



14728 - Hearts of Darkness: Compact Obscured Nuclei in S0/a Galaxies

Cycle: 24, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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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) NGC-1377	WFC3/IR WFC3/UVIS	3	09-Nov-2016 11:52:32.0	yes
02	(2) NGC-4355	WFC3/IR WFC3/UVIS	2	09-Nov-2016 11:52:34.0	yes
03	(3) CGCG-049-057	WFC3/IR WFC3/UVIS	2	09-Nov-2016 11:52:35.0	yes

7 Total Orbits Used

ABSTRACT

Recent high angular resolution millimeter observations have revealed extraordinary features in the centers of nearby S0/a galaxies. These nuclei are compact (< 100 pc) and heavily obscured by $\sim 10^7$ - 10^8 M_{sun} of dense, dusty gas at levels that challenge ALMA. The three archetypal compact obscured nuclei (CONs) that we are targeting for HST UVOIR imaging are luminous FIR sources without obvious starbursts which suggests that the CONs are associated with AGN in a previously unrecognized type of SMBH growth phase. Our molecular line observations detect substantial molecular inflows and outflows from our targeted CONs, including a highly collimated molecular jet in NGC 1377; these systems are in dynamic states with significant momentum transfers within their gas. Because of the challenges associated with directly observing CONs even at millimeter wavelengths, these objects are best studied through their effects on the surrounding environment. Thus, we propose to obtain WFC3 HST imaging in the UVOIR to extend our understanding of the relationship between CONs and their host systems. The primary objectives of this HST project include measuring dust absorption to map the 3D structure of the ISM out to kiloparsec scales and to thereby constrain the mechanisms responsible for the dynamic behavior of the gas. The unique resolution and wavelength coverage of WFC3 images also will allow us to explore dust-to-gas ratios and CO-H₂ conversion factors, assess the levels of recent star formation and seek evidence of past galaxy interactions which might produce CONs in otherwise quiescent galaxies.

OBSERVING DESCRIPTION

Our goal is to obtain multi-wavelength images of 3 galaxies hosting compact nuclei that are heavily obscured by dust. The small scale structure of the interstellar media in the central regions is being explored, primarily through a combination of Atacama Large Millimeter Array (ALMA) and Sub-Millimeter Array (SMA) molecular line observations. These have few-to-sub-arcsecond angular resolution and excellent astrometric calibrations. A prime objective is to compare dust features with the millimeter maps. The dust can provide information on the spatial distribution of the dense gas through analysis of optical depths and foreground brightness levels that require a substantial wavelength baseline, while the millimeter data track gas column densities, temperatures, and kinematics. We therefore require careful placement of the WFC3/UVIS aperture to avoid areas with lower image quality, and will seek the best possible astrometric solutions for the comparison with the millimeter maps.

A second objective involves connections between the nuclei and kpc-scale thin dust lanes observed in ground-based optical images. These extend typically 30-40 arcseconds in radius and thus we can center on a single WFC3 CCD and not worry about specifying an orient.

The 3rd objective is to study the spectral energy distribution of the host galaxy (spectra indicate central regions have post-starburst properties) through color maps. These will need to be convolved with reasonable PSFs to allow us to compare across the angular resolution difference of a factor

of ~ 4 between the F336W and F160W observations. In addition we will search for intermediate age star clusters that could be remnants of a past starburst through SED fits to surrounding sources identified by angular size and color.

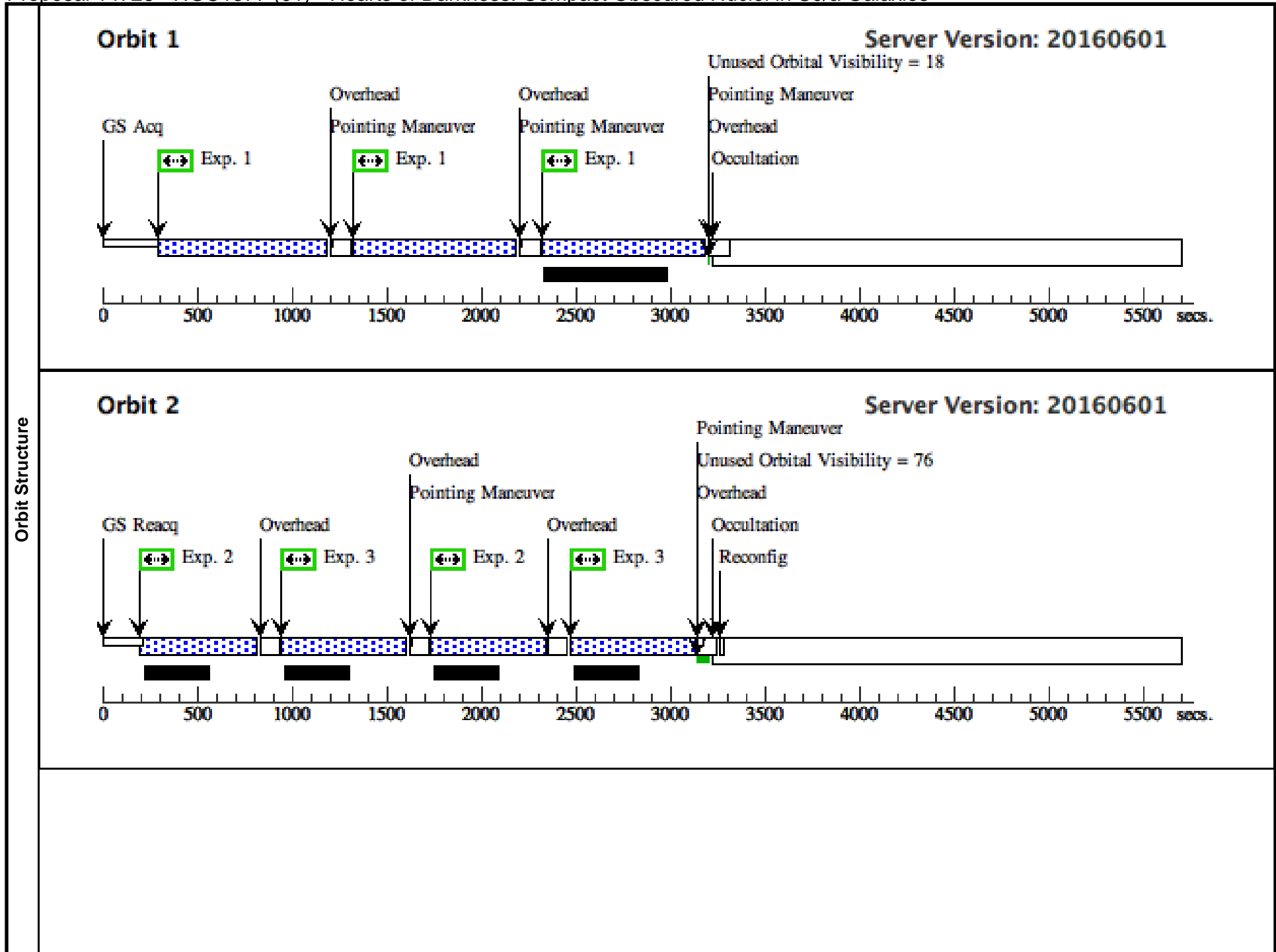
Proposal 14728 - NGC1377 (01) - Hearts of Darkness: Compact Obscured Nuclei in S0/a Galaxies

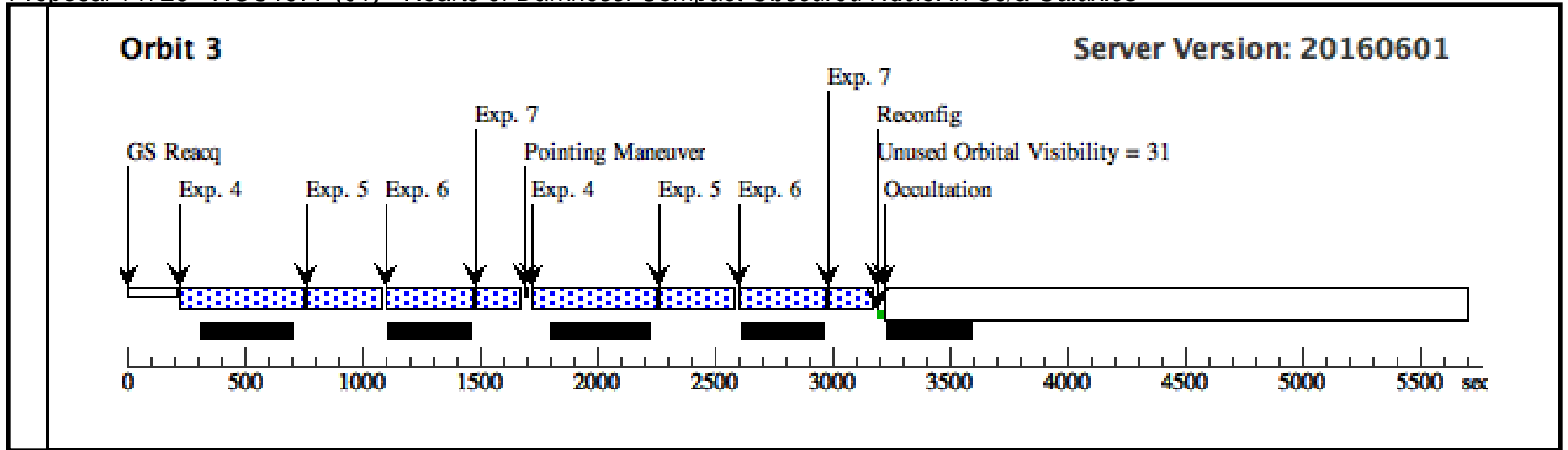
Wed Nov 09 16:52:36 GMT 2016

Visit	Proposal 14728, NGC1377 (01), implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR, WFC3/UVIS Special Requirements: ORIENT 35D TO 102.5 D; ORIENT 122.5D TO 192.5 D; ORIENT 212.5D TO 272 D; ORIENT 302.5D TO 12.5 D					
	#	Primary Pattern	Secondary Pattern	Exposures		
Patterns	(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing= Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(2-3)		
	(2)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing= Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1)		
	(3)	Pattern Type=WFC3-IR-DITHER-BLOB Purpose=DITHER Number Of Points=2 Point Spacing=5.183 Line Spacing= Coordinate Frame=POS-TARG Pattern Orientation=41.859 Angle Between Sides= Center Pattern=true		(4-7)		
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	NGC-1377	RA: 03 36 39.0770 (54.1628208d) Dec: -20 54 8.14 (-20.90226d) Equinox: J2000		V=13+/-0.3	Reference Frame: SIMBAD
<i>Comments: This object was generated by the target selector and retrieved from the SIMBAD database.</i> Extended=YES						

Proposal 14728 - NGC1377 (01) - Hearts of Darkness: Compact Obscured Nuclei in S0/a Galaxies

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	NGC1377U	(1) NGC-1377	WFC3/UVIS, ACCUM, UVIS2	F336W	FLASH=9.0		Pattern 2, Exps 1-1 in NGC1377 (01) (2)	865 Secs (2595 Secs)	
									[==>(Pattern 1)]	[1]
									[==>(Pattern 2)]	
									[==>(Pattern 3)]	
	2	NGC1377V	(1) NGC-1377	WFC3/UVIS, ACCUM, UVIS2	F555W			Pattern 1, Exps 2-3 in NGC1377 (01) (1)	600 Secs (1200 Secs)	
									[==>(Pattern 1)]	[2]
									[==>(Pattern 2)]	
	3	NGC1377I	(1) NGC-1377	WFC3/UVIS, ACCUM, UVIS2	F814W			Pattern 1, Exps 2-3 in NGC1377 (01) (1)	645 Secs (1290 Secs)	
									[==>(Pattern 1)]	[2]
								[==>(Pattern 2)]		
4	NGC1377Pbet	(1) NGC-1377	WFC3/IR, MULTIACCUM, IR	F128N	SAMP-SEQ=SPARS 50; NSAMP=11		Pattern 3, Exps 4-7 in NGC1377 (01) (3)	502.936801 Secs (1005.874 Secs)		
								[==>(Pattern 1)]	[3]	
								[==>(Pattern 2)]		
5	N1377Fe2	(1) NGC-1377	WFC3/IR, MULTIACCUM, IR	F164N	SAMP-SEQ=SPARS 50; NSAMP=7		Pattern 3, Exps 4-7 in NGC1377 (01) (3)	302.934997 Secs (605.87 Secs)		
								[==>(Pattern 1)]	[3]	
								[==>(Pattern 2)]		
6	N1377_F125	(1) NGC-1377	WFC3/IR, MULTIACCUM, IR	F125W	SAMP-SEQ=SPARS 50; NSAMP=8		Pattern 3, Exps 4-7 in NGC1377 (01) (3)	352.935448 Secs (705.871 Secs)		
								[==>(Pattern 1)]	[3]	
								[==>(Pattern 2)]		
7	N1377_F160	(1) NGC-1377	WFC3/IR, MULTIACCUM, IR	F160W	SAMP-SEQ=SPARS 25; NSAMP=8		Pattern 3, Exps 4-7 in NGC1377 (01) (3)	177.935896 Secs (355.872 Secs)		
								[==>(Pattern 1)]	[3]	
								[==>(Pattern 2)]		

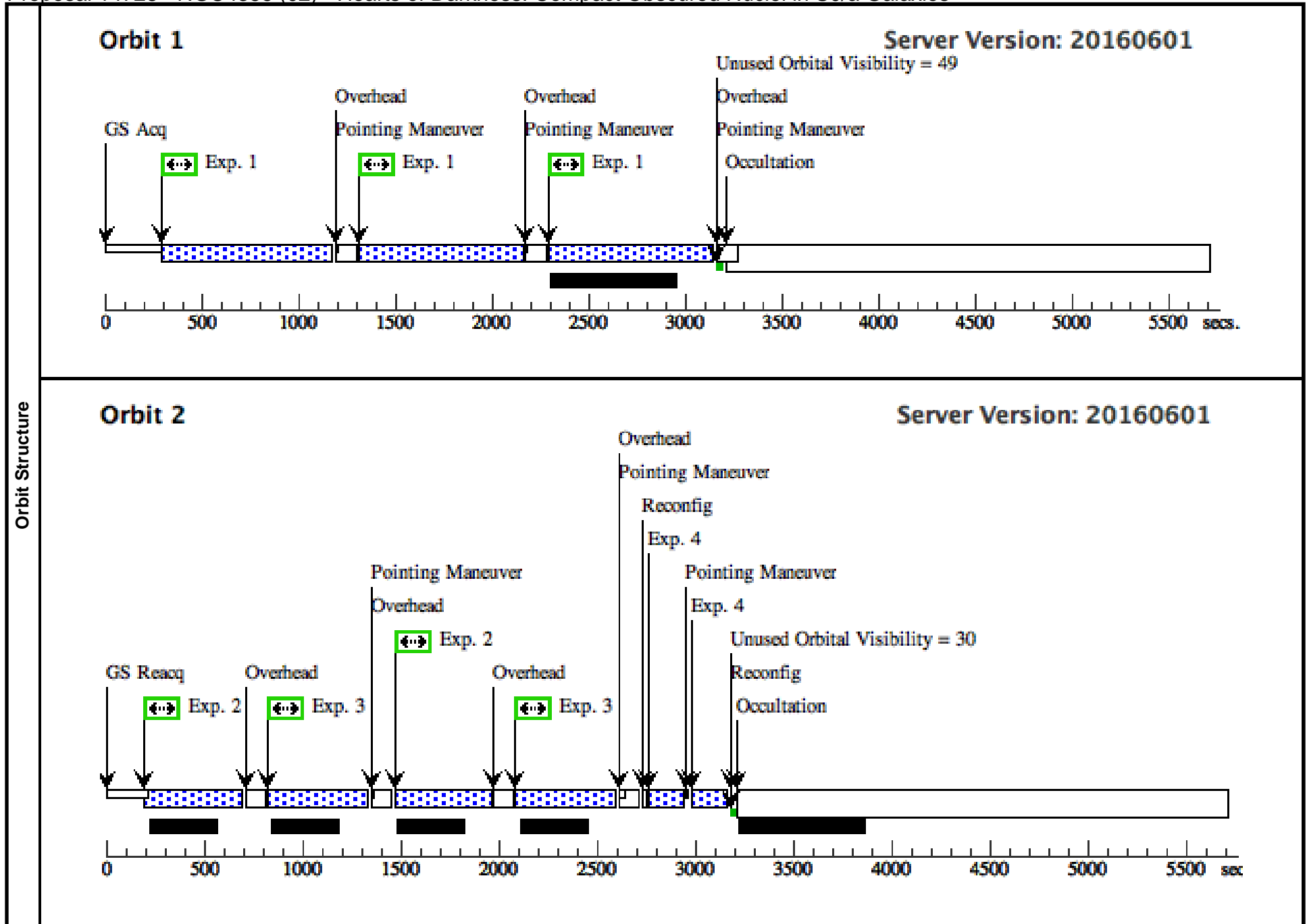




Proposal 14728 - NGC4355 (02) - Hearts of Darkness: Compact Obscured Nuclei in S0/a Galaxies

Wed Nov 09 16:52:36 GMT 2016

Visit	Proposal 14728, NGC4355 (02), implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR, WFC3/UVIS Special Requirements: ORIENT 40.8D TO 110.8 D; ORIENT 130.8D TO 145 D; ORIENT 180D TO 200 D; ORIENT 220.8D TO 290.8 D; ORIENT 310.8D TO 20.8 D									
	#	Primary Pattern	Secondary Pattern	Exposures						
Patterns	(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing= Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(2-3)						
	(2)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing= Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1)						
	(3)	Pattern Type=WFC3-IR-DITHER-BLOB Purpose=DITHER Number Of Points=2 Point Spacing=5.183 Line Spacing= Coordinate Frame=POS-TARG Pattern Orientation=41.859 Angle Between Sides= Center Pattern=true		(4)						
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(2)	NGC-4355 Alt Name1: NGC-4418	RA: 12 26 54.6280 (186.7276167d) Dec: -00 52 39.51 (-.87764d) Equinox: J2000		V=13.37	Reference Frame: SIMBAD				
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	NGC4355U	(2) NGC-4355	WFC3/UVIS, ACCUM, UVIS2	F336W	FLASH=11		Pattern 2, Exps 1-1 in NGC4355 (02) (2)	850 Secs (2550 Secs) [=>(Pattern 1)] [=>(Pattern 2)] [=>(Pattern 3)]	[1]
	2	NGC4355V	(2) NGC-4355	WFC3/UVIS, ACCUM, UVIS2	F555W			Pattern 1, Exps 2-3 in NGC4355 (02) (1)	480 Secs (960 Secs) [=>(Pattern 1)] [=>(Pattern 2)]	[2]
	3	NGC4355I	(2) NGC-4355	WFC3/UVIS, ACCUM, UVIS2	F814W			Pattern 1, Exps 2-3 in NGC4355 (02) (1)	500 Secs (1000 Secs) [=>(Pattern 1)] [=>(Pattern 2)]	[2]
	4	NGC4355_F125	(2) NGC-4355	WFC3/IR, MULTIACCUM, IR	F125W	SAMP-SEQ=SPARS 25; NSAMP=7		Pattern 3, Exps 4-4 in NGC4355 (02) (3)	152.935381 Secs (305.871 Secs) [=>(Pattern 1)] [=>(Pattern 2)]	[2]



Proposal 14728 - CGCG-049-057 (03) - Hearts of Darkness: Compact Obscured Nuclei in S0/a Galaxies

Wed Nov 09 16:52:37 GMT 2016

Visit	Proposal 14728, CGCG-049-057 (03), implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR, WFC3/UVIS Special Requirements: (none)										
	#	Primary Pattern				Secondary Pattern				Exposures	
Patterns	(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing= Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false								(2-3)	
	(2)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing= Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false								(1)	
	(3)	Pattern Type=WFC3-IR-DITHER-BLOB Purpose=DITHER Number Of Points=2 Point Spacing=5.183 Line Spacing= Coordinate Frame=POS-TARG Pattern Orientation=41.859 Angle Between Sides= Center Pattern=true								(4)	
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(3)	CGCG-049-057 Alt Name1: ZW049-057	RA: 15 13 13.0944 (228.3045600d) Dec: +07 13 31.84 (7.22551d) Equinox: J2000				V=15		Reference Frame: NED		
<i>Comments: This object was generated by the targetselector and retrieved from the NED database.</i>											
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit
	1	Zw049U	(3) CGCG-049-057	WFC3/UVIS, ACCUM, UVIS2	F336W	FLASH=11		Pattern 2, Exps 1-1 in CGCG-049-057 (03) (2)	850 Secs (2550 Secs)	[=>(Pattern 1)] [=>(Pattern 2)] [=>(Pattern 3)]	[1]
	2	Zw049V	(3) CGCG-049-057	WFC3/UVIS, ACCUM, UVIS2	F555W			Pattern 1, Exps 2-3 in CGCG-049-057 (03) (1)	480 Secs (960 Secs)	[=>(Pattern 1)] [=>(Pattern 2)]	[2]
	3	Zw049I	(3) CGCG-049-057	WFC3/UVIS, ACCUM, UVIS2	F814W			Pattern 1, Exps 2-3 in CGCG-049-057 (03) (1)	500 Secs (1000 Secs)	[=>(Pattern 1)] [=>(Pattern 2)]	[2]
	4	Zw049_F125	(3) CGCG-049-057	WFC3/IR, MULTIACCUM, IR	F125W	NSAMP=7; SAMP-SEQ=SPAR S25		Pattern 3, Exps 4-4 in CGCG-049-057 (03) (3)	152.935381 Secs (305.871 Secs)	[=>(Pattern 1)] [=>(Pattern 2)]	[2]

