17989 - Building an ANT-hill: STIS UV Follow-up of Ambiguous Nuclear Transients

Cycle: 33, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

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Dr. Anna Payne (CoI)	Space Telescope Science Institute

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(3) AT2024ZKR	STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	2	17-Jul-2025 13:00:15.0	yes
02	(3) AT2024ZKR	STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	2	17-Jul-2025 13:00:16.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
03	(2) NEW-ANT-2	STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	2	17-Jul-2025 13:00:17.0	yes
04	(2) NEW-ANT-2	STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	2	17-Jul-2025 13:00:17.0	yes

8 Total Orbits Used

ABSTRACT

Due in large part to the rapid growth of all-sky transient surveys, a rich diversity of nuclear transients has been discovered. The two most common such transients are tidal disruption events (TDEs) and active galactic nucleus (AGN) flares. However, it has become increasingly clear that there is a growing class of nuclear flares with characteristics distinct from typical TDEs and AGNs, currently known as ambiguous nuclear transients (ANTs). These ANTs likely represent a window into a hitherto unseen or poorly understood mode of accretion onto supermassive black holes, possibly a TDE occurring within an AGN disk. Here we propose to obtain 2 epochs of STIS UV spectroscopy each for 2 newly-discovered UV-bright ANTs in Cycles 32, 33, and 34 for a total of 12 spectra of 6 ANTs. For each ANT, emission lines in the UV spectra will identify if the source is more TDE-like or AGN-like in nature, providing physical insight into the complex interplay between the existing AGN disk and the disrupted tidal debris. The UV spectra will also allow for crucial insights into outflows launched by ANTs through measurements of broad absorption lines, photoionization physics from measurements of low- and high-ionization lines, and properties of circumnuclear gas through multi-ion curve of growth analysis. Obtaining two spectra per ANT separated by roughly 100 days will probe the temporal evolution of the emitting region, which will be compared with predictions from theoretical models of TDEs in AGN disks.

OBSERVING DESCRIPTION

The goal is to obtain a sequence of 2 STIS FUV-MAMA/G140L and NUV-MAMA/G230L UV spectra of two ambiguous nuclear transients (ANTs) per cycle, with a roughly 100-day spacing between the two epochs. This requires 2 orbits per spectroscopic epoch.

After identifying a UV-bright ANT (a Swift UVM2 flux above 1e-15 erg/s/cm^2/A), we will trigger one of our 12 ToOs (4 triggers per cycle). Although these are non-disruptive ToOs, we request that the first epoch occur as close to peak as possible. At the same time, we will trigger a second epoch roughly 100 days later as scheduling allows. The exact timing of this second epoch can be flexible, it is most important to have a long baseline

between the two epochs.

We have set the acquisition image for a point source with the clear/50CCD filter and a 5-second exposure time. This is appropriate for bright ANTs, which should have V~16-17 mag and yield a S/N of ~150 according to the STIS acquisition ETC. This exposure time will be fine for targets with 18.5 > V > 14.5 mag, outside of which we will tweak the exposure time to avoid saturation and ensure a sufficient S/N. We select the 50CCD filter as the contrast between the target (with a blue SED) and host galaxy will be larger than with the standard F28X50LP filter.

The source should be well above the sky, so the 52x0.2 slit should be fine for both the FUV and NUV observations.

Visit

Proposal 17989, Epoch 1 (AT2024zkr) (01) Thu Jul 17 17:00:18 GMT 2025

Diagnostic Status: Warning

Scientific Instruments: STIS/NUV-MAMA, STIS/CCD, STIS/FUV-MAMA

Special Requirements: SCHED 100%; ON HOLD ; TOO RESPONSE TIME 21.0D

Comments: First UV spectroscopic epoch of AT2024zkr.

On Hold Comments: Requires discovery of a sufficiently bright ambiguous nuclear transient.

Diagnostics

(Epoch 1 (AT2024zkr) (01)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Epoch 1 (AT2024zkr) (01)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Fixed Targets

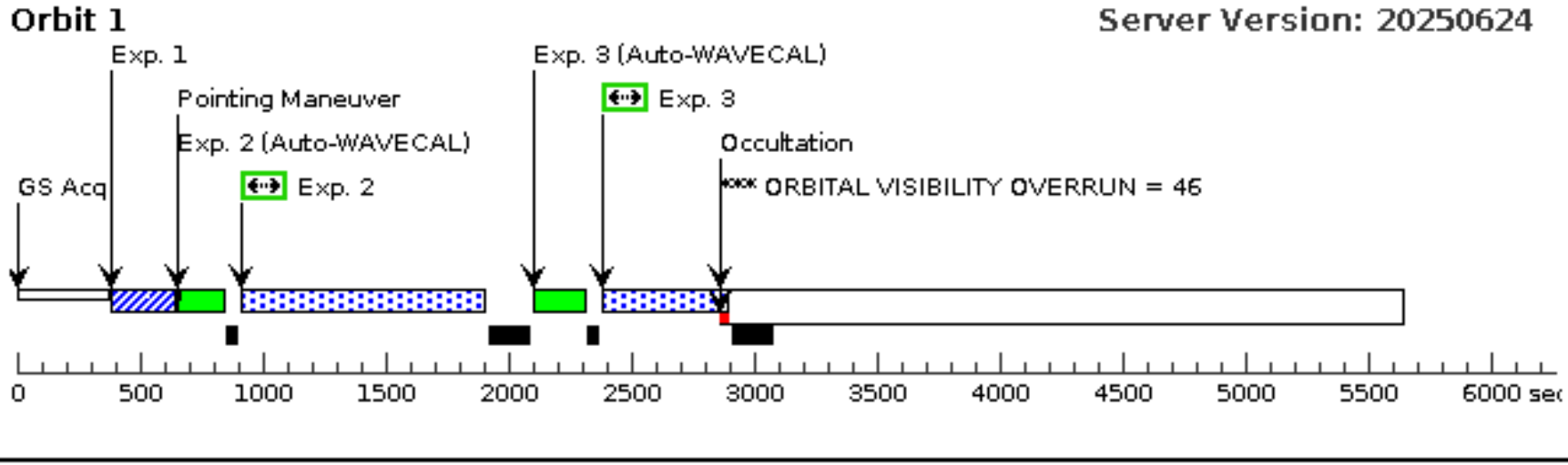
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	AT2024ZKR Alt Name1: ZTF18ABUXIWJ	RA: 01 54 22.9560 (28.5956500d) Dec: -05 59 50.42 (-5.99734d) Equinox: J2000	Redshift: 0.078	V=18.6+/-0.1 1.2e-15 erg/s/cm^2/A	Reference Frame: ICRS

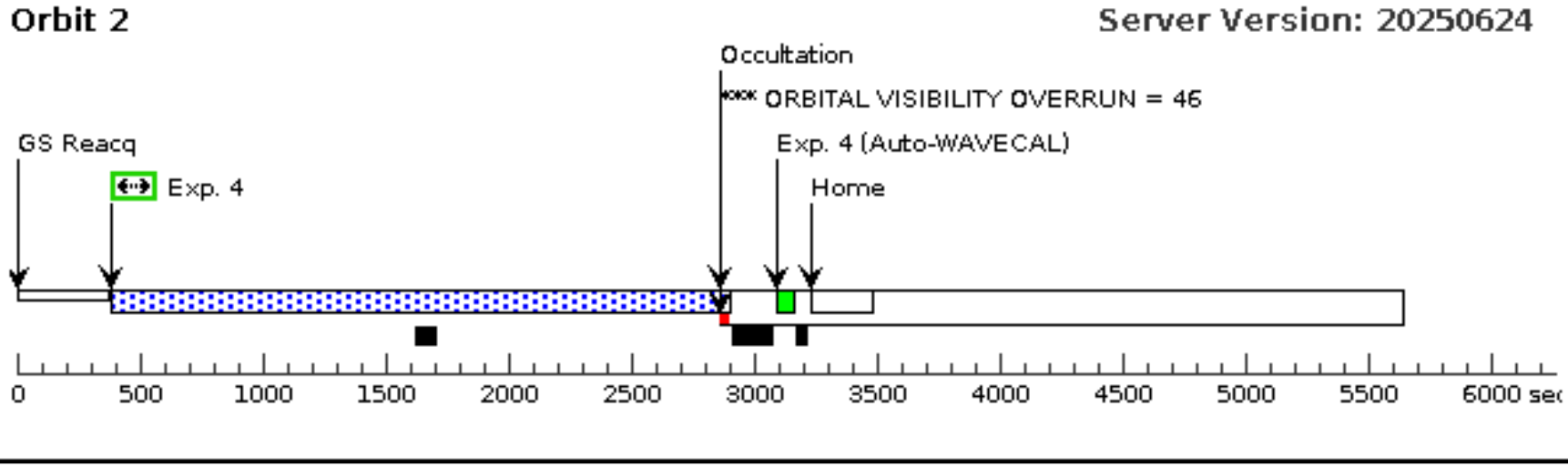
Comments: Flux in the Swift UVW2 filter.
Category=EXT-STAR
Description=[ACCRETION DISK, NUCLEUS]

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.ta.1928008)	(3) AT2024ZKR	STIS/CCD, ACQ, 50CCD	MIRROR				5 Secs (5 Secs)	
								[==>]	***[1]***
Comments: We select the clear/50CCD filter as our target will be blue and we want to maximize contrast from the redder host galaxy. The nominal exposure time of 5 seconds with the clear 50CCD filter will provide sufficient S/N for sources with V magnitudes between 14.5 and 18.5. Outside of this range we will adjust the acquistion exposure time slightly as needed.									
2	(STIS.sp.1848924)	(3) AT2024ZKR	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230L 2376 A	BUFFER-TIME=49 0			5 Secs (980 Secs)	
								[==>980.0 Secs]	***[1]***
Comments: The buffer time is calculated under the assumption that the source will be faint enough that the count rate is less than 4e6/exptime, which should generally be true for our sources. If the source is significantly brighter in the UV, we will lower the buffer time as recommended in Chapter 11.1 of the STIS instrument handbook.									
3	(STIS.sp.1848918)	(3) AT2024ZKR	STIS/FUV-MAMA, TIME-TAG, 52X0.2	G140L 1425 A	BUFFER-TIME=25 0			5 Secs (500 Secs)	
								[==>500 Secs]	***[1]***
Comments: The buffer time is calculated under the assumption that the source will be faint enough that the count rate is less than 4e6/exptime, which should nearly always be true for our ANTs in the FUV. Nevertheless, we will confirm the appropriate buffer time based on Swift observations of the UV SED of the source.									
4	(STIS.sp.1848918)	(3) AT2024ZKR	STIS/FUV-MAMA, TIME-TAG, 52X0.2	G140L 1425 A	BUFFER-TIME=12 50			5 Secs (2505 Secs)	
								[==>2505.0 Secs]	***[2]***
Comments: The buffer time is calculated under the assumption that the source will be faint enough that the count rate is less than 4e6/exptime, which should nearly always be true for our ANTs in the FUV. Nevertheless, we will confirm the appropriate buffer time based on Swift observations of the UV SED of the source.									

Orbit Structure





Visit

Proposal 17989, Epoch 2 (AT2024zkr) (02) Thu Jul 17 17:00:18 GMT 2025

Diagnostic Status: Warning

Scientific Instruments: STIS/NUV-MAMA, STIS/CCD, STIS/FUV-MAMA

Special Requirements: SCHED 100%; AFTER 01 BY 90 D TO 220 D; ON HOLD

Comments: Second UV spectroscopic epoch of AT2024zkr.

On Hold Comments: Requires discovery of a sufficiently bright ambiguous nuclear transient.

Diagnostics

(Epoch 2 (AT2024zkr) (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Epoch 2 (AT2024zkr) (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	AT2024ZKR Alt Name1: ZTF18ABUXIWJ	RA: 01 54 22.9560 (28.5956500d) Dec: -05 59 50.42 (-5.99734d) Equinox: J2000	Redshift: 0.078	V=18.6+/-0.1 1.2e-15 erg/s/cm^2/A	Reference Frame: ICRS

Comments: Flux in the Swift UVW2 filter.
Category=EXT-STAR
Description=[ACCRETION DISK, NUCLEUS]

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.ta.1928008)	(3) AT2024ZKR	STIS/CCD, ACQ, 50CCD	MIRROR				5 Secs (5 Secs) *[==>]*	 ***[1]***

Comments: We select the clear/50CCD filter as our target will be blue and we want to maximize contrast from the redder host galaxy. The nominal exposure time of 5 seconds with the clear 50CCD filter will provide s ufficient S/N for sources with V magnitudes between 14.5 and 18.5. Outside of this range we will adjust the acquistion exposure time slightly as needed.

2	(STIS.sp.1848924)	(3) AT2024ZKR	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230L 2376 A	BUFFER-TIME=50 0			5 Secs (980 Secs) *[==>980 Secs]*	 ***[1]***

Comments: The buffer time is calculated under the assumption that the source will be faint enough that the count rate is less than 4e6/exptime, which should generally be true for our sources. If the source is significant ly brighter in the UV, we will lower the buffer time as recommended in Chapter 11.1 of the STIS instrument handbook.

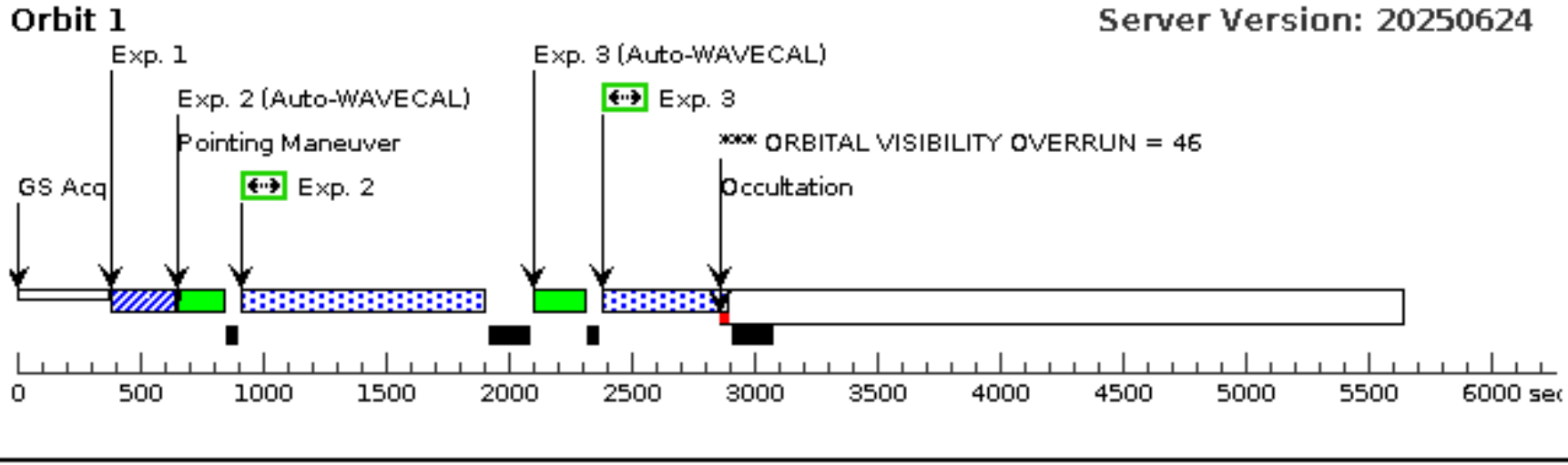
3	(STIS.sp.1848918)	(3) AT2024ZKR	STIS/FUV-MAMA, TIME-TAG, 52X0.2	G140L 1425 A	BUFFER-TIME=25 0			5 Secs (500 Secs) *[==>500 Secs]*	 ***[1]***

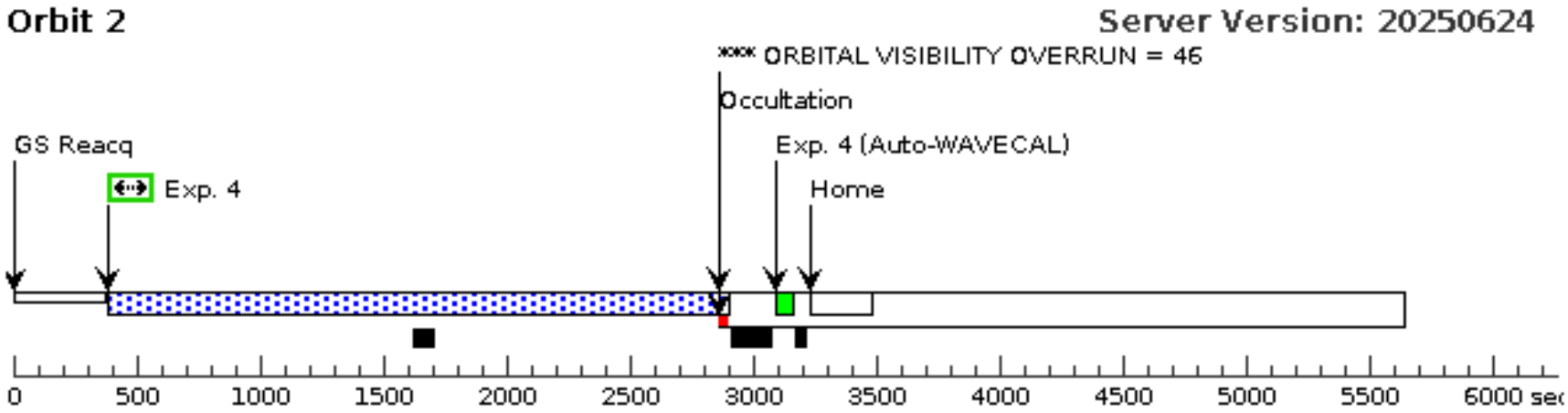
Comments: The buffer time is calculated under the assumption that the source will be faint enough that the count rate is less than 4e6/exptime, which should nearly always be true for our ANTs in the FUV. Nevertheles s, we will confirm the appropriate buffer time based on Swift observations of the UV SED of the source. We use the 52x0.2 aperture as our default, although if the source fades more quickly than expected over the 100 day timespan between epochs, it may be necessary to use the 52X0.2D1 pseudo-aperture to avoid the FUV-MAMA glow region.

4	(STIS.sp.1848918)	(3) AT2024ZKR	STIS/FUV-MAMA, TIME-TAG, 52X0.2	G140L 1425 A	BUFFER-TIME=12 50			5 Secs (2505 Secs) *[==>2505.0 Secs]*	 ***[2]***

Comments: The buffer time is calculated under the assumption that the source will be faint enough that the count rate is less than 4e6/exptime, which should nearly always be true for our ANTs in the FUV. Nevertheles s, we will confirm the appropriate buffer time based on Swift observations of the UV SED of the source. We use the 52x0.2 aperture as our default, although if the source fades more quickly than expected over the 100 day timespan between epochs, it may be necessary to use the 52X0.2D1 pseudo-aperture to avoid the FUV-MAMA glow region.

Orbit Structure





Visit

Proposal 17989, Epoch 1 (ANT 2) (03) Thu Jul 17 17:00:18 GMT 2025

Diagnostic Status: Warning

Scientific Instruments: STIS/NUV-MAMA, STIS/CCD, STIS/FUV-MAMA

Special Requirements: SCHED 100%; ON HOLD ; TOO RESPONSE TIME 21.0D

Comments: First UV spectroscopic epoch of newly-discovered ANT #2.

On Hold Comments: Requires discovery of a sufficiently bright ambiguous nuclear transient.

Diagnostics

(Epoch 1 (ANT 2) (03)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Epoch 1 (ANT 2) (03)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Generic Targets

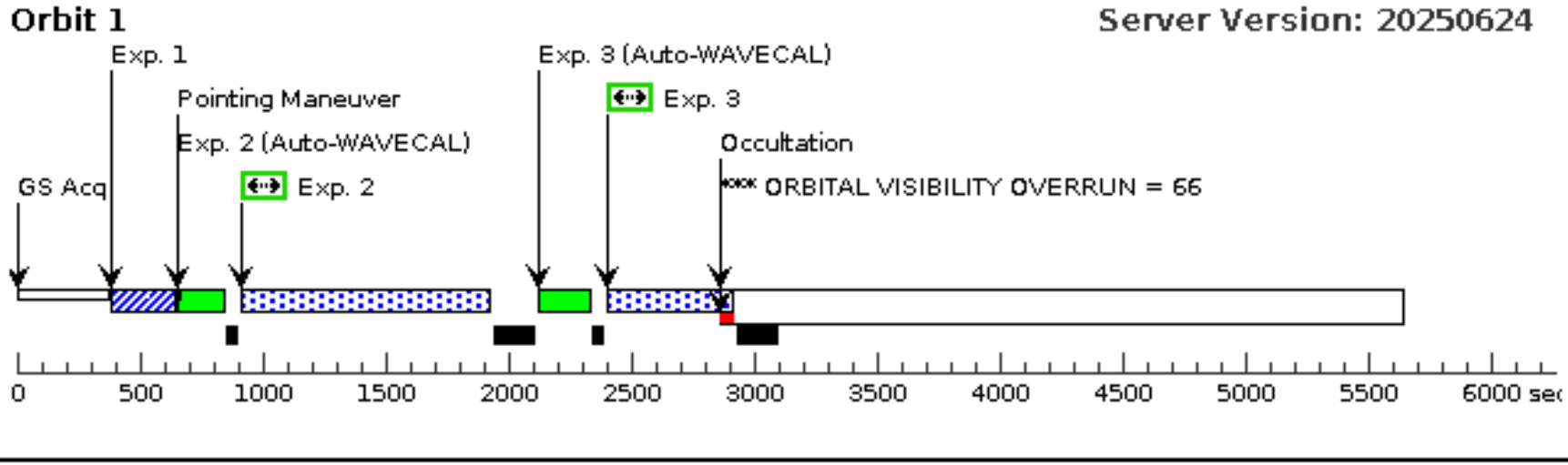
#	Name	Criteria	Description
(2)	NEW-ANT-2	Swift UV flux at 2250 A above 10^-15 erg/s/cm^2/A	

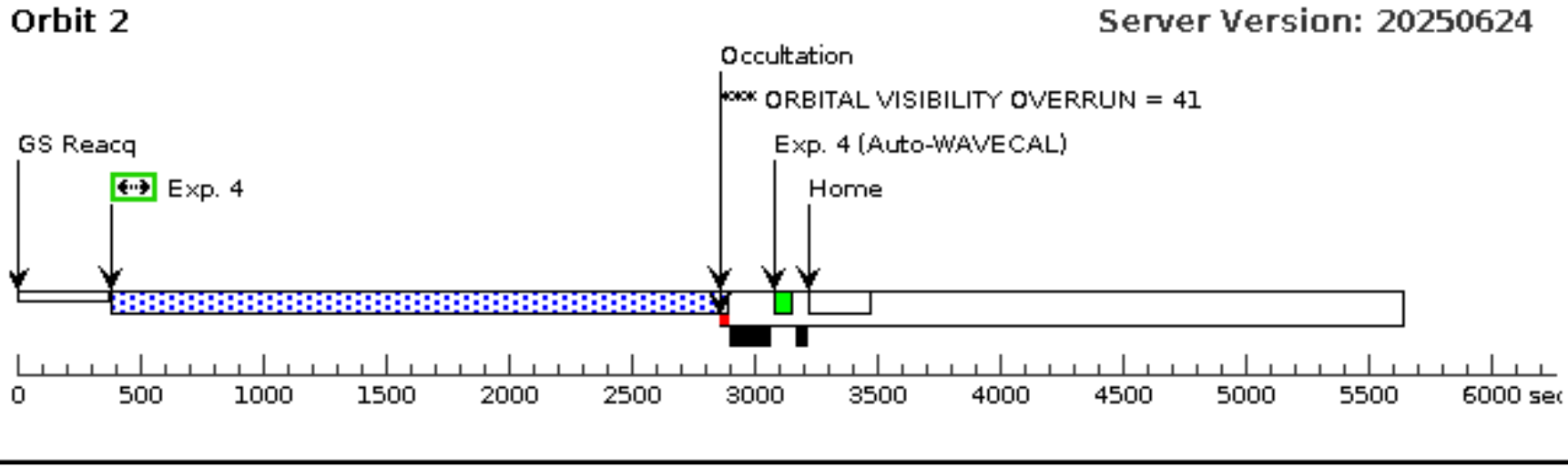
Comments: The V mag is approximate, and will be updated when a suitable target is discovered. Target would also have to meet STIS/MAMA safety criteria, based on Swift follow-up to measure the source UV mag.

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.ta.1928008)	(2) NEW-ANT-2	STIS/CCD, ACQ, 50CCD	MIRROR				5 Secs (5 Secs) *[==>]*	 ***[1]***
Comments: We select the clear/50CCD filter as our target will be blue and we want to maximize contrast from the redder host galaxy. The nominal exposure time of 5 seconds with the clear 50CCD filter will provide s ufficient S/N for sources with V magnitudes between 14.5 and 18.5. Outside of this range we will adjust the acquistion exposure time slightly as needed.									
2	(STIS.sp.1848924)	(2) NEW-ANT-2	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230L 2376 A	BUFFER-TIME=50 0			5 Secs (1000 Secs) *[==>1000.0 Secs]*	 ***[1]***
Comments: The buffer time is calculated under the assumption that the source will be faint enough that the count rate is less than 4e6/exptime, which should generally be true for our sources. If the source is significant ly brighter in the UV, we will lower the buffer time as recommended in Chapter 11.1 of the STIS instrument handbook.									
3	(STIS.sp.1848918)	(2) NEW-ANT-2	STIS/FUV-MAMA, TIME-TAG, 52X0.2	G140L 1425 A	BUFFER-TIME=25 0			5 Secs (500 Secs) *[==>500 Secs]*	 ***[1]***
Comments: The buffer time is calculated under the assumption that the source will be faint enough that the count rate is less than 4e6/exptime, which should nearly always be true for our ANTs in the FUV. Nevertheles s, we will confirm the appropriate buffer time based on Swift observations of the UV SED of the source.									
4	(STIS.sp.1848918)	(2) NEW-ANT-2	STIS/FUV-MAMA, TIME-TAG, 52X0.2	G140L 1425 A	BUFFER-TIME=12 50			5 Secs (2500 Secs) *[==>2500.0 Secs]*	 ***[2]***
Comments: The buffer time is calculated under the assumption that the source will be faint enough that the count rate is less than 4e6/exptime, which should nearly always be true for our ANTs in the FUV. Nevertheles s, we will confirm the appropriate buffer time based on Swift observations of the UV SED of the source.									

Orbit Structure





Visit

Proposal 17989, Epoch 2 (ANT 2) (04) Thu Jul 17 17:00:18 GMT 2025

Diagnostic Status: Warning

Scientific Instruments: STIS/NUV-MAMA, STIS/CCD, STIS/FUV-MAMA

Special Requirements: SCHED 100%; AFTER 03 BY 90 D TO 110 D; ON HOLD

Comments: Second UV spectroscopic epoch of newly-discovered ANT #2.

On Hold Comments: Requires discovery of a sufficiently bright ambiguous nuclear transient.

Diagnostics

(Epoch 2 (ANT 2) (04)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Epoch 2 (ANT 2) (04)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Generic Targets

#	Name	Criteria	Description
(2)	NEW-ANT-2	Swift UV flux at 2250 A above 10^-15 erg/s/cm^2/A	

Comments: The V mag is approximate, and will be updated when a suitable target is discovered. Target would also have to meet STIS/MAMA safety criteria, based on Swift follow-up to measure the source UV mag.

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.ta.1928008)	(2) NEW-ANT-2	STIS/CCD, ACQ, 50CCD	MIRROR				5 Secs (5 Secs) *[==>]*	 ***[1]***
	Comments: We select the clear/50CCD filter as our target will be blue and we want to maximize contrast from the redder host galaxy. The nominal exposure time of 5 seconds with the clear 50CCD filter will provide sufficient S/N for sources with V magnitudes between 14.5 and 18.5. Outside of this range we will adjust the acquistion exposure time slightly as needed.								
2	(STIS.sp.1848924)	(2) NEW-ANT-2	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230L 2376 A	BUFFER-TIME=50 0			5 Secs (1000 Secs) *[==>1000.0 Secs]*	 ***[1]***
	Comments: The buffer time is calculated under the assumption that the source will be faint enough that the count rate is less than 4e6/exptime, which should generally be true for our sources. If the source is significantly brighter in the UV, we will lower the buffer time as recommended in Chapter 11.1 of the STIS instrument handbook.								
3	(STIS.sp.1848918)	(2) NEW-ANT-2	STIS/FUV-MAMA, TIME-TAG, 52X0.2	G140L 1425 A	BUFFER-TIME=25 0			5 Secs (500 Secs) *[==>500 Secs]*	 ***[1]***
	Comments: The buffer time is calculated under the assumption that the source will be faint enough that the count rate is less than 4e6/exptime, which should nearly always be true for our ANTs in the FUV. Nevertheless, we will confirm the appropriate buffer time based on Swift observations of the UV SED of the source. We use the 52x0.2 aperture as our default, although if the source fades more quickly than expected over the 100 day timespan between epochs, it may be necessary to use the 52X0.2D1 pseudo-aperture to avoid the FUV-MAMA glow region.								
4	(STIS.sp.1848918)	(2) NEW-ANT-2	STIS/FUV-MAMA, TIME-TAG, 52X0.2	G140L 1425 A	BUFFER-TIME=12 50			5 Secs (2500 Secs) *[==>2500.0 Secs]*	 ***[2]***
	Comments: The buffer time is calculated under the assumption that the source will be faint enough that the count rate is less than 4e6/exptime, which should nearly always be true for our ANTs in the FUV. Nevertheless, we will confirm the appropriate buffer time based on Swift observations of the UV SED of the source. We use the 52x0.2 aperture as our default, although if the source fades more quickly than expected over the 100 day timespan between epochs, it may be necessary to use the 52X0.2D1 pseudo-aperture to avoid the FUV-MAMA glow region.								

Orbit Structure