

# Light Measurement Report

Print date: 28-4-2025

Measurement date and time: 28-4-2025 13:48:41 – Measurement no. VFR-250428-0946-MS

Measurement tracking No. and Link: [VT250428-004541](#)

Operator:



## Laboratory and Equipment

Laboratory Owner and Location  
Goniospectrometer System and Type  
Sensor Name, Calibr. Date and Serial No.  
Spectrometer Manufacturer and Model

Viso Systems, Copenhagen V, Denmark  
LabSpion – Type C, horizontal  
LabSensor Model2 – 11-1-2024 – 3130191315  
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  
Warm-up Time and Variation

24 planes – 15°  
5°  
5,29 m  
9,1 W – PF 0,53 – DPF 0,79  
230 V – 0,074 A  
50 Hz  
Lamp stabilized in 15 min 3 sec – 2,0%

## Tested Light Source

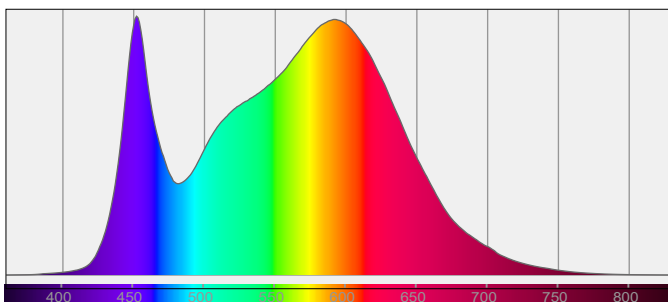
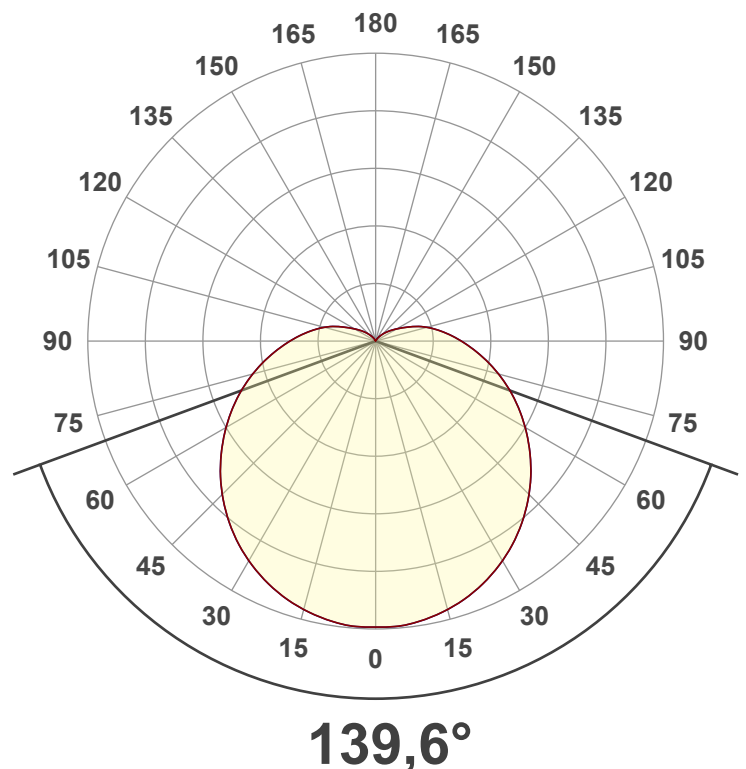
Product Name  
Item No. and Manufacturer  
Product Description (line 1)

276772-4000K  
276772-4000K – Dutchfulfillment  
T5 BALK | KOPPELBAAR | 60CM | 9W

## Main Light Measurement Results

Output – Total Lumen (Up% / Down%)  
Efficiency  
Peak Intensity and Beam Angle  
Correlated Color Temperature, Target/Measured  
Color Rendering Index  
Color Rendering TM30-18  
Color Shift, CIE duv and MacAdam Steps  
Flicker

947 lm – 15,07% / 84,93%  
104 lm/W  
207 cd – 139,6°  
CCT = 4000 K / 4107 K  
CRI 82,8  
 $R_f$  83,9 –  $R_g$  94,1  
Duv -0,0002 – SDCM 2,3  
SVM 0 – PstLM 0,01



# Light Measurement Report

Print date: 28-4-2025

Measurement date and time: 28-4-2025 13:48:41 – Measurement no. VFR-250428-0946-MS

Measurement tracking No. and Link: [VT250428-004541](https://www.viso-systems.com/VT250428-004541)

Operator:



## Luminous Intensity diagram

Unit: 0-100% of peak intensity

### Main Values

Output (total Lumen)	947 lm
Lumen Up% / Down%	15,07% / 84,93%
Peak Intensity	207 cd
Beam Angle (50%)	139,6°
Beam Angle (90%)	139,6°
Beam Angle (10%)	139,6°

### Cut-off Angle

Average 2,5%	276,8°
--------------	--------

### Field Angle

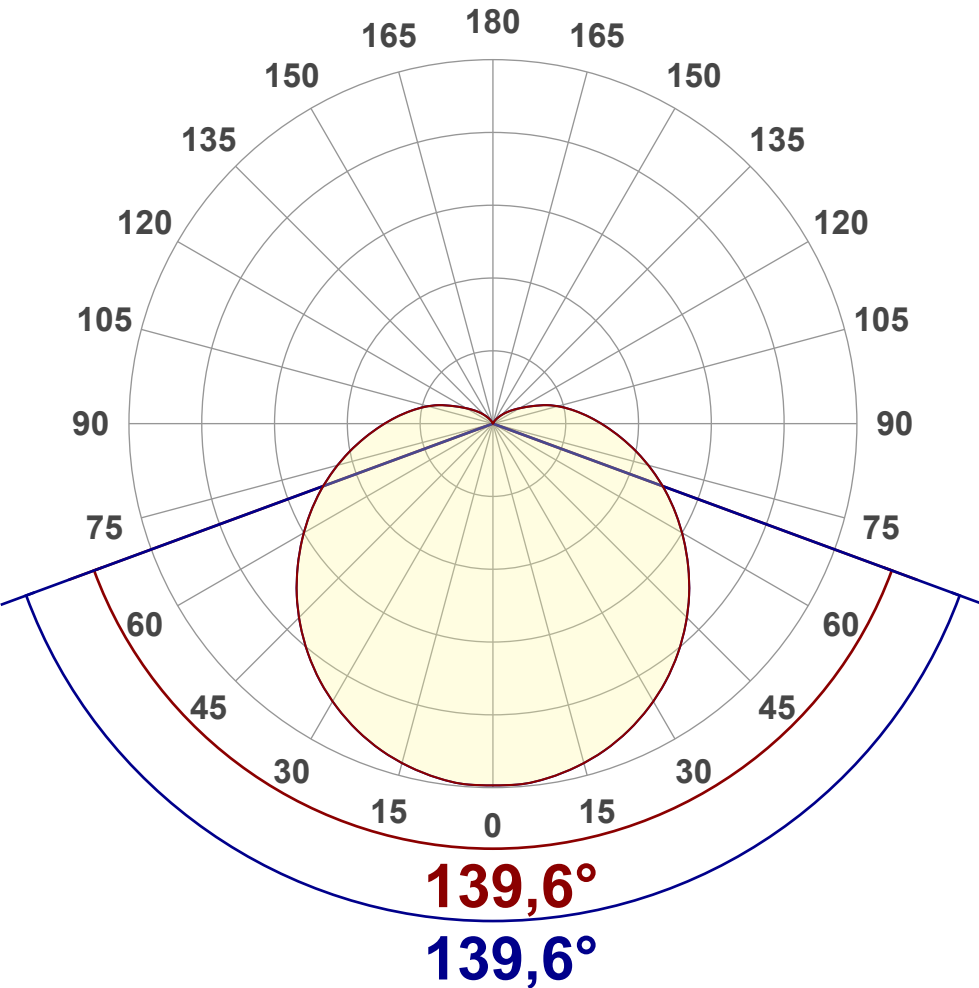
Average 10%	234,4°
-------------	--------

### Intensity Ratio

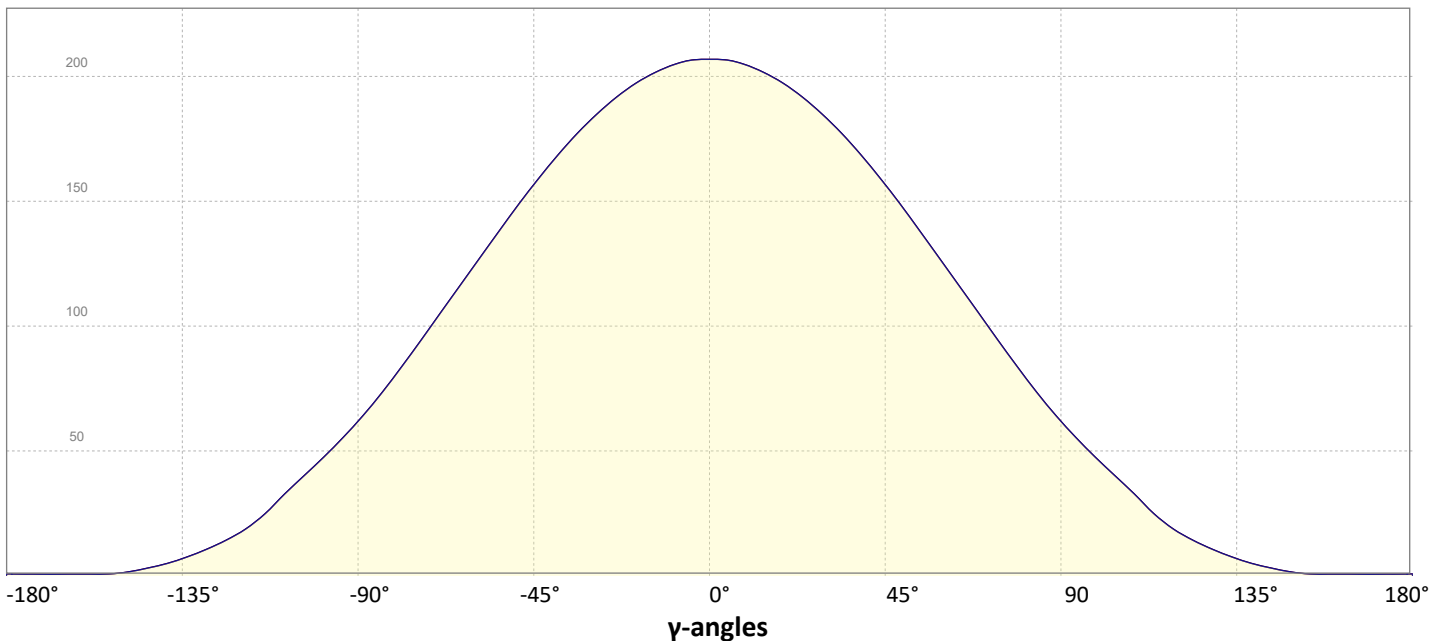
In 120° cone	54,5%
In 90° cone	35,2%

**C000-C180**

**C090-C270**



## Linear distribution diagram - Intensity (candela) vs $\gamma$ -angle



# Light Measurement Report

Print date: 28-4-2025

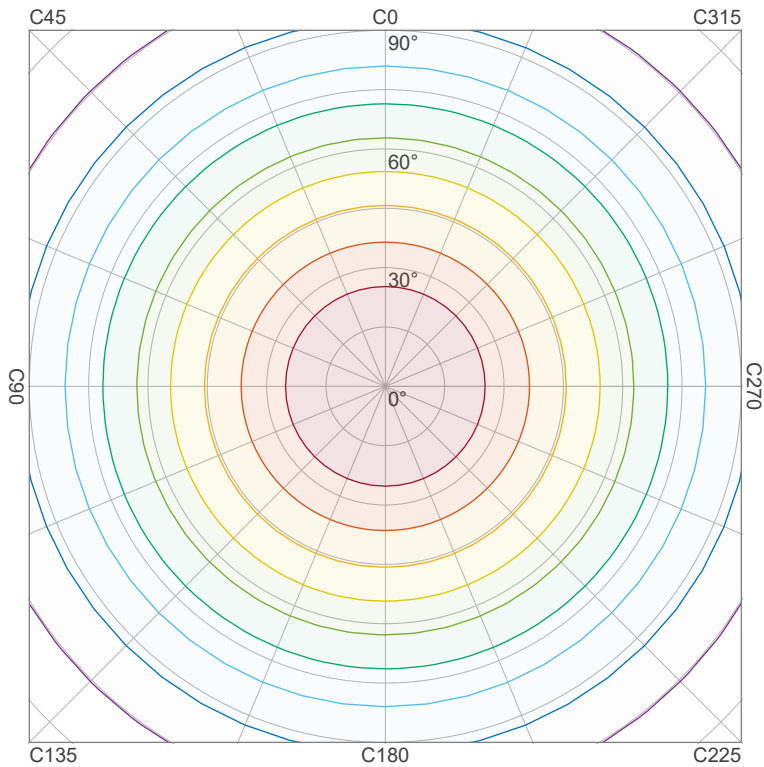
Measurement date and time: 28-4-2025 13:48:41 – Measurement no. VFR-250428-0946-MS

Measurement tracking No. and Link: [VT250428-004541](#)

Operator:



## Iso-intensity Diagram (Iso-candela)

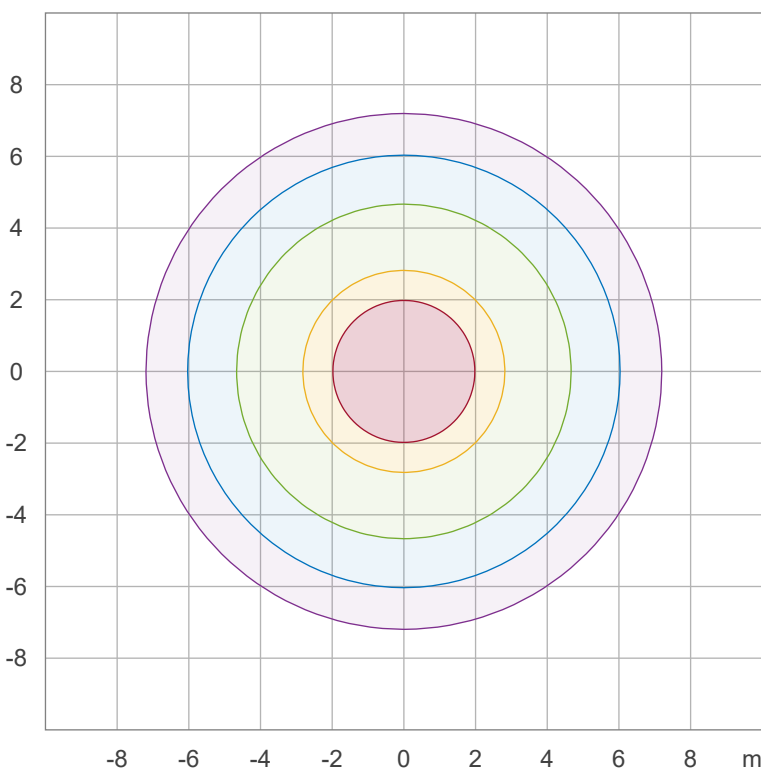


90 %	186,0 cd
80 %	165,3 cd
70 %	144,7 cd
60 %	124,0 cd
50 %	103,3 cd
40 %	82,7 cd
30 %	62,0 cd
20 %	41,3 cd
10 %	20,7 cd

Peak intensity: 206,7 cd

Number of c-planes: 24

## Iso-illuminance Diagram (Iso-lux)



50,0 %	11,5 lx
30,0 %	6,9 lx
10,0 %	2,3 lx
5,0 %	1,1 lx
3,0 %	0,7 lx

Peak illuminance: 23,0 lx

Mounting height: 3,0 m

Number of c-planes: 24

# Light Measurement Report

Print date: 28-4-2025

Measurement date and time: 28-4-2025 13:48:41 – Measurement no. VFR-250428-0946-MS

Measurement tracking No. and Link: [VT250428-004541](https://vt250428-004541)

Operator:



## Color details

Correlated Color Temperature, Target CCT = 4000 K  
 Correlated Color Temperature, Measured CCT = 4107 K  
 Color Rendering Index CRI 82,8  
 Color Rendering Index, R9 (red component) R9 = 2,5  
 Color Rendering TM30-18 R<sub>f</sub> 83,9 – R<sub>g</sub> 94,1  
 Color Quality Scale CQS = 81,6

MacAdam Steps SDCM = 2,3  
 Color coordinates CIE 1931 (x;y) = (0,381;0,377)  
 Color coordinate CIEs 1960 (u;v) = (0,225;0,334)  
 Color deviation from BBL Duv = -0,0002  
 Color coordinate CIEs 1976 (CIELUV) (u';v') = (0,225;0,502)

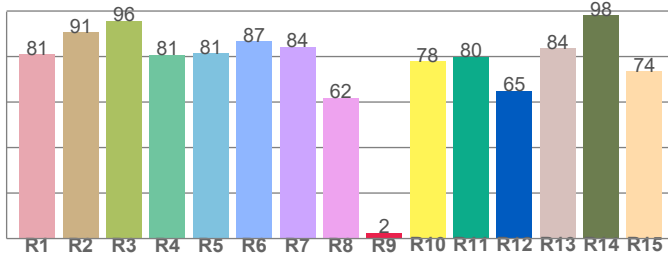
### CIE 1931



### CIE 1931 – zoomed on Planckian locus



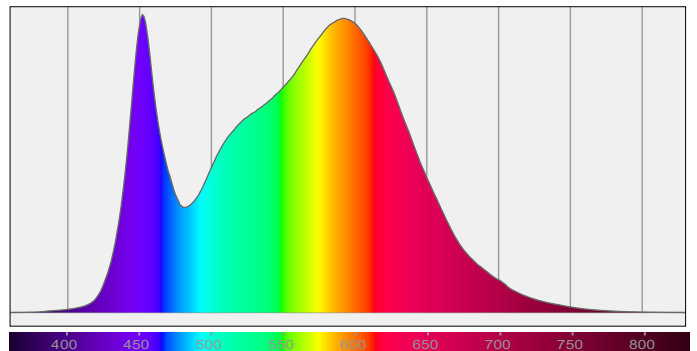
### Color Rendering Index per reference color (CIE 1995)



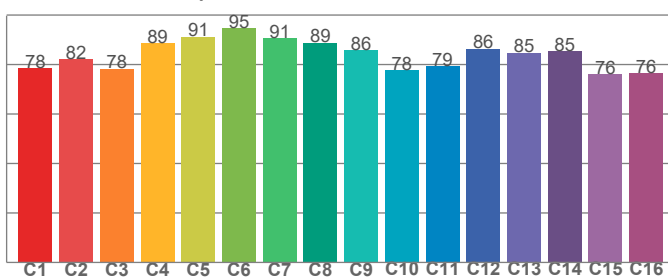
CRI R values, only R1-R8 are used to calculate final CRI value

R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
81,0	90,7	95,7	80,8	81,4	86,8	84,3	61,8	2,5	77,9	80,0	64,9	83,7	98,2	73,5

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



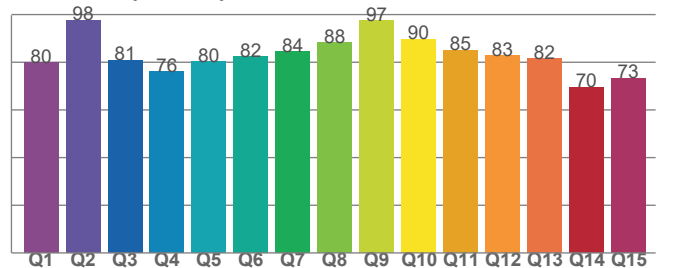
### TM30-18 Rf-values per hue bin



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
78,5	82,2	78,4	88,7	91,3	94,8	90,6	88,8	85,8	77,8	79,3	86,3	84,8	85,4	76,1	76,4

### Color Quality Scale by reference color



CQS Q values

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
79,7	97,7	80,8	76,0	80,3	82,3	84,5	88,3	97,4	89,7	85,1	82,7	81,6	69,6	73,3

# Light Measurement Report

Print date: 28-4-2025

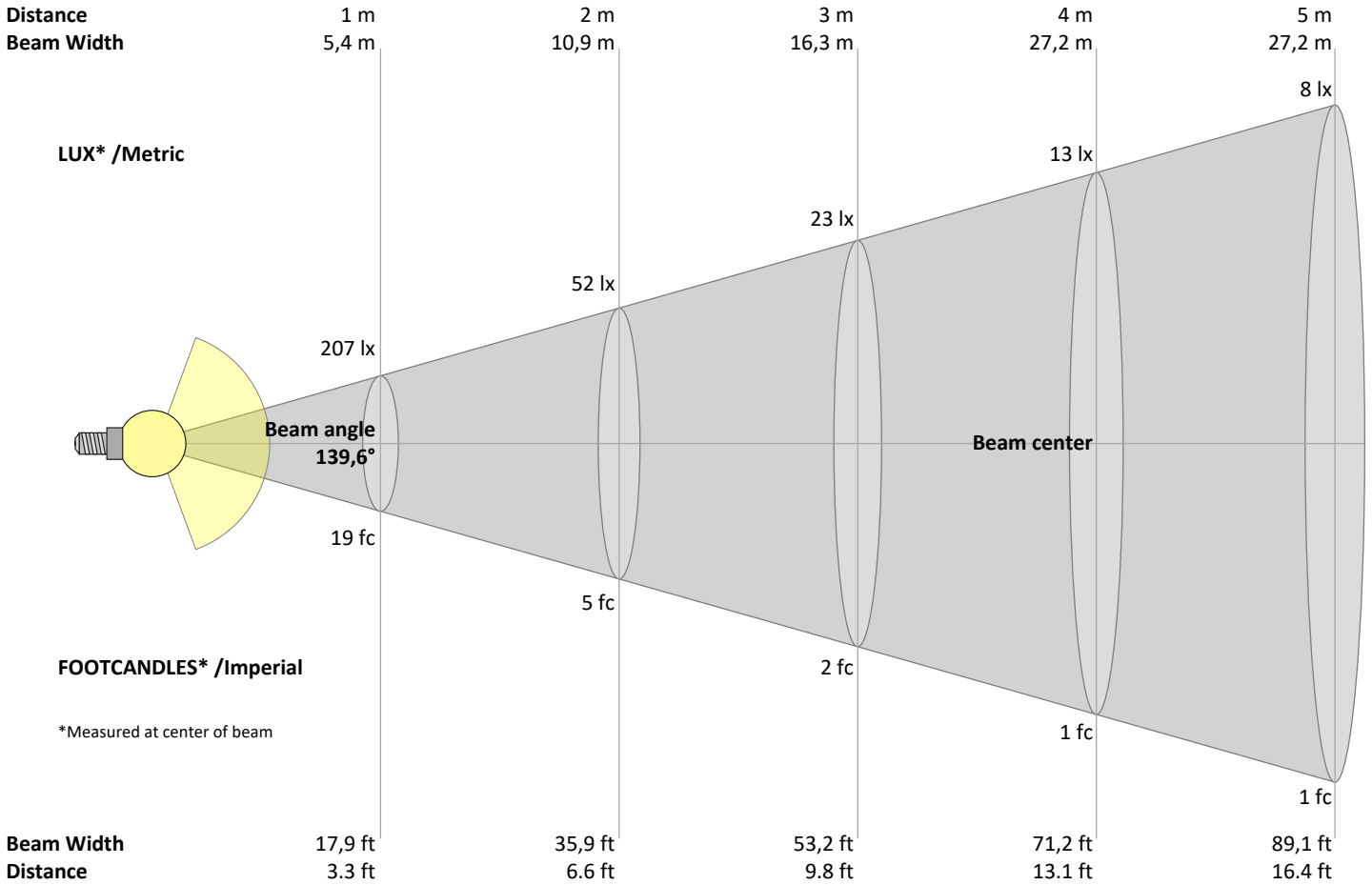
Measurement date and time: 28-4-2025 13:48:41 – Measurement no. VFR-250428-0946-MS

Measurement tracking No. and Link: [VT250428-004541](https://www.viso-systems.com/VT250428-004541)

Operator:



## 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
207	52	23	13	8	6	4	3	3	2	2	1	1	1	1	1	1	1	1	1	lux
19,2	4,8	2,1	1,2	0,8	0,5	0,4	0,3	0,2	0,2	0,2	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	fc

### Intensities in 0° c-plane

0°	9°	18°	27°	36°	45°	54°	63°	72°	81°	90°	99°	108°	117°	126°	135°	144°	153°	162°	171°	γ
207	205	198	187	173	157	138	118	98	79	62	47	34	21	13	7	3	1	1	1	cd
100%	99%	96%	91%	84%	76%	67%	57%	48%	38%	30%	23%	16%	10%	6%	3%	1%	0%	0%	0%	of 0°val

### Intensities in 90° c-plane

0°	9°	18°	27°	36°	45°	54°	63°	72°	81°	90°	99°	108°	117°	126°	135°	144°	153°	162°	171°	γ
207	205	198	187	173	157	138	118	98	79	62	47	34	21	13	7	3	1	1	1	cd
100%	99%	96%	91%	84%	76%	67%	57%	48%	38%	30%	23%	16%	10%	6%	3%	1%	0%	0%	0%	of 0°val

### Intensities in 180° c-plane

0°	9°	18°	27°	36°	45°	54°	63°	72°	81°	90°	99°	108°	117°	126°	135°	144°	153°	162°	171°	γ
207	205	198	187	173	157	138	118	98	79	62	47	34	21	13	7	3	1	1	1	cd
100%	99%	96%	91%	84%	76%	67%	57%	48%	38%	30%	23%	16%	10%	6%	3%	1%	0%	0%	0%	of 0°val

### Intensities in 270° c-plane

0°	9°	18°	27°	36°	45°	54°	63°	72°	81°	90°	99°	108°	117°	126°	135°	144°	153°	162°	171°	γ
207	205	198	187	173	157	138	118	98	79	62	47	34	21	13	7	3	1	1	1	cd
100%	99%	96%	91%	84%	76%	67%	57%	48%	38%	30%	23%	16%	10%	6%	3%	1%	0%	0%	0%	of 0°val

# Light Measurement Report

Print date: 28-4-2025

Measurement date and time: 28-4-2025 13:48:41 – Measurement no. VFR-250428-0946-MS

Measurement tracking No. and Link: [VT250428-004541](#)

Operator:



## Light Planning – UGR table

Uncorrected, comprehensive UGR table according to 117-1995

Reflectances		70	70	50	50	30	70	70	50	50	30
	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		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	20,8	22,0	21,3	22,5	23,1	21,4	22,6	21,9	23,1	23,7
	3H	22,9	24,1	23,5	24,6	25,1	23,7	24,9	24,3	25,4	26,0
	4H	23,9	25,1	24,5	25,6	26,2	25,0	26,1	25,6	26,7	27,2
	6H	25,1	26,1	25,6	26,6	27,3	26,4	27,5	27,0	28,0	28,7
	8H	25,6	26,6	26,1	27,2	27,8	27,2	28,2	27,7	28,8	29,4
	12H	26,1	27,2	26,7	27,7	28,4	28,0	29,1	28,6	29,6	30,3
4H	2H	21,6	22,8	22,2	23,3	23,9	22,0	23,2	22,6	23,7	24,3
	3H	24,0	25,0	24,5	25,5	26,2	24,7	25,7	25,2	26,2	26,9
	4H	25,1	26,2	25,8	26,7	27,5	26,0	27,1	26,7	27,6	28,4
	6H	26,4	27,3	27,0	27,8	28,5	27,6	28,5	28,3	29,0	29,7
	8H	27,0	27,8	27,7	28,4	29,0	28,4	29,2	29,1	29,8	30,5
	12H	27,6	28,3	28,3	28,9	29,6	29,4	30,1	30,1	30,7	31,4
8H	4H	25,7	26,5	26,4	27,1	27,8	26,4	27,2	27,1	27,8	28,5
	6H	27,2	27,8	27,9	28,5	29,3	28,2	28,9	28,9	29,5	30,3
	8H	28,0	28,5	28,7	29,2	30,1	29,2	29,8	29,9	30,5	31,4
	12H	28,7	29,2	29,5	29,9	30,8	30,4	30,9	31,1	31,6	32,4
12H	4H	25,8	26,5	26,5	27,2	27,9	26,5	27,2	27,2	27,8	28,6
	6H	27,4	28,0	28,1	28,7	29,6	28,4	28,9	29,1	29,7	30,5
	8H	28,3	28,8	29,0	29,5	30,3	29,5	29,9	30,2	30,7	31,5

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

S = 1.0H	0,1 / 0,0	0,1 / -0,1
S = 1.5H	0,1 / -0,1	0,1 / -0,1
S = 2.0H	0,2 / -0,2	0,2 / -0,2

## 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	115	115	115	115	111	111	111	111	103	103	103	95	95	95	88	88	88	85
1	102	96	90	85	97	92	87	82	85	81	77	78	75	72	72	70	67	64
2	91	82	74	67	87	78	71	65	72	66	61	67	62	57	61	57	54	51
3	83	71	61	54	79	68	59	53	63	56	50	58	52	47	53	48	44	41
4	75	62	52	45	72	60	51	44	55	48	42	51	45	39	47	42	37	34
5	69	55	45	38	66	53	44	37	49	41	35	45	39	34	42	36	32	29
6	63	49	40	33	60	47	39	32	44	36	31	41	34	29	38	32	28	25
7	59	44	35	29	56	43	34	28	40	32	27	37	31	26	35	29	24	22
8	54	40	31	25	52	39	31	25	36	29	24	34	27	23	32	26	22	20
9	51	37	28	23	48	36	28	22	33	26	21	31	25	20	29	24	19	17
10	47	34	26	20	45	33	25	20	31	24	19	29	23	18	27	22	18	16

# Light Measurement Report

Print date: 28-4-2025

Measurement date and time: 28-4-2025 13:48:41 – Measurement no. VFR-250428-0946-MS

Measurement tracking No. and Link: [VT250428-004541](#)

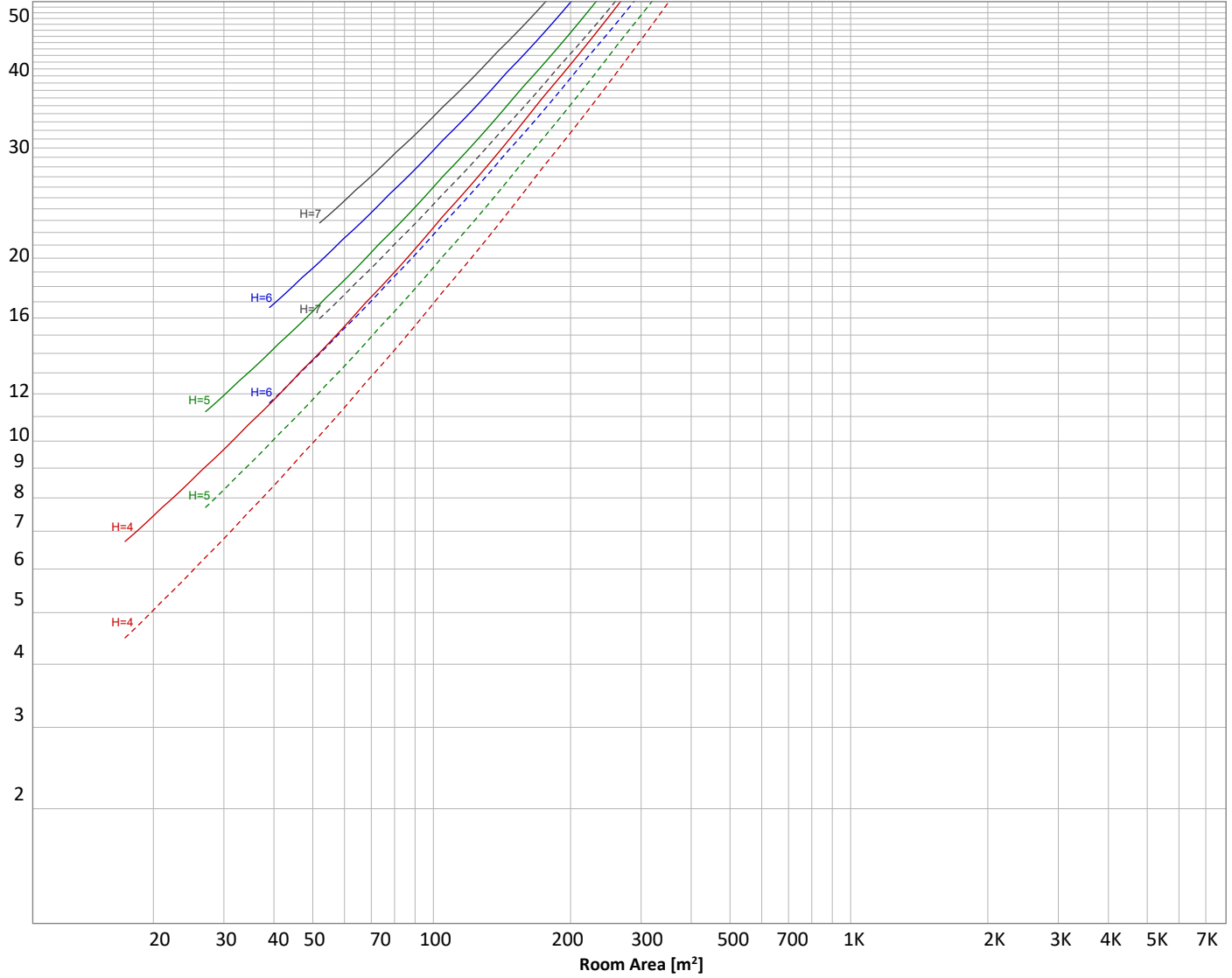
Operator:



## Luminaire budgetary diagram

Uncorrected, comprehensive UGR table according to 117-1995

LAMPS (number of lamps)



### Conditions

H = Room height	Flux = 947 lm				
H <sub>down</sub> = Lamp distance from ceiling =	0.00 m	Line type	Ceiling reflectance	ρ(%) Wall reflectance	Floor reflectance
H <sub>work</sub> = Work area height from floor =	0.00 m	-----	70	50	30
E <sub>work</sub> = Average lux on work area =	100 lx	_____	50	30	20

### Zonal Lumen Summary

0°-10°	10°-20°	20°-30°	30°-40°	40°-50°	50°-60°	60°-70°	70°-80°	80°-90°
19,6 lm	56,7 lm	87,7 lm	110 lm	121 lm	121 lm	113 lm	97,2 lm	77,8 lm
90°-100°	100°-110°	110°-120°	120°-130°	130°-140°	140°-150°	150°-160°	160°-170°	170°-180°
58,5 lm	40,6 lm	23,5 lm	12,2 lm	5,46 lm	1,79 lm	0,374 lm	0,177 lm	0,060 lm

# Light Measurement Report

Print date: 28-4-2025

Measurement date and time: 28-4-2025 13:48:41 – Measurement no. VFR-250428-0946-MS

Measurement tracking No. and Link: [VT250428-004541](#)

Operator:



## Outdoor Light Planning

### Lumen per Zone

Zone (γ)	Lumen	% Total
0-10°	20 lm	2,1%
10-20°	57 lm	6,0%
20-30°	88 lm	9,3%
30-40°	110 lm	11,6%
40-50°	121 lm	12,8%
50-60°	121 lm	12,8%
60-70°	113 lm	11,9%
70-80°	97 lm	10,3%
80-90°	78 lm	8,2%
90-100°	59 lm	6,2%
100-110°	41 lm	4,3%
110-120°	24 lm	2,5%
120-130°	12 lm	1,3%
130-140°	5 lm	0,6%
140-150°	2 lm	0,2%
150-160°	0 lm	0,0%
160-170°	0 lm	0,0%
170-180°	0 lm	0,0%
<b>Total</b>	<b>947 lm</b>	<b>100,0%</b>

### Intensity peaks

Max intensity	207 cd
Intensity, 90°	62 cd
Intensity, 0°	207 cd

### Zonal Lumen summary

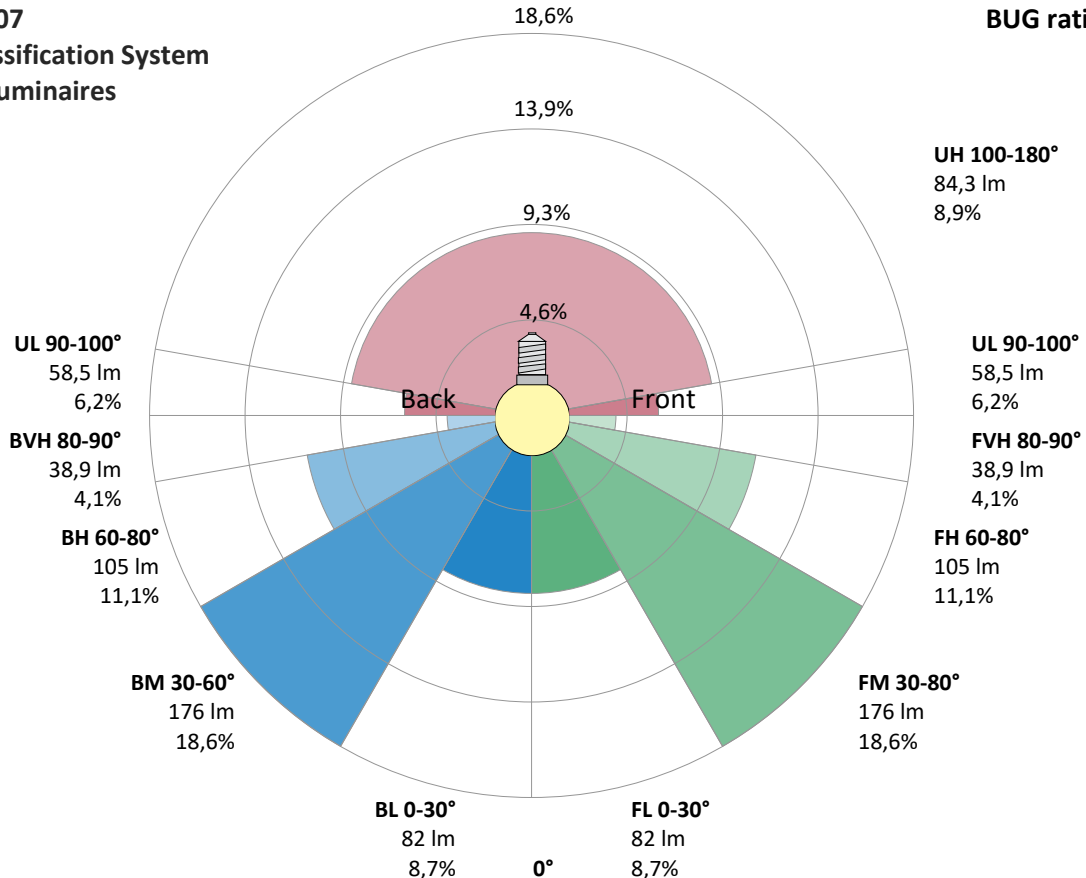
Zone (γ)	Lumen	% Total
0-30°	164 lm	17,3%
0-40°	274 lm	28,9%
0-60°	516 lm	54,5%
60-90°	288 lm	30,4%
70-100°	233 lm	24,7%
90-120°	123 lm	13,0%
0-90°	804 lm	84,9%
90-180°	143 lm	15,1%
0-180°	947 lm	100,0%

### BUG rating

	Lumen	% Total
<b>Forward light</b>		
Low(0-30°)	82 lm	8,7%
Medium(30-60°)	176 lm	18,6%
High(60-80°)	105 lm	11,1%
Very high(80-90°)	39 lm	4,1%
<b>Back light</b>		
Low(0-30°)	82 lm	8,7%
Medium(30-60°)	176 lm	18,6%
High(60-80°)	105 lm	11,1%
Very high(80-90°)	39 lm	4,1%
<b>Uplight</b>		
Low(90-100°)	59 lm	6,2%
High(100-180°)	84 lm	8,9%

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

BUG rating B0 U3 G1



# Light Measurement Report

Print date: 28-4-2025

Measurement date and time: 28-4-2025 13:48:41 – Measurement no. VFR-250428-0946-MS

Measurement tracking No. and Link: [VT250428-004541](#)

Operator:

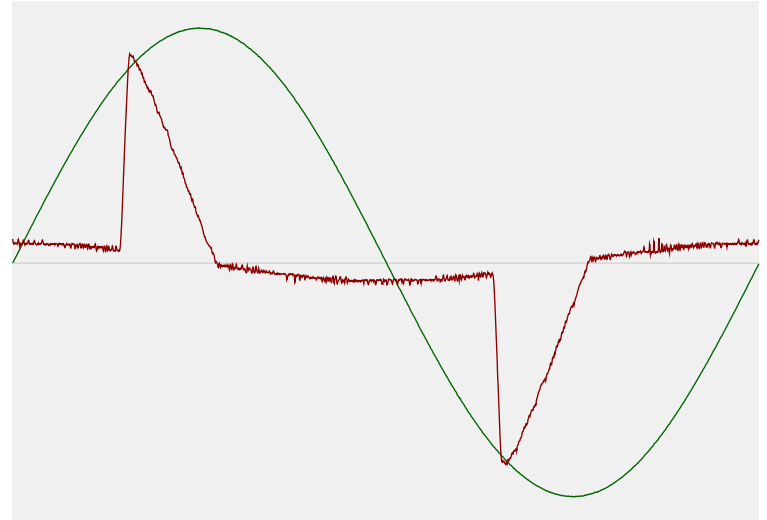


## Power Details

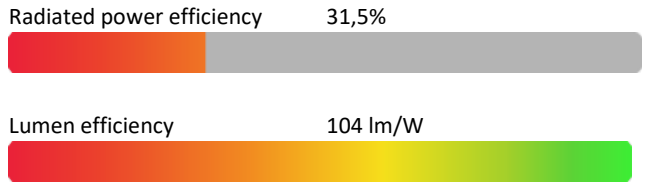
### Input Power

Power feed to light source	9,1 W
Frequency of input power	50 Hz
RMS Input voltage feed, $V_{RMS}$	230 V
RMS Input current feed, $I_{RMS}$	0,074 A
Volt-Ampere or apparent power = $V_{RMS} * I_{RMS}$	17,14 VA
Displacement factor of AC power feed	0,79
Power factor of AC current feed	0,53
Total harmonic distortion of the current	108,07%
Total harmonic distortion of the voltage	0,1%

### Input Power Curve



### Efficiency



## Stabilization Details

### Warmup Conditions

Stable period	15 min
Stable change max	2,0%
Minimum time	15 min

### Color Temperature Change

CCT start	3981 K
CCT shift	+19 K
CCT end	4000 K

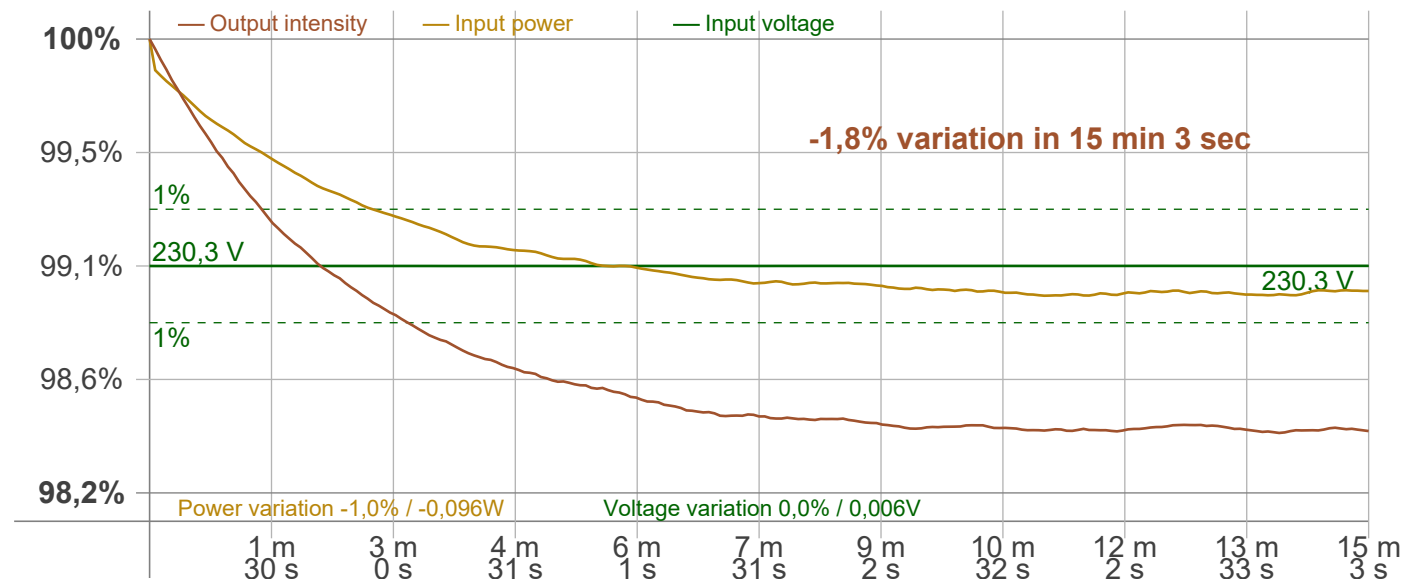
### Warmup Result

Total warmup time	Lamp stabilized in 15 min 3 sec
Warmup variation	-1,8%

### Output Change

Output start	963 lm
Output change	-16 lm
Output end	947 lm

### Stabilization Curve



# Light Measurement Report

Print date: 28-4-2025

Measurement date and time: 28-4-2025 13:48:41 – Measurement no. VFR-250428-0946-MS

Measurement tracking No. and Link: [VT250428-004541](#)

Operator:



## Flicker /TLA details

Flicker Meter Type Viso Systems LabFlicker  
 Frequency of input power 50 Hz  
 Flicker/TLA sample rate 20000 samples/s

**Measurement time**  
 PstLM 180 sec  
 All other indices 1,2 sec

### Flicker indices according to Illuminating Engineering Society (IES)

Flicker frequency 101,52 Hz  
 Percent Flicker 0,11 %  
 Flicker index 0

### Flicker indices according to California Energy Commission (CEC) 2016b

JA8/10 40 Hz 0,02 %  
 JA8/10 90 Hz 0,02 %  
 JA8/10 200 Hz 0,06 %  
 JA8/10 400 Hz 0,09 %  
 JA8/10 1000 Hz 0,11 %

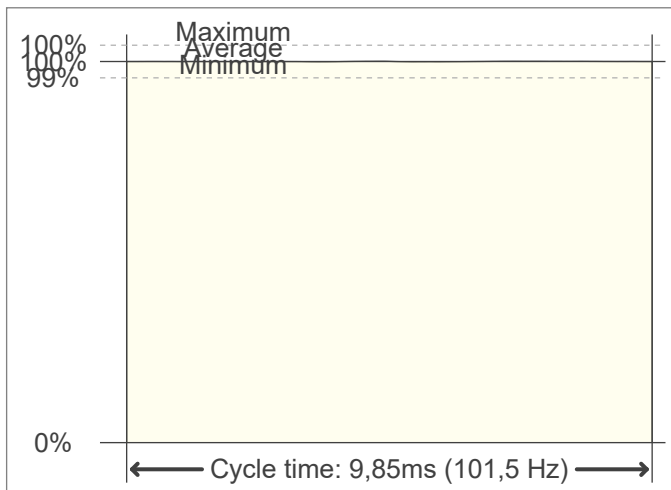
### TLA indices (re IEC TR 61547-1, IEC 61000-3-3 and IEC 61000-4-15)

PstLM value (F < 80 Hz) 0,01  
 SVM value (80 < F < 2000 Hz) 0

### Flicker indices according to Lighting Research Center (2015)

Perception metric, Assist Mp 0,01

### Flicker frame (frame of one flicker period in time domain)



### Flicker FFT (flicker curve in frequency domain)



### IEEE 1789 Frequency/modulation plot

