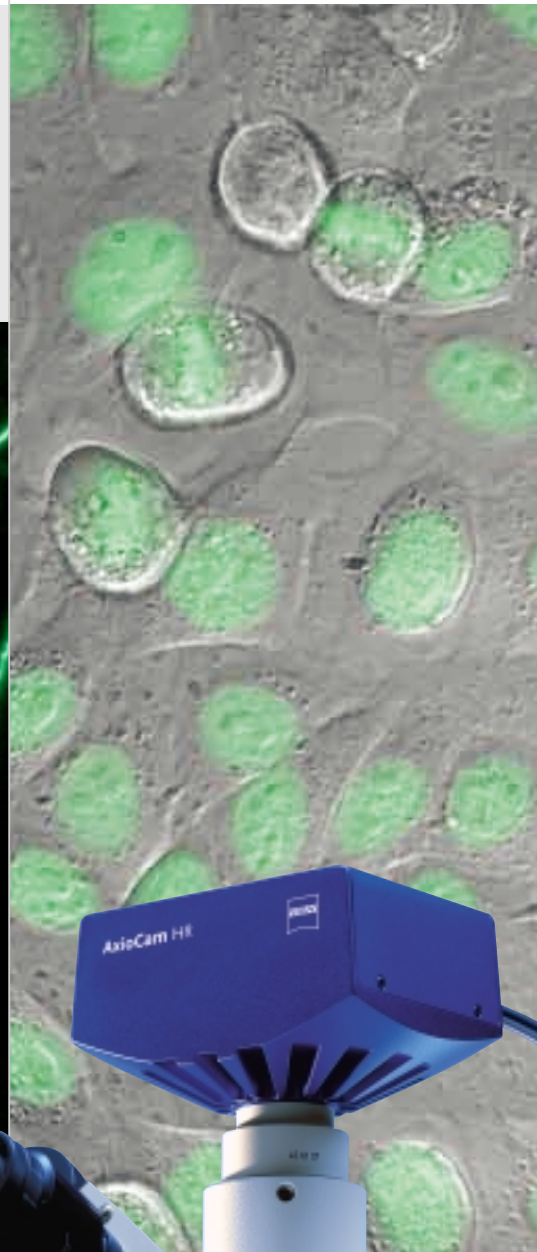
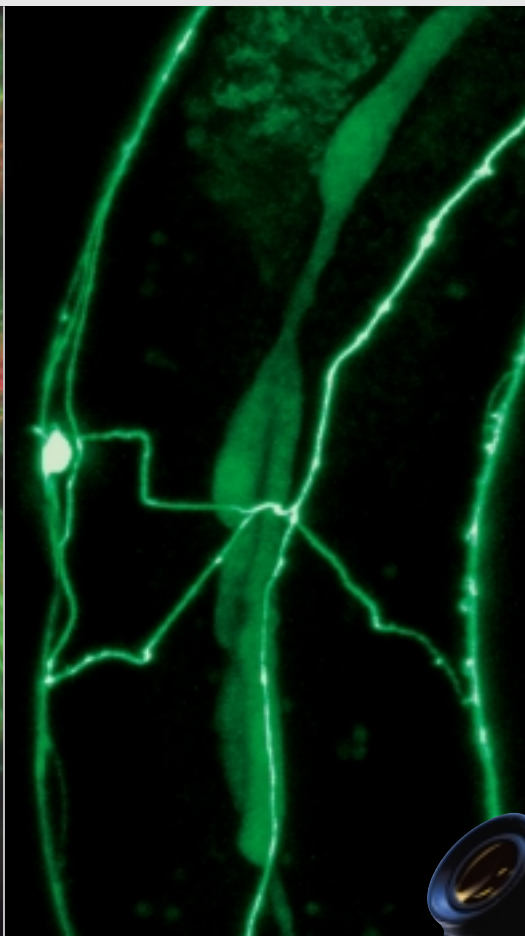
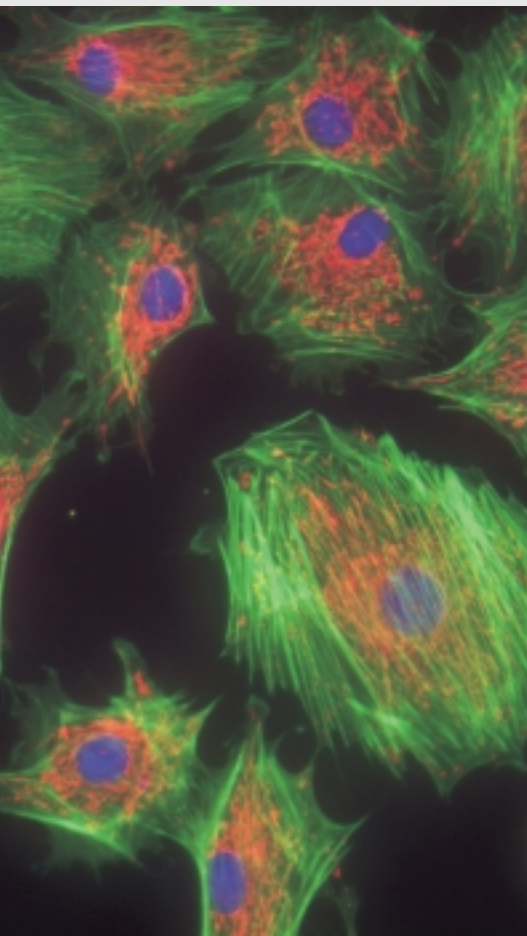


LSM 5 Family

AxioCam HR

High-End Camera for Laser Scanning Microscopes

The AxioCam HR is a cooled digital high-performance camera with selectable resolutions up to 12 megapixels. It is ideal for use with the LSM 510, LSM 510 META and LSM 5 PASCAL laser scanning microscopes. To the confocal image acquisition modes of these systems, the AxioCam HR adds the capability of taking wide-field fluorescent or transmitted light images with high sensitivity, large field of view and outstanding resolution. The camera is fully integrated in the powerful, easy-to-use software of the laser scanning microscope.



**Wide-Field Mode
on the Confocal Microscope**

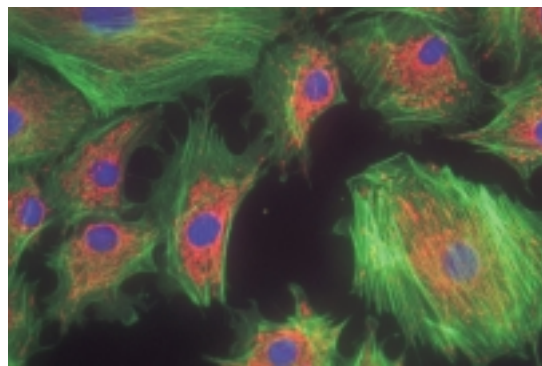
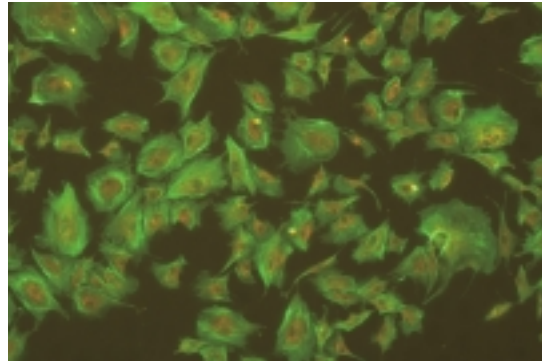


See More: Another Image Acquisition Mode for the LSM

To the capability of confocal microscopy to perform optical sectioning in thick specimens, the AxioCam HR adds another high-end detection mode: Maximum-resolution, high-sensitivity imaging of large fields of view, with fluorescent or transmitted light, in all contrast methods, and with objectives from 100x through 1x.

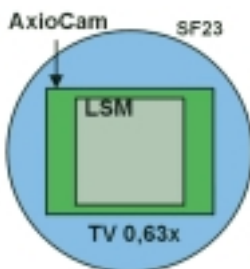
With an AxioCam HR added to a Carl Zeiss laser scanning microscope, researchers in neuro-, developmental or cell biology can now readily combine confocal and wide-field imaging, and use their LSM systems to record these images with high quality and precision.

While the laser beam of the laser scanning microscope typically scans a square frame in the center of the visual field, the AxioCam HR now adds a "panoramic" imaging mode: superbly resolved overview images of a large, rectangular field of view, especially with low-power objectives.

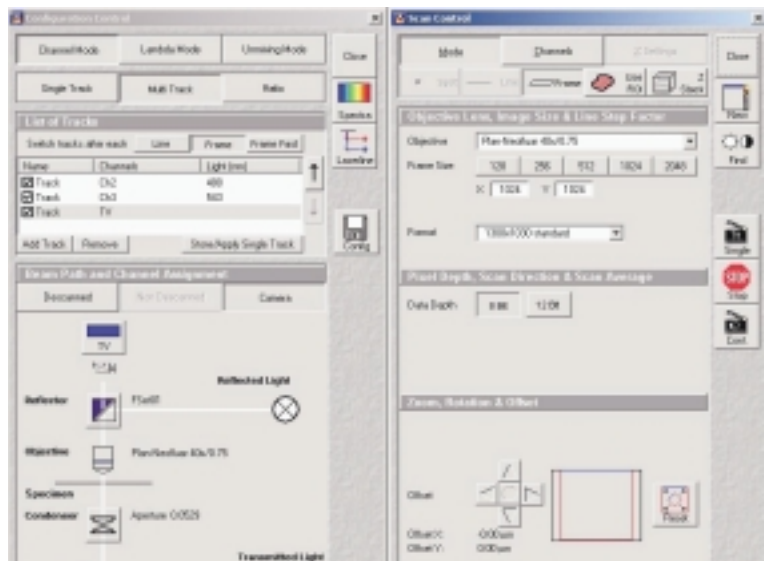


*BPAAE cells, triple fluorescence.
Top: Image taken with a 10x Plan-Neofluar objective and 12 megapixel resolution.
Bottom: Highly enlarged section.*

Fields of view of AxioCam HR and LSM. The "panoramic" format of the AxioCam can be used for overview micrographs.



Software interface. The AxioCam HR is fully integrated in the LSM software.



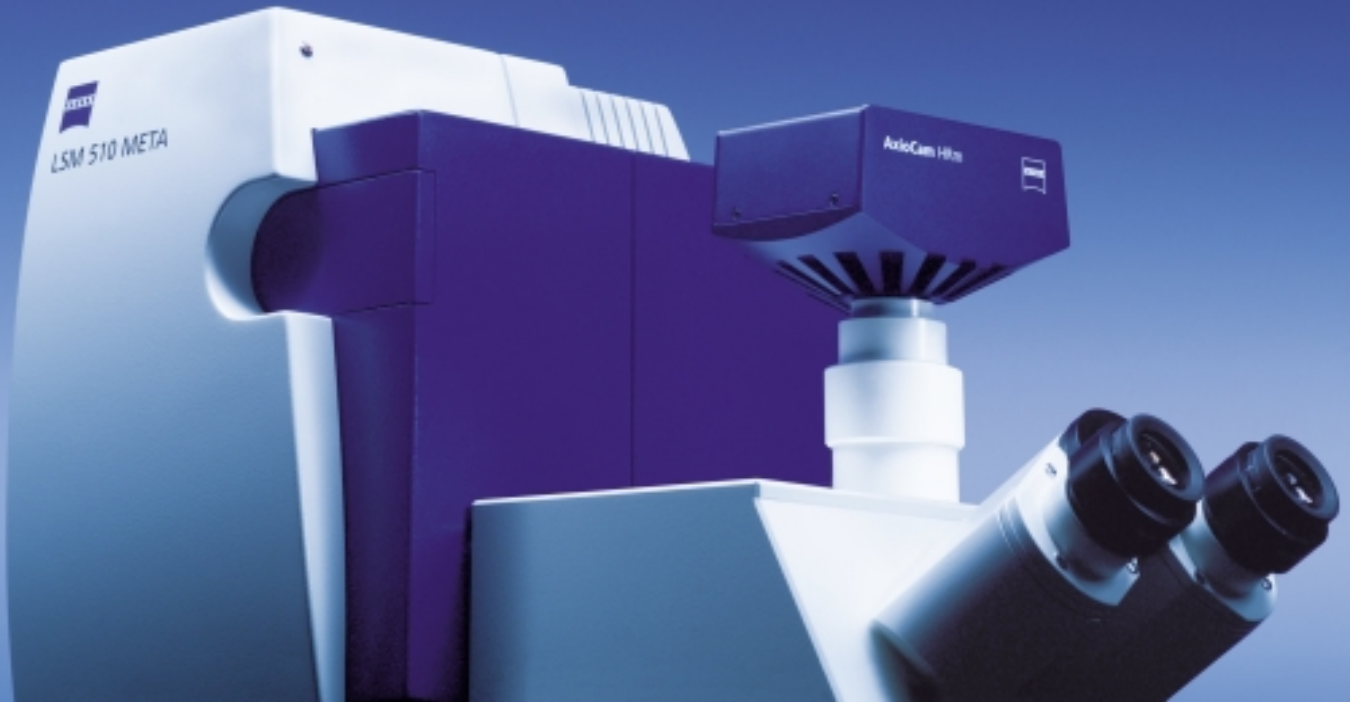
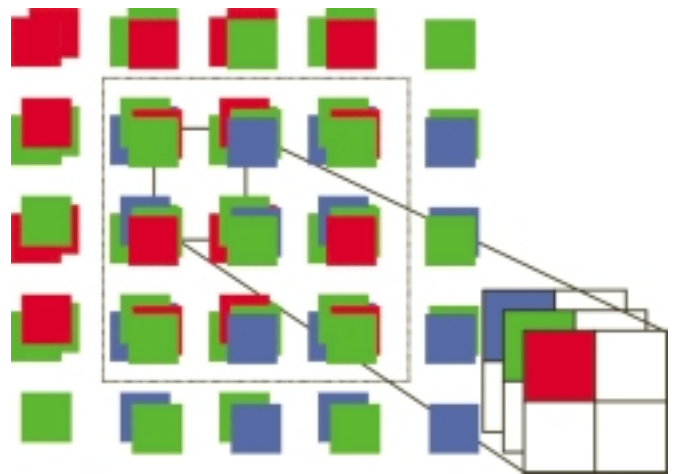


Image acquisition control of the AxioCam HR is fully integrated in the LSM software and follows the familiar, easy operation of the LSM's confocal channels. All functions of image acquisition control in the X, Y, Z and T dimensions are available in both the camera and confocal modes.

The AxioCam HR is available in color (HRc) and monochrome (HRm) versions. Both are Peltier-cooled and offer 12 megapixel resolution thanks to the unique Microscanning technique.

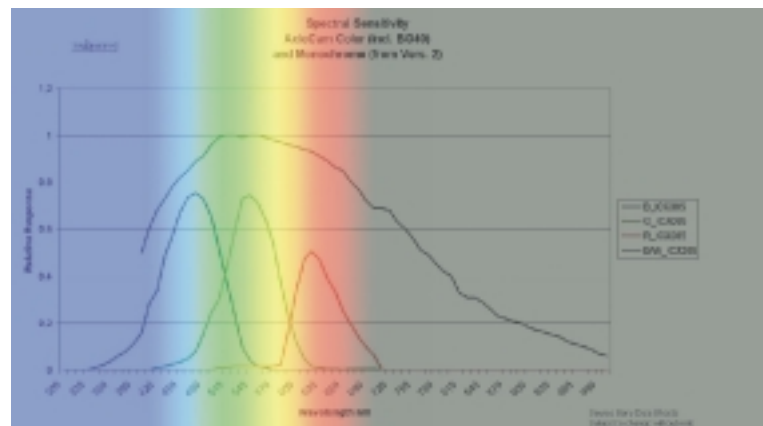
The color version provides brilliant images especially with transmitted light. Moreover, all colors are detectable in the same spot of the specimen (unlike the customary color interpolation make-shift).

The monochrome version delivers first-rate fluorescence images, as the absence of a color filter mask helps to improve sensitivity. The full 12 megapixel resolution is thus available throughout the complete image area.



Microscanning with the AxioCam HR. Depending on the camera version, either enhanced resolution or non-interpolated color detection can be achieved.

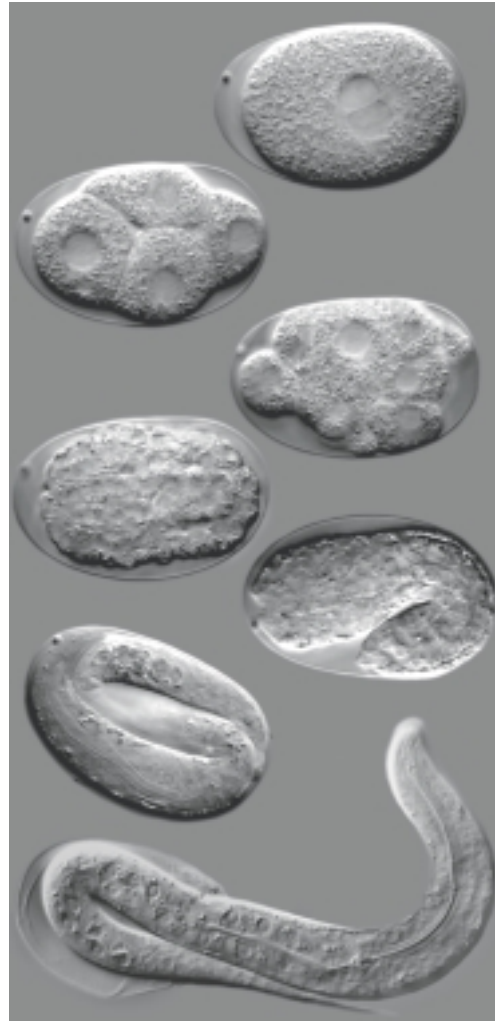
Spectral sensitivities of the AxioCam HR color and monochrome versions.



Fluorescence and DIC: The Comprehensive View

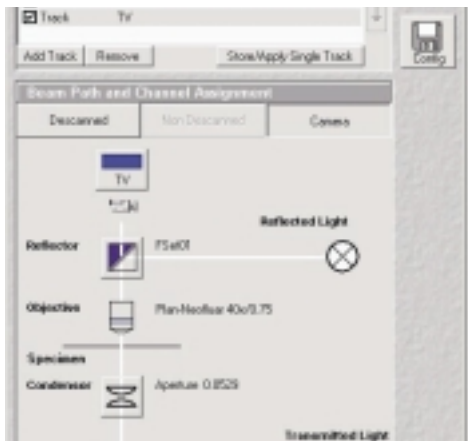
The AxioCam HR is perfect for capturing fluorescence images. As it uses the light microscope's wide-field illumination, all excitation lines of the HBO mercury vapor lamp are available – from UV to the near IR. On motorized microscopes, the Push & Click filter cubes and the HBO lamp shutter are controlled automatically by the LSM software. All settings can be saved and retrieved within seconds.

The AxioCam HR is a top performer in all the transmitted-light methods of a Zeiss light microscope: brightfield, differential interference contrast (DIC), or phase contrast. With motorized condensers, even switching between the contrast techniques is automatic. And everything is fully integrated in the LSM, at all objective magnifications, including comprehensive overviews.

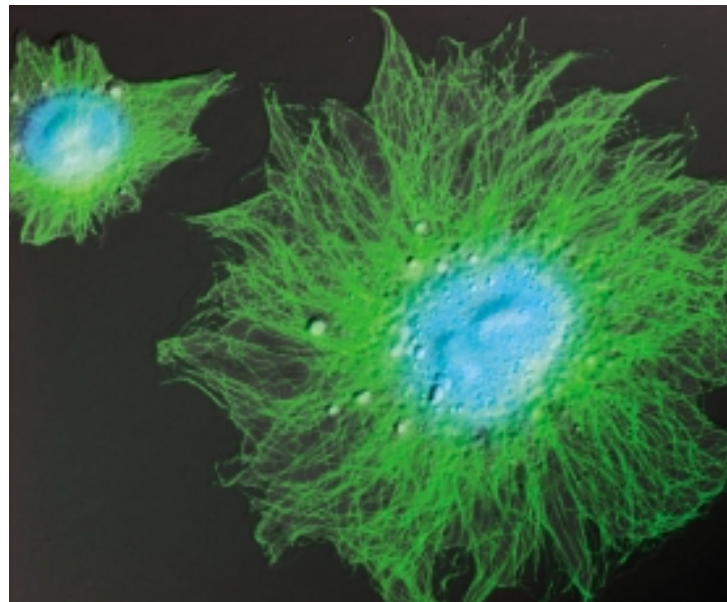


*Development of C. elegans,
wide-field DIC.
Specimen: Prof. Schnabel,
TU Braunschweig, Germany*

*Configuration Control menu
with beam path.*



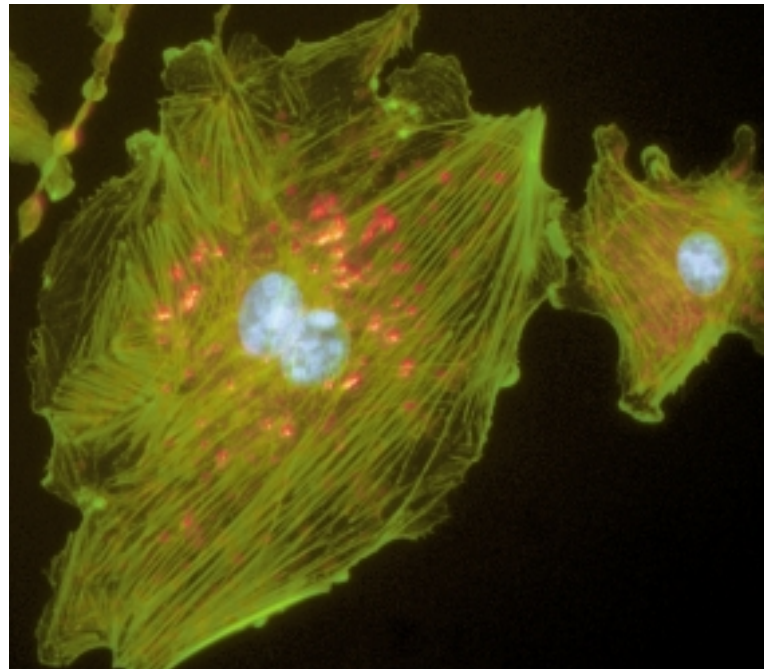
*Cultured cells. Perfect combination
of double fluorescence and DIC.*



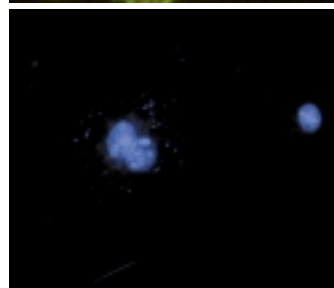
Separation of Multifluorescence Signals: Dependable, Straightforward Multitracking

Even in complex multifluorescence, the AxioCam HR delivers brilliant images. With excitation wavelengths properly selected, the software clearly separates fluorescence signals. Motorized switching of the Push & Click filter cubes allows the AxioCam HR to share the intuitive Multitracking capability of the Zeiss LSM. The resulting selective excitation ensures that the fluorescence channels are neatly split up. Even transmitted light can be defined as another multitrack channel.

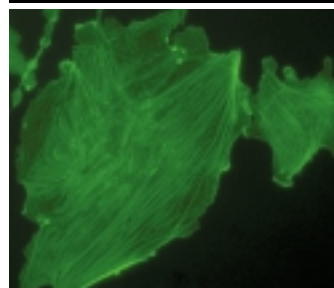
With the fully motorized Axiovert 200M, it is possible to use the LSM software to simultaneously control a Multitracking process for the AxioCam HR and confocal LSM channels. As users can define the area to be exposed to the AxioCam HR and employ the unique flexibility of the LSM 510's scanner control, it is possible to match the scanning area of the confocal channels with the position and pixel resolution of the AxioCam image.



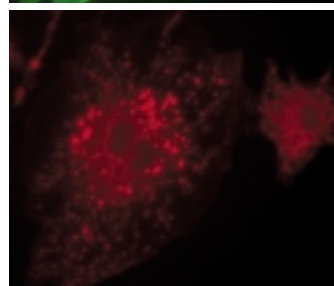
Triple fluorescence of a cultured cell (overlay)



*Track 1
Selective excitation for the nucleus*

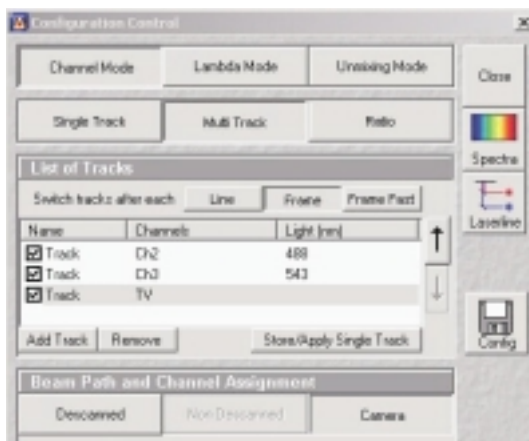


*Track 2
Selective excitation for filaments*



*Track 3
Selective excitation for mitochondria*

Multitracking setup with AxioCam

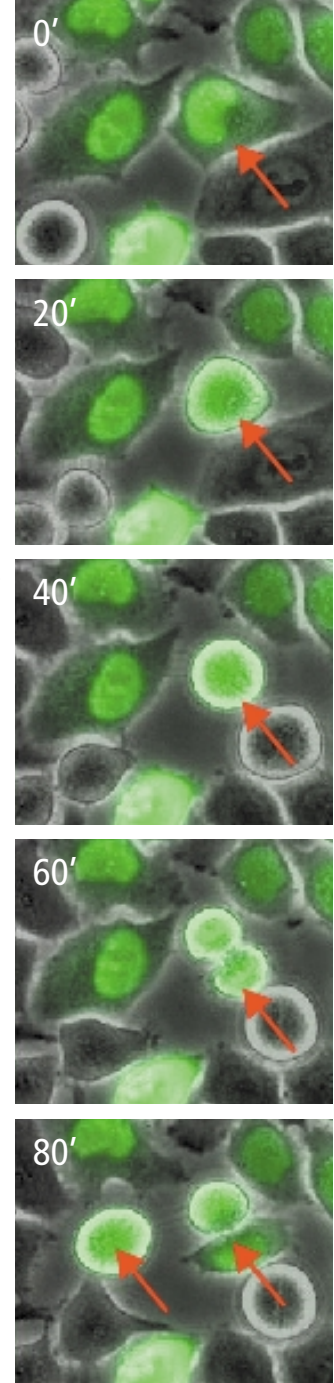


Multidimensional Shots: Time Lapse, Mark & Find, Z Stacks and More

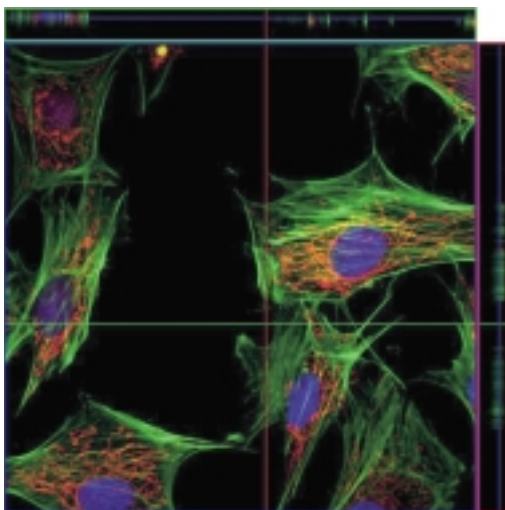
High sensitivity of the Peltier-cooled AxioCam HR is ideal for time-lapse recording of long-term experiments. Extensive experiments can be easily controlled with the LSM's Time Series functionality. With the LSM's XYT modes, the AxioCam HR performs as impressively as it does with the XY modes. The Multiple Time Series software option allows even the combination of confocal and wide-field image acquisition. If the user's interest is limited to particular specimen details, the Mark & Find function and the motorized scanning stages make it easy to position, save and retrieve predefined specimen areas.

The AxioCam HR can also be used for 3D imaging with the LSM: the XYZ and XYZT modes are available without restriction. The quality of the AxioCam images taken of transparent specimens or at low magnifications is more than impressive. Employing an AxioCam HR is always a smart supplement to the confocal modes.

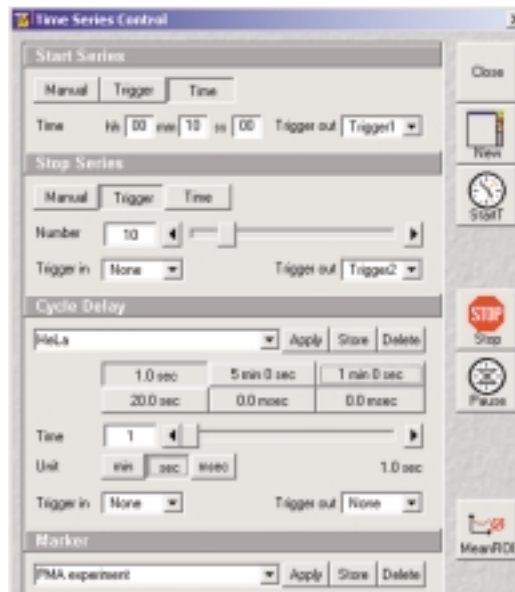
Time-lapse record of cell division of human cells (HeLa, Ran-GFP transfected). Specimen: Dr. Ruth Brack-Werner's lab, GSF Neuherberg, Germany



BPAE cells, triple fluorescence, Z stack, interactive 3D view.



In the Time Series Control dialog window, the user sets all parameters for data acquisition, such as number and duration of cycles, and triggers or markers for substance addition.

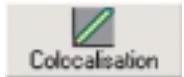


Colocalization: Visualized and Analyzed with Certainty, Speed and Precision

Teamed up, the AxioCam HR and the LSM handle quantitative colocalization experiments with unprecedented quality. Image presentation, scattergram and data table are interactively linked with the Region of Interest (ROI) and thresholding tools.

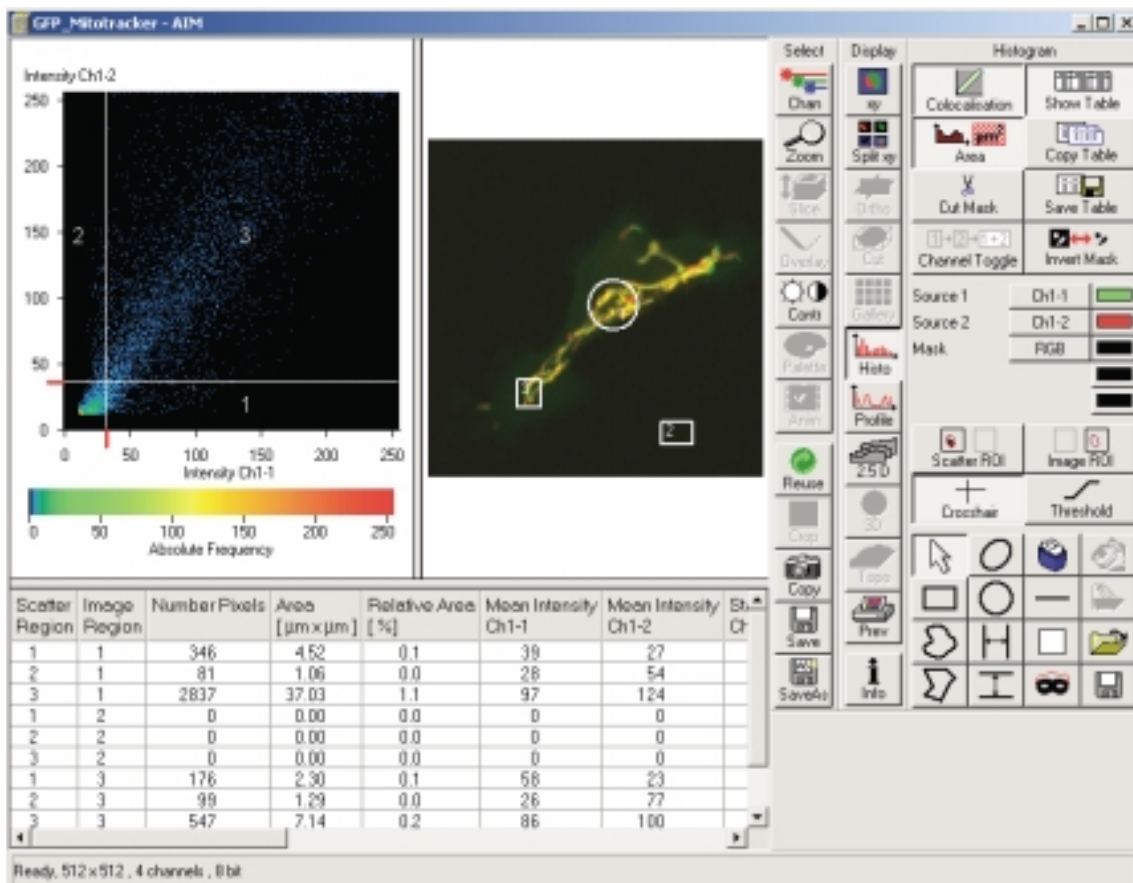
Once a region has been selected in an image, the software immediately analyzes the ratio of intensities and the degree of colocalization. Vice versa, it is also possible to select the colocalized areas in the scattergram and then visualize the corresponding pixels in the image. There is hardly a more intuitive and precise way to do colocalization experiments.

Display and analysis of colocalization experiments:



- Interactively linked image displays, scattergrams and data tables
- Interactive or automated determination of thresholds
- Overlay of image channels with results of the colocalization analysis
- Quantitative colocalization analysis for up to 99 ROIs, with:
 - area and average gray level intensity
 - colocalization degree
 - colocalization coefficient
 - Pearson's correlation coefficient
 - Manders' overlap coefficient
- Export of analysis results

Use first-class tools correctly: Image display, scattergram and data table are interactively linked to the ROI and thresholding tools. Expression of GFP-hMsrA (green), and labeling of mitochondria with MitoTracker (red). Specimen: Prof. S. H. Heinemann, University of Jena, Germany



The Software at a Glance: Unique Functionality

ReUse

Use this function to quickly retrieve image parameters and reproduce any experiment under identical conditions with a mouse click.



Find

This function automatically sets the exposure time of the AxioCam HR with a short test scan. Without lengthy trials, the appropriate sensitivity range is found by pressing a single button.



Multitracking

This scanning mode of the LSM system quickly switches between the excitations to produce multifuorescence images without disturbing crosstalk of the emission signals. It can be used with the AxioCam HR thanks to the automatic control of the reflector turret in the microscope.



Image Display

Image display window with a unique toolbar for analyzing and presenting the image content. View a single image, a gallery, or the XY overlay of a multichannel image set. Use 3D data records to either freely navigate in X/Y/Z, to display an overlay of all images, or to replay time lapse series as movies.



Measurement

Use this interactive function to make measurements in any image. The function reads out and makes allowance for all relevant parameters – objective, Zoom & Crop settings of the LSM, and even the camera adapter used on the light microscope.



Crop

This function allows you to select any region of interest (ROI). With the AxioCam HR you can select any frame size (e.g., 1024 x 1024 pixels). With the LSM, use the Zoom and Crop functions to apply any selected pixel resolution to a freely definable area; in this case only the ROI selected will be illuminated.



XY Overlay, Drawing Overlay

Use this function to combine the images of a multichannel fluorescence set, or to add a transmitted-light channel. You may switch off channels separately. Use text or drawing tools to add arrows, inscriptions etc. as another overlay.



Profiles

This function shows the image together with an intensity profile, measured along a freely positioned line. The function also reveals the dynamics of a fluorescence signal in time-lapse series, or the dimension of fluorescent particles against a dark background.



Histogram

See a statistic graph of the brightness distribution in an image. The advanced colocalization analysis of the signals from two channels is part of the histogram function of the LSM software.

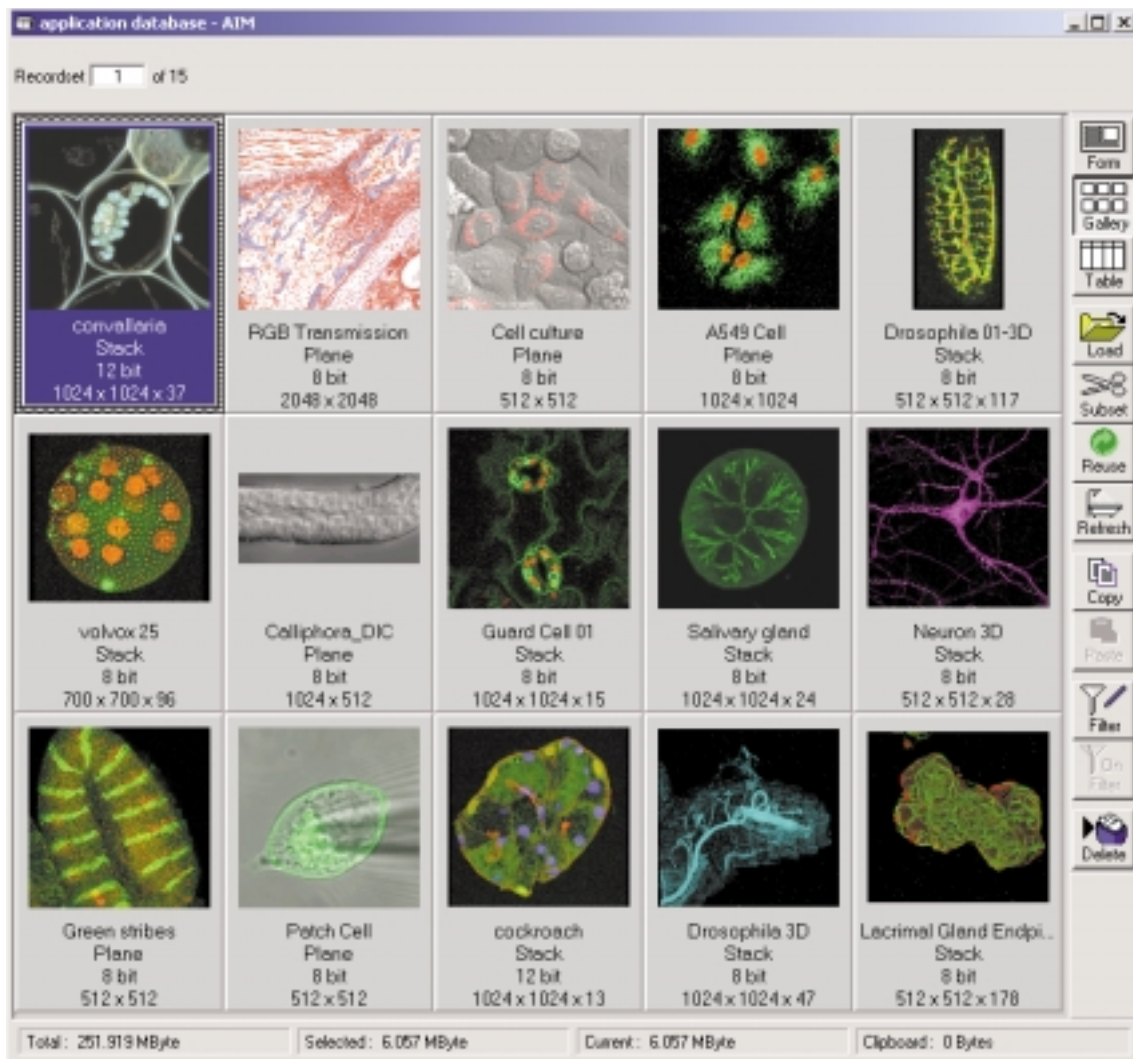


LSM Image Database

The images recorded with the AxioCam HR are filed in the image database in the original LSM image format. Lucidity and a clear arrangement were prime considerations for the design of this archiving system. The image database organizes all data, including the taking parameters and the type of objective (e.g., for the ReUse function), as well as user-specific comments



and thumbnails. The presentation modes allow for individual requirements. You can, for example, copy images, remove parts from series, or apply filters to several images at a time. Many export formats are available, including AVI and Quicktime. Measured data and tables can be exported and printed.

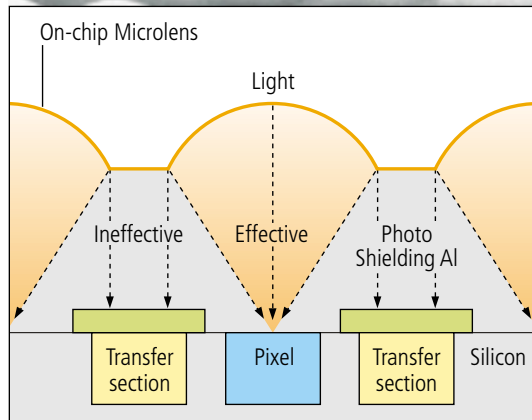
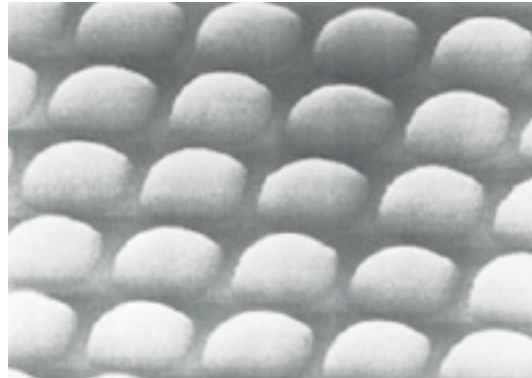


Perfection to the Last Detail: The Technology of the AxioCam HR

Fully integrated in the LSM software, the Carl Zeiss AxioCam HR is compatible with the LSM 510, LSM 510 META, LSM 5 PASCAL, LSM 5 PASCAL MAT and ConfoCor/LSM 510 combi instruments. Optimum electrical integration is ensured by digital data transmission and fiber-optic coupling.

The CCD chip used in the AxioCam HR is a well established high-performance type combined with the unique Zeiss Microscanning function. The joint action of Peltier cooling and on-the-chip microlenses results in outstanding sensitivity, which guarantees short exposure times and minimum light load on the specimen.

To permit loss-free acquisition of the microscopic image, users can freely choose the frame size, and thus scale between fast acquisition speeds of more than 20 frames/s and the maximum resolution of 12 megapixels. This allows optimum adaptation to the requirements of the specimen and the resolving powers of the objectives (see table on page 11). High pixel resolution with low-power objectives ideally complements the confocal detection modes of the laser scanning microscope.

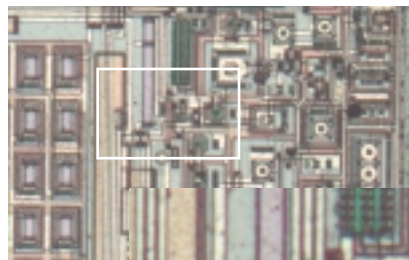


Maximum light efficiency of the AxioCam sensor through the microlens design.

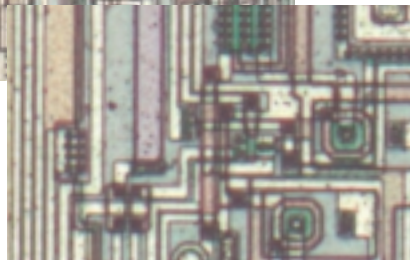
Detail of a microchip image taken with a professional 3-chip video camera; resolution 768x580 pixels.



Microchip taken with AxioCam and 5x/0.15 Epiplan-Neofluar objective; resolution 3900x3090 pixels.



Enlarged detail of the AxioCam image; resolution 1300x1000 pixels.



Specification

High Resolution Microscope Camera AxioCam HRm Version 2

High Range monochrome, incl. digital interface and cable	
Number of pixels:	1388 (H) x 1040 (V) = 1.4 megapixel
Chip size:	8.9 mm x 6.7 mm equivalent to 2/3"
Spectral range:	With BK-7 protection glass up to 1000 nm With optional IR barrier filter BG40 limited to about 350 nm to 700 nm
Selectable resolution (by binning and microscanning)	
H x V	Frame (s) @ 20 ms exposure
462 x 346	0.05 (20 frames/sec.)
694 x 520	0.07 (13 frames/sec.)
1388 x 1040	0.2 (5 frames/sec.)
2776 x 2080	Microscanning
4164 x 3120	Microscanning
Dynamic range:	Typical 2000:1 @ 8 e readout noise
Integration time:	1 ms to several minutes
Cooling:	One stage Peltier cooling
Optical interface:	C-Mount
Size:	11 cm x 8 cm x 6.5 cm (2.3" x 3.2" x 2.6")
Registration:	GS, CE, cUL
Power supply:	12V DC, 1A, 230V/110V, autodetecting

High Resolution Microscope Camera AxioCam HRc

High Range colour incl. digital interface and cable	
Number of pixels:	1300 (H) x 1030 (V) = 1.3 megapixel
Chip size:	8.7 mm x 6.9 mm equivalent to 2/3"
Spectral range:	Limited by IR barrier filter BG40 About 400 nm to 700 nm
Selectable resolution (by binning and microscanning)	
H x V	Frame (s) @ 20 ms exposure
432 x 342	0.07 (colour interpolation, 13 frames/sec.)
1300 x 1030	0.2 (colour interpolation, 5 frames/sec.)
1300 x 1030	0.7 (full resolution colour, 1.3 frames/sec.)
2600 x 2060	Microscanning
3900 x 3090	Microscanning
Dynamic range:	Typical 2000:1 @ 9 e readout noise
Integration time:	1 ms to several minutes
Cooling:	One stage Peltier cooling
Optical interface:	C-Mount
Size:	11 cm x 8 cm x 6.5 cm (2.3" x 3.2" x 2.6")
Registration:	GS, CE, cUL
Power supply:	12V DC, 1A, 230V/110V, autodetecting

Microscope Camera Port Adapters for the AxioCam

Adapter Video V200 C 2/3" 0.63x for frontport Axiovert 200M (Catalog No. 000000-1071-171)
Adapter Video 60 C 2/3" 0.63x for LSM-tube at Axioplan 2 imaging and Axioskop 2 (Catalog No. 000000-1069-414)
Adapter Video 44 C 2/3" 0.63x for Axiovert 100M BP/SP (Catalog No. 452997-0000-000)

Objectives, Line and Pixel Resolution of Sensor (with 0.63x Adapter)

Objective	Magnification	N.A.	Lp/mm	Pixels required
Plan-Neofluar	1.25x	0.035	152	2548 x 1946
Fluar	2.5x	0.12	229	3893 x 2931
Plan-Neofluar	5x	0.15	143	2431 x 1830
Plan-Neofluar	20x	0.50	119	2023 x 1523
Plan-Apochromat	20x	0.75	179	3040 x 2291
Plan-Neofluar	25x	0.80 Imm	152	2584 x 1946
Plan-Neofluar	40x	0.75	89	1513 x 1139
Plan-Neofluar	40x	1.30 Oil	155	2635 x 1984
Plan-Apochromat	63x	1.40 Oil	106	1802 x 1357

Everything fits everything:



LSM 510 with AxioCam HRm
on the Axioplan 2 imaging microscope



LSM 510 META with AxioCam HRC
on the Axiovert 200M microscope



LSM 5 PASCAL with AxioCam HRm
on the Axioskop 2 FS mot microscope

Title page illustrations (left to right):

BPAE (bovine pulmonary artery endothelial) cells,
mitochondria labeled with MitoTracker Red CMXRos,
F-actin with BODIPY FL, and nucleus with DAPI.
Specimen: Molecular Probes, Netherlands

C. elegans, GFP-labeled neurons.
Specimen: H. Hutter, MPI Heidelberg, Germany

HeLa cells, H2B-GFP fusion.
Specimen: Dr. R. Brack and H. Wolff,
GSF Institute of Molecular Virology,
Neuherberg, Germany

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www.zeiss.de/lsm

Subject to change.