15893 - Observing Changes in the Primary Shock Front of the Cygnus Loop: An HST 20+ Year Perspective

Cycle: 27, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
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Dr. William P. Blair (CoI)	The Johns Hopkins University	wblair@jhu.edu

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) CYGLOOP-NENR1	WFC3/UVIS	3	24-Jun-2020 19:00:18.0	yes
02	(1) CYGLOOP-NENR1	WFC3/UVIS	3	24-Jun-2020 19:00:19.0	yes

6 Total Orbits Used

ABSTRACT

We propose to re-observe the faint, primary blast wave of the Cygnus Loop supernova remnant with WFC3, a region that has been observed twice before with WFPC2, in 1997 and 2001. The region contains a delicate rippled sheet of plasma visible in H-alpha, that represents a section of the primary non-radiative supernova shock, and an adjacent [O III] 5007-emitting filament that is a shock in transition to becoming radiative. This would be the third epoch in H-alpha, and the second in [O III] 5007. With the recent accurate GAIA DR2-derived distance to the Cygnus Loop (735 +/- 25 pc), and the proper motion in H-alpha from epochs 1 and 2, the derived shock velocity is 245 km/s. The epoch 3 H-alpha data and long time baseline will permit a sensitive search for signs of deceleration of the filament, either globally or locally along portions of the filament structure. The two epochs of [O III] will measure or constrain any changes in the filament structure over ~20 years due to catastrophic cooling, thermal instabilities,

or density variations that are predicted to occur as SN remnant shocks turn radiative. The Cygnus Loop provides a unique target to test for these changes since the densities and shock velocities involved provide for the possibility of observable changes on a reasonable timescale.

OBSERVING DESCRIPTION

Two WFC3/UVIS filters, F656N and F502N, will be used to image a single field in the Cygnus Loop supernova remnant, targeting a narrow, extended H-alpha emitting filament, with portions of it emitting in [OIII]. There are two visits, each with three orbits. The first visit uses F656N, and the second visit uses F502N. For each visit, a dither pattern to cover the chip gap, plus a subpattern to remove cosmic rays and bad pixels have been specified. This results in two sub-exposures per orbit.

Orientation requirements have been specified in order to get the entire filament on a single UVIS detector, with the second detector covering a region towards the interior of the remnant (i.e. southwest of the filament). The range for the allowed orientation is such that the exact target co-ordinates (specified in the proposal for the UVIS CENTER aperture) will need to be tweaked after the visits have been scheduled in the long-range plan. Therefore we request that once we the target is scheduled we are given the opportunity to update the target co-ordinates in the Phase II proposal before execution.

We have also specified that visit 02 be obtained at the same orientation as visit 01, to best match the relative locations of the H-alpha and [OIII] emission. Also, we have specified that the two visits be obtained within 60 days of each other, so they are included in the same visibility window, and there is no significant temporal evolution of the shock between them.

Visit

Proposal 15893, F656N (01), implementation Wed Jun 24 23:00:19 GMT 2020

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: SCHED 100%; ORIENT 330D TO 15 D; ORIENT 150D TO 195 D

Diagnostics

(F656N (01)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(F656N (01)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(F656N (01)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Exposure 1 (Pattern 1, Exps 1-1 in F656N (01))) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser

Patterns

#	Primary Pattern		Secondary Pattern		Exposures
(1)	Pattern Type=WFC3-UVIS-GAP-LINE Purpose=MOSAIC Number Of Points=2 Point Spacing=2.414 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=true	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=1.485 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false	(1)

Fixed Targets

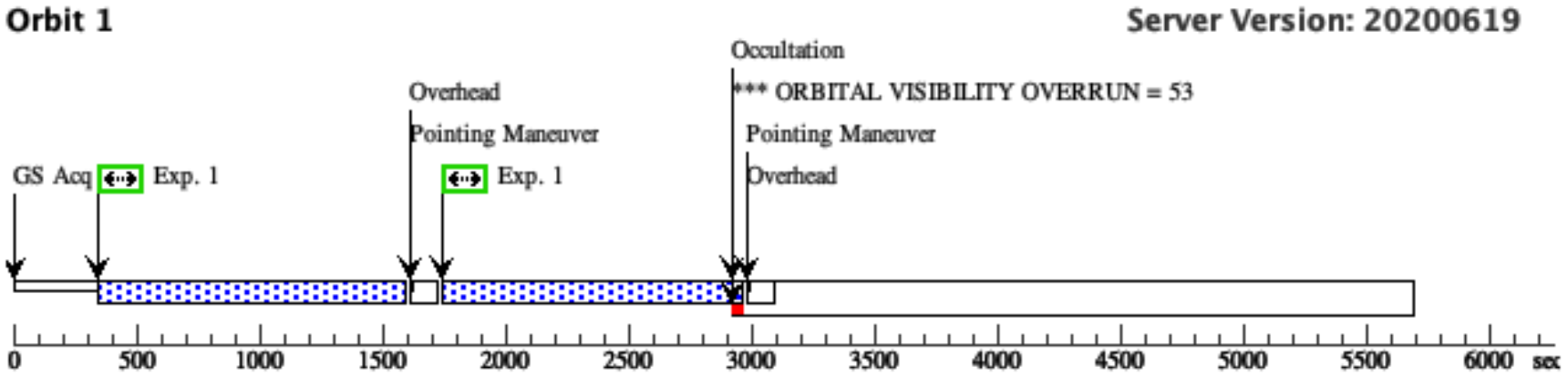
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	CYGLOOP-NENR1	RA: 20 56 1.6044 (314.0066850d) Dec: +31 56 9.91 (31.93609d) Equinox: J2000		V=35+/-0 H-alpha surface brightness 6.0 + /- 0.5 E-16 erg/s/cm2/arcsec2	Reference Frame: ICRS

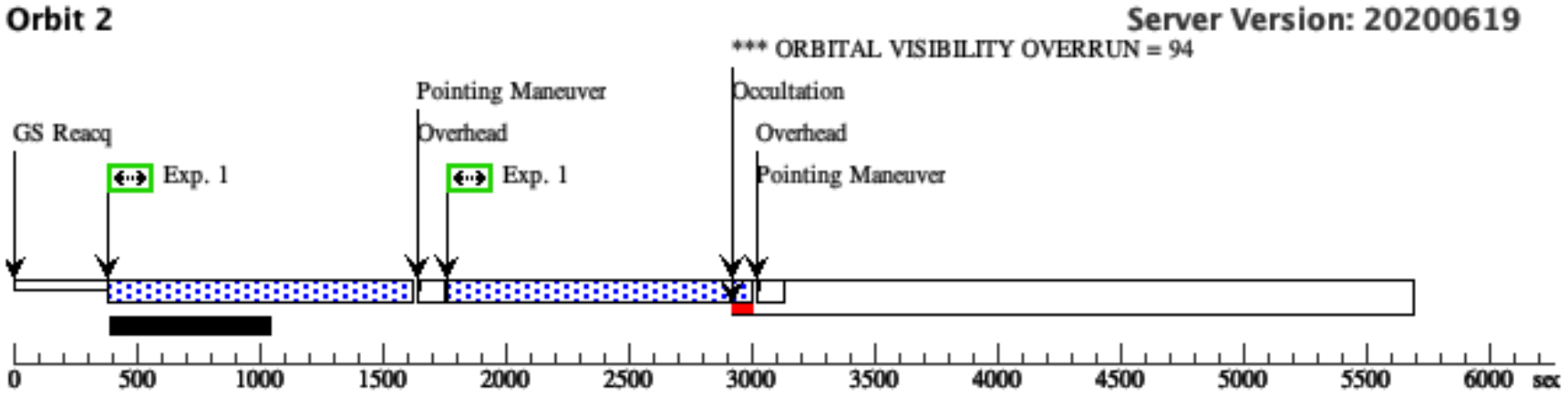
Comments:
Category=ISM
Description=[EMISSION LINE NEBULA, FILAMENT, SHOCK FRONT, SNR]

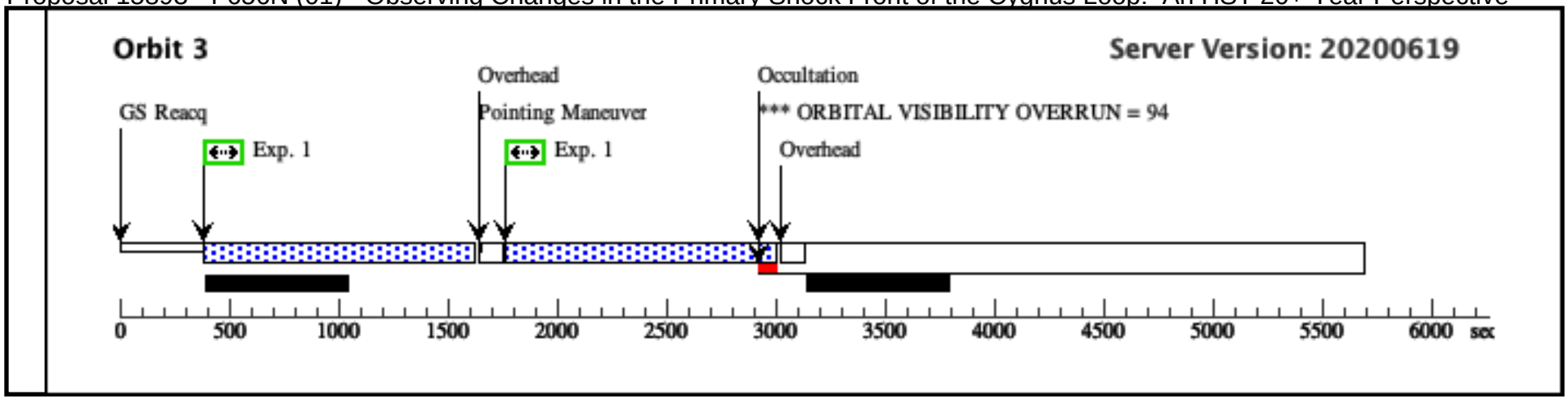
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) CYGLOOP-NENR1	WFC3/UVIS, ACCUM, UVIS-CENTER	F656N	FLASH=20		Pattern 1, Exps 1-1 in F656N (01) (1)	1200 Secs (7414 Secs)	
								[==>1225.0 Secs (Pattern 1,1)] *[==>1225.0 Secs (Pattern 1,2)]*	***[1]***
								[==>1241.0 Secs (Pattern 1,3)] *[==>1241.0 Secs (Pattern 2,1)]*	***[2]***
								[==>1241.0 Secs (Pattern 2,2)] *[==>1241.0 Secs (Pattern 2,3)]*	***[3]***

Orbit Structure






Orbit 3
Server Version: 20200619
GS Reacq
Exp. 1
Overhead
Pointing Maneuver
Exp. 1
Occultation
*** ORBITAL VISIBILITY OVERRUN = 94
Overhead
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec

Visit

Proposal 15893, F502N (02), implementation Wed Jun 24 23:00:20 GMT 2020

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: SCHED 100%; SAME ORIENT AS 01; GROUP 02,01 WITHIN 60D

Diagnostics

(F502N (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(F502N (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(F502N (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Exposure 1 (Pattern 1, Exps 1-1 in F502N (02))) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser

Patterns

#	Primary Pattern		Secondary Pattern		Exposures
(1)	Pattern Type=WFC3-UVIS-GAP-LINE Purpose=MOSAIC Number Of Points=2 Point Spacing=2.414 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=true	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=1.485 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false	(1)

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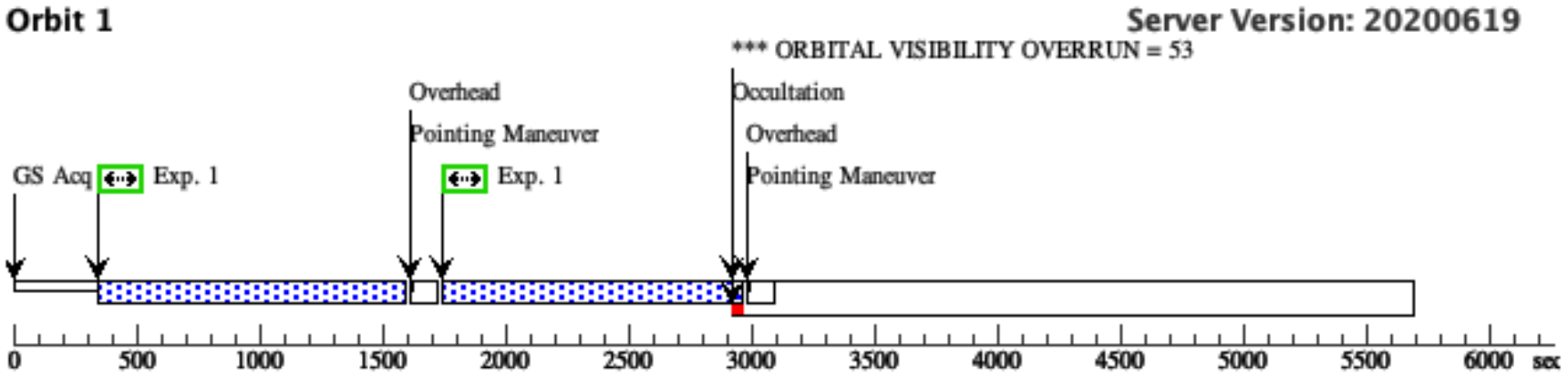
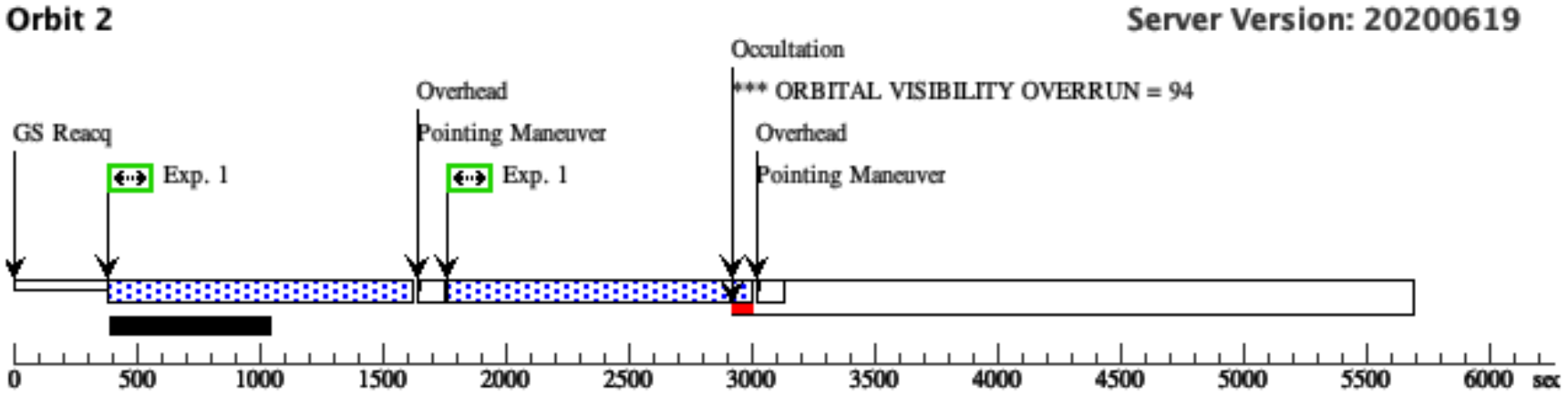
Comments:
Category=ISM
Description=[EMISSION LINE NEBULA, FILAMENT, SHOCK FRONT, SNR]

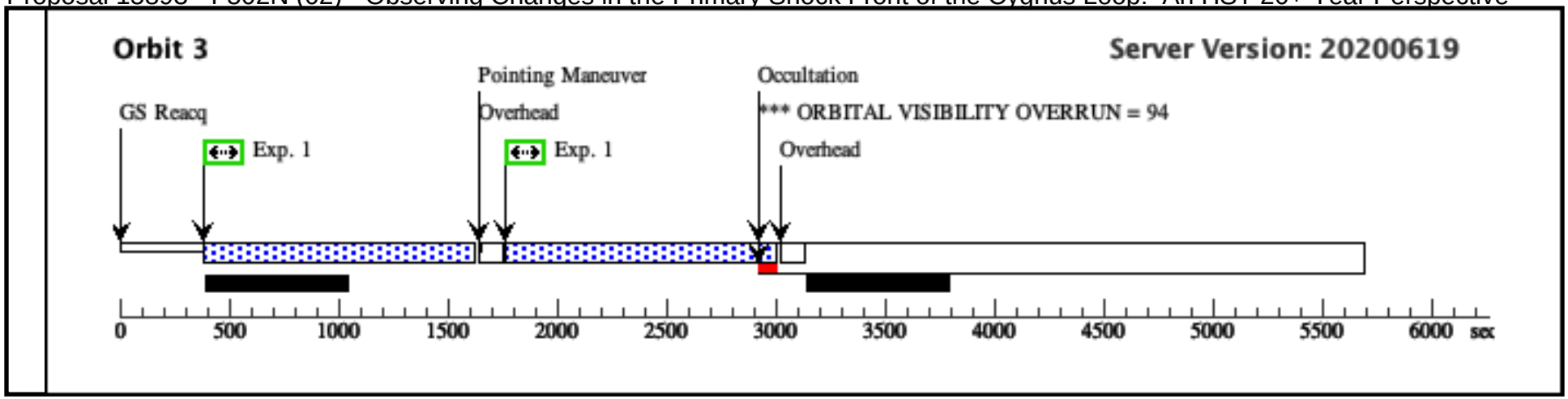
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) CYGLOOP-NENR1	WFC3/UVIS, ACCUM, UVIS-CENTER	F502N	FLASH=20		Pattern 1, Exps 1-1 in F502N (02) (1)	1200 Secs (7414 Secs)	
								[==>1225.0 Secs (Pattern 1,1)] *[==>1225.0 Secs (Pattern 1,2)]*	***[1]***
								[==>1241.0 Secs (Pattern 1,3)] *[==>1241.0 Secs (Pattern 2,1)]*	***[2]***
								[==>1241.0 Secs (Pattern 2,2)] *[==>1241.0 Secs (Pattern 2,3)]*	***[3]***

Orbit Structure






Orbit 3
Server Version: 20200619
Pointing Maneuver
Occultation
GS Reacq
Overhead
*** ORBITAL VISIBILITY OVERRUN = 94
Exp. 1
Exp. 1
Overhead
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec