

Light efficiency:

70 Lumen/Watt

Light quality:

CRI: 92,7

Color temperature:

2767 K

Output: 320 lm

Peak: 530 cd

Power: 4,5 W

PF: 1,0



Product name:

**F L-S O - 2-4 C -1 0 0-W-LSWT-W2**

Item number:

**F L / S O - 2 / 4 C / 1 0 0 / W / LSWT / W2**

Date and time:

**08.03.2019 15:36:21**

Description:

Toleranzen:

Lumen +/-4%

Candela +/-2,5%

Colour Temp +/-35 Grad K

CRI +/-0,7

Angular Resolution 1 Grad step

Last Calibration 06.06.2018

Pruefer:

**Mourad Benzineb**

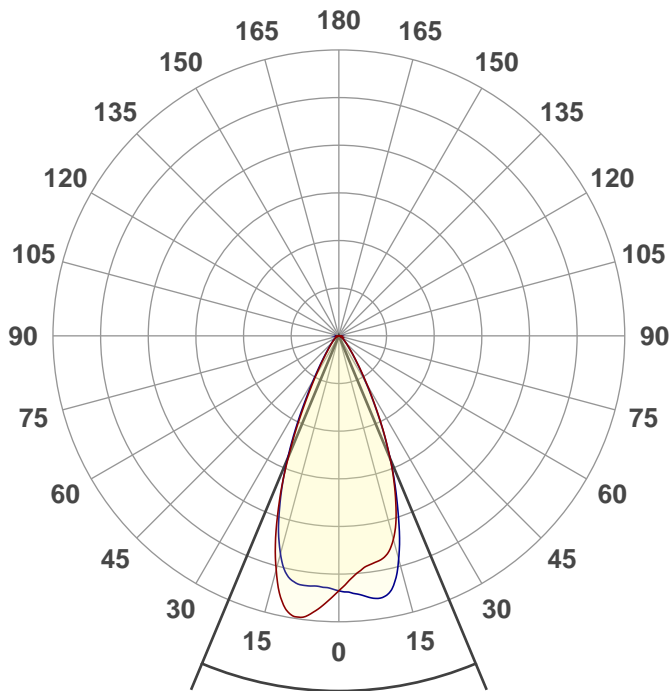
**Master of Engineering**

Pruefort:

**Lichtlabor**

**Gaustasse13-15**

**55411 Bingen am Rhein**



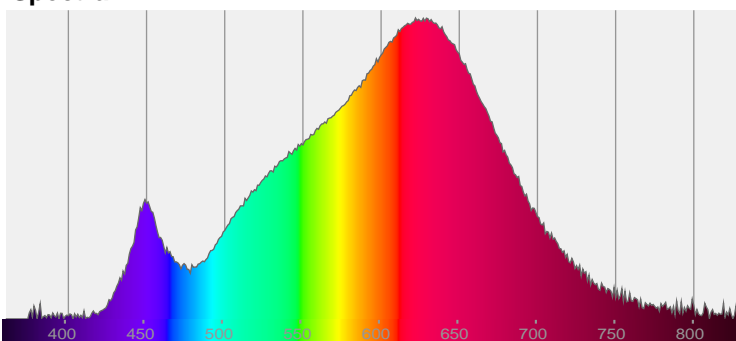
Beam angle

**45,3°**

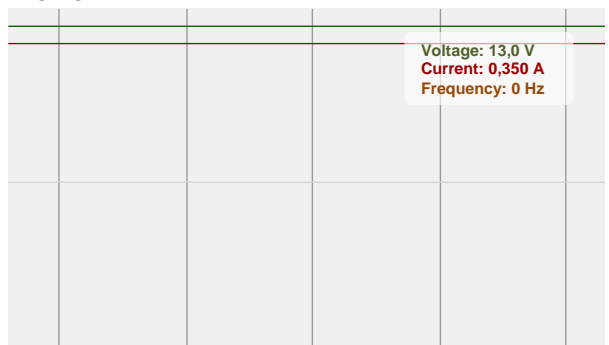


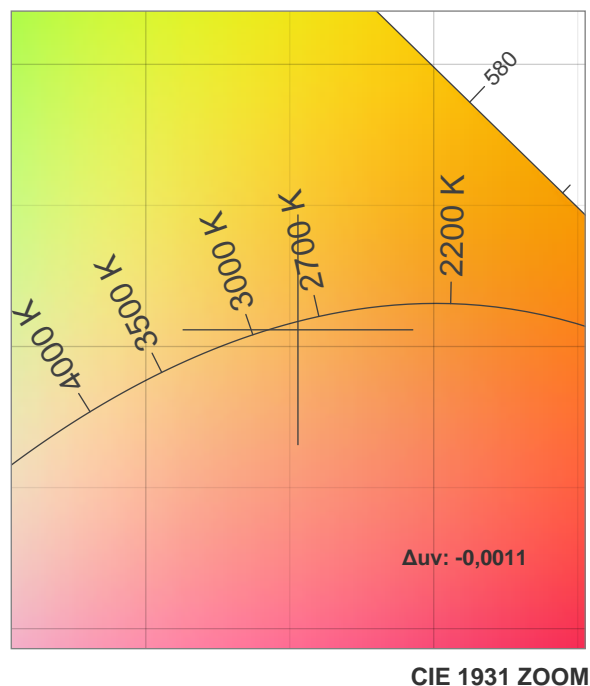
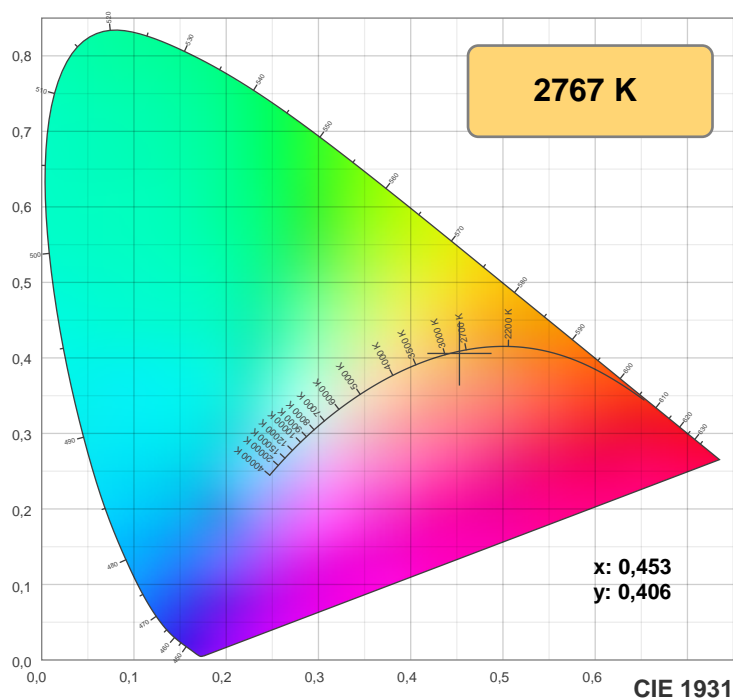
CIE 1931  
x: 0,453  
y: 0,406

Spectra

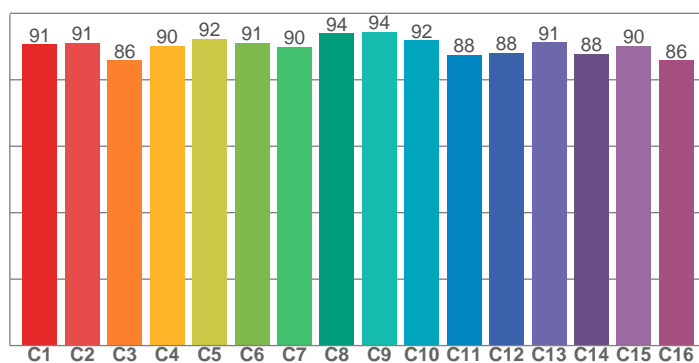


Power

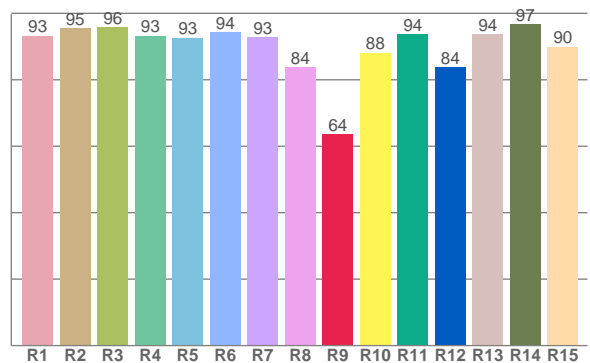




TM30: 90,2



CRI: 92,7 (R1-R8)



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  |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 93,3 | 95,5 | 95,7 | 93,2 | 92,6 | 94,4 | 92,8 | 83,9 | 63,5 | 88,1 | 93,7 | 83,8 | 93,8 | 96,7 | 89,9 |

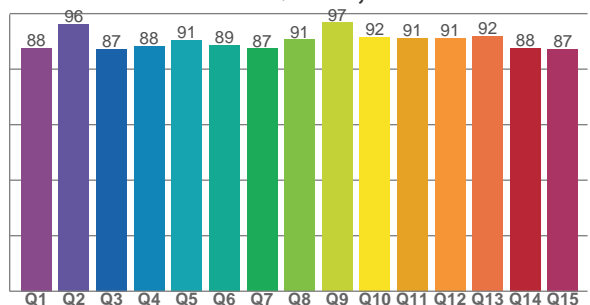
TM30 C values, 16 binned values out of total of 99 C values

| C1   | C2   | C3   | C4   | C5   | C6   | C7   | C8   | C9   | C10  | C11  | C12  | C13  | C14  | C15  | C16  |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 90,7 | 91,1 | 85,8 | 90,1 | 92,3 | 91,1 | 90,0 | 93,9 | 94,4 | 91,9 | 87,6 | 88,1 | 91,2 | 87,8 | 90,1 | 85,9 |

CQS Q values

| Q1   | Q2   | Q3   | Q4   | Q5   | Q6   | Q7   | Q8   | Q9   | Q10  | Q11  | Q12  | Q13  | Q14  | Q15  |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 87,6 | 96,3 | 87,2 | 88,2 | 90,5 | 88,8 | 87,4 | 90,6 | 96,8 | 91,7 | 91,2 | 91,2 | 91,8 | 87,6 | 87,3 |

CQS: 89,7



## Color parameters

| Color temperature | Color rendering index | Red component | Color fidelity | Color gamut | Color quality scale | Color coordinate cie 1931 | Color coordinate cie 1931 | Color coordinate | Color coordinate | Color deviation from black body |
|-------------------|-----------------------|---------------|----------------|-------------|---------------------|---------------------------|---------------------------|------------------|------------------|---------------------------------|
| CCT               | CRI                   | CRI R9        | TM30 Rf        | TM30 Rg     | CQS                 | x                         | y                         | u                | v                | Δuv                             |
| 2767 K            | 92,7                  | 63,5          | 90,2           | 101,5       | 89,7                | 0,453                     | 0,406                     | 0,260            | 0,350            | -0,0011                         |

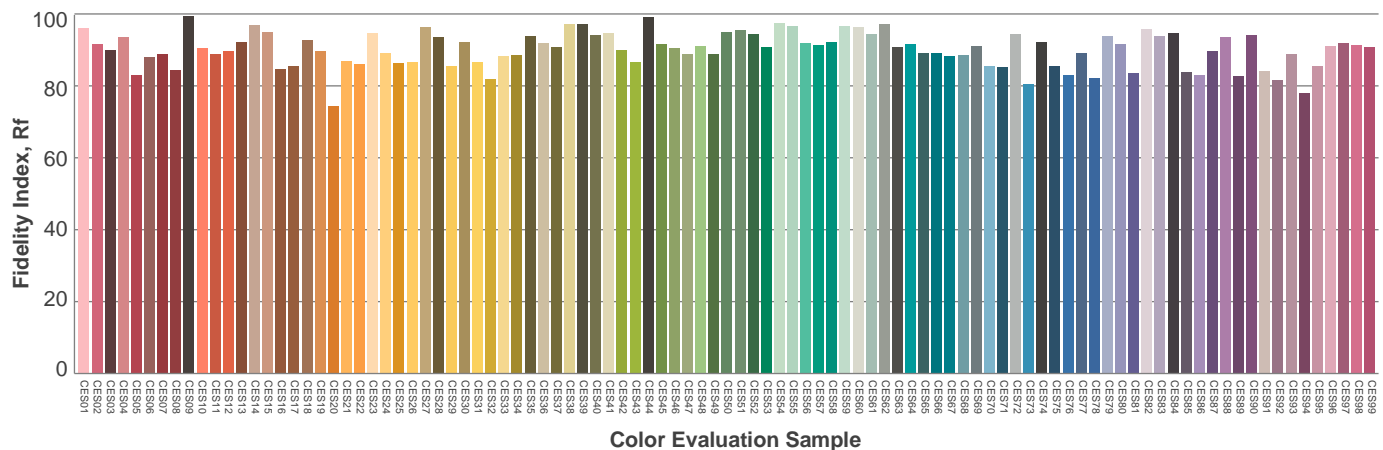
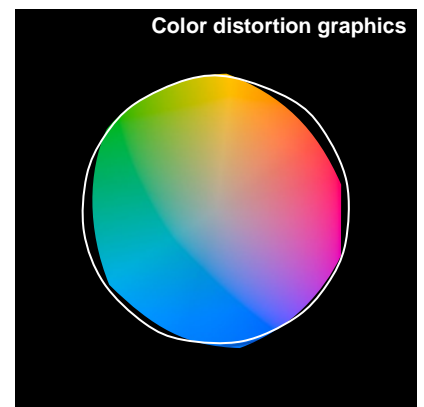
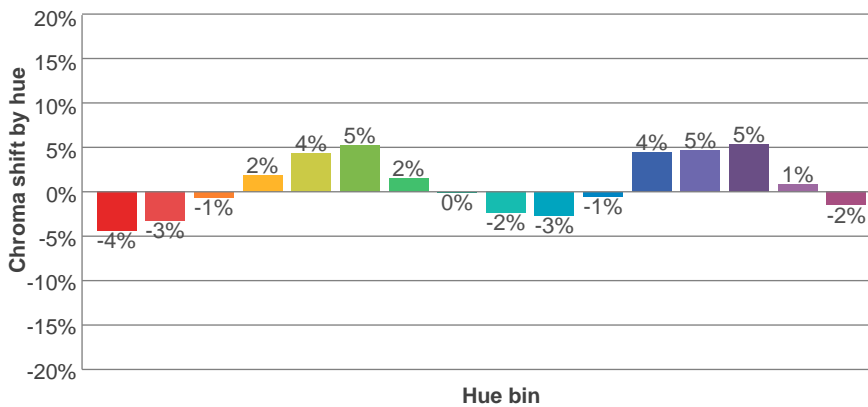
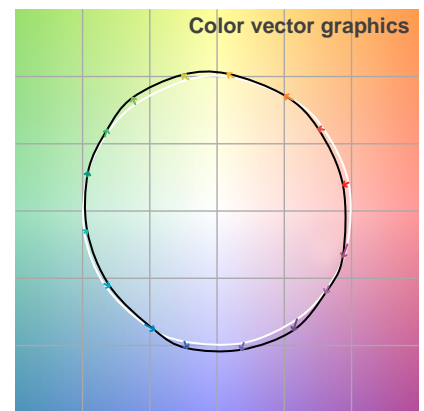
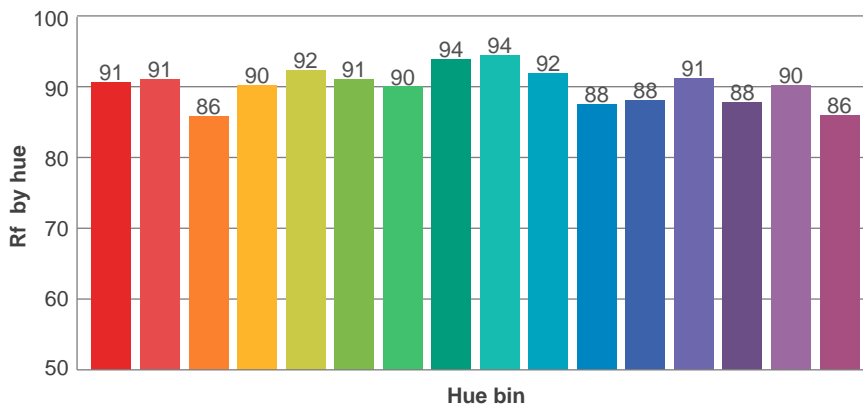
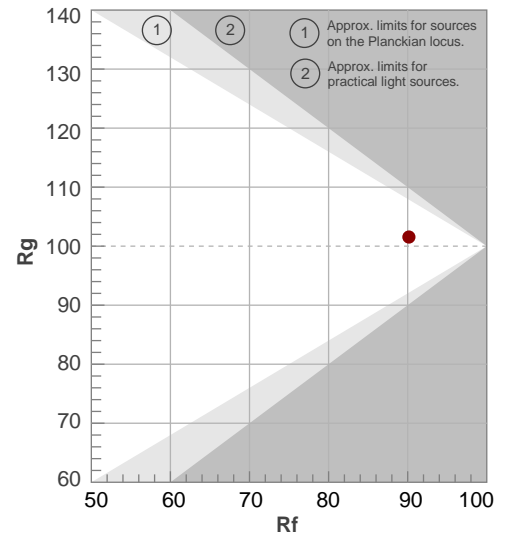
**Rf 90,2**

Fidelity index Rf

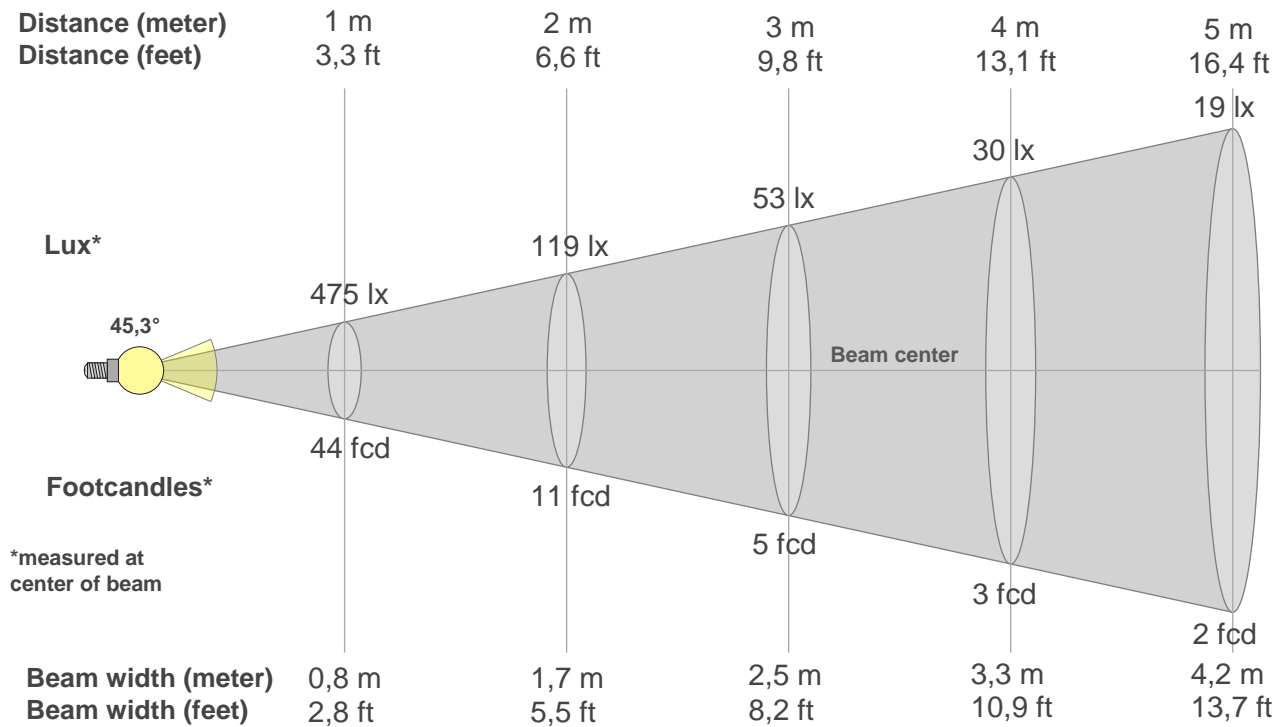
**Rg 101,5**

Gammut index Rg

| Hue Bin | R <sub>f</sub> | Graphic shifts (%) |      |
|---------|----------------|--------------------|------|
|         |                | Chroma             | Hue  |
| 1       | 91             | -4%                | -1%  |
| 2       | 91             | -3%                | 3%   |
| 3       | 86             | -1%                | 7%   |
| 4       | 90             | 2%                 | 5%   |
| 5       | 92             | 4%                 | 4%   |
| 6       | 91             | 5%                 | -1%  |
| 7       | 90             | 2%                 | -5%  |
| 8       | 94             | 0%                 | -4%  |
| 9       | 94             | -2%                | -1%  |
| 10      | 92             | -3%                | 4%   |
| 11      | 88             | -1%                | 8%   |
| 12      | 88             | 4%                 | 3%   |
| 13      | 91             | 5%                 | -3%  |
| 14      | 88             | 5%                 | -7%  |
| 15      | 90             | 1%                 | -5%  |
| 16      | 86             | -2%                | -10% |



## Beam details



### Beam intensities from 1-20m

| 1m      | 2m    | 3m     | 4m     | 5m     | 6m     | 7m     | 8m     | 9m     | 10m    | 11m    | 12m    | 13m    | 14m    | 15m    | 16m    | 17m    | 18m    | 19m    | 20m    |
|---------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 3,3ft   | 6,6ft | 9,8ft  | 13,1ft | 16,4ft | 19,7ft | 23ft   | 26,2ft | 29,5ft | 32,8ft | 36,1ft | 39,4ft | 42,7ft | 45,9ft | 49,2ft | 52,5ft | 55,8ft | 59,1ft | 62,3ft | 65,6ft |
| 475lx   | 119lx | 53lx   | 30lx   | 19lx   | 13lx   | 10lx   | 7lx    | 6lx    | 5lx    | 4lx    | 3lx    | 3lx    | 2lx    | 2lx    | 2lx    | 2lx    | 1lx    | 1lx    | 1lx    |
| 44,1fcd | 11fcd | 4,9fcd | 2,8fcd | 1,8fcd | 1,2fcd | 0,9fcd | 0,7fcd | 0,5fcd | 0,4fcd | 0,4fcd | 0,3fcd | 0,3fcd | 0,2fcd | 0,2fcd | 0,2fcd | 0,2fcd | 0,1fcd | 0,1fcd | 0,1fcd |

### 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° |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 475  | 459 | 446 | 435 | 430 | 426 | 419 | 404 | 379 | 345 | 305 | 263 | 218 | 176 | 137 | 106 | 81  | 63  | 49  | 39  |
| 100% | 97% | 94% | 92% | 90% | 90% | 88% | 85% | 80% | 73% | 64% | 55% | 46% | 37% | 29% | 22% | 17% | 13% | 10% | 8%  |

### 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° |
|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 475  | 477  | 482  | 488  | 494  | 493  | 480  | 451 | 409 | 361 | 312 | 264 | 217 | 172 | 133 | 101 | 77  | 58  | 46  | 36  |
| 100% | 101% | 101% | 103% | 104% | 104% | 101% | 95% | 86% | 76% | 66% | 56% | 46% | 36% | 28% | 21% | 16% | 12% | 10% | 8%  |

### Intensities in 180° c-plane

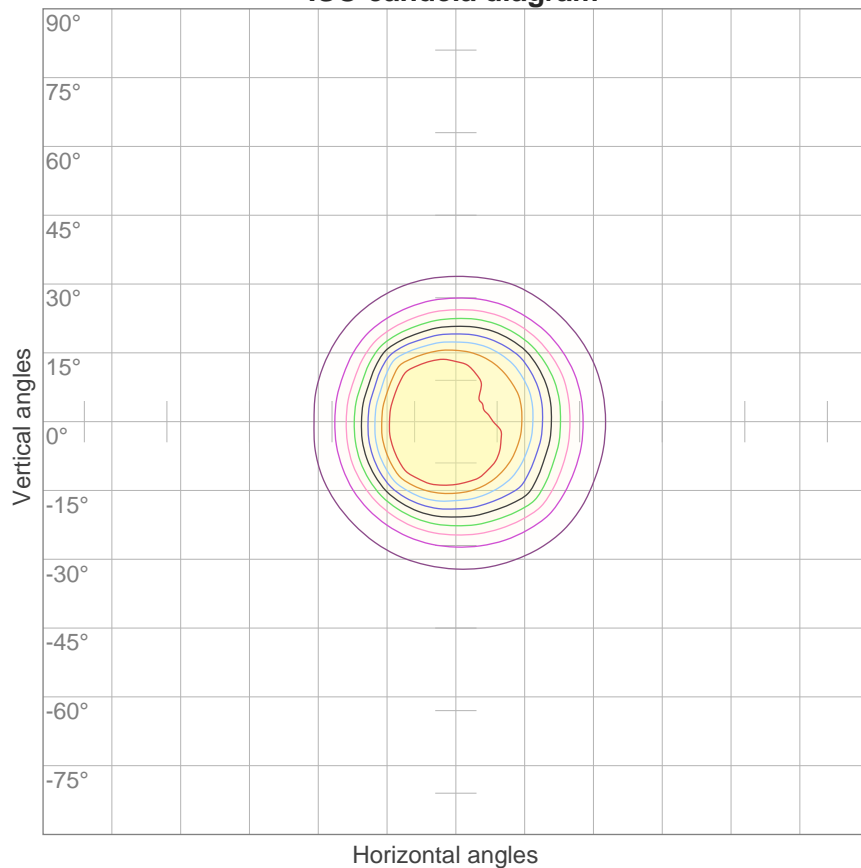
| 0°   | 2°   | 4°   | 6°   | 8°   | 10°  | 12°  | 14°  | 16° | 18° | 20° | 22° | 24° | 26° | 28° | 30° | 32° | 34° | 36° | 38° |
|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 475  | 491  | 508  | 522  | 529  | 525  | 507  | 473  | 429 | 378 | 321 | 263 | 206 | 156 | 116 | 87  | 66  | 50  | 40  | 32  |
| 100% | 103% | 107% | 110% | 111% | 111% | 107% | 100% | 90% | 80% | 68% | 55% | 43% | 33% | 24% | 18% | 14% | 11% | 8%  | 7%  |

### 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° |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 475  | 471 | 469 | 469 | 469 | 467 | 457 | 436 | 403 | 363 | 316 | 265 | 214 | 166 | 125 | 94  | 71  | 55  | 44  | 35  |
| 100% | 99% | 99% | 99% | 99% | 98% | 96% | 92% | 85% | 76% | 66% | 56% | 45% | 35% | 26% | 20% | 15% | 12% | 9%  | 7%  |

| Beam angle 50% | Field angle 10% | Cutoff angle 2,5% | Intensity ratio in 120° cone | Intensity ratio in 90° cone |
|----------------|-----------------|-------------------|------------------------------|-----------------------------|
| 45,3°          | 70,1°           | 101,2°            | 97,5%                        | 92,7%                       |

ISO candela diagram



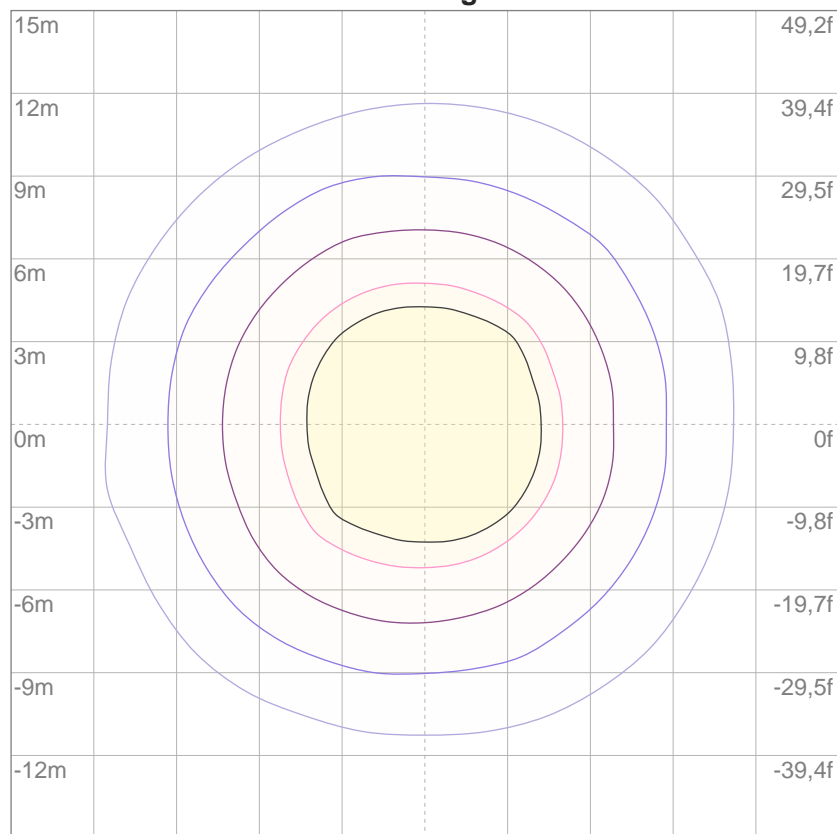
|     |        |
|-----|--------|
| 10% | 47 cd  |
| 20% | 95 cd  |
| 30% | 142 cd |
| 40% | 190 cd |
| 50% | 237 cd |
| 60% | 285 cd |
| 70% | 332 cd |
| 80% | 380 cd |
| 90% | 427 cd |

Conditions:

Number of c-planes: 16

Candela at center: 475 cd

ISO lux diagram



|     |          |
|-----|----------|
| 3%  | 0,142 lx |
| 5%  | 0,237 lx |
| 10% | 0,475 lx |
| 30% | 1,42 lx  |
| 50% | 2,37 lx  |

Conditions:

Number of c-planes: 16

Lux at center: 4,75 lx

*Lux distribution on a surface  
when lamp is mounted at 10  
meters from the surface.*

## Glare Evaluation According to UGR

|   |     |   |      |      |      |      |   |      |      |      |      |
|---|-----|---|------|------|------|------|---|------|------|------|------|
| 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<br>X      Y   |     | Viewing direction at right angles to<br>lamp axis |      |      |      |      | Viewing direction parallel to lamp axis |      |      |      |      |
| 2H  | 2H  | 11,0  | 11,7 | 11,2 | 11,9 | 12,1 | 10,7                                    | 11,4 | 10,9 | 11,6 | 11,8 |
|   | 3H  | 11,4  | 12,0 | 11,6 | 12,3 | 12,5 | 11,1                                    | 11,7 | 11,4 | 12,0 | 12,2 |
|   | 4H  | 11,5  | 12,2 | 11,8 | 12,4 | 12,7 | 11,3                                    | 11,9 | 11,6 | 12,1 | 12,4 |
|   | 6H  | 11,7  | 12,3 | 12,1 | 12,6 | 12,9 | 11,5                                    | 12,0 | 11,8 | 12,3 | 12,6 |
|   | 8H  | 11,8  | 12,4 | 12,2 | 12,7 | 13,0 | 11,5                                    | 12,1 | 11,9 | 12,4 | 12,7 |
|   | 12H | 12,0  | 12,5 | 12,3 | 12,8 | 13,1 | 11,6                                    | 12,2 | 12,0 | 12,5 | 12,8 |
| 4H  | 2H  | 11,1  | 11,8 | 11,4 | 12,0 | 12,3 | 10,8                                    | 11,5 | 11,1 | 11,7 | 12,0 |
|   | 3H  | 11,6  | 12,1 | 12,0 | 12,4 | 12,8 | 11,3                                    | 11,9 | 11,7 | 12,2 | 12,5 |
|   | 4H  | 11,9  | 12,4 | 12,3 | 12,7 | 13,0 | 11,6                                    | 12,1 | 12,0 | 12,4 | 12,8 |
|   | 6H  | 12,2  | 12,6 | 12,6 | 12,9 | 13,3 | 11,9                                    | 12,3 | 12,3 | 12,7 | 13,1 |
|   | 8H  | 12,3  | 12,7 | 12,8 | 13,1 | 13,5 | 12,1                                    | 12,4 | 12,5 | 12,8 | 13,2 |
|   | 12H | 12,5  | 12,8 | 13,0 | 13,2 | 13,7 | 12,2                                    | 12,5 | 12,7 | 12,9 | 13,4 |
| 8H  | 4H  | 11,9  | 12,3 | 12,4 | 12,7 | 13,1 | 11,7                                    | 12,0 | 12,1 | 12,4 | 12,8 |
|   | 6H  | 12,3  | 12,6 | 12,8 | 13,0 | 13,4 | 12,1                                    | 12,3 | 12,5 | 12,8 | 13,2 |
|   | 8H  | 12,5  | 12,8 | 13,0 | 13,2 | 13,7 | 12,3                                    | 12,5 | 12,7 | 12,9 | 13,4 |
|   | 12H | 12,8  | 13,0 | 13,3 | 13,5 | 14,0 | 12,5                                    | 12,7 | 13,0 | 13,2 | 13,7 |
| 12H   | 4H  | 11,9  | 12,2 | 12,4 | 12,6 | 13,0 | 11,7                                    | 12,0 | 12,1 | 12,4 | 12,8 |
|   | 6H  | 12,3  | 12,5 | 12,8 | 13,0 | 13,4 | 12,1                                    | 12,3 | 12,5 | 12,7 | 13,2 |
|   | 8H  | 12,6  | 12,7 | 13,0 | 13,2 | 13,7 | 12,3                                    | 12,5 | 12,8 | 13,0 | 13,5 |
| Variation of the observer position for the luminaire distance S |     |   |      |      |      |      |   |      |      |      |      |
| S = 1,0H  |     | +1,8 / -1,2                                       |      |      |      |      | +1,8 / -1,2                             |      |      |      |      |
| S = 1,5H  |     | +3,6 / -1,8                                       |      |      |      |      | +3,5 / -1,9                             |      |      |      |      |
| S = 2,0H  |     | +5,2 / -2,4                                       |      |      |      |      | +5,2 / -2,4                             |      |      |      |      |
| Standard table  |     | BK03  |      |      |      |      | BK03                                    |      |      |      |      |
| Correction<br>summand   |     | -5,2  |      |      |      |      | -5,5                                    |      |      |      |      |
| Corrected glare indices referring to 320 lm total luminous flux |     |   |      |      |      |      |   |      |      |      |      |

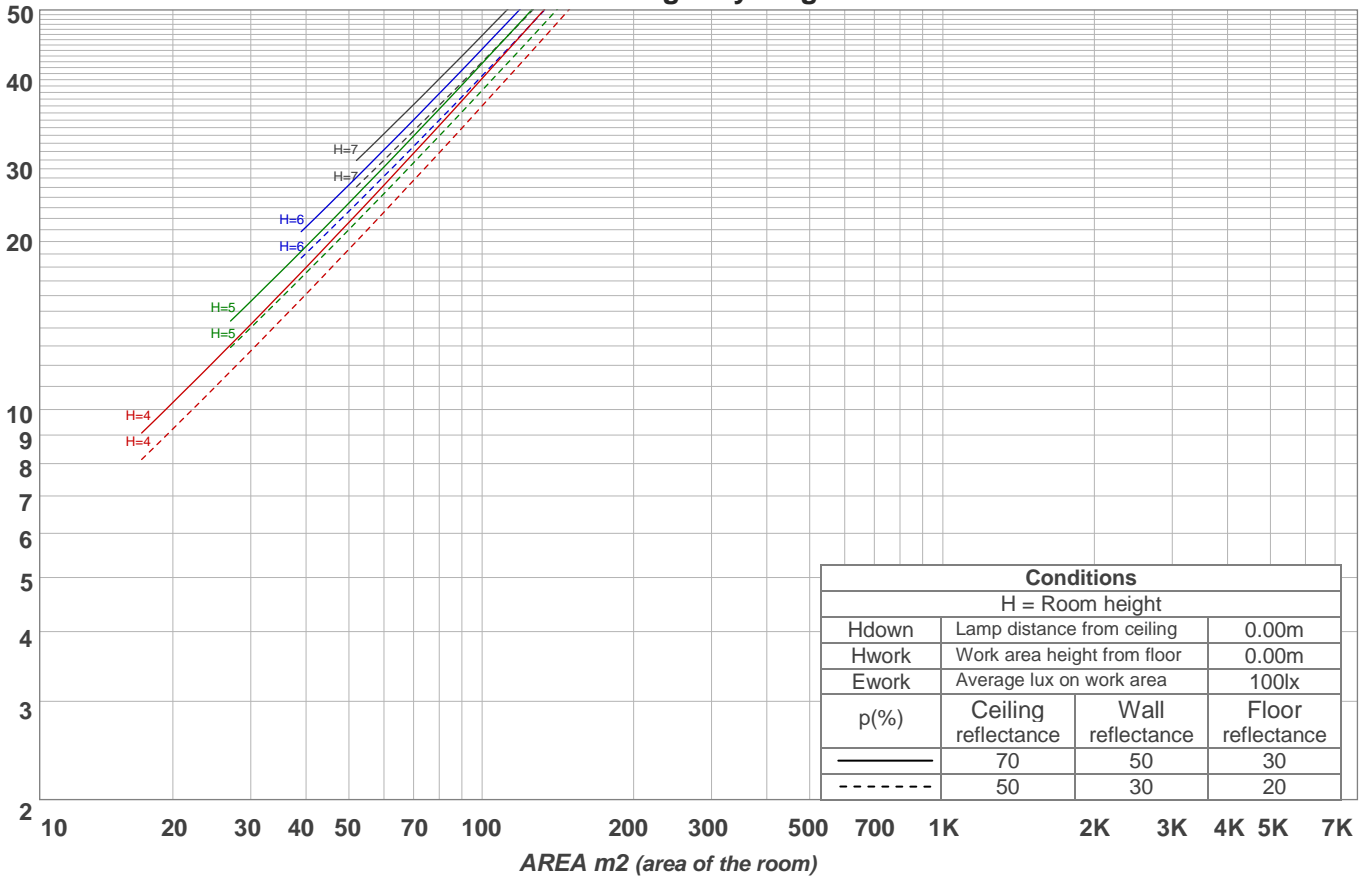
UGR data could be incorrect as lamp output is not symmetrical. Goto Edit->Photometric->Corrections and select Correct asymmetry.

## 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 Lumens 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 | 105 | 103 | 101 | 101 | 99  | 98  | 97  | 96  | 95  | 93  |
| 2                   | 108  | 103 | 99  | 96  | 106 | 102 | 98  | 95  | 98  | 95  | 93  | 95  | 93  | 91  | 93  | 91  | 89  | 87  |
| 3                   | 103  | 97  | 92  | 88  | 101 | 95  | 91  | 87  | 93  | 89  | 86  | 90  | 87  | 85  | 88  | 86  | 83  | 82  |
| 4                   | 98   | 91  | 86  | 82  | 96  | 90  | 85  | 81  | 88  | 83  | 80  | 86  | 82  | 79  | 84  | 81  | 78  | 77  |
| 5                   | 94   | 86  | 80  | 76  | 92  | 85  | 80  | 76  | 83  | 78  | 75  | 81  | 77  | 74  | 80  | 76  | 74  | 72  |
| 6                   | 89   | 81  | 75  | 71  | 88  | 80  | 75  | 71  | 79  | 74  | 71  | 77  | 73  | 70  | 76  | 72  | 70  | 68  |
| 7                   | 86   | 77  | 71  | 67  | 84  | 76  | 71  | 67  | 75  | 70  | 67  | 74  | 69  | 66  | 73  | 69  | 66  | 65  |
| 8                   | 82   | 73  | 67  | 63  | 81  | 72  | 67  | 63  | 71  | 67  | 63  | 70  | 66  | 63  | 69  | 66  | 63  | 61  |
| 9                   | 79   | 69  | 64  | 60  | 77  | 69  | 64  | 60  | 68  | 63  | 60  | 67  | 63  | 60  | 66  | 62  | 60  | 58  |
| 10                  | 75   | 66  | 61  | 57  | 74  | 66  | 61  | 57  | 65  | 60  | 57  | 64  | 60  | 57  | 64  | 60  | 57  | 56  |

LAMPS (number of lamps)

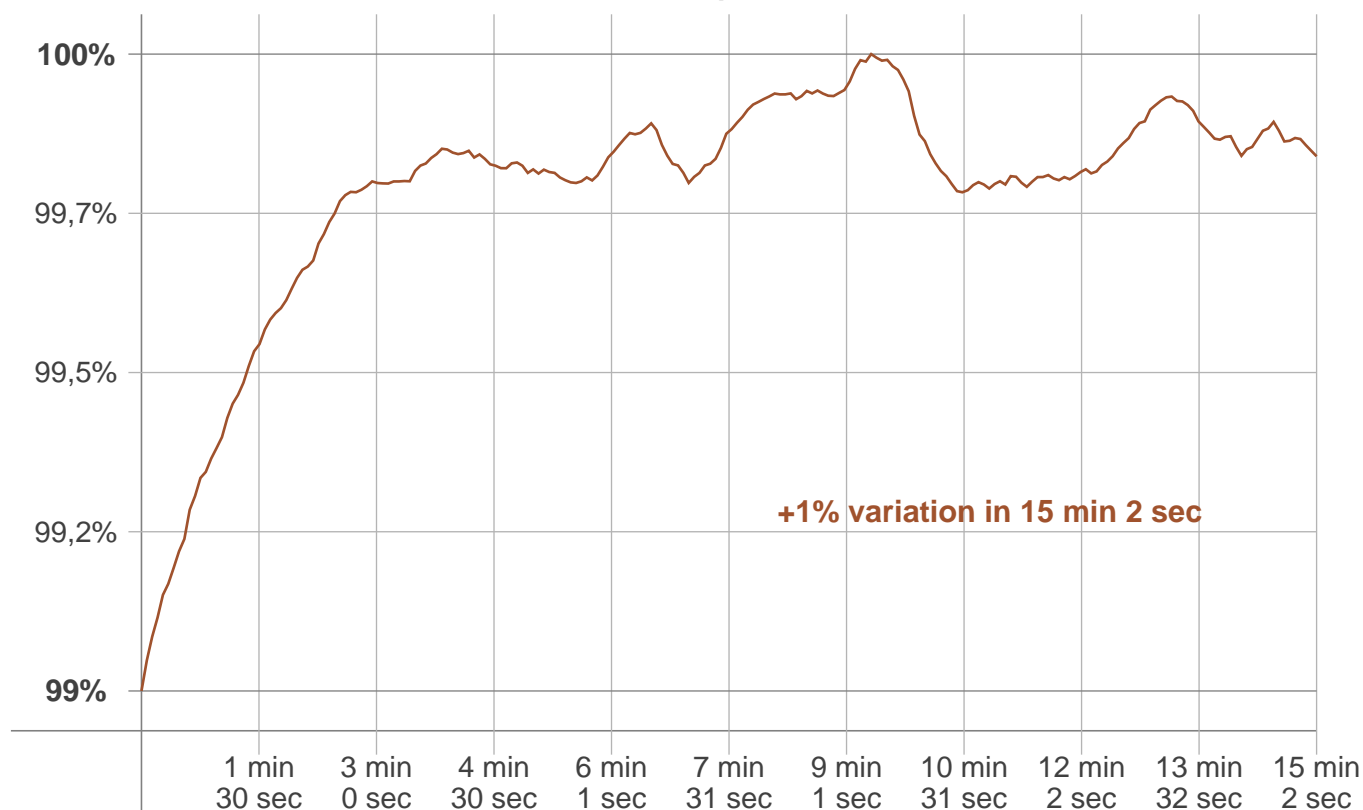
## Luminaire budgetary diagram



## Zonal Lumen Summary

| 0°-10°    | 10°-20°   | 20°-30°   | 30°-40°   | 40°-50°   | 50°-60°   | 60°-70°   | 70°-80°   | 80°-90°   |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| {LUM0-10} | 116 lm    | 91,3 lm   | 34,6 lm   | 15,4 lm   | 8,78 lm   | 4,69 lm   | 2,27 lm   | 1,03 lm   |
| 90°-100°  | 100°-110° | 110°-120° | 120°-130° | 130°-140° | 140°-150° | 150°-160° | 160°-170° | 170°-180° |
| 0,017 lm  | 0,000 lm  | 0,000 lm  | 0,000 lm  | 0,000 lm  | 0,000 lm  | 0,000 lm  | 0,000 lm  | 0,000 lm  |

Warmup curve



Warmup result

|                  |              |
|------------------|--------------|
| Warmup time:     | 15 min 2 sec |
| Warmup variation | +1,0%        |

Warmup conditions

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

Color temperature change

|           |            |         |
|-----------|------------|---------|
| CCT start | CCT change | CCT end |
| 2770 K    | -3 K       | 2767 K  |

Output change

|              |               |            |
|--------------|---------------|------------|
| Output start | Output change | Output end |
| 318 lm       | +2 lm         | 320 lm     |



## Flicker curve (complete sampled flicker signal)



## Flicker frame (frame of one flicker period)



## Flicker FFT (frequency scope of flicker curve)



## Flicker results:

|                       |        |
|-----------------------|--------|
| Flicker frequency:    | n/a Hz |
| Flicker index:        | n/a    |
| Flicker percentage:   | n/a %  |
| SVM: (Visual flicker) | n/a    |

## Flicker conditions:

|              |                       |
|--------------|-----------------------|
| Sample rate: | 60.000 samples/second |
|--------------|-----------------------|