



# K2™ Direct Detection Camera

Model 1000.B K2 Base™ Model 1000.S K2 Summit™



K2 is a revolutionary Direct Detection camera for Electron Microscopy (EM) and is already making its impact in low dose cryo-EM (single particle and tomography).

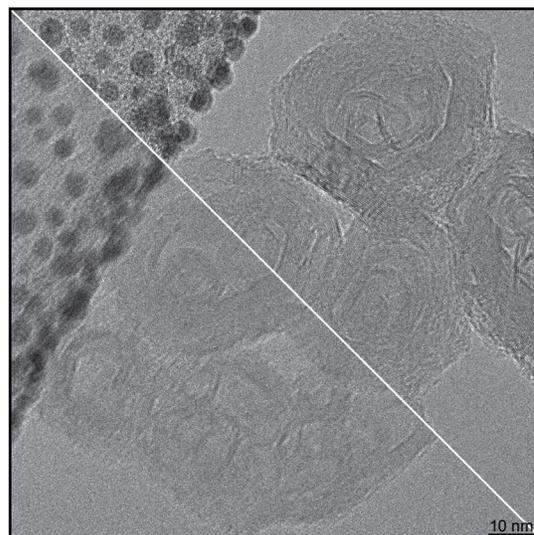
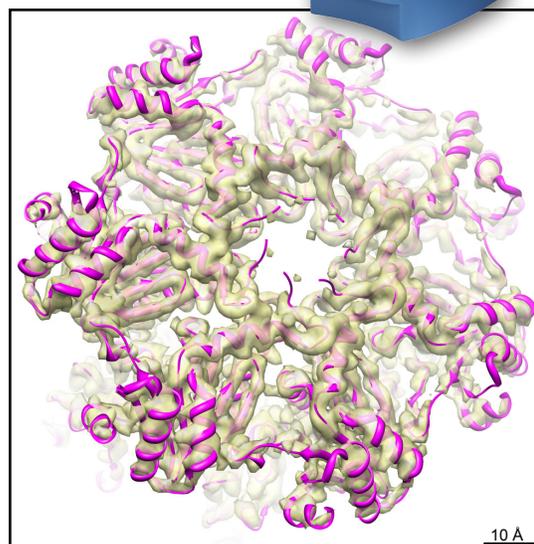
A traditional EM camera's resolution is limited by the scattering of the electrons and photons in the scintillator or fiber optics, or by the inherent limitations of lens coupling. Thus each electron event is delocalized from the point at which the electron entered the camera, into a cloud of light at the sensor. This Point Spread Function (PSF) grows at higher beam energies as the more energetic electrons penetrate more deeply and backscatter off the fiber optics. The image quality in a traditional camera is further limited by noise typically coming from statistical variation in the electron scattering and the energy deposition processes, read noise from the camera electronics, and from distortion and fixed patterns associated with the fiber optics or from softening due to use of lenses.

Direct Detection cameras receive the incoming electrons directly onto the sensor, and in the case of K2 can detect them in several modes. This direct detection eliminates the need for scintillators and fiber optics or lenses and greatly reduces the PSF. Furthermore, in Gatan's counting modes, noise can be essentially eliminated, particularly since with Gatan's transmission sensor, the number of scattered electrons re-entering the detector from below is minimized.

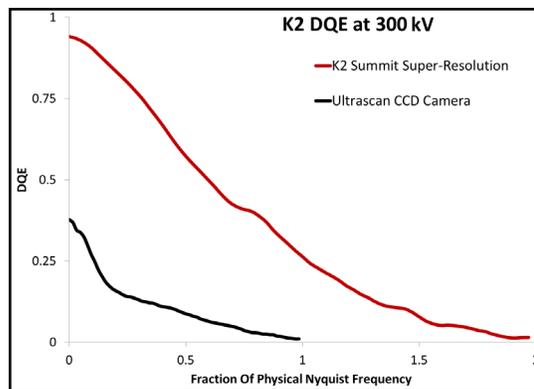
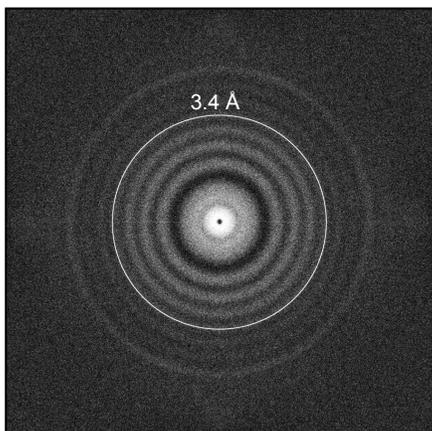
**K2: The One That Counts.** The K2 Summit 4k x 4k direct detection camera is unique in its ability to count individual electrons, as opposed to the traditional integration of their analog signal. Specifically designed for electron counting, the K2 Summit has unprecedented sensitivity and Detective Quantum Efficiency (DQE), the most important measures by which to judge a high resolution EM camera.

The K2 Summit's strong contrast at low spatial frequency allows the use of a smaller TEM defocus, ultimately contributing to higher resolution in the individual images and in the final 3D reconstruction.

The K2 Summit's Super-Resolution mode is able to pinpoint electron landing coordinates with sub-pixel accuracy and extends the effective resolution to 57 Megapixels, allowing a larger specimen area to be imaged at the same resolution, at lower magnification.



Features	Benefits
Super-Resolution	Pinpoints electron landing coordinates with sub-pixel accuracy and extends the effective resolution to 57 Megapixels, allowing a larger specimen area to be imaged at the same resolution, at lower magnification.
Electron counting	Unique capability to count individual image electrons, as opposed to the traditional integration of their analog signal.
Smaller TEM defocus	Strong contrast at low spatial frequency allows the use of a smaller TEM defocus, ultimately contributing to higher resolution in the individual images and in the final 3D reconstruction.
Unparalleled Detective Quantum Efficiency (DQE)	DQE is the best parameter for characterizing the real performance of an imaging system. K2's superior DQE results in the highest detectability of small, low-contrast objects.



Images front page: Top: Cryo-EM reconstruction of 20S proteasome at 4.4 Å resolution. Images were collected at 300 kV, 39kx nominal magnification (~1 Å per pixel) with a total dose of 25 e<sup>-</sup>/Å<sup>2</sup>. All data were collected using the Gatan K2 Summit™ Counting mode. Images and reconstructions provided courtesy of Dr. Yifan Cheng and Dr. Xueming Li of the University of California, San Francisco. Bottom: Images of graphitized carbon collected using the Gatan K2 Summit Counting mode using the dose fractionation acquisition method built into Gatan DigitalMicrograph®. Images were collected at 200 kV, 39kx nominal magnification (~1 Å per pixel). 14 frames were collected with a total exposure time of 7 seconds with a dose rate of 12 e<sup>-</sup>/pixel/s. Shown are the drift corrected image (top right) and the non-drift corrected image (lower left).

Images back page: Left: FFT of an image of a platinum iridium sample collected using the Gatan K2 Summit camera in Super-Resolution mode. The image was collected at 23kx nominal magnification (1.7 Å per physical pixel and 0.85 Å per effective pixel) and 20 e<sup>-</sup>/Å<sup>2</sup>. The total exposure time to collect this image was 3 seconds. The white circle indicates 3.4 Å resolution and indicates the information limit (Nyquist frequency) of the camera without Super-Resolution mode. The information in this K2 Summit Super-Resolution image extends to at least 2.3 Å resolution, well beyond the physical pixel information limit. Right: Detective quantum efficiency (DQE) of the Gatan K2 Summit camera in Super-Resolution mode was estimated from knife edge images collected at 300 kV. The DQE of the Gatan UltraScan® 4k x 4k CCD camera was measured using the same method.

**Specifications**

	K2 Base	K2 Summit
TEM operating voltage	200 – 400 kV	
Sensor active area	19.2 mm x 18.6 mm	
Sensor size in pixels	3840 x 3712	
Readout modes	Conventional	Conventional Counting Counting Super-Resolution
DQE performance (300 kV)	> 0.30 (peak) > 0.25 at 0.5 of physical Nyquist	> 0.85 (peak) > 0.50 at 0.5 of physical Nyquist > 0.06 at 1.25 of physical Nyquist
Physical pixel size	5 µm	
Binning	1 – 8x	
Sensor read-out	Any arbitrary area	
Magnification relative to film	1.3x – 1.5x	
Sensor read-out	50 full fps	400 full fps
Transfer speed to computer	10 full fps	40 full fps
Image display	10 full fps	
Software	Gatan Microscopy Suite including DigitalMicrograph	

**Ordering information**

Model	Configuration	Description
1000.B	K2 Base	K2 Base System
1000.S	K2 Summit	K2 Summit System
1000.U	Upgrade path	Upgrade from K2 Base to K2 Summit
1000.R	Replacement Sensor	K2 Replacement Sensor

Please consult with your sales representative for details.

**Primary Applications:**

- Low-dose cryo-EM
- Cryo-tomography
- Other configurations available for:
- High speed *in situ* TEM

Scan the K2 QR Code with your smartphone for complete product information.



Note: Specifications are typical and subject to change.

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