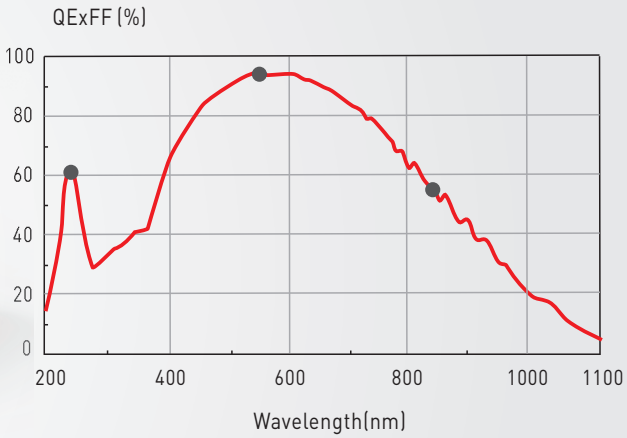
# Dhyana 400BSI V2.0

## BSI Scientific CMOS Camera




**74** fps CameraLink **40** fps USB3.0

Faster Capture

**6.5** μm Pixel Size **4.2** MP Resolution

High Resolution

**0.2** $e^-$ DSNU **0.3** % PRNU **1.2** $e^-$ Read Noise

More Accurate

**60** % QE UV light @ 254 nm **95** % QE Visible light @ 550 nm **53** % QE Near-infrared @ 850 nm

High Sensitivity

ISO9001 CE RoHS

www.tucsen.com

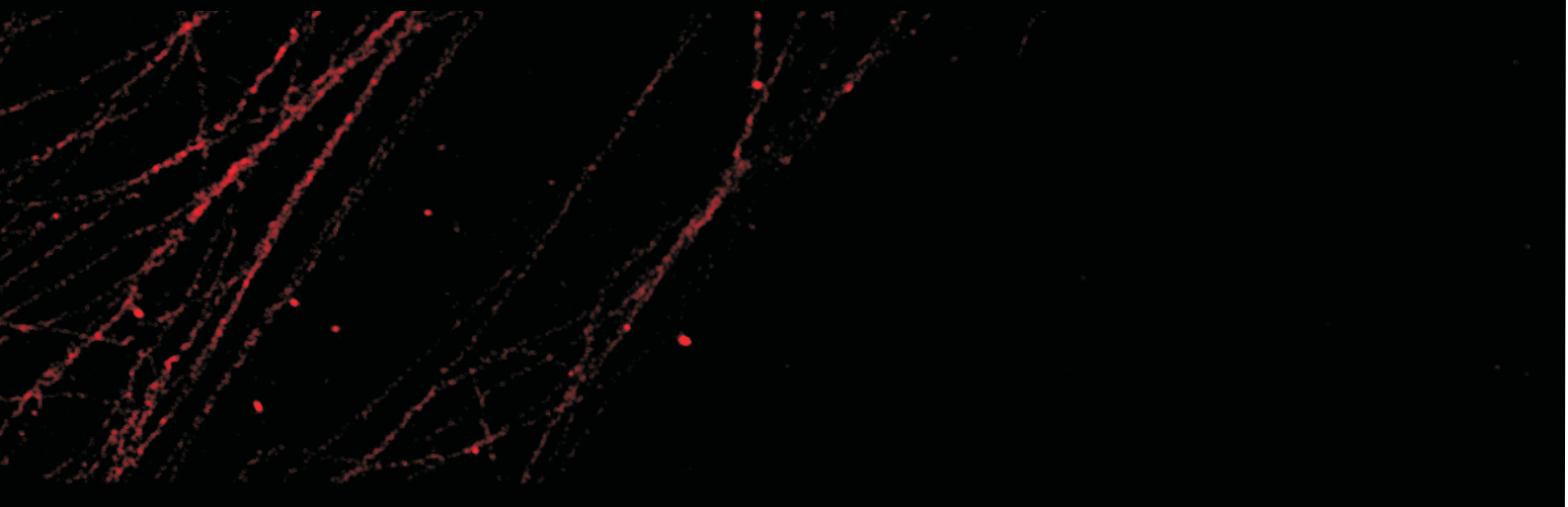
# A New Breakthrough for New Discoveries!

Since its launch, the Dhyana 400BSI sCMOS camera has been receiving great attention and focus. The image quality of the product is fully recognized to be comparable, or even better than its competitors. However, the Tucsen R&D group continues to pursue greater levels of excellence. This resulted in an upgraded product, the Dhyana 400BSI [V2.0].

The Dhyana 400BSI [V2.0] achieves a core breakthrough in the transmission speed compared with 400BSI [V1.0], and a high-speed data transmission rate of 74fps @ Cameralink and 40fps @ USB3.0 at full resolution. Moreover to meet the demands for accurate quantification for high-end scientific imaging such as single molecule and super resolution, the 400BSI [V2.0] calibrated DSNU & PRNU, minimized the difference between each pixel and reduced fixed pattern noise. So we are now able to achieve more accurate quantitative imaging data, providing a guarantee of reliable analysis results. The DSNU & PRNU calibration is of a great importance of quantitative analysis.

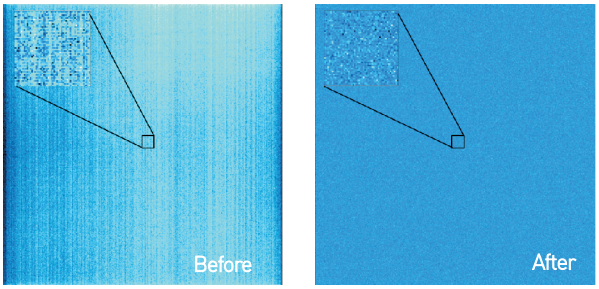
Simultaneously, the Dhyana 400BSI [V2.0] preserves all the essences of Dhyana 400BSI [V1.0], including the latest developed back-illuminated SCMOS sensor, ultra-high quantum efficiency of 95%, microscope-friendly 6.5μm x 6.5μm pixel and 1.2e- @ Median ultra-low readout noise.

So, no matter of chasing for brilliant scientific images or accurate images quantitative data, 400BSI [V2.0] is easy to implement!



# DSNU/PRNU calibration, more accurate quantitative analysis

To improve the overall performance of the camera, the Dhyana 400BSI (V2.0) was calibrated in DSNU (dark signal non-uniformity) and PRNU (photo response non-uniformity) characteristically. After calibration, the DSNU value reduced from 0.3e- to 0.2e-, the PRNU value reduced from 1.6% to 0.3%. Thus the new upgraded camera has a more sophisticated capabilities, making it more suitable for quantitative analysis applications.




Dark Signal Non-Uniformity (DSNU) Optimization

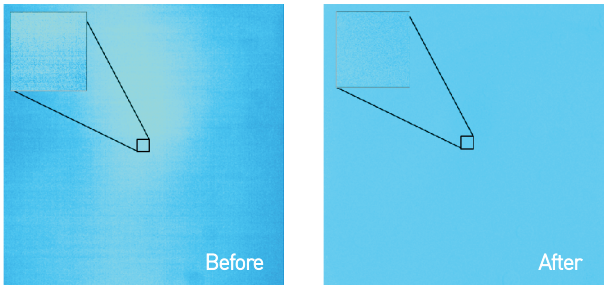



Photo Response Non-Uniformity (PRNU) Optimization

# Top-level cooling technology to reduce the impact of noise

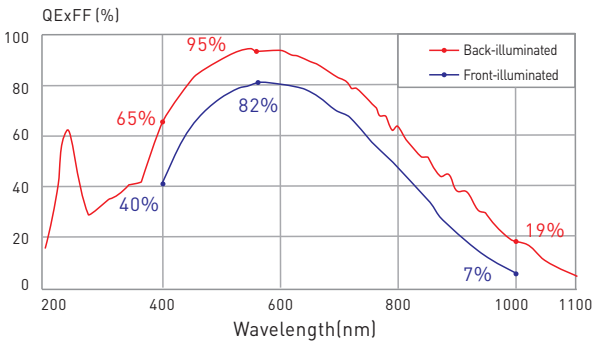
Dhyana 400BSI V2.0 advanced cooling mode can further reduce the impact of noise on imaging: compared to 1.2e- readout noise and 0.2e-DSNU, the dark curret corresponding to 100ms is less than 0.02e-. In high-end imaging applications,dark current becomes negligible.

| Cooling Method | Cooling Temperature | Dark Current |
|---|---|---|
| Forced air (Ambient at +20 °C) | -15°C | 0.15e-/p/s(typ.) |
| Water (Ambient at +20 °C) | -25°C | 0.10e-/p/s(typ.) |

# Wide spectral response range, high sensitivity

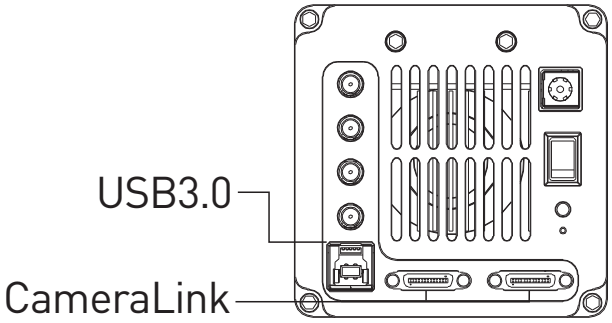
With its ultra-low noise, the advantage of the quantum efficiency in Dhyana 400BSI (V2.0) is very significant. This is a huge breakthrough for scien-tific applications, not only in the visible region, but also in the ultraviolet and near-infrared.

Quantum Efficiency Comparison ▶



# 74fps @ CameraLink, 40fps @ USB3.0, faster data capture

In addition to the signal to noise ratio advantage, the Dhyana 400BSI (V2.0) has enhanced transmission speed, on one hand though the new CameraLink interface to meet the needs of high-end imaging research for higher frame rates, on the other hand through hardware improvements that increase the USB 3.0 throughput. These have achieved the ultimate transfer rate of 74fps with CameraLink and 40fps with USB3.0 at 4.2 MP full resolution.




| Column | Row | USB3.0 | CameraLink |
|---|---|---|---|
| 2048 | 2040 | 40.4fps | 74.0fps |
| 2048 | 1024 | 79.9fps | 147.9fps |
| 2048 | 512 | 158.8fps | 293.9fps |
| 2048 | 256 | 317.6fps | 582.8fps |
| 2048 | 128 | 629.2fps | 1147.9fps |
| 2048 | 64 | 1242.6fps | 2227.8fps |

# Third-party applications

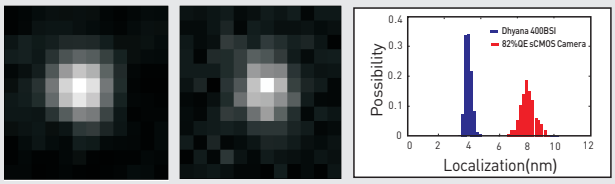
Third-party applications supported by Dhyana 400BSI (V2.0) have also been greatly expanded, including Micromanager, Labview, Matlab, etc., to provide more application support and help.

Support μ-Manager
The Open Source Microscopy Software
Image J Image processing software

Support LabVIEW

Support Matlab

# Customer applications

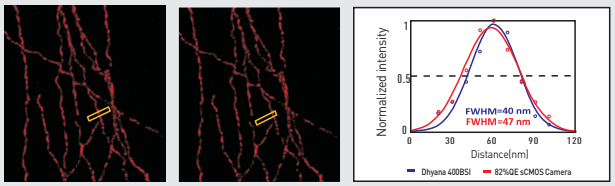



Dhyana 400BSI 82%QE sCMOS Camera Comparison

Source: Wuhan National Laboratory for Optoelectronics-Huazhong University of Science and Technology

## Single molecule localization

The high SNR can effectively improve the intensity of single-molecule fluorescence emission. The statistical results of the localization accuracy of the fluorescent sphere shows that the accurancy of localization with 400BSI is twice as that of the third generation 82% QE sCMOS camera.

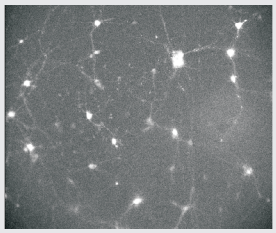



Dhyana 400BSI 82%QE sCMOS Camera Comparison

Source: Wuhan National Laboratory for Optoelectronics-Huazhong University of Science and Technology

## Super-resolution imaging

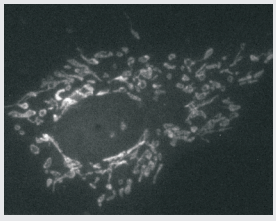
The lower the FWHM, the higher the resolution. In STORM super-resolution imaging, the capturing spatial resolution of 400BSI reaches to 40 nm, while those of the third generation of 82% QE sCMOS can only achieve 47 nm resolution, so the spatial resoluiton of 400BSI with STORM super resolution microscope carries a superiority of 7nm.



Camera: Dhyana 400BSI
Lens: 20X Nikon (NA0.75)
Fluorescent labeling: GFP neuronal labeling
Excitation light: 488nm
ROI: 50μm x 50μm
Exposure time: 100 ms
Source: Zhejiang University School of Medicine

## Neuron fluorescence imaging

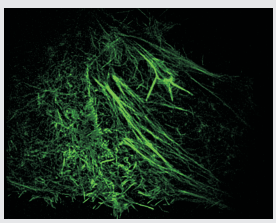
With the increasing of the exposure time, luminescent fluorophores produce phototoxicity to the cells. Compared with other cameras,the exposure time of 400BSI is shorter, which can protect cell samples from light damage better.



Camera: Dhyana 400BSI
Microscope: Fluorescence microscope
Lens: 100X TIRF dedicated oil mirror (NA1.49)
Excitation light: 561 nm
ROI: 55μm x 43μm
Exposure time: 170 ms
Source: College of Optical Science and Engineering, Zhejiang University

## TIRF wide field imaging

In the TIRF applications, the light signal of the samples is very weak, but 400BSI with the ultra-high SNR camera is able to capture the practical and good quanlity of images effectively with rather short exposure time, resulting in a faster and fully widefield imaging.



Camera: Dhyana 400BSI
Microscope: Fluorescence microscope
Excitation light: 488nm,fluorescent: 525nm
Exposure time: 20 ms
fastest frame rate: > 50fps
Source:Suzhou Institute of Biomedical Engineering and Technology Chinese Academy of Sciences

## SIM cytoskeleton imaging

SIM imaging requires the cameras to capture as sharp as possible pictures with as low as possible the exposure time, along with others same shooting conditions, the Dhyana 400BSI (V2.0) has a significant signal-to-noise ratio advantage, resulting in better images quality than other cameras.

# Technical Specifications

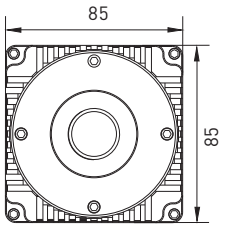
| | |
|---|---|
| Model | Dhyana 400BSI (V2.0) |
| Sensor size | 1.2" |
| Sensor model | Backside-illuminated sCMOS |
| Color/Monochrome | Monochrome |
| Quantum efficency | 60%@254nm, 95%@550nm, 53%@850nm |
| Effective resolution | 2048(H) x 2048(V) |
| Pixel size | 6.5μm x 6.5μm |
| Effective area | 13.3mm x 13.3mm |
| Full well capacity | 30,000e- |
| Frame rate | 74fps @4.2MP @CameraLink<br>40fps @4.2MP @USB3.0 |
| Readout noise | 1.2e- (Median); 1.8e- (RMS) |
| Shutter type | Rolling Shutter |
| Exposure time | 6.6μs-10s |
| DSNU | 0.2e- |
| PRNU | 0.3% |
| Cooling | Forced air (Ambient at +20°C): -15°C<br>Water (Ambient at +20°C): -25°C |
| Dark current | Forced air: 0.15 e-/p/s (-15°C)(typ.)<br>Water: 0.10 e-/p/s (-25°C)(typ.) |
| Binning | 2x2 / 4x4 |
| Sub-array | Available |
| External trigger mode | Standard / Synchronous / Global trigger |
| Trigger delay function | 0-10s(1μs steps) |
| External trigger connector | SMA |
| Signal output ports | 3 ( Exposure / Global / Readout ) |
| Digital interface | USB3.0 / CameraLink |
| SDK | Support |
| Bit depth | 16bit |
| Lens mount | C-mount |
| Power supply | 12V / 8A |
| Power consumption | 55W |
| Camera size | 85mm x 85mm x 125mm |
| PC software | Mosaic / LabVIEW / Matlab / Micromanager |
| Compatible system | Windows/Linux is supported<br>Mac is under development |
| Operating environment | Temperature: 0-40°C Humidity: 10%-85% |

# Applications

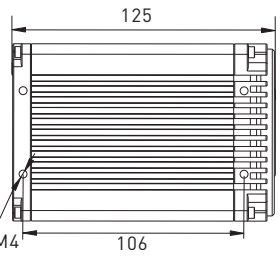
- Super-resolution microscopy
- Real-time confocal microscopy
- Gene sequencing
- Live-cell imaging
- Single molecule detection
- Astronomy observation
- FRET
- TIRF
- DIC

# Dimensions

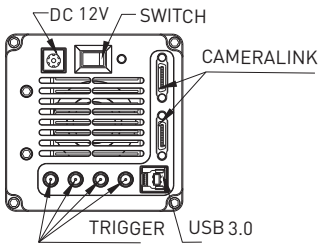
Front Side




Side Face




Reverse Side

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