Objectives for biological microscopes

CFI Plan Apochromat

Lambda D

Shedding New Light On **MICROSCOPY**

With conventional objective

Capture Every Detail of Biological Phenomena

Microscopic imaging continues to rapidly evolve together with such advances in digital technology as confocal microscopes and high-sensitivity, large field-of-view CMOS cameras. The newly developed CFI Plan Apochromat Lambda D is a high-performance objective series optimized for digital solutions that are essential for future life science research.

The Lambda D series objectives provide high image quality across the large field of view of 25 mm and chromatic aberration correction over a wide wavelength range. They improve the accuracy of quantitative analysis and realize highly reliable data acquisition.

With Lambda D objective ①

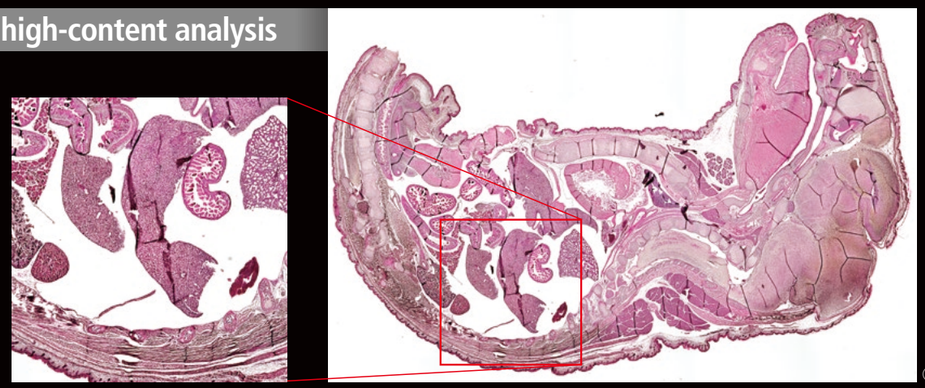
Both the brightness and image quality at the edges of the field of view have been improved, enabling images of fibrous microstructures to be captured at high resolutions.

Lambda D

Seamless image stitching

Macro imaging of large samples

Quantitative high-content analysis



Acquisition of large FOV high-definition images ②

Bright and Clear over a Large Field of View

Image flatness has been improved by adopting a newly-developed high-refractive index glass and correcting field curvature in the oil immersion objectives. Bright and clear images can be obtained right up to the edge of the 25 mm field of view.
This results in:

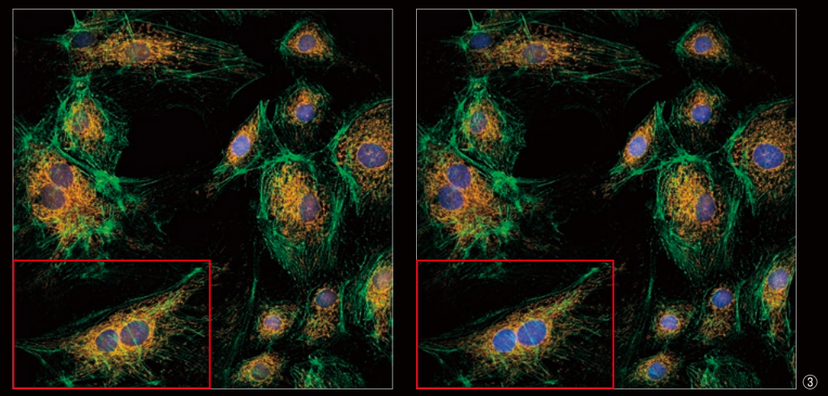
- Improved light intensity measurement accuracy
- Generation of seamless macro images in a short time
- Acquisition of a wide range of life phenomena with a single image
- Enhancement of high-content screening throughput

Reduced light intensity deterioration at the periphery of the field of view

The Lambda D series objectives minimize light intensity deterioration at the periphery of the field of view. This allows (DAPI stained) cell nuclei at the edges of the image to be observed brightly, even with confocal imaging.

With conventional objective

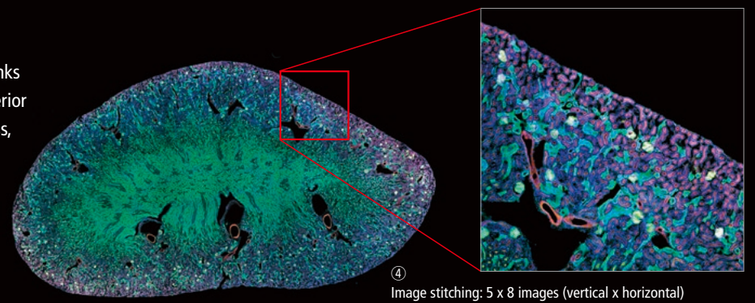
With Lambda D objective



③

High-precision image stitching

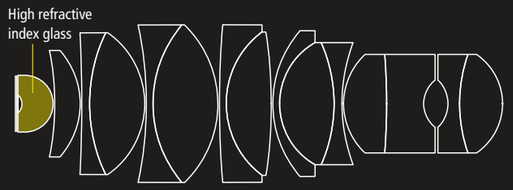
Since image acquisition time can be reduced thanks to a large 25 mm diagonal field of view and superior image quality up to the image periphery, seamless, high-quality stitched images can be efficiently obtained.



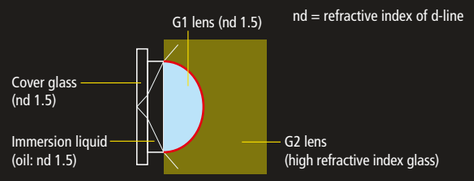
④

Image stitching: 5 x 8 images (vertical x horizontal)
Objective: 10X

High refractive index glass achieves uniform brightness and image quality



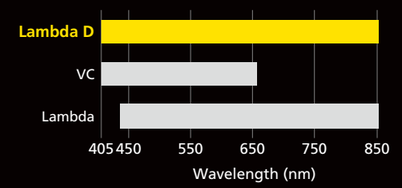
The Lambda D series employs glass with a high refractive index as the material for the front lens at the head of the oil immersion objective to correct field curvature.



By adopting glass with a higher refractive index than that of the G1 lens for the G2 lens, the Petzval sum of the entire objective is reduced, and image flatness and performance at the periphery of the field of view are improved.

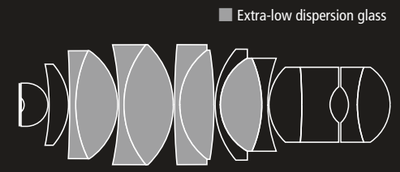
Accurate Data Acquisition in All Wavelengths

Extra-low dispersion glass has been employed as a lens material, simultaneously correcting chromatic aberration over a wide wavelength range of 405 nm to 850 nm. Since deviation of the image plane for each wavelength is imperceptible, high-precision multicolor imaging is enhanced.
Highly reliable quantitative data can be obtained when measuring the light intensity of nuclear stains.



The Lambda D series covers the correction range of the conventional VC and Lambda high performance objectives.

Extra-low dispersion glass corrects chromatic aberration



Using glass with low dispersion characteristics corrects chromatic aberration from 405 nm.

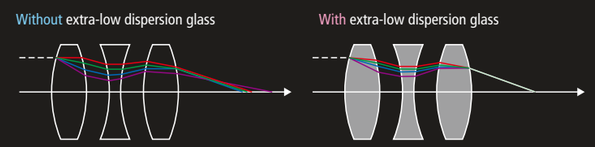
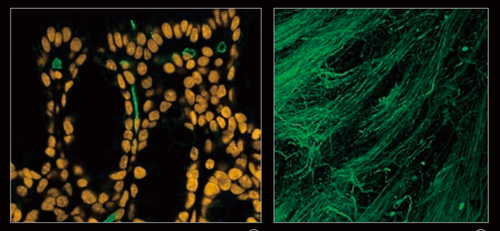


Image formation positions of different wavelengths can be corrected using extra-low dispersion glass.

The Endless Pursuit of High Resolution

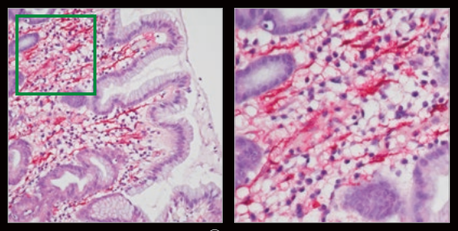
Using technology that processes the edge of lens elements to the minimum thickness, Nikon has maximized the use of the light rays that pass through the periphery of the lens diameter to increase numerical aperture, delivering high resolution of fine structures.

Clear fluorescent images with high S/N ratios can be obtained.



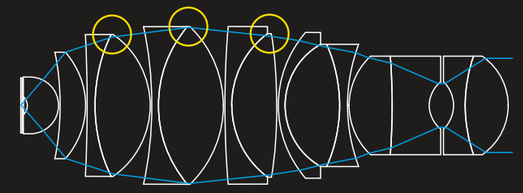
⑤ ⑥

High resolution images can be captured with a large field of view.

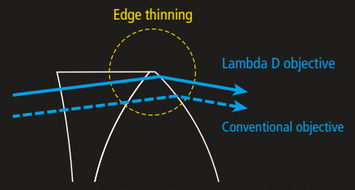


⑦

Edge thinning technology that achieves high resolution



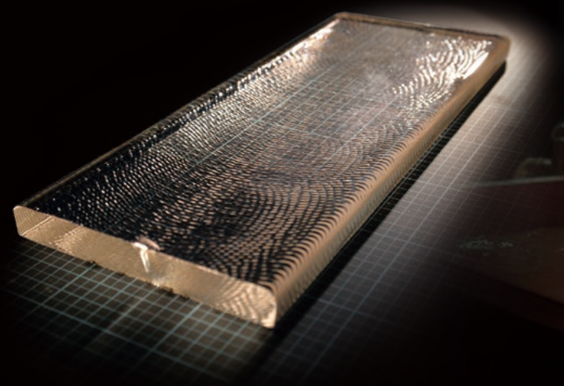
The edge thickness of each of the lens elements is processed to be as thin as possible to expand each element's effective diameter.



By enlarging the effective diameter of the lens, light beams with larger divergence angles emitted from objects can be captured, improving the numerical aperture.

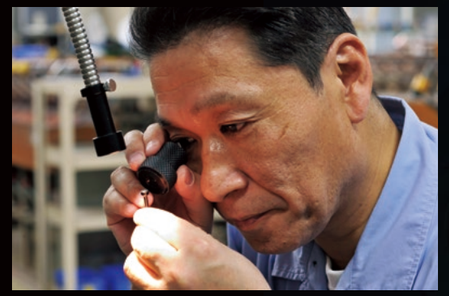
It Starts with the Glass

Nikon has been developing optical glass since its inception in 1917, and has built its own system that manufactures glass materials in-house. For this reason, Nikon can flexibly meet the developmental needs of high-performance lenses with specific refractive indices, dispersion characteristics, and transmittance. Optical glass starts as an ingot with the target refractive index, which is formed by blending glass elements and melting them. It is precision-cut, polished and coated to produce lens elements for objectives.

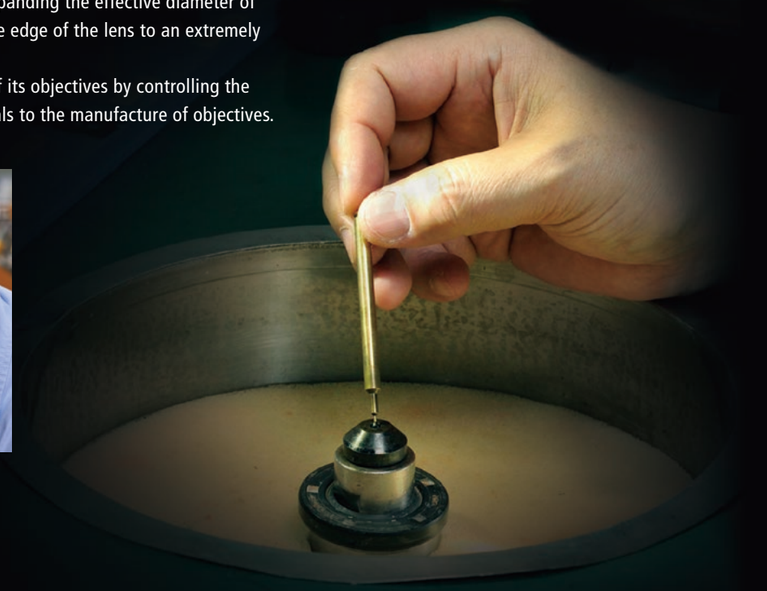


Mastering Excellence

Since the front lens of a high-performance objective is very small and has a special shape, the lens is hand-polished by Nikon's most highly skilled experts, not by a machine. Also, its numerical aperture has been improved by expanding the effective diameter of the lens, with advanced technology that processes the edge of the lens to an extremely low thickness with high precision.
Nikon ensures the highest quality and performance of its objectives by controlling the entire process, from the development of glass materials to the manufacture of objectives.

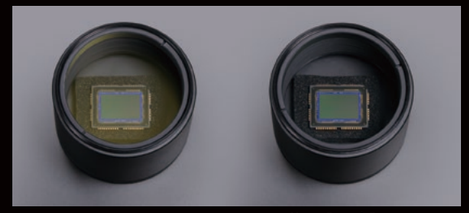


Polished front lens (Right)

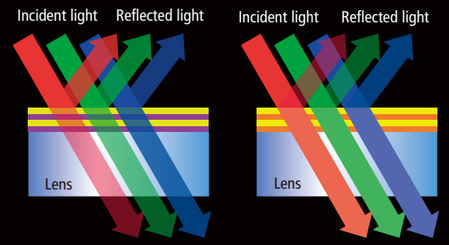


Anti-Reflective Nano Crystal Coat

Nano Crystal Coat is ultra-low refractive index thin film technology that applies a nanoparticle film used for the projection lens of Nikon's semiconductor manufacturing equipment. An extremely high antireflection effect is achieved by forming a low-density film with particles of a few nanometers to a dozen nanometers. Nano Crystal Coat reduces the reflection of vertically incident light compared to conventional antireflection film, achieving extremely high transmittance in a wide wavelength range. It also has an unprecedented effect with respect to ghosting and flares caused by obliquely incident light.



Conventional anti-reflection multilayer film　　Nano Crystal Coat



Conventional multi-layer coating　　Nano Crystal Coat

Main specifications of Lambda D series

Product	Immersion	NA	W.D. (mm)	Cover glass thickness (mm)	Correction ring	Brightfield	Darkfield	DIC	Phase contrast	Simple polarizing	Fluorescence (405-853 nm)	Confocal (405-656 nm)
CFI Plan Apochromat Lambda D 2X		0.10	8.50	0/0.17		◎					◎	◎*
CFI Plan Apochromat Lambda D 4X		0.20	20.00	0/0.17		◎					◎	◎
CFI Plan Apochromat Lambda D 10X		0.45	4.00	0.17		◎	△	◎		◎	◎	◎
CFI Plan Apochromat Lambda D 20X		0.80	0.80	0.17		◎	◎	◎		◎	◎	◎
CFI Plan Apochromat Lambda D 40XC		0.95	0.21	0.11～0.23	✓	◎	◎	◎		◎	◎	◎*
CFI Plan Apochromat Lambda D 60X Oil	Oil	1.42	0.15	0.17		◎		◎	★	◎	◎	◎
CFI Plan Apochromat Lambda D 100X Oil	Oil	1.45	0.13	0.17		◎		◎	★	◎	◎	◎

◎ = Recommended for best results, △ = Possible, ★ = Compatible with Ti2 inverted microscope external phase contrast system, *: Supports 488-656 nm

Recommended System Configuration

For fluorescence imaging

Achieves high throughput even for acquisition of the large amounts of data in the large 25 mm field of view.

Large field of view system
Lambda D objectives
Ti2 series inverted research microscope
Digital Sight 10 microscope camera

For pathological examination

Improves the reliability of examinations, with color that is faithful to the sample and high resolution.

Examination system
Lambda D objectives
Ni series upright research microscope
Digital Sight 10 microscope camera

For confocal imaging

Corrects chromatic aberrations over a wide range of wavelengths from 405 nm to near-infrared, and improves the reliability of multicolor imaging.

Confocal imaging system
Lambda D objectives
Ti2-E motorized inverted research microscope
AX confocal microscope

Sample images

① Mouse kidney; Label: Alexa 488 WGA, Alexa 568 Phalloidin, DAPI; Camera: DS-Qi2; Objective: CFI Plan Apochromat Lambda D 10X
② Mouse embryo; Label: H&E staining; Camera: Digital Sight 10; Objective: CFI Plan Apochromat Lambda D 4X
③ BPAE cells; Label: GFP, MitoTracker Red, DAPI; Microscope: AX R; Objective: CFI Plan Apochromat Lambda D 60X Oil
④ Mouse kidney; Label: Alexa 488 WGA, Alexa 568 Phalloidin, DAPI; Camera: DS-Qi2; Objective: CFI Plan Apochromat Lambda D 10X
⑤ Mouse intestine; Label: Alexa 488, Alexa 633; Microscope: AX R; Objective: CFI Plan Apochromat Lambda D 100X Oil
⑥ Mouse cerebral nerve (MIP); Label: GFP; Z range: 165.5 µm; Z step: 0.147 µm; Microscope: AX R; Objective: CFI Plan Apochromat Lambda D 100X Oil
⑦ Gastric wall; Label: SMA antibody staining; Camera: Digital Sight 10; Objective: CFI Plan Apochromat Lambda D 40XC; Image courtesy of Nichirei Biosciences Inc.

Specifications and equipment are subject to change without any notice or obligation on the part of the manufacturer. February 2022

⚠ WARNING	TO ENSURE CORRECT USAGE, READ THE CORRESPONDING MANUALS CAREFULLY BEFORE USING YOUR EQUIPMENT.

Lambda D product page

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