



18018 - Phoenix from the Ashes: Searching for Surviving Companions to SN~2023bee with early excess

Cycle: 33, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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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>
03	(1) SN-2023BEE	WFC3/IR WFC3/UVIS	3	14-Aug-2025 13:00:19.0	yes

3 Total Orbits Used

ABSTRACT

Despite their important role in modern cosmology, the exact progenitor system of Type Ia supernovae (SNe Ia) remains elusive. The community has been trying to resolve this question in many indirect ways, but HST offers a unique opportunity to do so directly by observing a nearby SN Ia, SN 2023bee. This supernova has an early excess flux that could be due to the interaction between the SN ejecta and a non-degenerate companion. If observed, this would be the first direct detection of the single-degenerate SN Ia progenitor channel. According to theoretical models, the surviving non-degenerate companion will be heated by SN ejecta and inflate, resulting in a significant increase in its luminosity. The late-time bolometric light curves of SNe Ia are also indicative of their isotope composition, and thus of their progenitor systems. HST, with its exquisite depth, resolution, and multi-band coverage from UV to NIR, is the only resource suitable for discovering these heated surviving companions and constraining the progenitor channels of SNe Ia. Using HST to observe SN 2023bee over three cycles, we will be able to confirm or exclude the existence of a non-degenerate companion in this system, and provide strong constraints on the progenitor system.

OBSERVING DESCRIPTION

We propose to observe SN 2023bee with 3 orbits in 5 filters: 1st orbit with F336W only, 2nd orbit with F606W & F814W, and 3rd orbit with F110W and F160W. The target is distant from the host galaxy and has a relatively clear background, so we do not worry much about the resolution or the exact location of the target.

For first orbit we choose to do a straightforward CR split as it uses single filter.

For second orbit we choose to do a 3-point dither with 2 filters. The order of filters is chosen to minimize the overhead time.

For third orbit we choose to do similar 3-point dither with 2 NIR filters.

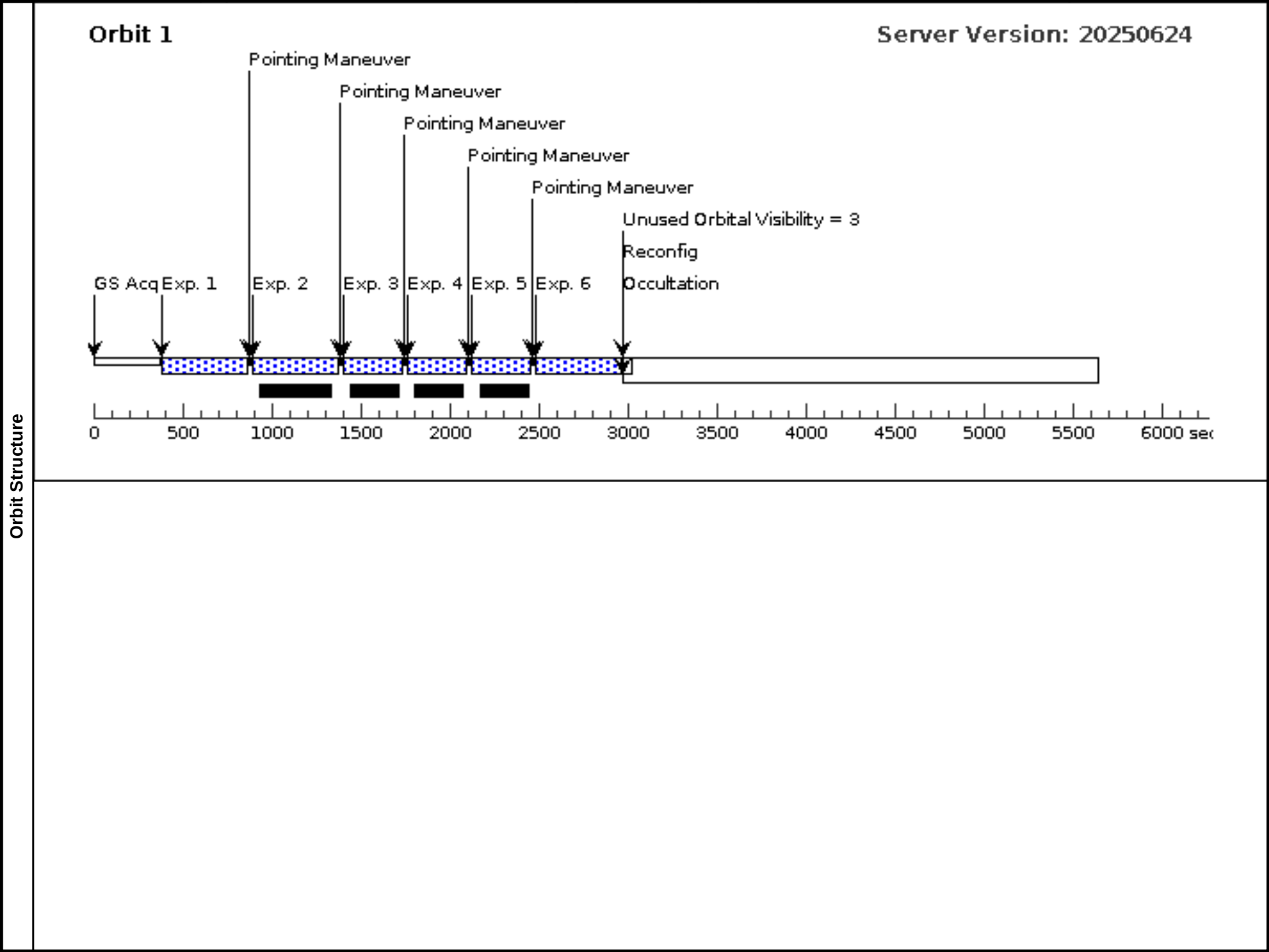
The three orbits should be around Oct-Dec 2025, ideally 3 continuous orbits or at least close to each other.

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Visit	Proposal 18018, all (03), implementation Thu Aug 14 17:00:20 GMT 2025				
	Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR, WFC3/UVIS Special Requirements: BETWEEN 10-OCT-2025:00:00:00 AND 28-DEC-2025:00:00:00				
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	(7)	
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes
	(1)	SN-2023BEE	RA: 08 56 11.6280 (134.0484500d) Dec: -03 19 32.05 (-3.32557d) Equinox: J2000		V=26
Comments: This object was generated by the targetselector and retrieved from the NED database. Category=EXT-STAR Description=[SUPERNOVA TYPE IA] Extended=NO					
Reference Frame: NED					

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Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	F160W1	(1) SN-2023BEE	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=STEP5 0			449.233834 Secs (449.234 Secs) [==>]	[1]
	2	F160W2	(1) SN-2023BEE	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=STEP5 0	POS TARG 0.451,0. 403		449.233834 Secs (449.234 Secs) [==>]	[1]
	3	F110W1	(1) SN-2023BEE	WFC3/IR, MULTIACCUM, IR	F110W	NSAMP=11; SAMP-SEQ=STEP5 0	POS TARG 0.474,0. 424		299.232481 Secs (299.232 Secs) [==>]	[1]
	4	F110W2	(1) SN-2023BEE	WFC3/IR, MULTIACCUM, IR	F110W	NSAMP=11; SAMP-SEQ=STEP5 0	POS TARG 0.925,0. 827		299.232481 Secs (299.232 Secs) [==>]	[1]
	5	F110W3	(1) SN-2023BEE	WFC3/IR, MULTIACCUM, IR	F110W	NSAMP=11; SAMP-SEQ=STEP5 0	POS TARG 1.376,1. 230		299.232481 Secs (299.232 Secs) [==>]	[1]
	6	F160W3	(1) SN-2023BEE	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=STEP5 0	POS TARG 0.902,0. 806		449.233834 Secs (449.234 Secs) [==>]	[1]
	7		(1) SN-2023BEE	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F336W	FLASH=21		Pattern 1, Exps 7-7 i n all (03) (1)	565 Secs (2260 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[2]
	8		(1) SN-2023BEE	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=14	POS TARG 0,0		153 Secs (153 Secs) [==>]	[3]
	9		(1) SN-2023BEE	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=14	POS TARG 0,0		308 Secs (308 Secs) [==>]	[3]
	10		(1) SN-2023BEE	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=14	POS TARG .092,,09 8		308 Secs (308 Secs) [==>]	[3]
	11		(1) SN-2023BEE	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=14	POS TARG .092,,09 8		153 Secs (153 Secs) [==>]	[3]
	12		(1) SN-2023BEE	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=14	POS TARG .185,,19 7		153 Secs (153 Secs) [==>]	[3]
	13		(1) SN-2023BEE	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=14	POS TARG .185,,19 7		308 Secs (308 Secs) [==>]	[3]
	14		(1) SN-2023BEE	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=14	POS TARG .276,,29 4		308 Secs (308 Secs) [==>]	[3]
	15		(1) SN-2023BEE	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=14	POS TARG .276,,29 4		153 Secs (153 Secs) [==>]	[3]



Orbit 2

Server Version: 20250624

