13370 - The Formation History of UGC 12591 - the Most Massive Known Field S0 Galaxy

Cycle: 21, 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) UGC-1259-UVIS (2) UGC-1259-IR	ACS/WFC WFC3/IR WFC3/UVIS	4	17-Jun-2013 22:04:12.0	yes

4 Total Orbits Used

ABSTRACT

We propose to determine the formation history of UGC12591 - the most massive known field S0 galaxy in the nearby Universe (D ~ 98Mpc). Its maximum rotational velocity of 483 km/s yields a dynamical mass within 50 kpc of 2x10^12 solar masses. Given its field location, this poses the question of how such a massive bulge can grow in isolation? To trace the UGC12591 star formation and assembly history we will use the properties of its globular clusters (GCs) and massive compact stellar systems which are expected in huge numbers given its mass. In particular, GCs are well known to be among the best indicators of major (merger) galaxy formation episodes, capturing the physical conditions at the time of their formation.

With the wide spectral coverage of the proposed obesrvations, we will 1) search for multiple/intermediate-age GC populations and 2) measure whether the specific frequency of the metal-rich GCs relative to the bulge luminosity is enhanced. If any of these points are confirmed, this would strongly favor a merger-driven (gas-rich) as opposed to "passive" bulge growth (secular evolution). The only possible way to derive robust photometric GC ages and metallicities at the distance of UGC12591 in a reasonable amount of time is by employing the efficiency of HST/WFC3 and the age-metallicity sensitive V, I, H filter combination (F606W, F814W, F160W). In four orbits we will observe the brighter half of the GC population of UGC12591, which will enable us to derive GC population peak age and metallicity (+/- 20%).
The results from this proposal will offer an important leap forward in our understanding of the assembly history of extremely massive isolated S0 galaxies.

OBSERVING DESCRIPTION

Observations will be performed with the UVIS & IR F606W, F814W, F160W filter set (i.e. V, I, H) to allow a robust GC age and metallicity derivation. Exposure times are estimated based on the STScI ETC and a custom made script to account for the local background surface brightness. To reach V<27.5mag with S/N>5, a BC03 G2V spectrum, E(B-V)=0.114mag, an "elliptical galaxy" background surface brightness of mu_V = 21 mag/arcsec^2 (typical for a few arcsec from the galaxy center), and zodiacal light calculated from the UGC 12591 position, we obtain the following exposure times: 2500, 3000 and 5700 seconds in WFC3/UVIS F606W, F814W , and IR F160W, respectively. Three-point dither-line pattern for the F606W and F814W and four-point for F160W will allow a good sampling of the PSF, and facilitate cosmic-ray and detectors artifacts removal. With the APT Phase II orbit planner optimization, and accounting for overheads, we were able to accommodate the following exposure time splits:
3x873 = 2619 and 3x913 = 2739 seconds for F606W and F814W, and
4x1400 seconds (NSAMP = 14, STEP200) in F160W. We note that beyond the central mu_V = 21 mag/arcsec^2 the S/N will be higher, i.e. at radius where the majority of the GCs are located in a galaxy.

UGC 12591 is perfectly covered by one WFC3 pointing to about 2x of its D25 = 1.23' (RC3). The position and min and maxorient (230-265 degrees) were chosen such that the galaxy is entirely covered by one of the WFC3/UVIS detectors as well as the nearby satellite galaxy in the other. For proper analysis of the UGC 12591 evolution history, it is important to keep the observations within the specified position and orientation.

To estimate background contamination from unresolved distant galaxies and foreground Galactic stars, we will use in coordinated parallel the ACS/WFC camera in F606W and F814W filters. The high spatial resolution of both WFC3 (0.04"/pix) and ACS (0.05"/pix) will already allow to significantly reduce the number of background contamination, unachievable with ground-based observations. Their exposure time splits have been

adjusted such that the total integration time for each filter reaches S/N~10 at V=27.5mag.

Visit

Proposal 13370, UVIS & ACS (01) Tue Jun 18 02:04:27 GMT 2013

Diagnostic Status: Warning

Scientific Instruments: WFC3/IR, WFC3/UVIS, ACS/WFC

Special Requirements: ORIENT 230D TO 265 D

Diagnostics

(UVIS & ACS (01)) Warning (Orbit Planner): PARALLELS SIGNIFICANTLY EXTEND ALIGNMENT TIME

(UVIS & ACS (01)) Warning (Orbit Planner): PARALLELS SIGNIFICANTLY EXTEND ALIGNMENT TIME

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=0.145 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1-2), (3-4)
(2)	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=4 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(5-7)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	UGC-1259-UVIS	RA: 23 25 27.0342 (351.3626425d) Dec: +28 29 25.56 (28.49043d) Equinox: J2000		V=13.4	Reference Frame: ICRS
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.					
(2)	UGC-1259-IR	RA: 23 25 23.4749 (351.3478121d) Dec: +28 29 52.11 (28.49781d) Equinox: J2000		V=13.0	Reference Frame: ICRS
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.					

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	WFC3 F606W (344028)	(1) UGC-1259-UVIS	WFC3/UVIS, ACCUM, UVIS1	F606W	CR-SPLIT=NO; BIN=NONE	POS TARG -0.6944182534020316,-11.059692956474212	Pattern 1, Exps 1-2 in UVIS & ACS (01) (1) Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 in UVIS & ACS (01)	1600 Secs (2619 Secs) *[==>873.0 Secs (Pattern 1)]* *[==>873.0 Secs (Pattern 2)]* *[==>873.0 Secs (Pattern 3)]*	***[1]***
2	ACS 606	(1) UGC-1259-UVIS	ACS/WFC, ACCUM, WFC	F606W	CR-SPLIT=NO; GAIN=2.0		Pattern 1, Exps 1-2 in UVIS & ACS (01) (1) Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 in UVIS & ACS (01)	1100 Secs (2384 Secs) *[==>793.0 Secs (Pattern 1)]* *[==>843.0 Secs (Pattern 2)]* *[==>748.0 Secs (Pattern 3)]*	***[1]***
3	WFC3 F814W (343965)	(1) UGC-1259-UVIS	WFC3/UVIS, ACCUM, UVIS1	F814W	CR-SPLIT=NO; BIN=NONE		Pattern 1, Exps 3-4 in UVIS & ACS (01) (1) Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in UVIS & ACS (01)	3100 Secs (2739 Secs) *[==>913.0 Secs (Pattern 1)]* *[==>913.0 Secs (Pattern 2)]* *[==>913.0 Secs (Pattern 3)]*	***[2]***
4	ACS 814	(1) UGC-1259-UVIS	ACS/WFC, ACCUM, WFC	F814W	CR-SPLIT=NO; GAIN=2.0		Pattern 1, Exps 3-4 in UVIS & ACS (01) (1) Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in UVIS & ACS (01)	2100 Secs (2482 Secs) *[==>852.0 Secs (Pattern 1)]* *[==>852.0 Secs (Pattern 2)]* *[==>778.0 Secs (Pattern 3)]*	***[2]***
5	F160W	(2) UGC-1259-IR	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=STEP200		Pattern 2, Exps 5-7 in UVIS & ACS (01) (2) Prime + Parallel Group 5-7 in Pattern 2, Exps 5-7 in UVIS & ACS (01)	1399.231402 Secs (5596.926 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[3]*** ***[4]***
6		(2) UGC-1259-IR	ACS/WFC, ACCUM, WFC	F606W	CR-SPLIT=NO; GAIN=2.0		Pattern 2, Exps 5-7 in UVIS & ACS (01) (2) Prime + Parallel Group 5-7 in Pattern 2, Exps 5-7 in UVIS & ACS (01)	400 Secs (1735 Secs) *[==>336.0 Secs (Pattern 1)]* *[==>500.0 Secs (Pattern 2)]* *[==>399.0 Secs (Pattern 3)]* *[==>500.0 Secs (Pattern 4)]*	***[3]*** ***[4]***
7		(2) UGC-1259-IR	ACS/WFC, ACCUM, WFC	F814W	CR-SPLIT=NO; GAIN=2.0		Pattern 2, Exps 5-7 in UVIS & ACS (01) (2) Prime + Parallel Group 5-7 in Pattern 2, Exps 5-7 in UVIS & ACS (01)	670 Secs (2680 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[3]*** ***[4]***

Orbit Structure

Orbit 1

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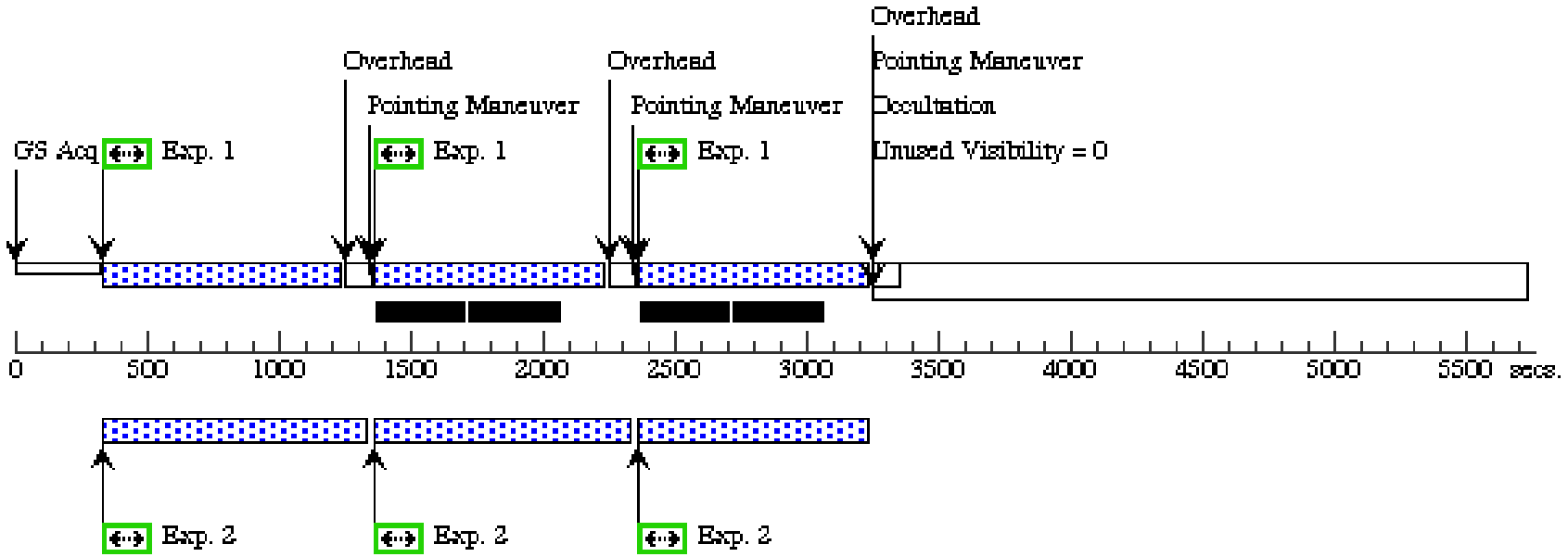

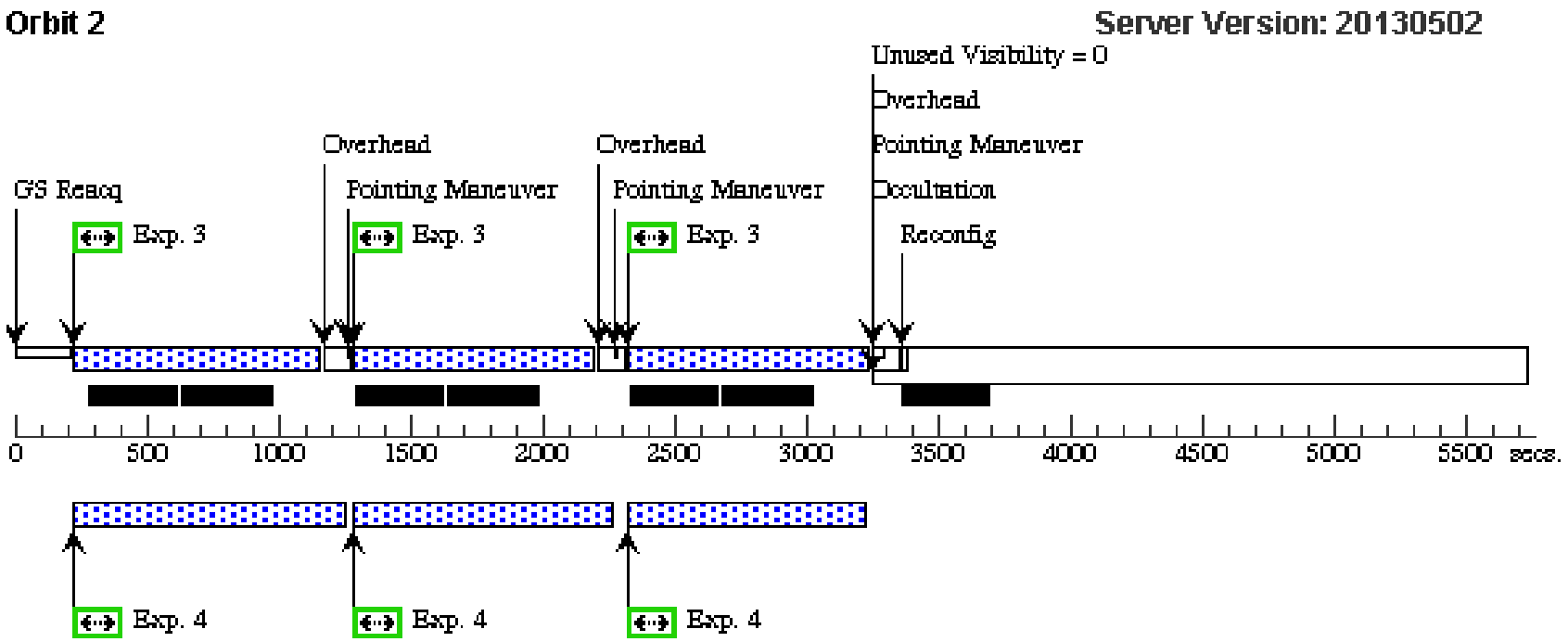
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Overhead
Pointing Maneuver
Occultation
Reconfig
Overhead
Pointing Maneuver
Overhead
Pointing Maneuver
GS Reacq
Exp. 3
Exp. 3
Exp. 3
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1000
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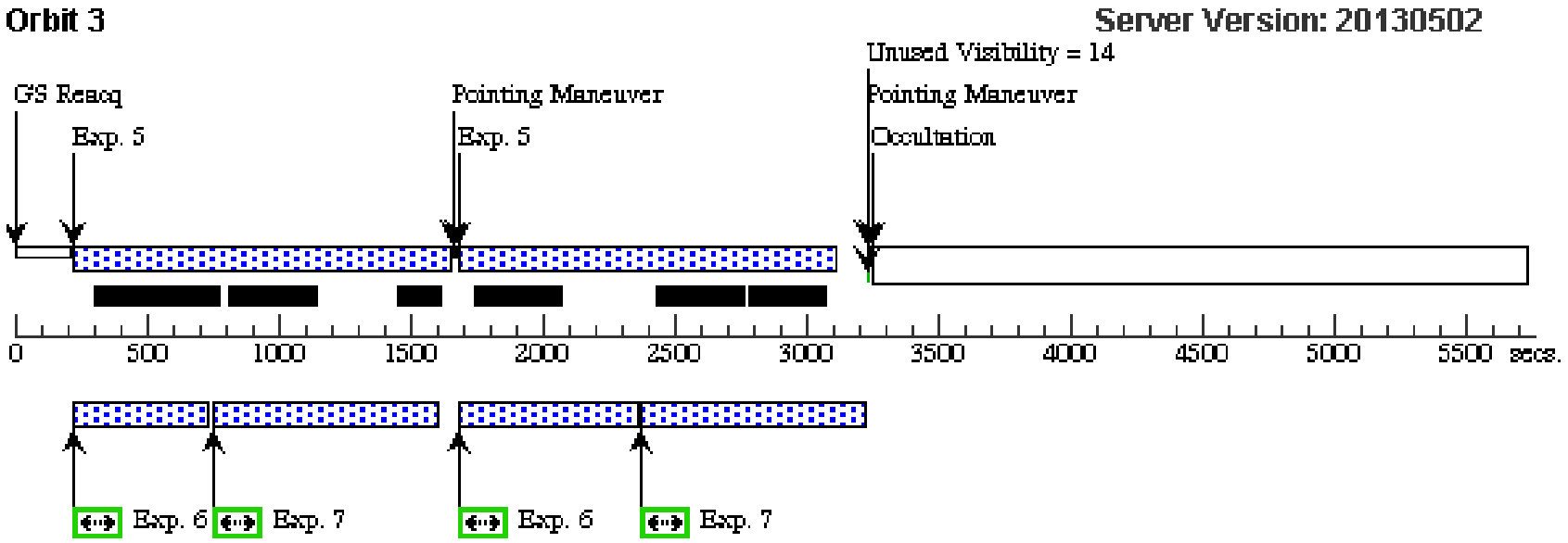
5500
secs.
Exp. 4
Exp. 4
Exp. 4


Orbit 3
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Pointing Maneuver
Occultation
GS Reacq
Pointing Maneuver
Exp. 5
Exp. 5
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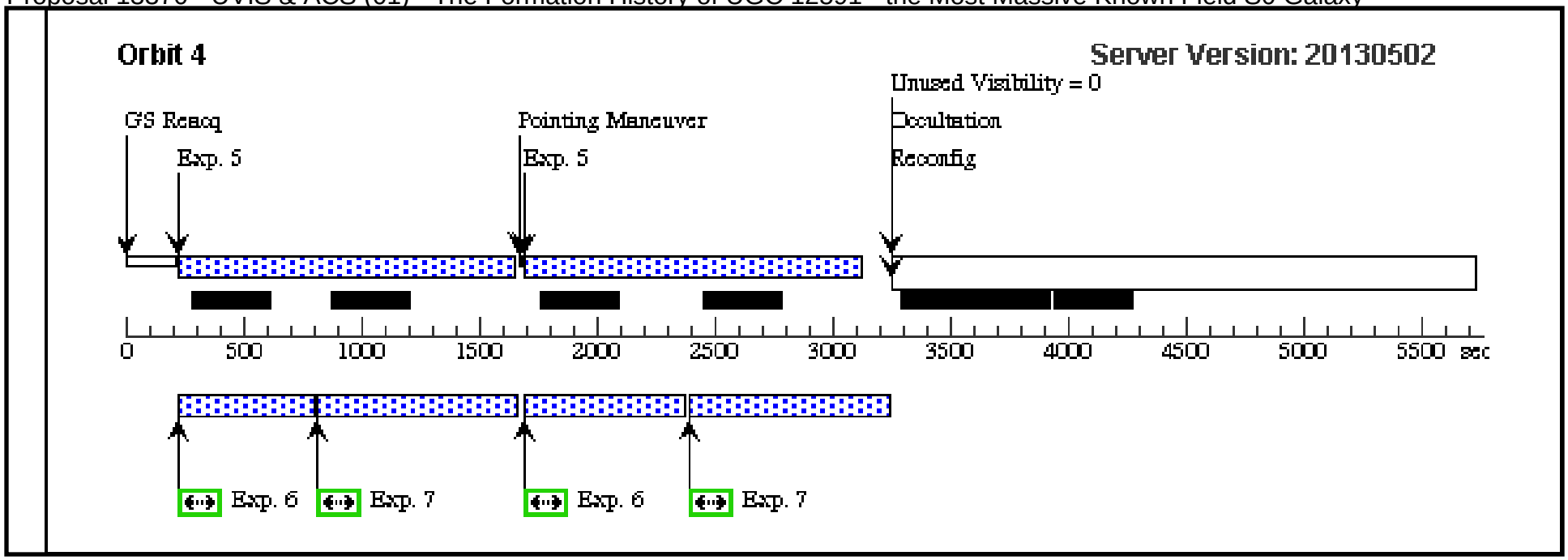
secs.
Exp. 6
Exp. 7
Exp. 6
Exp. 7


Orbit 4
Server Version: 20130502
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Exp. 5
Pointing Maneuver
Exp. 5
Occultation
Reconfig
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3000
3500
4000
4500
5000
5500
sec
Exp. 6
Exp. 7
Exp. 6
Exp. 7