Princeton Instruments

SPECTROSCOPY GROUP

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ProEM: 1600(2)/1600(4)

The ProEM: 1600 EMCCD cameras from Princeton Instruments are the most advanced spectroscopy EMCCD cameras on the market. ***The 1600 x 200 and 1600 x 400 format sensors, featuring PI's exclusive eXcelon ™ technology, provide the lowest etaloning in the NIR, and enhanced QE in blue and red.*** These cameras feature a high speed EM mode to capture fast kinetics as well as a normal CCD mode with very low read noise for precision photometry. The ProEM: 1600(2)/1600(4) cameras are deep cooled using either air or liquid, while the all metal, hermetic vacuum seals are warrantied for life – the only such guarantee in the industry. Both models feature the latest Gigabit Ethernet (GigE) interface to allow remote operation over a single cable without the need for custom frame grabbers.

FEATURES	BENEFITS
eXcelon technology	Higher QE in the UV and NIR than conventional back-thinned EMCCDs with greatly reduced etaloning effects
NEW! 1600 x 200 and 1600 x 400 format	Custom EMCCDs for high speed and low-light spectroscopy
Electron multiplication (EM) gain	Low-noise, impact-ionization process for single-photon sensitivity
OptiCAL ™	Linear, absolute EM gain calibration using built in precision light source
BASE ™	Baseline Active Stability Engine: stable reference for quantitative measurements
PINS ™	Princeton Instruments Noise Suppression technology: Independently optimized EM and non-EM modes for the lowest noise and the best linearity
Deep cooling	Thermoelectric cooling minimizes dark current and allows long exposure times; Camera can be cooled with air or liquid, and fan can be permanently turned off for vibration-sensitive environments
Single optical window	Vacuum window is the only optical surface between incident light and the CCD surface; Advanced AR coatings for the highest throughput
Built-in manual shutter	Conveniently capture dark reference frames and protect camera from dust when not in use
Dual amplifiers	Individually optimized signal chains for a true 2-in-1 camera configuration, for high speed (EM mode) or long integration (normal CCD mode) applications
16-bit digitization	Wide dynamic range to capture weak and strong lines in a single spectrum
4 and 6.67 MHz readout	Up to 3 kHz binned spectral rate in Custom Chip mode
100 kHz readout	Low noise register provides conventional CCD readout when EM gain is not needed
Gigabit Ethernet (GigE)	Reliable data transmission over 50 m for remote operation
Standard spectroscopy mount	Easily interfaces with Acton Series spectrometers

Applications:
Scanning Confocal Spectroscopy, Hyperspectral Imaging and Single Molecule Spectroscopy

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SPECIFICATIONS

	ProEM:1600(2)_eXcelon	ProEM:1600(4)_eXcelon
Features	Back-illuminated EMCCD with eXcelon technology. 3.2 mm sensor height for high-speed data acquisition.	Back-illuminated EMCCD with eXcelon technology. 6.4 mm sensor height for multiple-ROI spectroscopy with multi-fiber bundles.
CCD format	1600 X 200, 16 µm pixels 25.6 X 3.2 mm (optically centered)	1600 X 400, 16 µm pixels 25.6 X 6.4 mm (optically centered)
	EM mode	***Low noise mode***
Read noise (typical)	25 e- rms @ 1 MHz 35 e- rms @ 4 MHz 65 e- rms @ 6.67 MHz Read noise effectively reduced to <1 e- rms with on-chip multiplication gain enabled	3 - 7 e- rms @ 100 kHz 5 - 8 e- rms @ 1 MHz 15 - 20 e- rms @ 5 MHz
Full well (typical)	800 ke- (EM register)	400 ke- (low noise register)
Nonlinearity	<2%	<1%
Operating temperature (@ +20° C ambient)	-55° C (typical, +/- 0.05° C) Maximum Cooling: -70° C (air), -85° C (+20° C liquid), -90° C (+10° C liquid)	
Dark current	0.2 e-/p/sec at -55° C 0.016 e-/p/sec at -70° C	
Clock-induced charge (CIC) (typical)	0.005 e-/pixel/frame measured with 30 msec exposure time and ~1000x multiplication gain	
Electron multiplication (EM) gain	1 to 1000x, controlled in linear, absolute steps	
Digitization	16 bits	
Vertical shift rate	1.5 µsec/row - 6 µsec/row (variable)	
Spectral rate @ 6.67 MHz	Full Vertical Binning (1600x200) > 1500 fps Full Vertical Binning (1600x400) > 1000 fps Custom chip (both formats) > 3000 fps (10 rows binned)	
Binning	Flexible binning in vertical, and 2x to 32x in horizontal	
Operating systems supported	Windows XP/7 (32-bit) and Windows 7/Vista (64-bit)	
I/O signals	Exposure, Readout, Trigger In, Trigger Out, Waiting for Trigger	
Operating environment	0 to 30° C ambient, 0 to 80% relative humidity, non-condensing	

NOTE: All specifications subject to change

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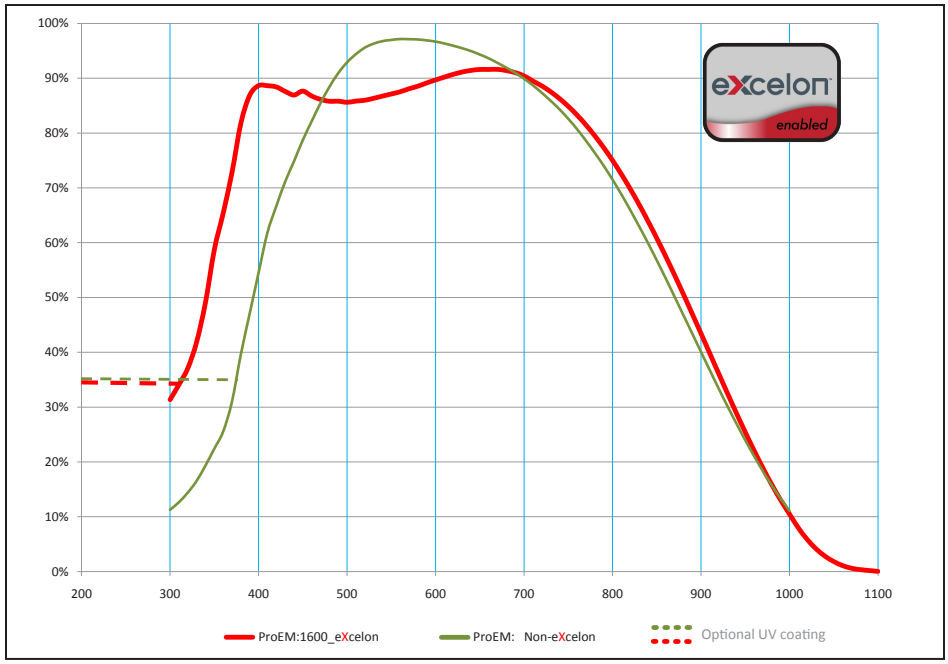
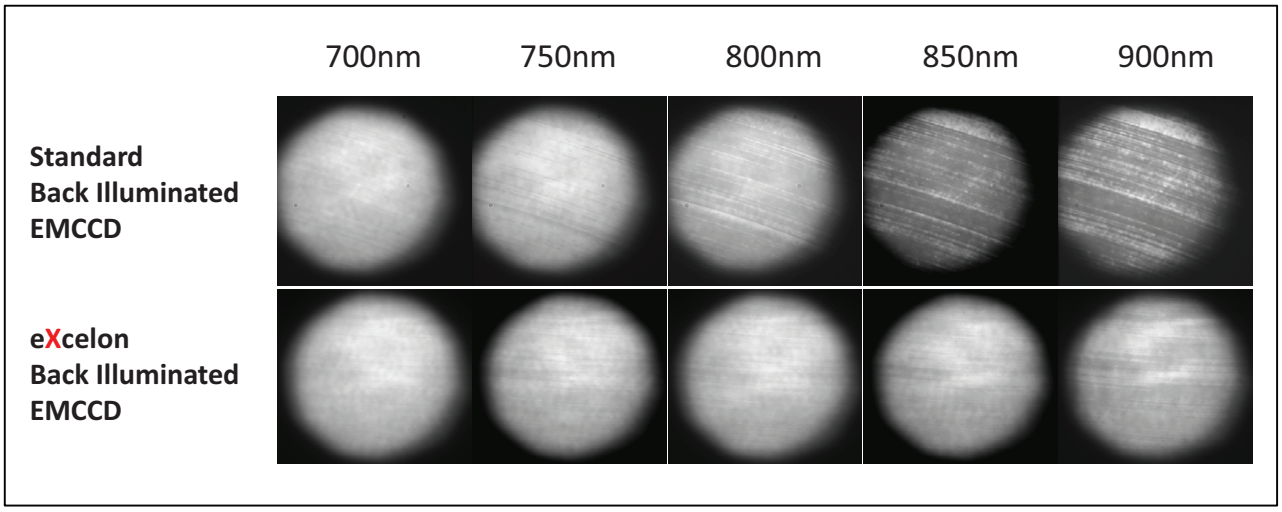
ProEM: 1600 QE Curve



NOTES: 1) QE data @ +25° C
2) The eXcelon QE data represents calculated and measured values



Data taken with white light source through a monochromator comparing etaloning performance of eXcelon vs conventional back-illuminated EMCCDs