



17610 - Late time UV spectroscopy of SN 2023ixf in M101: Unique constraints on the progenitor mass loss history

Cycle: 31, Proposal Category: GO/DD

(Availability Mode: SUPPORTED)

INVESTIGATORS

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Dr. Jennifer Andrews (CoI)	Gemini Observatory
Jeniveve Pearson (CoI)	University of Arizona

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) SN2023IXF	STIS/CCD STIS/FUV-MAMA	2	21-Feb-2024 10:02:41.0	yes
02	(1) SN2023IXF	STIS/CCD STIS/FUV-MAMA	2	21-Feb-2024 10:02:42.0	yes
03	(1) SN2023IXF	STIS/CCD STIS/FUV-MAMA	2	21-Feb-2024 10:02:42.0	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>
04	(1) SN2023IXF	STIS/CCD STIS/NUV-MAMA	2	21-Feb-2024 10:02:43.0	yes
05	(1) SN2023IXF	STIS/CCD STIS/NUV-MAMA	2	21-Feb-2024 10:02:44.0	yes

10 Total Orbits Used

ABSTRACT

We request 10 orbits of HST STIS UV spectroscopy to observe the nearby type IIP supernova 2023ixf in order to trace the late-time interaction between the ejecta and surrounding circumstellar material (CSM). Observations of nearby core collapse (CC) supernovae can teach us about the final years of massive stars in the run-up to their explosion, a portion of stellar evolution that is difficult to model. Some recent observations of type II supernovae have shown evidence for strong CSM interaction, implying that the red supergiant (RSG) progenitor star experienced 10^{-3} - 10^{-1} solar masses/year of mass loss in their final months, far higher than the 10^{-6} solar masses/year seen in RSGs. To try to reconcile these measurements, observations in the nebular-phase are necessary (≥ 300 days) to probe material that was blown off the progenitor star decades before explosion. For this task, ultraviolet (UV) observations are more sensitive than the optical, where models predict strong Lyman alpha and MgII emission to trace CSM interaction strength.

The recent discovery of SN2023ixf in M101 (~ 6.4 Mpc) gives us a unique chance to trace mass loss to late phases when the CSM interaction dominates in the ultraviolet. HST observations have shown that SN2023ixf, in the UV, experienced clear CSM interaction through 200 days after explosion. This non-disruptive ToO will observe SN2023ixf 300-400 days after explosion and complete our understanding of the mass loss and CSM interaction for a typical type IIP supernova. Given how close SN2023ixf is and the lifetime of HST, this is probably the finally opportunity to fill a crucial gap in our knowledge of the evolution of CC supernovae in the UV.

OBSERVING DESCRIPTION

This proposal will be triggered on SN 2023ixf a nearby SN discovered on 19 May 2023.

We will observe the SN with STIS FUV-MAMA G140L observation with the 52x0.2" slit and STIS NUV-MAMA G230L observation with the 52x0.2" slit.

The observations should be scheduled between March and April 2024 in the first window of observation to monitor the supernova at the appropriate

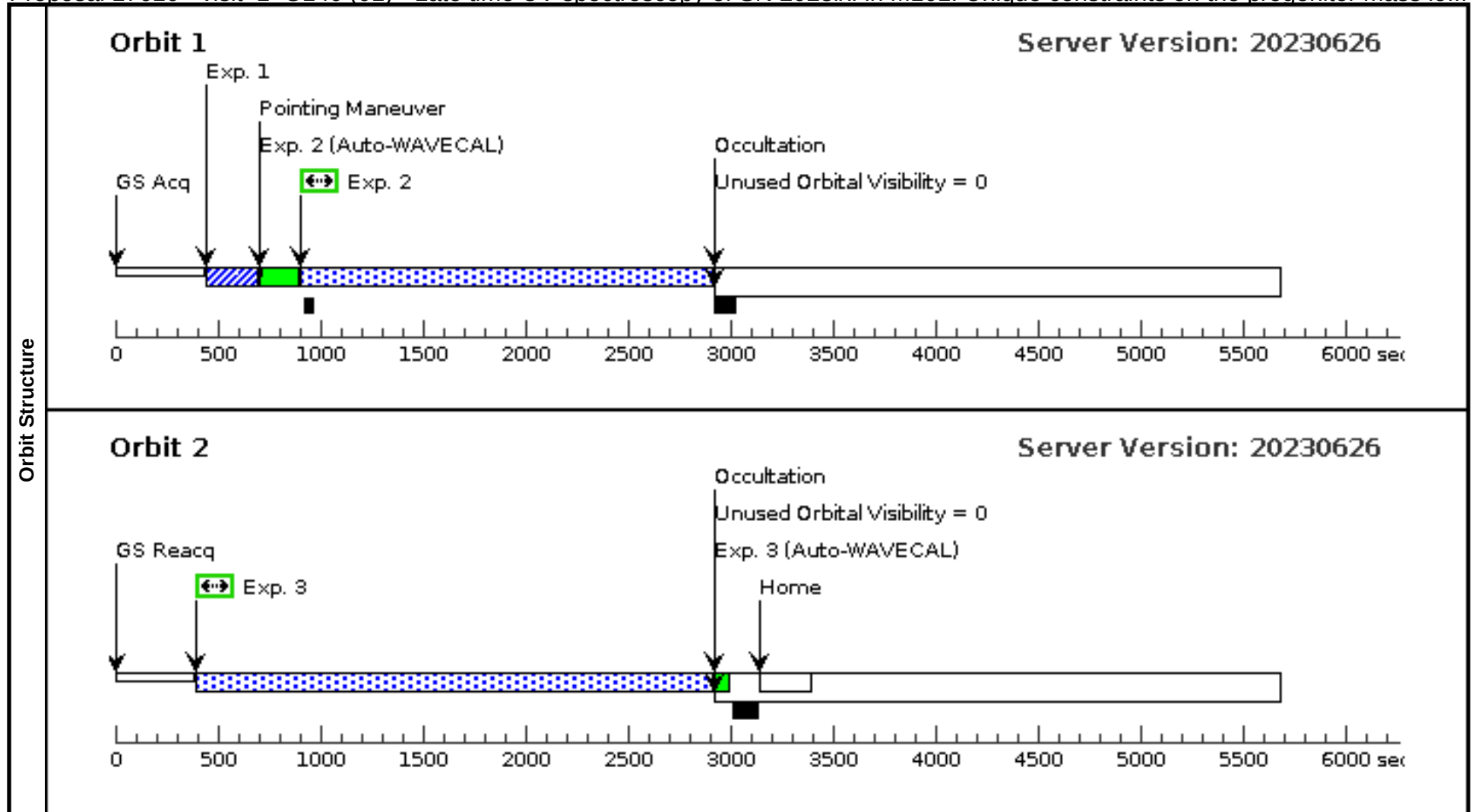
Proposal 17610 (STScI Edit Number: 1, Created: Wednesday, February 21, 2024 at 10:02:44 AM Eastern Standard Time) - Overview
phase and to ensure available guide stars for this field.

Please execute all the visits as close as possible in time of so that we are able to combine this data for a time-varying object
Ideally last visit should be within 3 weeks from first visit.

visit 1	STIS FUV-MAMA G140L	2 orbits
visit 2	STIS FUV-MAMA G140L	2 orbits
visit 3	STIS FUV-MAMA G140L	2 orbits
visit 4	STIS FUV-MAMA G230L	2 orbits
visit 5	STIS FUV-MAMA G230L	2 orbits

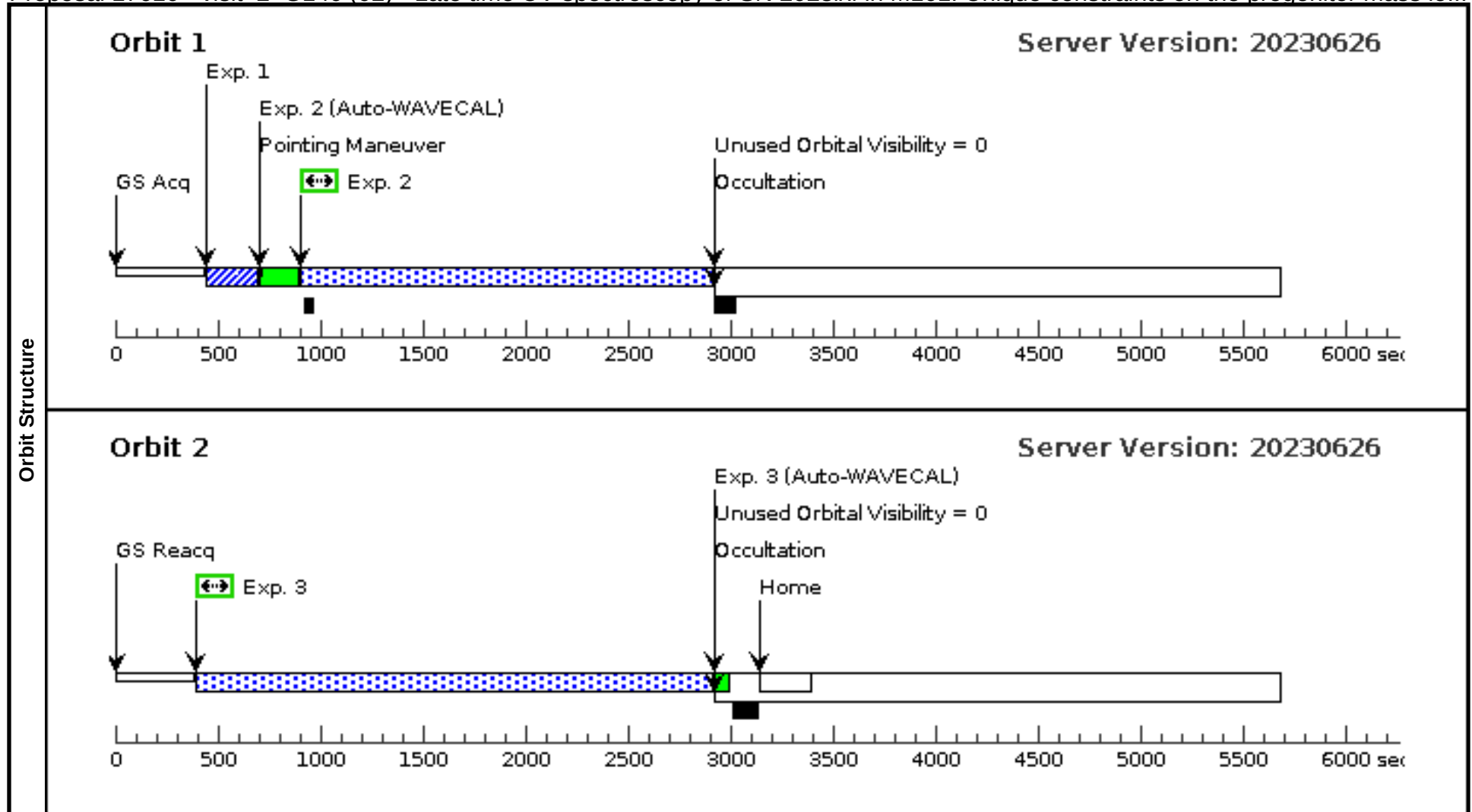
Proposal 17610 - visit 1 G140 (01) - Late time UV spectroscopy of SN 2023ixf in M101: Unique constraints on the progenitor mass lo...

Visit	Proposal 17610, visit_1_G140 (01), implementation								Wed Feb 21 15:02:44 GMT 2024	
	Diagnostic Status: No Diagnostics									
	Scientific Instruments: STIS/CCD, STIS/FUV-MAMA									
	Special Requirements: SCHED 100%; BETWEEN 21-FEB-2024:00:00:00 AND 30-APR-2024:00:00:00									
	Comments: This is visit 1 of 5 that should be executed as close as possible in time to previous visit.									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(1)	SN2023IXF	RA: 14 03 38.5640 (210.9106833d)			V=19		Reference Frame: ICRS		
			Dec: +54 18 42.00 (54.31167d)							
			Equinox: J2000							
	Comments: Category=EXT-STAR Description=[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 (1901245)	(1) SN2023IXF	STIS/CCD, ACQ, F28X50LP	MIRROR				5 Secs (5 Secs)	
									[==>]	[1]
	2	G140L (1901245)	(1) SN2023IXF	STIS/FUV-MAMA, ACCUM, 52X0.2	G140L 1425 A				3000 Secs (1994 Secs)	
									[==>1994.0 Secs]	[1]
	3	G140L (1901245)	(1) SN2023IXF	STIS/FUV-MAMA, ACCUM, 52X0.2	G140L 1425 A				3000 Secs (2506 Secs)	
									[==>2506.0 Secs]	[2]



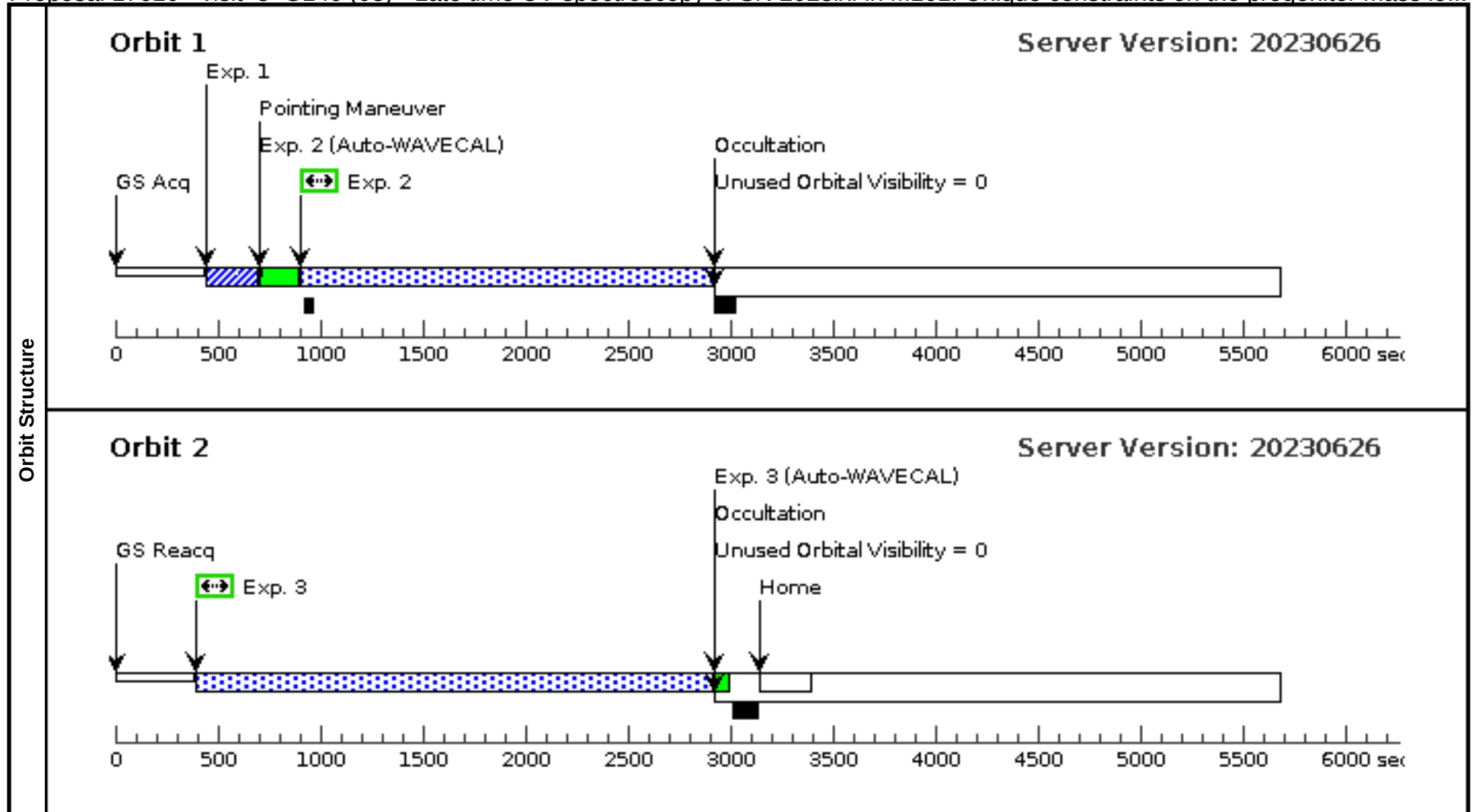
Proposal 17610 - visit 2 G140 (02) - Late time UV spectroscopy of SN 2023ixf in M101: Unique constraints on the progenitor mass lo...

Visit	Proposal 17610, visit_2_G140 (02), implementation								Wed Feb 21 15:02:44 GMT 2024	
	Diagnostic Status: No Diagnostics									
	Scientific Instruments: STIS/CCD, STIS/FUV-MAMA									
	Special Requirements: SCHED 100%; AFTER 01 BY 0 D TO 14 D; BETWEEN 21-FEB-2024:00:00:00 AND 30-APR-2024:00:00:00									
	Comments: This is visit 2 of 5 that should be executed as close as possible in time to previous visit.									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(1)	SN2023IXF	RA: 14 03 38.5640 (210.9106833d)			V=19		Reference Frame: ICRS		
			Dec: +54 18 42.00 (54.31167d)							
			Equinox: J2000							
		Comments: Category=EXT-STAR Description=[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 (1901245)	(1) SN2023IXF	STIS/CCD, ACQ, F28X50LP	MIRROR				5 Secs (5 Secs)	
									[==>]	[1]
	2	G140L (1901245)	(1) SN2023IXF	STIS/FUV-MAMA, ACCUM, 52X0.2	G140L 1425 A				3000 Secs (1994 Secs)	
									[==>1994.0 Secs]	[1]
	3	G140L (1901245)	(1) SN2023IXF	STIS/FUV-MAMA, ACCUM, 52X0.2	G140L 1425 A				3000 Secs (2506 Secs)	
									[==>2506.0 Secs]	[2]



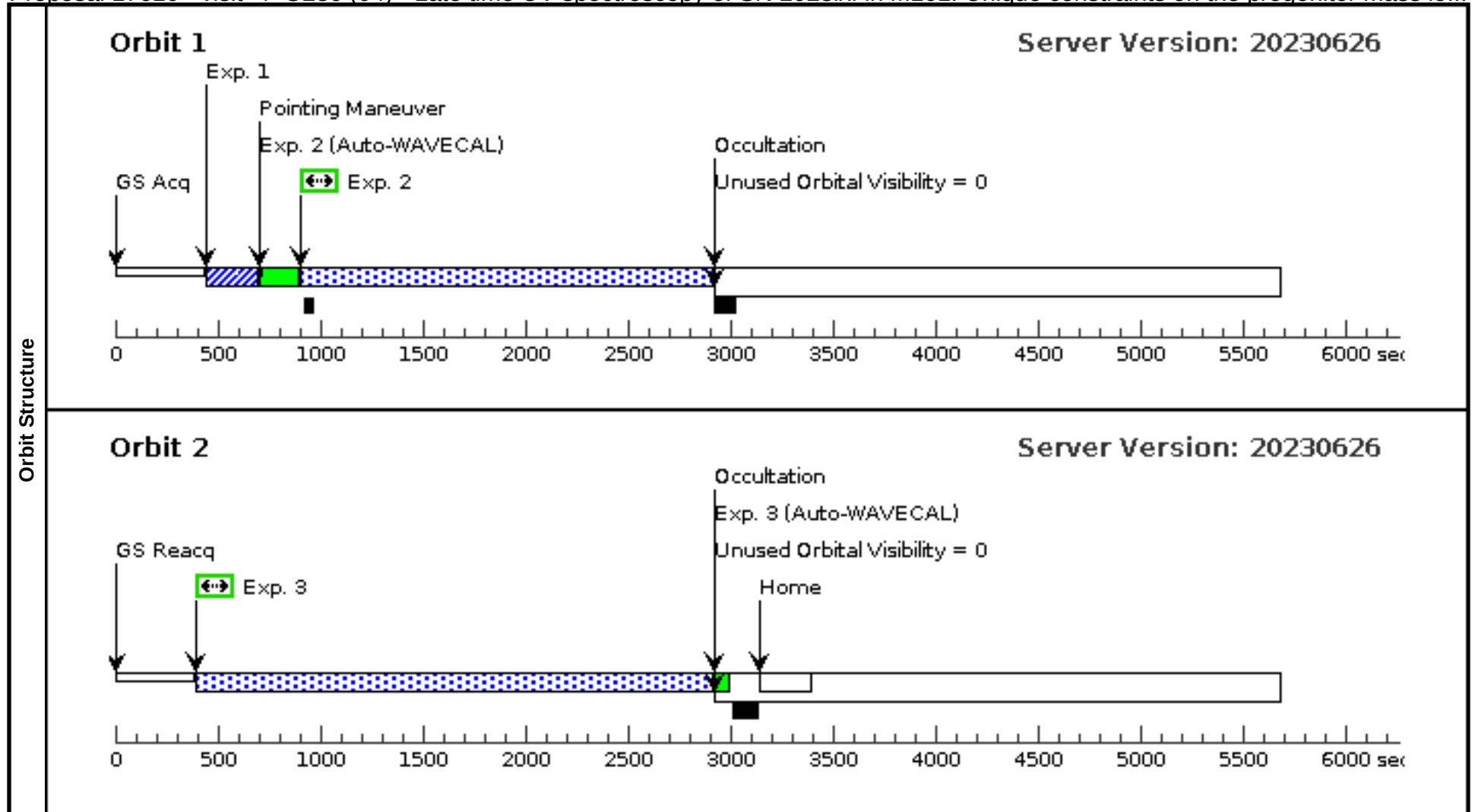
Proposal 17610 - visit 3 G140 (03) - Late time UV spectroscopy of SN 2023ixf in M101: Unique constraints on the progenitor mass lo...

Visit	Proposal 17610, visit_3_G140 (03), implementation								Wed Feb 21 15:02:44 GMT 2024	
	Diagnostic Status: No Diagnostics									
	Scientific Instruments: STIS/CCD, STIS/FUV-MAMA									
	Special Requirements: SCHED 100%; AFTER 01 BY 0 D TO 14 D; BETWEEN 21-FEB-2024:00:00:00 AND 30-APR-2024:00:00:00									
	Comments: This is visit 3 of 5 that should be executed as close as possible in time to previous visit.									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(1)	SN2023IXF	RA: 14 03 38.5640 (210.9106833d) Dec: +54 18 42.00 (54.31167d) Equinox: J2000			V=19		Reference Frame: ICRS		
	Comments: Category=EXT-STAR Description=[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 (1901245)	(1) SN2023IXF	STIS/CCD, ACQ, F28X50LP	MIRROR				5 Secs (5 Secs)	
									[==>]	[1]
	2	G140L (1901245)	(1) SN2023IXF	STIS/FUV-MAMA, ACCUM, 52X0.2	G140L 1425 A				3000 Secs (1994 Secs)	
									[==>1994.0 Secs]	[1]
	3	G140L (1901245)	(1) SN2023IXF	STIS/FUV-MAMA, ACCUM, 52X0.2	G140L 1425 A				3000 Secs (2506 Secs)	
									[==>2506.0 Secs]	[2]



Proposal 17610 - visit 4 G230 (04) - Late time UV spectroscopy of SN 2023ixf in M101: Unique constraints on the progenitor mass lo...

Visit	Proposal 17610, visit_4_G230 (04), implementation								Wed Feb 21 15:02:44 GMT 2024	
	Diagnostic Status: No Diagnostics									
	Scientific Instruments: STIS/NUV-MAMA, STIS/CCD									
	Special Requirements: SCHED 100%; BETWEEN 21-FEB-2024:00:00:00 AND 30-APR-2024:00:00:00									
	Comments: This is visit 4 of 5 that should be executed as close as possible in time to previous visit.									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(1)	SN2023IXF	RA: 14 03 38.5640 (210.9106833d) Dec: +54 18 42.00 (54.31167d) Equinox: J2000			V=19		Reference Frame: ICRS		
	Comments: Category=EXT-STAR Description=[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 (1901242)	(1) SN2023IXF	STIS/CCD, ACQ, F28X50LP	MIRROR				5 Secs (5 Secs)	
									[==>]	[1]
	2	G230L (1901242)	(1) SN2023IXF	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				3000 Secs (1994 Secs)	
									[==>1994.0 Secs]	[1]
	3	G230L (1901242)	(1) SN2023IXF	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				3000 Secs (2506 Secs)	
									[==>2506.0 Secs]	[2]



Proposal 17610 - visit 5 G230 (05) - Late time UV spectroscopy of SN 2023ixf in M101: Unique constraints on the progenitor mass lo...

Visit	Proposal 17610, visit_5_G230 (05), implementation								Wed Feb 21 15:02:44 GMT 2024	
	Diagnostic Status: No Diagnostics									
	Scientific Instruments: STIS/NUV-MAMA, STIS/CCD									
	Special Requirements: SCHED 100%; AFTER 04 BY 0 D TO 14 D; BETWEEN 21-FEB-2024:00:00:00 AND 30-APR-2024:00:00:00									
	Comments: This is visit 5 of 5 that should be executed as close as possible in time to previous visit.									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(1)	SN2023IXF	RA: 14 03 38.5640 (210.9106833d)			V=19		Reference Frame: ICRS		
			Dec: +54 18 42.00 (54.31167d)							
			Equinox: J2000							
		Comments: Category=EXT-STAR Description=[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 (1901242)	(1) SN2023IXF	STIS/CCD, ACQ, F28X50LP	MIRROR				5 Secs (5 Secs)	
									[==>]	[1]
	2	G230L (1901242)	(1) SN2023IXF	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L				3000 Secs (1994 Secs)	
					2376 A				[==>1994.0 Secs]	[1]
	3	G230L (1901242)	(1) SN2023IXF	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L				3000 Secs (2506 Secs)	
					2376 A				[==>2506.0 Secs]	[2]

