Modular Confocal Laser Microscope System
DIGITAL ECLIPSE C1plus

Nikon

C1

DIGITAL ECLIPSE

plus

Modular Confocal Laser Microscope System

CFi®60
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

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 90i Upright Research Microscope

- Detector
- Pin-hole
- Laser
- Dichroic Mirror
- Objective
- Scanning Mirror
- Specimen
- Focal Plane

Configured with the ECLIPSE TE2000-E Inverted Research Microscope

- 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.
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.

Precision objectives for aberration-free confocal microscopy

CF 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.

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.

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.

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.

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.)
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.

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.

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.

---

**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.

---

**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 TRF 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 SN ratio, enabling observations of single molecules. When combined with the sectioning capabilities of the C1plus, this allows for multi-perspective cellular analysis.

**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.

---

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

---

**Images courtesy of Dr. Keizo Asanaga, Dept. of Virology, Research Institute for Microbial Diseases, Osaka University**

---

**Images courtesy of Hiroshi Kimura, Horizontal Medical Research Organization, Faculty of Medicine, Kyoto University**

---

**Digital camera is an option.**

---

**Images courtesy of Dr. Koito Asanaga, Dept. of Virology, Research Institute for Microbial Diseases, Osaka University**
Confocal image gallery

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

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

Specimen: living mouse egg, Hoechst3342 (nucleus) and MitoTrakerOrange (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, Institute of Environmental Studies, University of Tokushima Graduate School

Specimen: argulus acetabulum
Courtesy of School of Environmental Sciences and Development, North-West University, South Africa
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 (UV 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 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 coverslip thickness changes, improving observation quality on a consistent basis is possible.
**Recommended layout**

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

- **Controller**
- **Laser Unit**
- **Scanning Head**
- **Standard Epi-fl Detector**

**Combination with the Upright Microscope ECLIPSE 80i/90i**

- **Controller**
- **AOM Controller**

**In mm**

---

**Specifications**

**Laser unit**
- Laser type: V-LD (408), 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:

**Optical zoom**
- Continuously variable from 1x to 100x
- F. O. V.: Square inscribed in a ø18mm circle

**Image bit depth**
- 12 bits

**Diascopic detector (option)**
- 1 channel (motorized or manual)

**Compatible microscopes**
- Upright type: ECLIPSE 90i, E800, E1000*
- Inverted type: TE2000-PFS, TE2000-E, TE2000-U*
- Fixed stage type: ECLIPSE FN1, E600FN*
- External motor: Stepping motor, 50nm step

**Compatible PC**
- OS: Windows® 2000/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)

---

**Combination Examples of Lasers and Filters According to Dye**

### Dual Stain

<table>
<thead>
<tr>
<th>B excitation</th>
<th>G excitation</th>
<th>Laser 1</th>
<th>Laser 2</th>
<th>Filter set</th>
</tr>
</thead>
<tbody>
<tr>
<td>FITC or Alexa 488</td>
<td>TMR or Cy-3</td>
<td>Ar (488)</td>
<td>G-HeNe (543)</td>
<td>1st DM: 488/543</td>
</tr>
<tr>
<td>FITC or Alexa 488</td>
<td>Texas Red or Alexa 594</td>
<td>Ar (488)</td>
<td>Y-HeNe (594)</td>
<td>1st DM: 488/594</td>
</tr>
</tbody>
</table>

### Triple Stain

<table>
<thead>
<tr>
<th>V excitation</th>
<th>B excitation</th>
<th>G excitation</th>
<th>Laser 1</th>
<th>Laser 2</th>
<th>Laser 3</th>
<th>Filter set</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAPI</td>
<td>FITC or Alexa 488</td>
<td>TMR or Cy-3</td>
<td>V-LD (408)</td>
<td>Ar (488)</td>
<td>G-HeNe (543)</td>
<td>1st DM: 406/408/543</td>
</tr>
<tr>
<td>FITC or Alexa 488</td>
<td>TMR or Cy-3</td>
<td>Cy-5</td>
<td>Ar (488)</td>
<td>G-HeNe (543)</td>
<td>R-HeNe (633)</td>
<td>1st DM: 406/543/633</td>
</tr>
</tbody>
</table>