



## 15451 - COS FUV Focus Sweep for G140L/800

Cycle: 25, Proposal Category: CAL/COS

(Calibration)

(Availability Mode: RESTRICTED)

### INVESTIGATORS

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### VISITS

<i>Visit</i>	<i>Targets used in Visit</i>	<i>Configurations used in Visit</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
01	(1) AZV75 NONE	COS COS/FUV COS/NUV	5	06-Mar-2018 14:11:46.0	yes

5 Total Orbits Used

### ABSTRACT

COS cenwave G140L/800 will place wavelengths from 800 to 1950 Å on segment A, with coverage about 300 Å blueward of G140L/1105, and it lacks the gap between segments that affects G140L/1280. It is optimized to reduce astigmatism in the region below 1100 Å, giving increased sensitivity at these wavelengths compared to 1280/B, due to the lower background. This program is designed to determine the best focus of the new cenwave at COS FUV Lifetime Position 4. We will check focus steps from -1000 to +1000 relative to the predicted best focus of -1087 (absolute

## Proposal 15451 (STScI Edit Number: 1, Created: Tuesday, March 6, 2018 2:11:49 PM EST) - Overview

steps of -2087 to -87), which was determined by extrapolation from the LP4 focuses for existing G140L cenwaves 1105 and 1280. We will increment the focus in steps of 200, or 100 near the center of the range, as is typical for focus sweeps. We will optimize the spectral resolution as well as the cross-dispersion width at short wavelengths, since a low cross-dispersion width below 1100 Å is intended to be a unique benefit of this mode. The target is AzV 75, as in previous G140L focus sweeps such as PID 14874. The exposure time at each step is 940 s in order to obtain sufficient S/N below 1100 Å. The throughput there is relatively low, but the new cenwave is intended to facilitate science in this range.

### **OBSERVING DESCRIPTION**

This program performs a focus sweep at LP4 with newly proposed G140L/800 cenwave. The new cenwave will be offered only for segment A. The target is AzV 75.

The program is designed as follows:

1. Perform an ACQ/SEARCH (to avoid past difficulties in acquiring this target) and ACQ/IMAGE to acquire target AzV 75. ORIENT constraints are set in order to keep bright field objects out of the PSA when the BOA is being used for acquisition.
2. Initialization exposure to set up the correct instrument mode for the focus sweep, G140L/1105 (the closest instrument mode to G140L/800). Segment B is off by default for G140L/1105 and will remain so for the rest of the exposures.
3. ALIGN/OSM exposure:
  - i. Move the focus to -1000 steps from the G140L/800 focus value ( $f=-1087$ , determined from extrapolation from all G140L focus values as a function of cenwave). The FOCUS value supplied here is \*relative\* to the absolute focus value of G140L/1105 ( $f=-413$ ). E.g.  $\text{FOCUS} = -1087 - 1000 - (-413) = -1674$ .
  - ii. Set OSMROT1=17, which is the OSM rotation position offset between c800 and c1105 ( $1615-1598=17$ ). This prevents it from defaulting to OSMROT1=0 when we change the focus values.
4. Take a spectrum with adequate counts between 900 and 1100Å.
5. Repeat steps 3 and 4, sweeping over focus values of -1000 to +1000 relative to G140L/800, in increments of 200 steps (apart from  $-400 < f < +200$  when the increments are 100 in size). This equates to  $\text{FOCUS}=-1674$  to +326.
6. Re-set the focus offset and OSMROT to 0 (this moves the focus back to the  $f=-413$ , the absolute position of G140L/1105).

The focus sweep ranging between +/-1000 relative to the estimated G140L/800 focus value is designed to cover a broad-enough region to determine the focus-curve minimum. We sample more finely down to -400 because analysis of existing cenwaves indicates that the cross-dispersion width at

the shortest wavelengths, an important consideration for this mode, will be minimized in this range.

The \*absolute\* focus positions covered by the sweep were verified: at LP4, G140L/1105 has a focus of -413, as determined from the flight software table. Extrapolating all G140L cenwave focus values down to 800A gives an estimated focus of -1087 for G140L/800. Sweeping from -1000 to +1000 around these central focus positions is within the allowed range.

The spectroscopic ETC calculation is for cenwave 1105 at the lowest available wavelength. The ETC shows a mild count-rate violation for G140L spectroscopy, but this star was used for the G140L focus sweep in Cycle 24 without incident. To determine the requisite exposure time at the wavelengths below 1100 A that will drive cenwave 800 science, we noted that program 12501 (PI McCandliss) obtained adequate counts for focusing at these wavelengths by exposing for 1056 s. Their target is 60% as bright as ours over the 900-1100 A range, and the sensitivity of this grating has declined by about 20% since the execution of that program. To obtain the same number of counts, we thus multiply  $1056 \text{ s} * 0.6 * 1.2 = 760 \text{ s}$ . Filling the orbits leads to exposures of 940 s.

Buffer times are set to 111 s. Observations of AzV 75 at cenwave 1105 in focus sweep program 14874 yielded between 14,000 and 15,000 counts per second. This implies  $1.55\text{e}6$  to  $1.67\text{e}6$  counts in 111 s, or 66 to 71% of the  $2.35\text{e}6$  counts that fill a buffer, which leaves an acceptable margin.

-----Notes on the above program design-----

Previous focus sweeps at new cenwaves that don't exist in APT were executed by defining the TEST row. Program 12501 and 12505 were executed using the TEST row where each time the TEST row was patched using the absolute value of the focus and rotations (STEP, RES1, RES2, FOCUS, CENTWAVE). This TEST row was then 'called' using the SQL comment qesilogsheet.minwave. Each test row patch was then followed by an FP-POS=ALL exposure. By doing this, TRANS would pad enough time to plan for the OSM move between FP-POS, thus giving enough time for the focus moves. However, in our program we are only taking data at a single FPPOS. This is constrained by the analysis. By doing this, we do not have enough time for the focus to move as TRANS only sees the 1105 FP-POS=3 exposures. As such, it does not plan for the right amount of time needed for the focus moves between the different exposures.

RES1 and RES2 are the resolver encoder positions against which the readback values are checked by the FSW. It should be noted that in the design presented here, there is no need to define the RES1 and RES2 values for each ALIGN/OSM because we are moving relative to the 1105 settings, and the readback resolver positions will not be checked against RES1 and RES2. Once executed, we will check the readback values obtained from the telemetry to check against the RES1 and RES2 values that we have supplied to Goddard for this new cenwave.

SPECIAL REQUESTS:

1. Please turn off calibration for the COS/FUV exposures.
2. Please disassociate all exposures.

SQL is used to meet the above requests. In case 1 qexposure.control\_id is modified. In case 2 qeassociation records are deleted. Please see G. Chapman/M. Reinhart.

Proposal 15451 - G140L\_800 focus (01) - COS FUV Focus Sweep for G140L/800

Tue Mar 06 19:11:49 GMT 2018

<b>Visit</b>	<p><b>Proposal 15451, G140L_800_focus (01), scheduling</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Scientific Instruments: COS, COS/FUV, COS/NUV</p> <p>Special Requirements: SCHED 30%; ORIENT 270D TO 60 D; ORIENT 160D TO 165 D; BETWEEN 31-JAN-2018:00:00:00 AND 31-MAR-2018:00:00:00</p> <p><i>Comments: Bypass calibration for the noted exposures. Disassociate the exposures (i.e. delete geassociations).</i></p>												
<b>Diagnostics</b>	<p>(G140L_800_focus (01)) Warning (Form): For the best data quality, it is strongly recommended that the maximum number of allowed FP-POS positions is used when observing at a given COS CENWAVE setting. See full description for details.</p>												
<b>Fixed Targets</b>	<table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th>Targ. Coord. Corrections</th> <th>Fluxes</th> <th>Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(1)</td> <td>AZV75</td> <td>RA: 00 50 32.3900 (12.6349583d) Dec: -72 52 36.50 (-72.87681d) Equinox: J2000</td> <td>Epoch of Position: 2000</td> <td>V=12.79</td> <td>Reference Frame: ICRS</td> </tr> </tbody> </table> <p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Category=STAR Description=[MAIN SEQUENCE O] Extended=NO</i></p>	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous	(1)	AZV75	RA: 00 50 32.3900 (12.6349583d) Dec: -72 52 36.50 (-72.87681d) Equinox: J2000	Epoch of Position: 2000	V=12.79	Reference Frame: ICRS
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous								
(1)	AZV75	RA: 00 50 32.3900 (12.6349583d) Dec: -72 52 36.50 (-72.87681d) Equinox: J2000	Epoch of Position: 2000	V=12.79	Reference Frame: ICRS								

Proposal 15451 - G140L 800 focus (01) - COS FUV Focus Sweep for G140L/800

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	ACQ/SEAR CH (COS.ta.104 7783)	(1) AZV75	COS/NUV, ACQ/SEARCH, BOA	MIRRORA	SCAN-SIZE=2; STEP-SIZE=1.767; CENTER=FLUX-W T			7.3 Secs (7.3 Secs) [==>]	[1]
2	ACQ/IMAG E (COS.ta.104 7793)	(1) AZV75	COS/NUV, ACQ/IMAGE, BOA	MIRRORA				15 Secs (15 Secs) [==>]	[1]
3	Initialize G1 40L/1105 at LP4 (COS.sp.104 9092)	(1) AZV75	COS/FUV, TIME-TAG, PSA	G140L 1105 A	FP-POS=3; BUFFER-TIME=10 00; WAVECAL=NO; FLASH=NO; LIFETIME-POS=L P4			0.1 Secs (0.1 Secs) [==>]	[1]
<i>Comments: Initializing G140L/1105 at nominal aperture and focus position. SQL is required to bypass calibration and to delete qeassociations.</i>									
4	Move to -10 00 relative t o 800 (=16 74 relative t o 1105 focus )	NONE	COS, ALIGN/OSM		OSMIROT=17; FOCUS=-1674			0 Secs (0 Secs) [==>]	[1]
5	800_f-1000 (COS.sp.104 9092)	(1) AZV75	COS/FUV, TIME-TAG, PSA	G140L 1105 A	FP-POS=3; BUFFER-TIME=11 1			940 Secs (940 Secs) [==>]	[1]
<i>Comments: SQL is required to bypass calibration and to delete qeassociations.</i>									
6	Move to -80 0 relative to 800 (=1474 relative to 1 105 focus)	NONE	COS, ALIGN/OSM		OSMIROT=17; FOCUS=-1474			0 Secs (0 Secs) [==>]	[1]
7	800_f-800 (COS.sp.104 9092)	(1) AZV75	COS/FUV, TIME-TAG, PSA	G140L 1105 A	FP-POS=3; BUFFER-TIME=11 1			940 Secs (940 Secs) [==>]	[1]
<i>Comments: SQL is required to bypass calibration and to delete qeassociations.</i>									
8	Move to -60 0 relative to 800 (=1274 relative to 1 105 focus)	NONE	COS, ALIGN/OSM		OSMIROT=17; FOCUS=-1274			0 Secs (0 Secs) [==>]	[1]
9	800_f-600 (COS.sp.104 9092)	(1) AZV75	COS/FUV, TIME-TAG, PSA	G140L 1105 A	FP-POS=3; BUFFER-TIME=11 1			940 Secs (940 Secs) [==>]	[2]
<i>Comments: SQL is required to bypass calibration and to delete qeassociations.</i>									
10	Move to -40 0 relative to 800 (=1074 relative to 1 105 focus)	NONE	COS, ALIGN/OSM		OSMIROT=17; FOCUS=-1074			0 Secs (0 Secs) [==>]	[2]

Exposures

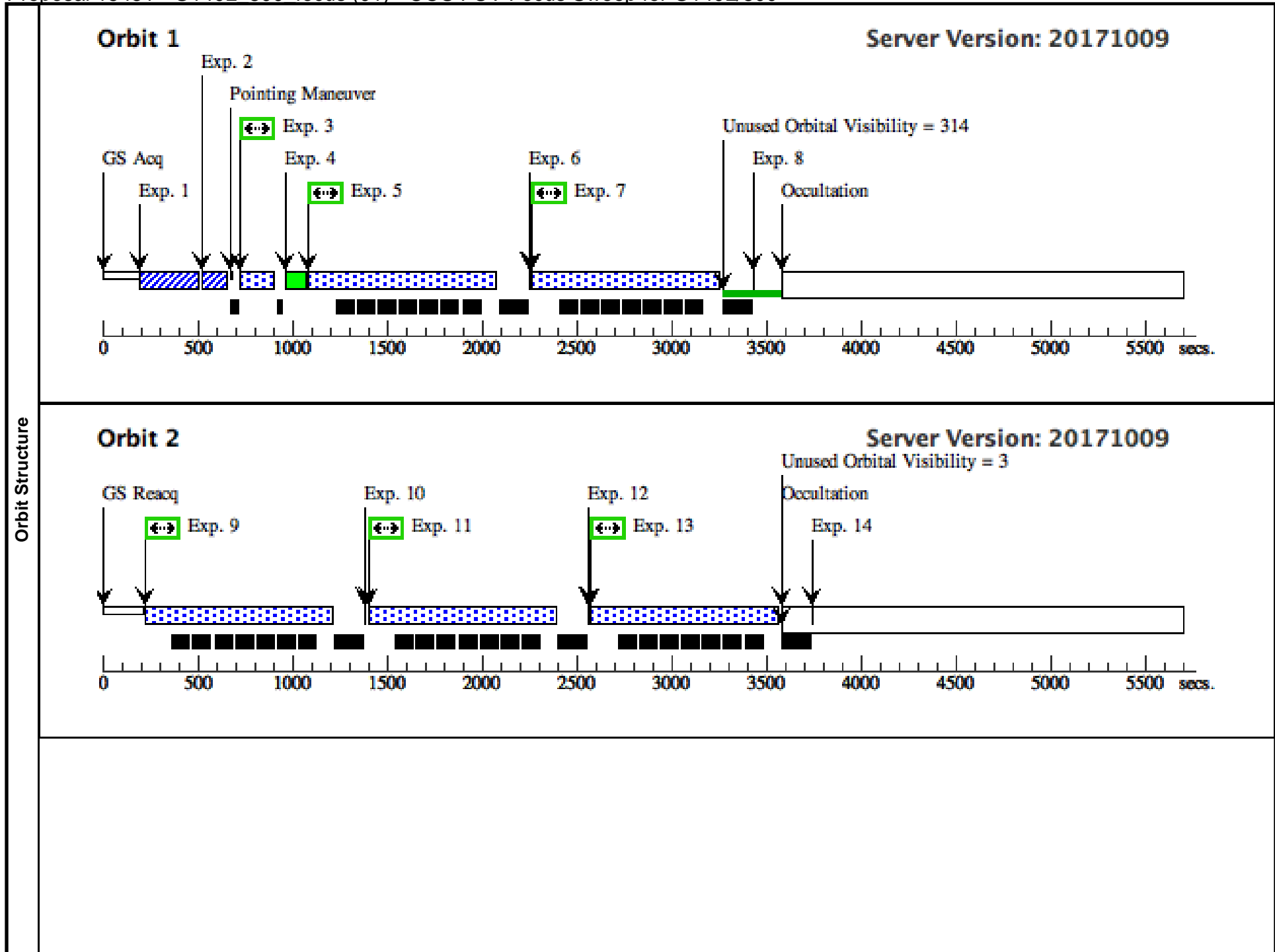
Proposal 15451 - G140L 800 focus (01) - COS FUV Focus Sweep for G140L/800

11	800_f-400 (COS.sp.104 9092)	(1) AZV75	COS/FUV, TIME-TAG, PSA	G140L 1105 A	FP-POS=3; BUFFER-TIME=11 1	940 Secs (940 Secs) [==>]	[2]
<i>Comments: SQL is required to bypass calibration and to delete qeassociations.</i>							
12	Move to -30 0 relative to 800 (= -974 r elative to 11 05 focus)	NONE	COS, ALIGN/OSM		OSMIROT=17; FOCUS=-974	0 Secs (0 Secs) [==>]	[2]
13	800_f-300 (COS.sp.104 9092)	(1) AZV75	COS/FUV, TIME-TAG, PSA	G140L 1105 A	FP-POS=3; BUFFER-TIME=11 1	940 Secs (940 Secs) [==>]	[2]
<i>Comments: SQL is required to bypass calibration and to delete qeassociations.</i>							
14	Move to -20 0 relative to 800 (= -874 r elative to 11 05 focus)	NONE	COS, ALIGN/OSM		OSMIROT=17; FOCUS=-874	0 Secs (0 Secs) [==>]	[2]
15	800_f-200 (COS.sp.104 9092)	(1) AZV75	COS/FUV, TIME-TAG, PSA	G140L 1105 A	FP-POS=3; BUFFER-TIME=11 1	940 Secs (940 Secs) [==>]	[3]
<i>Comments: SQL is required to bypass calibration and to delete qeassociations.</i>							
16	Move to -10 0 relative to 800 (= -774 r elative to 11 05 focus)	NONE	COS, ALIGN/OSM		OSMIROT=17; FOCUS=-774	0 Secs (0 Secs) [==>]	[3]
17	800_f-100 (COS.sp.104 9092)	(1) AZV75	COS/FUV, TIME-TAG, PSA	G140L 1105 A	FP-POS=3; BUFFER-TIME=11 1	940 Secs (940 Secs) [==>]	[3]
<i>Comments: SQL is required to bypass calibration and to delete qeassociations.</i>							
18	Move to 0 re lative to 800 (= -674 relati ve to 1105 f ocus)	NONE	COS, ALIGN/OSM		OSMIROT=17; FOCUS=-674	0 Secs (0 Secs) [==>]	[3]
19	800_f-0 (COS.sp.104 9092)	(1) AZV75	COS/FUV, TIME-TAG, PSA	G140L 1105 A	FP-POS=3; BUFFER-TIME=11 1	940 Secs (940 Secs) [==>]	[3]
<i>Comments: SQL is required to bypass calibration and to delete qeassociations.</i>							
20	Move to +10 0 relative to 800 (= -574 r elative to 11 05 focus)	NONE	COS, ALIGN/OSM		OSMIROT=17; FOCUS=-574	0 Secs (0 Secs) [==>]	[3]
21	800_f+100 (COS.sp.104 9092)	(1) AZV75	COS/FUV, TIME-TAG, PSA	G140L 1105 A	FP-POS=3; BUFFER-TIME=11 1	940 Secs (940 Secs) [==>]	[4]
<i>Comments: SQL is required to bypass calibration and to delete qeassociations.</i>							
22	Move to +20 0 relative to 800 (= -474 r elative to 11 05 focus)	NONE	COS, ALIGN/OSM		OSMIROT=17; FOCUS=-474	0 Secs (0 Secs) [==>]	[4]

Proposal 15451 - G140L 800 focus (01) - COS FUV Focus Sweep for G140L/800

23	800_f+200 (COS.sp.104 9092)	(1) AZV75	COS/FUV, TIME-TAG, PSA	G140L 1105 A	FP-POS=3; BUFFER-TIME=11 1	940 Secs (940 Secs) [==>]	[4]
<i>Comments: SQL is required to bypass calibration and to delete qeassociations.</i>							
24	Move to +40 0 relative to 800 (= -274 r relative to 11 05 focus)	NONE	COS, ALIGN/OSM		OSMIROT=17; FOCUS=-274	0 Secs (0 Secs) [==>]	[4]
25	800_f+400 (COS.sp.104 9092)	(1) AZV75	COS/FUV, TIME-TAG, PSA	G140L 1105 A	FP-POS=3; BUFFER-TIME=11 1	940 Secs (940 Secs) [==>]	[4]
<i>Comments: SQL is required to bypass calibration and to delete qeassociations.</i>							
26	Move to +60 0 relative to 800 (= -74 re lative to 110 5 focus)	NONE	COS, ALIGN/OSM		OSMIROT=17; FOCUS=-74	0 Secs (0 Secs) [==>]	[4]
27	800_f+600 (COS.sp.104 9092)	(1) AZV75	COS/FUV, TIME-TAG, PSA	G140L 1105 A	FP-POS=3; BUFFER-TIME=11 1	940 Secs (940 Secs) [==>]	[5]
<i>Comments: SQL is required to bypass calibration and to delete qeassociations.</i>							
28	Move to +80 0 relative to 800 (= +126 relative to 1 105 focus)	NONE	COS, ALIGN/OSM		OSMIROT=17; FOCUS=126	0 Secs (0 Secs) [==>]	[5]
29	800_f+800 (COS.sp.104 9092)	(1) AZV75	COS/FUV, TIME-TAG, PSA	G140L 1105 A	FP-POS=3; BUFFER-TIME=11 1	940 Secs (940 Secs) [==>]	[5]
<i>Comments: SQL is required to bypass calibration and to delete qeassociations.</i>							
30	Move to +10 00 relative t o 800 (= +32 6 relative to 1105 focus)	NONE	COS, ALIGN/OSM		OSMIROT=17; FOCUS=326	0 Secs (0 Secs) [==>]	[5]
31	800_f+1000 (COS.sp.104 9092)	(1) AZV75	COS/FUV, TIME-TAG, PSA	G140L 1105 A	FP-POS=3; BUFFER-TIME=11 1	940 Secs (940 Secs) [==>]	[5]
<i>Comments: SQL is required to bypass calibration and to delete qeassociations.</i>							
32	ALIGN/OS M back to 0 (relative to 1 105)	NONE	COS, ALIGN/OSM		OSMIROT=0; FOCUS=0	0 Secs (0 Secs) [==>]	[5]

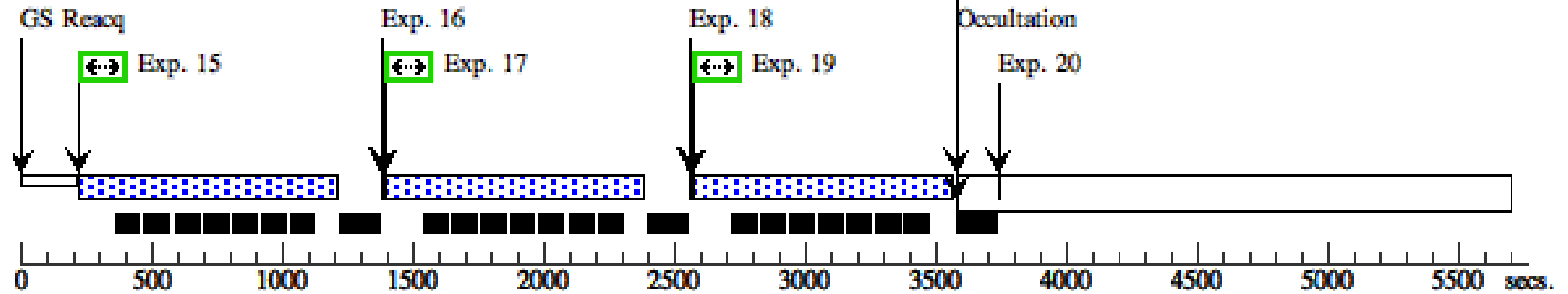




**Orbit 3**

Server Version: 20171009

Unused Orbital Visibility = 5



**Orbit 4**

Server Version: 20171009

Unused Orbital Visibility = 3

