17170 - Measuring the Effect of Progenitor Metallicity on Type Ia Supernova Distance Estimates

Cycle: 30, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

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Dr. J. Craig Wheeler (CoI)	University of Texas at Austin

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(5) SN2023BEE CCDFLAT	STIS/CCD STIS/NUV-MAMA	2	26-Jun-2023 18:00:29.0	yes
02	(6) SN2023GFT CCDFLAT	STIS/CCD STIS/NUV-MAMA	2	26-Jun-2023 18:00:31.0	yes
03	(7) SN2023LNH CCDFLAT	STIS/CCD STIS/NUV-MAMA	2	26-Jun-2023 18:00:32.0	yes
04	(4) SN4 CCDFLAT	STIS/CCD STIS/NUV-MAMA	2	26-Jun-2023 18:00:33.0	yes

8 Total Orbits Used

ABSTRACT

Despite using Type Ia supernovae (SN Ia) to precisely measure cosmological parameters, we do not know basic facts about the progenitor systems and explosions. Theory suggests that SN Ia progenitor metallicity is correlated with peak luminosity, but not how quickly it fades, which we use to calibrate the luminosity and measure distances. This effect should lead to an increased Hubble scatter, reducing the precision with which we measure distances. If the mean progenitor metallicity changes with redshift or population, cosmological measurements such as the dark energy equation-of-state parameter and the Hubble constant could be biased. Models also indicate that changing progenitor metallicity will have little effect on the appearance of optical/NIR SN data, but significantly alter UV spectra. These data can only be obtained with HST.

HST observations of 2 "twin" SN (having nearly identical optical spectra and light-curve shapes) with different UV spectra and peak optical luminosities indicate progenitor metallicity differences consistent with models. The current sample of SN Ia with near-peak spectra is siginificantly lacking in its representation of high-velocity (HV) SN Ia. To determine the overall impact of progenitor metallicity on cosmological measurements, we must increase this sample.

The community now discovers ~20 SN Ia each year >2 weeks before peak. With the increased discovery rate of young SN, we can expect to observe 4 HV SN Ia in the UV in a single Cycle and constrain how velocity affects the diversity of SN Ia UV properties. This is our best opportunity to further our understanding of SN Ia while directly improving the utility of SN Ia for cosmology.

OBSERVING DESCRIPTION

There are 4 separate TOO targets, each will obtain a single spectrum. Each of these targets will require 2 orbits.

Fast turn around is important, and we will work closely to speed this process up. Some tweaking to the visits will be required for each trigger.

Visit

Proposal 17170, Visit 01, completed Mon Jun 26 22:00:33 GMT 2023

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/NUV-MAMA, STIS/CCD

Special Requirements: SCHED 70%; ON HOLD ; TOO RESPONSE TIME 21.0D

On Hold Comments: Activate upon discovery of first viable target

Fixed Targets

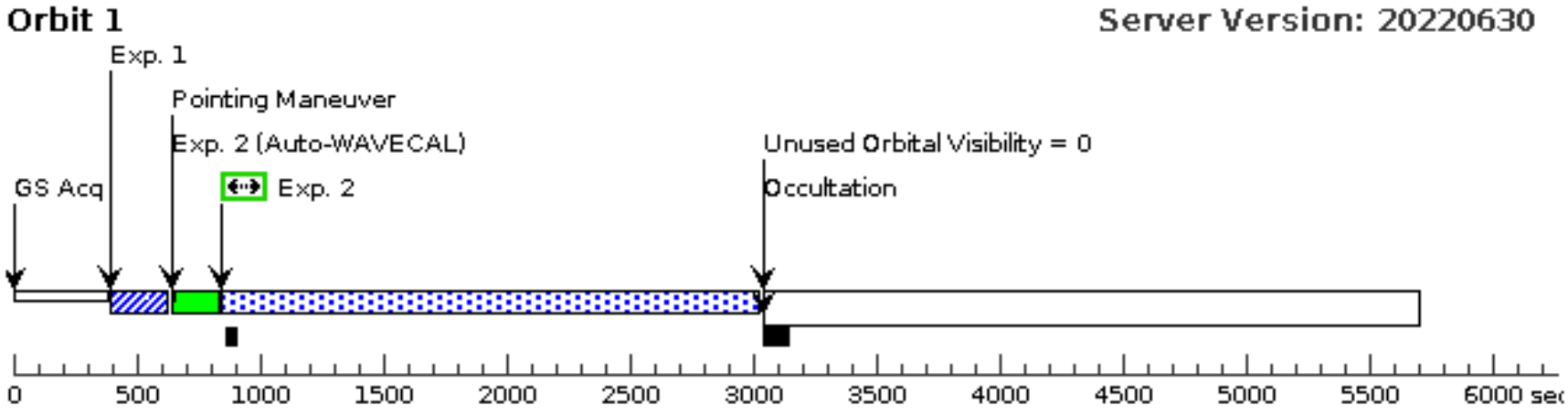
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(5)	SN2023BEE	RA: 08 56 11.6400 (134.0485000d) Dec: -03 19 31.91 (-3.32553d) Equinox: J2000		V=13	Reference Frame: ICRS

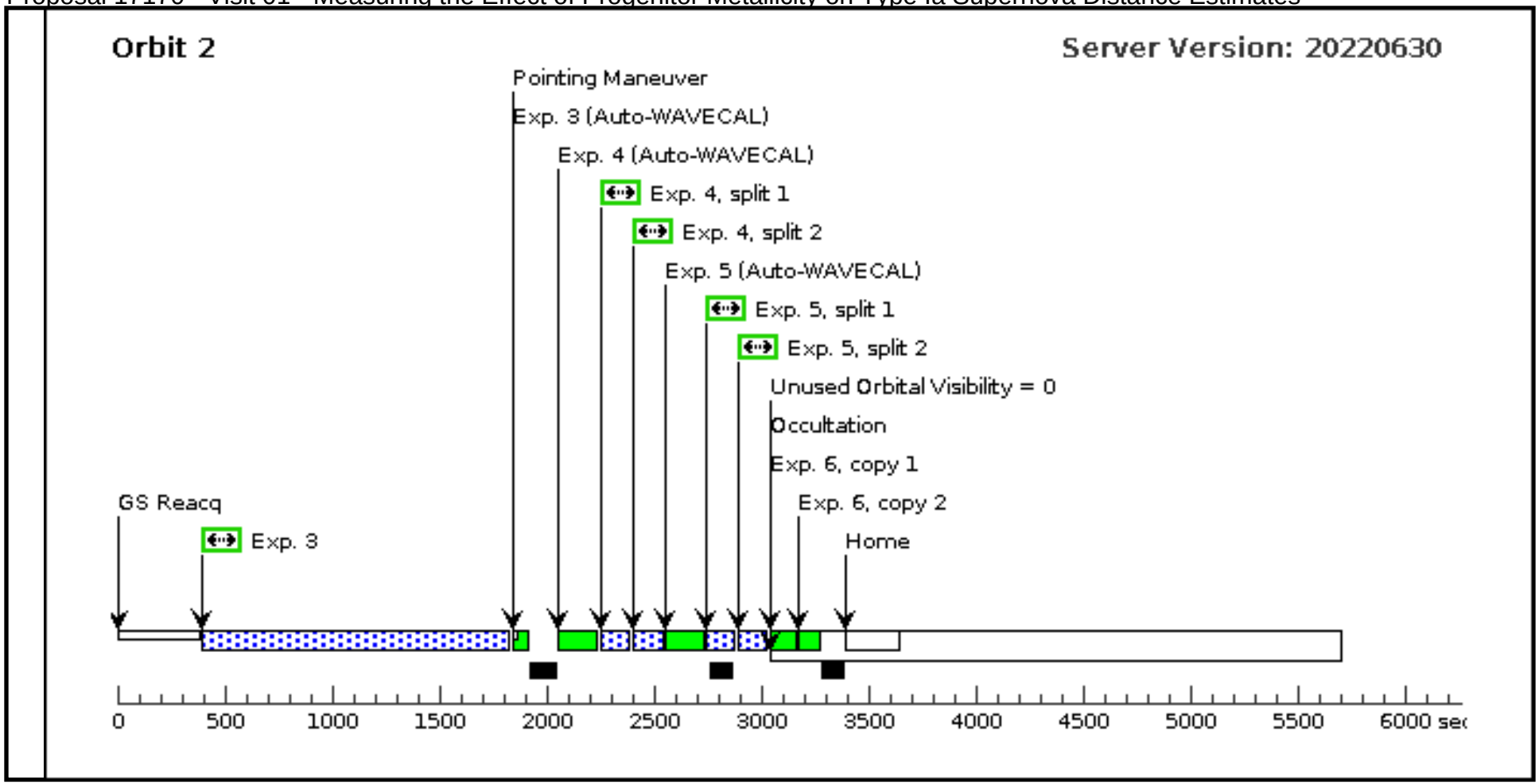
Comments: Rising SN Ia
Category=EXT-STAR
Description=[SUPERNOVA TYPE IA]

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(5) SN2023BEE	STIS/CCD, ACQ, F28X50LP	MIRROR				2 Secs (2 Secs) *[==>]*	***[1]***
2	(STIS.sp.18 6468)	(5) SN2023BEE	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				2170 Secs (2170 Secs) *[==>2170 Secs]*	***[1]***
3	(STIS.sp.18 6471)	(5) SN2023BEE	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				1420 Secs (1420 Secs) *[==>1420 Secs]*	***[2]***
4		(5) SN2023BEE	STIS/CCD, ACCUM, 52X0.2E1	G430L 4300 A	CR-SPLIT=2			200 Secs (200 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[2]***
5		(5) SN2023BEE	STIS/CCD, ACCUM, 52X0.2E1	G750L 7751 A	CR-SPLIT=2			200 Secs (200 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[2]***
6		CCDFLAT	STIS/CCD, ACCUM, 52X0.1	G750L 7751 A				25 Secs X 2 (50 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[2]***

Orbit Structure




Orbit 2
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Pointing Maneuver
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Exp. 4 (Auto-WAVECAL)
Exp. 4, split 1
Exp. 4, split 2
Exp. 5 (Auto-WAVECAL)
Exp. 5, split 1
Exp. 5, split 2
Unused Orbital Visibility = 0
Occultation
Exp. 6, copy 1
Exp. 6, copy 2
Home
GS Reacq
Exp. 3
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1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec

Visit

Proposal 17170, Visit 02, completed Mon Jun 26 22:00:34 GMT 2023

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/NUV-MAMA, STIS/CCD

Special Requirements: SCHED 70%; ON HOLD ; TOO RESPONSE TIME 21.0D

On Hold Comments: Activate upon discovery of second viable target

Fixed Targets

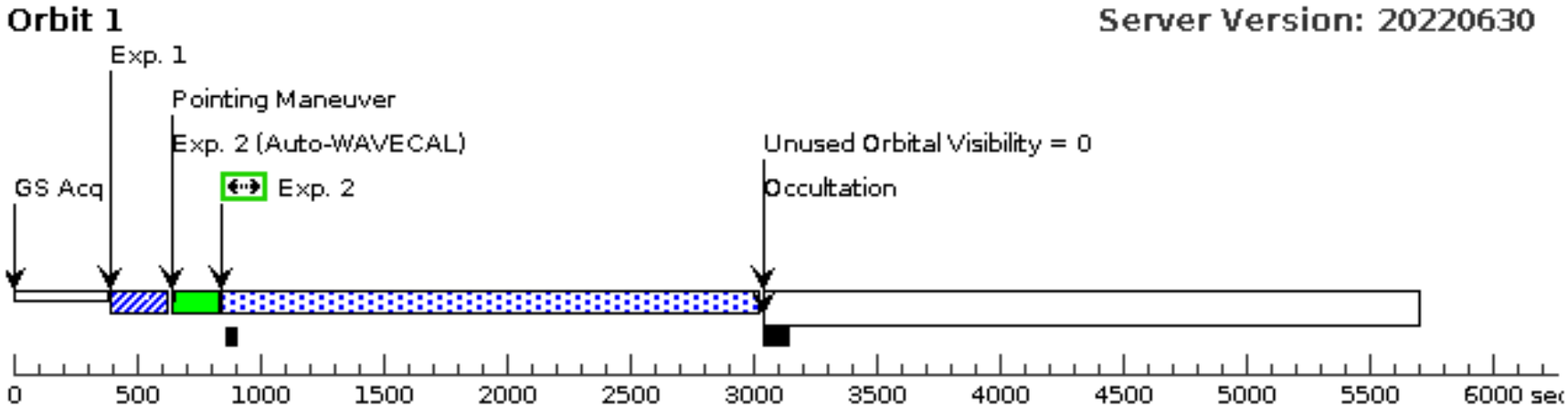
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(6)	SN2023GFT	RA: 21 26 1.3200 (321.5055000d) Dec: -03 47 53.65 (-3.79824d) Equinox: J2000		V=14	Reference Frame: ICRS

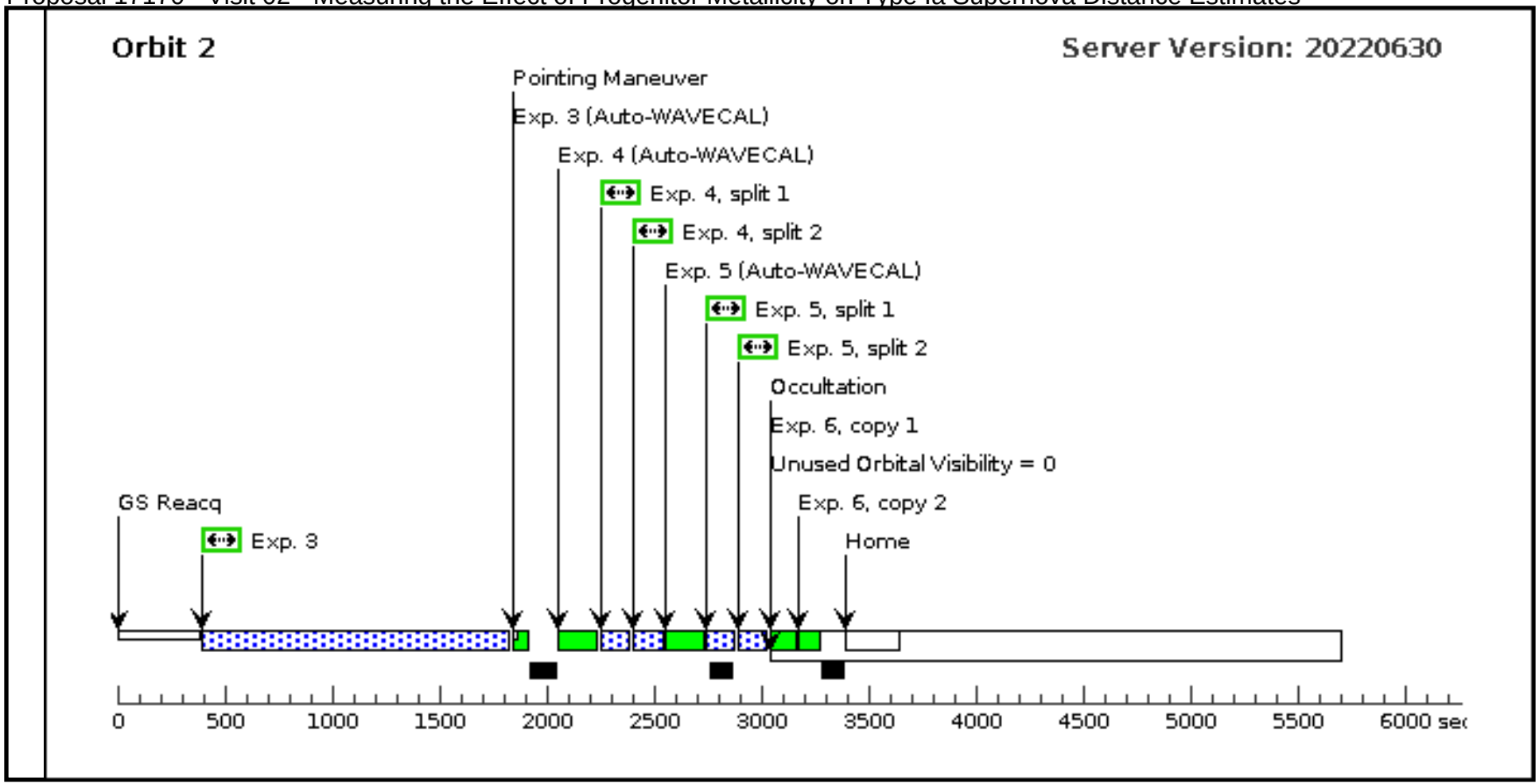
Comments: Rising SN Ia
Category=EXT-STAR
Description=[SUPERNOVA TYPE IA]

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(6) SN2023GFT	STIS/CCD, ACQ, F28X50LP	MIRROR				2 Secs (2 Secs) *[==>]*	***[1]***
2	(STIS.sp.18 6468)	(6) SN2023GFT	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				2170 Secs (2170 Secs) *[==>2170 Secs]*	***[1]***
3	(STIS.sp.18 6471)	(6) SN2023GFT	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				1420 Secs (1420 Secs) *[==>1420 Secs]*	***[2]***
4		(6) SN2023GFT	STIS/CCD, ACCUM, 52X0.2E1	G430L 4300 A	CR-SPLIT=2			200 Secs (200 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[2]***
5		(6) SN2023GFT	STIS/CCD, ACCUM, 52X0.2E1	G750L 7751 A	CR-SPLIT=2			200 Secs (200 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[2]***
6		CCDFLAT	STIS/CCD, ACCUM, 52X0.1	G750L 7751 A				25 Secs X 2 (50 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[2]***

Orbit Structure




Orbit 2
Server Version: 20220630
Pointing Maneuver
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Exp. 4 (Auto-WAVECAL)
Exp. 4, split 1
Exp. 4, split 2
Exp. 5 (Auto-WAVECAL)
Exp. 5, split 1
Exp. 5, split 2
Occultation
Exp. 6, copy 1
Unused Orbital Visibility = 0
Exp. 6, copy 2
Home
GS Reacq
Exp. 3
0
500
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3500
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5500
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Visit

Proposal 17170, Visit 03, implementation Mon Jun 26 22:00:34 GMT 2023

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/NUV-MAMA, STIS/CCD

Special Requirements: SCHED 70%; ON HOLD ; TOO RESPONSE TIME 21.0D

On Hold Comments: Activate upon discovery of third viable target

Fixed Targets

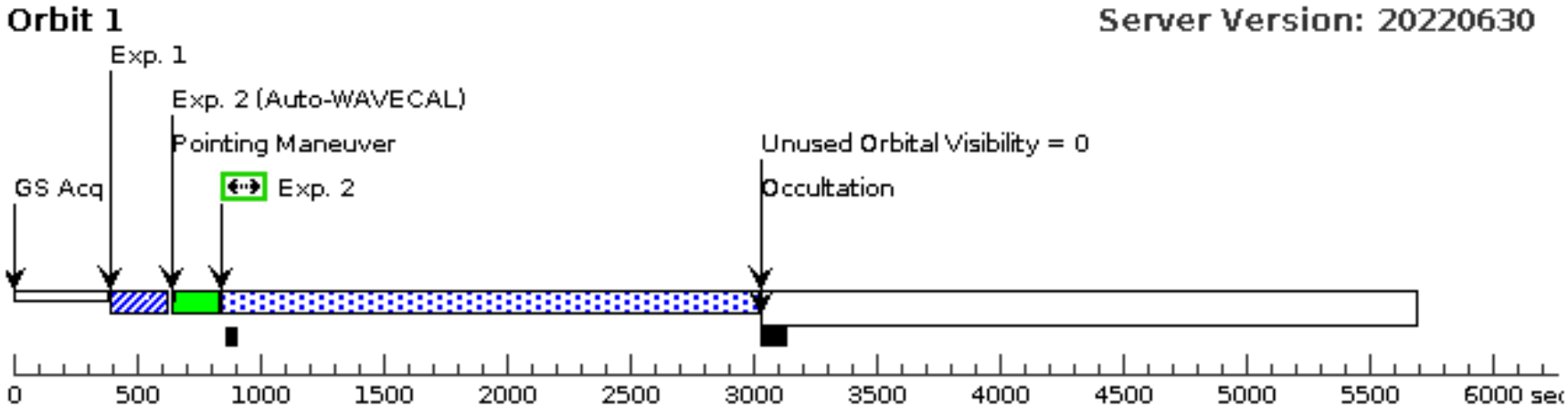
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(7)	SN2023LNH	RA: 00 34 2.2400 (8.5093333d) Dec: -09 42 14.20 (-9.70394d) Equinox: J2000		V=14.5	Reference Frame: ICRS

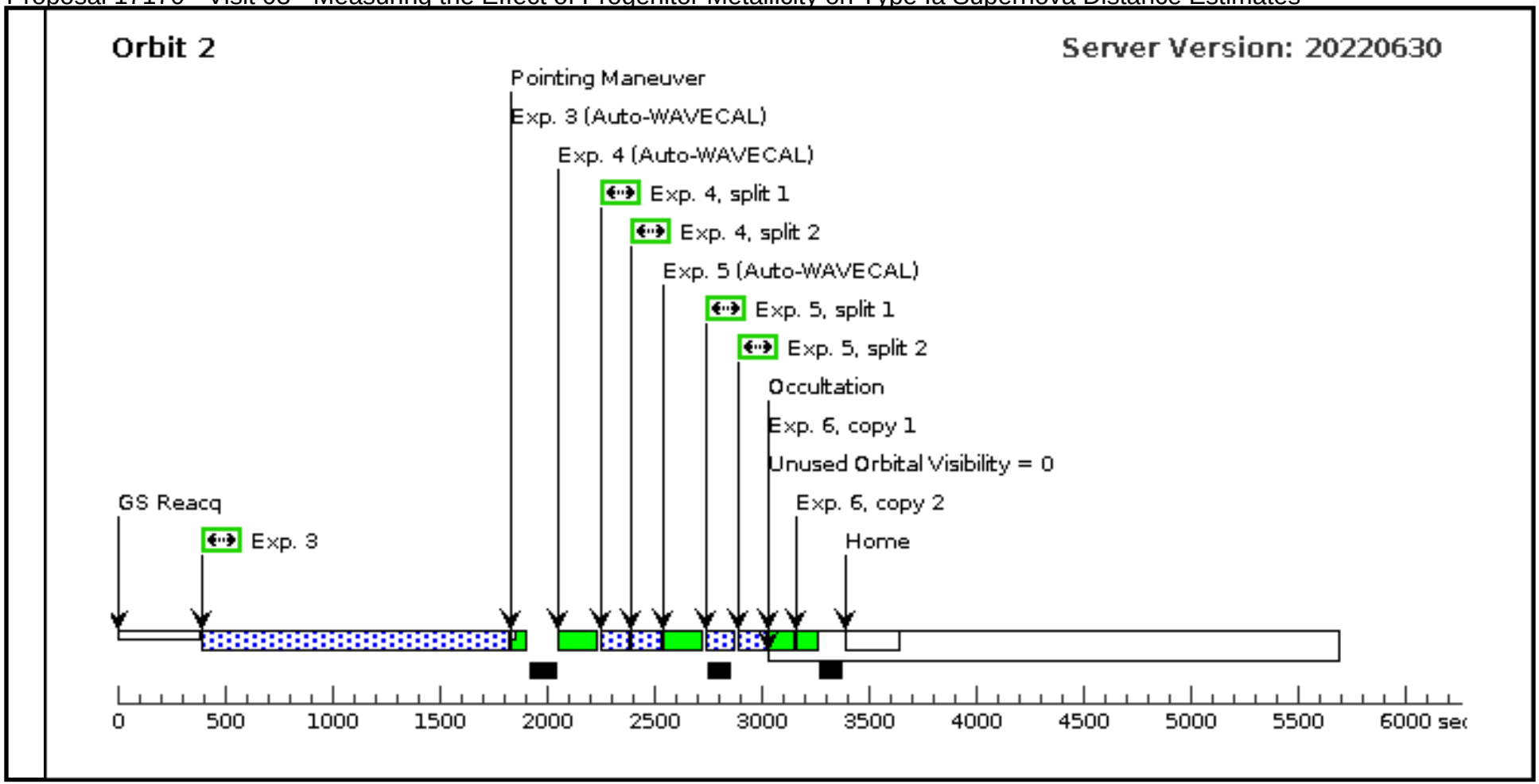
Comments: Rising SN Ia
Category=EXT-STAR
Description=[SUPERNOVA TYPE IA]

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(7) SN2023LNH	STIS/CCD, ACQ, F28X50LP	MIRROR				2 Secs (2 Secs) *[==>]*	***[1]***
2	(STIS.sp.18 6468)	(7) SN2023LNH	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				2168 Secs (2168 Secs) *[==>2168 Secs]*	***[1]***
3	(STIS.sp.18 6471)	(7) SN2023LNH	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				1418 Secs (1418 Secs) *[==>1418 Secs]*	***[2]***
4		(7) SN2023LNH	STIS/CCD, ACCUM, 52X0.2E1	G430L 4300 A	CR-SPLIT=2			200 Secs (200 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[2]***
5		(7) SN2023LNH	STIS/CCD, ACCUM, 52X0.2E1	G750L 7751 A	CR-SPLIT=2			200 Secs (200 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[2]***
6		CCDFLAT	STIS/CCD, ACCUM, 52X0.1	G750L 7751 A				25 Secs X 2 (50 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[2]***

Orbit Structure

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Pointing Maneuver
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Exp. 4, split 1
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Exp. 5 (Auto-WAVECAL)
Exp. 5, split 1
Exp. 5, split 2
Occultation
Exp. 6, copy 1
Unused Orbital Visibility = 0
Exp. 6, copy 2
Home
GS Reacq
Exp. 3
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5500
6000 sec

Visit

Proposal 17170, Visit 04, implementation Mon Jun 26 22:00:34 GMT 2023

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/NUV-MAMA, STIS/CCD

Special Requirements: ON HOLD ; TOO RESPONSE TIME 21.0D

On Hold Comments: Activate upon discovery of fourth viable target

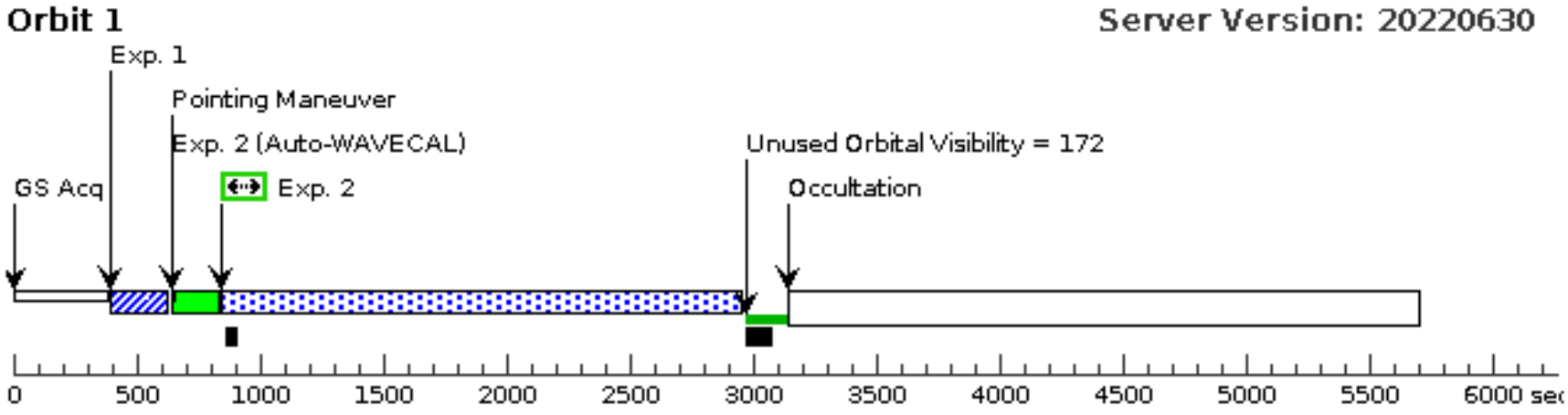
Generic Targets

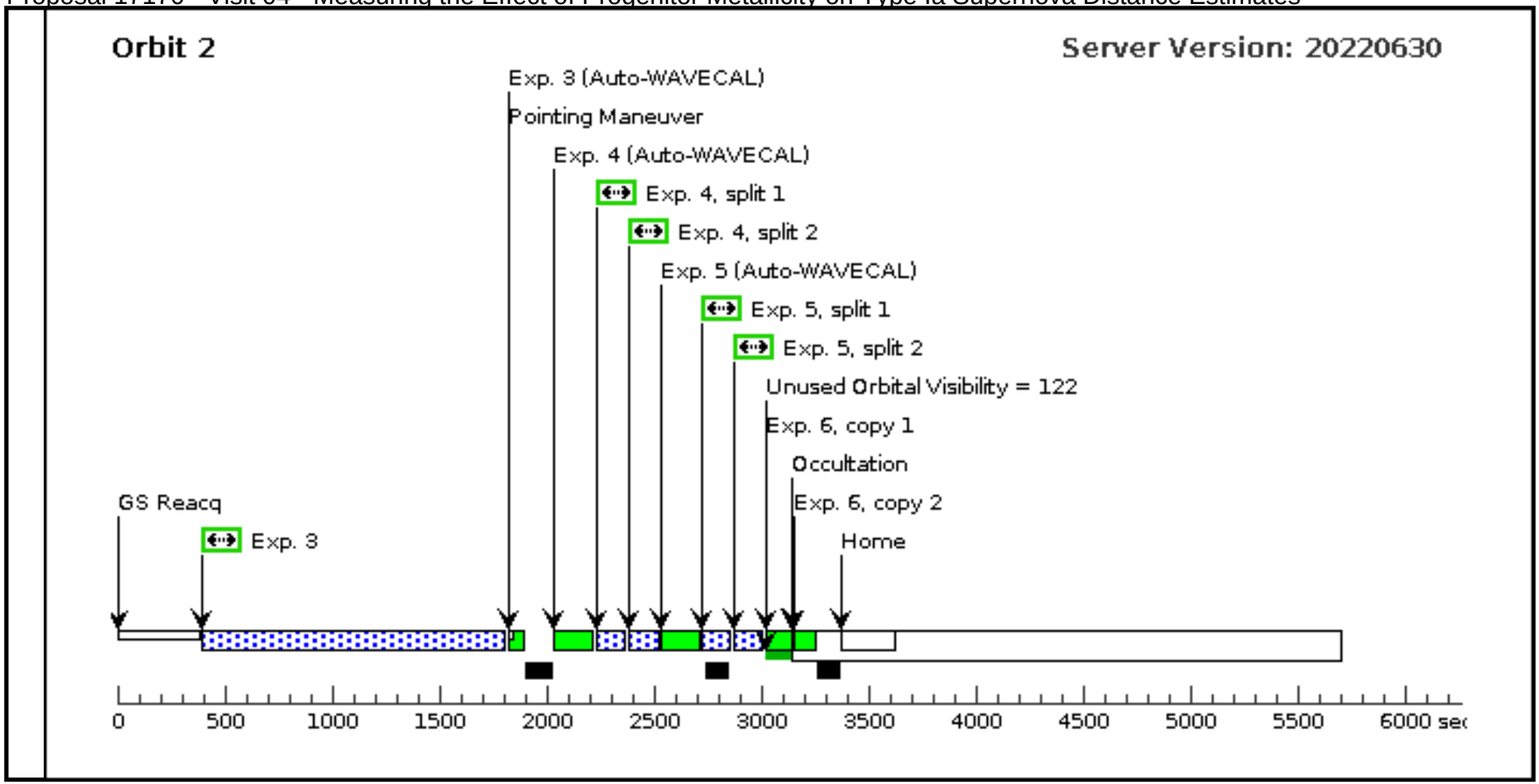
#	Name	Criteria	Description
(4)	SN4	TOO	SUPERNOVA TYPE IA

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(4) SN4	STIS/CCD, ACQ, F28X50LP	MIRROR				2 Secs (2 Secs) *[==>]*	 ***[1]***
2	(STIS.sp.18 6468)	(4) SN4	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				2100 Secs (2100 Secs) *[==>]*	 ***[1]***
3	(STIS.sp.18 6471)	(4) SN4	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				1400 Secs (1400 Secs) *[==>]*	 ***[2]***
4		(4) SN4	STIS/CCD, ACCUM, 52X0.2E1	G430L 4300 A	CR-SPLIT=2			200 Secs (200 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	 ***[2]***
5		(4) SN4	STIS/CCD, ACCUM, 52X0.2E1	G750L 7751 A	CR-SPLIT=2			200 Secs (200 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	 ***[2]***
6		CCDFLAT	STIS/CCD, ACCUM, 52X0.1	G750L 7751 A				25 Secs X 2 (50 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	 ***[2]***

Orbit Structure

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Pointing Maneuver
Exp. 4 (Auto-WAVECAL)
Exp. 4, split 1
Exp. 4, split 2
Exp. 5 (Auto-WAVECAL)
Exp. 5, split 1
Exp. 5, split 2
Unused Orbital Visibility = 122
Exp. 6, copy 1
Occultation
Exp. 6, copy 2
Home
GS Reacq
Exp. 3
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