Nikon

ECLIPSE Ti

Inverted Research Microscope

ECLIPSE Ti

At the Center of Your Research Discoveries

New Ti-LAPP system modular illuminators provide incredible flexibility and expandability in imaging capabilities.

Microscopes are critical tools for cutting-edge research in biology, physics, pharmaceutical sciences and medicine. To meet the demands of today's high-end research, Nikon has developed the Ti series of microscopes. Combined with NIS-Elements imaging software, the Ti enables diverse image acquisition and analysis methods such as multi-dimensional time-lapse imaging to acquire temporal, spatial and spectral information of fast, dynamic live cell processes. The Ti microscope's hallmark modularity has now been further improved with the addition of the newly designed high-performance LAPP illumination system. Combined with intelligently designed automation, the Ti-LAPP system is the ideal instrument for carrying out advanced, multi-modal imaging applications, including TIRF, confocal, FRET and photobleaching/photoactivation to study the dynamics and interactions of fluorescent protein molecules in living cells and tissues.

ECLIPSE Ti-E

The flagship model that is fully motorized for automated multimode image techniques and acquisition

Advanced functions of Ti-E dramatically expand research imaging possibilities

Advanced Time-lapse Imaging
Advanced built-in Perfect Focus System (PFS) for improved automatic focus correction *P4*

Fast and Automated
High-speed motorized components allow fast, coordinated and seamless image acquisition *P6*

Screening
Multimode scanning of well plate at an unprecedented speed *P7*

High-quality Phase Contrast Observation
"Full intensity" optical components enable phase contrast with high NA non-phase-contrast objectives *P8*

Multiple Cameras
Image acquisition and analysis with multiple side ports and back port cameras *P9*

Simultaneous, Multi-point Photoactivation/conversion of Custom ROIs
With the new digital micromirror device (DMD) module, users can generate complex illumination patterns and simultaneously photoactivate/convert multiple, custom-drawn regions *P15*

Auto-alignment for TIRF Observation
New H-TIRF module automatically adjusts the laser incident angle and optical focus alignment for TIRF observation *P16*

Muliphoton, Confocal, Super-resolution Imaging
Flexible configuration that enables system building for cutting-edge research applications *P24*

ECLIPSE Ti-U

The universal model that can be configured for use with motorized components

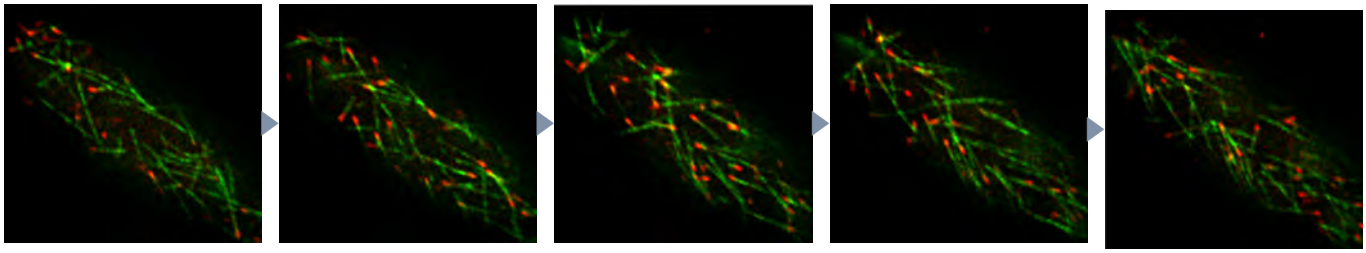
ECLIPSE Ti-S

The basic model with two built-in imaging ports that can be dedicated to specific tasks

Remarkably stable and reliable time-lapse imaging of living cells

Nikon's Perfect Focus System (PFS) provides real-time focus correction that overcomes microscope focus drift caused by thermal and mechanical effects. The use of PFS dramatically improves the quality of long-term time-lapse image data.

Nikon's Perfect Focus System (PFS) automatically corrects focus drift caused by thermal and mechanical changes that occur during long-term observations and when reagents are added. Images remain in focus even when using higher magnification and higher resolution techniques such as TIRF imaging. The latest generation of PFS offers significant enhancements, setting a new standard for live cell imaging. Its streamlined design enables easier access to objective lenses and correction collars. Two models are available: one for UV-visible imaging and another for Visible-IR imaging for multiphoton microscopy.

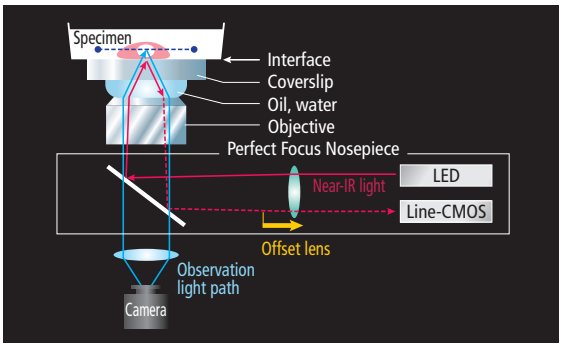


EB1 and tubulin in the cortex of Physcomitrella patens moss
Images were acquired on a spinning disk confocal with a Plan Apochromat VC 100x oil (NA 1.40) lens at the Marine Biological Laboratory.
Photos courtesy of: Drs. Jeroen de Keijzer and Marcel Janson, Wageningen University, and Dr. Gohta Goshima, Nagoya University.

Optical offset technology

Nikon's proprietary technology allows focusing at a desired height above the coverslip while simultaneously detecting the coverslip interface. PFS immediately corrects focus drift resulting from stage movement during multi-point imaging or temperature drops when reagents are added. PFS eliminates the need to capture extra images of different planes in anticipation of focus drift, resulting in minimized light exposure and photobleaching.

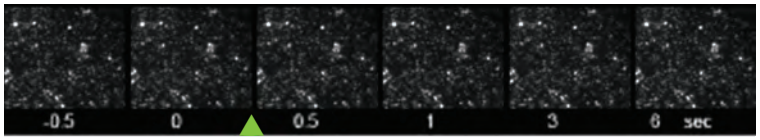
Concept of the Perfect Focus System



The diagram shows the case when an immersion type objective is used.
A dry type objective is also available.

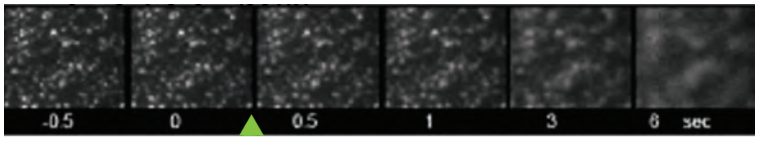
Correction to focus drift when reagents are added

With PFS



Adding reagent

Without PFS

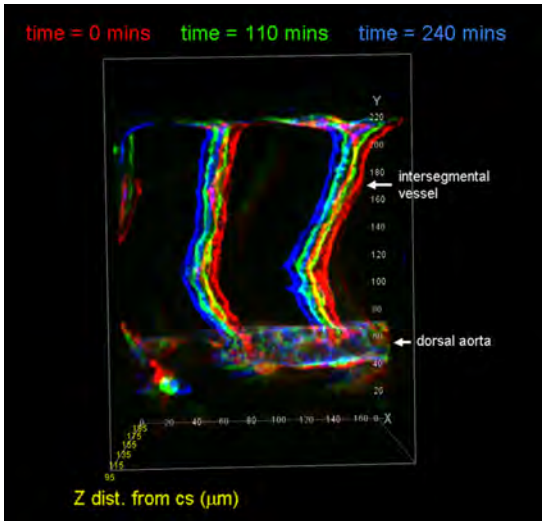


Adding reagent

The change in temperature caused by adding media (indicated by the arrow) causes the focus to drift if PFS is not used. Engaging PFS eliminates this problem entirely.

Maintaining focus at greater depths

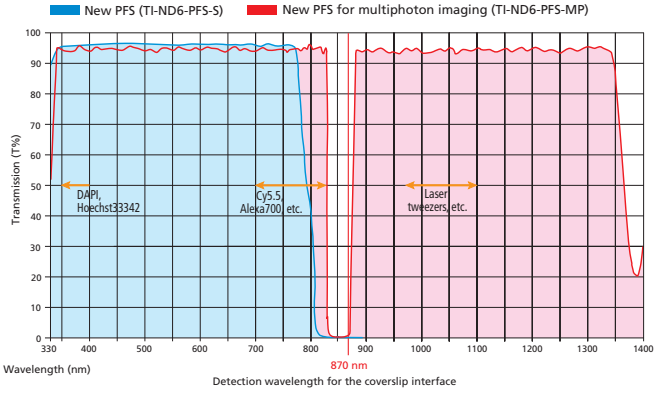
Due to its improved optics and sensitivity, PFS allows for correction of focus drift at significantly greater distances from the objective lens and at greater depths within the specimen than before.
This capability is ideal for developmental biology and applications that require studying the dynamics of cells in thick samples such as tissues or organs.
This broadened focus drift correction range results in more reliable data.

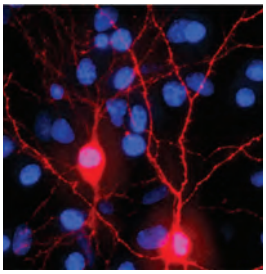


3D time-lapse image of the developing vasculature of a zebrafish embryo (Z-series is imaged at 95-186 µm away from the coverslip).
Because PFS can maintain focus at greater depths within the specimen, whole images of intersegmental vessels sprouting upward from the dorsal aorta are clearly captured.
Shown in the three channels are three different timepoint volumes.
Objective: CFI Apochromat LWD40xWI λ S (NA 1.15)
Photo courtesy of: Dr. Robert Fischer, Marine Biological Laboratory

Compatible with diverse fluorescence dyes with improved performance in broader wavelength range

PFS utilizes an 870nm wavelength LED for detection of the coverslip interface, enabling imaging of near-infrared fluorescence dyes such as Cy5.5 without interference. The overall wavelength range has increased, allowing researchers to acquire focused-data sets in applications that require a broad spectrum of imaging wavelengths, including Ca^{2+} imaging in the UV range and laser tweezer applications in the IR range.
The multiphoton model can correct for focus drift even when imaging with wavelengths ranging from 880-1300 nm.





Live imaging of primary rat cortical neurons stained with Hoechst33342 and DiR
Photo courtesy of: Drs. Ippei Kotera and Shinya Hosaka, Research Institute for Electronic Science, Hokkaido University and Dr. Takeharu Nagai, The Institute of Scientific and Industrial Research, Osaka University

Compatible with plastic dishes and well plates

In addition to glass bottom dishes, plastic dishes, which are less expensive but suitable for cell culture, can be used with PFS. This plastic-compatibility feature enables a cost-effective means for focused imaging in high-throughput screening applications that involve multi-well plates.

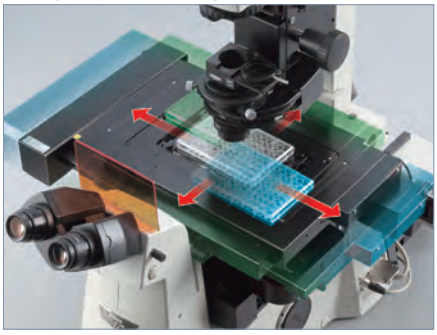
High-speed Motorized Control and Acquisition

The synchronized control of motorized components allows researchers to use the microscope for a wide range of automated multi-dimensional experiments. Faster device movements and image acquisition minimizes unnecessary light exposure to the specimen and subsequent photo-toxicity, resulting in more accurate and reliable data.

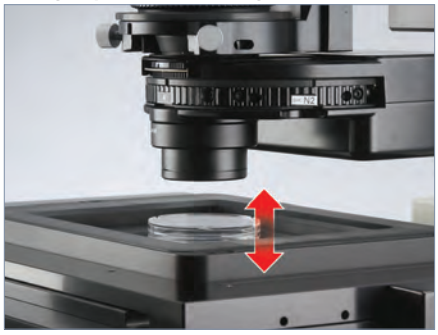
Enhanced speed of individual motorized components

Operation and/or changeover speed of objectives, filter cubes, XY stage, and excitation/barrier filters have been greatly enhanced, enabling a stress-free operational environment that allows researchers to focus on the acquired data and analysis. The controller memorizes and accurately reproduces acquisition parameters and the joystick easily allows control of the stage in XY and Z, making the microscope feel like a natural extension of the eyes and hands.

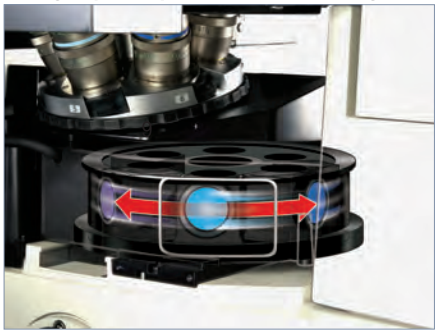
High-speed XY stage movement



High-speed Piezo Z stage movement



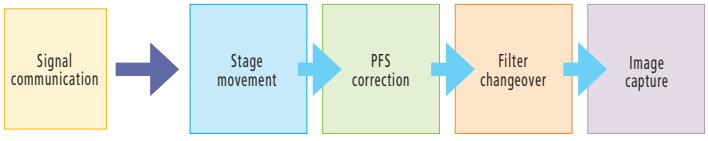
High-speed epi-fl filter cubes changeover



The digital Controller Hub significantly increases motorized accessory speed by reducing the communication overhead time between components, boosting total operation speed.

PC control and automation of the Ti's motorized components are optimized to reduce the respective communication time between action commands and movements producing high-speed total control. By adding firmware intelligence to the microscope, total operation time of the motorized components is reduced. For example, the total time for continuous image acquisition in three modes (two fluorescence channels and one phase contrast) with illumination shutter control is greatly reduced, enhancing cell viability.

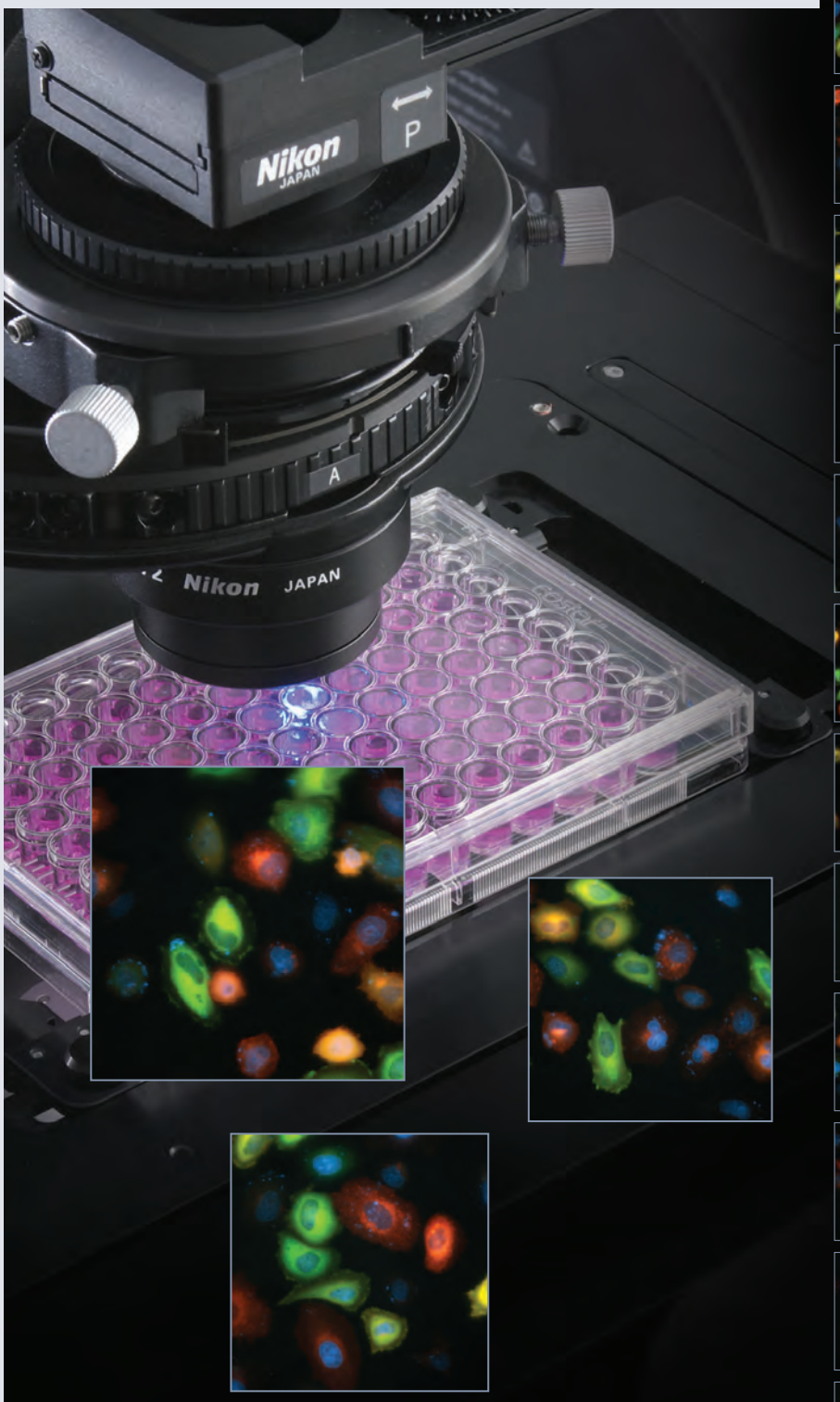
Control process

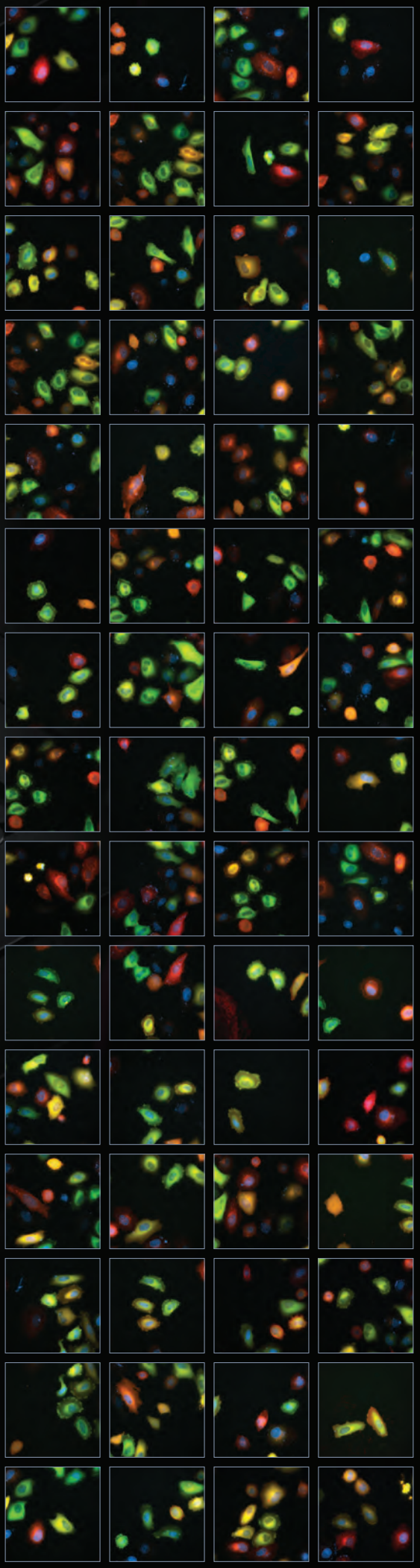


Once it receives command signals from a PC, the Ti controller takes over control of each motorized component, allowing the communication time between PC and each motorized component to be eliminated, minimizing overall operation time.

Remarkably Fast Image Acquisition!

Screening image capture of 96 wells in three modes (two-channel fluorescence and phase contrast) is possible at a speed of more than twice that of conventional models.





Multipoint snapshots of HeLa cells transiently expressing Venus-tubulin and mCherry-actin and stained with Hoechst33342 and DiD. (All in pseudo-color)

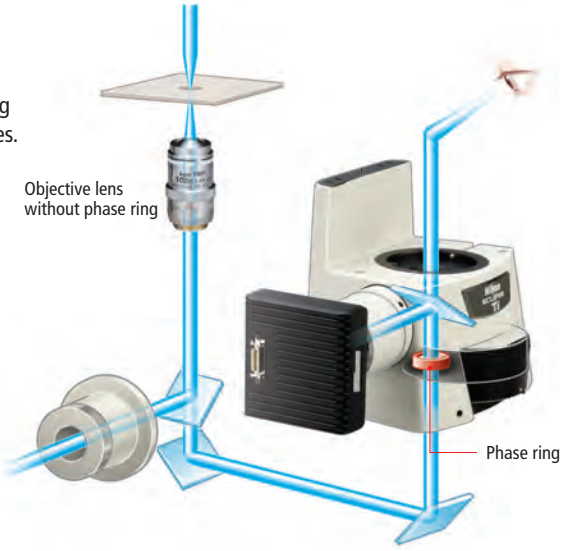
Photos courtesy of: Dr. Kenta Saito, Research Institute for Electronic Science, Hokkaido University and Dr. Takeharu Nagai, The Institute of Scientific and Industrial Research, Osaka University

High-quality Phase Contrast Images with High NA Lens

With Nikon's unique "full intensity" external phase contrast unit, a phase ring is incorporated in the microscope body instead of the objective lens enables the acquisition of uncompromised, full-intensity fluorescence images as well as phase-contrast images with high-NA objectives that do not contain phase rings.

Phase ring is incorporated in the microscope body

Incorporating a phase ring—that was normally positioned within the phase contrast objective lens—into the external phase contrast unit optically allows use of specified high NA objectives to produce high-resolution phase contrast images. Moreover, using the objectives without a phase ring enables "full intensity" bright fluorescence images. Five types of phase contrast rings are available according to the objectives used. (common for Ti-E/U/S)



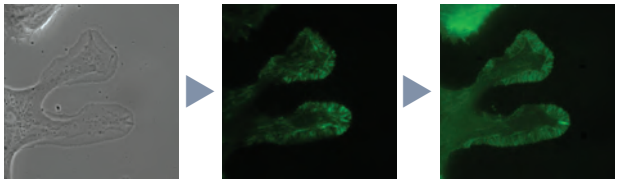
Changing the conventional concept of phase contrast

Unprecedented high resolution

Nikon's high-performance objective lenses, including the 60x and 100x TIRF objectives with the world's highest numerical aperture of 1.49 incorporating spherical aberration correction collars, deliver high-resolution phase contrast images that can not be captured with any standard phase contrast objective.

Bright fluorescence image using same objective

Because there is no light loss due to a phase ring, bright "full intensity" fluorescence, confocal and TIRF images can be captured using the same objective as well as providing phase contrast observation.



NG108 cell: Growth cone stained with EGFP-fascin

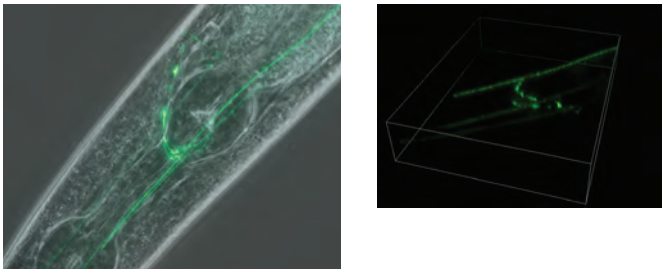
Photos courtesy of: Drs. Satoe Ebihara, Kaoru Katoh, The National Institute of Advanced Industrial Science and Technology (AIST)

Use of laser tweezers without changing lens

Because an objective without a phase ring can be used for phase contrast observation, use of laser tweezers is possible without changing the objective lens.

Phase contrast observation with water immersion objective

It is now possible to use a water immersion objective for phase contrast observation. Clear, high-resolution—refractive index matched—phase contrast images with minimal aberration of deep specimen areas can be captured.



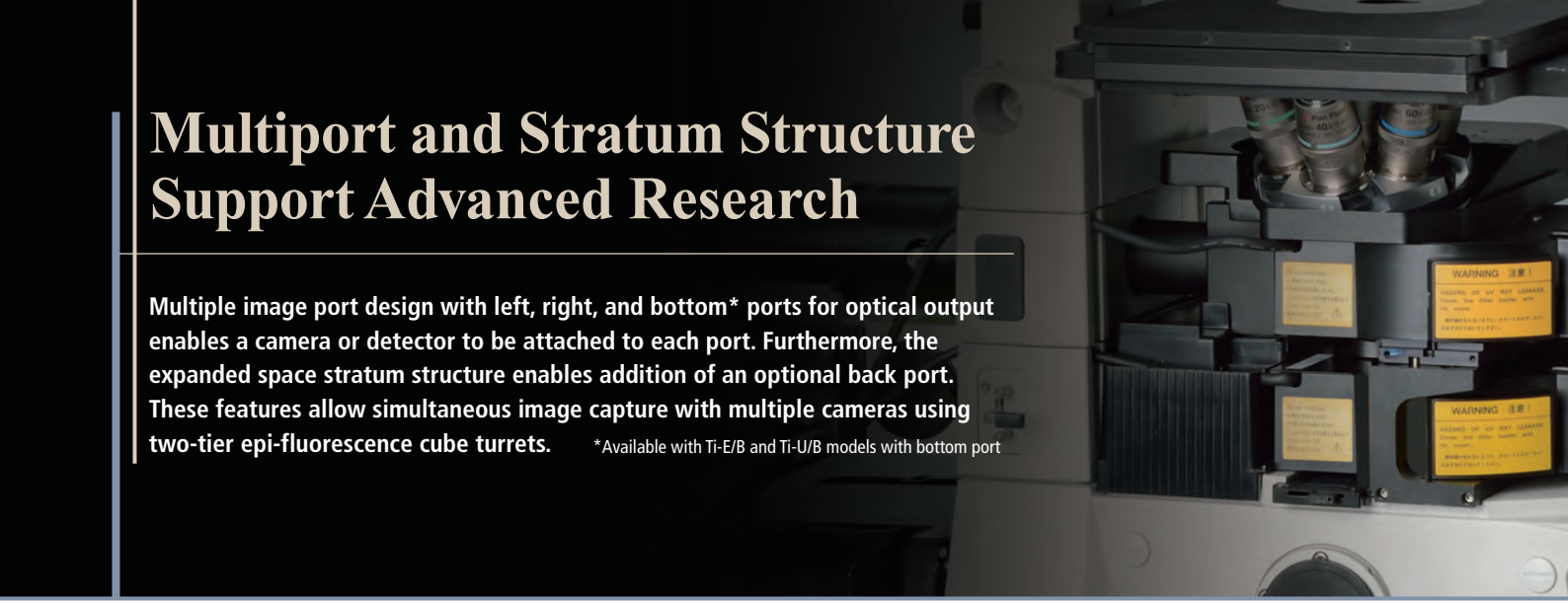
C. elegans: Touch neurons stained with EGFP

Photos courtesy of: Drs. Motomichi Doi and Kaoru Katoh, The National Institute of Advanced Industrial Science and Technology (AIST)

High resolution effective for image analysis

Because phase contrast observation is also possible with the same objective used for TIRF observation as well as DIC observation, phase contrast images with less oblique background shading than that of DIC observation are captured, allowing high-precision data processing and image analysis such as cell contour definition of TIRF image specimen.

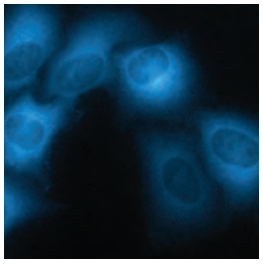
Multiport and Stratum Structure Support Advanced Research



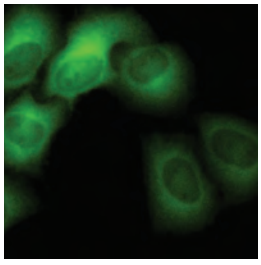
Multiple image port design with left, right, and bottom* ports for optical output enables a camera or detector to be attached to each port. Furthermore, the expanded space stratum structure enables addition of an optional back port. These features allow simultaneous image capture with multiple cameras using two-tier epi-fluorescence cube turrets. *Available with Ti-E/B and Ti-U/B models with bottom port

Back port enables multiple camera imaging

Use of an optional back port expands the image capture capability. Used in combination with the side port it allows simultaneous image acquisition for two wavelengths with two cameras. For example, when observing interaction between fluorescence proteins with FRET (Förster Resonance Energy Transfer) and intensity difference between CFP and YFP is great, individual camera sensitivity adjustment allows comparison of high S/N ratio images.

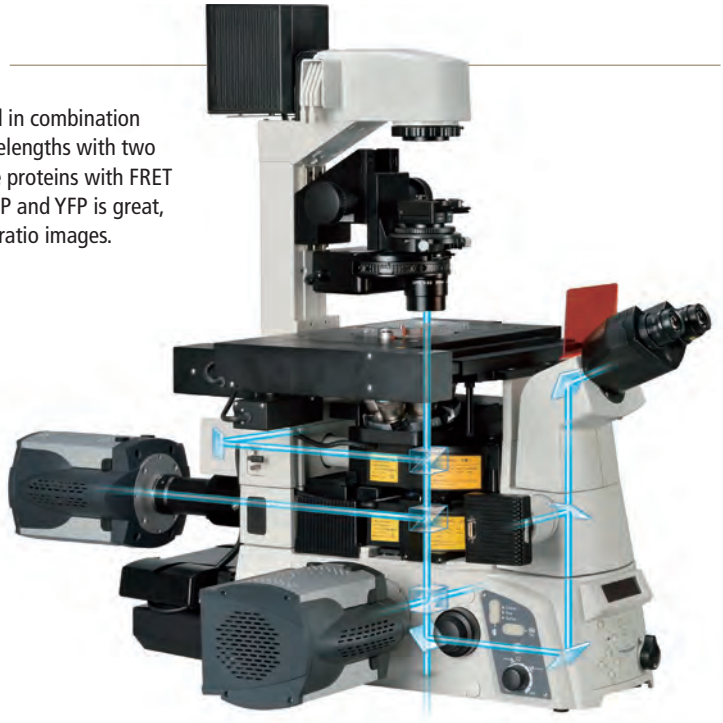


ECFP image from YC3.60



cp173Venus image from YC3.60

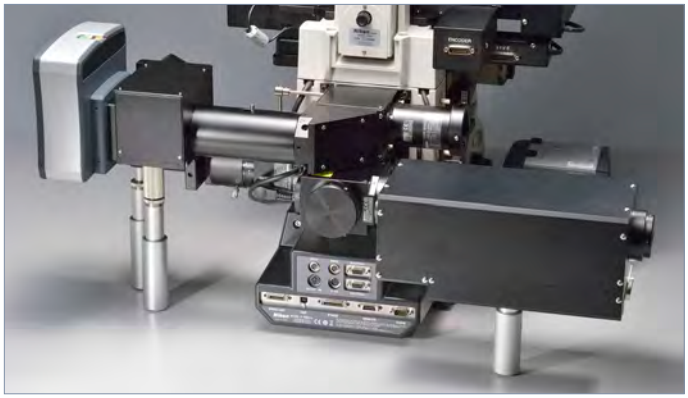
Photos courtesy of: Dr. Kenta Saito, Research Institute for Electronic Science, Hokkaido University and Dr. Takeharu Nagai, The Institute of Scientific and Industrial Research, Osaka University



Back port can be attached as an option.

Stratum structure enables flexible configurations and expandability

The Ti employs a stratum structure that takes advantage of infinity optics. Using the "stage-up kit," the Ti can accommodate two optical layers in addition to the nosepiece layer. The PFS is seamlessly integrated into the nosepiece unit and does not require a separate optical layer.
With the new LAPP illumination system, all five illumination modules (H-TIRF, TIRF, EPI FL, FRAP, and DMD) can be incorporated into a single Ti microscope, if needed. The stratum structure of the Ti combined with the new LAPP illuminators enables endless flexibility in configurations and can easily accommodate additional illumination applications, including laser tweezers.
The stratum structure not only allows for the incorporation of a large number of illumination applications but also provides flexibility in the imaging method. For example, by placing the photoactivation and TIRF modules in separate optical layers, one can simultaneously use different filter cubes for photoactivation and TIRF that are optimized for each illuminator/application.



Example: A DMD module (upper tier), H-TIRF module and EPI FL module (lower tier) are attached.

Use of Optimal Optical Technology for Each Observation Method Allows Uncompromised Image Capture

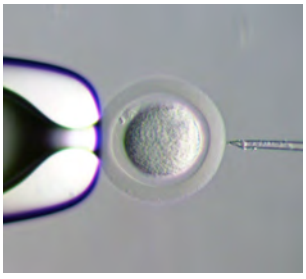
Nikon's uncompromising optical technologies provide diverse multi-modal visual information of a specimen using any observation method, delivering the full range of cellular details to researchers.

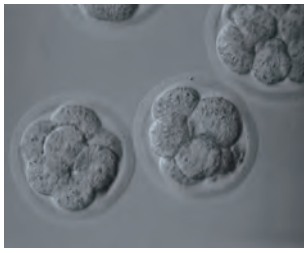
Nikon Advanced Modulation Contrast

Nikon has developed dedicated objectives for advanced modulation contrast. Colorless and transparent samples can be observed in high relief with a plastic dish, which is not possible in DIC observation. The direction of contrast can be matched to S Plan Fluor ELWD NAMC objectives, thereby allowing optimal contrast selection for techniques like microinjection and ICSI.

CFI S Plan Fluor ELWD NAMC series

CFI Achromat NAMC series





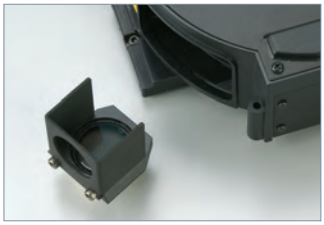
Photos courtesy of: Gianpiero D. Palermo, M.D., Ph.D., Cornell University

Nomarski DIC

The perfect balance of high contrast and high resolution is imperative for the observation of smaller structures. Nikon's unique DIC system is designed to achieve uniform high-resolution images even at low magnifications. The DIC sliders (dry types) include high-resolution and high-contrast choices.

Motorized analyzer cube

A filter cube style DIC analyzer can be mounted on the motorized filter turret to minimize switching time between DIC observation and fluorescence observation.



Filter cube style DIC analyzer

Darkfield

Use of high NA condenser allows darkfield observation. Long-term observation of nanoparticles without photobleaching is possible.

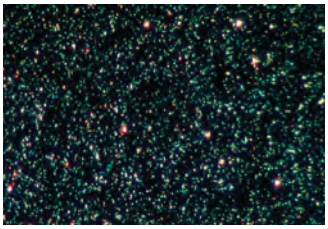


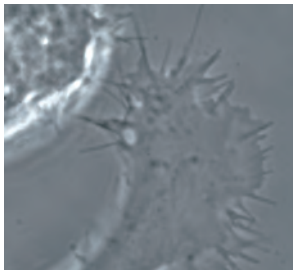
Photo courtesy of: Dr. Jan Liphardt, University of California Berkeley

Highly parallel single-molecule DNA bending assay using darkfield microscopy. Each bright green spot is a single plasmon ruler, composed of a pair of DNA-linked gold nanoparticles. Enzymatic DNA bending or cleavage can be monitored by following the intensity and color of the plasmon rulers. For more information see Reinhard et al, PNAS (2007).

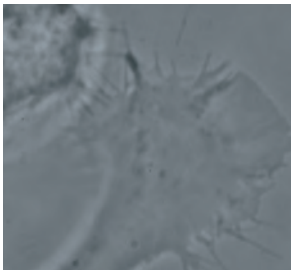
Phase contrast

For critical phase contrast observation, the CFI Plan Fluor ADH 100x oil objective is available. This objective reduces halos and doubles the contrast of minute cell detail compared to conventional phase contrast objectives. It enables phase contrast observation of specimens with low-contrast minute structures within the cell.

CFI Plan Fluor ADH 100x oil objective



Viewed with an ADH objective



Viewed with a conventional phase contrast objective

Enhanced Operability Enables Comfortable Observation

All buttons and control switches for motorized operation are designed considering ease of operation, visibility and understandability. Users can concentrate on their research without being hindered by microscope operations.

Fast and comfortable operation with motorized components

Operation buttons on both sides of microscope body

Fluorescence filter changeover, objective changeover, objective retraction, Z-axis coarse/fine changeover, PFS on/off control and offset storage, diascopic illumination on/off control can be operated quickly with easy-to-identify buttons on the microscope body.

High-speed position changing of the filter cubes in 0.25 second

Joystick and ergonomic controllers

High-speed motorized XY stage and Z-axis can be controlled using the joystick or ergo controller units. The joystick also allows a custom programmed speed adjustment with precise and natural operational feel.

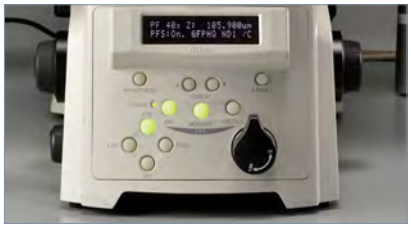
Joystick unit

Ergonomic controller

Joystick and ergonomic controllers can not be used simultaneously; they are offered to provide a personal choice of control.

VFD screen and operation buttons on front of microscope body

Microscope status including attached objective information and on/off condition of the PFS can be confirmed on the display at a glance.



Visual conformation of the buttons can be clearly viewed in the dark

PFS offset controller

Can be placed outside an environmental enclosure, minimizing temperature and mechanical fluctuations to the system. Buttons for operating the dichroic mirror and coarse/fine Z-focus switching are available.

PFS offset controller

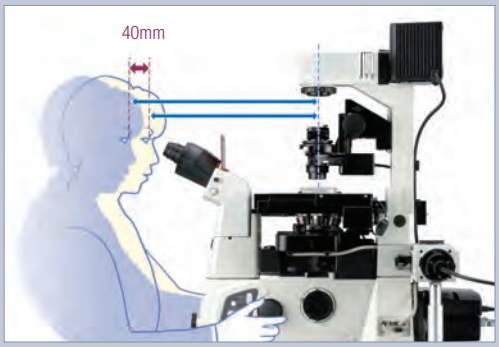
Remote control pad touch panel and preset buttons

The microscope can be operated and microscope status is confirmed with icons. Also, observation conditions can be memorized with preset buttons. This enables switching observations from phase contrast to fluorescence with a single touch of a button, allowing the user to concentrate on observation without stress or averting attention from the task.

Remote control pad

Sophisticated original slant design

By inclining the front part of the microscope's body slightly backward the distance between the operator's eyepoint and the specimen has been reduced by about 40mm, improving visibility and ergonomic design.



Fast, automatic operation by integrated control with NIS-Elements software

Microscopes have evolved from merely observation devices to software-controlled data acquisition devices. Nikon's Ti series not only features fast and comfortable motorized operation, but it also realizes acquisition of reliable data by controlling all motorized components for automatic imaging with the NIS-Elements imaging software.

Motorized XY stage

Fast and precise positioning is possible. Suitable for multipoint time-lapse observation. (Available as encoded or non-encoded versions)

Piezo Z stage

High-speed, precise Z-axis control is possible. (Manufactured by Mad City Labs, Inc.)

Motorized nosepiece

Six objective positions can be changed. (Photo shows motorized PFS nosepiece)

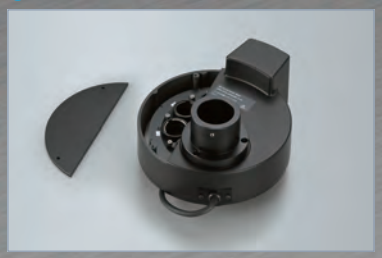
Motorized filter rotating turret

Position of fluorescence filter cubes can be changed in 0.3 sec. per position. (Photo shows high-performance type)

Motorized condenser turret

Motorized condenser changeover is possible.

Motorized barrier filter wheel



Fluorescence barrier filter positions (8 positions—using 25mm filters) can be changed at a high speed of 0.15 sec. between adjacent positions.

Remote control pad

Microscope status can be confirmed with icons. The microscope can be operated via the touch panel.

PFS offset controller

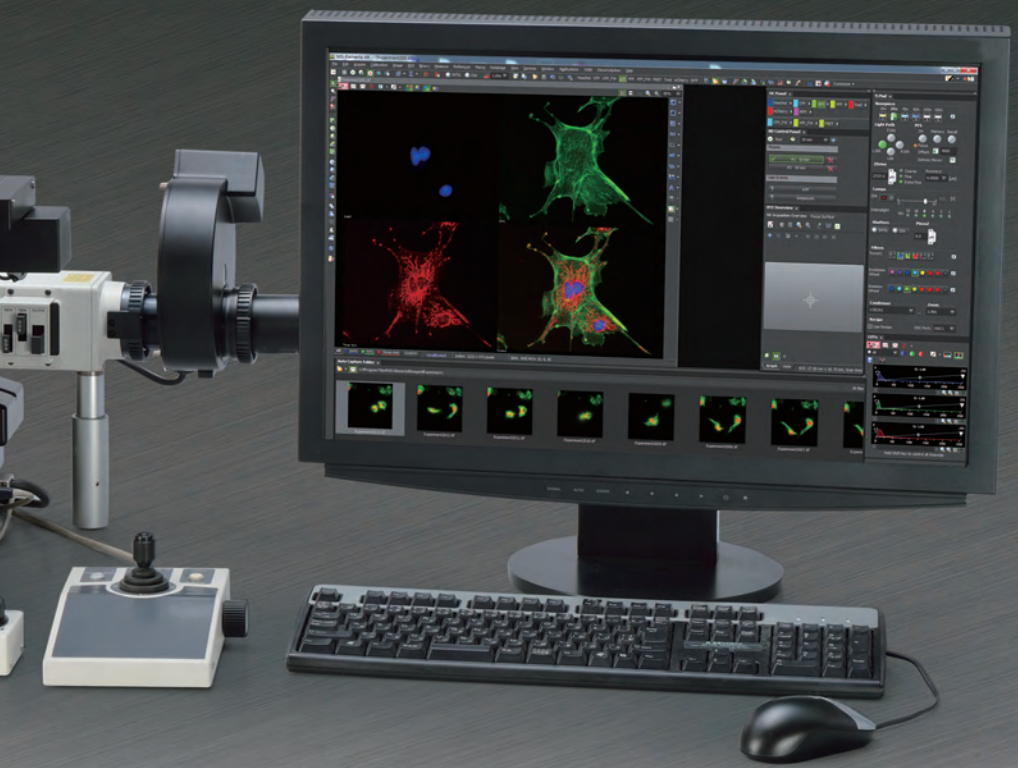
Real-time offset amount of Z-axis depth can be controlled after PFS setting.

Ti-E can be fully motorized with the HUB-A

Communication speed is dramatically increased through proprietary motorization algorithms, innovatively accelerating the sequence of operation. The Ti-E assures more reliable and efficient data acquisition in the research field.

Ti-U/S can be motorized with HUB-A-U

Motorized accessories can be controlled by the HUB-A-U when it is attached to the Ti-U/S.



C-LEDFI Epi-Fl LED Illuminator

Ensures stable and quantitative brightness of illumination and easier operation.

Motorized HG precentered fiber illuminator "Intensilight"

Controls shutter on/off and intensity of fluorescence excitation light.

H-TIRF module

Automatically adjusts the focus and incident angle of the laser for TIRF observation.

Motorized shutter

High-speed shutter compatible with both diascopic and episcopic illuminations

Joystick unit

Flexible positioning of the motorized stage is possible.

Ergonomic controller

Enables ergonomic manual control of a microscope at a distance.

Motorized excitation filter wheel

Fluorescence excitation filters (8 positions—using 25mm filters) can be changed at a high speed of 0.15 sec. between adjacent positions.

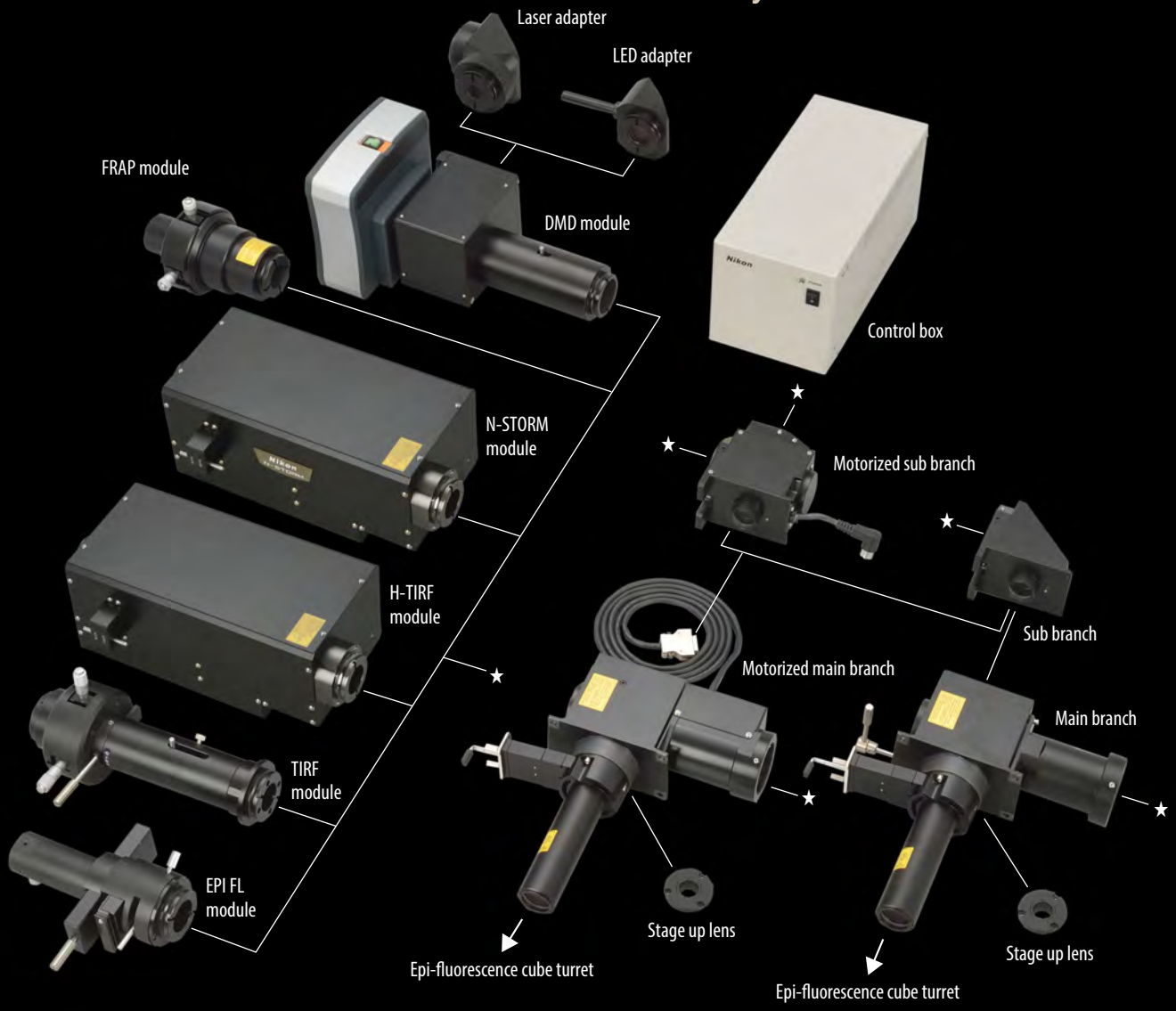
Ti-LAPP System

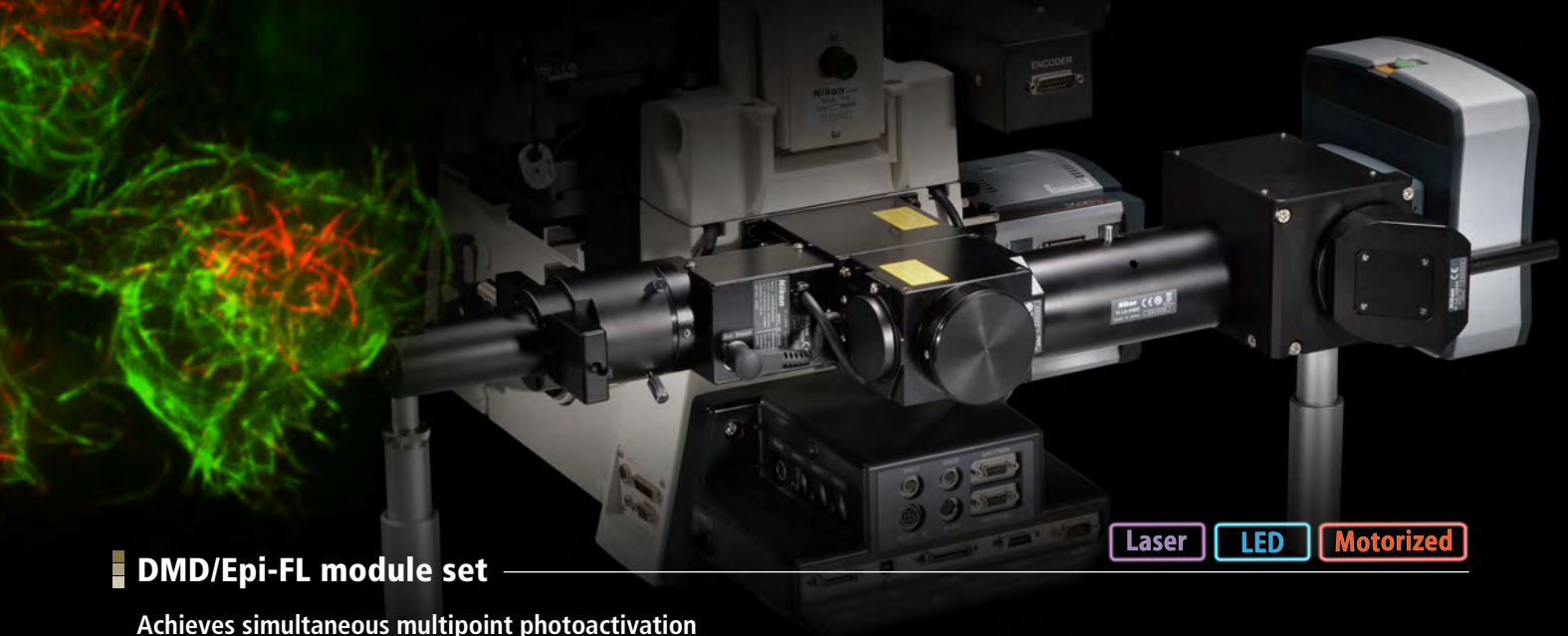
Modular illumination system with ultimate flexibility and expandability

The new Ti-LAPP system provides a wide range of illumination modules that can be flexibly combined to create an imaging system tailored for your research. The modularity of the Ti-LAPP system also provides flexibility when the system configuration needs to be changed, an important feature in core imaging facilities and labs that have changing imaging needs.

The Nikon Ti-LAPP system provides modular illuminators for total internal reflection fluorescence (TIRF), photoactivation/conversion, photobleaching and epi-fluorescence. Each module can be flexibly combined to build microscope systems that are optimized for individual research needs. For example, multiple TIRF modules can be incorporated into a single microscope for anisotropy experiments and fast, multi-angle TIRF imaging. Combined with the Ti's stratum structure, up to five illumination modules can be incorporated into a single microscope (e.g. two TIRFs, a FRAP, a DMD and an Epi-FL module can all be integrated into one Ti).
A fully motorized H-TIRF module with automatic laser incident angle adjustment and focus adjustment for TIRF observation and a DMD module with multi-point, customizable illumination ROIs have been newly developed for the Ti-LAPP system.
The new Ti-LAPP system with its flexibility and expandability provides a powerful imaging system that can be easily tailored to a wide range of imaging experiments, from unique, streamlined applications to complex, multi-modal imaging experiments, whilst maintaining flexibility to meet future needs for changes to the system configuration.

Ti-LAPP Modular Illumination System



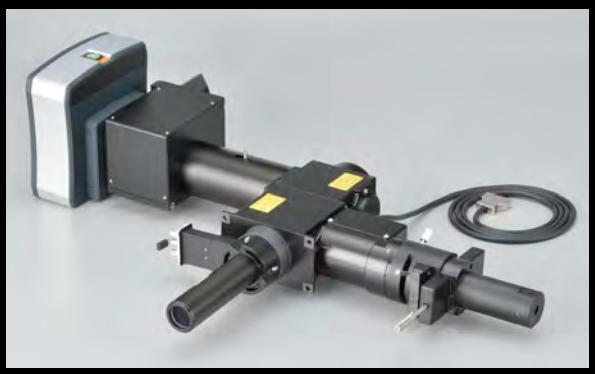


Laser LED Motorized

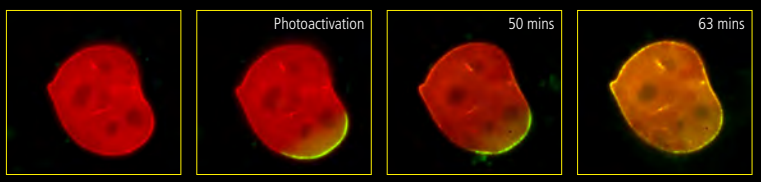
DMD/Epi-FL module set

Achieves simultaneous multipoint photoactivation

The new DMD module enables photoactivation and photoconversion of a user-specified pattern and position(s), whereas the conventional FRAP unit only enables photoactivation of a single, manually-positioned spot. The DMD illumination shape, size, position and number can be freely customized using the NIS-Elements software. This capability allows researchers to optically mark a subset of cells or protein populations within a single cell or multiple cells to track their behavior. The DMD module is also optimally suited for optogenetics experiments in which highly customized ROIs can be used to optically induce functional changes in subsets of cells or protein populations. The DMD module can be used with either laser illumination or less phototoxic LED illumination.

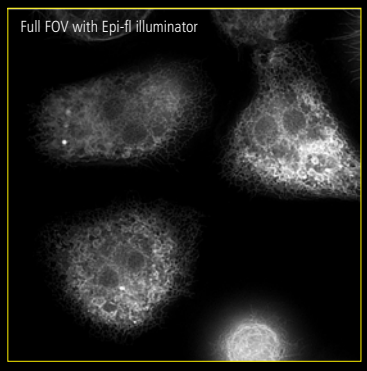


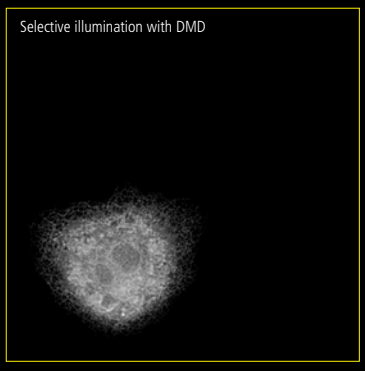
Motorized main branch + motorized sub branch + DMD module + LED adapter + EPI FL module



A mouse embryonic fibroblast co-expressing mCherry-tagged lamin A (red) and photoactivatable GFP-tagged lamin A was photoconverted (green) in the lower right region using the DMD module and 405 nm LED light. Time-lapse images were captured using the epi-fluorescence illuminator. By photoactivating a sub-population of the lamin proteins, one can observe their dynamics and subunit-exchange behavior.

Image courtesy of Drs. Takeshi Shimi and Bob Goldman, Northwestern University Medical School





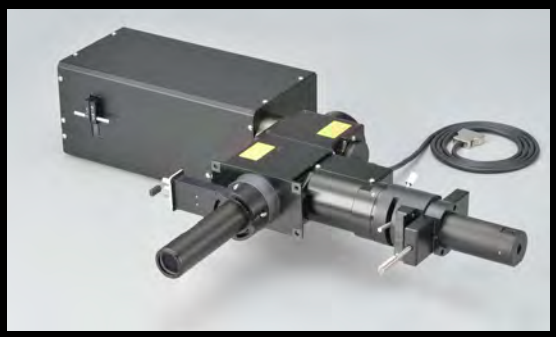
Drosophila S2 cells expressing a GFP-tagged endoplasmic reticulum marker (KDEL). The full camera field of view imaged with the epi-fluorescence illuminator (left). Using the DMD module, a single cell can be illuminated and imaged without unnecessary photobleaching or photo-damage to neighboring cells in the FOV (right).

Image courtesy of Drs. Nico Stuurman and Ron Vale, University of California, San Francisco

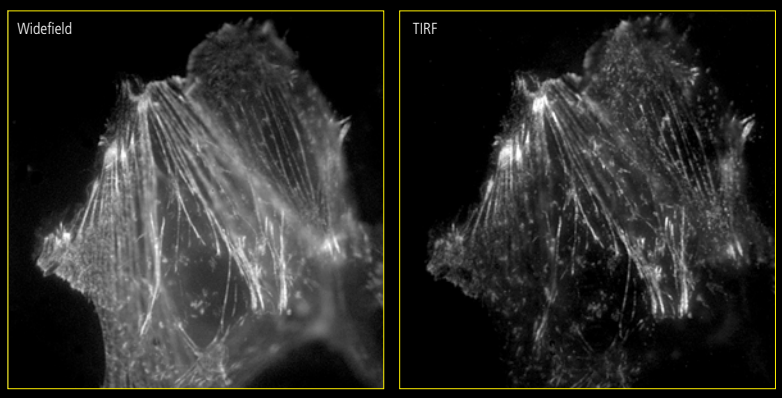
H-TIRF/Epi-FL module set

Fully automated TIRF adjustment and observation is now possible

The ideal incident angle and focus of the laser for TIRF observation vary depending on specimen and observation conditions. Adjusting the incident angle and focus for achieving TIRF requires skill and experience. The new H-TIRF module automatically adjusts the focus and incident angle of the laser for TIRF observation by monitoring the reflection beam. This automatic laser focus adjustment and incident angle adjustment is carried out by the auto-alignment function in NIS-Elements software. Incident angles and penetration depths of the evanescent fields can be saved and reproduced for subsequent experiments to ensure consistent imaging results.
The H-TIRF module is configured with a gradation neutral density (ND) filter that can be moved into the light path to achieve an even field of TIRF illumination.

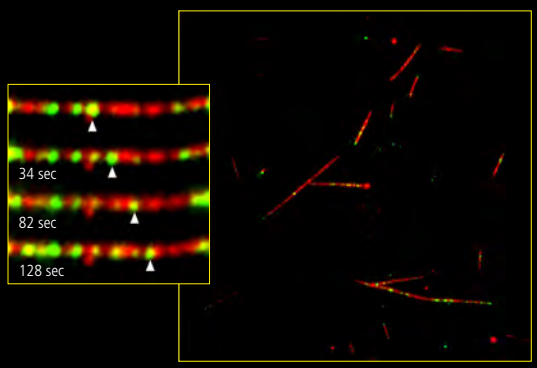


Motorized main branch + motorized sub branch + H-TIRF module + EPI FL module



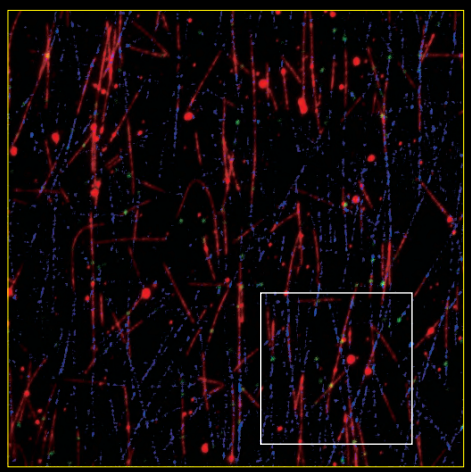
A cell expressing GFP-tagged actin was imaged using the epi-fluorescence illuminator (left panel) and the H-TIRF illuminator (right panel).

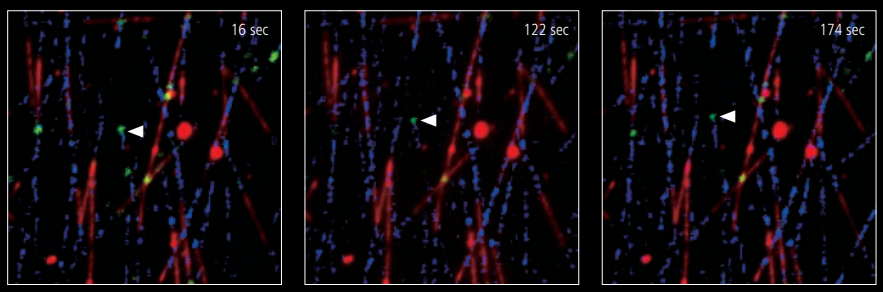
Image courtesy of Dr. Teng-Leong Chew, Nikon Imaging Center at Northwestern University



An *in vitro* preparation of fluorescently-labeled microtubules (Alexa 647) and dynein (tetramethylrhodamine) was imaged as a time series using the H-TIRF illuminator. Single molecules of dynein (in green) can be visualized moving along microtubules shown in red (see insert for a time series of one of the microtubules at a higher magnification; arrowheads point to a moving dynein molecule).

Image courtesy of Dr Ron Vale, University of California, San Francisco





The time series shows the movement of the microtubule binding protein tracking the growing end of the microtubule (green dot).

Three-color TIRF image
Using the gradation ND filter, a very even TIRF illumination is achieved.
An *in vitro* preparation of fluorescently-labeled microtubules (tetramethylrhodamine and Alexa 647) and tubulin binding proteins (Alexa 488) was imaged using the H-TIRF illuminator and the gradation ND filter. Incident angles can be automatically adjusted for multiple wavelengths.

Image courtesy of Melissa Hendershott and Dr. Ron Vale, University of California, San Francisco

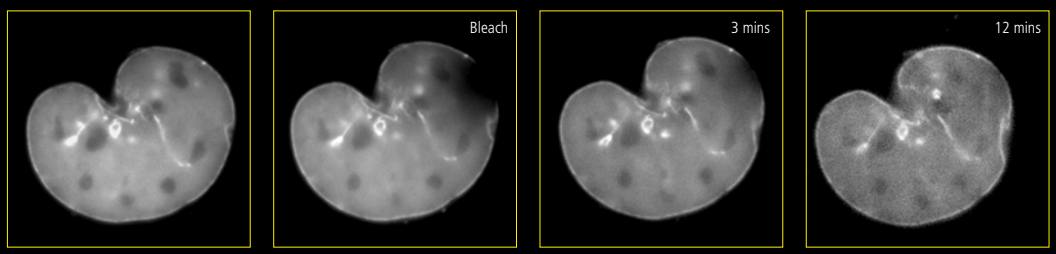
Laser Manual

FRAP/Epi-FL module set

For analysis of intracellular-protein dynamics

With the FRAP module, photobleaching and photoactivation/conversion experiments coupled with the use of high-frame-rate, high-sensitivity cameras for detection are possible. This module can spot-illuminate a target position in the cell, providing a cost-effective means for the study of intracellular protein dynamics without the use of a point-scanning confocal microscope.

Main branch + sub branch + FRAP module + EPI FL module



A mouse embryonic fibroblast expressing mCherry-lamin A was spot-photobleached in the upper right corner of the nucleus using the FRAP module to study the dynamics of lamin A molecules. Time-lapse images were acquired using the epi-fluorescence illuminator.

Image courtesy of Drs. Takeshi Shimi and Bob Goldman, Northwestern University Medical School

Laser Manual

TIRF/Epi-FL module set

For observation of cell membrane dynamics and single molecules

The newly designed manual TIRF module includes a gradation ND filter (similar to the H-TIRF module), enabling even TIRF illumination across the field of view. Using high-sensitivity cameras, one can image single molecules and dynamics of proteins in and near the cell membrane using this TIRF illuminator.

Main branch + sub branch + TIRF module + EPI FL module

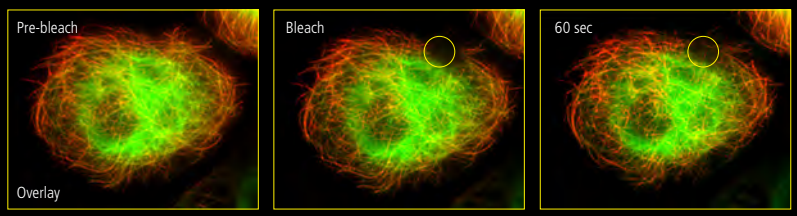
Flexible module combination

The Ti-Lapp system's modularity and flexible configuration capability provide custom imaging solutions for individual research needs. Modules can also be easily exchanged or added to adapt to changing experimental needs, an important feature for labs with evolving research directions and multi-user, core facilities. For example, by adding a second TIRF module to a single-TIRF configuration, users can easily carry out anisotropy experiments and fast, multi-angle TIRF experiments. Adding a photoactivation/conversion module such as the DMD or FRAP module enables tracking of a sub-fraction of a protein population, providing insights into protein behaviors that would otherwise be illusive when imaging the entire population.

H-TIRF/DMD/Epi-FL module set (in single layer)

Motorized main branch + motorized sub branch + H-TIRF module + DMD module + LED adapter + EPI FL module

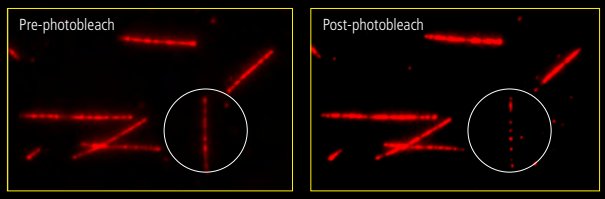
H-TIRF/FRAP/Epi-FL module set



A small region in a GFP-tagged tubulin expressing Drosophila S2 cell was photobleached using the FRAP module to analyze the motility of microtubules. Both H-TIRF and epi-fluorescence illuminators were used to image the recovery dynamics in TIRF and widefield (shown in red and green, respectively). The photobleached region is indicated by a circle.

Image courtesy of Drs. Nico Stuurman and Ron Vale, University of California, San Francisco

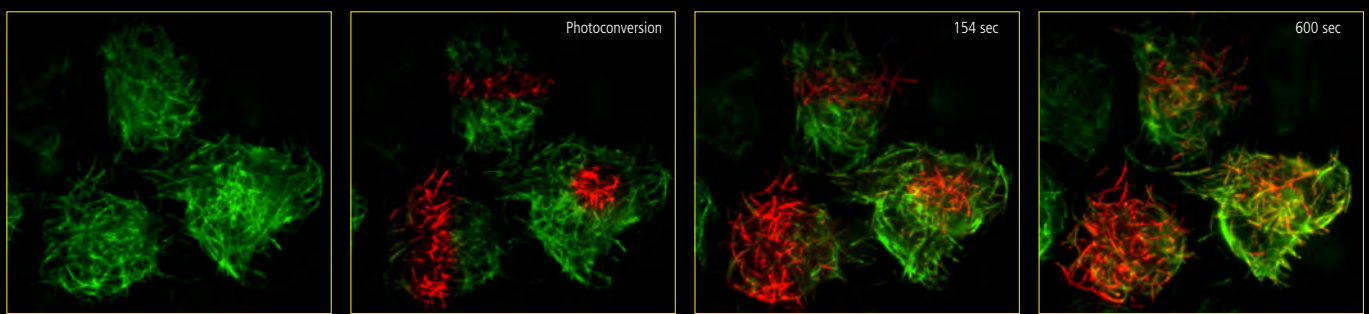
Motorized main branch + motorized sub branch + FRAP module + H-TIRF module + EPI FL module



An *in vitro* preparation of fluorescently-labeled microtubules (Alexa 488) and dynein (tetramethylrhodamine) was imaged using the H-TIRF illuminator. This preparation contained high concentrations of dynein and single motor molecules were difficult to visualize. By using the FRAP module to photobleach a large portion of the motor molecules bound to a microtubule, single molecules of dynein could be clearly visualized (compare pre- and post-photobleach panels; photobleached area is circled).

Image courtesy of Dr. Ron Vale, University of California, San Francisco

DMD/H-TIRF/TIRF module set



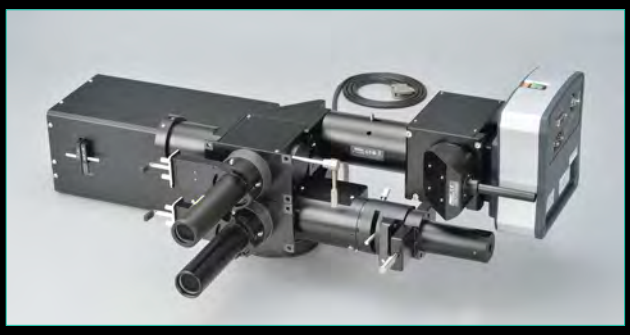
Drosophila S2 cells expressing EOS-tagged tubulin. Three ROIs of different shapes (horizontal rectangle; vertical rectangle; circle) were simultaneously photoconverted using the DMD module and 405 nm LED light. Multiple, custom ROIs for photoconversion were easily set using NIS-Elements. Fast, dual color TIRF images to track the converted and unconverted proteins were achieved by using two TIRF illuminators. The H-TIRF illuminator was used for imaging the converted proteins (561 nm excitation, red) and a manual TIRF illuminator for imaging the unconverted proteins (488 nm excitation, green). The TIRF angles were optimized for each wavelength using the two independent illuminators. The use of multiple TIRF illuminators enables fast, multi-angle TIRF imaging as well as anisotropy experiments.

Image courtesy of Michael Winding and Dr. Vladimir Gelfand, Northwestern University Medical School

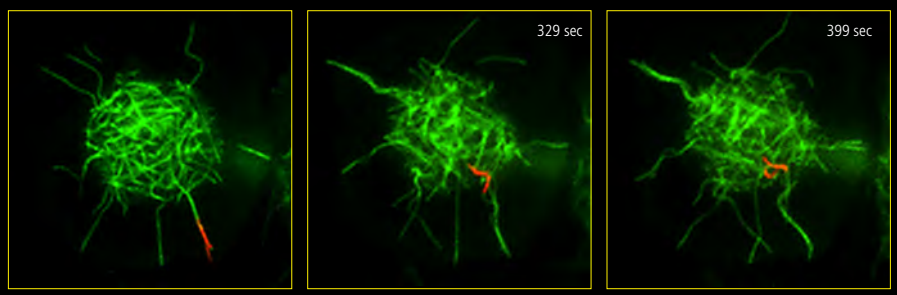
Two-tiered configuration capability

Taking advantage of the Nikon Ti's stratum structure, modules can be incorporated as two separate layers with multiple modules per layer. Using a dual layer configuration enables optimal filter configuration for each illumination module. For example, by placing the H-TIRF module in the lower layer and a DMD module in the upper layer, separate filter cubes specific for TIRF imaging and photoactivation can be simultaneously used in their respective filter turrets also residing in the lower and upper layers. This configuration enables optimal filter selection and improves experimental accuracy whilst maintaining the highest acquisition speeds.

H-TIRF/DMD/Epi-FL module set (in two layers)

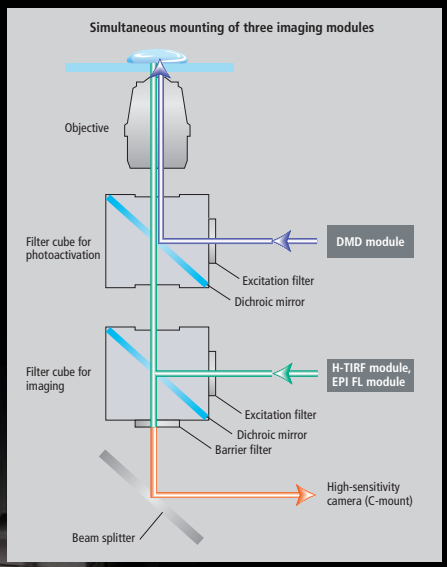


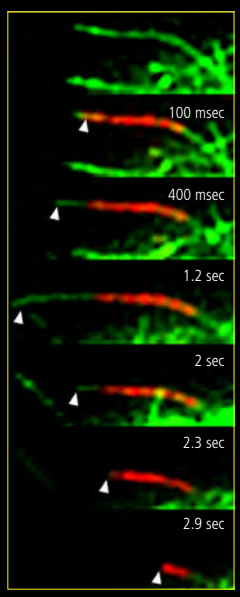
Upper layer: motorized main branch + sub branch + DMD module + LED adapter
Lower layer: motorized main branch + motorized sub branch + H-TIRF module + EPI FL module

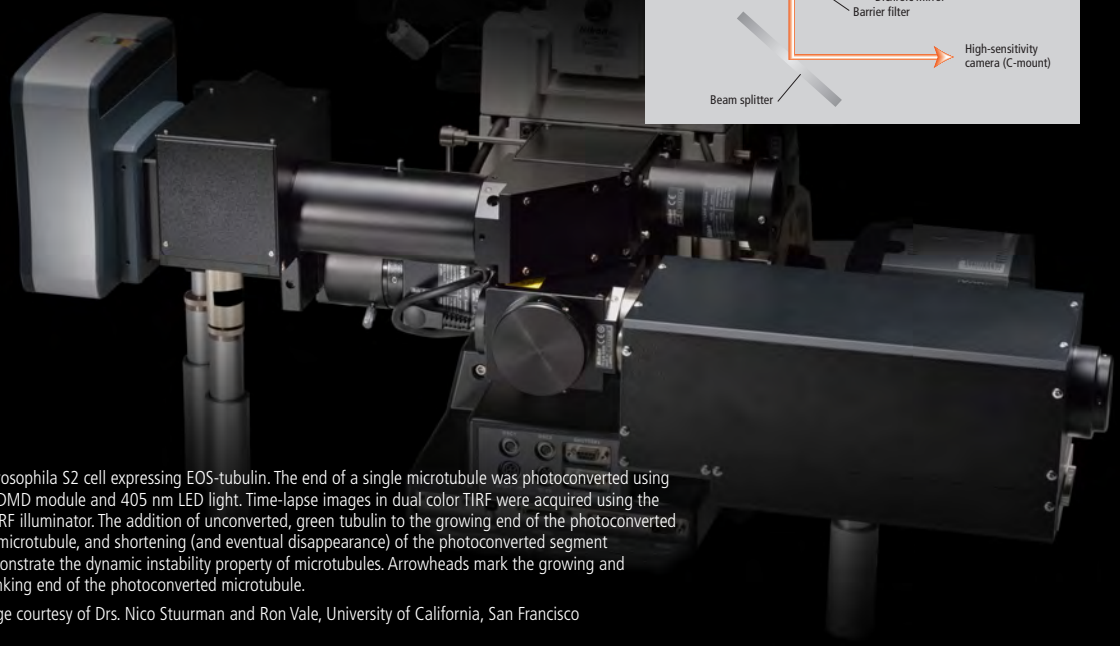


A Drosophila S2 cell expressing EOS-tagged tubulin. A short segment of a microtubule bundle was photoconverted using the DMD module and 405 nm LED light. Time-lapse images of the photoconverted tubulin (red) and unconverted tubulin (green) using dual color-TIRF were acquired with the H-TIRF illuminator. Images show rapid movement of the photoconverted microtubules.

Image courtesy of Drs. Nico Stuurman and Ron Vale, University of California, San Francisco







A Drosophila S2 cell expressing EOS-tubulin. The end of a single microtubule was photoconverted using the DMD module and 405 nm LED light. Time-lapse images in dual color TIRF were acquired using the H-TIRF illuminator. The addition of unconverted, green tubulin to the growing end of the photoconverted red microtubule, and shortening (and eventual disappearance) of the photoconverted segment demonstrate the dynamic instability property of microtubules. Arrowheads mark the growing and shrinking end of the photoconverted microtubule.

Image courtesy of Drs. Nico Stuurman and Ron Vale, University of California, San Francisco

Ti-LAPP system modules

DMD module

Allows for the generation of multiple, custom illumination patterns and positions for simultaneous multi-point photoactivation/conversion experiments

Laser adapter/LED adapter

The laser adapter (left) enables the DMD module to accept laser illumination, while the LED adapter (right) enables LED illumination.

H-TIRF module

Enables automatic laser focus adjustment and incident angle adjustment for TIRF observations (includes gradation ND filter)

N-STORM module

Equipped with illumination field (1x, 2x, 4x) motorized switching, as well as an auto-alignment function. Enables the Ti-LAPP system to be used for N-STORM microscopy.

FRAP module

Enables spot photobleaching and activation/ conversion with manual position and spot size adjustment

TIRF module

Enables manual adjustment of laser incident angle and focus (includes gradation ND filter)

EPI FL module

Introduce illumination for epi-fluorescence observations

Motorized main branch

Connects illumination modules with Ti and provides motorized control of IN/OUT for the optical path switching mirror

Main branch

Connects illumination modules with Ti and provides manual control of IN/OUT for the optical path switching mirror.
* Motorized modules cannot be connected.

Motorized sub branch

Enables two optical paths to be added and makes motorized path switching possible
* Can only be attached to the motorized main branch

Sub branch

Enables one optical path to be added

Control box

Controls communications between the H-TIRF module, motorized main branch and motorized sub branch

Optional illumination units for single application

A simple configuration that integrates both the light projection tube and the illumination unit into one illumination system. This system offers high cost performance and can easily be mounted on the Ti microscope.

White light TIRF unit

Mercury Manual

Integrates the white light TIRF unit and the epi-fluorescence illumination unit. The white light TIRF unit allows high-performance low-cost TIRF observations using a mercury lamp as a light source. White light TIRF, epi-fluorescence and oblique epi-fluorescence observations using one mercury light source is possible.
Observation modes can be easily switched.
The wide wavelength range of mercury light allows multiple wavelength TIRF observations by simply changing epi-fluorescence filter cubes.

Epi-fl illuminator unit with white light TIRF

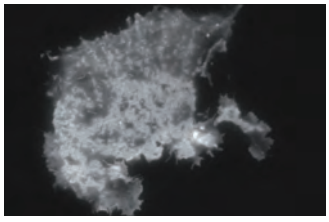


Photo courtesy of: Dr. Yasushi Okada, Laboratory for Cell Polarity Regulation, Quantitative Biology Center, RIKEN

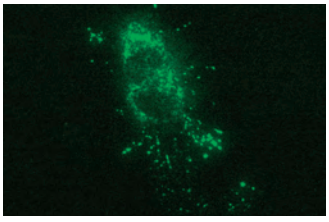
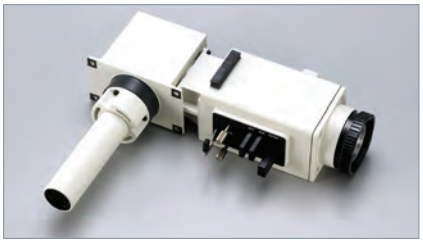


Photo courtesy of: Richard Cheney Ph.D., UNC Chapel Hill

Epi-fluorescence unit

Mercury LED Manual

Chromatic aberrations have been substantially reduced in the wide wavelength range, and clear and bright imaging is possible with this epi-fluorescence unit. Combined with fluorescence filter cube/filter cube turrets that use Nikon's original noise terminator mechanism to eliminate stray light, this unit produces clear, high-S/N-fluorescence imaging.

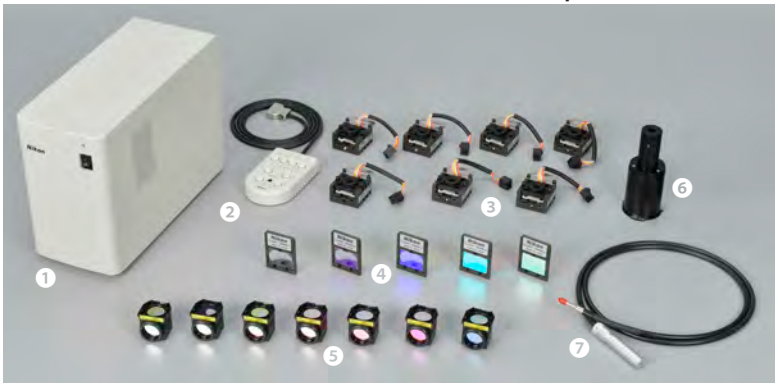


Epi-fl illuminator unit

Epi-Fl LED Illuminator for long periods of fluorescence time-lapse imaging

A newly developed epi-fluorescence illuminator equipped with an LED light ensures more stable and quantitative brightness of illumination. It is also easier to operate than a mercury illuminator.

C-LEDFI Epi-Fl LED Illuminator



1. Epi-FL LED Illuminator main unit (up to 4 LED units and up to 3 dichroic mirror units can be assembled)
2. Simple remote control pad
   7 light intensity control steps (0, 10, 20, 40, 60, 80, 100%)
3. LED unit (385/455/470/505/525/590/625 nm)
4. Dichroic mirror unit (425/455/470/565/610 nm)
5. Epi-Fl Filter Cube
6. HG100W Adapter R
7. Fiber (1.5 m/3.0 m)

Stable light intensity

Stable illumination brightness ensures quantitative and reliable fluorescence intensity measurement.
The LED illuminator ensures minimal output fluctuation of less than 0.1% in 100 Hz (10 ms.). In addition, it maintains output fluctuation at below 3% even when the illuminator is switched on and off intermittently over 72 hours of time-lapse observation.

Zero warm-up time

The illuminator requires zero warm-up time and enables observation immediately after it is switched on. Thus it can even be employed only when capturing images during time-lapse imaging, thereby eliminating the need for fluorescence shutters.

Wavelength intensity control

The illuminator allows for a flexible combination of LED units, enabling simultaneous lighting with multiple wavelengths for multi-color observation. The intensity of the excitation LED light for each wavelength can be consecutively controlled, thereby eliminating the need for ND filters.

Control with NIS-Elements software

Turning the illuminator on and off and changing wavelengths in synchronization with image acquisition is possible with NIS-Elements imaging software.

Maintenance free

An LED has a minimum lifespan of 10,000 hours, eliminating the need for frequent lamp replacement.

Alignment free

The LED and dichroic units do not need to be aligned each time they are changed over. Furthermore, the Epi-Fl LED Illuminator is connected to the microscope fluorescent attachment using a dedicated optical fiber cable, eliminating the need to center the light source.

Laser units

**The two laser unit series are compatible with microscope systems using laser illumination, such as the Ti-LAPP Modular Illumination System and confocal microscopes.
The LU-NV series supports up to eight wavelengths and switching of seven fiber outputs.
The series is compatible with Nikon's super-resolution microscope systems.
The LU-N4/LU-N4S/LU-N3 comes with four lasers (the LU-N3 with three), and achieves both high efficiency and compactness of size.**

LU-NV series

Multiple laser light sources can be mounted to the laser units and up to eight wavelengths are available. Output through up to seven fibers is possible. Switching them allows a single laser unit to support a microscope system that combines multiple laser applications, such as TIRF and photoactivation, with the Ti-LAPP Modular Illumination System and Confocal Microscopes A1$^+$ and C2$^+$, as well as Super Resolution Microscope N-SIM and N-STORM.

- The lasers available for this series are: 405 nm, 445 nm, 458 nm, 488 nm, 514 nm, 532 nm, 561 nm, 594 nm, 640 nm and 647 nm.
- High-power lasers for Super Resolution Microscope N-SIM/N-STORM and confocal microscopes are also available.
- Lasers can be individually turned ON/OFF, boosting the efficiency of the lasers.
- The optical axis of each laser is adjusted at the time of shipping, making the system easy to set up.
- The monolithic laser combiner prevents alignment shift even after long-term use.
- The AOTF allows the laser power to be controlled and modulated.

Configuration with Ti-E and Ti-LAPP systems
(LU-NV Laser Unit with LU Controller Box B (top))

LU-N4/N4S 4-laser unit
LU-N3 3-laser unit

The LU-N4/LU-N4S/LU-N3 is a compact laser unit that supports laser application systems such as TIRF and photoactivation with Ti-LAPP Modular Illumination System or Confocal Microscope A1$^+$ and C2$^+$. The LU-N4/LU-N4S* is equipped with four lasers (405 nm, 488 nm, 561 nm, and 640 nm), while LU-N3 has three lasers (405 nm, 488 nm, and 561 nm). The optical axis of each laser is adjusted at the time of shipping, making the system easy to set up. The monolithic laser combiner prevents alignment shift even after long-term use. The AOTF allows the laser power to be controlled and modulated.

*LU-N4S is compatible with spectral imaging but not with Ti-LAPP system.

Configuration with Ti-E and Ti-LAPP systems

Digital cameras for microscopes

A wide range of digital cameras for microscopes from the Digital Sight series are available, including high-definition cameras equipped with the Nikon FX-format CMOS sensor and compact camera heads with a choice of control units.

Microscope Camera DS-Ri2

This 16.25-megapixel, high-definition camera is equipped with Nikon's digital SLR camera FX-format CMOS sensor that has been optimized for microscopes. The high frame rate of up to 45 fps (1636 x 1088 pixels) enables fast focusing. The new image processing engine allows accurate color reproduction of microscopy images. Color fluorescent images can be clearly captured with its low-noise design.

Monochrome Microscope Camera DS-Qi2

The DS-Qi2 monochrome CMOS sensor camera (16.25-megapixel) enables high sensitivity imaging with superb S/N ratio, as well as high-speed image capture of up to 45 fps (1636 x 1088 pixels). A Peltier cooling mechanism provides bright images with reduced dark-current noise. Reliable quantitative analysis of fluorescent intensity change is possible with a low linearity error within ±1%.

High-speed Color Camera Head DS-Vi1

High-speed 2.0-megapixel color camera head displays smooth, high-quality live images.

High-definition Cooled Color Camera Head DS-Fi1c

High-definition 5.0-megapixel cooled color camera head. Cooling mechanism retains CCD at room temperature minus 20°C and realizes low noise.

High-definition Color Camera Head DS-Fi2

High-definition 5.0-megapixel color camera head features high frame rate, high red sensitivity, high resolution and accurate color reproduction.

Control units for DS-Vi1, DS-Fi1c, DS-Fi2

PC-use Control Unit DS-U3

DS-U3 allows image capture, control of microscope and peripheral equipment, measurement, analysis and data management on a PC using Nikon's imaging software NIS-Elements. High-speed image transfer to a PC is possible via the IEEE1394b interface.

Stand-alone Control Unit DS-L3

The stand-alone controller and its large display monitor enable image capture without a computer. Touch-panel or mouse operation allows setting and control of a camera by simply choosing the observation technique using the "scene mode" icons. Simple measurement functions, such as distance measurement between two points, are also available.

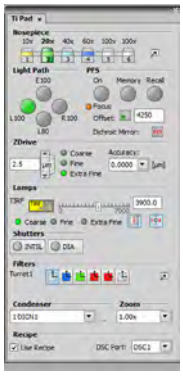
Imaging software NIS-Elements

Imaging software NIS-Elements provides seamlessly integrated control of the microscope, cameras, and peripherals. It allows for the programming of automated imaging sequences tailored to the user's imaging needs, further simplifying the imaging workflow. As a complete acquisition and analysis software, NIS-Elements offers many tools and controls to facilitate flexible and reliable data acquisition, paired with a diverse suite of analysis tools for measurement, documentation and data-management.

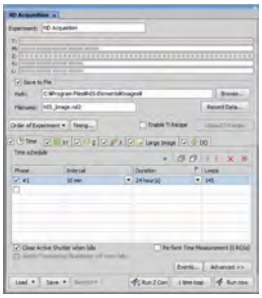
Control of multidimensional time-lapse imaging

Intuitive GUI and efficient workflow of NIS-Elements simplify 6D (X, Y, Z, t (time), Lambda (wavelength), multipoint) complex imaging experiments. The user simply selects the required parameters for each imaging dimension and images are automatically captured and presented as multi-dimensional ND2 files that can be seamlessly viewed, analyzed, and exported, all within NIS-Elements. Converting multi-dimensional ND2 files to standard image formats for external analysis is also easy to accomplish.

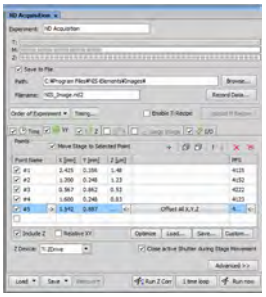
● Microscope setting



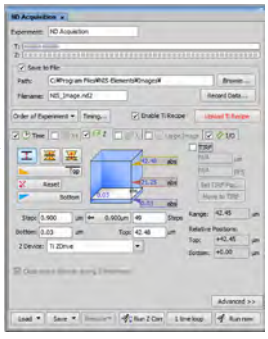
● Time-lapse (camera) setting



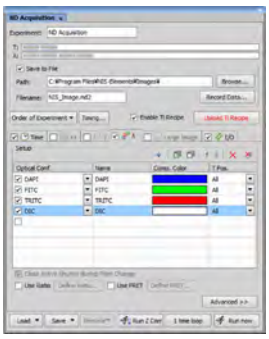
● XY (stage) setting



● Z setting



● λ (fluorescence turret) setting



Advanced confocal laser microscopes optimally match the Ti-E

Confocal microscope

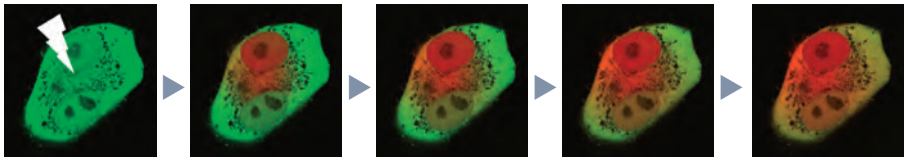
A1+/A1R+

The A1R+ with a revolutionary hybrid scanner realizes ultrafast and high-resolution imaging

- Hybrid scanner capable of high-speed imaging at 420 fps (512 x 32 pixels) allows simultaneous imaging and photoactivation (A1R+)
- High-resolution imaging up to 4096 x 4096 pixels
- With the VAAS pinhole unit, flare can be eliminated and image brightness retained; different sectioning can be simulated after image acquisition
- Dichroic mirror with 30% increased fluorescence efficiency provides high image quality

Simultaneous imaging and photoactivation (A1R+)

While imaging a HeLa cell expressing Kaede with green and red fluorescence using 488nm and 561nm lasers as excitation lights, Kaede in a ROI is continuously activated with the 405nm laser for photoconversion. The dispersion of Kaede red fluorescence produced by photoconversion can be observed.



Activation laser wavelength: 405nm, Imaging laser wavelength: 488nm/561nm, Image size: 512 x 512 pixels, 1 fps
Photos courtesy of: Drs. Tomoki Matsuda and Takeharu Nagai, The Institute of Scientific and Industrial Research, Osaka University

True spectral imaging confocal microscope

A1si+/A1Rsi+

High-performance spectral detector supports simultaneous excitation of multiple wavelengths

- Acquisition of 32 channels (512 x 32 pixels) at 24 fps in a single scan
- Accurate, real-time spectral unmixing
- Simultaneous excitation of four lasers
- V-filtering function adjusts individual sensitivity of up to four spectral ranges, allowing production of customized filters that are optimal for various fluorescence probes

A1Rsi+

Multiphoton confocal microscope

A1 MP+/A1R MP+

High-speed imaging of deep area in a living specimen

- A1R MP+ resonant scanner enables imaging up to 420 fps (512x32 pixels)
- Deep imaging with high-sensitivity NDD (non-descanned detector)
- Sharper, brighter imaging with high NA objectives deposited with Nano Crystal Coat
- High-speed, high-precision unmixing with NDD
- Multiphoton laser beam can be automatically aligned with a single click

A1R MP+

Confocal microscope

C2+

Personal confocal microscope now supports FRAP

- 1000x optical zoom of ROI
- ROI scanning is possible with an optional AOM/AOTF
- Accommodates a greater variety of lasers with wavelengths ranging from 405 to 640nm
- 4-channel simultaneous acquisition such as 3-channel confocal plus DIC
- Image acquisition up to 100 fps is possible

True spectral imaging confocal microscope

C2si+

Spectra across a wide 320nm range captured with a single scan

- High-speed, low-invasive imaging by a single scan acquisition
- Unmixing of spectral images without crosstalk
- Nikon's proprietary DEES and DISP technology for bright images
- Accuracy of spectra is maintained with diverse correction technologies

Super resolution imaging of the nanoscopic world beyond the diffraction limit

The amazingly high resolution of Nikon's Super Resolution Microscopes enables elucidation of the structures and functions of nanoscopic machinery within living cells. N-SIM and N-STORM, as well as a confocal laser microscope system, can be simultaneously mounted on the Ti-E, allowing multilateral imaging of a single live-cell specimen.

Super Resolution Microscope

N-SIM

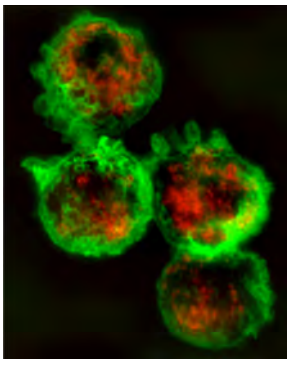
Live-cell imaging at double the resolution of conventional optical microscopes

- Offering nearly twice (up to approx. 115nm*) the resolution of conventional optical microscopes
- Ultrahigh temporal resolution of up to 0.6 sec/frame** enables super-resolution time-lapse imaging of dynamic molecular interactions in living cells
- High-speed TIRF-SIM/2D-SIM mode, TIRF-SIM mode for super-resolution TIRF imaging and 3D-SIM mode for axial super resolution imaging
- 5-laser multi-spectral super-resolution imaging

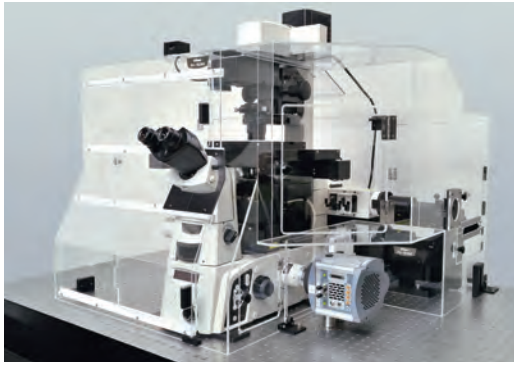
* Excited with 488 nm laser, in 3D-SIM mode

** With TIRF-SIM/2D-SIM mode

Live-cell N-SIM imaging of mitochondria labeled with Mito-Tracker red.
Live-cell imaging with N-SIM reveals dynamics of mitochondria at twice the spatial resolution. Cristae in mitochondria are also clearly observed.
Mode: 3D-SIM
Objective: CFI Apochromat TIRF 100x oil (NA 1.49)
Image capturing interval: approx. 1 sec. (movie)



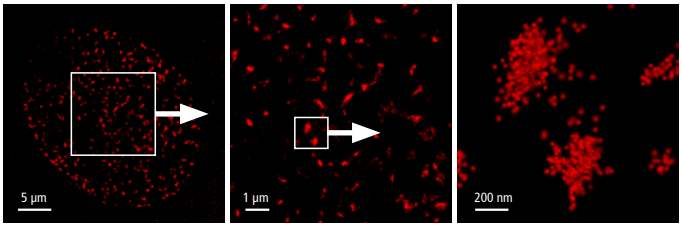
Macrophages (J774 cells expressing mVenus-SNAP23) phagocytosing opsonized beads that were incubated with Alexa555 labeled secondary antibodies after fixation. The beads without red signals are in phagosomes containing mVenus-SNAP23.
Photographed with the cooperation of: Drs. Chie Sakurai, Kiyotaka Hatsuzawa and Ikuo Wada, Fukushima Medical University School of Medicine.



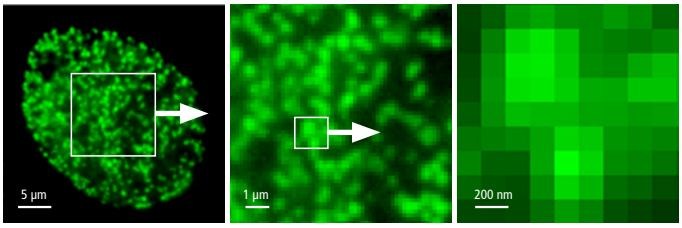
N-STORM

Resolution 10 times that of conventional optical microscopes enables molecular-level observations

- Ultrahigh spatial resolution 10 times higher (approx. 20 nm) than that of conventional optical microscopes
- A tenfold enhancement in axial resolution (approx. 50 nm) provides 3D information at the nanoscopic scale
- Multicolor super-resolution imaging provides critical insights into the co-localization and interaction of multiple proteins at the molecular level



N-STORM images



Conventional widefield images

Sites of DNA synthesis in a pig kidney epithelial cell (LLC-PK1) visualized at super resolution with continuous activation imaging using Alexa647-labeled EdU.
Photos courtesy of: Dr. Michael W. Davidson, National High Magnetic Field Laboratory, Florida State University

Accessories

Incubator

The internal temperature of the case is maintained at 37ºC. However, temperature adjustment from room temperature to 50ºC is possible.
The incubator is compatible with both the rectangular stage and the motorized stage. Various dishes can be used, including a well plate, with different inside attachments.

Manufactured by Tokai Hit Co., Ltd.

Thermal plate warmer ThermoPlate TP series

A temperature-controllable stage ring with a glass-heating plate ensures more accurate and reliable thermal control of specimens.
The temperature can be set at between room temperature +5ºC and 50ºC in 0.1ºC increments. A sterilized sensor allows measurement of the actual temperature of dish contents. Management software and continuous current control provide solutions to a wide range of requirements.

Manufactured by Tokai Hit Co., Ltd.

For motorized stage

For manual stage

Stage incubation system INU series

It sustains the internal temperature at 37ºC with humidity of 90% and CO_2 of 5% to keep the specimen in a stable and precise condition for about three days. A special technique is employed to minimize focus drift caused by thermal expansion of a stage. The glass heater on top of the chamber prevents condensation and enables clear images.

Manufactured by Tokai Hit Co., Ltd.

NT-88-V3 micromanipulator system

A packaged set of compact instrumentation—about half the size of a conventional model—for cellular micromanipulation, the NT-88-V3 is ideal for IVF (in-vitro fertilization), ICSI (intracytoplasmic sperm injection), electrophysiology, or transgenic biotechnology applications. Hanging joystick design provides superior ergonomics and operability. Remote oil hydraulic operation minimizes pipette vibration. An index of the coarse manipulator enables easy position adjustment of the pipette.

Manufactured by Narishige Co., Ltd.

Ergonomic Tube

Eyepiece inclination is adjustable from 15° to 45°. Includes darkslide shutter and Bertrand lens.

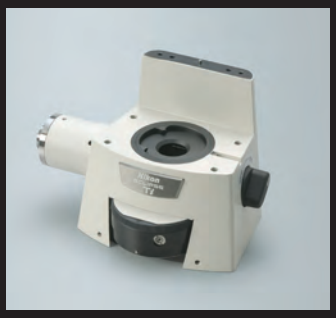
Binocular Tube D

Observation of conoscope image with incorporated Bertrand lens (phase telescope) is possible and darkslide shutter is provided.

Binocular Tube S

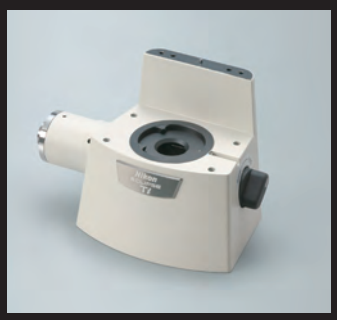
Standard model

Tube Base Unit/Phase Contrast



High-resolution imaging with "full intensity" external phase contrast system is possible. TV port is incorporated.

Tube Base Unit/Side Port



TV port is incorporated.

Plain Tube Base Unit

Standard model

Eyelevel Riser

Eyepoint height can be raised 25 mm. Two 25mm emission filters can be installed.

Stage Up Position Set

Stage height can be raised by 70mm to mount multiple components utilizing expanded stratum structure.

Stage Base

Stage base for configuration without diascopic illumination

Back Port Unit

Combined use with stage up riser allows a camera to be mounted on a back port.

High NA Condenser (Oil/Dry)

Perfect for observation with high NA objectives

CLWD Condenser

For high NA long working distance objectives

NAMC Condenser

For observation of Nikon Advanced Modulation Contrast

Stage Ring

Acrylic ring (left) features superior objective lens visibility and the glass ring (right) features less thermal expansion— ideal for time-lapse observation.

Epi-fluorescence Attachments

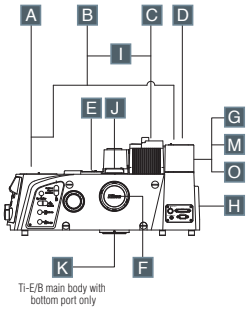
Light source and illumination optics for high S/N images

Double Lamphouse Adapter

For attaching two light sources

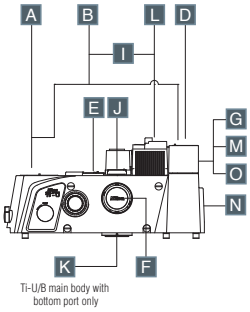
System Diagram

Ti-E



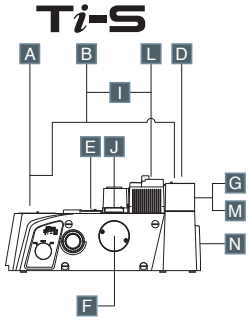
Ti-E/B main body with bottom port only

Ti-U



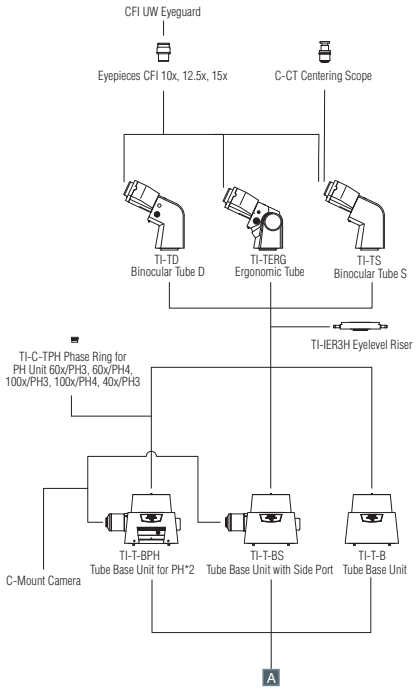
Ti-U/B main body with bottom port only

Ti-S

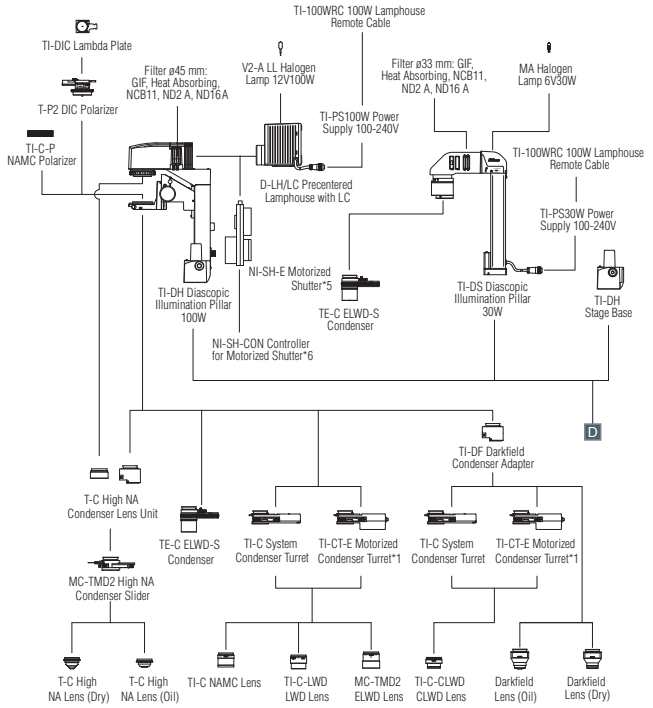


L100 is available as option

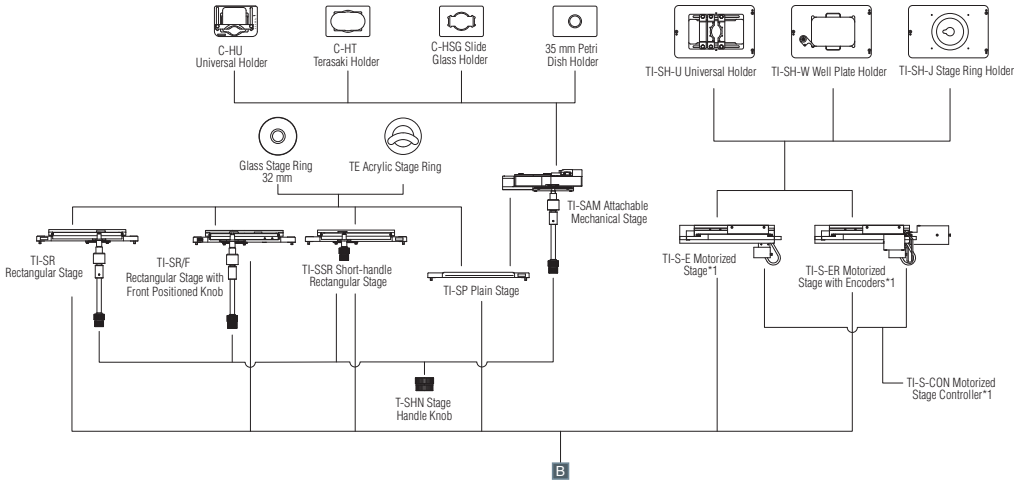
A Eyepieces/Tubes/Tube Base Units



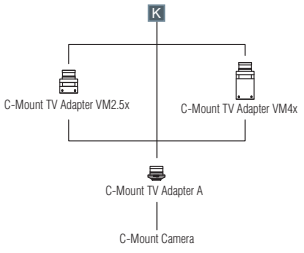
D Illumination Pillars



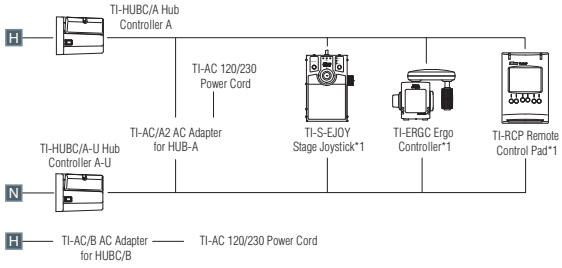
B Stages



K Bottom Port

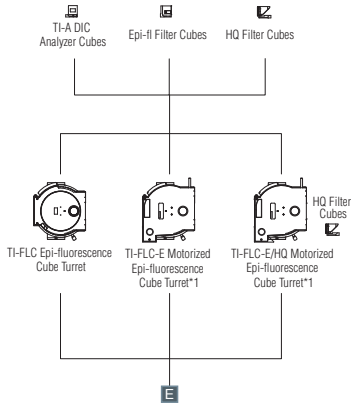


H N Communication Hub Units/Controllers

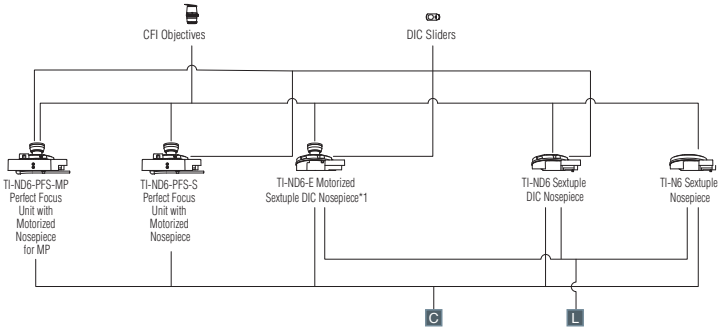


*1: Requires a Communication Hub Controller *2: When used with stage riser, TI-T-B Stage-up lens is required
*3: Combined use with C-HGFI/HGFIE Fiber Illuminator "Intensilight" or C-LEDFI Epi-FI LED Illuminator is not recommended
*4: Necessary for incorporating an illuminator unit in lower tier of the stratum structure
*5: A dedicated adapter is required. Please contact Nikon for more details.
*6: Two NI-SH-E units can be connected. For each NI-SH-E connection, an NI-SHCL Motorized Shutter Cable Long is required.

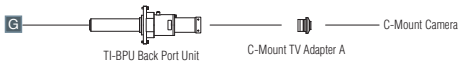
E Epi-fluorescence Cube Turrets



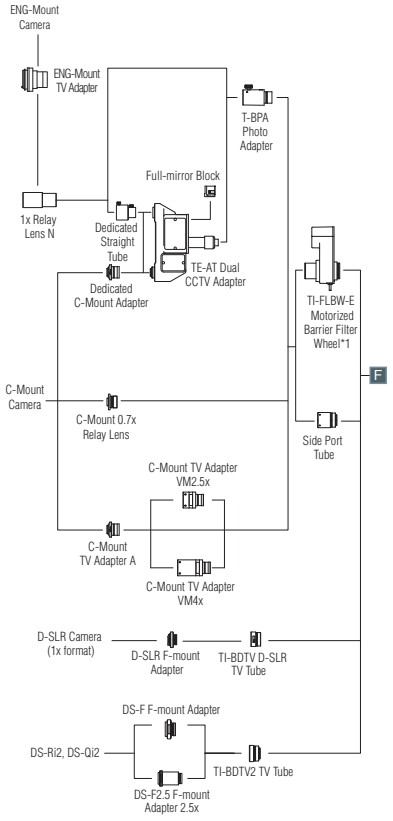
C L Nosepieces



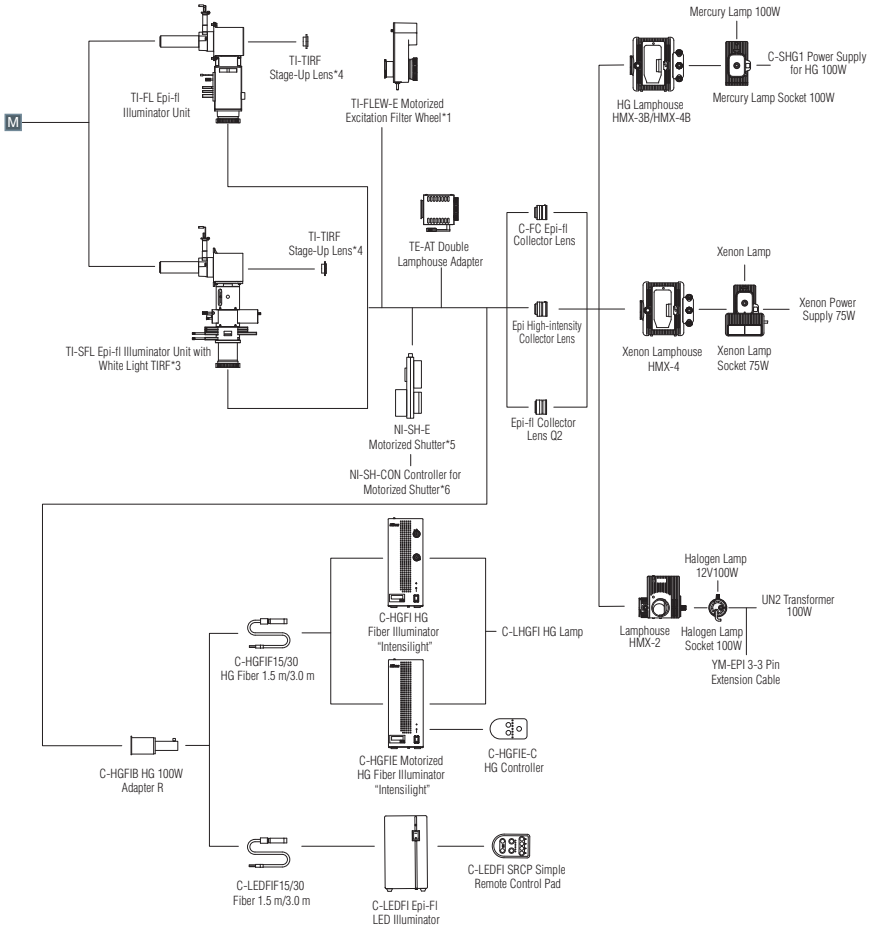
G Back Port



F Side Port

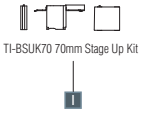


M Epi-fluorescence Illuminator Unit/White Light TIRF Illuminator Unit



J Analyzer

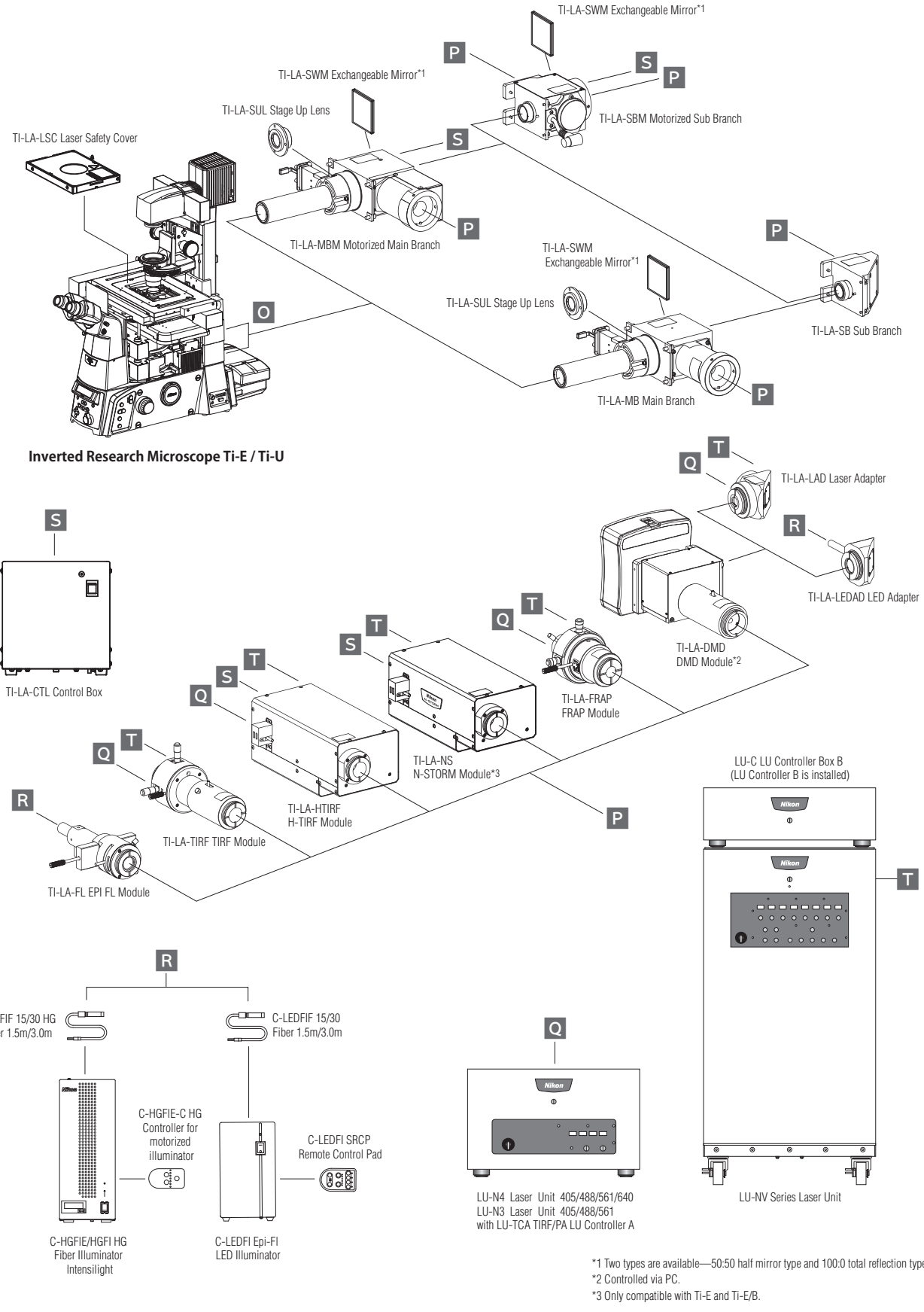
I Stage Riser



System Diagram

There are restrictions for some module combinations. For more information, please consult with Nikon.

O Ti-LAPP System



*1 Two types are available—50:50 half mirror type and 100:0 total reflection type.
*2 Controlled via PC.
*3 Only compatible with Ti-E and Ti-E/B.

Specifications

Ti-E

Ti-U

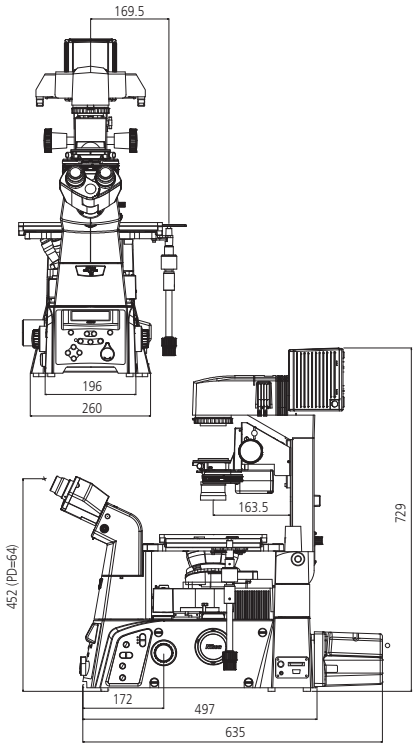
Ti-S

		Ti-E, Ti-E/B	Ti-U, Ti-U/B	Ti-S, Ti-S/L100
Main body	Port	Ti-E: 3 ports Eyepiece 100%, left 100%, right 100%*, eyepiece 20%/left 80%* Ti-E/B: 4 ports Eyepiece 100%, left 100%, right 100%**, bottom 100% Motorized optical path switching	Ti-U: 3 ports Eyepiece 100%, left 100%, right 100%, AUX** Ti-U/B: 4 ports, Eyepiece 100%, left 100%, right 100%**, bottom 100% Manual optical path switching	Ti-S: 2 ports Eyepiece 100%, eyepiece 20%/left 80%***, Ti-S/L100: 2 ports Eyepiece 100%, left 100%*** Manual optical path switching
		Two ports (tube base unit with side port, back port) can be added optionally.		
	Focusing	Via motorized nosepiece up/down movement Stroke (motorized): up 7.5 mm, down 2 mm Motorized (pulse motor) Minimum step: 0.025 µm Maximum speed: 2.5 mm/sec Motorized escape and refocus mechanism (coarse) Coarse/fine/exfine switchable	Via nosepiece up/down movement Stroke (manual): up 8 mm, down 3 mm Coarse stroke: 5.0 mm/rotation Fine stroke: 0.1 mm/rotation Minimum fine reading: 1 µm Coarse refocusing mechanism	—
	Intermediate magnification	1.5x		—
	Other	Light intensity control, Light on/off switch, VFD display on front of body, Operation with controller	—	
Tube	Tube body	TI-TD Binocular Tube D, TI-TS Binocular Tube S, TI-TERG Ergonomic Tube		
	Tube base unit	TI-T-B Eyepiece Tube Base Unit, TI-T-BPH Eyepiece Tube Base Unit for PH, TI-T-BS Eyepiece Tube Base Unit with Side Port		
	Eyepieces	CFI 10x, 12.5x, 15x		
Illumination pillar		TI-DS Diascopic Illumination Pillar 30W, TI-DH Diascopic Illumination Pillar 100W		
Condenser		ELWD condenser, LWD condenser, NAMC condenser, ELWD-S condenser, High NA condenser, Darkfield condenser, CLWD condenser		
Nosepiece		TI-ND6-PFS-S Perfect Focus Unit with Motorized Nosepiece, TI-ND6-PFS-MP Perfect Focus Unit with Motorized Nosepiece for MP	—	
		TI-ND6-E Motorized Sextuple DIC Nosepiece, TI-N6 Sextuple Nosepiece, TI-ND6 Sextuple DIC Nosepiece		
Objectives		CFI60 objectives		
Stage		TI-S-ER Motorized Stage with Encoders, TI-S-E Motorized Stage — Cross travel: X110 x Y75 mm, Size: W400 x D300 mm (except extrusions) TI-SR Rectangular Mechanical Stage, TI-SR/F Rectangular Stage with front positioned knob, TI-SSR Short-handle Rectangular Stage—Cross travel: X70 x Y50mm, Size: W310 x D300mm TI-SP Plain Stage — Size: W260 x D300 mm TI-SAM Attachable Mechanical Stage — Cross travel: X126 x Y84 mm when used with TI-SP Plain Stage		
Motorized functions		Focusing, Port switching	—	
Epi-fluorescence attachment		Sextuple fluorescence filter cube rotating turret, Filter cubes with noise terminator mechanism, Field diaphragm centerable, 33 mm ND4/ND8 filters, 25 mm heat absorbing filter Option: Motorized sextuple fluorescence filter cube rotating turret, Motorized excitation filter wheel, Motorized barrier filter wheel		
Nomarski DIC system		Contrast control: Senarmont method (by rotating polarizer) Objective side prism: for individual objectives (installed in nosepiece) Condenser side prism: LWD N1/N2/NR (Dry), HNA N2/NR (Dry/Oil) types		
Weight (approx.)		Phase contrast set: 41.5 kg Epi-fl set: 45.4 kg	Phase contrast set: 38.5 kg Epi-fl set: 42.3 kg	Phase contrast set: 29.6 kg Epi-fl set: 33.4 kg
Power consumption (max.)		Full set (with HUB-A and peripherals): approx. 95W	Full set (with HUB-A-U and peripherals): approx. 40W	

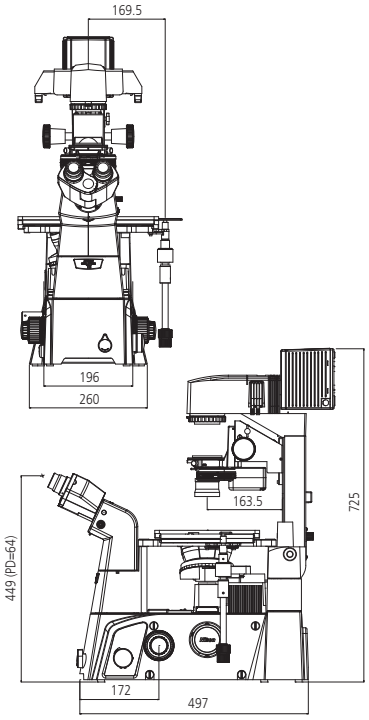
The following options are available at time of purchase;
Change * to eyepiece 20%/right 80%
Change ** to eyepiece 20%/right 80% or eyepiece 20%/left 80%
Change *** to right 100% or eyepiece 20%/right 80%

Dimensional Diagram

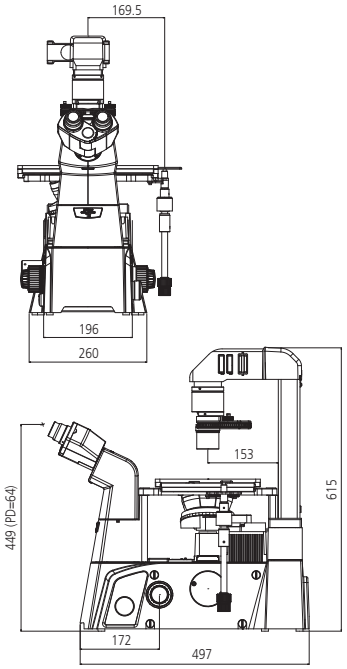
Ti-E



Ti-U



Ti-S



Unit: mm
PD = Pupillary distance

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