17514 - Three new isolated, faint and star-forming dwarf galaxies beyond the Local Group

Cycle: 31, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*
Dr. Burcin Mutlu-Pakdil (PI) (Contact)	**Dartmouth College**
Prof. David J. Sand (CoI) (CoPI)	University of Arizona
Dr. Denija Crnojevic (CoI) (CoPI)	University of Tampa
Dr. Alex Drlica-Wagner (CoI) (CoPI)	Fermi National Accelerator Laboratory (FNAL)
Dr. Ananthan Karunakaran (CoI) (CSA Member) (CoPI)	University of Toronto
Dr. Michael Gordon Jones (CoI) (CoPI)	University of Arizona
Dr. Kristine Spekkens (CoI) (CSA Member) (CoPI)	Royal Military College of Canada
Dr. Catherine Fielder (CoI) (CoPI)	University of Arizona
Dr. Paul Bennet (CoI) (CoPI)	Space Telescope Science Institute
Kai Robert Herron (CoI) (CoPI)	Dartmouth College
Prof. Dennis Zaritsky (CoI) (CoPI)	University of Arizona
Richard Donnerstein (CoI) (CoPI)	University of Arizona

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) CORVUS ANY	ACS/WFC WFC3/UVIS	1	17-Jun-2024 13:01:32.0	yes
02	(2) KAMINO ANY	ACS/WFC WFC3/UVIS	1	17-Jun-2024 13:01:33.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
52	(2) KAMINO	ACS/WFC	1	17-Jun-2024 13:01:34.0	yes
03	(3) PAVO ANY	ACS/WFC WFC3/UVIS	1	17-Jun-2024 13:01:34.0	yes

4 Total Orbits Used

ABSTRACT

The Local Group satellite dwarf galaxies are frequently used as benchmarks for testing galaxy formation and evolution theories on the smallest scales because they are the lowest-mass galaxies for which we have detailed observations. However, the vast majority of these dwarfs have been affected by the Local Group environment. If we want to understand the physical mechanisms driving the evolution of low-mass galaxies, it is essential to study pristine isolated dwarf galaxies beyond the Local Group as a control sample. Unfortunately, identifying such galaxies in the field is extremely challenging due to their extreme faintness. To date, Leo P is the only known isolated, star-forming galaxy that is independent of group dynamics in an extremely low-mass regime (<10^6 Msun) but close enough at 1.6 Mpc to be studied with resolved stars. With only one system, it is challenging to draw broad conclusions about low-mass star-forming galaxies evolving in isolation.

We request three orbits of HST/ACS imaging (F606W+F814W) to follow up three new nearby isolated, faint, star-forming dwarf galaxies discovered in ground-based surveys. The galaxies are likely just beyond the edge of the Local Group, with apparent morphologies and colors strikingly similar to Leo P. HST imaging is essential to the determination of secure distances, measurement of basic physical properties, and measurement of star formation histories of these three newly discovered dwarfs. The requested observations will put these three galaxies into context with other dwarf galaxies in and beyond the Local Group, providing a rare opportunity to assess the impact of environment on low-mass systems.

OBSERVING DESCRIPTION

The observations are going to be performed with ACS/WFC (primary) and WFC3/UVIS (parallel) to match previous observations of faint dwarfs beyond the Local Group (e.g. Weisz et al. 2014, Hargis et al. 2020, Danieli et al. 2017, Bennet et al. 2019, Crnojevic et al. 2019, Mutlu-Pakdil et al 2022). We request imaging in F606W and F814W filters (broad V and I) for both instruments, in order to compute accurate TRGB distances for our targets and characterize their stellar content, while optimizing the exposure times. 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.

Given the small size of each target (<1 arcmin), one pointing is sufficient to cover the entire spatial extent of each galaxy. Each dwarf will be placed on one of the ACS/WFC chips, and small dithers between exposures will remove detector defects and improve the PSF sampling. Given that the possible distance range for our targets is ~1-3 Mpc, we use existing HST ACS data of Local Volume dwarfs at <3 Mpc (NGC253 dwarfs [GO-14259, GO-15938], CenA dwarfs [GO-13856], MADCASH dwarfs [GO-15228]) to guide our observational request and ensure that the depth is sufficient for the science goals of this proposal.

The archival ACS data for similar limiting magnitudes were obtained with 2 CR-SPLIT exposures of 1200 sec in F606W and 900 sec in F814W. The required exposure times nicely fit into one orbit per object after taking into account realistic overheads. With these exposures, the achieved SNR given by the ACS ETC is ~10 at 1 mag below the TRGB for both bands (assuming a distance of 3~Mpc), with a limiting magnitude of ~27 in F814W, thus fulfilling our requirements. This translates into only a total of three orbits for our three dwarfs. We have checked that the charge transfer efficiency losses of ACS do not significantly affect our observations (at most 10% loss of flux). Our visits are 1-orbit, and we have no ORIENT requirements. Nor does this program have time constraints (other than the baseline excitement of the science!). We can also achieve our science goals with a longer acquisition time, if necessary.

Visit

Proposal 17514, Visit 01, completed Mon Jun 17 17:01:35 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: (none)

Diagnostics

(Visit 01) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Fixed Targets

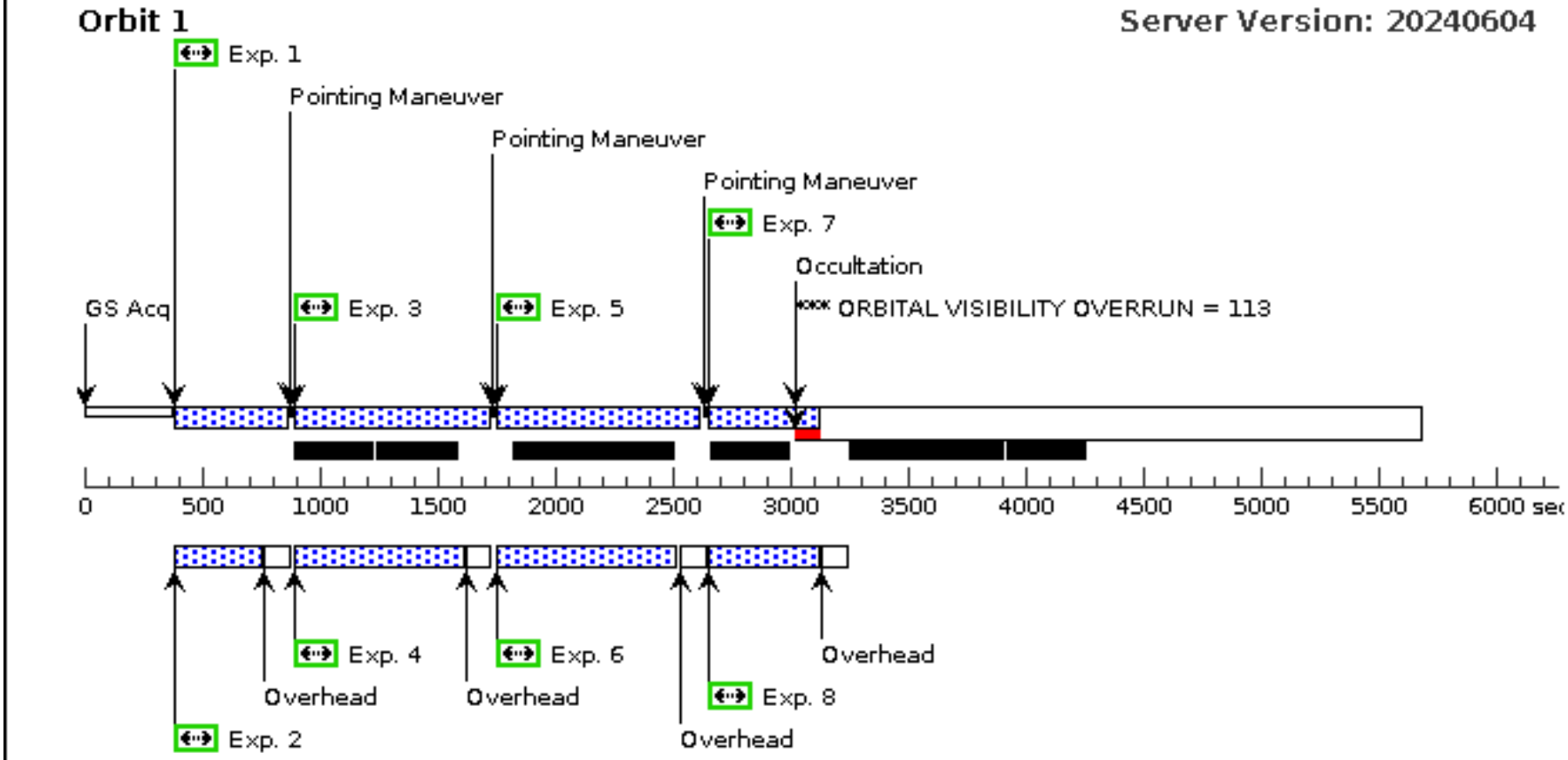
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	CORVUS	RA: 12 14 45.8400 (183.6910000d) Dec: -16 23 49.92 (-16.39720d) Equinox: J2000		V=16+/-0.1	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[DWARF SPHEROIDAL]
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) CORVUS	ACS/WFC, ACCUM, WFC2	F606W			Prime + Parallel Group 1-2 in Visit 01	270 Secs (270 Secs) *[==>]*	 ***[1]***
2		ANY	WFC3/UVIS, ACCUM, UVIS1	F606W	FLASH=5		Prime + Parallel Group 1-2 in Visit 01	345 Secs (345 Secs) *[==>]*	 ***[1]***
3		(1) CORVUS	ACS/WFC, ACCUM, WFC2	F606W		POS TARG 0.25,0.27	Prime + Parallel Group 3-4 in Visit 01	710 Secs (710 Secs) *[==>]*	 ***[1]***
4		ANY	WFC3/UVIS, ACCUM, UVIS1	F606W			Prime + Parallel Group 3-4 in Visit 01	720 Secs (720 Secs) *[==>]*	 ***[1]***
5		(1) CORVUS	ACS/WFC, ACCUM, WFC2	F814W			Prime + Parallel Group 5-6 in Visit 01	685 Secs (685 Secs) *[==>]*	 ***[1]***
6		ANY	WFC3/UVIS, ACCUM, UVIS1	F814W	FLASH=6		Prime + Parallel Group 5-6 in Visit 01	737 Secs (737 Secs) *[==>]*	 ***[1]***
7		(1) CORVUS	ACS/WFC, ACCUM, WFC2	F814W		POS TARG 0.25,0.27	Prime + Parallel Group 7-8 in Visit 01	342 Secs (342 Secs) *[==>]*	 ***[1]***
8		ANY	WFC3/UVIS, ACCUM, UVIS1	F814W	FLASH=6		Prime + Parallel Group 7-8 in Visit 01	468 Secs (468 Secs) *[==>]*	 ***[1]***

Orbit Structure



Visit

Proposal 17514, Visit 02, failed Mon Jun 17 17:01:35 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: (none)

Diagnostics

(Visit 02) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Fixed Targets

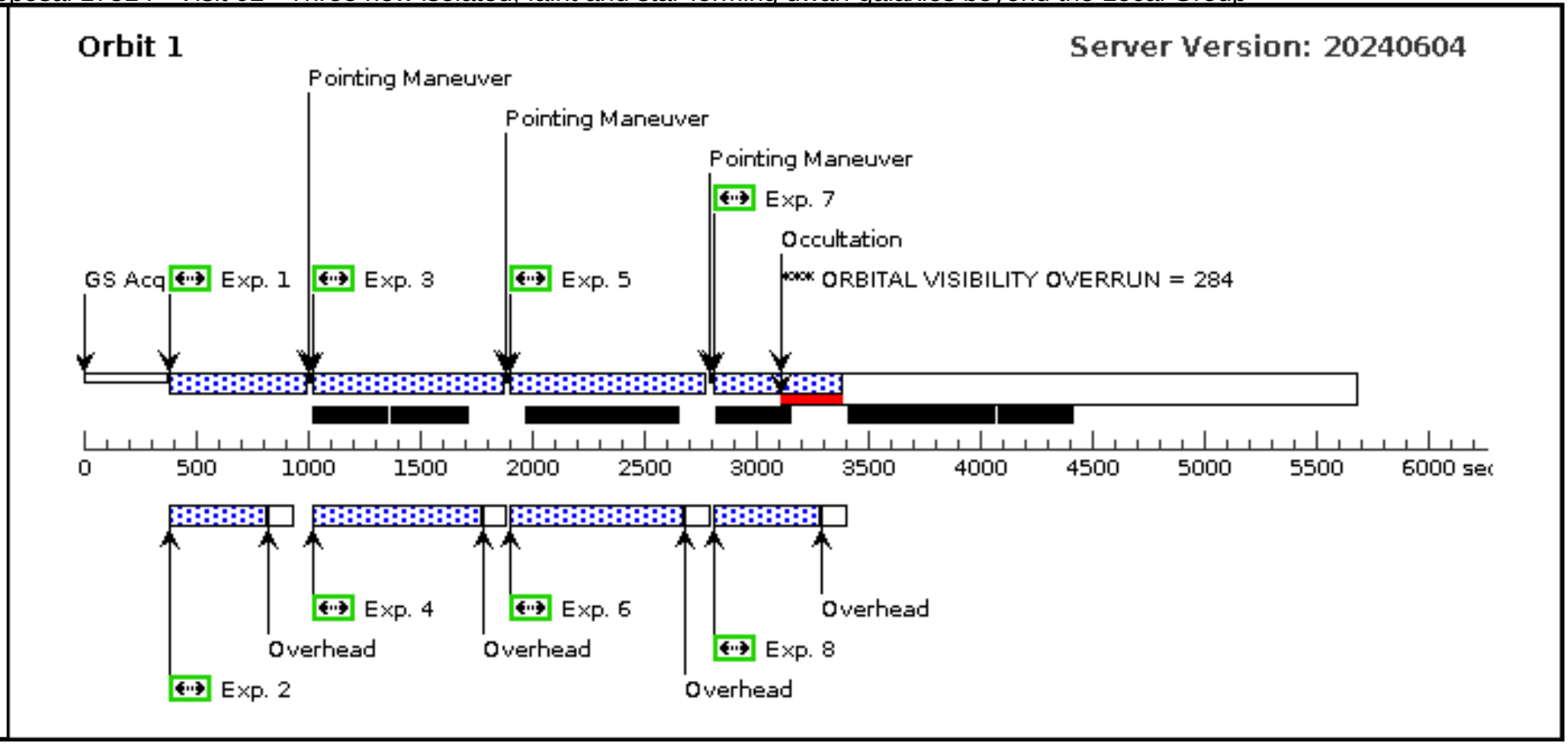
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	KAMINO	RA: 04 15 49.1280 (63.9547000d) Dec: -60 43 51.24 (-60.73090d) Equinox: J2000		V=16+/-0.1	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[DWARF SPHEROIDAL]
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) KAMINO	ACS/WFC, ACCUM, WFC2	F606W			Prime + Parallel Group up 1-2 in Visit 02	400 Secs (400 Secs) *[==>]*	 ***[1]***
2		ANY	WFC3/UVIS, ACCUM, UVIS1	F606W	FLASH=5		Prime + Parallel Group up 1-2 in Visit 02	400 Secs (400 Secs) *[==>]*	 ***[1]***
3		(2) KAMINO	ACS/WFC, ACCUM, WFC2	F606W		POS TARG 0.25,0.27	Prime + Parallel Group up 3-4 in Visit 02	729 Secs (729 Secs) *[==>]*	 ***[1]***
4		ANY	WFC3/UVIS, ACCUM, UVIS1	F606W			Prime + Parallel Group up 3-4 in Visit 02	750 Secs (750 Secs) *[==>]*	 ***[1]***
5		(2) KAMINO	ACS/WFC, ACCUM, WFC2	F814W			Prime + Parallel Group up 5-6 in Visit 02	695 Secs (695 Secs) *[==>]*	 ***[1]***
6		ANY	WFC3/UVIS, ACCUM, UVIS1	F814W	FLASH=6		Prime + Parallel Group up 5-6 in Visit 02	747 Secs (747 Secs) *[==>]*	 ***[1]***
7		(2) KAMINO	ACS/WFC, ACCUM, WFC2	F814W		POS TARG 0.25,0.27	Prime + Parallel Group up 7-8 in Visit 02	450 Secs (450 Secs) *[==>]*	 ***[1]***
8		ANY	WFC3/UVIS, ACCUM, UVIS1	F814W	FLASH=6		Prime + Parallel Group up 7-8 in Visit 02	468 Secs (468 Secs) *[==>]*	 ***[1]***

Orbit Structure



Visit

Proposal 17514, Visit 52, implementation Mon Jun 17 17:01:35 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: ACS/WFC

Special Requirements: (none)

Comments: Repeat of visit 02

Diagnostics

(Prime + Parallel Group 1-1 in Visit 52) Warning (Form): No Parallel Exposures Specified in Parallel Exposure Group

(Prime + Parallel Group 2-2 in Visit 52) Warning (Form): No Parallel Exposures Specified in Parallel Exposure Group

(Prime + Parallel Group 3-3 in Visit 52) Warning (Form): No Parallel Exposures Specified in Parallel Exposure Group

(Prime + Parallel Group 4-4 in Visit 52) Warning (Form): No Parallel Exposures Specified in Parallel Exposure Group

Fixed Targets

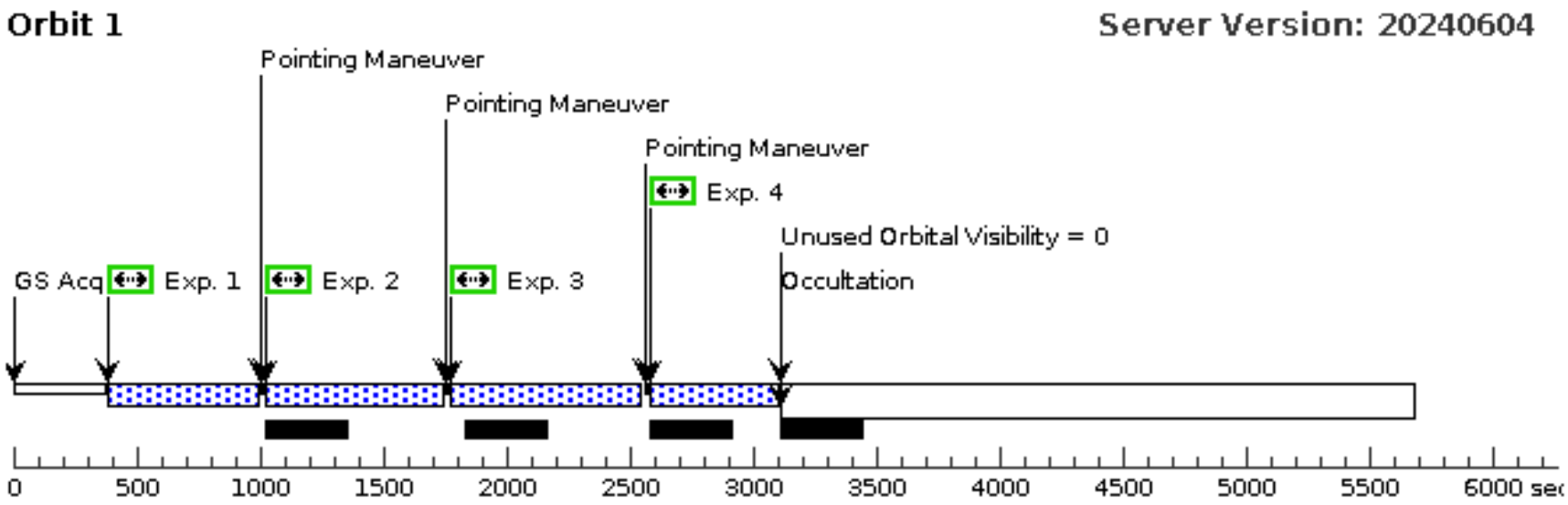
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	KAMINO	RA: 04 15 49.1280 (63.9547000d) Dec: -60 43 51.24 (-60.73090d) Equinox: J2000		V=16+/-0.1	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[DWARF SPHEROIDAL]
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) KAMINO	ACS/WFC, ACCUM, WFC2	F606W			Prime + Parallel Group 1-1 in Visit 52	400 Secs (400 Secs) *[==>]*	 ***[1]***
2		(2) KAMINO	ACS/WFC, ACCUM, WFC2	F606W		POS TARG 0.25,0.27	Prime + Parallel Group 2-2 in Visit 52	595 Secs (595 Secs) *[==>]*	 ***[1]***
3		(2) KAMINO	ACS/WFC, ACCUM, WFC2	F814W			Prime + Parallel Group 3-3 in Visit 52	595 Secs (595 Secs) *[==>]*	 ***[1]***
4		(2) KAMINO	ACS/WFC, ACCUM, WFC2	F814W		POS TARG 0.25,0.27	Prime + Parallel Group 4-4 in Visit 52	400 Secs (400 Secs) *[==>]*	 ***[1]***

Orbit Structure



Visit

Proposal 17514, Visit 03, completed Mon Jun 17 17:01:35 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: (none)

Diagnostics

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	PAVO	RA: 19 55 0.4800 (298.7520000d) Dec: -61 04 40.08 (-61.07780d) Equinox: J2000		V=16+/-0.1	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[DWARF SPHEROIDAL]
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(3) PAVO	ACS/WFC, ACCUM, WFC2	F606W			Prime + Parallel Group 1-2 in Visit 03	286 Secs (286 Secs) *[==>]*	 ***[1]***
2		ANY	WFC3/UVIS, ACCUM, UVIS1	F606W	FLASH=5		Prime + Parallel Group 1-2 in Visit 03	360 Secs (360 Secs) *[==>]*	 ***[1]***
3		(3) PAVO	ACS/WFC, ACCUM, WFC2	F606W		POS TARG 0.25,0.27	Prime + Parallel Group 3-4 in Visit 03	720 Secs (720 Secs) *[==>]*	 ***[1]***
4		ANY	WFC3/UVIS, ACCUM, UVIS1	F606W			Prime + Parallel Group 3-4 in Visit 03	750 Secs (750 Secs) *[==>]*	 ***[1]***
5		(3) PAVO	ACS/WFC, ACCUM, WFC2	F814W			Prime + Parallel Group 5-6 in Visit 03	926 Secs (926 Secs) *[==>]*	 ***[1]***
6		ANY	WFC3/UVIS, ACCUM, UVIS1	F814W	FLASH=6		Prime + Parallel Group 5-6 in Visit 03	747 Secs (747 Secs) *[==>]*	 ***[1]***
7		(3) PAVO	ACS/WFC, ACCUM, WFC2	F814W		POS TARG 0.25,0.27	Prime + Parallel Group 7-8 in Visit 03	342 Secs (342 Secs) *[==>]*	 ***[1]***
8		ANY	WFC3/UVIS, ACCUM, UVIS1	F814W	FLASH=6		Prime + Parallel Group 7-8 in Visit 03	468 Secs (468 Secs) *[==>]*	 ***[1]***

Orbit Structure