

Revised WFIRST IR Detectors TAC Report on Milestone #3 Review

A telecon review of Milestone #3 for the WFIRST instrument detector technology program was held on October 28, 2015. Milestone #3 is a continuation of the same H4RG detector development effort characterized by the previous Milestones #1 and #2. Full-array lots of both the PV2A and PV3 passivation detectors were fabricated by Teledyne, and the PV2A devices were subjected to rigorous testing in the DCL facility at GSFC. The full-array lots included process variations intended to study charge persistence. 11 of the 15 PV2A devices delivered by Teledyne met the specific performance requirements of Milestone #3. The Milestone specified the production of arrays that met the following requirements: interconnect operability > 95%, median dark currents less than 0.1 electrons/pixel/sec, median CDS noise less than 20 electrons, median quantum efficiency (QE) greater than 60% over the entire wavelength band, and nearest neighbor inter-pixel capacitance/crosstalk (IPC) of less than 3%, all tested at 100 K. The measured performances by these 11 devices were interconnect operability >95%, median dark currents less than 0.02 electrons/pixel/sec, median CDS noise less than 18 electrons, median QE greater than 88% averaged over 800 nm to 2350 nm, and crosstalk less than 2% for nearest neighbor pixels. The TAC unanimously agrees that the WFIRST team members presented persuasive evidence that the requirements for Milestone #3 have been met. However, by inspecting detailed histograms for each of the 11 arrays, it was clear that not all arrays would be deemed flight quality.

In our Milestone #2 report, the TAC requested to learn more at this telecon about the effort underway with NIST to understand why measured QE values exceed the physical bound of 100% for certain devices at certain wavelengths. Due to contractual problems with NIST, this effort is just beginning and has not as yet yielded an explanation for these unphysical results. The TAC encourages the team to continue working on this question and hopes that this issue will be resolved in time for the next Milestone (#4), currently scheduled for September 15, 2016.

At the request of the TAC, the team also presented informally the results of their ongoing studies of charge persistence with the devices, which, while not a formal element of the Milestones #1, #2, or #3 reviews, illustrates one of the key remaining challenges for a survey telescope with a short (180 s) observing cadence. In combination with the device performance goals highlighted in the Milestones to date, achieving an acceptable level of charge persistence will be a key determinant of the optimum “sweet spot” for the flight H4RGs for WFIRST. We look forward to continued progress by the WFIRST and Teledyne teams in advancing this crucial technology development effort.

We note that this review was originally scheduled for September 15, 2015, but was delayed to accommodate the schedules of the TAC members. The presentation charts delivered to the TAC on September 15, 2015 show that the Milestone #3 goals were met by that date, so the Project is clearly keeping to their schedule.

This report was revised following its initial submission after clarifications were received from team members regarding the calculation of the effects of IPC on measured quantities such as the noise, dark current, and QE.

Finally, we thank Dave Content, Robert Hill, John Auyeung, Eric Piquette, and other WFIRST and Teledyne team members for their presentations and comments during the review.

WFIRST IR Detectors TAC Members

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