15243 - The Leoncino Dwarf: The Lowest Metallicity Star-Forming Galaxy in the Nearby Universe

Cycle: 25, Proposal Category: GO

(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) LEONCINO	WFC3/UVIS	2	20-Sep-2017 14:01:46.0	yes
02	(1) LEONCINO	WFC3/UVIS	2	20-Sep-2017 14:01:47.0	yes
03	(1) LEONCINO	WFC3/UVIS	2	20-Sep-2017 14:01:48.0	yes
04	(1) LEONCINO	WFC3/UVIS	2	20-Sep-2017 14:01:49.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
05	(1) LEONCINO	WFC3/UVIS	2	20-Sep-2017 14:01:49.0	yes
06	(1) LEONCINO	WFC3/UVIS	2	20-Sep-2017 14:01:50.0	yes

12 Total Orbits Used

ABSTRACT

Extremely metal-poor (XMP) galaxies are dwarf irregular galaxies with very low metallicities, traced by their gas-phase oxygen abundance. Galaxy evolution scenarios suggest three pathways to form an XMP: (1) secular evolution at low galaxy masses, (2) slow evolution in voids, or (3) dilution of measured abundances from infall of pristine gas. These scenarios have proven challenging to test because, despite concerted efforts, XMP galaxies in the nearby universe have proven hard to find.

A notable exception is the recently discovered dwarf galaxy Leoncino. Leoncino has the lowest gas-phase oxygen abundance ever measured in a galaxy in the local Universe. From optical spectroscopy, the oxygen abundance is 12+log(O/H)=7.02+/-0.03, more than 40% lower than the iconic low-metallicity galaxy I Zw 18 and less than 2% Z_sun.

Despite a precision oxygen abundance measurement, the evolutionary context of Leoncino remains uncertain without a secure distance. We propose HST WFC3 high-resolution optical imaging of Leoncino to accurately measure the distance to the galaxy using the tip of the red giant branch (TRGB) method. The distance will determine whether Leoncino is located in a typical field environment or in a void, and whether the galaxy is consistent with the luminosity-metallicity relation at low galaxy masses. The detailed study of Leoncino will provide benchmark results for future XMP discoveries in the nearby Universe, and an exceptionally timely comparison for studies of chemically primitive, high-redshift galaxies that will be observable in the JWST era.

OBSERVING DESCRIPTION

The goal of this proposal is to measure the TRGB distance to the newly discovered, extemely metal-poor galaxy, Leoncino, reconstruct the overall star formation history (SFH), and explore the environment and evolutionary pathways of such a metal-poor system. The planned data consist of WFC3 imaging in the F606W and F814W filters. Orbit allocation = 12 orbits.

All visits span 2-orbits with the WFC3; each orbit is split between one F606W and one F814W exposure (with no CR-splits). We use the WFC3-

UVIS-DITHER-LINE small dither pattern of 2.5 pixel shifts in x and y between orbits in order to remove hot pixels and to smooth the detector response. We have also added a small 2-4 pixel shift using POS-TARG between visits to minimize the impact of hot pixels affecting any individual star. We don't intend to cover the interchip gap. There will be 6 visits total and the observations will complete 6 dither patterns. Since the exposure times per orbit are ~1200s in F606W and ~1500s in F814W, we have not used the post-flash option.

We have placed the target on the UVIS2 chip in quadrant C which minimizes geometric distortions, increases quantum efficiency, and has the absence of figure 8 shots relative to the other quadrants. The first visit is requested with a range of orientation that keeps the galaxy near the center of the quadrant and avoids getting too near the edge of the chip. Subsequent visits are requested to be obtained with the same ORIENT at visit 1 for consistent execution of our dither pattern.

Visit

Proposal 15243, Leoncino-1 (01), implementation Wed Sep 20 18:01:51 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: ORIENT 120D TO 144 D

Comments: Based on the visibility windows in the Visit Planner, the target is visible in early 2018 and early 2019. Given that these data will help inform on extremely metal-poor systems at high redshift that will be observed by JWST, including providing tests of stellar evolution models, the observing dates in 2018 would optimize the timing of the results for future JWST studies. This is not a hard constraint, but, if at all possible, the 2018 dates would be highly preferred. Thank you.

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)

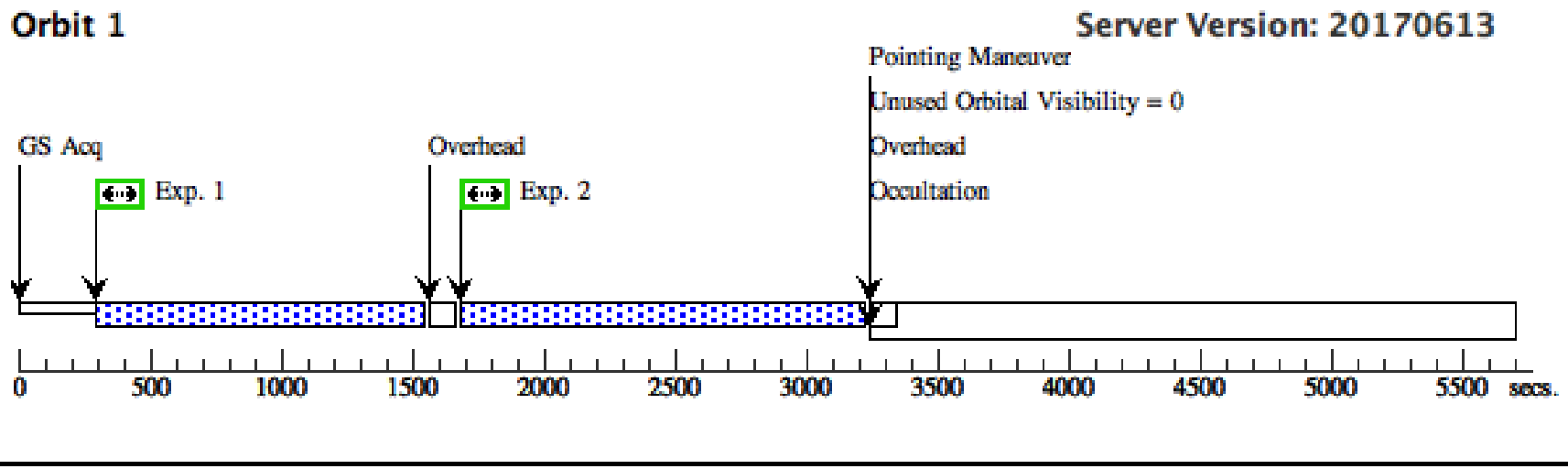
Fixed Targets

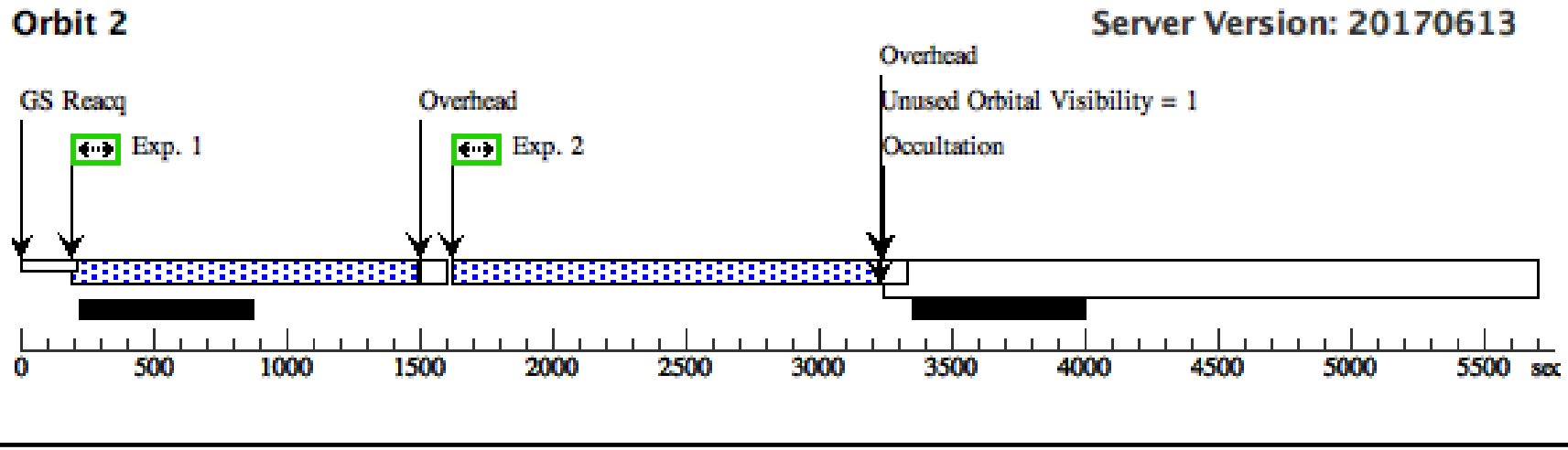
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LEONCINO	RA: 09 43 28.9969 (145.8708204d) Dec: +33 27 2.64 (33.45073d) Equinox: J2000		V=19.53+/-0.03	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F606W-1.12	(1) LEONCINO	WFC3/UVIS, ACCUM, UVIS2	F606W			Pattern 1, Exps 1-2 in Leoncino-1 (01) (1)	1200 Secs (2503 Secs)	
								[==>1224.0 Secs (Pattern 1)]	***[1]***
								[==>1279.0 Secs (Pattern 2)]	***[2]***
2	F814W-1.12	(1) LEONCINO	WFC3/UVIS, ACCUM, UVIS2	F814W			Pattern 1, Exps 1-2 in Leoncino-1 (01) (1)	1500 Secs (3103 Secs)	
								[==>1524.0 Secs (Pattern 1)]	***[1]***
								[==>1579.0 Secs (Pattern 2)]	***[2]***

Orbit Structure





Visit

Proposal 15243, Leoncino-2 (02), implementation Wed Sep 20 18:01:51 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SAME ORIENT AS 01

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)

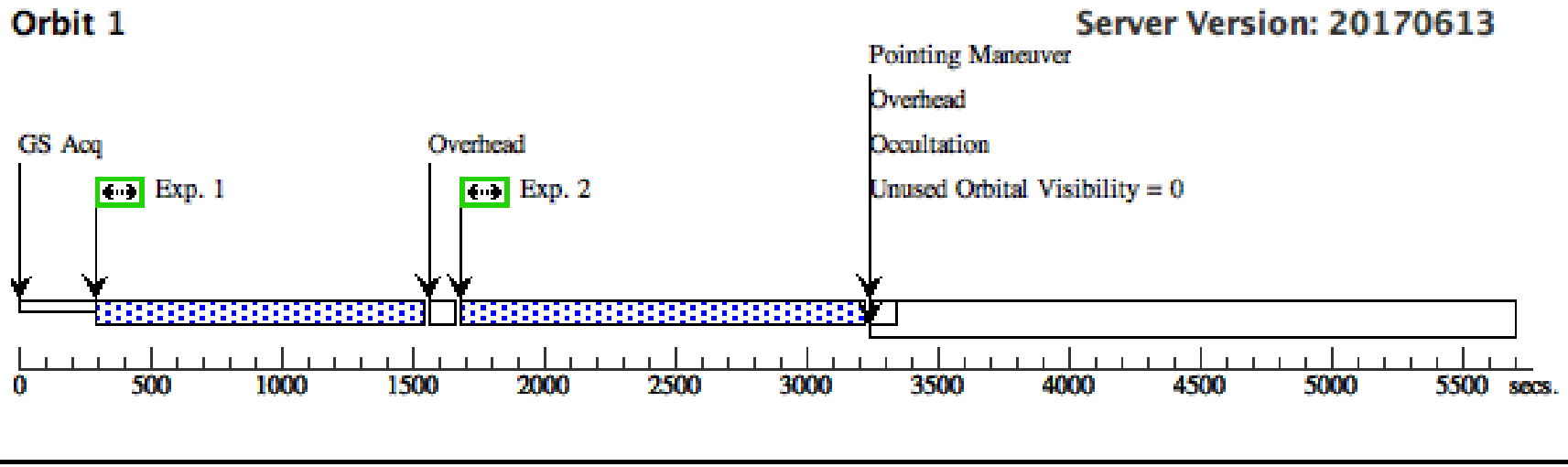
Fixed Targets

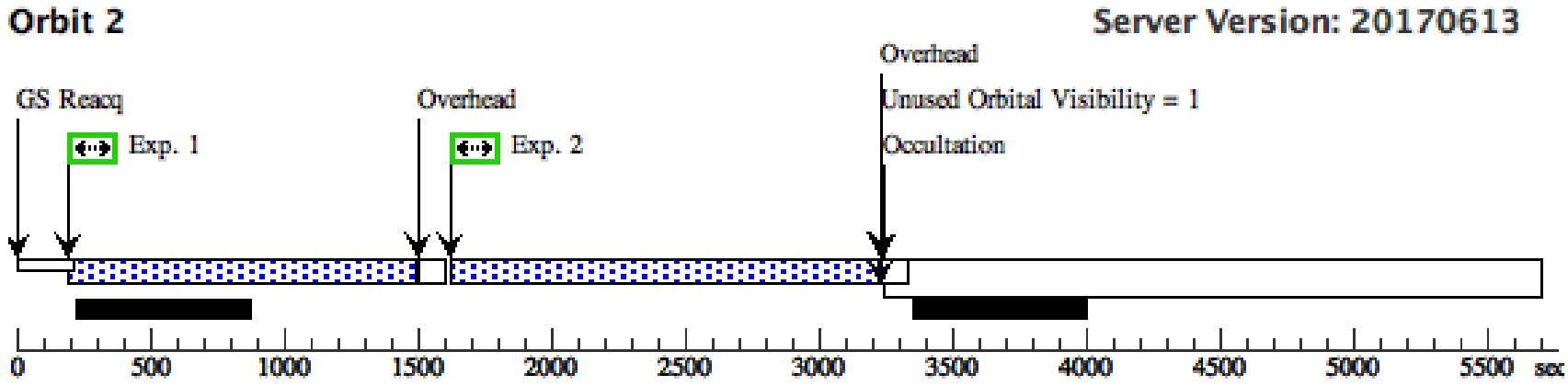
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LEONCINO	RA: 09 43 28.9969 (145.8708204d) Dec: +33 27 2.64 (33.45073d) Equinox: J2000		V=19.53+/-0.03	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F606W-2.12	(1) LEONCINO	WFC3/UVIS, ACCUM, UVIS2	F606W		POS TARG 0.085,0.0	Pattern 1, Exps 1-2 in Leoncino-2 (02) (1)	1200 Secs (2503 Secs)	
								[==>1224.0 Secs (Pattern 1)]	***[1]***
								[==>1279.0 Secs (Pattern 2)]	***[2]***
2	F814W-2.12	(1) LEONCINO	WFC3/UVIS, ACCUM, UVIS2	F814W		POS TARG 0.085,0.0	Pattern 1, Exps 1-2 in Leoncino-2 (02) (1)	1500 Secs (3103 Secs)	
								[==>1524.0 Secs (Pattern 1)]	***[1]***
								[==>1579.0 Secs (Pattern 2)]	***[2]***

Orbit Structure





Visit

Proposal 15243, Leoncino-3 (03), implementation Wed Sep 20 18:01:51 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SAME ORIENT AS 01

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)	LEONCINO	RA: 09 43 28.9969 (145.8708204d) Dec: +33 27 2.64 (33.45073d) Equinox: J2000		V=19.53+/-0.03	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F606W-1.12	(1) LEONCINO	WFC3/UVIS, ACCUM, UVIS2	F606W		POS TARG 0.085,0.085	Pattern 1, Exps 1-2 in Leoncino-3 (03) (1)	1200 Secs (2503 Secs)	
								[==>1224.0 Secs (Pattern 1)]	***[1]***
								[==>1279.0 Secs (Pattern 2)]	***[2]***
2	F814W-1.12	(1) LEONCINO	WFC3/UVIS, ACCUM, UVIS2	F814W		POS TARG 0.085,0.085	Pattern 1, Exps 1-2 in Leoncino-3 (03) (1)	1500 Secs (3103 Secs)	
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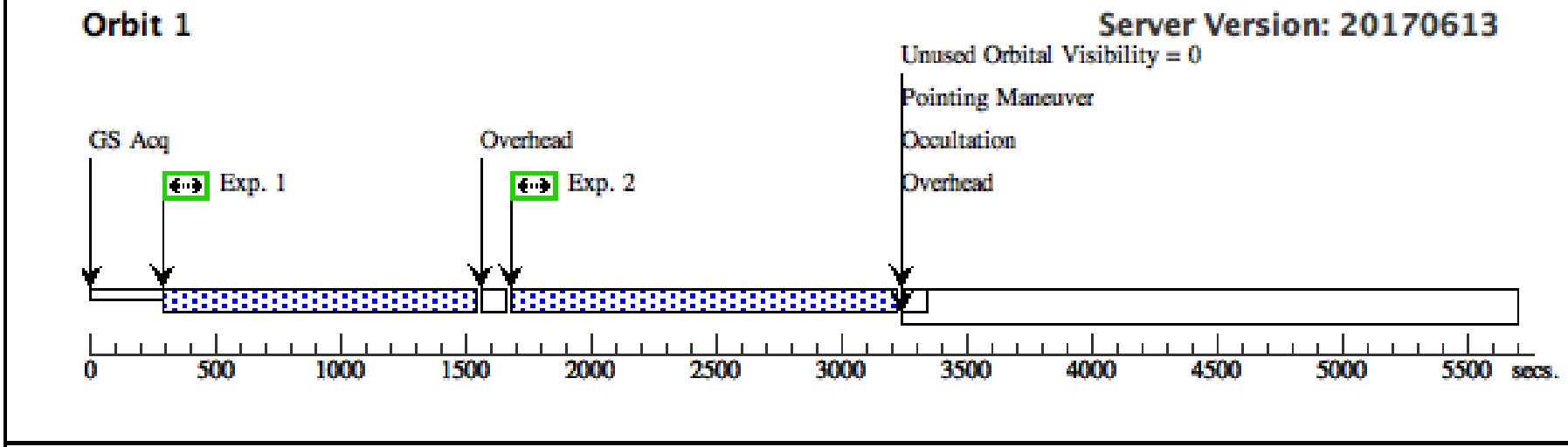
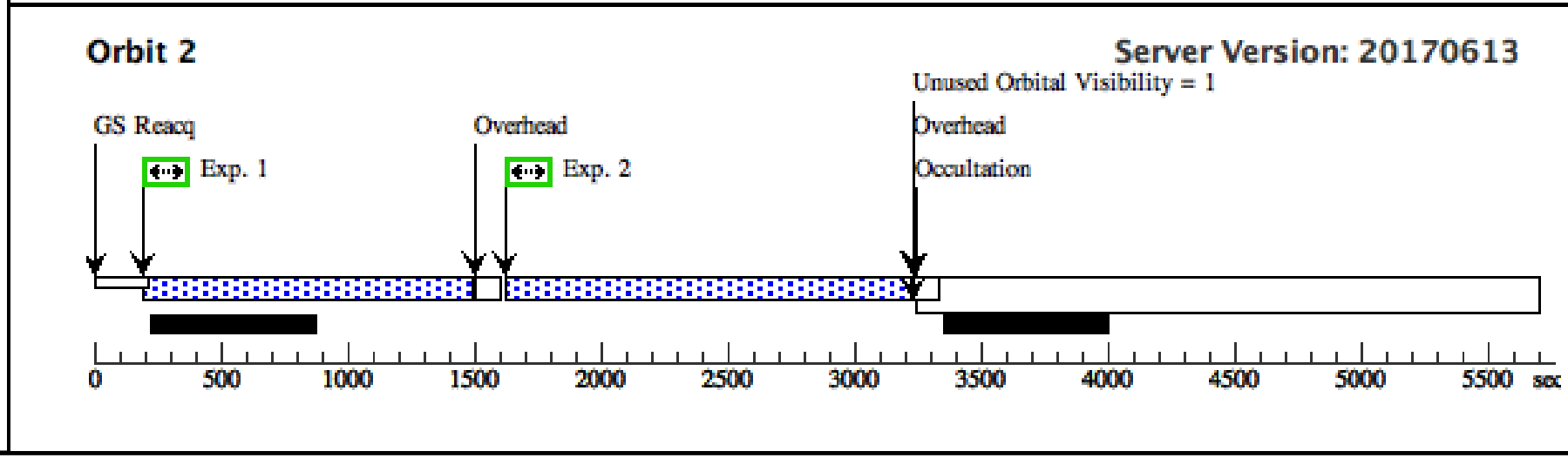
								[==>1579.0 Secs (Pattern 2)]	***[2]***

Orbit Structure





Visit

Proposal 15243, Leoncino-4 (04), implementation Wed Sep 20 18:01:51 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SAME ORIENT AS 01

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)

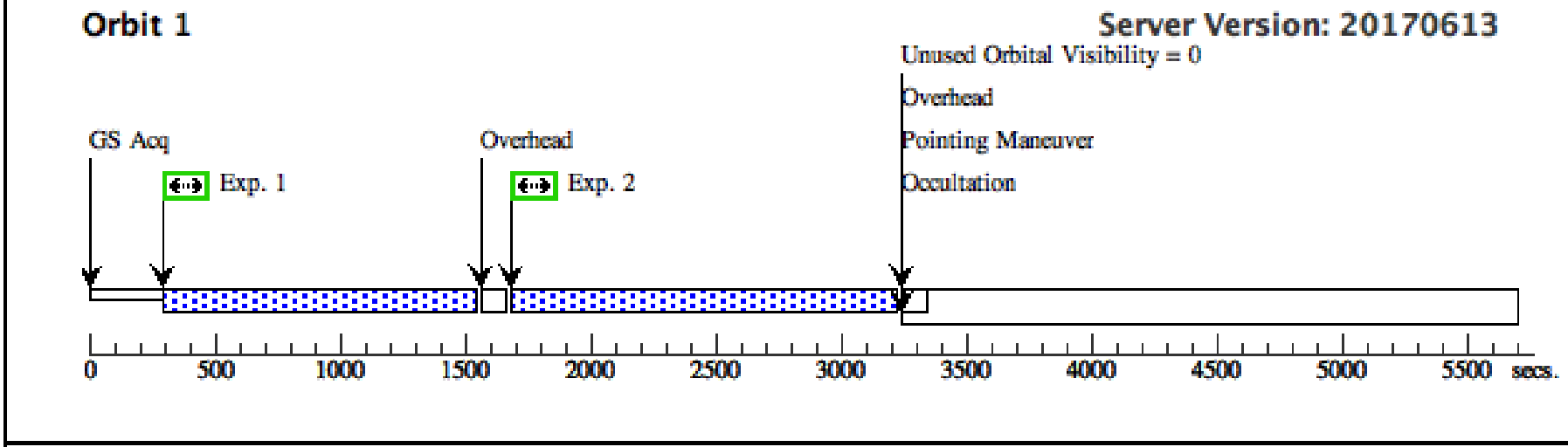
Fixed Targets

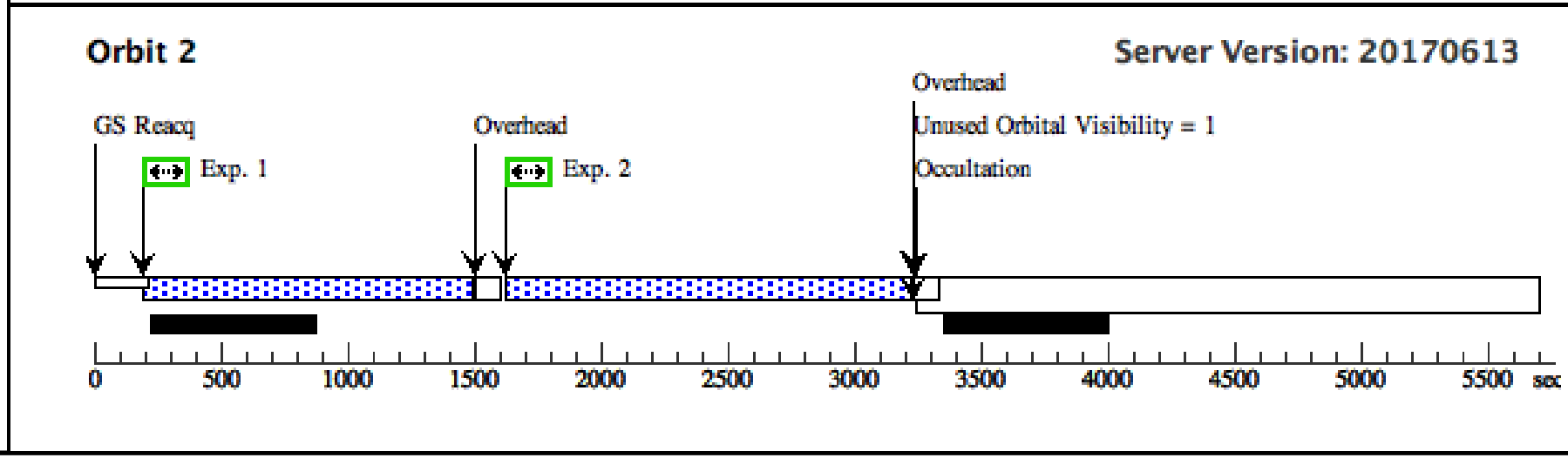
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LEONCINO	RA: 09 43 28.9969 (145.8708204d) Dec: +33 27 2.64 (33.45073d) Equinox: J2000		V=19.53+/-0.03	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F606W-1.12	(1) LEONCINO	WFC3/UVIS, ACCUM, UVIS2	F606W		POS TARG 0.085,0.17	Pattern 1, Exps 1-2 in Leoncino-4 (04) (1)	1200 Secs (2503 Secs)	
								[==>1224.0 Secs (Pattern 1)]	***[1]***
								[==>1279.0 Secs (Pattern 2)]	***[2]***
2	F814W-1.12	(1) LEONCINO	WFC3/UVIS, ACCUM, UVIS2	F814W		POS TARG 0.085,0.17	Pattern 1, Exps 1-2 in Leoncino-4 (04) (1)	1500 Secs (3103 Secs)	
								[==>1524.0 Secs (Pattern 1)]	***[1]***
								[==>1579.0 Secs (Pattern 2)]	***[2]***

Orbit Structure





Visit

Proposal 15243, Leoncino-5 (05), implementation Wed Sep 20 18:01:51 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SAME ORIENT AS 01

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)

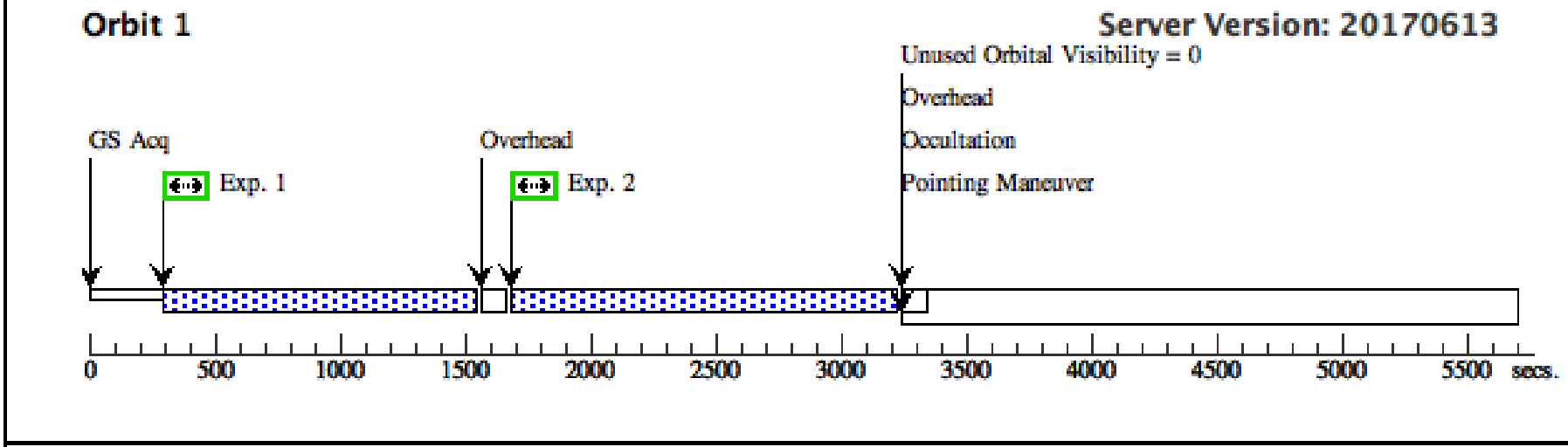
Fixed Targets

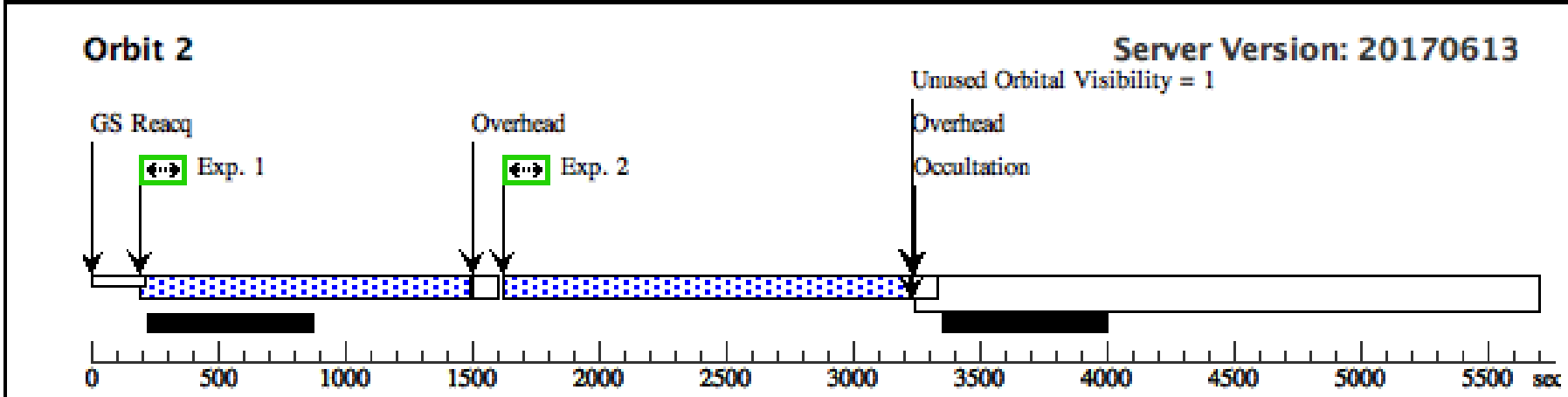
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LEONCINO	RA: 09 43 28.9969 (145.8708204d) Dec: +33 27 2.64 (33.45073d) Equinox: J2000		V=19.53+/-0.03	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F606W-1.12	(1) LEONCINO	WFC3/UVIS, ACCUM, UVIS2	F606W		POS TARG 0.0,0.17	Pattern 1, Exps 1-2 in Leoncino-5 (05) (1)	1200 Secs (2503 Secs)	
								[==>1224.0 Secs (Pattern 1)]	***[1]***
								[==>1279.0 Secs (Pattern 2)]	***[2]***
2	F814W-1.12	(1) LEONCINO	WFC3/UVIS, ACCUM, UVIS2	F814W		POS TARG 0.0,0.17	Pattern 1, Exps 1-2 in Leoncino-5 (05) (1)	1500 Secs (3103 Secs)	
								[==>1524.0 Secs (Pattern 1)]	***[1]***
								[==>1579.0 Secs (Pattern 2)]	***[2]***

Orbit Structure





Visit

Proposal 15243, Leoncino-6 (06), implementation Wed Sep 20 18:01:51 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SAME ORIENT AS 01

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)	LEONCINO	RA: 09 43 28.9969 (145.8708204d) Dec: +33 27 2.64 (33.45073d) Equinox: J2000		V=19.53+/-0.03	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F606W-1.12	(1) LEONCINO	WFC3/UVIS, ACCUM, UVIS2	F606W		POS TARG 0.0,0.085	Pattern 1, Exps 1-2 in Leoncino-6 (06) (1)	1200 Secs (2503 Secs)	
								[==>1224.0 Secs (Pattern 1)]	***[1]***
								[==>1279.0 Secs (Pattern 2)]	***[2]***
2	F814W-1.12	(1) LEONCINO	WFC3/UVIS, ACCUM, UVIS2	F814W		POS TARG 0.0,0.085	Pattern 1, Exps 1-2 in Leoncino-6 (06) (1)	1500 Secs (3103 Secs)	
								[==>1524.0 Secs (Pattern 1)]	***[1]***
								[==>1579.0 Secs (Pattern 2)]	***[2]***

Orbit Structure