13757 - The Progenitor System of a Peculiar Thermonuclear White-Dwarf Supernova

Cycle: 22, Proposal Category: GO

(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) SN-2012Z	ACS/WFC	3	23-Jul-2014 21:30:58.0	yes
02	(1) SN-2012Z	ACS/WFC	3	23-Jul-2014 21:31:00.0	yes
03	(1) SN-2012Z	ACS/WFC	3	23-Jul-2014 21:31:01.0	yes
04	(1) SN-2012Z	ACS/WFC	3	23-Jul-2014 21:31:03.0	yes
05	(1) SN-2012Z	ACS/WFC	2	23-Jul-2014 21:31:03.0	yes

14 Total Orbits Used

ABSTRACT

Type Ia supernovae (SN Ia) have enormous importance to cosmology and astrophysics, but their progenitors and explosion mechanisms are not known in detail. Recently, observations and theoretical models have suggested that not all thermonuclear white-dwarf supernova explosions are normal SN Ia. In particular, type Iax supernovae (peculiar cousins to SN Ia), are also thought to be exploding white dwarfs. In deep and serendipitous HST pre-explosion data, we have discovered a luminous, blue progenitor system for the type Iax SN 2012Z in NGC 1309. The light in this system, called S1, could be dominated by: a companion star to the exploding white dwarf, accretion onto the exploding white dwarf, a massive star that exploded (suggesting SN Iax are not in fact white-dwarf supernovae), or if we were very unlucky, an unrelated star in a chance alignment. Here we propose HST Cycle 22 ACS/WFC optical imaging to see what, if anything, has happened to S1. These data will allow us to definitively confirm and characterize what may be the first progenitor system discovered for a thermonuclear white dwarf supernova.

OBSERVING DESCRIPTION

We will obtain late-time optical ACS/WFC BVI images at the location of SN~2012Z in NGC 1309 to look for changes from the progenitor system S1. Our best measurement of any changes from the pre-explosion images will come from image-subtraction analysis. As such, it is important for our new observations to be taken with ACS in the same filters as the pre-explosion data. We will use dithering and subsampling to improve the spatial resolution of the ACS images, as we did in our analysis of the pre-explosion images to identify the progenitor.

To measure a meaningful change in S1, we will aim for S/N $\simeq$ 10 at the brightness of S1 in the new F435W and F555W images, and S/N $\simeq$ 7 in F814W. Based on the ACS/WFC ETC, we require ~9500 sec of exposure in F435W, ~12500 sec in F555W, and ~12500 sec in F814W. With overheads, this requires 14 orbits. With these depths, we will be able to definitively state whether S1 has remained consistent with the pre-explosion photometry, brightened, reddened, faded, or disappeared.

We want the SN itself to fade as much as possible, so we need to schedule the new observations at the end of Cycle 22 (late 2015).

We are also interested in checking for variability in S1, so we have designed our observations in 5 visits; 4 in F435W, F555W, and F814W and one in just F555W and F814W.

Visit

Proposal 13757, Visit 01

Thu Jul 24 01:31:05 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: SCHED 70%; ORIENT 240D TO 80 D; AFTER 01-SEP-2015:00:00:00

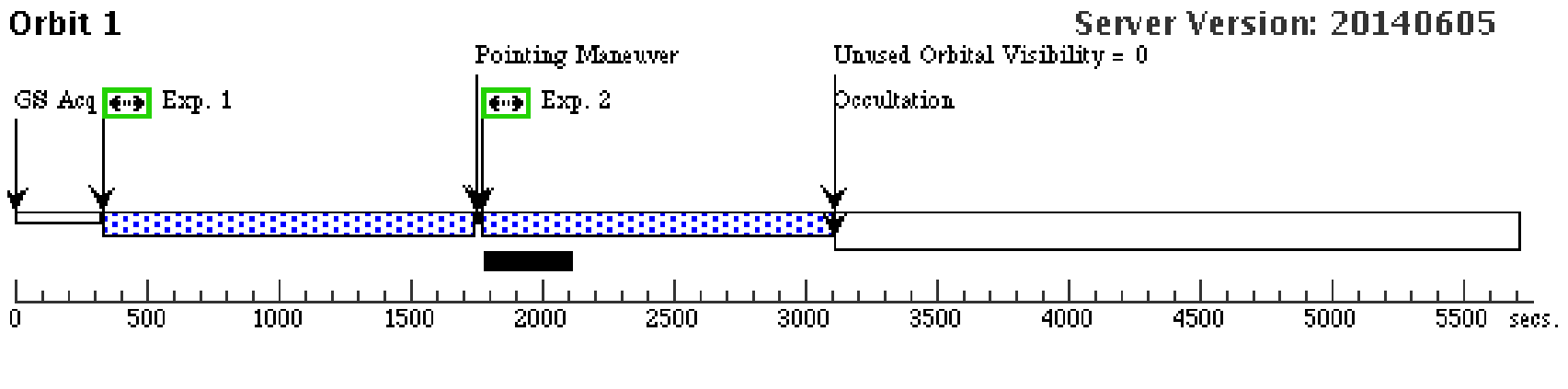
Fixed Targets

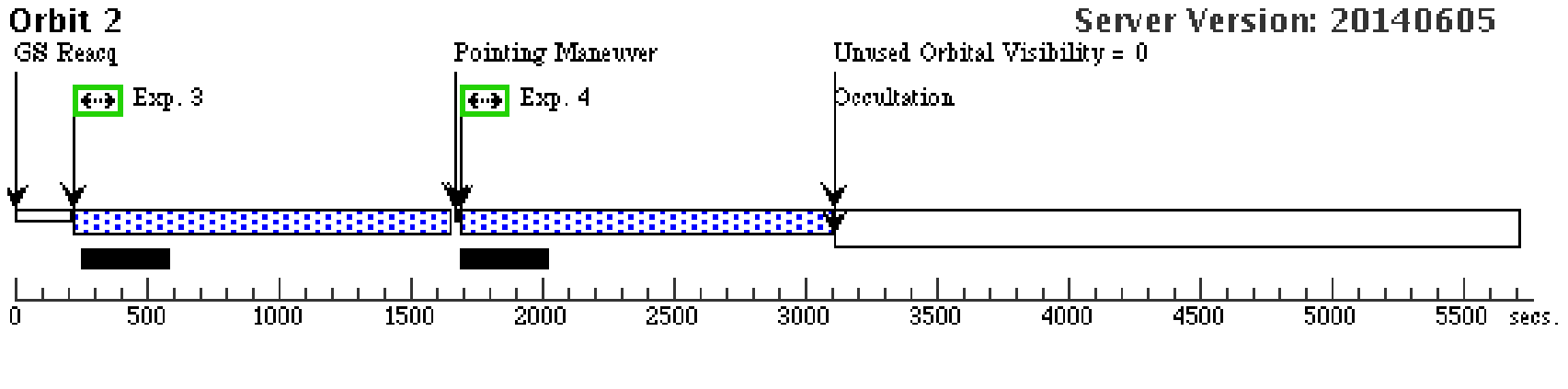
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SN-2012Z	RA: 03 22 5.3500 (50.5222917d) Dec: -15 23 15.60 (-15.38767d) Equinox: J2000		V=27.6+/-2.0	Reference Frame: ICRS

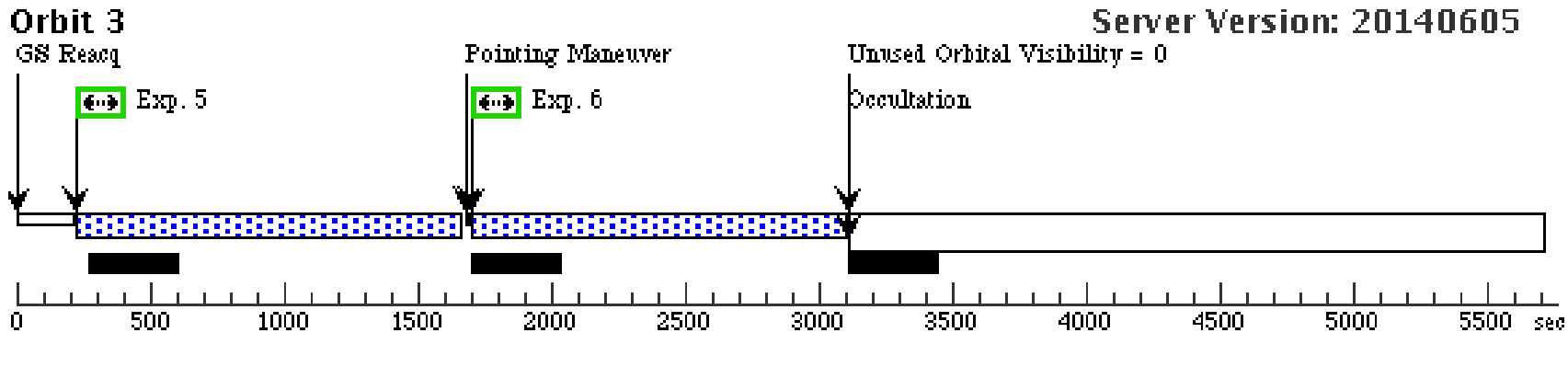
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) SN-2012Z	ACS/WFC, ACCUM, WFC1	F435W		POS TARG 0.000,0.000		1203 Secs (1203 Secs)	
								[==>]	***[1]***
2		(1) SN-2012Z	ACS/WFC, ACCUM, WFC1	F435W		POS TARG 0.247,0.094		1203 Secs (1203 Secs)	
								[==>]	***[1]***
3		(1) SN-2012Z	ACS/WFC, ACCUM, WFC1	F814W		POS TARG 0.247,0.094		1289 Secs (1289 Secs)	
								[==>]	***[2]***
4		(1) SN-2012Z	ACS/WFC, ACCUM, WFC1	F814W		POS TARG 0.000,0.000		1288 Secs (1288 Secs)	
								[==>]	***[2]***
5		(1) SN-2012Z	ACS/WFC, ACCUM, WFC1	F555W		POS TARG 0.000,0.000		1280 Secs (1280 Secs)	
								[==>]	***[3]***
6		(1) SN-2012Z	ACS/WFC, ACCUM, WFC1	F555W		POS TARG 0.247,0.094		1279 Secs (1279 Secs)	
								[==>]	***[3]***

Orbit Structure







Visit

Proposal 13757, Visit 02

Thu Jul 24 01:31:05 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: SCHED 70%; SAME ORIENT AS 01; AFTER 01-SEP-2015:00:00:00

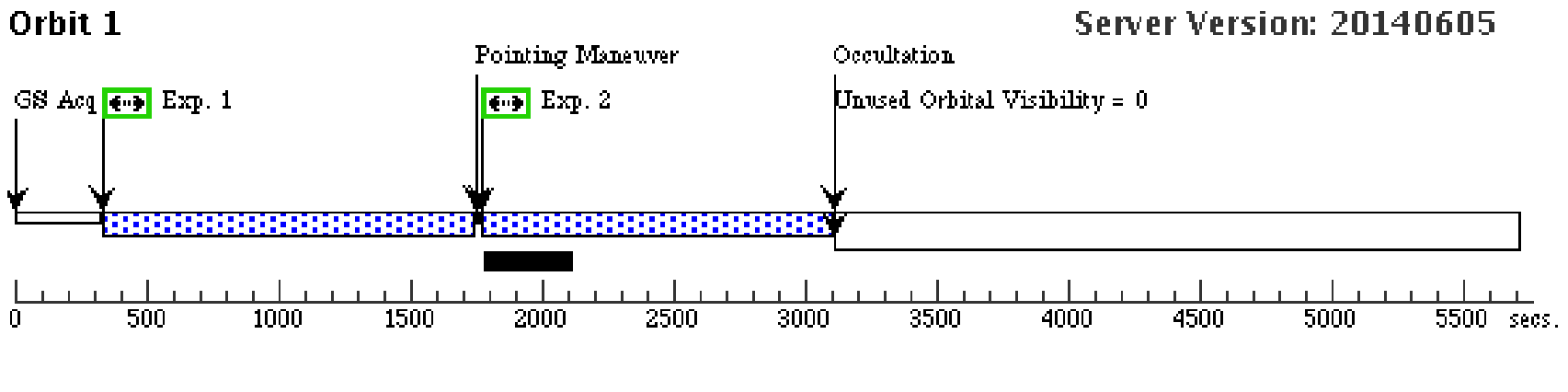
Fixed Targets

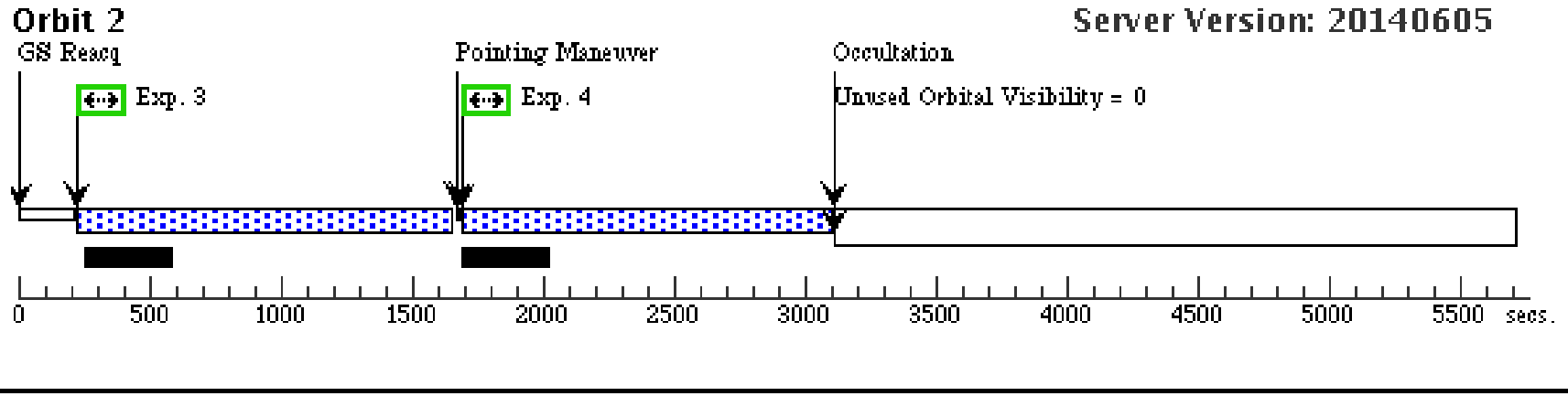
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SN-2012Z	RA: 03 22 5.3500 (50.5222917d) Dec: -15 23 15.60 (-15.38767d) Equinox: J2000		V=27.6+/-2.0	Reference Frame: ICRS

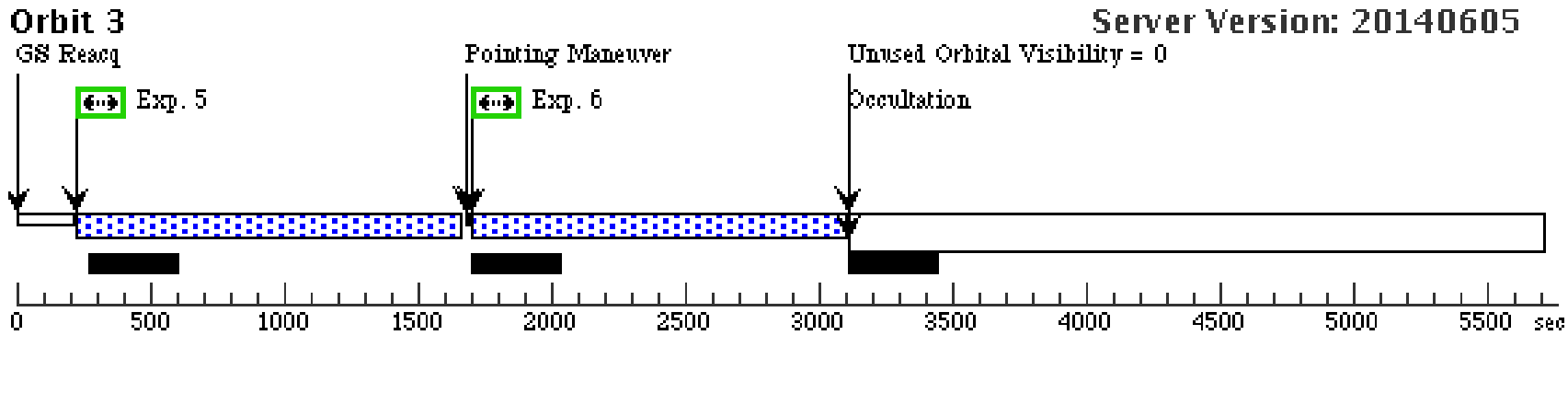
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) SN-2012Z	ACS/WFC, ACCUM, WFC1	F435W		POS TARG 0.124,0.232		1203 Secs (1203 Secs) *[==>]*	***[1]***
2		(1) SN-2012Z	ACS/WFC, ACCUM, WFC1	F435W		POS TARG -0.124,0.138		1203 Secs (1203 Secs) *[==>]*	***[1]***
3		(1) SN-2012Z	ACS/WFC, ACCUM, WFC1	F814W		POS TARG -0.124,0.138		1289 Secs (1289 Secs) *[==>]*	***[2]***
4		(1) SN-2012Z	ACS/WFC, ACCUM, WFC1	F814W		POS TARG 0.124,0.232		1288 Secs (1288 Secs) *[==>]*	***[2]***
5		(1) SN-2012Z	ACS/WFC, ACCUM, WFC1	F555W		POS TARG 0.124,0.232		1280 Secs (1280 Secs) *[==>]*	***[3]***
6		(1) SN-2012Z	ACS/WFC, ACCUM, WFC1	F555W		POS TARG -0.124,0.138		1279 Secs (1279 Secs) *[==>]*	***[3]***

Orbit Structure







Visit

Proposal 13757, Visit 03 Thu Jul 24 01:31:05 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: SCHED 70%; SAME ORIENT AS 01; AFTER 01-SEP-2015:00:00:00

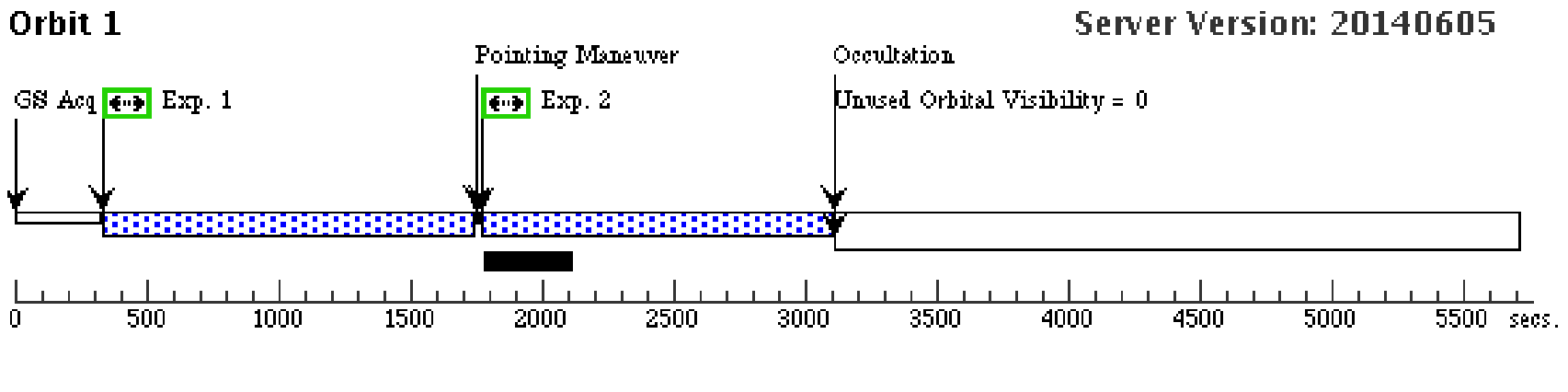
Fixed Targets

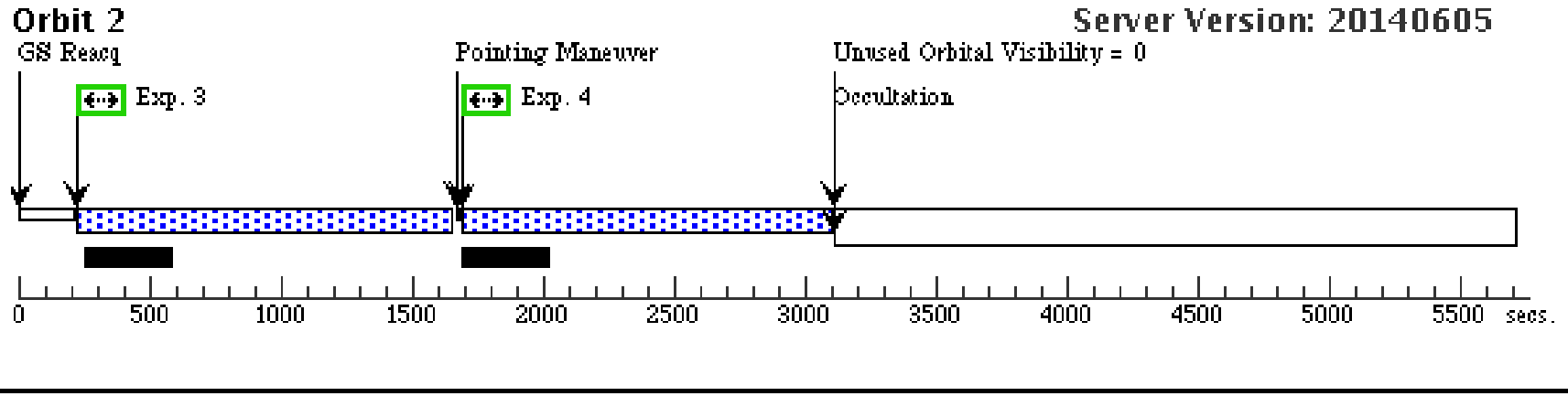
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SN-2012Z	RA: 03 22 5.3500 (50.5222917d) Dec: -15 23 15.60 (-15.38767d) Equinox: J2000		V=27.6+/-2.0	Reference Frame: ICRS

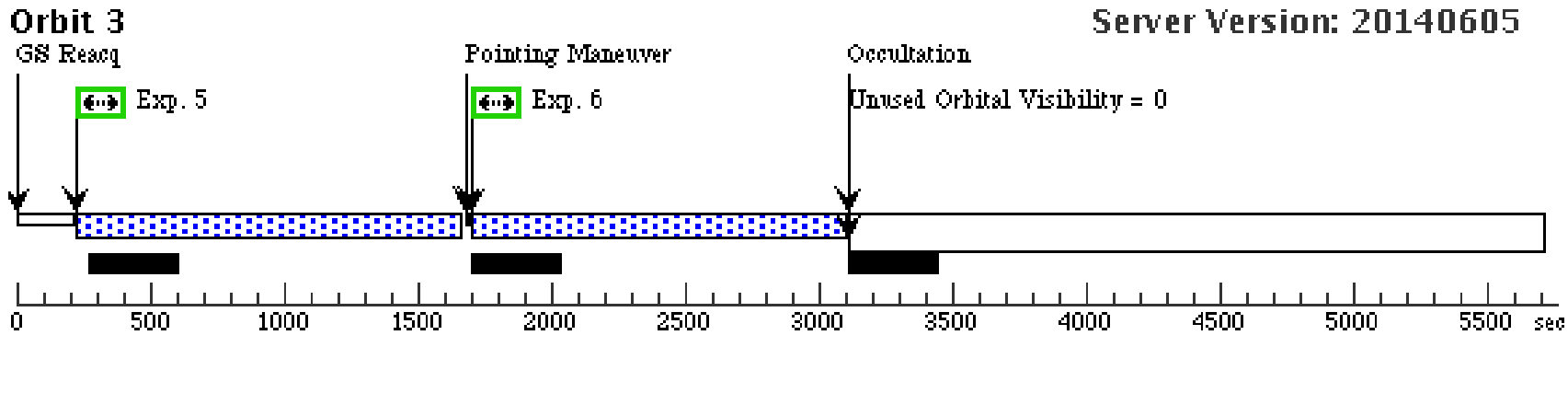
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) SN-2012Z	ACS/WFC, ACCUM, WFC1	F435W		POS TARG 0.000,0.000		1203 Secs (1203 Secs)	
								[==>]	***[1]***
2		(1) SN-2012Z	ACS/WFC, ACCUM, WFC1	F435W		POS TARG 0.247,0.094		1203 Secs (1203 Secs)	
								[==>]	***[1]***
3		(1) SN-2012Z	ACS/WFC, ACCUM, WFC1	F814W		POS TARG 0.247,0.094		1289 Secs (1289 Secs)	
								[==>]	***[2]***
4		(1) SN-2012Z	ACS/WFC, ACCUM, WFC1	F814W		POS TARG 0.000,0.000		1288 Secs (1288 Secs)	
								[==>]	***[2]***
5		(1) SN-2012Z	ACS/WFC, ACCUM, WFC1	F555W		POS TARG 0.000,0.000		1280 Secs (1280 Secs)	
								[==>]	***[3]***
6		(1) SN-2012Z	ACS/WFC, ACCUM, WFC1	F555W		POS TARG 0.247,0.094		1279 Secs (1279 Secs)	
								[==>]	***[3]***

Orbit Structure







Visit

Proposal 13757, Visit 04 Thu Jul 24 01:31:05 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: SCHED 70%; SAME ORIENT AS 01; AFTER 01-SEP-2015:00:00:00

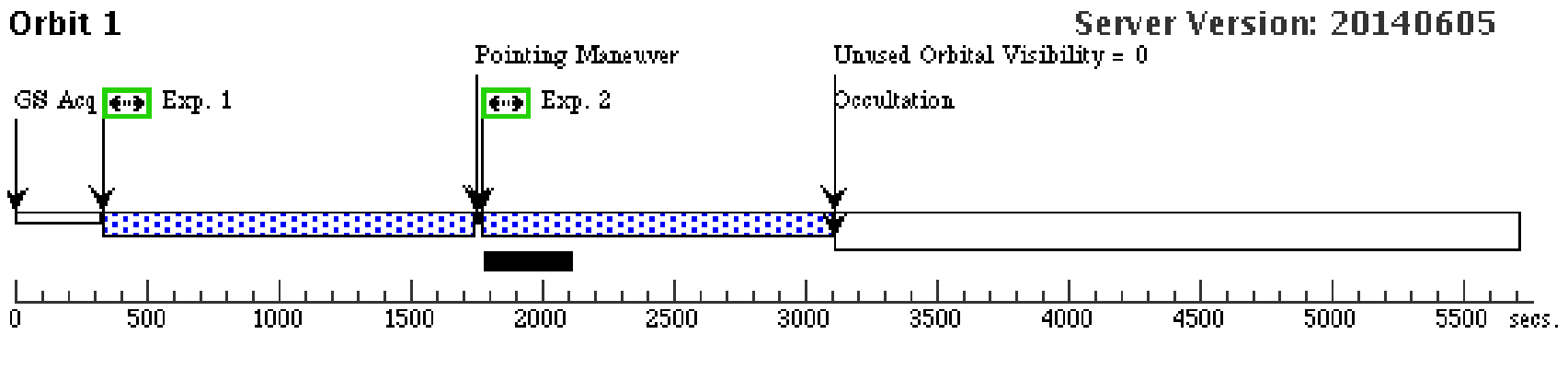
Fixed Targets

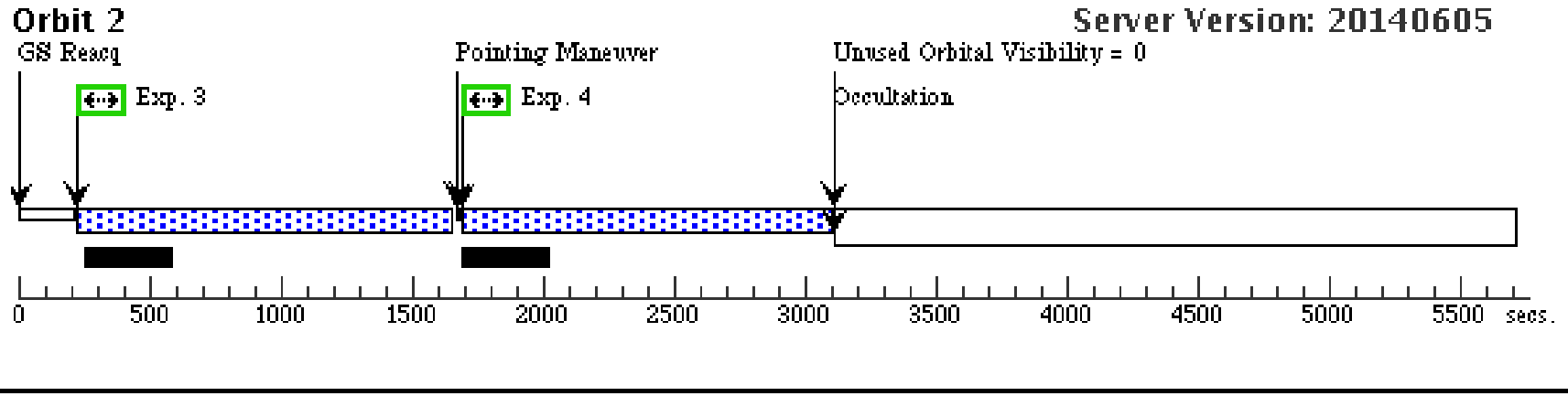
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SN-2012Z	RA: 03 22 5.3500 (50.5222917d) Dec: -15 23 15.60 (-15.38767d) Equinox: J2000		V=27.6+/-2.0	Reference Frame: ICRS

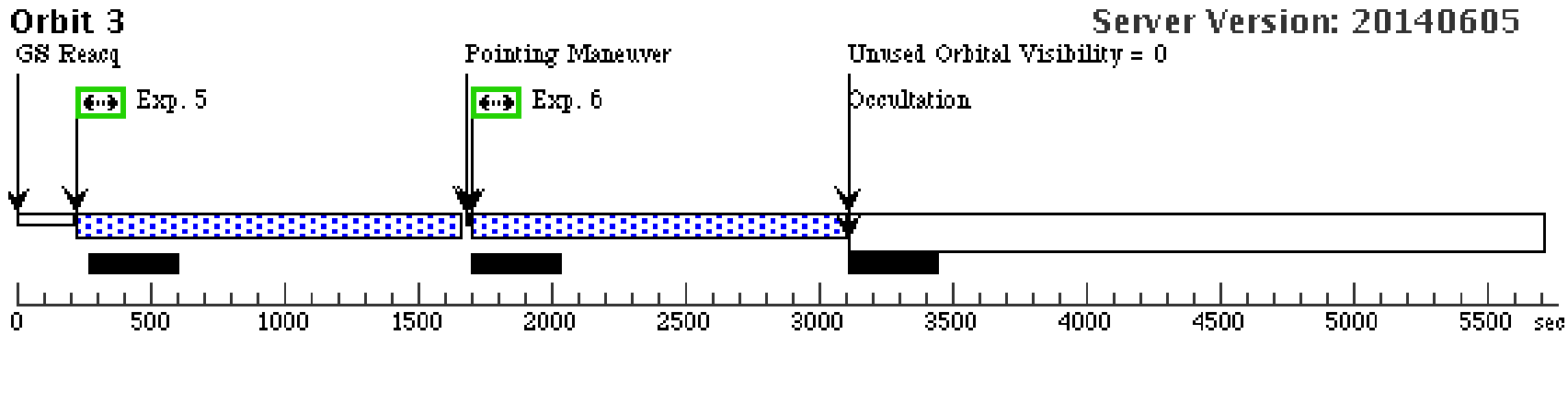
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) SN-2012Z	ACS/WFC, ACCUM, WFC1	F435W		POS TARG 0.124,0.232		1203 Secs (1203 Secs)	
								[==>]	***[1]***
2		(1) SN-2012Z	ACS/WFC, ACCUM, WFC1	F435W		POS TARG -0.124,0.138		1203 Secs (1203 Secs)	
								[==>]	***[1]***
3		(1) SN-2012Z	ACS/WFC, ACCUM, WFC1	F814W		POS TARG -0.124,0.138		1289 Secs (1289 Secs)	
								[==>]	***[2]***
4		(1) SN-2012Z	ACS/WFC, ACCUM, WFC1	F814W		POS TARG 0.124,0.232		1288 Secs (1288 Secs)	
								[==>]	***[2]***
5		(1) SN-2012Z	ACS/WFC, ACCUM, WFC1	F555W		POS TARG 0.124,0.232		1280 Secs (1280 Secs)	
								[==>]	***[3]***
6		(1) SN-2012Z	ACS/WFC, ACCUM, WFC1	F555W		POS TARG -0.124,0.138		1279 Secs (1279 Secs)	
								[==>]	***[3]***

Orbit Structure







Visit

Proposal 13757, Visit 05

Thu Jul 24 01:31:06 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: SCHED 70%; SAME ORIENT AS 01; AFTER 01-SEP-2015:00:00:00

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SN-2012Z	RA: 03 22 5.3500 (50.5222917d) Dec: -15 23 15.60 (-15.38767d) Equinox: J2000		V=27.6+/-2.0	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) SN-2012Z	ACS/WFC, ACCUM, WFC1	F555W		POS TARG 0.000,0.000		1203 Secs (1203 Secs) *[==>]*	 ***[1]***
2		(1) SN-2012Z	ACS/WFC, ACCUM, WFC1	F555W		POS TARG 0.247,0.094		1203 Secs (1203 Secs) *[==>]*	 ***[1]***
3		(1) SN-2012Z	ACS/WFC, ACCUM, WFC1	F814W		POS TARG 0.247,0.094		1280 Secs (1280 Secs) *[==>]*	 ***[2]***
4		(1) SN-2012Z	ACS/WFC, ACCUM, WFC1	F814W		POS TARG 0.000,0.000		1280 Secs (1280 Secs) *[==>]*	 ***[2]***

Orbit Structure