VisiLuxx-II

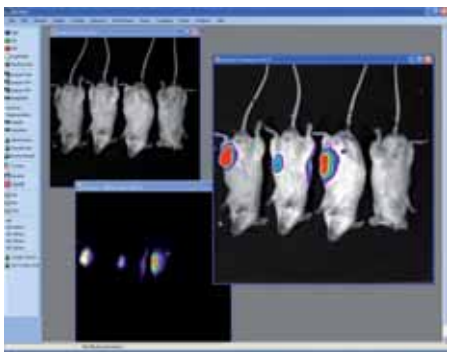
Luminescence and Fluorescence Imager

VisiLuxx-II Imager

Luminescence and Fluorescence Imaging

The new VisiLuxx-II Imager is a perfect solution for macroscopic in-vivo imaging of luminescence and fluorescence signals in living animals, plants and bacteria. The flexibility of our system and the use of the latest camera technologies open up a wide variety of applications. Increased resolution, high dynamic range and lowest noise offer the best platform for all kinds of spatial and quantitative analysis.

VisiLuxx-II in-vivo luminescence imager.



VisiView imaging software for control and analysis.

Features

- Thermoelectrically cooled CCD camera system down to –90°C
- High quantum efficiency CCD (up to 95 %)
- From 512 x 512 pixel up to 2048 x 2048 pixel resolution
- Standard or EM CCD technology
- Low readout noise
- Extremely low dark charge
- Compact and functional design
- Programmable LED for reflected light illumination
- Specially selected optics
- Field of view e.g. 2 x 2 cm up to 20 x 30 cm

VisiLuxx-II Imager

Setup and Design

The VisiLuxx-II imager allows to image faint luminescent and fluorescent signals. The versatile darkbox is absolutely light tight and the field of view can be easily selected with the enclosed height adjustable stage. All systems are prepared for the extension with our spectral analysis and fluorescence option, so that the new VisiLuxx-II imager can be upgraded at any time to perform multi-wavelengths experiments.

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Applications:

Bioluminescence:

- Luciferase-reporter gene (luc, ruc, lux) active in mammals and plants or bacteria's e.g. gene expression and virus activation in tumors,
- Monitoring of in vivo activation of transcription factors in mice
- Phytochrome expression in plants, promotor-assays in bacteria
- BRET: bioluminescence resonance energy transfer of e.g. luciferase to YFP for the detection of protein interaction

Chemilumicence:

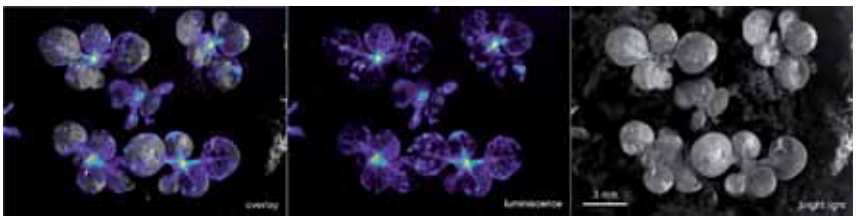
- Detection of Southern-, Nothern-, Western- and Ligand-Blots
- Promotor assays e.g. with lacZ as reporter gene
- Colony hybridization e.g. with digoxigenin-labeled cDNA
- DNA microarrays e.g. with biotinylated cDNA

Chemifluorescence:

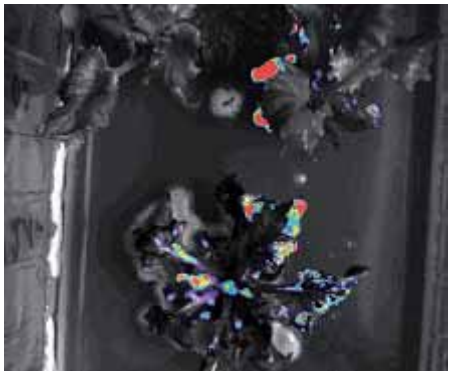
- Detection of Southern-, Northern- and Western-Blots with fluorescence excitation of enzymatically generated fluorescent products.

Fluorescence:

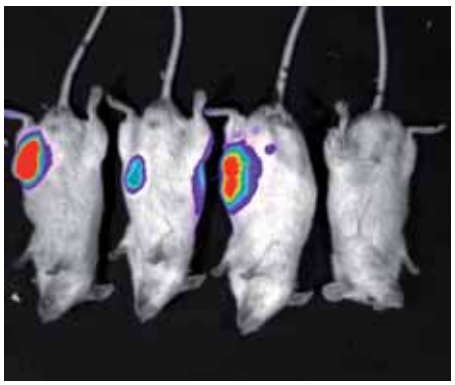
- GFP-fusion protein expression and localization
- GFP as reporter gene e.g. instead of lacZ
- DNA-microarrays with fluorescently labelled cDNAs
- Antibody-microarrays e.g. with Cy3 labelled protein
- Detection of DNA/RNA with SYBR dyes and EtBr
- Protein detection with SYPRO-dyes and fluorescence-conjugated antibodies



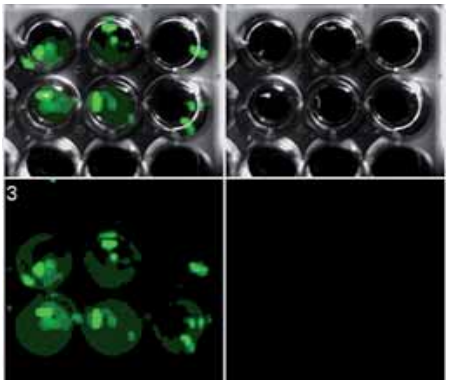
Luciferase measurement in plants - Dr. Greb, Academy of Science Vienna.



Luminescence of plants.



Luminsecence (in-vivo) mouse.



Luminescence microtiter plate.

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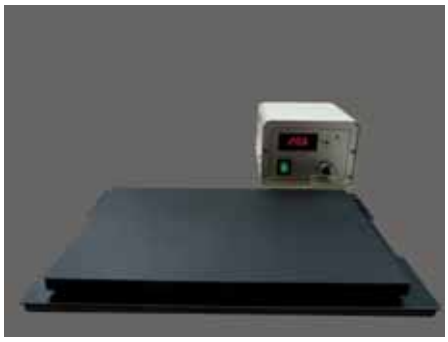
GAS Anesthesia for In-Vivo Application in Mice

The VisiLuxx anesthesia is very safe for small animals. There is minimal threat of animal loss resulting from the system. It is simple to use and virtually eliminates human error. The system is a totally integrated turnkey design that includes all hardware components required for anesthesia. The system includes mouse induction chamber, oxygen regulation, mouse nosecone and filters.

VisiLuxx with small animal anesthesia system.

Multi-Animal Breather.



Heating plate with control unit.

VisiLuxx with illumination equipment.

Heating plate Option

The heating plate for the temperature control of specimens or living animals which needs to be kept at a specific constant temperature. The temperature range is selectable from 3°C above ambient up to max. 60°C. Power requirement approx. 8 W at 37°C.

Accessories of the VisiLuxx-II System

The modularity of the VisiLuxx system offers the customer a broad range of different components. Based on the power of the luminescence of fluorescence a range of scientific grade CCD cameras are available with different field of view and sensitivity. Also, options like trans-illumination system, LED illumination, optics etc. are available to expand the VisiLuxx system.

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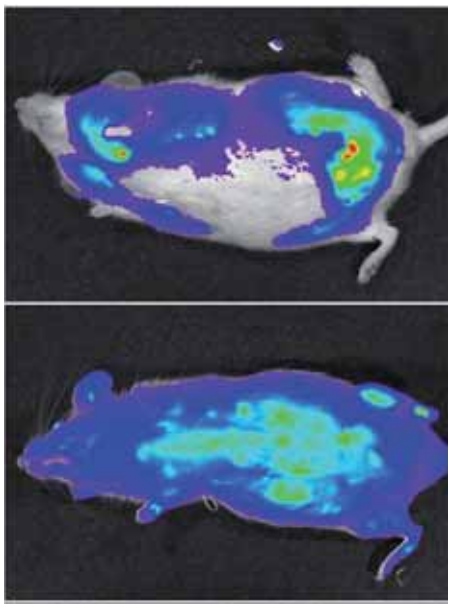
Fluorescence Option

The Fluorescence Option adds fluorescent imaging capability to the VisiLuxx-II System. The VisiLuxx-II Imager can be used for both in-vitro and in-vivo applications. The sensitivity wavelength range of the VisiLuxx Imager for fluorescence application is approximately 400-900 nm. As with bioluminescent imaging wavelength greater than 600 nm are preferred for in-vivo application because of the lower absorbance in tissue.

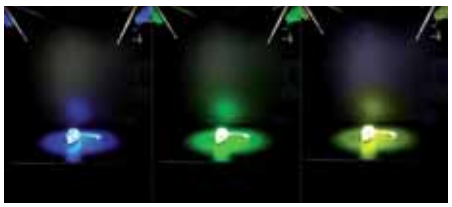
Chamber with Fluorescence Illumination

The fluorescence light is coupled by a special liquid fiber cable with a twin output from the fluorescence light source to the VisiLuxx dark chamber. The fiber ends are flexible steal armour and can be easily positioned where the mouse or object is located.

Fluorochrome	Excitation filter	Emission filter
GFP	ET470/40x	ET535/30m
CY3	ET545/25x	ET600/30m
Texas Red	ET572/35x	ET635/30m



GFP fluorescence mouse model.



Fluorescence illumination with spectral filter curve.

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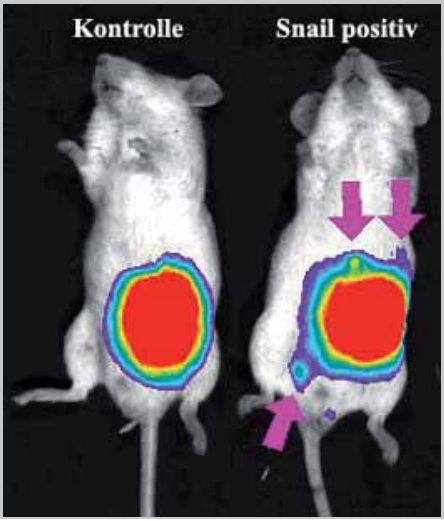
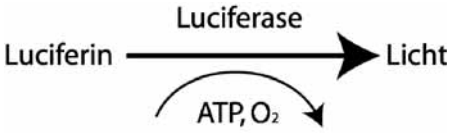
Application Note

To measure the very faint light signals an absolutely light proof dark chamber is necessary. The signals are acquired with a highly sensitive camera with specifications depending on the needs of the application. There are two key numbers: The quantum efficiency (i.e. the sensitivity) of the CCD-chip and the cooling of the CCD-chip. The cooler the CCD-chip the better is the signal to noise ratio because the thermal noise becomes smaller.



Quantitative Bioluminescence In-Vivo Imaging

The macroscopic observation of luminescence is a frequently used technique for medical or biological applications (Toth et al., 2001; Sölling und Rainov, 2003; Sato et al., 2004). It takes advantage of the biochemical reaction of the firefly:



In presence of ATP, the enzyme luciferase catalyses the oxidation of luciferin and emits light. Thus, living mammalian cells, which express luciferase e.g. because of a genetag, will emit light if the organism has been treated with luciferin.

As the organism is not injured during the imaging process, this technique is suitable to study the influence of drugs on the same individual animal. This increases statistics and minimizes the number of necessary animals. The technique is not restricted to measurements close to the animal's surface but can also detect light coming from viscera and even from the brain since light can penetrate mammalian cells by several centimeters.

For luminescence applications, the cooling is usually exceeding the capability of regular fluorescence cameras.

Advanced multilevel peltier elements offer thermoelectrical cooling down to –90°C. Using liquid nitrogen, it can go down to –120°C.

The VisiLuxx II Imager by Visitron Systems GmbH is a system solution which offers all the necessary features for in-vivo luminescence measurements. As an application example, Dr. Strand and coworkers examined the influence of the transcription factor Snail on the development of metastases in mice. Hek293 cells have been transfected with the Luciferase gene either with an empty vector (control) or with a vector of Snail cDNA (Snail positive).

The transfected cells have been injected subcutaneously and imaged in the Visiluxx II after 21 days. Strong light emission is clearly visible in both animals (control and Snail positive). However, in contrast to the control the Snail transfected animal exhibits additional growth of the tumor which has been marked with arrows.

Visitron Systems GmbH

Sato A et al. In vivo bioluminescence imaging. Comp. Med. 2004. Vol. 54, pp 631.
Sölling A, Rainov NG, Bioluminescence imaging in vivo – application to cancer research. Expert Opin. Biol. Ther 2003. Vol. 3, pp 1163
Strand D., Kashyap A., I. Medizinische Klinik und Poliklinik, Johannes-Gutenberg Universität, pers. Kommunikation 2006
Toth R, et al. Circadian Clock-Regulated Expression of Phytochrome and Cryptochrome Genes in Arabidopsis. Plant Phys, 2001, Vol. 127, pp 1607.