



11001 - Fallback Debris Disks Around Neutron Stars

Cycle: 15, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>	<i>E-Mail</i>
Prof. Deepto Chakrabarty (PI)	Massachusetts Institute of Technology	deepto@space.mit.edu
Dr. Zhongxiang Wang (CoI)	Massachusetts Institute of Technology	wangzx@space.mit.edu
Dr. David L. Kaplan (CoI)	Massachusetts Institute of Technology	dlk@space.mit.edu

VISITS

<i>Visit</i>	<i>Targets used in Visit</i>	<i>Configurations used in Visit</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
01	(1) RXJ0822.0-4300	NIC2	6	31-Aug-2006 21:57:04.0	yes
02	(1) RXJ0822.0-4300	ACS/WFC	3	31-Aug-2006 21:57:17.0	yes

9 Total Orbits Used

ABSTRACT

Our Spitzer/IRAC discovery of a dusty debris disk around the young neutron star 4U 0142+61 is the first detection of a fallback disk around a neutron star. Fallback, the notion that some material from a supernova explosion could remain bound to the compact remnant, is a general prediction of core-collapse supernova models, yet until now there were few if any meaningful observational constraints on the size (or existence) of such disks. Here we propose to test the ubiquity of such disks with deep IRAC observations of two young neutron stars, each a representative of a different

class of object (a rotation-powered pulsar and a radio-quiet neutron star in a supernova remnant). We will examine whether fallback disks are common to all neutron stars or depend on the factors that separate these classes. Our proposed observations will pave the way for future surveys and in-depth investigations of individual objects.

OBSERVING DESCRIPTION

With HST, we choose to use ACS/WFC with the i' filter in the optical and NICMOS/Nic2 with the F160W filter (approximately H-band) in the near-IR. These will allow very deep exposures that have wavelength coverage to complement the Spitzer observations. We used a visual extinction $A_V=1.6$ for exposure-time calculations based on the column density inferred from the X-ray. Using the ACS imaging ETC, we find that we will need 150 min of HST time (3 orbits, with a visibility time of 53 min per orbit) to reach the desired level of $i'=27.5$ mag with $S/N=5$. With ACS, we will use only a single WFC chip for a 100×200 arcsec field-of-view; this will allow us to avoid the $V=9.7$ star HD 70745. Given that the WFC is only marginally sampled, we will use four dithered exposures of 9 min in each orbit for spatial sampling and psf reconstruction.

Using the NICMOS imaging ETC, we find that we need 285 min on-source (6 orbits) to reach $H=25.3$ mag with $S/N=5$. (Both of these include instrumental overheads). We will use MULTIACCUM readout with Step=16, Nsamp=25, a 8-point spiral dither and 304-s exposures to make sure that we achieve full spatial sampling and can correctly measure the background. The full HST request is then 9 orbits.

Proposal 11001 - Visit 01 - Fallback Debris Disks Around Neutron Stars

Visit	Proposal 11001, Visit 01, implementation										Fri Sep 01 01:57:23 GMT 2006	
	Diagnostic Status: No Diagnostics											
	Scientific Instruments: NIC2											
	Special Requirements: (none)											
Patterns	#	Primary Pattern				Secondary Pattern				Exposures		
	(1)	Pattern Type=NIC-SPIRAL-DITH Purpose=DITHER Number Of Points=2 Point Spacing=1.537 Line Spacing=		Coordinate Frame=POS-TARG Pattern Orientation=0 Angle Between Sides= Center Pattern=false						(1), (2), (3), (4), (5), (6)		
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous			
	(1)	RXJ0822.0-4300	RA: 08 21 58.2000 (125.4925000d) Dec: -43 00 22.00 (-43.00611d) Equinox: J2000				V=30.0		Reference Frame: ICRS			
Exposures	#	Label	Target	Config,Mode,Aperture		Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]		Orbit
	1	NICMOS	(1) RXJ0822.0-4300	NIC2, MULTIACCUM, NIC2		F160W	NSAMP=12; SAMP-SEQ=SPARS 128; CAMERA-FOCUS=DEF; OFFSET=SAM		Pattern 1-1 (1)	[==>(Pattern 1)] [==>(Pattern 2)]		[1]
	2	NICMOS	(1) RXJ0822.0-4300	NIC2, MULTIACCUM, NIC2		F160W	NSAMP=12; SAMP-SEQ=SPARS 128; CAMERA-FOCUS=DEF; OFFSET=SAM	POS TARG 1,0	Pattern 2-2 (1)	[==>(Pattern 1)] [==>(Pattern 2)]		[2]
	3	NICMOS	(1) RXJ0822.0-4300	NIC2, MULTIACCUM, NIC2		F160W	NSAMP=12; SAMP-SEQ=SPARS 128; CAMERA-FOCUS=DEF; OFFSET=SAM	POS TARG 0,1	Pattern 3-3 (1)	[==>(Pattern 1)] [==>(Pattern 2)]		[3]
	4	NICMOS	(1) RXJ0822.0-4300	NIC2, MULTIACCUM, NIC2		F160W	NSAMP=12; SAMP-SEQ=SPARS 128; CAMERA-FOCUS=DEF; OFFSET=SAM	POS TARG 1,1	Pattern 4-4 (1)	[==>(Pattern 1)] [==>(Pattern 2)]		[4]

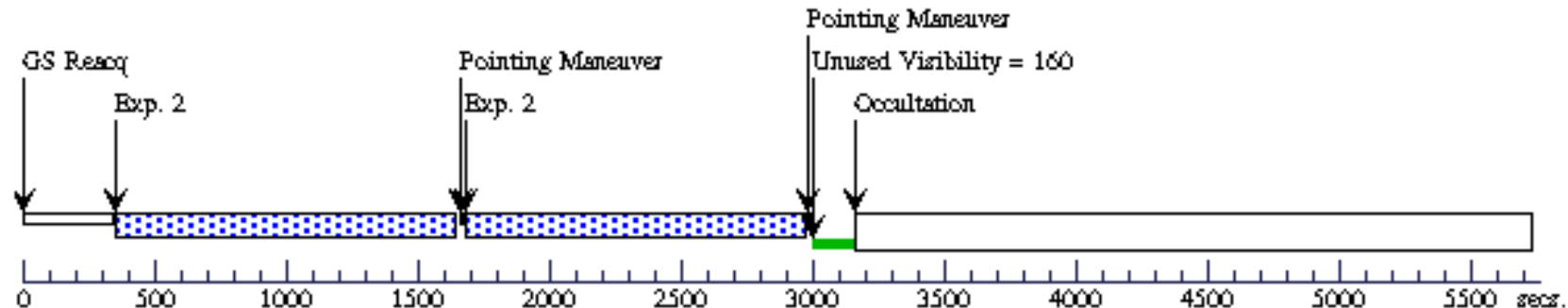
Proposal 11001 - Visit 01 - Fallback Debris Disks Around Neutron Stars

Exposures (continued)	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	5	NICMOS	(1) RXJ0822.0-4300	NIC2, MULTIACCUM, NIC2	F160W	NSAMP=12; SAMP-SEQ=SPARS 128; CAMERA-FOCUS= DEF; OFFSET=SAM	POS TARG -1,0	Pattern 5-5 (1)	[==>(Pattern 1)] [==>(Pattern 2)]	[5]
	6	NICMOS	(1) RXJ0822.0-4300	NIC2, MULTIACCUM, NIC2	F160W	NSAMP=12; SAMP-SEQ=SPARS 128; CAMERA-FOCUS= DEF; OFFSET=SAM	POS TARG 0,-1	Pattern 6-6 (1)	[==>(Pattern 1)] [==>(Pattern 2)]	[6]
Orbit Structure	Orbit 1 Server Version: 20060619									

Orbit Structure (continued)

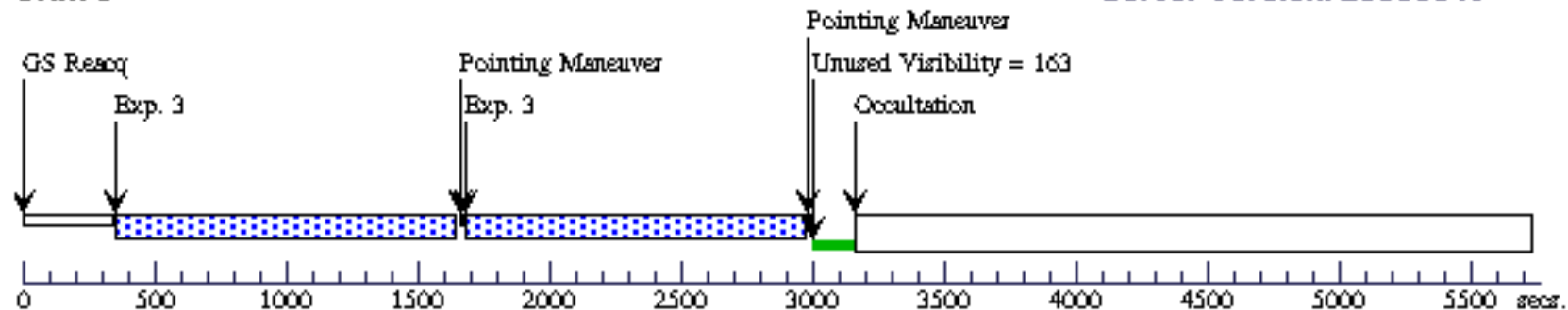
Orbit 2

Server Version: 20060619



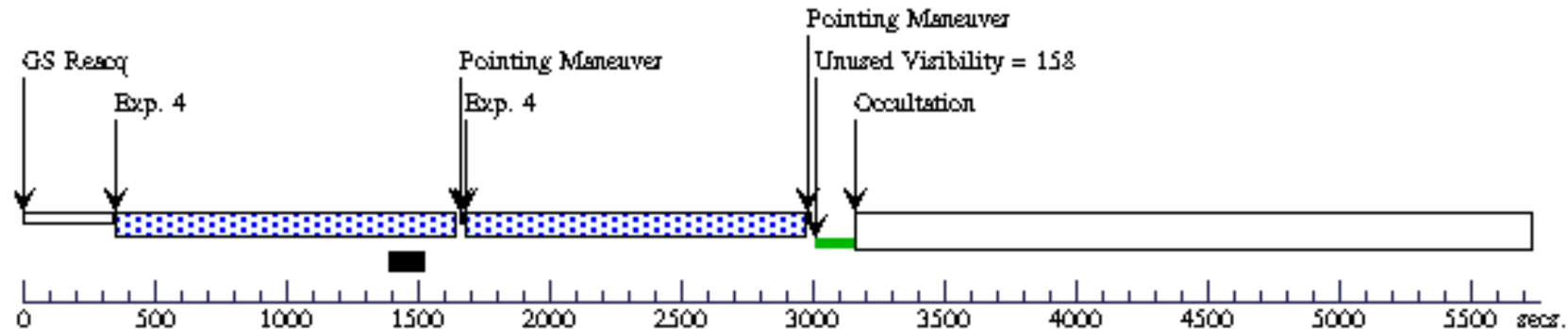
Orbit 3

Server Version: 20060619



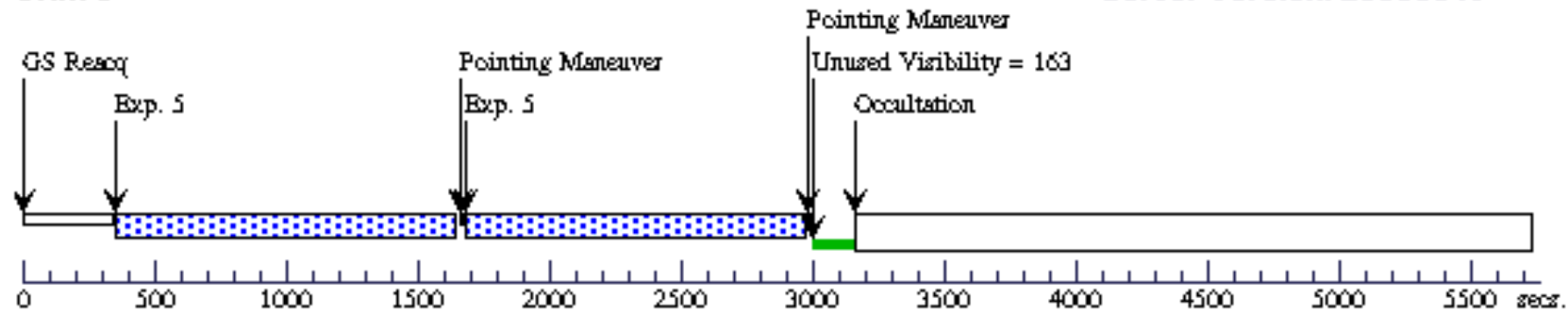
Orbit 4

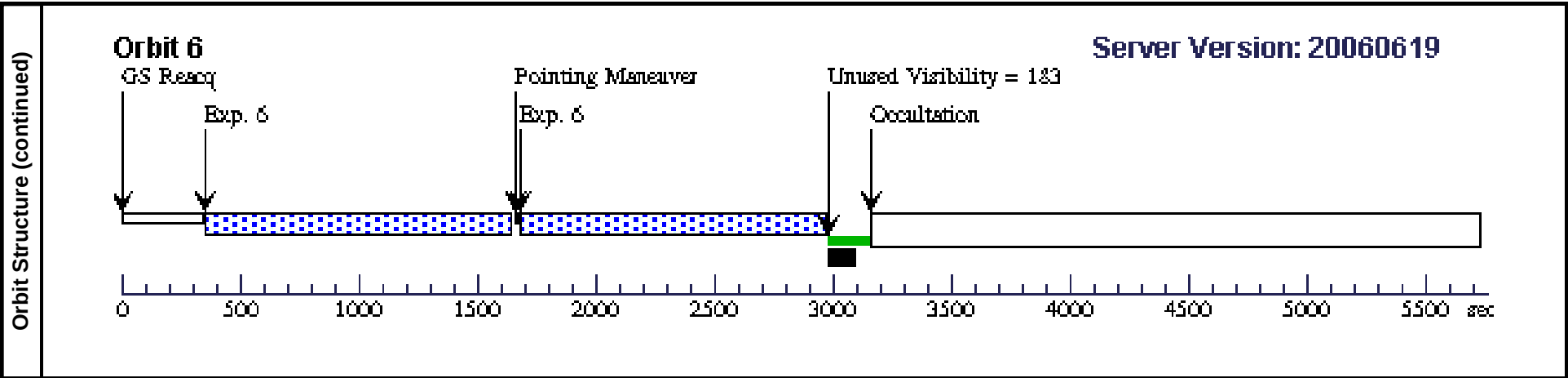
Server Version: 20060619



Orbit 5

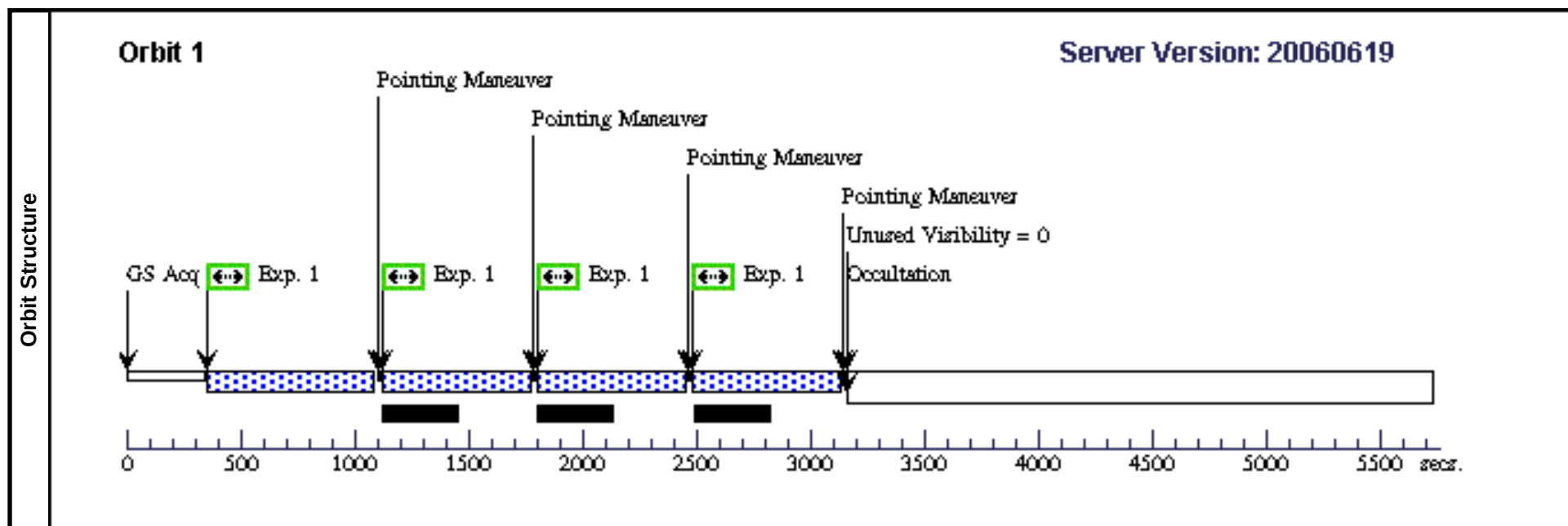
Server Version: 20060619





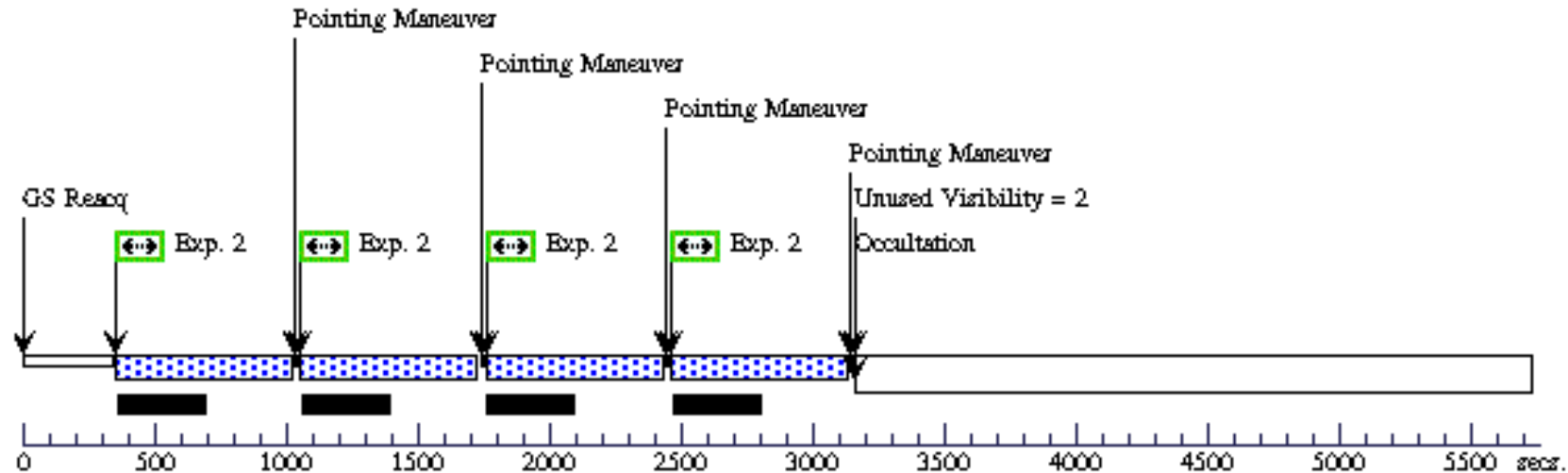
Proposal 11001 - Visit 02 - Fallback Debris Disks Around Neutron Stars

Visit	Proposal 11001, Visit 02, implementation										Fri Sep 01 01:57:25 GMT 2006		
	Diagnostic Status: No Diagnostics												
	Scientific Instruments: ACS/WFC												
	Special Requirements: ORIENT 170.0D TO 225.0 D; ORIENT 350.0D TO 40.0 D												
Patterns	#	Primary Pattern					Secondary Pattern				Exposures		
	(2)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.265 Line Spacing=0.187			Coordinate Frame=POS-TARG Pattern Orientation=20.7 Angle Between Sides=69.1 Center Pattern=false						(1), (2), (3)		
Fixed Targets	#	Name		Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous			
	(1)	RXJ0822.0-4300		RA: 08 21 58.2000 (125.4925000d) Dec: -43 00 22.00 (-43.00611d) Equinox: J2000				V=30.0		Reference Frame: ICRS			
Exposures	#	Label	Target	Config,Mode,Aperture		Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]		Orbit	
	1	ACS	(1) RXJ0822.0-4300	ACS/WFC, ACCUM, WFC1		F775W	CR-SPLIT=NO		Pattern 1-1 (2)	500.0 Secs		[1]	
										[==>527.0 Secs (Pattern 1)]			
										[==>527.0 Secs (Pattern 2)]			
										[==>527.0 Secs (Pattern 3)]			
										[==>527.0 Secs (Pattern 4)]			
	2	ACS	(1) RXJ0822.0-4300	ACS/WFC, ACCUM, WFC1		F775W	CR-SPLIT=NO	POS TARG 1,0	Pattern 2-2 (2)	500.0 Secs		[2]	
										[==>547.0 Secs (Pattern 1)]			
										[==>547.0 Secs (Pattern 2)]			
										[==>547.0 Secs (Pattern 3)]			
										[==>547.0 Secs (Pattern 4)]			
	3	ACS	(1) RXJ0822.0-4300	ACS/WFC, ACCUM, WFC1		F775W	CR-SPLIT=NO	POS TARG 0,1	Pattern 3-3 (2)	500.0 Secs		[3]	
										[==>552.0 Secs (Pattern 1)]			
										[==>552.0 Secs (Pattern 2)]			
										[==>552.0 Secs (Pattern 3)]			
										[==>552.0 Secs (Pattern 4)]			



Orbit 2

Server Version: 20060619



Orbit 3

Server Version: 20060619

