16182 - Catching wind with the HST: novel UV spectroscopy of a bona fide ultraluminous X-ray source

Cycle: 28, 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) SST2011-J081929.00+704219.3	COS/FUV COS/NUV	1	03-Dec-2020 14:00:17.0	yes
02	(1) SST2011-J081929.00+704219.3	COS/FUV COS/NUV	4	03-Dec-2020 14:00:18.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
03	(1) SST2011-J081929.00+704219.3	COS/FUV COS/NUV	4	03-Dec-2020 14:00:19.0	yes
04	(1) SST2011-J081929.00+704219.3	COS/FUV COS/NUV	4	03-Dec-2020 14:00:20.0	yes
05	(1) SST2011-J081929.00+704219.3	COS/FUV COS/NUV	4	03-Dec-2020 14:00:21.0	yes

17 Total Orbits Used

ABSTRACT

We request 17 orbits to secure for the first time an UV spectrum of a generic ultraluminous X-ray source (ULX). Consisting of an accreting compact object, a neutron star or a black hole, and a non-degenerate donor star, ULXs have highest X-ray luminosities among all types of X-ray binaries. These ultra-high luminosities can be achieved either (1) because of an unusual supercritical regime of accretion, or/and (2) because the black holes have masses exceeding a few tens solar, i.e., in the upper range among those detected by gravitational wave observatories. Advances in X-ray astronomy have already proven that supercritically accreting systems indeed exist among the ULX population. Herewith, we request UV spectroscopy to probe the second scenario and establish the existence of ULXs consisting of heavy black holes in a close orbit around a very massive star.

ULXs have a broad spectral energy distribution, from X-rays to UV to optical. They are well studied in X-rays, while optical spectra are secured for about ten ULXs. However, no UV spectrum of an ULX exists yet. We propose to close this gap by obtaining a high-quality UV spectrum of the bona fide ULX, Ho II X-1. Our target is the closest among the generic group of those ULXs which show Wolf-Rayet spectra in the optical. The COS spectra will test whether we observe the donor star or the accretion disk wind. Securing the first UV spectrum of a typical ULX is also necessary to gauge the models of the Universe re-ionization which incorporate ULXs as important feedback agents. The UV spectroscopy of an ULX is a necessary addition to the HST UV legacy.

OBSERVING DESCRIPTION

Our target is an ultraluminous X-ray source, which was first discovered in X-rays. The target is located in the galaxy Ho II in a relatively crowded field which was imaged by the HST.

(1) Coordinates

The science target coordinates are from the The Pan-STARRS release 1 (PS1) Survey - DR1. The coordinates were verified with the optical images; they are consistent with the images in ACS WFC1 F550M MJD#53763.1819. The coordinates are 0.4 arcsec away from the Chandra coordinates of the X-ray source. Neither optical nor X-ray star coordinates are consistent with the images ACS SBC F165LP MJD#54066.3627' or with the HST source catalog coordinates. We believe that this is because of the `` astrometric errors due to imperfect fits to GAIA stars during post-processing.

2) Acquisition

There are two nearby stars, approx 0.8 arcsec away from our targtet, however the target is birghter in the UV and optical.

We were not able to find a UV bright star with GAIA coordinates which we could use for acquisition. Therefore, after discussion with the support scientist, we decided to proceed with the Acq using imaging. Can you please look at this, do we need to use ACQ/SEARCH? The APT gives warning without it.

3) Orient constrain.

Because of the other two stars within the COS aperture, we request orient constrain. The line between the Star1 and the science target has position angle 5deg (from north via east). Intended dispersion direction: 90deg against this, i.e. 95deg or 275deg

Following the document: https://hst-docs.stsci.edu/display/HPIOM/6.2.2++Target+Orientation+Visit-level+Special+Requirements

COS is mounted such that one has to add 45deg to get the ORIENT angle, i.e.: 140deg or 320deg

Allowing for +- 30deg from the ideal ORIENT results in: 110 -- 170 deg or 290 - 350 deg

Can you please confirm that these are correct considerations?

(4) Visits

We were allocated 17 orbits. We split the program to 5 visits, where the first visit is only one orbit and is mainly to verify the aquisition strategy. The acquisition is performed only during
the first orbit of each visit.

Can you please verify that this is a sensible strategy?

(5) Buffer-time
We are observing a faint source, therefore buffer time is large (> 20 000 sec) . To optimaize observaitons, we choose buffer-time 3200 sec, can you please verify that thst this is sensible.

Visit

Proposal 16182, Visit 01, implementation

Thu Dec 03 19:00:21 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: ORIENT 110D TO 170 D; ORIENT 290D TO 350 D

Fixed Targets

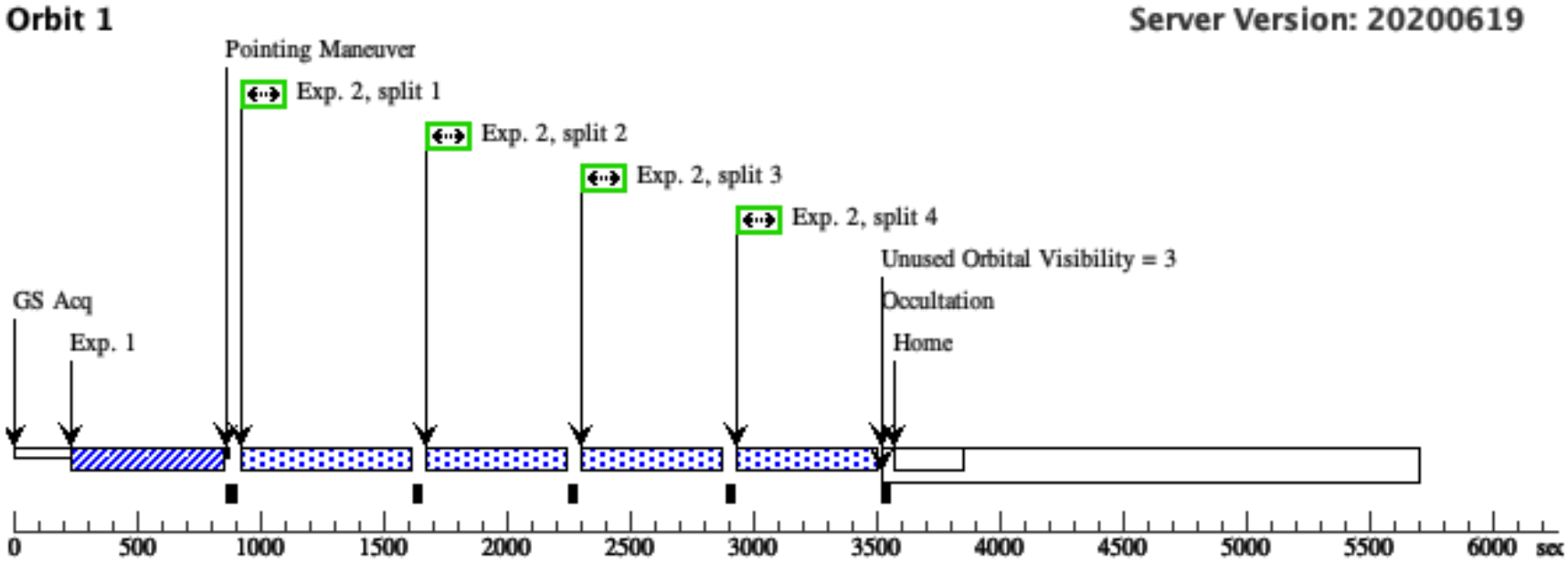
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SST2011-J081929.00+704219.3 Alt Name1: HOLMBERG-II-X-1 Alt Name2: HOLMBERG-II-ULX1	RA: 08 19 28.9760 (124.8707333d) Dec: +70 42 18.99 (70.70528d) Equinox: J2000		V=21.5	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[GIANT O]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	acq (COS.ta.1472682)	(1) SST2011-J081929.00+704219.3	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				200 Secs (200 Secs) *[==>]*	 ***[1]***
2	1 orbit to check aquisition (COS.sp.1451374)	(1) SST2011-J081929.00+704219.3	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=3400; FLASH=YES; FP-POS=ALL; SEGMENT=BOTH			500 Secs (2068 Secs) *[==>517.0 Secs (Split 1)]* *[==>517.0 Secs (Split 2)]* *[==>517.0 Secs (Split 3)]* *[==>517.0 Secs (Split 4)]*	 ***[1]***

Orbit Structure



Visit

Proposal 16182, Visit 02, implementation Thu Dec 03 19:00:21 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: SAME ORIENT AS 01; AFTER 01 BY 17 D TO 90 D; ON HOLD FOR 01

On Hold Comments: We need a quick look on the the image and the low S/N spectrum obtained in Visit 1 to ensure that our acqusition strategy is working well.

Fixed Targets

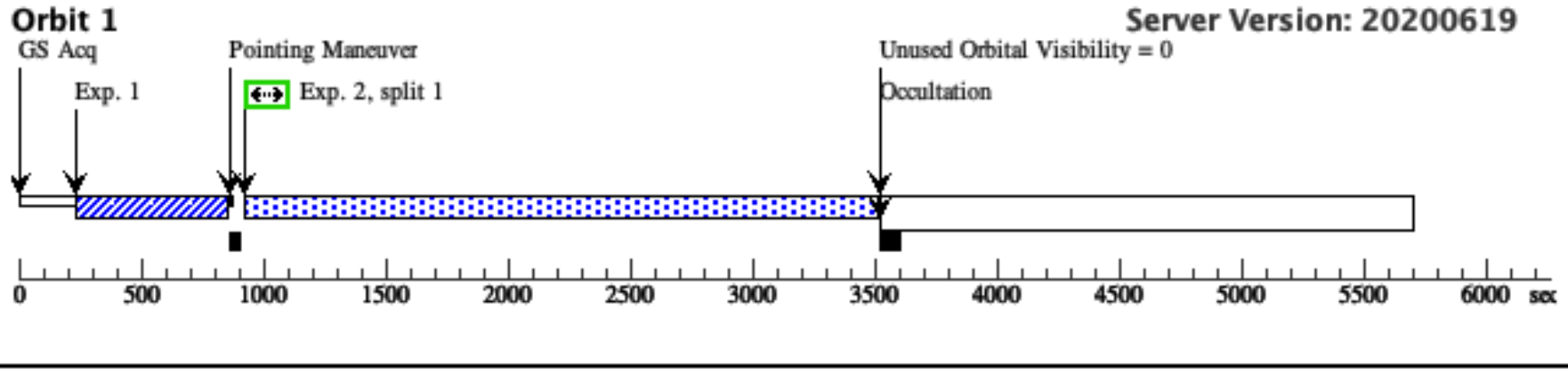
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SST2011-J081929.00+704219.3 Alt Name1: HOLMBERG-II-X-1 Alt Name2: HOLMBERG-II-ULX1	RA: 08 19 28.9760 (124.8707333d) Dec: +70 42 18.99 (70.70528d) Equinox: J2000		V=21.5	Reference Frame: ICRS

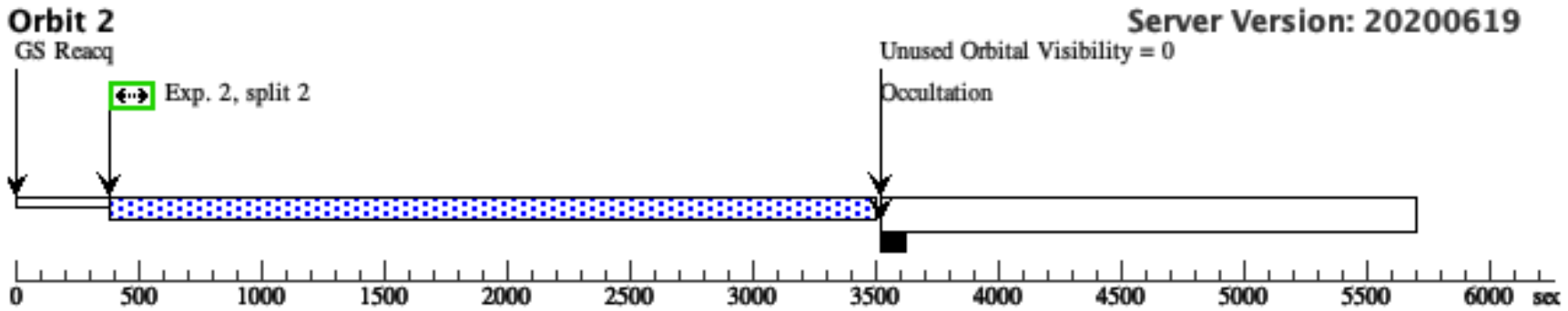
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[GIANT O]
Extended=NO

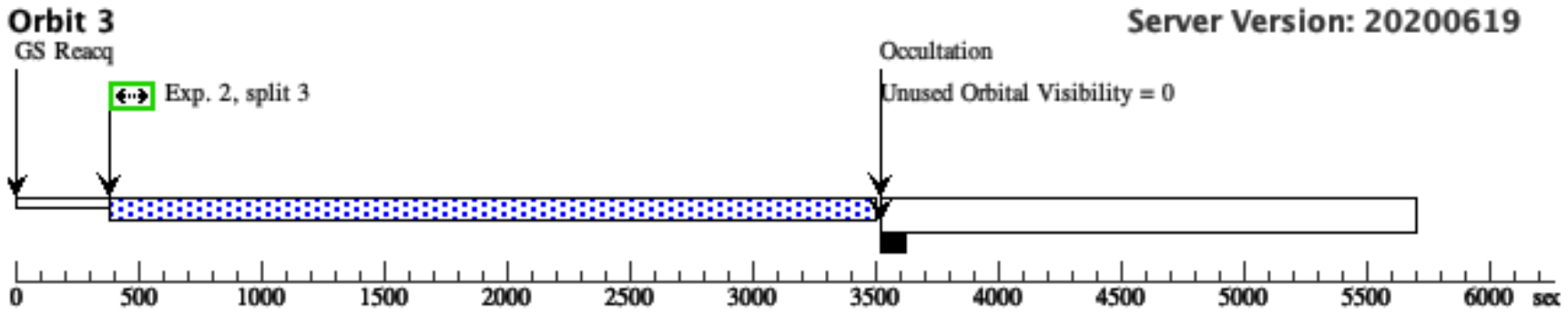
Exposures

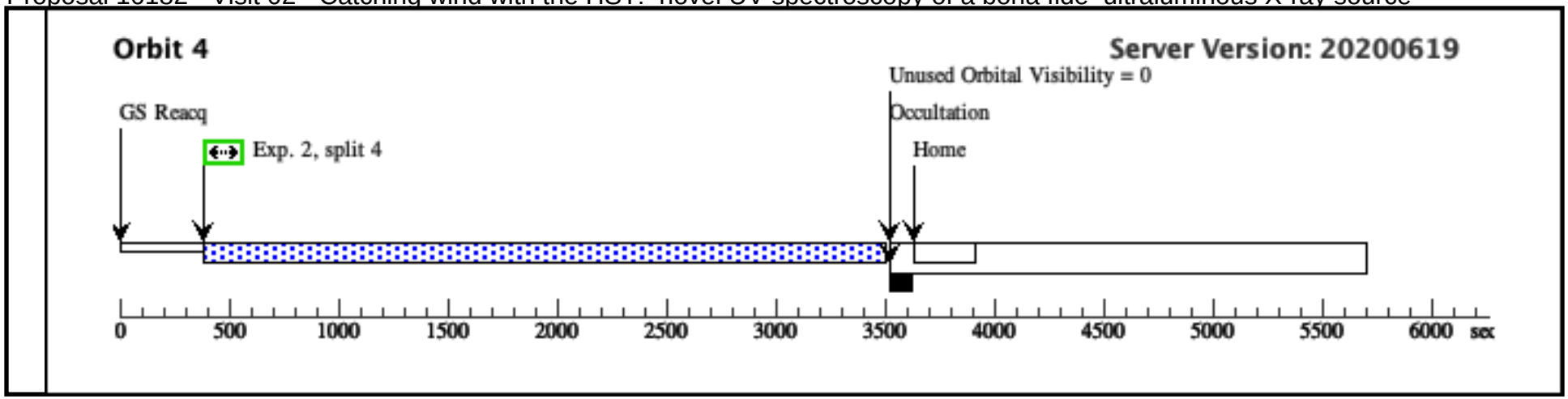
#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	acq (COS.ta.1472682)	(1) SST2011-J081929.00+704219.3	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				200 Secs (200 Secs)	
								[==>]	***[1]***
2	4 orbits (COS.sp.1451374)	(1) SST2011-J081929.00+704219.3	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=3200; FLASH=YES; FP-POS=ALL; SEGMENT=BOTH			3200 Secs (11623 Secs)	
								[==>2416.0 Secs (Split 1)]	***[1]***
								[==>3069.0 Secs (Split 2)]	***[2]***
								[==>3069.0 Secs (Split 3)]	***[3]***
								[==>3069.0 Secs (Split 4)]	***[4]***

Orbit Structure








Orbit 4
Server Version: 20200619
Unused Orbital Visibility = 0
GS Reacq
Occultation
Exp. 2, split 4
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec

Visit

Proposal 16182, Visit 03, implementation Thu Dec 03 19:00:22 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: SAME ORIENT AS 01; AFTER 01 BY 17 D TO 90 D; ON HOLD FOR 01

On Hold Comments: We need a quick look on the the image and the low S/N spectrum obtained in Visit 1 to ensure that our acqusition strategy is working well.

Fixed Targets

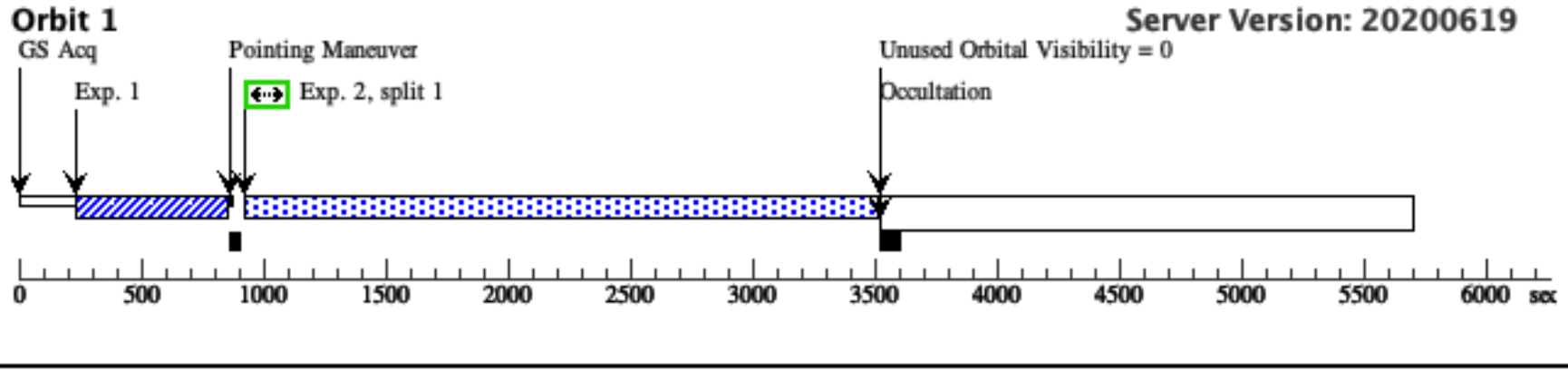
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SST2011-J081929.00+704219.3 Alt Name1: HOLMBERG-II-X-1 Alt Name2: HOLMBERG-II-ULX1	RA: 08 19 28.9760 (124.8707333d) Dec: +70 42 18.99 (70.70528d) Equinox: J2000		V=21.5	Reference Frame: ICRS

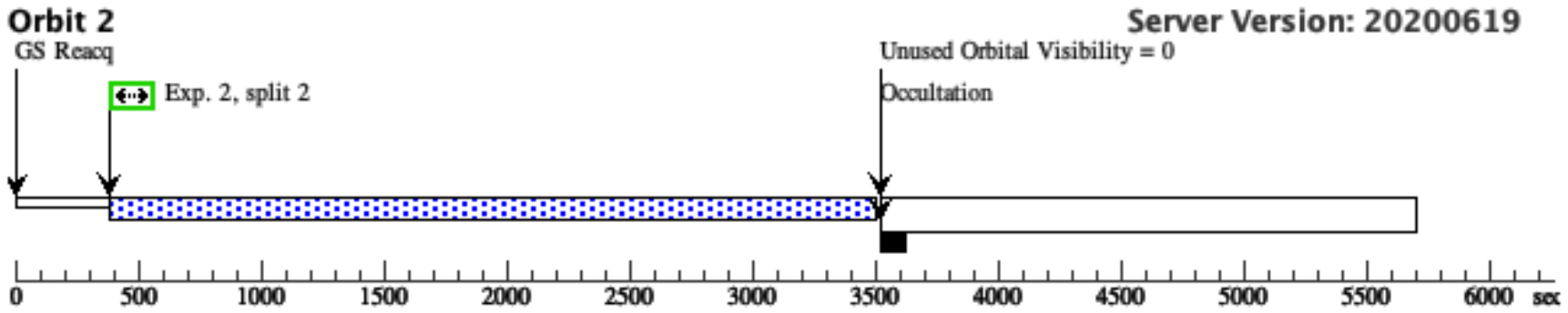
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[GIANT O]
Extended=NO

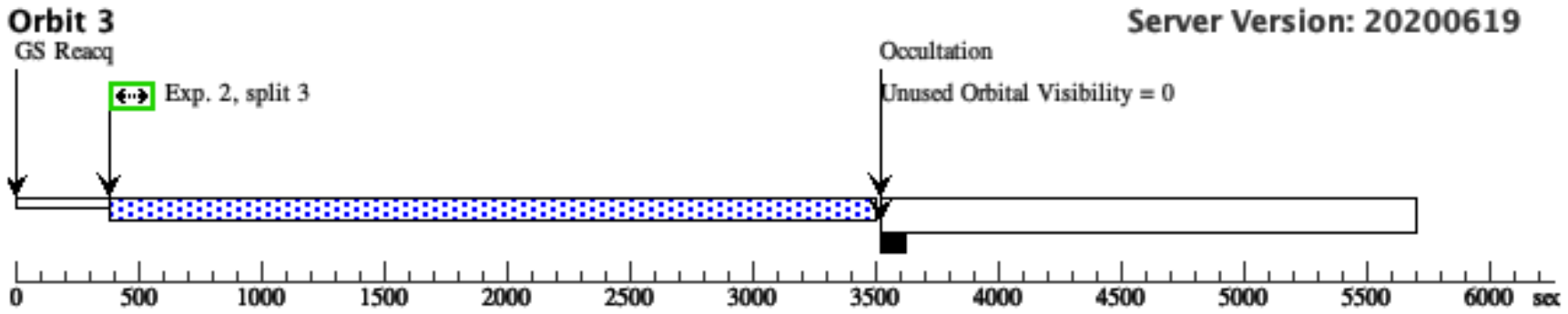
Exposures

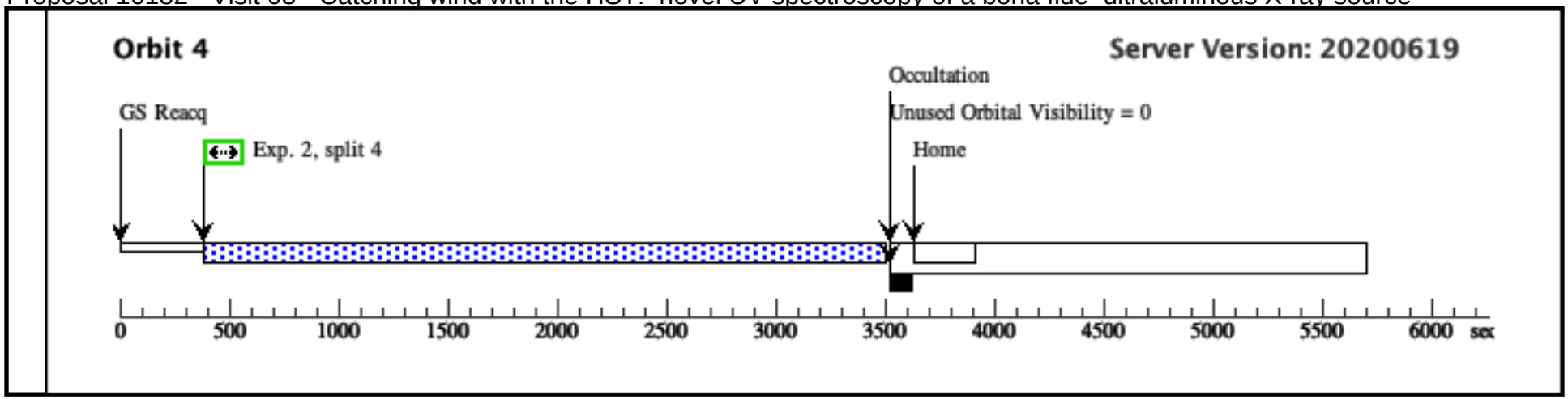
#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	acq (COS.ta.1472682)	(1) SST2011-J081929.00+704219.3	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				200 Secs (200 Secs)	
								[==>]	***[1]***
2	4 orbits (COS.sp.1451374)	(1) SST2011-J081929.00+704219.3	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=3200; FLASH=YES; FP-POS=ALL; SEGMENT=BOTH			3200 Secs (11623 Secs)	
								[==>2416.0 Secs (Split 1)]	***[1]***
								[==>3069.0 Secs (Split 2)]	***[2]***
								[==>3069.0 Secs (Split 3)]	***[3]***
								[==>3069.0 Secs (Split 4)]	***[4]***

Orbit Structure








Orbit 4
Server Version: 20200619
Occultation
GS Reacq
Unused Orbital Visibility = 0
Exp. 2, split 4
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec

Visit

Proposal 16182, Visit 04, implementation Thu Dec 03 19:00:22 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: SAME ORIENT AS 01; AFTER 01 BY 17 D TO 90 D; ON HOLD FOR 01

On Hold Comments: We need a quick look on the the image and the low S/N spectrum obtained in Visit 1 to ensure that our acqusition strategy is working well.

Fixed Targets

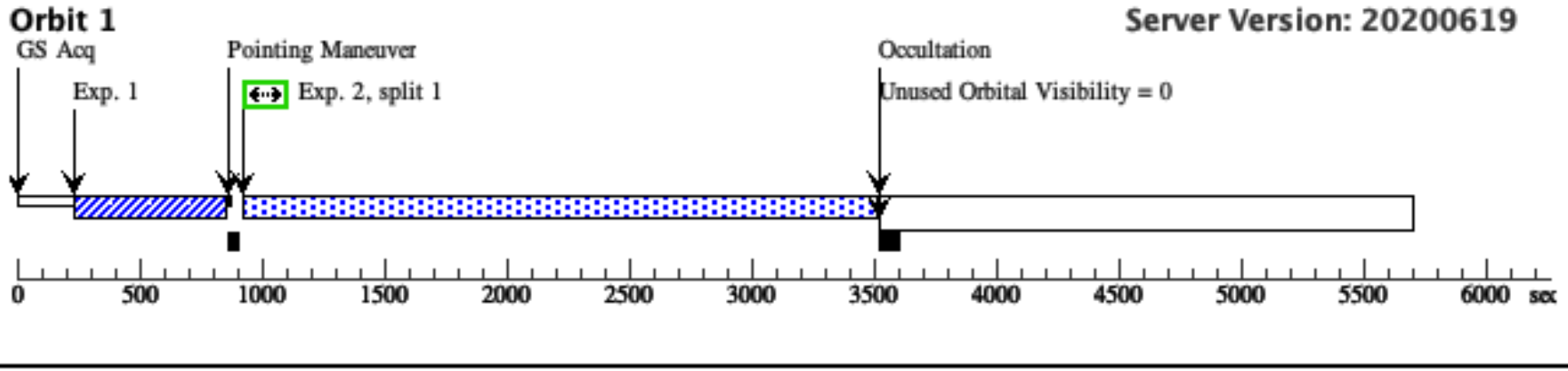
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SST2011-J081929.00+704219.3 Alt Name1: HOLMBERG-II-X-1 Alt Name2: HOLMBERG-II-ULX1	RA: 08 19 28.9760 (124.8707333d) Dec: +70 42 18.99 (70.70528d) Equinox: J2000		V=21.5	Reference Frame: ICRS

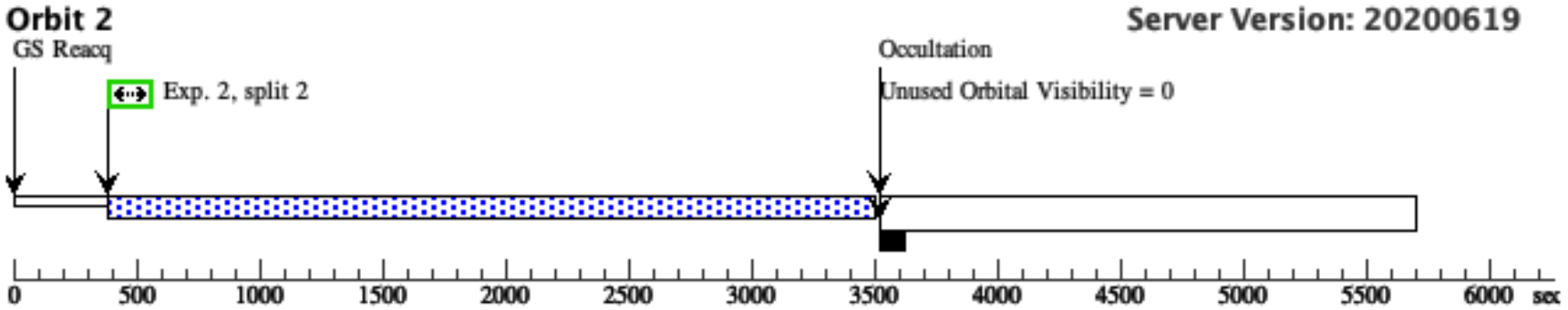
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[GIANT O]
Extended=NO

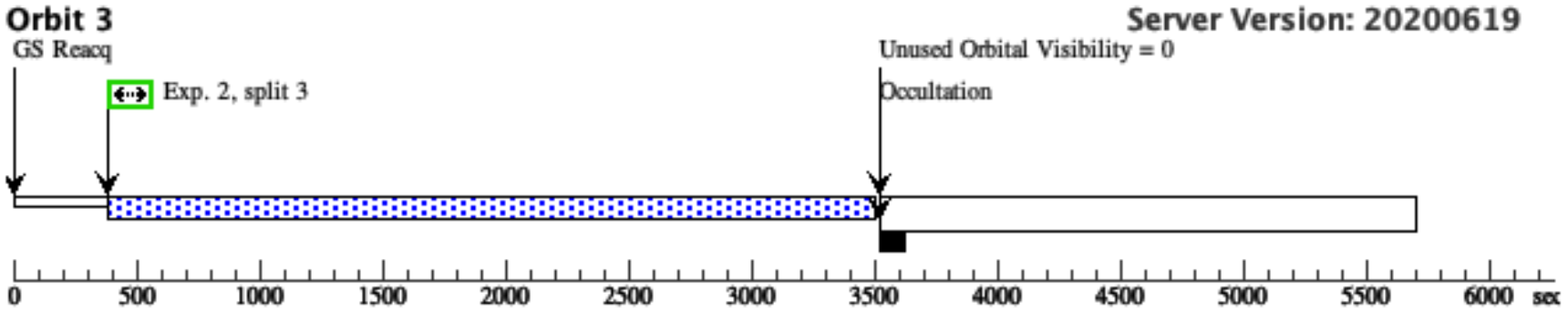
Exposures

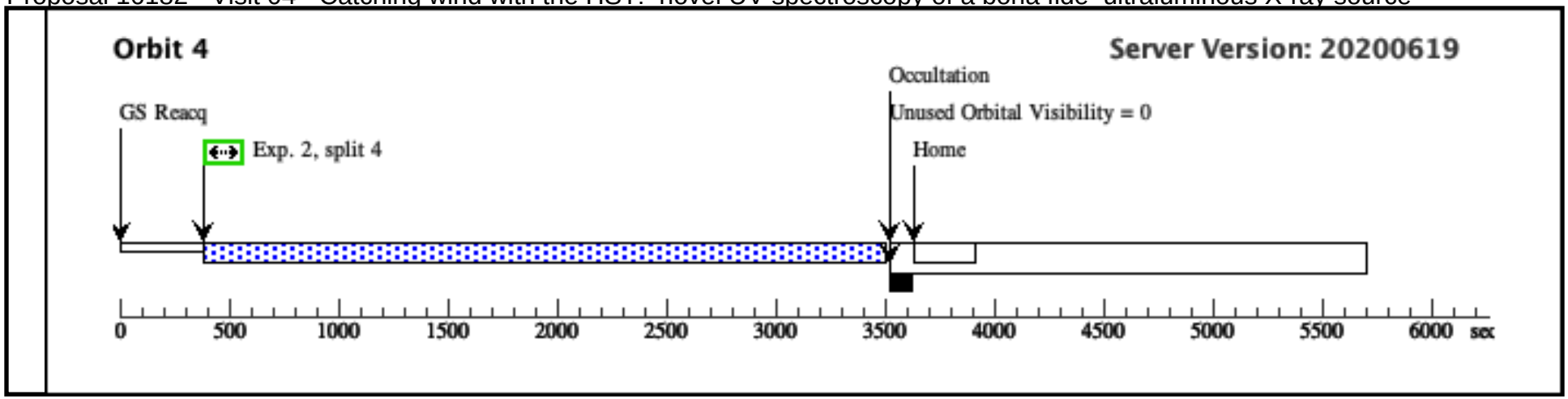
#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	acq (COS.ta.1472682)	(1) SST2011-J081929.00+704219.3	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				200 Secs (200 Secs)	
								[==>]	***[1]***
2	4 orbits (COS.sp.1451374)	(1) SST2011-J081929.00+704219.3	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=3200; FLASH=YES; FP-POS=ALL; SEGMENT=BOTH			3200 Secs (11623 Secs)	
								[==>2416.0 Secs (Split 1)]	***[1]***
								[==>3069.0 Secs (Split 2)]	***[2]***
								[==>3069.0 Secs (Split 3)]	***[3]***
								[==>3069.0 Secs (Split 4)]	***[4]***

Orbit Structure








Orbit 4
Server Version: 20200619
Occultation
GS Reacq
Unused Orbital Visibility = 0
Exp. 2, split 4
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec

Visit

Proposal 16182, Visit 05, implementation Thu Dec 03 19:00:22 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: SAME ORIENT AS 01; AFTER 01 BY 17 D TO 90 D; ON HOLD FOR 01

On Hold Comments: We need a quick look on the the image and the low S/N spectrum obtained in Visit 1 to ensure that our acqusition strategy is working well.

Fixed Targets

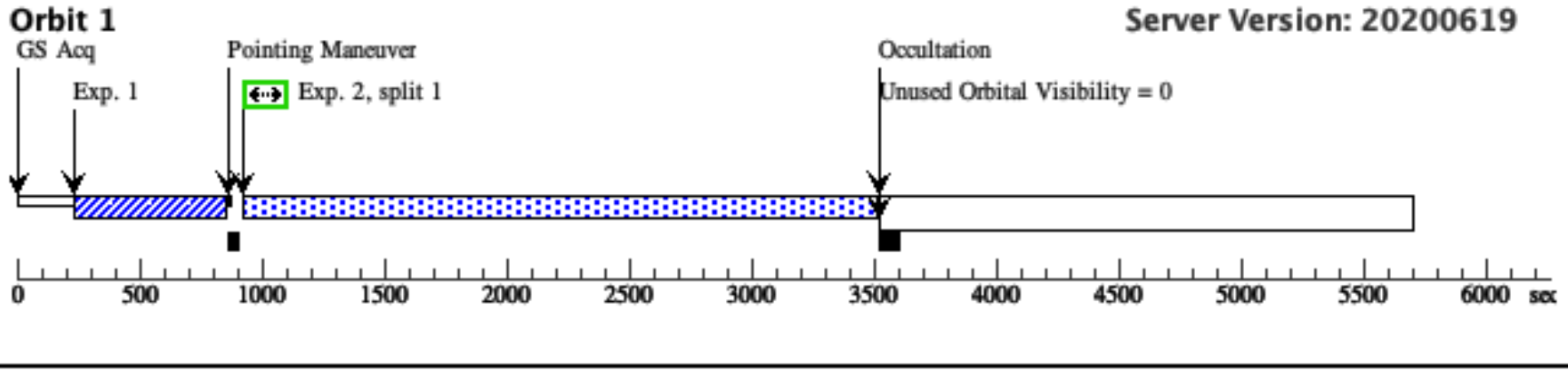
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SST2011-J081929.00+704219.3 Alt Name1: HOLMBERG-II-X-1 Alt Name2: HOLMBERG-II-ULX1	RA: 08 19 28.9760 (124.8707333d) Dec: +70 42 18.99 (70.70528d) Equinox: J2000		V=21.5	Reference Frame: ICRS

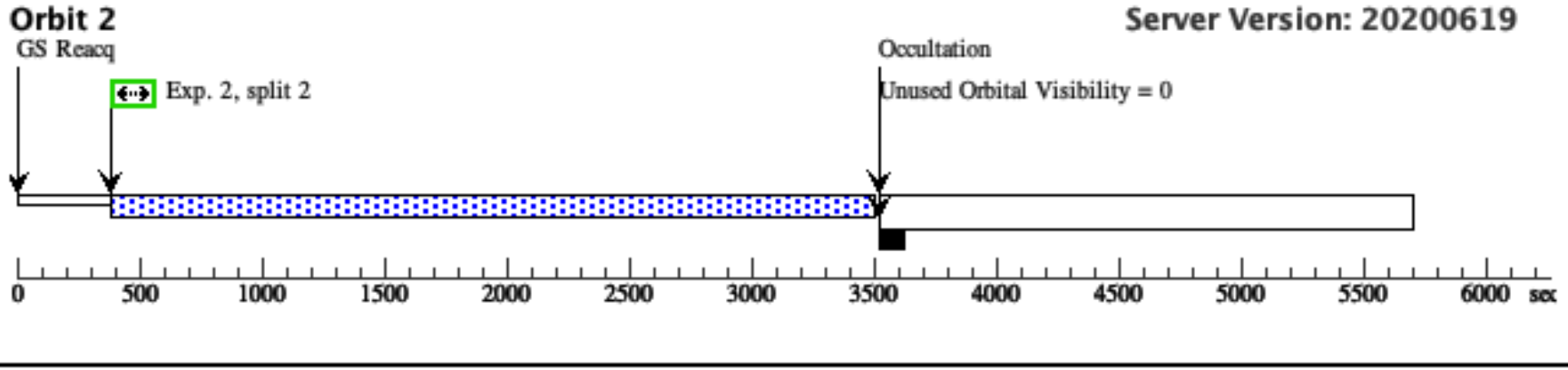
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[GIANT O]
Extended=NO

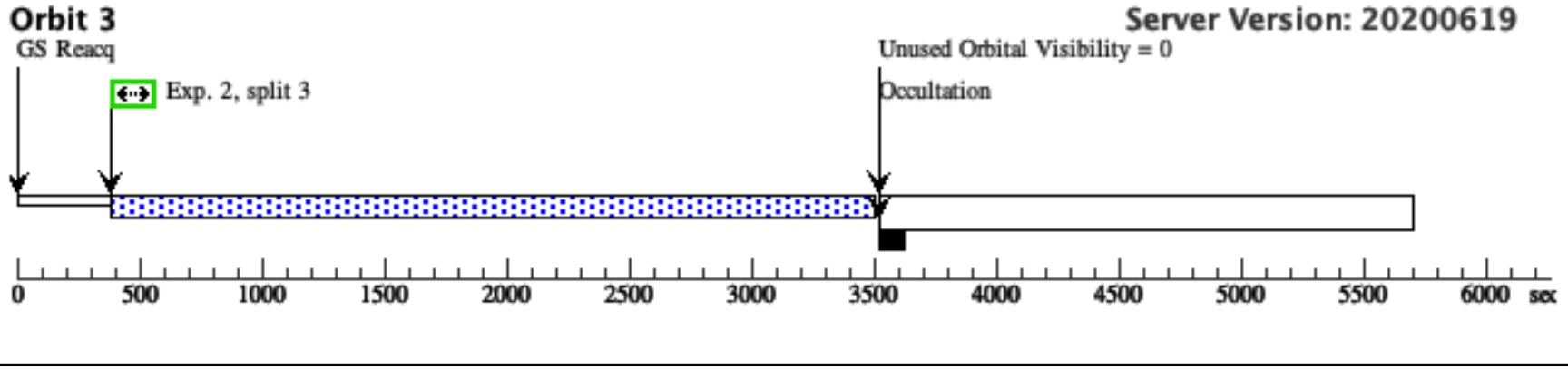
Exposures

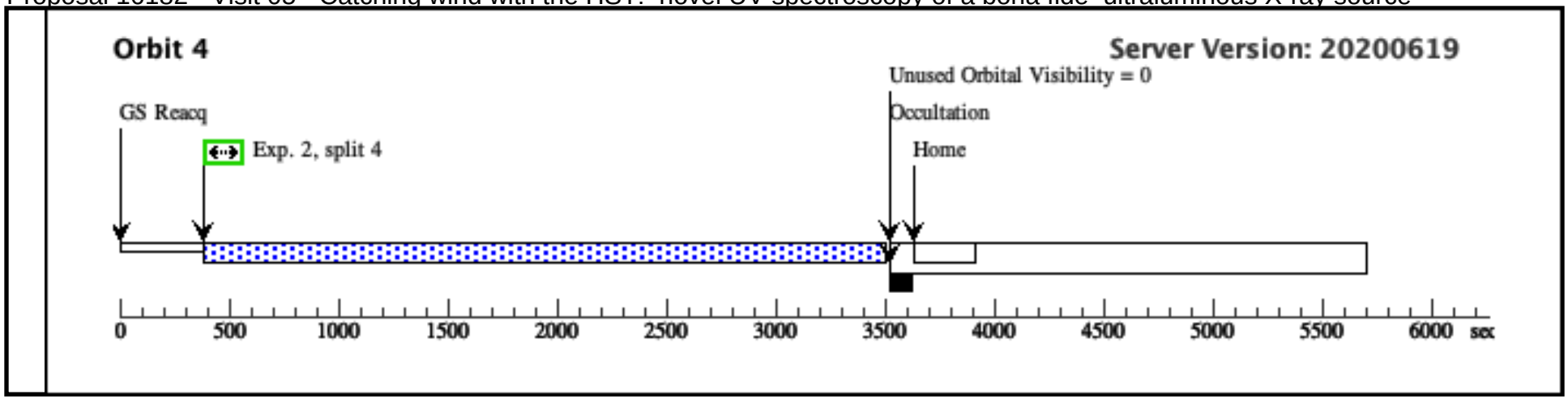
#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	acq (COS.ta.1472682)	(1) SST2011-J081929.00+704219.3	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				200 Secs (200 Secs)	
								[==>]	***[1]***
2	4 orbits (COS.sp.1451374)	(1) SST2011-J081929.00+704219.3	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=3200; FLASH=YES; FP-POS=ALL; SEGMENT=BOTH			3200 Secs (11623 Secs)	
								[==>2416.0 Secs (Split 1)]	***[1]***
								[==>3069.0 Secs (Split 2)]	***[2]***
								[==>3069.0 Secs (Split 3)]	***[3]***
								[==>3069.0 Secs (Split 4)]	***[4]***

Orbit Structure








Orbit 4
Server Version: 20200619
Unused Orbital Visibility = 0
GS Reacq
Occultation
Exp. 2, split 4
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec