AEQUORIA MDS

Macroscopic Imaging Syste for Life Science Application







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customer service was laid by building a new company site. HF has ca. 65 employees with a sales office in Geldern and further

representative offices in the Netherlands, Poland and Denmark. HPD supports Germany as well as Austria, Hungary, Bulgaria, Romania, Greece, Turkey, the Czech republic, Slovakia, Yugoslavia, Croatia and Serbia.

Utilising detector and sensor technologies from Hamamatsu's Electron Tube and Solid State groups, Systems Division focus upon implementation of optical, electronical and mechanical knowledge and expertise to produce complete cameras and imaging systems. Product lines include high sensitivity digital cameras, including the "ORCA" brand name camera that is wi used in life science and bioscience areas for fl uorescence and luminescence imaging, microscopy and macroscopic applications. The new "ImagEM" camera is probably the most sensitive camera on the market today.

Hamamatsu also provides more dedicated instruments, includ the FDSS (functional drug screening systems) for assay disco and HTS in drug discovery. The NanoZoomer for high speed c pathology (this takes a 3 gigapixel image of a conventional medical slide for telepathology) and the NIRO which makes cerebral oxygenation measurements in real time.

Hamamatsu Photonics Deutschland is accredited according to 9001 and 14001.

Hamamatsu Photonics Deutschland GmbH

Hamamatsu Photonics Deutschland (HPD) was founded 1973 officially as a 100% affiliate of Hamamatsu Photonics K.K., then named Hamamatsu Television Europa GmbH (HTV). In 1986, the company changed its name to Hamamatsu Photonic Deutschland GmbH and relocated the office from Hechendorf/ Seefeld to Herrsching at lake Ammersee. In 2005 the cornerstone for further expansion and best possib







Dealer and



AEQUORIA MDS – What is new?

The NEW AEQUORIA MDS is Hamamatsu's improved system Features

for imaging macroscopic fluorescence emission and weak 🛛 🔳 Acquisition of faint luminescence and fluorescence signals





Typical Applications

In-vivo gene regulation

1. Transgenic Arabidopsis plants expressing the Firefl y luciferase, placed under the control of a 100 bp promoter element of the CATALASE 3 gene.

The LUC signal is emitted mostly by the main vasculature of the leaves, with a signal of lower intensity coming from the remaining leaf tissue. Images were acquired with an ORCA II-BT camera. Courtesy of Dr. Patrice Salome, Department Molecular Biology, Max Planck Institute for Developmental Biology, Tuebingen, Germany.

2. Visualisation of reporter gene activities by luminescence monitoring.

Leaves of Arabidopsis plants carrying a wound-responsive luciferase reporter-gene construct, have been squeezed using forceps. Light emission was integrated for 10 minutes directly after treatment.

Courtesy of Dr. Norbert Nass, Institute of Plant Biochemistry, University of Halle, Germany.





Plant imaging

1. Example for fl uorescence optical imaging:

Bacteria immobilized on roots of a tomato plant. The bacteria are stained with a fluorescent green marker. Autofluorescence of the plant cells tinted red. Images were acquired with an ImagEM camera and LuxiFlux fluorescence system.

Courtesy of Dr. Massimiliano Cardinale and Prof. Gabriele Berg, Institute for Environmental Biotechnology, TU Graz, Austria.



Metabolic Imaging

Distribution of metabolite concentrations in tissue with a spatial resolution at the cellular level.

Example: Slice of human squamous cell carcinoma from head-neck The ATP distribution is shown by bioluminescence imaging and gives information about the metabolism in small malign tumors. The calibrated light emission is shown in pseudo colors. ATP is coupled enzymatically to the light emitting reaction. Cancer regions have a high ATP concentration due to abnormal cellular activity while its concentration in unaffected regions is very low. Courtesy of Dr. Stefan Walenta, Institute for Physiology and Pathophysiology, University of Mainz, Germany.



Microplate reader

Parallel detection of luminescence assays on microplates is especially useful for kinetics and long time measurements. Wi our imaging system the user is free to use different types of microplates. Quantification of luminescent reactions in drug screening and measurement of oxygen species are typical applications of the camera based microplate reader. AEQUOF then, stands for the first step in microplate screening application that could be completed by Hamamatsu's drug screening solutions (Website).

Courtesy of Prof. Pichler, Laboratory for preclinical Imaging, University Tuebingen, Germany.

We call your attention to the existence of third party rights on certain methods for in vivo imaging of animals, especially EP0861093B, which is owned by the Board of Trustees of the Leland Stanford Junior University and protects the method for non-invasive detection of the integration of a trans-gene in mammals other than human. We further refer your attention to the divisional application of the above-mentioned patent, namely EP1016419A. Use of the Hamamatsu imaging system for such applications may breach this patent, if performed by the methods described therein. The purchase of a Hamamatsu imaging system does not include the right to use these patent rights.



There are also patent applications of AntiCancer Incorporated, specifi cally EP1294906A. Use of the Hamamatsu imaging system could make use of the patent and/or application if performed in a way as eventually granted. The purchase of a Hamamatsu imaging system does not include the right to use these patent or patents even if used for small animal imaging.



Setup and Design



A schematic drawing shows the main components of our AEQUORIA MDS system. Features and functions of all components are described.

1. The Darkbox

- Light-tight
- Multiple ports for accessories
- Fully computer controlled
- Dimensions: 43 x 35 x 75 cm (W x D x H)
- Weight ~15 kg
- Sample stage 25 x 25 cm
- Motorized height adjustment
- Distance between stage and lens: 10 60 cm
- Stage temperature control between room temperature and 40 °C

2. Motorized lens



For imaging even very weak signals, lenses with high numerical aperture are required in order to collect as much light as possible. The lens with the best light transmission characteristics on the market combined with our outstanding

camera technology guarantees the unique sensitivity of our AEQUORIA system.

Iris and focus of the lens are controlled by the software for convenient operation and best image quality.

3. Fluorescence system LuxiFlux

Our high-performance light source is the LED based **LuxiFlux**. It features 2 x 4 LED arrays in symmetrical arrangement and provides highly uniform excitation light at 470 nm and 633 nm. For discrimination of the emission wavelength, a motorized 3-filter



position wheel is equipped th corresponding emission ters (520 nm - 680 nm).

te fully software-controlled **ixiFlux** provides superior tput brightness and mogeneity of illumination. her illumination colors are available on request.



4. Software

4.1. AEQUORIA-Software



4.2. HCImage



Our dedicated AEQUORIA software is highly intuitive and easyOur high performance HCImage software is a very powerful and to use. It is designed for applications like molecular imaging arfitexible image acquisition and processing software for biological features following functions.

- Support of AEQUORIA MDS darkbox
- Integrated support for excitation light sources (LuxiFlux, IT3900, CT1000)
- Integrated support for motorized lens
- Support for all Hamamatsu cameras
- Image acquisition and storage
- Special acquisition modes: background subtraction, spotnoise reduction
- Image tinting and overlay
- Intensity scalebar
- Data analysis: line profiles, intensity analysis in ROIs on single images and image sequences, data transfer to Excel
- Template based creation of metadata-document about the acquired images (required by GLP)





HCImage Acquisition provides the user with drivers for controlling darkbox, camera and periphery. It offers functions like image overlay, contrast enhancement and quantitative image analysis functions.

The optional modul HCImage Analysis adds an extensive selection of image analysis tools; over 150 measurements are available, including count, size, shape, position and intensity of objects. Additional measurements as well as macros can be created by the user, tracking is included. Furthermore special modules for FRET or 3D-Visualization are available.





5. The Cameras

The AEQUORIA MDS system can be equipped with various cameras. Both the ImagEM EM-CCD camera and the Orca II back comprise a back-thinned CCD sensor with especially high quantum efficiency.

5.1 ImagEM EM-CCD camera for imaging with high frame rate

Imaging device

Electron multiplication back-thinned frame transfer CCD

Pixel number 512 x 512 (1024 x 1024 optional)

Cooling

- Forced air: -65 °C
- Water: -75 °C

Dark current

- Forced air: 0.01 e-/pix/s (-65 °C)
- Water: 0.001 e-/pix/s (-75 °C)

Mechanical shutter

No

QE

High quantum efficiency of >90 %



Dual readout mode

- EM-CCD readout (short exposure, high sensitivity)
- Normal-CCD readout (long exposure, high dynamic range) High precision readout (long exposure)

5.2 ORCA II back-thinned CCD cameras for luminescence imaging

Imaging device Full-frame transfer CCD

Pixel number 1024 x 1024 (512 x 512 optional)

Cooling

Forced air: -65 °C
Water: -75 °C

Dark current

■ Forced air: 0.17 e-/pix/s (-65°C)

■ Water: 0.032 e-/pix/s (-75°C)

Mechanical shutter

Yes

QE

High quantum efficiency of >90 %



Dual readout mode

Fast readout (bright field imaging, sample positioning)
 High precision readout (long exposure)



5.1 ImagEM EM-CCD camera for imaging with high frame rate



5.2 ORCA II back-thinned CCD cameras for luminescence imaging

Weak luminescence or fl uorescence signals can be accumulated for seconds to hours on the CCD chip.

Ultra low light detection

Photon imaging mode, a unique and patented technology for enhancing low light signals. It overcomes the limitation caused by excess noise related to the EM amplification process.

Full well capacity 370 000 electrons (max. 800 000)

Output signal/ External control CameraLink

A/D converter 16 bit

Lens mount C-mount

DSP functions

Real time image processing features:

- Background subtraction
- Shading correction
- Recursive fi Iter
- Frame averaging
- Spot noise reducer

Special features

EM-Gain warning and protection function

Full well capacity 230 000 electrons

Output signal/ External control IEEE1394 ("FireWire")

A/D converter 16/12 bit

Lens mount C-mount

Special features Exceptionally low noise

6. Optional Features

6.1 Halogen based fl uorescence system

Optional for special applications an external halogen light sou is available. The light of the 150 W halogen lamp reaches the sample chamber through a light guide. Its fiber ends in a ring light mounted in front of the lens. The light source features eith a 8-position filter wheel or a manual filter slider.

An emission filter wheel is mounted in front of the lens for discrimination of the emitted light holding up to 5 filters.



6.2 Darkbox options



 Microplate holder w/o temperature control



 Fittings for ventilation system

- Spacer for raising the stage to a working distance of either 20-50 or 15-45 cm
- Power plug inside the box
- Manual lens 0.95/25 mm: cost effective option to the motorized lens with identical performance
- Close-up lenses for further magnifi cation
- For applications demanding a larger darkbox or a plant chamber please contact us
- For use of other Hamamatsu cameras with the AEQUORIA system please contact us

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