14202 - The Unprecedented Supernova Metamorphosis of SN 2014C

Cycle: 23, Proposal Category: GO

(UV Initiative)

(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) SN2014C	WFC3/UVIS	3	10-Sep-2015 21:13:24.0	yes
02	(1) SN2014C	STIS/CCD	2	10-Sep-2015 21:13:29.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
03	(2) SN2014C-COPY	COS/FUV COS/NUV	3	10-Sep-2015 21:13:32.0	yes

8 Total Orbits Used

ABSTRACT

Recent observations of major eruptions preluding supernova explosions within one year of core collapse have challenged long held notions of stellar evolution. These events are not easily explained by our current understanding of the physical mechanisms that drive mass loss in evolved massive stars, and the disconnect between theory and observation presents a real problem for many fields of research that depend on the predictions of stellar evolution models. Our group has been leading an extensive X-ray-through-radio monitoring campaign of a unique supernova metamorphosis -- SN 2014C -- that extends the poorly understood timescale between intensified mass loss and core collapse. A crucial component of our multi-wavelength investigation is UV spectroscopy and high-resolution UV/optical imaging, which only HST can deliver. The combined data set will enable a global understanding of the SN explosion and its delayed interaction with surrounding circumstellar material, as well as a detailed examination of the mass loss and evolutionary transitions a massive star may undergo in its final stages approaching core collapse.

OBSERVING DESCRIPTION

HST observations are to be obtained of supernova SN 2014C. This is a fading source (~0.1 mag per month) that shows strong emission lines. Imaging will map immediate stellar and gaseous environment of supernova progenitor system and pinpoint precise location. Spectroscopy will probe the UV emission anticipated to arise from the supernova's interaction with surrounding circumstellar material.

Three visits are planned:
Visit 1: Imaging with WFC3/UVIS with filters F275W, F438W, F814W, and F657N
Visit 2: Spectroscopy with STIS/CCD with G230LB and G430L
Visit 3: Spectroscopy with COS/FUV G130M (1300) and G160M (1589)
**Visit 1 and 2 should be scheduled together and will be used to estimate the FUV flux in order to plan Visit 3 which should be scheduled ~ 1 month later.

Visit

Proposal 14202, Visit 01, completed Fri Sep 11 01:13:34 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SEQ 01,02 WITHIN 3 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1-2)
(2)	Pattern Type=WFC3-UVIS-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=false		(3-4)

Fixed Targets

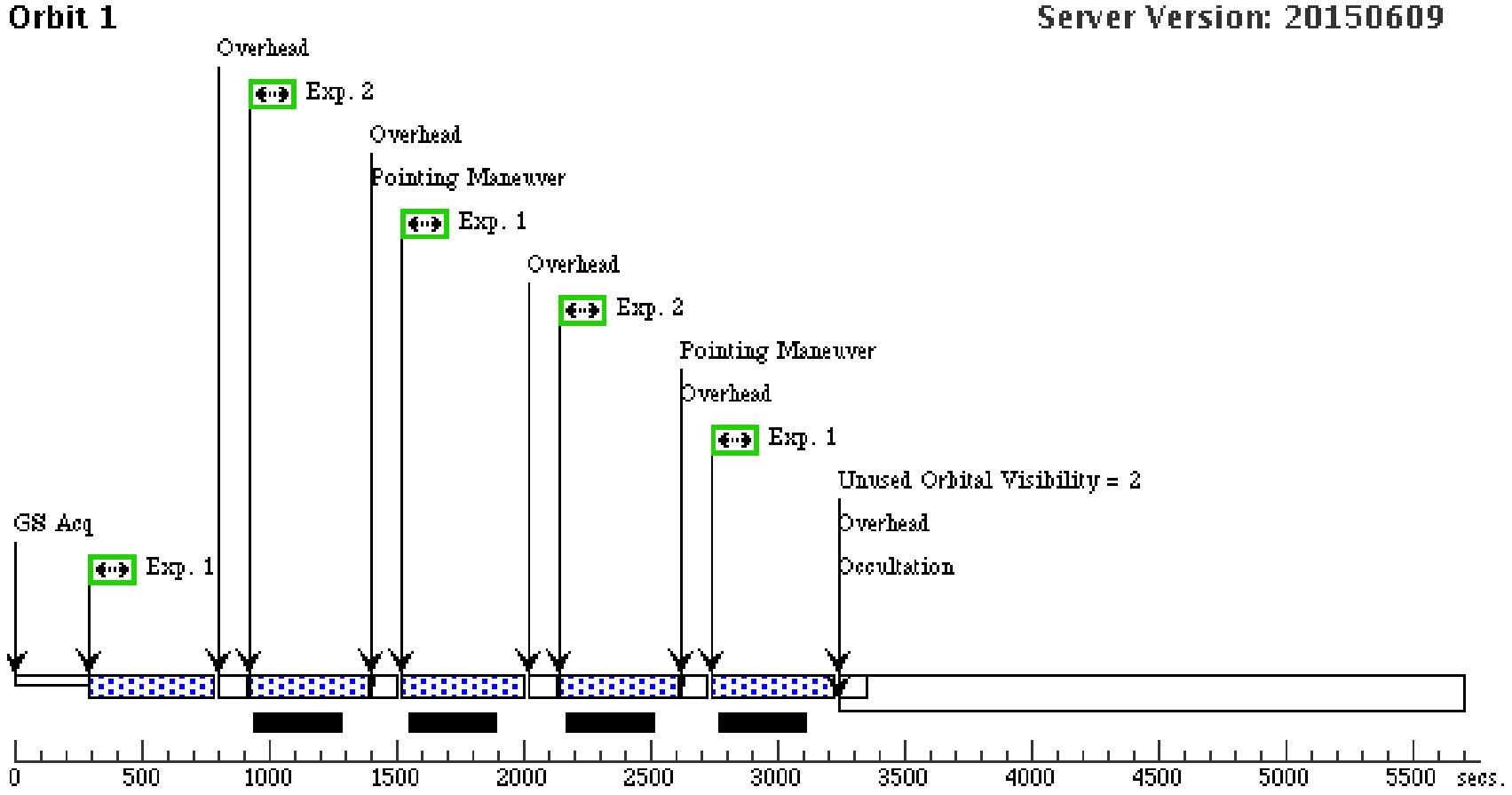
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SN2014C	RA: 22 37 5.6000 (339.2733333d) Dec: +34 24 31.90 (34.40886d) Equinox: J2000		V=19+/-1	Reference Frame: ICRS

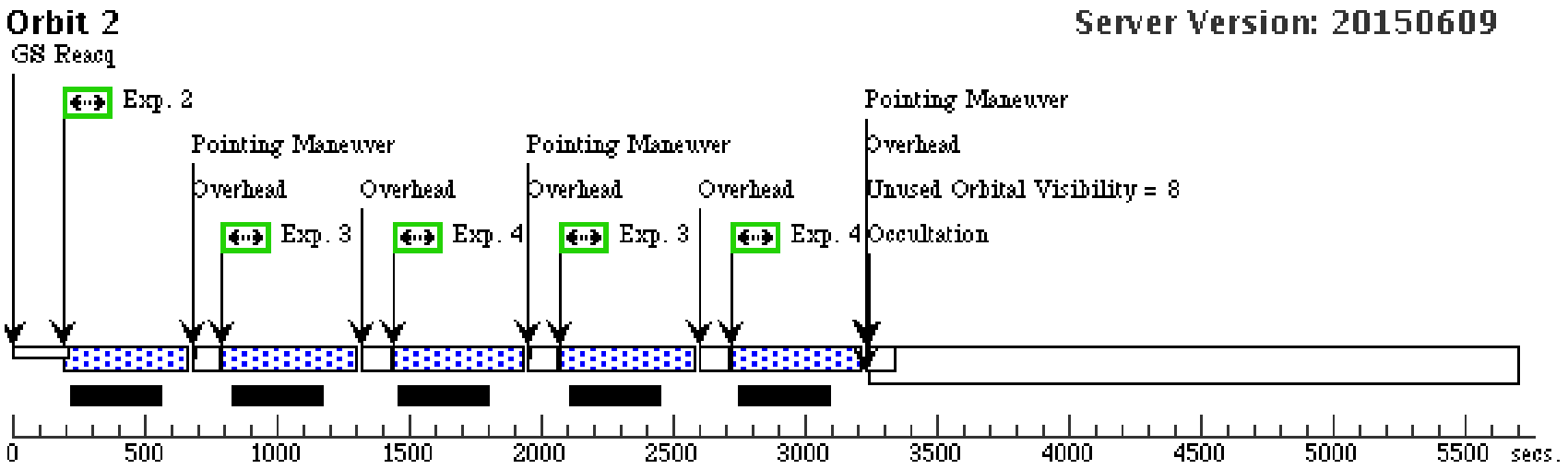
Comments: Extended=NO

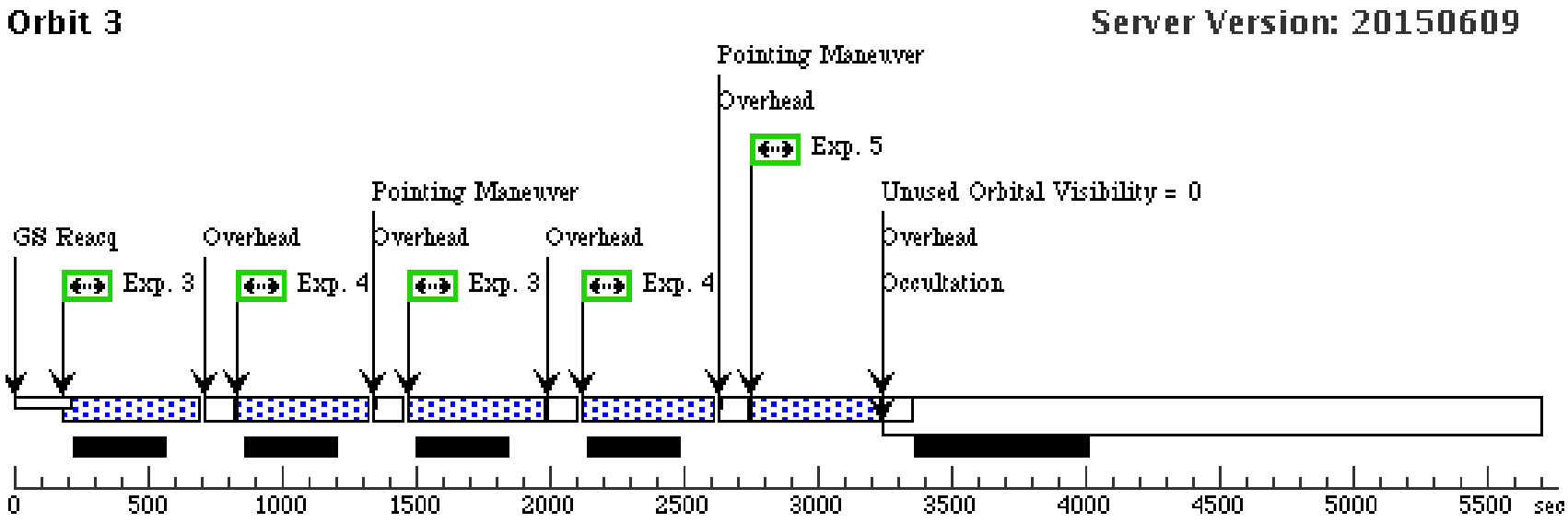
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) SN2014C	WFC3/UVIS, ACCUM, UVIS2	F438W	FLASH=8		Pattern 1, Exps 1-2 in Visit 01 (1)	460 Secs (1380 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[1]***
2		(1) SN2014C	WFC3/UVIS, ACCUM, UVIS2	F814W	FLASH=1		Pattern 1, Exps 1-2 in Visit 01 (1)	450 Secs (1350 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]*	***[1]***
								[==>(Pattern 3)]	***[2]***
3		(1) SN2014C	WFC3/UVIS, ACCUM, UVIS2	F275W	FLASH=12		Pattern 2, Exps 3-4 in Visit 01 (2)	486 Secs (1944 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]*	***[2]***
								[==>(Pattern 3)] *[==>(Pattern 4)]*	***[3]***
4		(1) SN2014C	WFC3/UVIS, ACCUM, UVIS2	F657N	FLASH=12		Pattern 2, Exps 3-4 in Visit 01 (2)	480 Secs (1920 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]*	***[2]***
								[==>(Pattern 3)] *[==>(Pattern 4)]*	***[3]***
5		(1) SN2014C	WFC3/UVIS, ACCUM, UVIS2	F657N	FLASH=12			480 Secs (480 Secs)	
								[==>]	***[3]***

Orbit Structure




Orbit 2
Server Version: 20150609
GS Reacq
Exp. 2
Pointing Maneuver
Overhead
Exp. 3
Overhead
Exp. 4
Pointing Maneuver
Overhead
Exp. 3
Overhead
Exp. 4
Pointing Maneuver
Overhead
Unused Orbital Visibility = 8
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.


Orbit 3
Server Version: 20150609
Pointing Maneuver
Overhead
Exp. 5
Unused Orbital Visibility = 0
Overhead
Occultation
Pointing Maneuver
Overhead
Overhead
Overhead
GS Reacq
Exp. 3
Exp. 4
Exp. 3
Exp. 4
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 14202, Visit 02, completed Fri Sep 11 01:13:34 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(3)	Pattern Type=STIS-ALONG-SLIT Purpose=DITHER Number Of Points=3 Point Spacing=0.3 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=90.0 Angle Between Sides= Center Pattern=false		(2), (4)
(4)	Pattern Type=STIS-ALONG-SLIT Purpose=DITHER Number Of Points=2 Point Spacing=0.7 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=90.0 Angle Between Sides= Center Pattern=false		(5)

Fixed Targets

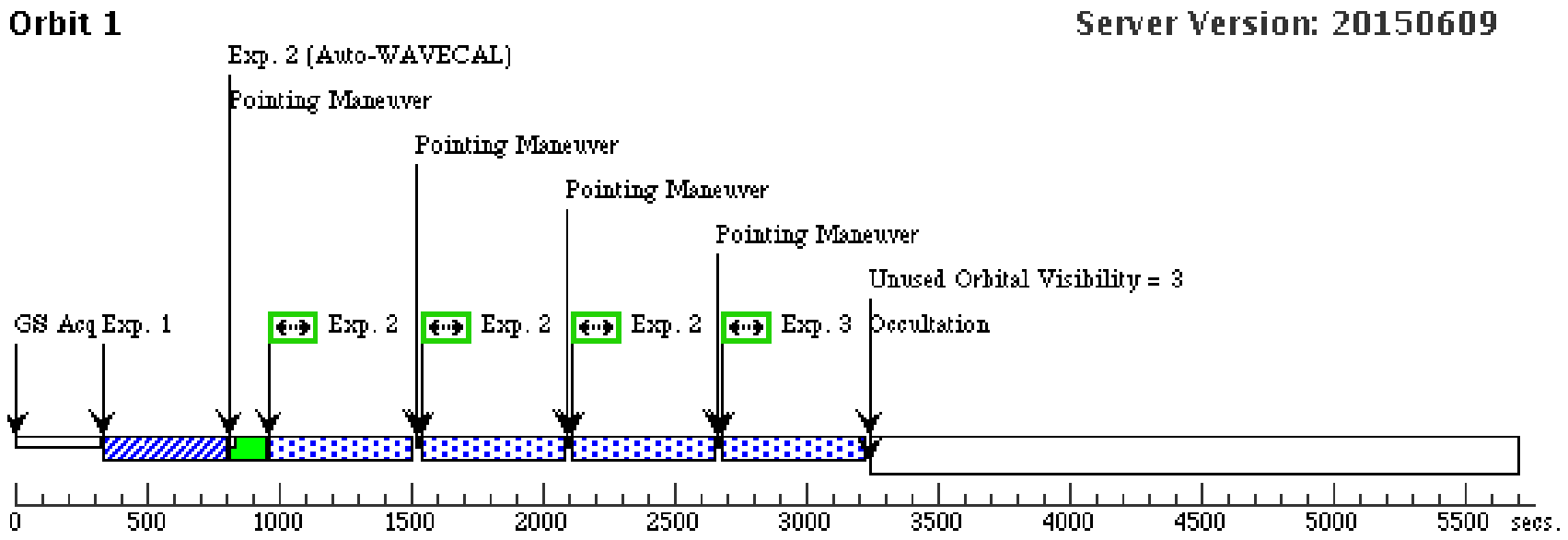
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SN2014C	RA: 22 37 5.6000 (339.2733333d) Dec: +34 24 31.90 (34.40886d) Equinox: J2000		V=19+/-1	Reference Frame: ICRS

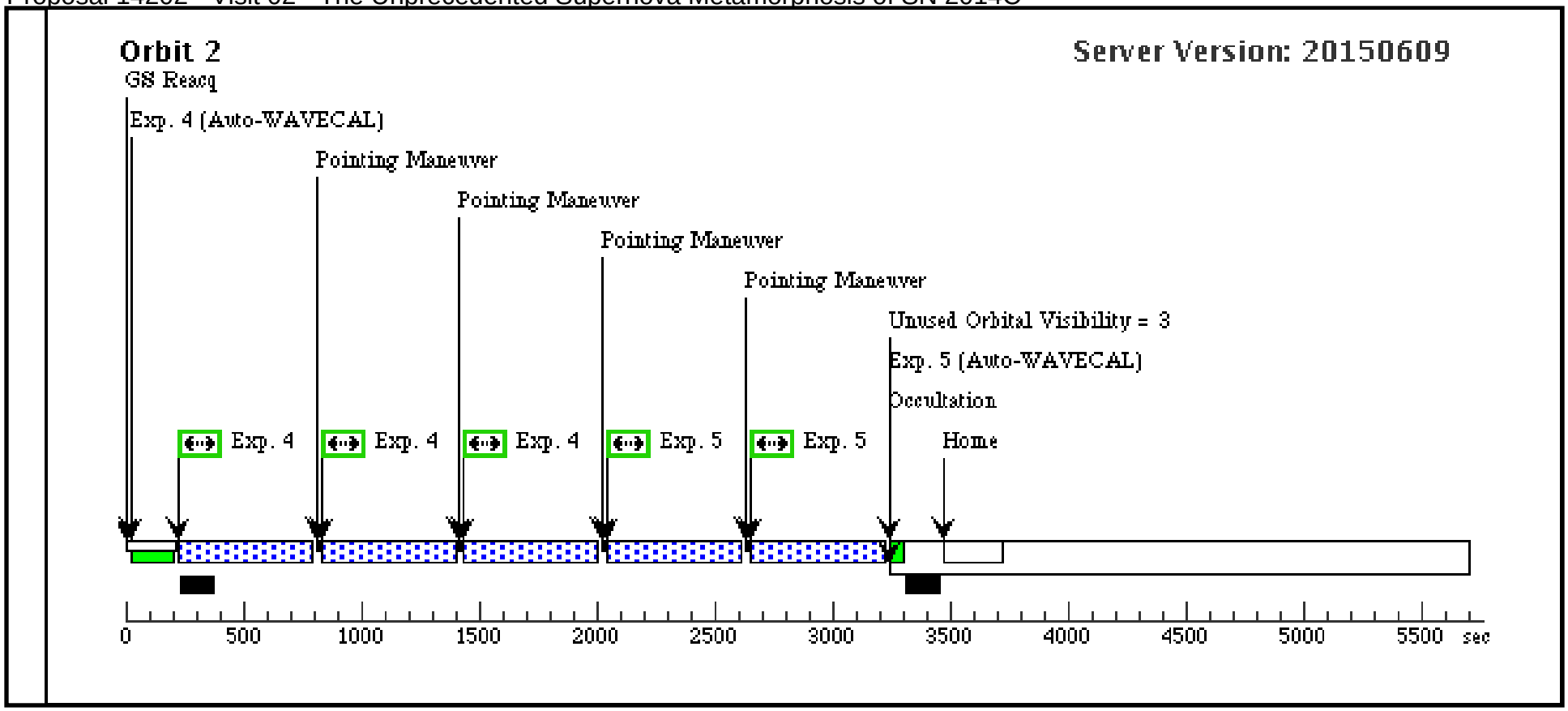
Comments: Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) SN2014C	STIS/CCD, ACQ, F28X50LP	MIRROR				60 Secs (60 Secs) *[==>]*	 ***[1]***
Comments: Acqusition for faint SN with estimated r = 20.0 mag at time of observation.									
2		(1) SN2014C	STIS/CCD, ACCUM, 52X0.2E1	G430L 4300 A	CR-SPLIT=NO		Pattern 3, Exps 2-2 in Visit 02 (3)	503 Secs (1509 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	 ***[1]***
3		(1) SN2014C	STIS/CCD, ACCUM, 52X0.2E1	G430L 4300 A	CR-SPLIT=NO			503 Secs (503 Secs) *[==>]*	 ***[1]***
4		(1) SN2014C	STIS/CCD, ACCUM, 52X0.2E1	G230LB 2375 A	CR-SPLIT=NO		Pattern 3, Exps 4-4 in Visit 02 (3)	538 Secs (1614 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	 ***[2]***
5		(1) SN2014C	STIS/CCD, ACCUM, 52X0.2E1	G230LB 2375 A	CR-SPLIT=NO		Pattern 4, Exps 5-5 in Visit 02 (4)	538 Secs (1076 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	 ***[2]***

Orbit Structure




Orbit 2
Server Version: 20150609
GS Reacq
Exp. 4 (Auto-WAVECAL)
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Unused Orbital Visibility = 3
Exp. 5 (Auto-WAVECAL)
Occultation
Exp. 4
Exp. 4
Exp. 4
Exp. 5
Exp. 5
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 14202, Visit 03, implementation Fri Sep 11 01:13:35 GMT 2015

Diagnostic Status: Warning

Scientific Instruments: COS/NUV, COS/FUV

Special Requirements: AFTER 02 BY 60.0 D TO 365.0 D; ON HOLD FOR 02

Comments: This visit will be scheduled after Visits 1 and 2 are completed. Visit 1 and 2 will provide measure of UV flux to estimate proper observing strategy for COS for Visit 3.

Exposure times and BUFFER-TIMEs presently inputted (17 July 2015) are placeholders until accurate values can be estimated from observations obtained in Visit 1 and 2.

On Hold Comments: Visit 3 must be scheduled after Visit 2. We require STIS spectra from Visit 2 to estimate the FUV flux from the supernova in order to correctly estimate exposure times and instrument configuration for COS. We prefer to also have Visit 1 completed before Visit 2 so that accurate coordinates (< 0.4 arcsec) can be determined and avoid use of offset star for COS target acquisition.

Diagnostics

(Visit 03) Warning (Orbit Planner): INEFFICIENT ORDERING OF FP-POS POSITIONS

(Visit 03) Warning (Form): If the target coordinates are not known to 0.4" (or better), an ACQ/SEARCH should precede the ACQ/IMAGE.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	SN2014C-COPY	RA: 22 37 5.6370 (339.2734875d) Dec: +34 24 31.57 (34.40877d) Equinox: J2000		V=19+/-1	Reference Frame: ICRS

Comments: Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(COS.ta.741304)	(2) SN2014C-COPY	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				860 Secs (860 Secs) *[==>]*	*[1]*
2	(COS.sp.741303)	(2) SN2014C-COPY	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=845; FP-POS=1			845 Secs (845 Secs) *[==>]*	*[1]*
3	(COS.sp.741303)	(2) SN2014C-COPY	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=845; FP-POS=2			845 Secs (845 Secs) *[==>]*	*[2]*
4	(COS.sp.741303)	(2) SN2014C-COPY	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=845; FP-POS=3			845 Secs (845 Secs) *[==>]*	*[2]*
5	(COS.sp.741303)	(2) SN2014C-COPY	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=845; FP-POS=4			845 Secs (845 Secs) *[==>]*	*[2]*
6	(COS.sp.741303)	(2) SN2014C-COPY	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=845; FP-POS=2			845 Secs (845 Secs) *[==>]*	*[3]*
7	(COS.sp.741303)	(2) SN2014C-COPY	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=845; FP-POS=3			845 Secs (845 Secs) *[==>]*	*[3]*
8	(COS.sp.741303)	(2) SN2014C-COPY	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=845; FP-POS=4			845 Secs (845 Secs) *[==>]*	*[3]*

Orbit Structure