16661 - Dwarf Galaxies with Radio-Selected Massive Black Holes

Cycle: 29, 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) J1136+1252	WFC3/UVIS	2	17-Aug-2021 14:01:33.0	yes
02	(2) J1200-0341	WFC3/UVIS	2	17-Aug-2021 14:01:34.0	yes
03	(3) J1253-0312	WFC3/UVIS	2	17-Aug-2021 14:01:35.0	yes

6 Total Orbits Used

ABSTRACT

Studies of massive black holes (BHs) in nearby dwarf galaxies can provide important constraints on the birth and growth of the first seed BHs in the early Universe. Using high-resolution observations from the Very Large Array, Reines et al. (2020) discovered a set of compact radio sources in nearby dwarf galaxies with luminosities indicative of accreting massive BHs. Moreover, some of these radio sources are not in the centers of the galaxies with offsets on the order of ~1 kpc. As part of a pilot study, we propose HST/WFC3 observations of 3 dwarf galaxies hosting radio-selected ("wandering") massive BHs that also have guaranteed X-ray observations with Chandra. We propose narrow-band H-alpha imaging and wide-band optical continuum imaging to 1) determine spatially-resolved star formation rates and colors, 2) search for faint, small optical counterparts of the BHs, and 3) determine detailed morphologies of the dwarf host galaxies. The proposed observations are crucial to asses possible contributions from

star-formation-related emission at X-ray and radio wavelengths, and characterize the properties of this new class of BH-hosting dwarf galaxies.

OBSERVING DESCRIPTION

We will obtain HST/WFC3 UVIS observations in three filters, including narrow-band H-alpha imaging (F680N) and wide-band continuum imaging at 4300 Ang (F438W) and 8000 Ang (F814W). We choose the F438W and F814W filters to bracket the wavelength of H-alpha (for continuum subtraction) and to avoid strong emission lines such as [OIII] 5007 and the [OII] 3727, 3729 doublet. We have three target galaxies and can achieve our science goals with two HST orbits per galaxy for a total of 6 orbits.

From prior experience, exposure times are based on detecting a 5 Myr-old, ~3x10^4 Msun star cluster at the distance of our target galaxies (z ~ 0.02-0.03) with a signal-to-noise ratio of S/N=10. Starburst99 models of an instantaneous burst indicate that the corresponding H-alpha flux is ~10^-16 erg/s/cm^2 with an underlying continuum flux density of ~3 x 10^-19 erg/s/cm^2/Ang. Assuming the cluster is a point source, the WFC3/UVIS exposure time calculator suggests we need ~35 minutes in F680N. The required times in F814W and F438W are ~13 and ~ 11 minutes, respectively. Note that we have also allowed for 1 magnitude of visual extinction (AV = 1 mag) in these calculations. We will break the total time into four dithered exposures to improve the PSF sampling and avoid bad pixels, as well as include a post flash to avoid poor charge efficiency. We will use the 2k x 2k subarray (to avoid buffer dumps) with the more efficient chip 2. Our galaxies are quite compact so using a subarray will not compromise our science or limit our sky subtraction. A similar observing strategy has been successfully employed in previous work (Kimbro et al. 2021).

To summarize, we can achieve our science goals with 2 orbits per galaxy. We will spend one orbit on narrow-band H-alpha imaging (F680N) and one orbit on wide-band continuum imaging (F438W and F814W). Our observing strategy provides the requisite time on source in each filter, as well as sufficient time for acquisition and instrument overheads (including guide-star acquisition, readout and dithering).

Visit

Proposal 16661, Visit 01, implementation Tue Aug 17 18:01:36 GMT 2021

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Diagnostics

(Visit 01) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Exposure 2 (Pattern 3, Exps 2-2 in Visit 01)) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(3)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1), (2), (3)

Fixed Targets

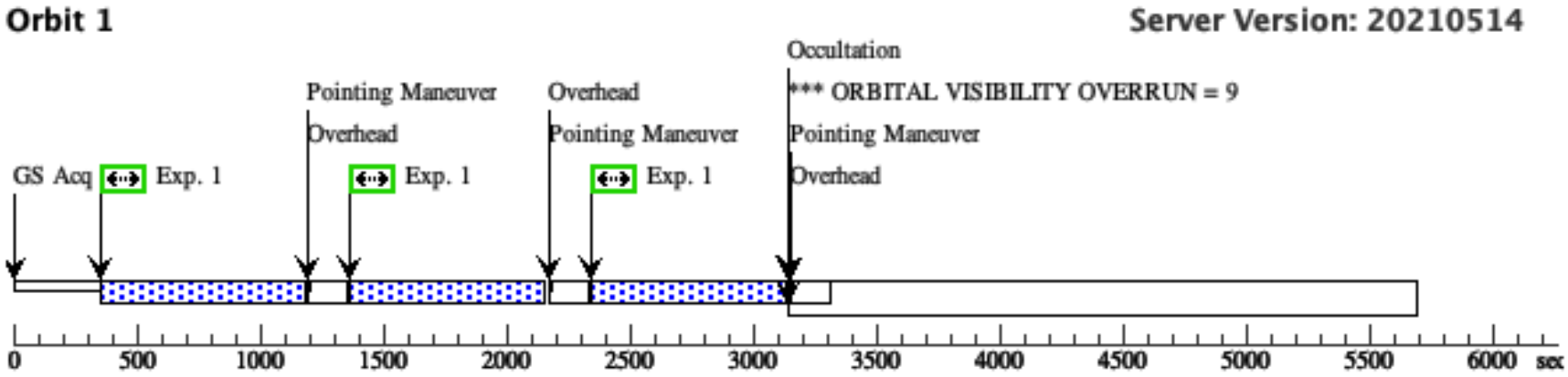
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	J1136+1252	RA: 11 36 48.5256 (174.2021900d) Dec: +12 52 39.90 (12.87775d) Equinox: J2000	Redshift: 0.034	V=17.2	Reference Frame: ICRS

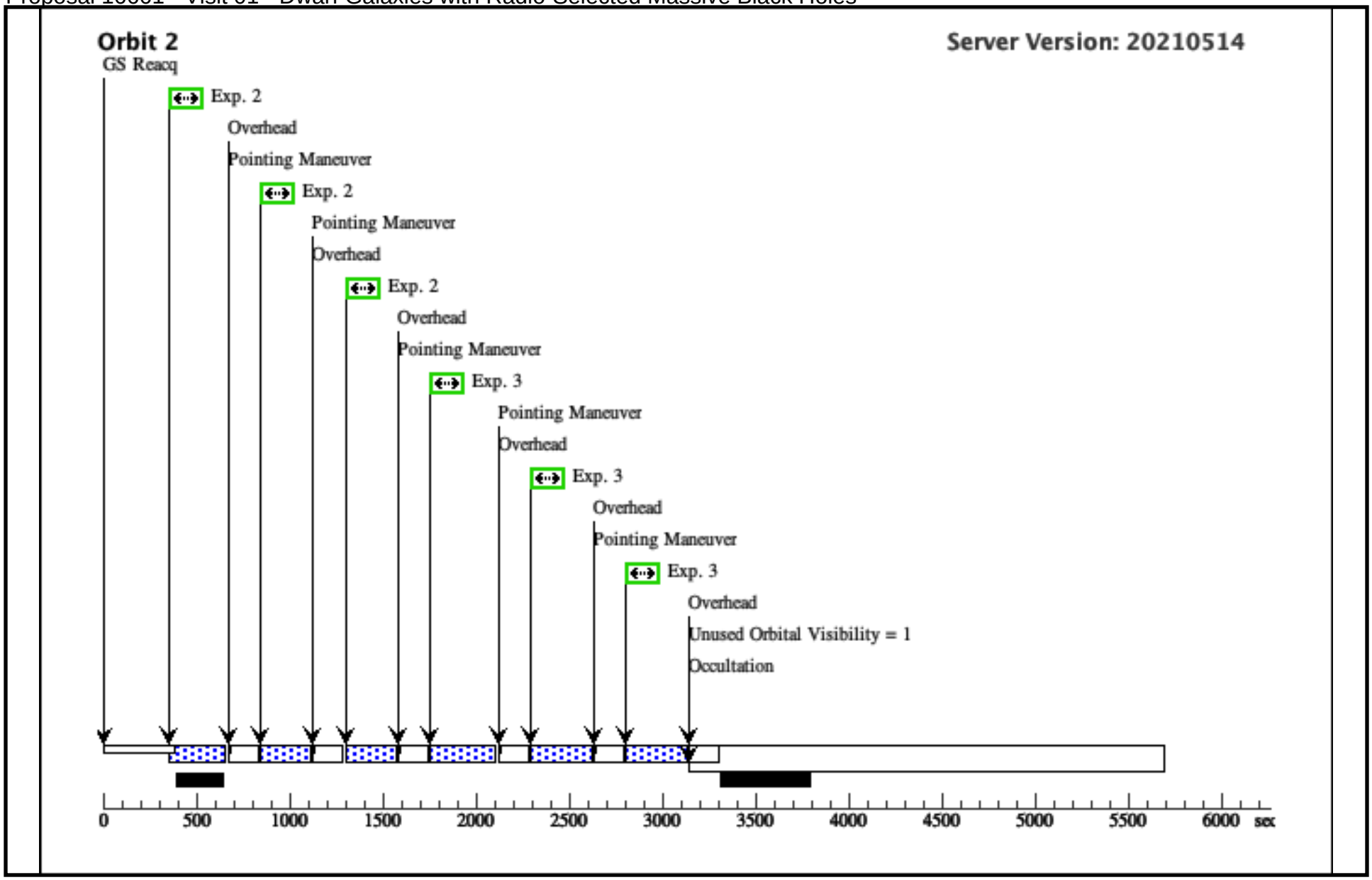
Comments:
Category=GALAXY
Description=[DWARF COMPACT, INTERACTING GALAXY, RADIO GALAXY]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) J1136+1252	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F680N	FLASH=9	GS ACQ SCENARIO BASE1BE	Pattern 3, Exps 1-1 in Visit 01 (3)	797 Secs (2391 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[1]***
2		(1) J1136+1252	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F438W	FLASH=16		Pattern 3, Exps 2-2 in Visit 01 (3)	270 Secs (810 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[2]***
3		(1) J1136+1252	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F814W	FLASH=6		Pattern 3, Exps 3-3 in Visit 01 (3)	332 Secs (996 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[2]***

Orbit Structure




Orbit 2
Server Version: 20210514
GS Reacq
Exp. 2
Overhead
Pointing Maneuver
Exp. 2
Pointing Maneuver
Overhead
Exp. 2
Overhead
Pointing Maneuver
Exp. 3
Pointing Maneuver
Overhead
Exp. 3
Overhead
Pointing Maneuver
Exp. 3
Overhead
Unused Orbital Visibility = 1
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec

Visit

Proposal 16661, Visit 02, implementation Tue Aug 17 18:01:36 GMT 2021

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Diagnostics

(Visit 02) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Exposure 2 (Pattern 3, Exps 2-2 in Visit 02)) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(3)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1), (2), (3)

Fixed Targets

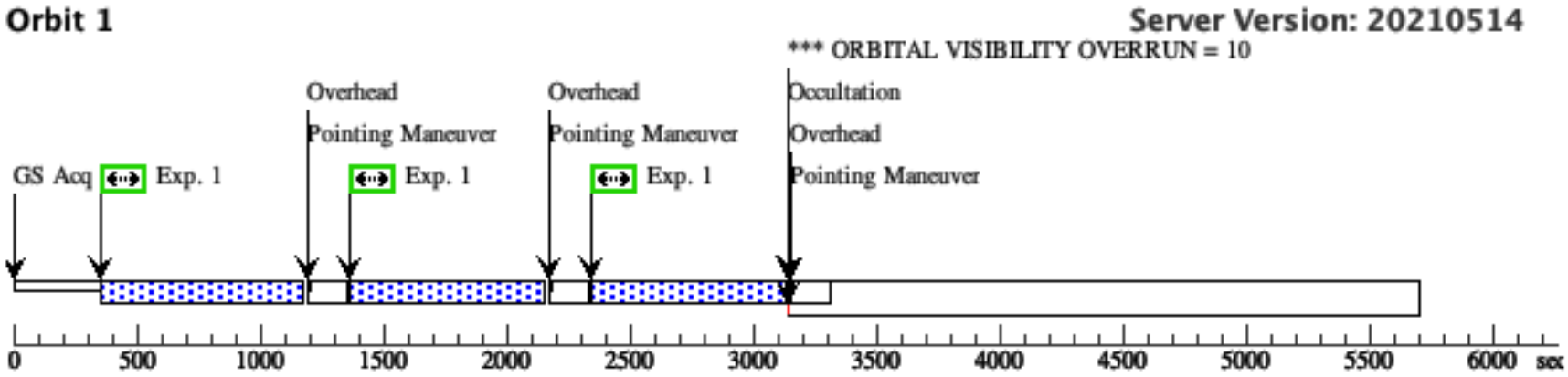
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	J1200-0341	RA: 12 00 58.3008 (180.2429200d) Dec: -03 41 18.46 (-3.68846d) Equinox: J2000	Redshift: 0.026	V=16.8	Reference Frame: ICRS

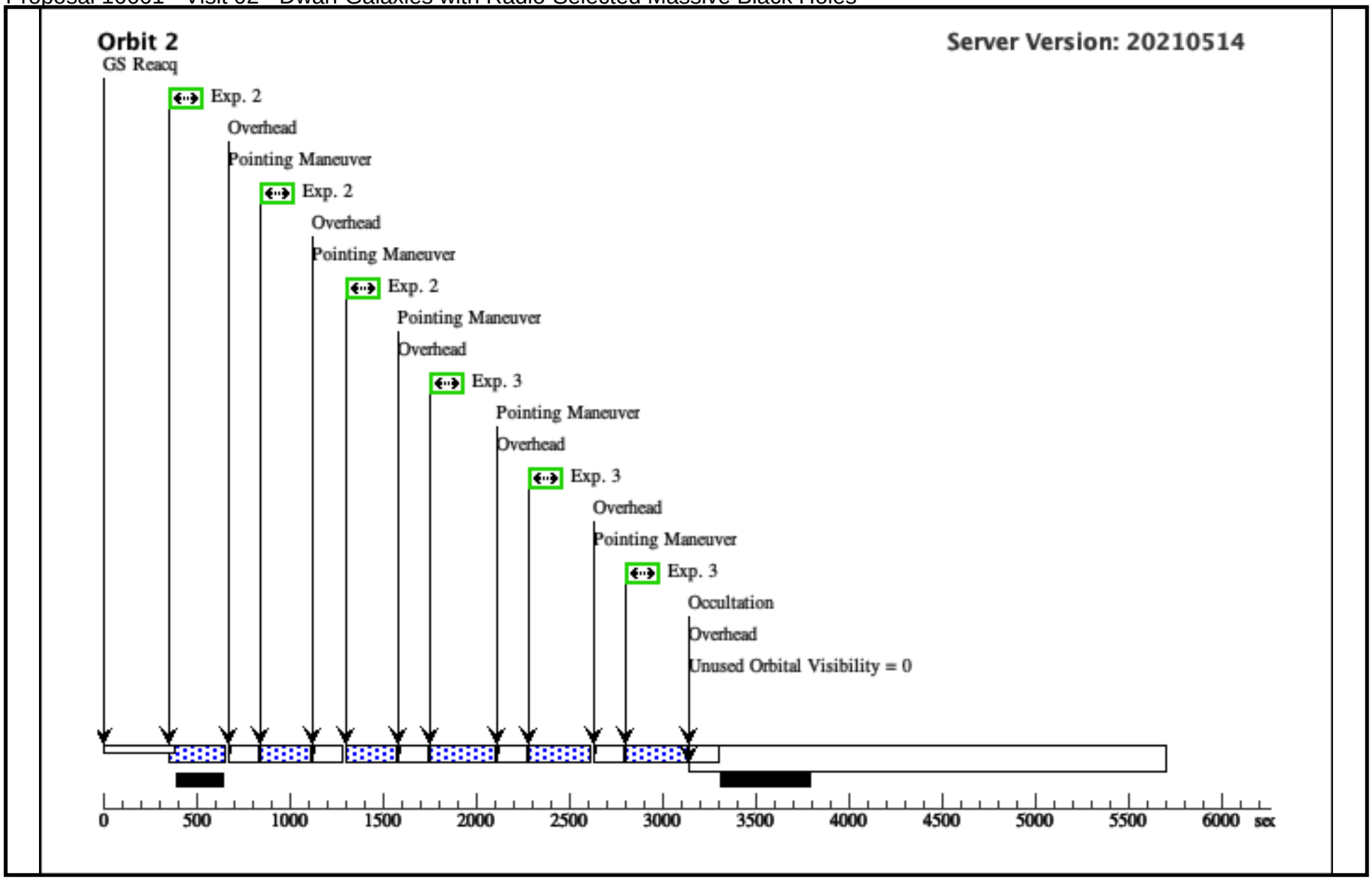
Comments:
Category=GALAXY
Description=[DWARF COMPACT, INTERACTING GALAXY, RADIO GALAXY]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) J1200-0341	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F680N	FLASH=9	GS ACQ SCENARIO BASE1BE	Pattern 3, Exps 1-1 in Visit 02 (3)	795 Secs (2385 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[1]***
2		(2) J1200-0341	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F438W	FLASH=16		Pattern 3, Exps 2-2 in Visit 02 (3)	270 Secs (810 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[2]***
3		(2) J1200-0341	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F814W	FLASH=6		Pattern 3, Exps 3-3 in Visit 02 (3)	330 Secs (990 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[2]***

Orbit Structure




Orbit 2
Server Version: 20210514
GS Reacq
Exp. 2
Overhead
Pointing Maneuver
Exp. 2
Overhead
Pointing Maneuver
Exp. 2
Pointing Maneuver
Overhead
Exp. 3
Pointing Maneuver
Overhead
Exp. 3
Overhead
Pointing Maneuver
Exp. 3
Occultation
Overhead
Unused Orbital Visibility = 0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec

Visit

Proposal 16661, Visit 03, implementation Tue Aug 17 18:01:36 GMT 2021

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Diagnostics

(Exposure 1 (Pattern 3, Exps 1-1 in Visit 03)) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser

(Exposure 2 (Pattern 3, Exps 2-2 in Visit 03)) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(3)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1), (2), (3)

Fixed Targets

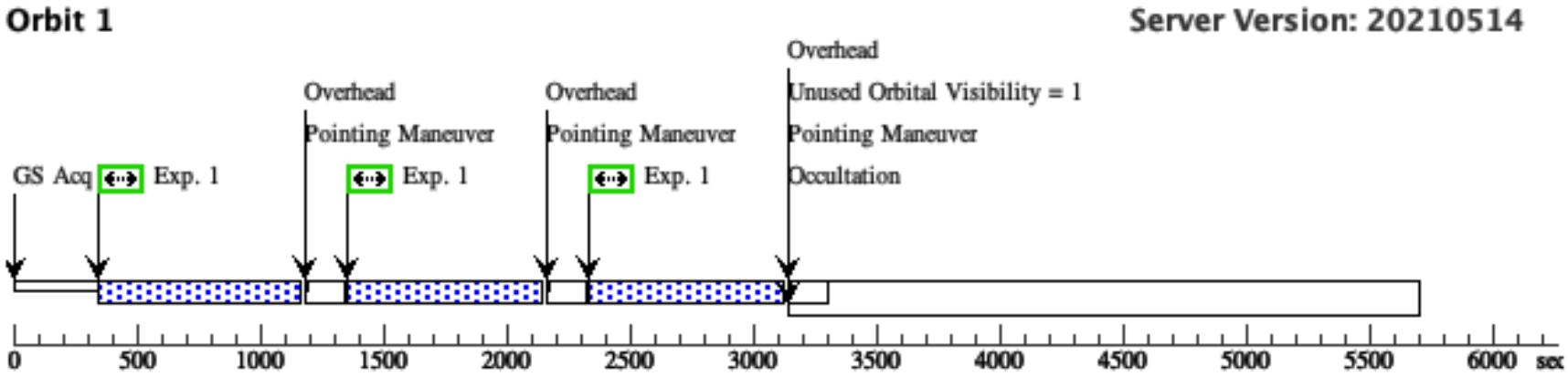
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	J1253-0312	RA: 12 53 5.9688 (193.2748700d) Dec: -03 12 58.75 (-3.21632d) Equinox: J2000	Redshift: 0.022	V=15.5	Reference Frame: ICRS

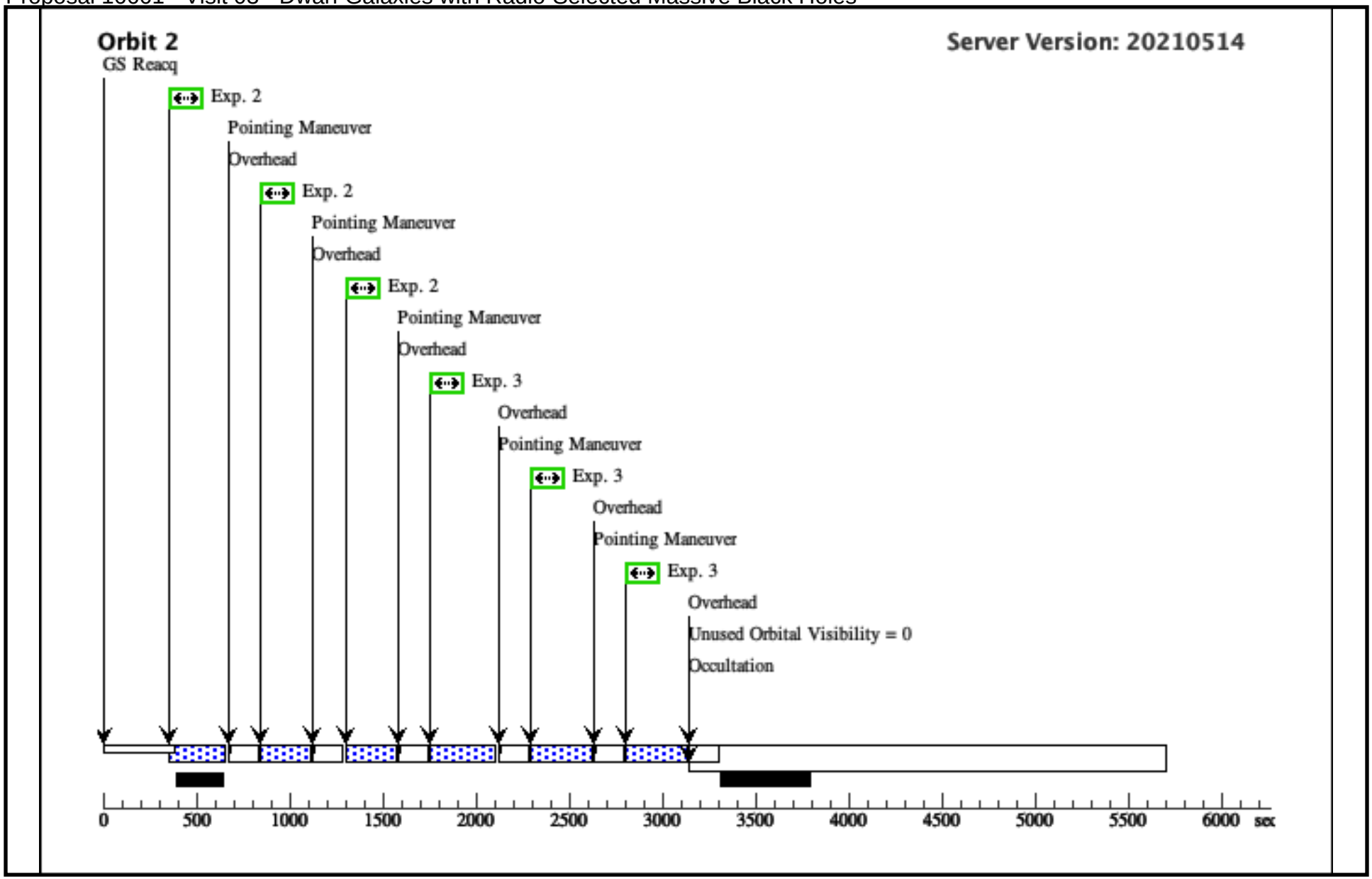
Comments:
Category=GALAXY
Description=[DWARF COMPACT, INTERACTING GALAXY, RADIO GALAXY]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(3) J1253-0312	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F680N	FLASH=10		Pattern 3, Exps 1-1 in Visit 03 (3)	794 Secs (2382 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[1]***
2		(3) J1253-0312	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F438W	FLASH=17		Pattern 3, Exps 2-2 in Visit 03 (3)	270 Secs (810 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[2]***
3		(3) J1253-0312	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F814W	FLASH=7		Pattern 3, Exps 3-3 in Visit 03 (3)	329 Secs (987 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[2]***

Orbit Structure




Orbit 2
Server Version: 20210514
GS Reacq
Exp. 2
Pointing Maneuver
Overhead
Exp. 2
Pointing Maneuver
Overhead
Exp. 2
Pointing Maneuver
Overhead
Exp. 3
Overhead
Pointing Maneuver
Exp. 3
Overhead
Pointing Maneuver
Exp. 3
Overhead
Unused Orbital Visibility = 0
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec