



Cycle 22 COS FUV Detector Gain Maps

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ABSTRACT

Program 13970 used the onboard deuterium lamp to illuminate the LP2 and LP3 regions of the COS FUV detector at the time of the Lifetime 3 move. The pulse height information obtained was used to create gain maps in order to monitor the detector gain sag and to determine when high voltage changes and Lifetime Position changes were needed.

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1. Introduction

Monitoring the modal gain of the COS FUV detector is crucial to ensure optimal performance. When the modal gain at a particular region of the detector drops below a value of about three, approximately 5% of the counts there fall below the lower pulse height threshold, which leads to an apparent local loss of sensitivity (Sahnou et al.

2011). The gain drops are most severe in the regions of the detector at which Lyman- α airglow lines fall.

Gain maps are created weekly using all COS FUV exposures, but the area of the detector for which data is available varies from week to week, depending on the exposures taken. In order to ensure more complete coverage at a given Lifetime Position (LP), exposures are taken with the internal deuterium lamp both before and after any change to the nominal detector high voltage (HV) or Lifetime Position.

2. Execution

Visit B1 of program 13970 executed on February 8, 2015 at HV=173/175 (for Segment A/B) at LP2, immediately before the move to LP3 on February 9, 2015. Visits B2 and B3 were executed on February 9, 2015 at LP3, immediately after the move. Visit B2 used HV values of 167/163 (the values for the Standard Modes), while B3 used 171/167 (the G130M/1222 values). All three visits executed as expected.

Visits A1 and A2, which would have been executed had the nominal HV on Segment A been changed before the Lifetime Move, were withdrawn.

3. Summary of Analysis and Results

The standard gain map creation routines were used to make fits to the peak of the pulse height distribution for each binned pixel in order to calculate the modal gain at LP2 before the move, and at LP3 after. Based on the repeatability of the weekly modal gain data, the accuracy of the measurements is typically ~ 0.1 pulse height bins.

The primary purpose of this program was to obtain final (at LP2) and initial (LP3) gain maps in order to more accurately determine the slope of the modal gain vs. extracted charge curve over the entire illuminated area of the detector. Anchoring the ends in this manner allows a more accurate determination of the slope, which leads to more accurate predictions of when the gain is likely to drop to 3, and thus when a high voltage change or Lifetime Position change will be needed.

Data from this program, along with data from other gain measurements, is also used in the construction of the GSAGTAB, which flags the regions where the modal gain has dropped too low.

This program has been continued in Cycle 23 as Program 14439.

Change History for COS ISR 2016-07

Version 1: 20 September 2016 – Original Document

References

D. Sahnou et al., 2011, Instrument Science Report COS 2011-05, "Gain sag in the FUV detector of the Cosmic Origins Spectrograph"