



13431 - The First Spectroscopic Phase Curve of a Transiting Planet: Understanding the Deeper Atmosphere

Cycle: 21, 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) WASP-19CEN	WFC3/IR	5	11-Jul-2013 21:20:24.0	yes
02	(1) WASP-19CEN	WFC3/IR	5	11-Jul-2013 21:26:54.0	yes
03	(1) WASP-19CEN	WFC3/IR	5	11-Jul-2013 21:33:08.0	yes

15 Total Orbits Used

ABSTRACT

Characterization of extrasolar planets has accelerated rapidly thanks to low-density transiting hot Jupiters, which have large signals in transmission and secondary eclipse and enable the study of atmospheres in new and extreme conditions. Despite this, such observations are limited since they cannot directly be linked to physical atmospheric processes.

Phase curves are crucial because they provide information about the circulation in a planetary atmosphere by constraining the day-night temperature contrast and horizontal wind speeds. The only existing exoplanet phase curves are photometric. We propose to measure the first spectroscopic phase curve, to probe the 3D atmospheric thermal, chemical and wind structure. Unlike previous work, this will constrain degeneracies between atmospheric opacities and temperatures. We will target WASP-19b, an ideal candidate with a short orbital period, large expected signal and constrained composition.

We propose to measure the first near-IR phase curve using WFC3, to probe down to 0.4 bar, a previously unobserved regime and the deepest currently possible for thermal phase curves. WASP-19b is at the critical temperature where thermal redistribution could become less efficient. Deep-atmosphere observations, where advection should dominate, will provide the best constraints (Showman & Guillot, 2002) and will also reach down to the optical photosphere for transmission spectroscopy.

The proposed observations will extend our knowledge to 3D circulation, and constrain physical processes in a previously unobserved altitude regime in an important object near the thermal redistribution efficiency limit. They are only achievable with the HST.

OBSERVING DESCRIPTION

This program uses the WFC3 instrument to perform precision photometry over the course of half an orbit of an exoplanet. The aim is to measure the change in brightness of the tidally-locked planet over the course of its orbit to determine how the planet's temperature varies across its surface.

The target will be observed in 3 separate visits each containing 5 orbits. Each visit will be offset from the others in phase so that the gaps for Earth occultation occur in different phases of the planet's orbit for each visit. This will ensure that we obtain as complete coverage as possible over the duration of the phase curve.

The first orbit of each visit will not be used for analysis due to the systematics introduced by the HST settling into its new pointing position. This is a well known phenomenon, and all other similar transiting HST programs have adopted this strategy. We will use the G141 grism to cover the

Proposal 13431 (STScI Edit Number: 1, Created: Thursday, July 11, 2013 8:33:43 PM EST) - Overview

wavelength range 1.1-1.6 microns and will adopt exposure times of 47 seconds. We will use the 512 subarray to reduce overheads but still have a large enough FOV to encompass a comparison star, which will help us to correct for visit-long systematic trends. Each orbit contains 29 exposures (apart from the first orbit).

We will use the new spatial scan mode which will lengthen the spectrum along the y-axis of the detector during an exposure. This avoids saturation and permits relatively long exposures, greatly increasing the efficiency. We will observe both WASP-19 and a comparison star simultaneously with a roll angle requirement to avoid overlapping spectra. There is an additional roll angle requirement in place due to a third star close to the comparison star.

Our target for the observation is the center of the field between our science target (WASP-19) and the comparison star. This will be centred in the middle of the detector, meaning that each of the two stars we wish to observe will be in a different half of the detector. This strategy enables two different possible roll ranges 180 degrees apart and eases scheduling.

REAL TIME JUSTIFICATION

We have placed a constraint that we want to observe the target between November 2013 and June 2014. Out of this time, we would strongly prefer the period from February 2014 to June 2014. This is to enable ground-based monitoring of the star from the CTIO to characterise and remove contamination from stellar variability in the signal. WASP-19 is observable from the CTIO from November 2013 to June 2014, but the CTIO observing semester only actually starts in February 2014. We have put in a director's discretionary proposal to enable the observations to start sooner. If that proposal is accepted, then we can hopefully use the whole range between November 2013 to June 2014.

Aside from this, each visit is phase constrained to start around a certain point in the planet's orbit.

Proposal 13431 - Visit 01 - The First Spectroscopic Phase Curve of a Transiting Planet: Understanding the Deeper Atmosphere

Fri Jul 12 01:33:43 GMT 2013

Visit	<p>Proposal 13431, Visit 01, implementation</p> <p>Diagnostic Status: No Diagnostics</p> <p>Scientific Instruments: WFC3/IR</p> <p>Special Requirements: SCHED 30%; ORIENT 4D TO 29 D; ORIENT 107D TO 132 D; ORIENT 184D TO 209 D; ORIENT 287D TO 312 D; BETWEEN 01-NOV-2013:00:00:00 AND 30-JUN-2014:00:00:00; Period 0.7888400 D AND ZERO-PHASE HJD2455168.96801</p> <p><i>Comments: It is essential that the 5 orbits be scheduled in a continuous block.</i></p>					
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes
(1)		WASP-19CEN	RA: 09 53 41.1806 (148.4215858d) Dec: -45 39 5.50 (-45.65153d) Equinox: J2000	Proper Motion RA: 0 mas/yr Proper Motion Dec: 0 mas/yr Epoch of Position: 2014	V=12.6	Reference Frame: ICRS
<p><i>Comments: Center point between WASP-19 and a comparison star.</i></p>						

Proposal 13431 - Visit 01 - The First Spectroscopic Phase Curve of a Transiting Planet: Understanding the Deeper Atmosphere

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
Exposures	1	ACQ, phase constrained	(1) WASP-19CEN	WFC3/IR, MULTIACCUM, IRSUB512	F139M	SAMP-SEQ=RAPID ; NSAMP=9	POS TARG 0.0,-2.4 2; PHASE 0.76956037 TO 0.78666922	7.677243 Secs (7.677 Secs) [==>]	[1]
	2	WASP-19 G 141 Orbit 1	(1) WASP-19CEN	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=SPARS 25; NSAMP=3	POS TARG -12.9,-2.42; SPATIAL SCAN 0.0 26,90.0 Degrees,Forward	46.695529 Secs X 27 (1260.779 Secs) [==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)] [==>(Copy 10)] [==>(Copy 11)] [==>(Copy 12)] [==>(Copy 13)] [==>(Copy 14)] [==>(Copy 15)] [==>(Copy 16)] [==>(Copy 17)] [==>(Copy 18)] [==>(Copy 19)] [==>(Copy 20)] [==>(Copy 21)] [==>(Copy 22)] [==>(Copy 23)] [==>(Copy 24)] [==>(Copy 25)] [==>(Copy 26)] [==>(Copy 27)]	[1]
	3	WASP-19 G 141 Orbit 1 Extra	(1) WASP-19CEN	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=RAPID ; NSAMP=9	POS TARG -12.9,-2.42; SPATIAL SCAN 0.0 26,90.0 Degrees,Forward	7.677243 Secs (7.677 Secs) [==>]	[1]
<p>Comments: Extra exposure to force buffer dump into occultation time.</p>									

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4	WASP-19 G (1) WASP-19CEN 141 Orbit 2	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=SPARS 25; NSAMP=3	POS TARG -12.9,-2. 42; SPATIAL SCAN 0.0 26,90.0 Degrees,For ward	46.695529 Secs X 29 (1354.17 Secs)	[==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)] [==>(Copy 10)] [==>(Copy 11)] [==>(Copy 12)] [==>(Copy 13)] [==>(Copy 14)] [==>(Copy 15)] [==>(Copy 16)] [==>(Copy 17)] [==>(Copy 18)] [==>(Copy 19)] [==>(Copy 20)] [==>(Copy 21)] [==>(Copy 22)] [==>(Copy 23)] [==>(Copy 24)] [==>(Copy 25)] [==>(Copy 26)] [==>(Copy 27)] [==>(Copy 28)] [==>(Copy 29)]	[2]
5	WASP-19 G (1) WASP-19CEN 141 Orbit 2 Extra	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=RAPID ; NSAMP=14	POS TARG -12.9,-2. 42; SPATIAL SCAN 0.0 26,90.0 Degrees,For ward	11.942378 Secs (11.942 Secs)	[==>]	[2]
<i>Comments: Extra exposure to force buffer dump into occultation time.</i>								

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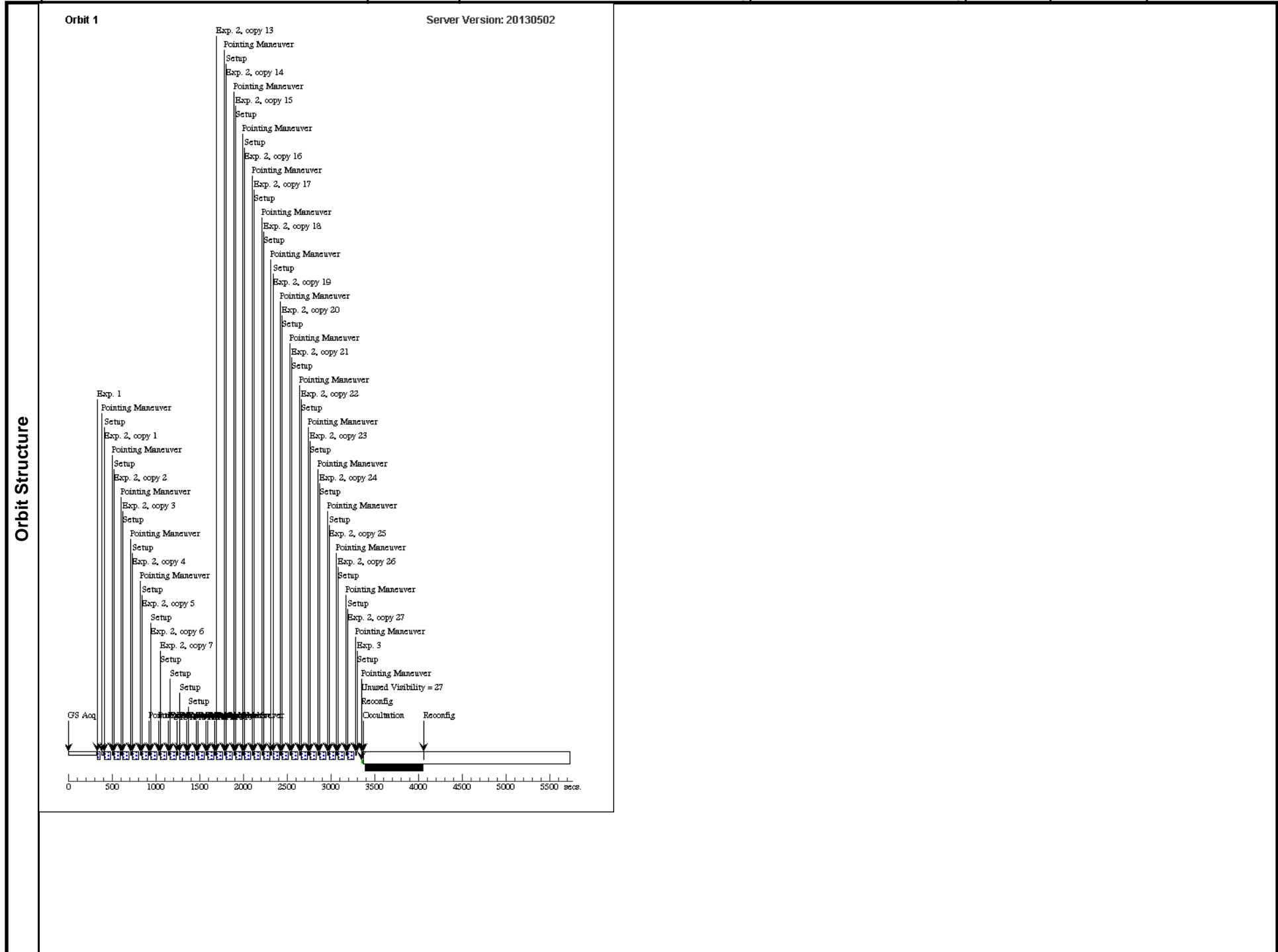
6	WASP-19 G (1) WASP-19CEN 141 Orbit 3	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=SPARS 25; NSAMP=3	POS TARG -12.9,-2. 42; SPATIAL SCAN 0.0 26,90.0 Degrees,For ward	46.695529 Secs X 29 (1354.17 Secs)	[==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)] [==>(Copy 10)] [==>(Copy 11)] [==>(Copy 12)] [==>(Copy 13)] [==>(Copy 14)] [==>(Copy 15)] [==>(Copy 16)] [==>(Copy 17)] [==>(Copy 18)] [==>(Copy 19)] [==>(Copy 20)] [==>(Copy 21)] [==>(Copy 22)] [==>(Copy 23)] [==>(Copy 24)] [==>(Copy 25)] [==>(Copy 26)] [==>(Copy 27)] [==>(Copy 28)] [==>(Copy 29)]	[3]
7	WASP-19 G (1) WASP-19CEN 141 Orbit 3 Extra	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=RAPID ; NSAMP=14	POS TARG -12.9,-2. 42; SPATIAL SCAN 0.0 26,90.0 Degrees,For ward	11.942378 Secs (11.942 Secs)	[==>]	[3]
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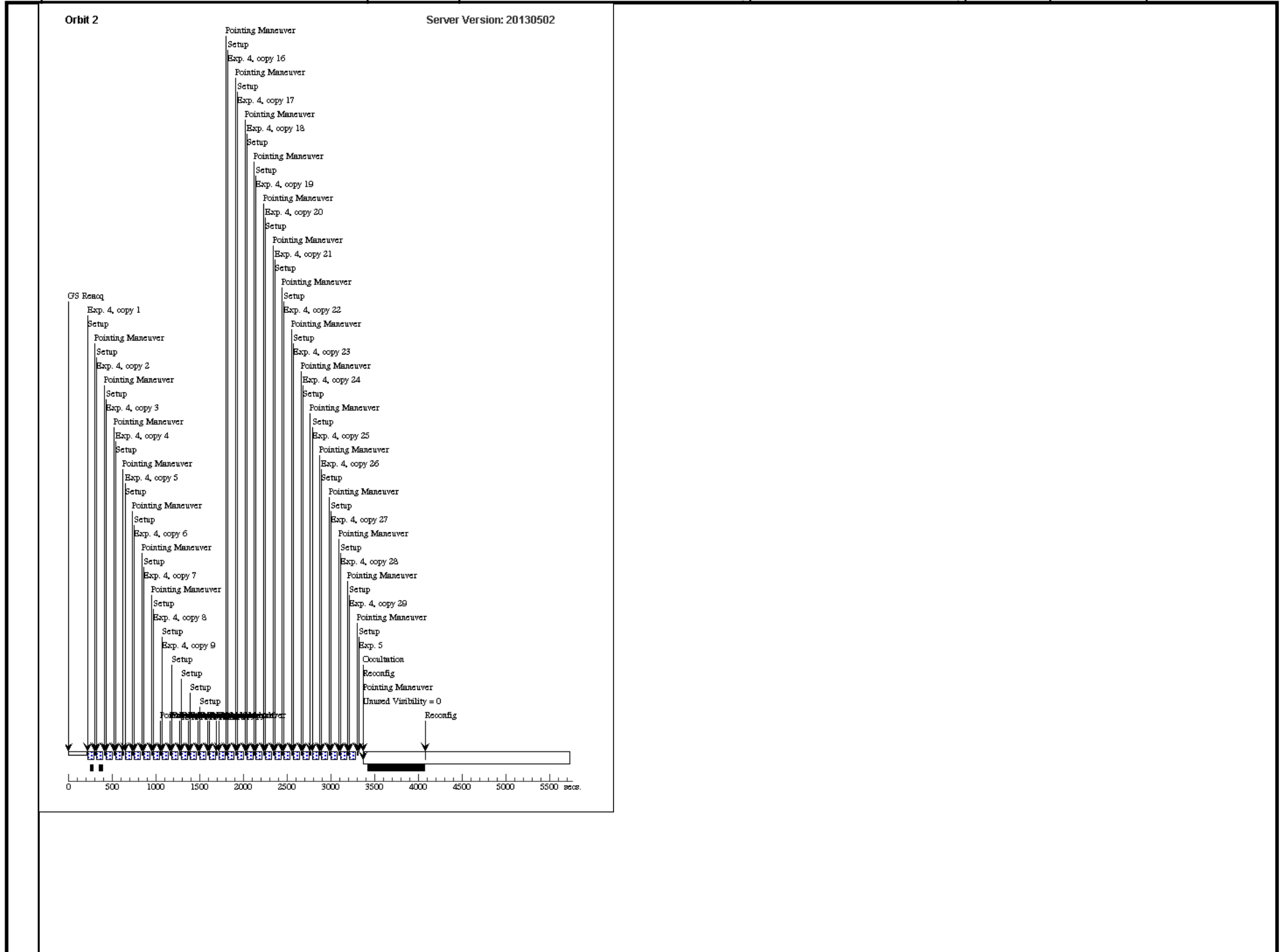
8	WASP-19 G (1) WASP-19CEN 141 Orbit 4	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=SPARS 25; NSAMP=3	POS TARG -12.9,-2. 42; SPATIAL SCAN 0.0 26,90.0 Degrees,For ward	46.695529 Secs X 29 (1354.17 Secs)	[==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)] [==>(Copy 10)] [==>(Copy 11)] [==>(Copy 12)] [==>(Copy 13)] [==>(Copy 14)] [==>(Copy 15)] [==>(Copy 16)] [==>(Copy 17)] [==>(Copy 18)] [==>(Copy 19)] [==>(Copy 20)] [==>(Copy 21)] [==>(Copy 22)] [==>(Copy 23)] [==>(Copy 24)] [==>(Copy 25)] [==>(Copy 26)] [==>(Copy 27)] [==>(Copy 28)] [==>(Copy 29)]	[4]
9	WASP-19 G (1) WASP-19CEN 141 Orbit 4 Extra	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=RAPID ; NSAMP=14	POS TARG -12.9,-2. 42; SPATIAL SCAN 0.0 26,90.0 Degrees,For ward	11.942378 Secs (11.942 Secs)	[==>]	[4]
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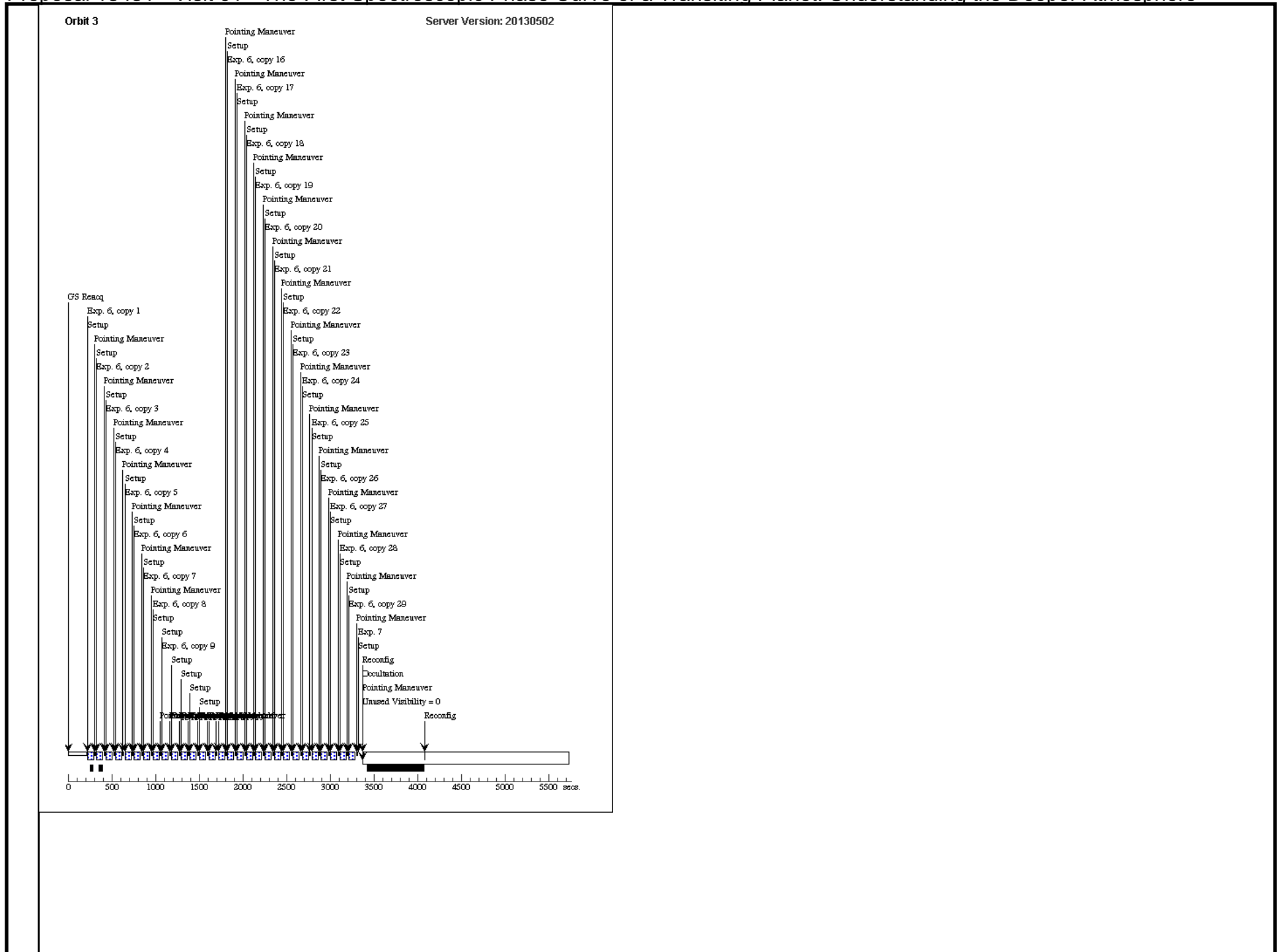
10	WASP-19 G (1) WASP-19CEN 141 Orbit 5	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=SPARS 25; NSAMP=3	POS TARG -12.9,-2. 42; SPATIAL SCAN 0.0 26,90.0 Degrees,For ward	46.695529 Secs X 29 (1354.17 Secs)	[==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)] [==>(Copy 10)] [==>(Copy 11)] [==>(Copy 12)] [==>(Copy 13)] [==>(Copy 14)] [==>(Copy 15)] [==>(Copy 16)] [==>(Copy 17)] [==>(Copy 18)] [==>(Copy 19)] [==>(Copy 20)] [==>(Copy 21)] [==>(Copy 22)] [==>(Copy 23)] [==>(Copy 24)] [==>(Copy 25)] [==>(Copy 26)] [==>(Copy 27)] [==>(Copy 28)] [==>(Copy 29)]	[5]
11	WASP-19 G (1) WASP-19CEN 141 Orbit 5 Extra	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=RAPID ; NSAMP=14	POS TARG -12.9,-2. 42; SPATIAL SCAN 0.0 26,90.0 Degrees,For ward	11.942378 Secs (11.942 Secs)	[==>]	[5]
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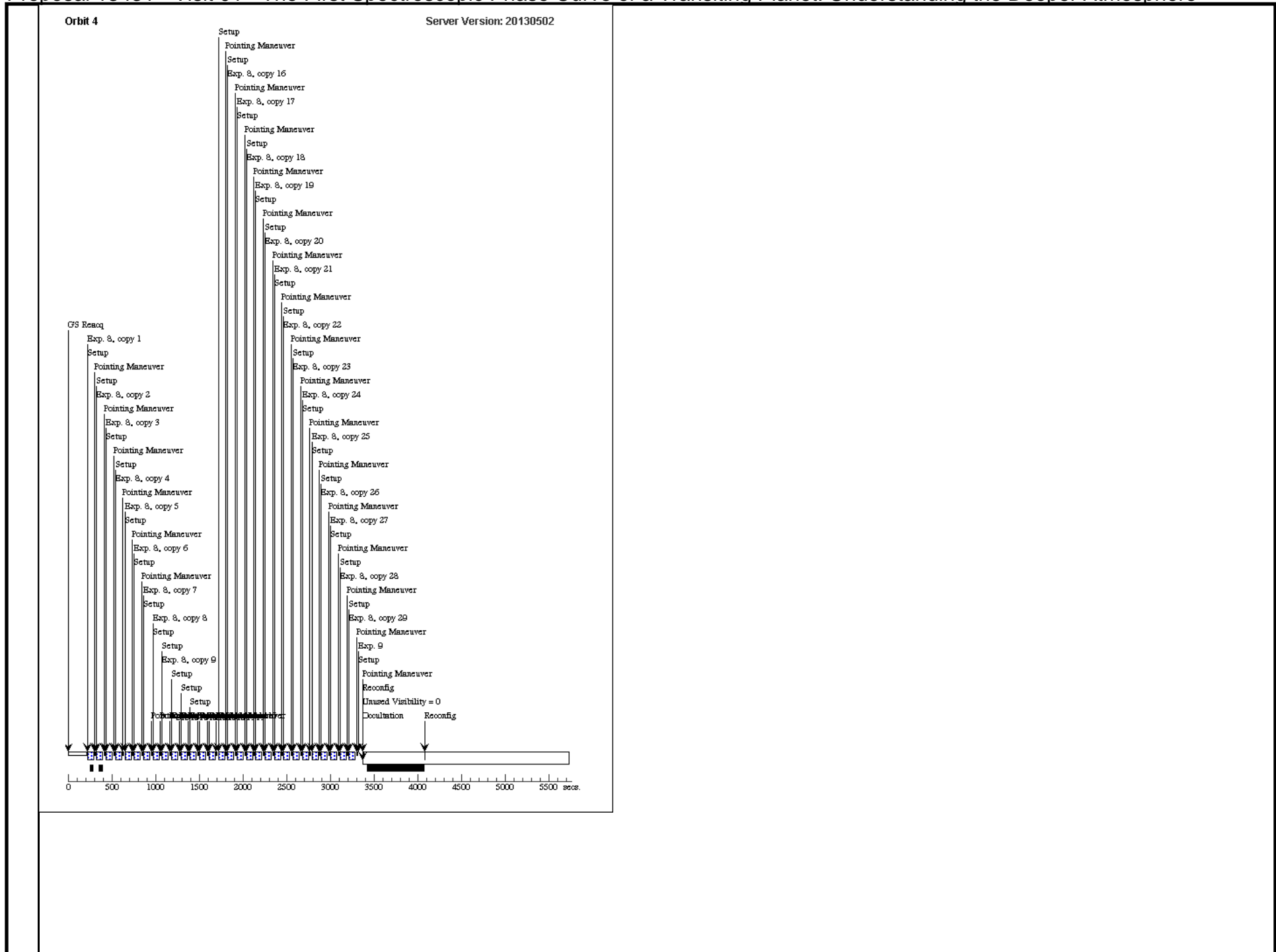
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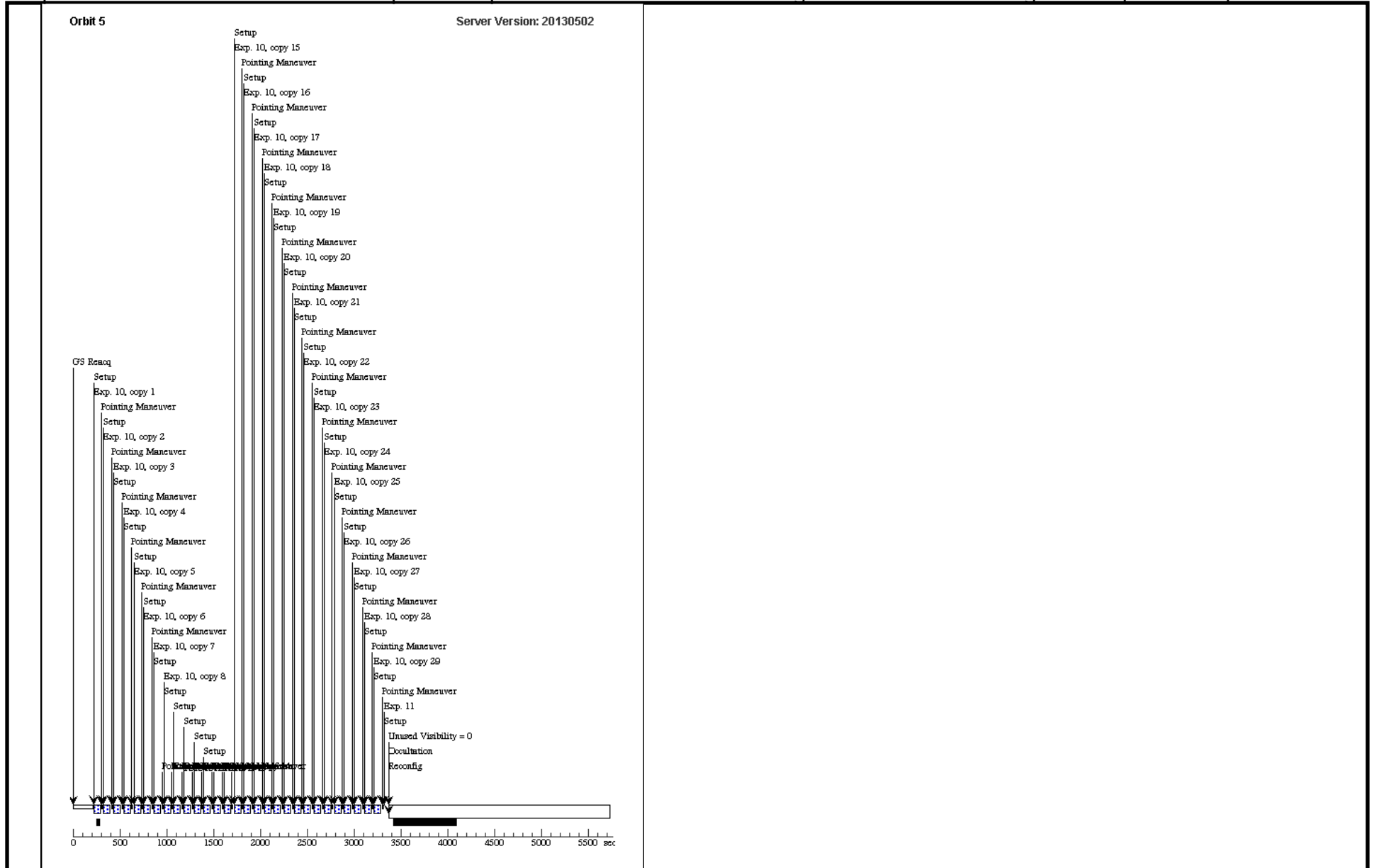
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Proposal 13431 - Visit 02 - The First Spectroscopic Phase Curve of a Transiting Planet: Understanding the Deeper Atmosphere

Fri Jul 12 01:33:57 GMT 2013

Visit	<p>Proposal 13431, Visit 02, implementation</p> <p>Diagnostic Status: No Diagnostics</p> <p>Scientific Instruments: WFC3/IR</p> <p>Special Requirements: SCHED 30%; ORIENT 4D TO 29 D; ORIENT 107D TO 132 D; ORIENT 184D TO 209 D; ORIENT 287D TO 312 D; BETWEEN 01-NOV-2013:00:00:00 AND 30-JUN-2014:00:00:00; Period 0.7888400 D AND ZERO-PHASE HJD2455168.96801</p> <p><i>Comments: It is essential that the 5 orbits be scheduled in a continuous block.</i></p>					
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<p><i>Comments: Center point between WASP-19 and a comparison star.</i></p>						

Proposal 13431 - Visit 02 - The First Spectroscopic Phase Curve of a Transiting Planet: Understanding the Deeper Atmosphere

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Proposal 13431 - Visit 02 - The First Spectroscopic Phase Curve of a Transiting Planet: Understanding the Deeper Atmosphere

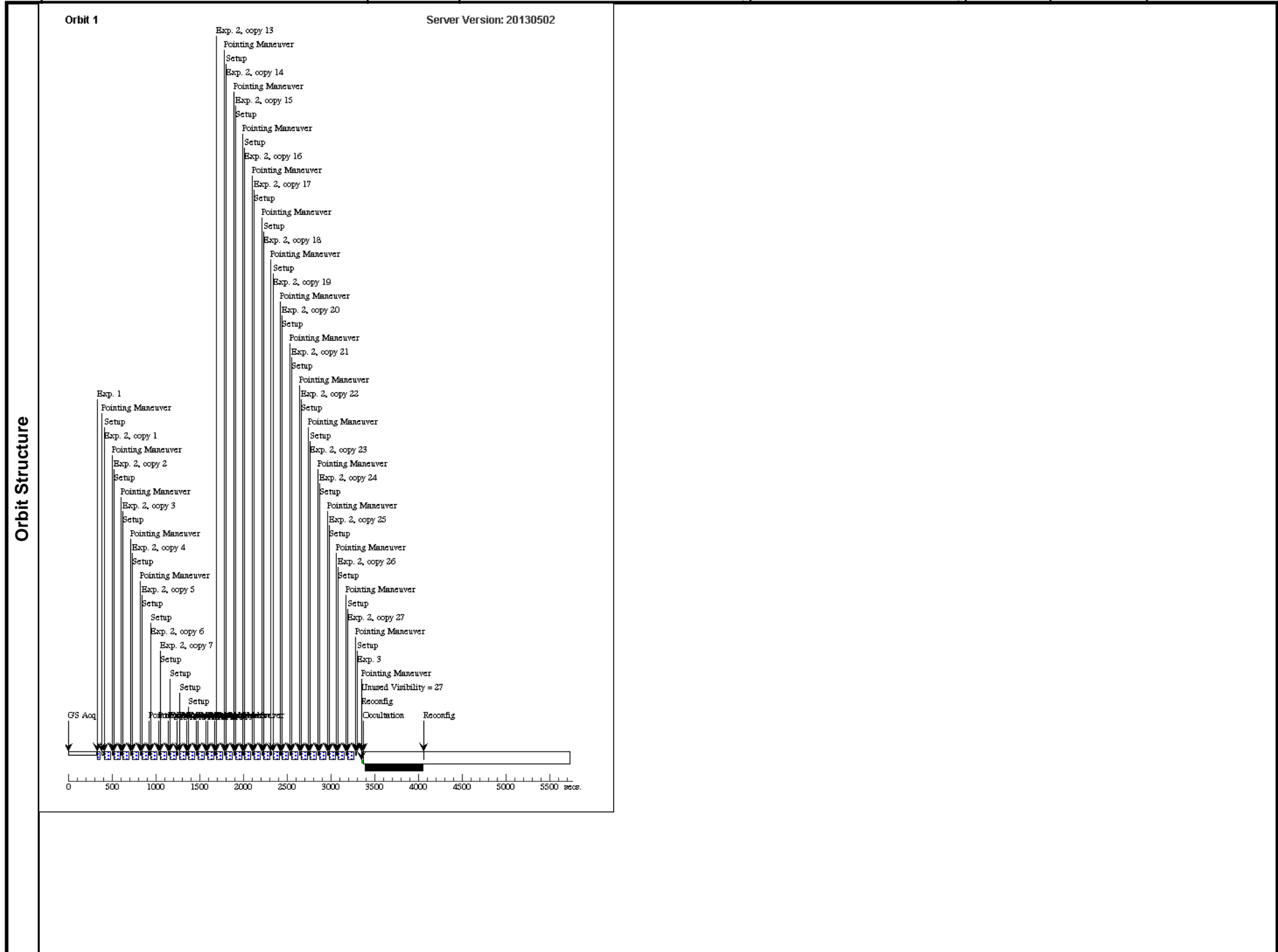
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Proposal 13431 - Visit 02 - The First Spectroscopic Phase Curve of a Transiting Planet: Understanding the Deeper Atmosphere

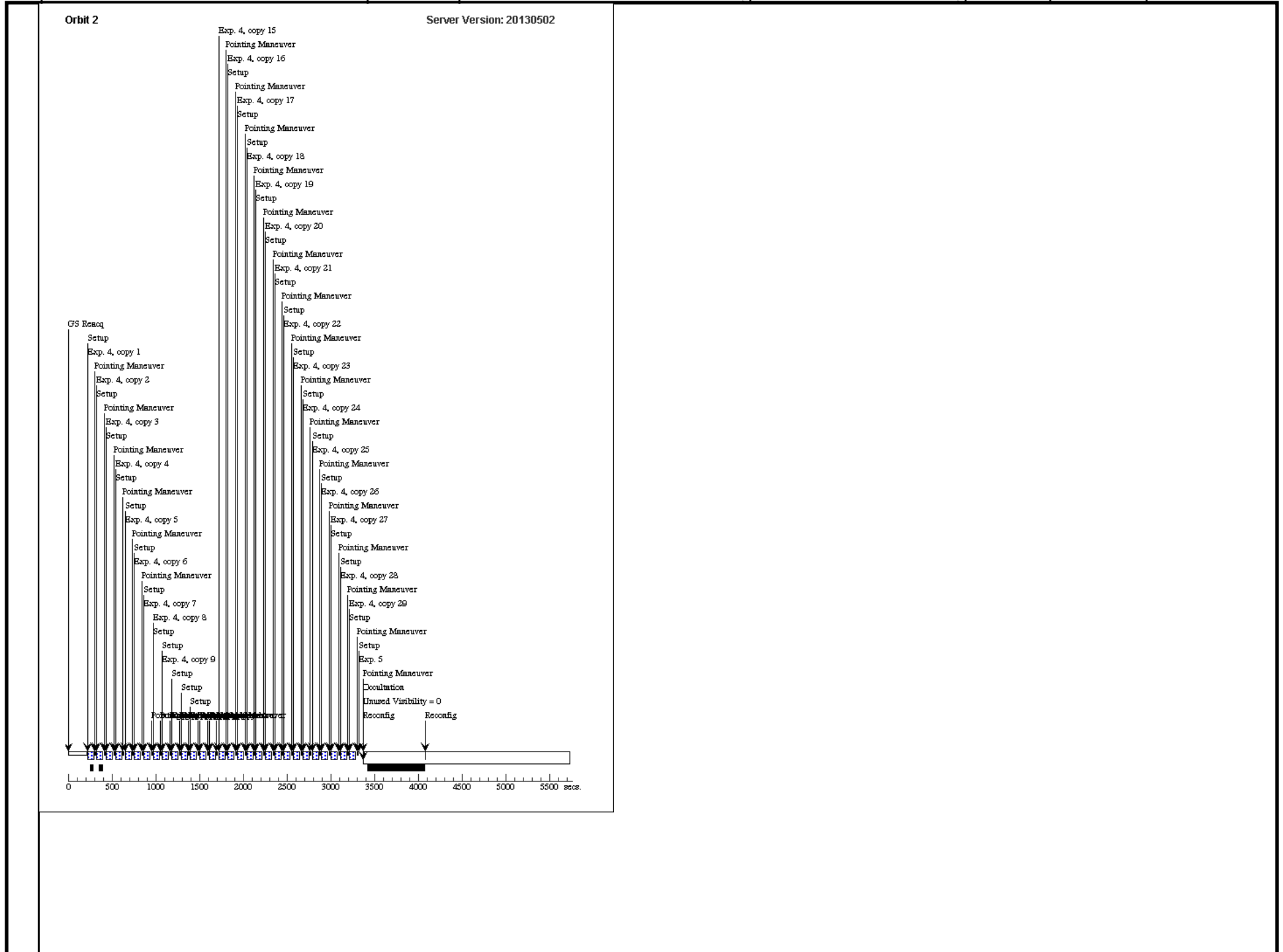
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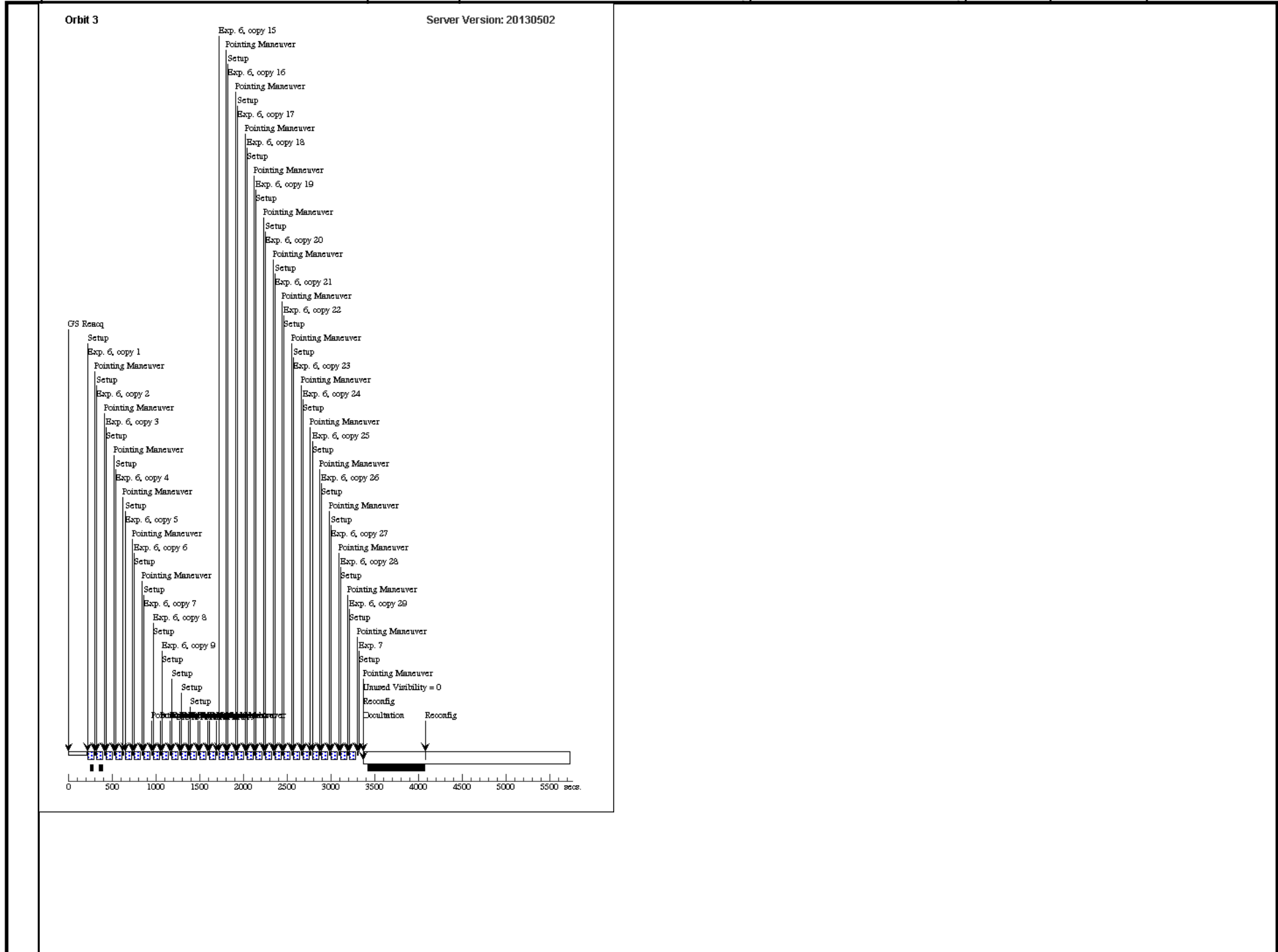
10	WASP-19 G (1) WASP-19CEN 141 Orbit 5	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=SPARS 25; NSAMP=3	POS TARG -12.9,-2. 42; SPATIAL SCAN 0.0 26,90.0 Degrees,For ward	46.695529 Secs X 29 (1354.17 Secs)	[==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)] [==>(Copy 10)] [==>(Copy 11)] [==>(Copy 12)] [==>(Copy 13)] [==>(Copy 14)] [==>(Copy 15)] [==>(Copy 16)] [==>(Copy 17)] [==>(Copy 18)] [==>(Copy 19)] [==>(Copy 20)] [==>(Copy 21)] [==>(Copy 22)] [==>(Copy 23)] [==>(Copy 24)] [==>(Copy 25)] [==>(Copy 26)] [==>(Copy 27)] [==>(Copy 28)] [==>(Copy 29)]	[5]
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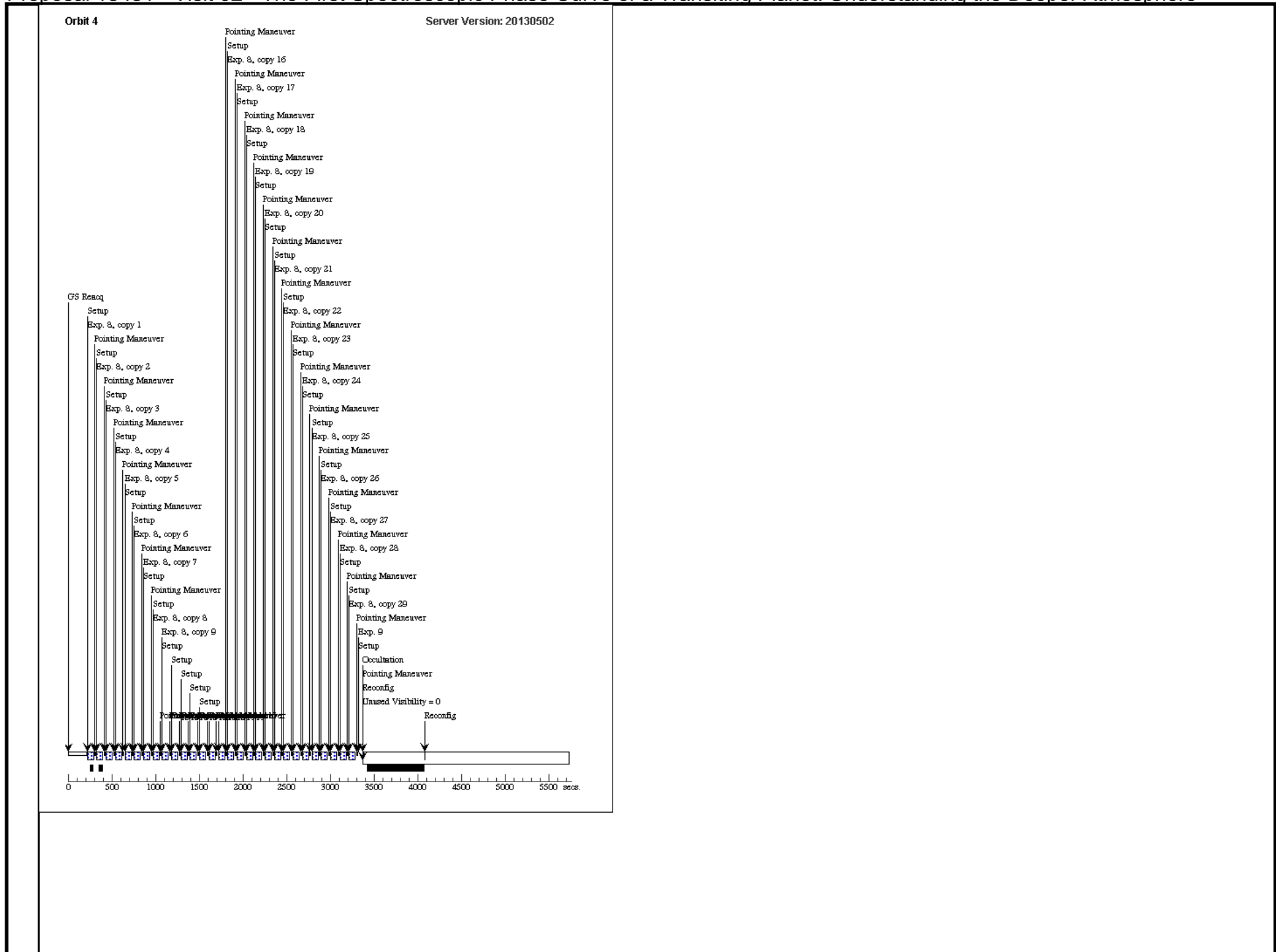
Proposal 13431 - Visit 02 - The First Spectroscopic Phase Curve of a Transiting Planet: Understanding the Deeper Atmosphere



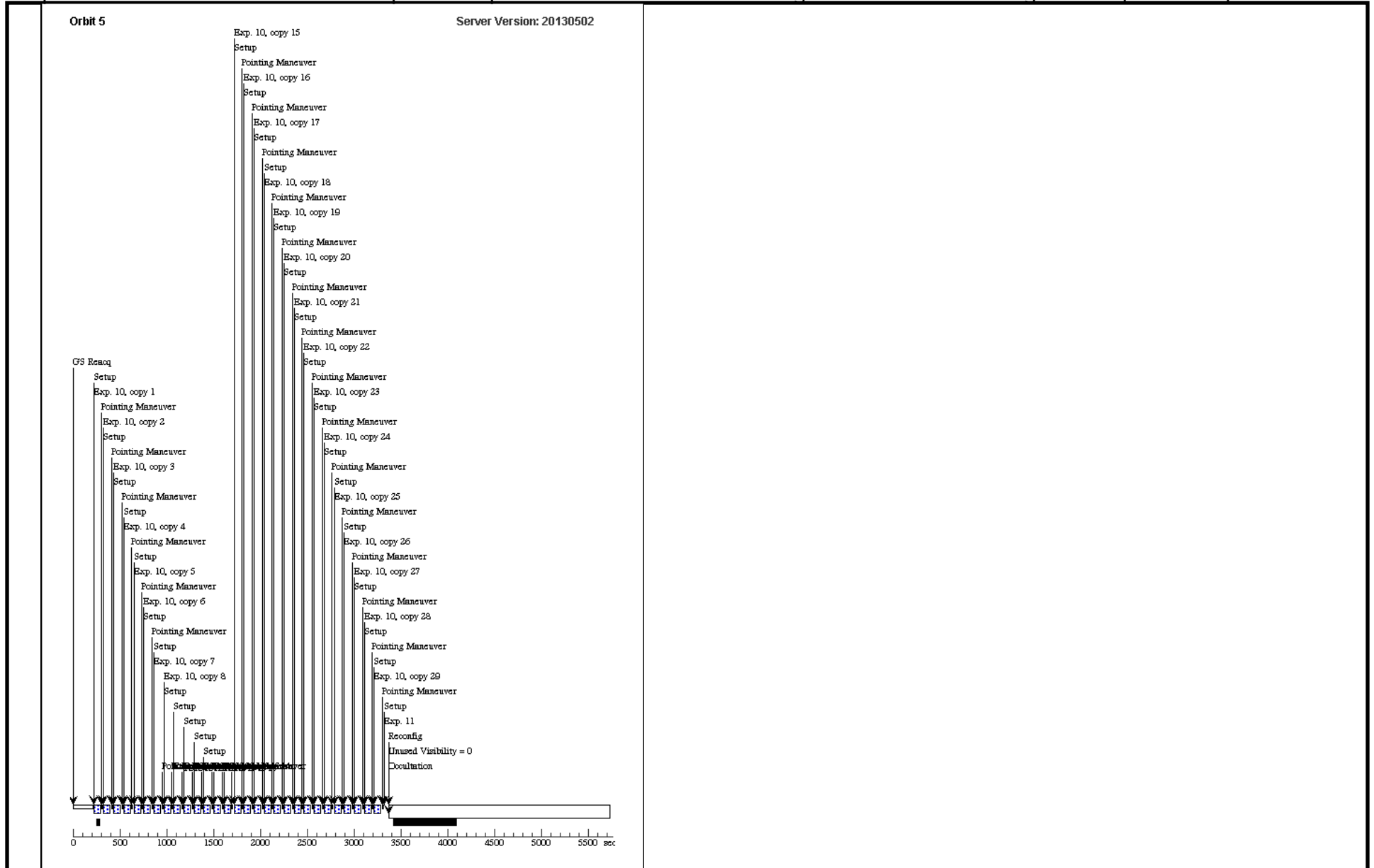
Proposal 13431 - Visit O2 - The First Spectroscopic Phase Curve of a Transiting Planet: Understanding the Deeper Atmosphere



Proposal 13431 - Visit 02 - The First Spectroscopic Phase Curve of a Transiting Planet: Understanding the Deeper Atmosphere



Proposal 13431 - Visit 02 - The First Spectroscopic Phase Curve of a Transiting Planet: Understanding the Deeper Atmosphere



Proposal 13431 - Visit 03 - The First Spectroscopic Phase Curve of a Transiting Planet: Understanding the Deeper Atmosphere

Fri Jul 12 01:34:07 GMT 2013

Visit	Proposal 13431, Visit 03, implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR Special Requirements: SCHED 30%; ORIENT 4D TO 29 D; ORIENT 107D TO 132 D; ORIENT 184D TO 209 D; ORIENT 287D TO 312 D; BETWEEN 01-NOV-2013:00:00:00 AND 30-JUN-2014:00:00:00; Period 0.7888400 D AND ZERO-PHASE HJD2455168.96801 <i>Comments: It is essential that the 5 orbits be scheduled in a continuous block.</i>					
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes
(1)		WASP-19CEN	RA: 09 53 41.1806 (148.4215858d) Dec: -45 39 5.50 (-45.65153d) Equinox: J2000	Proper Motion RA: 0 mas/yr Proper Motion Dec: 0 mas/yr Epoch of Position: 2014	V=12.6	Reference Frame: ICRS
<i>Comments: Center point between WASP-19 and a comparison star.</i>						

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#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
Exposures	1	ACQ, phase constrained	(1) WASP-19CEN	WFC3/IR, MULTIACCUM, IRSUB512	F139M	SAMP-SEQ=RAPID ; NSAMP=9	POS TARG 0.0,-2.4 2; PHASE 0.2027628 T O 0.2198716	7.677243 Secs (7.677 Secs) [==>]	[1]
	2	WASP-19 G 141 Orbit 1	(1) WASP-19CEN	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=SPARS 25; NSAMP=3	POS TARG -12.9,-2.42; SPATIAL SCAN 0.0 26,90.0 Degrees,Forward	46.695529 Secs X 27 (1260.779 Secs) [==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)] [==>(Copy 10)] [==>(Copy 11)] [==>(Copy 12)] [==>(Copy 13)] [==>(Copy 14)] [==>(Copy 15)] [==>(Copy 16)] [==>(Copy 17)] [==>(Copy 18)] [==>(Copy 19)] [==>(Copy 20)] [==>(Copy 21)] [==>(Copy 22)] [==>(Copy 23)] [==>(Copy 24)] [==>(Copy 25)] [==>(Copy 26)] [==>(Copy 27)]	[1]
	3	WASP-19 G 141 Orbit 1 Extra	(1) WASP-19CEN	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=RAPID ; NSAMP=9	POS TARG -12.9,-2.42; SPATIAL SCAN 0.0 26,90.0 Degrees,Forward	7.677243 Secs (7.677 Secs) [==>]	[1]
<p>Comments: Extra exposure to force buffer dump into occultation time.</p>									

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4	WASP-19 G (1) WASP-19CEN 141 Orbit 2	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=SPARS 25; NSAMP=3	POS TARG -12.9,-2. 42; SPATIAL SCAN 0.0 26,90.0 Degrees,For ward	46.695529 Secs X 29 (1354.17 Secs)	[==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)] [==>(Copy 10)] [==>(Copy 11)] [==>(Copy 12)] [==>(Copy 13)] [==>(Copy 14)] [==>(Copy 15)] [==>(Copy 16)] [==>(Copy 17)] [==>(Copy 18)] [==>(Copy 19)] [==>(Copy 20)] [==>(Copy 21)] [==>(Copy 22)] [==>(Copy 23)] [==>(Copy 24)] [==>(Copy 25)] [==>(Copy 26)] [==>(Copy 27)] [==>(Copy 28)] [==>(Copy 29)]	[2]
5	WASP-19 G (1) WASP-19CEN 141 Orbit 2 Extra	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=RAPID ; NSAMP=14	POS TARG -12.9,-2. 42; SPATIAL SCAN 0.0 26,90.0 Degrees,For ward	11.942378 Secs (11.942 Secs)	[==>]	[2]

Comments: Extra exposure to force buffer dump into occultation time.

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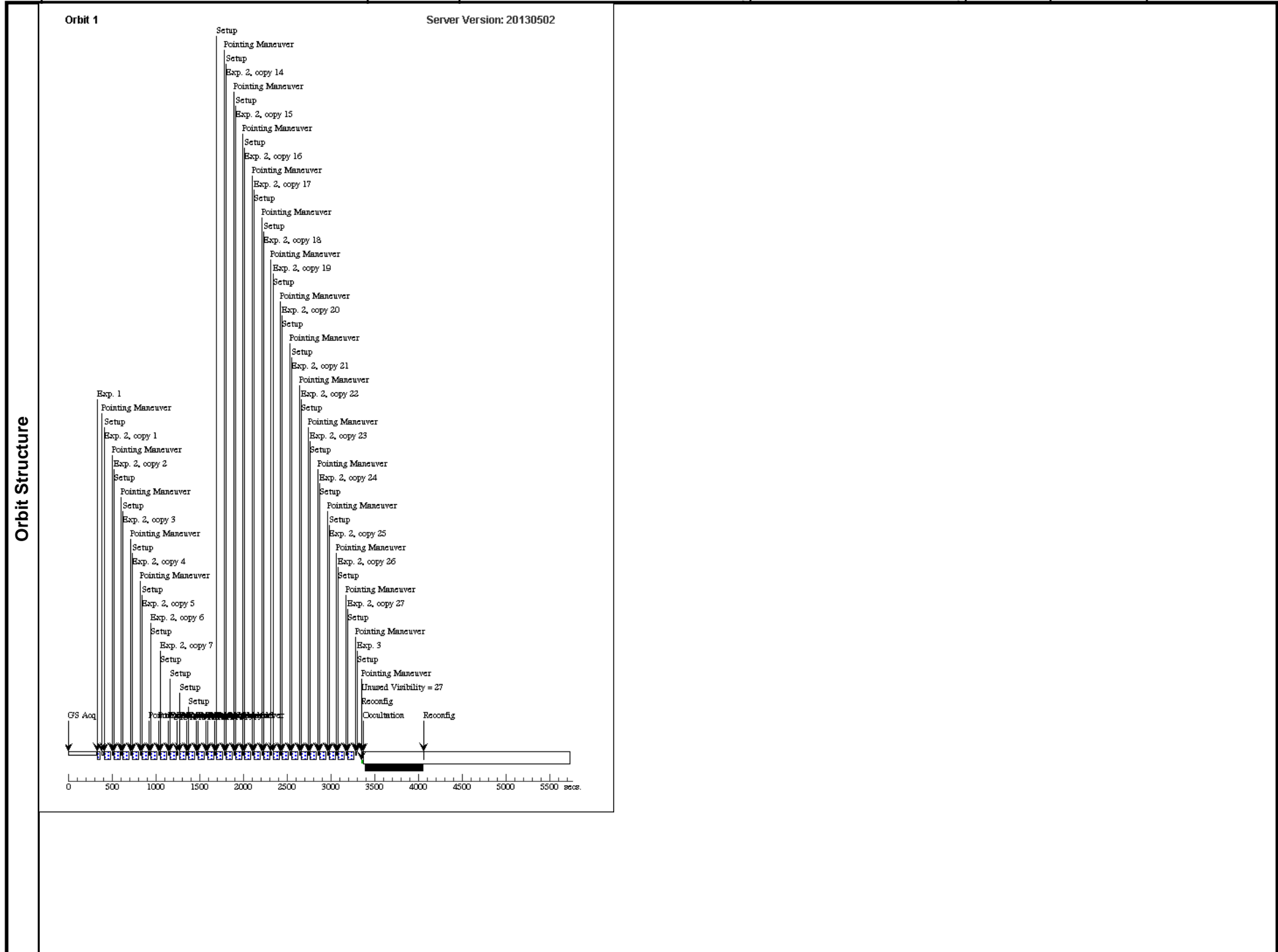
6	WASP-19 G (1) WASP-19CEN 141 Orbit 3	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=SPARS 25; NSAMP=3	POS TARG -12.9,-2. 42; SPATIAL SCAN 0.0 26,90.0 Degrees,For ward	46.695529 Secs X 29 (1354.17 Secs)	[==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)] [==>(Copy 10)] [==>(Copy 11)] [==>(Copy 12)] [==>(Copy 13)] [==>(Copy 14)] [==>(Copy 15)] [==>(Copy 16)] [==>(Copy 17)] [==>(Copy 18)] [==>(Copy 19)] [==>(Copy 20)] [==>(Copy 21)] [==>(Copy 22)] [==>(Copy 23)] [==>(Copy 24)] [==>(Copy 25)] [==>(Copy 26)] [==>(Copy 27)] [==>(Copy 28)] [==>(Copy 29)]	[3]
7	WASP-19 G (1) WASP-19CEN 141 Orbit 3 Extra	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=RAPID ; NSAMP=14	POS TARG -12.9,-2. 42; SPATIAL SCAN 0.0 26,90.0 Degrees,For ward	11.942378 Secs (11.942 Secs)	[==>]	[3]
<i>Comments: Extra exposure to force buffer dump into occultation time.</i>								

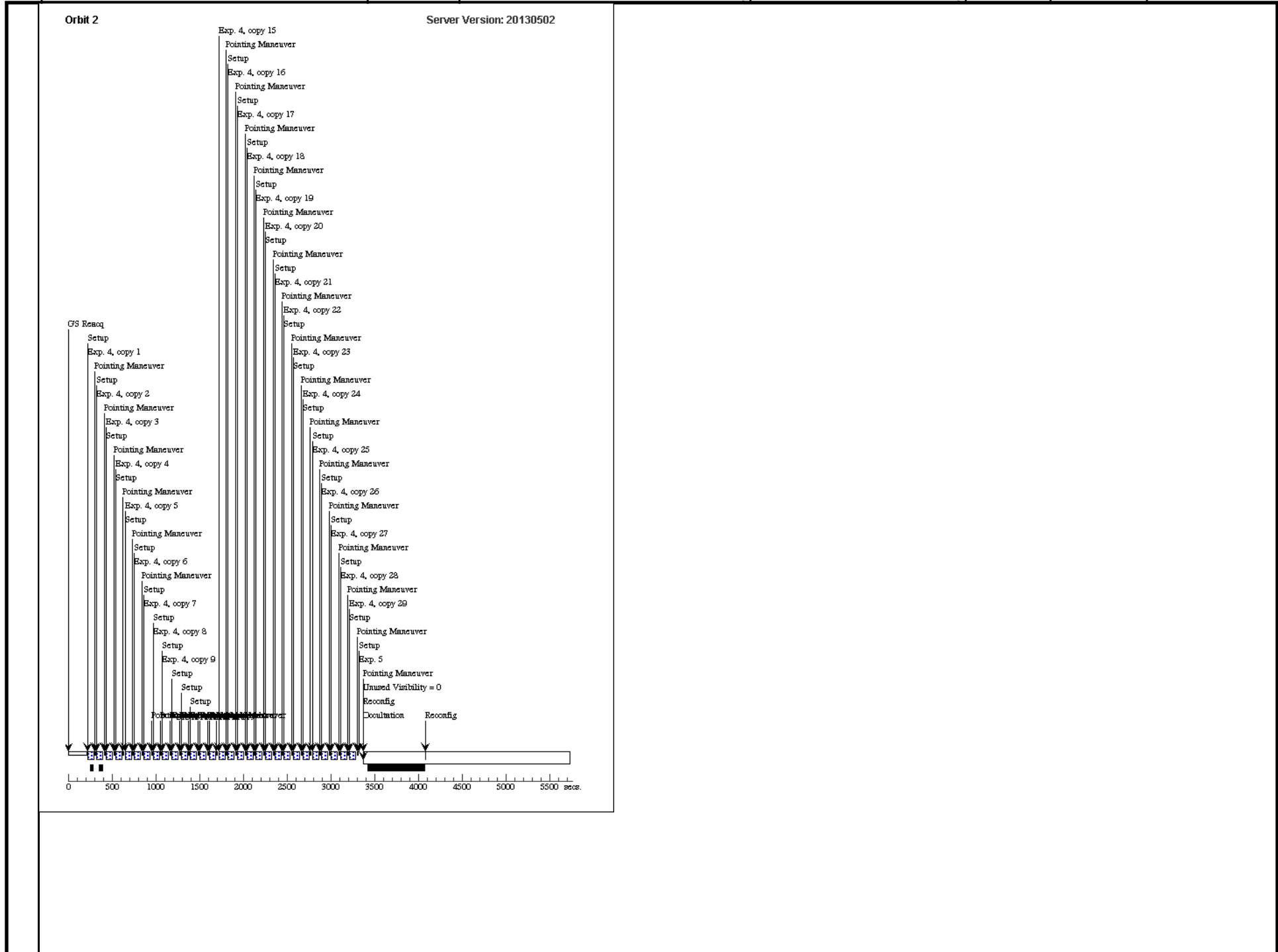
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8	WASP-19 G (1) WASP-19CEN 141 Orbit 4	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=SPARS 25; NSAMP=3	POS TARG -12.9,-2. 42; SPATIAL SCAN 0.0 26,90.0 Degrees,For ward	46.695529 Secs X 29 (1354.17 Secs)	[==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)] [==>(Copy 10)] [==>(Copy 11)] [==>(Copy 12)] [==>(Copy 13)] [==>(Copy 14)] [==>(Copy 15)] [==>(Copy 16)] [==>(Copy 17)] [==>(Copy 18)] [==>(Copy 19)] [==>(Copy 20)] [==>(Copy 21)] [==>(Copy 22)] [==>(Copy 23)] [==>(Copy 24)] [==>(Copy 25)] [==>(Copy 26)] [==>(Copy 27)] [==>(Copy 28)] [==>(Copy 29)]	[4]
9	WASP-19 G (1) WASP-19CEN 141 Orbit 4 Extra	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=RAPID ; NSAMP=14	POS TARG -12.9,-2. 42; SPATIAL SCAN 0.0 26,90.0 Degrees,For ward	11.942378 Secs (11.942 Secs)	[==>]	[4]
<i>Comments: Extra exposure to force buffer dump into occultation time.</i>								

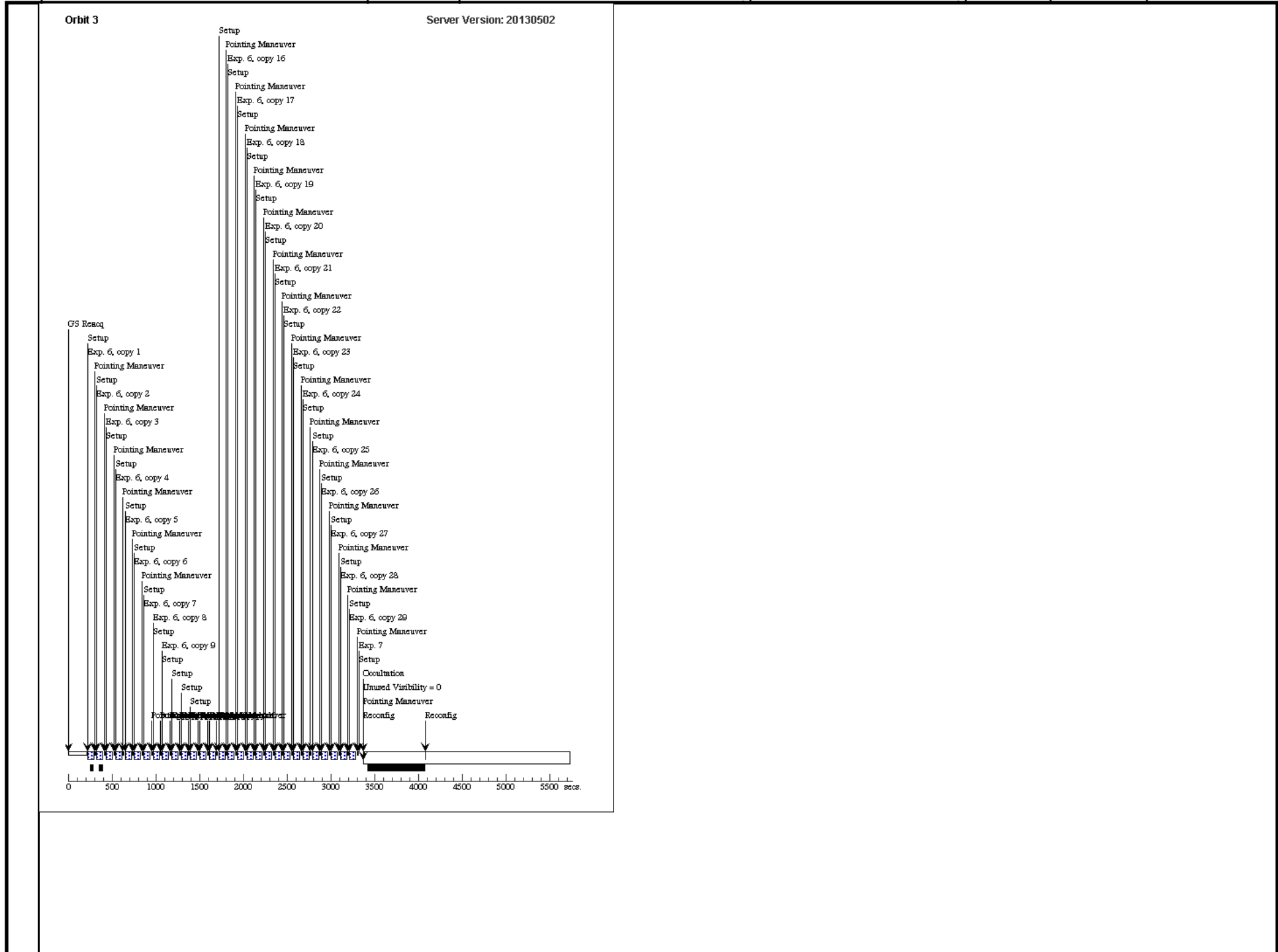
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10	WASP-19 G (1) WASP-19CEN 141 Orbit 5	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=SPARS 25; NSAMP=3	POS TARG -12.9,-2. 42; SPATIAL SCAN 0.0 26,90.0 Degrees,For ward	46.695529 Secs X 29 (1354.17 Secs)	[==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)] [==>(Copy 10)] [==>(Copy 11)] [==>(Copy 12)] [==>(Copy 13)] [==>(Copy 14)] [==>(Copy 15)] [==>(Copy 16)] [==>(Copy 17)] [==>(Copy 18)] [==>(Copy 19)] [==>(Copy 20)] [==>(Copy 21)] [==>(Copy 22)] [==>(Copy 23)] [==>(Copy 24)] [==>(Copy 25)] [==>(Copy 26)] [==>(Copy 27)] [==>(Copy 28)] [==>(Copy 29)]	[5]
11	WASP-19 G (1) WASP-19CEN 141 Orbit 5 Extra	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=RAPID ; NSAMP=14	POS TARG -12.9,-2. 42; SPATIAL SCAN 0.0 26,90.0 Degrees,For ward	11.942378 Secs (11.942 Secs)	[==>]	[5]
<i>Comments: Extra exposure to force buffer dump into occultation time.</i>								

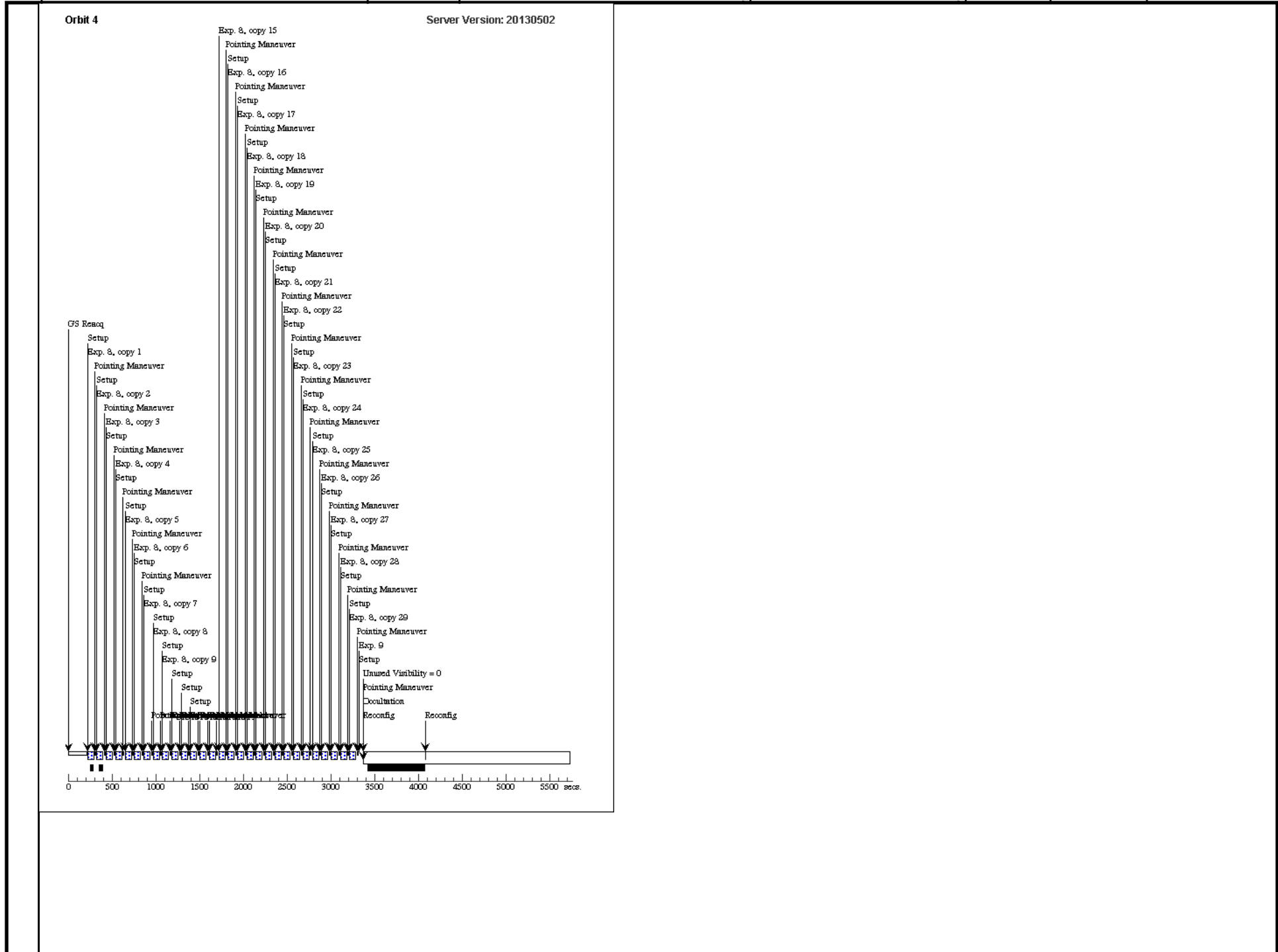




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