15938 - The NGC253 Satellite Luminosity Function: A Case Study for Low Density Environments

Cycle: 27, 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) NGC253-DW1 ANY	ACS/WFC WFC3/UVIS	1	26-Jul-2019 10:03:14.0	yes
02	(2) NGC253-DW3 ANY	ACS/WFC WFC3/UVIS	1	26-Jul-2019 10:03:15.0	yes
03	(3) NGC253-DW4 ANY	ACS/WFC WFC3/UVIS	1	26-Jul-2019 10:03:16.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
04	(4) NGC253-DW5 ANY	ACS/WFC WFC3/UVIS	1	26-Jul-2019 10:03:18.0	yes
05	(5) NGC253-DW6 ANY	ACS/WFC WFC3/UVIS	1	26-Jul-2019 10:03:19.0	yes

5 Total Orbits Used

ABSTRACT

The faint end of the galaxy luminosity function is a strong test for models of galaxy formation and evolution, but can only be studied in the most constraining "ultra-faint" regime in the nearest galaxies. Deep satellite counts around a limited sample of nearby Milky Way-mass galaxies show evidence for a large variation in the number of dwarfs. These results could reflect either stochastic variations in satellite populations or systematic changes with environmental density. The origin of these variations can help elucidate the poorly-understood physical processes that contribute to the evolution of low mass galaxies, such as reionization.

This proposal requests 5 orbits of HST/ACS for two-band imaging of five new faint candidate dwarfs in the halo of NGC253 (D=3.5 Mpc), a Milky Way-mass spiral galaxy in a nearly isolated environment. This imaging will enable the measurement of distances, luminosities, metallicities, and star formation histories for these dwarfs, all of which can only be done with HST. The confirmation of these dwarfs will complete the first dwarf satellite census of NGC253 down to Mv ~ -7, testing cosmological predictions for the faint end of the satellite luminosity function in low density environments.

OBSERVING DESCRIPTION

The observations are going to be performed with ACS/WFC (primary) and WFC3/UVIS (parallel). 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 (star formation histories and metallicities), 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.

Our goal is to obtain a minimum SNR of ~10 at ~1 mag below the TRGB in I band, assuming that the TRGB is found at M_I = ~-4.0 and M_V = ~-2.5, in order to derive precise distance measurements, structural properties and average metallicities. With the requested SNR, the photometric errors

will be ~0.05 mag in magnitude and ~0.1 mag in color at the TRGB. We will obtain distance uncertainties as low as ~0.1 mag, corresponding to ~150 kpc at the distance of NGC253.

Since the exact distances for our targets are unknown, the candidate NGC253 satellites are assumed to be at the distance of NGC253 (~3.5 Mpc). Given their low masses, these are expected to be metal-poor objects, thus having average colours of V - I ~ 1.5. At this distance, the TRGB is found at a magnitude of I ~ 24.2 and V ~ 25.7. The exposures to obtain the required SNR at 1 mag below the TRGB for both bands are ~ 1000 sec in F606W and ~ 1000 sec in F814W (as computed with the latest version of the ACS ETC), which result in one orbit per target. Each exposure will be split in two with a dither pattern in order to subsequently remove detector defects and improve the PSF sampling. We have checked that the charge transfer efficiency losses of ACS do not significantly affect our observations (at most 10% loss of flux).

This program is resilient to two-gyro mode, we believe. Our visits are 1-orbit, and we have no ORIENT requirements (we have one visit with a loose ORIENT). 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 15938, Visit 01, implementation Fri Jul 26 14:03:19 GMT 2019

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: (none)

Diagnostics

(Parallel Exposure 4 (Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in Visit 01)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.364 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=47.23 Angle Between Sides= Center Pattern=false		(1-2), (3-4)

Fixed Targets

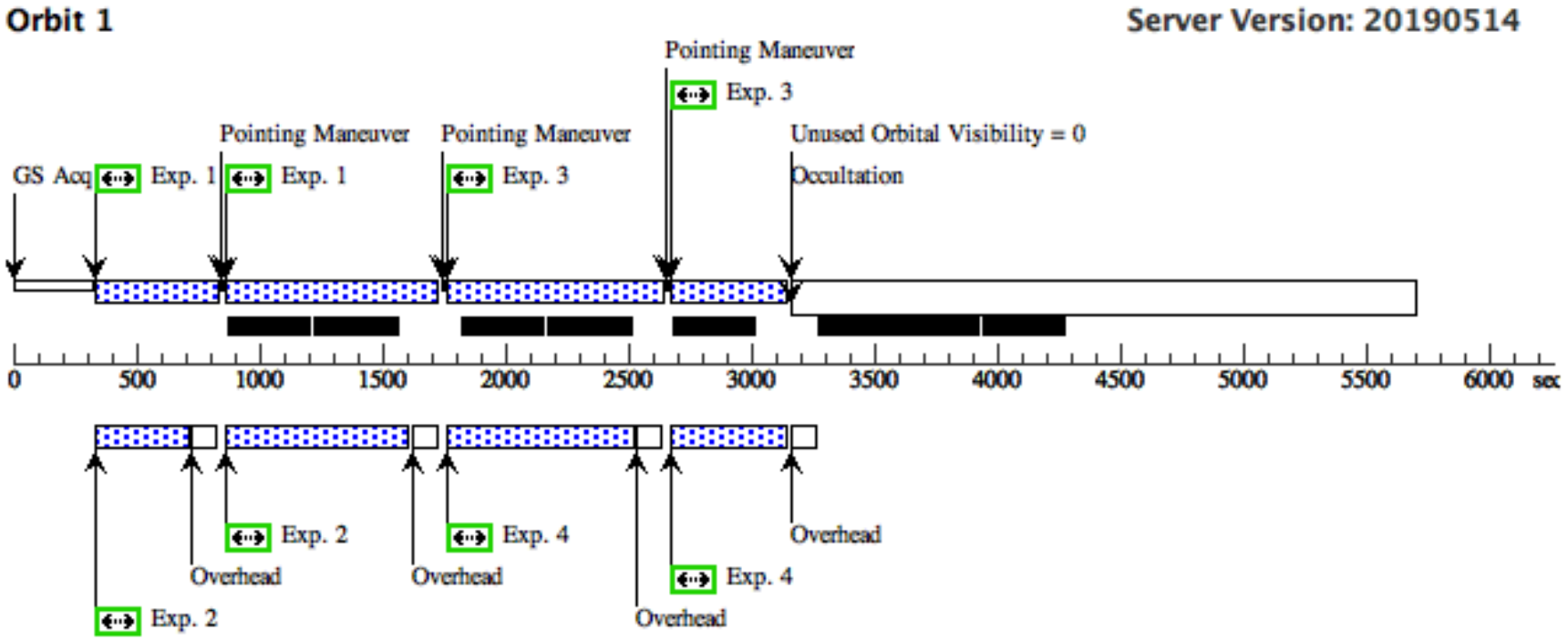
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	NGC253-DW1	RA: 00 47 34.9300 (11.8955417d) Dec: -26 23 19.70 (-26.38881d) Equinox: J2000		V=17.4	Reference Frame: ICRS

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) NGC253-DW1	ACS/WFC, ACCUM, WFC1	F606W			Pattern 1, Exps 1-2 in Visit 01 (1) Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 in Visit 01	650 Secs (1030 Secs) *[==>295.0 Secs (Pattern 1)]* *[==>735.0 Secs (Pattern 2)]*	***[1]***
2		ANY	WFC3/UVIS, ACCUM, UVIS1	F606W			Pattern 1, Exps 1-2 in Visit 01 (1) Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 in Visit 01	350 Secs (1090 Secs) *[==>(Pattern 1)]* *[==>740.0 Secs (Pattern 2)]*	***[1]***
3		(1) NGC253-DW1	ACS/WFC, ACCUM, WFC1	F814W			Pattern 1, Exps 3-4 in Visit 01 (1) Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in Visit 01	450 Secs (1053 Secs) *[==>705.0 Secs (Pattern 1)]* *[==>348.0 Secs (Pattern 2)]*	***[1]***
4		ANY	WFC3/UVIS, ACCUM, UVIS1	F814W			Pattern 1, Exps 3-4 in Visit 01 (1) Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in Visit 01	360 Secs (1213 Secs) *[==>742.0 Secs (Pattern 1)]* *[==>471.0 Secs (Pattern 2)]*	***[1]***

Orbit Structure



Visit

Proposal 15938, Visit 02, implementation Fri Jul 26 14:03:19 GMT 2019

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: (none)

Diagnostics

(Parallel Exposure 4 (Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in Visit 02)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.364 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=47.23 Angle Between Sides= Center Pattern=false		(1-2), (3-4)

Fixed Targets

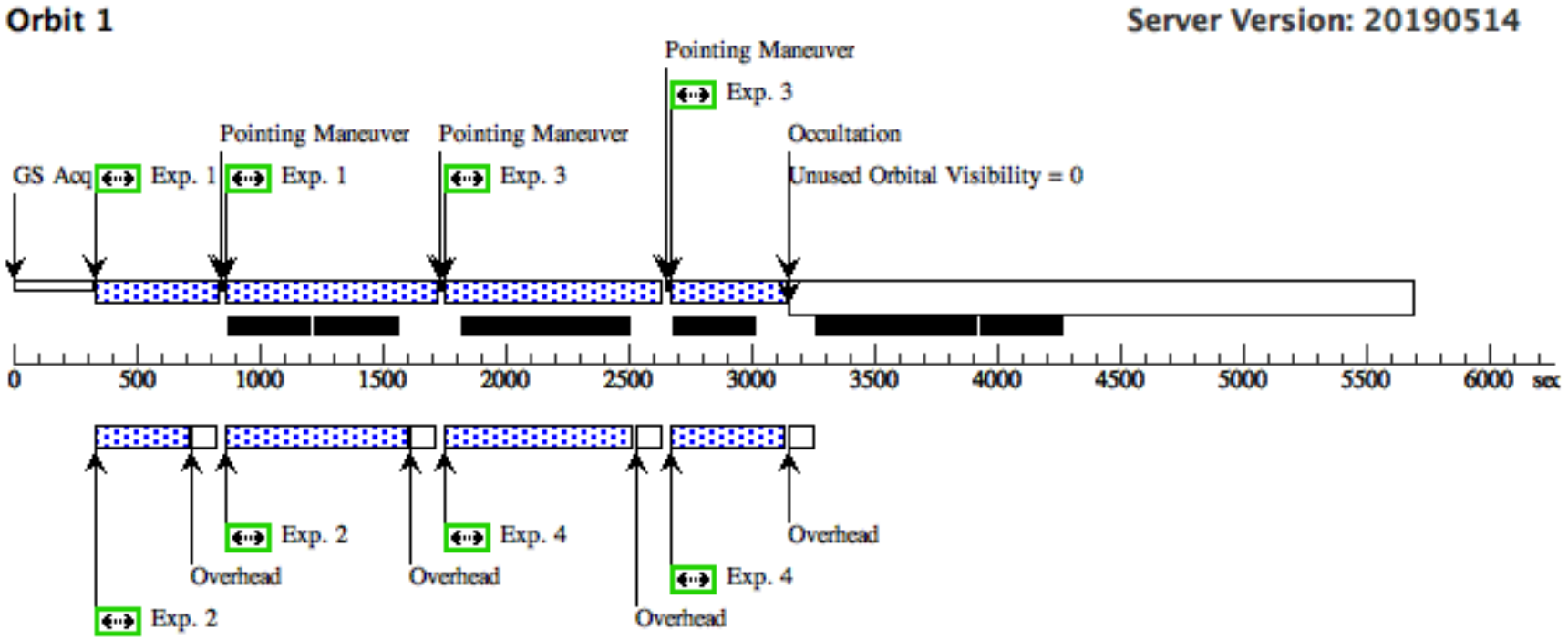
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	NGC253-DW3	RA: 00 47 7.1770 (11.7799042d) Dec: -23 57 21.68 (-23.95602d) Equinox: J2000		V=19.85	Reference Frame: ICRS

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) NGC253-DW3	ACS/WFC, ACCUM, WFC1	F606W			Pattern 1, Exps 1-2 in Visit 02 (1) Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 in Visit 02	650 Secs (1026 Secs) *[==>293.0 Secs (Pattern 1)]* *[==>733.0 Secs (Pattern 2)]*	***[1]***
2		ANY	WFC3/UVIS, ACCUM, UVIS1	F606W			Pattern 1, Exps 1-2 in Visit 02 (1) Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 in Visit 02	350 Secs (1090 Secs) *[==>(Pattern 1)]* *[==>740.0 Secs (Pattern 2)]*	***[1]***
3		(2) NGC253-DW3	ACS/WFC, ACCUM, WFC1	F814W			Pattern 1, Exps 3-4 in Visit 02 (1) Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in Visit 02	450 Secs (1049 Secs) *[==>703.0 Secs (Pattern 1)]* *[==>346.0 Secs (Pattern 2)]*	***[1]***
4		ANY	WFC3/UVIS, ACCUM, UVIS1	F814W			Pattern 1, Exps 3-4 in Visit 02 (1) Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in Visit 02	360 Secs (1208 Secs) *[==>742.0 Secs (Pattern 1)]* *[==>466.0 Secs (Pattern 2)]*	***[1]***

Orbit Structure



Visit

Proposal 15938, Visit 03, implementation Fri Jul 26 14:03:20 GMT 2019

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: (none)

Diagnostics

(Parallel Exposure 4 (Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in Visit 03)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.364 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=47.23 Angle Between Sides= Center Pattern=false		(1-2), (3-4)

Fixed Targets

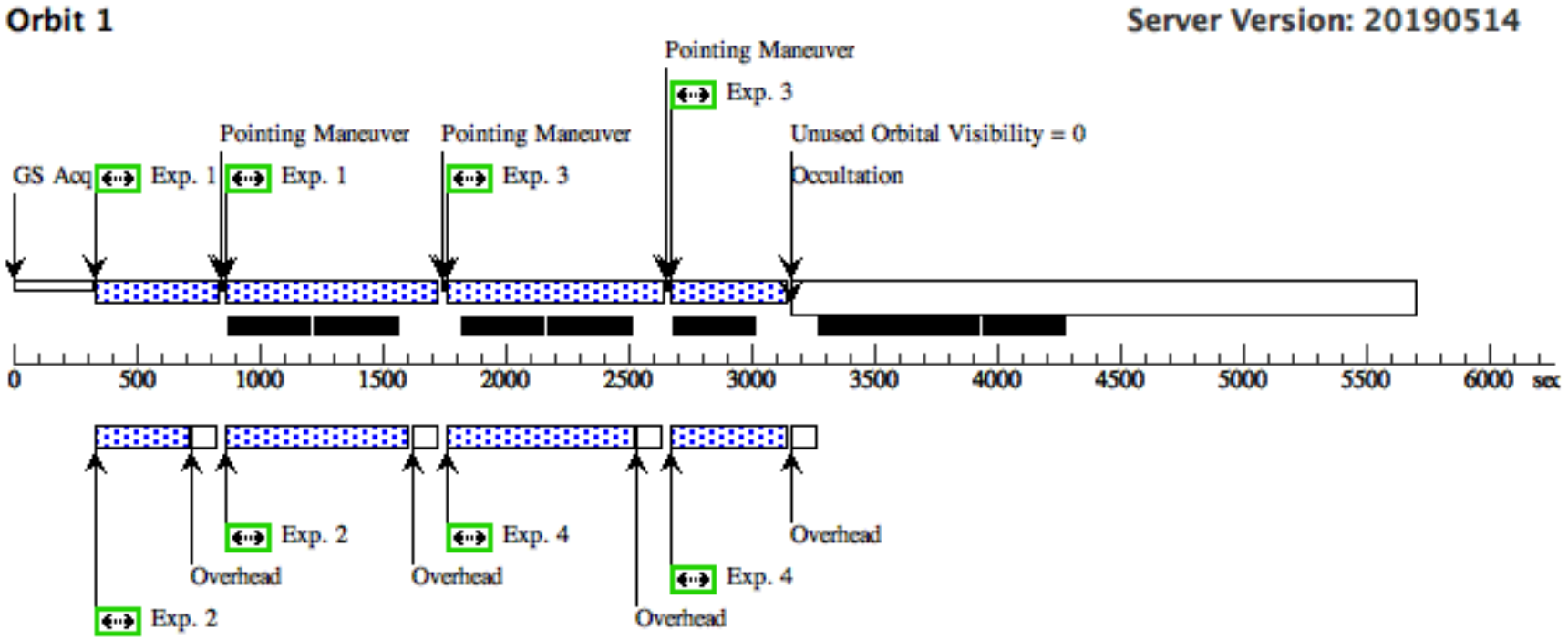
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	NGC253-DW4	RA: 00 53 49.0293 (13.4542887d) Dec: -25 28 28.43 (-25.47456d) Equinox: J2000		V=19.8	Reference Frame: ICRS

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) NGC253-DW4	ACS/WFC, ACCUM, WFC1	F606W			Pattern 1, Exps 1-2 in Visit 03 (1) Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 in Visit 03	650 Secs (1030 Secs) *[==>295.0 Secs (Pattern 1)]* *[==>735.0 Secs (Pattern 2)]*	***[1]***
2		ANY	WFC3/UVIS, ACCUM, UVIS1	F606W			Pattern 1, Exps 1-2 in Visit 03 (1) Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 in Visit 03	350 Secs (1090 Secs) *[==>(Pattern 1)]* *[==>740.0 Secs (Pattern 2)]*	***[1]***
3		(3) NGC253-DW4	ACS/WFC, ACCUM, WFC1	F814W			Pattern 1, Exps 3-4 in Visit 03 (1) Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in Visit 03	450 Secs (1053 Secs) *[==>705.0 Secs (Pattern 1)]* *[==>348.0 Secs (Pattern 2)]*	***[1]***
4		ANY	WFC3/UVIS, ACCUM, UVIS1	F814W			Pattern 1, Exps 3-4 in Visit 03 (1) Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in Visit 03	360 Secs (1213 Secs) *[==>742.0 Secs (Pattern 1)]* *[==>471.0 Secs (Pattern 2)]*	***[1]***

Orbit Structure



Visit

Proposal 15938, Visit 04, implementation Fri Jul 26 14:03:20 GMT 2019

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: (none)

Diagnostics

(Parallel Exposure 4 (Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in Visit 04)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.364 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=47.23 Angle Between Sides= Center Pattern=false		(1-2), (3-4)

Fixed Targets

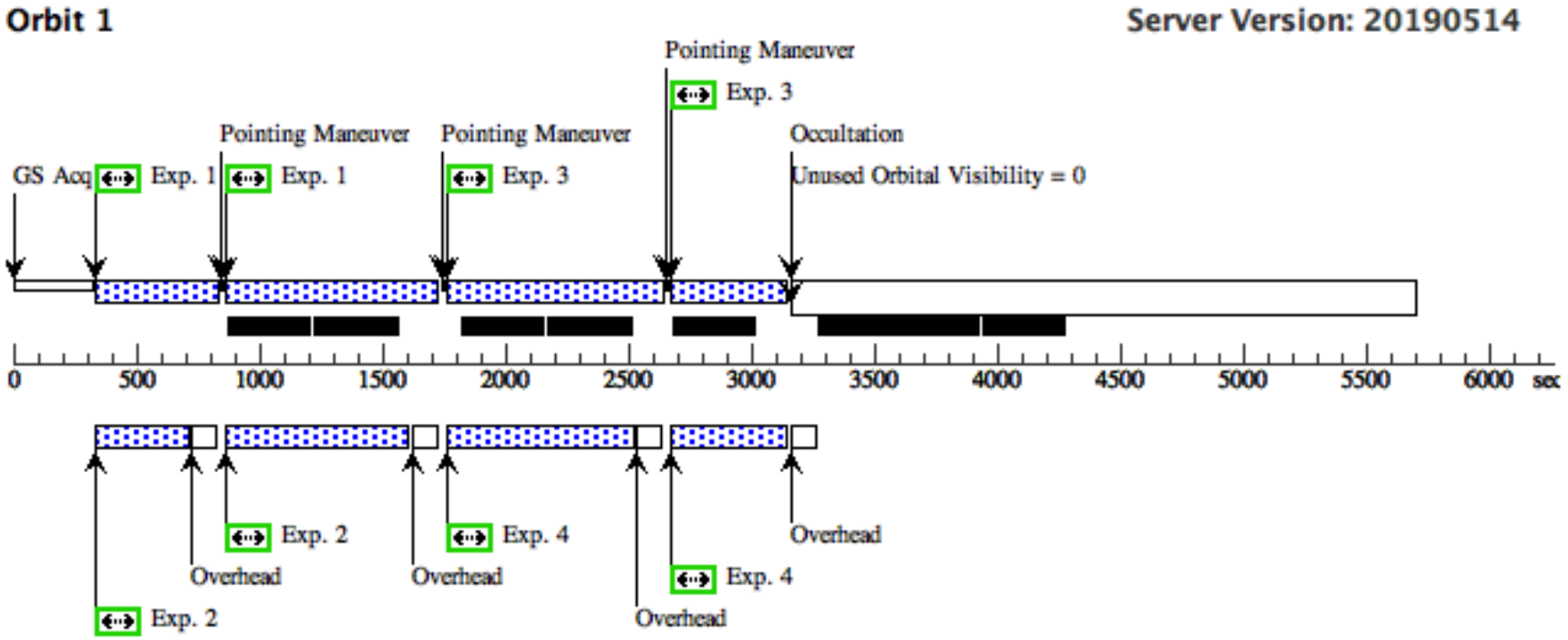
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	NGC253-DW5	RA: 00 50 26.0148 (12.6083950d) Dec: -26 43 42.76 (-26.72854d) Equinox: J2000		V=20.8	Reference Frame: ICRS

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		(4) NGC253-DW5	ACS/WFC, ACCUM, WFC1	F606W			Pattern 1, Exps 1-2 in Visit 04 (1) Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 in Visit 04	650 Secs (1030 Secs) *[==>295.0 Secs (Pattern 1)]* *[==>735.0 Secs (Pattern 2)]*	***[1]***
2		ANY	WFC3/UVIS, ACCUM, UVIS1	F606W			Pattern 1, Exps 1-2 in Visit 04 (1) Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 in Visit 04	350 Secs (1090 Secs) *[==>(Pattern 1)]* *[==>740.0 Secs (Pattern 2)]*	***[1]***
3		(4) NGC253-DW5	ACS/WFC, ACCUM, WFC1	F814W			Pattern 1, Exps 3-4 in Visit 04 (1) Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in Visit 04	450 Secs (1053 Secs) *[==>705.0 Secs (Pattern 1)]* *[==>348.0 Secs (Pattern 2)]*	***[1]***
4		ANY	WFC3/UVIS, ACCUM, UVIS1	F814W			Pattern 1, Exps 3-4 in Visit 04 (1) Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in Visit 04	360 Secs (1213 Secs) *[==>742.0 Secs (Pattern 1)]* *[==>471.0 Secs (Pattern 2)]*	***[1]***

Orbit Structure



Visit

Proposal 15938, Visit 05, implementation Fri Jul 26 14:03:20 GMT 2019

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: (none)

Diagnostics

(Parallel Exposure 4 (Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in Visit 05)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.364 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=47.23 Angle Between Sides= Center Pattern=false		(1-2), (3-4)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(5)	NGC253-DW6	RA: 00 47 27.1826 (11.8632608d) Dec: -25 13 7.55 (-25.21876d) Equinox: J2000		V=21.2	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		(5) NGC253-DW6	ACS/WFC, ACCUM, WFC1	F606W			Pattern 1, Exps 1-2 in Visit 05 (1) Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 in Visit 05	650 Secs (1030 Secs) *[==>295.0 Secs (Pattern 1)]* *[==>735.0 Secs (Pattern 2)]*	***[1]***
2		ANY	WFC3/UVIS, ACCUM, UVIS1	F606W			Pattern 1, Exps 1-2 in Visit 05 (1) Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 in Visit 05	350 Secs (1090 Secs) *[==>(Pattern 1)]* *[==>740.0 Secs (Pattern 2)]*	***[1]***
3		(5) NGC253-DW6	ACS/WFC, ACCUM, WFC1	F814W			Pattern 1, Exps 3-4 in Visit 05 (1) Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in Visit 05	450 Secs (1053 Secs) *[==>705.0 Secs (Pattern 1)]* *[==>348.0 Secs (Pattern 2)]*	***[1]***
4		ANY	WFC3/UVIS, ACCUM, UVIS1	F814W			Pattern 1, Exps 3-4 in Visit 05 (1) Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in Visit 05	360 Secs (1213 Secs) *[==>742.0 Secs (Pattern 1)]* *[==>471.0 Secs (Pattern 2)]*	***[1]***

Orbit Structure