17481 - Discovery of Six Isolated Ultra-Faint Dwarf Galaxy Candidates in the Local Group

Cycle: 31, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*
Dr. Kristen B W McQuinn (PI) (Contact)	**Space Telescope Science Institute**
Dr. Yao-Yuan Mao (CoI)	University of Utah
Prof. Matthew Buckley (CoI)	Rutgers the State University of New Jersey
Prof. David Shih (CoI)	Rutgers the State University of New Jersey
Dr. Andrew Eugene Dolphin (CoI)	Raytheon Company
Dr. Roger Cohen (CoI)	Rutgers the State University of New Jersey

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) CETUS-K ANY	ACS/WFC WFC3/UVIS	1	24-Jun-2024 11:00:17.0	yes
51	(7) CETUS-K-UPDATE ANY	ACS/WFC WFC3/UVIS	1	24-Jun-2024 11:00:18.0	yes
07	(2) LEO-B ANY	ACS/WFC WFC3/UVIS	1	24-Jun-2024 11:00:19.0	yes
03	(3) CANES-VENATICI-C ANY	ACS/WFC WFC3/UVIS	1	24-Jun-2024 11:00:20.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
04	(4) ERIDANUS-M ANY	ACS/WFC WFC3/UVIS	1	24-Jun-2024 11:00:21.0	yes
05	(5) VIRGO-S ANY	ACS/WFC WFC3/UVIS	1	24-Jun-2024 11:00:22.0	yes
06	(6) SCULPTOR-Y ANY	ACS/WFC WFC3/UVIS	1	24-Jun-2024 11:00:23.0	yes

7 Total Orbits Used

ABSTRACT

Ultra-faint dwarf galaxies are the least luminous, most dark matter dominated, and least chemically evolved galaxies known. Detailed studies have shown that their star formation quenched at early times, which is generally thought to be caused by reionization and stellar feedback. Intriguingly, the recently discovered, relatively isolated ultra-faint dwarf, Pegasus W, has had an extended star formation history, suggesting it was not quenched by reionization and contradicting the generally accepted framework that reionization ubiquitously quenches ultra-faint dwarfs. This suggests that, in addition to reionization, environment may play a role in quenching ultra-faint dwarfs.

Pegasus W is thought to be the tip-of-the-iceberg of a population of low mass halos in the Local Group at farther distances that have yet to be detected. Indeed, we have found six ultra-faint dwarf galaxy candidates that appear to be in the Local Group, but, similar to Pegasus W, outside the halos of the MW, M31, and the LMC. Here, we propose 1-orbit of HST imaging per target to confirm these systems are bona fide ultra-faint dwarf galaxies and characterize their properties. The data will be of sufficient depth to (i) robustly measure their distances via horizontal branch stars, (ii) determine the systems' structural parameters and total luminosities, and (iii) derive the star formation histories, placing constraints on the quenching timescales. We will explore the role of enviroment in determining their properties via comparison with Pegasus W as well as ultra-faint dwarf galaxies that are satellite galaxies, all as a fuction of distance to a massive host.

OBSERVING DESCRIPTION

The observations included ACS/WFC and WFC3/UVIS imaging in the F606W and F814W filters. The data will be used to confirm that the targets are galaxies, measure the distances to the systems from resolved stars (TRGB and/or Horizontal Branch methods), characterize the stellar properites (star formation histories and metallicities), and measure the structural parameters of the galaxies. The parallel pointings will allow us to observe a

field region next to our targets. We will thus be able to estimate more precisely the number of background/foreground contaminants present in our ACS fields.

Each of the 6 targets will be observed for 1 orbit. We use a 5x5 pixel dither implemented using pos-targ (equivalent to the ACS WFC DITHER LINE pattern #14) to reject cosmic rays and handle hot pixels. The first pointing is executed with both filters in ACS and with both filters in WFC3 parallel fields. After the dither, the observations are then repeated. The exposure time per orbit is split roughly equally between the F606W and F814W filters.

In order to obtain 4 exposures in both ACS and WFC3 in one orbit and accomodate buffer dumps during exposures, we have added a special requirement to the visibility intervals, which has been approved via PCR 92614.

Each visit is 1-orbit. We have place ORIENT constraints to ensure we maximum coverage of the stellar disk and prevent the galaxy centers from falling in the ACS chip gap, while avoiding nearby bright stars.

Visit

Proposal 17481, CETUS-K (01), failed Mon Jun 24 15:00:23 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: ORIENT 84D TO 88 D; VISIBILITY INTERVAL 3267 S

Diagnostics

(CETUS-K (01)) Warning (Orbit Planner): GS ACQ SCENARIO REQUESTED INCONSISTENT WITH VISIT GYRO MODE

(Primary Exposure 1 (Prime + Parallel Group 1-2 in CETUS-K (01)) special requirements) Warning (Form): The specified GS Acq Scenario is not in the current list of valid scenarios.

Fixed Targets

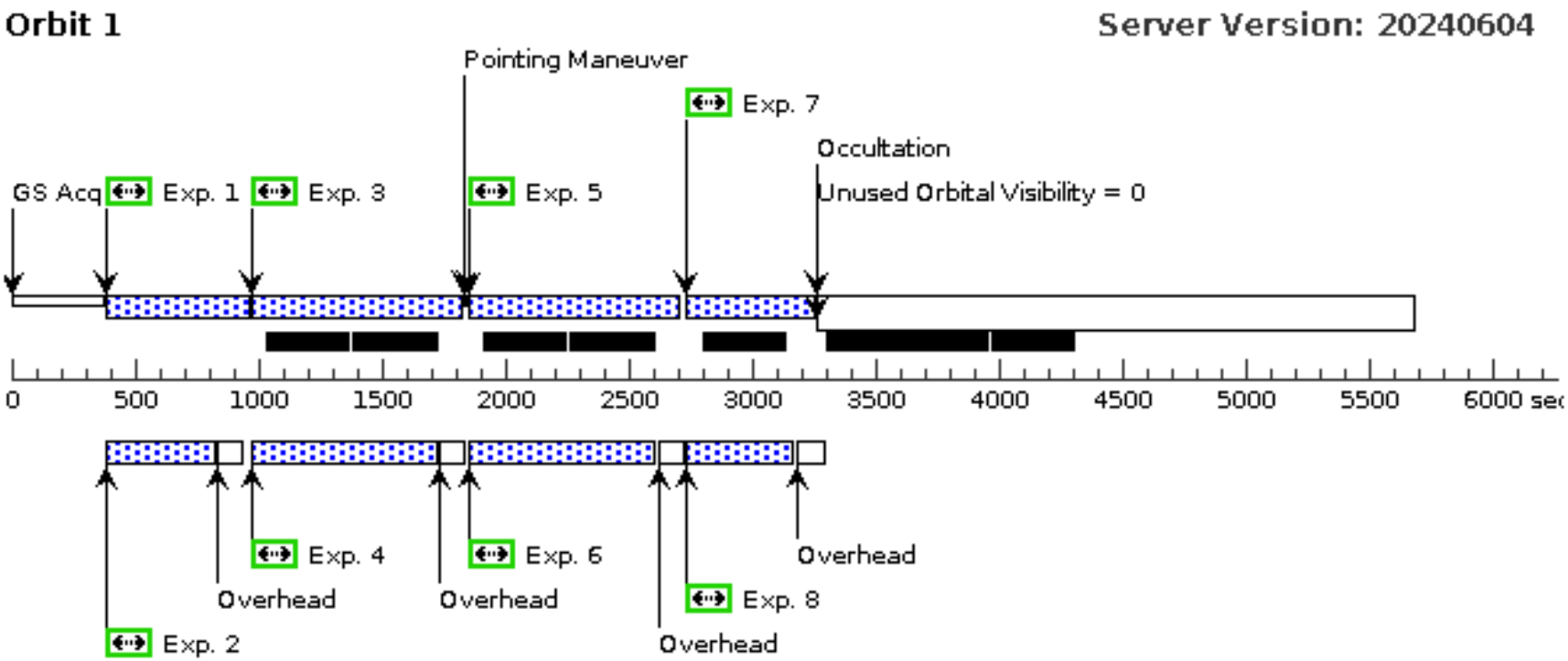
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	CETUS-K	RA: 01 57 47.4724 (29.4478017d) Dec: -13 47 6.54 (-13.78515d) Equinox: J2000		V=17	Reference Frame: ICRS

Comments:
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		(1) CETUS-K	ACS/WFC, ACCUM, WFC	F606W		GS ACQ SCENARIO BASE1B3	Prime + Parallel Group 1-2 in CETUS-K (01)	370 Secs (370 Secs) *[==>]*	 ***[1]***
2		ANY	WFC3/UVIS, ACCUM, UVIS	F606W			Prime + Parallel Group 1-2 in CETUS-K (01)	410 Secs (410 Secs) *[==>]*	 ***[1]***
3		(1) CETUS-K	ACS/WFC, ACCUM, WFC	F814W			Prime + Parallel Group 3-4 in CETUS-K (01)	670 Secs (670 Secs) *[==>]*	 ***[1]***
4		ANY	WFC3/UVIS, ACCUM, UVIS	F814W			Prime + Parallel Group 3-4 in CETUS-K (01)	730 Secs (730 Secs) *[==>]*	 ***[1]***
5		(1) CETUS-K	ACS/WFC, ACCUM, WFC	F606W		POS TARG 0.247,0.267	Prime + Parallel Group 5-6 in CETUS-K (01)	670 Secs (670 Secs) *[==>]*	 ***[1]***
6		ANY	WFC3/UVIS, ACCUM, UVIS	F606W			Prime + Parallel Group 5-6 in CETUS-K (01)	730 Secs (730 Secs) *[==>]*	 ***[1]***
7		(1) CETUS-K	ACS/WFC, ACCUM, WFC	F814W		SAME POS AS 5	Prime + Parallel Group 7-8 in CETUS-K (01)	337 Secs (337 Secs) *[==>]*	 ***[1]***
8		ANY	WFC3/UVIS, ACCUM, UVIS	F814W	FLASH=11		Prime + Parallel Group 7-8 in CETUS-K (01)	410 Secs (410 Secs) *[==>]*	 ***[1]***

Orbit Structure



Visit

Proposal 17481, CETUS-K (51), completed Mon Jun 24 15:00:24 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: ORIENT 80D TO 95 D; VISIBILITY INTERVAL 3197 S

Diagnostics

(CETUS-K (51)) Warning (Orbit Planner): GS ACQ SCENARIO REQUESTED INCONSISTENT WITH VISIT GYRO MODE

(Primary Exposure 1 (Prime + Parallel Group 1-2 in CETUS-K (51)) special requirements) Warning (Form): The specified GS Acq Scenario is not in the current list of valid scenarios.

Fixed Targets

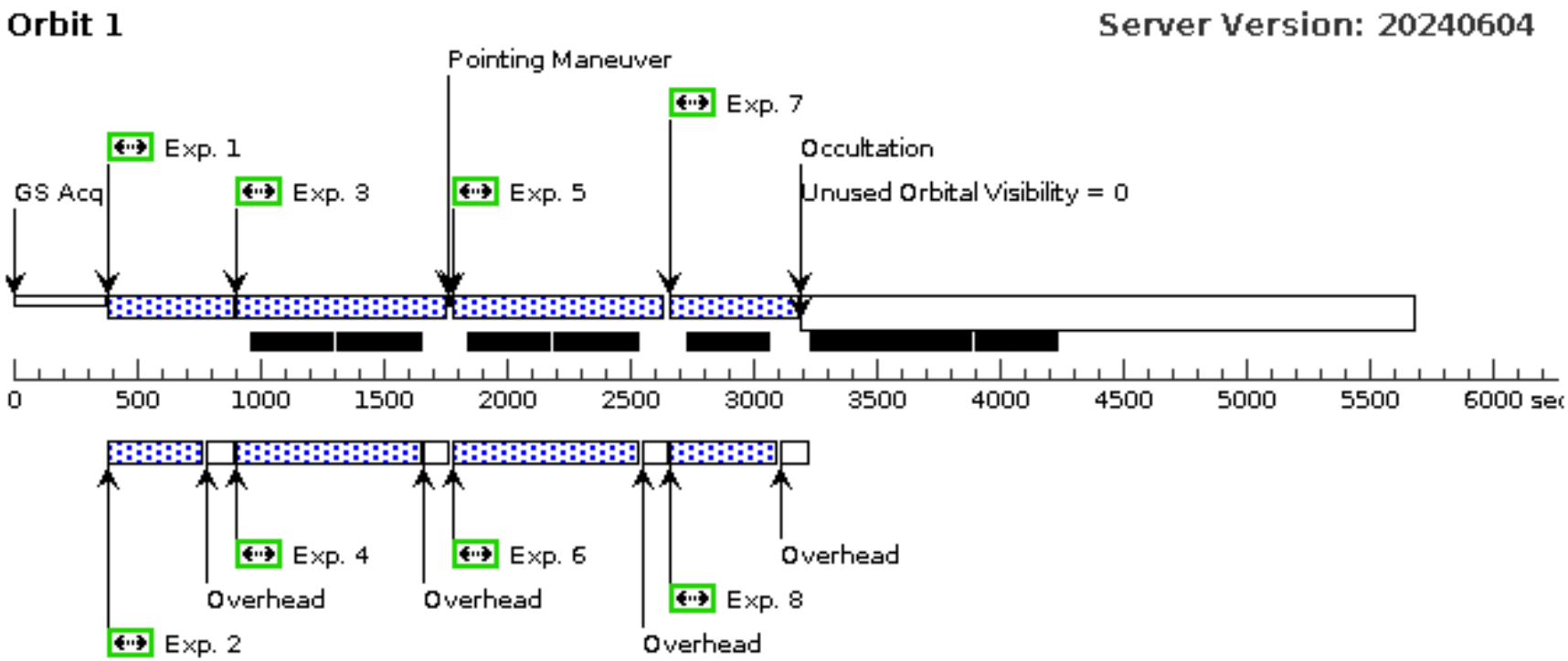
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(7)	CETUS-K-UPDATE	RA: 01 57 47.0395 (29.4459979d) Dec: -13 47 18.02 (-13.78834d) Equinox: J2000		V=17	Reference Frame: ICRS

Comments:
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		(7) CETUS-K-UPDATE	ACS/WFC, ACCUM, WFC	F606W		GS ACQ SCENARIO BASE1B3	Prime + Parallel Group 1-2 in CETUS-K (51)	300 Secs (300 Secs) *[==>]*	 ***[1]***
2		ANY	WFC3/UVIS, ACCUM, UVIS	F606W	FLASH=6		Prime + Parallel Group 1-2 in CETUS-K (51)	355 Secs (355 Secs) *[==>]*	 ***[1]***
3		(7) CETUS-K-UPDATE	ACS/WFC, ACCUM, WFC	F814W			Prime + Parallel Group 3-4 in CETUS-K (51)	670 Secs (670 Secs) *[==>]*	 ***[1]***
4		ANY	WFC3/UVIS, ACCUM, UVIS	F814W			Prime + Parallel Group 3-4 in CETUS-K (51)	730 Secs (730 Secs) *[==>]*	 ***[1]***
5		(7) CETUS-K-UPDATE	ACS/WFC, ACCUM, WFC	F606W		POS TARG 0.247,0.267	Prime + Parallel Group 5-6 in CETUS-K (51)	670 Secs (670 Secs) *[==>]*	 ***[1]***
6		ANY	WFC3/UVIS, ACCUM, UVIS	F606W			Prime + Parallel Group 5-6 in CETUS-K (51)	730 Secs (730 Secs) *[==>]*	 ***[1]***
7		(7) CETUS-K-UPDATE	ACS/WFC, ACCUM, WFC	F814W		SAME POS AS 5	Prime + Parallel Group 7-8 in CETUS-K (51)	337 Secs (337 Secs) *[==>]*	 ***[1]***
8		ANY	WFC3/UVIS, ACCUM, UVIS	F814W	FLASH=11		Prime + Parallel Group 7-8 in CETUS-K (51)	410 Secs (410 Secs) *[==>]*	 ***[1]***

Orbit Structure



Visit

Proposal 17481, LEO-B (07) Mon Jun 24 15:00:24 GMT 2024

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: VISIBILITY INTERVAL 3128 S

Comments: exposure times adjusted to accomodate reduced gyro mode.

Fixed Targets

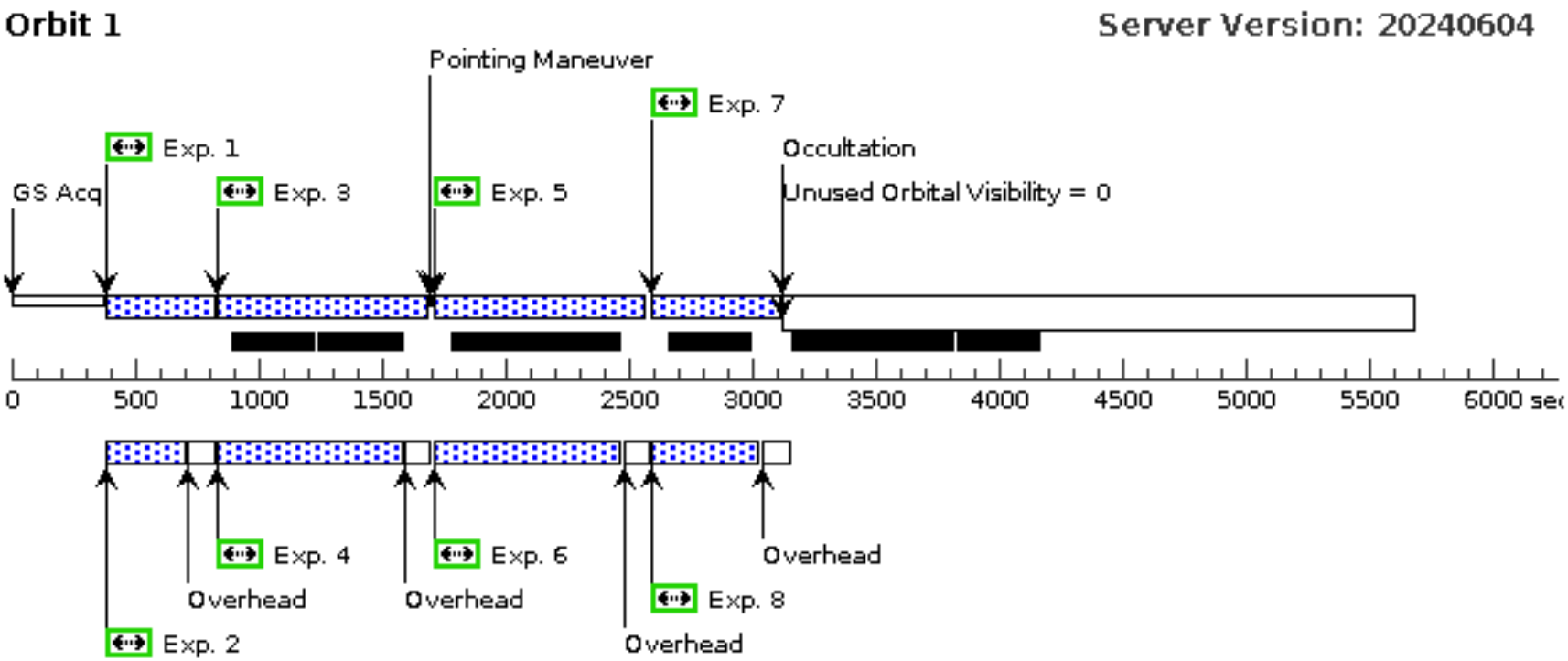
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	LEO-B	RA: 11 22 27.3807 (170.6140863d) Dec: +05 49 36.16 (5.82671d) Equinox: J2000		V=17	Reference Frame: ICRS

Comments:
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		(2) LEO-B	ACS/WFC, ACCUM, WFC	F606W			Prime + Parallel Group 1-2 in LEO-B (07)	234 Secs (234 Secs) *[==>]*	 ***[1]***
2		ANY	WFC3/UVIS, ACCUM, UVIS	F606W	FLASH=6		Prime + Parallel Group 1-2 in LEO-B (07)	289 Secs (289 Secs) *[==>]*	 ***[1]***
3		(2) LEO-B	ACS/WFC, ACCUM, WFC	F814W			Prime + Parallel Group 3-4 in LEO-B (07)	670 Secs (670 Secs) *[==>]*	 ***[1]***
4		ANY	WFC3/UVIS, ACCUM, UVIS	F814W			Prime + Parallel Group 3-4 in LEO-B (07)	730 Secs (730 Secs) *[==>]*	 ***[1]***
5		(2) LEO-B	ACS/WFC, ACCUM, WFC	F606W		POS TARG 0.247,0.267	Prime + Parallel Group 5-6 in LEO-B (07)	670 Secs (670 Secs) *[==>]*	 ***[1]***
6		ANY	WFC3/UVIS, ACCUM, UVIS	F606W			Prime + Parallel Group 5-6 in LEO-B (07)	730 Secs (730 Secs) *[==>]*	 ***[1]***
7		(2) LEO-B	ACS/WFC, ACCUM, WFC	F814W		SAME POS AS 5	Prime + Parallel Group 7-8 in LEO-B (07)	337 Secs (337 Secs) *[==>]*	 ***[1]***
8		ANY	WFC3/UVIS, ACCUM, UVIS	F814W	FLASH=11		Prime + Parallel Group 7-8 in LEO-B (07)	410 Secs (410 Secs) *[==>]*	 ***[1]***

Orbit Structure



Visit

Proposal 17481, CANES-VENATICI-C (03), completed Mon Jun 24 15:00:24 GMT 2024

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: ORIENT 250D TO 263 D; ORIENT 276D TO 290 D; VISIBILITY INTERVAL 3260 S

Fixed Targets

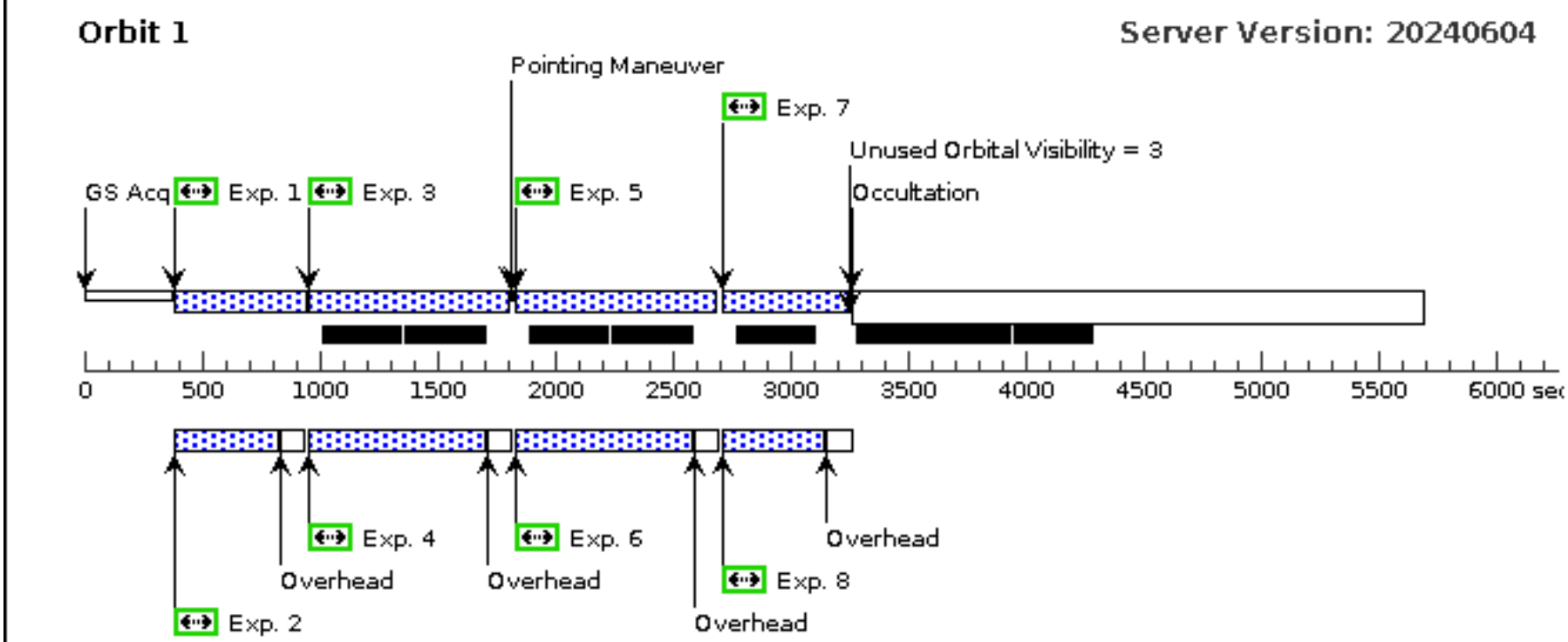
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	CANES-VENATICI-C	RA: 12 17 39.4373 (184.4143221d) Dec: +33 20 49.68 (33.34713d) Equinox: J2000		V=17	Reference Frame: ICRS

Comments:
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		(3) CANES-VENATICI-C	ACS/WFC, ACCUM, WFC	F606W			Prime + Parallel Group 1-2 in CANES-VENATICI-C (03)	350 Secs (350 Secs) *[==>]*	 ***[1]***
2		ANY	WFC3/UVIS, ACCUM, UVIS	F606W			Prime + Parallel Group 1-2 in CANES-VENATICI-C (03)	410 Secs (410 Secs) *[==>]*	 ***[1]***
3		(3) CANES-VENATICI-C	ACS/WFC, ACCUM, WFC	F814W			Prime + Parallel Group 3-4 in CANES-VENATICI-C (03)	670 Secs (670 Secs) *[==>]*	 ***[1]***
4		ANY	WFC3/UVIS, ACCUM, UVIS	F814W			Prime + Parallel Group 3-4 in CANES-VENATICI-C (03)	730 Secs (730 Secs) *[==>]*	 ***[1]***
5		(3) CANES-VENATICI-C	ACS/WFC, ACCUM, WFC	F606W		POS TARG 0.247,0.267	Prime + Parallel Group 5-6 in CANES-VENATICI-C (03)	670 Secs (670 Secs) *[==>]*	 ***[1]***
6		ANY	WFC3/UVIS, ACCUM, UVIS	F606W			Prime + Parallel Group 5-6 in CANES-VENATICI-C (03)	730 Secs (730 Secs) *[==>]*	 ***[1]***
7		(3) CANES-VENATICI-C	ACS/WFC, ACCUM, WFC	F814W		SAME POS AS 5	Prime + Parallel Group 7-8 in CANES-VENATICI-C (03)	350 Secs (350 Secs) *[==>]*	 ***[1]***
8		ANY	WFC3/UVIS, ACCUM, UVIS	F814W	FLASH=11		Prime + Parallel Group 7-8 in CANES-VENATICI-C (03)	410 Secs (410 Secs) *[==>]*	 ***[1]***

Orbit Structure



Visit

Proposal 17481, ERIDANUS-M (04), completed Mon Jun 24 15:00:24 GMT 2024

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: ORIENT 340D TO 14 D; ORIENT 30D TO 46 D; VISIBILITY INTERVAL 3260 S

Fixed Targets

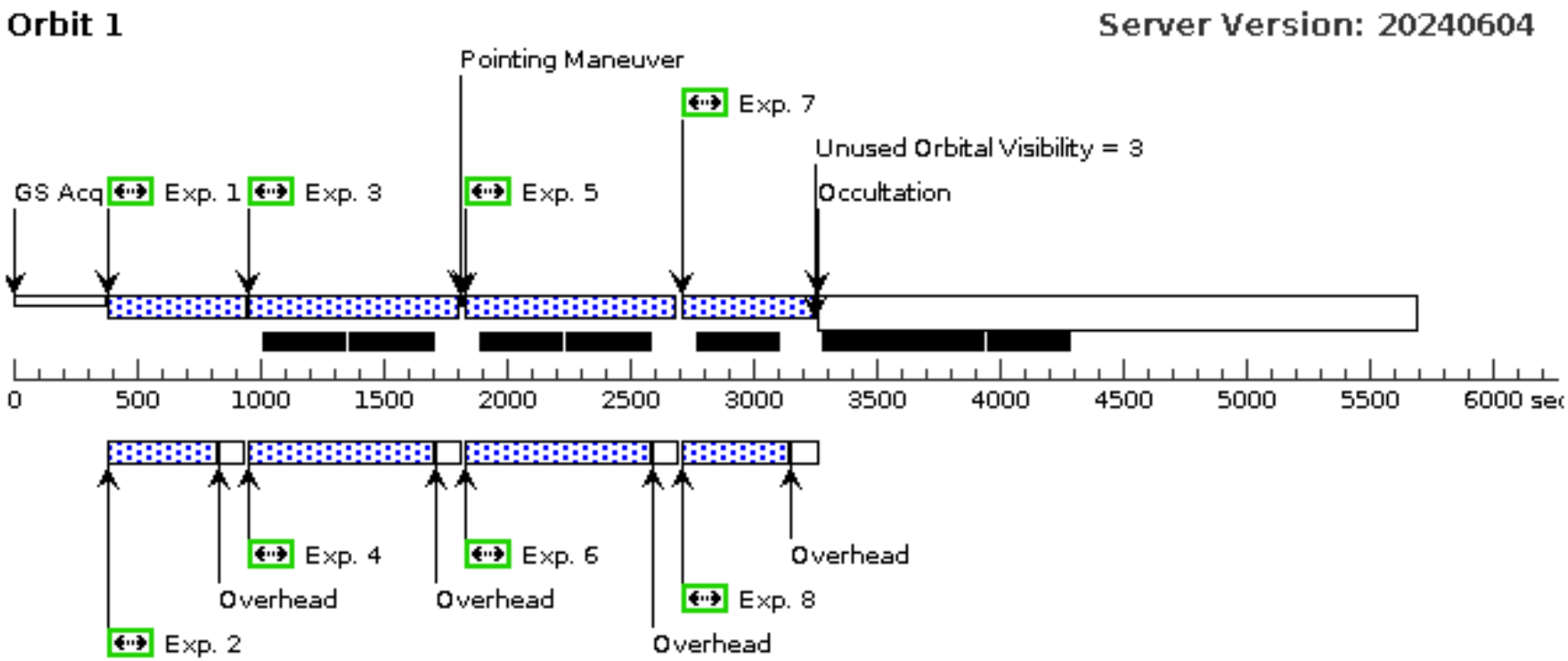
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	ERIDANUS-M	RA: 04 23 42.1937 (65.9258071d) Dec: -35 27 34.22 (-35.45951d) Equinox: J2000		V=17	Reference Frame: ICRS

Comments:
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		(4) ERIDANUS-M	ACS/WFC, ACCUM, WFC	F606W			Prime + Parallel Group 1-2 in ERIDANUS-M (04)	350 Secs (350 Secs) *[==>]*	 ***[1]***
2		ANY	WFC3/UVIS, ACCUM, UVIS	F606W			Prime + Parallel Group 1-2 in ERIDANUS-M (04)	410 Secs (410 Secs) *[==>]*	 ***[1]***
3		(4) ERIDANUS-M	ACS/WFC, ACCUM, WFC	F814W			Prime + Parallel Group 3-4 in ERIDANUS-M (04)	670 Secs (670 Secs) *[==>]*	 ***[1]***
4		ANY	WFC3/UVIS, ACCUM, UVIS	F814W			Prime + Parallel Group 3-4 in ERIDANUS-M (04)	730 Secs (730 Secs) *[==>]*	 ***[1]***
5		(4) ERIDANUS-M	ACS/WFC, ACCUM, WFC	F606W		POS TARG 0.247,0.267	Prime + Parallel Group 5-6 in ERIDANUS-M (04)	670 Secs (670 Secs) *[==>]*	 ***[1]***
6		ANY	WFC3/UVIS, ACCUM, UVIS	F606W			Prime + Parallel Group 5-6 in ERIDANUS-M (04)	730 Secs (730 Secs) *[==>]*	 ***[1]***
7		(4) ERIDANUS-M	ACS/WFC, ACCUM, WFC	F814W		SAME POS AS 5	Prime + Parallel Group 7-8 in ERIDANUS-M (04)	350 Secs (350 Secs) *[==>]*	 ***[1]***
8		ANY	WFC3/UVIS, ACCUM, UVIS	F814W	FLASH=11		Prime + Parallel Group 7-8 in ERIDANUS-M (04)	410 Secs (410 Secs) *[==>]*	 ***[1]***

Orbit Structure



Visit

Proposal 17481, VIRGO-S (05), completed Mon Jun 24 15:00:24 GMT 2024

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: ORIENT 110D TO 120 D; VISIBILITY INTERVAL 3247 S

Fixed Targets

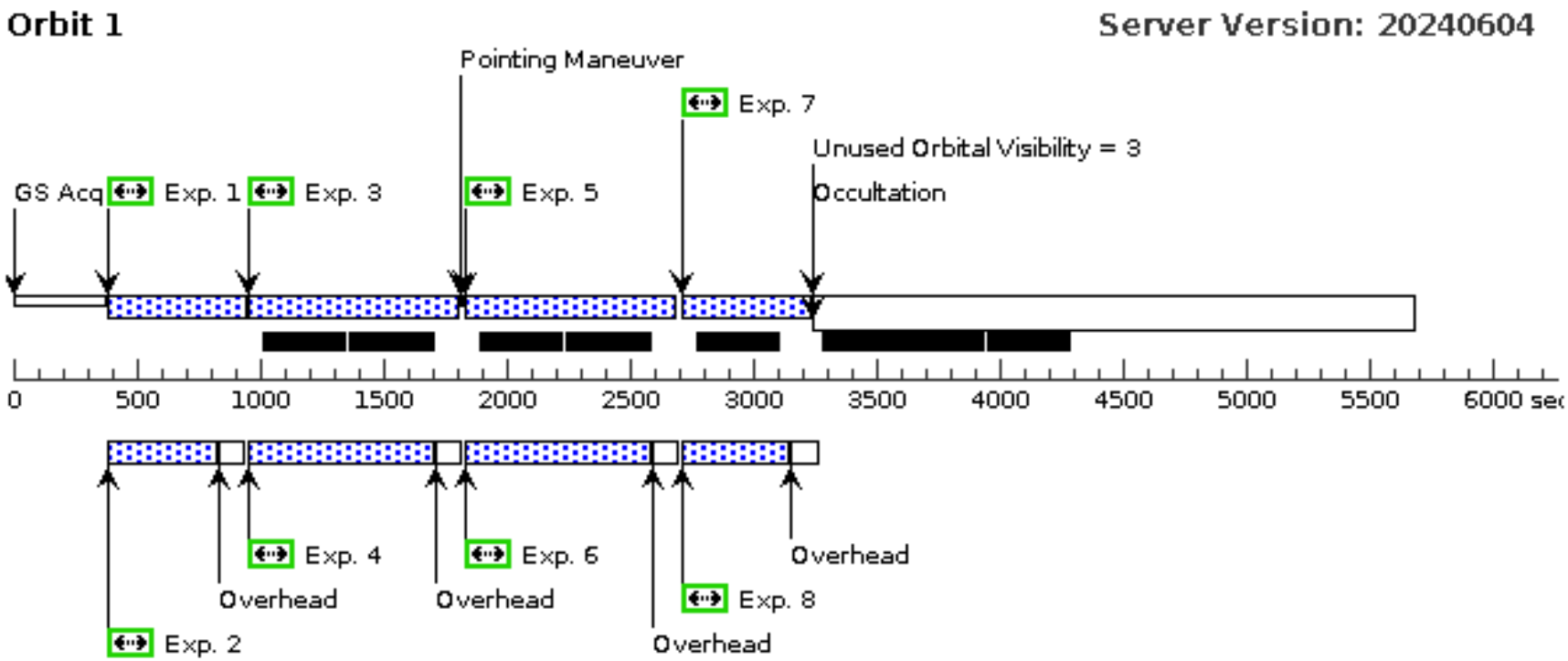
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(5)	VIRGO-S	RA: 12 38 35.3510 (189.6472958d) Dec: -02 33 15.99 (-2.55444d) Equinox: J2000		V=17	Reference Frame: ICRS

Comments:
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		(5) VIRGO-S	ACS/WFC, ACCUM, WFC	F606W			Prime + Parallel Group 1-2 in VIRGO-S (05)	350 Secs (350 Secs) *[==>]*	 ***[1]***
2		ANY	WFC3/UVIS, ACCUM, UVIS	F606W			Prime + Parallel Group 1-2 in VIRGO-S (05)	410 Secs (410 Secs) *[==>]*	 ***[1]***
3		(5) VIRGO-S	ACS/WFC, ACCUM, WFC	F814W			Prime + Parallel Group 3-4 in VIRGO-S (05)	670 Secs (670 Secs) *[==>]*	 ***[1]***
4		ANY	WFC3/UVIS, ACCUM, UVIS	F814W			Prime + Parallel Group 3-4 in VIRGO-S (05)	730 Secs (730 Secs) *[==>]*	 ***[1]***
5		(5) VIRGO-S	ACS/WFC, ACCUM, WFC	F606W		POS TARG 0.247,0.267	Prime + Parallel Group 5-6 in VIRGO-S (05)	670 Secs (670 Secs) *[==>]*	 ***[1]***
6		ANY	WFC3/UVIS, ACCUM, UVIS	F606W			Prime + Parallel Group 5-6 in VIRGO-S (05)	730 Secs (730 Secs) *[==>]*	 ***[1]***
7		(5) VIRGO-S	ACS/WFC, ACCUM, WFC	F814W		SAME POS AS 5	Prime + Parallel Group 7-8 in VIRGO-S (05)	337 Secs (337 Secs) *[==>]*	 ***[1]***
8		ANY	WFC3/UVIS, ACCUM, UVIS	F814W	FLASH=11		Prime + Parallel Group 7-8 in VIRGO-S (05)	410 Secs (410 Secs) *[==>]*	 ***[1]***

Orbit Structure



Visit

Proposal 17481, SCULPTOR-Y (06), withdrawn Mon Jun 24 15:00:24 GMT 2024

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: ORIENT 188D TO 237 D; ORIENT 6D TO 132 D; VISIBILITY INTERVAL 3260 S

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(6)	SCULPTOR-Y	RA: 00 57 52.7392 (14.4697467d) Dec: -35 51 11.02 (-35.85306d) Equinox: J2000		V=17	Reference Frame: ICRS

Comments:
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		(6) SCULPTOR-Y	ACS/WFC, ACCUM, WFC	F606W			Prime + Parallel Group 1-2 in SCULPTOR-Y (06)	350 Secs (350 Secs) *[==>]*	 ***[1]***
2		ANY	WFC3/UVIS, ACCUM, UVIS	F606W			Prime + Parallel Group 1-2 in SCULPTOR-Y (06)	410 Secs (410 Secs) *[==>]*	 ***[1]***
3		(6) SCULPTOR-Y	ACS/WFC, ACCUM, WFC	F814W			Prime + Parallel Group 3-4 in SCULPTOR-Y (06)	670 Secs (670 Secs) *[==>]*	 ***[1]***
4		ANY	WFC3/UVIS, ACCUM, UVIS	F814W			Prime + Parallel Group 3-4 in SCULPTOR-Y (06)	730 Secs (730 Secs) *[==>]*	 ***[1]***
5		(6) SCULPTOR-Y	ACS/WFC, ACCUM, WFC	F606W		POS TARG 0.247,0.267	Prime + Parallel Group 5-6 in SCULPTOR-Y (06)	670 Secs (670 Secs) *[==>]*	 ***[1]***
6		ANY	WFC3/UVIS, ACCUM, UVIS	F606W			Prime + Parallel Group 5-6 in SCULPTOR-Y (06)	730 Secs (730 Secs) *[==>]*	 ***[1]***
7		(6) SCULPTOR-Y	ACS/WFC, ACCUM, WFC	F814W		SAME POS AS 5	Prime + Parallel Group 7-8 in SCULPTOR-Y (06)	350 Secs (350 Secs) *[==>]*	 ***[1]***
8		ANY	WFC3/UVIS, ACCUM, UVIS	F814W	FLASH=11		Prime + Parallel Group 7-8 in SCULPTOR-Y (06)	410 Secs (508 Secs) *[==>508.0 Secs]*	 ***[1]***

Orbit Structure