telight

LiveCodim

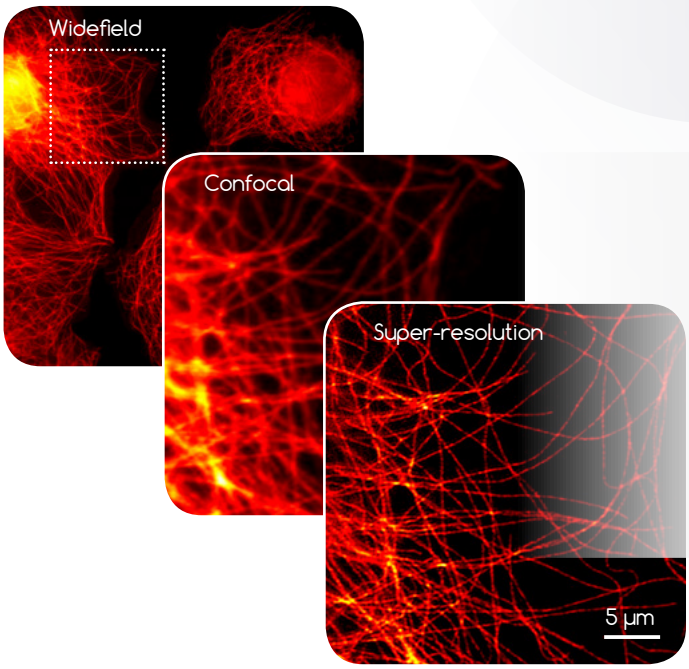
3-in-1 imaging platform

Widefield – Confocal – Super-resolution

Key features

Gentle super-resolution for living cells

- Up to **90 nm lateral resolution**
- Substantially reduced phototoxicity
- Little-to-no photobleaching
- Multicolor: up to 4 lasers lines covering the whole visible spectrum
- **Deeper scanning up to 500 µm**



Easy-to-use and flexible

- No need to modify sample preparation from what would be done for confocal imaging
- Simple and user-friendly software
- 3-in-1 imaging options: **widefield, confocal and super-resolution**

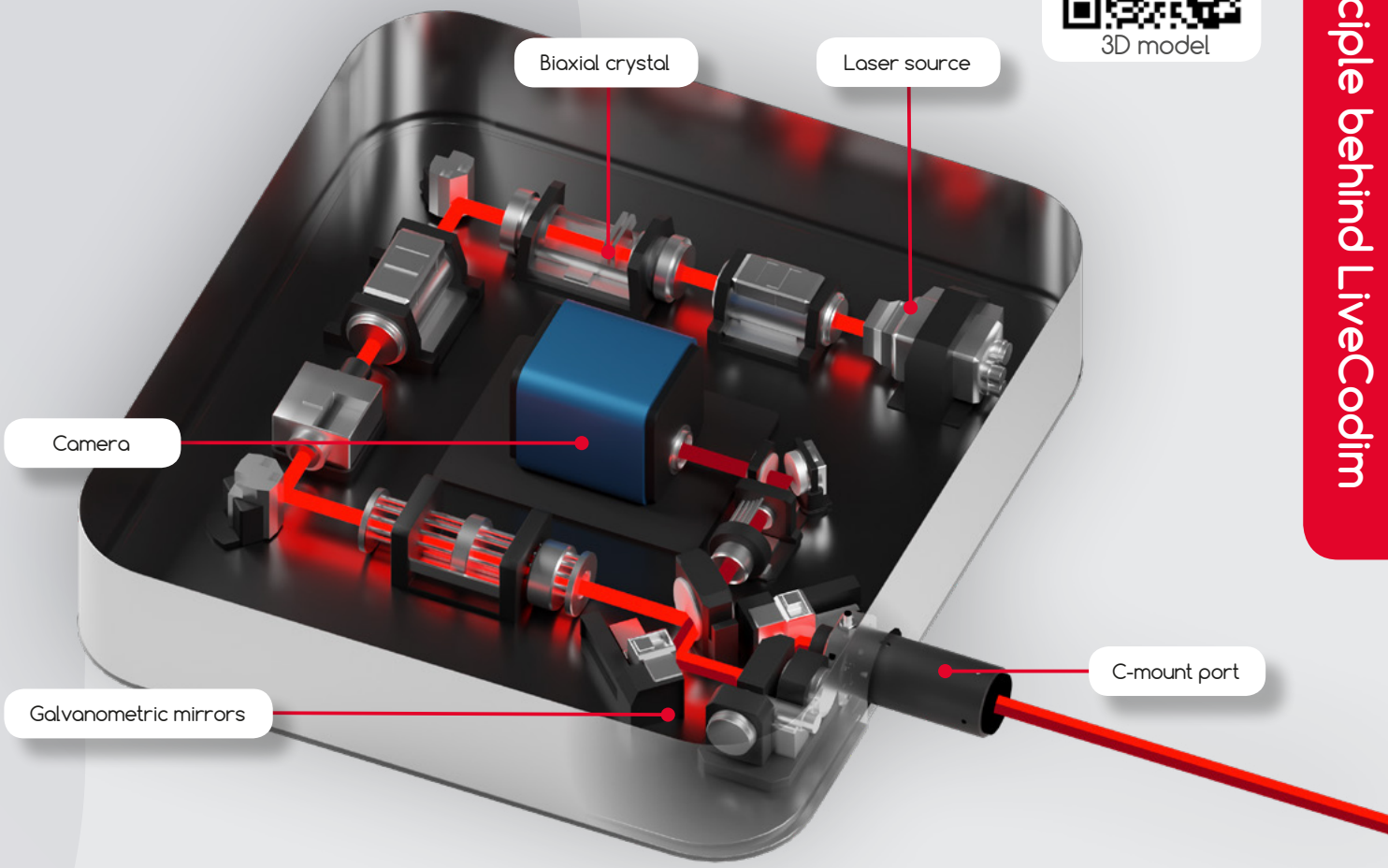
Achromatic and modular

- No fluorophore restrictions: customizable for 400-1000 nm
- **Compatible with any commercial microscope** with available left or right side port
- Compatible with incubator and CO_2 fittings
- All images output in **TIFF format**

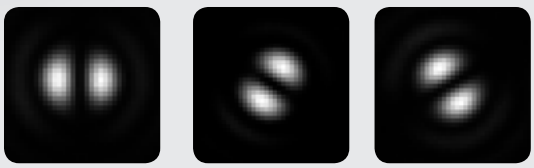
Principle behind LiveCodim

LiveCodim is based on conical diffraction to produce localized structured illumination and **generate super-resolved images**.

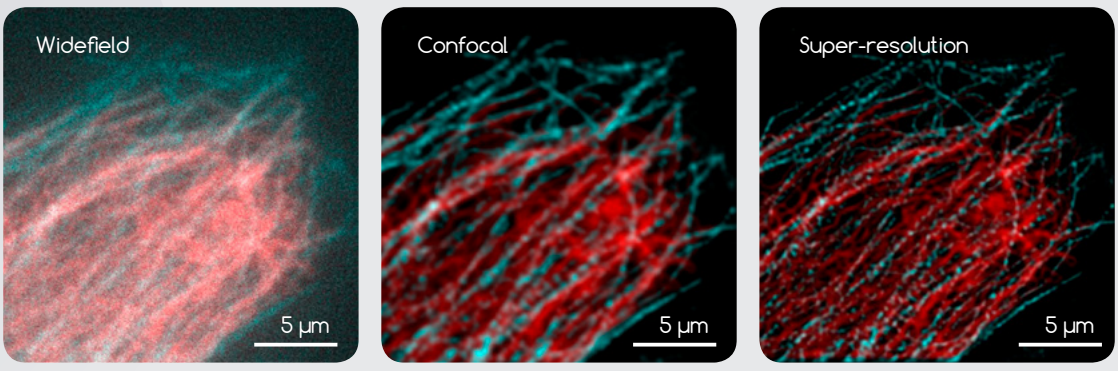
3D model



It exploits the properties of a biaxial crystal to generate patterns of light that have a sharply oriented region of darkness between two lobes of light. These patterns of light are focused on the sample and rotated in three orientations.

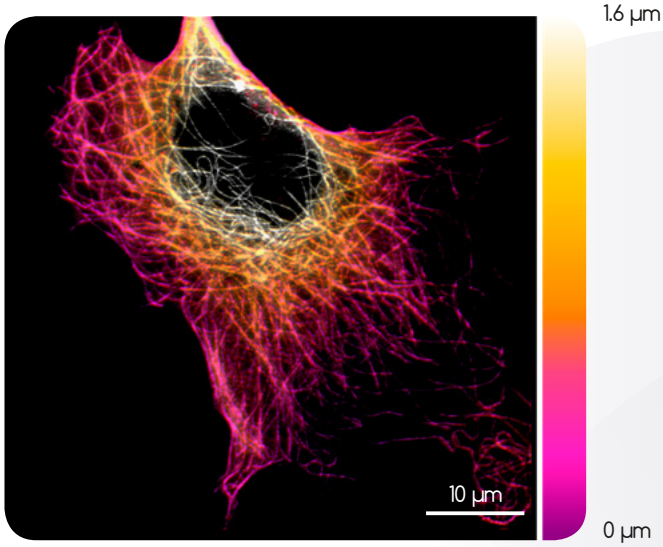


The resulting fluorescence signal is collected on a camera and used to reconstruct the immediate surroundings of the scanned area. LiveCodim converts a standard widefield microscope to one with confocal and super-resolution capabilities.

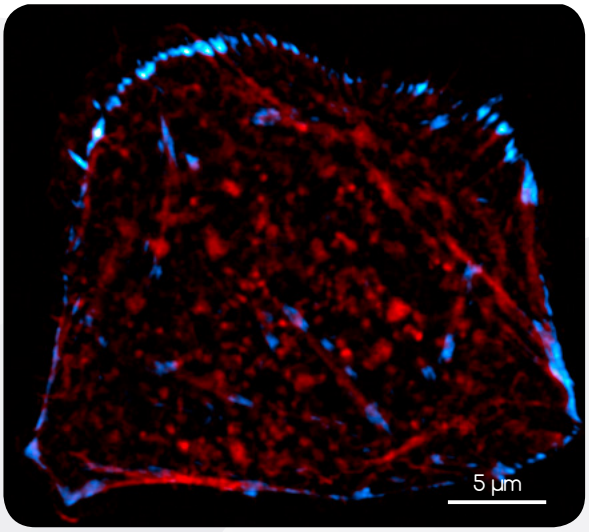


Key advantages

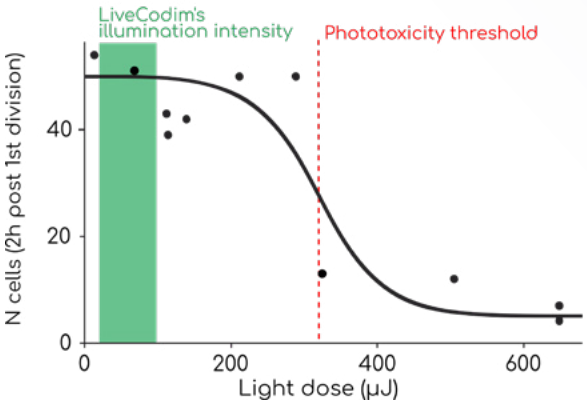
3D projection of the microtubule network



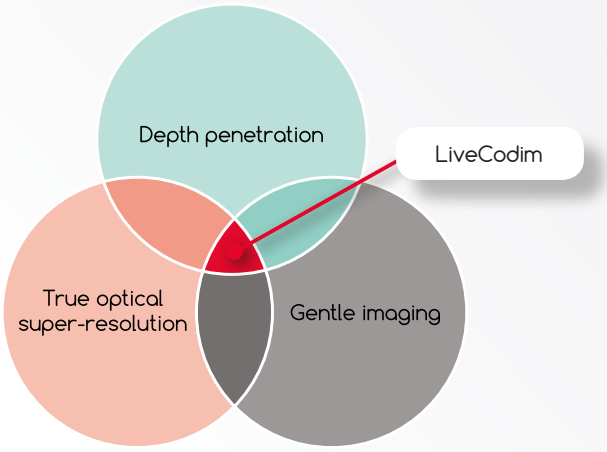
Dynamics of the focal adhesion sites in an MDCK cell



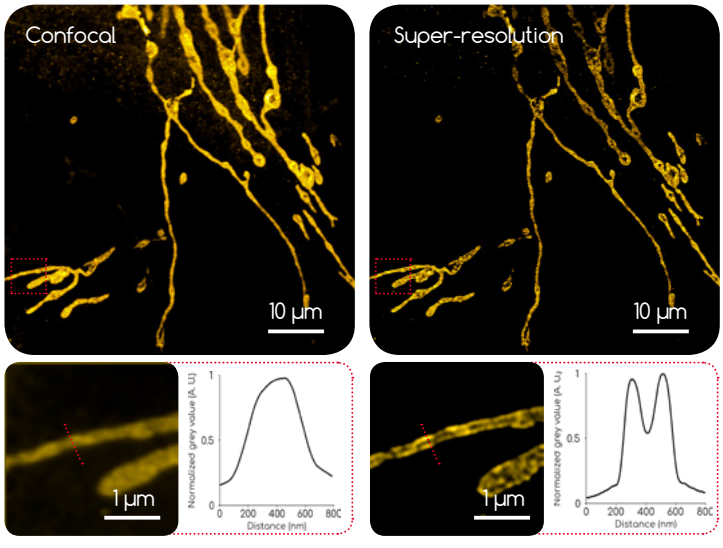
Phototoxicity curve for confocal laser scanning microscopy



The green region represents the range of light intensities used in LiveCodim's super-resolution mode.



Outer mitochondrial membrane



Benefitting from true optical super-resolution, LiveCodim **achieves 90 nm** of lateral resolution using gentle illumination, **meaning little-to-no photobleaching or phototoxicity** to ensure the highest protection of living or fixed samples. Thanks to its confocal-like laser-scanning geometry, it retains comparable depth penetration advantages.

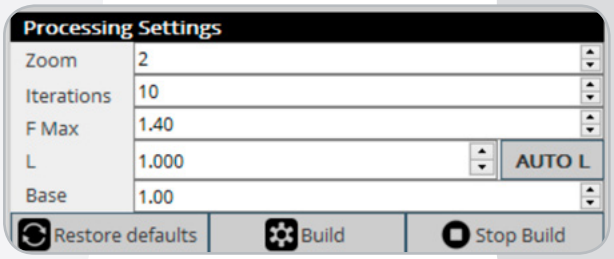
The images on the left are taken in confocal mode and compared to super-resolution mode on the right. The inserts are higher magnifications of the region bounded by the red dashed squares.

Plots of normalized intensity profiles along the red lines.

LiveCodim's software: an intuitive user interface to perform multi-modal imaging and processing.

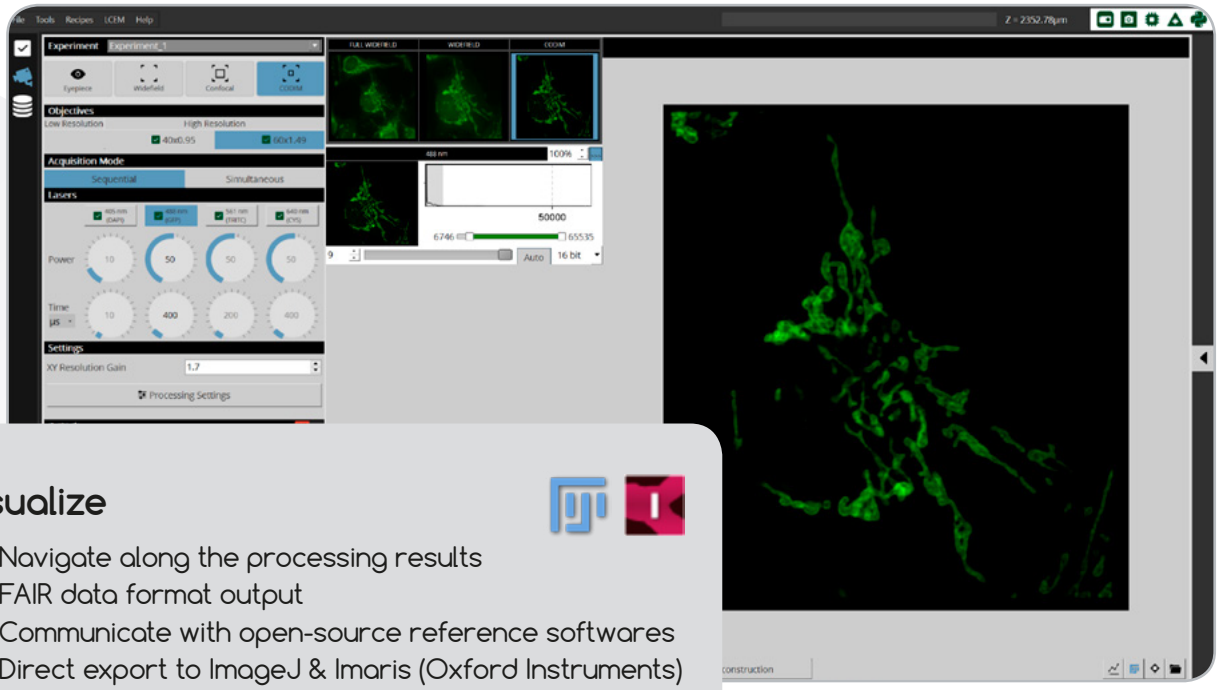
Acquire

- Switch between imaging modes with a click
- Simple interface to define the acquisition settings



Process

- Tune the processing parameters
- Unique reconstruction algorithm
- Fast results thanks to GPU-based acceleration

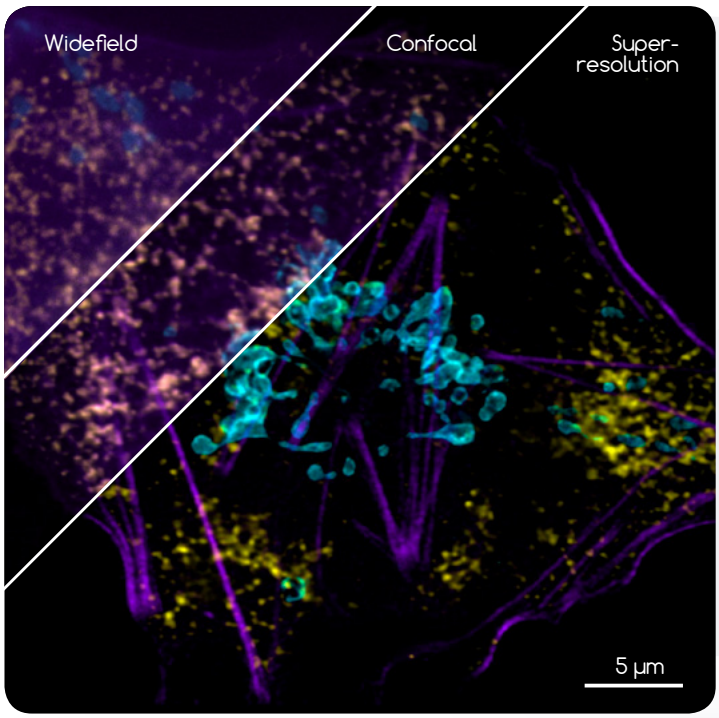


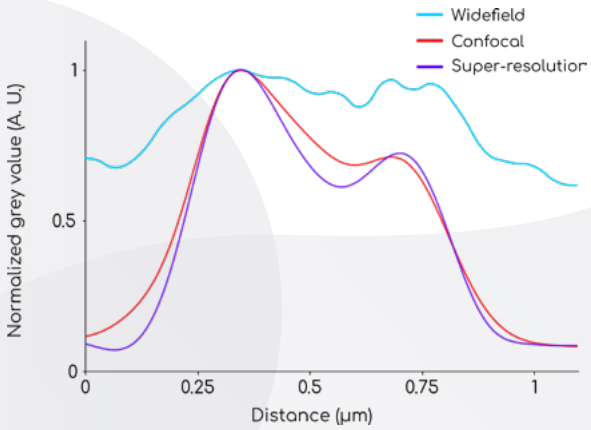
Visualize

- Navigate along the processing results
- FAIR data format output
- Communicate with open-source reference softwares
- Direct export to ImageJ & Imaris (Oxford Instruments)

Resolution improvements

Multicolor LiveCodim images of cellular organelles and actin cytoskeleton





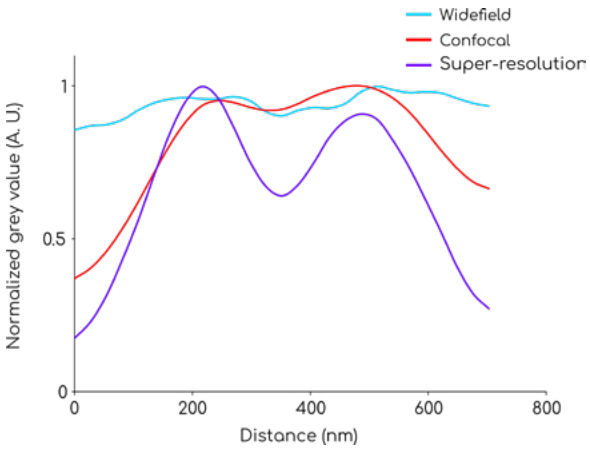
Plot of the normalized fluorescence intensity along a line profile, measured for each of LiveCodim's three imaging modes.

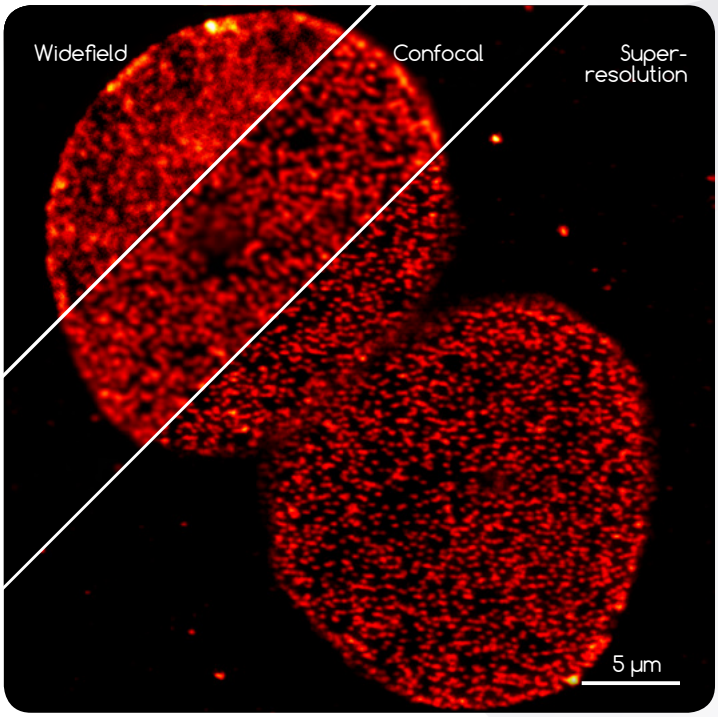
Actin Mitochondria Endoplasmic reticulum

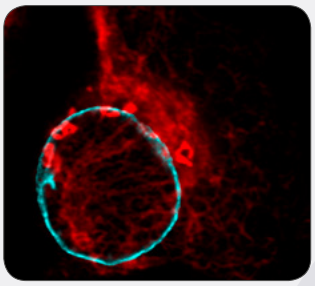
Explore the unseen

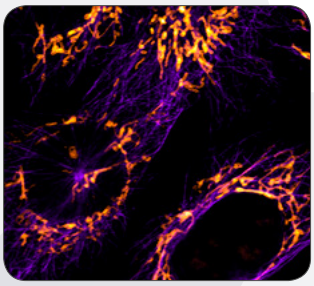
Double your lateral resolution and access the finest details of your samples

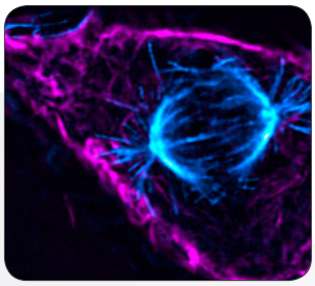
Multi-modal images of the nuclear pore complex

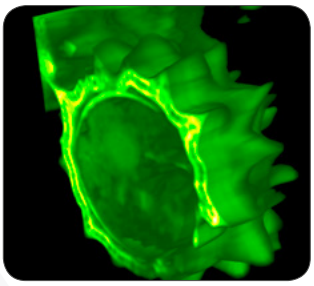


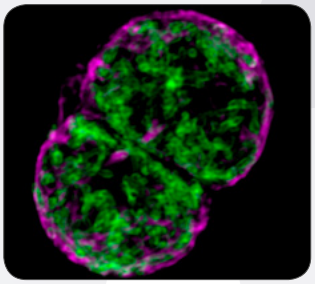


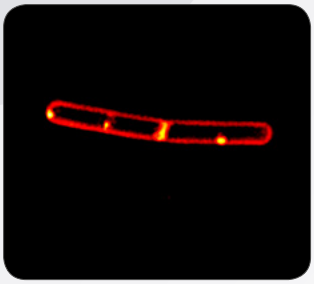

Cell biology

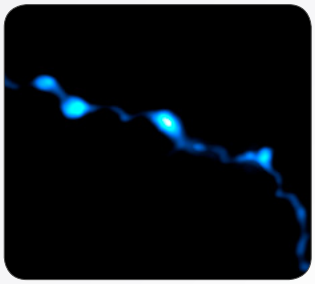

Cytoskeleton dynamics


Cell cycle


Plant biology


Cancer biology


Microbiology


Neurobiology

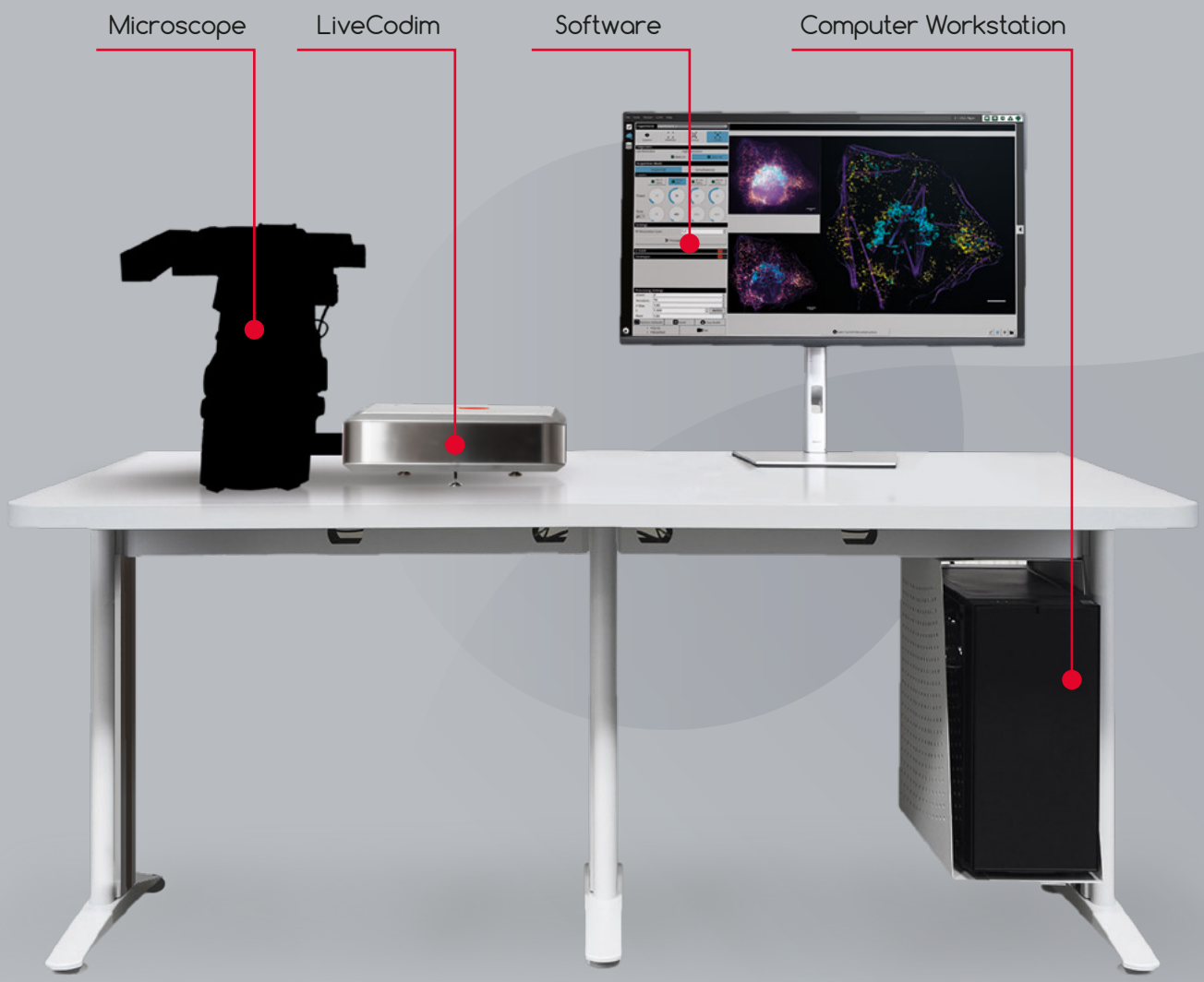
Your sample

Requirements

Inverted microscope with c-mount	Upgrade existing frame like Nikon Ti, Zeiss AxioObserver, Evident IX83, Leica DMi series or any frame supported by MicroManager
Widefield illumination	Examples: CoolLED® or other LED source, metal halide
Filter turret	Motorized
Fluorescence filter cubes	For widefield illumination according to source type and selected laser lines
Objectives	For highest resolution: High NA objectives i.e. 60x/63x 1.49/1.40 NA oil immersion
Z-drive	Motorized
XY stage	Recommended motorized
Anti-vibration table or breadboard	Inch or metric holes

Specifications

Laser lines	405 / 488 / 561 / 640 nm (customizable upon request)
Lateral resolution	Up to 90 nm at 488 nm with a high-NA oil immersion objective, such as TIRF
Axial resolution	Up to 500 nm at 488 nm with a high-NA oil immersion objective
Depth penetration	Up to 500 µm with a long working distance objective, i.e. 25x 1.05 NA
Max scanned field of view	60 x 60 µm with 60x objective
Acquisition speed	2s for 10 x 10 µm
Camera	sCMOS, 96%QE
Mode of operation	point scanning with structured PSF, variable pinhole dimensions
Software	Automated and adaptive super-resolution image processing, fast switching between image acquisition modes, GPU accelerated image reconstruction, intuitive and user-friendly interface
File format	OME-TIFF
Fluorophore compatibility	Visible to near infrared
Dimensions	52 (L) x48 (W) x14.5 (H) cm
Weight	20 kg



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Page 2: Top = Resolution test using 90 nm GATTAQuant nanorulers, acquired with 488 nm laser illumination; Middle = Multi-modal imaging of microtubules, labeled with anti-tubulin-Alexa Fluor 555. From left to right: widefield, confocal and super-resolution resulting images; Bottom = 4-color image of GATTA-Cell 4C, revealing the nucleic acids (purple), mitochondria (cyan), microtubules (orange) and actin (magenta).
Page 3: Center = Images of the 3 patterns of light LiveCodim uses to generate super-resolution images; Bottom = from left to right, widefield, confocal and super-resolution images of intermediate filament (red) and microtubule (cyan) networks of a huVEC cell. Sample courtesy of Claire Leclech - Ecole Polytechnique - Palaiseau.
Page 4: Top left = 3D projection of a z-stack of anti-tubulin-labeled microtubules from deep (violet) to superficial (white) from a human fibroblast (huFIB, GATTA-Cell); Top right = Live cell imaging of an MDCK cell labeled for vinculin (blue) and actin (red). Sample courtesy of Tomáš Grouš – Institute of Microbiology of the CAS – Prague; Center right = Phototoxicity curve for confocal laser scanning microscopy, adapted from Caron *et al*, 2014. The green region represents the range of light intensities used in LiveCodim super-resolution mode; Bottom = outer mitochondrial membrane labeled with anti-TOMM22-Alexa Fluor 488. The images on the left are taken in confocal mode and compared to super-resolution mode on the right; Inserts: Higher magnification of the regions limited by the red dashed squares. Plots of normalized intensity profiles along the red lines. Sample courtesy of Ana Oña - CNB-CSIC - Madrid.
Page 6: Top = HBMEC cells labelled with anti-TOMM22-Alexa Fluor 488 (cyan), phalloidin-TRITC (purple) and anti-PDI-Alexa Fluor 647 (yellow); Sample courtesy of Ana Oña - CNB-CSIC - Madrid; Bottom = Multi-modal image of U2OS cells labelled with anti-Nup96-Alexa Fluor 555 (GATTAQuant®).
Page 7: Cell biology = HeLa cell labeled with anti-lamin A/C-Alexa Fluor 488 (nuclear envelope - cyan) and anti-giantin-Alexa Fluor 647 (Golgi apparatus - red); Cytoskeleton dynamics = huFIB labeled with anti-TOM20-Alexa Fluor 488 (mitochondria, in orange) and anti-tubulin-Alexa Fluor 561 (microtubules, in purple); Cell cycle: mitotic spindle in COS-7 cells labeled with SiR-actin (magenta) and anti-tubulin-TMR conjugated antibodies (cyan); Plant biology: 3D reconstruction of a daisy pollen grain; Cancer biology: COS-7 cells labeled with SiR-actin (magenta) and anti-TOM20-Alexa Fluor 488 (green); Microbiology: *Bacillus subtilis* labeled with Nile Red lipid dye; Neurobiology: cortical neurons expressing GFP captured in mouse brain slices.