14743 - Determining the explosion mechanism of a superluminous supernova through the deepest ever late-time study

Cycle: 24, 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) SN2015BN+HOST	ACS/WFC	3	13-Mar-2017 21:01:25.0	yes

3 Total Orbits Used

ABSTRACT

The superluminous supernova (SLSN) SN 2015bn is one of the three nearest objects of its kind to date, and is now the best studied. However, despite a wealth of observations within ~1 year of peak light, the explosion mechanism remains elusive. Here we propose to distinguish between the popular scenarios of magnetar spin-down, circumstellar interaction and pair-instability explosion, by obtaining the latest and deepest ever images of a SLSN at around 2 years after explosion. At this phase, competing models predict robust colour differences, which we can detect in 3 orbits of HST+ACS observations (with 3 more orbits in the following cycle required for host galaxy template subtraction, also leading to a detailed host analysis). In the decade or so since the first SLSNe were discovered, no event has had the combination of late-time luminosity, proximity and a sufficiently faint host to be able to follow to such a late phase. We stress that these observations are new, timely, and only possible for ~1 SLSN per decade. Furthermore,

we have a robust magnitude prediction based on extensive data, and the colour test we wish to perform is powerful yet relatively straightforward, and only possible using HST.

OBSERVING DESCRIPTION

We will use 3 orbits in Cycle 24 to observe SN 2015bn with the Advanced Camera for Surveys in the F475W, F625W and F775W filters, and 3 orbits in Cycle 25 to obtain images of the host galaxy in the same filters and with the same depth, after the SN has disappeared (during the same months in Cycle 25, the SN flux will be negligible, at r >30). These filters have been specifically chosen to cover the wavelength range where we expect most of the SN light to be concentrated.

Taking into account the visibility window per orbit of ~54 min based on the target declination, and the time needed for guide star acquisition, dithering (in a standard 4 point pattern) and per-exposure overheads, the available time for integration on the target is ~2100 s in each orbit. Using this exposure time in each filter (i.e. 3 orbits total), the SN should be detectable with S/N >~ 5. If it has faded faster than expected, we will stack the exposures in a deep 'white-light' image to recover the SN.

Visit

Proposal 14743, Visit 01, implementation Tue Mar 14 01:01:26 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.262 Line Spacing=0.192	Coordinate Frame=POS-TARG Pattern Orientation=18.39 Angle Between Sides=68.14 Center Pattern=false		(1), (2), (3)

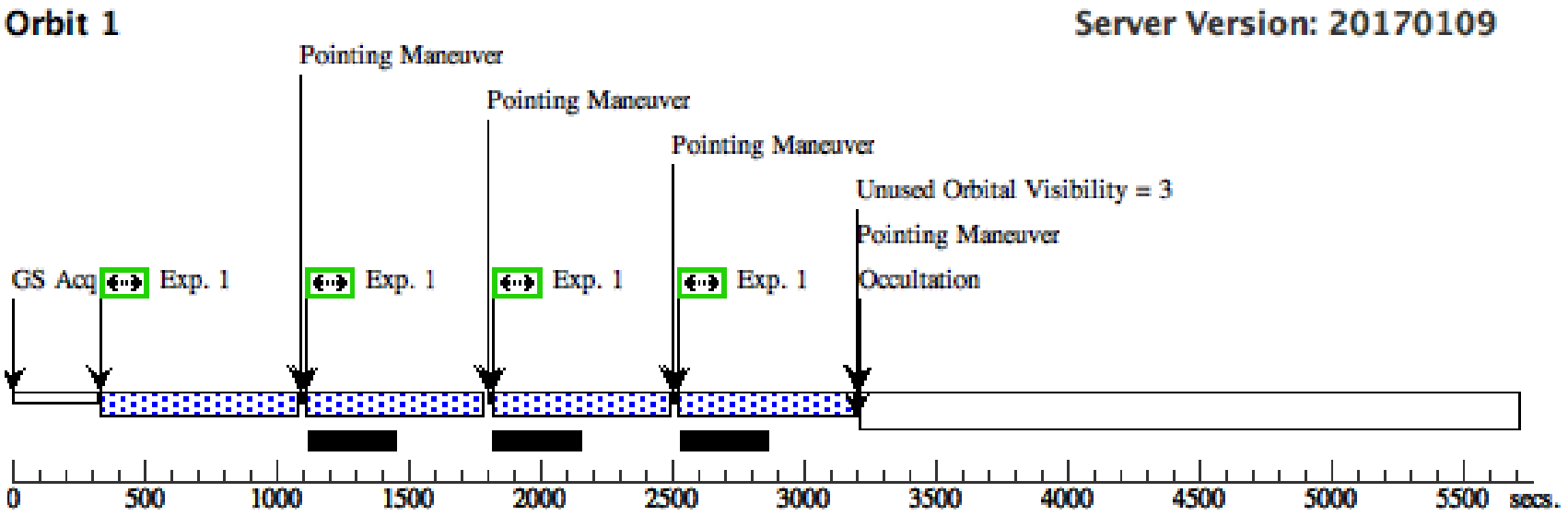
Fixed Targets

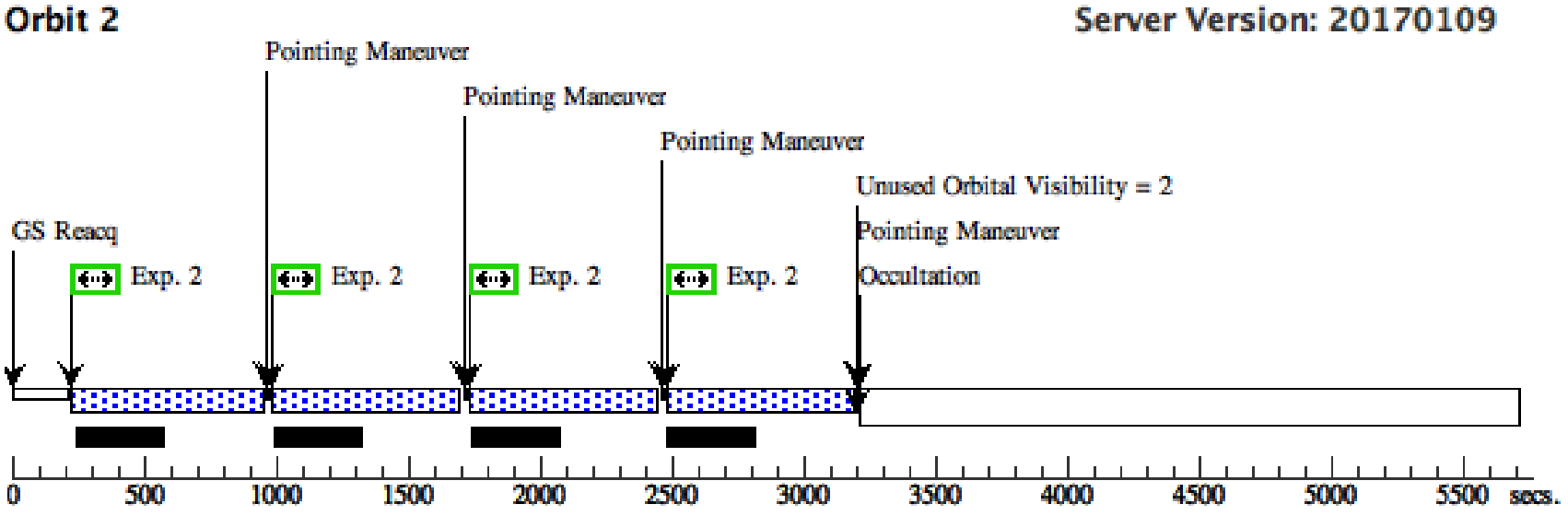
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SN2015BN+HOST Alt Name1: SDSSJ113341.53+004333.3 Alt Name2: PS15AE	RA: 11 33 41.5500 (173.4231250d) Dec: +00 43 33.40 (.72594d) Equinox: J2000	Redshift: 0.1136	V=(?) supernova: r = 28 AB mag, host: r = 22 AB mag	Reference Frame: ICRS

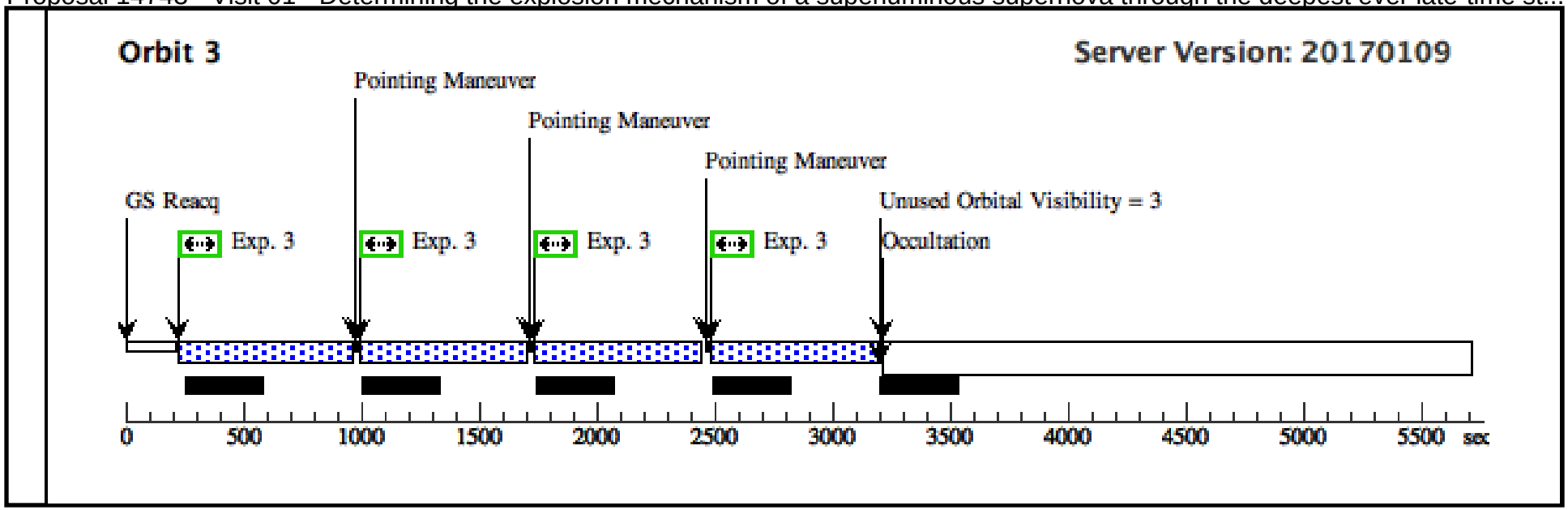
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	i-sn	(1) SN2015BN+HOST	ACS/WFC, ACCUM, WFC1	F775W		GS ACQ SCENARIO BASE1B3	Pattern 1, Exps 1-1 in Visit 01 (1)	500 Secs (2180 Secs) *[==>545.0 Secs (Pattern 1)]* *[==>545.0 Secs (Pattern 2)]* *[==>545.0 Secs (Pattern 3)]* *[==>545.0 Secs (Pattern 4)]*	***[1]***
2	r-sn	(1) SN2015BN+HOST	ACS/WFC, ACCUM, WFC1	F625W			Pattern 1, Exps 2-2 in Visit 01 (1)	525 Secs (2356 Secs) *[==>589.0 Secs (Pattern 1)]* *[==>589.0 Secs (Pattern 2)]* *[==>589.0 Secs (Pattern 3)]* *[==>589.0 Secs (Pattern 4)]*	***[2]***
3	g-sn	(1) SN2015BN+HOST	ACS/WFC, ACCUM, WFC1	F475W			Pattern 1, Exps 3-3 in Visit 01 (1)	525 Secs (2344 Secs) *[==>586.0 Secs (Pattern 1)]* *[==>586.0 Secs (Pattern 2)]* *[==>586.0 Secs (Pattern 3)]* *[==>586.0 Secs (Pattern 4)]*	***[3]***

Orbit Structure






Orbit 3
Server Version: 20170109
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
GS Reacq
Exp. 3
Exp. 3
Exp. 3
Exp. 3
Unused Orbital Visibility = 3
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
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5500
sec