

sensicam qe cooled digital 12 bit CCD camera system

- super quantum efficiency up to 65 %
- extremely low noise, down to 4 e⁻ rms
- 12bit dynamic range
- thermoelectrical cooling (Peltier) down to -12 °C
- high resolution 1376 x 1040 pixel
- shutter / exposure times from 500 ns – 3600 s
- binning (horizontal & vertical)
- region of interest (ROI)
- 10 frames per second at full CCD resolution
- remote control up to 1500m distance (with fiber optic link)
- free software camware and software development kit included
- short interframing time of 500 ns for PIV (double shutter mode)



sensicam qe

This high performance cooled digital 12bit CCD camera system comprises advanced CCD and electronics technology. The system features thermo-electrical cooling of the image sensor (down to $-12\text{ }^{\circ}\text{C}$), extremely low noise ($4\text{ e}^{-}\text{ rms}$) and an outstanding quantum efficiency, which achieves a high spectral sensitivity in general and especially in the NIR. Exposure time modes (software selectable) range from 500 ns (fast shutter) to 3600 s (long exposure). The double shutter version for PIV records two images with a remarkable interframing time of 500 ns. A high speed serial data link connects the system to the PC (fiber optic link available). This low light camera system is perfectly suited for many sensitive and low noise imaging applications, like fluorescence imaging, confocal & light microscopy etc..

technical data

	unit	setpoint	sensicam qe
resolution (hor x ver) ¹	pixel		1376 x 1040
pixel size (hor x ver)	μm^2		6.45 x 6.45
sensor format / diagonal	inch / mm		2/3" / 11.14
quantum efficiency	%	@ 500 nm typical	62
full well capacity	e^{-}		18 000
image sensor			ICX285AL
dynamic range	dB	@ gain low, CCD + camera	70.1
dynamic range A/D ²	bit		12
readout noise	$\text{e}^{-}\text{ rms}$	@ gain high @ gain low	4..5 5..6
imaging frequency, frame rate	fps	@ full frame @ binning 2x2	10.0 19.8
pixel scan rate	MHz		16
A/D conversion factor	$\text{e}^{-} / \text{count}$	@ gain high @ gain low	2 4
spectral range	nm		290..1200
exposure time	s		500 ns..3600 s
anti-blooming factor		@ standard light mode / @ low light mode @ 100 ms exp. time	> 400 / > 4
smear	%		<0.002
binning horizontal	pixel		1,2,4,8
binning vertical	pixel		1,2,4,8,16
dark current	$\text{e}^{-} / \text{pixel} \cdot \text{s}$	@ $-12\text{ }^{\circ}\text{C}$ & standard light mode	0.1

technical data

	unit	setpoint	sensicam qe
region of interest	pixel		down to 32 x 32
extinction ratio		@ 1 ms exposure time	1 : 2000
non linearity	%	full temperature range	< 1
uniformity darkness DSNU ³	count	@ 90% center zone	1
uniformity brightness PRNU ⁴	%		0.6
trigger, auxiliary signals		internal / external	software / TTL level
power consumption	W		36
power supply	VAC		90..260
mechanical dimensions camera (w x h x l)	mm ³		93 x 78 x 210
mechanical dimensions power supply (w x h x l)	mm ³		84 x 50 x 155
weight	kg	camera	1.6
operating temperature range	°C		+5..+40
operating humidity range	%	non condensing	10..90
storage temperature range	°C		-20..+70
optical input			c-mount with adjustable back focal length
optical input window			fused silica
data interface			PCI local bus, Rev. 2.1, burst rate 132 MByte/s
CE certified			yes
cooled CCD temperature	°C		-12
cooling method			2 stage Peltier cooler with forced air cooling
modes			standard / low light standard – high double shutter
interframing time	ns	double shutter mode	500

[1] horizontal versus vertical

[2] Analog-to-Digital-converter

[3] dark signal non-uniformity

[4] photo response non-uniformity

data transfer to PC

standard: twin coaxial cable (5m)
optional: fiber optic link (10m – 1500m)

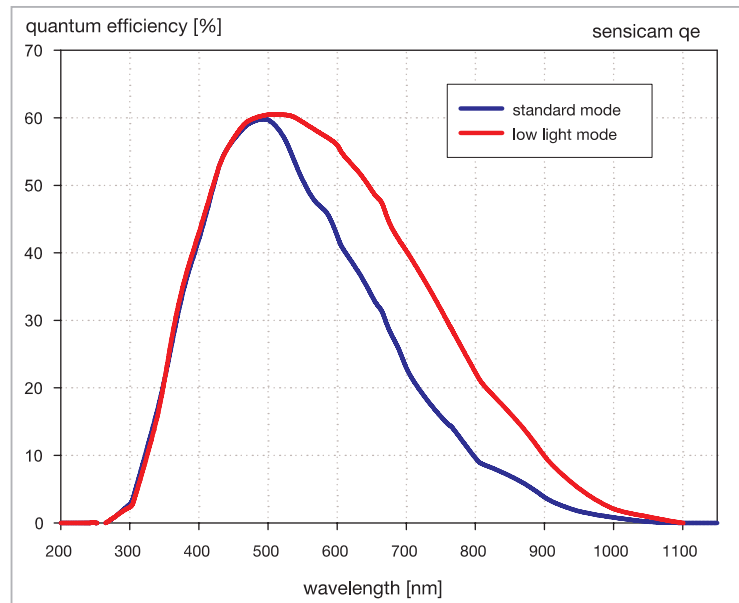
software

camware software for camera control, display, storage and printing of image data under WindowsXP, Windows2000; software development kit (SDK) with demo software for the above mentioned operating systems; TWAIN drivers; drivers or plug-in's for popular third party image processing products

options

hardened against high magnetic fields
external fan cooling
custom-made versions

quantum efficiency



(measured by pco).

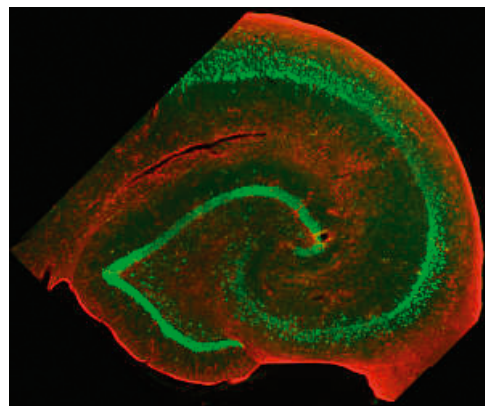
areas of application

- laser induced fluorescence
- fluorescence microscopy
- electron microscopy
- Red and NIR fluorescence applications
- bioluminescence / chemoluminescence
- spectroscopy
- PIV particle image velocimetry
- ion imaging
- low light level imaging
- solar cell quality measurements
- imaging of bio markers (e.g. green fluorescent protein, GFP)

examples of applications

Glia (red) and neurons (green) are visible in a dog hippocampus slice.

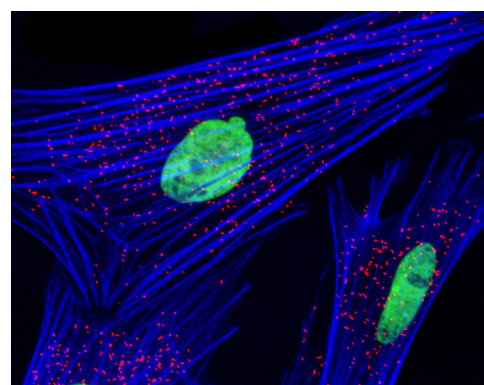
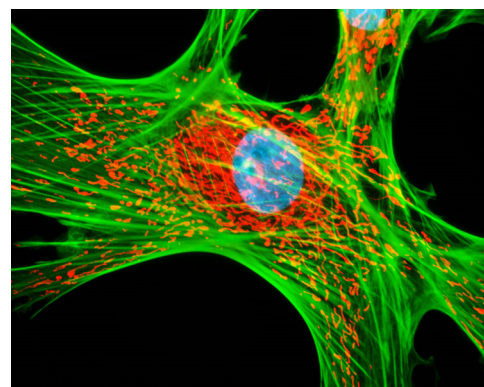
...with friendly permission of Gloria E. Hoffman and colleagues, Maryland School of Medicine, Baltimore, USA



Fluorescence microscope images:

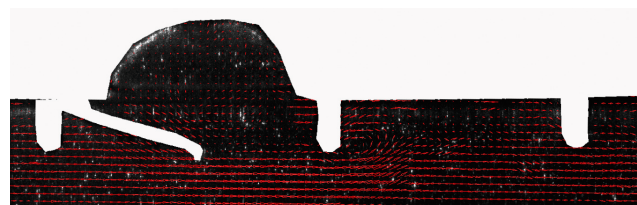
Upper photo: normal tahr ovary epithelial cells (HJ1. ov) stained with MitoTracker Red CMXRos, BODIPY FL – Phalloidin and Hoechst 32258, lower photo: Indian muntjac deer epidermis fibroblast cells stained with Alexa Fluor 568 – PMP 70 (Rb), Cy2 – Histones (Ms) and Alexa Fluor 350 – Phalloidin

...the Cooke Corporation



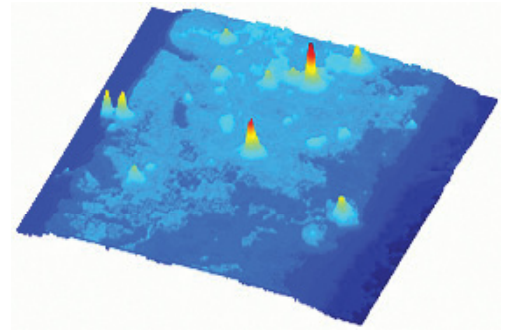
Velocity distribution vectors on top of an original PIV image with fluorescent seed particles inside an artificial heart valve experiment.

...with friendly permission of: ILA Intelligent Laser Applications GmbH, Germany, www.ila.de



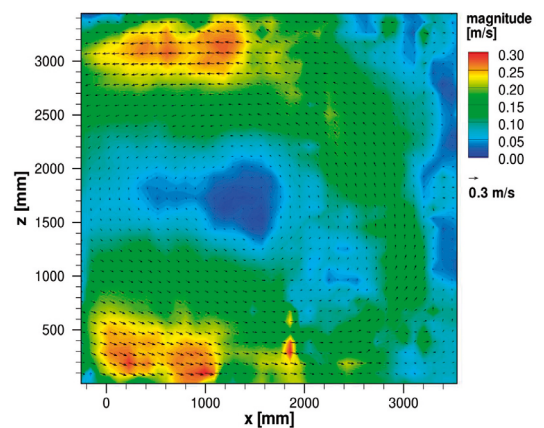
An area of $50\mu\text{m} \times 50\mu\text{m}$ is visible, the bright peaks correspond to single Terrylene molecules – single-molecule spectroscopy at low temperatures.

...with friendly permission of:
Institute for Experimental
Physics IV, L. Kador &
M. Bauer, University Bayreuth,
Germany,
www.ep4.phy.uni-bayreuth.de



Time-average of a large-scale flow field inside a convection cell for turbulent convection in air ("barrel of Ilmenau").

...with friendly permission of:
Institute for Aerodynamics
and Flow Technology, DLR,
Goettingen, Germany and
Department of Mechanical
Engineering, Ilmenau
University of Technology,
Germany



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