STScI | SPACE TELESCOPE SCIENCE INSTITUTE

Instrument Science Report COS 2020-08(v1)

Cycle 26 COS FUV Dark Monitor Summary

Dzhuliya Dashtamirova[1] and Mees Fix[1]

[1] Space Telescope Science Institute, Baltimore, MD

2 October 2020

ABSTRACT

Here we summarize the Cycle 26 FUV Dark Monitoring Program for the Cosmic Origins Spectrograph (COS) on the Hubble Space Telescope (HST) covering dates November 2018 to October 2019. We give an overview of the calibration plan and summary for this calibration program.

Contents

1. Introduction

Program 15533 ("COS/FUV Detector Dark Monitor," PI C. Magness) is designed to perform routine monitoring of the 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 COS/FUV Exposure Time Calculator (ETC). Every week, five 22-minute exposures were taken with the shutter closed for a total of 260 internal orbits.

The dark rate of each observation in Program 15533 was measured in 25 second intervals for five different regions on the FUVA and FUVB detector segments. These regions have been newly redefined from Cycle 24 to better track the enhanced dark rate seen along the edges of FUVA. The five regions capture the top, bottom, left, right, and inner portions of the detector active area. More information can be found in COS ISR 2019–11 (Dashtamirova et al. 2019). Dark rates were measured vs. time and summed darks for each visit were constructed for each region of each segment.

2. Analysis and Results

The overall trend in the dark rate has been constant for Segments A and B. In Figures 1 and 2, we show the dark rate vs. time for each of the five regions tracked for FUVA and FUVB, respectively. We also show similar plots for only Cycle 26 data in Figures 3 and 4 for FUVA and FUVB, respectively. This cycle there was a temporary increase in dark rate, most obviously seen in the bottom and left edge of FUVA around 2019.0 (see Figure 1). This has been seen in the past (see around 2018.5 and 2015.5 in Figure 1) and is not unexpected. Additionally, both segments show individual observations and portions of observations that significantly vary from the baseline dark rate, which has also been observed in past cycles.

Due to the lack of a measurable 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 that exclude the enhanced edges over a period of the previous 6 months to 1 year. The ETC rates adopted from Cycle 26 data are listed below in Table 1.

Table 1. COS FUV ETC Dark Rates from Cycle 26

Detector	Mode	Dark Rate (count/sec/pix)
FUVA	Spectroscopic	2.01e-06
FUVA	Target ACQ	3.02e-06
FUVB	Spectroscopic	1.85e-06
FUVB	Target ACQ	2.97e-06

3. Summary

The COS FUV XDL detector dark rate continues to follow former trends. The FUVB segment 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.

Change History for COS ISR 2020-08

Version 1: 2 October 2020- Original Document

References

Dashtamirova, D., White, J., Sahnow, D., 2019, COS Instrument Science Report 2019-11, "Changes in the COS/FUV Dark Rate: Impact on the Monitoring Program and Background Extraction Regions"

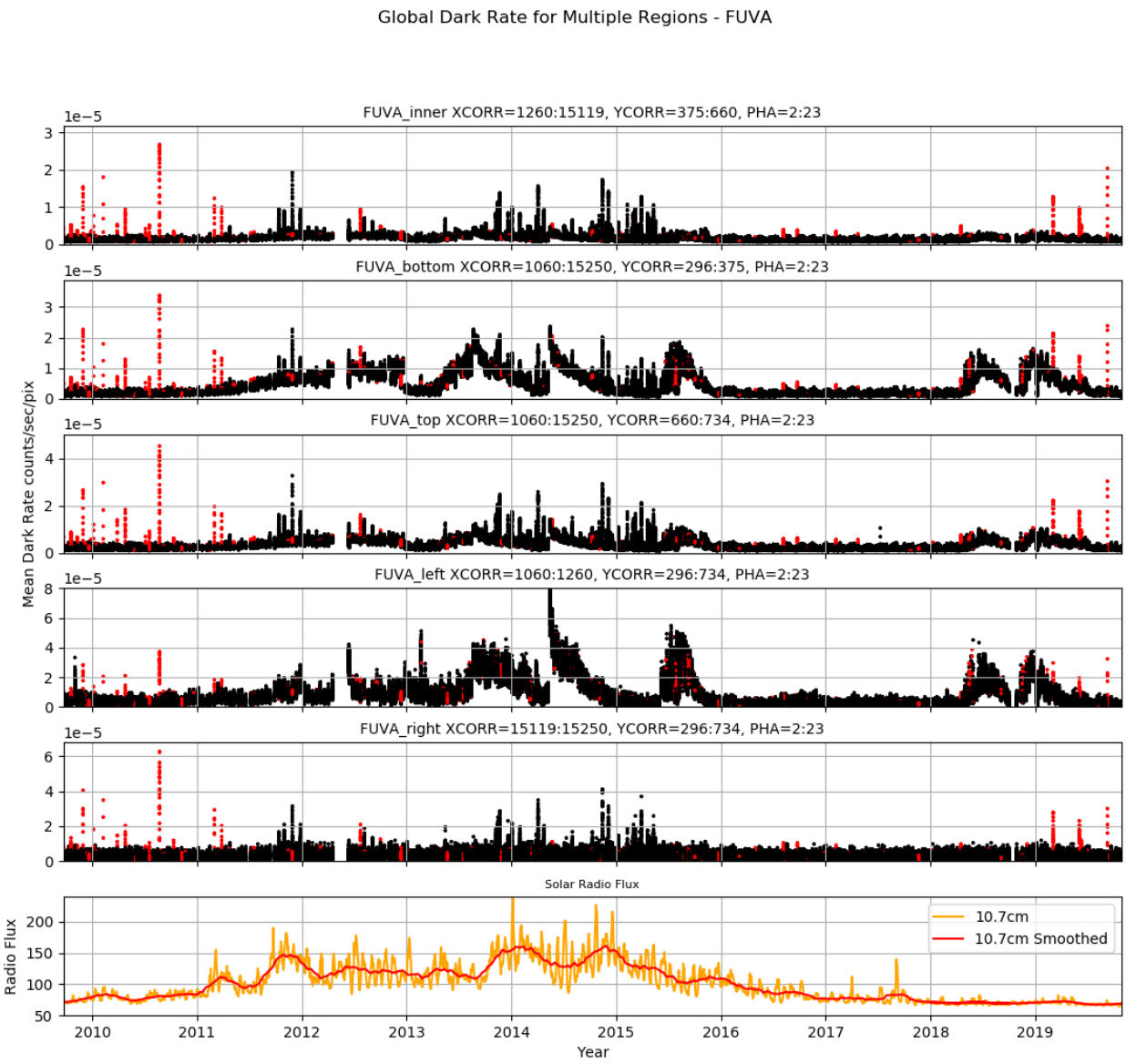

Figure 1. COS/FUV dark rates on FUVA as a function of time for each of the different areas on the detector monitored. The top 5 panels show the measured dark rate in 25 second increments throughout every exposure. The red dots represent dark rates that were observed close to when HST was passing over the South Atlantic Anomaly. The bottom panels display the 10.7 cm solar radio emission tracking the solar cycle.

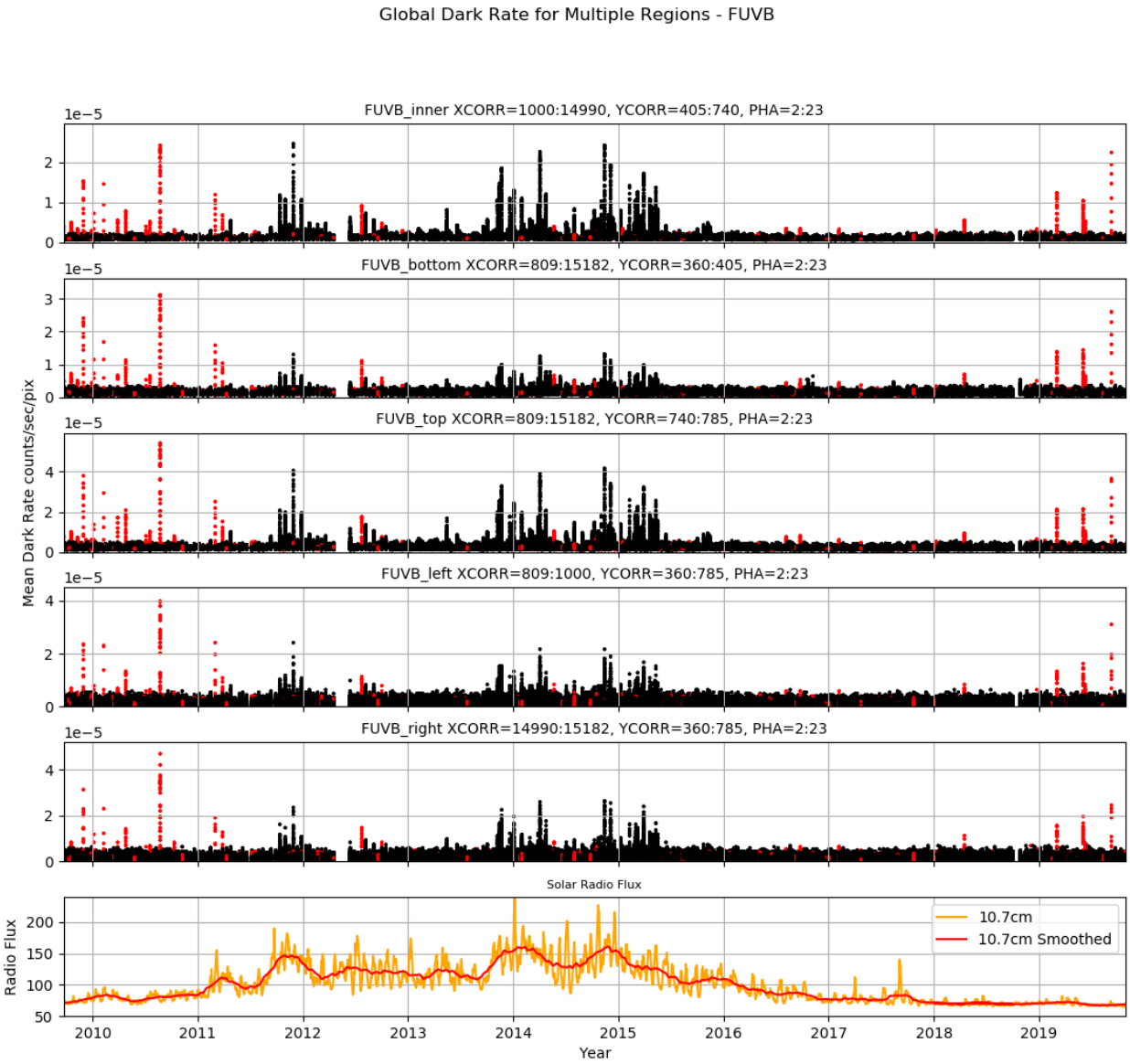

Figure 2. Same as Figure 1 but for FUVB.

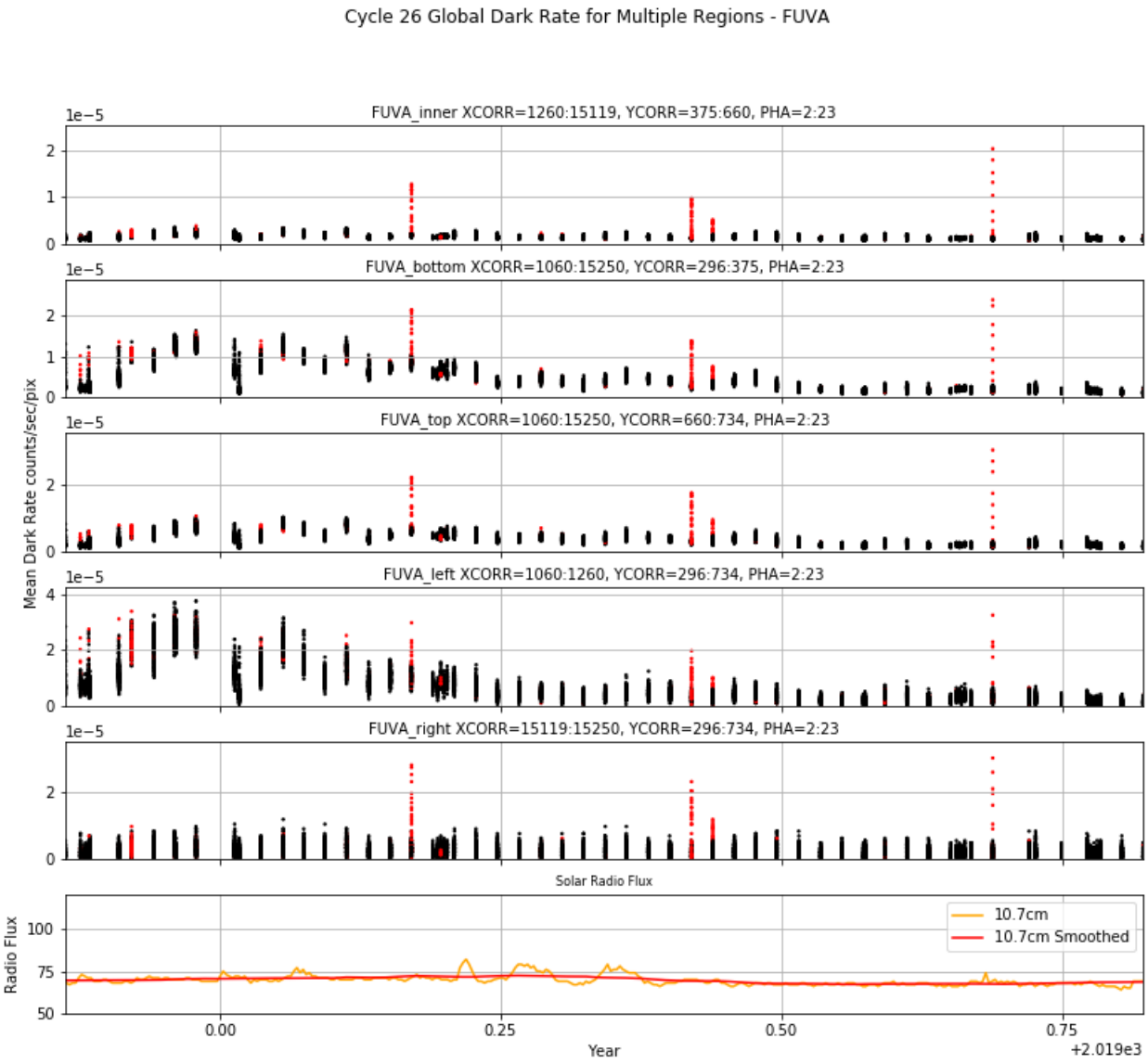

Figure 3. Same as Figure 1 for Cycle 26 data only.

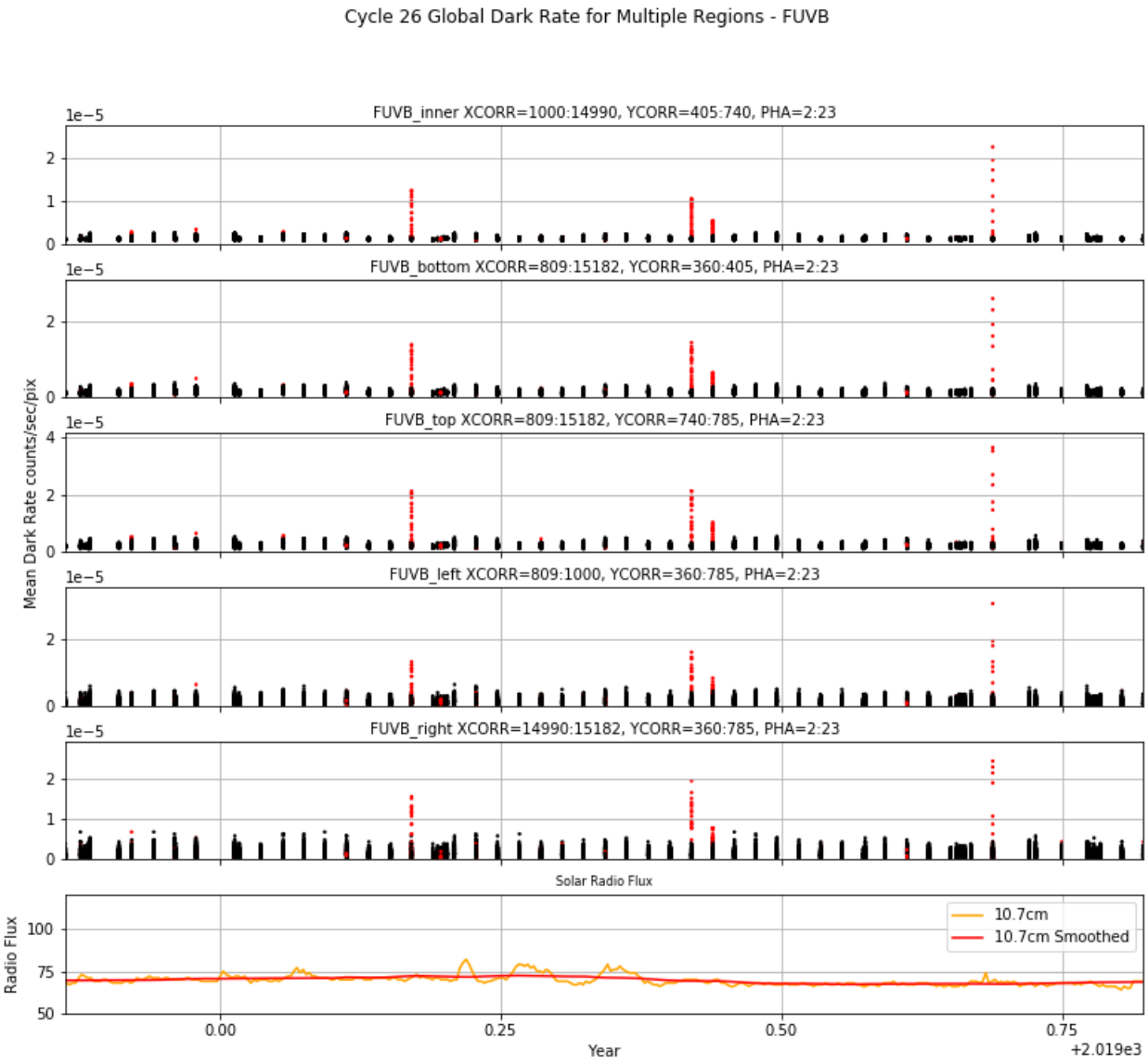

Figure 4. Same as Figure 2 for Cycle 26 data only.