Final report: E2V 231-42 2k CCD Camera for UNAM

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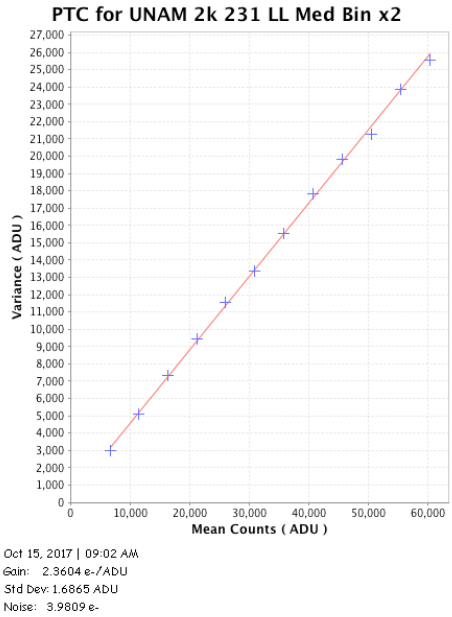
This CCD has an imaging area of 2048 cols x 2064 rows pixels, each 15 microns square. The camera can be read out in single readout mode from any one of the four quadrants, or in quad readout mode from all quadrants simultaneously. Additionally three readout speeds may be chose, slow, medium and fast, with medium being the default. The following data was all obtained in quad readout mode, that is, with readouts operating simultaneously:

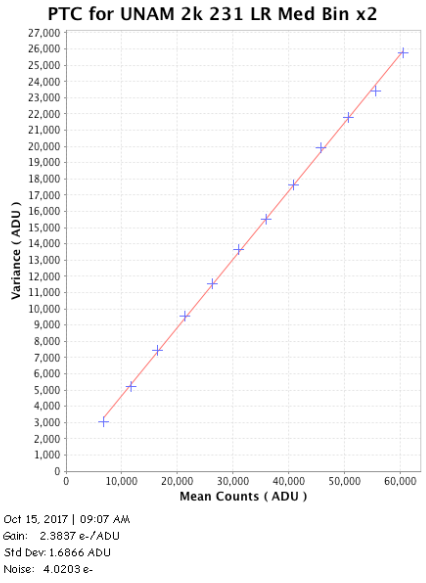
		Noise	Gain	Full Well	Readout time
Lower Left	Slow	3.59	1.72		9.3 sec
channel #0	Medium	3.98	2.36		5.9 sec
	Fast	7.80	2.83		2.0 sec
Lower Right	Slow	3.63	1.73		
channel #1	Medium	4.02	2.38		
	Fast	7/07	2.76		
Upper Left	Slow	3.50	1.70		
channel #2	Medium	3.98	2.31		
	Fast	7.05	2.74		
Upper Right	Slow	3.49	1.69		
channel #	Medium	3.95	2.29		

Fast



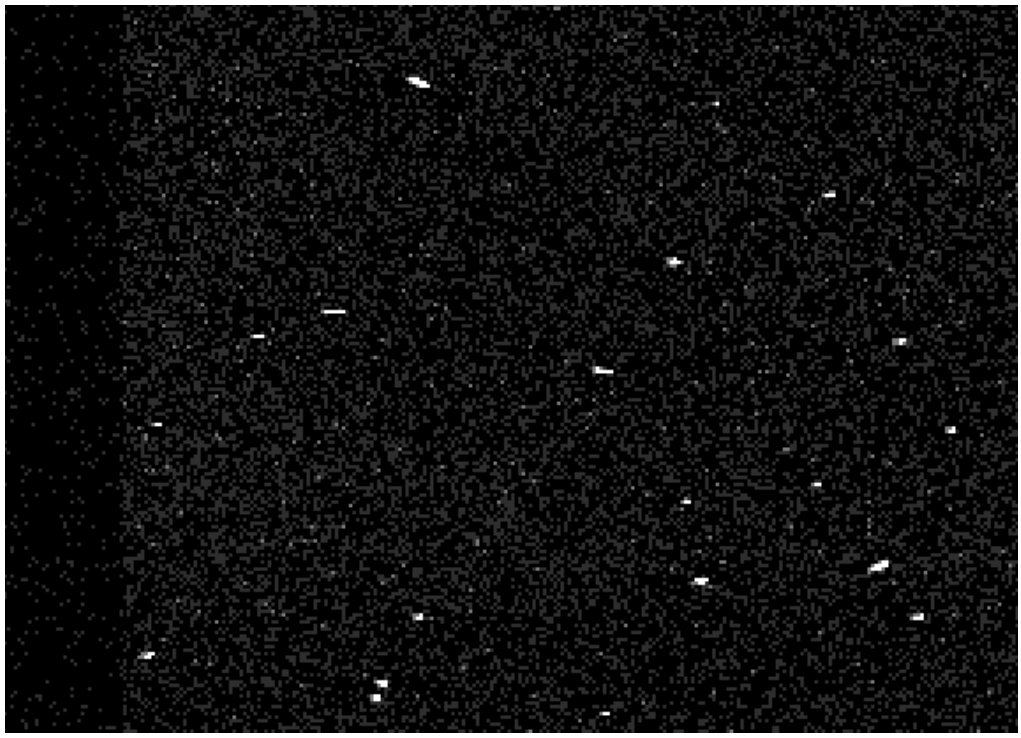
6.66

2.15

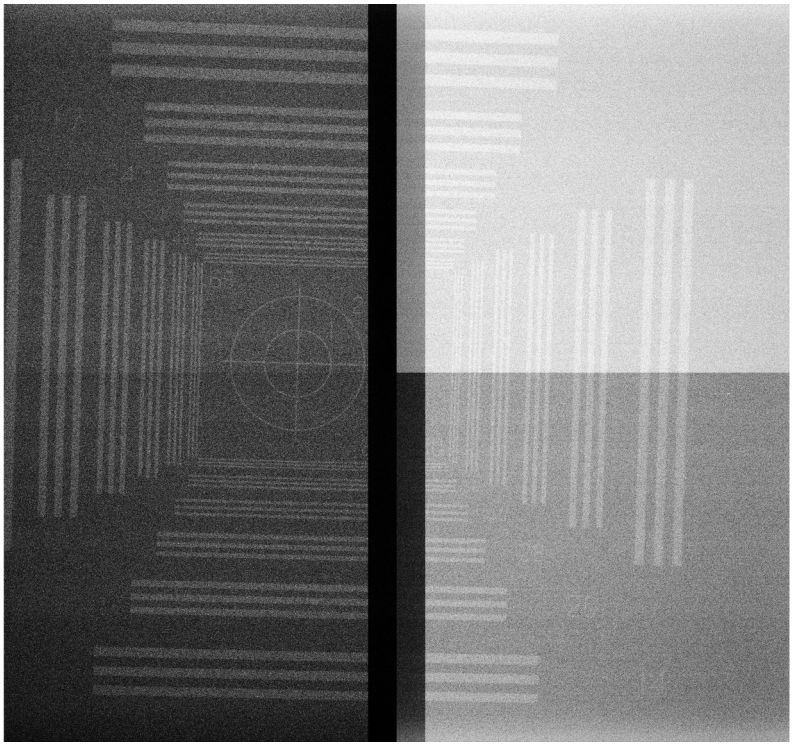


Two typical photon transfer curves are shown. As with earlier 42-40 devices the photon transfer curves were considerably more linear at a binning of 2x2 pixels compared to no binning, a well-understood effect of charge repulsion between electrons of neighboring small pixels. I verified that the linearity of counts versus time is good, about 1% over the full dynamic range.

Long dark frames were obtained in dual quad mode. The CCD was operated at a temperature of -110 C, the recommended temperature for operation in the field. The frame shown is a 20 minute dark. The two vertical regions in the center are the oversan regions. The measured dark current rate is less 5 electrons per pixel per hour. The white objects on the right side are cosmic rays, not visible on the left because of the grey scale mapping. The absence of trails indicates excellet charge transfer efficiency even at sharp contrast.



Images of a target were obtained at saturated, medium and low light levels. They were all well behaved. A low light level image is shown below at about 10 electrons illumination in the pattern. This is the raw image read from the camera, with no image processing. The target is clearly visible.



The images can be binned on the sensor in the vertical and horizontal directions independently. Selected rectangular regions can be selected for readout as well. This subarray readout mode only works effectively in single readout mode. These readout modes reduce the frame readout time considerably and my be useful for field acquistion, setup, focussing and so on. The binning parameters should be selected before the subarray readout parameters. A subarray image, binned 2 x 2 of our Air Force target slide is shown, with the dark region on the right side being 100 colum wide overscan pixels.

The quantum efficiency values measured by E2V for this device are listed below. I've never seen an E2V device with values this high.

350 nm	58.2 %
400	98.7
500	98.3
650	98.5
900	62.6

Also, the CCD was classified internally as a grade 0 device, but shipped as a grade 1 device to meet the customer’s specifications.