12532 - The Scale Sizes of Globular Clusters: Tidal Limits, Evolution, and the Outer Halo

Cycle: 19, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) M87-F3	ACS/WFC WFC3/UVIS	2	29-Jul-2011 21:15:51.0	yes
02	(3) M87-F5	ACS/WFC WFC3/UVIS	2	29-Jul-2011 21:16:00.0	yes
03	(5) M87-F7	ACS/WFC WFC3/UVIS	2	29-Jul-2011 21:16:09.0	yes
04	(7) M87-F8	ACS/WFC WFC3/UVIS	2	29-Jul-2011 21:16:17.0	yes
05	(6) M3-SOUTH	ACS/WFC WFC3/UVIS	2	29-Jul-2011 21:16:24.0	yes

10 Total Orbits Used

ABSTRACT

The physical factors that determine the linear sizes of massive star clusters are not well understood. Their scale sizes were long thought to be governed by the tidal field of the parent galaxy, but major questions are now emerging. Globular clusters, for example, have mean sizes nearly independent of location in the halo. Paradoxically, the recently discovered "anomalous extended clusters" in M31 and elsewhere have scale sizes that fit much better with tidal theory, but they are puzzlingly rare. Lastly, the persistent size difference between metal-poor and metal-rich clusters still lacks a quantitative explanation. Many aspects of these observations call for better modelling of dynamical evolution in the outskirts of clusters, and also their conditions of formation including the early rapid mass loss phase of protoclusters.

A new set of accurate measurements of scale sizes and structural parameters, for a large and homogeneous set of globular clusters, would represent a major advance in this subject. We propose to carry out a (WFC3+ACS) imaging survey of the globular clusters in the supergiant Virgo elliptical M87 to cover the complete run of the halo. M87 is an optimum target system because of its huge numbers of clusters and HST's ability to resolve the cluster profiles accurately. We will derive cluster effective radii, central concentrations, luminosities, and colors for more than 4000 clusters using PSF-convolved King-model profile fitting. In parallel, we are developing theoretical tools to model the expected distribution of cluster sizes versus galactocentric distance as functions of cluster mass, concentration, and orbital anisotropy.

OBSERVING DESCRIPTION

A sequence of 2-orbit visits will be executed for four target fields in the halo of M87, plus one additional target field in the outskirts of the globular cluster M3 for PSF calibration. On each visit, one orbit will be spent with the F475W filter and one orbit with the F814W filter. The scientific goal is to measure the linear scale sizes (effective radii) of the M87 globular clusters and to trace the dependence of r_h versus galactocentric distance.

CALIBRATION JUSTIFICATION

The M3-SOUTH target field is to be used for precise definition of the PSF shape as a function of location on the WFC3 and ACS/WFC cameras, through identical filters as will be used for the M87 fields. Accurate measurement of the globular cluster radii will require convolving the measured PSF with King-type models for the cluster profiles.

Visit

Proposal 12532, Visit 01, implementation Sat Jul 30 01:16:31 GMT 2011

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: ORIENT 280D TO 283 D; ORIENT 345D TO 90 D; ORIENT 150D TO 151 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(5)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1-2), (3-4)

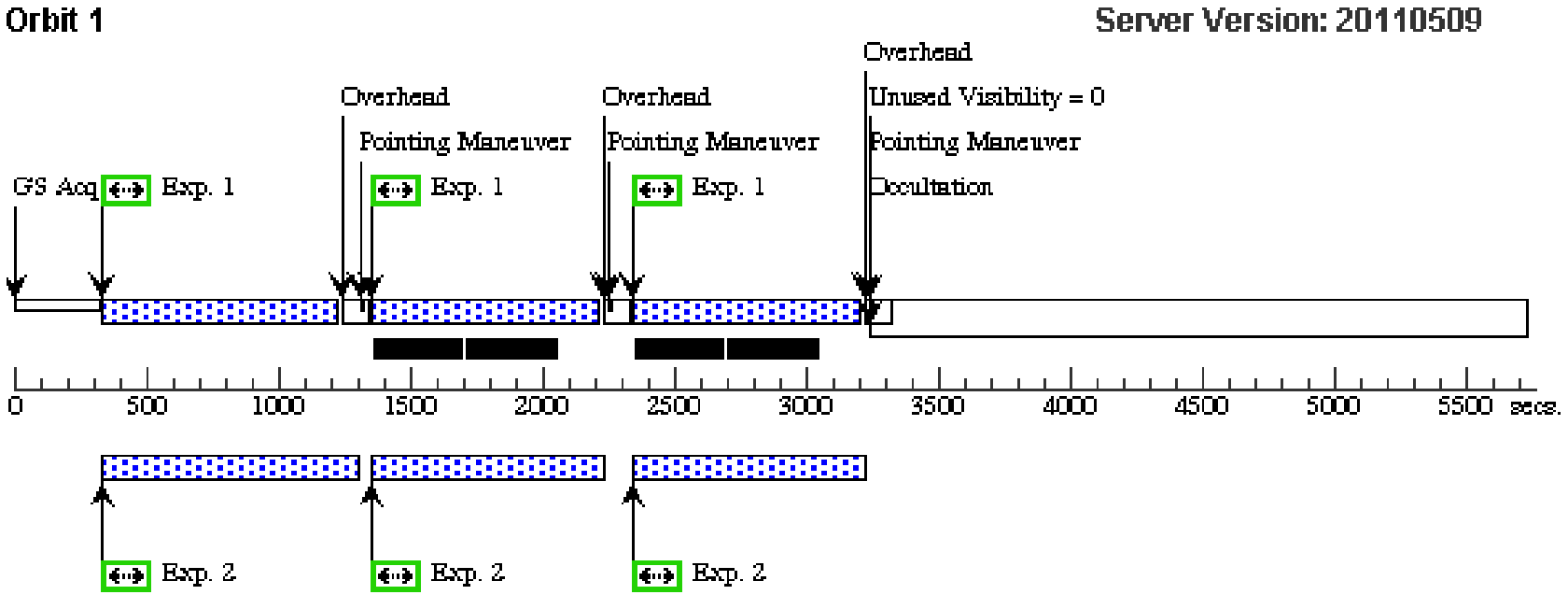
Fixed Targets

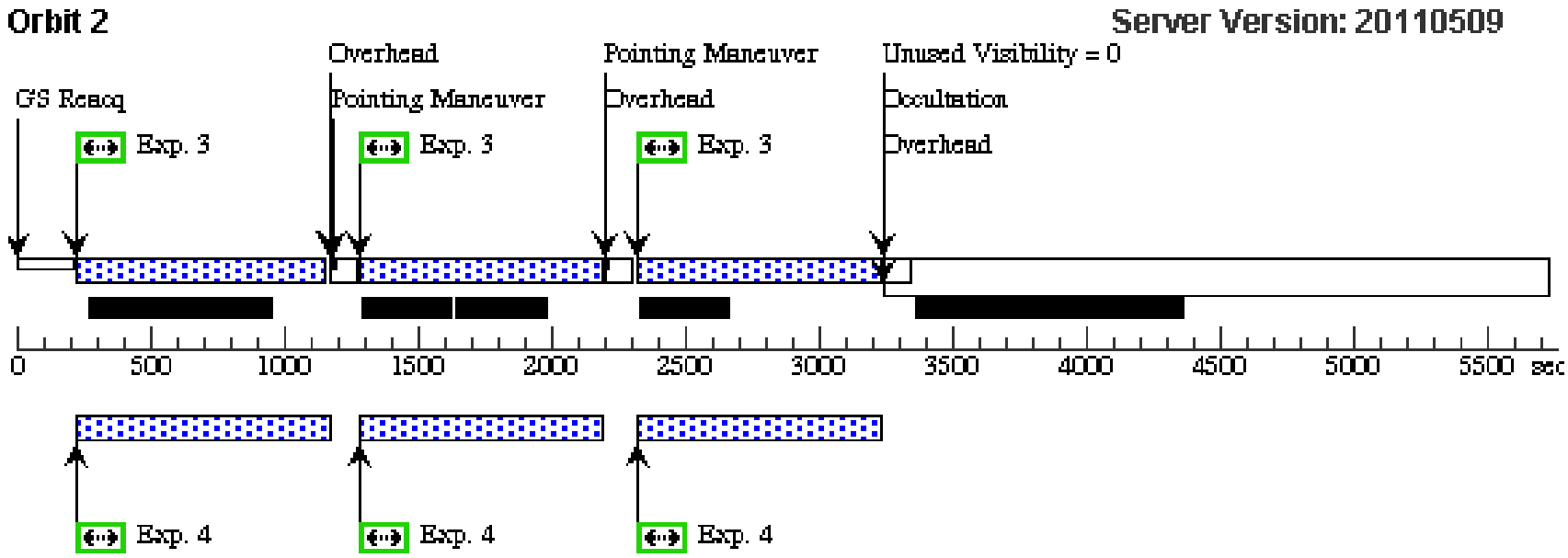
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	M87-F3	RA: 12 30 56.4857 (187.7353571d) Dec: +12 21 48.30 (12.36342d) Equinox: J2000		V=20.0+/-0.2 V magnitude is brightest globular cluster	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) M87-F3	WFC3/UVIS, ACCUM, UVIS-CENTER	F814W		GS ACQ SCENARIO BASE1B3	Pattern 5, Exps 1-2 in Visit 01 (5) Prime + Parallel Group 1-2 in Pattern 5, Exps 1-2 in Visit 01	855 Secs *[==>863.0 Secs (Pattern 1)]* *[==>863.0 Secs (Pattern 2)]* *[==>863.0 Secs (Pattern 3)]*	***[1]***
2		(1) M87-F3	ACS/WFC, ACCUM, WFC	F814W			Pattern 5, Exps 1-2 in Visit 01 (5) Prime + Parallel Group 1-2 in Pattern 5, Exps 1-2 in Visit 01	760 Secs *[==>761.0 Secs (Pattern 1)]* *[==>761.0 Secs (Pattern 2)]* *[==>760.0 Secs (Pattern 3)]*	***[1]***
3		(1) M87-F3	WFC3/UVIS, ACCUM, UVIS-CENTER	F475W			Pattern 5, Exps 3-4 in Visit 01 (5) Prime + Parallel Group 3-4 in Pattern 5, Exps 3-4 in Visit 01	855 Secs *[==>910.0 Secs (Pattern 1)]* *[==>910.0 Secs (Pattern 2)]* *[==>909.0 Secs (Pattern 3)]*	***[2]***
4		(1) M87-F3	ACS/WFC, ACCUM, WFC	F475W			Pattern 5, Exps 3-4 in Visit 01 (5) Prime + Parallel Group 3-4 in Pattern 5, Exps 3-4 in Visit 01	760 Secs *[==>784.0 Secs (Pattern 1)]* *[==>784.0 Secs (Pattern 2)]* *[==>783.0 Secs (Pattern 3)]*	***[2]***

Orbit Structure





Visit

Proposal 12532, Visit 02, implementation Sat Jul 30 01:16:33 GMT 2011

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: ORIENT 280D TO 285 D; ORIENT 152D TO 153 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(5)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1-2), (3-4)

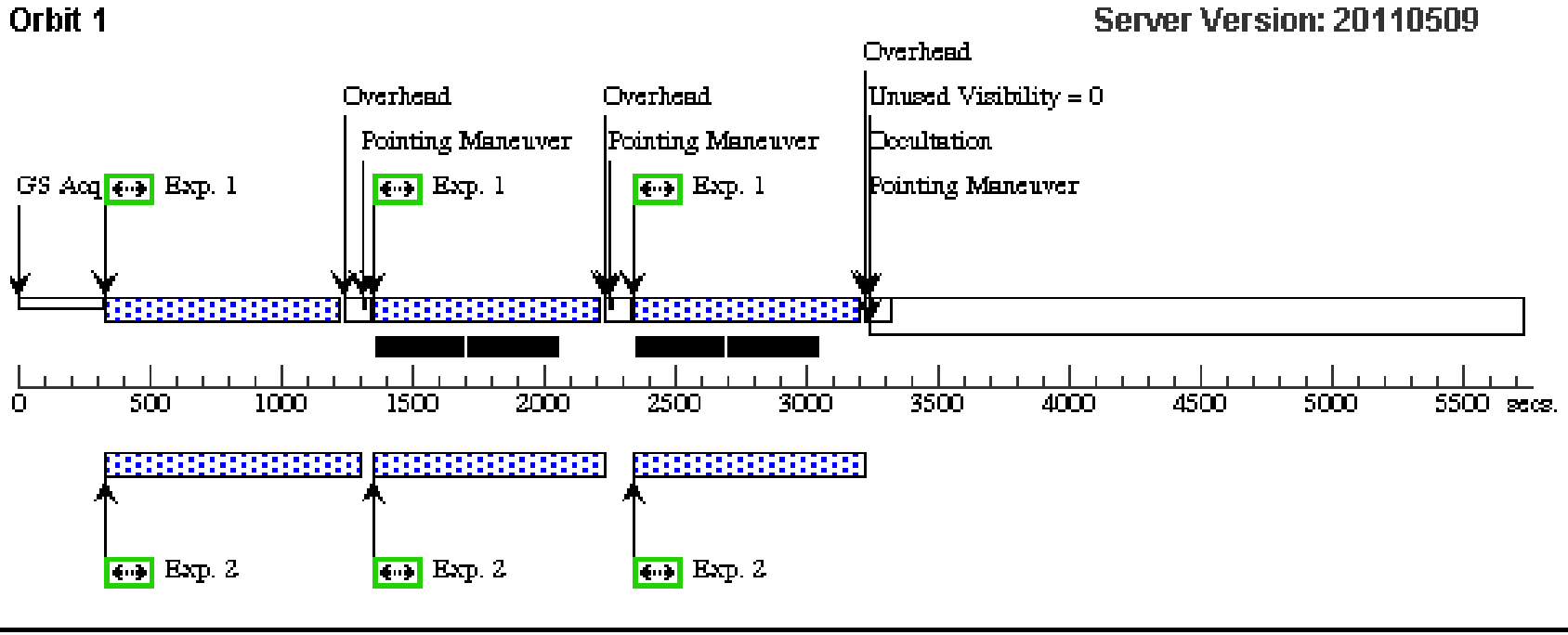
Fixed Targets

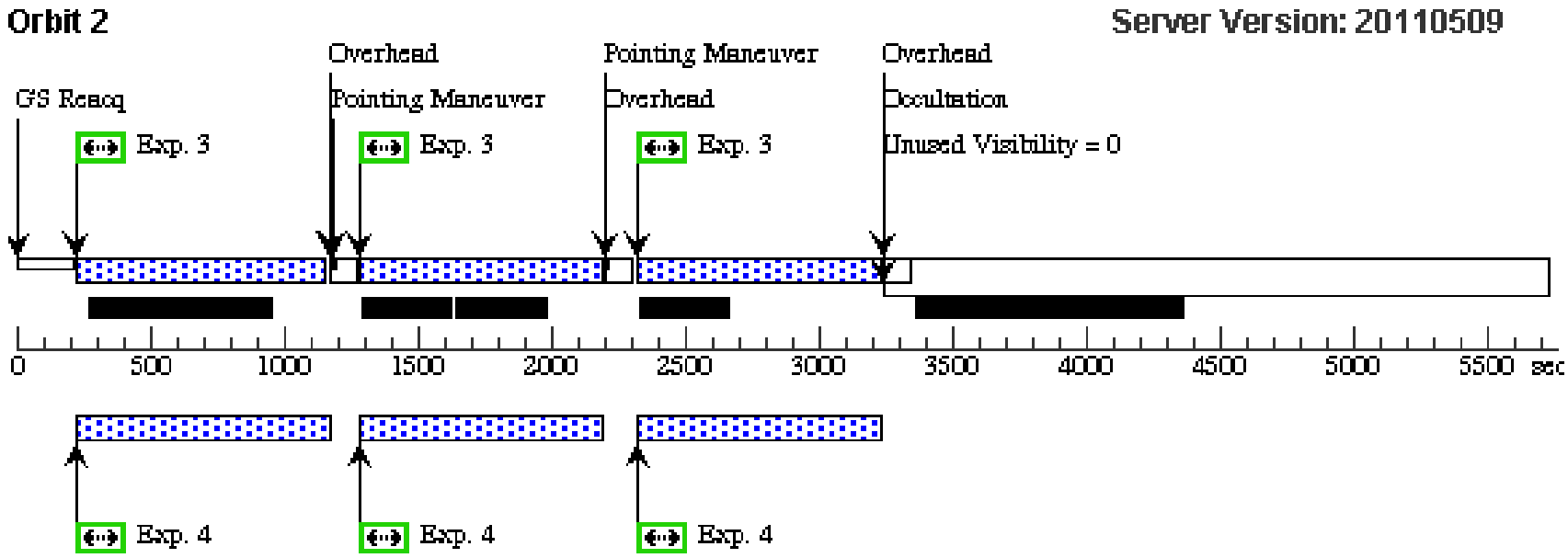
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	M87-F5	RA: 12 31 15.3600 (187.8140000d) Dec: +12 21 48.30 (12.36342d) Equinox: J2000		V=20.0+/-0.2	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(3) M87-F5	WFC3/UVIS, ACCUM, UVIS-CENTER	F814W			Pattern 5, Exps 1-2 in Visit 02 (5) Prime + Parallel Group 1-2 in Pattern 5, Exps 1-2 in Visit 02	855 Secs *[==>863 Secs (Pattern 1)]* *[==>863 Secs (Pattern 2)]* *[==>863 Secs (Pattern 3)]*	***[1]***
2		(3) M87-F5	ACS/WFC, ACCUM, WFC	F814W			Pattern 5, Exps 1-2 in Visit 02 (5) Prime + Parallel Group 1-2 in Pattern 5, Exps 1-2 in Visit 02	760 Secs *[==>761 Secs (Pattern 1)]* *[==>761 Secs (Pattern 2)]* *[==>760 Secs (Pattern 3)]*	***[1]***
3		(3) M87-F5	WFC3/UVIS, ACCUM, UVIS-CENTER	F475W			Pattern 5, Exps 3-4 in Visit 02 (5) Prime + Parallel Group 3-4 in Pattern 5, Exps 3-4 in Visit 02	855 Secs *[==>910 Secs (Pattern 1)]* *[==>910 Secs (Pattern 2)]* *[==>909 Secs (Pattern 3)]*	***[2]***
4		(3) M87-F5	ACS/WFC, ACCUM, WFC	F475W			Pattern 5, Exps 3-4 in Visit 02 (5) Prime + Parallel Group 3-4 in Pattern 5, Exps 3-4 in Visit 02	760 Secs *[==>784 Secs (Pattern 1)]* *[==>784 Secs (Pattern 2)]* *[==>783 Secs (Pattern 3)]*	***[2]***

Orbit Structure





Visit

Proposal 12532, Visit 03, implementation Sat Jul 30 01:16:34 GMT 2011

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: ORIENT 265D TO 273 D; ORIENT 155D TO 185 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(5)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1-2), (3-4)

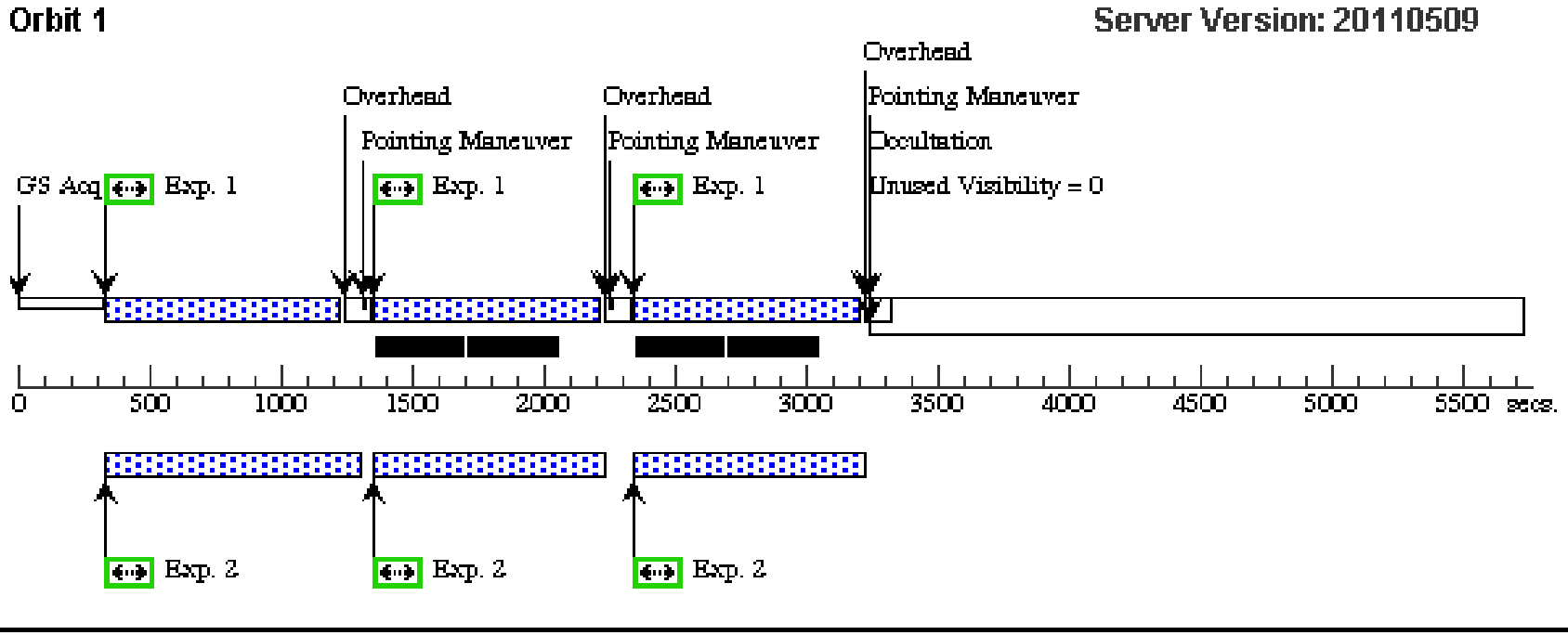
Fixed Targets

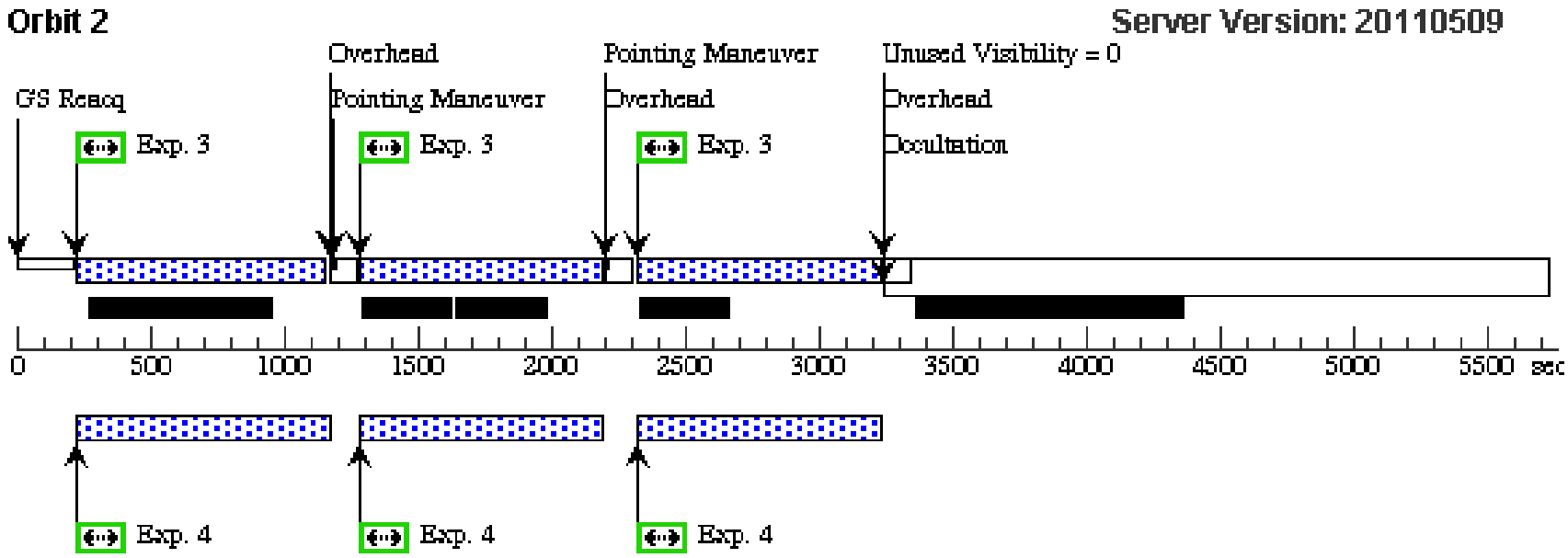
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(5)	M87-F7	RA: 12 31 34.8486 (187.8952025d) Dec: +12 21 48.30 (12.36342d) Equinox: J2000		V=20.0+/-0.2	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(5) M87-F7	WFC3/UVIS, ACCUM, UVIS-CENTER	F814W			Pattern 5, Exps 1-2 in Visit 03 (5) Prime + Parallel Group 1-2 in Pattern 5, Exps 1-2 in Visit 03	855 Secs *[==>863.0 Secs (Pattern 1)]* *[==>863.0 Secs (Pattern 2)]* *[==>863.0 Secs (Pattern 3)]*	***[1]***
2		(5) M87-F7	ACS/WFC, ACCUM, WFC	F814W			Pattern 5, Exps 1-2 in Visit 03 (5) Prime + Parallel Group 1-2 in Pattern 5, Exps 1-2 in Visit 03	760 Secs *[==>761.0 Secs (Pattern 1)]* *[==>761.0 Secs (Pattern 2)]* *[==>760.0 Secs (Pattern 3)]*	***[1]***
3		(5) M87-F7	WFC3/UVIS, ACCUM, UVIS-CENTER	F475W			Pattern 5, Exps 3-4 in Visit 03 (5) Prime + Parallel Group 3-4 in Pattern 5, Exps 3-4 in Visit 03	855 Secs *[==>910.0 Secs (Pattern 1)]* *[==>910.0 Secs (Pattern 2)]* *[==>909.0 Secs (Pattern 3)]*	***[2]***
4		(5) M87-F7	ACS/WFC, ACCUM, WFC	F475W			Pattern 5, Exps 3-4 in Visit 03 (5) Prime + Parallel Group 3-4 in Pattern 5, Exps 3-4 in Visit 03	760 Secs *[==>784.0 Secs (Pattern 1)]* *[==>784.0 Secs (Pattern 2)]* *[==>783.0 Secs (Pattern 3)]*	***[2]***

Orbit Structure





Visit

Proposal 12532, Visit 04, implementation Sat Jul 30 01:16:35 GMT 2011

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: ORIENT 150D TO 295 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(5)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1-2), (3-4)

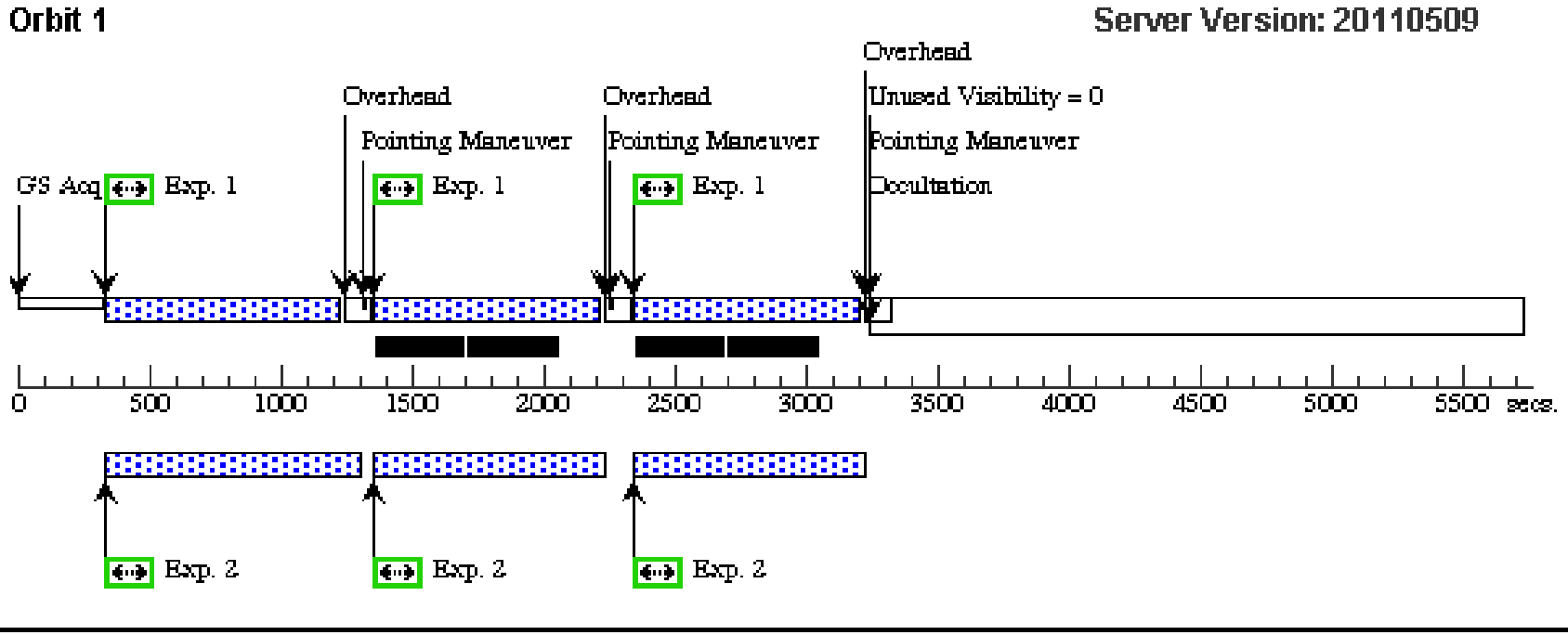
Fixed Targets

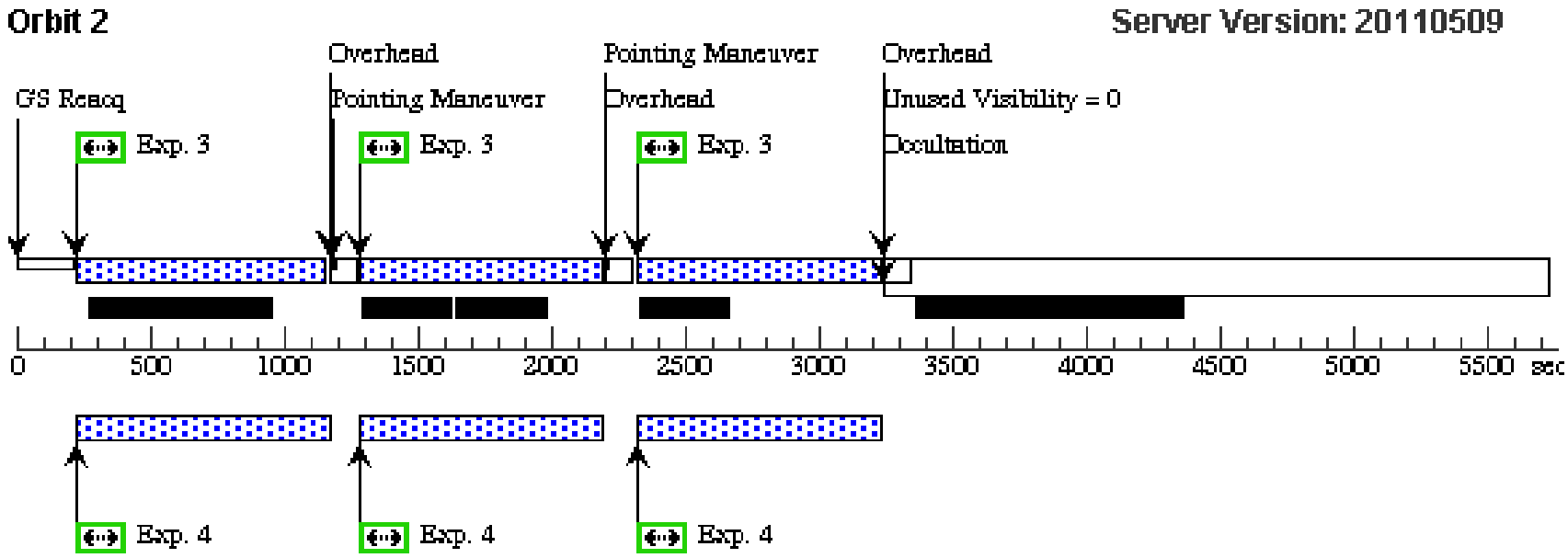
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(7)	M87-F8	RA: 12 32 6.6418 (188.0276742d) Dec: +12 21 25.08 (12.35697d) Equinox: J2000		V=20.0+/-0.2	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(7) M87-F8	WFC3/UVIS, ACCUM, UVIS-CENTER	F814W			Pattern 5, Exps 1-2 in Visit 04 (5) Prime + Parallel Group 1-2 in Pattern 5, Exps 1-2 in Visit 04	855 Secs *[==>863.0 Secs (Pattern 1)]* *[==>863.0 Secs (Pattern 2)]* *[==>863.0 Secs (Pattern 3)]*	***[1]***
2		(7) M87-F8	ACS/WFC, ACCUM, WFC	F814W			Pattern 5, Exps 1-2 in Visit 04 (5) Prime + Parallel Group 1-2 in Pattern 5, Exps 1-2 in Visit 04	760 Secs *[==>761.0 Secs (Pattern 1)]* *[==>761.0 Secs (Pattern 2)]* *[==>760.0 Secs (Pattern 3)]*	***[1]***
3		(7) M87-F8	WFC3/UVIS, ACCUM, UVIS-CENTER	F475W			Pattern 5, Exps 3-4 in Visit 04 (5) Prime + Parallel Group 3-4 in Pattern 5, Exps 3-4 in Visit 04	855 Secs *[==>910.0 Secs (Pattern 1)]* *[==>910.0 Secs (Pattern 2)]* *[==>909.0 Secs (Pattern 3)]*	***[2]***
4		(7) M87-F8	ACS/WFC, ACCUM, WFC	F475W			Pattern 5, Exps 3-4 in Visit 04 (5) Prime + Parallel Group 3-4 in Pattern 5, Exps 3-4 in Visit 04	760 Secs *[==>784.0 Secs (Pattern 1)]* *[==>784.0 Secs (Pattern 2)]* *[==>783.0 Secs (Pattern 3)]*	***[2]***

Orbit Structure





Visit

Proposal 12532, Visit 05, implementation Sat Jul 30 01:16:35 GMT 2011

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: ORIENT 30D TO 140 D; ORIENT 210D TO 256 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(5)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1-2), (3-4)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(6)	M3-SOUTH	RA: 13 42 11.2000 (205.5466667d) Dec: +28 07 0.00 (28.11667d) Equinox: J2000		V=13.0+/-0.1	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(6) M3-SOUTH	WFC3/UVIS, ACCUM, UVIS-CENTER	F814W			Pattern 5, Exps 1-2 in Visit 05 (5) Prime + Parallel Group 1-2 in Pattern 5, Exps 1-2 in Visit 05	855 Secs *[==>860. Secs (Pattern 1)]* *[==>860. Secs (Pattern 2)]* *[==>860. Secs (Pattern 3)]*	***[1]***
2		(6) M3-SOUTH	ACS/WFC, ACCUM, WFC	F814W			Pattern 5, Exps 1-2 in Visit 05 (5) Prime + Parallel Group 1-2 in Pattern 5, Exps 1-2 in Visit 05	760 Secs *[==>760. Secs (Pattern 1)]* *[==>760. Secs (Pattern 2)]* *[==>760. Secs (Pattern 3)]*	***[1]***
3		(6) M3-SOUTH	WFC3/UVIS, ACCUM, UVIS-CENTER	F475W			Pattern 5, Exps 3-4 in Visit 05 (5) Prime + Parallel Group 3-4 in Pattern 5, Exps 3-4 in Visit 05	855 Secs *[==>900. Secs (Pattern 1)]* *[==>900. Secs (Pattern 2)]* *[==>900. Secs (Pattern 3)]*	***[2]***
4		(6) M3-SOUTH	ACS/WFC, ACCUM, WFC	F475W			Pattern 5, Exps 3-4 in Visit 05 (5) Prime + Parallel Group 3-4 in Pattern 5, Exps 3-4 in Visit 05	760 Secs *[==>800. Secs (Pattern 1)]* *[==>800. Secs (Pattern 2)]* *[==>800. Secs (Pattern 3)]*	***[2]***

Orbit Structure