



# 17429 - Elevating the Scientific Output of JWST by using HST to Examine the Heart of Type Ia Supernova 2021aefx

Cycle: 31, Proposal Category: GO

(Availability Mode: SUPPORTED)

## INVESTIGATORS

<i>Name</i>	<i>Institution</i>
<b>Michael Tucker (PI) (Contact)</b>	<b>The Ohio State University</b>
Dr. James M DerKacy (CoI)	Virginia Polytechnic Institute and State University
Prof. Chris Ashall (CoI)	Virginia Polytechnic Institute and State University
Prof. Benjamin John Shappee (CoI)	University of Hawaii
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/IR WFC3/UVIS	3	11-Jun-2024 18:00:45.0	yes
02	(1) 2021AEFX	WFC3/IR WFC3/UVIS	2	11-Jun-2024 18:00:46.0	yes
03	(1) 2021AEFX	WFC3/IR WFC3/UVIS	2	11-Jun-2024 18:00:47.0	yes
04	(1) 2021AEFX	WFC3/UVIS	3	11-Jun-2024 18:00:48.0	yes

10 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.

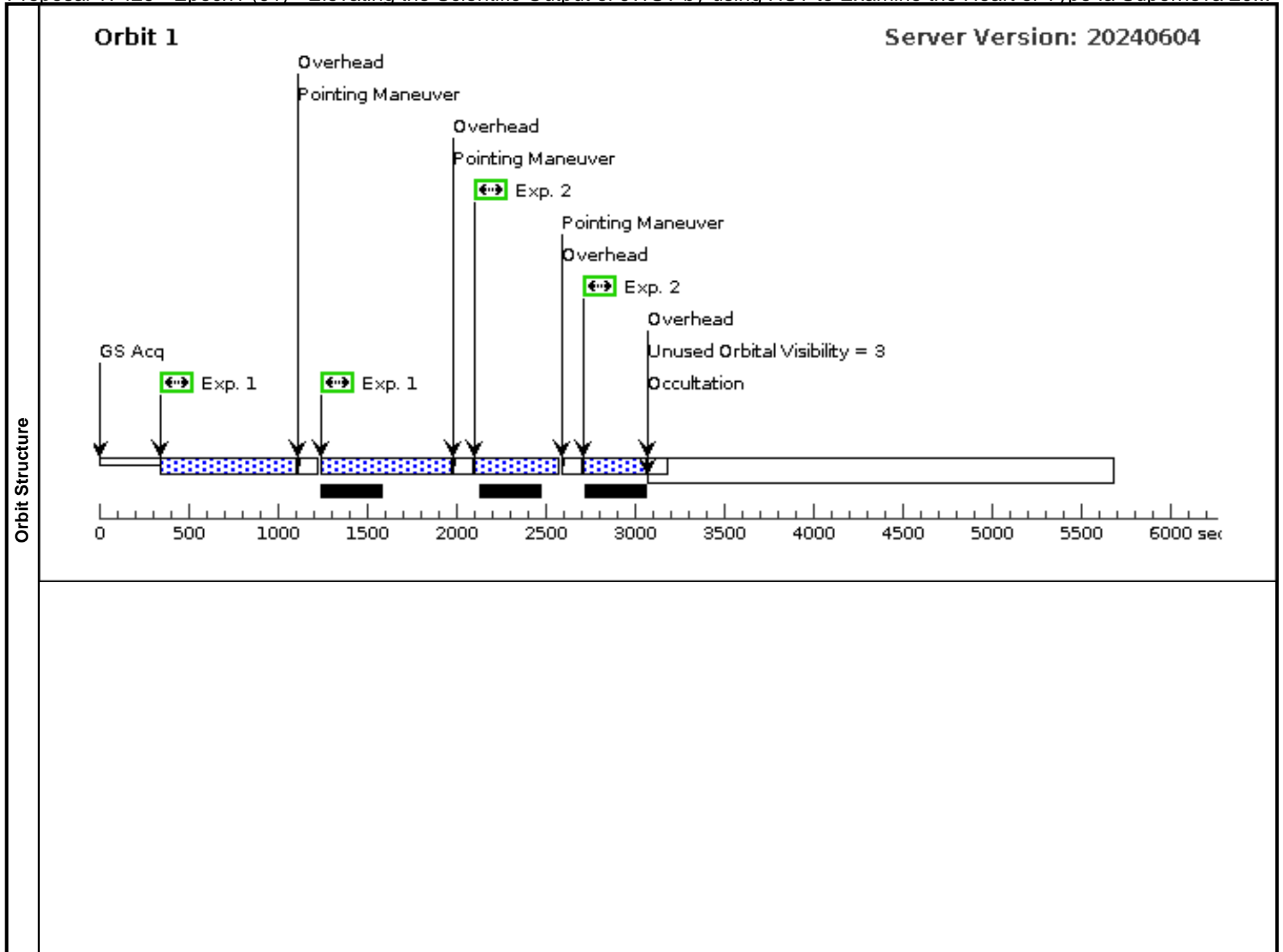
Proposal 17429 - Epoch1 (01) - Elevating the Scientific Output of JWST by using HST to Examine the Heart of Type Ia Supernova 20...

Tue Jun 11 22:00:48 GMT 2024

<b>Visit</b>	<b>Proposal 17429, Epoch1 (01), implementation</b> <b>Diagnostic Status: Warning</b> Scientific Instruments: WFC3/IR, WFC3/UVIS Special Requirements: (none) <i>Comments: Epoch1 - 750d after peak brightness. Observations in F438W, F555W, F600LP, F110W, F160W</i>					
	<b>Diagnosics</b> (Epoch1 (01)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN (Epoch1 (01)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN (F438W (01.001)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser					
<b>Patterns</b>	<b>#</b>	<b>Primary Pattern</b>	<b>Secondary Pattern</b>	<b>Exposures</b>		
	(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)		
<b>Fixed Targets</b>	<b>#</b>	<b>Name</b>	<b>Target Coordinates</b>	<b>Targ. Coord. Corrections</b>	<b>Fluxes</b>	<b>Miscellaneous</b>
	(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]						

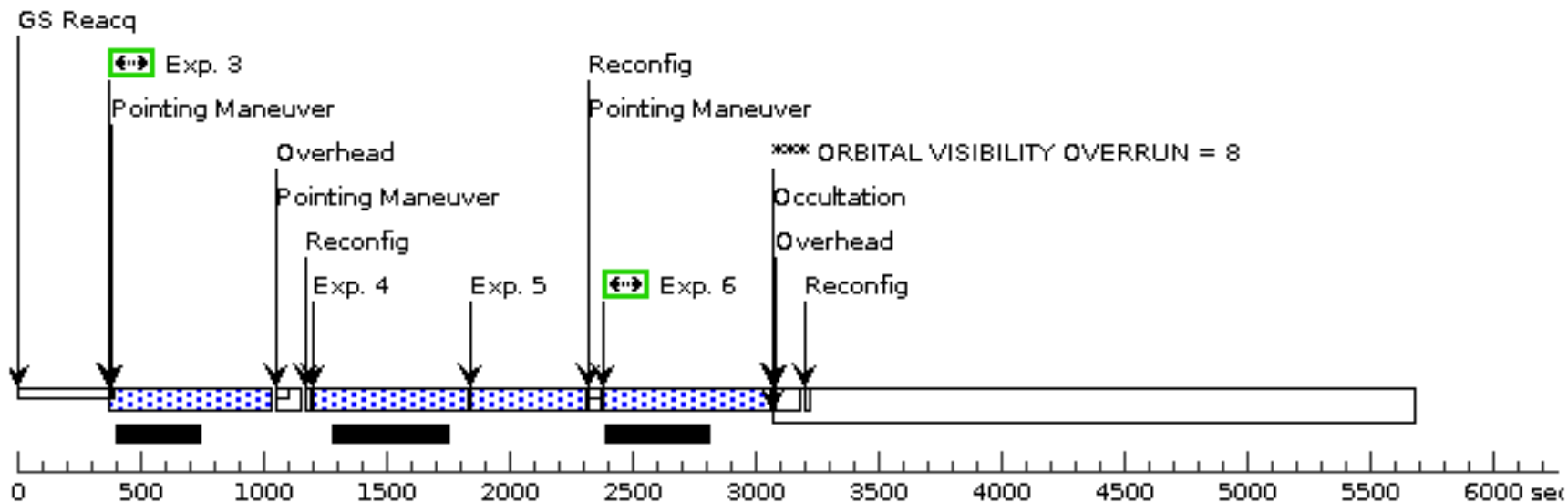
Proposal 17429 - Epoch1 (01) - Elevating the Scientific Output of JWST by using HST to Examine the Heart of Type Ia Supernova 20...

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	F438W	(1) 2021AEFX	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F438W	FLASH=10	NEW OBSET FULL ACQ; NEW ALIGNMENT	Pattern 2, Exps 1-1 in Epoch1 (01) (2)	800 Secs (1460 Secs) [==>730.0 Secs (Pattern 1)] [==>730.0 Secs (Pattern 2)]	[1]
	2	F555W	(1) 2021AEFX	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F555W	FLASH=10		Pattern 2, Exps 2-2 in Epoch1 (01) (2)	400 Secs (799 Secs) [==>450.0 Secs (Pattern 1)] [==>349.0 Secs (Pattern 2)]	[1]
	3	F600LP	(1) 2021AEFX	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F600LP				790 Secs (648 Secs) [==>648.0 Secs ]	[2]
	4	F110W-1	(1) 2021AEFX	WFC3/IR, MULTIACCUM, IR	F110W	NSAMP=12; SAMP-SEQ=STEP100	POS TARG 0.000,0.000		599.232292 Secs (599.232 Secs) [==>]	[2]
	5	F160W-1	(1) 2021AEFX	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=STEP50	POS TARG 0.00,0.00		449.233834 Secs (449.234 Secs) [==>]	[2]
	6	F600LP	(1) 2021AEFX	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F600LP				700 Secs (685 Secs) [==>685.0 Secs ]	[2]
	7	F160W-2	(1) 2021AEFX	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=11; SAMP-SEQ=STEP200	POS TARG 0.451,0.403		799.231201 Secs (799.231 Secs) [==>]	[3]
	8	F110W-2	(1) 2021AEFX	WFC3/IR, MULTIACCUM, IR	F110W	NSAMP=13; SAMP-SEQ=STEP100	POS TARG 0.474,0.424		699.232615 Secs (699.233 Secs) [==>]	[3]
	9	F160W-3	(1) 2021AEFX	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=12; SAMP-SEQ=STEP200	POS TARG 0.902,0.806		999.231268 Secs (999.231 Secs) [==>]	[3]



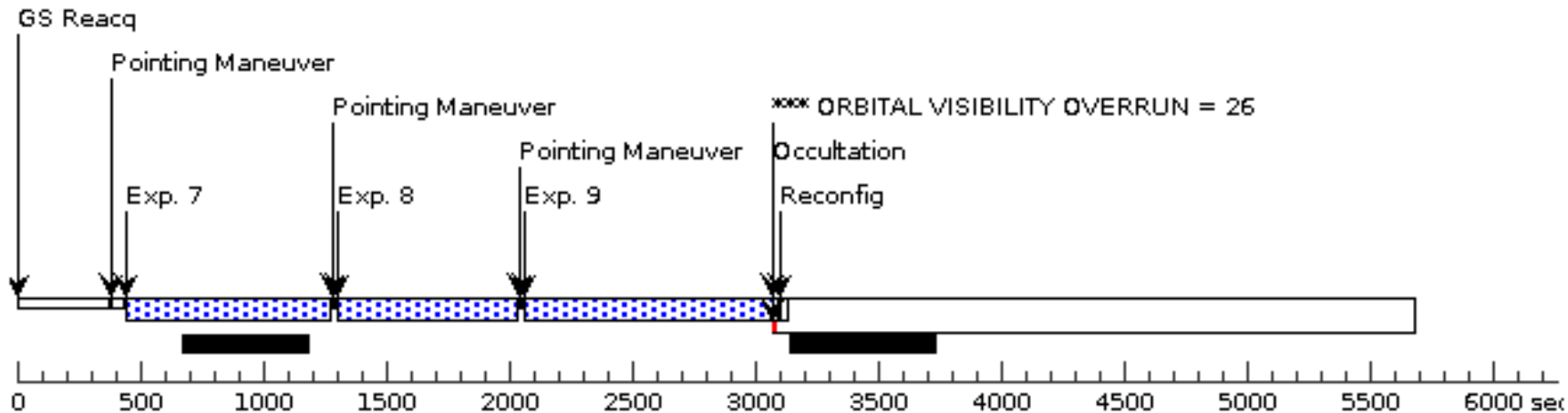
### Orbit 2

Server Version: 20240604



### Orbit 3

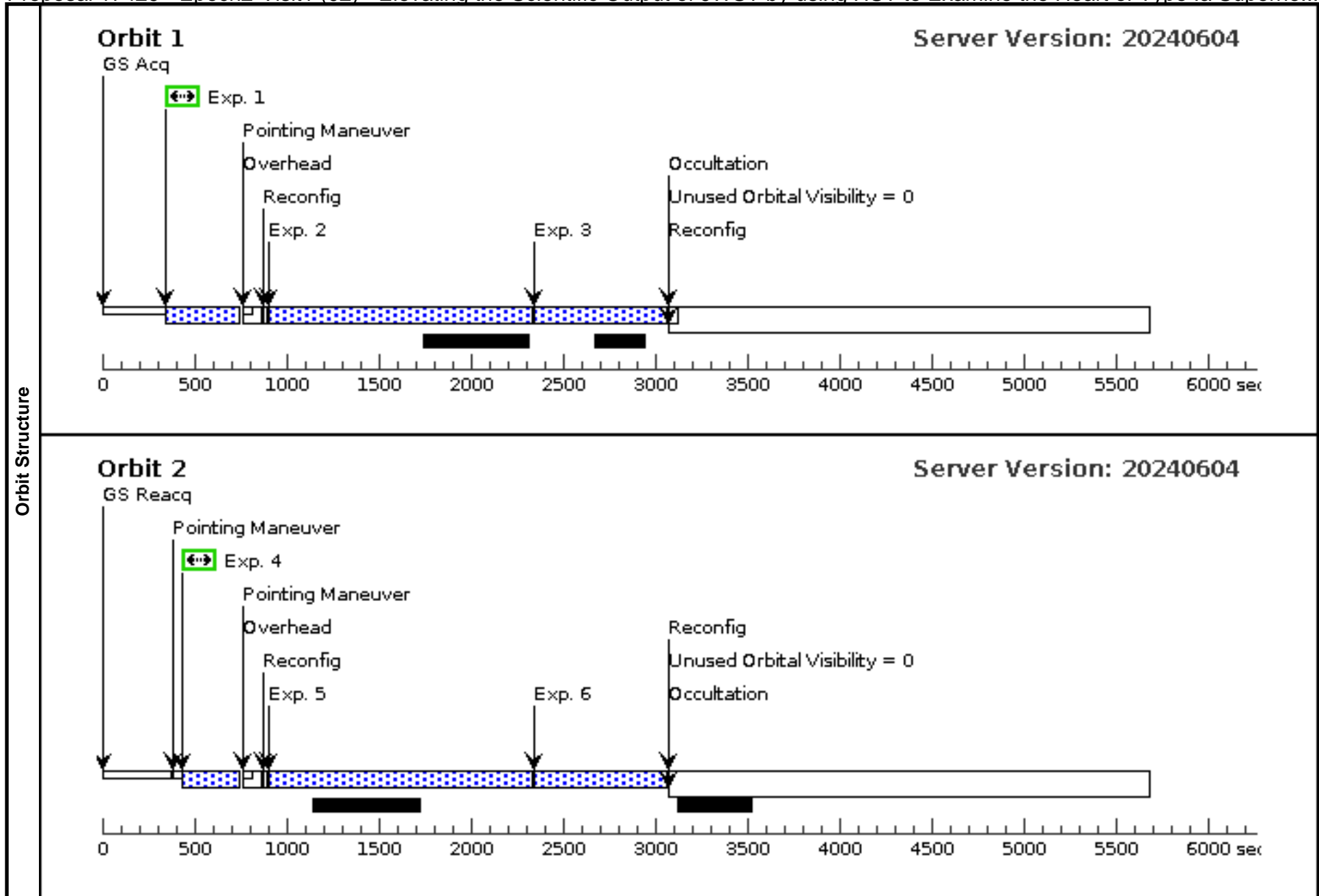
Server Version: 20240604



Proposal 17429 - Epoch2-Visit1 (02) - Elevating the Scientific Output of JWST by using HST to Examine the Heart of Type Ia Superno...

Tue Jun 11 22:00:49 GMT 2024

<b>Visit</b>	<b>Proposal 17429, Epoch2-Visit1 (02), scheduling</b> <b>Diagnostic Status: Warning</b> Scientific Instruments: WFC3/IR, WFC3/UVIS Special Requirements: BETWEEN 09-AUG-2024:00:00:00 AND 09-SEP-2024:00:00:00 <i>Comments: WFC3-IR observations for Epoch2</i>																																																																										
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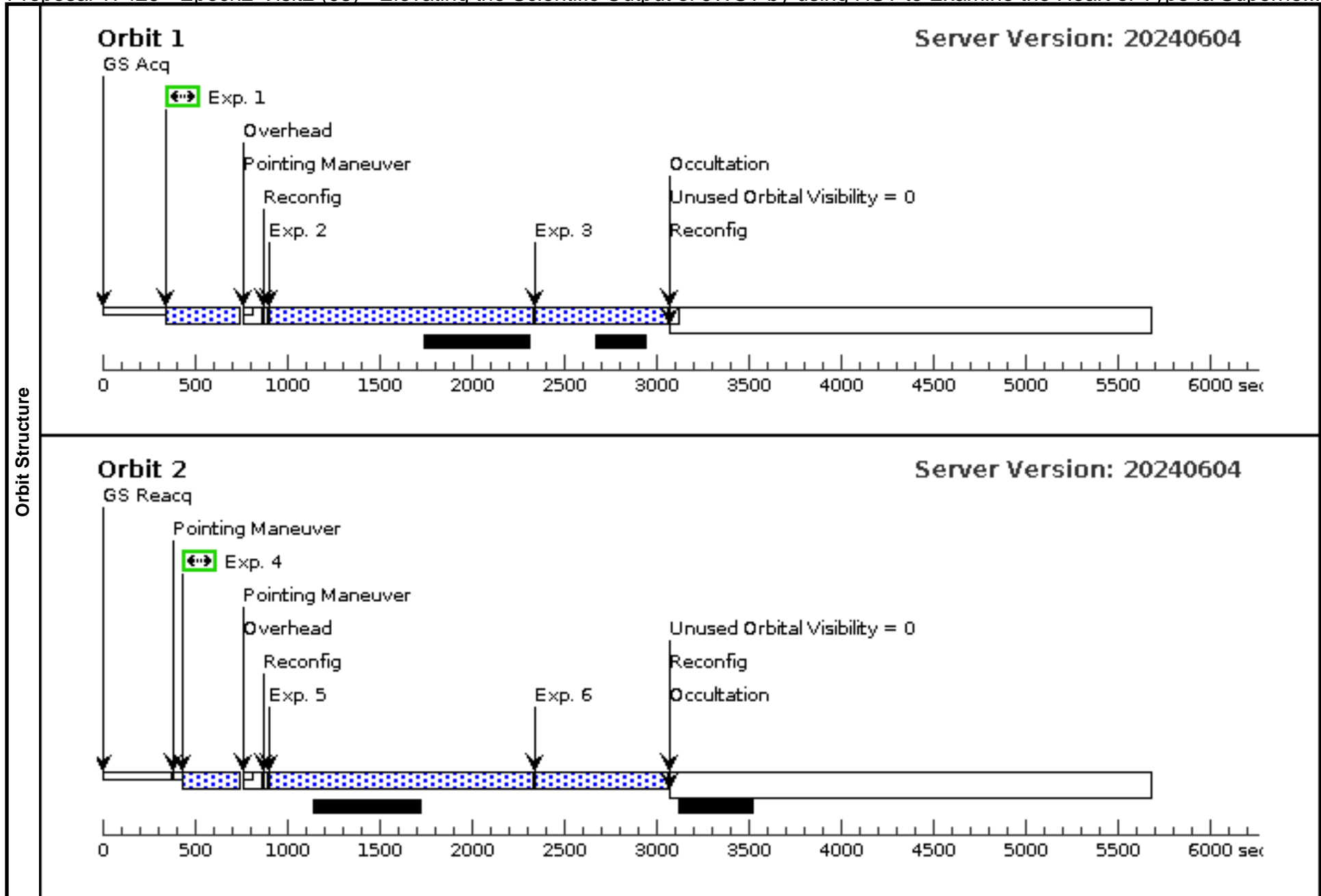




Proposal 17429 - Epoch2-Visit2 (03) - Elevating the Scientific Output of JWST by using HST to Examine the Heart of Type Ia Superno...

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	4	F600LP-4	(1) 2021AEFX	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F600LP		POS TARG -0.060,0.095		600 Secs (311 Secs) [==>311.0 Secs]	[2]																																																																	
	5	F110W-4	(1) 2021AEFX	WFC3/IR, MULTIACCUM, IR	F110W	NSAMP=14; SAMP-SEQ=STEP200	POS TARG -0.203,0.303		1399.231402 Secs (1399.231 Secs) [==>]	[2]																																																																	
6	F160W-4	(1) 2021AEFX	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=13; SAMP-SEQ=STEP100	POS TARG -0.203,0.303		699.232615 Secs (699.233 Secs) [==>]	[2]																																																																		



Proposal 17429 - Epoch2-Visit3 (04) - Elevating the Scientific Output of JWST by using HST to Examine the Heart of Type Ia Superno...

Tue Jun 11 22:00:49 GMT 2024

<b>Visit</b>	<b>Proposal 17429, Epoch2-Visit3 (04), scheduling</b> <b>Diagnostic Status: Warning</b> Scientific Instruments: WFC3/UVIS Special Requirements: BETWEEN 09-AUG-2024:00:00:00 AND 09-SEP-2024:00:00:00									
	<b>Diagnostics</b> (F438W-1 (04.001)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F555W-1 (04.002)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F438W-2 (04.003)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F555W-2 (04.004)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F555W-3 (04.005)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (F555W-4 (04.006)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser									
<b>Fixed Targets</b>	<b>#</b>	<b>Name</b>	<b>Target Coordinates</b>	<b>Targ. Coord. Corrections</b>	<b>Fluxes</b>	<b>Miscellaneous</b>				
	(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]										
<b>Exposures</b>	<b>#</b>	<b>Label</b>	<b>Target</b>	<b>Config,Mode,Aperture</b>	<b>Spectral Els.</b>	<b>Opt. Params.</b>	<b>Special Reqs.</b>	<b>Groups</b>	<b>Exp. Time (Total)/[Actual Dur.]</b>	<b>Orbit</b>
	1	F438W-1	(1) 2021AEFX	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F438W		POS TARG 0.00,0.0 0		2000 Secs (1969 Secs) [==>1969.0 Secs ]	[1]
	2	F555W-1	(1) 2021AEFX	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F555W		POS TARG 0.00,0.0 0		600 Secs (569 Secs) [==>569.0 Secs ]	[1]
	3	F438W-2	(1) 2021AEFX	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F438W		POS TARG 0.099,0. 106		2000 Secs (1959 Secs) [==>1959.0 Secs ]	[2]
	4	F555W-2	(1) 2021AEFX	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F555W		POS TARG 0.158,0. 070		600 Secs (559 Secs) [==>559.0 Secs ]	[2]
	5	F555W-3	(1) 2021AEFX	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F555W		POS TARG 0.099,0. 165		600 Secs (536 Secs) [==>536.0 Secs ]	[3]
	6	F555W-4	(1) 2021AEFX	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F555W		POS TARG -0.060,0. .095		600 Secs (536 Secs) [==>536.0 Secs ]	[3]
	7	F600LP-6	(1) 2021AEFX	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F600LP		POS TARG 0.099,0. 106		600 Secs X 2 (1194 Secs) [==>536.0 Secs (Copy 1)] [==>658.0 Secs (Copy 2)]	[3]

