12503 - The True Origin of Hypervelocity Stars

Cycle: 19, 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) SDSSJ090745.0+024507	WFC3/UVIS	2	19-Oct-2012 21:01:14.0	yes
02	(2) SDSSJ093320.86+441705.4	WFC3/UVIS	2	19-Oct-2012 21:01:29.0	yes
03	(3) HE0437-5439	WFC3/UVIS	2	19-Oct-2012 21:01:44.0	yes
04	(4) SDSSJ091301.0+305120	WFC3/UVIS	2	19-Oct-2012 21:01:58.0	yes

8 Total Orbits Used

ABSTRACT

We propose to obtain WFC3 images of 4 hypervelocity stars in the Galactic halo, in order to conclusively establish their origin. This will be a final epoch of a long-term program to measure precise proper motions in an absolute inertial frame. The origin of these unique stars with extremely large

positive radial velocities, in excess of the escape speed from the Galaxy, is consistent only with being ejected by the massive black hole at the Galactic center. Reconstructing the full three-dimensional space motion of these stars, through astrometric proper motions, provides a unique opportunity to measure the shape of the triaxial dark matter halo, at larger distances than is afforded by tidal streams. In Cycles 15 and 17 our team obtained two epochs of observations for these stars with ACS. The accuracy of the proper motion measurement was affected by the CTE degradation in ACS and the unexpected change in the PSF after SM4. The CTE error of HVS3 was unfortunately amplified by the need to use different guide stars and take the second-epoch observations at a 180 degree different orientation. We request third-epoch observations for 4 targets with WFC3 to double the proper motion baseline to 5-6 years and to reduce the systematic error using our newly-developed CTE correction. The new measurement will conclusively confirm or reject the Galactocentric origin of HVSs.

OBSERVING DESCRIPTION

These are 3rd-epoch images of 4 hypervelocity stars, aimed at determining precise proper motions relative to background galaxies. The 1st and 2nd epochs were observed with ACS, but for the 3rd epoch we are changing to WFC3/UVIS.

We will spend 2 orbits on each of the 4 targets. During the first orbit, we take dithered exposures centered around the center of the UVIS1 chip, and during the 2nd orbit they are dithered around the center of the UVIS2 chip. We have specified ORIENT angles such that the long direction of the chips will be parallel to what we used for the long direction of the ACS chips at the 1st and 2nd epochs. We also use the same filters that were used with ACS (F814W for 3 of the stars, F850LP for one of them). The AFTER dates are set so that we will observed about 3 years since the more recent ACS observation.

Visit

Proposal 12503, Visit 01, implementation Sat Oct 20 01:02:06 GMT 2012

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SCHED 70%; ORIENT 54.941093D TO 54.941093 D; ORIENT 234.941093D TO 234.941093 D; AFTER 30-SEP-2012

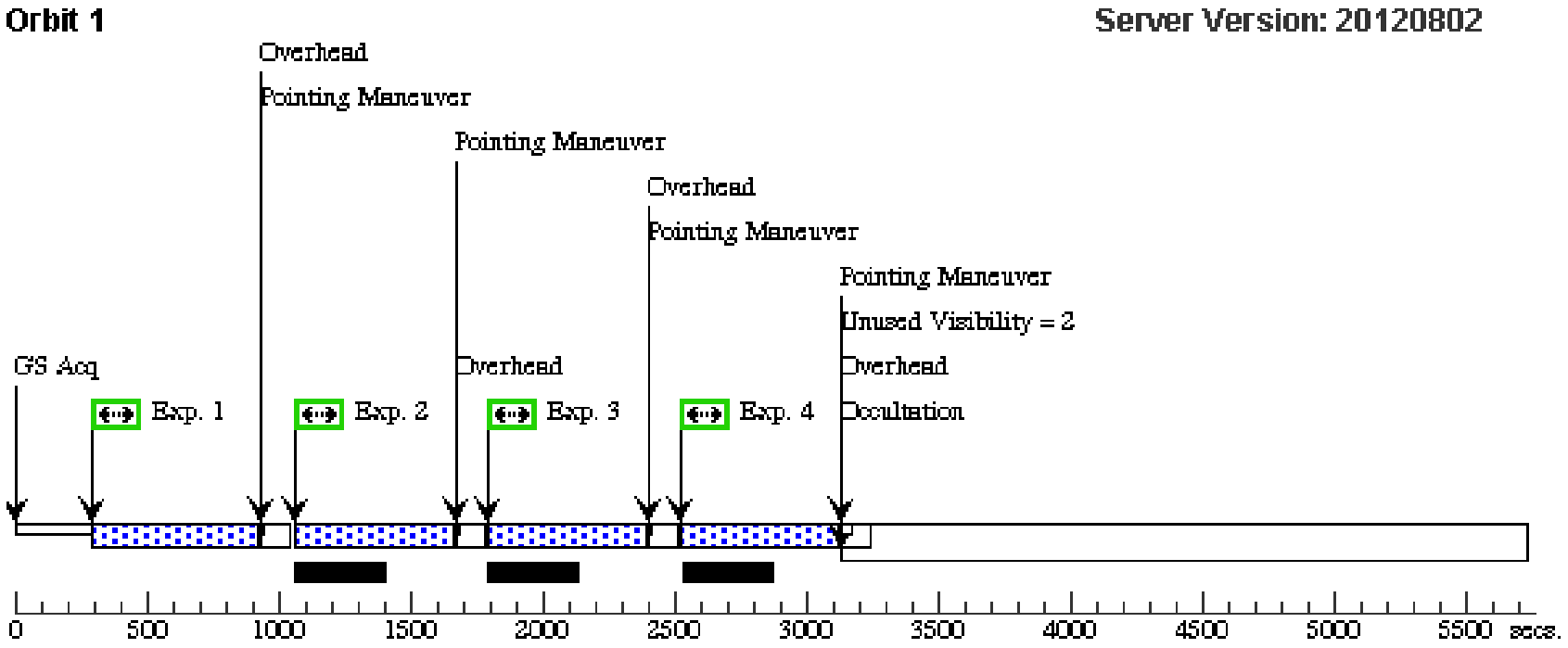
Fixed Targets

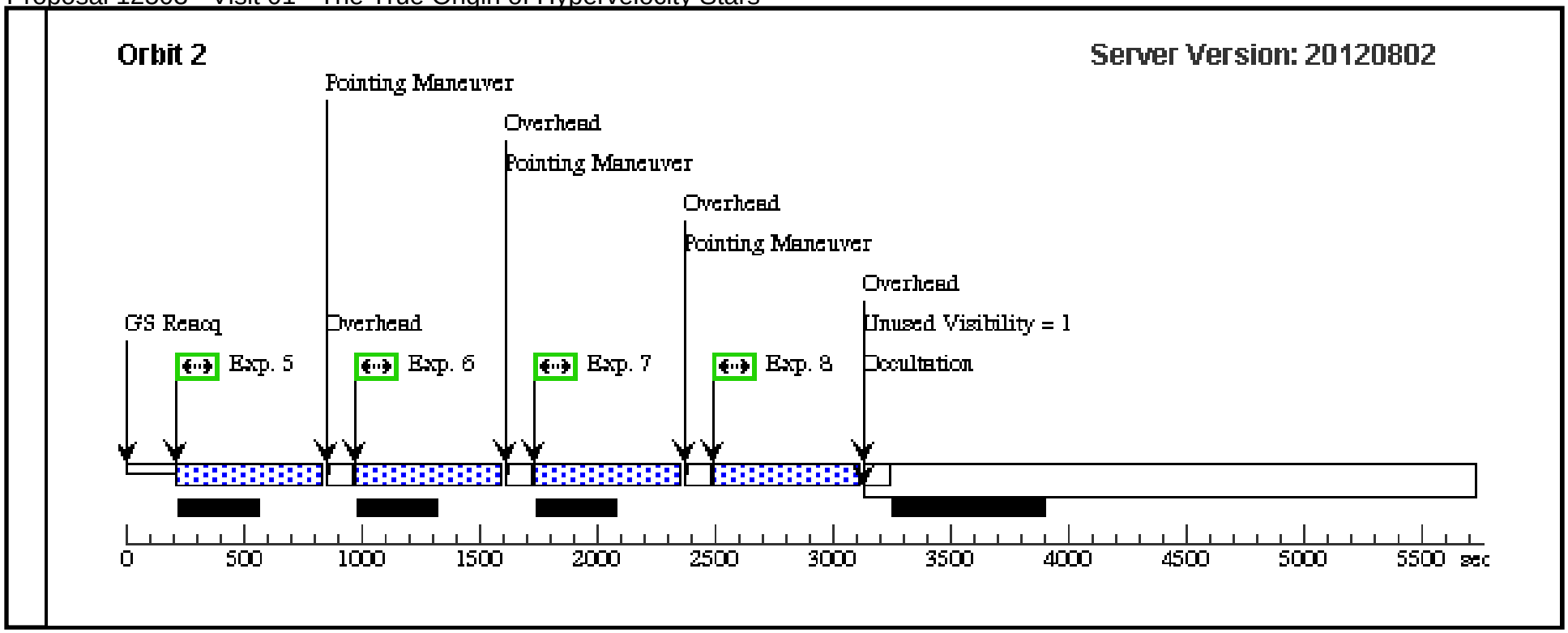
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SDSSJ090745.0+024507 Alt Name1: HVS1	RA: 09 07 44.9900 (136.9374583d) Dec: +02 45 6.40 (2.75178d) Equinox: J2000		V=19.96+/-0.2	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) SDSSJ090745.0+024507	WFC3/UVIS, ACCUM, UVIS1	F814W	CR-SPLIT=NO; FLASH=9	POS TARG -0.23702,-0.13447		600 Secs *[==>598.0 Secs]*	 ***[1]***
2		(1) SDSSJ090745.0+024507	WFC3/UVIS, ACCUM, UVIS1	F814W	CR-SPLIT=NO; FLASH=9	POS TARG 0.11851,-0.20786		600 Secs *[==>598.0 Secs]*	 ***[1]***
3		(1) SDSSJ090745.0+024507	WFC3/UVIS, ACCUM, UVIS1	F814W	CR-SPLIT=NO; FLASH=9	POS TARG 0.25677,0.13586		600 Secs *[==>598.0 Secs]*	 ***[1]***
4		(1) SDSSJ090745.0+024507	WFC3/UVIS, ACCUM, UVIS1	F814W	CR-SPLIT=NO; FLASH=9	POS TARG -0.09876,0.24854		600 Secs *[==>598.0 Secs]*	 ***[1]***
5		(1) SDSSJ090745.0+024507	WFC3/UVIS, ACCUM, UVIS2	F814W	CR-SPLIT=NO; FLASH=9	POS TARG -0.23702,-0.13447		600 Secs *[==>626.0 Secs]*	 ***[2]***
6		(1) SDSSJ090745.0+024507	WFC3/UVIS, ACCUM, UVIS2	F814W	CR-SPLIT=NO; FLASH=9	POS TARG 0.11851,-0.20786		600 Secs *[==>626.0 Secs]*	 ***[2]***
7		(1) SDSSJ090745.0+024507	WFC3/UVIS, ACCUM, UVIS2	F814W	CR-SPLIT=NO; FLASH=9	POS TARG 0.25677,0.13586		600 Secs *[==>626.0 Secs]*	 ***[2]***
8		(1) SDSSJ090745.0+024507	WFC3/UVIS, ACCUM, UVIS2	F814W	CR-SPLIT=NO; FLASH=9	POS TARG -0.09876,0.24854		600 Secs *[==>626.0 Secs]*	 ***[2]***

Orbit Structure

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Server Version: 20120802
Pointing Maneuver
Overhead
Pointing Maneuver
Overhead
Pointing Maneuver
Overhead
GS Reacq
Overhead
Unused Visibility = 1
Exp. 5
Exp. 6
Exp. 7
Exp. 8
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 12503, Visit 02, implementation Sat Oct 20 01:02:11 GMT 2012

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SCHED 60%; ORIENT 98D TO 98 D; ORIENT 278D TO 278 D; AFTER 15-SEP-2012

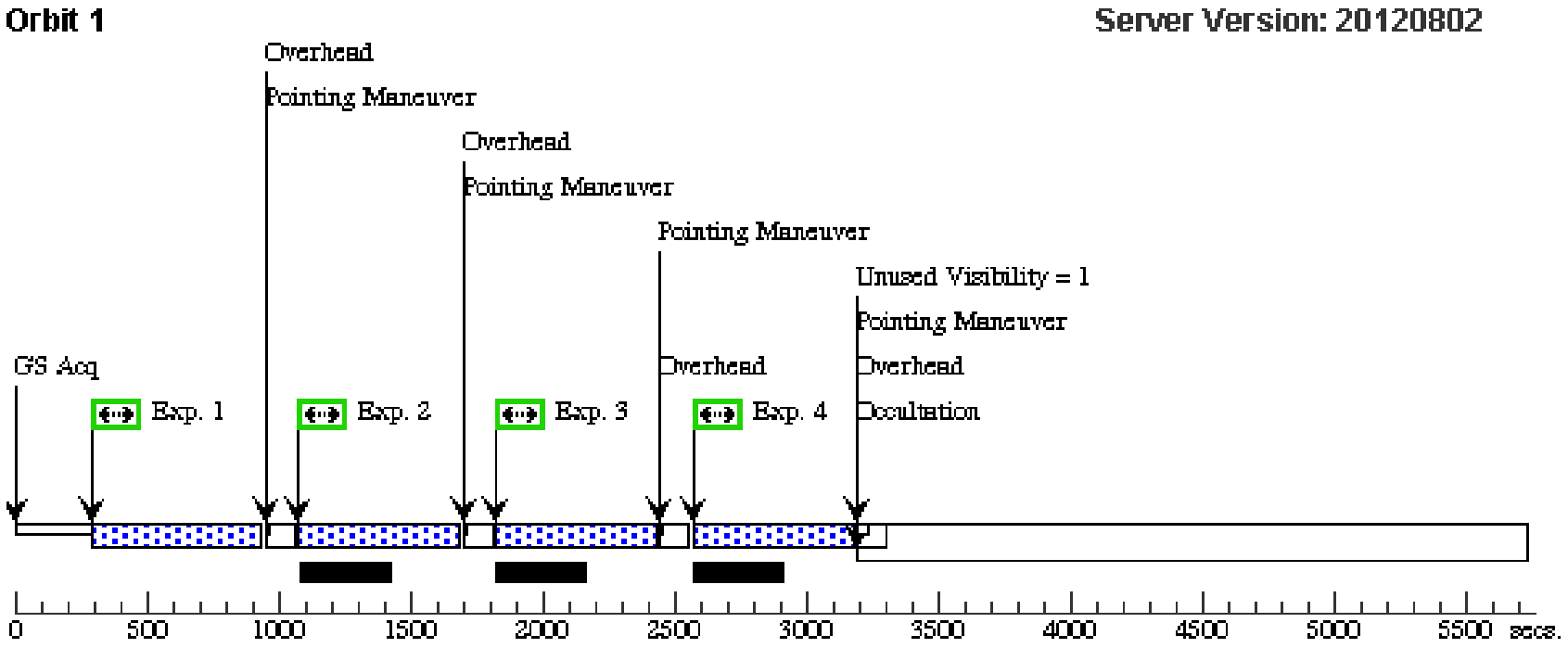
Fixed Targets

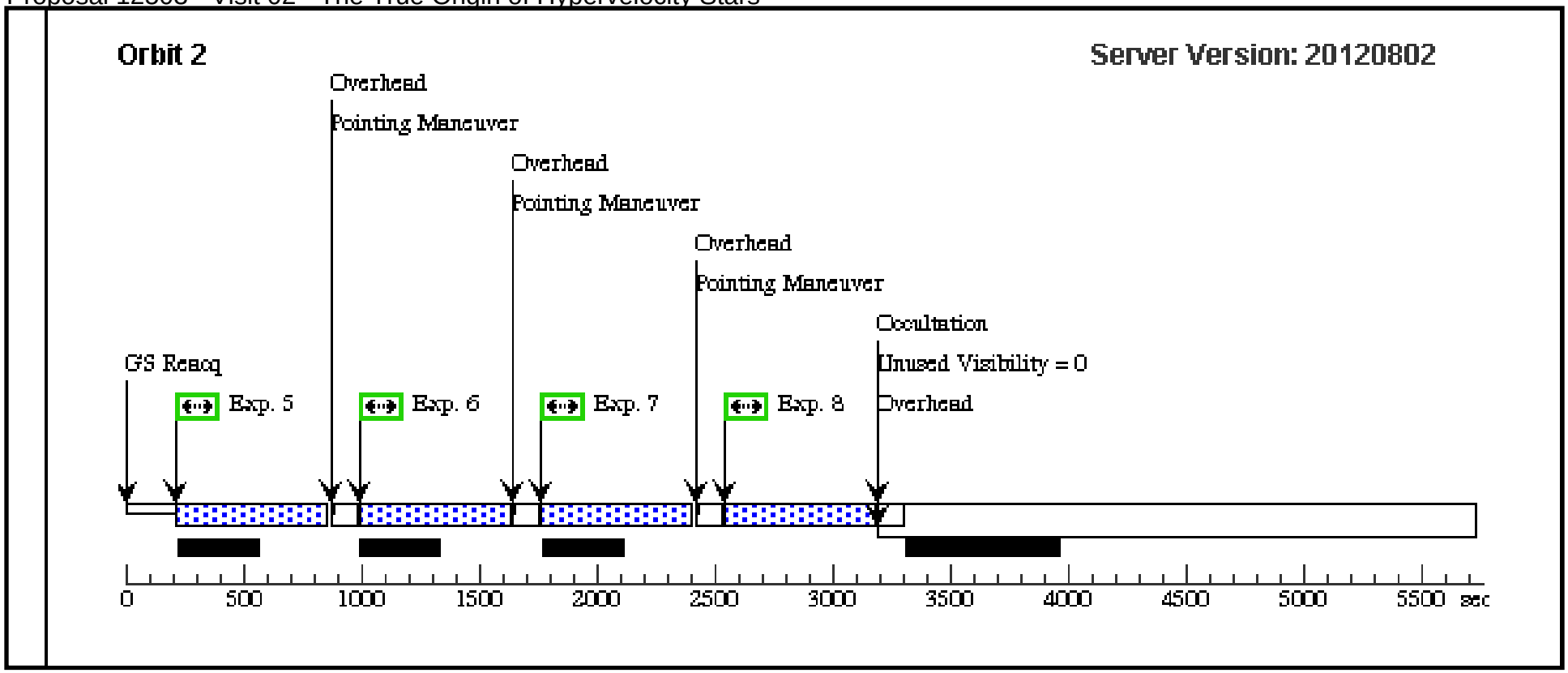
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	SDSSJ093320.86+441705.4 Alt Name1: HVS2 Alt Name2: US708	RA: 09 33 20.8800 (143.3370000d) Dec: +44 17 5.50 (44.28486d) Equinox: J2000		V=19+/-0.2	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(2) SDSSJ093320.86+441705.4	WFC3/UVIS, ACCUM, UVIS1	F814W	CR-SPLIT=NO; FLASH=9	POS TARG -0.23702,-0.13447		600 Secs *[==>613.0 Secs]*	 ***[1]***
2		(2) SDSSJ093320.86+441705.4	WFC3/UVIS, ACCUM, UVIS1	F814W	CR-SPLIT=NO; FLASH=9	POS TARG 0.11851,-0.20786		600 Secs *[==>613.0 Secs]*	 ***[1]***
3		(2) SDSSJ093320.86+441705.4	WFC3/UVIS, ACCUM, UVIS1	F814W	CR-SPLIT=NO; FLASH=9	POS TARG 0.25677,0.13586		600 Secs *[==>613.0 Secs]*	 ***[1]***
4		(2) SDSSJ093320.86+441705.4	WFC3/UVIS, ACCUM, UVIS1	F814W	CR-SPLIT=NO; FLASH=9	POS TARG -0.09876,0.24854		600 Secs *[==>613.0 Secs]*	 ***[1]***
5		(2) SDSSJ093320.86+441705.4	WFC3/UVIS, ACCUM, UVIS2	F814W	CR-SPLIT=NO; FLASH=9	POS TARG -0.23702,-0.13447		600 Secs *[==>641.0 Secs]*	 ***[2]***
6		(2) SDSSJ093320.86+441705.4	WFC3/UVIS, ACCUM, UVIS2	F814W	CR-SPLIT=NO; FLASH=9	POS TARG 0.11851,-0.20786		600 Secs *[==>641.0 Secs]*	 ***[2]***
7		(2) SDSSJ093320.86+441705.4	WFC3/UVIS, ACCUM, UVIS2	F814W	CR-SPLIT=NO; FLASH=9	POS TARG 0.25677,0.13586		600 Secs *[==>641.0 Secs]*	 ***[2]***
8		(2) SDSSJ093320.86+441705.4	WFC3/UVIS, ACCUM, UVIS2	F814W	CR-SPLIT=NO; FLASH=9	POS TARG -0.09876,0.24854		600 Secs *[==>641.0 Secs]*	 ***[2]***

Orbit Structure




Orbit 2
Server Version: 20120802
Overhead
Pointing Maneuver
Overhead
Pointing Maneuver
Overhead
Pointing Maneuver
Occultation
Unused Visibility = 0
Overhead
GS Reacq
Exp. 5
Exp. 6
Exp. 7
Exp. 8
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 12503, Visit 03, completed Sat Oct 20 01:02:14 GMT 2012

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: SCHED 60%; ORIENT 170.014702D TO 170.014702 D; ORIENT 350.014702D TO 350.014702 D; ORIENT 80.014702D TO 80.014702 D; ORIENT 260.014702D TO 260.014702 D; AFTER 01-SEP-2012

Diagnostics

(Visit 03) Warning (Orbit Planner): VISIBILITY OVERRUN

(Visit 03) Warning (Orbit Planner): VISIBILITY OVERRUN

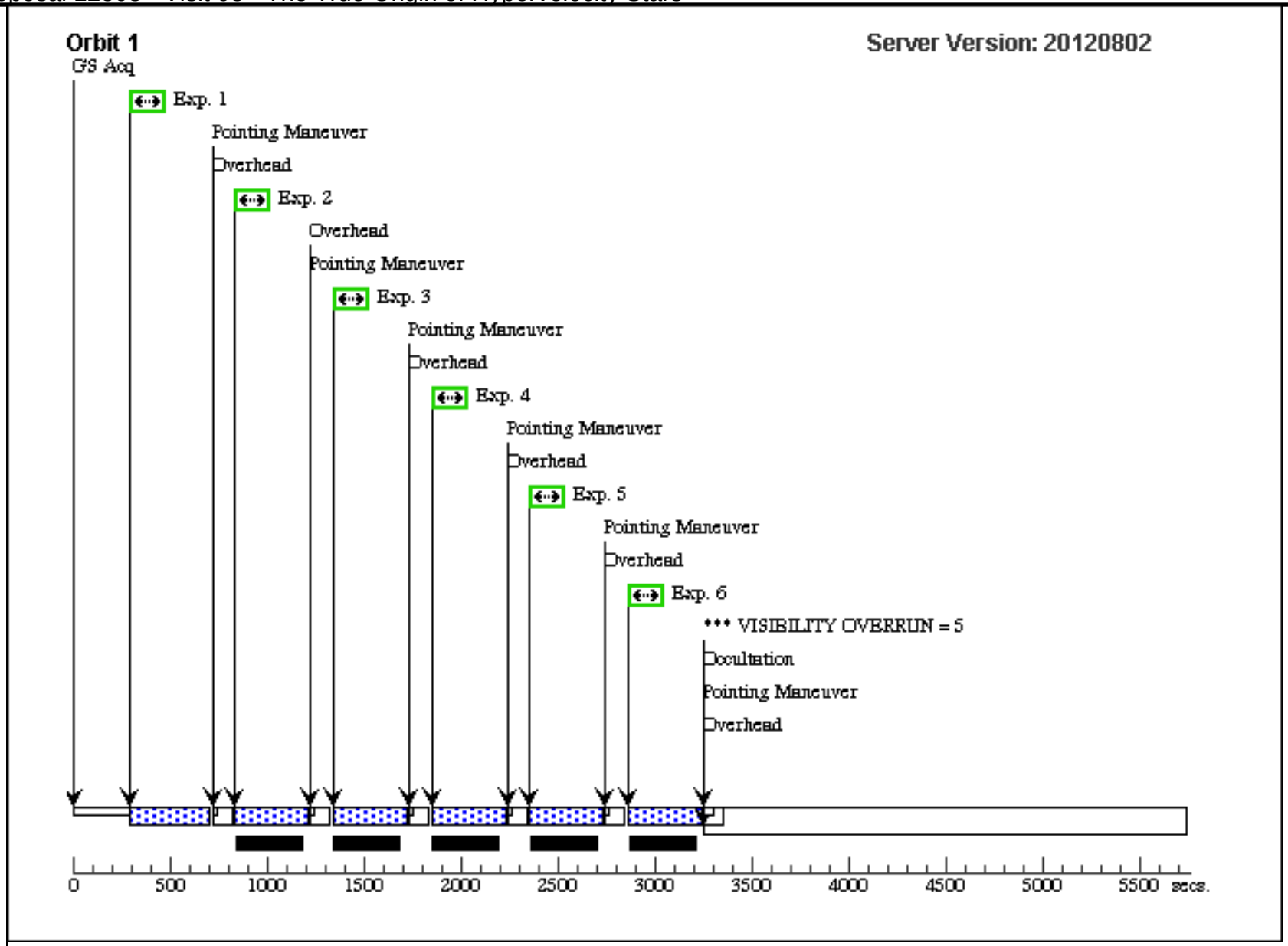
Fixed Targets

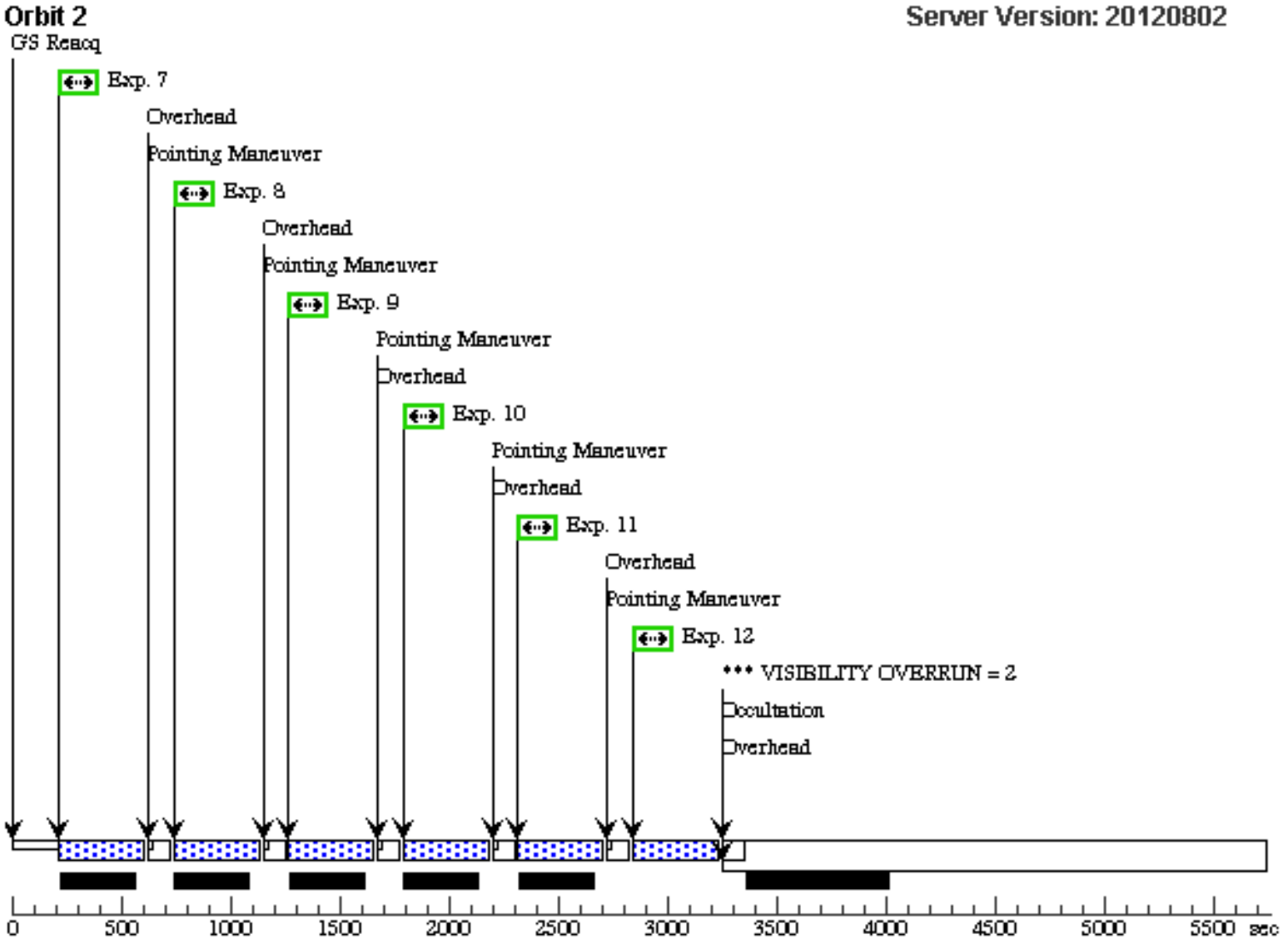
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	HE0437-5439	RA: 04 38 12.7700 (69.5532083d)		V=16.2+/-0.2	Reference Frame: ICRS
	Alt Name1: HVS3	Dec: -54 33 11.80 (-54.55328d)			
		Equinox: J2000			

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(3) HE0437-5439	WFC3/UVIS, ACCUM, UVIS1	F850LP	CR-SPLIT=NO	POS TARG -25,0		350 Secs	
								[==>379.0 Secs]	***[1]***
2		(3) HE0437-5439	WFC3/UVIS, ACCUM, UVIS1	F850LP	CR-SPLIT=NO	POS TARG -15,0		350 Secs	
								[==>379.0 Secs]	***[1]***
3		(3) HE0437-5439	WFC3/UVIS, ACCUM, UVIS1	F850LP	CR-SPLIT=NO	POS TARG -5,0		350 Secs	
								[==>379.0 Secs]	***[1]***
4		(3) HE0437-5439	WFC3/UVIS, ACCUM, UVIS1	F850LP	CR-SPLIT=NO	POS TARG 5,0		350 Secs	
								[==>379.0 Secs]	***[1]***
5		(3) HE0437-5439	WFC3/UVIS, ACCUM, UVIS1	F850LP	CR-SPLIT=NO	POS TARG 15,0		350 Secs	
								[==>379.0 Secs]	***[1]***
6		(3) HE0437-5439	WFC3/UVIS, ACCUM, UVIS1	F850LP	CR-SPLIT=NO	POS TARG 25,0		350 Secs	
								[==>379.0 Secs]	***[1]***
7		(3) HE0437-5439	WFC3/UVIS, ACCUM, UVIS2	F850LP	CR-SPLIT=NO	POS TARG -25,0		350 Secs	
								[==>397.0 Secs]	***[2]***
8		(3) HE0437-5439	WFC3/UVIS, ACCUM, UVIS2	F850LP	CR-SPLIT=NO	POS TARG -15,0		350 Secs	
								[==>397.0 Secs]	***[2]***
9		(3) HE0437-5439	WFC3/UVIS, ACCUM, UVIS2	F850LP	CR-SPLIT=NO	POS TARG -5,0		350 Secs	
								[==>397.0 Secs]	***[2]***
10		(3) HE0437-5439	WFC3/UVIS, ACCUM, UVIS2	F850LP	CR-SPLIT=NO	POS TARG 5,0		350 Secs	
								[==>397.0 Secs]	***[2]***
11		(3) HE0437-5439	WFC3/UVIS, ACCUM, UVIS2	F850LP	CR-SPLIT=NO	POS TARG 15,0		350 Secs	
								[==>397.0 Secs]	***[2]***
12		(3) HE0437-5439	WFC3/UVIS, ACCUM, UVIS2	F850LP	CR-SPLIT=NO	POS TARG 25,0		350 Secs	
								[==>397.0 Secs]	***[2]***

Orbit Structure




Orbit 2
Server Version: 20120802
GS Reacq
Exp. 7
Overhead
Pointing Maneuver
Exp. 8
Overhead
Pointing Maneuver
Exp. 9
Pointing Maneuver
Overhead
Exp. 10
Pointing Maneuver
Overhead
Exp. 11
Overhead
Pointing Maneuver
Exp. 12
*** VISIBILITY OVERRUN = 2
Occultation
Overhead
0
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1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 12503, Visit 04, implementation Sat Oct 20 01:02:16 GMT 2012

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SCHED 60%; ORIENT 160D TO 160 D; AFTER 01-OCT-2012

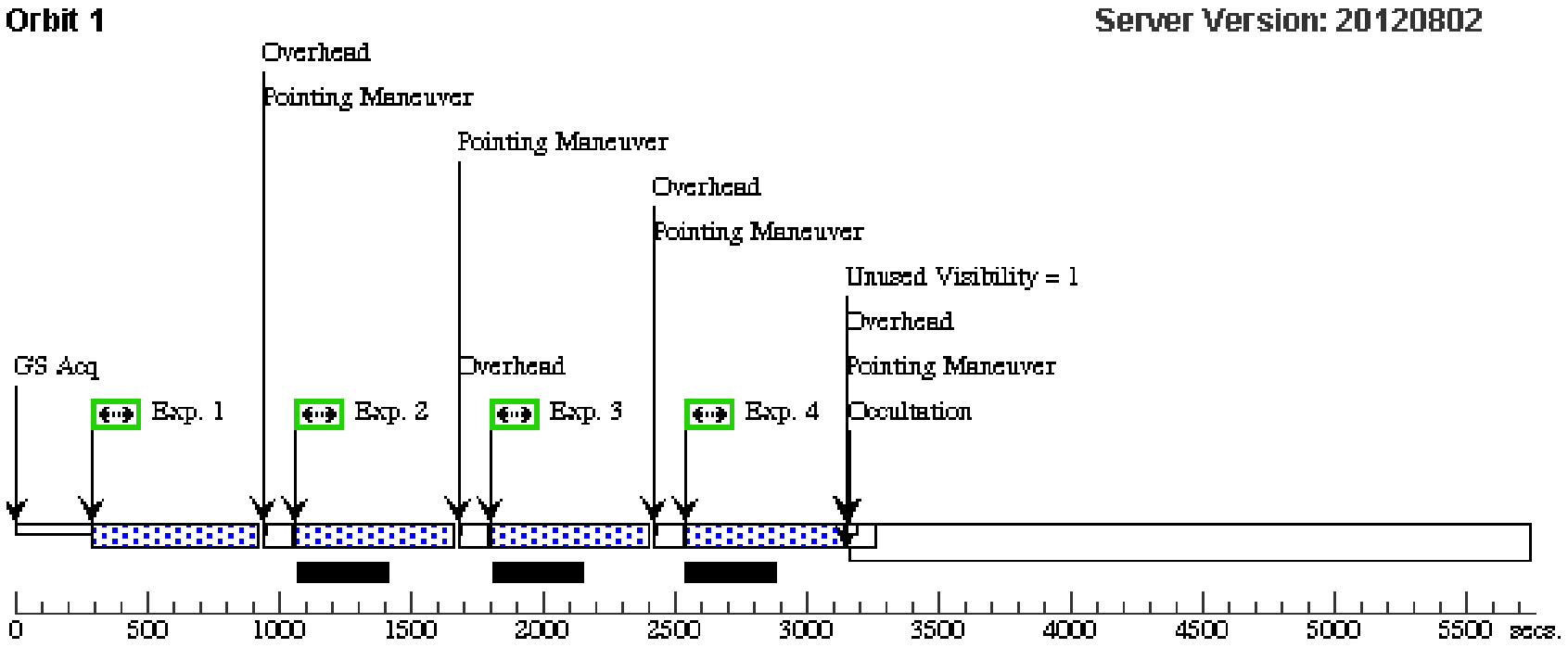
Fixed Targets

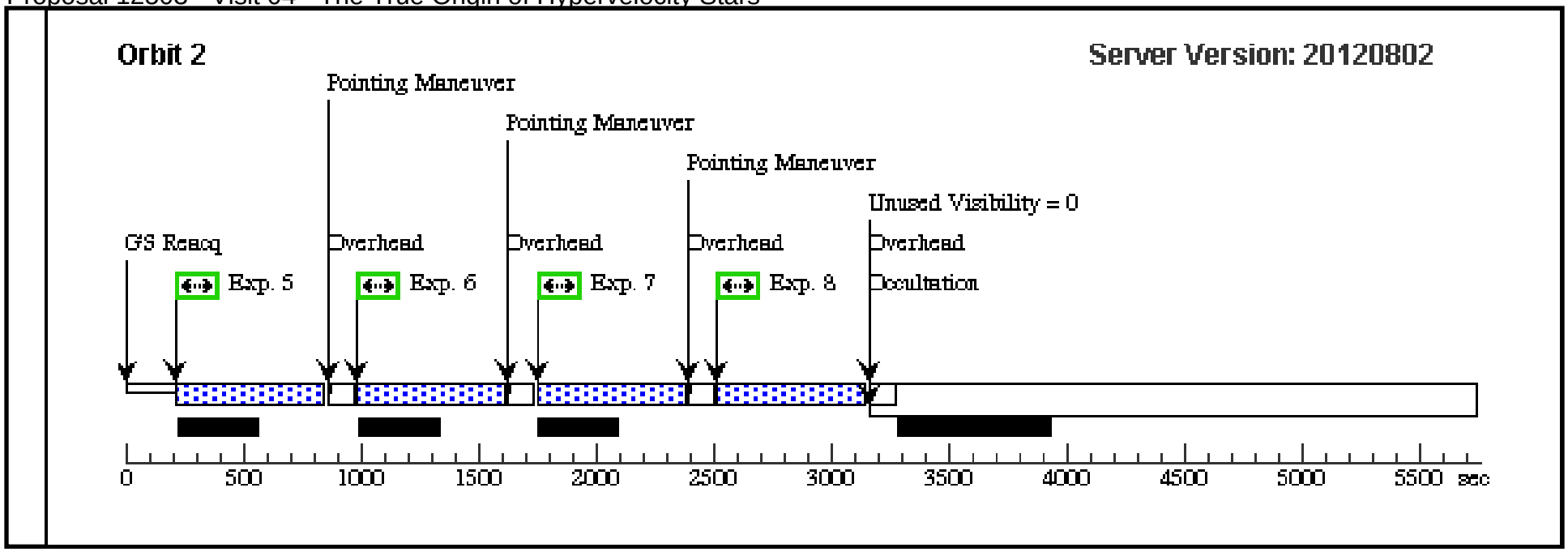
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	SDSSJ091301.0+305120 Alt Name1: HVS4	RA: 09 13 1.0000 (138.2541667d) Dec: +30 51 20.20 (30.85561d) Equinox: J2000		V=18.59+/-0.2	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(4) SDSSJ091301.0+305120	WFC3/UVIS, ACCUM, UVIS1	F814W	CR-SPLIT=NO; FLASH=9	POS TARG -0.23702,-0.13447; GS ACQ SCENARIO BASE1B3		600 Secs *[==>604.0 Secs]*	 ***[1]***
2		(4) SDSSJ091301.0+305120	WFC3/UVIS, ACCUM, UVIS1	F814W	CR-SPLIT=NO; FLASH=9	POS TARG 0.11851,-0.20786		600 Secs *[==>604.0 Secs]*	 ***[1]***
3		(4) SDSSJ091301.0+305120	WFC3/UVIS, ACCUM, UVIS1	F814W	CR-SPLIT=NO; FLASH=9	POS TARG 0.25677,0.13586		600 Secs *[==>604.0 Secs]*	 ***[1]***
4		(4) SDSSJ091301.0+305120	WFC3/UVIS, ACCUM, UVIS1	F814W	CR-SPLIT=NO; FLASH=9	POS TARG -0.09876,0.24854		600 Secs *[==>604.0 Secs]*	 ***[1]***
5		(4) SDSSJ091301.0+305120	WFC3/UVIS, ACCUM, UVIS2	F814W	CR-SPLIT=NO; FLASH=9	POS TARG -0.23702,-0.13447		600 Secs *[==>632.0 Secs]*	 ***[2]***
6		(4) SDSSJ091301.0+305120	WFC3/UVIS, ACCUM, UVIS2	F814W	CR-SPLIT=NO; FLASH=9	POS TARG 0.11851,-0.20786		600 Secs *[==>632.0 Secs]*	 ***[2]***
7		(4) SDSSJ091301.0+305120	WFC3/UVIS, ACCUM, UVIS2	F814W	CR-SPLIT=NO; FLASH=9	POS TARG 0.25677,0.13586		600 Secs *[==>632.0 Secs]*	 ***[2]***
8		(4) SDSSJ091301.0+305120	WFC3/UVIS, ACCUM, UVIS2	F814W	CR-SPLIT=NO; FLASH=9	POS TARG -0.09876,0.24854		600 Secs *[==>632.0 Secs]*	 ***[2]***

Orbit Structure




Orbit 2
Server Version: 20120802
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Unused Visibility = 0
GS Reacq
Overhead
Overhead
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Overhead
Exp. 5
Exp. 6
Exp. 7
Exp. 8
Occultation
0
500
1000
1500
2000
2500
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4000
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5000
5500
sec