15919 - Rise of the Titans: Unveiling the Nature of a Binary Hyper-Luminous Starburst at Redshift 6

Cycle: 27, 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) ADFS27	ACS/WFC	2	18-Jul-2019 10:01:04.0	yes
02	(1) ADFS27	WFC3/IR	3	18-Jul-2019 10:01:05.0	yes

5 Total Orbits Used

ABSTRACT

We propose HST/WFC3-IR and ACS observations in 3 bands to characterize the nature and the environment of ADFS-27, the most distant binary hyper-luminous starburst known, at a redshift of 5.655. This rare, gas-rich (Mgas~2.5x10^11Msun), dusty starburst (SFR~2500Msun/yr) system was recently discovered with ALMA and Herschel. It consists of two merging galaxies ~2kpc in diameter with dynamical masses of >3x10^11Msun each, separated by only 9kpc, resolved in dust emission by ALMA at 0.15" (1kpc) resolution. We here request imaging of the rest-frame ultraviolet light at matching resolution to measure the unobscured star formation rate, stellar mass and star formation history of this system through a complete SED analysis, as well as the morphology and sizes of the stellar disks and the UV extinction profile. We will also use the multi-band data to search for dropout galaxies in its environment on Mpc scales using the Lyman-break technique, which will put constraints on its formation history and the dark matter halo mass scale. This investigation could reveal the presence of a massive proto-cluster of galaxies within the first billion years of the Big Bang. Finally, the HST imaging will unambiguously address the possibility of a weak gravitational magnification of this system. Given its extreme cosmic rarity, this is key to properly place the existence and evolution of ADFS-27 into context with cosmological simulations and models of starburst galaxies at different epochs. This study will be an important pathfinder for detailed investigations of the most exceptional star-forming environments in the early universe with JWST.

OBSERVING DESCRIPTION

Program uses 5 orbits, 3 with WFC3/IR in the F098M and F160W filters, and 2 with ACS/WFC and the F606W filter.
It is broken up into two visits, one consisting of the two ACS orbits, and the other consisting of the three WFC3 IR orbits (concatenated to ensure similar rotation angles between orbits, and thus, coverage of the same galaxies in both filters - this is not an issue for ACS, given the much larger field of view relative to WFC3, it will cover the full area of interest at any orientation angle). There is no restriction on the orientation angle.

All observations are of the same target field (ADFS27). 4-point position/readout dither patterns are employed, primarily to improve the PSF through subpixel sampling, i.e., to mitigate the effects of the large detector pixel sizes (especially for WFC3/IR), as well as to offset by a sufficiently large amount to move persistent pixels to different locations on the sky in each exposure, and to provide good cosmic ray rejection. For ACS/WFC, this is also important to cover the 50 pixel gap in y direction between the two detector chips.

The ACS/WFC dither pattern consists of 2 positions with offset large enough to cover the inter-chip gap, and 2 subpositions each to dither on subpixel scales.

The WFC3/IR dither patterns consist of 2 postions large enough to cover the "death star" feature, and 2 subpositions each to dither on subpixel scales.

For the one F098M orbit, 4 positions are targeted. For the two F160W orbits, each orbit contains two subpixel dither positions, and the larger re-positioning is done between orbits.

Visit

Proposal 15919, ACS-F606W (01) Thu Jul 18 14:01:06 GMT 2019

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern		Exposures
(1)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=3.011 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.28 Angle Between Sides= Center Pattern=false	Pattern Type=LINE Purpose=BACKGROUND Number Of Points=2 Point Spacing=0.149 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=34.25 Angle Between Sides= Center Pattern=false	(1)

Fixed Targets

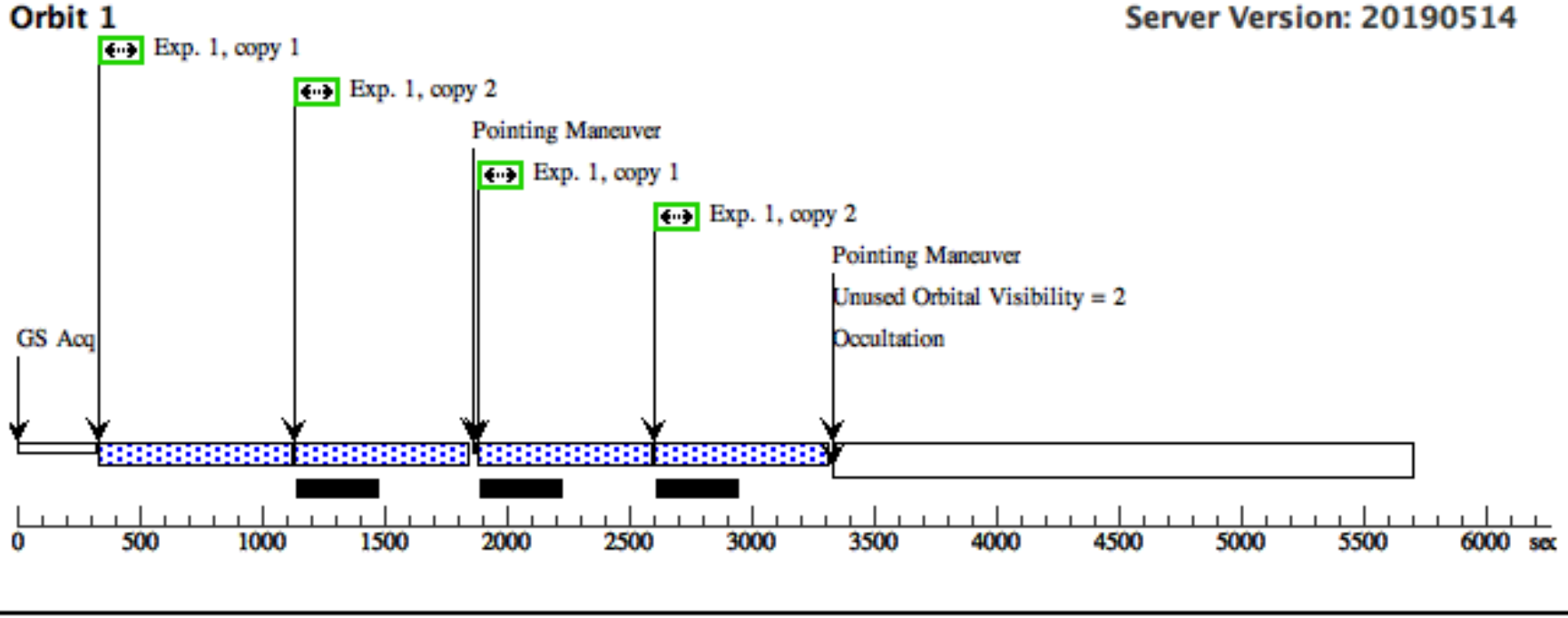
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	ADFS27 Alt Name1: ADFS-27	RA: 04 36 57.0300 (69.2376250d) Dec: -54 38 9.00 (-54.63583d) Equinox: J2000		V=27+/-0.5	Reference Frame: ICRS

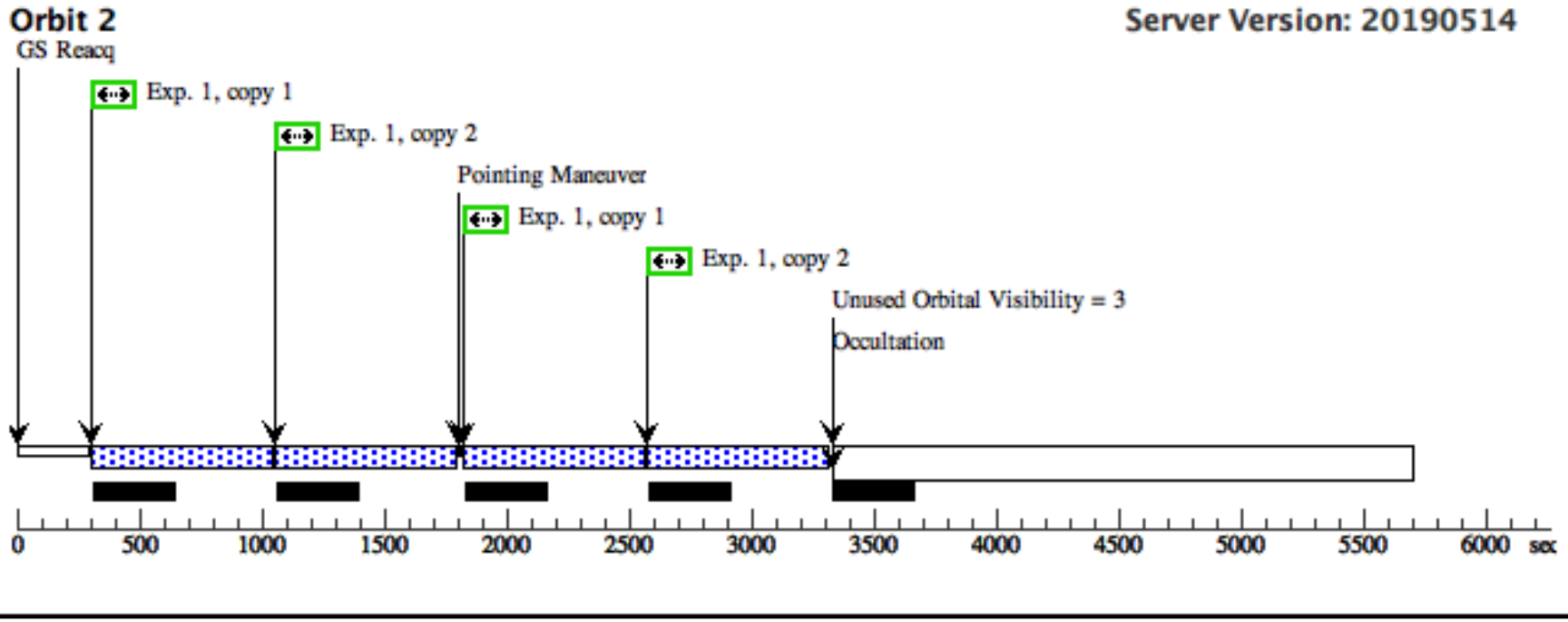
Comments:
Category=GALAXY
Description=[HIGH REDSHIFT GALAXY, INTERACTING GALAXY, STARBURST, ULTRALUMINOUS IR GAL]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) ADFS27	ACS/WFC, ACCUM, WFC	F606W	CR-SPLIT=NO		Pattern 1, Exps 1-1 in ACS-F606W (01) (1)	549 Secs X 2 (4800 Secs)	
								[==>586.0 Secs (Pattern 1,1, Copy 1)] *[==>586.0 Secs (Pattern 1,1, Copy 2)]* *[==>586.0 Secs (Pattern 1,2, Copy 1)]* *[==>586.0 Secs (Pattern 1,2, Copy 2)]*	***[1]***
								[==>614.0 Secs (Pattern 2,1, Copy 1)] *[==>614.0 Secs (Pattern 2,1, Copy 2)]* *[==>614.0 Secs (Pattern 2,2, Copy 1)]* *[==>614.0 Secs (Pattern 2,2, Copy 2)]*	***[2]***

Orbit Structure





Visit

Proposal 15919, WFC3-IR (02) Thu Jul 18 14:01:06 GMT 2019

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Fixed Targets

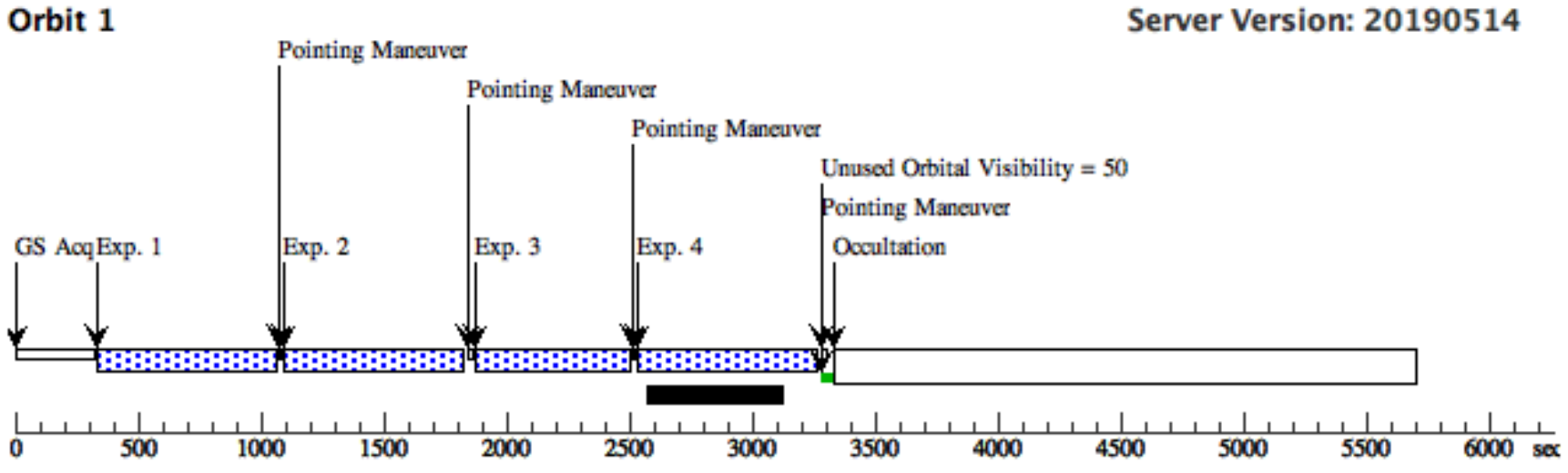
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	ADFS27	RA: 04 36 57.0300 (69.2376250d)		V=27+/-0.5	Reference Frame: ICRS
	Alt Name1: ADFS-27	Dec: -54 38 9.00 (-54.63583d)			
		Equinox: J2000			

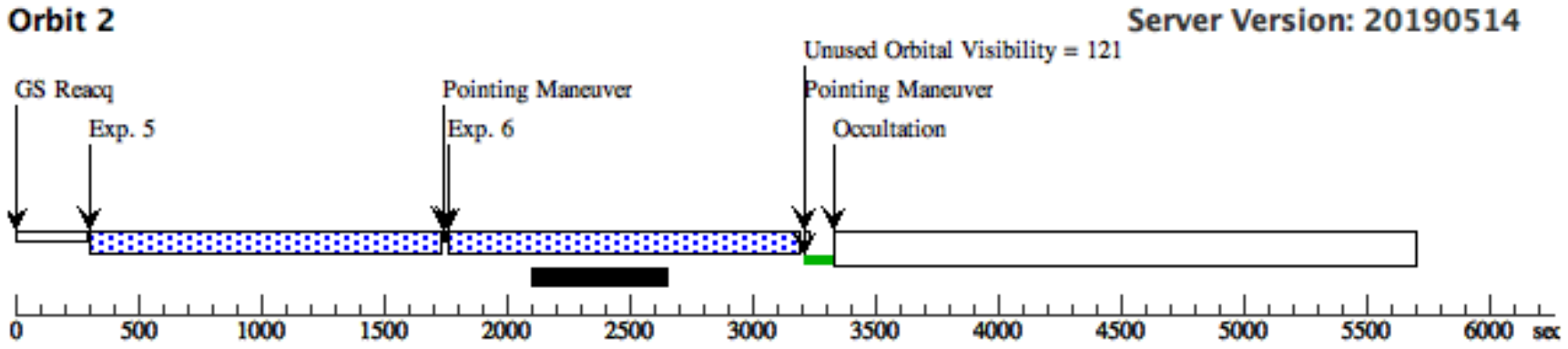
Comments:
Category=GALAXY
Description=[HIGH REDSHIFT GALAXY, INTERACTING GALAXY, STARBURST, ULTRALUMINOUS IR GAL]
Extended=NO

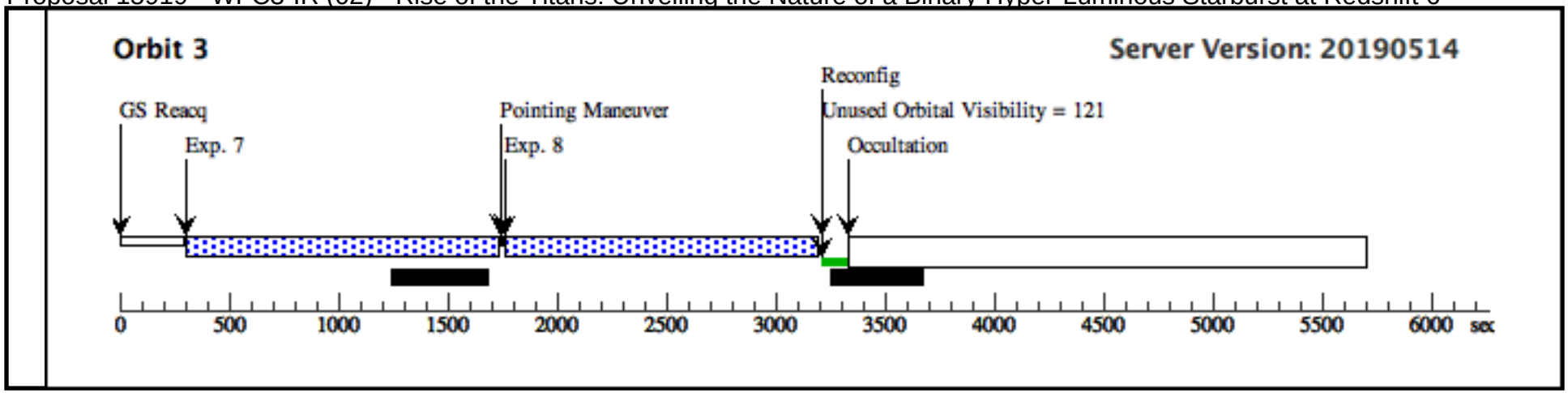
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F098M Dither1 Pos1	(1) ADFS27	WFC3/IR, MULTIACCUM, IR-FIX	F098M	NSAMP=8; SAMP-SEQ=SPARS100	POS TARG -3.3875, -3.0275		702.934552 Secs (702.935 Secs)	
								[==>]	***[1]***
2	F098M Dither2 Pos1	(1) ADFS27	WFC3/IR, MULTIACCUM, IR-FIX	F098M	NSAMP=8; SAMP-SEQ=SPARS100	POS TARG -3.8615, -3.4515		702.934552 Secs (702.935 Secs)	
								[==>]	***[1]***
3	F098M Dither1 Pos2	(1) ADFS27	WFC3/IR, MULTIACCUM, IR-FIX	F098M	NSAMP=7; SAMP-SEQ=SPARS100	POS TARG 3.3875,3.0275		602.934229 Secs (602.934 Secs)	
								[==>]	***[1]***
4	F098M Dither2 Pos2	(1) ADFS27	WFC3/IR, MULTIACCUM, IR-FIX	F098M	NSAMP=8; SAMP-SEQ=SPARS100	POS TARG 3.8615,3.4515		702.934552 Secs (702.935 Secs)	
								[==>]	***[1]***
5	F160W Dither1 Pos1	(1) ADFS27	WFC3/IR, MULTIACCUM, IR-FIX	F160W	NSAMP=15; SAMP-SEQ=SPARS100	POS TARG -3.3875, -3.0275		1402.936813 Secs (1402.937 Secs)	
								[==>]	***[2]***
6	F160W Dither2 Pos1	(1) ADFS27	WFC3/IR, MULTIACCUM, IR-FIX	F160W	NSAMP=15; SAMP-SEQ=SPARS100	POS TARG -3.8615, -3.4515		1402.936813 Secs (1402.937 Secs)	
								[==>]	***[2]***
7	F160W Dither1 Pos2	(1) ADFS27	WFC3/IR, MULTIACCUM, IR-FIX	F160W	NSAMP=15; SAMP-SEQ=SPARS100	POS TARG 3.3875,3.0275		1402.936813 Secs (1402.937 Secs)	
								[==>]	***[3]***
8	F160W Dither2 Pos2	(1) ADFS27	WFC3/IR, MULTIACCUM, IR-FIX	F160W	NSAMP=15; SAMP-SEQ=SPARS100	POS TARG 3.8615,3.4515		1402.936813 Secs (1402.937 Secs)	
								[==>]	***[3]***

Orbit Structure



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GS Reacq
Exp. 7
Pointing Maneuver
Exp. 8
Reconfig
Unused Orbital Visibility = 121
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sec