

"Max Proj d'une cellule en anaphase", Debora Olivier (Group Laure Crabbe «Telomeres and Genome Organization», CBI / LBCMCP UMR 5088 CNRS/Université Toulouse III)

Get more from the DeltaVision™ OMX Flex super-resolution microscope

- Higher quality images
- Comprehensive insights
- Faster acquisition speeds
- Reproducible data for faster publication

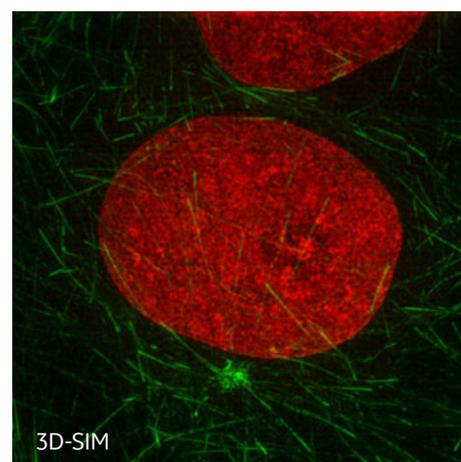
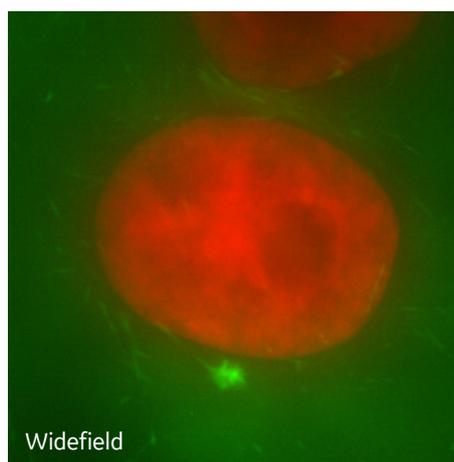


gelifesciences.com/OMXFlex

Reveal more, acquire more, capture more...

Gain comprehensive insights by using multiple imaging modes

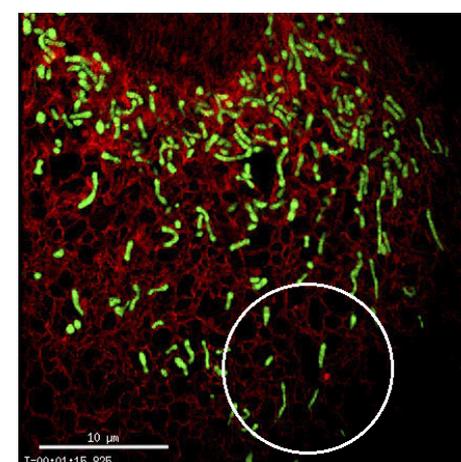
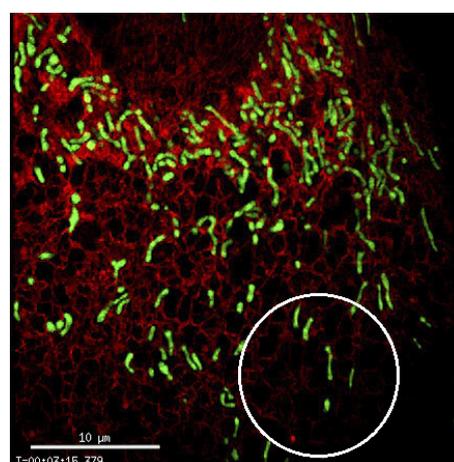
- One microscope platform with multiple imaging modes. Increases instrument utilization, reduces training needs, and minimizes purchase risk.
- Easily switch between modes with just a click of a button:
 - No changing or moving biological sample needed.
 - No hardware alignment needed.



HeLa cells histone H2B labeled in red, EB3 labeled in green, Michael Porter, AQLM.

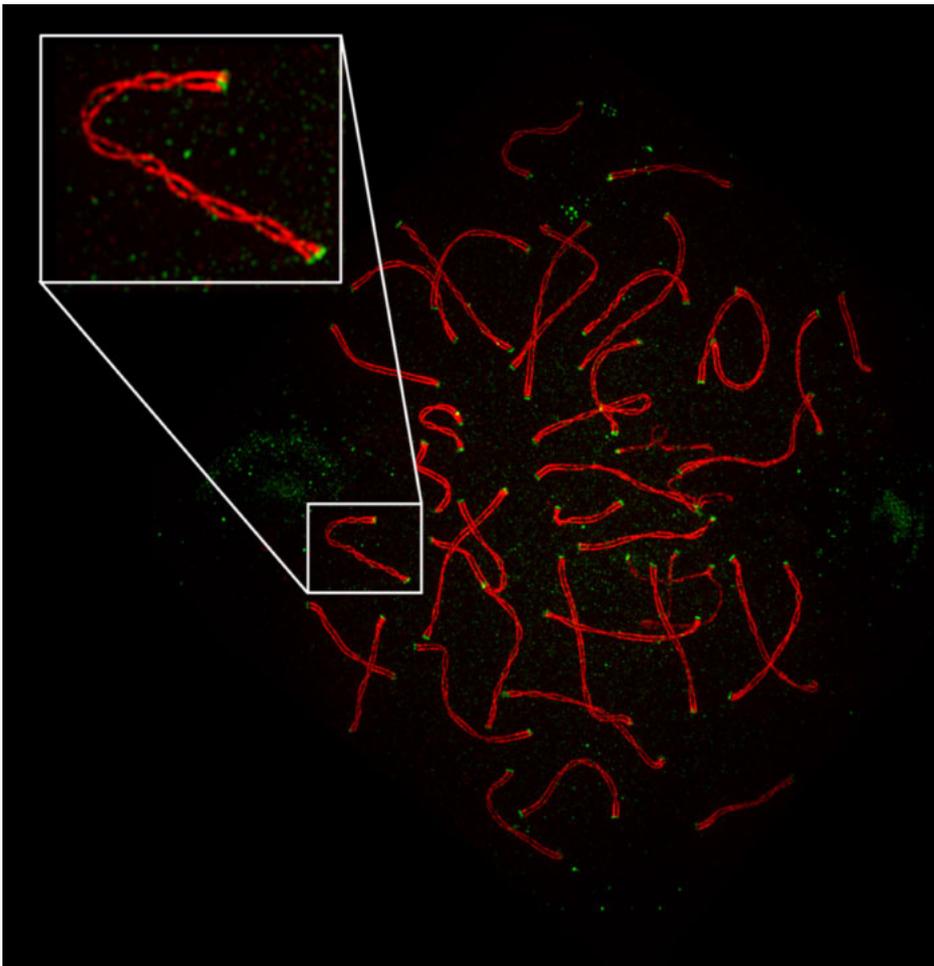
Capture dynamic processes quickly and efficiently

- Image as fast as your biology requires without having to sacrifice image quality or speed with minimal photobleaching.
- Total internal reflections fluorescence (TIRF)-SIM delivers the ability to observe some of the most challenging biological processes in super-resolution microscopy at 20 reconstructed frames per second (fps).
- Simultaneously acquire up to four wavelengths at a time with ultrafast widefield imaging (> 375 fps at 512 × 512).



Individual mitochondria (green) interacting with the endoplasmic reticulum (mCherry) network. (2-color imaging for 200 time points at 96 fps). Vaughn Lab, UW

Acquire high-quality images



Synaptonemal Complex of Mouse Spermatocyte, Graham Wright, Institute of Medical Biology.

- Experience two-fold resolution improvement in all three dimensions for an eight-fold volumetric improvement in resolution (3D structured illumination microscopy, SIM).
- Each imaging mode maximizes image contrast:
 - extremely efficient delivery and detection of light.
 - gather more data and image longer with minimal photobleaching.

—Get it all in one powerful system.

How small?

What level of detail do you need to answer your biological questions and achieve your research goals?

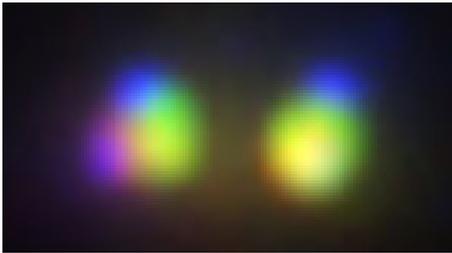
Do you want to see how mitochondria interact with the endoplasmic reticulum?

Do you want to observe changes within individual mitochondria during apoptosis?

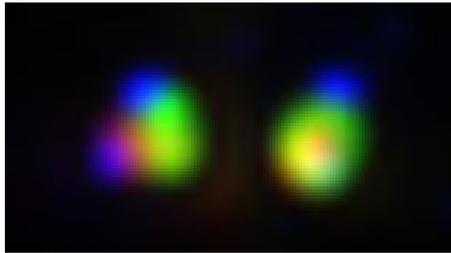
Do you want to follow the path of a virus leaving the host cell?

Do you want to locate multiple proteins within a single algal cell?

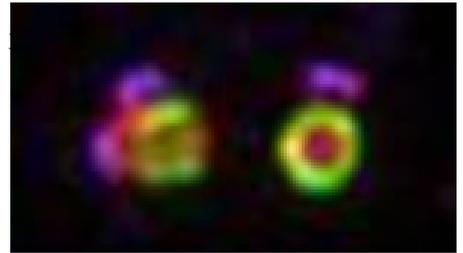
Widefield



Deconvolved



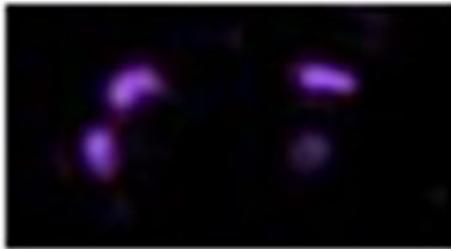
3D-SIM



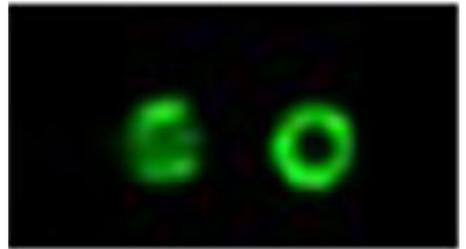
DeltaVision OMX Flex allows you to use multiple imaging modes from confocal to single molecule localization to go from a macro- to a nanoview of tissues, cells, and organelles.

- Conventional resolution with widefield deconvolution and line scanning confocal.
- Fast 3D-SIM for volumetric observation at 100 nm resolution.
- DeltaVision localization microscopy for 30 nm level of detail.

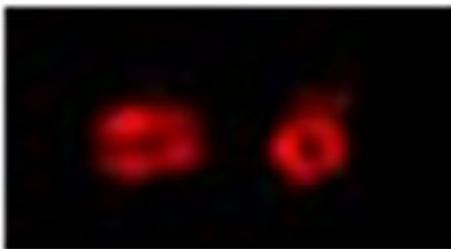
Distal



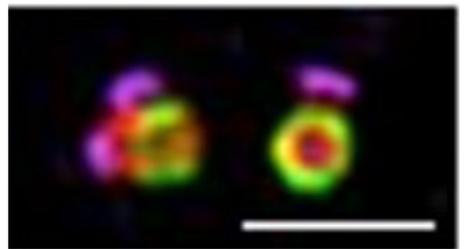
Proximal



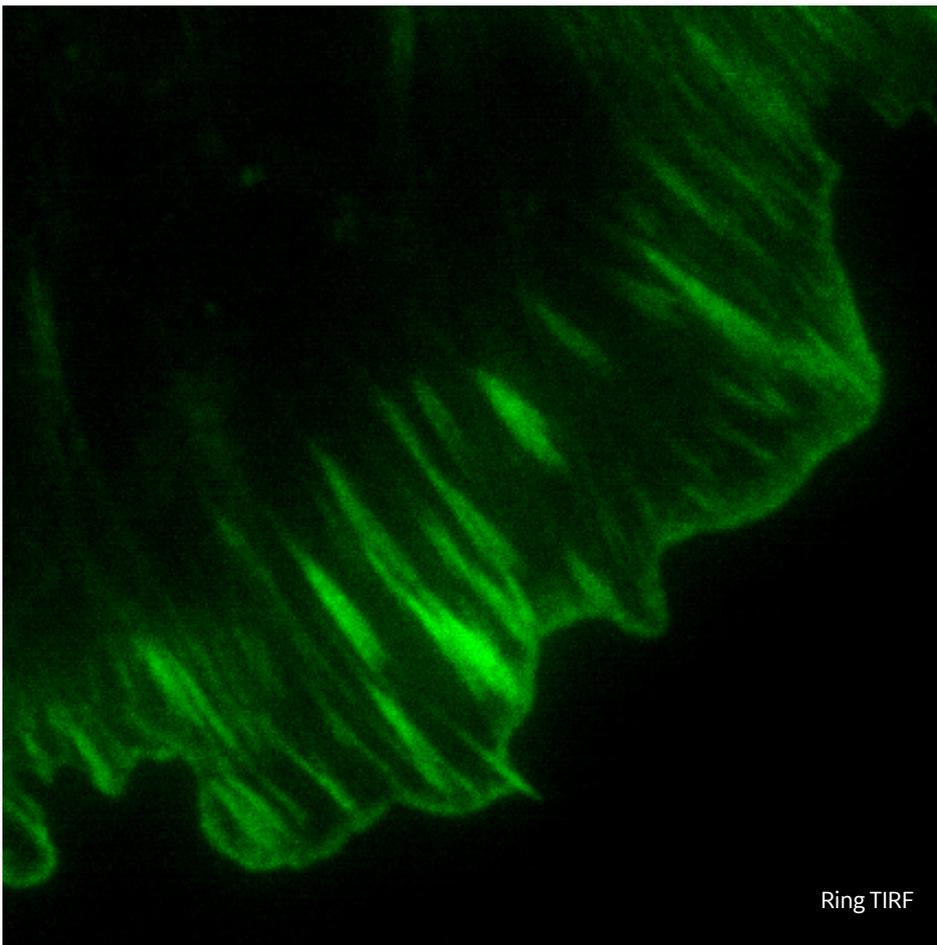
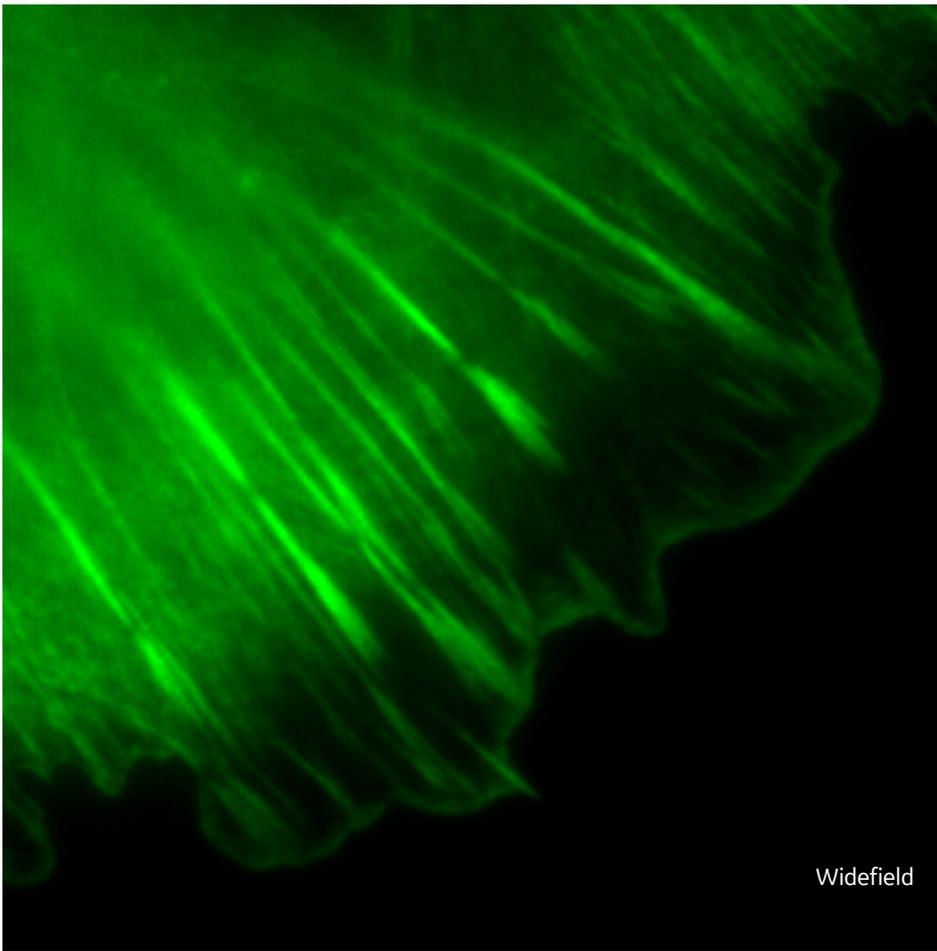
Walls



Merged



Centrosomes, A. Ferrand, University of Basel, *Sonnen et al.*, *Journal Cell Science*, 2013. "Adapted from Sonnen K. F. et al. Human Cep192 and Cep152 cooperate in Plk4 recruitment and centriole duplication. *J. Cell Sci.* **126**, 3223–3233 (2013).



Actin in U2OS cells.

How deep?

Some biological processes occur at the surface of the cell, while other interactions are deep beneath the cell membrane layer. Do you want to observe the formation of structures on a cell surface? Do you want to observe the flagella on bacteria? Do you want information about the 3D structure of an organoid? Do you want to follow the path of a drug as it traverses through cultured cells or spheroids? Do you want to build a picture of how cells and organelles are organized within a tissue section?

DeltaVision OMX Flex gives you the power to observe incredibly close to the coverslip in multiple imaging modalities or to build images in 3D of deep samples.

- TIRF microscopy in conventional and SIM modes for exquisite detail close to the coverslip.
- 3D-SIM and deconvolution microscopy for increased resolution and contrast to 50 μm depth.
- Line scanning confocal microscopy for large tissue and cleared samples.

How fast?

Would faster imaging speeds augment your understanding of your biological system? Do you want to follow life cycles over hours or days or very rapid events that are over in a matter of seconds? Would faster imaging allow you to observe more events from one sample preparation?

DeltaVision OMX Flex provides fast imaging for the observation of dynamic events whilst also providing an efficient platform for imaging multiple field of views very rapidly.

- Fast reproducible stage with point visiting capabilities.
- 20 TIRF-SIM fps imaging speeds.
- Multiple sCMOS cameras and computers for four color simultaneous acquisition at > 375 fps burst mode.
- Multiple imaging modes for flexible rapid imaging.



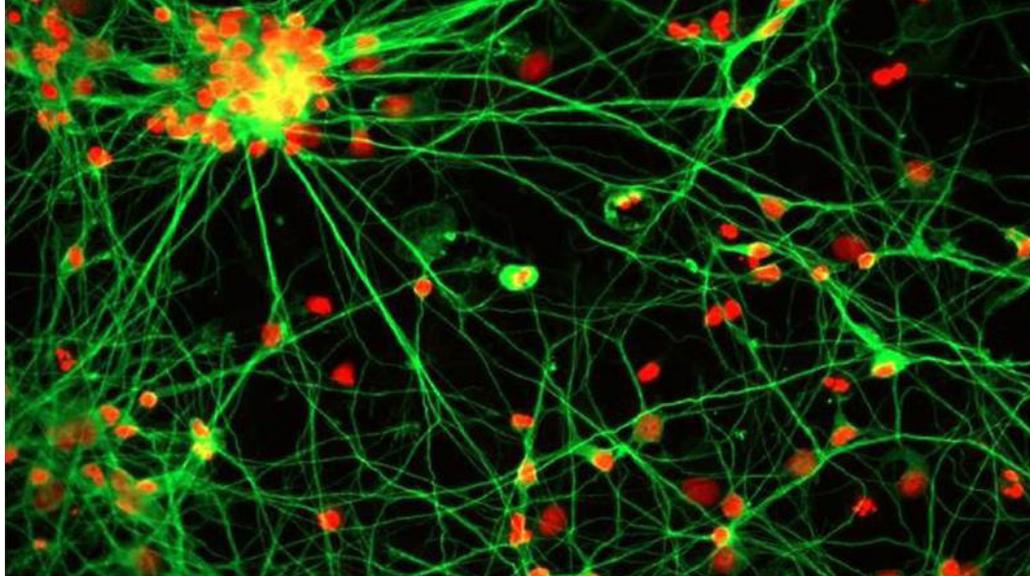
TIRF-SIM of mCherry-LifeAct-Actin in HeLa cells, Michael Porter, AQLM.

How many?

Are you studying events in a single cell or handful of cells? Do you want to observe phenomena after mutation or drug treatment in multiple cells? Do you want to get more from your investment in sample preparation?

DeltaVision OMX Flex has multiple tools to help you increase the efficiency and volume of your imaging.

- Rapid imaging speeds in all modalities to allow more acquisitions from a single sample.
- Point visiting for a single timepoint or multiple timepoints.



Stem cell-derived human neurons.

How alive?

Do you struggle with photobleaching limiting your live cell experiments? Are you limited by the temporal resolution you can achieve on your current microscope? Do you need to improve resolution in space and time?

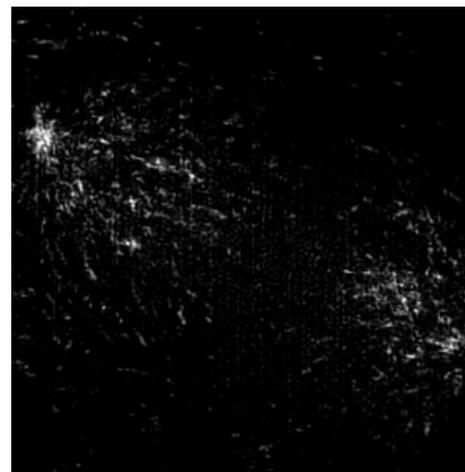
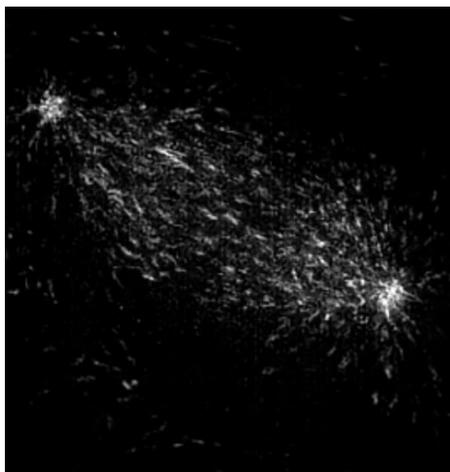
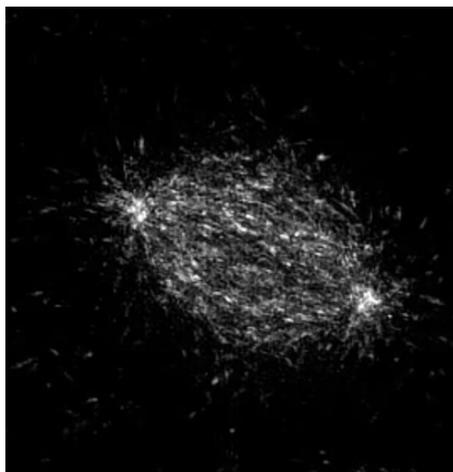
Live cell imaging faces many challenges, including preserving cell health while improving spacial and temporal resolution over extended periods of time. Researchers want to see dynamic processes, in real-time and over time, such as vesicle trafficking, membrane ruffling, and bacterial twitching. They want more from their microscopes—

more speed, more resolution, more depth but use as little light as possible to minimize photobleaching. DeltaVision OMX Flex microscope is designed to focus on reducing background noise, which enhances contrast and ensures measurable signal to deliver high-quality images.

Proper environmental control is critical for biologically relevant live cell imaging. DeltaVision OMX Flex microscope can be equipped with an optional multifunctional Environmental Control Module to maintain and control optimal temperature, gas, and humidity conditions for the duration of a

live cell imaging experiment. The module is software controlled from the workstation and the hardware is located within the DeltaVision OMX Flex microscope enclosure.

- Image as fast as your biology requires without having to sacrifice speed or image quality with minimal photobleaching.
- Precise control of sample temperature, gas concentration and humidified air to the sample to preserve cell viability.
- Cells remain in a metabolic state with no nonspecific changes that could alter the process being observed.



Cells undergoing mitosis, Heidi Hehnly, Scott Lab University of Washington & HHMI.

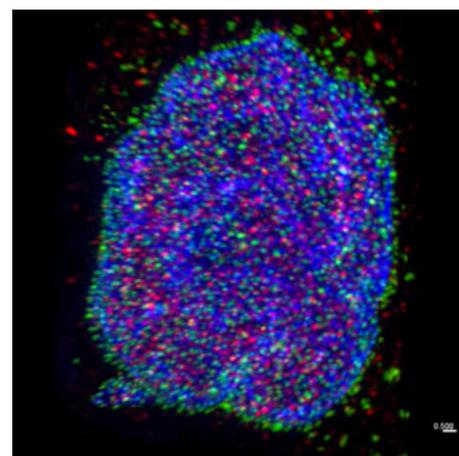
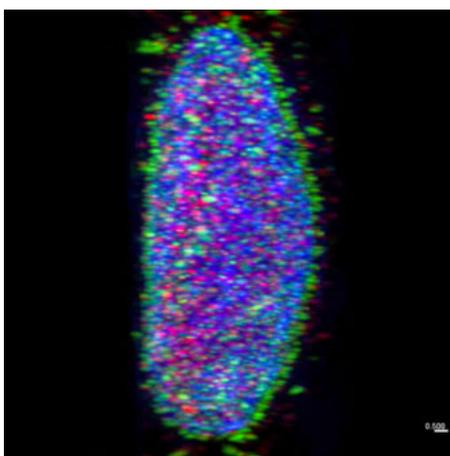
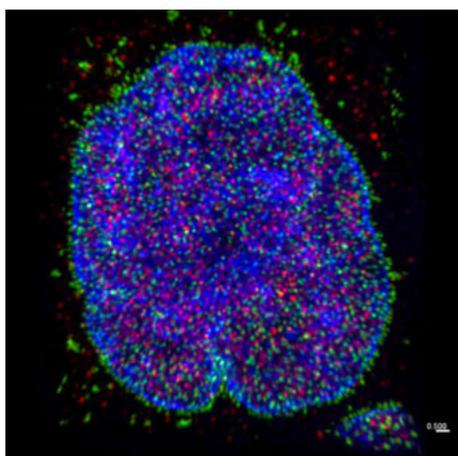
Structured illumination microscopy (SIM)

The patented Blaze SIM light path efficiently delivers ultrafast and flexible structured illumination imaging modes, enabling you to reveal more of your biological features invisible with the resolution limits of classic microscopy approaches. Structured illumination diffracts the illumination laser beam into two or three parallel beams that are combined by the objective to produce 3D-, 2D-, or TIRF-SIM interference fringe patterns on the sample. Multiple images of the sample are collected while shifting and rotating the fringe pattern and stepping through the sample in the vertical direction (Z dimension). The mathematical SIM algorithm reconstructs a super-resolution image by solving large systems of linear equations with data from all captured images.

No special sample preparation methods are required when using the DeltaVision OMX Flex. You can use the same preparation methods and apply the same fluorescent labeling reagents (antibodies and protein tags).

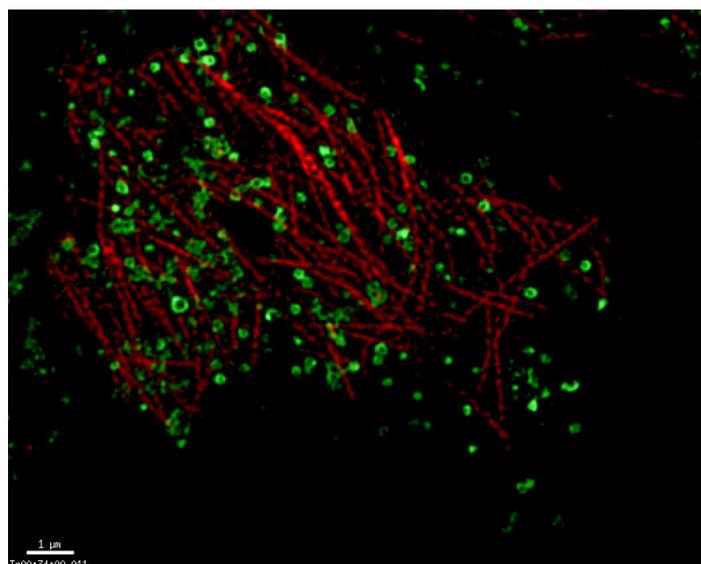
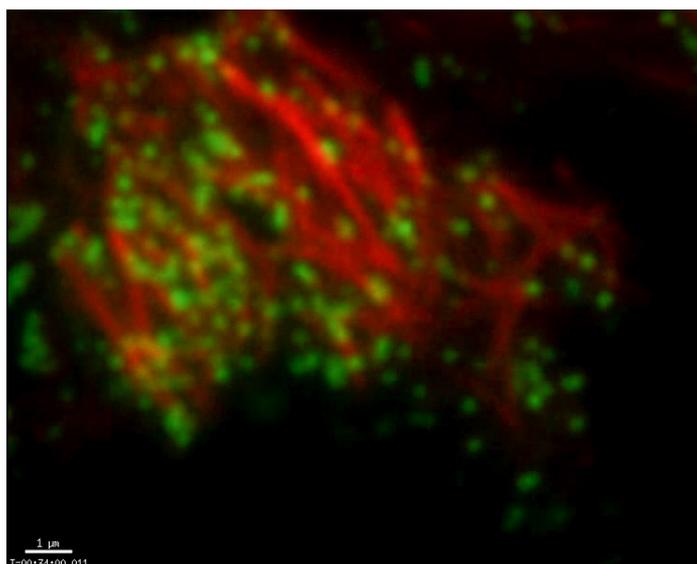
Benefits

- 3D-SIM yields a two-fold resolution improvement in all three dimensions (X,Y, and Z), which translates into an *eight-fold volumetric resolution increase*. (3D-SIM imaging at 110 nm lateral and 300 nm axial resolution in 488, 60× 1.42NA objective).
- TIRF-SIM allows you to capture super-resolution images of the most dynamic live cell processes occurring right on the coverslip surface. Use TIRF-SIM to validate correlative light-electron microscopy (CLEM) data. (TIRF-SIM resolution 110 ± 5 nm lateral resolution in 488, 60× 1.42NA objective, 25 reconstructed fps).
- Blaze SIM pattern generation paired with a single-mode fiber optic cable ensures excitation light polarization is preserved through the excitation light path delivering the sharpest SIM interference pattern resulting in maximal resolution gains.
- Automatic SIM pattern optimization provides the best resolution for each wavelength in every experiment without a user having to compromise between imaging speed or resolution in other wavelengths.
- Switch between TIRF-SIM, 2D-SIM, and 3D-SIM modes instantaneously with a mouse click only; no hardware alignment needed.
- Easily add a photokinetic PK event within any SIM experiments (requires TIRF or confocal module in configuration).



Nuclear Pore Complexes in 3D-SIM, K. Schleicher, A. Ferrand, University of Basel.

360 total time points in TIRF-SIM every 30 seconds for 3 hours



mCherry-Tubulin and GFP-Clathrin in HeLa Cells, Michael Porter, AQLM.

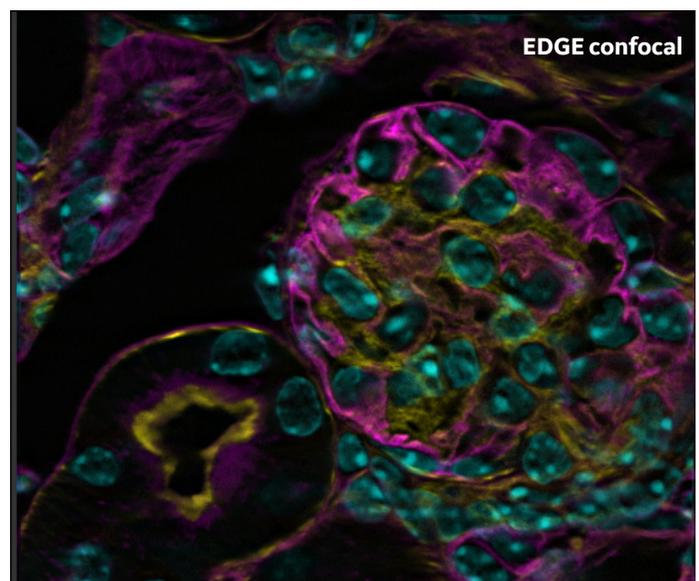
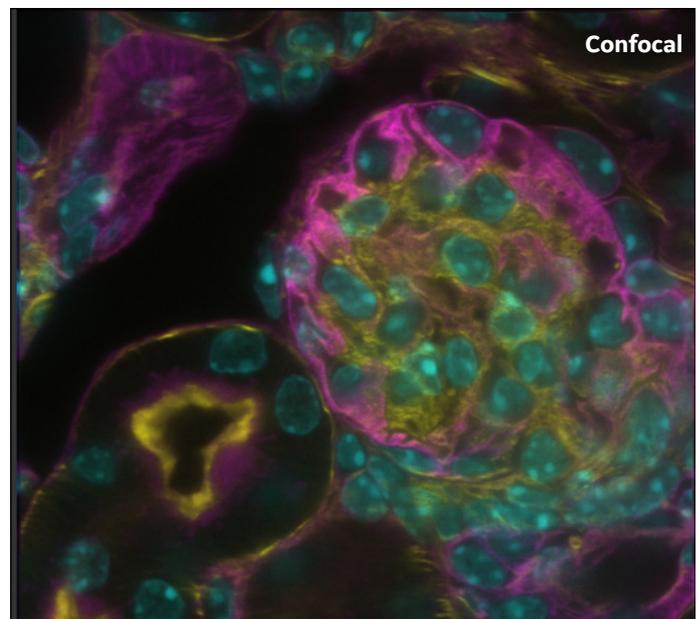
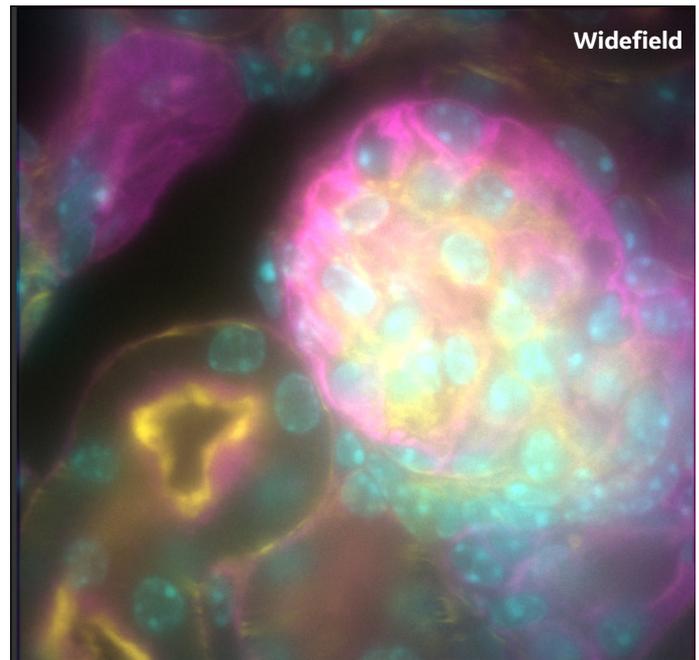
NEW EDGE confocal line scanning

EDGE enhanced confocal technique is newly integrated into the DeltaVision OMX Flex microscope along with our IRIS line scanning confocal technology. IRIS confocal imaging mode leverages a virtual confocal aperture by synchronizing the laser illumination line as it is swept over the sample with the active readout rows of the sCMOS camera in rolling shutter mode.

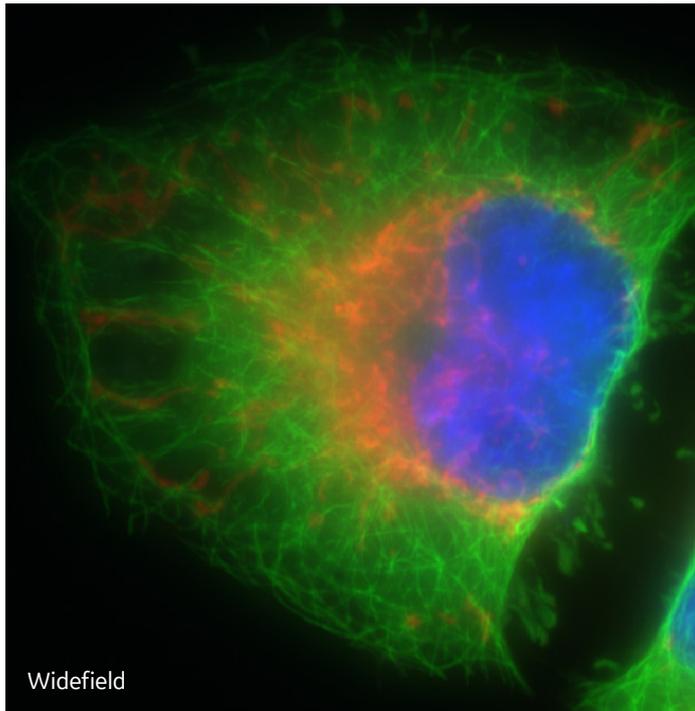
EDGE enhanced confocal imaging technique uses an innovative approach to measure and remove the out-of-focus light contribution that can otherwise remain in traditional line-scanning confocal images. This image quality enhancement is especially prominent for cells grown in 3D culture such as spheroids and organoids, where out-of-focus light dramatically affects image contrast.

Benefits

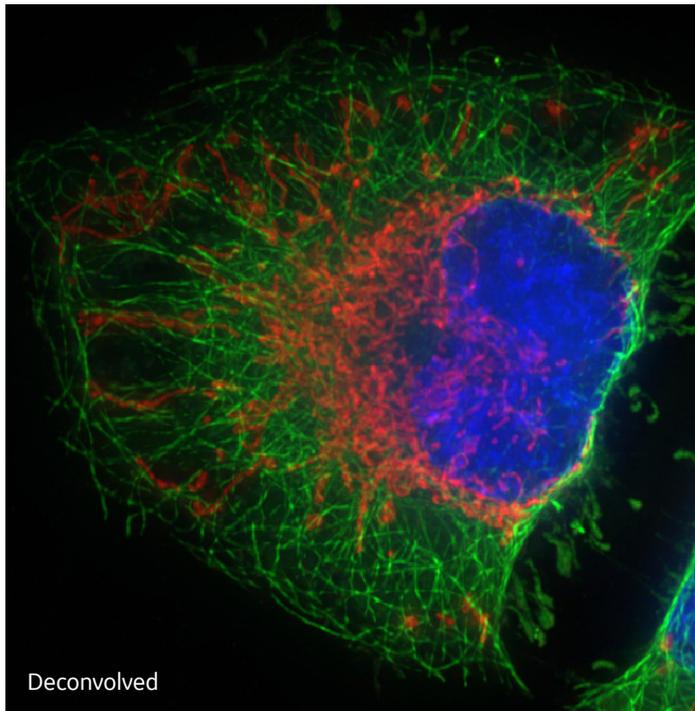
- IRIS line scanning confocal adjustable aperture enables optimized imaging of any magnification level, wavelength, assay, or experiment.
- EDGE confocal mode delivers an order of magnitude improvement to image contrast and up to a two-fold resolution improvement axially (Z dimension).
- EDGE delivers improved signal-to-noise ratio than conventional confocal approaches.
- Confocal and super-resolution functionality is combined into one instrument giving you the flexibility to image any biology at any level of resolution, contrast, depth, or speed.
- Easily add a PK event within your confocal experiments.



Mouse kidney section with Alexa Fluor™ 488 WGA, Alexa Fluor™ 568 Phalloidin, and DAPI.



Widefield



Deconvolved

HeLa cells with DAPI (blue), tubulin (green), and mitochondrial membrane (red).

Widefield with deconvolution

In addition to its super-resolution capability, DeltaVision OMX Flex system is capable of high-speed widefield imaging.

Unlike confocal microscopy approaches, widefield microscopy illuminates the entire sample at once. The images captured contain both in-focus and out-of-focus light. This out-of-focus light makes raw data appear blurry and can mask small or dim structures. Widefield data can be significantly improved with deconvolution. Deconvolution utilizes a measured point spread function (PSF)—a model of how light spreads through microscope optics—to reassign blurred light back to its original point source. Small, fine, or dim structures that may have been masked by out-of-focus blur in raw data are suddenly detectable, and data at lower signal-to-background levels can be collected, preserving cell health.

The thoughtful widefield imaging mode designed and optimized algorithm ensures that users can focus on their biology and trust DeltaVision OMX Flex to do the rest.

Benefits

- Utilizing deconvolution with widefield imaging produces higher quality images due to significantly improved contrast.
- Configurable up to four cameras, which enables true simultaneous imaging in four wavelengths.
- Burst mode frame rates for up to four wavelengths simultaneously of:
 - > 375 fps at 512×512 (> 1500 images/s).
 - > 735 fps at 256×256 (> 2940 images/s).
- Proprietary deconvolution algorithm is linear and quantitative (no intensity values are added or subtracted) making data quantitation possible.
- Easily add a photokinetic (PK) event within any widefield experiments with just milliseconds between PK event and image acquisition. (requires TIRF or confocal module in configuration).

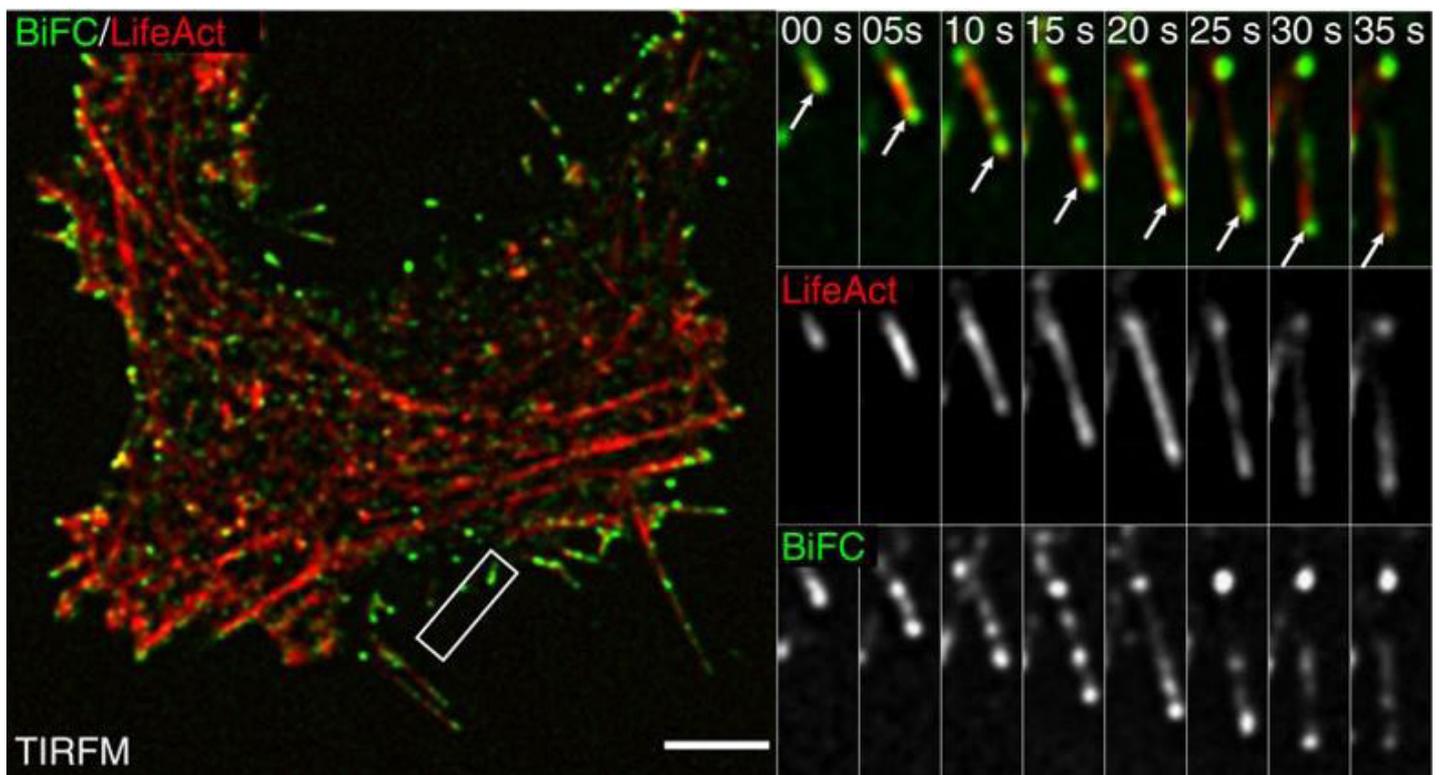
Total internal reflection fluorescence (TIRF)

TIRF, an optical sectioning technique, uses an established law of physics to improve biological imaging within the first 200 nm of the sample.

When light passes from a medium of high refractive index to a medium of low refractive index and the angle of incidence is greater than or equal to the critical angle, the light will reflect off the interface and not actually enter the second medium. The excitation light then reflects within the coverslip, creating an evanescent wave that propagates along the surface of the glass. One challenge with this approach is that any defects in the sample where the light passes, including dirt or dust on the coverslip, can result in an uneven TIRF illumination field, resulting in poor sample excitation. Ring TIRF on the other hand utilizes a "ring" of laser light creating an evanescent wave plane that is generated from multiple sides, producing a more even TIRF field and improved sample illumination.

Benefits

- TIRF imaging results in image data with enhanced image contrast and axial (Z dimension) resolution at a super-resolution scale (< 200 nm).
- Ring TIRF design delivers a significant improvement over traditional TIRF techniques as it removes interference fringes and provides a highly uniform TIRF excitation field that optimally illuminates the cell structure.
- High speed galvanometer-controlled beam steering module, 300 Hz rotation speed.
- TIRF depth for each excitation wavelength optimized easily by adjusting the diameter of the ring.
- Photokinetic event added easily within any TIRF experiments with just milliseconds between PK event and image acquisition.



Dynamic nature of filopodia is captured by time-lapse Ring TIRF, U2-OS cells expressing BiFC and LifeAct. Scale bar 5 μ m. Image reproduced according to Creative Commons license. Title: A RIAM/lamellipodin-talin-integrin complex forms the tip of sticky fingers that guide cell migration. Authors: F. Lagarrigue, P. Anekal, H. Lee, A. Bachir, J. Ablack, A. Horwitz, M. Ginsberg. Source: <http://www.nature.com/ncomms/2015/150930/ncomms9492/full/ncomms9492.html>. Modification: Cropped License: CC BY 4.0, <http://creativecommons.org/licenses/by/4.0/>

DeltaVision localization microscopy (DLM)

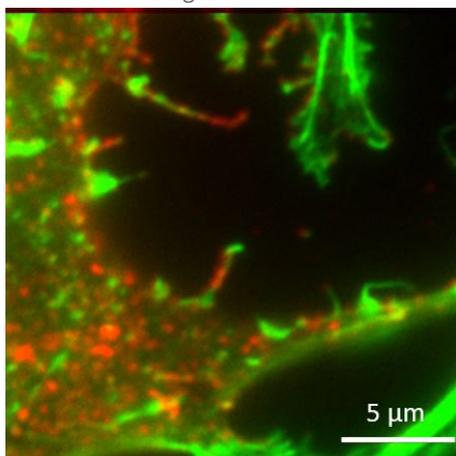
DeltaVision localization microscopy (DLM) is a super-resolution microscopy option for when your biology presents the most challenging of resolution questions. Localization microscopy has its foundations in single molecule imaging techniques which determine the position of fluorophores by statistically localizing their position within an image.

Only one (or a few) fluorophores are allowed to fluoresce at a given time. Control of the fluorescence is achieved using photoactivatable proteins, photoswitchable dyes, or ground state depletion systems combined with appropriate sample buffer solutions. DLM uses the proprietary Dense Stochastic Sampling Imaging (DSSI) algorithm that can determine the location of the fluorophores in overlapping diffraction-limited spots. This differs from other localization microscopy techniques which rely on single Gaussian fitting models, which would throw away all overlapping events.

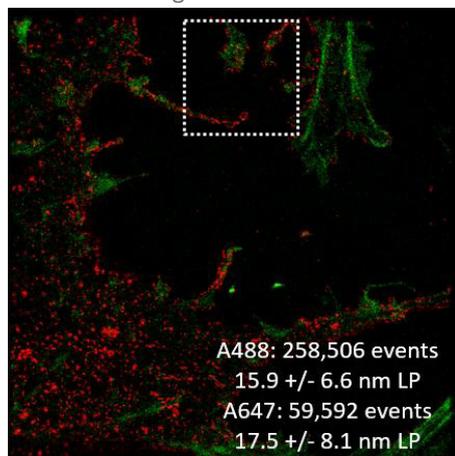
Benefits

- DLM enables processing of higher density image data making it possible to use denser sample labeling.
- Provides localization precision down to 20 nm laterally (requires appropriate labeling density and signal-to-noise ratio).
- Supports all standard approaches to sample labeling for single molecule localization microscopy; photoconversion (dSTORM), photoactivation, and photoswitchable fluorophore biological preparations.

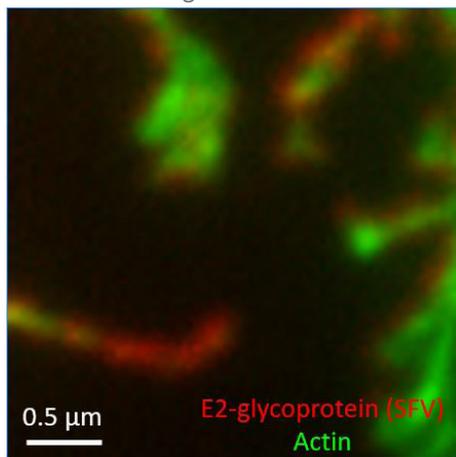
Conventional image



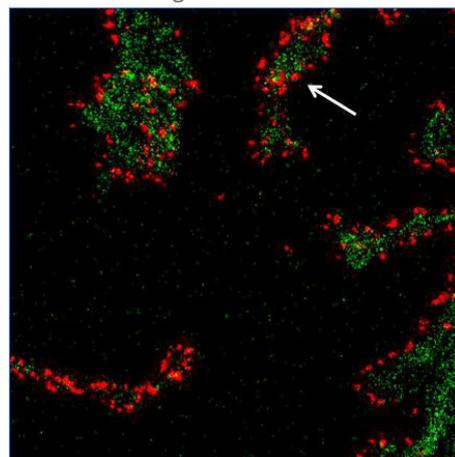
2-color DLM image



Conventional image zoomed in



2-color DLM image zoomed in



Viral clusters on a cell membrane (Kielian Lab, Albert Einstein). DLM shows viral clusters that are 60–80 nm.

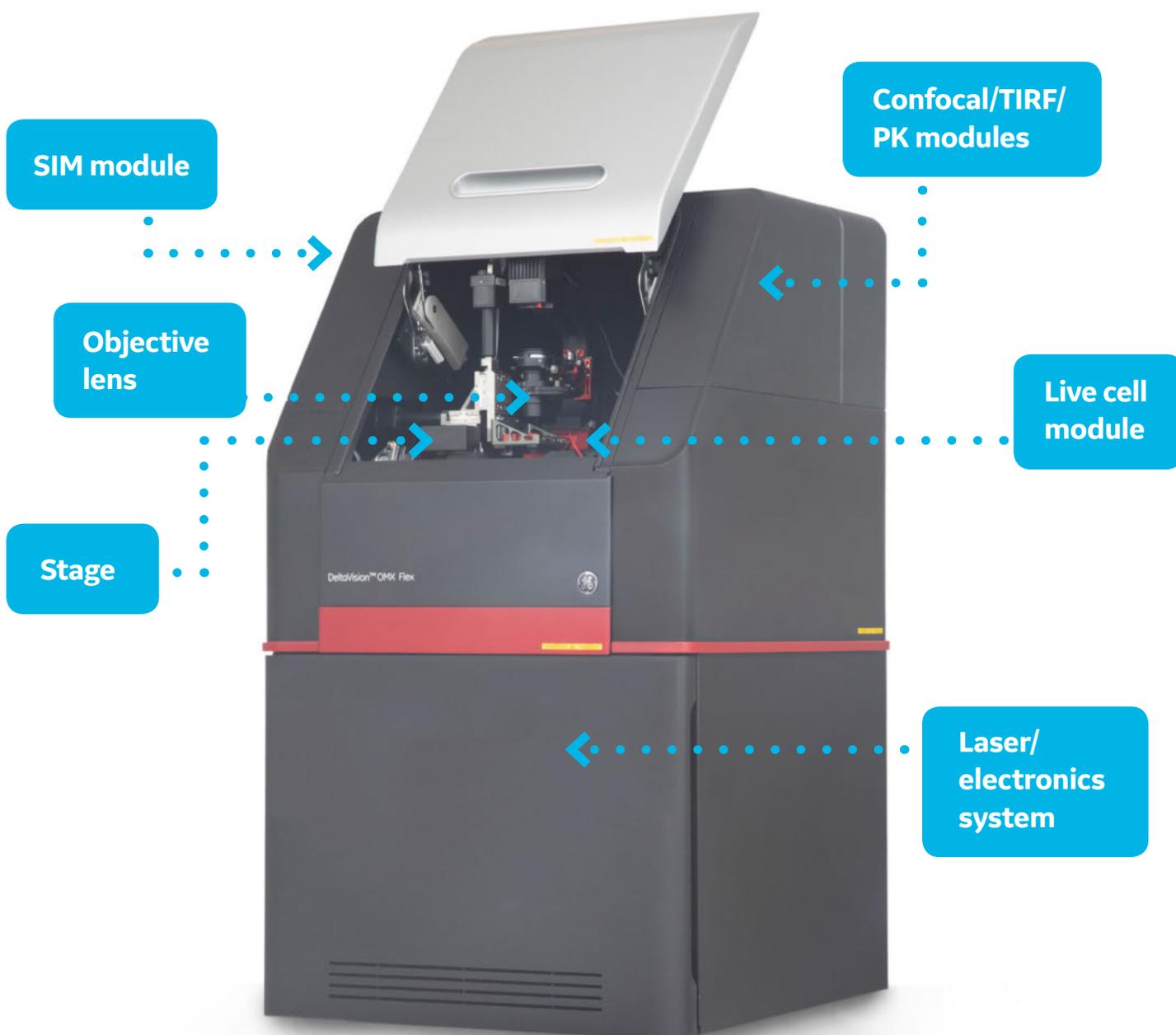
Intuitive acquisition and analysis software

DeltaVision OMX Flex is controlled using AcquireSR acquisition software running on the workstation under the CentOS 6 operating system. Image reconstruction and analysis is performed using our softWoRx™ software package running on the same workstation. Included in the softWoRx software are the algorithms necessary to reconstruct 3D-SIM, 2D-SIM, and TIRF-SIM super-resolved images, and proprietary quantitative deconvolution algorithm for widefield images. A comprehensive Image Registration tool enables precise measurement of chromatic offset and systematically correct it in all data. In addition, softWoRx includes a variety of visualization and routine analysis tools for viewing acquired data and performing quantitative analysis.

The software provides preprogrammed smart settings to make life easier for the beginner while offering more advanced features for the expert user.



Components



Microscope system	Laser/electronics system
Microscope	Camera computer(s)
Objective lens	Instrument controller chassis
Stage	Nanomotion chassis
Cameras (up to four)	Laser chassis module
Polychroic drawers	Piezo controller (for Z motion)
Emission filter wheels	
SIM module (for 3D, 2D, TIRF-SIM)	
Confocal TIRF/PK modules	
Live cell module	

System specifications

Parameter	Specifications
Illumination modalities	Structured illumination microscopy—3D-SIM, 2D-SIM, TIRF-SIM IRIS/EDGE line-scanning confocal Widefield with deconvolution Ring TIRF Photokinetics/photoactivation (PK/PA) DeltaVision localization microscopy (DLM) Brightfield illumination and differential interference contrast (DIC)
Excitation lasers (nm)	405, 488, 561, 640
CDRH class	Class 1
Standard supported dyes / fluorophores	Blue (DAPI, Hoechst, CF™405M) Green (GFP, Cy™2, Alexa Fluor™488, ATTO-488, CellTracker™ Green, Calcein AM) Red (mCherry, mKate2, Alexa Fluor 568) Far Red (Cy5, Alexa Fluor 647, To-Pro™-3, SiR)
Standard objective lens	Certified 60× 1.42 NA PlanApoN PSF
Camera	sCMOS detector 2040 × 2040 imaging array 6.5 μm × 6.5 μm pixels 16-bit dynamic range 272 MHz, 95 MHz readout speed options 0.9 (median)/1.4 (rms) e-readout noise
Stage travel (X × Y × Z)	25 × 50 × 25 mm
Standard supported sample types	Microscope slides (75 × 25 mm) 35 mm dishes 2, 4, or 8-well chambered coverglass (24 × 60 mm) 2, 4, or 8-well chambered microscope slides (75 × 25 mm)
Dimensions (W × H × D) and weights	Microscope enclosure, door closed: 86 cm (33.7 in.) × 160 cm (62 in.) × 92 cm (36.2 in.) Microscope enclosure, door open: 86 cm (33.7 in.) × 192 cm (75.5 in.) × 92 cm (36.2 in.) Monitor: 61 cm (24 in.) × 61 cm (24 in.) × 30.5 cm (12 in.); 9.5 kg (20.94 lbs) Workstation: 43.2 cm (17 in.) × 45.8 cm (18 in.) × 17.8 cm (7 in.); 17.24 kg (38 lbs)
Workstation	CentOS 6 or higher 32 GB 1600 MHz DDR3 256 GB SSD OS hard disk 3 × 1 TB Onboard RAID5 Array
Operating conditions	Operating temperature: stable from 18°C to 24°C (64°F to 75°F) Fluctuation rate: no more than ± 2°C over 4 h with an hourly variation of no more than 1°C. Fluctuations may introduce alignment drift into the system.
Humidity	Stable under 50%, noncondensing
Power requirements	100 to 127/200 to 240 V ~, 50/60 Hz
Power consumption	900 VA
Heat output	2050 BTU, exhaust duct option available
Noise output	< 65 dB
Overvoltage category	Overvoltage Category II
Manufacturing site	GE Healthcare, Issaquah, WA, USA

Service

GE Healthcare Life Sciences' Services has over 50 yr of experience in providing service solutions for the research industry. We understand that maintaining complex instruments in prime condition is a science in itself. To enable excellent lifelong performance, we build serviceability into our equipment from the development stage.

Benefits of our service agreements

- Confidence in your results through regular preventive maintenance visits.
- Predictable ownership costs—rates are guaranteed for the duration of the contract.
- Minimal disruptions with priority response from our trained service engineer.

We offer several service options with varying levels of support, enabling you to choose the service level that best suits your needs:

- FullCare takes care of your every need at a fixed price.
- SafeCare protects you against excessive costs.

Options

	PM visits	Parts	Travel & labor	Accelerated Response Option
FullCare 				
FullCare Plus 				
SafeCare 		 <small>Denotes that major service issues are covered by SafeCare, while service costs below the agreed instrument-specific limit are covered by the customer.</small>	 <small>Denotes that major service issues are covered by SafeCare, while service costs below the agreed instrument-specific limit are covered by the customer.</small>	



Denotes that major service issues are covered by SafeCare, while service costs below the agreed instrument-specific limit are covered by the customer.

	PM visits	Parts	Travel & labor	Accelerated Response Option
EssentialCare 				

We can help you choose the right option for your lab, which will provide you with peace of mind.

GE Healthcare is customer focused and meets all expectations for service. Instrumentation is designed and built with sensitivity to real world issues emanating from the field. Also, [the Field Engineer] is knowledgeable, professional and efficient. His visits are always a pleasure. Core Facility Manager

Timely response. Fast, friendly staff. Staff's knowledge of the instrument. Principal Investigator

Ordering information

System	Product code
DeltaVision OMX Flex Microscope System	29381022
Blaze SIM Module (includes 60× 1.42 NA PSF objective)	29380863
Line Scanning Confocal/PK Module	29347194
Ring TIRF add-on for Confocal Option	29381021
Ring TIRF/PK Module (includes 60× 1.49 NA TIRF objective)	29349758
DeltaVision Localization Microscopy (DLM) Option	29087663
PCO EDGE 4.2 sCMOS Camera Package	29272711
Live Cell Option	29133064
40× 1.25 NA UPlanSApo Silicone Objective (Optional, not for SIM imaging)	29383051
60× 1.2 NA UPlanSApo Water Objective (Optional, not for SIM imaging)	53-850009-114
60× 1.3 NA UPlanSApo Silicone Objective (Optional, not for SIM imaging)	52-852956-000
60× 1.42 NA PlanApoN PSF Objective (included with Blaze SIM module, optional for systems without SIM)	52-852175-116
DIC Accessory Kit (includes Nomarski prism for 60× objective lenses, 38 mm)	29133063
40× Nomarski Prism, matched for 40× 1.25 NA Objective lens, 38 mm	34-018019-132
Offline Analysis Workstation	53-853053-000
DLM license for Offline Analysis Workstation	29096142
Additional Monitor for Dual Display Setup	29243592

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From Image on page 11

Title: A RIAM/lamellipodin-talin-integrin complex forms the tip of sticky fingers that guide cell migration

Authors: F. Lagarrigue, P. Anekal, H. Lee, A. Bachir, J. Ablack, A. Horwitz, M. Ginsberg

Source: <http://www.nature.com/ncomms/2015/150930/ncomms9492/full/ncomms9492.html>

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