LEDiL

Guide for horticultural lighting optics

V1-0 / 2022

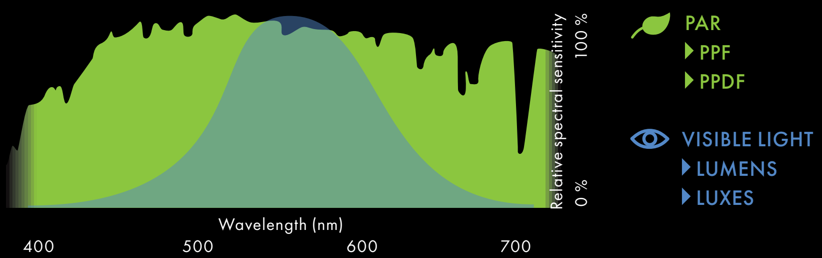
Horticultural lighting in a nutshell

Plants have a completely different sensitivity to light colours. Contrary to other lighting applications which are made for humans and valued in luxes, plants consume light and need **photons** for photosynthesis. The amount and ratio of different **wavelengths** from the light determine how, and how fast, plants grow and produce crop.

Regardless of different seasons or unstable weather today's artificially created horticultural lighting can mimic any daylight integral and have stable, **optimized growing conditions** for each plant.

Some terms to know

The **photosynthetic photon flux** (PPF), which comes from the total amount of **photosynthetically active radiation** (PAR), is what has the most effect on how strong plant growth will be. More PPF means more photons and more power, and this value can be easily measured and used as a parallel to lumens. On the other hand **photosynthetic flux density** (PPFD) means how many of the photons actually hit their target, and this can be related to luxes.

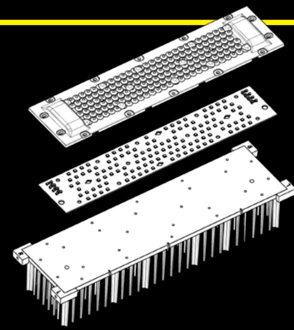


Key design questions

Component	Affecting	Key questions
Leds & driver	PPF Spectral power	Generating enough photons? Correct ratio of photons?
Optics	PPFD (min, max, uniformity)	Are the photons going where they are consumed? Distance required between luminaires? Distance required between luminaire & plants?
All	PPF/J, W/m2, W/kg (efficacy)	How efficient the installation is?

Successful grow light fixture is the sum of it's components

Why LEDiL



Wide range of modular designs available for all types of horticultural lighting.

- Efficient single lenses and arrays, IP-solutions, uniform colour mixing and various light distributions
- Optimised results with the latest LEDs
- Reduced luminaire BOM costs
- Use same luminaire design over and over again

Supporting components available from our partners.

Made in collaboration to provide thermally, optically and efficiently optimised off-the-shelf solutions to make your luminaire designs easier. Just add personality.

LED Light for you powered by OSRAM

LED vs HID

Advantages

Longer lifetime

Expected lifespan after hours of usage

LED at 25.000 h	90 %
LED at 50.000 h	85 %
HID at 20.000 h	50 %

Less energy/ electricity used -30 %

(No savings if additional heating is needed)

Spectrum optimization > **Higher yield & Healthier crops**

Disadvantages

Investment cost

2.0–5.0 times higher

Lower light output

Light should be focused only on plants to maximise PPFD

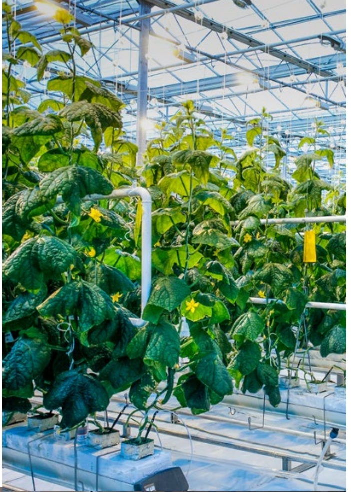
But the right optics can help to

Focus light more efficiently

Reduce the number of LEDs/ luminaires needed

Improve PPFD with less power

Optimise your system ROI with the right components



BEST MATCH

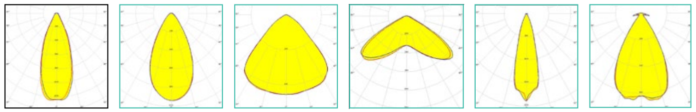
Greenhouse top lighting

Illumination of the hall and plants from ceiling level.

Challenges:

- Light concentration on plants
- Uniformity and constant quality of light spectrum
- High amount of power needed

Typical beams:



W | WW | WWW | TL110 | VIOLET-S | VIOLET-W

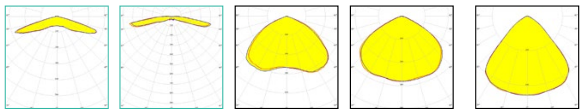
Vertical farming

Illumination of the plants from above at close distance.

Challenges:

- Uniform intensity and spectral distribution
- Plants shading each other
- Photosynthetic efficiency (PPF/W)
- Heat

Typical beams:



VSM | S | C | CY | WWW

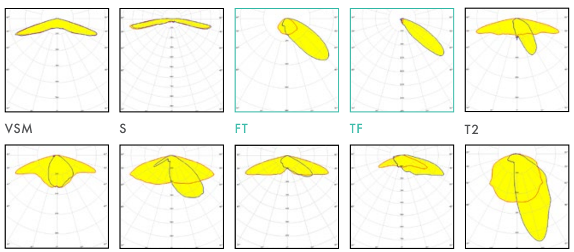
Intra-canopy lighting

Illumination on the side or in between the plants.

Challenges:

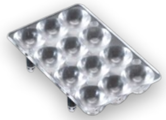
- Uniform PPFD
- Good color uniformity (if continuous/wide spectrum)
- Spectrum fit to the rest of lighting
- Light direction

Typical beams:



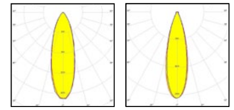
VSM | S | FT | TF | T2

T2-M | T3 | T3-M | T4-B | NHS



PETUNIA

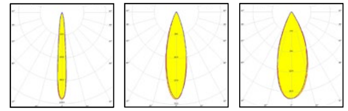
29.5 x 46.5 mm low profile and dense array with 12 lenses for horticultural lighting and up to 3535 size LED packages.



PETUNIA | PETUNIA2

VIRPI

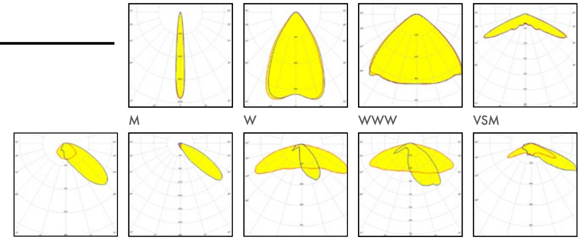
75 x 75 mm 25-up multi-lenses for spot- and track lighting and up to 3535 size LED packages.



S | M | W

2X2 & IP-2X6 (STRADA & HB)

Standardized modular product families designed for street and industrial lighting, but also suitable for a wide range of other applications.



M | W | WWW | VSM

FT (2X2 only) | TF (2X2 only) | T2 | T3 | T4-B

MX/S (STRADA & HB)

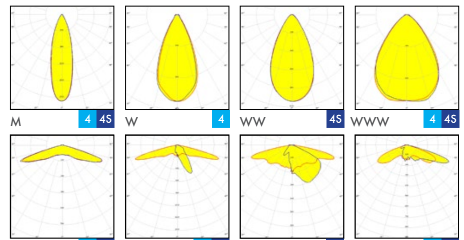
90 x 90 mm ingress protected arrays.

MX: up to 7070 size LED packages

MXS: also for up to 9 mm COBs

Number of lenses in an array: 4

Versions in silicone: S

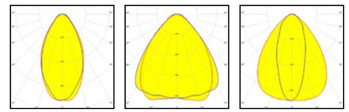


M | W | WW | WWW

VSM | T2 | T3 | T4-B

FLORENCE-3R-IP

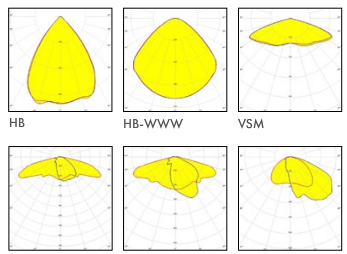
3-row (Zhaga book 7) ingress protected linear lenses for humid, wet and dusty environments.



Z60 | Z90 | O

STELLA

Ø90 mm ingress protected silicone lenses for street, wide area and high bay lighting and up to 30 mm LES size COBs.

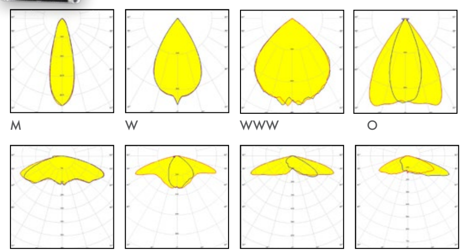


HB | HB-WWW | VSM

T2 | T3 | T4

IP-24 (STRADA & HB)

173 x 71.4 mm 24-up ingress protected lens arrays for flat 5050 size LEDs to boost energy efficiency.

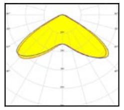


M | W | WWW | O

VSM | T2-M | T3-M | T4-B

DAHLIA

Highly efficient linear platform for horticultural lighting.



TL110

- Extremely uniform lighting on the growth area resulting in optimal growing conditions
- High power density by 120 closely spaced lenses
- Ingress protection with easy to clean smooth surface
- Made from PMMA (good chemical resistance)
- PPFD deviation 10 % over the growth area

Compatibility: Typical horticultural 3535 HP LEDs (e.g. Osram Oslon SQ Horti, Luxeon SunPlus 35 Line LEDs)

Simulation results

36 DAHLIA modules in three lines

Distance to tray:	3.2 m
Spacing:	3.1 x 6.8 m
Power:	260 W / module
PPF:	700 µmol/s / module*
Efficacy:	2.69 µmol/J

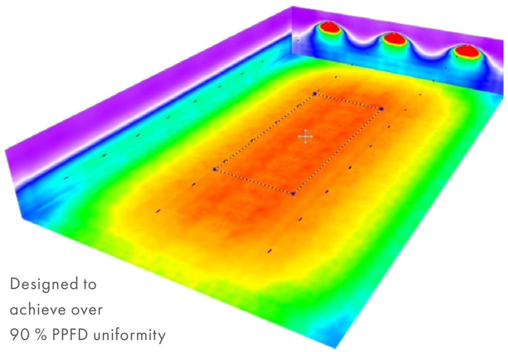
Results at center tray (width 6.2 m)

Min 36 µmol/m², Max 39 µmol/m²
Average PPFD 38 µmol/m²
PPFD uniformity on grow tray 95.3 %

Results at first and last tray

Min 22 µmol/m², Max 38 µmol/m²
Average PPFD 32 µmol/m²
PPFD uniformity on grow tray 67.2 %

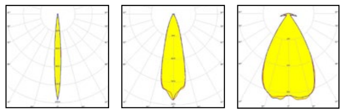
*with red/white LED ration being 3:1



Designed to achieve over 90 % PPFD uniformity across the 6 meter growing tray while reducing power consumption.

VIOLET

Ingress protected silicone lens array for cost-efficient horticultural and UV disinfection applications.



RS S W

- Special silicone grade for high UV transmittance. LEDiL's first UV-C resistant optic.
- Enables creation of cost-efficient UV solutions with half the dosage time using as few UV LEDs as possible compared to traditional quartz glass
- Can be used with up to 4 LED clusters* for maximum efficiency and output. ***Depends on LED**

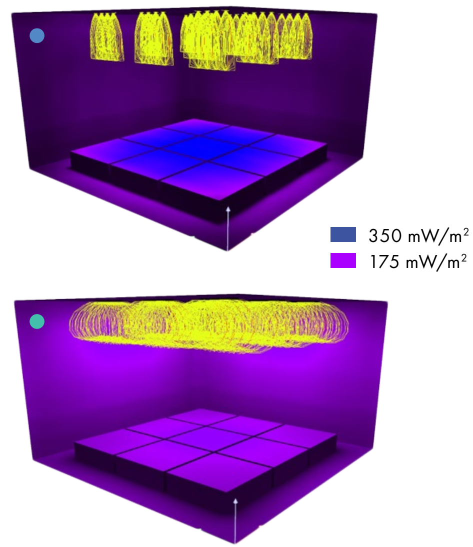
Compatibility: UV LEDs from Seoul Viosys, Nichia

Simulation results

Horticultural lighting with VIOLET and WICOP LEDs

Distance to tray:	4.5 m
Number of luminaires:	9 pcs
Optics/luminaire:	4 pcs

	VIOLET and WICOP LED	WICOP LED only
Average:	258 mW/m²	119 mW/m²
Min:	243 mW/m²	116 mW/m²
Max:	280 mW/m²	121 mW/m²
Uo:	0.94	0.98



How to read polar curves

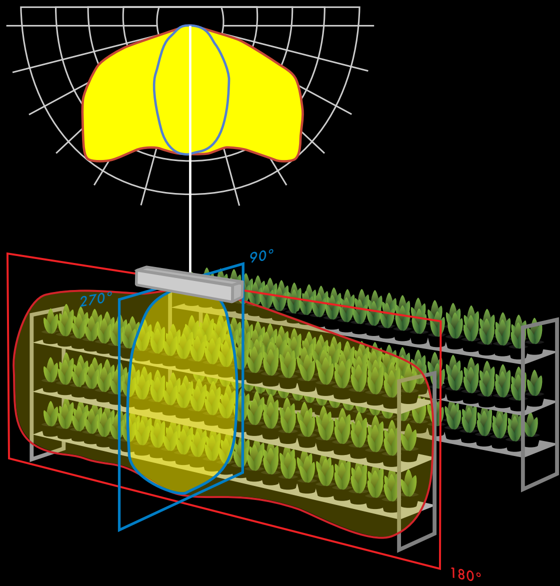
0° to 180°

Longitudinal light distribution

90° to 270°

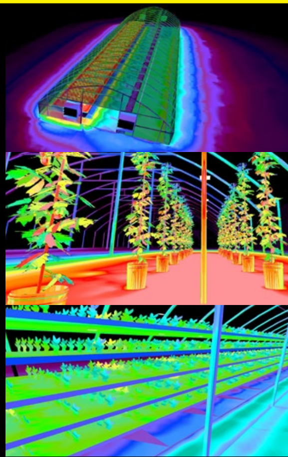
Horizontal light distribution

The polar curve can be used to estimate optimal beam for installation



Technical support

- Simulations to show optic performance in real applications
- Guides and tips for installations
- Thermal analysis for luminaire designs



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