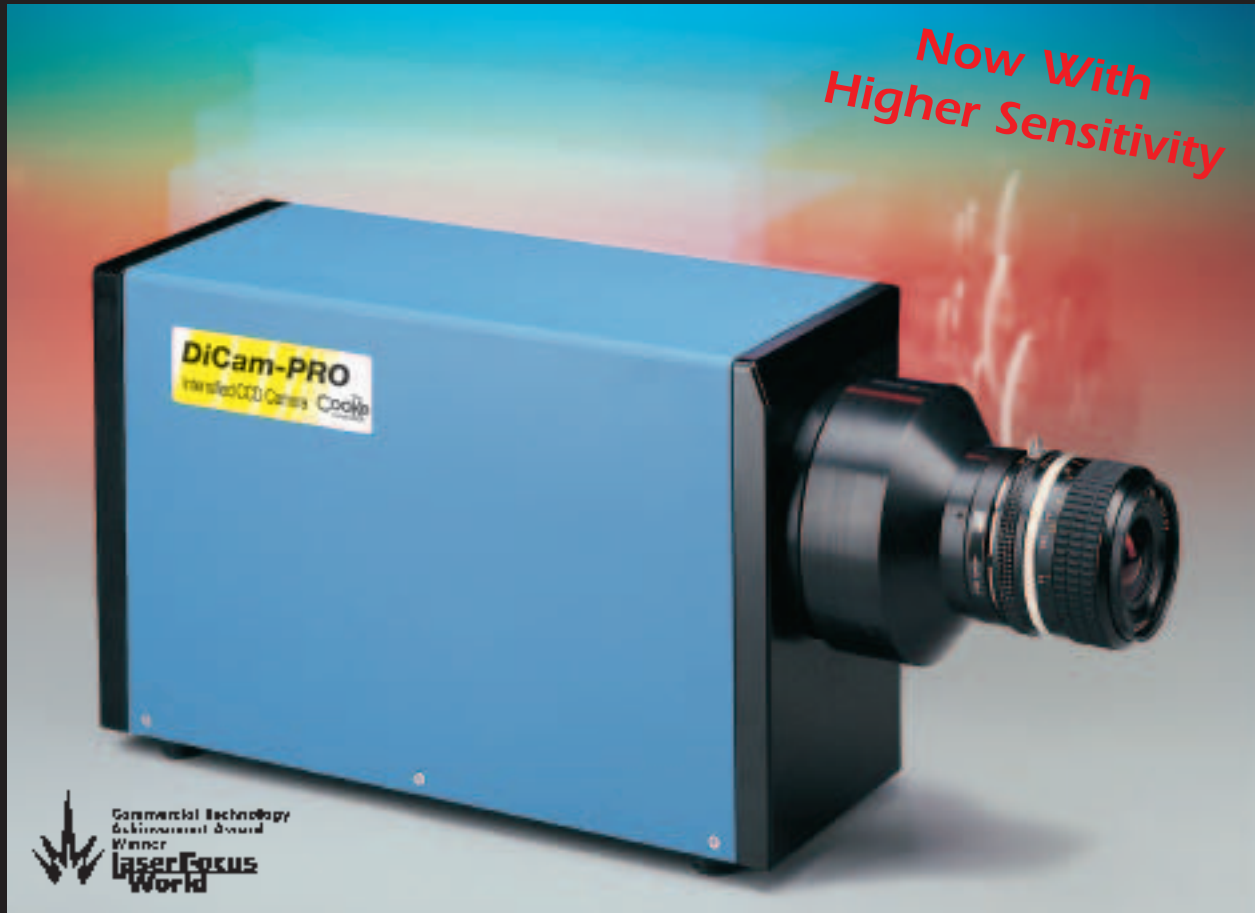


DiCam-PRO

Intensified CCD Imaging System



High Sensitivity

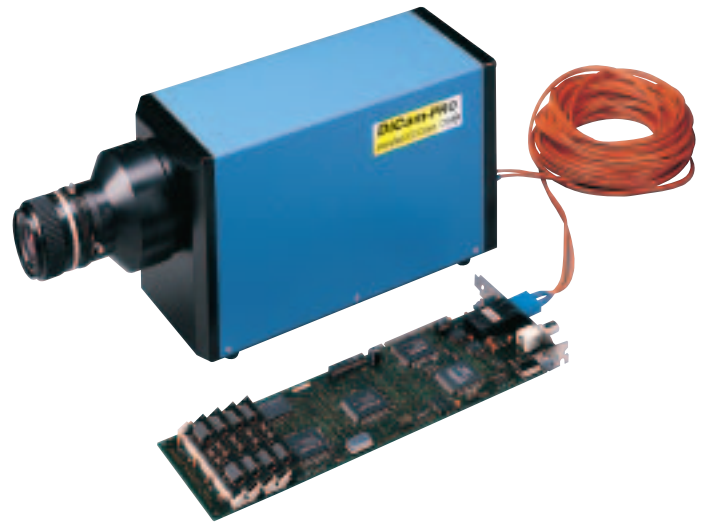
1280 x 1024 Pixel Resolution

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corporation

DiCam-PRO

Features

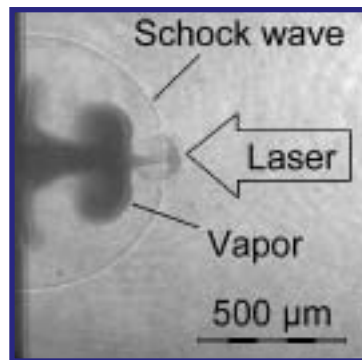
- 12-bit dynamic range
- Gen2 or enhanced Gen3 (higher QE and longer lifetime) photocathodes available
- Fast shutter down to 3ns (1.5ns optional)
- Long exposure up to 1000s
- High system sensitivity allows single photon detection
- High resolution sensor 1280 x 1024 (SVGA)
- 25mm MCP-image intensifier
- Spectral sensitivity UV to NIR
- PCI Board "plug & play"
- Quiet correlated double sampling (QCDS) readout
- Horizontal and vertical binning/ROI
- Cooled down to -12°C
- Optical or electrical triggering
- Two distinct shots with an interframing time of 500ns (PIV)
- Multiple exposures or sequential imaging



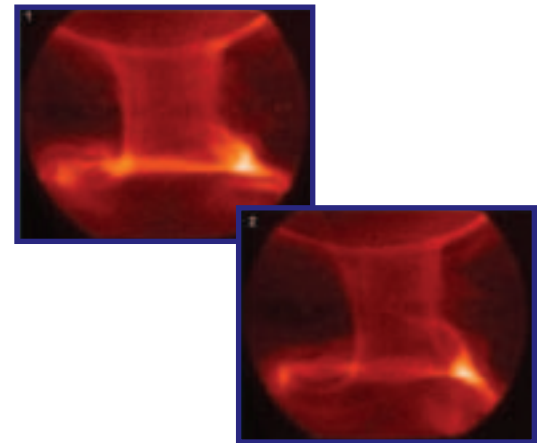
DiCam-PRO shown connected via fiber optic cable (Fiber Optic Link up to 1500m).

Applications

- Laser Induced Fluorescence
- Wind Tunnel Fluorescence
- Time-Resolved Spectroscopy
- LIB Spectroscopy
- Plasma Physics
- Voltage Sensitive Dyes
- Chemiluminescence
- Bioluminescence
- Ballistics
- Fast Flow Analysis
- PIV/PTV
- Fuel Injection Studies
- Spray and Particle
- Combustion Research
- Fluorescence Microscopy
- Flame Analysis



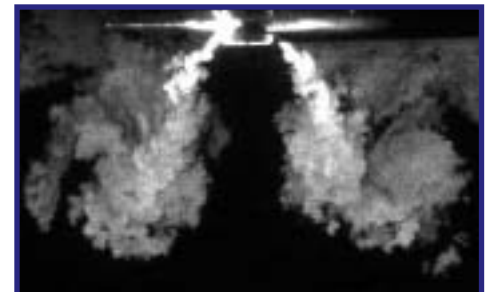
Plasma Imaging
(Courtesy of the Institut für Strahlwerkzeuge (IFSW), University of Stuttgart, Micromachining Group, www.ifsw.uni-stuttgart.de, Stuttgart, Germany)



Plasma Imaging
(Images courtesy of Carlos A. Romero T. and Paul M. Bellan from Caltech, and the SSPX team from LLNL.)



Projectile Sabot Separation



Fuel Spray
(Courtesy of Colorado State University Engine and Energy Conversion Lab)

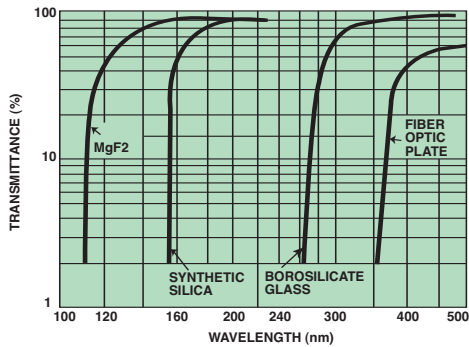
Specifications

OPTICAL INPUT	Flange with clamp, Ø 80 mm	
	Easy adaptation to Nikon F-Mount. C-Mount or special mounts (optional)	
IMAGE INTENSIFIER	Type	Proximity Focused MCP (single stage MCP)
	Optional	HighRes MCP (6µm channel)
	Diameter	18 or 25mm
	Input Window	Fused Silica
	Output Window	Glass
	Photocathode	S20, S25, GaAs, GaAsP, others on request
	Phosphor Screen	P43 or P46
POWER AND GATING SUPPLY	Phosphor Voltage	6 to 7.5kV internally adjusted, ripple ±15mV
	MCP Voltage	0 to 1100V externally adjustable, ripple ±1mV
	Photocathode Voltage	on: -180V off: +80V
	Ultra-Fast Gating mode	Minimum pulse width: 3ns, 1.5ns optional Maximum pulsing frequency: 4kHz
	High Rate Gating mode	Minimum pulse width: 20ns Maximum pulsing frequency: 2MHz (in bursts)
OPTICAL COUPLING	"Ultra Speed Tandem Lens" between image intensifier and CCD collimator lens F2.5/100mm Output lens F1.0/33mm or F1.4/46mm (depending on CCD) <ul style="list-style-type: none"> • transmission efficiency > 20% • resolution > 60lp/mm • vignetting < 3% • distortion free 	
	Scaling rate	<ul style="list-style-type: none"> • 25 mm image intensifier to SVGA CCD sensor 1 : 2.17 • 25 mm image intensifier to VGA CCD Sensor 1:3 • 18 mm GaAs image intensifier to SVGA CCD Sensor 1:2.17 • >100 counts/photoelectron with P43 phosphor, and >25 counts/photoelectron with P46 phosphor.
COOLING	2-stage peltier cooler with forced air cooling to -12°C	
SYSTEM DATA	Sensitivity	Single photon detection. Dynamic range greater than factor of 5 compared to RMS noise. This corresponds to < 1µlux (at 20ms exposure time)
	Resolution	Up to 1000 lines
IMAGING MODES Single Image	Ultra-fast Gating Mode	Exposure Time: 3, 5, 10... 30 (in 5 nsec steps), 30-100nsec in 10nsec steps, 100ns-1000msec in 20nsec steps, 1000msec-1000sec in 1µsec steps. Delay Time: 0-50ns in 1ns steps, 50-100ns in 5ns steps, 100ns-1000ms in 20ns steps, 1000ms-1000s in 1µs steps. Maximum pulsing frequency of 3.3kHz for exposure times < 20ns and 2MHz for exposure times ≥20 ns.

IMAGING MODES (continued)		
Multiple Exposure	5 pairs, freely programmable	Exposure Time: 20ns-999ms in 20ns steps Delay Time: 0-999ms in 20ns steps Maximum pulsing frequency: 2 MHz
Double Shot	2 full resolution images captured with minimum interframing time of 500ns	Exposure Time: 20 ns-999ms in 20ns steps Delay Time: 0-10ms in 20ns steps Maximum pulsing frequency: 2 MHz
	Common to all imaging modes	Intrinsic delay (trigger input-shutter): 50ns approx. Jitter: (<100ns exposure time) <0.5ns Jitter: (>100ns exposure time) <5ns
EXPOSURE TIME CCD	CCD Integration Time	1 ms to 1000s adjustable. Automatically triggered by gate unit.
CAMERA INTERFACE	Data Transfer	Fiber Optic Link (FOL), double SC connector, cable length 10m to 1500m.
	Control Output	Active while photocathode on, TTL level, BNC connector
	Trigger Input	Electrical trigger (TTL level, BNC connector) Light trigger (SC connector)
	Shutter Disable	High speed TTL input (for disabling the shutter), BNC connector
PCI INTERFACE BOARD	Board	PCI local bus compatible, revision 2.1, burst rate 132 MByte/s
POWER SUPPLY	12V DC	Desktop power supply with 90 to 260V input voltage and IEC connector included. CE Certified, UL Approved.
SOFTWARE	The system includes CamWare software and software development kit (SDK) compatible with all Windows OS for camera control, image acquisition/enhancement, and archiving in various file formats. TWAIN driver and other drivers for popular 3rd party software packages also available. Custom software development capabilities available.	
GENERAL INFORMATION	Dimensions (Head): 120 (W) x 180 (H) x 340 (L) mm	
	Operating Temperature: +5 to 40°C	
	Storage Temperature: -20 to +70°C	
	Humidity: 10 to 90% non-condensing	
	Housing: Shielded EMC design	

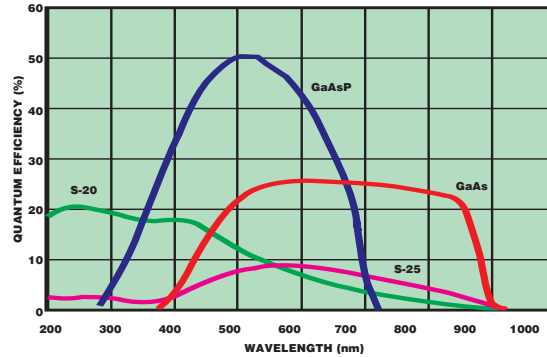
DiCam-PRO

Image Intensifier



Input Window

The material of the input window limits the lower range of the spectral response.

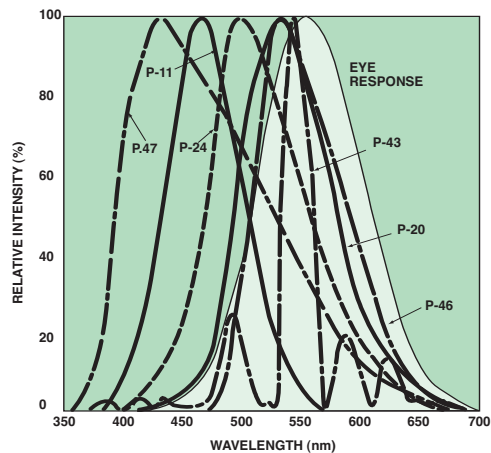


Photocathode

The photocathode materials are selected based on the spectral range required.

Photocathode Material	Peak Wavelength (nm)	Quantum Efficiency at peak wavelength (%)	Equivalent background input (EBI) (W/cm ²)	Dark Counts (S ⁻¹ /cm ²)
S20 (multialkali)	430	14-18	3×10^{-14}	1500
S25 (multialkali)	600	8.3-9.3	2×10^{-14}	10,000
Enhanced Gen 3 (GaAs)	830	23	4×10^{-14}	30,000
Enhanced Gen 3 (GaAsP, filmless)	500	50	2×10^{-14}	10,000

Phosphor Response Curve



Phosphor Specifications

Phosphor	Phosphor Decay (Typical) To		Typical Efficiency
	... 10%	... 1%	
P43	1 ms	4 ms	100%
P46	0.2 - 0.4 μs	2 μsec	30%

SVGA CCD Sensor

Sensor Type	CCD-Interline Progressive Scan with "lens-on-chip"	Smear	<0.005%
CCD Sensor	ICX085AL	Anti-Blooming	>1000
Number of Pixels	1280(H) x 1024(V)*	CCD Quality	Grade 0
Pixel Size	6.7µm x 6.7µm	Quantum Efficiency @ 500nm	Typ. 40%
Sensor Format/Diagonal	2/3"/11.0mm	Spectral Response	280 to 1000nm
Scan Area	8.6mm x 6.9mm	Dark Current	<0.1 electrons/pixel/sec
Full Well Capacity	25,000 electrons	Extinction Ratio	1:2000
Dynamic Range A/D	12-bit	Non-Linearity	<1%
Dynamic Range (CCD Sensor and Camera)	69.3 dB	Binning Horizontal	1 to 8
Scan Rate	12.5 MHz	Binning Vertical	1 to 32
Readout Noise @ 12.5 MHz	7 to 8 electrons	Region Of Interest (ROI)	rectangular with minimum 32 x 32 pixel independent control of horizontal and vertical resolution
A/D Conversion Factor	5 electrons/count	Peak Quantum Efficiency	depends on photocathode material.
Frame Rate	8		

*VGA CCD Sensor 640 x 480 also available with 30 Hz frame rate.

Ordering Information

The DiCam-PRO Intensified CCD Imaging System comes complete with PCI Interface Board, Standard Coax Cable, CamWare Software, Power Supply and Manual.

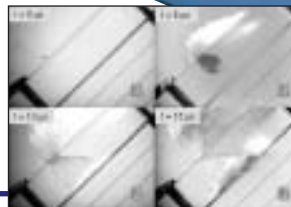
To order specify:

Image intensifier and Phosphor screen

Contact our technical sales team to assist you in configuring an optimum system for your application.

HSFC-PRO Ultra-High Speed Framing Camera

This four-channel framing camera combines the power of four DiCam-PRO cameras into one system. With each channel functioning as one DiCam-PRO, this system delivers framing rates up to 500 million frames-per-second at 1280 x 1024 pixel resolution. Light sources such as pulsed lasers can be synchronized with the HSFC-PRO.



Space Debris Impact

Images courtesy of the Fraunhofer-Institut für Kurzzeitdynamik - Ernst-Mach-Institute, www.emi.fhg.de

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*Specifications subject to change with technological advancements.