



15721 - WFC3 UVIS CTE Monitor (Star Cluster)

Cycle: 27, Proposal Category: CAL/WFC3

(Availability Mode: RESTRICTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>	<i>E-Mail</i>
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Dr. Marc Rafelski (CoI) (Contact)	Space Telescope Science Institute	mrafelski@stsci.edu

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	(2) NGC-6791	WFC3/UVIS	1	10-Jul-2019 09:00:23.0	yes
02	(1) NGC-104	WFC3/UVIS	3	10-Jul-2019 09:00:26.0	yes
03	(2) NGC-6791	WFC3/UVIS	1	10-Jul-2019 09:00:28.0	yes
04	(1) NGC-104	WFC3/UVIS	3	10-Jul-2019 09:00:31.0	yes

8 Total Orbits Used

ABSTRACT

The UVIS star cluster-based CTE Monitor program aims to monitor the degrading Charge Transfer Efficiency (CTE) with changing epoch, as well as varying target brightness and image background. The aperture photometry-based CTE model and the empirical pixel-based CTE correction are directly updated by the results of this proposal. The sparse cluster NGC 6791, and the dense field NGC 104 of 47 Tuc are the targets for this proposal (as they were for the former proposals). This allows for comparison with former CTE loss as well as changing CTE with field crowding. ACS has also observed NGC 104 with varying post flash levels, allowing for direct comparison between the two instruments CTEs, as well as changing post flash.

OBSERVING DESCRIPTION

We propose these 8 orbits to continue with a long standing series of external CTE monitoring proposals. From cycle 20 onwards, varying post-flash has been used to better estimate the impact of post-flash on CTE mitigation.

Using the F502N filter, these observations of NGC 6791 (sparse field) and NGC 104 (dense field) will monitor variation of CTE with field density. Dithering long exposures by 2000 pixels vertically will allow us to measure absolute CTE. The field is first observed in UVIS2, and then dithered in the y-direction by a 2048-pixel step corresponding to the chip-height, and then an identical exposure of the same field is taken in UVIS1. A source that is near an amplifier in one chip will be further from an amplifier in the other chip enabling an absolute measure of the CTE. Shorter exposures will provide a long-short flux ratio. With varying field density, post flash, and exposure length, we build and maintain a CTE model based on many parameters. Although, historically, the external CTE proposal was 3 epochs per cycle, the smooth and slow evolution of CTE degradation allows for fewer epochs.

The NGC 6791 orbit (per epoch) will consist of pairs of F502N exposures with a difference of 2000 pixels vertically dithered. Of the two long-exposure pairs, one will have an applied post-flash of 12 electrons/pixel, which is the current recommendation for CTE-mitigation (though it does increase noise moderately).

The NGC 104 orbits will have one long and one short pair of exposures with no post-flash (and effectively no background). One short exposure pair will have an applied post flash of 12 electrons/pixel, and the remaining eight long pairs of exposures will have varied post-flash from 6 to 130 electrons/pixel. This background was estimated by Baggett & Anderson 2012 (HST WFC3 ISR 2012-12). And

like NGC 6791, the difference in the pairs will be the dithered 2000 pixels.

This proposal consists of eight total orbits over 2 epochs (4/epoch) with 1 and 3 orbits on NGC 6791 and NGC 104 respectively per orbit.

This proposal is in a series of external CTE calibration from 17 to now 27, including CAL/WFC3 proposals 11924, 12379, 12692, 13083, 13566, 14012, 14378, 14541, 14990, and 15576.

----- Scheduling -----

The CTE long-term monitoring observations will be taken at two epochs in Cycle 27, starting six months after the latest Cycle 26 observations. The first epoch should be scheduled in January/February 2020, the second epoch in July/August 2020.

We ask that both pairs of NGC 6791 and 47 Tuc observations (Visits 01-02, Visits 03-04) are taken within seven days from each other, to sample the CTE at similar epochs.

We have set visit-level timing requirements for visit groups accordingly.

----- Calibration Justification -----

These data will be used to determine the rate of change of the CTE with time, and with position on the detector. Results will be compared to Cycles 17-26 CTE measurements for WFC3/UVIS CCDs, as well as to ACS/CCDs, and where possible to

CTE measurements of first and second generation HST instruments.

The analysis of the data will be used to continue calibrating a model of CTE-induced losses in both FLT and DRZ UVIS images, with a precision of better than 1% for stellar photometry and less than 5% for astrometric effects from CTE-induced source centroid shifts.

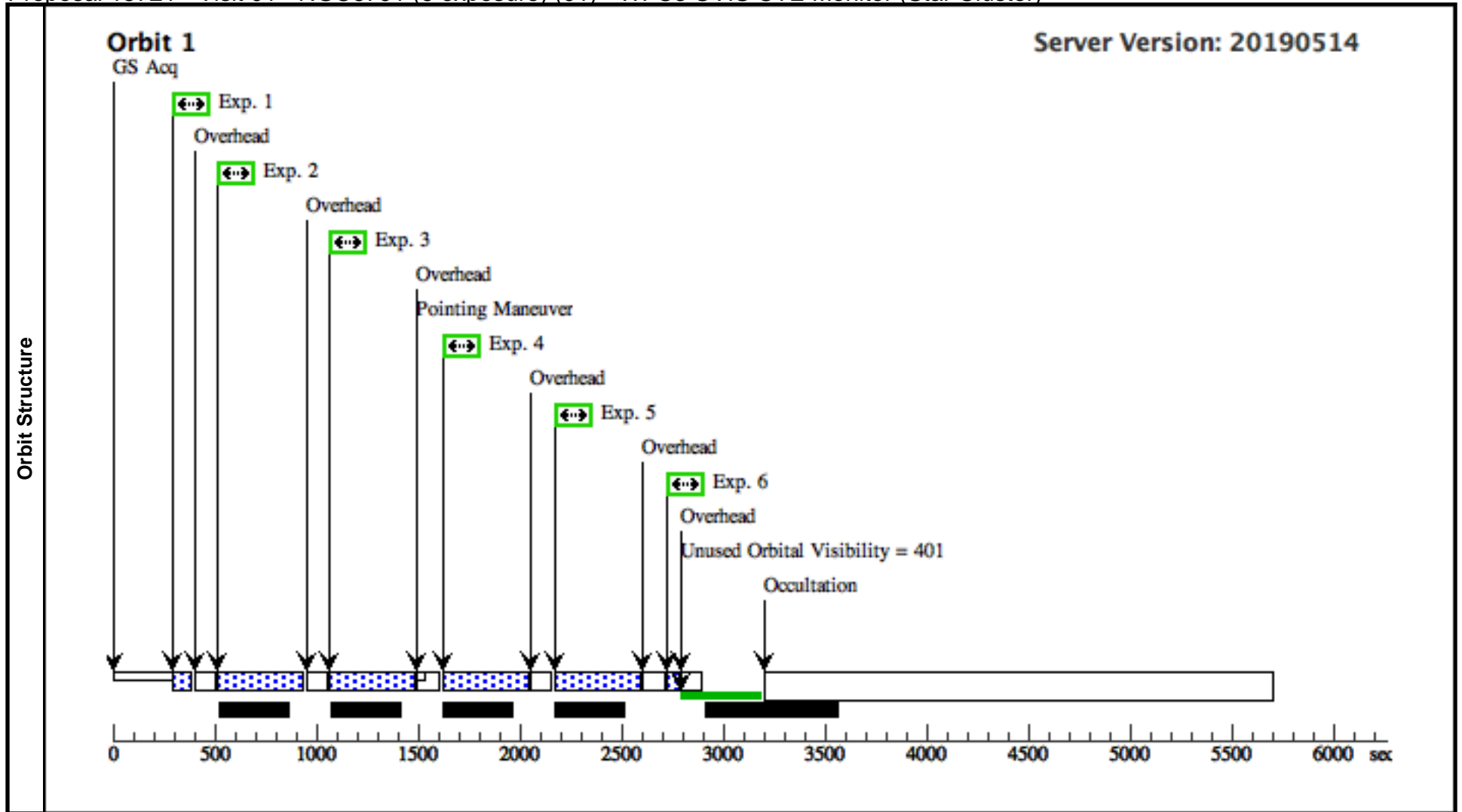
The background levels, set through post-flash in some exposures, will allow to monitor the performance of post-flash to mitigate CTE.

All exposures taken in this program will also be used to test the pixel-based UVIS CTE correction algorithm developed by J. Anderson.

Proposal 15721 - Visit 01 - NGC6791 (6 exposure) (01) - WFC3 UVIS CTE Monitor (Star Cluster)

Wed Jul 10 13:00:32 GMT 2019

Visit	Proposal 15721, Visit 01 - NGC6791 (6 exposure) (01) Diagnostic Status: Warning Scientific Instruments: WFC3/UVIS Special Requirements: BETWEEN 01-JAN-2020 AND 28-FEB-2020 <i>Comments: USE SAME GUIDE STAR THROUGHOUT VISIT. USE SAME ORIENTATION THROUGHOUT VISIT.</i>																																																																											
	(Visit 01 - NGC6791 (6 exposure) (01)) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE (Visit 01 - NGC6791 (6 exposure) (01)) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE (Visit 01 - NGC6791 (6 exposure) (01)) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE (Visit 01 - NGC6791 (6 exposure) (01)) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE NO ORIENT (Visit 01 - NGC6791 (6 exposure) (01)) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE NO ORIENT (Visit 01 - NGC6791 (6 exposure) (01)) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE NO ORIENT (Exposure 1 (Visit 01 - NGC6791 (6 exposure) (01))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (Exposure 2 (Visit 01 - NGC6791 (6 exposure) (01))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (Exposure 4 (Visit 01 - NGC6791 (6 exposure) (01))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser (Exposure 6 (Visit 01 - NGC6791 (6 exposure) (01))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser																																																																											
Diagnostics	<table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th>Targ. Coord. Corrections</th> <th>Fluxes</th> <th>Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(2)</td> <td>NGC-6791</td> <td>RA: 19 20 53.9500 (290.2247917d) Dec: +37 48 9.60 (37.80267d) Equinox: J2000</td> <td>Proper Motion RA: 3.432609092782651E-4 sec of time/yr Proper Motion Dec: 5.8E-4 arcsec/yr Epoch of Position: 2015.5</td> <td>V=9.5</td> <td>Reference Frame: ICRS</td> </tr> </tbody> </table>						#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous	(2)	NGC-6791	RA: 19 20 53.9500 (290.2247917d) Dec: +37 48 9.60 (37.80267d) Equinox: J2000	Proper Motion RA: 3.432609092782651E-4 sec of time/yr Proper Motion Dec: 5.8E-4 arcsec/yr Epoch of Position: 2015.5	V=9.5	Reference Frame: ICRS																																																										
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Exposures																																																																												



Proposal 15721 - Visit 02 - NGC 104 (22 exposure) (02) - WFC3 UVIS CTE Monitor (Star Cluster)

Visit	Proposal 15721, Visit 02 - NGC 104 (22 exposure) (02)	Wed Jul 10 13:00:32 GMT 2019
	Diagnostic Status: Warning	
	Scientific Instruments: WFC3/UVIS	
	Special Requirements: GROUP 02,01 WITHIN 7D	
	<i>Comments: USE SAME GUIDE STAR THROUGHOUT VISIT. USE SAME ORIENTATION THROUGHOUT VISIT.</i>	

Proposal 15721 - Visit 02 - NGC 104 (22 exposure) (02) - WFC3 UVIS CTE Monitor (Star Cluster)

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	NGC-104 Alt Name1: 47-TUC	RA: 00 22 38.2500 (5.6593750d) Dec: -72 03 54.00 (-72.06500d) Equinox: J2000	Proper Motion RA: 0.0015731412087106966 sec of time/yr Proper Motion Dec: -0.001250000013897079 arcsec/yr Epoch of Position: 2015.5	V=4.91	Reference Frame: ICRS
<i>Comments:</i> <i>Category=STELLAR CLUSTER</i> <i>Description=[GLOBULAR CLUSTER]</i>						

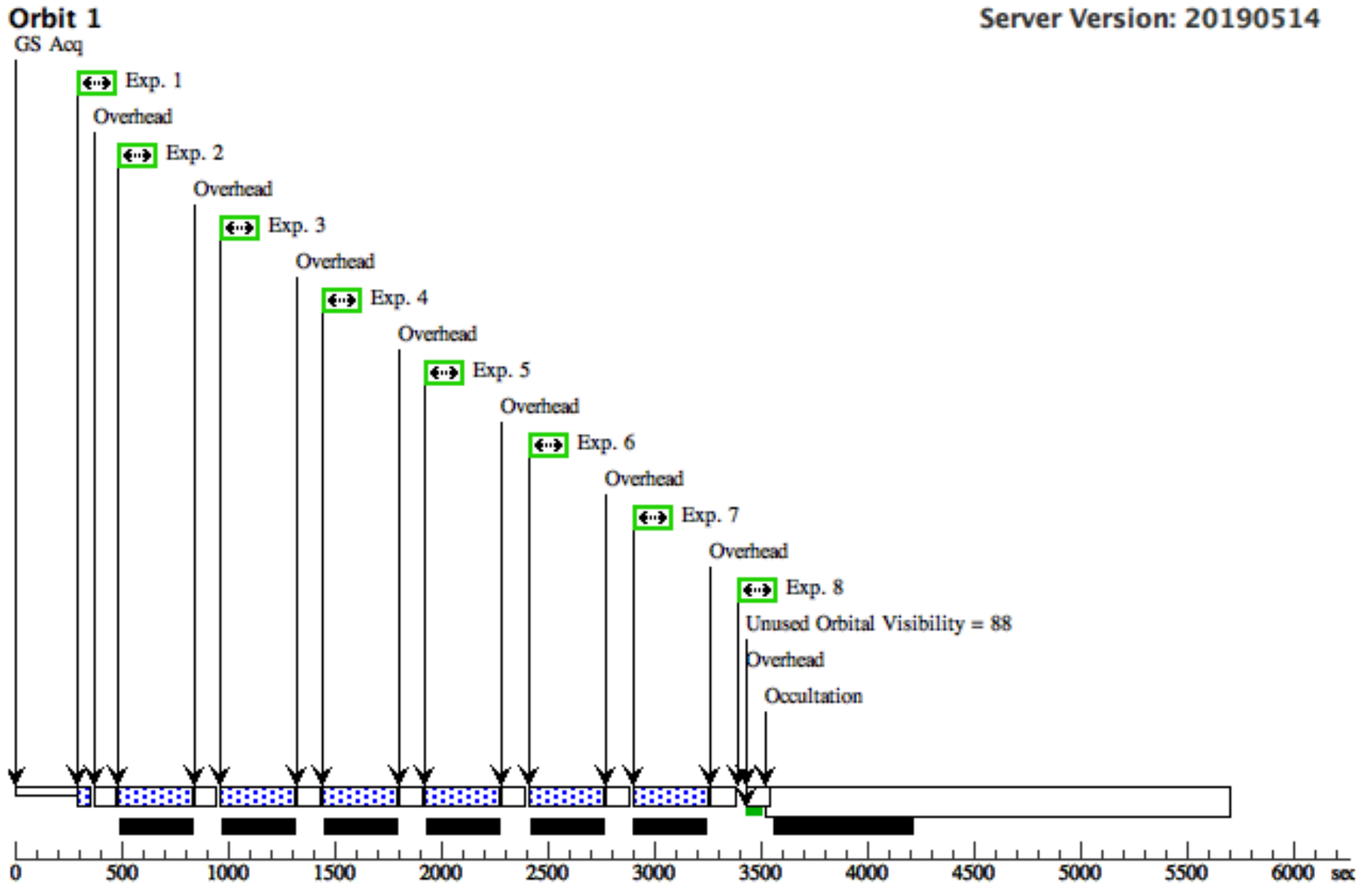
Proposal 15721 - Visit 02 - NGC 104 (22 exposure) (02) - WFC3 UVIS CTE Monitor (Star Cluster)

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
Exposures	1	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO			30 Secs (30 Secs) [==>]	[1]
	2	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO			348 Secs (348 Secs) [==>]	[1]
	3	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASH=6.			348 Secs (348 Secs) [==>]	[1]
	4	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASH=12.	POS TARG 0,0		348 Secs (348 Secs) [==>]	[1]
	5	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASH=18	POS TARG 0,0		348 Secs (348 Secs) [==>]	[1]
	6	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASH=24	POS TARG 0,0		348 Secs (348 Secs) [==>]	[1]
	7	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASHCUR=LOW; FLASHEXP=13.	POS TARG 0,0		348 Secs (348 Secs) [==>]	[1]
	8	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASH=12.	POS TARG 0,0		30 Secs (30 Secs) [==>]	[1]
	9	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASHCUR=LOW; FLASHEXP=21.5			348 Secs (348 Secs) [==>]	[2]
	10	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASHCUR=MEDI UM; FLASHEXP=1.24	POS TARG 0,0		348 Secs (348 Secs) [==>]	[2]
	11	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASHCUR=MEDI UM; FLASHEXP=1.59	POS TARG 0,0		348 Secs (348 Secs) [==>]	[2]
	12	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO	POS TARG 0,81.6		348 Secs (348 Secs) [==>]	[2]
	13	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASH=6.	POS TARG 0,81.6		348 Secs (348 Secs) [==>]	[2]
	14	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASH=12.	POS TARG 0,81.6		348 Secs (348 Secs) [==>]	[2]
	15	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASH=12.	POS TARG 0,81.6		30 Secs (30 Secs) [==>]	[2]
	16	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASH=18	POS TARG 0,81.6		348 Secs (348 Secs) [==>]	[3]
	17	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASH=24	POS TARG 0,81.6		348 Secs (348 Secs) [==>]	[3]
	18	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASHCUR=LOW; FLASHEXP=13.	POS TARG 0,81.6		348 Secs (348 Secs) [==>]	[3]

Proposal 15721 - Visit 02 - NGC 104 (22 exposure) (02) - WFC3 UVIS CTE Monitor (Star Cluster)

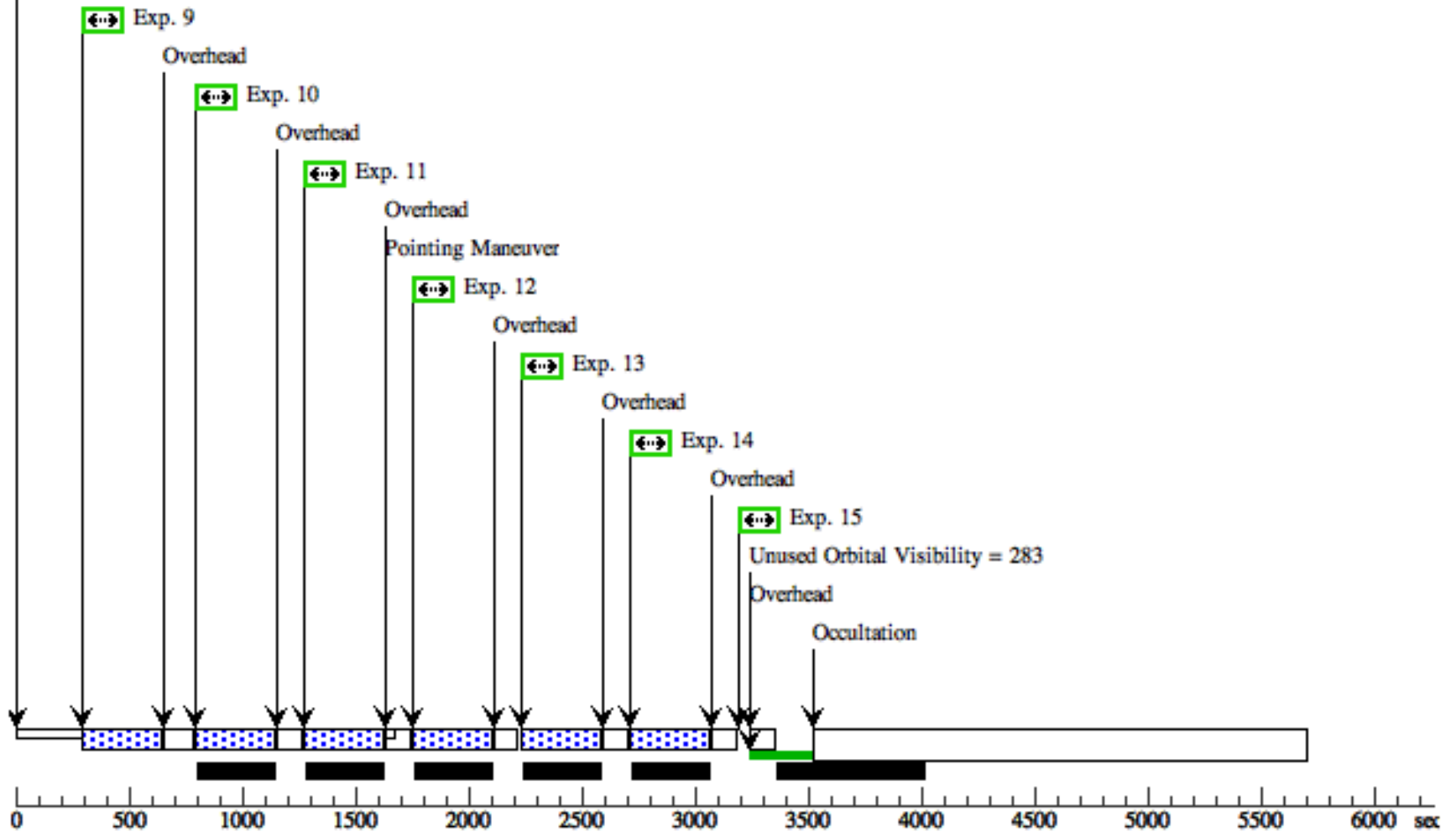
19	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; POS TARG 0,81.6 FLASHCUR=LOW; FLASHEXP=21.5	348 Secs (348 Secs)	
					[==>]	[3]
20	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; POS TARG 0,81.6 FLASHCUR=MEDI UM; FLASHEXP=1.24	348 Secs (348 Secs)	
					[==>]	[3]
21	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; POS TARG 0,81.6 FLASHCUR=MEDI UM; FLASHEXP=1.59	348 Secs (348 Secs)	
					[==>]	[3]
22	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO POS TARG 0,81.6	30 Secs (30 Secs)	
					[==>]	[3]

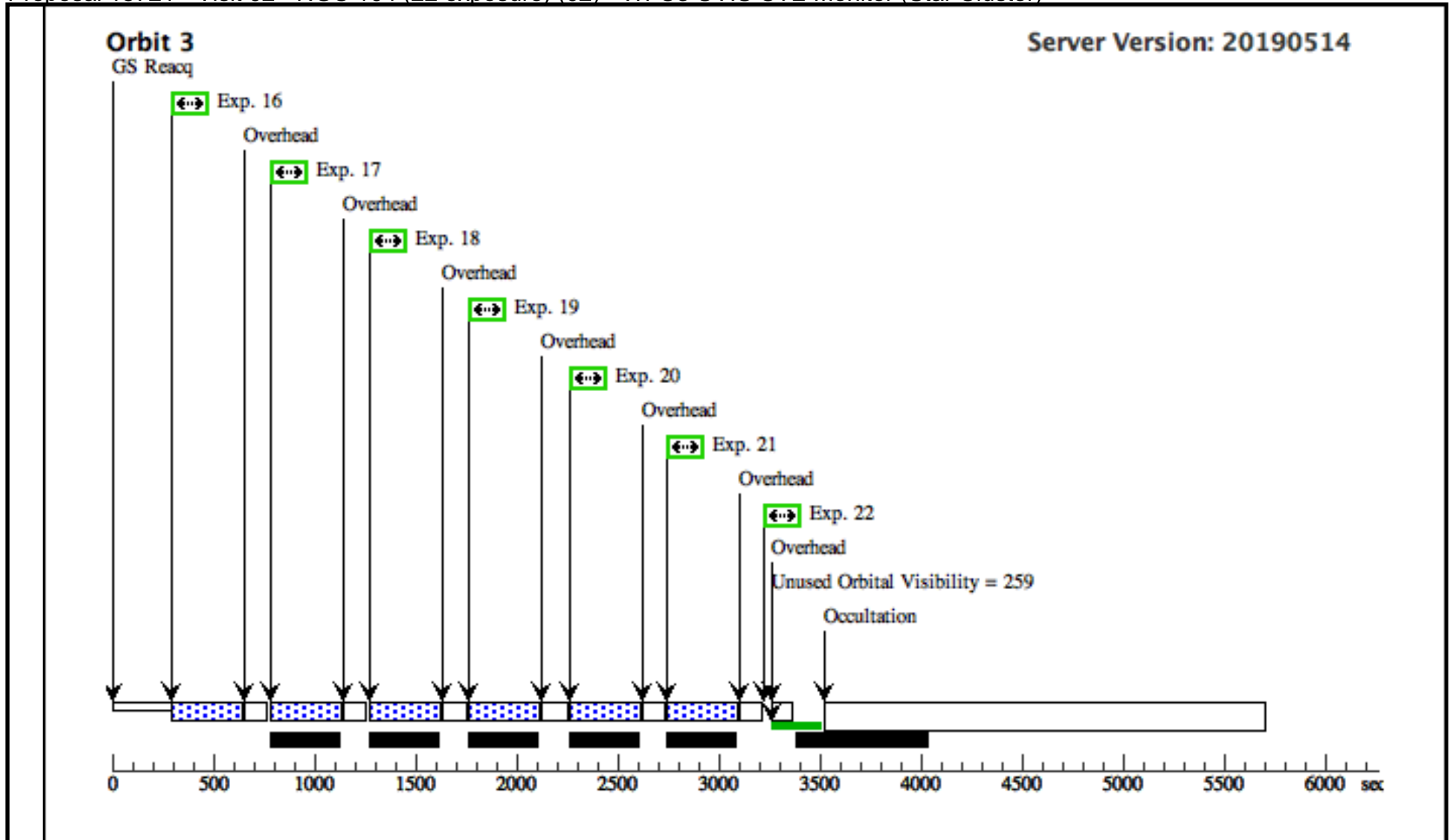
Orbit Structure

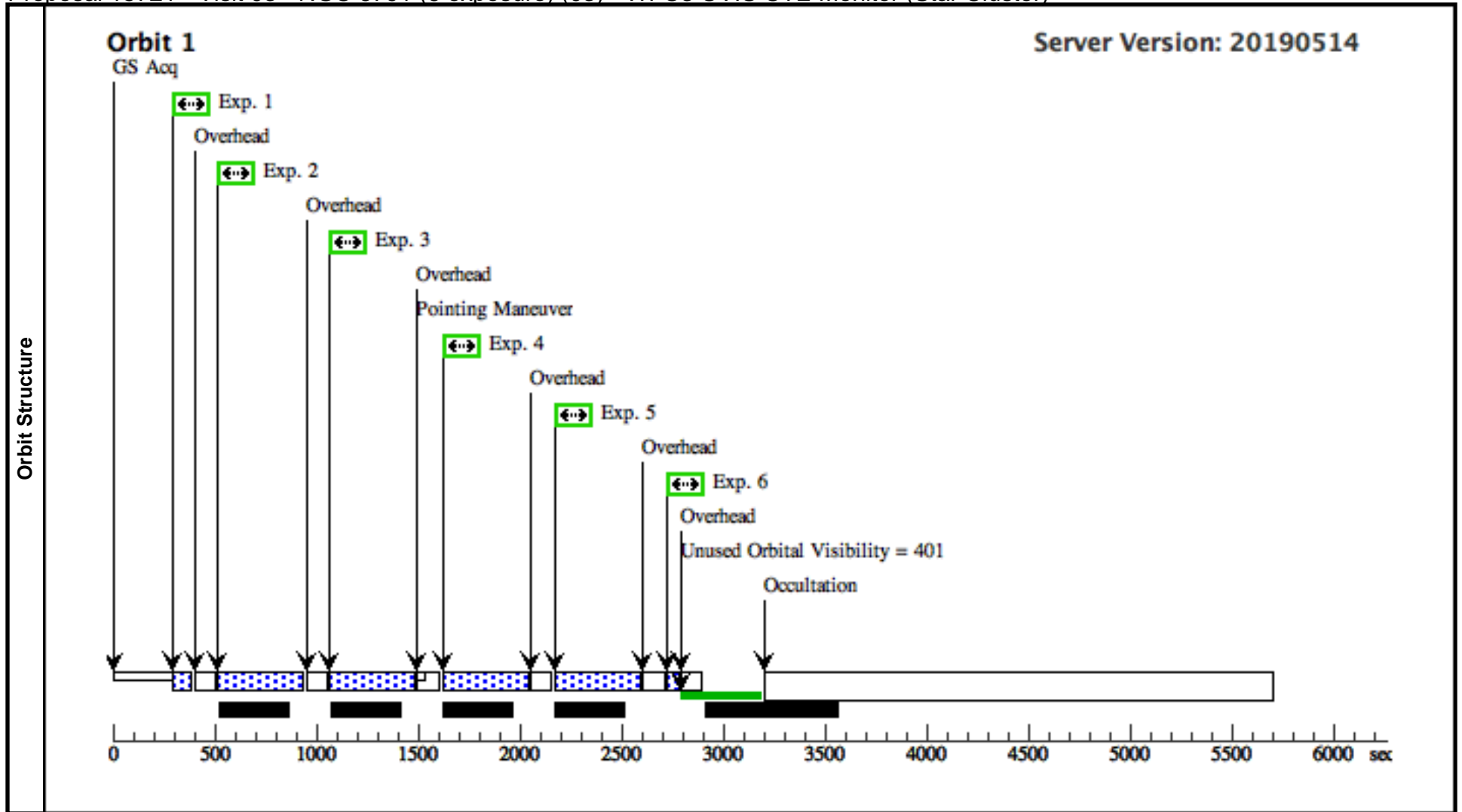


Orbit 2

GS Reacq







Proposal 15721 - Visit 04 - NGC 104 (12 exposure) (04) - WFC3 UVIS CTE Monitor (Star Cluster)

Visit	<p data-bbox="142 105 640 129">Proposal 15721, Visit 04 - NGC 104 (12 exposure) (04)</p> <p data-bbox="142 138 409 162">Diagnostic Status: Warning</p> <p data-bbox="142 170 462 194">Scientific Instruments: WFC3/UVIS</p> <p data-bbox="142 203 588 227">Special Requirements: GROUP 04,03 WITHIN 7D</p> <p data-bbox="142 235 682 276"><i>Comments: USE SAME GUIDE STAR THROUGHOUT VISIT. USE SAME ORIENTATION THROUGHOUT VISIT.</i></p>	<p>Wed Jul 10 13:00:33 GMT 2019</p>
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Proposal 15721 - Visit 04 - NGC 104 (12 exposure) (04) - WFC3 UVIS CTE Monitor (Star Cluster)

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	NGC-104 Alt Name1: 47-TUC	RA: 00 22 38.2500 (5.6593750d) Dec: -72 03 54.00 (-72.06500d) Equinox: J2000	Proper Motion RA: 0.0015731412087106966 sec of time/yr Proper Motion Dec: -0.001250000013897079 arcsec/yr Epoch of Position: 2015.5	V=4.91	Reference Frame: ICRS
<i>Comments:</i> <i>Category=STELLAR CLUSTER</i> <i>Description=[GLOBULAR CLUSTER]</i>						

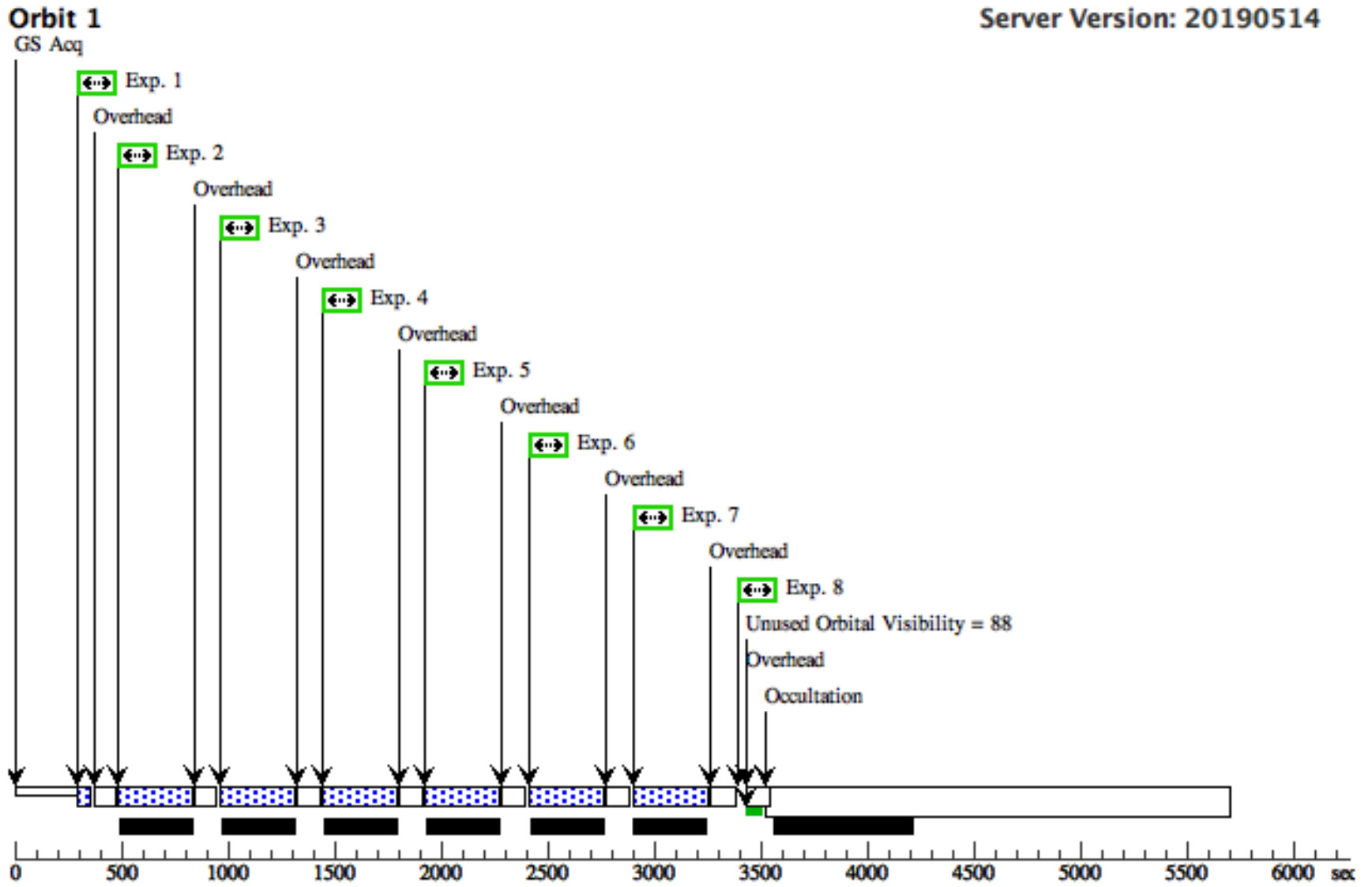
Proposal 15721 - Visit 04 - NGC 104 (12 exposure) (04) - WFC3 UVIS CTE Monitor (Star Cluster)

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
Exposures	1	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO			30 Secs (30 Secs)	
								[==>]	[1]
	2	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO			348 Secs (348 Secs)	
								[==>]	[1]
	3	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASH=6.			348 Secs (348 Secs)	
								[==>]	[1]
	4	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASH=12.	POS TARG 0,0		348 Secs (348 Secs)	
								[==>]	[1]
	5	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASH=18	POS TARG 0,0		348 Secs (348 Secs)	
								[==>]	[1]
	6	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASH=24	POS TARG 0,0		348 Secs (348 Secs)	
								[==>]	[1]
	7	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASHCUR=LOW; FLASHEXP=13.	POS TARG 0,0		348 Secs (348 Secs)	
								[==>]	[1]
	8	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASH=12.	POS TARG 0,0		30 Secs (30 Secs)	
								[==>]	[1]
	9	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASHCUR=LOW; FLASHEXP=21.5			348 Secs (348 Secs)	
								[==>]	[2]
10	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASHCUR=MEDI UM; FLASHEXP=1.24	POS TARG 0,0		348 Secs (348 Secs)		
							[==>]	[2]	
11	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASHCUR=MEDI UM; FLASHEXP=1.59	POS TARG 0,0		348 Secs (348 Secs)		
							[==>]	[2]	
12	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO	POS TARG 0,81.6		348 Secs (348 Secs)		
							[==>]	[2]	
13	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASH=6.	POS TARG 0,81.6		348 Secs (348 Secs)		
							[==>]	[2]	
14	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASH=12.	POS TARG 0,81.6		348 Secs (348 Secs)		
							[==>]	[2]	
15	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASH=12.	POS TARG 0,81.6		30 Secs (30 Secs)		
							[==>]	[2]	
16	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASH=18	POS TARG 0,81.6		348 Secs (348 Secs)		
							[==>]	[3]	
17	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASH=24	POS TARG 0,81.6		348 Secs (348 Secs)		
							[==>]	[3]	
18	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; FLASHCUR=LOW; FLASHEXP=13.	POS TARG 0,81.6		348 Secs (348 Secs)		
							[==>]	[3]	

Proposal 15721 - Visit 04 - NGC 104 (12 exposure) (04) - WFC3 UVIS CTE Monitor (Star Cluster)

19	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; POS TARG 0,81.6 FLASHCUR=LOW; FLASHEXP=21.5	348 Secs (348 Secs)	
					[==>]	[3]
20	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; POS TARG 0,81.6 FLASHCUR=MEDI UM; FLASHEXP=1.24	348 Secs (348 Secs)	
					[==>]	[3]
21	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO; POS TARG 0,81.6 FLASHCUR=MEDI UM; FLASHEXP=1.59	348 Secs (348 Secs)	
					[==>]	[3]
22	(1) NGC-104	WFC3/UVIS, ACCUM, UVIS	F502N	CR-SPLIT=NO POS TARG 0,81.6	30 Secs (30 Secs)	
					[==>]	[3]

Orbit Structure



Orbit 2

GS Reacq

