17873 - Transient LMXBs in Globular Clusters

Cycle: 32, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*
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Dr. Craig Heinke (CoI) (CSA Member)	University of Alberta

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) GCTRANSIENT1	ACS/WFC	2	23-Oct-2024 18:00:16.0	yes
02	(2) GCTRANSIENT2	ACS/WFC	2	23-Oct-2024 18:00:17.0	yes

4 Total Orbits Used

ABSTRACT

Deep Chandra observations of globular clusters have revealed that globular clusters contain numerous quiescent LMXBs, any of which could go into outburst. Recent Chandra studies have confirmed that globular clusters can indeed harbor multiple transients and that more quiescent LMXBs are hiding under the sensitivity limits of even relatively deep Chandra exposures. Both findings have significant implications for studies of accreting neutron stars and have provided better insight into globular cluster compact binary populations. Here we propose a Chandra program to precisely localize new transients in globular clusters. As part of this effort we further request HST observations to identify the optical counterparts of these transients.

OBSERVING DESCRIPTION

The goal of this joint Chandra/HST Target-of-Opportunity (ToO) proposal is to measure accurate coordinates of the next two X-ray transients in a globular cluster with Chandra, and to use HST subsequently to look for their optical counterparts inside the Chandra positional error circles. The Chandra error circle is large enough (about 0.6" radius) that it likely contains multiple globular-cluster stars. Comparison of the photometry that is extracted from the observations requested here (to be taken about 25 days after triggering the proposal) with photometry from archival HST data reveals highly variable objects in the error circle, and hence the identity of the true counterpart. Our choice for the ACS/WFC is driven by the existence of a large body of archival globular-cluster images taken with this camera.

We have been allocated time to do Chandra/HST follow-up for two X-ray transients. For the HST component we have been granted 4 HST orbits in total (two orbits per transient). Our program consists of two completely independent but identical visits of two orbits each. One orbit in a visit is spent on observations in the F606W band, and the other orbit on observations in the F814W band. The structure of these two orbits is the same.

We start an orbit with a short exposure (30s) to obtain photometry of relatively bright stars that are saturated in the longer exposures. The short exposure is followed by 4 longer (about 430s) exposures. The exact number of exposures and the exposure times depend of the duration of the orbit and will be determined once the target coordinates are known. We aim for a minimum of 4 long exposures so that they can be arranged in an ACS-DITHER-BOX pattern. These 4 long exposures are put in a Pattern container that is coupled to the default ACS-DITHER-BOX pattern with center=yes. To elevate the background levels, we have added a post-flash of 25e- to each short (=30s) exposure.

Given the ToO nature of our program, our targets have been defined as two generic targets with unknown coordinates. Once the coordinates are known, we can fine-tune the observational setup, such as the exposure times and number of exposures, as well as the detailed placement of the target (i.e. the Chandra error circle) on the ACS/WFC detectors.

** Impact of reduced-gyro operations

The primary impact of reduced-gyro operations is a reduction of HST's field of regard. Therefore, we expect that the main effect on our program is a possible reduced likelihood of responding to our Target-of-Opportunity trigger within the requested time frame of 25 days.

Visit

Proposal 17873, Visit-Transient1 (01) Wed Oct 23 22:00:18 GMT 2024

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: ON HOLD ; TOO RESPONSE TIME 25.0D

On Hold Comments: Target of Opportunity

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.2637 Line Spacing=0.1856	Coordinate Frame=POS-TARG Pattern Orientation=20.7 Angle Between Sides=69.02 Center Pattern=true		(2), (4)

Generic Targets

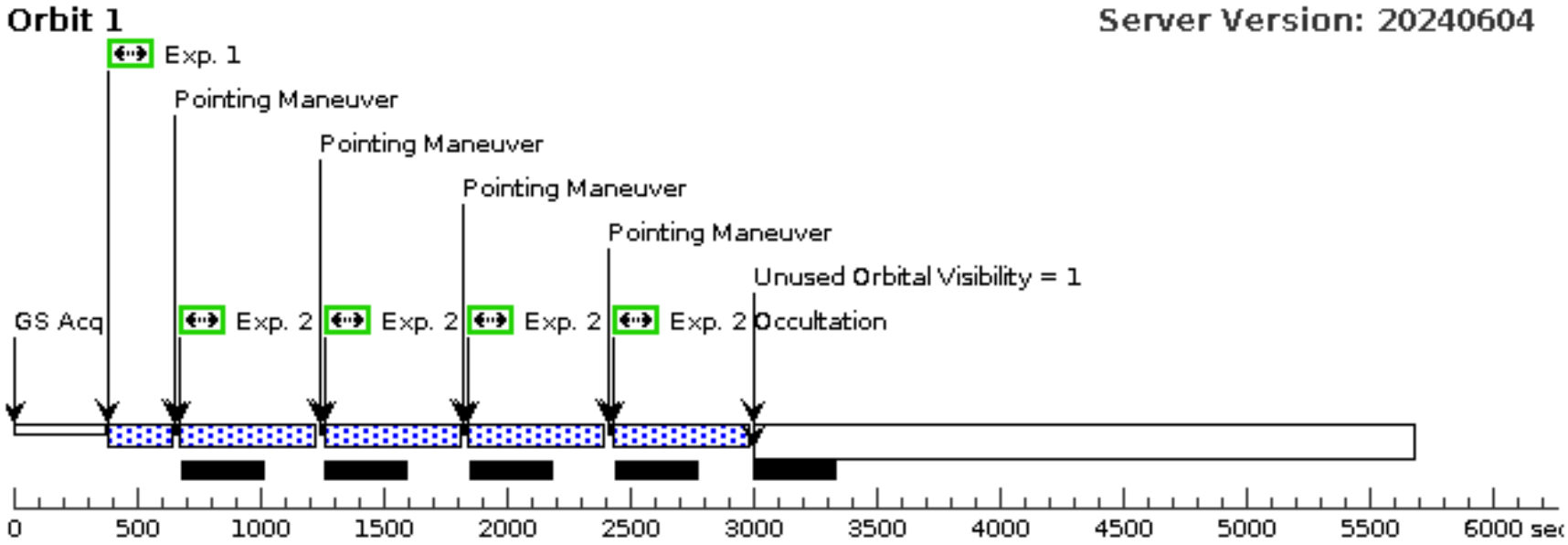
#	Name	Criteria	Description
(1)	GCTRANSIENT1	first trigger of globular-cluster X-ray transient program	X-RAY TRANSIENT

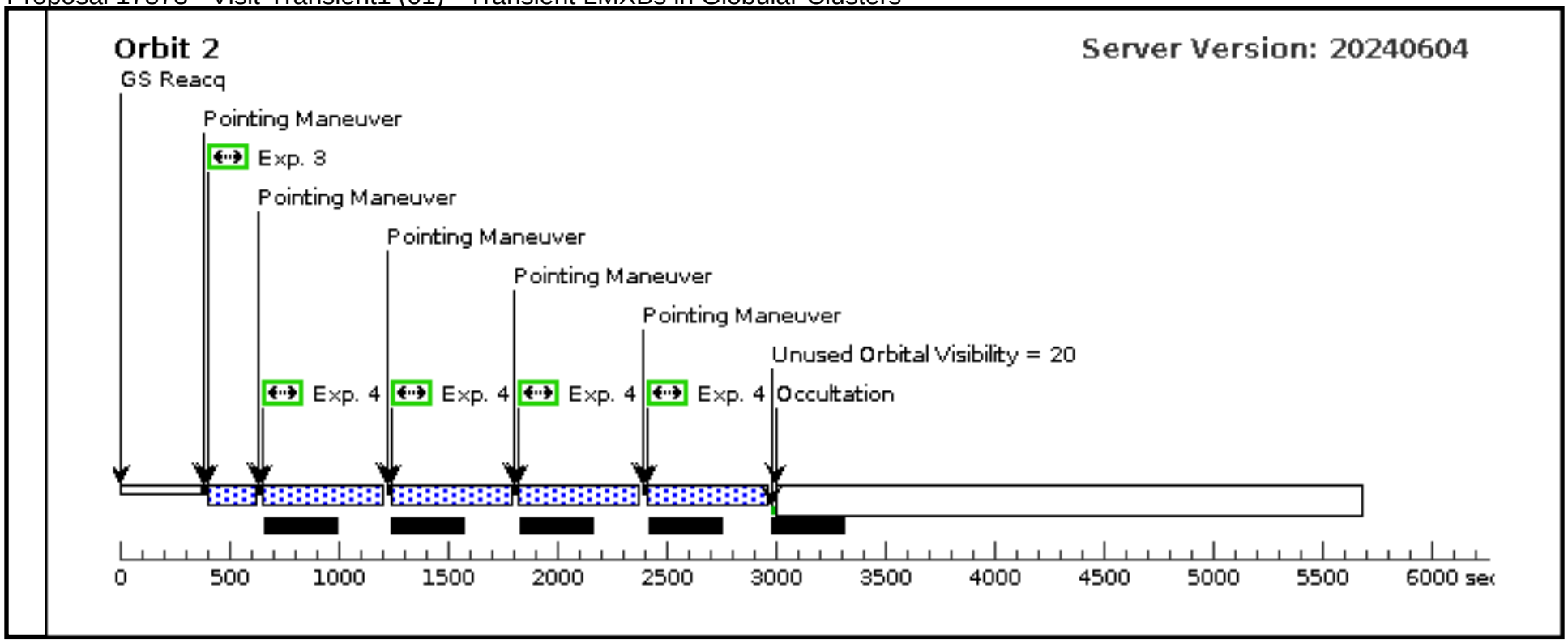
Comments: next X-ray transient discovered in a Galactic globular cluster, whose position can only be accurately determined with Chandra

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	short-V	(1) GCTRANSIENT1	ACS/WFC, ACCUM, WFC1	F606W	FLASH=25			30 Secs (30 Secs)	
								[==>]	***[1]***
2	long-V-dithebox	(1) GCTRANSIENT1	ACS/WFC, ACCUM, WFC1	F606W			Pattern 1, Exps 2-2 in Visit-Transient1 (01) (1)	430 Secs (1720 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
3	short-I	(1) GCTRANSIENT1	ACS/WFC, ACCUM, WFC1	F814W	FLASH=25			30 Secs (30 Secs)	
								[==>]	***[2]***
4	long-I-dithebox	(1) GCTRANSIENT1	ACS/WFC, ACCUM, WFC1	F814W			Pattern 1, Exps 4-4 in Visit-Transient1 (01) (1)	430 Secs (1720 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***

Orbit Structure




Orbit 2
Server Version: 20240604
GS Reacq
Pointing Maneuver
Exp. 3
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Unused Orbital Visibility = 20
Exp. 4
Exp. 4
Exp. 4
Exp. 4
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec

Visit

Proposal 17873, Visit-Transient2 (02) Wed Oct 23 22:00:18 GMT 2024

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: ON HOLD ; TOO RESPONSE TIME 25.0D

On Hold Comments: Target of Opportunity

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.2637 Line Spacing=0.1856	Coordinate Frame=POS-TARG Pattern Orientation=20.7 Angle Between Sides=69.02 Center Pattern=true		(2), (4)

Generic Targets

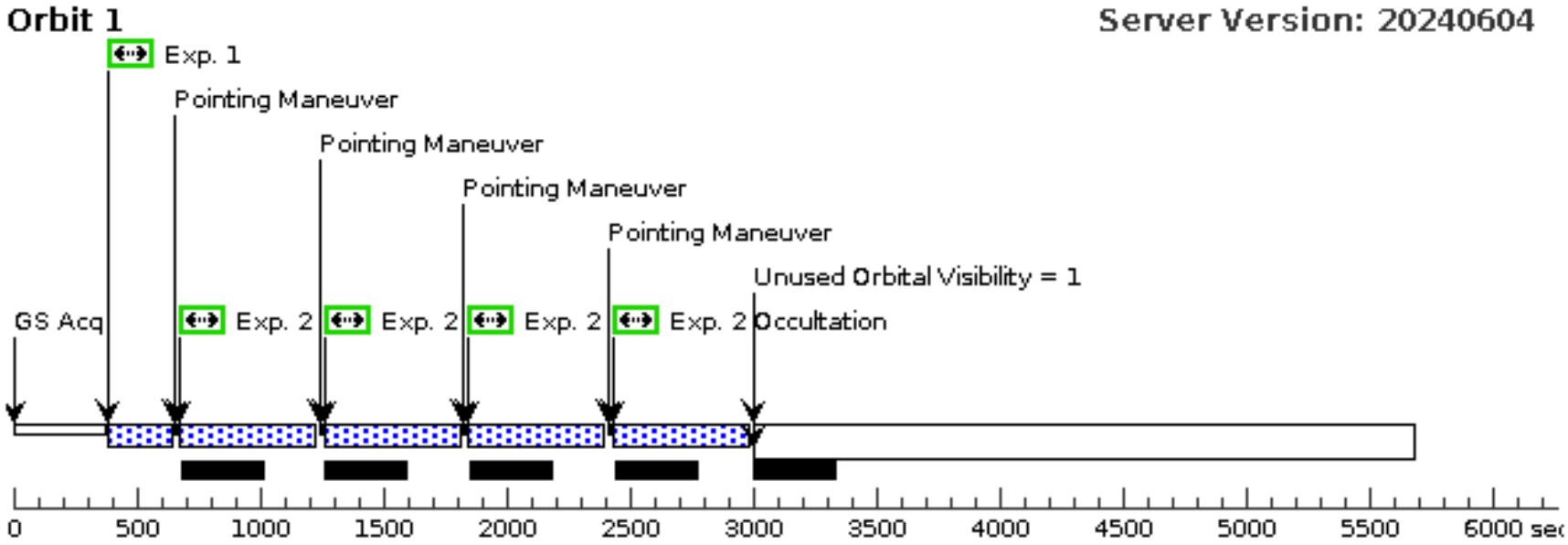
#	Name	Criteria	Description
(2)	GCTRANSIENT2	second trigger of globular-cluster X-ray transient program	X-RAY TRANSIENT

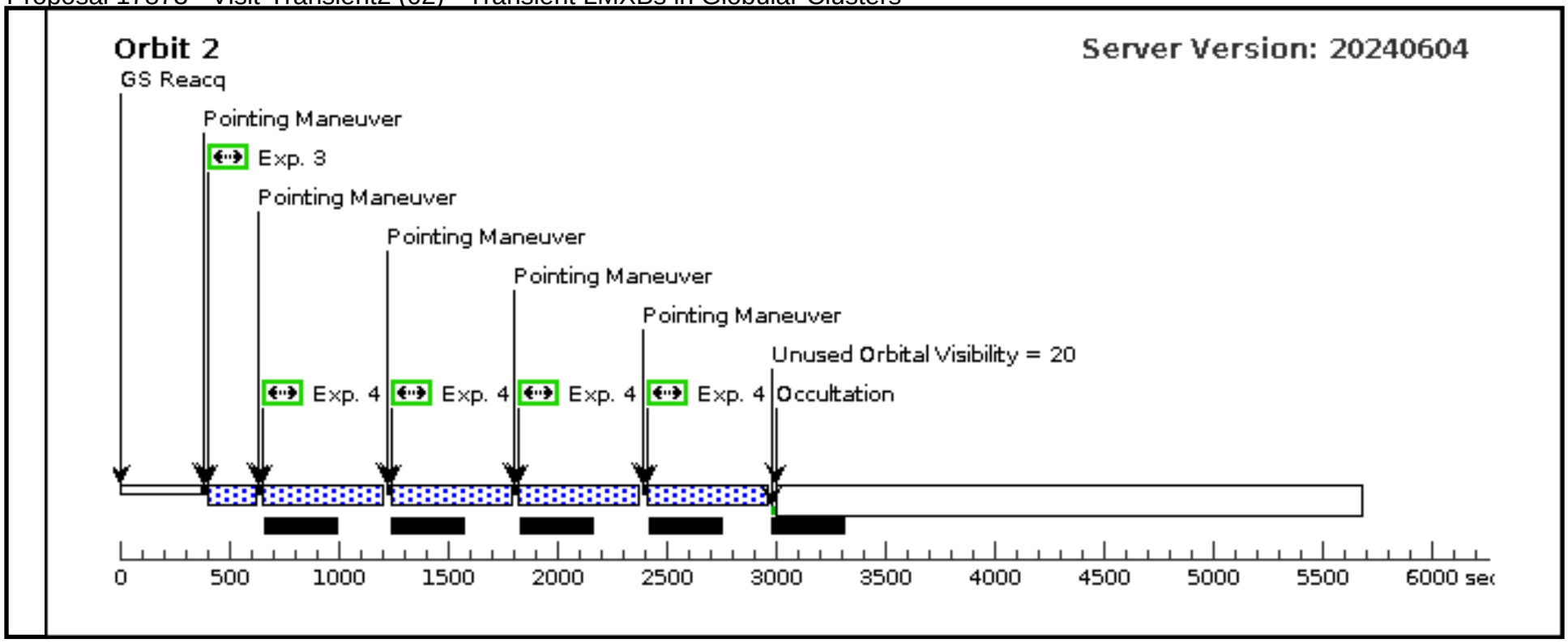
Comments: next X-ray transient discovered in a Galactic globular cluster, whose position can only be accurately determined with Chandra

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	short-V	(2) GCTRANSIENT2	ACS/WFC, ACCUM, WFC1	F606W	FLASH=25			30 Secs (30 Secs)	
								[==>]	***[1]***
2	long-V-dithebox	(2) GCTRANSIENT2	ACS/WFC, ACCUM, WFC1	F606W			Pattern 1, Exps 2-2 in Visit-Transient2 (02) (1)	430 Secs (1720 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
3	short-I	(2) GCTRANSIENT2	ACS/WFC, ACCUM, WFC1	F814W	FLASH=25			30 Secs (30 Secs)	
								[==>]	***[2]***
4	long-I-dithebox	(2) GCTRANSIENT2	ACS/WFC, ACCUM, WFC1	F814W			Pattern 1, Exps 4-4 in Visit-Transient2 (02) (1)	430 Secs (1720 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***

Orbit Structure

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Server Version: 20240604
GS Reacq
Pointing Maneuver
Exp. 3
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Unused Orbital Visibility = 20
Exp. 4
Exp. 4
Exp. 4
Exp. 4
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec