17731 - Are All Type IIn Supernovae Terminal Explosions?

Cycle: 32, Proposal Category: SNAP

(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) SN1989L	WFC3/UVIS	1	15-Nov-2024 12:00:17.0	yes
02	(2) SN1994AK	WFC3/UVIS	1	15-Nov-2024 12:00:17.0	yes
03	(3) SN1995N	WFC3/UVIS	1	15-Nov-2024 12:00:18.0	yes
04	(4) SN1996CR	WFC3/UVIS	1	15-Nov-2024 12:00:18.0	yes
05	(5) SN1997EG	WFC3/UVIS	1	15-Nov-2024 12:00:19.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
06	(6) SN1998S	WFC3/UVIS	1	15-Nov-2024 12:00:19.0	yes
07	(7) SN1999EB	WFC3/UVIS	1	15-Nov-2024 12:00:20.0	yes
08	(8) SN1999EL	WFC3/UVIS	1	15-Nov-2024 12:00:20.0	yes
09	(9) SN2000P	WFC3/UVIS	1	15-Nov-2024 12:00:21.0	yes
10	(10) 2000CL	WFC3/UVIS	1	15-Nov-2024 12:00:21.0	yes
11	(11) SN2001IR	WFC3/UVIS	1	15-Nov-2024 12:00:22.0	yes
12	(12) SN2003LO	WFC3/UVIS	1	15-Nov-2024 12:00:22.0	yes
13	(13) SN2006AM	WFC3/UVIS	1	15-Nov-2024 12:00:22.0	yes
14	(14) SN2010BT	WFC3/UVIS	1	15-Nov-2024 12:00:23.0	yes
15	(15) SN2010JP	WFC3/UVIS	1	15-Nov-2024 12:00:23.0	yes
16	(16) 2011FH	WFC3/UVIS	1	15-Nov-2024 12:00:24.0	yes
17	(17) GAIA14AHL	WFC3/UVIS	1	15-Nov-2024 12:00:24.0	yes
18	(18) SN2014G	WFC3/UVIS	1	15-Nov-2024 12:00:25.0	yes
19	(19) SN2015BH	WFC3/UVIS	1	15-Nov-2024 12:00:26.0	yes
20	(20) ASASSN-15LX	WFC3/UVIS	1	15-Nov-2024 12:00:26.0	yes
21	(21) SN2011HT	WFC3/UVIS	1	15-Nov-2024 12:00:26.0	yes

21 Total Orbits Used

ABSTRACT

There is evidence that some Type IIn supernovae, whose diverse spectra and light curves exhibit signs of interaction between the ejected material and circumstellar matter (CSM), are actually nonterminal outbursts of massive evolved stars such as luminous blue variables (LBVs); such objects are thus "SN impostors," at least until they undergo a terminal explosion. An outstanding example is SN 2009ip, which was classified as an SN IIn but three years later experienced an even larger, terminal explosion; the 2009 event was an SN impostor. In other cases of SNe IIn, it is possible that the initial outburst was an impostor, and the terminal explosion has not yet occurred. We propose to obtain deep, two-filter HST snapshot images of the sites of confirmed SNe IIn (> 9 years after outburst), in order to see whether the progenitor did indeed disappear and thus likely suffered a terminal explosion. The precise position of each of our targets will be known from post-eruption archival HST images. If instead we find an object at the site

of the SN IIn, it is likely either the surviving progenitor, a companion star, or long-lived emission from the shocked CSM. The color of the star, obtained from the HST snapshot images, will provide a strong clue: LBVs are generally blue, ejecta-CSM interactors (with H-alpha emission) and RSG companions are red. The detection or nondetection of an object at the SN site will already provide fundamental information. However, to further explore the nature of any detected object, we will subsequently obtain essentially guaranteed, ground-based complementary spectra to search for medium/broad H-alpha emission characteristic of shocked CSM.

OBSERVING DESCRIPTION

We wish to obtain deep (mag 26--27) WFC3 images of the sites of relatively old (>~ 9yr) SNe\,IIn that were previously imaged by HST after outburst but still visible (data available in the HST archive), so that we know precisely where they are located and thus where we should look. In ~30% of the cases, there are also archival HST images from before the outburst, so that we know the brightness of the progenitor (or have limits on it). Preliminary analysis suggests that a few with sufficiently good data appear to likely be LBVs (based on their luminosity and colors); more-detailed studies will be conducted in this program.

The new HST images will be compared with the existing HST images to look for an object at the correct location. If no object is present, we will know that the progenitor probably suffered a terminal explosion --- the conclusion made by most other previous studies of massive-star SNe when an object is not detected at the precise location. (Perhaps it survived but is enshrouded in dust, a possibility we will explore with a future JWST proposal that would have been poorly motivated without an HST study first.) If, instead, an object is present, it is either the surviving star, long-lived emission from the SN shock, or a companion star or star cluster (light echoes are ruled out, being very faint and/or resolved). The object's color (from the HST snapshot data) will shed considerable light on these possibilities, which will be further explored with ground-based spectra; we will look for H_alpha emission and measure its width. Future HST proposals for multiband imaging will also be submitted, but we stress that this Cycle 32 proposal can

be considered successful (the main goals will have been achieved) even if no future JWST or HST data are acquired.

WFC3 is superior to ACS for our purposes, owing to its higher resolution and shorter overhead time for the relatively brief snapshot visits. Note that a substantial part of the host galaxies of the SNe will be imaged with WFC3, and the data can be used for many other studies, such as galaxy morphology, stellar populations, variable stars, star clusters, H II regions, and the search for future SN progenitors. We will remedy the CTE efficiency losses by using post-flash.

After registering the new images astrometrically with the archival HST images to pinpoint the SN position, we will perform photometry on the new images using DOLPHOT v2.0 (Dolphin 2000). In most cases, there will either be a clearly detected isolated point source corresponding to the SN, or no flux evident at the SN position. When no object is detected, we will inject fake sources into the image adjacent to the SN position, and attempt to recover them to estimate a robust limit on the object's flux. In unusual cases, nearby sources such as stellar associations need to be simultaneously modeled to estimate the object's flux.

Our top-priority desire is to go deep, in order to increase our chances of detecting a source at the position of the SN. However, we also want to obtain a color of any detected object. After running calculations on the WFC3 UVIS ETC, we decided to use the F475W (SDSS-g) and F625W (SDSS-r) filters, distributing the available time equally between them. (We also considered using only a single filter, F350LP, to go even deeper --- but the disadvantage is that this provides no color information, and the observed magnitude strongly depends on the object's SED.) The chosen filters are efficient and provide a commonly measured color.

For a visit to be ~45 min long (close to the peak of the distribution of snapshot visits; http://www.stsci.edu/hst/HST_overview/documents/ uir/UIR_SNAP.pdf), there can be only

one dithered, CR-SPLIT pair of 900s WFC3 exposures through each of two filters. From the ETC, we find that we reach S/N = 5 at limiting magnitudes of 26.6 (F475W) and 27.2 (F625W) when normalized to Johnson V using the spectrum of SN~IIn 2010jl about 7 yr after explosion and no extinction. (This input spectrum is representative of what we expect if the object exhibits SN ejecta-CSM shock interaction.) Similarly, instead using a B0 V Pickels input spectrum (there is no option for B0 I, closer to an LBV, but it should make little difference), we reach S/N = 5 at limiting magnitudes of 27.0 (F475W) and 26.1 (F625W). Adopting a representative magnitude of 26.6, the data will allow us to probe objects more luminous than roughly -6.0 mag at z = 0.007 (using H_0 = 71 km /s /Mpc), close to our average redshift. This is substantially fainter than typical LBVs and yellow hypergiants -7 to -12), and it is even in the general range of supergiant stars (-6 to -9; e.g., Humphreys & Davidson 1994; Smith et al. 2019). Thus, excluding a large amount of extinction produced by dust, we should be able to detect the surviving star, if one exists. Moreover, we will measure a broad-band color (approximately SDSS g-r), allowing us to distinguish between an LBV (g-r <~ 0 mag in quiescence, but sometimes red because of dust formation) and ejecta-CSM interaction (which typically produces strong H_alpha emission but almost no blue continuum at late times) or an RSG (g-r > ~1 mag).

In cases where an object is detected at the correct position, we will also obtain follow-up optical spectra with large ground-based telescopes to which our team has private access and/or nationally available time (through proposals). The main goal will be to search for intermediate-width (~1000 km /s) or broad H_alpha emission that would indicate that the object was a genuine SN whose ejecta are interacting with (and shocking) CSM. Such emission can often be detected in very faint objects (mag 25--26), since the flux density in the emission line far exceeds that in the continuum (e.g., Shahbandeh et al 2023; Sziros et al. 2024). If such H_alpha emission is not detected but the object is sufficiently bright for a decent spectrum to be obtained, that spectrum will allow us to classify the object (LBV, RSG, etc.), ruling out a companion or associated star cluster.

If no object is detected, it will likely mean that the SN IIn did indeed explode; see, for example, the cases of SN 2005gl (Gal-Yam & Leonard 2009) and 7 other SNe (Van Dyk et al. 2013, 2023).

However, there exists the possibility that it actually survived but is enshrouded in dust; the only way to test this is to propose future near-IR and mid-IR JWST observations -- but this program is the necessary first step.

Our request is 21 snapshots in 21 visits (~45 min/visit). We have chosen 21 nearby (mostly z <~ 0.01, a few out to z = 0.02) SNe IIn that erupted >~ 9 yr ago, and for which HST images showing the SN in the first few years post-SN are available (so we can measure precise positions).

Visit

Proposal 17731, Visit 01, implementation Fri Nov 15 17:00:27 GMT 2024

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

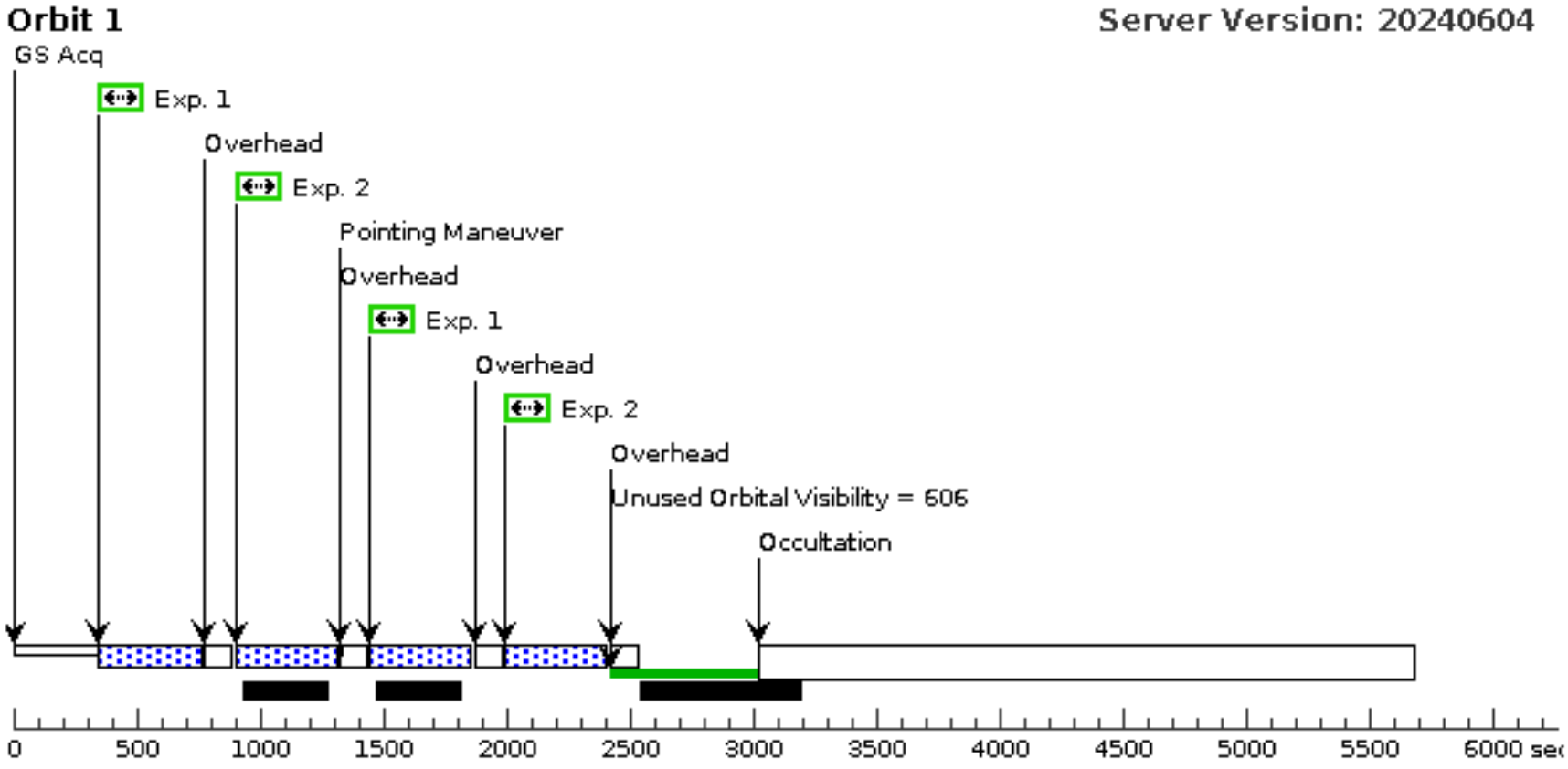
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SN1989L	RA: 22 37 49.7100 (339.4571250d) Dec: +23 47 15.70 (23.78769d) Equinox: J2000		V=26.0+/-0.3	Reference Frame: ICRS

Comments:
Category=STAR
Description=[SUPERNOVA]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F625W	(1) SN1989L	WFC3/UVIS, ACCUM, UVIS	F625W	FLASH=10		Pattern 1, Exps 1-2 in Visit 01 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
2	F475W	(1) SN1989L	WFC3/UVIS, ACCUM, UVIS	F475W	FLASH=12		Pattern 1, Exps 1-2 in Visit 01 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***

Orbit Structure



Visit

Proposal 17731, Visit 02, implementation Fri Nov 15 17:00:27 GMT 2024

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Patterns

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Fixed Targets

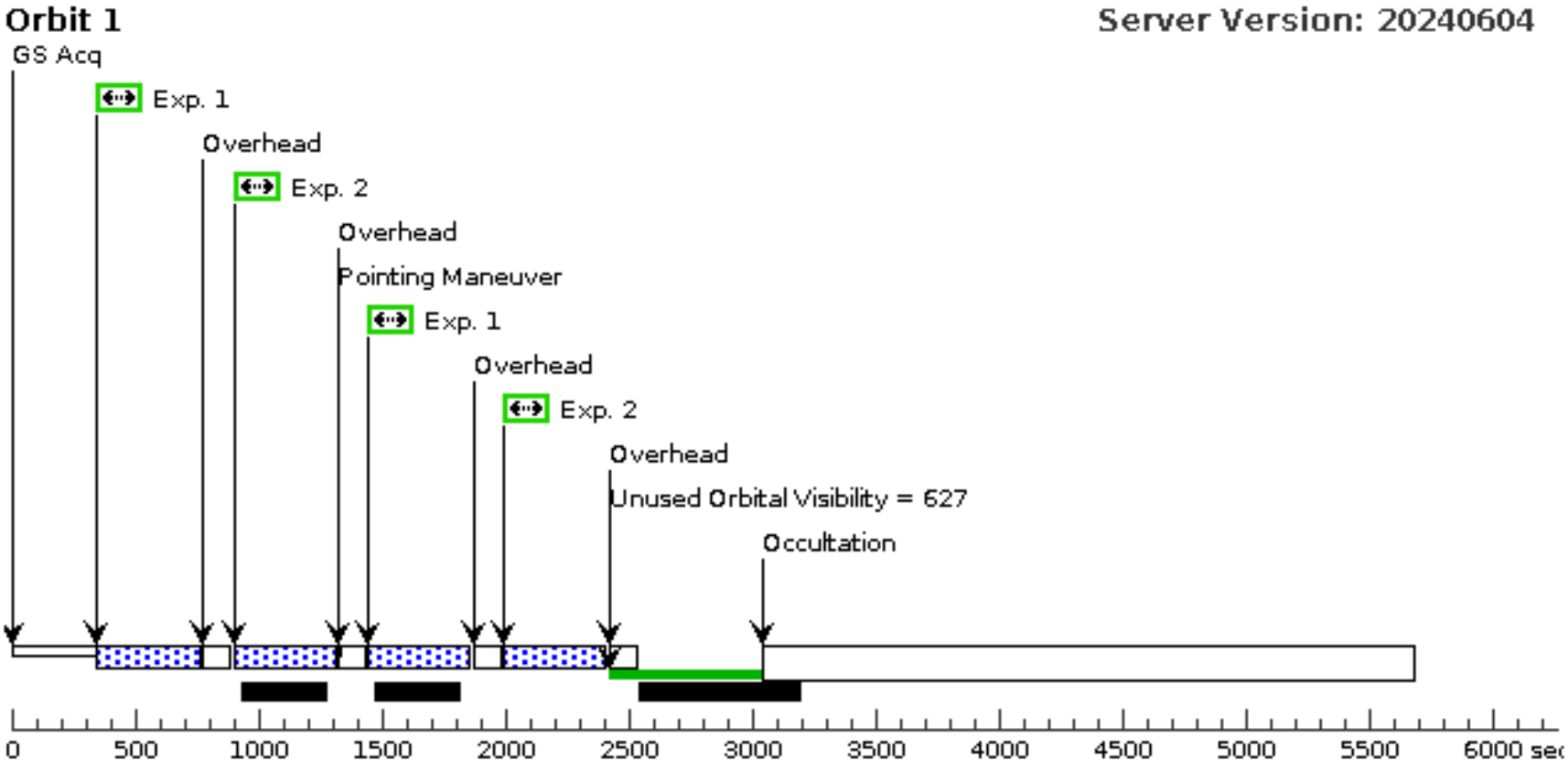
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	SN1994AK	RA: 09 14 1.4700 (138.5061250d) Dec: +40 06 21.50 (40.10597d) Equinox: J2000		V=26.0+/-0.3	Reference Frame: ICRS

Comments:
Category=STAR
Description=[SUPERNOVA]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F625W	(2) SN1994AK	WFC3/UVIS, ACCUM, UVIS	F625W	FLASH=10		Pattern 1, Exps 1-2 in Visit 02 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
2	F475W	(2) SN1994AK	WFC3/UVIS, ACCUM, UVIS	F475W	FLASH=12		Pattern 1, Exps 1-2 in Visit 02 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***

Orbit Structure



Visit

Proposal 17731, Visit 03, implementation Fri Nov 15 17:00:27 GMT 2024

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

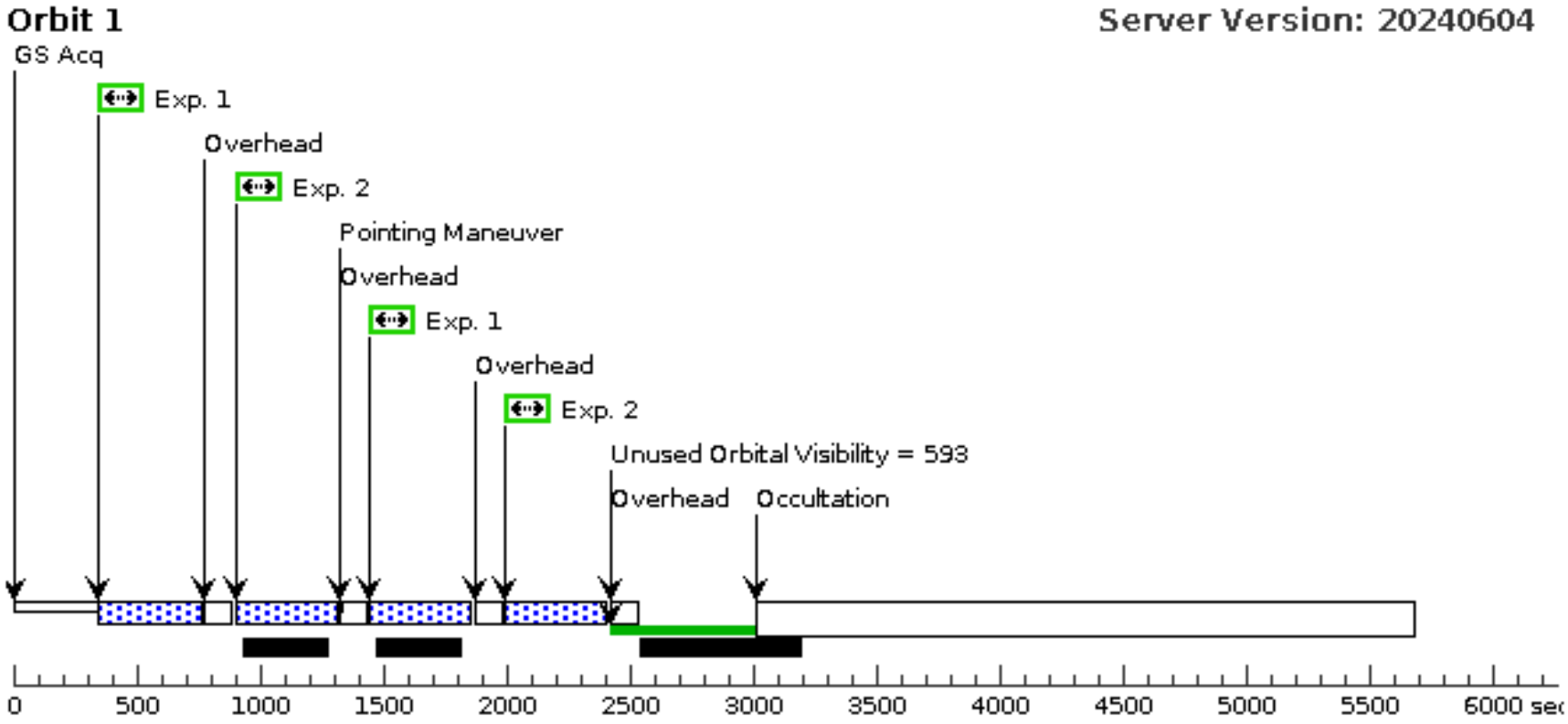
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	SN1995N	RA: 14 49 28.2900 (222.3678750d) Dec: -10 10 14.40 (-10.17067d) Equinox: J2000		V=26.0+/-0.3	Reference Frame: ICRS

Comments:
Category=STAR
Description=[SUPERNOVA]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F625W	(3) SN1995N	WFC3/UVIS, ACCUM, UVIS	F625W	FLASH=10		Pattern 1, Exps 1-2 in Visit 03 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
2	F475W	(3) SN1995N	WFC3/UVIS, ACCUM, UVIS	F475W	FLASH=12		Pattern 1, Exps 1-2 in Visit 03 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***

Orbit Structure



Visit

Proposal 17731, Visit 04, implementation Fri Nov 15 17:00:27 GMT 2024

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Patterns

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Fixed Targets

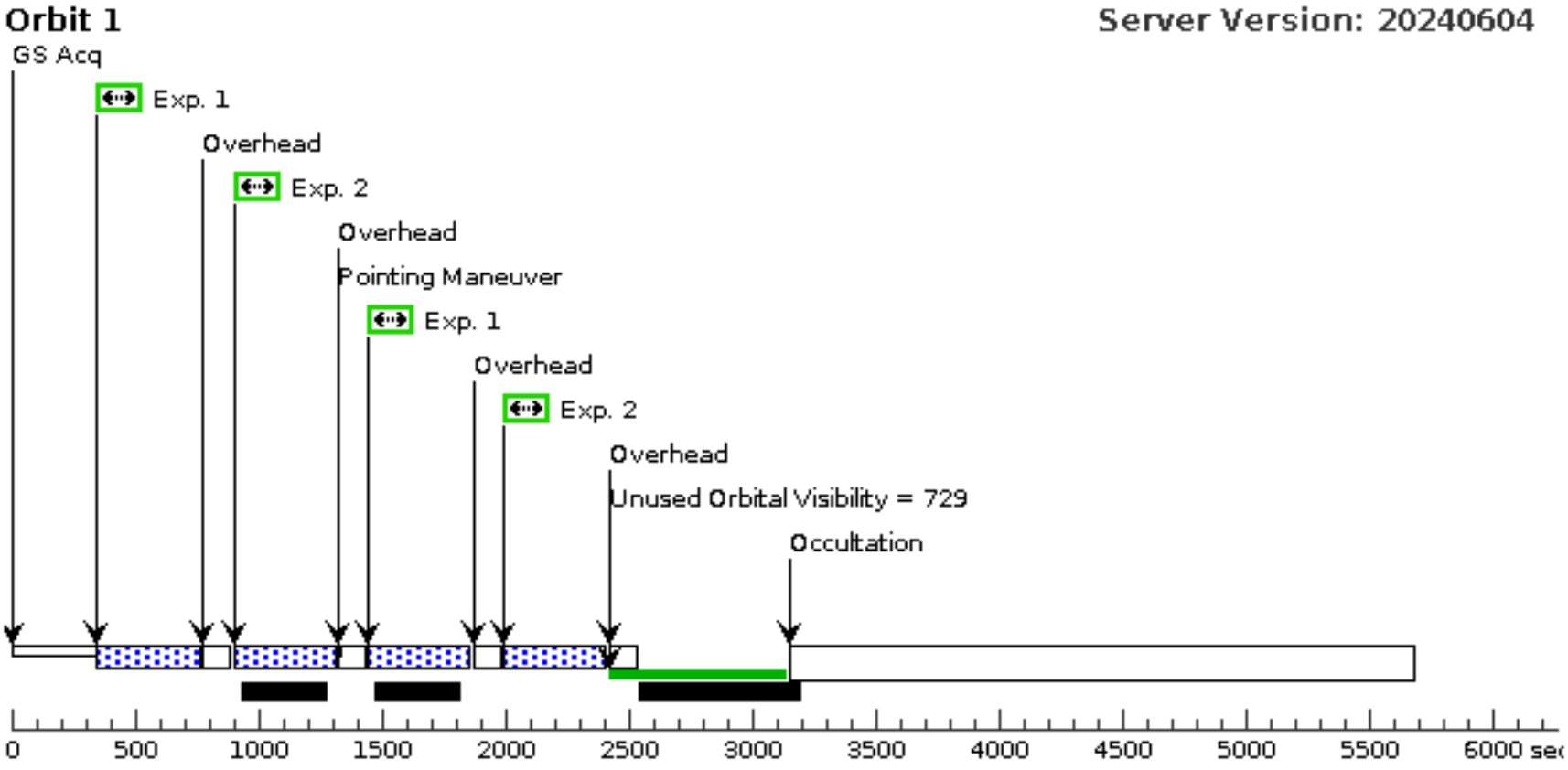
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	SN1996CR	RA: 14 13 10.0500 (213.2918750d) Dec: -65 20 44.40 (-65.34567d) Equinox: J2000		V=26.0+/-0.3	Reference Frame: ICRS

Comments:
Category=STAR
Description=[SUPERNOVA]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F625W	(4) SN1996CR	WFC3/UVIS, ACCUM, UVIS	F625W	FLASH=10		Pattern 1, Exps 1-2 in Visit 04 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
2	F475W	(4) SN1996CR	WFC3/UVIS, ACCUM, UVIS	F475W	FLASH=12		Pattern 1, Exps 1-2 in Visit 04 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***

Orbit Structure



Visit

Proposal 17731, Visit 05, implementation Fri Nov 15 17:00:27 GMT 2024

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Patterns

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Fixed Targets

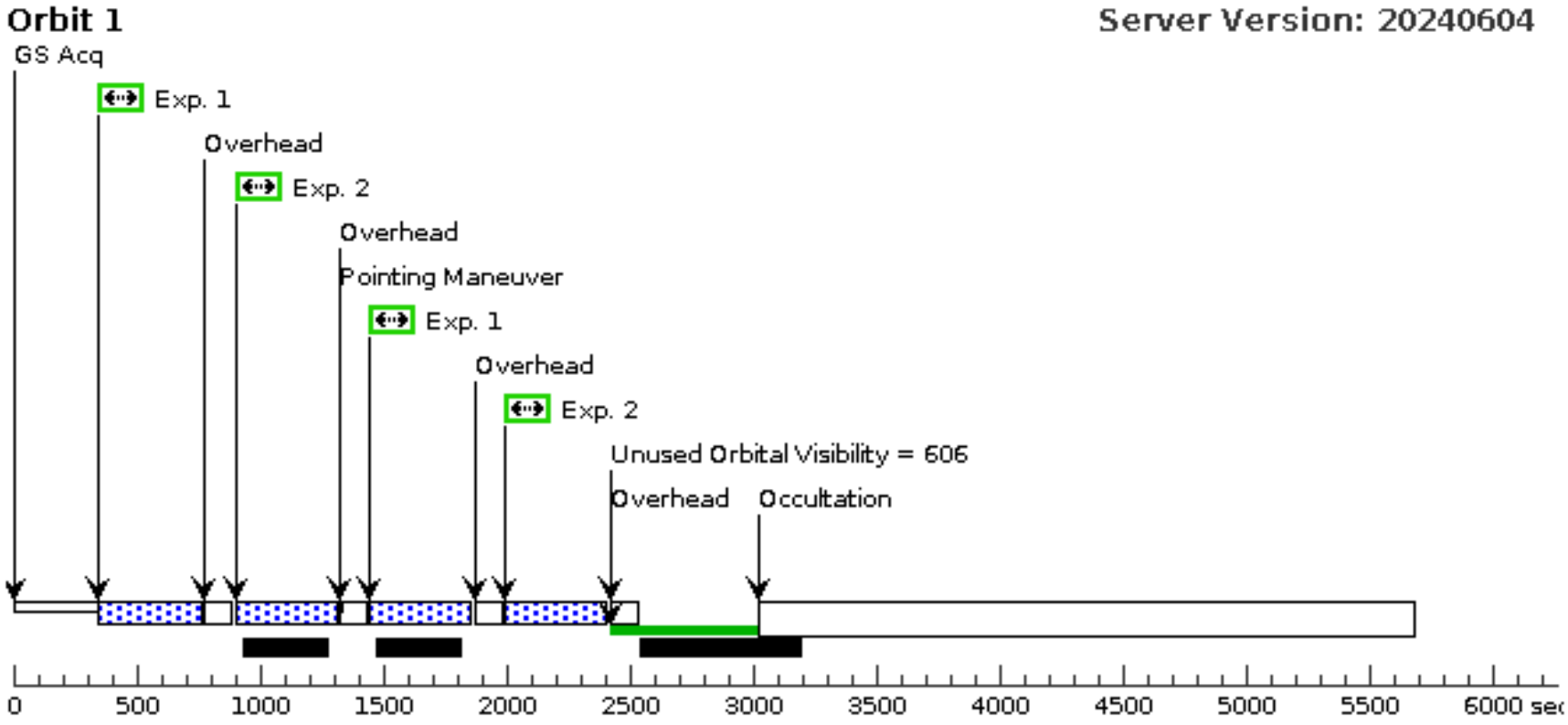
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(5)	SN1997EG	RA: 13 11 36.7300 (197.9030417d) Dec: +22 55 29.40 (22.92483d) Equinox: J2000		V=26.0+/-0.3	Reference Frame: ICRS

Comments:
Category=STAR
Description=[SUPERNOVA]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F625W	(5) SN1997EG	WFC3/UVIS, ACCUM, UVIS	F625W	FLASH=10		Pattern 1, Exps 1-2 in Visit 05 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
2	F475W	(5) SN1997EG	WFC3/UVIS, ACCUM, UVIS	F475W	FLASH=12		Pattern 1, Exps 1-2 in Visit 05 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***

Orbit Structure



Visit

Proposal 17731, Visit 06, implementation Fri Nov 15 17:00:27 GMT 2024

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Patterns

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Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(6)	SN1998S	RA: 11 46 6.1300 (176.5255417d) Dec: +47 28 55.40 (47.48206d) Equinox: J2000		V=26.0+/-0.3	Reference Frame: ICRS

Comments:
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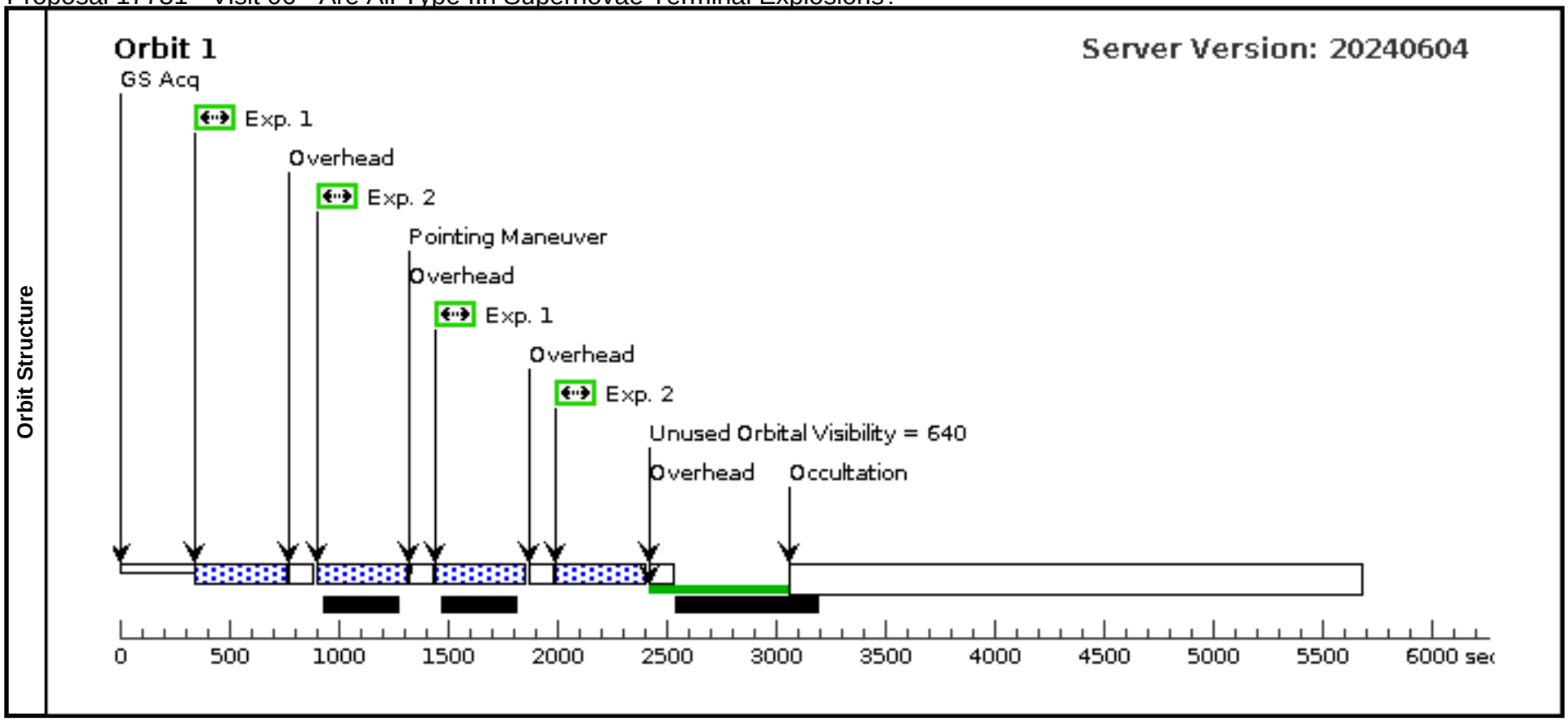
Description=[SUPERNOVA]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F625W	(6) SN1998S	WFC3/UVIS, ACCUM, UVIS	F625W	FLASH=10		Pattern 1, Exps 1-2 in Visit 06 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
2	F475W	(6) SN1998S	WFC3/UVIS, ACCUM, UVIS	F475W	FLASH=12		Pattern 1, Exps 1-2 in Visit 06 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***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Exp. 1
Overhead
Exp. 2
Pointing Maneuver
Overhead
Exp. 1
Overhead
Exp. 2
Unused Orbital Visibility = 640
Overhead
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec

Visit

Proposal 17731, Visit 07, implementation Fri Nov 15 17:00:27 GMT 2024

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
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Fixed Targets

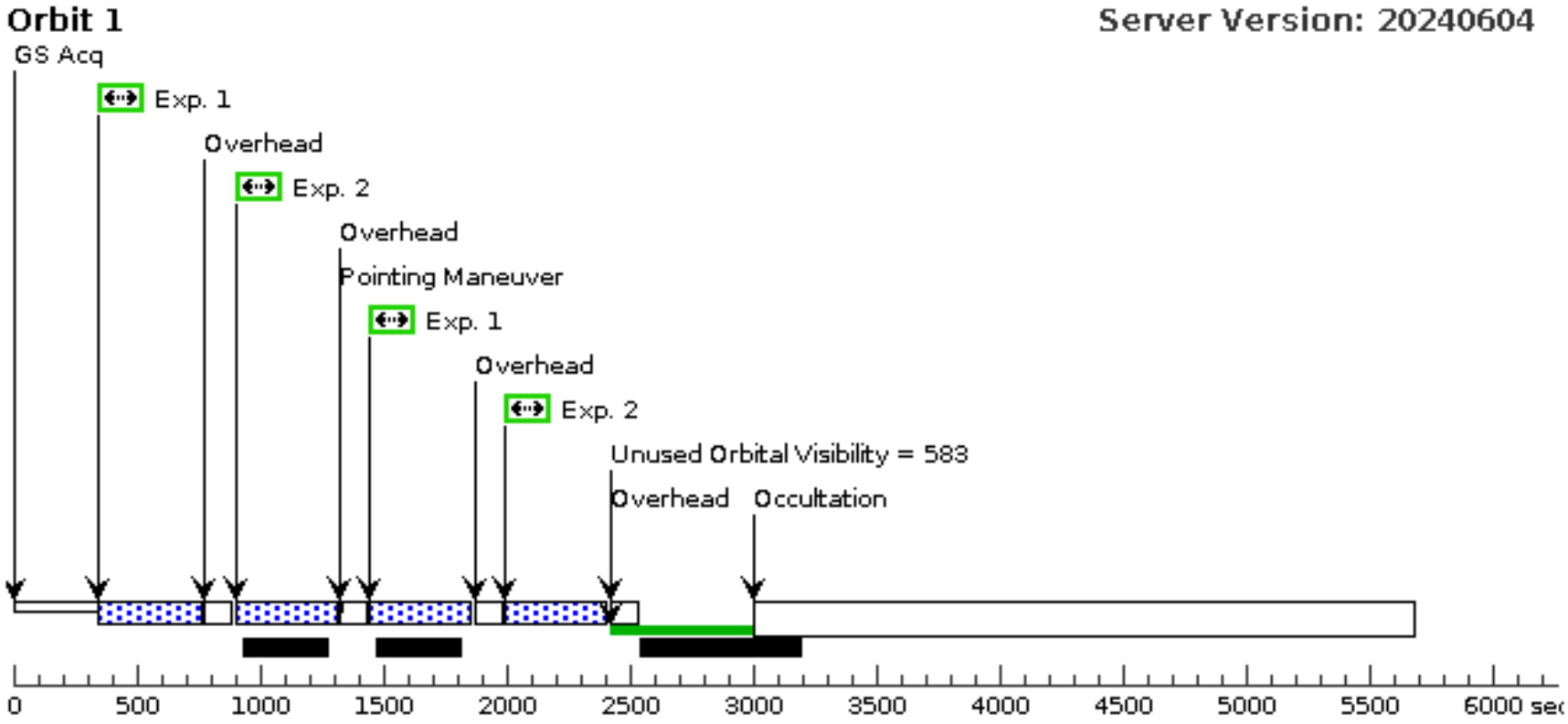
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(7)	SN1999EB	RA: 01 43 45.4500 (25.9393750d) Dec: +04 13 25.90 (4.22386d) Equinox: J2000		V=26.0+/-0.3	Reference Frame: ICRS

Comments:
Category=STAR
Description=[SUPERNOVA]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F625W	(7) SN1999EB	WFC3/UVIS, ACCUM, UVIS	F625W	FLASH=10		Pattern 1, Exps 1-2 in Visit 07 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
2	F475W	(7) SN1999EB	WFC3/UVIS, ACCUM, UVIS	F475W	FLASH=12		Pattern 1, Exps 1-2 in Visit 07 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***

Orbit Structure



Visit

Proposal 17731, Visit 08, implementation Fri Nov 15 17:00:27 GMT 2024

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
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Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(8)	SN1999EL	RA: 20 37 18.0300 (309.3251250d) Dec: +66 06 11.90 (66.10331d) Equinox: J2000		V=26.0+/-0.3	Reference Frame: ICRS

Comments:
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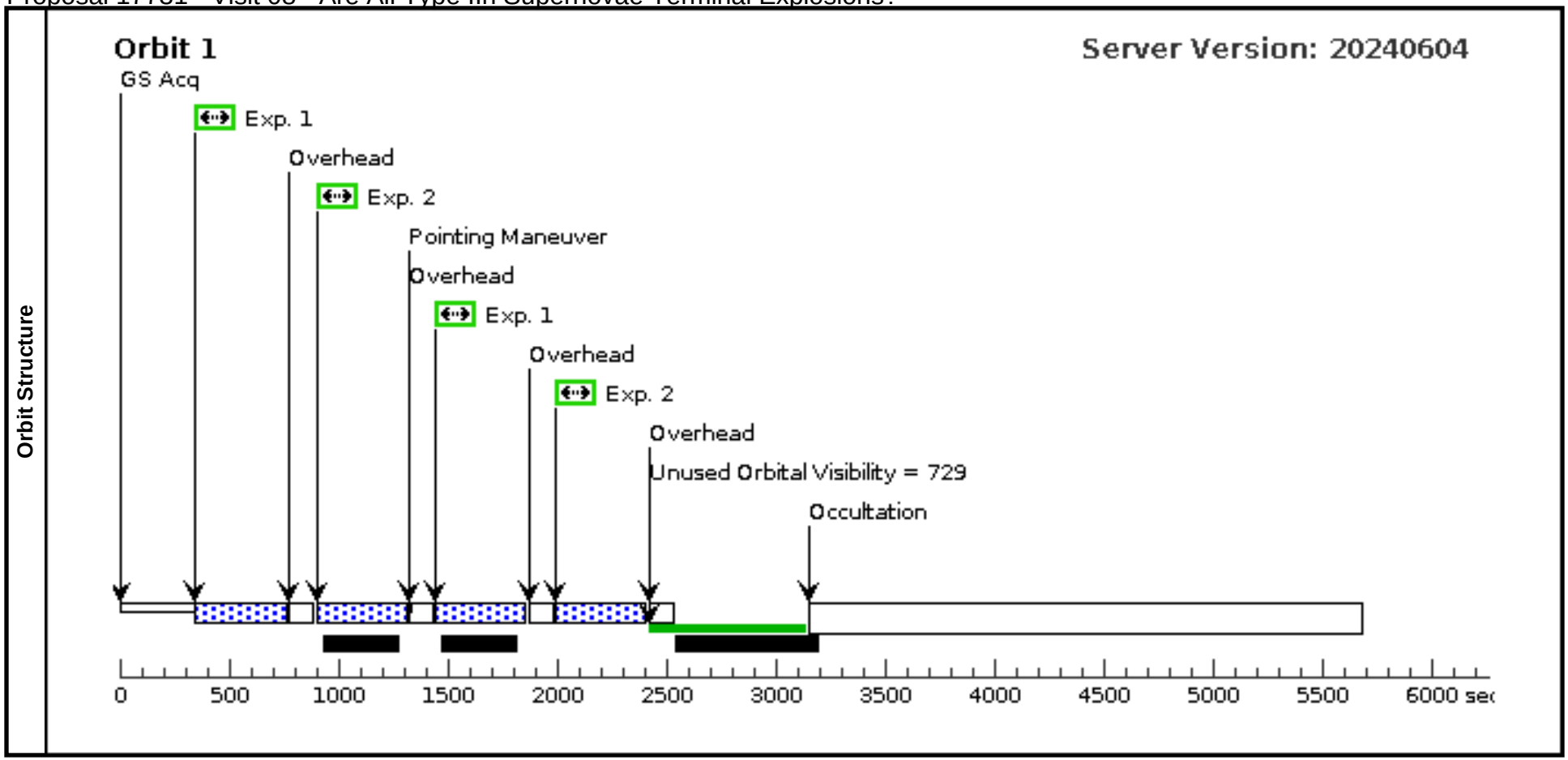
Description=[SUPERNOVA]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F625W	(8) SN1999EL	WFC3/UVIS, ACCUM, UVIS	F625W	FLASH=10		Pattern 1, Exps 1-2 in Visit 08 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
2	F475W	(8) SN1999EL	WFC3/UVIS, ACCUM, UVIS	F475W	FLASH=12		Pattern 1, Exps 1-2 in Visit 08 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***


Orbit Structure
Orbit 1
Server Version: 20240604
GS Acq
Exp. 1
Overhead
Exp. 2
Pointing Maneuver
Overhead
Exp. 1
Overhead
Exp. 2
Overhead
Unused Orbital Visibility = 729
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec

Visit

Proposal 17731, Visit 09, implementation Fri Nov 15 17:00:27 GMT 2024

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

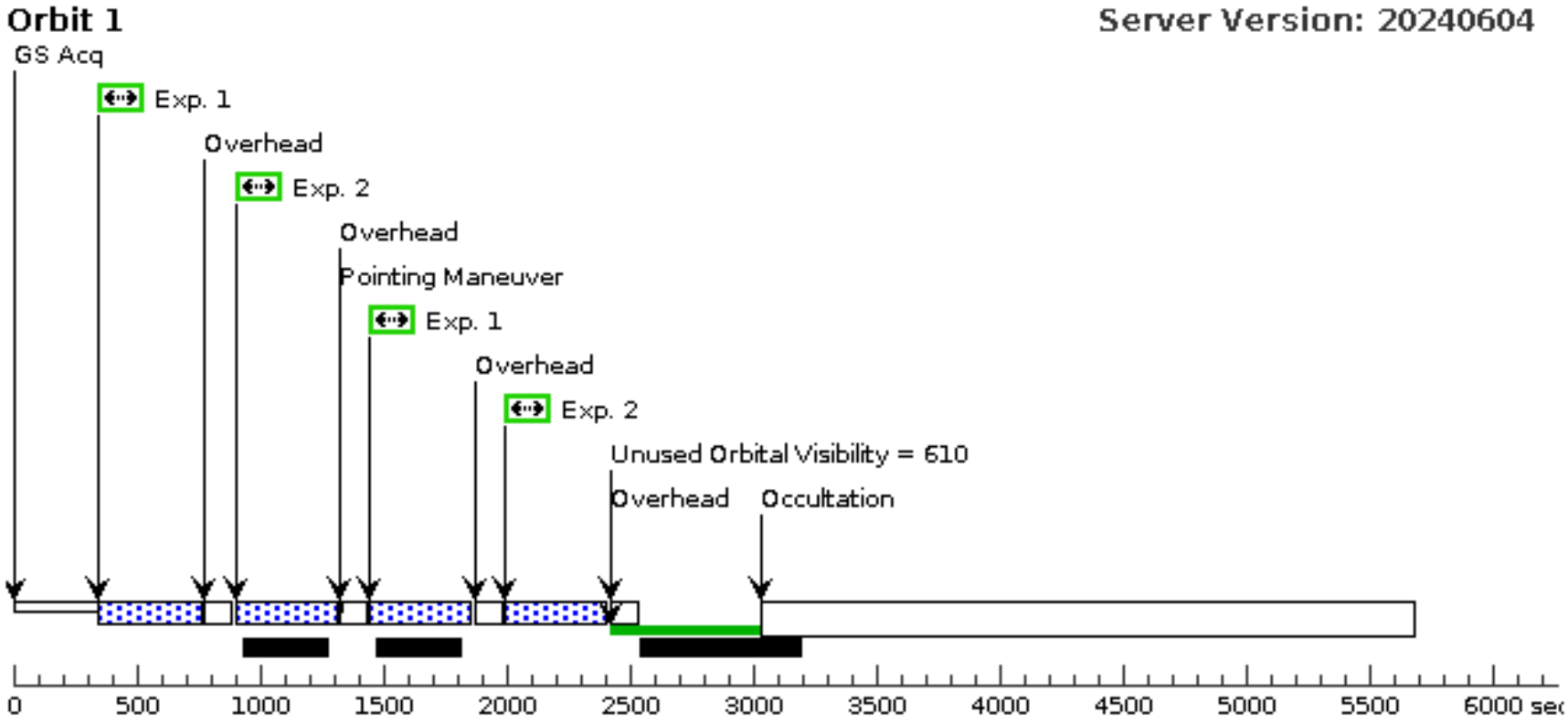
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(9)	SN2000P	RA: 13 07 10.5300 (196.7938750d) Dec: -28 14 2.50 (-28.23403d) Equinox: J2000		V=26.0+/-0.3	Reference Frame: ICRS

Comments:
Category=STAR
Description=[SUPERNOVA]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F625W	(9) SN2000P	WFC3/UVIS, ACCUM, UVIS	F625W	FLASH=10		Pattern 1, Exps 1-2 in Visit 09 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
2	F475W	(9) SN2000P	WFC3/UVIS, ACCUM, UVIS	F475W	FLASH=12		Pattern 1, Exps 1-2 in Visit 09 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***

Orbit Structure



Visit

Proposal 17731, Visit 10, implementation Fri Nov 15 17:00:27 GMT 2024

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)

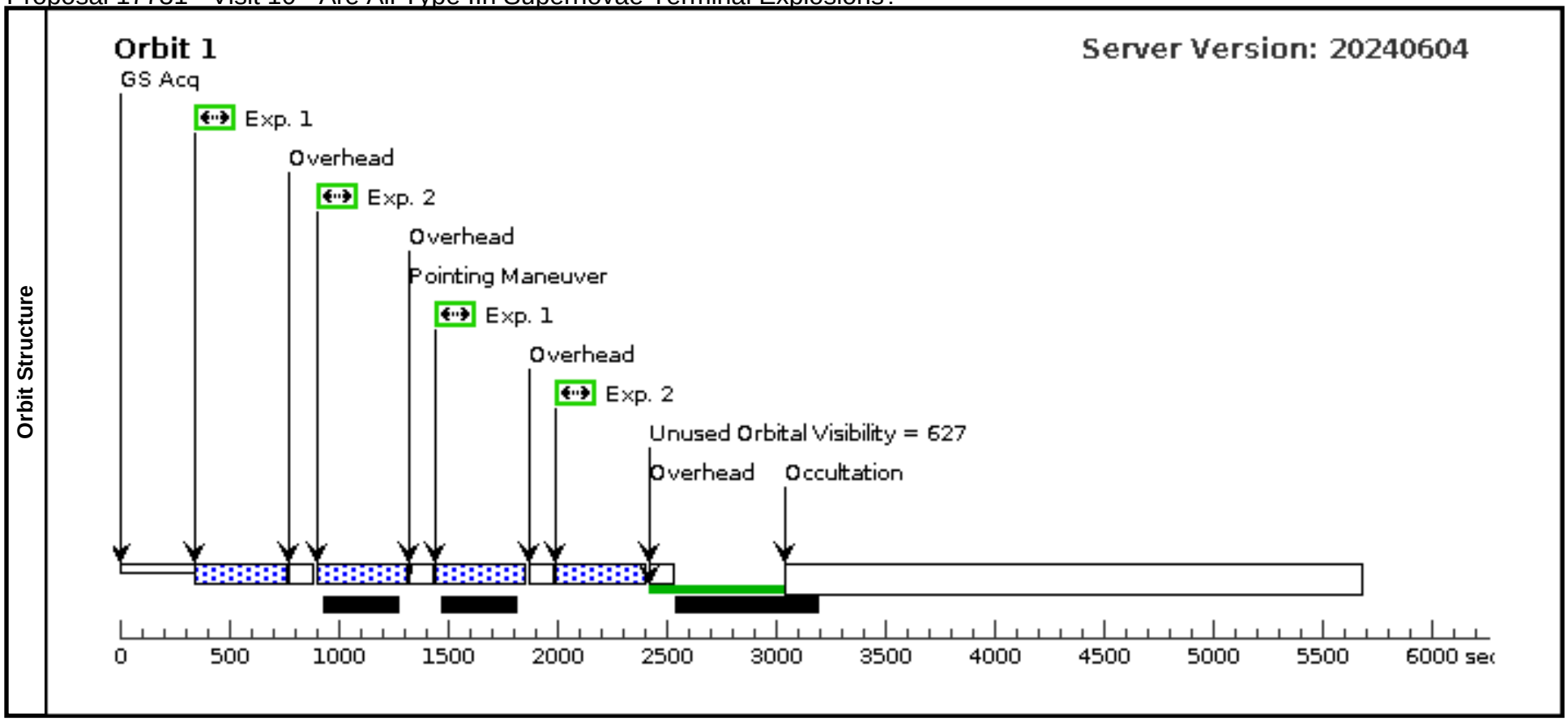
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(10)	2000CL	RA: 10 37 16.0700 (159.3169583d) Dec: -41 37 47.78 (-41.62994d) Equinox: J2000		V=26.0+/-0.3	Reference Frame: ICRS

Comments:
Category=STAR
Description=[SUPERNOVA]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F625W	(10) 2000CL	WFC3/UVIS, ACCUM, UVIS	F625W	FLASH=10		Pattern 1, Exps 1-2 in Visit 10 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
2	F475W	(10) 2000CL	WFC3/UVIS, ACCUM, UVIS	F475W	FLASH=12		Pattern 1, Exps 1-2 in Visit 10 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***


Orbit Structure
Orbit 1
Server Version: 20240604
GS Acq
Exp. 1
Overhead
Exp. 2
Overhead
Pointing Maneuver
Exp. 1
Overhead
Exp. 2
Unused Orbital Visibility = 627
Overhead
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec

Visit

Proposal 17731, Visit 11, implementation Fri Nov 15 17:00:27 GMT 2024

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

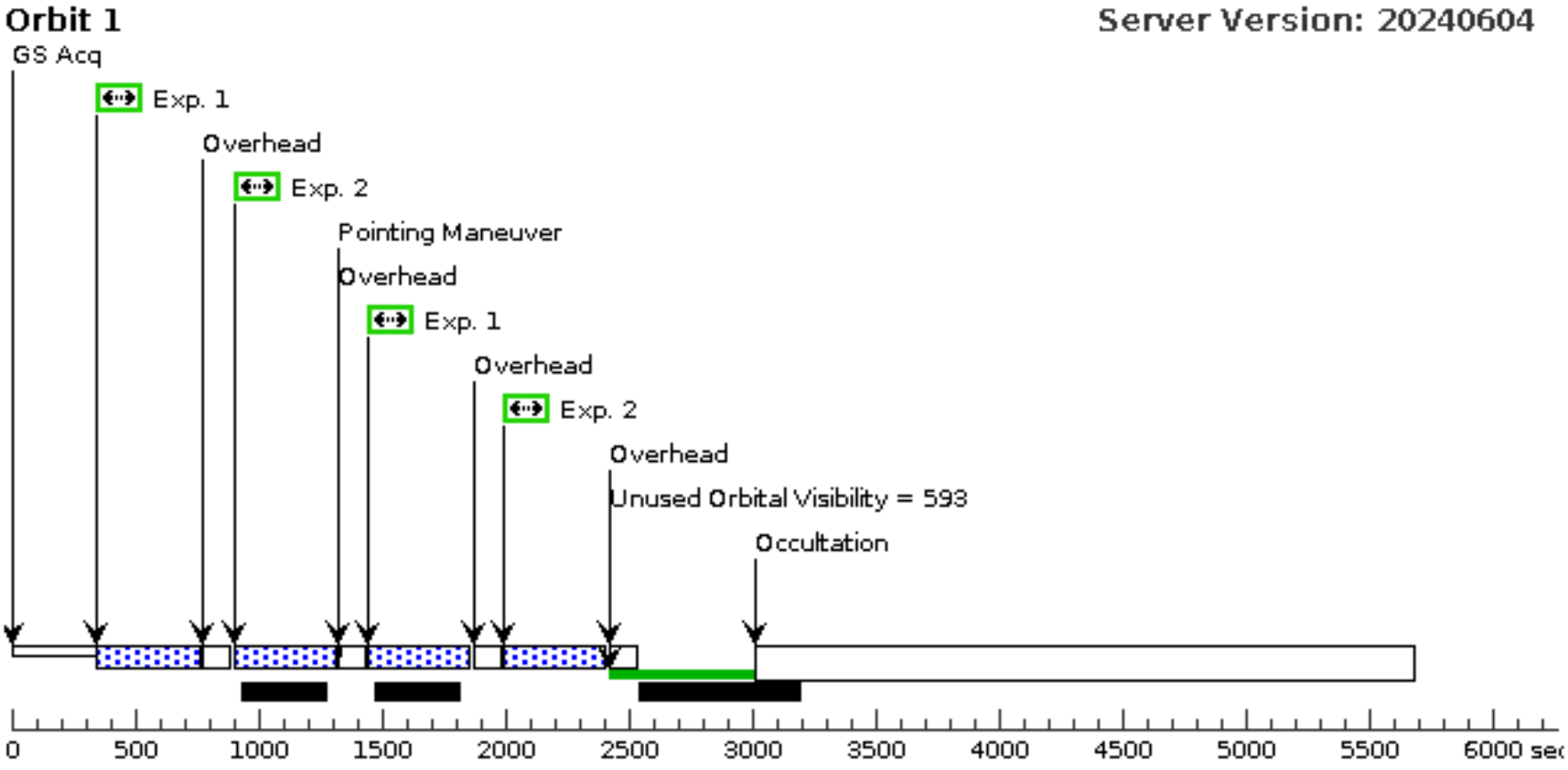
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(11)	SN2001IR	RA: 08 36 28.1200 (129.1171667d) Dec: -11 50 3.50 (-11.83431d) Equinox: J2000		V=26.0+/-0.3	Reference Frame: ICRS

Comments:
Category=STAR
Description=[SUPERNOVA]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F625W	(11) SN2001IR	WFC3/UVIS, ACCUM, UVIS	F625W	FLASH=10		Pattern 1, Exps 1-2 in Visit 11 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
2	F475W	(11) SN2001IR	WFC3/UVIS, ACCUM, UVIS	F475W	FLASH=12		Pattern 1, Exps 1-2 in Visit 11 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***

Orbit Structure



Visit

Proposal 17731, Visit 12, implementation Fri Nov 15 17:00:28 GMT 2024

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

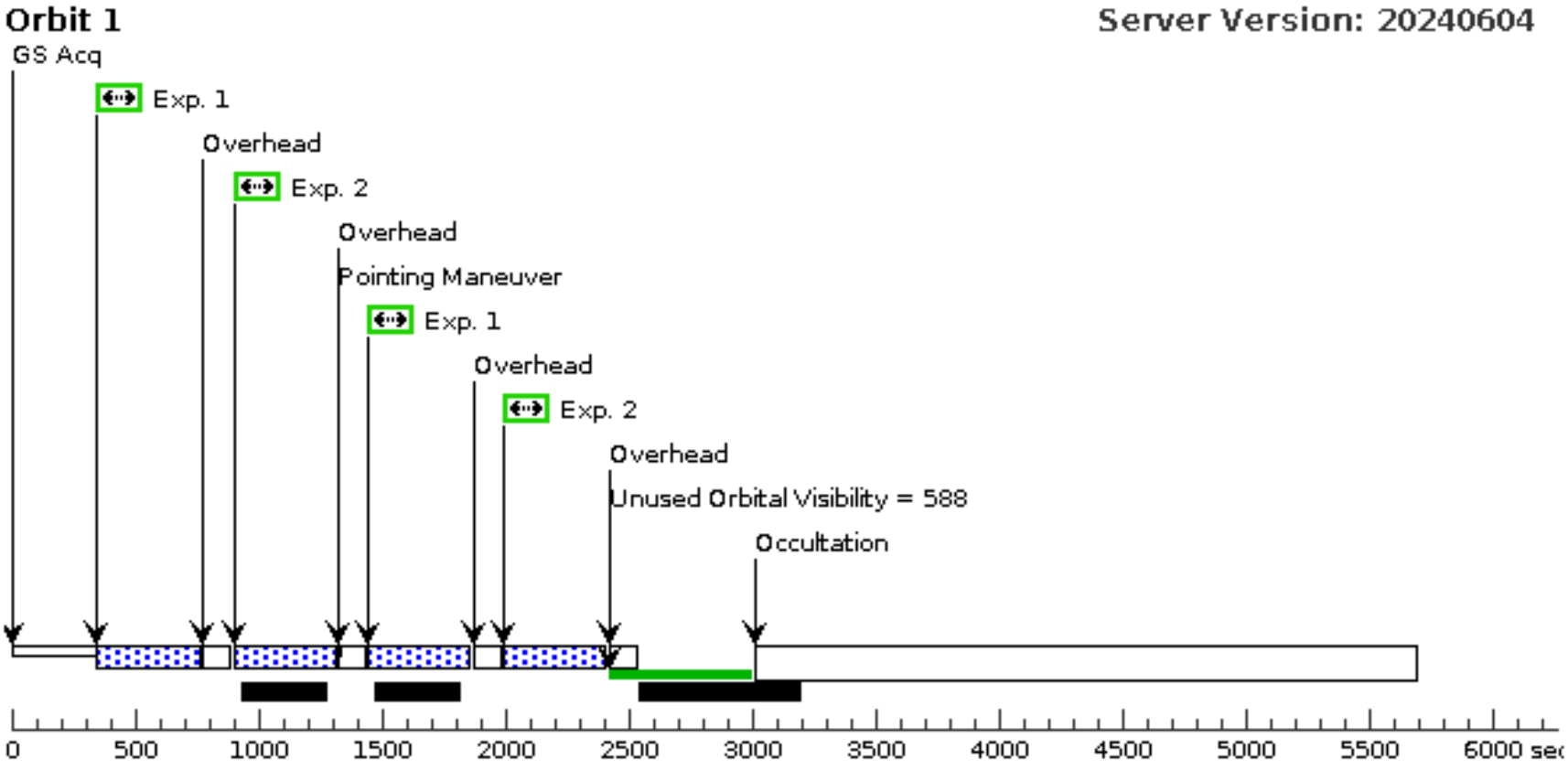
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(12)	SN2003LO	RA: 03 37 5.1200 (54.2713333d) Dec: -05 02 17.30 (-5.03814d) Equinox: J2000		V=26.0+/-0.3	Reference Frame: ICRS

Comments:
Category=STAR
Description=[SUPERNOVA]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F625W	(12) SN2003LO	WFC3/UVIS, ACCUM, UVIS	F625W	FLASH=10		Pattern 1, Exps 1-2 in Visit 12 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
2	F475W	(12) SN2003LO	WFC3/UVIS, ACCUM, UVIS	F475W	FLASH=12		Pattern 1, Exps 1-2 in Visit 12 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***

Orbit Structure



Visit

Proposal 17731, Visit 13, implementation Fri Nov 15 17:00:28 GMT 2024

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

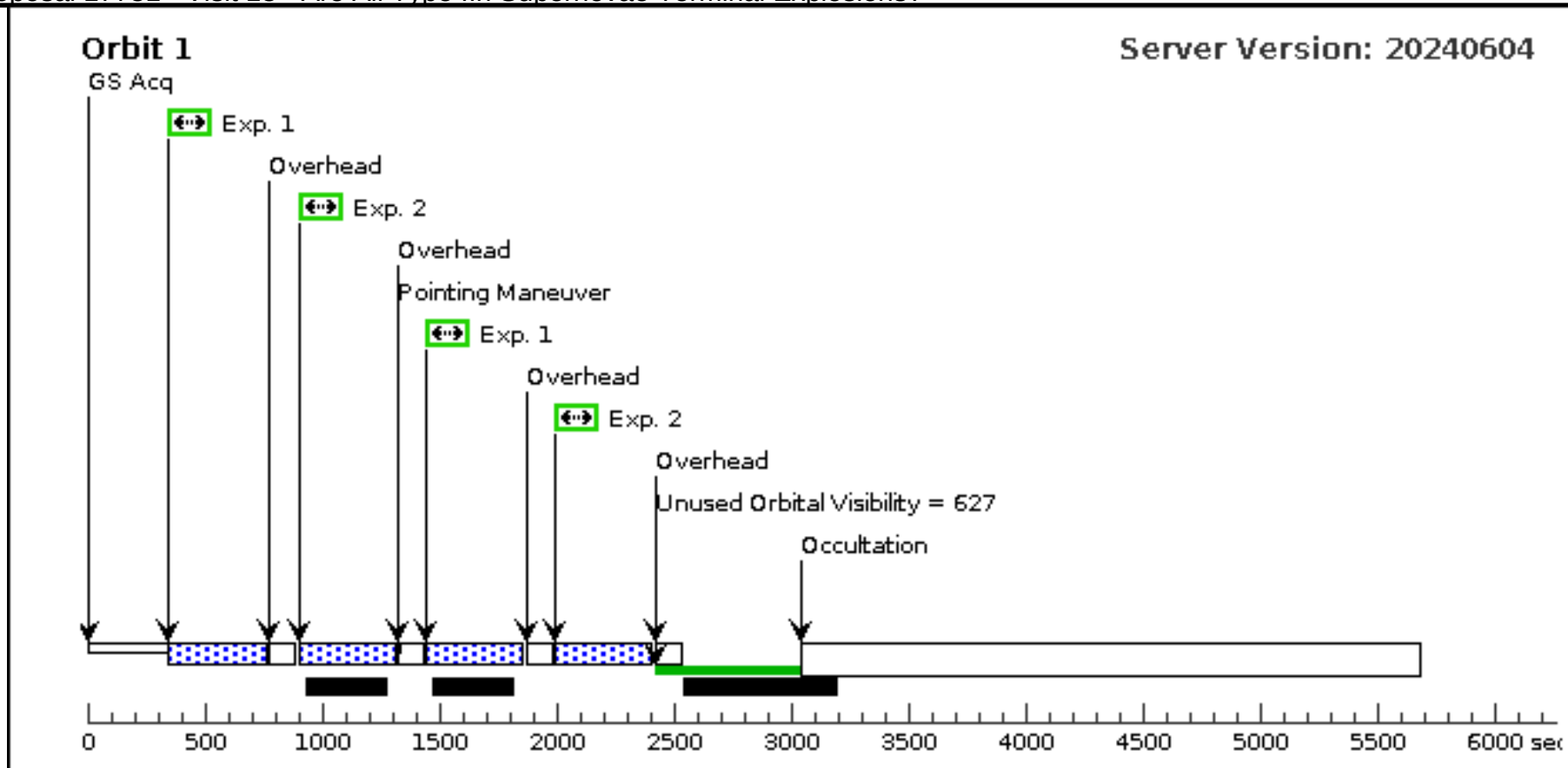
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(13)	SN2006AM	RA: 14 27 37.2400 (216.9051667d) Dec: +41 15 35.40 (41.25983d) Equinox: J2000		V=26.0+/-0.3	Reference Frame: ICRS

Comments:
Category=STAR
Description=[SUPERNOVA]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F625W	(13) SN2006AM	WFC3/UVIS, ACCUM, UVIS	F625W	FLASH=10		Pattern 1, Exps 1-2 in Visit 13 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
2	F475W	(13) SN2006AM	WFC3/UVIS, ACCUM, UVIS	F475W	FLASH=12		Pattern 1, Exps 1-2 in Visit 13 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***

Orbit Structure



Visit

Proposal 17731, Visit 14, implementation Fri Nov 15 17:00:28 GMT 2024

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

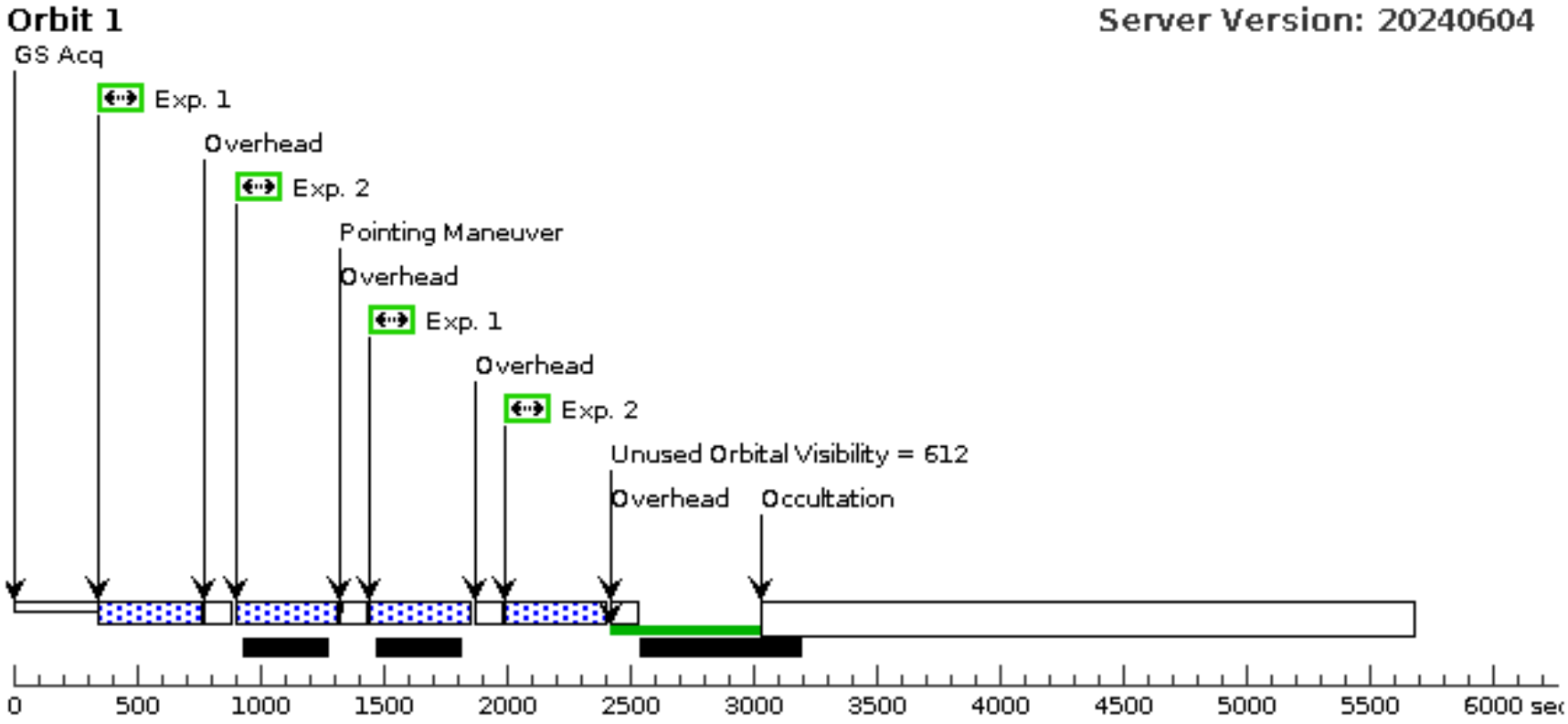
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(14)	SN2010BT	RA: 21 48 20.2200 (327.0842500d) Dec: -34 57 16.50 (-34.95458d) Equinox: J2000		V=26.0+/-0.3	Reference Frame: ICRS

Comments:
Category=STAR
Description=[SUPERNOVA]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F625W	(14) SN2010BT	WFC3/UVIS, ACCUM, UVIS	F625W	FLASH=10		Pattern 1, Exps 1-2 in Visit 14 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
2	F475W	(14) SN2010BT	WFC3/UVIS, ACCUM, UVIS	F475W	FLASH=12		Pattern 1, Exps 1-2 in Visit 14 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***

Orbit Structure



Visit

Proposal 17731, Visit 15, implementation Fri Nov 15 17:00:28 GMT 2024

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

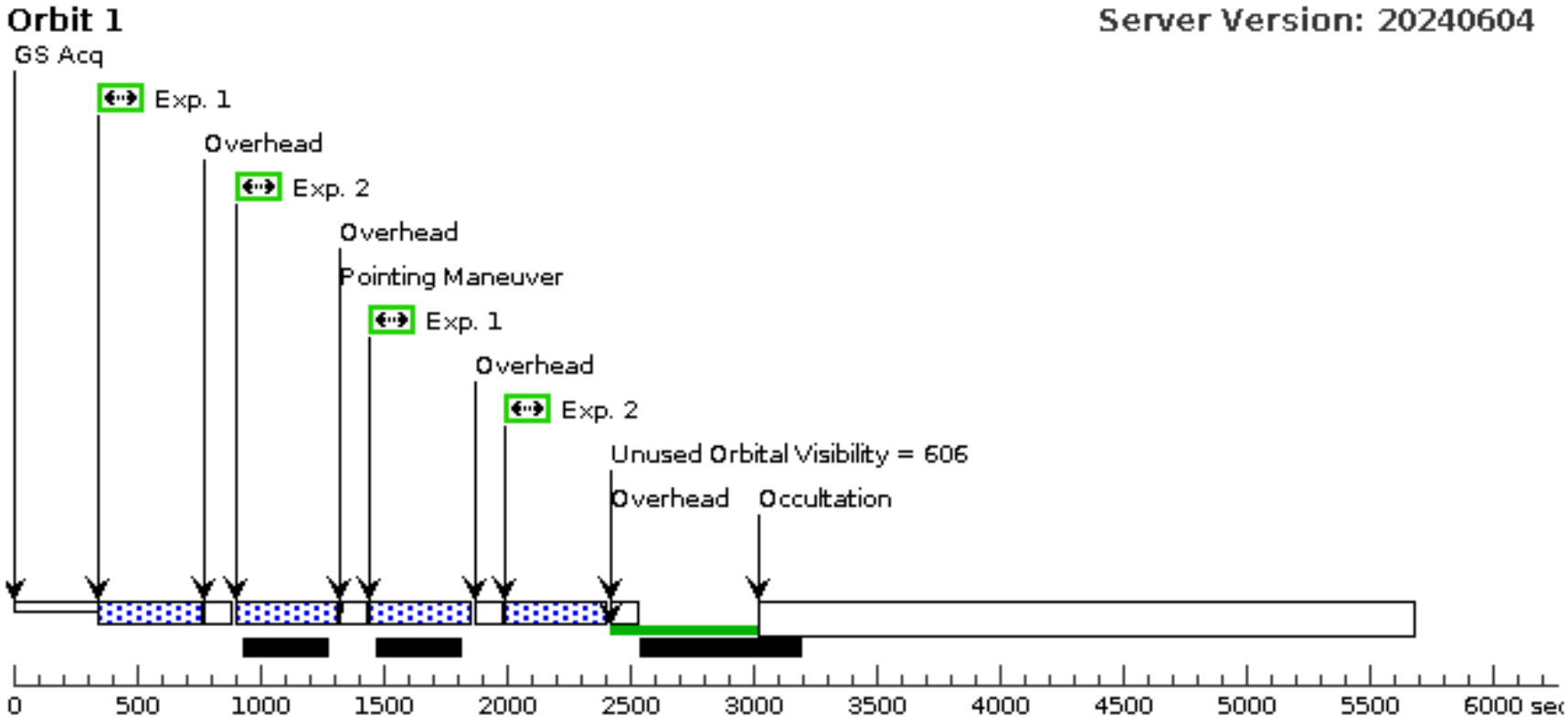
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(15)	SN2010JP	RA: 06 16 30.6300 (94.1276250d) Dec: -21 24 36.30 (-21.41008d) Equinox: J2000		V=26.0+/-0.3	Reference Frame: ICRS

Comments:
Category=STAR
Description=[SUPERNOVA]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F625W	(15) SN2010JP	WFC3/UVIS, ACCUM, UVIS	F625W	FLASH=10		Pattern 1, Exps 1-2 in Visit 15 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
2	F475W	(15) SN2010JP	WFC3/UVIS, ACCUM, UVIS	F475W	FLASH=12		Pattern 1, Exps 1-2 in Visit 15 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***

Orbit Structure



Visit

Proposal 17731, Visit 16, implementation Fri Nov 15 17:00:28 GMT 2024

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

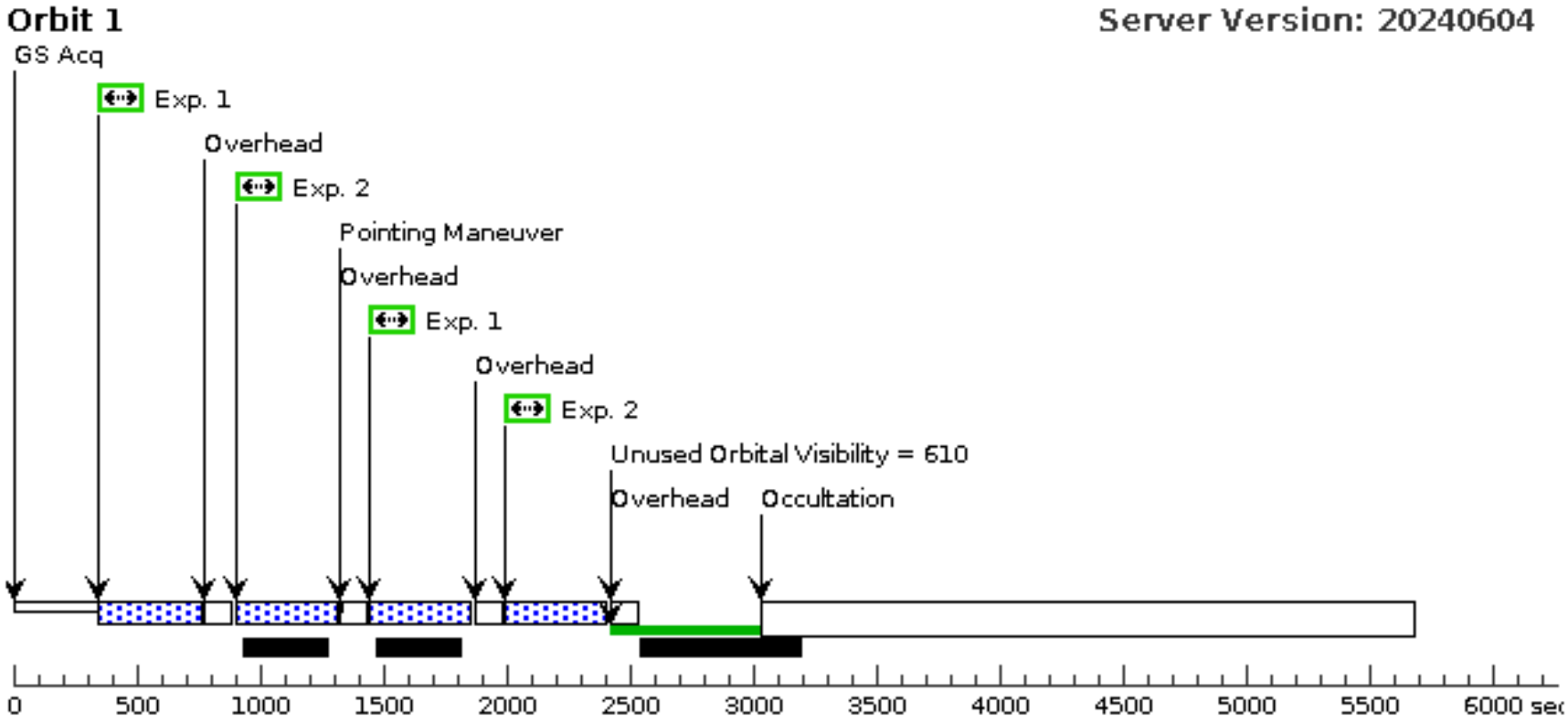
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(16)	2011FH	RA: 12 56 14.0100 (194.0583750d) Dec: -29 29 54.82 (-29.49856d) Equinox: J2000		V=26.0+/-0.3	Reference Frame: ICRS

Comments:
Category=STAR
Description=[SUPERNOVA]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F625W	(16) 2011FH	WFC3/UVIS, ACCUM, UVIS	F625W	FLASH=10		Pattern 1, Exps 1-2 in Visit 16 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
2	F475W	(16) 2011FH	WFC3/UVIS, ACCUM, UVIS	F475W	FLASH=12		Pattern 1, Exps 1-2 in Visit 16 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***

Orbit Structure



Visit

Proposal 17731, Visit 17, implementation Fri Nov 15 17:00:28 GMT 2024

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

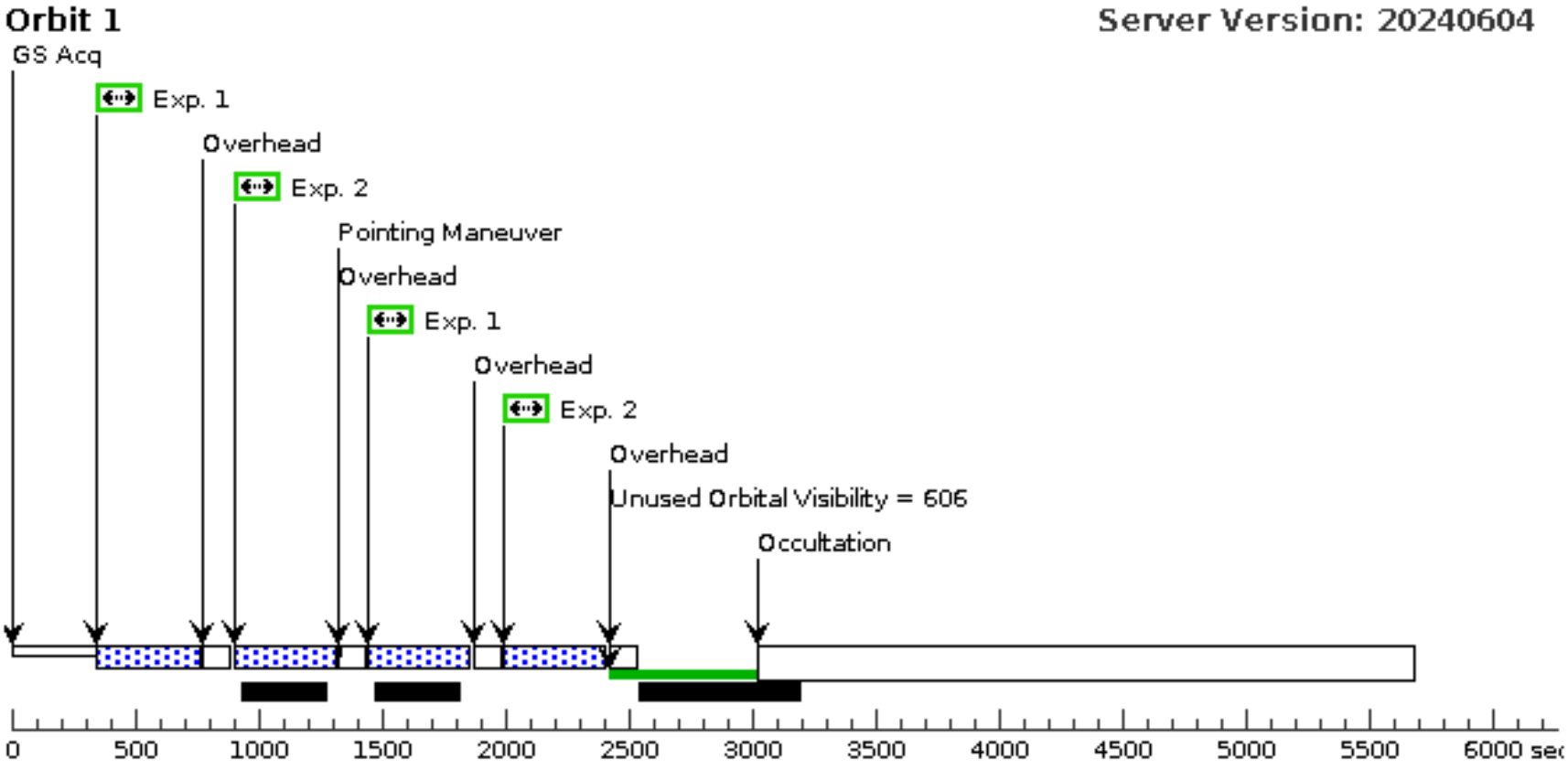
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(17)	GAIA14AHL	RA: 04 42 12.0900 (70.5503750d) Dec: +23 06 15.00 (23.10417d) Equinox: J2000		V=26.0+/-0.3	Reference Frame: ICRS

Comments:
Category=STAR
Description=[SUPERNOVA]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F625W	(17) GAIA14AHL	WFC3/UVIS, ACCUM, UVIS	F625W	FLASH=10		Pattern 1, Exps 1-2 in Visit 17 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
2	F475W	(17) GAIA14AHL	WFC3/UVIS, ACCUM, UVIS	F475W	FLASH=12		Pattern 1, Exps 1-2 in Visit 17 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***

Orbit Structure



Visit

Proposal 17731, Visit 18, implementation Fri Nov 15 17:00:28 GMT 2024

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

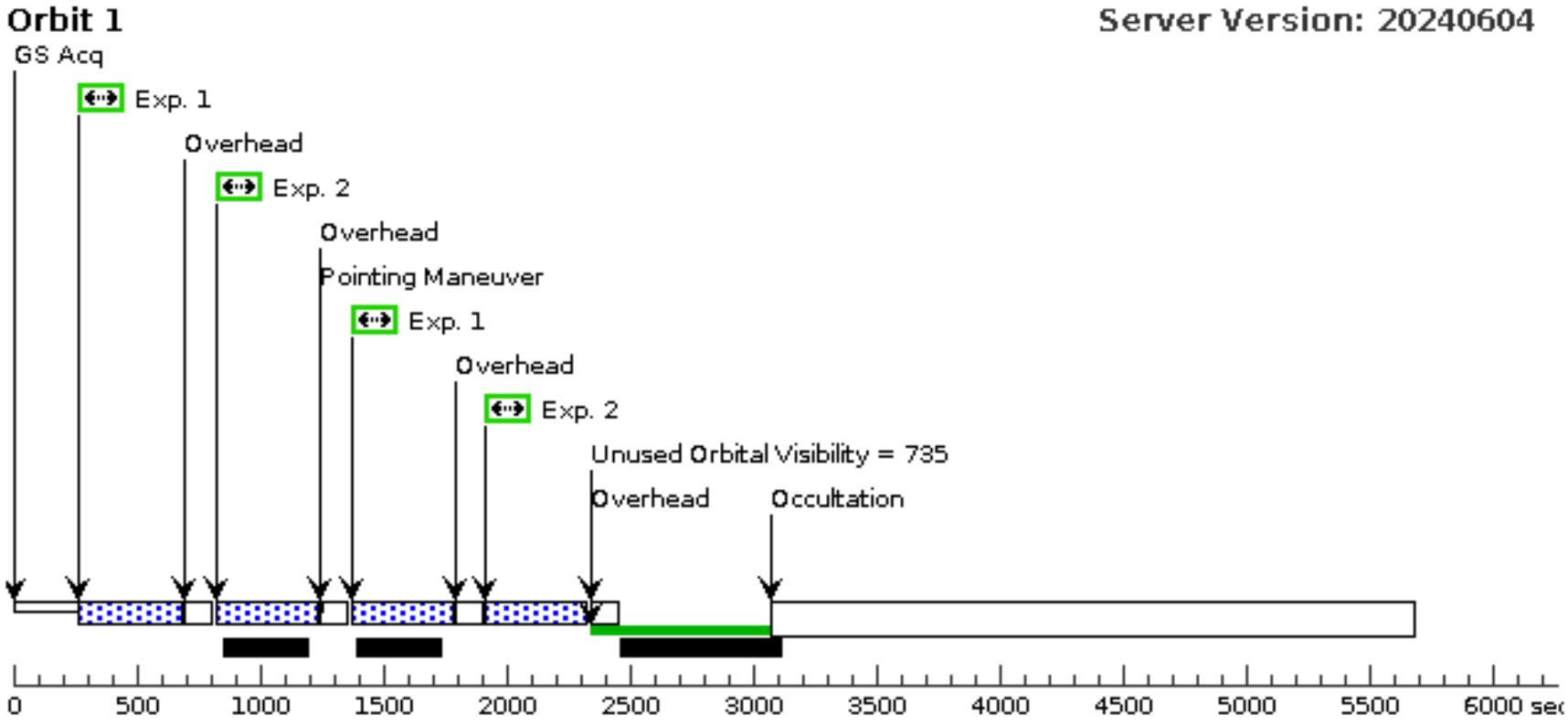
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(18)	SN2014G	RA: 10 54 34.1300 (163.6422083d) Dec: +54 17 56.90 (54.29914d) Equinox: J2000		V=26.0+/-0.3	Reference Frame: ICRS

Comments:
Category=STAR
Description=[SUPERNOVA]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F625W	(18) SN2014G	WFC3/UVIS, ACCUM, UVIS	F625W	FLASH=10	GS ACQ SCENARIO SINGLE	Pattern 1, Exps 1-2 in Visit 18 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
2	F475W	(18) SN2014G	WFC3/UVIS, ACCUM, UVIS	F475W	FLASH=12		Pattern 1, Exps 1-2 in Visit 18 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***

Orbit Structure



Visit

Proposal 17731, Visit 19, implementation Fri Nov 15 17:00:28 GMT 2024

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)

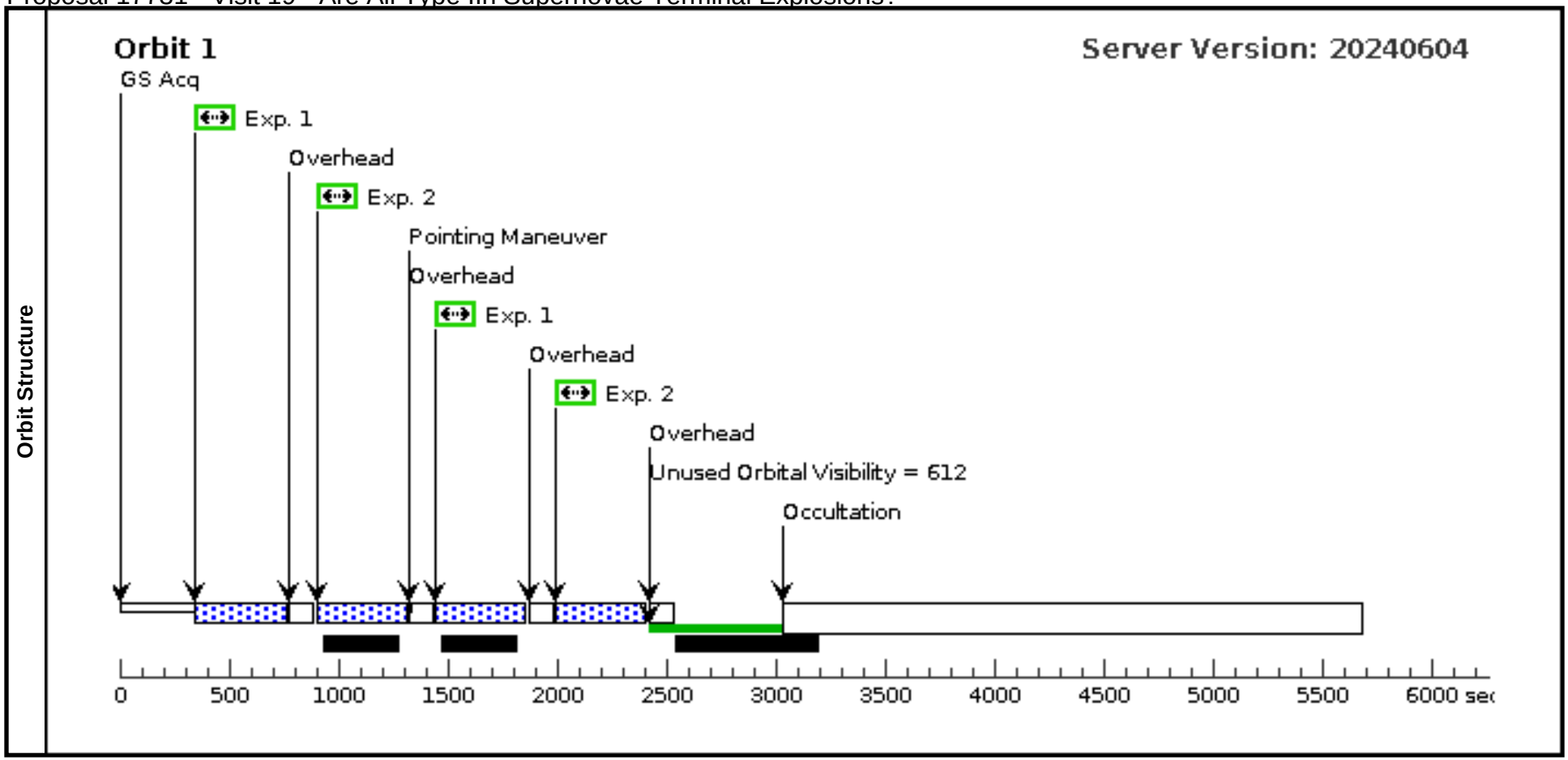
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(19)	SN2015BH	RA: 09 09 34.9600 (137.3956667d) Dec: +33 07 20.40 (33.12233d) Equinox: J2000		V=26.0+/-0.3	Reference Frame: ICRS

Comments:
Category=STAR
Description=[SUPERNOVA]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F625W	(19) SN2015BH	WFC3/UVIS, ACCUM, UVIS	F625W	FLASH=10		Pattern 1, Exps 1-2 in Visit 19 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
2	F475W	(19) SN2015BH	WFC3/UVIS, ACCUM, UVIS	F475W	FLASH=12		Pattern 1, Exps 1-2 in Visit 19 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***


Orbit Structure
Orbit 1
Server Version: 20240604
GS Acq
Exp. 1
Overhead
Exp. 2
Pointing Maneuver
Overhead
Exp. 1
Overhead
Exp. 2
Overhead
Unused Orbital Visibility = 612
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec

Visit

Proposal 17731, Visit 20, implementation Fri Nov 15 17:00:28 GMT 2024

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

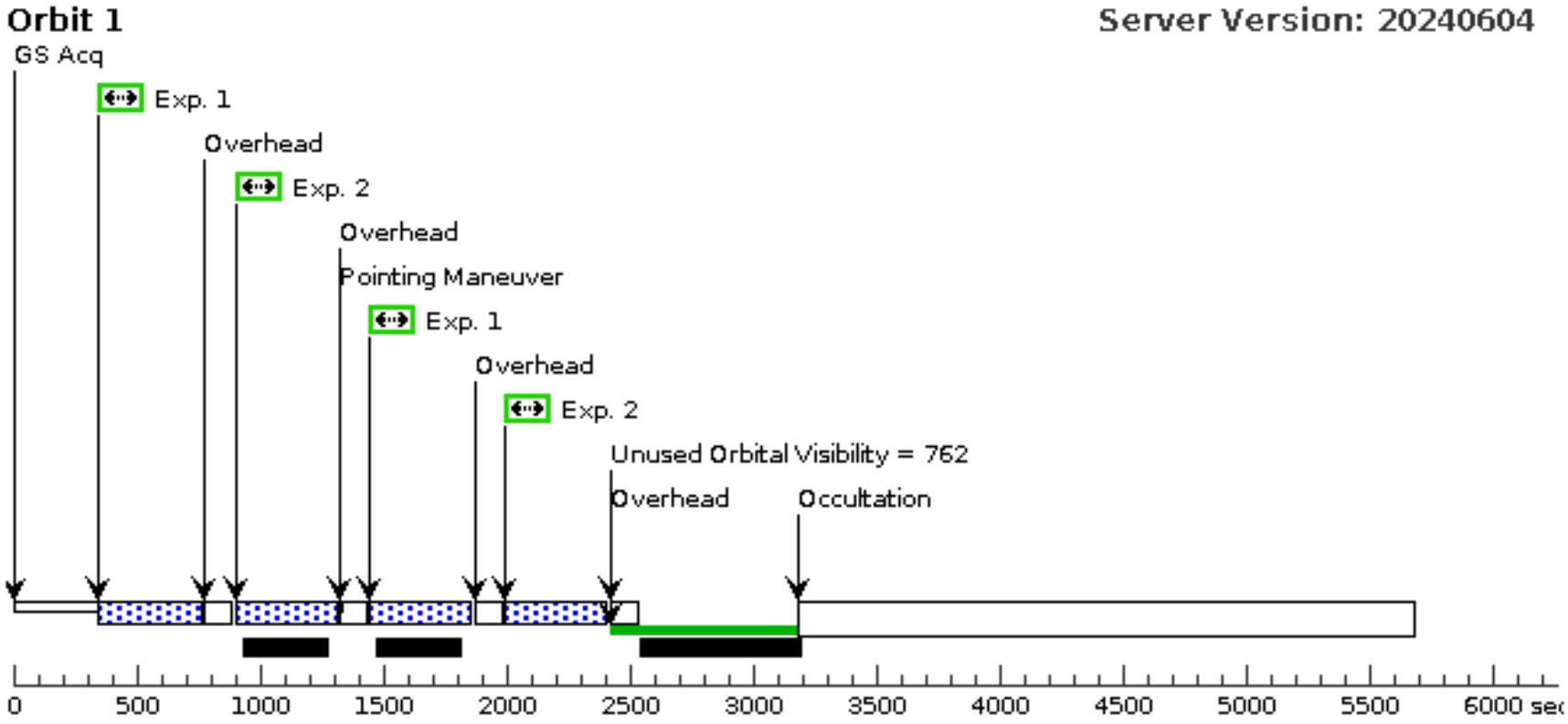
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(20)	ASASSN-15LX	RA: 20 36 5.2400 (309.0218333d) Dec: -73 06 32.41 (-73.10900d) Equinox: J2000		V=26.0+/-0.3	Reference Frame: ICRS

Comments:
Category=STAR
Description=[SUPERNOVA]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F625W	(20) ASASSN-15LX	WFC3/UVIS, ACCUM, UVIS	F625W	FLASH=10		Pattern 1, Exps 1-2 in Visit 20 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
2	F475W	(20) ASASSN-15LX	WFC3/UVIS, ACCUM, UVIS	F475W	FLASH=12		Pattern 1, Exps 1-2 in Visit 20 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***

Orbit Structure



Visit

Proposal 17731, Visit 21, implementation Fri Nov 15 17:00:28 GMT 2024

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)

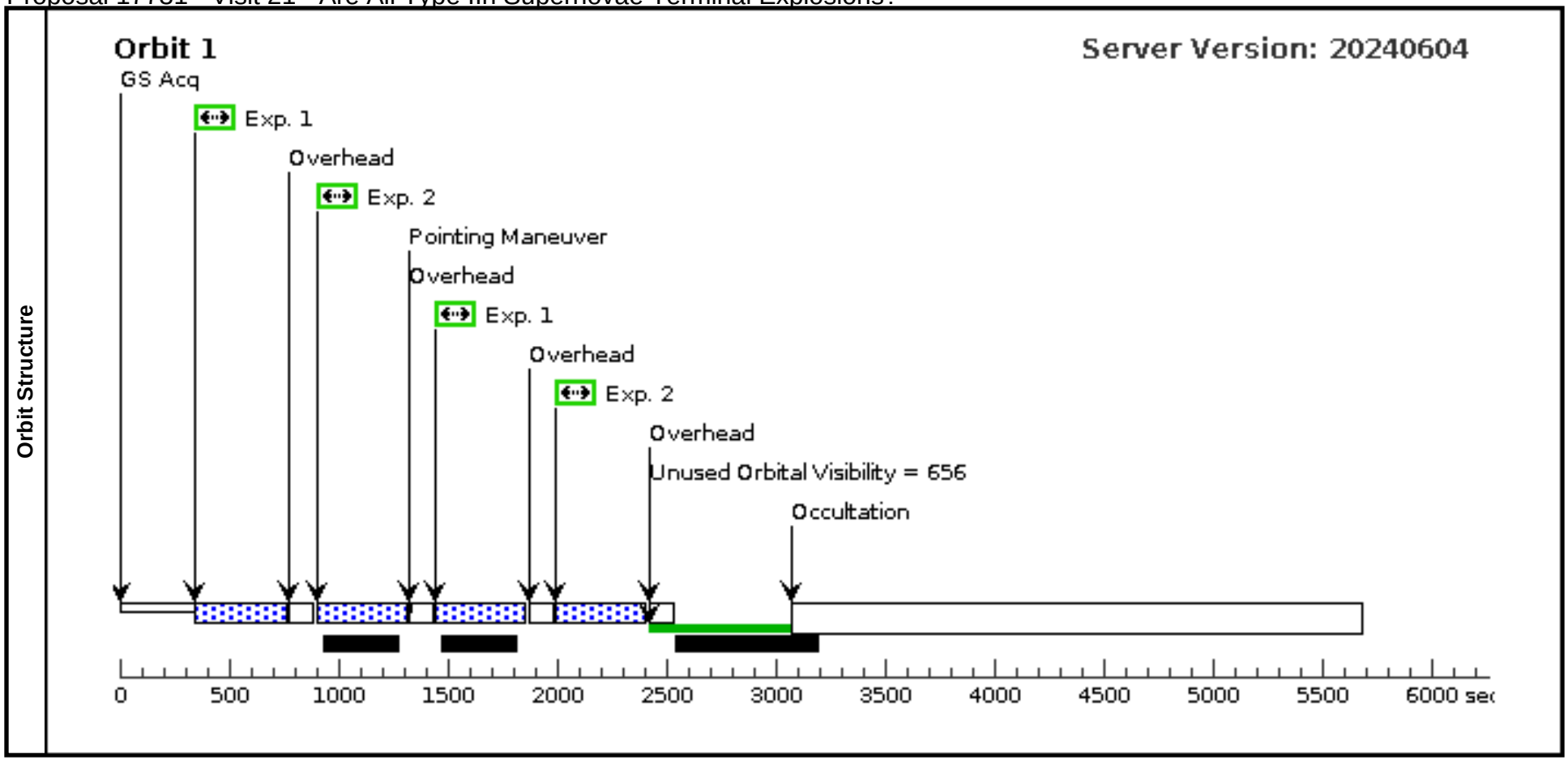
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(21)	SN2011HT	RA: 10 08 10.5600 (152.0440000d) Dec: +51 50 57.12 (51.84920d) Equinox: J2000		V=26.0+/-0.3	Reference Frame: ICRS

Comments:
Category=STAR
Description=[SUPERNOVA]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F625W	(21) SN2011HT	WFC3/UVIS, ACCUM, UVIS	F625W	FLASH=10		Pattern 1, Exps 1-2 in Visit 21 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
2	F475W	(21) SN2011HT	WFC3/UVIS, ACCUM, UVIS	F475W	FLASH=12		Pattern 1, Exps 1-2 in Visit 21 (1)	390 Secs (780 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***


Orbit Structure
Orbit 1
Server Version: 20240604
GS Acq
Exp. 1
Overhead
Exp. 2
Pointing Maneuver
Overhead
Exp. 1
Overhead
Exp. 2
Overhead
Unused Orbital Visibility = 656
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec