15152 - Finally, the Progenitor of the Type Ib iPTF13bvn

Cycle: 25, 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) IPTF-13BVN	ACS/WFC	1	10-Dec-2018 08:01:13.0	yes
02	(1) IPTF-13BVN	WFC3/UVIS	4	10-Dec-2018 08:01:14.0	yes

5 Total Orbits Used

ABSTRACT

Supernovae (SNe) are among the most powerful events in the Universe and have a profound influence on galaxy evolution. Whereas we have been able to identify the luminous red supergiant progenitor stars of the most common core-collapse explosions, the hydrogen-rich Type II, the progenitors of hydrogen-poor Type Ib and Type Ic have been far more elusive. To strip away a SN Ib/c progenitor's outer layers, theoretical models with either (a) a highly-massive star with prodigious winds during the Wolf-Rayet phase or (b) a somewhat lower-mass star in a close, mass-exchange binary system have been proposed. One example exists so far of a progenitor identification, for the SN Ib iPTF13bvn in NGC 5806. Both models have been invoked to explain this event, although most evidence to date points toward the binary model. Our combined team observed this SN with WFC3 in Cycle 22, about 2 years after explosion, to investigate whether the progenitor had disappeared. As a result, we were able to report that indeed it had. We also attempted to better characterize the nature of the progenitor by subtracting our images from the pre-explosion HST data. Unfortunately, the old SN was apparently still conspicuously present. We therefore propose to reimage the SN site, when the SN should then be well below detectability, to produce high-quality templates of the host galaxy for subtraction. We can then finally fully reveal the progenitor and understand its true nature. iPTF13bvn is one of the most important historical SNe and will most probably be the best available case of a SN Ib progenitor for HST's remaining lifetime. It is imperative to understand the nature of this SN and its progenitor object.

OBSERVING DESCRIPTION

We are reimaging, once again, the site of iPTF13bvn in NGC 5806, to better establish the characteristics of its progenitor. We know now that the object identified by Cao et al. (2013) is indeed the progenitor. However, we need to look at the site again, when the SN itself has finally faded below detectability. We have simply duplicated the observing schemes from GO-13684 (PI: Van Dyk) at F438W (B) and F555W (V) and from GO-13822 (PI: Folatelli) at F814W (I), in order to go at least as deep as those previous observations. The new observations at F438W and F555W consist of line-dithered 1422-s exposures in each orbit (except for the first orbit, which consists of a 1365 s and a 1368 s exposure, to allow for guide star acquisition overhead) with WFC3/UVIS, and a trio of dithered 775-s exposures at F814W with ACS/WFC. If the remaining SN light continues to be powered by radioactive positron trapping, with a later contribution from 44Ti decay, then the SN should be at ~31--32 mag during Cycle 25. We will be able to perform a far better subtraction than from the pre-SN images from 2005 and, thus, far more significantly constrain the actual brightness and color of the progenitor. We will compare our measurements to current progenitor models for SNe Ib. The primary visibility window in Cycle 25 is 07 June to 17 Sep 2018. These observations can certainly also be scheduled during Cycle 26. Since the SN will have effectively faded, it should not make little difference if there is a time gap between the WFC3 and ACS visits.

Visit

Proposal 15152, ACS-F814W (01), implementation Mon Dec 10 13:01:15 GMT 2018

Diagnostic Status: Warning

Scientific Instruments: ACS/WFC

Special Requirements: (none)

Diagnostics

(ACS-F814W (01)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=3.034 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.29 Angle Between Sides= Center Pattern=false		(1)

Fixed Targets

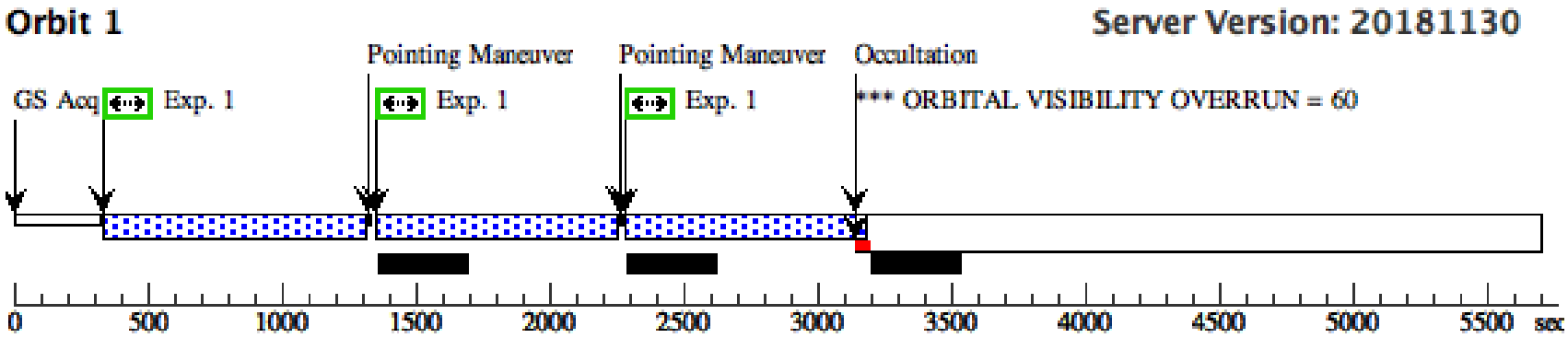
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	IPTF-13BVN	RA: 15 00 0.1520 (225.0006333d) Dec: +01 52 53.17 (1.88144d) Equinox: J2000		V=31+/-1	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=EXT-STAR
Description=[SUPERNOVA, SUPERNOVA TYPE IB]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) IPTF-13BVN	ACS/WFC, ACCUM, WFC	F814W			Pattern 1, Exps 1-1 in ACS-F814W (01) (1)	775 Secs (2325 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	*[1]*

Orbit Structure



Visit

Proposal 15152, WFC3-F438W-F555W (02), implementation Mon Dec 10 13:01:15 GMT 2018

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Diagnostics

(WFC3-F438W-F555W (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(WFC3-F438W-F555W (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(WFC3-F438W-F555W (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(3)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=4 Point Spacing=0.145 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1), (2)

Fixed Targets

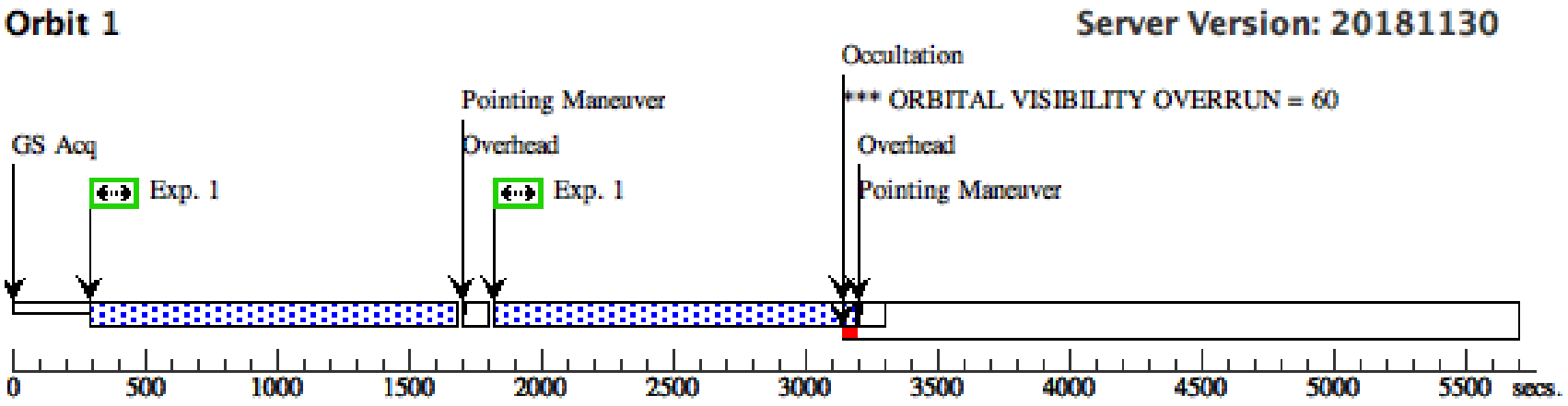
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	IPTF-13BVN	RA: 15 00 0.1520 (225.0006333d) Dec: +01 52 53.17 (1.88144d) Equinox: J2000		V=31+/-1	Reference Frame: ICRS

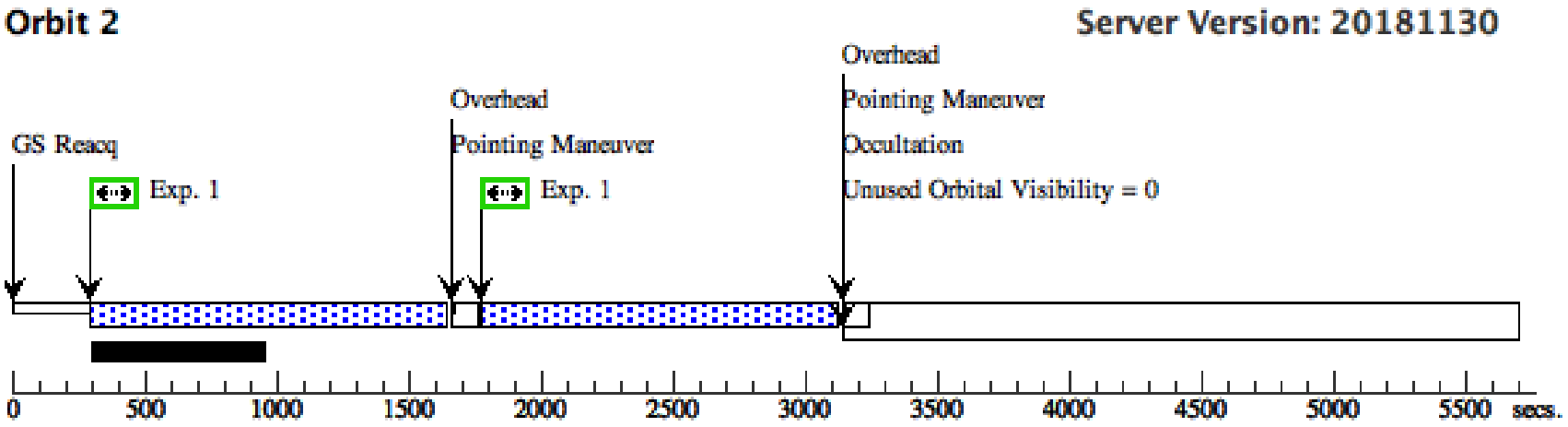
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=EXT-STAR
Description=[SUPERNOVA, SUPERNOVA TYPE IB]

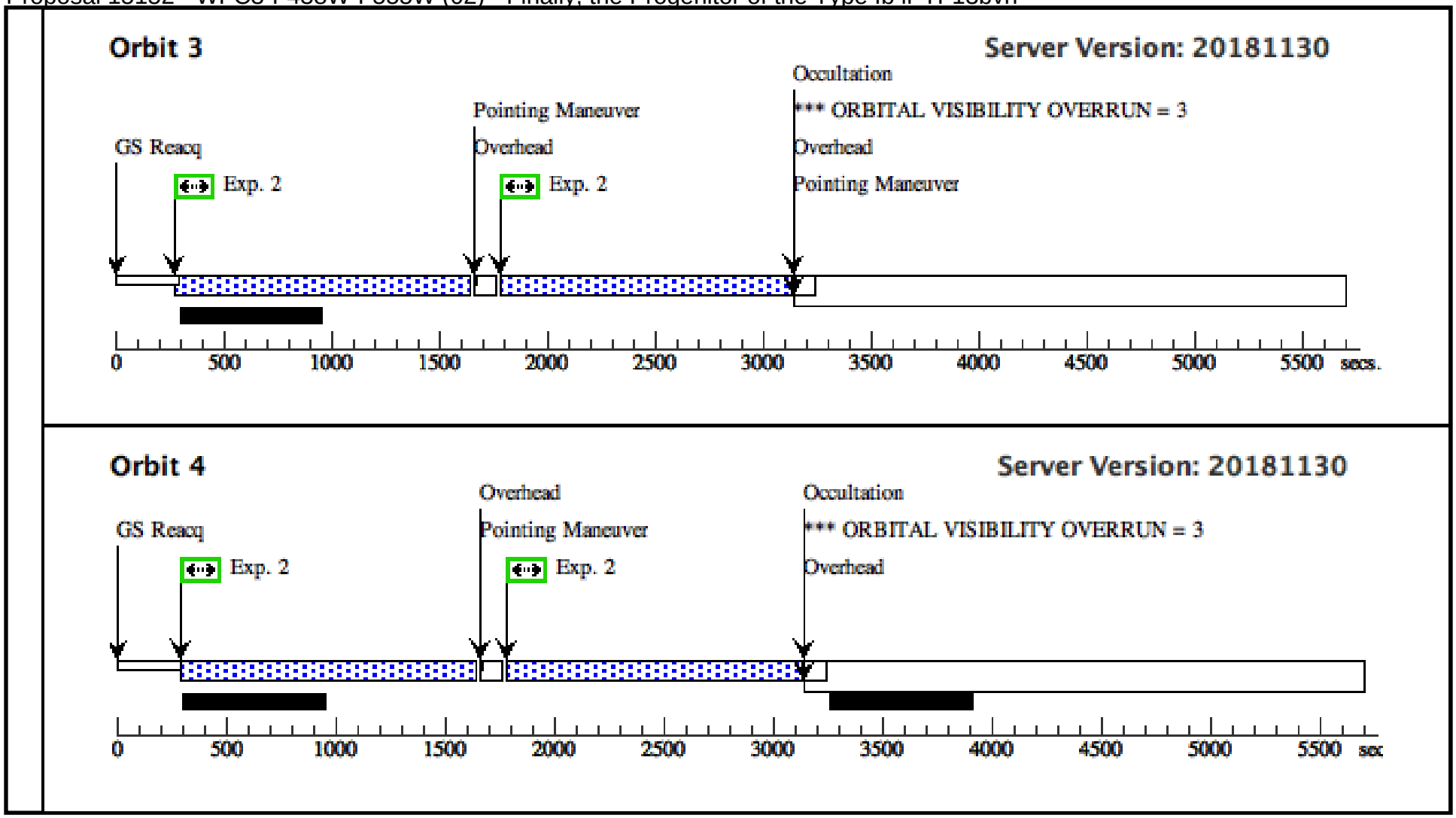
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) IPTF-13BVN	WFC3/UVIS, ACCUM, UVIS	F555W			Pattern 3, Exps 1-1 in WFC3-F438W-F555W (02) (3)	1422 Secs (5437 Secs)	
								[==>1365.0 Secs (Pattern 1)] *[==>1368.0 Secs (Pattern 2)]*	***[1]***
								[==>1352.0 Secs (Pattern 3)] *[==>1352.0 Secs (Pattern 4)]*	***[2]***
2		(1) IPTF-13BVN	WFC3/UVIS, ACCUM, UVIS	F438W	FLASH=1		Pattern 3, Exps 2-2 in WFC3-F438W-F555W (02) (3)	1300 Secs (5408 Secs)	
								[==>1352.0 Secs (Pattern 1)] *[==>1352.0 Secs (Pattern 2)]*	***[3]***
								[==>1352.0 Secs (Pattern 3)] *[==>1352.0 Secs (Pattern 4)]*	***[4]***

Orbit Structure






Orbit 3
Server Version: 20181130
Occultation
Pointing Maneuver
*** ORBITAL VISIBILITY OVERRUN = 3
GS Reacq
Overhead
Overhead
Exp. 2
Exp. 2
Pointing Maneuver
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2000
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3000
3500
4000
4500
5000
5500
secs.
Orbit 4
Server Version: 20181130
Overhead
Occultation
GS Reacq
Pointing Maneuver
*** ORBITAL VISIBILITY OVERRUN = 3
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Exp. 2
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4000
4500
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sec