OLYMPUS

Your Vision, Our Future

Imaging, Done Your Way

Area	Perimeter	Mean (Diameter)
396.19 µm³	70.56 µm	22.46 µm
218.25 µm³	52.37 µm	16.67 µm
149.13 µm³	43.29 µm	13.78 µm
198.56 µm³	49.95 µm	15.90 µm

Start

Resolution: 1376 x 1038

Automatic Processes
Manual Processes

Add Channel

Layers

Measurement & ROI

wholeview

BEHIND EVERY GREAT IMAGE

The Olympus cellSens software family

The microscopic realm is an essential study area for many scientific investigations and one which requires specialised optical tools. Olympus has been at the forefront of this exciting area for many years and has developed an extensive range of microscopes and accessories. More important than ever though is the need for versatile, user-centric imaging and analysis software programs that can maximise microscope-based investigations. The Olympus cellSens software family offers this and much more, providing peerless solutions for all imaging requirements.

Olympus: your route to scientific excellence

Olympus is dedicated to making state-of-the-art microscopes, accessories and imaging system solutions to support your work on all levels. We have therefore worked closely with customers to produce the ultimate in flexible and accessible microscopes and software interfaces. As a result, we support your scientific efforts with the best imaging equipment you can think of.

MAKING SENSE OF MICROSCOPE IMAGING

Microscopy research with a personal touch

With microscope optics pushing the boundaries of resolution at all magnifications and microscope design enabling new techniques, it is important to be able to efficiently capture and process the images produced. In addition, an increasing number of researchers are using microscopy and it is therefore essential that imaging and analysis are both flexible and user-centric. The Olympus cellSens software family fulfils all these requirements with its unique personalisation concept.

IT'S TIME TO GET PERSONAL

Olympus has been at the forefront of microscopy for over 90 years and has developed microscopes and systems for a broad spectrum of applications. As a result, we know that each researcher has individual requirements that can't all be met by fixed solutions. The Olympus cellSens software family consists of three packages, all featuring a peerless user-definable interface. As a result, each user can define what they want cellSens to show them within the defined work areas.

Together in harmony

All microscope hardware devices and accessories are fully integrated into the cellSens environment. This means that the user does not need to know any details about the hardware used, as the software ensures proper integration and therefore the right result is obtained with a minimum of mouse clicks.

Dynamic interface

B Creating an efficient workflow requires careful definition of the tasks and tools at each stage. With the cellSens platform's dynamic GUI, the same is true – the tools you need for each stage are clearly available, without clutter or the need to search. Olympus has developed a number of interface layouts, which develop with the increasing capabilities of the package in use.

- **Acquisition layout** – for selecting between different acquisition processes and adjusting the camera settings
- **Processing layout** – this is where post-acquisition functions are accessible: Execution of measurements and resulting statistics as well as annotation and image processing
- **Object detection** – determination of particle quantities based on threshold classification and multi-variant object definition
- **Reporting layout** – the report-generating function brings together all of the tools required for documenting and passing on the results

A blank canvas

C It is your workflow, so with cellSens you can have it your way: Within each of the predefined layouts, users can specify how many or how few tools and controls are shown on screen, eliminating unnecessary controls and placing the ones that are frequently used exactly where they are wanted. The tools and features of cellSens are presented through three different components:

- **document group**
- **tool window**
- **toolbar**

The "document group" displays existing files, such as previously captured images, while the "tool window" contains elements that help you use and configure the software. The toolbars contain buttons to control the various tools and processes: the layout of these is down to you.

Our expertise in your hands

Olympus has brought its imaging and analysis expertise directly to you via the unique workflow management concept. This novel idea guides users, step by step, through all the tasks from basic image capture to multiple image alignment and onto advanced processes utilising microscope automation. In effect, the workflow management concept ensures there are no mistakes, just reproducible results.

Integration not re-education

Olympus cellSens software programs have been developed to integrate seamlessly with Microsoft Windows and Office software programs, rather than re-inventing key processes. As a result you will feel "at home" using them, even for complex processes like statistical analysis, which are completed directly in Excel, or for report template generation in Word.

Future-proof

D Olympus cellSens is ready for your future applications, even if you don't know what they are as yet. For example, the specialised solution modules available for the cellSens Dimension append key functionalities, including multidimensional imaging and advanced deconvolution. The Database Solution adds professional and secure storage, retrieval and file sharing. This gives the user the capacity to not only organise their workflows as they want them, but to build a system that precisely meets their needs.

D Solutions Packages
To tailor cellSens according to application requirements
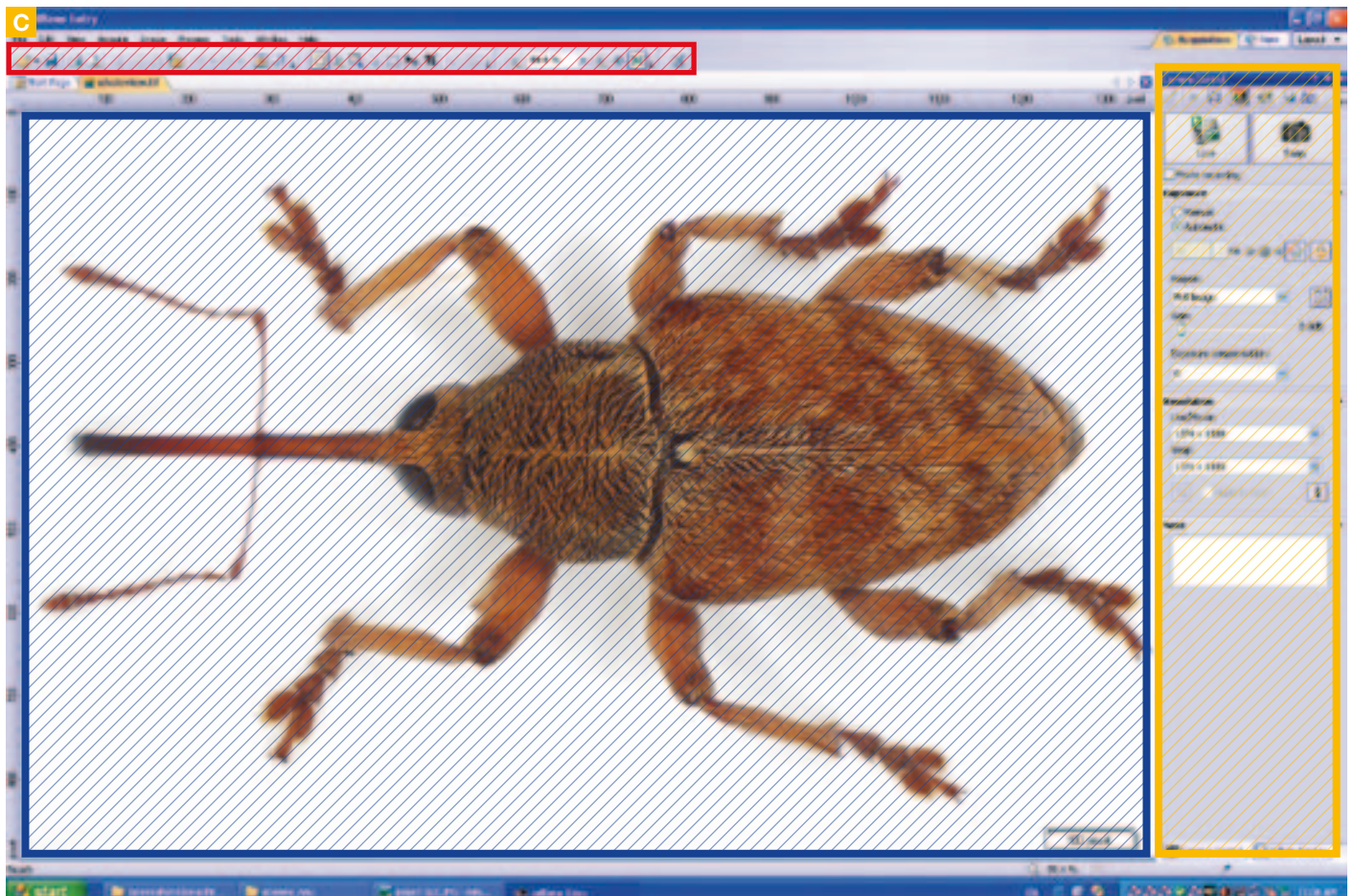
FROM ENTRY LEVEL TO ADVANCED RESEARCH

Flexible solutions for all life science research

Whether you are looking for a microscope system that can dependably capture and store images or a fully functional imaging and analysis system capable of pushing your research, the Olympus cellSens family and xcellence systems deliver.
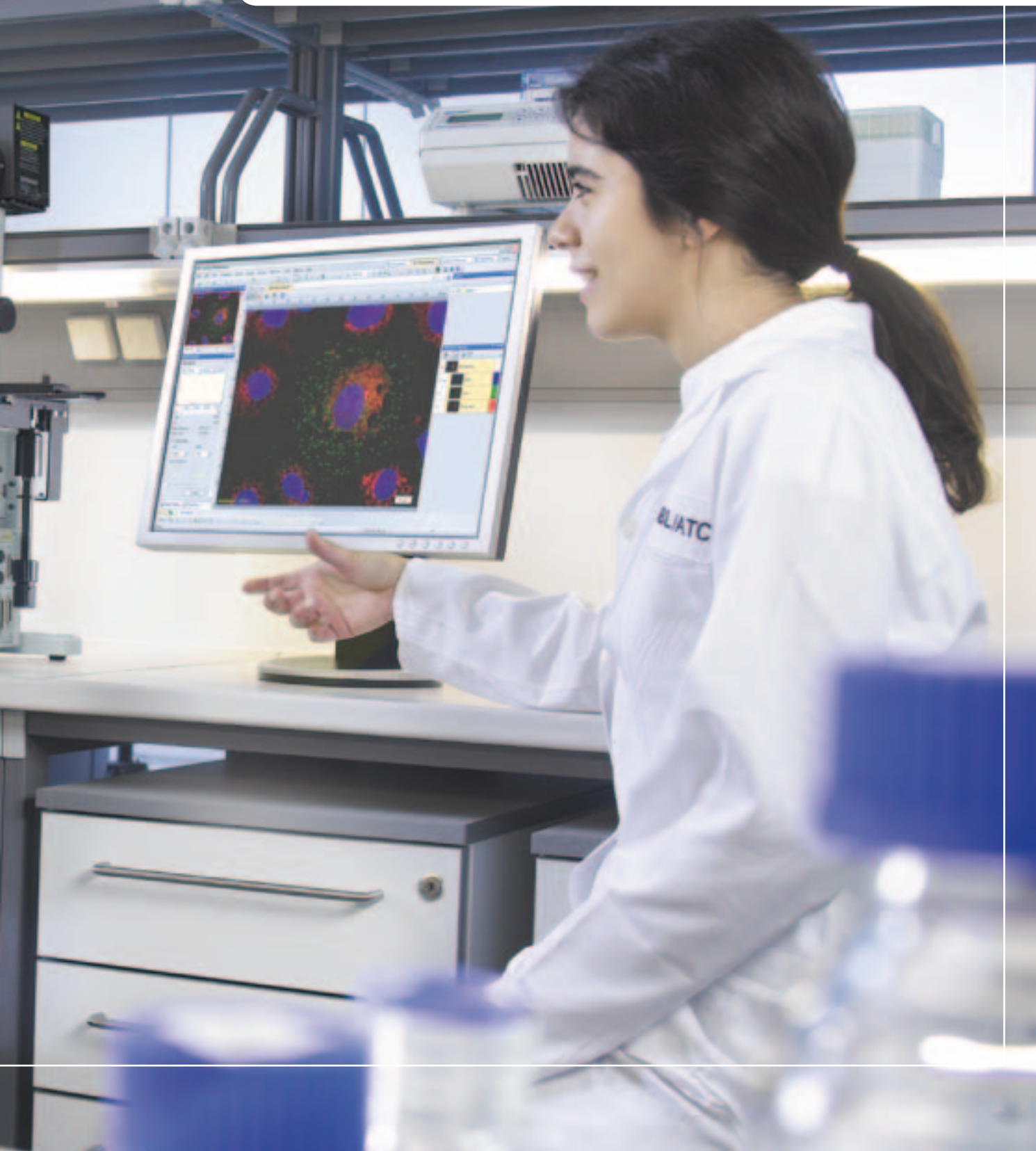
RESULTS DOCUMENTATION – cellSens *ENTRY*

cellSens Entry is the ideal stepping stone for researchers wanting to move into digital image acquisition and documentation. By providing control over the camera via the unique customisable interface, the Olympus cellSens Entry guarantees that each and every user can capture the images that they require using the settings that they want.

Camera control

A The most important component that requires software control when imaging is the digital camera. Modern cameras feature a number of functions that can be changed to enhance or perfect an image; for example, exposure time and pixel binning. Olympus cellSens Entry software controls such features on all Olympus digital microscope cameras, from the latest high-end research cameras, e.g. the Olympus XM10, to the entry-level documentation cameras, e.g. the Olympus SC30. As a result, scientists can maximise the quality of their images.

Live image acquisition

Olympus cellSens Entry supports live image acquisition in a number of different formats, as well as the direct generation of movies in AVI format. For this, cellSens includes an integrated solution for automatic exposure control. Live optimisation functions are also available, which include shading correction, contrast enhancement and live image overlays. A live histogram and the overexposure indicator make it easier to exploit the camera's entire dynamic range.

File handling

Olympus cellSens Entry integrates with standard Microsoft Windows systems, enabling images to be saved, retrieved, deleted and printed via familiar commands and interfaces. Results are saved in the proprietary Olympus format and can be exported into standard image formats (JPEG, TIFF and PNG). The integrated image navigator provides all the tools required to navigate the images, including a zoom function, and the gallery view feature makes the selection of micrographs easy via the use of thumbnail images. Furthermore, a Microsoft Windows File Explorer pane can be included within any of the workflow areas for instant access to the entire folder structure of the PC and this includes drag and drop functionality for opening images.

Metadata

B All available metadata, for example image history and its associated properties, is saved alongside the main image results. This includes information on all the components used (e.g. the camera, light source and microscope), along with all their settings.

Layers, editing and drawing

C The cellSens Entry software can be used to perform straightforward post-capture processing, including intensity and white balance adjustment, contrast optimisation and image inversion. The Olympus cellSens layers technology enables the addition of arrows, annotations and measurements to highlight regions of interest, without actually influencing the original image (i.e. there is no overwriting of pixels with fonts or symbols). In addition, images can be combined into multilayered image files which can subsequently be edited to change layer order or delete unwanted layers.
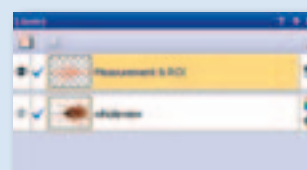
B Saved within

All image-relevant information and acquisition settings
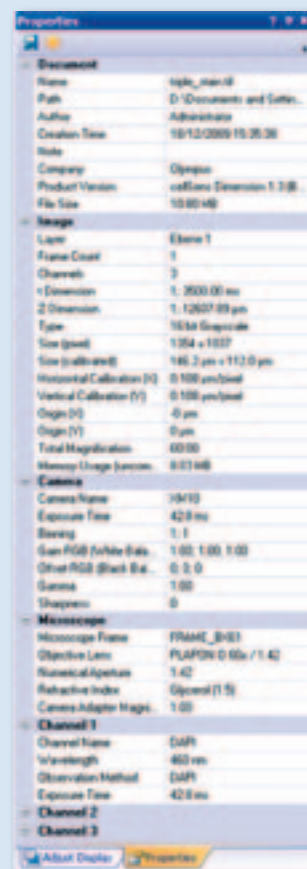
C Without disturbance

Measurement lines and annotation text are kept on a separate layer

Time series

Precise timing and device control
for time-lapse experiments

EXPERIMENT DOCUMENTATION – cellSens *STANDARD*

Olympus cellSens Standard builds upon the cellSens Entry package, taking acquisition beyond an image by enabling more advanced image capture processes (e.g. time lapses). It also supplies contrast-based software autofocus along with acquisition from TWAIN sources, as well as offering additional image processing and measurement capabilities.

Time lapse

A In order to document a live sample, still images can be captured at various intervals over a given time period to monitor activity. In cellSens Standard, a tool is available that enables the parameters of the time-lapse series to be set quickly and easily.

Interactive measurements

B The unique measurement function enables interactive measurement tasks and dimensioning. Capabilities such as measuring distances between two points within a sample, as well as angles, rectangles, circles, ellipses and polygons within one image plane, are all possible using the cellSens Standard software. The ability to produce such a range of measurements provides the user with an extended level of flexibility, facilitating the accurate measurement of the desired distances, regardless of shape and size.

These measurements can subsequently be stored as overlay layers, so as not to have any adverse effects on the original image. All measurements obtained are based on the calibrated values of the system. In order to aid simple analysis, all data and averages are clearly stored and displayed in a table below the image.

B Measurement & ROI

Type	Name	Area	Perimeter	Mean (Diameter)
3 Points Circle		396.19 µm²	70.56 µm	22.46 µm
3 Points Circle		218.25 µm²	52.37 µm	16.67 µm
3 Points Circle		149.13 µm²	43.29 µm	13.78 µm
3 Points Circle		198.56 µm²	49.95 µm	15.90 µm
Count	-	4	4	4
Minimum	-	149.13 µm²	43.29 µm	13.78 µm
Maximum	-	396.19 µm²	70.56 µm	22.46 µm
Mean	-	240.53 µm²	54.04 µm	17.20 µm

Measurement & ROI | Count & Measure Results

Image geometry

Researchers using cellSens Standard benefit from enhanced image geometry functions, including the ability to mirror, rotate, resize and crop images and to decrease the size of data volumes for storage purposes. In addition, smaller file sizes facilitate faster file sharing between users and simple post-processing tasks. With the ability to shift fluorescence channels and adjust image stacks, complex Z-stacks can be accurately viewed from all sides. This essentially allows the user to enhance images for clear visualisation and analysis. All of the functionality required for image geometry will be readily available on your personalised desktop for quick and easy processing.

Filters

A wide range of different filter algorithms can be used to enhance various aspects of an image, essentially to improve clarity. With the capability to sharpen image borders, enhance subtle differences, reduce background fluorescence and apply shading correction, smaller features can be made more distinct and the overall image precision increased.

Enhanced hardware control

C Many image features are determined by the microscope optics and illumination systems in use, such as magnification, imaging technique and brightness. Therefore, as well as complete control over a broad range of Olympus and third-party cameras, most of the components essential for them can be operated automatically, including objective and filter changes, focusing and internal shutters. Via Olympus cellSens Standard, the user can control all of these, greatly enhancing their capability to precisely manage image acquisition.

Enhanced image processing

The Olympus cellSens Standard software is supplied with enhanced image geometry functions – mirroring, rotation, resizing, cropping and channel shifting. Furthermore, additional image processing tools are available, including contrast adjustment, smoothing (lowpass) and image sharpening, as well as noise and shading correction. cellSens Standard can convert the bitdepth and colour space settings of the image, providing greater flexibility for the more knowledgeable user. To further increase this versatility, the software contains processing tools for multidimensional images, such as combination, extraction and separation of imaging and RGB channels.

Data Export

All data and statistics can be exported to a Microsoft Excel spreadsheet for statistical analysis or Word document for report generation. By working with existing Microsoft programs, protocols can be followed in a familiar, well-known format, making the whole process as simple as possible for the user to complete. Furthermore, data within a Microsoft Powerpoint document is easily supplemented with images for presentation purposes.

Archiving

Once processed, all images can be archived easily, using the drag and drop functionality, directly in Windows Explorer. Images are saved quickly and easily in the proprietary Olympus format, which can subsequently be exported into standard image formats such as JPEG or TIFF. All available metadata, including image history and its associated properties as well as the camera type used and its settings, are saved alongside the main image results.
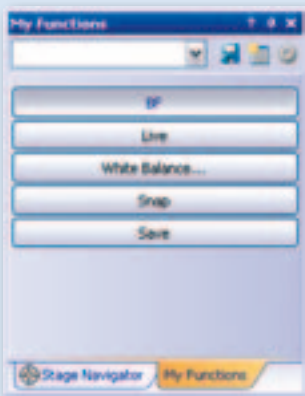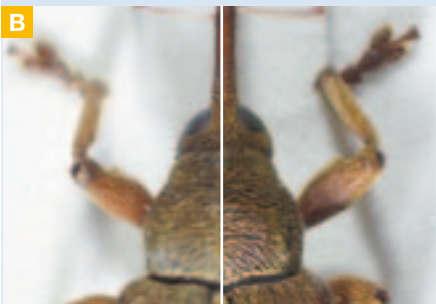
C Motorised microscope

All device parameters controlled within one tool window, including motorised stage control
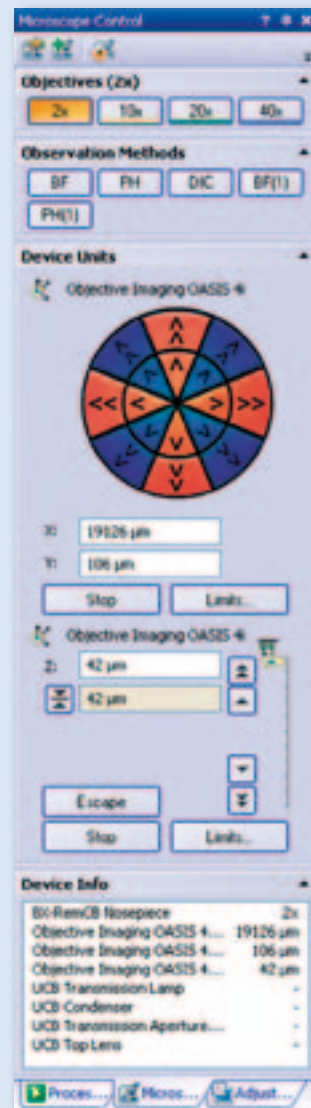
EFI (on the right) gives in-depth information on larger, thicker samples

EXPERIMENTAL SYSTEMS – cellSens *DIMENSION*

The most versatile member of the Olympus cellSens software family is cellSens Dimension, which is designed to provide the control and processing requirements for integrated microscope-based experiment systems. As a result, it builds on cellSens Standard with a broad range of advanced features, as well as specialised optional solution modules.

Ultimate customisation

A The My Functions feature automates complex workflows via a simple customisable tool window. The user can define and store any workflow they would like to execute by queuing the relevant icons, ensuring that only the required functionalities are displayed.

Advanced image capture

B Olympus cellSens Dimension offers a very efficient solution for samples with a large depth of field – extended focal imaging (EFI) – where a single image is created from the in-focus pixels of a series of images taken through the sample. The EFI process can be automated via a motorised Z-drive, so that the user only needs to define the top and bottom focal planes along with the number of slices or the desired step size for the interim focal planes. The automated Z-drive is also perfect for Z-stack acquisition and the subsequent creation of three-dimensional (3D) images. Olympus has implemented extended XY imaging with its multiple image alignment (MIA) tool, which combines multiple overlapping images into one seamless high-resolution image. cellSens Dimension is installed with "online" features including greyscale deblurring and image browsing for surfing through captured images whilst acquiring new ones. Moreover, live images can be viewed remotely via a network, effectively turning the cellSens Dimension system into a webcam.

Advanced device control

C An expanded range of non-Olympus cameras can be integrated with the cellSens Dimension software, including the Hamamatsu ORCA range and models from QImaging, Roper and Jenoptik. Furthermore, a number of advanced fluorescence light sources can be controlled directly, including the EXFO X-Cite® and X-Cite® *exacte* burner-based systems, as well as the coolLED 3 and 4-channel LED systems.

Advanced image analysis

Along with threshold-based phase analysis and offline kinetic functions, cellSens Dimension adds a range of image processing and analysis functions, for example, arithmetic and logical operations, edge detection, projections calculations and image smoothing. Intensity calibration can be carried out on each channel. What is more, with cellSens Dimension, users can set markers on defined stage positions to include them in multi-position time-lapse experiments.

Report composer

The unique report composer uses Microsoft Word templates and a special applet to generate user-defined reports that retrieve images and image information elements from the cellSens database – a consistent and reliable tool for the documentation of mandatory and editable content connected to the objects under examination.
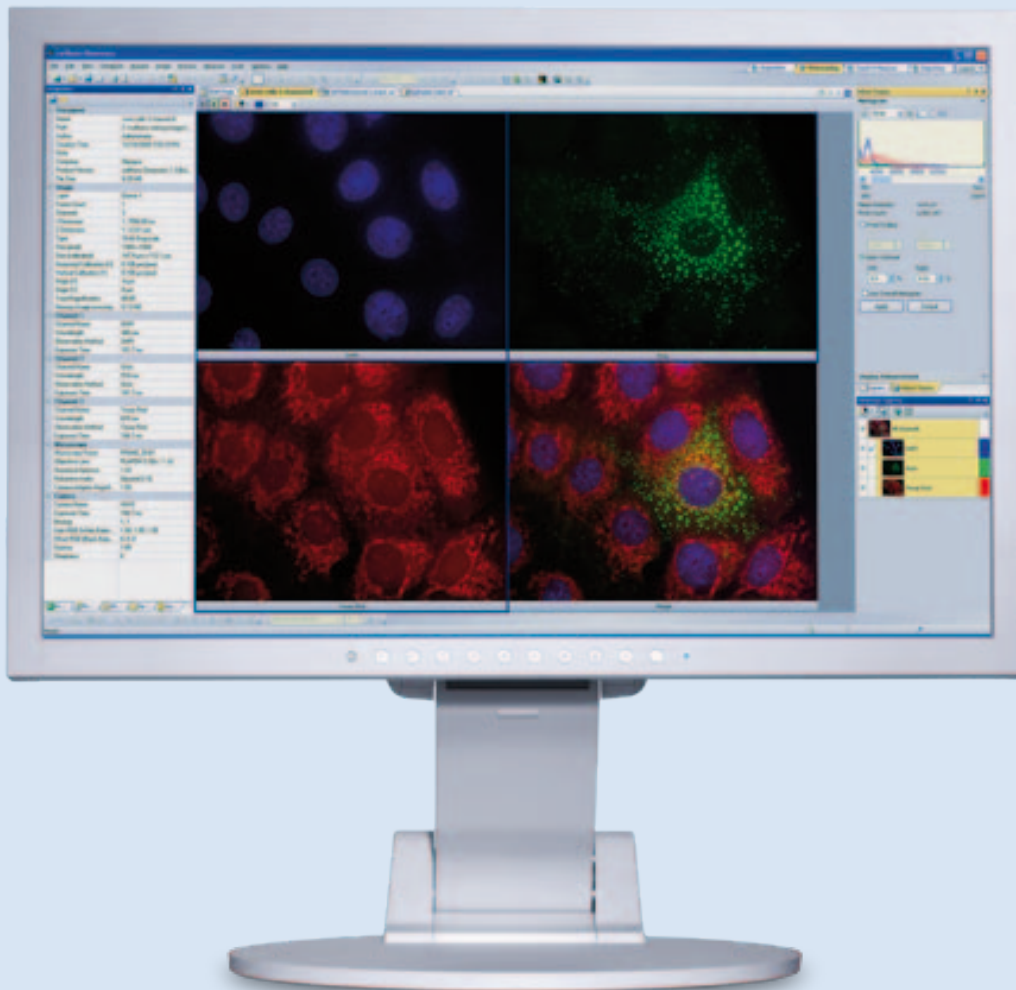
A Solutions packages

To tailor cellSens according to application requirements

B Multidimensionality

Easy configuration of multi-dimensional imaging tasks

C Multi-position Solution

Multi image alignment (MIA) for creation of panoramic images

D Database Solution

For controlling and handling a large amount of data

SPECIALISED IMAGING SOLUTIONS

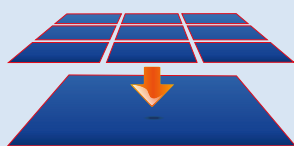**The functionality of Olympus cellSens Dimension can be further expanded with a series of specialised solution modules.**

Multichannel 5D Solution

B The Multichannel 5D Solution for cellSens Dimension has been developed specifically for advanced, automatic acquisition of images combining any number of the following dimensions: X, Y, Z, multichannel with transmission overlay, time lapse and optional multi-position. As a result, this solution module conducts highly complex microscope experiments with multiple regions of interest. As a result, colocalisation studies and spectral unmixing for overlapping fluorescence emission signals are easily performed. Furthermore, the user interface adjusts according to the needs of the image, so that only the required elements are displayed.

With the Multichannel 5D Solution module, cellSens can also integrate the Olympus spinning disk confocal unit, as well as the Lambda DG-4 filter wheel. For more complex fluorescence analysis, such as ion imaging, a number of key tools are available in the Multichannel 5D Solution module, including intensity kinetics and colocalisation statistics, as well as ratio and $\Delta F/F$ analyses. Results are provided as false-colour images, graphs of regions of interest and data sheets.

Multi-position Solution

C The Multi-position Solution module introduces automated MIA functionality for the rapid creation of panoramic images. It also makes it possible to capture images from multiple stage positions or entire stage areas. The module is designed to control a variety of motorised stages from a range of manufacturers, e.g. Oasis, Prior, Ludl and Märzhäuser.

By creating panoramic images over large areas, MIA overcomes the physical limitations of the optical field of view. Multiple images with overlapping edges are acquired at neighbouring positions and a comprehensive pattern recognition algorithm is used to stitch the individual images together into one seamless, high-resolution image. This process can be fully automated using the Multi-position Solution module, making it far easier and quicker. The stage navigator tool enables the user to select their MIA scanning area on a low-resolution overview image. The Multi-position Solution module can subsequently combine any number of images due to the bespoke compression and memory management capabilities of its Virtual Sample Image (VSI) format.

Database Solution

D If large amounts of microscope imaging data are generated, it is important to be able to manage and search this effectively. The Database Solution module for the cellSens Dimension adds a client-server database using Microsoft SQL Server 2005 Express Edition, ensuring that image data and associated metadata are managed in a clear and controllable way. It provides cellSens Dimension users with the ultimate level of control over their data, due to its highly structured system hierarchy. Consequently, data can be stored, queried and retrieved via simple or complex searchable terms, including the relevant project, job or order.

Extensive search functions and predefined search masks guarantee the fastest possible access to the data needed most frequently. Furthermore, if the number of workstations increases, cellSens Dimension can be integrated with a centralised server for all data, without any hassle. This can be particularly important for institutes that utilise consistent data structures or biotech companies requiring clear documentation routines.
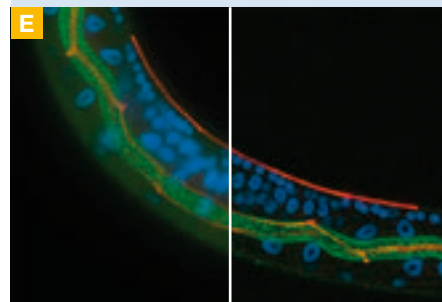
Deconvolution Solution

E The Olympus cellSens Dimension Deconvolution Solution module uses a specialised constrained iterative (CI) algorithm, developed exclusively for Olympus to remove out-of-focus blur and sharpen images so that researchers can extract more information from their images. Maximising modern PC computing capabilities, it leverages multicore processor architectures to provide an extremely powerful deconvolution facility, enabling you to obtain a fast, comprehensive deconvolution.

The resulting image stacks can be visualised with the powerful Voxel Viewer, which can order structures, isosurfaces and projections. This enables more in-depth analysis, with the capability to display stereo adaptations of the image. A broad range of image types can be deconvolved using the Olympus Deconvolution Solution module, including fluorescence, confocal and brightfield. With the additional capability to perform blind deconvolution, the software is able to use a theoretical point spread function (PSF), adapting it to the specific data. Furthermore, the PSF calculation can be saved and applied when performing subsequent deconvolutions.

Object Detection Solution

F The Object Detection Solution module adds efficient and precise threshold-based object detection, as well as classification. It also enables spectral unmixing in brightfield images to correct overlapping dye signals and emphasise the subtle differences between even the faintest stains.

A broad variety of discriminative factors, such as form, intensity and colour, can be easily combined to effectively separate objects within an image. A step-by-step workflow guides the user through the execution of the desired detection and classification. Changes to the threshold values can be made interactively, so the user can see the effect of each adjustment as they make it. As a result, the correct parameters can be set quickly and with great ease. Once defined, each detection parameter can be saved for application to other images, or stacks, and easily adjusted to account for variations in slide preparation. All the results are displayed as an overlay on the image and are automatically saved in an easy-to-use spreadsheet format. Data can then be easily presented using the cellSens report functionality, or exported to Microsoft Excel for further analysis.

Comprehensive constraint iterative deconvolution: for crisp and detailed results

Image provided courtesy of Peter Gutierrez in Prof. Dr. Alex Hajnal's laboratory at the Institute of Zoology, University of Zurich, Switzerland.
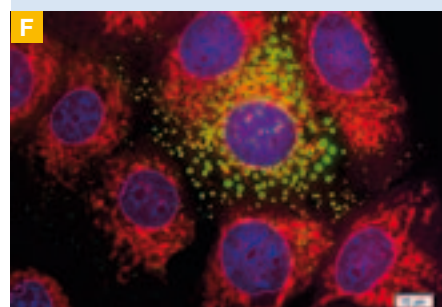
Retrieveing figures out of images. Object detection gives reliable numeric data

FASTER, BETTER AND MORE FLEXIBLE

Olympus xcellence platform

Olympus always strives to develop systems that don't just do the job; they do it faster, better and with greater flexibility. As a result, the xcellence system covers an amazing array of advanced fluorescence techniques, including TIRFM, FRET, FRAP and spinning disk confocal, presenting users with an easy-to-use interface and peerless options. Whatever the fluorescence challenges, the xcellence platform is the perfect starting point.
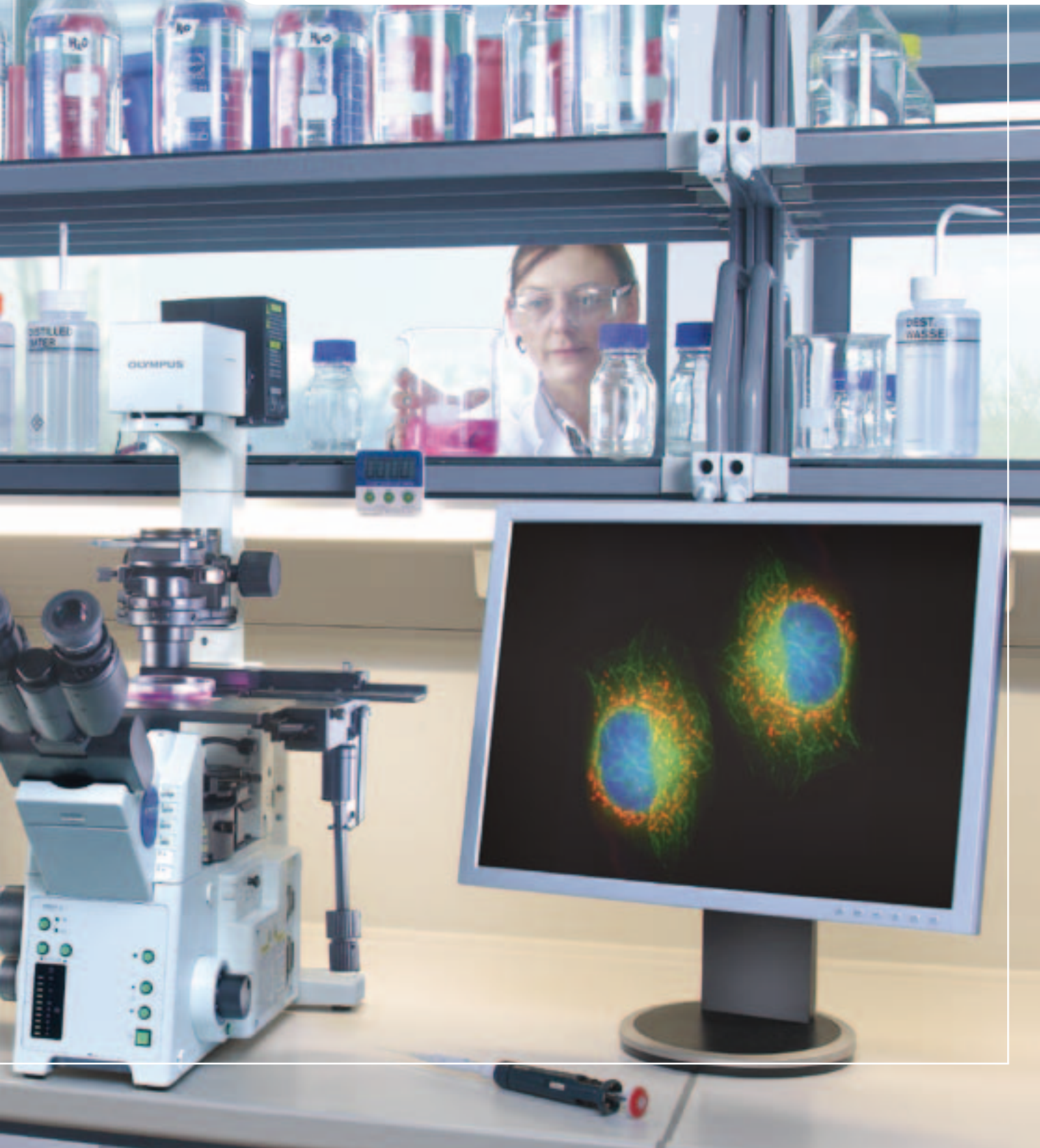
A **Experiment manager**

Intuitive graphical planning tool for complex experiments
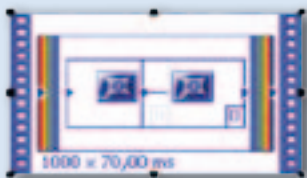
B **MT20 illumination system**

Highly stabilised, fast-switching light source for advanced imaging tasks

C
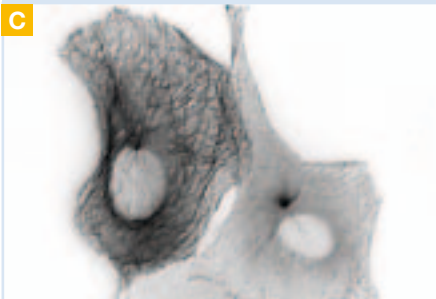
GFP staining of microtubules and microtubule ends in different Vero cells

INTUITIVE IMAGING SYSTEM

The powerful xcellence platform combines high-end microscope optics with advanced components and motorisation via the comprehensive xcellence software. The software brings in extensive imaging and analysis tools along with logical archiving. As a result, the xcellence platform is the ideal choice for a broad range of live cell fluorescence imaging processes.

Power is nothing without control

The xcellence platform uses independent plug-in CPU boards and digital trigger ports to integrate and control components more efficiently. For complex multi-device experiments, the "real-time controller" board has a μsec timing precision, conducting multiple processes in parallel to guarantee hardware interplay and efficiency. For procedures that do not require such high speed or parallel operation, the "System Coordinator" board offers < 5 $m$sec precision with processes controlled sequentially.

The experiment manager

A With full control of the microscope and all the components, the Olympus xcellence experiment manager is a highly intuitive planning and execution tool that enables even the most complex tasks to be completed with ease. Experiments can be set up and parameterised by the intuitive drag-and-drop assembly of command icons — for example "image acquisition", "Z-stack" or "time loop". This simple procedure creates the control code for the whole series of required hardware actions, meaning the user does not have to consider these in detail.

Let there be light

B Fast switching between excitation wavelengths is crucial for many applications, e.g. dual excitation ratio measurements or fast multicolour time-lapse experiments. The all-in-one illumination systems, MT20 (integrates with the real-time controller) and MT10 (integrates with the system coordinator board), match these exacting requirements with filter switching times of 58 and 85 msec respectively, between the eight excitation filter positions.

Image capture

C The xcellence platform has been developed to leverage the full capabilities of Olympus digital imaging cameras along with a broad range of third-party CCD and intensifying EMCCD cameras, enabling pixel binning and partial readout area features. The software also supports advanced features, such as overlapping readout, EM gain control, real gain control and photon imaging.

BEYOND FLUORESCENCE

Modern imaging techniques have taken fluorescence microscopy and pushed it forward, creating unique ways of imaging with greater resolution, clarity and precision: moving the microscope away from being a tool for "seeing", to being an instrument for "discovery".

cell^frap

D, **E** The Olympus xcellence systems are designed with high-speed components, so that sample bleaching does not happen during long-term imaging experiments. This is one of the reasons why the systems are the perfect starting point for conducting experiments that require accurate bleaching of specific parts of a sample using cell^frap, e.g. fluorescence recovery after photobleaching (FRAP), inverse FRAP (iFRAP), fluorescence loss in photobleaching (FLIP) and fluorescence loss after photobleaching (FLAP). Importantly, cell^frap is ideal for more sophisticated processes, including photoconversion, photoactivation and pattern bleaching.

cell^tirf

F Total internal reflection fluorescence microscopy (TIRFM) has firmly established itself over the last few years as a key technique in the investigation of molecular interactions at or near the cell surface. Olympus has been at the forefront of providing advanced TIRFM solutions and cell^tirf takes this to the next level with a series of peerless features. Its software interface gives the user direct insight into the created penetration depth of the exciting wave, independently for up to 4 lasers.

Combined power

Due to the unique optical characteristics of the Olympus microscopes and accessories, all of the xcellence modules can be combined in one system to form a peerless experiment platform capable of pushing any research project forward.

D cell^frap
Galvanometer-based fast-scanning photo manipulation unit

E
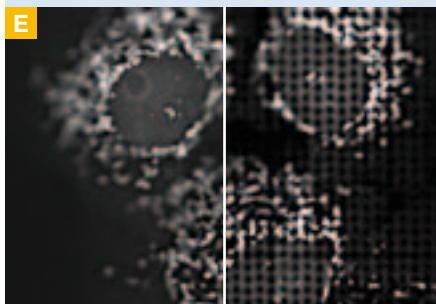
Pattern bleaching: left image before; right image after bleach

F cell^tirf
Motorised multiline TIRFM illuminator for precise control of the evanescent field

F xcellence
High-end system for advanced life science imaging

cellSens and xcellence software specifications

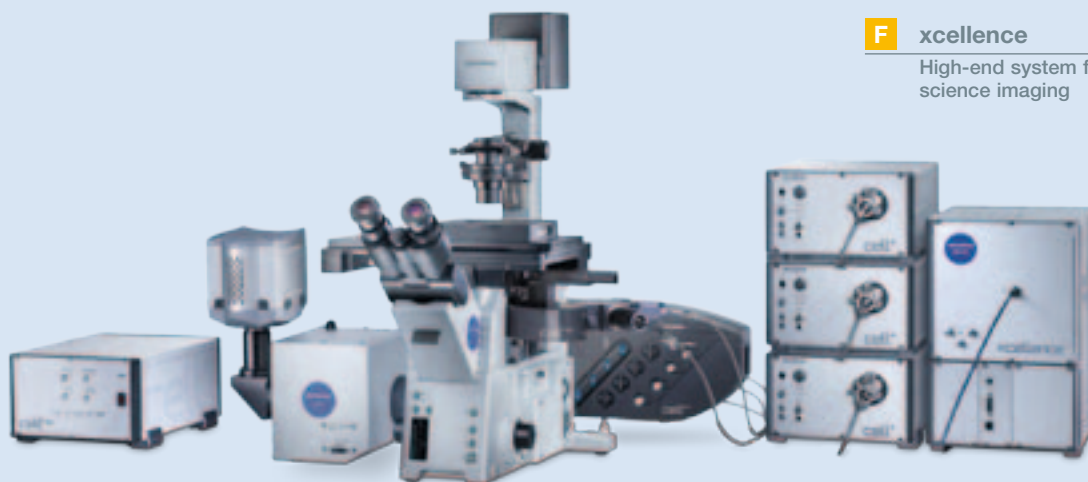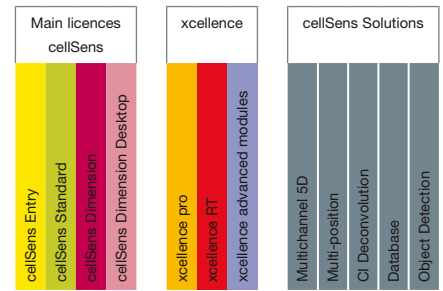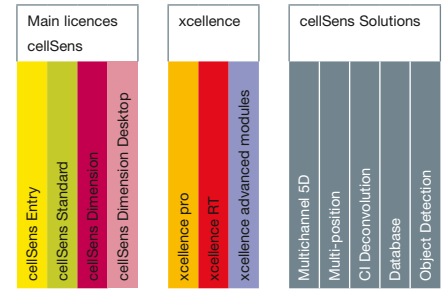|		Main licences cellSens				xcellence			cellSens Solutions				
		cellSens Entry	cellSens Standard	cellSens Dimension	cellSens Dimension Desktop	xcellence pro	xcellence RT	xcellence advanced modules	Multichannel 5D	Multi-position	CI Deconvolution	Database	Object Detection
Basic image acquisition													
Live image acquisition	Captures live images in various formats	●	●	●	—	●	●						
Movie	Creates AVI movie files	●	●	●	—	▲	▲						
Basic image tools													
Image history and properties	Displays image history and properties	●	●	●	●	●	●						
Image navigator	Enables tool window for image navigation and zooming	●	●	●	●	●	●						
Layers	Enables viewing, extraction and deletion of single image layers	●	●	●	●	▲	▲						
Adjusting display	Adjusts display settings automatically	●	●	●	●	●	●						
Combining RGB images	Enables the combining of multiple RGB images in one multilayer image	●	●	●	●	●	●						
Static annotations	Draws text, arrows, lines, rectangles and ellipses on the image	●	●	●	●	●	●						
	(cellSens Entry: text and arrows only)												
Gallery view	Displays thumbnails of open images in a gallery	●	●	●	●	—	—						
Extended image tools													
Image geometry	Enables the mirroring, rotating, resizing amd cropping of images and channel shifting.	—	●	●	●	●	●						
	Enables the adjustment of image stacks (cellSens Dimension only)												
Extended image processing filters and tools	Enables contrast adjustment, smoothing (lowpass) and sharpening of images, and	—	●	●	●	●	●						
	noise and shading correction												
Mode	Enables the conversion of bit-depth and colour space	—	●	●	●	●	●						
Multidimensional image processing	Enables the combination, extraction and separation of frames, channels and RGB	—	●	●	●	●	●						
Basic reporting													
Data export and statistics	Exports measurement data to MS Excel and cellSens workbook format (cellSens Dimension)	—	●	●	●	▲	▲						
	and enables the statistical analysis of measurements												
Interactive measurement													
Field of view measurement	Measures distances, angles, rectangles, circles, ellipses and polygons	—	●	●	●	—	—						
Advanced acquisition process													
Instant EFI	Instantly creates an EFI image while focusing	—	—	●	—	▲	▲						
Motorised EFI	Automatically creates an EFI image via predefined numbers of slices, step size and	—	—	●	—	▲	▲						
	top/bottom range (requires motorised Z)												
Online browsing	Enables browsing through already captured images during process acquisition	—	—	●	—	—	—						
Online deblur	Enables the deblurring of greyscale images online	—	—	●	—	—	—						
NetCam	Enables remote live image viewing via TCP/IP	—	—	●	—	—	—						
Advanced image tools													
Image arithmetic	Performs arithmetic and logical operations with images	—	—	●	●	●	●						
Advanced image processing filters and tools	Enables edge detection, projection calculations (min, max, mean on time, wavelength	—	—	●	●	●	●						
	or Z) and further smoothing functions												
3D slice view	Performs basic 3D visualisation	—	—	●	●	●	●						
Intensity calibration	Performs intensity calibration of channels	—	—	●	●	●	●						
Deblur	Enables the deblurring of images by no neighbour, nearest neighbour and Wiener filter	—	—	●	●	●	●						
Extended reporting functions													
Report composer	Creates reports interactively and exports to MS Word. Reports can be modified and	—	—	●	●	▲	▲						
	created directly in Word as well												
Basic image analysis													
Phase analysis	Performs threshold-based phase segmentation on full image and ROIs (rectangle, circle and	—	—	●	●	●	●						
	polygon), calculates area, area fraction and object count												
Customisation													
My Functions	Creates a workflow and large button bar for frequently used commands	—	—	●	●	—	—						

● = fully available | ○ = optional/available in Solution | ▲ = similar function available

cellSens and xcellence software specifications

		Main licences cellSens				xcellence			cellSens Solutions				
		cellSens Entry	cellSens Standard	cellSens Dimension	cellSens Dimension Desktop	xcellence pro	xcellence RT	xcellence advanced modules	Multichannel 5D	Multi-position	CI Deconvolution	Database	Object Detection

Advanced motorised acquisition process

		Entry	Std	Dim	Desktop	pro	RT	adv	MC5D	MP	CID	DB	OD
5D multidimensional image acquisition	Enables automatic acquisition of 5D images in X, Y, Z, as multichannel with transmission overlay functionality and with time lapse.			O	—	●	●		●				
Position lists and stage navigator	Captures images at multiple stage positions or over stage areas	—	—	O	—	▲	▲			●			
Automatic MIA	Creates panoramic images over areas (requires motorised stage)	—	—	O	—	▲	▲			●			

Specialised image tools

		Entry	Std	Dim	Desktop	pro	RT	adv	MC5D	MP	CID	DB	OD
Fluorescence unmixing	Enables spectral unmixing to correct overlapping fluorescence signals by isolating signals from the emission of other fluochromes	—	—	O	O	●	●		●				
Brightfield unmixing	Enables spectral unmixing to correct overlapping dye signals by isolating signals from the emission of other dyes	—	—	O	O	—	—						●
Deconvolution	Performs deconvolution of images by using the constrained iterative method	—	—	O	O	O	O	●			●		
3D voxel view	Performs advanced 3D visualisation	—	—	O	O	●	●				●		

Advance image analysis

		Entry	Std	Dim	Desktop	pro	RT	adv	MC5D	MP	CID	DB	OD
Object analysis	Performs threshold-based object detection and classification	—	—	O	O	O	O	●					●
Colocalisation	Enables colocalisation analysis of objects	—	—	O	O	▲	▲				●		

Data management

		Entry	Std	Dim	Desktop	pro	RT	adv	MC5D	MP	CID	DB	OD
Database client	Provides image and data management solution for microscopy (utilises Microsoft SQL Server 2005 Express)	—	—	O	O	—	—					●	
Image database	Provides image and data management solution	—	—	—	—	●	●						

Specialised acquisition process

		pro	RT
Experiment manager	Enables universal experiment planning tool	●	●
Interactive experiment	Enables interactive change of acquisition settings	●	●
Online kinetics	Performs online measurements of intensities on ROIs	●	●
Online ratio imaging	Performs online ratio images with predefined settings	●	●
FRET acquisition	Enables the acquisition of two colours simultaneously	●	●
Overlapping exposure	Enables simultaneous acquisition and readout of cameras	●	●
Real gain EMCCD	Enables linear EM gains	●	●
Photon imaging mode	Enables signal enhancement for low light	●	●
Illumination timer	Enables timer to switch burner off in overnight experiments	●	●

xcellence image tools

		pro	RT
Ratio measurement	Performs detection of ratio changes in two channels	●	●
ΔF/F	Normalises signal amplitudes in fluorescence images	●	●
Kymogram	Enables 2-dimensional display of dynamic behaviour	●	●
Bleaching correction	Performs substraction of photo bleaching effects in images and image series	●	●
Imaging C	Enables functional programming	●	●

xcellence modules

		pro	RT	adv
FRET analysis	Performs measurement of fluorescent energy transfer	O	O	●
trackIT!	Enables the manual and automated tracking of particles over time	O	O	●

● = fully available | O = optional/available in Solution | ▲ = similar function available

cellSens and xcellence hardware control specifications

		Main licences cellSens				xcellence			cellSens Solutions				
		cellSens Entry	cellSens Standard	cellSens Dimension	cellSens Dimension Desktop	xcellence pro	xcellence RT	xcellence advanced modules	Multichannel 5D	Multi-position	CI Deconvolution	Database	Object Detection
Basic device control													
Olympus cameras	Controls Olympus cameras DP20, DP21, DP25, DP70, DP71, SC30, UC30, XC10, XC10IR, XC10T, XC10TIR, XC30, XC50 and old RoHS-compatible models CC12, CVI, CVII, CVIII, CVIIIu	●	●	●	–	–	–						
	Controls Olympus cameras DP72, XM10, XM10IR, XM10T, XM10TIR and old RoHS-compatible model F-View II	●	●	●	–	●	●						
Extended device control													
Olympus microscope control	Controls motorised Olympus microscope systems BX2, IX2	–	●	●	–	●	●						
	Controls motorised Olympus microscope systems SZX, SZX2, BX-REMCB		●	●	–	–	–						
Non-Olympus cameras	Controls non-Olympus cameras. QImaging cameras: MicroPublisher 3.3 RTV and 5 RTV	–	●	●	–	–	–						
Shutter	UNIBLITZ shutter controllers: VMM-D1, VCM-D1, VMM-D3	–	●	●	–	–	–						
	Olympus UFSHA, UNIBLITZ shutter control via TTL signal	–	–	–	–	●	●						
Advanced device control													
Non-Olympus cameras I	Controls non-Olympus cameras. QImaging Retiga cameras: Retiga SRV, 2000 RV, 4000 RV, 2000 R, 4000 R, Retiga Exi, Exi BLUE; Roper cameras: Roper CoolSnapHQ2; Jenoptik cameras: ProgRes C3, ProgRes C5; Hamamatsu cameras: C9300, Orca AG, Orca ER, Orca R2, Orca03, Orca05	–	–	●	–	–	–						
Non-Olympus cameras II	Controls non-Olympus cameras. Hamamatsu cameras Orca AG, Orca ER, Orca R2, ImagEM, C9100-02, C9300-211, C9300-201, Orca II BT-512G; Andor cameras: iXon 897, iXon 888, iXon 885, Luca R, Luca S, iKon M	–	–	–	–	●	●						
3rd-party light sources	Controls CoolLED 3 and 4-channel light sources	–	–	●		●	●						
	Controls EXFO® X-cite, EXFO® X-cite *exacte* light sources	–	–	●		–	–						
Specialised device control													
Advanced Olympus microscope control	Controls Olympus devices DSU and FCB	–	–	○	–	●	●		●				
3rd-party light sources	Controls Lambda DG-4 shutter	–	–	○		–	–		●				
3rd-party stage controls I	Controls X/Y-stage controllers for OASIS, LUDL MAC 5000 and 6000, Märzhäuser Tango, ITK Corvus, Lang L-Step, Prior ProScan I and II	–	–	○		–	–	–				●	
3rd-party stage controls II	Controls X/Y-stage controllers Olympus STC for Märzhäuser stages, Prior ProScan, OptoScan and ITK Corvus	–	–	–	–	●	●	–					
xcellence device control													
System coordinator	Controls the xcellence system coordinator	–	–	–	–	●	–	–					
Real-time controller	Controls the xcellence real-time controller	–	–	–	–	–	●	–					
Light sources	Controls the MT10 illumination system	–	–	–	–	●	–	–					
	Controls the MT20 illumination system	–	–	–	–	–	●	–					
	Enables Olympus laser control (shutter and intensity) for cell^tirf, cell^frap	–	–	–	–	○	○	●					
	Controls the TILL Photonics monochromator Poly5000	–	–	–	–	●	●	–					
Optigrid M	Controls motorised structured illumination device	–	–	–	–	○	○	●					
Dualview	Controls the TILL Photonics Microimager splitting device to divide two fluorescence channels on one camera	–	–	–	–	●	●	–					
Piezo stepper devices	Controls Physic Instruments PIFOC Piezo steppers (build-in frame, nosepiece or stage)	–	–	–	–	●	●	–					
Fast communication standard	TTL out and TTL in control	–	–	–	–	●	●	–					
xcellence modules													
cell^tirf	Controls motorised TIRF illuminator	–	–	–	–	○	○	●					
cell^frap	Controls galvanometric scanning device	–	–	–	–	○	○	●					

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