CAMERA LINE UP CATALOG

HAMAMATSU

PHOTON IS OUR BUSINESS

APPLICATION

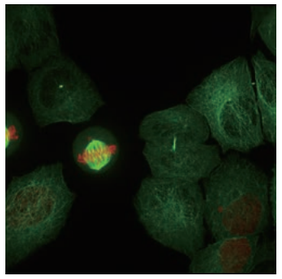
Application & Case study https://camera.hamamatsu.com/all/en/application_and_case_study.html

We have a diverse lineup of cameras that support a wide range of wavelengths from X-rays to the near-infrared and support a variety of applications.

Life science

Super resolution microscopy

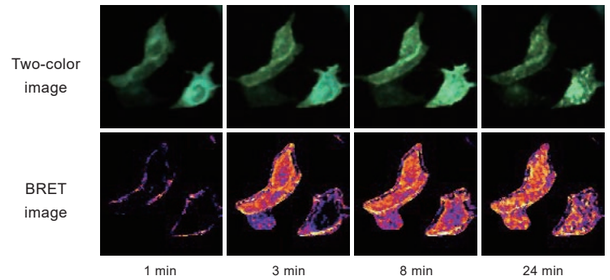
Cells are observed with higher spatial resolution than diffraction limit by the super resolution microscopy.



Camera: ORCA®-Quest
Super resolution imaging system: VT-iSIM
Data courtery of: Steven Coleman (Visitech international Ltd.)

Bioluminescence measurements

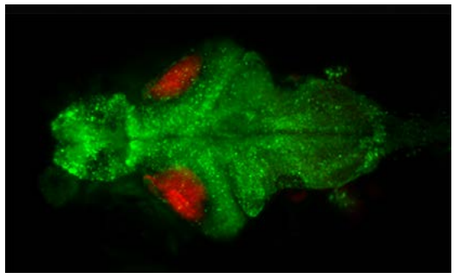
Ligand-stimulated binding of NanoLuc-Arrestin to GPCR-mVenus and its intracellular uptake are observed by simultaneous two-wavelength luminescence imaging.



Data courtery of: Masataka Yanagawa (Tohoku university)

Light sheet microscope

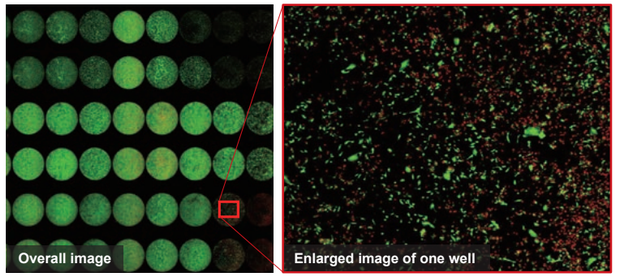
The zebrafish larvae brain function during its natural behavior is observed with light sheet fluorescence microscope.



Data courtery of: Drew Robson (Max Planck Institute for Biological Cybernetics)

Observation of cultured cells

Cells cultured in one well of a microplate are observed by high-resolution imaging with fluorescent images.

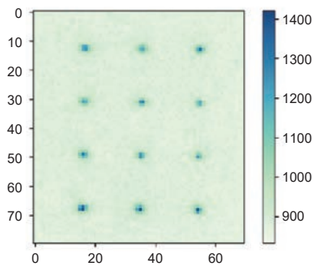


* Displayed with pseudo color by image processing.

Quantum Technology

Quantum computing (Neutral atom, Ion)

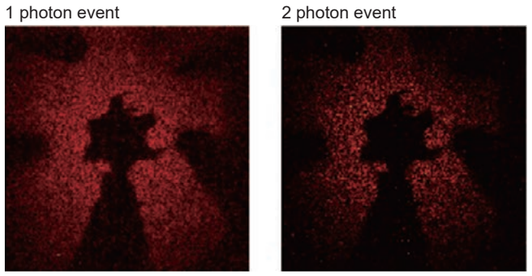
Position and quantum state of Rb atoms, trapped and arranged one by one in vacuum, are diagnosed via fluorescence.



Camera: ORCA®-Quest
Data courtery of: Takashi Yamamoto, Toshiki Kobayashi (Osaka university)

Quantum optics

qCMOS® camera is used for absorption imaging with quantum light source to compare between 1 photon event and 2 photon event images.

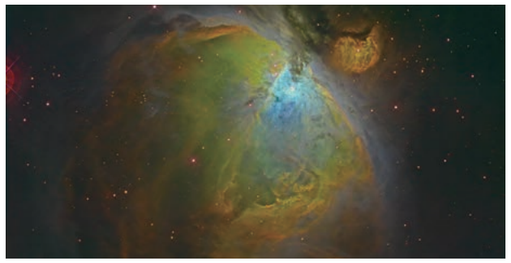


Camera: ORCA®-Quest
Data courtery of: Miles Padgett (University of Glasgow)

Astronomy

Lucky imaging

Wide field of view and low-noise imaging is used to obtain a clear image of the stars by integrating, from among many acquired images, that are less affected by atmospheric turbulence.



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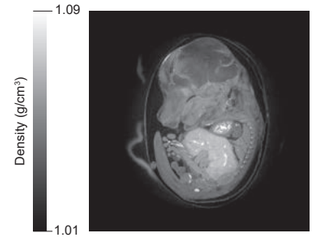
Synchrotron imaging

X-ray phase contrast CT image of mouse embryo

The mouse embryo is observed using the synchrotron X-ray.

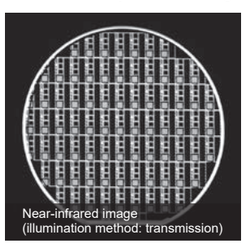


ORCA®-Quest combined with High resolution X-ray imaging system (M11427)
Data courtery of: SPring-8 BL20B2 beamline by Dr. Masato Hoshino, Senior researcher in Japan Synchrotron Radiation Research Institute (JASRI)

Semiconductor inspection

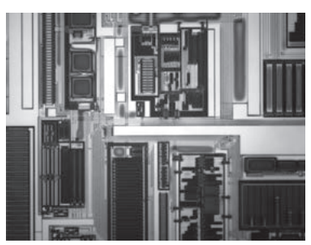
Transmission observation of Si wafer

The pattern formed on the backside of the Si wafer is observed transmitted through the front side by infrared imaging.



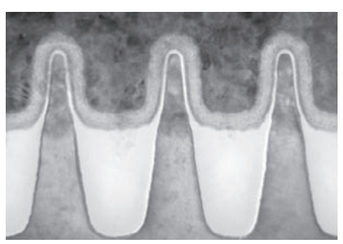
Semiconductor device observation

The pattern under the Si layer is observed by infrared imaging.



Structure observation of semiconductor devices

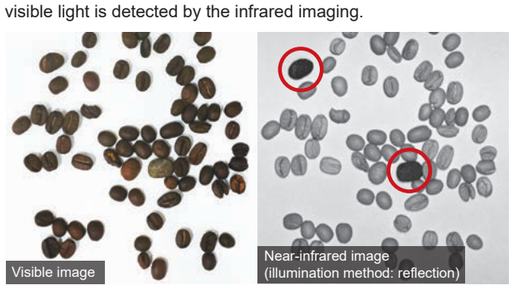
The interior structure of a semiconductor device is analyzed at the nano-level by high-resolution imaging using an electron microscope.



Food inspection

Foreign object detection

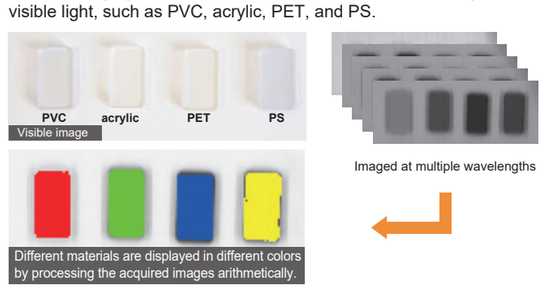
Small stones mixed in coffee beans that are difficult to see with visible light is detected by the infrared imaging.



Analysis / Spectroscopy

Material identification

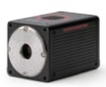
Infrared imaging identifies materials that are difficult to distinguish in visible light, such as PVC, acrylic, PET, and PS.



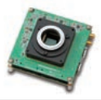
* Displayed with pseudo color by image processing.

CAMERA LINE UP

For detailed information https://www.hamamatsu.com/all/en/product/cameras.html

Wavelength range	Visible to near-infrared								Near-infrared				
Name	ORCA®-Quest 2 qCMOS® camera	ORCA®-Fire Digital CMOS camera	ORCA®-Fusion BT Digital CMOS camera	ORCA®-Fusion Digital CMOS camera	ORCA®-Flash4.0 V3 Digital CMOS camera	ORCA®-Flash4.0 LT3 Digital CMOS camera	ORCA®-spark Digital CMOS camera	TDI camera	InGaAs camera				InGaAs line scan camera
Type	C15550-22UP	C16240-20UP	C15440-20UP	C14440-20UP	C13440-20CU	C11440-42U40	C11440-36U	C10000-801	C16741-40U	C14041-10U	C12741-03	C12741-11	C15333-10E04
Appearance													
Image sensor type	Area sensor							TDI sensor	Area sensor				Line sensor
Sensitivity wavelength range (nm) (Spectral response: See P5)	250 to 1000 ❶	250 to 1000 ❷	350 to 1000 ❸	350 to 1000 ❹	350 to 1000 ❺	350 to 1000 ❺	350 to 1000 ❻	200 to 1000 ❼	400 to 1700 *3	950 to 1700 ❽		900 to 1550 ❾	950 to 1700 ❿
Effective number of pixels (H × V)	4096 × 2304	4432 × 2368	2304 × 2304	2304 × 2304	2048 × 2048	2048 × 2048	1920 × 1200	2048 × 128	1280 × 1024	320 × 256	640 × 512	640 × 512	1024 × 1
Pixel size ((H) µm × (V) µm)	4.6 × 4.6	4.6 × 4.6	6.5 × 6.5	6.5 × 6.5	6.5 × 6.5	6.5 × 6.5	5.86 × 5.86	12 × 12	5 × 5	20 × 20			12.5 × 12.5
Effective area ((H) mm × (V) mm)	18.841 × 10.598	20.387 × 10.892	14.976 × 14.976	14.976 × 14.976	13.312 × 13.312	13.312 × 13.312	11.25 × 7.03	24.58 × 1.536	6.40 × 5.12	6.4 × 5.12	12.8 × 10.24	12.8 × 10.24	12.8 × 0.0125
Full well capacity (electrons) typ.*1	7000	20 000	15 000	15 000	30 000	30 000	33 000	80 000	-	-		300 000	-
Dynamic range typ.*1	23 000:1	20 000:1	21 400:1	21 400:1	37 000:1	33 000:1	5000:1	1600:1	-	-		-	-
Cooling method	Forced-air cooled/ Water cooled	Forced-air cooled	Forced-air cooled/ Water cooled	Forced-air cooled/ Water cooled	Forced-air cooled/ Water cooled	Forces-air cooled	-	-	Forced-air cooled/ Natural-air cooled	Forced-air cooled		Forced-air cooled/ Water cooled	-
Cooling temperature (°C)*1	-35 (Water cooled)	+20	-15 (Water cooled)	-15 (Water cooled)	-30 (Water cooled)	+10	-	-	+15 (Forced-air cooled)	+10		-70 (Water cooled)	-
Readout speed (frame/s) (Full resolution)*1	120	115	89.1	89.1	100	30	64.9	50 kHz (Line rate)	71.53	216.6	59.774	7.2	40 kHz (Line rate)
Readout noise (electrons) rms typ.*1	0.30	1.0	0.7	0.7	1.4	1.5	6.6	50	-	-		500	-
Dark current (electrons/pixel/s) typ.*1	0.006 (Water cooled)	0.6	0.7 (Water cooled)	0.2 (Water cooled)	0.006 (Water cooled)	0.6	-	-	-	-		130 (Water cooled)	-
Interface	CoaXPress (Quad CXP-6)/ USB 3.1 Gen1	CoaXPress (Quad CXP-6)/ USB 3.1 Gen1	CoaXPress (Dual CXP-6)/ USB 3.0 *2	CoaXPress (Dual CXP-6)/ USB 3.0 *2	Camera Link/USB 3.0 *2	USB 3.1 Gen 1	USB 3.0 *2	Camera Link	USB 3.1 Gen 1	USB 3.0 *2	USB 3.0 *2/EIA	Camera Link	Gigabit Ethernet
Applications	Life science imaging Quantum technology Astronomy Semiconductor inspection Synchrotron imaging Electron microscope	Life science imaging Synchrotron imaging Electron microscope	Life science imaging Synchrotron imaging Electron microscope	Life science imaging Semiconductor inspection Synchrotron imaging Electron microscope	Life science imaging Semiconductor inspection Synchrotron imaging Electron microscope	Life science imaging Semiconductor inspection	Life science imaging Synchrotron imaging	Life science imaging Semiconductor inspection	Life science imaging Semiconductor inspection	Semiconductor inspection Food inspection Analysis/spectroscopy		Life science imaging Semiconductor inspection	Semiconductor inspection Food inspection

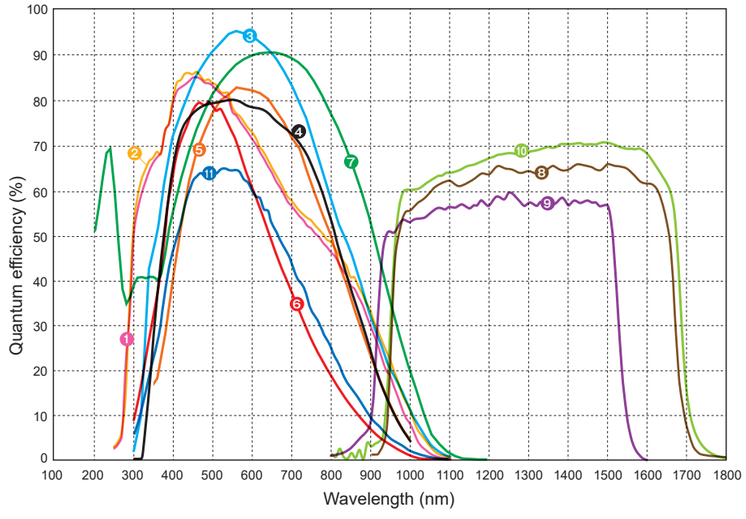
*1 Depends on the mode and conditions. For details, refer to each product catalog.
*2 Equivalation to USB 3.1 Gen1
*3 For detailed information, please refer to product catalog.

Camera type	Board type camera for OEM					
Name	Scientific CMOS board level camera		Digital CMOS board level camera			TDI board level camera
Type	C11440-62U	C11440-52U30	C13949-50U	C13770-50U	C13752-50U	C10000-A01
Appearance						
Image sensor type	Area sensor		Area sensor			TDI sensor
Sensitivity wavelength range (nm) (Spectral response: See P5)	350 to 1000 ❹		350 to 1000 ⓫			200 to 1000 ❼
Effective number of pixels (H × V)	2048 × 2048		4096 × 3008	2464 × 2056	2048 × 1544	2048 × 128
Pixel size ((H) µm × (V) µm)	6.5 × 6.5		3.45 × 3.45			12 × 12
Effective area ((H) mm × (V) mm)	13.312 × 13.312		14.13 × 10.37	8.50 × 7.09	7.06 × 5.32	24.53 × 1.536
Full well capacity (electrons) typ.*1	30 000		10 500			80 000
Dynamic range typ.*1	20 000:1	18 000:1	4565:1			1600:1
Readout speed (frame/s) (Full resolution)*1	30		15	40	65	50 kHz (Line rate)
Readout noise (electrons) rms typ.*1	2.1	2.3	2.3			50
Interface	USB 3.0 *2		USB 3.0 *2			Camera Link
Applications	Contact us	Contact us	Contact us	Contact us	Contact us	Contact us

*1 Depends on the mode and conditions. For details, refer to each product catalog.
*2 Equivalation to USB 3.1 Gen1

For X-ray		
X-ray sCMOS camera	ORCA®-Lightning X X-ray sCMOS camera	
C12849-111U	C15606-101P	C15606-102P
		
Area sensor	Area sensor	
25 kV to 90 kV (Recommended X-ray tube voltage range)	25 kV to 70 kV (Recommended X-ray tube voltage range)	
2048 × 2048	4608 × 2592	
6.5 × 6.5	5.5 × 5.5	
13.312 × 13.312	25.344 × 14.256	
30 000	38 000	
18 000:1	15 000:1	
30	30	
2.3	3.0	
USB 3.0 *2	CoaXPress (Quad CXP-6)	
Synchrotron imaging	Synchrotron imaging	

Spectral response



OEM CAMERA

We design and manufacture OEM cameras specific to each customer. We provide various types of cameras with options such as shape, sensor, interface, cooling method, software, etc. to meet customers' requests. The measurement wavelength range covers not only the visible range but spans widely from X-ray to infrared.

Cost reduction with minimum required functions

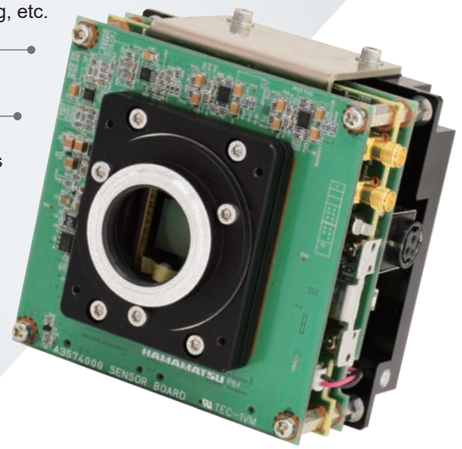
Cooling method
Air cooled
Water cooled
Peltier cooling, etc.

Camera type
Board type
Cased type
Camera head separated type
Integrated optical system

Interface
USB
Camera Link
Gigabit Ethernet
CoaXPress and others

Sensor type
sCMOS
TDI
Other company's sensor, etc.

Software/firmware
FPGA
Correction data
Library
Simulation



Shorten delivery time with simulation technology

We can perform imaging simulations that match the characteristics of various cameras (wavelength, sensitivity, speed, etc.).
By using this technology, we can shorten the process of repeating design and trial production, and provide cameras that meet your purpose efficiently and in a short time.

Flow from inquiry to delivery

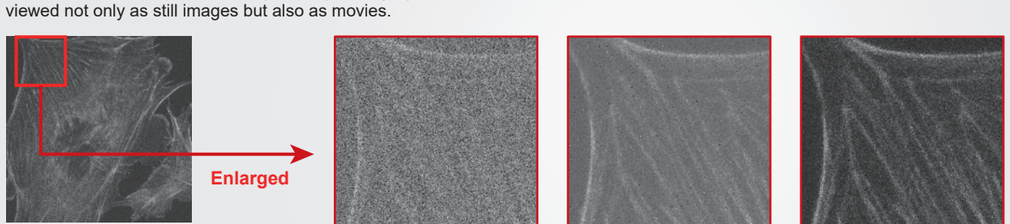
Without simulation

Inquiry → Consultation Planning → Repeating designs and trial productions → Delivery

With simulation (in our company)

Inquiry → Consultation Planning → Simulation → Design and trial production → Delivery

This is a simulation example using a cytoskeleton sample. The amount of light per pixel is set to the same value for simulation. Simulations can be performed by flexibly changing the acquisition conditions such as exposure time, and the results can be viewed not only as still images but also as movies.

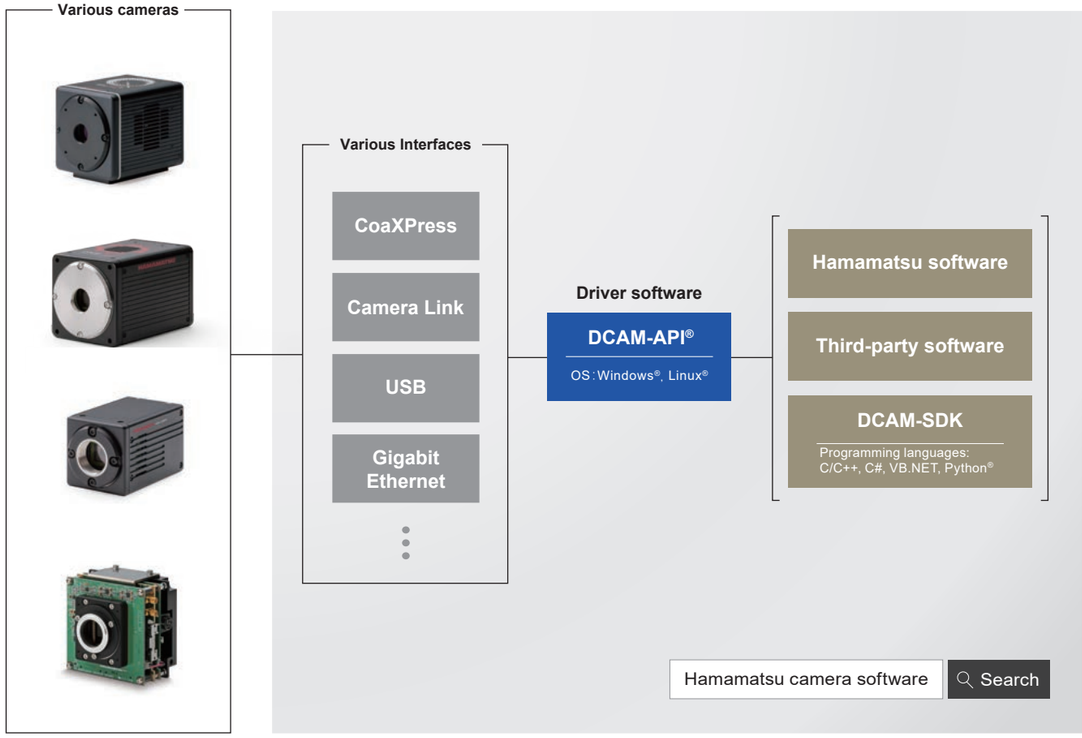


Sample image before enlargement | Cooled CCD camera | Gen II CMOS camera | Gen III CMOS camera

You can try the simulation on our website. Access it from the URL below.
Camera Simulation Engine URL: https://camera.hamamatsu.com/all/en/learn/camera_simulation_engine.html

SOFTWARE

We provide a common camera library "DCAM-API®," Hamamatsu Photonics software that can maximize the characteristics of your camera, and a tool "DCAM-SDK," that allows you to build your own control software. Through DCAM-API®, even if the camera or interface is changed, the software modification/change can be minimized.



Third-party software

Our cameras can be controlled by combining our cameras and peripherals with software from each microscope manufacturer, bioimaging software, or the following software.

Plugins that are compatible with third-party software

Software	Manufacturer	OS
LabView	National Instruments	Windows®
MATLAB	The MathWorks	Windows®
µManager	Open source	Windows®
EPICS	Open source	Linux®

*For details on external software, please contact the manufacturer.

Please download plugins from the URL below.
URL: https://dcam-api.com/third-party-plugins/

For details, please refer to the following link. https://www.hamamatsu.com/all/en/product/cameras/driver-software.html

RELATED PRODUCTS

Imaging optical system

We also have a lineup of Imaging optical systems to expand usability of our cameras, such as multi wavelength imaging and High resolution X-ray imaging system.

Image splitting optics
W-VIEW GEMINI A12801

Product details page URL:
https://www.hamamatsu.com/all/en/product/optical-components/image-splitting-optics.html

High resolution X-ray imaging system
M11427

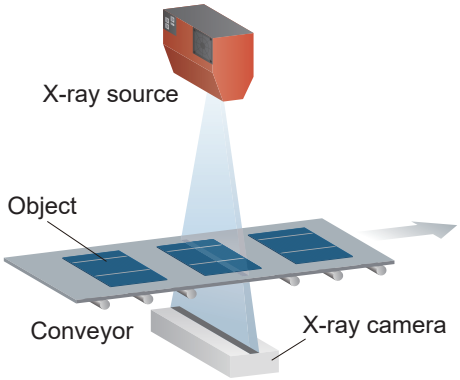
Product details page URL:
https://www.hamamatsu.com/all/en/product/cameras/high-resolution-x-ray-imaging-system.html

X-ray line scan camera/X-ray TDI camera

We have a lineup of X-ray non-destructive inspection cameras that can be used in-line. Since it is possible to inspect the inside of substances that cannot be seen with visible light or infrared light, these cameras are suitable for foreign matter inspection of foods and pharmaceuticals, defect inspection of printed circuit board, etc.

X-ray line scan camera
C14300 series

X-ray TDI camera
C12300 series



For details, please refer to the following link. https://www.hamamatsu.com/all/en/applications/non-destructive-testing.html

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