Cycle 25 COS NUV Detector Dark Monitor

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ABSTRACT

This report summarizes the calibration plan, analysis, and results for the Cycle 25 NUV Dark Monitoring Program (14942) for the Cosmic Origins Spectrograph (COS) on the Hubble Space Telescope (HST). Observations for this program were taken for the entirety of Cycle 25, spanning from the end of 2017 October to the end of 2018 October.

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1. Introduction

COS Calibration Program 14942 ("NUV Detector Dark Monitor," PI M. Fix) is designed for routine monitoring of the NUV MAMA detector, which is then analyzed to produce a dark rate for use in the Exposure Time Calculator (ETC). It is important to monitor the dark rate for on-orbit time dependence and variations that may be due to anomalies or new features of the detector. Like the NUV (and FUV) dark-monitoring programs

of recent history, exposures are taken with a regular cadence every two weeks. For the NUV program, two 22 minute exposures were taken for a total of 52 orbits throughout Cycle 25, from 2017 October to 2018 October. All observations were taken successfully.

2. Analysis and Results

For each observation, the dark rate was measured and compared to all other Cycle 25 observations to monitor the rate as a function of time. Originally following commission, the dark rate of the NUV MAMA was increasing along a fairly consistent linear slope, but in recent years the increase has slowed dramatically. It continues to follow this trend (Figure 1). The ETC estimate for the dark rate is calculated by creating a distribution of the values from the observations throughout the entire cycle period and fitting a standard probability distribution to the data; the value corresponding to the level enclosing 95% of the distribution is then reported to the ETC, with appropriate errors (Figure 2). Because the trends observed in this program did not significantly deviate from previous cycles, we did not update the NUV dark rates used in the ETC.
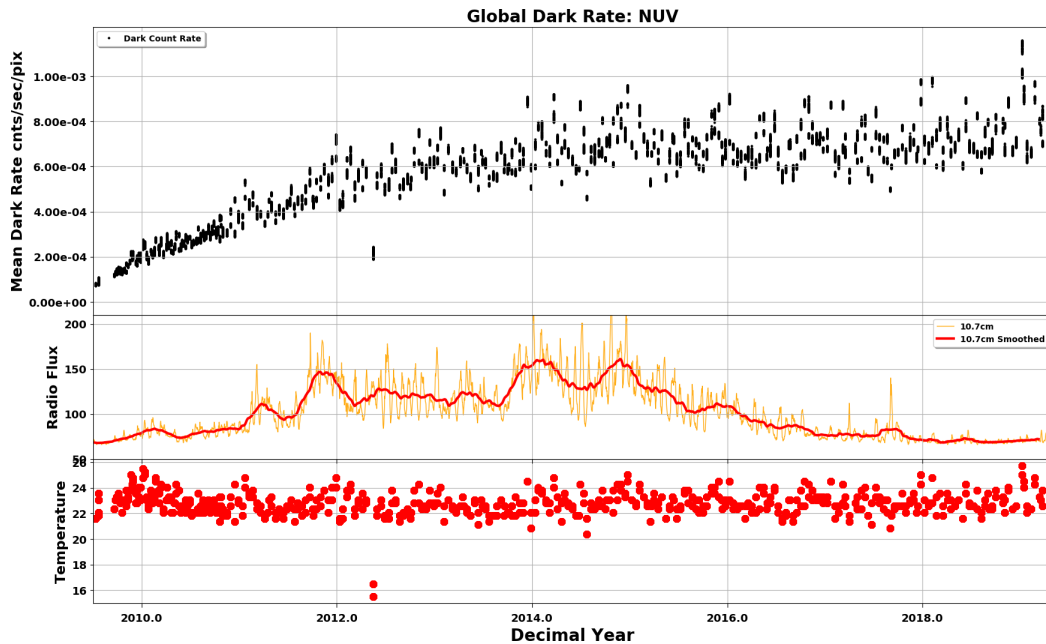

Figure 1. Dark Rate vs. Time: The COS NUV dark rate as a function of time, spanning from installation through Cycle 25. The dark rate is measured in 25 s increments, which is then plotted against the time in decimal year (*top*). Groupings of points occur naturally, as they correspond to the individual exposures of their origin, also displaying the natural variation within an exposure. We also plot these trends against the 10.7 cm radio flux, used as a signifier of the solar cycle (*middle*), and the on-board detector temperature for each observation (*bottom*).
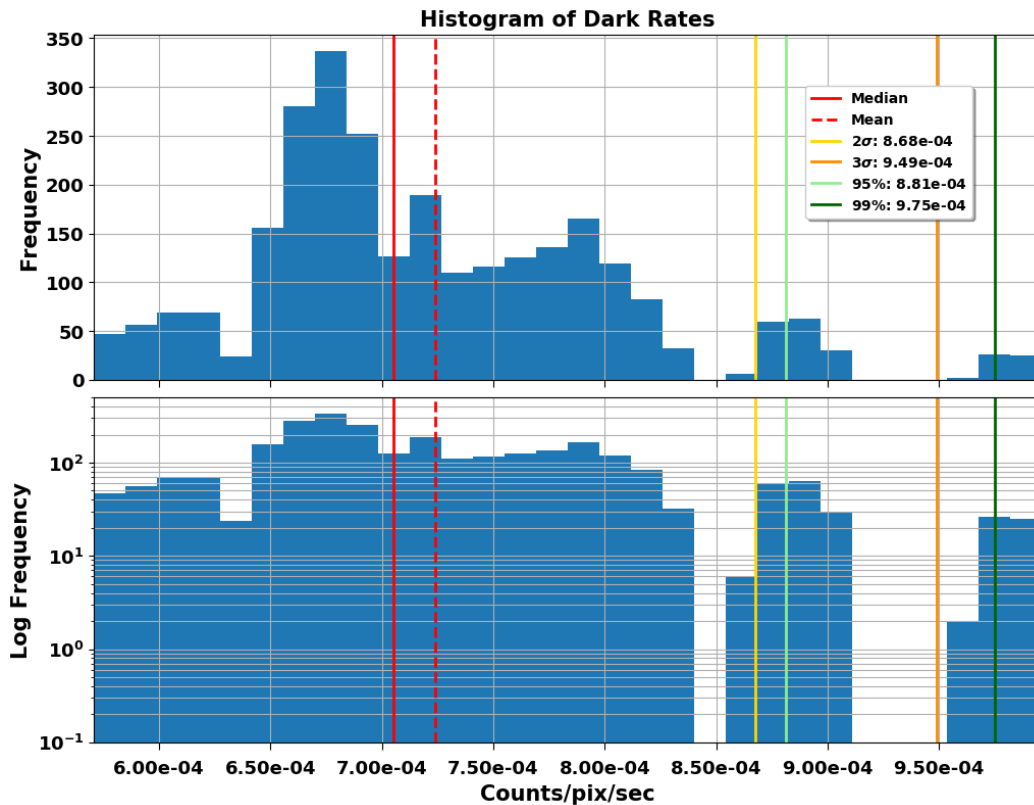
Figure 2. Dark Rate Distribution: The COS NUV dark rate, binned and then fit with a standard probability distribution to determine the value below which 95% of measured values fall.

3. Summary

The COS NUV MAMA detector continues to follow former trends of a slight linear increase with larger variability than originally seen. We will continue this monitoring program into future cycles and perform new analysis as necessary.

Change History for COS ISR 2019-19

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