



# 14785 - Enhanced rates of tidal disruptions in E+A galaxies: resolving the central dynamics of post-starburst galactic nuclei with HST observations

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) MCG+08-17-011 (2) STAR-J09003127+4641285	WFC3/UVIS	2	23-Jan-2017 21:03:18.0	yes
02	(3) MCG+09-21-043 (4) STAR-J124637.64+504843.8	WFC3/UVIS	2	23-Jan-2017 21:03:21.0	yes
03	(5) MCG+05-32-048 (6) STAR-J133839.26+262025.8	WFC3/UVIS	2	23-Jan-2017 21:03:24.0	yes
04	(7) UGC-10935 (8) STAR-J173844.64+571511.0	WFC3/UVIS	2	23-Jan-2017 21:03:26.0	yes

8 Total Orbits Used

## **ABSTRACT**

Recent optically selected samples of tidal disruption flares (TDFs) have uncovered an interesting puzzle. In post-starburst galaxies, the observed rate of stellar disruptions is enhanced by 1-2 orders of magnitude. A natural explanation of the enhanced rate is an overdense central stellar cusp, created during the recent starburst. The short relaxation times in these cusps can significantly boost the number of stars that are scattered towards the central supermassive black hole. This scenario has a clear observational signature: a steep surface brightness profile on scale of 1-10 pc. Archival HST/WFC3 imaging of the low-redshift post-starburst galaxy NGC 3156 confirms this signature. Our dynamical analysis of the surface brightness profile suggests this galaxy could be a true TDE factory, with stellar disruptions occurring as often as once per millennium. Clearly, observations of more galaxies are needed to improve the significance of this result. Using a recently compiled catalog of post-starburst galaxies, we have found four galaxies that allow for an improved measurement of the TDE rate compared to work on NGC 3156. We propose multi-band HST/WFC3 imaging of these targets. These observations provide the only method to directly measure the TDE rate from the surface brightness profile of post-starburst galaxies and will therefore critically test the overdensity hypothesis.

## **OBSERVING DESCRIPTION**

The targets of this proposal are four galaxies. Their sizes are of 5" to 10". Our primary goal is measuring the slope of the surface brightness profile of the innermost pixels.

For each target, we will observe with four filters: F225W, F475W, F625W, and F814W (NUV, g, r, and I, respectively). We use two orbits per target.

We aim for high-resolution imaging in the F475W and F625W bands. For these bands we use a 4-point dither. To obtain an empirical model of the PSF, we plan to observe a nearby reference star at approximately the same pixel location as the center of the galaxy. The reference stars have been selected to have a similar color as the galaxy and are within a 1 arcmin of target, hence they can be observed without switching and re-acquiring guide stars. To account for breathing of the secondary mirror, we placed the observations of the reference star in the orbit following (or preceding) the science target and at a similar orbital phase as the mid-point of science target observations.

For the outer bands (F225W and F814W), we have less stringent requirements on the angular resolution. We therefore use a 2-point dither and no

extra observations of a reference star.

To reduce readout overheads, we plan to observe with the 1/4 subarray.

We use a 12e flash for the reference star observations. No flash is used for the science targets because they are extended and provide plenty of electrons. The exception is the NUV, where we plan to use a 11e flash.

For the reference star observations that are 30 seconds or shorter, we request the use of shutter A (BLADE=A).

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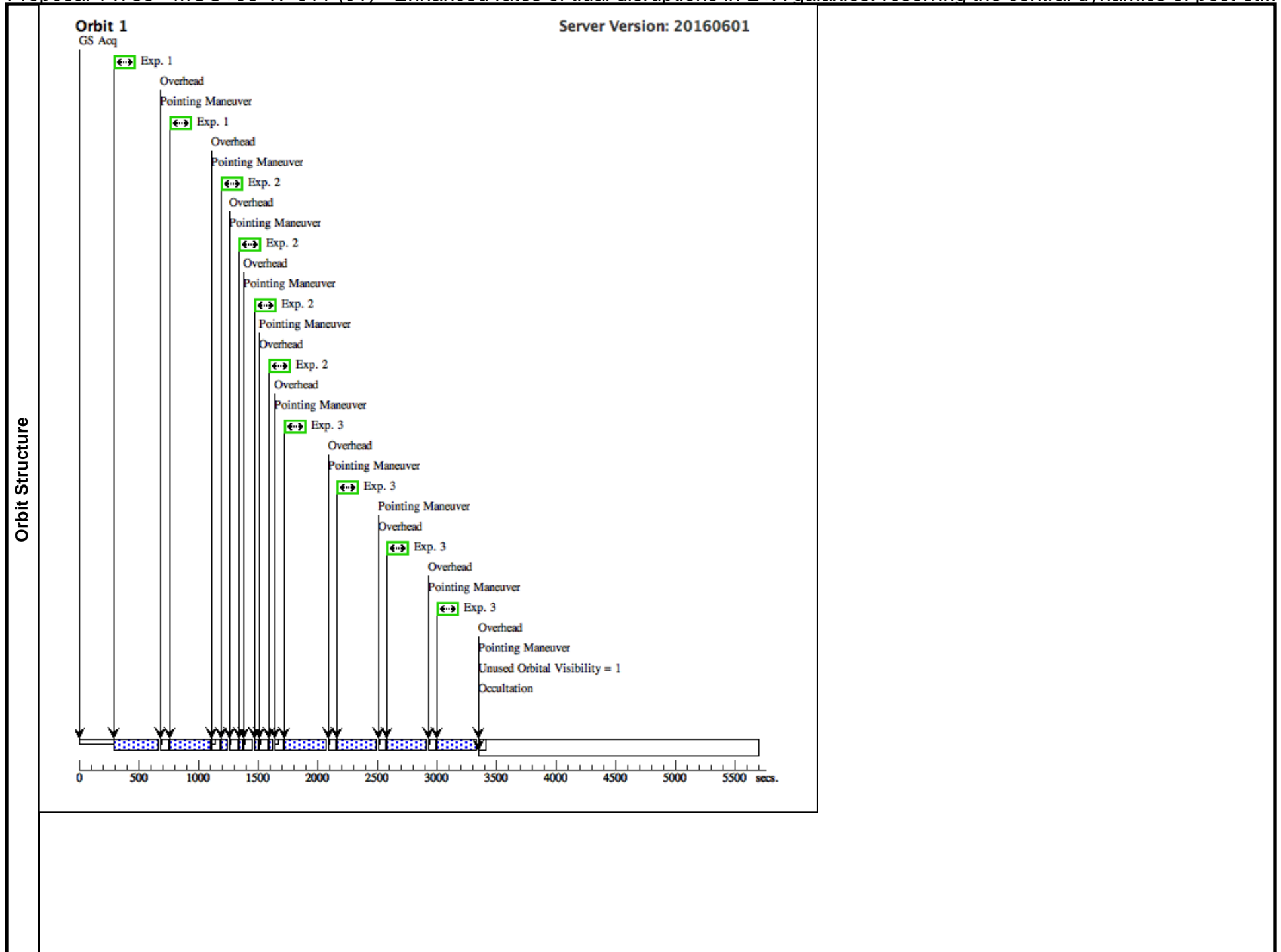
<b>Visit</b>	<b>Proposal 14785, MGC+08-17-011 (01), implementation</b>		
	<b>Diagnostic Status: No Diagnostics</b>		
	Scientific Instruments: WFC3/UVIS		
	Special Requirements: (none)		

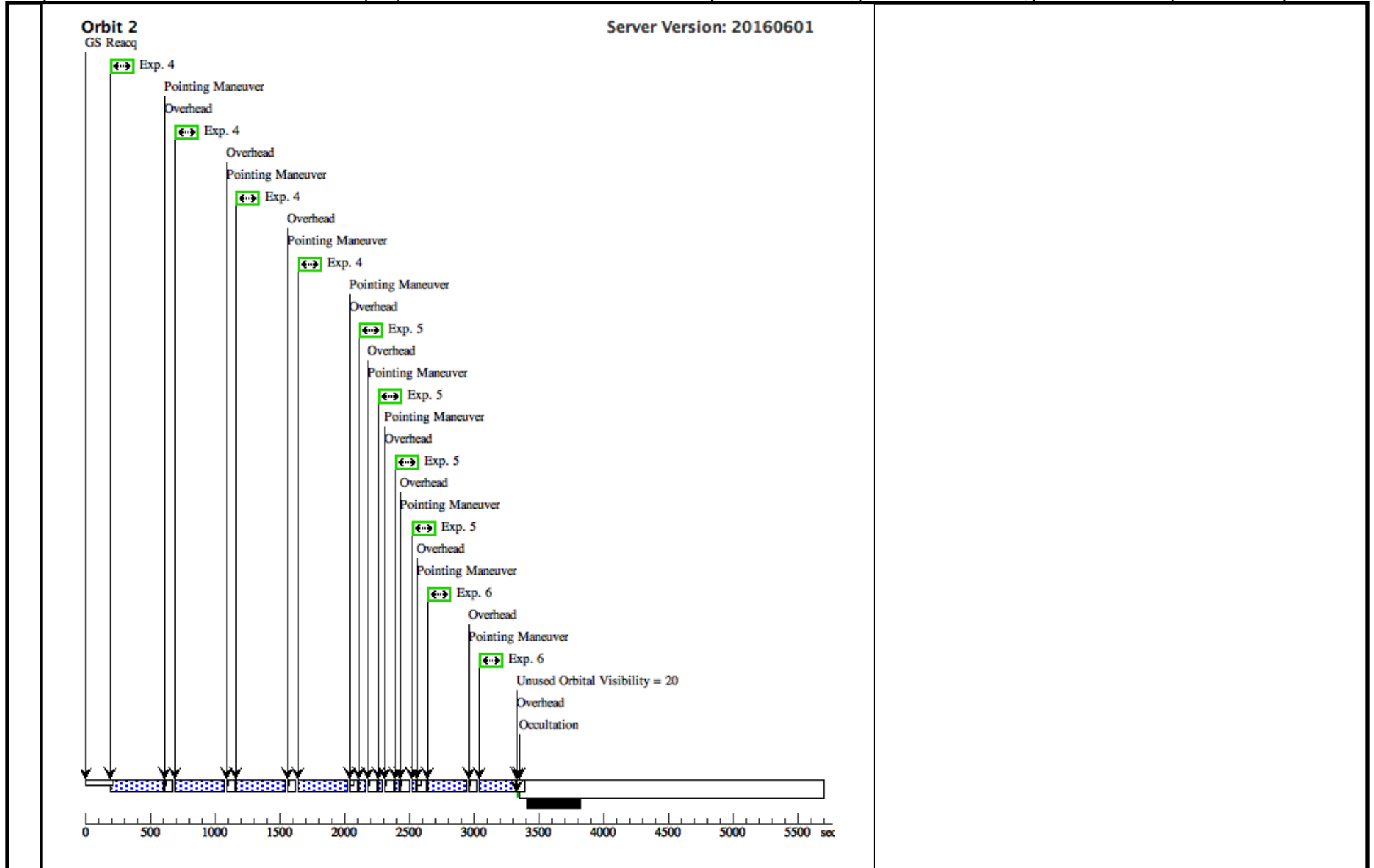
<b>Patterns</b>	#	Primary Pattern	Secondary Pattern	Exposures	
	(2)	Pattern Type=WFC3-UVIS-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=false		(2), (3), (4), (5)
	(3)	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), (6)

<b>Fixed Targets</b>	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	MCG+08-17-011	RA: 09 00 36.0800 (135.1503333d) Dec: +46 41 11.20 (46.68644d) Equinox: J2000	Redshift: 0.027	V=14.4+/-0.1	Reference Frame: SIMBAD
	<p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Coodindates updated to SDSS.</i>                      SDSS ID: 1237657609113894960</p> <p><i>Petro: NUV, g, r, i = 18.86, 14.67, 14.01, 13.72</i>  <i>PSF: g, r, i = 16.13, 15.68, 15.39</i>  <i>PSF: g-r = 0.45</i>                      Extended=YES</p>					
(2)	STAR-J09003127+4641285	RA: 09 00 31.2800 (135.1303333d) Dec: +46 41 28.55 (46.69126d) Equinox: J2000		V=16.1+/-0.1 g=16.44; r=16.09 (AB)	Reference Frame: SIMBAD	
<p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Coodindates updated to SDSS.</i>                      SDSS ID 1237657609113894951.</p> <p><i>Star for MCG+08-17-011: g-r = 0.35</i>                      Extended=NO</p>						

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#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
Exposures	1	NUV	(1) MCG+08-17-011	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F275W	FLASH=11	Sequence 1-3 Non-Int in MGC+08-17-011 (01) Pattern 3, Exps 1-1 in Sequence 1-3 Non-Int in MGC+08-17-011 (01) (3)	340 Secs (680 Secs) [==>(Pattern 1)] [==>(Pattern 2)]	[1]
	2	g-band refstar	(2) STAR-J09003127+4641285	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F475W	FLASH=12	Sequence 1-3 Non-Int in MGC+08-17-011 (01) Pattern 2, Exps 2-2 in Sequence 1-3 Non-Int in MGC+08-17-011 (01) (2)	30 Secs (120 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]
	3	r-band target	(1) MCG+08-17-011	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F625W	FLASH=4	Sequence 1-3 Non-Int in MGC+08-17-011 (01) Pattern 2, Exps 3-3 in Sequence 1-3 Non-Int in MGC+08-17-011 (01) (2)	330 Secs (1320 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]
	4	g-band target	(1) MCG+08-17-011	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F475W	FLASH=4	Sequence 4-6 Non-Int in MGC+08-17-011 (01) Pattern 2, Exps 4-4 in Sequence 4-6 Non-Int in MGC+08-17-011 (01) (2)	385 Secs (1540 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[2]
	5	r-band refstar	(2) STAR-J09003127+4641285	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F625W	FLASH=12	Sequence 4-6 Non-Int in MGC+08-17-011 (01) Pattern 2, Exps 5-5 in Sequence 4-6 Non-Int in MGC+08-17-011 (01) (2)	30 Secs (120 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[2]
	6	I-band target	(1) MCG+08-17-011	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=6	Sequence 4-6 Non-Int in MGC+08-17-011 (01) Pattern 3, Exps 6-6 in Sequence 4-6 Non-Int in MGC+08-17-011 (01) (3)	280 Secs (560 Secs) [==>(Pattern 1)] [==>(Pattern 2)]	[2]





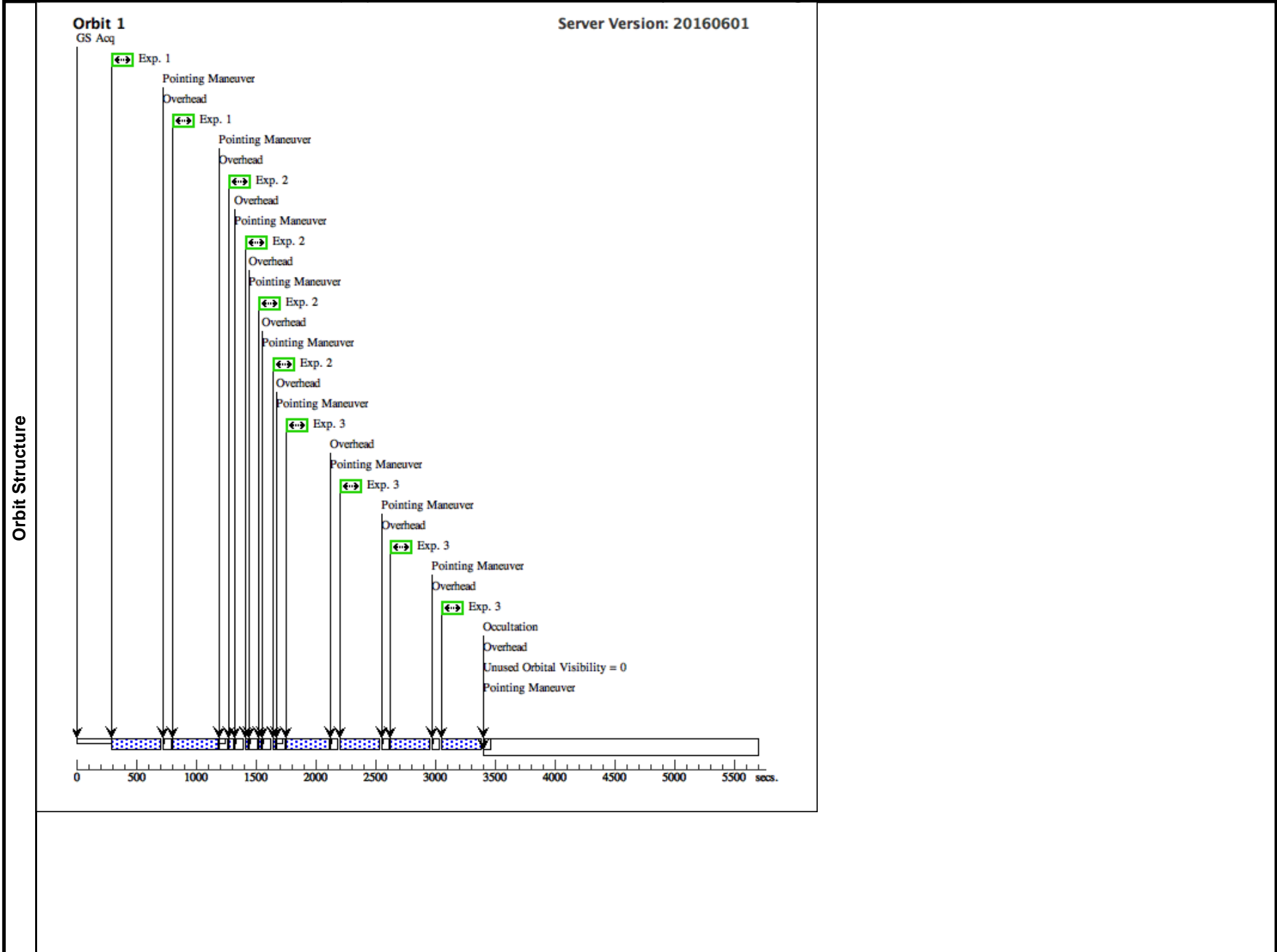
Proposal 14785 - MGC+09-21-043 (02) - Enhanced rates of tidal disruptions in E+A galaxies: resolving the central dynamics of post-st...

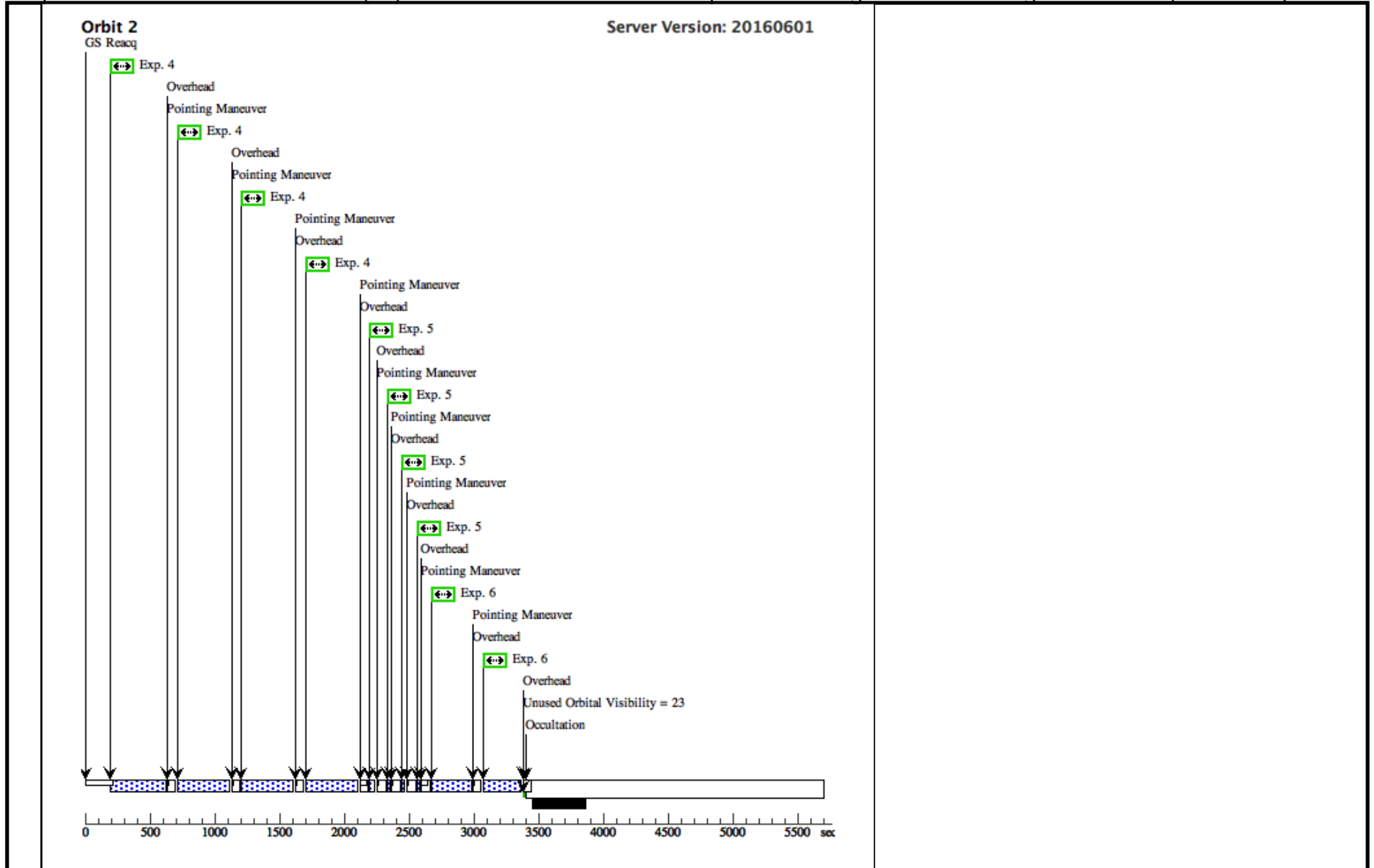
Tue Jan 24 02:03:28 GMT 2017

Visit	<b>Proposal 14785, MGC+09-21-043 (02), implementation</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: WFC3/UVIS Special Requirements: (none)					
	#	Primary Pattern	Secondary Pattern	Exposures		
Patterns	(2)	Pattern Type=WFC3-UVIS-DITHER-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		(2), (3), (4), (5)		
	(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), (6)		
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(3)	MCG+09-21-043	RA: 12 46 26.8400 (191.6118333d) Dec: +50 47 31.39 (50.79205d) Equinox: J2000	Redshift: 0.027	V=14.5+/-0.1	Reference Frame: SIMBAD
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Coordinates updated to SDSS.                      SDSS ID: 1237661152451035152</i> Petro: NUV, g, r, i = 19.5, 14.86, 14.17, 13.79 PSF: g, r, i = 16.57, 15.92, 15.58 PSF: g-r = 0.65 Extended=YES						
(4)	STAR-J124637.64+504843.8	RA: 12 46 37.6400 (191.6568333d) Dec: +50 48 43.82 (50.81217d) Equinox: J2000		V=15.1+/-0.1 g=15.51; r=15.14 (AB)	Reference Frame: ICRS	
<i>Comments: SDSS coordinates.                      g-r = 0.37                      Extended=NO</i>						

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#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
Exposures	1	NUV	(3) MCG+09-21-043	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F275W	FLASH=11	Sequence 1-3 Non-Int in MGC+09-21-043 (02) Pattern 3, Exps 1-1 in Sequence 1-3 Non-Int in MGC+09-21-043 (02) (3)	380 Secs (760 Secs) [==>(Pattern 1)] [==>(Pattern 2)]	[1]
	2	g-band refstar	(4) STAR-J124637.64+504843.8	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F475W	FLASH=12	Sequence 1-3 Non-Int in MGC+09-21-043 (02) Pattern 2, Exps 2-2 in Sequence 1-3 Non-Int in MGC+09-21-043 (02) (2)	17 Secs (68 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]
	3	r-band target	(3) MCG+09-21-043	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F625W	FLASH=4	Sequence 1-3 Non-Int in MGC+09-21-043 (02) Pattern 2, Exps 3-3 in Sequence 1-3 Non-Int in MGC+09-21-043 (02) (2)	336 Secs (1344 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]
	4	g-band target	(3) MCG+09-21-043	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F475W	FLASH=4	Sequence 4-6 Non-Int in MGC+09-21-043 (02) Pattern 2, Exps 4-4 in Sequence 4-6 Non-Int in MGC+09-21-043 (02) (2)	405 Secs (1620 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[2]
	5	r-band refstar	(4) STAR-J124637.64+504843.8	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F625W	FLASH=12	Sequence 4-6 Non-Int in MGC+09-21-043 (02) Pattern 2, Exps 5-5 in Sequence 4-6 Non-Int in MGC+09-21-043 (02) (2)	17 Secs (68 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[2]
	6	I-band target	(3) MCG+09-21-043	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=6	Sequence 4-6 Non-Int in MGC+09-21-043 (02) Pattern 3, Exps 6-6 in Sequence 4-6 Non-Int in MGC+09-21-043 (02) (3)	290 Secs (580 Secs) [==>(Pattern 1)] [==>(Pattern 2)]	[2]





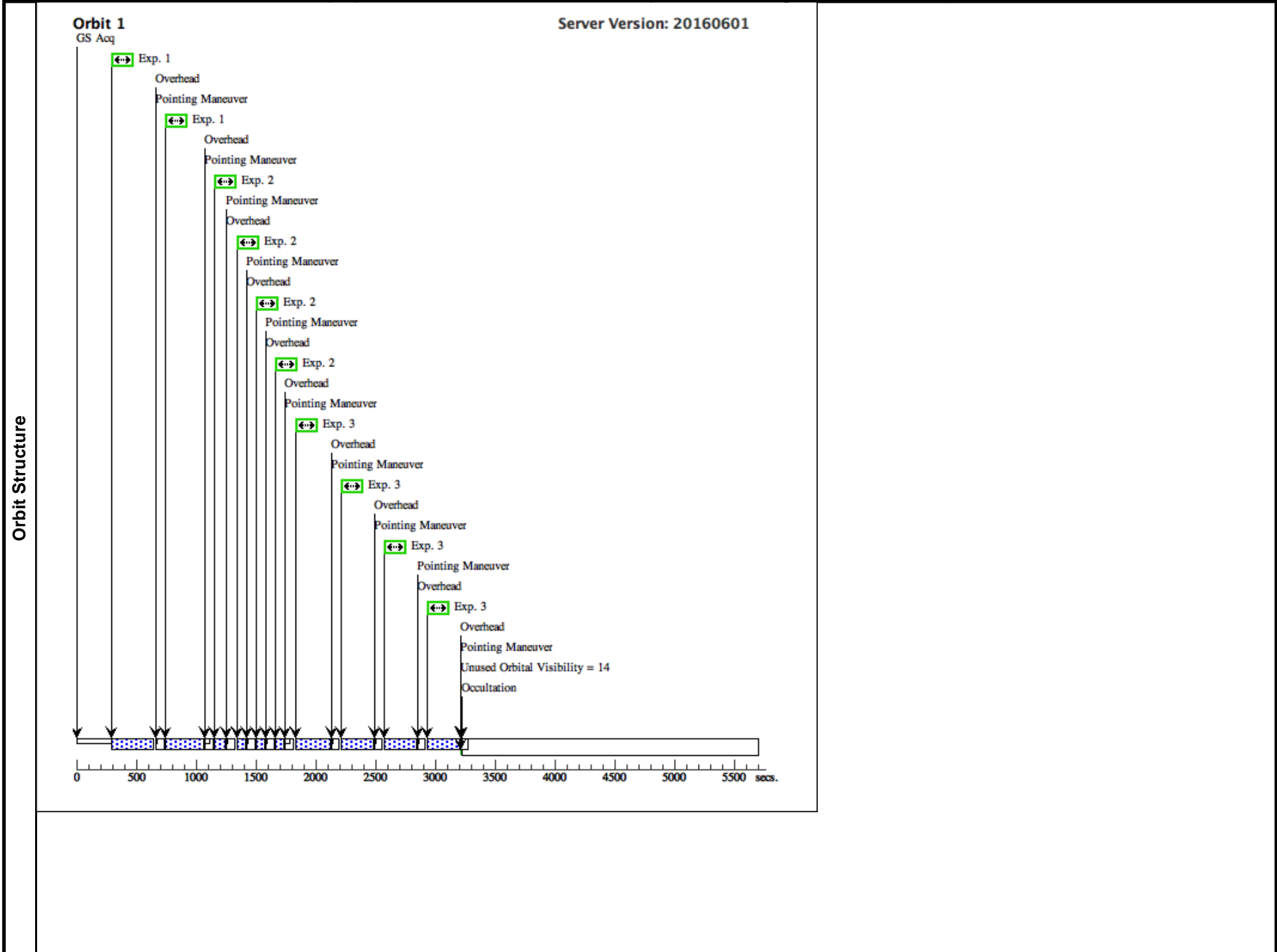
Proposal 14785 - MGC+05-32-48 (03) - Enhanced rates of tidal disruptions in E+A galaxies: resolving the central dynamics of post-sta...

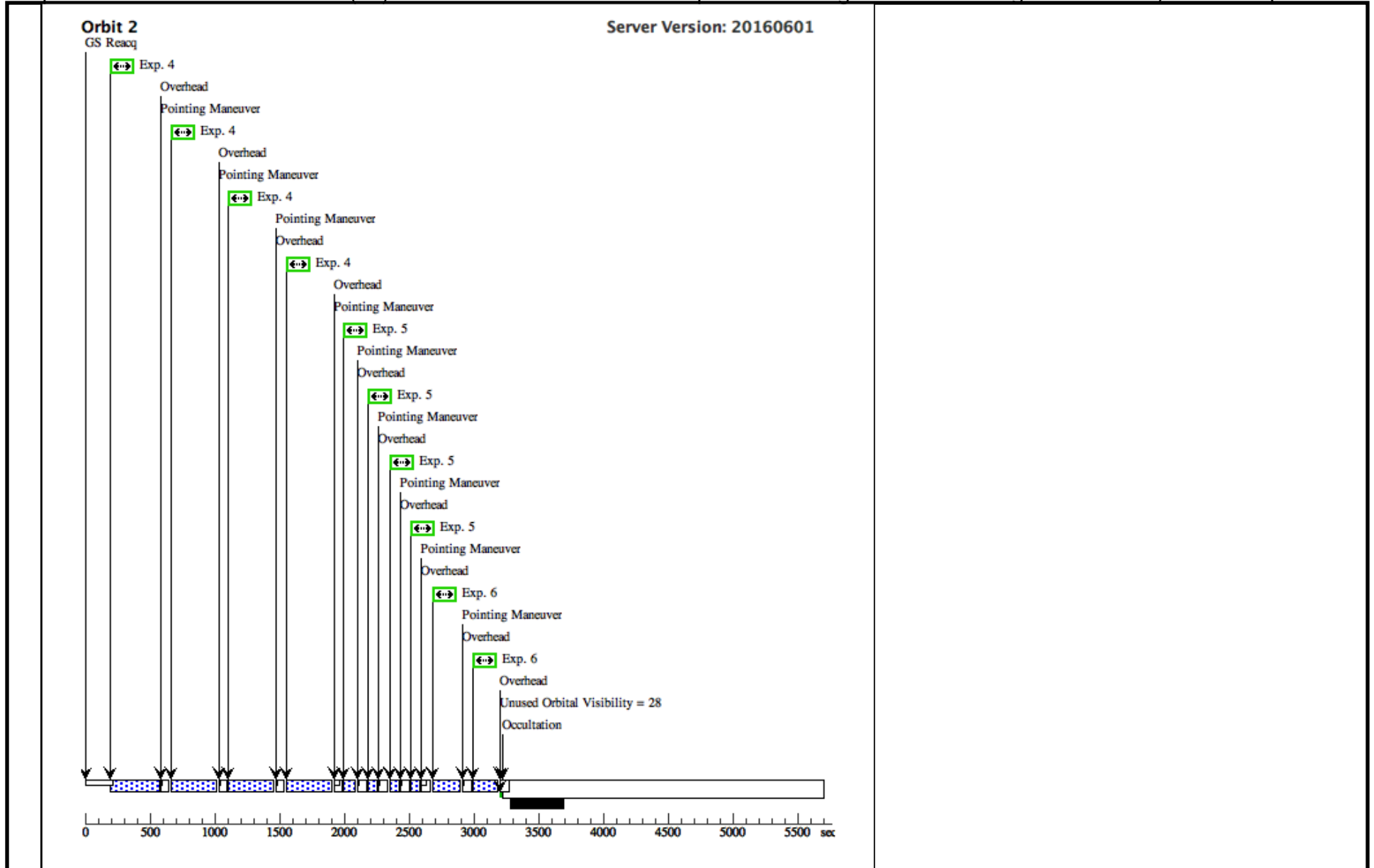
Tue Jan 24 02:03:28 GMT 2017

Visit	Proposal 14785, MGC+05-32-48 (03), implementation					
		Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: (none)				
Patterns	#	Primary Pattern	Secondary Pattern	Exposures		
	(2)	Pattern Type=WFC3-UVIS-DITHER-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		(2), (3), (4), (5)	
	(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), (6)	
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(5)	MCG+05-32-048	RA: 13 38 44.1100 (204.6837917d) Dec: +26 19 42.72 (26.32853d) Equinox: J2000	Redshift: 0.028	V=14.6+/-0.1	Reference Frame: SIMBAD
	<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Coodindates updated to SDSS.SDSS ID: 1237665532244984005</i> Petro: NUV, g, r, i = 18.9, 15.18, 14.39, 14.00 PSF: g, r, i = 18.17, 17.53, 17.12 PSF: g-r = 0.64 Extended=YES					
(6)	STAR-J133839.26+262025.8	RA: 13 38 39.2600 (204.6635833d) Dec: +26 20 25.80 (26.34050d) Equinox: J2000		V=17.0+/-0.1 g=17.43; r=16.97 (AB)	Reference Frame: ICRS	
<i>Comments: Coodinates from SDSS.</i> g-r = 0.43 Extended=NO						

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#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
Exposures	1	NUV	(5) MCG+05-32-048	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F275W	FLASH=11	Sequence 1-3 Non-Int in MGC+05-32-48 (03) Pattern 3, Exps 1-1 in Sequence 1-3 Non-Int in MGC+05-32-48 (03) (3)	320 Secs (640 Secs) [==>(Pattern 1)] [==>(Pattern 2)]	[1]
	2	g-band refstar	(6) STAR-J133839.2 6+262025.8	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F475W	FLASH=12	Sequence 1-3 Non-Int in MGC+05-32-48 (03) Pattern 2, Exps 2-2 in Sequence 1-3 Non-Int in MGC+05-32-48 (03) (2)	66 Secs (264 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]
	3	r-band target	(5) MCG+05-32-048	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F625W	FLASH=4	Sequence 1-3 Non-Int in MGC+05-32-48 (03) Pattern 2, Exps 3-3 in Sequence 1-3 Non-Int in MGC+05-32-48 (03) (2)	270 Secs (1080 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]
	4	g-band target	(5) MCG+05-32-048	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F475W	FLASH=4	Sequence 4-6 Non-Int in MGC+05-32-48 (03) Pattern 2, Exps 4-4 in Sequence 4-6 Non-Int in MGC+05-32-48 (03) (2)	355 Secs (1420 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[2]
	5	r-band refstar	(6) STAR-J133839.2 6+262025.8	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F625W	FLASH=12	Sequence 4-6 Non-Int in MGC+05-32-48 (03) Pattern 2, Exps 5-5 in Sequence 4-6 Non-Int in MGC+05-32-48 (03) (2)	68 Secs (272 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[2]
	6	I-band target	(5) MCG+05-32-048	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=8	Sequence 4-6 Non-Int in MGC+05-32-48 (03) Pattern 3, Exps 6-6 in Sequence 4-6 Non-Int in MGC+05-32-48 (03) (3)	195 Secs (390 Secs) [==>(Pattern 1)] [==>(Pattern 2)]	[2]





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<b>Visit</b>	<b>Proposal 14785, UGC-10935 (04), implementation</b>		
	<b>Diagnostic Status: No Diagnostics</b>		
	Scientific Instruments: WFC3/UVIS		
	Special Requirements: (none)		

<b>Patterns</b>	#	Primary Pattern	Secondary Pattern	Exposures	
	(2)	Pattern Type=WFC3-UVIS-DITHER-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		(2), (3), (4), (5)
	(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), (6)

<b>Fixed Targets</b>	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(7)	UGC-10935	RA: 17 38 43.2500 (264.6802083d) Dec: +57 14 21.15 (57.23921d) Equinox: J2000		V=14.9+/-0.1	Reference Frame: SIMBAD
	<p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Coodindates updated to SDSS.</i></p> <p><i>SDSS ID: 1237659897784566134</i>  <i>redshift: 0.030</i></p> <p><i>Petro: NUV, g, r, i = 19.68, 15.43, 14.47, 13.97</i>  <i>PSF: g, r, i = 18.22, 17.03, 16.59</i>  <i>PSF: g-r = 1.19</i>  <i>Extended=YES</i></p>					
(8)	STAR-J173844.64+571511.0	RA: 17 38 44.6400 (264.6860000d) Dec: +57 15 11.04 (57.25307d) Equinox: J2000		V=19.1 g=19.06; r=18.15 (AB)	Reference Frame: ICRS	
<p><i>Comments: Coordinates from SDSS.</i></p> <p><i>g-r = 0.91</i>  <i>Extended=NO</i></p>						

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Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	NUV	(7) UGC-10935	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F275W	FLASH=11		Sequence 1-3 Non-Int in UGC-10935 (04) Pattern 3, Exps 1-1 in Sequence 1-3 Non-Int in UGC-10935 (04) (3)	340 Secs (680 Secs) [==>(Pattern 1)] [==>(Pattern 2)]	[1]
	2	g-band refstar	(8) STAR-J173844.64+571511.0	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F475W	FLASH=12		Sequence 1-3 Non-Int in UGC-10935 (04) Pattern 2, Exps 2-2 in Sequence 1-3 Non-Int in UGC-10935 (04) (2)	92 Secs (368 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]
	3	r-band target	(7) UGC-10935	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F625W	FLASH=4		Sequence 1-3 Non-Int in UGC-10935 (04) Pattern 2, Exps 3-3 in Sequence 1-3 Non-Int in UGC-10935 (04) (2)	294 Secs (1176 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]
	4	g-band target	(7) UGC-10935	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F475W	FLASH=4		Sequence 4-6 Non-Int in UGC-10935 (04) Pattern 2, Exps 4-4 in Sequence 4-6 Non-Int in UGC-10935 (04) (2)	385 Secs (1540 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[2]
	5	r-band refstar	(8) STAR-J173844.64+571511.0	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F625W	FLASH=12		Sequence 4-6 Non-Int in UGC-10935 (04) Pattern 2, Exps 5-5 in Sequence 4-6 Non-Int in UGC-10935 (04) (2)	70 Secs (280 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[2]
	6	I-band target	(7) UGC-10935	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=6		Sequence 4-6 Non-Int in UGC-10935 (04) Pattern 3, Exps 6-6 in Sequence 4-6 Non-Int in UGC-10935 (04) (3)	245 Secs (490 Secs) [==>(Pattern 1)] [==>(Pattern 2)]	[2]

