16071 - Preparing for JWST with HST/COS spectroscopy of Pox 186: a local analogue of z > 6 galaxies

Cycle: 27, Proposal Category: GO

(UV Initiative, JWST Initative)

(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) LEDA-46982	COS/FUV COS/NUV	2	26-Mar-2020 15:03:48.0	yes
02	(1) LEDA-46982	COS/NUV	5	26-Mar-2020 15:03:50.0	yes

7 Total Orbits Used

ABSTRACT

ALMA has revolutionized the study of reionization-era galaxies. With the launch of JWST just over one year way, it is crucial to establish a local reference sample of high-redshift "analog" galaxies covering essential UV, optical and FIR emission lines that will soon become available in the upcoming JWST+ALMA era. In doing so, we recently (Dec 2019) discovered that a local (z ~ 0.0039), metal-poor (12 + log(O/H) = 7.76) blue compact dwarf galaxy, Pox 186, exhibits not only extreme [OIII]88/[CII]158 but also an unpublished CIII]1908 equivalent width (~ 20 A) in its archival STIS spectrum (for which the CIII] was never published). This extreme CIII] is comparable to those observed in galaxies at redshifts of z ~

6-7, when the reionization process is thought to be completed. We request mid-cycle time to obtain FUV and NUV COS spectroscopy for this galaxy, to obtain high S/N constraints on the UV emission lines, as it will allow us to complement a multi-wavelength initiative involving far-infrared and optical integral field spectroscopy. The proposed mid-cycle HST/COS observations will be very timely as they will inform proposals for the upcoming Cycle 1 deadline of JWST, targeted to explore the epoch of reionization.

OBSERVING DESCRIPTION

We propose to obtain good quality (S/N > 3) HST/COS spectra of Pox 186, the potentially most extreme local analogue of high-redshift (6{7) galaxies. We will use G160M/1623 and G185M/1913 to cover wavelength range of 1434-1796 A and 1797-2027 A, respectively, which will allow us to detect the key nebular and stellar features CIV 1548, 1550, He II 1640, O III] 1661, 1666, and C III] 1907, 1909 (Fig 3) which are ubiquitous at high redshifts. Moreover, spectral resolutions of G160M and G185M is sufficient to resolve the doublets mentioned above. The UV spectra were acquired previously with STIS/HST in 2000 but the S/N was too low for extracting reliable information from these spectra. COS is 10 times more sensitive than STIS in the FUV, and its spectral resolution is 25 times better than STIS (14 km s^-11 for G160 M compared to 360 km s^-11 for STIS), which will allow us to detect and resolve the required emission lines.

Pox 186 is compact and unresolved in F336W, and thus is ideal to be observed by COS which is optimized for observing point sources. We used COS ETC to estimate the exposure times for spectroscopic observations and target acquisition as described below: We extracted the FUV and NUV spectra from the archival STIS observations (PID:8333) and used them in COS ETC for the G160M/1623 and G185M/1913 settings for FUV and NUV spectroscopy, respectively. We estimated the required exposure time for achieving S/N = 3 (per resolution element) at wavelengths of 1548 A and 1909 A for gratings G160M and and G185M/1913 settings for FUV and NUV spectroscopy, respectively. We estimated the required exposure time for achieving S/N = 3 (per resolution element) at wavelengths of 1548 A and 1909 A for gratings G160M and G185M, respectively. Similarly, using the STIS FUV and NUV spectra, we also estimated exposure time for obtaining the ACQ/Image using PSA/MirrorA for a recommended S/N = 20. We conservatively considered an HST orbit lasting 52 minutes minus overheads as suggested by the APT: guide star (re-)acquisition (5-6 min), target acquisition (5-6 min), and exposure overheads including FP-POS split (2-12 min). The above procedure resulted in 2 orbits for G160M and 5 orbits for G185M.

The ETC reported no warnings for violations of the local and/or global bright object limits, so we expect the target to be safe to observe. The spectroscopic exposures in each pointing will be executed with FP-split to mitigate flatfielding uncertainties, remove grid wire residuals and improve S/N.

The G160M and G185M have dispersions of 73.4 and 102 mA resolution element. We will estimate the approximate spectral resolution by fitting narrow Milky Way absorption features, which we will use to bin the reduced and extracted (via CALCOS pipeline) one dimensional spectra by

averaging over the length of resolution elements (or multiple thereof) to achieve higher S/N per pixel. This will allow us to detect and analyse any weak spectral features.

In total, we request for 7 orbits to obtain FUV and NUV spectra using HST/COS covering a wavelength range of 1434-2027 A for Pox 186.

Visit

Proposal 16071, Pox 186 (01), implementation Thu Mar 26 19:03:50 GMT 2020

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Diagnostics

(Pox 186 (01)) Warning (Orbit Planner): INEFFICIENT ORDERING OF FP-POS POSITIONS

Fixed Targets

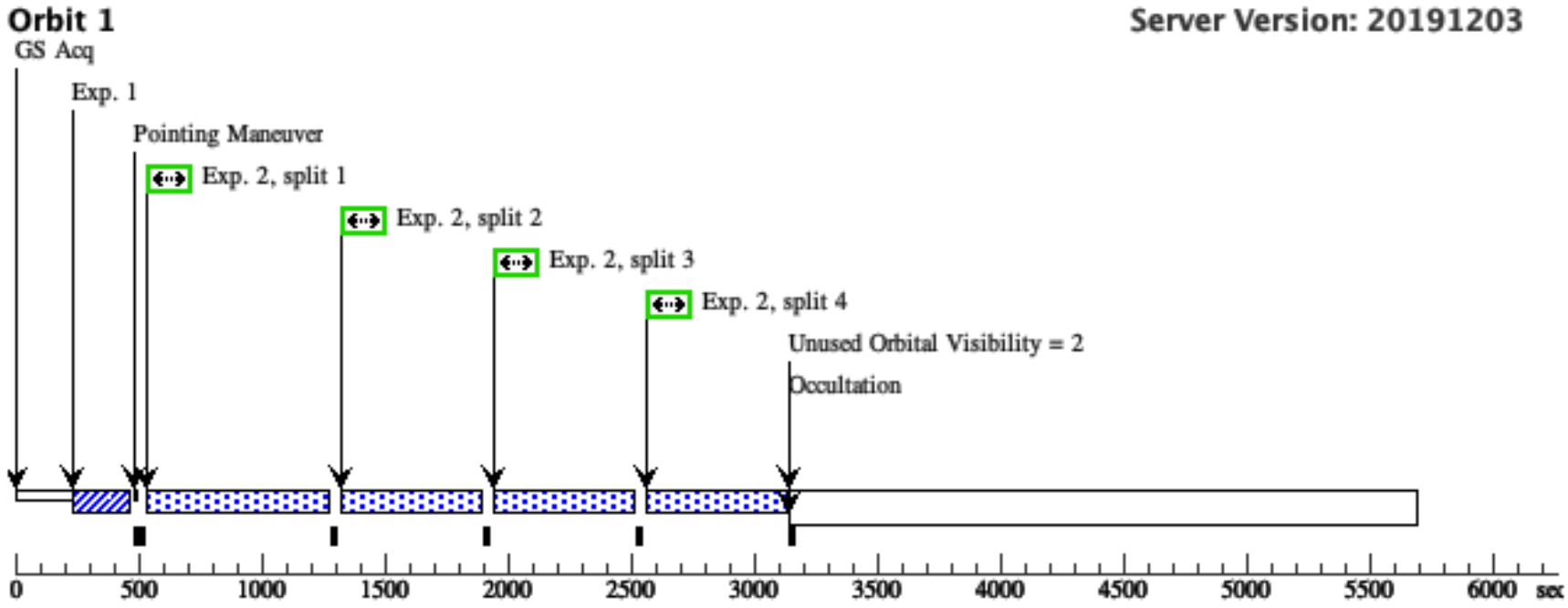
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LEDA-46982	RA: 13 25 48.6413 (201.4526721d) Dec: -11 36 37.94 (-11.61054d) Equinox: J2000	Epoch of Position: 2000 Redshift: 0.003903	V=17.43+/-0.03 B = 17.93+/-0.53	Reference Frame: ICRS

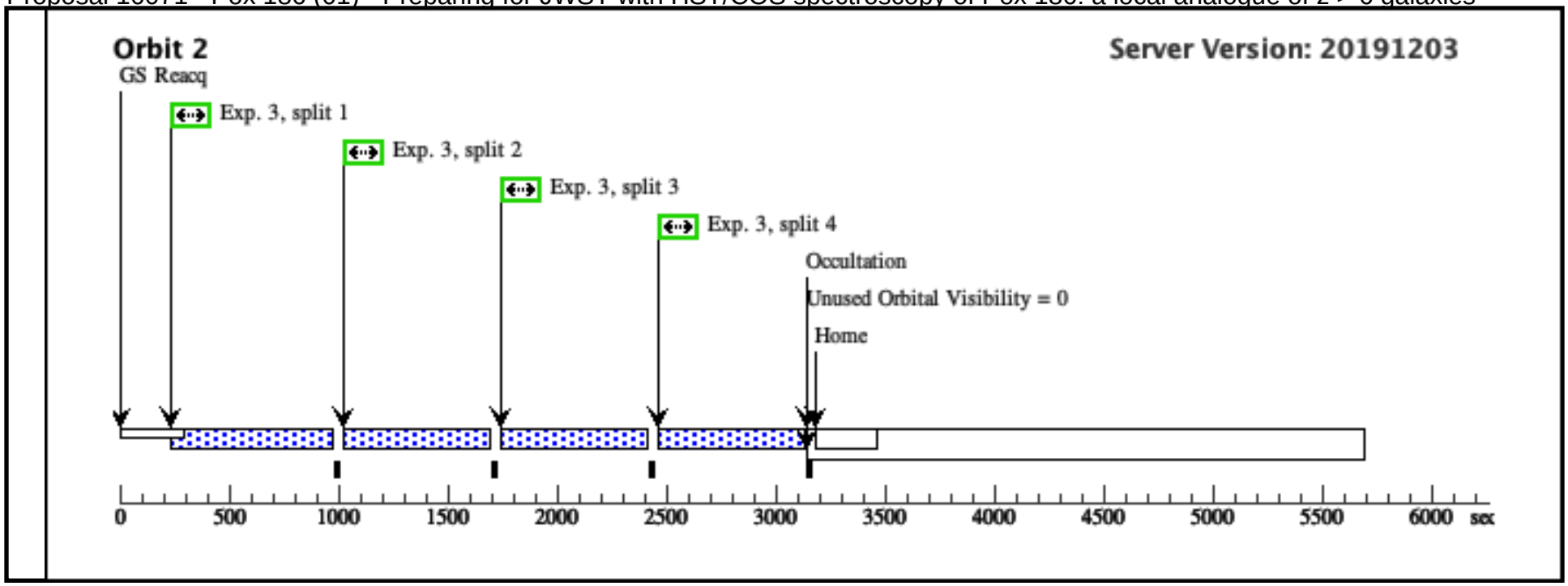
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=GALAXY
Description=[DWARF COMPACT]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Acq/image (1433821)	(1) LEDA-46982	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				7 Secs (7 Secs) *[==>]*	 ***[1]***
Comments: We notice that BOT/GSC reports a warning about exceeding the local count rate. However, when we ran ETC using already existing FUV and NUV spectra of this target, ETC reported no such warning. We also checked 21.5" arcsec field around the target in a HST/F336W image, which shows that the field does not have any other source other than our target.									
2	COS/FUV (1432963)	(1) LEDA-46982	COS/FUV, TIME-TAG, PSA	G160M 1623 A	FLASH=YES; BUFFER-TIME=1885; FP-POS=ALL			985 Secs (2060 Secs) *[==>515.0 Secs (Split 1)]* *[==>515.0 Secs (Split 2)]* *[==>515.0 Secs (Split 3)]* *[==>515.0 Secs (Split 4)]*	 ***[1]***
3	COS/FUV (1432963)	(1) LEDA-46982	COS/FUV, TIME-TAG, PSA	G160M 1623 A	FLASH=YES; BUFFER-TIME=1885; FP-POS=ALL			617 Secs (2468 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	 ***[2]***

Orbit Structure




Orbit 2
Server Version: 20191203
GS Reacq
Exp. 3, split 1
Exp. 3, split 2
Exp. 3, split 3
Exp. 3, split 4
Occultation
Unused Orbital Visibility = 0
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec

Visit

Proposal 16071, Pox 186 (02) Thu Mar 26 19:03:51 GMT 2020

Diagnostic Status: Warning

Scientific Instruments: COS/NUV

Special Requirements: (none)

Diagnostics

(Pox 186 (02)) Warning (Orbit Planner): INEFFICIENT ORDERING OF FP-POS POSITIONS

Fixed Targets

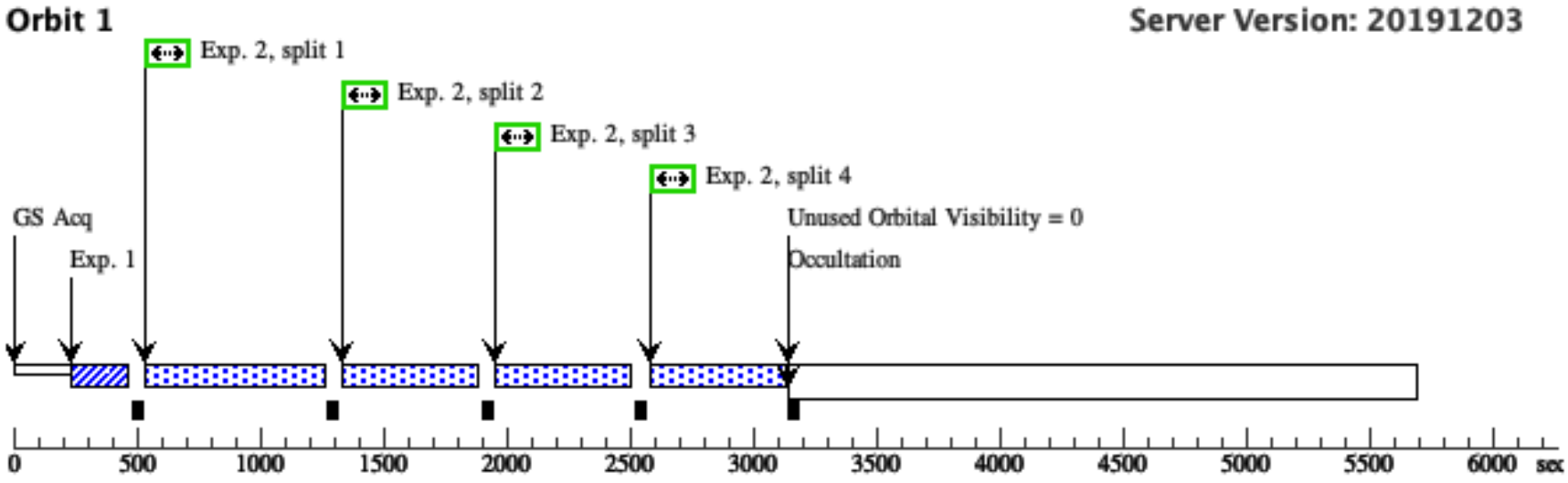
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LEDA-46982	RA: 13 25 48.6413 (201.4526721d) Dec: -11 36 37.94 (-11.61054d) Equinox: J2000	Epoch of Position: 2000 Redshift: 0.003903	V=17.43+/-0.03 B = 17.93+/-0.53	Reference Frame: ICRS

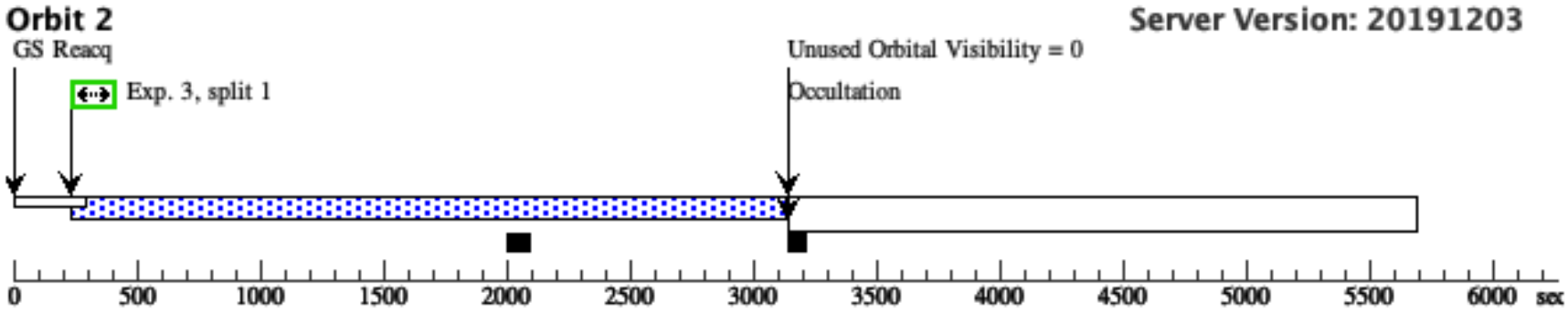
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=GALAXY
Description=[DWARF COMPACT]
Extended=NO

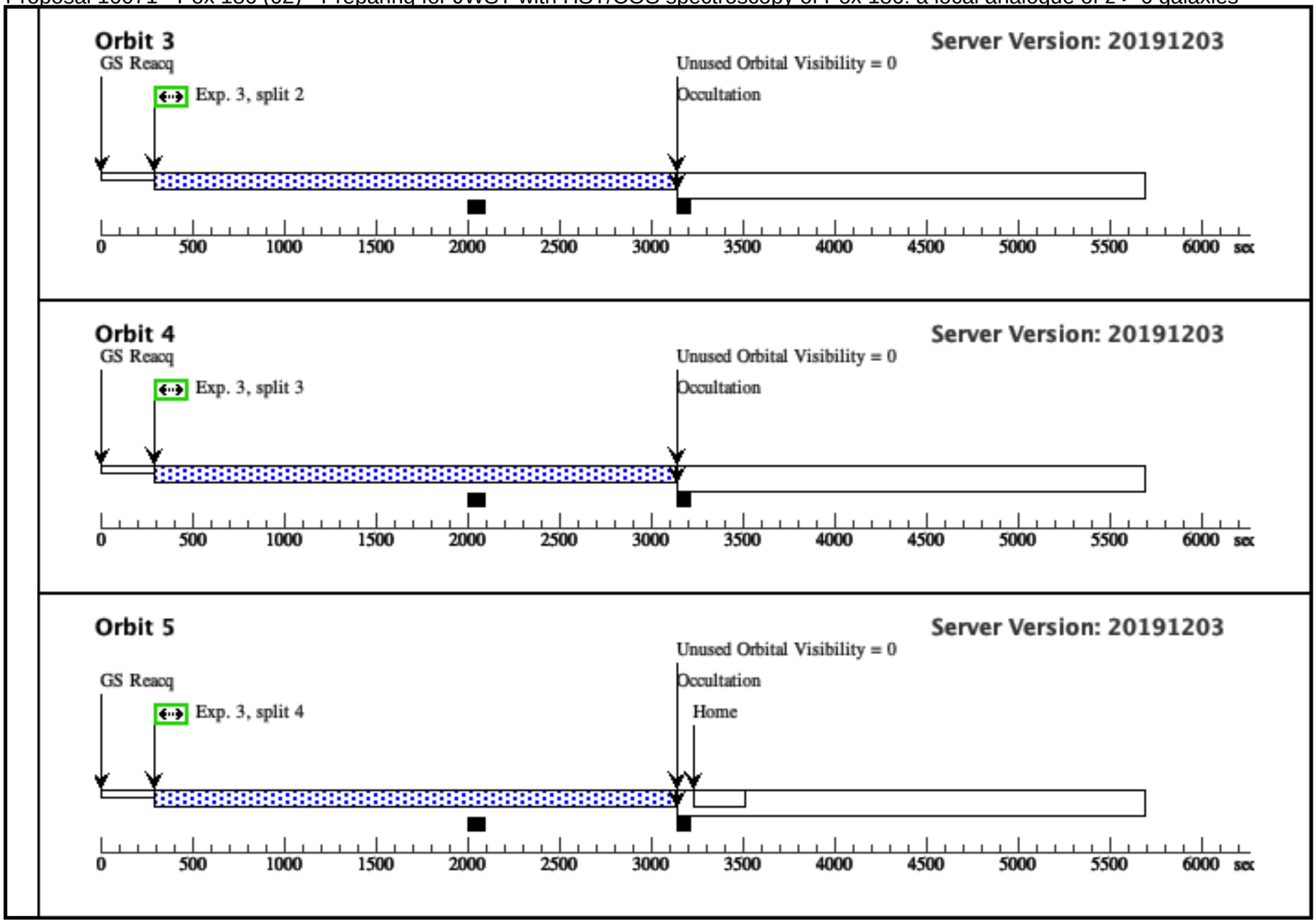
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Acq/image (1433821)	(1) LEDA-46982	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				7 Secs (7 Secs)	
								[==>]	***[1]***
Comments: We notice that BOT/GSC reports a warning about exceeding the local count rate. However, when we ran ETC using already existing FUV and NUV spectra of this target, ETC reported no such warning. We also checked 21.5" arcsec field around the target in a HST/F336W image, which shows that the field does not have any other source other than our target.									
2	COS/NUV (1432966)	(1) LEDA-46982	COS/NUV, TIME-TAG, PSA	G185M 1913 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=1704			400 Secs (2148 Secs) *[==>537.0 Secs (Split 1)]* *[==>537.0 Secs (Split 2)]* *[==>537.0 Secs (Split 3)]* *[==>537.0 Secs (Split 4)]*	***[1]***
3	COS/NUV (1432966)	(1) LEDA-46982	COS/NUV, TIME-TAG, PSA	G185M 1913 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=1704			2818 Secs (11280 Secs) *[==>2820.0 Secs (Split 1)]* *[==>2820.0 Secs (Split 2)]* *[==>2820.0 Secs (Split 3)]* *[==>2820.0 Secs (Split 4)]*	 ***[2]*** ***[3]*** ***[4]*** ***[5]***

Orbit Structure






Orbit 3
Server Version: 20191203
GS Reacq
Exp. 3, split 2
Unused Orbital Visibility = 0
Occultation
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Orbit 4
Server Version: 20191203
GS Reacq
Exp. 3, split 3
Unused Orbital Visibility = 0
Occultation
0 500 1000 1500 2000 2500 3000 3500 4000 4500 5000 5500 6000 sec
Orbit 5
Server Version: 20191203
Unused Orbital Visibility = 0
Occultation
GS Reacq
Exp. 3, split 4
Home
0 500 1000 1500 2000 2500 3000 3500 4000 4500 5000 5500 6000 sec