Model ST-9XE
CCD Imaging Camera

SBIG

ASTRONOMICAL
INSTRUMENTS

Model ST-9XE Dual CCD Self-Guiding Camera

ST-9XE CCD IMAGING CAMERA

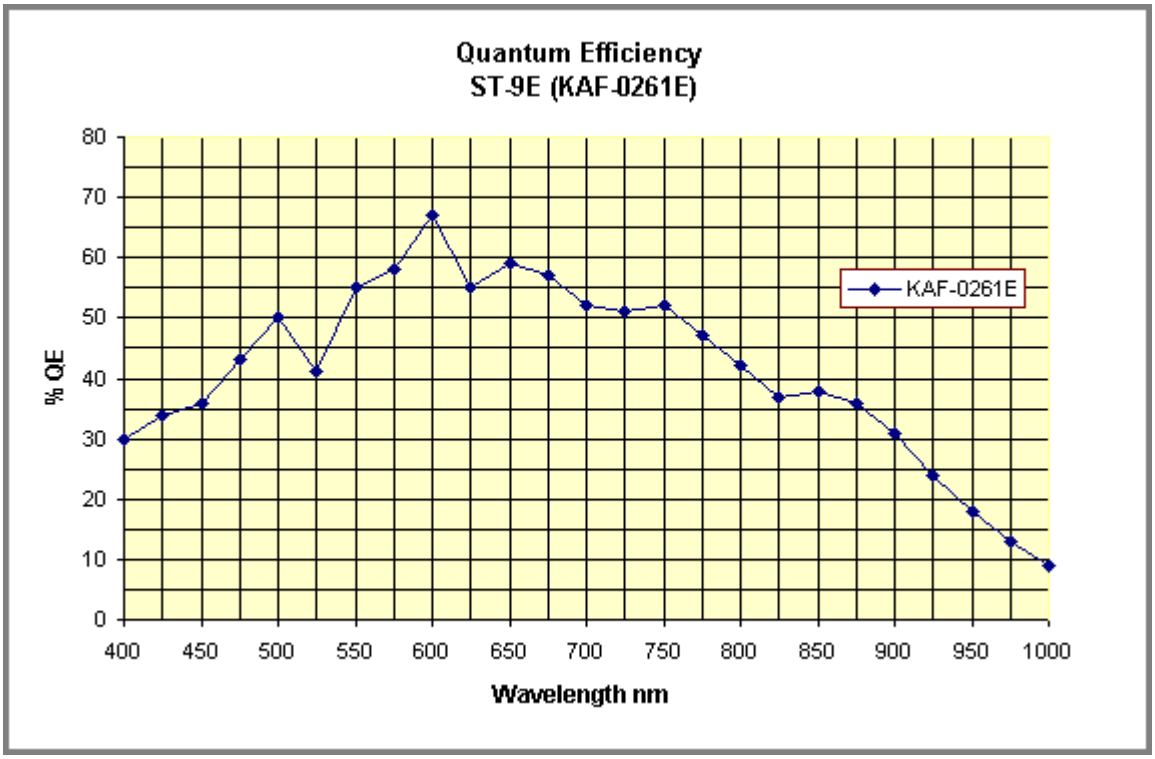
The ST-9XE is identical to the ST-7/8/10/2000 cameras with the exception of the imaging CCD. The ST-9XE utilizes the same patented dual sensor head design integrating one CCD for self-guiding and another CCD for imaging. In the case of the ST-9XE the imaging sensor is the Enhanced KAF-0261E detector from Kodak with 512 x 512 pixels at 20 microns square (Due to its large pixel size, this CCD is not available in a microlens version). The ST-9XE Imaging Camera is ideal for use on long focal length scopes where a larger field of view than an ST-7XE is desired, but one's budget does not allow for an ST-8XE camera. Large scopes, even those with relatively fast f/ratios, have focal lengths that "waste" sensitivity of cameras using detectors with small pixels. Longer focal lengths also mean smaller fields of view given a fixed detector size. Take, for example, a C-14 at f/7, 16" SCT at f/6.3 and a 20" f/5. In all of these cases the telescopes have focal lengths of about 98 to 100 inches. When used at 100 inches of focal length, the 9 micron pixels of the ST-7XME and ST-8XME cameras subtend about 0.7 arcseconds - a bit small for this focal length under average seeing conditions. So these cameras are often operated binned 2x2 at focal lengths of 100 inches or more unless the optics and seeing are rather exceptional.

M13. ST-9E prototype First Light: a single 120 second cropped image taken through a 10" f/6.3 SCT (1/4 size). Michael Barber / SBIG

M33. ST-9E production First Light: a single 360 second image taken through a 12" SCT at f/6.3. Courtesy Gary Hug

For the ST-8XE this is no problem because the detector has 1.5 million pixels and binning 2x2 still leaves the user with a reasonable 765 x 510 pixels @ 18 microns. But binning the ST-7XE 2x2 yields an image that is 382 x 255 so the image size on the monitor begins to get small for this size camera. However, the ST-9XE's 20 micron pixels subtend about 1.6 arcseconds per pixel at 100 inches focal length without binning. Just

about perfect for optimum sensitivity under typical seeing conditions. This gives the long focal length user the advantage of larger more sensitive pixels and a reasonably large image of 512 x 512 at a substantial savings compared to an ST-8XE. Moreover, the FOV of the ST-9XE is nearly as large as an ST-8XE.



Sensitivity:

With its relatively large (20 micron) pixels, the ST-9XE is approximately 20 times as sensitive as an ABG version of the ST-7XE (binned 1x1) with a field of view approximately 3.3x as large as the ST-7XE. This compares very favorably with an ST-8XE NABG operating in 2x2 binned mode at about half the cost of the ST-8XE. So for long focal lengths where one cannot take advantage of the smaller pixels of the ST-7XE or ST-8XE, the ST-9XE is an excellent choice

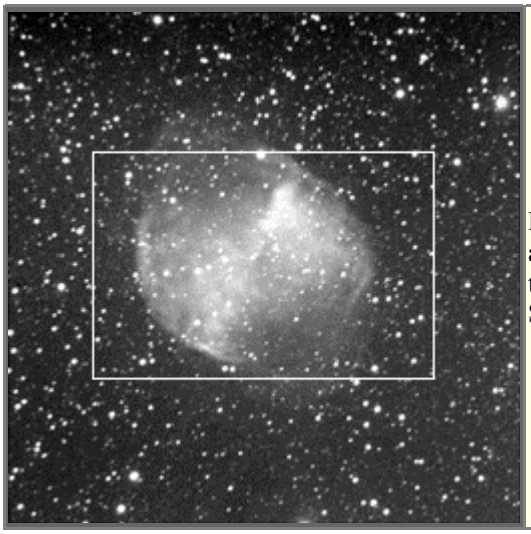
M27. LRGB color image for reference only by Robert Dalby

Relative Intensities Recorded in image	ST-8 ABG	ST-8E ABG	ST-9E NABG
(A) Background	1	1.3	14.2
(B) Star peak (color unknown)	1	2.0	13.7
(C), (D) H-a regions	1	2.2	18.4
(E) OIII bright (~50% above background)	1	2.1	25.0
(F) OIII faint (>10% above background)	1	1.5	20.0

Field of View:

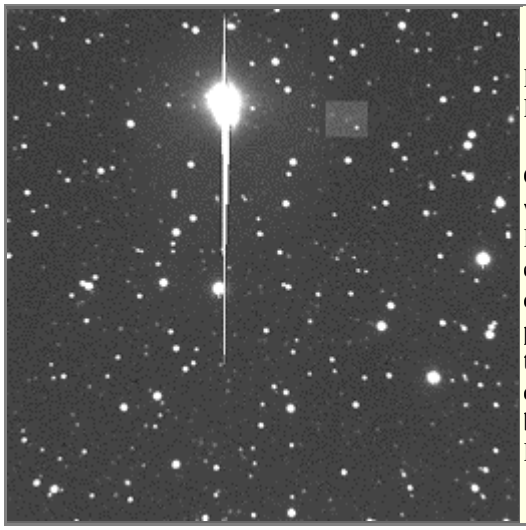
The image and diagram below demonstrates the larger field of view one obtains with the ST-9XE detector compared to the ST-7XE. Note this has nothing to do with the number of pixels on the detector or how the image is displayed on your computer monitor. Rather, it is strictly based on the overall size of the detector.

The ST-9XE is an excellent choice for minor planet and supernova searches when one's budget does not allow for a very large CCD camera such as the KAF-1001E based ST-1001E camera. Moreover, the ST-9XE is capable of self-guiding with a built-in TC237 tracking CCD. It is therefore capable of hour long self-guided exposures for deep space imaging. The ST-9XE accepts all of the same accessories as the ST-7XE and ST-8XE cameras including the integrated CFW8A color filter wheel for color imaging or UBVRI photometric measurements, AO-7 adaptive optics device, CLA7 camera lens adapter, etc.



Full frame is the field of view of the ST-9E at 110 inches focal length. The area inside the white box is the field of view of the ST-7 at the same focal length.

One month after taking delivery of one of our first production ST-9E cameras, two amateurs, Gary Hug and Graham Bell, discovered a ~19th magnitude comet: **Comet P/1999 X1 Hug-Bell**. With a single exception we are informed that this is the faintest comet ever discovered by an amateur astronomer. Gary and Graham were using a 12" SCT at f/6.3. The discovery was made while blinking 6 minute exposures taken in search of an asteroid. Subsequent 10 minute and 20 minute exposures revealed the comet's tail.



Discovery image (reduced) with comet P/1999 X1 Hug-Bell in the highlighted box.

Gary Hug writes: "The comet (P/1999 X1 Hug-Bell) was discovered Dec 10th and has been published in the IAU Circular #7331. Orbital information shows this comet to orbit between Mars and just outside Jupiter's orbit although some distance above the giant planet's path. It's currently about magnitude 18.5, located near the beehive cluster, and was magnitude 18.8 at discovery. The comet will maintain a near even brightness for the next few weeks then gradually fade. It's period is 7.01 yrs.

ST-9XE Typical Specifications

CCD Specifications	
CCD	Kodak KAF-0261E + TC-237
Pixel Array	512 x 512 pixels, 10.2 mm x 10.2 mm
Total Pixels	262,000
Pixel Size	20 x 20 microns
Full Well Capacity (NABG)	~150,000 e-
Dark Current	10e^{-}/pixel/sec at 0° C
Antiblooming	Non-ABG only

Readout Specifications	
Shutter	Electromechanical
Exposure	0.11 to 3600 sec., 10ms resolution
Correlated Double Sampling	Yes
A/D Converter	16 bits
A/D Gain	1.6e-/ADU
Read Noise	15e- RMS
Binning Modes	1 x 1, 2 x 2, 3 x 3
Pixel Digitization Rate	Up to 420,000 pxels per second
Full Frame Acquisition	~ 1 seconds

Optical Specifications (8" f/10)	
Field of View	17.3 x 17.3 arcminutes
Pixel FOV	2 x 2 arcseconds
Limiting Magnitude	Magnitude 14 in 1 second
(for 3 arcsec FWHM stars)	Magnitude 18 in 1 minute

System Specifications	
Cooling - standard	Single Stage Thermoelectric, Active Fan, Water Assist Ready -45 C from Ambient Typical
Temperature Regulation	±0.1°C
Power	5 VDC at 1.5 amps, ±12 VDC at 0.5 amp desktop power supply included
Computer Interface	USB
Computer Compatibility	Win 98/NT/2000/Me/XP/Mac OS-X
Guiding	Dual CCD Self-Guiding

Physical Dimensions	
Optical Head	5 inches dia. x 3 inches, 12.5 cm dia. x 7.5 cm deep, 2 pounds/0.9 Kg
CPU	All electronics integrated into Optical Head, No CPU
Mounting	T-Thread, 1.25" and 2" nosepieces included
Backfocus	0.92 inches/2.3 cm

Prices ans specifications are subject to change without notice