Cycle 29 COS Calibration Plan Spring Orbit Request for Unchanging Programs

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for the COS Team

Summary of COS Orbit Requested for Cycle 29
(Programs Remaining Unchanged since Cycle 28)

Title (PI)	External	Internal	Frequency (orbits x repeats)
FUV Monitors			
COS FUV Wavelength Scale Monitor (W. Fischer)	3		3x1
NUV Monitors			
COS NUV Detector Dark Monitor (Dashtamirova)		52	2 x26
COS NUV MAMA Fold Distribution (Wheeler)		1	1x1
COS NUV Spectroscopic Sensitivity Monitor (W. Fischer)	4		2x2
COS NUV Wavelength Scale Monitor (W. Fischer)	1		1x1
COS NUV Target Acquisition Monitor (Dieterich)	3		3x1
Contingency Programs			
COS FUV Detector Recovery After Anomalous Shutdown (Wheeler)		(17)	
COS NUV Detector Recovery After Anomalous Shutdown (Wheeler)		(4)	
Cycle 29 Spring Request	11	53+(21)	

Cycle 29 vs. Cycle 28

- In preparation for the commissioning of lifetime position 5 (LP5), most FUV calibration programs are changing and are not included in this spring request
- One FUV program is not changing:
  - COS FUV Wavelength Scale Monitor
    - G130M exposures will move to LP5 (except c1222 remaining at LP4 and c1096 remaining at LP2). G140L exposures will move to LP3. These changes require no adjustments in the Phase 2, since APT will select the correct LIFETIME-POS for each cenwave automatically.
- All NUV programs are unchanging from Cycle 28

COS Side 2 Programs Carried Over to Cycle 29

- 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.

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

- Engineering programs (22 Internal orbits)
  - 13187 - COS Side 2 Dump Test and Verification of COS Memory Loads (1 internal orbit)
  - 13188 - COS Side 2 Science Data Buffer Check/Self-Tests for CS Buffer RAM and DIB RAM (14 internal orbits)
  - 13189 - COS Side 2 NUV Detector Recovery After MEB Side Switch (2 internal orbits)
  - 13190 - COS Side 2 FUV Detector Recovery After MEB Side Switch (4 internal orbits)
  - 13191 - COS Side 2 NUV MAMA Fold Test (1 internal orbit)

- Science programs (7 Internal + 3 external)
  - 13192 - COS Side 2 Initial NUV Channel Checkout (1 external orbits, 1 internal orbit)
  - 13193 - COS Side 2 Initial FUV Checkout (2 external orbits, 1 internal orbit)
  - 13194 - COS Side 2 Internal NUV Wavelength Verification (2 internal orbits)
  - 13195 - COS Side 2 Internal FUV Wavelength Verification (3 internal orbits)

Total Cycle 29 Carry Over: 29 internal + 3 external orbits

FUV Monitors

COS FUV Wavelength Scale Monitor
PI: Will Fischer

Purpose	This program monitors the offset (zero-point) between the wavelength scale set by the internal wavecal versus that defined by absorption lines in external target AV 75 obtained through the PSA.
Description	This program monitors the zero-point offset between the internal and external wavelength scales. To verify and monitor this, the program takes spectra of AV 75 with the G130M/1096-1222-1291-1327, G160M/1577-1623, and G140L/1105-1280 cenwaves. Spectra are compared to convolved STIS spectra and those obtained with previous iterations of the program.
Fraction GO/GTO Programs Supported	93% of COS exposure time in Cycle 28.
Resources Required: Observations	3 external orbits
Resources Required: Analysis	4 FTE weeks
Products	Update of wavelength dispersion reference file, if necessary, and a summary ISR
Accuracy Goals	G140L 150 km/s, 9 pixels G130M 7.5 km/s, 3 pixels (G130M/1096 15 km/s, 6 pixels) G160M 7.5 km/s, 3 pixels
Scheduling & Special Requirements	Executes once per cycle. ORIENT is set to avoid bright field targets, so visibility is restricted. March (15 days): preferred window to maintain pattern of ~12 months between visits.
Changes from Cycle 28	G130M exposures will move to LP5 (except c1222 remaining at LP4 and c1096 remaining at LP2). G140L exposures will move to LP3. These changes require no adjustments in the Phase 2, since APT will select the correct LIFETIME-POS for each cenwave automatically.

NUV Monitors

COS NUV Detector Dark Monitor
PI: Dzhuliya Dashtamirova

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 are < 1800s. Dark rate trends can be viewed on the COS website at https://www.stsci.edu/hst/instrumentation/cos/performance/monitoring.
Fraction GO/GTO Programs Supported	7% of COS total exposure time in Cycle 28.
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 28	No changes.

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	99.9% of Cycle 28 target acquisitions use the NUV.
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 28	No changes.

COS NUV Spectroscopic Sensitivity Monitor
PI: Will Fischer

Purpose	Monitor sensitivity of NUV gratings to detect any change due to contamination or other causes. Track time dependence of the sensitivity with wavelength. The NUV gratings on COS have degraded at an overall steady rate since the start of on-orbit operations, with the bare-Aluminum gratings (G225M and G285M) degrading at a faster rate (~-3 and -11%/yr) than the MgF_2 coated gratings (G185M and G230L, ~0%/yr).
Description	This program obtains exposures with NUV gratings using external targets WD1057+719 (G230L) and G191B2B (G185M, G225M). The following modes are monitored: G230L/2635-2950, G185M/1786-1921-2010, and G225M/2186-2306-2410. Due to its rapidly declining sensitivity, G285M was removed from the monitoring in Cycle 26. These cenwaves constitute the reddest, middle, and bluest central wavelengths containing only first-order light, with the exception of G230L. TDS trends can be viewed on the COS website at https://www.stsci.edu/hst/instrumentation/cos/performance/sensitivity.
Fraction GO/GTO Programs Supported	7% of COS total exposure time in Cycle 28.
Resources Required: Observations	4 external orbits – 2 closely spaced visits of 1 orbit each, repeated ~6 months later.
Resources Required: Analysis	5 FTE weeks
Products	Time-Dependent Sensitivity Reference File and a summary ISR.
Accuracy Goals	Characterize evolution of TDS within 2% .
Scheduling & Special Requirements	Observe at 6 month intervals.
Changes from Cycle 28	No changes.

COS NUV Wavelength Scale Monitor
PI: Will Fischer

Purpose	This program monitors the offset (zero-point) between the wavelength scale set by the internal wavecal versus that defined by absorption lines in external target HD 6655 obtained through the PSA.
Description	This program monitors the zero-point offset between the internal and external wavelength scales. To verify and monitor this, the program takes spectra of HD 6655 with the G185M/2010, G225M/2217, and G230L/2635-2950-3000 cenwaves. Spectra are compared to convolved STIS spectra and those obtained with previous iterations of the program.
Fraction GO/GTO Programs Supported	7% of COS total exposure time in Cycle 28.
Resources Required: Observations	1 external orbit. Schedulability is set to 60% to fit all observations within the orbit.
Resources Required: Analysis	3 FTE weeks
Products	Update of wavelength dispersion reference file, if necessary, and a summary ISR
Accuracy Goals	G230L 175 km/s, 2.0-3.7 pixels G185M 15 km/s, 1.7-2.4 pixels G225M 15 km/s, 2.3-3.2 pixels
Scheduling & Special Requirements	Executes once per cycle. Star is in a crowded field, and all the stars have significant proper motion. Careful selection of guide stars is required. Aug/Sept (31 days): preferred window to maintain pattern of ~12 months between visits, acquire good GS pair
Changes from Cycle 28	No changes.

COS NUV Target Acquisition Monitor
PI: Serge Dieterich

Purpose	Monitor COS NUV Target Acquisition (TA) Parameters and Performance. Measure/monitor the WCA-to-PSA/BOA offsets used for imaging target acquisition, and WCA-to-PSA offsets for NUV spectroscopic TAs.
Description	There are 4 NUV ACQ/IMAGE mechanism combinations: 2 science apertures (SAs: PSA & BOA) x 2 mirror modes (MIRRORA & MIRRORB). During SMOV, the WCA-to-PSA+MIRRORA offset was determined by an aperture scan; the other WCA-to-SA offsets were bootstrapped from this offset. We verify the ACQ/IMAGE co-alignment in a similar manner. Three targets of different brightness are required to bootstrap across the pairings. All NUV spectroscopic WCA-PSA offsets, all WCA-SA imaging offsets, and co-alignment for all ACQ/IMAGE modes are monitored by this program. PSA spectra of the targets are obtained with all NUV gratings to track any changes in the spectroscopic WCA-to-PSA offsets as a function of time.
Fraction GO/GTO Programs Supported	99.9% of Cycle 28 target acquisitions use the NUV. Slightly less is predicted for Cycle 29.
Resources Required: Observations	3 external one-orbit visits. Each visit uses a target of different brightness to match the ACQ/IMAGE modes being verified.
Resources Required: Analysis	2 FTE weeks for analysis, and verifying WCA-to-SA offsets. Should changes be warranted to existing offsets, additional effort will be needed, as this requires changes to the COS flight software (FSW) or SIAF.
Products	Updated NUV imaging WCA-to-SA offsets, NUV Spectroscopic WCA-to-PSA offsets and summary ISR.
Accuracy Goals	Imaging WCA-to-SA offsets need to be known to better than 0.5 NUV pixels in both dispersion and cross-dispersion (XD). Spectroscopic WCA-to-PSA offsets to 0.5 XD and AD pixel.
Scheduling & Special Requirements	Executes annually (in the Fall). All three visits should execute within 30 days of each other.
Changes from Cycle 28	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	This is a contingency proposal and only activated in the event of an anomalous shutdown of the FUV detector.
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 28	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	This is a contingency proposal and only activated in the event of an anomalous shutdown of the NUV detector.
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 28	No changes.