12909 - WFC3 Micro-arcsecond astrometry of the possible SNIa progenitor BPM 71214

Cycle: 20, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
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Dr. John W. MacKenty (CoI) (Contact)	Space Telescope Science Institute	mackenty@stsci.edu

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) V-LL-ERI	WFC3/UVIS	2	13-Nov-2013 21:01:13.0	yes
02	(1) V-LL-ERI	WFC3/UVIS	2	13-Nov-2013 21:01:28.0	yes

4 Total Orbits Used

ABSTRACT

We propose to use the newly commissioned scanning mode on WFC3 to obtain astrometric measurements of the ~0.008 AU WD/M dwarf binary BPM 71214. This system is a fascinating mystery for post-common envelope binary evolution and may be a SN1a progenitor. COS spectra of the

WD in the system shows that it is rapidly rotating with a vsin i of 200 km/s, implying that it has already accreted significant mass from its companion, but mass transfer has since stopped. The COS spectra imply a near Chandrasekar mass for the WD, while optical spectroscopy suggests a mass of 0.8 M_Sun. We propose to take four orbits of WFC3 observations in scanning mode to obtain astrometric measurements of this system at a per-measurement precision of ~30~micro-arcseconds. Such measurements will definitively constrain the mass of the WD and fully solve for both masses in the binary.

OBSERVING DESCRIPTION

We wish to obtain spatial scans along the xpos and ypos directions of BPM 71214 (LL Eri) in order to obtain high precision astrometric measurements relative to comparison stars in order to resolve its orbital motion between an M dwarf and WD. We attempt this using a combination of Red (F814W) and Blue (F390W) scans. The first two orbits we plan to take spatial scans only in the Red filters to accurately determine the orientation of the orbit on the sky. This will allow us to maximize our sensitivity by aligning our subsequent scan direction perpendicular to the maximum elongation direction of the binary orbit on the sky. We wish to have two consecutive HST orbits for both sets of observations, to ensure measurements that roughly overlap in orbital phase. We wish to make sure that our orbits begin at approximately orbital phase=0.25+/-0.05 or 0.75+/-0.050, whichever is more schedualable. The ephemeris currently has unacceptably large uncertainty, but we should have an updated ephemeris within a few weeks.

Visit

Proposal 12909, Red Measurements (01), completed Thu Nov 14 02:01:37 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SCHED 100%; ORIENT 309D TO 330 D; ORIENT 39D TO 60 D; ORIENT 129D TO 150 D; Period 0.201626 D AND ZERO-PHASE HJD2452318.102

Comments: Take scans in Xpos and Ypos directions in F814W, starting from the UVIS1 point. Scans should be ~2000 (X), 1000 (Y) pixels in length almost aligned with Xpos and Ypos directions, but slightly off to allow pixel boundary crossings. Ideally we want to start the target and its reference, which is at a separation of ~16.3" and a PA of 324.8 degrees, in a region of the detector least affected by detector and geometric distortion effects.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	V-LL-ERI	RA: 03 32 43.4518 (53.1810492d)	Proper Motion RA: 118.9 mas/yr	V=14.6	Reference Frame: ICRS
		Dec: -08 55 39.32 (-8.92759d)	Proper Motion Dec: -94.4 mas/yr		
		Equinox: J2000	Epoch of Position: 1998.936		

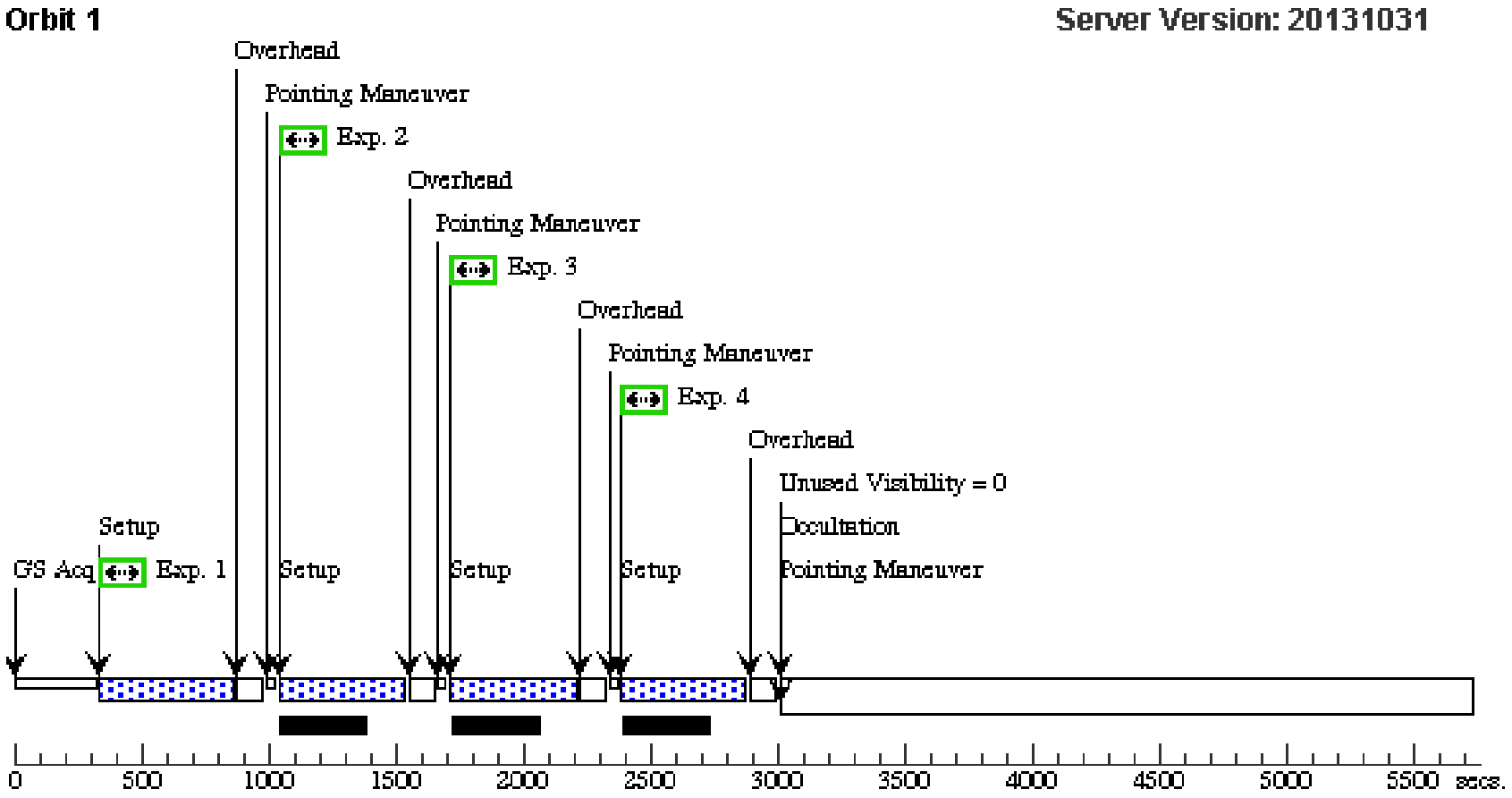
Comments: Target coordinates also confirmed with coordinates from GO 12474

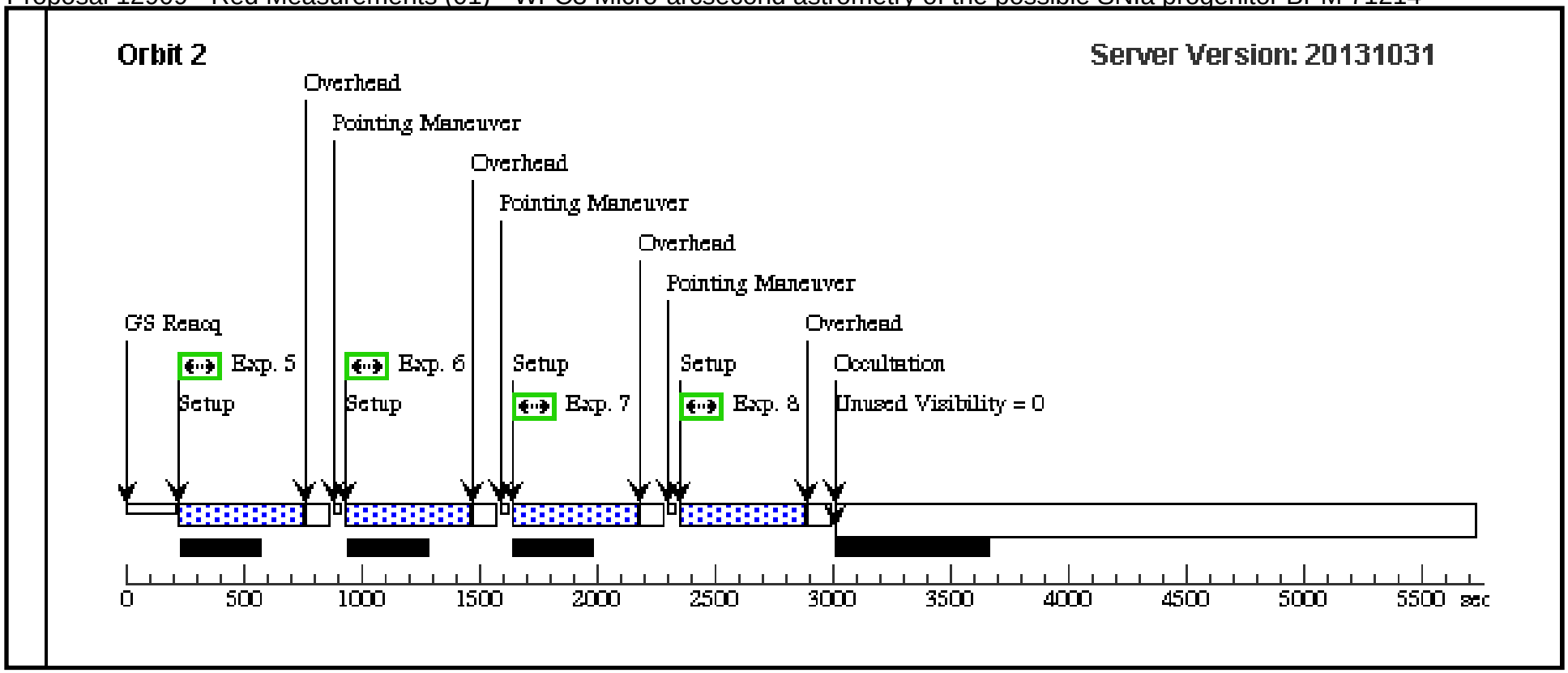
This object was generated by the targetselector and retrieved from the SIMBAD database.This object was generated by the targetselector and retrieved from the SIMBAD database.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	X Scan-RED	(1) V-LL-ERI	WFC3/UVIS, ACCUM, UVIS1	F814W		POS TARG 10,null; SPATIAL SCAN 0.15,183.65 Degrees,Forward; PHASE 0.205 TO 0.230; GS ACQ SCENARIO BASE1B3	Sequence 1-4 Non-Int in Red Measurements (01)	496 Secs (496 Secs) *[==>]*	***[1]***
2	Y Scan-RED	(1) V-LL-ERI	WFC3/UVIS, ACCUM, UVIS1	F814W		POS TARG -15,null; SPATIAL SCAN 0.07,90.05 Degrees,Forward	Sequence 1-4 Non-Int in Red Measurements (01)	495 Secs (495 Secs) *[==>]*	***[1]***
3	X Scan-RED	(1) V-LL-ERI	WFC3/UVIS, ACCUM, UVIS1	F814W		POS TARG 10,0; SPATIAL SCAN 0.15,183.65 Degrees,Forward	Sequence 1-4 Non-Int in Red Measurements (01)	496 Secs (496 Secs) *[==>]*	***[1]***
4	Y Scan-RED	(1) V-LL-ERI	WFC3/UVIS, ACCUM, UVIS1	F814W		POS TARG -15,null; SPATIAL SCAN 0.08,90.05 Degrees,Forward	Sequence 1-4 Non-Int in Red Measurements (01)	494 Secs (494 Secs) *[==>]*	***[1]***
5	X Scan-RED	(1) V-LL-ERI	WFC3/UVIS, ACCUM, UVIS1	F814W		POS TARG 15,null; SPATIAL SCAN 0.15,183.65 Degrees,Forward	Sequence 5-8 Non-Int in Red Measurements (01)	532 Secs (532 Secs) *[==>]*	***[2]***
6	Y Scan-RED	(1) V-LL-ERI	WFC3/UVIS, ACCUM, UVIS1	F814W		POS TARG -15,-10; SPATIAL SCAN 0.08,90.05 Degrees,Forward	Sequence 5-8 Non-Int in Red Measurements (01)	529 Secs (529 Secs) *[==>]*	***[2]***
7	X-Scan RED	(1) V-LL-ERI	WFC3/UVIS, ACCUM, UVIS1	F814W		POS TARG 15,null; SPATIAL SCAN 0.15,183.65 Degrees,Forward	Sequence 5-8 Non-Int in Red Measurements (01)	533 Secs (533 Secs) *[==>]*	***[2]***
8	Y Scan-RED	(1) V-LL-ERI	WFC3/UVIS, ACCUM, UVIS1	F814W		POS TARG -15,-10; SPATIAL SCAN 0.08,90.05 Degrees,Forward	Sequence 5-8 Non-Int in Red Measurements (01)	529 Secs (529 Secs) *[==>]*	***[2]***

Orbit Structure




Orbit 2
Server Version: 20131031
Overhead
Pointing Maneuver
Overhead
Pointing Maneuver
Overhead
Pointing Maneuver
Overhead
GS Reacq
Exp. 5
Setup
Exp. 6
Setup
Setup
Exp. 7
Setup
Exp. 8
Occultation
Unused Visibility = 0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 12909, Red+Blue Measurements (02), implementation Thu Nov 14 02:01:40 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SCHED 100%; ORIENT 309D TO 330 D; ORIENT 39D TO 60 D; ORIENT 129D TO 150 D; Period 0.201626 D AND ZERO-PHASE HJD2452318.102

Comments: Same as Visit 1 but with F814W and F390W

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	V-LL-ERI	RA: 03 32 43.4518 (53.1810492d)	Proper Motion RA: 118.9 mas/yr	V=14.6	Reference Frame: ICRS
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		Equinox: J2000	Epoch of Position: 1998.936		

Comments: Target coordinates also confirmed with coordinates from GO 12474

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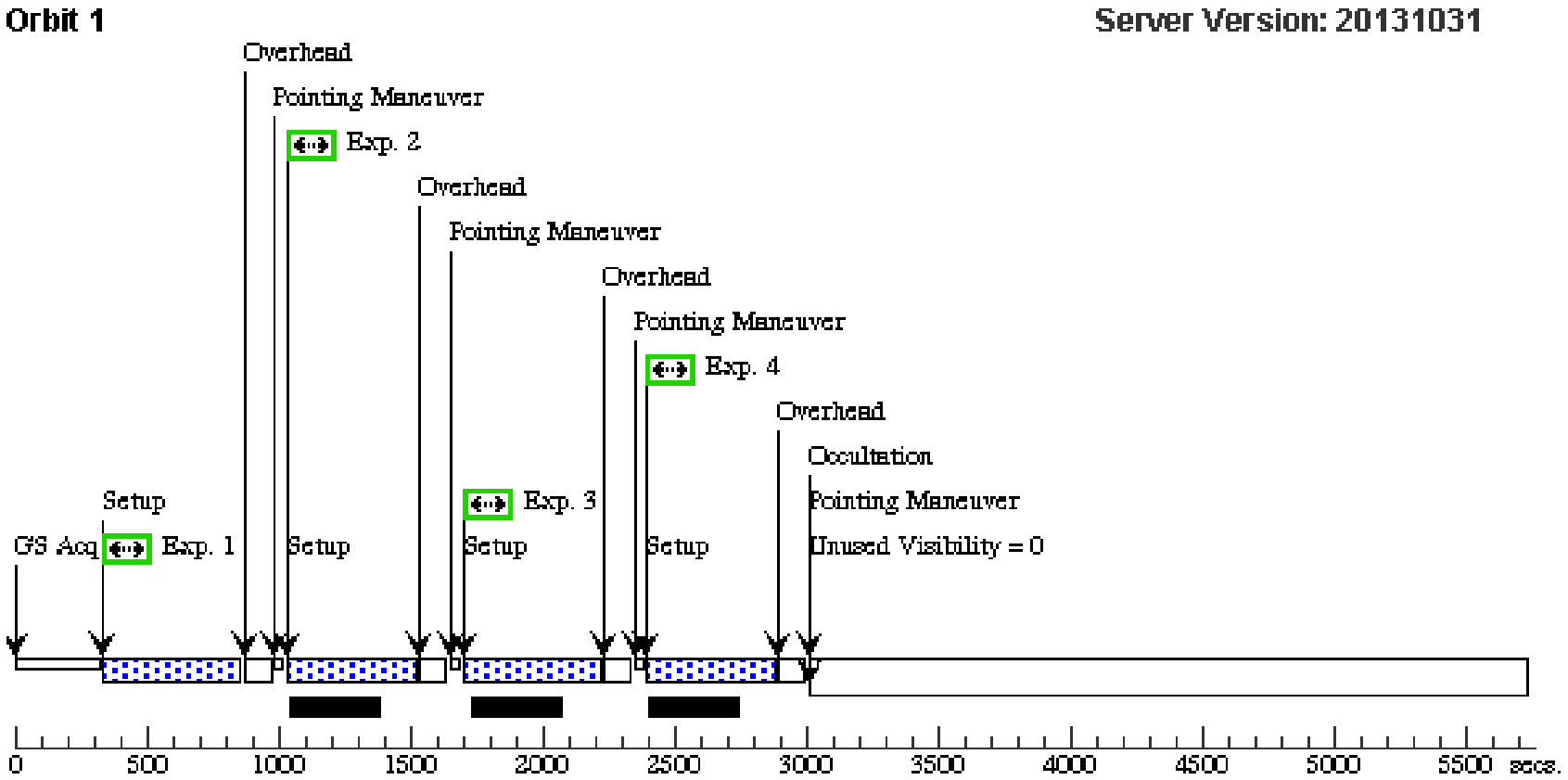
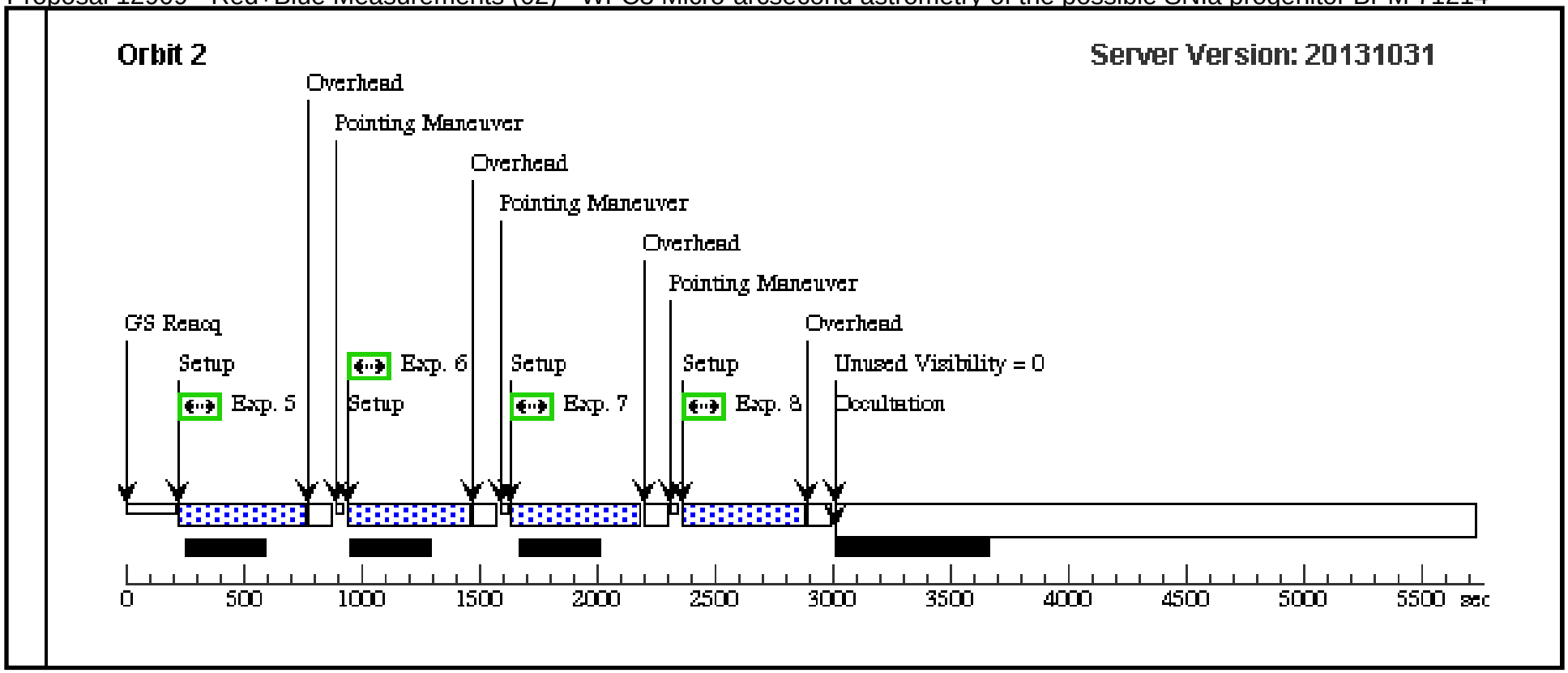
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	X Scan-RED	(1) V-LL-ERI	WFC3/UVIS, ACCUM, UVIS1	F814W		POS TARG 10,null; SPATIAL SCAN 0.15,183.65 Degrees,Forward; PHASE 0.205 TO 0.230; GS ACQ SCENARIO BASE1B3	Sequence 1-4 Non-Int in Red+Blue Measurements (02)	492 Secs (492 Secs) *[==>]*	***[1]***
2	Y Scan-RED	(1) V-LL-ERI	WFC3/UVIS, ACCUM, UVIS1	F814W		POS TARG -15,null; SPATIAL SCAN 0.07,90.05 Degrees,Forward	Sequence 1-4 Non-Int in Red+Blue Measurements (02)	487 Secs (487 Secs) *[==>]*	***[1]***
3	X Scan-BLUE	(1) V-LL-ERI	WFC3/UVIS, ACCUM, UVIS1	F390W		POS TARG 10,0; SPATIAL SCAN 0.15,183.65 Degrees,Forward	Sequence 1-4 Non-Int in Red+Blue Measurements (02)	492 Secs (492 Secs) *[==>]*	***[1]***
4	Y Scan-BLUE	(1) V-LL-ERI	WFC3/UVIS, ACCUM, UVIS1	F390W		POS TARG -15,null; SPATIAL SCAN 0.07,90.05 Degrees,Forward	Sequence 1-4 Non-Int in Red+Blue Measurements (02)	486 Secs (486 Secs) *[==>]*	***[1]***
5	X Scan-RED	(1) V-LL-ERI	WFC3/UVIS, ACCUM, UVIS1	F814W		POS TARG 15,null; SPATIAL SCAN 0.15,183.65 Degrees,Forward	Sequence 5-8 Non-Int in Red+Blue Measurements (02)	522 Secs (522 Secs) *[==>]*	***[2]***
6	Y Scan-RED	(1) V-LL-ERI	WFC3/UVIS, ACCUM, UVIS1	F814W		POS TARG -15,null; SPATIAL SCAN 0.07,90.05 Degrees,Forward	Sequence 5-8 Non-Int in Red+Blue Measurements (02)	517 Secs (517 Secs) *[==>]*	***[2]***
7	X-Scan BLUE	(1) V-LL-ERI	WFC3/UVIS, ACCUM, UVIS1	F390W		POS TARG 15,null; SPATIAL SCAN 0.15,183.65 Degrees,Forward	Sequence 5-8 Non-Int in Red+Blue Measurements (02)	522 Secs (522 Secs) *[==>]*	***[2]***
8	Y Scan-BLUE	(1) V-LL-ERI	WFC3/UVIS, ACCUM, UVIS1	F390W		POS TARG -15,null; SPATIAL SCAN 0.07,90.05 Degrees,Forward	Sequence 5-8 Non-Int in Red+Blue Measurements (02)	517 Secs (517 Secs) *[==>]*	***[2]***

Orbit Structure




Orbit 2
Server Version: 20131031
Overhead
Pointing Maneuver
Overhead
Pointing Maneuver
Overhead
Pointing Maneuver
Overhead
GS Reacq
Setup
Exp. 5
Exp. 6
Setup
Setup
Exp. 7
Setup
Exp. 8
Unused Visibility = 0
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec