11139 - NICMOS Observations of the Microquasar GRS 1758-258

Cycle: 16, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Dr. Ian Andrew Smith (PI)	**Rice University**	**iansmith@rice.edu**

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) GRS1758-258	NIC1 NIC2	2	17-Jan-2008 22:00:26.0	yes
02	(1) GRS1758-258	NIC1 NIC2	2	17-Jan-2008 22:00:35.0	yes
03	(1) GRS1758-258	NIC1 NIC2	2	17-Jan-2008 22:00:45.0	yes

6 Total Orbits Used

ABSTRACT

The galactic black hole candidate GRS 1758-258 is normally one of the brightest persistent gamma-ray sources in the vicinity of the galactic center. It is a microquasar with relativistic radio jets emanating from a central variable source. Microquasars are excellent nearby test laboratories for studying the complex accretion and outflow processes that take place near black hole horizons.

Despite an accurate location provided by Chandra and the VLA and over a decade of careful ground-based studies, the optical/infrared counterpart to GRS 1758-258 remains unknown. A stellar counterpart is expected, but the current candidates are all more than 2 sigma from the center of the error circle. The ground-based infrared flux limits are also right at the values expected for the synchrotron emission from the outflow from the black hole, and possibly for the emission from the accretion disk. This leaves open the question as to what is powering this very energetic persistent source.

Here we propose to use NICMOS to perform broad-band imaging of the GRS 1758-258 error box. These images will be more than three magnitudes more sensitive than the current ground-based ones. The resulting spectra will reveal the thermal/non-thermal nature of the sources in the region of the error box, and the high spatial resolution images may reveal a jet structure. We propose to perform three visits of two orbits each spanning the suggested 18.45 day binary orbital period of the system: a correct counterpart identification should be confirmed by its variability. We will also aim to support the HST observations with X- and gamma-ray observations using Swift or INTEGRAL, and with longer wavelength observations from the ground.

OBSERVING DESCRIPTION

Our observations will focus on the central point source VLA-C, which is located at RA(J2000) 18:01:12.40, Dec(J2000) -25:44:36.1.

For a declination of -25.7deg, the maximum visibility of GRS 1758-258 is 53 minutes per HST orbit. The visibility constraints allow the first visit to take place between 2008 February 19 and 2008 June 12. To facilitate possible ground-based observations, we prefer that the HST observations be scheduled towards the end of the visibility window. However, adequate time should be allowed so that all three visits are completed. Thus May 2008 is preferred.

We do not apply any roll constraints.

The observations will be split into 3 visits of 2 orbits each. The 3 visits should be spread approximately uniformly across the 18.45 day orbital period.

Each visit will use the same filter selections and exposure times. The observations will be made using 3 NICMOS broadband filters: NIC1/F110W, NIC2/F160W, and NIC2/F205W. The NIC1/F110W observation will take place in the first orbit, and the NIC2/F160W and NIC2/F205W observations in the second orbit. We will switch from using NIC1 to NIC2 while the source is not being observed in between the orbits. Given the likely variability of GRS 1758-258, the two orbits should be contiguous.

As an approximate upper limit to the flux from GRS 1758-258, we assume that the flat 0.14 mJy radio spectrum extends into the infrared. After absorption using an average galactic reddening of E(B-V) = 2.196, this gives K=17.5 (6.2E-5 Jy) and J=19.9 (1.8E-5 Jy); this is also the approximate limit from the current ground-based observations. To detect (with a S/N of 10) a source with a flux that is 3 magnitudes fainter than this requires 29.8 minutes for NIC1/F110W, 6.6 minutes for NIC2/F160W, and 18.1 minutes for NIC2/F205W.

The nearby K giant star A (K=14) will give a 10sigma detection in roughly 1 second for all three filters. We will therefore use STEP MULTIACCUM read-out modes to obtain a combination of short and long integration times; this will allow us to study both the brighter and fainter sources in the region.

For the NIC1/F110W orbit, we will perform a 2x2 dither. To keep the number of reads down, we will perform one STEP32 MULTIACCUM at each location. For the NIC2 orbit, we will again perform a 2x2 dither. At each location, we will use the F160W and F205W filters. For both filters we will use one STEP16 MULTIACCUM at each location.

Visit

Proposal 11139, Visit 01, implementation Fri Jan 18 03:00:49 GMT 2008

Diagnostic Status: No Diagnostics

Scientific Instruments: NIC2, NIC1

Special Requirements: PCS MODE FINE; AFTER 01-APR-2008:00:00:00

Patterns

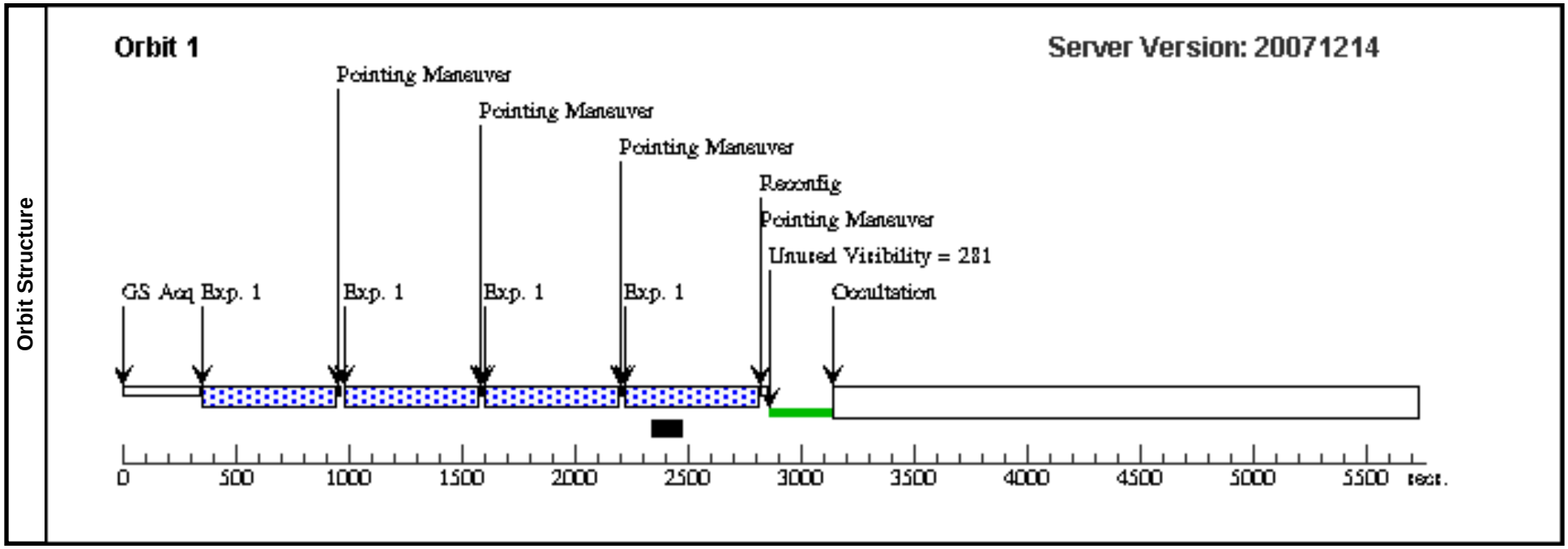
#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=NIC-SQUARE-WAVE-DITH Purpose=DITHER Number Of Points=4 Point Spacing=2.0 Line Spacing=2.0	Coordinate Frame=POS-TARG Pattern Orientation=90.0 Angle Between Sides=270.0 Center Pattern=true		(1), (2-3)

Fixed Targets

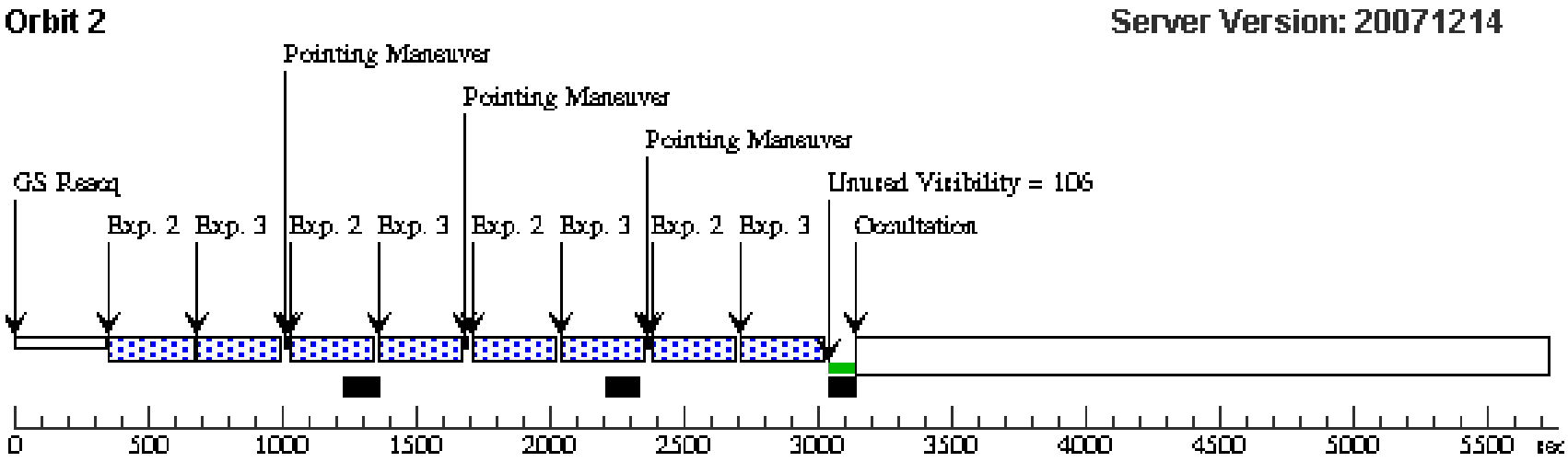
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	GRS1758-258	RA: 18 01 12.4000 (270.3016667d) Dec: -25 44 36.10 (-25.74336d) Equinox: J2000		V=27 K>=17.5, J>=19.9, E(B-V)=2.196, K_nearby_star_A=14	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) GRS1758-258	NIC1, MULTIACCUM, NIC1	F110W	SAMP-SEQ=STEP32; NSAMP=25		Pattern 1-1 (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2		(1) GRS1758-258	NIC2, MULTIACCUM, NIC2	F160W	SAMP-SEQ=STEP16; NSAMP=25		Pattern 2-3 (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***
3		(1) GRS1758-258	NIC2, MULTIACCUM, NIC2	F205W	SAMP-SEQ=STEP16; NSAMP=25		Pattern 2-3 (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***


Orbit Structure
Orbit 1
Server Version: 20071214
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Reconfig
Pointing Maneuver
Unused Visibility = 281
GS Acq
Exp. 1
Exp. 1
Exp. 1
Exp. 1
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec.

Orbit Structure (continued)



Visit

Proposal 11139, Visit 02, implementation Fri Jan 18 03:00:51 GMT 2008

Diagnostic Status: No Diagnostics

Scientific Instruments: NIC2, NIC1

Special Requirements: PCS MODE FINE; AFTER 01 BY 5.0 D TO 7.0 D

Patterns

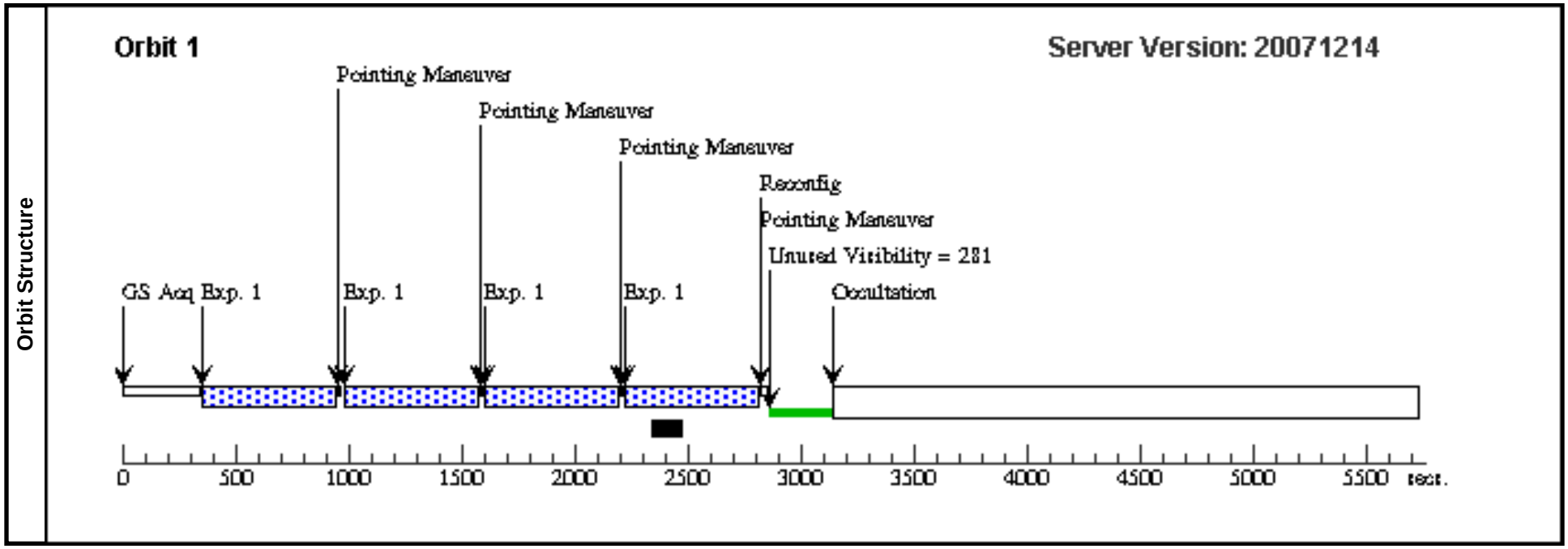
#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=NIC-SQUARE-WAVE-DITH Purpose=DITHER Number Of Points=4 Point Spacing=2.0 Line Spacing=2.0	Coordinate Frame=POS-TARG Pattern Orientation=90.0 Angle Between Sides=270.0 Center Pattern=true		(1), (2-3)

Fixed Targets

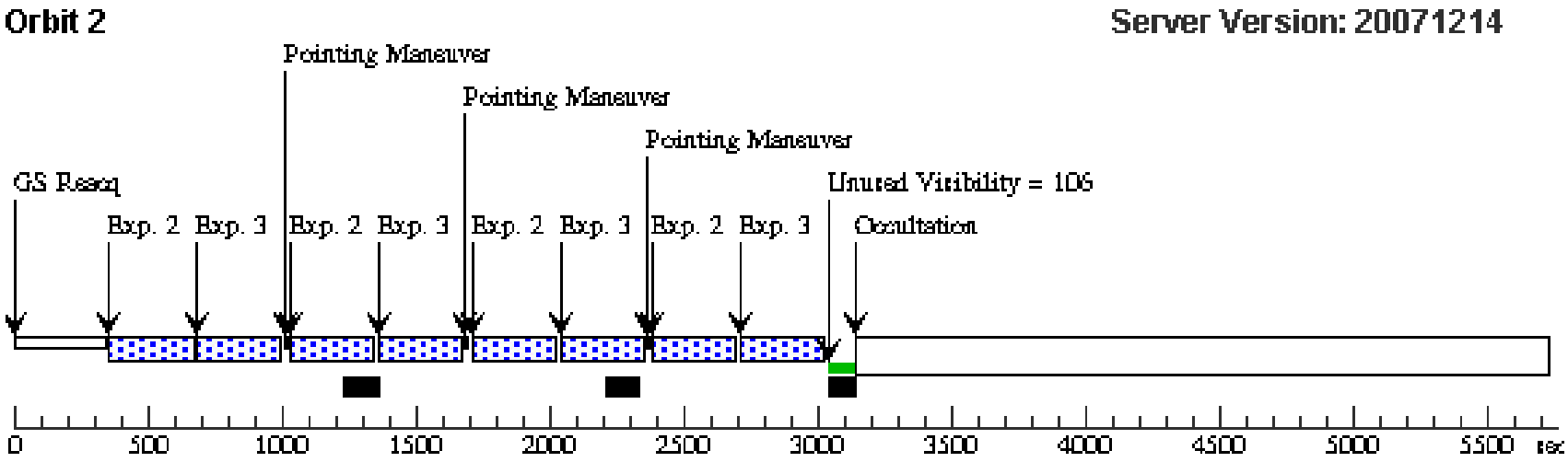
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	GRS1758-258	RA: 18 01 12.4000 (270.3016667d) Dec: -25 44 36.10 (-25.74336d) Equinox: J2000		V=27 K>=17.5, J>=19.9, E(B-V)=2.196, K_nearby_star_A=14	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) GRS1758-258	NIC1, MULTIACCUM, NIC1	F110W	SAMP-SEQ=STEP32; NSAMP=25		Pattern 1-1 (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2		(1) GRS1758-258	NIC2, MULTIACCUM, NIC2	F160W	SAMP-SEQ=STEP16; NSAMP=25		Pattern 2-3 (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***
3		(1) GRS1758-258	NIC2, MULTIACCUM, NIC2	F205W	SAMP-SEQ=STEP16; NSAMP=25		Pattern 2-3 (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***


Orbit Structure
Orbit 1
Server Version: 20071214
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Reconfig
Pointing Maneuver
Unused Visibility = 281
GS Acq
Exp. 1
Exp. 1
Exp. 1
Exp. 1
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec.

Orbit Structure (continued)



Visit

Proposal 11139, Visit 03, implementation Fri Jan 18 03:00:51 GMT 2008

Diagnostic Status: No Diagnostics

Scientific Instruments: NIC2, NIC1

Special Requirements: PCS MODE FINE; AFTER 02 BY 5.0 D TO 7.0 D

Patterns

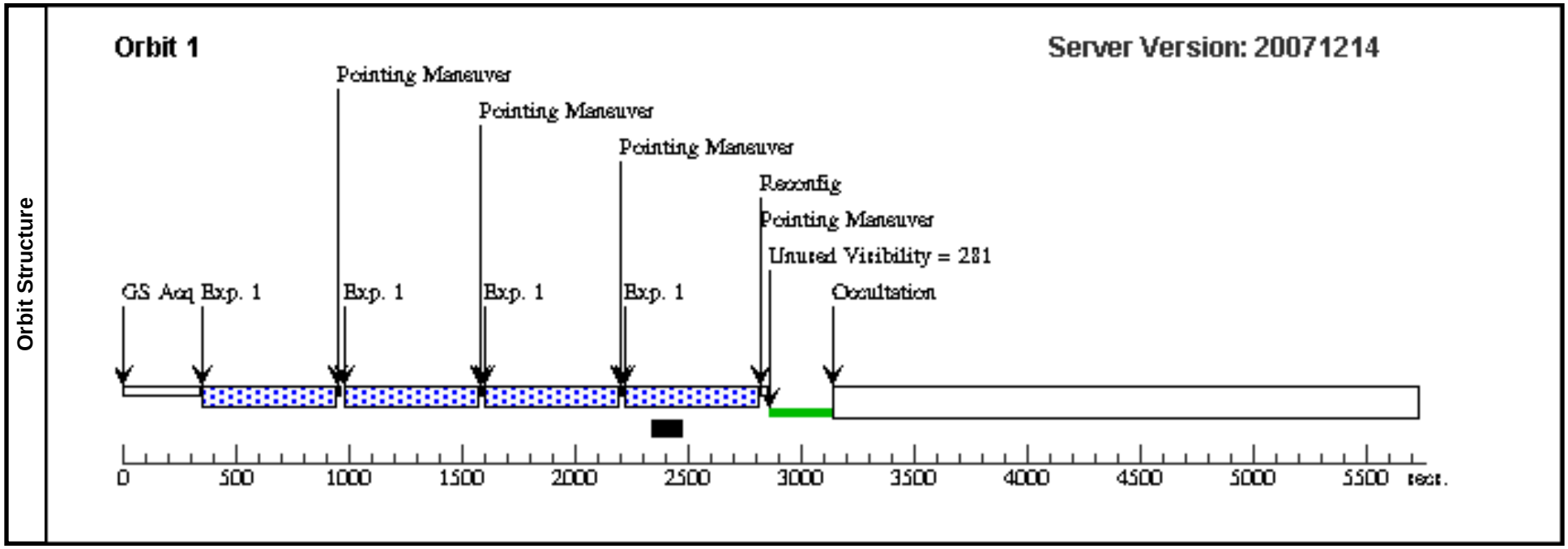
#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=NIC-SQUARE-WAVE-DITH Purpose=DITHER Number Of Points=4 Point Spacing=2.0 Line Spacing=2.0	Coordinate Frame=POS-TARG Pattern Orientation=90.0 Angle Between Sides=270.0 Center Pattern=true		(1), (2-3)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	GRS1758-258	RA: 18 01 12.4000 (270.3016667d) Dec: -25 44 36.10 (-25.74336d) Equinox: J2000		V=27 K>=17.5, J>=19.9, E(B-V)=2.196, K_nearby_star_A=14	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) GRS1758-258	NIC1, MULTIACCUM, NIC1	F110W	SAMP-SEQ=STEP32; NSAMP=25		Pattern 1-1 (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2		(1) GRS1758-258	NIC2, MULTIACCUM, NIC2	F160W	SAMP-SEQ=STEP16; NSAMP=25		Pattern 2-3 (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***
3		(1) GRS1758-258	NIC2, MULTIACCUM, NIC2	F205W	SAMP-SEQ=STEP16; NSAMP=25		Pattern 2-3 (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***


Orbit Structure
Orbit 1
Server Version: 20071214
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Reconfig
Pointing Maneuver
Unused Visibility = 281
GS Acq
Exp. 1
Exp. 1
Exp. 1
Exp. 1
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec.

Orbit Structure (continued)