16464 - Mapping the Porous Neutral Gas Reservoir in an Extremely High Ionization Galaxy

Cycle: 28, 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) J1418+2102	WFC3/UVIS	3	01-Dec-2020 09:00:19.0	yes
02	(1) J1418+2102	WFC3/UVIS	3	01-Dec-2020 09:00:20.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
03	(1) J1418+2102	WFC3/UVIS	3	01-Dec-2020 09:00:21.0	yes
04	(1) J1418+2102	WFC3/UVIS	3	01-Dec-2020 09:00:21.0	yes
05	(1) J1418+2102	WFC3/UVIS	3	01-Dec-2020 09:00:22.0	yes

15 Total Orbits Used

ABSTRACT

We do not empirically know how the first galaxies reionized the early universe. In particular, how does neutral gas transmit ionizing photons from gas-rich star-forming regions into the intergalactic medium? One solution is that small regions of ionized gas preferentially funnel ionizing photons out of galaxies. However, this anisotropic escape dramatically changes the morphology of cosmic reionization and the subsequent structure of the universe. The James Webb Space Telescope aims to provide the empirical foundation of the epoch of reionization, but it will not sufficiently resolve the morphology of neutral gas nor the isotropy of the escape of ionizing photons. Here, we propose 15 orbits of HST mid-cycle observations to obtain 35 pc spatial resolution WFC3 images of the neutral resonant Mg II emission line. The proposed high-ionization emission line galaxy has recently been discovered to have a massive, but porous, neutral gas reservoir. Regions of bright resonant Mg II emission will trace the low column density holes through which the newly observed Lyman Alpha must propagate through. These Mg II maps will test where photons are transmitted out of this galaxy to answer how isotropically ionizing photons stream into the intergalactic medium. We will complement the Mg II maps with optical emission line maps to determine whether strong optical lines trace these low column density holes. These observations are crucial for understanding upcoming JWST observations and will illuminate one of the key empirical obstacles towards understanding cosmic reionization.

OBSERVING DESCRIPTION

Here we aim to image the Mg II emission from an extreme emission line galaxy with WFC3/UVIS. We then aim to understand why this resonant emission escapes the extreme emission line galaxy. To do this we will image the galaxy in 9 different filters: Mg II emission (F275W)m Mg II continuum (F280N), [O II] (F373N), [O II] continuum (F343N), [O III] (F502N), H-beta (F487N), the H-beta + [O III] continuum (F467N), H-alpha (F665N) and the H-alpha continuum (F645N).

We use previous SDSS and MUSE spatially resolved imaging to determine the surface brightnesses that we must integrate down to and the WFC3/UVIS ETC to determine the required exposure times.

We will break the individual visits up into 3 orbit visits. Where possible, we will try to have as long of visits as possible to increase the background and the CTE, while reducing the pre-flash required. We calculate the pre-flash required for each exposure using the WFC3 ETC and determining the flash required to reach a total background of 20 e-.

We will use the WFC3 Dither-line pattern, which will allow us to do 2 exposures per filter set up to account for bad pixels and sub-sample the PSF.

In order to avoid large buffer dump issues, we include some of our shorter orbits (e.g. H-alpha and O III) with some of our longer orbits. This enables the buffer dump to occur during the longer exposure.

Visit

Proposal 16464, Mg II + H-alpha (01) Tue Dec 01 14:00:23 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1), (2-3)

Fixed Targets

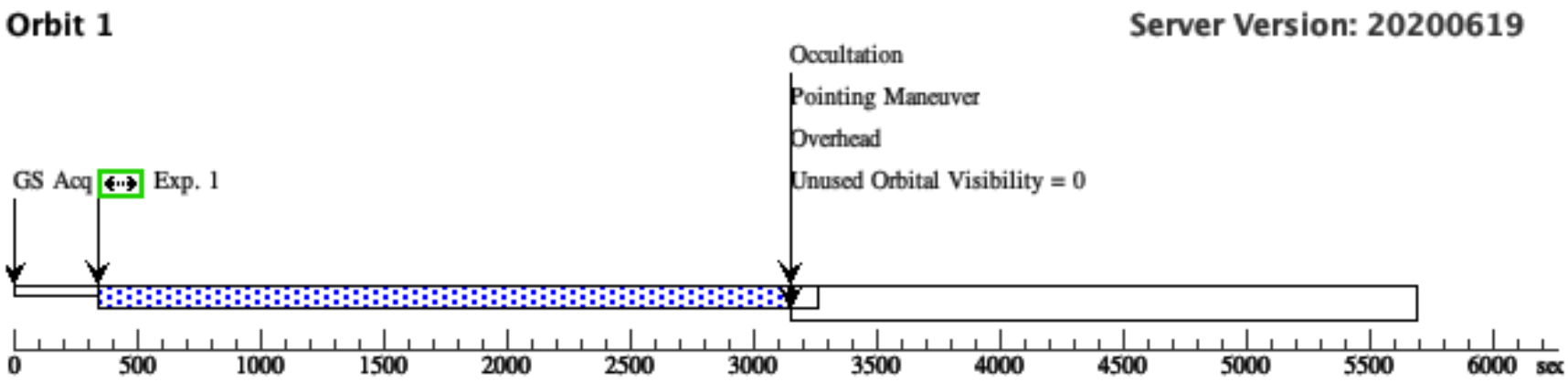
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	J1418+2102	RA: 14 18 51.1190 (214.7129958d) Dec: +21 02 39.84 (21.04440d) Equinox: J2000		V=17.74	Reference Frame: ICRS

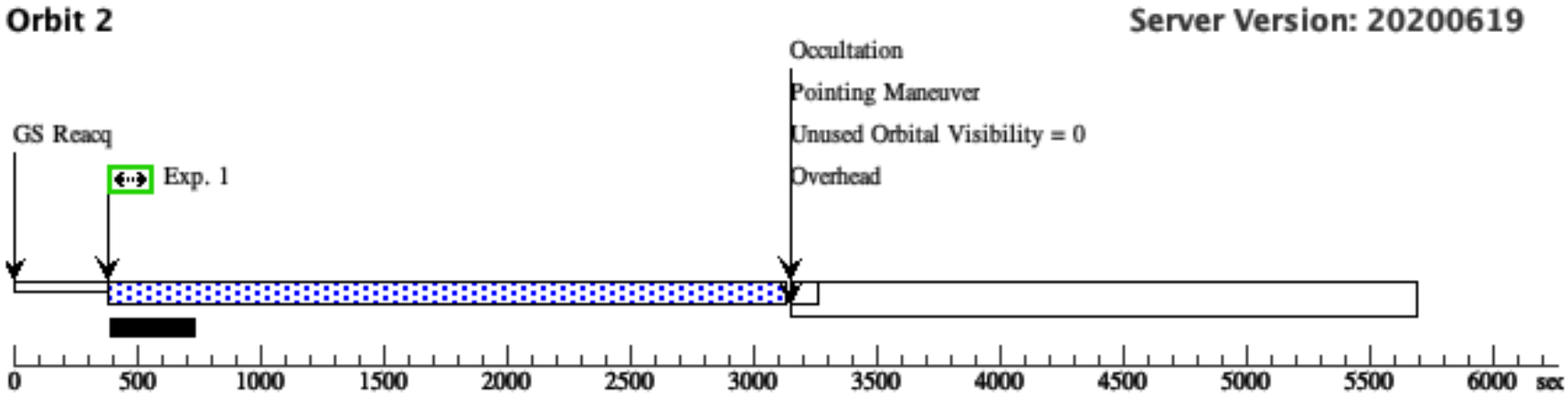
Comments:
Category=GALAXY
Description=[EMISSION LINE NEBULA, STARBURST]
Extended=YES

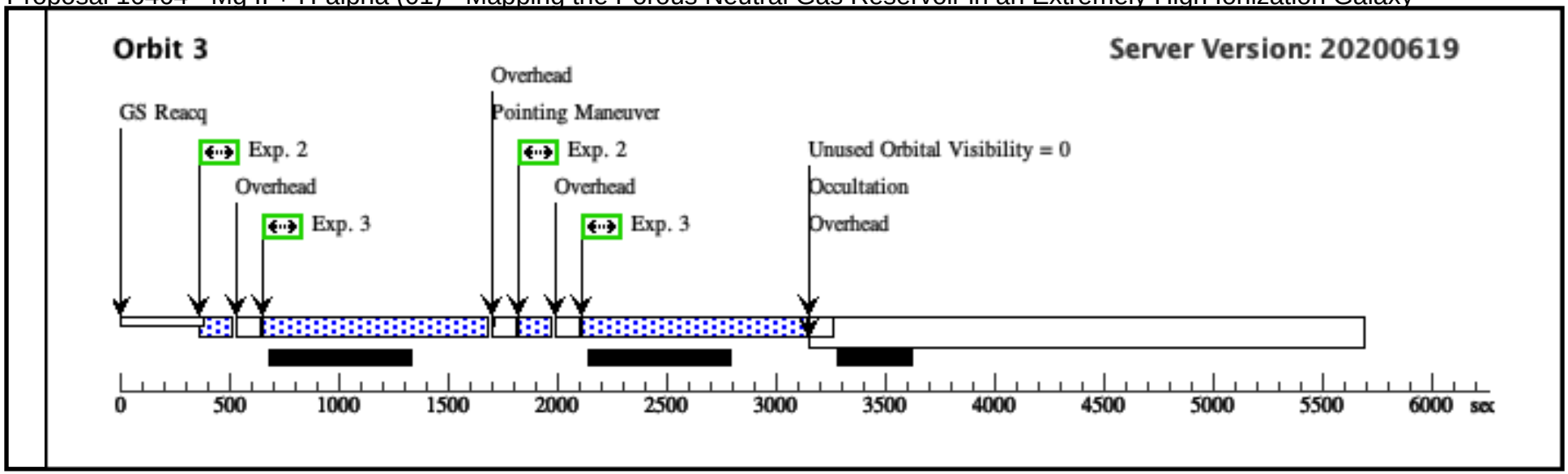
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Mg II (1472605)	(1) J1418+2102	WFC3/UVIS, ACCUM, UVIS2	F275W	FLASH=6		Pattern 1, Exps 1-1 in Mg II + H-alpha (01) (1)	2700 Secs (5523 Secs)	
								[==>2766.0 Secs (Pattern 1)]	***[1]***
								[==>2757.0 Secs (Pattern 2)]	***[2]***
2	H-alpha (1472616)	(1) J1418+2102	WFC3/UVIS, ACCUM, UVIS2	F665N	FLASH=14		Pattern 1, Exps 2-3 in Mg II + H-alpha (01) (1)	135 Secs (270 Secs)	
								[==>135.0 Secs (Pattern 1)] *[==>135.0 Secs (Pattern 2)]*	***[3]***
3	Mg II (1472608)	(1) J1418+2102	WFC3/UVIS, ACCUM, UVIS2	F275W	FLASH=11		Pattern 1, Exps 2-3 in Mg II + H-alpha (01) (1)	1500 Secs (2012 Secs)	
								[==>1006.0 Secs (Pattern 1)] *[==>1006.0 Secs (Pattern 2)]*	***[3]***

Orbit Structure



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GS Reacq
Exp. 2
Overhead
Exp. 3
Overhead
Pointing Maneuver
Exp. 2
Overhead
Exp. 3
Unused Orbital Visibility = 0
Occultation
Overhead
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec

Visit

Proposal 16464, Mg II + O III (02) Tue Dec 01 14:00:23 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1), (2-3)

Fixed Targets

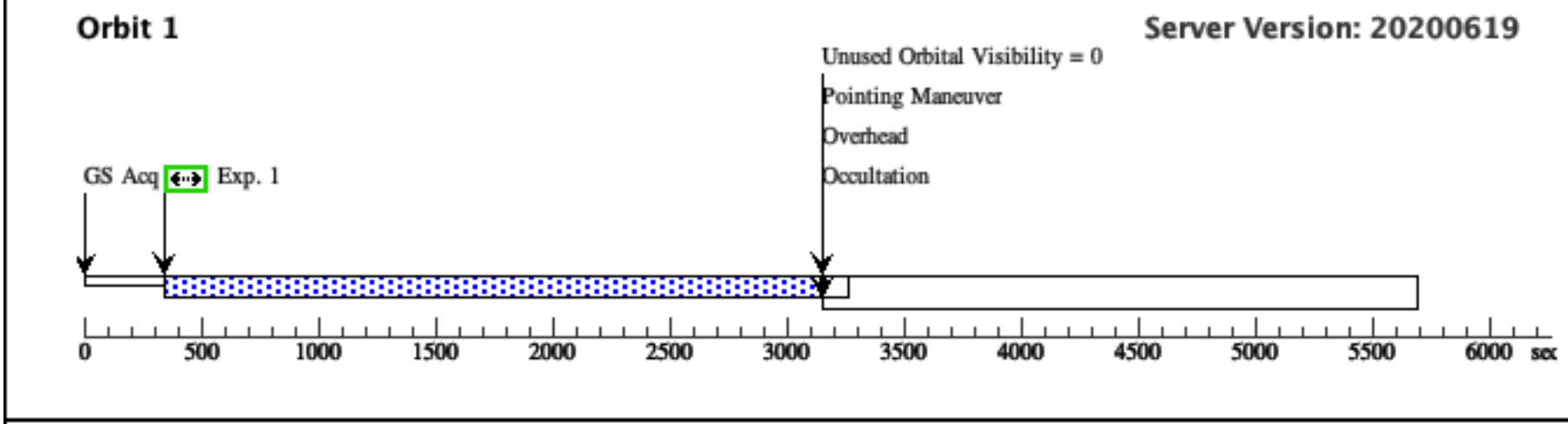
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	J1418+2102	RA: 14 18 51.1190 (214.7129958d) Dec: +21 02 39.84 (21.04440d) Equinox: J2000		V=17.74	Reference Frame: ICRS

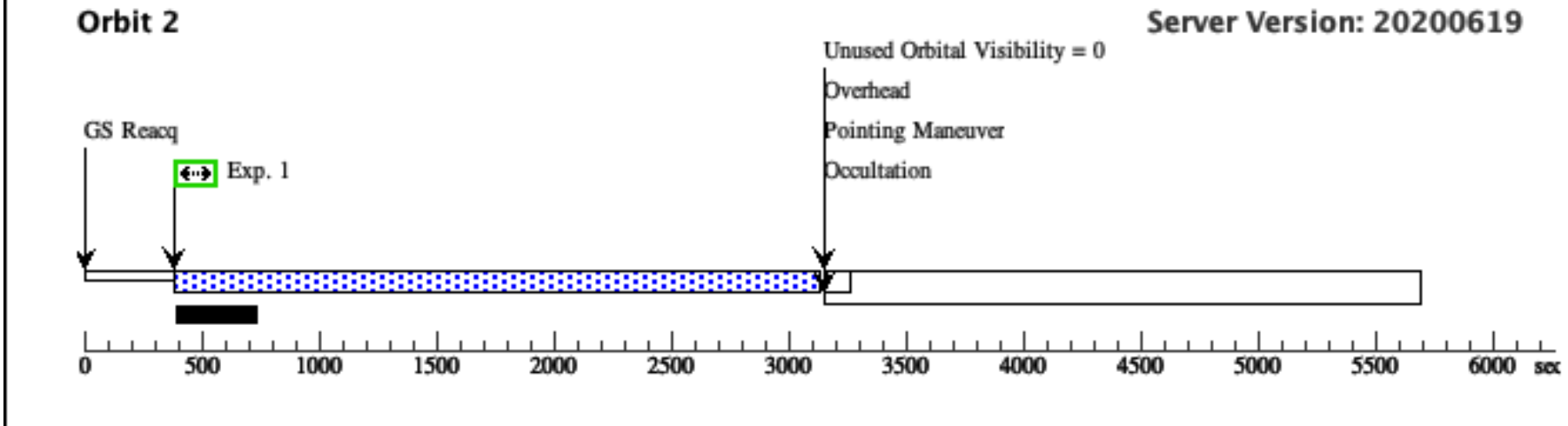
Comments:
Category=GALAXY
Description=[EMISSION LINE NEBULA, STARBURST]
Extended=YES

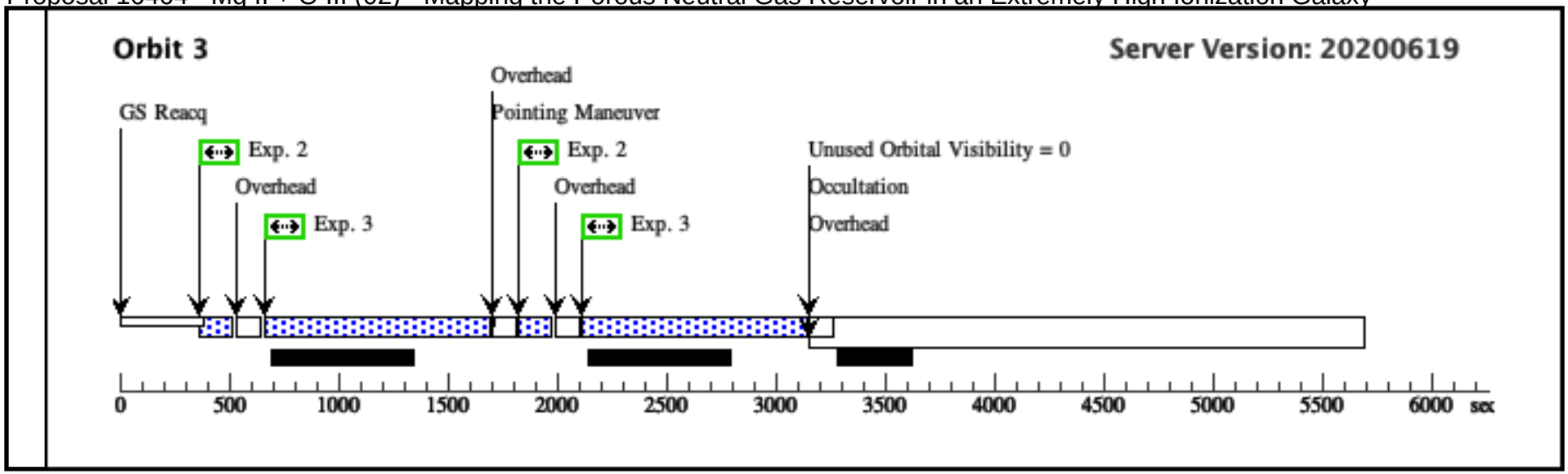
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Mg II (1472605)	(1) J1418+2102	WFC3/UVIS, ACCUM, UVIS2	F275W	FLASH=6		Pattern 1, Exps 1-1 in Mg II + O III (02) (1)	2700 Secs (5523 Secs)	
								[==>2766.0 Secs (Pattern 1)]	***[1]***
								[==>2757.0 Secs (Pattern 2)]	***[2]***
2	O III	(1) J1418+2102	WFC3/UVIS, ACCUM, UVIS2	F502N	FLASH=12		Pattern 1, Exps 2-3 in Mg II + O III (02) (1)	135 Secs (270 Secs)	
								[==>135 Secs (Pattern 1)] *[==>135 Secs (Pattern 2)]*	***[3]***
3	Mg II (1472608)	(1) J1418+2102	WFC3/UVIS, ACCUM, UVIS2	F275W	FLASH=11		Pattern 1, Exps 2-3 in Mg II + O III (02) (1)	1500 Secs (2004 Secs)	
								[==>1002.0 Secs (Pattern 1)] *[==>1002.0 Secs (Pattern 2)]*	***[3]***

Orbit Structure



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Server Version: 20200619
GS Reacq
Exp. 2
Overhead
Exp. 3
Overhead
Pointing Maneuver
Exp. 2
Overhead
Exp. 3
Unused Orbital Visibility = 0
Occultation
Overhead
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500
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1500
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5500
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sec

Visit

Proposal 16464, Mg II + H-alpha continuum (03) Tue Dec 01 14:00:23 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1), (2-3)

Fixed Targets

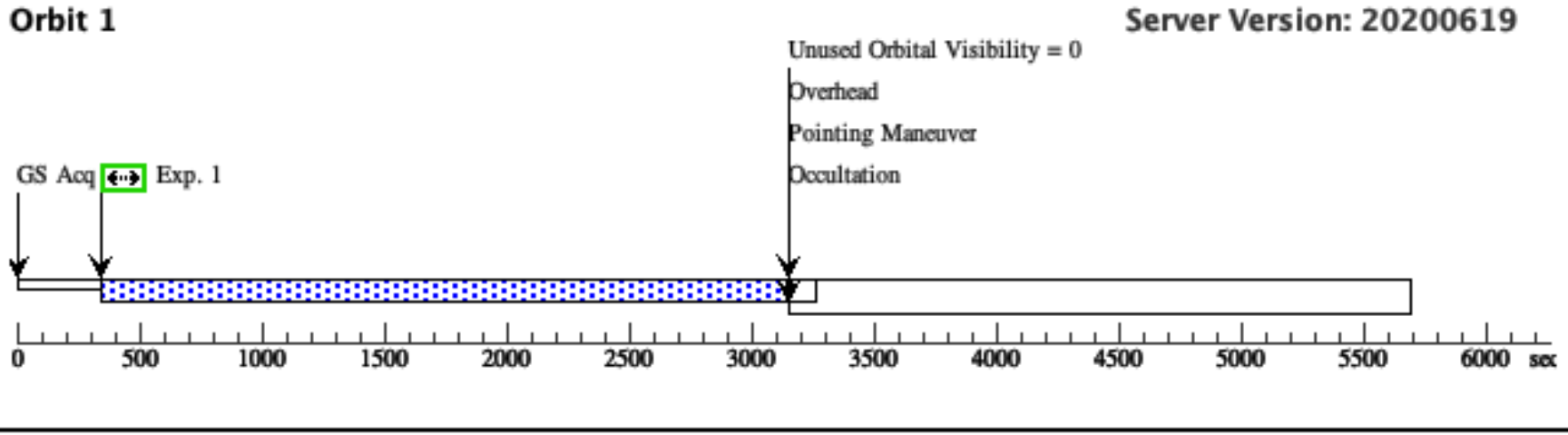
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	J1418+2102	RA: 14 18 51.1190 (214.7129958d) Dec: +21 02 39.84 (21.04440d) Equinox: J2000		V=17.74	Reference Frame: ICRS

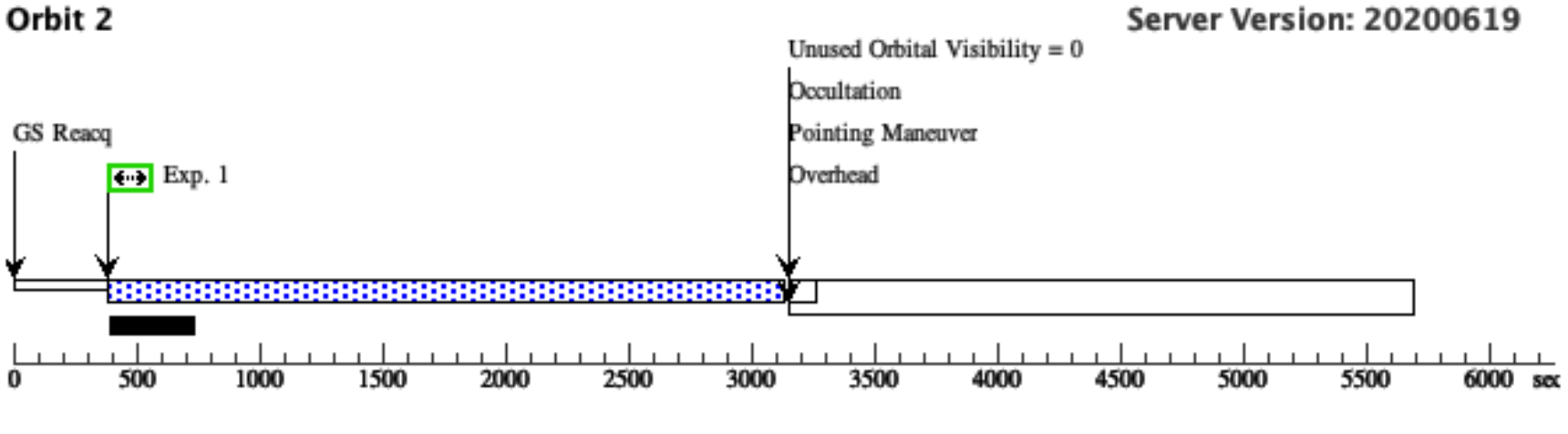
Comments:
Category=GALAXY
Description=[EMISSION LINE NEBULA, STARBURST]
Extended=YES

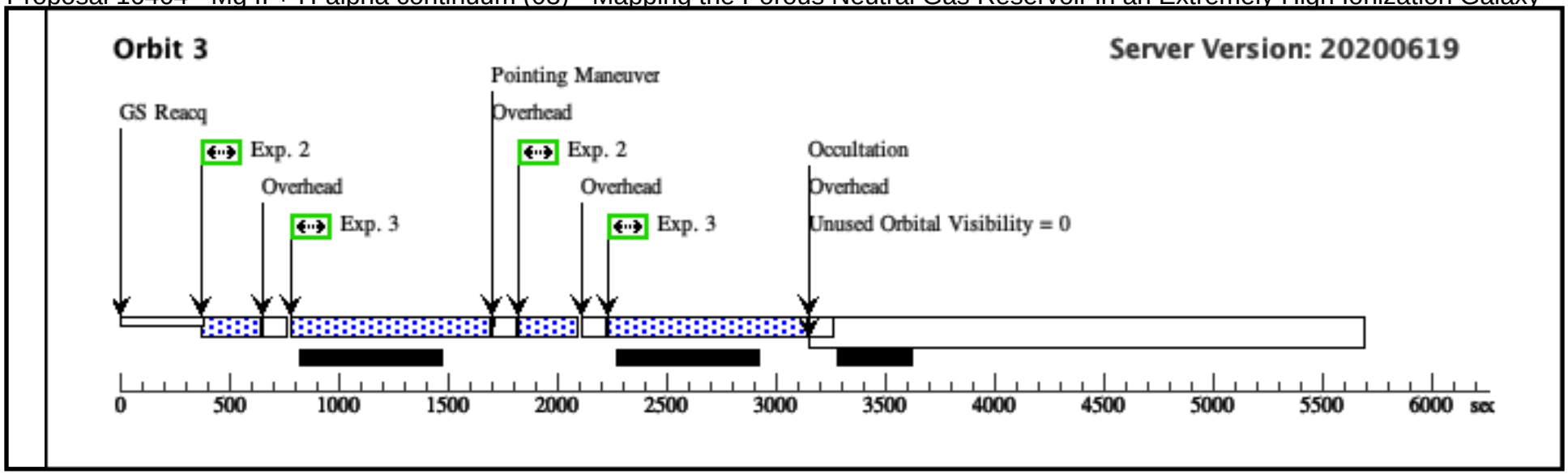
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Mg II (1472605)	(1) J1418+2102	WFC3/UVIS, ACCUM, UVIS2	F275W	FLASH=6		Pattern 1, Exps 1-1 in Mg II + H-alpha continuum (03) (1)	2700 Secs (5523 Secs)	
								[==>2766.0 Secs (Pattern 1)]	***[1]***
								[==>2757.0 Secs (Pattern 2)]	***[2]***
2	H-alpha Continuum	(1) J1418+2102	WFC3/UVIS, ACCUM, UVIS2	F645N	FLASH=12		Pattern 1, Exps 2-3 in Mg II + H-alpha continuum (03) (1)	270 Secs (518 Secs)	
								[==>259.0 Secs (Pattern 1)] *[==>259.0 Secs (Pattern 2)]*	***[3]***
3	Mg II (1472608)	(1) J1418+2102	WFC3/UVIS, ACCUM, UVIS2	F275W	FLASH=11		Pattern 1, Exps 2-3 in Mg II + H-alpha continuum (03) (1)	1500 Secs (1756 Secs)	
								[==>878.0 Secs (Pattern 1)] *[==>878.0 Secs (Pattern 2)]*	***[3]***

Orbit Structure






Orbit 3
Server Version: 20200619
GS Reacq
Exp. 2
Overhead
Exp. 3
Pointing Maneuver
Overhead
Exp. 2
Overhead
Exp. 3
Occultation
Overhead
Unused Orbital Visibility = 0
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500
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sec

Visit

Proposal 16464, Mg II Continuum (04) Tue Dec 01 14:00:24 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1), (2)

Fixed Targets

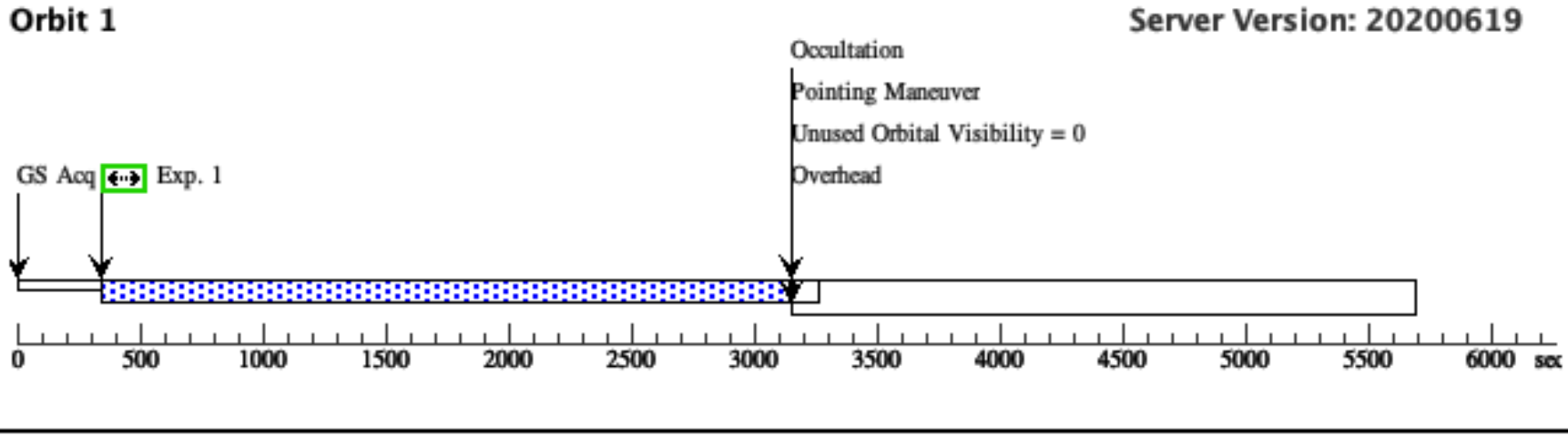
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	J1418+2102	RA: 14 18 51.1190 (214.7129958d) Dec: +21 02 39.84 (21.04440d) Equinox: J2000		V=17.74	Reference Frame: ICRS

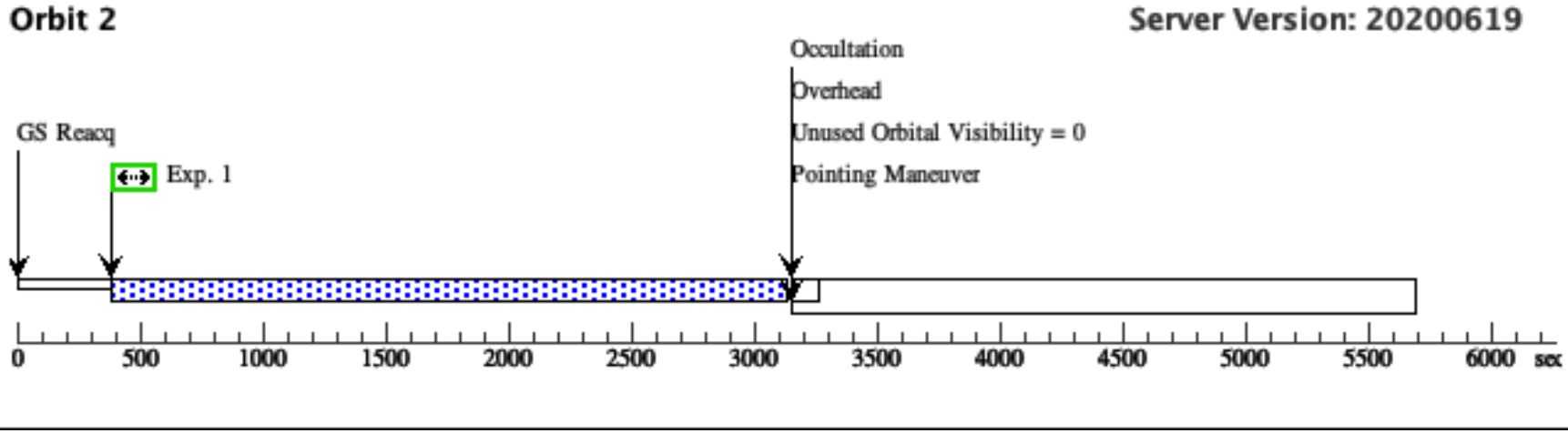
Comments:
Category=GALAXY
Description=[EMISSION LINE NEBULA, STARBURST]
Extended=YES

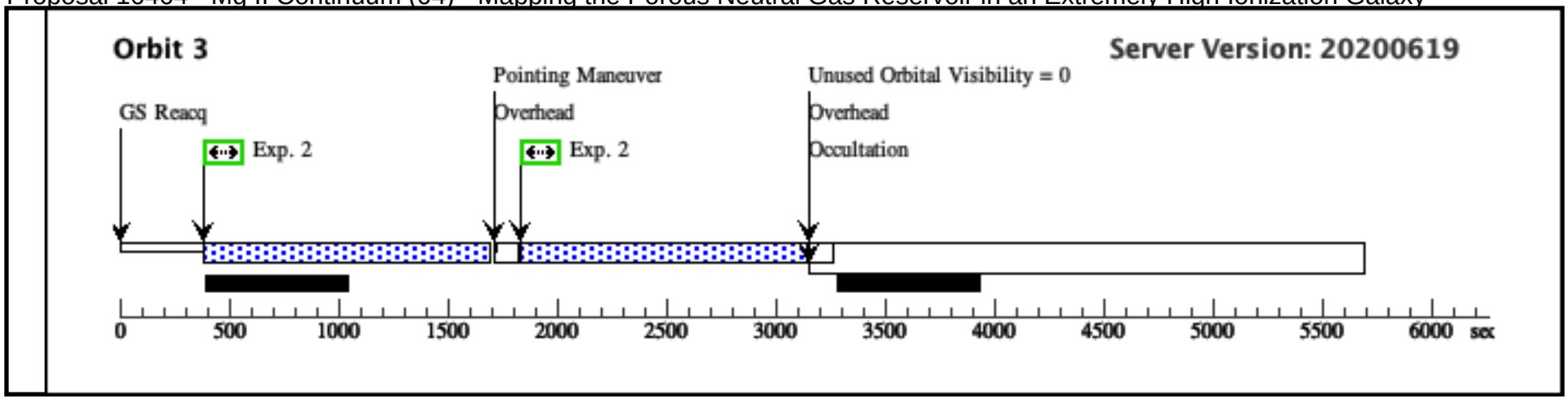
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(1472611)	(1) J1418+2102	WFC3/UVIS, ACCUM, UVIS2	F280N	FLASH=10		Pattern 1, Exps 1-1 in Mg II Continuum (04) (1)	2700 Secs (5523 Secs)	
								[==>2766.0 Secs (Pattern 1)]	***[1]***
								[==>2757.0 Secs (Pattern 2)]	***[2]***
2	(1472586)	(1) J1418+2102	WFC3/UVIS, ACCUM, UVIS2	F280N	FLASH=13		Pattern 1, Exps 2-2 in Mg II Continuum (04) (1)	1311 Secs (2621 Secs)	
								[==>1310.0 Secs (Pattern 1)] *[==>1311.0 Secs (Pattern 2)]*	***[3]***

Orbit Structure



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Overhead
Overhead
Exp. 2
Exp. 2
Occultation
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sec

Visit

Proposal 16464, Emission Lines (05) Tue Dec 01 14:00:24 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1-2), (3-4), (5)

Fixed Targets

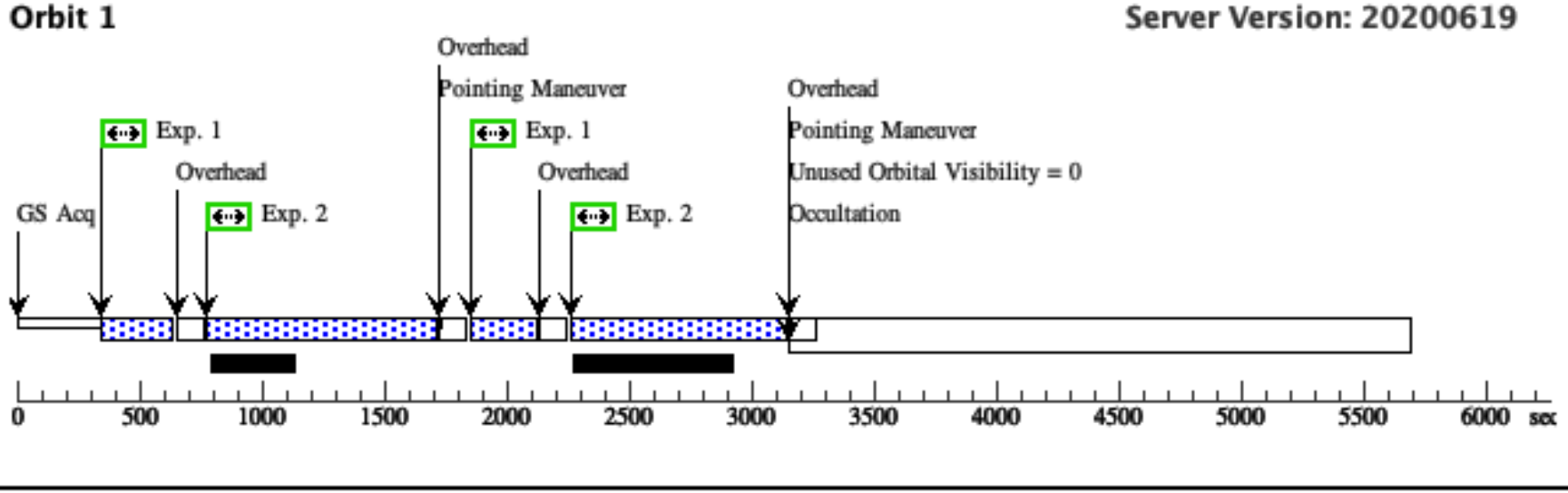
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	J1418+2102	RA: 14 18 51.1190 (214.7129958d) Dec: +21 02 39.84 (21.04440d) Equinox: J2000		V=17.74	Reference Frame: ICRS

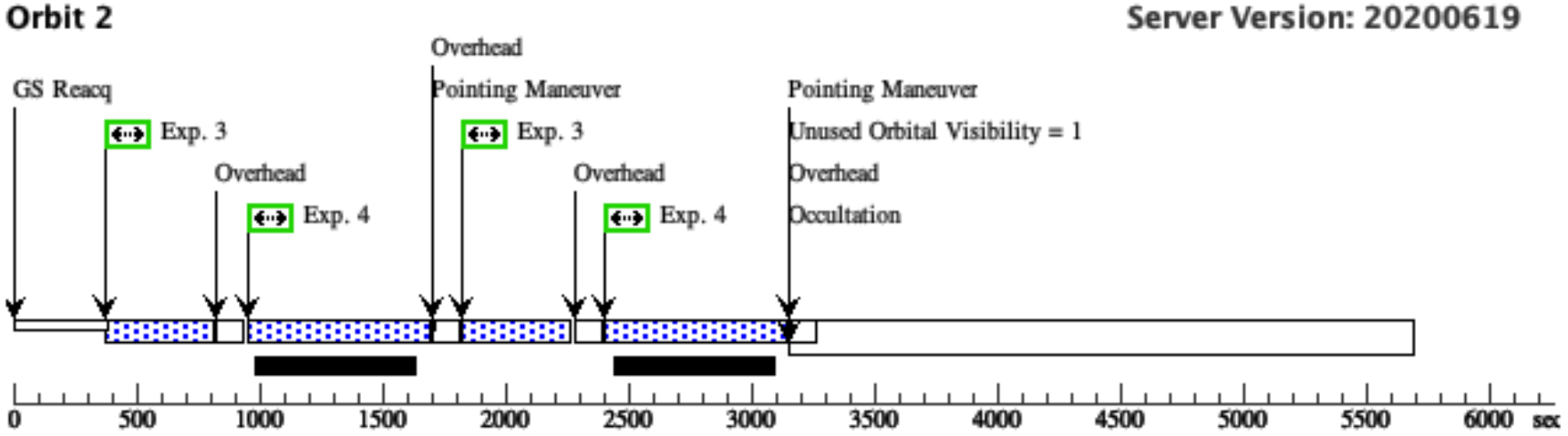
Comments:
Category=GALAXY
Description=[EMISSION LINE NEBULA, STARBURST]
Extended=YES

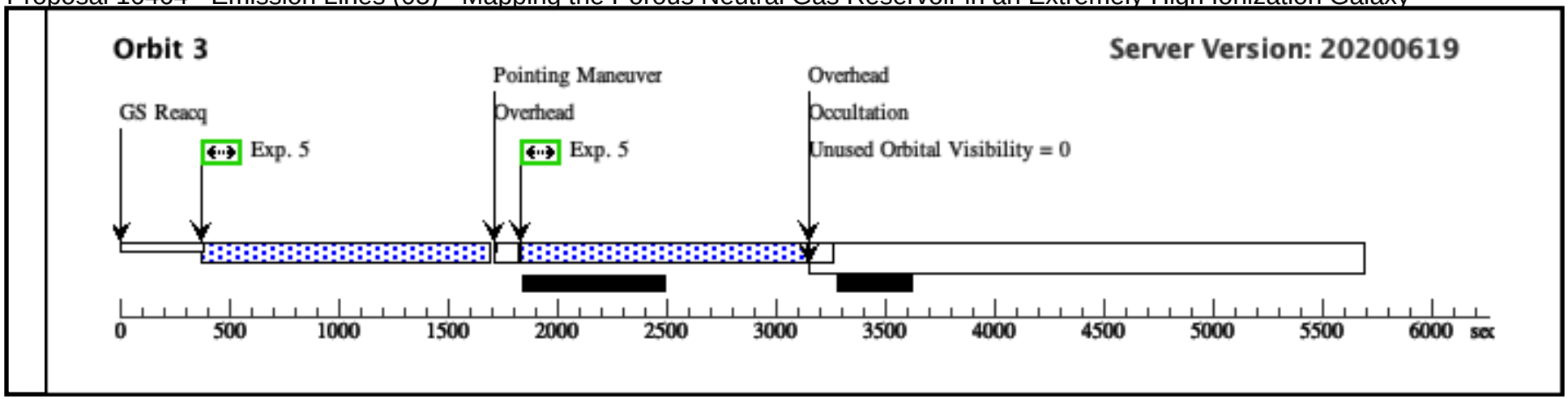
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	HB+OIII continuum	(1) J1418+2102	WFC3/UVIS, ACCUM, UVIS2	F467M	FLASH=12		Pattern 1, Exps 1-2 in Emission Lines (05) (1)	259 Secs (518 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
2	Mg II (1472603)	(1) J1418+2102	WFC3/UVIS, ACCUM, UVIS2	F275W	FLASH=12		Pattern 1, Exps 1-2 in Emission Lines (05) (1)	874 Secs (1807 Secs) *[==>933.0 Secs (Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
3	O II Continuum	(1) J1418+2102	WFC3/UVIS, ACCUM, UVIS2	F343N	FLASH=12		Pattern 1, Exps 3-4 in Emission Lines (05) (1)	270 Secs (858 Secs) *[==>429.0 Secs (Pattern 1)]* *[==>429.0 Secs (Pattern 2)]*	***[2]***
4	H-beta	(1) J1418+2102	WFC3/UVIS, ACCUM, UVIS2	F487N	FLASH=10		Pattern 1, Exps 3-4 in Emission Lines (05) (1)	650 Secs (1418 Secs) *[==>709.0 Secs (Pattern 1)]* *[==>709.0 Secs (Pattern 2)]*	***[2]***
5	O II (1472596)	(1) J1418+2102	WFC3/UVIS, ACCUM, UVIS2	F373N	FLASH=12		Pattern 1, Exps 5-5 in Emission Lines (05) (1)	1311 Secs (2622 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[3]***

Orbit Structure



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Exp. 5
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Occultation
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sec