18237 - Late-time spectral energy distribution of the first off-nuclear tidal disruption event AT 2024tvd

Cycle: 33, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*
Dr. Kishore C. Patra (PI) (Contact)	**University of California - Santa Cruz**
Dr. Samaporn Tinyanont (CoI)	National Astronomical Research Institute of Thailand
Nicholas Earl (CoI)	University of Illinois at Urbana - Champaign
Prof. Ryan Foley (CoI) (AdminUSPI)	University of California - Santa Cruz
Kyle Davis (CoI)	University of California - Santa Cruz
Dr. Enrico Ramirez-Ruiz (CoI)	University of California - Santa Cruz
Prof. Ashley Villar (CoI)	Harvard University
Dr. Sebastian Gomez (CoI)	University of Texas at Austin
Dr. K. Decker French (CoI)	University of Illinois at Urbana - Champaign
Dr. Kirsty Taggart (CoI)	Universities Space Research Association
Prasiddha Arunachalam (CoI)	University of California - Santa Cruz
Dr. Phillip Macias (CoI)	University of California - Santa Cruz
Ravjit Kaur (CoI)	University of California - Santa Cruz

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) 2024TVD	ACS/SBC	1	15-Jun-2026 07:00:26.0	yes
02	(1) 2024TVD	WFC3/UVIS	2	15-Jun-2026 07:00:26.0	yes

3 Total Orbits Used

ABSTRACT

Tidal disruption events (TDEs) are luminous flares produced when a star is torn apart and accreted by a massive black hole (MBH). More than 100 TDEs have been discovered so far, almost all originating from galactic nuclei where MBHs typically reside. However, galaxy-merger simulations predict a substantial population of wandering MBHs outside galactic centers--yet no TDE had ever been associated with one until now. The discovery of AT 2024tvd, the first confirmed off-nuclear TDE, opens an entirely new window on this phenomenon. Its location, offset from the bright stellar background of the galactic nucleus, offers a uniquely clean view of accretion physics in action and a chance to test the long-standing idea that TDEs arise from stars bound in nuclear star clusters (NSCs).

We propose coordinated multiwavelength observations with JWST (infrared; NIRSpec IFU + NIRCam), HST (UV + optical imaging), and XMM-Newton (X-ray) to obtain a late-time (>700 days after optical peak) spectral energy distribution (SED) spanning X-ray to infrared wavelengths. The SED will be modeled with three components--the accretion disk, an NSC, and a dust echo--to constrain the MBH mass, accretion rate, and disk size. The NSC component will directly test the presence of a bound stellar cluster and measure its mass, age, and metallicity, testing whether the wandering MBH was delivered through a past galaxy merger. The dust component will characterize the temperature and luminosity of the surrounding dust. These observations will provide unique insights into the progression of accretion in TDEs, in addition to the demographics and growth pathways of wandering MBHs.

OBSERVING DESCRIPTION

One orbit will be used for ACS/SBC imaging in
F140LP and F165LP (for red-leak correction).

Two orbits for WFC3 imaging in F225W,
F336W, F621M, and F775W.

Visit

Proposal 18237, ACS-SBC visit (01), implementation Mon Jun 15 11:00:27 GMT 2026

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/SBC

Special Requirements: (none)

Comments: Far-UV observation of 2024tvd

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-SBC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.179 Line Spacing=0.116	Coordinate Frame=POS-TARG Pattern Orientation=20.02 Angle Between Sides=63.65 Center Pattern=false		(1-2)

Fixed Targets

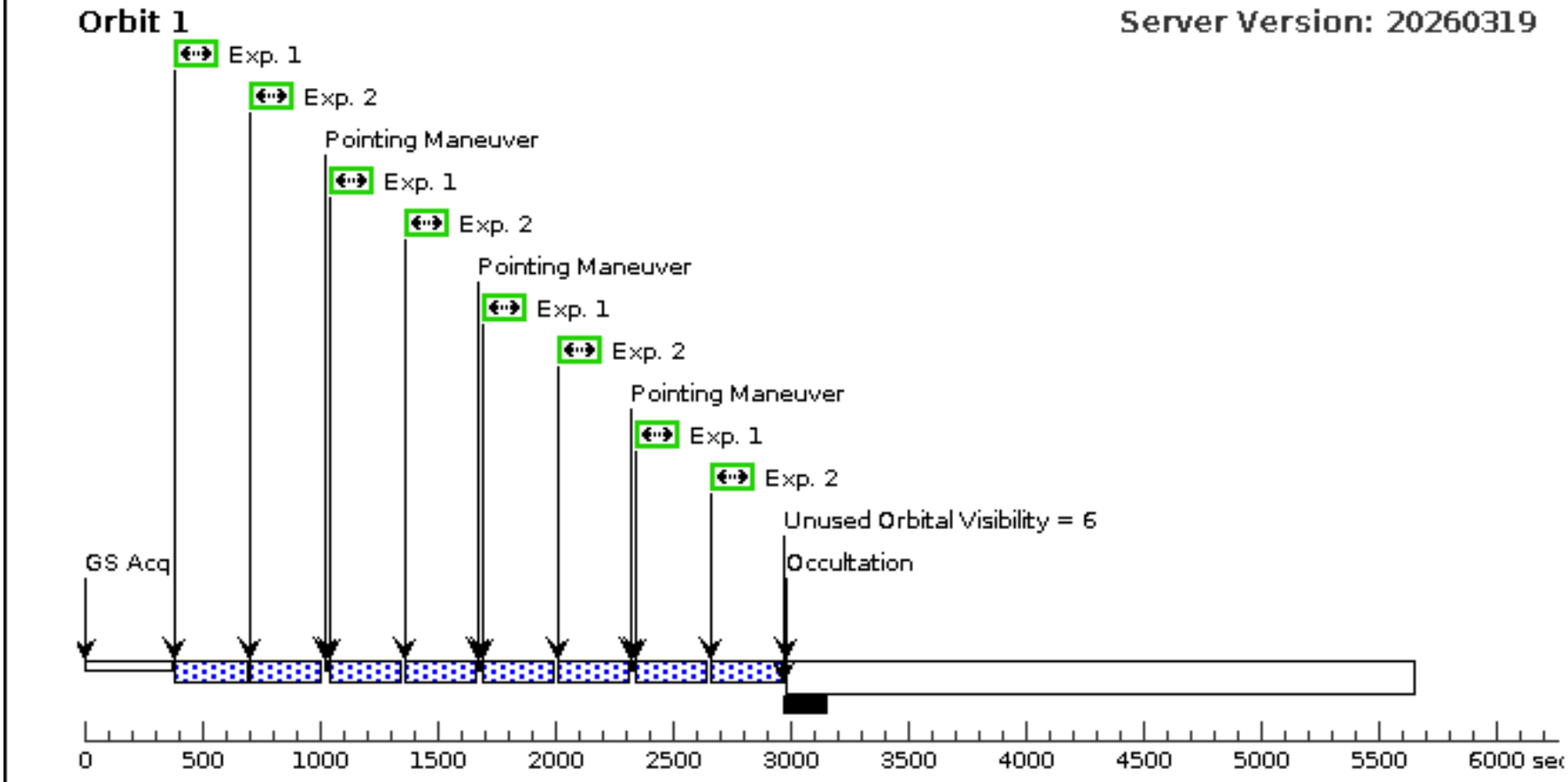
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	2024TVD	RA: 17 10 42.5700 (257.6773750d) Dec: +28 50 14.99 (28.83750d) Equinox: J2000	Epoch of Position: 2000 Redshift: 0.045	V=22	Reference Frame: ICRS

Comments:
Category=UNIDENTIFIED
Description=[ACCRETION DISK, INFRARED EMITTER, OPTICAL EMITTER, ULTRAVIOLET EMITTER, X-RAY EMITTER]

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F140LP (2330479)	(1) 2024TVD	ACS/SBC, ACCUM, SBC	F140LP		GS ACQ SCENARIO BASE1OR	Pattern 1, Exps 1-2 in ACS-SBC visit (01) (1)	200 Secs (992 Secs) *[==>248.0 Secs (Pattern 1)]* *[==>248.0 Secs (Pattern 2)]* *[==>248.0 Secs (Pattern 3)]* *[==>248.0 Secs (Pattern 4)]*	***[1]***
2	F165LP (2330480)	(1) 2024TVD	ACS/SBC, ACCUM, SBC	F165LP			Pattern 1, Exps 1-2 in ACS-SBC visit (01) (1)	200 Secs (992 Secs) *[==>248.0 Secs (Pattern 1)]* *[==>248.0 Secs (Pattern 2)]* *[==>248.0 Secs (Pattern 3)]* *[==>248.0 Secs (Pattern 4)]*	***[1]***

Orbit Structure



Visit

Proposal 18237, WFC3 visit (02), implementation Mon Jun 15 11:00:27 GMT 2026

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Comments: Near-UV and optical observations of 2024tvd

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	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		(1-4)

Fixed Targets

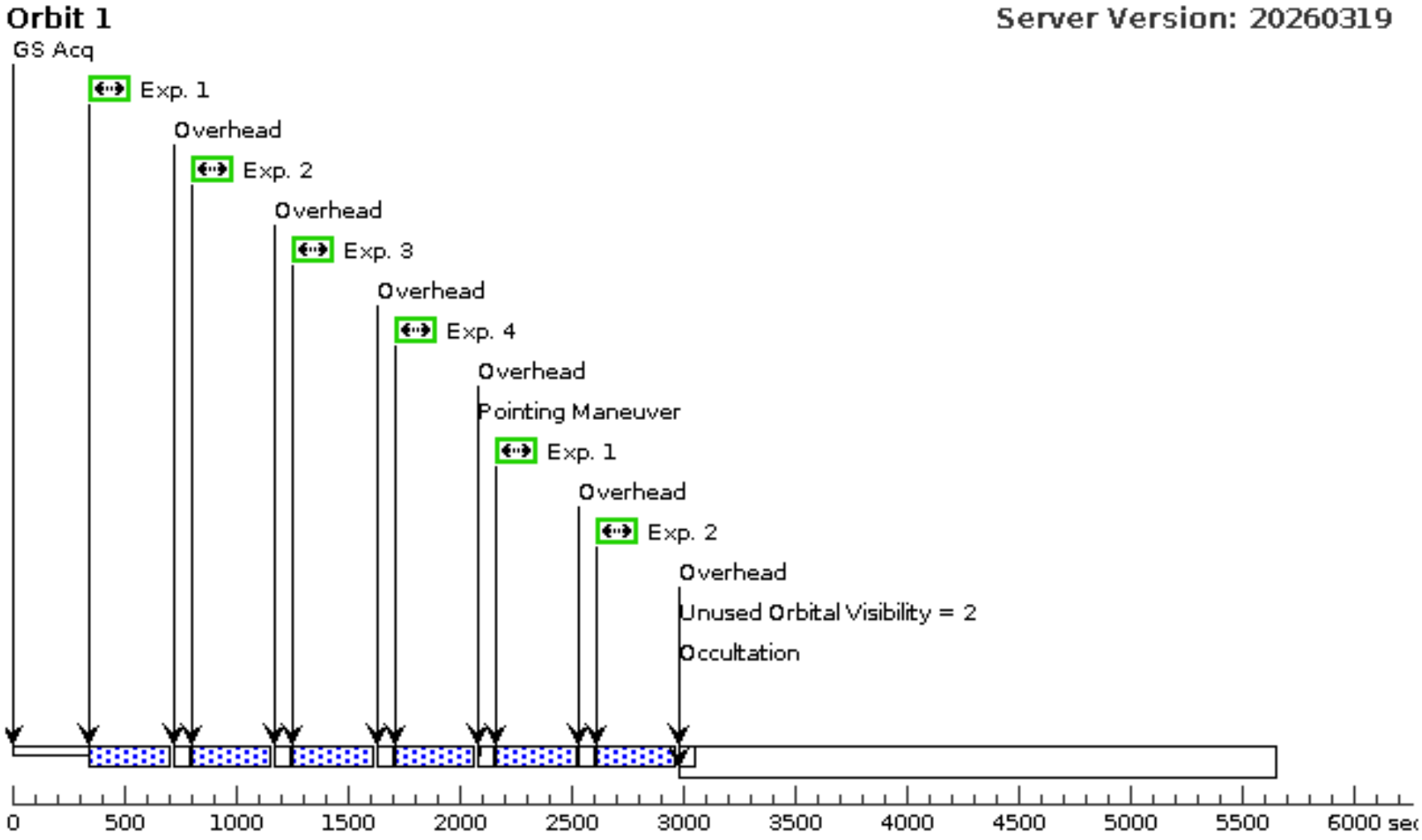
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	2024TVD	RA: 17 10 42.5700 (257.6773750d) Dec: +28 50 14.99 (28.83750d) Equinox: J2000	Epoch of Position: 2000 Redshift: 0.045	V=22	Reference Frame: ICRS

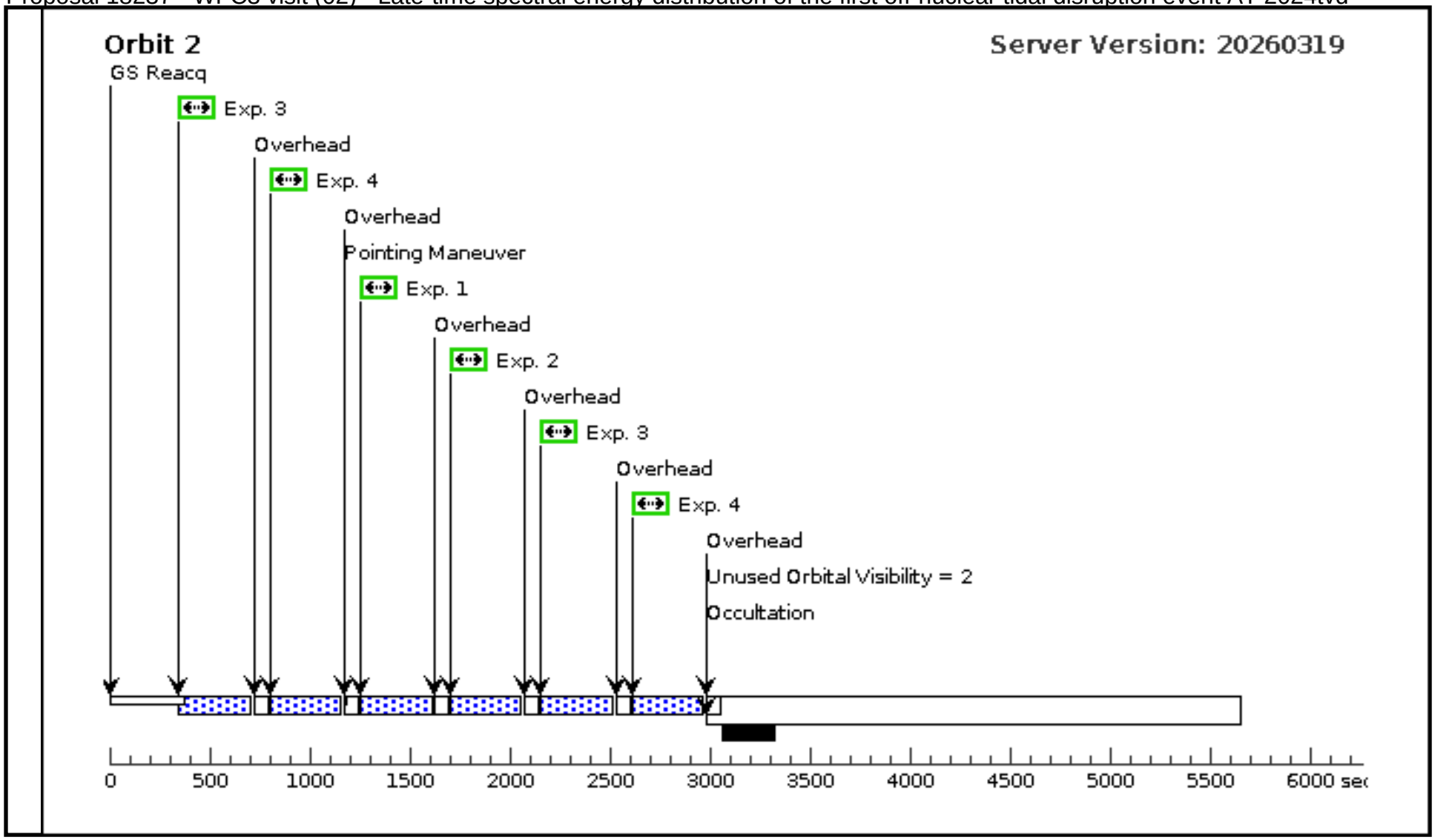
Comments:
Category=UNIDENTIFIED
Description=[ACCRETION DISK, INFRARED EMITTER, OPTICAL EMITTER, ULTRAVIOLET EMITTER, X-RAY EMITTER]

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F225W (2330548)	(1) 2024TVD	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F225W	FLASH=16	GS ACQ SCENARIO BASE1OR	Pattern 2, Exps 1-4 in WFC3 visit (02) (2)	300 Secs (1005 Secs)	
								[==>335.0 Secs (Pattern 1)] *[==>335.0 Secs (Pattern 2)]*	***[1]***
								[==>335.0 Secs (Pattern 3)]	***[2]***
2	F621M (2330549)	(1) 2024TVD	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F621M	FLASH=12		Pattern 2, Exps 1-4 in WFC3 visit (02) (2)	300 Secs (1005 Secs)	
								[==>335.0 Secs (Pattern 1)] *[==>335.0 Secs (Pattern 2)]*	***[1]***
								[==>335.0 Secs (Pattern 3)]	***[2]***
3	F336W (2330550)	(1) 2024TVD	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F336W	FLASH=15		Pattern 2, Exps 1-4 in WFC3 visit (02) (2)	300 Secs (1005 Secs)	
								[==>335.0 Secs (Pattern 1)]	***[1]***
								[==>335.0 Secs (Pattern 2)] *[==>335.0 Secs (Pattern 3)]*	***[2]***
4	F775W (2330551)	(1) 2024TVD	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F775W	FLASH=10		Pattern 2, Exps 1-4 in WFC3 visit (02) (2)	300 Secs (1005 Secs)	
								[==>335.0 Secs (Pattern 1)]	***[1]***
								[==>335.0 Secs (Pattern 2)] *[==>335.0 Secs (Pattern 3)]*	***[2]***

Orbit Structure




Orbit 2
Server Version: 20260319
GS Reacq
Exp. 3
Overhead
Exp. 4
Overhead
Pointing Maneuver
Exp. 1
Overhead
Exp. 2
Overhead
Exp. 3
Overhead
Exp. 4
Overhead
Unused Orbital Visibility = 2
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec