15228 - Testing Galaxy Evolution in Unexplored Environments: the First Faint Dwarf Satellites of Local Volume LMC Analogs

Cycle: 25, 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) MADCASH-1 ANY	ACS/WFC WFC3/UVIS	2	18-Dec-2018 09:01:46.0	yes
02	(2) MADCASH-2 ANY	ACS/WFC WFC3/UVIS	2	18-Dec-2018 09:01:49.0	yes

4 Total Orbits Used

ABSTRACT

We propose to use four HST/ACS orbits to obtain follow-up imaging and resolved photometry of two candidate dwarf galaxies in the halos of Local Volume LMC analogs, which have been discovered as part of our ground-based MADCASH survey: MADCASH-1, which is a satellite of NGC 2403 (D = 3.2 Mpc), and MADCASH-2, near NGC 4214 (D = 2.9 Mpc). These are the faintest dwarf satellites known around host galaxies of Large

Magellanic Cloud stellar mass outside the Local Group. We will measure accurate TRGB distances to confirm their associations with their host galaxies, derive their structural parameters, and assess their stellar populations. These two dwarf galaxies, the first of their kind around LMC analogs, are vital probes of dwarf evolution in different environments. Both of these MADCASH dwarfs are at luminosities intermediate between the "classical" Milky Way dwarf galaxies and the "ultra-faint" dwarfs. The proposed observations will resolve individual stars in these systems of small angular size, allowing us to quantify the relative presence of ancient stellar populations and younger, more metal-enriched stars, and to measure their physical properties. We will compare these to the Milky Way classical and ultra-faint dwarfs to place these systems in a broader context and assess similarities or differences between these "dwarfs around dwarfs" and Local Group satellites.

OBSERVING DESCRIPTION

Our observing strategy is to obtain deep imaging in two filters (ACS/WFC F606W and F814W) in order to (a) confirm the association of two new dwarf galaxies (MADCASH-1 and MADCASH-2) with their putative LMC-analog hosts via accurate TRGB distances, (b) assess their stellar populations and star formation histories, and (c) derive their structural parameters (size, luminosity, ellipticity, and position angle) via resolved photometry. To accomplish these goals, we require deep, precise photometry with S/N~5 at least 2 magnitudes below the RGB tip in the target galaxies. Our choices of filters and exposure times are motivated by numerous studies and HST programs similar to ours (e.g., Williams et al. 2013, Dalcanton et al. 2009, Radburn-Smith et al. 2011). For low metallicity systems, the TRGB can be easily distinguished (using, e.g., a Sobel edge detection filter) due to the quick cutoff at M_I = -4.0 mag if the imaging in the I band (F814W) is sufficiently deep. The use of the V band (F606W) allows us to minimize galaxy contamination using photometric colors, and to use the detected member stars of each galaxy to assess their stellar populations and derive their structural parameters. We will use one orbit per filter per target galaxy, splitting the observing time into exposures of 1415/1272 sec (for MADCASH-1/MADCASH-2) in F606W and 1484/1341 sec in F814W, requiring a total of 4 HST orbits. Each exposure will be split into a two-line dither pattern to cover the ACS/WFC chip gap and facilitate cosmic ray removal. Each of the two galaxy candidates is small enough to fit onto one of the ACS/WFC chips, and given the lack of nearby bright stars, any HST orientation angle is sufficient for observing these targets. However, for MADCASH-1, we have placed limitations on the orientation in order to avoid placing nearby very bright stars onto the WFC3/UVIS chip during parallel observations. Our requested parallel observations with WFC3/UVIS will obtain neighboring fields from which we will assess the contribution of background sources. We note that these filters are similar to the g- and i-band filters we are using for our Subaru/HSC survey. These proposed parallel observations will thus provide an ancillary benefit by allowing us to use the deeper, higher-resolution HST data in regions of the WFC3/UVIS field of view well beyond our dwarf galaxy targets to assess the veracity of our star/galaxy classification in the ground-based MADCASH imaging, and improve our techniques in order to reduce the contamination from unresolved background galaxies.

Visit

Proposal 15228, MADCASH-1 (01), completed Tue Dec 18 14:01:50 GMT 2018

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: ORIENT 140D TO 360 D; ORIENT 60D TO 85 D

Diagnostics

(MADCASH-1 (01)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(MADCASH-1 (01)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=4 Point Spacing=3.034 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.29 Angle Between Sides= Center Pattern=false		(1-2), (3-4)

Fixed Targets

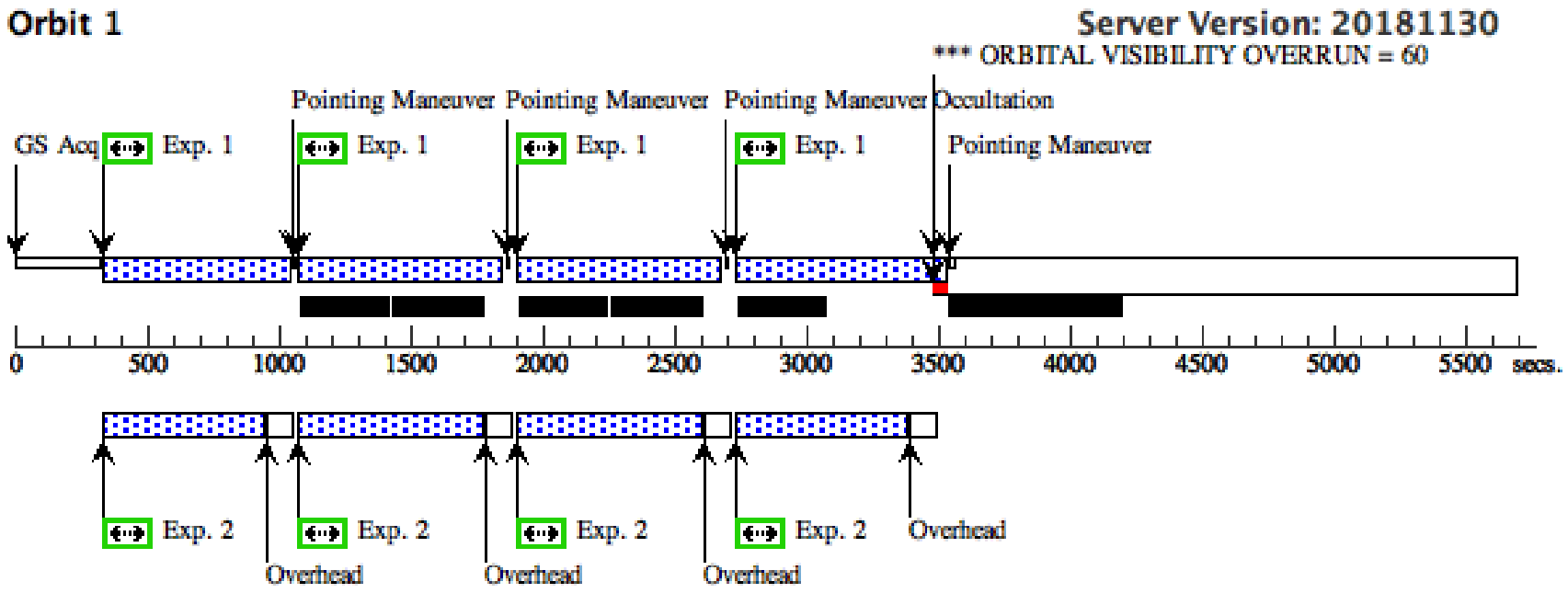
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	MADCASH-1 Alt Name1: MADCASH-J074238+652501-DW	RA: 07 42 38.8870 (115.6620292d) Dec: +65 25 1.89 (65.41719d) Equinox: J2000	Epoch of Position: 2000.0	V=20.0+/-0.7	Reference Frame: ICRS

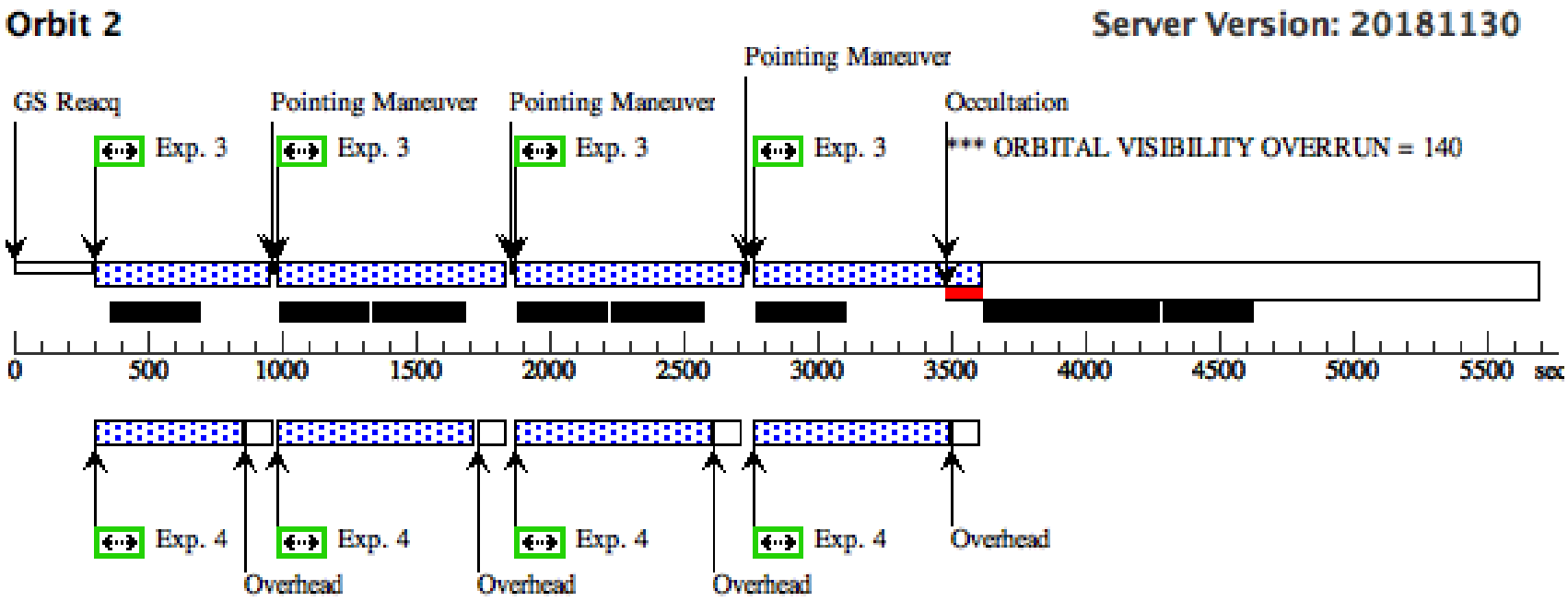
Comments: Note: V~20 is the total integrated magnitude of the dwarf galaxy.
Category=GALAXY
Description=[DWARF SPHEROIDAL]

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	MADCASH-1-F606W (ACS.im.10.09357)	(1) MADCASH-1	ACS/WFC, ACCUM, WFC1	F606W			Pattern 1, Exps 1-2 in MADCASH-1 (01) (1) Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 in MADCASH-1 (01)	453 Secs (2475 Secs) *[==>500.0 Secs (Pattern 1)]* *[==>650.0 Secs (Pattern 2)]* *[==>650.0 Secs (Pattern 3)]* *[==>675.0 Secs (Pattern 4)]*	***[1]***
2	MADCASH-1-parallel_F606W	ANY	WFC3/UVIS, ACCUM, UVIS	F606W			Pattern 1, Exps 1-2 in MADCASH-1 (01) (1) Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 in MADCASH-1 (01)	500 Secs (2630 Secs) *[==>580.0 Secs (Pattern 1)]* *[==>700.0 Secs (Pattern 2)]* *[==>700.0 Secs (Pattern 3)]* *[==>650.0 Secs (Pattern 4)]*	***[1]***
3	MADCASH-1-F814W	(1) MADCASH-1	ACS/WFC, ACCUM, WFC1	F814W			Pattern 1, Exps 3-4 in MADCASH-1 (01) (1) Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in MADCASH-1 (01)	500 Secs (2645 Secs) *[==>470.0 Secs (Pattern 1)]* *[==>725.0 Secs (Pattern 2)]* *[==>725.0 Secs (Pattern 3)]* *[==>725.0 Secs (Pattern 4)]*	***[2]***
4	MADCASH-1-parallel_F814W	ANY	WFC3/UVIS, ACCUM, UVIS	F814W			Pattern 1, Exps 3-4 in MADCASH-1 (01) (1) Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in MADCASH-1 (01)	510 Secs (2720 Secs) *[==>530.0 Secs (Pattern 1)]* *[==>730.0 Secs (Pattern 2)]* *[==>730.0 Secs (Pattern 3)]* *[==>730.0 Secs (Pattern 4)]*	***[2]***

Orbit Structure




Orbit 2
Server Version: 20181130
Pointing Maneuver
GS Reacq
Pointing Maneuver
Pointing Maneuver
Occultation
Exp. 3
Exp. 3
Exp. 3
Exp. 3
*** ORBITAL VISIBILITY OVERRUN = 140
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec
Exp. 4
Exp. 4
Exp. 4
Exp. 4
Overhead
Overhead
Overhead
Overhead

Visit

Proposal 15228, MADCASH-2 (02), implementation Tue Dec 18 14:01:50 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=4 Point Spacing=3.034 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.29 Angle Between Sides= Center Pattern=false		(1-2), (3-4)

Fixed Targets

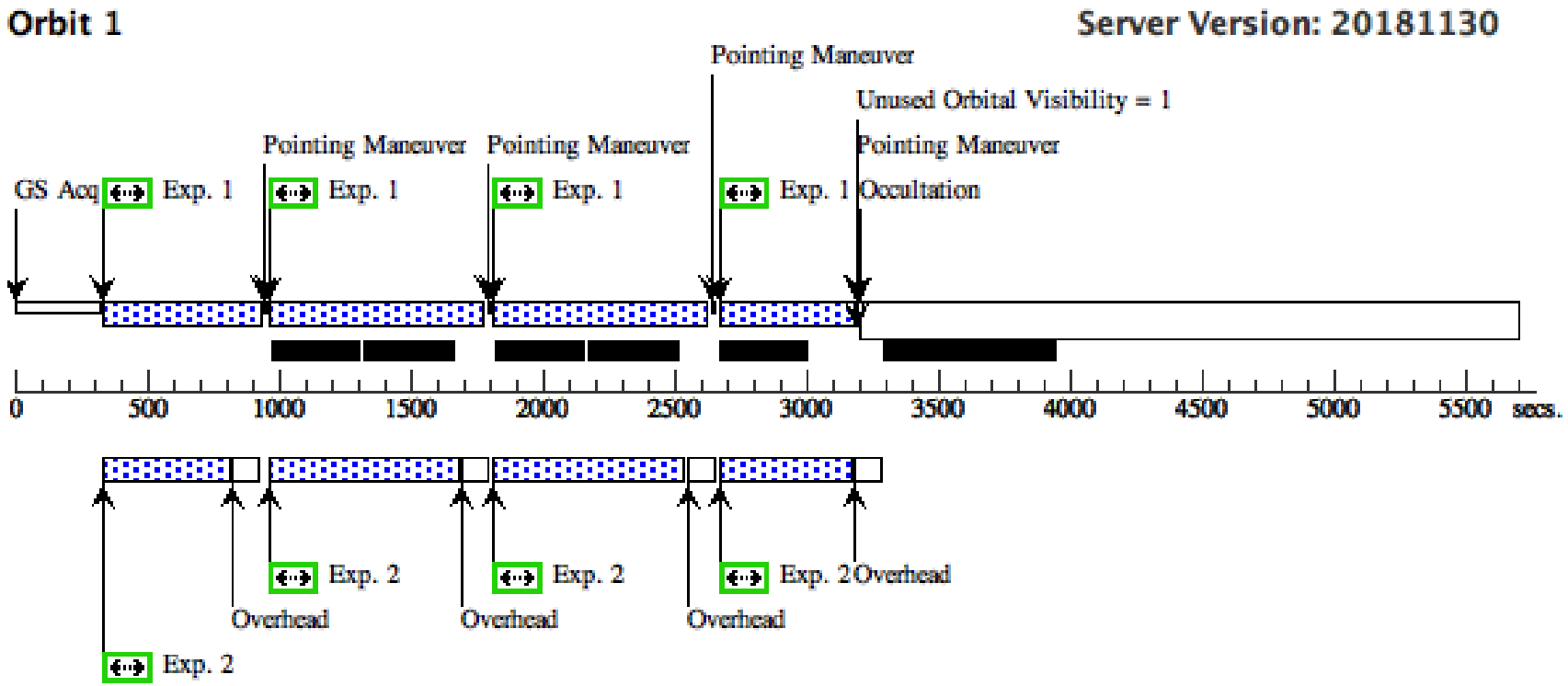
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	MADCASH-2	RA: 12 10 6.7230 (182.5280125d) Dec: +35 26 36.29 (35.44341d) Equinox: J2000		V=19+/-1	Reference Frame: ICRS

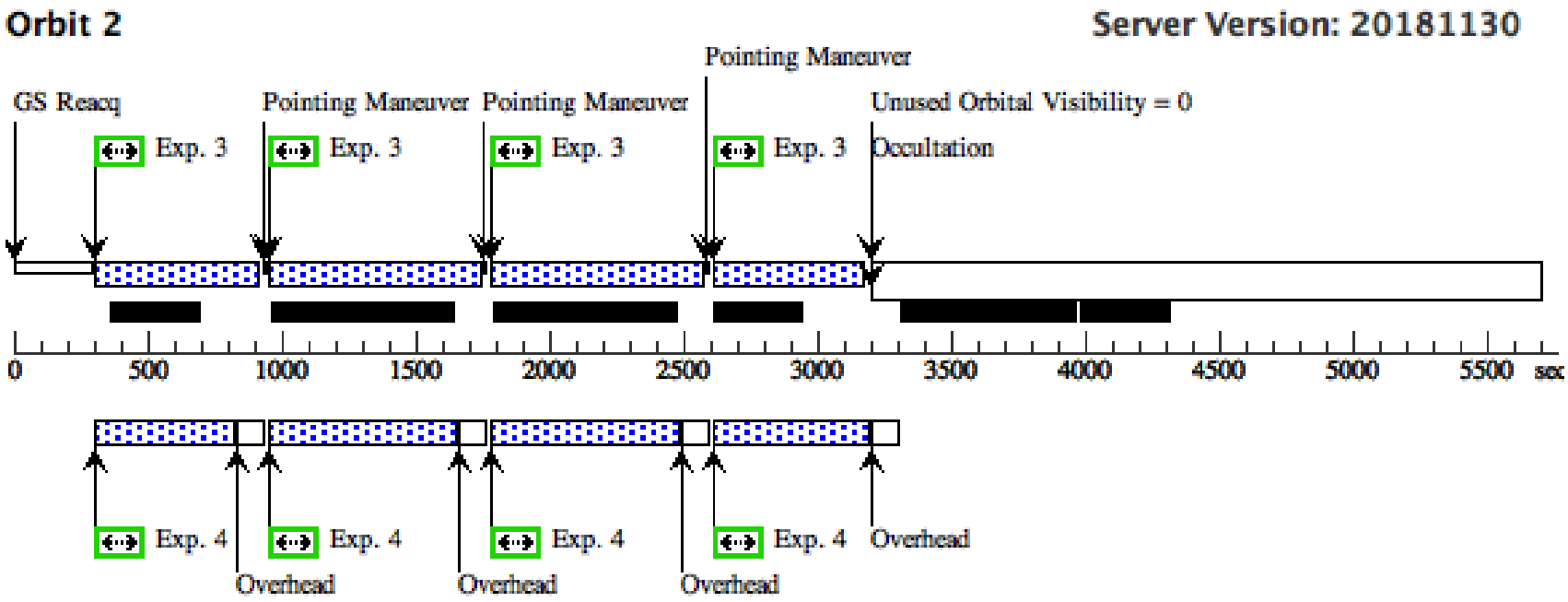
Comments: Note: V~19 is the total integrated magnitude of the dwarf galaxy.
Category=GALAXY
Description=[DWARF SPHEROIDAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	MACDASH-2-F606W	(2) MADCASH-2	ACS/WFC, ACCUM, WFC1	F606W			Pattern 1, Exps 1-2 in MADCASH-2 (02) (1) Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 in MADCASH-2 (02)	394 Secs (2160 Secs) *[==>390.0 Secs (Pattern 1)]* *[==>690.0 Secs (Pattern 2)]* *[==>690.0 Secs (Pattern 3)]* *[==>390.0 Secs (Pattern 4)]*	***[1]***
2	MADCASH-2-parallel-F606W	ANY	WFC3/UVIS, ACCUM, UVIS	F606W			Pattern 1, Exps 1-2 in MADCASH-2 (02) (1) Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 in MADCASH-2 (02)	405 Secs (2390 Secs) *[==>450.0 Secs (Pattern 1)]* *[==>720.0 Secs (Pattern 2)]* *[==>720.0 Secs (Pattern 3)]* *[==>500.0 Secs (Pattern 4)]*	***[1]***
3	MACDASH-2-F814W	(2) MADCASH-2	ACS/WFC, ACCUM, WFC1	F814W			Pattern 1, Exps 3-4 in MADCASH-2 (02) (1) Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in MADCASH-2 (02)	428 Secs (2200 Secs) *[==>435.0 Secs (Pattern 1)]* *[==>665.0 Secs (Pattern 2)]* *[==>665.0 Secs (Pattern 3)]* *[==>435.0 Secs (Pattern 4)]*	***[2]***
4	MADCASH-2-parallel-F814W	ANY	WFC3/UVIS, ACCUM, UVIS	F814W			Pattern 1, Exps 3-4 in MADCASH-2 (02) (1) Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in MADCASH-2 (02)	446 Secs (2478 Secs) *[==>500.0 Secs (Pattern 1)]* *[==>700.0 Secs (Pattern 2)]* *[==>700.0 Secs (Pattern 3)]* *[==>578.0 Secs (Pattern 4)]*	***[2]***

Orbit Structure




Orbit 2
Server Version: 20181130
Pointing Maneuver
GS Reacq
Pointing Maneuver
Pointing Maneuver
Unused Orbital Visibility = 0
Exp. 3
Exp. 3
Exp. 3
Exp. 3
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec
Exp. 4
Exp. 4
Exp. 4
Exp. 4
Overhead
Overhead
Overhead
Overhead