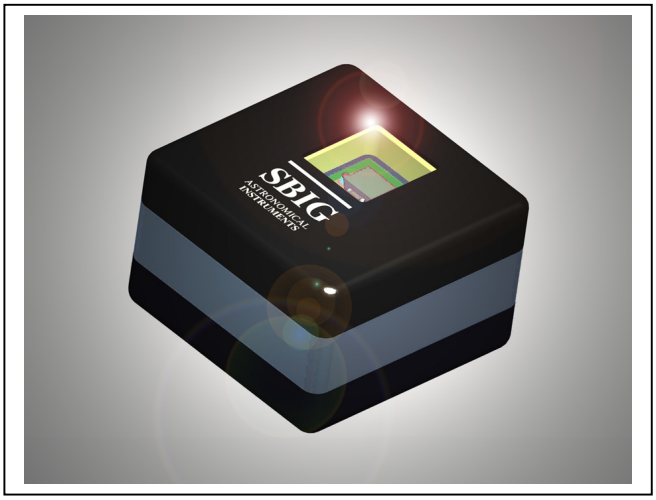
New STX Series Cameras

The new STX Series Cameras from SBIG leave nothing to be desired: Greater cooling, faster download rates, better guiding, new imaging CCDs, larger tracking CCD, dual interface and more:

- USB 2.0 and Ethernet Connections
- 12VDC Operation
- Full Frame Image Buffer
- Air Cooling to –50C from ambient
- Water Cooling Ready
- Internal and External Self-Guiding
- Simultaneous Dual CCD Guiding
- Differential Guiding (patent pending)
- Continuous Guiding During Download
- Adaptive Optics Control
- Even-illumination Mechanical Shutter
- Gas Purge Option CCD Chamber
- 40% Larger Tracking CCD
- Focus Mechanism for Tracking CCD



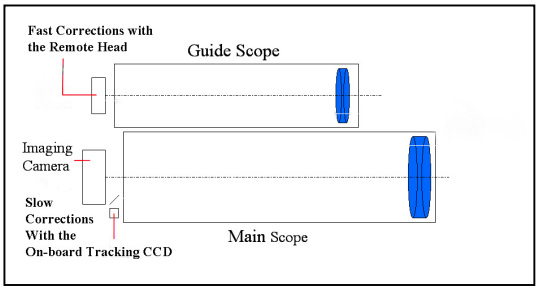
NEW CCDs	Pixels	Array	Pixel	Mono / Color	Notes
KAF-8300	8.3 Megapixels	3326 x 2504	5.4u	Mono or color	Full Frame Microlens ABG
KAI-10100	10.1 Megapixels	3648 x 2760	4.75u	Color	2x2 Color Binning
KAI-16000	16 Megapixels	4872 x 3248	7.4u	Mono or color	35mm format
KAF-9000	9 Megapixels	3056 x 3056	12u	Mono	Full Frame Microlens ABG
KAF-16803	16 Megapixels	4096 x 4096	9u	Mono	Full Frame Microlens ABG
CCD42-40	4 Megapixels	2048 x 2048	13.5u	Mono	Back illuminated High QE
CCD47-10	1 Megapixels	1056 x 1027	13u	Mono	Back illuminated High QE
CCD42-00	262,144 Pixels	512 x 512	24u	Mono	Back illuminated High QE

Internal and external guiders can be operated simultaneously for both fast and slow corrections to handle differential deflection. Guiding will continue during downloads and autograb sequences. The new 10100 color CCD can be binned 2x2 without losing color information, giving the camera 2.5 megapixels at 9.5 microns, or 10.1 megapixels at 4.75 microns. More new STX features, details inside.

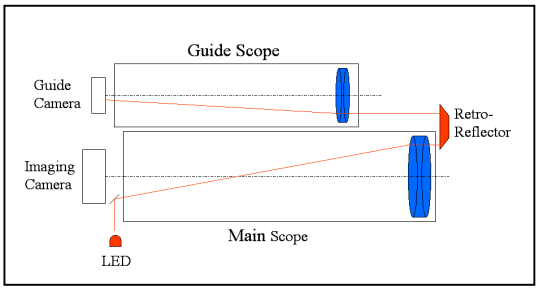
Santa Barbara Instrument Group 147-A Castilian Drive, Santa Barbara, CA 93117 USA
Tel (805) 571-7244 Fax (805) 571-1147 E-mail: sbig@sbig.com Web: http://www.sbig.com

New Guiding Techniques for the STX

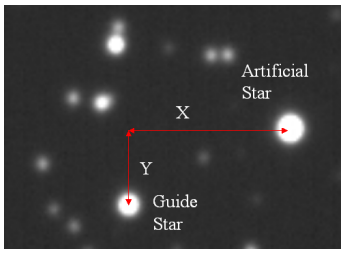
It is well known that the advantage of easier guiding through a separate guide scopes is often limited by differential deflection of the guide scope relative to the main optical axis due to mechanical flexure or shifting of the mirror in the main OTA. This difficulty is addressed with two new guiding techniques developed by SBIG and implemented in the STX series cameras: *Simultaneous Guiding* and *Differential Guiding*.



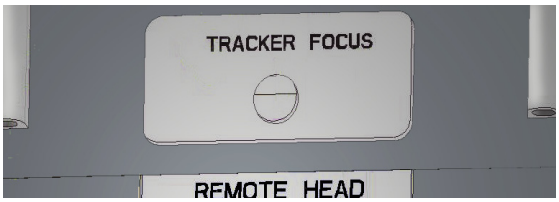
Simultaneous Guiding: The external guide head will not only continue to guide while the imaging CCD is downloading an image, but it can be operated simultaneously with the on-board guiding CCD. This allows a unique type of guiding through a separate guide scope that will correct for differential deflection by using the external guider to make fast corrections while the on-board guider makes slow corrections. Differential deflection tends to occur over a longer period of time than drive errors, typically minutes vs. seconds. A long exposure taken with the built-in guider is capable of reaching dim stars without searching, even though dark filters, and a long exposure with slow corrections by the on-board guider will correct for slow differential deflection typically experienced with separate guide scopes. In the mean time, the external guider will continue to make fast corrections using the brighter stars easily found with a short refractor mounted externally. With the new STX series cameras this technique will only require a Remote Guide Head.

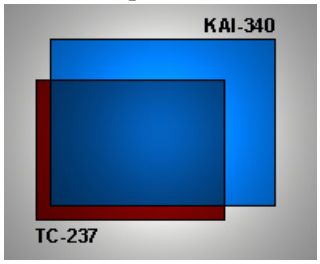


Differential Guiding: SBIG has a patent pending on a new guiding technique using an artificial guide star. Although artificial stars are used in a variety of techniques on professional telescopes, the SBIG technique is somewhat different and easy to implement on amateur scopes. An artificial star is created near the focal plane of the imaging CCD and an image of this star is retro-reflected into a separate guide scope. By using one real star in the FOV of the guide scope and the artificial star image reflected from the main scope, the difference in separation caused by telescope drift is used to make the corrections to the telescope drive. There is no problem with differential deflection and a single CCD external guider can be used to monitor both the real and artificial guide stars. The artificial star image is not seen by the imaging CCD.



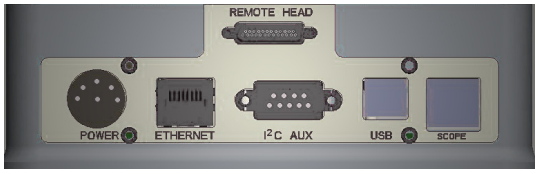
Larger Guiding CCD with Adjustable Focus: The guiding CCD in the STX cameras will be a new KAI-340 CCD with 640 x 480 pixels at 9u. This CCD is approximately 40% larger than the TC-237 currently used in ST and STL series cameras. The KAI-340 CCD will also be used in a new Remote Guide Head made for the STX series cameras. As the imaging and guiding CCDs get larger, the guiding CCD gets pushed farther away from the center of the optical axis. Depending on the nature of the optical system, this can cause the image on the guiding CCD to be slightly out of focus when the image on the main CCD is in focus. To address this, the new STX cameras will have a user accessible adjustment for changing the focal point of the on-board guiding CCD.



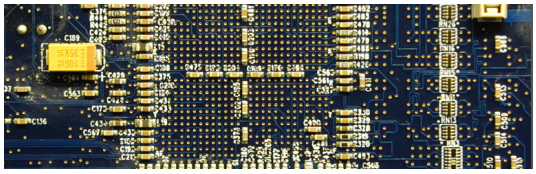


Design Features for the STX

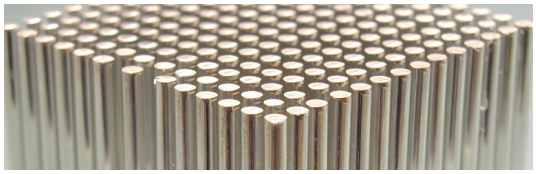
USB 2.0 and Ethernet: Both USB 2.0 ***and*** Ethernet will be available on each STX camera. The user will not have to choose the interface at the time of purchase. The STX cameras will have the same convenient I2C AUX port that we use on the ST and STL cameras for power and control of accessories such as filter wheels and Adaptive Optics, and will operate from any unregulated 12VDC source.



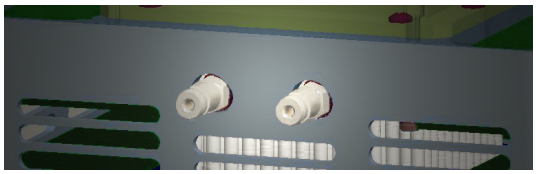
Full Frame Image Buffer: The STX series cameras will have a full frame image buffer for storing image date during download. We are exploring the possibility of using this buffer for pre-processing pixel defects based on a defect map provided by the CCD manufacturer, at the user's direction.



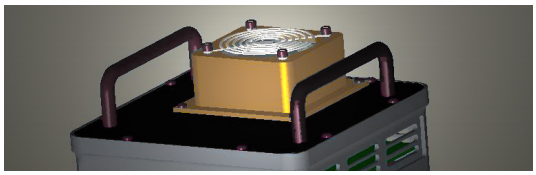
Improved Cooling: Our engineers have modeled an optimum cooling design for this camera using a large custom pin grid array heat sink mated directly to the hot side of the 2 stage TE cooler to achieve maximum heat dissipation with a single large fan. The STX is designed to achieve a minimum delta of -50 degrees C with air only, and a similar delta with water only.



Water Circulation Ready: While the design is aimed at sufficient cooling without water assist, it is possible to use water instead of air or in addition to air for optimum cooling. Using water instead of air will not require the use of a fan. Chilled water may also be used alone or with the fan for even greater cooling.



Variable Speed Fan Control: If the user desires air cooling only, the fan speed is controllable through software. Variable speed control allows the user to "tune" to fan to eliminate any resonance with the user's telescope thus suppressing harmonic vibrations.



Desiccant + Gas Purge Ports: In order to allow the user the greatest flexibility in the field, and to avoid having to return the camera to the factory in order to purge the CCD chamber with inert gas, we have designed the chamber to accept both a rechargeable desiccant plug similar to our current ST and STL cameras, and an optional quick disconnect gas purge port for purging the chamber with Argon or other inert gas .

Even-illumination Shutter: From the first ST-7 camera, SBIG has incorporated an even illumination shutter for taking short exposure flat field frames on all self-guiding cameras. However, the rotating disk design becomes rather large with ever increasing CCD sizes. Therefore, a new shutter design will be introduced with the STX series that reduces the overall size and weight of the camera body, while maintaining even illumination on short exposures with large CCDs.