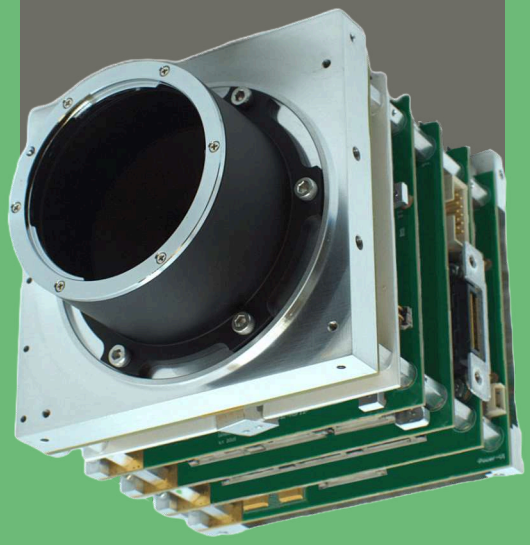
nüvü cameras

every photon counts

nüSpace

EMCCD BUILT FOR SPACE

BREAKING BARRIERS IN
LOW LIGHT
SPACE-BASED IMAGING



ULTIMATE SENSITIVITY AT HIGH FRAME RATES

CUSTOMIZABLE CAMERA PLATFORM FOR CUBESATS

nüSpace EMCCD

CHARACTERISTICS	SPECIFICATIONS
Size (H W D)[1]	96.0 x 96.0 x 95.5 mm Tailored to fit in 1U
Mass[1]	<1.1 kg
Power[2]	<15 W
Thermal Vacuum Cycling (TVAC) tests	-35°C to 60°C and <10^{-4} Torr NASA-STD-7000B
Random vibration testing	6.8 g RMS, 1 min/axis, 20-2000 Hz NASA-STD-7001B
Radiation tolerance	>25 kRad for >5 years in LEO Contact us for GEO specifications
Control & image interface	Camera Link
Imaging features	Binning Multiple ROI Photon Counting More available on request
Scanning modes	High Dynamic Range (HDR) mode Time Delay Integration (TDI) mode
Environmental operation temperature	-35 °C to 60 °C

OUTSTANDING PERFORMANCES THANKS TO NÜVÜ'S PROPRIETARY TECHNOLOGIES

The nüSpace platform is a state-of-the-art imaging solution built to bring Nüvü's signature electronics to nanosatellites, based on our design developed for NASA's flagship Roman Space Telescope.

With unmatched imaging sensitivity and flexibility with customizable detectors, integrated optics & interfaces, nüSpace camera platform supports novel space mission goals.

Potential space applications :

- Nighttime & daytime Earth observation
- Space surveillance (SSA)
- Extrasolar planet imaging
- Adaptive optics
- High resolution spectroscopy

nüSpace EMCCD

With EMCCD sensors, the nüSpace enables single photon level imaging in space, combined with innovative readout modes like TDI and our exclusive HDR mode (patent pending).

Benefit from Nüvü's extensive expertise focused on sensor control electronics for sensitive imaging applications both space and ground-based.

The nüSpace is available with multiple EMCCD sensors, contact us for more specifications.

nüSpace using Teledyne's CCD201-20 sensor

CHARACTERISTICS	SPECIFICATIONS
Operation frequencies[3]	10 MHz horizontal frequency 800 kHz vertical frequency
Imaging area	1024 x 1024 pixels 13 x 13 µm pixel area 13.3 mm x 13.3 mm effective area
Operating temperatures[4]	-135 °C to 60 °C
Frame rate	8.5 fps, faster with ROI
Readout noise[5]	<0.1 ē with EM gain
Linearity	>99%
Clock-induced charges[5]	0.0015 ē/pixel/frame
Dark current[5]	0.00007 ē/pixel/s @ -85°C
EM gain	1-5000
Spectral range	250-1100 nm
Data format	16 bits, FITS images available

With optics (customizable)

CHARACTERISTICS	SPECIFICATIONS
Swath	7.4 km
GSD	7.2 m
Focal length	900 mm
Aperture	80.5 mm

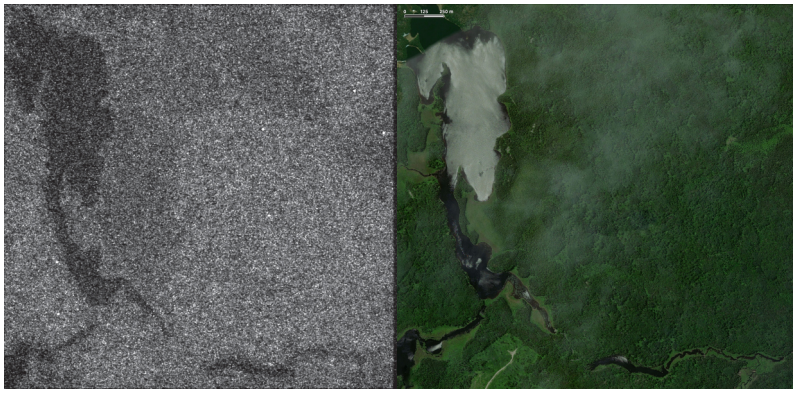


Figure 1

Left: Nighttime nüSpace EMCCD ground image in starlight conditions taken with f/11 optics using 1 fps standard snapshot imaging with EM gain;
Right: Comparative satellite daytime ground image.

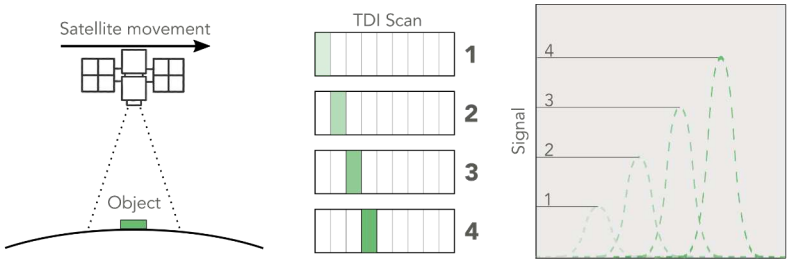


Figure 2

TDI readout scheme. TDI allows the capture of low-light-level images at very high satellite speeds. This mode overcomes limitations in illumination by shifting the image across the sensor during integration to track a moving target, thus achieving longer exposures & higher signal without blurring.

QUANTUM EFFICIENCY

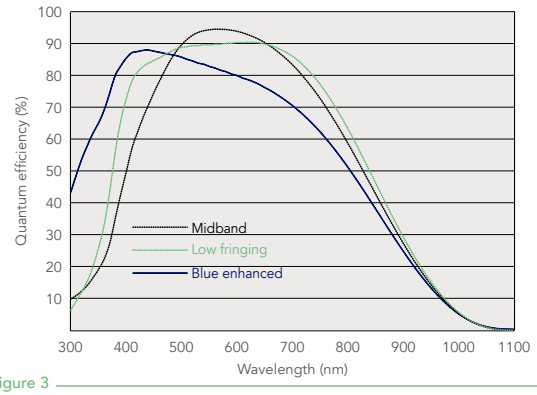
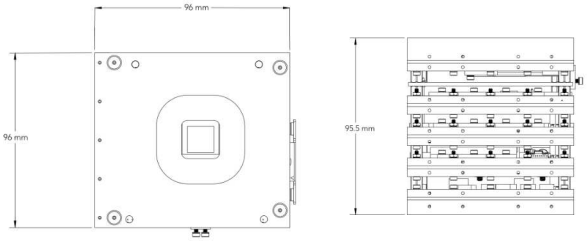


Figure 3

Typical spectral response as a function of wavelength, as specified by the EMCCD detector manufacturer[6]

TECHNICAL DRAWINGS[1]



1 With standard front & back plates. Mechanical interface plates can be removed and/or modified.
2 Mean power. Measured at 1 FPS.
3 More clock speeds available upon request.
4 As per the EMCCD detector manufacturer's data sheet. Other configurations may exist.
5 Typical values measured at horizontal frequency 10 MHz, vertical frequency 800 kHz and EM Gain 1000. These numbers may vary depending on the individual EMCCD detector.
6 Nüvü gives only the specifications of the EMCCD detector's manufacturer for grade 1 sensors (e.g. Quantum efficiency, aesthetic specifications, blemishes).

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nüSpace Specification Sheet 3.1.1