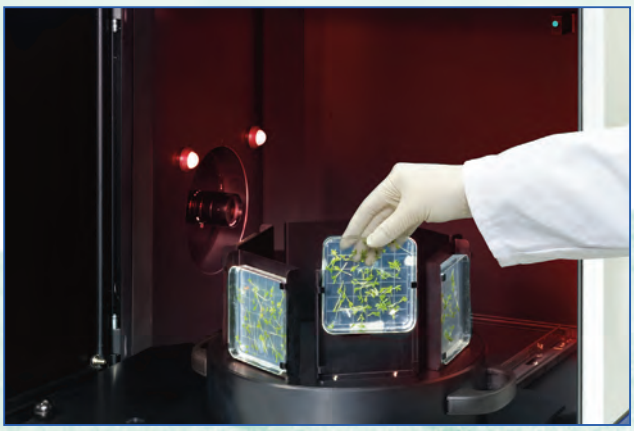
BERTHOLD TECHNOLOGIES

detect and identify



NightSHADE LB 985

Plant imaging system

BERTHOLD TECHNOLOGIES

NightSHADE LB 985 - plant imaging system

NightSHADE is the first imaging system fully dedicated to plant research. It's heart is a cooled CCD camera. It can be mounted on top or at the side of the absolutely light-tight darkroom – the sample chamber – to facilitate imaging from above or laterally.

The darkroom itself may be temperature or humidity controlled. Fluorescence excitation and emission optics enable the measurement of multiple fluorescent and luminescent reporter genes and dyes.
A turntable can be applied to take images of a plant from different angles with the side view camera. Powerful LED panels in the sample chamber can be programmed for daylight simulation.

- deeply cooled CCD camera
- top and side view
- luminescence & fluorescence
- large darkbox
- LED daylight simulation
- rotating table to hold multiple dishes
- temperature & humidity

detect and identify

NightSHADE is a modular plant imaging system ideally suited for today´s and tomorrow´s applications in plant research. Even long-term monitoring of luciferase or GFP expression is now possible.

- genetic regulation
- circadian rhythms
- regulation of plant growth
- stress tolerance
- abundance of reactive oxygen species (ROS)
- *in planta* drug discovery

BERTHOLD TECHNOLOGIES

NightSHADE LB 985 - plant imaging system

Intelligent Dark Box

The primary function of the darkbox is to keep the samples in the dark for uncompromised imaging which is the reason special care is taken to have an absolutely light-tight sample chamber.

In addition it provides the sockets and software-driven connectors for the turntables and LED lighting system and user-specific equipment. A drawer-like base plate facilitates quick and easy insertion of samples as well as accessories such as the turntable.

A flange with light-tight ports allows for the introduction of lightguides, cables or tubings, e.g. to water the plants inside.

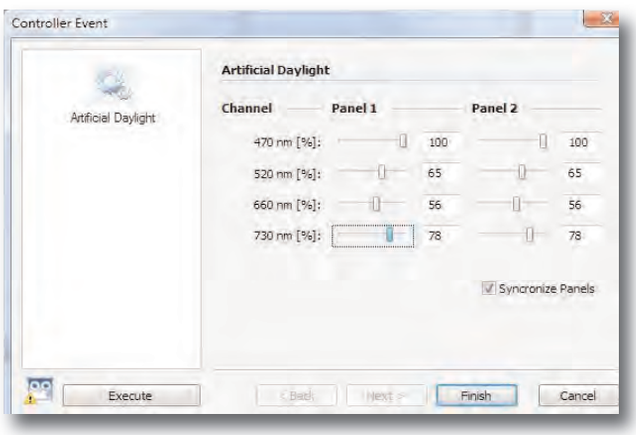
Temperature & Humidity Control

Due to the reasonably sized housing the entire instrument can be placed into an appropriate environmental chamber. Alternative devices, e.g. a temperature controlled base plate for Petri dishes or a temperature control system for the entire sample chamber, will be available to keep the temperature stable at user defined settings between 15 and 30 °C.

Daylight simulation with LED lighting

A set of 2 LED panels can be mounted at different heights inside the dark room providing a homogeneous illumination of up to 1,800 µE or 15,000 Lux.

Each of the colours is individually tunable in intensity and duration to simulate daylight with both spectral and intensity gradients. For imaging the panels are turned off well in advance and automatically.

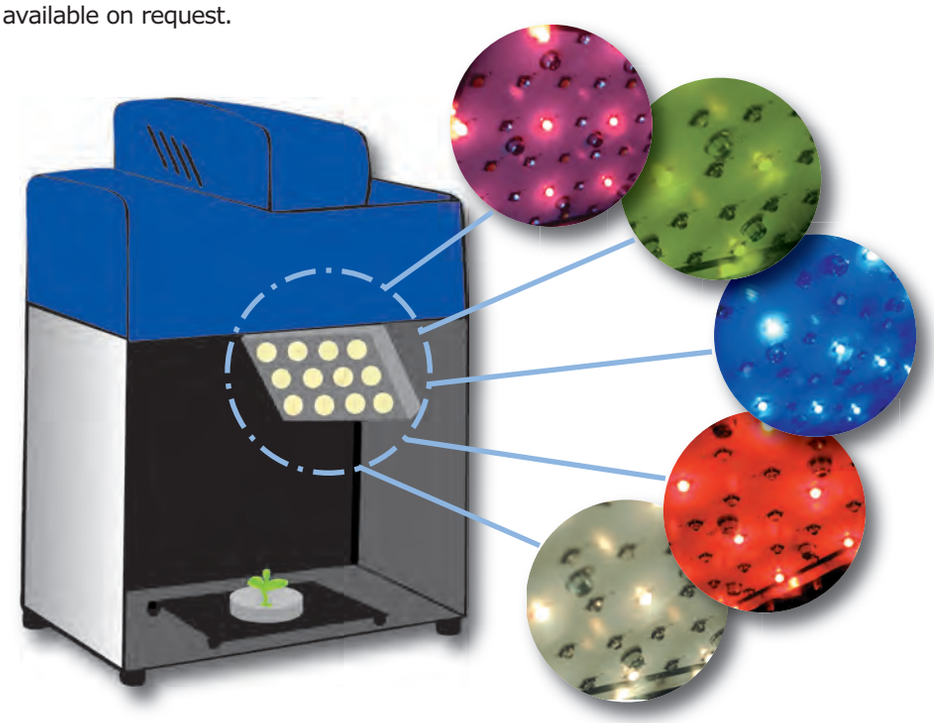


The panels are equipped with a medley of 4 LED colours:

- blue (470 nm)
- green (520 nm)
- red (660 nm)
- far-red (730 nm)

- blue (470 nm)
- white
- red (660 nm)
- far-red (730 nm)

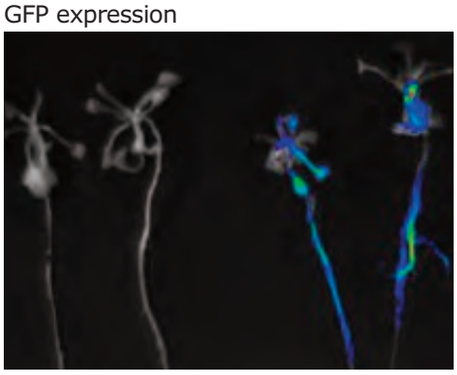
Customized compositions and additional colours are available on request.



NightSHADE LB 985 - plant imaging system

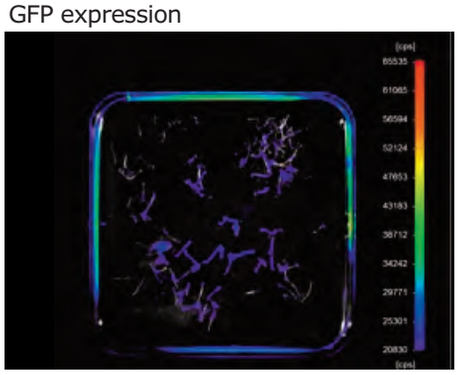
Applications

GFP expression



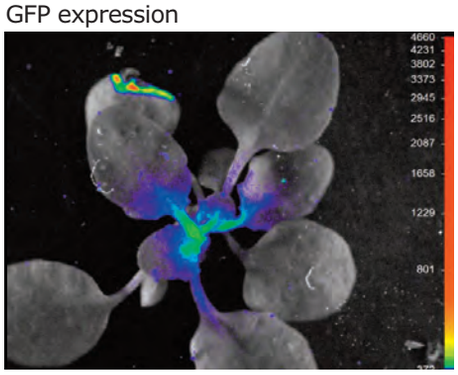
GFP-transfected (right) and non-transfected (left) *Arabidopsis thaliana* seedlings, epi illumination with gooseneck, excitation filter 475 nm, emission filter 520 nm, exposure time 2 sec

GFP expression



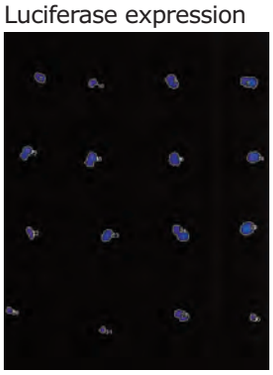
GFP-transfected *Arabidopsis thaliana* plants, excitation with 365 nm transilluminator, emission filter 520 nm, exposure time 2 sec

GFP expression



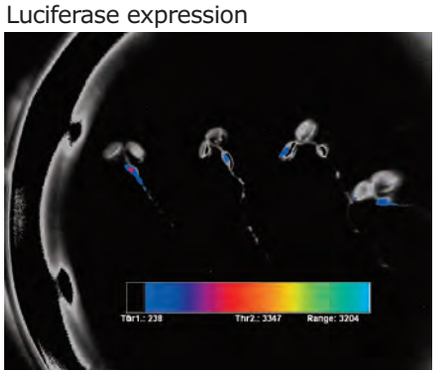
GFP-transfected *Arabidopsis thaliana* plant, excitation filter 475 nm, emission filter 520 nm, exposure time 20 sec, 60 mm macro lens

Luciferase expression



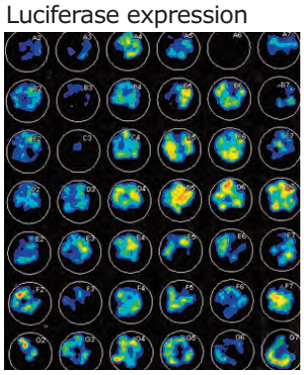
Arabidopsis thaliana seedlings transfected with luciferase, exposure time 2 min

Luciferase expression



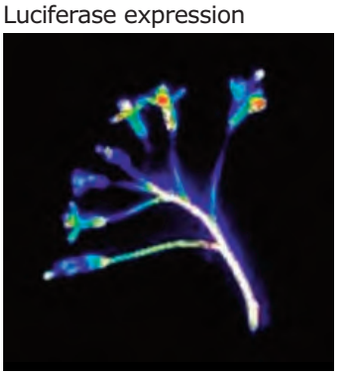
Petri dish with *Arabidopsis thaliana* seedlings transfected with luciferase, exposure 2 min

Luciferase expression



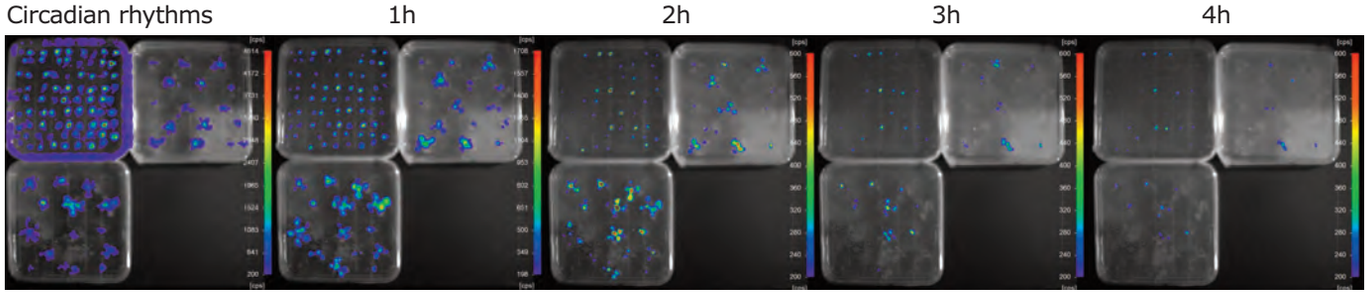
Microplate with *Arabidopsis thaliana* seedlings transfected with luciferase, exposure time 2 min

Luciferase expression



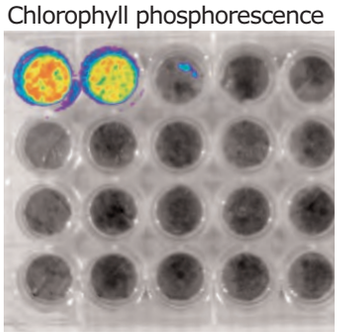
Luciferase expression in petals of flowering *Arabidopsis thaliana*, exposure time 5 min

Circadian rhythms 1h 2h 3h 4h



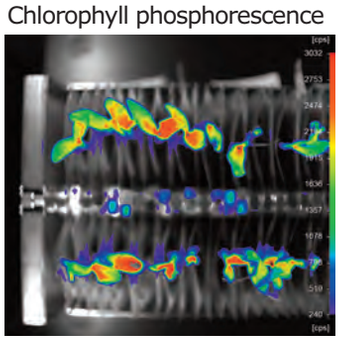
Time course of circadian rhythms in *Arabidopsis thaliana* seedlings transfected with luciferase, exposure time 1 min

Chlorophyll phosphorescence



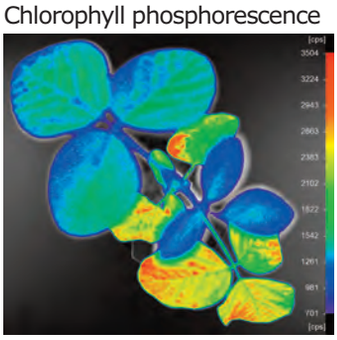
Chlorophyll phosphorescence of punched tomatoe leaves in 24 well plate, except for the samples in A1 and A2 the leaves had been infected with fungi, CLF planta LED illumination for 30 sec, exposure time 20 sec

Chlorophyll phosphorescence



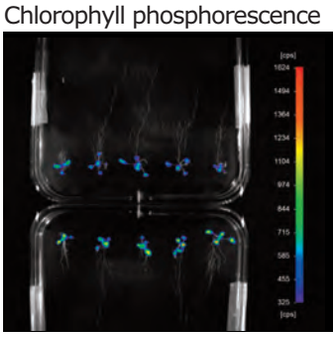
Chlorophyll phosphorescence of maize plants in a box, CLF planta LED illumination for 30 sec, exposure time 20 sec

Chlorophyll phosphorescence



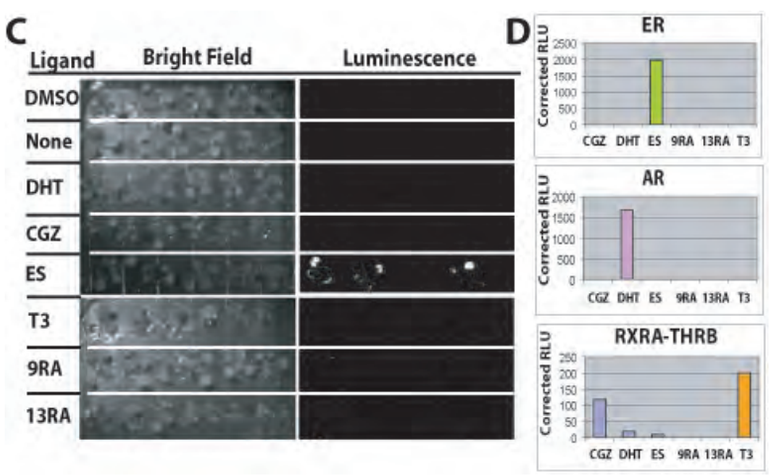
Chlorophyll phosphorescence of soybean (*Glycine max*) after CLF planta LED illumination for 30 sec, exposure time 30 sec, the plant was kept two days without water, upper leaves exhibit low Clorophyll signal, lower leaves exhibit strong Chlorophyll signal

Chlorophyll phosphorescence



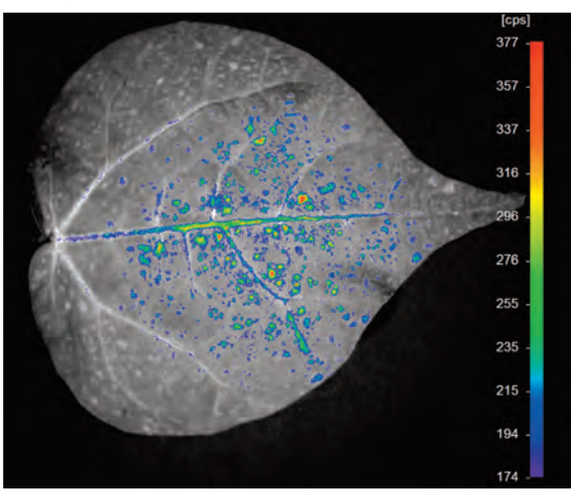
Chlorophyll phosphorescence of *Arabidopsis thaliana* seedlings, the ratios of leave volumes to root volumes were examined, seedlings in the dishes had been exposed to two different compounds, CLF planta LED illumination for 30 sec, exposure time 20 sec

In planta drug screening



Left: *Arabidopsis seedlings* transfected with ER-Luc were tested with different ligands. Addition of estradiol (ES) triggers luciferase activity.
Right: Quantitative analysis of luciferase signals from *Arabidopsis* seedlings transgenic to ER-Luc, AR-Luc or RXRA/THRB treated with different ligands. Courtesy of Nestor Apuya, Ceres Inc.

Prompt fluorescence



Fluorescence of a spray pattern of Umbelliferone labelled compounds on a cotton leaf, excitation filter 475 nm, emission filter 520 nm, exposure time 1 sec

BERTHOLD TECHNOLOGIES

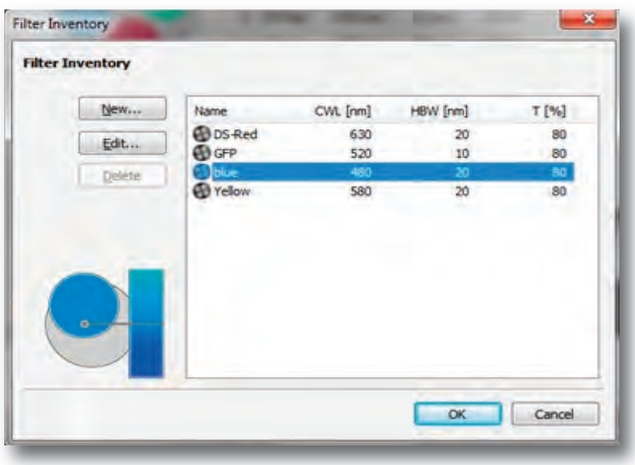
NightSHADE LB 985 - plant imaging system

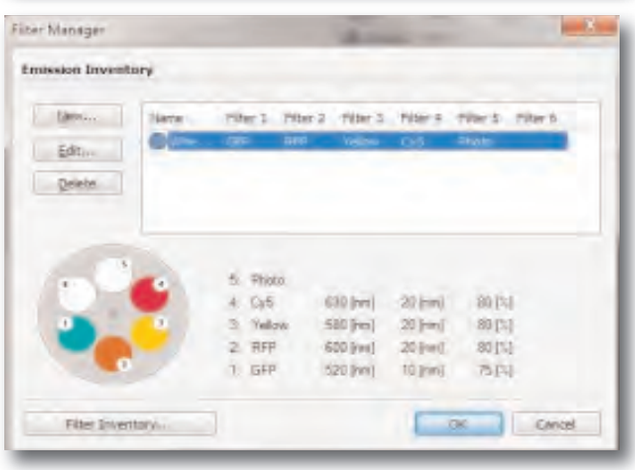
Fluorescence Excitation and Emission Optics

Many reporter genes are intrinsically fluorescent like GFP and YFP or use fluorogenic substrates as do many enzymatic assays. To accommodate for the various dyes the NightSHADE has changeable excitation filter sliders and exchangeable emission filters. Up to 4 excitation filters and up to 5 emission filters can be used at a time.

Depending on the sample size and type you are able to choose between different excitation devices:

- ringlight for single microplates or dishes
- dual gooseneck for spot illumination of dedicated areas
- 4-fold floodlight for uniform illumination of large areas





detect and identify

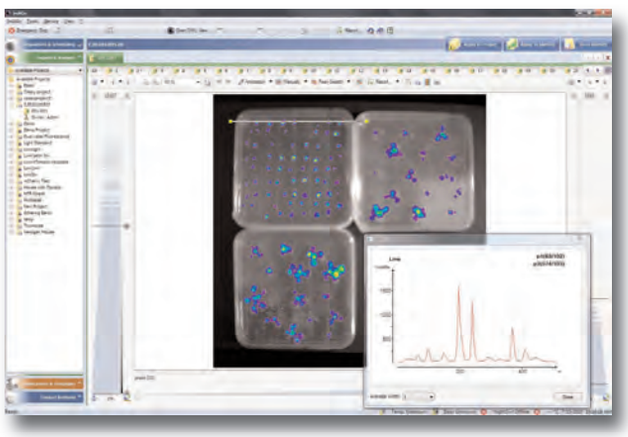
IndiGO™ Software

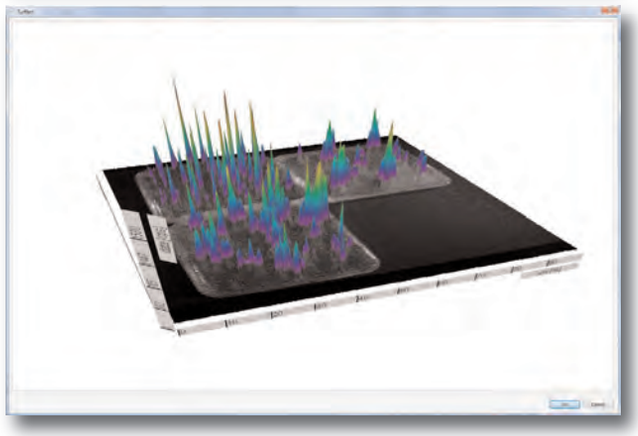
IndiGO is a scientific, user-friendly instrument control and image processing software. Tailor made for the NightSHADE it allows to setup multiday studies with just a few mouse clicks.

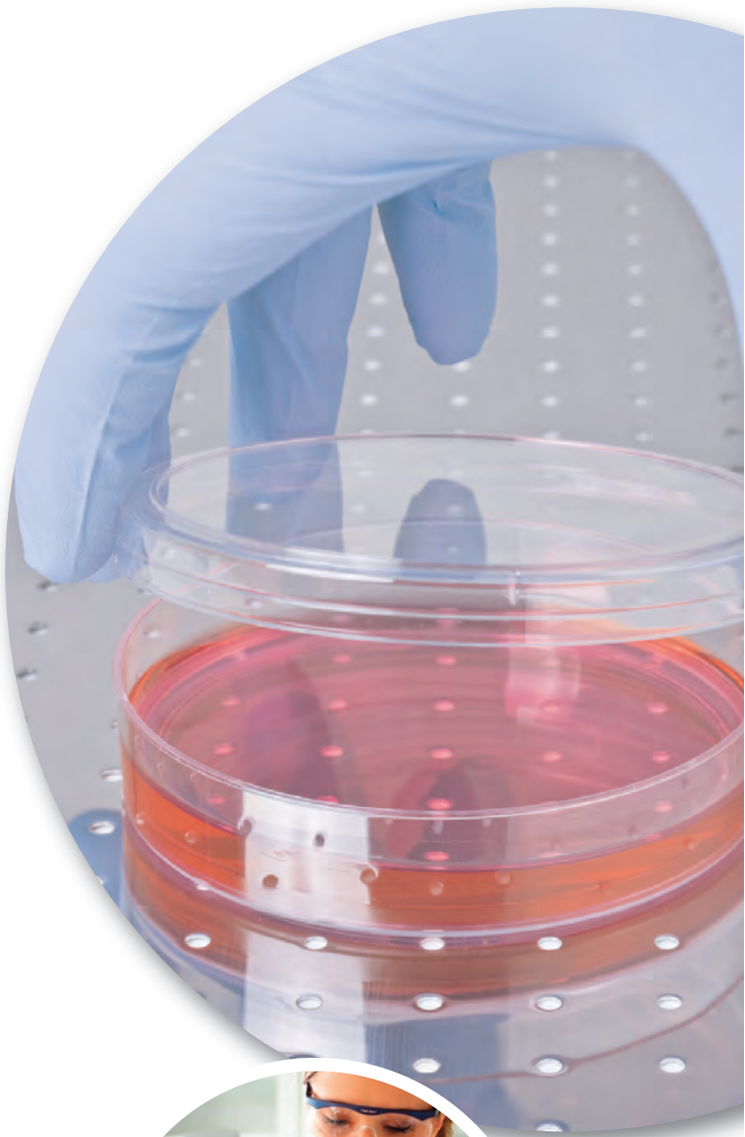
The powerful multi-wavelength view mode enables the user to display multiple wavelength measurements in just one image. Videos from sequential measurements can be instantly created within the software.

The indiGO controller monitors the hardware and manages the measurements. Multiple or multiday measurements are managed through a scheduler in the background so the user interface is available for image analysis. Thanks to the powerful batch manipulation features e.g. small changes in the scaling, can be applied to other images within seconds.

A user management system with different access levels prevents unauthorized access to images and projects. The powerful 3D view has more answers than a plain image can provide.





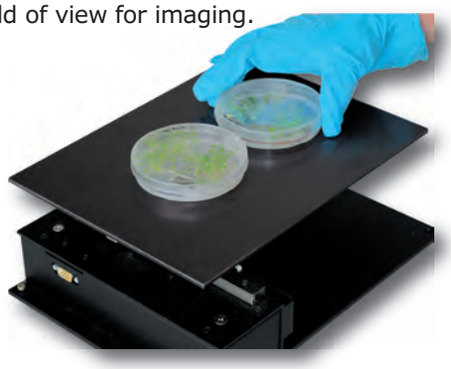


BERTHOLD TECHNOLOGIES

NightSHADE LB 985 - plant imaging system

X/Y table

Large sample trays or multiple small sample trays, e.g. up to 4 microplates can be placed onto the X/Y table. They will then be sequentially moved into the camera´s field of view for imaging.



Multiple samples on the rotary table

Various sample holders, e.g. for square Petri dishes or DeWit tubes, can be mounted on the turntable allowing for a high throughput and unattended processing of multiple samples in combination with the laterally mounted CCD camera. Seedlings can be maintained in a natural vertical axis during the whole experiment.

Larger plants can be viewed from various angles using the rotating table and the side view camera. An additional image may be taken with a camera mounted on top to get an overall impression of the locations of gene expression.

Side view camera mounting

Traditionally cameras are mounted on top of an instrument and images are taken from above. This is the method of choice to monitor luminescence and fluorescence signals in leaves and shoot meristems.

Yet, in many research projects it is necessary to monitor gene expression in roots and shoots and correlate to growth morphology. In order not to disturb the geotropic behaviour the seedlings have to be maintained upright in their natural vertical orientation.

The laterally mounted camera and the rotating table holding the trays with the seedlings in a vertical orientation are the solution.

detect and identify

NightSHADE models

NightSHADE comes in 4 models tailored to their applications. All models can be equipped with the accessories and options at any time due to a fully modular design.

Features	LULu	IKlu	LUFlu	IKFlu
Lu emCCD camera (top mounted)	x		x	
IK CCD camera (top mounted), deeply cooled		x		x
Connections for plug-and-play accessories	x	x	x	x
Sample drawer	x	x	x	x
Fluorescence excitation optics			x	x
Fluorescence emission optics			x	
Emission filter carrier (manually)				x
GFP filter set			x	x
4-fold floodlight			x	x
Applications				
Luminescence	x	x	x	x
High sensitivity luminescence		x		x
Fluorescence			x	x
High frame rates	x	x		
Use of turntables	x	x	x	x
Use of X/Y tables	x	x	x	x
Use of LED daylight simulation	x	x	x	x
Use of turntables with vertical samples*	x	x	x	x

* With camera conversion kit for lateral mounting of the camera

Due to impacts caused by the earthquake in Japan the LU camera is no longer available.

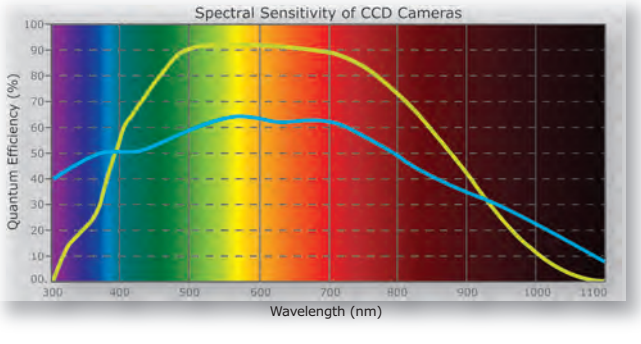
In consequence, the models LULu (55393-10) and LUFlu (55393-20) have been discontinued.

Choice of CCD Cameras

The LU is a scientific CCD camera cooled to -20 °C. It achieves its excellent performance as it is operated in electron multiplying (emCCD) mode. It makes this camera extremely suitable when short exposure times and high frame rates are needed.

The IK is a slow scan CCD camera deeply cooled by multiple Peltier stages to a delta value of -100 °C. It ensures lowest background and highest sensitivity even when very long exposure times are required due to faint signals of the samples.

Both cameras have excellent spectral responses with the quantum efficiencies peaking in the wavelength ranges of Firefly luciferase and the fluorescent proteins.



LU emCCD IK CCD

NightSHADE LB 985 - plant imaging system

Due to impacts caused by the earthquake in Japan the LU camera is no longer available.

In consequence, the models LULu (55393-10) and LUFlu (55393-20) have been discontinued.

Technical Specification

LU emCCD Camera	1004 x 1002 pixels (1 Mio pixels) operational at electron multiplying or slow scan mode, Pixel size 8 x 8 µm² Thermoelectrical air cooling to -20 °C Spectral range: 400 - 1000 nm Quantum efficieny 65 % at 600 nm
IK CCD Camera	1024 x 1024 pixels (1 Mio pixels) Slow scan mode, Pixel size 13 x 13 µm² Thermoelectrical air cooling Δ 100 °C back-lit midband-coated full frame chip Spectral range: 350 - 1050 nm, Quantum efficieny 90 % at 620 nm
Lens	25 mm, f 0.95, C-mount for most efficient light collection
Field of view (top mount)	LU: 130 x 130 mm² IK: 200 x 200 mm²
Resolution	130 µm (emCCD), 195 µm (low noise CCD), manual focus
Sample height	max. 250 mm
Exposure times	from 30 milliseconds to hours
Pixel binning	variabel up to 8 x 8
Light source	Halogen lamp, 75 W, 340 - 750 nm software controlled lamp stabilisation
Filters	with LUFLu model: 4 position excitation filter carrier, equipped with GFP filter 5 position emission filter carrier, equipped with GFP filter
Darkbox	300 x 550 x 300 mm (H x W x D) with flanges for light tight ports and side view mounting areas for turn tables and LED panels mains supply (2x) digital I/O
Interface	USB
Dimensions	80 x 60 x 40 cm (H x W x D)
Weight	45 Kg
Regulations	CE, EN

Laboratory environment

Power supply	110–240 V; 50/60 Hz; max 400 VA; minmum 4 sockets
Temp. range	max. 30 °C
Humidity	10 – 80 %, non condensing
PC requirements	Multi core CPU, 4 GB RAM, 500 GB HDD, Windows 7 (x64; x86), DVD ROM, 2x USB2.0, Ethernet port, internet access (for remote support and software updates)
Bench	stable to sustain 45 kg of the instrument; minimum size 60 x 50 cm (L x D); plus space for PC

Order Information

	Order number
NightSHADE LULu, 1 Mp emCCD, 25 mm lens, indiGO software	55393-10
NightSHADE IKLu, 1 Mp slow scan CCD, 25 mm lens, indiGO software	55393-30
NightSHADE LUFlu, 1 Mp emCCD, 25 mm lens, fluorescence unit, indiGO software	55393-20
NightSHADE IKFlu, 1 Mp slowscan CCD, 25 mm lens, fluorescence excitation, indiGO software	55393-40

Options & Accessoires

	Order number
LED plant growth illumination (blue, green, red, far-red)	56589-01
LED plant growth illumination (blue, white, red, far-red)	56589-10
X/Y table	54821
Turntable	56625-04
Turntable complete for square Petri dishes (100 x 100)	56625-01
Turntable complete for square Petri dishes (130 x 130)	56625-02
Turntable complete for DeWit tubes	56625-03
Upper part for square Petri dishes (100 x 100)	56599-01
Upper part for square Petri dishes (130 x 130)	56599-02
Upper part for DeWit tubes	56599-03
Side view camera LU, 1 Mpixel emCCD	56608
Side view camera IK, 1 Mpixel low noise CCD	56612
Camera conversion kit	56605
Temperature control	56606
Temperature & humidity control	56607
Gooseneck spot illumination	29663
Ringlight epi illumination	51685
Dual-line epi illumination	52295
Flight case	56218
Cooling unit for LED plant growth illumination 115 V	56706
Cooling unit for LED plant growth illumination 230 V	56695

Patents: EU 10.005795.9 (pending);
DE 20 2010 002 010.7 (pending); US 12/796,259 (pending)

BERTHOLD TECHNOLOGIES GmbH & Co. KG

P.O. Box 100 163
75312 Bad Wildbad
Germany

Phone: +49 7081 177-0
Fax: +49 7081 177-100
E-mail: Bio@Berthold.com
Internet: www.Berthold.com/Bio

NightSHADE LB 985 · 02-2011 · 3000 · Id-Nr. 55393PR2 Rev00