12602 - Beyond the Hydrogen-burning limit: Deep IR observations of the Globular Clusters M4

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) M-4	ACS/WFC WFC3/IR WFC3/UVIS	4	09-Jul-2011 02:10:49.0	yes
02	(1) M-4	ACS/WFC WFC3/IR	4	09-Jul-2011 02:11:18.0	yes

8 Total Orbits Used

ABSTRACT

We propose to use ultra-deep near-infrared imaging with WFC3 in M4 to explore the very lowest mass domain in this globular cluster. We expect to detect the first brown dwarfs in globular clusters, and in fact perhaps the first PopII BDs anywhere. In doing so, we will also explore the hydrogen-burning limit and determine the mass-luminosity relationship around the stellar/sub-stellar border of the main sequence. In addition we will search the cluster white dwarfs for evidence of infrared excess which could herald the presence of a planetary disk or planets themselves. This ultra-deep near-IR data set will allow us to test fundamental physical predictions quantitatively for the first time. This will have important consequences for many astrophysical aspects from stellar structure and evolution, to planet formation in the early Universe, to ages, formation and evolution of GCs.

OBSERVING DESCRIPTION

The observations will be obtained using a dither pattern so that the PSF will be well sampled. For our WFC3-IR observations, we chose a WFC3-IR-DITHER-BOX-MIN to best sample the PSF, and for our WFC3-UVIS observations we chose a combination of WFC3-UVIS-GAP-LINE and WFC3-UVIS-LINE-3PT to step over the gap between the two UVIS CCD and to sample the PSF with a 3 point dither.
We split our observations into 2 visits with 4 orbits each. The first visit will be spend on 2 orbits F110W followed by 2 orbits on F390W.
The first two orbits in F110W will be done with a NSAMP14 SPARS50 and the four point dither pattern.
The third and forth orbit will be spent on F390W, with 911 or 922 sec individual exposure times, once on each of the three dither positions (3 exposures per orbit).
The second visit will consist of 4 orbits on F160W observations, again with the WFC3-IR-DITHER-BOX-MIN to best sample the PSF, and with the same NSAMP14 SPARS50.

Our deep near-IR data will be matched to the already existing optical HST ACS WFC data sets. Thus, we want to have our WFC3 IR observations within the field of view of the existing ACS WFC data, but we also want to avoid the bulk of bright stars that will be saturated in our images. The best orientation angles are thus between 30 - 65 degree or between 290 - 330 degree.

The parallel observations will be done with ACS WFC F606W (2 orbits) and ACS WFC F814W (6 orbits).

Visit

Proposal 12602, Visit 01, implementation Sat Jul 09 06:11:27 GMT 2011

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR, WFC3/UVIS, ACS/WFC

Special Requirements: ORIENT 30D TO 65 D; ORIENT 290D TO 330 D

Patterns

#	Primary Pattern		Secondary Pattern		Exposures
(1)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.572 Line Spacing=0.365	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=false			(1-2), (3-4)
(2)	Pattern Type=WFC3-UVIS-GAP-LINE Purpose=MOSAIC Number Of Points=2 Point Spacing=2.414 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=true	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	(5-6)

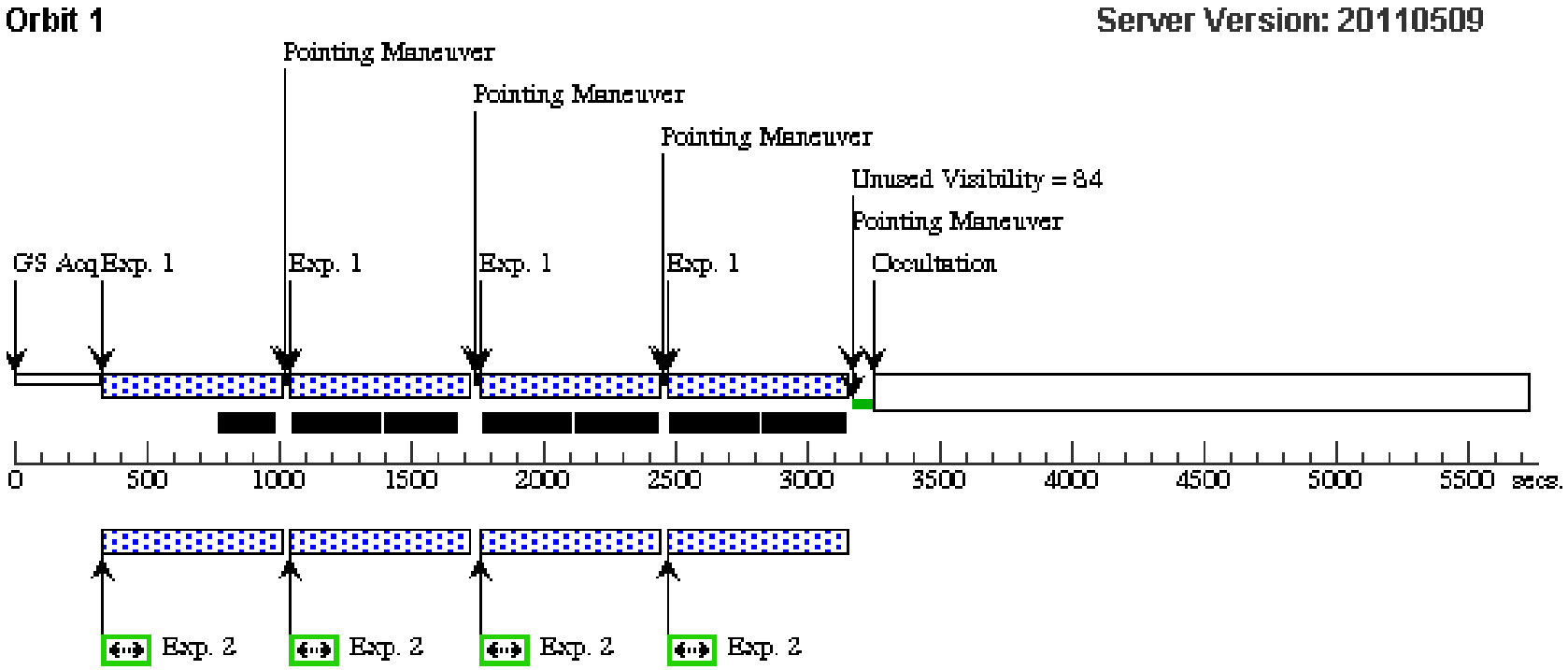
Fixed Targets

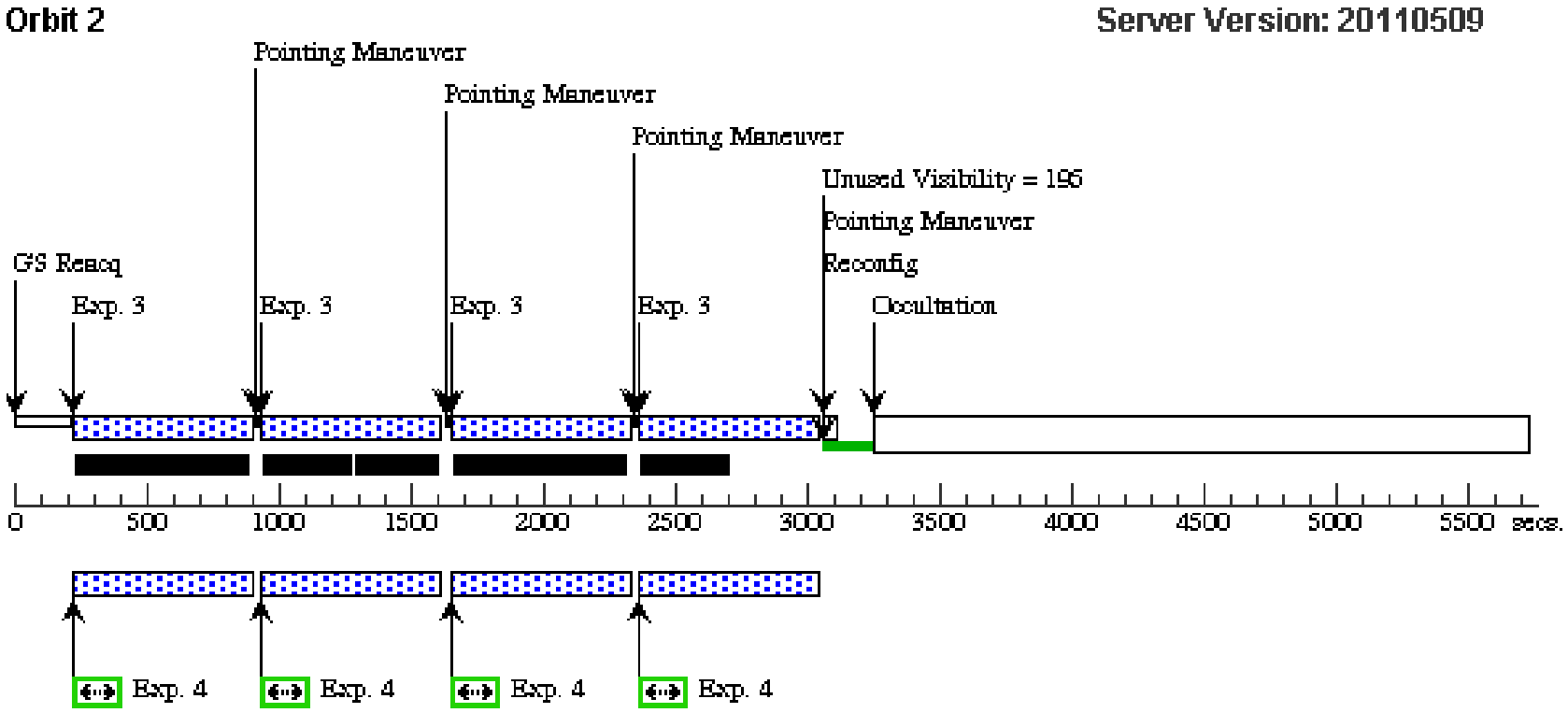
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	M-4	RA: 16 23 41.7158 (245.9238158d) Dec: -26 30 19.01 (-26.50528d) Equinox: J2000		V=7.12	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) M-4	WFC3/IR, MULTIACCUM, IR-UVIS-FIX	F110W	NSAMP=14; SAMP-SEQ=SPARS50		Pattern 1, Exps 1-2 in Visit 01 (1) Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 in Visit 01	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2		(1) M-4	ACS/WFC, ACCUM, WFC-FIX	F606W			Pattern 1, Exps 1-2 in Visit 01 (1) Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 in Visit 01	350 Secs *[==>475.0 Secs (Pattern 1)]* *[==>557.0 Secs (Pattern 2)]* *[==>557.0 Secs (Pattern 3)]* *[==>557.0 Secs (Pattern 4)]*	***[1]***
3		(1) M-4	WFC3/IR, MULTIACCUM, IR-UVIS-FIX	F110W	NSAMP=14; SAMP-SEQ=SPARS50		Pattern 1, Exps 3-4 in Visit 01 (1) Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in Visit 01	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***
4		(1) M-4	ACS/WFC, ACCUM, WFC-FIX	F606W			Pattern 1, Exps 3-4 in Visit 01 (1) Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in Visit 01	350 Secs *[==>557.0 Secs (Pattern 1)]* *[==>557.0 Secs (Pattern 2)]* *[==>557.0 Secs (Pattern 3)]* *[==>557.0 Secs (Pattern 4)]*	***[2]***
5		(1) M-4	WFC3/UVIS, ACCUM, UVIS-IR-FIX	F390W			Pattern 2, Exps 5-6 in Visit 01 (2) Prime + Parallel Group 5-6 in Pattern 2, Exps 5-6 in Visit 01	750 Secs *[==>911.0 Secs (Pattern 1,1)]* *[==>911.0 Secs (Pattern 1,2)]* *[==>911.0 Secs (Pattern 1,3)]* *[==>922.0 Secs (Pattern 2,1)]* *[==>922.0 Secs (Pattern 2,2)]* *[==>922.0 Secs (Pattern 2,3)]*	***[3]*** ***[4]***
6		(1) M-4	ACS/WFC, ACCUM, WFC-FIX	F814W			Pattern 2, Exps 5-6 in Visit 01 (2) Prime + Parallel Group 5-6 in Pattern 2, Exps 5-6 in Visit 01	600 Secs *[==>860.0 Secs (Pattern 1,1)]* *[==>880.0 Secs (Pattern 1,2)]* *[==>780.0 Secs (Pattern 1,3)]* *[==>890.0 Secs (Pattern 2,1)]* *[==>890.0 Secs (Pattern 2,2)]* *[==>790.0 Secs (Pattern 2,3)]*	***[3]*** ***[4]***

Orbit Structure

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Exp. 3
Exp. 3
Exp. 3
Occultation
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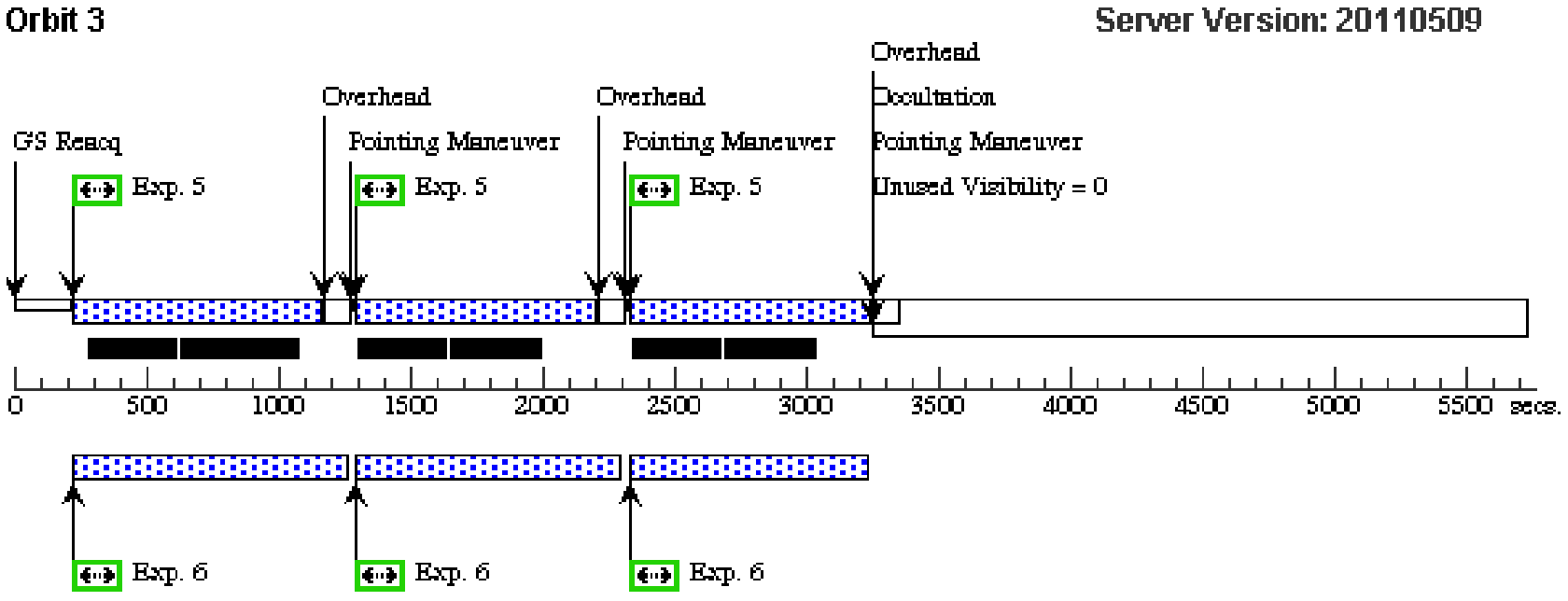
Exp. 4
Exp. 4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Occultation
Pointing Maneuver
Unused Visibility = 0
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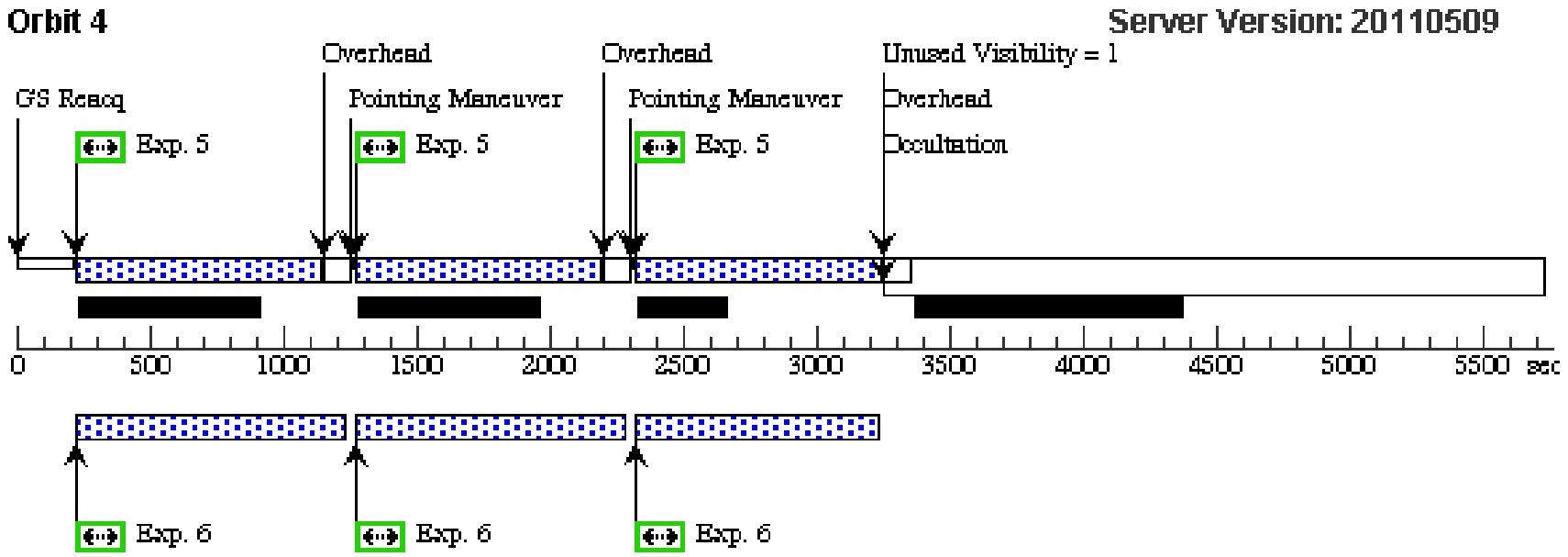
Exp. 6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Overhead
Occultation
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1000
1500
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2500
3000
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4000
4500
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5500
sec
Exp. 6
Exp. 6
Exp. 6

Visit

Proposal 12602, Visit 02, implementation Sat Jul 09 06:11:30 GMT 2011

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR, ACS/WFC

Special Requirements: SAME ORIENT AS 01

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.572 Line Spacing=0.365	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=false		(1-2), (3-4), (5-6), (7-8)

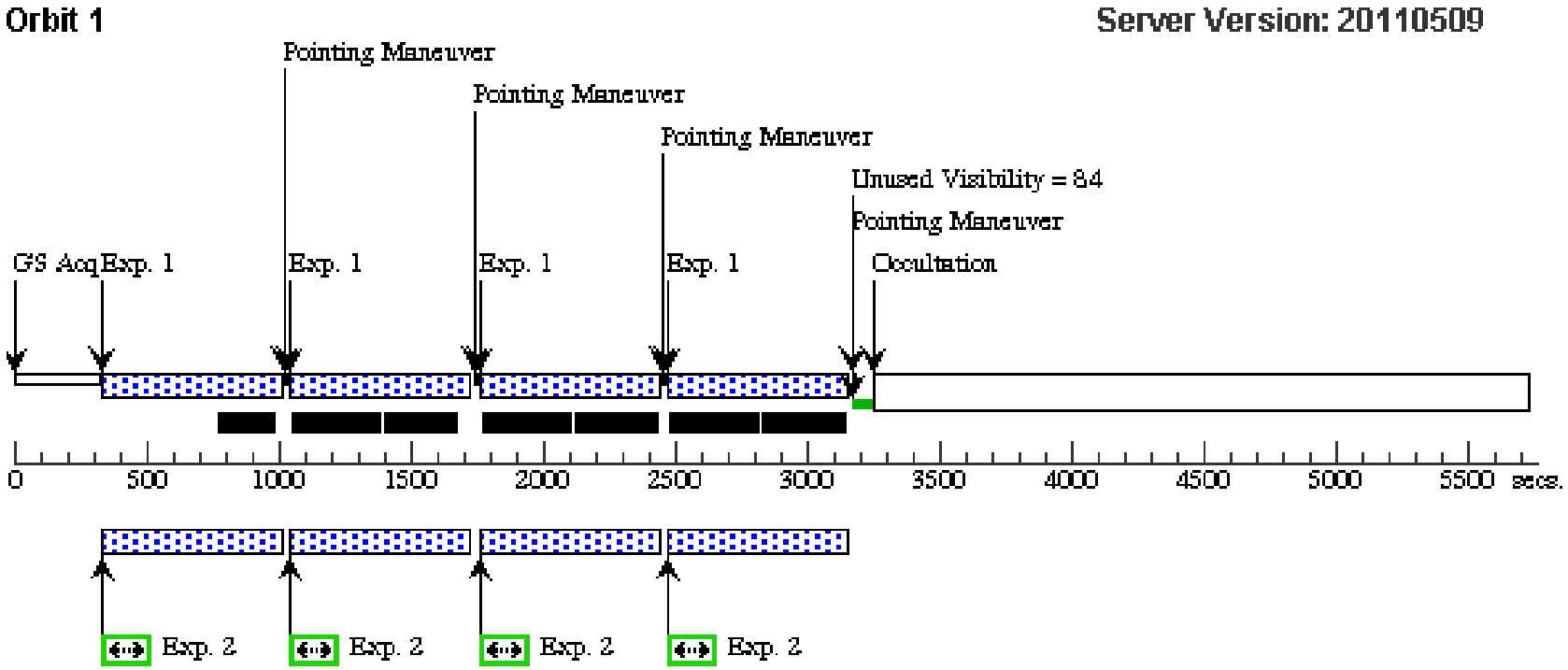
Fixed Targets

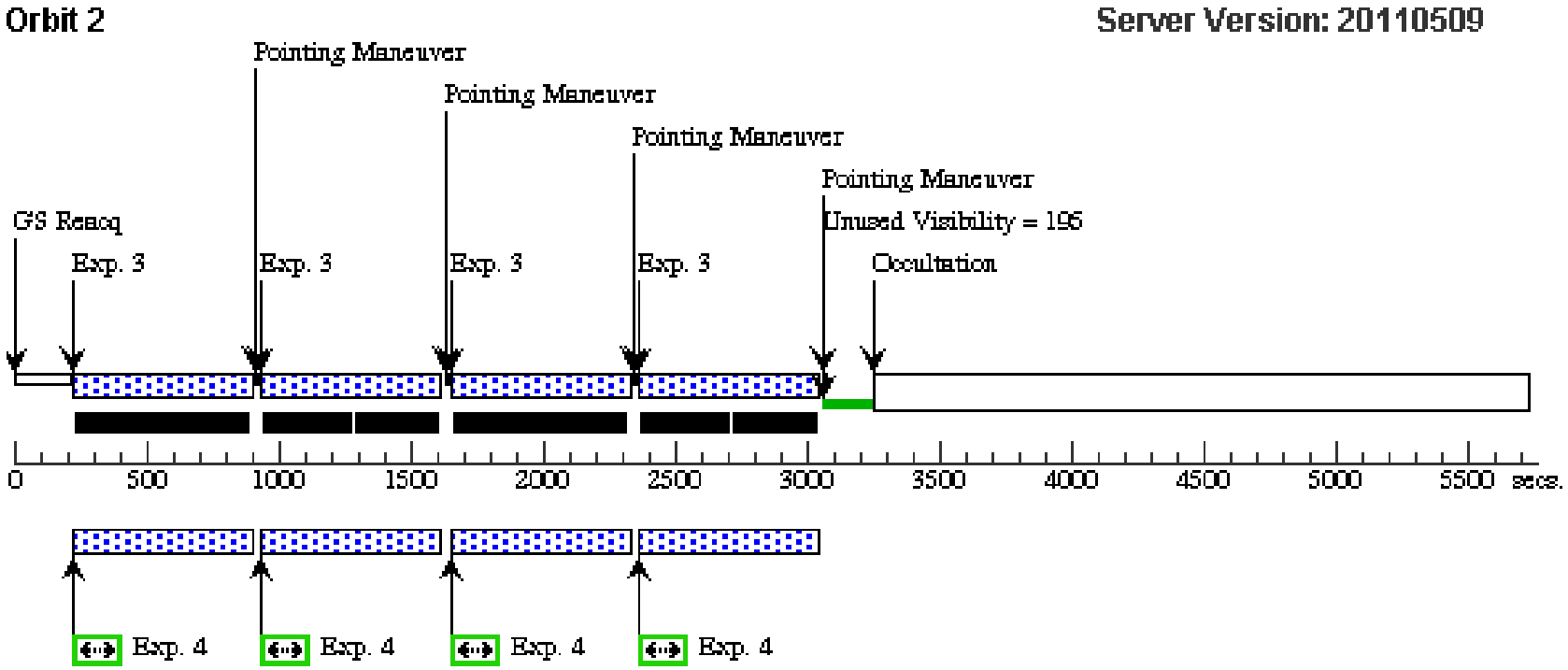
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	M-4	RA: 16 23 41.7158 (245.9238158d) Dec: -26 30 19.01 (-26.50528d) Equinox: J2000		V=7.12	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) M-4	WFC3/IR, MULTIACCUM, IR-UVIS-FIX	F160W	NSAMP=14; SAMP-SEQ=SPARS50		Pattern 1, Exps 1-2 in Visit 02 (1) Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 in Visit 02	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2		(1) M-4	ACS/WFC, ACCUM, WFC-FIX	F814W			Pattern 1, Exps 1-2 in Visit 02 (1) Prime + Parallel Group 1-2 in Pattern 1, Exps 1-2 in Visit 02	450 Secs *[==>475.0 Secs (Pattern 1)]* *[==>557.0 Secs (Pattern 2)]* *[==>557.0 Secs (Pattern 3)]* *[==>557.0 Secs (Pattern 4)]*	***[1]***
3		(1) M-4	WFC3/IR, MULTIACCUM, IR-UVIS-FIX	F160W	NSAMP=14; SAMP-SEQ=SPARS50		Pattern 1, Exps 3-4 in Visit 02 (1) Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in Visit 02	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***
4		(1) M-4	ACS/WFC, ACCUM, WFC-FIX	F814W			Pattern 1, Exps 3-4 in Visit 02 (1) Prime + Parallel Group 3-4 in Pattern 1, Exps 3-4 in Visit 02	450 Secs *[==>557.0 Secs (Pattern 1)]* *[==>557.0 Secs (Pattern 2)]* *[==>557.0 Secs (Pattern 3)]* *[==>557.0 Secs (Pattern 4)]*	***[2]***
5		(1) M-4	WFC3/IR, MULTIACCUM, IR-UVIS-FIX	F160W	NSAMP=14; SAMP-SEQ=SPARS50		Pattern 1, Exps 5-6 in Visit 02 (1) Prime + Parallel Group 5-6 in Pattern 1, Exps 5-6 in Visit 02	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[3]***
6		(1) M-4	ACS/WFC, ACCUM, WFC-FIX	F814W			Pattern 1, Exps 5-6 in Visit 02 (1) Prime + Parallel Group 5-6 in Pattern 1, Exps 5-6 in Visit 02	450 Secs *[==>557.0 Secs (Pattern 1)]* *[==>557.0 Secs (Pattern 2)]* *[==>557.0 Secs (Pattern 3)]* *[==>557.0 Secs (Pattern 4)]*	***[3]***
7		(1) M-4	WFC3/IR, MULTIACCUM, IR-UVIS-FIX	F160W	NSAMP=14; SAMP-SEQ=SPARS50		Pattern 1, Exps 7-8 in Visit 02 (1) Prime + Parallel Group 7-8 in Pattern 1, Exps 7-8 in Visit 02	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[4]***
8		(1) M-4	ACS/WFC, ACCUM, WFC-FIX	F814W			Pattern 1, Exps 7-8 in Visit 02 (1) Prime + Parallel Group 7-8 in Pattern 1, Exps 7-8 in Visit 02	450 Secs *[==>557.0 Secs (Pattern 1)]* *[==>557.0 Secs (Pattern 2)]* *[==>557.0 Secs (Pattern 3)]* *[==>557.0 Secs (Pattern 4)]*	***[4]***

Orbit Structure

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Exp. 3
Exp. 3
Exp. 3
Exp. 3
Unused Visibility = 196
Occultation
0
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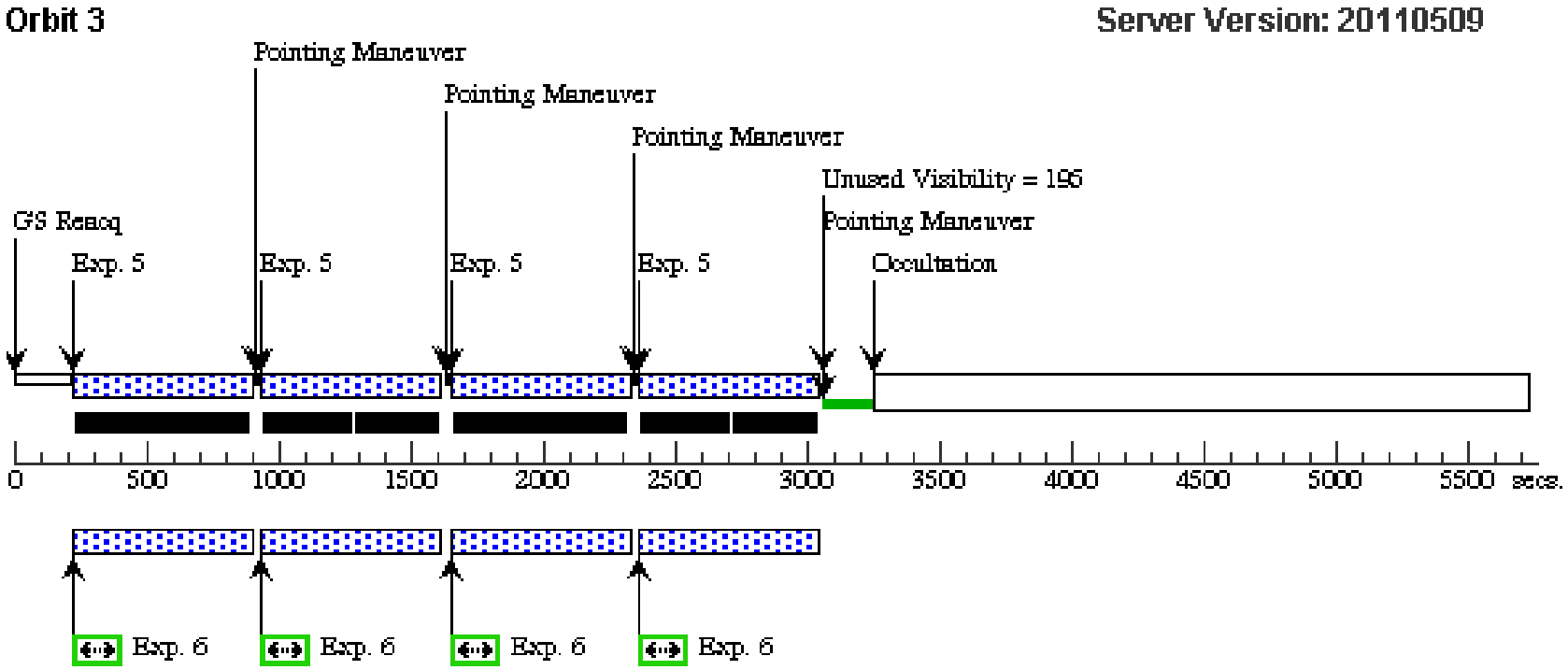
secs.
Exp. 4
Exp. 4
Exp. 4
Exp. 4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Exp. 5
Exp. 5
Exp. 5
Exp. 5
Occultation
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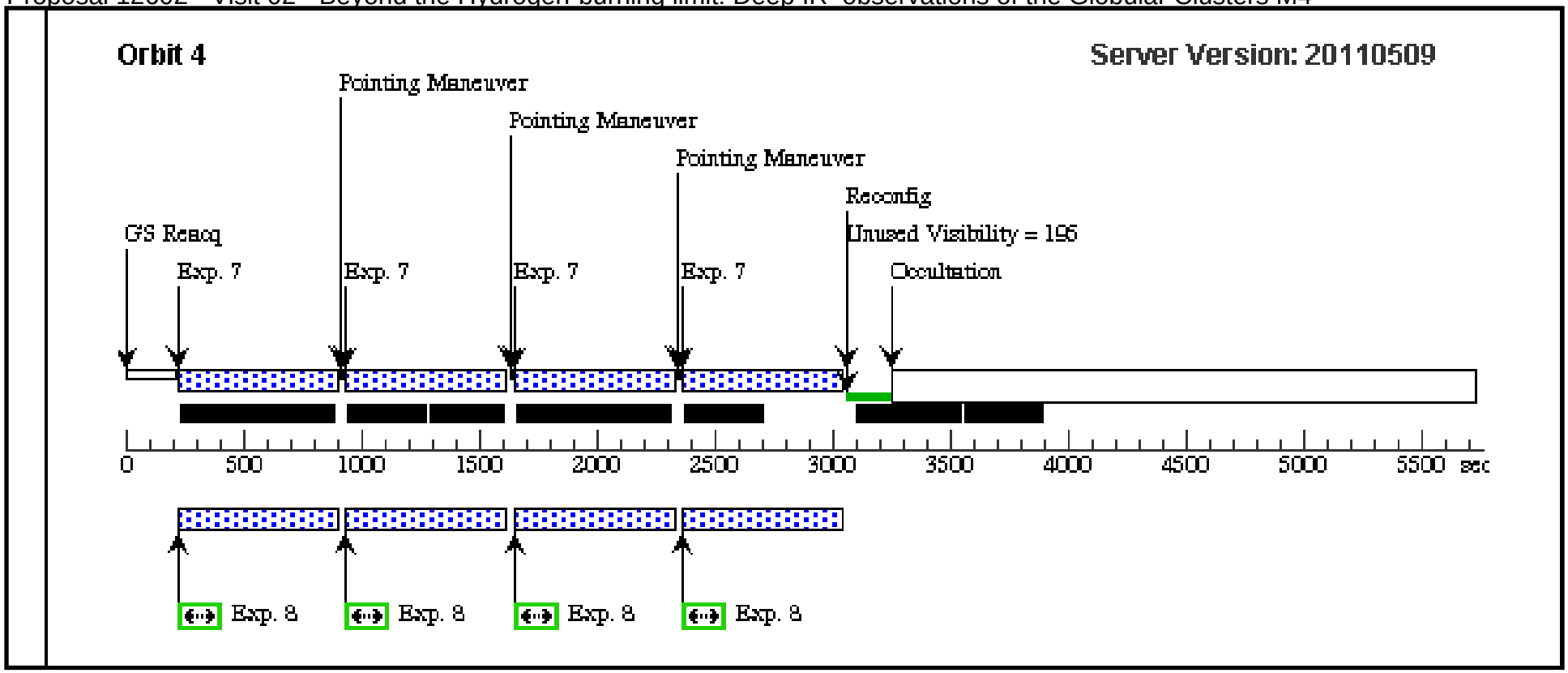
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sec
Exp. 8
Exp. 8
Exp. 8
Exp. 8