



14604 - Connecting the shape of the FUV spectrum with disk morphology: a combined HST and ALMA study of young stellar objects in Lupus

Cycle: 24, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

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) V-MY-LUP	COS/FUV COS/NUV STIS/CCD STIS/NUV-MAMA	5	13-Jan-2017 21:01:39.0	yes
02	(2) CD-33-10685	COS/FUV COS/NUV STIS/CCD STIS/NUV-MAMA	5	13-Jan-2017 21:01:43.0	yes
03	(3) TYC-7851-810-1	COS/FUV COS/NUV STIS/CCD STIS/NUV-MAMA	5	13-Jan-2017 21:01:46.0	yes

15 Total Orbits Used

ABSTRACT

The physical properties of planets reflect the physical and chemical content of the disk in which they form. Direct resolved observations of disks, e.g., with ALMA, provide us with crucial information on the disk properties to verify planet formation theories. ALMA observations have now reached levels of detail that demand as much detail in the modeling. A major input for models to reproduce resolved ALMA observations of gas in disks, the shape and intensity of the FUV radiation impinging on the disk, is still poorly understood. We thus propose to observe the FUV spectrum of three almost unextincted and still accreting young stars surrounded by disks with different morphology, recently studied with our new high-resolution ALMA observations.

Our proposed observations aim at:

- 1) characterizing the FUV flux of young stars surrounded by disks detected with resolved observations both in dust (0.89mm) and gas (13CO, C18O, and CN) emission with ALMA,
- 2) studying the chemical properties of their disks to model their gas content, in particular including the FUV flux in the $\lambda < 1100$ AA region reachable only with HST, which is crucial for H₂ and CO photodissociation,
- 3) determining the relation between the shape of the observed FUV spectrum, in particular the molecular emission lines, with the disk morphology,
- 4) obtaining simultaneous coverage of the FUV and NUV spectrum to determine the physical origin and shape of the FUV excess above the disk accretion emission.

Finally, the FUV flux determined here will also be a crucial ingredient for disk evolution models, such as photoevaporation models, to test whether they can explain the observed morphology and properties of disks.

OBSERVING DESCRIPTION

Our observing strategy is driven by the aim to provide a good wavelength coverage for measuring continuum and Ly α fluxes. Specifically, we want to cover the wavelengths range from approx. 1000 AA up to 4000 AA, i.e., from the spectral region that drives CO and H₂ photodissociation up to the Balmer continuum and jump region, that provides a direct measure for the excess continuum caused by accretion. Another important requirement is the near-simultaneity of our observations in the various bands, as young stars are known to vary on timescales of about one day. Therefore, we plan an observing strategy that includes a mixture of near-simultaneous low and high resolution gratings: we will use three COS gratings, namely G140L (at 1280 AA, two orbits), G130M (at 1291 AA, one orbit) and G160 M (at 1577 AA, one orbit) as well as two STIS gratings (G230L and G430L in one orbit).

ORBIT 1: Spectral range 1700 - 5700 AA: we observe the NUV range with the G230L grating (MAMA detector). A short exposure (ca. 1min) with the STIS G430L grating to cover the Balmer jump is done before the G230L one.

ORBIT 2-3: Spectral range $\lambda < 1100$ AA: To measure the flux of the continuum we do not need high spectral resolution below 1100 AA, because contaminating H₂ lines are rarer than at longer wavelengths. Therefore, we can use the G140L grating centered at 1280 AA to cover this region (spectral resolution about 1 AA) as it provides the highest sensitivity. At these wavelengths, the background is expected to be relevant. Binning the spectrum to large bins (~ 1 AA) free of emission lines mitigates this effect. We only use FP-POS=1 and 2 to avoid the gap at short wavelength (~ 1140 and 1120 AA, respectively) as this wavelength range is crucial for our science case.

ORBIT 4-5: Spectral range 1200 to 1700 AA: In this region, a wealth of H₂ emission lines is present so that higher resolution of the M-mode gratings is necessarily required to disentangle continuum and emission lines. To provide a good sampling of the continuum in this region, we will use the G130M centered at 1291 AA and 1318 AA, and the G160M set to 1577 AA and 1611 AA for one orbit each. The reason to use two different central wavelengths is to have a complete wavelength coverage. Similarly, we will also determine the flux of the emission lines with high S/N. In particular, Ly α provides the majority of the FUV flux for CTTSs and the G130M spectrum also covers the Ly α emission line at sufficiently high spectral resolution to reconstruct the intrinsic Ly α flux using the method presented in Schindhelm et al. (2012, ApJ, 756, L23). This will allow us to determine the Ly α to continuum ratio for our target, which is an important parameter for disk chemistry modeling.

All observations for each target should be performed as close in time as possible, that is within one day at most. We think that all observations for each target can be fitted in one visit as we did for the mid- cycle 23 observation of RY Lup. If this turns out to be difficult to schedule, we can tolerate to separate the first orbit in a different visit with a maximum separation between the first and the end of the last exposure of one day, which we would implement through the WITHIN option.

Detector safety: Based on the RY Lup successful observations, and on the RU Lup available spectra, we have estimated that our exposure times will not harm the detectors in any setting. These stars have fainter V mags than RY Lup. The RY Lup data were well below instrument safety limits, and we have no reason to believe these stars will be brighter in any continuum range or gas emission lines.

BOT reports errors, because it misinterprets our targets as an OV star. Coordinates match exactly. Our targets are NOT and OV star.

Proposal 14604 - MYLup (01) - Connecting the shape of the FUV spectrum with disk morphology: a combined HST and ALMA study o...

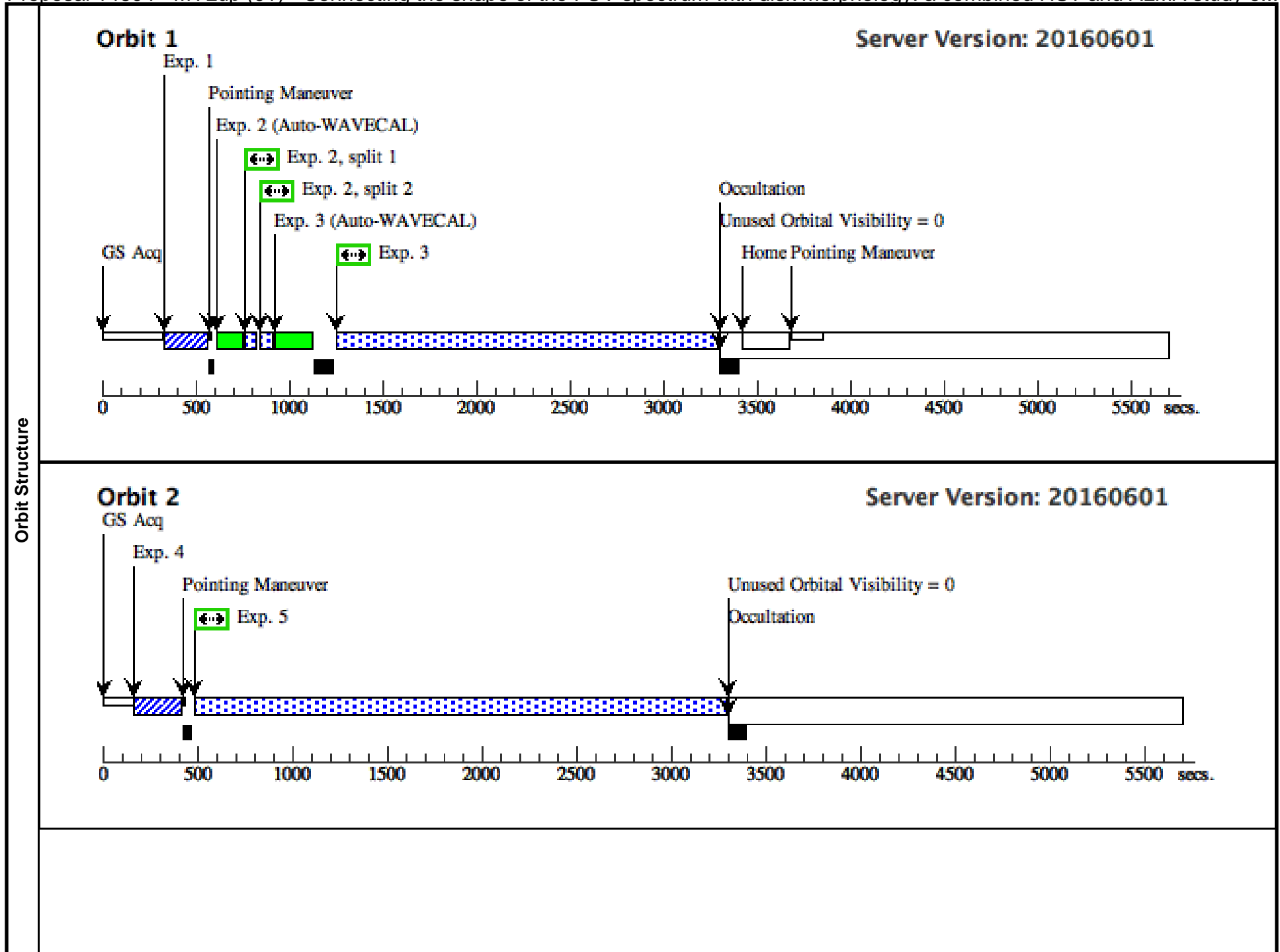
Visit	Proposal 14604, MYLup (01), implementation Sat Jan 14 02:01:47 GMT 2017 Diagnostic Status: Warning Scientific Instruments: STIS/NUV-MAMA, STIS/CCD, COS/FUV, COS/NUV Special Requirements: (none)																												
	Diagnosics (MYLup (01)) Warning (Form): For the best data quality, it is strongly recommended that all four FP-POS positions be used when observing at a given COS CENWAVE setting.																												
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Proposal 14604 - MYLup (01) - Connecting the shape of the FUV spectrum with disk morphology: a combined HST and ALMA study o...

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit	
Exposures	1	(STIS.ta.756 (1) V-MY-LUP 304)	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT			0.1 Secs (0.1 Secs) [==>]	[1]	
	<i>Comments: ETC is for the observed flux-calibrated optical spectrum for this target observed few months ago with VLT/X-Shooter</i>									
	2	(STIS.sp.75 (1) V-MY-LUP 6307)	STIS/CCD, ACCUM, 52X0.2	G430L 4300 A	CR-SPLIT=2			60 Secs (60 Secs) [==>(Split 1)] [==>(Split 2)]	[1]	
	<i>Comments: ETC is for the observed flux-calibrated optical spectrum for this target observed few months ago with VLT/X-Shooter</i>									
	3	(STIS.sp.75 (1) V-MY-LUP 6325)	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				2400 Secs (2027 Secs) [==>2027.0 Secs]	[1]	
	<i>Comments: This ETC run is done using the IUE spectrum of this target. This target is variable within a factor of 4 in V. We are a factor of ~15 below the brightness limit.</i>									
	4	(COS.ta.756 (1) V-MY-LUP 346)	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				10 Secs (10 Secs) [==>]	[2]	
	<i>Comments: This ETC run is done using the IUE and optical spectra of this target</i>									
	5	(COS.sp.756 (1) V-MY-LUP 926)	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=30 00; FP-POS=1			2450 Secs (2636 Secs) [==>2636.0 Secs]	[2]	
	<i>Comments: This ETC run is done using the STIS G140L spectrum of this target.</i>									
	6	(COS.sp.756 (1) V-MY-LUP 926)	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=30 00; FP-POS=2			2450 Secs (3021 Secs) [==>3021.0 Secs]	[3]	
	<i>Comments: This ETC run is done using the STIS G140L spectrum of this target.</i>									
7	(COS.sp.756 (1) V-MY-LUP 934)	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=10 00; FP-POS=1			658 Secs (620 Secs) [==>620.0 Secs]	[4]		
<i>Comments: This ETC run is done using the G140L spectrum of this target. We have removed the peak of the observed Lyalpha as this was due to girocoronal emission.</i>										
8	(COS.sp.756 (1) V-MY-LUP 934)	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=10 00; FP-POS=2			658 Secs (620 Secs) [==>620.0 Secs]	[4]		
<i>Comments: This ETC run is done using the G140L spectrum of this target. We have removed the peak of the observed Lyalpha as this was due to girocoronal emission.</i>										
9	(COS.sp.756 (1) V-MY-LUP 935)	COS/FUV, TIME-TAG, PSA	G130M 1318 A	BUFFER-TIME=10 00; FP-POS=3			658 Secs (620 Secs) [==>620.0 Secs]	[4]		
<i>Comments: This ETC run is done using the G140L spectrum of this target.</i>										
10	(COS.sp.756 (1) V-MY-LUP 935)	COS/FUV, TIME-TAG, PSA	G130M 1318 A	BUFFER-TIME=10 00; FP-POS=4			658 Secs (620 Secs) [==>620.0 Secs]	[4]		
<i>Comments: This ETC run is done using the G140L spectrum of this target.</i>										
11	(COS.sp.756 (1) V-MY-LUP 936)	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=30 00; FP-POS=1			650 Secs (648 Secs) [==>648.0 Secs]	[5]		
<i>Comments: This ETC run is done using the G140L spectrum of this target.</i>										
12	(COS.sp.756 (1) V-MY-LUP 936)	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=30 00; FP-POS=2			650 Secs (648 Secs) [==>648.0 Secs]	[5]		
<i>Comments: This ETC run is done using the G140L spectrum of this target.</i>										

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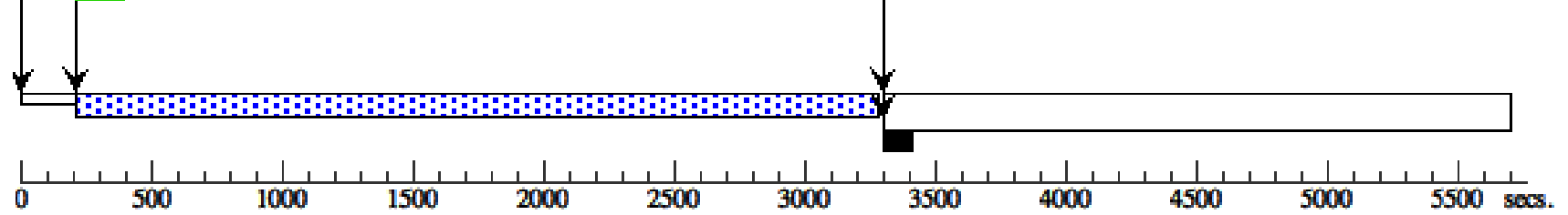
13	(COS.sp.756 (1) V-MY-LUP 937)	COS/FUV, TIME-TAG, PSA	G160M 1611 A	BUFFER-TIME=30 00; FP-POS=3	650 Secs (648 Secs)	
					[==>648.0 Secs]	[5]
<i>Comments: This ETC run is done using the G140L spectrum of this target.</i>						
14	(COS.sp.756 (1) V-MY-LUP 937)	COS/FUV, TIME-TAG, PSA	G160M 1611 A	BUFFER-TIME=30 00; FP-POS=4	650 Secs (648 Secs)	
					[==>648.0 Secs]	[5]
<i>Comments: This ETC run is done using the G140L spectrum of this target.</i>						



Orbit 3

GS Reacq

Exp. 6



Orbit 4

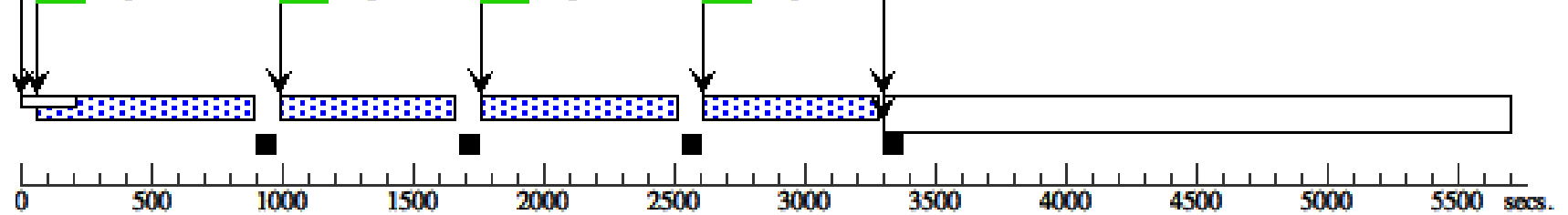
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Exp. 7

Exp. 8

Exp. 9

Exp. 10



Orbit 5

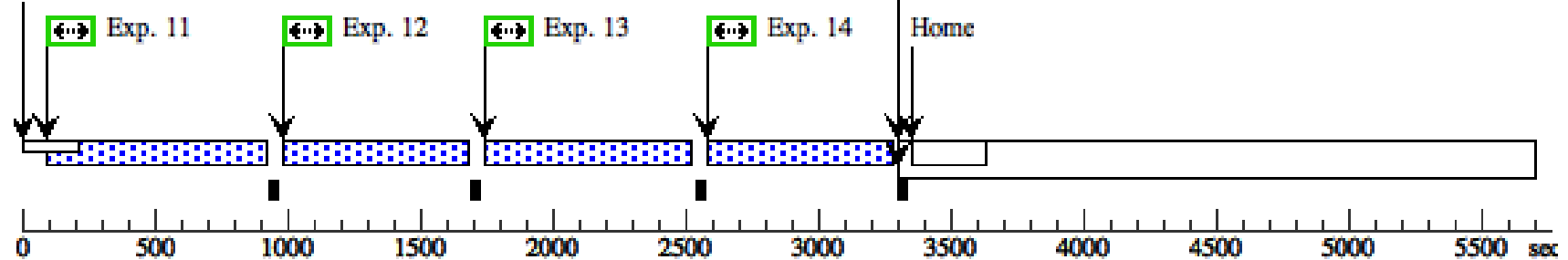
GS Reacq

Exp. 11

Exp. 12

Exp. 13

Exp. 14



Proposal 14604 - Sz68 (02) - Connecting the shape of the FUV spectrum with disk morphology: a combined HST and ALMA study of y...

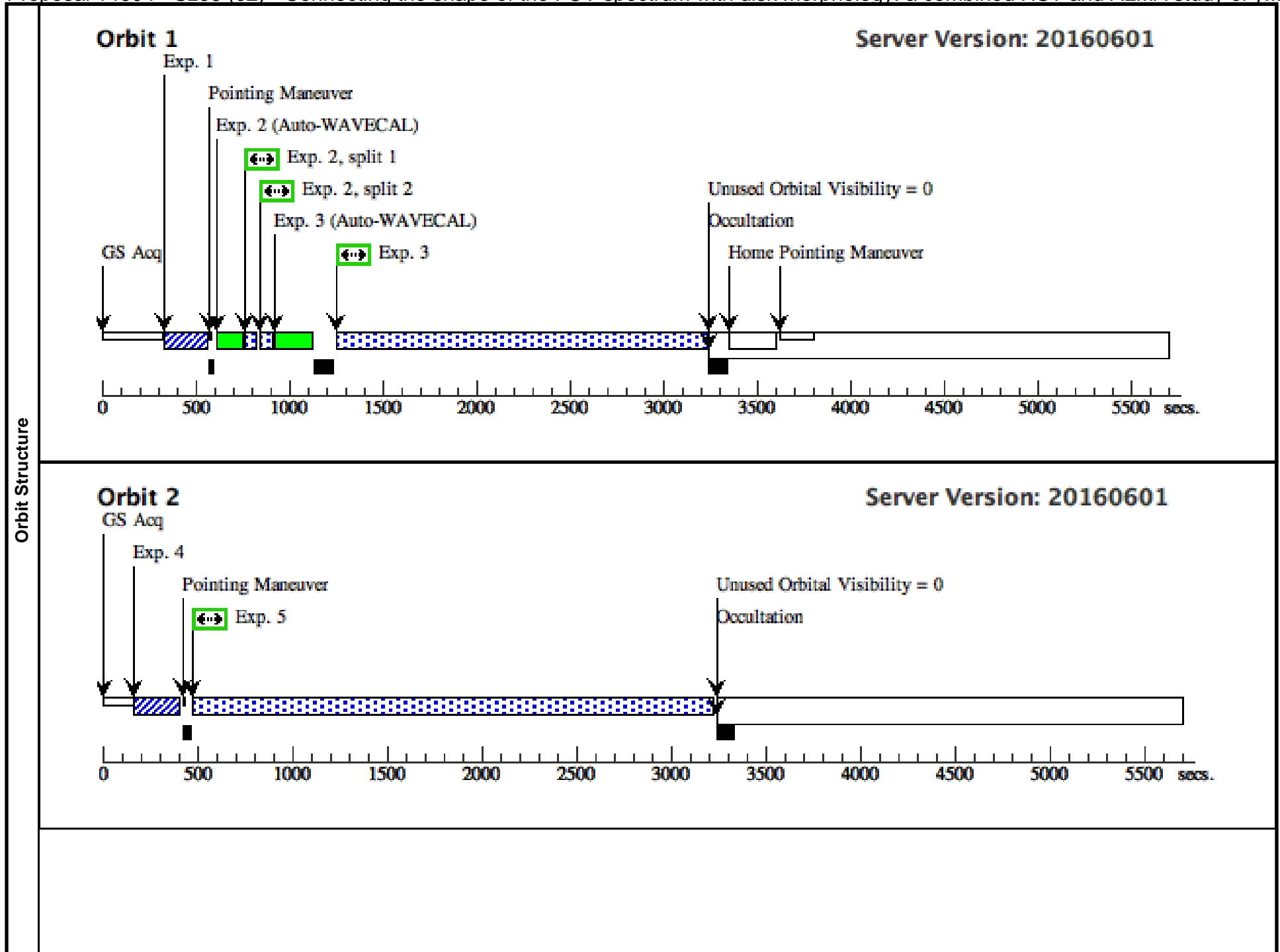
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Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit	
	1	(STIS.ta.756 304)	(2) CD-33-10685	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT			0.1 Secs (0.1 Secs)		
									[==>]	[1]	
	<i>Comments: ETC is for the observed flux-calibrated optical spectrum for this target observed few months ago with VLT/X-Shooter</i>										
	2	(STIS.sp.75 6307)	(2) CD-33-10685	STIS/CCD, ACCUM, 52X0.2	G430L 4300 A	CR-SPLIT=2			60 Secs (60 Secs)		
									[==>(Split 1)]	[1]	
									[==>(Split 2)]		
	<i>Comments: ETC is for the observed flux-calibrated optical spectrum for this target observed few months ago with VLT/X-Shooter</i>										
	3	(STIS.sp.75 6325)	(2) CD-33-10685	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				2400 Secs (1965 Secs)		
									[==>1965.0 Secs]	[1]	
	<i>Comments: This ETC run is done using the IUE spectrum of this target. This target is variable within a factor of 4 in V. We are a factor of ~15 below the brightness limit.</i>										
	4	(COS.ta.756 346)	(2) CD-33-10685	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				8 Secs (8 Secs)		
								[==>]	[2]		
<i>Comments: This ETC run is done using the IUE and optical spectra of this target</i>											
5	(COS.sp.756 926)	(2) CD-33-10685	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=30 00; FP-POS=1			2450 Secs (2578 Secs)			
								[==>2578.0 Secs]	[2]		
<i>Comments: This ETC run is done using the STIS G140L spectrum of this target.</i>											
6	(COS.sp.756 926)	(2) CD-33-10685	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=30 00; FP-POS=2			2450 Secs (2959 Secs)			
								[==>2959.0 Secs]	[3]		
<i>Comments: This ETC run is done using the STIS G140L spectrum of this target.</i>											
7	(COS.sp.756 934)	(2) CD-33-10685	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=10 00; FP-POS=1			658 Secs (605 Secs)			
								[==>605.0 Secs]	[4]		
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10	(COS.sp.756 935)	(2) CD-33-10685	COS/FUV, TIME-TAG, PSA	G130M 1318 A	BUFFER-TIME=10 00; FP-POS=4			658 Secs (604 Secs)			
								[==>604.0 Secs]	[4]		
<i>Comments: This ETC run is done using the G140L spectrum of this target.</i>											
11	(COS.sp.756 936)	(2) CD-33-10685	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=30 00; FP-POS=1			650 Secs (633 Secs)			
								[==>633.0 Secs]	[5]		
<i>Comments: This ETC run is done using the G140L spectrum of this target.</i>											
12	(COS.sp.756 936)	(2) CD-33-10685	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=30 00; FP-POS=2			650 Secs (633 Secs)			
								[==>633.0 Secs]	[5]		
<i>Comments: This ETC run is done using the G140L spectrum of this target.</i>											

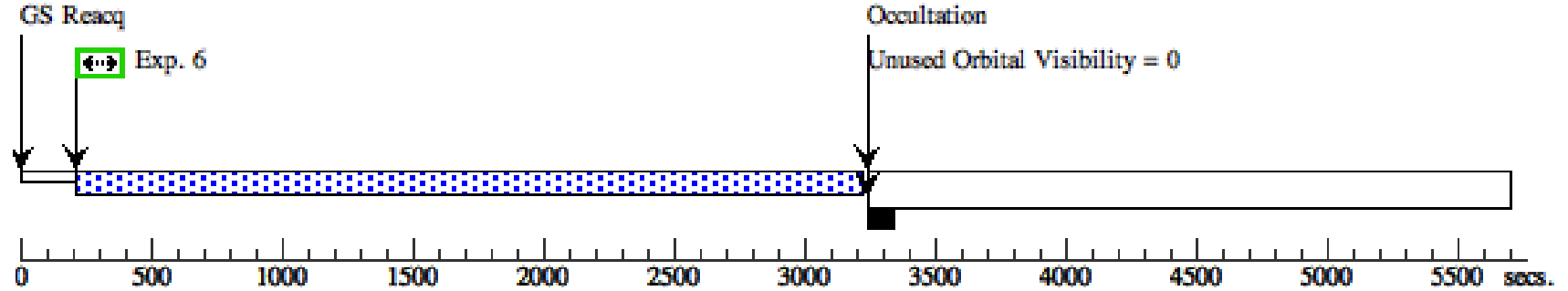
Proposal 14604 - Sz68 (02) - Connecting the shape of the FUV spectrum with disk morphology: a combined HST and ALMA study of y...

13	(COS.sp.756 (2) CD-33-10685 937)	COS/FUV, TIME-TAG, PSA	G160M 1611 A	BUFFER-TIME=30 00; FP-POS=3	650 Secs (633 Secs)	
					[==>633.0 Secs]	[5]
<i>Comments: This ETC run is done using the G140L spectrum of this target.</i>						
14	(COS.sp.756 (2) CD-33-10685 937)	COS/FUV, TIME-TAG, PSA	G160M 1611 A	BUFFER-TIME=30 00; FP-POS=4	650 Secs (634 Secs)	
					[==>634.0 Secs]	[5]
<i>Comments: This ETC run is done using the G140L spectrum of this target.</i>						



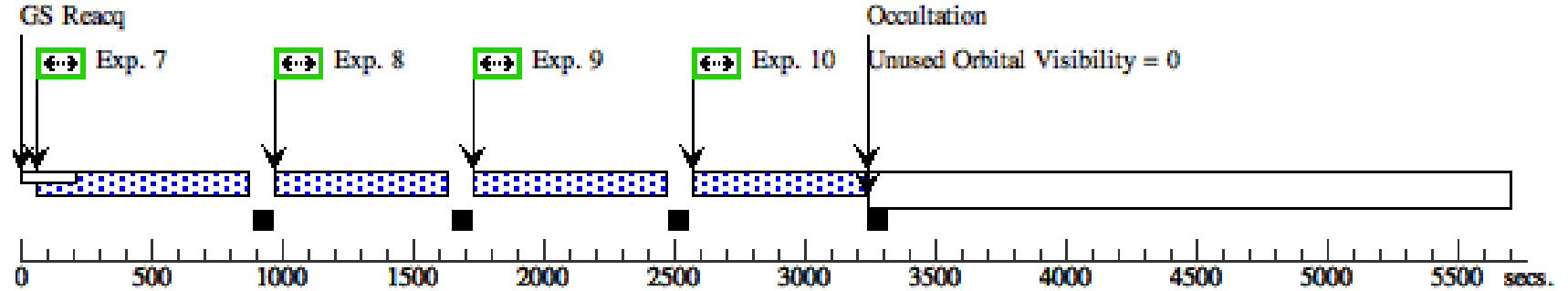
Orbit 3

Server Version: 20160601



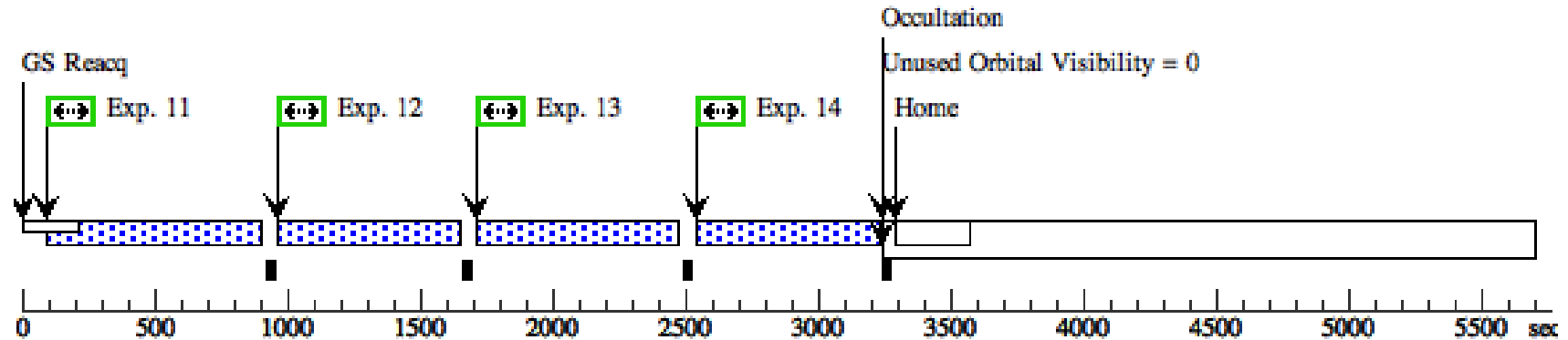
Orbit 4

Server Version: 20160601



Orbit 5

Server Version: 20160601



Proposal 14604 - J160830.7-382827 (03) - Connecting the shape of the FUV spectrum with disk morphology: a combined HST and A...

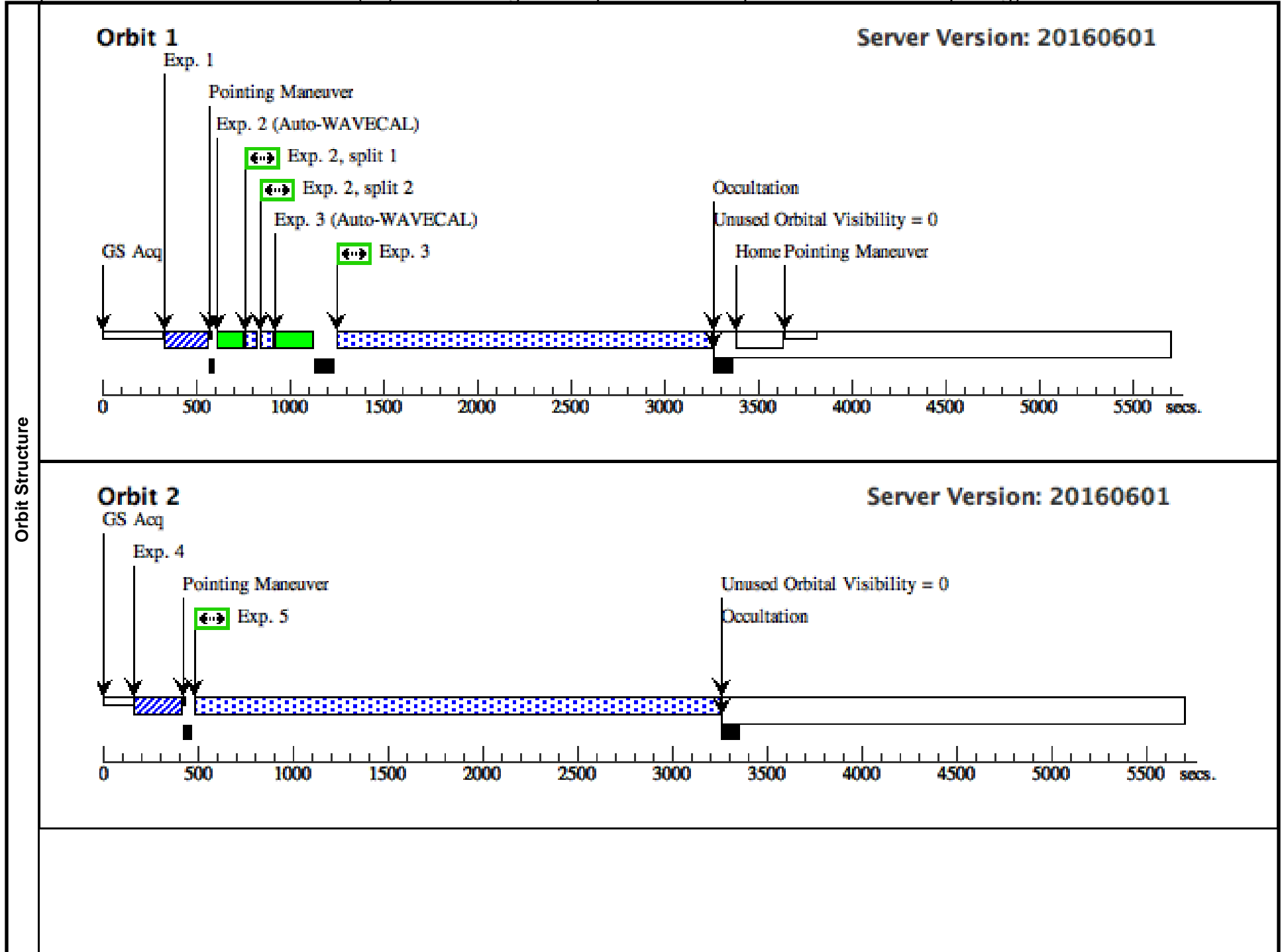
Visit	Proposal 14604, J160830.7-382827 (03), implementation Sat Jan 14 02:01:47 GMT 2017 Diagnostic Status: Warning Scientific Instruments: STIS/NUV-MAMA, STIS/CCD, COS/FUV, COS/NUV Special Requirements: (none)																						
	(J160830.7-382827 (03)) Warning (Form): For the best data quality, it is strongly recommended that all four FP-POS positions be used when observing at a given COS CENWAVE setting.																						
Fixed Targets	<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>(3)</td> <td>TYC-7851-810-1</td> <td>RA: 16 08 30.6940 (242.1278917d)</td> <td>Epoch of Position: 2016</td> <td>V=11.15</td> <td>Reference Frame: ICRS</td> </tr> <tr> <td></td> <td>Alt Name1: J160830.7-382827</td> <td>Dec: -38 28 27.27 (-38.47424d) Equinox: J2000</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>					#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous	(3)	TYC-7851-810-1	RA: 16 08 30.6940 (242.1278917d)	Epoch of Position: 2016	V=11.15	Reference Frame: ICRS		Alt Name1: J160830.7-382827	Dec: -38 28 27.27 (-38.47424d) Equinox: J2000			
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Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Coordinates are adjusted for 2016 using proper motion information from Tycho-2. Extended=NO																							

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Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit	
	1	(STIS.ta.756 304)	(3) TYC-7851-810-1	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT			0.1 Secs (0.1 Secs)		
									[==>]	[1]	
	<i>Comments: ETC is for the observed flux-calibrated optical spectrum for this target observed few months ago with VLT/X-Shooter</i>										
	2	(STIS.sp.75 6307)	(3) TYC-7851-810-1	STIS/CCD, ACCUM, 52X0.2	G430L 4300 A	CR-SPLIT=2			60 Secs (60 Secs)		
									[==>(Split 1)]	[1]	
									[==>(Split 2)]		
	<i>Comments: ETC is for the observed flux-calibrated optical spectrum for this target observed few months ago with VLT/X-Shooter</i>										
	3	(STIS.sp.75 6325)	(3) TYC-7851-810-1	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				2400 Secs (1987 Secs)		
									[==>1987.0 Secs]	[1]	
	<i>Comments: This ETC run is done using the IUE spectrum of this target. This target is variable within a factor of 4 in V. We are a factor of ~15 below the brightness limit.</i>										
	4	(COS.ta.756 346)	(3) TYC-7851-810-1	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				10 Secs (10 Secs)		
								[==>]	[2]		
<i>Comments: This ETC run is done using the IUE and optical spectra of this target</i>											
5	(COS.sp.756 926)	(3) TYC-7851-810-1	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=30 00; FP-POS=1			2450 Secs (2596 Secs)			
								[==>2596.0 Secs]	[2]		
<i>Comments: This ETC run is done using the STIS G140L spectrum of this target.</i>											
6	(COS.sp.756 926)	(3) TYC-7851-810-1	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=30 00; FP-POS=2			2450 Secs (2981 Secs)			
								[==>2981.0 Secs]	[3]		
<i>Comments: This ETC run is done using the STIS G140L spectrum of this target.</i>											
7	(COS.sp.756 934)	(3) TYC-7851-810-1	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=10 00; FP-POS=1			658 Secs (610 Secs)			
								[==>610.0 Secs]	[4]		
<i>Comments: This ETC run is done using the G140L spectrum of this target. We have removed the peak of the observed Lyalpha as this was due to girocoronal emission.</i>											
8	(COS.sp.756 934)	(3) TYC-7851-810-1	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=10 00; FP-POS=2			658 Secs (610 Secs)			
								[==>610.0 Secs]	[4]		
<i>Comments: This ETC run is done using the G140L spectrum of this target. We have removed the peak of the observed Lyalpha as this was due to girocoronal emission.</i>											
9	(COS.sp.756 935)	(3) TYC-7851-810-1	COS/FUV, TIME-TAG, PSA	G130M 1318 A	BUFFER-TIME=10 00; FP-POS=3			658 Secs (610 Secs)			
								[==>610.0 Secs]	[4]		
<i>Comments: This ETC run is done using the G140L spectrum of this target.</i>											
10	(COS.sp.756 935)	(3) TYC-7851-810-1	COS/FUV, TIME-TAG, PSA	G130M 1318 A	BUFFER-TIME=10 00; FP-POS=4			658 Secs (611 Secs)			
								[==>611.0 Secs]	[4]		
<i>Comments: This ETC run is done using the G140L spectrum of this target.</i>											
11	(COS.sp.756 936)	(3) TYC-7851-810-1	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=30 00; FP-POS=1			650 Secs (639 Secs)			
								[==>639.0 Secs]	[5]		
<i>Comments: This ETC run is done using the G140L spectrum of this target.</i>											
12	(COS.sp.756 936)	(3) TYC-7851-810-1	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=30 00; FP-POS=2			650 Secs (639 Secs)			
								[==>639.0 Secs]	[5]		
<i>Comments: This ETC run is done using the G140L spectrum of this target.</i>											

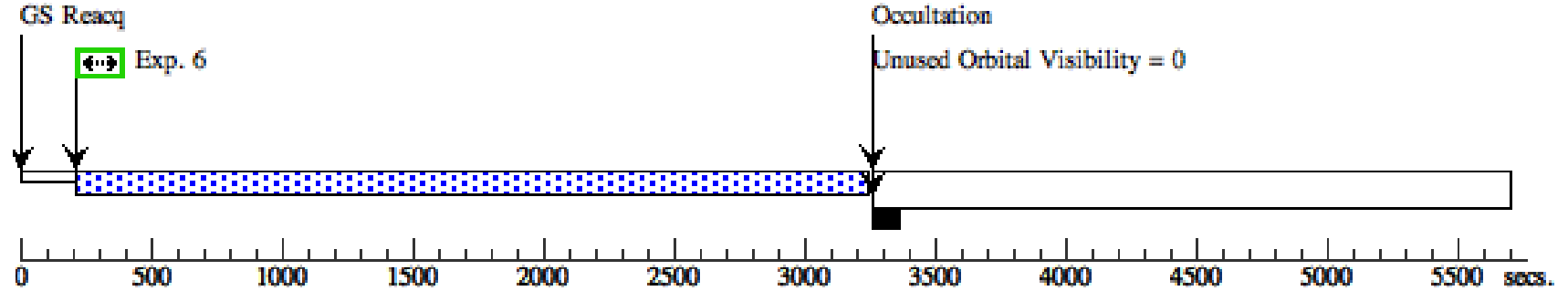
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13	(COS.sp.756 (3) TYC-7851-810-1 937)	G160M 1611 A	BUFFER-TIME=30 00; FP-POS=3	650 Secs (639 Secs)	
<i>Comments: This ETC run is done using the G140L spectrum of this target.</i>				[==>639.0 Secs]	[5]
14	(COS.sp.756 (3) TYC-7851-810-1 937)	G160M 1611 A	BUFFER-TIME=30 00; FP-POS=4	650 Secs (638 Secs)	
<i>Comments: This ETC run is done using the G140L spectrum of this target.</i>				[==>638.0 Secs]	[5]



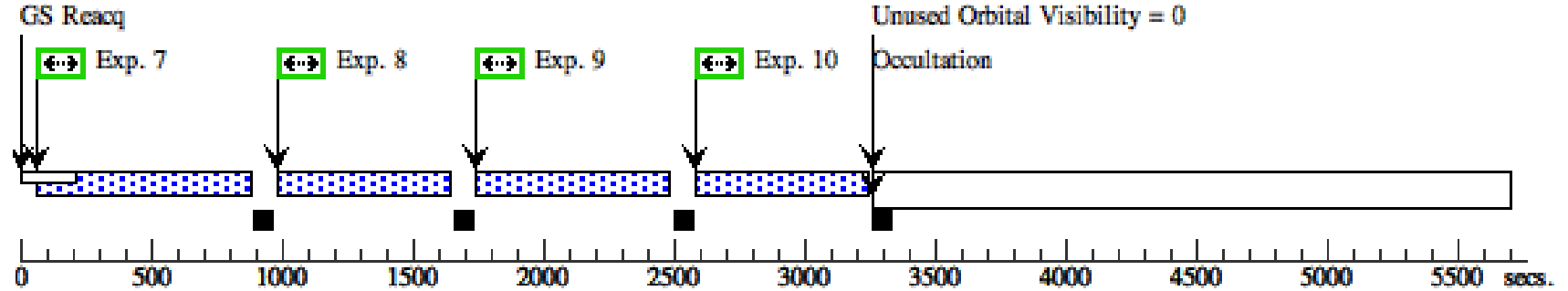
Orbit 3

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Orbit 4

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Orbit 5

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