Custom CCD and Controller Developments From STA

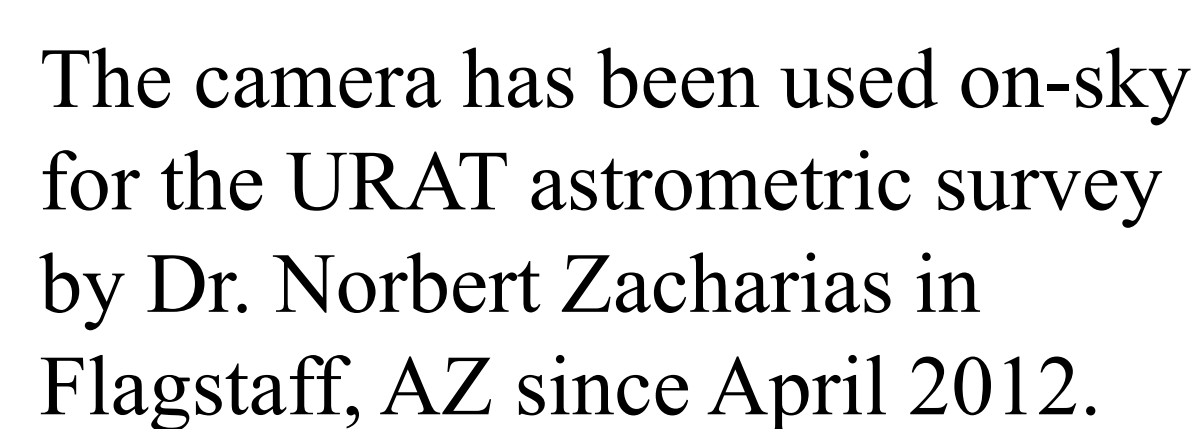Greg Bredthauer, STA
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Introduction

Semiconductor Technology Associates, Inc. has specialized in the design and manufacture of custom CCDs, controllers, and imaging systems for scientific, aerospace and commercial applications since 2000.

As a small company with decades of CCD design experience, we are uniquely positioned to deliver imagers specifically tailored to the low volume applications of each customer.
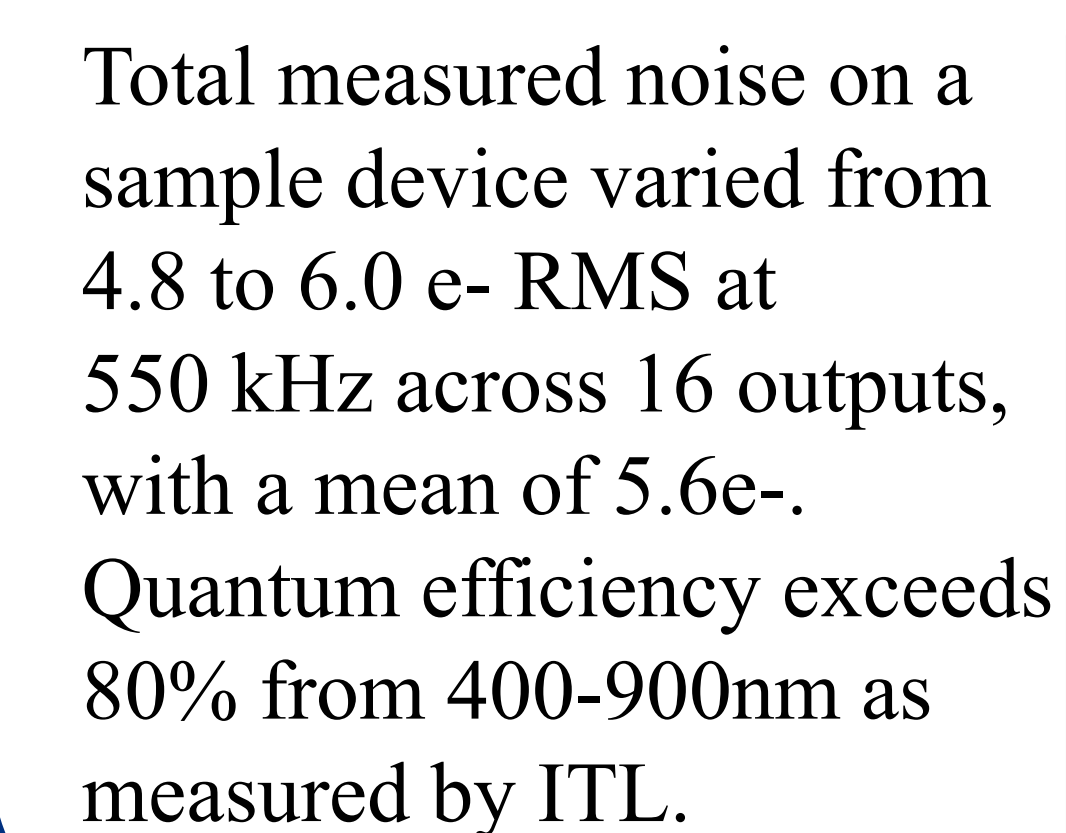
Our CCD designs are fabricated on 150mm wafers at the Teledyne DALSA foundry in Bromont, CA.

A selection of recent custom CCDs is presented.

STA1600

The STA1600 is an ultra-high resolution 10560x10560 CCD with 9um pixels and 16 outputs developed for the US Naval Observatories for astrometry. STA delivered a camera using a 2x2 array of STA1600 CCDs plus guiders and controllers to the USNO Robotic Astrometric Telescope (URAT) in August 2011.

The camera has been used on-sky for the URAT astrometric survey by Dr. Norbert Zacharias in Flagstaff, AZ since April 2012.

STA3800

STA has delivered multiple lots of the 4k x 4k deep-depletion STA3800 with 10um pixels and 16 outputs to Mike Lesser at the University of Arizona Imaging Technology Lab (ITL). These devices are thinned and packaged by ITL for delivery to LSST, the Large Synoptic Survey Telescope.

Total measured noise on a sample device varied from 4.8 to 6.0 e- RMS at 550 kHz across 16 outputs, with a mean of 5.6e-. Quantum efficiency exceeds 80% from 400-900nm as measured by ITL.

STA3900

STA recently delivered Geostationary Lightning Mapper (GLM) flight devices to Lockheed Martin for integration into a GOES-R satellite. The CCDs capture earth images for lightning strike monitoring at 500 frames per second through 56 outputs. Compensation for the curvature of the earth is achieved through a unique variable pixel pitch, with 30x30um pixels at the center shrinking to 20x24um pixels at the detector edge. The active image area is 1300x1372. The instrument is intended to improve severe weather forecasting.
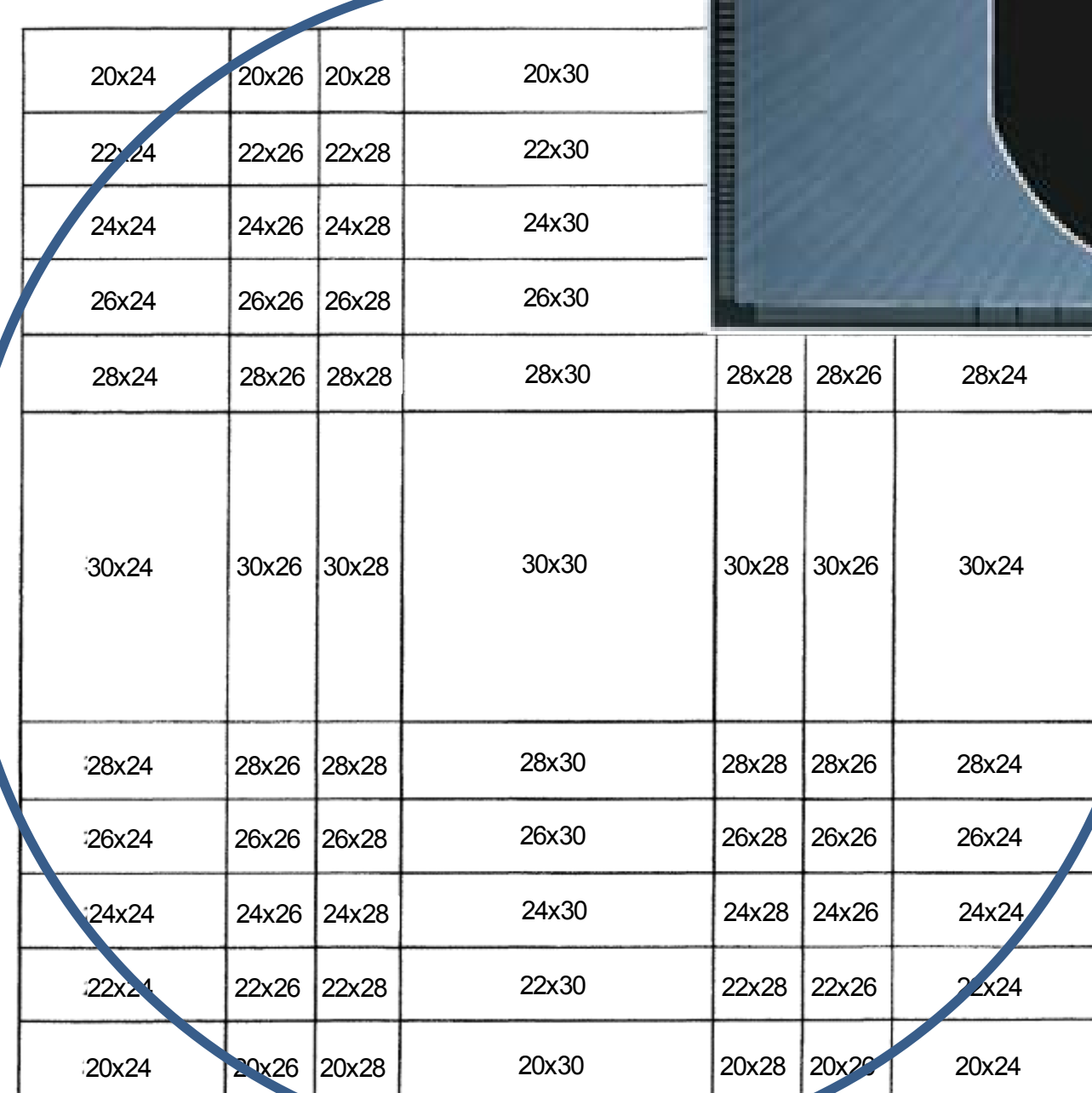
Archon Controller

- Up to 16 AC-coupled fully differential channels of 16-bit 100 MHz ADCs, with digital CDS and simultaneous raw waveform capture.
- 14-bit 100 MHz clock drivers, with arbitrary multi-level clocking and programmable slew rates.
- Flexible, highly parallel timing generation with 10 ns resolution using a nested, parameterized text-based state machine language.
- 16-bit bias DACs, with voltage/current monitoring and programmable power up/down sequencing.
- Standard gigabit Ethernet TCP/IP interface, either copper or fiber optic.
- Simple text-based configuration files and network commands for easy integration into scripted work flows.
- Dynamic range of **108 dB at 100 kHz**, **98 dB at 1 MHz**, 16 or 32 bits per pixel.

System Performance

An uncorrected image from an STA1600LN at 100 kHz near full well (binning 2x2, with vertical and horizontal overscan) is shown in the GUI screenshot to the right. The CCD temperature was -120°C.

The dynamic range in this image is **101.6 dB**.
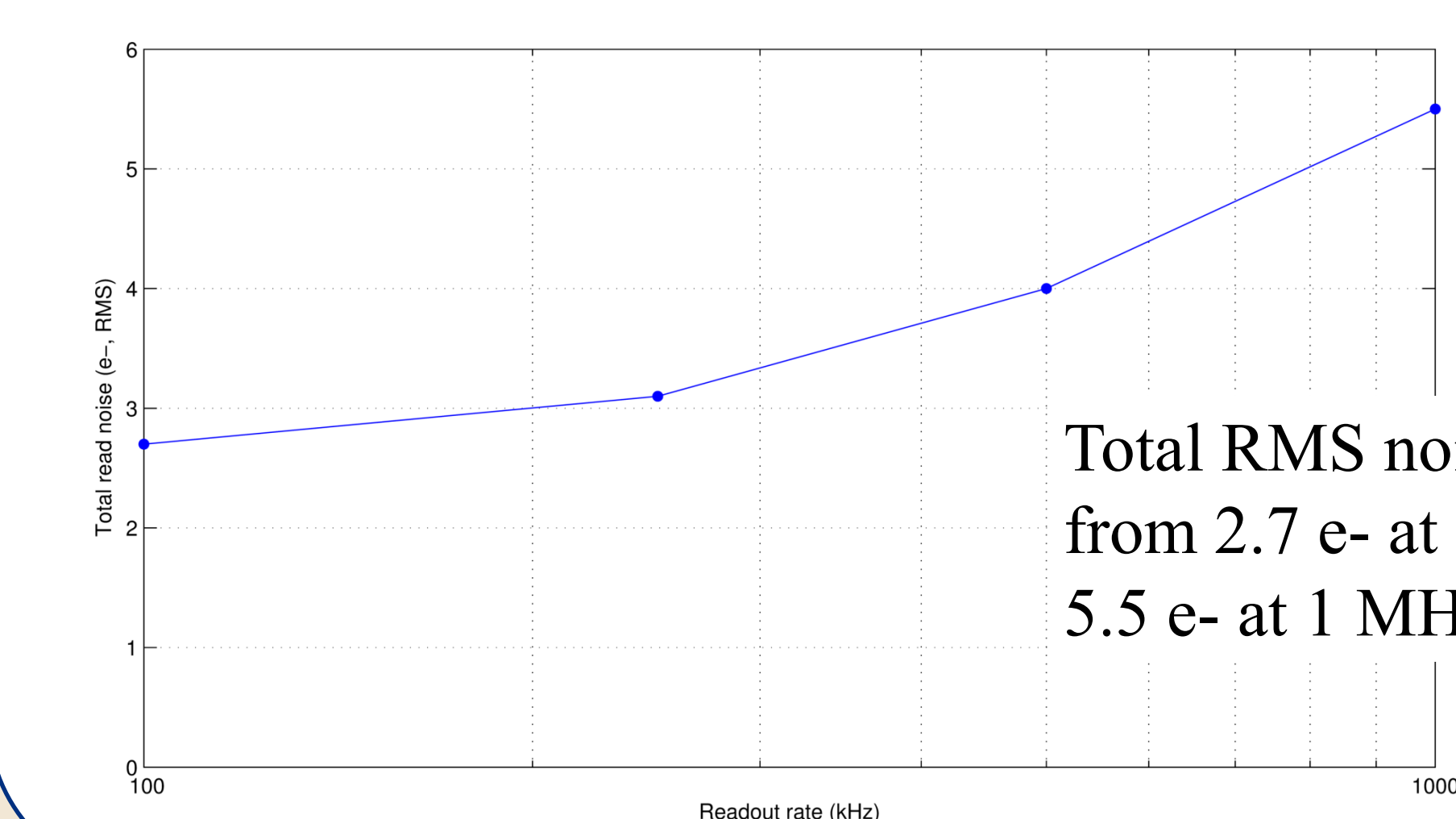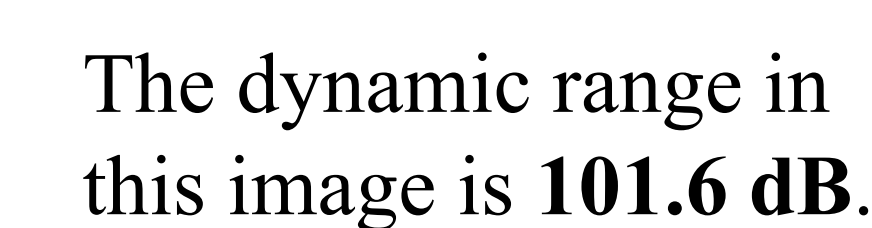
Total RMS noise varied from 2.7 e- at 100 kHz to 5.5 e- at 1 MHz.