



# 17195 - UV Spectroscopic Signatures from Fast Evolving Transients

Cycle: 30, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

## INVESTIGATORS

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## 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) AT-2023TSV	STIS/CCD STIS/NUV-MAMA	1	29-Sep-2023 17:00:22.0	yes
02	(1) AT-2023TSV	STIS/CCD STIS/FUV-MAMA	1	29-Sep-2023 17:00:22.0	yes
03	(1) AT-2023TSV	STIS/CCD STIS/FUV-MAMA	1	29-Sep-2023 17:00:23.0	yes
04	(1) AT-2023TSV	STIS/CCD STIS/NUV-MAMA	1	29-Sep-2023 17:00:23.0	yes
05	(1) AT-2023TSV	STIS/CCD STIS/NUV-MAMA	1	29-Sep-2023 17:00:23.0	yes
06	(1) AT-2023TSV	STIS/CCD STIS/NUV-MAMA	1	29-Sep-2023 17:00:24.0	yes

6 Total Orbits Used

## ABSTRACT

A new subclass of fast rising and fading transients is being uncovered as higher cadence all-sky surveys come online (e.g., ZTF, YSE), including FBOTs and supernovae (SNe) Type Ibn/Icn. This subclass generally tends to be described as "extreme" given they are some of the hottest, bluest, most luminous, and fastest evolving transients known, defying our current understanding of stellar evolution and explosions. While shock interaction with a dense circumstellar medium is likely, other powering mechanisms may be at play. Yet compared to other SNe, very little is known about these events. One of the reasons is that the optical spectra tend to be dominated by a featureless continuum. The UV, however, provides an important window by which to study these events, as a significant amount of energy emerges at these wavelengths and a multitude of emission lines probe the abundances of both iron-group and intermediate-mass elements. Recent advances in theoretical models (CMFGEN, specifically) now allow for the

Proposal 17195 (STScI Edit Number: 4, Created: Friday, September 29, 2023 at 4:00:24 PM Eastern Standard Time) - Overview  
treatment of these fast transients, including in the UV. While several UV spectra exist, they do not adequately span the known diversity of this subclass. Furthermore, they tend not to be obtained early enough relative to peak to build a complete model of the event (e.g. CSM composition and mass, energetics). Published spectra offer qualitative comparisons, but do not perform any detailed modeling. Here we propose a disruptive ToO with HST/STIS to obtain 2 epochs of UV spectra of a fast transient within 250 Mpc. Follow-up modeling will result in a detailed probe of mass-loss history and powering mechanism in this extreme(!) new subclass.

## **OBSERVING DESCRIPTION**

We propose to obtain 2 epochs (3 orbits each) of STIS-MAMA spectra of a single Fast Transient supernova. The brightness is really the most important factor, but fast transients can vary in brightness substantially (magnitudes). We offer rough guidelines of a target within 250 Mpc and as close to light-curve maximum as possible. The goal is to detect UV signatures that can distinguish between progenitor scenarios. These observations will also trace circumstellar interaction, constrain the progenitor mass loss, and identify late-time heating mechanisms for potential warm dust.

The initial spectrum will be triggered as a \*disruptive\* ToO, and observations should be scheduled as soon as possible. The second epoch should be obtained again within 10 days (the goal is to maximize the time between the two epochs, so there may be some wiggle room depending on the brightness and evolution timeline of the SN). We will use the data to trace circumstellar interaction, constrain the progenitor mass loss, and measure the CNO processing. Comparisons to other SN and FBOT subclasses will also help distinguish between progenitor systems and central engine powering mechanisms.

The first epoch will include observations in both the G140 and G230L bandpasses.

The second epoch will include observations in only the G230L bandpass.

We choose STIS over COS for several reasons. Most importantly, STIS offers spatially resolved spectra that exploit the intrinsically high resolution of HST over a large spectral range (accommodating both the C III] 1909 Ang and Mg II 2800 Ang lines). The long slit length will allow us to subtract contamination from zodiacal light, earthshine, the host galaxy, and H II regions. STIS also has superior sensitivity to COS in the NUV. While COS is optimized for isolated, faint point sources in the FUV with medium resolution, we would suffer from less wavelength coverage and require more integrations. We would also lose the advantages of the slit described above.

Proposal 17195 - STIS-SN2023tsz-Epoch1 (NUV) (01) - UV Spectroscopic Signatures from Fast Evolving Transients

Fri Sep 29 21:00:24 GMT 2023

**Propos**al 17195, STIS-SN2023tsz-Epoch1 (NUV) (01), implementation

**Diagnostic Status: No Diagnostics**

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

Special Requirements: ON HOLD ; TOO RESPONSE TIME 2.0D

Comments: Likely to acquire on bright SN.

On Hold Comments: Target-of-Opportunity.

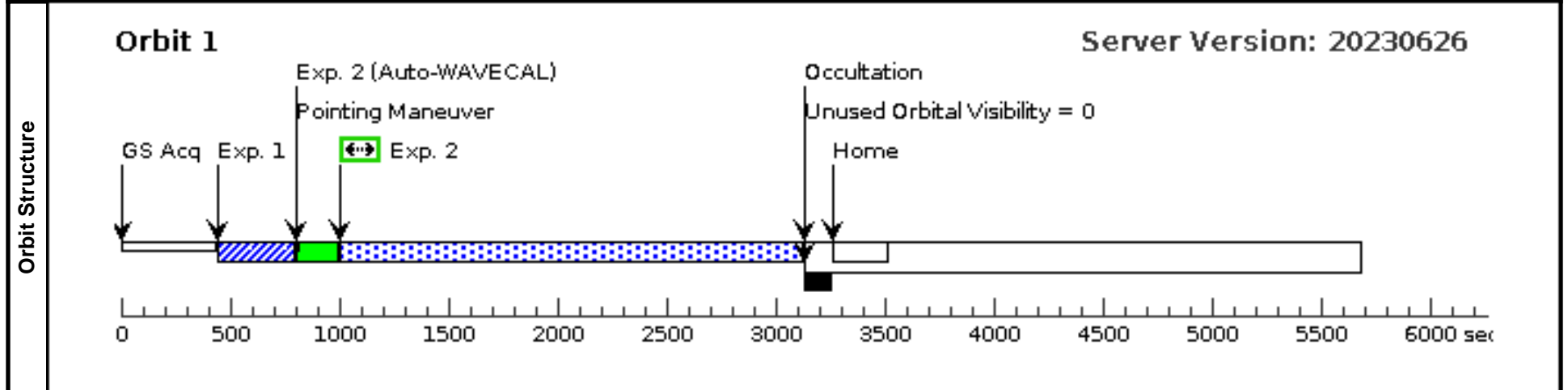
The initial spectrum will be triggered as a disruptive ToO, and observations should be scheduled as soon as possible (2-5 days as stated in the CfP). Less than 2 days could be possible since PI Fox works at STScI and has worked on ultra-rapid responses with HST planners in the past.

The main goal, however, is to make sure the observations are obtained around peak, which typically happens about 3 days post-discovery.

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	AT-2023TSV	RA: 08 37 29.5230 (129.3730125d) Dec: -00 02 35.70 (-.04325d) Equinox: J2000		V=17.5	Reference Frame: ICRS

Comments:  
Category=STAR  
Description=[SUPERNOVA]  
Extended=NO

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	ACQ (STIS.im.13 67909)	(1) AT-2023TSV	STIS/CCD, ACQ, F28X50LP	MIRROR				30 Secs (30 Secs) [==>]	[1]
Comments: Used 10,000K Blackbody normalized to V=16. SN should be bright during initial acquisition.									
2	STIS/NUV Exp 1 (STIS.sp.13 67898)	(1) AT-2023TSV	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				2000 Secs (2104 Secs) [==>2104.0 Secs ]	[1]
Comments: Assuming a 10,000K Blackbody around peak.									



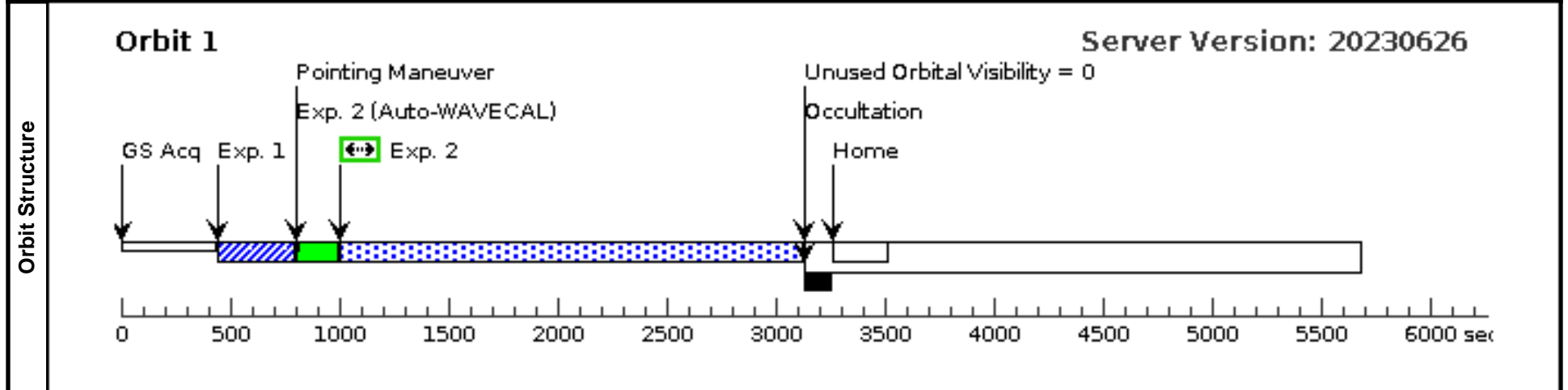
Proposal 17195 - STIS-SN2023tsz-Epoch1 (FUV) (02) - UV Spectroscopic Signatures from Fast Evolving Transients

Fri Sep 29 21:00:24 GMT 2023

**Propos**al 17195, STIS-SN2023tsz-Epoch1 (FUV) (02), implementation  
**Diagnostic Status: No Diagnostics**  
 Scientific Instruments: STIS/CCD, STIS/FUV-MAMA  
 Special Requirements: AFTER 01 BY 0 Orbits TO 1.1 Orbits; ON HOLD ; TOO RESPONSE TIME 2.0D  
 Comments: Likely to acquire on bright SN.  
 On Hold Comments: Target-of-Opportunity.  
 The initial spectrum will be triggered as a disruptive ToO, and observations should be scheduled as soon as possible (2-5 days as stated in the CfP). Less than 2 days could be possible since PI Fox works at STScI and has worked on ultra-rapid responses with HST planners in the past.  
 The main goal, however, is to make sure the observations are obtained around peak, which typically happens about 3 days post-discovery.

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	AT-2023TSV	RA: 08 37 29.5230 (129.3730125d) Dec: -00 02 35.70 (-.04325d) Equinox: J2000		V=17.5	Reference Frame: ICRS
Comments: Category=STAR Description=[SUPERNOVA] Extended=NO					

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	ACQ (STIS.im.13 67909)	(1) AT-2023TSV	STIS/CCD, ACQ, F28X50LP	MIRROR				30 Secs (30 Secs) [==>]	[1]
Comments: Used 10,000K Blackbody normalized to V=16. SN should be bright during initial acquisition.									
2	STIS/FUV E xp 1 (STIS.sp.13 67897)	(1) AT-2023TSV	STIS/FUV-MAMA, ACCUM, 52X0.2D1	G140L 1425 A				2000 Secs (2104 Secs) [==>2104.0 Secs ]	[1]
Comments: Assuming a 10,000K Blackbody around peak.									



Proposal 17195 - STIS-SN2023tsz-Epoch1 (FUV) (03) - UV Spectroscopic Signatures from Fast Evolving Transients

Fri Sep 29 21:00:24 GMT 2023

**Propos**al 17195, STIS-SN2023tsz-Epoch1 (FUV) (03), implementation

**Diagnostic Status: No Diagnostics**

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

Special Requirements: AFTER 02 BY 0 Orbits TO 1.1 Orbits; ON HOLD ; TOO RESPONSE TIME 2.0D

Comments: Likely to acquire on bright SN.

On Hold Comments: Target-of-Opportunity.

The initial spectrum will be triggered as a disruptive ToO, and observations should be scheduled as soon as possible (2-5 days as stated in the CfP). Less than 2 days could be possible since PI Fox works at STScI and has worked on ultra-rapid responses with HST planners in the past.

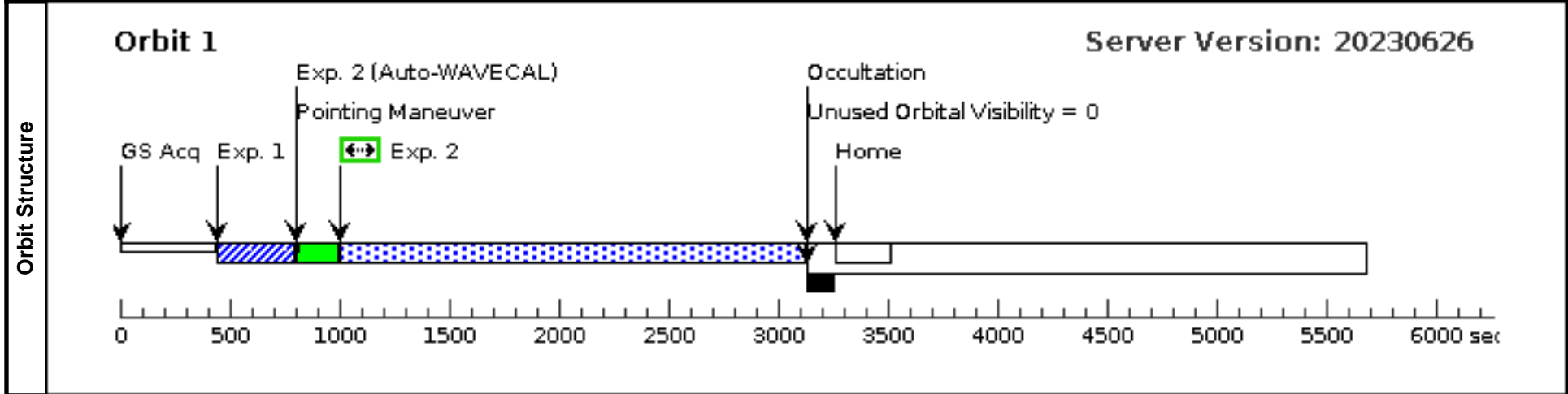
The main goal, however, is to make sure the observations are obtained around peak, which typically happens about 3 days post-discovery.

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	AT-2023TSV	RA: 08 37 29.5230 (129.3730125d) Dec: -00 02 35.70 (-.04325d) Equinox: J2000		V=17.5	Reference Frame: ICRS

Comments:  
Category=STAR  
Description=[SUPERNOVA]  
Extended=NO

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	ACQ (STIS.im.13 67909)	(1) AT-2023TSV	STIS/CCD, ACQ, F28X50LP	MIRROR				30 Secs (30 Secs) [==>]	[1]
Comments: Used 10,000K Blackbody normalized to V=16. SN should be bright during initial acquisition.									
2	STIS/FUV E xp 2 (STIS.sp.13 67897)	(1) AT-2023TSV	STIS/FUV-MAMA, ACCUM, 52X0.2D1	G140L 1425 A				2000 Secs (2104 Secs) [==>2104.0 Secs ]	[1]

Comments: Assuming a 10,000K Blackbody around peak.



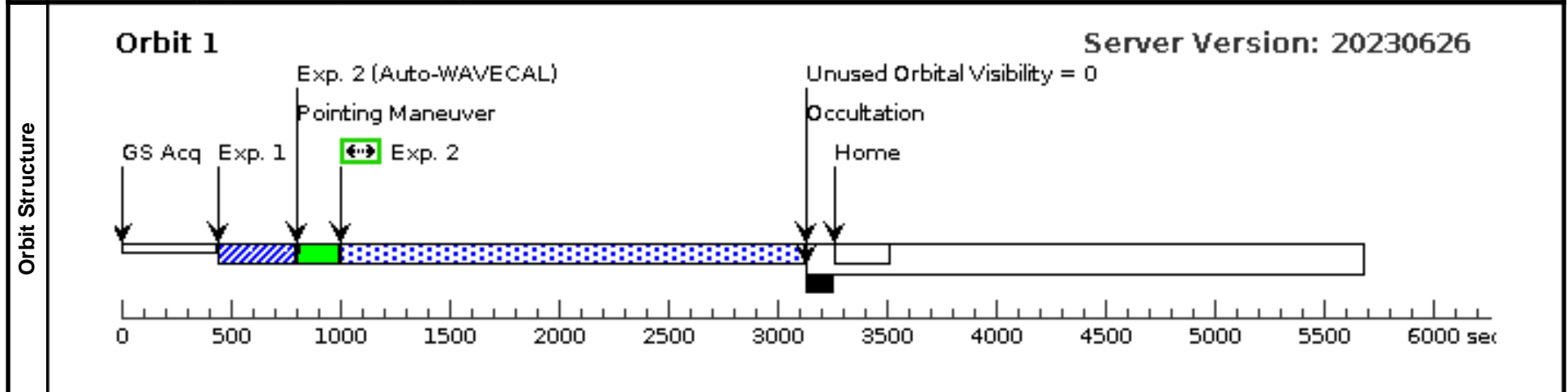
Proposal 17195 - STIS-SN2023tsz-Epoch2 (NUV) (04) - UV Spectroscopic Signatures from Fast Evolving Transients

Fri Sep 29 21:00:24 GMT 2023

**Visit**  
**Proposal 17195, STIS-SN2023tsz-Epoch2 (NUV) (04), implementation**  
**Diagnostic Status: No Diagnostics**  
 Scientific Instruments: STIS/NUV-MAMA, STIS/CCD  
 Special Requirements: AFTER 01 BY 6 D TO 12 D; ON HOLD  
 Comments: Likely to acquire on bright SN.  
 On Hold Comments: Target-of-Opportunity.  
 This visit will be scheduled for 6-12 days following the first visit (as specified in the Timing Requirements), ideally aiming for 10 days. But we'd like to have some flexibility with our final submission to account for the brightness and light-curve evolution.

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	AT-2023TSV	RA: 08 37 29.5230 (129.3730125d) Dec: -00 02 35.70 (-.04325d) Equinox: J2000		V=17.5	Reference Frame: ICRS
Comments: Category=STAR Description=[SUPERNOVA] Extended=NO					

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	ACQ (STIS.im.13 67910)	(1) AT-2023TSV	STIS/CCD, ACQ, F28X50LP	MIRROR				30 Secs (30 Secs) [=>]	[1]
Comments: Used 10,000K Blackbody normalized to V=16. SN should be bright during initial acquisition.									
2	STIS/NUV Exp 1 (STIS.sp.13 67905)	(1) AT-2023TSV	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				2000 Secs (2104 Secs) [=>2104.0 Secs ]	[1]
Comments: Assuming a 7,000K Blackbody around 10 days post-max.									



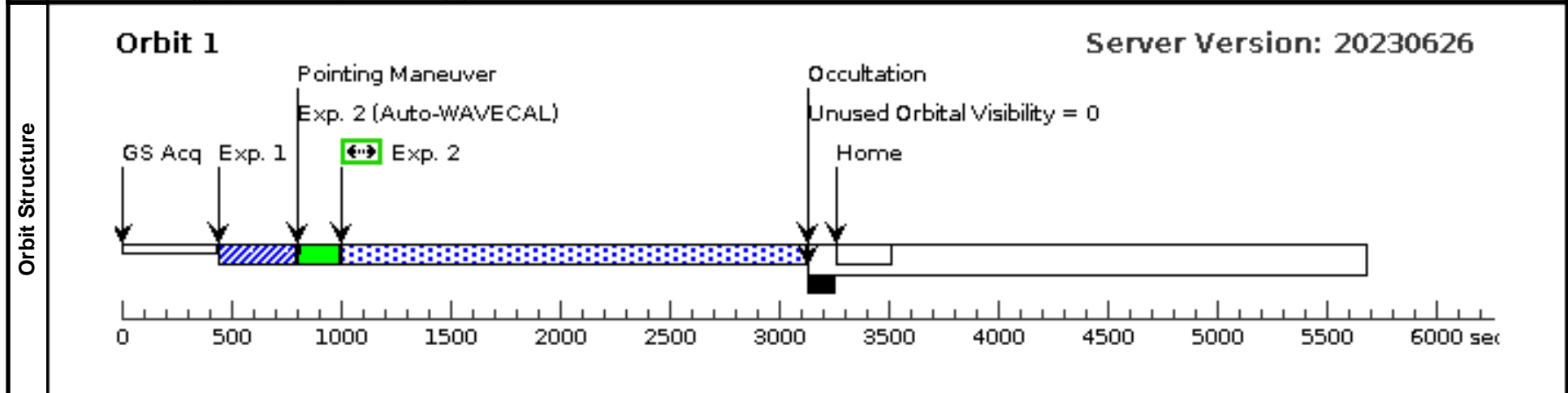
Proposal 17195 - STIS-SN2023tsz-Epoch2 (NUV) (05) - UV Spectroscopic Signatures from Fast Evolving Transients

Fri Sep 29 21:00:24 GMT 2023

**Visit**  
**Proposal 17195, STIS-SN2023tsz-Epoch2 (NUV) (05), implementation**  
**Diagnostic Status: No Diagnostics**  
 Scientific Instruments: STIS/NUV-MAMA, STIS/CCD  
 Special Requirements: AFTER 04 BY 0 Orbits TO 1.1 Orbits; ON HOLD  
 Comments: Likely to acquire on bright SN.  
 On Hold Comments: Target-of-Opportunity.  
 This visit will be scheduled for 6-12 days following the first visit (as specified in the Timing Requirements), ideally aiming for 10 days. But we'd like to have some flexibility with our final submission to account for the brightness and light-curve evolution.

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	AT-2023TSV	RA: 08 37 29.5230 (129.3730125d) Dec: -00 02 35.70 (-.04325d) Equinox: J2000		V=17.5	Reference Frame: ICRS
Comments: Category=STAR Description=[SUPERNOVA] Extended=NO					

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	ACQ (STIS.im.13 67910)	(1) AT-2023TSV	STIS/CCD, ACQ, F28X50LP	MIRROR				30 Secs (30 Secs) [==>]	[1]
Comments: Used 10,000K Blackbody normalized to V=16. SN should be bright during initial acquisition.									
2	STIS/NUV Exp 2 (STIS.sp.13 67905)	(1) AT-2023TSV	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				2000 Secs (2104 Secs) [==>2104.0 Secs ]	[1]
Comments: Assuming a 7,000K Blackbody around 10 days post-max.									





Proposal 17195 - STIS-SN2023tsz-Epoch2 (NUV) (06) - UV Spectroscopic Signatures from Fast Evolving Transients

Fri Sep 29 21:00:24 GMT 2023

**Visit**  
**Proposal 17195, STIS-SN2023tsz-Epoch2 (NUV) (06), implementation**  
**Diagnostic Status: No Diagnostics**  
 Scientific Instruments: STIS/NUV-MAMA, STIS/CCD  
 Special Requirements: AFTER 05 BY 0 Orbits TO 1.1 Orbits; ON HOLD  
 Comments: Likely to acquire on bright SN.  
 On Hold Comments: Target-of-Opportunity.  
 This visit will be scheduled for 6-12 days following the first visit (as specified in the Timing Requirements), ideally aiming for 10 days. But we'd like to have some flexibility with our final submission to account for the brightness and light-curve evolution.

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	AT-2023TSV	RA: 08 37 29.5230 (129.3730125d) Dec: -00 02 35.70 (-.04325d) Equinox: J2000		V=17.5	Reference Frame: ICRS
Comments: Category=STAR Description=[SUPERNOVA] Extended=NO					

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	ACQ (STIS.im.13 67910)	(1) AT-2023TSV	STIS/CCD, ACQ, F28X50LP	MIRROR				30 Secs (30 Secs) [==>]	[1]
Comments: Used 10,000K Blackbody normalized to V=16. SN should be bright during initial acquisition.									
2	STIS/NUV Exp 3 (STIS.sp.13 67905)	(1) AT-2023TSV	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				2000 Secs (2104 Secs) [==>2104.0 Secs ]	[1]
Comments: Assuming a 7,000K Blackbody around 10 days post-max.									

