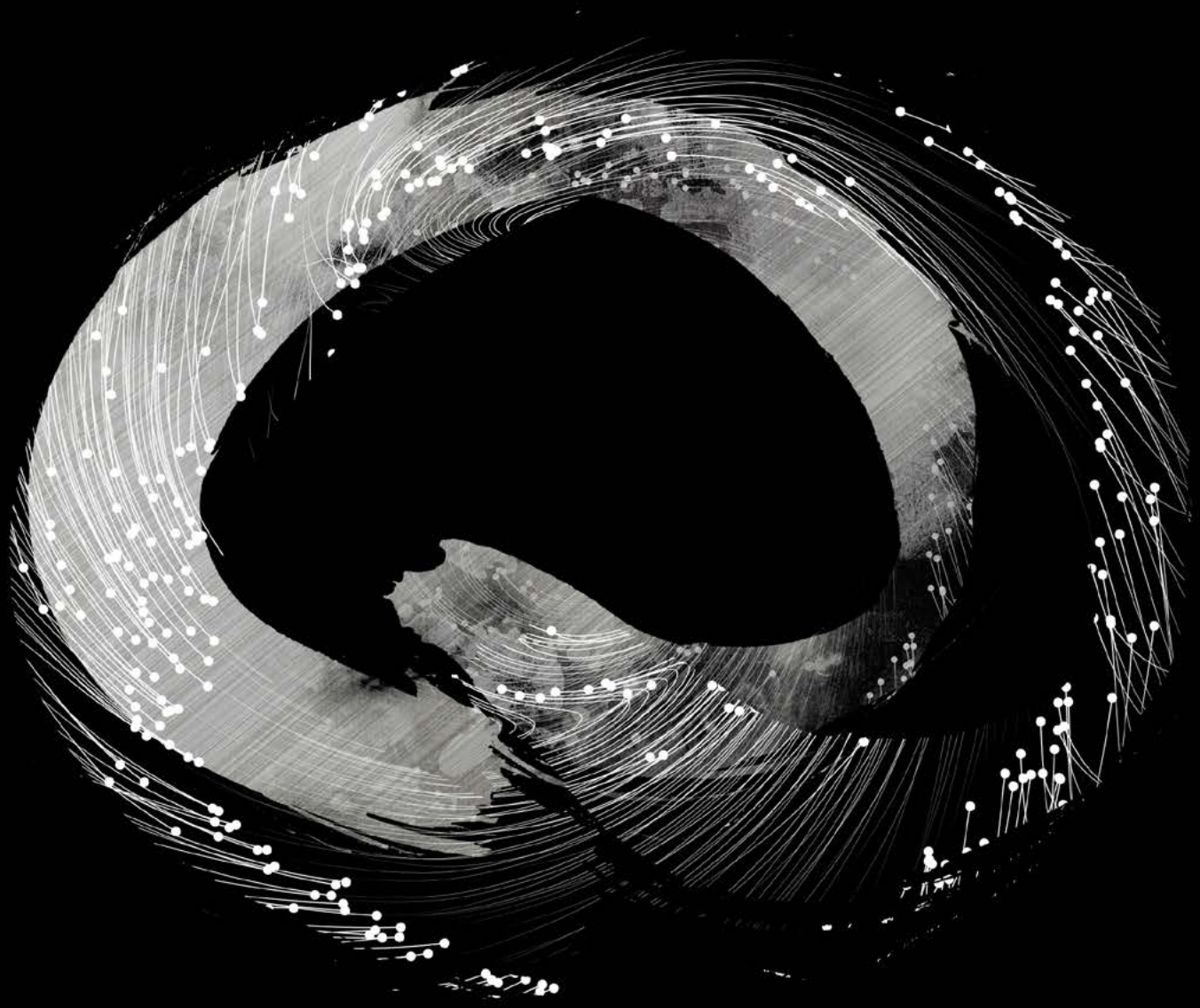


ORCA®-FusionBT

SEE WHAT YOU'VE BEEN MISSING

HAMAMATSU

PHOTON IS OUR BUSINESS

See what you've been missing.

Ultra-low readout noise and CCD-like uniformity. Fast frame rates and back-thin boosted high QE. Exceptional photon detection and collection.

Capture visually stunning high S/N images from the fewest photons. Resolve high-speed temporal events. Computationally analyze images with confidence.

LOW READOUT NOISE

0.7 ELECTRONS RMS

ULTRA QUIET SCAN

HIGH QE

95 % @550 nm

GEN III BACK-ILLUMINATED SCMOS

HIGH SPEED

89.1 FRAMES/S

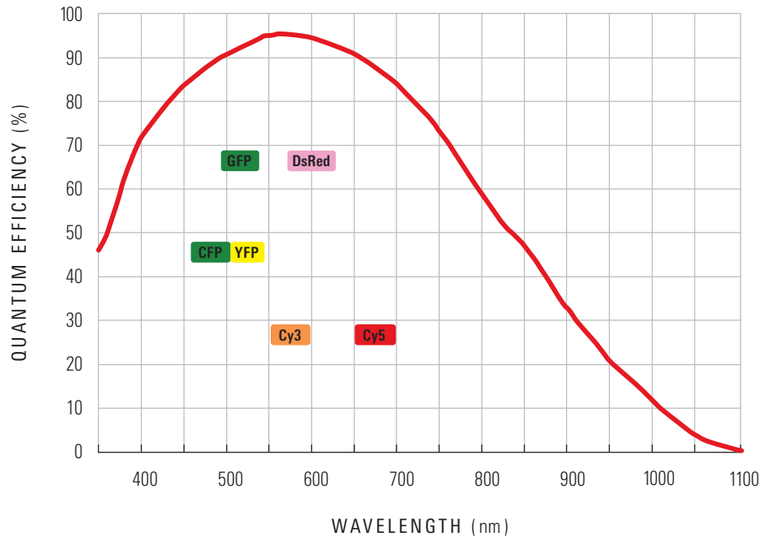
@2304 PIXELS × 2304 PIXELS (16 BIT)

HIGH RESOLUTION

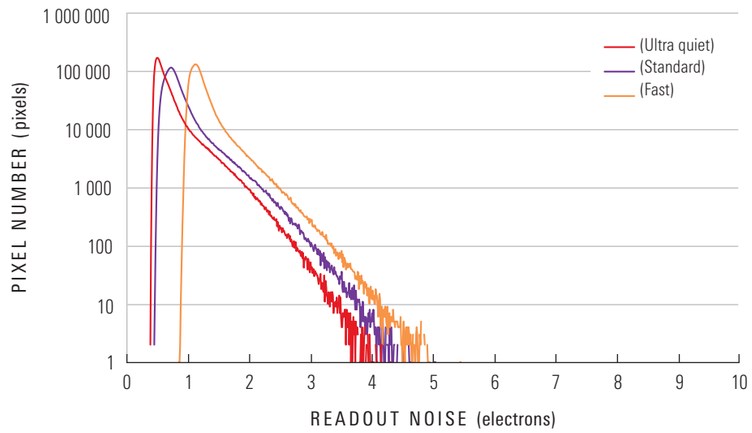
2304 × 2304

5.3 MEGAPIXELS

Back-thin Boosted QE for Maximum Photon Collection

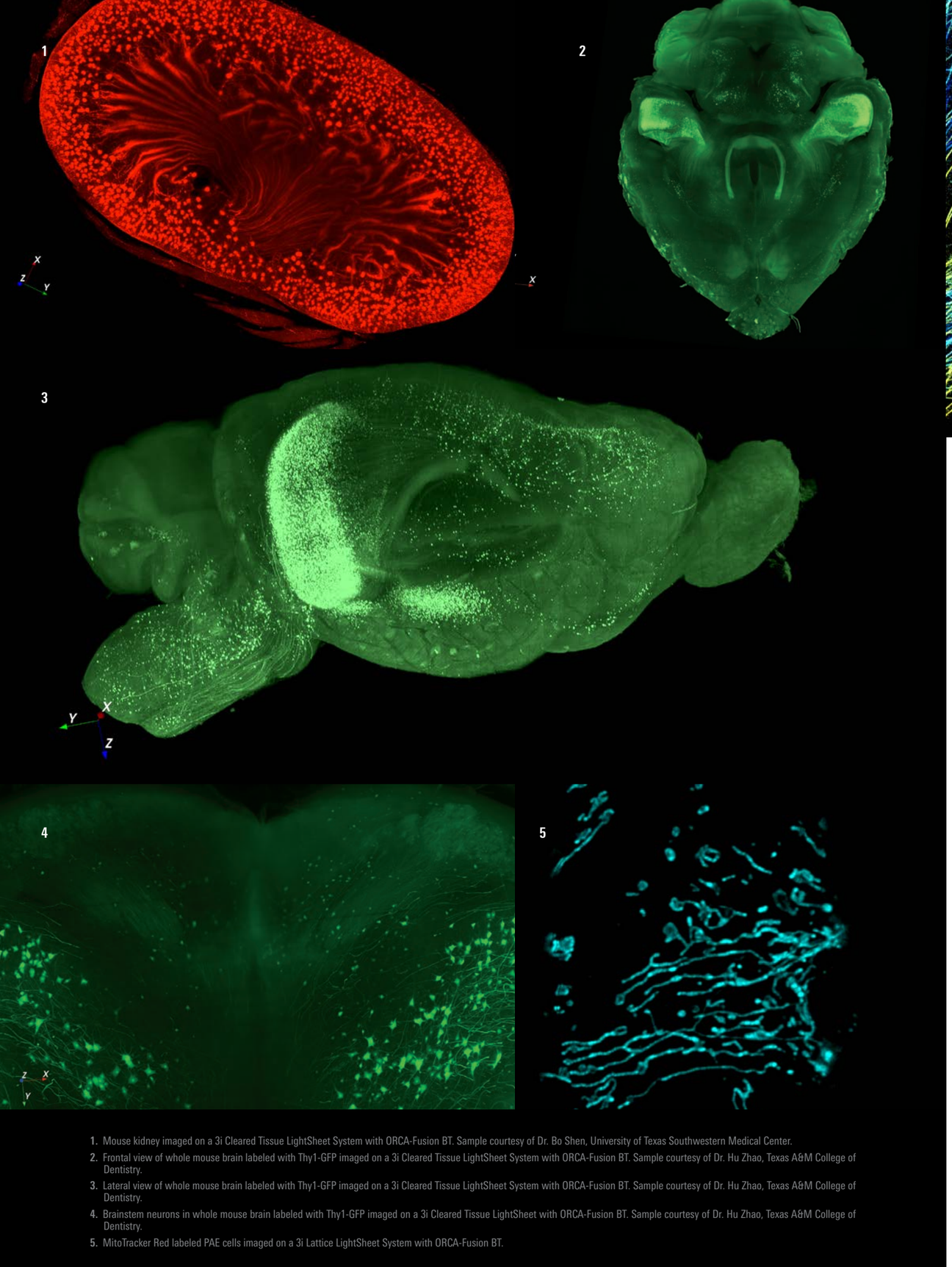


Minimal and Highly Uniform Readout Noise Results in Maximum Low Light Detection

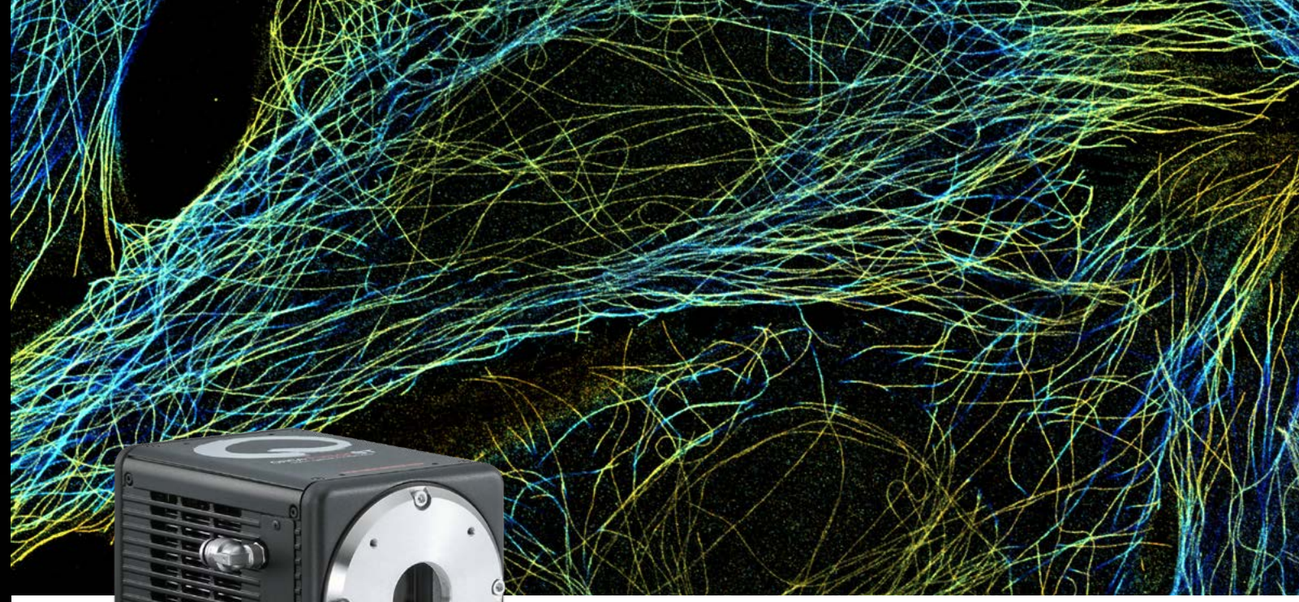


ORCA-Fusion BT: Detection Optimized

The ORCA-Fusion represented a leap forward from "Gen II" sCMOS, providing significant advantages in readout noise and uniformity for improved image quality. The ORCA-Fusion BT is the natural technological progression. The unique combination of back-thin boosted QE plus low noise and high uniformity delivers the ultimate in camera performance, versatility and sensitivity.



1. Mouse kidney imaged on a 3i Cleared Tissue LightSheet System with ORCA-Fusion BT. Sample courtesy of Dr. Bo Shen, University of Texas Southwestern Medical Center.
2. Frontal view of whole mouse brain labeled with Thy1-GFP imaged on a 3i Cleared Tissue LightSheet System with ORCA-Fusion BT. Sample courtesy of Dr. Hu Zhao, Texas A&M College of Dentistry.
3. Lateral view of whole mouse brain labeled with Thy1-GFP imaged on a 3i Cleared Tissue LightSheet System with ORCA-Fusion BT. Sample courtesy of Dr. Hu Zhao, Texas A&M College of Dentistry.
4. Brainstem neurons in whole mouse brain labeled with Thy1-GFP imaged on a 3i Cleared Tissue LightSheet with ORCA-Fusion BT. Sample courtesy of Dr. Hu Zhao, Texas A&M College of Dentistry.
5. MitoTracker Red labeled PAE cells imaged on a 3i Lattice LightSheet System with ORCA-Fusion BT.



Super resolution image of fixed Cos7 cells labeled with Tubulin-AF647. Image acquired using Olympus microscope IX83 with 100× TIRF 1.50 and ZDC 2 + Abbelight SAFe 360 with ORCA-Fusion BT camera for a FOV of 85 µm × 85 µm. Localization precision of 10 nm / 10 nm / 15 nm (x,y,z). Image courtesy of Abbelight.

Frames per second (fps)

READOUT MODE		AREA READOUT MODE				LIGHTSHEET READOUT MODE	
Scan mode		Fast scan		Standard scan	Ultra quiet scan	Fast scan	
X (pixels)	Y (pixels)	CoaXPress	USB 3.0 *1 (16 bit)	CoaXPress and USB 3.0 (16 bit)	CoaXPress and USB 3.0 (16 bit)	CoaXPress	USB 3.0 *1 (16 bit)
2304	2304	89.1	31.6	23.2	5.4	88.9	31.6
2304	2048	100	35.5	26.1	6.1	100	35.5
2304	1024	200	71.1	52.3	12.1	199	71.1
2304	512	400	142	104	24.3	397	142
2304	256	799	284	208	48.6	787	284
2304	128	1590	569	415	96.8	1540	569
2304	8	22 800	9330	5950	1380	15 800	9330
2304	4	41 000	18 600	10 700	2500	22 800	18 600

*1 Faster frame rates achievable at 8 bit and 12 bit.

Typical FPS with 2×2 binning

READOUT MODE		AREA READOUT MODE			LIGHTSHEET READOUT MODE
Scan mode		Fast scan	Standard scan	Ultra quiet scan	Fast scan
X (pixels)	Y (pixels)	CoaXPress and USB 3.0 (16 bit)	CoaXPress and USB 3.0 (16 bit)	CoaXPress and USB 3.0 (16 bit)	CoaXPress and USB 3.0 (16 bit)
1152	1152	89.1	23.2	5.4	N/A
1152	1024	100	26.1	6.1	N/A
1152	512	200	52.3	12.1	N/A
1152	256	400	104	24.3	N/A
1152	128	799	208	48.6	N/A
1152	64	1590	415	96.8	N/A
1152	4	22 800	5950	1380	N/A
1152	2	41 000	10 700	2500	N/A

FPS = Frames Per Second

Custom designed with research in mind

No one camera can delivery perfect performance for every application. But the ORCA-Fusion BT comes close. This custom sensor was created to make the most demanding imaging applications easy. Few photons? No problem. Fast live cell events? Turn up the speed. Require reliable raw images for quantitative analysis? Compute with individualized camera noise calibration data.

Detect the whisper

A dim sample has secrets to tell but can only be heard if the camera noise doesn't overwhelm the signal. With the lowest available readout noise on the market, the ORCA-Fusion BT is ready to listen.

Never waste a photon

Back-thin boosted QE enhances photon collection. So when scientific insight hinges on infinitesimal differences in intensity, the ORCA-Fusion BT will register signal with confidence.

Believe in binning

A 2×2 binned CMOS pixel has 2× the readout noise of native pixels. But with readout noise this low, the ORCA-Fusion BT makes binning a beautiful option for everything from increasing readout speed and improving S/N to optimizing pixel size relative to magnification.

Experience the ecosystem

A camera isn't useful without robust software. The ORCA-Fusion BT joins a long line of ORCA cameras that are supported by our DCAM drivers, integrated into third party software and equipped with advanced features such as dual interface options, multiple cooling, multiple triggering, and patented readout modes.

ORCA-Fusion BT

Camera
ORCA-Fusion BT

Product Number
C15440-20UP

Pixel Size
6.5 µm (H) × 6.5 µm (V)

Effective number of pixels
2304 (H) × 2304 (V)

Effective Area
14.976 (H) mm × 14.976 mm (V)

*1 Typical value

*2 Calculated from the ratio of the full well capacity and the RMS readout noise

*3 Dark current depends on cooling temperature

*4 In ultra quiet scan

*5 Equivalent to USB 3.1 Gen 1 (SuperSpeed USB 5 Gbps)

Readout noise *1	
Fast scan	1.6 electrons (rms) / 1.5 electrons (median)
Standard scan	1.0 electrons (rms) / 0.9 electrons (median)
Ultra quiet scan	0.7 electrons (rms) / 0.6 electrons (median)
Quantum efficiency *1	
@ 400 nm	72 %
@ 550 nm	95 %
@ 700 nm	83 %
@ 800 nm	58 %
Full well capacity *1	15 000 electrons
Dynamic range *1, *2, *4	21400:1 (rms) / 25 000:1 (median)
Conversion factor *1, *2	0.24 electrons / count
Cooling Temperature	
With forced-air	-8 ˚C (Ambient temperature: +25 ˚C)
Water cooled	-8 ˚C (Water temperature: +25 ˚C)
Water cooled (Max cooling)	Less than -15 ˚C (Ambient temperature: +20 ˚C, water temperature: +20 ˚C)
Dark current *1, *3	
@ -8 ˚C	1.0 electrons/pixel/second
@ -15 ˚C	0.7 electrons/pixel/second
Dark offset	100 counts
Dark signal non-uniformity (DSNU) *1, *4	0.06 electrons rms in Ultra quiet scan
Photo response non-uniformity (PRNU)	
@7500 electrons *1	0.06 % rms
Linearity error*1 (EMVA 1288 standard)	0.5 %
Readout modes	Full resolution / Digital binning (2×2, 4×4) / Sub-array / Lightsheet
Readout times at full resolution	
Fast scan	11.22 ms (89.1 fps with CoaXPress or 31.6 fps with USB 3.0)
Standard scan	42.99 ms (23.2 fps with CoaXPress or USB 3.0)
Ultra quiet scan	184.4 ms (5.4 fps with CoaXPress or USB 3.0)
Lightsheet readout (fast scan)	
Row interval time	4.868 µs to 963.8 µs
Readout time at full resolution	11.22 ms to 2.221 s
Readout modes	Full resolution / Sub-array
Readout directions	Top to bottom readout / Bottom to top readout
Exposure times	
Fast scan	17 µs to 10 s (4.87 µs step)
Standard scan	65 µs to 10 s (18.65 µs step)
Ultra quiet scan	280 µs to 10 s (80.00 µs step)
Trigger modes	Edge / Level / Sync readout / Start / Global reset edge / Global reset level / Programmable
Input trigger connector	SMA x1
Trigger delay function	Yes
Trigger output	Global exposure timing / Trigger ready / Low / High / 3 Programmable timing outputs
Output trigger connectors	SMA x3
Master pulse mode	Free running / Start trigger / Burst
Digital output	16 bit / 12 bit / 8 bit
Interface	CoaXPress (Dual CXP-6) and USB 3.0 Super Speed *5
Lens mount	C-mount (Standard) / F-mount C15440-20UP01
Software	HCImage / LabVIEW / MATLAB / µManager
Ambient operating temperature	0 ˚C to + 40 ˚C
Ambient operating humidity	30 % to 80 %, with no condensation
Ambient storage temperature	-10 °C to +50 °C
Ambient storage humidity	90 % max., with no condensation

ORCA-Fusion BT

CAMERA SPECS

LOW NOISE AND EXCEPTIONAL
READOUT NOISE UNIFORMITY WITH HIGH QE

LOW READOUT NOISE
0.7 electrons rms
Ultra quiet Scan

HIGH QE
95 % @550 nm
Gen III Back-illuminated sCMOS

HIGH SPEED
89.1 fps
@ 2304 × 2304 (16 bit)

HIGH RESOLUTION
2304 × 2304
5.3 Megapixels

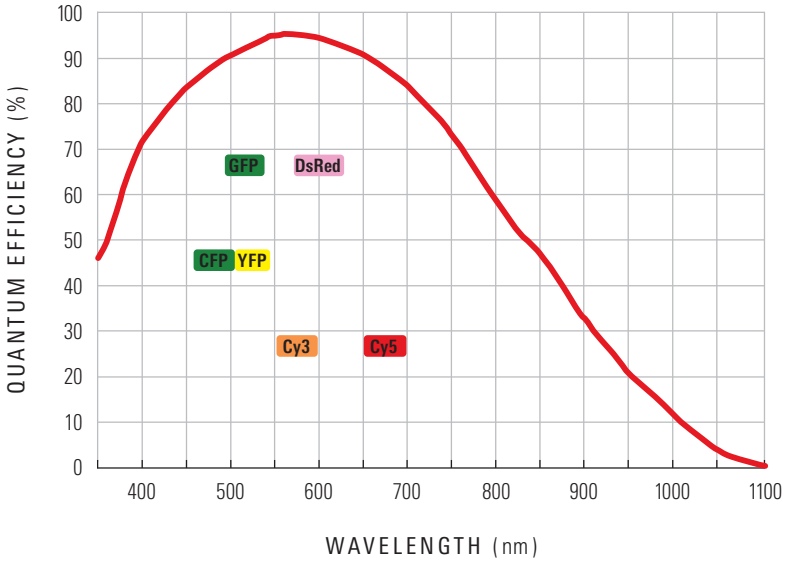
PRNU
0.06 % rms
@ 7500 electrons

PIXEL SIZE
6.5 µm × 6.5 µm

DYNAMIC RANGE
21 400:1
Ultra quiet Scan

DSNU
0.06 electrons rms
Ultra quiet Scan

Back-thin Boosted QE for Maximum Photon Collection



HAMAMATSU PHOTONICS K.K.

Visit our website for product and contact information.
www.hamamatsu.com

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