17133 - Mapping the morphology of the ionizing radiation from a LyC emitting galaxy at z=4.00

Cycle: 30, Proposal Category: GO

(Availability Mode: SUPPORTED)

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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) ION3	WFC3/UVIS	3	08-Jul-2022 16:01:52.0	yes
02	(1) ION3	WFC3/UVIS	3	08-Jul-2022 16:01:52.0	yes
03	(1) ION3	WFC3/UVIS	3	08-Jul-2022 16:01:53.0	yes
04	(1) ION3	WFC3/UVIS	1	08-Jul-2022 16:01:53.0	yes
05	(1) ION3	WFC3/IR	1	08-Jul-2022 16:01:54.0	yes

11 Total Orbits Used

ABSTRACT

We propose multi-band WFC3 imaging of the ionizing radiation and non-ionizing continuum (F390W, F814W, and F140W) from the most distant and strongest Lyman continuum (LyC) emitting galaxy at z=4, dubbed Ion3. Available VLT/FORS2 and X-Shooter spectra reveal a strong LyC emission from 912 Ang down to 750 Ang, as well as a multiple-peaked Lya profile. Unfortunately, no information on the sub-kpc morphology of Ion3 exist at any wavelengths. This information is vital to constrain the detailed mechanisms that regulate the emission of LyC radiation from star-forming galaxies, especially at 3<z<4, the highest redshift likely to yield direct observations of LyC and the closest to the Epoch of Reionization. With this program we will map the morphology and extent of the LyC and non-ionizing radiation (NUV and FUV) that emerge from Ion3. The HST imaging is essential to (1) investigate the size and light profile of the LyC emission, locate its centroid and study if it is co-spatial or off-centered with respect to the FUV and NUV emission; (2) measure the Balmer break, providing us with age estimates and insight into underlying old stellar population. The HST multi-band imaging will enable us to understand the physical properties of Ion3 and to compare it with those from other detected LyC emitters at high and lower redshift. This will provide the unique opportunity to unveil the mechanisms that regulate the escape of ionizing photons from the LyC galaxy that is the closest in time to those at the EoR.

OBSERVING DESCRIPTION

This program images a Lyman continuum emitter at z~4 with the F390W, F814W, and F140W filters to obtain rest-frame FUV through NUV imaging data. Full orbit integrations are obtained for F390W in order to minimize post-flash and read-noise and maximize the total depth. We break up F390W observations into three visits of 3 orbits to aid in scheduling, but emaphsize the necessity of having 3 exposures per visit to be able to sufficiently clean cosmic rays for alignment and combining all 9 exposures. F390W do not require post-flash to reach sufficient background per pixel, but F814W requires 3e- due to 4 exposures in the 1 orbit to obtain a very clean image.

The target is placed at the CTE optimized location (near readout on Chip C) via the CTE aperture for F390W and F814W. For F140W we keep the target in the center. Given the possiple orientations of the WFC3/UVIS observations, the fraction of overlap of the WFC3/UVIS and WFC3/IR could vary a lot. We add an additional POSTARG to the WFC3/IR observations to overlap the WFC3/UVIS and WFC3/IR data and avoid the bright star. Lastly, we allow the ORIENT for the F814W and F140W visits to vary by +-5 degrees to ensure overlap but aid in scheduling of the observations.

Each filter utilizes a different dither pattern. The two WFC3/UVIS visits use a larger than default pattern to help minimize the blotchy pattern observed in F336W imaging (i.e., similar to that seen in Rafelski et al. 2015, AJ, 150 31, Figure 15) and to dither over the chip gap. For F390W, we use three 3-point dither patterns with each visit offset from the other two by 3" in both x and y. The 3 point dither pattern point spacing is increased by a factor of 9. For F814W, we use the standard 4-point box pattern with the point and line spacing multiplied by a factor of 19.

We tie the orient of the different visits to each other as stated in the phase I special requirements. We also specify an orient range to avoid placing the bright v_mag=8.5 star on the detector, and try to keep the bright star sufficiently far away from the detector to minimize dragon's breath.

Our program is not significantly affected by the possibility of one gyro mode. While we do have an orient constraint, we could place the target on a different part of the detector if necessary to support a different orient while avoiding the bright star. This is not ideal, but would enable more flexibility in one gyro mode.

Visit

Proposal 17133, F390W (01) Fri Jul 08 20:01:54 GMT 2022

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: ORIENT 70D TO 260 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(3)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=1.215 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1)

Fixed Targets

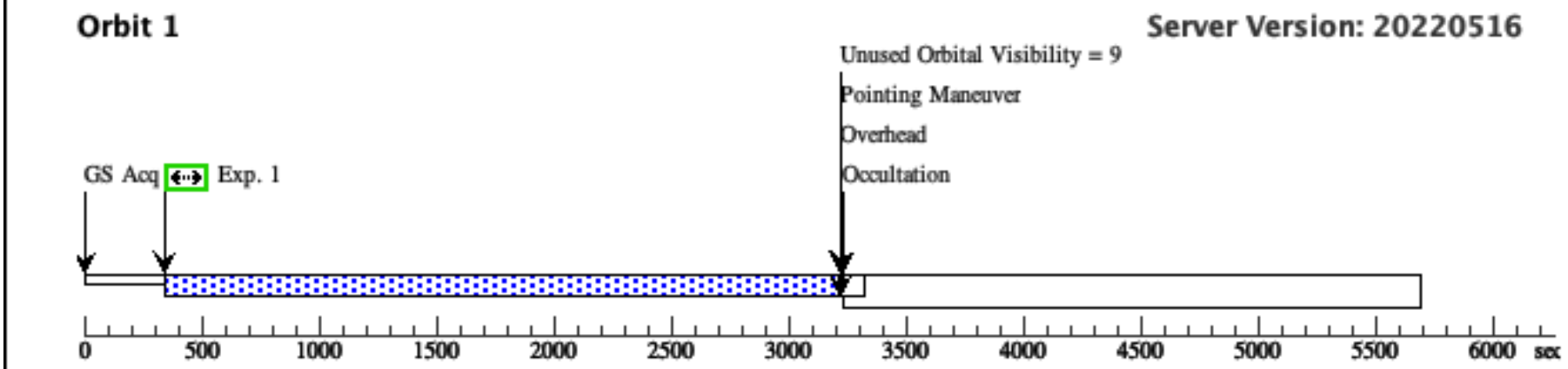
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	ION3	RA: 22 48 56.7140 (342.2363083d) Dec: -44 34 46.10 (-44.57947d) Equinox: J2000		V=24.96+/-0.10 R-band=23.72+/-0.05; I-band= 23.91+/-0.05	Reference Frame: ICRS

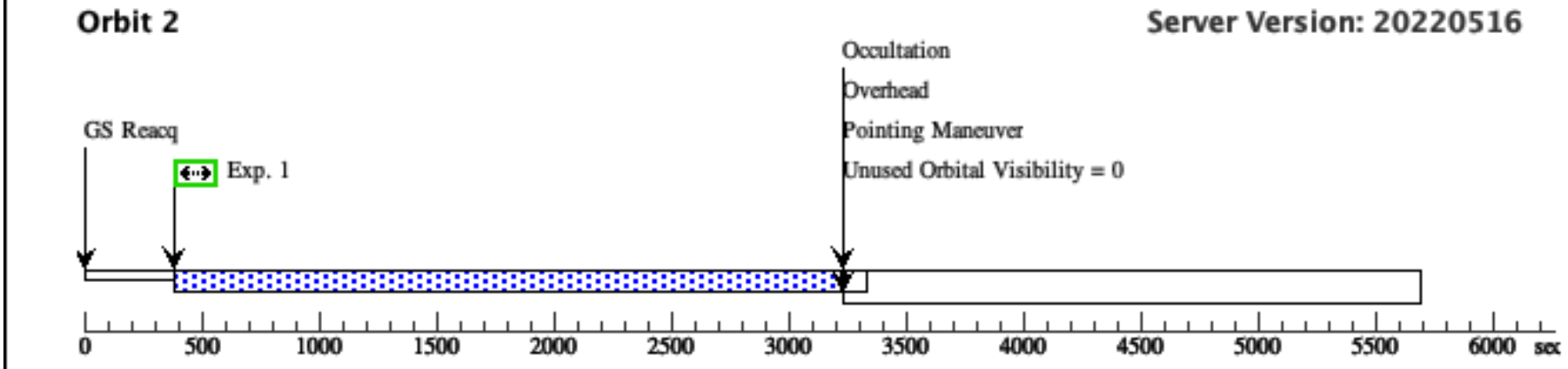
Comments:
Category=GALAXY
Description=[HIGH REDSHIFT GALAXY]
Extended=YES

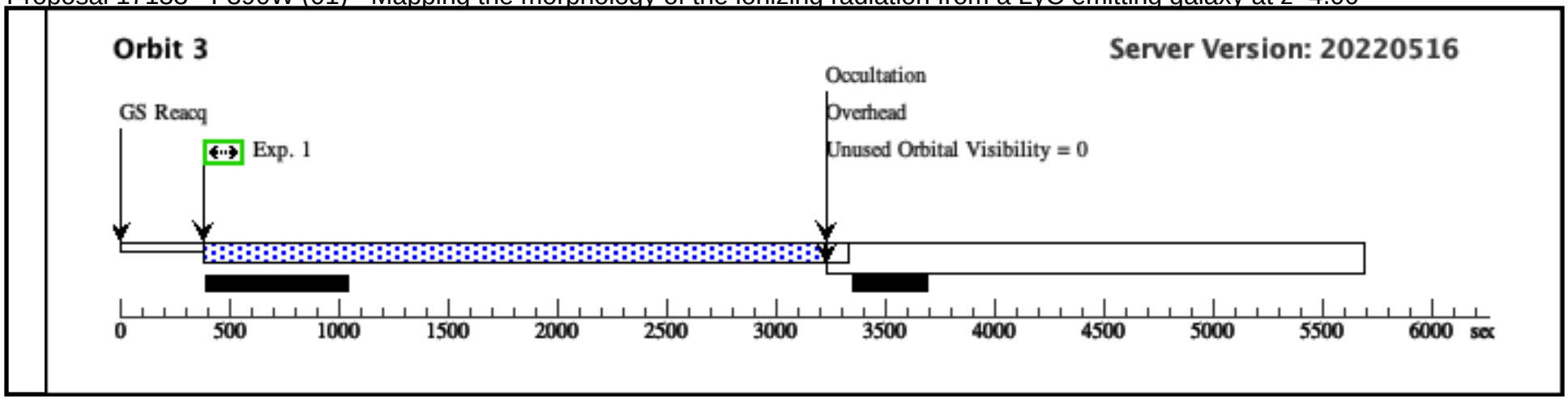
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) ION3	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F390W			Pattern 3, Exps 1-1 in F390W (01) (3)	2838 Secs (8514 Secs)	
								[==>(Pattern 1)]	***[1]***
								[==>(Pattern 2)]	***[2]***
								[==>(Pattern 3)]	***[3]***

Orbit Structure






Orbit 3
Server Version: 20220516
Occultation
GS Reacq
Overhead
Exp. 1
Unused Orbital Visibility = 0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec

Visit

Proposal 17133, F390W (02) Fri Jul 08 20:01:54 GMT 2022

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SAME ORIENT AS 01

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(3)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=1.215 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1)

Fixed Targets

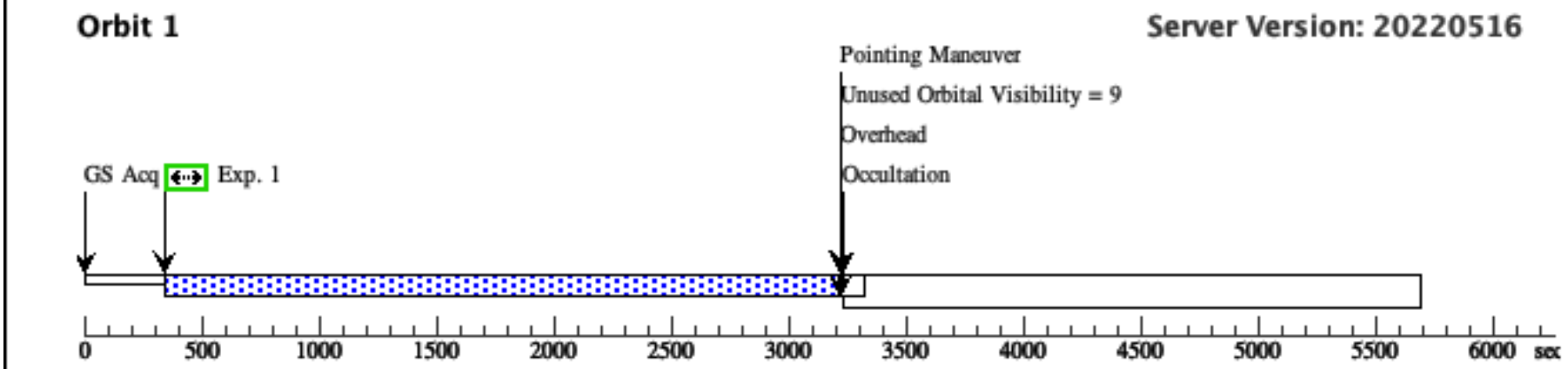
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	ION3	RA: 22 48 56.7140 (342.2363083d) Dec: -44 34 46.10 (-44.57947d) Equinox: J2000		V=24.96+/-0.10 R-band=23.72+/-0.05; I-band= 23.91+/-0.05	Reference Frame: ICRS

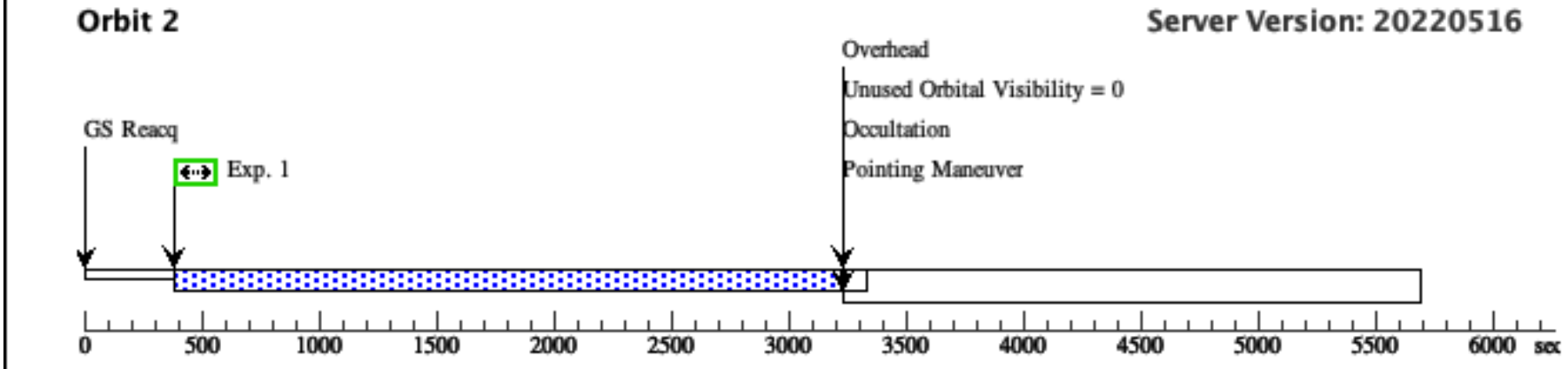
Comments:
Category=GALAXY
Description=[HIGH REDSHIFT GALAXY]
Extended=YES

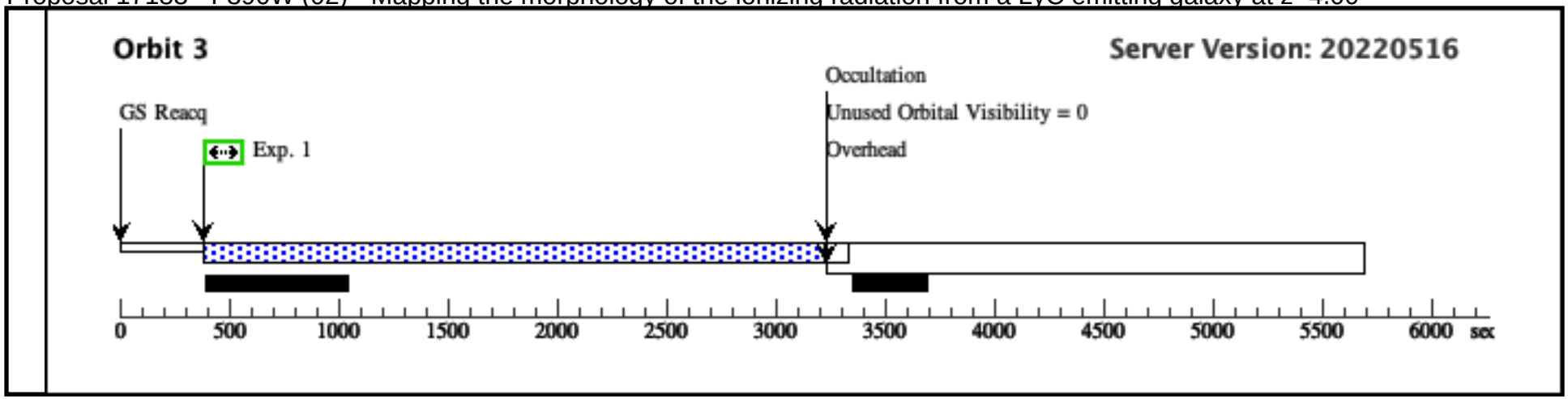
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) ION3	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F390W		POS TARG 3,3	Pattern 3, Exps 1-1 in F390W (02) (3)	2838 Secs (8514 Secs)	
								[==>(Pattern 1)]	***[1]***
								[==>(Pattern 2)]	***[2]***
								[==>(Pattern 3)]	***[3]***

Orbit Structure






Orbit 3
Server Version: 20220516
Occultation
GS Reacq
Unused Orbital Visibility = 0
Exp. 1
Overhead
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec

Visit

Proposal 17133, F390W (03) Fri Jul 08 20:01:54 GMT 2022

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SAME ORIENT AS 01

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(3)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=1.215 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1)

Fixed Targets

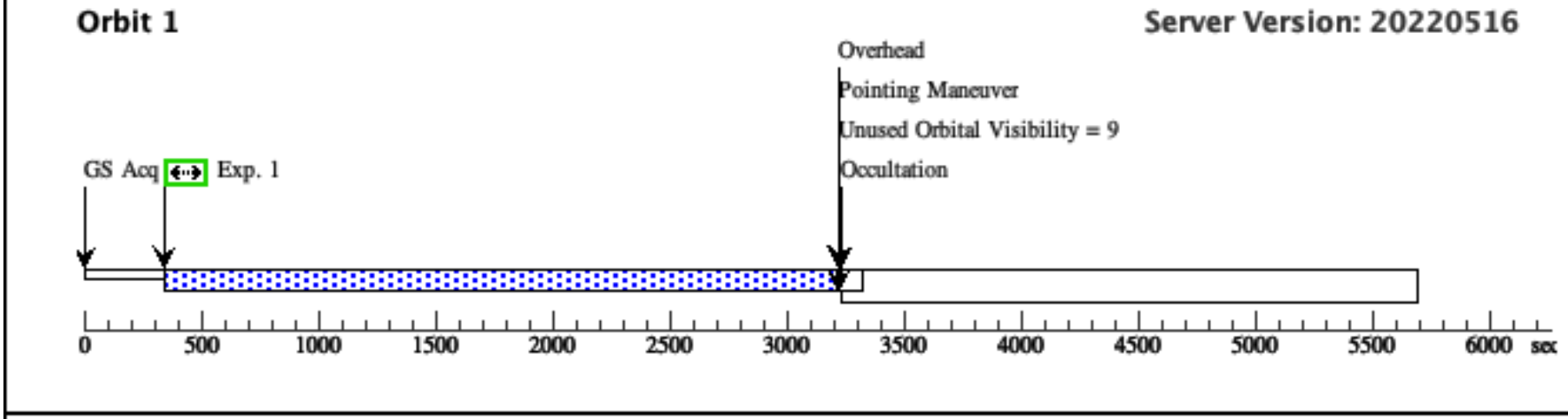
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	ION3	RA: 22 48 56.7140 (342.2363083d) Dec: -44 34 46.10 (-44.57947d) Equinox: J2000		V=24.96+/-0.10 R-band=23.72+/-0.05; I-band= 23.91+/-0.05	Reference Frame: ICRS

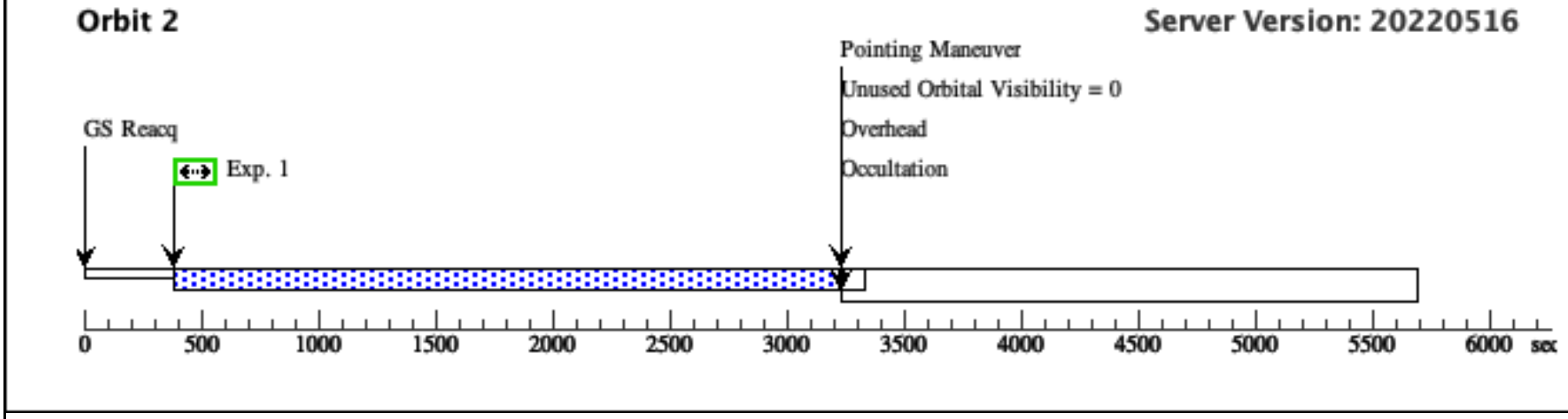
Comments:
Category=GALAXY
Description=[HIGH REDSHIFT GALAXY]
Extended=YES

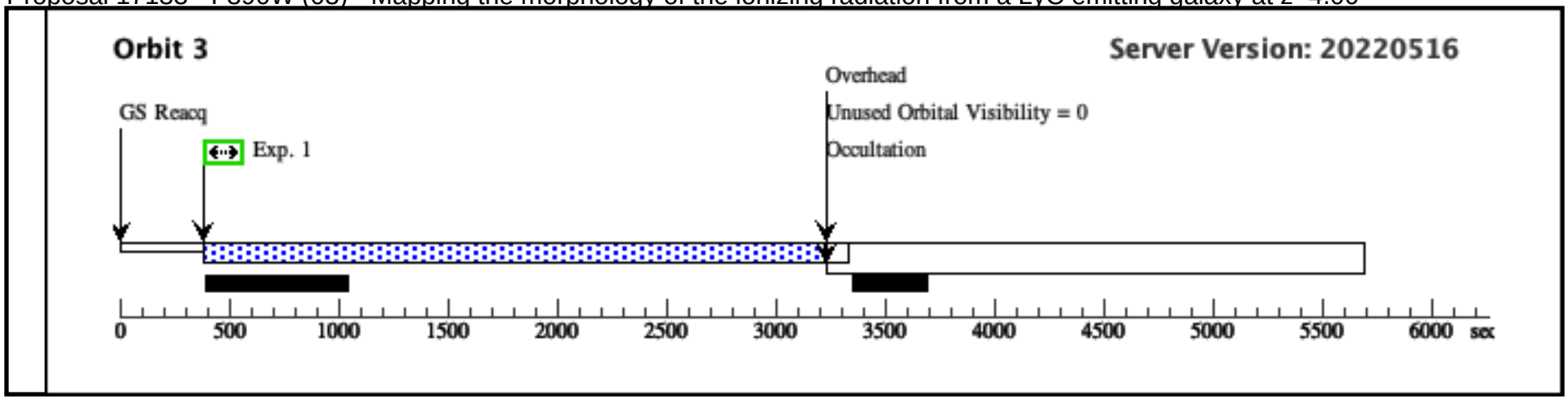
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) ION3	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F390W		POS TARG -3,-3	Pattern 3, Exps 1-1 in F390W (03) (3)	2838 Secs (8514 Secs)	
								[==>(Pattern 1)]	***[1]***
								[==>(Pattern 2)]	***[2]***
								[==>(Pattern 3)]	***[3]***

Orbit Structure






Orbit 3
Server Version: 20220516
Overhead
GS Reacq
Unused Orbital Visibility = 0
Exp. 1
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec

Visit

Proposal 17133, F814W (04)

Fri Jul 08 20:01:55 GMT 2022

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: ORIENT -5D TO 5D FROM 01

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=3.287 Line Spacing=2.128	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=false		(1)

Fixed Targets

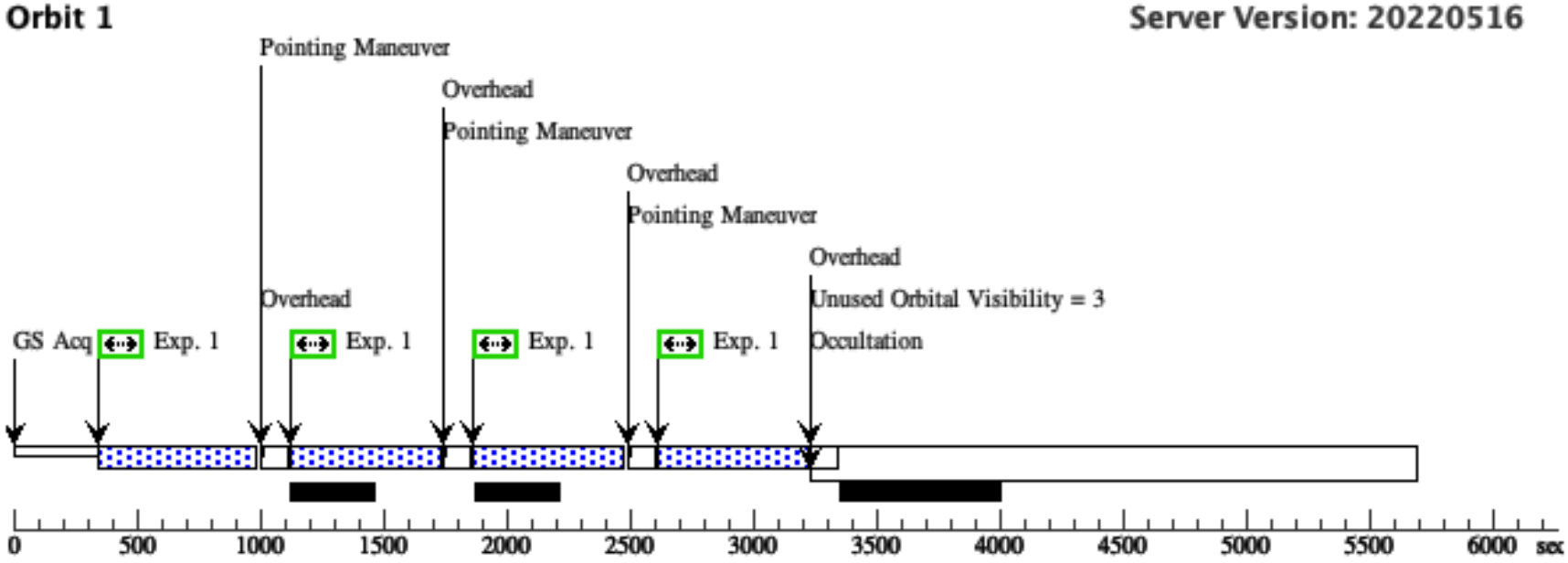
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	ION3	RA: 22 48 56.7140 (342.2363083d) Dec: -44 34 46.10 (-44.57947d) Equinox: J2000		V=24.96+/-0.10 R-band=23.72+/-0.05; I-band= 23.91+/-0.05	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[HIGH REDSHIFT GALAXY]
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) ION3	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F814W	FLASH=3		Pattern 1, Exps 1-1 in F814W (04) (1)	612 Secs (2448 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Orbit Structure



Visit

Proposal 17133, F140W (05) Fri Jul 08 20:01:55 GMT 2022

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: ORIENT -5D TO 5D FROM 01

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.572 Line Spacing=0.365	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=false		(1)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	ION3	RA: 22 48 56.7140 (342.2363083d) Dec: -44 34 46.10 (-44.57947d) Equinox: J2000		V=24.96+/-0.10 R-band=23.72+/-0.05; I-band= 23.91+/-0.05	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[HIGH REDSHIFT GALAXY]
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) ION3	WFC3/IR, MULTIACCUM, IR	F140W	NSAMP=14; SAMP-SEQ=SPARS50	POS TARG -55,-45	Pattern 2, Exps 1-1 in F140W (05) (2)	652.938154 Secs (2611.753 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Orbit Structure