



18441 - A UV Search for a Surviving He-Star Companion in SN 1181: A Critical Test of the SN Iax Progenitor Channel

Cycle: 34, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>
Dr. Kohki Uno (PI) (Contact)	Columbia University in the City of New York
Prof. Daichi Hiramatsu (CoI) (CoPI) (AdminUSPI)	University of Florida
Daichi Tsuna (CoI) (CoPI)	Harvard University
Dr. Tomoya Kinugawa (CoI)	Shinshu University
Dr. Takatoshi Ko (CoI)	University of Tokyo, Institute of Astronomy

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) SN1181	WFC3/UVIS	3	19-Aug-2026 11:06:10.0	yes

3 Total Orbits Used

ABSTRACT

SN 1181, the only historical supernova identified as a faint Type Iax supernova (SN Iax), provides an important laboratory for testing the progenitor channel of this class. Its remnant hosts a surviving white dwarf (WD), pointing to an incomplete thermonuclear explosion and favoring a pure-deflagration scenario. A central prediction of this model is that the He-star companion that donated material onto the WD before explosion should also survive. Detecting or ruling out such a companion would provide direct evidence for the progenitor channel of a faint SN Iax and would test whether the faint and bright SN Iax subclasses share a common single-degenerate origin. More broadly, it would inform debate over the explosion channels of Type Ia supernovae. We propose three orbits of HST WFC3/UVIS imaging in F225W, F275W, and F336W to carry out the UV search

Proposal 18441 (STScI Edit Number: 0, Created: Wednesday, August 19, 2026, 10:06:11AM Eastern Standard Time) - Overview

for a surviving He-star companion in the SN 1181 remnant. Our binary stellar evolution calculations and existing constraints by GALEX indicate that the surviving companion is most likely a low-mass He star (0.3-0.5 Msun) with an effective temperature of 20,000-40,000 K, making UV observations essential. HST WFC3/UVIS provides the sensitivity and spatial resolution required to detect such a source or place stringent limits on its presence. This program is designed to deliver a decisive result: either the detection of the long-sought surviving companion or strong constraints that exclude it. In either case, the proposed observations will provide the most direct test yet of the progenitor system of a faint SN Iax and an important step toward clarifying the physical diversity of thermonuclear supernovae.

OBSERVING DESCRIPTION

We will obtain WFC3/UVIS imaging of the SN 1181 field in a single 3-orbit visit using the UVIS2-C1K1C-SUB aperture centered on the central white dwarf. The approximately 40 arcsec x 40 arcsec subarray fully covers the expected companion search region of approximately 10 arcsec radius.

Two orbits are devoted to sixteen 250 s F225W exposures, for a total integration time of 4000 s. The third orbit contains four 250 s F275W exposures and four 250 s F336W exposures, for total integration times of 1000 s in each filter. All exposures use the four-point WFC3-UVIS-DITHER-BOX pattern for hot-pixel and cosmic-ray mitigation and improved PSF sampling.

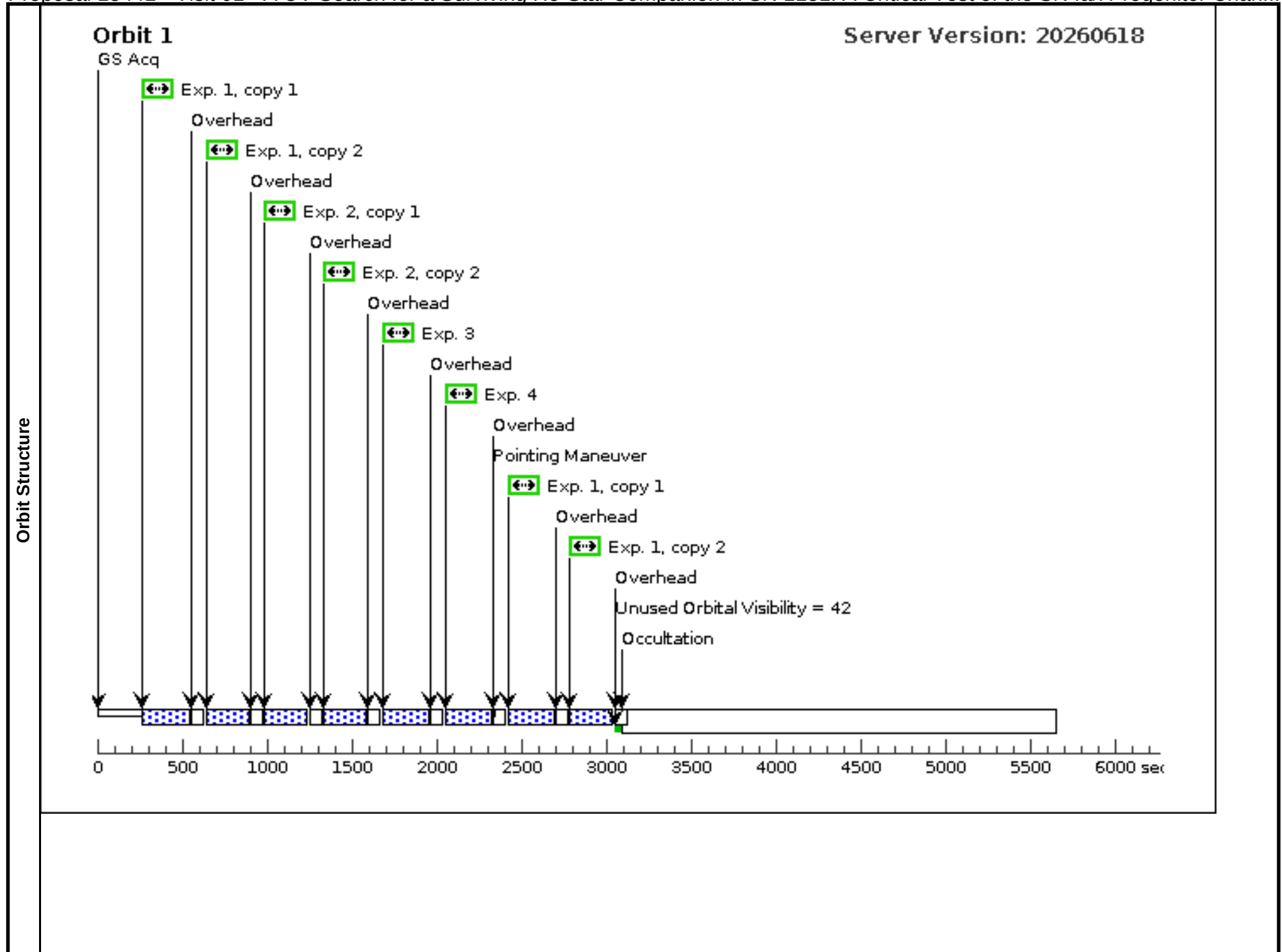
The central white dwarf is expected to saturate in the individual exposures. The science targets are the surrounding stars rather than the central source. Dividing the observations into 250 s integrations reduces blooming relative to the originally proposed 500 s integrations while preserving the Phase I total exposure times. No orientation or timing constraints are required.

Proposal 18441 - Visit 01 - A UV Search for a Surviving He-Star Companion in SN 1181: A Critical Test of the SN Iax Progenitor Chan...

Visit	Proposal 18441, Visit 01, implementation Wed Aug 19 15:06:11 GMT 2026				
	Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: (none)				
Patterns	#	Primary Pattern	Secondary Pattern		Exposures
	(1)	Pattern Type=WFC3-UVIS-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=false		(1-4)
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes
	(1)	SN1181 Alt Name1: PA30 Alt Name2: IRAS00500+6713	RA: 00 53 11.2100 (13.2967083d) Dec: +67 30 2.40 (67.50067d) Equinox: J2000		V=15.4 Reference Frame: ICRS
Comments: Category=STAR Description=[SUPERNOVA, SUPERNOVA TYPE IA] Extended=NO					

Proposal 18441 - Visit 01 - A UV Search for a Surviving He-Star Companion in SN 1181: A Critical Test of the SN Iax Progenitor Chan...

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	F225W_1	(1) SN1181	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F225W	FLASH=17		Pattern 1, Exps 1-4 in Visit 01 (1)	250 Secs X 2 (2000 Secs)	
									[==>(Pattern 1, Copy 1)]	[1]
									[==>(Pattern 1, Copy 2)]	
									[==>(Pattern 2, Copy 1)]	[2]
									[==>(Pattern 2, Copy 2)]	
									[==>(Pattern 3, Copy 1)]	[3]
									[==>(Pattern 3, Copy 2)]	
									[==>(Pattern 4, Copy 1)]	[3]
									[==>(Pattern 4, Copy 2)]	
	2	F225W_2	(1) SN1181	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F225W	FLASH=17		Pattern 1, Exps 1-4 in Visit 01 (1)	250 Secs X 2 (2000 Secs)	
									[==>(Pattern 1, Copy 1)]	[1]
									[==>(Pattern 1, Copy 2)]	
									[==>(Pattern 2, Copy 1)]	[2]
									[==>(Pattern 2, Copy 2)]	
									[==>(Pattern 3, Copy 1)]	[3]
									[==>(Pattern 3, Copy 2)]	
									[==>(Pattern 4, Copy 1)]	[3]
									[==>(Pattern 4, Copy 2)]	
	3	F275W	(1) SN1181	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F275W	FLASH=17		Pattern 1, Exps 1-4 in Visit 01 (1)	250 Secs (1000 Secs)	
									[==>(Pattern 1)]	[1]
									[==>(Pattern 2)]	[2]
									[==>(Pattern 3)]	[3]
									[==>(Pattern 4)]	
	4	F336W	(1) SN1181	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F336W	FLASH=17		Pattern 1, Exps 1-4 in Visit 01 (1)	250 Secs (1000 Secs)	
									[==>(Pattern 1)]	[1]
									[==>(Pattern 2)]	[2]
									[==>(Pattern 3)]	[3]
									[==>(Pattern 4)]	



Orbit 2

Server Version: 20260618

