



17164 - Exploring The Plane of Satellites Around NGC253: A Case Study for Isolated Environments

Cycle: 30, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>	<i>E-Mail</i>
Dr. Burcin Mutlu-Pakdil (PI) (Contact)	Dartmouth College	burchinmutlu@gmail.com
Prof. David J. Sand (CoI)	University of Arizona	dave.j.sand@gmail.com
Dr. Denija Crnojevic (CoI)	University of Tampa	dcrnojevic@ut.edu
Dr. Michael Gordon Jones (CoI)	University of Arizona	jonesmg@arizona.edu
Dr. Paul Bennet (CoI)	Space Telescope Science Institute	pbennet@stsci.edu
Dr. Ananthan Karunakaran (CoI) (ESA Member)	Instituto de Astrofisica de Andalucia (IAA)	karunakarananathan@gmail.com
Dr. Kristine Spekkens (CoI) (CSA Member)	Royal Military College of Canada	kristine.spekkens@rmc.ca

VISITS

<i>Visit</i>	<i>Targets used in Visit</i>	<i>Configurations used in Visit</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
01	(1) DOIII ANY	ACS/WFC WFC3/UVIS	1	05-Aug-2022 11:00:56.0	yes
02	(2) DOIIV ANY	ACS/WFC WFC3/UVIS	1	05-Aug-2022 11:00:57.0	yes
03	(3) SCULPTORSR ANY	ACS/WFC WFC3/UVIS	1	05-Aug-2022 11:00:58.0	yes
04	(4) DW0036M2828 ANY	ACS/WFC WFC3/UVIS	1	05-Aug-2022 11:00:59.0	yes

4 Total Orbits Used

ABSTRACT

The distribution of dwarf satellite galaxies is a strong test for models of galaxy formation and evolution, independent of the exact details of baryonic physics. The three observed planes of satellites known today (around the Milky Way, M31, and Centaurus A) constitute a main problem for the standard cosmological models, where satellite systems are expected to have a nearly isotropic distribution. As these three systems reside in rich galaxy groups, their specific local environment could be responsible for the observed satellite planes. Exploration of satellite planes in other galaxies, in different environments, is thus a critical first step in solving the 'plane of satellites' problem.

A spatially flattened dwarf satellite system has recently been proposed around NGC253 ($D=3.5$ Mpc), a Milky Way-mass spiral galaxy in an isolated environment. However, four faint dwarf candidates still lack distance measurements, and prevent us to draw a final conclusion on the true nature of this alleged plane of satellites (based on ten confirmed dwarf satellites). We request four orbits of HST/ACS in F606W and F814W to image these four NGC253 dwarf candidates in order to confirm their nature, precisely measure their distances, and study the 3D structure of the NGC253 dwarf satellite system as a whole. The results from this modest request will constrain the proposed plane of satellite galaxies in NGC253, an essential test for cosmological models in isolated environments.

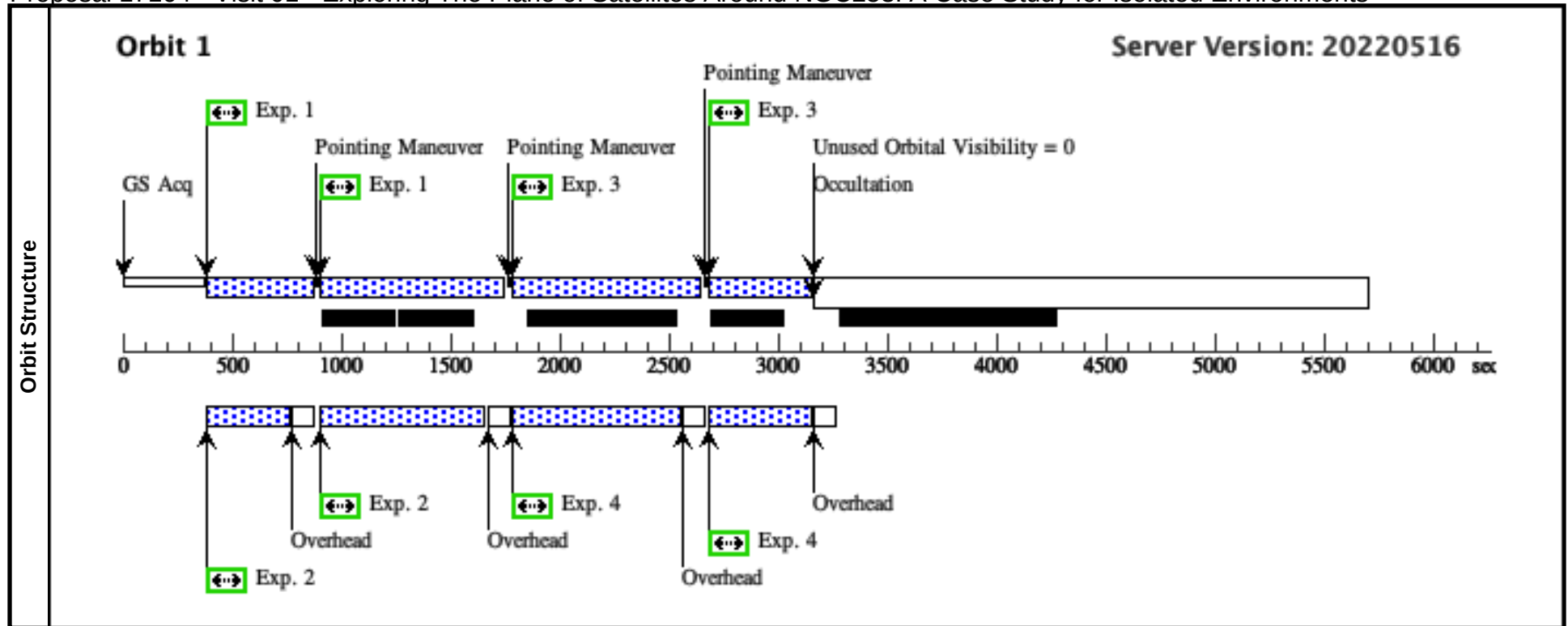
OBSERVING DESCRIPTION

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, 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 $M_I \sim -4.0$ and $M_V \sim -2.5$, 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 $V-I \sim 1.5$. At this distance, the TRGB is found at a magnitude of $I \sim 24.2$ and $V \sim 25.7$. 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. 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.

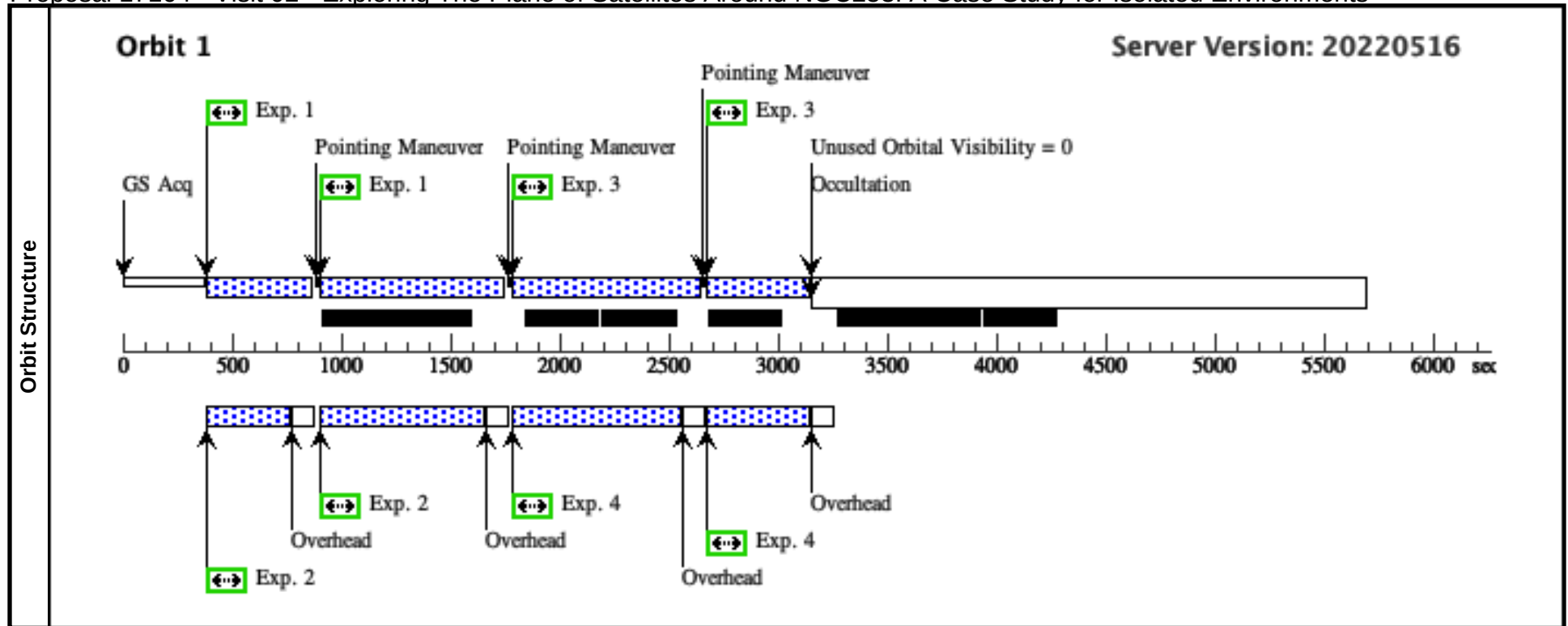
Proposal 17164 - Visit 01 - Exploring The Plane of Satellites Around NGC253: A Case Study for Isolated Environments

Visit	Proposal 17164, Visit 01, implementation										Fri Aug 05 15:00:59 GMT 2022		
	Diagnostic Status: Warning												
	Scientific Instruments: WFC3/UVIS, ACS/WFC												
	Special Requirements: (none)												
Diagnostics	(Parallel Exposure 2 (Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 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												
	(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)	DOIII		RA: 01 09 24.5500 (17.3522917d) Dec: -27 20 49.60 (-27.34711d) Equinox: J2000				V=18.75		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) DOIII	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 (1006 Secs) [==>286.0 Secs (Pattern 1)] [==>720.0 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 (1100 Secs) [==>(Pattern 1)] [==>750.0 Secs (Pattern 2)]	[1]		
	3		(1) DOIII	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 (1027 Secs) [==>685.0 Secs (Pattern 1)] [==>342.0 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 (1215 Secs) [==>747.0 Secs (Pattern 1)] [==>468.0 Secs (Pattern 2)]	[1]		



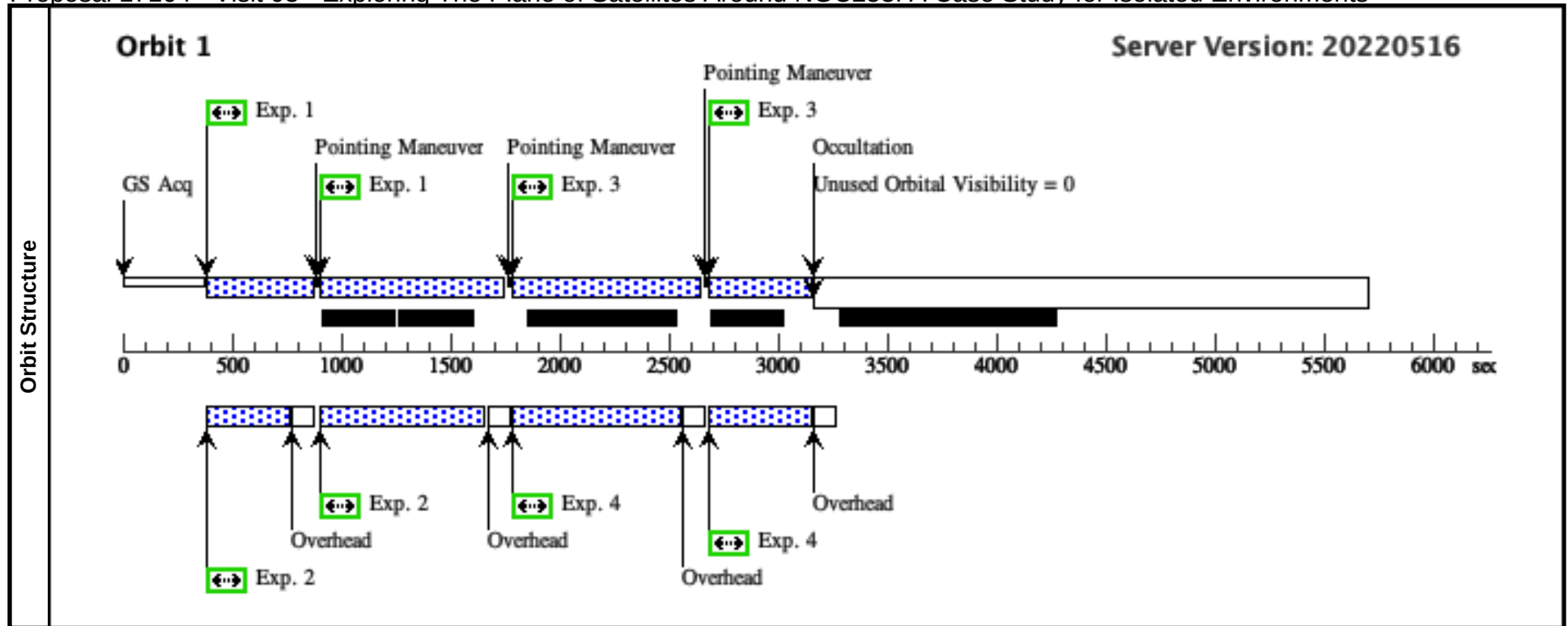
Proposal 17164 - Visit 02 - Exploring The Plane of Satellites Around NGC253: A Case Study for Isolated Environments

Visit	Proposal 17164, Visit 02, implementation										Fri Aug 05 15:00:59 GMT 2022		
	Diagnostic Status: Warning												
	Scientific Instruments: WFC3/UVIS, ACS/WFC												
	Special Requirements: (none)												
Diagnostics	(Parallel Exposure 2 (Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 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												
	(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)	DOIV		RA: 00 47 2.9500 (11.7622917d) Dec: -21 40 51.60 (-21.68100d) Equinox: J2000				V=19.99		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) DOIV	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 (999 Secs) [==>279.0 Secs (Pattern 1)] [==>720.0 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 (1100 Secs) [==>(Pattern 1)] [==>750.0 Secs (Pattern 2)]	[1]		
	3		(2) DOIV	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 (1026 Secs) [==>684.0 Secs (Pattern 1)] [==>342.0 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 (1214 Secs) [==>746.0 Secs (Pattern 1)] [==>468.0 Secs (Pattern 2)]	[1]		



Proposal 17164 - Visit 03 - Exploring The Plane of Satellites Around NGC253: A Case Study for Isolated Environments

Visit	Proposal 17164, Visit 03, implementation										Fri Aug 05 15:00:59 GMT 2022	
	Diagnostic Status: Warning											
	Scientific Instruments: WFC3/UVIS, ACS/WFC											
	Special Requirements: ORIENT 44D TO 341 D											
Diagnostics	(Parallel Exposure 2 (Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 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											
	(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)	SCULPTORSR	RA: 00 33 51.7920 (8.4658000d) Dec: -27 50 24.00 (-27.84000d) Equinox: J2000				V=17.8		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) SCULPTORSR	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 (1006 Secs) [==>286.0 Secs (Pattern 1)] [==>720.0 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 (1100 Secs) [==>(Pattern 1)] [==>750.0 Secs (Pattern 2)]		[1]	
	3		(3) SCULPTORSR	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 (1027 Secs) [==>685.0 Secs (Pattern 1)] [==>342.0 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 (1215 Secs) [==>747.0 Secs (Pattern 1)] [==>468.0 Secs (Pattern 2)]		[1]	



Proposal 17164 - Visit 04 - Exploring The Plane of Satellites Around NGC253: A Case Study for Isolated Environments

Visit	Proposal 17164, Visit 04, implementation										Fri Aug 05 15:01:00 GMT 2022		
	Diagnostic Status: Warning												
	Scientific Instruments: WFC3/UVIS, ACS/WFC												
	Special Requirements: (none)												
Diagnostics	(Parallel Exposure 2 (Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 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												
	(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)	DW0036M2828		RA: 00 36 30.4800 (9.1270000d) Dec: -28 28 12.00 (-28.47000d) 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		(4) DW0036M2828	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 (1006 Secs) [==>286.0 Secs (Pattern 1)] [==>720.0 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 (1100 Secs) [==>(Pattern 1)] [==>750.0 Secs (Pattern 2)]		[1]	
	3		(4) DW0036M2828	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 (1027 Secs) [==>685.0 Secs (Pattern 1)] [==>342.0 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 (1215 Secs) [==>747.0 Secs (Pattern 1)] [==>468.0 Secs (Pattern 2)]		[1]	

