Princeton Instruments

ProEM®-HS:512BX3

The ProEM-HS: 512BX3 is the most advanced EMCCD camera on the market. It features Princeton Instruments' patented eXcelon®3 technology which delivers the best combination of sensitivity, fringe suppression and high speed. The high speed 20 MHz, > 60 fps EM mode captures low light, fast kinetics, while a slow scan CCD mode with very low read noise is suited for precision photometry applications. ProEM-HS:512BX3 also features ultra-fast custom CCD readout for >10,000 fps at reduced resolution and linear, absolute EM gain. This camera can be cooled to below -90° C, and the all-metal, hermetic vacuum seals are guaranteed for life – the only such warranty in the industry. ProEM-HS:512BX3 features the latest Gigabit Ethernet (GigE) interface to allow remote operation over a single cable without the need for custom frame grabbers.

FEATURES	BENEFITS
Patented eXcelon®3 technology	Enhanced QE and fringe suppression versus standard back illuminated sensors.
20 MHz/16-bit readout	61 fps rate at full-frame resolution. Use ROI/binning for hundreds of frames per second.
All-metal, hermetic vacuum design	Lifetime vacuum guarantee and deep cooling. No epoxies used. Lowest dark current.
OptiCAL	Linear, absolute EM gain calibration using built in precision light source. EM and Non-EM modes for the lowest noise and the best linearity.
BASE	Baseline Active Stability Engine - stable reference for quantitative measurements.
High speed CCD readout	>1000 fps with reduced ROI size, >10,000 fps in spectroscopy mode.
100 kHz/16-bit readout	Noise performance of a slow scan camera for precise photometry applications.
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 shutter	Conveniently capture dark reference frames and protect camera from dust when not in use.
Flexible lens mounts	C-mount (standard), Canon mount and adjustable C-to-Spectroscope mount - easily attaches to microscopes, standard lenses, telescopes or other optical instruments.
Gigabit Ethernet (GigE) interface	Industry standard for fast data transfer over long distances, up to 50m. Extenders available for even greater distance.
Optional: LightField® (for Windows 8/7, 64-bit) Or WinView/Spec (for Windows 8/7/XP, 32-bit)	Flexible software packages for data acquisition, display and analysis; LightField offers intuitive, cutting edge user interface, IntelliCal® and more.
PICAM (64-bit) / PVCAM (32-bit) software development kits (SDKs)	Compatible with Windows 8/7/XP, and Linux; Universal programming interfaces for easy custom programming.
LabVIEW™	Easy integration of camera into complex experiments.

ProEM-HS: 512 shown with lens, sold separately.

Applications:

Single molecule detection, spectroscopy, chemiluminescence, astronomy, adaptive optics, hyperspectral imaging, phosphor imaging and tomography

Princeton Instruments | 3660 Quakerbridge Rd | Trenton, NJ 08619 USA | +1 609-631-4000 | www.princetoninstruments.com | info@princetoninstruments.com

	ProEM-HS: 512BX3	
Sensor Format	Back-illuminated 512 x 512 eXcelon3 EMCCD, 16 x 16 µm pixels, 8.2 x 8.2 mm imaging area	
Shutter	25 mm shutter included	
	EM mode	Normal CCD mode
Read noise	25 e- rms @ 5 MHz 50 e- rms @ 10 MHz 120 e- rms @ 20 MHz Read noise effectively reduced to <1 e- rms with on-chip multiplication gain enabled	3 e- rms @ 100 kHz 4.9 e- rms @ 1 MHz
Non-Linearity	<2%	<1%
Analog gain	12, 6, 3 e-/ADU	3.2, 1.6, 0.8 e-/ADU
Full well EM mode only EM and Normal CCD modes	 800 ke- (output amplifier) 200 ke- (single pixel)	
Deepest cooling temperature* (@ +20° C ambient; 10 MHz ADC)	-70° C +/- 0.05° C (guaranteed) Maximum Cooling: -80° C (air), -85° C (+20° C liquid), -90° C (+10° C liquid)	
Dark current	0.001 e-/p/sec (typical), 0.02 e-/p/sec (maximum)	
Clock induced charge (CIC) *Measured at 1000x EM Gain*	0.002 e-/pixel/frame	
Electron multiplication (EM) gain	1 to 1000x, controlled in linear, absolute steps	
Digitization	16 bits @ 20 MHz, 10 MHz, 5 MHz, 1 MHz and 100 kHz	
Vertical shift rate	300 nsec/row - 5 µsec/row (variable)	
Operating systems supported	Windows 8/7 (64-bit) and Linux (64-bit), Windows 8/7/XP (32-bit)	
I/O signals	Exposure, Readout, Trigger In, Image Shift, Waiting for Trigger	
Operating environment	0 to 30° C ambient, 0 to 80% relative humidity, non-condensing	
Certification	CE	
Dimensions Weight	8.02 inches (20.37 cm) x 5.8 inches (14.73 cm) x 5.8 inches (14.73 cm) L x W x H Approximately 9.2 lbs (4.2 kg)	

* Due to increased thermal dissipation, a higher sensor temperature control point must be set at 20 MHz or in high speed readout modes speed readout modes

NOTE: All specifications are subject to change. Measured at -70° C, 10 MHz ADC setting unless specified.

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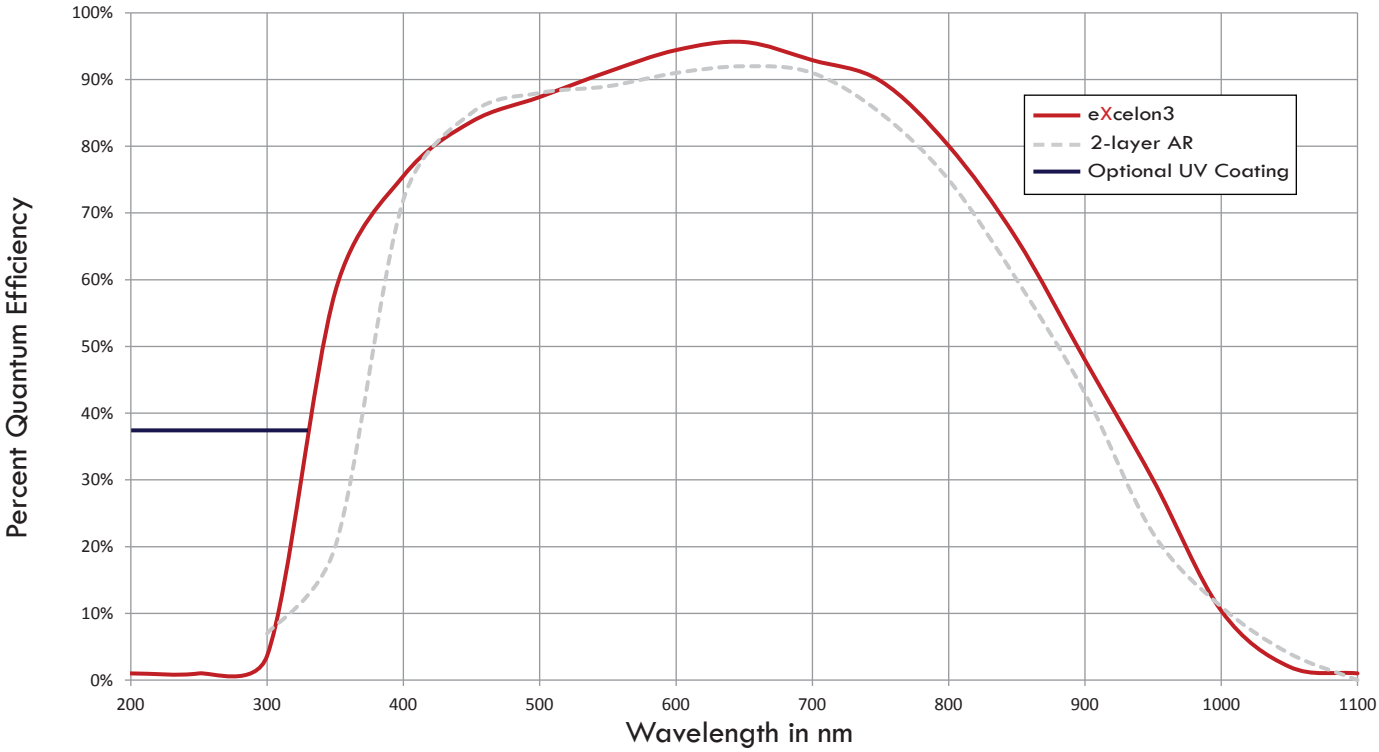
QUANTUM EFFICIENCY CURVE



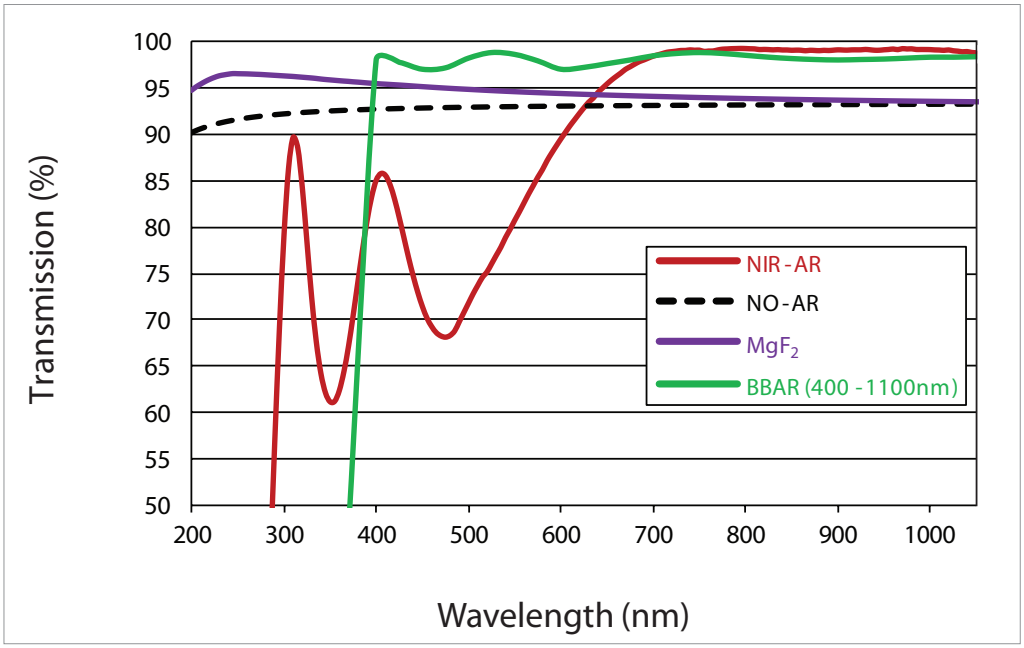
NOTE: Graph shows typical Quantum Efficiency (QE) data measured at + 25° C. Quantum Efficiency is a function of temperature and actual results will depend upon CCD temperature.

VACUUM WINDOW AR COATINGS

NOTES:

- Standard anti-reflection (AR) coating options shown on graph
- Designed by Acton Optics, our BBAR coating offers unmatched performance for 400 nm - 1100 nm
- Custom wedge window options and other AR coatings are also available

Contact your local sales engineer for more information



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Frame Rates (Standard Mode)

Binning	512 x 512	256 x 256	128 x 128	64 x 64	32 x 32
1 x 1	61	120	228	416	711
2 x 2	120	228	416	711	1099
4 x 4	228	416	711	1099	1506
8 x 8	416	711	1099	1506	1851

Frame Rates (High Speed CCD Readout Mode)

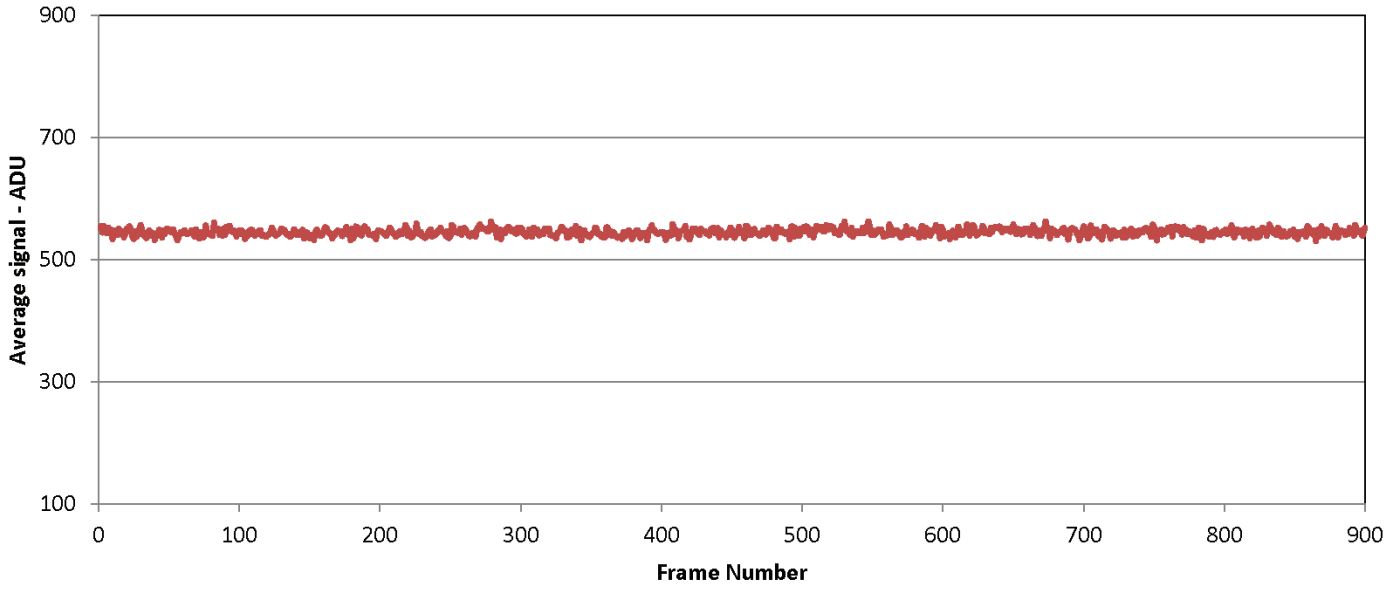
Binning	512 x 512	256 x 172	92 x 101	64 x 62	32 x 30
1 x 1	61	201.6	865	1529	3472
2 x 2	120	381	1557	2652	5617
4 x 4	228	682	2645	4132	7490
8 x 8	416	1131	3968	5899	9708

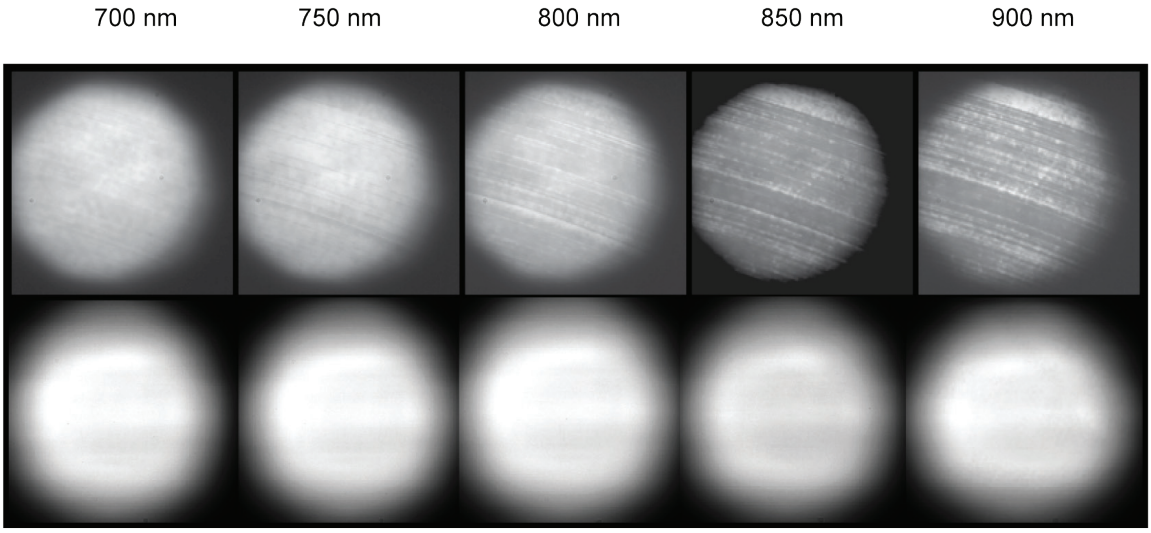
(High Speed Spectroscopy Readout Mode)

Binning	512 x 100	512 x 32	512 x 1
1 x 100	13850		
1 x 32		19305	
1 x 1			23529

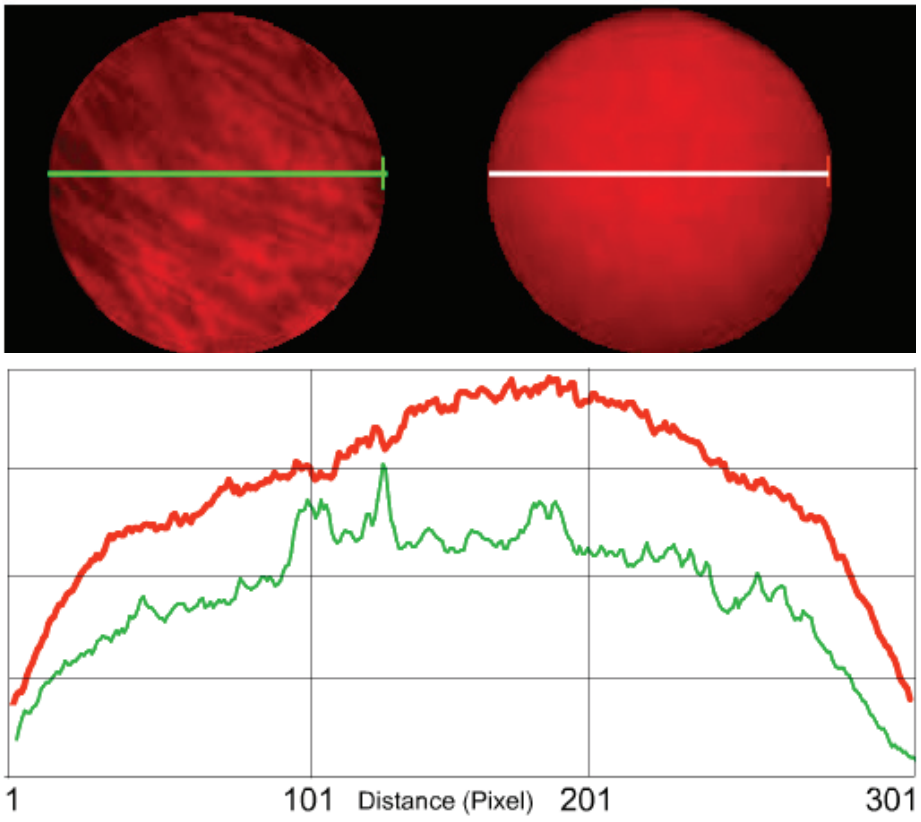
Frame rates are measured with 20 MHz ADC rate and 300 ns vertical shift rate

Baseline Stability at Maximum EM Gain, Measured at 20 MHz and 300 ns





Data taken with white light source through a monochromator comparing fringe supression of eXcelon vs. conventional back-illuminated EMCCDs.



Reduced etaloning: CCD PIXIS etaloning- Comparison of Standard Back-Illuminated CCD vs. eXcelon BI CCD

EMCCD etaloning: Comparison of Competition vs. eXcelon3 Back-Illuminated EMCCD

Image shows the reduction in etaloning provided by eXcelon3 back-illuminated EMCCDs (right) compared to less-sophisticated back-illuminated EMCCD designs (left).

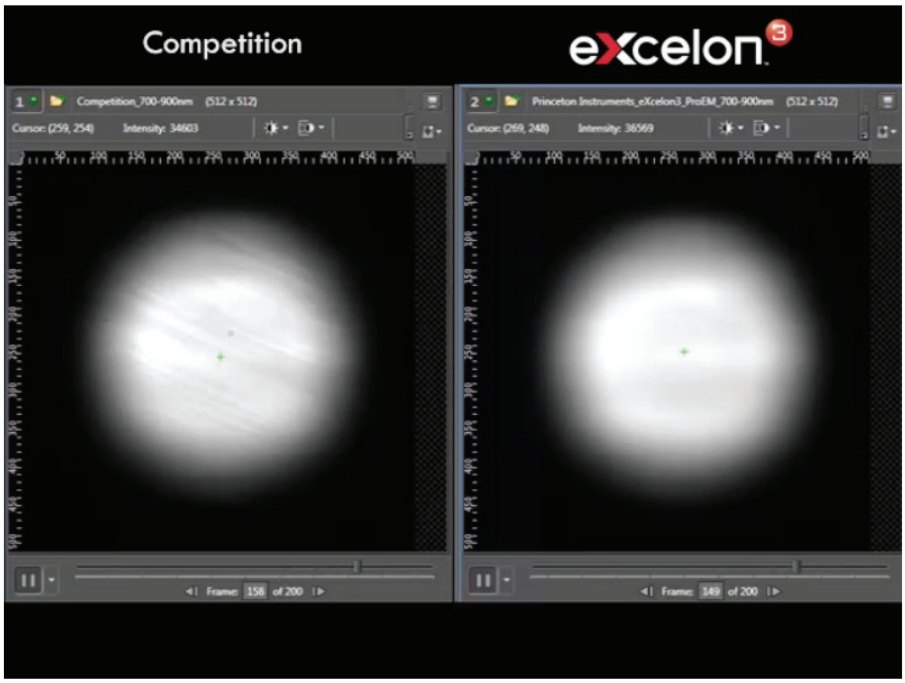
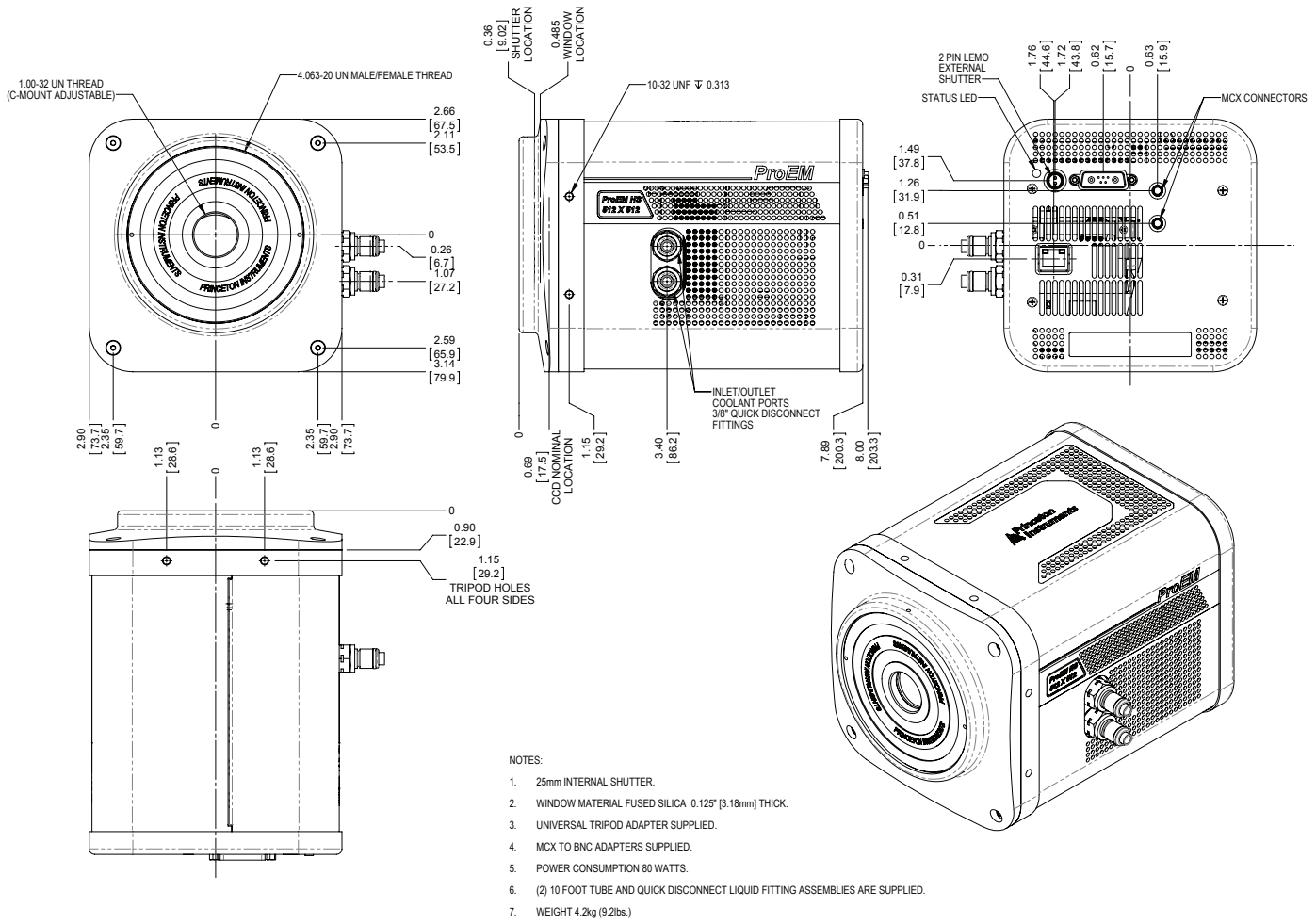


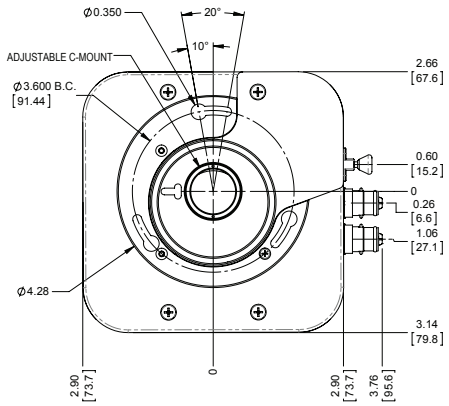
Image shows the reduction in etaloning provided by eXcelon3 back-illuminated EMCCDs (right) compared to less-sophisticated back-illuminated EMCCD designs (left).

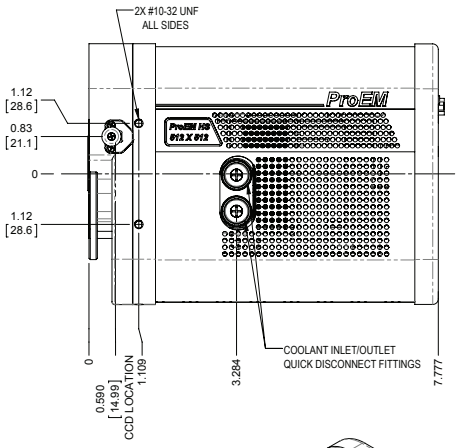


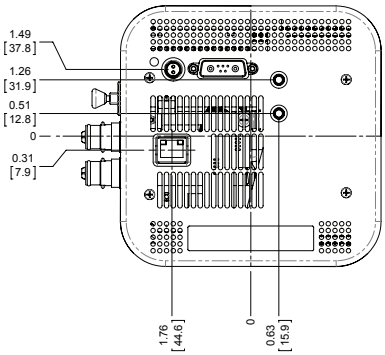
NOTES:

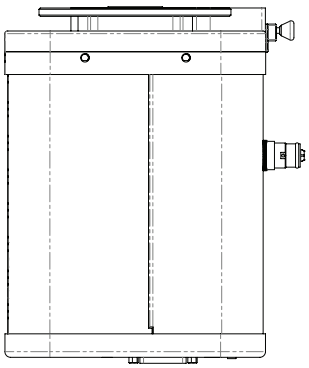
1. 25mm INTERNAL SHUTTER.
2. WINDOW MATERIAL FUSED SILICA 0.125" [3.18mm] THICK.
3. UNIVERSAL TRIPOD ADAPTER SUPPLIED.
4. MCX TO BNC ADAPTERS SUPPLIED.
5. POWER CONSUMPTION 80 WATTS.
6. (2) 10 FOOT TUBE AND QUICK DISCONNECT LIQUID FITTING ASSEMBLIES ARE SUPPLIED.
7. WEIGHT 4.2kg (9.2lbs.)

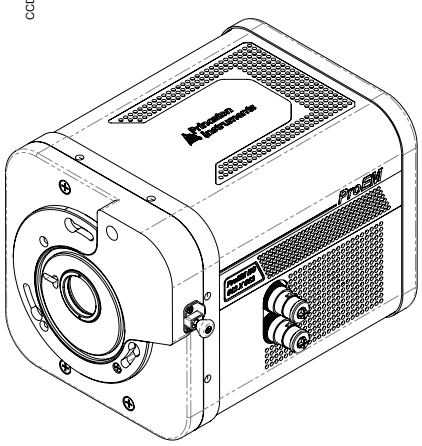
OUTLINE DRAWING FOR SPECTROSCOPY











NOTES:

1. INTERNAL MANUAL SHUTTER
2. WINDOW MATERIAL FUSED SILICA 0.125" [3.18MM] THICK
3. MCX TO BNC CABLE SUPPLIED
4. POWER CONSUMPTION 80 WATTS.