Cycle 30 COS Calibration Plan
Fall Orbit Request for Changing Programs

September 2022
Elaine Frazer & Kate Rowlands
for the COS Team
Summary of the Cycle 30 Requests

For Cycle 30, the COS team will make changes to 4 of the FUV regular calibration programs and 2 FUV carryover programs to account for operations of G160M modes at LP6.

Due to the added tests and increased overheads at LP6, our Cycle 30 request requires 5 more external orbits, plus 4 more external contingency orbits than the Cycle 29 request.

Though Cycle 30 will span 14 months, we will keep our calibration programs on their regular 12 month cadence. We'll start our Cycle 31 programs 2 months early to compensate.

This Fall orbit request includes the following programs:

- COS FUV Spectroscopic Sensitivity Monitor
- COS FUV Change in Spectroscopic Sensitivity Trends
- COS FUV Target Acquisition Monitor
  - This program was approved for 3 external orbits in the Spring unchanging request, in which we decided that no additional monitoring of LP6 was needed because target acquisitions (TAs) were recently tested in our LP6 enabling program. However, we now request 1 additional orbit to repeat the enabling test for LP6 PEAKXD TAs due to anomalous results seen in our analysis.
- COS FUV Wavelength Scale Monitor
- COS Side 2 Initial FUV Checkout
- COS Side 2 Internal FUV Wavelength Verification
- COS FUV Detector Dark Monitor (not changing)
- COS FUV Detector Gain Maps (not changing)
- COS FUV Characterization of Modal Gain When Changing High Voltage (not changing)

The Spring orbit request included all NUV regular and NUV carryover programs.
# Summary of COS Calibration Orbits for Cycle 30 (Fall Request, Changing Programs)

<table>
<thead>
<tr>
<th>Title (PI)</th>
<th>External</th>
<th>Internal</th>
<th>Frequency (orbits x repeats)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FUV Monitors</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COS FUV Detector Dark Monitor (Johnson)</td>
<td></td>
<td>260</td>
<td>5x52</td>
</tr>
<tr>
<td>COS FUV Gain Maps (Sahnow)</td>
<td></td>
<td>8</td>
<td>4x2</td>
</tr>
<tr>
<td>COS FUV Spectroscopic Sensitivity Monitor (Rowlands)</td>
<td>34 [31]</td>
<td></td>
<td>2x6 + 2x6 + 2x5 [3x5 + 2x5 + 2x2 + 2x1]</td>
</tr>
<tr>
<td>COS FUV Target Acquisition Monitor (Dieterich)</td>
<td>+1 (total 4) [3]*</td>
<td>4x1 [3x1]</td>
<td></td>
</tr>
<tr>
<td>COS FUV Wavelength Scale Monitor (French)</td>
<td>4 [3]</td>
<td></td>
<td>4x1 [3x1]</td>
</tr>
<tr>
<td><strong>Contingency Programs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COS FUV Change in Spectroscopic Sensitivity Trends (Rowlands)</td>
<td>(32) [(28)]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COS FUV Characterization of Modal Gain When Changing High Voltage (Sahnow)</td>
<td></td>
<td>(2)</td>
<td></td>
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</tbody>
</table>

- Cycle 30 Fall Request: 39 + (32) [37 + (28)] 268 + (2)

() indicate contingency orbits  [] indicate # of orbits requested in Cycle 29  Red: Changes from Cycle 29

* 3 orbits were already allocated to this program in the Cycle 30 spring request
# Summary of COS Orbit Requested for Cycle 30

(Performances Remaining Unchanged since Cycle 29)

<table>
<thead>
<tr>
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<td><strong>FUV Monitors</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>COS FUV Target Acquisition Monitor (Dieterich)*</td>
<td>3</td>
<td></td>
<td>3x1</td>
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<td><strong>NUV Monitors</strong></td>
<td></td>
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<td></td>
<td>52</td>
<td>2x26</td>
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<tr>
<td>COS NUV MAMA Fold Distribution (Wheeler)</td>
<td></td>
<td>1</td>
<td>1x1</td>
</tr>
<tr>
<td>COS NUV Spectroscopic Sensitivity Monitor (W. Fischer)</td>
<td>4</td>
<td></td>
<td>2x2</td>
</tr>
<tr>
<td>COS NUV Wavelength Scale Monitor (French)</td>
<td>1</td>
<td></td>
<td>1x1</td>
</tr>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>COS FUV Detector Recovery After Anomalous Shutdown (Wheeler)</td>
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<td></td>
<td>(17)</td>
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<td></td>
<td>(4)</td>
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<td><strong>Cycle 30 Spring Request</strong></td>
<td></td>
<td></td>
<td>11</td>
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</tbody>
</table>

() indicate contingency orbits

* 3 orbits were allocated to this program in the Cycle 30 spring request, but we are now requesting one additional orbit to add a test for LP6 TAs, making it a changing program
## COS Cycle 30 Summary of Full Calibration Plan

<table>
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<tr>
<td>Cycle 30 Complete Request</td>
<td>50 + (32) [45 + (28)]</td>
<td>321 + (23)</td>
<td></td>
</tr>
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() indicate contingency orbits   [] indicate # of orbits requested in Cycle 29   Red: Changes from Cycle 29
COS Side 2 Programs Carried Over to Cycle 30

The side 2 programs are carried along each cycle’s calibration plan (keeping the same PID) so that the impact of any changes to operating conditions can be evaluated and modifications to the programs implemented as needed. These only execute in the event of a failure of the COS side 1 electronics.

Two FUV science programs will require changes:

- **PID 13193 - COS Side 2 Initial FUV Checkout (2 external orbits, 1 internal orbit)**
  - This program confirms the spectra are being placed on the detector where they should be and the commanded focus is the best focus
  - We are changing the target acquisition in Visit 02 that’s taken with the G130M/1291 mode from LP4 to LP5, and turning off segment B for the G130M/1327 exposures in Visit 02. This change requires no additional orbits.

- **PID 13195 - COS Side 2 Internal FUV Wavelength Verification (3 internal orbits)**
  - This program tests that the OSM1 coarse resolver goes to the proper location at blue modes and all FUV extreme central wavelength settings using the side-2 electronics, as well as the deuterium lamp #1 functionality on side-2
  - We are changing the exposures from LP1 to LP4, with the exception of the blue modes, which are moving from LP1 to LP2, as well as adding monitoring of the new extreme cenwaves, G140L/800 and G160M/1533. No extra orbits are needed.

The remaining side 2 programs require no changes 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)
  - 13194 - COS Side 2 Internal NUV Wavelength Verification (2 internal orbits)
FUV Monitors
## COS FUV Detector Dark Monitor
### PI: Christian Johnson

### 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 are < 1800s. Dark rate trends can be viewed on the [COS Website](#).

### Fraction GO/GTO Programs Supported
97% of COS exposure time in Cycle 29.

### 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 29
No changes. This was not included in the Spring request because at the time the home position was set to G130M/1222 at LP4, which has a different HV than where most observations (LP5 and later LP6) are (or will be) taken. Since then, we determined that LP6 will have the same starting HV as LP5, and coincidentally the home position was changed to G130M/1291 at LP5, thus removing the HV disparity for the darks versus most science exposures. The FUV dark program can now proceed using the home position and without any specific HV instructions.

9/2/22
### COS FUV Detector Gain Maps
**PI:** David Sahnow

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Obtain gain maps of the FUV detector periodically during the cycle. These data will be used to track the modal gain as a function of time.</th>
</tr>
</thead>
</table>
| **Description** | Use the deuterium lamp to illuminate the appropriate regions of the COS FUV detector every 6 months at the following locations:  
- LP5 G130M Standard Modes & LP6 G160M: Snapshot to monitor the change in gain every 6 months (2 orbits)  
- LP4 G160M and 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) |
| **Fraction GO/GTO Programs Supported** | 97% of COS exposure time in Cycle 29. |
| **Resources Required: Observations** | 8 internal orbits. |
| **Resources Required: Analysis** | 2 FTE weeks. Existing CCI / gain map procedures will be used to process these data as 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. |
| **Changes from Cycle 29** | No changes. Since the initial LP6 voltage will be the same as LP5 and the lamp would illuminate the same region on the detector, there is no need to add extra visits for LP6. |
## COS FUV Spectroscopic Sensitivity Monitor
**PI: Kate Rowlands**

| **Purpose** | Monitor the sensitivity of each FUV grating to detect any change due to contamination or other causes. The FUV gratings are the most heavily used modes on COS and have also experienced several changes in the time-dependent spectroscopic sensitivity since launch. These trends are grating, segment, and wavelength dependent. |
| **Description** | To track the TDS as a function of wavelength we obtain exposures of two standard stars (WD0308-565 and GD71) every 2 months with all FUV gratings. The monitoring sequence consists of three visits, for a total of 6 orbits. The first 2-orbit visit (GD71) covers the G130M/1096/FUVA, G160M/1533/FUVA, G160M/1577/FUVA, G160M/1611/FUVA and G160M/1623/FUVA modes. Another 2-orbit visit (WD0308-565) covers G130M/1222, G130M/1291, G130M/1327/FUVA, G130M/1055/FUVA, G140L/800, G140L/1105, and G140L/1280 modes. The last 2-orbit visit (WD0308-565) covers G160M/1533/FUVB, G160M/1577/FUVB, G160M/1611/FUVA, G160M/1623/FUVA at LP6, with two of these cenwaves at LP4, alternating between 1533 & 1577 and 1611 & 1623 each visit. The standard shortest and longest wavelength settings for each grating, the G130M “blue-modes” and 1291, and the two new cenwaves are covered in the program. TDS trends can be viewed on the [COS Website](https://cassini.gsfc.nasa.gov/). |
| **Fraction GO/GTO Programs Supported** | 97% of COS exposure time in Cycle 29. |
| **Resources Required: Observations** | 34 external orbits |
| **Resources Required: Analysis** | 6 FTE weeks |
| **Products** | Time-Dependent Sensitivity reference file as necessary, update to ETC throughputs, the COS monitoring webpages, and a summary ISR |
| **Accuracy Goals** | - SNR of 15 per resel at wavelength of least sensitivity for the standard modes, SNR of 25 per resel at wavelength of most sensitivity for the blue modes. For the blue modes, this will ensure S/N > 15 for l> 1030Å for 1096/FUVA, l>1130Å for 1055/FUVA and 1222/FUVB. SNR of 5 per resel in the short wavelength region for G140L/800, which yields SNR of 32 per 20 Å bin (used in the TDS analysis). - TDS calibration better than 2% relative and 5% absolute for standard modes and blue modes |
| **Scheduling & Special Requirements** | • Monitoring sequence should occur every 2 months starting in December 2022  
• The FUVA turn-off of the GD71 visit should be hidden in the GS-ACQ  
• GD71 is not visible from late April to early August 2022, resulting in a reduced monitoring sequence for the month of June (1 visit) |
| **Changes from Cycle 29** | • G160M monitoring moved from LP4 to LP6. Orbit count increased due to higher overheads at LP6  
• LP4-LP6 connection exposures every visit to check sensitivity changes between LPs, two G160M cenwaves per visit.  
• Split WD0308-565 visits into 2x2 orbits to ease scheduling, avoiding 4 orbit visits |
Overview of Changes – LP6 and LP4 TDS monitoring

• Move G160M observations to LP6 from LP4.
• Continue to monitor G160M at LP4 by taking regular LP4 to LP6 connection visits, alternating between cenwaves 1533+1577 and 1611+1623 in each bimonthly visit.
• These connections will allow us to track any changes between LP4 and LP6 with adequate cadence, while minimizing the number of additional orbits needed, and lifetime impact on the detector. Make sure if there is a divergence between LP4 and LP6 (e.g. due to detector or cenwave dependence of the TDS), LP4 flux calibration does not exceed our quoted specifications.
• Support a Cycle 30 GO program which requires LP4 TDS visits at the beginning, middle and end of the cycle to make sure they can track the LP4 flux calibration well enough to compare to their LP4 observations from a previous cycle. Additional support of ULLYSES which continues to observe with G160M at LP4.
Overview of Changes – LP6 and LP4 monitoring

• Split WD0308-565 visits into 2x2 orbits to ease scheduling, avoiding 4 orbit visits

Old visit structure (WD0308-565):

NUV ACQ/IMAGE
G130M/1055 BOTH LP2
G130M/1222 BOTH LP4
G130M/1291 BOTH LP5
G140L/1280 BOTH LP3
Dark (FUVA off)
NUV ACQ/IMAGE
G160M/1533B LP4
G160M/1577B LP4
G160M/1611B LP4
G160M/1623B LP4
Dark (FUVB off, FUVA on)
G140L/800A LP3
G140L/1105A LP3
G130M/1327A LP5

New visit structure (WD0308-565):

Visit A
NUV ACQ/IMAGE
G130M/1055 BOTH LP2
G130M/1222 BOTH LP4
G130M/1291 BOTH LP5
G140L/1280 BOTH LP3
Dark (FUVB off, FUVA on)
G140L/800A LP3
G140L/1105A LP3
G130M/1327A LP5

Visit B
NUV ACQ/IMAGE
G160M/1533B or G160M/1611B LP4
G160M/1577B or G160M/1623B LP4
G160M/1533B LP6
G160M/1577B LP6
G160M/1611B LP6
G160M/1623B LP6
Overview of Changes – LP6 and LP4 monitoring

• LP4 visits alternate between 1533 & 1577, and 1611 & 1623

Old visit structure (GD71):
NUV ACQ/IMAGE
G130M/1096B LP2
Dark (FUVB off, FUVA on)
G130M/1096A WAVE LP2
G160M/1533A LP4
G160M/1577A LP4
G160M/1611A LP4
G160M/1623A LP4

New visit structure (GD71):
NUV ACQ/IMAGE
G130M/1096B LP2
Dark (FUVB off, FUVA on)
G130M/1096A WAVE LP2
G160M/1533A LP6
G160M/1577A LP6
G160M/1611A LP6
G160M/1623A LP6
G160M/1533A or G160M/1611A LP4
G160M/1577A or G160M/1623A LP4
**COS FUV Wavelength Scale Monitor**  
**PI: David French**

<table>
<thead>
<tr>
<th><strong>Purpose</strong></th>
<th>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.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Fraction GO/GTO Programs Supported</strong></td>
<td>97% of COS exposure time in Cycle 29.</td>
</tr>
<tr>
<td><strong>Resources Required: Observations</strong></td>
<td>4 external orbits</td>
</tr>
<tr>
<td><strong>Resources Required: Analysis</strong></td>
<td>4 FTE weeks</td>
</tr>
<tr>
<td><strong>Products</strong></td>
<td>Update of wavelength dispersion reference file, if necessary, and a summary ISR</td>
</tr>
</tbody>
</table>
| **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 29** | G160M spectra are taken at both LP4 and LP6. This requires an additional orbit, bringing the total to 4. |
# COS FUV Target Acquisition Monitor

**PI:** Serge Dieterich

## Special Note
Most of this program was originally submitted and approved as an unchanging calibration program. The monitoring of FUV acquisitions at LP6 was originally not included because the LP6 enabling program (PID 16851) accomplished the same goal. Anomalous results from the LP6 TA enabling program (PID 16851 visit 3) now call for the close monitoring of FUV PEAKXD acquisitions. We are therefore adding one orbit to the original request for these tests. The full request is discussed here. Changes from the originally approved request are discussed in **bold**.

## Purpose
Monitor COS FUV ACQ/PEAKD and PEAKXD performance at LP4 and LP5, and ACQ/PEAKXD at LP6.

## Description
The FUV acquisition algorithms compute the centroiding of raw counts falling on the acquisition subarrays at several NUM-POS offsets, which cause the light from the target to be partially blocked by the aperture. In the cross dispersion (XD) direction, these offsets also cause the spectrum to move along the Y direction in the detector. Because there are detector effects such as gain sag and Y-walk, areas of the detector with non-uniform response, and asymmetric vignetting for the off-axis beam, it is desirable to monitor the FUV PEAKXD centering over multiple cycles to watch for unexpected changes and to compare the results at different LPs. All FUV gratings (G130M at LP5, G160M at LP4, G140L at LP4) are tested in PEAKXD. Grating G130M at LP5 is also tested in PEAKD to verify the NUV to FUV LP5 SIAF entries for the FUV acquisition subarrays in both AD and XD. The default NUM-POS is 3 for PEAKXD and 5 for PEAKD. G130M and G140L PEAKXD are also tested with NUM-POS=5. Any difference in centroiding of a point source in PEAKXD with NUM-POS=3 and NUM-POS=5 would most likely be indicative of disparate flux changes due to the PSF's asymmetry as it moves off-axis. Additionally, the LP6 target acquisition enabling test detected a slightly off-centered result for ACQ/PEAKXD, so we are repeating the same test here.

## Fraction GO/GTO Programs Supported
~10.4% of Cycle 29 target acquisitions used the FUV channel.

## Resources Required:
### Observations
4 external orbits. Three orbits were already allocated in the non-changing request. **One orbit is added for the LP6 ACQ/PEAKXD test.**

### Analysis
3 FTE weeks for analysis and documentation.

## Products
Summary ISR.

## Accuracy Goals
FUV Spectroscopic XD TAs are required to center the target to within ±0.3" (~ ±3 rows), with the goal of routine centering to ±0.1" (~ 1 row). Targets not centered to within 0.3" are subject to vignetting and loss of spectral resolution and flux calibration. Along-dispersion centering requirements are cenwave-specific, but the strictest requirement is ±0.106" for the G130M grating.

## Scheduling & Special Requirements
Executes annually. Visits 1 and 2 (original visits) should execute within ±30 days from Visit PB of NUV program (same target). Visit 3 should execute any time before mid-February.

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*9/2/22*
Overview of Changes

The additional orbit in this program will be a repeat of visit 3 of PID 16851 (COS LP6 FUV Target Acquisition Enabling and Verification), including using the same target, WDG-1. This visit uses “virtual targets” to execute offset acquisitions along the XD direction to test PEAKXD acquisitions at LP6. All ORIENT angles are allowed, but the PI must configure the offsets for the virtual targets once the ORIENT for the visit is known. Here we use the more thorough enabling test structure as opposed to the simpler yearly monitor structure because repeating the exact same test is key to determining if there has been any evolution of the anomaly.

The visit has the following format.

1. Acquiring the target in NUV ACQ/IMAGE
2. Taking a centered spectrum with grating/cenwave G160M/1577
3. Using POSTARG offsets at XD -1.6”, -0.8”, +0.8”, and +1.6” to simulate the positions that will be searched during FUV acquisition. These spectra will map all areas of the detector used in the acquisition and will be downlinked and provide detector diagnostics
4. Moving the telescope to virtual target locations at XD -0.7”, -0.3”, +0.3”, and +0.7”.
5. Re-acquiring the target from the offset location using FUV ACQ/PEAKXD.
6. Re-observe the spectrum (repeat step 2)

Comparison of 6 and 2 verify a successful acquisition procedure

We are only repeating the PEAKXD test in this monitor, because the other TA enabling test results (ACQ/SEARCH and ACQ/PEAKD) were as expected.
Contingency Programs
## COS FUV Change in Spectroscopic Sensitivity Trends

**PI: Kate Rowlands**

### Purpose

To supplement the COS FUV Spectroscopic Sensitivity Monitor that runs every 2 months in the event that TDS trends change rapidly. With the extra orbits in this program, the TDS trends will be observed monthly.

### Description

To track the TDS as a function of wavelength we obtain exposures of two standard stars (WD0308-565 and GD71) every 2 months with all FUV gratings. The monitoring sequence consists of three visits, for a total of 6 orbits. The 2-orbit visit (GD71) covers the G130M/1096/FUVB, G160M/1533/FUVA, G160M/1577/FUVA, G160M/1611/FUVA and G160M/1623/FUVA modes. One other 2-orbit visit (WD0308-565) covers G130M/1222, G130M/1291, G130M/1327/FUVA, G130M/1055/FUVA, G140L/800, G140L/1105, and G140L/1280 modes. The other 2-orbit visit (WD0308-565) covers G160M/1533/FUVB, G160M/1577/FUVB, G160M/1611/FUVB, G160M/1623/FUVB at LP6, with two of these cenwaves at LP4, alternating between 1533 & 1577 and 1611 & 1623 each visit.

### Fraction GO/GTO Programs Supported

97% of COS exposure time in Cycle 29.

### Resources Required: Observations

32 external orbits

### Resources Required: Analysis

6 FTE weeks

### Products

These data will be used along with the data obtained in the COS FUV Spectroscopic Sensitivity Monitor to create a new Time-Dependent Sensitivity reference file, update ETC throughputs, update the COS monitoring webpages, and write a summary ISR.

### Accuracy Goals

- SNR of 15 per resel at wavelength of least sensitivity for the standard modes, SNR of 25 per resel at wavelength of most sensitivity for the blue modes. For the blue modes, this will ensure S/N > 15 for λ > 1030 Å for 1096/FUVB, λ > 1130 Å for 1055/FUVA and 1222/FUVB. SNR of 5 per resel in the short wavelength region for G140L/800, which yields SNR of 32 per 20 Å bin (used in the TDS analysis).
- TDS calibration better than 2% for standard modes and 5% for blue modes

### Scheduling & Special Requirements

- This is a contingency proposal only activated in the event that TDS trends are seen to be changing rapidly
- The extra monitoring sequence should occur every 2 months starting in the month the program is activated and should be the alternate month of the standard COS FUV TDS program
- The FUVA turn-off of the GD71 visit should be hidden in the GS-ACQ
- GD71 is not visible from late April to early August 2022, resulting in a reduced monitoring sequence for the months of May and July (1 visit)

### Changes from Cycle 29

- G160M monitoring moved from LP4 to LP6. Orbit count increased due to higher overheads at LP6
- LP4-LP6 connection exposures every visit to check sensitivity changes between LPs, two G160M cenwaves per visit.
- Split WD0308-565 visits into 2x2 orbits to ease scheduling, avoiding 4 orbit visits

**9/2/22**
### Purpose
Obtain gain maps of the FUV detector before and after changes to the nominal high voltage levels. These data will be used to check that the expected modal gain is achieved for HV changes.

### Description
Up to two one-orbit contingency visits will be needed for each HV change made during Cycle 30. One will be taken immediately before the change using the current HV values, and one will be taken after at the new value. The team tries to coordinate HV changes close in time to the regular FUV gain map program visits, so only one visit of this contingency program may be necessary. The deuterium lamp will be used to illuminate the regions of the COS FUV detector currently in use.

The program includes inactive visits for each LP (LP2, LP3, LP4, and LP5/LP6). When it is determined that the HV of one LP needs changing, this structure allows the program to be “ready to go” at the right LP by just selecting the correct visit.

### Fraction GO/GTO Programs Supported
97% of COS exposure time in Cycle 29.

### Resources Required: Observations
2 internal orbits

### Resources Required: Analysis
1 FTE week. Existing CCI / gain map procedures will be used to process these data as part of normal gain monitoring.

### Products
Gain map files. These will be used to check that the expected modal gain is achieved after the HV has changed.

### Accuracy Goals
0.1 pulse height bin

### Scheduling & Special Requirements
This is a contingency proposal only activated immediately before and immediately after any HV change.

### Changes from Cycle 29
No changes. Since the initial LP6 voltage will be the same as LP5 and the lamp would illuminate the same region on the detector, there is no need to add extra visits for LP6.