ENGINEERING CHANGE ORDER

Center for Astrophysics & Space Astronomy
University of Colorado, Boulder

ECO No. **COS-049**
Date 5 January 2001
Sheet 1 **of** 6

Drawing Title	Drawing No.	Revision Letter Current	Revision Letter New	Special Distribution
OP-01	COS-01-0001	4	5	
				Stop Production Now
				❑ Yes
				❑ No

Description of change:

1. Replace Section 5.2.2 with the following text and tables.

5.2.2 Sub-arrays for Target Acquisition

Target Acquisition (TA) exposures are obtained in Time-tag mode. The sub-arrays specified below apply to isolated UV point sources. There is no need for Doppler correction during target acquisition. The science sub-arrays are the same for either the Primary Science Aperture (PSA) or Bright Object Aperture (BOA). Wavelength calibration spectra taken through the Wavelength Calibration Aperture (WCA) use different sub-arrays. The sub-arrays specified assume there are no hot spots or dead spots on the detector. If such features develop and need to be excluded from target acquisition, additional sub-arrays may need to be specified.

5.2.2.1 FUV TA Sub-arrays

Target acquisition with the COS FUV detector is in dispersed light only. The pixel coordinates specified are relevant to the initial FUV detector region used for science observations, and will need to be adjusted appropriately when fresh detector regions are used for detector lifetime purposes. The specified FUV sub-arrays assume FUV pixels that have spatial extents of 1 X (dispersion) pixel = 6 microns, and 1 Y (cross-dispersion) pixel = 23 microns. In

Reason for Change:	**Disposition/Effectivity**				
Updates to COS operations.	To Comply With ECO				
	Use As Is				
	Rework To ECO				
	Scrap And Rebuild				
	Record change Only				
	Other (See Above)				

Prepared By:	Jon Morse	Date	5 Jan 2001	CCB Required ❑Yes ❑No	❑Approved ❑Not Approved
Design Engr		Date			
Project Engr (EE)		Date		❑Class I ❑Class II	Immediate Incorporatic ❑Yes ❑
Project Engr (ME)		Date			
QA Mgr		Date		Completion	
Project Mgr		Date		Date	
Sponsor		Date			

general, the X (dispersion) dimension of the FUV sub-arrays, which are positioned to avoid geocoronal airglow lines, are not a power of 2.

The FUV sub-arrays on each segment for each grating will be used to isolate the most useful portions of the input spectrum for target acquisition. For G130M, the sub-arrays exclude the strongest geocoronal airglow lines, which could bias the target acquisition calculations. For G140L, the sub-arrays exclude large portions of the detector which are not illuminated by the science spectrum as well as geocoronal airglow lines. The bright FUV airglow lines that are to be avoided during target acquisition are Lyman α 1216Å, O I 1304Å, and O I 1356Å. The airglow lines will appear as bright, comparatively diffuse blobs because the airglow represents uniform emission that fills the aperture.

The FUV XDL stim pulses should not be included in the flux measurements for each dwell point in target acquisition, and, therefore, the stim pulses are not included in any TA sub-arrays. (It is recommended that the stim pulses be turned off during target acquisition exposures by setting the rate to 0 Hz.)

The FUV TA sub-arrays for the different phases of target acquisition follow.

Phase 2 – Calibrate aperture location

The wavelength calibration spectrum TA extraction sub-arrays are shown in Table 5.2-1.

Table 5.2-1: Phase 2 FUV Wave Cal TA Extraction Sub-arrays

Aperture/Grating	Central λ (Å)	Sub-array Sizes (pixels)	Pixel Coordinates of FUV Sub-array Vertices (segment specified)
WCA/G130M	1298	(14468 × 32) (14468 × 32)	Segment A, Sub-array 1: (958,612),(958,643),(15425,643),(15425,612) Segment B, Sub-array 1: (958,612),(958,643),(15425,643),(15425,612)
WCA/G130M	**1309**	(14468 × 32) (14468 × 32)	Segment A, Sub-array 1: (958,612),(958,643),(15425,643),(15425,612) Segment B, Sub-array 1: (958,612),(958,643),(15425,643),(15425,612)
WCA/G130M	1320	(14468 × 32) (14468 × 32)	Segment A, Sub-array 1: (958,612),(958,643),(15425,643),(15425,612) Segment B, Sub-array 1: (958,612),(958,643),(15425,643),(15425,612)
WCA/G160M	1586	(14468 × 32) (14468 × 32)	Segment A, Sub-array 1: (958,612),(958,643),(15425,643),(15425,612) Segment B, Sub-array 1: (958,612),(958,643),(15425,643),(15425,612)
WCA/G160M	**1600**	(14468 × 32) (14468 × 32)	Segment A, Sub-array 1: (958,612),(958,643),(15425,643),(15425,612) Segment B, Sub-array 1: (958,612),(958,643),(15425,643),(15425,612)
WCA/G160M	1614	(14468 × 32) (14468 × 32)	Segment A, Sub-array 1: (958,612),(958,643),(15425,643),(15425,612) Segment B, Sub-array 1: (958,612),(958,643),(15425,643),(15425,612)
WCA/G140L	1150	(14468 × 32)	Segment A, Sub-array 1: (958,612),(958,643),(15425,643),(15425,612)

			Segment B: (no sub-array)
WCA/G140L	**1230**	(14468 × 32)	Segment A, Sub-array 1: (958,612),(958,643),(15425,643),(15425,612) Segment B: (no sub-array)

Phases 3, 4, and 5 – Target Search (LTASRCH) and Peak-ups (LTAPKD, LTAPKXD)

The FUV science object TA extraction sub-arrays are given in Table 5.2-2.

Table 5.2-2: Phases 3, 4, 5 FUV Object TA Extraction Sub-arrays

Aperture/Grating	**Central λ (Å)**	**Sub-array Sizes (pixels)**	**Pixel Coordinates of FUV Sub-array Vertices (segment specified)**
PSA or BOA/G130M	1298	(8215 × 64) (4706 × 64) (6474 × 64) (7647 × 64)	Segment A, Sub-array 1: (958,481),(958,544),(9172,544),(9172,481) Segment A, Sub-array 2: (9520,481),(9520,544),(14225,544),(15425,481) Segment B, Sub-array 1: (958,481),(958,544),(7431,544),(7431,481) Segment B, Sub-array 2: (7779,481),(7779,544),(15425,544),(15425,481)
PSA or BOA/G130M	**1309**	(9415 × 64) (4706 × 64) (7674 × 64) (6447 × 64)	Segment A, Sub-array 1: (958,481),(958,544),(10372,544),(10372,481) Segment A, Sub-array 2: (10720,481),(10720,544),(15425,544),(15425,481) Segment B, Sub-array 1: (958,481),(958,544),(8631,544),(8631,481) Segment B, Sub-array 2: (8979,481),(8979,544),(15425,544),(15425,481)
PSA or BOA/G130M	1320	(10615 × 64) (3506 × 64) (7674 × 64) (5247 × 64)	Segment A, Sub-array 1: (958,481),(958,544),(11572,544),(11572,481) Segment A, Sub-array 2: (11920,481),(11920,544),(15425,544),(15425,481) Segment B, Sub-array 1: (2158,481),(2158,544),(9831,544),(9831,481) Segment B, Sub-array 2: (10179,481),(10179,544),(15425,544),(15425,481)
PSA or BOA/G160M	1586	(14468 × 64) (14468 × 64)	Segment A, Sub-array 1: (958,481),(958,544),(15425,544),(15425,481) Segment B, Sub-array 1: (958,481),(958,544),(15425,544),(15425,481)
PSA or BOA/G160M	**1600**	(14468 × 64) (14468 × 64)	Segment A, Sub-array 1: (958,481),(958,544),(15425,544),(15425,481) Segment B, Sub-array 1: (958,481),(958,544),(15425,544),(15425,481)
PSA or BOA/G160M	1614	(14468 × 64) (14468 × 64)	Segment A, Sub-array 1: (958,481),(958,544),(15425,544),(15425,481) Segment B, Sub-array 1: (958,481),(958,544),(15425,544),(15425,481)
PSA or BOA/G140L	1150	(11873 × 64) (688 × 64)	Segment A, Sub-array 1: (958,481),(958,544),(12830,544),(12830,481) Segment A, Sub-array 2: (13778,481),(13778,544),(14465,544),(14465,481) Segment B: (no sub-array)

PSA or BOA/G140L	**1230**	(12698 × 64) (961 × 64)	Segment A, Sub-array 1: (958,481),(958,544),(13655,544),(13655,481) Segment A, Sub-array 2: (14465,481),(14465,544),(15425,544),(15425,481) Segment B: (no sub-array)

5.2.2.2 NUV TA Sub-arrays

The sub-arrays specified below are for dispersed light target acquisition with the NUV detector. The NUV MAMA pixel sizes are 25 microns in X (cross-dispersion) and Y (dispersion). The spectral stripes run along the Y pixel direction on the NUV MAMA detector.

In general, the NUV sub-arrays to be used for target acquisition will depend on the spectral *stripe* being used, rather than by the wavelength setting. However, for G230L, the optimum stripe to use does depend on the wavelength being observed, and may be stripe A or B. (See Table 1.3-2 for the spectral coverage in each stripe for different G230L settings.) In order to avoid light from one stripe leaking into the sub-array of an adjacent stripe, the science spectral stripe sub-arrays generally will not be a power of 2 in cross-dispersion dimension. There are no appreciably bright airglow lines in the NUV portion of the spectrum.

The proposer will be responsible for specifying the NUV spectral stripe, hence TA extraction sub-array, to be used for the calibrate aperture and cross-dispersion peak-up phases. The default for all modes is to use stripe B (the middle stripe). The FSW uses a single cross-dispersion offset constant between the science stripe and the spectral calibration stripe. This offset constant will be set to that appropriate for stripe B; if stripe A or C is used, the target will be slightly misplaced in the cross-dispersion direction. While this misplacement will not appreciably affect the flux transmitted through the aperture or the wavelength calibration in the dispersion direction, the proposer should be made aware of it.

Phase 2 – Calibrate aperture location

The wavelength calibration spectrum TA extraction sub-arrays are shown in Table 5.2-3.

Table 5.2-3: Phase 2 NUV Wave Cal TA Extraction Sub-arrays

Aperture/Grating	Central λ (Å)	Sub-array Sizes (pixels)	Pixel Coordinates of NUV Sub-array Vertices (spectral stripe specified)
WCA/G185M	1700-2000	64 × 1024	Stripe A: (366,0),(366,1023),(429,1023),(429,0) **Stripe B: (255,0),(255,1023),(318,1023),(318,0)** Stripe C: (143,0),(143,1023),(206,1023),(206,0)
WCA/G225M	2000-2500	64 × 1024	Stripe A: (366,0),(366,1023),(429,1023),(429,0) **Stripe B: (255,0),(255,1023),(318,1023),(318,0)** Stripe C: (143,0),(143,1023),(206,1023),(206,0)
WCA/G285M	2500-3200	64 × 1024	Stripe A: (366,0),(366,1023),(429,1023),(429,0) **Stripe B: (255,0),(255,1023),(318,1023),(318,0)** Stripe C: (143,0),(143,1023),(206,1023),(206,0)
WCA/G230L	1700-3200	64 × 1024	Stripe A: (366,0),(366,1023),(429,1023),(429,0) **Stripe B: (255,0),(255,1023),(318,1023),(318,0)** Stripe C: (not used with G230L)

Phases 3 and 5 – Target Search (LTASRCH) and Dispersion Peakup (LTAPKD)

The total counts from all three stripes (G185M, G225M, G285M) can be used to maximize the photon counting statistics. For G230L, stripes A and B can be combined. Even if a particular setting (e.g., for G230L between 2000-2500 Å on stripe A) produces few or no counts on one of the stripes, we can foresee no problem using a large sub-array during these phases. The science TA extraction sub-arrays for the NUV detector for Phases 3 and 5 are specified in Table 5.2-4.

Table 5.2-4: Phases 3 and 5 NUV Object TA Extraction Sub-arrays

Aperture/Grating	Central λ (Å)	Sub-array Sizes (pixels)	Pixel Coordinates of NUV Sub-array Vertices (spectral stripe specified)
PSA or BOA/G185M	1700-2000	335 × 1024	Stripes A,B,C: (513,0),(513,1023),(847,1023),(847,0)
PSA or BOA/G225M	2000-2500	335 × 1024	Stripes A,B,C: (513,0),(513,1023),(847,1023),(847,0)
PSA or BOA/G285M	2500-3200	335 × 1024	Stripes A,B,C: (513,0),(513,1023),(847,1023),(847,0)
PSA or BOA/G230L	1700-3200	224 × 1024	Stripes A,B: (624,0),(624,1023),(847,1023),(847,0) Stripe C: (not used with G230L)

Phase 4 – Cross-dispersion Peakup (LTAPKXD)

The nominal centers of the science stripes are at X = 794, 680, and 566 for stripes A, B, and C, respectively. The proposer can choose which stripe with which to do the cross-dispersion peak-up, though this stripe should be the same one selected for the wavelength calibration stripe in Phase 2.

The pixel differences between the science and calibration stripes are +396, +393, and +391 pixels for stripes A, B, and C, respectively. Because the FSW only carries a single constant for the offset, the value of +393 pixels will be used and the COS Handbook should encourage proposers to use stripe B for cross-dispersion peak-up. If an alternate stripe is selected, the peak-up will be offset by +/- 2-3 pixels depending on which stripe (A or C) is selected. This 2-3 pixel offset corresponds to < +/- 0.09", so there should be little effect on the transmitted flux. Note that stripe C should not be used with G230L, because no first-order light is imaged onto stripe C with this grating. The science TA extraction sub-arrays for the NUV detector for Phase 4 are specified in Table 5.2-5.

Table 5.2-5: Phase 4 NUV Object TA Extraction Sub-arrays

Aperture/Grating	Central λ (Å)	Sub-array Sizes (pixels)	Pixel Coordinates of NUV Sub-array Vertices (spectral stripe specified)
PSA or BOA/G185M	1700-2000	51 × 1024	Stripe A: (769,0),(769,1023),(819,1023),(819,0) **Stripe B: (630,0),(630,1023),(680,1023),(680,0)** Stripe C: (541,0),(541,1023),(591,1023),(591,0)
PSA or BOA/G225M	2000-2500	51 × 1024	Stripe A: (769,0),(769,1023),(819,1023),(819,0) **Stripe B: (630,0),(630,1023),(680,1023),(680,0)** Stripe C: (541,0),(541,1023),(591,1023),(591,0)
PSA or BOA/G285M	2500-3200	51 × 1024	Stripe A: (769,0),(769,1023),(819,1023),(819,0) **Stripe B: (630,0),(630,1023),(680,1023),(680,0)** Stripe C: (541,0),(541,1023),(591,1023),(591,0)
PSA or BOA/G230L	1700-3200	51 × 1024	Stripe A: (769,0),(769,1023),(819,1023),(819,0) **Stripe B: (630,0),(630,1023),(680,1023),(680,0)** Stripe C: (not used with G230L)

5.2.2.3 NUV TA1 Imaging TA Sub-arrays

The sub-arrays specified below are for imaging target acquisition with the TA1 mirror and NUV detector. The sub-array in Table 5.2-6 is to be used for the "Calibrate Aperture Location" phase (LTAIMCAL) of the TA1 imaging target acquisition sequence. The sub-array size, which captures the spot produced by the wavelength calibration lamp, accounts for mechanism wobble, +/- 1 rotation (dispersion direction) step drift in the rotary mechanisms for both OSM1 (+/- 240 pixels) and OSM2 (+/- 49 pixels), plus some buffer in case the spot should appear near an extreme.

Table 5.2-6: TA1 Wave Cal TA Sub-array

Aperture/Mirror	λ Coverage (Å)	Sub-array Sizes (pixels)	Pixel Coordinates of NUV TA1 Sub-array Vertices
WCA/TA1	1700-3200	200 × 660	(186,141),(186,800),(385,800),(385,141)

Table 5.2-7 gives the sub-array needed for isolating the science target on the NUV detector during TA1 imaging target acquisition (LTAIMAGE). The size of this science target sub-array allows for mechanism wobble, +/- 1 rotation step drift in the rotary mechanisms for both OSM1 and OSM2, the field of view at the aperture (+/- 2 arcsecs = +/- 80 pixels), plus some buffer in case the target should appear near an extreme.

Table 5.2-7: TA1 Science TA Sub-array

Aperture/Mirror	λ Coverage (Å)	Sub-array Sizes (pixels)	Pixel Coordinates of NUV TA1 Sub-array Vertices
PSA or BOA/TA1	1700-3200	345 × 816	(506,123),(506,123),(849,938),(849,938)