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Instrument Science Report COS 2016-05(v1)

# Cycle 22 COS FUV Dark Monitor Summary

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## ABSTRACT

*Here we summarize the Cycle 22 FUV Dark Monitoring Program for the Cosmic Origins Spectrograph (COS) on the Hubble Space Telescope (HST) covering dates November 2014 to October 2015. We give an overview of the calibration plan and summary for this calibration program.*

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## 1 Introduction

The FUV detector dark monitor program (13968) is designed to perform routine monitoring of FUV XDL detector dark rate. The main purpose is to look for evidence of a change in the dark rate, both to track on-orbit time dependence and to check for a developing detector problem. Results from this program are used to update the ETC.

Every week, five 22-minute exposures were taken with the shutter closed for a total of 260 orbits. After the move to LP3, the G130M/1222 setting will remain at LP2 and will require 5 more exposures per week while it operates at a different high voltage setting than the M-modes to make a total of 430 orbits. Visits 4C, 4D, 4E, 4F, and 4G failed and all data was lost due to HST entering safe mode on June 5, 2015. These visits were not repeated because without them there would be no significant impact to the program.

## **2 Analysis and Results**

After screening for SAA passages, the dark rate of each observation was measured in 25 second intervals from a region that excluded the noisy edges of the active area. Dark rates were measured vs. time and summed darks for each visit were constructed from all non- SAA impacted events.

The overall trend in the dark rate has been relatively constant for Segment B, while Segment A appears to have again experienced a persistent baseline increase in mid 2015. The baseline jump exhibits similar behavior to past occurrences: an initial discontinuous increase followed by a slow, many-week, decrease back to nominal (Figure 1).

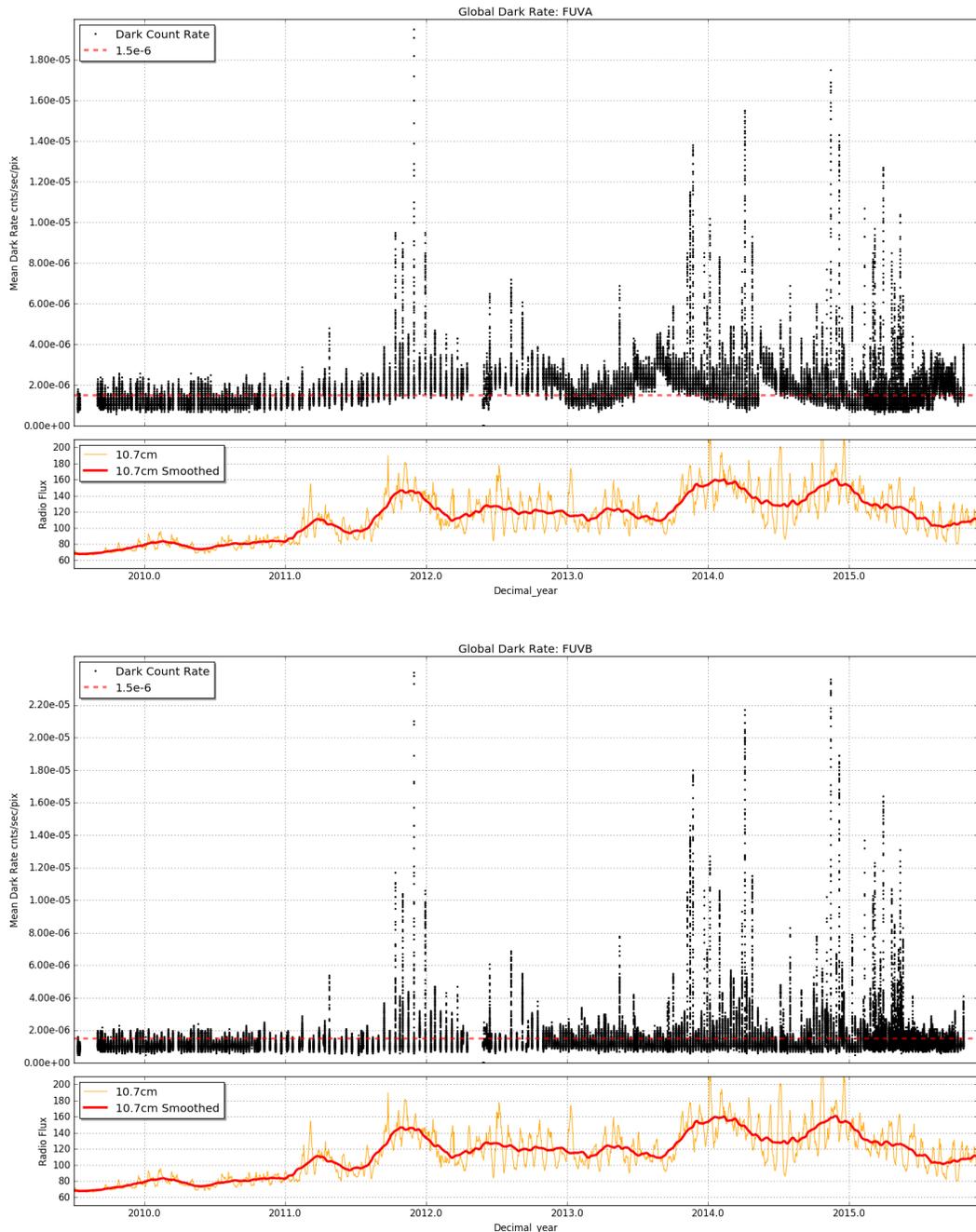
Additionally, both segments show individual observations and portions of observations that significantly vary from the baseline dark rate. Both of these effects appear to have some correlation with the solar cycle, though direct cause and effect have not yet been determined.

Due to the lack of a measureable trend and the extreme variability seen in observations, we adopt an ETC estimate for the dark-rate that corresponds to the 95% level in the probability distribution function determined from dark measurements over a period of the previous 6 months to 1 year.

The extra orbits were removed in Cycle 23 program 14436 because there was no significant difference in the dark rate for the different settings at different high voltage levels.

## **3 Summary**

The COS FUV XDL detector dark rate continues to follow former trends. The FUVB detector shows a relatively constant dark rate trend where as FUVA continues to experience baseline increase and a slow decrease back to nominal as it has in the past. The extra orbits for extra exposures show no significant difference in the dark rate for different high voltage settings.



**Figure 1:** COS/FUV dark rates on FUVA (top) and FUVB (bottom) as a function of time, from COS installation through Cycle 22. The first subplot shows the measured dark-rate in 25 second increments throughout every observation. The groupings of points represent individual visits, and demonstrate that the variability within a given exposure is sometimes extremely large. The red dashed line displays a fiducial dark rate of  $1.5 \times 10^{-6}$  cts/pix/s. The bottom panels display the 10.7 cm emission tracking the solar cycle.

## **Change History for COS ISR 2016-05**

Version 1: 20 September 2016 - Original Document

### **References**

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