



## 14753 - Supernova 1987A at 30 years

Cycle: 24, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

### INVESTIGATORS

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### 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	(3) SN1987A-STIS3 (5) SN1987A-POINT	STIS/CCD STIS/FUV-MAMA	3	01-Feb-2017 21:01:42.0	yes
02	(2) SN1987A-STIS2 (3) SN1987A-STIS3 (4) SN1987A-STIS4 (5) SN1987A-POINT	STIS/CCD STIS/NUV-MAMA	3	01-Feb-2017 21:01:44.0	yes
03	(2) SN1987A-STIS2 (3) SN1987A-STIS3 (4) SN1987A-STIS4 (5) SN1987A-POINT	STIS/CCD	3	01-Feb-2017 21:01:46.0	yes
04	(2) SN1987A-STIS2 (3) SN1987A-STIS3 (4) SN1987A-STIS4 (5) SN1987A-POINT CCDFLAT	STIS/CCD	3	01-Feb-2017 21:01:50.0	yes
10	(6) SN-1987A-COS-ACQ (7) SN-1987A-COS	COS/FUV COS/NUV	3	01-Feb-2017 21:01:52.0	yes
11	(6) SN-1987A-COS-ACQ (7) SN-1987A-COS	COS/FUV COS/NUV	4	01-Feb-2017 21:01:55.0	yes
20	(8) SN-1987A	WFC3/UVIS	3	01-Feb-2017 21:01:57.0	yes

22 Total Orbits Used

### ABSTRACT

This programme will provide a 30 year legacy point for SN 1987A, the brightest supernova since 1604. HST is the essential tool for resolving and analysing SN 1987A's several physical components. The inner, asymmetric ejecta are being heated by X-rays from the circumstellar ring and allow

us to directly observe the geometry of the explosion. At the same time the fastest-moving ejecta are interacting with the ring, giving rise to bright emission from shocks. Our latest observations show that the ring is fading and that new spots are appearing outside, signalling that the blast wave has passed the ring and is now interacting with previously unseen material. It is also the beginning of the end for the ring. Here we propose to use COS and STIS to obtain a complete UV/optical spectrum of the ejecta and ring. The spectrum will enable a detailed modelling of the nucleosynthesis, which is a powerful diagnostic of the explosion, and provide a unique opportunity to study a supernova spectrum in the transition phase between a radioactively powered supernova and a shock heated remnant. It will also allow us to distinguish between different excitation mechanisms for the molecular hydrogen, recently discovered in the NIR. We also propose a set of broad and narrow band images to monitor the evolution of the flux and morphology of ejecta, ring and new spots outside the ring. The latter will tell us about the mass-loss history of the progenitor. The proposed observations will provide a crucial complement to recent Herschel and ALMA observations of dust, CO and SiO in the ejecta.

## **OBSERVING DESCRIPTION**

### Ultraviolet Spectroscopy with COS and STIS

We will take advantage of the complementary capabilities of COS and STIS to provide the definitive UV spectral observations of SN 1987A at late times. With the low background and high effective area of COS, we are  $\sim 50$  times more sensitive to faint spectral features from the debris, reverse shock, and circumstellar ring (see France et al. 2011a). However, the limited spatial resolution of COS (about 1" in a 2.5" aperture) leaves some spatial-spectral ambiguity in the deep spectral data. We propose to complement the deep COS observations with high angular resolution (0.1"), lower spectral resolution observations with STIS.

The COS observations will probe the line profiles of a whole inventory of high-velocity atomic features and possibly molecular emission in the system. One of the main features in the COS/FUV data is the broad, red-shifted emission component of N V 1240Å at a flux of  $(1-2 \times 10^{15} \text{ ergs/cm}^2/\text{s}/\text{angstrom})$ . Using the COS ETC with this flux, an exposure time of 2.5 orbits with COS G130M will be required to achieve a S/N ratio of 15. To search for the molecular emission lines, we request S/N  $\sim 10$  in the narrower CIV ring emission in G160M as a baseline for H<sub>2</sub> "1600 angstrom bump" studies, based on FUV spectra of protoplanetary disks (France et al. 2011b; France et al. 2014). This can be achieved in  $\sim 4.5$  orbits with G160M. At this depth, we expect to observe blue-shifted Lyman Alpha (S/N  $\sim 20$ ), CIV (S/N  $\sim 10$ ), and HeII (S/N  $\sim 15$ ). Combining these, we require 7 orbits for the COS observations. We will observe SN 1987A using four central wavelength settings of each the G130M (1291, 1300, 1309, 1318) and G160M (1589, 1600, 1611, 1623) gratings. This ensures continuous wavelength coverage at relatively constant S/N, and effectively performs a focal plane split to minimize fixed pattern noise and maximize lifetime of the COS MCP detector. We will perform COS target acquisition following the established offset from an isolated 18th mag star used during previous STIS observations. The acquisition with COS will use NUV/MIRRORA/PSA. In our 2011 COS observations, we successfully demonstrated that by judicious choice of spacecraft roll orientation, we could

## Proposal 14753 (STScI Edit Number: 3, Created: Wednesday, February 1, 2017 9:01:58 PM EST) - Overview

minimize the impact of stellar light from outside the COS PSA. The flux from "Star 3", 1.7" away from the center of the remnant, does not significantly contaminate the spectrum ( $\leq 10\%$ ), provided we orient the spacecraft so that the cross-dispersion axis of COS is parallel to the star-PSA line at an angle of  $-62$  degrees ( $\pm 10$  degrees).

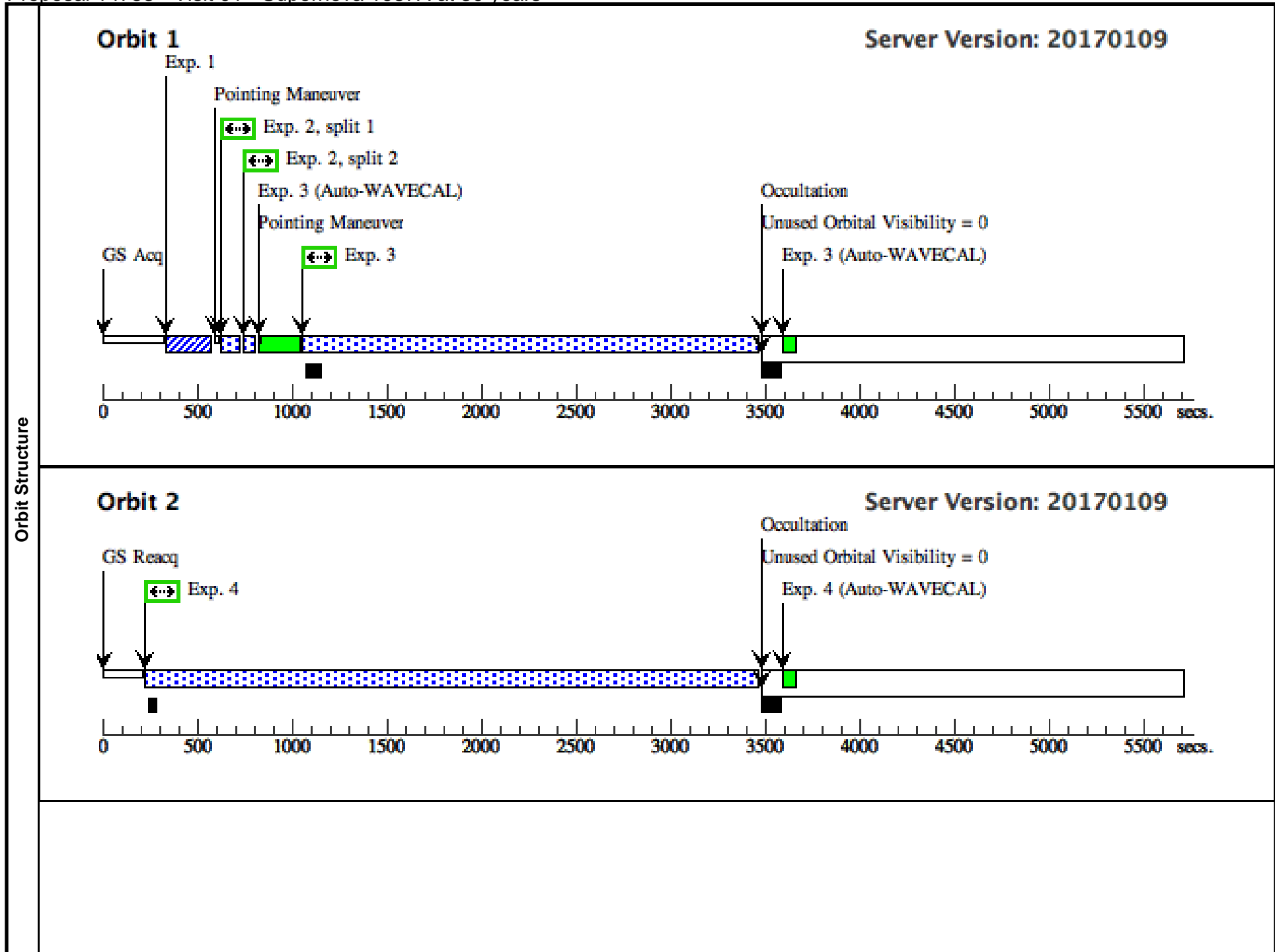
We base our STIS observations on our last UV imaging spectroscopy reported in France et al. (2010). STIS gratings G140L, G230L, G430L, and G750L using the  $52'' \times 0.2''$  slit, aligned along the N-S axis of the remnant will provide high angular resolution constraints on the emission over the UV to optical range. To cover the ejecta we will use 3 parallel slits (Fig 2) for the range not covered by COS (the G230L, G430L, and G750L gratings), and a central slit for G140L. This imaging spectroscopy will be used to constrain the relative position of the bright emission features and explore the spatial variation of the lines. For a  $S/N = 20$  at the peak of the northern high-velocity Lyman Alpha emission and the northern Mg II emission feature to ensure high-quality data that will complement the COS spectra. Taking the 2009 SAINTS observations, assuming a 25% ejecta brightening, and running these values through the STIS on-line ETC, we find that we require 3 orbits for G140L and one orbit each for each slit position of G230L, G430L and G 750L. In total, we require  $7 + 3 + 3 \times 3 \times 1 = 19$  orbits for the spectral observations of SN 1987A.

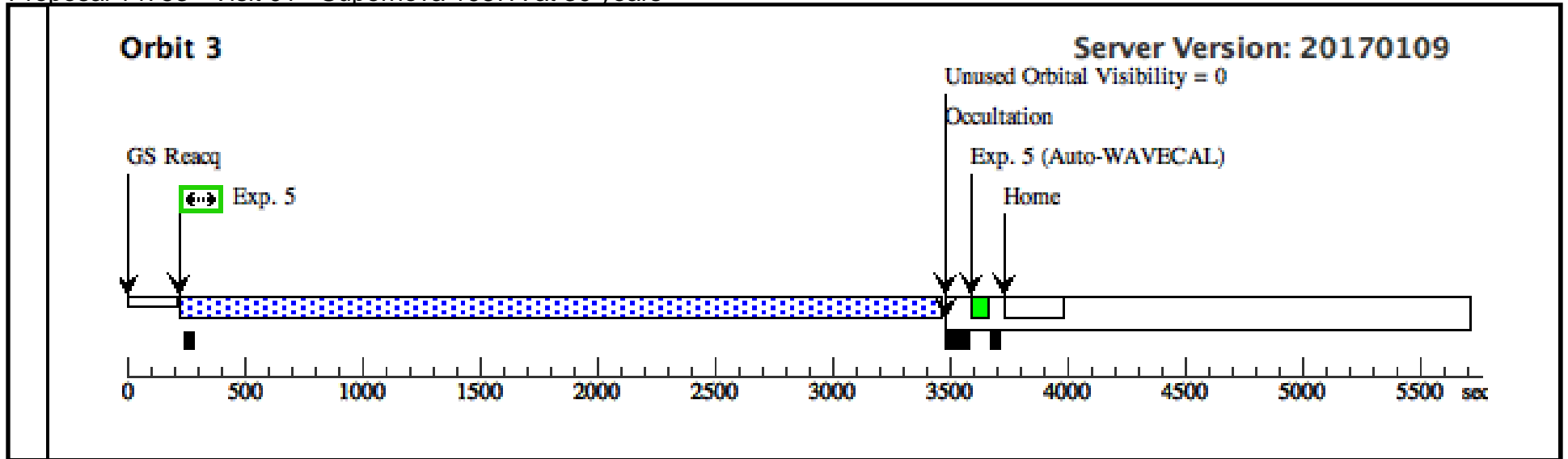
Imaging with WFPC3: The WFC3/UVIS observations using filters F435W, F625W, F657N and F502N will connect with our earlier observations at similar S/N ratio through drizzled observations. These new images will allow us to follow the light curve, the morphology of the ejecta, ring and to follow new spots and diffuse gas outside the ring. Based on our 2015 observations we request 3 orbits in total.

Proposal 14753 - Visit 01 - Supernova 1987A at 30 years

Thu Feb 02 02:01:58 GMT 2017

Visit	<b>Proposal 14753, Visit 01, implementation</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: STIS/CCD, STIS/FUV-MAMA Special Requirements: ORIENT 45D TO 45 D; ORIENT 225D TO 225 D; SEQ 01,02,03,04 WITHIN 10 D; VISIBILITY INTERVAL 58 M <i>Comments: STIS.sp.828027</i>									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
(3)		SN1987A-STIS3	Offset from SN1987A-POINT RA Offset: -2.4815 Secs Dec Offset: 7.32 Arcsec		V=21.0	Offset Position (SN1987A-STIS3)				
<i>Comments: OFFSET measured on recent WFC3/UVIS image</i>										
(5)	SN1987A-POINT	RA: 05 35 30.5170 (83.8771542d) Dec: -69 16 18.52 (-69.27181d) Equinox: J2000		V=16.07+/-0.1	Reference Frame: ICRS					
<i>Comments: position is measured from both STIS and UVIS images Also on PLATE A298 position is 5:35:30.484 -69:16:18.36 so all these positions agree to about 0.1 arcsecond</i>										
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(5) SN1987A-POINT	STIS/CCD, ACQ, 50CCD	MIRROR				1 Secs (1 Secs)	
			T						[==>]	[1]
	2		(3) SN1987A-STIS3	STIS/CCD, ACCUM, 50CCD	MIRROR				60 Secs (52 Secs)	
									[==>26.0 Secs (Split 1)]	
									[==>26.0 Secs (Split 2)]	[1]
	3	(STIS.sp.82 8027)	(3) SN1987A-STIS3	STIS/FUV-MAMA, ACCUM, 52X0.2	G140L 1425 A				2400 Secs (2396 Secs)	
								[==>2396.0 Secs ]	[1]	
4	(STIS.sp.82 8027)	(3) SN1987A-STIS3	STIS/FUV-MAMA, ACCUM, 52X0.2	G140L 1425 A				3300 Secs (3230 Secs)		
								[==>3230.0 Secs ]	[2]	
5	(STIS.sp.82 8027)	(3) SN1987A-STIS3	STIS/FUV-MAMA, ACCUM, 52X0.2	G140L 1425 A				3300 Secs (3230 Secs)		
								[==>3230.0 Secs ]	[3]	

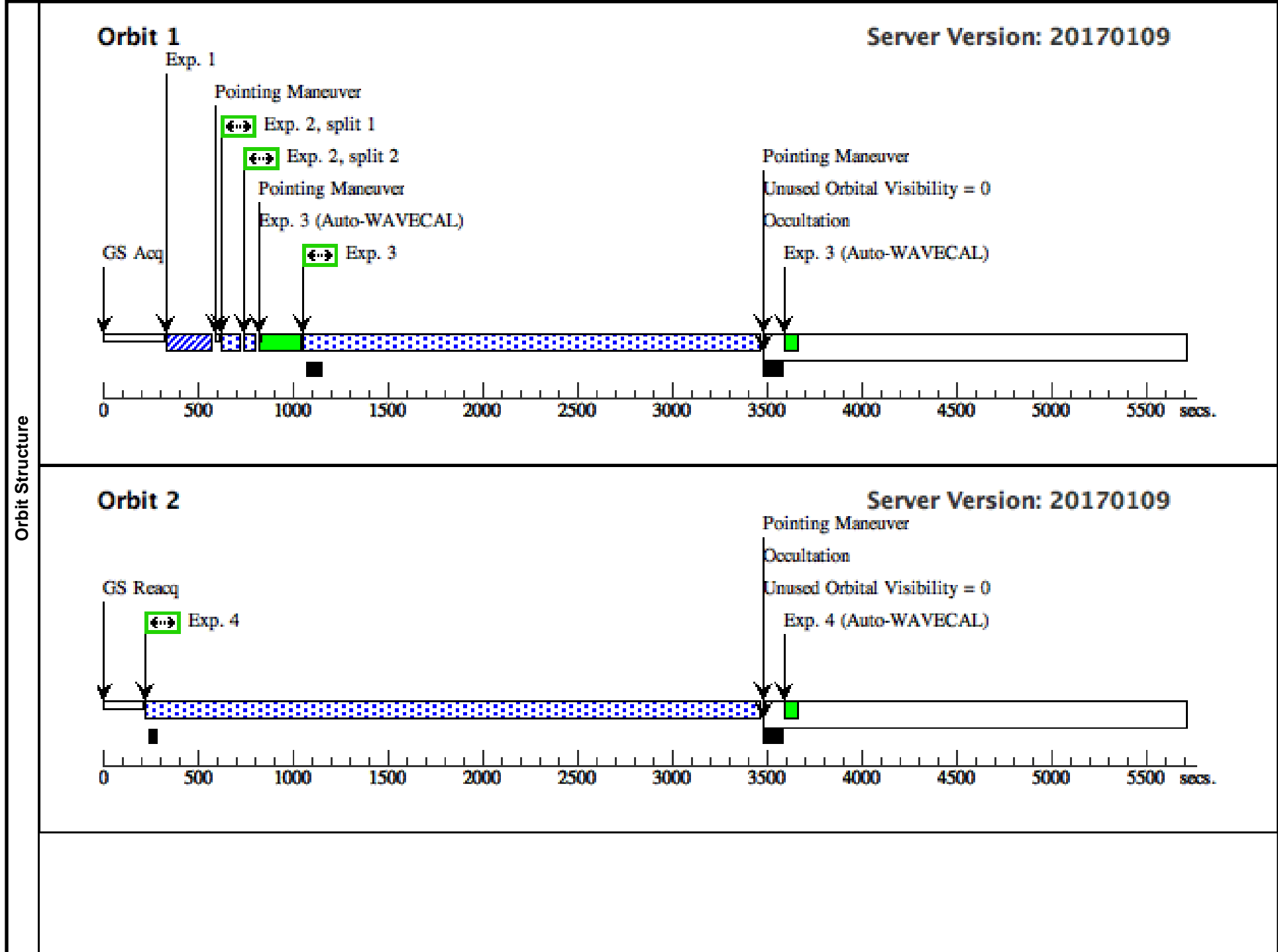


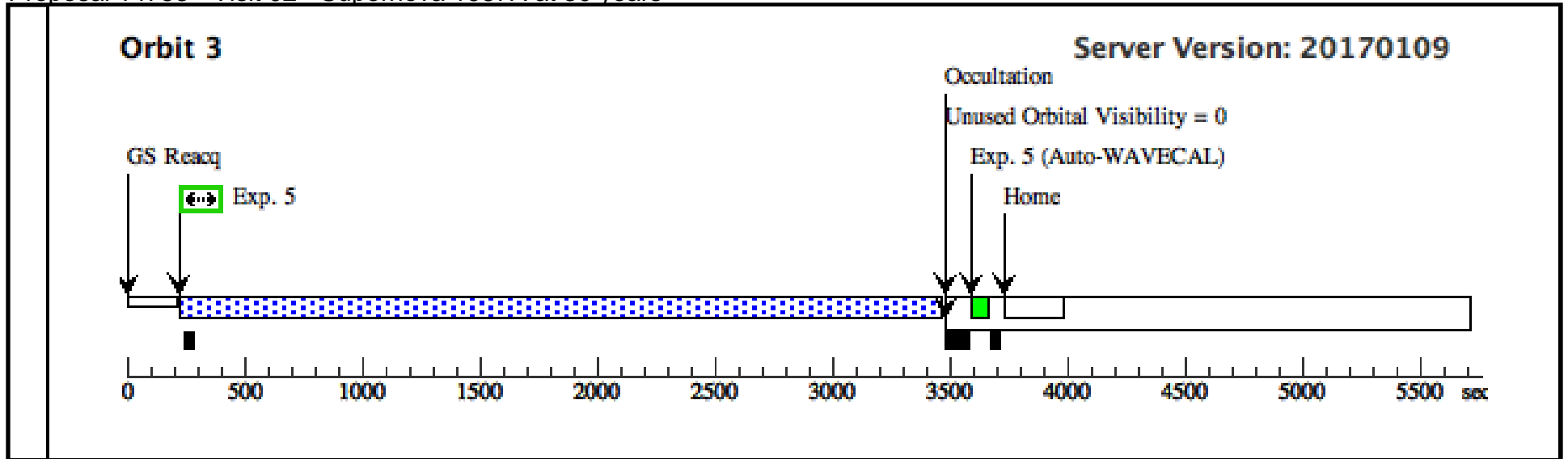


Proposal 14753 - Visit 02 - Supernova 1987A at 30 years

Thu Feb 02 02:01:58 GMT 2017

Visit	<b>Proposal 14753, Visit 02, implementation</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: STIS/NUV-MAMA, STIS/CCD Special Requirements: ORIENT 45D TO 45 D; ORIENT 225D TO 225 D; VISIBILITY INTERVAL 58 M <i>Comments: STIS.sp.828029</i>									
	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
Fixed Targets	(2)	SN1987A-STIS2	Offset from SN1987A-POINT RA Offset: -2.4625 Secs Dec Offset: 7.32 Arcsec		V=21.0	Offset Position (SN1987A-STIS2)				
	<i>Comments: OFFSET measured on recent WFC3/UVIS image</i>									
	(3)	SN1987A-STIS3	Offset from SN1987A-POINT RA Offset: -2.4815 Secs Dec Offset: 7.32 Arcsec		V=21.0	Offset Position (SN1987A-STIS3)				
	<i>Comments: OFFSET measured on recent WFC3/UVIS image</i>									
	(4)	SN1987A-STIS4	Offset from SN1987A-POINT RA Offset: -2.5005 Secs Dec Offset: 7.32 Arcsec		V=21.0	Offset Position (SN1987A-STIS4)				
<i>Comments: OFFSET measured on recent WFC3/UVIS image</i>										
(5)	SN1987A-POINT	RA: 05 35 30.5170 (83.8771542d) Dec: -69 16 18.52 (-69.27181d) Equinox: J2000		V=16.07+/-0.1	Reference Frame: ICRS					
<i>Comments: position is measured from both STIS and UVIS images Also on PLATE A298 position is 5:35:30.484 -69:16:18.36 so all these positions agree to about 0.1 arcsecond</i>										
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(5) SN1987A-POINT	STIS/CCD, ACQ, 50CCD	MIRROR				1 Secs (1 Secs)	
			T						[==>]	[1]
	2		(3) SN1987A-STIS3	STIS/CCD, ACCUM, 50CCD	MIRROR				60 Secs (52 Secs)	
									[==>26.0 Secs (Split 1)]	[1]
									[==>26.0 Secs (Split 2)]	
	3	(STIS.sp.82, 8029)	(2) SN1987A-STIS2	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				2400 Secs (2396 Secs)	
								[==>2396.0 Secs ]	[1]	
4	(STIS.sp.82, 8029)	(3) SN1987A-STIS3	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				3300 Secs (3230 Secs)		
								[==>3230.0 Secs ]	[2]	
5	(STIS.sp.82, 8029)	(4) SN1987A-STIS4	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				3300 Secs (3230 Secs)		
								[==>3230.0 Secs ]	[3]	





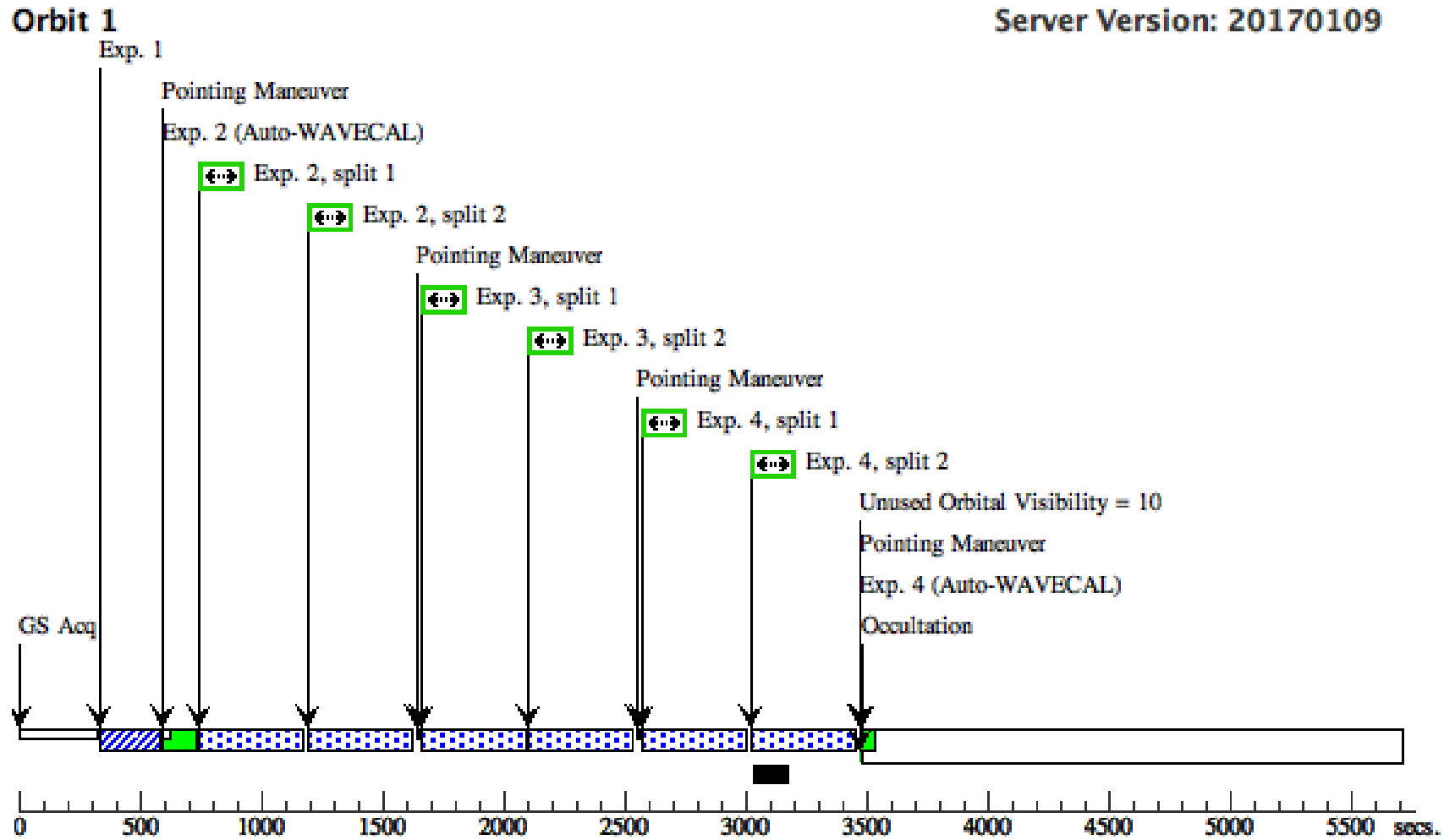
Proposal 14753 - Visit 03 - Supernova 1987A at 30 years

Visit	<p>Proposal 14753, Visit 03, implementation <span style="float: right;">Thu Feb 02 02:01:58 GMT 2017</span>  <b>Diagnostic Status: No Diagnostics</b>                      Scientific Instruments: STIS/CCD                      Special Requirements: ORIENT 45D TO 45 D; ORIENT 225D TO 225 D; VISIBILITY INTERVAL 58 M</p>					
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes
(2)		SN1987A-STIS2	Offset from SN1987A-POINT RA Offset: -2.4625 Secs Dec Offset: 7.32 Arcsec <i>Comments: OFFSET measured on recent WFC3/UVIS image</i>		V=21.0	Offset Position (SN1987A-STIS2)
(3)		SN1987A-STIS3	Offset from SN1987A-POINT RA Offset: -2.4815 Secs Dec Offset: 7.32 Arcsec <i>Comments: OFFSET measured on recent WFC3/UVIS image</i>		V=21.0	Offset Position (SN1987A-STIS3)
(4)		SN1987A-STIS4	Offset from SN1987A-POINT RA Offset: -2.5005 Secs Dec Offset: 7.32 Arcsec <i>Comments: OFFSET measured on recent WFC3/UVIS image</i>		V=21.0	Offset Position (SN1987A-STIS4)
(5)		SN1987A-POINT	RA: 05 35 30.5170 (83.8771542d) Dec: -69 16 18.52 (-69.27181d) Equinox: J2000 <i>Comments: position is measured from both STIS and UVIS images                      Also on PLATE A298 position is 5:35:30.484 -69:16:18.36                      so all these positions agree to about 0.1 arcsecond</i>		V=16.07+/-0.1	Reference Frame: ICRS

Proposal 14753 - Visit 03 - Supernova 1987A at 30 years

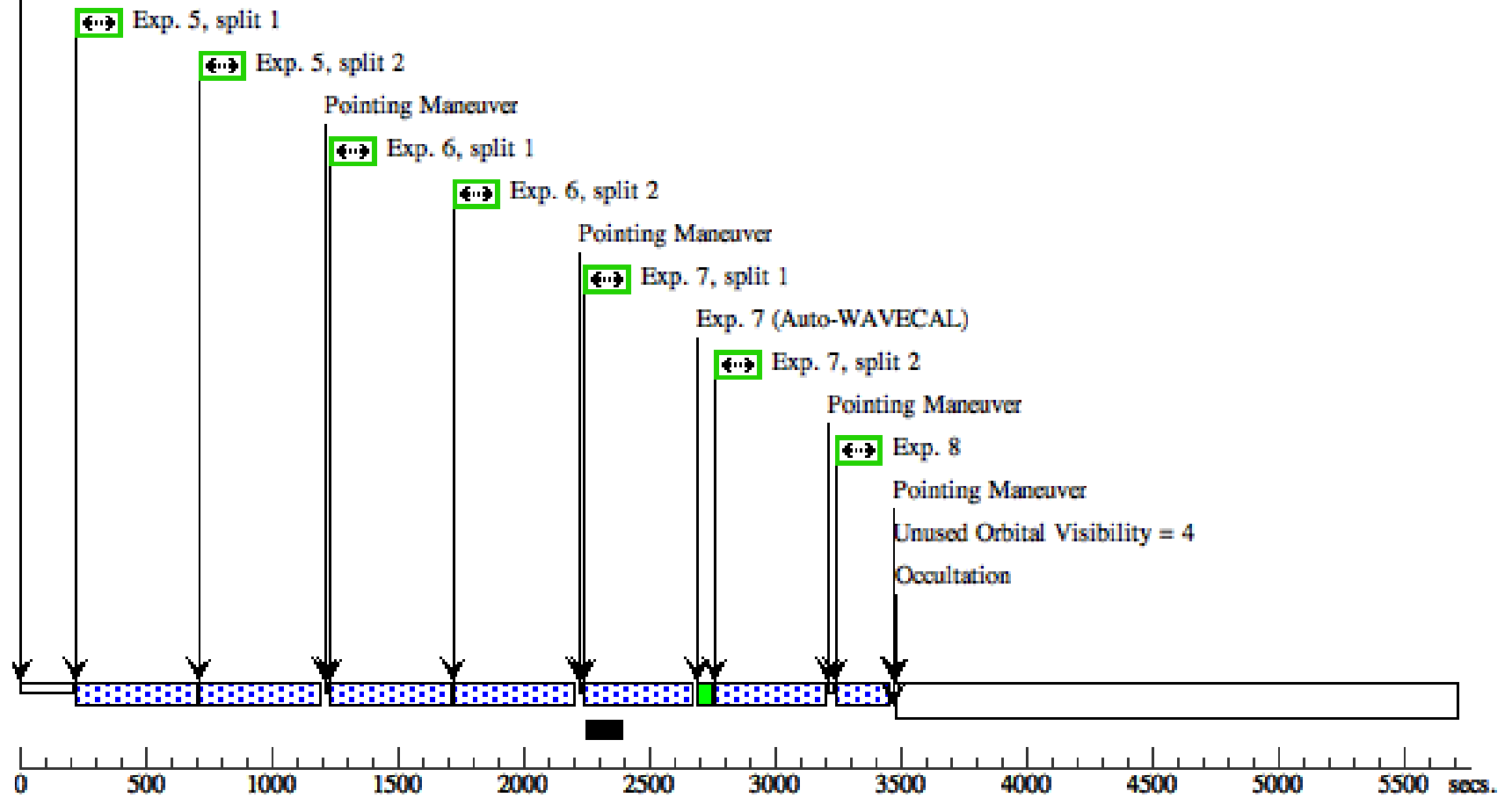
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(5) SN1987A-POIN T	STIS/CCD, ACQ, 50CCD	MIRROR				1 Secs (1 Secs)	
									[==>]	[1]
	2		(2) SN1987A-STIS2	STIS/CCD, ACCUM, 52X0.2E1	G430L 4300 A	CR-SPLIT=2			800 Secs (800 Secs)	
									[==>(Split 1)]	[1]
									[==>(Split 2)]	
	3		(2) SN1987A-STIS2	STIS/CCD, ACCUM, 52X0.2E1	G430L 4300 A	CR-SPLIT=2	POS TARG 0,0.10		800 Secs (800 Secs)	
									[==>(Split 1)]	[1]
									[==>(Split 2)]	
	4		(2) SN1987A-STIS2	STIS/CCD, ACCUM, 52X0.2E1	G430L 4300 A	CR-SPLIT=2	POS TARG 0,0.2		800 Secs (800 Secs)	
									[==>(Split 1)]	[1]
									[==>(Split 2)]	
5		(4) SN1987A-STIS4	STIS/CCD, ACCUM, 52X0.2E1	G430L 4300 A	CR-SPLIT=2	POS TARG 0,0.2		900 Secs (896 Secs)		
								[==>448.0 Secs (Split 1)]	[2]	
								[==>448.0 Secs (Split 2)]		
6		(4) SN1987A-STIS4	STIS/CCD, ACCUM, 52X0.2E1	G430L 4300 A	CR-SPLIT=2	POS TARG 0,0.10		900 Secs (896 Secs)		
								[==>448.0 Secs (Split 1)]	[2]	
								[==>448.0 Secs (Split 2)]		
7		(4) SN1987A-STIS4	STIS/CCD, ACCUM, 52X0.2E1	G430L 4300 A	CR-SPLIT=2	POS TARG 0,0		800 Secs (796 Secs)		
								[==>398.0 Secs (Split 1)]	[2]	
								[==>398.0 Secs (Split 2)]		
8		(4) SN1987A-STIS4	STIS/CCD, ACCUM, 50CCD	MIRROR	CR-SPLIT=NO	POS TARG 0,0		60 Secs (58 Secs)		
								[==>58.0 Secs ]	[2]	
9		(3) SN1987A-STIS3	STIS/CCD, ACCUM, 52X0.2E1	G430L 4300 A	CR-SPLIT=2	POS TARG 0,0		900 Secs (896 Secs)		
								[==>448.0 Secs (Split 1)]	[3]	
								[==>448.0 Secs (Split 2)]		
10		(3) SN1987A-STIS3	STIS/CCD, ACCUM, 52X0.2E1	G430L 4300 A	CR-SPLIT=2	POS TARG 0,0.1		900 Secs (896 Secs)		
								[==>448.0 Secs (Split 1)]	[3]	
								[==>448.0 Secs (Split 2)]		
11		(4) SN1987A-STIS4	STIS/CCD, ACCUM, 52X0.2E1	G430L 4300 A	CR-SPLIT=2	POS TARG 0,0.2		800 Secs (796 Secs)		
								[==>398.0 Secs (Split 1)]	[3]	
								[==>398.0 Secs (Split 2)]		
12		(3) SN1987A-STIS3	STIS/CCD, ACCUM, 50CCD	MIRROR	CR-SPLIT=NO	POS TARG 0,0		60 Secs (58 Secs)		
								[==>58.0 Secs ]	[3]	

Orbit Structure



### Orbit 2

GS Reacq



### Orbit 3

GS Reacq

Exp. 9 (Auto-WAVECAL)

Exp. 9, split 1

Exp. 9, split 2

Pointing Maneuver

Exp. 10, split 1

Exp. 10, split 2

Pointing Maneuver

Exp. 11, split 1

Exp. 11 (Auto-WAVECAL)

Exp. 11, split 2

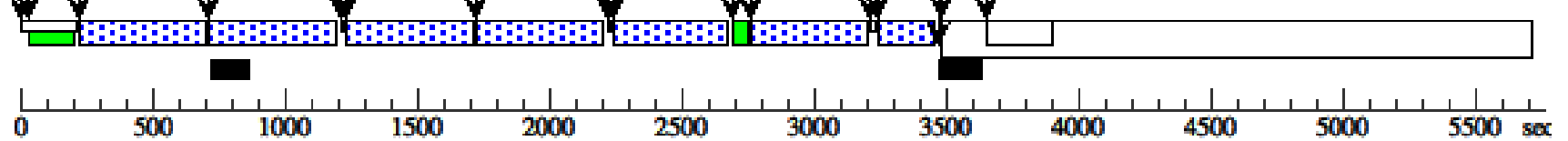
Pointing Maneuver

Exp. 12

Unused Orbital Visibility = 4

Occultation

Home



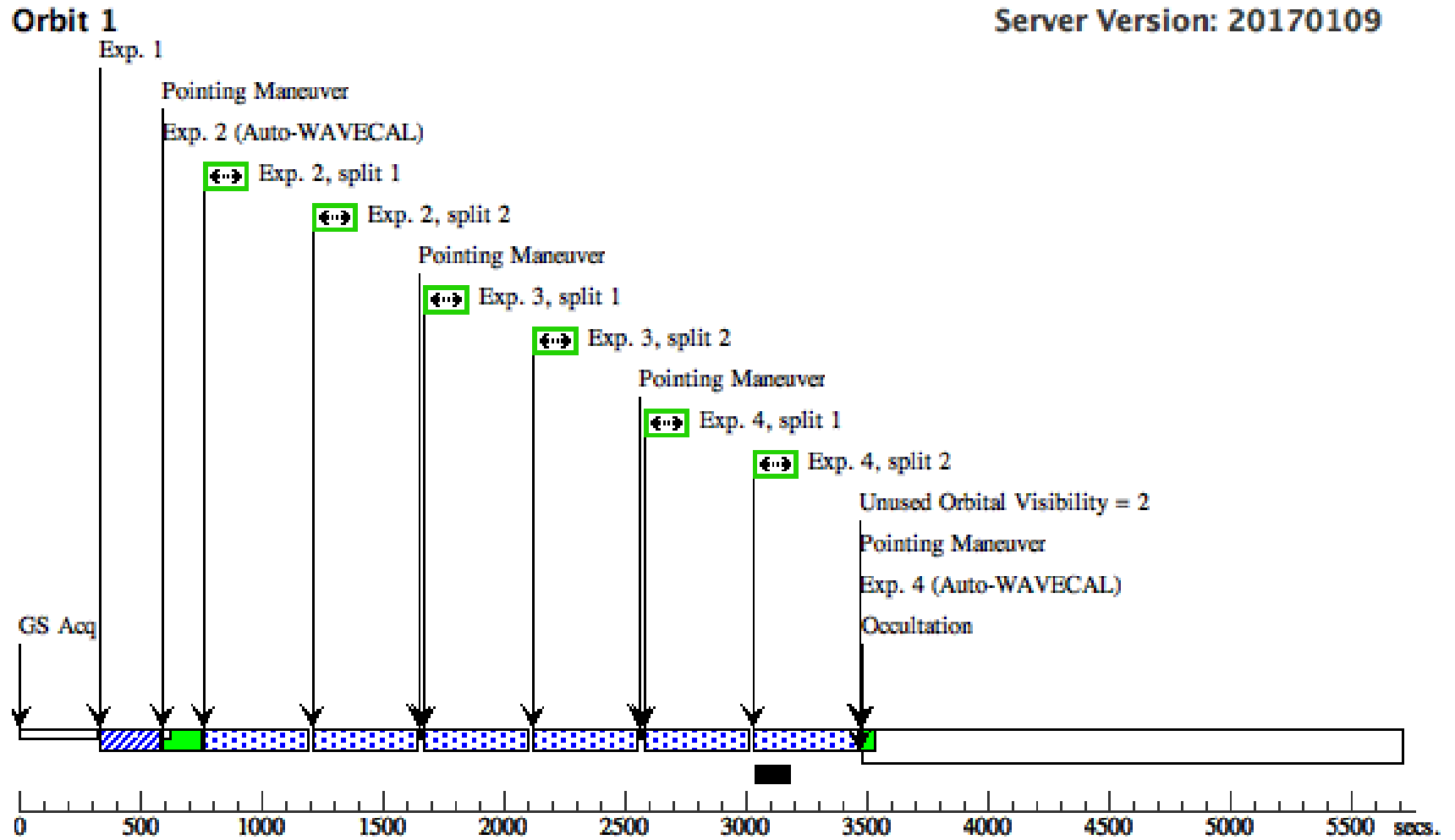
Proposal 14753 - Visit 04 - Supernova 1987A at 30 years

Visit	<p>Proposal 14753, Visit 04, implementation <span style="float: right;">Thu Feb 02 02:01:59 GMT 2017</span>  <b>Diagnostic Status: No Diagnostics</b>                      Scientific Instruments: STIS/CCD                      Special Requirements: ORIENT 45D TO 45 D; ORIENT 225D TO 225 D; VISIBILITY INTERVAL 58 M</p>					
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes
(2)		SN1987A-STIS2	Offset from SN1987A-POINT RA Offset: -2.4625 Secs Dec Offset: 7.32 Arcsec <i>Comments: OFFSET measured on recent WFC3/UVIS image</i>		V=21.0	Offset Position (SN1987A-STIS2)
(3)		SN1987A-STIS3	Offset from SN1987A-POINT RA Offset: -2.4815 Secs Dec Offset: 7.32 Arcsec <i>Comments: OFFSET measured on recent WFC3/UVIS image</i>		V=21.0	Offset Position (SN1987A-STIS3)
(4)		SN1987A-STIS4	Offset from SN1987A-POINT RA Offset: -2.5005 Secs Dec Offset: 7.32 Arcsec <i>Comments: OFFSET measured on recent WFC3/UVIS image</i>		V=21.0	Offset Position (SN1987A-STIS4)
(5)		SN1987A-POINT	RA: 05 35 30.5170 (83.8771542d) Dec: -69 16 18.52 (-69.27181d) Equinox: J2000 <i>Comments: position is measured from both STIS and UVIS images                      Also on PLATE A298 position is 5:35:30.484 -69:16:18.36                      so all these positions agree to about 0.1 arcsecond</i>		V=16.07+/-0.1	Reference Frame: ICRS

Proposal 14753 - Visit 04 - Supernova 1987A at 30 years

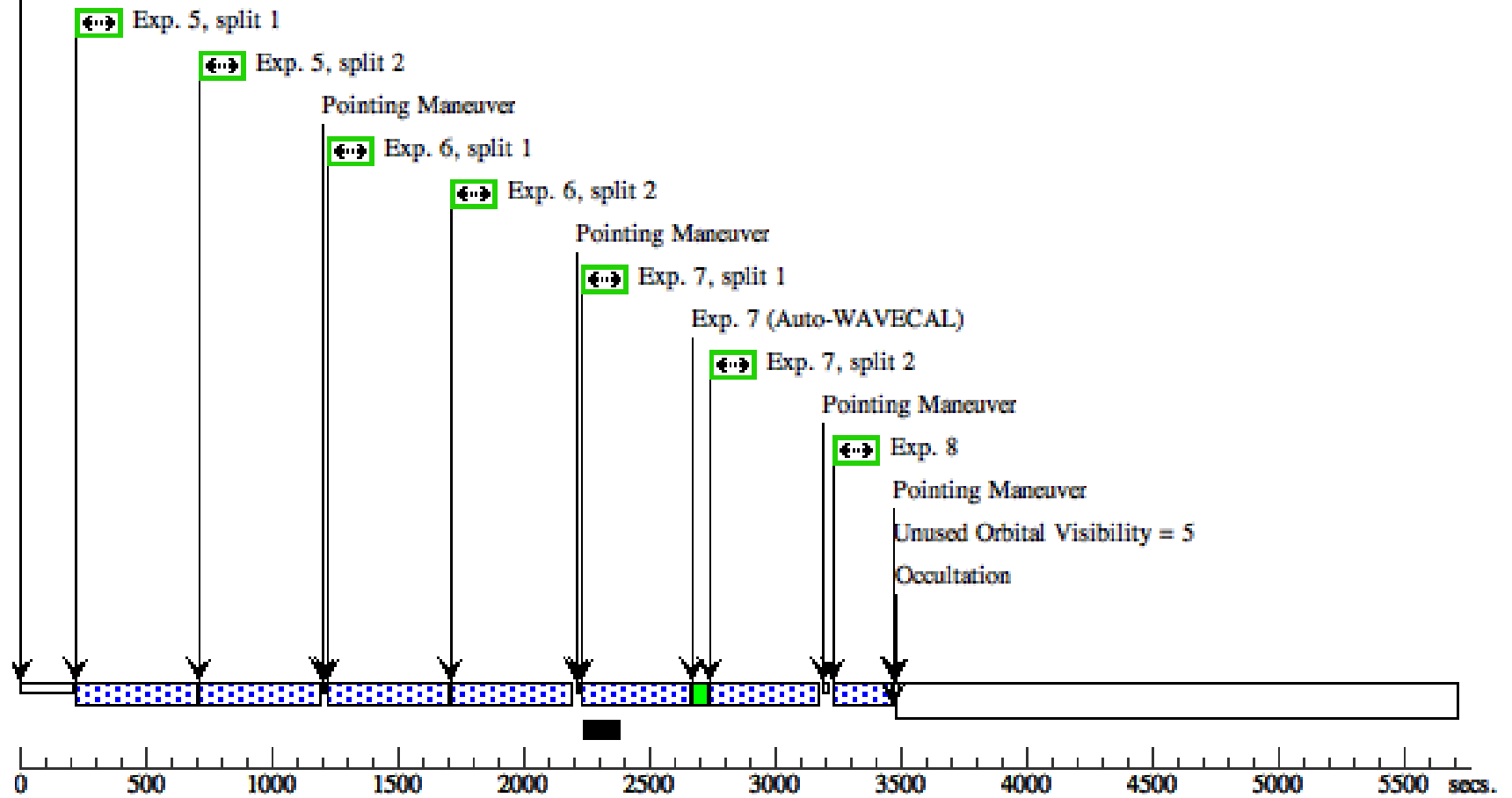
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(5) SN1987A-POIN T	STIS/CCD, ACQ, 50CCD	MIRROR				1 Secs (1 Secs)	
									[==>]	[1]
	2		(2) SN1987A-STIS2	STIS/CCD, ACCUM, 52X0.2E1	G750L 7751 A	CR-SPLIT=2			800 Secs (796 Secs)	
									[==>398.0 Secs (Split 1)]	[1]
									[==>398.0 Secs (Split 2)]	
	3		(2) SN1987A-STIS2	STIS/CCD, ACCUM, 52X0.2E1	G750L 7751 A	CR-SPLIT=2	POS TARG 0,0.10		800 Secs (796 Secs)	
									[==>398.0 Secs (Split 1)]	[1]
									[==>398.0 Secs (Split 2)]	
	4		(2) SN1987A-STIS2	STIS/CCD, ACCUM, 52X0.2E1	G750L 7751 A	CR-SPLIT=2	POS TARG 0,0.2		800 Secs (796 Secs)	
									[==>398.0 Secs (Split 1)]	[1]
									[==>398.0 Secs (Split 2)]	
	5		(4) SN1987A-STIS4	STIS/CCD, ACCUM, 52X0.2E1	G750L 7751 A	CR-SPLIT=2	POS TARG 0,0.2		900 Secs (890 Secs)	
								[==>445.0 Secs (Split 1)]	[2]	
								[==>445.0 Secs (Split 2)]		
6		(4) SN1987A-STIS4	STIS/CCD, ACCUM, 52X0.2E1	G750L 7751 A	CR-SPLIT=2	POS TARG 0,0.10		900 Secs (890 Secs)		
								[==>445.0 Secs (Split 1)]	[2]	
								[==>445.0 Secs (Split 2)]		
7		(4) SN1987A-STIS4	STIS/CCD, ACCUM, 52X0.2E1	G750L 7751 A	CR-SPLIT=2	POS TARG 0,0		800 Secs (790 Secs)		
								[==>395.0 Secs (Split 1)]	[2]	
								[==>395.0 Secs (Split 2)]		
8		(4) SN1987A-STIS4	STIS/CCD, ACCUM, 50CCD	MIRROR	CR-SPLIT=NO	POS TARG 0,0		60 Secs (55 Secs)		
								[==>55.0 Secs ]	[2]	
9		(3) SN1987A-STIS3	STIS/CCD, ACCUM, 52X0.2E1	G750L 7751 A	CR-SPLIT=2	POS TARG 0,0		900 Secs (890 Secs)		
								[==>445.0 Secs (Split 1)]	[3]	
								[==>445.0 Secs (Split 2)]		
10		(3) SN1987A-STIS3	STIS/CCD, ACCUM, 52X0.2E1	G750L 7751 A	CR-SPLIT=2	POS TARG 0,0.1		900 Secs (890 Secs)		
								[==>445.0 Secs (Split 1)]	[3]	
								[==>445.0 Secs (Split 2)]		
11		(4) SN1987A-STIS4	STIS/CCD, ACCUM, 52X0.2E1	G750L 7751 A	CR-SPLIT=2	POS TARG 0,0.2		800 Secs (790 Secs)		
								[==>395.0 Secs (Split 1)]	[3]	
								[==>395.0 Secs (Split 2)]		
12		(3) SN1987A-STIS3	STIS/CCD, ACCUM, 50CCD	MIRROR	CR-SPLIT=NO	POS TARG 0,0		60 Secs (55 Secs)		
								[==>55.0 Secs ]	[3]	
13		CCDFLAT	STIS/CCD, ACCUM, 52X0.2	G750L 7751 A				[==>(Copy 1)]	[3]	
								[==>(Copy 2)]		

Orbit Structure



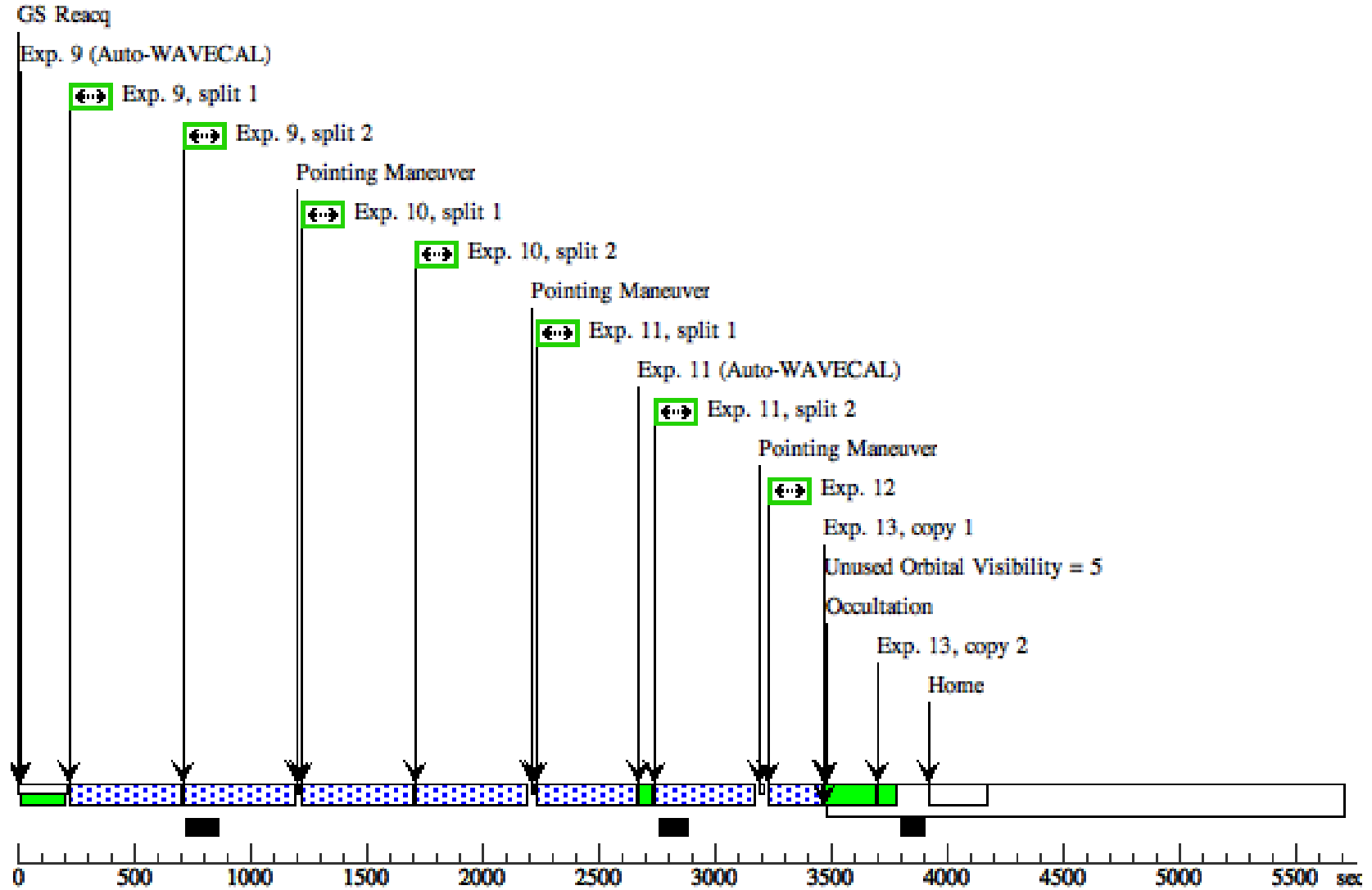
### Orbit 2

GS Reacq



**Orbit 3**

Server Version: 20170109



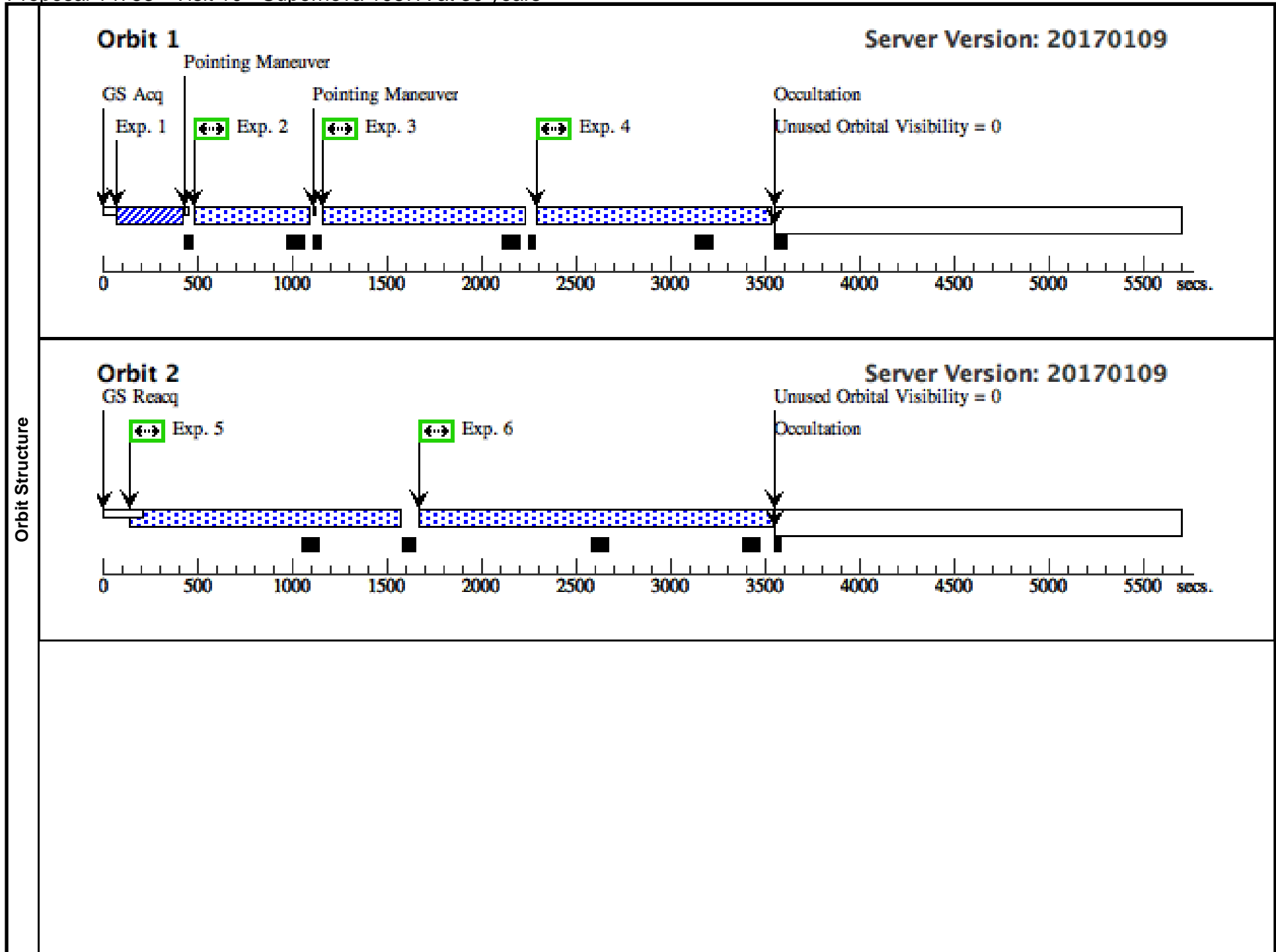
Proposal 14753 - Visit 10 - Supernova 1987A at 30 years

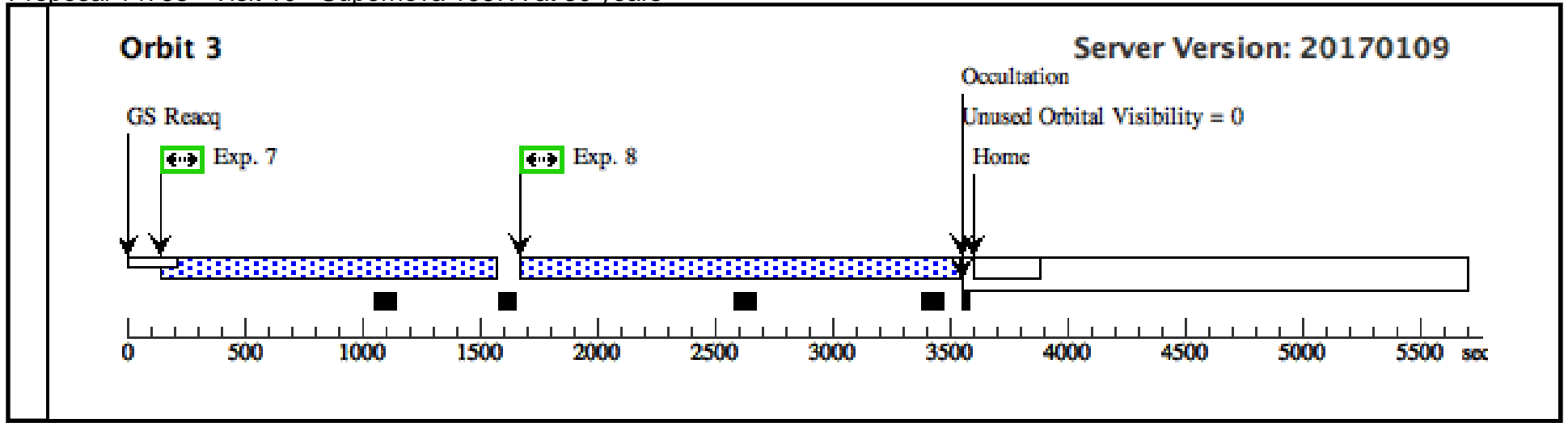
Thu Feb 02 02:01:59 GMT 2017

<b>Visit</b>	<p><b>Proposal 14753, Visit 10, implementation</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Scientific Instruments: COS/FUV, COS/NUV</p> <p>Special Requirements: ORIENT 60.0D TO 90.0 D; SEQ 10,11 WITHIN 1 D</p> <p><i>Comments: ideal angle is 75. Note that an identical copy of these observations were carried out in Cycle 19. These data will allow us to inspect the relatively temporal variability of the lines and continuum.</i></p> <p><i>on Jan 09, 2017 pete challis changed the target for exposure 2 from the acquisition star to the supernova SN-1987A-COS</i></p>																																			
	<p>(Visit 10) Warning (Form): For the best data quality, it is strongly recommended that all four FP-POS positions be used when observing at a given COS CENWAVE setting.</p> <p>(Exposure 3 (Visit 10)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.</p> <p>(Exposure 4 (Visit 10)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.</p> <p>(Exposure 5 (Visit 10)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.</p> <p>(Exposure 6 (Visit 10)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.</p> <p>(Exposure 7 (Visit 10)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.</p> <p>(Exposure 8 (Visit 10)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.</p>																																			
<b>Diagnosics</b>																																				
<b>Fixed Targets</b>	<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>(6)</td> <td>SN-1987A-COS-ACQ</td> <td>RA: 05 35 30.5100 (83.8771250d) Dec: -69 16 18.52 (-69.27181d) Equinox: J2000</td> <td></td> <td>V=16.071 B=15.915, U=15.029</td> <td>Reference Frame: ICRS</td> </tr> <tr> <td colspan="6"> <p><i>Comments: V=16.071, B-V=-0.156, U-B=-0.886, V-R=-0.057, V-I=-0.109</i></p> <p><i>B=15.915</i></p> <p><i>U=15.029</i></p> <p><i>COS.A351911, ACQ= MIRROR B + PSA</i></p> <p><i>Brightest pixel 18.753</i></p> <p><i>Count rate entire detector 515.776 ives: Time = 11.8457</i></p> <p><i>Extended=NO</i></p> </td> </tr> <tr> <td>(7)</td> <td>SN-1987A-COS</td> <td>Offset from SN-1987A-COS-ACQ RA Offset: -2.5 Secs Dec Offset: 7.6 Arcsec</td> <td></td> <td>V=23.0</td> <td>Offset Position (SN-1987A-COS)</td> </tr> <tr> <td colspan="6"> <p><i>Comments: This object was generated by the targetselector and retrieved from the NED database.</i></p> <p><i>Extended=YES</i></p> </td> </tr> </tbody> </table>	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous	(6)	SN-1987A-COS-ACQ	RA: 05 35 30.5100 (83.8771250d) Dec: -69 16 18.52 (-69.27181d) Equinox: J2000		V=16.071 B=15.915, U=15.029	Reference Frame: ICRS	<p><i>Comments: V=16.071, B-V=-0.156, U-B=-0.886, V-R=-0.057, V-I=-0.109</i></p> <p><i>B=15.915</i></p> <p><i>U=15.029</i></p> <p><i>COS.A351911, ACQ= MIRROR B + PSA</i></p> <p><i>Brightest pixel 18.753</i></p> <p><i>Count rate entire detector 515.776 ives: Time = 11.8457</i></p> <p><i>Extended=NO</i></p>						(7)	SN-1987A-COS	Offset from SN-1987A-COS-ACQ RA Offset: -2.5 Secs Dec Offset: 7.6 Arcsec		V=23.0	Offset Position (SN-1987A-COS)	<p><i>Comments: This object was generated by the targetselector and retrieved from the NED database.</i></p> <p><i>Extended=YES</i></p>										
	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous																														
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(7)	SN-1987A-COS	Offset from SN-1987A-COS-ACQ RA Offset: -2.5 Secs Dec Offset: 7.6 Arcsec		V=23.0	Offset Position (SN-1987A-COS)																															
<p><i>Comments: This object was generated by the targetselector and retrieved from the NED database.</i></p> <p><i>Extended=YES</i></p>																																				

Proposal 14753 - Visit 10 - Supernova 1987A at 30 years

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit	
Exposures	1	(COS.A351911)	(6) SN-1987A-COS-ACQ	COS/NUV, ACQ/IMAGE, PSA	MIRRORB			14 Secs (14 Secs)			
								[==>]		[1]	
	<p>Comments: COS.A351911                      Model ID = 98217                      + Kurucz (B3V): Temp = 18700, LogZ = 0.0, Logg = 3.9                      . Renormalized to Johnson U = 15.03 in magnitudes relative to Vega                      COS.A351916 Kurucz (B5V): Temp = 15400,                      I average the two.. 12 seconds with B3V, and 16 seconds with B5V</p>										
	2	(COS.A331366)	(7) SN-1987A-COS	COS/NUV, TIME-TAG, PSA	MIRRORB	BUFFER-TIME=49 0			600 Secs (600 Secs)		
									[==>]		[1]
	<p>Comments: star 3: V=15.60 B-V 0.46 U-B -0.89                      V = 15.60 B=16.06 U=15.17 B3 star                      Exposure ID: COS.A331360</p> <p>If the aperture falls on nearby star 3;COS.A331366                      Brightest pixel 16.484                      Count rate entire detector 491.586                      Exposure time (seconds) = 600.0000                      Model ID = 96513                      + Kurucz (B3V): Temp = 18700, LogZ = 0.0, Logg = 3.9                      . Renormalized to Johnson U = 15.17 in magnitudes relative to Vega</p> <p>The distance between star 3 and the edge of the COS aperture is 0.69",                      figure 7.1 show the throughput is 0.7</p>										
	3	(COS.sp.828031)	(7) SN-1987A-COS	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=1; BUFFER-TIME=80 0			900 Secs (900 Secs)		
									[==>]		[1]
4	(COS.sp.828031)	(7) SN-1987A-COS	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=80 0; FP-POS=2			1191 Secs (1191 Secs)			
								[==>]		[1]	
5	(COS.sp.828031)	(7) SN-1987A-COS	COS/FUV, TIME-TAG, PSA	G130M 1300 A	BUFFER-TIME=80 0; FP-POS=3			1300 Secs (1300 Secs)			
								[==>]		[2]	
6	(COS.sp.828031)	(7) SN-1987A-COS	COS/FUV, TIME-TAG, PSA	G130M 1309 A	BUFFER-TIME=80 0; FP-POS=4			1744 Secs (1744 Secs)			
								[==>]		[2]	
7	(COS.sp.828031)	(7) SN-1987A-COS	COS/FUV, TIME-TAG, PSA	G130M 1318 A	BUFFER-TIME=80 0; FP-POS=3			1300 Secs (1300 Secs)			
								[==>]		[3]	
8	(COS.sp.828031)	(7) SN-1987A-COS	COS/FUV, TIME-TAG, PSA	G130M 1327 A	BUFFER-TIME=80 0; FP-POS=1			1744 Secs (1744 Secs)			
								[==>]		[3]	





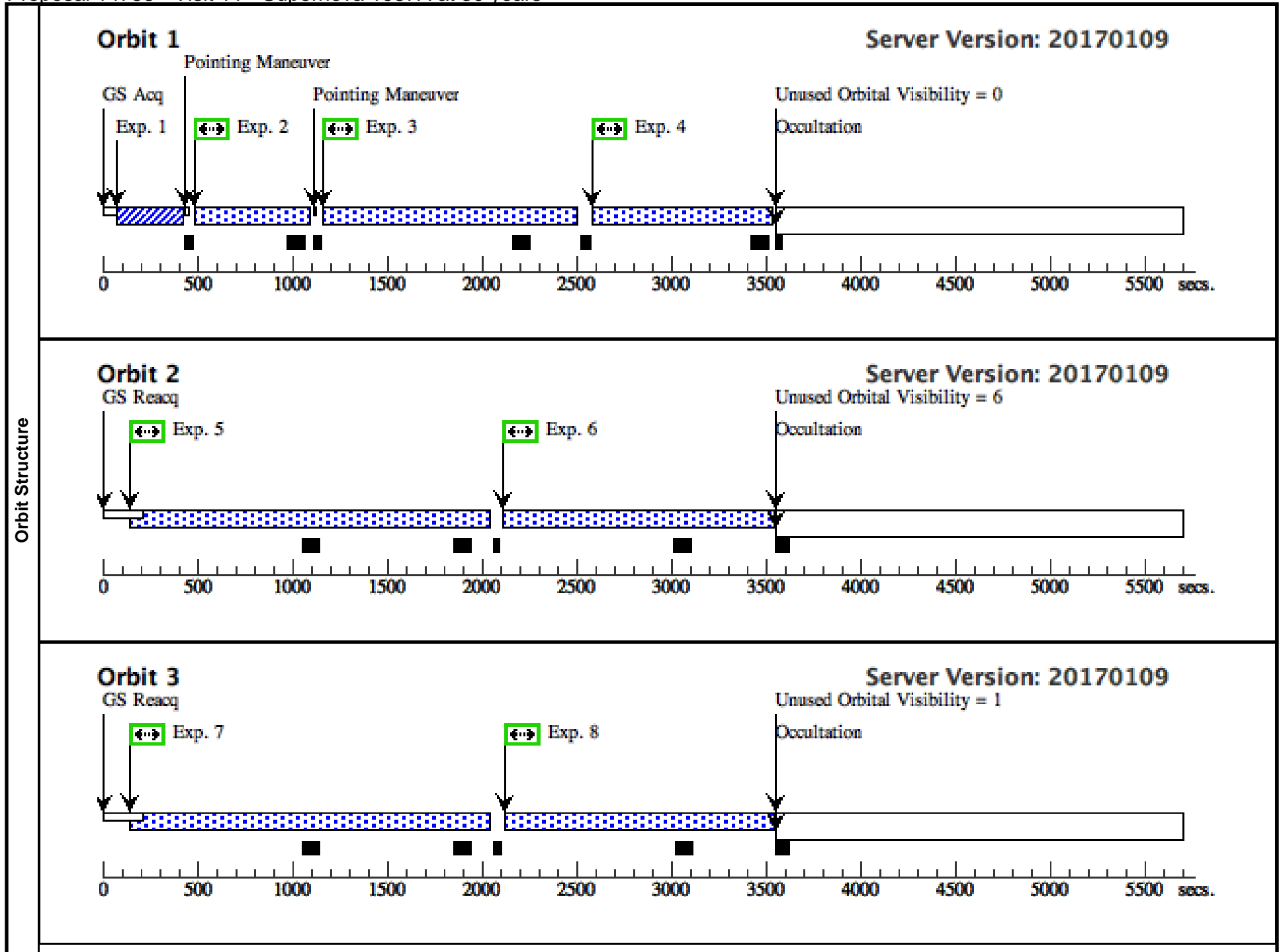
Proposal 14753 - Visit 11 - Supernova 1987A at 30 years

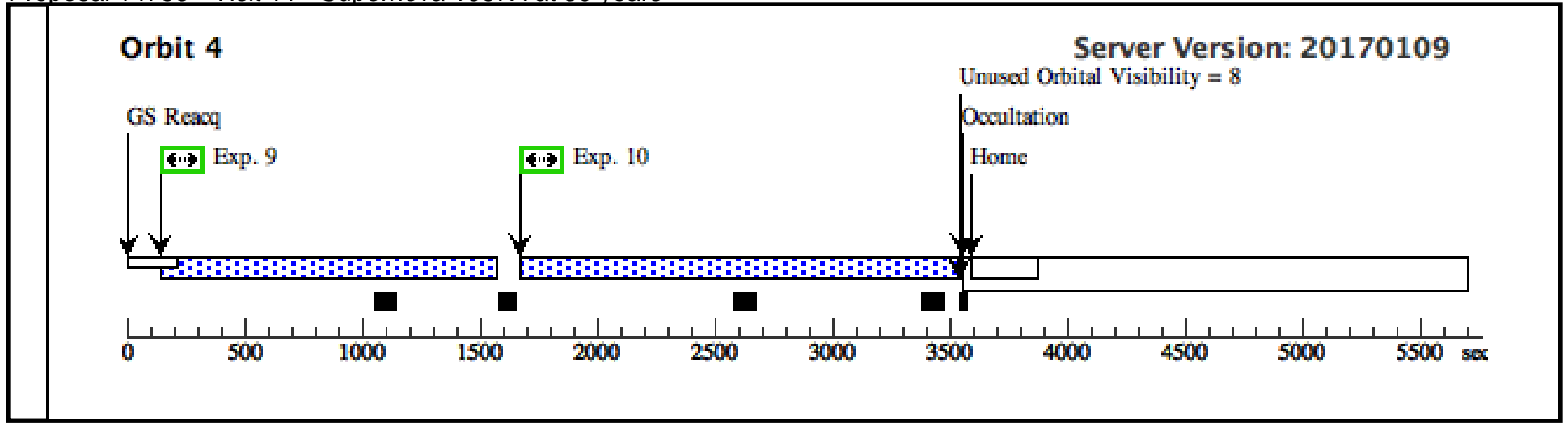
Thu Feb 02 02:01:59 GMT 2017

<b>Visit</b>	<p><b>Proposal 14753, Visit 11, implementation</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Scientific Instruments: COS/FUV, COS/NUV</p> <p>Special Requirements: SAME ORIENT AS 10; GROUP 11,10 WITHIN 1D; SEQ 10,11 WITHIN 1 D</p> <p><i>Comments: ideal angle is 75 same as visit 10. Note that an identical copy of these observations were carried out in Cycle 19. These data will allow us to inspect the relatively temporal variability of the lines and continuum.</i></p>																																			
	<p>(Visit 11) Warning (Orbit Planner): INEFFICIENT ORDERING OF FP-POS POSITIONS</p> <p>(Visit 11) Warning (Form): For the best data quality, it is strongly recommended that all four FP-POS positions be used when observing at a given COS CENWAVE setting.</p> <p>(Exposure 3 (Visit 11)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.</p> <p>(Exposure 4 (Visit 11)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.</p> <p>(Exposure 5 (Visit 11)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.</p> <p>(Exposure 6 (Visit 11)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.</p> <p>(Exposure 7 (Visit 11)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.</p> <p>(Exposure 8 (Visit 11)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.</p> <p>(Exposure 9 (Visit 11)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.</p> <p>(Exposure 10 (Visit 11)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.</p>																																			
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<b>Fixed Targets</b>	<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>(6)</td> <td>SN-1987A-COS-ACQ</td> <td>RA: 05 35 30.5100 (83.8771250d) Dec: -69 16 18.52 (-69.27181d) Equinox: J2000</td> <td></td> <td>V=16.071 B=15.915, U=15.029</td> <td>Reference Frame: ICRS</td> </tr> <tr> <td colspan="6"> <p><i>Comments: V=16.071, B-V=-0.156,U-B=-0.886,V-R=-0.057,V-I=-0.109</i></p> <p><i>B=15.915</i></p> <p><i>U=15.029</i></p> <p><i>COS.A351911, ACQ= MIRROR B + PSA</i></p> <p><i>Brightest pixel 18.753</i></p> <p><i>Count rate entire detector 515.776 ives: Time = 11.8457</i></p> <p><i>Extended=NO</i></p> </td> </tr> <tr> <td>(7)</td> <td>SN-1987A-COS</td> <td>Offset from SN-1987A-COS-ACQ RA Offset: -2.5 Secs Dec Offset: 7.6 Arcsec</td> <td></td> <td>V=23.0</td> <td>Offset Position (SN-1987A-COS)</td> </tr> <tr> <td colspan="6"> <p><i>Comments: This object was generated by the targetselector and retrieved from the NED database.</i></p> <p><i>Extended=YES</i></p> </td> </tr> </tbody> </table>	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous	(6)	SN-1987A-COS-ACQ	RA: 05 35 30.5100 (83.8771250d) Dec: -69 16 18.52 (-69.27181d) Equinox: J2000		V=16.071 B=15.915, U=15.029	Reference Frame: ICRS	<p><i>Comments: V=16.071, B-V=-0.156,U-B=-0.886,V-R=-0.057,V-I=-0.109</i></p> <p><i>B=15.915</i></p> <p><i>U=15.029</i></p> <p><i>COS.A351911, ACQ= MIRROR B + PSA</i></p> <p><i>Brightest pixel 18.753</i></p> <p><i>Count rate entire detector 515.776 ives: Time = 11.8457</i></p> <p><i>Extended=NO</i></p>						(7)	SN-1987A-COS	Offset from SN-1987A-COS-ACQ RA Offset: -2.5 Secs Dec Offset: 7.6 Arcsec		V=23.0	Offset Position (SN-1987A-COS)	<p><i>Comments: This object was generated by the targetselector and retrieved from the NED database.</i></p> <p><i>Extended=YES</i></p>										
	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous																														
(6)	SN-1987A-COS-ACQ	RA: 05 35 30.5100 (83.8771250d) Dec: -69 16 18.52 (-69.27181d) Equinox: J2000		V=16.071 B=15.915, U=15.029	Reference Frame: ICRS																															
<p><i>Comments: V=16.071, B-V=-0.156,U-B=-0.886,V-R=-0.057,V-I=-0.109</i></p> <p><i>B=15.915</i></p> <p><i>U=15.029</i></p> <p><i>COS.A351911, ACQ= MIRROR B + PSA</i></p> <p><i>Brightest pixel 18.753</i></p> <p><i>Count rate entire detector 515.776 ives: Time = 11.8457</i></p> <p><i>Extended=NO</i></p>																																				
(7)	SN-1987A-COS	Offset from SN-1987A-COS-ACQ RA Offset: -2.5 Secs Dec Offset: 7.6 Arcsec		V=23.0	Offset Position (SN-1987A-COS)																															
<p><i>Comments: This object was generated by the targetselector and retrieved from the NED database.</i></p> <p><i>Extended=YES</i></p>																																				

Proposal 14753 - Visit 11 - Supernova 1987A at 30 years

Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit	
	1	(COS.A351 911)	(6) SN-1987A-COS- ACQ	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				14 Secs (14 Secs) [==>]	[1]	
	<i>Comments: COS.A351911</i> <i>Model ID = 98217</i> <i>+ Kurucz (B3V): Temp = 18700, LogZ = 0.0, Logg = 3.9</i> <i>. Renormalized to Johnson U = 15.03 in magnitudes relative to Vega</i> <i>COS.A351916 Kurucz (B5V): Temp = 15400,</i> <i>I average the two.. 12 seconds with B3V, and 16 seconds with B5V</i>										
	2	(COS.A331 366)	(7) SN-1987A-COS	COS/NUV, TIME-TAG, PSA	MIRRORB	BUFFER-TIME=49 0			600 Secs (600 Secs) [==>]	[1]	
	<i>Comments: star 3: V=15.60 B-V 0.46 U-B -0.89</i> <i>V = 15.60 B=16.06 U=15.17 B3 star</i> <i>Exposure ID: COS.A331360</i>  <i>If the aperture falls on nearby star 3;COS.A331366</i> <i>Brightest pixel 16.484</i> <i>Count rate entire detector 491.586</i> <i>Exposure time (seconds) = 600.0000</i> <i>Model ID = 96513</i> <i>+ Kurucz (B3V): Temp = 18700, LogZ = 0.0, Logg = 3.9</i> <i>. Renormalized to Johnson U = 15.17 in magnitudes relative to Vega</i>  <i>The distance between star 3 and the edge of the COS aperture is 0.69",</i> <i>figure 7.1 show the throughput is 0.7</i>										
	3	(COS.sp.828 032)	(7) SN-1987A-COS	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=80 0; FP-POS=1			1124 Secs (1124 Secs) [==>]	[1]	
	4	(COS.sp.828 032)	(7) SN-1987A-COS	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=80 0; FP-POS=2			900 Secs (900 Secs) [==>]	[1]	
	5	(COS.sp.828 032)	(7) SN-1987A-COS	COS/FUV, TIME-TAG, PSA	G160M 1589 A	BUFFER-TIME=80 0; FP-POS=3			1776 Secs (1776 Secs) [==>]	[2]	
	6	(COS.sp.828 032)	(7) SN-1987A-COS	COS/FUV, TIME-TAG, PSA	G160M 1600 A	BUFFER-TIME=80 0; FP-POS=4			1300 Secs (1300 Secs) [==>]	[2]	
	7	(COS.sp.828 032)	(7) SN-1987A-COS	COS/FUV, TIME-TAG, PSA	G160M 1611 A	BUFFER-TIME=80 0; FP-POS=4			1778 Secs (1778 Secs) [==>]	[3]	
8	(COS.sp.828 032)	(7) SN-1987A-COS	COS/FUV, TIME-TAG, PSA	G160M 1611 A	BUFFER-TIME=80 0; FP-POS=1			1300 Secs (1300 Secs) [==>]	[3]		
9	(COS.sp.828 032)	(7) SN-1987A-COS	COS/FUV, TIME-TAG, PSA	G160M 1589 A	BUFFER-TIME=80 0; FP-POS=2			1300 Secs (1300 Secs) [==>]	[4]		
10	(COS.sp.828 032)	(7) SN-1987A-COS	COS/FUV, TIME-TAG, PSA	G160M 1623 A	BUFFER-TIME=80 0; FP-POS=3			1730 Secs (1730 Secs) [==>]	[4]		



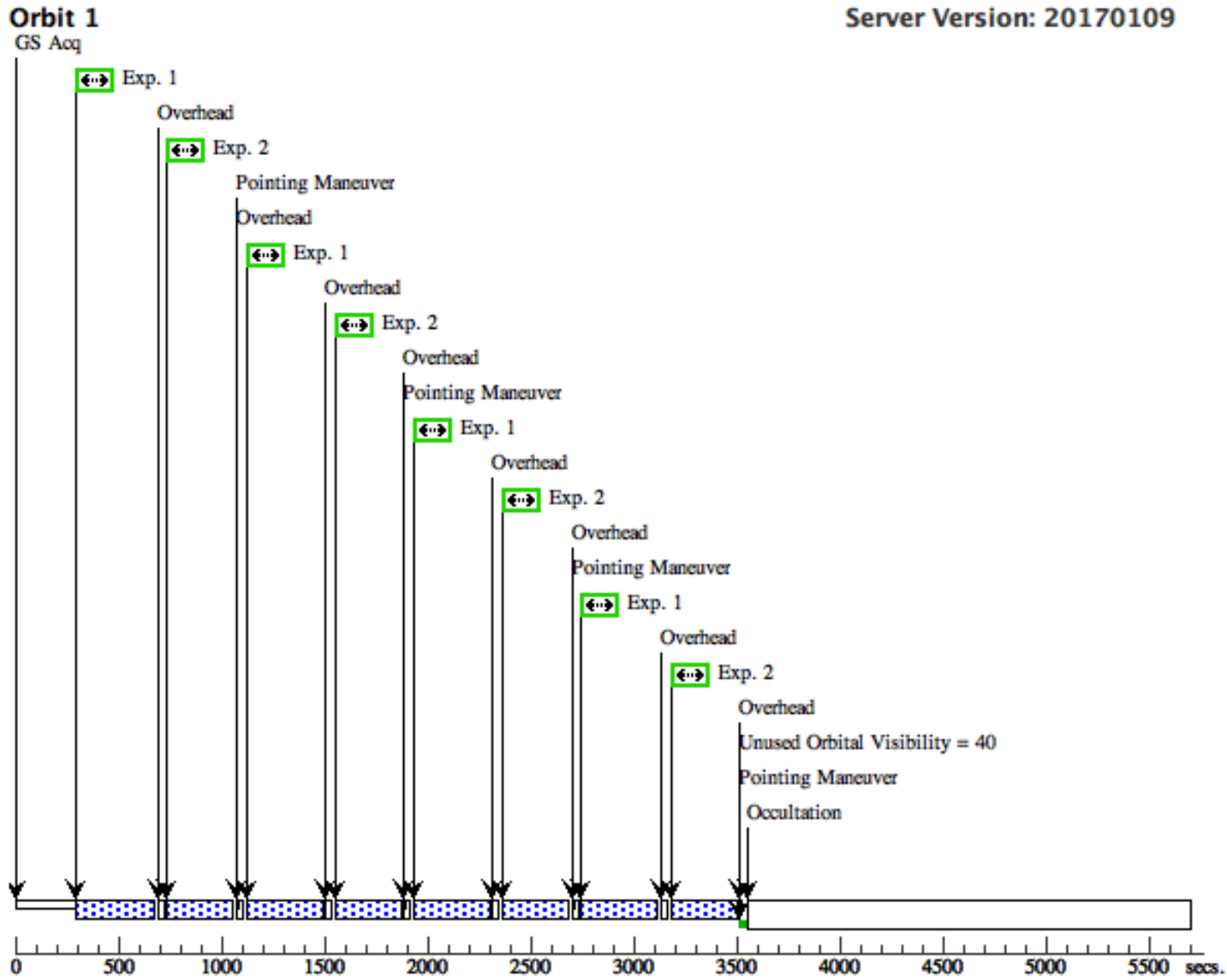


Proposal 14753 - Visit 20 - Supernova 1987A at 30 years

Thu Feb 02 02:01:59 GMT 2017

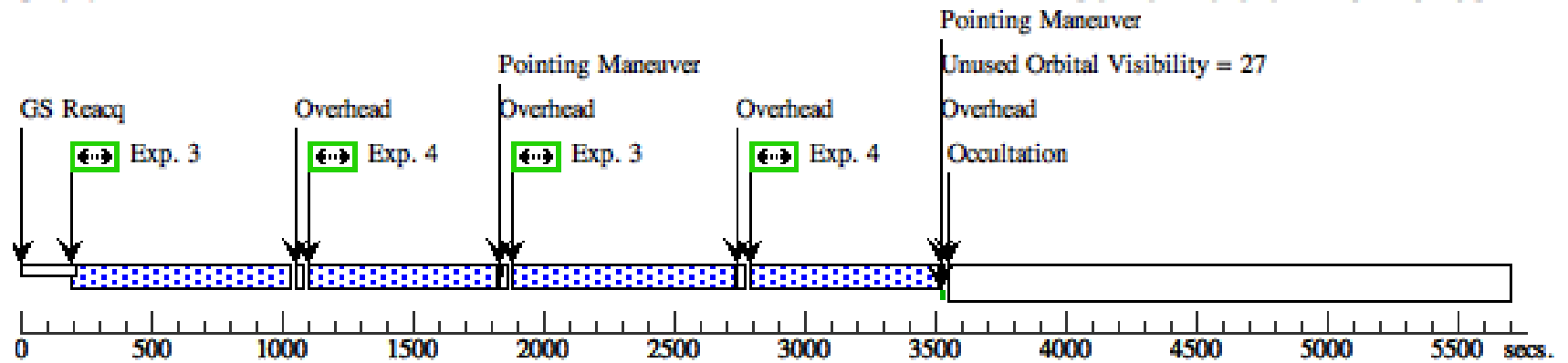
Visit	<b>Proposal 14753, Visit 20, implementation</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: WFC3/UVIS Special Requirements: BETWEEN 01-AUG-2017:00:00:00 AND 30-AUG-2017:00:00:00									
	Patterns	#	Primary Pattern	Secondary Pattern	Exposures					
	(1)	Pattern Type=WFC3-UVIS-DITHER-BOX 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		(1-2), (3-4)					
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(8)	SN-1987A	RA: 05 35 28.0200 (83.8667500d) Dec: -69 16 11.07 (-69.26974d) Equinox: J2000		V=4.81	Reference Frame: SIMBAD				
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i> Extended=NO										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(8) SN-1987A	(8) SN-1987A	WFC3/UVIS, ACCUM, UVIS2-M512C-SUB	F438W	CR-SPLIT=NO; FLASH=10		Pattern 1, Exps 1-2 in Visit 20 (1)	350 Secs (1400 Secs)	
									[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]
	2	(8) SN-1987A	(8) SN-1987A	WFC3/UVIS, ACCUM, UVIS2-M512C-SUB	F625W	CR-SPLIT=NO; FLASH=5		Pattern 1, Exps 1-2 in Visit 20 (1)	300 Secs (1200 Secs)	
									[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]
3	(8) SN-1987A	(8) SN-1987A	WFC3/UVIS, ACCUM, UVIS2-M512C-SUB	F502N	CR-SPLIT=NO; FLASH=12		Pattern 1, Exps 3-4 in Visit 20 (1)	825 Secs (3300 Secs)		
								[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[2]	
4	(8) SN-1987A	(8) SN-1987A	WFC3/UVIS, ACCUM, UVIS2-M512C-SUB	F657N	CR-SPLIT=NO; FLASH=12		Pattern 1, Exps 3-4 in Visit 20 (1)	700 Secs (2800 Secs)		
								[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[2]	
								[==>(Pattern 3)] [==>(Pattern 4)]	[3]	

Orbit Structure



### Orbit 2

Server Version: 20170109



### Orbit 3

Server Version: 20170109

