

# Goniophotometry Report

1\_PHOT\_SKIN+BONES-4750lmChip-4000K-58Deg\_2303  
www.factorylux.com



Tested Light Source - 1\_PHOT\_SKIN+BONES-4750lmChip-4000K-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

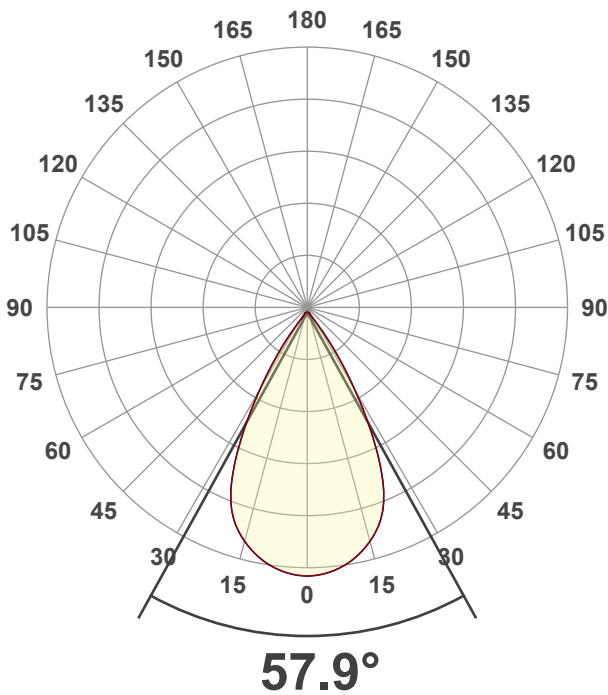
4 planes – 90°  
2.5°  
1.50 m  
41.3 W – PF 0.97 – DPF 0.97  
243 V – 0.176 A  
50.1 Hz

## Main Light Measurement Results

Output  
Efficiency  
Peak Intensity and Beam Angle  
Color Rendering Index

4207 lm  
102 lm/W  
4761 cd – 57.9°  
CRI 92.5

## Light Intensity Distribution



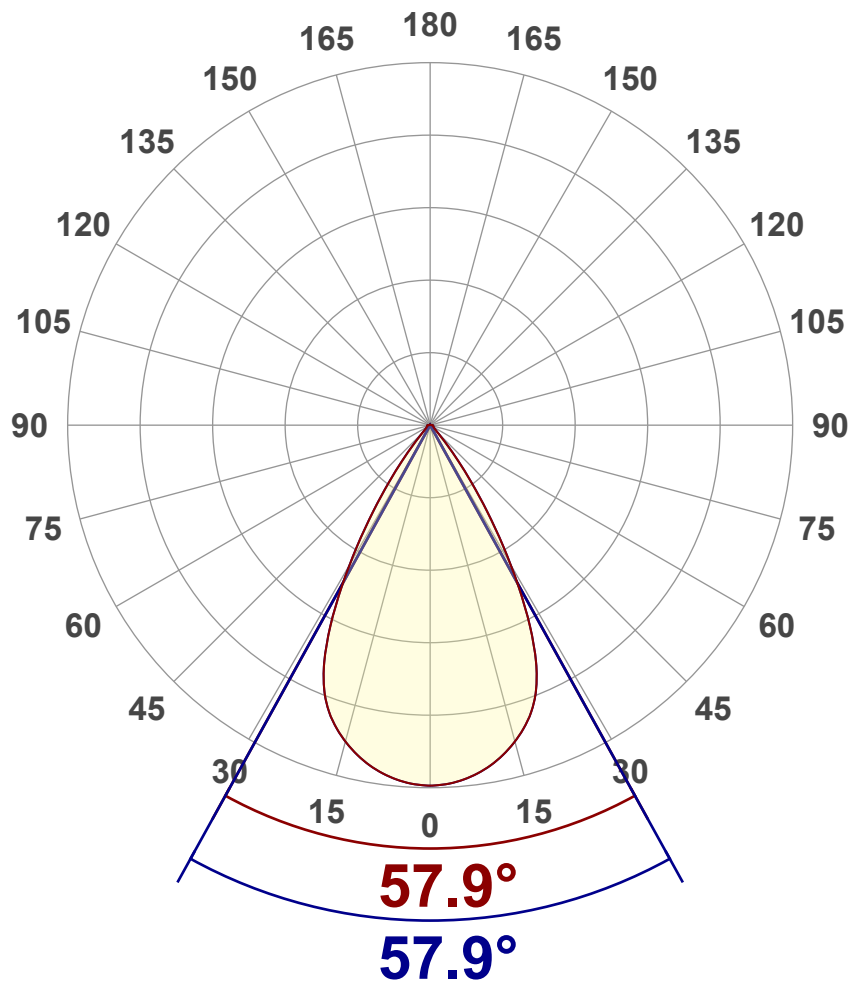
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## Luminous Intensity diagram

Unit: 0-100% of peak intensity



## Main Values

Output (total Lumen)	4207 lm
Peak Intensity	4761 cd
Beam Angle (50%)	57.9°
Beam Angle (90%)	57.9°
Beam Angle (10%)	57.9°

## Cut-off Angle

Average 2,5%	93.7°
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## Field Angle

Average 10%	78.7°
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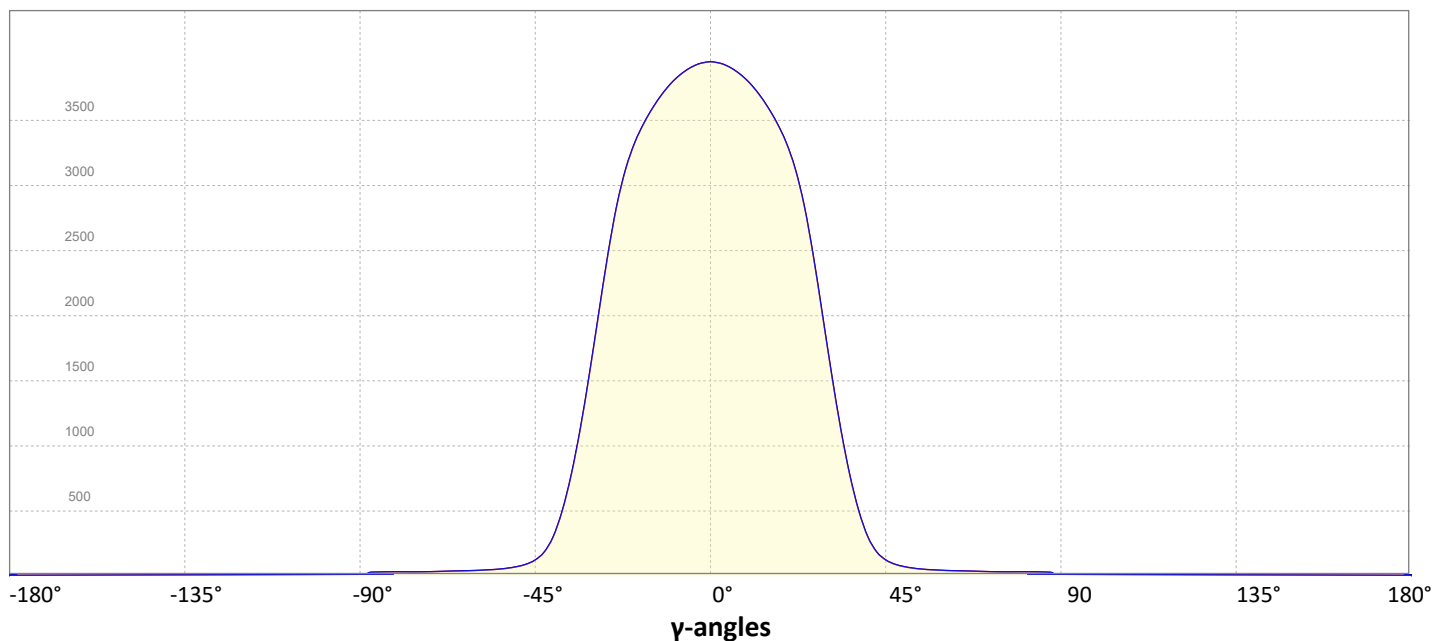
## Intensity Ratio

In 120° cone	94.8%
In 90° cone	92.4%

C000-C180

C090-C270

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

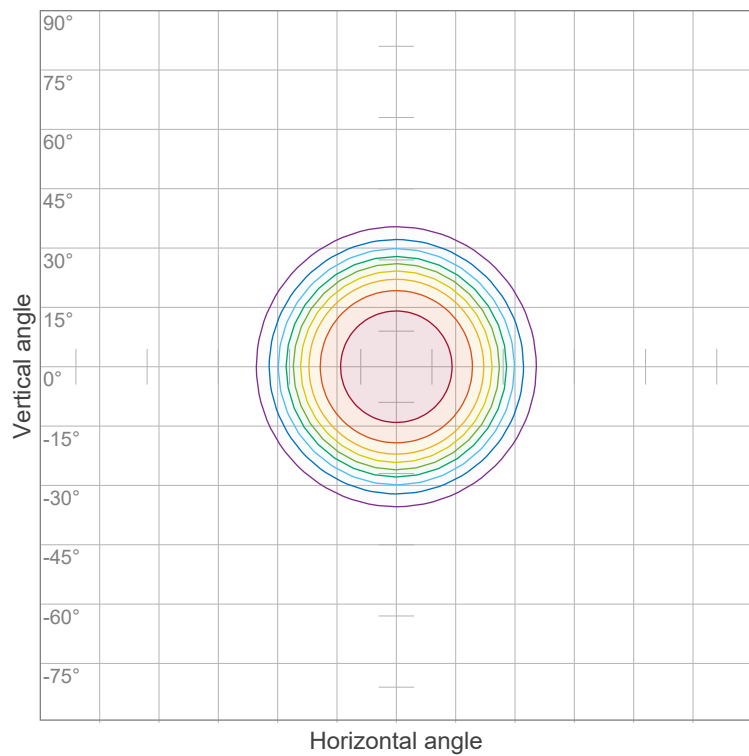


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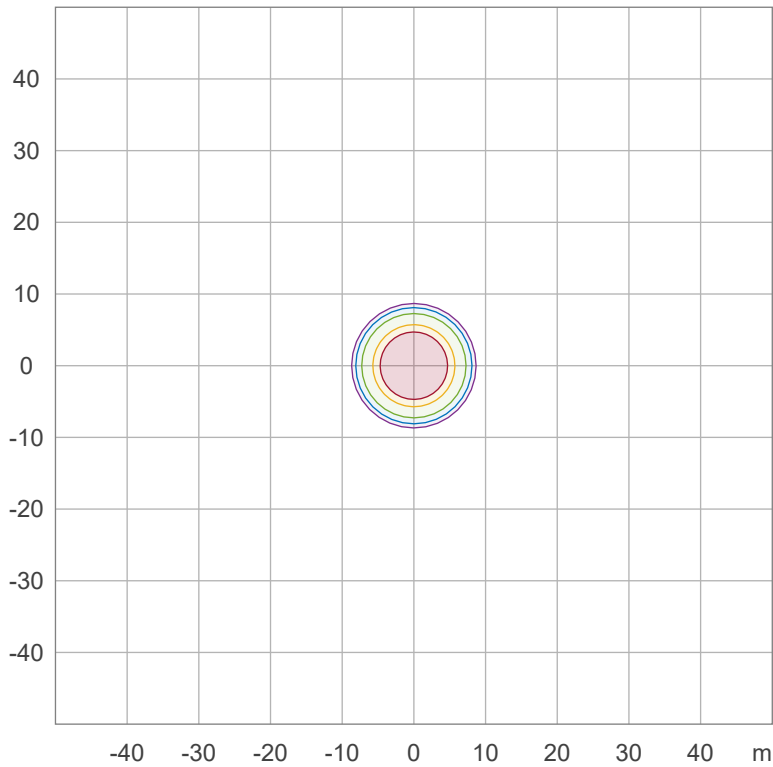
## Iso-intensity Diagram (Iso-candela)



90 %	4285.0 cd
80 %	3808.9 cd
70 %	3332.8 cd
60 %	2856.7 cd
50 %	2380.6 cd
40 %	1904.4 cd
30 %	1428.3 cd
20 %	952.2 cd
10 %	476.1 cd

Peak intensity: 4761.1 cd  
Number of c-planes: 4

## Iso-illuminance Diagram (Iso-lux)



50.0 %	23.8 lx
30.0 %	14.3 lx
10.0 %	4.8 lx
5.0 %	2.4 lx
3.0 %	1.4 lx

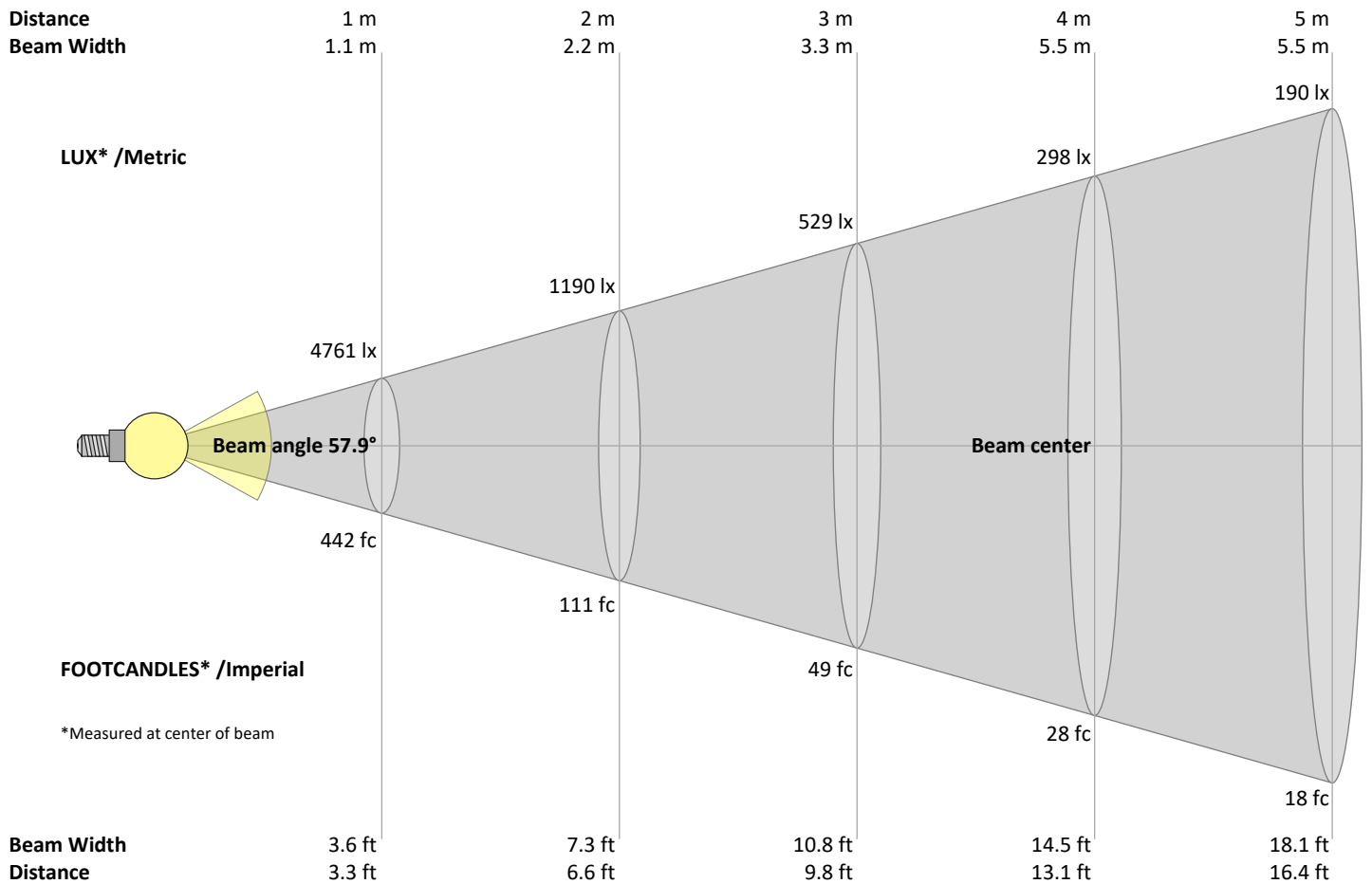
Peak illuminance: 47.6 lx  
Mounting height: 10.0 m  
Number of c-planes: 4

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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
4761	1190	529	298	190	132	97	74	59	48	39	33	28	24	21	19	16	15	13	12	lux
442.3	110.6	49.1	27.6	17.7	12.3	9	6.9	5.5	4.4	3.7	3.1	2.6	2.3	2	1.7	1.5	1.4	1.2	1.1	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
4761	4751	4727	4688	4636	4568	4482	4381	4264	4126	3957	3737	3442	3047	2597	2129	1676	1263	906	617	cd
100%	100%	99%	98%	97%	96%	94%	92%	90%	87%	83%	78%	72%	64%	55%	45%	35%	27%	19%	13%	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
4761	4751	4727	4688	4636	4568	4482	4381	4264	4126	3957	3737	3442	3047	2597	2129	1676	1263	906	617	cd
100%	100%	99%	98%	97%	96%	94%	92%	90%	87%	83%	78%	72%	64%	55%	45%	35%	27%	19%	13%	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
4761	4751	4727	4688	4636	4568	4482	4381	4264	4126	3957	3737	3442	3047	2597	2129	1676	1263	906	617	cd
100%	100%	99%	98%	97%	96%	94%	92%	90%	87%	83%	78%	72%	64%	55%	45%	35%	27%	19%	13%	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
4761	4751	4727	4688	4636	4568	4482	4381	4264	4126	3957	3737	3442	3047	2597	2129	1676	1263	906	617	cd
100%	100%	99%	98%	97%	96%	94%	92%	90%	87%	83%	78%	72%	64%	55%	45%	35%	27%	19%	13%	of 0°val

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 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	22.7	23.4	22.8	23.6	23.8	22.7	23.4	22.8	23.6	23.8
	3H	22.7	23.5	23.1	23.7	23.9	22.7	23.5	23.1	23.7	23.9
	4H	22.9	23.7	23.3	23.9	24.1	22.9	23.7	23.3	23.9	24.1
	6H	23.3	23.9	23.6	24.2	24.6	23.3	23.9	23.6	24.2	24.6
	8H	23.5	24.1	23.8	24.4	24.8	23.5	24.1	23.8	24.4	24.8
	12H	23.8	24.4	24.1	24.7	25.1	23.8	24.4	24.1	24.7	25.1
4H	2H	22.5	23.2	22.9	23.5	23.7	22.5	23.2	22.9	23.5	23.7
	3H	22.8	23.4	23.2	23.8	24.2	22.8	23.4	23.2	23.8	24.2
	4H	23.1	23.6	23.5	24.0	24.6	23.1	23.6	23.5	24.0	24.6
	6H	23.6	24.2	24.1	24.5	24.9	23.6	24.2	24.1	24.5	24.9
	8H	24.0	24.5	24.5	24.8	25.2	24.0	24.5	24.5	24.8	25.2
	12H	24.4	24.8	24.9	25.2	25.7	24.4	24.8	24.9	25.2	25.7
8H	4H	23.2	23.7	23.7	24.0	24.4	23.2	23.7	23.7	24.0	24.4
	6H	24.0	24.3	24.5	24.8	25.3	24.0	24.3	24.5	24.8	25.3
	8H	24.5	24.8	25.0	25.3	26.0	24.5	24.8	25.0	25.3	26.0
	12H	25.1	25.4	25.7	25.9	26.5	25.1	25.4	25.7	25.9	26.5
12H	4H	23.2	23.6	23.7	24.0	24.5	23.2	23.6	23.7	24.0	24.5
	6H	24.1	24.4	24.6	24.9	25.5	24.1	24.4	24.6	24.9	25.5
	8H	24.7	24.9	25.3	25.4	26.1	24.7	24.9	25.3	25.4	26.1
Variations with the observer position for the luminaire spacings, S:											
S = 1.0H		2.7 / -1.2					2.7 / -1.2				
S = 1.5H		4.9 / -1.2					4.9 / -1.2				
S = 2.0H		6.6 / -1.4					6.6 / -1.4				

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	105	105	105	100	100	100	98	
1	112	110	107	104	110	107	105	103	103	101	99	99	97	96	95	94	93	91
2	107	102	97	94	104	100	96	93	96	93	90	93	90	88	90	88	86	84
3	101	95	90	86	99	93	89	85	90	86	83	88	84	82	85	82	80	78
4	96	89	83	79	94	87	82	78	85	81	77	83	79	76	81	77	75	73
5	92	83	77	73	90	82	77	72	80	75	72	78	74	71	76	73	70	68
6	87	78	72	68	85	77	72	68	76	71	67	74	70	66	72	69	66	64
7	83	74	68	63	81	73	67	63	71	66	63	70	66	62	69	65	62	60
8	79	70	64	60	78	69	63	59	68	63	59	66	62	59	65	61	58	57
9	75	66	60	56	74	65	60	56	64	59	56	63	58	55	62	58	55	54
10	72	62	57	53	71	62	56	53	61	56	52	60	55	52	59	55	52	51

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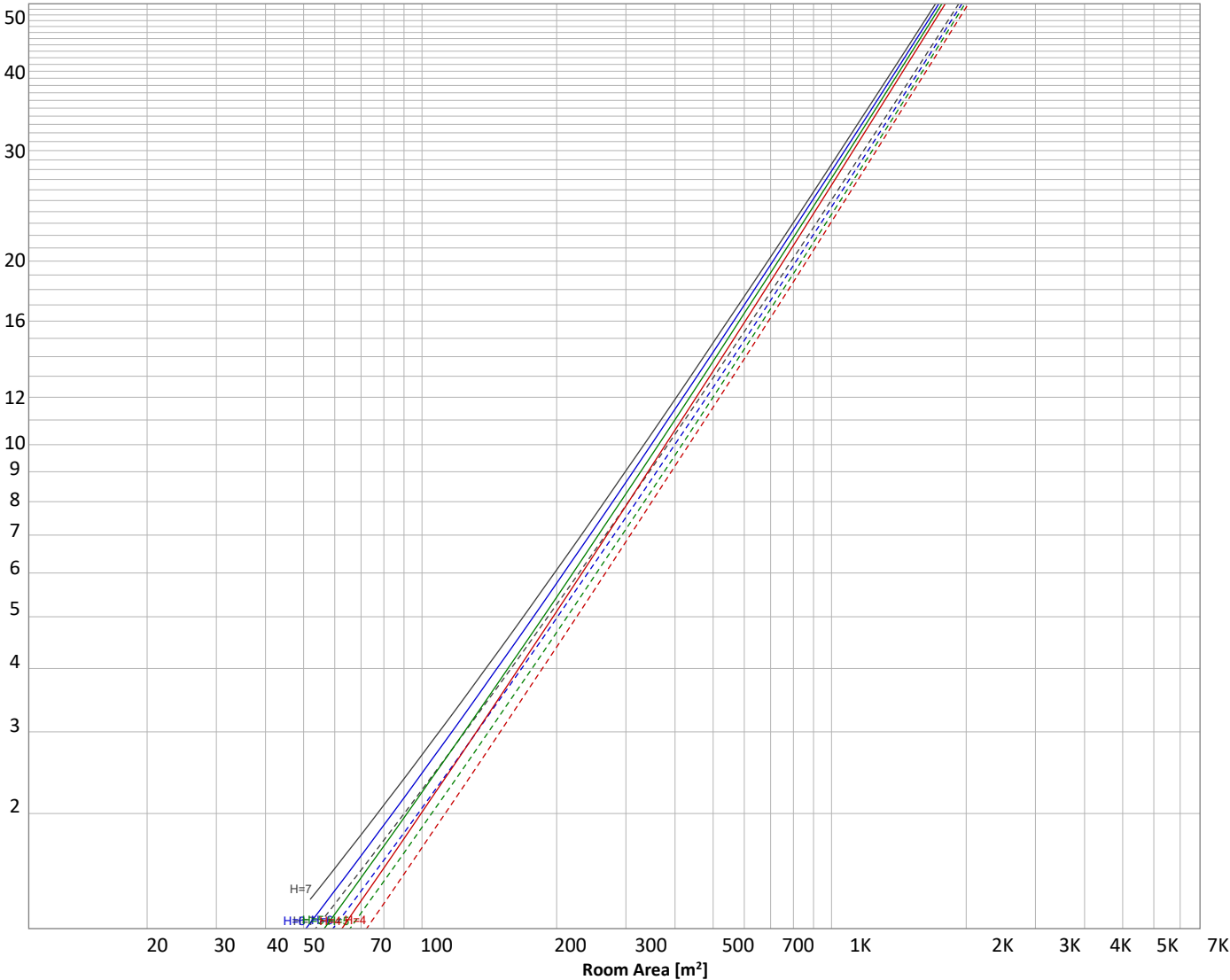
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Luminaire budgetary diagram

Uncorrected, comprehensive UGR table according to 117-1995

LAMPS (number of lamps)



Conditions

H = Room height	Flux = 4207 lm	p(%)		
H <sub>down</sub> = Lamp distance from ceiling =	0.00 m	Line type	Ceiling reflectance	Wall reflectance
H <sub>work</sub> = Work area height from floor =	0.00 m	-----	70	50
E <sub>work</sub> = Average lux on work area =	100 lx	-----	50	30
				Floor reflectance
				20

Zonal Lumen Summary

0°-10°	10°-20°	20°-30°	30°-40°	40°-50°	50°-60°	60°-70°	70°-80°	80°-90°
445 lm	1212 lm	1449 lm	687 lm	138 lm	58.5 lm	47.9 lm	43.0 lm	37.0 lm
90°-100°	100°-110°	110°-120°	120°-130°	130°-140°	140°-150°	150°-160°	160°-170°	170°-180°
18.6 lm	18.0 lm	16.9 lm	15.3 lm	8.61 lm	5.22 lm	3.85 lm	2.36 lm	0.794 lm

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## Outdoor Light Planning

### Lumen per Zone

Zone (γ)	Lumen	% Total
0-10°	445 lm	10.6%
10-20°	1212 lm	28.8%
20-30°	1449 lm	34.4%
30-40°	687 lm	16.3%
40-50°	138 lm	3.3%
50-60°	58 lm	1.4%
60-70°	48 lm	1.1%
70-80°	43 lm	1.0%
80-90°	37 lm	0.9%
90-100°	19 lm	0.4%
100-110°	18 lm	0.4%
110-120°	17 lm	0.4%
120-130°	15 lm	0.4%
130-140°	9 lm	0.2%
140-150°	5 lm	0.1%
150-160°	4 lm	0.1%
160-170°	2 lm	0.1%
170-180°	1 lm	0.0%
Total	4207 lm	100.0%

### Intensity peaks

Max intensity	4761 cd
Intensity, 90°	17 cd
Intensity, 0°	4761 cd

### Zonal Lumen summary

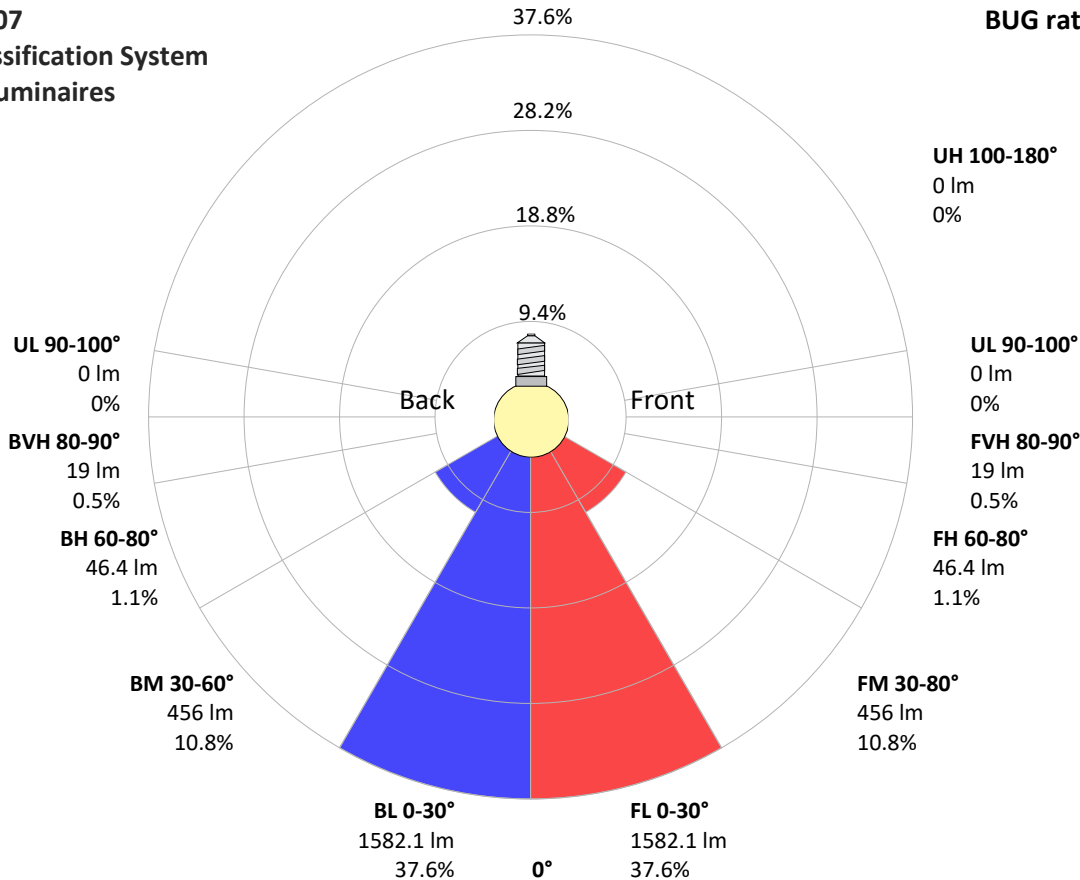
Zone (γ)	Lumen	% Total
0-30°	3106 lm	73.8%
0-40°	3793 lm	90.2%
0-60°	3989 lm	94.8%
60-90°	128 lm	3.0%
70-100°	99 lm	2.3%
90-120°	54 lm	1.3%
0-90°	4117 lm	97.9%
90-180°	90 lm	2.1%
0-180°	4207 lm	100.0%

### BUG rating

	Lumen	% Total
<b>Forward light</b>		
Low(0-30°)	1582 lm	37.6%
Medium(30-60°)	456 lm	10.8%
High(60-80°)	46 lm	1.1%
Very high(80-90°)	19 lm	0.5%
<b>Back light</b>		
Low(0-30°)	1582 lm	37.6%
Medium(30-60°)	456 lm	10.8%
High(60-80°)	46 lm	1.1%
Very high(80-90°)	19 lm	0.5%
<b>Uplight</b>		
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 G1



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## Power Details

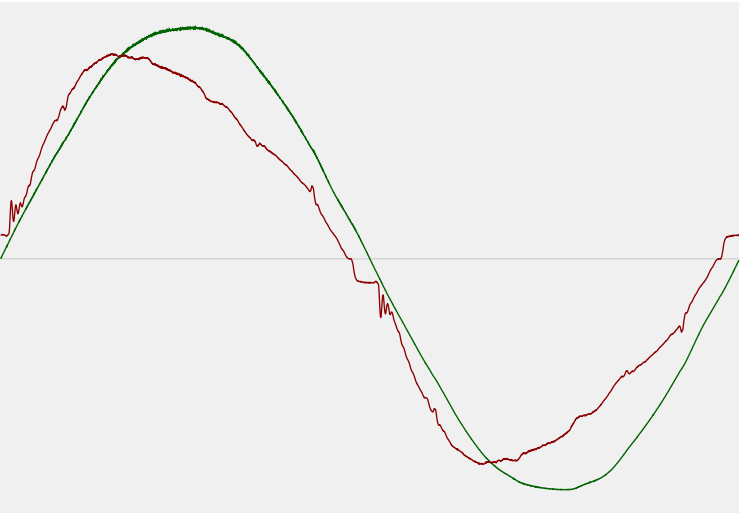
### Input Power

Power feed to light source	41.3 W
Frequency of input power	50.1 Hz
RMS Input voltage feed, $V_{RMS}$	243 V
RMS Input current feed, $I_{RMS}$	0.176 A
Volt-Ampere or apparent power = $V_{RMS} \cdot I_{RMS}$	42.75 VA
Displacement factor of AC power feed	0.97
Power factor of AC current feed	0.97
Total harmonic distortion of the current	10.86%
Total harmonic distortion of the voltage	1.23%

### Efficiency

Radiated power efficiency	36.8%
<div><div></div></div>	
Lumen efficiency	102 lm/W
<div><div></div></div>	

### Input Power Curve



# Goniophotometry Report

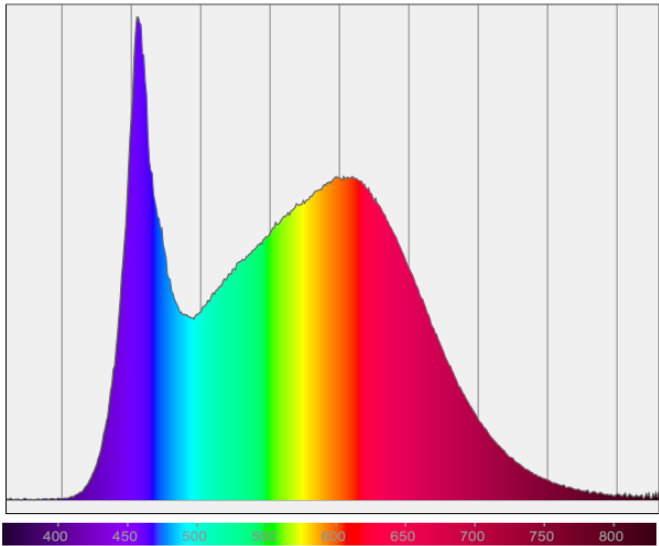
1\_PHOT\_SKIN+BONES-4750lmChip-4000K-58Deg\_2303  
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## Color Measurements

Correlated Color Temperature	CCT = 4000 K
Color Rendering TM30-18	R <sub>f</sub> 88.9 – R <sub>g</sub> 98.5
Color Shift, CIE duv	Duv ±0.0003

## Spectral distribution



## Color details

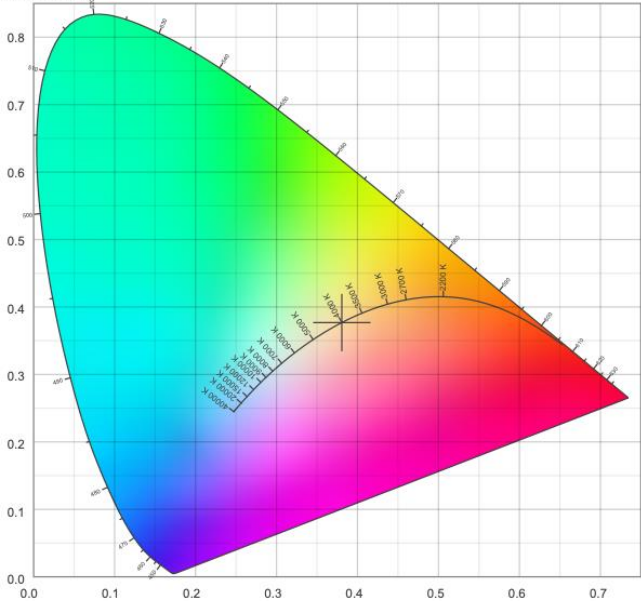
Correlated Color Temperature	CCT = 4000 K	Color coordinates CIE 1931	(x;y) = (0.381;0.377)
Color Rendering Index	CRI 92.6	Color coordinate CIEs 1960	(u;v) = (0.225;0.334)
Color Rendering Index, R9 (red component)	R9 = 72.2	Color deviation from BBL	Duv = ±0.0003
Color Rendering TM30-18	R <sub>f</sub> 88.9 – R <sub>g</sub> 98.5	Color coordinate CIEs 1976 (CIELUV)	(u';v') = (0.225;0.225)
Color Quality Scale	CQS = 88.9		

Goniophotometry Report

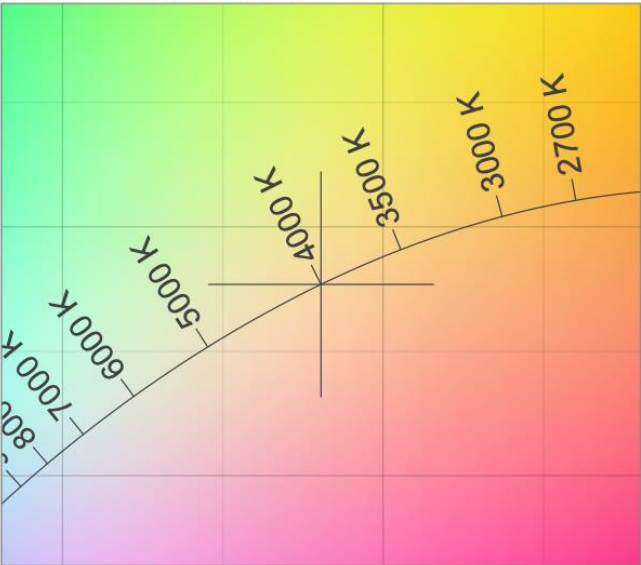
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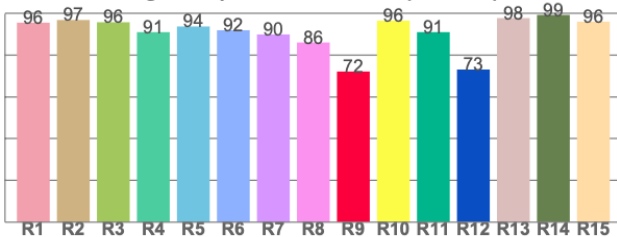
CIE 1931



CIE 1931 – zoomed on Planckian locus



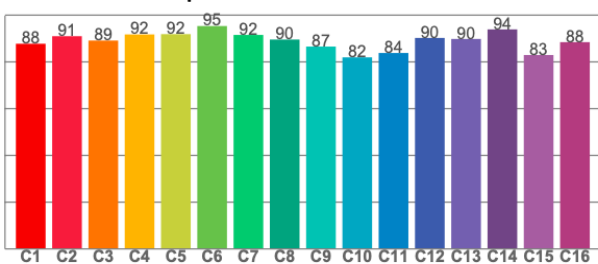
Color Rendering Index per reference color (CIE 1995)



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
95.5	96.8	95.7	91.0	93.7	91.9	89.9	86.0	72.2	96.4	91.0	73.1	97.7	99.2	96.0

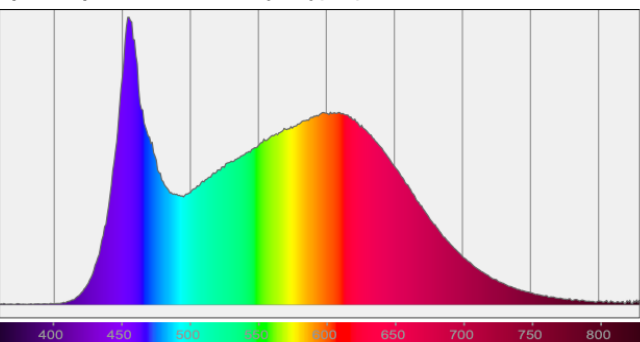
TM30-18 Rf-values per hue bin



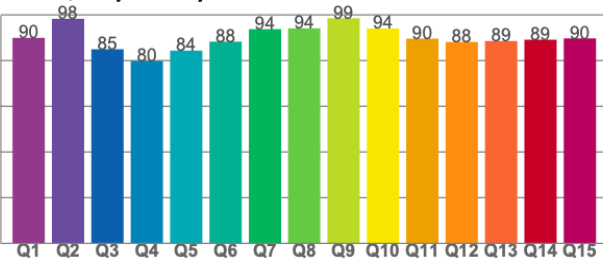
TM30 C values, 16 binned values out of total of 99 C values

C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16
87.8	91.0	89.1	91.7	91.9	95.3	91.5	89.6	86.6	81.9	83.8	90.3	89.8	93.9	83.0	88.4

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



Color Quality Scale by reference color



CQS Q values

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
89.9	98.3	84.9	79.8	84.3	88.3	93.7	94.1	98.5	94.0	89.6	88.1	88.6	89.1	89.7