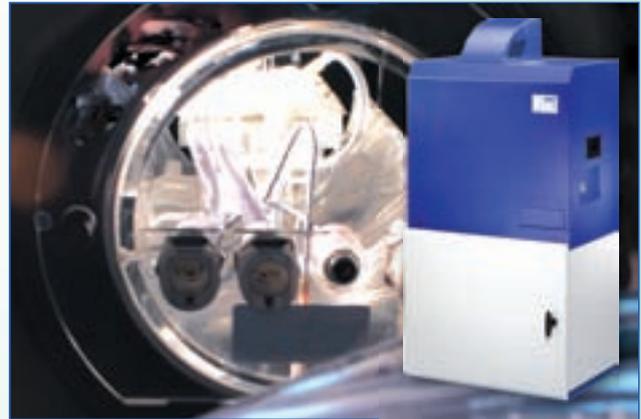


detect and identify



## NightOWL Accessories

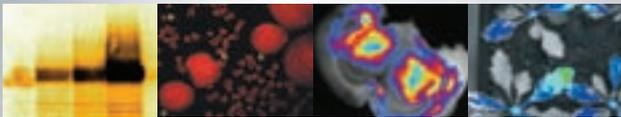
# NightOWL Accessories

Bioluminescence imaging (BLI) and biofluorescence imaging (BFI) allow monitoring of gene expression in living organisms\*.



The conditions required to image living organisms can be very different. For example, today gas anesthesia is used for small animals but is never used in plant imaging. For plants control of light, temperature or humidity are of more importance.

In the field of infectious diseases or food processing the study of bacterial growth is the objective. In dermatology and material science the very faint luminescence from free radical oxygen species (ROS) is measured. In life science, quality control or forensic studies you need a very sensitive instrument for Western, Southern and Northern blots.



To cover all these applications BERTHOLD TECHNOLOGIES provides the very flexible low light luminescence and fluorescence imaging system NightOWL and a wide variety of accessories:

Moving of camera inside the cabinet	✓
Height correction in each position	✓
Large space inside the cabinet	✓
Easy exchange of camera	✓
Microscope and plant chamber adaption	✓
Power sockets inside the cabinet	✓
Control of interface inside the cabinet	✓
Positioning plates	✓
Macro table	✓
Flange	✓
Gas anaesthesia unit	✓
Workstation	✓
Fluorescence Reflectance Imaging	✓
Ring-light epi illumination	✓
Dual Line epi illumination	✓
Gooseneck spot illumination	✓
Transilluminators	✓
Orthogonal 3D-Imaging option	✓
Animal beds for multimodality imaging	✓



\* Some techniques for generating and/or detecting light in biological subjects are patented and may require licences from third parties. Users are advised to independently determine for themselves whether their activities infringe any valid patent.

### Calibration plate

BERTHOLD TECHNOLOGIES offers a certified calibration plate for NightOWL, a so called secondary standard. The secondary standard requires an annual certification against a primary standard. Additionally a frame to hold neutral density filters is offered. Combinations of these filters allow linearity checks over six orders of magnitude.



#### Order information

Calibration plate	40105-10
Positioning plate for calibration plate	53613
Frame with 3 filters (OD 1, OD 2, OD 3)	53558

### Workstation

The workstation makes it very easy to move the NightOWL imaging systems to other locations. The workstation provides enough space for the anaesthesia system, computer etc. The workstation is covered with a stainless steel plate for easy cleaning.

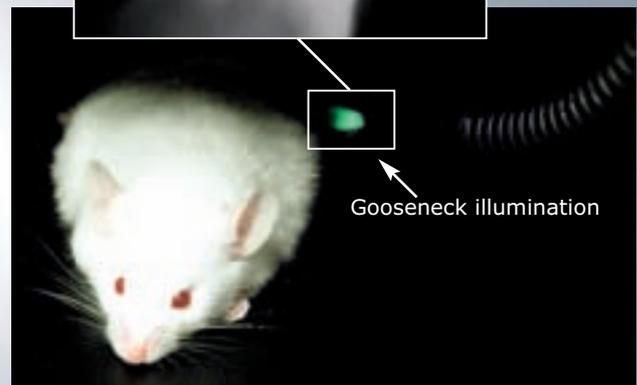
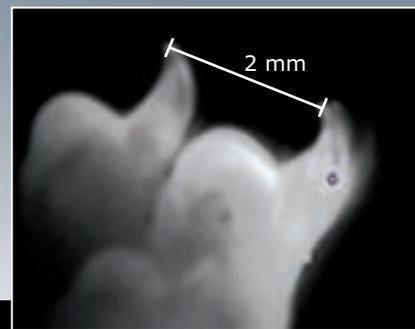


#### Order information

Workstation	
Size: 180x60x70 cm (LxWxH)	51082

### Macro table

The closer the camera to the sample the more photons can be collected due to the spherical angle of the lens. Sometimes also small objects have to be acquired. With the macro table the magnification goes up to 5 fold. With another 5-fold digital zoom the overall magnification can be up to 25-fold.



The left hind leg of the anaesthetised mouse was illuminated with the gooseneck spot illumination. Only with flexible fibre optics it is possible to image the leg between macro table and camera. The distance between camera and object was only 2.5 cm (dsRed excitation at 525 nm and emission 605 nm; 3-fold digital magnification of the mouse claw).

The macro table for LB 983 is covered with a magnetic foil. A magnetic anaesthesia gas nozzle can be mounted in any direction for optimal animal arrangement under the camera.

#### Order information

Macro table for LB 981/LB 983	41613
Macro table with heating for LB 983	51578

### Fresnell option for micro plates

Due to parallax error imaging of microplates with normal optics is not possible. To overcome this an additional lens – a Fresnell lens – has to be added.

#### Order information

Fresnell option	53607
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# NightOWL Accessories

## Bioluminescence Tomography

The only detectable signal in luminescent in-vivo imaging are the photons coming out of the object boundary, which is in practise the surface of the animal.

The simple measurement of bioluminescent signals from a mouse from different angles is not unique when constructing the set of all the solutions to this inverse problem.

Since the origin of the photons cannot be determined, a 3D reconstruction in luminescence is not possible without any assumptions.

This is the Statement of: Wang, G., Y. Li & M. Jiang (2004): Uniqueness theorems in bioluminescence tomography. Med. Phys. 31 (8): 2289 – 2299.

Furthermore, Wang, Li and Jiang mention a recently launched 3D-instrument where "a diffuse luminescent imaging tomography algorithm is used to reconstruct an internal source, coupled with a homogeneous scattering-media assumption".

They come to the conclusion, that "clearly, this approach may reveal subcutaneous depth information, but satisfactory reconstruction of a bioluminescent source distribution (both geometric and power) cannot be archived in general without compensation for the heterogeneous anatomy of the mouse".

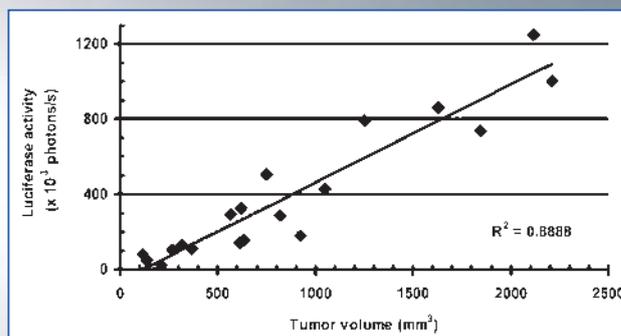
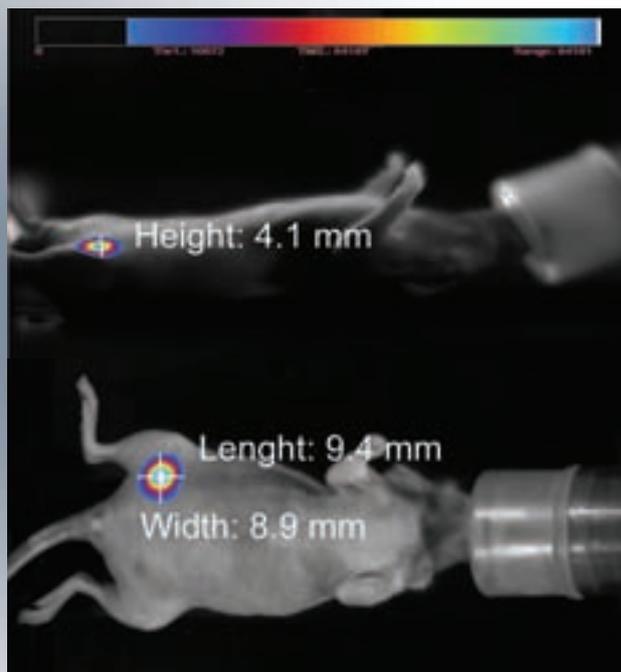
## Orthogonal 3D-Imaging

Obviously the research community is not satisfied with 2D-imaging anymore. To have more information about depth of the signal BERTHOLD TECHNOLOGIES has developed an orthogonal 3D-Imaging option.



This option allows imaging of mice from top, left and right side. The sample is moved on the tray without changing the position. To obtain images from left or right side with the same magnification the camera position has to be lowered according to the same working distance.

With WinLight software the researcher is able to calculate roughly the volume of the illuminated spot, but it is not possible to do any reconstruction due to the inverse problem.



Correlation between luminescent signal and tumour volume during exponential proliferation. Luciferase activity and manually measured xenograft volume were plotted from five different mice that gave 19 separate measurements ( $r^2=0,8888$ ). Tumour volume ( $\text{mm}^3$ ) was estimated by the formula  $d_1 \times d_2 \times d_3 / 2$  ( $d_1$ =tumour length,  $d_2$ =width,  $d_3$ =height).

To solve the inverse problem in bioluminescence, another set of data with another technology has to be acquired. This technology may be X-ray-CT or MRI combined with optical imaging.

BERTHOLD TECHNOLOGIES has a strong focus on such multimodal imaging technologies, combined with the adequate multimodal software packages.

[Order information](#)

Orthogonal 3D-Imaging option

48005

## Positioning plates

For easy positioning of microplates or Petri dishes.

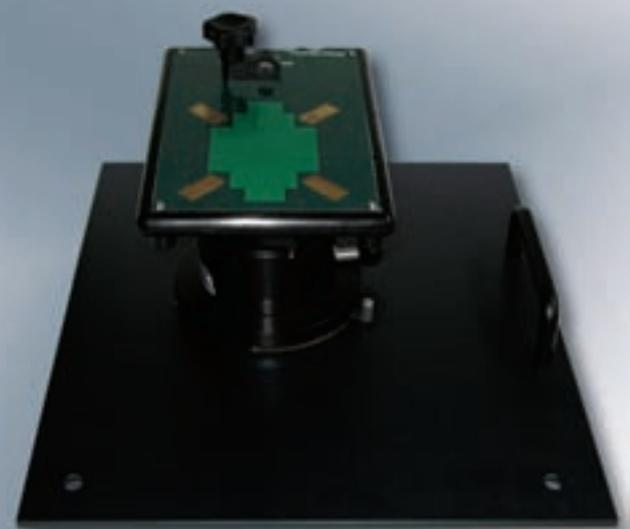


### Order information

Positioning plate for microtiter plates	41606
Positioning plate for Petri dishes (ø88mm)	41609
Positioning plate for 3D orthogonal optics	51678
Other positioning plates	on request

## Positioning plates for multimodality

Vevo 770 positioning plate allows quick transfer of the animal bed from Vevo 770 ultrasound scanner into NightOWL. Gas anaesthesia connection is possible.



### Order information

Positioning plate for VEVO 770	51674
Other positioning plates	on request

## Animal beds and holders for multimodality imaging

NMR (MRI), PET, CT, SPECT, Ultrasound and Optical Imaging are today's basic technologies applied in molecular imaging research. Each technology has its advantages and provides unique information. Researchers have to do sequential imaging or scanning in different instruments to get the required data.

To benefit from all technologies and to be able to compile and compare the information a mouse has to be kept in the same position during sequential scanning in different instruments. Therefore BERTHOLD TECHNOLOGIES developed different animal beds and holders.



Animal bed for YAP-PET Scanner



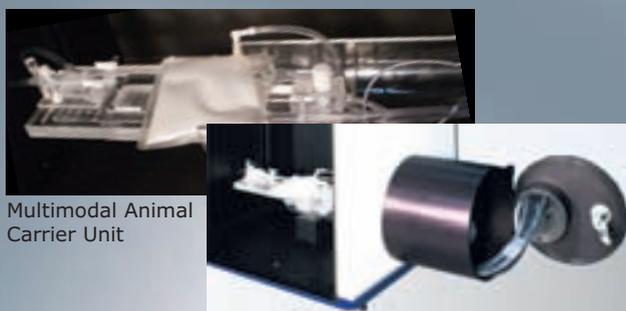
### Order information

ISE YAP-PET holder	on request
SkyScan 1178 holder	50756
Scanco vivaCT 40/70	on request
Other holders	on request

# NightOWL Accessories

## MACU® Multimodal Animal Carrier Unit

For long acquisition times – in MRI up to 4 hours – the animal has to be anaesthetized by gas and the temperature controlled. For this purpose the Medres MACU® - "Multimodal Animal Carrier Unit" - has been developed and adapted to the optical imaging system NightOWL for bioluminescence or bio-fluorescence imaging.



Multimodal Animal Carrier Unit

MACU flange mounted onto NightOWL

With MACU the animal can be imaged with different scanners in one anaesthesia session. Using a rectal temperature probe the unit is heated or cooled with water by a temperature control unit (stability < 0.2 °C). Anaesthesia is supplied by a mask in combination with the bite bar.

Surplus gas is removed with a vacuum line. ECG is non-invasively done by forepaw electrodes. For NMR investigation a 30 mm Helmholtz detector can be added to the setup and removed without interfering with the animal. The mobile operation and transportation unit supports all MACU features: body temperature, ECG, respiration, etc.

Since the NightOWL camera can be moved vertically inside the light-tight cabinet, the image size can be adjusted to the respective image taken by MRI or PET instruments.

MACU option for NightOWL consists of MACU carrier, flange and MACU plate carrier. To adapt the MACU flange, the NightOWL has to be equipped with the flange option (Order Number: 40275 for LB 981).

### Order informations

MACU carrier	47577
MACU flange	47581
MACU plate carrier	47582
MACU epi ring-light	47583

The MACU flange's diameter is 14 cm, so the carrier unit for a 12 cm MRI-bore fits easily. The MACU flange is light-tight, even though transparent tubes for water and gas are used.

On the MACU plate a guide rail is integrated for easy mounting and exact positioning of MACU. A stopper on the plate avoids crashes of the camera with MACU in case of accidental movement.

The remaining MACU setup, i. e. the tubes for hot water, the tubes connected to the gas anaesthesia system, the cables for sensors and triggers, the temperature control unit and the plug & work master box with low-noise power supply, is identical, regardless, if it is used in different MRI or PET instruments or the NightOWL.

### Options in combination with other imaging technologies

Optical sensor	47578
Platin-electrodes	47579
Temperature control unit	47580
Plug & Work masterbox	47567
MACU plug-in	47568
Respiration amplifier plug-in	47569
Electrocardiogram amplifier plug-in	47570
Bloodpressure amplifier plug-in	47571
Electrocardiogram trigger plug-in	47572
Respiration trigger plug-in	47573
Difference amplifier plug-in	47574
Stimulation plug-in	47575



MACU-adaptor for human MRI scanner.

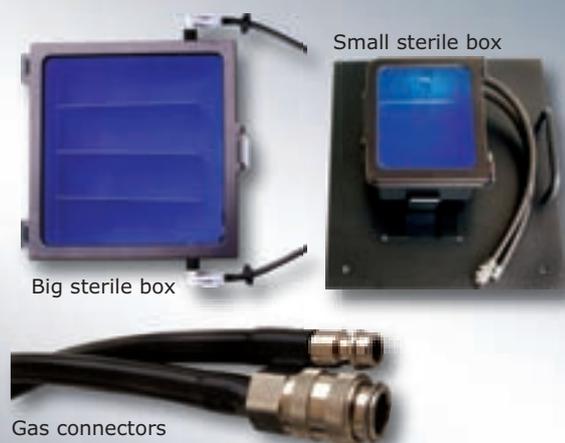
## Multimodality software

VINCI ("Volume Imaging in Neurological Research, Co-Registration and ROIs included") software package, developed by Max-Planck institute for neurological research, Cologne (Germany), is highly modular, expandable, compact, entirely true colour based and allows online fusion and contour rendering of several images, more than 50 studies can be displayed simultaneously in orthogonal views on current PCs. Since VINCI version 2.05, fts-files generated by NightOWL can be visualized and analyzed further.

The Swiss company PMOD ([www.pmod.com](http://www.pmod.com)) offers another software package for image registration and fusion.

## Sterile boxes

Sterile boxes, offered by the company Summit can be used in NightOWL. Different options are available to fit the NightOWL flange. For small sterile box BERTHOLD TECHNOLOGIES offers a positioning plate.



### Order information

Big sterile box	on request
Small sterile box	on request
Positioning plate for small sterile box	52638
Gas connectors for flange	47969

## Filters

BERTHOLD TECHNOLOGIES offers a complete range of filters between 340nm up to 1100nm. Filters have to be used in fluorescence and as well BRET or FRET applications. If a transilluminator is used only an emission filter is needed.

BERTHOLD TECHNOLOGIES offers filter pairs for NightOWL for following standard dyes amongst others:

	Excitation	Order info	Emission	Order info
GFP	475/20	53183	520/10	39805
Cy5	630/20	50097	680/30	49180
Cy5.5	630/20	50097	700/20	50479
Cy7	700/20	50475	780/20	50476
ICG	740/30	50480	820/30	50481
dsRed	530/20	38536	600/20	50477
Qdot700®	630/20	50097	700/20	50479
Qdot800®	630/20	50097	820/30	50481
mCherry	550/10	39796	620/10	40540

## Transilluminators

For the NightOWL system BERTHOLD TECHNOLOGIES offers special transilluminators with illuminated area on the left side ensuring a complete field of view as the camera is also positioned on the left side.

The area of all transilluminators for NightOWL is 20x20 cm. The illumination by eight lamps each with 8 Watts gives the most uniform distribution of light. Housings of stainless steel and glass cover sealed with silicon ensure stability and long lifetime.



Since NightOWL cameras are very sensitive BERTHOLD TECHNOLOGIES offers only transilluminators with adjustable intensity in 10 % steps.

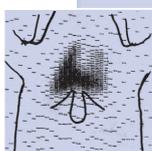
### Available transilluminators

UV transilluminator, 254 nm, intensity adjustable,	230 V	42600
	150 V	45133
UV transilluminator, 312 nm, intensity adjustable,	230 V	42601
	115 V	45134
UV transilluminator, 365 nm, intensity adjustable,	230 V	42602
	150 V	45135
Blue light transilluminator, 470 nm, intensity adjustable,	230 V	42604
	150 V	45136
Yellow light transilluminator, 595 nm, intensity adjustable,	230 V	50973
	150 V	50982
Red light transilluminator, 625 nm, intensity adjustable,	230 V	49742
	150 V	50981
White light transilluminator, intensity adjustable,	230 V	42606
	150 V	45394
Converter plates		on request

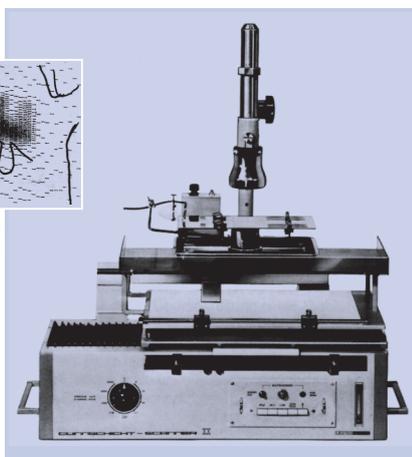
# NightOWL Accessories

## BERTHOLD TECHNOLOGIES, one of the pioneers in Molecular Imaging

BERTHOLD TECHNOLOGIES GmbH & Co. KG is located in Bad Wildbad, Germany. The company was founded in 1949 by Prof. Dr. Rudolf Berthold and was named "Laboratorium Prof. Dr. Rudolf Berthold". At the end of the 70s BERTHOLD developed an animal based imager based on a TLC scanner.



Scan of a lung of a rat using 150 µCi <sup>99m</sup>Tc with Ironhydroxid.



In the early 80s Siemens Germany, developed a high sensitive intensified camera. Prof. Szalay pioneered the non-invasive measurement of gene expression in living organisms using this camera.

In collaboration with Siemens BERTHOLD introduced the first low light imaging instrument for this application in 1989, the LB 980 Luminograph. The first in-vivo gene expression experiments in plants and animals performed on this instrument date back to the year 1993.

With the improvement of slow scanned CCD cameras and the inherent problems of linearity and dynamic range of intensified cameras BERTHOLD introduced the NightOWL in 1996. This instrument used the state of the art slow scan cooled CCD technology to provide an extremely sensitive molecular imaging system.

Today a new generation of slow scan CCD cameras have been developed further enhancing the sensitivity. Furthermore, based on the microplate reader technology of BERTHOLD, in LB 983 NightOWL II fluorescence imaging has been optimised using a sophisticated lamp and beam control with automated filter changing.

BERTHOLD TECHNOLOGIES reserves the right to implement technical improvements and/or design changes without prior notice. NightOWL is a trademark of BERTHOLD TECHNOLOGIES, Image-Pro of MediaCybernetics. MACU® is a registered trademark of medres. Quantum Dots® is a registered trademark of Invitrogen. Third party products may not be available in all countries.



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