Highly efficient LEDiL optics for UVC disinfection and other applications

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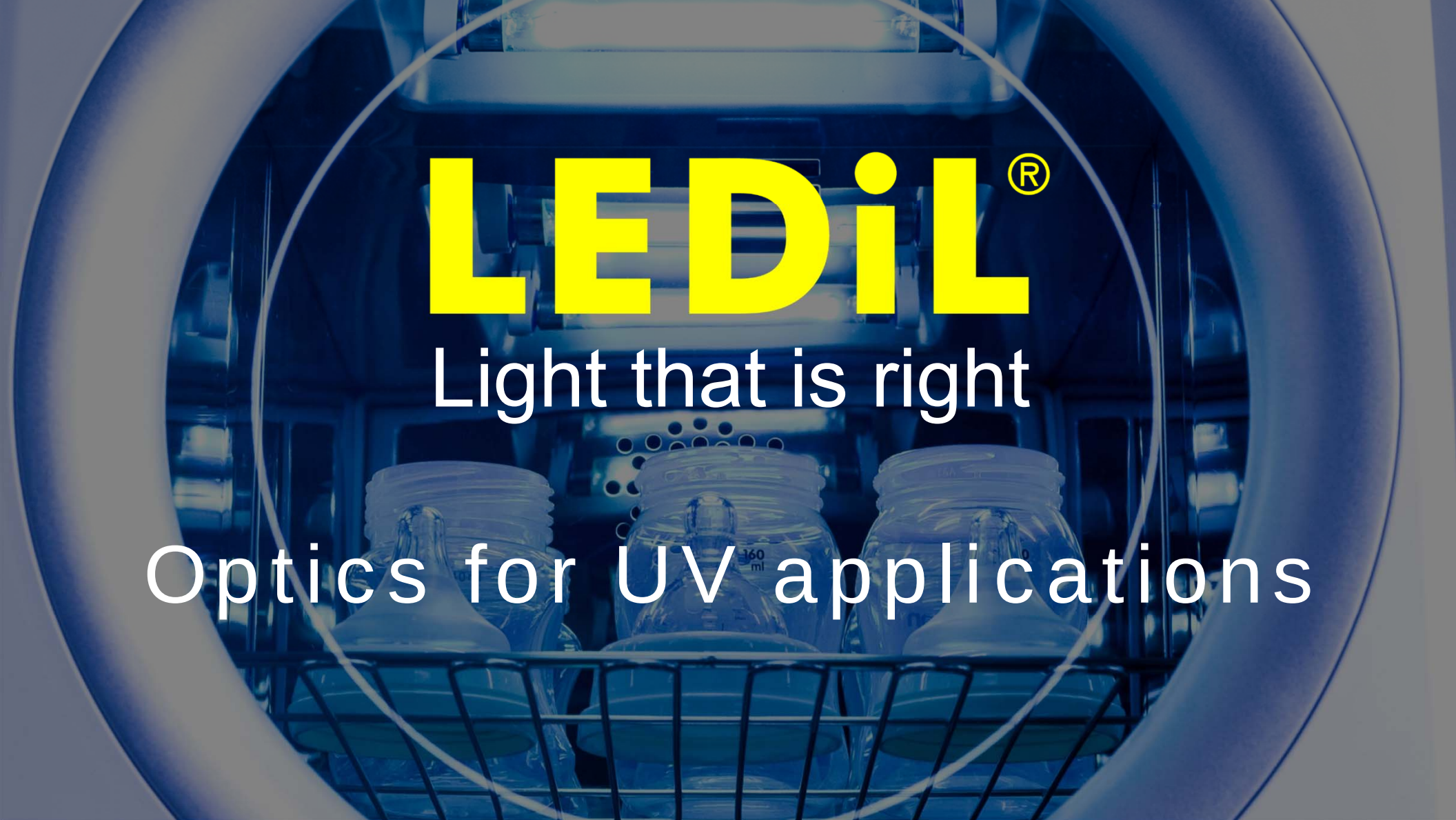
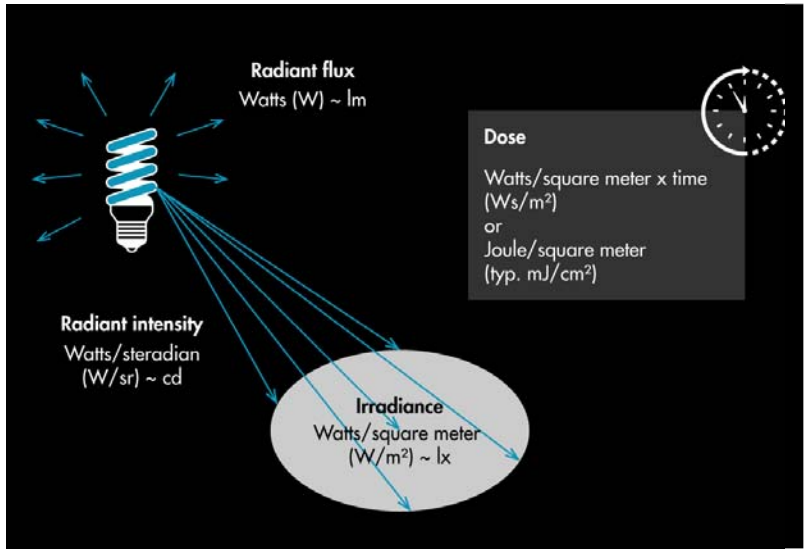
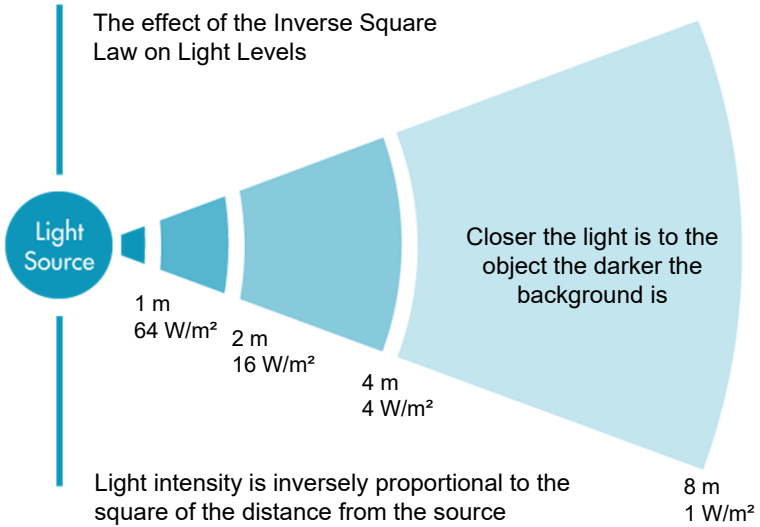

LEDiL®
Light that is right
Optics for UV applications

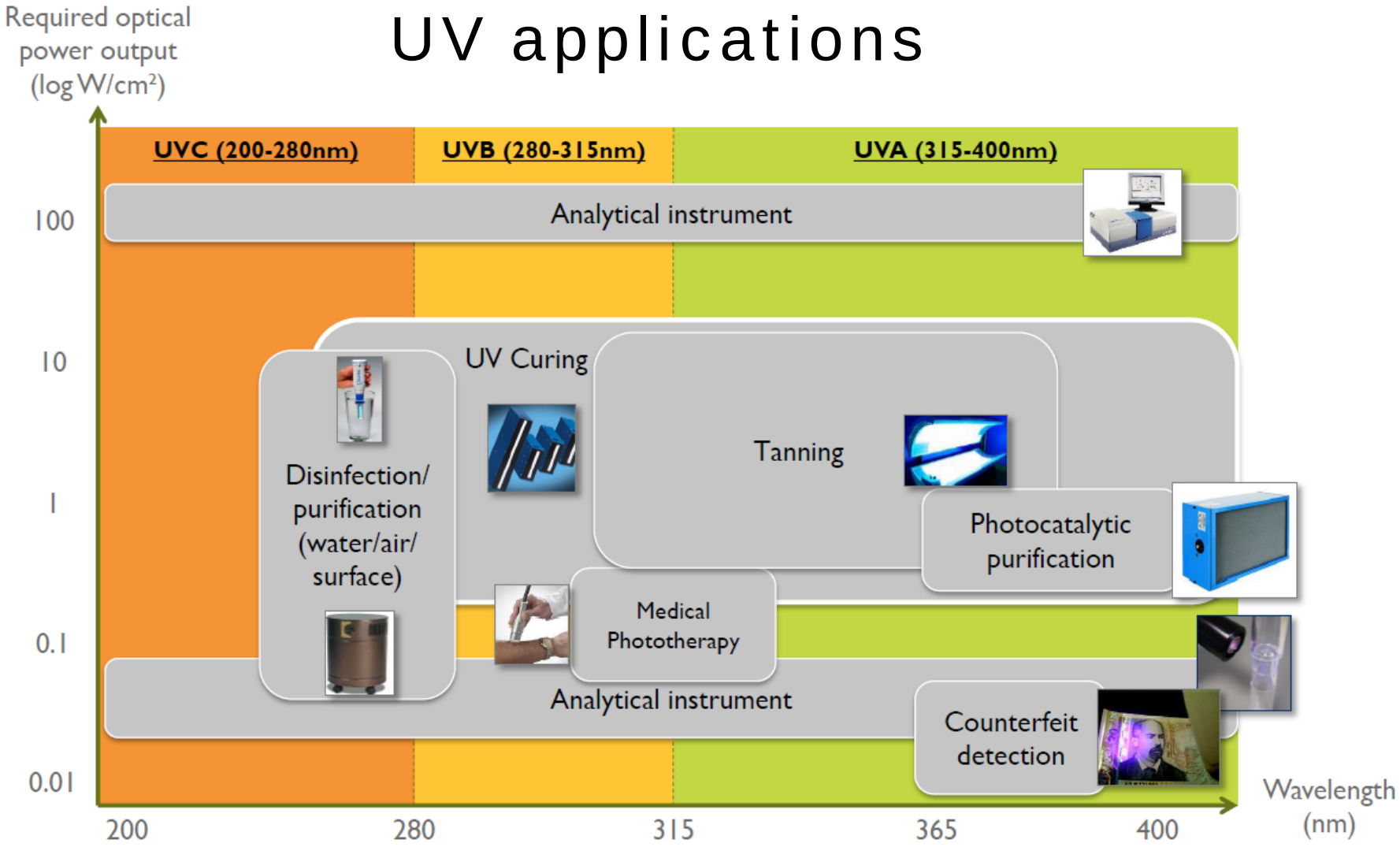
Ultraviolet light



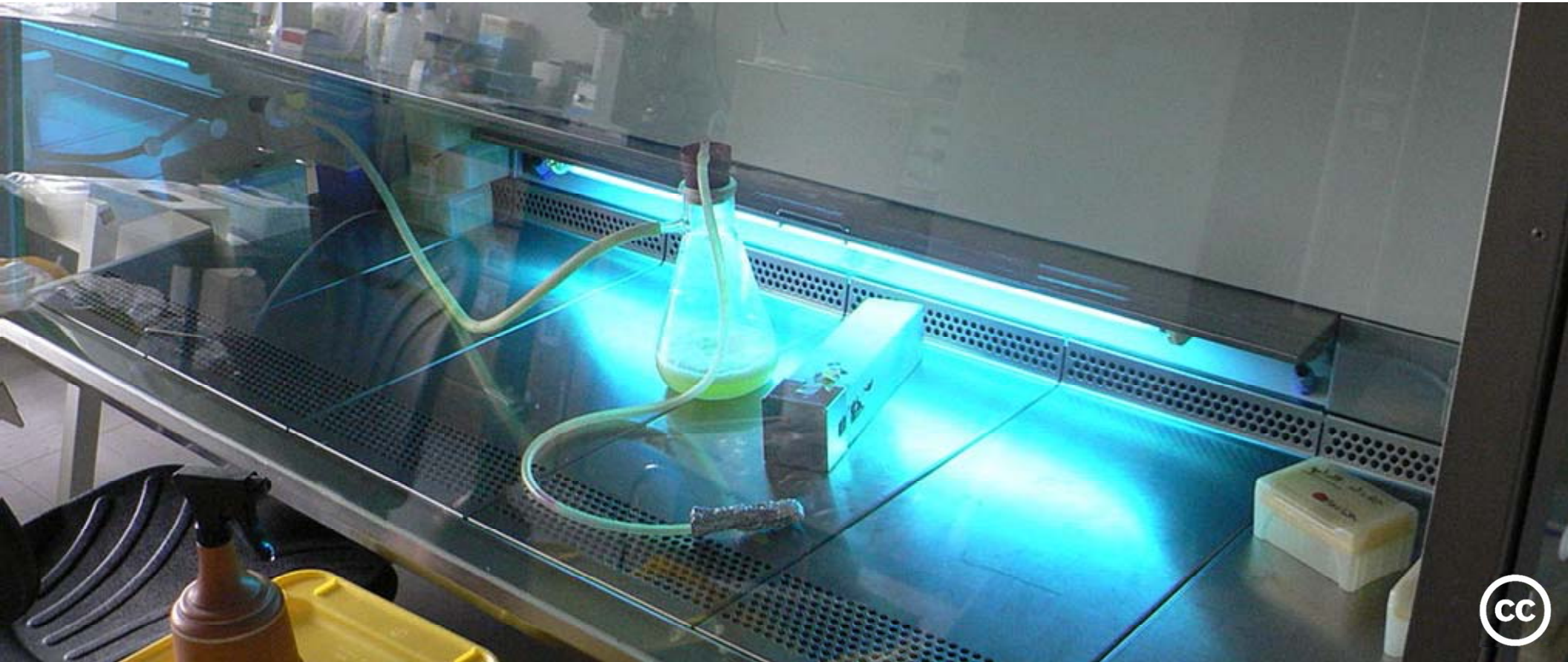


- UV-C is scattered in air which reduces its intensity
- Traditionally produced by mercury lamps with very short life, recently UV-LEDs have become commercially viable solution (longer lifetime, easier to control)
- Possible risk for humans, esp. UV-C can produce sun burns very quickly and lead to skin cancer. UV is not visible to human eye!
- Very short UV-C wavelengths produce ozone that can be a health risk

UV applications

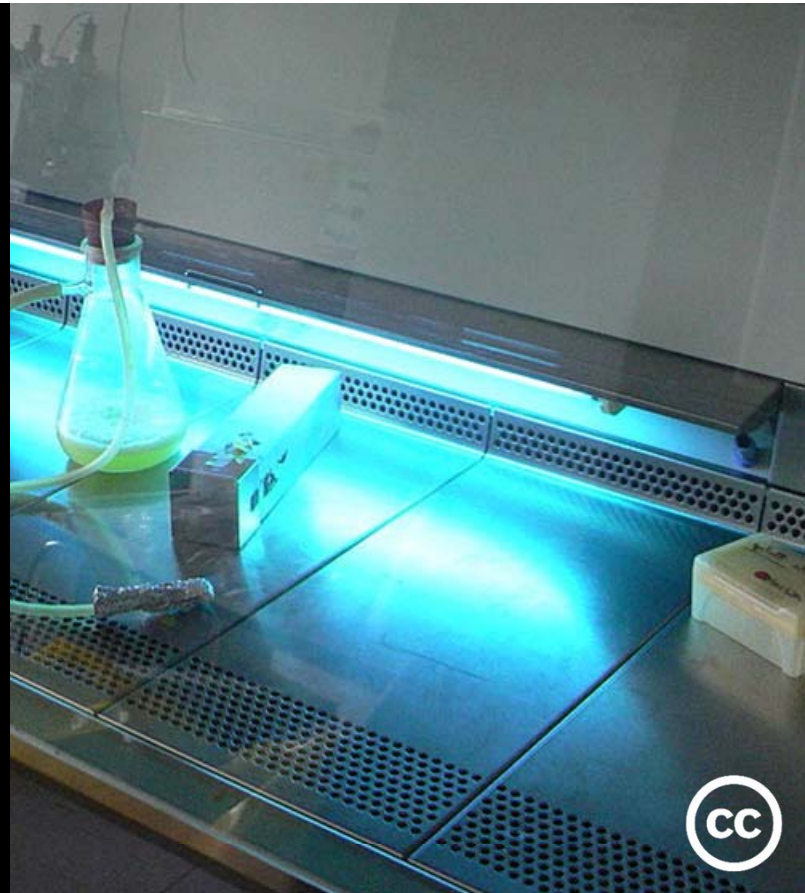


UV-C disinfection



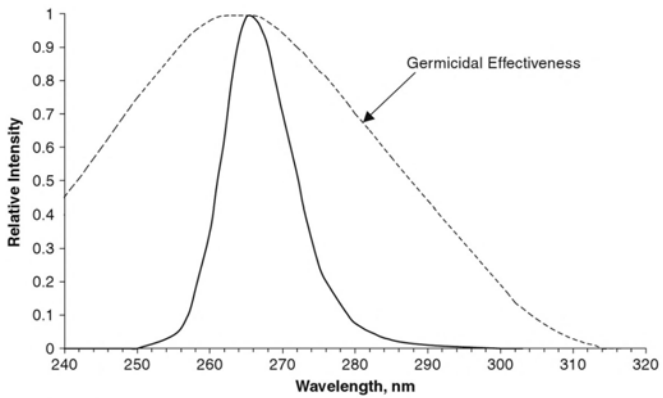
UV-C disinfection

- Chemical free and contactless form of disinfection
- Disinfection method that uses short-wavelength ultraviolet (UV-C) light to kill or inactivate microorganisms by destroying nucleic acids and disrupting their DNA, leaving them unable to perform vital cellular functions
- DNA and RNA of most bacteria and viruses is most sensitive to radiation wavelengths between 260−270 nm however germicidal effectiveness range goes up to 310 nm wavelength
    - UV-C absorption by proteins can lead to ruptures of cell walls and death of organism
    - UV-C can break bonds in amino acids esp. thymine forming dimers which disrupt DNA replication process and the cells cannot replicate



Effectiveness of UV-C Disinfection

- Needs to be designed for lamp output at the end of lifetime
- Effectiveness depends on dosage (power x time) and wavelength, same dosage can be achieved with lower irradiance levels if the exposure time is extended
  - Effectiveness is usually measured as log reduction value i.e. logarithmic reduction of germs
    (1-log = 90 %, 2-log = 99 %, 3-log = 99.9 %, …)
- Line-of sight exposure, shadowing reduces effectivity
- It is not necessary to kill pathogens with UV light, but rather apply enough UV light to prevent the organism from replicating
  - UV doses required to prevent replication are orders of magnitude lower than required to kill, making the cost of UV treatment to prevent infection commercially viable

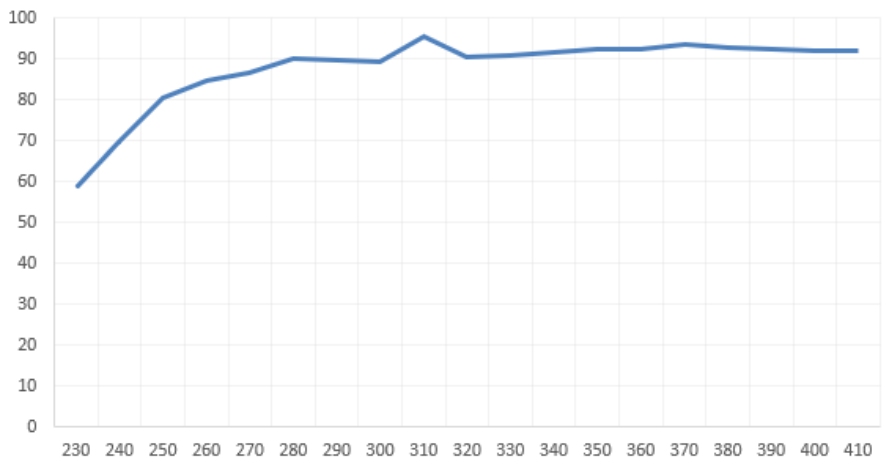


LEDiL materials for UV optics

LEDiL Silicone:

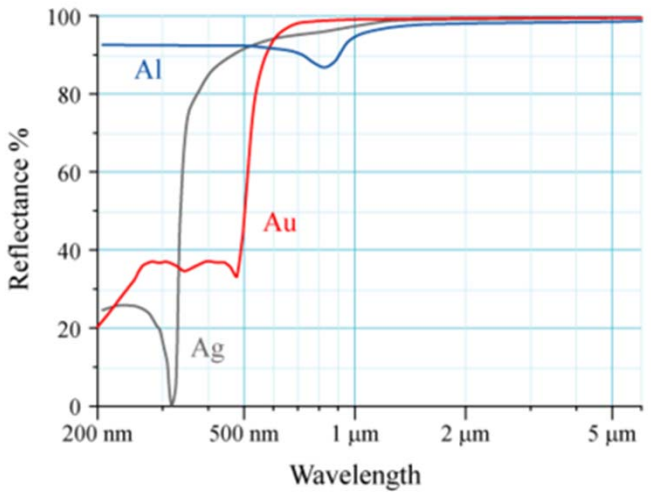
- High transmission in UV wavelengths, including UV-C
- Suitable for complex optical lens designs
- Easy to achieve ingress protection

[%T] (1mm thickness)



Aluminium:

- Cost effective option
- For UV-LED clusters
- Highly reflective in all UV wavelengths



LEDiL UV optics

UV-A
UV-B
UV-C

VIOLET & VIOLETTA
- 12-up lens arrays and single lenses
- Clusters or single LEDs 3535, 6868, CSP

UV-A
UV-B
UV-C

STELLA (WWW, Fresnel)
- Clusters up to 30 mm
- 3535, 6868 packages, CSP

UV-A
UV-B
UV-C

ZORYA
- Big clusters
- Clusters 3535, 6868, CSP

UV-A
UV-B
UV-C

ALISE
- Clusters up to 22 mm
- 3535, 6868, CSP

UV-A
UV-B

JENNY (CY)
- Clusters up to 11 mm
- 3535, CSP

UV-A
UV-B

SAGA
- Clusters up to 14 mm
- 3535, 6868, CSP

UV-A
UV-B

G2-ROSE-UV / G2-NIS033U
- Single LEDs 3535/6868

UV-A

SAKURA
- Clusters up to 25 mm
- 3535, 6868, CSP

ALISE

ALISE

Cost efficient and versatile reflector system for UV

- Thermally capable solution
- Suitable for cluster light engines
- Highly reflective aluminium suitable for UV-C

Features

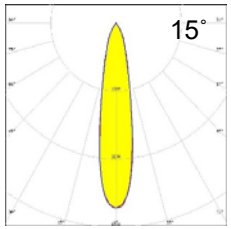
- Ø50 mm, Ø70 mm, Ø110 mm
- Made of aluminium (for good heat resistance)
- Attachment to small upper flange
- Efficiency ~90 %

Typical Applications

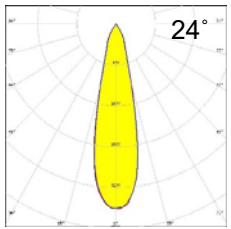
- UV-C disinfection
- Room disinfection

Compatibility

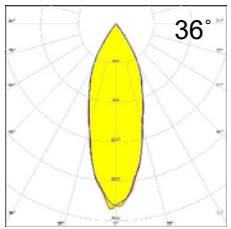
- Optimized:
  - Ø50 mm: LES 10 mm
  - Ø70 mm: LES 14.5 mm
  - Ø110 mm: LES 22 mm
- Optimized for Zhaga connectors
  e.g. Lumawise LED holders Z35, Z45, Z50



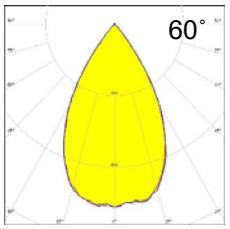
C16907_ALISE-50-S
C16903_ALISE-70-S
C16899_ALISE-110-S



C16908_ALISE-50-M
C16904_ALISE-70-M
C16900_ALISE-110-M



C16909_ALISE-50-W
C16905_ALISE-70-W
C16901_ALISE-110-W



C16910_ALISE-50-WW
C16906_ALISE-70-WW
C16902_ALISE-110-WW

VIOLET

VIOLET

The first standard silicone optic in the world designed specifically for UV-C applications

- Special silicone for high UV transmittance
- Lens and stainless steel frame made from highly resistant UV materials
- Enables creation of more cost-efficient solutions than with quartz glass
- Can be used with up to 4 LED clusters* for maximum efficiency and output

*Depends on LED

Features

- 293.3 x 41.6 mm
- 12 lenses
- Stainless steel installation frame
- Up to IP67

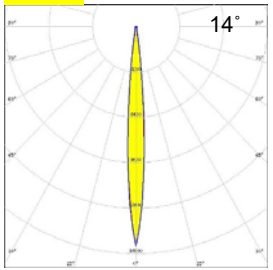
Typical Applications

- Disinfection (surface, air, water)
- Horticultural lighting (prevention of plant diseases etc)

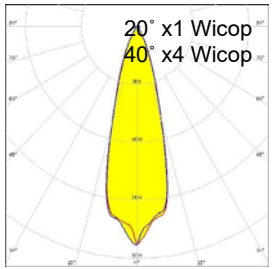
Compatibility

- UV LEDs from Seoul Viosys, Nichia

NEW

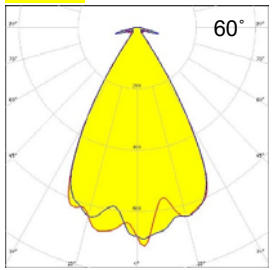


FN17810_VIOLET-12X1-RS



FN17294_VIOLET-12X1-S

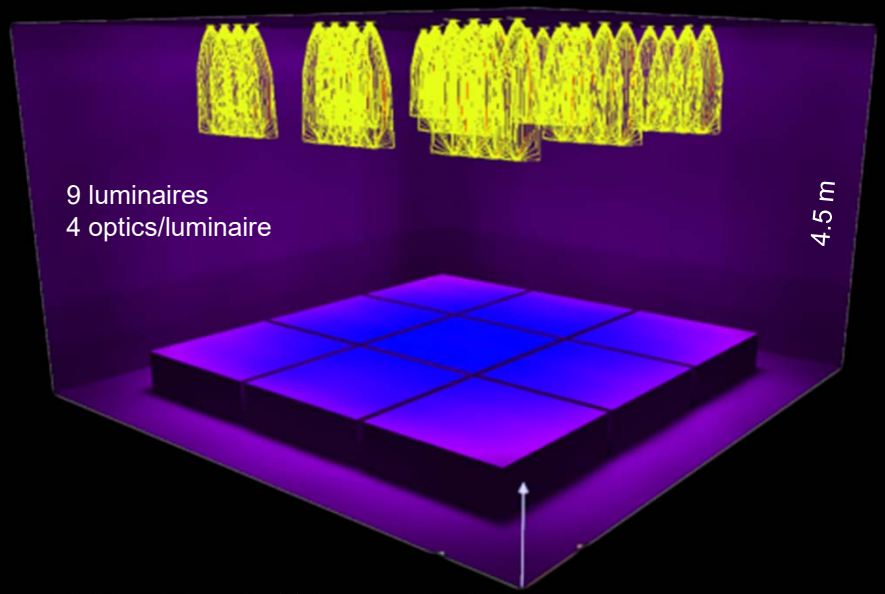
NEW

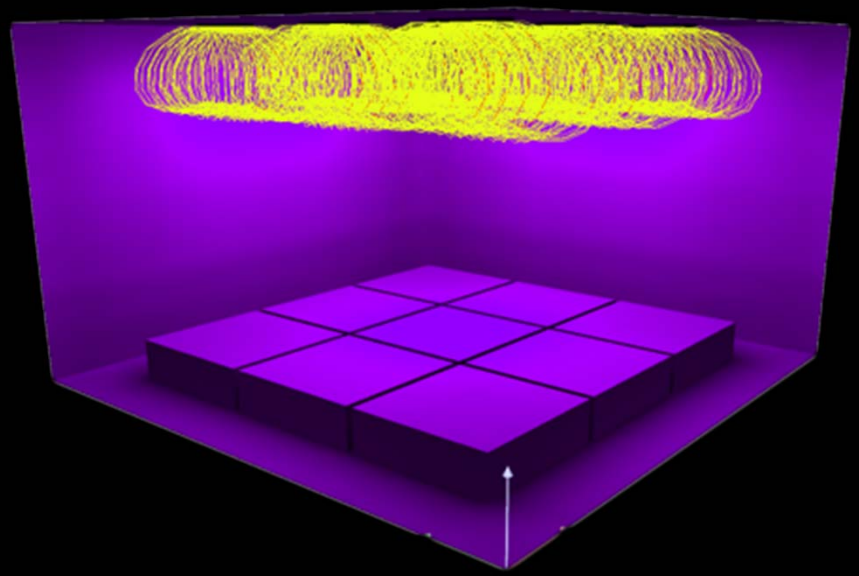


FN17818_VIOLET-12X1-W

EXAMPLE 1/2

Disinfection with VIOLET & Wicop LED vs Wicop LED only





VIOLET with Wicop LED

RESULTS
On workplane at 0.6 m

Average:	**258 mW/m2**
Min:	**243 mW/m2**
Max:	**280 mW/m2**
u0:	**0.942**

Wicop LED only

RESULTS
On workplane at 0.6 m

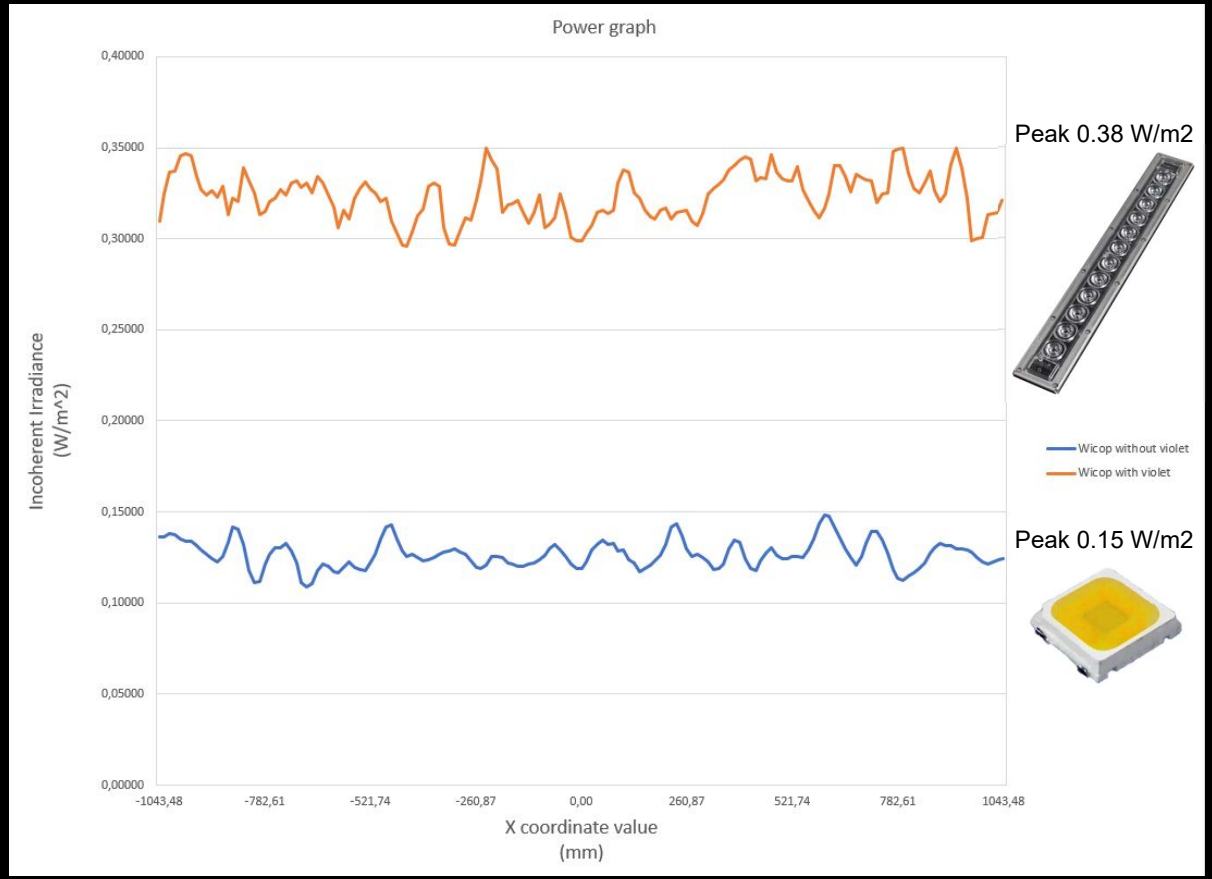
Average:	**119 mW/m2**
Min:	**116 mW/m2**
Max:	**121 mW/m2**
u0:	**0.977**

Irradiance

- 350 mW/m2
- 175 mW/m2
- 0 W/m2

EXAMPLE 2/2

Irradiance: VIOLET & Wicop LED vs Wicop LED only

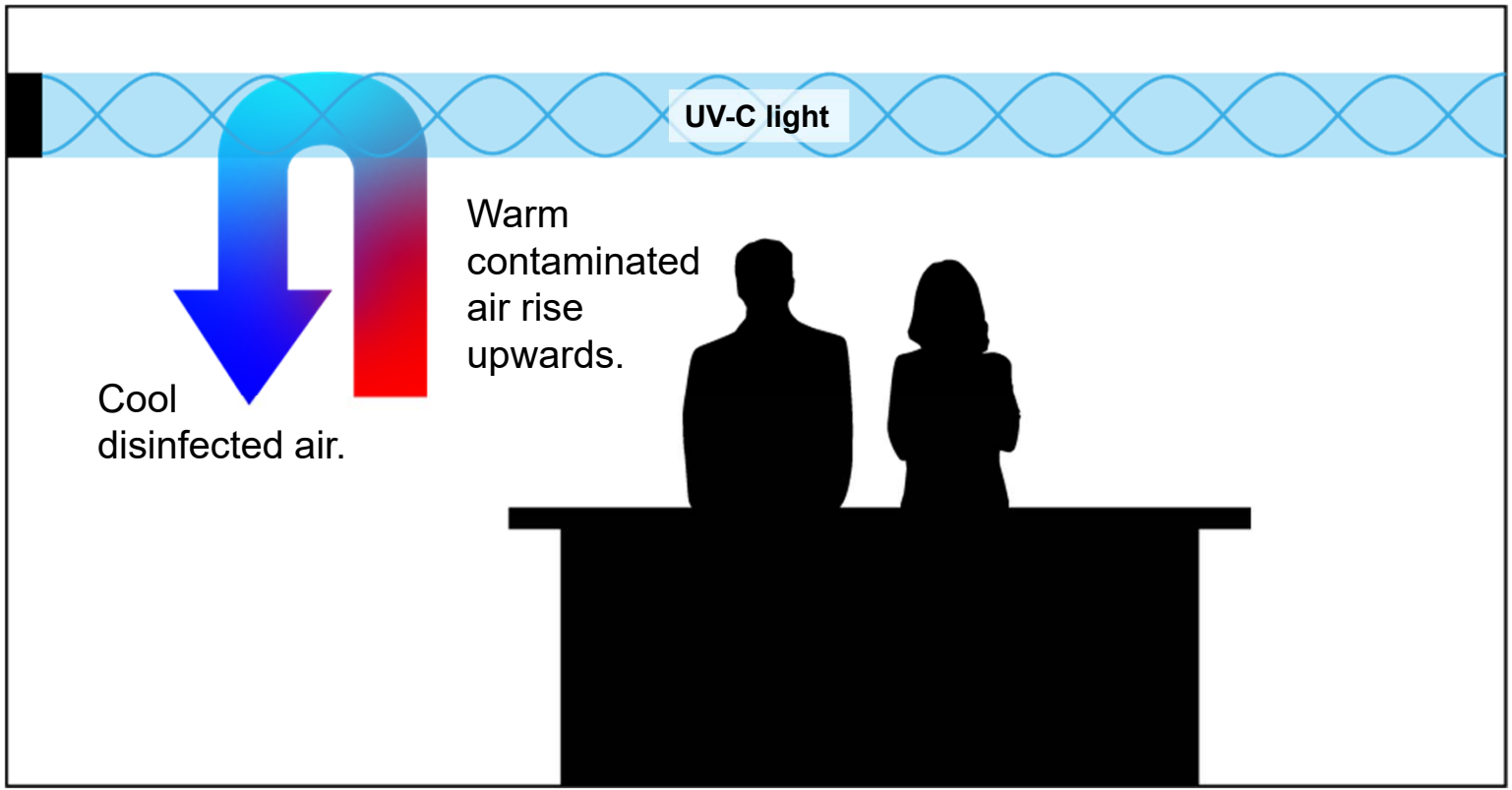


Peak 0.38 W/m2

Peak 0.15 W/m2

UVGI

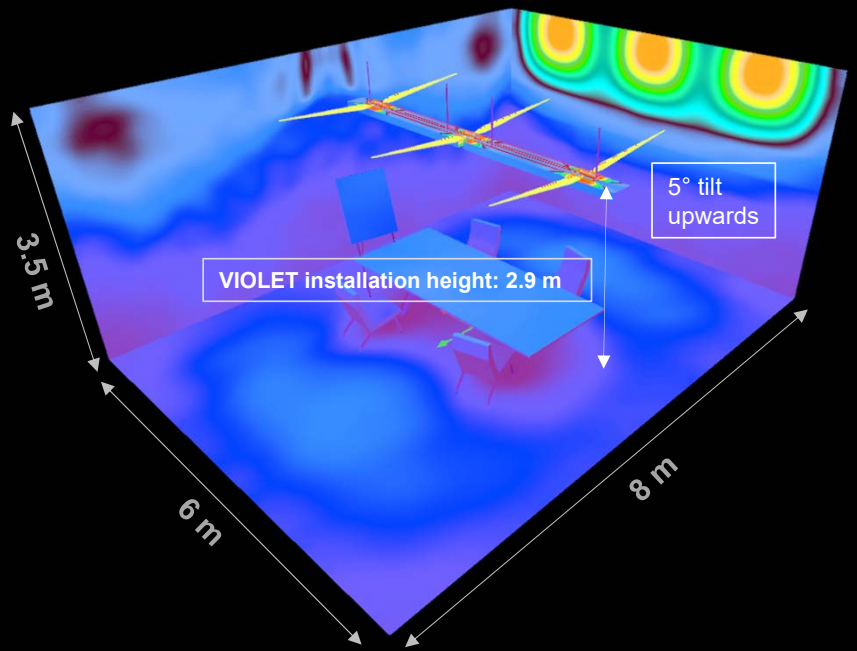
Disinfects large volumes of air at once

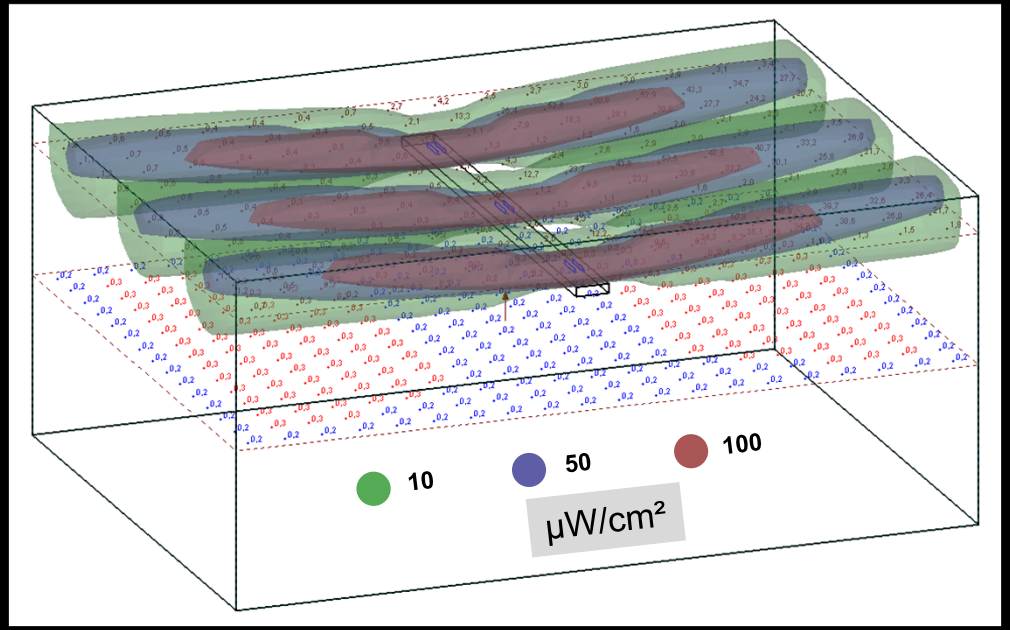


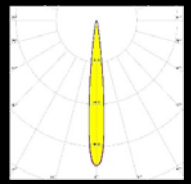
Low velocity ceiling fans and air condintioning can improve air circulation.

EXAMPLE

UR-UVGI(-LED)
Upper room ultraviolet germicidal inactivation (with light-emitting diodes) + LEDiL VIOLET







Surface reflectance: 10 %
Optics: LEDiL VIOLET-12-RS (80 % eff.)
LED: Nichia NCSU334A (280 nm)

Total UV-C output/VIOLET-RS: 528 mW
Total power/12 LEDs: 21.84 W

RESULTS

UPPER AIR (3.1 m)	EYE LEVEL (1.7 m)
Max: 60.8 µW/cm²	Max: 0.3 µW/cm²

VIOLETTA

VIOLETTA

Single silicone lens for near-field UV-C applications

- Unique silicone lens with high UV transmittance
- Easy to achieve ingress protection (IP) with sandwich mount between faceplate and PCB
- Single lens format allows for a wide variety of luminaire designs

Features

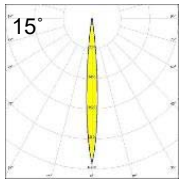
- 21.7 x 21.7 mm, H 6.51−6.6 mm
- Made from silicone
- Over 80% efficiency in 280 nm
- Shares the same footprint with LEDiL ROSE
- Multiple installation methods:
  - Steel frame
  - Potting
  - Sandwich type sealing

Typical Applications

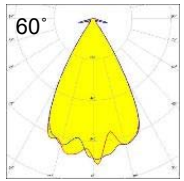
- Near-field UV-C irradiation
- Handheld sanitizers, hand dryers, UV-appliances, water bottles, hand-held lamps

Compatibility

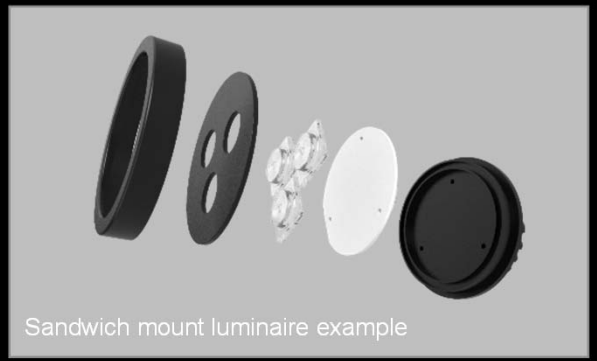
- Up to 7070 size LED packages or 2X2 LED clusters with up to 3030 package size



F17822_VIOLETTA-S

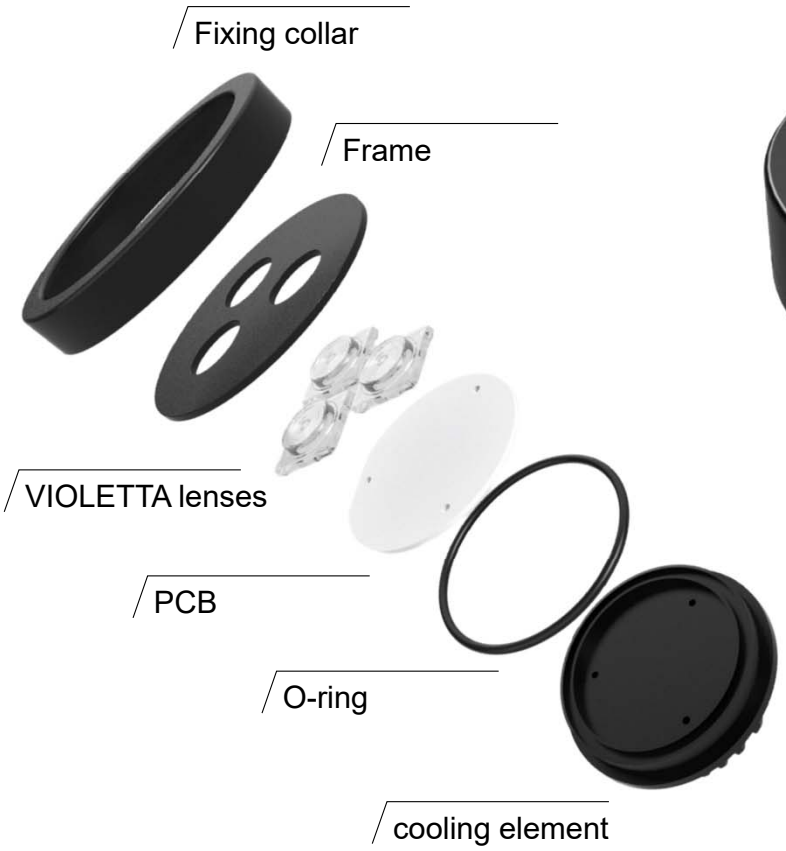


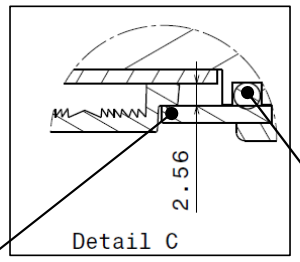
F17826_VIOLETTA-W


Sandwich mount luminaire example

Optics efficiency: 80 %
Total UV-C output: 132 mW
Total power: 5.46 W

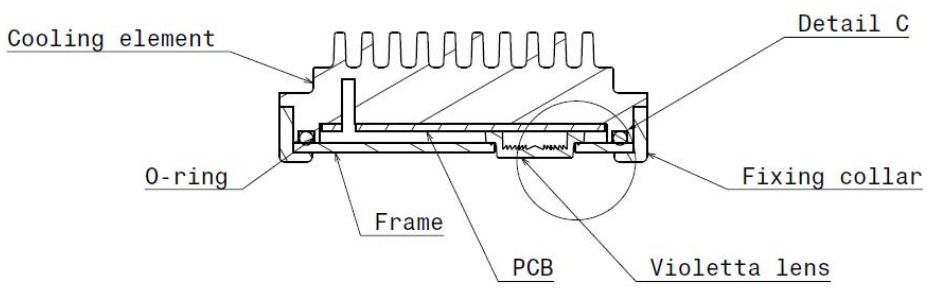
VIOLETTA luminaire example





Enough **pressure for integrated lens gasket** to seal the lens from top.

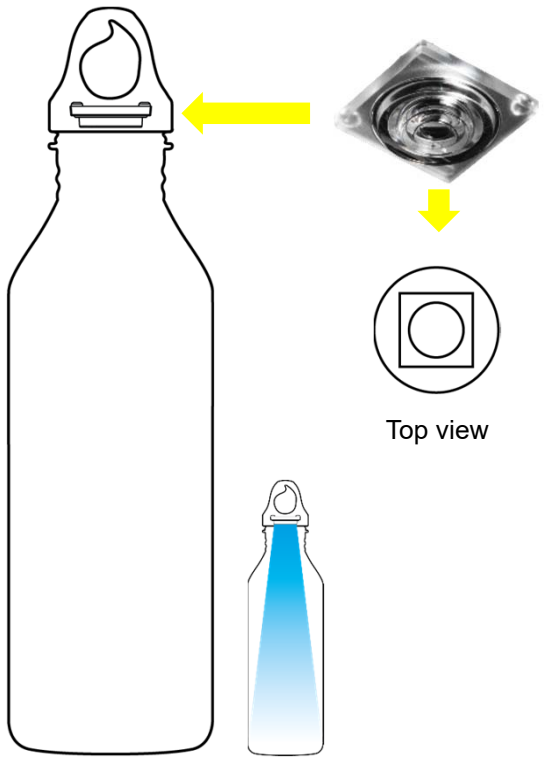
O-ring to seal PCB from the sides.



UV-C disinfection application examples with VIOLETTA

Drinking bottles

Disinfects the bottle and its content while the cap is fastened.

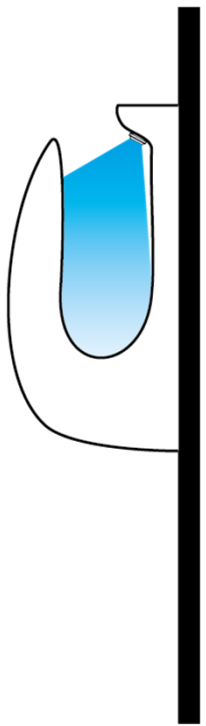


Top view

Side view

Hand-dryers

Disinfects the whole chamber where hands are dried.

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