



17614 - Exploring the Ultraviolet Evolution of SN 2024ggi: Unveiling Red Supergiant Mass Loss with HST Spectroscopy

Cycle: 31, Proposal Category: GO/DD

(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>
Dr. Kyra Azalee Bostroem (PI) (Contact)	University of Arizona
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Mr. Nicolas Eduardo Meza Retamal (CoI)	University of California - Davis
Dr. Michael Jon Lundquist (CoI)	California Association for Research in Astronomy (CARA)
Mr. Yize Dong (CoI)	University of California - Davis
Emily Hoang (CoI)	University of California - Davis
Dr. Aravind Pazhayath Ravi (CoI)	University of California - Davis

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) SN2024GGI	STIS/CCD	1	14-Aug-2024 12:00:17.0	yes
02	(1) SN2024GGI	STIS/CCD STIS/NUV-MAMA	2	14-Aug-2024 12:00:18.0	yes

<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) SN2024GGI	STIS/CCD STIS/NUV-MAMA	3	14-Aug-2024 12:00:19.0	yes
04	(1) SN2024GGI	STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	4	14-Aug-2024 12:00:20.0	yes

10 Total Orbits Used

ABSTRACT

Hydrogen-rich supernovae, the end phase of massive star evolution, offer critical insights into stellar evolution and the interplay between stars and their surroundings. SN 2024ggi exploded on Apr 10, 2024 in NGC 3621 (D=6.5-7.5 Mpc). This nearby event presents a rare opportunity to investigate the interaction between the SN ejecta and circumstellar material in unprecedented detail. Leveraging the unique ultraviolet capabilities of the Hubble Space Telescope (HST), we propose to map the mass loss history of the progenitor star over the its last 25 years by observing the supernova at 10, 20, 50 and 100 days post-explosion. With these observations, we can not only trace the evolution of circumstellar interaction, but also study the elemental composition of the circumstellar material and shed light on the mechanisms driving mass loss in massive stars. By comparing our observations with the extensively studied hydrogen-rich SN 2023ixf, we will determine commonalities and differences in their mass loss processes and their impact on supernova evolution. Beyond fundamental questions in stellar astrophysics this proposal also lays the groundwork for interpreting high-redshift hydrogen-rich supernovae. Additionally, this proposal fills a critical gap in our understanding of the evolution of hydrogen-rich supernovae as there are only a handful of core-collapse supernovae with HST ultraviolet observations and the majority of them occur within 3 weeks of explosion. Probing the late phases of ultraviolet evolution, after the flux has normally faded can only be done for a supernova this nearby and only with HST.

OBSERVING DESCRIPTION

This is a disruptive ToO to monitor the evolution CSM interaction with the ejecta of SN 2024ggi. We request observations at 20, 50, and 100d. Day 20 will be with the STIS/CCD detector to allow rapid schedulability without the need for a BOP review and day 50 and 100 will be with the STIS/NUV detector.

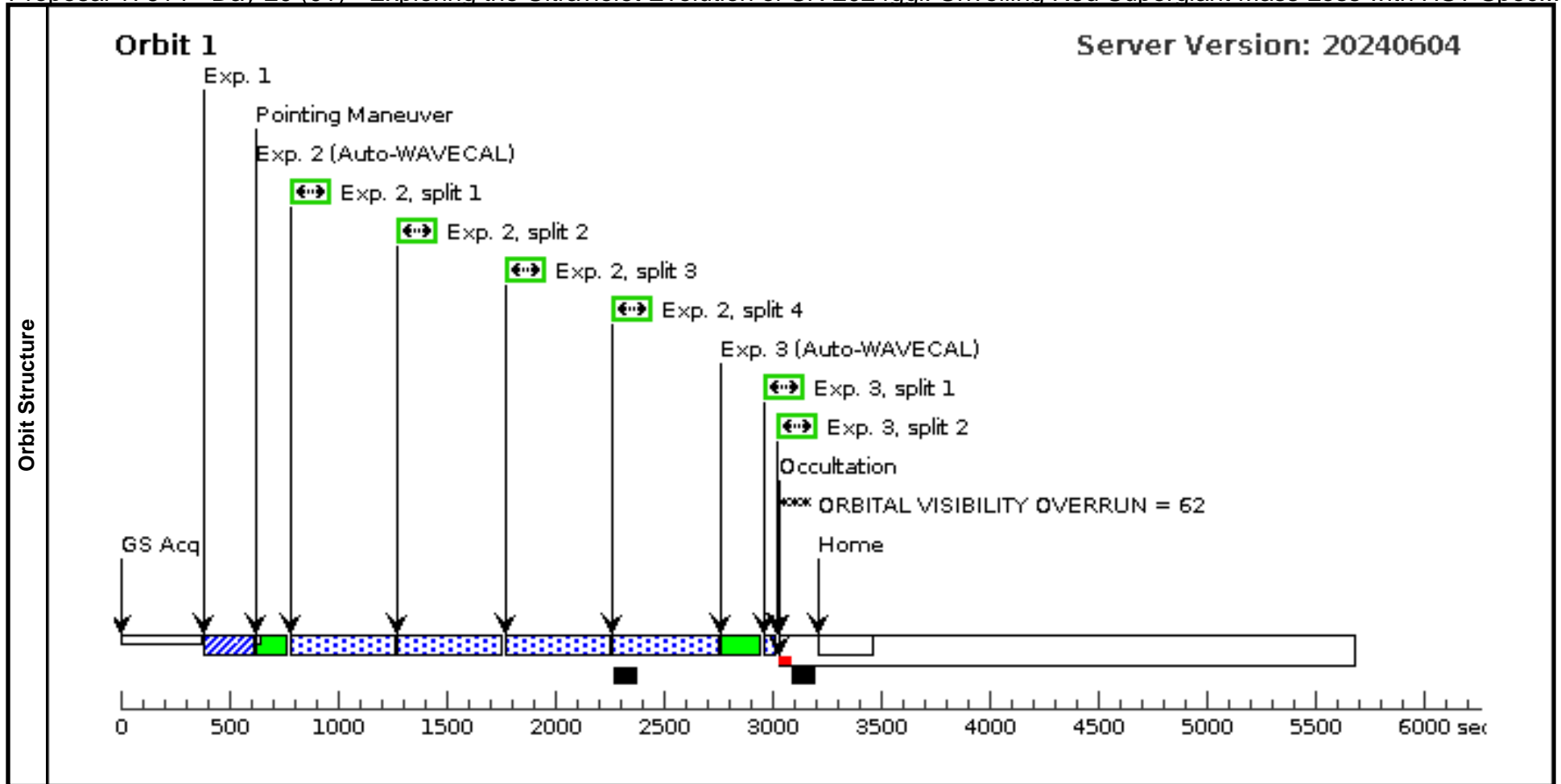
We allow the first visit to execute between 15-25d

The second and third visit have a +/-10 d window around our preferred epoch

Proposal 17614 - Day 20 (01) - Exploring the Ultraviolet Evolution of SN 2024ggi: Unveiling Red Supergiant Mass Loss with HST Spec...

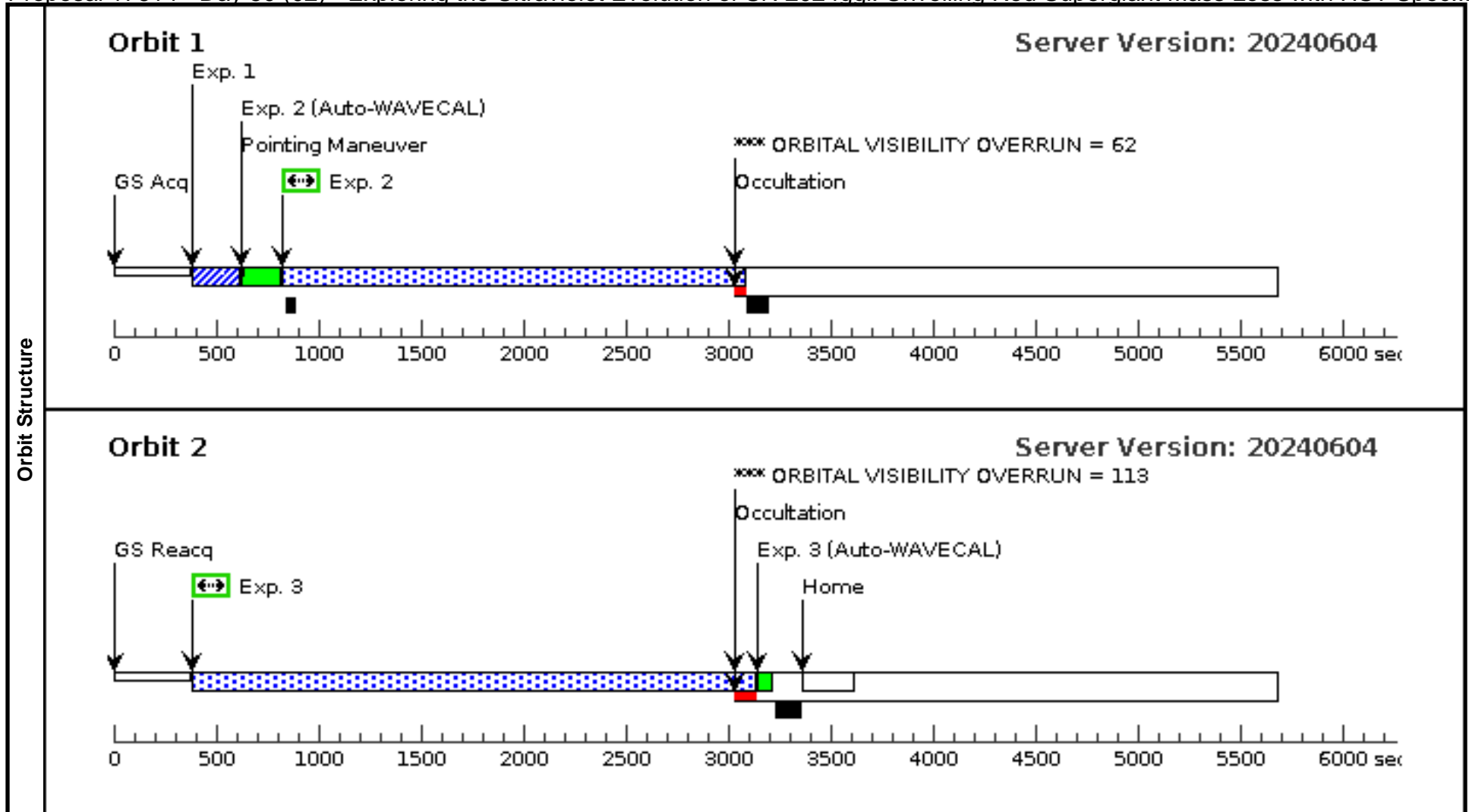
Wed Aug 14 16:00:20 GMT 2024

Visit	Proposal 17614, Day 20 (01), pi Diagnostic Status: Warning Scientific Instruments: STIS/CCD Special Requirements: BETWEEN 12-MAY-2024:00:00:00 AND 31-MAY-2024:00:00:00; TOO RESPONSE TIME 11.0D <i>Comments: WITHDRAW THIS VISIT - REPLACED WITH VISIT 4</i>									
	(Day 20 (01)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	SN2024GGI	RA: 11 18 22.0870 (169.5920292d) Dec: -32 50 15.27 (-32.83758d) Equinox: J2000		V=12.05	Reference Frame: ICRS				
<i>Comments: Category=EXT-STAR Description=[SUPERNOVA, SUPERNOVA TYPE II]</i>										
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.192 4303)	(1) SN2024GGI	STIS/CCD, ACQ, F28X50LP	MIRROR				2 Secs (2 Secs) [==>]	[1]
	<i>Comments: STIS DD 23ixf visit 2 spectrum renormalized to V=12.35 w/ E(B-V)=0.3</i>									
	2	G230LB (STIS.sp.19 23971)	(1) SN2024GGI	STIS/CCD, ACCUM, 52X0.2E1	G230LB 2375 A	CR-SPLIT=4			1800 Secs (1800 Secs) [==>(Split 1)] [==>(Split 2)] [==>(Split 3)] [==>(Split 4)]	[1]
<i>Comments: STIS DD 23ixf visit 2 spectrum renormalized to V=12.35 w/ E(B-V)=0.3</i>										
3	G430L	(1) SN2024GGI	STIS/CCD, ACCUM, 52X0.2E1	G430L 4300 A	CR-SPLIT=2			36 Secs (36 Secs) [==>(Split 1)] [==>(Split 2)]	[1]	
<i>Comments: STIS DD 23ixf visit 2 spectrum renormalized to V=12.35 w/ E(B-V)=0.3</i>										



Proposal 17614 - Day 50 (02) - Exploring the Ultraviolet Evolution of SN 2024ggi: Unveiling Red Supergiant Mass Loss with HST Spec...

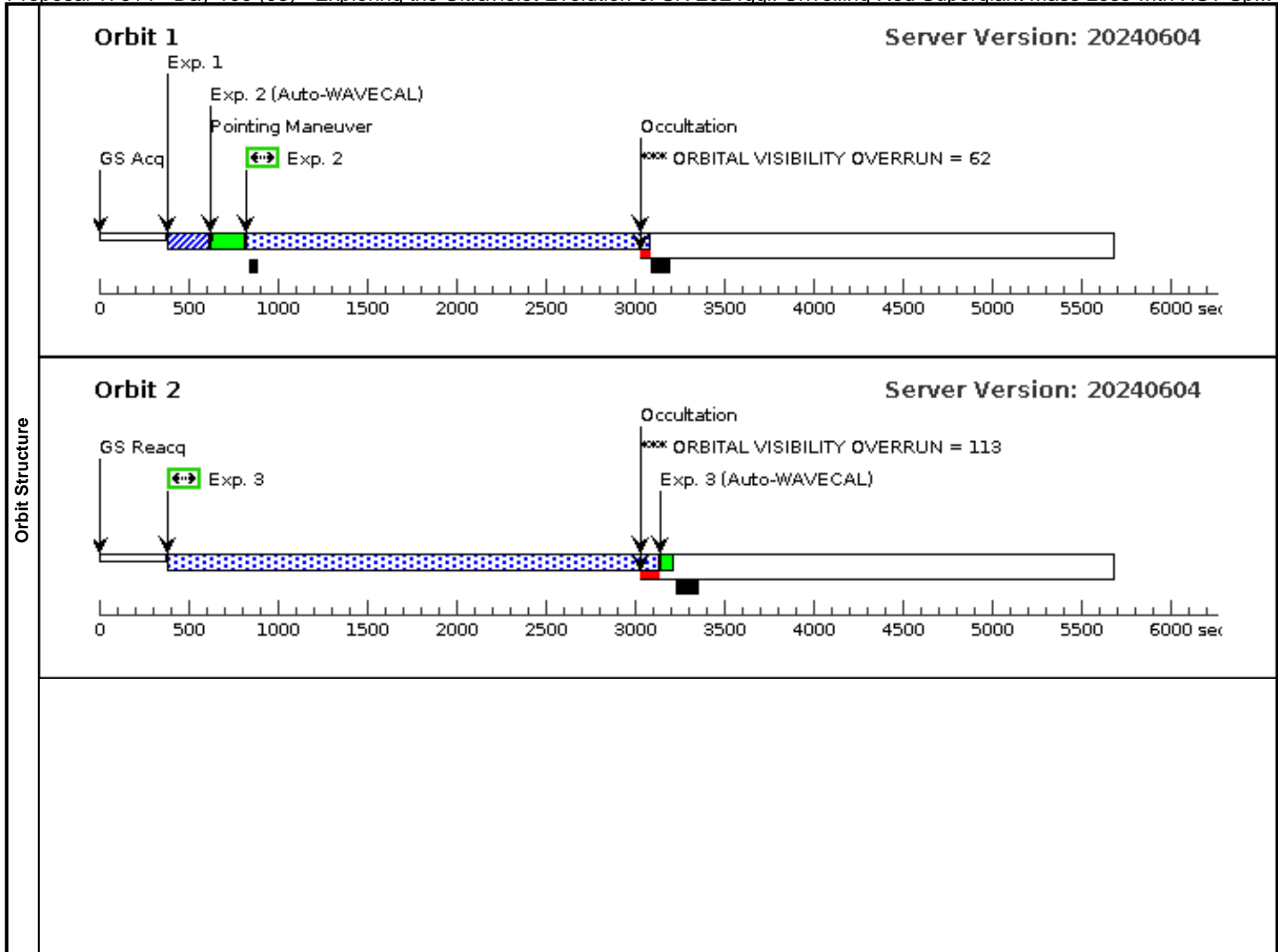
Visit	Proposal 17614, Day 50 (02), completed Wed Aug 14 16:00:20 GMT 2024 Diagnostic Status: Warning Scientific Instruments: STIS/NUV-MAMA, STIS/CCD Special Requirements: BETWEEN 20-MAY-2024:00:00:00 AND 06-JUN-2024:00:00:00																																																																							
	Diagnosics (Day 50 (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN (Day 50 (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN																																																																							
Fixed Targets	<table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th>Targ. Coord. Corrections</th> <th>Fluxes</th> <th>Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(1)</td> <td>SN2024GGI</td> <td>RA: 11 18 22.0870 (169.5920292d) Dec: -32 50 15.27 (-32.83758d) Equinox: J2000</td> <td></td> <td>V=12.05</td> <td>Reference Frame: ICRS</td> </tr> </tbody> </table>					#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous	(1)	SN2024GGI	RA: 11 18 22.0870 (169.5920292d) Dec: -32 50 15.27 (-32.83758d) Equinox: J2000		V=12.05	Reference Frame: ICRS																																																							
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	1	TA (STIS.ta.192 4344)	(1) SN2024GGI	STIS/CCD, ACQ, F28X50LP	MIRROR				1 Secs (1 Secs) [==>]	[1]																																																														
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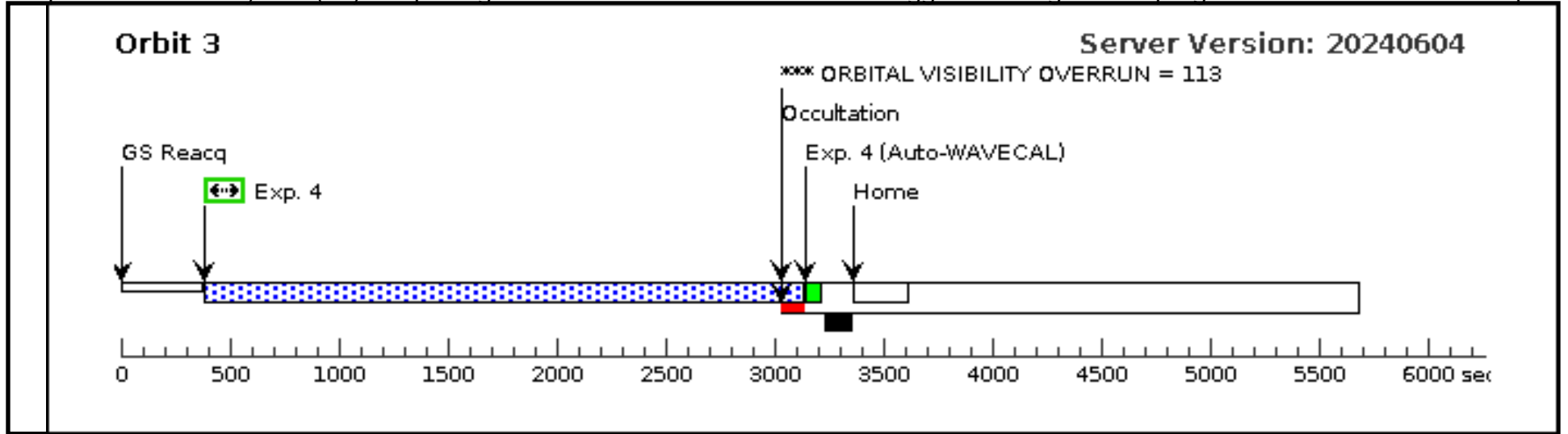


Proposal 17614 - Day 100 (03) - Exploring the Ultraviolet Evolution of SN 2024ggi: Unveiling Red Supergiant Mass Loss with HST Sp...

Wed Aug 14 16:00:20 GMT 2024

Visit	Proposal 17614, Day 100 (03), pi Diagnostic Status: Warning Scientific Instruments: STIS/NUV-MAMA, STIS/CCD Special Requirements: BETWEEN 09-JUL-2024:00:00:00 AND 29-JUL-2024:00:00:00 <i>Comments: WITHDRAW THIS VISIT - REPLACED WITH VISIT 4</i>										
	(Day 100 (03)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN (Day 100 (03)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN (Day 100 (03)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN										
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous					
	(1)	SN2024GGI	RA: 11 18 22.0870 (169.5920292d) Dec: -32 50 15.27 (-32.83758d) Equinox: J2000		V=12.05	Reference Frame: ICRS					
<i>Comments: Category=EXT-STAR Description=[SUPERNOVA, SUPERNOVA TYPE II]</i>											
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.192 4343)	(1) SN2024GGI	STIS/CCD, ACQ, F28X50LP	MIRROR				1 Secs (1 Secs) [==>]	[1]	
	<i>Comments: FLOYDS 23ixf 8/26 (day 100) spectrum renormalized to V=15.6 w/ E(B-V)=0.3</i>										
	2	G230L (STIS.sp.19 23990)	(1) SN2024GGI	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				2200 Secs (2243 Secs) [==>2243.0 Secs]	[1]	
	<i>Comments: STIS DD 23ixf visit 2 spectrum renormalized to V=15.6 w/ E(B-V)=0.3</i>										
3	G230L (STIS.sp.19 23990)	(1) SN2024GGI	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				2455 Secs (2739 Secs) [==>2739.0 Secs]	[2]		
<i>Comments: STIS DD 23ixf visit 2 spectrum renormalized to V=15.6 w/ E(B-V)=0.3</i>											
4	G230L (STIS.sp.19 23990)	(1) SN2024GGI	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				2455 Secs (2739 Secs) [==>2739.0 Secs]	[3]		
<i>Comments: STIS DD 23ixf visit 2 spectrum renormalized to V=15.6 w/ E(B-V)=0.3</i>											





Proposal 17614 - Day 200 (04) - Exploring the Ultraviolet Evolution of SN 2024ggi: Unveiling Red Supergiant Mass Loss with HST Sp...

Wed Aug 14 16:00:21 GMT 2024

Visit	Proposal 17614, Day 200 (04) Diagnostic Status: No Diagnostics Scientific Instruments: STIS/NUV-MAMA, STIS/CCD, STIS/FUV-MAMA Special Requirements: BETWEEN 21-NOV-2024:00:00:00 AND 06-DEC-2024:00:00:00 Comments: Estimated brightness $V=17.5$ is from SN 2018zd V band light curve (with 24ggi distance and extinction) at 225d based on match to the light curve. SN 2018zd had a large fall from plateau so we consider this a conservative estimate Inclusion of FUV approved by TTRB - but this will need a new BOP check									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
(1)		SN2024GGI	RA: 11 18 22.0870 (169.5920292d) Dec: -32 50 15.27 (-32.83758d) Equinox: J2000		V=12.05	Reference Frame: ICRS				
Comments: Category=EXT-STAR Description=[SUPERNOVA, SUPERNOVA TYPE II]										
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.193 2609)	(1) SN2024GGI	STIS/CCD, ACQ, F28X50LP	MIRROR				3 Secs (3 Secs) [==>]	[1]
	2	NUV orbit 1 (STIS.sp.19 32614)	(1) SN2024GGI	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				2170 Secs (2170 Secs) [==>]	[1]
	3	NUV orbit 2 (STIS.sp.19 32614)	(1) SN2024GGI	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				2625 Secs (2625 Secs) [==>]	[2]
	4	FUV orbit 1 (STIS.sp.19 32615)	(1) SN2024GGI	STIS/FUV-MAMA, ACCUM, 52X0.2	G140L 1425 A				2625 Secs (2625 Secs) [==>]	[3]
	5	FUV orbit 2 (STIS.sp.19 32615)	(1) SN2024GGI	STIS/FUV-MAMA, ACCUM, 52X0.2	G140L 1425 A				2625 Secs (2625 Secs) [==>]	[4]

