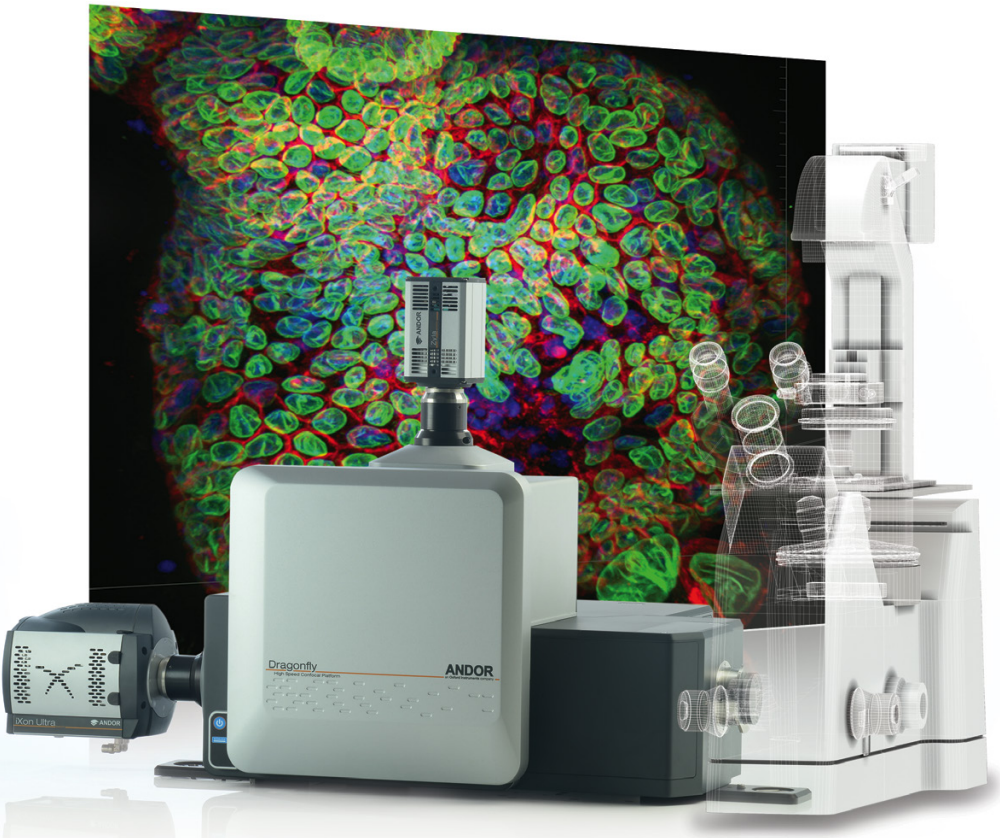
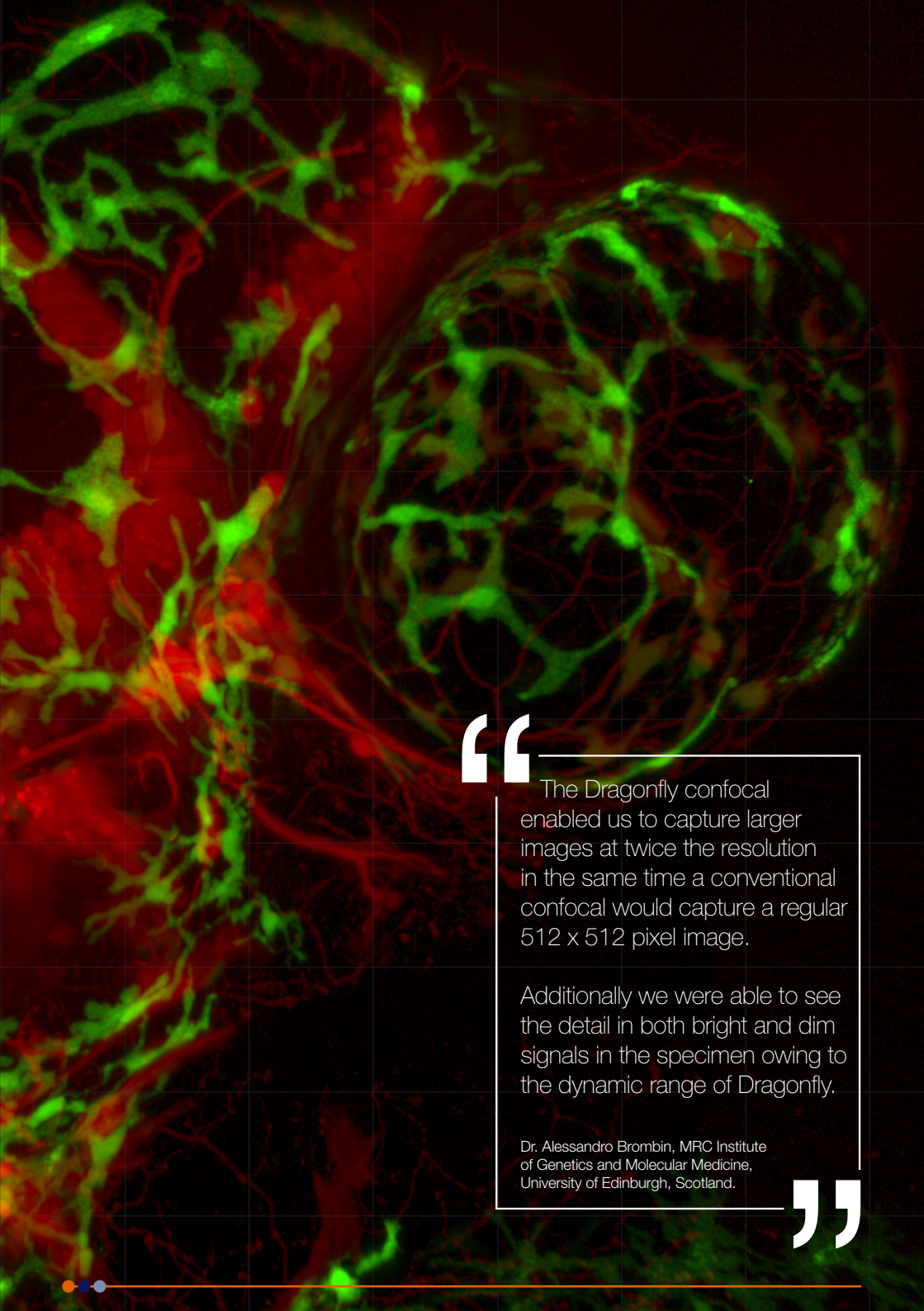
ANDOR
an Oxford Instruments company

Dragonfly

High Speed Confocal Imaging Platform





"The Dragonfly confocal enabled us to capture larger images at twice the resolution in the same time a conventional confocal would capture a regular 512 x 512 pixel image.

Additionally we were able to see the detail in both bright and dim signals in the specimen owing to the dynamic range of Dragonfly."

Dr. Alessandro Brombin, MRC Institute of Genetics and Molecular Medicine, University of Edinburgh, Scotland.

Dragonfly - High Speed Confocal Platform

The most flexible imaging solution ever!

The game-changer in confocal microscopy: with the Andor Dragonfly you can image at an unrivaled combination of speed, sensitivity and dynamic range in a range of contrast modes. Dragonfly is the all encompassing tool for fixed and live cell imaging.

As a manufacturer of Dragonfly, laser engines, software, and market leading EMCCD and sCMOS cameras, we offer the best choice for your imaging requirements. Confocal, TIRFM, single molecule imaging, and high speed widefield applications all benefit from this unique combination of technology.

Dragonfly
It's more than confocal...

What can Dragonfly do for you?

Confocal, TIRF and widefield working seamlessly for your imaging experiment.

Having these three modalities in a single solution allows you to investigate, in great detail, the multi-dimensional structure and/or dynamic physiology of a wide range of samples, from bacteria on biofilm to whole zebrafish.

- As an individual researcher you have the imaging tools to investigate from the whole organism down to a subcellular level, using multiple approaches to address a wide range of questions.
- If you run a core facility, you have a cost effective way to support multiple imaging techniques.

Key Applications

- Live and fixed cell imaging
- Developmental biology
- Cancer research
- Organoids
- Neuroscience
- Plant biology
- Membrane trafficking
- Single molecule localization imaging

Multi-Point Confocal

At the heart of the Dragonfly Imaging Platform is a newly designed microlens confocal scanner, tightly integrated with our highest sensitivity cameras and presented via our new imaging software, Fusion. The result is speeds of 10 to 20 times faster than a traditional confocal, leaving you with no more waiting for an image to be built up point-by-point and line-by-line. Dragonfly offers the following major benefits:

- Minimal phototoxicity and photobleaching - ideal for live or delicate specimens.
- High speeds for imaging fast dynamic events, or high throughput.
- Large uniform field of view for larger specimens or montage stitching.

Widefield

Confocal is not always the best imaging mode, some samples simply work better with epifluorescence e.g. yeast and other thin specimens. Dragonfly delivers high-contrast high-resolution images using laser widefield and ClearView™ deconvolution in Fusion. ClearView™ is CUDA-GPU accelerated and runs 10 to 20 times faster than conventional solutions.

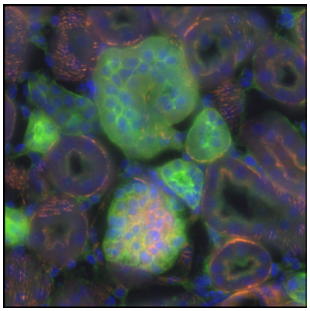
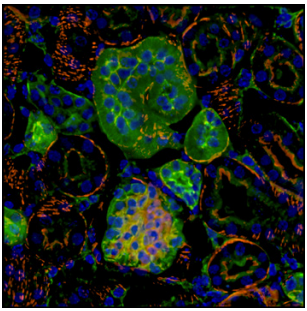
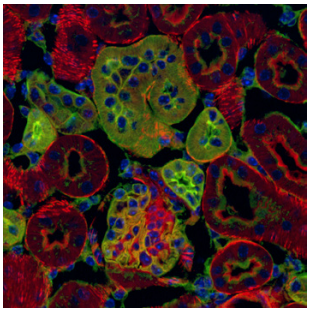
- Minimal phototoxicity and photobleaching - ideal for live or delicate specimens.
- Maximize emission bandwidth for high S/N ratio with minimal exposure.
- GPU-accelerated deconvolution delivers clear, sharp images fast.

TIRF

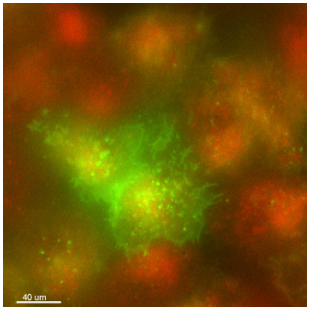
Our novel, patent-pending, design offers chromatically corrected TIRF illumination for multi-color simultaneous imaging at the same penetration depth, ensuring accurate spatial information for detailed interpretation of your results. You can control the critical angle for TIRF and penetration depth into the specimen, or choose to operate in oblique (HiLo) mode to capture deeper signals.

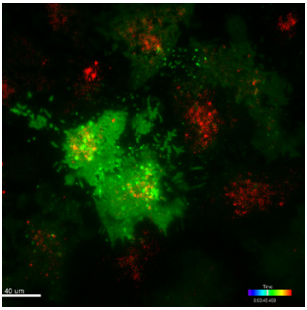
- Adjust TIRF angle according to specimen configuration.
- Match penetration depth of two labelled targets. Ideal for intra or extra-cellular imaging.
- HiLo mode for rapid and deep imaging into the cell, probing membrane proximal dynamics.

From Bacteria to Organoids...

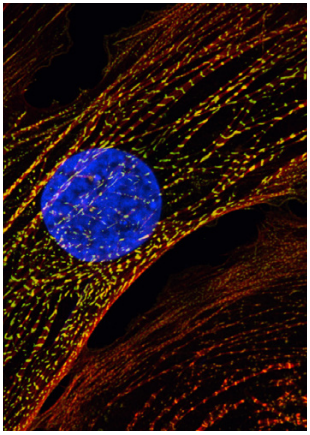
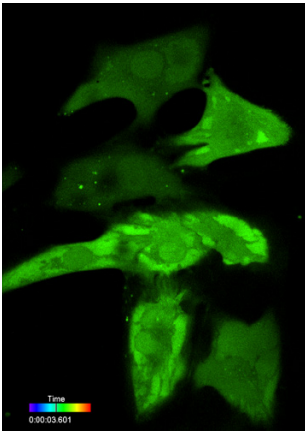
A sample imaged in widefield (left), deconvolved widefield (center) and confocal. Each image is captured at a single optical plane (60x 1.2NA). The widefield image clearly has out-of-focus signal, and deconvolution restores that signal to improve contrast and sharpness. The same confocal image delivers a finer optical plane with more detail in a single capture.





Hela cells expressing GFP fusion protein and labelled with DiI which is retained in the lipid bilayers of the cell membrane. TIRF shows thin optical section and huge enhancement in contrast. Images from same field with Dragonfly – TIRF Penetration ~130 nm.

Courtesy of The Brass Lab, UMASS Medical School, USA.

Left: Confocal image of human ips derived cardiomyocyte stained with dapi, alpha actinin 488 and phalloidin 560.

Right: iPS derived cardiomyocytes loaded with a calcium sensitive dye. Imaged at 60x magnification with 40 µm pinhole using iXon Ultra 888 (1024 x 1024) capturing at 25 fps.

Both courtesy of Dr. Travis Hinston, The Pat and Jim Calhoun Cardiology Center, University of Connecticut Health Center and The Jackson Laboratory for Genomic Medicine.

Introducing Dragonfly - The high

Simplified Experimental Workflow

It's more than confocal...

Central to the Dragonfly concept is the goal of maximizing throughput: this is achieved by optimizing both imaging performance and data flow. Fusion and Imaris provide seamless transitions from imaging and deconvolution, through to visualization to analysis, while open source directly supports Dragonfly's native HDF5-based file format. As a result you spend less time pre-processing and transferring between systems, and more time collecting high quality data.

Speed Hypothesis Testing

Hypothesis testing is a fundamental part of the scientific method. The familiar cycle of data creation and evaluation are delivered by the Dragonfly workflow, supporting demanding experimental regimes. Extended observations, large fields of view and high quality data provide the input for statistical analysis and data mining.

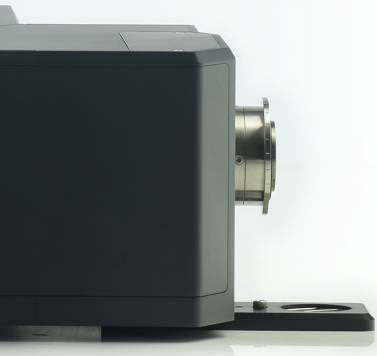
speed confocal imaging platform

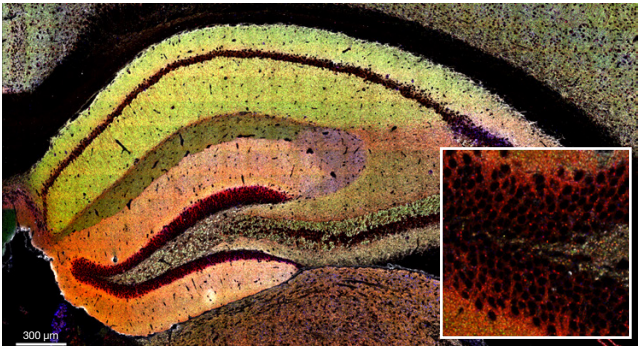
Features	Benefits
Large field of view	Capture more in a single image.
High-speed multi-point confocal	Capture up to 400 fps in confocal mode for fast specimen dynamics. Up to 20x faster than conventional confocal for greater productivity.
2 pinhole diameters (25 µm and 40 µm)	High contrast imaging for large samples to subcellular imaging.
Simultaneous dual color TIRFM	Matched penetration depth for two simultaneous wavelengths. More accurate co-localization analysis.
Laser-illuminated widefield mode	Conventional fluorescence imaging modality, offering high power for single molecule localization.
16-bit dynamic range	Ability to capture weak and bright signals in one shot.
Zoom illumination optics Camera Zoom optics (1x, 1.5x, 2x)	Higher illumination power density for some applications. Highest resolution image capture.
Astigmatic lens	For single molecule localization imaging in a volume.

Borealis - Perfect Illumination Delivery™ Solution

Key to optimal optical performance in confocal and widefield modalities is our patented Borealis Perfect Illumination Delivery™ solution. Borealis is comprised of several optical elements including the use of multimode fibers, illumination matching to the sensor shape, optimally filling the microlenses in the confocal disk and maintaining telecentricity to the microscope.

The benefits of Borealis are: three times more light to the sample so lower laser powers can be used, higher contrast imaging for better image quality, high cross-field uniformity for seamless image tiling and more accurate cross-field analysis, improved axial geometry, extended imaging range into the NIR for broader fluorophore choice and avoiding autofluorescence.

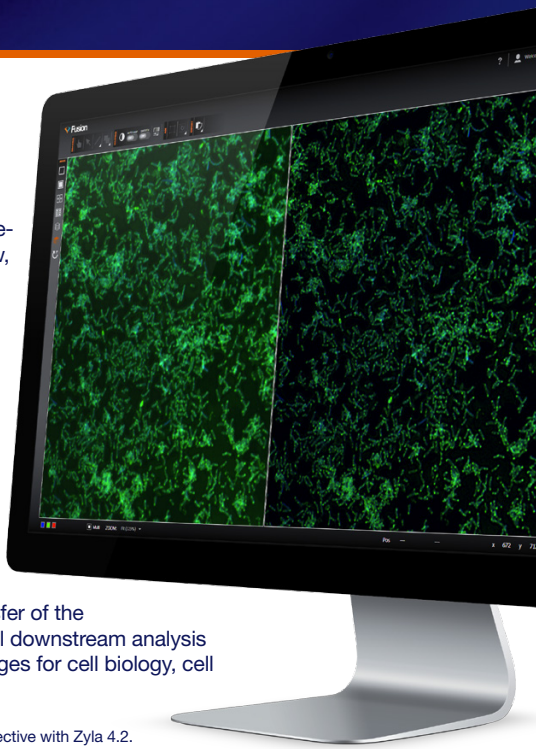




A demonstration of the cross-field uniformity Borealis illumination confers. This image of synaptome mapping in the hippocampus is comprised of 364 fields captured using a 100x objective, four wavelengths for each tile. Courtesy of Drs. Fei Zhu and Melissa Cizeron, Grant Laboratory, Centre for Clinical Brain Sciences, University of Edinburgh.

Fusion Software

Acquire | Visualize | Analyze



Fusion is a brand new software solution designed to meet the requirements of today's expectations for ease-of-use and immediate visual feedback with data review, whilst fulfilling tomorrow's aspirations for handling multi-modal imaging.

Fusion simplifies the control of the Dragonfly system, with its multiple imaging modes, to both fluorophore and imaging mode selection in very few mouse clicks. Once the sample is on the microscope you can control all hardware, including the x,y stage, with its unique software joystick. Real-time 3D visualization provides a powerful insight to your experiment, and GPU accelerated deconvolution delivers enhanced clarity when required.

Saving files in Imaris format, Fusion permits easy transfer of the data into Imaris software for detailed multi-dimensional downstream analysis including solid surface rendering, measurement packages for cell biology, cell lineage, neuroscience and much more.

* Bacteria on biofilm. Confocal image (left) captured at 40x (0.75 NA) objective with Zyla 4.2. Deconvolved image on right. Dr. Nigel Ternan and Dr. Barry O'Hagan, University of Ulster , UK.

Real-Time Rendering

Real-time rendering within Fusion allows for an on-going verification of the quality of experiment and status of your sample.

Having instantaneous feedback on your data set in multiple dimensions is critical for establishing the correct hardware settings and subsequent progress of your experiment. Fusion gives you access to various ways of displaying your image, enabling efficient setup up of z-volumes, balancing laser and camera settings across different channels and real-time data review with unique 3D rendering.

Deconvolution

Deconvolution is an invaluable tool for bringing clarity to those subtle details of your 3D data set that might otherwise pass unnoticed. This is especially useful for widefield images, but can even benefit the best quality confocal stack.

Fusion employs ClearView™, a GPU accelerated, user-friendly, deconvolution tool for ten times faster processing. The speed benefit means you can run deconvolution whilst an image capture protocol is running, so avoiding post-capture processing time.

Visualize Complex Data

Compare and contrast experimental groups by visualizing your image data in five dimensions as uni- or multi-variate scatterplots. Along with the use of box + whisker plots, ImarisVantage will help you interpret intrinsically complex and dynamic phenomena.

Vantage enables researchers to dissect their multi-dimensional, multi-object images by creating a series of fully customizable plots for better understanding of hidden relationships and associations between calculated measurements, objects or groups of objects.

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Customer Support

Andor products are regularly used in critical applications and we can provide a variety of customer support services to maximize the return on your investment and ensure that your product continues to operate at its optimum performance.

Andor has customer support teams located across North America, Asia and Europe, allowing us to provide local technical assistance and advice. Requests for support can be made at any time by contacting our technical support team at andor.com/support.

Andor offers a variety of support under the following format:

- On-site product specialists can assist you with the installation and commissioning of your chosen product
- Training services can be provided on-site or remotely via the Internet
- A testing service to confirm the integrity and optimize the performance of existing equipment in the field is also available on request.

A range of extended warranty packages are available for Andor products giving you the flexibility to choose one appropriate for your needs. These warranties allow you to obtain additional levels of service and include both on-site and remote support options, and may be purchased on a multi-year basis allowing users to fix their support costs over the operating life cycle of the products.

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Front cover image: Confocal volume of Mouse Colonic Epithelial Organoid, 101 µm thick, 112 optical slices, captured at 20x (0.75 NA) with 25 µm pinhole. Courtesy of Ronan Mellin and Dr. Luke Boulter, MRC Human Genetics Unit, University of Edinburgh, Scotland.

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