17764 - Unraveling Red Supergiant Mass Loss with Early FUV Spectra of a Type IIP/L Supernova

Cycle: 32, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

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Prof. Griffin Hosseinzadeh (CoI)	University of California - San Diego
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Ms. Darshana Mehta (CoI)	University of California - Davis

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) SN2025TIS	STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	3	08-Aug-2025 18:00:14.0	yes
02	(1) SN2025TIS	STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	3	08-Aug-2025 18:00:15.0	yes
03	(1) SN2025TIS	STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	2	08-Aug-2025 18:00:16.0	yes
04	(1) SN2025TIS	STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	4	08-Aug-2025 18:00:17.0	yes

12 Total Orbits Used

ABSTRACT

During the red supergiants phase, the progenitors of hydrogen-rich Type IIP/L supernovae undergo substantial mass loss. However, there is no first principle theory that predicts the mass-loss rate. Furthermore, prescriptions based on observations vary by orders of magnitude. Additionally, observations of supernovae during the early evolution, can show evidence of even higher mass-loss rates occurring just prior to explosion, although it is unknown what fraction of supernovae this occurs in. While optical spectra can detect the highest mass-loss rates via narrow high-ionization lines that disappear within 2 weeks of explosion, the ultraviolet is sensitive to the full range of possible mass loss, with the majority of strong resonance lines occurring in the far ultraviolet (FUV) as well as continuum emission from the ejecta's interaction with circumstellar material. In this way, FUV spectra can be used to characterize the density, location, and composition of the circumstellar material. Despite these strong indicators, only one Type IIP/L supernova has been observed in the FUV within a week of explosion. This is because only about one Type IIP/L supernova per year is discovered young, unextincted, and close enough for FUV study and these observations require a disruptive ToO to execute. We propose a disruptive ToO to obtain FUV and NUV observations of an infant, nearby, Type IIP/L supernova to understand the red supergiant mass loss and the diversity of supernovae in the UV. Beyond the local universe, these observations are critical for understanding the high redshift supernovae, which may be some of the first single objects observable in the early universe.

OBSERVING DESCRIPTION

We will trigger this ToO on a Type II supernova that is UV bright and discovered within 24 hours of explosion. We would like the First visit to execute as soon as possible with the second visit executing a day later and the third visit a day after that. The final visit will execute 7 days after the last visit.

We request a full GS acquisition at the beginning of each orbit as the supernova will change on the timescale of a day and thus these observations are not repeatable.

Visit

Proposal 17764, Visit 01, implementation Fri Aug 08 22:00:18 GMT 2025

Diagnostic Status: No Diagnostics

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

Special Requirements: ON HOLD ; TOO RESPONSE TIME 2.0D

Comments: Please put a full GS acq at the beginning of each orbit so if one orbit fails the others have a chance of succeeding. I can adjust the exposure times if needed

First epoch should be executed as soon as possible after trigger
For SN with initial brightness around r=17 mag

On Hold Comments: Waiting for a suitable supernova to explode.
I understand this response time is likely a lower limit on what STScI is capable of but the sooner the better for this program

Fixed Targets

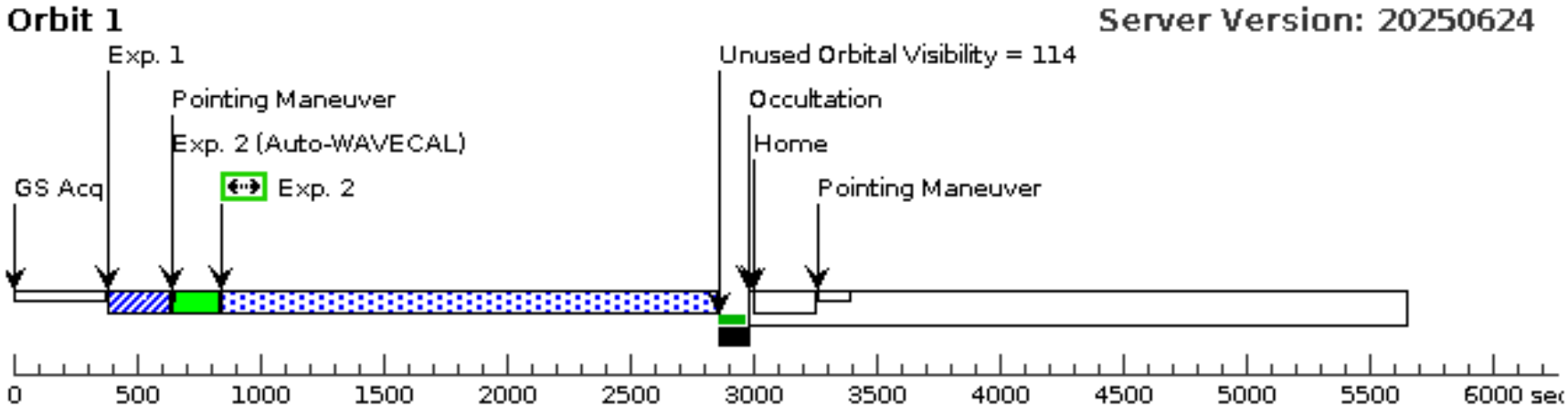
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SN2025TIS	RA: 03 55 22.7790 (58.8449125d) Dec: -28 09 32.68 (-28.15908d) Equinox: J2000		V=17+/-0.1	Reference Frame: ICRS

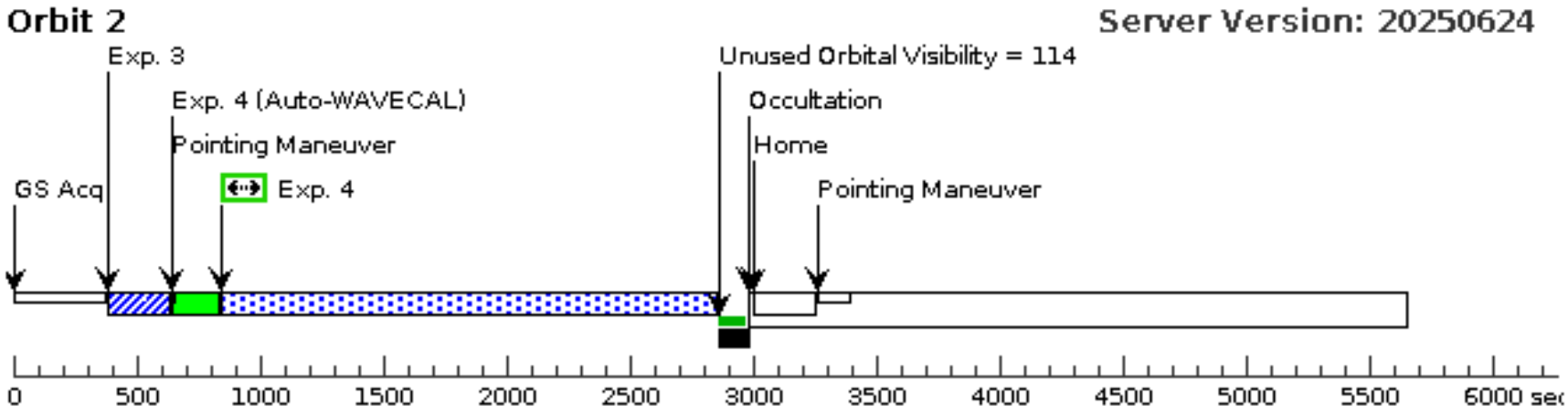
Comments:
Category=EXT-STAR
Description=[SUPERNOVA, SUPERNOVA TYPE II]
Extended=NO

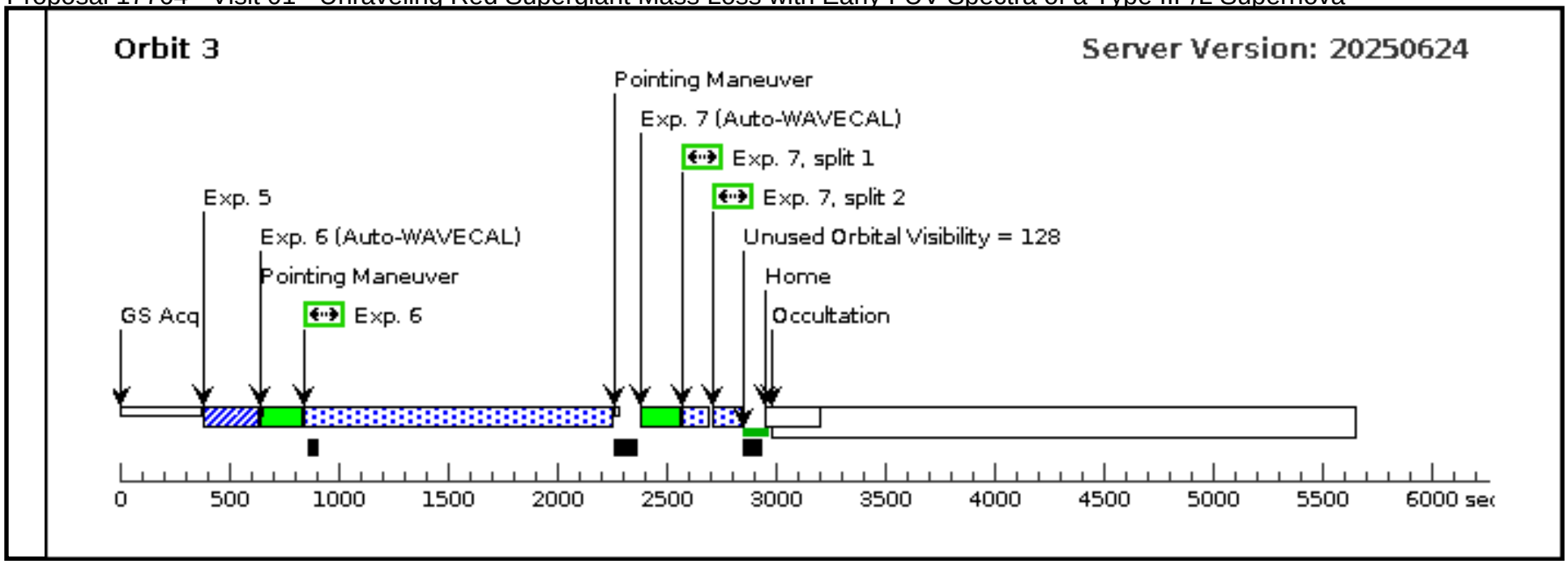
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	TA (STIS.ta.2025004)	(1) SN2025TIS	STIS/CCD, ACQ, F28X50LP	MIRROR				5 Secs (5 Secs) *[==>]*	***[1]***
2	G140L (STIS.sp.2025005)	(1) SN2025TIS	STIS/FUV-MAMA, ACCUM, 52X0.2	G140L 1425 A				2000 Secs (2000 Secs) *[==>]*	***[1]***
3	TA (STIS.ta.2025004)	(1) SN2025TIS	STIS/CCD, ACQ, F28X50LP	MIRROR		NEW OBSET FULL ACQ		5 Secs (5 Secs) *[==>]*	***[2]***
4	G140L (STIS.sp.2025005)	(1) SN2025TIS	STIS/FUV-MAMA, ACCUM, 52X0.2	G140L 1425 A				2000 Secs (2000 Secs) *[==>]*	***[2]***
5	TA (STIS.ta.2025004)	(1) SN2025TIS	STIS/CCD, ACQ, F28X50LP	MIRROR		NEW OBSET FULL ACQ		5 Secs (5 Secs) *[==>]*	***[3]***
6	G230L (STIS.sp.2025005)	(1) SN2025TIS	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				1400 Secs (1400 Secs) *[==>]*	***[3]***
7	G430L (STIS.sp.2024984)	(1) SN2025TIS	STIS/CCD, ACCUM, 52X0.2E1	G430L 4300 A				180 Secs (180 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[3]***

Orbit Structure






Orbit 3
Server Version: 20250624
Pointing Maneuver
Exp. 7 (Auto-WAVECAL)
Exp. 7, split 1
Exp. 7, split 2
Exp. 5
Exp. 6 (Auto-WAVECAL)
Unused Orbital Visibility = 128
Pointing Maneuver
Home
GS Acq
Exp. 6
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec

Visit

Proposal 17764, Visit 02, implementation Fri Aug 08 22:00:18 GMT 2025

Diagnostic Status: No Diagnostics

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

Special Requirements: AFTER 01 BY 18 H TO 28 H; ON HOLD

Comments: Please put a full GS acq at the beginning of each orbit so if one orbit fails the others have a chance of succeeding. I can adjust the exposure times if needed

Second epoch should be executed 24 hours after first visit
For SN with initial brightness around r=17 mag
If possible execute at same orientation as visit 1

On Hold Comments: Waiting for a suitable supernova to explode.

Fixed Targets

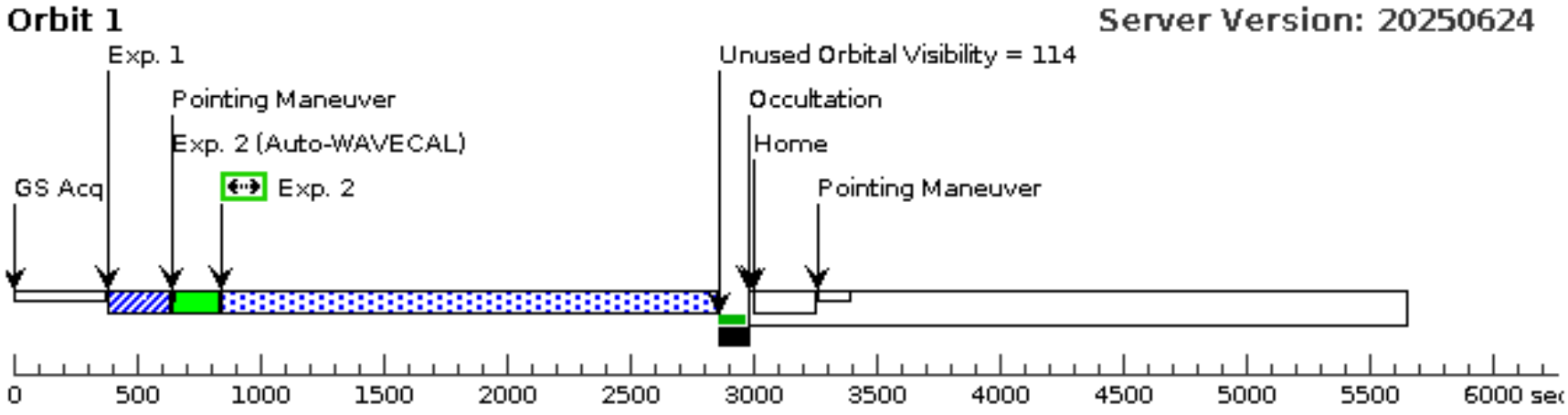
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SN2025TIS	RA: 03 55 22.7790 (58.8449125d) Dec: -28 09 32.68 (-28.15908d) Equinox: J2000		V=17+/-0.1	Reference Frame: ICRS

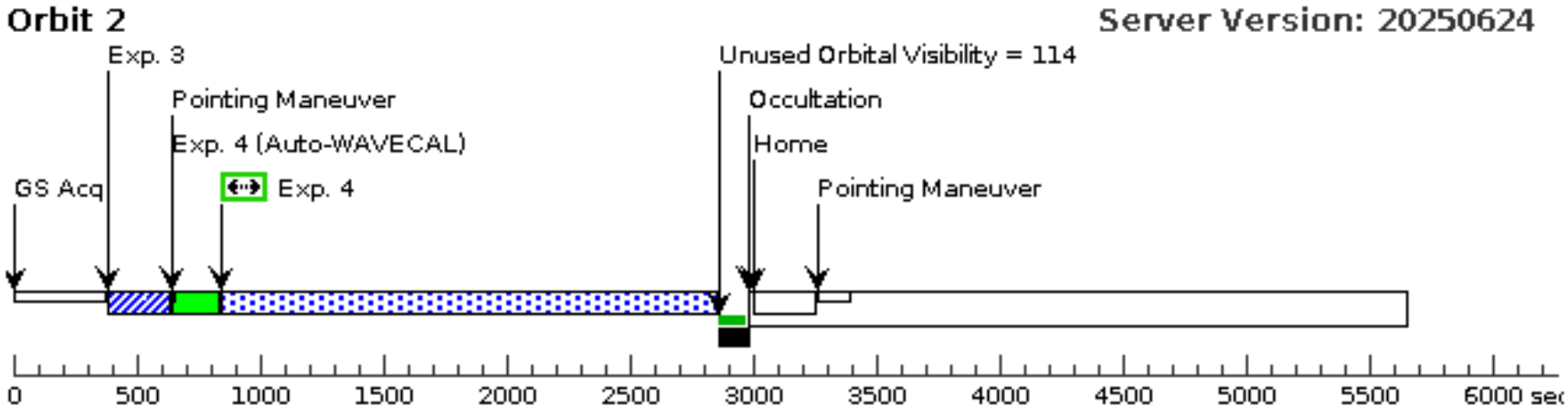
Comments:
Category=EXT-STAR
Description=[SUPERNOVA, SUPERNOVA TYPE II]
Extended=NO

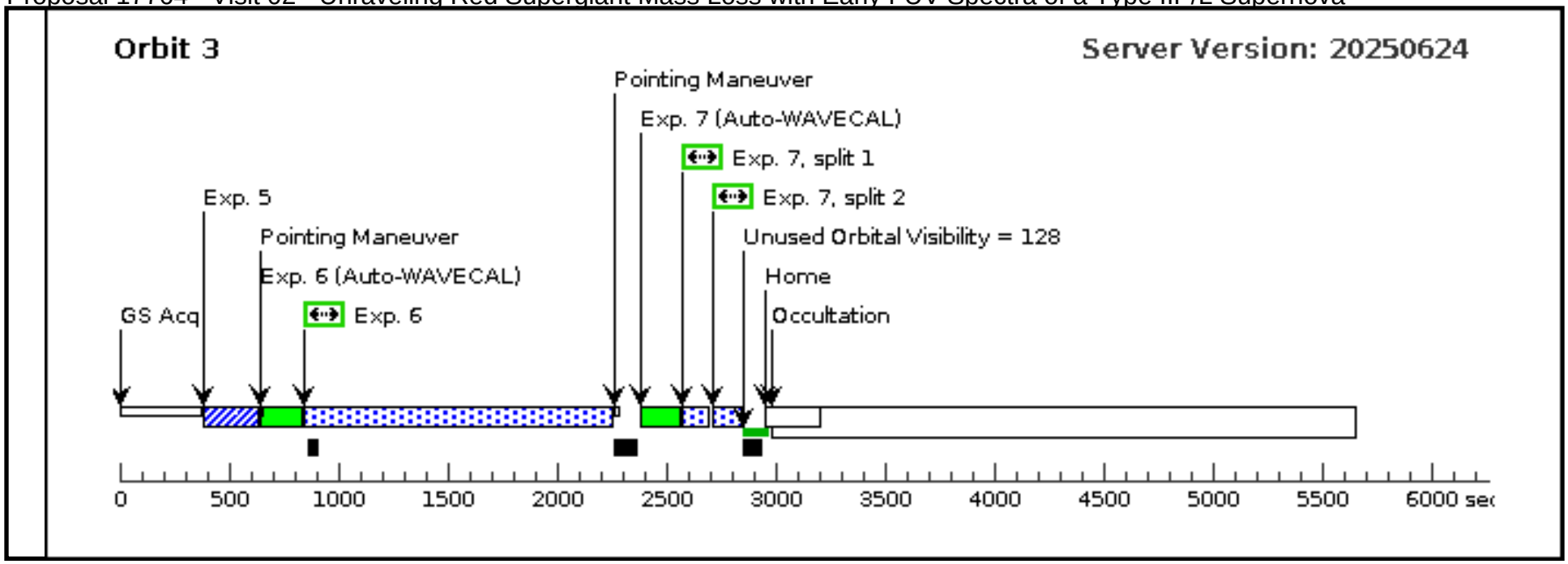
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	TA (STIS.ta.2025004)	(1) SN2025TIS	STIS/CCD, ACQ, F28X50LP	MIRROR				5 Secs (5 Secs) *[==>]*	***[1]***
2	G140L (STIS.sp.2025005)	(1) SN2025TIS	STIS/FUV-MAMA, ACCUM, 52X0.2	G140L 1425 A				2000 Secs (2000 Secs) *[==>]*	***[1]***
3	TA (STIS.ta.2025004)	(1) SN2025TIS	STIS/CCD, ACQ, F28X50LP	MIRROR		NEW OBSET FULL ACQ		5 Secs (5 Secs) *[==>]*	***[2]***
4	G140L (STIS.sp.2025005)	(1) SN2025TIS	STIS/FUV-MAMA, ACCUM, 52X0.2	G140L 1425 A				2000 Secs (2000 Secs) *[==>]*	***[2]***
5	TA (STIS.ta.2025004)	(1) SN2025TIS	STIS/CCD, ACQ, F28X50LP	MIRROR		NEW OBSET FULL ACQ		5 Secs (5 Secs) *[==>]*	***[3]***
6	G230L (STIS.sp.2025005)	(1) SN2025TIS	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				1400 Secs (1400 Secs) *[==>]*	***[3]***
7	G430L (STIS.sp.2024984)	(1) SN2025TIS	STIS/CCD, ACCUM, 52X0.2E1	G430L 4300 A				180 Secs (180 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[3]***

Orbit Structure






Orbit 3
Server Version: 20250624
Pointing Maneuver
Exp. 7 (Auto-WAVECAL)
Exp. 7, split 1
Exp. 7, split 2
Exp. 5
Unused Orbital Visibility = 128
Pointing Maneuver
Exp. 6 (Auto-WAVECAL)
Home
GS Acq
Exp. 6
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec

Visit

Proposal 17764, Visit 03, implementation Fri Aug 08 22:00:18 GMT 2025

Diagnostic Status: No Diagnostics

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

Special Requirements: AFTER 02 BY 18 H TO 24 H; ON HOLD

Comments: Please put a full GS acq at the beginning of each orbit so if one orbit fails the others have a chance of succeeding. I can adjust the exposure times if needed

Third epoch should be executed 24 hours after second visit and 48 hours after first visit
For SN with initial brightness around r=17 mag
If possible execute at same orientation as visit 1

On Hold Comments: Waiting for a suitable supernova to explode.

Fixed Targets

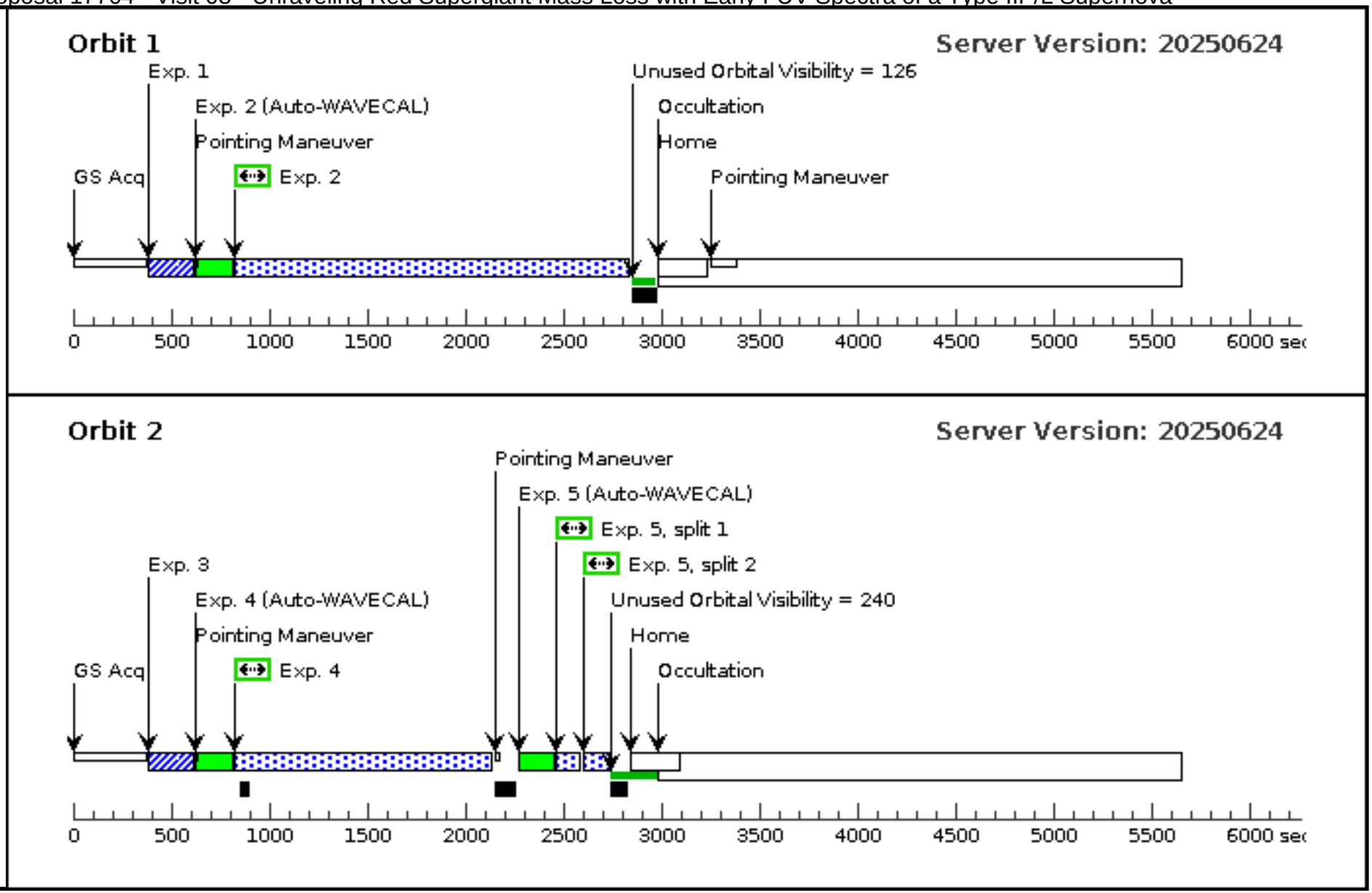
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SN2025TIS	RA: 03 55 22.7790 (58.8449125d) Dec: -28 09 32.68 (-28.15908d) Equinox: J2000		V=17+/-0.1	Reference Frame: ICRS

Comments:
Category=EXT-STAR
Description=[SUPERNOVA, SUPERNOVA TYPE II]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	TA (STIS.ta.1933695)	(1) SN2025TIS	STIS/CCD, ACQ, F28X50LP	MIRROR				2 Secs (2 Secs) *[==>]*	 ***[1]***
2	G140L (STIS.sp.1933703)	(1) SN2025TIS	STIS/FUV-MAMA, ACCUM, 52X0.2	G140L 1425 A				2000 Secs (2000 Secs) *[==>]*	 ***[1]***
3	TA (STIS.ta.1933695)	(1) SN2025TIS	STIS/CCD, ACQ, F28X50LP	MIRROR		NEW OBSET FULL ACQ		2 Secs (2 Secs) *[==>]*	 ***[2]***
4	G230L (STIS.sp.1933806)	(1) SN2025TIS	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				1300 Secs (1300 Secs) *[==>]*	 ***[2]***
5	G430L (STIS.sp.1933807)	(1) SN2025TIS	STIS/CCD, ACCUM, 52X0.2E1	G430L 4300 A				180 Secs (180 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	 ***[2]***

Orbit Structure



Visit

Proposal 17764, Visit 04, implementation Fri Aug 08 22:00:18 GMT 2025

Diagnostic Status: No Diagnostics

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

Special Requirements: AFTER 03 BY 6 D TO 8 D; ON HOLD

Comments: Please put a full GS acq at the beginning of each orbit so if one orbit fails the others have a chance of succeeding. I can adjust the exposure times if needed

fourth epoch should be executed 7 days after third visit
For SN with initial brightness around r=17 mag
If possible execute at same orientation as visit 1

On Hold Comments: Waiting for a suitable supernova to explode.

Fixed Targets

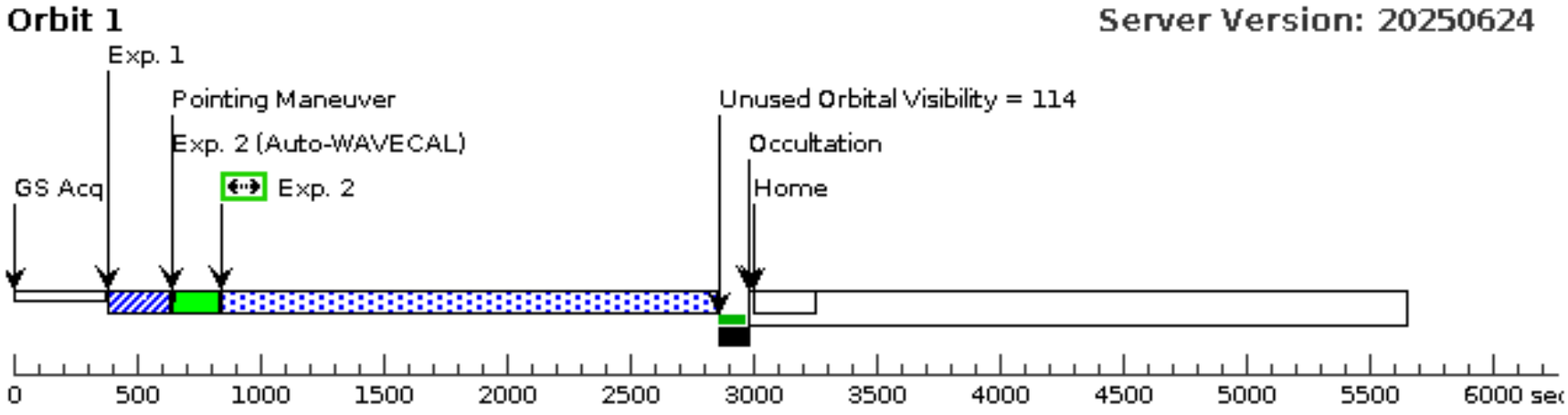
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SN2025TIS	RA: 03 55 22.7790 (58.8449125d) Dec: -28 09 32.68 (-28.15908d) Equinox: J2000		V=17+/-0.1	Reference Frame: ICRS

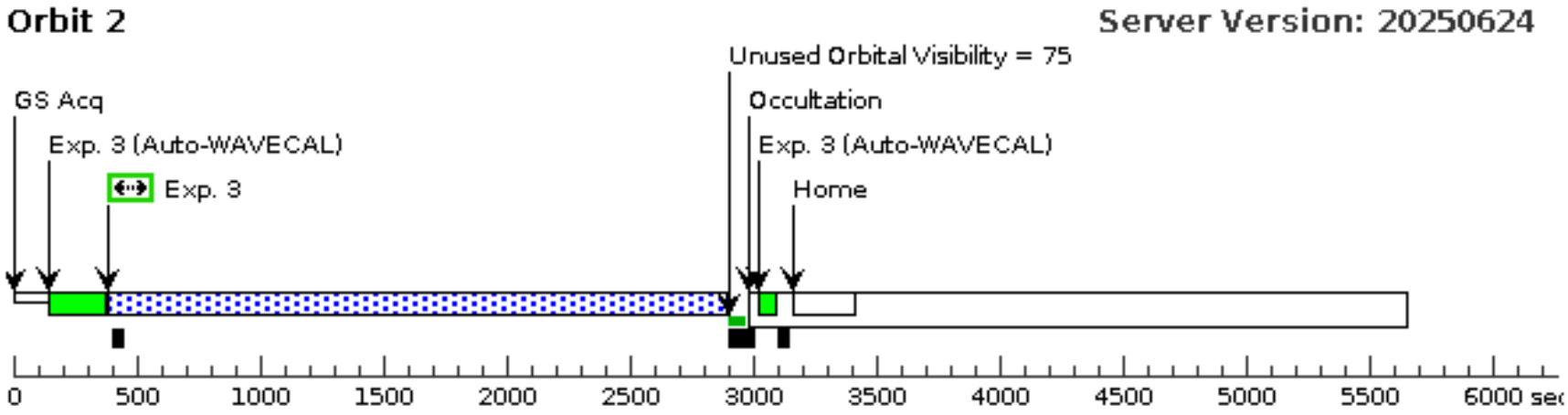
Comments:
Category=EXT-STAR
Description=[SUPERNOVA, SUPERNOVA TYPE II]
Extended=NO

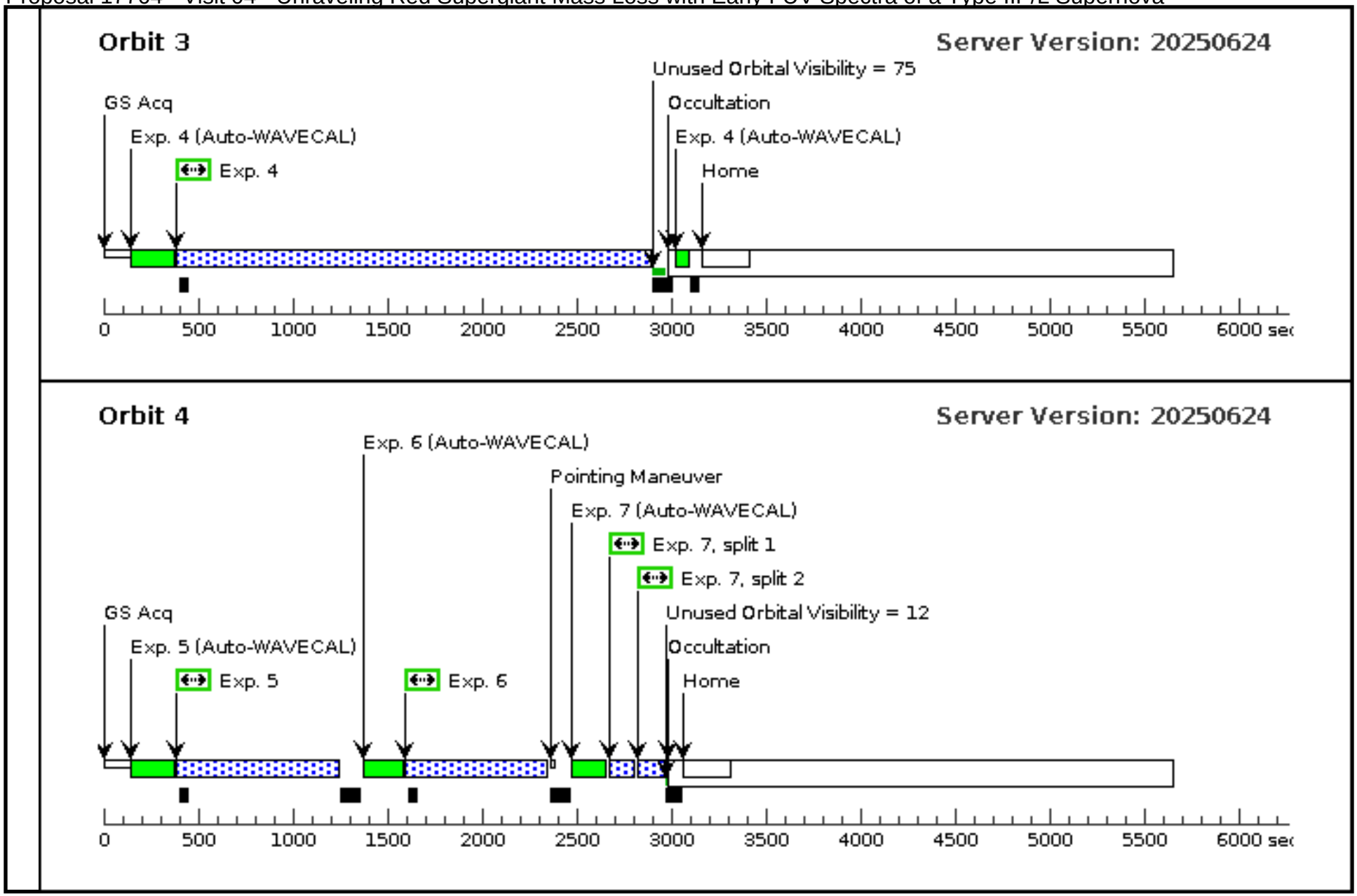
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	TA (STIS.ta.1933483)	(1) SN2025TIS	STIS/CCD, ACQ, F28X50LP	MIRROR				5 Secs (5 Secs) *[==>]*	***[1]***
2	G140L (STIS.sp.1933752)	(1) SN2025TIS	STIS/FUV-MAMA, ACCUM, 52X0.2	G140L 1425 A				2000 Secs (2000 Secs) *[==>]*	***[1]***
3	G140L (STIS.sp.1933752)	(1) SN2025TIS	STIS/FUV-MAMA, ACCUM, 52X0.2	G140L 1425 A		NEW OBSET FULL ACQ		2500 Secs (2500 Secs) *[==>]*	***[2]***
4	G140L (STIS.sp.1933752)	(1) SN2025TIS	STIS/FUV-MAMA, ACCUM, 52X0.2	G140L 1425 A		NEW OBSET FULL ACQ		2500 Secs (2500 Secs) *[==>]*	***[3]***
5	G140L (STIS.sp.1933752)	(1) SN2025TIS	STIS/FUV-MAMA, ACCUM, 52X0.2	G140L 1425 A		NEW OBSET FULL ACQ		850 Secs (850 Secs) *[==>]*	***[4]***
6	G230L (STIS.sp.1933749)	(1) SN2025TIS	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				740 Secs (740 Secs) *[==>]*	***[4]***
7	G430L (STIS.sp.1933744)	(1) SN2025TIS	STIS/CCD, ACCUM, 52X0.2E1	G430L 4300 A				200 Secs (200 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[4]***

Orbit Structure






Orbit 3
Server Version: 20250624
Unused Orbital Visibility = 75
GS Acq
Occultation
Exp. 4 (Auto-WAVECAL)
Exp. 4 (Auto-WAVECAL)
Exp. 4
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec
Orbit 4
Server Version: 20250624
Exp. 6 (Auto-WAVECAL)
Pointing Maneuver
Exp. 7 (Auto-WAVECAL)
Exp. 7, split 1
Exp. 7, split 2
GS Acq
Unused Orbital Visibility = 12
Exp. 5 (Auto-WAVECAL)
Occultation
Exp. 5
Exp. 6
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec