Super Resolution for All Types of Live Cell Imaging

SpinSR10
IXploRE

EVIDENT

Spinning Disk Confocal Super Resolution Microscope
Higher Level of Super Resolution Imaging

Designed for live cell imaging with 120-nanometer resolution, the SpinSR10 super resolution imaging system balances speed, resolution, and efficiency in a single, flexible platform. Researchers can observe the fine details and dynamics of cellular structures and processes with the ability to easily switch between super resolution, confocal, and widefield imaging. The system’s advanced confocal technology enables researchers to capture super resolution images with excellent clarity.

Olympus Super Resolution

Olympus super resolution (OSR) technology is fast, easy to use, and can provide images from up to 100 microns deep within a cell in areas that are hard to access using other super resolution modes. Live cell super resolution images of internal cellular structures can be captured with 120 nm resolution from all kinds of samples using conventional fluorescent dyes. Processing on a single confocal image achieves super resolution imaging with minimum data volume as well as high speed.


Images of two adjacent emission points

![Image of two adjacent emission points](image)

Principle of OSR

![Principle of OSR](image)

Dedicated Magnification Changer

Our dedicated magnification changer delivers even illumination across the entire field of view. The changer’s telecentric optical system optimized for the IX83PZ2F inverted microscope maximizes the performance of the objectives during confocal and super resolution imaging while enabling seamless switching between confocal and super resolution.

Motorized Magnification Changer

![Motorized Magnification Changer](image)
Fast Super Resolution Imaging and a Wide Field of View

Instead of painstakingly scanning the entire field of view, the sensitive imaging sensor on the SpinSR10 system captures snapshots of the entire sample area in one step for fast imaging, enabling researchers to observe high-speed biological phenomena. In widefield and confocal mode, the microscope’s optical system has a field number (FN) of 18 to capture images with a larger field of view, while two cameras enable users to simultaneously acquire dual-color super resolution images.

Spinning Disk Delivers Bright Live Cell Imaging

Each confocal pinhole on the disk has a microlens that enables you to image with lower laser power, reducing photobleaching and phototoxicity in your sample while enabling bright super resolution images.

Live Cell Super Resolution Imaging

The SpinSR10 system combines speed, reduced phototoxicity, and stability during time-lapse experiments to create 3D super resolution data that enables users to observe dynamic changes and phenomena within live cells.

Live Super Resolution

The spinning disk confocal optical system acquires live super resolution images at up to 200 frames per second.

Real-Time Super Resolution

High-speed data processing algorithms enable the viewing of super resolution images in a live display window. This enables for real-time viewing of cellular activities compared to other computational super resolution techniques that require post processing before a super resolution image can be displayed.
Two-Color Simultaneous Imaging

The SpinSR10 system can use two cameras simultaneously to provide fast, two-color localization imaging.

Mitotic spindle at metaphase cell

HeLa cells derived from human cervical cancer were fixed and stained for α-tubulin (microtubules, red) and Hec1 (kinetochores, green), respectively. DNA was stained with DAPI (chromosomes, blue). Chromosomes interact with microtubules constituting mitotic spindle via kinetochores assembled on centromere region of chromosomes.

Image data courtesy of: Masanori Ikeda and Kozo Tanaka, Department of Molecular Oncology, Institute of Development, Aging and Cancer

Stereocilia and kinocilia of inner hair cells in the organ of Corti (Actin:Orange, Tubulin:Green):

Image data courtesy of: Hatsuho Kanoh1, Toru Kamitani1,2, Hirofumi Sakaguchi, Sachiko Tsukita1

1 Graduate School of Frontier Biosciences and Graduate School of Medicine, Osaka University
2 Department of Otolaryngology-Head and Neck Surgery, Kyoto Prefectural University of Medicine

Keep Your Samples in Focus

During time-lapse imaging, minute changes in temperature, humidity, and other factors can cause your sample to go out of focus. The TruFocus™ Z-drift compensator uses a low phototoxicity infrared laser to identify the sample plane and adjust the focus for clear time-lapse images. The continuous autofocus function works with glass and even plastic vessels.

Reduced Phototoxicity

The real-time controller (U-RTCE) synchronizes the laser and camera with microsecond illumination accuracy to reduce photobleaching and phototoxicity, helping cells remain healthy during complex experiments.
Observation at Depth
Clearly observe small individual spines on the surface of the sample and up to 100 microns deep within the sample.

Purkinje cells labeled with GFP
XYZ image with confocal and super resolution image in different Z positions. Super resolution images are projected by Z (10 slices). 3D displayed by FV31S-DT.
Image data courtesy of: Yukari Takeo, Michisuke Yuzaki, PhD, Department of Physiology, School of Medicine, Keio University

Image Three-Dimensional Structures
Obtain detailed three-dimensional super resolution image data during time-lapse imaging.

3D time-lapse of neuron
Time-lapse image of mouse primary neuron labeled with EGFP after co-culture with astrocyte for 2 weeks. Easy to see the difference between immature spine (yellow arrow) and mature spine (blue arrow), and detect the morphological change in time. 3D was acquired with exposure time 500 ms/frame, 0.15 µm Z step for 41 slices. Images were acquired every 2 minutes for 1 hour. 3D displayed by FV31S-DT.
Image data courtesy of: Yuji Ikegaya, PhD, Laboratory of Chemical Pharmacology, Graduate School of Pharmaceutical Sciences, The University of Tokyo
The Refractive Index Is Important with Deep Tissue Observation

When working with an oil immersion objective, the difference between the refractive index of the samples and oil results in spherical aberration in deep tissue, causing the resolution to deteriorate and fluorescence to become dim.

When working with a silicone immersion objective, the difference between the refractive index of the samples and silicone oil is minimal. This objective achieves brighter fluorescence images with higher resolution for deep tissue observation.

In deep tissue observation, image quality depends on keeping the refractive index of the sample and immersion medium as close to each other as possible.

Improved Z Resolution

Olympus silicone immersion objectives are designed for deep tissue observation. Observation depth is negatively impacted by spherical aberration caused by refractive index mismatch. The refractive index of silicone oil (ne=1.40) is close to that of living cells or cultured tissue slices (ne=1.38), enabling super resolution imaging of internal cellular structures at tens of micrometers in depth with minimal spherical aberration.

Reduce Spherical Aberration

The remote correction collar unit is used to adjust the lens position within the objective to correct for spherical aberration caused by refractive index mismatch, resulting in dramatically improved signal, resolution, and contrast. The IX3-RCC unit works with any Olympus UIS2 objective that has a correction collar.

Sharp Super Resolution Images

Our TruSight™ deconvolution works with super resolution images to create clear, sharp 3D images.
A Flexible System that Helps Simplify Your Research

celisens™ image analysis software supports the complex experiments conducted with the Spisr10 system. The software’s efficient workflows enable users to effectively manage their data and perform advanced analysis that helps unlock new insights. The system integrates easily into existing protocols without necessitating major changes; labs can continue using their existing sample and labeling protocols.

One System, Three Imaging Modes
Researchers can use the imaging mode that most suits their sample. Users can switch between widefield, confocal, and super resolution, and multicolor imaging with one click to locate areas of interest and then image fine structures.

Easily Switch Observation Methods
The software makes it easy for you to change observation conditions. Switch between fluorescence channels, confocal, super resolution just by clicking a button.

Macro-to-Micro Observation
By easily switching observation methods and objective lenses on the software, it is possible to acquire macro images for observing the entire sample and micro images that enable detailed observation of the target area.

Manage Complex Experiments
The process manager makes it simple to acquire multicolor, Z-stack, and time-lapse images. The programmable graphic experiment manager (GEM) enables users to design more complex automation from a visual interface to support a wide variety of experimental imaging protocols and device triggering. Customize flexible experiment protocols that can be easily changed as needed anytime during the imaging process.
Powerful, Intuitive Image Analysis

cellSens™ imaging software enables various types of numerical data to be extracted from images obtained using the software’s image analysis functions. Straight line distance, boundary length, or the area of a polygon can all be measured. The following additional advanced measurements are also possible:

Analyze Object Information
Analyze information about objects in your images, including the number of objects, area measurement, luminosity, and morphology.

Discriminate Spectrum Overlap
The colocalization function analyzes the fluorescent spectrum and discriminates between overlapping spectra.

Track Time-Lapse Imaging Data
During time-lapse imaging, the tracking function enables users to measure and analyze cell migration, division, and luminosity.
SpinSR10 System Description

The SpinSR10 system is capable of performing widefield, confocal, and super resolution image observation quickly and easily.
## SpinSR10 specifications

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<tr>
<th>Laser Lines</th>
<th>Super Resolution/Confocal Configuration</th>
<th>Confocal Configuration*</th>
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<tbody>
<tr>
<td>405 nm: 50 mW, 445 nm: 75 mW, 488 nm: 100 mW, 514 nm: 40 mW, 561 nm: 100 mW, 640 nm: 100 mW</td>
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| Laser Combiner      | Main combiner: 405 nm, 488 nm, 561 nm, 640 nm + 1 line (445 nm or 514 nm) |
|---------------------| Sub combiner: 445 nm, 514 nm |
|                     | 2x Interlock shutter available |

| Laser Light Control | Direct modulation by U-RTCE, ultra-fast ON/OFF control and intensity modulation with individual laser lines, continuously variable (0 % - 100 %, 1 % increments) |

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<tr>
<th>Scanner</th>
<th>Yokogawa CSU-W1</th>
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<td>Disk Unit</td>
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<td>Camera Port</td>
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<td>Acquisition Speed (Max.)</td>
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<td>Optical Zoom</td>
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<td>Optical Resolution***</td>
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<td>Field Number</td>
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<tr>
<th>Scanner</th>
<th>Super Resolution Imaging</th>
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<td>Optical Zoom</td>
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| Imaging Sensor      | HAMAMATSU ORCA Flash 4.0 V3 (CameraLink) |

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<th>Microscope</th>
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<td></td>
<td>IX83P2ZF motorized inverted microscope</td>
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<tr>
<th>Microscope</th>
<th>Objectives for Super Resolution</th>
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<tr>
<td></td>
<td>UPLSAPO60XS2, UPLSAPO100XS, UPLAPO60XOHL, UPLAPO100XOHR, UPLAXAPO60XO, UPLAXAPO100XO, PLAPON60XOCS2</td>
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<th>Microscope</th>
<th>Super Resolution Adapter</th>
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<td>Confocal/super resolution light path changer (Motorized)</td>
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<th>Imaging Software</th>
<th>cellSens Dimension</th>
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<td>Multi-dimensional acquisition and analysis</td>
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<th>Imaging Software</th>
<th>Super resolution imaging module</th>
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*Confocal configuration is the system without the super resolution function. Can be upgraded to the super resolution/confocal configuration. **Restrictions depend on the disk unit combinations. ***Typical experimental FWHM values with UPLSAPO100XS at 488 nm excitation. SoRa disk with 40 nm diameter beads and 50 μm pinhole disk with 100 nm diameter beads.

## Dimensions

[unit: mm]

1289 | 363 | 660 | 508 | 798

IX83P2ZF + CSUW1-T1S/CSUW1-T2S/CSUW1-T1SR/CSUW1-T2SR/CSUW1-T2SSR + SD-MGCA
Cover image captions:

Left: Cultured epithelial cell. Image data courtesy of: Dr. Huiwen Hao, et al., Standard Imaging Co., Ltd. and Sun Lab, College of Future Technology, PKU.

Center: Actin cytoskeleton (green) and endocytosis-related molecules (red) at the tips of neurites. NG108-15 cells expressing GFP-actin, Endophilin A3-mCherry. Image data courtesy of: Motohiro Nozumi, Michihiro Igarashi, Department of Neurochemistry, Niigata University.

Right: Embryo of chicken intestine-derived cells. Cytoskeleton visualized by mCherry. Image data courtesy of: Yoshiko Takahashi, Rei Yagasaki, Graduate School of Science, Division of Biological Sciences, Kyoto University.

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