Cycle 25 COS Calibration Plan
Spring Orbit Request

June 2017

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for the COS Team

Summary of COS Orbit Requested for Programs Remaining Unchanged since Cycle 24

Title (PI)	External	Internal	Frequency (orbits x repeats)
FUV Monitors			
FUV Detector Dark Monitor (Fix)		260	5x52
FUV Gain Maps (Sahnow)		8+(2*)	4x2 + (if HV change)
NUV Monitors			
NUV Detector Dark Monitor (Fix)		52	2 x26
NUV MAMA Fold Distribution (Wheeler)		1	1x1
Contingency Programs			
FUV Detector Recovery After Anomalous Shutdown (Wheeler)		(17)	
NUV Detector Recovery After Anomalous Shutdown (Wheeler)		(4)	
Cycle 25 Spring Request		321+(23)	

* Per HV change.
() indicate contingency orbits

Cycle 25 vs. Cycle 24

- The list of programs on the previous page is identical to the Cycle 24 request, except that the *Pure Parallel Observations of Geocoronal Ly α* program has been removed. With the adoption of the COS2025 plan starting in Cycle 25, this program will no longer be necessary.
- The COS2025 Plan is expected to affect several programs that will be presented in the fall

COS Side 2 Programs Carried Over to Cycle 25

- Programs are carried along each cycle's calibration plan (keeping the same ID) so that the impact of any changes to operating conditions can be evaluated and modifications to the programs implemented as needed. Two engineering programs using external orbits (13192 and 13193) will be discussed in late 2017, since they are impacted by 1-gyro mode operations and the COS2025 changes.

- No changes are needed to the internal programs listed below at this time.

- **Engineering programs** (22 Internal orbits)
  - 13187 - COS Side 2 Dump Test and Verification of COS Memory Loads
  - 13188 - COS Side 2 Science Data Buffer Check/Self-Tests for CS Buffer RAM and DIB RAM
  - 13189 - COS Side 2 NUV Detector Recovery After MEB Side Switch
  - 13190 - COS Side 2 FUV Detector Recovery After MEB Side Switch
  - 13191 - COS Side 2 NUV MAMA Fold Test

- **Science programs** (7 Internal)
  - 13194 - COS Side 2 Internal NUV Wavelength Verification
  - 13195 - COS Side 2 Internal FUV Wavelength Verification

Total Cycle 25 Carry Over: 29 internal Orbits

FUV Monitors

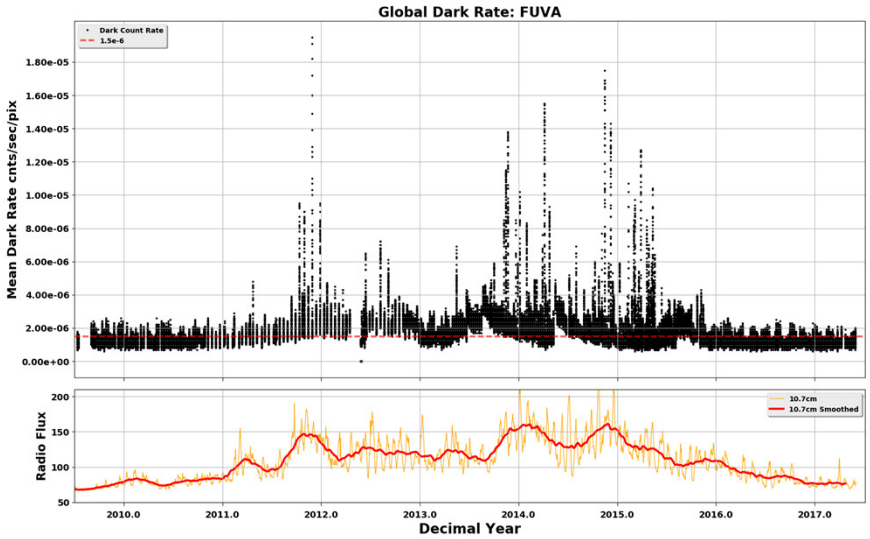
COS FUV Detector Dark Monitor
PI: Mees Fix

Purpose	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.
Description	Monitor the FUV detector dark rate by taking TIME-TAG science exposures with no light on the detector. Five times every week a 22-min exposure is taken with the FUV detector with the shutter closed. The length of the exposures is chosen to make them fit in Earth occultations. All orbits < 1800s.
Fraction GO/GTO Programs Supported	92% of COS total exposure time in Cycle 24
Resources Required: Observations	260 internal orbits. All orbits < 1800s.
Resources Required: Analysis	2 FTE weeks.
Products	Provide ETC and IHB dark rate estimates, along with weekly monitoring for changes and a summary in the end of cycle ISR. Update monitor and COS webpages. As allowed by resources and necessitated by data quality: improve dark subtraction method and update bad-pixel tables.
Accuracy Goals	Obtain enough counts to track 1% level changes on timescales of ~1-3 months.
Scheduling & Special Requirements	5x / week at nominal HV during Earth occultation.
Changes from Cycle 24	No changes.

COS FUV Dark Rate Trends

Temporal variability of the dark level

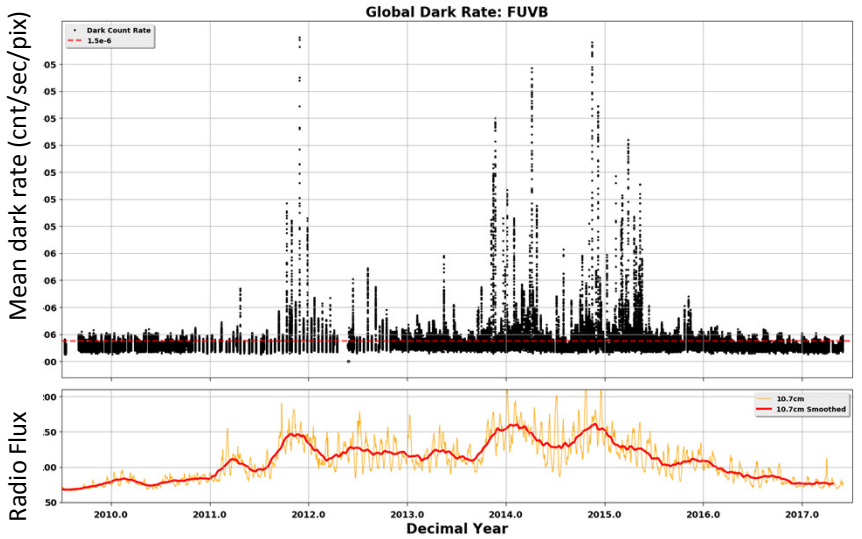
FUVA



Date

Temporal variability of the dark level

FUVB



Date

<u>COS FUV dark rate monitoring:</u>

- Dark rate trends are constant over the past few years
- Fewer dark-rate spikes as the radio flux from the Sun decreases (decreased solar activity)
- Baseline jump on FUVA similar in magnitude to events seen in the past.

COS FUV Detector Gain Maps
PI: David Sahnow

Purpose	Obtain gain maps of the FUV detector before and after changes to the nominal high voltage levels, and periodically during the cycle. These data will be used to check that the expected modal gain is achieved for HV changes, and to track the modal gain as a function of time.
Description	Use the deuterium lamp to illuminate the appropriate LP2/LP3/LP4 region of the COS FUV detector at the following times: • LP4 Standard Modes: Snapshot to monitor the change in gain every 6 months (2 orbits) • LP4 G130M/1222: Snapshot to monitor the change in gain every 6 months (2 orbits) • LP3 Standard Modes: Snapshot to monitor the change in gain every 6 months (2 orbits) • LP2 Blue Modes: Snapshot to monitor the change in gain every 6 months (2 orbits) • Contingency for LP3 Standard Modes: Immediately before and after a Segment A HV change (2 orbits)
Fraction GO/GTO Programs Supported	92% of FUV observations for cycle 24
Resources Required: Observations	8 internal orbits 2 internal contingency orbits
Resources Required: Analysis	2 FTE weeks. Existing CCI / gain map procedures will be used to process these data part of normal gain monitoring.
Products	Gain map files. These will be used to update the GSAGTAB (and possibly the BPIXTAB), and also improve the models of gain vs. HV and gain vs. exposure.
Accuracy Goals	0.1 pulse height bin
Scheduling & Special Requirements	Every 6 months and immediately before and immediately after any HV change.
Changes from Cycle 24	3 additional orbits since we are now monitoring three Lifetime Positions instead of 2. 1 less contingency orbit

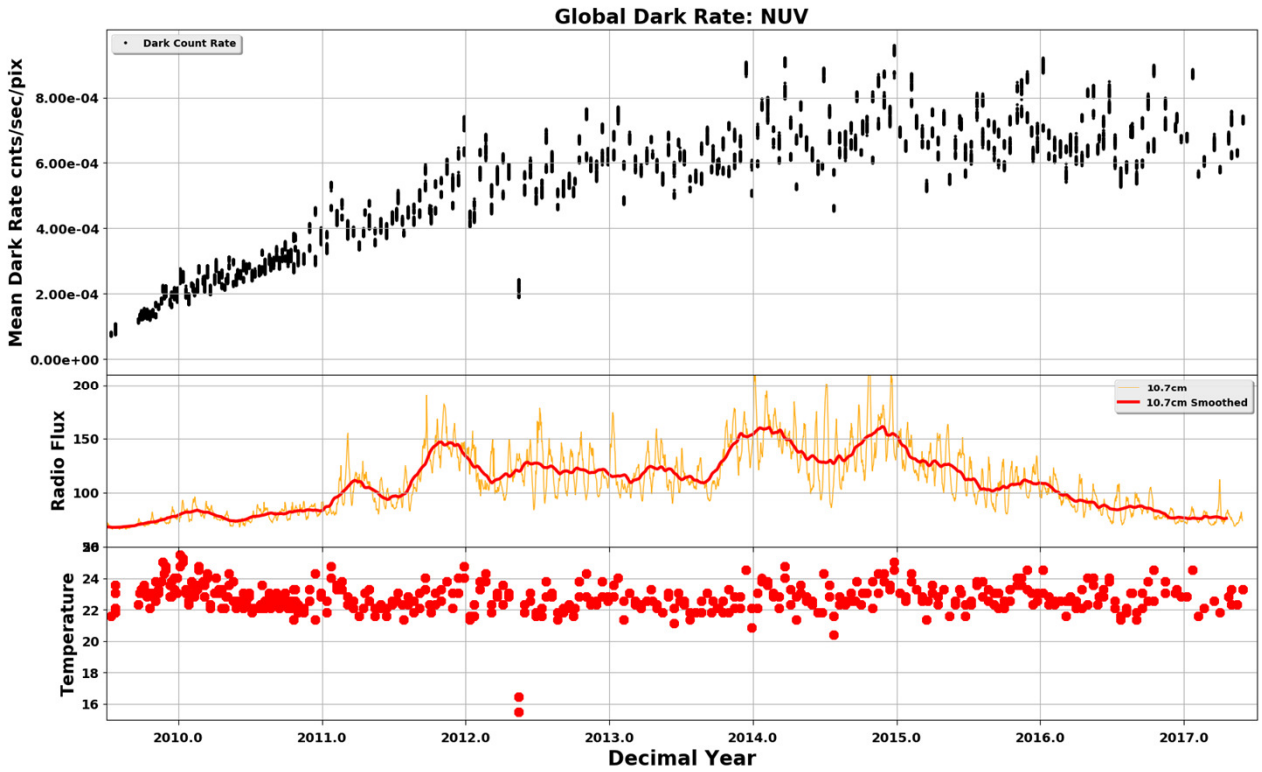
NUV Monitors

COS NUV Detector Dark Monitor
PI: Mees Fix

Purpose	Perform routine monitoring of the MAMA detector dark current. 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.
Description	Monitor the NUV detector dark rate by taking TIME-TAG science exposures without illuminating the detector. Twice every other week a 22-min exposure is taken with the NUV (MAMA) detector with the shutter closed. The length of the exposures is chosen to make them fit in Earth occultation. All orbits < 1800s.
Fraction GO/GTO Programs Supported	8% of COS total exposure time in Cycle 24
Resources Required: Observations	52 internal orbits. All orbits < 1800s.
Resources Required: Analysis	2 FTE weeks.
Products	Provide ETC and IHB dark rate estimates, along with weekly monitoring for changes and a summary in the end of cycle ISR. As allowed by resources and necessitated by data quality: update bad-pixel tables. Update monitor webpage
Accuracy Goals	30%
Scheduling & Special Requirements	Twice every other week, in Earth occultation
Changes from Cycle 24	No changes.

COS NUV Dark Trends

Temporal Variability of the Dark Level



<u>COS NUV dark monitoring:</u>

- Dark rate trend shows approximately linear increase with time, flattening since ~2012
- Dark rate variability decreases as the radio flux from the Sun decreases (decreased solar activity)

COS NUV MAMA Fold Distribution
PI: Thomas Wheeler

Purpose	The fold analysis provides a measurement of the distribution of charge cloud sizes incident upon the anode providing some measure of changes in the pulse-height distribution of the MCP and, therefore, MCP gain.
Description	While globally illuminating the detector with a flat field, the valid event (VE) rate counter is monitored while various combinations of row and column folds are selected.
Fraction GO/GTO Programs Supported	~50% of COS (includes COS/FUV programs with NUV TA acquisitions)
Resources Required: Observations	1 internal orbit
Resources Required: Analysis	0.5 FTE day.
Products	The results are sent to the COS Team and Ball Aerospace (Steve Franka)
Accuracy Goals	5% accuracy on the peak position of the fold distribution
Scheduling & Special Requirements	This proposal is executed annually.
Changes from Cycle 24	No changes.

Contingency Programs

COS FUV Detector Recovery after Anomalous Shutdown
PI: Thomas Wheeler

Purpose	The safe and orderly turn-on and ramping-up the COS FUV high voltage in a conservative manner after a HV anomalous shutdown.
Description	Day 01 activities, visits 01-07, contain both QE grid off and on HV ramping to HVLow (100/100) with diagnostics (DCE dumps) and darks to exclude QE grid involvement in the shutdown. Subsequent to day 01, all HV rampings, diagnostics and darks will be with the QE grid on. The HV commanded values for the subsequent days are: 154/151, 160/157, 167,163, etc. until the desired HV is obtained.
Fraction GO/GTO Programs Supported	92% of COS exposure time in Cycle 24
Resources Required: Observations	17 internal orbits
Resources Required: Analysis	If activated, 0.5 FTE day per test.
Products	After thorough data analysis for each test day, a Go/No-Go to proceed will be given.
Accuracy Goals	
Scheduling & Special Requirements	This is a contingency proposal activated only in the event of an anomalous shutdown.
Changes from Cycle 24	No changes.

COS NUV Detector Recovery after Anomalous Shutdown
PI: Thomas Wheeler

Purpose	The safe and orderly recovery of the NUV-MAMA detector after an anomalous shutdown.
Description	The recovery procedure consists of four separate tests (i.e. visits) to check the MAMA's health after an anomalous shutdown. Each must be successfully completed before proceeding onto the next. They are: (1) signal processing electronics check, (2) slow, intermediate voltage high-voltage ramp-up, (3) ramp-up to full operating voltage, and (4) fold analysis test.
Fraction GO/GTO Programs Supported	8% of COS exposure time in Cycle 24
Resources Required: Observations	4 internal orbits
Resources Required: Analysis	If activated, 0.5 FTE day per visit.
Products	For tests 1-3, only a Go/No-Go to proceed will be given. For test 4, the results will be sent to the COS Team and Ball Aerospace (Steve Franka).
Accuracy Goals	
Scheduling & Special Requirements	This is a contingency proposal activated only in the event of an anomalous shutdown.
Changes from Cycle 24	No changes.