15290 - Spectacular optical filaments in the X-ray brightest group cool core

Cycle: 25, Proposal Category: GO

(UV Initiative)

(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) NGC5044-1 (2) NGC5044-2 (3) NGC5044-3	WFC3/UVIS	3	13-Jul-2017 12:06:34.0	yes
02	(4) NGC5044-4	WFC3/UVIS	2	13-Jul-2017 12:06:35.0	yes

5 Total Orbits Used

ABSTRACT

Studies of the cold gas and star formation in X-ray cool cores are important for understanding galaxy formation and evolution. An eye-catching and mysterious phenomenon in X-ray cool cores is the optical emission-line nebula, which is similar to those filaments found around distant radio galaxies and some proto-galaxies. These optical emission-line nebulae are markers of the cold gas and the AGN feedback process. They provide important kinematic and timescale constraints on gas flows in cool cores, from ~ 50 kpc down to regions within the Bondi radius on scales of 50 - 100 pc. We have obtained optical narrow-band imaging data for a sample of cool cores in galaxy groups and some interesting systems were revealed. In this proposal, we ask for the WFC3 narrow-band imaging data of the brightest and the closest Halpha nebula in the sample, as well as the NUV data to study the associated star formation. The proposed HST observations, in combination with our rich supporting data in other bands, will provide important constraints on the properties of optical filaments, the strength of magnetic field and the star formation history in the cool core and energy transfer.

OBSERVING DESCRIPTION

Our science goals are to study optical filaments and star formation in NGC 5044. At NGC 5044's distance, 0.04" = 6.0 pc so similar filaments as those in NGC 1275 and NGC 4696 (60 - 70 pc width from Fabian et al. 2008, 2016) will be easily resolved into many threads. We plan to spend five orbits on NGC 5044 with WFC3. The narrow-band imaging with the F665N filter will take three and a half orbits for an unprecedented sharp view on an emission-line nebula. The remaining time is used for the continuum imaging (F814W) and the search for young star clusters (F300X). For NGC 5044's redshift of 0.00928, Halpha and the two [NII] lines are at 6626 A, 6611 A and 6646 A respectively (at vacuum not at air), well covered by the F665N filter with > 10% throughput at 6588 A - 6724 A. We have run WFC3/ETC simulations. The optical filaments in NGC 5044 have surface brightness of (1.4 - 6) x 10^-16 ergs s^-1 cm^-2 arcsec^-2 (Halpha+[NII] fluxes). With the relative continuum levels, the brightest and the faintest filaments will have 5.9-sigma detection in 2x2 pixels and 3.4-sigma detection in 4x4 pixels respectively in 8400 sec. The ground Halpha+[NII] data were taken at ~ 1.0" seeing so the actual surface brightness of the optical filaments should be higher. Averaging along the filaments allows their widths measured to the limits of the resolution. Faint ones not shown from the ground can also be revealed. The continuum image will be taken with the F814W filter for about 800 sec.

Visit

Proposal 15290, F665N (01) Thu Jul 13 16:06:36 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-GAP-LINE	Coordinate Frame=POS-TARG		(1), (2), (3)
	Purpose=MOSAIC	Pattern Orientation=85.759		
	Number Of Points=2	Angle Between Sides=		
	Point Spacing=2.414	Center Pattern=true		
	Line Spacing=			

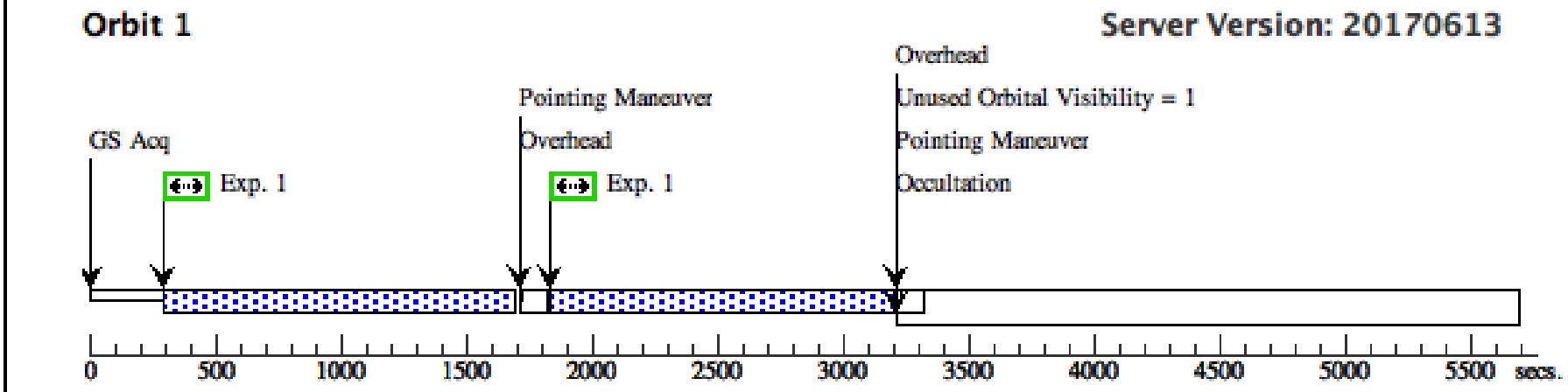
Fixed Targets

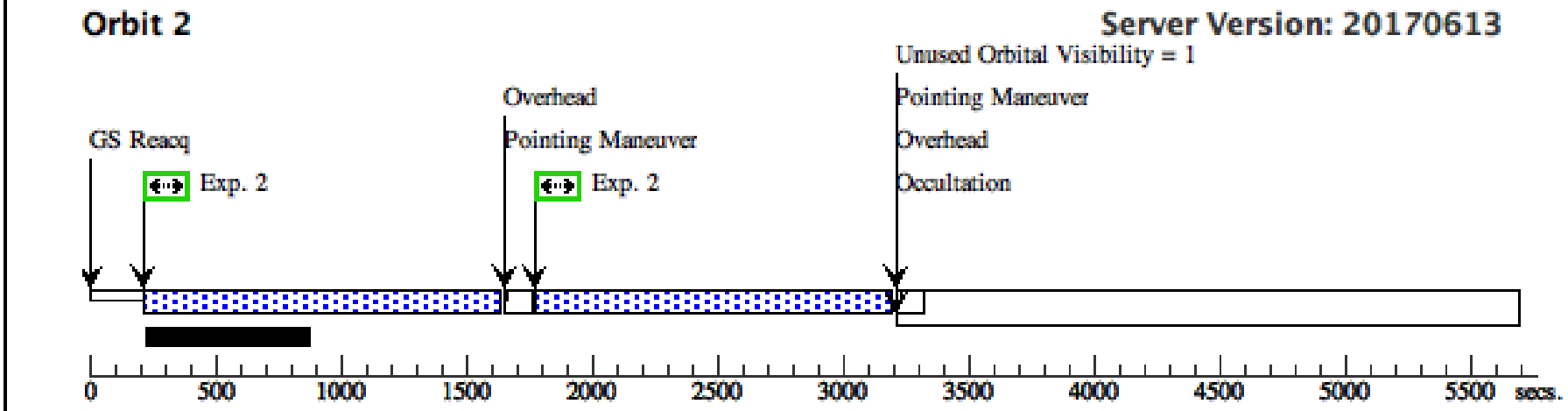
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	NGC5044-1	RA: 13 15 24.2980 (198.8512417d) Dec: -16 23 5.72 (-16.38492d) Equinox: J2000		V=11.4	Reference Frame: ICRS
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Extended=YES					
(2)	NGC5044-2	RA: 13 15 23.6390 (198.8484958d) Dec: -16 23 4.03 (-16.38445d) Equinox: J2000		V=11.4	Reference Frame: ICRS
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Extended=YES					
(3)	NGC5044-3	RA: 13 15 23.7870 (198.8491125d) Dec: -16 23 13.19 (-16.38700d) Equinox: J2000		V=11.4	Reference Frame: ICRS
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Extended=YES					

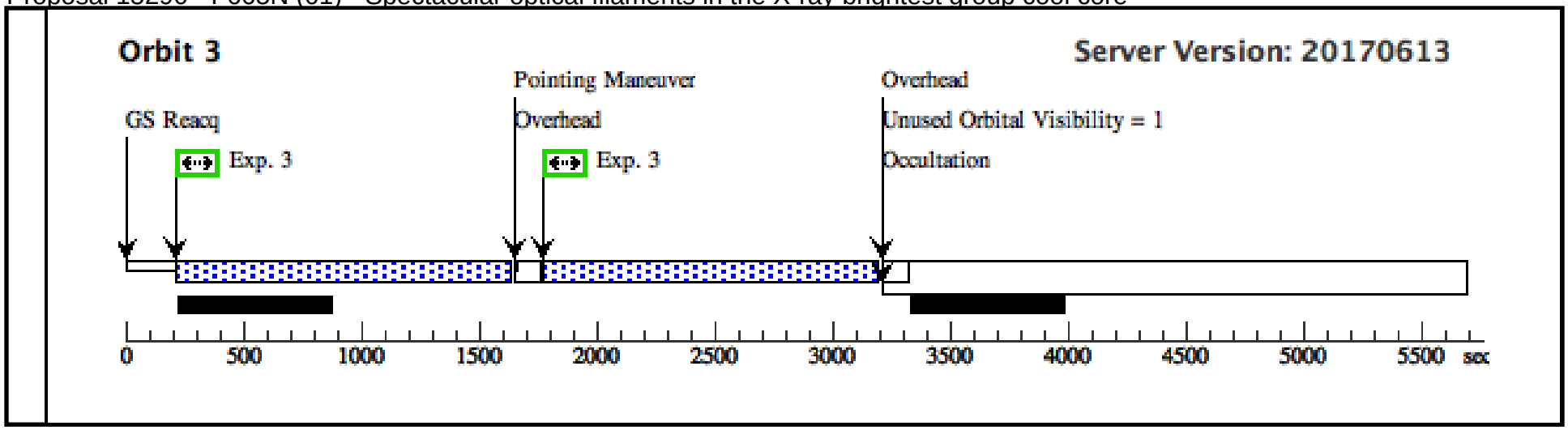
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) NGC5044-1	WFC3/UVIS, ACCUM, UVIS-CENTER	F665N	FLASH=8		Pattern 1, Exps 1-1 in F665N (01) (1)	1370 Secs (2740 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
2		(2) NGC5044-2	WFC3/UVIS, ACCUM, UVIS-CENTER	F665N	FLASH=7		Pattern 1, Exps 2-2 in F665N (01) (1)	1426 Secs (2852 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[2]***
3		(3) NGC5044-3	WFC3/UVIS, ACCUM, UVIS-CENTER	F665N	FLASH=7		Pattern 1, Exps 3-3 in F665N (01) (1)	1426 Secs (2852 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[3]***

Orbit Structure






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

Visit

Proposal 15290, F300X and others (02) Thu Jul 13 16:06:37 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-GAP-LINE Purpose=MOSAIC Number Of Points=2 Point Spacing=2.414 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=true		(2-3)
(2)	Pattern Type=WFC3-UVIS-MOS-DITH-LINE Purpose=MOSAIC Number Of Points=3 Point Spacing=2.4 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.754 Angle Between Sides= Center Pattern=true		(1)

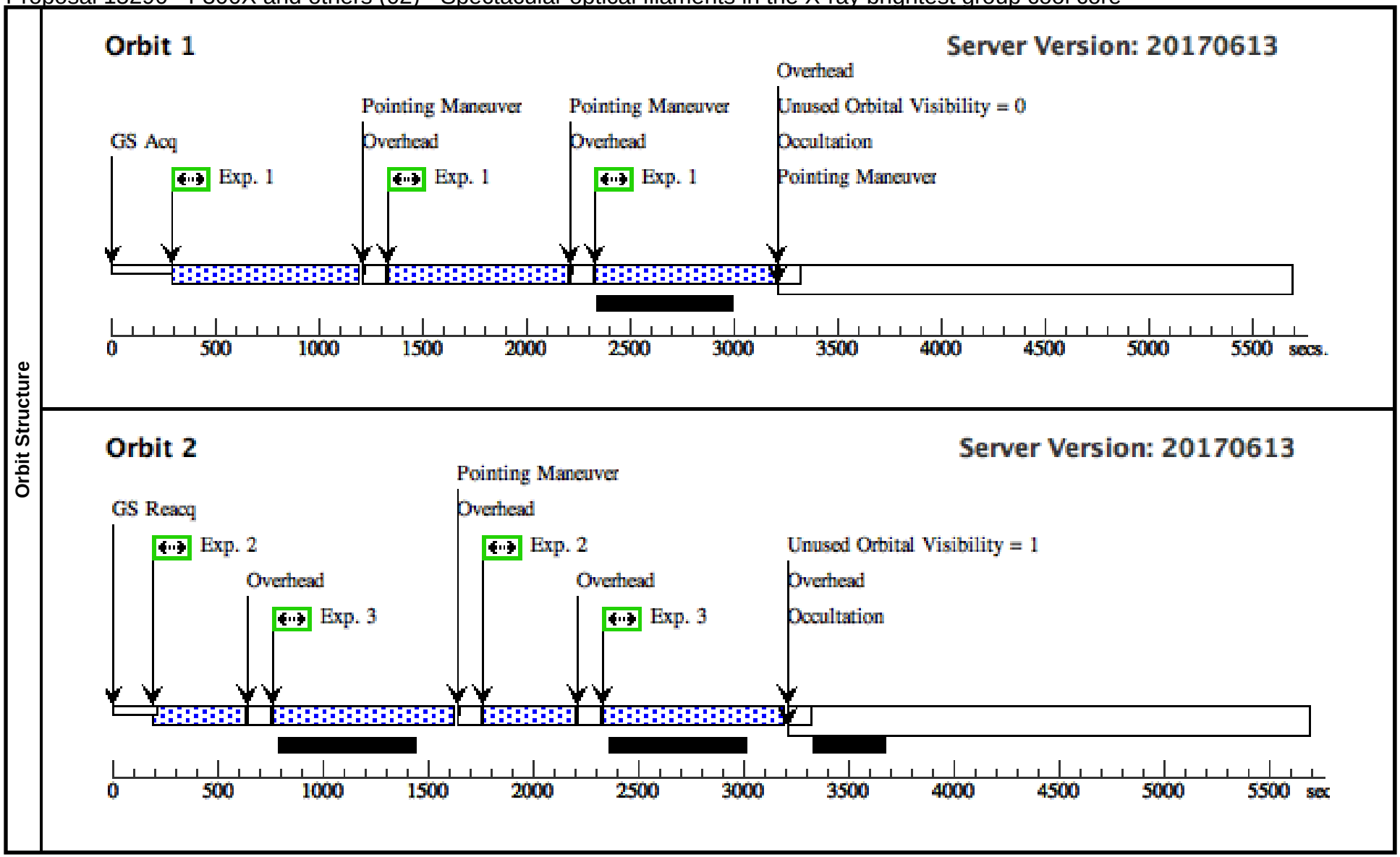
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	NGC5044-4	RA: 13 15 24.3510 (198.8514625d) Dec: -16 23 13.79 (-16.38716d) Equinox: J2000		V=11.4	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(4) NGC5044-4	WFC3/UVIS, ACCUM, UVIS-CENTER	F300X	FLASH=9		Pattern 2, Exps 1-1 in F300X and others (02) (2)	873 Secs (2607 Secs) *[==>869.0 Secs (Pattern 1)]* *[==>869.0 Secs (Pattern 2)]* *[==>869.0 Secs (Pattern 3)]*	***[1]***
2		(4) NGC5044-4	WFC3/UVIS, ACCUM, UVIS-CENTER	F814W	FLASH=4		Pattern 1, Exps 2-3 in F300X and others (02) (1)	417 Secs (834 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[2]***
3		(4) NGC5044-4	WFC3/UVIS, ACCUM, UVIS-CENTER	F665N	FLASH=9		Pattern 1, Exps 2-3 in F300X and others (02) (1)	842 Secs (1684 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[2]***


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