



Digital Cameras for Microscopes



DIGITAL CAMERAS FOR MICROSCOPES

# DIGITAL SIGHT

SERIES



■ BINO  
■ BINO &  
PHOTO  
■ PHOTO

# Introducing two new high resolution 16.25 megapixel CMOS cameras to Nikon's lineup of cameras for microscopy

Two Nikon FX-format CMOS sensor cameras join the Digital Sight series of microscope digital cameras: the DS-Ri2 color digital camera and the DS-Qi2 monochrome digital camera.

High pixel density and large field of view coupled with USB3.0 high speed data transfer offer fast frame rates and high resolution images with these new CMOS sensors.



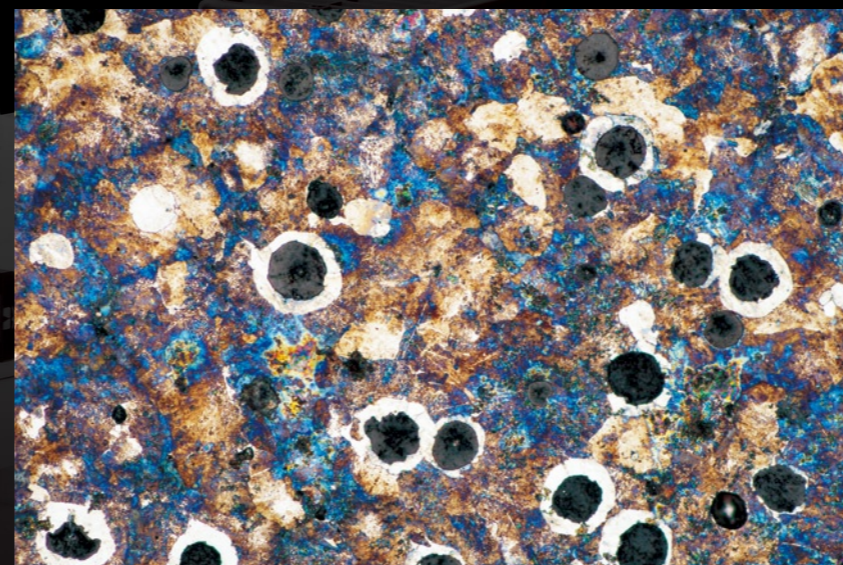
## Large Format CMOS Sensors

Nikon manufactures CMOS sensors and imaging technologies for professional DSLR cameras, and now has optimized our sensors for microscopy



## DS-Ri2

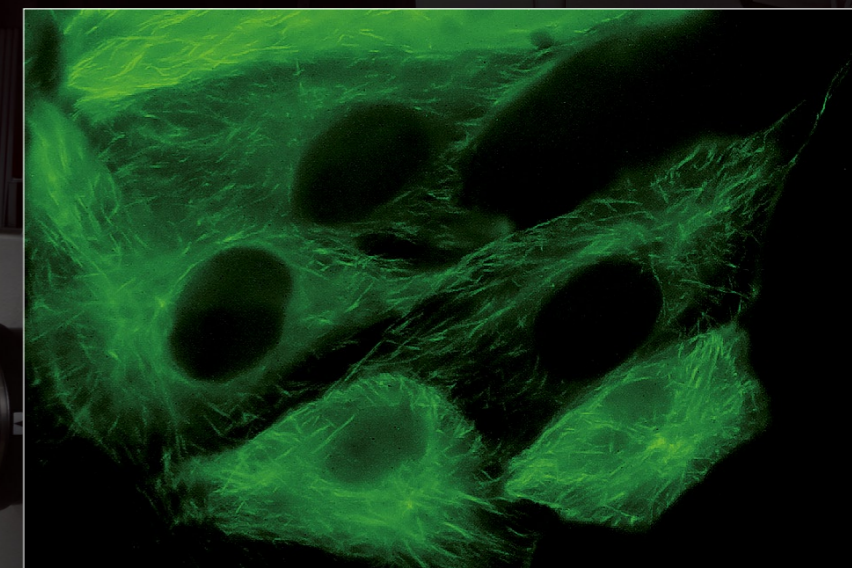
16.25 million pixels (not interpolated) and accurate color rendition are features that make the DS-Ri2 an excellent choice for recreating color images as they eyes see them



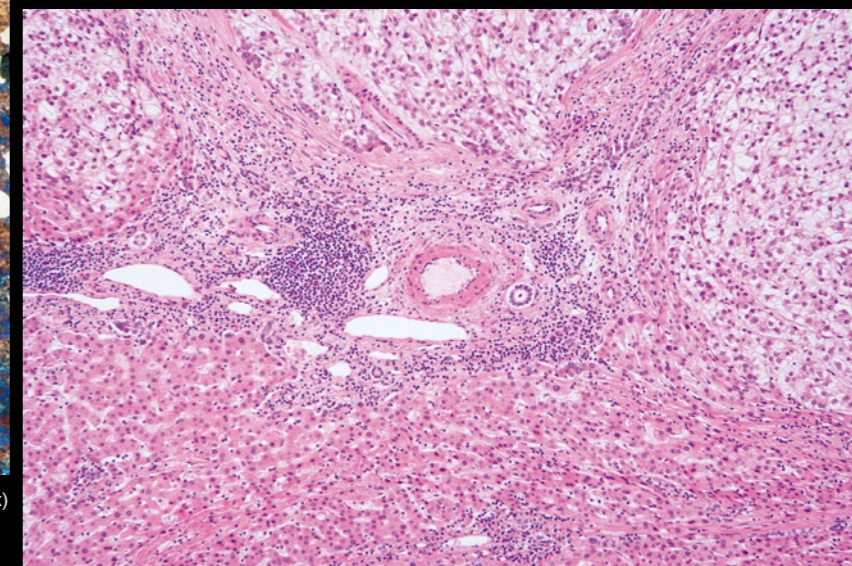
Malleablecastiron (Objective: TU Plan Fluor 20x)

## DS-Qi2

High pixel density, high sensitivity and low noise are key features of the DS-Qi2 monochrome camera



Pig kidney epithelial cells expressing GFP-EB3 tubulin  
Sample courtesy of: Michael Davidson, National High Magnetic Field Laboratory, Florida State University



The tissues of the liver, HE staining (Objective: CFI Plan Apochromat  $\lambda$  10x)  
Photos courtesy of: Kazuhiro Muraoka, Photography Division, Tokyo Women's Medical University

# Fast, one-shot capture of ultra-high resolution color images.

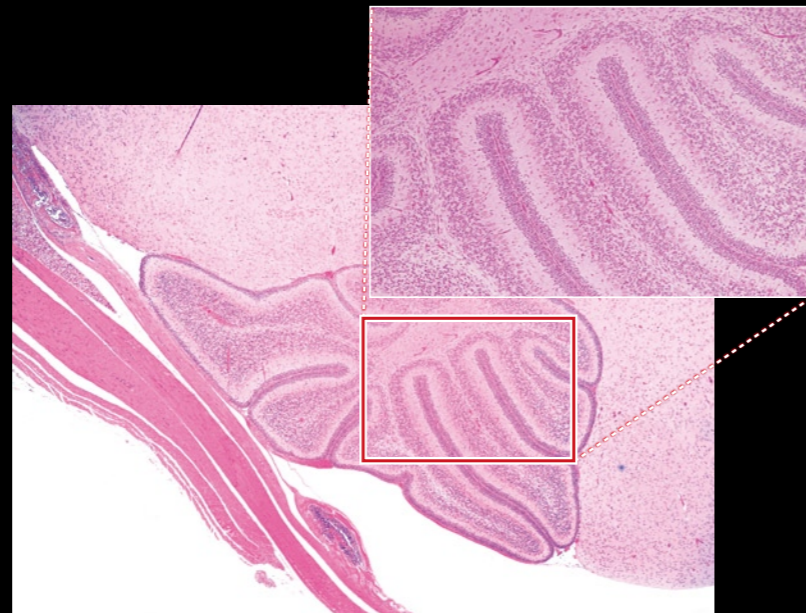
Microscope Camera

## DS-Ri2

16.25-megapixel

Color

High-resolution



Mouse cerebellum sagittal section, hematoxylin and eosin stained  
(Objective: CFI Plan ApoChromat  $\lambda$  4x)

### High-resolution images

#### 16.25-megapixel CMOS sensors for astonishing image quality

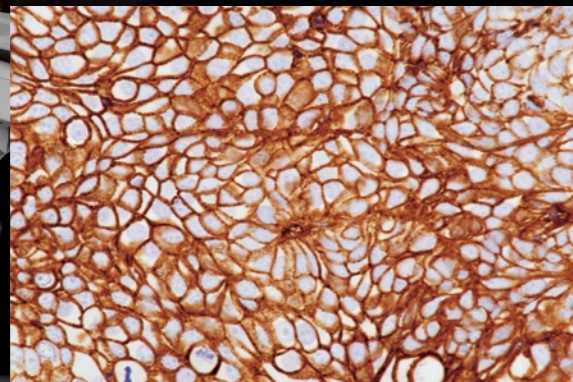
The DS series enables one-shot instantaneous capture and fast storage of images with resolution as high as 4908 x 3264 pixels, without pixel shifting or pixel stepping.

This pixel density is ideally suited for photomicrography of ultra-fine structures or patterns in biological or industrial samples, at low or high magnifications.

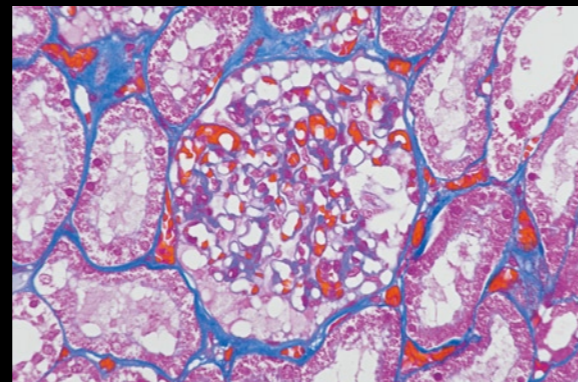
### Photography with the natural colors seen through the microscope

#### Nikon is a leader in development of algorithms for reproducing color just as the eyes see it

The DS models' new image processing engine is based on extensive data accumulated over many years of developing microscope color digital cameras, resulting in perfect reproduction of the colors your eyes see in the microscope.

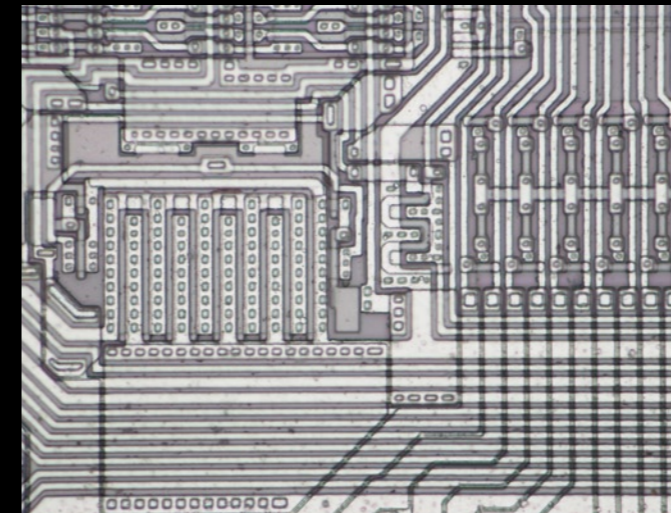


Pancreatic cancer cell, NGFR immunostaining\*1  
(Objective: CFI Plan ApoChromat  $\lambda$  40x)



Human glomerulus of kidney, Azan stain\*2  
(Objective: CFI Plan ApoChromat  $\lambda$  40x)

\*1, \*2 Photos courtesy of: Dr. Atsushi Furuhashi and Noriyoshi Sueyoshi, Assistant General Manager, Laboratory of morphology and image analysis, BioMedical Research Center, Juntendo University Graduate School of Medicine



Semiconductors (IC wafers)  
(Objective: TU Plan Fluor 20x)

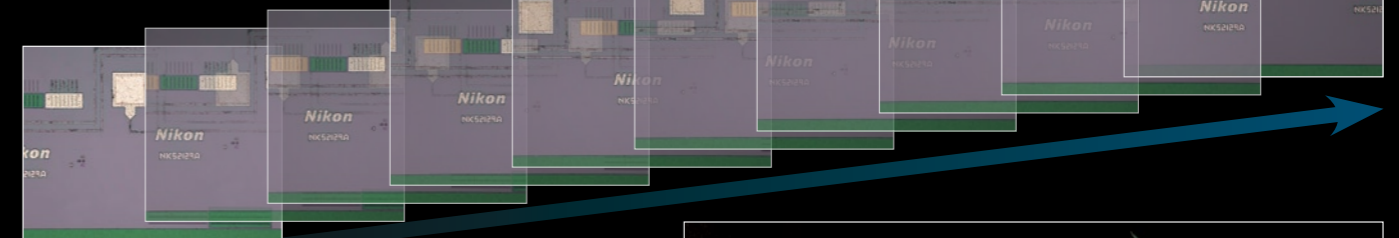
### High-speed live display

#### High-speed display, even of supra-HDTV-class live images

The DS-Ri2 can display 4908x3264 pixel (full-pixel) images at 6 fps, or 1636x1088 pixel (3x3 pixel averaging) images at 45 fps.

This fast live frame rate makes fine focusing easy to perform.

Semiconductors (IC wafers)  
(Objective: TU Plan Fluor 5x)  
1636x1088 pixel / Exposure time: 100 $\mu$ sec

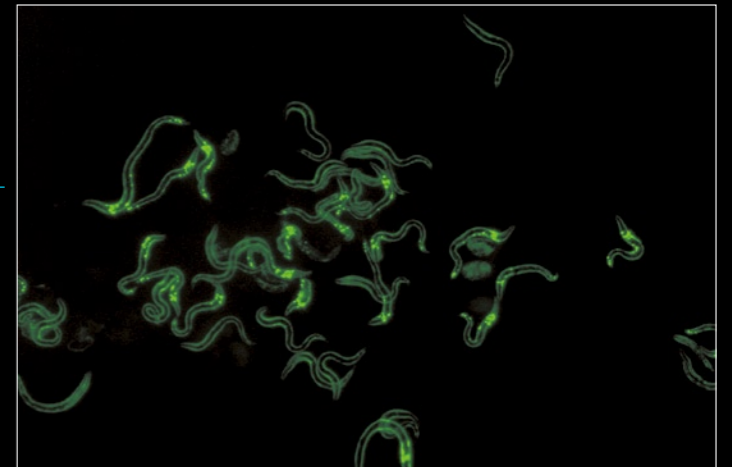


### High sensitivity, low noise

#### Fluorescent color image capture with high signal to-noise ratio

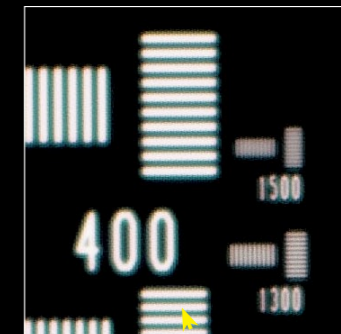
Sensitivity settings that span the range from ISO200 to ISO12800 allow the capture of vivid fluorescent color images.

Transgenic *C. elegans* expressing venus in the head neurons and EGFP in the body wall muscles.  
Photos courtesy of: Drs. Keiko Gengyo-Ando and Junichi Nakai, Saitama University Brain Science Institute



Conventional camera

DS-Ri2



Resolution chart  
(Objective: TU Plan Fluor 20x)



Example of combination  
with the LV100ND  
industrial microscope

# Capture Low light fluorescence and Large Fields of View

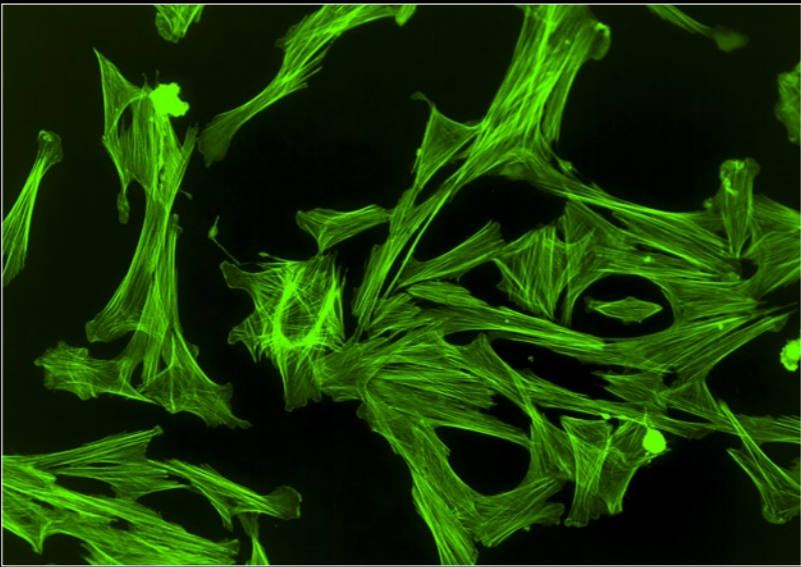
Monochrome Microscope Camera

**DS-Qi2**

16.25-megapixel

Monochrome

Cooled

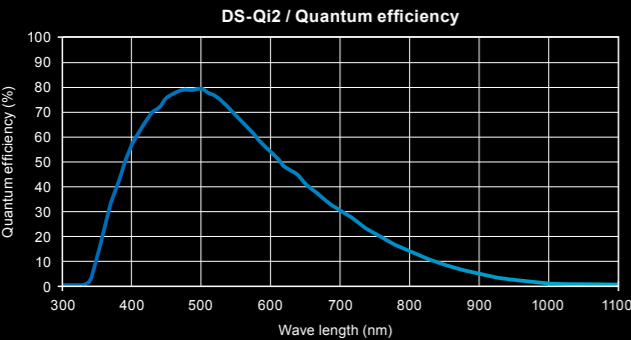


Indian Muntjac Deer Skin Fibroblast Cells, Cytoskeletal F-actin labeled with Alexa Fluor 488  
Sample courtesy of: Michael Davidson and Florida State University

## High sensitivity

Detects even faint fluorescent signals

7.3µm pixels, high quantum efficiency, and very low read noise allow the DS-Qi2 to read in even faint fluorescent signals.



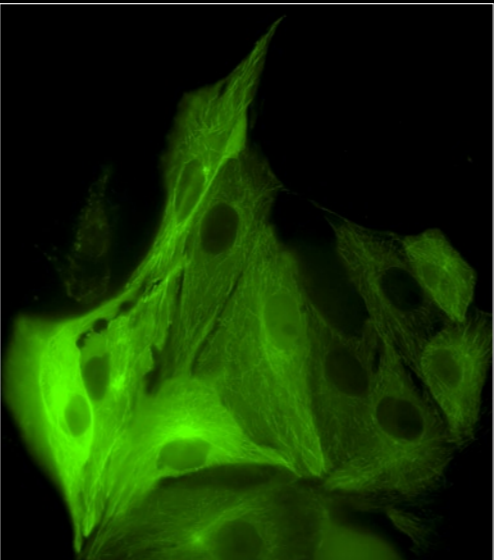
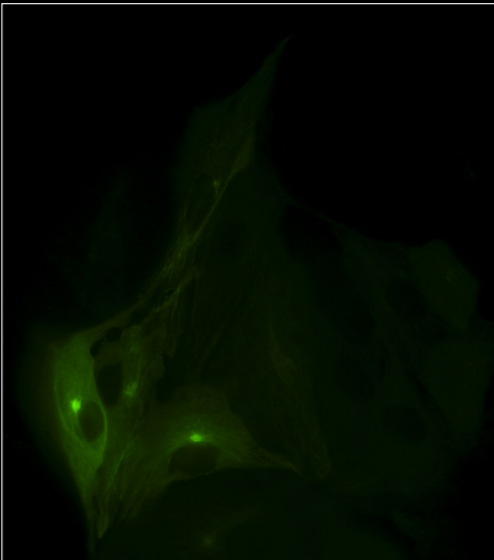
## Low noise

Acquires dim fluorescent signals with ultra-low noise

Both 2.2 electrons read noise coupled with a large full-well capacity and 0.6 electrons dark current allow the acquisition of fluorescence images with very little noise.

LLC-PK1 cells expressing GFP-EB3 tubulin with low noise. Large linear full well capacity allows acquiring both the brightest and dimmest areas in a single capture.

Sample courtesy of: Michael Davidson, National High Magnetic Field Laboratory, Florida State University



## Excellent linearity

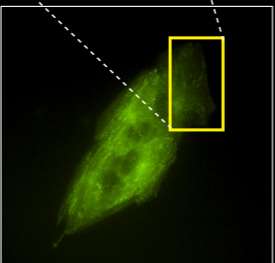
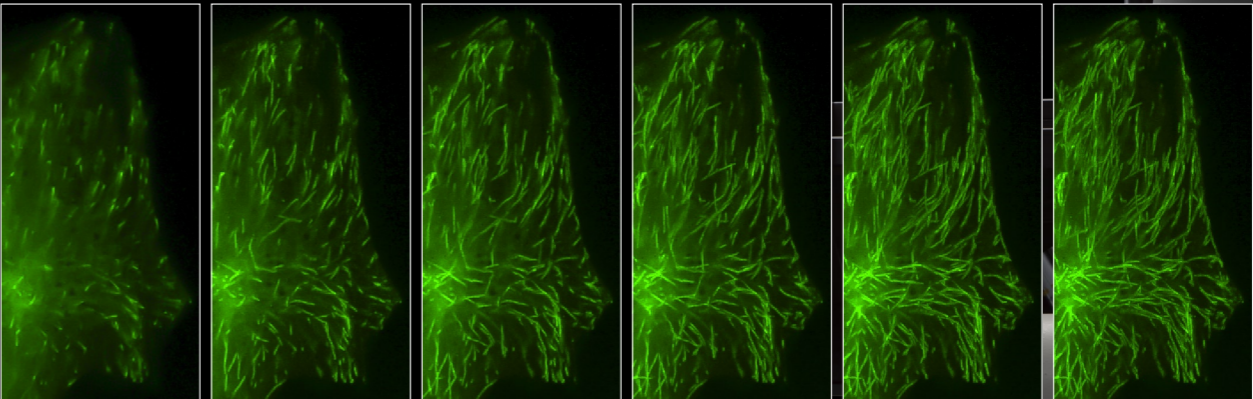
Reliable quantitative analysis made possible

With a linearity error of  $\pm 1\%$ , the DS-Qi2 is a superb tool for measuring intensities in fluorescence samples, including time-based intensity measurement and ratiometric measurement.

## High frame rate

Fast focusing, even with fluorescent images

With a high-sensitivity CMOS sensor and USB 3.0-based data transfer, the DS-Qi2 enables high-speed live imaging and image capture at up to 45 fps (1636x1088 pixels).



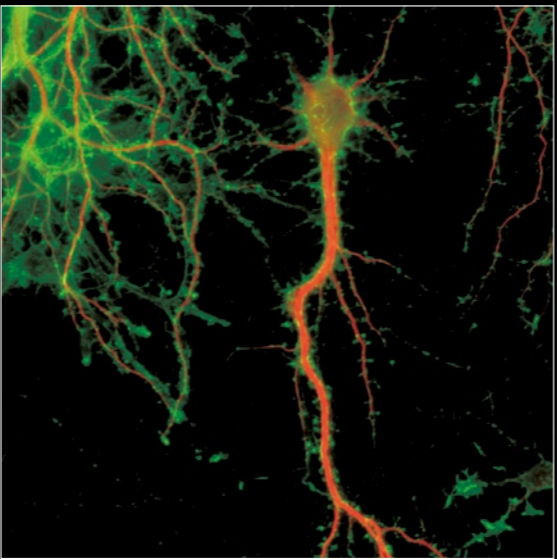
Time-lapse images (every 1 second) of LLC-PK1 cells with GFP-EB3 tubulin. Each image represents the maximum intensity projection of the timelapse, allowing visualization of the end-binding protein located on the microtubule plus-ends, and allowing tracing of the microtubule path.  
DS-Qi2 captures an extremely large field of view, but still represents very fine details as demonstrated in this cropped timelapse sequence from a large FOV image.  
Objective: CFI Plan Apochromat  $\lambda$  60x oil / NA: 1.4)

Sample courtesy of: Michael Davidson, National High Magnetic Field Laboratory, Florida State University

## Time-lapse photography

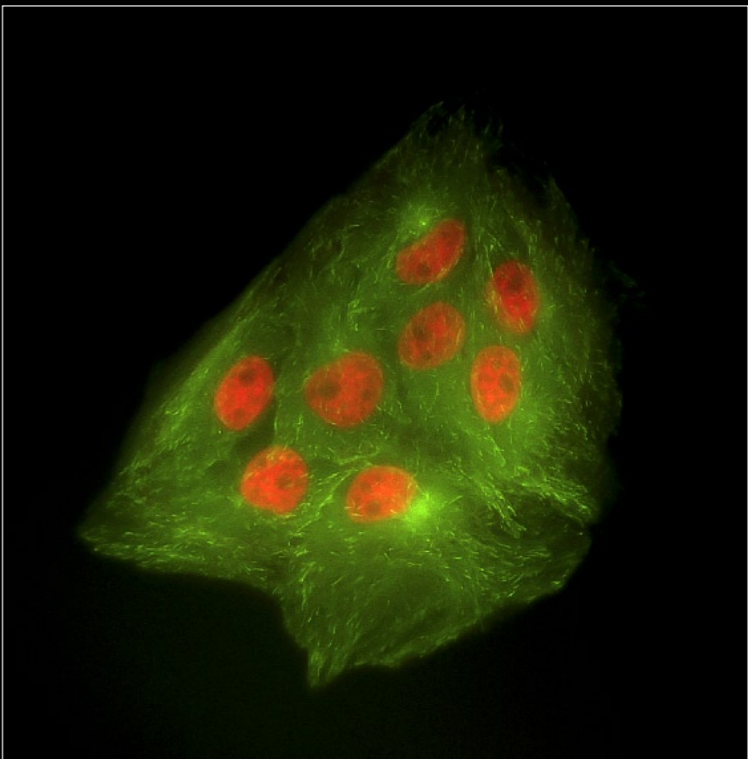
Fluorescent time-lapse imaging through integration with NIS-Elements software

With a large field of view and pixel density, and low noise, the DS-Qi2 is ideal for time-resolved imaging applications.



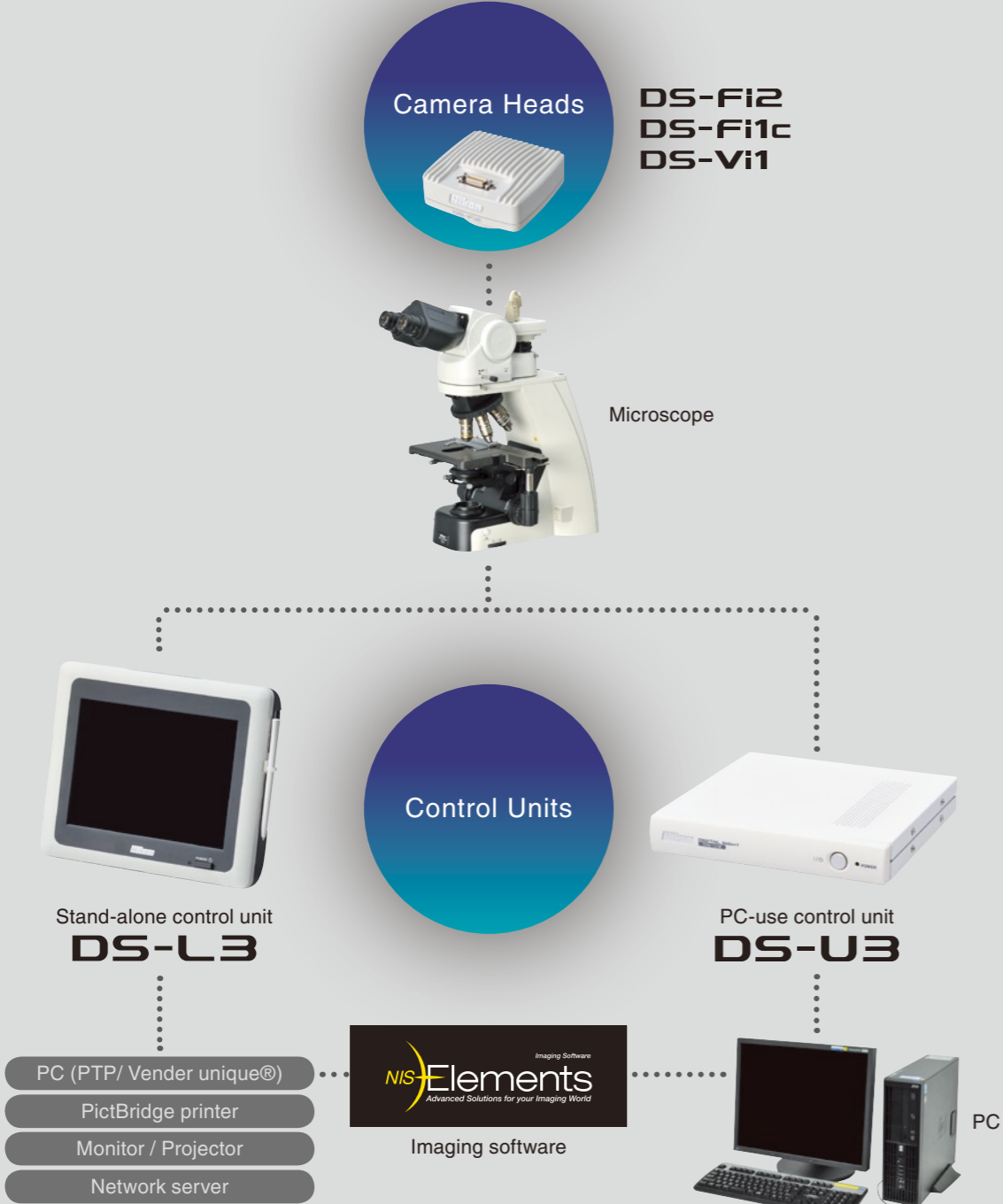
▲ Rat primary culture neuron  
Dendron labeled with MAP-2(Red) and Actin(cytoskeleton) labeled with Phalloidin (Green)

► LLC-PK1 cells expressing GFP-EB3 tubulin (green) and H2B-labeled histones (red) illustrating the large field of view of the DS-Qi2 camera.  
Sample courtesy of: Michael Davidson, National High Magnetic Field Laboratory, Florida State University



A microscope digital camera system with selectable combinations of camera head and controller for every application

Three models of compact color digital cameras for microscopy are available as camera heads. Two models of controller are available: a stand-alone type with built-in monitor for easy image capture, and a PC-use controlled type that enables advanced image processing and analysis via imaging software. The three camera head models and two controller models can be freely combined to create a system for every purpose.



Digital camera heads



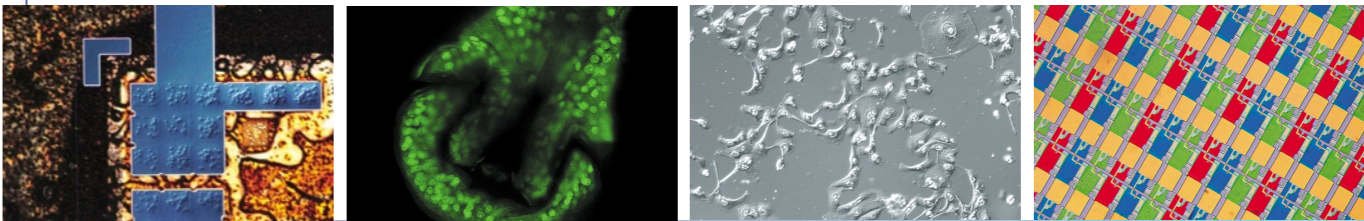
DS-Fi2 5.0-megapixel Color High-resolution

High-definition color camera head

The DS-Fi2 is capable of high-resolution 2560×1920 pixel shooting. In addition to a high-speed frame rate of 21 fps\*, this model expands the range of settings available for exposure time to adapt to a wider variety of samples. Suitable for a wide range of applications including brightfield, phase contrast, and differential interference, the DS-Fi2 achieves high functionality and high cost-performance.

\* When using DS-L3 and FAST mode

Image sensor		2/3" color, 5.0 megapixels, CCD
Max recordable pixels		2560×1920
Display speed	DS-U3	4.4 fps (2560×1920), max. 37 fps
	DS-L3	Standalone: 10 fps (2560×1920), max. 37 fps Used with NIS-Elements: 2.0 fps (2560×1920), max. 37 fps
ISO sensitivity		Equivalent to ISO 64
Features and main applications		High resolution/brightfield, phase contrast, differential interference, etc.

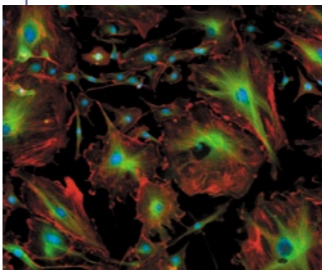


DS-Fi1c 5.0-megapixel Color Cooled High-resolution

High-definition cooled color camera head

The DS-Fi1c is equipped with a 5.0-megapixel color CCD and Peltier element capable of cooling to a -20°C ambient temperature. Even in fluorescent image shooting requiring long exposure times, high-contrast images can be obtained with limited thermal background noise.

Image sensor		2/3" color, 5.0 megapixels, CCD
Max recordable pixels		2560×1920
Cooling device		20°C below ambient temperature
Display speed	DS-U3	4.4 fps (2560×1920), max. 23 fps
	DS-L3	Standalone: 5.9 fps (2560×1920), max. 23 fps Used with NIS-Elements: 2.0 fps (2560×1920), max. 23 fps
ISO sensitivity		Equivalent to ISO 64
Features and main applications		High-speed live display/brightfield, phase contrast, differential interference, etc.



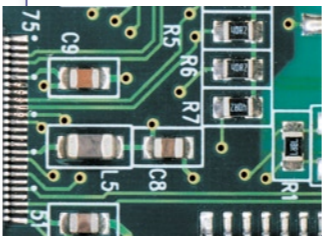
DS-Vi1 2.0-megapixel Color

High-speed color camera head

The DS-Vi1 is equipped with a 2.0-megapixel color CCD that displays SXGA video at a high frame rate of 15 fps\* (maximum 29 fps). This model is suitable for monitoring applications as well, with an excellent balance of smooth movement and clear imaging made possible through its high sensitivity.

\* When using DS-L3 or external monitor output.

Image sensor		1/1.8" color, 2.0 megapixels, CCD
Max recordable pixels		1600×1200
Display speed	DS-U3	12 fps (1600×1200), max. 27 fps
	DS-L3	Standalone: 15 fps (1600×1200), max. 29 fps Used with NIS-Elements: 5.0 fps (1600×1200), max. 27 fps
ISO sensitivity		Equivalent to ISO 100
Features and main applications		High-speed live display/brightfield, phase contrast, differential interference, etc.



Stand-alone control unit

# DS-L3

Equipped with a large touch panel monitor and a rich feature set, the DS-L3's ease of operation enables quick image acquisition even without a PC or computer monitor.



Configuration of ECLIPSE L200ND

### High-definition touch panel monitor

Built-in 8.4" 1024x768 monitor. Easy to see and easy to use, the large touch-panel monitor allows simple setting and operation of the camera head with a touch of a finger or stylus.

### GUI for intuitive operation

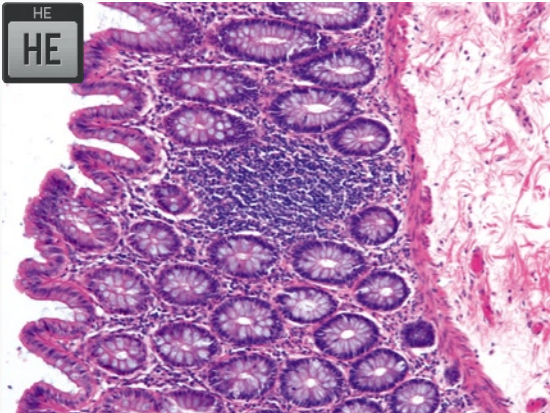
The DS-L3's icon-based menu screens offer excellent recognizability. From image acquisition to setting of shooting parameters, measurement, and export of image data, all operations can be performed easily by touching the screen.



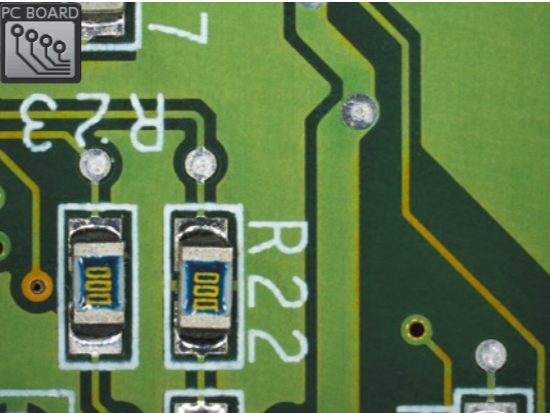
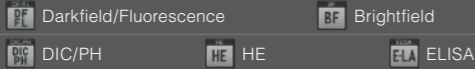
Main menu/Tool menu GUI

### Scene mode

Optimal imaging parameters for each sample type and observation method can easily be set through the icons. A choice of five modes for biological imaging and four modes for industrial imaging are available, and up to seven custom modes with freely configurable shooting parameters can be set.



Biological Scene Mode



Industrial Scene Mode



### Improved image processing performance

The DS-L3 reduces or eliminates diagonal line jaggedness in images and improves color reproduction as well, reducing unevenness in sample colors caused by cameras.



### Integration with microscopes

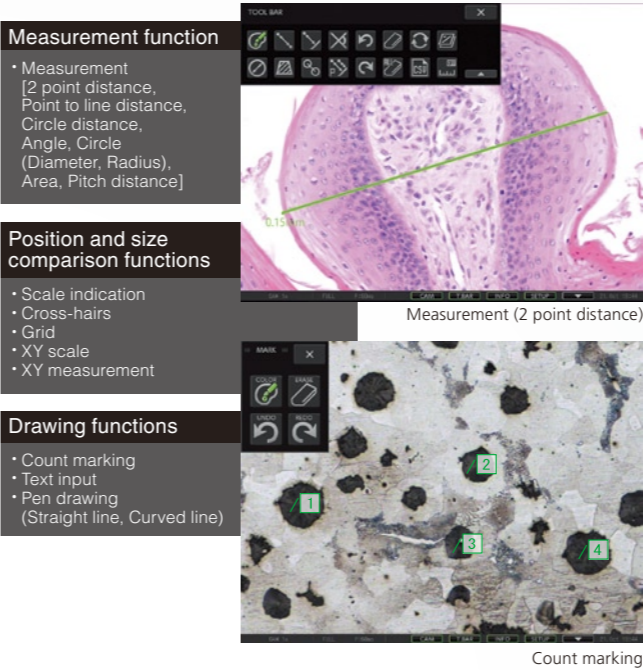
When used with a microscope equipped with motorized units or state detection units, the microscope motor functions and peripheral equipment can be controlled through the DS-L3, with automatic detection of information such as objective lens magnification.



Used with ECLIPSE Ni-E

### A wide variety of tools

The DS-L3 enables the conducting of simple measurements on images, with input of lines and comments. These can also be written onto and saved with the image, and measurement data can be output.



### Interface for a full range of peripheral equipment

Interface	Connector, Type	Connected device	Signal format	Features, etc.
CF card	CF card slot	CF card Typel	FAT16/32 format	Data storage
USB (host)	USB Type A (2 ports)	USB mouse, USB keyboard	2.0/1.1 compatible	Camera operation
		USB bar code reader	2.0/1.1 compatible	Bar code reader (file/directory names)
		USB memory stick	2.0/1.1 compatible, FAT16/32 format	Data storage
		Microscope	2.0/1.1 compatible	Microscope state detection/control
USB (device) (mode selection)	USB Type B	PC	2.0/1.1 compatible, PTP	Data transfer
		Printer	2.0/1.1 compatible, Vendor unique	Controlled via NIS-Elements series
Network	RJ-45	PC, network hub	10Base-T/100Base-TX compatible	Printing possible at set magnification ratios (real 10 mode) with direct printing/specified relay lens combination
External monitor output	DVI-I	PC monitor, Projector	IP address automatically acquirable via DHCP	HTTP/FTP/telnet server (data transfer and camera operation), FTP client (data storage)
External sync input/output	ø3.5 stereo pin-jack	External microscope, etc.	Analog RGB/DVI	Image display Resolution SXGA/XGA/720p switchable
			(Input) 4.7 kΩ pull-up (Output) TTI Level	Video syncing with external device



### PC-use control unit

# DS-U3

From display and shooting of live images to advanced image processing and analysis, the DS-U3 allows the control of all functions from a PC and is flexibly adaptable to a wide range of applications.

### Controllable via PC

The DS-L3 can be controlled via PC using the NIS-Elements software (available separately; see page 12). The DS-L3 can also be used as is for complicated analysis and image processing.

### Saving and printing functions

Saving to a wide range of media (CF cards, USB memory devices, etc.) is possible, as is network transfer. Direct printing to PictBridge printers is a standard feature. Print scaling can be set and adjusted.

### Network functions

Images acquired or under observation can be viewed simultaneously on the DS-L3, a projector, a PC monitor, etc. Through split-screen display, simultaneous comparative observation of an acquired image and a live image is possible, as is upload of shot images to an FTP server.



### Adaptable to a wide range of applications

Using NIS-Elements imaging software(available separately; see page 12), you can perform image acquisition, processing, and analysis with integrated control of the camera and microscope peripherals.

### Integration with microscopes

The DS-U3 enables the control of a motorized microscope system (turning of nosepiece or filter turret, etc.) and automatic detection of objective magnification using a state detection nosepiece.



Configuration of ECLIPSE Ti

## Integration with the comprehensive imaging software series

Nikon uses the NIS-Elements series as control software. NIS-Elements allows functions from basic imaging to control of the microscope and peripheral devices to be performed, as well as the measurement, analysis, and management of acquired images. Four basic packages and a variety of optional modules are available to suit every application and objective.

\* See the NIS-Elements Catalog for details.

### F Free package

Bundled

The bundled free package offers functions for the display of scale on live images, full-screen display, and more. The simple operation screen makes shooting easy.

### D Documentation package

The documentation package is equipped with measurement and report creation functions. It enables general microscopic image acquisition in fields from biomedical to industrial, and is expandable through optional added features such as EDF and databases.

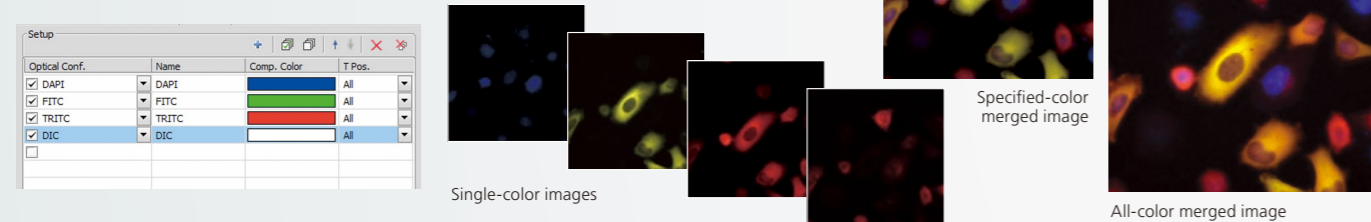
### Br Ar Research package

The research package enables the construction of advanced image acquisition systems, including multidimensional imaging (up to 4 dimensions for Br, 6 dimensions for Ar), through integration with systemized microscopes. Sets equipped with a rich range of image processing and analysis functions are available for every application.

Compatible OS: Windows® 7 Pro 32/64bit (DS-Ri2 / DS-Qi2 / DS-U3 / DS-L3 vender unique mode) \* Nikon provides confirmed compatible PCs with up-to-date specifications. Contact Nikon for details.

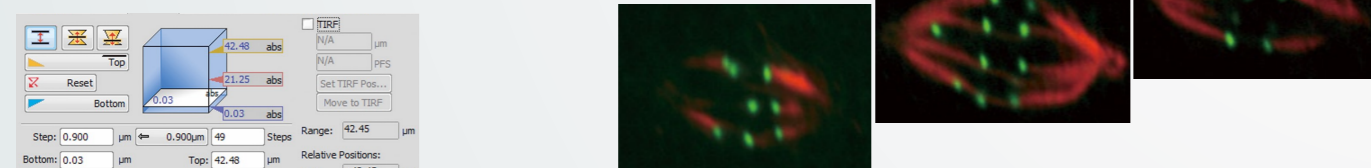
## Multichannel (multi color)

NIS-Elements can acquire full bit depth multi-color images, combining multiple fluorescence wavelengths and different illumination methods (DIC, phase contrast etc.), while offering independently scalable channels.



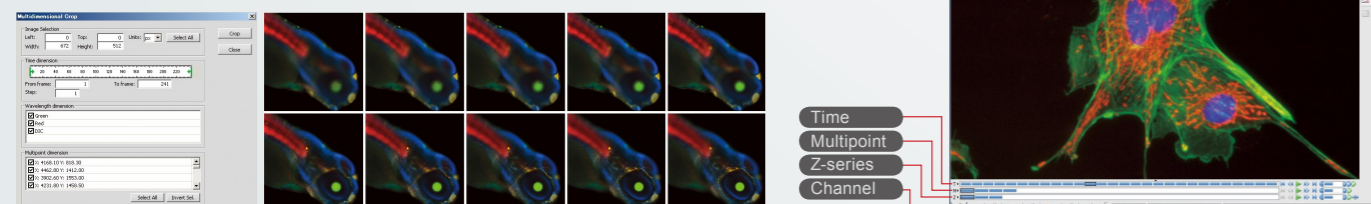
## Z-series

Through motorized focus control, NIS-Elements reconstructs and renders 3D images from multiple Z-axis planes.



## Multi-dimensional Image Display

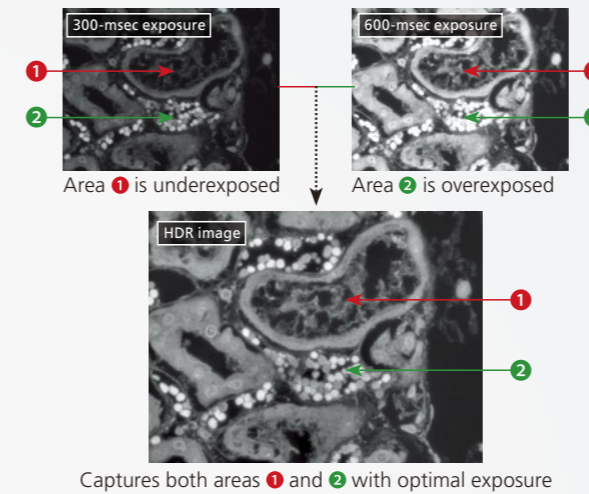
NIS-Elements displays time lapse, multi-channel, multiple X, Y, Z positions in an intuitive layout, which allows for automatic playback and the ability to select subsections of the data to be saved as a new file.



## HDR (High Dynamic Range) image acquisition

Ar Option Br D

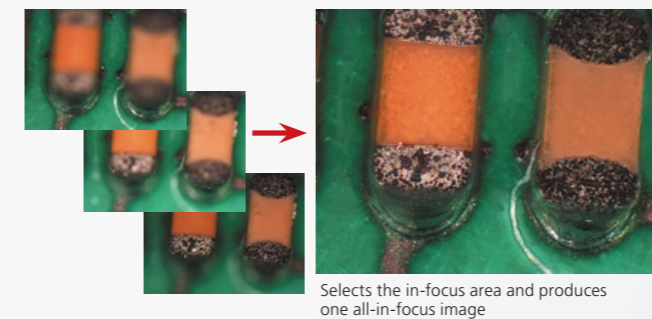
HDR creates an image with appropriate brightness in both the dark and bright regions in a sample by combining multiple images acquired with different exposure settings. It is also possible to create HDR image using multiple captured images.



## EDF (Extended Depth of Focus)

Option Ar Br D

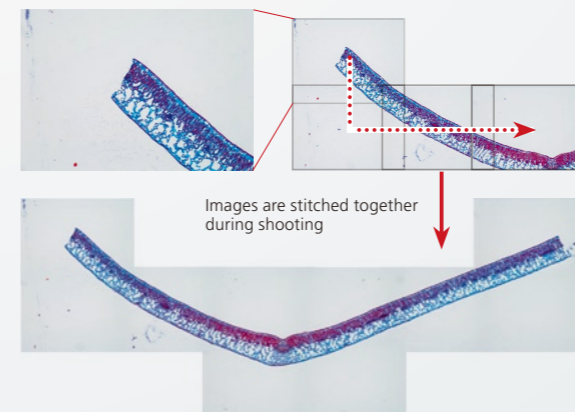
Creates a single, all-in-focus image from images of differing focus. Such images can now be created by simply turning the focus knob.



## Image stitching (Large Image)

Option Ar Br D

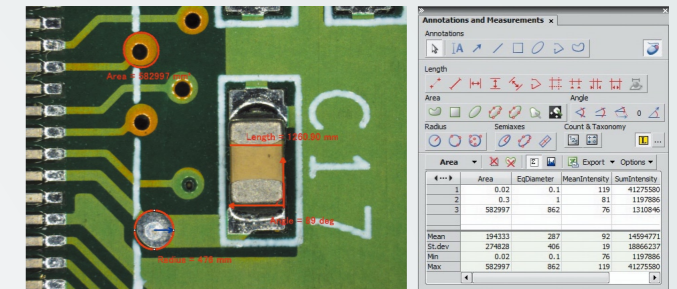
Stitches together images from multiple fields of view during shooting to create an image with wide field of view. Images already acquired can also be stitched together.



## Manual measurement and image annotation

Ar Br D

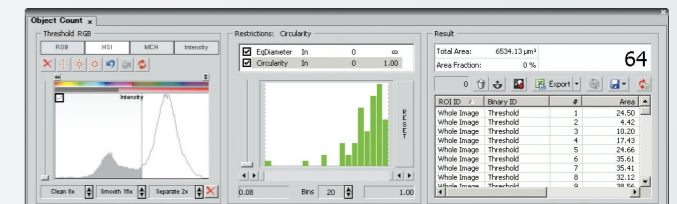
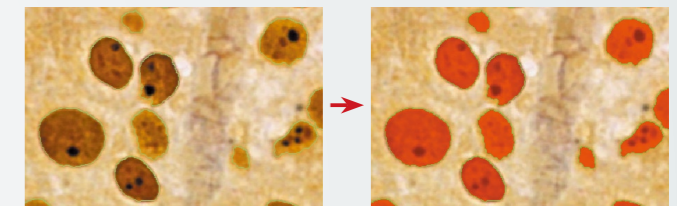
Manual Measurement allows easy measurement of length and area by drawing lines or an object directly on the image. The results can be attached to the image, and also exported as text or to an Excel spreadsheet.



## Auto measurement (Object Counting)

Ar Br Option D

Performs binarization on images using previously set thresholds to measure the number, area, brightness, etc. of identified objects.



## Grain size analysis

Option Ar Br D

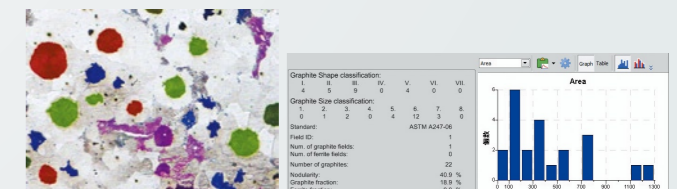
Detects and measures grains in one and two phase samples according to JIS G0551 or ASTM E112-96/E1382-97 standards.



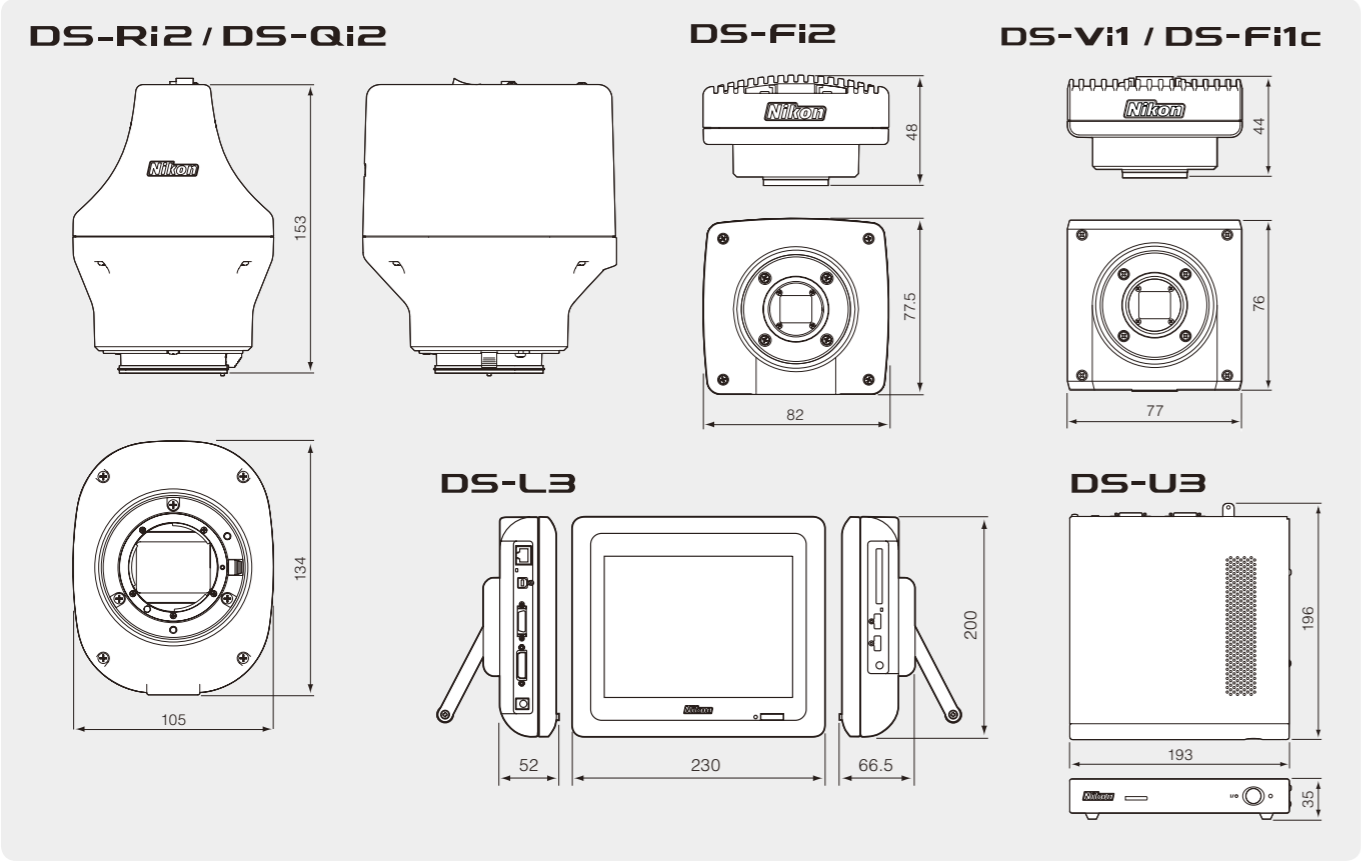
## Cast iron analysis

Option Ar Br D

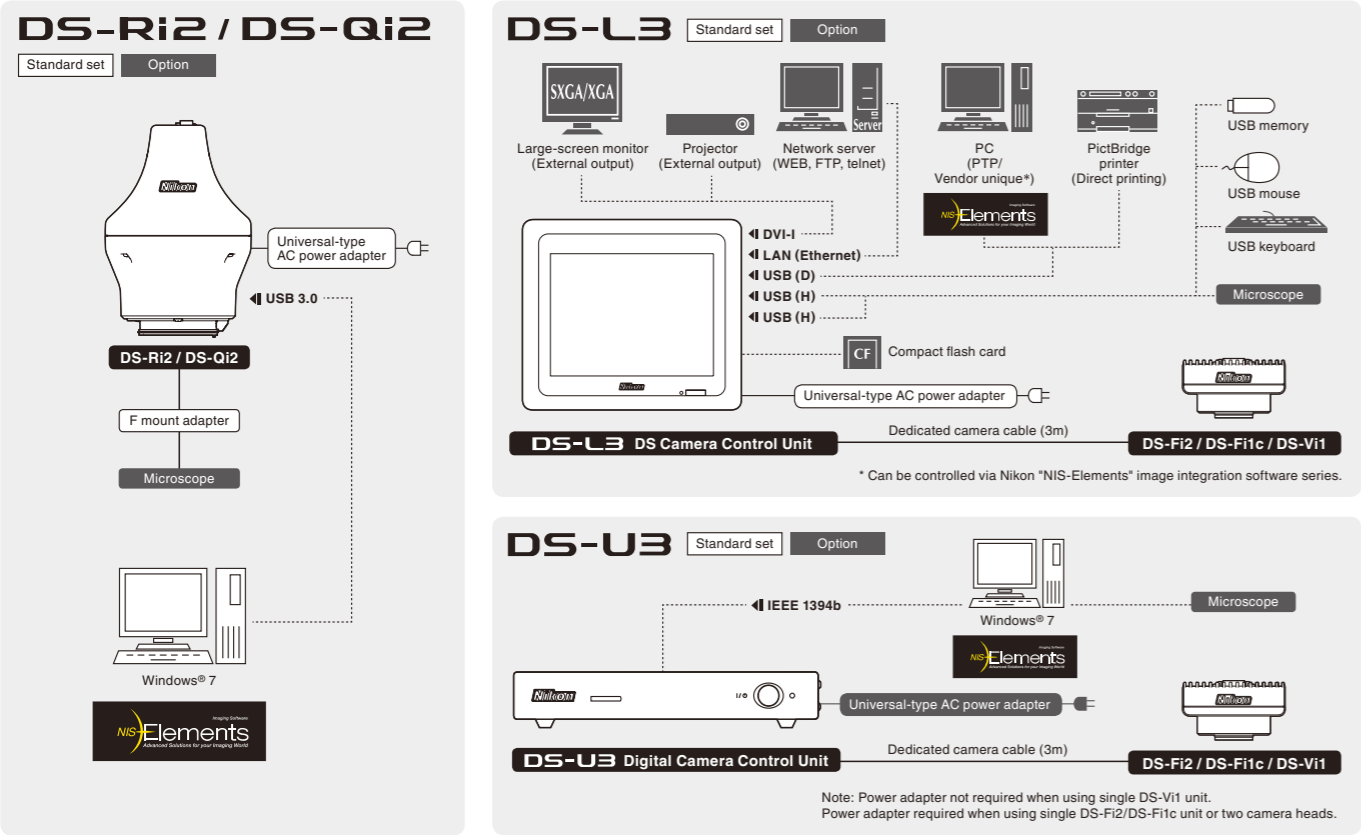
Detects, measures and classifies graphite content as well as ferrite content in graphite-corrected samples according to JIS G5502 or ASTM A247-06 standards.



Dimensions



System Diagram



Specifications

Camera Type		
Digital Camera	DS-Ri2	DS-Qi2
Image sensor	Nikon FX-format, Color CMOS sensor / Size: 36.0×23.9mm	Nikon FX-format, Monochrome CMOS sensor / Size: 36.0×23.9mm
	Effective 16.25 megapixels	
Recordable pixels	4908×3264 pixel (full-pixel), 1636×1088 pixel (3×3 pixel averaging)	
Cooling method	—	Electronic cooling
ISO sensitivity (recommended exposure index)	Standard: equivalent to ISO 200 (Selectable from ISO200 to12800 equivalent)	Standard: equivalent to ISO 800 (Selectable from ISO800 to 51200 equivalent)
Quantum efficiency	—	77%
Full well Capacity	—	60000e- (typ.)
Readout noise	—	2.2e- (typ.)
Dark current	—	0.6e-/p/s (Ta=25°C) (typ.)
Live display mode	Full-pixel 4908×3264 pixel (max 6fps) / 3×3 pixel averaging 1636×1088 (max 45fps)	
Lens mount	F mount	
Exposure time	100 μsec to 60 sec	
Image format	BMP, TIFF, JPEG, etc., selectable in NIS-Elements	
Interface	USB3.0 (computer control connection) ×1, External sync input/output ×1	
Power supply	AC100-240V 50/60Hz	
Power consumption	13W	24W
Dimensions	105 (W) × 134 (D) × 153 (H) mm	
Weight	1200g	
Operating environment	0-40°C, 60% RH max. (without condensation)	0-30°C, 80% RH max, 30-40°C, 60% RH max. (without condensation)

Camera Head	DS-Fi2	DS-Fi1c	DS-Vi1
Image sensor	2/3 in. high-density CCD; Total number of pixels: 5.24 megapixels (effective 5.07 megapixels)		1/1.8 in. high-density CCD: Total number of pixels: 2.11 megapixels (effective 2.01 megapixels)
Recordable pixels	2560×1920, 1280×960, 640×480		1600×1200, 800×600, 400×300
Cooling method	—	Electronic cooling	—
ISO sensitivity (recommended exposure index)	Standard: equivalent to ISO64 (Selectable from ISO32 to 1250 equivalent)		Standard: equivalent to ISO100 (Selectable from ISO50 to 2000 equivalent)
Live display mode (DS-L3 Standalone mode)	2560×1920 (max. 10 fps), 1280×960 (max. 21 fps), ROI mode (max. 37 fps) *Display reduced or enlarged to SXGA/XGA		1600×1200 (max. 15 fps), 800×600 (max. 27 fps), 800×560 (max. 29 fps), Center Scan (max. 29 fps) *Display reduced or enlarged to SXGA/XGA
Live display mode (DS-L3/Used with NIS-Elements)	2560×1920 (max. 2.0 fps), 1280×960 (max. 7.8 fps), 640×480 (max. 21 fps), ROI mode (max. 37 fps)		1600×1200 (max. 5.0 fps), 800×600 (max. 27 fps), ROI mode (max. 15 fps)
Live display mode (DS-U3)	2560×1920 (max. 4.4 fps), 1280×960 (max. 18 fps), 640×480 (max. 21 fps), ROI mode (max. 37 fps)		1600×1200 (max. 12 fps), 800×600 (max. 27 fps), ROI mode (max. 15 fps)
Lens mount	C mount		
Exposure time	130 μsec to 60 sec	1/1000 to 600 sec	1/1000 to 60 sec
Dimensions	82 (W) × 77.5 (D) × 48 (H) mm	77 (W) × 76 (D) × 44 (H) mm	
Weight	270g	290g	260g
Operating environment	0-40°C, 60% RH max. (without condensation)	0-30°C, 80% RH max, 30-40°C, 60% RH max. (without condensation)	

Control Unit	DS-L3 (Standalone)	DS-L3 (Used with NIS-Elements)	DS-U3
Exposure control	Program AE, Shutter-priority AE, Focus AE, Manual with AE lock function		
Exposure correction	Correction range: ±2.0, Step: 1/3		
Digital zoom	Up to 16× (8 steps)		
Interval shooting	10 sec. - 6 hr. intervals		
Exposure metering	Average metering, Peak hold metering		
Exposure metering range	Position/size adjustable		
White balance	Set method, Color balance adjustable		
Image adjustments	Gamma correction, shading adjustment, black level adjustment, Chroma, hue adjustment, color saturation adjustment		
Recordable image file format	RGB 8 bit	RGB 8 bit	RGB 8 bit/16 bit
Storage format	BMP, TIFF, JPEG (3-step compression)		
Interface	USB device port × 1 (Printer, PTP support, Vendor unique / switching) USB host port × 2 (USB mouse, USB memory stick, USB keyboard, bar code reader, microscope connection), External sync input/output, Camera I/F × 1		
Power supply	AC100-240V 50/60Hz		
Power consumption	70W		
Dimensions	230 (W) × 66.5 (D) × 200 (H) mm		
Weight	1800g		
Operating environment	0-40°C, 60% RH max. (without condensation)		
Networking	Ethernet (10/100Base-TX), DHCP compatible, HTTP, TELNET or FTP server, FTP client		
LCD monitor	8.4-in. TFT color LCD XGA (1024×768, 60Hz)		
External monitor output	DVI-I (Digital: Conforms to DVI 1.0/Analog: 0.7 Vpp (75 Ω) SXGA/XGA/720p)		
Storage media	USB memory stick, CompactFlash™ card		
Direct printing	PictBridge printer (sold separately)		

Specifications and equipment are subject to change without any notice or obligation on the part of the manufacturer. June 2014 ©2004-2014 NIKON CORPORATION

N.B. Export of the products\* in this catalog is controlled under the Japanese Foreign Exchange and Foreign Trade Law. Appropriate export procedures shall be required in case of export from Japan.

\*Products: Hardware and its technical information (including software)



#### WARNING

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



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