16925 - Probing the nature of a UV-bright point source at the precise location of AT 2018cow

Cycle: 29, 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) AT2018COW	WFC3/UVIS	3	22-Mar-2022 09:00:13.0	yes

3 Total Orbits Used

ABSTRACT

Recent advances in high-cadence surveys have revealed a new class of luminous and rapidly-evolving transients, which are not intrinsically rare but pose significant challenges to conventional supernova models. In 2018, an extreme member of this class, AT2018cow, was identified. AT2018cow was the first rapidly-evolving transient discovered promptly at a small distance, facilitating intensive multiwavelength follow-up. However, despite being the most extensively studied transient of its class, its true nature is still debated, with possibilities ranging from tidal disruption events to the failed explosion of a massive star.

Late-time observations of rapidly-evolving transients offer a means to break this degeneracy, and HST images taken during 2020 (more than 700 days post-explosion) reveal a UV-bright point source at the precise position of AT 2018cow. However, the nature of this underlying source is ambiguous as it can be interpreted as either the emission from the transient or an underlying stellar population--both of which would place significant constraints on the origin of AT2018cow. Recently, a shallow HST SNAP observation in 2021 showed tentative (2-sigma) evidence for fading in the optical (where the source is faint). Here we request a single epoch of HST/UVIS imaging to confirm the transient nature of the source and measure its rate-of-decline, necessary to constrain the power source. Extrapolations based on physically and observationally motivated models show that the source may be detected during this Mid-Cycle at 25.5-26.0 mag (AB). We emphasize that HST is the only current instrument with the resolution and depth capable of probing this source.

OBSERVING DESCRIPTION

We request three orbits of observations with WFC3/UVIS to measure the properties of the source identified at the position of AT2018cow and determine whether it is constant or evolving with time. For the observations, we request the use of two UV filters (F225W and F336W) and two optical filters (F555W and F814W).

Each filter will have three exposures with a 3-point line dither. Each orbit will contain four exposures - one exposure for each filter - and the three orbits will complete exactly the desired twelve exposures for all filters (three exposures x four filters). The UVIS2-C1K1C-SUB aperture is used for all exposures to reduce overheads.

Visit

Proposal 16925, Visit 01 Tue Mar 22 13:00:13 GMT 2022

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	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

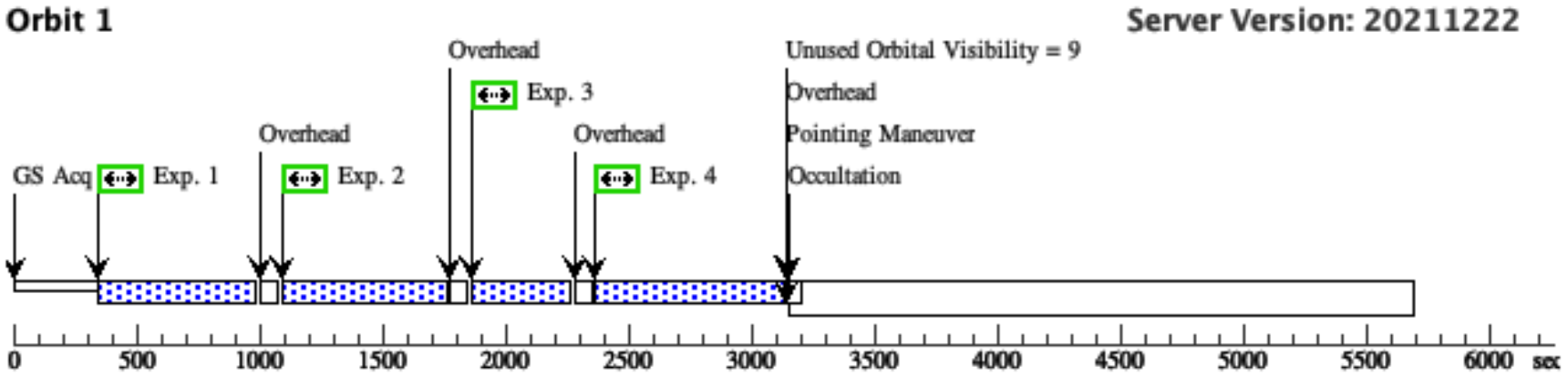
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	AT2018COW	RA: 16 16 0.2290 (244.0009542d) Dec: +22 16 4.83 (22.26801d) Equinox: J2000		V=(?) 26.0 ABmag in F555W	Reference Frame: ICRS

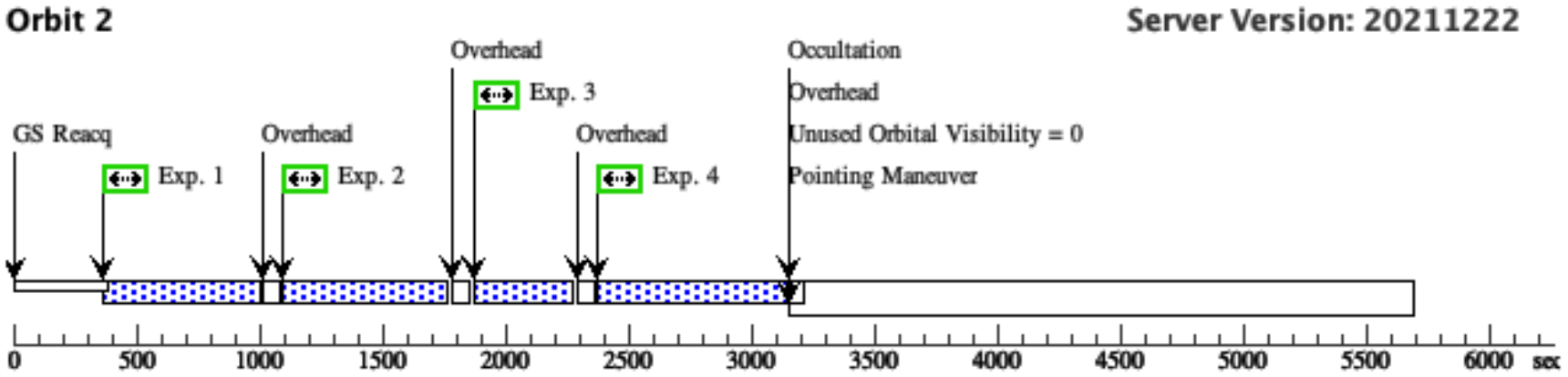
Comments: Magnitude is a rough estimate from extrapolating the brightness assuming the same spectral shape.
Category=EXT-STAR
Description=[SUPERNOVA]

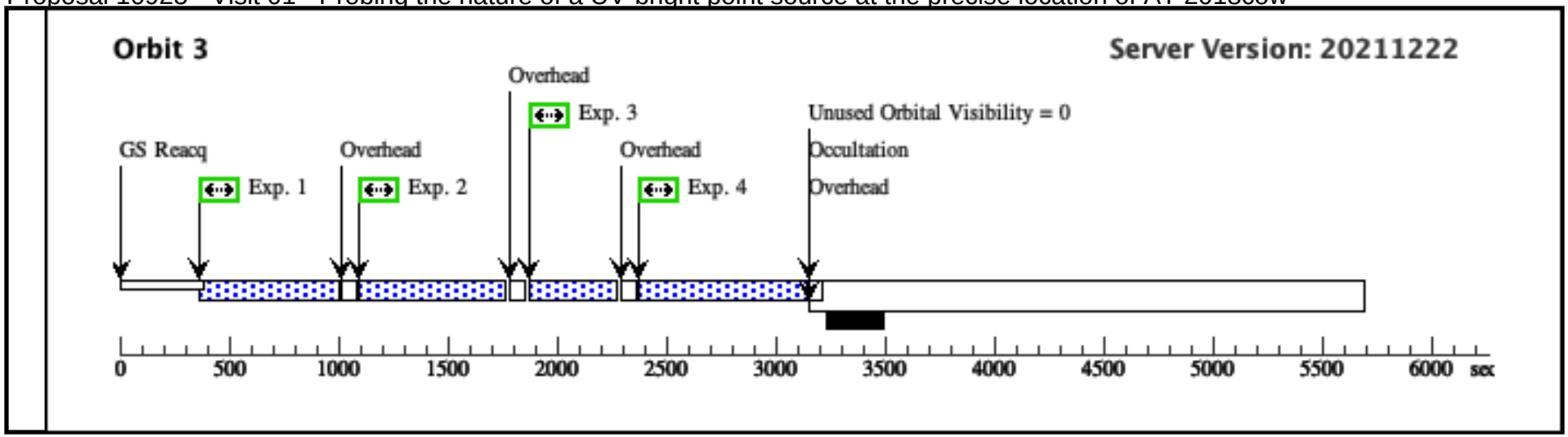
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) AT2018COW	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F225W	FLASH=18		Pattern 1, Exps 1-4 in Visit 01 (1)	615 Secs (1845 Secs)	
								[==>(Pattern 1)]	***[1]***
								[==>(Pattern 2)]	***[2]***
								[==>(Pattern 3)]	***[3]***
2		(1) AT2018COW	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F336W	FLASH=18		Pattern 1, Exps 1-4 in Visit 01 (1)	651 Secs (1953 Secs)	
								[==>(Pattern 1)]	***[1]***
								[==>(Pattern 2)]	***[2]***
								[==>(Pattern 3)]	***[3]***
3		(1) AT2018COW	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F555W	FLASH=10		Pattern 1, Exps 1-4 in Visit 01 (1)	383 Secs (1149 Secs)	
								[==>(Pattern 1)]	***[1]***
								[==>(Pattern 2)]	***[2]***
								[==>(Pattern 3)]	***[3]***
4		(1) AT2018COW	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W			Pattern 1, Exps 1-4 in Visit 01 (1)	757 Secs (2271 Secs)	
								[==>(Pattern 1)]	***[1]***
								[==>(Pattern 2)]	***[2]***
								[==>(Pattern 3)]	***[3]***

Orbit Structure






Orbit 3
Server Version: 20211222
GS Reacq
Exp. 1
Overhead
Exp. 2
Overhead
Exp. 3
Overhead
Exp. 4
Unused Orbital Visibility = 0
Occultation
Overhead
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec