14236 - The First Proper Motions of Ultra-faint Dwarf Galaxies: Probing Reionization and Planar Associations of Satellites

Cycle: 23, 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) CVN-II-DSPH ANY	ACS/WFC WFC3/UVIS	4	22-Jul-2015 22:22:29.0	yes
02	(2) HERCULES-DSPH ANY	ACS/WFC WFC3/UVIS	3	22-Jul-2015 22:22:32.0	yes
03	(3) LEO-IV-DSPH ANY	ACS/WFC WFC3/UVIS	4	22-Jul-2015 22:22:36.0	yes
04	(4) UMA-I-DSPH ANY	ACS/WFC WFC3/UVIS	3	22-Jul-2015 22:22:40.0	yes

14 Total Orbits Used

ABSTRACT

Ultra-faint dwarf (UFDs) galaxies are the least luminous, dark-matter dominated galaxies in our Universe. As potential fossil relics of the epoch of reionization, these extreme galaxies play a crucial role in reconciling predictions from LCDM theory, such as the observed number of satellites about our Milky Way (MW). However, none of these galaxies have measured proper motions (PMs), meaning we do not know their orbital histories or their relationship to other satellites over time. We propose to use HST ACS/WFC to make the first PM measurements for 6 UFDs with star formation histories suggesting quenching at the epoch of reionization. Using techniques we have developed to model the orbits of satellites like Leo I and the Magellanic Clouds, these PMs will constrain the orbital histories of a representative sample of UFDs for the first time. We will furthermore compare these orbits to predictions for UFDs from cosmological simulations made by our team. HST is significantly more accurate for PM measurements of our target galaxies than Gaia. Moreover, with HST we can do these measurements now, whereas the most accurate Gaia measurements are still 7 years into the future. With only a modest investment of HST time and proven techniques of our team, these novel HST observations will thus revolutionize our understanding of UFDs, establishing for the first time: (1) Whether star formation was suppressed by reionization; (2) Whether the UFDs ever passed close enough to the MW to have undergone significant tidal heating; and (3) Whether the UFDs orbit in a plane that is associated with the classical satellites.

OBSERVING DESCRIPTION

To measure absolute proper motions of our 4 target galaxies, we will use compact background galaxies in the field of view (FOV) as stationary reference sources. We will measure the average motion of stars in the target galaxies between epochs 1 and 2 with respect to these reference sources. Our analysis techniques and expected accuracies are described in the Phase I proposal. First epoch ACS data are available as part of previous observing programs by PI T. Brown (Proposal GO-12549). The present project will obtain the second epoch data.

The first epoch ACS data were obtained in two filters (F606W and F814W) to make deep color magnitude diagrams that reach well below the main sequence turn-off of our target galaxies. The available broad-band colors and depth are sufficient for separating dwarf member stars, foreground stars, and background galaxies to first order. For the second epoch it is therefore sufficient to take data in only one of the filters. We will observe the target galaxies with the F606W filter using the same pointing and orientation used for the first epoch data. Individual exposures will be sub-pixel dithered and will last one-third to half an orbit. We will use customized dither patterns to maximize the pixel phase coverage. To maximize the time baseline, we have added Timing Requirements for 3 of our visits.

During our second epoch observations, the WFC3/UVIS camera will be pointed ~6 arcmin away in the outer halo of each target galaxy. These parallel fields overlap with the first-epoch images as well, but the expected stellar density is much lower than the ACS/WFC fields. Nevertheless, we will identify dwarf member stars and measure their proper motions using the same measurement technique as we use for the ACS/WFC data. These will further reduce our final proper motion errors.

Visit

Proposal 14236, CVNII (01) Thu Jul 23 02:22:42 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: ORIENT 146.9847D TO 146.9847 D

Comments: This visit is for obtaining second-epoch images of the Canes Venatici II dwarf spheroidal galaxy. Four orbits are required to complete this visit. Since our goal is to measure proper motions of stars in our target galaxies, our orientation is set to exactly match the first-epoch images of GO-12549. We adopt a customized dither pattern to optimally cover the pixel phase using the POS-TARG requirements.

Fixed Targets

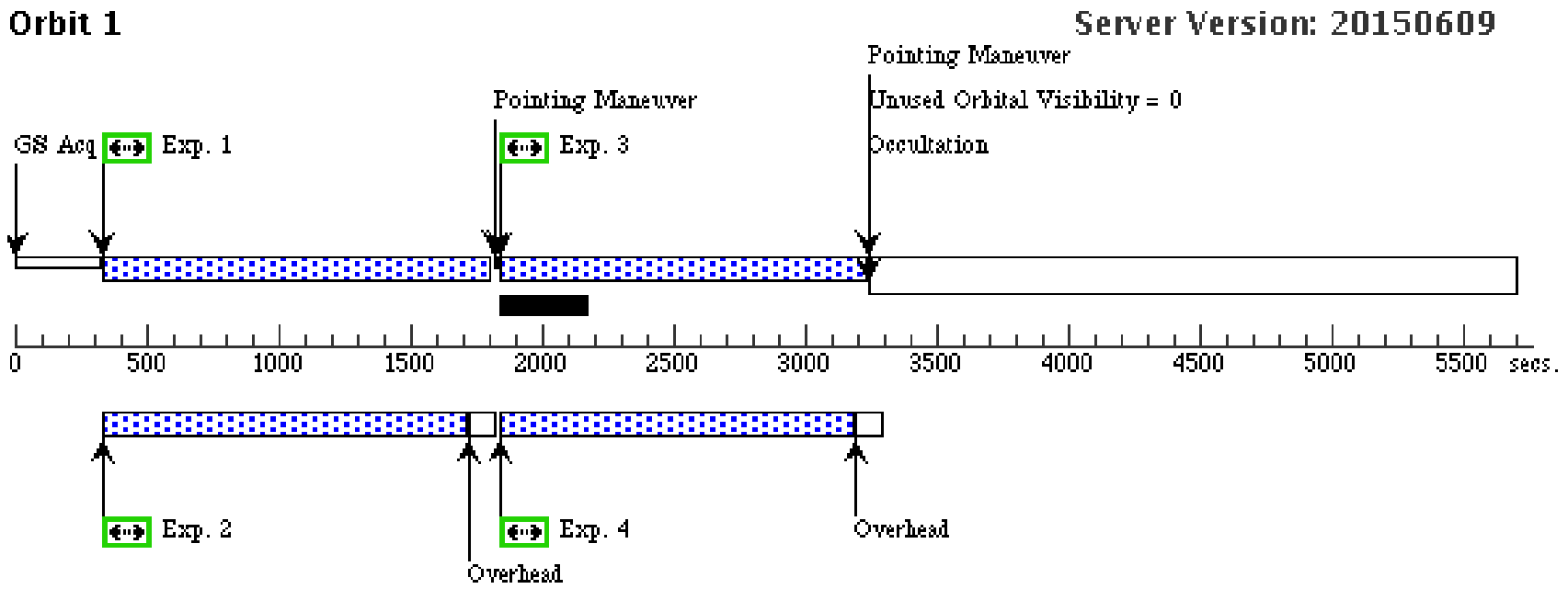
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	CVN-II-DSPH	RA: 12 57 10.5066 (194.2937775d) Dec: +34 19 22.01 (34.32278d) Equinox: J2000		V=16.1	Reference Frame: ICRS

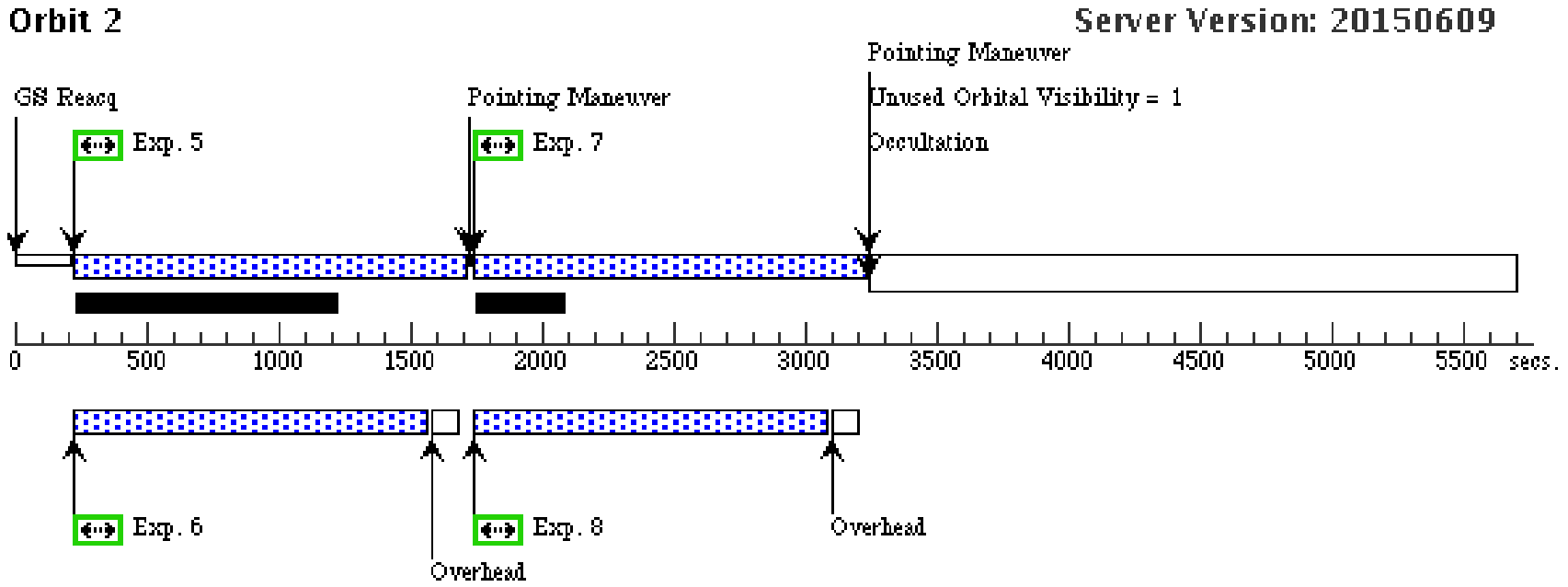
Exposures

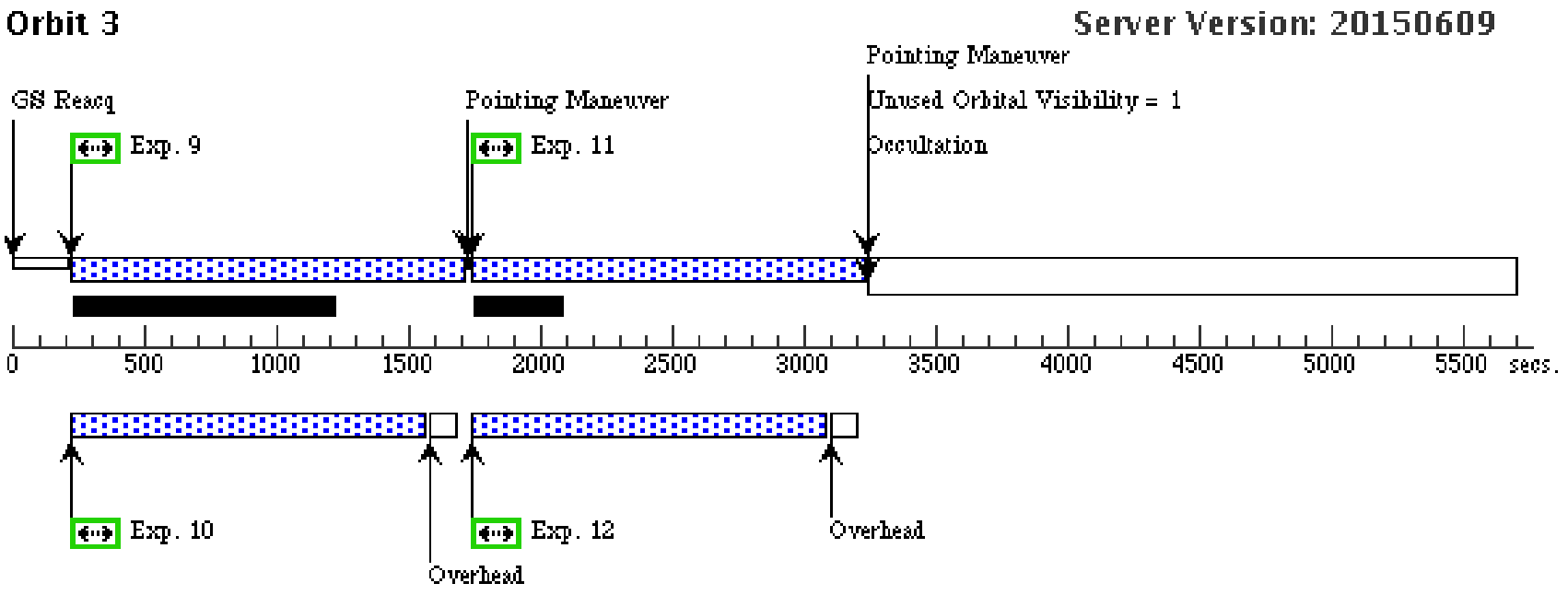
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) CVN-II-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.0000,0.0000	Sequence 1-4 Non-Int in CVNII (01) Prime + Parallel Group 1-2 in Sequence 1-4 Non-Int in CVNII (01)	1267 Secs (1267 Secs) *[==>]*	***[1]***
2		ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W			Sequence 1-4 Non-Int in CVNII (01) Prime + Parallel Group 1-2 in Sequence 1-4 Non-Int in CVNII (01)	1347 Secs (1347 Secs) *[==>]*	***[1]***
3		(1) CVN-II-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.1740,0.2350	Sequence 1-4 Non-Int in CVNII (01) Prime + Parallel Group 3-4 in Sequence 1-4 Non-Int in CVNII (01)	1267 Secs (1267 Secs) *[==>]*	***[1]***
4		ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W			Sequence 1-4 Non-Int in CVNII (01) Prime + Parallel Group 3-4 in Sequence 1-4 Non-Int in CVNII (01)	1347 Secs (1347 Secs) *[==>]*	***[1]***
5		(1) CVN-II-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.3232,0.1235	Sequence 5-8 Non-Int in CVNII (01) Prime + Parallel Group 5-6 in Sequence 5-8 Non-Int in CVNII (01)	1363 Secs (1363 Secs) *[==>]*	***[2]***
6		ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W			Sequence 5-8 Non-Int in CVNII (01) Prime + Parallel Group 5-6 in Sequence 5-8 Non-Int in CVNII (01)	1347 Secs (1347 Secs) *[==>]*	***[2]***
7		(1) CVN-II-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.1005,0.3305	Sequence 5-8 Non-Int in CVNII (01) Prime + Parallel Group 7-8 in Sequence 5-8 Non-Int in CVNII (01)	1363 Secs (1363 Secs) *[==>]*	***[2]***
8		ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W			Sequence 5-8 Non-Int in CVNII (01) Prime + Parallel Group 7-8 in Sequence 5-8 Non-Int in CVNII (01)	1347 Secs (1347 Secs) *[==>]*	***[2]***
9		(1) CVN-II-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.5075,0.0505	Sequence 9-12 Non-Int in CVNII (01) Prime + Parallel Group 9-10 in Sequence 9-12 Non-Int in CVNII (01)	1363 Secs (1363 Secs) *[==>]*	***[3]***

	10	ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W		Sequence 9-12 Non-Int in CVNII (01) Prime + Parallel Group 9-10 in Sequence 9-12 Non-Int in CVNII (01)	1347 Secs (1347 Secs) *[==>]*	***[3]***
	11	(1) CVN-II-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W	POS TARG 0.6815,0.2855	Sequence 9-12 Non-Int in CVNII (01) Prime + Parallel Group 11-12 in Sequence 9-12 Non-Int in CVNII (01)	1363 Secs (1363 Secs) *[==>]*	***[3]***
	12	ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W		Sequence 9-12 Non-Int in CVNII (01) Prime + Parallel Group 11-12 in Sequence 9-12 Non-Int in CVNII (01)	1347 Secs (1347 Secs) *[==>]*	***[3]***
	13	(1) CVN-II-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W	POS TARG 0.8300,0.1735	Sequence 13-16 Non-Int in CVNII (01) Prime + Parallel Group 13-14 in Sequence 13-16 Non-Int in CVNII (01)	1363 Secs (1363 Secs) *[==>]*	***[4]***
	14	ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W		Sequence 13-16 Non-Int in CVNII (01) Prime + Parallel Group 13-14 in Sequence 13-16 Non-Int in CVNII (01)	1347 Secs (1347 Secs) *[==>]*	***[4]***
	15	(1) CVN-II-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W	POS TARG 0.6080,0.3810	Sequence 13-16 Non-Int in CVNII (01) Prime + Parallel Group 15-16 in Sequence 13-16 Non-Int in CVNII (01)	1363 Secs (1363 Secs) *[==>]*	***[4]***
	16	ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W		Sequence 13-16 Non-Int in CVNII (01) Prime + Parallel Group 15-16 in Sequence 13-16 Non-Int in CVNII (01)	1347 Secs (1347 Secs) *[==>]*	***[4]***

Orbit Structure



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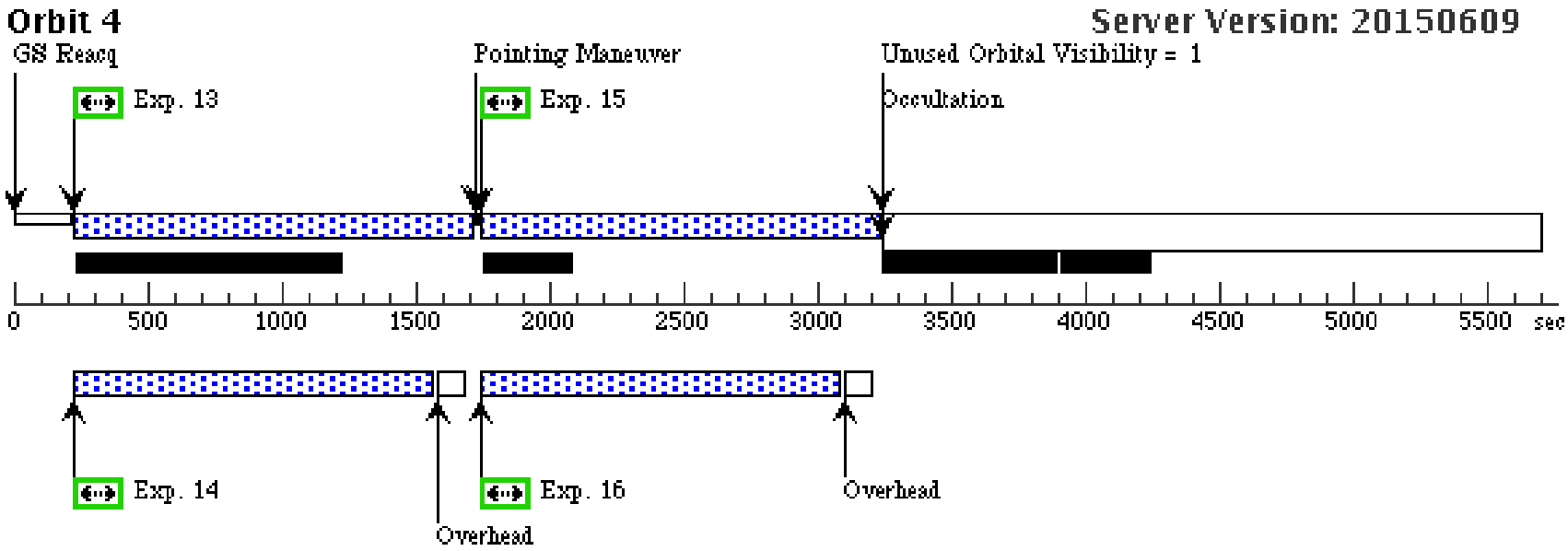
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4000
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sec
Exp. 14
Exp. 16
Overhead
Overhead

Visit

Proposal 14236, HERCULES (02) Thu Jul 23 02:22:43 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: ORIENT 103.0180D TO 103.0180 D; AFTER 01-JAN-2016:00:00:00

Comments: This visit is for obtaining second-epoch images of the Hercules dwarf spheroidal galaxy. Three orbits are required to complete this visit. Since our goal is to measure proper motions of stars in our target galaxies, our orientation is set to exactly match the first-epoch images of GO-12549. We adopt a customized dither pattern to optimally cover the pixel phase using the POS-TARG requirements. The Visit Planner shows that our observations for this visit are available during two separate windows: one in Aug 2015 and the other in Aug 2016. It is necessary to maximize the time baseline of our proper motion measurements to fulfill our scientific goals, se we request this visit to be taken in Aug 2016. For this, we have added the Timing Requirements.

Fixed Targets

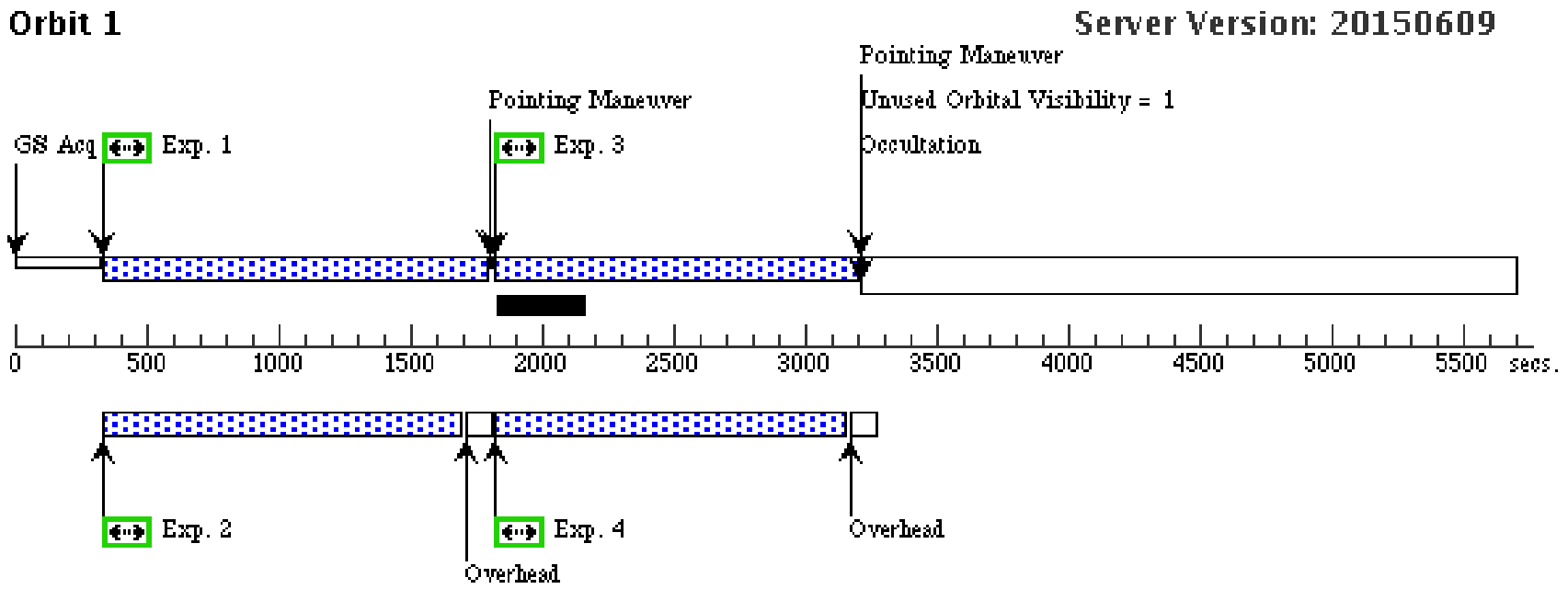
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	HERCULES-DSPH	RA: 16 31 11.6052 (247.7983550d) Dec: +12 46 47.54 (12.77987d) Equinox: J2000		V=14.0	Reference Frame: ICRS

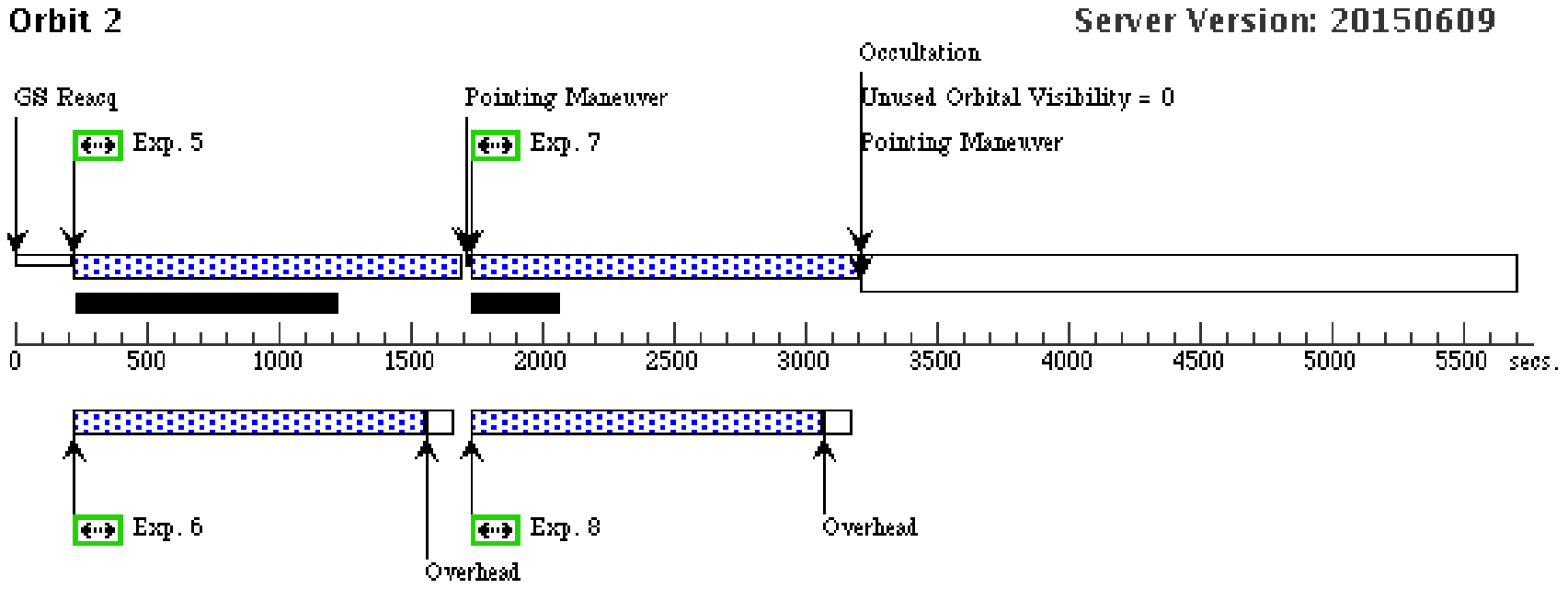
Exposures

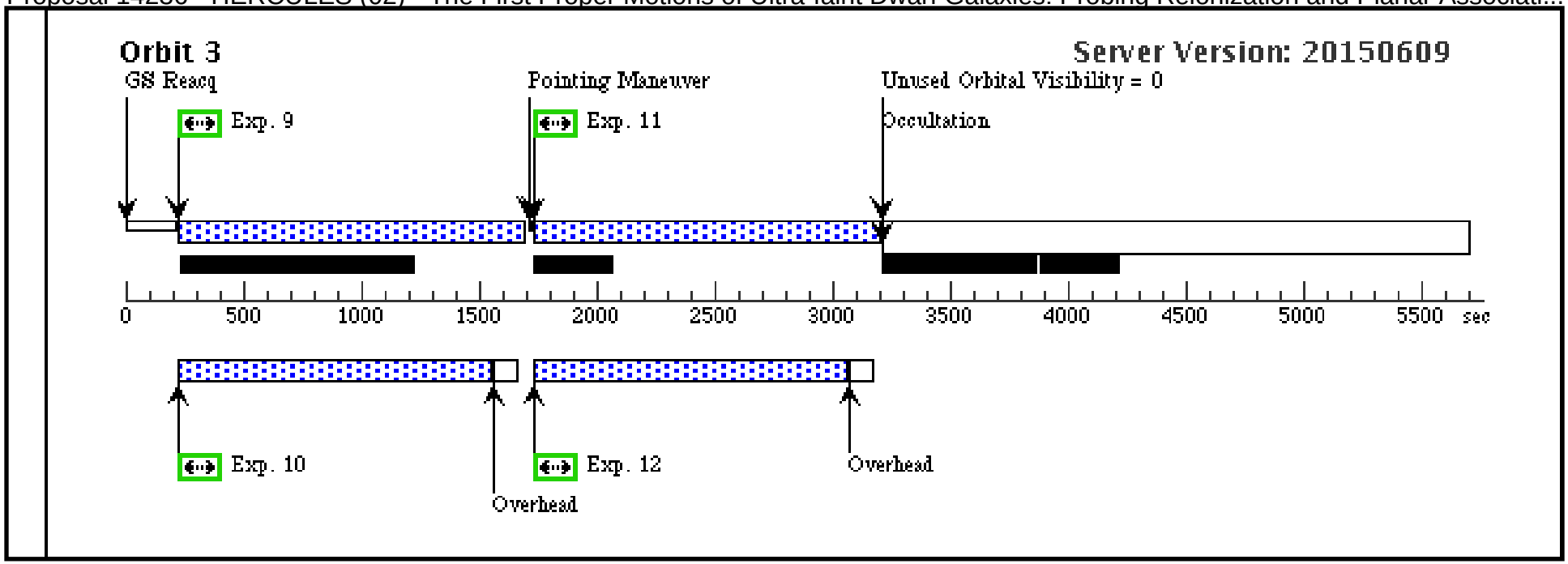
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) HERCULES-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.0000,0.0000	Sequence 1-4 Non-Int in HERCULES (02) Prime + Parallel Group 1-2 in Sequence 1-4 Non-Int in HERCULES (02)	1253 Secs (1253 Secs) *[==>]*	***[1]***
2		ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W			Sequence 1-4 Non-Int in HERCULES (02) Prime + Parallel Group 1-2 in Sequence 1-4 Non-Int in HERCULES (02)	1333 Secs (1333 Secs) *[==>]*	***[1]***
3		(2) HERCULES-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.1647,0.0124	Sequence 1-4 Non-Int in HERCULES (02) Prime + Parallel Group 3-4 in Sequence 1-4 Non-Int in HERCULES (02)	1253 Secs (1253 Secs) *[==>]*	***[1]***
4		ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W			Sequence 1-4 Non-Int in HERCULES (02) Prime + Parallel Group 3-4 in Sequence 1-4 Non-Int in HERCULES (02)	1333 Secs (1333 Secs) *[==>]*	***[1]***
5		(2) HERCULES-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.3293,0.0248	Sequence 5-8 Non-Int in HERCULES (02) Prime + Parallel Group 5-6 in Sequence 5-8 Non-Int in HERCULES (02)	1350 Secs (1350 Secs) *[==>]*	***[2]***
6		ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W			Sequence 5-8 Non-Int in HERCULES (02) Prime + Parallel Group 5-6 in Sequence 5-8 Non-Int in HERCULES (02)	1333 Secs (1333 Secs) *[==>]*	***[2]***
7		(2) HERCULES-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.0747,0.1294	Sequence 5-8 Non-Int in HERCULES (02) Prime + Parallel Group 7-8 in Sequence 5-8 Non-Int in HERCULES (02)	1350 Secs (1350 Secs) *[==>]*	***[2]***
8		ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W			Sequence 5-8 Non-Int in HERCULES (02) Prime + Parallel Group 7-8 in Sequence 5-8 Non-Int in HERCULES (02)	1333 Secs (1333 Secs) *[==>]*	***[2]***

	9	(2) HERCULES-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W	POS TARG 0.2393,0.1418	Sequence 9-12 Non-Int in HERCULES (02) Prime + Parallel Group 9-10 in Sequence 9-12 Non-Int in HERCULES (02)	1350 Secs (1350 Secs) *[==>]*	***[3]***
	10	ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W		Sequence 9-12 Non-Int in HERCULES (02) Prime + Parallel Group 9-10 in Sequence 9-12 Non-Int in HERCULES (02)	1333 Secs (1333 Secs) *[==>]*	***[3]***
	11	(2) HERCULES-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W	POS TARG 0.4039,0.1541	Sequence 9-12 Non-Int in HERCULES (02) Prime + Parallel Group 11-12 in Sequence 9-12 Non-Int in HERCULES (02)	1350 Secs (1350 Secs) *[==>]*	***[3]***
	12	ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W		Sequence 9-12 Non-Int in HERCULES (02) Prime + Parallel Group 11-12 in Sequence 9-12 Non-Int in HERCULES (02)	1333 Secs (1333 Secs) *[==>]*	***[3]***

Orbit Structure



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Occultation
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1500
2000
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4000
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sec
Exp. 10
Exp. 12
Overhead
Overhead

Visit

Proposal 14236, LEOIV (03) Thu Jul 23 02:22:43 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: SCHED 40%; ORIENT 295.0003D TO 295.0003 D; AFTER 01-JUL-2016:00:00:00

Comments: This visit is for obtaining second-epoch images of the Leo IV dwarf spheroidal galaxy. Four orbits are required to complete this visit. Since our goal is to measure proper motions of stars in our target galaxies, our orientation is set to exactly match the first-epoch images of GO-12549. We adopt a customized dither pattern to optimally cover the pixel phase using the POS-TARG requirements. We have found that the with the requested orientation and default Schedulabilty, The Visit Planner fails to find observable windows. Therefore, we increased the Schedulability to 40. Also, the Visit Planner shows that our observations for this visit are available during two separate windows: one in late 2015 to early 2016, and the other in late 2016 to early 2017. It is necessary to maximize the time baseline of our proper motion measurements to fulfill our scientific goals, se we request this visit to be taken in the latter window. For this, we have added the Timing Requirements.

Fixed Targets

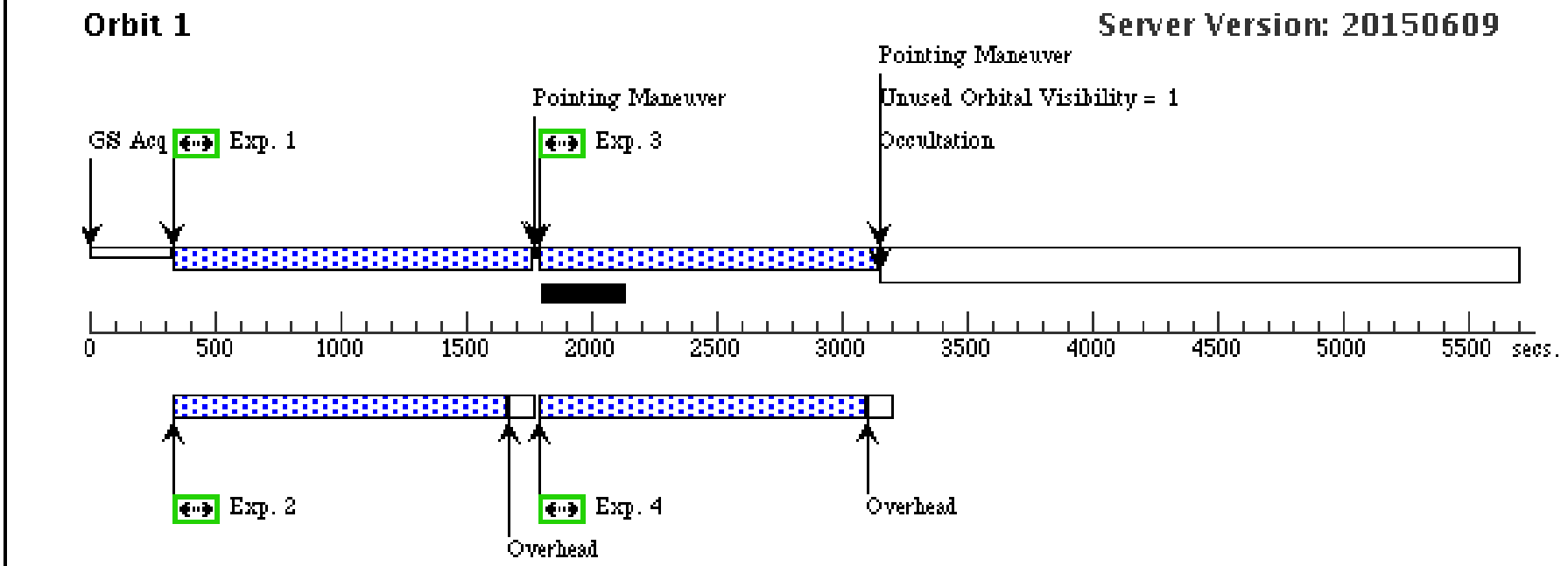
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	LEO-IV-DSPH	RA: 11 32 57.3376 (173.2389067d) Dec: -00 30 59.97 (-.51666d) Equinox: J2000		V=15.1	Reference Frame: ICRS

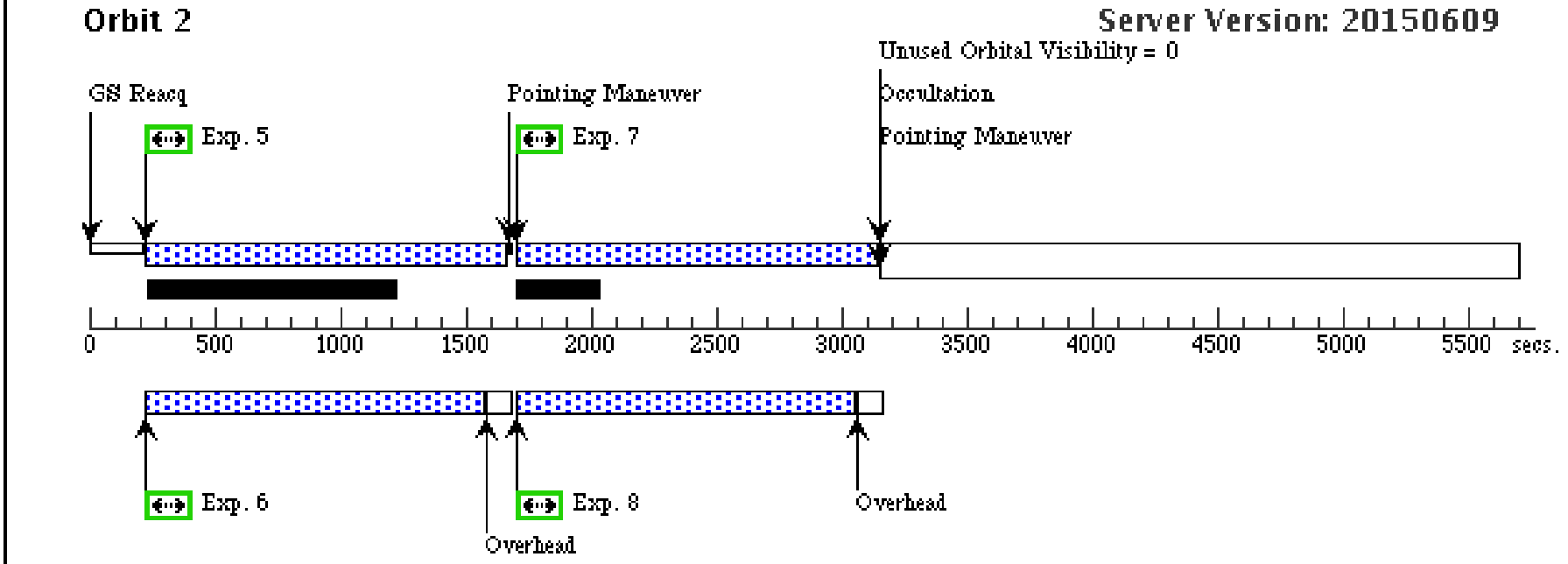
Exposures

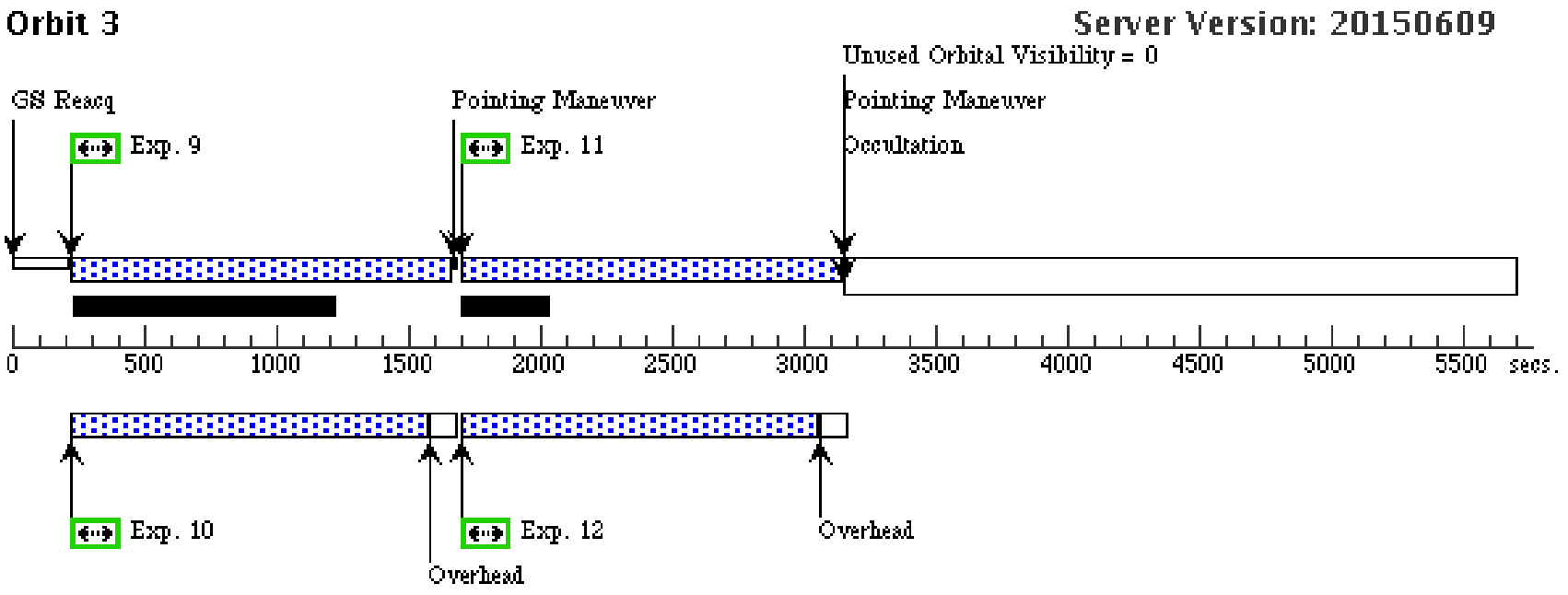
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(3) LEO-IV-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.0000,0.0000	Sequence 1-4 Non-Int in LEOIV (03) Prime + Parallel Group 1-2 in Sequence 1-4 Non-Int in LEOIV (03)	1222 Secs (1222 Secs) *[==>]*	***[1]***
2		ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W			Sequence 1-4 Non-Int in LEOIV (03) Prime + Parallel Group 1-2 in Sequence 1-4 Non-Int in LEOIV (03)	1300 Secs (1300 Secs) *[==>]*	***[1]***
3		(3) LEO-IV-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.1740,0.2350	Sequence 1-4 Non-Int in LEOIV (03) Prime + Parallel Group 3-4 in Sequence 1-4 Non-Int in LEOIV (03)	1222 Secs (1222 Secs) *[==>]*	***[1]***
4		ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W			Sequence 1-4 Non-Int in LEOIV (03) Prime + Parallel Group 3-4 in Sequence 1-4 Non-Int in LEOIV (03)	1300 Secs (1300 Secs) *[==>]*	***[1]***
5		(3) LEO-IV-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.3232,0.1235	Sequence 5-8 Non-Int in LEOIV (03) Prime + Parallel Group 5-6 in Sequence 5-8 Non-Int in LEOIV (03)	1319 Secs (1319 Secs) *[==>]*	***[2]***
6		ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W			Sequence 5-8 Non-Int in LEOIV (03) Prime + Parallel Group 5-6 in Sequence 5-8 Non-Int in LEOIV (03)	1350 Secs (1350 Secs) *[==>]*	***[2]***
7		(3) LEO-IV-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.1005,0.3305	Sequence 5-8 Non-Int in LEOIV (03) Prime + Parallel Group 7-8 in Sequence 5-8 Non-Int in LEOIV (03)	1318 Secs (1318 Secs) *[==>]*	***[2]***
8		ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W			Sequence 5-8 Non-Int in LEOIV (03) Prime + Parallel Group 7-8 in Sequence 5-8 Non-Int in LEOIV (03)	1350 Secs (1350 Secs) *[==>]*	***[2]***
9		(3) LEO-IV-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.5075,0.0505	Sequence 9-12 Non-Int in LEOIV (03) Prime + Parallel Group 9-10 in Sequence 9-12 Non-Int in LEOIV (03)	1319 Secs (1319 Secs) *[==>]*	***[3]***

	10	ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W		Sequence 9-12 Non-Int in LEOIV (03) Prime + Parallel Group 9-10 in Sequence 9-12 Non-Int in LEOIV (03)	1350 Secs (1350 Secs) *[==>]*	***[3]***
	11	(3) LEO-IV-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W	POS TARG 0.6815,0.2855	Sequence 9-12 Non-Int in LEOIV (03) Prime + Parallel Group 11-12 in Sequence 9-12 Non-Int in LEOIV (03)	1318 Secs (1318 Secs) *[==>]*	***[3]***
	12	ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W		Sequence 9-12 Non-Int in LEOIV (03) Prime + Parallel Group 11-12 in Sequence 9-12 Non-Int in LEOIV (03)	1350 Secs (1350 Secs) *[==>]*	***[3]***
	13	(3) LEO-IV-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W	POS TARG 0.8300,0.1735	Sequence 13-16 Non-Int in LEOIV (03) Prime + Parallel Group 13-14 in Sequence 13-16 Non-Int in LEOIV (03)	1319 Secs (1319 Secs) *[==>]*	***[4]***
	14	ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W		Sequence 13-16 Non-Int in LEOIV (03) Prime + Parallel Group 13-14 in Sequence 13-16 Non-Int in LEOIV (03)	1350 Secs (1350 Secs) *[==>]*	***[4]***
	15	(3) LEO-IV-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W	POS TARG 0.6080,0.3810	Sequence 13-16 Non-Int in LEOIV (03) Prime + Parallel Group 15-16 in Sequence 13-16 Non-Int in LEOIV (03)	1318 Secs (1318 Secs) *[==>]*	***[4]***
	16	ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W		Sequence 13-16 Non-Int in LEOIV (03) Prime + Parallel Group 15-16 in Sequence 13-16 Non-Int in LEOIV (03)	1350 Secs (1350 Secs) *[==>]*	***[4]***

Orbit Structure



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Pointing Maneuver
Pointing Maneuver
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Exp. 11
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3000
3500
4000
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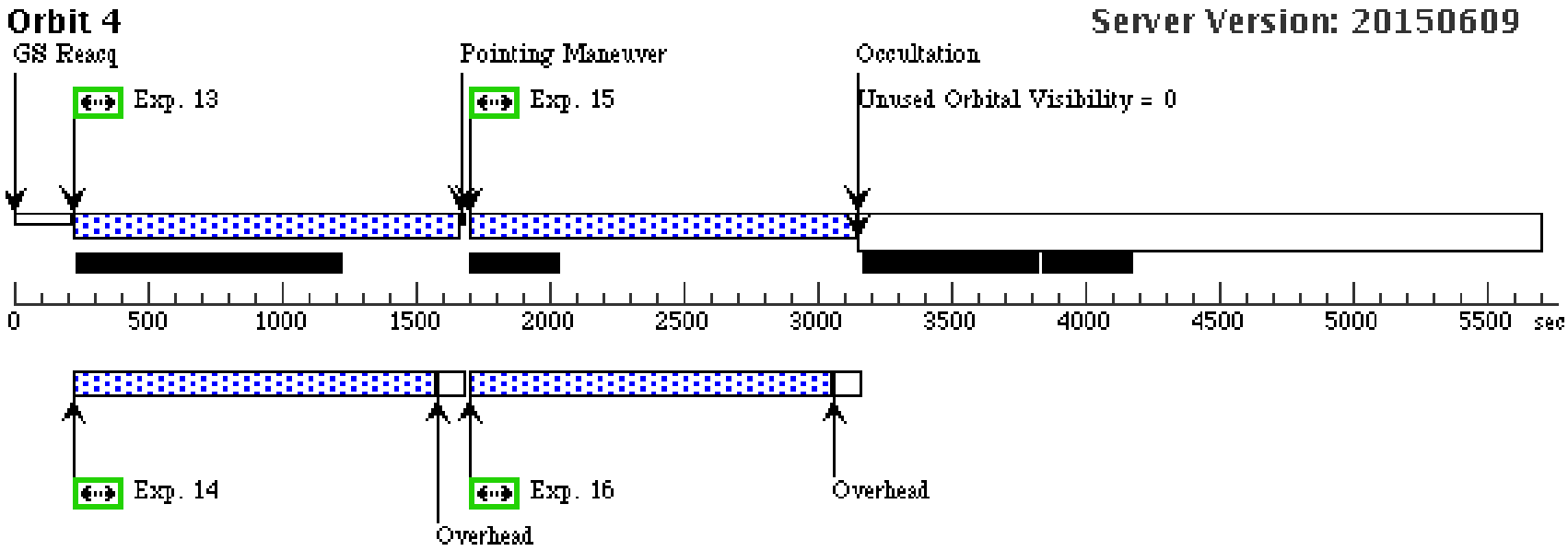
secs.
Exp. 10
Exp. 12
Overhead
Overhead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2000
2500
3000
3500
4000
4500
5000
5500
sec
Exp. 14
Exp. 16
Overhead
Overhead

Visit

Proposal 14236, UMAI (04) Thu Jul 23 02:22:43 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: ORIENT 206.8769D TO 206.8769 D; AFTER 01-JUL-2016:00:00:00

Comments: This visit is for obtaining second-epoch images of the Hercules dwarf spheroidal galaxy. Three orbits are required to complete this visit. Since our goal is to measure proper motions of stars in our target galaxies, our orientation is set to exactly match the first-epoch images of GO-12549. We adopt a customized dither pattern to optimally cover the pixel phase using the POS-TARG requirements. The Visit Planner shows that our observations for this visit are available during two separate windows: one in Jan-Feb 2016 and the other in Jan-Feb 2017. It is necessary to maximize the time baseline of our proper motion measurements to fulfill our scientific goals, so we request this visit to be taken in Jan-Feb 2017. For this, we have added the Timing Requirements.

Fixed Targets

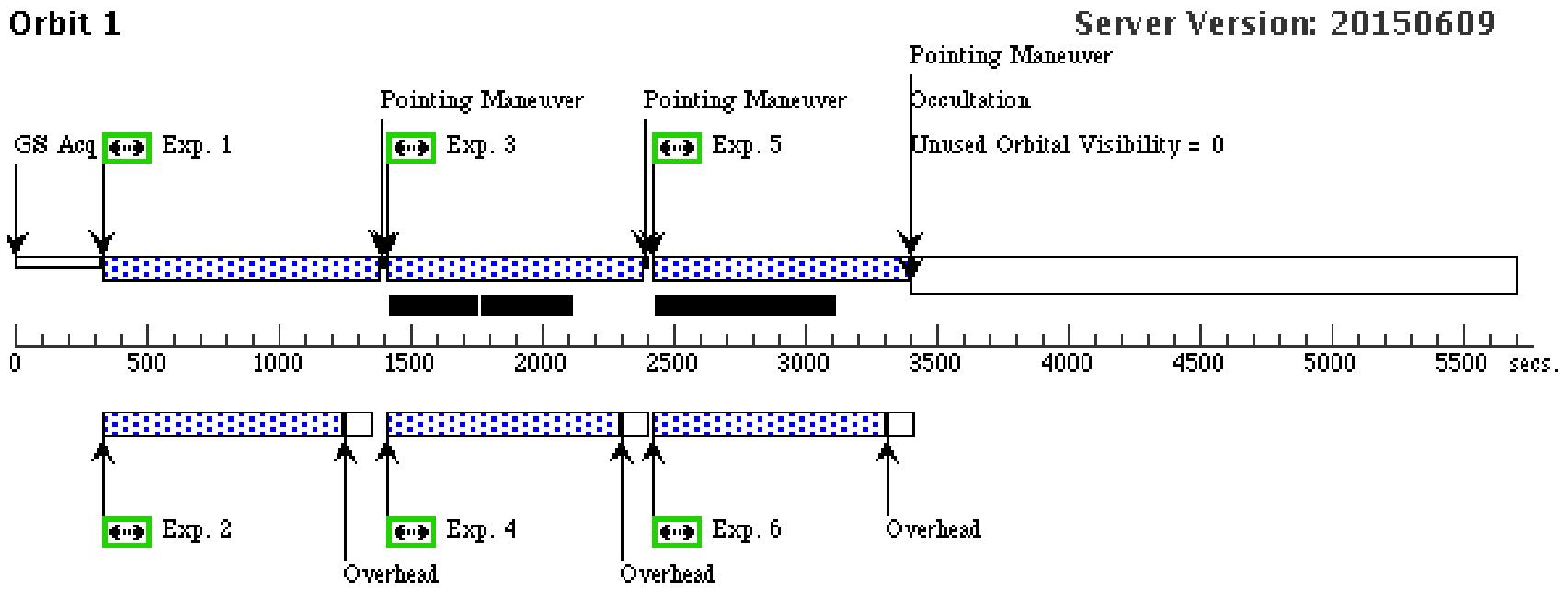
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	UMA-I-DSPH	RA: 10 35 4.1638 (158.7673492d) Dec: +51 56 51.23 (51.94756d) Equinox: J2000		V=14.4	Reference Frame: ICRS

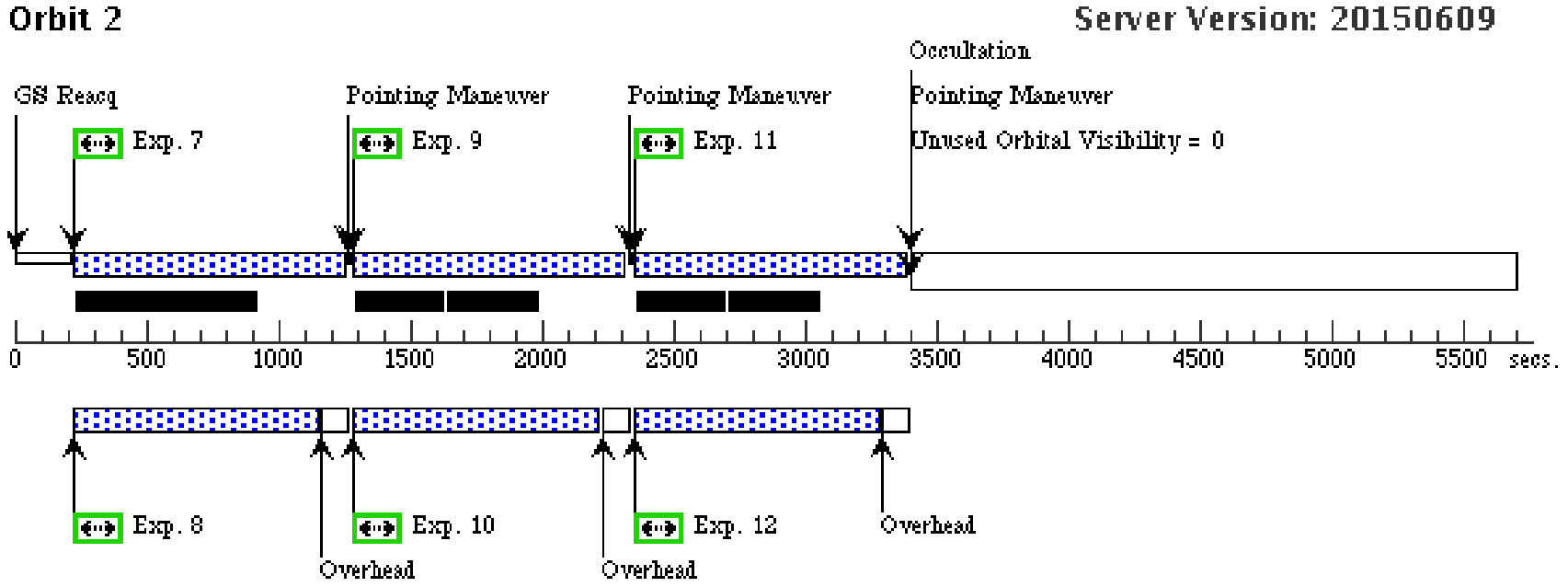
Exposures

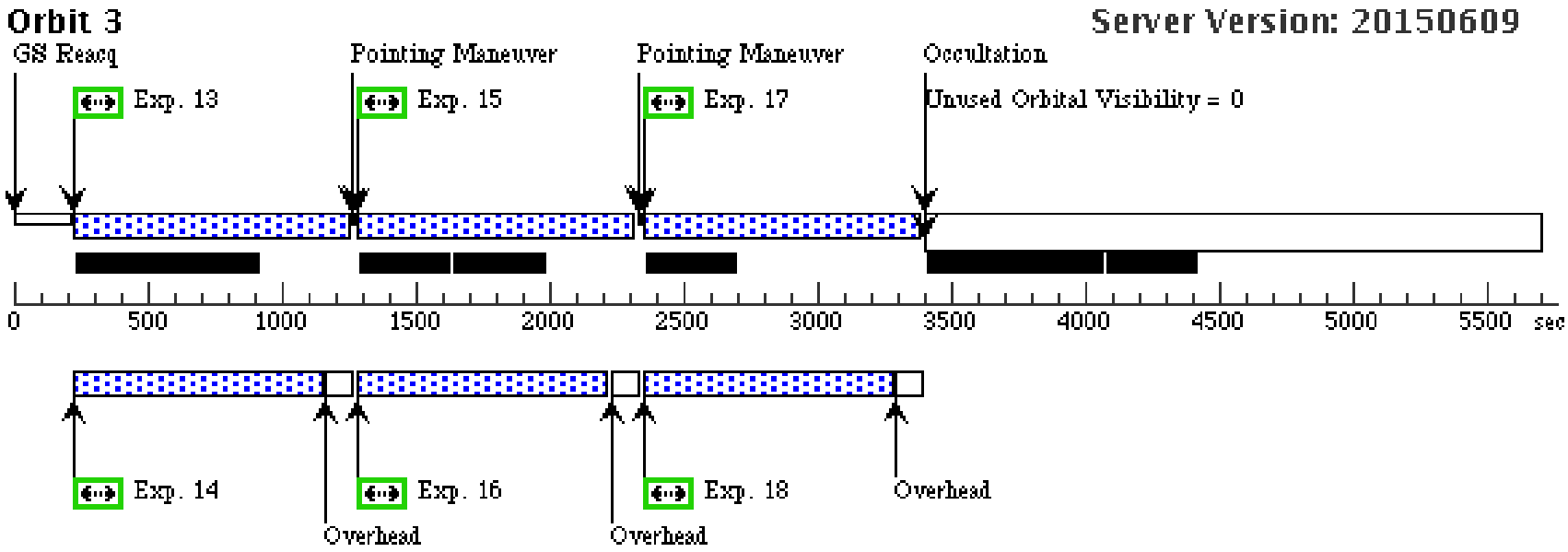
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(4) UMA-I-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.0000,0 .0000	Sequence 1-6 Non-Int in UMAI (04) Prime + Parallel Group 1-2 in Sequence 1-6 Non-Int in UMAI (04)	842 Secs (842 Secs) *[==>]*	***[1]***
2		ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W			Sequence 1-6 Non-Int in UMAI (04) Prime + Parallel Group 1-2 in Sequence 1-6 Non-Int in UMAI (04)	880 Secs (880 Secs) *[==>]*	***[1]***
3		(4) UMA-I-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.2141,0 .0161	Sequence 1-6 Non-Int in UMAI (04) Prime + Parallel Group 3-4 in Sequence 1-6 Non-Int in UMAI (04)	842 Secs (842 Secs) *[==>]*	***[1]***
4		ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W			Sequence 1-6 Non-Int in UMAI (04) Prime + Parallel Group 3-4 in Sequence 1-6 Non-Int in UMAI (04)	880 Secs (880 Secs) *[==>]*	***[1]***
5		(4) UMA-I-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.4281,0 .0322	Sequence 1-6 Non-Int in UMAI (04) Prime + Parallel Group 5-6 in Sequence 1-6 Non-Int in UMAI (04)	842 Secs (842 Secs) *[==>]*	***[1]***
6		ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W			Sequence 1-6 Non-Int in UMAI (04) Prime + Parallel Group 5-6 in Sequence 1-6 Non-Int in UMAI (04)	880 Secs (880 Secs) *[==>]*	***[1]***
7		(4) UMA-I-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.0504,0 .2183	Sequence 7-12 Non-Int in UMAI (04) Prime + Parallel Group 7-8 in Sequence 7-12 Non-Int in UMAI (04)	909 Secs (909 Secs) *[==>]*	***[2]***
8		ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W			Sequence 7-12 Non-Int in UMAI (04) Prime + Parallel Group 7-8 in Sequence 7-12 Non-Int in UMAI (04)	930 Secs (930 Secs) *[==>]*	***[2]***
9		(4) UMA-I-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.2644,0 .2344	Sequence 7-12 Non-Int in UMAI (04) Prime + Parallel Group 9-10 in Sequence 7-12 Non-Int in UMAI (04)	909 Secs (909 Secs) *[==>]*	***[2]***

	10	ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W		Sequence 7-12 Non-Int in UMAI (04) Prime + Parallel Group 9-10 in Sequence 7-12 Non-Int in UMAI (04)	930 Secs (930 Secs) *[==>]*	***[2]***
	11	(4) UMA-I-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W	POS TARG 0.4784,0.2505	Sequence 7-12 Non-Int in UMAI (04) Prime + Parallel Group 11-12 in Sequence 7-12 Non-Int in UMAI (04)	909 Secs (909 Secs) *[==>]*	***[2]***
	12	ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W		Sequence 7-12 Non-Int in UMAI (04) Prime + Parallel Group 11-12 in Sequence 7-12 Non-Int in UMAI (04)	930 Secs (930 Secs) *[==>]*	***[2]***
	13	(4) UMA-I-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W	POS TARG 0.1008,0.4366	Sequence 13-18 Non-Int in UMAI (04) Prime + Parallel Group 13-14 in Sequence 13-18 Non-Int in UMAI (04)	909 Secs (909 Secs) *[==>]*	***[3]***
	14	ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W		Sequence 13-18 Non-Int in UMAI (04) Prime + Parallel Group 13-14 in Sequence 13-18 Non-Int in UMAI (04)	930 Secs (930 Secs) *[==>]*	***[3]***
	15	(4) UMA-I-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W	POS TARG 0.3148,0.4527	Sequence 13-18 Non-Int in UMAI (04) Prime + Parallel Group 15-16 in Sequence 13-18 Non-Int in UMAI (04)	909 Secs (909 Secs) *[==>]*	***[3]***
	16	ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W		Sequence 13-18 Non-Int in UMAI (04) Prime + Parallel Group 15-16 in Sequence 13-18 Non-Int in UMAI (04)	930 Secs (930 Secs) *[==>]*	***[3]***
	17	(4) UMA-I-DSPH	ACS/WFC, ACCUM, WFCENTER	F606W	POS TARG 0.5288,0.4688	Sequence 13-18 Non-Int in UMAI (04) Prime + Parallel Group 17-18 in Sequence 13-18 Non-Int in UMAI (04)	909 Secs (909 Secs) *[==>]*	***[3]***
	18	ANY	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W		Sequence 13-18 Non-Int in UMAI (04) Prime + Parallel Group 17-18 in Sequence 13-18 Non-Int in UMAI (04)	930 Secs (930 Secs) *[==>]*	***[3]***

Orbit Structure






Orbit 3
Server Version: 20150609
GS Reacq
Pointing Maneuver
Pointing Maneuver
Occultation
Exp. 13
Exp. 15
Exp. 17
Unused Orbital Visibility = 0
0
500
1000
1500
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4000
4500
5000
5500
sec
Exp. 14
Exp. 16
Exp. 18
Overhead
Overhead
Overhead