaire budgetary diagram

Uncorrected, comprehensive UGR table according to 117-1995

LAMPS (number of lamps)



Conditions

H = Room height	Flux = 3579 lm	p(%)		
H _{down} = Lamp distance from ceiling =	0.00 m	Line type	Ceiling reflectance	Wall reflectance
H _{work} = Work area height from floor =	0.00 m	-----	70	50
E _{work} = Average lux on work area =	100 lx	-----	50	30
				Floor reflectance
				30
				20

Zonal Lumen Summary

0°-10°	10°-20°	20°-30°	30°-40°	40°-50°	50°-60°	60°-70°	70°-80°	80°-90°
1120 lm	1259 lm	604 lm	258 lm	134 lm	77.7 lm	51.3 lm	37.3 lm	19.2 lm
90°-100°	100°-110°	110°-120°	120°-130°	130°-140°	140°-150°	150°-160°	160°-170°	170°-180°
3.75 lm	2.99 lm	2.80 lm	2.53 lm	2.19 lm	1.77 lm	1.31 lm	0.801 lm	0.270 lm

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Outdoor Light Planning

Lumen per Zone

Zone (γ)	Lumen	% Total
0-10°	1120 lm	31.3%
10-20°	1259 lm	35.2%
20-30°	604 lm	16.9%
30-40°	258 lm	7.2%
40-50°	134 lm	3.8%
50-60°	78 lm	2.2%
60-70°	51 lm	1.4%
70-80°	37 lm	1.0%
80-90°	19 lm	0.5%
90-100°	4 lm	0.1%
100-110°	3 lm	0.1%
110-120°	3 lm	0.1%
120-130°	3 lm	0.1%
130-140°	2 lm	0.1%
140-150°	2 lm	0.0%
150-160°	1 lm	0.0%
160-170°	1 lm	0.0%
170-180°	0 lm	0.0%
Total	3579 lm	100.0%

Intensity peaks

Max intensity	15927 cd
Intensity, 90°	6 cd
Intensity, 0°	15927 cd

Zonal Lumen summary

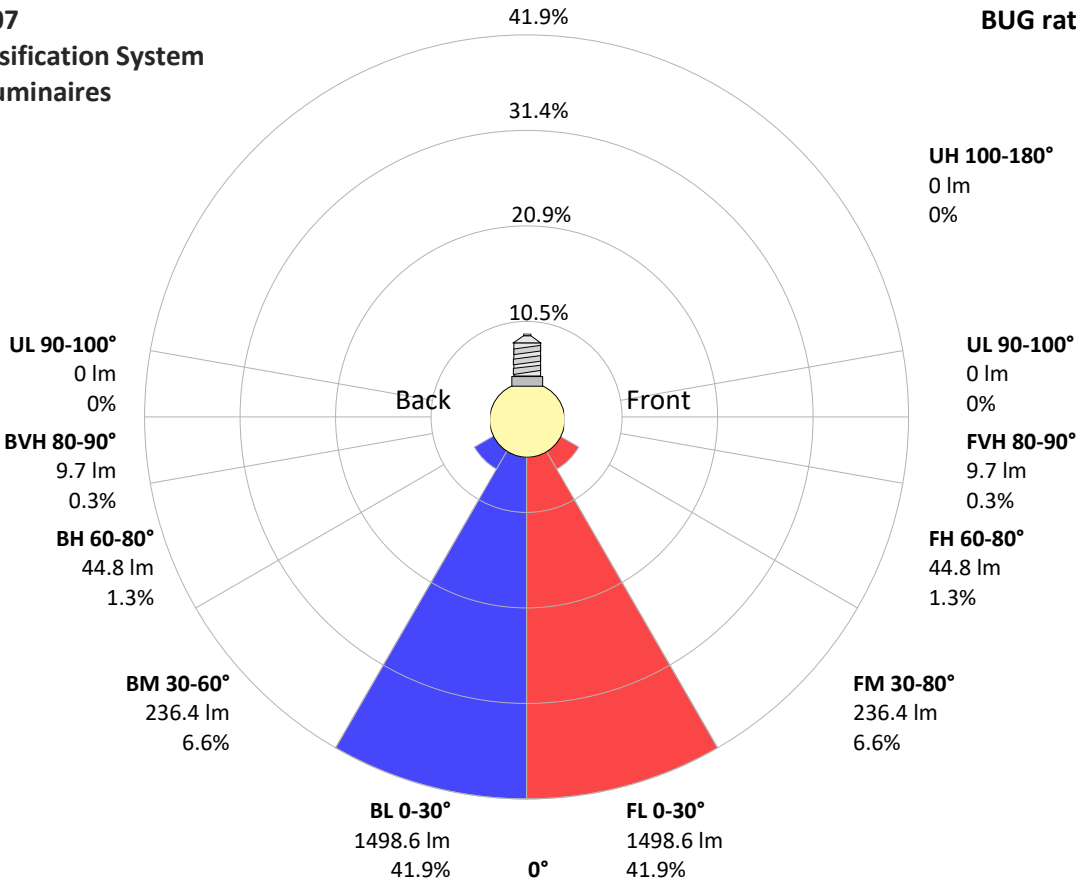
Zone (γ)	Lumen	% Total
0-30°	2983 lm	83.3%
0-40°	3241 lm	90.6%
0-60°	3453 lm	96.5%
60-90°	108 lm	3.0%
70-100°	60 lm	1.7%
90-120°	10 lm	0.3%
0-90°	3561 lm	99.5%
90-180°	18 lm	0.5%
0-180°	3579 lm	100.0%

BUG rating

	Lumen	% Total
Forward light		
Low(0-30°)	1499 lm	41.9%
Medium(30-60°)	236 lm	6.6%
High(60-80°)	45 lm	1.3%
Very high(80-90°)	10 lm	0.3%
Back light		
Low(0-30°)	1499 lm	41.9%
Medium(30-60°)	236 lm	6.6%
High(60-80°)	45 lm	1.3%
Very high(80-90°)	10 lm	0.3%
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 B3 U1 G0



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Power Details

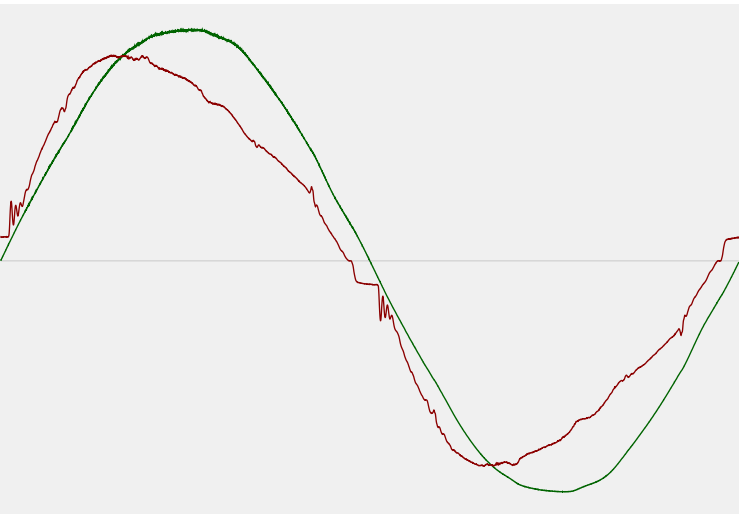
Input Power

Power feed to light source	41.4 W
Frequency of input power	50 Hz
RMS Input voltage feed, V_{RMS}	242 V
RMS Input current feed, I_{RMS}	0.177 A
Volt-Ampere or apparent power = $V_{RMS} \cdot I_{RMS}$	42.86 VA
Displacement factor of AC power feed	0.97
Power factor of AC current feed	0.97
Total harmonic distortion of the current	10.87%
Total harmonic distortion of the voltage	1.24%

Efficiency

Radiated power efficiency	31.2%
<div><div></div></div>	
Lumen efficiency	86 lm/W
<div><div></div></div>	

Input Power Curve



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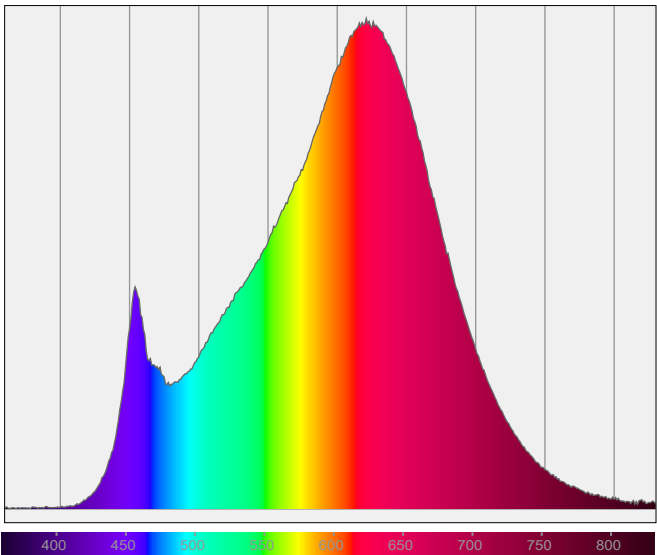
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Color Measurements

Correlated Color Temperature	CCT = 2700 K
Color Rendering TM30-18	R _f 91.6 — R _g 99.6
Color Shift, CIE duv	Duv ±0.0003

Spectral distribution



Color details

Correlated Color Temperature	CCT = 2700 K	Color coordinates CIE 1931	(x;y) = (0.460;0.411)
Color Rendering Index	CRI 92.7	Color coordinate CIEs 1960	(u;v) = (0.263;0.352)
Color Rendering Index, R9 (red component)	R9 = 61.6	Color deviation from BBL	Duv = ±0.0003
Color Rendering TM30-18	R _f 91.6 — R _g 99.6	Color coordinate CIEs 1976 (CIELUV)	(u';v') = (0.263;0.263)
Color Quality Scale	CQS = 90.0		

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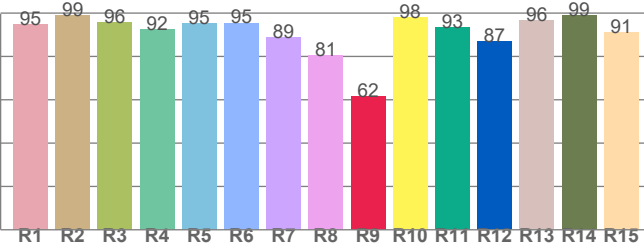
CIE 1931



CIE 1931 – zoomed on Planckian locus



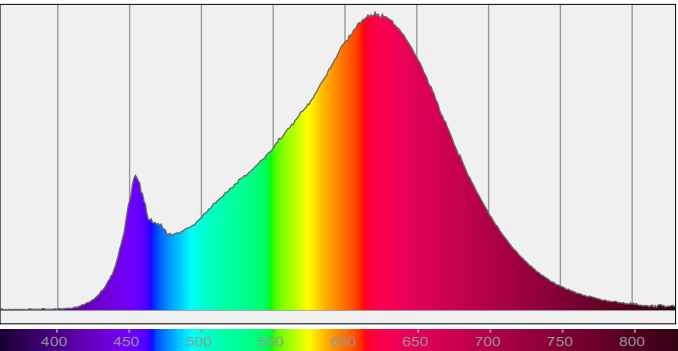
Color Rendering Index per reference color (CIE 1995)



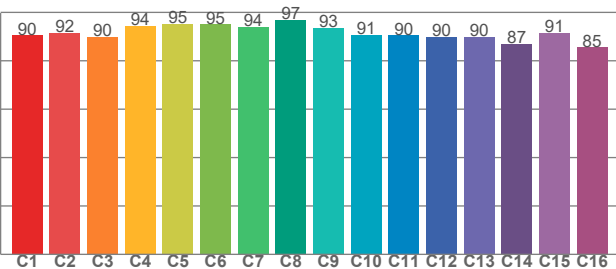
CRI R values, only R1-R8 are used to calculate final CRI value

R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
94.7	98.9	95.8	92.3	95.2	95.5	88.8	80.5	61.6	97.9	93.3	87.0	96.5	98.8	91.0

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



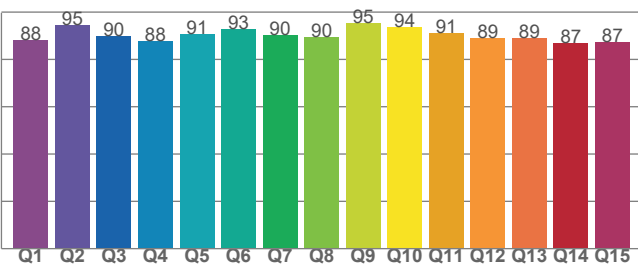
TM30-18 Rf-values per hue bin



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
90.4	91.5	89.8	94.5	95.3	95.0	93.9	96.7	93.5	90.6	90.5	89.7	89.8	87.0	91.4	85.5

Color Quality Scale by reference color



CQS Q values

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
88.1	94.6	89.8	87.9	90.8	92.9	90.2	89.5	95.3	93.7	91.1	89.1	88.8	87.0	87.1