Innovators in Bio-Photonics

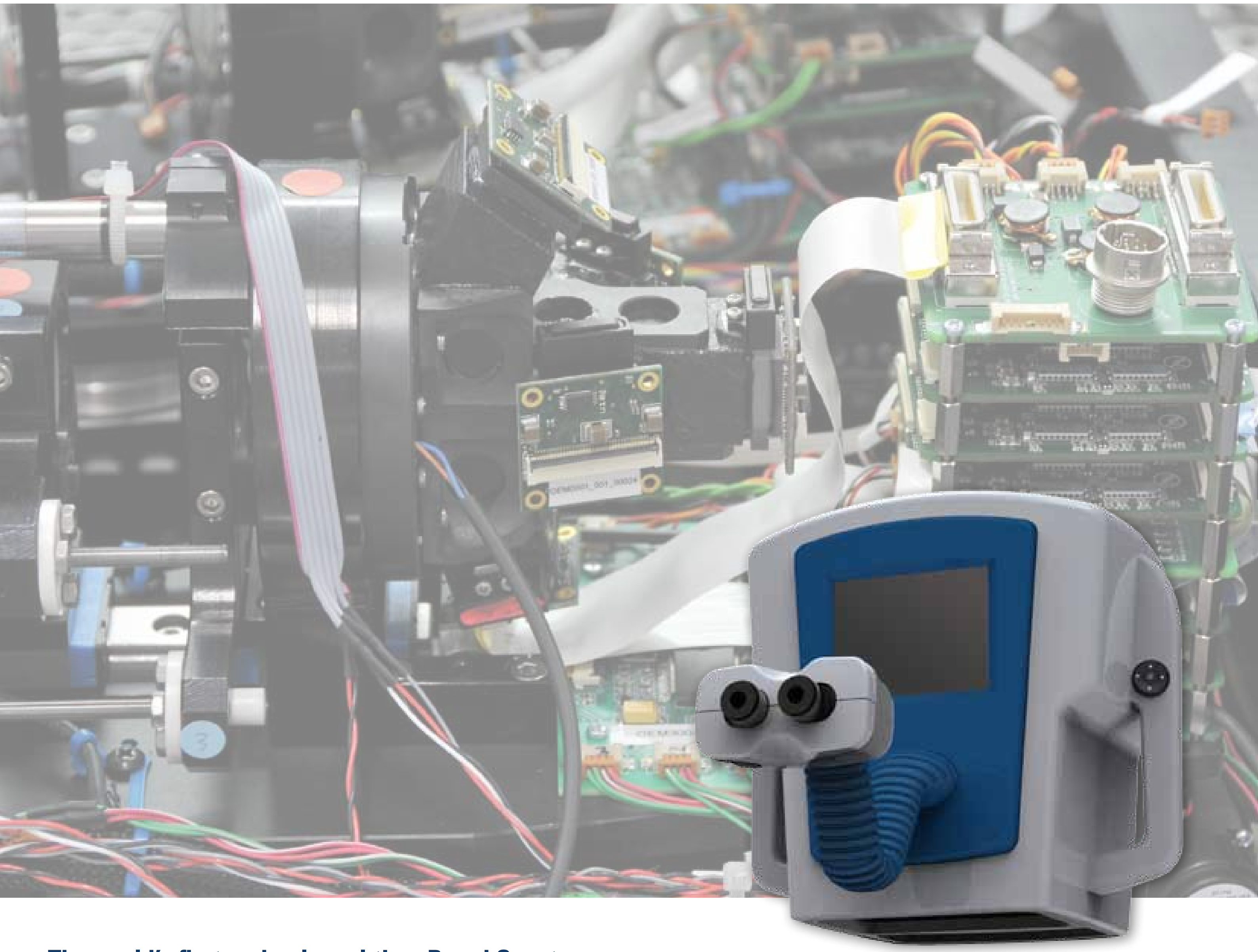
O2view

BROAD SPECTRUM IMAGING

VIS NIR SWIR

Technology explained

"State of the Art" technology in Broad Spectrum Molecular Imaging



The world's first and only real-time Broad Spectrum Stereoscopic Molecular Imaging System, combining Visible light with Near Infrared light images. Resulting in 3D visualization of fluorescent molecules, superimposed on perfect color stereoscopic vision. The best starting point for surgical oncology research and other demanding surgical research interventions.

Artemis 3D HD VIS-NIR

Real stereoscopic imaging

The Artemis provides the real 3D pictures by grabbing two different images coming from two different optical axes. The variable angle between the two optical axis, will provide the proper visualization. Optics are aligned in order to maximize the 3D effect, overlapping the two grabbed images with an accuracy better than 1 pixel.
The main new characteristics are the zoom solution with large field of view; the large (one camera) wavelength range (400-1000nm) is also a new imaging technique.

Multispectral images

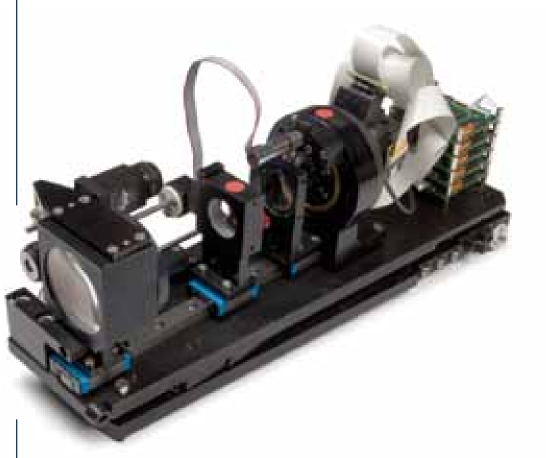
The worlds first five channel cameras have been developed for the Artemis system, able to capture images from 5 different CCD/CMOS sensors simultaneously with 5 different color bands.
The prism solution covers the range from 400 – 1000 nm (Visible to NIR, Near Infrared Region). Tolerances of the prisms are specifically defined to minimize any chromatic aberration that can compromise the image quality .

Surface flatness better than £/10 and prism angles better than 30 sec. are the main parameters under control to maximize the quality of the system. Dichroic coating on the prism has been designed for a better selection of the color (reference wavelength o ± 7nm and curve slope within 25 nm); antireflection coating (AR) efficiency, over the entire wavelength range, better than 99.6% for every surface.

Apochromatic design

The Artemis System (and all components) has been designed to minimize the chromatic aberration in the images. Two different types of Chromatic aberration are normally present in a optical system:

a) The white light (polychromatic), coming trough an optical element or system, is split in different radiation (different colors). This is caused by the different value of the refraction index VS the wavelength (at shorter wavelength higher refraction index values are related and vice-versa).



b) Axial Chromatic Aberration: means different focal plane position related to the wavelength value.
c) Lateral Chromatic Aberration: means different size of the image related to the wavelength value.

Normally the axial chromatic aberration is expressed in microns and the lateral chromatic aberration in pixels or pixels fraction .

In Artemis System:
The Axial chromatic aberration is totally compensated by the sensor alignment into the best focal plane: individually for every zoom system with the 5 channel camera.
The lateral Chromatic aberration is less than 1/4 of the pixel (means <2 micron) corresponding to a 0.023% (over the entire image format of 11mm diagonal) and in the worst case less than 1 pixel (means < 6.7 micron) corresponding to a 0.061% (over the entire image format of 11mm diagonal)

Vignetting

Image quality is guaranteed with Vignetting lower than 12%. This means, energy variation between the center and the corner of the image will not exceed the 12% variation. The uniformity of the image is well appreciated on medical imaging systems, wit-

hout any electronic compensation that can generate an higher noise level into the image.

Resolution Uniformity

This parameter is well controlled in order to minimize the resolution difference between the center and the corner of the image. Maximum variation of the contrast, at the same spatial resolution value, will be around 15 - 20%. This means we have a good image quality over the entire sensor .

Digital Zoom

The zoom variation is not controlled by mechanical zoom, but by a digital control system: the two optical groups are motorized and controlled in position by a high resolution encoder (barrel position accuracy is better than 1 micron and repeatability is better than 0.1 micron). In this manner a lighter system, more accurate and properly calibrated, has been designed.
Motor life is guaranteed for more than 500.000 cycles (one cycle is defined as min-max zoom variation, max-min zoom variation and 5 intermediate steps of control).

Iris Diaphragm

Totally motorized and digitally controlled, can be adjusted with an accuracy better than 10% and repeatability better than 3%. The iris is mounted on micro ball-bearing to guarantee the life and accuracy over 500.000 cycles (cycle is defined as: open-close, close-open, N. 5 steps from F6 to F22 in both directions). The iris can be automatically controlled and driven by the video signal level (like an auto iris device) or selectable by the operator.

DMD Illumination System

Very flexible and powerful system, is able to project light with different wavelength values (trough a dichroic prism) onto the object plane with different beam magnifications (trough a zoom lens), in different positions (trough a tilt-able mirror) and with different shapes (trough a DMD mirror).
Wavelengths are selectable from 400 to 1000 nm. In the Artemis design different laser / LED lightsources can be used and mixed all together contemporary or individually over a common optical axis trough a collimator lens.

The beam is also focuses onto a pin-hole (to optimize the edge of the light cone, and after that captured by a 4X zoom lens to project the beam with different size (from 45 to 180 mm diameter). Flexibility is extremely important and well guaranteed by :

- Laser selection
- LED selection and ON/OFF switching system
- Dichroic coating onto the prism to mix all the wavelength
- Pure beam quality generated by the pin-hole presence into the focal plane of the projection zoom lens
- Variable beam size trough the optical zoom
- Movable beam position trough a tilt-able mirror
- Selectable shape and pattern of the beam through the DMD mirror .

Light power is generated by the laser / LED components and well controlled by the proper optical design and coating efficiency. The projector system is able to handle different kind of LED's, with source dimensions of 1x1 mm and 2x2 mm. Different laser sources can be coupled.

Electronics

All Artemis electronic systems are specifically designed for high performance real time imaging, using latest generation FPGA components. In total more than 30 custom boards are incorporated in the Artemis system, controlling more than 13 motors, 10 CCD sensors and multiple displays. 2 optical connections are build in to export over 500 Mb/sec real time.

Ring Light Illumination

The Artemis is designed with a ringlight system incorporating 96 glass optical fibers. The glass fibers are equally divided into 3 bundles. Each of the bundles (32 fibers) are connected to an external Halogen light source. The specific O_2View ligthsources are equipped with filter-wheels, enabling the user to illuminate the surface with any combination of diffuse light. Mechanical dim possibility controls intensity without affecting the color temperature.

Technical Data

Key Features and Benefits

Integrated autofocus	Ensures a crystal clear, 3D image at every working distance from 400 mm to 500 mm
DLP high power projector, multiple wavelengths	DLP projected illumination of the work area, automatic focused pattern with zoom system. Auto angle correction for different working distances
Integrated ring light for diffuse lighting	With 96 glass fibres the Artemis ringlight system connects to 3 external Halogen lightsources
Connected storage and retrievel system	High quality storage and retrieval, stereoscopic raw data archiving for review, evaluation and display at any location at any time
Large field of view	Outstanding overview: 141 mm x 188 mm
Optical zoom	Stepless and precisely adjustable, 4x. Electronic magnification 2x
Unlimited application	Variable pupillary distance, individual vision correction and freedom of movement
High resolution	30 Micrometer at 400 mm working distance

O_2view Artemis Specifications

Working distance	400 mm to 500 mm
Magnification	Stepless 4x optical zoom combined with 2x electronic zoom (total 8x)
Auto angle	8 - 20 degrees
CCD Format	2/3″ CCD (Sony ICX285) sensors (2 x 5 units). Depending on your application needs, other sensors can be applied (custom design)
Pixel number per sensor	1360 x 1024
Pixel size	6.45 x 6.45 Micrometer
Prism design	2 x 5 Channel prisms with relevant dichroic splitting
Field of view	Max 141 x 188 mm, Min 22.5 x 36 mm (depending on working distance and optical zoom)
Distortion	< 2%
Vignetting	< 12%
Sensor alignment accuracy	Better than ¼ of a pixel
Chromatic aberration	Negligible
DLP LED / laser projector	Pattern illumination of the work area at every working distance. For certain applications external light sources can be coupled with the integrated lighting system
Integrated ring light	96 glass fibres (2.5mm diameter each) coupled with 3 external Halogen lightsources. Filters can be customized for each application
Autofocus	Autofocus controlled and maintained over zoom variation
Wavelengths	System optimized over 430 - 1000 nm range. Standard prism contains RGB (3) channels + (2) NIR channels. Dichroic splitting and filtering can be adjusted to your specific (oncology) application needs (custom design)

Technical specifications are subject to change without prior notice

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Artemis 3D HD VIS-NIR technologies are protected by international patents

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