



*High-sensitivity Quantitative Camera for  
Time-lapse Fluorescence Observation*

DIGITAL SIGHT SERIES  
**DS-Qi1**

# The definitive digital camera for time-lapse fluorescence observation.

## High-sensitivity, low noise and excellent quantitative capability!

Nikon proudly introduces the DS-Qi1, a high-sensitivity cooled monochrome camera. By combining low-noise electronics and a high-quantum efficiency detector, the DS-Qi1 can capture a wide dynamic range of intensities while maintaining quantitative linearity. Added features such as a fast analog-to-digital converter (ADC), very low read noise, and programmable gain control make the DS-Qi1 an ideal detector for fluorescence imaging applications.

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Photoconversion of Kaede by BD laser optical stimulation system

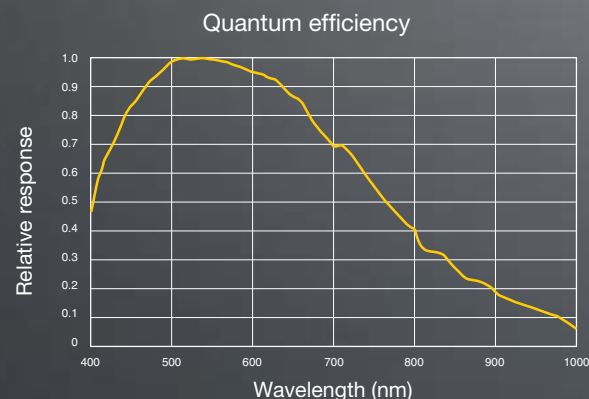


Fluorescent protein vector "CoralHue" Kaede" of Amalgaam Co., Ltd. expressed in HeLa cell

### High sensitivity

#### Faint fluorescence detection

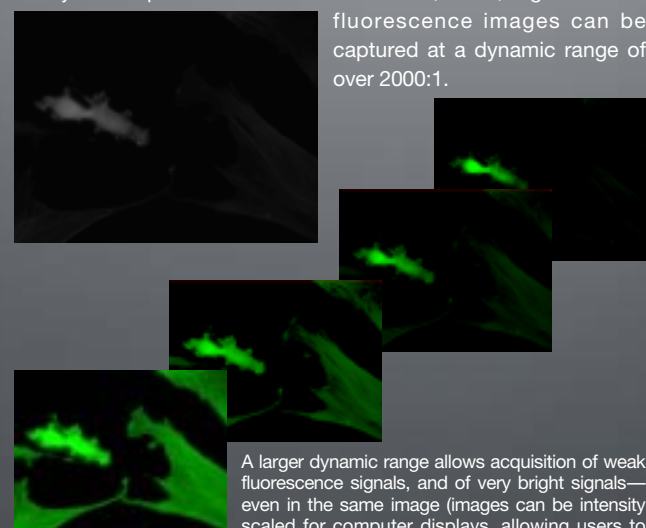
The high-sensitivity CCD, which has outstanding quantum efficiency (>65% at 500nm), combined with low read noise, allows the capture of even low light fluorescence signals. Intensity and time of fluorescence excitation can therefore be minimized to reduce photobleaching.



### Low noise

#### Clear, high-contrast images

The Peltier cooling mechanism cools the CCD down to 10°C below ambient temperature, reducing the average dark current to 0.7e-/pixel/s. Also, the readout noise is reduced to 8e- rms with the newly developed CCD drive circuit. Thus, clear, high-contrast



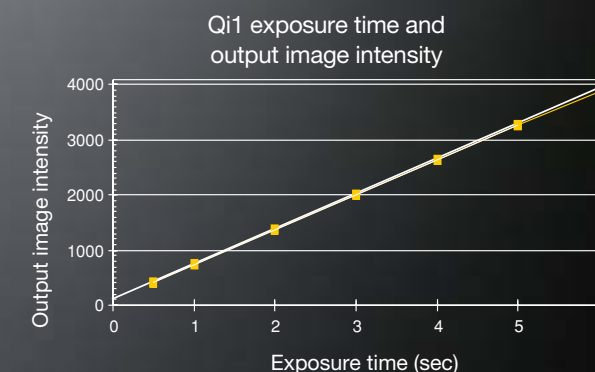
fluorescence images can be captured at a dynamic range of over 2000:1.

A larger dynamic range allows acquisition of weak fluorescence signals, and of very bright signals—even in the same image (images can be intensity scaled for computer displays, allowing users to visualize the high dynamic range).

### Superior linearity

#### Reliable quantitative analysis

Linearity, a quantity index, has been improved to >98%. This, together with reduced noise, assures comparable, quantitative image data collection over a wide exposure range.



### High frame rate

#### Smooth, stress-free image display

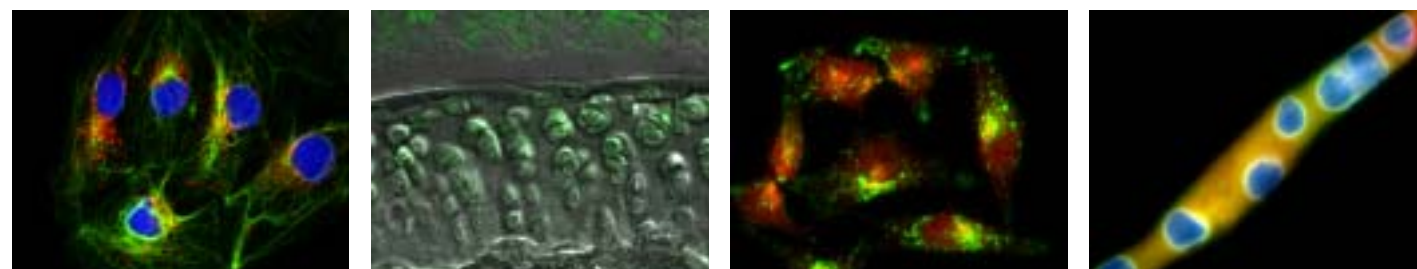
A high frame rate of up to 32fps with 640 x 480 pixel image size (2 x 2 binning) is possible, using a fast 36MHz analog-to-digital converter. As images can be displayed in near real time, focusing and positioning is easy, even in fluorescence. The CCD can also be binned and/or subregioned. Thus, the duration of a specimen's exposure to the excitation light can be reduced, resulting in less photobleaching.

### Software



#### Easy image acquisition

High performance and flexible imaging software NIS-Elements will simplify image acquisition and analysis. With this powerful software, Nikon offers a complete total imaging solution for the demanding live-cell application.



### Programmable gain amplifier (PGA)

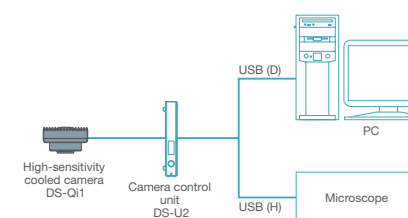
#### Built-in CCD amplifier

DS-Qi1 incorporates a programmable gain amplifier for low-light levels, or for shorter exposures. Users can easily choose the gain of the CCD output to reduce exposure time or to increase frame rates. The electronic design ensures linearity when using any gain setting.

### Interface

#### High-speed transfer of image data

The USB2.0 interface for connecting camera control unit DS-U2 to a PC allows high-speed data transfer. It also enables stress-free PC operation.



### Trigger port

#### Signal IN from external trigger

The DS-Qi1 comes standard with trigger port, enabling external shutter operation and triggered exposures.



Imaging software



NIS-Elements imaging software integrates microscope image capture, document data management and analysis. Comprehensive control of microscope, camera and peripheral devices makes it possible to configure the multidimensional time-lapse imaging system easily and it enhances research efficiency.

**Ar** **NIS-Elements Advanced Research**  
NIS-Elements AR is optimized for advanced research applications. It features fully automated acquisition and device control through full 6 dimensions (X, Y, Z, Wavelength, Time, Multipoint) image acquisition and analysis.

**Br** **NIS-Elements Basic Research**  
NIS-Elements BR is suited for standard research applications. It features acquisition and device control through 4 dimensions (up to four dimensions can be selected from X, Y, Z, Wavelength, Time, Multipoint).

**Multidimensional acquisition (4D/6D) Ar Br**

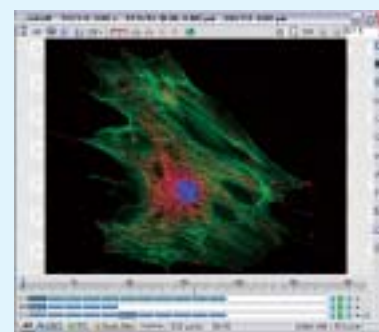
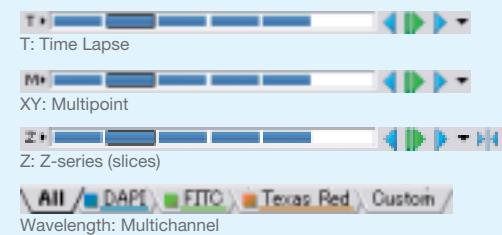
NIS-Elements can combine X, Y, Z, Lambda (wavelength), Time and Multi points within one integrated platform for multidimensional imaging. All combinations of multidimensional images can be linked together in single file sequence using an efficient workflow and intuitive GUI. Format conversion of captured multidimensional images is made easier.



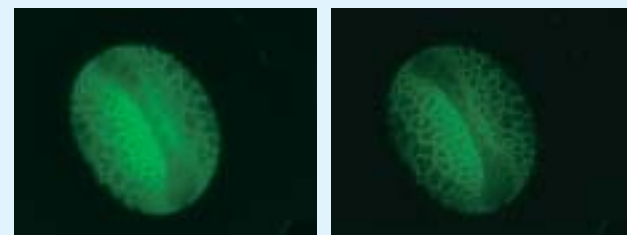
T, XY, Z, λ simultaneous acquisition

**nD Viewer (multidimensional image display) Ar Br**

Easy-to-use parameters for multidimensional imaging operation are displayed with the image.



**3D deconvolution Ar (option)**



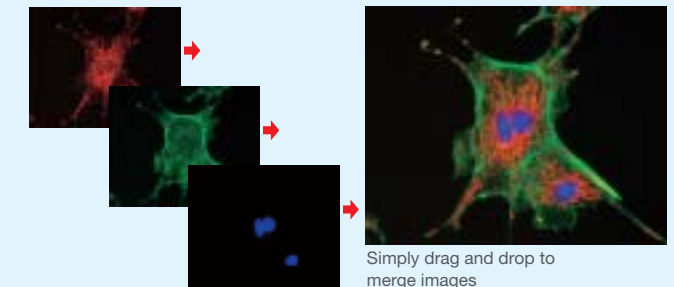
Before deconvolution After deconvolution

**2D real-time deconvolution Ar (option)**



**Image overlay (merge) Ar Br**

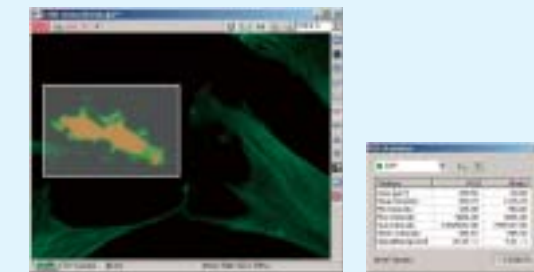
Intuitive overlay of fluorescence pseudo-colors is possible by simply dragging and dropping images. Multichannel images captured with different fluorescence filters and camera settings can be merged into one image.



Simply drag and drop to merge images

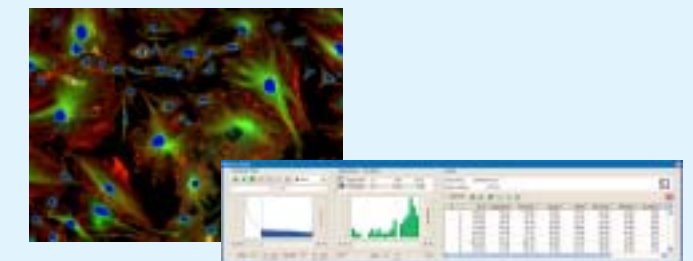
**ROI statistics Ar Br**

Statistics pertaining to area and brightness of defined region of interest (ROI) can be easily collected. Results can be saved as an Excel file. It is also possible to compare ROI analysis data of different channels.



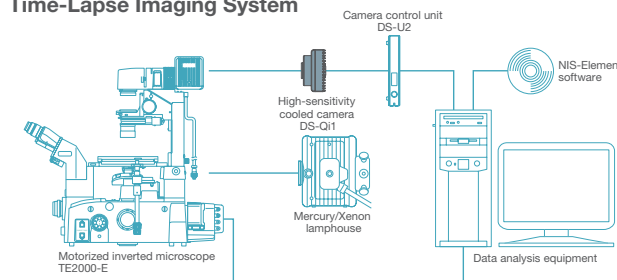
**Object counting Ar Br**

Complicated procedures such as Thresholding, Morphology and Restrictions are pulled into one control window, simplifying the measurement process and boosting ease of use. Settings are applied to measurement results in real time.

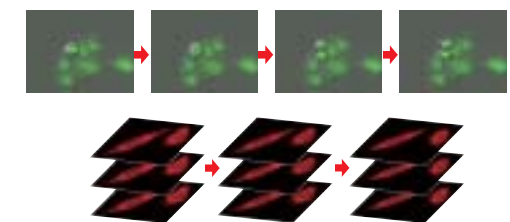


**System configuration examples**

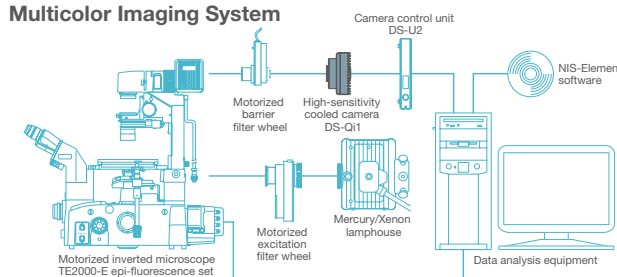
**3D (XYt), 4D (XYZt) Time-Lapse Imaging System**



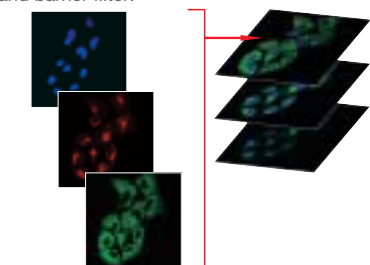
By controlling the shutter, long-term time-lapse observation is possible. High-Speed RAM capturing is also possible. By controlling the focus of a microscope, 4D time-lapse acquisition including information of the Z-axis (depth direction) is also possible.



**4D (XYZλ) Multicolor Imaging System**



Images in a different Z-axis can be captured, while changing the excitation and barrier filter.



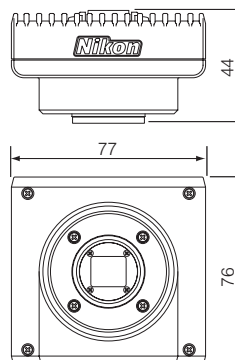
## Specifications

CCD	2/3-in. square pixel CCD; total number of pixels: 1.5 mega (effective 1.45 mega)					
Recording pixels	1280 x 1024, 640 x 512, 640 x 480, 320 x 240					
CCD cooling	Peltier device, 10°C below ambient temperature (max.)					
ISO sensitivity (recommended exposure index)	Equivalent to ISO 800 (switchable sensitivity equivalent to ISO400 to 8000)					
Saturation charge quantity	17000e-					
Read noise	8e- (typical)					
Dark current	0.7e-/pixel/s (typical)					
Linearity error	<2% (typical)					
Digitizer	12bit A/D conversion					
Live display mode	Normal display		Binning mode		ROI mode	
	DS-U2/ NIS-ELEMENTS AP/BR/D (Supports 12bit live display)	1280 x 1024 640 x 512	10fps 19fps	640 x 480 (2 x 2) 320 x 240 (4 x 4)	32fps 48fps	640 x 480 320 x 240 320 x 240 (4 x 4 ROI)
DS-U2/ NIS-ELEMENTS F (Supports 8bit live display)	1280 x 1024 640 x 512	19fps 19fps	640 x 480 (2 x 2) 320 x 240 (4 x 4)	32fps 48fps	640 x 480 320 x 240 320 x 240 (4 x 4 ROI)	32fps 48fps
	DS-L2 (Supports 8bit live display)	1280 x 1024	19fps	640 x 480 (2 x 2) 320 x 240 (4 x 4)	32fps 48fps	1280 x 720 (ROI) 640 x 480
Lens mount	C-mount					
Exposure time	1 msec to 600 sec.					
Dimensions	77 (W) x 76 (D) x 44 (H)mm					
Weight	290g					

Accessories	Camera cable 3m
Optional accessories	0.7x relay lens (C-mount) for observation of wide field of view
Control unit (DS-U2)	Exposure control: Manual/Auto Exposure Exposure metering: Average/Peak hold, Metering position/size adjustable. Storage format: BMP/TIFF/JPEG/JPEG2000 Interface: USB device port (PC control), USB host port (microscope control) Power consumption: 35VA Dimensions: 193 (W) x 195 (D) x 35 (H)mm

## Dimensional diagram

Unit: mm



## 2.0-megapixel camera heads for fluorescence imaging



### High-speed cooled monochrome camera head DS-2MBWc

For time-lapse observation of bright fluorescence images  
Incorporating a cooling device, thermal noise is reduced. With its high-sensitivity and high frame rate, excitation time can be shortened.



### High-speed monochrome camera head DS-2MBW

For observation of bright fluorescence images of fixed samples  
This cost-effective non-cooled type camera provides smooth live image display with a high frame rate.

## Two distinctive controllers



### DS-U2

PC-use control unit with advanced imaging and processing/analysis capability



### DS-L2

Standalone control unit with a large, high-definition LCD monitor  
\*Image overlay is not possible when used in combination with DS-L2.

Specifications and equipment are subject to change without any notice or obligation on the part of the manufacturer. July 2007 ©2007 NIKON CORPORATION

	<b>WARNING</b> TO ENSURE CORRECT USAGE, READ THE CORRESPONDING MANUALS CAREFULLY BEFORE USING YOUR EQUIPMENT.
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\* Monitor images are simulated.  
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