



## 14153 - Measuring the Mass of El Gordo to Near the Virial Radius

Cycle: 23, 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) ACTJ0102-4915-F1	ACS/WFC	1	29-Jul-2016 13:08:36.0	yes
02	(2) ACTJ0102-4915-F2	ACS/WFC	1	29-Jul-2016 13:08:37.0	yes
03	(3) ACTJ0102-4915-F3	ACS/WFC	1	29-Jul-2016 13:08:38.0	yes
04	(4) ACTJ0102-4915-F4	ACS/WFC	1	29-Jul-2016 13:08:38.0	yes
05	(5) ACTJ0102-4915-F5	ACS/WFC	1	29-Jul-2016 13:08:39.0	yes
06	(6) ACTJ0102-4915-F6	ACS/WFC	1	29-Jul-2016 13:08:39.0	yes
07	(7) ACTJ0102-4915-F7	ACS/WFC	1	29-Jul-2016 13:08:40.0	yes
08	(8) ACTJ0102-4915-F8	ACS/WFC	1	29-Jul-2016 13:08:41.0	yes

8 Total Orbits Used

## **ABSTRACT**

We propose a wide-area weak gravitational lensing study of ACT J0102-4915 "El Gordo," the hottest, most massive, X-ray luminous, and brightest Sunyaev-Zel'dovich effect cluster and the only bullet-like merging cluster known at redshifts beyond 0.6. Our proposed ACS/WFC/F606W observations will result in a definitive, unbiased, model-independent mass profile to near the virial radius and an internal structure map of this  $z=0.87$  merging cluster to strengthen the constraints its existence places on the growth of structure and the nature of dark matter in the standard cosmological model.

## **OBSERVING DESCRIPTION**

The target is a rich cluster of galaxies at a redshift of 0.87. The observation goals are to obtain a weak lensing mass measurement out to the virial radius.

Currently there exists a 4-point mosaic of the center of the cluster in the F606W filter from HST program 12477. Our program expands the areal coverage by adding 8 more pointings in an annulus around the central region. The goal is to have complete spatial coverage of the field without any significant gaps between and among the existing 4-point mosaic and the 8 new pointings.

As requested in our proposal, the orientation angle of the new 8 WFC/ACS pointings should be within  $\pm 20$  degrees of the existing observations from program 12477. The given "Fixed Targets" coordinates were optimised assuming that the orientation angle will be within this range.

We use one orbit for each point in the mosaic, employing a 4-point box dither pattern intended to perform 1/2 subpixel sampling and cover the chip gaps of ACS/WFC.

Each pointing (orbit) is scheduled as a separate visit. Visit 1 has an ORIENT value designed to match the existing 4-point mosaic within  $\pm 20$  degrees (allowing also for a 180 degree rotation). The ORIENT values for the remaining 7 visits are set to be the same as Visit 1.

Proposal 14153 - Visit 01 - Measuring the Mass of El Gordo to Near the Virial Radius

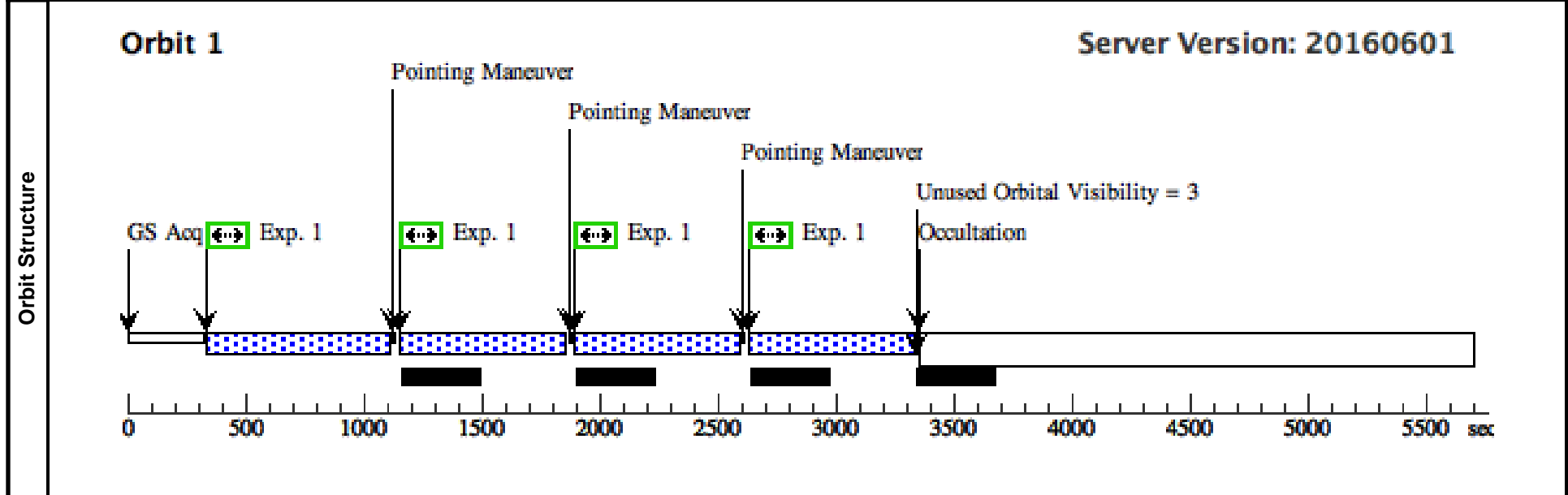
Fri Jul 29 17:08:41 GMT 2016

<b>Visit</b>	<b>Proposal 14153, Visit 01, implementation</b>		
	<b>Diagnostic Status: No Diagnostics</b>		
	Scientific Instruments: ACS/WFC		
	Special Requirements: ORIENT 8D TO 8 D; BETWEEN 26-SEP-2016 AND 09-OCT-2016		

<b>Patterns</b>	#	Primary Pattern	Secondary Pattern	Exposures
	(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=5.943 Line Spacing=3.077	Coordinate Frame=POS-TARG Pattern Orientation=91.429 Angle Between Sides=166.993 Center Pattern=false	

<b>Fixed Targets</b>	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	ACTJ0102-4915-F1	RA: 01 02 58.2080 (15.7425333d) Dec: -49 10 35.00 (-49.17639d) Equinox: J2000		V=20	Reference Frame: ICRS

<b>Exposures</b>	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(1) ACTJ0102-4915-F1	ACS/WFC, ACCUM, WFCENTER	F606W			GS ACQ SCENARIO BASE1B3	Pattern 1, Exps 1-1 in Visit 01 (1)	576 Secs (2304 Secs)
									[=>(Pattern 1)] [=>(Pattern 2)] [=>(Pattern 3)] [=>(Pattern 4)]	



Proposal 14153 - Visit 02 - Measuring the Mass of El Gordo to Near the Virial Radius

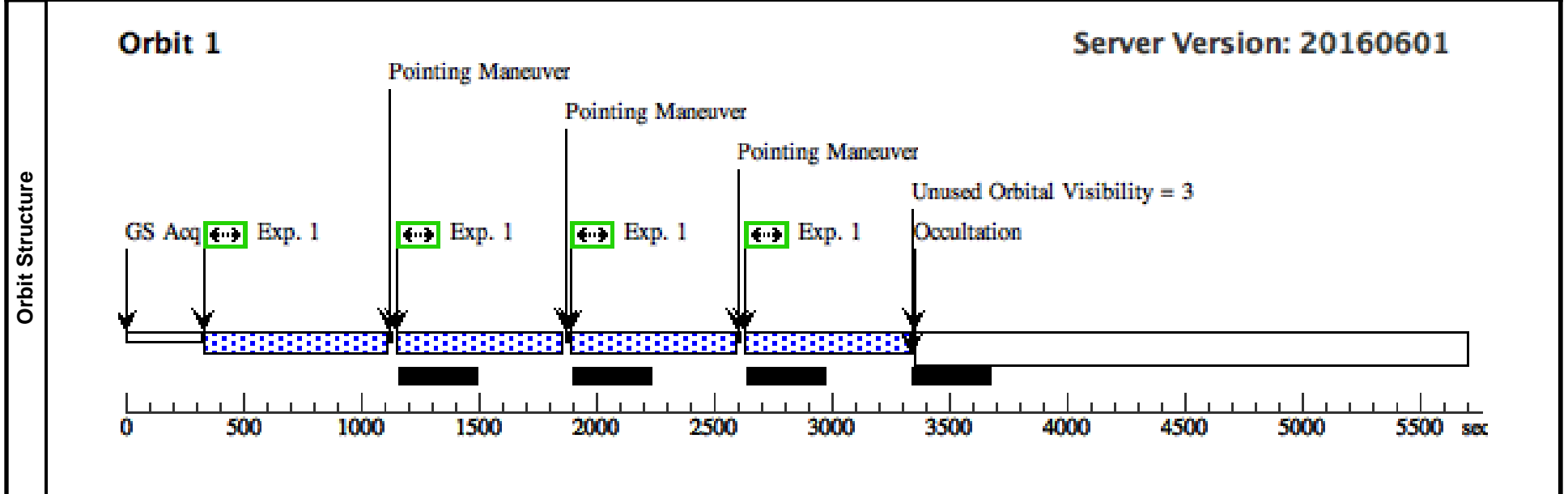
Fri Jul 29 17:08:42 GMT 2016

<b>Visit</b>	<b>Proposal 14153, Visit 02, implementation</b>		
	<b>Diagnostic Status: No Diagnostics</b>		
	Scientific Instruments: ACS/WFC		
	Special Requirements: SAME ORIENT AS 01		

<b>Patterns</b>	#	Primary Pattern	Secondary Pattern	Exposures
	(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=5.943 Line Spacing=3.077	Coordinate Frame=POS-TARG Pattern Orientation=91.429 Angle Between Sides=166.993 Center Pattern=false	

<b>Fixed Targets</b>	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(2)	ACTJ0102-4915-F2	RA: 01 03 16.6990 (15.8195792d) Dec: -49 12 43.97 (-49.21221d) Equinox: J2000		V=20	Reference Frame: ICRS

<b>Exposures</b>	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(2) ACTJ0102-4915-F2	ACS/WFC, ACCUM, WFCENTER	F606W			GS ACQ SCENARIO BASE1B3	Pattern 1, Exps 1-1 in Visit 02 (1)	576 Secs (2304 Secs)
									[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	



Proposal 14153 - Visit 03 - Measuring the Mass of El Gordo to Near the Virial Radius

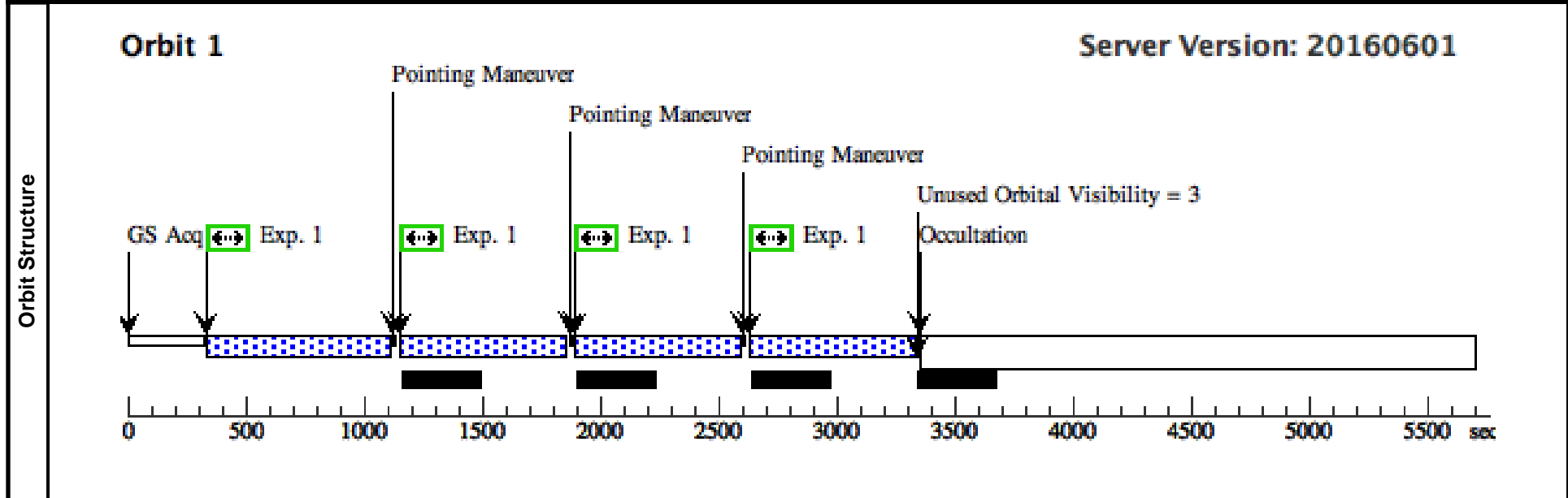
Fri Jul 29 17:08:42 GMT 2016

<b>Visit</b>	<b>Proposal 14153, Visit 03, implementation</b>		
	<b>Diagnostic Status: No Diagnostics</b>		
	Scientific Instruments: ACS/WFC		
	Special Requirements: SAME ORIENT AS 01		

<b>Patterns</b>	#	Primary Pattern	Secondary Pattern	Exposures
	(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=5.943 Line Spacing=3.077	Coordinate Frame=POS-TARG Pattern Orientation=91.429 Angle Between Sides=166.993 Center Pattern=false	

<b>Fixed Targets</b>	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(3)	ACTJ0102-4915-F3	RA: 01 03 22.2430 (15.8426792d) Dec: -49 16 14.02 (-49.27056d) Equinox: J2000		V=20	Reference Frame: ICRS

<b>Exposures</b>	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(3) ACTJ0102-4915-F3	ACS/WFC, ACCUM, WFCENTER	F606W			GS ACQ SCENARIO BASE1B3	Pattern 1, Exps 1-1 in Visit 03 (1)	576 Secs (2304 Secs)
									[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	



Proposal 14153 - Visit 04 - Measuring the Mass of El Gordo to Near the Virial Radius

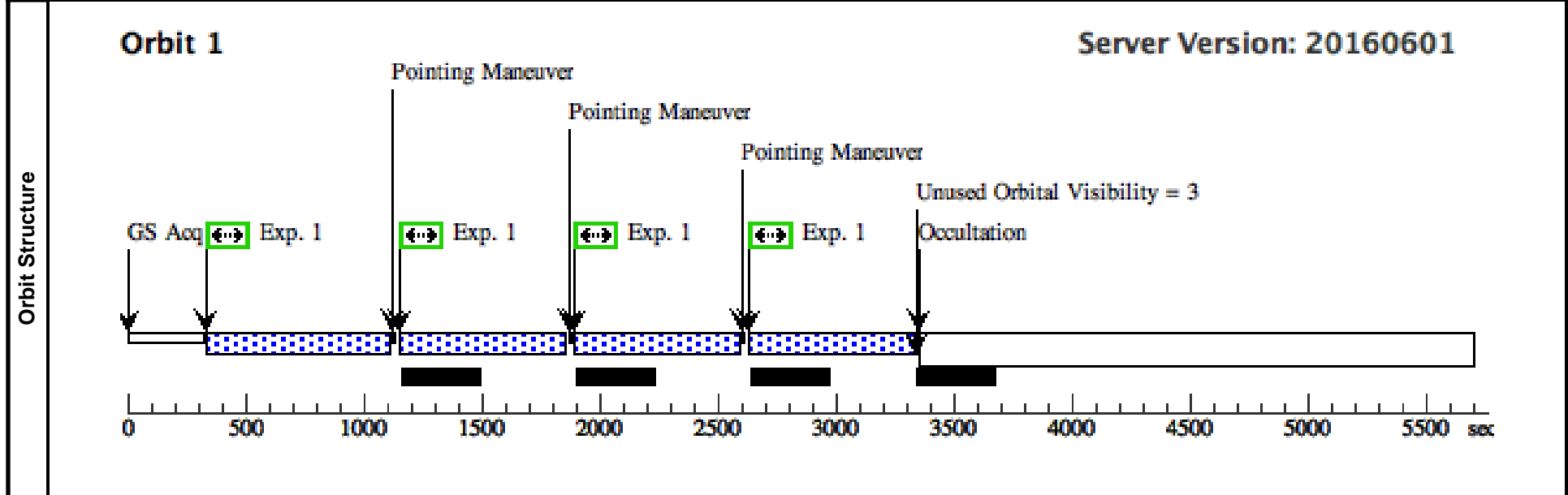
Fri Jul 29 17:08:42 GMT 2016

<b>Visit</b>	<b>Proposal 14153, Visit 04, implementation</b>		
	<b>Diagnostic Status: No Diagnostics</b>		
	Scientific Instruments: ACS/WFC		
	Special Requirements: SAME ORIENT AS 01		

<b>Patterns</b>	#	Primary Pattern	Secondary Pattern	Exposures
	(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=5.943 Line Spacing=3.077	Coordinate Frame=POS-TARG Pattern Orientation=91.429 Angle Between Sides=166.993 Center Pattern=false	

<b>Fixed Targets</b>	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(4)	ACTJ0102-4915-F4	RA: 01 03 13.2050 (15.8050208d) Dec: -49 19 14.93 (-49.32081d) Equinox: J2000		V=20	Reference Frame: ICRS

<b>Exposures</b>	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(4) ACTJ0102-4915-F4	ACS/WFC, ACCUM, WFCENTER	F606W			GS ACQ SCENARIO BASE1B3	Pattern 1, Exps 1-1 in Visit 04 (1)	576 Secs (2304 Secs)
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Proposal 14153 - Visit 05 - Measuring the Mass of El Gordo to Near the Virial Radius

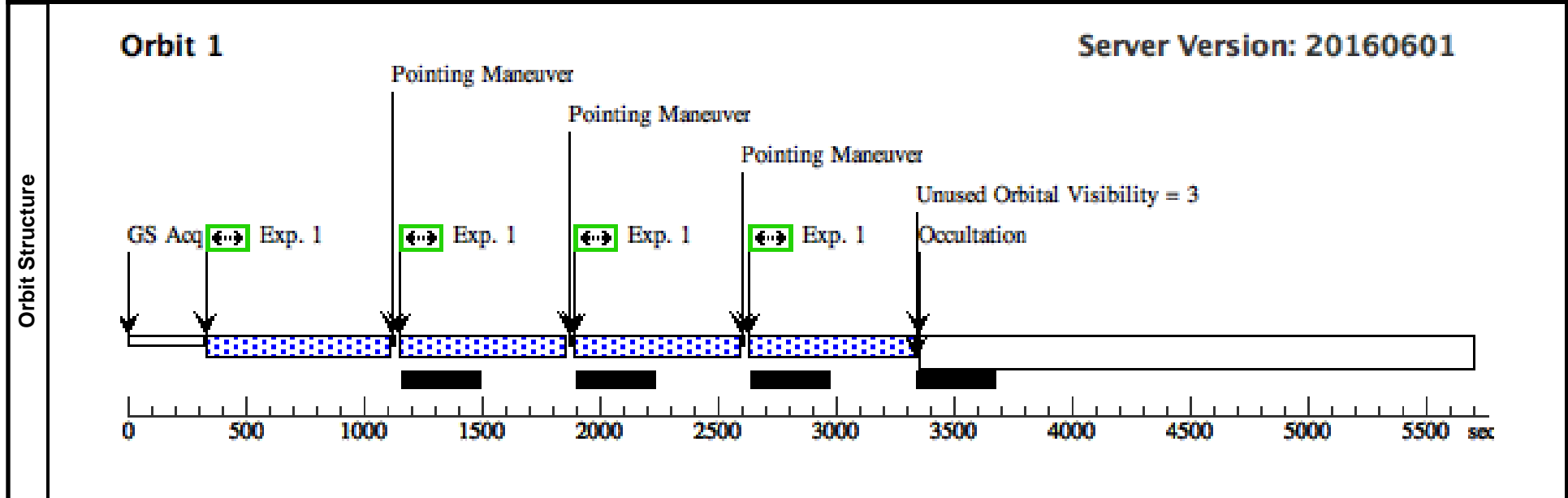
Fri Jul 29 17:08:42 GMT 2016

<b>Visit</b>	<b>Proposal 14153, Visit 05, implementation</b>		
	<b>Diagnostic Status: No Diagnostics</b>		
	Scientific Instruments: ACS/WFC		
	Special Requirements: SAME ORIENT AS 01		

<b>Patterns</b>	#	Primary Pattern	Secondary Pattern	Exposures
	(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=5.943 Line Spacing=3.077	Coordinate Frame=POS-TARG Pattern Orientation=91.429 Angle Between Sides=166.993 Center Pattern=false	

<b>Fixed Targets</b>	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(5)	ACTJ0102-4915-F5	RA: 01 02 52.8800 (15.7203333d) Dec: -49 20 3.49 (-49.33430d) Equinox: J2000		V=20	Reference Frame: ICRS

<b>Exposures</b>	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(5) ACTJ0102-4915-F5	ACS/WFC, ACCUM, WFCENTER	F606W			GS ACQ SCENARIO BASE1B3	Pattern 1, Exps 1-1 in Visit 05 (1)	576 Secs (2304 Secs)
									[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	



Proposal 14153 - Visit 06 - Measuring the Mass of El Gordo to Near the Virial Radius

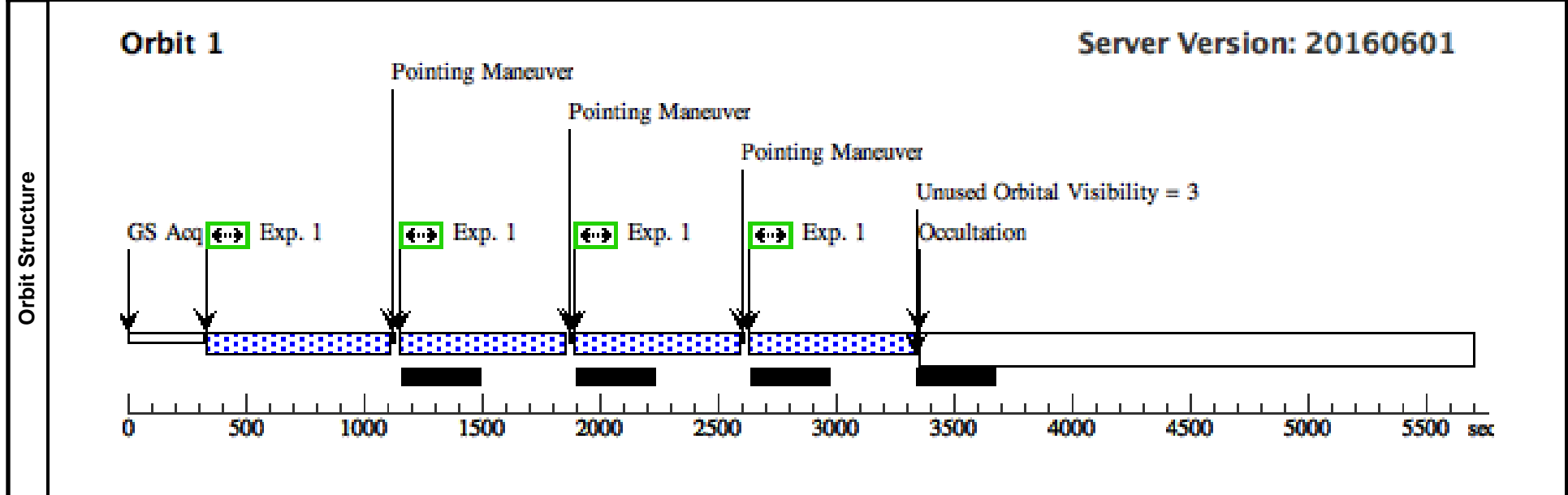
Fri Jul 29 17:08:42 GMT 2016

<b>Visit</b>	<b>Proposal 14153, Visit 06, implementation</b>		
	<b>Diagnostic Status: No Diagnostics</b>		
	Scientific Instruments: ACS/WFC		
	Special Requirements: SAME ORIENT AS 01		

<b>Patterns</b>	#	Primary Pattern	Secondary Pattern	Exposures
	(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=5.943 Line Spacing=3.077	Coordinate Frame=POS-TARG Pattern Orientation=91.429 Angle Between Sides=166.993 Center Pattern=false	

<b>Fixed Targets</b>	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(6)	ACTJ0102-4915-F6	RA: 01 02 34.0140 (15.6417250d) Dec: -49 18 13.01 (-49.30361d) Equinox: J2000		V=20	Reference Frame: ICRS

<b>Exposures</b>	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(6) ACTJ0102-4915-F6	ACS/WFC, ACCUM, WFCENTER	F606W			GS ACQ SCENARIO BASE1B3	Pattern 1, Exps 1-1 in Visit 06 (1)	576 Secs (2304 Secs)
									[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	





Proposal 14153 - Visit 07 - Measuring the Mass of El Gordo to Near the Virial Radius

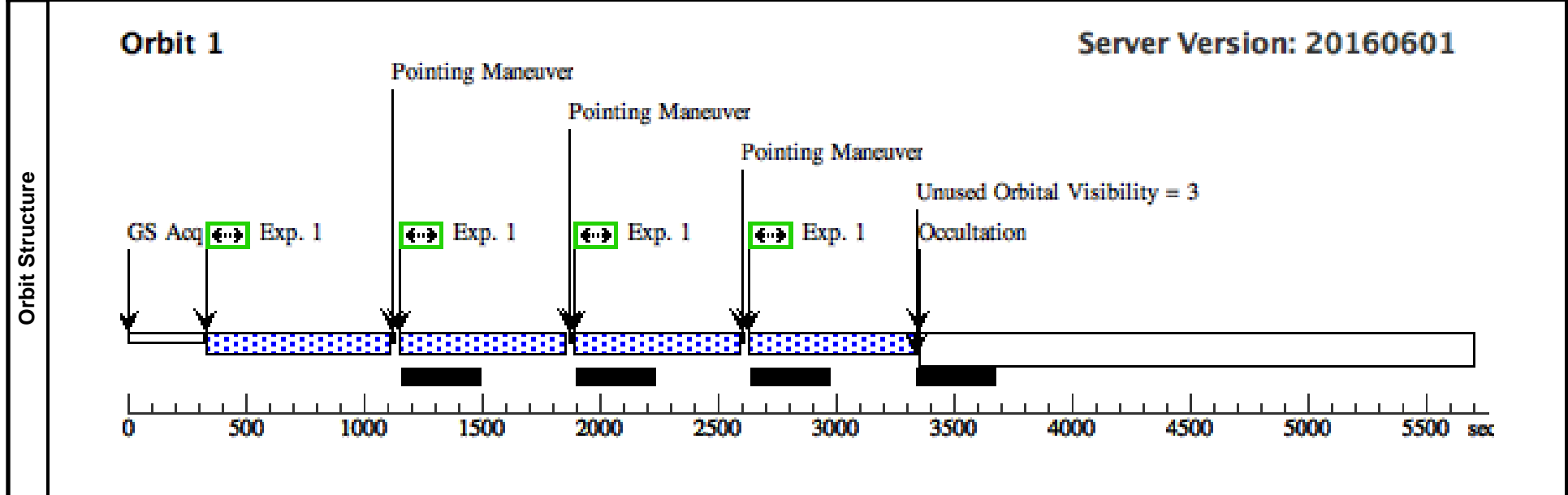
Fri Jul 29 17:08:42 GMT 2016

<b>Visit</b>	<b>Proposal 14153, Visit 07, implementation</b>		
	<b>Diagnostic Status: No Diagnostics</b>		
	Scientific Instruments: ACS/WFC		
	Special Requirements: SAME ORIENT AS 01		

<b>Patterns</b>	#	Primary Pattern	Secondary Pattern	Exposures
	(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=5.943 Line Spacing=3.077	Coordinate Frame=POS-TARG Pattern Orientation=91.429 Angle Between Sides=166.993 Center Pattern=false	

<b>Fixed Targets</b>	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(7)	ACTJ0102-4915-F7	RA: 01 02 26.5720 (15.6107167d) Dec: -49 14 41.30 (-49.24481d) Equinox: J2000		V=20	Reference Frame: ICRS

<b>Exposures</b>	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(7) ACTJ0102-4915-F7	ACS/WFC, ACCUM, WFCENTER	F606W			GS ACQ SCENARIO BASE1B3	Pattern 1, Exps 1-1 in Visit 07 (1)	576 Secs (2304 Secs)
									[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	



Proposal 14153 - Visit 08 - Measuring the Mass of El Gordo to Near the Virial Radius

Fri Jul 29 17:08:42 GMT 2016

<b>Visit</b>	<b>Proposal 14153, Visit 08, implementation</b>		
	<b>Diagnostic Status: No Diagnostics</b>		
	Scientific Instruments: ACS/WFC		
	Special Requirements: SAME ORIENT AS 01		

<b>Patterns</b>	#	Primary Pattern	Secondary Pattern	Exposures
	(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=5.943 Line Spacing=3.077	Coordinate Frame=POS-TARG Pattern Orientation=91.429 Angle Between Sides=166.993 Center Pattern=false	

<b>Fixed Targets</b>	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(8)	ACTJ0102-4915-F8	RA: 01 02 37.9640 (15.6581833d) Dec: -49 11 44.27 (-49.19563d) Equinox: J2000		V=20	Reference Frame: ICRS

<b>Exposures</b>	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(8) ACTJ0102-4915-F8	ACS/WFC, ACCUM, WFCENTER	F606W			GS ACQ SCENARIO BASE1B3	Pattern 1, Exps 1-1 in Visit 08 (1)	576 Secs (2304 Secs)
									[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]

