17449 - Early spectroscopy of tidal disruption events: outflow signatures or chemical composition ?

Cycle: 31, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) AT2022DBL	COS/FUV COS/NUV	1	22-Sep-2025 14:00:32.0	yes
02	(1) AT2022DBL	STIS/CCD STIS/NUV-MAMA	1	22-Sep-2025 14:00:33.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
03	(1) AT2022DBL	COS/FUV COS/NUV	1	22-Sep-2025 14:00:34.0	yes
04	(1) AT2022DBL	STIS/CCD STIS/NUV-MAMA	1	22-Sep-2025 14:00:35.0	yes
05	(1) AT2022DBL	COS/FUV COS/NUV	1	22-Sep-2025 14:00:36.0	yes
06	(1) AT2022DBL	STIS/CCD STIS/NUV-MAMA	1	22-Sep-2025 14:00:36.0	yes

6 Total Orbits Used

ABSTRACT

Tidal Disruption Events (TDEs) happen when stars get tidally disrupted by the gravitational field of a supermassive black hole. TDEs are bright panchromatic events and evolve on human-friendly time scales, which makes them prime tools to study accretion physics and black holes in all types of galaxies. Despite considerable progress achieved in the last few years, and the increasing number of TDEs discovered in the optical/UV wavelengths, we still do not know what powers the optical/UV emission of these events, with reprocessed accretion and debris stream collisions being the leading candidates. Important clues to their nature can be derived from spectroscopy, including the presence of Bowen fluorescent emission and the study of kinematical offsets. A growing number of optical TDEs show transient blueshifted line profiles, which are particularly prominent at the He + Bowen blend and at early phases. These have been interpreted as signatures of outflows, which are an inherent prediction of super-Eddington accretion models. However, the blended nature of optical lines makes it hard to disentangle outflows (measured by blueshifts) from chemical composition (the relative contributions of He II and N III). Early UV spectroscopy is required to break this degeneracy by observing the profiles of isolated He II and high-ionisation lines before maximum light, something which has never been possible to achieve before. We therefore propose a ToO program to obtain the first pre-max spectrum of a TDE in the UV and solve this outstanding question. In addition, our proposed COS-STIS observations will contribute to slowly increasing a small legacy sample of TDEs with UV spectroscopy.

OBSERVING DESCRIPTION

This is a target of opportunity program. We propose to obtain spectra of a TDE with STIS + COS in order to cover both the NUV and FUV wavelength range, and study a range of spectral lines at different wavelengths. In total, we request for observations at three separate epochs: the first spectrum should be obtained as soon as possible after the early discovery and spectroscopic classification (by means of an optical spectrum) of a

TDE showing blueshifted features. Hence, this is a disruptive ToO. Two more epochs will be obtained around the peak of the light curve (or a bit after the peak) and at a few weeks after the peak. These observations will allow us to monitor the evolution of the line profiles, strengths and offsets. These two observations will be linked to be separated by ~3 and ~6 weeks from the first trigger and they will therefore be nondisruptive for the telescope schedule. At the same time, this is an adequate time scale for probing TDE evolution.

We will apply strict selection criteria in order to ensure that the data will be adequate to address our goals. We will only trigger our program on a TDE which i) is discovered and spectroscopically classified before peak and ii) shows a blueshifted broad emission line of He II (possibly blended with N III) and iii) is sufficiently bright. Based on our S/N calculations we have set our brightness cut-off to UVM2 < 15.5 mag (Vega) at peak, corresponding to a typical TDE at z < 0.05. During the rise (time of first trigger) and decay, this translates to UVM2 < 16.5 mag. To obtain a quick estimate of the UV magnitude, we will request for a Swift visit within 24 hours from spectroscopic classification and identification as a potential target. However, this is not required and it will not be part of our triggering criteria. If Swift observations are not available or possible within a fast time scale, we will estimate the UV color, using typical TDE optical - UV colors (g-UVW2 = 2.1+/-0.46 based on a large number of TDEs), where the optical color will be provided by the discovery survey. Prior to triggering, a safety control will be performed for nearby bright objects, in compliance with the COS + STIS regulations.

Disruptive nature of ToO and justification: As explained, we request a disruptive ToO. This is the only way to obtain a spectrum of a TDE prior to maximum light. TDEs have typical rise times of 20-25 days and the earliest available classifications (i.e. spectroscopic confirmation of their nature) are 1-2 weeks before peak. In addition, spectroscopic evolution is fast at these phases and the line profiles we wish to observe are of transient nature. We can therefore not afford waiting 3 weeks for a non-disruptive trigger but we request a turnaround of 2-5 days. The two follow-up observations will not be disruptive but will be linked to be ~3 and ~6 weeks after the first trigger.

Visit

Proposal 17449, COS - epoch 1 (01), completed

Mon Sep 22 18:00:37 GMT 2025

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: SCHED 70%; TOO RESPONSE TIME 5.0D

Diagnostics

(COS - epoch 1 (01)) Warning (Orbit Planner): GS ACQ SCENARIO REQUESTED INCONSISTENT WITH VISIT GYRO MODE

(acquisition (01.001) special requirements) Warning (Form): The specified GS Acq Scenario is not in the current list of valid scenarios.

Fixed Targets

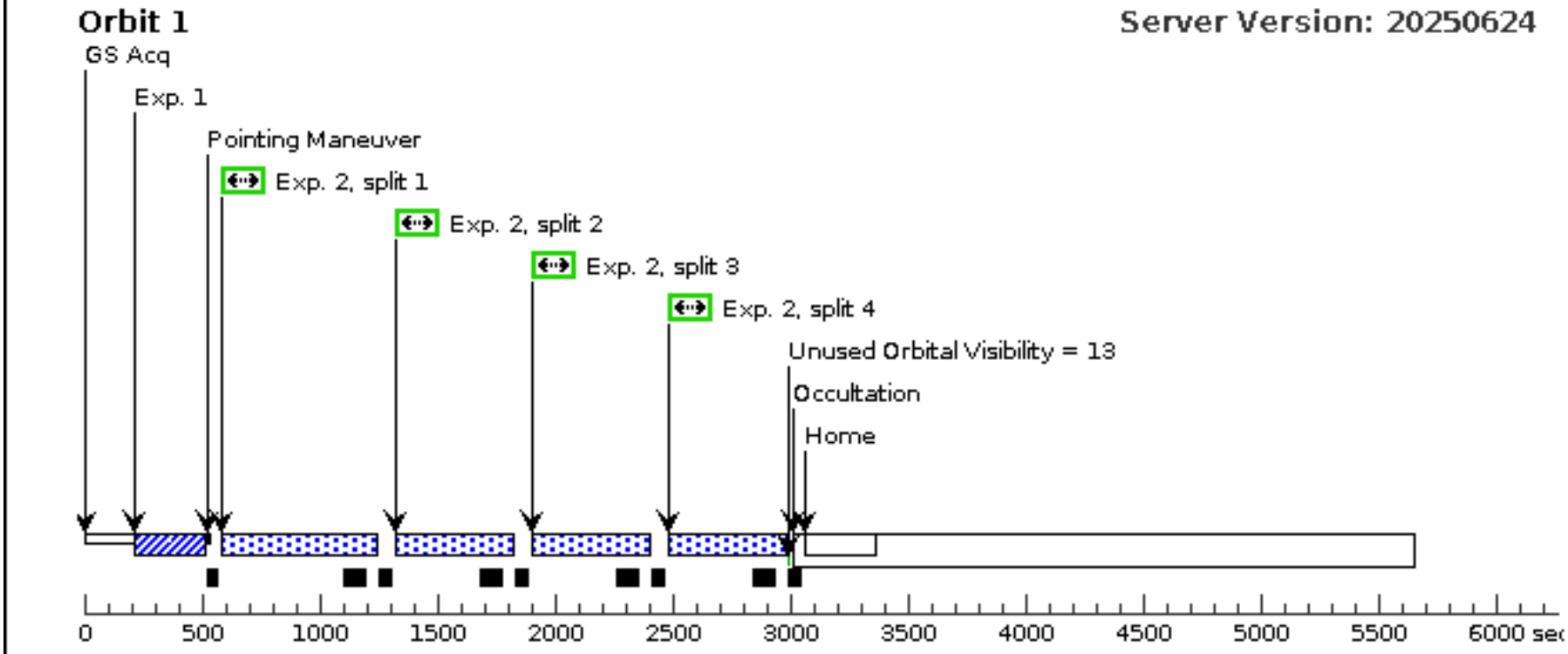
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	AT2022DBL Alt Name1: ATLAS18BCNL Alt Name2: ZTF18AABDAJX	RA: 12 20 45.0500 (185.1877083d) Dec: +49 33 4.61 (49.55128d) Equinox: J2000		V=18.3+/-0.2 UV (2000 AA): 16.1 mag (Vega)	Reference Frame: ICRS

Comments: The V-magnitude is a difference magnitude provided by the ATLAS survey (in the orange filter)
The UV magnitude is measured by Swift UVOT in the UVM2 filter on 2024-02-03
Category=EXT-STAR
Description=[ACCRETION DISK, UNDESIGNATED, X-RAY TRANSIENT]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	acquisition (1813884)	(1) AT2022DBL	COS/NUV, ACQ/IMAGE, BOA	MIRRORA		GS ACQ SCENARIO BASE1B3		37 Secs (37 Secs) *[==>]*	 ***[1]***
2	science (1813844)	(1) AT2022DBL	COS/FUV, TIME-TAG, PSA	G140L 800 A	FP-POS=ALL; FLASH=YES; BUFFER-TIME=320			500 Secs (1784 Secs) *[==>446.0 Secs (Split 1)]* *[==>446.0 Secs (Split 2)]* *[==>446.0 Secs (Split 3)]* *[==>446.0 Secs (Split 4)]*	 ***[1]***

Orbit Structure



Visit

Proposal 17449, STIS - epoch 1 (02), completed Mon Sep 22 18:00:37 GMT 2025

Diagnostic Status: Warning

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

Special Requirements: SCHED 70%; AFTER 01 BY 0.9 Orbits TO 1.1 Orbits; TOO RESPONSE TIME 5.0D

Diagnostics

(STIS - epoch 1 (02)) Warning (Orbit Planner): GS ACQ SCENARIO REQUESTED INCONSISTENT WITH VISIT GYRO MODE

(STIS - epoch 1 (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(acquisition (02.001) special requirements) Warning (Form): The specified GS Acq Scenario is not in the current list of valid scenarios.

Fixed Targets

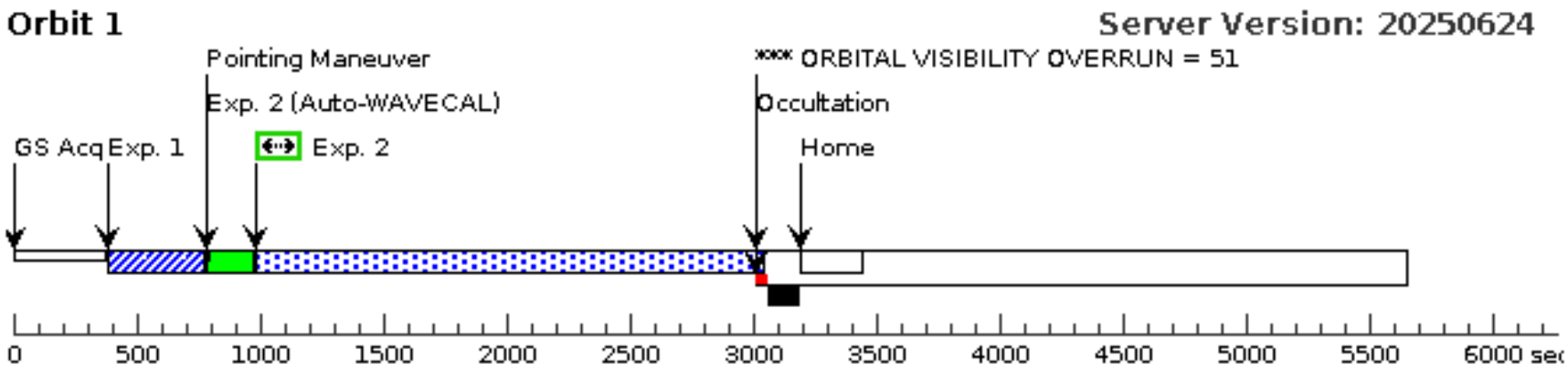
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	AT2022DBL Alt Name1: ATLAS18BCNL Alt Name2: ZTF18AABDAJX	RA: 12 20 45.0500 (185.1877083d) Dec: +49 33 4.61 (49.55128d) Equinox: J2000		V=18.3+/-0.2 UV (2000 AA): 16.1 mag (Vega)	Reference Frame: ICRS

Comments: The V-magnitude is a difference magnitude provided by the ATLAS survey (in the orange filter)
The UV magnitude is measured by Swift UVOT in the UVM2 filter on 2024-02-03
Category=EXT-STAR
Description=[ACCRETION DISK, UNDESIGNATED, X-RAY TRANSIENT]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	acquisition (1813280)	(1) AT2022DBL	STIS/CCD, ACQ, F28X50LP	MIRROR		GS ACQ SCENARIO BASE1B3		40 Secs (40 Secs) *[==>]*	 ***[1]***
2	science (1812149)	(1) AT2022DBL	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				2000 Secs (2050 Secs) *[==>2050.0 Secs]*	 ***[1]***

Orbit Structure



Visit

Proposal 17449, COS - epoch 2 (03), completed

Mon Sep 22 18:00:37 GMT 2025

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: SCHED 100%; AFTER 01 BY 11 D TO 30 D

Diagnostics

(COS - epoch 2 (03)) Warning (Orbit Planner): GS ACQ SCENARIO REQUESTED INCONSISTENT WITH VISIT GYRO MODE

(acquisition (03.001) special requirements) Warning (Form): The specified GS Acq Scenario is not in the current list of valid scenarios.

Fixed Targets

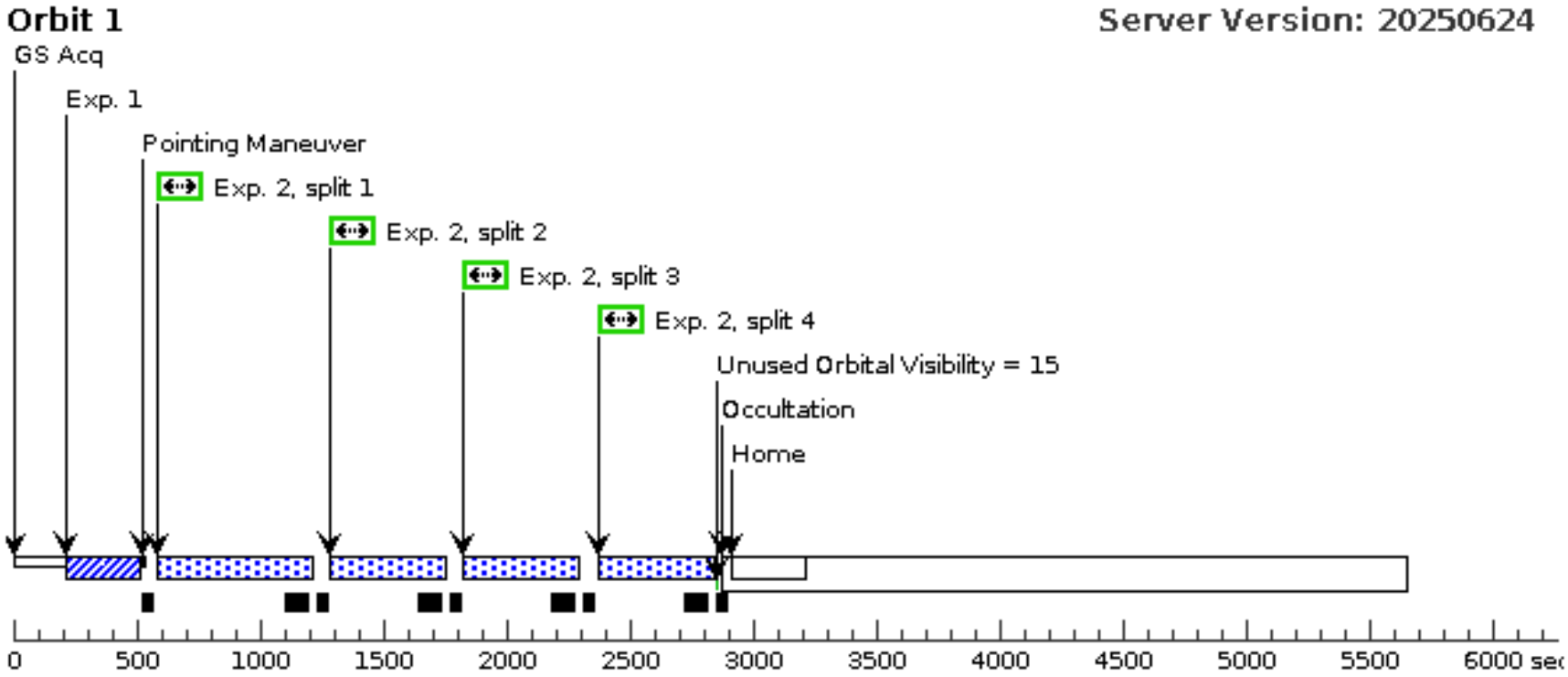
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	AT2022DBL Alt Name1: ATLAS18BCNL Alt Name2: ZTF18AABDAJX	RA: 12 20 45.0500 (185.1877083d) Dec: +49 33 4.61 (49.55128d) Equinox: J2000		V=18.3+/-0.2 UV (2000 AA): 16.1 mag (Vega)	Reference Frame: ICRS

Comments: The V-magnitude is a difference magnitude provided by the ATLAS survey (in the orange filter)
The UV magnitude is measured by Swift UVOT in the UVM2 filter on 2024-02-03
Category=EXT-STAR
Description=[ACCRETION DISK, UNDESIGNATED, X-RAY TRANSIENT]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	acquisition (1813884)	(1) AT2022DBL	COS/NUV, ACQ/IMAGE, BOA	MIRRORA		GS ACQ SCENARIO BASE1B3		37 Secs (37 Secs) *[==>]*	 ***[1]***
2	science (1813844)	(1) AT2022DBL	COS/FUV, TIME-TAG, PSA	G140L 800 A	FP-POS=ALL; FLASH=YES; BUFFER-TIME=320			500 Secs (1672 Secs) *[==>418.0 Secs (Split 1)]* *[==>418.0 Secs (Split 2)]* *[==>418.0 Secs (Split 3)]* *[==>418.0 Secs (Split 4)]*	 ***[1]***

Orbit Structure



Visit

Proposal 17449, STIS - epoch 2 (04), completed Mon Sep 22 18:00:37 GMT 2025

Diagnostic Status: Warning

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

Special Requirements: SCHED 100%; AFTER 03 BY 0.9 Orbits TO 1.1 Orbits

Diagnostics

(STIS - epoch 2 (04)) Warning (Orbit Planner): GS ACQ SCENARIO REQUESTED INCONSISTENT WITH VISIT GYRO MODE

(acquisition (04.001) special requirements) Warning (Form): The specified GS Acq Scenario is not in the current list of valid scenarios.

Fixed Targets

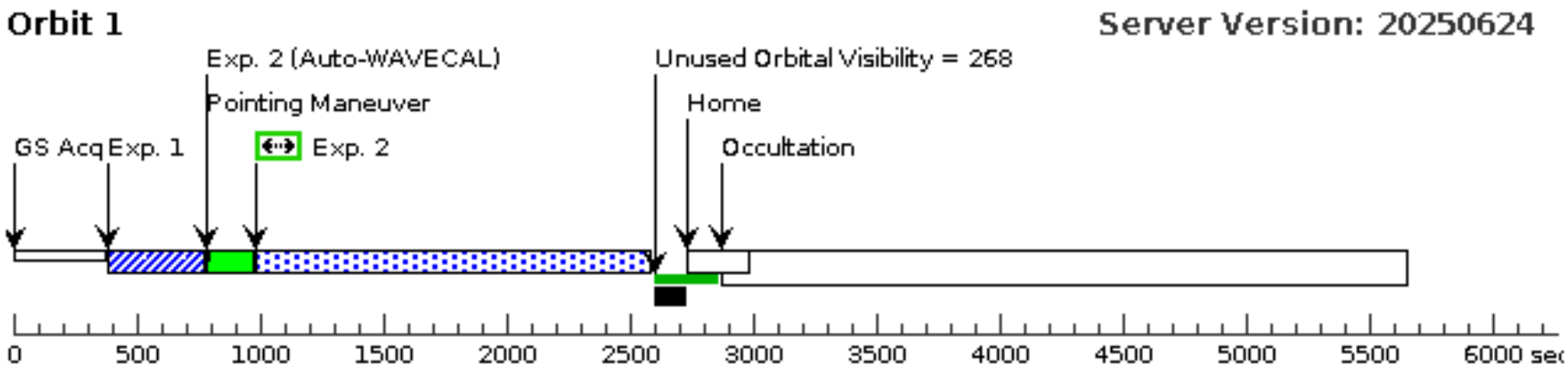
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	AT2022DBL Alt Name1: ATLAS18BCNL Alt Name2: ZTF18AABDAJX	RA: 12 20 45.0500 (185.1877083d) Dec: +49 33 4.61 (49.55128d) Equinox: J2000		V=18.3+/-0.2 UV (2000 AA): 16.1 mag (Vega)	Reference Frame: ICRS

Comments: The V-magnitude is a difference magnitude provided by the ATLAS survey (in the orange filter)
The UV magnitude is measured by Swift UVOT in the UVM2 filter on 2024-02-03
Category=EXT-STAR
Description=[ACCRETION DISK, UNDESIGNATED, X-RAY TRANSIENT]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	acquisition (1813280)	(1) AT2022DBL	STIS/CCD, ACQ, F28X50LP	MIRROR		GS ACQ SCENARIO BASE1B3		40 Secs (40 Secs) *[==>]*	 ***[1]***
2	science (1812149)	(1) AT2022DBL	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				2000 Secs (1591 Secs) *[==>1591.0 Secs]*	 ***[1]***

Orbit Structure



Visit

Proposal 17449, COS - epoch 3 (05), completed

Mon Sep 22 18:00:37 GMT 2025

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: AFTER_03 BY 15 D TO 27 D

Diagnostics

(COS - epoch 3 (05)) Warning (Orbit Planner): GS ACQ SCENARIO REQUESTED INCONSISTENT WITH VISIT GYRO MODE

(COS - epoch 3 (05)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(acquisition (05.001) special requirements) Warning (Form): The specified GS Acq Scenario is not in the current list of valid scenarios.

Fixed Targets

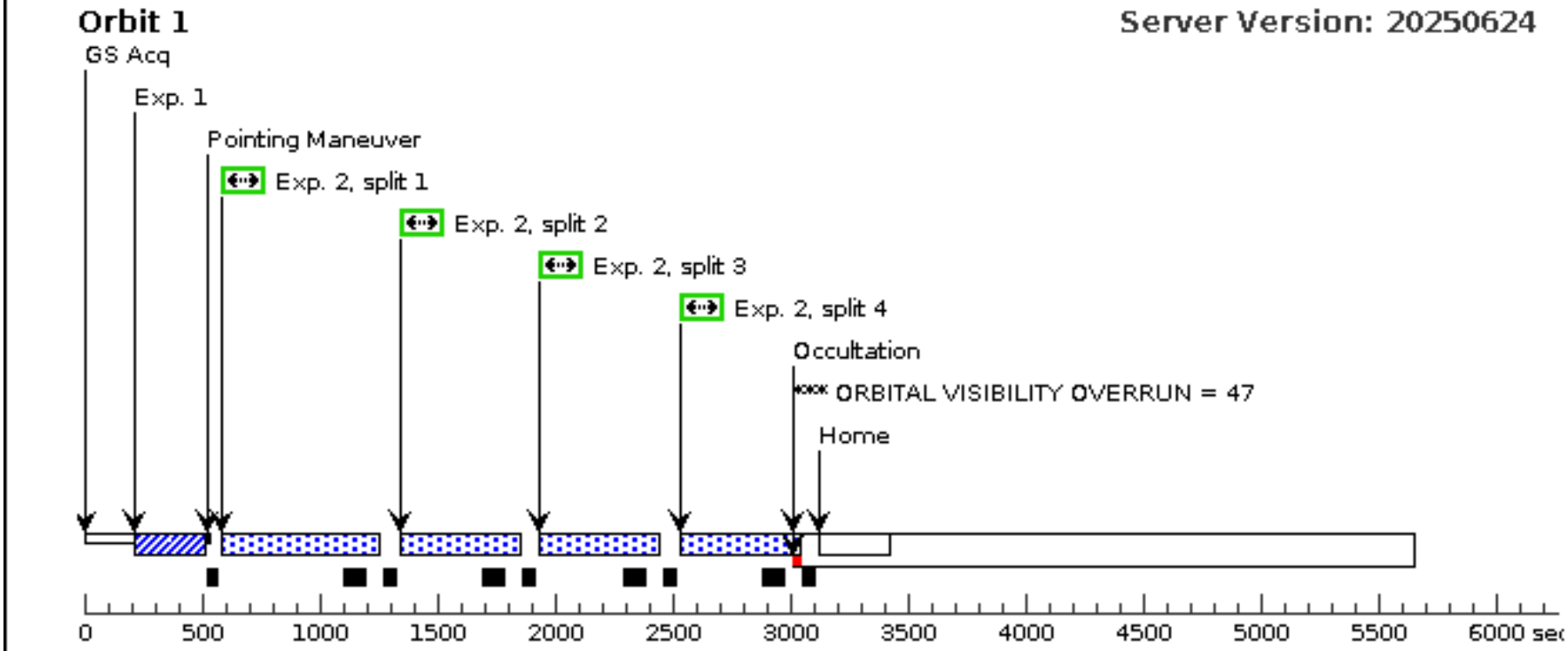
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	AT2022DBL Alt Name1: ATLAS18BCNL Alt Name2: ZTF18AABDAJX	RA: 12 20 45.0500 (185.1877083d) Dec: +49 33 4.61 (49.55128d) Equinox: J2000		V=18.3+/-0.2 UV (2000 AA): 16.1 mag (Vega)	Reference Frame: ICRS

Comments: The V-magnitude is a difference magnitude provided by the ATLAS survey (in the orange filter)
The UV magnitude is measured by Swift UVOT in the UVM2 filter on 2024-02-03
Category=EXT-STAR
Description=[ACCRETION DISK, UNDESIGNATED, X-RAY TRANSIENT]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	acquisition (1813884)	(1) AT2022DBL	COS/NUV, ACQ/IMAGE, BOA	MIRRORA		GS ACQ SCENARIO BASE1B3		37 Secs (37 Secs) *[==>]*	 ***[1]***
2	science (1813844)	(1) AT2022DBL	COS/FUV, TIME-TAG, PSA	G140L 800 A	FP-POS=ALL; FLASH=YES; BUFFER-TIME=320			500 Secs (1844 Secs) *[==>461.0 Secs (Split 1)]* *[==>461.0 Secs (Split 2)]* *[==>461.0 Secs (Split 3)]* *[==>461.0 Secs (Split 4)]*	 ***[1]***

Orbit Structure



Visit

Proposal 17449, STIS - epoch 3 (06), completed Mon Sep 22 18:00:37 GMT 2025

Diagnostic Status: Warning

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

Special Requirements: AFTER 05 BY 0.9 Orbits TO 1.1 Orbits

Diagnostics

(STIS - epoch 3 (06)) Warning (Orbit Planner): GS ACQ SCENARIO REQUESTED INCONSISTENT WITH VISIT GYRO MODE

(STIS - epoch 3 (06)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(acquisition (06.001) special requirements) Warning (Form): The specified GS Acq Scenario is not in the current list of valid scenarios.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	AT2022DBL Alt Name1: ATLAS18BCNL Alt Name2: ZTF18AABDAJX	RA: 12 20 45.0500 (185.1877083d) Dec: +49 33 4.61 (49.55128d) Equinox: J2000		V=18.3+/-0.2 UV (2000 AA): 16.1 mag (Vega)	Reference Frame: ICRS

Comments: The V-magnitude is a difference magnitude provided by the ATLAS survey (in the orange filter)
The UV magnitude is measured by Swift UVOT in the UVM2 filter on 2024-02-03
Category=EXT-STAR
Description=[ACCRETION DISK, UNDESIGNATED, X-RAY TRANSIENT]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	acquisition (1813280)	(1) AT2022DBL	STIS/CCD, ACQ, F28X50LP	MIRROR		GS ACQ SCENARIO BASE1B3		40 Secs (40 Secs) *[==>]*	 ***[1]***
2	science (1812149)	(1) AT2022DBL	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				2000 Secs (2167 Secs) *[==>2167.0 Secs]*	 ***[1]***

Orbit Structure