



18374 - Fresh Takes on Old (HST) Favorites: Uncovering Shocks in Well-studied Planetary Nebulae

Cycle: 34, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>
Dr. Joel H. Kastner (PI) (Contact)	Rochester Institute of Technology
Dr. Paula Moraga Baez (CoI) (CSA Member)	The University of Western Ontario
Dr. Bruce Balick (CoI)	University of Washington
Dr. Stavros Akras (CoI) (ESA Member)	National Observatory of Athens
Dr. Rodolfo Montez Jr. (CoI)	Smithsonian Institution Astrophysical Observatory
Diana Ryder (CoI)	Rochester Institute of Technology

VISITS

<i>Visit</i>	<i>Targets used in Visit</i>	<i>Configurations used in Visit</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
20	(6) NGC-6543	WFC3/IR WFC3/UVIS	3	12-Aug-2026 13:00:17.0	yes
06	(7) NGC-7009	WFC3/IR WFC3/UVIS	3	12-Aug-2026 13:00:18.0	yes
07	(8) NGC-3242	WFC3/IR WFC3/UVIS	3	12-Aug-2026 13:00:20.0	yes
08	(2) PN-HB-5	WFC3/IR WFC3/UVIS	3	12-Aug-2026 13:00:21.0	yes

<i>Visit</i>	<i>Targets used in Visit</i>	<i>Configurations used in Visit</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
09	(3) NGC-2440	WFC3/IR WFC3/UVIS	3	12-Aug-2026 13:00:22.0	yes
05	(1) NGC-7027	WFC3/UVIS	1	12-Aug-2026 13:00:24.0	yes
11	(5) NGC-2818A	WFC3/IR WFC3/UVIS	3	12-Aug-2026 13:00:25.0	yes
21	(4) NGC-6537	WFC3/IR WFC3/UVIS	3	12-Aug-2026 13:00:26.0	yes

22 Total Orbits Used

ABSTRACT

Planetary nebulae (PNe) present a dizzying array of morphologies, and the "origin story" underlying this morphological diversity remains one of the unsolved problems of PN research. HST imaging first established the remarkable structural complexity of PNe, and HST narrow-band imaging still holds the key to understanding the mechanisms responsible for this complexity. We propose an HST GO/AR program consisting of first-time WFC3 atomic emission-line imaging of a sample of intensively-studied PNe, combined with comparative analysis of these new WFC3 images with the extensive library of archival WFPC2 narrow-band imaging available for these same iconic nebulae. The proposed HST/WFC3 observing program will unambiguously disentangle the zones of shocks and UV photoionization within the PNe, via spatial analysis ratios of forbidden line ([S II], N II), [Fe II] and [O I]) emission intensities to each other and to H recombination lines. The companion nebular expansion analysis obtained from comparison of late-1990's/early-2000's WFPC2 archival imaging data with the new WFC3 imagery will yield precise feature proper motions and, hence, precise nebular growth measurements. We will further employ JWST/NIRCam H2 and PAH imaging to establish the distribution of UV-irradiated molecular gas and dust within the target PNe. The proposed study will thereby provide stringent constraints on models of PN formation and structural evolution, and will serve as a pathfinder for future joint HST+JWST studies aimed at diagnosing the domains and evolution of shock-excited vs. photoionized plasma in a wide variety of astrophysical environments, from SNRs to AGN.

OBSERVING DESCRIPTION

Filters: We will obtain WFC3 images of each target PN in 8 narrow-band filters: UVIS module filters F631N+F673N+F658N+F656N for [O I] + [S II] + [N II] + H-alpha, and IR module filters F128N+F130N and F164N+F167N, respectively, for Pa-alpha and [Fe II] + off-line continuum.

Feasibility and orbit requirements: The feasibility of the proposed program is demonstrated by

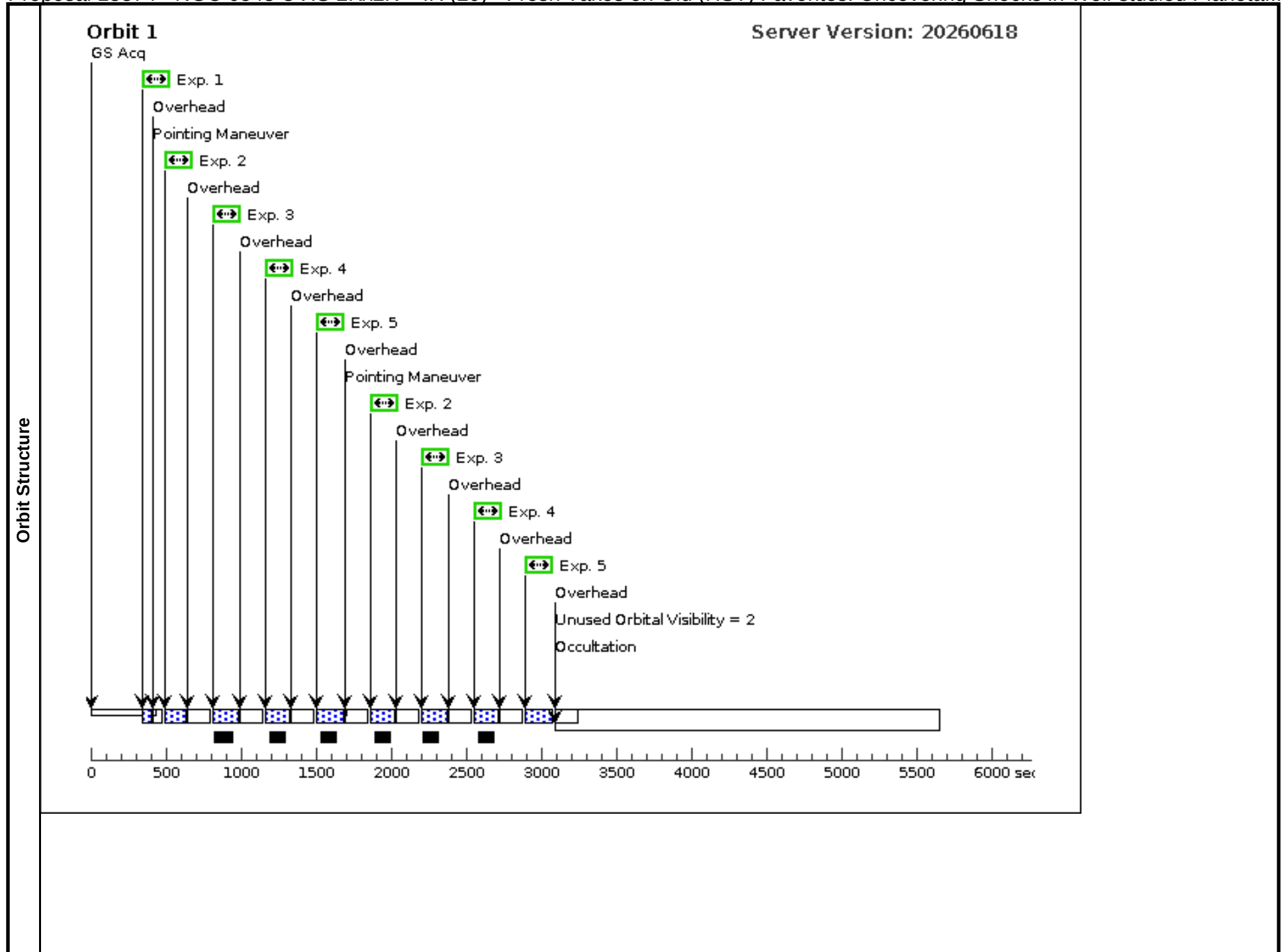
Cycle 27 (2019-2020) WFC3 imaging surveys of NGC 7027 and NGC 6302 as well as the archival (1994-2008) WFPC2 imaging of the other target PNe that, together, represent the foundation for this proposal. Exposure times in the WFPC2 narrow-band filters corresponding to the aforementioned WFC3/UVIS filters ranged from a few tens of seconds (F656N H-alpha) to a few hundred seconds (F673N [S II]), yielding high S/N imaging (see Fig. 1 of proposal), and WFC3 has greater sensitivity than WFPC in all filters. We can hence bundle the UVIS imaging into a single orbit, with total exposure times of 500-600 s per filter; exposures will be obtained via a combination of short and long integrations, to obtain unsaturated images in the brighter lines (i.e., H-alpha, [N II]). The IR module images will be obtained in two orbits (one for F128N+F130N, one for F164N+F167N), yielding sensitivities well below the threshold of the previously [Fe II]-detected nebulae (see Fig. 2). We will employ 4-point dither patterns to dither over the chip gap and provide effective CR elimination (for the UVIS module) and to maximize PSF sampling (for the IR module). The angular extents of the target PNe (from 30" to 100"; see Fig. 1 of proposal) are well matched to the WFC3 UVIS and IR FOVs, so each can be imaged with a single pointing.

Proposal 18374 - NGC 6543 UVIS 2Kx2K + IR (20) - Fresh Takes on Old (HST) Favorites: Uncovering Shocks in Well-studied Planeta...

Visit	Proposal 18374, NGC 6543 UVIS 2Kx2K + IR (20) Wed Aug 12 17:00:27 GMT 2026				
	Diagnostic Status: Warning Scientific Instruments: WFC3/IR, WFC3/UVIS Special Requirements: (none)				
Diagnostics	(F656N short exp (20.001)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F656N (20.002)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F631N (20.003)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F658N (20.004)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F673N (20.005)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser				
Patterns	#	Primary Pattern		Secondary Pattern	Exposures
	(4)	Pattern Type=WFC3-UVIS-DITHER- LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=		Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false	(2-5)
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes
	(6)	NGC-6543	RA: 17 58 33.4040 (269.6391833d) Dec: +66 37 58.75 (66.63299d) Equinox: J2000	Proper Motion RA: -0.434 mas/yr Proper Motion Dec: -6.531999952130718 mas/yr Parallax: 7.321E-4" Epoch of Position: 2000	V=11.28
	Miscellaneous Reference Frame: ICRS				
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM. Category=ISM Description=[PLANETARY NEBULA] Extended=YES				

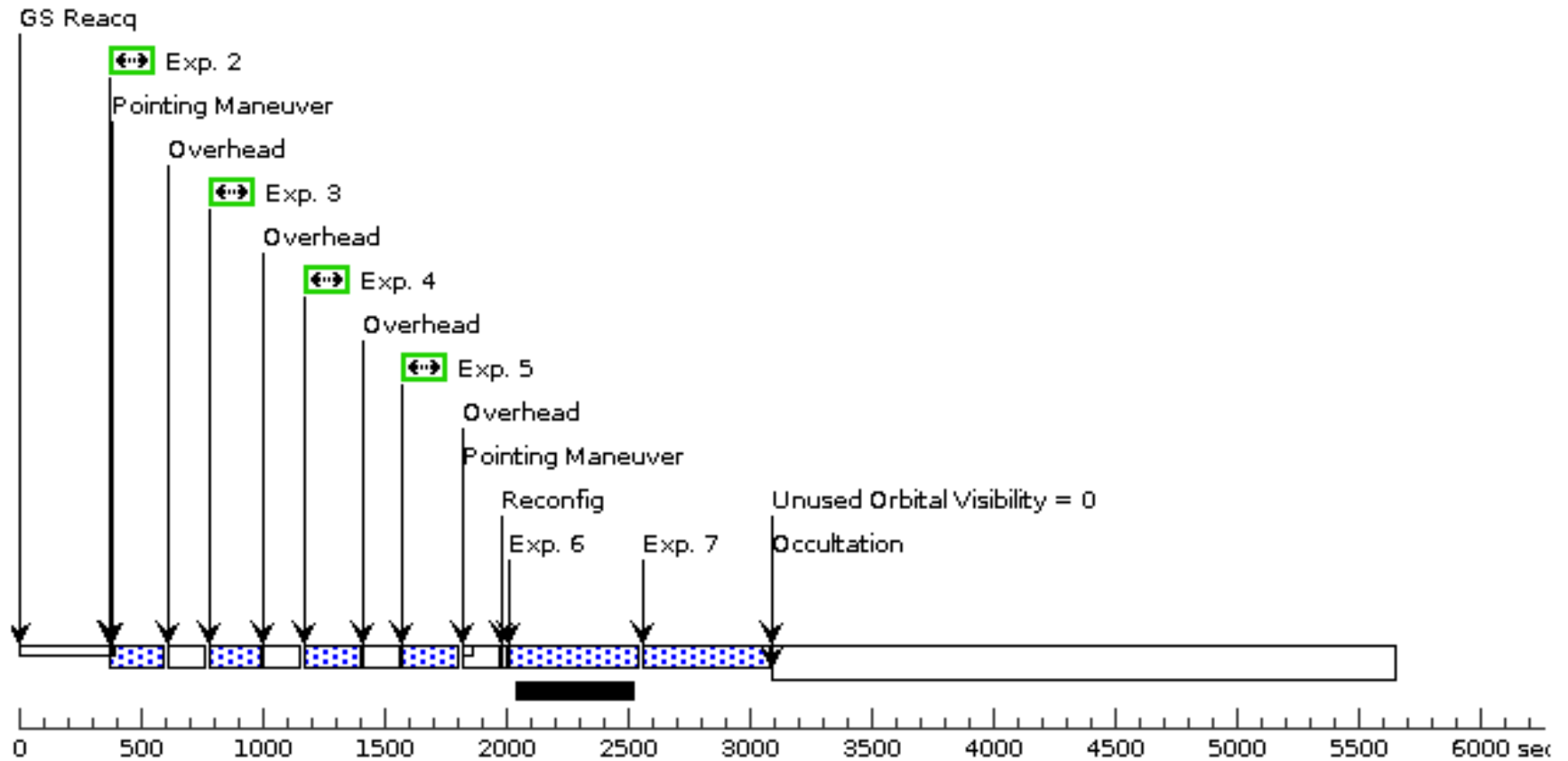
Proposal 18374 - NGC 6543 UVIS 2Kx2K + IR (20) - Fresh Takes on Old (HST) Favorites: Uncovering Shocks in Well-studied Planeta...

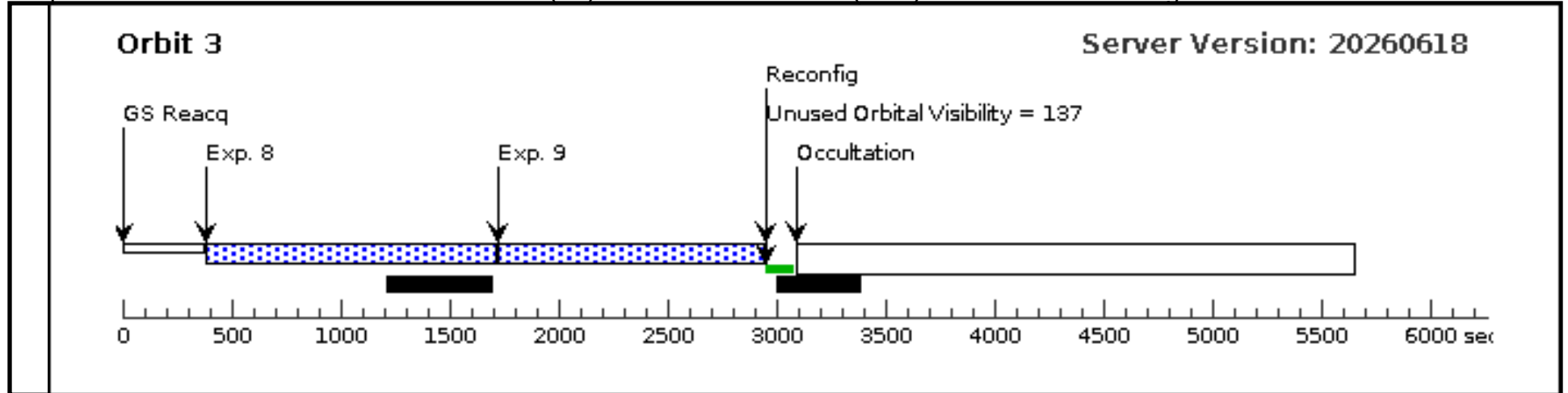
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	F656N short exp	(6) NGC-6543	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F656N				40 Secs (31 Secs) [==>31.0 Secs]	[1]
	2	F656N	(6) NGC-6543	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F656N			Pattern 4, Exps 2-5 in NGC 6543 UVIS 2 Kx2K + IR (20) (4)	200 Secs (479 Secs) [==>136.0 Secs (Pattern 1)] [==>136.0 Secs (Pattern 2)] [==>207.0 Secs (Pattern 3)]	[1] [2]
	3	F631N	(6) NGC-6543	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F631N			Pattern 4, Exps 2-5 in NGC 6543 UVIS 2 Kx2K + IR (20) (4)	200 Secs (529 Secs) [==>161.0 Secs (Pattern 1)] [==>161.0 Secs (Pattern 2)] [==>207.0 Secs (Pattern 3)]	[1] [2]
	4	F658N	(6) NGC-6543	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F658N			Pattern 4, Exps 2-5 in NGC 6543 UVIS 2 Kx2K + IR (20) (4)	200 Secs (479 Secs) [==>136.0 Secs (Pattern 1)] [==>136.0 Secs (Pattern 2)] [==>207.0 Secs (Pattern 3)]	[1] [2]
	5	F673N	(6) NGC-6543	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F673N			Pattern 4, Exps 2-5 in NGC 6543 UVIS 2 Kx2K + IR (20) (4)	200 Secs (527 Secs) [==>160.0 Secs (Pattern 1)] [==>160.0 Secs (Pattern 2)] [==>207.0 Secs (Pattern 3)]	[1] [2]
	6	F128N	(6) NGC-6543	WFC3/IR, MULTIACCUM, IR	F128N	NSAMP=6; SAMP-SEQ=SPAR S100			502.933906 Secs (502.934 Secs) [==>]	[2]
	7	F130N	(6) NGC-6543	WFC3/IR, MULTIACCUM, IR	F130N	NSAMP=6; SAMP-SEQ=SPAR S100			502.933906 Secs (502.934 Secs) [==>]	[2]
	8	F164N	(6) NGC-6543	WFC3/IR, MULTIACCUM, IR	F164N	NSAMP=14; SAMP-SEQ=SPAR S100			1302.93649 Secs (1302.936 Secs) [==>]	[3]
	9	F167N	(6) NGC-6543	WFC3/IR, MULTIACCUM, IR	F167N	NSAMP=13; SAMP-SEQ=SPAR S100			1202.936167 Secs (1202.936 Secs) [==>]	[3]



Orbit 2

Server Version: 20260618



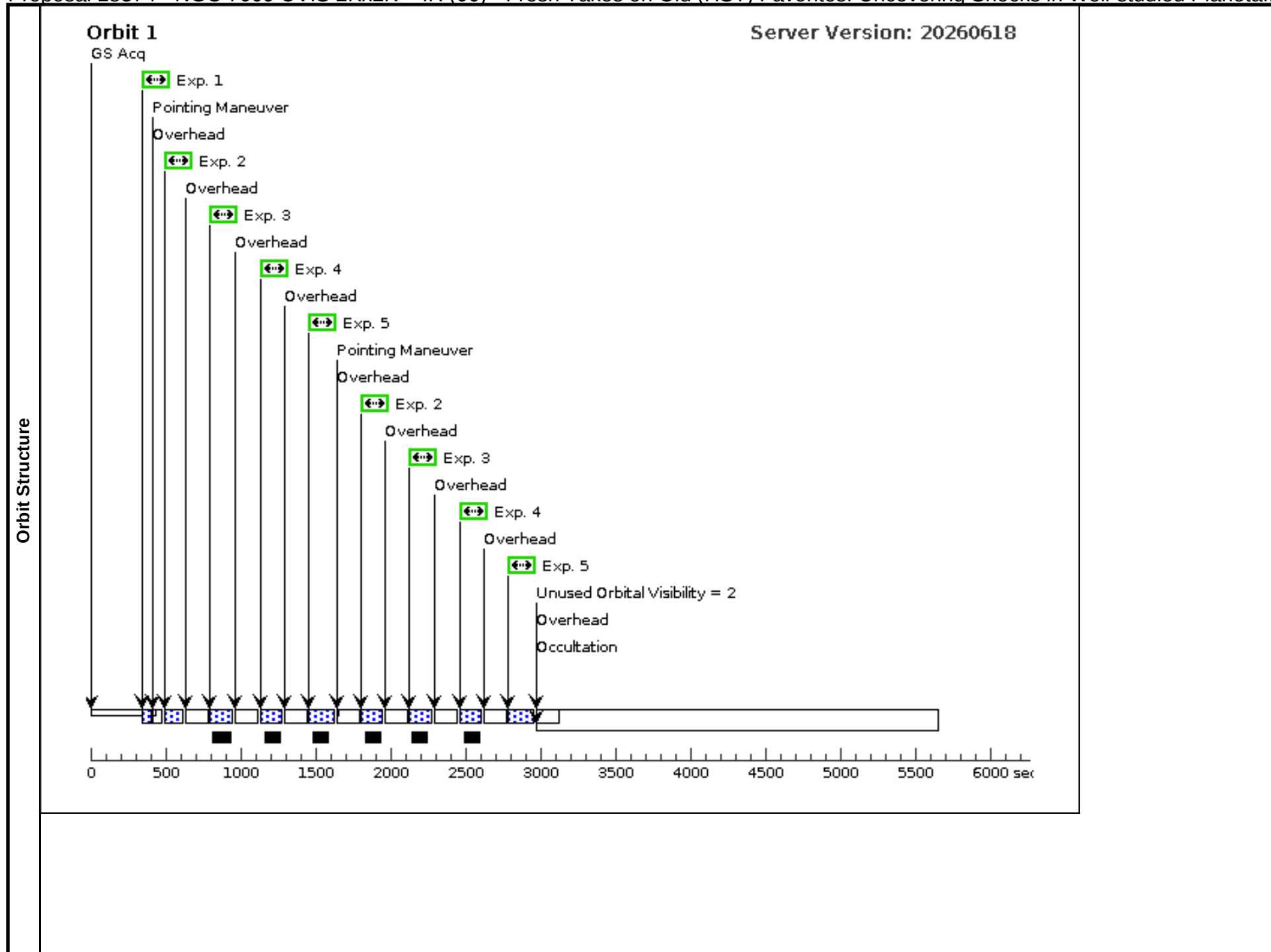


Proposal 18374 - NGC 7009 UVIS 2Kx2K + IR (06) - Fresh Takes on Old (HST) Favorites: Uncovering Shocks in Well-studied Planeta...

Visit	Proposal 18374, NGC 7009 UVIS 2Kx2K + IR (06) Wed Aug 12 17:00:27 GMT 2026				
	Diagnostic Status: Warning Scientific Instruments: WFC3/IR, WFC3/UVIS Special Requirements: (none)				
Diagnostics	(F656N short exp (06.001)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F656N (06.002)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F631N (06.003)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F658N (06.004)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F673N (06.005)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser				
Patterns	#	Primary Pattern		Secondary Pattern	Exposures
	(4)	Pattern Type=WFC3-UVIS-DITHER- LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=		Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false	(2-5)
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes
	(7)	NGC-7009	RA: 21 04 10.8155 (316.0450646d) Dec: -11 21 48.58 (-11.36349d) Equinox: J2000	Proper Motion RA: 7.568 mas/yr Proper Motion Dec: 0.874 mas/yr Parallax: 8.123000000000001E-4" Epoch of Position: 2000	V=12.07
	Miscellaneous Reference Frame: ICRS				
	<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i> <i>SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.</i> Category=ISM Description=[PLANETARY NEBULA] Extended=YES				

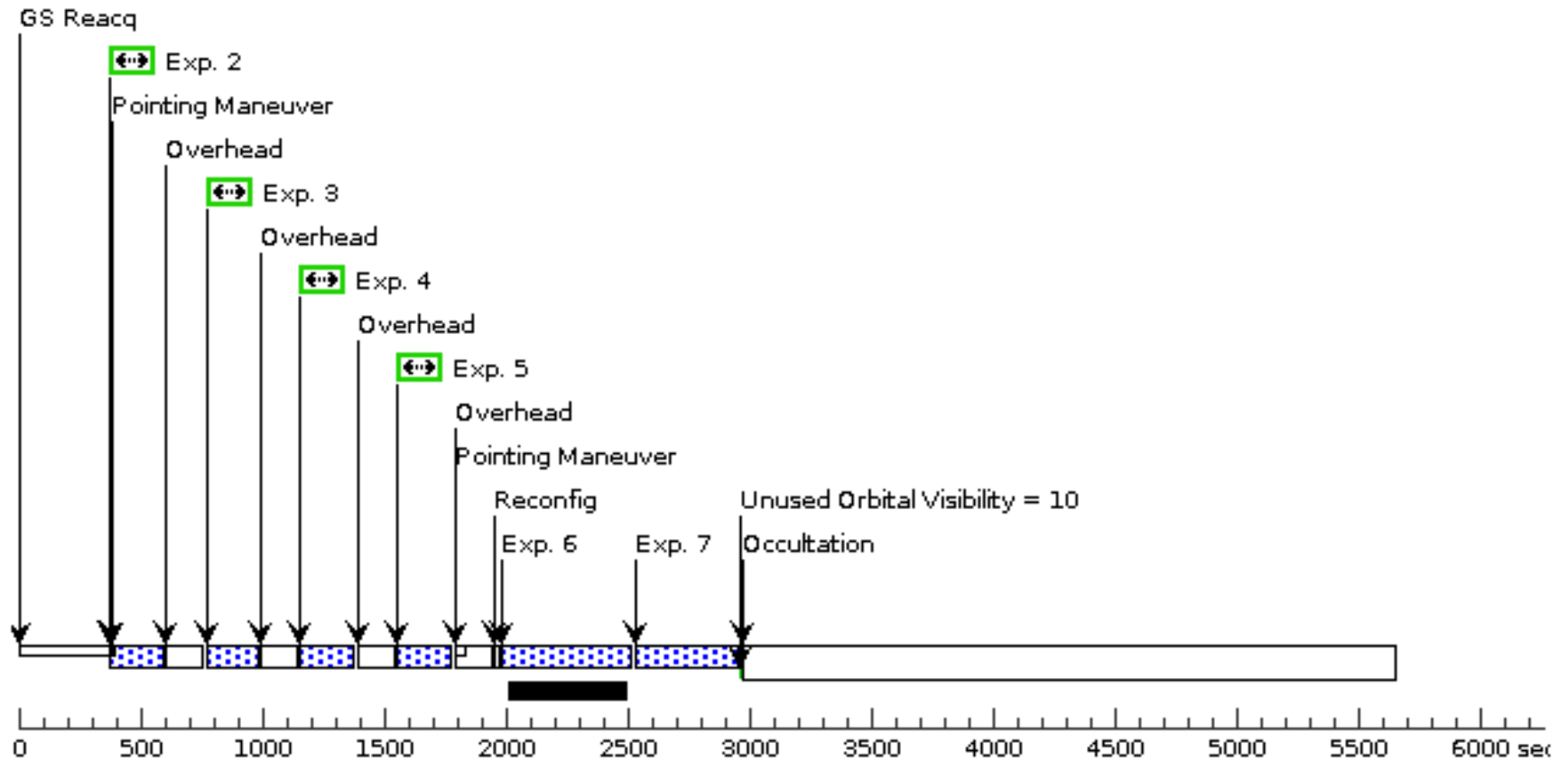
Proposal 18374 - NGC 7009 UVIS 2Kx2K + IR (06) - Fresh Takes on Old (HST) Favorites: Uncovering Shocks in Well-studied Planeta...

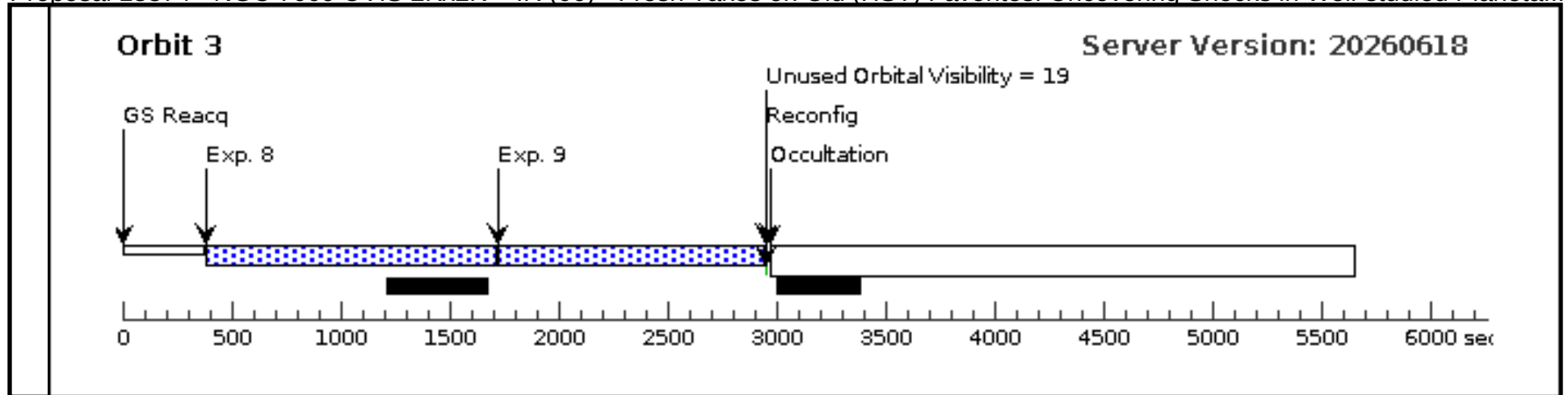
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	F656N short exp	(7) NGC-7009	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F656N				40 Secs (31 Secs) [==>31.0 Secs]	[1]
	2	F656N	(7) NGC-7009	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F656N			Pattern 4, Exps 2-5 in NGC 7009 UVIS 2 Kx2K + IR (06) (4)	200 Secs (442 Secs) [==>121.0 Secs (Pattern 1)] [==>121.0 Secs (Pattern 2)] [==>(Pattern 3)]	[1] [2]
	3	F631N	(7) NGC-7009	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F631N			Pattern 4, Exps 2-5 in NGC 7009 UVIS 2 Kx2K + IR (06) (4)	200 Secs (492 Secs) [==>146.0 Secs (Pattern 1)] [==>146.0 Secs (Pattern 2)] [==>(Pattern 3)]	[1] [2]
	4	F658N	(7) NGC-7009	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F658N			Pattern 4, Exps 2-5 in NGC 7009 UVIS 2 Kx2K + IR (06) (4)	200 Secs (442 Secs) [==>121.0 Secs (Pattern 1)] [==>121.0 Secs (Pattern 2)] [==>(Pattern 3)]	[1] [2]
	5	F673N	(7) NGC-7009	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F673N			Pattern 4, Exps 2-5 in NGC 7009 UVIS 2 Kx2K + IR (06) (4)	200 Secs (492 Secs) [==>146.0 Secs (Pattern 1)] [==>146.0 Secs (Pattern 2)] [==>(Pattern 3)]	[1] [2]
	6	F128N	(7) NGC-7009	WFC3/IR, MULTIACCUM, IR	F128N	NSAMP=6; SAMP-SEQ=SPAR S100			502.933906 Secs (502.934 Secs) [==>]	[2]
	7	F130N	(7) NGC-7009	WFC3/IR, MULTIACCUM, IR	F130N	NSAMP=5; SAMP-SEQ=SPAR S100			402.933583 Secs (402.934 Secs) [==>]	[2]
	8	F164N	(7) NGC-7009	WFC3/IR, MULTIACCUM, IR	F164N	NSAMP=14; SAMP-SEQ=SPAR S100			1302.93649 Secs (1302.936 Secs) [==>]	[3]
	9	F167N	(7) NGC-7009	WFC3/IR, MULTIACCUM, IR	F167N	NSAMP=13; SAMP-SEQ=SPAR S100			1202.936167 Secs (1202.936 Secs) [==>]	[3]



Orbit 2

Server Version: 20260618





Proposal 18374 - NGC 3242 UVIS 2Kx2K + IR (07) - Fresh Takes on Old (HST) Favorites: Uncovering Shocks in Well-studied Planeta...

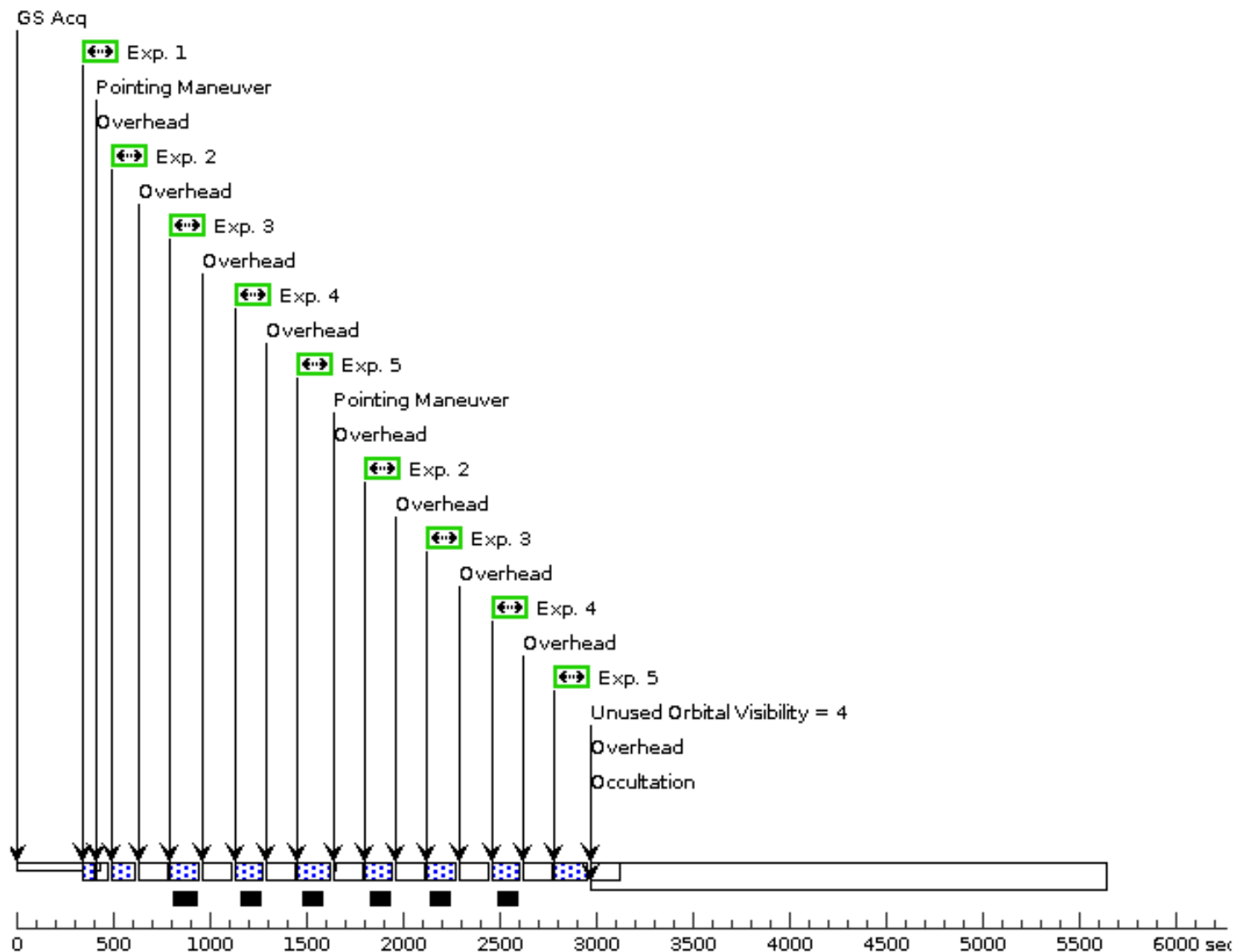
Visit	Proposal 18374, NGC 3242 UVIS 2Kx2K + IR (07) Wed Aug 12 17:00:27 GMT 2026				
	Diagnostic Status: Warning Scientific Instruments: WFC3/IR, WFC3/UVIS Special Requirements: (none)				
Diagnostics	(F656N short exp (07.001)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F656N (07.002)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F631N (07.003)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F658N (07.004)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F673N (07.005)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser				
Patterns	#	Primary Pattern		Secondary Pattern	Exposures
	(4)	Pattern Type=WFC3-UVIS-DITHER- LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=		Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false	(2-5)
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes
	(8)	NGC-3242	RA: 10 24 46.1336 (156.1922233d) Dec: -18 38 32.30 (-18.64231d) Equinox: J2000	Proper Motion RA: -4.596 mas/yr Proper Motion Dec: 0.825 mas/yr Parallax: 7.452E-4" Epoch of Position: 2000	V=12.15
	Miscellaneous Reference Frame: ICRS				
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM. Category=ISM Description=[PLANETARY NEBULA] Extended=YES				

Proposal 18374 - NGC 3242 UVIS 2Kx2K + IR (07) - Fresh Takes on Old (HST) Favorites: Uncovering Shocks in Well-studied Planeta...

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	F656N short exp	(8) NGC-3242	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F656N				40 Secs (31 Secs) [==>31.0 Secs]	[1]
	2	F656N	(8) NGC-3242	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F656N			Pattern 4, Exps 2-5 in NGC 3242 UVIS 2 Kx2K + IR (07) (4)	200 Secs (396 Secs) [==>121.0 Secs (Pattern 1)] [==>121.0 Secs (Pattern 2)] [==>154.0 Secs (Pattern 3)]	[1] [2]
	3	F631N	(8) NGC-3242	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F631N			Pattern 4, Exps 2-5 in NGC 3242 UVIS 2 Kx2K + IR (07) (4)	200 Secs (446 Secs) [==>146.0 Secs (Pattern 1)] [==>146.0 Secs (Pattern 2)] [==>154.0 Secs (Pattern 3)]	[1] [2]
	4	F658N	(8) NGC-3242	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F658N			Pattern 4, Exps 2-5 in NGC 3242 UVIS 2 Kx2K + IR (07) (4)	200 Secs (372 Secs) [==>121.0 Secs (Pattern 1)] [==>121.0 Secs (Pattern 2)] [==>130.0 Secs (Pattern 3)]	[1] [2]
	5	F673N	(8) NGC-3242	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F673N			Pattern 4, Exps 2-5 in NGC 3242 UVIS 2 Kx2K + IR (07) (4)	200 Secs (446 Secs) [==>146.0 Secs (Pattern 1)] [==>146.0 Secs (Pattern 2)] [==>154.0 Secs (Pattern 3)]	[1] [2]
	6	F128N	(8) NGC-3242	WFC3/IR, MULTIACCUM, IR	F128N	NSAMP=7; SAMP-SEQ=SPAR S100			602.934229 Secs (602.934 Secs) [==>]	[2]
	7	F130N	(8) NGC-3242	WFC3/IR, MULTIACCUM, IR	F130N	NSAMP=6; SAMP-SEQ=SPAR S100			502.933906 Secs (502.934 Secs) [==>]	[2]
	8	F164N	(8) NGC-3242	WFC3/IR, MULTIACCUM, IR	F164N	NSAMP=14; SAMP-SEQ=SPAR S100			1302.93649 Secs (1302.936 Secs) [==>]	[3]
	9	F167N	(8) NGC-3242	WFC3/IR, MULTIACCUM, IR	F167N	NSAMP=13; SAMP-SEQ=SPAR S100			1202.936167 Secs (1202.936 Secs) [==>]	[3]

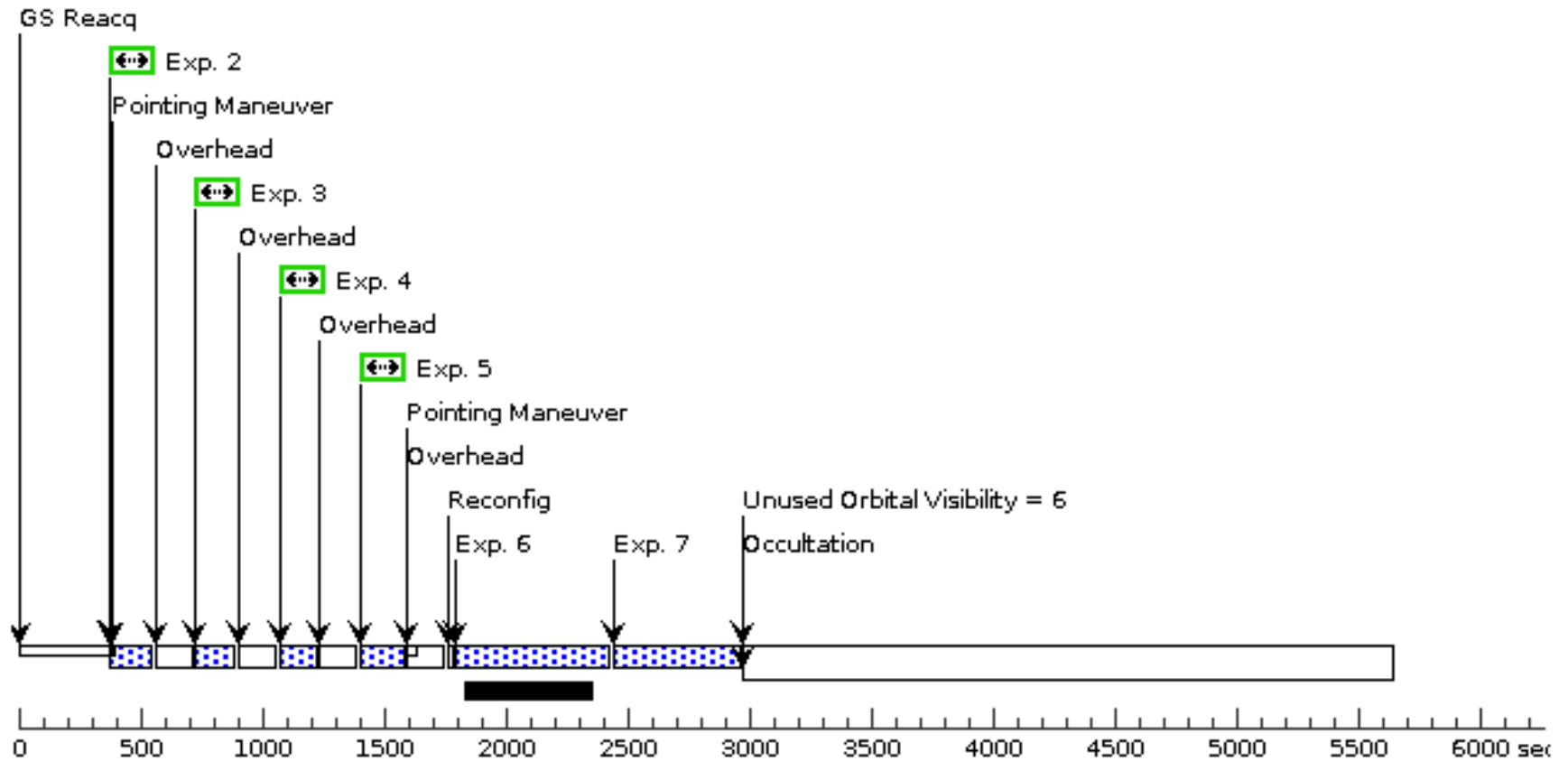
Orbit 1

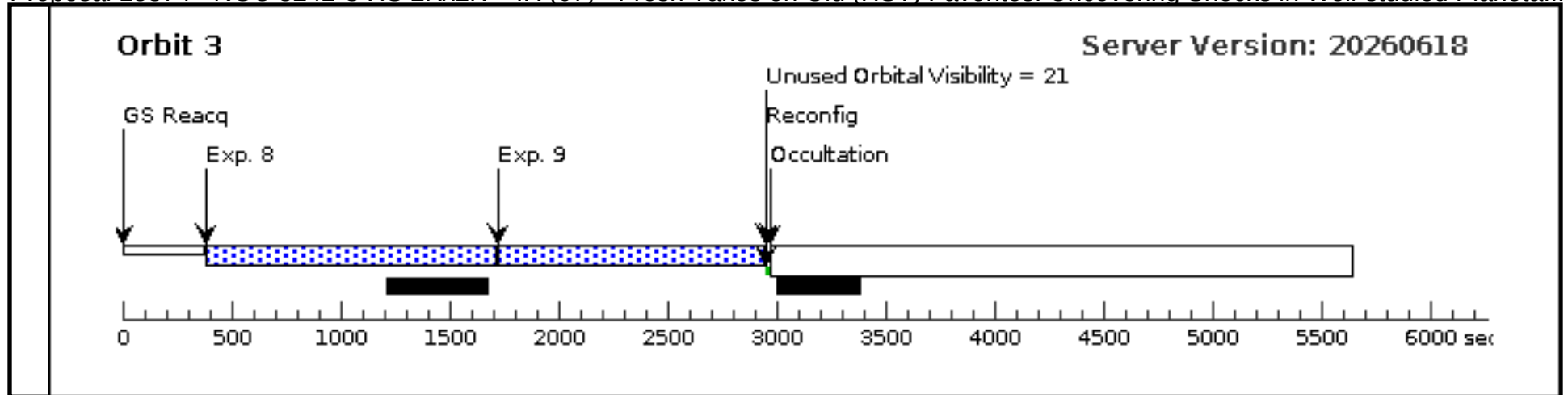
Server Version: 20260618



Orbit 2

Server Version: 20260618



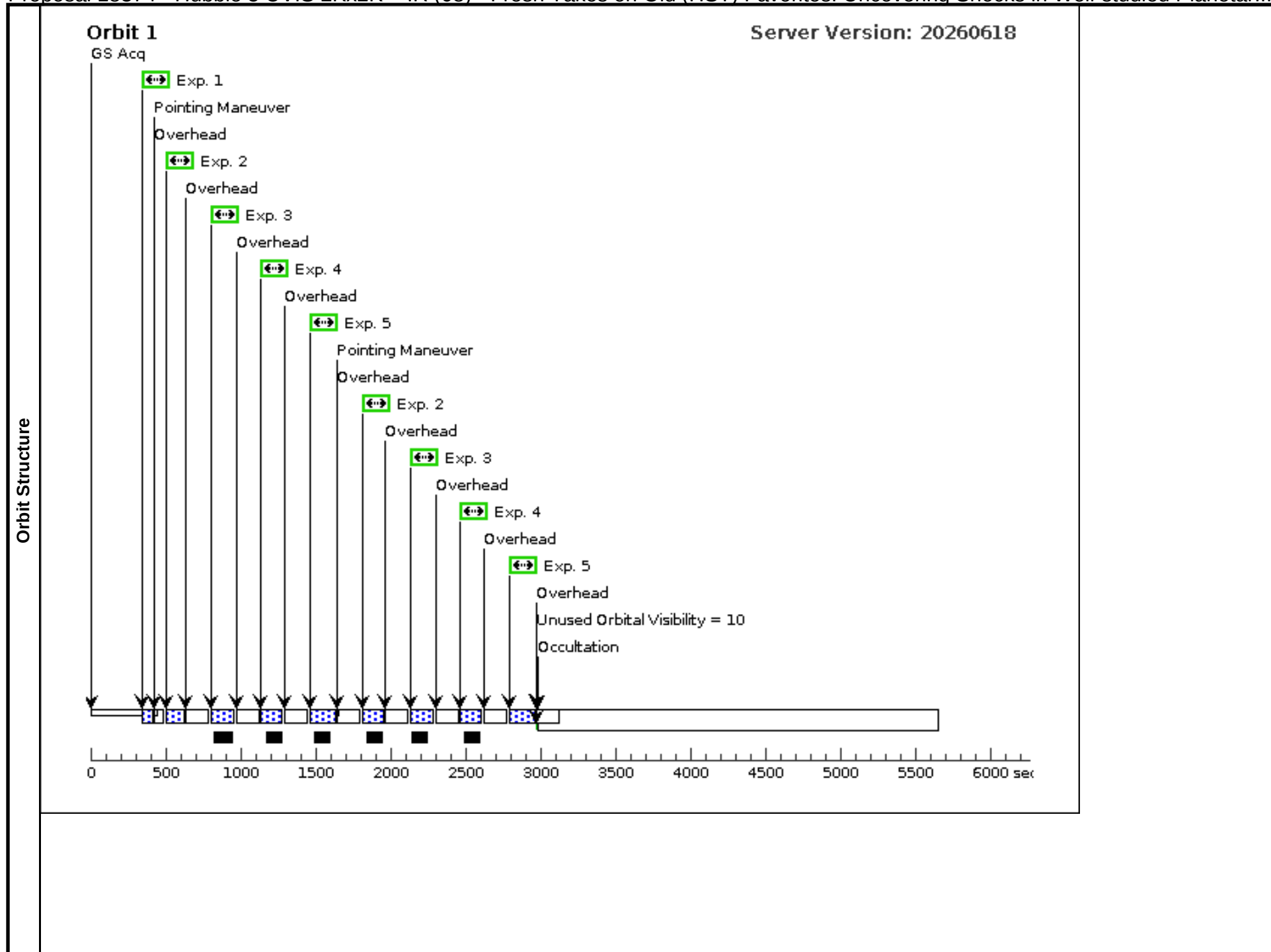


Proposal 18374 - Hubble 5 UVIS 2Kx2K + IR (08) - Fresh Takes on Old (HST) Favorites: Uncovering Shocks in Well-studied Planetar...

Visit	Proposal 18374, Hubble 5 UVIS 2Kx2K + IR (08) Wed Aug 12 17:00:27 GMT 2026				
	Diagnostic Status: Warning Scientific Instruments: WFC3/IR, WFC3/UVIS Special Requirements: (none)				
Diagnostics	(F656N short exp (08.001)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F656N (08.002)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F631N (08.003)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F658N (08.004)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F673N (08.005)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser				
Patterns	#	Primary Pattern	Secondary Pattern	Exposures	
	(4)	Pattern Type=WFC3-UVIS-DITHER- LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false	(2-5)	
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes
	(2)	PN-HB-5	RA: 17 47 56.2000 (266.9841667d) Dec: -29 59 39.60 (-29.99433d) Equinox: J2000	Epoch of Position: 2000	V=10.78
	Miscellaneous Reference Frame: ICRS				
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Category=ISM Description=[PLANETARY NEBULA] Extended=YES				

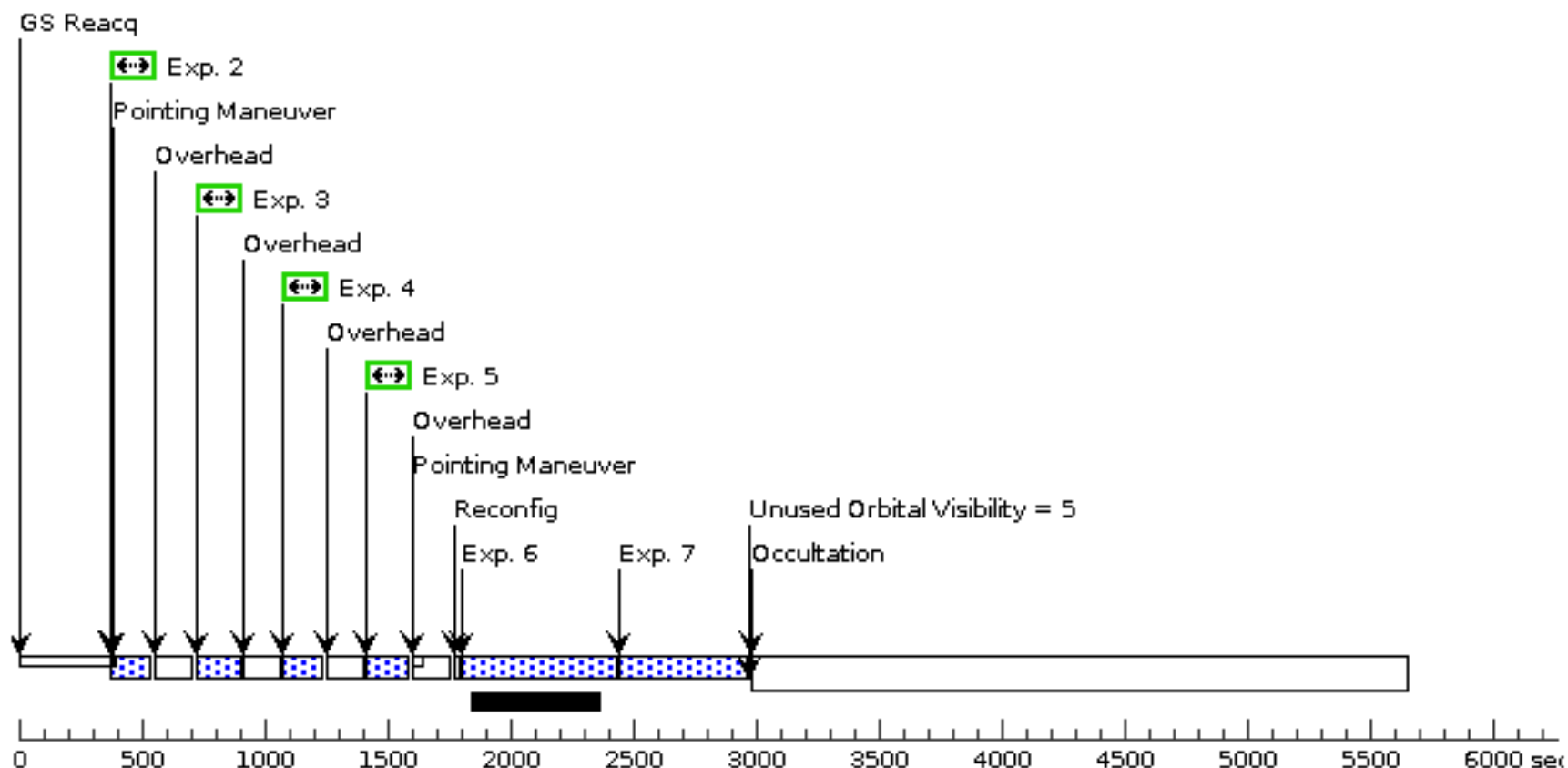
Proposal 18374 - Hubble 5 UVIS 2Kx2K + IR (08) - Fresh Takes on Old (HST) Favorites: Uncovering Shocks in Well-studied Planetar...

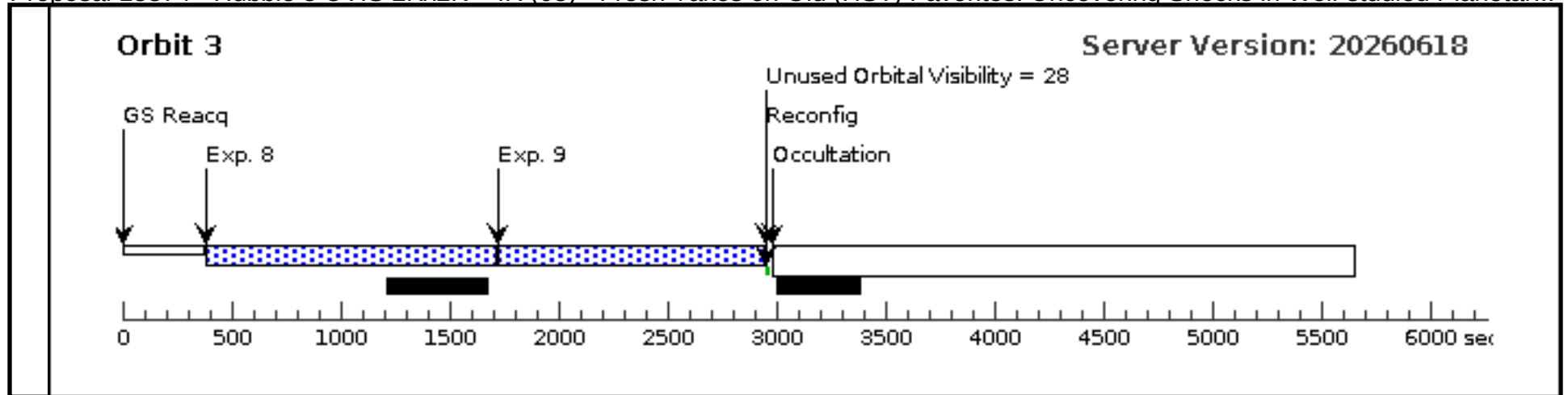
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	F656N short exp	(2) PN-HB-5	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F656N				40 Secs (40 Secs) [==>40.0 Secs]	[1]
	2	F656N	(2) PN-HB-5	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F656N			Pattern 4, Exps 2-5 in Hubble 5 UVIS 2K x2K + IR (08) (4)	200 Secs (385 Secs) [==>120.0 Secs (Pattern 1)] [==>120.0 Secs (Pattern 2)] [==>145.0 Secs (Pattern 3)]	[1] [2]
	3	F631N	(2) PN-HB-5	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F631N			Pattern 4, Exps 2-5 in Hubble 5 UVIS 2K x2K + IR (08) (4)	200 Secs (460 Secs) [==>145.0 Secs (Pattern 1)] [==>145.0 Secs (Pattern 2)] [==>170.0 Secs (Pattern 3)]	[1] [2]
	4	F658N	(2) PN-HB-5	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F658N			Pattern 4, Exps 2-5 in Hubble 5 UVIS 2K x2K + IR (08) (4)	200 Secs (375 Secs) [==>120.0 Secs (Pattern 1)] [==>120.0 Secs (Pattern 2)] [==>135.0 Secs (Pattern 3)]	[1] [2]
	5	F673N	(2) PN-HB-5	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F673N			Pattern 4, Exps 2-5 in Hubble 5 UVIS 2K x2K + IR (08) (4)	200 Secs (440 Secs) [==>145.0 Secs (Pattern 1)] [==>145.0 Secs (Pattern 2)] [==>150.0 Secs (Pattern 3)]	[1] [2]
	6	F128N	(2) PN-HB-5	WFC3/IR, MULTIACCUM, IR	F128N	NSAMP=7; SAMP-SEQ=SPAR S100			602.934229 Secs (602.934 Secs) [==>]	[2]
	7	F130N	(2) PN-HB-5	WFC3/IR, MULTIACCUM, IR	F130N	NSAMP=6; SAMP-SEQ=SPAR S100			502.933906 Secs (502.934 Secs) [==>]	[2]
	8	F164N	(2) PN-HB-5	WFC3/IR, MULTIACCUM, IR	F164N	NSAMP=14; SAMP-SEQ=SPAR S100			1302.93649 Secs (1302.936 Secs) [==>]	[3]
	9	F167N	(2) PN-HB-5	WFC3/IR, MULTIACCUM, IR	F167N	NSAMP=13; SAMP-SEQ=SPAR S100			1202.936167 Secs (1202.936 Secs) [==>]	[3]



Orbit 2

Server Version: 20260618



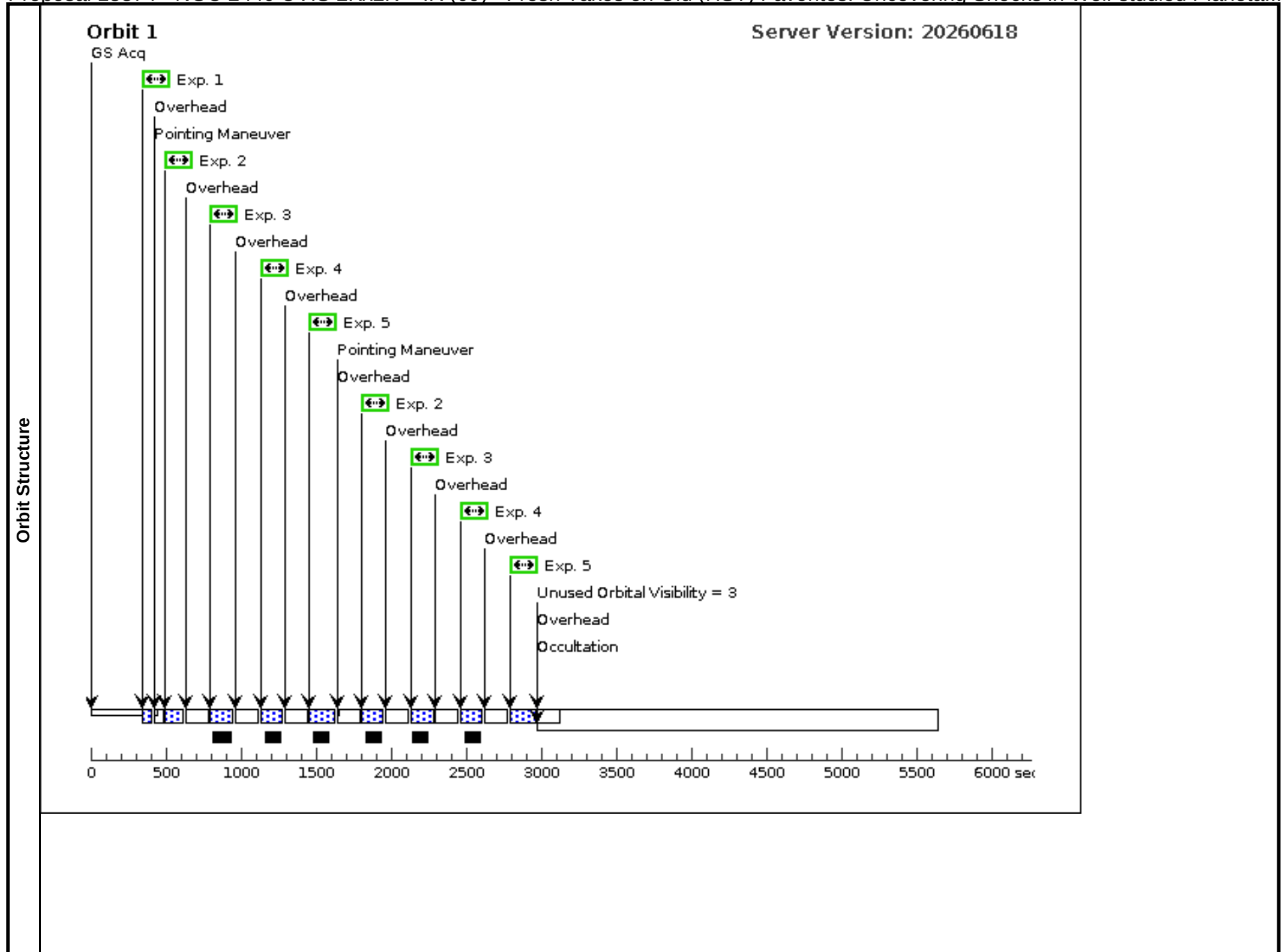


Proposal 18374 - NGC 2440 UVIS 2Kx2K + IR (09) - Fresh Takes on Old (HST) Favorites: Uncovering Shocks in Well-studied Planeta...

Visit	Proposal 18374, NGC 2440 UVIS 2Kx2K + IR (09) Wed Aug 12 17:00:27 GMT 2026				
	Diagnostic Status: Warning Scientific Instruments: WFC3/IR, WFC3/UVIS Special Requirements: (none)				
Diagnostics	(F656N short exp (09.001)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F656N (09.002)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F631N (09.003)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F658N (09.004)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F673N (09.005)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser				
Patterns	#	Primary Pattern	Secondary Pattern	Exposures	
	(4)	Pattern Type=WFC3-UVIS-DITHER- LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false	(2-5)	
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes
	(3)	NGC-2440	RA: 07 41 55.3460 (115.4806083d) Dec: -18 12 30.41 (-18.20845d) Equinox: J2000	Epoch of Position: 2000	V=10.104
	Miscellaneous Reference Frame: ICRS				
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Category=ISM Description=[PLANETARY NEBULA] Extended=YES				

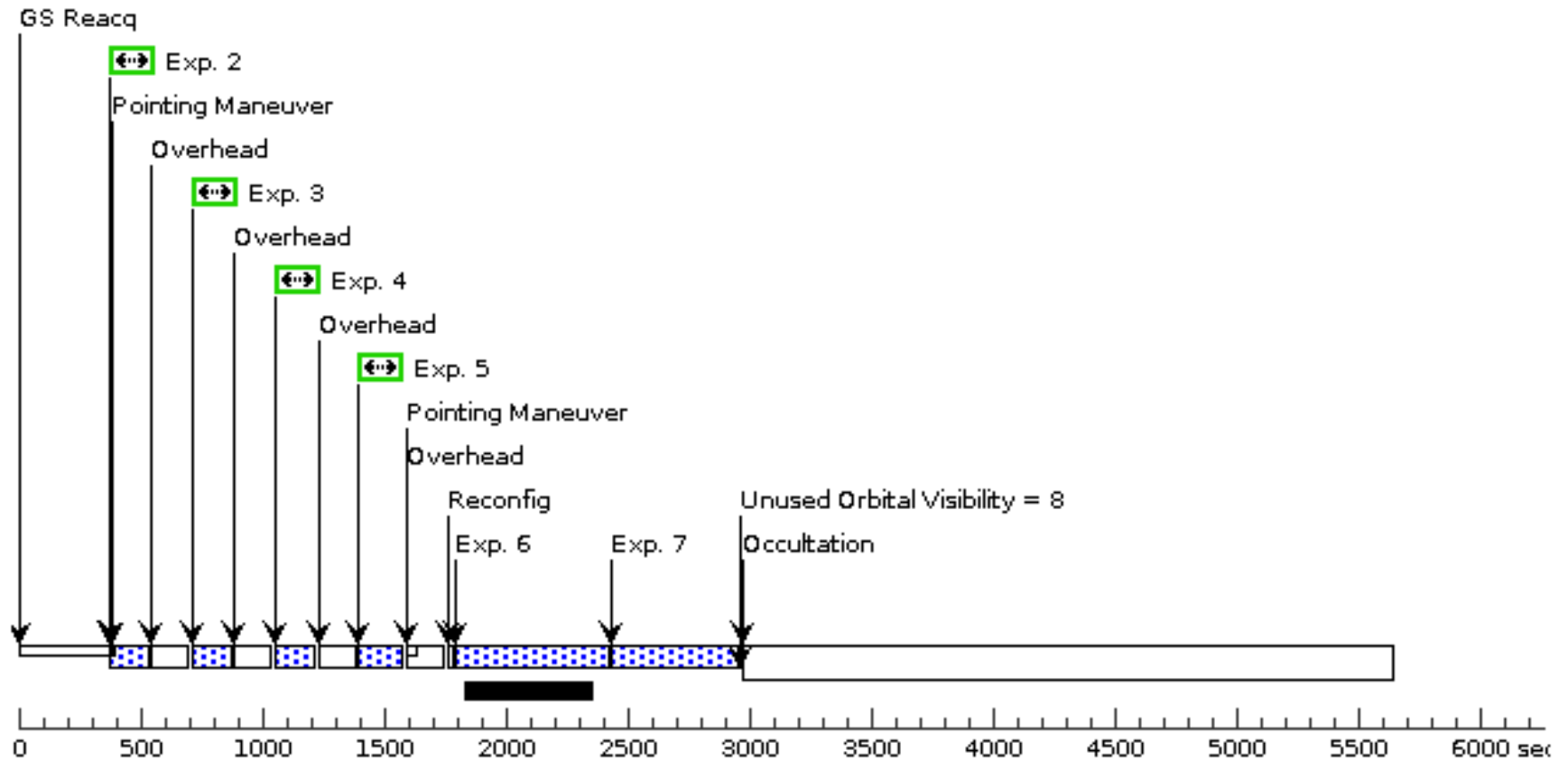
Proposal 18374 - NGC 2440 UVIS 2Kx2K + IR (09) - Fresh Takes on Old (HST) Favorites: Uncovering Shocks in Well-studied Planeta...

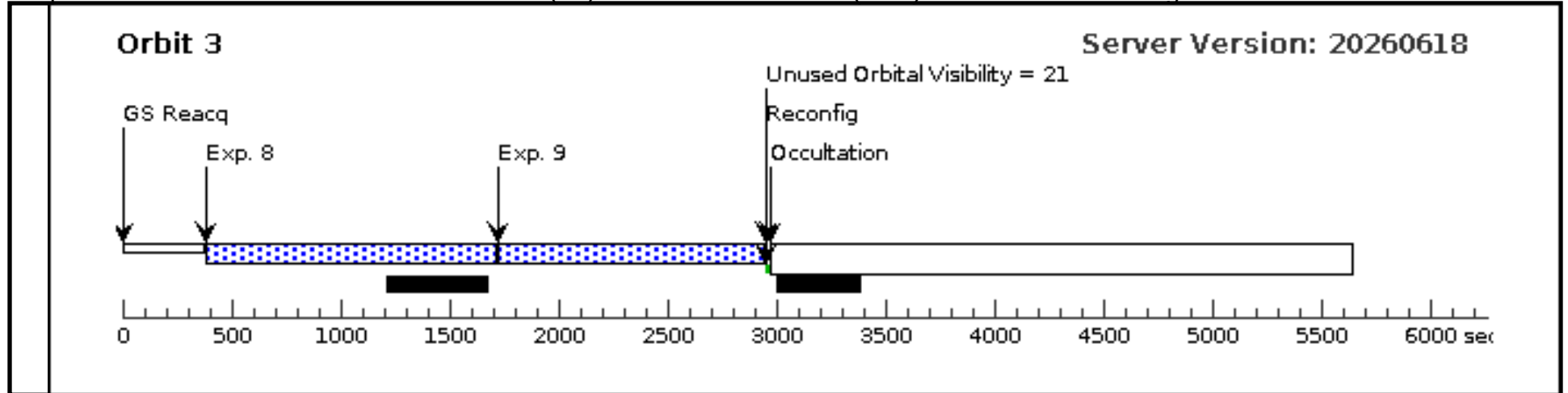
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	F656N short exp	(3) NGC-2440	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F656N				40 Secs (32 Secs) [==>32.0 Secs]	[1]
	2	F656N	(3) NGC-2440	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F656N			Pattern 4, Exps 2-5 in NGC 2440 UVIS 2 Kx2K + IR (09) (4)	200 Secs (382 Secs) [==>121.0 Secs (Pattern 1)] [==>121.0 Secs (Pattern 2)] [==>140.0 Secs (Pattern 3)]	[1] [2]
	3	F631N	(3) NGC-2440	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F631N			Pattern 4, Exps 2-5 in NGC 2440 UVIS 2 Kx2K + IR (09) (4)	200 Secs (442 Secs) [==>146.0 Secs (Pattern 1)] [==>146.0 Secs (Pattern 2)] [==>150.0 Secs (Pattern 3)]	[1] [2]
	4	F658N	(3) NGC-2440	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F658N			Pattern 4, Exps 2-5 in NGC 2440 UVIS 2 Kx2K + IR (09) (4)	200 Secs (382 Secs) [==>121.0 Secs (Pattern 1)] [==>121.0 Secs (Pattern 2)] [==>140.0 Secs (Pattern 3)]	[1] [2]
	5	F673N	(3) NGC-2440	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F673N			Pattern 4, Exps 2-5 in NGC 2440 UVIS 2 Kx2K + IR (09) (4)	200 Secs (452 Secs) [==>146.0 Secs (Pattern 1)] [==>146.0 Secs (Pattern 2)] [==>160.0 Secs (Pattern 3)]	[1] [2]
	6	F128N	(3) NGC-2440	WFC3/IR, MULTIACCUM, IR	F128N	NSAMP=7; SAMP-SEQ=SPAR S100			602.934229 Secs (602.934 Secs) [==>]	[2]
	7	F130N	(3) NGC-2440	WFC3/IR, MULTIACCUM, IR	F130N	NSAMP=6; SAMP-SEQ=SPAR S100			502.933906 Secs (502.934 Secs) [==>]	[2]
	8	F164N	(3) NGC-2440	WFC3/IR, MULTIACCUM, IR	F164N	NSAMP=14; SAMP-SEQ=SPAR S100			1302.93649 Secs (1302.936 Secs) [==>]	[3]
	9	F167N	(3) NGC-2440	WFC3/IR, MULTIACCUM, IR	F167N	NSAMP=13; SAMP-SEQ=SPAR S100			1202.936167 Secs (1202.936 Secs) [==>]	[3]



Orbit 2

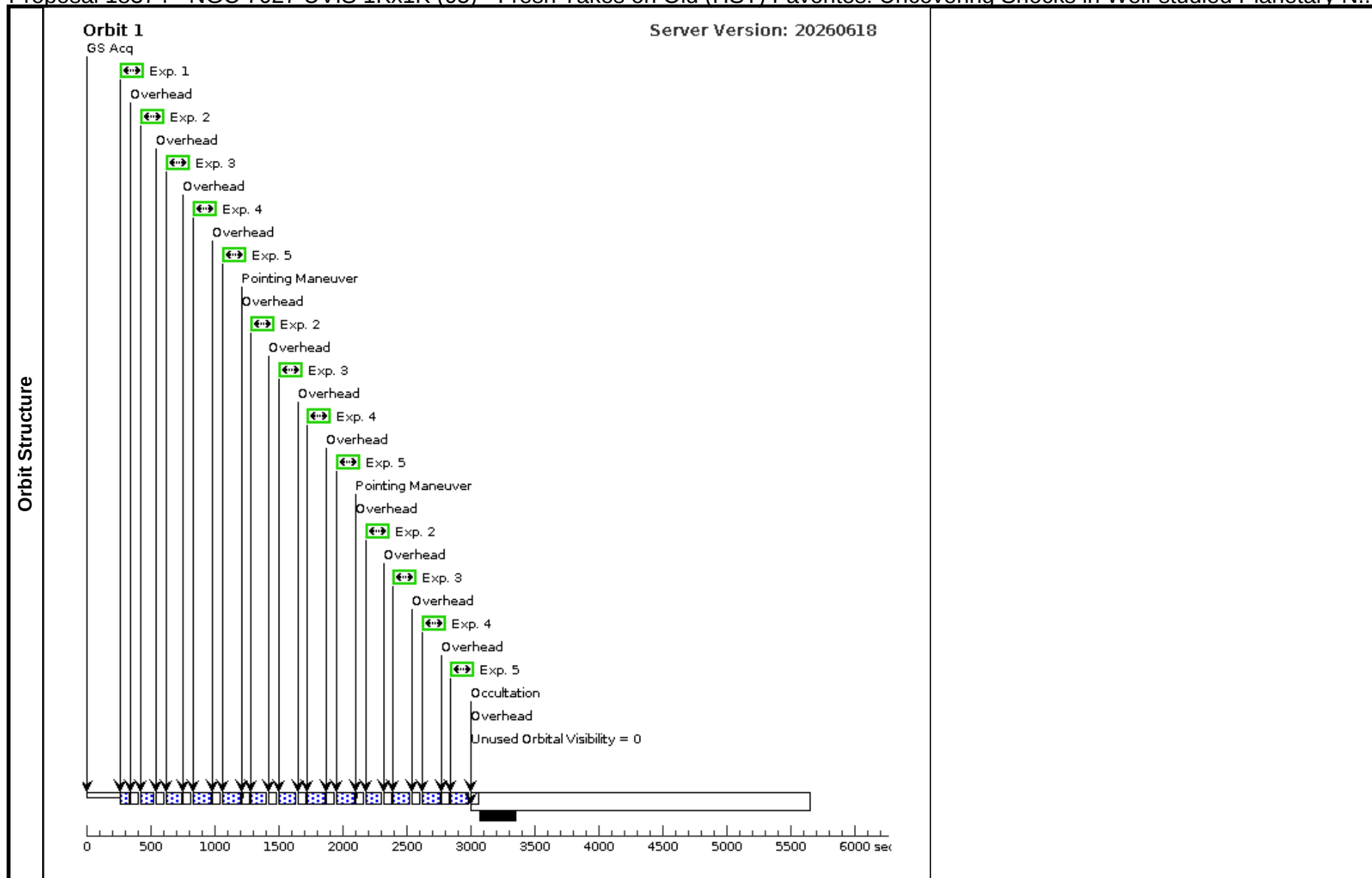
Server Version: 20260618





Proposal 18374 - NGC 7027 UVIS 1Kx1K (05) - Fresh Takes on Old (HST) Favorites: Uncovering Shocks in Well-studied Planetary N...

Visit	Proposal 18374, NGC 7027 UVIS 1Kx1K (05)										Wed Aug 12 17:00:27 GMT 2026			
	Diagnostic Status: Warning													
	Scientific Instruments: WFC3/UVIS													
	Special Requirements: (none)													
Diagnostics	(F656N short exp (05.001)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser													
	(F656N (05.002)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser													
	(F631N (05.003)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser													
	(F658N (05.004)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser													
	(F673N (05.005)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser													
Patterns	#	Primary Pattern					Secondary Pattern					Exposures		
	(4)	Pattern Type=WFC3-UVIS-DITHER- LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=					Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false					(2-5)		
Fixed Targets	#	Name		Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous				
	(1)	NGC-7027		RA: 21 07 1.5720 (316.7565500d) Dec: +42 14 10.47 (42.23624d) Equinox: J2000		Proper Motion RA: -22.7 mas/yr Proper Motion Dec: -4.4000000571031705 mas/yr Epoch of Position: 2000		V=8.831		Reference Frame: ICRS				
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.													
	SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.													
	Category=ISM Description=[PLANETARY NEBULA] Extended=YES													
Exposures	#	Label	Target	Config,Mode,Aperture		Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit		
	1	F656N short exp	(1) NGC-7027	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB		F656N				40 Secs (40 Secs) [==>40.0 Secs]		[1]		
	2	F656N	(1) NGC-7027	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB		F656N			Pattern 4, Exps 2-5 in NGC 7027 UVIS 1 Kx1K (05) (4)	200 Secs (315 Secs) [==>105.0 Secs (Pattern 1)] [==>105.0 Secs (Pattern 2)] [==>105.0 Secs (Pattern 3)]		[1]		
	3	F631N	(1) NGC-7027	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB		F631N			Pattern 4, Exps 2-5 in NGC 7027 UVIS 1 Kx1K (05) (4)	200 Secs (365 Secs) [==>115.0 Secs (Pattern 1)] [==>125.0 Secs (Pattern 2)] [==>125.0 Secs (Pattern 3)]		[1]		
	4	F658N	(1) NGC-7027	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB		F658N			Pattern 4, Exps 2-5 in NGC 7027 UVIS 1 Kx1K (05) (4)	200 Secs (345 Secs) [==>115.0 Secs (Pattern 1)] [==>115.0 Secs (Pattern 2)] [==>115.0 Secs (Pattern 3)]		[1]		
	5	F673N	(1) NGC-7027	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB		F673N			Pattern 4, Exps 2-5 in NGC 7027 UVIS 1 Kx1K (05) (4)	200 Secs (345 Secs) [==>115.0 Secs (Pattern 1)] [==>115.0 Secs (Pattern 2)] [==>115.0 Secs (Pattern 3)]		[1]		

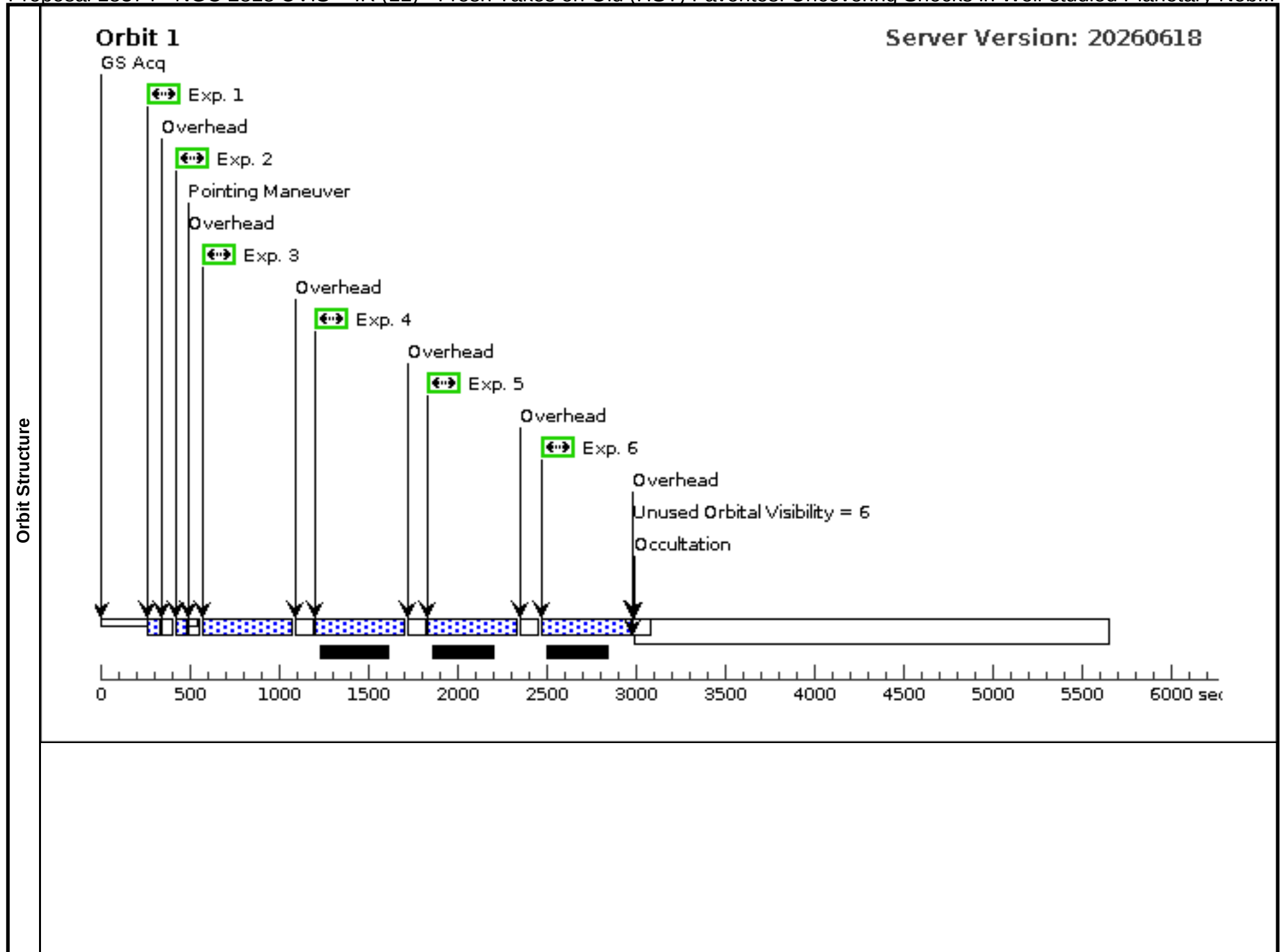


Proposal 18374 - NGC 2818 UVIS + IR (11) - Fresh Takes on Old (HST) Favorites: Uncovering Shocks in Well-studied Planetary Neb...

Visit	Proposal 18374, NGC 2818 UVIS + IR (11) Wed Aug 12 17:00:27 GMT 2026				
	Diagnostic Status: Warning Scientific Instruments: WFC3/IR, WFC3/UVIS Special Requirements: (none)				
Diagnostics	(F658N short exp (11.001)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F656N short exp (11.002)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F658N (11.003)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F656N (11.004)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F673N (11.005)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F631N (11.006)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser				
Patterns	#	Primary Pattern	Secondary Pattern	Exposures	
	(2)	Pattern Type=WFC3-UVIS-GAP-LINE Coordinate Frame=POS-TARG Purpose=MOSAIC Pattern Orientation=85.759 Number Of Points=2 Angle Between Sides= Point Spacing=2.414 Center Pattern=true Line Spacing=		(3-6)	
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes Miscellaneous
	(5)	NGC-2818A	RA: 09 16 1.4902 (139.0062092d) Dec: -36 37 37.52 (-36.62709d) Equinox: J2000	Proper Motion RA: -3.712 mas/yr Proper Motion Dec: 4.94 mas/yr Parallax: 3.1899999999999996E-5" Epoch of Position: 2000	V=19.0 Reference Frame: ICRS
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM. Category=ISM Description=[PLANETARY NEBULA] Extended=YES				

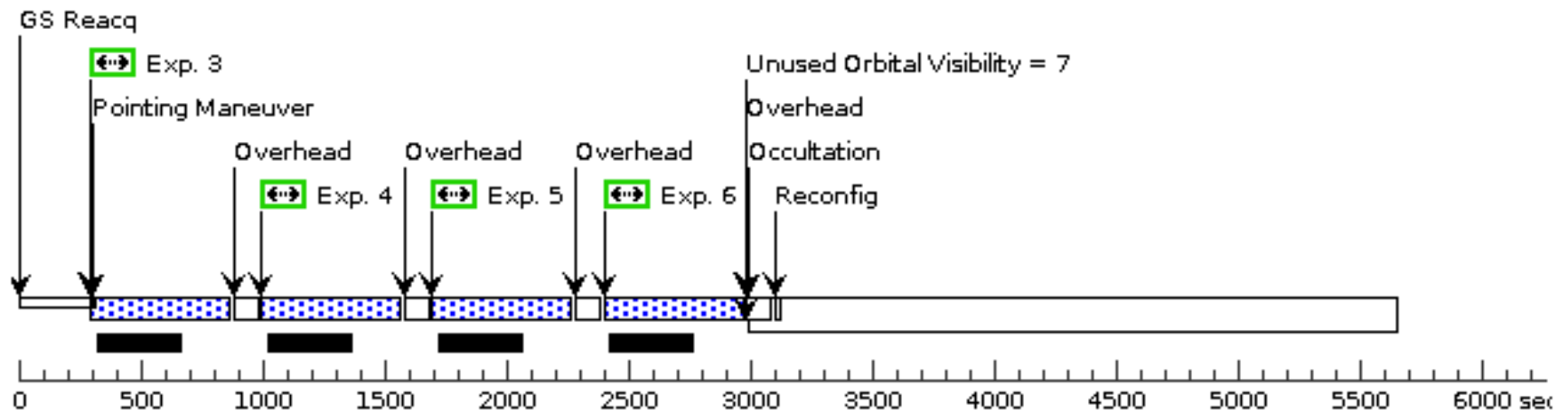
Proposal 18374 - NGC 2818 UVIS + IR (11) - Fresh Takes on Old (HST) Favorites: Uncovering Shocks in Well-studied Planetary Neb...

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	F658N short exp	(5) NGC-2818A	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F658N				40 Secs (40 Secs) [==>40.0 Secs]	[1]
	2	F656N short exp	(5) NGC-2818A	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F656N				40 Secs (40 Secs) [==>40.0 Secs]	[1]
	3	F658N	(5) NGC-2818A	WFC3/UVIS, ACCUM, UVIS	F658N			Pattern 2, Exps 3-6 in NGC 2818 UVIS + IR (11) (2)	200 Secs (1030 Secs) [==>480.0 Secs (Pattern 1)] [==>550.0 Secs (Pattern 2)]	[1] [2]
	4	F656N	(5) NGC-2818A	WFC3/UVIS, ACCUM, UVIS	F656N			Pattern 2, Exps 3-6 in NGC 2818 UVIS + IR (11) (2)	200 Secs (1030 Secs) [==>480.0 Secs (Pattern 1)] [==>550.0 Secs (Pattern 2)]	[1] [2]
	5	F673N	(5) NGC-2818A	WFC3/UVIS, ACCUM, UVIS	F673N			Pattern 2, Exps 3-6 in NGC 2818 UVIS + IR (11) (2)	200 Secs (1030 Secs) [==>480.0 Secs (Pattern 1)] [==>550.0 Secs (Pattern 2)]	[1] [2]
	6	F631N	(5) NGC-2818A	WFC3/UVIS, ACCUM, UVIS	F631N			Pattern 2, Exps 3-6 in NGC 2818 UVIS + IR (11) (2)	200 Secs (1030 Secs) [==>480.0 Secs (Pattern 1)] [==>550.0 Secs (Pattern 2)]	[1] [2]
	7	F128N	(5) NGC-2818A	WFC3/IR, MULTIACCUM, IR	F128N	NSAMP=7; SAMP-SEQ=SPAR S100			602.934229 Secs (602.934 Secs) [==>]	[3]
	8	F130N	(5) NGC-2818A	WFC3/IR, MULTIACCUM, IR	F130N	NSAMP=7; SAMP-SEQ=SPAR S100			602.934229 Secs (602.934 Secs) [==>]	[3]
	9	F164N	(5) NGC-2818A	WFC3/IR, MULTIACCUM, IR	F164N	NSAMP=8; SAMP-SEQ=SPAR S100			702.934552 Secs (702.935 Secs) [==>]	[3]
	10	F167N	(5) NGC-2818A	WFC3/IR, MULTIACCUM, IR	F167N	NSAMP=7; SAMP-SEQ=SPAR S100			602.934229 Secs (602.934 Secs) [==>]	[3]



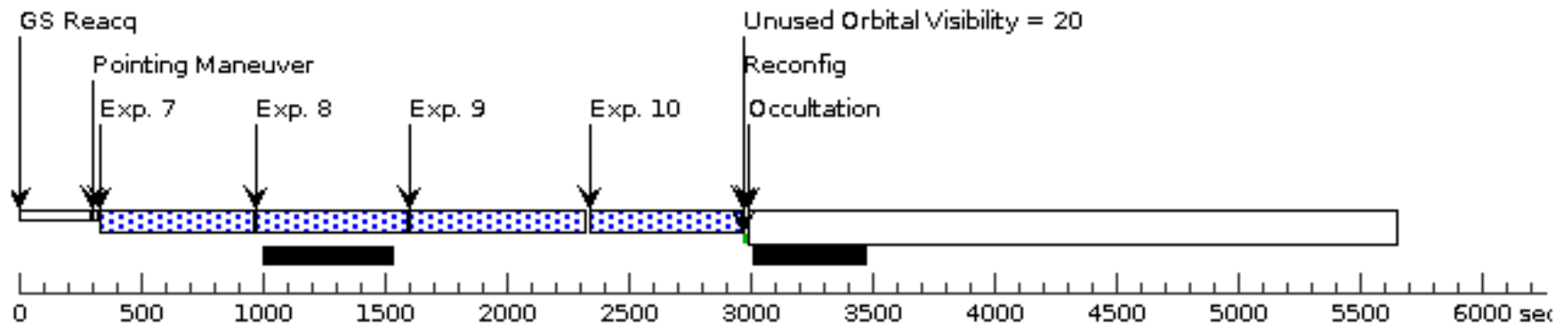
Orbit 2

Server Version: 20260618



Orbit 3

Server Version: 20260618

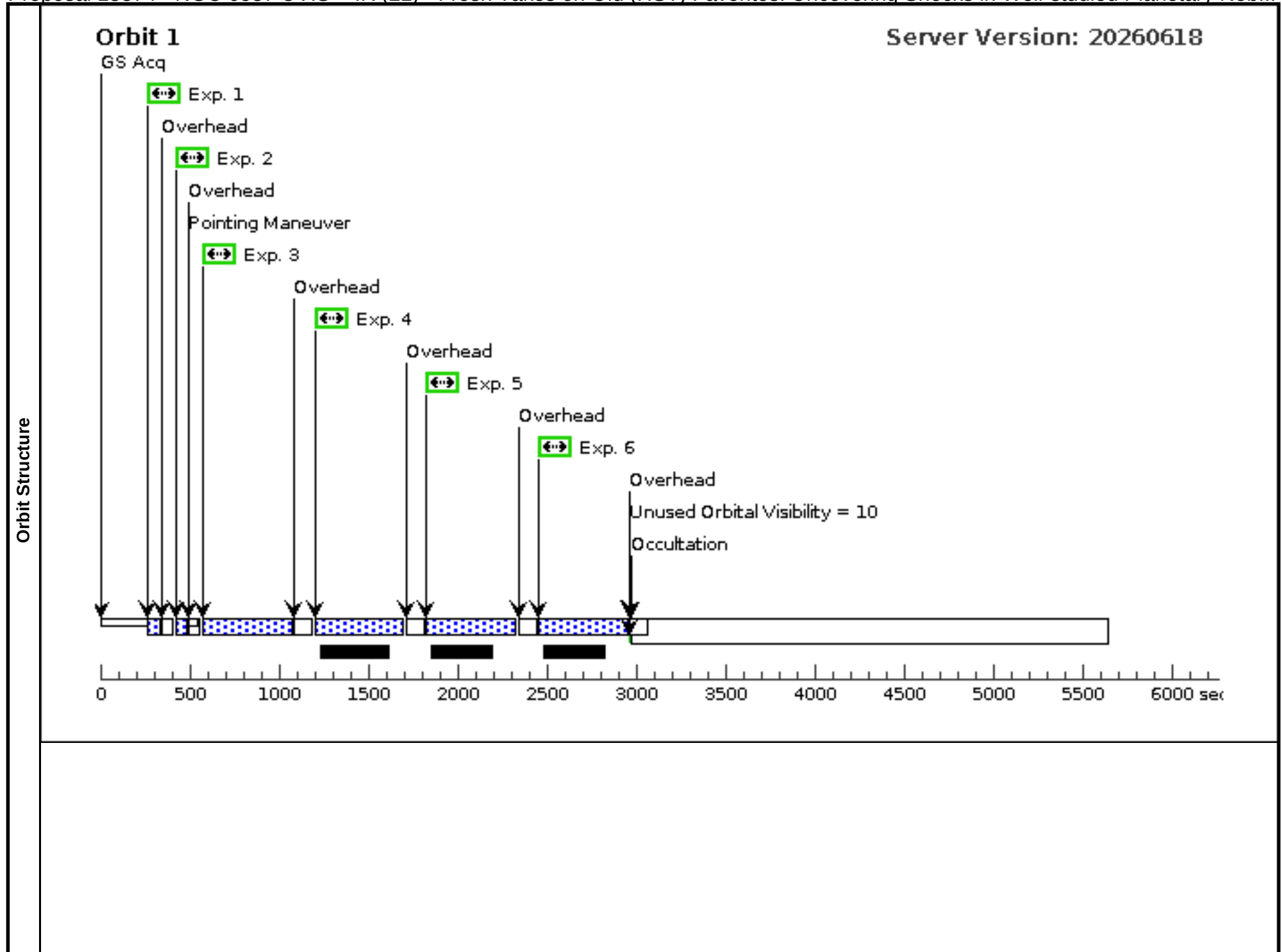


Proposal 18374 - NGC 6537 UVIS + IR (21) - Fresh Takes on Old (HST) Favorites: Uncovering Shocks in Well-studied Planetary Neb...

Visit	Proposal 18374, NGC 6537 UVIS + IR (21) Wed Aug 12 17:00:27 GMT 2026				
	Diagnostic Status: Warning Scientific Instruments: WFC3/IR, WFC3/UVIS Special Requirements: (none)				
Diagnostics	(F658N short exp (21.001)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F656N short exp (21.002)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F658N (21.003)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F656N (21.004)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F673N (21.005)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F631N (21.006)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser				
Patterns	#	Primary Pattern	Secondary Pattern	Exposures	
	(2)	Pattern Type=WFC3-UVIS-GAP-LINE Coordinate Frame=POS-TARG Purpose=MOSAIC Pattern Orientation=85.759 Number Of Points=2 Angle Between Sides= Point Spacing=2.414 Center Pattern=true Line Spacing=		(3-6)	
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes Miscellaneous
	(4)	NGC-6537	RA: 18 05 13.1040 (271.3046000d) Dec: -19 50 34.88 (-19.84302d) Equinox: J2000	Proper Motion RA: 17.5 mas/yr Proper Motion Dec: -1.4000000646774424 mas/yr Epoch of Position: 2000	V=13.58 Reference Frame: ICRS
	<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i> <i>SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.</i> Category=ISM Description=[PLANETARY NEBULA] Extended=YES				

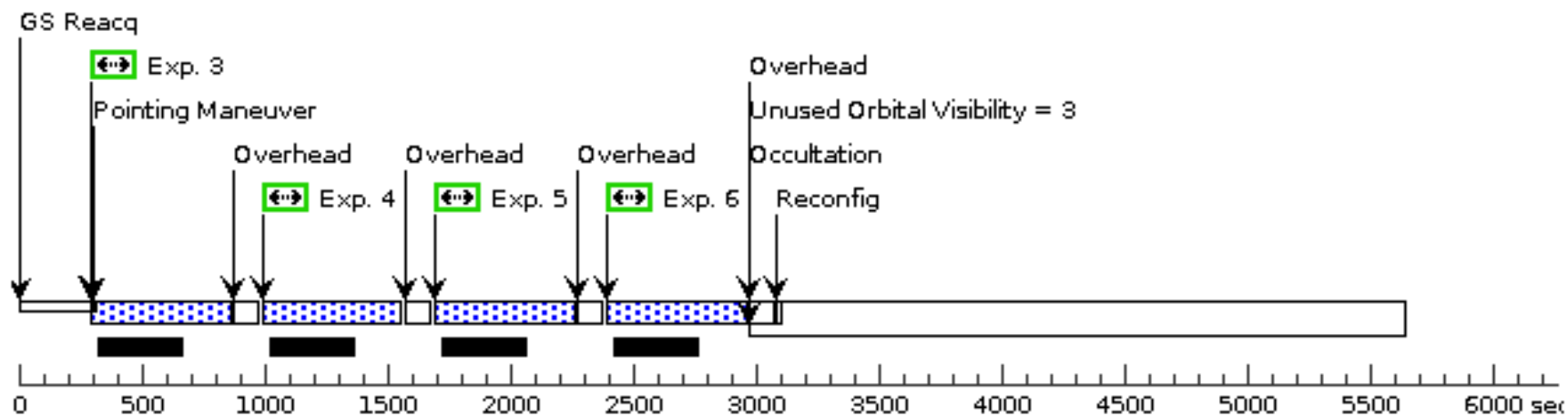
Proposal 18374 - NGC 6537 UVIS + IR (21) - Fresh Takes on Old (HST) Favorites: Uncovering Shocks in Well-studied Planetary Neb...

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	F658N short exp	(4) NGC-6537	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F658N				40 Secs (40 Secs) [==>40.0 Secs]	[1]
	2	F656N short exp	(4) NGC-6537	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F656N				40 Secs (40 Secs) [==>40.0 Secs]	[1]
	3	F658N	(4) NGC-6537	WFC3/UVIS, ACCUM, UVIS	F658N			Pattern 2, Exps 3-6 in NGC 6537 UVIS + IR (21) (2)	200 Secs (1022 Secs) [==>475.0 Secs (Pattern 1)] [==>547.0 Secs (Pattern 2)]	[1] [2]
	4	F656N	(4) NGC-6537	WFC3/UVIS, ACCUM, UVIS	F656N			Pattern 2, Exps 3-6 in NGC 6537 UVIS + IR (21) (2)	200 Secs (1022 Secs) [==>475.0 Secs (Pattern 1)] [==>547.0 Secs (Pattern 2)]	[1] [2]
	5	F673N	(4) NGC-6537	WFC3/UVIS, ACCUM, UVIS	F673N			Pattern 2, Exps 3-6 in NGC 6537 UVIS + IR (21) (2)	200 Secs (1022 Secs) [==>475.0 Secs (Pattern 1)] [==>547.0 Secs (Pattern 2)]	[1] [2]
	6	F631N	(4) NGC-6537	WFC3/UVIS, ACCUM, UVIS	F631N			Pattern 2, Exps 3-6 in NGC 6537 UVIS + IR (21) (2)	200 Secs (1022 Secs) [==>475.0 Secs (Pattern 1)] [==>547.0 Secs (Pattern 2)]	[1] [2]
	7	F128N	(4) NGC-6537	WFC3/IR, MULTIACCUM, IR	F128N	NSAMP=7; SAMP-SEQ=SPAR S100			602.934229 Secs (602.934 Secs) [==>]	[3]
	8	F130N	(4) NGC-6537	WFC3/IR, MULTIACCUM, IR	F130N	NSAMP=7; SAMP-SEQ=SPAR S100			602.934229 Secs (602.934 Secs) [==>]	[3]
	9	F164N	(4) NGC-6537	WFC3/IR, MULTIACCUM, IR	F164N	NSAMP=8; SAMP-SEQ=SPAR S100			702.934552 Secs (702.935 Secs) [==>]	[3]
	10	F167N	(4) NGC-6537	WFC3/IR, MULTIACCUM, IR	F167N	NSAMP=7; SAMP-SEQ=SPAR S100			602.934229 Secs (602.934 Secs) [==>]	[3]



Orbit 2

Server Version: 20260618



Orbit 3

Server Version: 20260618

