17500 - Expansion and Evolution of the Crab Nebula: A 23+ Year HST Perspective

Cycle: 31, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*
Dr. William P. Blair (PI) (Contact)	**The Johns Hopkins University**
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Dr. Dan Milisavljevic (CoI)	Purdue University

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) CRAB-MOSAIC-P1	WFC3/UVIS	5	14-Jun-2024 13:00:17.0	yes
02	(2) CRAB-MOSAIC-P2	WFC3/UVIS	5	14-Jun-2024 13:00:19.0	yes
03	(3) CRAB-MOSAIC-P3	WFC3/UVIS	5	14-Jun-2024 13:00:20.0	yes
04	(4) CRAB-MOSAIC-P4	WFC3/UVIS	5	14-Jun-2024 13:00:21.0	yes
05	(5) CRAB-MOSAIC-P5	WFC3/UVIS	5	14-Jun-2024 13:00:23.0	yes
06	(6) CRAB-MOSAIC-P6	WFC3/UVIS	5	14-Jun-2024 13:00:24.0	yes
07	(7) CRAB-HB-FIELD1	WFC3/UVIS	3	14-Jun-2024 13:00:25.0	yes
08	(8) CRAB-HB-FIELD2	WFC3/UVIS	3	14-Jun-2024 13:00:26.0	yes
09	(1) CRAB-MOSAIC-P1	WFC3/UVIS	1	14-Jun-2024 13:00:26.0	yes
11	(1) CRAB-MOSAIC-P1	WFC3/UVIS	1	14-Jun-2024 13:00:27.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
10	(2) CRAB-MOSAIC-P2	WFC3/UVIS	1	14-Jun-2024 13:00:27.0	yes

39 Total Orbits Used

ABSTRACT

The Crab Nebula is an iconic and well-studied galactic core-collapse supernova remnant with an active pulsar energizing an expanding debris field created in the 1054 CE explosion. Because of its proximity and known age, it has become a key object for study across the EM spectrum. It is thus surprising that no emission line imagery has been obtained with HST since the WPFC2 mosaic dating to circa 2000. With an expansion velocity of roughly 1250 km/s and a distance of ~2 kpc, significant and spatially variable proper motions of the filamentary structures are expected, as well as possible changes in the detailed ionization structures and evolution of the synchrotron nebula over time. Many more recent data sets, including JWST Cycle 1 NIR and MIR images of the filaments, dust, and synchrotron emission, require a current epoch of HST optical imaging to make accurate comparisons. Thus, we propose new emission line mosaics of the Crab with WFC3 and filters comparable to those use in the earlier WFPC2 mosaic. A continuum band (F547M) will sample the synchrotron emission and allow subtraction from the emission line data. We also propose a second continuum band (F763M) which will be used to study spatial spectral index variations and compare to JWST IR synchrotron maps when they are available. Finally, a two F487N (Hbeta) fields will provide a clean hydrogen linemap for the central bright filaments, permitting improved abundance studies. Finally, since comparison to the earlier WFPC2 data are so important, we will reprocess these data to the same standards and reference frame as the new WFC3 data and archive all as a High Level Science Product.

OBSERVING DESCRIPTION

For the imaging mosaics with the F502N, F547M, F631N and F673N filters, the goal is to duplicate the field coverage and depth of the earlier WFPC2 mosaics with similar filters. Since the relative throughput of WFC3 relative to WFPC2 as a function of wavelength is well known (Fig. 1 in HDocs article ``HST Primer: Scientific Instrument Comparisons''), as are the exposure times used previously, it is straightforward to calculate comparable exposures times for the proposed WFC3 imagery. All data will be dithered to aid in cosmic ray removal and appropriate FLASH parameters will be specified to (partially) mitigate charge transfer inefficiencies.

In addition to duplicating the earlier mosaics, we also request a full mosaic with a second medium continuum band in the red using F763M. This new filter provides a second clean synchrotron map which, in conjunction with the JWST NIR/MIR continuum exposures, will permit a spatial study of spectral index variations within the synchrotron emission.

We use 5 orbits per field to provide data that go at least as deep as the WFPC2 data (assuming 2x2 binning of the resultant data) plus obtain the additional F763M data. For the six fields of the mosaic then, we need 30 orbits.

Because of the kinematics and filter widths of the various `Halpha' filters in WFC3 and/or the WFPC2 existing data, Halpha emission is hopelessly blended with one or both of the [N II] lines (6548, 6583). We thus request two central WFC3 fields using the F487N filter to obtain clean, current epoch, high spatial resolution hydrogen line (Hbet$) images of the bright interior filaments. A clean hydrogen image will permit abundances with respect to hydrogen to be mapped out in the finest available spatial scales. Our proposed fields also include the majority of a single WFPC2 field that was observed with a comparable Hbeta filter with WFPC2, as well as covering two existing JWST Cy 1 MIRI MRS locations. However, Hbeta is a weaker line and is in the blue where HST response is somewhat lower, so the exposure time required is significantly longer than for the other filters. To obtain S/N comparable to the other emission lines will require 3 additional orbits per field, or 6 orbits total.

This makes the full proposal 36 orbits.

A word on orientation: The Crab Nebula is at quite low ecliptic latitude and so available angles are limited. There is real benefit to our analysis if, once the program is started at a given orientation, the remaining fields are done at the sme orientation (modulo 180 degrees if necessary). This includes the two Hbeta fields; while these are not aligned specifically with the other mosaic field positions, having the orientation the same will remove the concern that orientation corrections would induce into the abundance analysis.

Final (231207): This version has angle fixed to 87 degrees and several field positions were tweaked slightly to account for expansion since the DSS images were obtained.

Visit

Proposal 17500, Visit 01, failed Fri Jun 14 17:00:27 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: ORIENT 87D TO 87 D

Diagnostics

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

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

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

Patterns

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(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=2.414 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=false		(1), (2)
(2)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=2.414 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=false		(3), (4), (5)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	CRAB-MOSAIC-P1	RA: 05 34 39.7502 (83.6656258d) Dec: +21 59 12.09 (21.98669d) Equinox: J2000	Epoch of Position: 2015.5	V=9	Reference Frame: SIMBAD

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

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) CRAB-MOSAIC -P1	WFC3/UVIS, ACCUM, UVIS-CENTER	F547M	FLASH=10		Pattern 1, Exps 1-1 in Visit 01 (1)	550 Secs (1262 Secs)	
								[==>631.0 Secs (Pattern 1)] *[==>631.0 Secs (Pattern 2)]*	***[1]***
2		(1) CRAB-MOSAIC -P1	WFC3/UVIS, ACCUM, UVIS-CENTER	F763M	FLASH=15		Pattern 1, Exps 2-2 in Visit 01 (1)	450 Secs (1062 Secs)	
								[==>531.0 Secs (Pattern 1)] *[==>531.0 Secs (Pattern 2)]*	***[1]***
3		(1) CRAB-MOSAIC -P1	WFC3/UVIS, ACCUM, UVIS-CENTER	F502N	FLASH=20		Pattern 2, Exps 3-3 in Visit 01 (2)	800 Secs (2460 Secs)	
								[==>820.0 Secs (Pattern 1)] *[==>820.0 Secs (Pattern 2)]* *[==>820.0 Secs (Pattern 3)]*	***[2]***
4		(1) CRAB-MOSAIC -P1	WFC3/UVIS, ACCUM, UVIS-CENTER	F673N	FLASH=15		Pattern 2, Exps 4-4 in Visit 01 (2)	1100 Secs (3797 Secs)	
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5		(1) CRAB-MOSAIC -P1	WFC3/UVIS, ACCUM, UVIS-CENTER	F631N	FLASH=20		Pattern 2, Exps 5-5 in Visit 01 (2)	1100 Secs (3983 Secs)	
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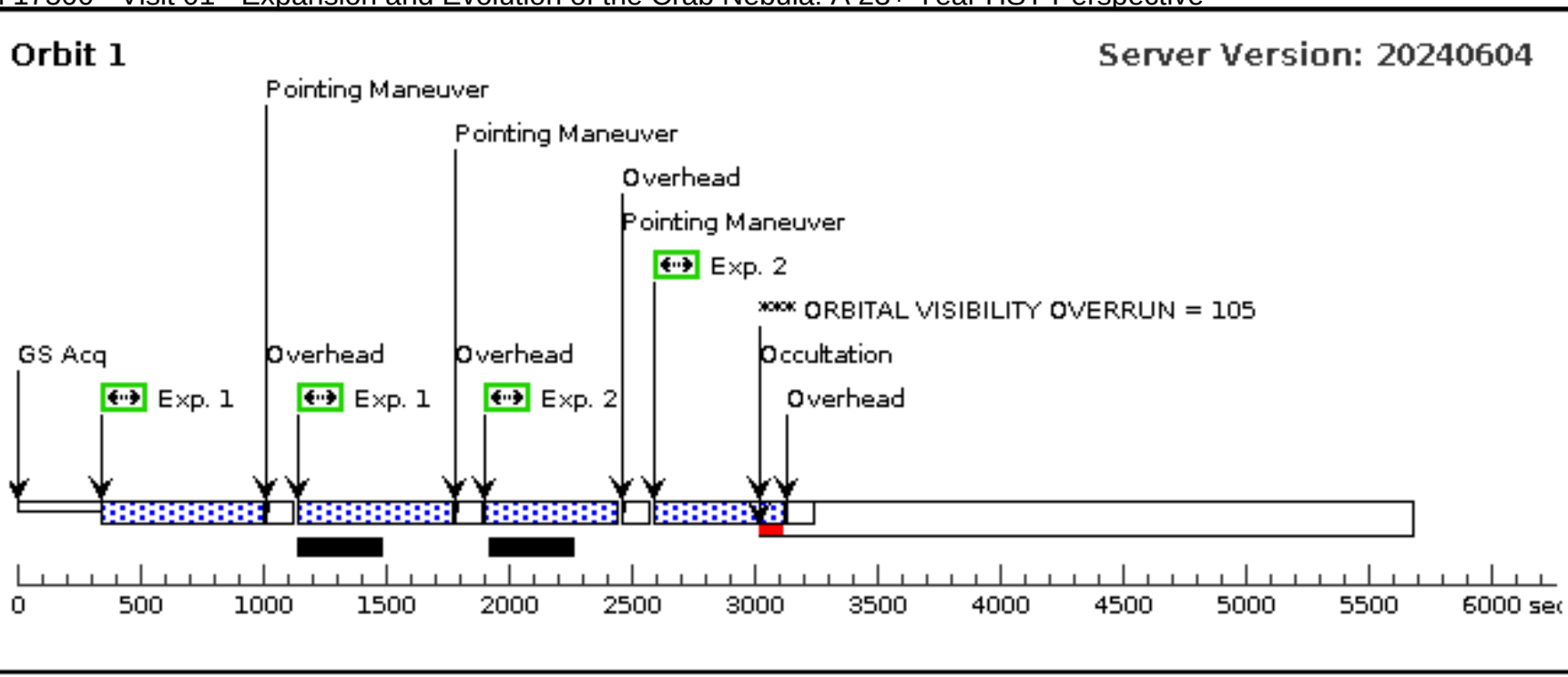
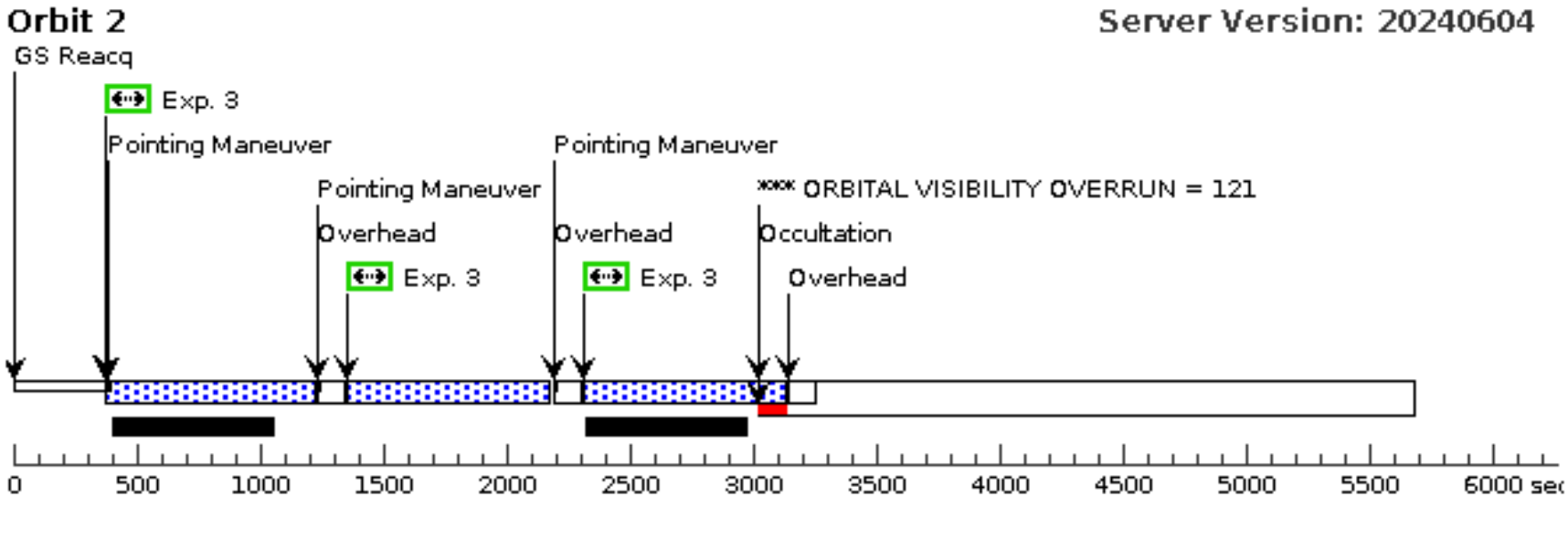
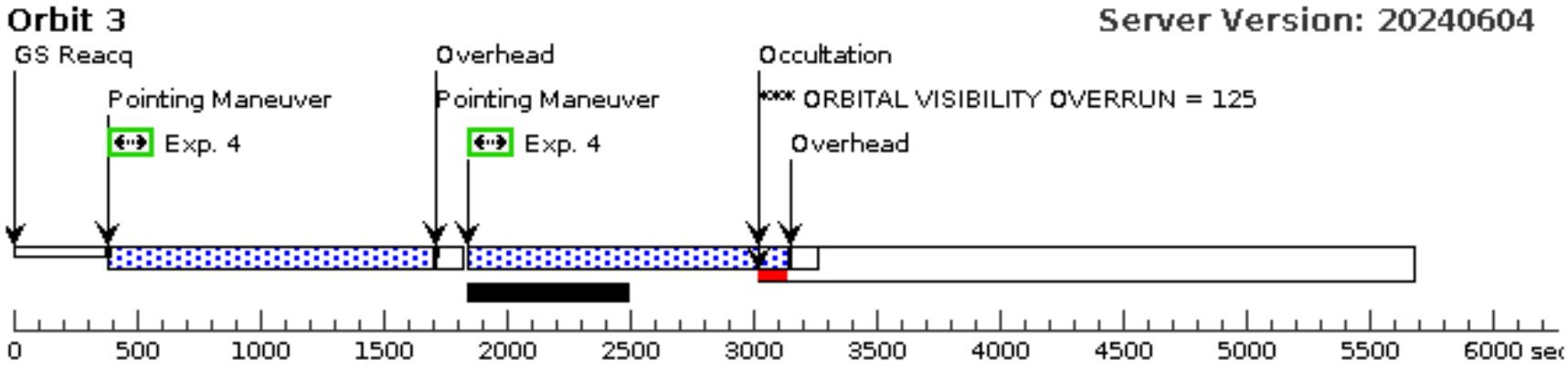
Orbit Structure



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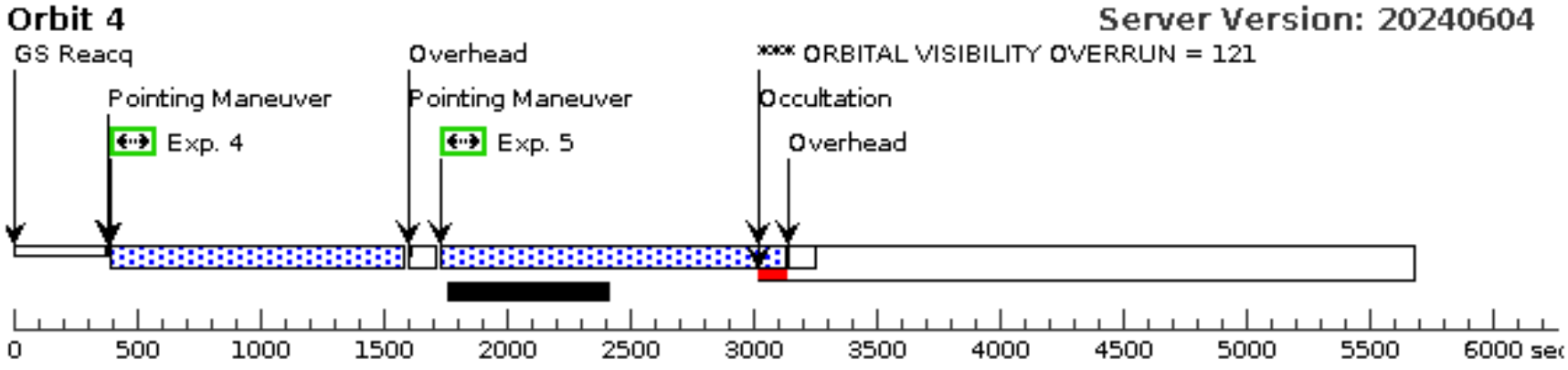
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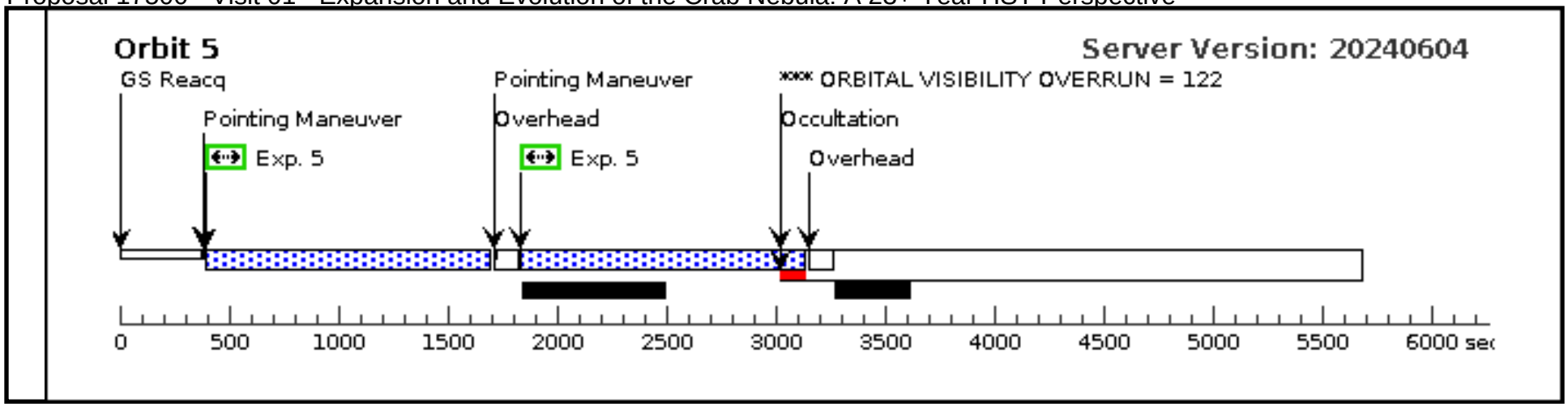
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Visit

Proposal 17500, Visit 02, failed Fri Jun 14 17:00:28 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: SAME ORIENT AS 01

Diagnostics

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

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

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

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Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=2.414 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=false		(1), (2)
(2)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=2.414 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=false		(3), (4), (5)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	CRAB-MOSAIC-P2	RA: 05 34 29.9379 (83.6247412d) Dec: +21 59 26.80 (21.99078d) Equinox: J2000	Epoch of Position: 2015.5	V=9	Reference Frame: SIMBAD

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

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) CRAB-MOSAIC -P2	WFC3/UVIS, ACCUM, UVIS-CENTER	F547M	FLASH=10		Pattern 1, Exps 1-1 in Visit 02 (1)	550 Secs (1262 Secs)	
								[==>631.0 Secs (Pattern 1)] *[==>631.0 Secs (Pattern 2)]*	***[1]***
2		(2) CRAB-MOSAIC -P2	WFC3/UVIS, ACCUM, UVIS-CENTER	F763M	FLASH=15		Pattern 1, Exps 2-2 in Visit 02 (1)	450 Secs (1062 Secs)	
								[==>531.0 Secs (Pattern 1)] *[==>531.0 Secs (Pattern 2)]*	***[1]***
3		(2) CRAB-MOSAIC -P2	WFC3/UVIS, ACCUM, UVIS-CENTER	F502N	FLASH=20		Pattern 2, Exps 3-3 in Visit 02 (2)	800 Secs (2460 Secs)	
								[==>820.0 Secs (Pattern 1)] *[==>820.0 Secs (Pattern 2)]* *[==>820.0 Secs (Pattern 3)]*	***[2]***
4		(2) CRAB-MOSAIC -P2	WFC3/UVIS, ACCUM, UVIS-CENTER	F673N	FLASH=15		Pattern 2, Exps 4-4 in Visit 02 (2)	1100 Secs (3888 Secs)	
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								[==>1288.0 Secs (Pattern 3)]	***[4]***
5		(2) CRAB-MOSAIC -P2	WFC3/UVIS, ACCUM, UVIS-CENTER	F631N	FLASH=20		Pattern 2, Exps 5-5 in Visit 02 (2)	1100 Secs (3888 Secs)	
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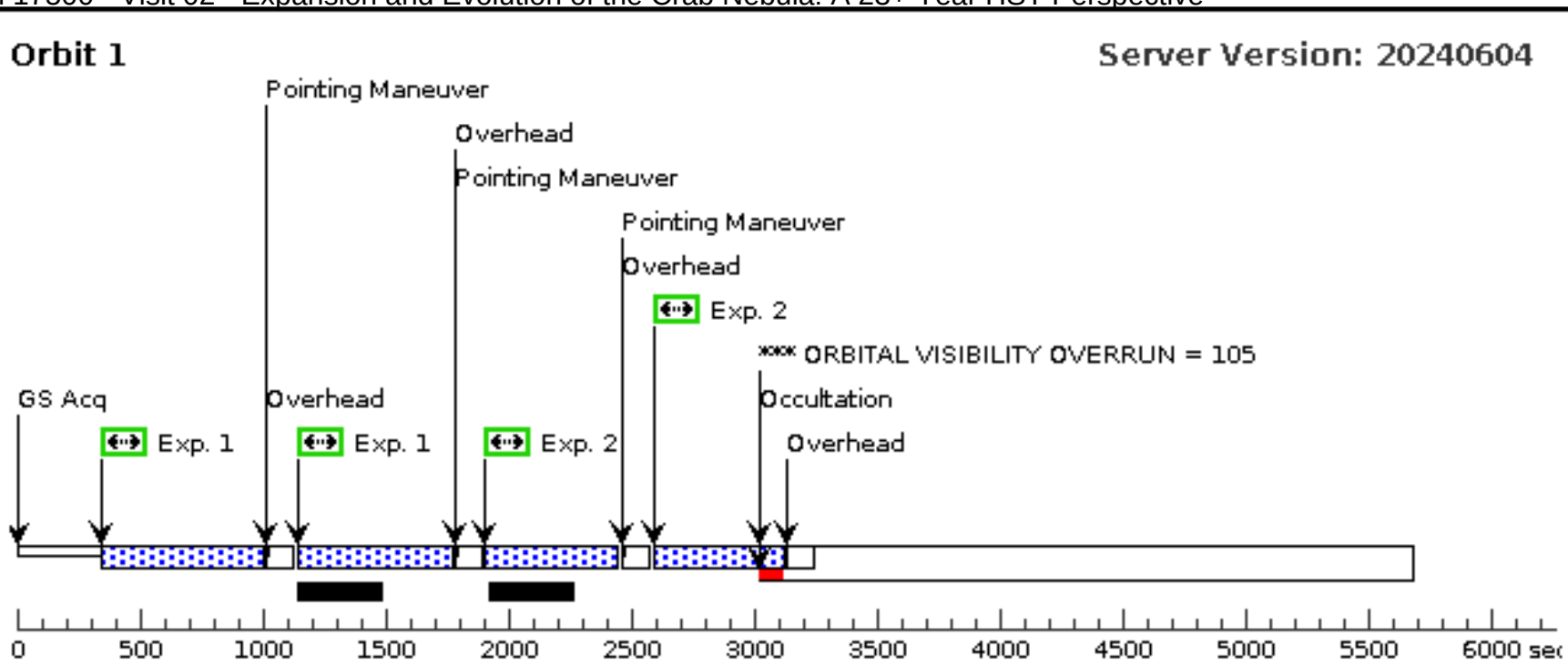
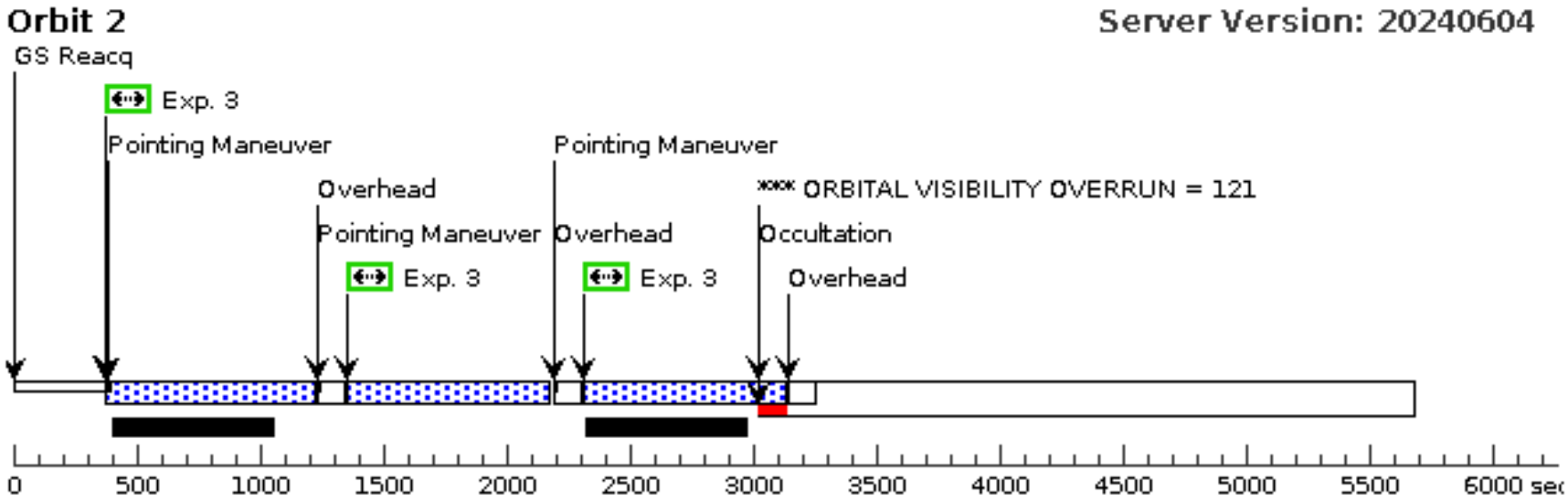
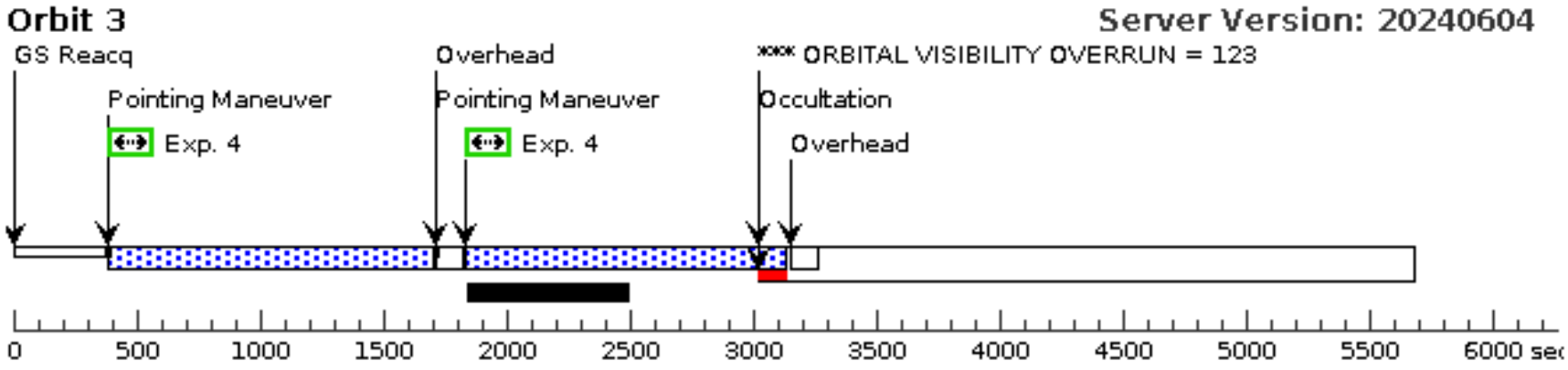
Orbit Structure



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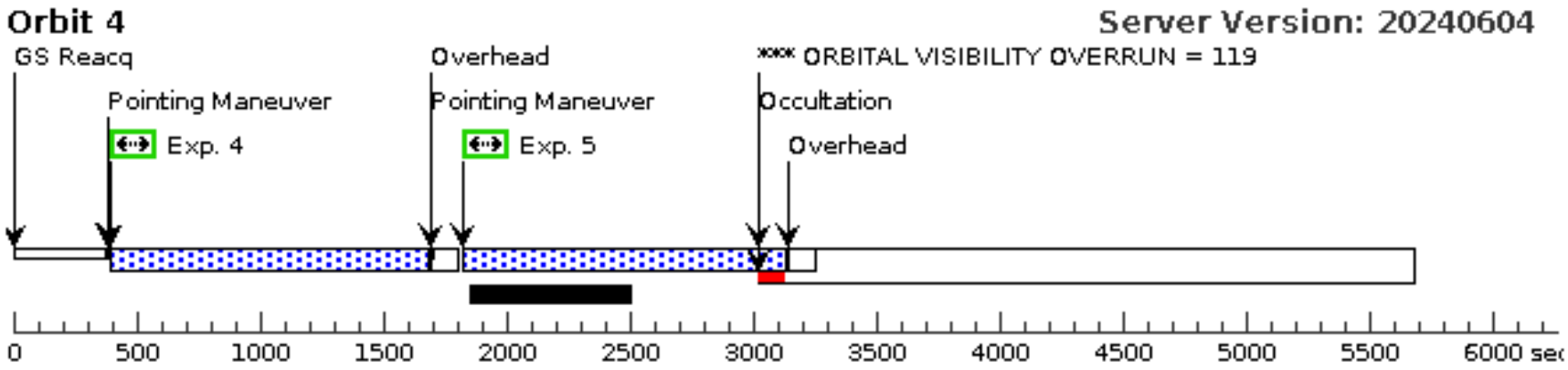
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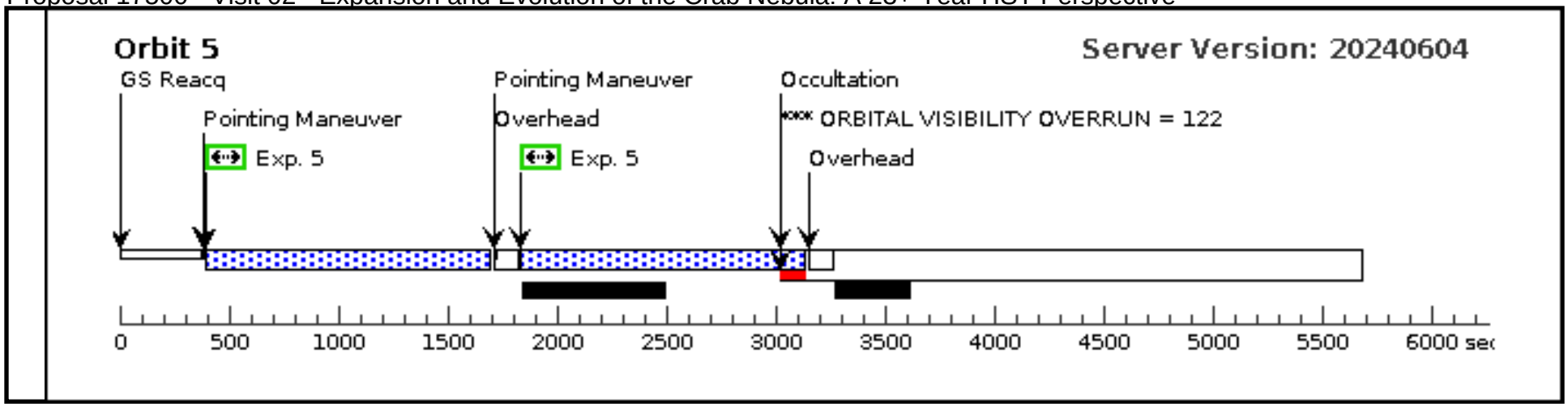
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Visit

Proposal 17500, Visit 03, completed Fri Jun 14 17:00:28 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: SAME ORIENT AS 01

Diagnostics

(Visit 03) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

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Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=2.414 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=false		(1), (2)
(2)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=2.414 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=false		(3), (4), (5)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	CRAB-MOSAIC-P3	RA: 05 34 21.2885 (83.5887021d) Dec: +22 01 14.58 (22.02072d) Equinox: J2000	Epoch of Position: 2015.5	V=9	Reference Frame: SIMBAD

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

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(3) CRAB-MOSAIC -P3	WFC3/UVIS, ACCUM, UVIS-CENTER	F547M	FLASH=10		Pattern 1, Exps 1-1 in Visit 03 (1)	550 Secs (1262 Secs)	
								[==>631.0 Secs (Pattern 1)] *[==>631.0 Secs (Pattern 2)]*	***[1]***
2		(3) CRAB-MOSAIC -P3	WFC3/UVIS, ACCUM, UVIS-CENTER	F763M	FLASH=15		Pattern 1, Exps 2-2 in Visit 03 (1)	450 Secs (1062 Secs)	
								[==>531.0 Secs (Pattern 1)] *[==>531.0 Secs (Pattern 2)]*	***[1]***
3		(3) CRAB-MOSAIC -P3	WFC3/UVIS, ACCUM, UVIS-CENTER	F502N	FLASH=20		Pattern 2, Exps 3-3 in Visit 03 (2)	800 Secs (2460 Secs)	
								[==>820.0 Secs (Pattern 1)] *[==>820.0 Secs (Pattern 2)]* *[==>820.0 Secs (Pattern 3)]*	***[2]***
4		(3) CRAB-MOSAIC -P3	WFC3/UVIS, ACCUM, UVIS-CENTER	F673N	FLASH=15		Pattern 2, Exps 4-4 in Visit 03 (2)	1100 Secs (3888 Secs)	
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								[==>1288.0 Secs (Pattern 3)]	***[4]***
5		(3) CRAB-MOSAIC -P3	WFC3/UVIS, ACCUM, UVIS-CENTER	F631N	FLASH=20		Pattern 2, Exps 5-5 in Visit 03 (2)	1100 Secs (3888 Secs)	
								[==>1288.0 Secs (Pattern 1)]	***[4]***
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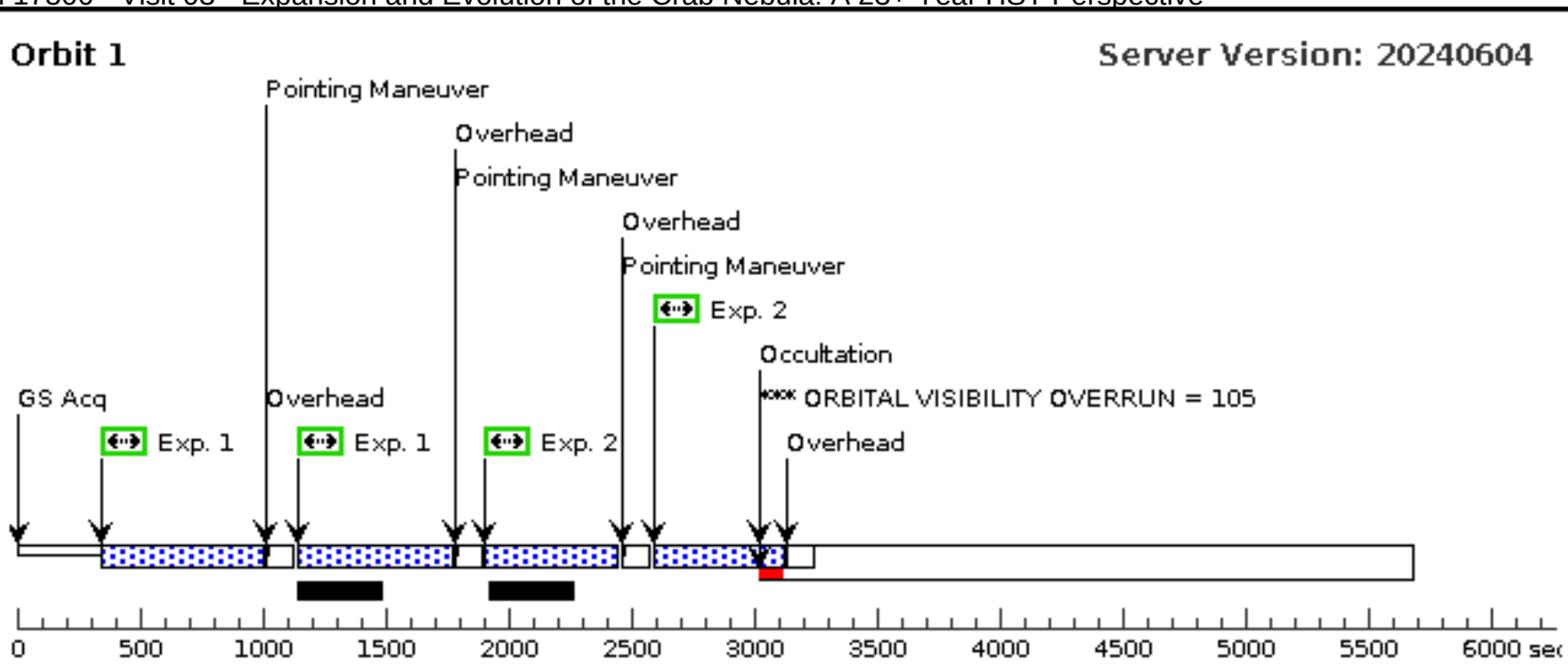
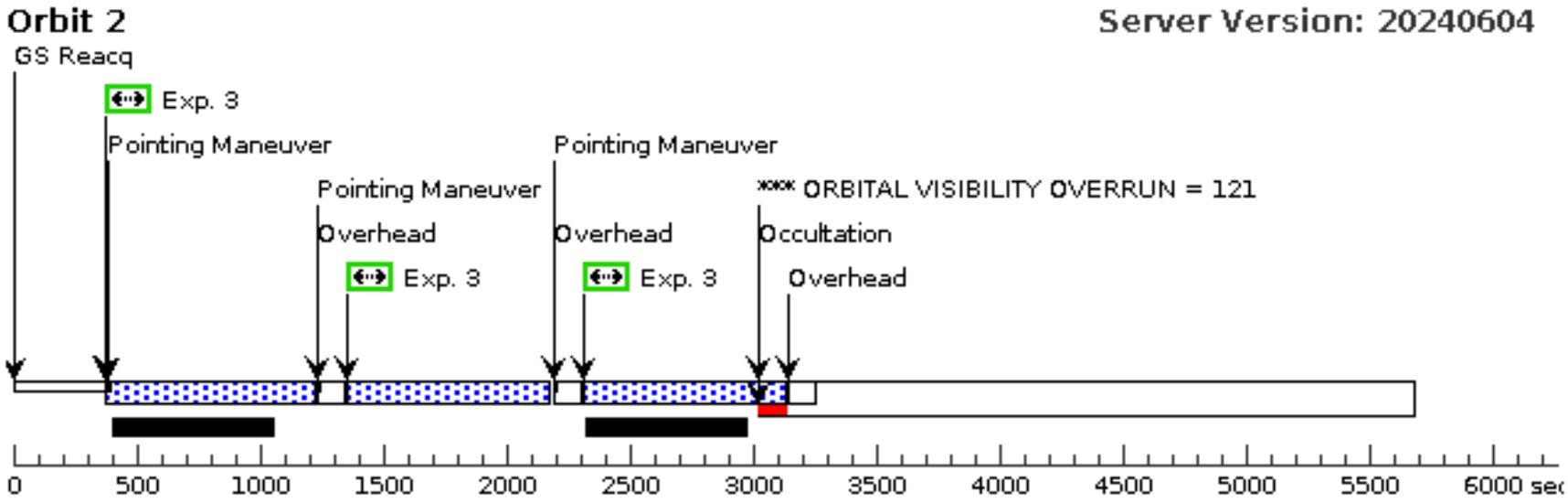
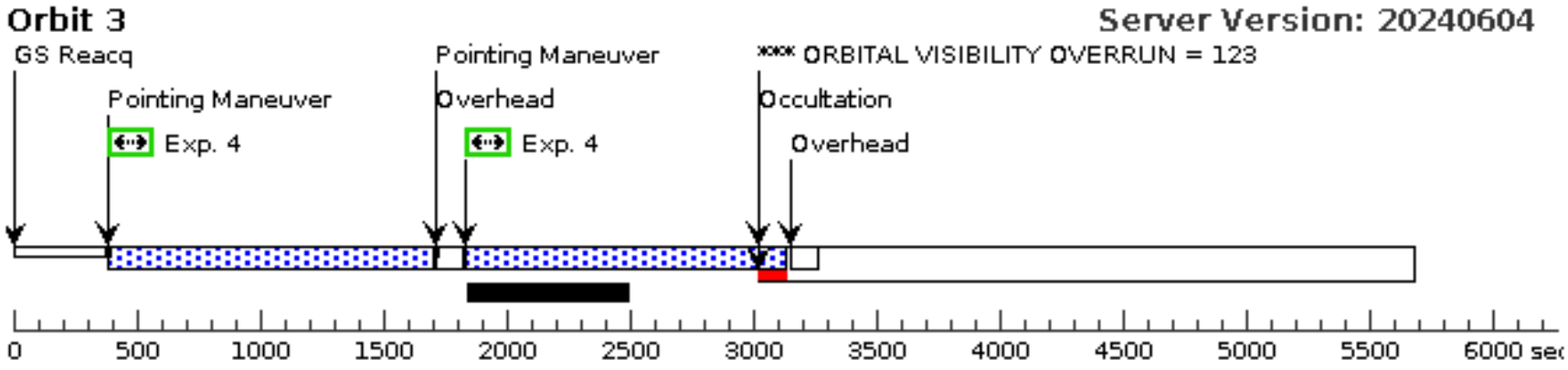
Orbit Structure



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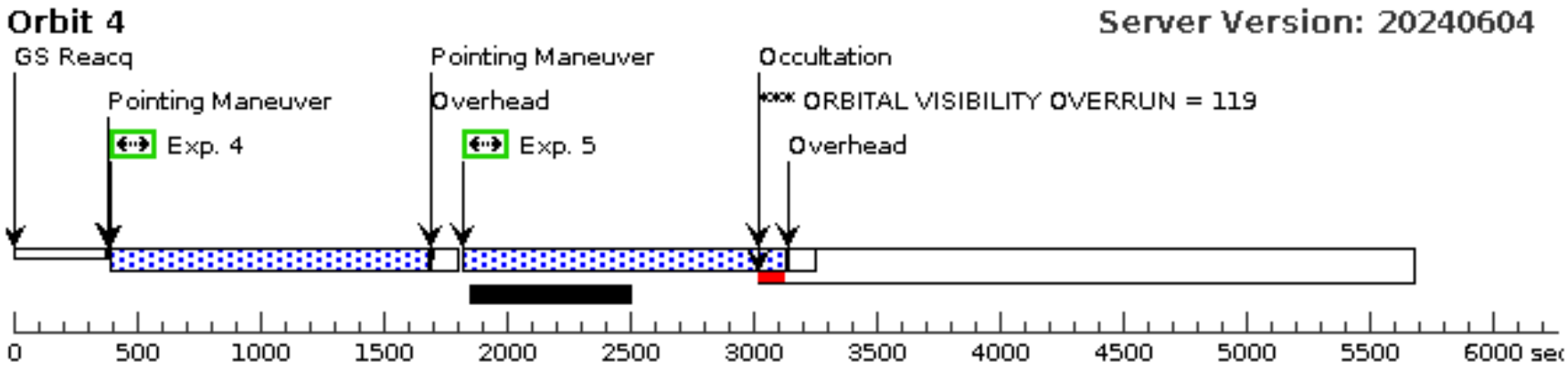
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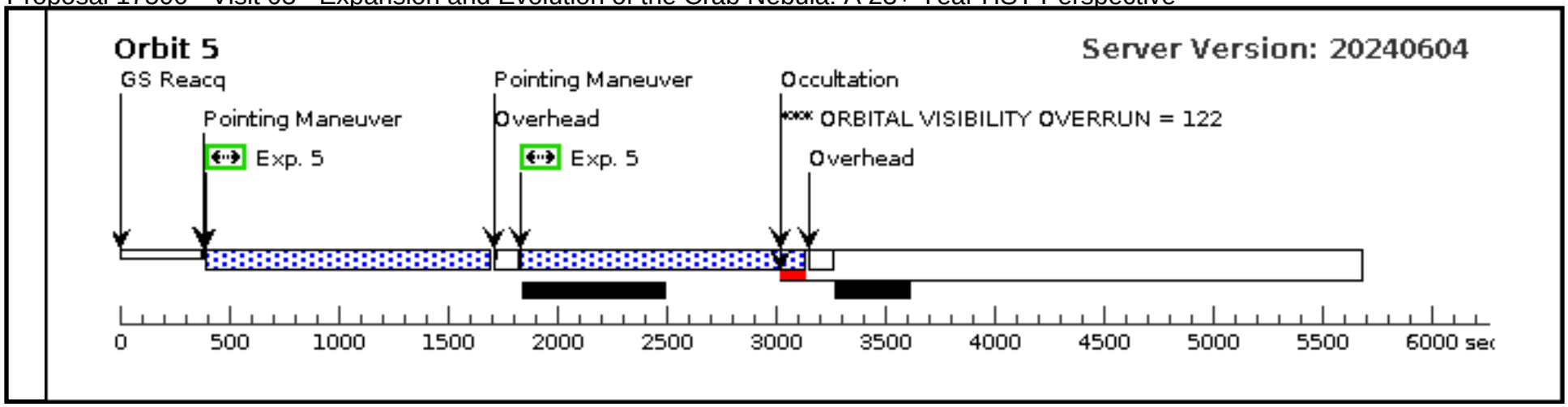
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Visit

Proposal 17500, Visit 04, completed Fri Jun 14 17:00:28 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: SAME ORIENT AS 01

Diagnostics

(Visit 04) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 04) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 04) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 04) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 04) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=2.414 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=false		(1), (2)
(2)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=2.414 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=false		(3), (4), (5)

Fixed Targets

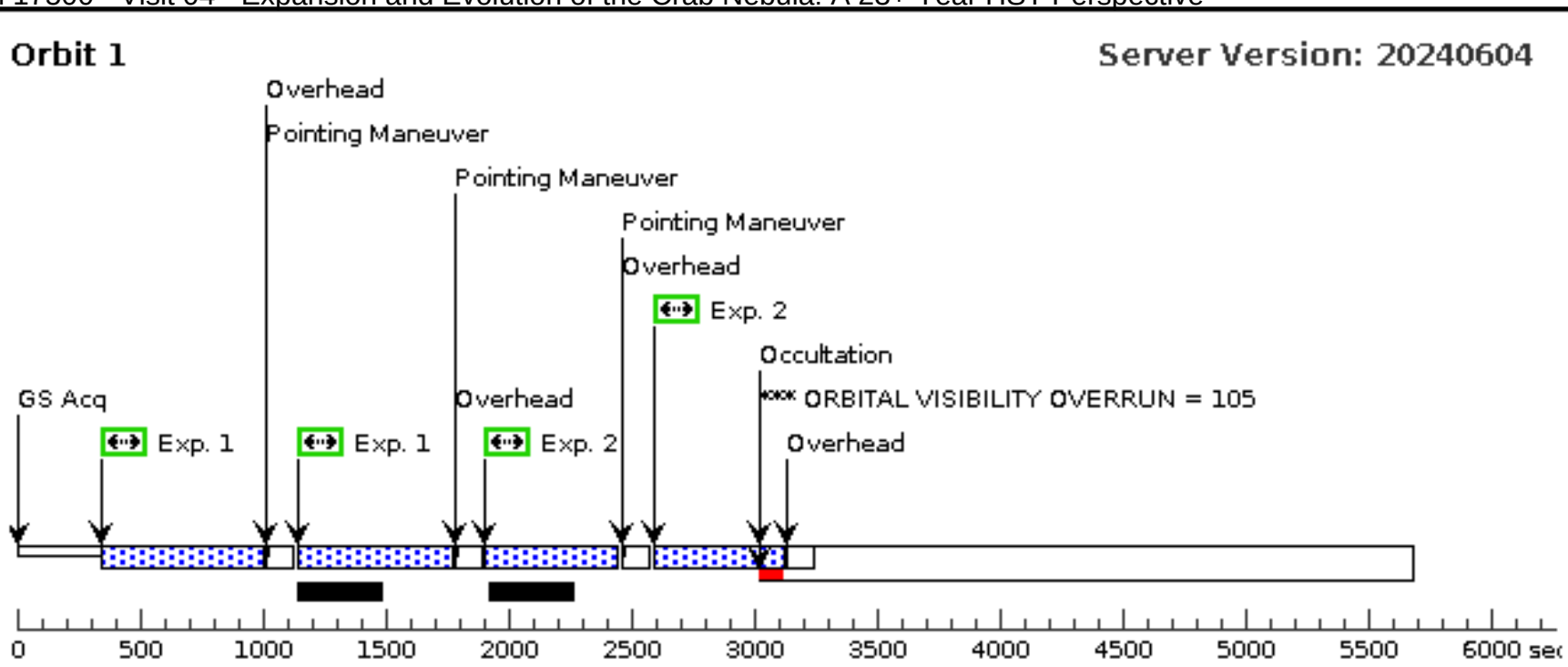
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	CRAB-MOSAIC-P4	RA: 05 34 38.4733 (83.6603054d) Dec: +22 01 8.69 (22.01908d) Equinox: J2000	Epoch of Position: 2015.5	V=9	Reference Frame: SIMBAD

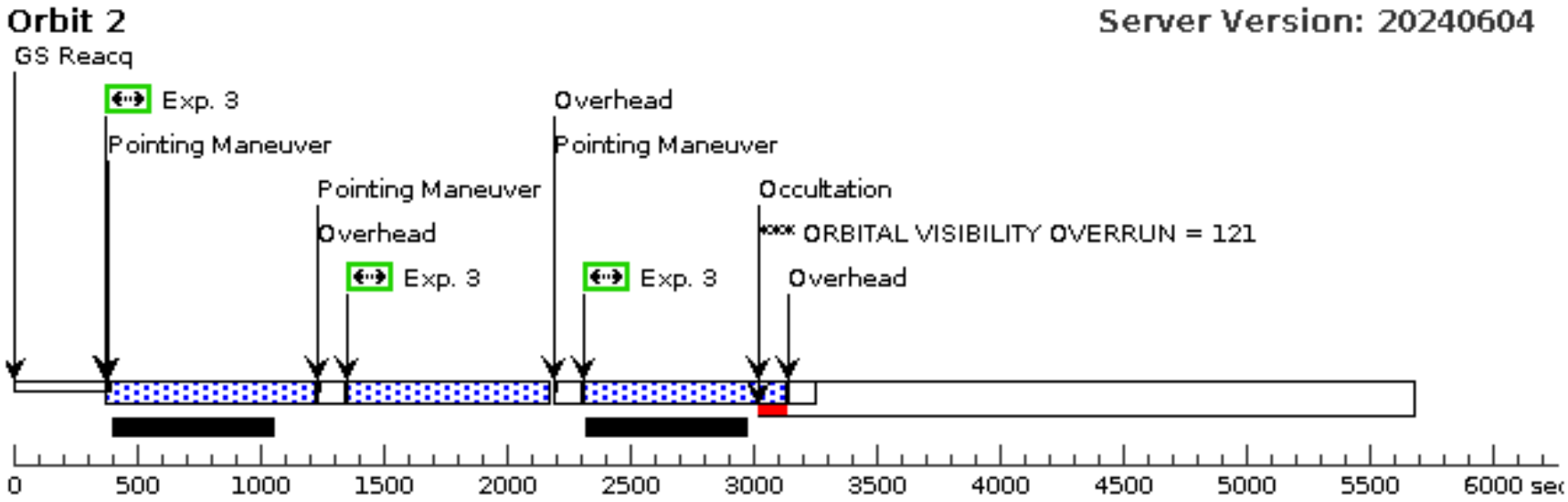
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=ISM
Description=[SNR]

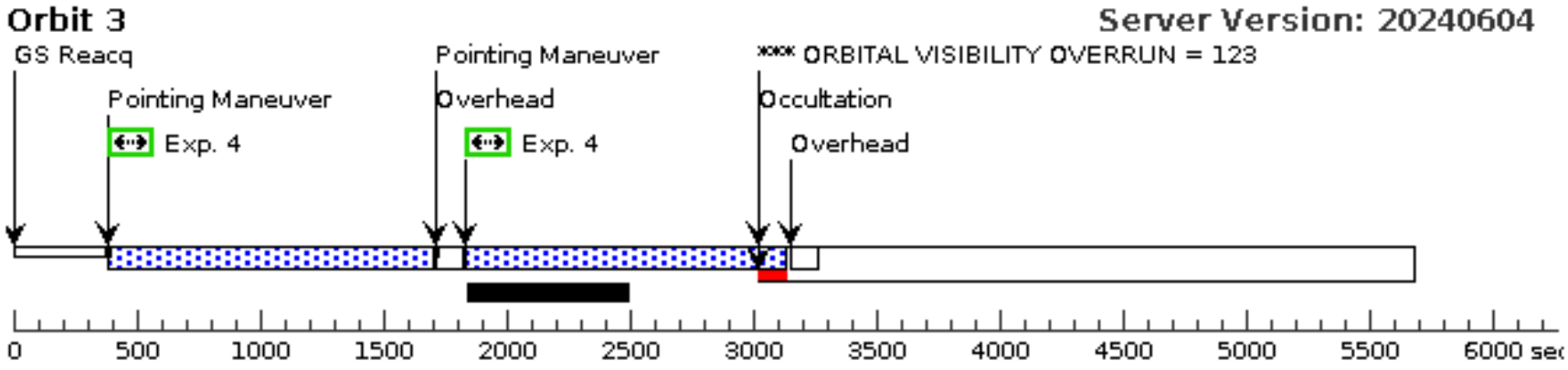
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(4) CRAB-MOSAIC -P4	WFC3/UVIS, ACCUM, UVIS-CENTER	F547M	FLASH=10		Pattern 1, Exps 1-1 in Visit 04 (1)	550 Secs (1262 Secs)	
								[==>631.0 Secs (Pattern 1)] *[==>631.0 Secs (Pattern 2)]*	***[1]***
2		(4) CRAB-MOSAIC -P4	WFC3/UVIS, ACCUM, UVIS-CENTER	F763M	FLASH=15		Pattern 1, Exps 2-2 in Visit 04 (1)	450 Secs (1062 Secs)	
								[==>531.0 Secs (Pattern 1)] *[==>531.0 Secs (Pattern 2)]*	***[1]***
3		(4) CRAB-MOSAIC -P4	WFC3/UVIS, ACCUM, UVIS-CENTER	F502N	FLASH=20		Pattern 2, Exps 3-3 in Visit 04 (2)	800 Secs (2460 Secs)	
								[==>820.0 Secs (Pattern 1)] *[==>820.0 Secs (Pattern 2)]* *[==>820.0 Secs (Pattern 3)]*	***[2]***
4		(4) CRAB-MOSAIC -P4	WFC3/UVIS, ACCUM, UVIS-CENTER	F673N	FLASH=15		Pattern 2, Exps 4-4 in Visit 04 (2)	1100 Secs (3888 Secs)	
								[==>1300.0 Secs (Pattern 1)] *[==>1300.0 Secs (Pattern 2)]*	***[3]***
								[==>1288.0 Secs (Pattern 3)]	***[4]***
5		(4) CRAB-MOSAIC -P4	WFC3/UVIS, ACCUM, UVIS-CENTER	F631N	FLASH=20		Pattern 2, Exps 5-5 in Visit 04 (2)	1100 Secs (3888 Secs)	
								[==>1288.0 Secs (Pattern 1)]	***[4]***
								[==>1300.0 Secs (Pattern 2)] *[==>1300.0 Secs (Pattern 3)]*	***[5]***

Orbit Structure



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GS Reacq
Pointing Maneuver
Exp. 4
Pointing Maneuver
Overhead
Exp. 4
**** ORBITAL VISIBILITY OVERRUN = 123
Occultation
Overhead
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1000
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2000
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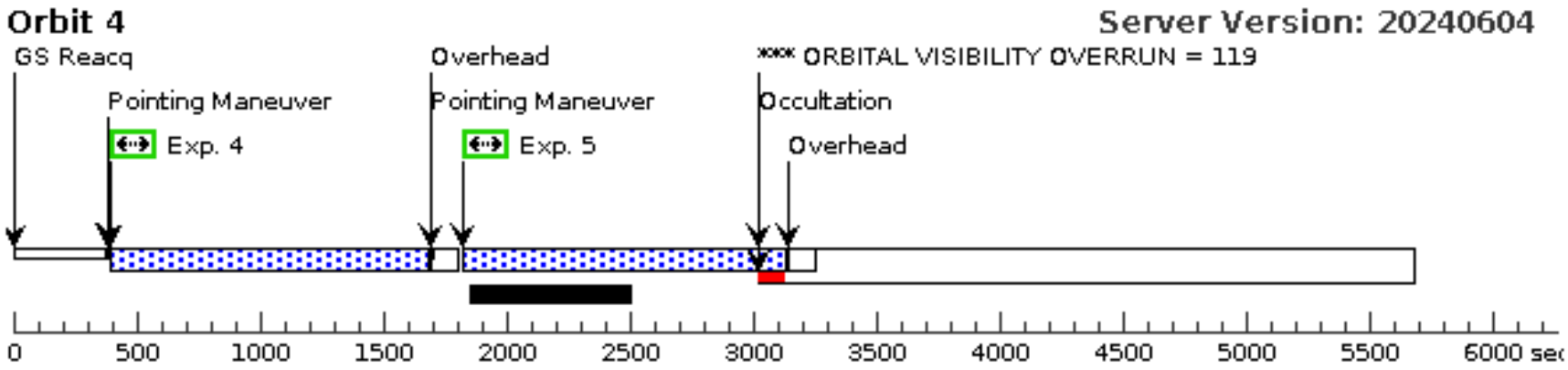
5000
5500
6000 sec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Server Version: 20240604
GS Reacq
Pointing Maneuver
Exp. 4
Overhead
Pointing Maneuver
Exp. 5
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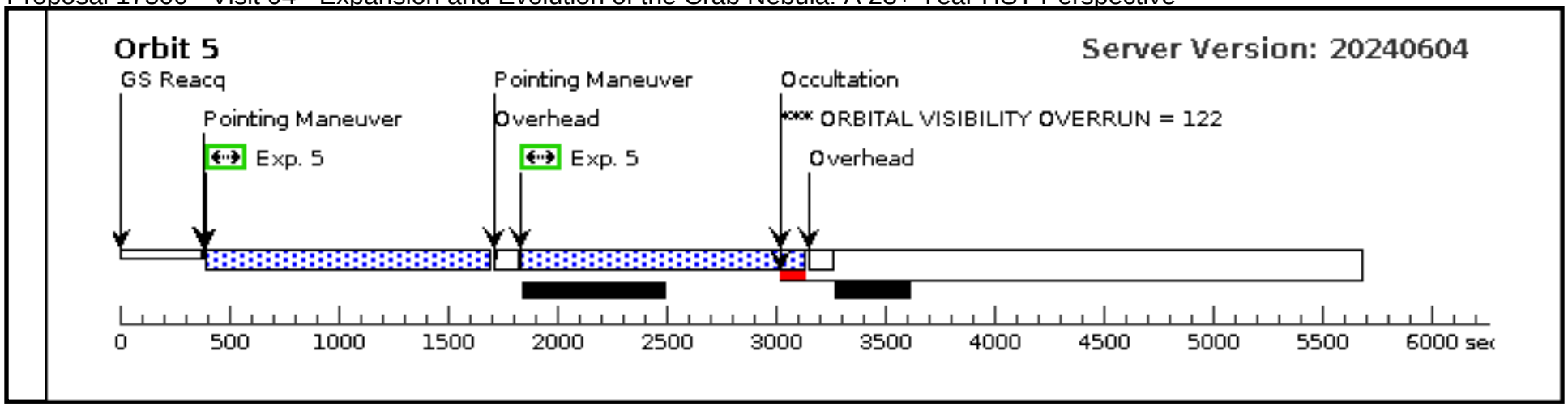
5000
5500
6000 sec


Orbit 5
Server Version: 20240604
GS Reacq
Pointing Maneuver
Exp. 5
Pointing Maneuver
Overhead
Exp. 5
Occultation
*** ORBITAL VISIBILITY OVERRUN = 122
Overhead
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500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec

Visit

Proposal 17500, Visit 05, completed Fri Jun 14 17:00:28 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: SAME ORIENT AS 01

Diagnostics

(Visit 05) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 05) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 05) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 05) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 05) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=2.414 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=false		(1), (2)
(2)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=2.414 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=false		(3), (4), (5)

Fixed Targets

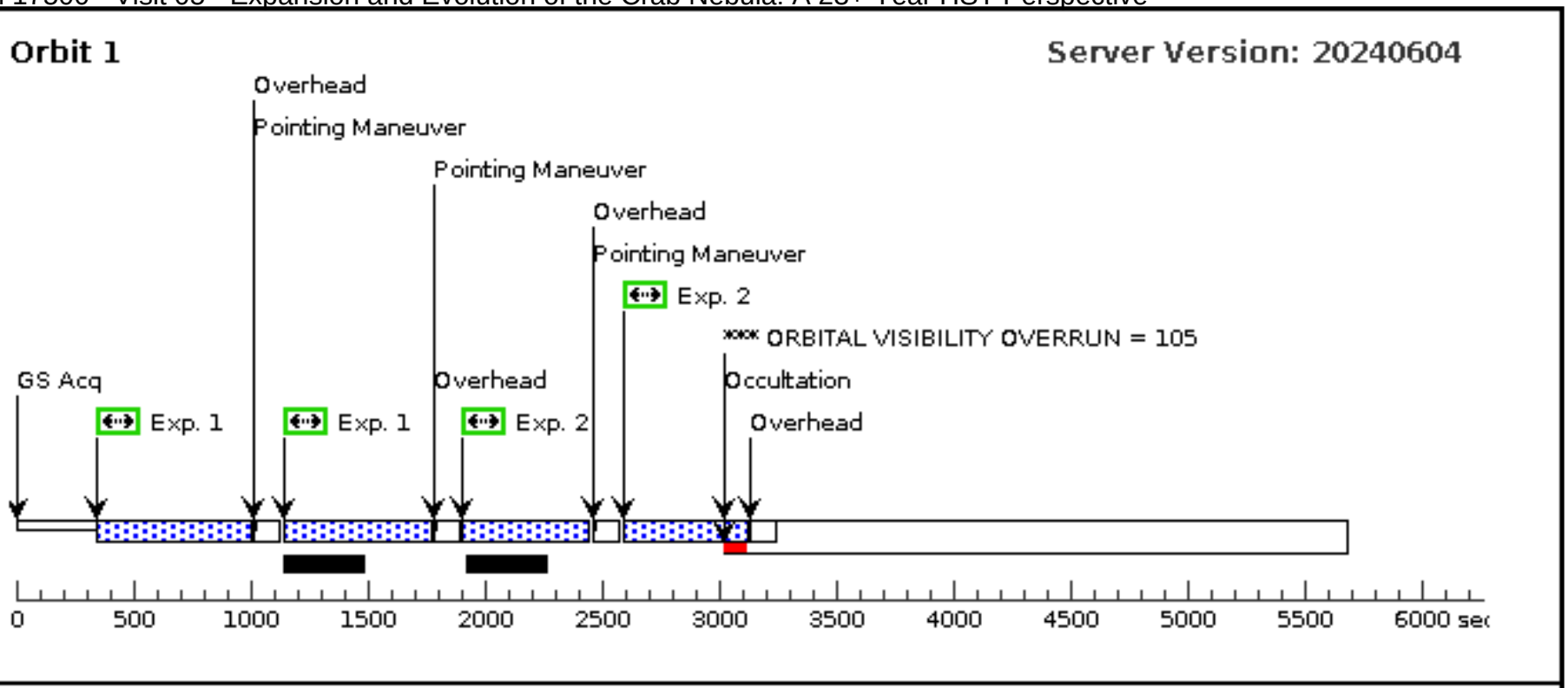
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(5)	CRAB-MOSAIC-P5	RA: 05 34 24.6624 (83.6027600d) Dec: +22 02 39.18 (22.04422d) Equinox: J2000	Epoch of Position: 2015.5	V=9	Reference Frame: SIMBAD

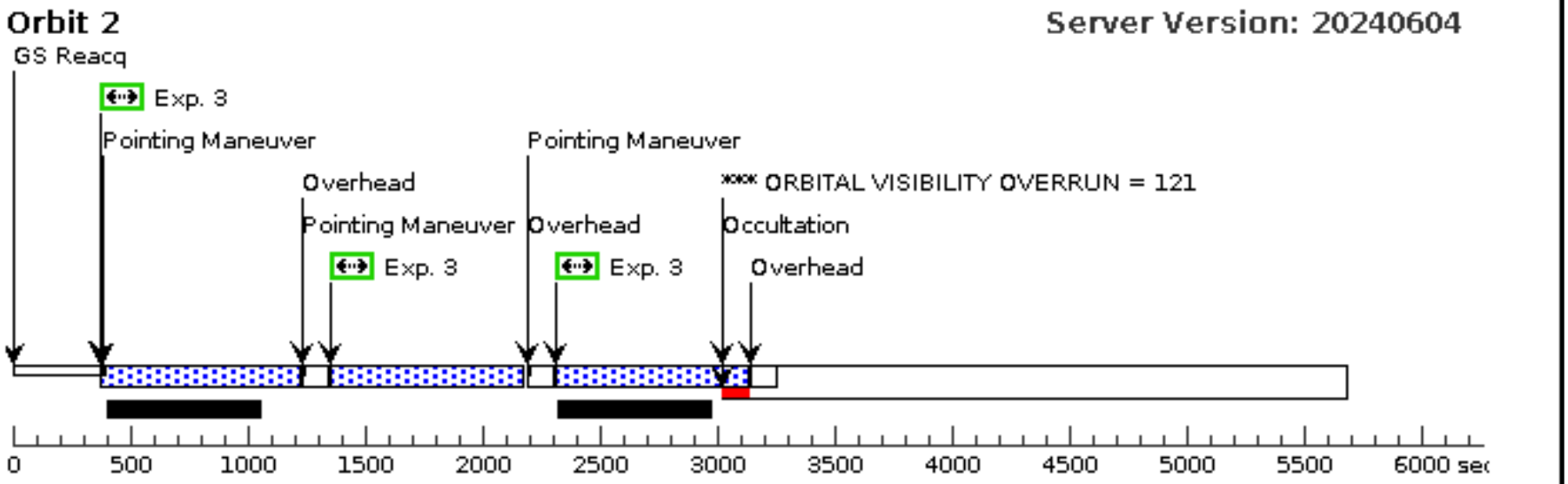
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=ISM
Description=[SNR]

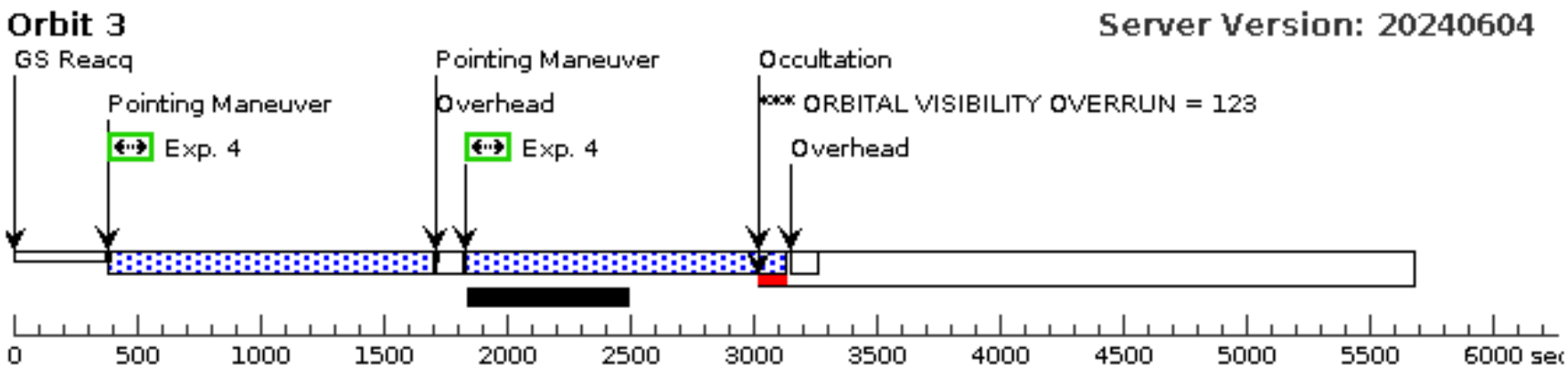
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(5) CRAB-MOSAIC -P5	WFC3/UVIS, ACCUM, UVIS-CENTER	F547M	FLASH=10		Pattern 1, Exps 1-1 in Visit 05 (1)	550 Secs (1262 Secs)	
								[==>631.0 Secs (Pattern 1)]	***[1]***
								[==>631.0 Secs (Pattern 2)]	
2		(5) CRAB-MOSAIC -P5	WFC3/UVIS, ACCUM, UVIS-CENTER	F763M	FLASH=15		Pattern 1, Exps 2-2 in Visit 05 (1)	450 Secs (1062 Secs)	
								[==>531.0 Secs (Pattern 1)]	***[1]***
								[==>531.0 Secs (Pattern 2)]	
3		(5) CRAB-MOSAIC -P5	WFC3/UVIS, ACCUM, UVIS-CENTER	F502N	FLASH=20		Pattern 2, Exps 3-3 in Visit 05 (2)	800 Secs (2460 Secs)	
								[==>820.0 Secs (Pattern 1)]	
								[==>820.0 Secs (Pattern 2)]	***[2]***
								[==>820.0 Secs (Pattern 3)]	
4		(5) CRAB-MOSAIC -P5	WFC3/UVIS, ACCUM, UVIS-CENTER	F673N	FLASH=15		Pattern 2, Exps 4-4 in Visit 05 (2)	1100 Secs (3888 Secs)	
								[==>1300.0 Secs (Pattern 1)]	***[3]***
								[==>1300.0 Secs (Pattern 2)]	
								[==>1288.0 Secs (Pattern 3)]	***[4]***
5		(5) CRAB-MOSAIC -P5	WFC3/UVIS, ACCUM, UVIS-CENTER	F631N	FLASH=20		Pattern 2, Exps 5-5 in Visit 05 (2)	1100 Secs (3888 Secs)	
								[==>1288.0 Secs (Pattern 1)]	***[4]***
								[==>1300.0 Secs (Pattern 2)]	***[5]***
								[==>1300.0 Secs (Pattern 3)]	

Orbit Structure



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GS Reacq
Pointing Maneuver
Exp. 4
Pointing Maneuver
Overhead
Exp. 4
Occultation
*** ORBITAL VISIBILITY OVERRUN = 123
Overhead
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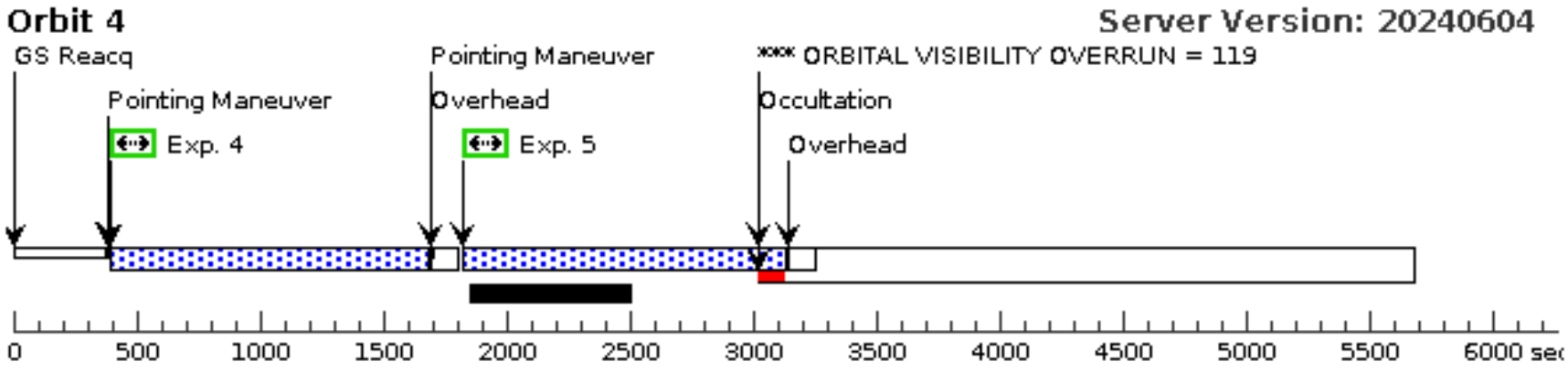
3500
4000
4500
5000
5500
6000 sec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Server Version: 20240604
GS Reacq
Pointing Maneuver
Exp. 4
Pointing Maneuver
Overhead
Exp. 5
*** ORBITAL VISIBILITY OVERRUN = 119
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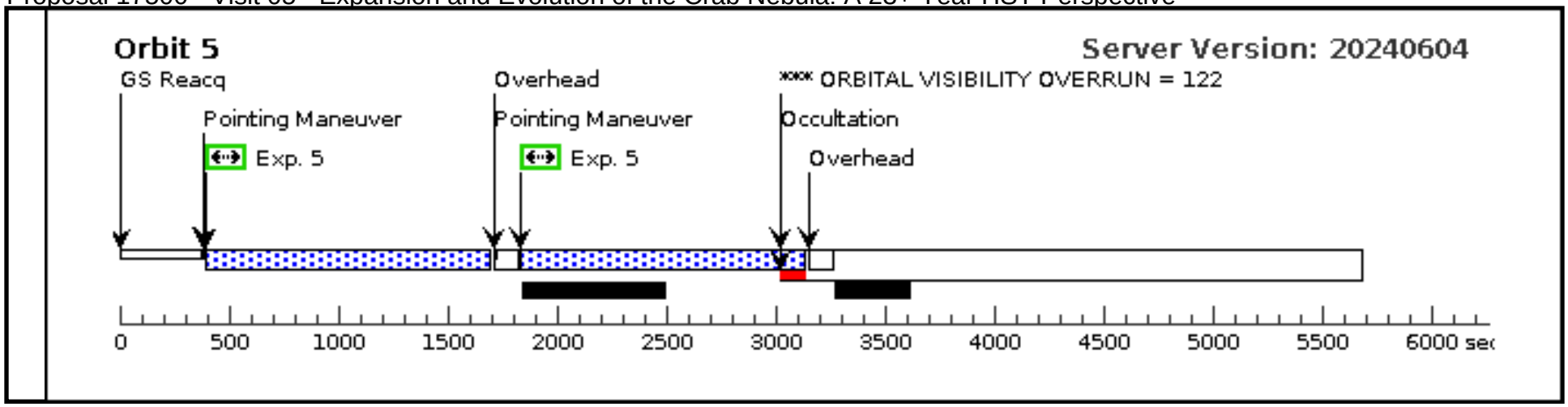
3500
4000
4500
5000
5500
6000 sec


Orbit 5
Server Version: 20240604
GS Reacq
Pointing Maneuver
Exp. 5
Overhead
Pointing Maneuver
Exp. 5
**** ORBITAL VISIBILITY OVERRUN = 122
Occultation
Overhead
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3500
4000
4500
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5500
6000 sec

Visit

Proposal 17500, Visit 06, completed Fri Jun 14 17:00:28 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: SAME ORIENT AS 01

Diagnostics

(Visit 06) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 06) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 06) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 06) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 06) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=2.414 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=false		(1), (2)
(2)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=2.414 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=false		(3), (4), (5)

Fixed Targets

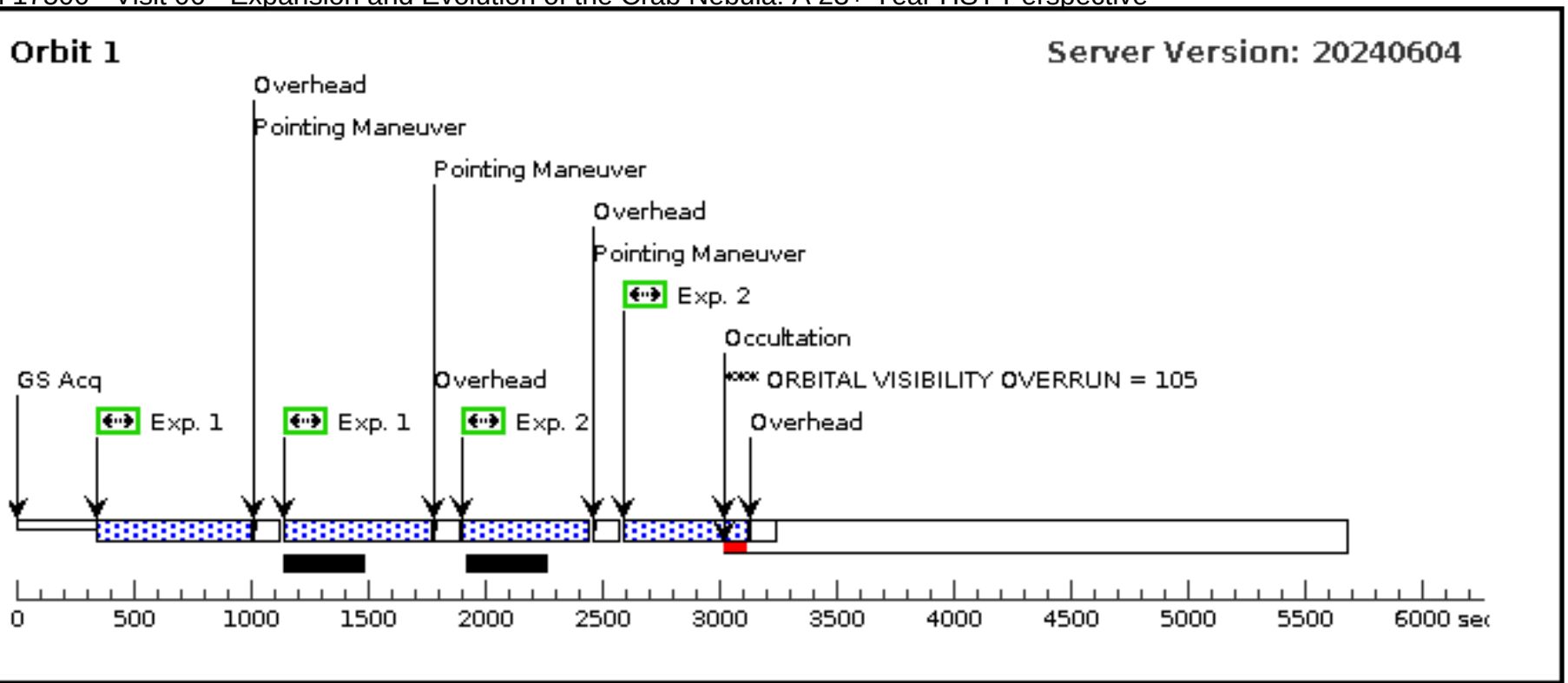
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(6)	CRAB-MOSAIC-P6	RA: 05 34 31.1900 (83.6299583d) Dec: +22 02 42.85 (22.04524d) Equinox: J2000	Epoch of Position: 2015.5	V=9	Reference Frame: SIMBAD

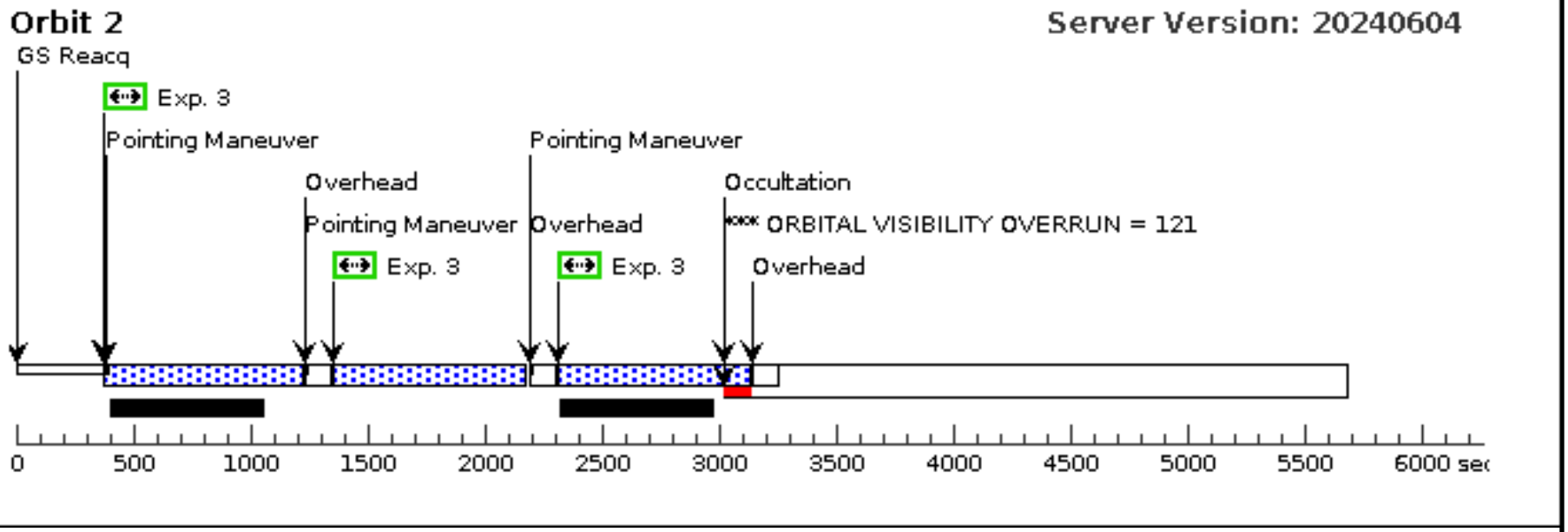
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=ISM
Description=[SNR]

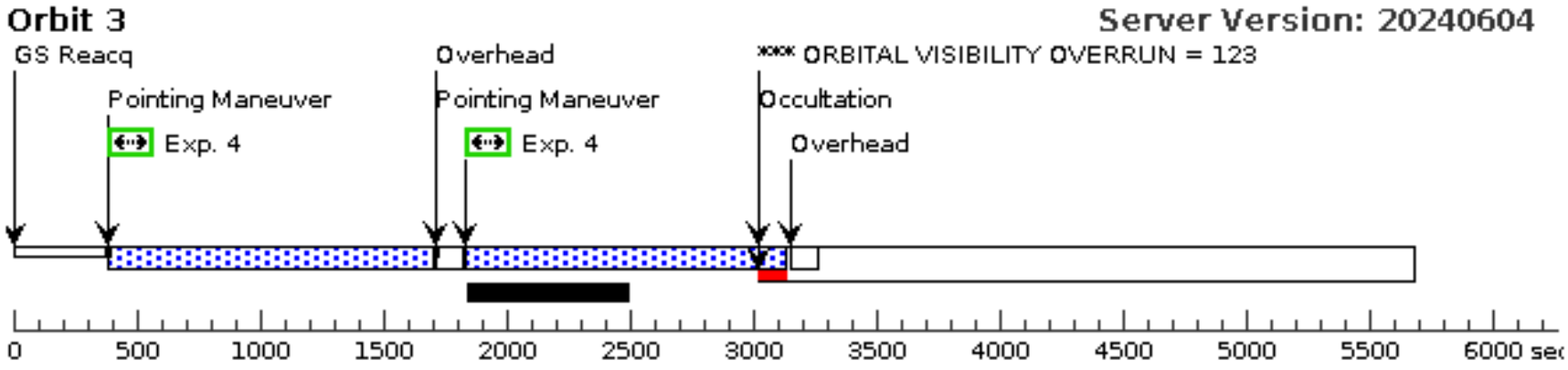
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(6) CRAB-MOSAIC -P6	WFC3/UVIS, ACCUM, UVIS-CENTER	F547M	FLASH=10		Pattern 1, Exps 1-1 in Visit 06 (1)	550 Secs (1262 Secs)	
								[==>631.0 Secs (Pattern 1)] *[==>631.0 Secs (Pattern 2)]*	***[1]***
2		(6) CRAB-MOSAIC -P6	WFC3/UVIS, ACCUM, UVIS-CENTER	F763M	FLASH=15		Pattern 1, Exps 2-2 in Visit 06 (1)	450 Secs (1062 Secs)	
								[==>531.0 Secs (Pattern 1)] *[==>531.0 Secs (Pattern 2)]*	***[1]***
3		(6) CRAB-MOSAIC -P6	WFC3/UVIS, ACCUM, UVIS-CENTER	F502N	FLASH=20		Pattern 2, Exps 3-3 in Visit 06 (2)	800 Secs (2460 Secs)	
								[==>820.0 Secs (Pattern 1)] *[==>820.0 Secs (Pattern 2)]* *[==>820.0 Secs (Pattern 3)]*	***[2]***
4		(6) CRAB-MOSAIC -P6	WFC3/UVIS, ACCUM, UVIS-CENTER	F673N	FLASH=15		Pattern 2, Exps 4-4 in Visit 06 (2)	1100 Secs (3888 Secs)	
								[==>1300.0 Secs (Pattern 1)] *[==>1300.0 Secs (Pattern 2)]*	***[3]***
								[==>1288.0 Secs (Pattern 3)]	***[4]***
5		(6) CRAB-MOSAIC -P6	WFC3/UVIS, ACCUM, UVIS-CENTER	F631N	FLASH=20		Pattern 2, Exps 5-5 in Visit 06 (2)	1100 Secs (3888 Secs)	
								[==>1288.0 Secs (Pattern 1)]	***[4]***
								[==>1300.0 Secs (Pattern 2)] *[==>1300.0 Secs (Pattern 3)]*	***[5]***

Orbit Structure



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GS Reacq
Pointing Maneuver
Exp. 4
Overhead
Pointing Maneuver
Exp. 4
**** ORBITAL VISIBILITY OVERRUN = 123
Occultation
Overhead
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2000
2500
3000
3500
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5000
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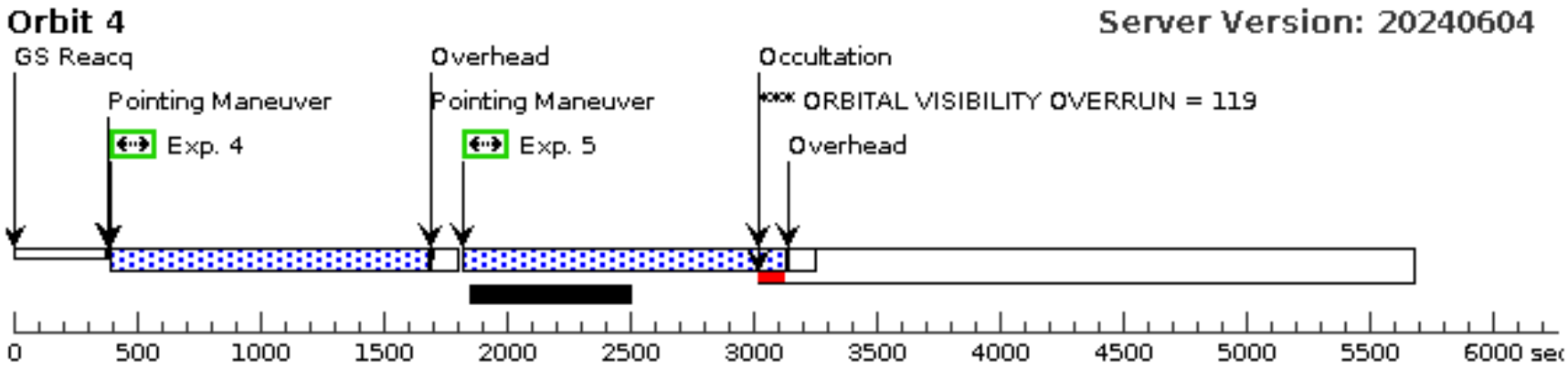
6000 sec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Server Version: 20240604
GS Reacq
Pointing Maneuver
Exp. 4
Overhead
Pointing Maneuver
Exp. 5
Occultation
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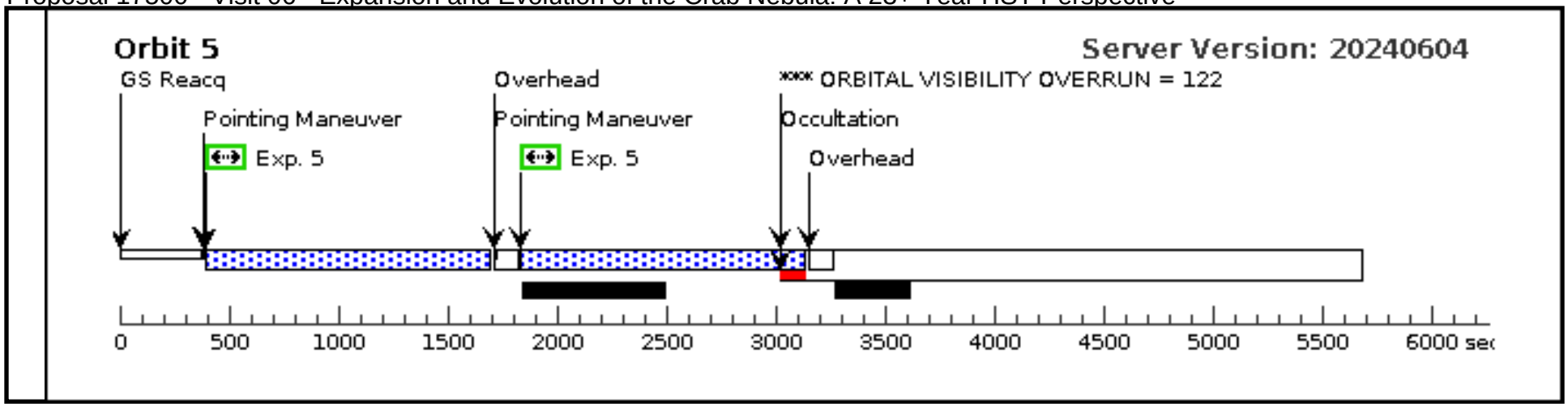
Orbit 5
Server Version: 20240604
GS Reacq
Pointing Maneuver
Exp. 5
Overhead
Pointing Maneuver
Exp. 5
**** ORBITAL VISIBILITY OVERRUN = 122
Occultation
Overhead
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3500
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4500
5000
5500
6000 sec

Visit

Proposal 17500, Visit 07, completed Fri Jun 14 17:00:28 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: SAME ORIENT AS 01

Diagnostics

(Visit 07) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 07) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 07) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=2.414 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=false		(1)

Fixed Targets

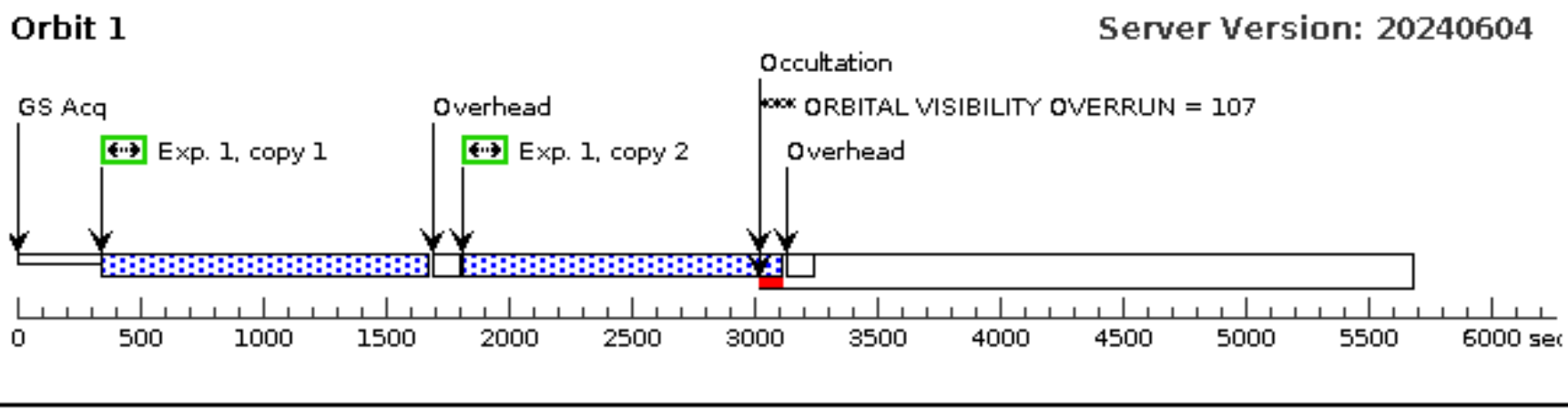
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(7)	CRAB-HB-FIELD1	RA: 05 34 29.2234 (83.6217642d) Dec: +21 59 37.35 (21.99371d) Equinox: J2000		V=9	Reference Frame: SIMBAD

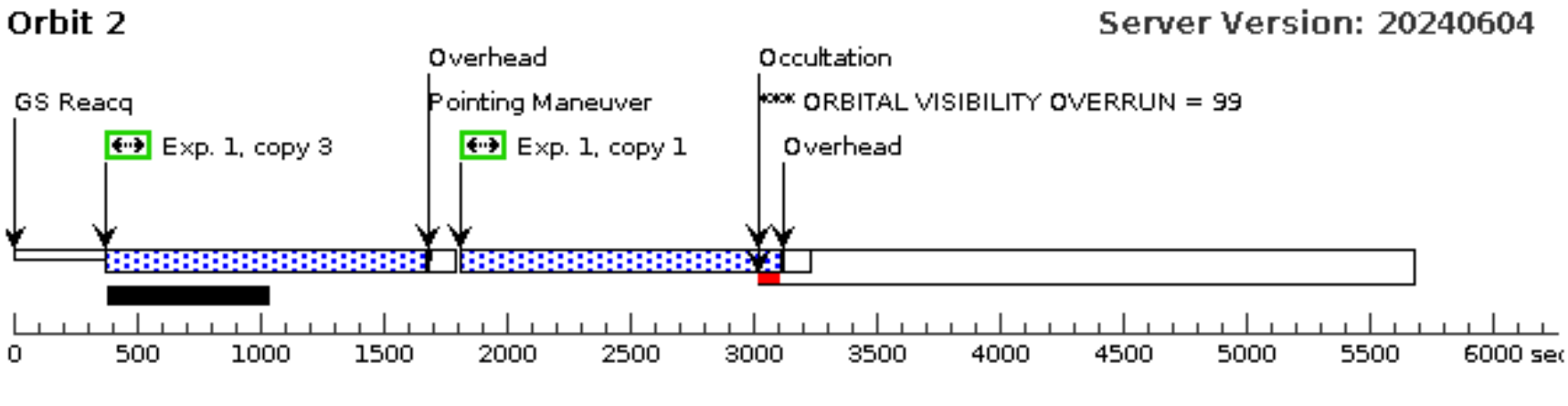
Comments:
Category=ISM
Description=[SNR]

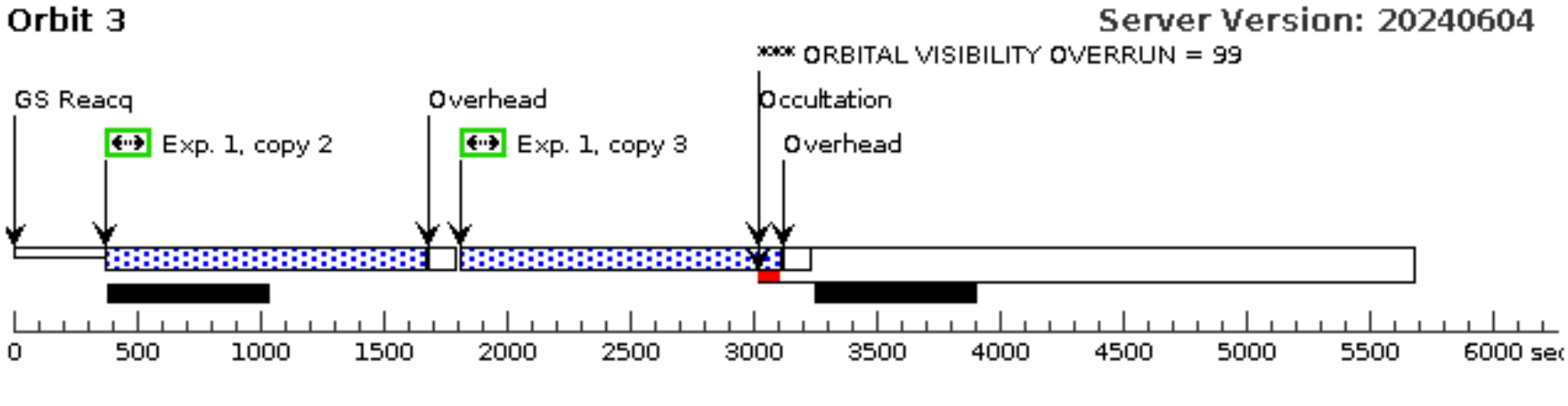
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(7) CRAB-HB-FIELD1	WFC3/UVIS, ACCUM, UVIS-CENTER	F487N	FLASH=20		Pattern 1, Exps 1-1 in Visit 07 (1)	1250 Secs X 3 (7808 Secs)	
								[==>1304.0 Secs (Pattern 1, Copy 1)] *[==>1304.0 Secs (Pattern 1, Copy 2)]*	***[1]***
								[==>1300.0 Secs (Pattern 1, Copy 3)] *[==>1300.0 Secs (Pattern 2, Copy 1)]*	***[2]***
								[==>1300.0 Secs (Pattern 2, Copy 2)] *[==>1300.0 Secs (Pattern 2, Copy 3)]*	***[3]***

Orbit Structure







Visit

Proposal 17500, Visit 08, completed Fri Jun 14 17:00:28 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: SAME ORIENT AS 01

Diagnostics

(Visit 08) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 08) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 08) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=2.414 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=false		(1)

Fixed Targets

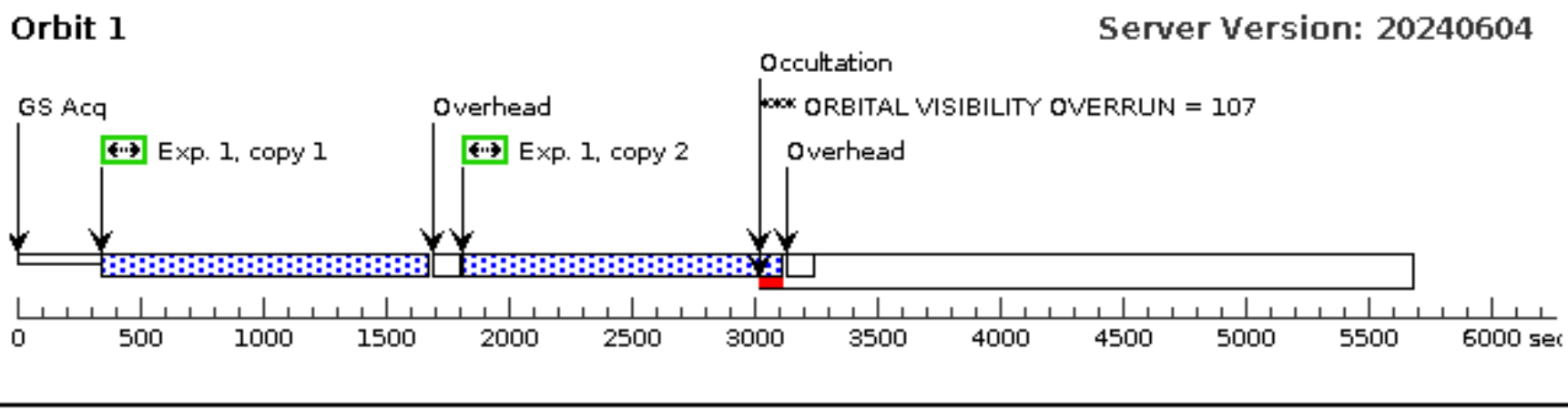
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(8)	CRAB-HB-FIELD2	RA: 05 34 29.2291 (83.6217879d) Dec: +22 01 33.13 (22.02587d) Equinox: J2000		V=9	Reference Frame: SIMBAD

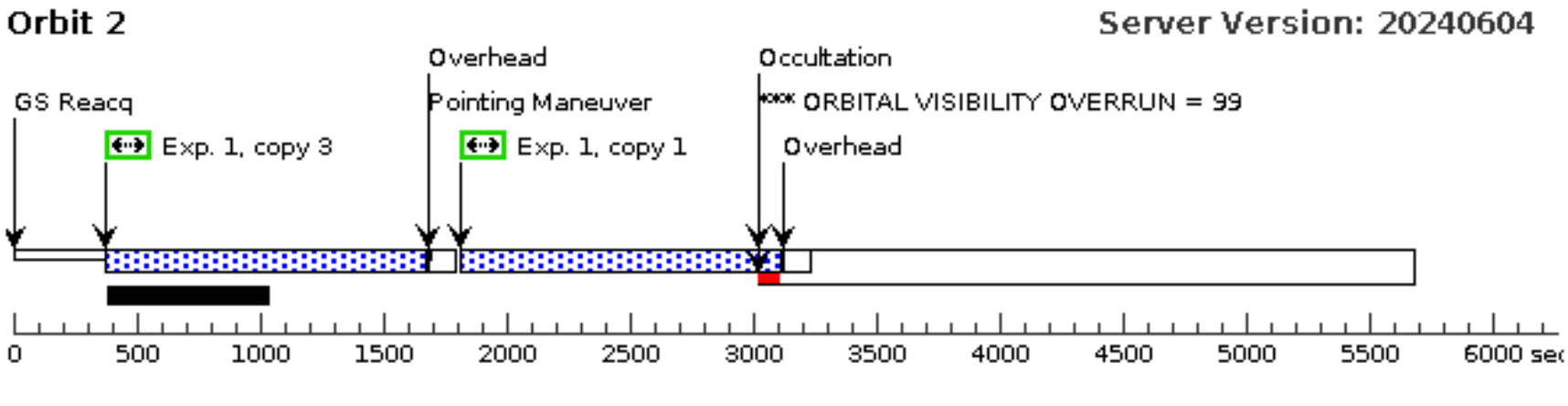
Comments:
Category=ISM
Description=[SNR]

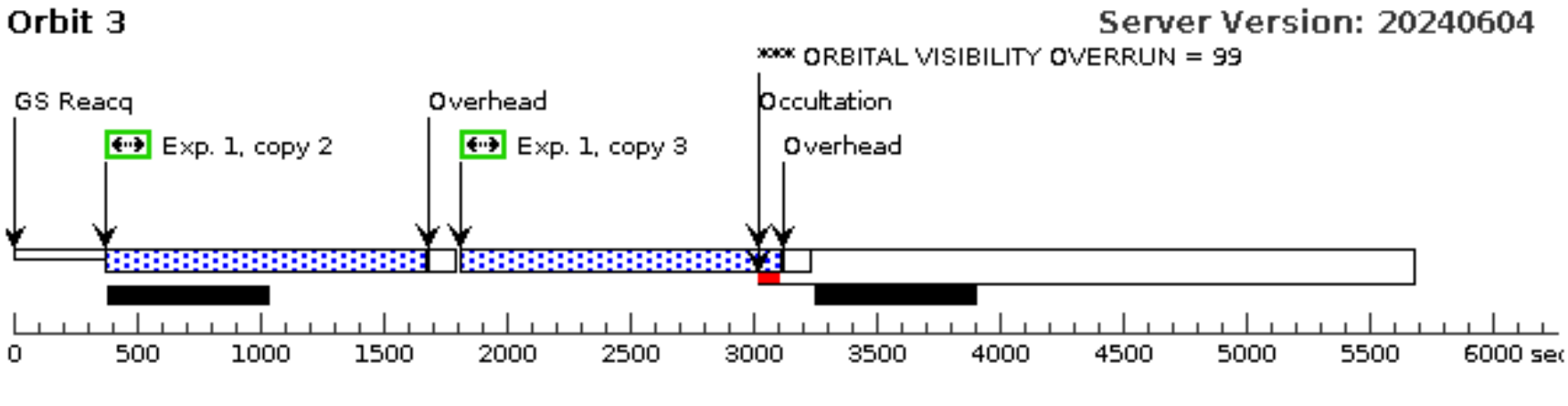
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(8) CRAB-HB-FIELD2	WFC3/UVIS, ACCUM, UVIS-CENTER	F487N	FLASH=20		Pattern 1, Exps 1-1 in Visit 08 (1)	1250 Secs X 3 (7808 Secs)	
								[==>1304.0 Secs (Pattern 1, Copy 1)] *[==>1304.0 Secs (Pattern 1, Copy 2)]*	***[1]***
								[==>1300.0 Secs (Pattern 1, Copy 3)] *[==>1300.0 Secs (Pattern 2, Copy 1)]*	***[2]***
								[==>1300.0 Secs (Pattern 2, Copy 2)] *[==>1300.0 Secs (Pattern 2, Copy 3)]*	***[3]***

Orbit Structure







Visit

Proposal 17500, Visit 09, failed Fri Jun 14 17:00:28 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: ORIENT 87D TO 87 D

Diagnostics

(Visit 09) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=2.414 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=false		(1), (2)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	CRAB-MOSAIC-P1	RA: 05 34 39.7502 (83.6656258d) Dec: +21 59 12.09 (21.98669d) Equinox: J2000	Epoch of Position: 2015.5	V=9	Reference Frame: SIMBAD

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

Exposures

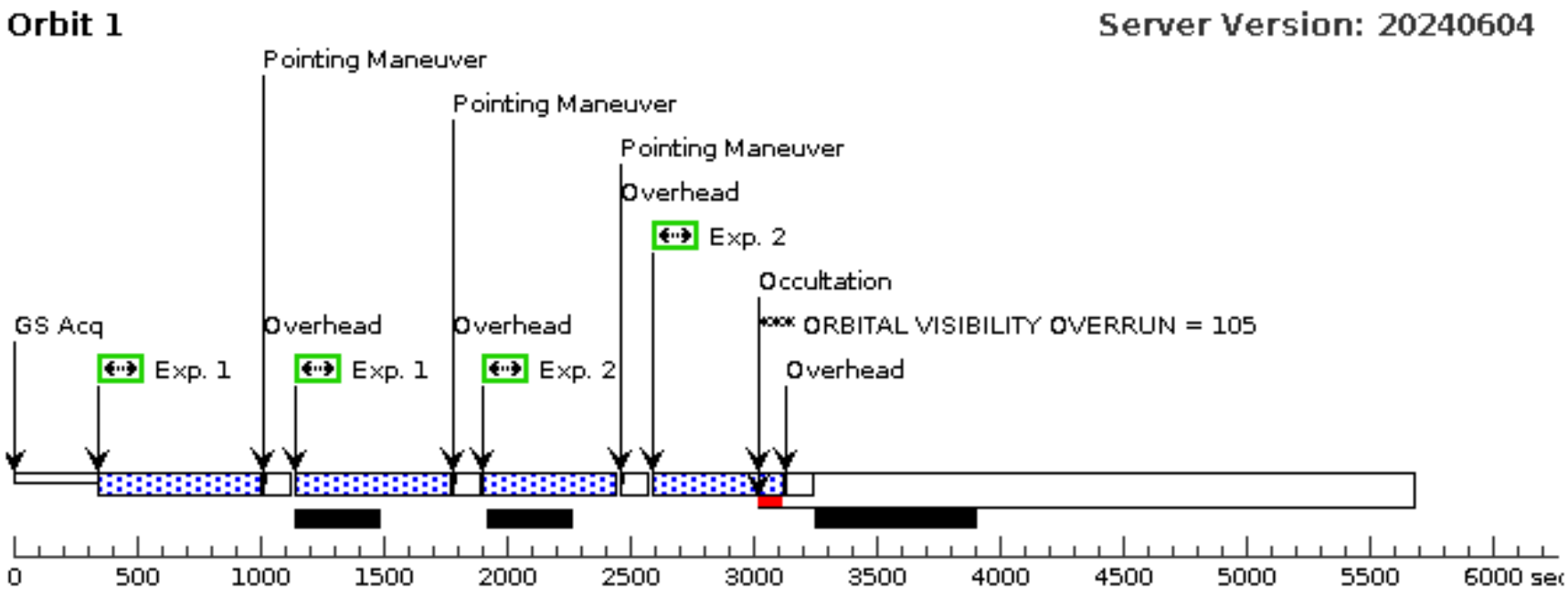
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) CRAB-MOSAIC-P1	WFC3/UVIS, ACCUM, UVIS-CENTER	F547M	FLASH=10		Pattern 1, Exps 1-1 in Visit 09 (1)	550 Secs (1262 Secs) *[==>631.0 Secs (Pattern 1)]* *[==>631.0 Secs (Pattern 2)]*	***[1]***

Comments: Re-do of visit 1 Exp. 1 (see HOPR 92765)

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
2		(1) CRAB-MOSAIC-P1	WFC3/UVIS, ACCUM, UVIS-CENTER	F763M	FLASH=15		Pattern 1, Exps 2-2 in Visit 09 (1)	450 Secs (1062 Secs) *[==>531.0 Secs (Pattern 1)]* *[==>531.0 Secs (Pattern 2)]*	***[1]***

Comments: Re-do of visit 1 Exp. 2 (see HOPR 92765)

Orbit Structure



Visit

Proposal 17500, Visit 11, implementation Fri Jun 14 17:00:28 GMT 2024

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: ORIENT 87D TO 87 D

Comments: Repeat of failed visit 09.

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=2.414 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=false		(1), (2)

Fixed Targets

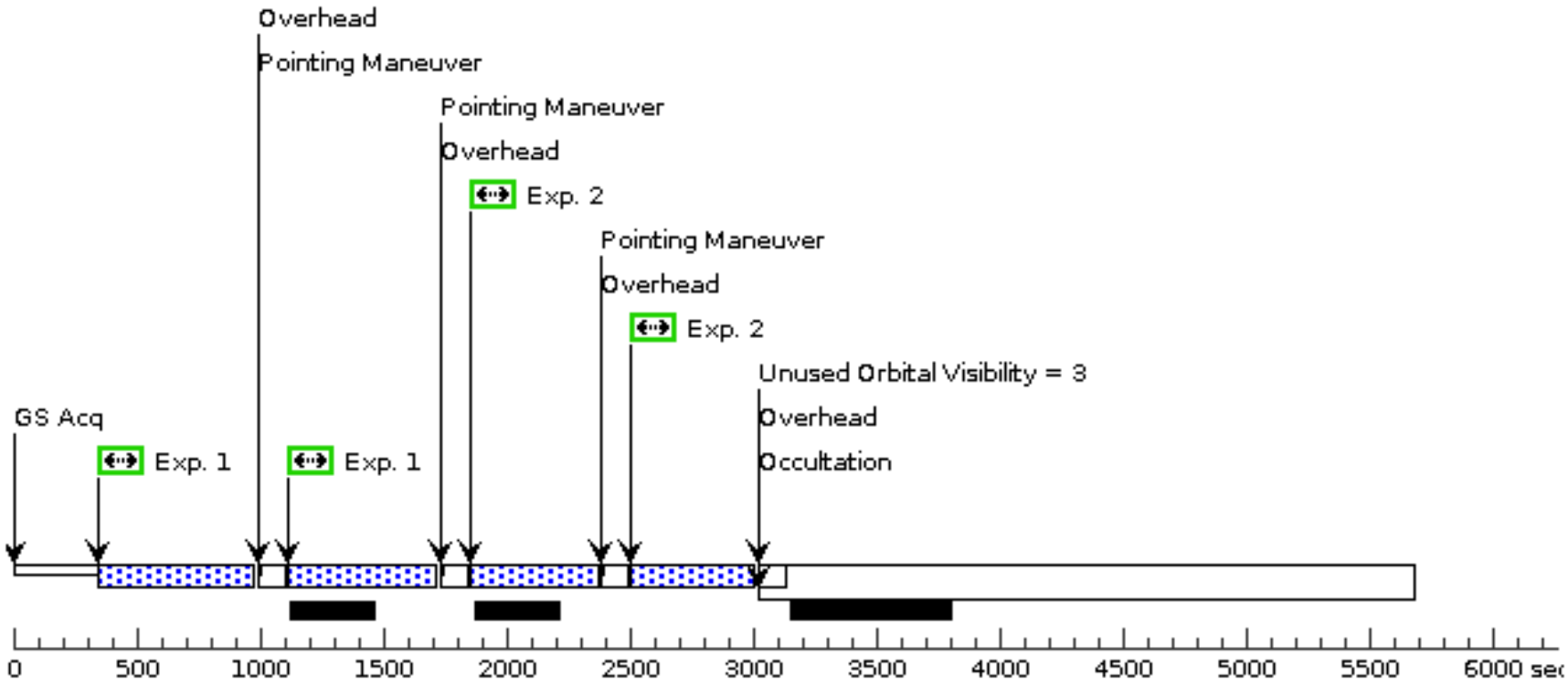
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	CRAB-MOSAIC-P1	RA: 05 34 39.7502 (83.6656258d) Dec: +21 59 12.09 (21.98669d) Equinox: J2000	Epoch of Position: 2015.5	V=9	Reference Frame: SIMBAD

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

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) CRAB-MOSAIC-P1	WFC3/UVIS, ACCUM, UVIS-CENTER	F547M	FLASH=10		Pattern 1, Exps 1-1 in Visit 11 (1)	550 Secs (1208 Secs) *[==>604.0 Secs (Pattern 1)]* *[==>604.0 Secs (Pattern 2)]*	***[1]***
Comments: Re-do of visit 1 Exp. 1 (see HOPR 92765)									
2		(1) CRAB-MOSAIC-P1	WFC3/UVIS, ACCUM, UVIS-CENTER	F763M	FLASH=15		Pattern 1, Exps 2-2 in Visit 11 (1)	450 Secs (1008 Secs) *[==>504.0 Secs (Pattern 1)]* *[==>504.0 Secs (Pattern 2)]*	***[1]***
Comments: Re-do of visit 1 Exp. 2 (see HOPR 92765)									

Orbit Structure



Visit

Proposal 17500, Visit 10, completed Fri Jun 14 17:00:28 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: SAME ORIENT AS 09

Diagnostics

(Visit 10) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=2.414 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=false		(1)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	CRAB-MOSAIC-P2	RA: 05 34 29.9379 (83.6247412d) Dec: +21 59 26.80 (21.99078d) Equinox: J2000	Epoch of Position: 2015.5	V=9	Reference Frame: SIMBAD

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

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) CRAB-MOSAIC-P2	WFC3/UVIS, ACCUM, UVIS-CENTER	F547M	FLASH=10		Pattern 2, Exps 1-1 in Visit 10 (2)	550 Secs (2478 Secs) *[==>826.0 Secs (Pattern 1)]* *[==>826.0 Secs (Pattern 2)]* *[==>826.0 Secs (Pattern 3)]*	***[1]***

Comments: Re-do of visit 2 Exp. 1 (see HOPR 92765). Pattern changes to make three dithers and use the full orbit.

Orbit Structure