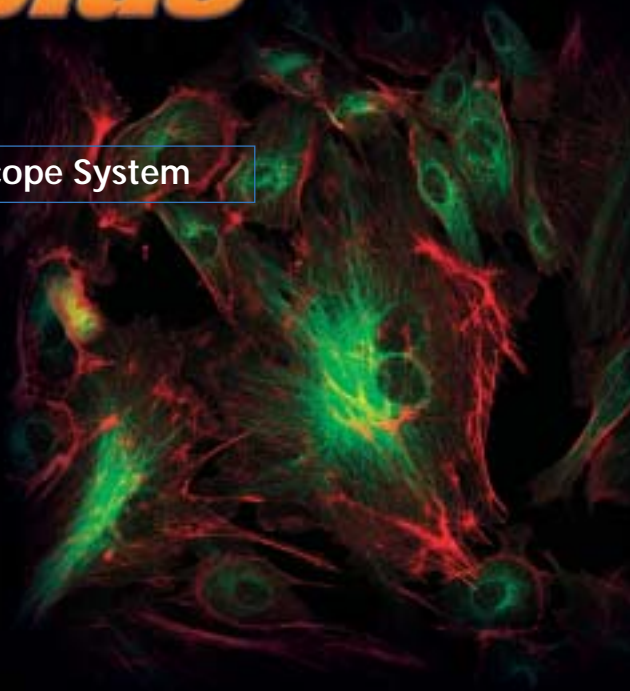
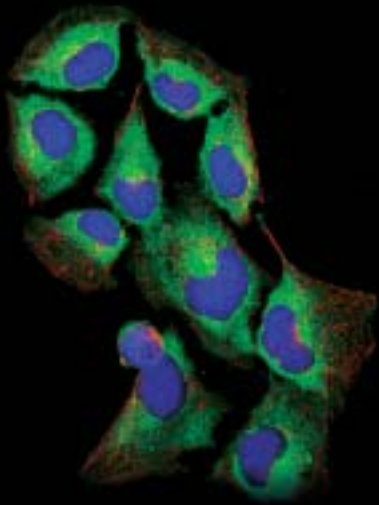




C1plus

DIGITAL ECLIPSE *plus*

Modular Confocal Laser Microscope System

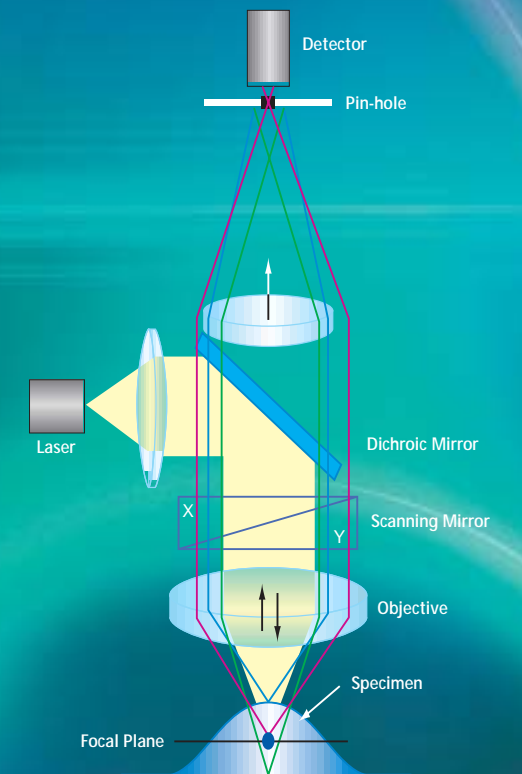


Confocal essentials plus pristine-clear images in a compact body

Nikon, with its long track record as an optical equipment company, drew from its deep pool of leading-edge optical technology to develop the Nikon C1plus. Although compact in size, this microscope system provides all the essentials for confocal microscopy while delivering pristine-clear images. At top-notch research institutes or private labs, the C1plus will perform beyond your expectations.

- High quality images with up to 2048 x 2048 pixel resolution and 12-bit gray scale
- Scan rotation and region of interest (ROI) scanning
- Compact, modular design
- Broad selection of lasers from 405 to 633nm
- Changeable filters to match fluorescent character
- Computer independent design
- Objectives with NA as high as 1.49 and chromatic aberration correction up to the h-line

Basic Principle of Confocal Microscopy



- Extremely high resolving power in the Z-axis direction (depth) makes confocal observation ideal for observing thick specimens such as embryos and eggs.
- Fluorescent-dyed specimens can be rendered in 3D.
- Resolving power on the XY plane is higher than that of ordinary fluorescent images.
- Extremely high S/N ratio images are obtainable.



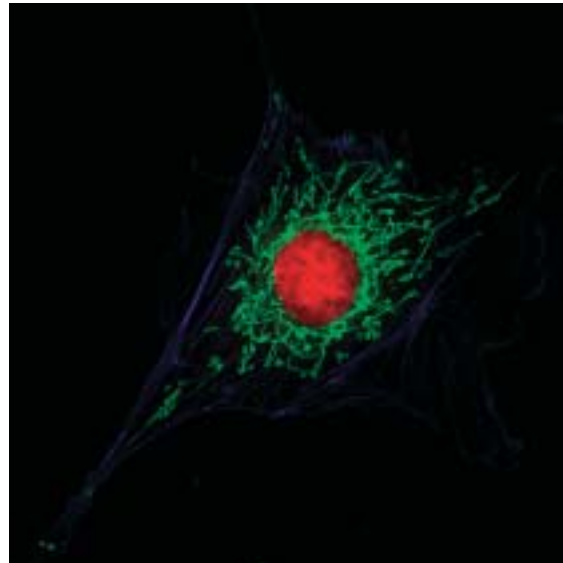
Configured with the ECLIPSE TE2000-E Inverted Research Microscope



Configured with the ECLIPSE 90i Upright Research Microscope

Superior optical performance for the highest level of image quality

High quality images unique to Nikon



The C1plus—the culmination of Nikon's long years of dedication as an optical equipment manufacturer—delivers optical performance of the highest level in this class of confocal systems. With the C1plus, fluorescence images are rendered with unprecedented brightness and DIC images are tack-sharp and of the highest possible contrast. Moreover, it redefines the definition of simple operability.



DIC image



Overlay of DIC and GFP images

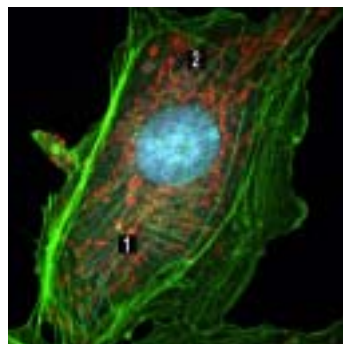
Precision objectives for aberration-free confocal microscopy



CFI Plan Apo VC series objectives correct axial chromatic aberration on the whole visible light spectrum up to 405 nm (h line), making this series perfect for multi-stained confocal observations.

ROI scanning

The mounting of an optional AOM (Acousto Optical Modulator) enables free shape scanning. It is effective for bleaching specific areas in FRAP/FLIP experiments or optical stimulation with a 405nm laser.



Excitation of all areas



Excitation of all but specific areas



Excitation of specific areas only

Compact and easy-to-upgrade modular design

Compact design



All major components are modular, including the scanning head, detector, and laser. Combined with an extremely compact design, this feature makes the microscope's desktop footprint extremely small, so it does not intrude on other peripherals.

Changeable filters for various fluorescence applications

Both excitation and emission filters can be easily changed without any additional adjustment. You can use the appropriate band-pass or long-pass filters to match the fluorescent character of your experiment. This design facilitates the use of the latest probes or dyes available today.



Broad selection of laser options

The C1plus accommodates a greater variety of lasers with wavelengths ranging from 405 to 633nm. It also supports solid-state lasers.



3-laser unit equipped with AOM

Computer independent design

The controller is separate from the computer, enabling the C1plus to function without restrictions. This means you can use nearly any computer you wish, or upgrade your computer to access the latest computer functions available at a given time.

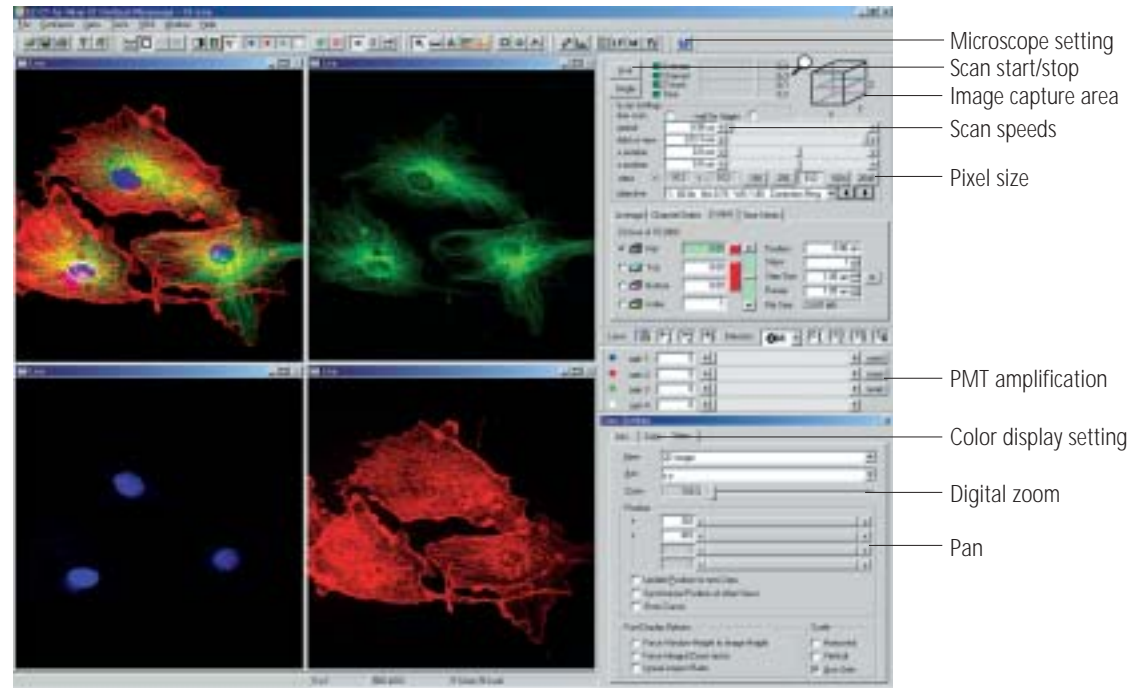
High functionality for a personal confocal system

The C1plus supports a host of sophisticated imaging techniques, including 4-channel simultaneous detection, e.g. 3-channel confocal fluorescence plus transmission DIC, 3D rendering, and time-lapse imaging. All the essentials are packed into this compact, personal-type confocal microscope system, which can also be retrofitted with existing Nikon microscopes.

Seamless image acquisition

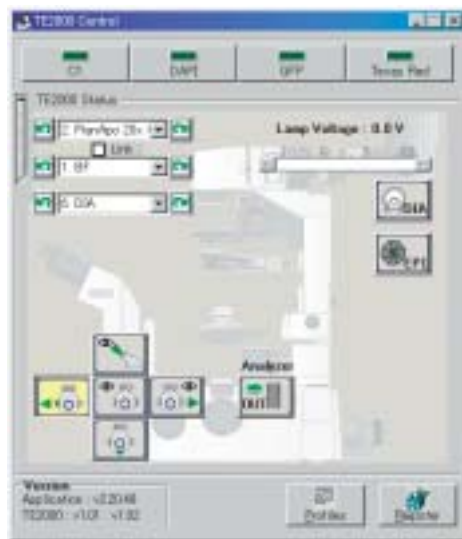
All settings and procedures required for live image capture—fundamentals in confocal microscopy—can be viewed in a single window, eliminating the need for the operator to switch between many windows. The operation panel gives you an at-a-glance picture of all important settings including scan speed, pixel size, zoom/pan, PMT settings, pinhole, shutter, and color image look-up table. With the C1plus, scanning modes are expanded from 2D (XY, YZ, XZ, XT), to 3D (XYZ, XYT), and even further to 4-dimensional (XYZT) scans.

At-a-glance setting panel



Simple switching between confocal and fluorescence observation

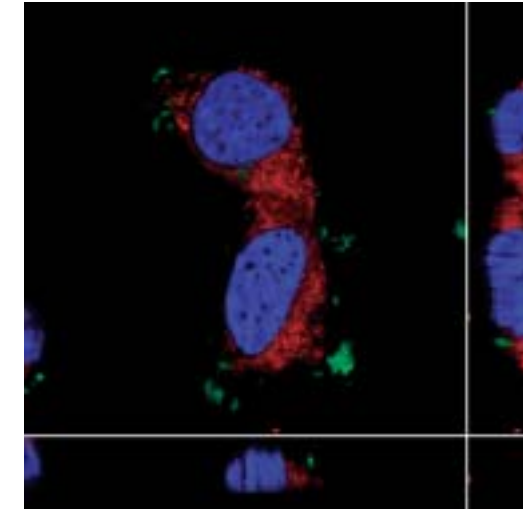
In configuration with a motorized microscope (such as the ECLIPSE TE2000-E and ECLIPSE 90i), confocal and fluorescence observation can be easily switched via a single click on the monitor's operation window. Microscope parameters can also be easily set here.



3D Imaging

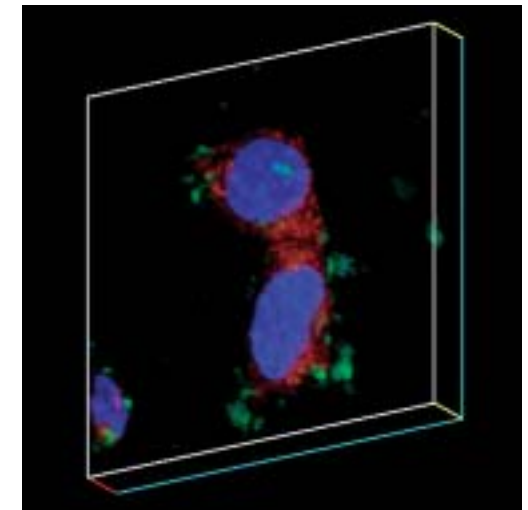
3D imaging

Clear, high-density Z-axis images are obtainable. 3D images provide information about the cross section of a specimen, a feat not possible with ordinary fluorescence microscopy.



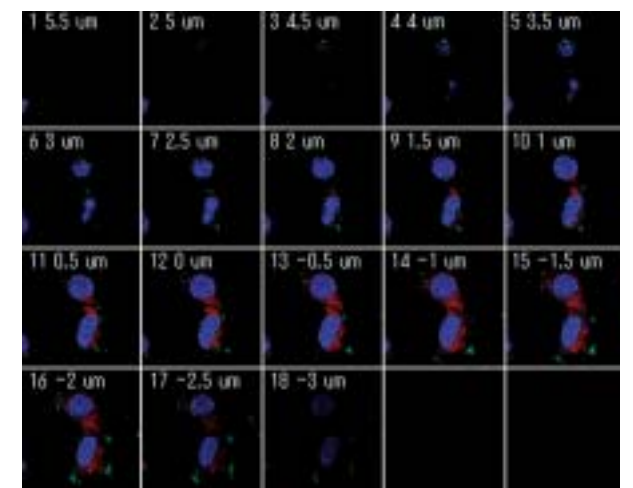
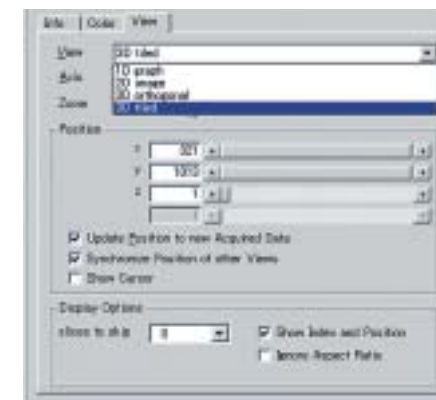
Volume rendering

Angles of 3D images can be freely changed.



3D tile image

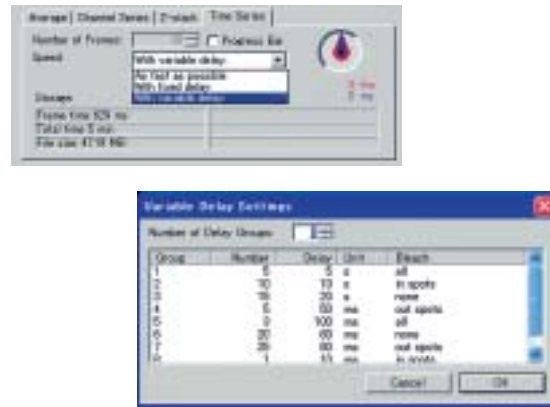
Images with different depth can be viewed simultaneously on a single screen.



Sample: MOCK cell, FITC (Bacteria), DAPI (Nucleolar), MitoTracker Red (Mitochondrial)
 Provided by Prof. Li-Kuang Chen, Department of Virology, Tzu Chi Hospital (Taiwan R.O.C.)

Time-lapse Imaging

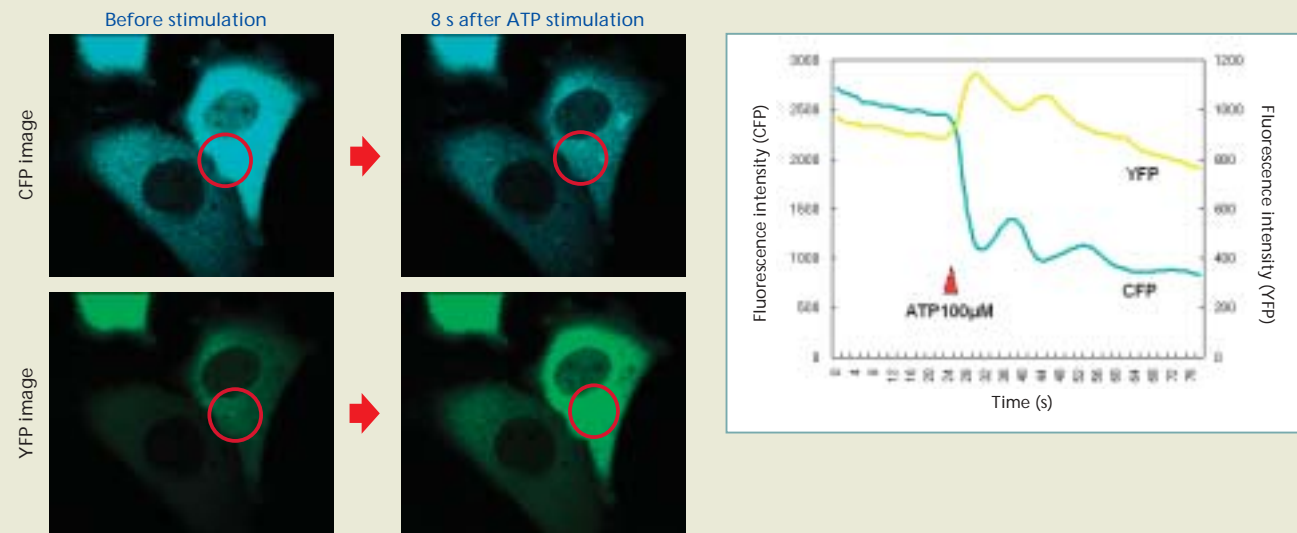
A new time-lapse feature with variable interval times allows you to capture highly detailed time series images. In a single time-lapse observation you can set multiple interval times and number of frames for capture, then perform these in sequence to capture arbitrary numbers of images at irregular intervals. This system enables optimum time-lapse imaging for individual experiments, such as the recording of changes in fluorescence intensity in FRET analysis and similar experiments.



Time-lapse imaging and analysis in FRET experiments

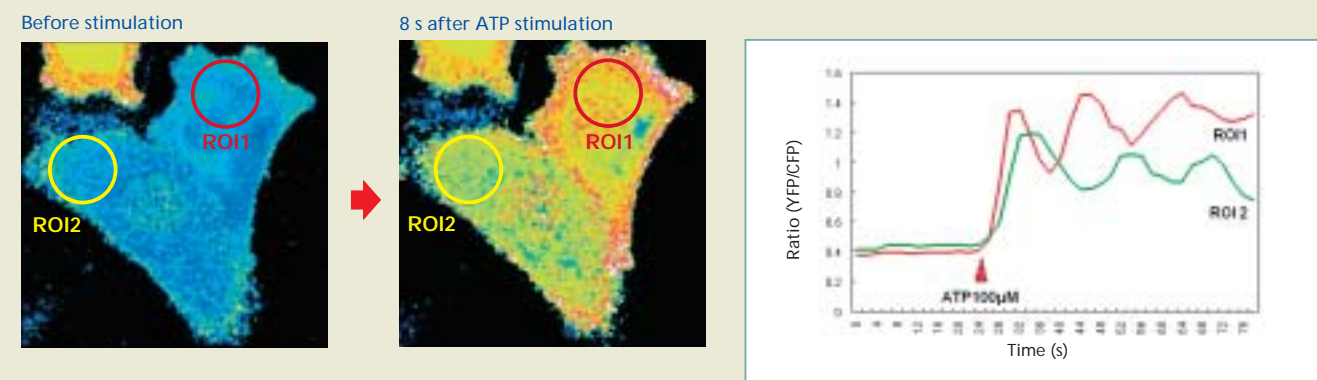
Changes in fluorescence intensity of CFP and YFP over time

Cells in which Yellow Cameleon had been expressed were excited with visible light (408nm) and their fluorescent images captured with a spectral detector. Changes in fluorescence intensity of CFP and YFP can be visualized by using respective filters.



YFP/CFP fluorescence intensity ratio analysis

It is possible to analyze intracellular Ca^{2+} concentration change over time in separate ROIs in FRET experiments (1, 2) without excessive fading.



Pictures taken in cooperation with Dr. Takashi Sakurai and Prof. Susumu Terakawa, Photon Medical Research Center, Hamamatsu University School of Medicine

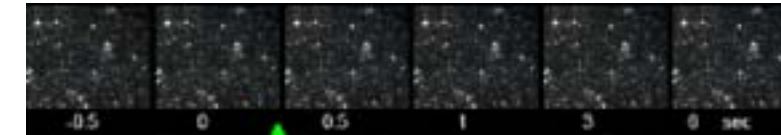


Confocal microscope with Perfect Focus system—C1plus-PFS

This system incorporates an automatic focus maintenance mechanism—Perfect Focus System (PFS)—to continuously correct focus drift caused by temperature changes resulting from reagent droplets or prolonged imaging. It therefore offers a stable platform for days and hours of confocal time-lapse imaging. PFS automatically detects the coverslip surface in real time and, using low intensity infrared LED, maintains focus by tracking this plane and resetting focus.

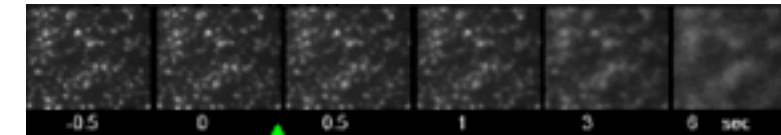
Correction to focus drift caused by expansion/contraction of the plastic dish when reagents are added

•PFS on



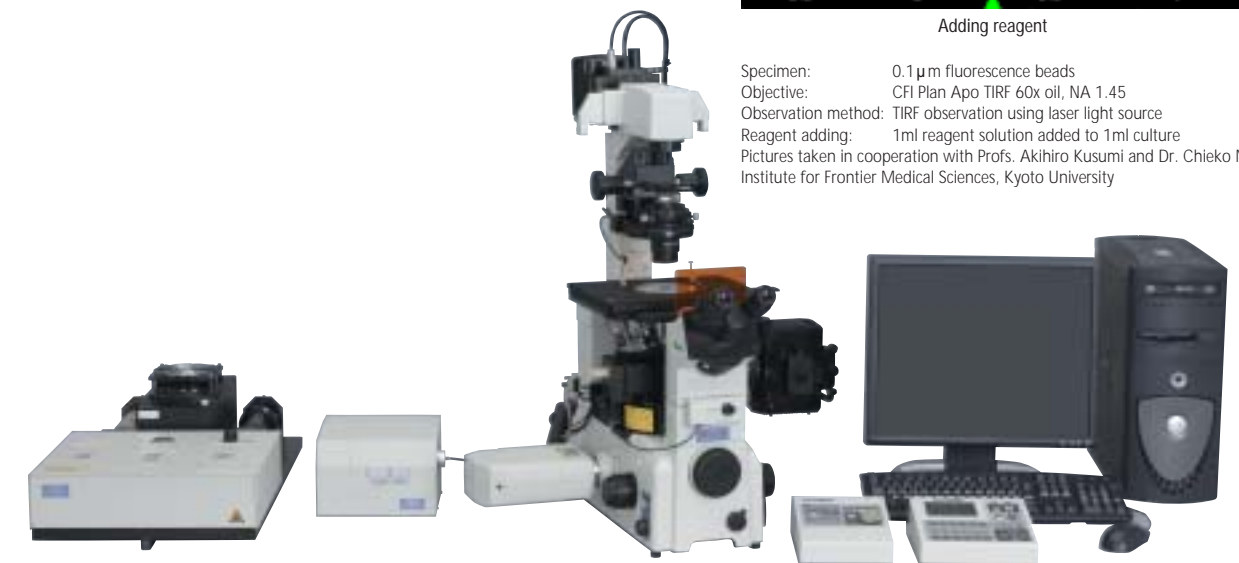
Adding reagent

•PFS off



Adding reagent

Specimen: 0.1 μ m fluorescence beads
 Objective: CFI Plan Apo TIRF 60x oil, NA 1.45
 Observation method: TIRF observation using laser light source
 Reagent adding: 1ml reagent solution added to 1ml culture
 Pictures taken in cooperation with Profs. Akihiro Kusumi and Dr. Chieko Nakada, Kusumi Office, Institute for Frontier Medical Sciences, Kyoto University



Microscope Culture Equipment—INU series

Temperature of the stage, water bath, cover, and objective lens is controlled, allowing living cells to be maintained for three days. A transparent glass heater prevents condensation, and loss of focus due to heat expansion on the stage surface is prevented, making this system ideal for lengthy time-lapse imaging applications.

Manufactured by Tokai Hit Co., Ltd.



FRAP (Fluorescence Recovery After Photobleaching)

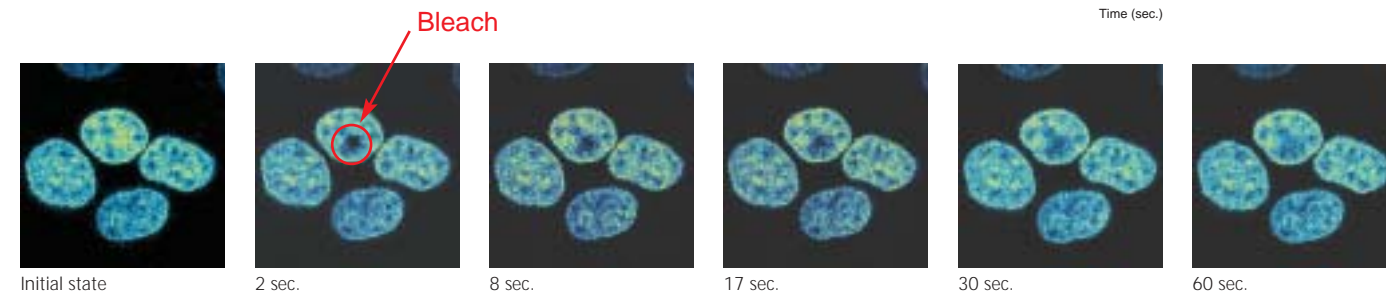
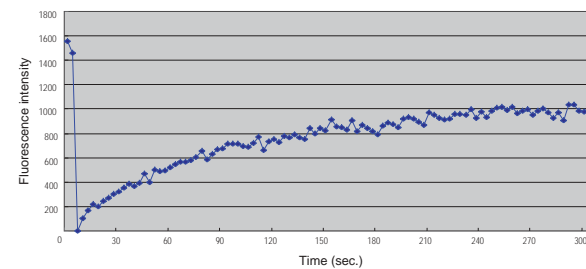
You can use the optional acousto-optical modulator (AOM) to perform high-speed laser switching. This allows you, for example, to make a scan of the ROI in any shape, which is useful for FRAP/FLIP experiments. After bleaching only a specific area, you can measure changes in fluorescence intensity over time to observe the recovery process through changes in fluorescence accompanying cell movement.

The ease with which laser intensity can be adjusted means that you can make fine adjustments in the intensity of individual fluorescent markers in multi-stained specimens by controlling excitation laser output in increments of 0.1%. This system facilitates FRAP/FLIP protocols with optimal laser and scan control.



FRAP experiment (HeLa cell histone GFP)

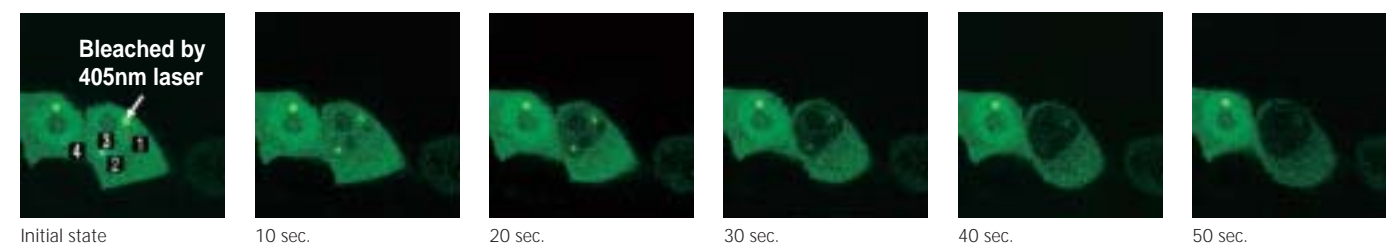
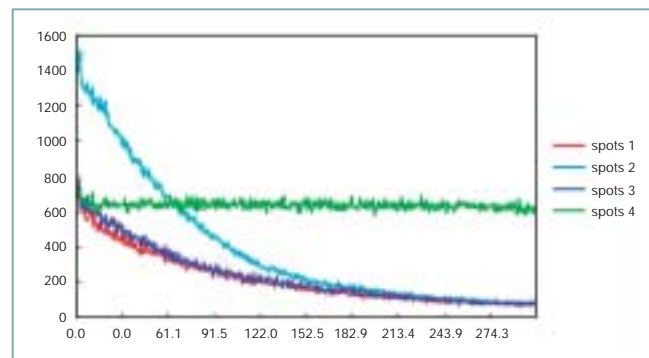
Part of a specimen in which H1 Histone-GFP in the nuclei of HeLa cells is expressed and the recovery of fluorescence intensity is observed in time-lapse recording.



Initial state 2 sec. 8 sec. 17 sec. 30 sec. 60 sec.
Specimen provided by Hiroshi Kimura, Horizontal Medical Research Organization, Faculty of Medicine, Kyoto University

FLIP (Fluorescence Loss in Photobleaching)

You can sequentially bleach and observe the region of interest (ROI) in a cell. This allows you to repeatedly bleach the desired area, and then observe how the fluorescence intensity of the unbleached areas is changing, which is useful for obtaining data about fast moving molecules or observing the permeability of fluorescent substances in a nuclear membrane.



Initial state 10 sec. 20 sec. 30 sec. 40 sec. 50 sec.
Specimen: Expression of P protein of BDV in which GFP has been fused to human-derived glia cells infected by BDV (Borna disease virus)
Images courtesy of Dr. Keizo Asanaga, Dept. of Virology, Research Institute for Microbial Diseases, Osaka University

Multimode Imaging

One microscope supports various imaging modalities, including confocal, TIRF, and epi-fluorescence, allowing you to make simultaneous observations of cells in the same field of view. This allows the investigation of single molecular dynamics of a cell in greater detail utilizing its 3D sectioning images.

Multimode imaging system—TIRF-C1

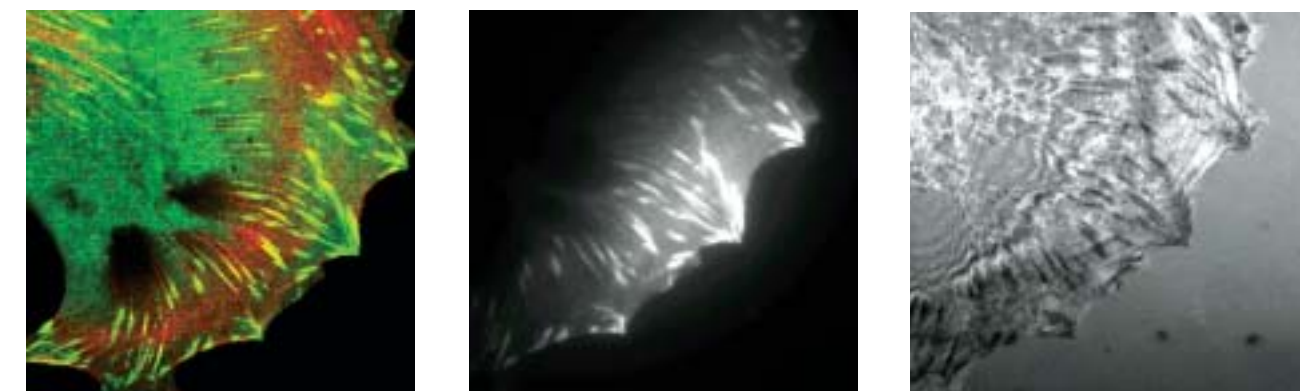
The TIRF-C1 combines the TE2000-E Motorized Inverted Research Microscope, the C1plus, and the TIRF2 laser TIRF system. The TIRF2 integrates a TIRF laser illumination module and an epi-fluorescence module using white light. Users can easily switch between the two light sources and make alignment adjustments as well. The system also includes a surface reflective interference contrast (SRIC) imaging function, allowing you to check the adhesion of cells to the glass before TIRF imaging. Laser TIRF imaging achieves images with an extremely high S/N ratio, enabling observations of single molecules. When combined with the sectioning capabilities of the C1plus, this allows for multi-perspective cellular analysis.



Digital camera is an option.

Comparison of mouse bone marrow stroma cell (ST2 cell) images taken by multimode imaging

After fixing in 4% formaldehyde, cells were treated with 0.25% Triton X-100 before double staining with paxillin antibodies and TRITC-phalloidin.



Confocal image

This shows the basal portion of the cell. A clear band of substantial F-actin (red) is shown at the leading edge of the cell, which is migrating toward the right side. Paxillin molecules are green. Stress fibers are facing the rear of the cell.

TIRF image

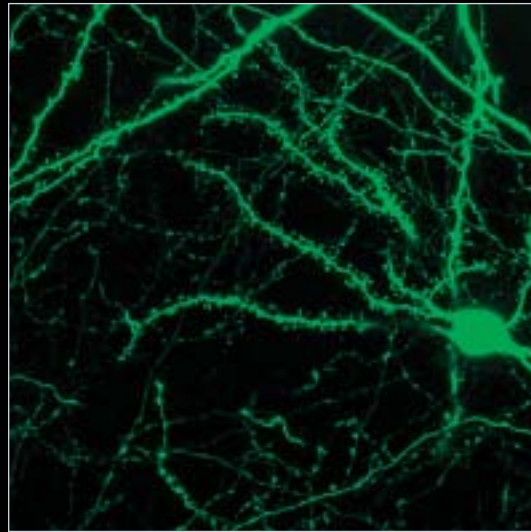
Strong and clear fluorescence derived from paxillin is observed in the evanescent field. The focal adhesions existing at the portion of cells in contact with the coverglass were clearly confirmed.

SRIC image

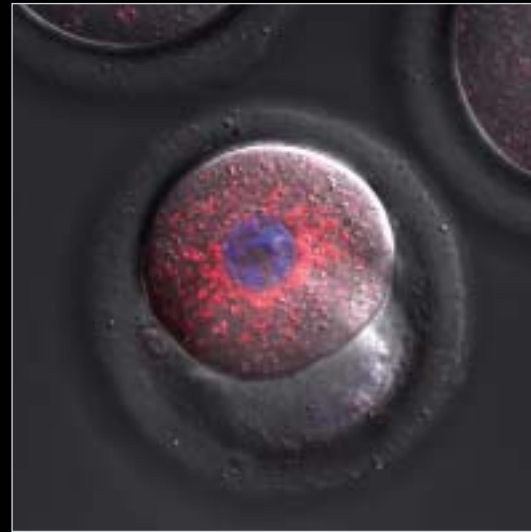
This SRIC image was observed using a conventional epi-fluorescence microscope with a simple modification. The black area is closest to the coverglass, and indicates the presence of paxillin molecules (focal adhesion). This method is available for identifying the portion of a cell in contact with the coverglass prior to TIRF imaging.

Images courtesy of Shuichi Obata, Ph.D., Kitasato University

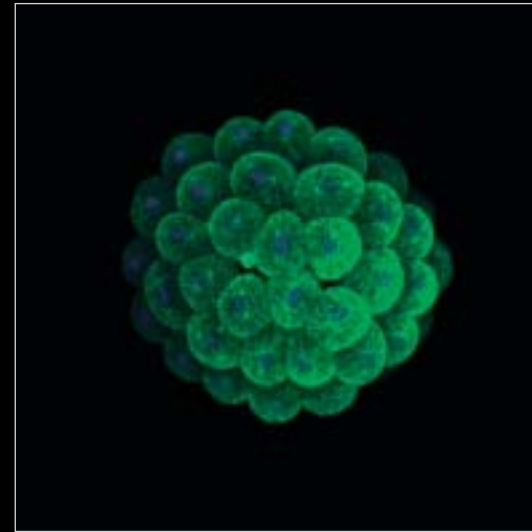
Confocal image gallery



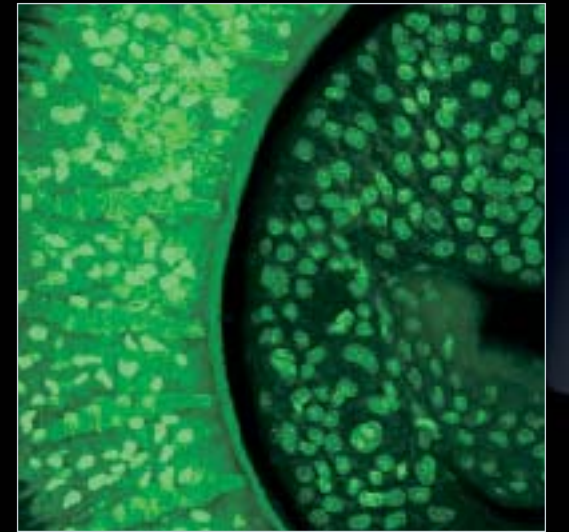
Specimen: sliced hippocampus of a transgenic rat (image of a nerve in the spine)
 Courtesy of Dr. Hu Qian, Chinese Academy of Science



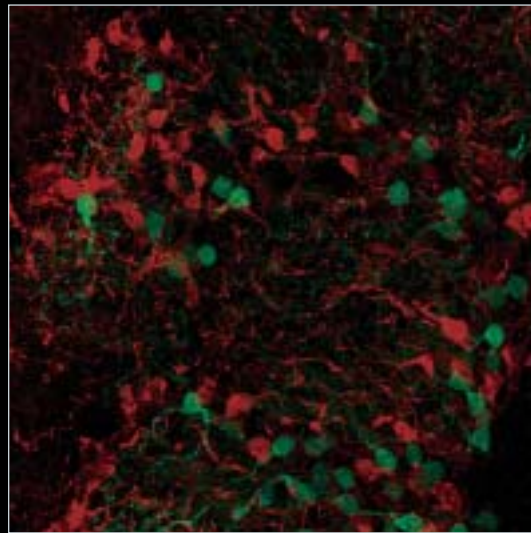
Specimen: living mouse egg, Hoechst3342 (nucleus) and MitoTrackerOrange (mitochondria)
 Courtesy of Dr. Atsuo Ogura and Dr. Hiromi Miki, RIKEN Tsukuba Institute, RIKEN BioResource Center, BioResource Engineering Division



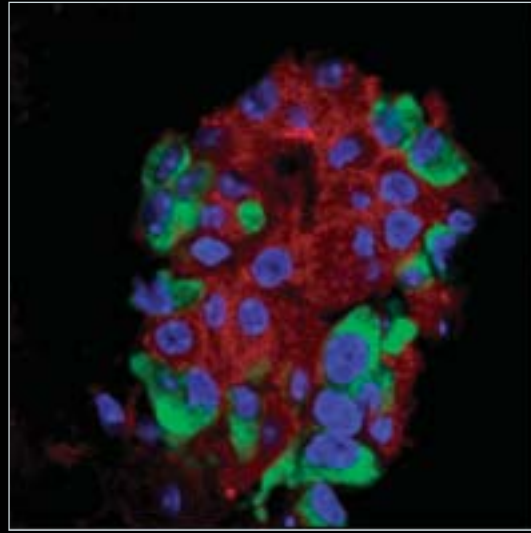
Specimen: embryo of Branchiostoma belcheri; network of an intracellular microtubulin
 Courtesy of Prof. Kinya Yasui, Assistant Prof. Kunifumi Tagawa, Marine Biological Laboratory, Hiroshima University Graduate School of Science



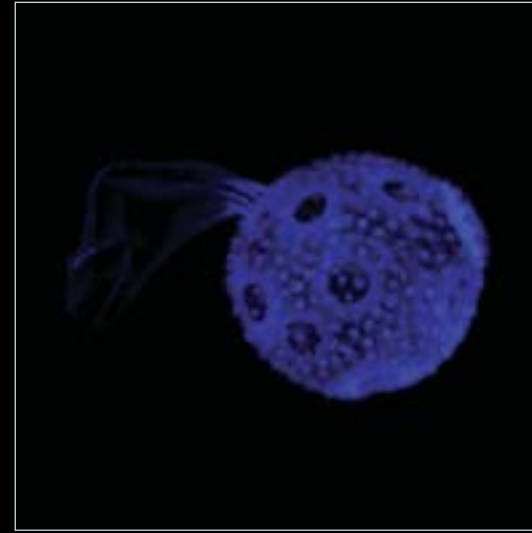
Specimen: argulus acetabulum
 Courtesy of School of Environmental Sciences and Development, North-West University, South Africa



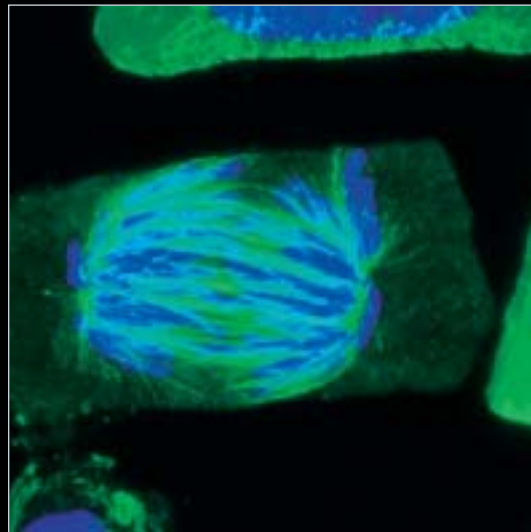
Specimen: rat's olfactory bulb stained with FITC, mouse monoclonal anti-calbindin antibody, Cy3 goat polyclonal anti-calretinin antibody
 Courtesy of Assistant Prof. Kazunori Toida, Department of Anatomy and Cell Biology, Institute of Health Biosciences, the University of Tokushima Graduate School



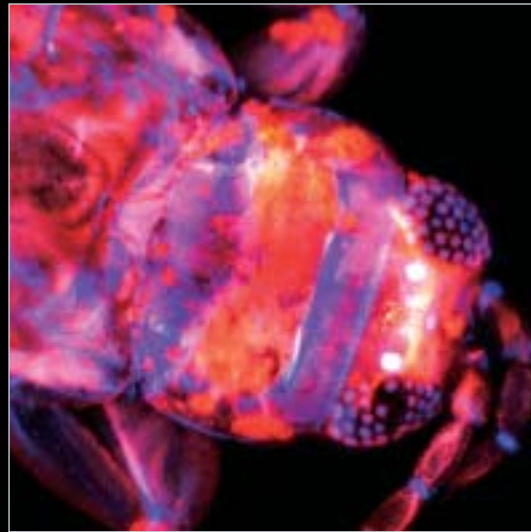
Specimen: pancreas islet cell stained with Alexa488,546
 Courtesy of Dr. Ulf Ahlgren, Umea University, Sweden



Specimen: fungus spore
 Courtesy of Prof. Rudi Verhoeven, Department of Plant Sciences, University of Free State Bloemfontein, South Africa



Specimen: cells of an onion root, Hoechst33258, OregonGreen488
 Courtesy of Dr. Yoshinobu Mineyuki, Department of Life Science, Graduate School of Life Science, University of Hyogo



Specimen: thrips, 408nm/488nm/543nm excitation
 Courtesy of Dr. Steve Cody, Ludwig Research Center



Modules

Compact modular design takes up less space and allows more freedom in layout. It does not intrude upon peripheral equipment.



Standard fluorescence detector

Has the flexibility to handle a variety of modes, including simultaneous 3-channel fluorescence observation or simultaneous 3-channel + diascopic DIC observation. Filters are all exchangeable, so new probes and dyes can be used with no hassle.



Scanning head

Scan rotation ability allows scanning of long, thin specimens such as neurons without rotating the stage. Bi-directional scanning increases scanning speed and captures rapid changes in the specimen.



AOM controller

AOM (Acousto-Optical Modulator) regulates laser power within a specific ROI. Laser power can be fine tuned easily. This allows for fine tuning of brightness for individual fluorescent labels in multi-stained specimens or critical regulation of power for photobleaching or photoactivation.



Laser unit

Now more laser lines than ever can be used, with a greater degree of freedom in selecting laser frequency. A Multi Argon laser (488/514 nm) is available for YFP, while a 408 nm laser is available for DAPI and CFP. Laser illumination can be restricted to the ROI, so FRAP is possible as well.



Z focus module

Super-precise focusing is possible with a minimum focal adjustment of 50 nm. You can easily accomplish a host of image acquisition settings from the software, including combinations of space and time axes (XYZ, XYZT, etc.).



Diascopic detector

High quality DIC images can be obtained simultaneously with confocal fluorescence images. Both images can be superimposed to aid in image analysis such as locating fluorescence labels. Compact and retrofittable to microscopes, this detector is available as either a motorized (pictured) or manual type.

Superb selection of CFI60 series of objectives

CFI Plan Apochromat VC series

Perfectly suited for digital imaging

These top-of-the-line objectives achieve both full correction of chromatic aberration in the visible range and high peripheral resolution. They are perfect for digital imaging, which requires uniform resolution from the image center to the periphery. These objectives remove aberrations in the peripheral visual field and also eliminate shading, resulting in images that are sharp all the way to the edges, a feature absolutely necessary when stitching images together.

Fluorescence observation of organic tissue

These lenses boast exceptional optical performance in brightfield, DIC, and multi-stained fluorescence observations. In addition to the chromatic aberration correction range (435-660 nm) of the previous Plan Apo series, axial chromatic aberration has been corrected up to 405 nm (h line), making this series appropriate for confocal observations. The 60x WI lens achieves high spectral transmittance in the UV range, making it optimal for fluorescence observation of living cell tissue culture.



CFI Plan Apo VC 100x oil/1.40 (left)
CFI Plan Apo VC 60x oil/1.40 (middle)
CFI Plan Apo VC 60x WI/1.20 (right)

CFI Apochromat TIRF series

Objectives with world's highest NA of 1.49

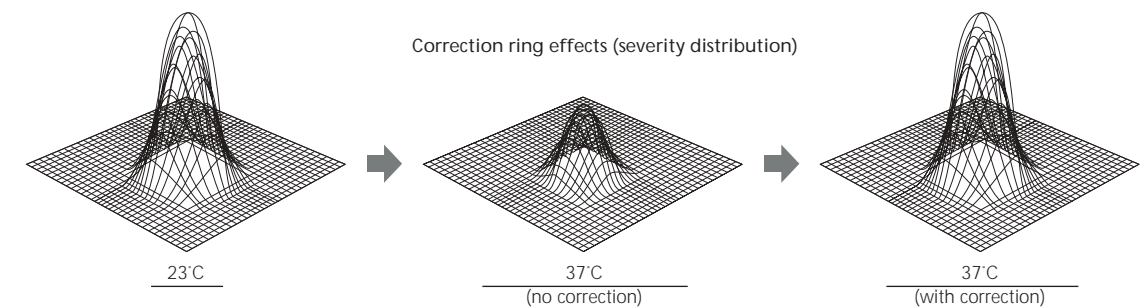
These new objectives boast an unprecedented NA of 1.49 even when a standard coverslip and immersion oil are used, producing optimal images for live cell imaging.

World's first temperature correction ring

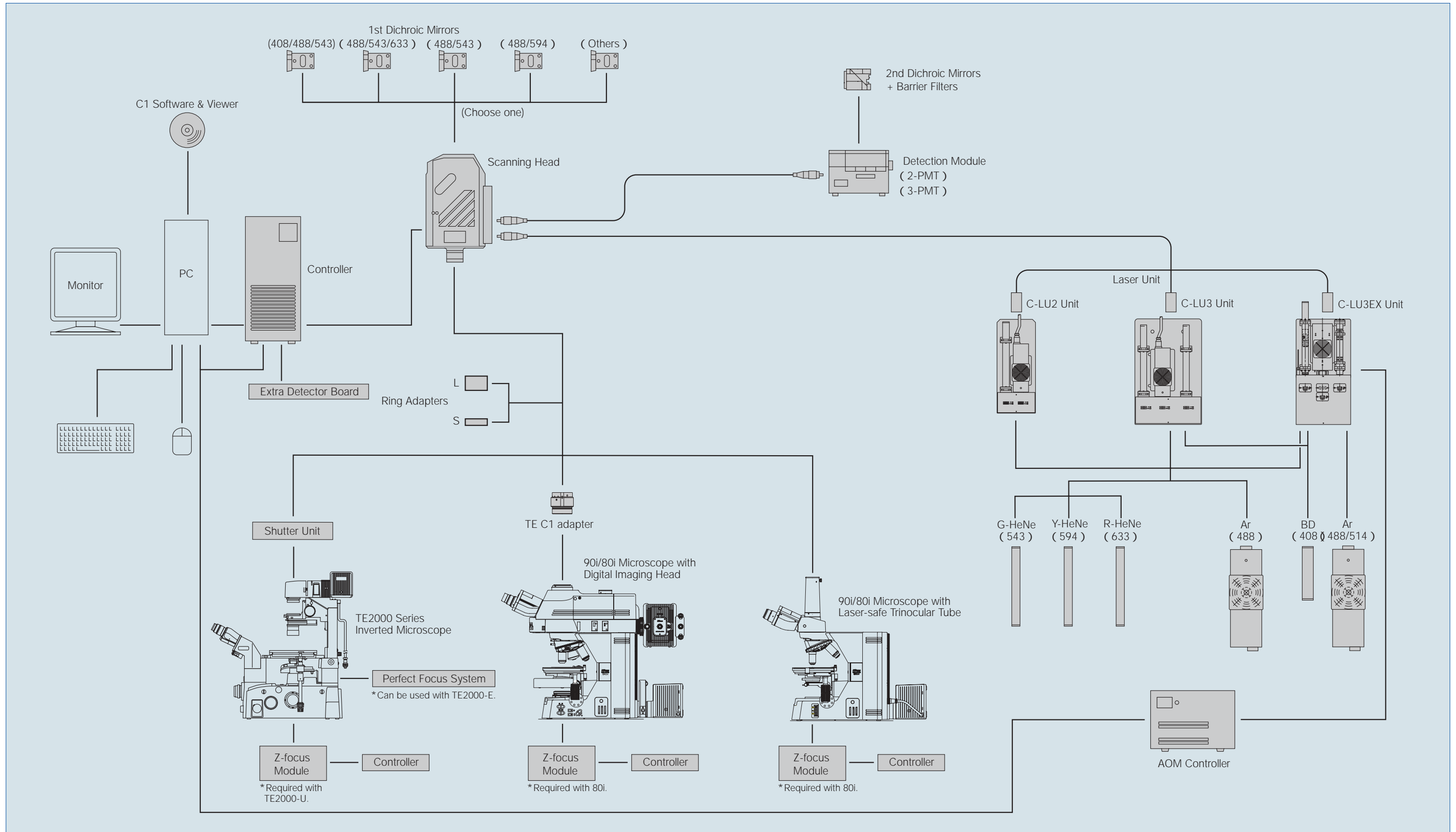
Both of these lenses utilize the world's first temperature correction mechanism. Changes in the refraction index of the immersion oils resulting from changes in temperature affect image quality. With these lenses, this change can be easily corrected with a correction ring in the range of 23°C (room temperature) to 37°C (incubation temperature). The correction ring is also effective in improving visualization of fine structures in DIC and epi-fluorescence microscopy, making this lens optimal for laser tweezers microscopy as well. As this lens allows for correction of the slight optical degradations that arise from temperature and coverglass thickness changes, improving observation quality on a consistent basis is possible.



CFI Apo TIRF 60x oil/1.49 (left)
CFI Apo TIRF 100x oil/1.49 (right)



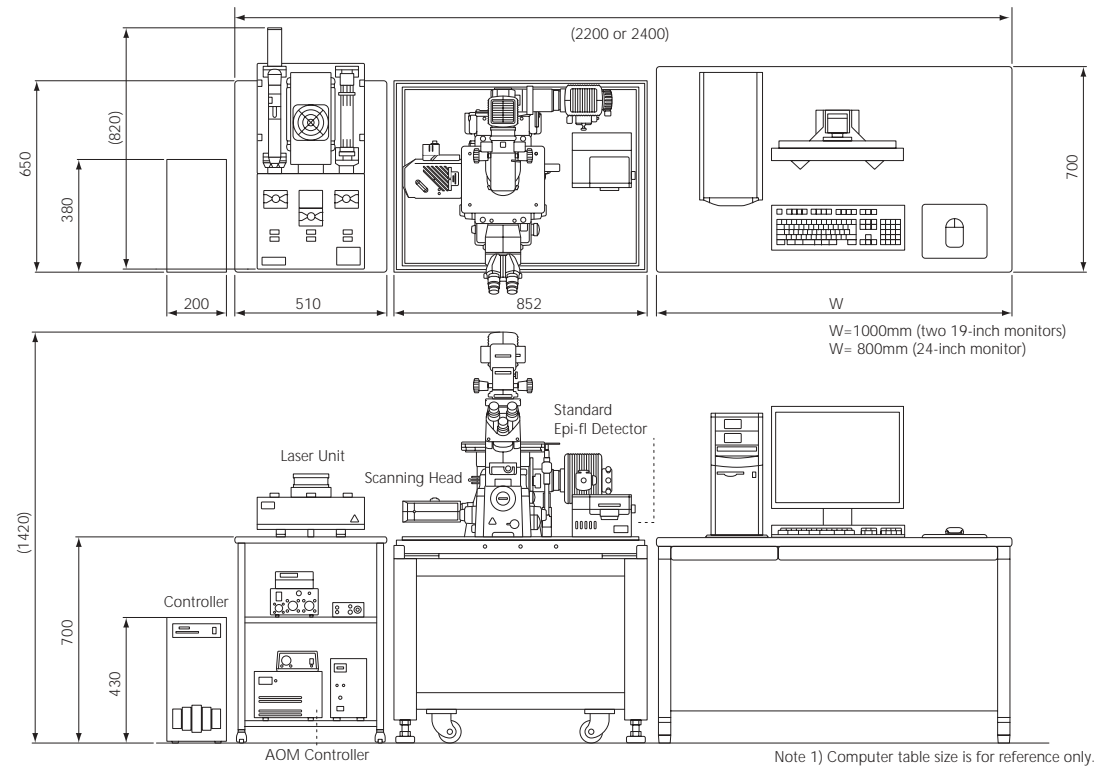
System diagram



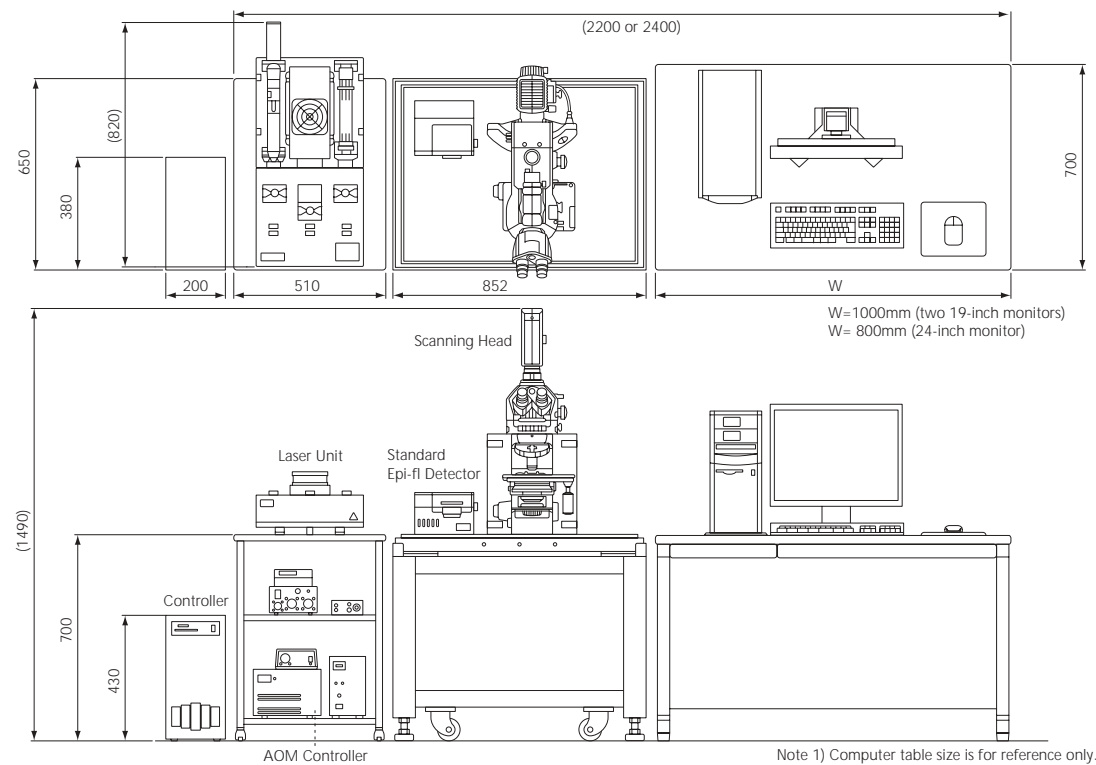
Recommended layout

In mm

Combination with the Inverted Microscope TE2000-E/TE2000-U



Combination with the Upright Microscope ECLIPSE 80i/90i



Specifications

Laser unit	Laser type	V-LD (408) (405), Ar (488), Multi-Ar (488/514), G-HeNe (543), Y-HeNe (594), R-HeNe (633) *When using laser wavelengths other than the above, consult Nikon or its distributors. Up to 3 lasers mountable, Continuously variable laser intensity with Manual/PC control (with AOM), Motorized mechanical laser shutter (each laser)
Standard fluorescence detector	Channel	3 fluorescence channels + 1 transmission diascopic DIC channel
	Dichroic mirrors	Interchangeable
Pinhole	Variable	3 pinhole size steps + Open, motorized switching
Scanning head	Display mode	160 x 16 to 2048 x 2048 pixels
	Scanning speed	Standard: 1 sec. (Bi-directional: 0.7 sec.) for 512 x 512 pixels
	Scanning mode	2D: X-Y, X-Z, Y-Z, X-T, 3D: X-Y-Z, X-Y-T, 4D: X-Y-Z-T, Special modes: Band-scan, Area-scan, Line-scan, Scan rotation, ROI scan (AOM is necessary)
	Optical zoom	Continuously variable from 1x to 1000x
	F. O. V.	Square inscribed in a $\phi 18\text{mm}$ circle
Image bit depth		12 bits
Diascopic detector (option)		1 channel (motorized or manual)
Compatible microscopes	Upright type	ECLIPSE 90i, 80i, E1000*, E800*, E600*
	Inverted type	ECLIPSE TE2000-PFS, TE2000-E, TE2000-U
	Fixed stage type	ECLIPSE FN1, E600FN*
Z-axis motor (option)	Built-in microscope motor	ECLIPSE 90i, E1000, TE2000-PFS, TE2000-E
	External motor	Stepping motor, 50nm step
Compatible PC	OS	Windows® 2000/Windows® XP Professional
	Interface	Ethernet
Analysis software		Time-lapse, Sequential channel, 3D imaging, Volume rendering, etc.
Power consumption	C1plus system	775W (PC, monitor, C1plus controller, AOM controller)

*Motorized diascopic detector cannot be attached

Combination Examples of Lasers and Filters According to Dye

Dual Stain

B excitation	G excitation	Laser 1	Laser 2	Filter set
FITC or Alexa 488	TMR or Cy-3	Ar (488)	G-HeNe (543)	1st DM: 488/543 2nd DM: 530 Em filter: 515/30, 570LP
FITC or Alexa 488	Texas Red or Alexa 594	Ar (488)	Y-HeNe (594)	1st DM: 488/594 2nd DM: 565 Em filter: 530/50, 610LP

Triple Stain

V excitation	B excitation	G excitation	Laser 1	Laser 2	Laser 3	Filter set
DAPI	FITC or Alexa 488	TMR or Cy-3	V-LD (408)	Ar (488)	G-HeNe (543)	1st DM: 408/488/543 2nd DM: 480 3rd DM: 530 Em filter: 450/35, 515/30, 605/75
B excitation	G excitation	R excitation	Laser 1	Laser 2	Laser 3	Filter set
FITC or Alexa 488	TMR or Cy-3	Cy-5	Ar (488)	G-HeNe (543)	R-HeNe (633)	1st DM: 488/543/633 2nd DM: 530 3rd DM: 625 Em filter: 515/30, 585/40, 665LP

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Yokohama Plant



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