AUROX

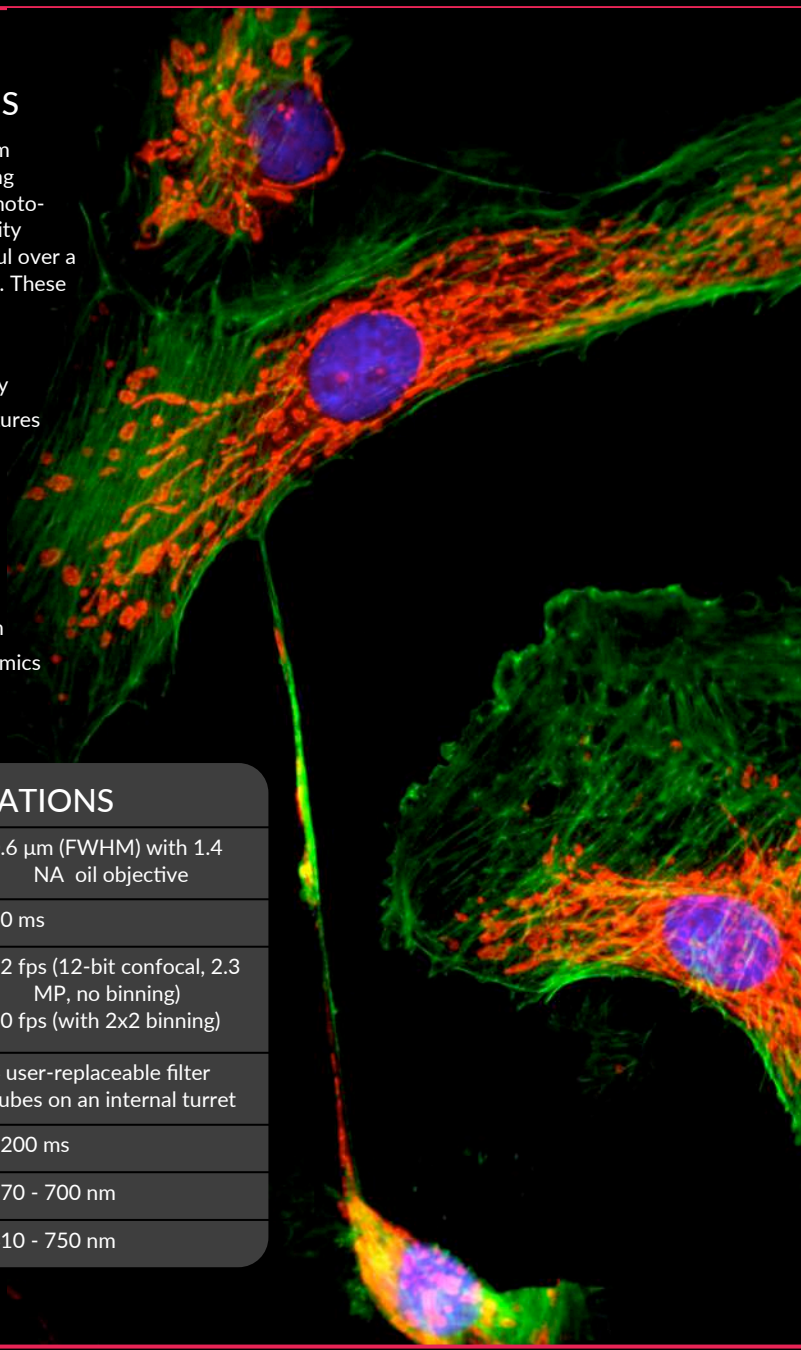
CLARITY LFC

LASER-FREE CONFOCAL

APPLICATIONS

The extended 370–750 nm spectral range, high imaging speed, long uptime, low photo-bleaching and photo-toxicity make the Clarity LFC useful over a wide range of applications. These include:

- Immunofluorescence
- Developmental biology
- Stem cells and 3D cultures
- Electrophysiology
- Embryology
- Plant biology
- Neuroscience
- Microfluidics
- Drug delivery research
- Cell and systems dynamics



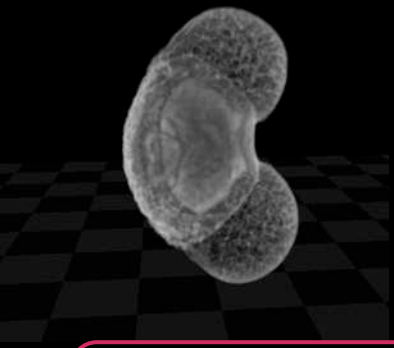
KEY SPECIFICATIONS

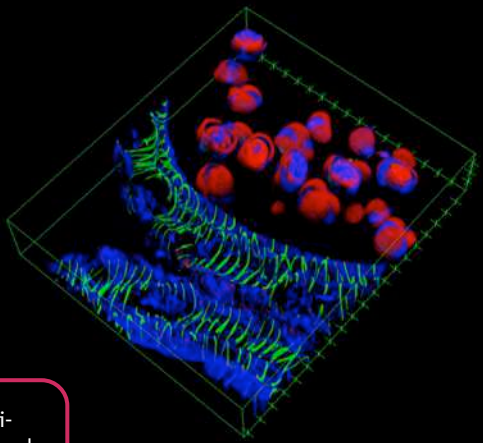
Confocality:	0.6 µm (FWHM) with 1.4 NA oil objective
Min exposure:	20 ms
Max frame rate:	22 fps (12-bit confocal, 2.3 MP, no binning) 50 fps (with 2x2 binning)
Imaging channels:	4 user-replaceable filter cubes on an internal turret
Channel switching:	<200 ms
Excitation range:	370 - 700 nm
Emission range:	410 - 750 nm

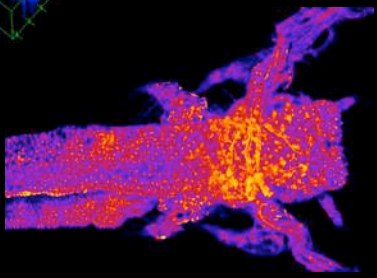
LASER FREE CONFOCAL

FEATURES AND BENEFITS

Laser free	Low cost of ownership, easy maintenance
High light throughput	Compatible with weakly fluorescing samples
Multi-sector disk design	Choice of 3 sectioning modes, optimised for resolution or speed
Large field of view	sCMOS cameras for wide field of view Compatible with tiling techniques for large area imaging
Broad spectral range	370-750nm excitation/emission with customisable filter cubes
Video-rate confocal imaging	50 fps for 1 MPix frames, more with aggressive binning Seamless switching between confocal and widefield modes
Microscope hardware agnostic	Use your preferred microscope/macroscope and light source
By-pass mode	Remove disk for extra light throughput





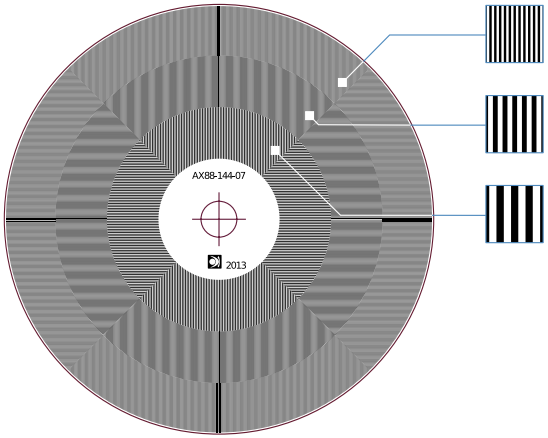


"This technology allows a fast multi-colour image acquisition at high speed and in multiple dimensions. Therefore it is particularly well suited for us to investigate the interaction between nanoparticles and living cells, including dendritic cells and cancer cells."

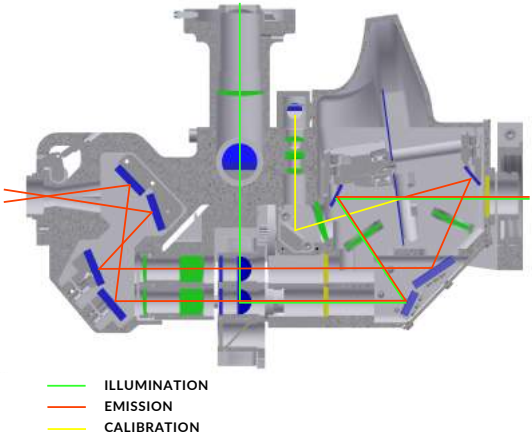
Prof Bruno De Geest
Ghent University, Belgium

The Aurox Clarity laser free confocal unit uses Aurox's patented optical system, based on a new design of spinning disc with a grid-like structured illumination pattern. This structured illumination pattern is used to both modulate the illumination field and demodulate the light emerging from the sample.

The unique optical system inside the Clarity LFC allows capturing of the images both transmitted (T) and reflected (R) by the disc to easily differentiate between in-focus and out-of-focus information. Computer subtraction of these images (T–R) creates a sectioned image whereby all out-of-focus blur is effectively suppressed and only the sharp in-focus image of the sample is retained. At the same time a conventional image is readily obtained by adding the two images (T+R).



Structured illumination encoder disk



Schematic diagram of the Clarity LFC

The Clarity LFC demonstrates an impressive combination of speed and image quality. It is worth mentioning that the optical sectioning of Clarity LFC is on a par with the more traditional (and significantly more expensive) point-scanning confocal laser microscopes, yet it can easily stream high-resolution data at 50 frames per second and more. Using a spinning disk as the modulator/demodulator virtually eliminates residual imaging artefacts that plague many structured illumination systems.These are just some of the benefits of the Clarity LFC approach.

SYSTEM CONFIGURATION

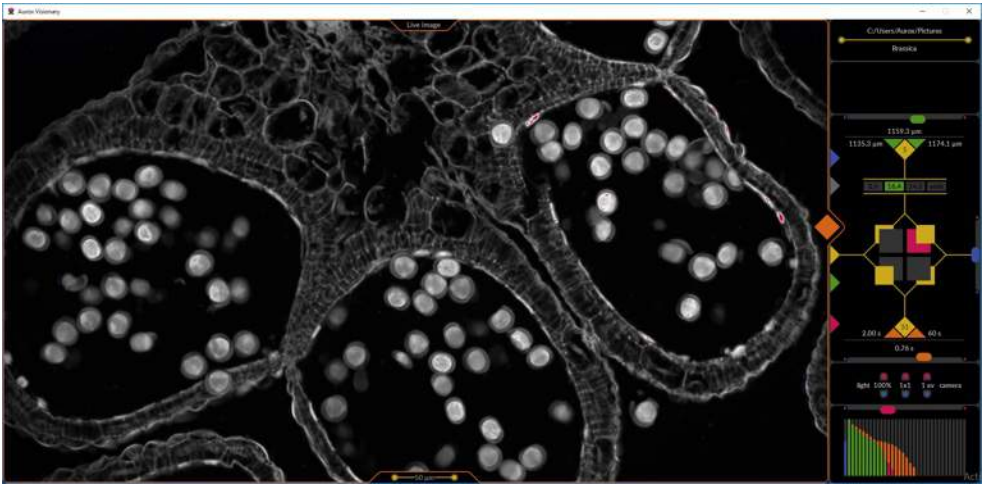
The Clarity Laser Free Confocal instrument has been engineered as a compact attachment to a conventional microscope frame thus allowing for flexible, highly cost-effective upgrade solutions. Virtually any fluorescence microscope has the potential to be upgraded to become a confocal microscope with the addition of the Aurox Clarity LFC. All major microscope frames are supported, as well as sCMOS cameras from PCO and Andor, light sources from CoolLED and Excelitas, Solent incubators and Prior translation stages.

The principal benefit of this approach is an affordable confocal device for your own laboratory eliminating the need to use core facilities. Over a longer term this becomes even more apparent as new imaging channels can be easily introduced by simply adding extra filter cubes, rather than purchasing new excitation lasers.

"The Aurox system has two main features that are advantageous for us: the narrow depth of field compared with widefield fluorescence and fast image acquisition, which allows us to tune the exposure time for a given flow rate in order to obtain suitable length streaks. It would be extremely challenging to obtain comparable images with a laser-scanning confocal system..."

Dr Simon J Haward
Okinawa Institute of Science and Technology, Japan

VISIONARY SOFTWARE



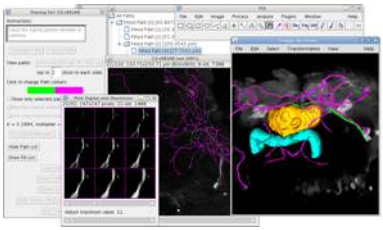
Screenshot of Aurox Visionary software

Aurox Visionary is a dedicated software package that has been developed for the acquisition of live cell imaging data using the Aurox Clarity LFC unit as part of a laser free confocal microscopy system. Designed with simplicity and ease of use at its core, this software implements a single graphical user interface to control all essential hardware settings, provides tools for the optimisation and control of the imaging set-up and supports a wide range of experimental protocols: from high-speed movies to multi-channel multi-position time lapse stacks. Data integrity is ensured by robust storage algorithms that use OME TIFF file format and Bio-Formats compatible meta-data structures.

Aurox Visionary is optimised for image acquisition and uses third-party software for subsequent image data processing and visualisation. Any package compatible with OME TIFF image format can be used for this purpose, ranging from open source software (Fiji) to commercial offerings, such as Imaris or Image Pro. Scripts can be provided for seamless integration of Visionary with a chosen image processing package via a single-click data transfer.

"While the interface initially looked very different to anything that we have worked with previously, it proved to be very intuitive to use, easy to learn and extremely sleek in operation. All your experiment settings accessible from a single panel! And it looks beautiful too..."

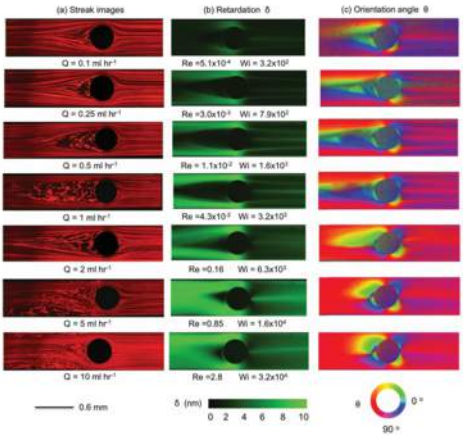
Prof. Jonathan Gibbins
University of Reading, UK



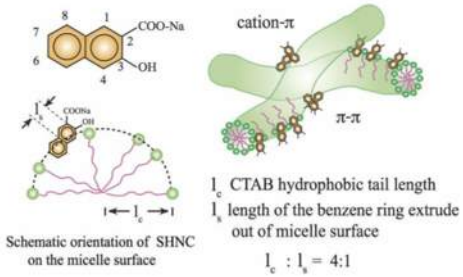
Examples of image stacks processed in Fiji

Flow of wormlike micellar solutions around confined microfluidic cylinders. Simon J Haward et al, Soft Matter 12: 8666 (2016)

Wormlike micellar (WLM) solutions are frequently used in enhanced oil and gas recovery applications in porous rock beds where complex microscopic geometries result in mixed flow kinematics with strong shear and extensional components. In this study, the flow behaviour of an aqueous WLM solution consisting of cationic surfactant and a stable hydrotropic salt were studied in microfluidic devices with three different cylinder blockage ratios.



The Micro/Bio/Nanofluidics Unit at the Okinawa Institute of Science and Technology was established in July 2014. The two core research areas in the unit are: the fundamental aspects of micro- and nano-fluidic flows (including fluid mechanics, soft matter physics and rheology) and related biotechnology, nanotechnology and healthcare applications (e.g. bioassays, biosensing, bio- and nano-materials synthesis). The unit members have unique and complementary expertises in fluid mechanics, soft matter physics, biomedical and chemical engineering, materials science and polymer/physical chemistry.



Flow pattern visualisations were performed by capturing streak images with an inverted epi-fluorescence spinning disk confocal microscope (Aurox/Andor DSD2), equipped with an Andor iXon camera and a Nikon 4x 0.13 NA objective lens. The fluids were seeded with fluorescent polystyrene particles with excitation and emission wavelengths of 530 nm and 607 nm respectively. Streak images were recorded with frame rates ranging from 0.3 to 10 frames per second and streak imaging videos were recorded over time periods of several seconds in order to observe the time dependent nature of the generated flow fields. The imaging system allowed high contrast and in-focus visualisation of the flow in a 100 µm thick optical section at the centre of the flow chamber.

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UNDER THE MICROSCOPE

Based at the Culham Science Centre in Oxfordshire, Aurox Ltd was established in 2004 to commercialise and build upon pioneering work from the Scanning Optical Microscopy Group at the University of Oxford, Department of Engineering Science

A leader in the design and manufacture of innovative optical equipment, Aurox has received multiple business and technology accolades including the Queen's Award for Enterprise, the Institute of physics (IOP) Innovation Award and the R&D100 Award

Aurox's leading product is the Clarity Laser Free Confocal unit. The Clarity LFC is the first in a portfolio of new generation of microscopy products under development by Aurox. These products set new benchmarks in price/performance ratio in the field of confocal microscopy, making this technology available to individual researchers and smaller research units.

Aurox has built on the success of the Clarity LFC, developing a core imaging technology that lies at the heart of a new range of confocal microscopy systems. These systems address specific market needs in applications ranging from high throughput screening to materials inspection and are available from such leaders in their respective fields as Carl Zeiss Microscopy and 3DHistech.

CONTACTS

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"Aurox have been supplying spinning disk technology to Carl Zeiss for more than 10 years now. All this time we have been constantly impressed by the company's technical expertise, attention to detail and eagerness to go an extra mile to satisfy a discerning customer. Reliable partners and really nice people to work with..."

Dr-Ing. Viktor Drescher
Carl Zeiss Microscopy, Germany

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