



17837 - Elevating the Scientific Output of JWST by using HST to Examine the Heart of Type Ia Supernova 2021aefx

Cycle: 32, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>
Michael Tucker (PI) (Contact)	The Ohio State University
Dr. James M DerKacy (CoI)	Space Telescope Science Institute
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Dr. Peter A. Hoeflich (CoI)	Florida State University
Dr. Melissa Shahbandeh (CoI)	Space Telescope Science Institute
Dr. Eddie Baron (CoI)	Planetary Science Institute

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>
01	(1) 2021AEFX	WFC3/UVIS	3	30-Jan-2025 16:00:20.0	yes
51	(1) 2021AEFX	WFC3/UVIS	3	30-Jan-2025 16:00:21.0	yes
02	(1) 2021AEFX	WFC3/UVIS	3	30-Jan-2025 16:00:21.0	yes
03	(1) 2021AEFX	WFC3/UVIS	2	30-Jan-2025 16:00:22.0	yes
53	(1) 2021AEFX	WFC3/UVIS	1	30-Jan-2025 16:00:22.0	yes

12 Total Orbits Used

ABSTRACT

Despite Type Ia supernovae (SNe Ia) remaining a benchmark of precision cosmology, a consensus on how and why some white dwarfs explode as SNe Ia eludes the astronomical community. Photometric observations of SNe Ia at late times measure the conversion efficiency of radioactive decay energy into photons. We request 10 orbits of HST/WFC3 observations in Cycle 31 and 8 orbits in Cycle 32 to observe the normal SN Ia 2021aefx at 750d, 1000d, and 1150d after the explosion in conjunction with already awarded JWST near- and mid-infrared spectra. These complimentary HST and JWST observations provide complete wavelength coverage from 0.4-14 microns spanning years after the explosion. Such data are non-existent in the literature and we do not foresee similar opportunities in the overlapping lifetimes of HST and JWST. Measuring the complete spectral energy distribution at nebular phases allows a direct estimate of the total radioactive decay energy, which in turn depends on the nucleosynthetic yield of the explosion. Many correlations have been proposed for estimating the nucleosynthetic yield of a SN Ia but uncertainties regarding emission in the mid-IR prevented definitive conclusions. With the proposed HST/WFC3 time we can elevate the scientific output from this SN to a level that JWST cannot reach alone, and SN~2021aefx will become a once-in-a-decade event that paves the way for the next generation of SN Ia models.

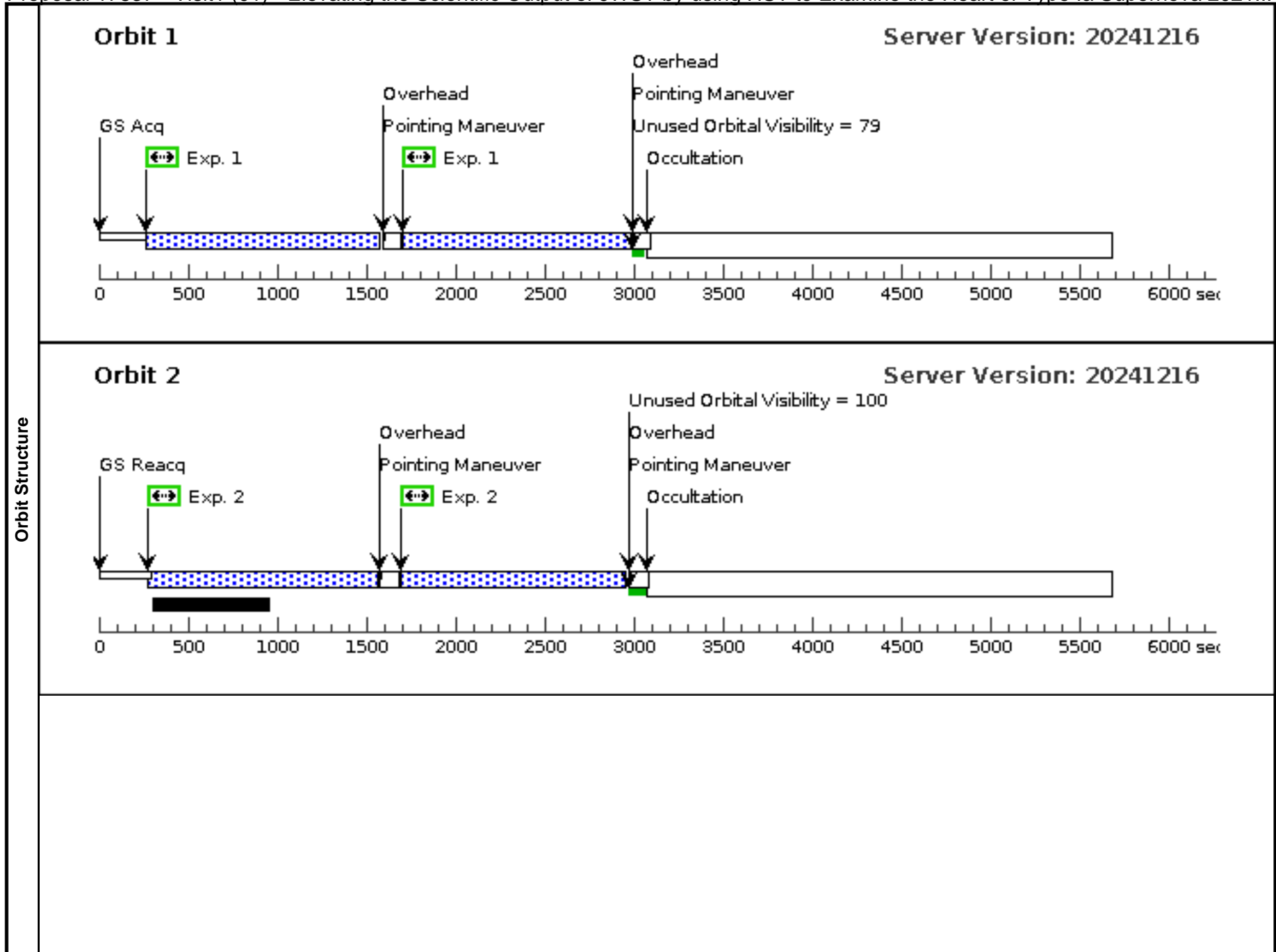
OBSERVING DESCRIPTION

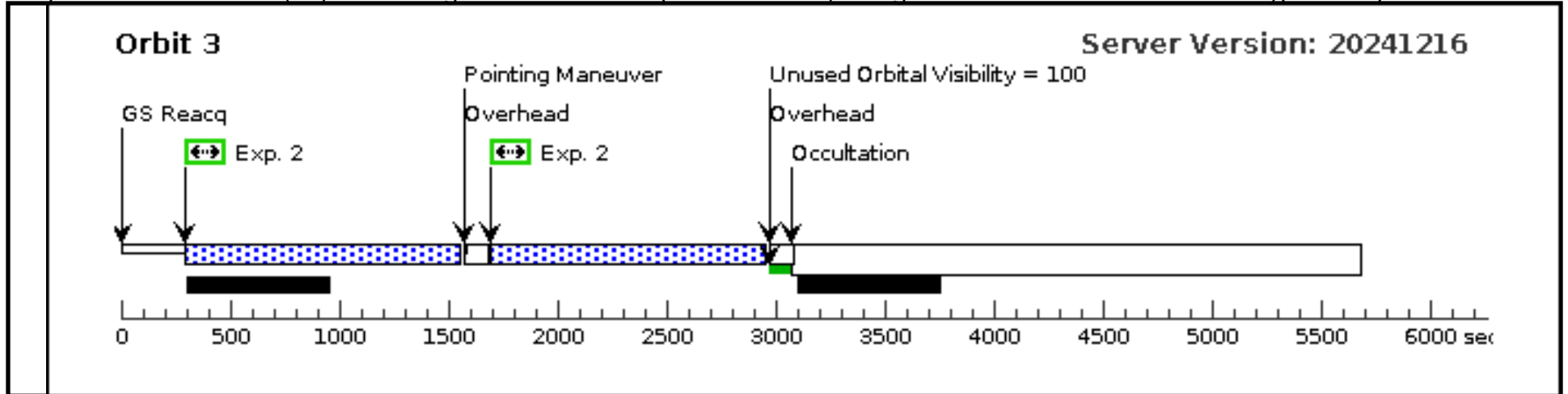
Late-time observations of SN Ia 2021aefx at 750d and 1000d coinciding with JWST observations using F438W, F555W, F600LP, F110W, and F160W filters.

Proposal 17837 - Visit1 (01) - Elevating the Scientific Output of JWST by using HST to Examine the Heart of Type Ia Supernova 2021...

Thu Jan 30 21:00:23 GMT 2025

Visit	Proposal 17837, Visit1 (01), failed Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: PCS MODE FINE; BETWEEN 15-JAN-2025:00:00:00 AND 15-FEB-2025:00:00:00 Comments: 1150d after peak brightness. Observations in F438W and F555W										
	Patterns	#	Primary Pattern	Secondary Pattern	Exposures						
		(2)	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)					
	(4)	Pattern Type=WFC3-UVIS-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=false		(2)						
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous					
	(1)	2021AEFX	RA: 04 19 53.4000 (64.9725000d) Dec: -54 56 53.09 (-54.94808d) Equinox: J2000		V=23+/-0.1	Reference Frame: ICRS					
	Comments: Category=EXT-STAR Description=[SUPERNOVA, SUPERNOVA TYPE IA]										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit	
	1	F555W - V1	(1) 2021AEFX	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F555W		NEW OBSET FULL ACQ; NEW ALIGNMENT ; GS ACQ SCENARIO SINGLE	Pattern 2, Exps 1-1 in Visit1 (01) (2)	800 Secs (2562 Secs) [==>1281.0 Secs (Pattern 1)] [==>1281.0 Secs (Pattern 2)]	[1]	
	2	F438W - V1 - A	(1) 2021AEFX	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F438W	FLASH=10			Pattern 4, Exps 2-2 in Visit1 (01) (4)	400 Secs (5068 Secs) [==>1267.0 Secs (Pattern 1)] [==>1267.0 Secs (Pattern 2)] [==>1267.0 Secs (Pattern 3)] [==>1267.0 Secs (Pattern 4)]	[2] [3]

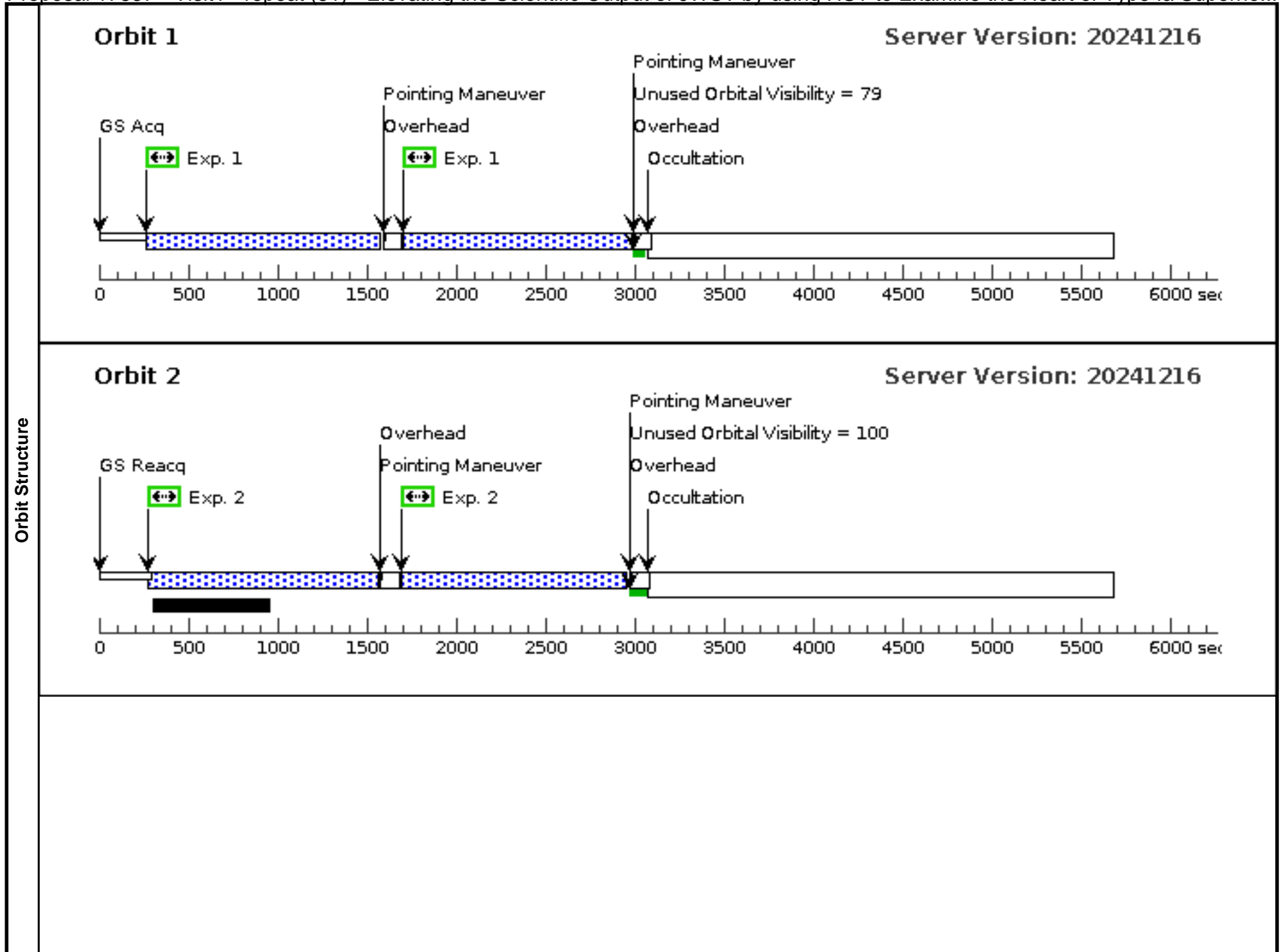


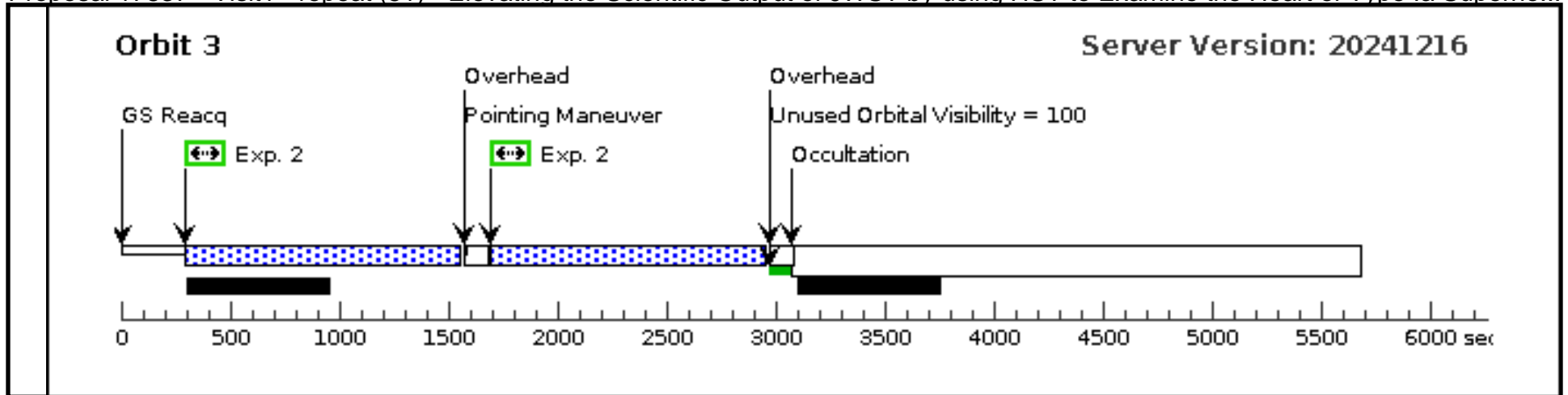


Proposal 17837 - Visit1 - repeat (51) - Elevating the Scientific Output of JWST by using HST to Examine the Heart of Type Ia Superno...

Thu Jan 30 21:00:23 GMT 2025

Visit	Proposal 17837, Visit1 - repeat (51) Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: PCS MODE FINE <i>Comments: 1150d after peak brightness. Observations in F438W and F555W</i>										
	#	Primary Pattern	Secondary Pattern	Exposures							
Patterns	(2)	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)							
	(4)	Pattern Type=WFC3-UVIS-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112 Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=false		(2)							
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous					
	(1)	2021AEFX	RA: 04 19 53.4000 (64.9725000d) Dec: -54 56 53.09 (-54.94808d) Equinox: J2000		V=23+/-0.1	Reference Frame: ICRS					
<i>Comments:</i> Category=EXT-STAR Description=[SUPERNOVA, SUPERNOVA TYPE IA]											
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit	
	1	F555W - V1	(1) 2021AEFX	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F555W		NEW OBSET FULL ACQ; NEW ALIGNMENT ; GS ACQ SCENARIO SINGLE	Pattern 2, Exps 1-1 in Visit1 - repeat (51) (2)	800 Secs (2562 Secs) [==>1281.0 Secs (Pattern 1)] [==>1281.0 Secs (Pattern 2)]	[1]	
	2	F438W - V1 - A	(1) 2021AEFX	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F438W	FLASH=10			Pattern 4, Exps 2-2 in Visit1 - repeat (51) (4)	400 Secs (5068 Secs)	
										[==>1267.0 Secs (Pattern 1)]	[2]
[==>1267.0 Secs (Pattern 2)]											
								[==>1267.0 Secs (Pattern 3)]			
								[==>1267.0 Secs (Pattern 4)]	[3]		

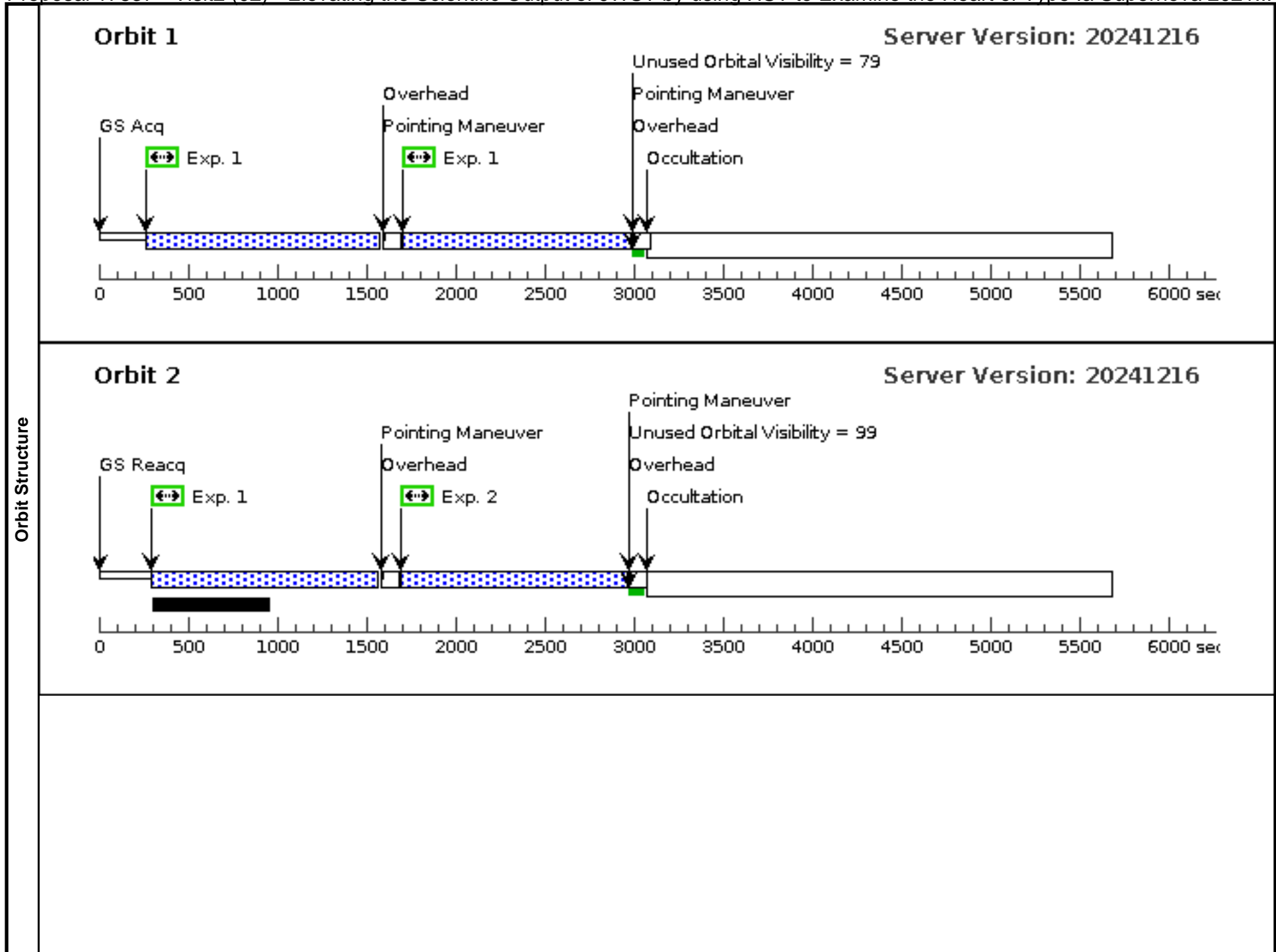


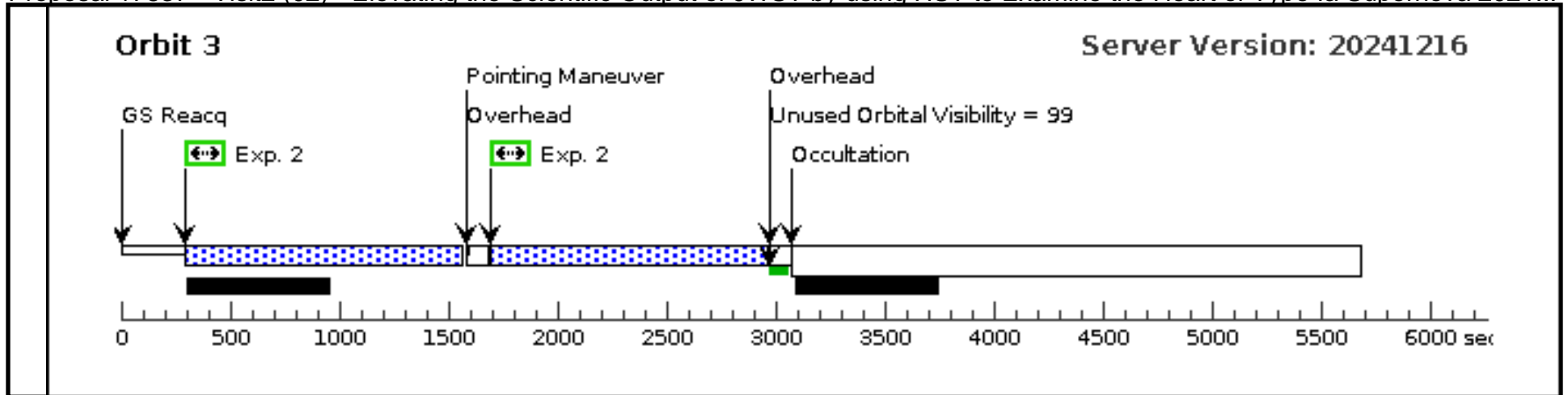


Proposal 17837 - Visit2 (02) - Elevating the Scientific Output of JWST by using HST to Examine the Heart of Type Ia Supernova 2021...

Thu Jan 30 21:00:23 GMT 2025

Visit	Proposal 17837, Visit2 (02), completed Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: PCS MODE FINE; BETWEEN 15-JAN-2025:00:00:00 AND 15-FEB-2025:00:00:00 <i>Comments: F600LP exposures, 3 orbits</i>										
	Patterns	#	Primary Pattern				Secondary Pattern			Exposures	
(5)		Pattern Type=WFC3-UVIS-DITHER- LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=				Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false			(1), (2)		
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections		Fluxes	Miscellaneous			
	(1)	2021AEFX	RA: 04 19 53.4000 (64.9725000d) Dec: -54 56 53.09 (-54.94808d) Equinox: J2000				V=23+/-0.1	Reference Frame: ICRS			
<i>Comments:</i> Category=EXT-STAR Description=[SUPERNOVA, SUPERNOVA TYPE IA]											
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit
	1	F600LP - V 2 - A	(1) 2021AEFX	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F600LP		GS ACQ SCENARI O SINGLE	Pattern 5, Exps 1-1 i n Visit2 (02) (5)	3000 Secs (3833 Secs)		
									[==>1281.0 Secs (Pattern 1)]		[1]
									[==>1281.0 Secs (Pattern 2)]		[2]
									[==>1271.0 Secs (Pattern 3)]		[3]
2	F600LP - V 2 - B	(1) 2021AEFX	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F600LP		POS TARG 0.1,0.1	Pattern 5, Exps 2-2 i n Visit2 (02) (5)	3600 Secs (3813 Secs)			
								[==>1271.0 Secs (Pattern 1)]		[2]	
								[==>1271.0 Secs (Pattern 2)]		[3]	
								[==>1271.0 Secs (Pattern 3)]		[3]	

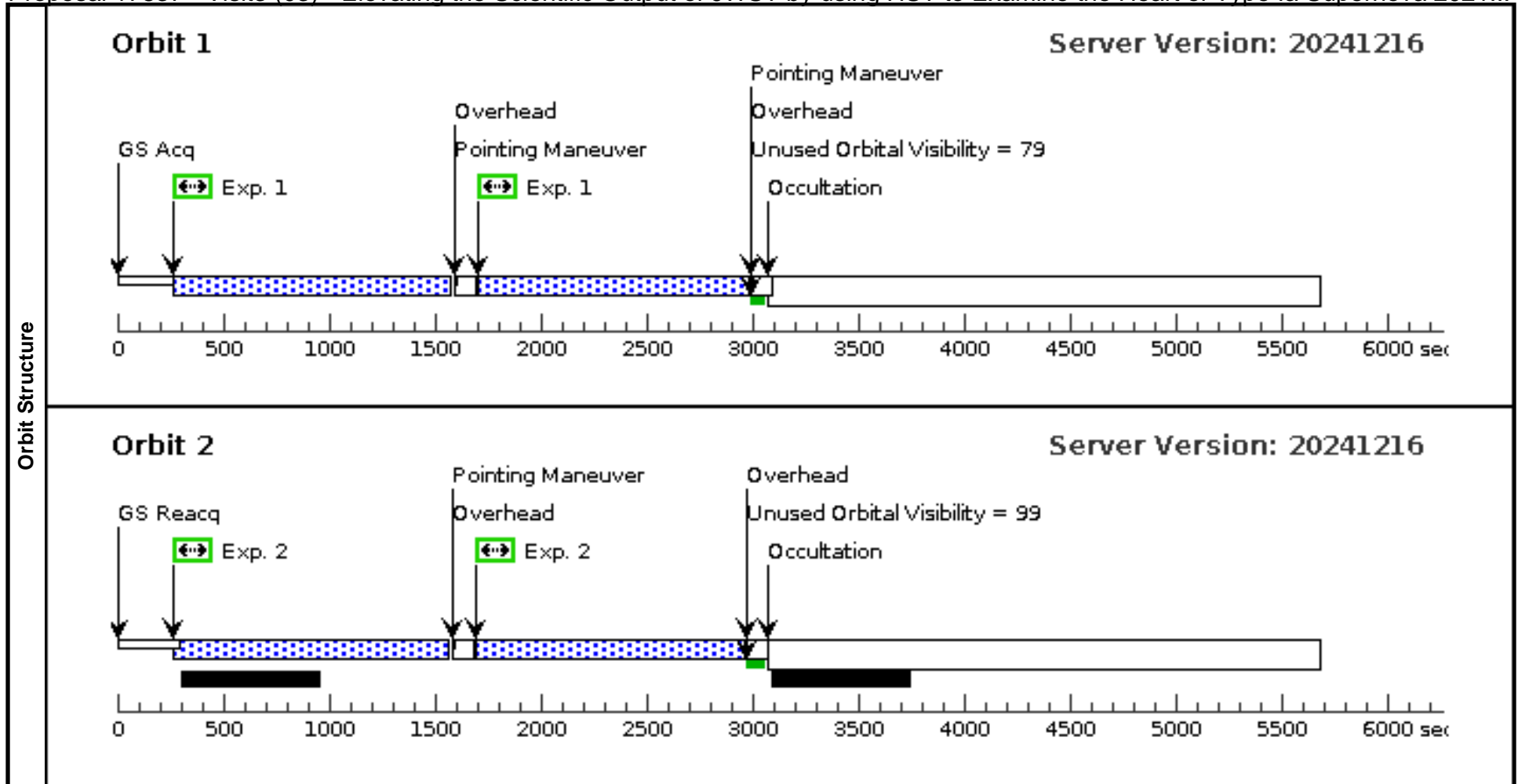




Proposal 17837 - Visit3 (03) - Elevating the Scientific Output of JWST by using HST to Examine the Heart of Type Ia Supernova 2021...

Thu Jan 30 21:00:23 GMT 2025

Visit	Proposal 17837, Visit3 (03), failed Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: BETWEEN 15-JAN-2025:00:00:00 AND 15-FEB-2025:00:00:00 Comments: Additional F555W and F600LP exposures									
	Patterns	#	Primary Pattern			Secondary Pattern			Exposures	
		(2)	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)	2021AEFX	RA: 04 19 53.4000 (64.9725000d) Dec: -54 56 53.09 (-54.94808d) Equinox: J2000			V=23+/-0.1	Reference Frame: ICRS			
	Comments: Category=EXT-STAR Description=[SUPERNOVA, SUPERNOVA TYPE IA]									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	F600LP - V3	(1) 2021AEFX	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F600LP		POS TARG 0.1,-0.1; GS ACQ SCENARIO SINGLE	Pattern 2, Exps 1-1 in Visit3 (03) (2)	3000 Secs (2562 Secs) [=>1281.0 Secs (Pattern 1)] [=>1281.0 Secs (Pattern 2)]	[1]
2	F555W - V3	(1) 2021AEFX	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F555W		POS TARG 0.1,0.1	Pattern 2, Exps 2-2 in Visit3 (03) (2)	3000 Secs (2542 Secs) [=>1271.0 Secs (Pattern 1)] [=>1271.0 Secs (Pattern 2)]	[2]	



Proposal 17837 - Visit3 - partial repeat (53) - Elevating the Scientific Output of JWST by using HST to Examine the Heart of Type Ia S...

Thu Jan 30 21:00:23 GMT 2025

Visit	Proposal 17837, Visit3 - partial repeat (53)		
	Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: (none) <i>Comments: Additional F555W and F600LP exposures</i>		

Patterns	#	Primary Pattern	Secondary Pattern	Exposures
	(2)	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	

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	2021AEFX	RA: 04 19 53.4000 (64.9725000d) Dec: -54 56 53.09 (-54.94808d) Equinox: J2000		V=23+/-0.1	Reference Frame: ICRS

Comments: Category=EXT-STAR Description=[SUPERNOVA, SUPERNOVA TYPE IA]

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	F555W - V3	(1) 2021AEFX	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F555W		POS TARG 0.1,0.1	Pattern 2, Exps 1-1 in Visit3 - partial repeat (53) (2)	3000 Secs (2542 Secs) [==>1271.0 Secs (Pattern 1)] [==>1271.0 Secs (Pattern 2)]	[1]

