



14721 - The Fundamental Plane of Ultra-Massive Galaxies at $z \sim 2$

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) UV-105842	WFC3/IR	1	29-Jul-2016 15:03:04.0	yes
02	(2) UV-108899	WFC3/IR	1	29-Jul-2016 15:03:05.0	yes
03	(3) UV-155853	WFC3/IR	1	29-Jul-2016 15:03:06.0	yes
04	(4) UV-171060	WFC3/IR	1	29-Jul-2016 15:03:07.0	yes
05	(5) UV-171687	WFC3/IR	1	29-Jul-2016 15:03:07.0	yes
06	(6) UV-239220	WFC3/IR	1	29-Jul-2016 15:03:08.0	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>
07	(7) UV-230929	WFC3/IR	1	29-Jul-2016 15:03:09.0	yes
08	(8) UV-250513	WFC3/IR	1	29-Jul-2016 15:03:09.0	yes
09	(9) UV-773654	WFC3/IR	1	29-Jul-2016 15:03:10.0	yes
10	(10) UV-90676	WFC3/IR	1	29-Jul-2016 15:03:10.0	yes
11	(11) UDS-19627	WFC3/IR	1	29-Jul-2016 15:03:11.0	yes

11 Total Orbits Used

ABSTRACT

The fundamental plane (FP), relating the effective radius, velocity dispersion, and surface brightness is a unique tool for studying the structural, stellar, and dark matter evolution of early-type galaxies, and can reveal how these galaxies have formed and evolved. Thus far, studies have been mostly limited to $z < 1.3$, beyond which the absorption lines used to derive velocity dispersions are redshifted out of the optical. With the advent of sensitive NIR spectrographs on 8m telescopes, it is now possible for the first time to study the FP directly at the epoch ($z \sim 2$), where lower redshift studies predict it to have formed. Through a large investment of time with the 8m - VLT NIR spectrograph X-SHOOTER, we have derived velocity dispersions for a unique sample of 11 quiescent galaxies at $z=2$, tripling the number of galaxies with such measurements. We propose to obtain WFC3/IR imaging of these galaxies, which when combined with our ground-based spectroscopy, will allow us to measure accurately the fundamental plane at $z \sim 2$ for the first time through accurate sizes derived from surface brightness profile fits to the data. This measurement of the FP will further reveal the time-scales and methods of formation for the most massive early type galaxies. The HST observations will also allow us to measure the structures of these galaxies, to search for any extended envelopes or asymmetries, and to examine the properties of their satellite galaxies. Three of our systems also show hints of having close companions through our spectroscopy and WFC3/IR imaging is required to investigate this further.

OBSERVING DESCRIPTION

This is an 11 orbit WFC3 IR program to obtain 1 orbit imaging of massive galaxies at $z \sim 2$. The observations are straightforward. They involve pointing to each of the 11 targets and then executing the WFC3 observations for one orbit per pointing. The imaging filter is F160W. We use dithering patterns to obtain an optimal image quality.

Proposal 14721 - Visit 01 - The Fundamental Plane of Ultra-Massive Galaxies at z~2

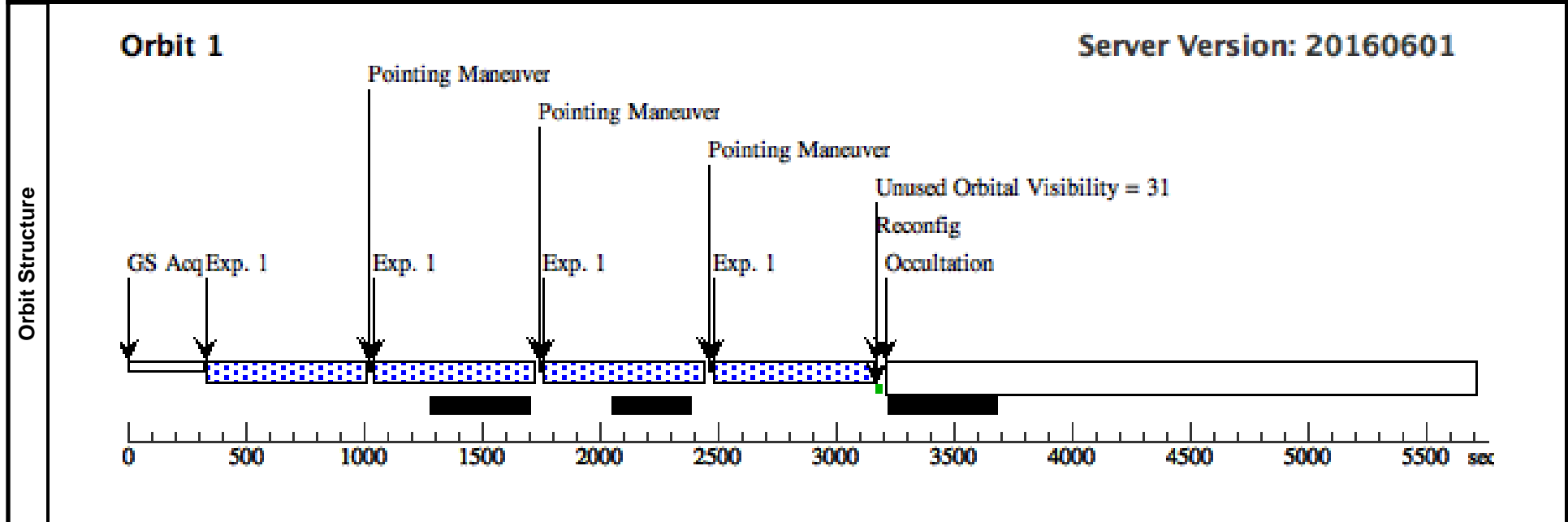
Fri Jul 29 19:03:12 GMT 2016

Visit	Proposal 14721, Visit 01, implementation		
	Diagnostic Status: No Diagnostics		
	Scientific Instruments: WFC3/IR		
	Special Requirements: (none)		

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

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	UV-105842	RA: 10 01 1.7690 (150.2573708d) Dec: +02 01 13.30 (2.02036d) Equinox: J2000			V=(?) K = 20.2, log M =11.4

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(1) UV-105842	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPAR S50			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)]



Proposal 14721 - Visit 02 - The Fundamental Plane of Ultra-Massive Galaxies at z~2

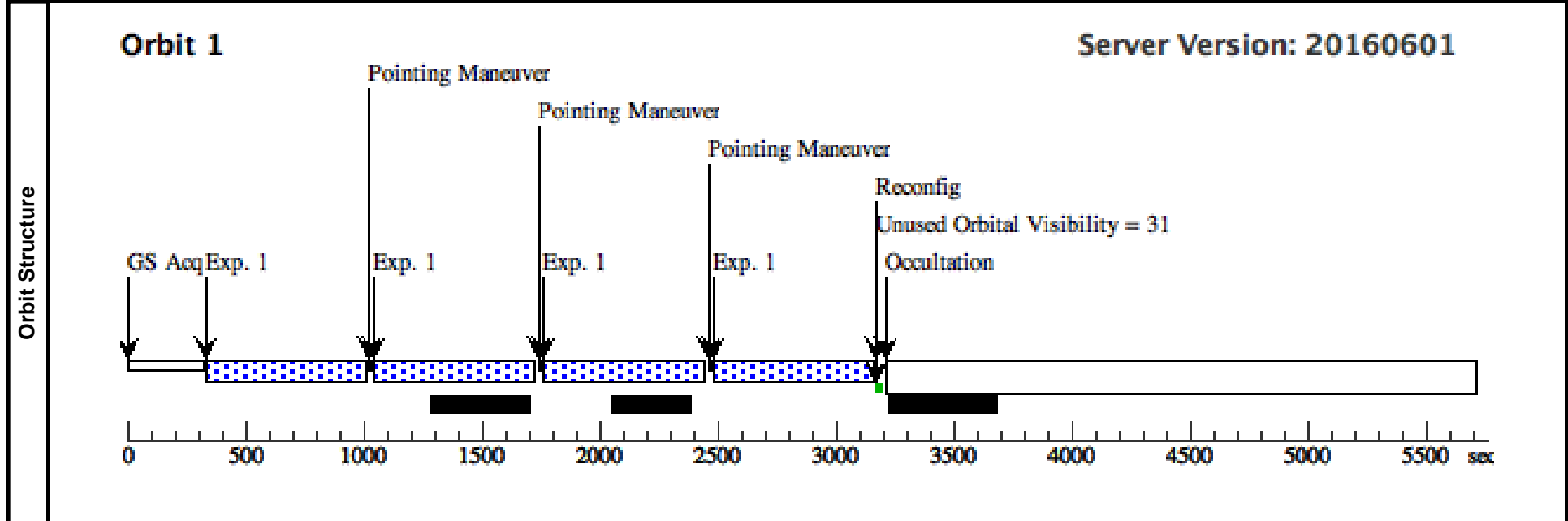
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Visit	Proposal 14721, Visit 02, implementation		
	Diagnostic Status: No Diagnostics		
	Scientific Instruments: WFC3/IR		
	Special Requirements: (none)		

Patterns	#	Primary Pattern	Secondary Pattern	Exposures	
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Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(2)	UV-108899	RA: 10 00 42.6500 (150.1777083d) Dec: +02 04 21.39 (2.07261d) Equinox: J2000			V=(?) K = 20.4, log M = 11.4

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(2) UV-108899	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPAR S50			Pattern 1, Exps 1-1 i n Visit 02 (1)	652.938154 Secs (2611.753 Secs) [==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 2,1)] [==>(Pattern 2,2)]



Proposal 14721 - Visit 03 - The Fundamental Plane of Ultra-Massive Galaxies at z~2

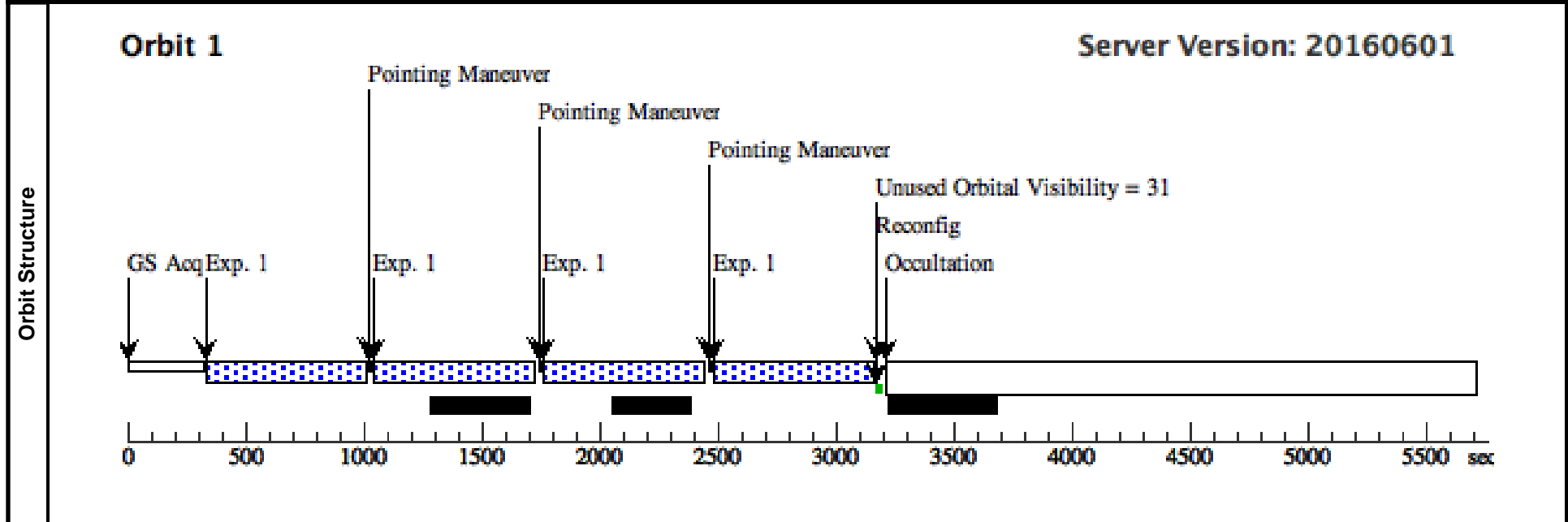
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Visit	Proposal 14721, Visit 03, implementation		
	Diagnostic Status: No Diagnostics		
	Scientific Instruments: WFC3/IR		
	Special Requirements: (none)		

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=

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(3)	UV-155853	RA: 09 58 13.5100 (149.5562917d) Dec: +02 10 2.09 (2.16725d) Equinox: J2000		V=(?) K = 20.4, log M = 11.3	Reference Frame: ICRS

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(3) UV-155853	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPAR S50			Pattern 1, Exps 1-1 i n Visit 03 (1)	652.938154 Secs (2611.753 Secs) [==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 2,1)] [==>(Pattern 2,2)]	[1]



Proposal 14721 - Visit 04 - The Fundamental Plane of Ultra-Massive Galaxies at z~2

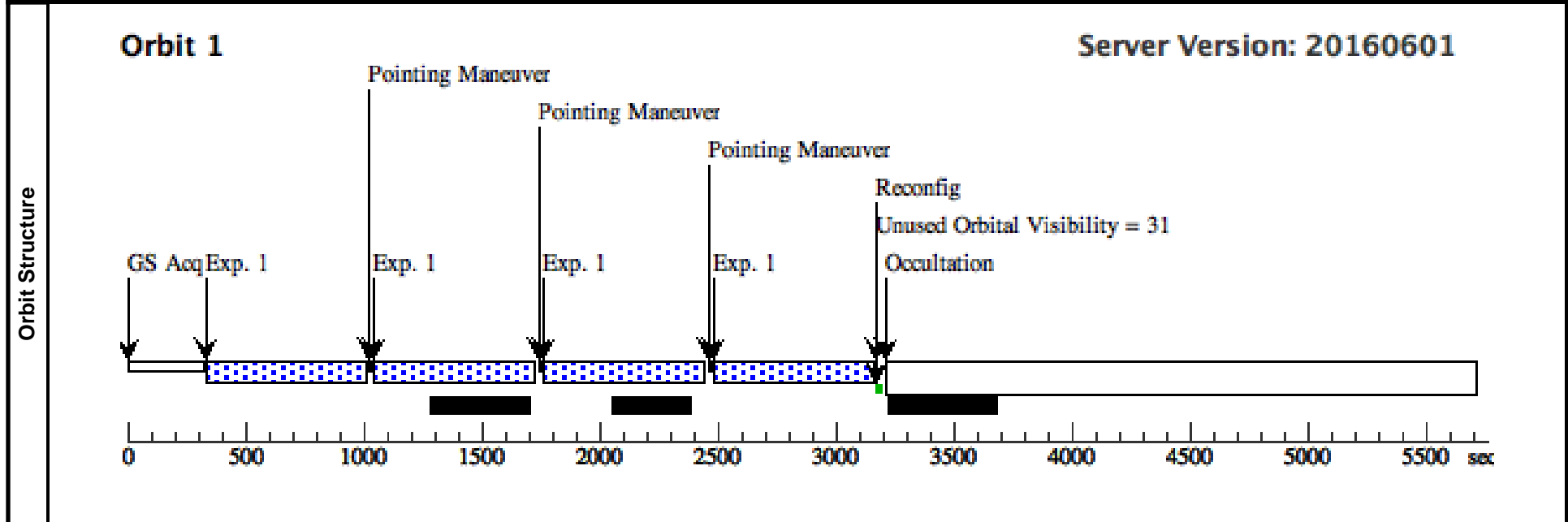
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Visit	Proposal 14721, Visit 04, implementation		
	Diagnostic Status: No Diagnostics		
	Scientific Instruments: WFC3/IR		
	Special Requirements: (none)		

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

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(4)	UV-171060	RA: 09 59 8.2000 (149.7841667d) Dec: +02 21 7.80 (2.35217d) Equinox: J2000			V=(?) K = 20.5, log M =11.3

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(4) UV-171060	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPAR S50			Pattern 1, Exps 1-1 i n Visit 04 (1)	652.938154 Secs (2611.753 Secs) [==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 2,1)] [==>(Pattern 2,2)]



Proposal 14721 - Visit 05 - The Fundamental Plane of Ultra-Massive Galaxies at z~2

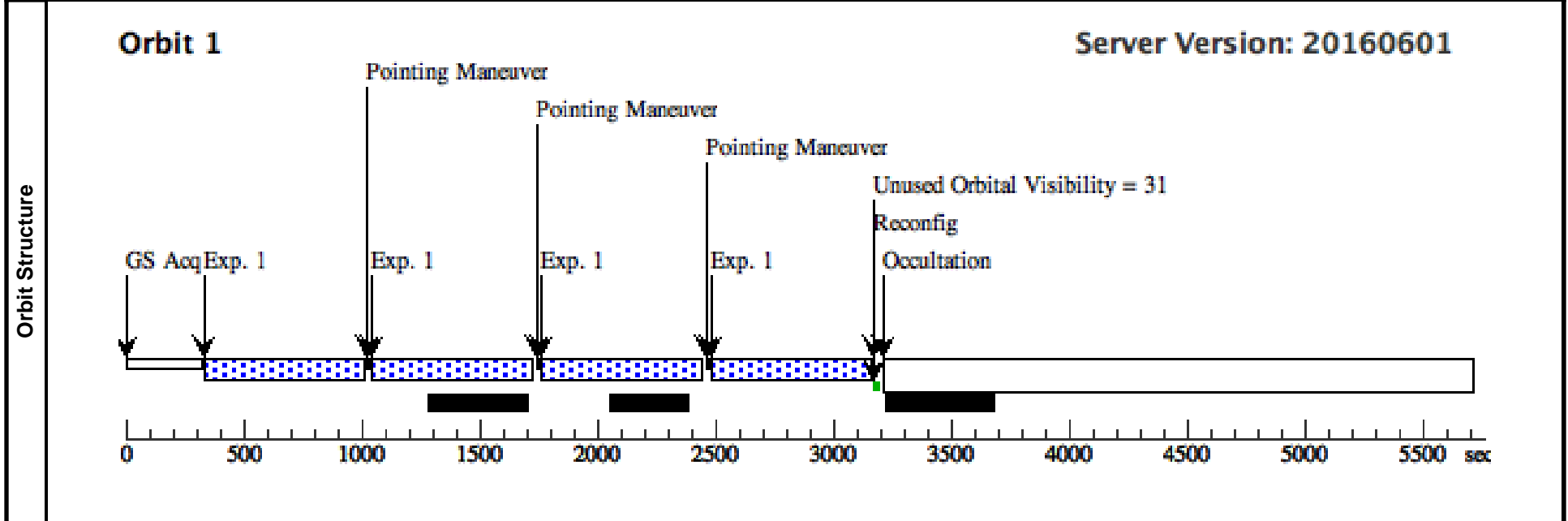
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Visit	Proposal 14721, Visit 05, implementation		
	Diagnostic Status: No Diagnostics		
	Scientific Instruments: WFC3/IR		
	Special Requirements: (none)		

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=

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(5)	UV-171687	RA: 09 59 31.3000 (149.8804167d) Dec: +02 20 46.60 (2.34628d) Equinox: J2000			V=(?) K = 20.5, log M = 11.2

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(5) UV-171687	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPAR S50			Pattern 1, Exps 1-1 i n Visit 05 (1)	652.938154 Secs (2611.753 Secs) [==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 2,1)] [==>(Pattern 2,2)]



Proposal 14721 - Visit 06 - The Fundamental Plane of Ultra-Massive Galaxies at z~2

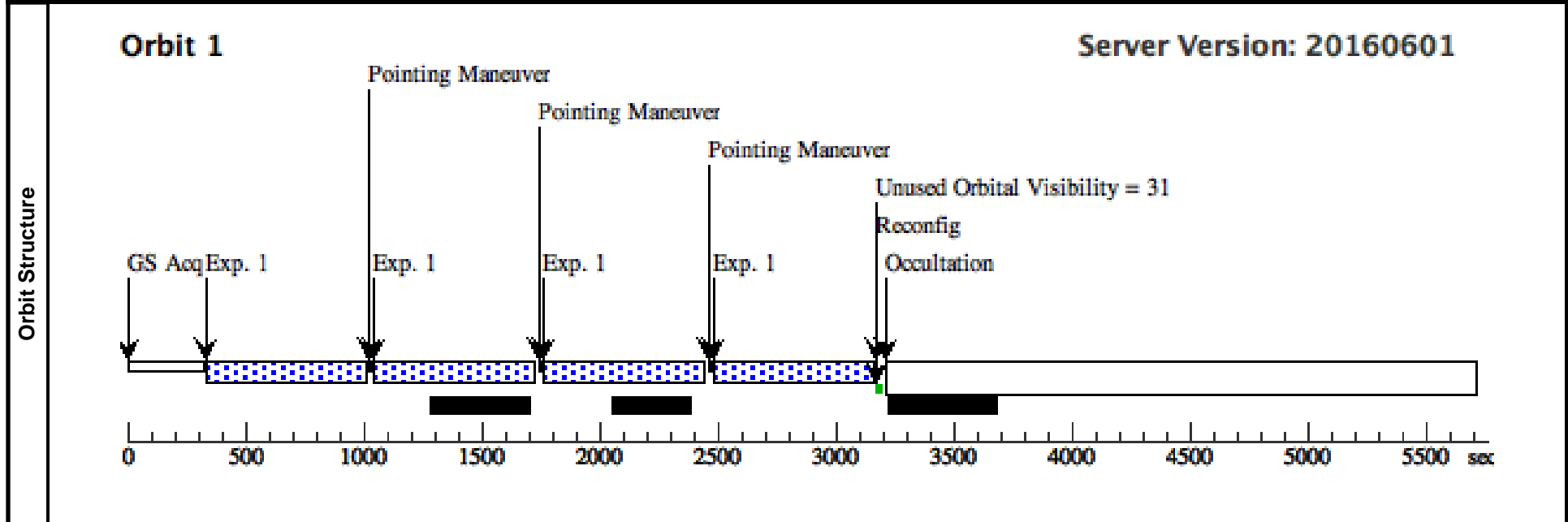
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Visit	Proposal 14721, Visit 06, implementation		
	Diagnostic Status: No Diagnostics		
	Scientific Instruments: WFC3/IR		
	Special Requirements: (none)		

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=

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(6)	UV-239220	RA: 09 57 43.8600 (149.4327500d) Dec: +02 30 38.31 (2.51064d) Equinox: J2000			V=(?) K = 20.4, log M = 11.4

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(6) UV-239220	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPAR S50			Pattern 1, Exps 1-1 i n Visit 06 (1)	652.938154 Secs (2611.753 Secs) [==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 2,1)] [==>(Pattern 2,2)]



Proposal 14721 - Visit 07 - The Fundamental Plane of Ultra-Massive Galaxies at z~2

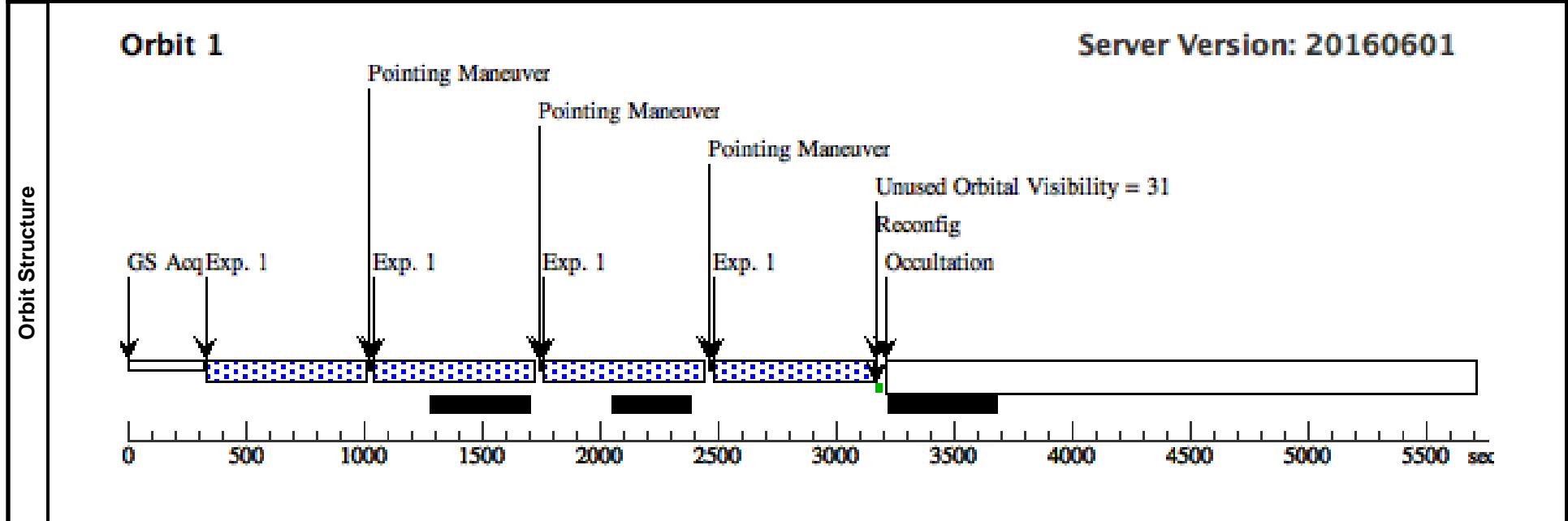
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Visit	Proposal 14721, Visit 07, implementation		
	Diagnostic Status: No Diagnostics		
	Scientific Instruments: WFC3/IR		
	Special Requirements: (none)		

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

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(7)	UV-230929	RA: 10 00 50.1600 (150.2090000d) Dec: +02 45 42.40 (2.76178d) Equinox: J2000			V=(?) K = 20.4, log M = 11.2

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(7) UV-230929	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPAR S50			Pattern 1, Exps 1-1 i n Visit 07 (1)	652.938154 Secs (2611.753 Secs) [==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 2,1)] [==>(Pattern 2,2)]



Proposal 14721 - Visit 08 - The Fundamental Plane of Ultra-Massive Galaxies at z~2

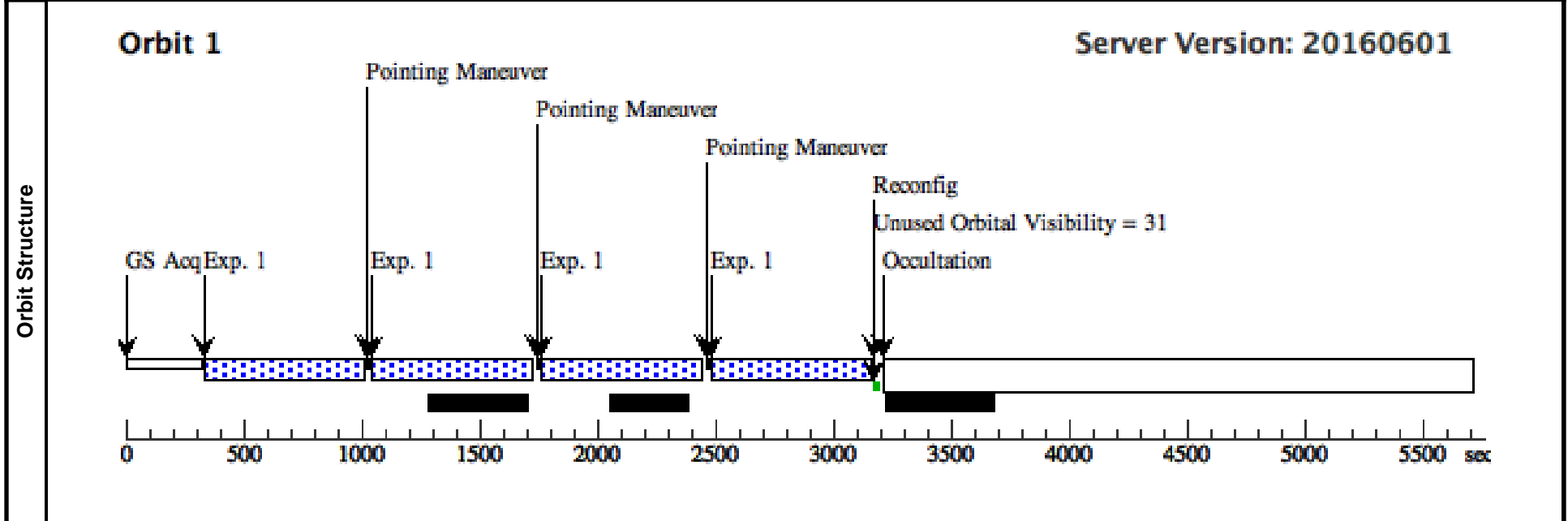
Fri Jul 29 19:03:12 GMT 2016

Visit	Proposal 14721, Visit 08, implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR Special Requirements: (none)		
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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

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(8)	UV-250513	RA: 09 59 17.1600 (149.8215000d) Dec: +02 39 12.43 (2.65345d) Equinox: J2000		V=(?) K = 20.4, log M =11.3	Reference Frame: ICRS
<i>Comments: Extended=YES</i>						

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(8) UV-250513	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPAR S50		Pattern 1, Exps 1-1 i n Visit 08 (1)	652.938154 Secs (2611.753 Secs) [==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 2,1)] [==>(Pattern 2,2)]	[1]



Proposal 14721 - Visit 09 - The Fundamental Plane of Ultra-Massive Galaxies at z~2

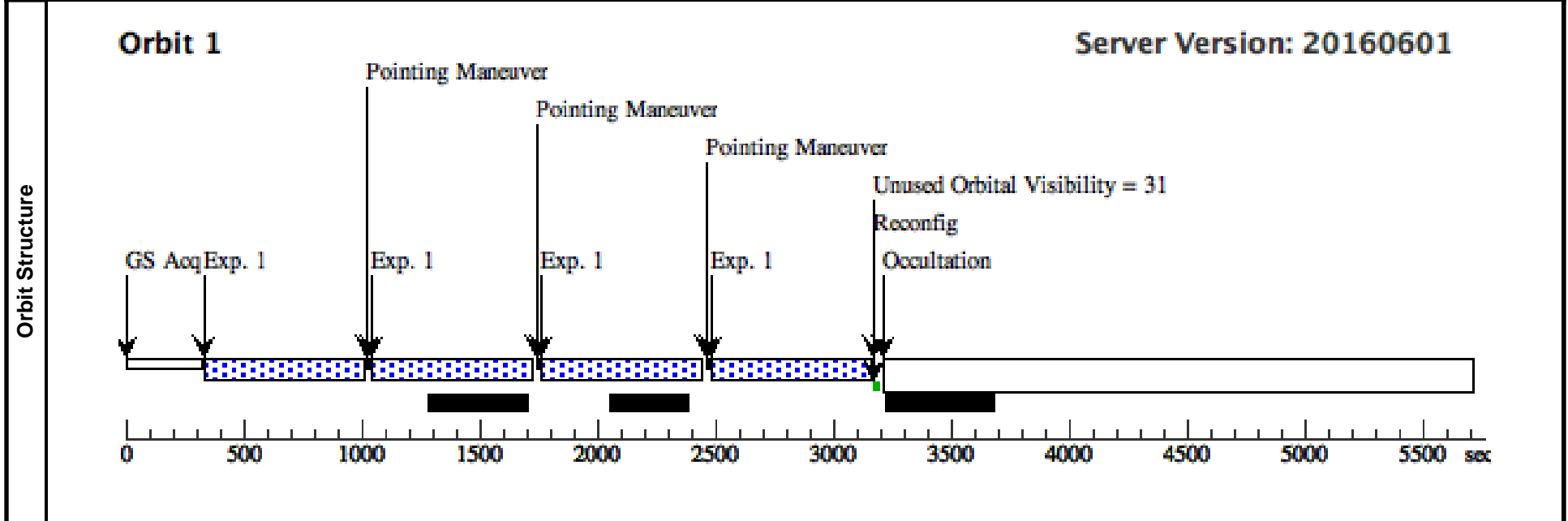
Fri Jul 29 19:03:12 GMT 2016

Visit	Proposal 14721, Visit 09, implementation		
	Diagnostic Status: No Diagnostics		
	Scientific Instruments: WFC3/IR		
	Special Requirements: (none)		

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

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(9)	UV-773654	RA: 10 02 58.9800 (150.7457500d) Dec: +02 00 37.77 (2.01049d) Equinox: J2000			V=(?) K = 20.4, log M = 11.4

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(9) UV-773654	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPAR S50			Pattern 1, Exps 1-1 i n Visit 09 (1)	652.938154 Secs (2611.753 Secs) [==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 2,1)] [==>(Pattern 2,2)]



Proposal 14721 - Visit 10 - The Fundamental Plane of Ultra-Massive Galaxies at z~2

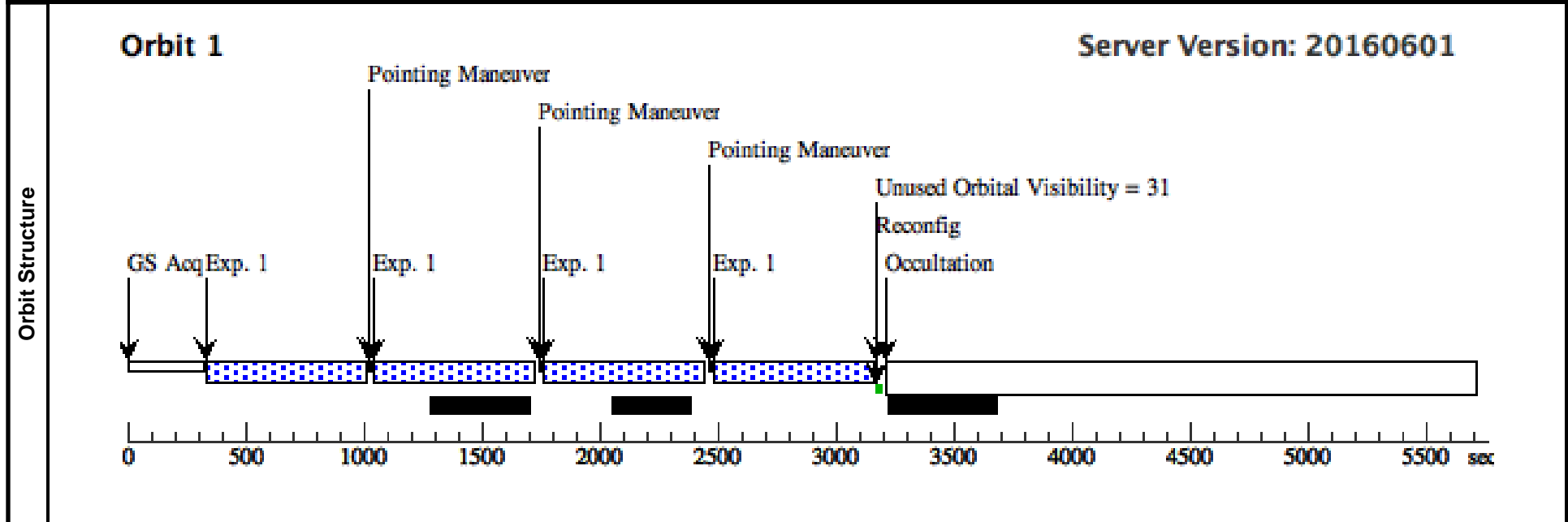
Fri Jul 29 19:03:12 GMT 2016

Visit	Proposal 14721, Visit 10, implementation		
	Diagnostic Status: No Diagnostics		
	Scientific Instruments: WFC3/IR		
	Special Requirements: (none)		

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

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(10)	UV-90676	RA: 10 01 59.3340 (150.4972250d) Dec: +02 16 11.24 (2.26979d) Equinox: J2000			V=(?) K = 20.4, log M =11.6

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(10) UV-90676	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPAR S50			Pattern 1, Exps 1-1 i n Visit 10 (1)	652.938154 Secs (2611.753 Secs) [==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 2,1)] [==>(Pattern 2,2)]



Proposal 14721 - Visit 11 - The Fundamental Plane of Ultra-Massive Galaxies at z~2

Fri Jul 29 19:03:12 GMT 2016

Visit	Proposal 14721, Visit 11, implementation		
	Diagnostic Status: No Diagnostics		
	Scientific Instruments: WFC3/IR		
	Special Requirements: (none)		

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

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(11)	UDS-19627	RA: 02 18 19.0540 (34.5793917d) Dec: -05 22 12.67 (-5.37019d) Equinox: J2000			V=(?) K = 20.2, log M = 11.3

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(11) UDS-19627	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPAR S50	GS ACQ SCENARI O BASE1B3	Pattern 1, Exps 1-1 i n Visit 11 (1)	652.938154 Secs (2611.753 Secs)	[==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 2,1)] [==>(Pattern 2,2)]

