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| [www.psi.cz](http://www.psi.cz)



**Photon  
Systems  
Instruments**

Professional Instruments  
for Plant Science, Biotechnology  
and Agriculture

A photograph of a single pink flower with a green stem and leaves, positioned in the lower right quadrant. The background is dark, filled with a grid of bright, circular LED lights that are out of focus, creating a bokeh effect. The overall scene suggests a controlled growth environment like a growth chamber.

**LEDs  
Let's Grow!**

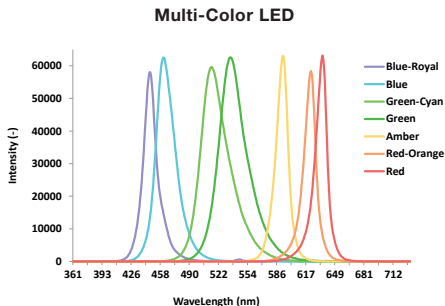
# Key Features of LED Light Sources

Light intensity and spectral quality is essential for optimal plant growth and biomass production.

- LEDs offers highly precise quality of light
- Extremely fast changes enabling microsecond light pulses
- Precise ramping changes of light intensities
- High homogeneity of irradiance
- Same light intensity at different distances
- Extreme light intensities up to  $5000 \mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$
- Lighting in side of canopy
- Irradiance control from 0 to 100 %
- Minimal heat effect
- Durable, and low power requiring systems long life span 6–7 years

## LEDs Provide Unique and Precise Light Quality Control

- Sun light simulation
- Cloudy sky imitation
- Dawn and Dusk imitation
- Specific pigment excitation
- Drive of individual phytochromes
- Simulation of red and far-red ratio same as is in canopy

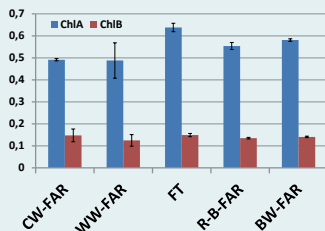


## Comparison of *Arabidopsis* Growth under Different Light Sources

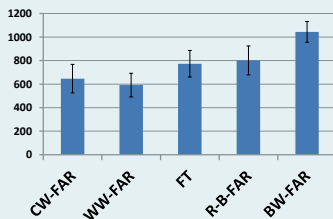
### Experimental Setup:

- 24 day old *Arabidopsis*
- 12/12h light regime 22/20 °C, 55% humidity
- Light intensity 150  $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$
- Mean and standard deviation presented (n=10)
- **CW-FAR** (Cool white LED with far-red)
- **WW-FAR** (Warm white LED with far-red)
- **FT** (Fluorescent tube)
- **R-B-FAR** (Red and blue LEDs with far-red)
- **BW-FAR** (Brightness cool white LED with far-red)

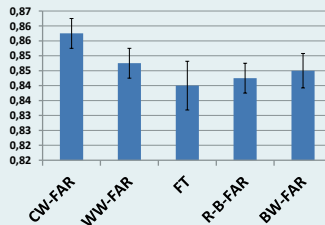
Total chlorophyll content ( $\mu\text{g}/\text{ml}$ )



Rosette area ( $\text{mm}^2$ )



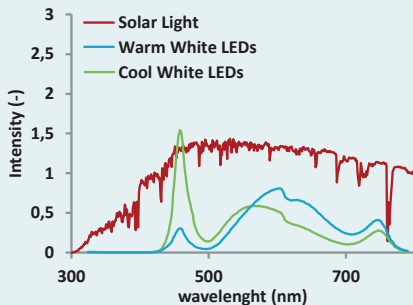
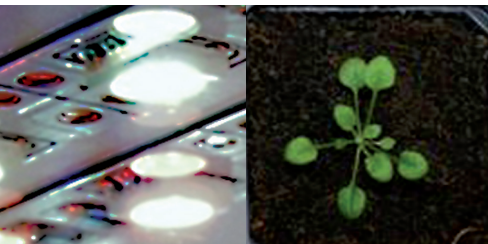
NDVI values



## White LEDs with Far-red

Standardly used in:

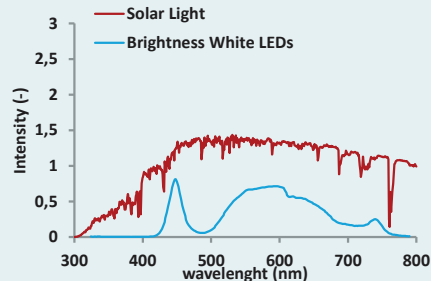
- Cultivation Banks
- Cultivation Shelves
- PhytoScopes
- LED light Bars



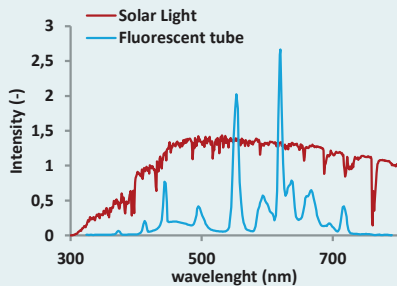
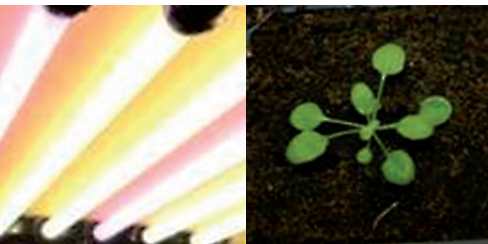
## Brightness white LED with Far-red

Standardly used in:

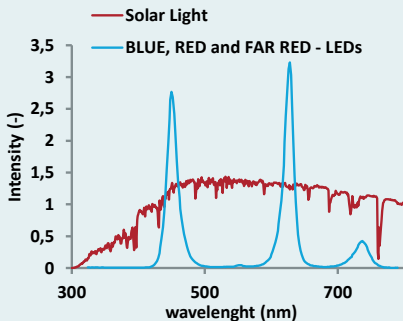
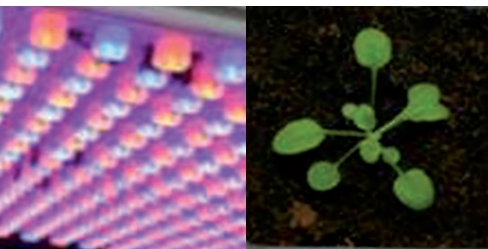
- PhytoScopes
- Walk-In chambers
- Step-In chambers
- LED Phyto-Panels
- SL 3500
- Optionally in other equipment



## Fluorescent Tubes



## Blue, Red and Far-red LEDs





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**LED Lighting  
Solutions**

# LED LIGHT SOURCE SL 3500

SL 3500 self contained high-performance LED panels that can operate in multiple regimes: flash, continuous or modulated light, or with user-defined modes of action, they can also complement other PSI instruments – **FluorCams, Photobioreactors, PhytoScopes**.

## Technical Specifications

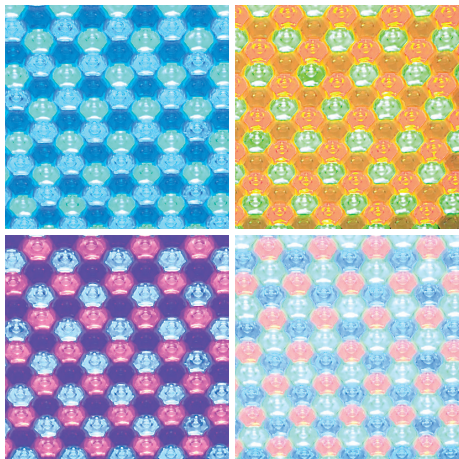
- Light intensity up to  $3000 \mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$
- Highly homogenous illumination
- Manual or software control
- Multicolor LED spectra from UVA to far-red
- Single, Bi- and Tri-Color versions available
- Precise control of light intensity and quality
- Microsecond pulses available

## Available panels

- 130 × 130 mm
- 200 × 200 mm
- 300 × 200 mm

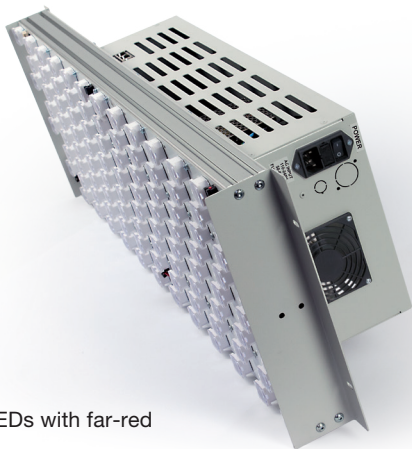
## Applications

- Plant research and biomedicine
- Light signaling study
- Plant handling under dim green light



# LED FYTO-PANELS

LED Fyto-Panels were developed for the illumination in growth chambers, where the large area has to be illuminated with uniform light source. Panels are delivered with the control unit for control of timing, light intensity and spectral quality



## Technical Specifications

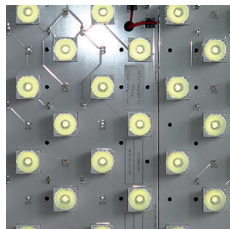
- PAR 200–1500  $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$  (at 100 cm)
- Highly homogenous illumination
- Standard version: Brightness cool white LEDs with far-red
- Multicolor LED spectra available as option
- Cooling of LED panel
- Precise control of light intensity and quality
- Independent control of each LED channel/color
- Light modes enabling ramping/cloudy sky simulation

## Available Sizes

- 270 × 810 mm
- 270 × 410 mm
- Combination of available sizes

## Applications

- Controlled uniform illuminance
- Plant research and biomedicine
- Agricultural and biotechnology research





# CULTIVATION SHELVES

- Cultivation Shelves are a modular system for application in growth rooms, with emphasis on maximal growth space usage. Each shelf has LED panels incorporated in the base of the shelf below. This modular system is delivered with Light Controller for user friendly programming of timing, light intensity and spectral quality of light.

## Technical Specifications

- PAR up to  $250 \mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$  (at 30 cm)
- Highly homogenous illumination
- White LED illumination with far-red LEDs
- Precise control of light intensity and quality
- Independent control of each LED channel
- Light modes enabling ramping/cloudy sky simulation

## Shelves:

- Maximal capacity of 8 shelves per unit
- Height adjustable in range 25 mm
- Easily removable

## Available Configurations<sup>\*)</sup>

- CS 250/300\_5\_3
- CS 250/300\_5\_2.4
- CS 250/200\_7\_4.2
- CS 250/200\_7\_3.4
- Custom formats

## Applications

- Maximizing space for growth in growth rooms
- Large scale experiments

<sup>\*)</sup> PAR/at distance\_number of shelves\_cultivation area (m<sup>2</sup>)



# LED LIGHT BARS

Individual LED light bars are designed for mounting in the greenhouses and growth chambers as supplementary light illumination. Main application of LED light bars is in enhancing plant growth. LED light bars also presents suitable alternative to current lighting options.

## Technical Specifications

- PAR up to  $500 \mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$   
(at 100 cm)
- White LEDs
- White LED enriched by
- far-red (735 nm)

## Available Sizes

- Maximal bar length 4 m
- Minimal bar length 20 cm
- Customized formats

