



13295 - Do the globular clusters in the Fornax dSph have multiple stellar populations?

Cycle: 21, 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) FORNAX-1	WFC3/UVIS	4	28-Feb-2014 21:01:27.0	yes
02	(2) FORNAX-2	WFC3/UVIS	4	28-Feb-2014 21:01:38.0	yes
03	(3) FORNAX-3	WFC3/UVIS	4	28-Feb-2014 21:01:47.0	yes
04	(5) FORNAX-5	WFC3/UVIS	4	28-Feb-2014 21:01:57.0	yes
05	(6) M-15	WFC3/UVIS	1	28-Feb-2014 21:02:06.0	yes
53	(3) FORNAX-3	WFC3/UVIS	1	28-Feb-2014 21:02:10.0	yes

18 Total Orbits Used

ABSTRACT

We propose to obtain WFC3 F343N-band imaging of the four most metal-poor globular clusters (GCs) in the Fornax dwarf spheroidal galaxy. With these data, we will establish whether red giant branch (RGB) stars in the clusters show a spread in their abundances of nitrogen. This will tell us whether the Fornax GCs host multiple stellar populations, as appears to be the case in most Galactic GCs.

The Fornax dSph is of special interest in this context because a very large fraction (about 20%-25%) of its metal-poor stars ($[\text{Fe}/\text{H}] < -2$) belong to the four most metal-poor GCs. N-body simulations suggest it is highly unlikely that a large number of field stars have been lost due to tidal interaction with the Milky Way. The GCs could therefore, at most, have been a factor of 5 more massive initially, or otherwise more metal-poor field stars should be observed. This result is in tension with some leading scenarios for the origin of multiple populations via self-enrichment in GCs, which require GCs to have been at least a factor of 10 more massive initially.

It is therefore crucial to establish whether the Fornax GCs do indeed host multiple stellar populations, and in what proportion. If they do, alternative explanations for the origin of multiple populations would have to be sought, which do not require a large number of first-generation stars to have been lost from the clusters (for example, by invoking a top-heavy first-generation IMF or accretion of additional gas). If they do not, this would have the interesting consequence that GC formation in the Fornax dSph differed significantly from that in the Milky Way.

OBSERVING DESCRIPTION

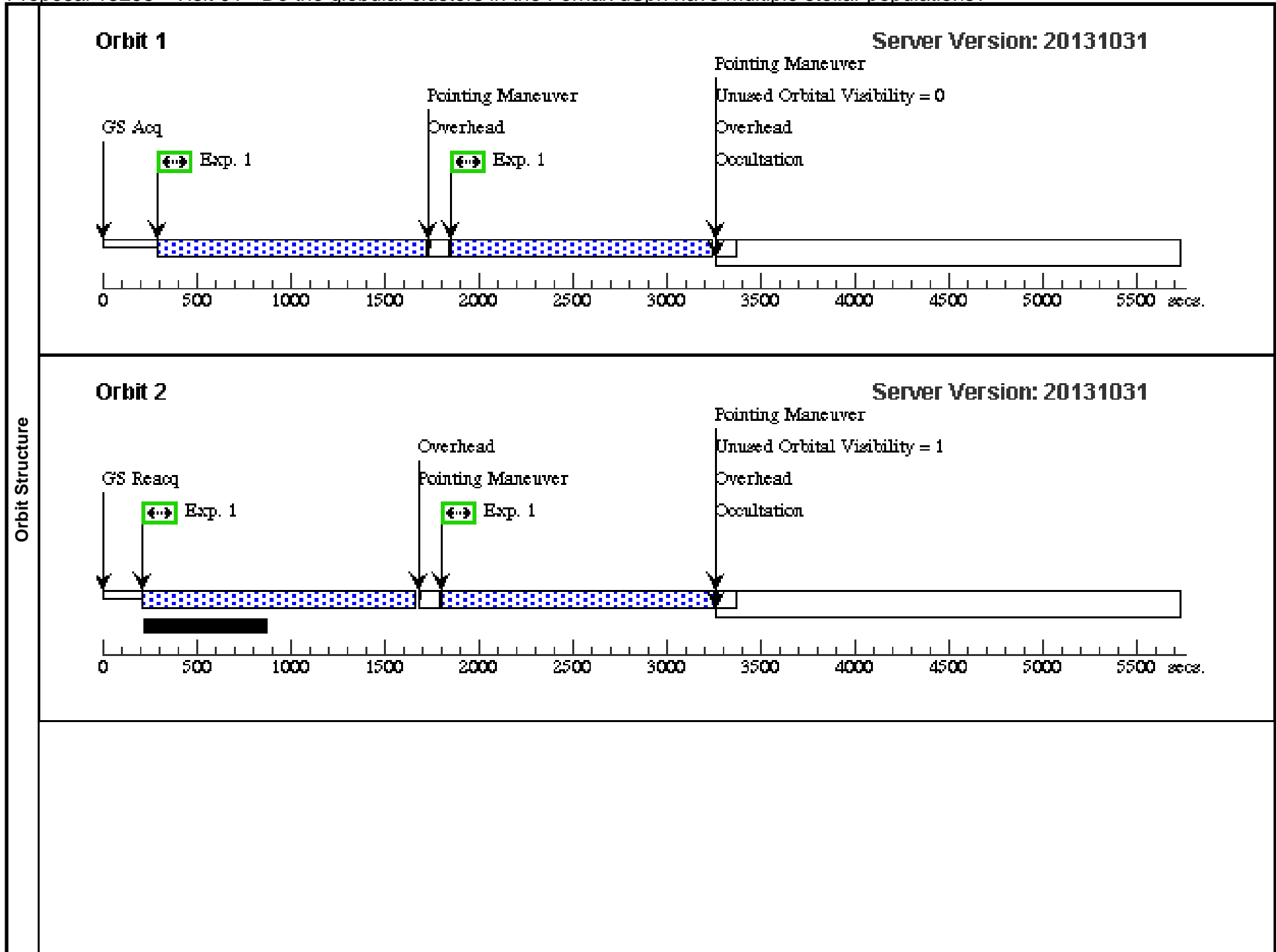
Each of the four most metal-poor globular clusters in the Fornax dSph will be observed in F343N for four orbits. We will use a four-point box dither pattern (one point per orbit) with a two-point line sub-pattern (each orbit split into two exposures).

Additionally, the globular cluster M15 will be observed in F343N, F555W and F814W as a calibration target.

Proposal 13295 - Visit 01 - Do the globular clusters in the Fornax dSph have multiple stellar populations?

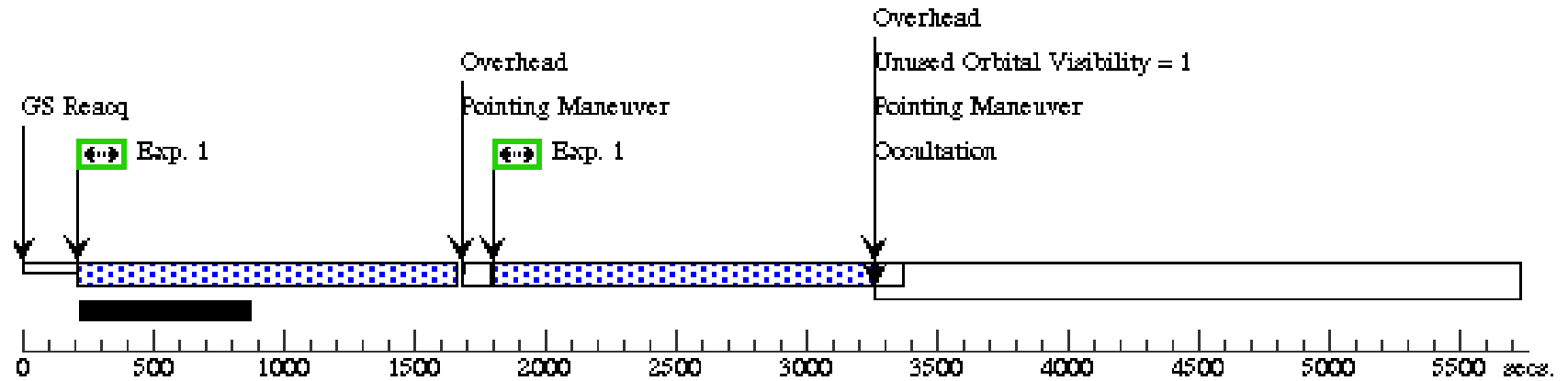
Sat Mar 01 02:02:18 GMT 2014

Visit	Proposal 13295, Visit 01, scheduling Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: (none)									
	Patterns	#	Primary Pattern				Secondary Pattern			
		(2)	Pattern Type=BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=false	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	(1)			
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	FORNAX-1	RA: 02 37 1.9008 (39.2579200d) Dec: -34 11 1.00 (-34.18361d) Equinox: J2000		V=15.6	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	Fornax-1	(1) FORNAX-1	WFC3/UVIS, ACCUM, UVIS2-FIX	F343N	FLASH=10	POS TARG 40,0	Pattern 2, Exps 1-1 i n Visit 01 (2)	1390 Secs (11498 Secs)	
								[==>1396.0 Secs (Pattern 1,1)]	[1]	
								[==>1396.0 Secs (Pattern 1,2)]		
								[==>1451.0 Secs (Pattern 2,1)]	[2]	
								[==>1451.0 Secs (Pattern 2,2)]		
								[==>1451.0 Secs (Pattern 3,1)]	[3]	
								[==>1451.0 Secs (Pattern 3,2)]		
								[==>1451.0 Secs (Pattern 4,1)]	[4]	
								[==>1451.0 Secs (Pattern 4,2)]		



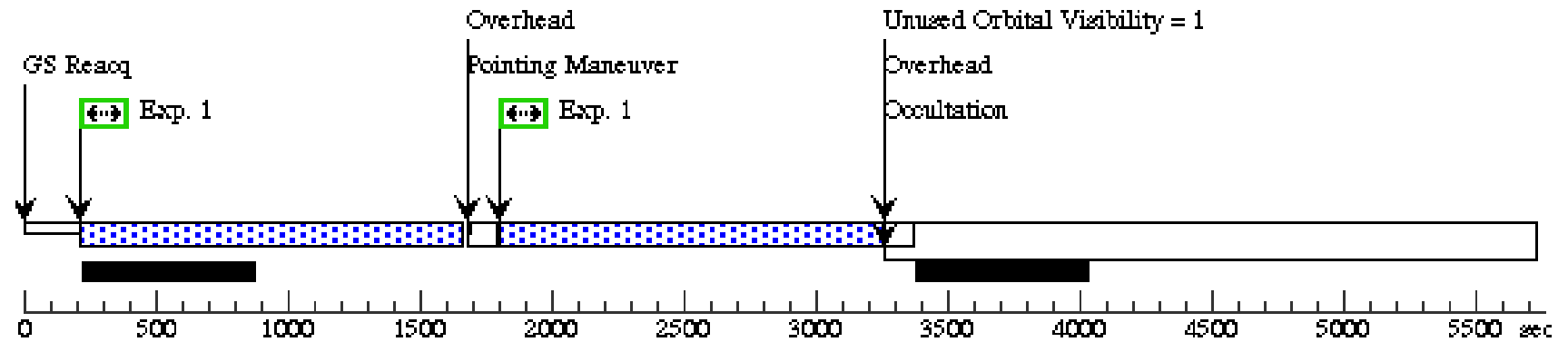
Orbit 3

Server Version: 20131031



Orbit 4

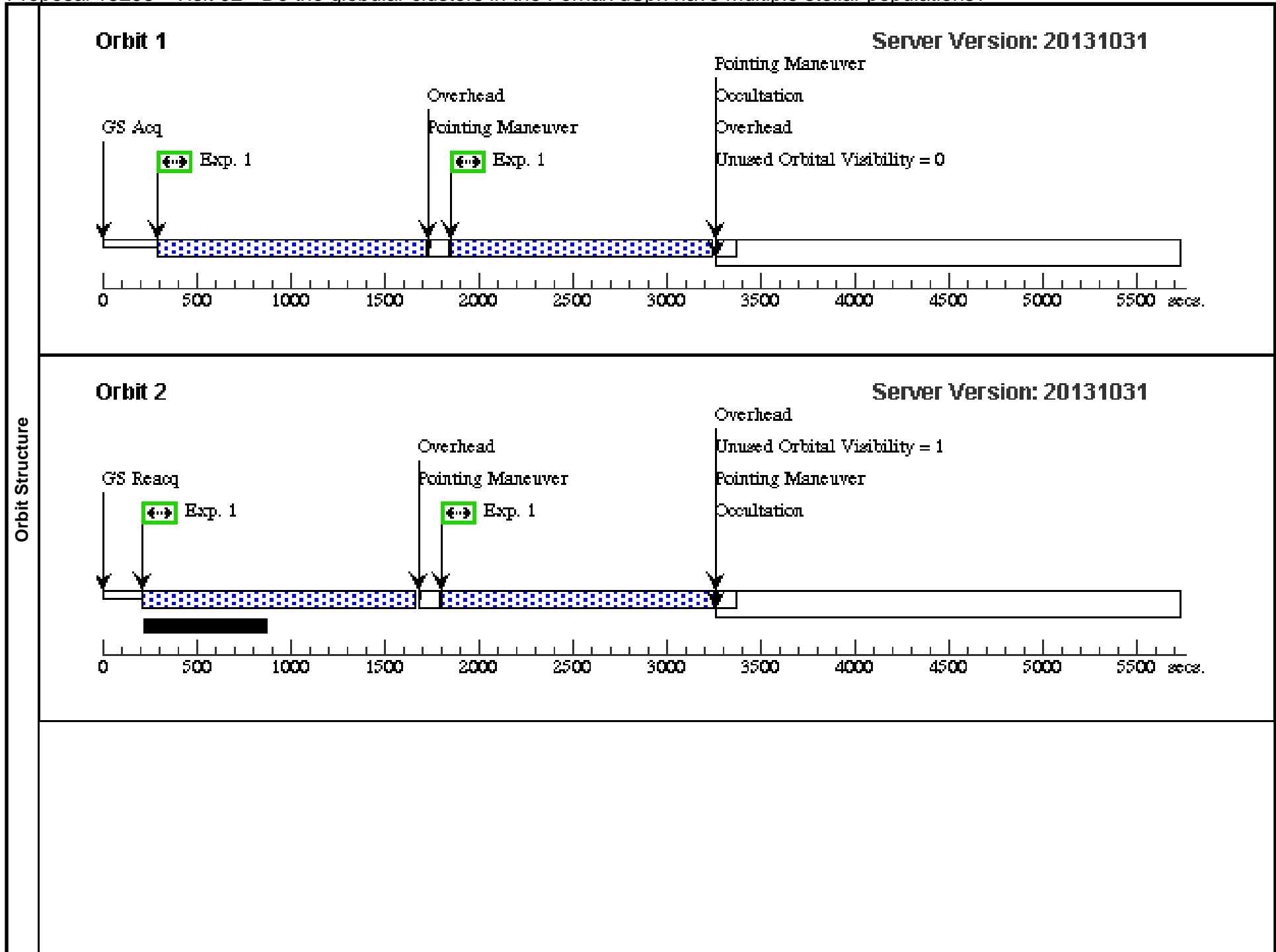
Server Version: 20131031



Proposal 13295 - Visit 02 - Do the globular clusters in the Fornax dSph have multiple stellar populations?

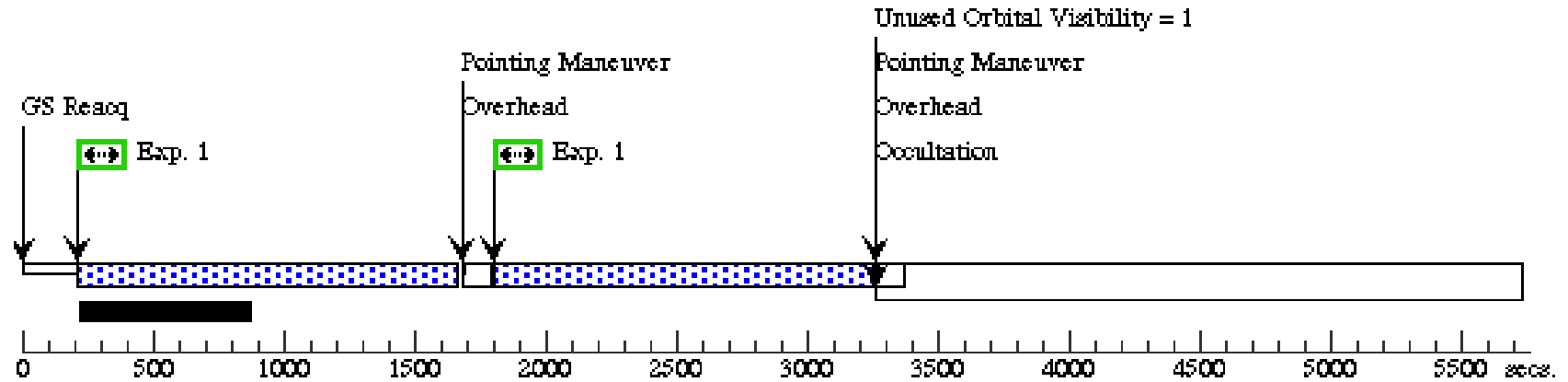
Sat Mar 01 02:02:22 GMT 2014

Visit	Proposal 13295, Visit 02, completed Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: (none)									
	Patterns	#	Primary Pattern	Secondary Pattern	Exposures					
		(2)	Pattern Type=BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=false	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	(1)			
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(2)	FORNAX-2	RA: 02 38 44.0000 (39.6833333d) Dec: -34 48 30.00 (-34.80833d) Equinox: J2000		V=13.5	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	Fornax-2	(2) FORNAX-2	WFC3/UVIS, ACCUM, UVIS2-FIX	F343N	FLASH=10	POS TARG 40,0	Pattern 2, Exps 1-1 i n Visit 02 (2)	1390 Secs (11498 Secs) [==>1396.0 Secs (Pattern 1,1)] [==>1396.0 Secs (Pattern 1,2)] [==>1451.0 Secs (Pattern 2,1)] [==>1451.0 Secs (Pattern 2,2)] [==>1451.0 Secs (Pattern 3,1)] [==>1451.0 Secs (Pattern 3,2)] [==>1451.0 Secs (Pattern 4,1)] [==>1451.0 Secs (Pattern 4,2)]	[1] [2] [3] [4]



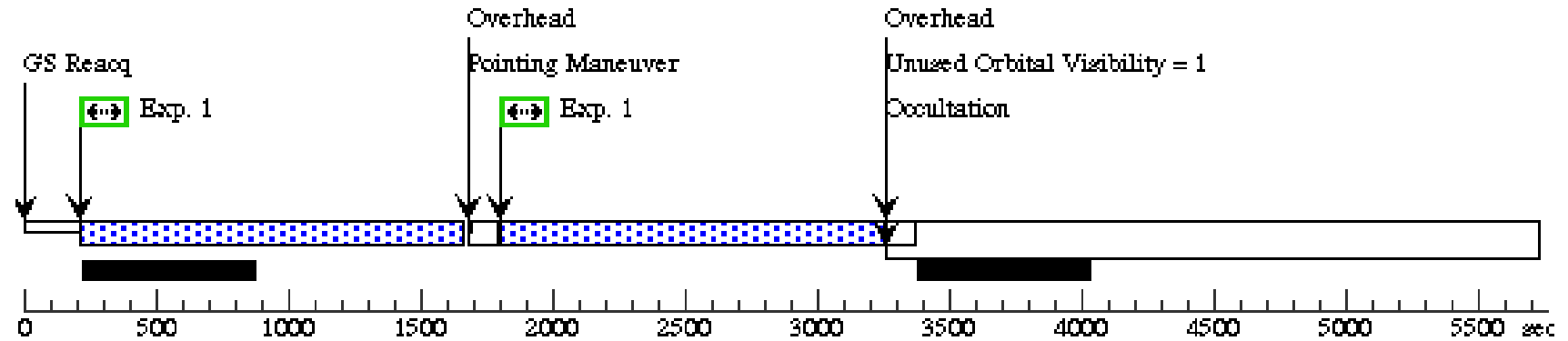
Orbit 3

Server Version: 20131031



Orbit 4

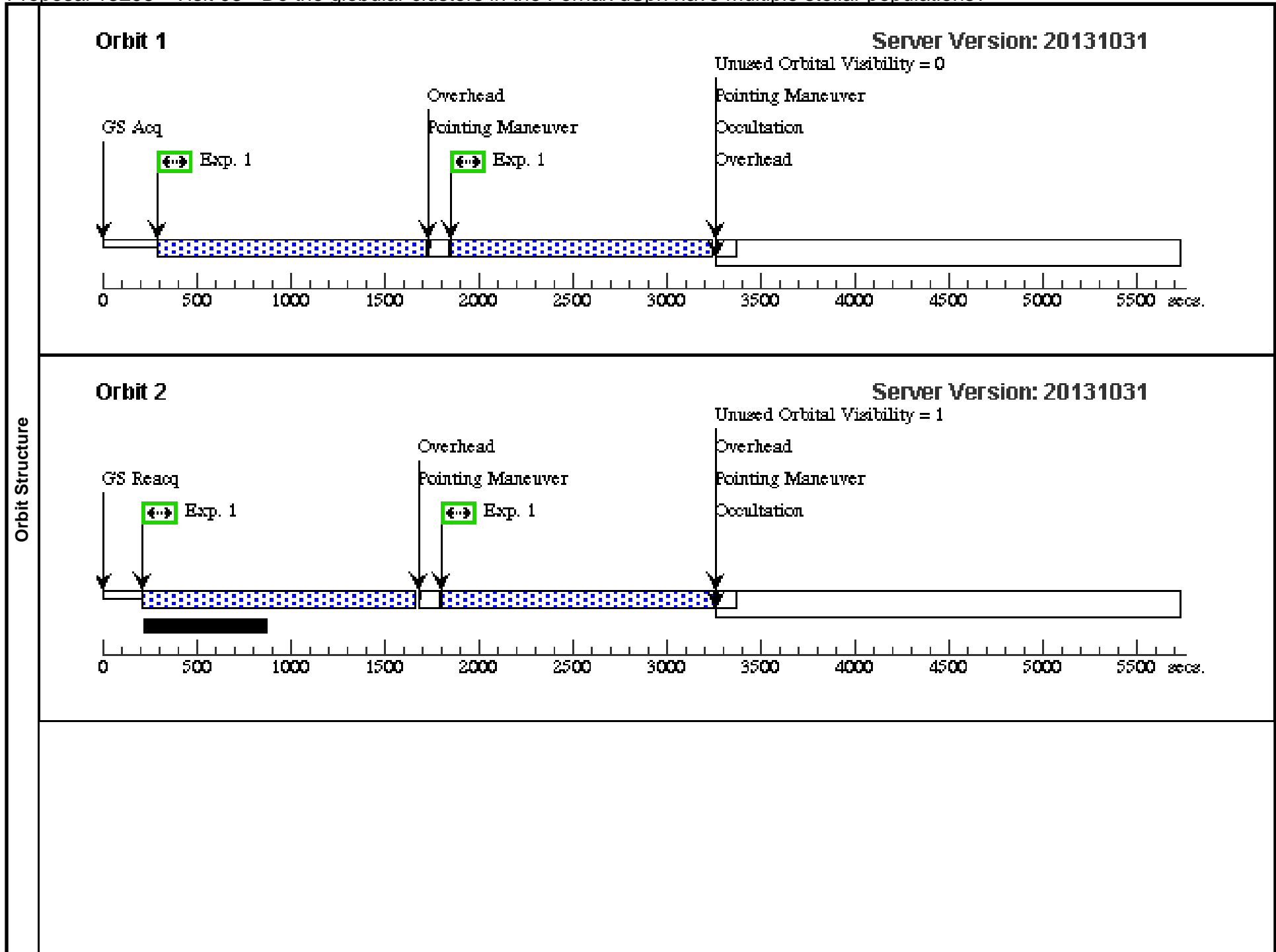
Server Version: 20131031



Proposal 13295 - Visit 03 - Do the globular clusters in the Fornax dSph have multiple stellar populations?

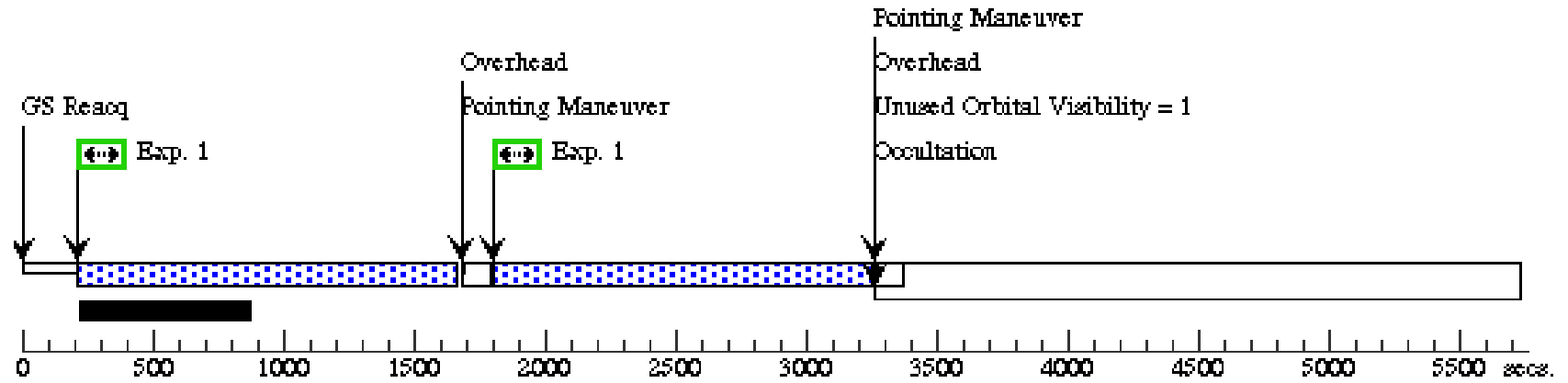
Sat Mar 01 02:02:24 GMT 2014

Visit	Proposal 13295, Visit 03, failed Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: (none)									
	Patterns	#	Primary Pattern				Secondary Pattern			
		(2)	Pattern Type=BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=false			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		
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(3)	FORNAX-3	RA: 02 39 48.1500 (39.9506250d) Dec: -34 15 28.20 (-34.25783d) Equinox: J2000		V=12.6	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	Fornax-3	(3) FORNAX-3	WFC3/UVIS, ACCUM, UVIS2-FIX	F343N	FLASH=10	POS TARG 40,0	Pattern 2, Exps 1-1 i n Visit 03 (2)	1390 Secs (11498 Secs)	
								[==>1396.0 Secs (Pattern 1,1)]	[1]	
								[==>1396.0 Secs (Pattern 1,2)]		
								[==>1451.0 Secs (Pattern 2,1)]	[2]	
								[==>1451.0 Secs (Pattern 2,2)]		
								[==>1451.0 Secs (Pattern 3,1)]	[3]	
								[==>1451.0 Secs (Pattern 3,2)]		
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								[==>1451.0 Secs (Pattern 4,2)]		



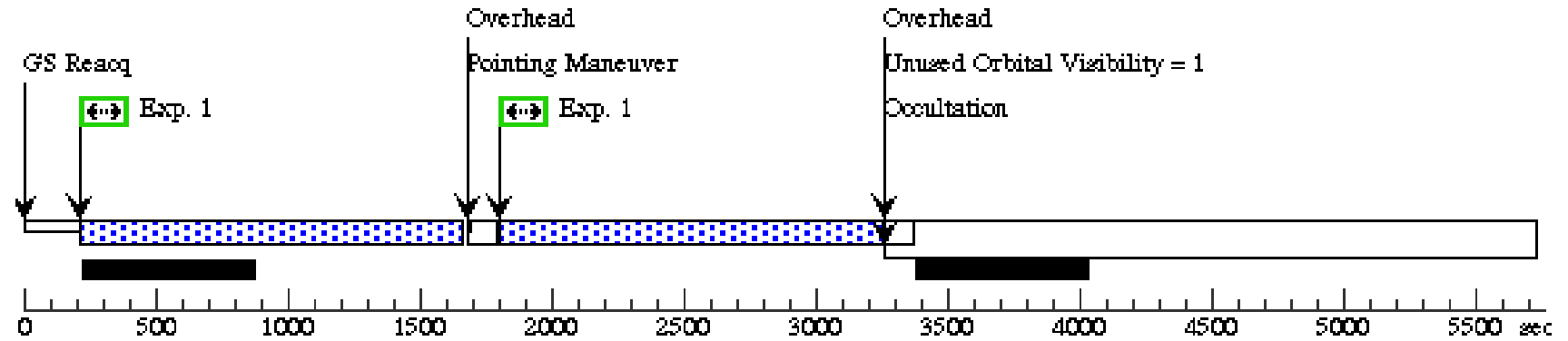
Orbit 3

Server Version: 20131031



Orbit 4

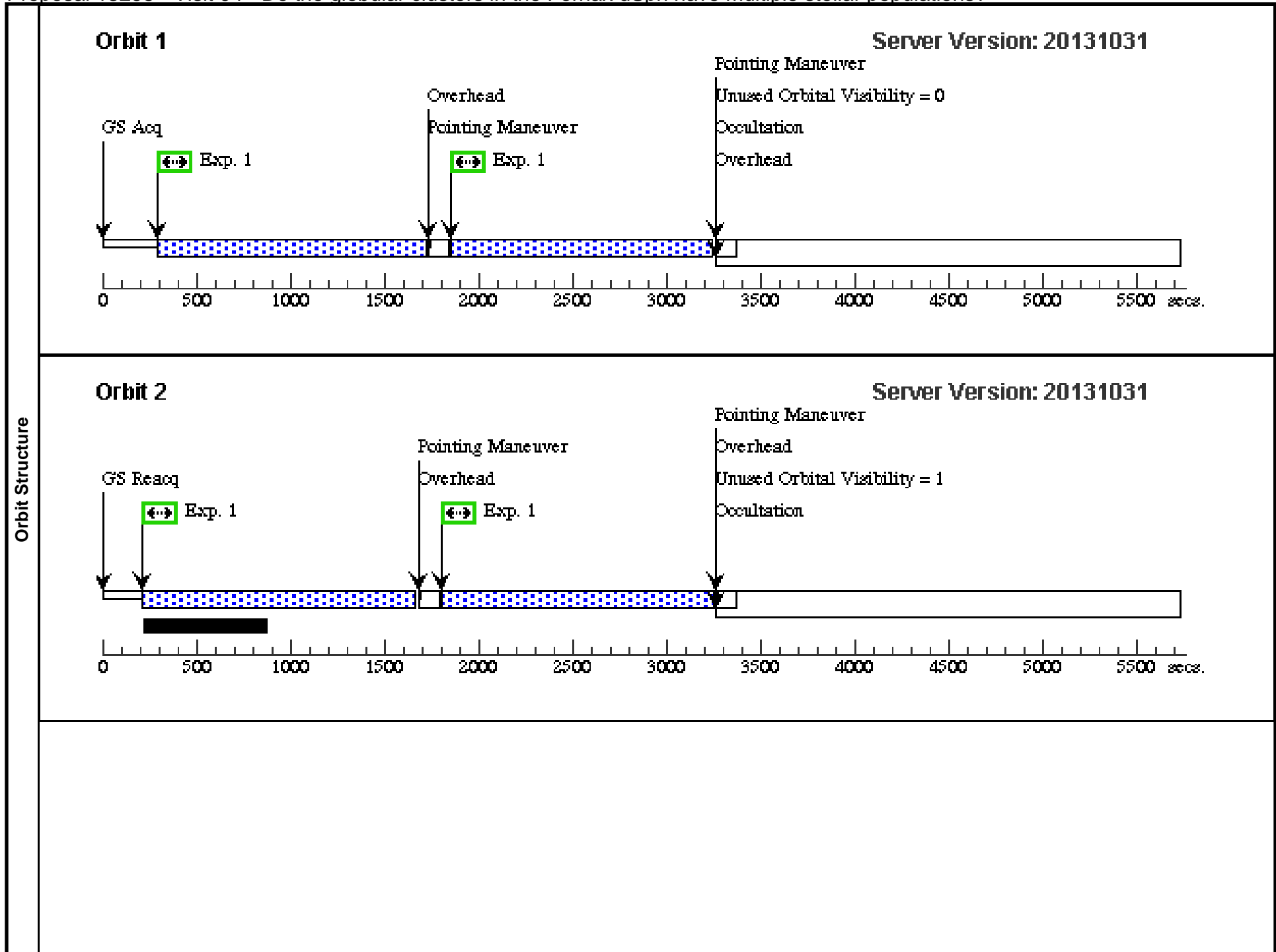
Server Version: 20131031



Proposal 13295 - Visit 04 - Do the globular clusters in the Fornax dSph have multiple stellar populations?

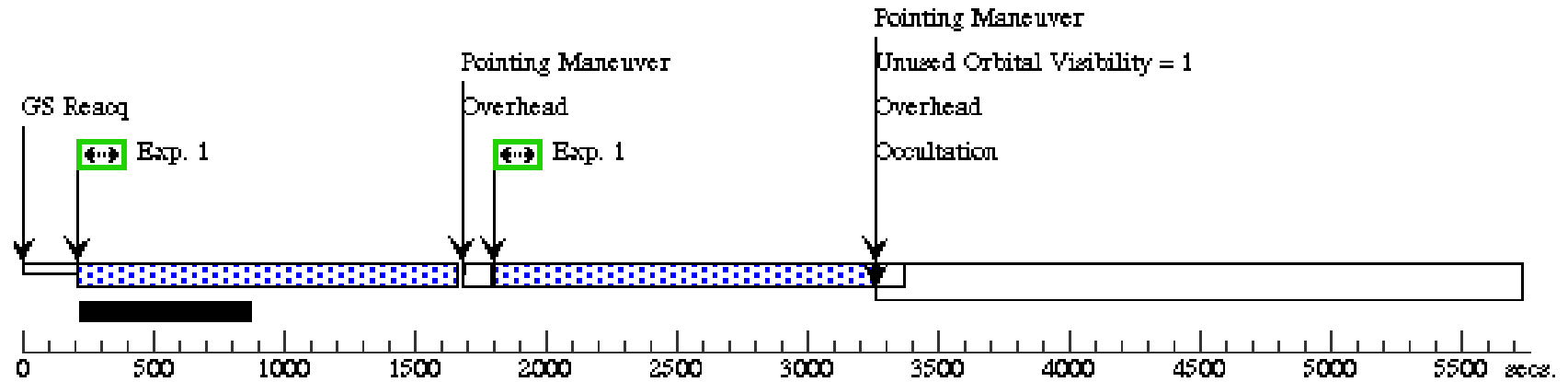
Sat Mar 01 02:02:25 GMT 2014

Visit	Proposal 13295, Visit 04, completed Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: (none)									
	Patterns	#	Primary Pattern				Secondary Pattern			
		(2)	Pattern Type=BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=false			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		
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections	Fluxes	Miscellaneous			
	(5)	FORNAX-5	RA: 02 42 21.1110 (40.5879625d) Dec: -34 06 5.80 (-34.10161d) Equinox: J2000			V=13.4	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	Fornax-5	(5) FORNAX-5	WFC3/UVIS, ACCUM, UVIS2-FIX	F343N	FLASH=10	POS TARG 40,0	Pattern 2, Exps 1-1 i n Visit 04 (2)	1390 Secs (11498 Secs)	
								[==>1396.0 Secs (Pattern 1,1)]	[1]	
								[==>1396.0 Secs (Pattern 1,2)]		
								[==>1451.0 Secs (Pattern 2,1)]	[2]	
								[==>1451.0 Secs (Pattern 2,2)]		
								[==>1451.0 Secs (Pattern 3,1)]	[3]	
								[==>1451.0 Secs (Pattern 3,2)]		
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								[==>1451.0 Secs (Pattern 4,2)]		



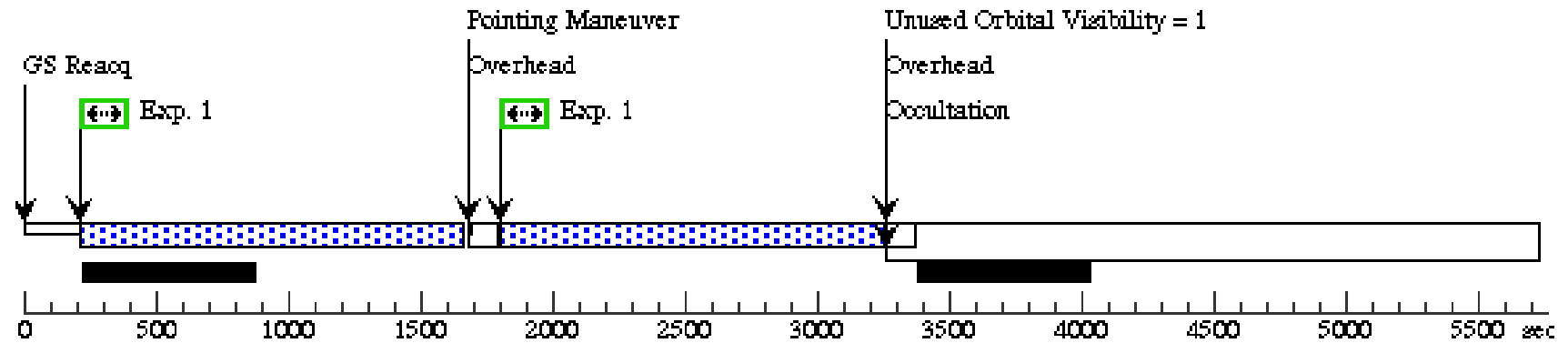
Orbit 3

Server Version: 20131031



Orbit 4

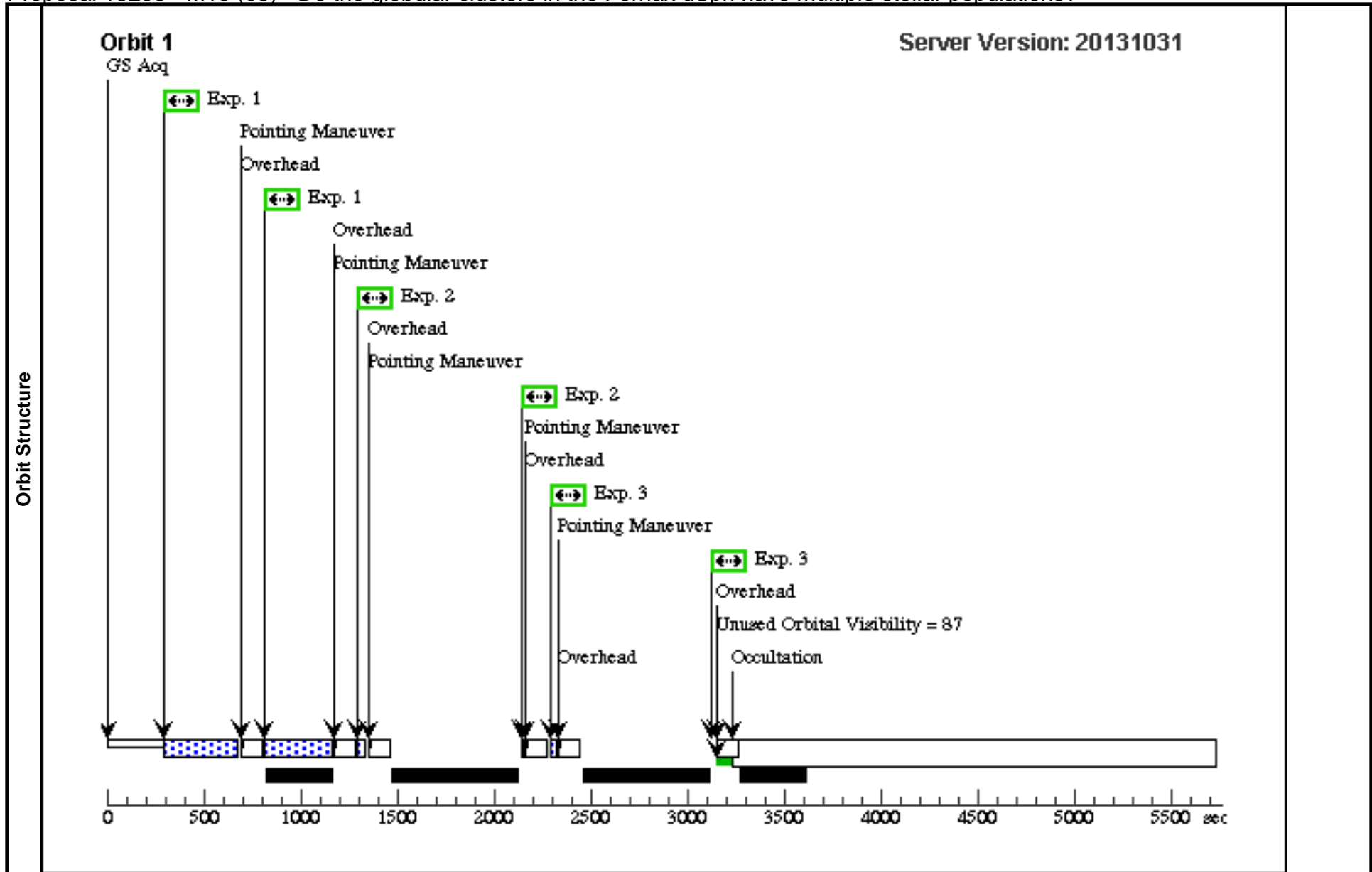
Server Version: 20131031



Proposal 13295 - M15 (05) - Do the globular clusters in the Fornax dSph have multiple stellar populations?

Sat Mar 01 02:02:27 GMT 2014

Visit	Proposal 13295, M15 (05), completed Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: (none)									
	Patterns	#	Primary Pattern	Secondary Pattern	Exposures					
		(3)	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		(1), (2), (3)				
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(6)	M-15	RA: 21 29 58.3300 (322.4930417d) Dec: +12 10 1.20 (12.16700d) Equinox: J2000		V=6.20+/-0.1	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	M15F343N	(6) M-15	WFC3/UVIS, ACCUM, UVIS2	F343N	FLASH=12		Pattern 3, Exps 1-1 i n M15 (05) (3)	350 Secs (700 Secs)	
									[=>(Pattern 1)] [=>(Pattern 2)]	[1]
	2	M15F555W	(6) M-15	WFC3/UVIS, ACCUM, UVIS2	F555W	FLASH=12		Pattern 3, Exps 2-2 i n M15 (05) (3)	10 Secs (20 Secs)	
								[=>(Pattern 1)] [=>(Pattern 2)]	[1]	
	3	M15F814W	(6) M-15	WFC3/UVIS, ACCUM, UVIS2	F814W	FLASH=12		Pattern 3, Exps 3-3 i n M15 (05) (3)	10 Secs (20 Secs)	
								[=>(Pattern 1)] [=>(Pattern 2)]	[1]	



Proposal 13295 - Fornax 3 (53) - Do the globular clusters in the Fornax dSph have multiple stellar populations?

Sat Mar 01 02:02:28 GMT 2014

Visit	Proposal 13295, Fornax 3 (53), implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: (none) <i>Comments: HOPR repeat of 2nd orbit from Visit 03</i>		
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Patterns	#	Primary Pattern	Secondary Pattern	Exposures
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Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(3)	FORNAX-3	RA: 02 39 48.1500 (39.9506250d) Dec: -34 15 28.20 (-34.25783d) Equinox: J2000		V=12.6	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(3) FORNAX-3	WFC3/UVIS, ACCUM, UVIS2-FIX	F343N	FLASH=10	POS TARG 40.158,0 .07; GS ACQ SCENARI O BASE1B3	Pattern 4, Exps 1-1 i n Fornax 3 (53) (4)	1390 Secs (2780 Secs) [==>(Pattern 1)] [==>(Pattern 2)]	[1]

