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.

**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.

**Superior linearity**

**Reliable quantitative analysis**

Linearity, a quantitivity 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.
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.

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

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.

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

- **3D deconvolution** (option)
- **2D real-time deconvolution** (option)

**nD Viewer (multidimensional image display)**

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.

**ROI statistics**

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**

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 (XYZ t)**
- **4D (XYZ t)**

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.

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

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.

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).
### CCDS
- 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, 10ºC below ambient temperature (max.)

### ISO sensitivity
- Equivalent to ISO 800 (switchable sensitivity equivalent to ISO400 to 8000)

### Read noise
- 8e- (typical)

### Dark current
- 0.7e-/pixel/s (typical)

### Linear error
- 0.2% (typical)

### Live display mode
- 12bit A/D conversion

#### Specifications
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<th>Normal display</th>
<th>Binning mode</th>
<th>ROI mode</th>
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<tr>
<td>DS-U2</td>
<td>1280 x 1024</td>
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<tr>
<td>NIS-ELEMENTS AR/BR/BD</td>
<td>1280 x 1024</td>
<td>1280 x 1024</td>
<td>1280 x 1024</td>
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<tr>
<td>(Supports 12bit live display)</td>
<td>640 x 480</td>
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<td>640 x 480</td>
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<tr>
<td>DS-U2</td>
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<tr>
<td>NIS-ELEMENTS F</td>
<td>1280 x 1024</td>
<td>1280 x 1024</td>
<td>1280 x 1024</td>
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<tr>
<td>(Supports 8bit live display)</td>
<td>640 x 480</td>
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<tr>
<td>(Supports 8bit live display)</td>
<td>640 x 480</td>
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</tbody>
</table>

#### Optional accessories
- 0.7x relay lens (C-mount) for observation of wide field of view

#### Control unit (DS-U2)
- Exposure control: Manual/Auto Exposure
- 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

#### 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, 10ºC below ambient temperature (max.)

### ISO sensitivity
- Equivalent to ISO 800 (switchable sensitivity equivalent to ISO400 to 8000)

#### Read noise
- 8e- (typical)

#### Dark current
- 0.7e-/pixel/s (typical)

#### Linear error
- 0.2% (typical)

#### Live display mode
- 12bit A/D conversion

### Two distinctive controllers

#### High-speed 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.

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*Monitor images are simulated.

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