16250 - Refining the Mira Distance Scale and Hubble Constant for the Era of JWST and WFIRST

Cycle: 28, 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) N2525	WFC3/IR	1	07-Oct-2021 14:00:58.0	yes
02	(1) N2525	WFC3/IR	1	07-Oct-2021 14:00:59.0	yes
03	(1) N2525	WFC3/IR	1	07-Oct-2021 14:01:00.0	yes
04	(1) N2525	WFC3/IR	1	07-Oct-2021 14:01:01.0	yes
05	(2) N1559	WFC3/IR	1	07-Oct-2021 14:01:02.0	yes
06	(2) N1559	WFC3/IR	1	07-Oct-2021 14:01:02.0	yes
07	(2) N1559	WFC3/IR	1	07-Oct-2021 14:01:03.0	yes
08	(3) N5643	WFC3/IR	1	07-Oct-2021 14:01:04.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
09	(3) N5643	WFC3/IR	1	07-Oct-2021 14:01:05.0	yes
10	(3) N5643	WFC3/IR	1	07-Oct-2021 14:01:05.0	yes
11	(4) N5861	WFC3/IR	1	07-Oct-2021 14:01:06.0	yes
12	(4) N5861	WFC3/IR	1	07-Oct-2021 14:01:07.0	yes
14	(4) N5861	WFC3/IR	1	07-Oct-2021 14:01:08.0	yes
13	(4) N5861	WFC3/IR	1	07-Oct-2021 14:01:08.0	yes

14 Total Orbits Used

ABSTRACT

Direct Hubble constant measurements rely on a solid extragalactic distance scale, which is conventionally calibrated with Cepheids and recently the tip of the red giant branch (TRGB). As a different approach, Mira variables exhibit promising properties as independent distance indicators. Miras are luminous in the NIR, follow tight period-luminosity relations (PLRs), and are present in all types of galaxies. Long-period Miras (400<P<1500 d) are much brighter and on steeper PLRs than the commonly used short-period Miras (100<P<400 d), and they would potentially add a new route to check the Hubble tension between the early and late Universe. For JWST and WFIRST they are easier to detect than Cepheids and reach further than the TRGB. We propose to (1) study the long-period Miras in the type Ia supernova host galaxy NGC 2525 and (2) refine the Mira-based Hubble constant with 4 Mira-SN calibrators. To do this we request four epochs of NIR imaging toward this face-on spiral galaxy. We will combine these observations with archival data to form a continuous time series with a 1300 d baseline, from which we will derive the period and mean intensity of long-period Miras in this system. We will calibrate the PLR for long-period Miras and develop them as a new longer-range distance indicator. For the second task we will measure the NIR colors in NGC 2525, NGC 1559, NGC 5643, and NGC 5861 in order to classify oxygen-rich Miras in these type Ia supernova hosts. The expanded Mira-SN calibrators and removal of carbon-rich Mira contamination will reduce the error in the current Mira-based Hubble constant by a factor of two.

OBSERVING DESCRIPTION

In order to phase the light curves of long-period Miras and measure their colors, we plan to image NGC 2525 with 4 epochs using the F160W and F110W filters and the WFC3/IR detector. For each epoch, we will take 2 and 3 dithered images with combined exposure times of 1000 s and 1500 s for F160W and F110W, respectively. For NGC 1559, NGC 5643, and NGC 5861, we plan the same observations but with 3 epochs. Below we

describe in detail the selected targets, existing data, and the observational designs.

(A) Target selection

Searching for long-period Miras (400<P<1500 d) and measuring their mean intensities & periods require NIR time-series observations spanning longer than their pulsation cycle. NGC 2525 is the best suitable target for a long-period Mira study because (1) there exist recent 700 d-baseline HST H-band observations for NGC 2525, reducing the required telescope time to only 4 orbits, and (2) it is a nearby face-on galaxy hosting hundreds to thousands of long-period Miras. To refine the Ho with short-period Miras, we selected SN Ia host galaxies with F160W time-series and >~1 year baseline. They include NGC 2525, NGC 1559, NGC 5643, and NGC 5861.

(B) Existing data

The existing NGC 2525 H-band time-series dataset consists of data from two recent programs. Program GO-15145 (PI: Riess) observed NGC 2525 with 10 epochs from February 2018 to March 2019. The same field was later observed with 4 epochs (one observation was off the center and will not be used for the Mira search) in Program GO-15693 (PI: Graur) from April 2019 to January 2020. The H-band data for NGC 1559, NGC 5643, and NGC 5861 are from GO-15145, with ~380 d baseline and ~10 epochs per galaxy. The exposure times for all these existing images are ~1000 s per epoch. We note that the existing data are not sufficient because (1) for a longer-period (P>700d) Mira study the NGC 2525 baseline is too short to determine their periods and mean intensities, and (2) the existing data do not include NIR colors for C-rich Mira classification, which is important to keep systematic errors low.

(C) Observation: Instrument and filter

Miras are very red stars (V-I~3 and ~4 mag for P<400 d and P>400 d, respectively) and thus best observed at NIR wavelengths for HST. The wide filter F160W (the HST H-band) on the WFC3 IR channel is a suitable bandpass for Mira measurements (Huang et al. 2018; 2020). This filter is also used in the above-mentioned existing data. We choose to use the same filter (F160W) and instrument (WFC3/IR) as the existing observations to extend the NGC 2525 time-series baseline, and additionally use the wide filter F110W (the HST Y/J-band) to measure the NIR color. Although the medium-band filters (F127M, F139M, and F153M) may better separate the C- and O-rich AGB stars (Boyer et al. 2013; 2017), we are limited by the imaging depth given the great distance. Ground-based observations for the LMC and M33 Miras indicate that the J-H color also effectively separates the C- and O-rich Miras. We choose F110W instead of F125W because the F110W -F160W color has a wider wavelength separation.

(D) Observation: Exposure time

We will take dithered images with 1000 s (two dithers) and 1500 s (three dithers) exposure times per epoch for F160W and F110W, respectively. The configuration of F160W observations will be the same as existing data, which provides high enough SNR for Miras with P>350 d based on our preliminary analysis. The F110W exposure will yield SNRs of >~10 (depends on the target) and ~85 (for NGC 2525) per epoch for 400~d and 1000 d O-rich Miras, respectively, based on the HST Exposure Time Calculator (ETC) and a J-H color of ~0.8 mag (Yuan et al. 2017). After combining all the epochs, the F110W SNRs will be even higher and deep enough for O-rich Miras in all the targets. A subset of the C-rich Miras will have F110W SNRs lower than the detection limit; however, even non-detection in F110W is equally useful for the C- and O-rich Mira classification as they provide color limit measurements. We note that the designed F160W and F110W exposures fit well in one HST orbit per epoch.

(E) Observation: Sampling pattern

For NGC 2525, we plan to schedule 4 widely-spaced epochs across Cycle 28 to sample the unmeasured phases of long-period Miras and extend the observation baseline to 1300 days. Gaps between epochs are >100 days, which corresponds to >~0.1 in phase and cause no aliases for the period range of interest. With 4 measurements we will be able to correct the random-phased F110W Mira measurements to their mean intensities using the F160W light curves. Random-phase magnitudes would lead to not only larger scatter in the PLR, but also a systematic bias compared to intensity mean ("log average"). Assuming negligible phase lags between the J and H light curves, we have 2 degrees of freedom for the phase correction (free parameters include the mean F110W magnitude and F110W amplitude). Considering the uncertainties in F110W photometry and F160W-based periods & phases, fewer degrees of freedom would limit the accuracy of the F110W-band phase correction.

For NGC 1559, NGC 5643, and NGC 5861 we plan to schedule 3 epochs separated by 350/3=120 d to sample the Mira colors at 3 different phases for typical ~350 d Miras.

Summary of observations

We designed a detailed observation strategy to study the long-period Miras in NGC 2525 and calibrate Ho with short-period Miras in 4 SN Ia hosts. We plan to acquire F160W and F110W images to phase the long-period Miras in NGC 2525, and measure the NIR colors in all 4 galaxies. We have done preliminary analysis and ETC calculations and determined 1000 s and 1500 s exposure times in F160W and F110W, respectively, which assure

sufficient SNR and yet best match the existing image depth. The proposed observations will cost 4+3x3=13 orbits in total.

Impact of reduced-gyro operations

The designed observations will be negatively impacted by the potential reduced-gyro operations. Our observations are time-critical, requiring a cadence spanning several months. Due to the significant loss of field of regards at specific dates, it will be more difficult to schedule our observations. We may need to increase our tolerance of between-orbit gaps in order to fit the limited time windows under reduced-gyro operations. As a result, the long-period Miras may be less effectively sampled. The two-minute increase in target acquisition time under reduced-gyro operations will slightly reduce the exposure time of our targets, but its effect is marginal compared to the schedule difficulties.

Visit

Proposal 16250, JHn2525 (01), completed Thu Oct 07 18:01:09 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(1)
(3)	Pattern Type=WFC3-IR-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.605 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(2)

Fixed Targets

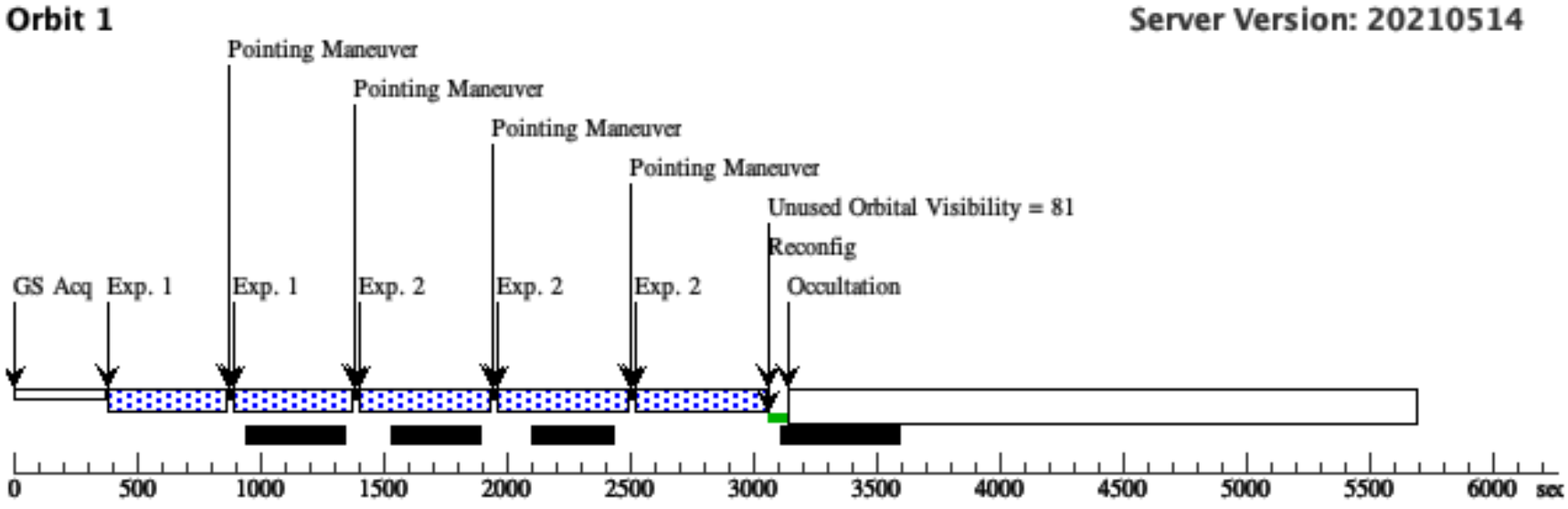
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	N2525	RA: 08 05 37.7611 (121.4073379d) Dec: -11 25 44.56 (-11.42904d) Equinox: J2000		V=26.5	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[SPIRAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) N2525	WFC3/IR, MULTIACCUM, IR-UVIS-CENTER	F160W	NSAMP=14; SAMP-SEQ=STEP50		Pattern 1, Exps 1-1 in JHn2525 (01) (1)	449.233834 Secs (898.468 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	 ***[1]***
2		(1) N2525	WFC3/IR, MULTIACCUM, IR-UVIS-CENTER	F110W	NSAMP=15; SAMP-SEQ=STEP50		Pattern 3, Exps 2-2 in JHn2525 (01) (3)	499.234285 Secs (1497.703 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	 ***[1]***

Orbit Structure



Visit

Proposal 16250, JHn2525 (02), scheduling Thu Oct 07 18:01:09 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: AFTER_01 BY 100 D TO 200 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(1)
(3)	Pattern Type=WFC3-IR-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.605 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(2)

Fixed Targets

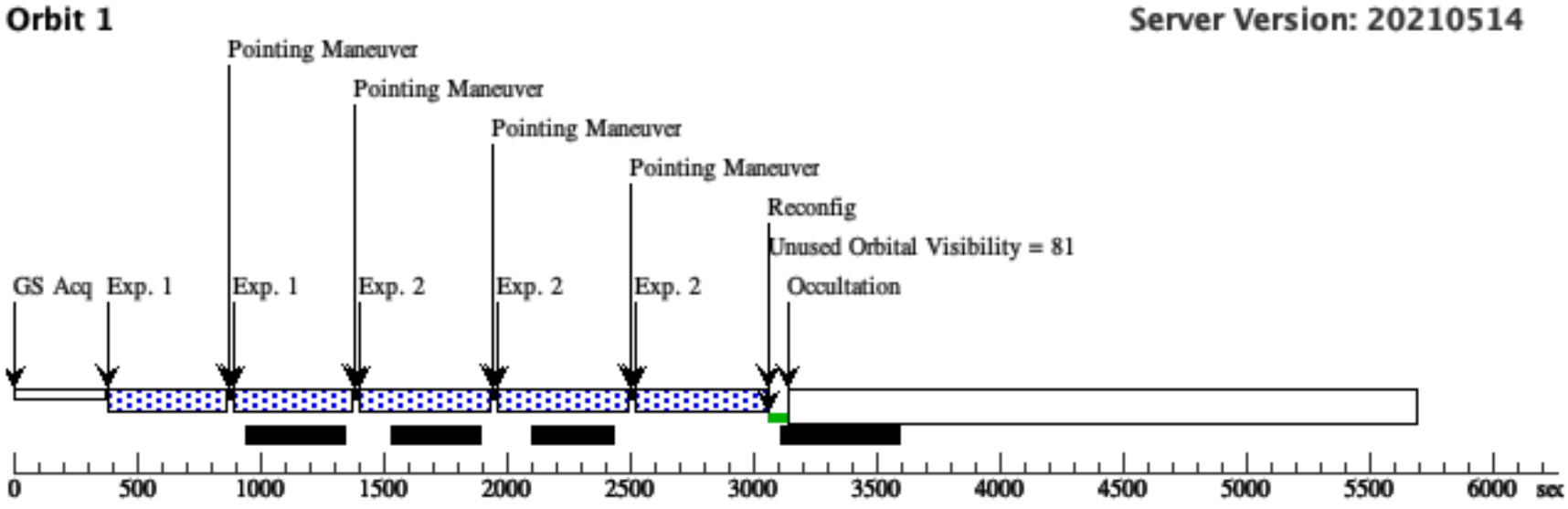
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	N2525	RA: 08 05 37.7611 (121.4073379d) Dec: -11 25 44.56 (-11.42904d) Equinox: J2000		V=26.5	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[SPIRAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) N2525	WFC3/IR, MULTIACCUM, IR-UVIS-CENTER	F160W	NSAMP=14; SAMP-SEQ=STEP50		Pattern 1, Exps 1-1 in JHn2525 (02) (1)	449.233834 Secs (898.468 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	 ***[1]***
2		(1) N2525	WFC3/IR, MULTIACCUM, IR-UVIS-CENTER	F110W	NSAMP=15; SAMP-SEQ=STEP50		Pattern 3, Exps 2-2 in JHn2525 (02) (3)	499.234285 Secs (1497.703 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	 ***[1]***

Orbit Structure



Visit

Proposal 16250, JHn2525 (03), scheduling Thu Oct 07 18:01:09 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: AFTER_02 BY 100 D TO 200 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(1)
(3)	Pattern Type=WFC3-IR-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.605 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(2)

Fixed Targets

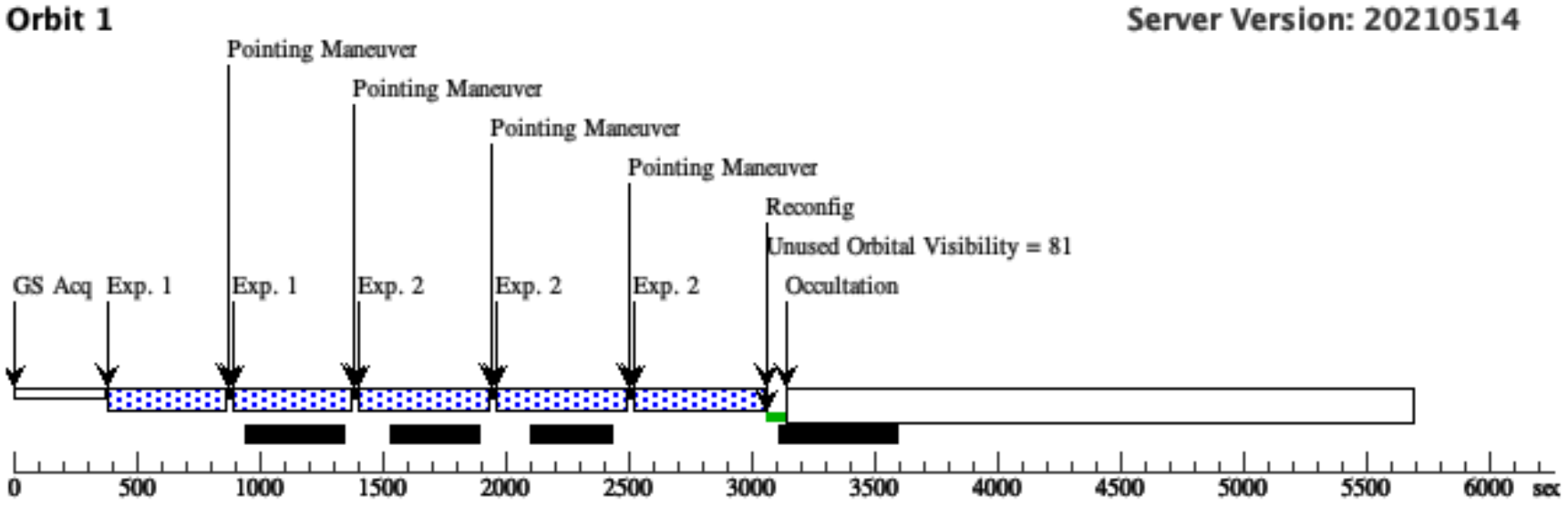
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	N2525	RA: 08 05 37.7611 (121.4073379d) Dec: -11 25 44.56 (-11.42904d) Equinox: J2000		V=26.5	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[SPIRAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) N2525	WFC3/IR, MULTIACCUM, IR-UVIS-CENTER	F160W	NSAMP=14; SAMP-SEQ=STEP50		Pattern 1, Exps 1-1 in JHn2525 (03) (1)	449.233834 Secs (898.468 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	 ***[1]***
2		(1) N2525	WFC3/IR, MULTIACCUM, IR-UVIS-CENTER	F110W	NSAMP=15; SAMP-SEQ=STEP50		Pattern 3, Exps 2-2 in JHn2525 (03) (3)	499.234285 Secs (1497.703 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	 ***[1]***

Orbit Structure



Visit

Proposal 16250, JHn2525 (04), scheduling Thu Oct 07 18:01:09 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: AFTER 03 BY 100 D TO 200 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(1)
(3)	Pattern Type=WFC3-IR-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.605 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(2)

Fixed Targets

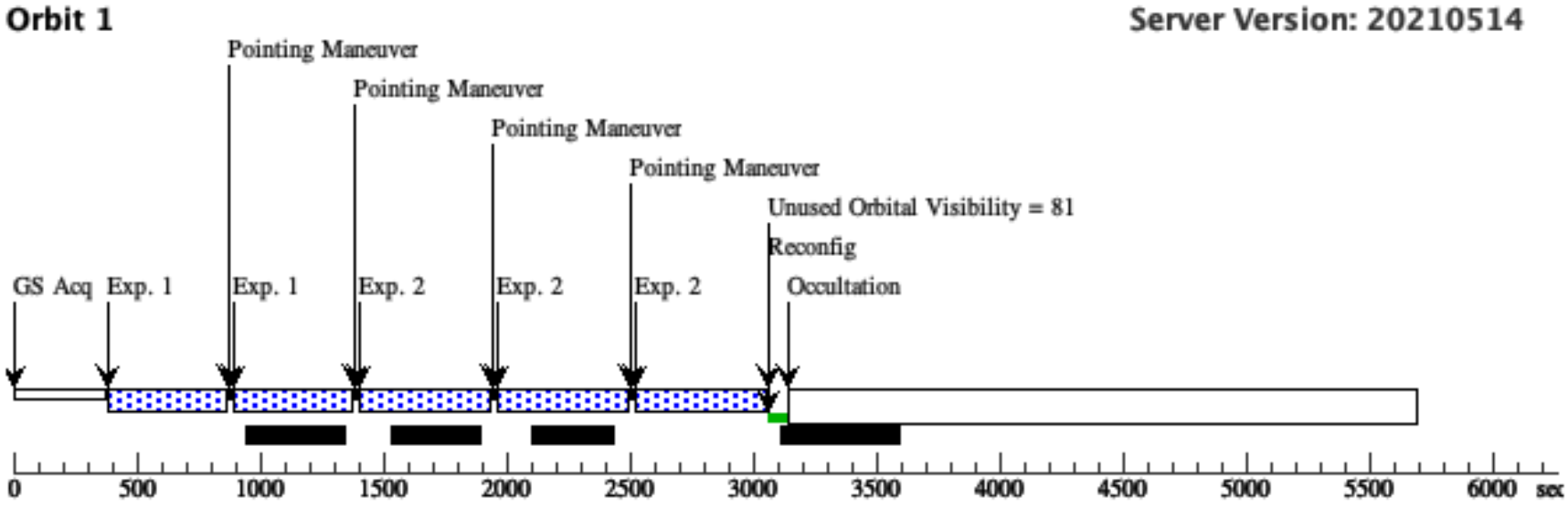
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	N2525	RA: 08 05 37.7611 (121.4073379d) Dec: -11 25 44.56 (-11.42904d) Equinox: J2000		V=26.5	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[SPIRAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) N2525	WFC3/IR, MULTIACCUM, IR-UVIS-CENTER	F160W	NSAMP=14; SAMP-SEQ=STEP50		Pattern 1, Exps 1-1 in JHn2525 (04) (1)	449.233834 Secs (898.468 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	 ***[1]***
2		(1) N2525	WFC3/IR, MULTIACCUM, IR-UVIS-CENTER	F110W	NSAMP=15; SAMP-SEQ=STEP50		Pattern 3, Exps 2-2 in JHn2525 (04) (3)	499.234285 Secs (1497.703 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	 ***[1]***

Orbit Structure



Visit

Proposal 16250, JHn1559 (05), completed Thu Oct 07 18:01:09 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: AFTER 01-OCT-2020:00:00:00

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(1)
(4)	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		(2)

Fixed Targets

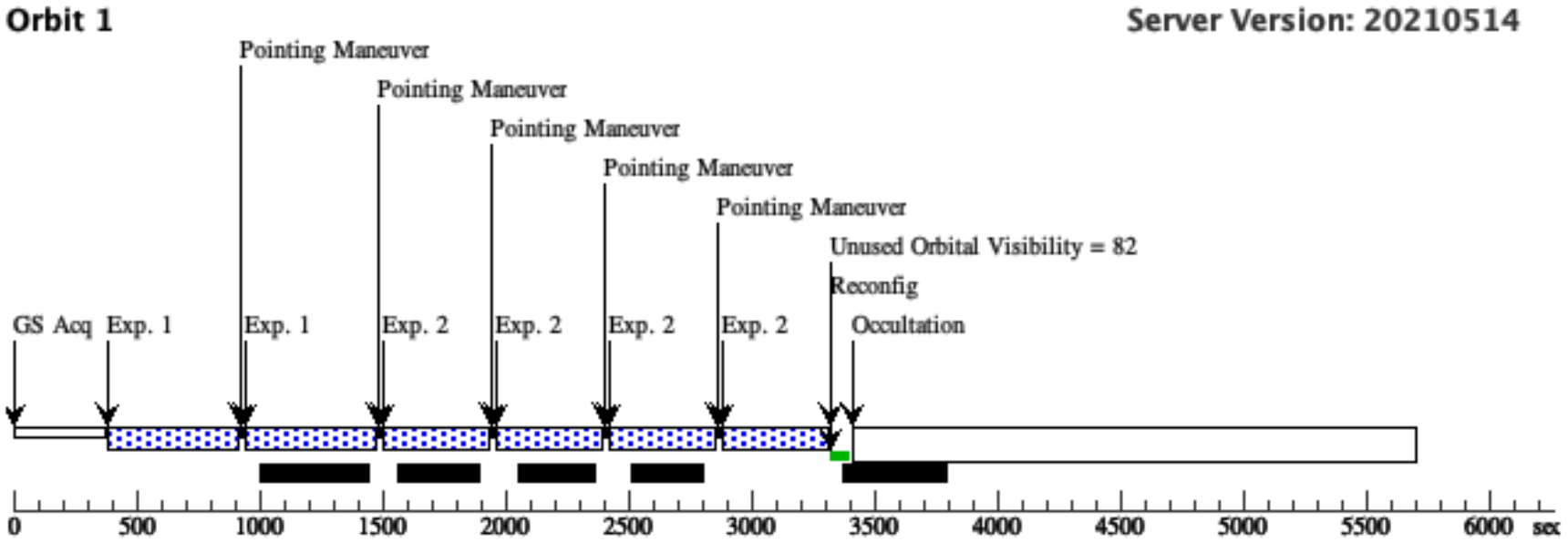
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	N1559	RA: 04 17 37.0000 (64.4041667d) Dec: -62 47 0.00 (-62.78333d) Equinox: J2000		V=26	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=GALAXY
Description=[SPIRAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) N1559	WFC3/IR, MULTIACCUM, IR-UVIS-CENTER	F160W	NSAMP=15; SAMP-SEQ=STEP50		Pattern 1, Exps 1-1 in JHn1559 (05) (1)	499.234285 Secs (998.469 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	*[1]*
2		(2) N1559	WFC3/IR, MULTIACCUM, IR-UVIS-CENTER	F110W	NSAMP=13; SAMP-SEQ=STEP50		Pattern 4, Exps 2-2 in JHn1559 (05) (4)	399.233383 Secs (1596.934 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	*[1]*

Orbit Structure



Visit

Proposal 16250, JHn1559 (06), completed Thu Oct 07 18:01:09 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: AFTER_05 BY 100 D TO 140 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
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(4)	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		(2)

Fixed Targets

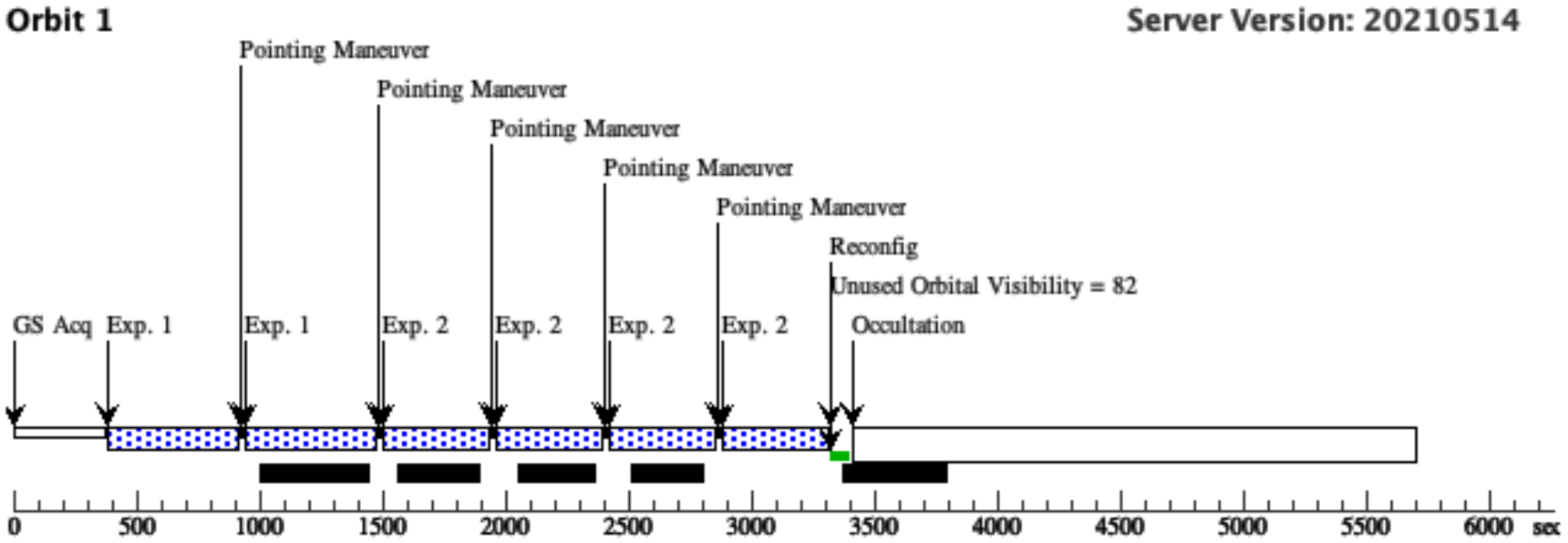
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	N1559	RA: 04 17 37.0000 (64.4041667d) Dec: -62 47 0.00 (-62.78333d) Equinox: J2000		V=26	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=GALAXY
Description=[SPIRAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) N1559	WFC3/IR, MULTIACCUM, IR-UVIS-CENTER	F160W	NSAMP=15; SAMP-SEQ=STEP50		Pattern 1, Exps 1-1 in JHn1559 (06) (1)	499.234285 Secs (998.469 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	*[1]*
2		(2) N1559	WFC3/IR, MULTIACCUM, IR-UVIS-CENTER	F110W	NSAMP=13; SAMP-SEQ=STEP50		Pattern 4, Exps 2-2 in JHn1559 (06) (4)	399.233383 Secs (1596.934 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	*[1]*

Orbit Structure



Visit

Proposal 16250, JHn1559 (07), completed Thu Oct 07 18:01:09 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: AFTER 06 BY 100 D TO 140 D; BEFORE 01-OCT-2021:00:00:00

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
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(4)	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		(2)

Fixed Targets

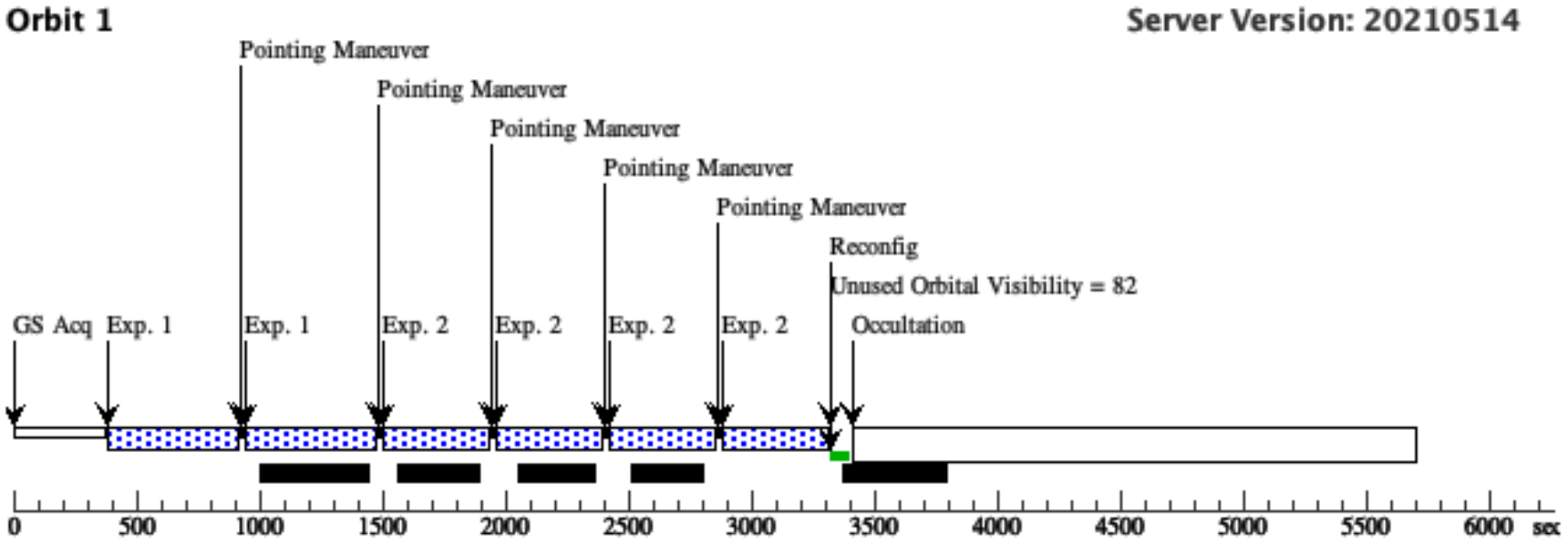
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	N1559	RA: 04 17 37.0000 (64.4041667d) Dec: -62 47 0.00 (-62.78333d) Equinox: J2000		V=26	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=GALAXY
Description=[SPIRAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) N1559	WFC3/IR, MULTIACCUM, IR-UVIS-CENTER	F160W	NSAMP=15; SAMP-SEQ=STEP50		Pattern 1, Exps 1-1 in JHn1559 (07) (1)	499.234285 Secs (998.469 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	*[1]*
2		(2) N1559	WFC3/IR, MULTIACCUM, IR-UVIS-CENTER	F110W	NSAMP=13; SAMP-SEQ=STEP50		Pattern 4, Exps 2-2 in JHn1559 (07) (4)	399.233383 Secs (1596.934 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	*[1]*

Orbit Structure



Visit

Proposal 16250, JHn5643 (08), completed Thu Oct 07 18:01:09 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: AFTER 01-OCT-2020:00:00:00

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(1)
(3)	Pattern Type=WFC3-IR-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.605 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(2)

Fixed Targets

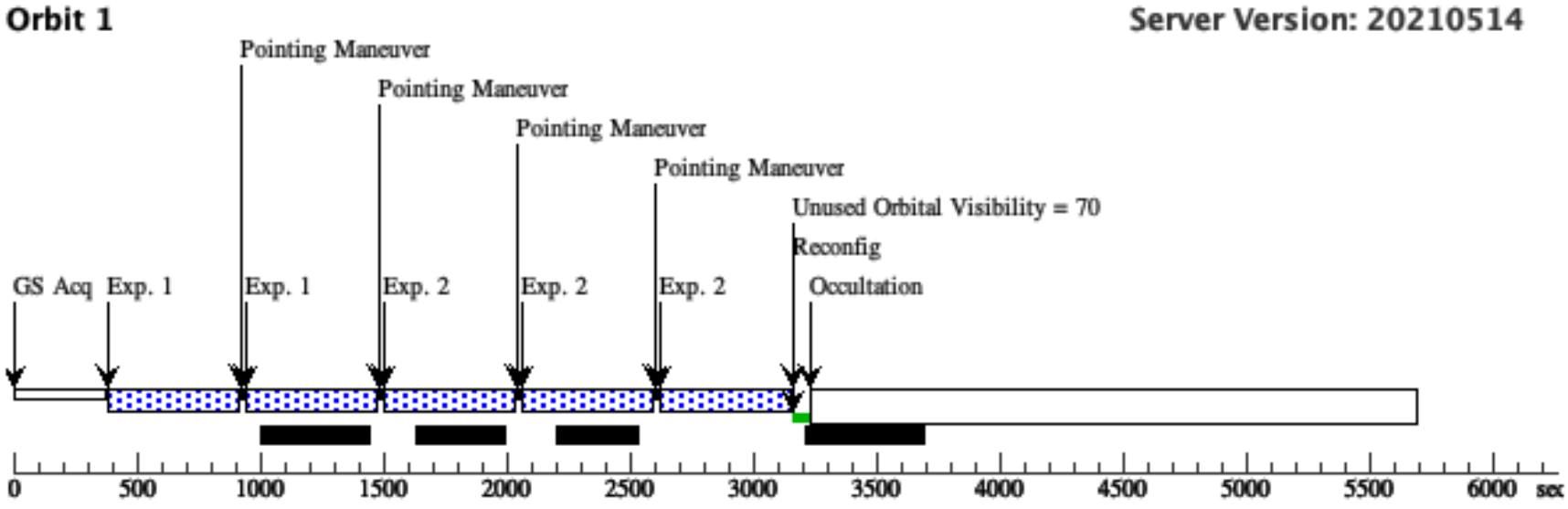
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	N5643	RA: 14 32 40.7780 (218.1699083d) Dec: -44 10 28.60 (-44.17461d) Equinox: J2000		V=26	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=GALAXY
Description=[SPIRAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(3) N5643	WFC3/IR, MULTIACCUM, IR-UVIS-CENTER	F160W	NSAMP=15; SAMP-SEQ=STEP50		Pattern 1, Exps 1-1 in JHn5643 (08) (1)	499.234285 Secs (998.469 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	 ***[1]***
2		(3) N5643	WFC3/IR, MULTIACCUM, IR-UVIS-CENTER	F110W	NSAMP=15; SAMP-SEQ=STEP50		Pattern 3, Exps 2-2 in JHn5643 (08) (3)	499.234285 Secs (1497.703 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	 ***[1]***

Orbit Structure



Visit

Proposal 16250, JHn5643 (09), completed Thu Oct 07 18:01:09 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: AFTER_08 BY 100 D TO 140 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(1)
(3)	Pattern Type=WFC3-IR-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.605 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(2)

Fixed Targets

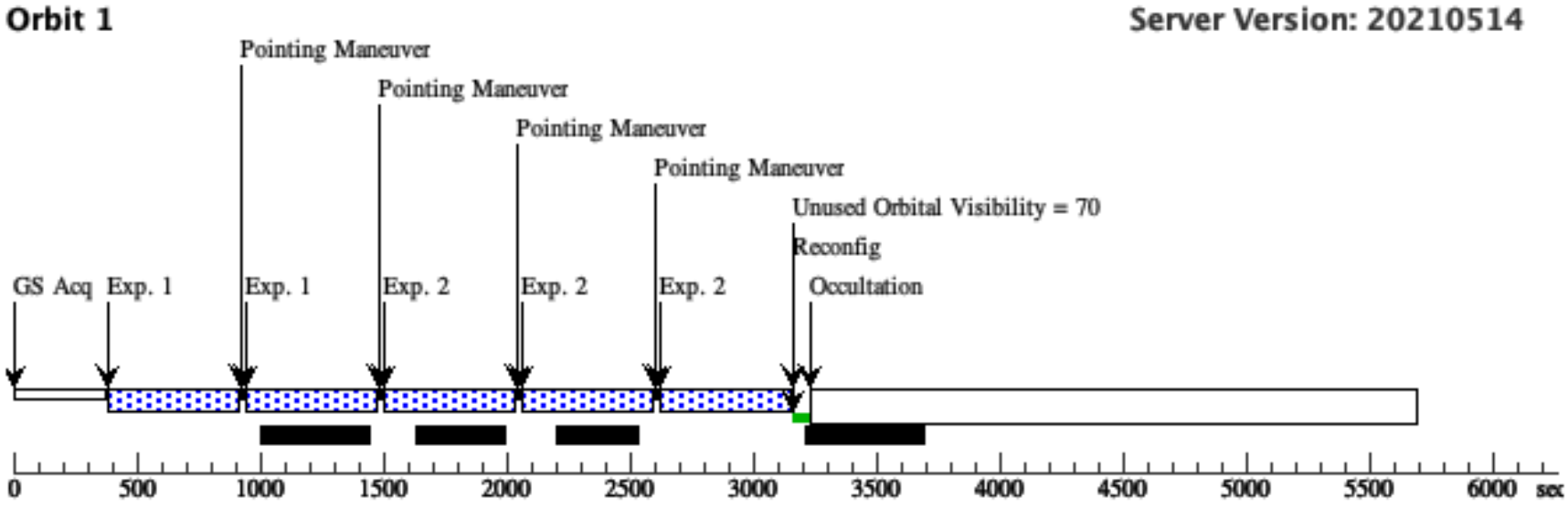
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	N5643	RA: 14 32 40.7780 (218.1699083d) Dec: -44 10 28.60 (-44.17461d) Equinox: J2000		V=26	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=GALAXY
Description=[SPIRAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(3) N5643	WFC3/IR, MULTIACCUM, IR-UVIS-CENTER	F160W	NSAMP=15; SAMP-SEQ=STEP50		Pattern 1, Exps 1-1 in JHn5643 (09) (1)	499.234285 Secs (998.469 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	 ***[1]***
2		(3) N5643	WFC3/IR, MULTIACCUM, IR-UVIS-CENTER	F110W	NSAMP=15; SAMP-SEQ=STEP50		Pattern 3, Exps 2-2 in JHn5643 (09) (3)	499.234285 Secs (1497.703 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	 ***[1]***

Orbit Structure



Visit

Proposal 16250, JHn5643 (10), completed Thu Oct 07 18:01:10 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: AFTER 09 BY 100 D TO 140 D; BEFORE 01-OCT-2021:00:00:00

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(1)
(3)	Pattern Type=WFC3-IR-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.605 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(2)

Fixed Targets

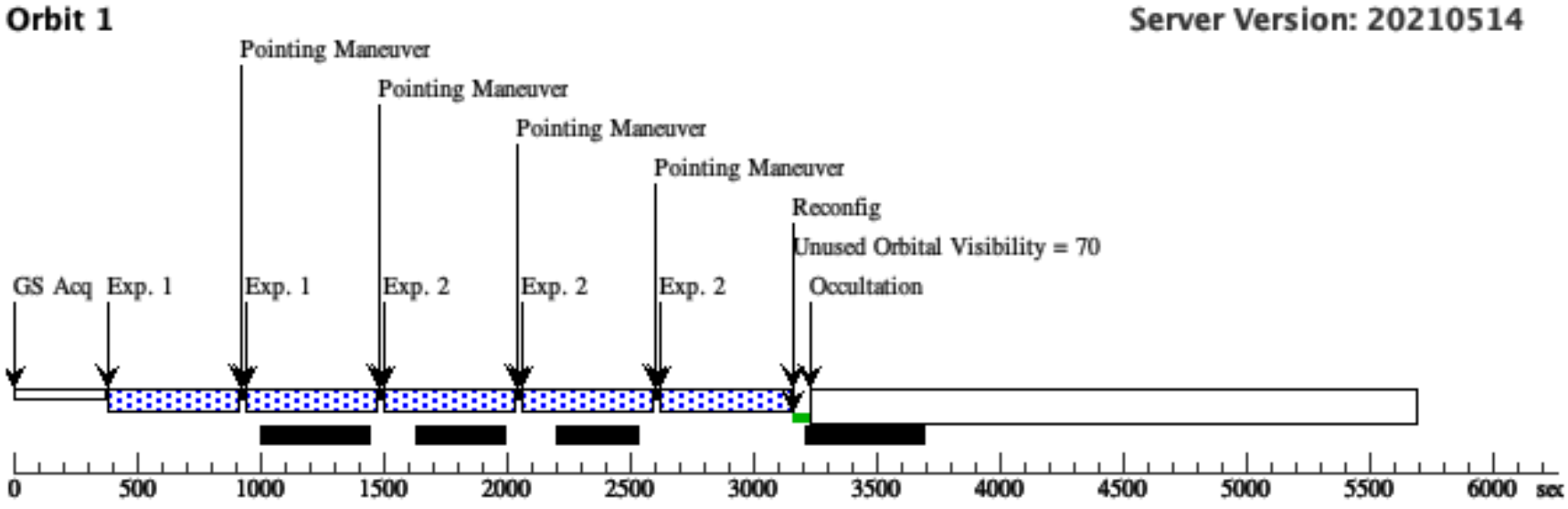
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	N5643	RA: 14 32 40.7780 (218.1699083d) Dec: -44 10 28.60 (-44.17461d) Equinox: J2000		V=26	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=GALAXY
Description=[SPIRAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(3) N5643	WFC3/IR, MULTIACCUM, IR-UVIS-CENTER	F160W	NSAMP=15; SAMP-SEQ=STEP50		Pattern 1, Exps 1-1 in JHn5643 (10) (1)	499.234285 Secs (998.469 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	 ***[1]***
2		(3) N5643	WFC3/IR, MULTIACCUM, IR-UVIS-CENTER	F110W	NSAMP=15; SAMP-SEQ=STEP50		Pattern 3, Exps 2-2 in JHn5643 (10) (3)	499.234285 Secs (1497.703 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	 ***[1]***

Orbit Structure



Visit

Proposal 16250, JHn5861 (11), completed Thu Oct 07 18:01:10 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: AFTER 01-OCT-2020:00:00:00

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(1)
(3)	Pattern Type=WFC3-IR-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.605 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(2)

Fixed Targets

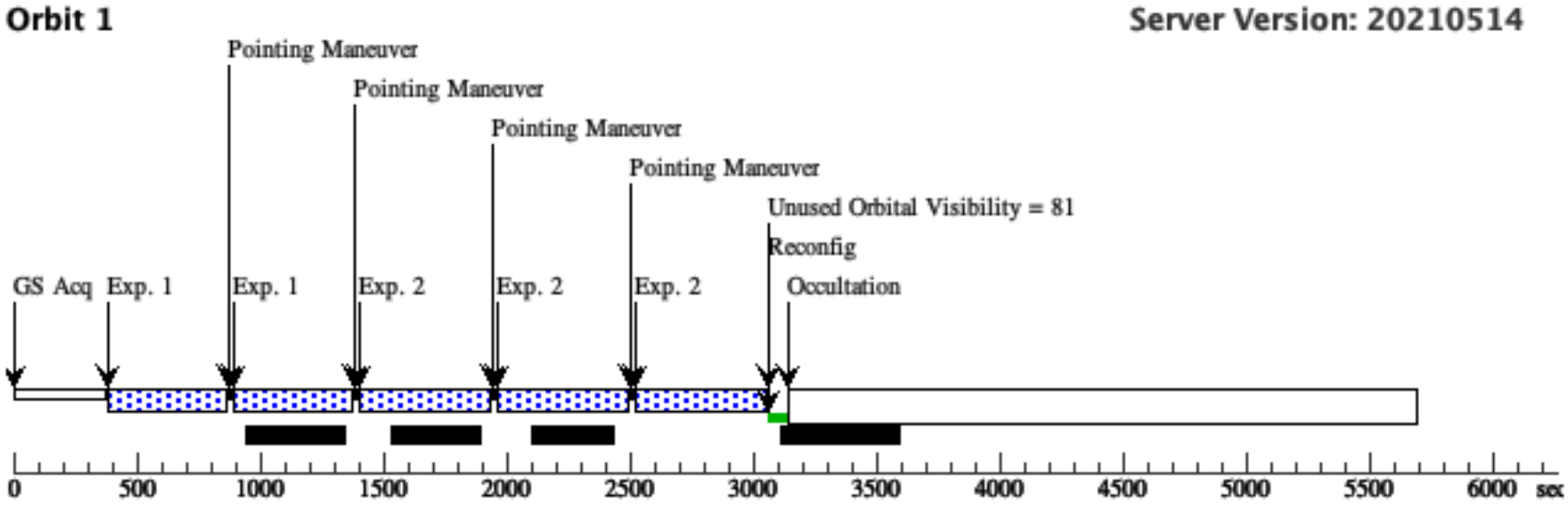
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	N5861	RA: 15 09 15.5100 (227.3146250d) Dec: -11 19 4.19 (-11.31783d) Equinox: J2000		V=26	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[SPIRAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(4) N5861	WFC3/IR, MULTIACCUM, IR-UVIS-CENTER	F160W	NSAMP=14; SAMP-SEQ=STEP50		Pattern 1, Exps 1-1 in JHn5861 (11) (1)	449.233834 Secs (898.468 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	 ***[1]***
2		(4) N5861	WFC3/IR, MULTIACCUM, IR-UVIS-CENTER	F110W	NSAMP=15; SAMP-SEQ=STEP50		Pattern 3, Exps 2-2 in JHn5861 (11) (3)	499.234285 Secs (1497.703 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	 ***[1]***

Orbit Structure



Visit

Proposal 16250, JHn5861 (12), failed Thu Oct 07 18:01:10 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: AFTER 11 BY 100 D TO 140 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(1)
(3)	Pattern Type=WFC3-IR-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.605 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(2)

Fixed Targets

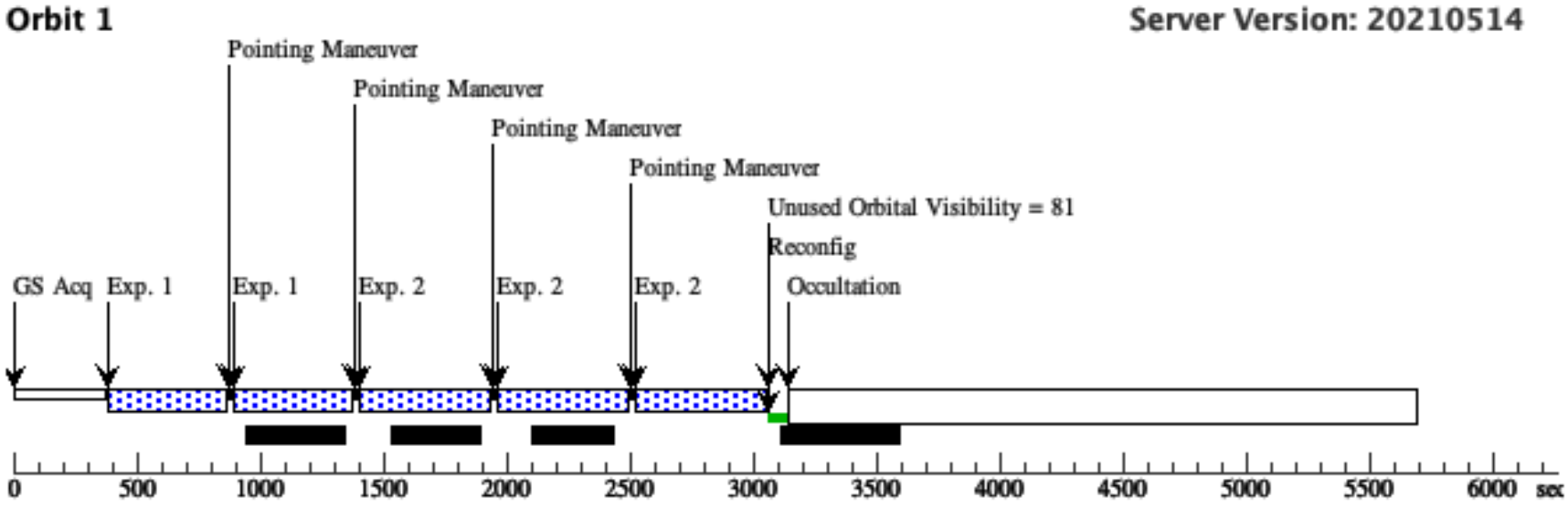
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	N5861	RA: 15 09 15.5100 (227.3146250d) Dec: -11 19 4.19 (-11.31783d) Equinox: J2000		V=26	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[SPIRAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(4) N5861	WFC3/IR, MULTIACCUM, IR-UVIS-CENTER	F160W	NSAMP=14; SAMP-SEQ=STEP50		Pattern 1, Exps 1-1 in JHn5861 (12) (1)	449.233834 Secs (898.468 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	 ***[1]***
2		(4) N5861	WFC3/IR, MULTIACCUM, IR-UVIS-CENTER	F110W	NSAMP=15; SAMP-SEQ=STEP50		Pattern 3, Exps 2-2 in JHn5861 (12) (3)	499.234285 Secs (1497.703 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	 ***[1]***

Orbit Structure



Visit

Proposal 16250, JHn5861 (14), implementation Thu Oct 07 18:01:10 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: BETWEEN 01-NOV-2021:00:00:00 AND 31-DEC-2021:00:00:00; BETWEEN 01-JAN-2022:00:00:00 AND 31-MAR-2022:00:00:00

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(1)
(3)	Pattern Type=WFC3-IR-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.605 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(2)

Fixed Targets

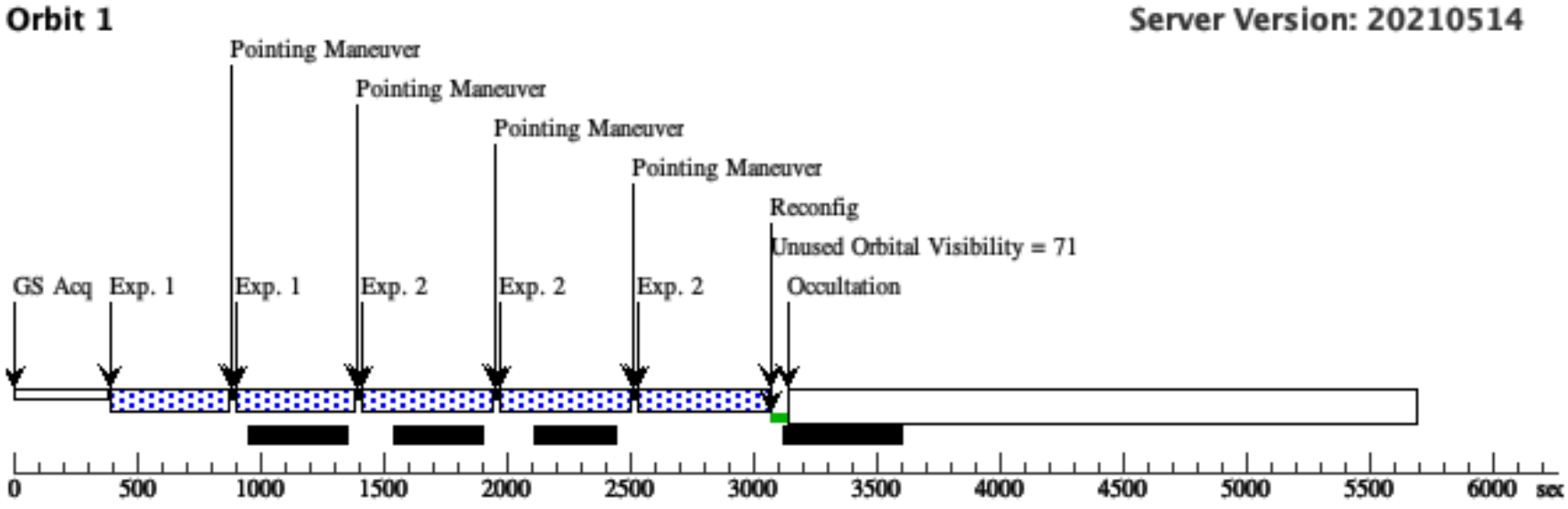
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	N5861	RA: 15 09 15.5100 (227.3146250d) Dec: -11 19 4.19 (-11.31783d) Equinox: J2000		V=26	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[SPIRAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(4) N5861	WFC3/IR, MULTIACCUM, IR-UVIS-CENTER	F160W	NSAMP=14; SAMP-SEQ=STEP50	GS ACQ SCENARIO BASE1BE	Pattern 1, Exps 1-1 in JHn5861 (14) (1)	449.233834 Secs (898.468 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
2		(4) N5861	WFC3/IR, MULTIACCUM, IR-UVIS-CENTER	F110W	NSAMP=15; SAMP-SEQ=STEP50		Pattern 3, Exps 2-2 in JHn5861 (14) (3)	499.234285 Secs (1497.703 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[1]***

Orbit Structure



Visit

Proposal 16250, JHn5861 (13), completed Thu Oct 07 18:01:10 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: AFTER 12 BY 100 D TO 140 D; BEFORE 01-OCT-2021:00:00:00

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(1)
(3)	Pattern Type=WFC3-IR-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.605 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(2)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	N5861	RA: 15 09 15.5100 (227.3146250d) Dec: -11 19 4.19 (-11.31783d) Equinox: J2000		V=26	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[SPIRAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(4) N5861	WFC3/IR, MULTIACCUM, IR-UVIS-CENTER	F160W	NSAMP=14; SAMP-SEQ=STEP50		Pattern 1, Exps 1-1 in JHn5861 (13) (1)	449.233834 Secs (898.468 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	*[1]*
2		(4) N5861	WFC3/IR, MULTIACCUM, IR-UVIS-CENTER	F110W	NSAMP=15; SAMP-SEQ=STEP50		Pattern 3, Exps 2-2 in JHn5861 (13) (3)	499.234285 Secs (1497.703 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	*[1]*

Orbit Structure