14679 - Extremely Metal Poor Galaxies with HST/COS: Completing the Groundwork for JWST

Cycle: 24, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

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VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) 6DFGS-GJ040520.4-364859	COS/FUV COS/NUV	2	11-Aug-2017 17:01:55.0	yes
51	(1) 6DFGS-GJ040520.4-364859	COS/FUV COS/NUV	2	11-Aug-2017 17:01:57.0	yes
02	(2) SBSG1129+576	COS/FUV COS/NUV	2	11-Aug-2017 17:01:59.0	yes
03	(3) SDSS-J111934.36+513012.1	COS/FUV COS/NUV	2	11-Aug-2017 17:02:01.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
04	(4) HS1442+4250	COS/FUV COS/NUV	2	11-Aug-2017 17:02:02.0	yes
05	(5) UM133	COS/FUV COS/NUV	2	11-Aug-2017 17:02:04.0	yes
06	(6) SDSS-J094012.84+293530.3	COS/FUV COS/NUV	2	11-Aug-2017 17:02:05.0	yes

14 Total Orbits Used

ABSTRACT

Over the last year, our first glimpse of the spectral properties of z~6-8 galaxies has emerged. Deep UV spectra have revealed very prominent line emission from nebular CIII] and CIV, pointing to a hard radiation field of unknown origin. High resolution COS observations of local galaxies have recently revealed that UV spectra begin to approach those now being seen at z>6 at metallicities below a tenth solar, suggesting that metal poor massive stars may power the extreme line emission. These high-ionization UV lines will likely be one of the only tools we can use to characterize the spectra of the most distant (z=10-15) galaxies JWST will be able to detect; yet we are completely unprepared to interpret them. Very few nearby galaxies at the extreme metallicities expected in the reionization era have been observed with the necessary high-resolution UV spectrographs. Here we propose to remedy this shortcoming by obtaining COS UV spectra of 6 nearby galaxies at less than a tenth of solar metallicity. Using the G160M and G185M gratings, we will characterize the strength of four diagnostic UV lines (CIV, He II, OIII], CIII]) and stellar features in these nearby systems. The data will probe in detail the nature of massive stars in this neglected metallicity regime, and determine what factors control the production of extreme nebular UV emission lines. The spectra will be used to test and calibrate the UV spectral models that will become commonplace in the JWST era. The UV spectral database we will assemble can only be obtained with HST/COS and will provide the necessary empirical baseline to which reionization-era systems observed by JWST can be properly compared.

OBSERVING DESCRIPTION

Goals: We will obtain medium-resolution FUV+NUV COS spectroscopy for star-forming regions in six extremely metal-poor local galaxies. The targets were selected to have optical gas-phase metallicity less than one-tenth solar, a compact morphology, and GALEX NUV/FUV magnitude brighter or similar to 17.5 AB. Coordinates of the targets were determined using archival imaging and previous spectroscopic acquisitions. The galaxies will be acquired using ACQ/IMAGE with COS/NUV. Based upon our cycle 23 COS program on similar objects and the GALEX

NUV/FUV and u-band brightness of the six targets, we will utilize mirror A in target acquisiton. Coordinates were computed using SDSS u-band images (and a WFC3/F336W image in the case of target 1). After acquisition, each source will be observed with the G160M and G185M gratings using the COS PSA. The central wavelength of both gratings has been chosen to place desired emission lines into the observable bandpass given the known redshift of each target. Exposures will be taken using TIME-TAG mode, with FLASH=YES and four focal plane positions per central wavelength.

Orbits: We have been awarded 12 orbits for our observations. Integration times have been chosen based on the known continuum brightness and expected emission line strengths. For the ACQ/IMAGE, we have chosen an integration time to deliver S/N>25; since the spatial extent of our objects is not known precisely, we compute a uniform TA time based on the flux of our dimmest source in the near-UV u-band. For the science exposures, the total integration time in each grating should deliver S/N>4 per resolution element, sufficient to measure the equivalent widths of the relevant emission lines.

Visit

Proposal 14679, Visit 01, scheduled Fri Aug 11 21:02:06 GMT 2017

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Diagnostics

(Visit 01) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 01) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Fixed Targets

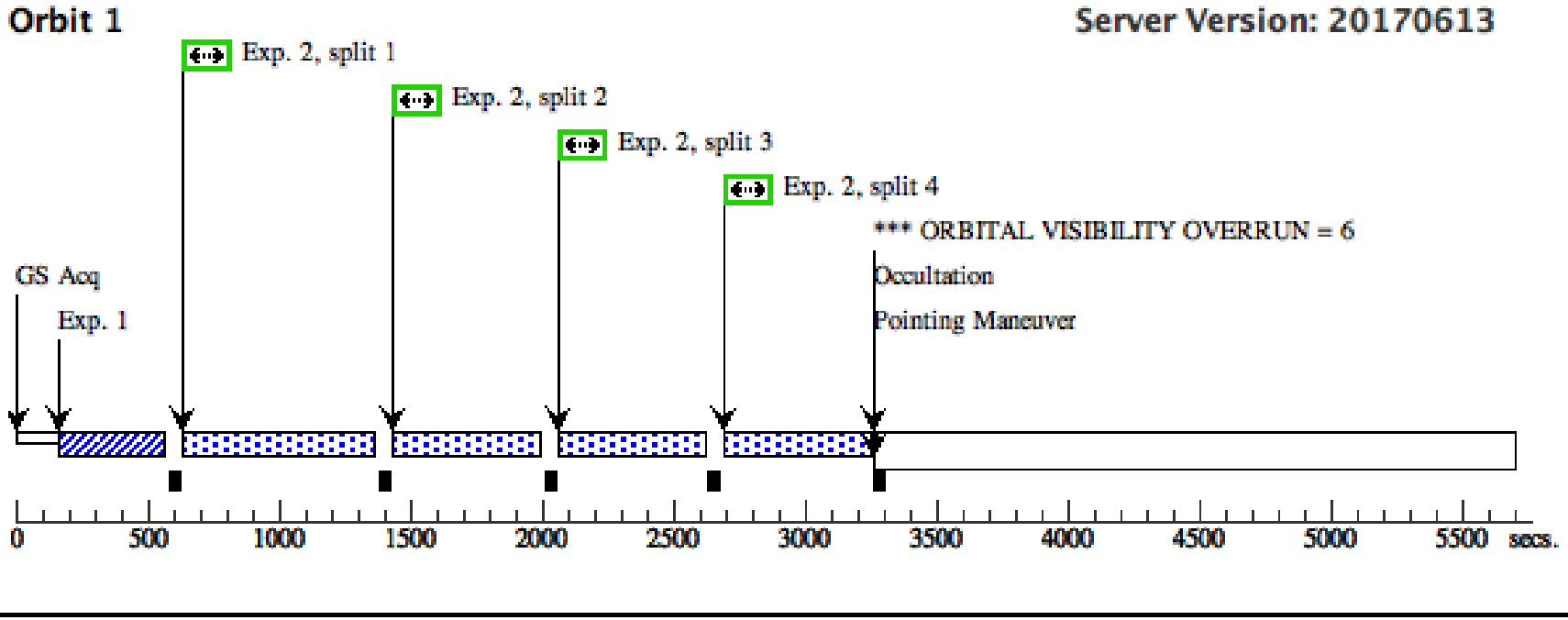
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	6DFGS-GJ040520.4-364859	RA: 04 05 20.4590 (61.3352458d) Dec: -36 48 59.14 (-36.81643d) Equinox: J2000	Redshift: 0.0028	V=17.0 17.0 (average of GALEX NUV/ FUV)	Reference Frame: ICRS

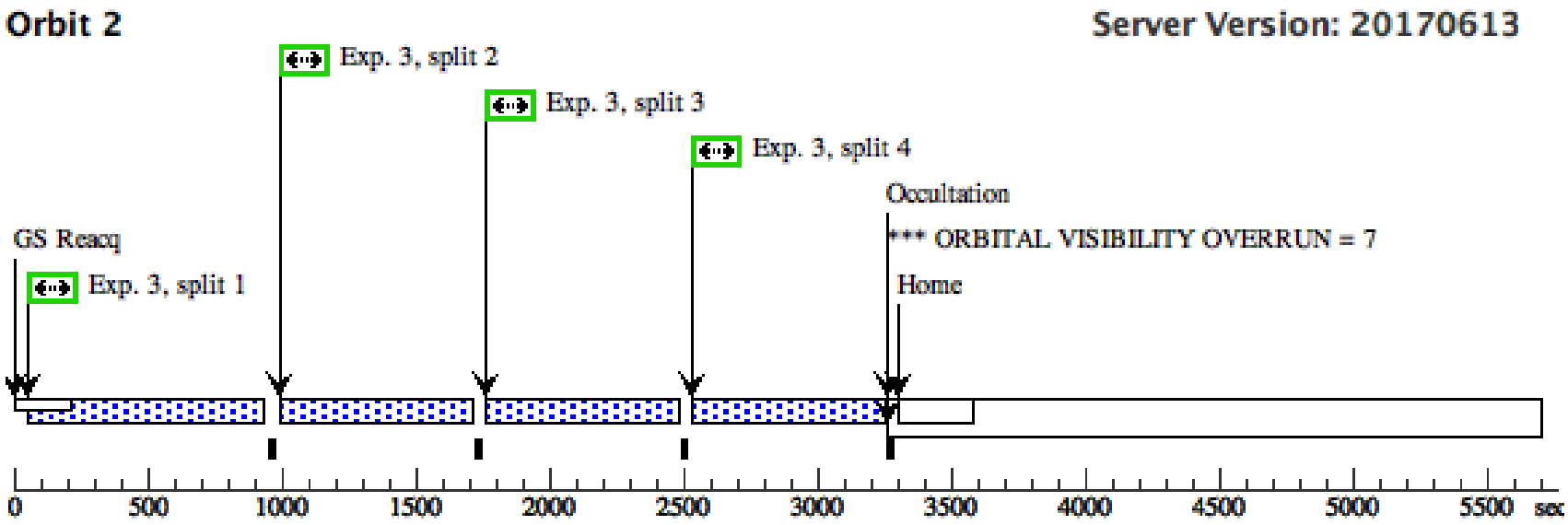
Comments: Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(COS.ta.827908)	(1) 6DFGS-GJ040520.4-364859	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				88 Secs (88 Secs)	
								[==>]	***[1]***
2	(COS.sp.825921)	(1) 6DFGS-GJ040520.4-364859	COS/NUV, TIME-TAG, PSA	G185M 1913 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=1.75e3			541 Secs (2164 Secs)	
								[==>(Split 1)] *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	***[1]***
3	(COS.sp.825923)	(1) 6DFGS-GJ040520.4-364859	COS/FUV, TIME-TAG, PSA	G160M 1623 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=7.1e3			666 Secs (2664 Secs)	
								[==>(Split 1)] *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	***[2]***

Orbit Structure





Visit

Proposal 14679, Visit 51 Fri Aug 11 21:02:07 GMT 2017

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Comments: Duplicate of Visit 01- due to Visit 01 failure

Diagnostics

(Visit 51) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 51) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Fixed Targets

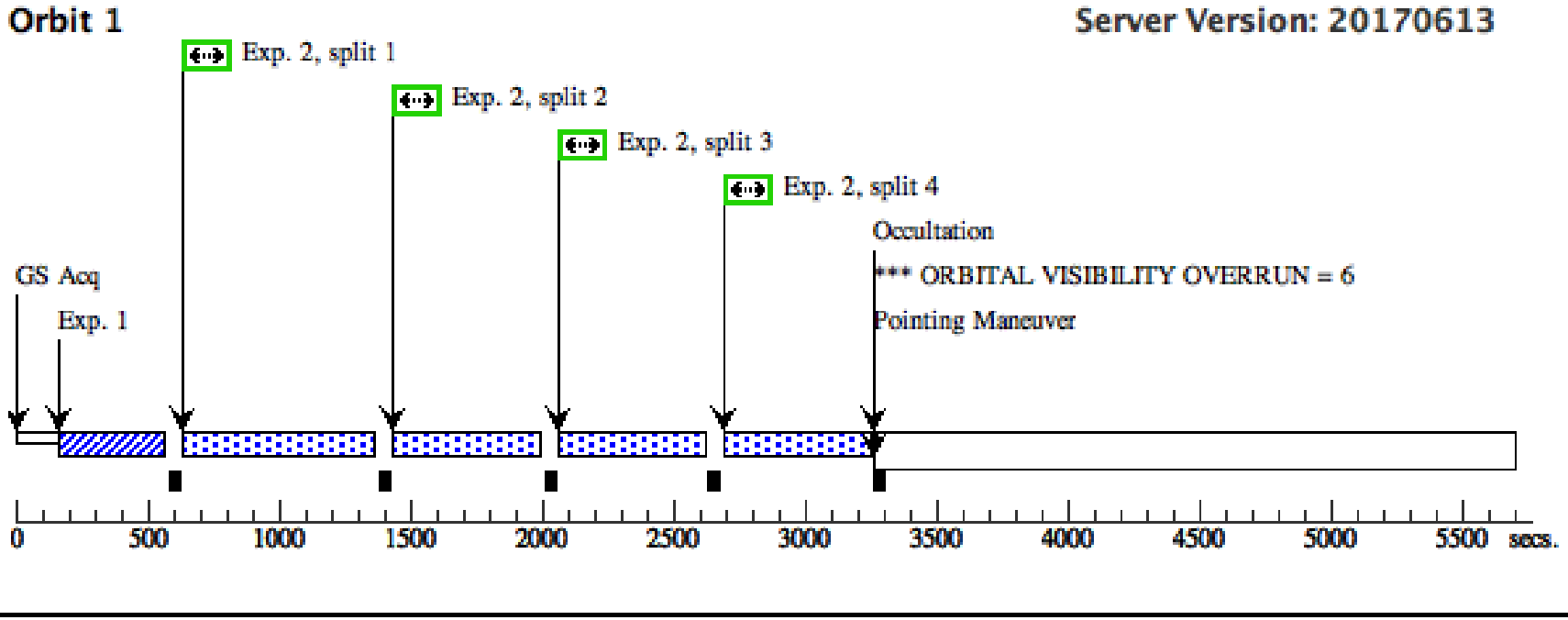
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	6DFGS-GJ040520.4-364859	RA: 04 05 20.4590 (61.3352458d) Dec: -36 48 59.14 (-36.81643d) Equinox: J2000	Redshift: 0.0028	V=17.0 17.0 (average of GALEX NUV/FUV)	Reference Frame: ICRS

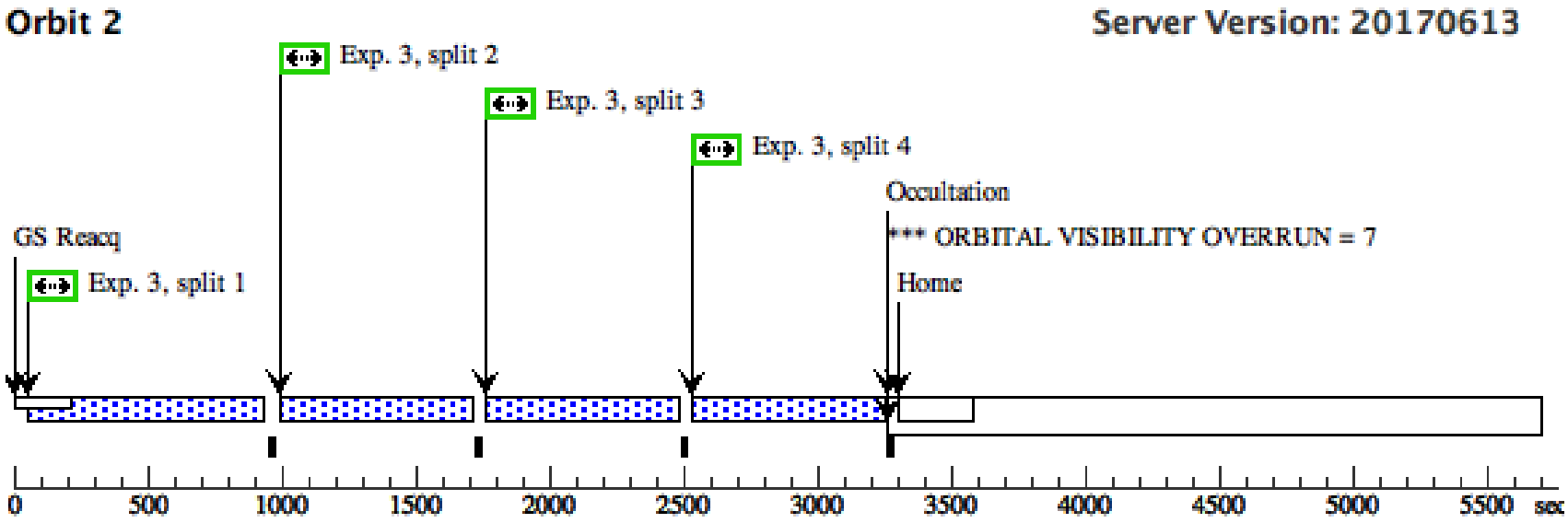
Comments: Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(COS.ta.827908)	(1) 6DFGS-GJ040520.4-364859	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				88 Secs (88 Secs)	
								[==>]	***[1]***
2	(COS.sp.825921)	(1) 6DFGS-GJ040520.4-364859	COS/NUV, TIME-TAG, PSA	G185M 1913 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=1.75e3			541 Secs (2164 Secs)	
								[==>(Split 1)] *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	***[1]***
3	(COS.sp.825923)	(1) 6DFGS-GJ040520.4-364859	COS/FUV, TIME-TAG, PSA	G160M 1623 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=7.1e3			666 Secs (2664 Secs)	
								[==>(Split 1)] *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	***[2]***

Orbit Structure





Visit

Proposal 14679, Visit 02, completed Fri Aug 11 21:02:07 GMT 2017

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Diagnostics

(Visit 02) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 02) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Fixed Targets

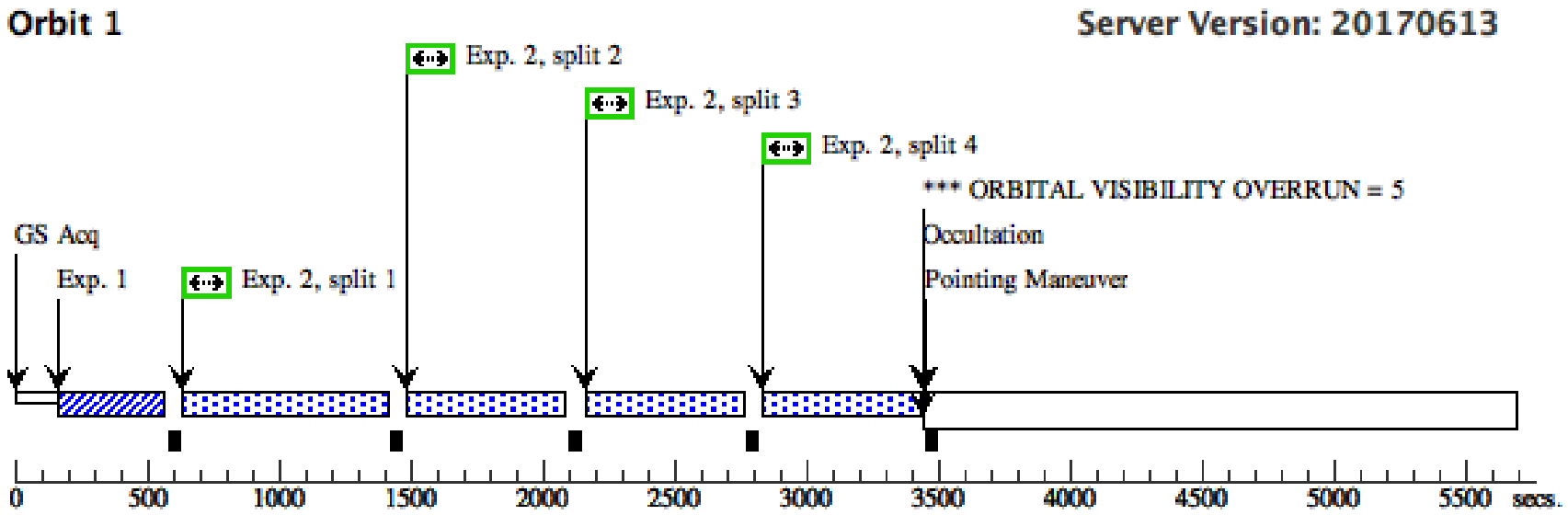
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	SBSG1129+576	RA: 11 32 2.6437 (173.0110154d) Dec: +57 22 36.39 (57.37678d) Equinox: J2000	Redshift: 0.00522	V=16.7 17.4 (average of GALEX NUV/ FUV)	Reference Frame: ICRS

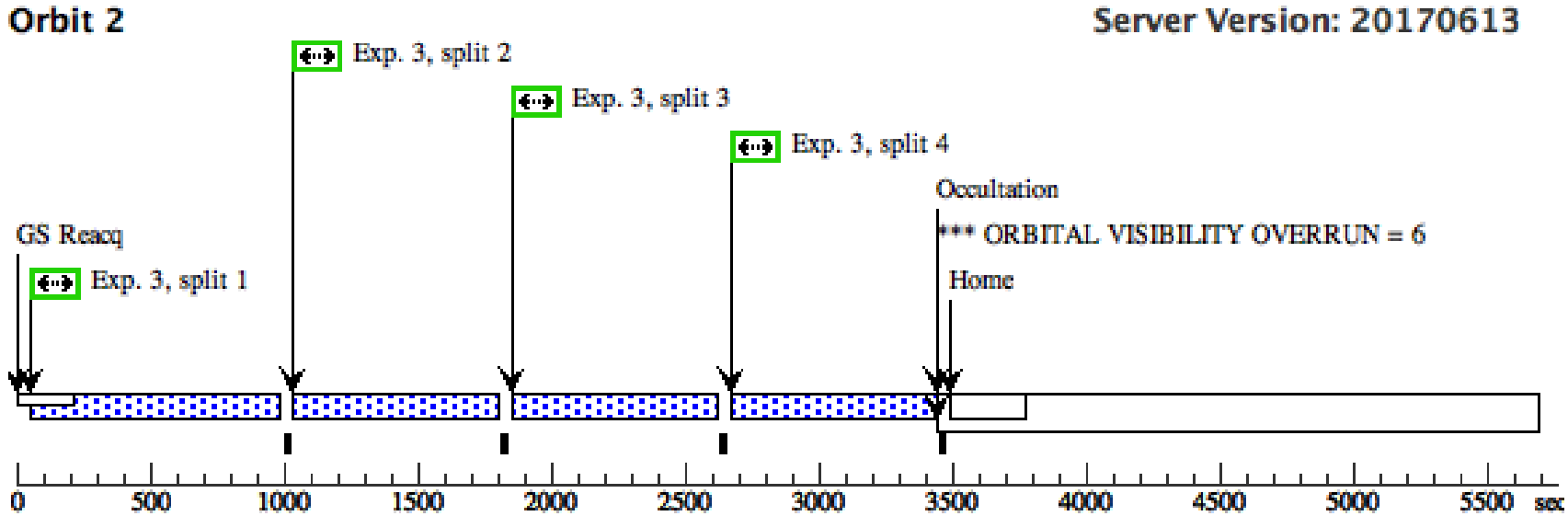
Comments: Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(COS.ta.827908)	(2) SBSG1129+576	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				88 Secs (88 Secs)	
								[==>]	***[1]***
2	(COS.sp.825925)	(2) SBSG1129+576	COS/NUV, TIME-TAG, PSA	G185M 1921 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=1.77e3			588 Secs (2352 Secs)	
								[==>(Split 1)] *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	***[1]***
3	(COS.sp.825926)	(2) SBSG1129+576	COS/FUV, TIME-TAG, PSA	G160M 1623 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=8.66e3			713 Secs (2852 Secs)	
								[==>(Split 1)] *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	***[2]***

Orbit Structure





Visit

Proposal 14679, Visit 03, scheduling Fri Aug 11 21:02:07 GMT 2017

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Diagnostics

(Visit 03) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 03) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Fixed Targets

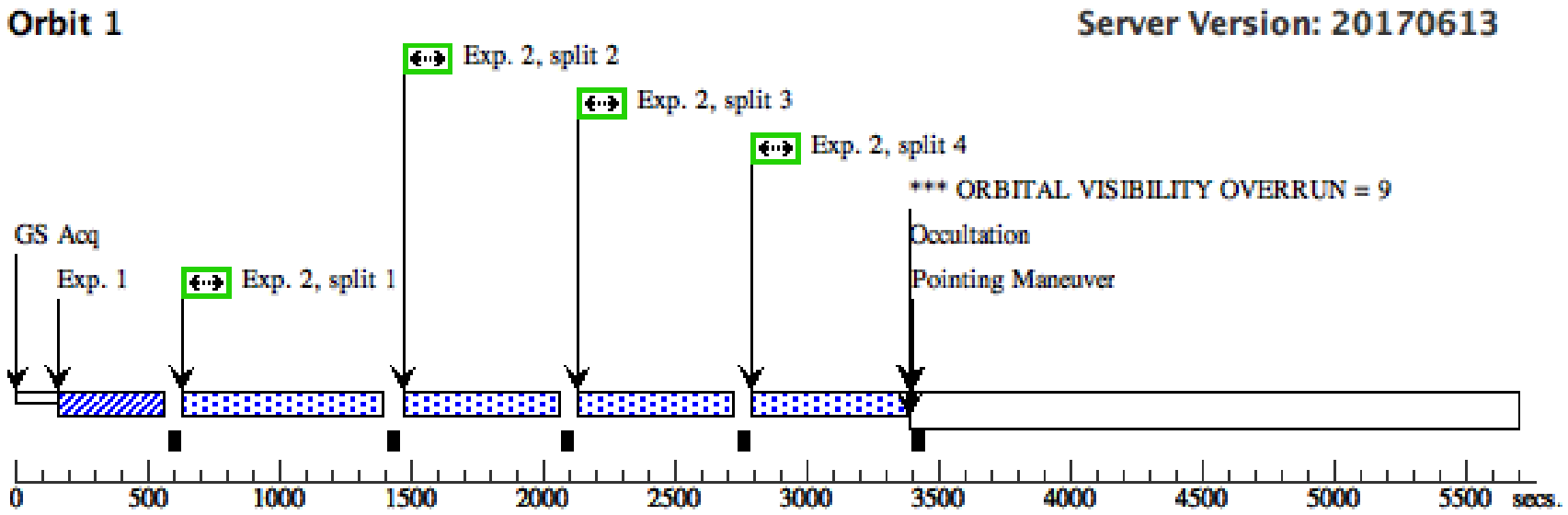
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	SDSS-J111934.36+513012.1	RA: 11 19 34.3650 (169.8931875d) Dec: +51 30 12.02 (51.50334d) Equinox: J2000	Redshift: 0.00446	V=16.8 17.2 (average of GALEX NUV/ FUV)	Reference Frame: ICRS

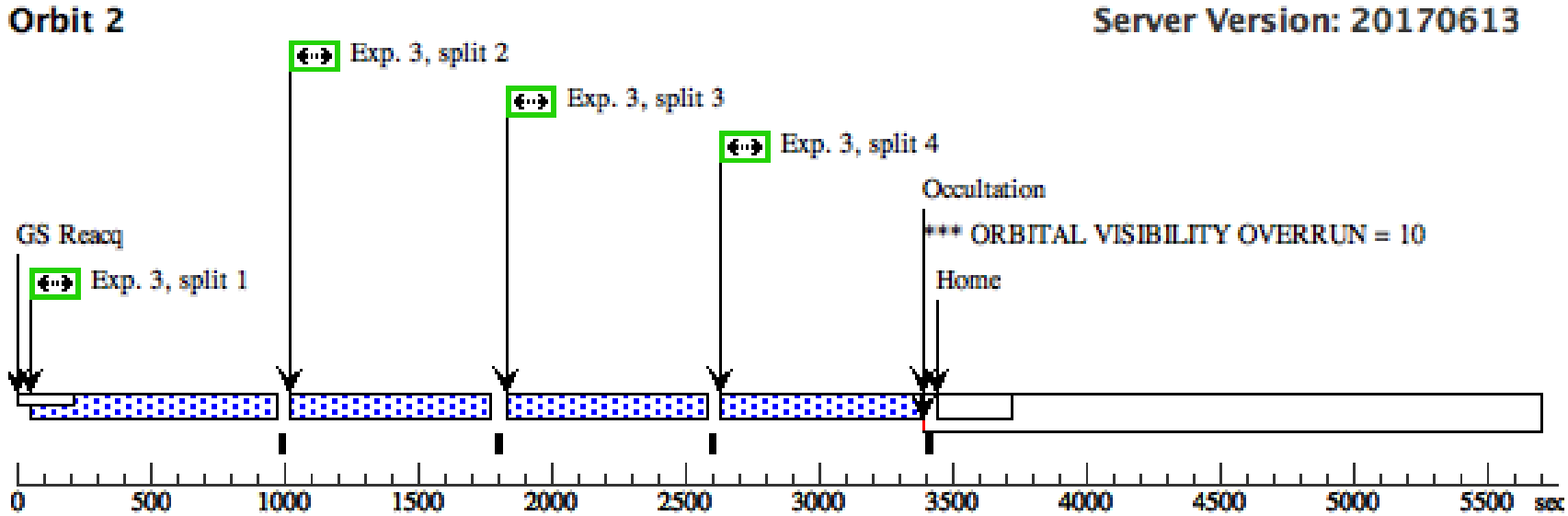
Comments: Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(COS.ta.827908)	(3) SDSS-J111934.36+513012.1	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				88 Secs (88 Secs)	
								[==>]	***[1]***
2	(COS.sp.825927)	(3) SDSS-J111934.36+513012.1	COS/NUV, TIME-TAG, PSA	G185M 1921 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=1.76e3			575 Secs (2300 Secs)	
								[==>(Split 1)] *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	***[1]***
3	(COS.sp.825928)	(3) SDSS-J111934.36+513012.1	COS/FUV, TIME-TAG, PSA	G160M 1623 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=7.89e3			700 Secs (2800 Secs)	
								[==>(Split 1)] *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	***[2]***

Orbit Structure





Visit

Proposal 14679, Visit 04, scheduling Fri Aug 11 21:02:07 GMT 2017

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Diagnostics

(Visit 04) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 04) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	HS1442+4250	RA: 14 44 11.4625 (221.0477604d) Dec: +42 37 35.57 (42.62655d) Equinox: J2000	Redshift: 0.0025	V=15.9 16.3 (average of GALEX NUV/ FUV)	Reference Frame: ICRS

Comments: Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(COS.ta.827 908)	(4) HS1442+4250	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				88 Secs (88 Secs)	
								[==>]	***[1]***
2	(COS.sp.825 929)	(4) HS1442+4250	COS/NUV, TIME-TAG, PSA	G185M 1913 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=1.70e3			551 Secs (2204 Secs)	
								[==>(Split 1)] *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	***[1]***
3	(COS.sp.825 930)	(4) HS1442+4250	COS/FUV, TIME-TAG, PSA	G160M 1623 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=4.61e3			668 Secs (2672 Secs)	
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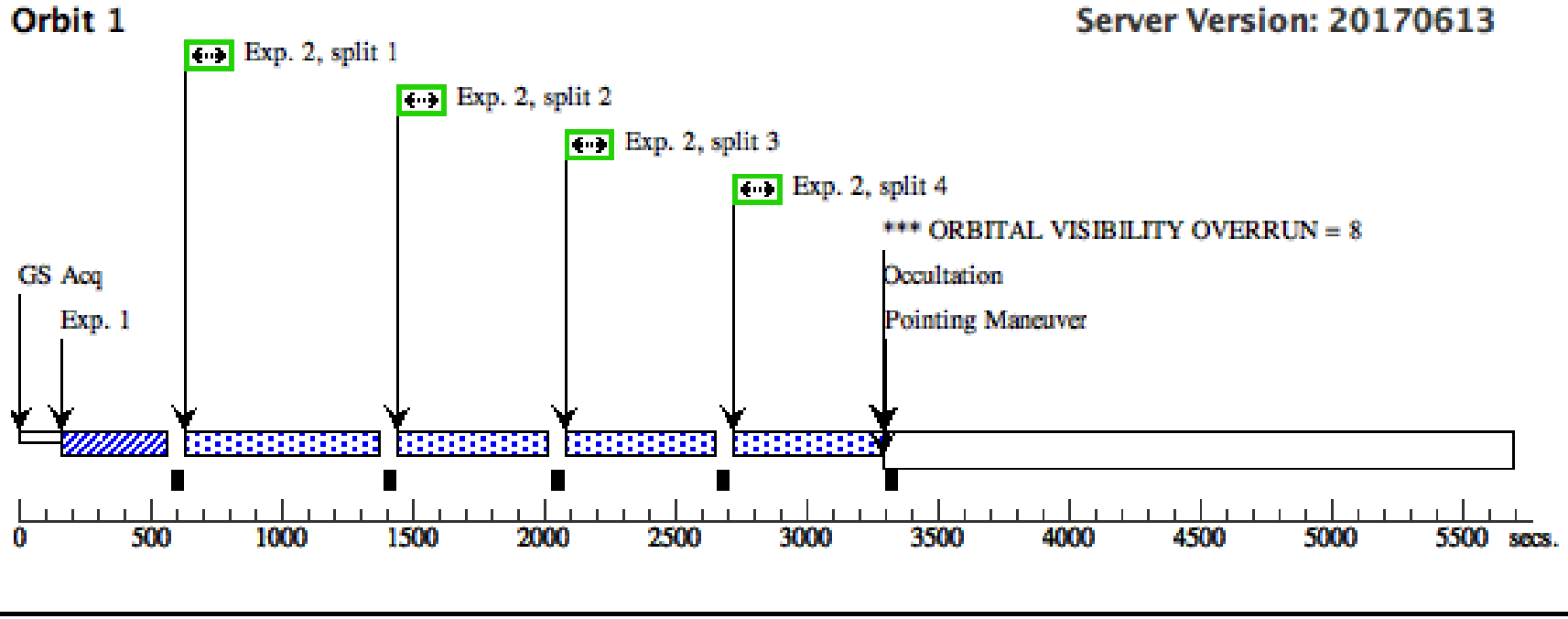
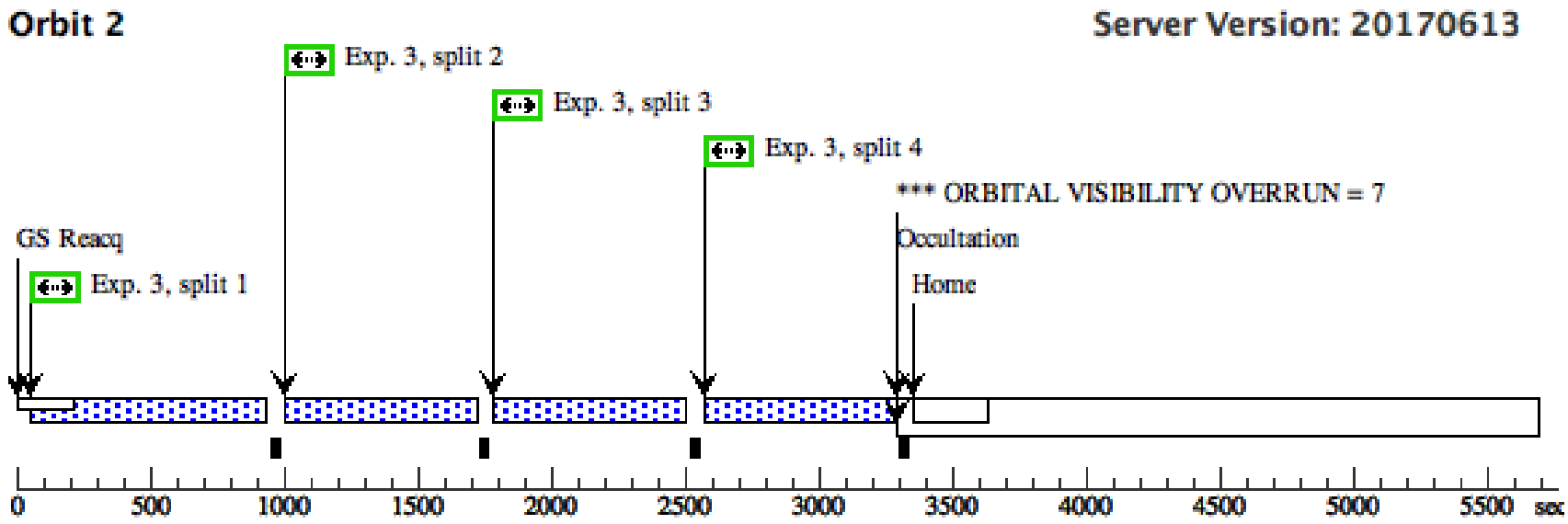
Orbit Structure





Visit

Proposal 14679, Visit 05, scheduling Fri Aug 11 21:02:07 GMT 2017

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Diagnostics

(Visit 05) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 05) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Fixed Targets

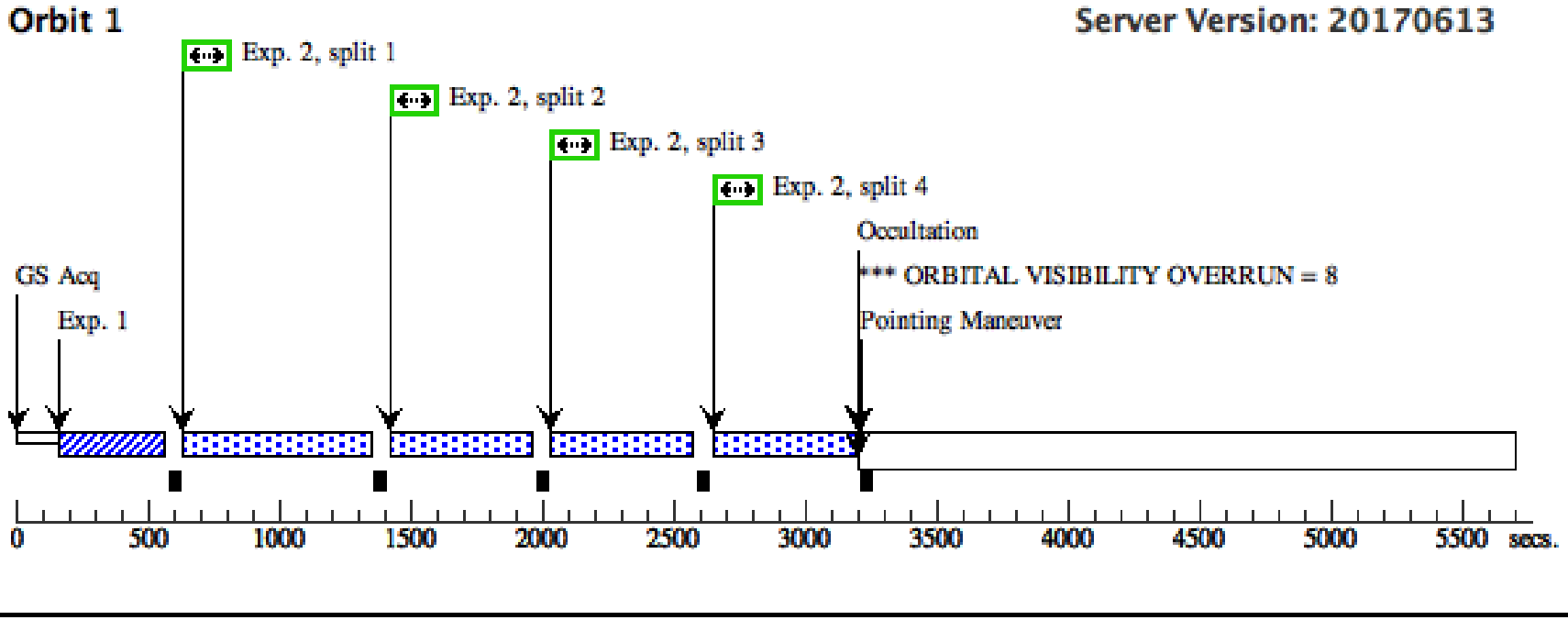
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(5)	UM133	RA: 01 44 41.3655 (26.1723562d) Dec: +04 53 25.32 (4.89037d) Equinox: J2000	Redshift: 0.0054	V=15.4 16.7 (average of GALEX NUV/ FUV)	Reference Frame: ICRS

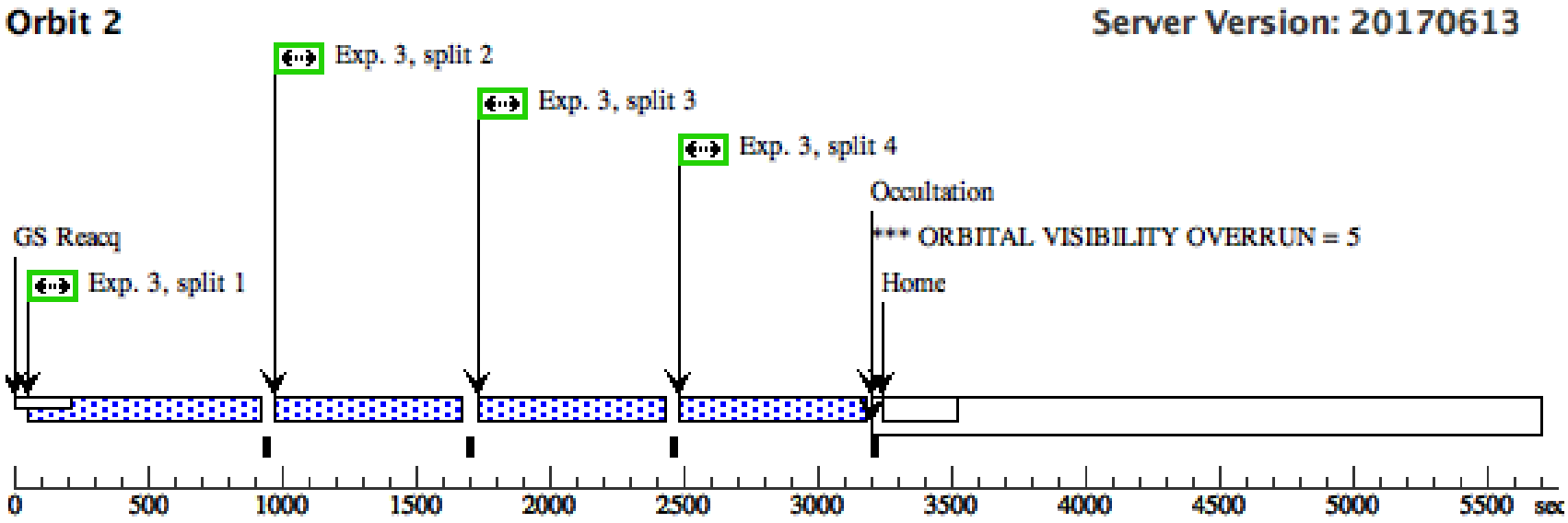
Comments: Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(COS.ta.827 908)	(5) UM133	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				88 Secs (88 Secs)	
								[==>]	***[1]***
2	(COS.sp.825 932)	(5) UM133	COS/NUV, TIME-TAG, PSA	G185M 1921 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=1.73e3			527 Secs (2108 Secs)	
								[==>(Split 1)] *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	***[1]***
3	(COS.sp.825 933)	(5) UM133	COS/FUV, TIME-TAG, PSA	G160M 1623 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=5.97e3			651 Secs (2604 Secs)	
								[==>(Split 1)] *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	***[2]***

Orbit Structure





Visit

Proposal 14679, Visit 06, scheduling Fri Aug 11 21:02:07 GMT 2017

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Diagnostics

(Visit 06) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 06) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(6)	SDSS-J094012.84+293530.3	RA: 09 40 12.8744 (145.0536433d) Dec: +29 35 30.21 (29.59173d) Equinox: J2000	Redshift: 0.0017	V=16.5 17.0 (average of GALEX NUV/ FUV)	Reference Frame: ICRS

Comments: Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(COS.ta.827908)	(6) SDSS-J094012.84+293530.3	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				88 Secs (88 Secs)	
								[==>]	***[1]***
2	(COS.sp.825937)	(6) SDSS-J094012.84+293530.3	COS/NUV, TIME-TAG, PSA	G185M 1913 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=1.75e3			531 Secs (2124 Secs)	
								[==>(Split 1)] *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	***[1]***
3	(COS.sp.825938)	(6) SDSS-J094012.84+293530.3	COS/FUV, TIME-TAG, PSA	G160M 1623 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=7.1e3			656 Secs (2624 Secs)	
								[==>(Split 1)] *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	***[2]***

Orbit Structure