



11216 - HST / Chandra Monitoring of a Dramatic Flare in the M87 Jet

Cycle: 16, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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Dr. John A. Biretta (PI)	Space Telescope Science Institute	biretta@stsci.edu
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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>
10	(1) M87-JET	WFPC2	1	18-Jan-2008 04:05:57.0	yes
11	(1) M87-JET	WFPC2	1	18-Jan-2008 04:06:02.0	yes
12	(1) M87-JET	WFPC2	1	18-Jan-2008 04:06:07.0	yes
20	(1) M87-JET	WFPC2	1	18-Jan-2008 04:06:11.0	yes
30	(1) M87-JET	WFPC2	1	18-Jan-2008 04:06:13.0	yes
40	(1) M87-JET	WFPC2	1	18-Jan-2008 04:06:16.0	yes
50	(1) M87-JET	WFPC2	1	18-Jan-2008 04:06:18.0	yes
51	(1) M87-JET	WFPC2	1	18-Jan-2008 04:06:21.0	yes

<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>
52	(1) M87-JET	WFPC2	1	18-Jan-2008 04:06:25.0	yes

9 Total Orbits Used

ABSTRACT

As the nearest galaxy with an optical jet, M87 affords an unparalleled opportunity to study extragalactic jet phenomena at the highest resolution. During 2002, HST and Chandra monitoring of the M87 jet detected a dramatic flare in knot HST-1 located ~1" from the nucleus. Its optical brightness eventually increased seventy-fold and peaked in 2005; the X-rays show a similarly dramatic outburst. In both bands HST-1 is still extremely bright and greatly outshines the galaxy nucleus. To our knowledge this is the first incidence of an optical or X-ray outburst from a jet region which is spatially distinct from the core source -- this presents an unprecedented opportunity to study the processes responsible for non-thermal variability and the X-ray emission.

We propose five epochs of HST/WFPC2 flux monitoring during Cycle 16, as well as seven epochs of Chandra/ACIS observation (5ksec each, six Chandra epochs contemporary with HST). At two of the HST/WFPC2 epochs we also gather spectral information, and at one epoch we will map the magnetic field structure. The results of this investigation are of key importance not only for understanding the nature of the X-ray emission of the M87 jet, but also for understanding flares in blazar jets, which are highly variable, but where we have never before been able to resolve the flaring region in the optical or X-rays. These new observations will allow us to track the decay phase of the giant flare, and study smaller secondary flares such as

seen late in 2006. Ultimately we will test synchrotron emission models for the X-ray outburst, constrain particle acceleration and loss timescales, and study the jet dynamics associated with this flaring component.

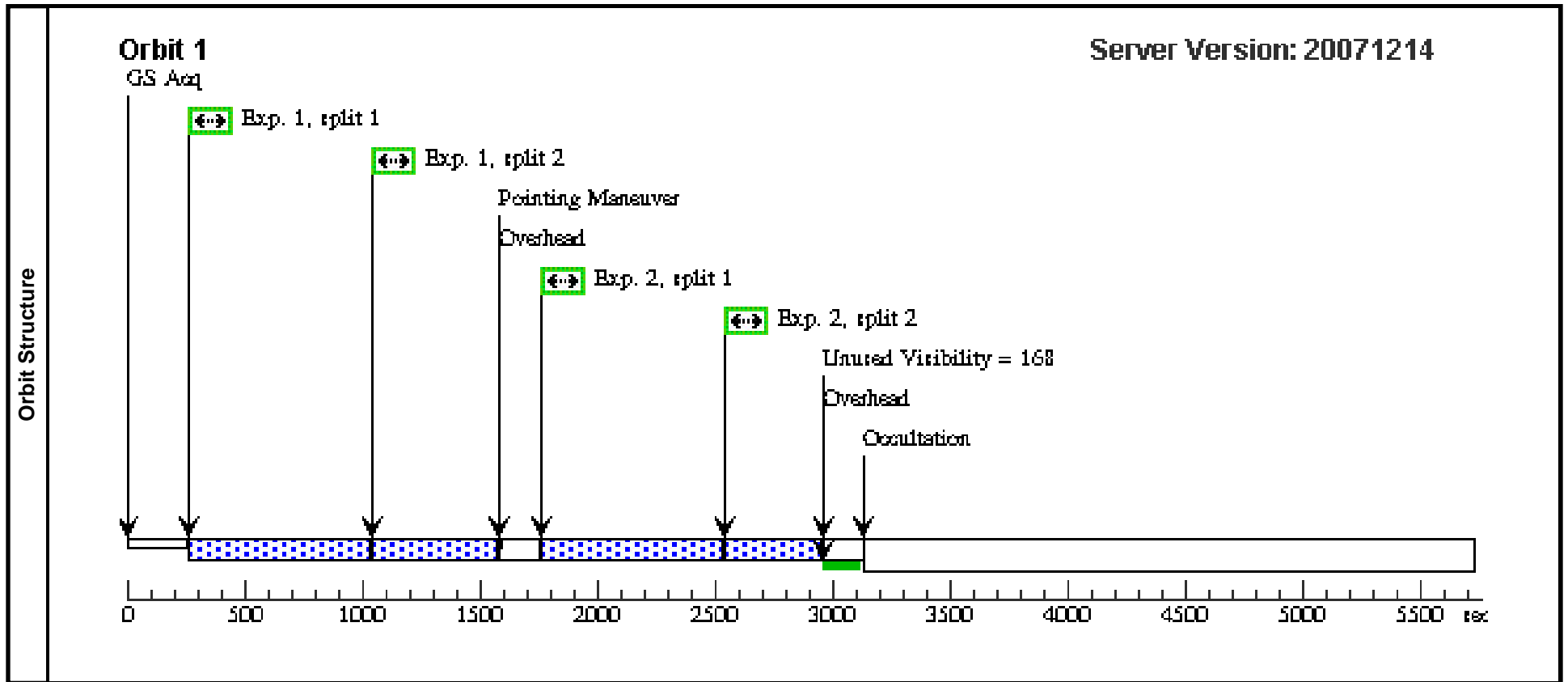
OBSERVING DESCRIPTION

There are 5 epochs represented by the first digit of the visit number. All epochs have one orbit of F255W imaging, which is close in wavelength to prior STIS and ACS/HRC data. Epochs 1 and 5 add spectral information in F450W, F606W, and F814W. The first epoch also contains F606W polarimetry in the WFC CCDs (visit 12). All imaging is on the PC, except for the polarimetry. Visits 10, 11, 12, 20 use single guidestars due to scheduling problems.

Proposal 11216 - Visit 10 - HST / Chandra Monitoring of a Dramatic Flare in the M87 Jet

Fri Jan 18 09:06:29 GMT 2008

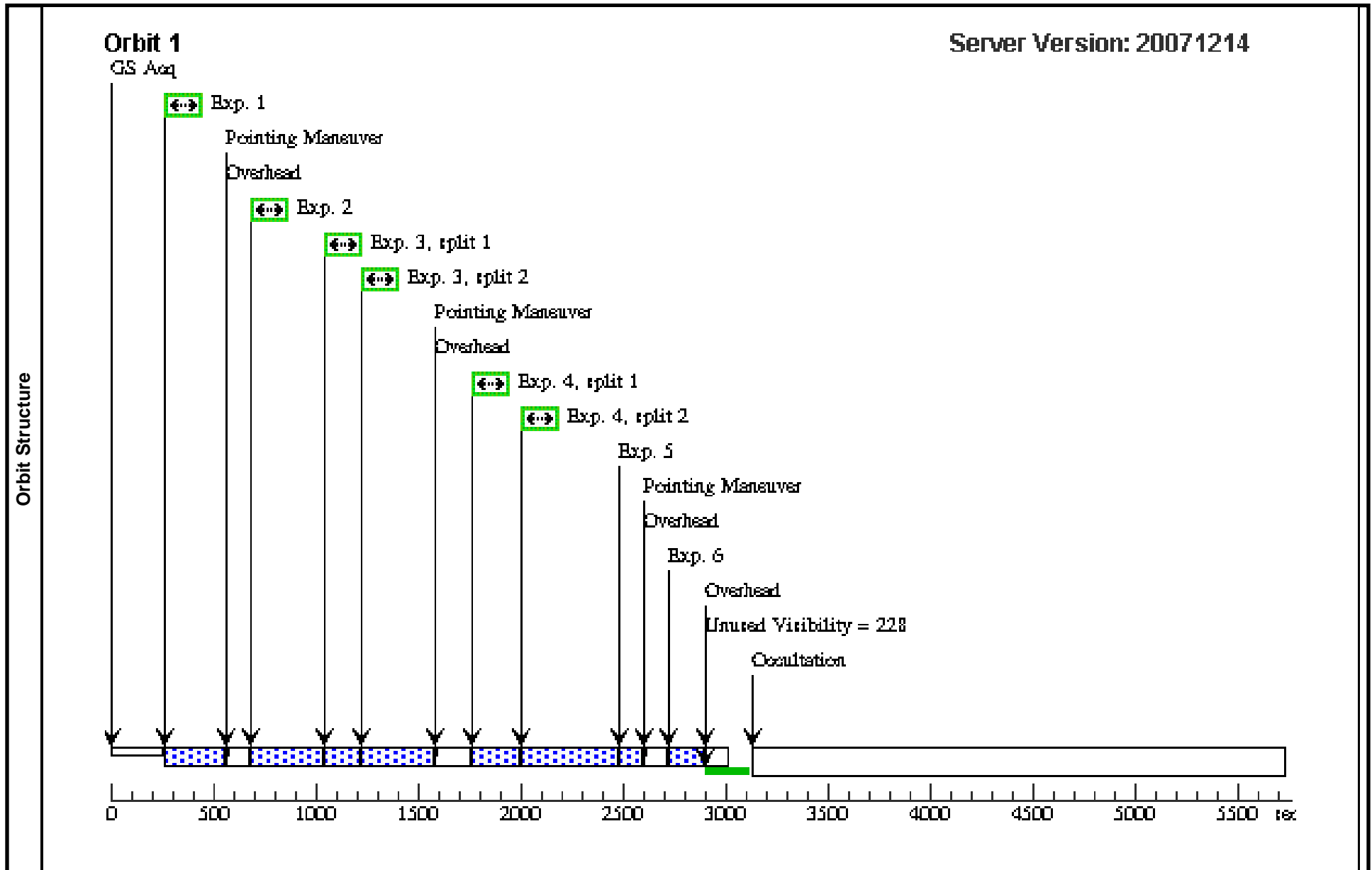
Visit	Proposal 11216, Visit 10, implementation Diagnostic Status: Warning Scientific Instruments: WFPC2 Special Requirements: PCS MODE FINE; BETWEEN 12-NOV-2007:00:00:00 AND 30-NOV-2007:00:00:00 <i>Comments: Please schedule as close as possible to Chandra observations on 15 Nov 2007. Single guide star.</i>																																		
	Diagnosics (Visit 10) Warning (OP): EXPOSURE TIME DECREASED FOR WFPC (Visit 10) Warning (OP): EXPOSURE TIME DECREASED FOR WFPC (Visit 10) Warning (OP): EXPOSURE TIME DECREASED FOR WFPC (Visit 10) Warning (OP): EXPOSURE TIME DECREASED FOR WFPC																																		
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Proposal 11216 - Visit 11 - HST / Chandra Monitoring of a Dramatic Flare in the M87 Jet

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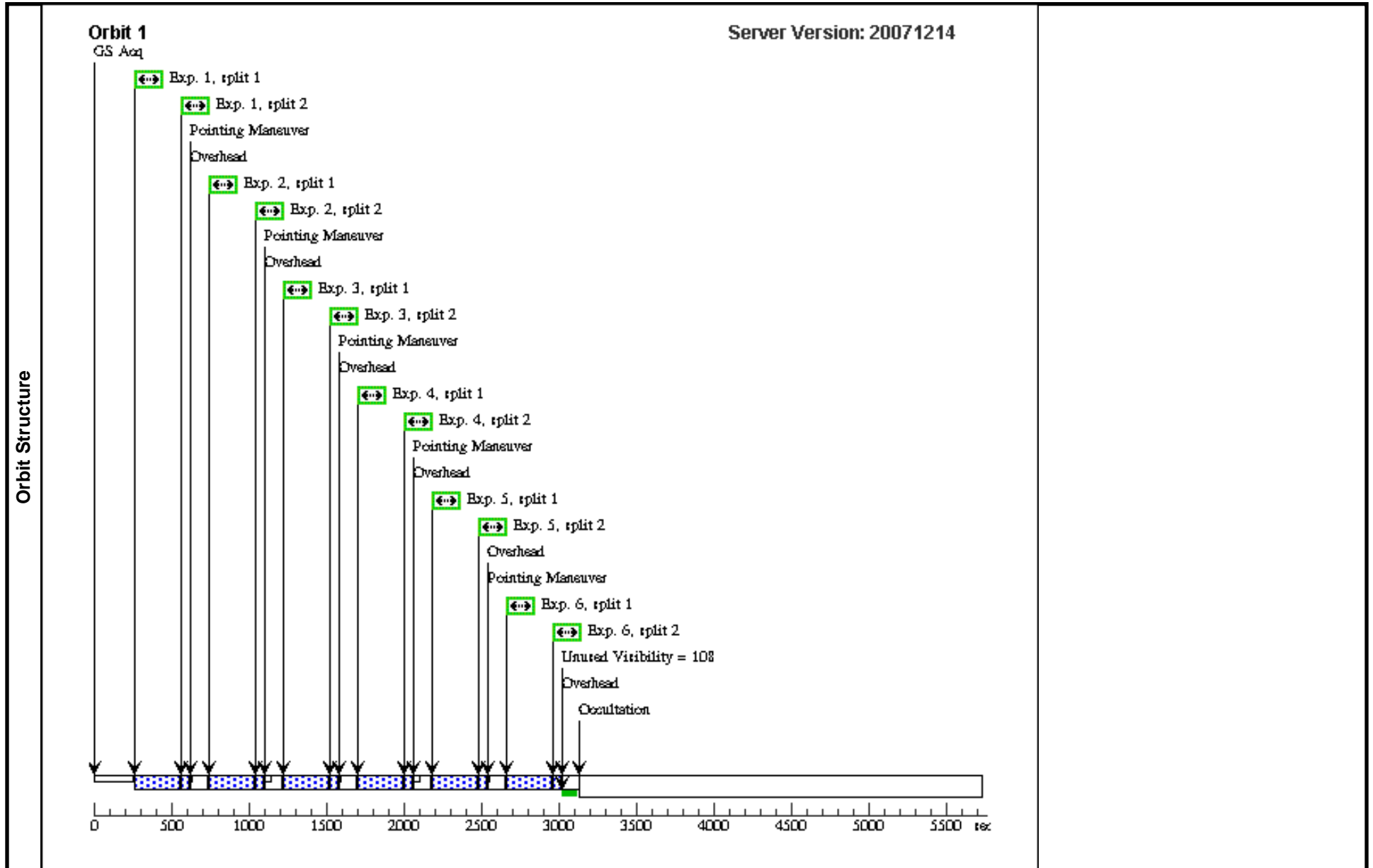
Visit	Proposal 11216, Visit 11, implementation Diagnostic Status: Warning Scientific Instruments: WFPC2 Special Requirements: PCS MODE FINE; SAME ORIENT AS 10; GROUP 11,10 WITHIN 1.0D <i>Comments: Please schedule as close as possible to Chandra observations on 15 Nov 2007. Single guide star.</i>																																																																															
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Proposal 11216 - Visit 12 - HST / Chandra Monitoring of a Dramatic Flare in the M87 Jet

Fri Jan 18 09:06:30 GMT 2008

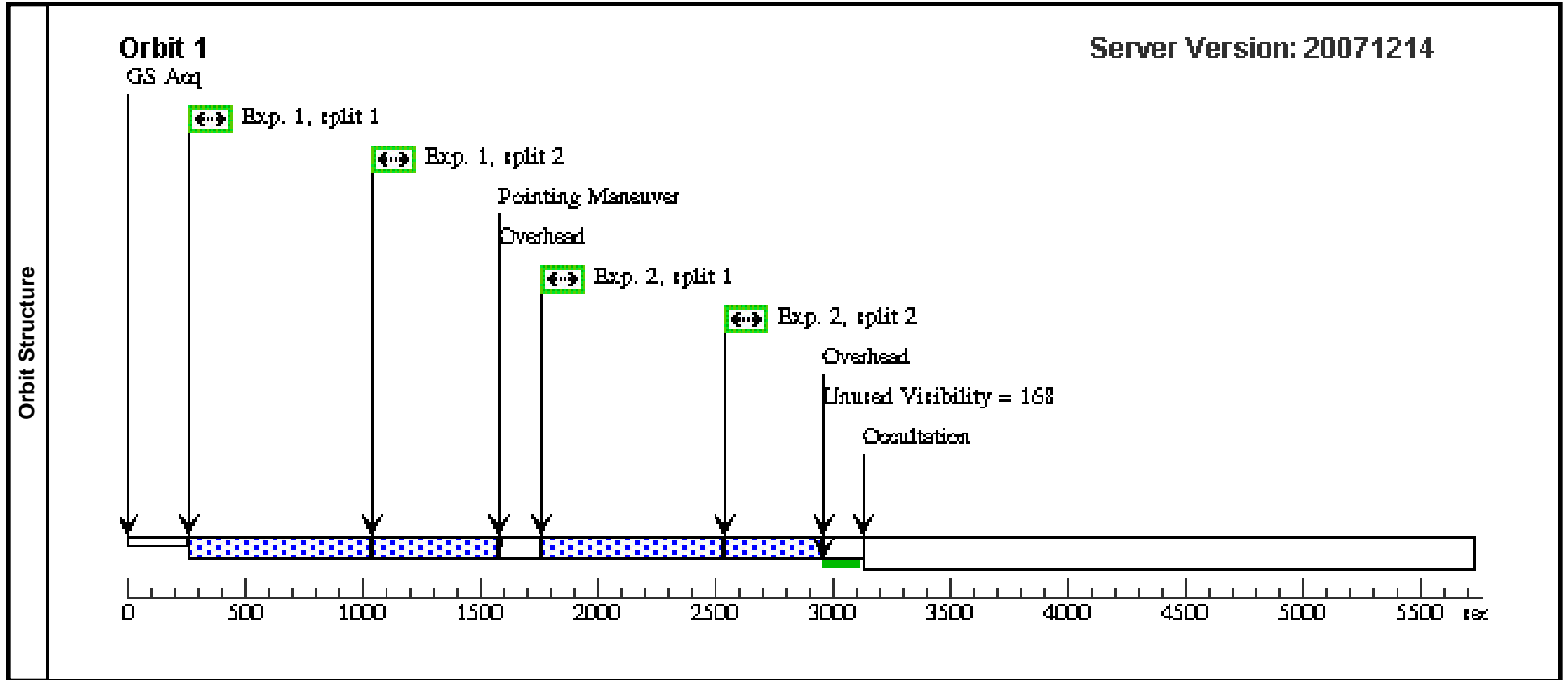
Visit	Proposal 11216, Visit 12, implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFPC2 Special Requirements: PCS MODE FINE; SAME ORIENT AS 10; GROUP 12,10 WITHIN 1.0D <i>Comments: Please schedule as close as possible to Chandra observations on 15 Nov 2007. Single guide star.</i>									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
	(1)	M87-JET	RA: 12 30 48.8200 (187.7034167d) Dec: +12 23 30.89 (12.39191d) Equinox: J2000		V=16.7	Reference Frame: ICRS				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	(1) M87-JET	WFPC2, IMAGE, WF2	F606W POLQ	CR-SPLIT=0.5; CR-TOLERANCE= 0	GS ACQ SCENARI O SINGLE	80.0 Secs [==>(Split 1)] [==>(Split 2)]		[1]	
	2	(1) M87-JET	WFPC2, IMAGE, WF2	F606W POLQ	CR-SPLIT=0.50; CR-TOLERANCE= 0	POS TARG 0.25,0.2 5	80.0 Secs [==>(Split 1)] [==>(Split 2)]		[1]	
	3	(1) M87-JET	WFPC2, IMAGE, WF3	F606W POLQ	CR-SPLIT=0.5; CR-TOLERANCE= 0	POS TARG 0.25,0.2 5	80.0 Secs [==>(Split 1)] [==>(Split 2)]		[1]	
	4	(1) M87-JET	WFPC2, IMAGE, WF3	F606W POLQ	CR-SPLIT=0.50; CR-TOLERANCE= 0		80.0 Secs [==>(Split 1)] [==>(Split 2)]		[1]	
	5	(1) M87-JET	WFPC2, IMAGE, WF4	F606W POLQ	CR-SPLIT=0.50; CR-TOLERANCE= 0		80.0 Secs [==>(Split 1)] [==>(Split 2)]		[1]	
	6	(1) M87-JET	WFPC2, IMAGE, WF4	F606W POLQ	CR-SPLIT=0.5; CR-TOLERANCE= 0	POS TARG 0.25,0.2 5	80.0 Secs [==>(Split 1)] [==>(Split 2)]		[1]	



Proposal 11216 - Visit 20 - HST / Chandra Monitoring of a Dramatic Flare in the M87 Jet

Fri Jan 18 09:06:31 GMT 2008

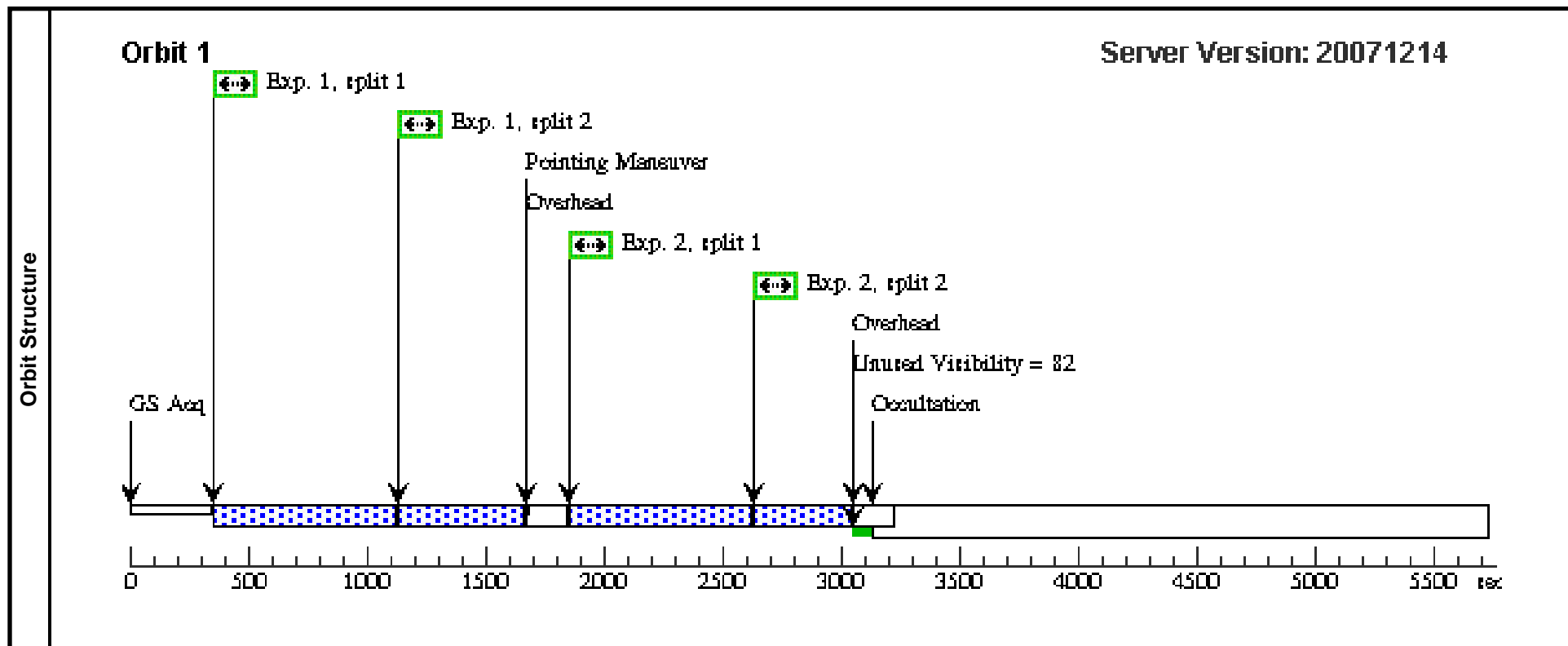
Visit	Proposal 11216, Visit 20, implementation Diagnostic Status: Warning Scientific Instruments: WFPC2 Special Requirements: PCS MODE FINE; BETWEEN 26-DEC-2007:00:00:00 AND 02-JAN-2008:00:00:00 <i>Comments: Please schedule as close as possible to Chandra observations on 29 Dec 2007. Single guide star.</i>																																		
	Diagnosics (Visit 20) Warning (OP): EXPOSURE TIME DECREASED FOR WFPC (Visit 20) Warning (OP): EXPOSURE TIME DECREASED FOR WFPC (Visit 20) Warning (OP): EXPOSURE TIME DECREASED FOR WFPC (Visit 20) Warning (OP): EXPOSURE TIME DECREASED FOR WFPC																																		
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Proposal 11216 - Visit 30 - HST / Chandra Monitoring of a Dramatic Flare in the M87 Jet

Fri Jan 18 09:06:32 GMT 2008

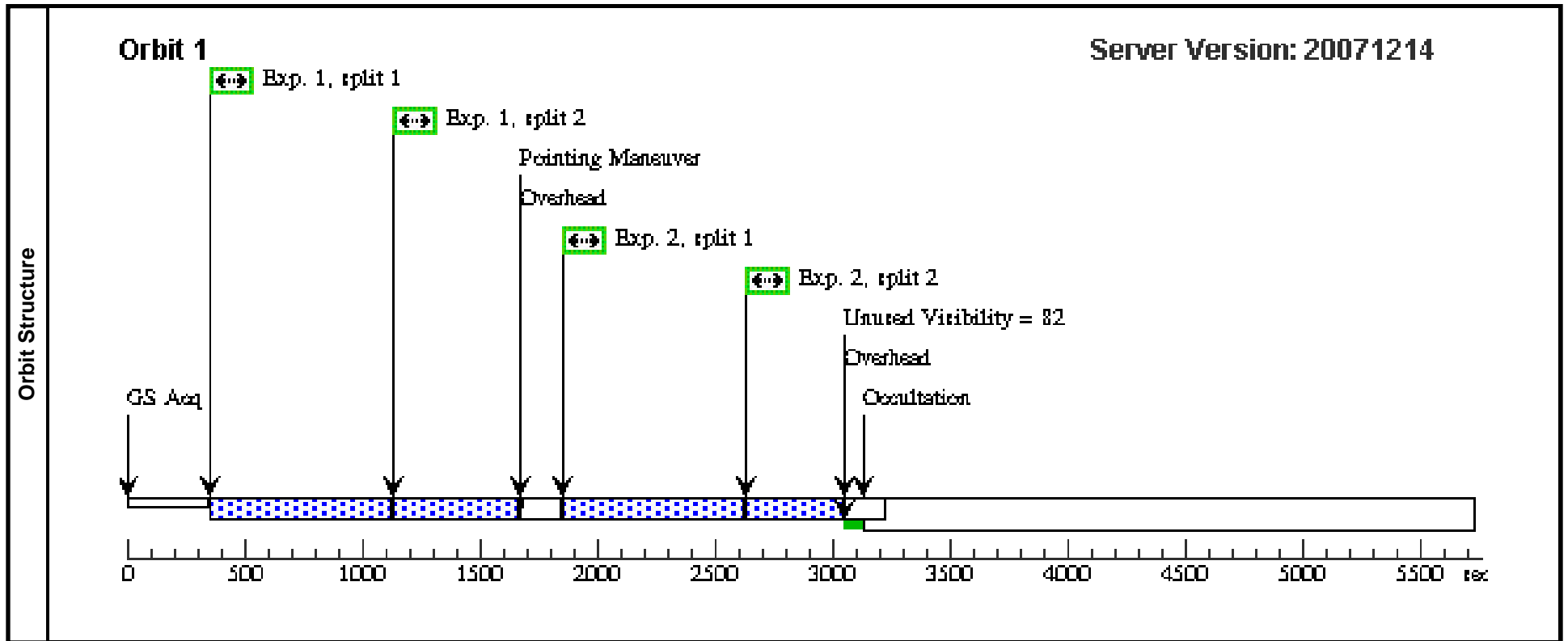
Visit	Proposal 11216, Visit 30, implementation Diagnostic Status: Warning Scientific Instruments: WFPC2 Special Requirements: PCS MODE FINE; BETWEEN 08-FEB-2008:00:00:00 AND 15-FEB-2008:00:00:00 <i>Comments: Please schedule as close as possible to Chandra observations on 12 Feb 2008.</i>																																		
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<table border="1"> <thead> <tr> <th>#</th> <th>Label</th> <th>Target</th> <th>Config,Mode,Aperture</th> <th>Spectral Els.</th> <th>Opt. Params.</th> <th>Special Reqs.</th> <th>Groups</th> <th>Exp. Time/[Actual Dur.]</th> <th>Orbit</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>(1) M87-JET</td> <td>WFPC2, IMAGE, PC1</td> <td>F255W</td> <td>CR-SPLIT=0.5; CR-TOLERANCE=0</td> <td></td> <td></td> <td></td> <td>1001.0 Secs [=>(Split 1)] [=>(Split 2)]</td> <td>[1]</td> </tr> <tr> <td>2</td> <td>(1) M87-JET</td> <td>WFPC2, IMAGE, PC1</td> <td>F255W</td> <td>CR-SPLIT=0.555; CR-TOLERANCE=0</td> <td>POS TARG 0.25,0.2</td> <td>5</td> <td></td> <td>901.0 Secs [=>(Split 1)] [=>(Split 2)]</td> <td>[1]</td> </tr> </tbody> </table>						#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit	1	(1) M87-JET	WFPC2, IMAGE, PC1	F255W	CR-SPLIT=0.5; CR-TOLERANCE=0				1001.0 Secs [=>(Split 1)] [=>(Split 2)]	[1]	2	(1) M87-JET	WFPC2, IMAGE, PC1	F255W	CR-SPLIT=0.555; CR-TOLERANCE=0	POS TARG 0.25,0.2	5		901.0 Secs [=>(Split 1)] [=>(Split 2)]	[1]
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit																										
1	(1) M87-JET	WFPC2, IMAGE, PC1	F255W	CR-SPLIT=0.5; CR-TOLERANCE=0				1001.0 Secs [=>(Split 1)] [=>(Split 2)]	[1]																										
2	(1) M87-JET	WFPC2, IMAGE, PC1	F255W	CR-SPLIT=0.555; CR-TOLERANCE=0	POS TARG 0.25,0.2	5		901.0 Secs [=>(Split 1)] [=>(Split 2)]	[1]																										



Proposal 11216 - Visit 40 - HST / Chandra Monitoring of a Dramatic Flare in the M87 Jet

Fri Jan 18 09:06:32 GMT 2008

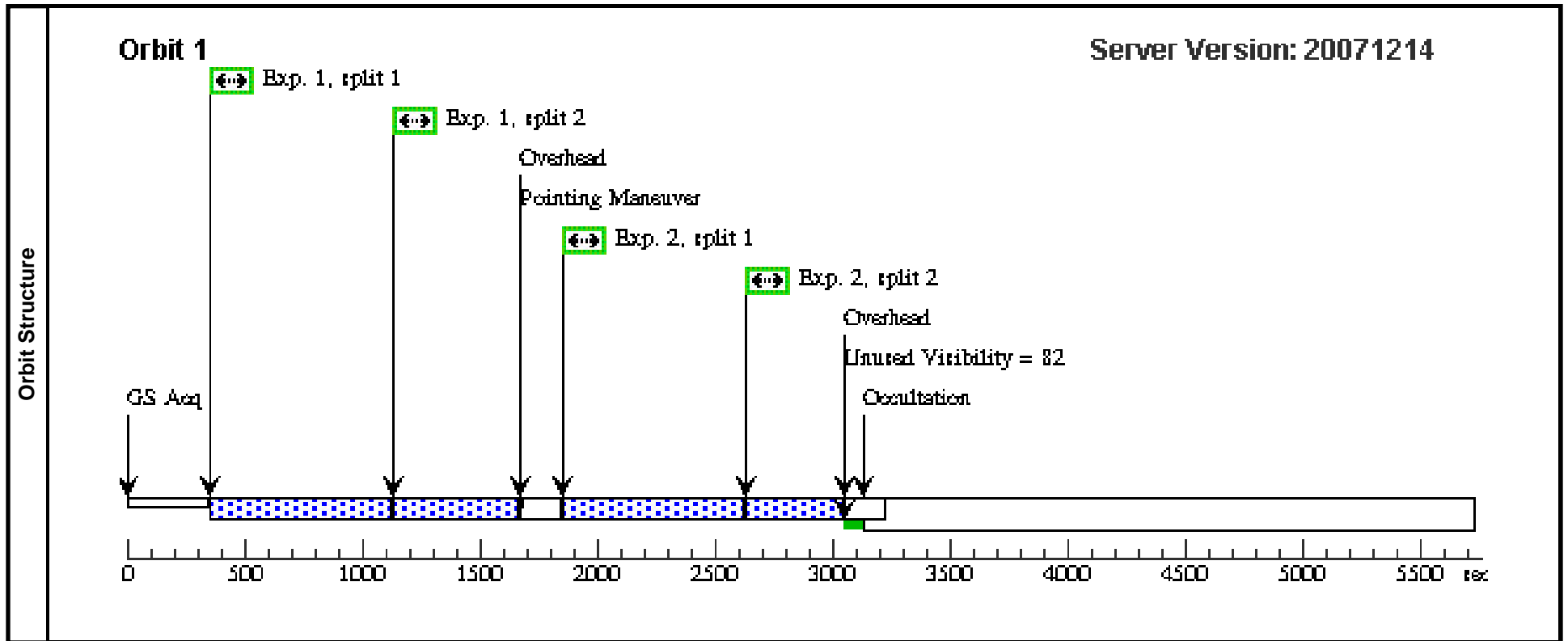
Visit	Proposal 11216, Visit 40, implementation Diagnostic Status: Warning Scientific Instruments: WFPC2 Special Requirements: PCS MODE FINE; BETWEEN 24-MAR-2008:00:00:00 AND 31-MAR-2008:00:00:00 <i>Comments: Please schedule as close as possible to Chandra observations on 27 Mar 2008.</i>																																		
	Diagnosics (Visit 40) Warning (OP): EXPOSURE TIME DECREASED FOR WFPC (Visit 40) Warning (OP): EXPOSURE TIME DECREASED FOR WFPC (Visit 40) Warning (OP): EXPOSURE TIME DECREASED FOR WFPC (Visit 40) Warning (OP): EXPOSURE TIME DECREASED FOR WFPC																																		
Fixed Targets	<table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th>Targ. Coord. Corrections</th> <th>Fluxes</th> <th>Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(1)</td> <td>M87-JET</td> <td>RA: 12 30 48.8200 (187.7034167d) Dec: +12 23 30.89 (12.39191d) Equinox: J2000</td> <td></td> <td>V=16.7</td> <td>Reference Frame: ICRS</td> </tr> </tbody> </table>						#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous	(1)	M87-JET	RA: 12 30 48.8200 (187.7034167d) Dec: +12 23 30.89 (12.39191d) Equinox: J2000		V=16.7	Reference Frame: ICRS																	
	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous																													
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#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit																										
1	(1) M87-JET	WFPC2, IMAGE, PC1	F255W	CR-SPLIT=0.5; CR-TOLERANCE=0				1001.0 Secs [=>(Split 1)] [=>(Split 2)]	[1]																										
2	(1) M87-JET	WFPC2, IMAGE, PC1	F255W	CR-SPLIT=0.555; CR-TOLERANCE=0	POS TARG 0.25,0.2	5		901.0 Secs [=>(Split 1)] [=>(Split 2)]	[1]																										



Proposal 11216 - Visit 50 - HST / Chandra Monitoring of a Dramatic Flare in the M87 Jet

Fri Jan 18 09:06:33 GMT 2008

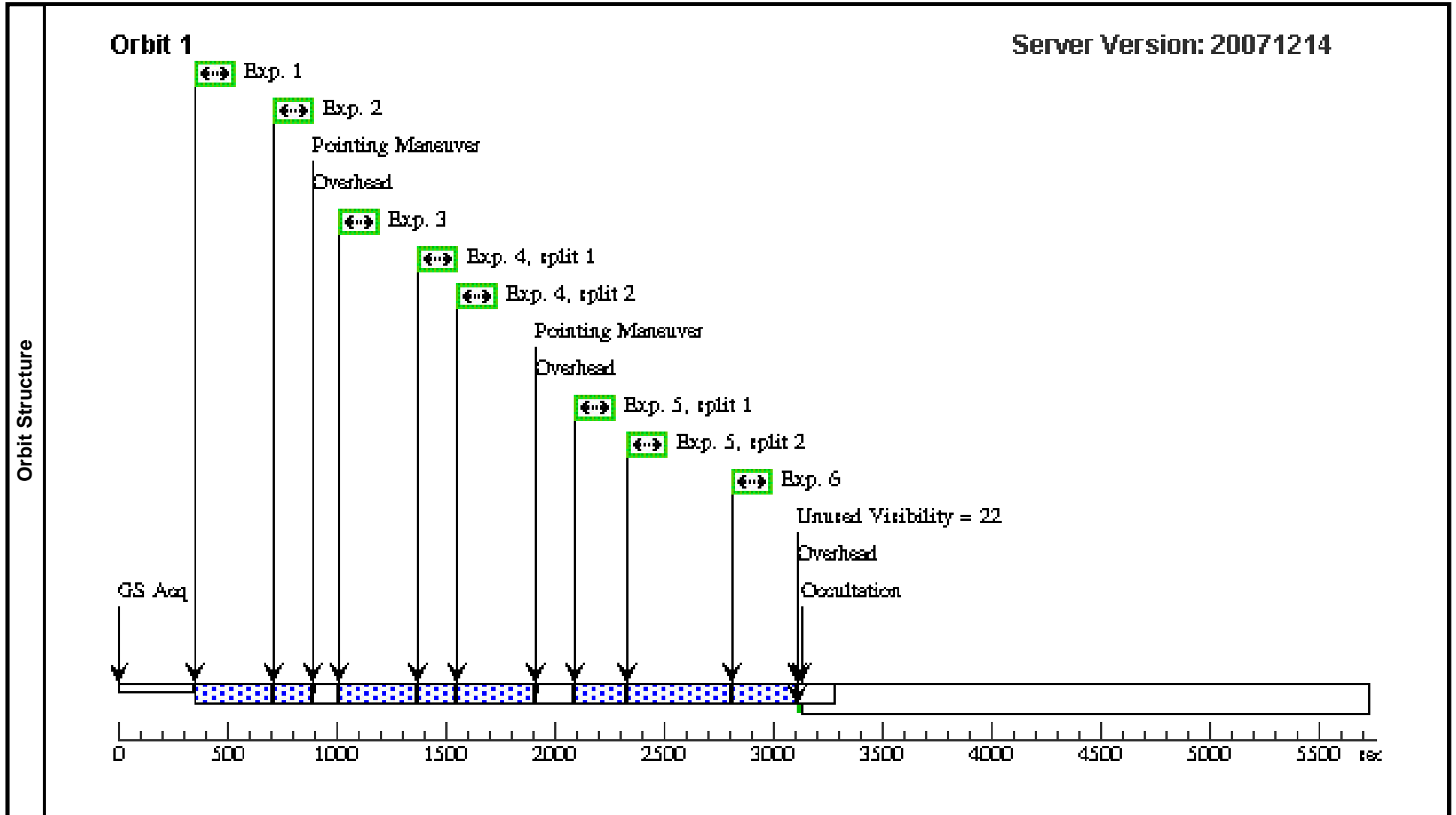
Visit	Proposal 11216, Visit 50, implementation Diagnostic Status: Warning Scientific Instruments: WFPC2 Special Requirements: PCS MODE FINE; BETWEEN 01-MAY-2008:00:00:00 AND 15-MAY-2008:00:00:00 <i>Comments: Please schedule as close as possible to Chandra observations on 10 May 2008.</i>									
	(Visit 50) Warning (OP): EXPOSURE TIME DECREASED FOR WFPC (Visit 50) Warning (OP): EXPOSURE TIME DECREASED FOR WFPC (Visit 50) Warning (OP): EXPOSURE TIME DECREASED FOR WFPC (Visit 50) Warning (OP): EXPOSURE TIME DECREASED FOR WFPC									
Diagnosics										
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	M87-JET	RA: 12 30 48.8200 (187.7034167d) Dec: +12 23 30.89 (12.39191d) Equinox: J2000		V=16.7	Reference Frame: ICRS				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	(1) M87-JET	WFPC2, IMAGE, PC1	F255W	CR-SPLIT=0.5; CR-TOLERANCE=0				1001.0 Secs [=>(Split 1)] [=>(Split 2)]	[1]
2	(1) M87-JET	WFPC2, IMAGE, PC1	F255W	CR-SPLIT=0.555; CR-TOLERANCE=0	POS TARG 0.25,0.2 5				901.0 Secs [=>(Split 1)] [=>(Split 2)]	[1]



Proposal 11216 - Visit 51 - HST / Chandra Monitoring of a Dramatic Flare in the M87 Jet

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Visit	Proposal 11216, Visit 51, implementation Diagnostic Status: Warning Scientific Instruments: WFPC2 Special Requirements: PCS MODE FINE; SAME ORIENT AS 50; GROUP 51,50 WITHIN 1.0D <i>Comments: Please schedule as close as possible to Chandra observations on 10 May 2008.</i>									
	Diagnosics (Visit 51) Warning (OP): EXPOSURE TIME DECREASED FOR WFPC (Visit 51) Warning (OP): EXPOSURE TIME DECREASED FOR WFPC (Visit 51) Warning (OP): EXPOSURE TIME DECREASED FOR WFPC (Visit 51) Warning (OP): EXPOSURE TIME DECREASED FOR WFPC									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections		Fluxes	Miscellaneous			
	(1)	M87-JET	RA: 12 30 48.8200 (187.7034167d) Dec: +12 23 30.89 (12.39191d) Equinox: J2000			V=16.7	Reference Frame: ICRS			
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	(1) M87-JET		WFPC2, IMAGE, PC1	F450W				160.0 Secs	
									[==>]	[1]
	2	(1) M87-JET		WFPC2, IMAGE, PC1	F450W				160.0 Secs	
									[==>]	[1]
	3	(1) M87-JET		WFPC2, IMAGE, PC1	F450W			POS TARG 0.25,0.2 5	160.0 Secs	
									[==>]	[1]
4	(1) M87-JET		WFPC2, IMAGE, PC1	F606W		CR-SPLIT=0.1176; CR-TOLERANCE= 0	POS TARG 0.25,0.2 5	342.0 Secs		
								[==>(Split 1)]	[1]	
								[==>(Split 2)]		
5	(1) M87-JET		WFPC2, IMAGE, PC1	F606W		CR-SPLIT=0.1176; CR-TOLERANCE= 0		342.0 Secs		
								[==>(Split 1)]	[1]	
								[==>(Split 2)]		
6	(1) M87-JET		WFPC2, IMAGE, PC1	F606W				260.0 Secs		
								[==>]	[1]	



Proposal 11216 - Visit 52 - HST / Chandra Monitoring of a Dramatic Flare in the M87 Jet

Fri Jan 18 09:06:34 GMT 2008

Visit	Proposal 11216, Visit 52, implementation Diagnostic Status: Warning Scientific Instruments: WFPC2 Special Requirements: PCS MODE FINE; SAME ORIENT AS 50; GROUP 52,50 WITHIN 1.0D <i>Comments: Please schedule as close as possible to Chandra observations on 10 May 2008.</i>																																																							
	(Visit 52) Warning (OP): EXPOSURE TIME DECREASED FOR WFPC (Visit 52) Warning (OP): EXPOSURE TIME DECREASED FOR WFPC (Visit 52) Warning (OP): EXPOSURE TIME DECREASED FOR WFPC (Visit 52) Warning (OP): EXPOSURE TIME DECREASED FOR WFPC (Visit 52) Warning (OP): EXPOSURE TIME DECREASED FOR WFPC (Visit 52) Warning (OP): EXPOSURE TIME DECREASED FOR WFPC (Visit 52) Warning (OP): EXPOSURE TIME DECREASED FOR WFPC (Visit 52) Warning (OP): EXPOSURE TIME DECREASED FOR WFPC																																																							
Diagnosics																																																								
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	2	(1) M87-JET	WFPC2, IMAGE, PC1	F814W	CR-SPLIT=0.1358; CR-TOLERANCE=0	POS TARG 0.48899 99999999993,0.249			302.0 Secs [==>(Split 1)] [==>(Split 2)]	[1]																																														
	3	(1) M87-JET	WFPC2, IMAGE, PC1	F814W	CR-SPLIT=0.1358; CR-TOLERANCE=0	POS TARG 0.249,0. 498			302.0 Secs [==>(Split 1)] [==>(Split 2)]	[1]																																														
4	(1) M87-JET	WFPC2, IMAGE, PC1	F814W	CR-SPLIT=0.1358; CR-TOLERANCE=0	POS TARG 0.747,0. 747			302.0 Secs [==>(Split 1)] [==>(Split 2)]	[1]																																															

