15061 - Pinpointing the Onset of Multiple Populations in Globular Clusters

Cycle: 25, 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) NGC419	WFC3/UVIS	5	25-Jul-2017 17:05:19.0	yes
02	(1) NGC419	WFC3/UVIS	3	25-Jul-2017 17:05:20.0	yes
03	(2) NGC104	WFC3/UVIS	1	25-Jul-2017 17:05:21.0	yes

9 Total Orbits Used

ABSTRACT

We have potentially pinpointed the onset of the multiple populations (MPs) phenomenon during our HST Cycle 23 program where we were looking for an abundance spreads in 12 massive LMC/SMC clusters with wide range of ages. All of the clusters have similar mass (~10^5 Msun), however, not all of the clusters were found to host MPs. From the observed sample, all clusters (five) above an age of 6 Gyr show clear signs of MPs in their post-main sequences (i.e., the RGB), while all clusters (seven) below this age do not show evidence of MPs. Such a relation with age is not expected in any scenario for the origin of MPs, and constitutes one of the most important findings in the field in recent years. One potential explanation for the observations is that MPs do exist within the young clusters, but only below a certain stellar mass limit. We propose to obtain deeper imaging of NGC 419, a 1.5 Gyr cluster that does not show MPs in its RGB (~1.6 Msun), in order to search for splitting along main sequence stars (~1 Msun and below) caused by the chemical anomalies. Based on stellar isochrones with MPs abundance variations, we expect to observe any main sequence splitting with an additional 8 orbits of exposure using our unique filter combination. Determining if a stellar mass limit exists for MPs would consistute a major step forward in the search for the origin of the multiple populations phenomenon.

OBSERVING DESCRIPTION

We propose to obtain imaging of 2 massive star clusters one within the LMC/SMC, and another one old
galactic globular cluster spanning a wide range of ages (0.1 - 10 Gyr), in order to search for elemental abundance spreads and multiple populations.
The clusters will be observed in the F343N, F336W and F438W WFC3/UVIS filters,
which will provide accurate color-magnitude diagrams (CMD) for studies of these phenomena.

A CMD for such a large range of stellar ages covers everything from red and very bright giants down to the main sequence stars of various brightness and colors. To reach our science goals, it is crucial not to saturate the bright giants by using a short exposure and to reach a sufficient depth beyond the main-sequence turn-off using long exposures. Therefore, for each cluster, a short exposure (observed in Cycle 23) and long exposures with CR-split in each filter are required. To cover the gap between the two WFC3/UVIS CCD chips, we use two dithered pointings. In order to maximize the overlap, we also require a specific orientation to match the orientation of those target clusters which have archival observations with the WFC3/UVIS. This orientation is specified in the Visit Orientation Requirement for these clusters/visits as follows:
Visit1 - ngc419, Min=307, Max=307;
Visit2 - ngc104 (47Tuc), Min=0, Min=1

Visit

Proposal 15061, Visit 01 - NGC 419 (01), implementation Tue Jul 25 21:05:22 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SCHED 70%; ORIENT 306D TO 308 D

Fixed Targets

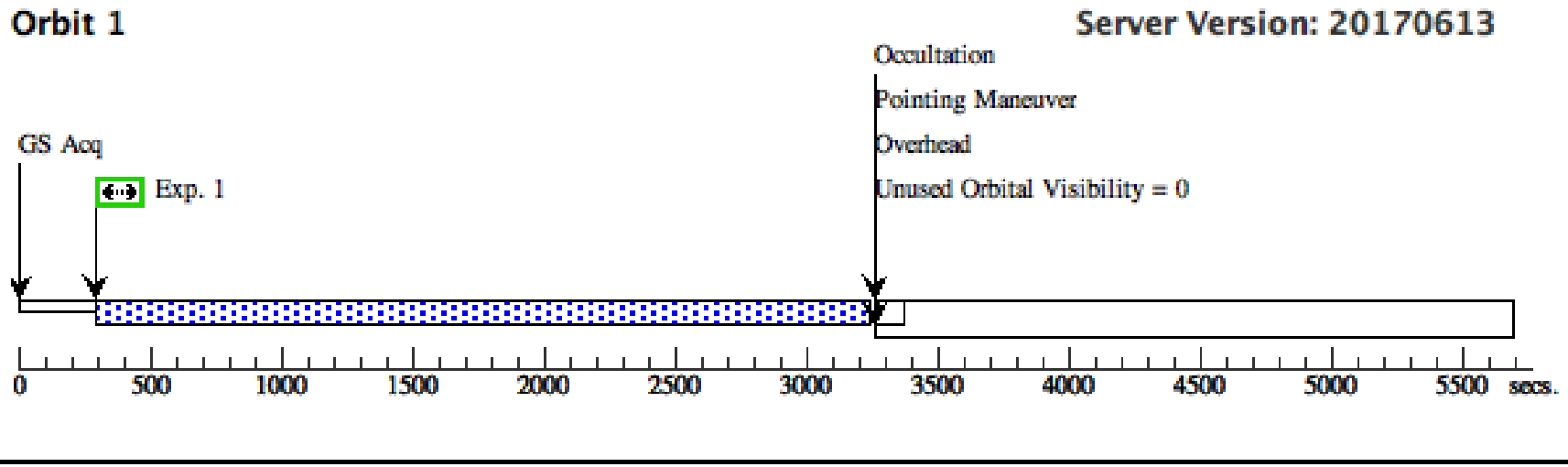
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	NGC419	RA: 01 08 17.0059 (17.0708579d) Dec: -72 53 16.59 (-72.88794d) Equinox: J2000		V=10.5	Reference Frame: SIMBAD

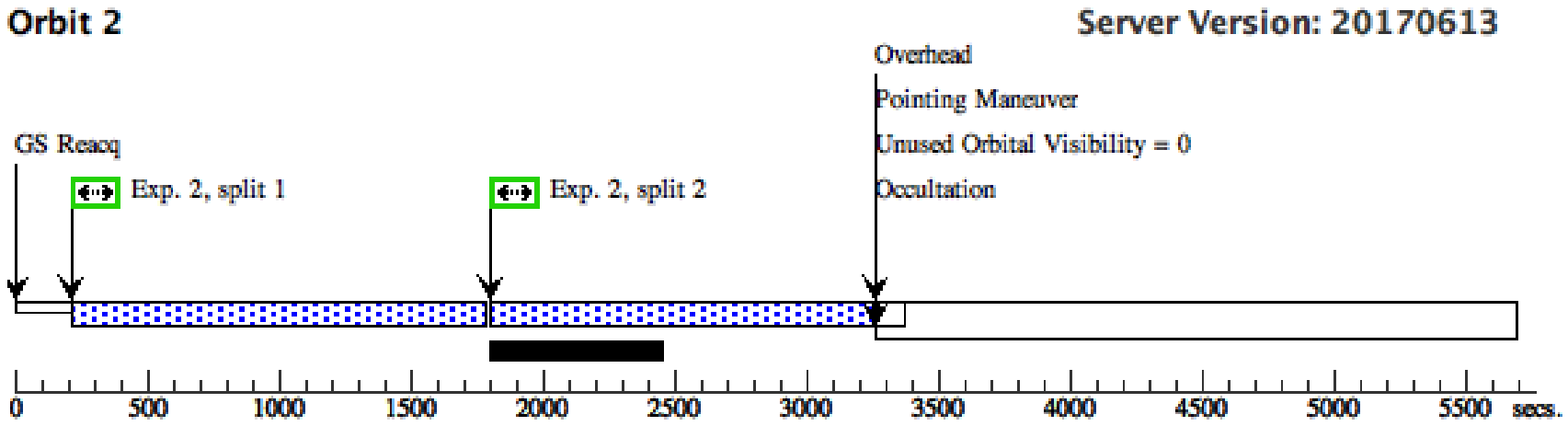
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Extended=NO

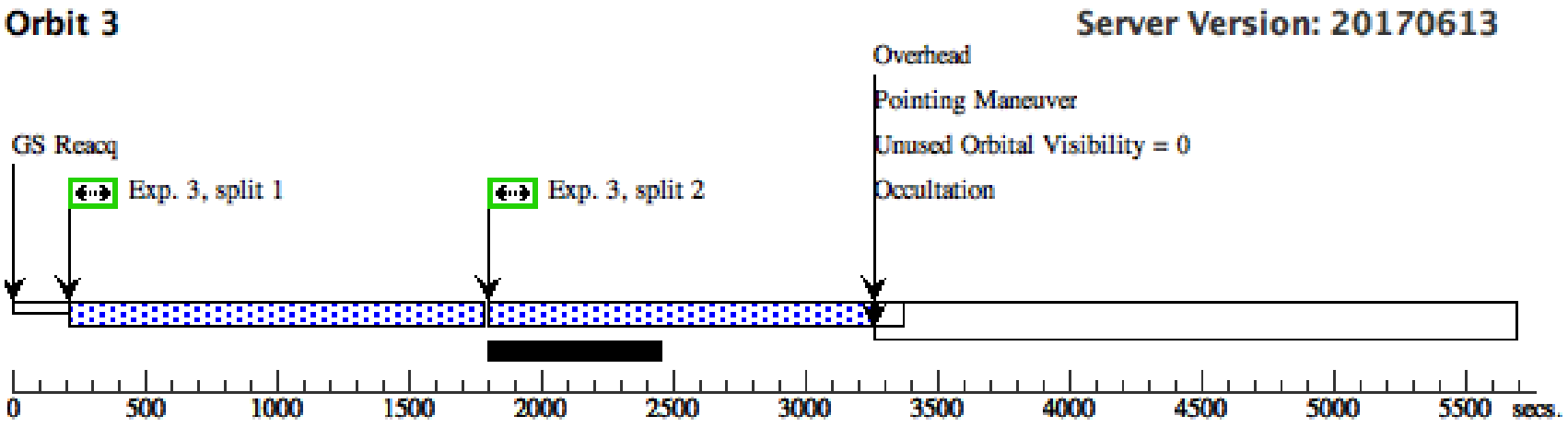
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	NGC419 - F 343N	(1) NGC419	WFC3/UVIS, ACCUM, UVIS1	F343N	FLASH=8	POS TARG 0 ,0		3244 Secs (2924.3 Secs) *[==>2924.3 Secs]*	***[1]***
2	NGC419 - F 343N	(1) NGC419	WFC3/UVIS, ACCUM, UVIS1	F343N	CR-SPLIT=2; FLASH=10	POS TARG 0.18,2.44		3355 Secs (2901 Secs) *[==>1450.5 Secs (Split 1)]* *[==>1450.5 Secs (Split 2)]*	***[2]***
3	NGC419 - F 343N	(1) NGC419	WFC3/UVIS, ACCUM, UVIS1	F343N	CR-SPLIT=2; FLASH=10	POS TARG -0.18,-2.44		3355 Secs (2901 Secs) *[==>1450.5 Secs (Split 1)]* *[==>1450.5 Secs (Split 2)]*	***[3]***
4	NGC419 - F 343N	(1) NGC419	WFC3/UVIS, ACCUM, UVIS1	F343N	FLASH=8	POS TARG -0.18,2.44		3355 Secs (3035.5 Secs) *[==>3035.5 Secs]*	***[4]***
5	NGC419 - F 343N	(1) NGC419	WFC3/UVIS, ACCUM, UVIS1	F343N	FLASH=6	POS TARG 0.18,-2.44		3355 Secs (3036 Secs) *[==>3036.0 Secs]*	***[5]***

Orbit Structure



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Overhead
Pointing Maneuver
Unused Orbital Visibility = 0
Occultation
GS Reacq
Exp. 3, split 1
Exp. 3, split 2
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2000
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3000
3500
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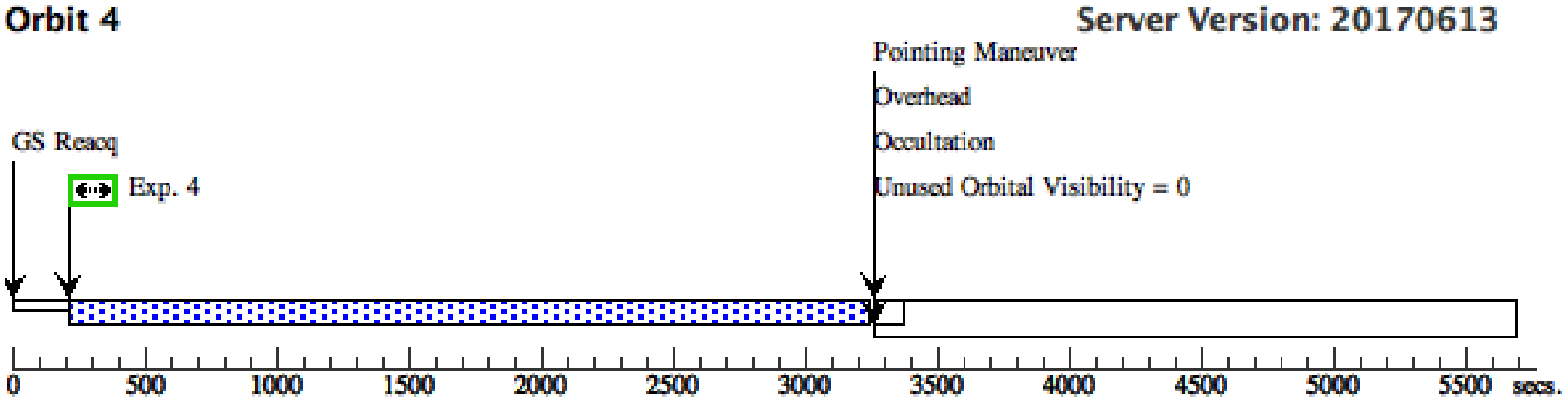
4500
5000
5500
secs.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Pointing Maneuver
Overhead
Occultation
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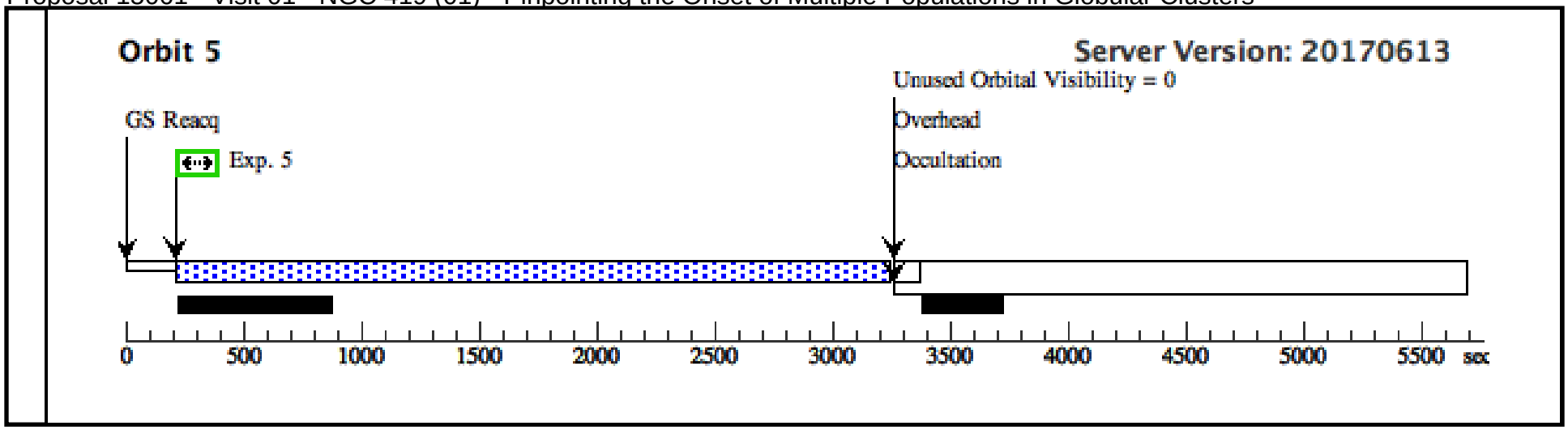
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Server Version: 20170613
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GS Reacq
Exp. 5
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Occultation
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1000
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2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 15061, Visit 02 - NGC 419 (02), implementation Tue Jul 25 21:05:23 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SCHED 70%; ORIENT 306D TO 308 D

Fixed Targets

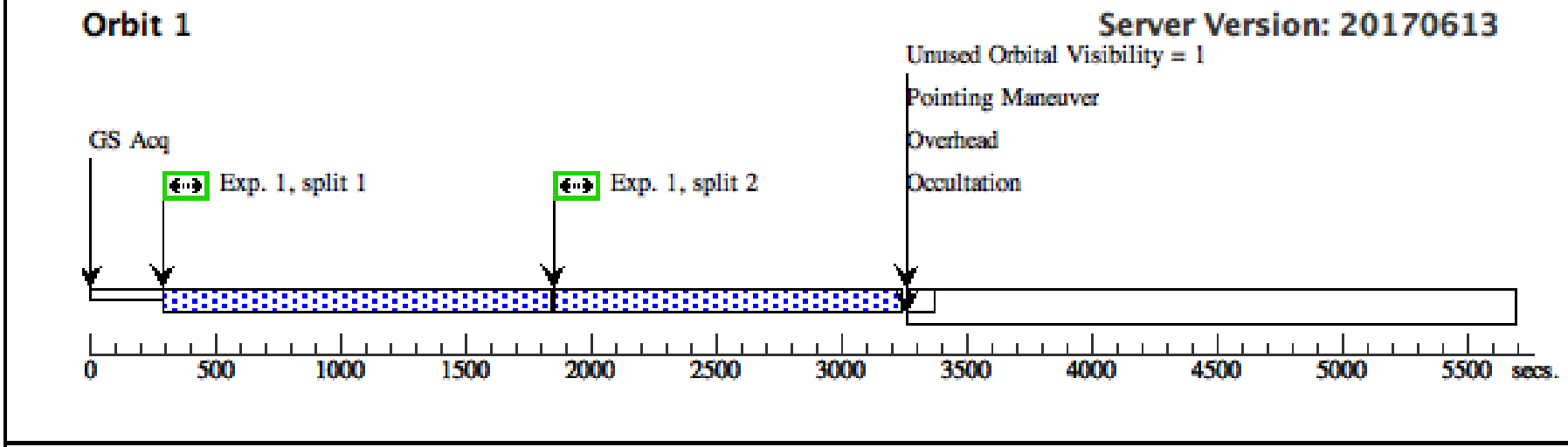
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	NGC419	RA: 01 08 17.0059 (17.0708579d) Dec: -72 53 16.59 (-72.88794d) Equinox: J2000		V=10.5	Reference Frame: SIMBAD

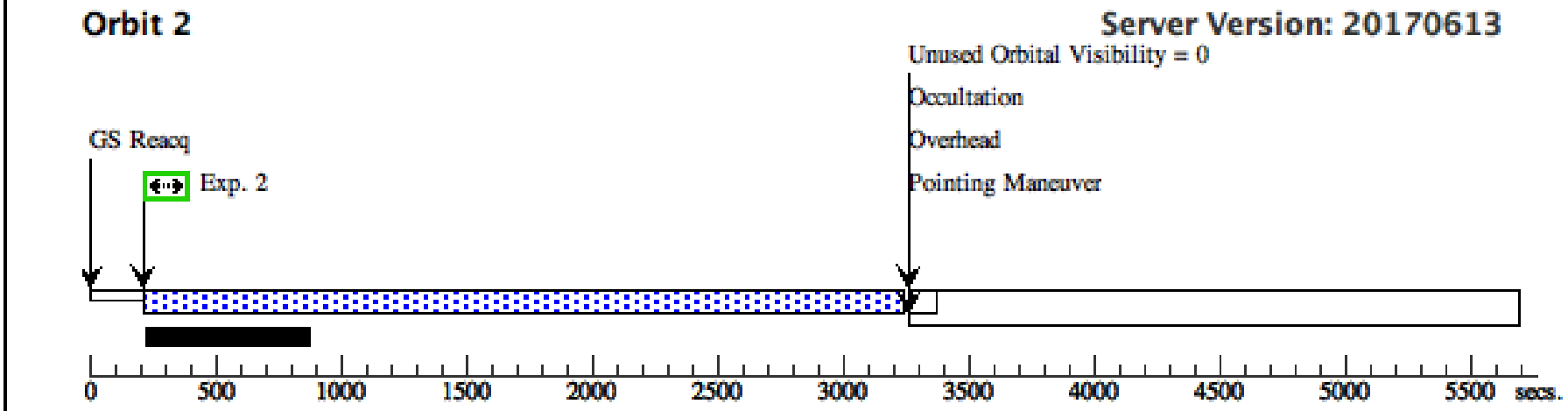
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Extended=NO

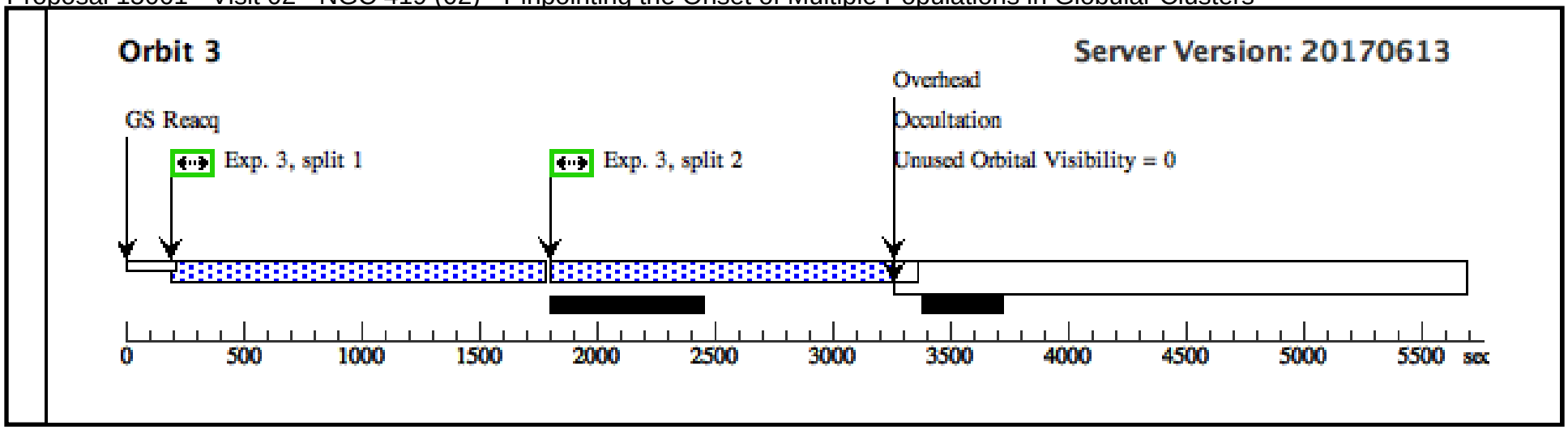
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	NGC419 - F336W	(1) NGC419	WFC3/UVIS, ACCUM, UVIS1	F336W	FLASH=8; CR-SPLIT=2	POS TARG 0 ,0		3000 Secs (2790 Secs) *[==>1395.0 Secs (Split 1)]* *[==>1395.0 Secs (Split 2)]*	***[1]***
2	NGC419 - F336W	(1) NGC419	WFC3/UVIS, ACCUM, UVIS1	F336W	FLASH=4	POS TARG 0.18,2.44		3000 Secs (3036 Secs) *[==>3036.0 Secs]*	***[2]***
3	NGC419 - F438W	(1) NGC419	WFC3/UVIS, ACCUM, UVIS1	F438W	CR-SPLIT=2	POS TARG 0 ,0		3000 Secs (2908 Secs) *[==>1454.0 Secs (Split 1)]* *[==>1454.0 Secs (Split 2)]*	***[3]***

Orbit Structure






Orbit 3
Server Version: 20170613
Overhead
GS Reacq
Occultation
Exp. 3, split 1
Exp. 3, split 2
Unused Orbital Visibility = 0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 15061, Visit 03 - NGC104 (03), implementation Tue Jul 25 21:05:23 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SCHED 30%; ORIENT 180D TO 180 D

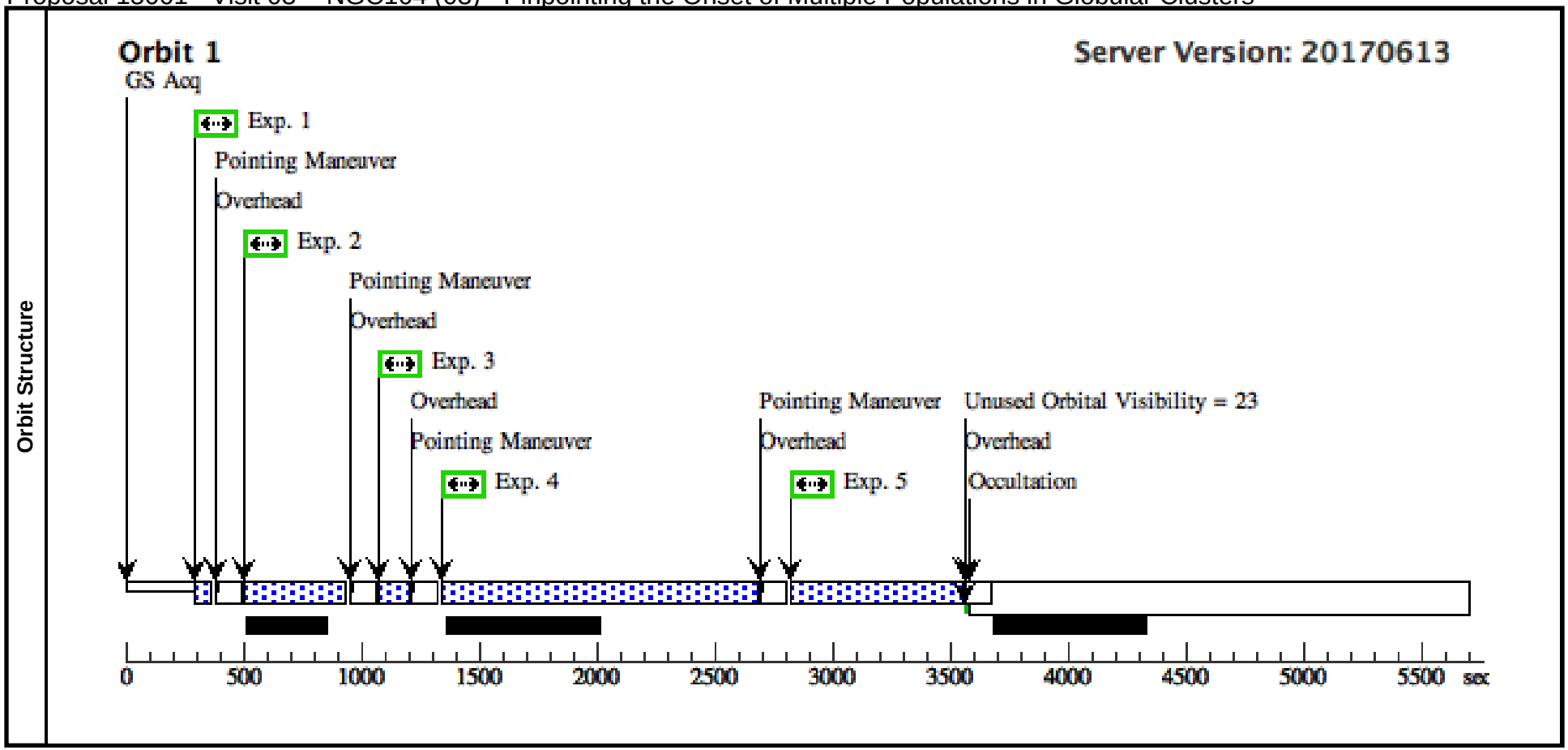
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	NGC104	RA: 00 24 15.2600 (6.0635833d) Dec: -72 05 47.93 (-72.09665d) Equinox: J2000		V=12	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	F438W	(2) NGC104	WFC3/UVIS, ACCUM, UVIS	F438W	FLASH=12	POS TARG 0,0; GS ACQ SCENARIO BASE1B3		65 Secs (40 Secs) *[==>40.0 Secs]*	 ***[1]***
2	F438W	(2) NGC104	WFC3/UVIS, ACCUM, UVIS	F438W	FLASH=8	POS TARG 0.18,2.44		460 Secs (435 Secs) *[==>435.0 Secs]*	 ***[1]***
3	F438W	(2) NGC104	WFC3/UVIS, ACCUM, UVIS	F438W	FLASH=12	POS TARG -0.18,-2.44		155 Secs (130 Secs) *[==>130.0 Secs]*	 ***[1]***
4	F343N	(2) NGC104	WFC3/UVIS, ACCUM, UVIS	F343N	FLASH=10	POS TARG 0,0		1325 Secs (1325 Secs) *[==>]*	 ***[1]***
5	F343N	(2) NGC104	WFC3/UVIS, ACCUM, UVIS	F343N	FLASH=10	POS TARG -0.18,2.44		730 Secs (730 Secs) *[==>]*	 ***[1]***


Orbit Structure
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Pointing Maneuver
Overhead
Exp. 2
Pointing Maneuver
Overhead
Exp. 3
Overhead
Pointing Maneuver
Exp. 4
Pointing Maneuver
Overhead
Exp. 5
Unused Orbital Visibility = 23
Overhead
Occultation
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