



14849 - The 3C111 Jet: X-ray Variability, Spectrum & Broadband SED

Cycle: 24, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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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) 3C-111-NORTH (2) 3C-111-SOUTH (3) 3C-111-POS3	WFC3/IR	3	09-Nov-2016 12:30:53.0	yes
02	(2) 3C-111-SOUTH	WFC3/IR	2	09-Nov-2016 12:30:55.0	yes

5 Total Orbits Used

ABSTRACT

The discovery of X-ray emission from AGN jets is a touchstone of the Chandra mission. Their X-ray emission processes have become the source of much debate, with implications for both jet physics and cluster feedback models. 3C111 has an extraordinary 2-arcminute long jet that is seen in X-

ray, near-IR and radio. At least 8 knots, plus both approaching and receding hotspots and lobes, are seen in the Chandra image. We request additional Chandra, HST and NuSTAR observations, to follow up on possible evidence of variability in two knots, pin down the knots' X-ray spectrum and SED, detect the jet above 10 keV, and study the morphology and X-ray spectrum of the extended lobes. These observations will place the tightest constraints yet on the physics of this fascinating system.

OBSERVING DESCRIPTION

We will obtain images of 3C 111, its jet, hotspots, and lobes with WFC3/IR (F110W, F140W, and F160W). This will allow us to characterize all jet components as well as the hotspots in the near-IR, obtain morphological information, and also optical and broadband spectral energy distributions. The latter will allow the fitting of synchrotron emission models.

These observations are to occur within 30 days of the approved Chandra observations (this program was approved in the Chandra review). Two pointings are necessary to image both of the hotspots and lobes given the large angular size of the system.

The northern jet pointing (Visit 01) is restricted to an orientation range of 87 to 107 or 122 to 137 degrees in order to include both the AGN core and the hotspot, while avoiding diffraction spikes overlapping the jet. A -90 degree rotation from this would fit everything in the field of view, however there would be a danger of the "Death Star" overlapping the hotspot region, and so we have not included that orientation range. Other rotations of 90 degrees would exclude either the core or the hotspot. In Visit 01, we have added in orbits 2 and 3 short exposures on the southern jet in order to obtain an F160W flux of the hotspot only (this integration time is just adequate to obtain 10 sigma on the S hotspot itself).

The southern jet pointing (Visit 02) requires a much tighter restriction on the orientation range of 15 degrees (87 to 102 degrees). This is needed to include important regions of the northern jet as well as the southern lobe, while also avoiding the diffraction spike from the AGN core overlapping the jet. A very bright star north of the southern lobe further constricts the orientation range because we cannot have its diffraction spike(s) overlapping the southern hotspot/lobe. This is necessary to constrain the SED of the southern lobe (which is detected in the radio and the X-ray).

Due to the tight constraint on the orientation range of the southern pointing, we have separated it into a separate visit to make scheduling easier.

Proposal 14849 - Visit 01 - The 3C111 Jet: X-ray Variability, Spectrum & Broadband SED

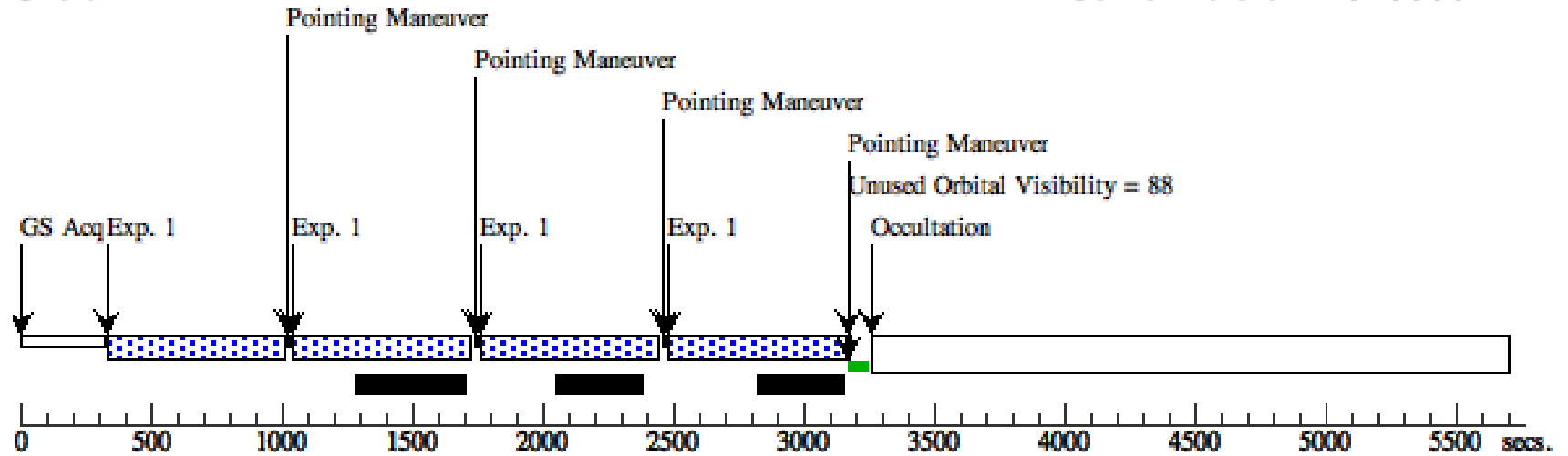
Wed Nov 09 17:30:56 GMT 2016

Visit	Proposal 14849, Visit 01, implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR Special Requirements: ORIENT 70D TO 70 D					
	Patterns	#	Primary Pattern	Secondary Pattern	Exposures	
(1)		Pattern Type=WFC3-IR-DITHER-BLOB Purpose=DITHER Number Of Points=2 Point Spacing=5.183 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.859 Angle Between Sides= Center Pattern=true	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false	(1), (2), (4)
(2)		Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false			(3), (5)
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	3C-111-NORTH	RA: 04 18 25.5000 (64.6062500d) Dec: +38 02 2.03 (38.03390d) Equinox: J2000		V=18.05	Reference Frame: ICRS
	(2)	3C-111-SOUTH	RA: 04 18 18.6686 (64.5777858d) Dec: +38 01 21.77 (38.02271d) Equinox: J2000		V=18.05	Reference Frame: ICRS
	(3)	3C-111-POS3	RA: 04 18 18.8450 (64.5785208d) Dec: +38 01 17.06 (38.02141d) Equinox: J2000		V=18.05	Reference Frame: ICRS

Proposal 14849 - Visit 01 - The 3C111 Jet: X-ray Variability, Spectrum & Broadband SED

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(1) 3C-111-NORTH	WFC3/IR, MULTIACCUM, IR	F110W	SAMP-SEQ=SPARS 50; NSAMP=14	GS ACQ SCENARI O BASE1B3	Pattern 1, Exps 1-1 i n Visit 01 (1)	652.938154 Secs (2611.753 Secs)		
								[==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 2,1)] [==>(Pattern 2,2)]	[1]	
	2	(1) 3C-111-NORTH	WFC3/IR, MULTIACCUM, IR	F140W	SAMP-SEQ=STEP1 00; NSAMP=12		Pattern 1, Exps 2-2 i n Visit 01 (1)	599.232292 Secs (2396.929 Secs)		
								[==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 2,1)] [==>(Pattern 2,2)]	[2]	
	3	(2) 3C-111-SOUTH	WFC3/IR, MULTIACCUM, IR	F160W	SAMP-SEQ=STEP2 5; NSAMP=9		Pattern 2, Exps 3-3 i n Visit 01 (2)	124.231771 Secs (248.464 Secs)		
							[==>(Pattern 1)] [==>(Pattern 2)]	[2]		
4	(1) 3C-111-NORTH	WFC3/IR, MULTIACCUM, IR	F160W	SAMP-SEQ=STEP1 00; NSAMP=12		Pattern 1, Exps 4-4 i n Visit 01 (1)	599.232292 Secs (2396.929 Secs)			
							[==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 2,1)] [==>(Pattern 2,2)]	[3]		
5	(3) 3C-111-POS3	WFC3/IR, MULTIACCUM, IR	F160W	SAMP-SEQ=STEP2 5; NSAMP=9		Pattern 2, Exps 5-5 i n Visit 01 (2)	124.231771 Secs (248.464 Secs)			
							[==>(Pattern 1)] [==>(Pattern 2)]	[3]		

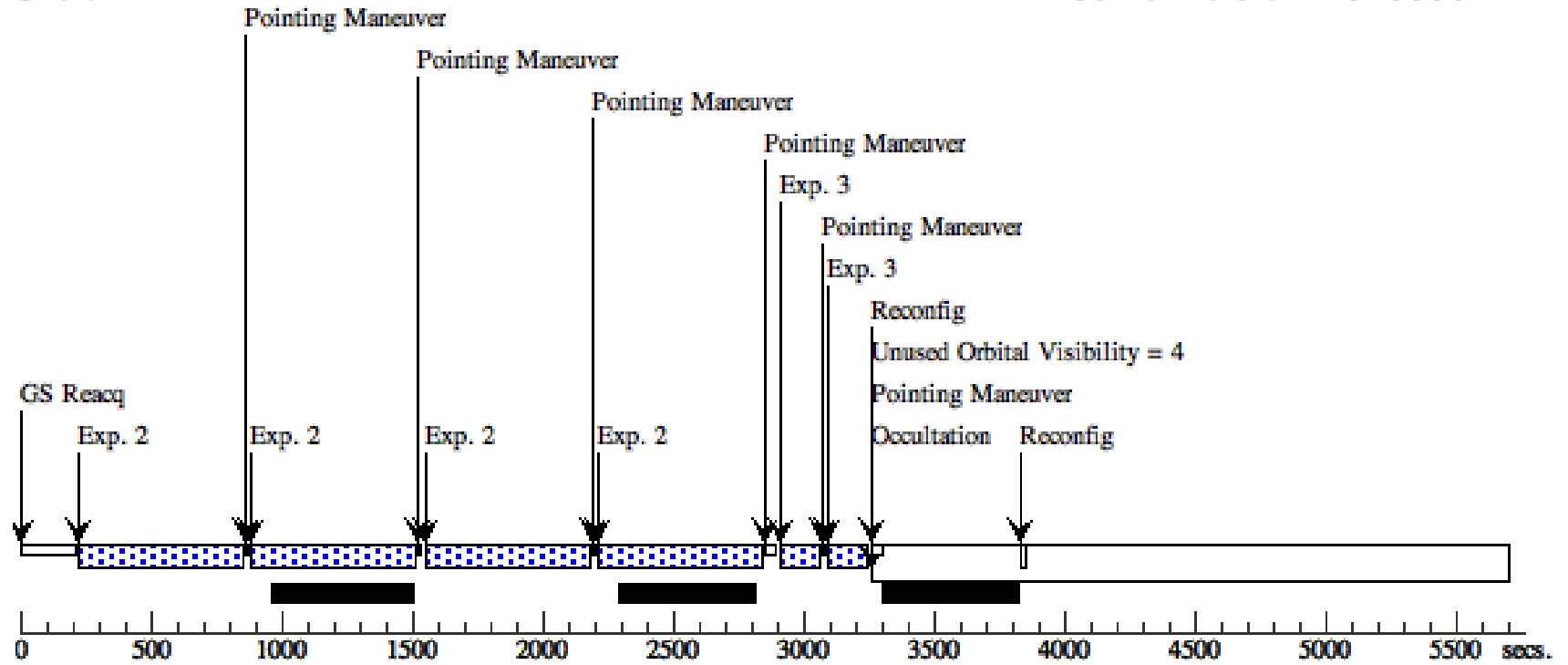
Orbit 1

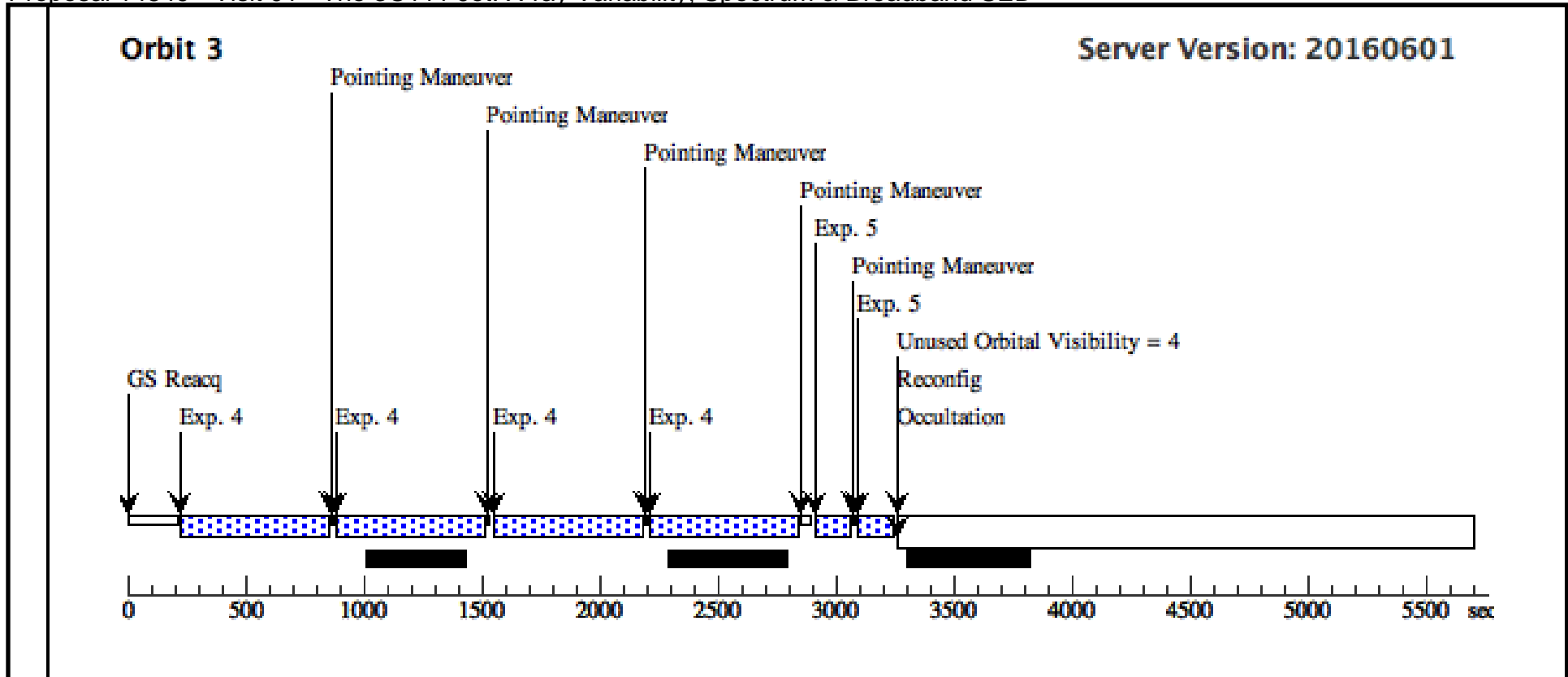


Orbit Structure

Orbit 2

Server Version: 20160601





Proposal 14849 - Visit 02 - The 3C111 Jet: X-ray Variability, Spectrum & Broadband SED

Wed Nov 09 17:30:56 GMT 2016

Visit	Proposal 14849, Visit 02, implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR Special Requirements: ORIENT 70D TO 70 D									
	Patterns	#	Primary Pattern			Secondary Pattern			Exposures	
		(1)	Pattern Type=WFC3-IR-DITHER-BLOB Purpose=DITHER Number Of Points=2 Point Spacing=5.183 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.859 Angle Between Sides= Center Pattern=true	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false	(1), (2)			
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(2)	3C-111-SOUTH	RA: 04 18 18.6686 (64.5777858d) Dec: +38 01 21.77 (38.02271d) Equinox: J2000		V=18.05	Reference Frame: ICRS				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(2) 3C-111-SOUTH	WFC3/IR, MULTIACCUM, IR	F140W	SAMP-SEQ=SPARS 50; NSAMP=14	GS ACQ SCENARIO BASE1B3	Pattern 1, Exps 1-1 in Visit 02 (1)	652.938154 Secs (2611.753 Secs) [==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 2,1)] [==>(Pattern 2,2)]	[1]
2		(2) 3C-111-SOUTH	WFC3/IR, MULTIACCUM, IR	F110W	SAMP-SEQ=STEP100; NSAMP=13		Pattern 1, Exps 2-2 in Visit 02 (1)	699.232615 Secs (2796.93 Secs) [==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 2,1)] [==>(Pattern 2,2)]	[2]	

