14272 - Long-Term Ultraviolet Spectroscopy of a Tidal Disruption Event at only 90 Mpc

Cycle: 23, Proposal Category: GO

(UV Initiative)

(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) ASASSN-14LI	STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	4	24-Jul-2015 23:23:16.0	yes
02	(1) ASASSN-14LI	STIS/CCD STIS/NUV-MAMA	3	24-Jul-2015 23:23:18.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
03	(1) ASASSN-14LI	STIS/CCD STIS/FUV-MAMA	3	24-Jul-2015 23:23:20.0	yes

10 Total Orbits Used

ABSTRACT

We propose multi-epoch ultraviolet spectroscopy of ASASSN-14li, a stellar tidal disruption event (TDE) at ~90 Mpc. Such very nearby stellar TDEs have been thus far only observed about once per decade and provides an exceptional opportunity to study broad emission lines which describe the abundances and accretion flow of the stellar debris in one of the most important physical regimes for understanding basic TDE behavior. We also request brief XMM observations to constrain the high-energy spectral evolution on similar timescales. These observations will build upon surprising new results, and will provide an important foundation for follow-up of more ambiguous TDE candidates subsequently identified by LSST and WFIRST at higher redshifts.

OBSERVING DESCRIPTION

This is the first cycle of a two-cycle program to spectroscopically monitor the decay of transient ASASSN-14li at the nucleus of galaxy PGC 043234/LEDA 43234. This transient appears to be due to the tidal disruption of a star by a supermassive black hole, and has been observed as a TOO in Cycle 22 by Cenko et al. To first order, we expect the host-subtracted transient spectrum to look like a quasar in the UV with some significant differences in terms of broad line strength.

For this program, we will be observing two UV STIS spectroscopic epochs in each of cycles 23 and 24. Since we are expecting joint time from a recently-successful Chandra program (#17700613) as well, we expect to coordinate two similar epochs from the Chandra program in order to improve temporal coverage of the transient. For HST program 14272, we expect two 6.5-ks observations from XMM-Newton joint time. Our Chandra program will also contain 145 ks of XMM-Newton joint time over the next two Chandra cycles, including one long 95-ks XMM observation and two short 5-ks XMM-Newton observations over Chandra cycles 17 and 18. We hope to coordinate Chandra or XMM-Newton observations as close to the HST epochs as possible, but given the narrow available observing windows for early HST cycle 23, the X-ray observatories may have better relative scheduling flexibility.

With our successful Chandra program, we also anticipate additional UV HST spectroscopy with STIS as Chandra joint time. In Cycle 23 (roughly),

we therefore expect four UV STIS spectroscopic epochs total: two from HST program 14272 and two from Chandra program 17700613. We have therefore selected timing windows for HST program 14272 to allow maximal temporal spacing in Cycle 23, expecting that the remaining windows outside our requested range for HST program 14272 would be used for the two UV STIS epochs from Chandra program 17700613.

For epochs 1 and 2 (both in Cycle 23), we are acquiring on the nucleus of PGC 043234 which is also the site of the target transient. Since the galaxy has good elliptical symmetry and the transient is well-centered (to within ~0.02 arcsec, vs 0.2 arcsec slit width for all spectroscopic observations), we are acquiring for a diffuse object, using the diffuse centroid with a 13-pixel checkbox. Since we are interested in weighting the acquisition on the UV-bright transient, we are using the CLEAR filter (F25ND3 was used by Cenko et al, but we expect exposure times for F25ND3 to be prohibitive by Cycle 23).

As a conservative estimate for minimum acquisition exposure, we subtract the transient from Keck AO K-band images to estimate the fractional flux in the checkbox relative to the whole galaxy, then rescale to the host r-band magnitude. We find S/N in 3.7 seconds, but request 12 seconds per acquisition to be conservative. Saturation should not be a major issue since readout is along the direction of the slit, but to be conservative we model the central point source as a quasar normalized at the host r-band magnitude (though we actually expect the UV flux to be much lower than for a quasar at such a late epoch, as low as GALEX NUV~20). The ETC expects saturation at about 22 seconds for a QSO with r~15.5.

In epoch 1, we plan 4 NUV G230L exposures with the 52x0.2 arcsec slit in 2 orbits, followed by 4 FUV G140L exposures with the 52x0.2 arcsec slit in 2 orbits. This epoch should be scheduled before 2016-Feb-01, and the earlier the better.

Epoch 2 consists of 6 orbits, and is broken up into two visits for ease of scheduling. We can tolerate 5-day separation, though a smaller interval is preferred to avoid short-timescale object variability. We plan 3 NUV G230L exposures with the 52x0.2 arcsec slit in 3 orbits for the first visit, and 3 FUV G140L exposures with the 52x0.2 arcsec slit in 3 orbits for the second visit. For this epoch we have designated a window in May/June of 2016.

We expect to coordinate Cycle 24 observations for this program at a later time according to the normal schedule of Phase II planning, but are happy to develop the Cycle 24 observations in advance, to the extent that this is possible.

Visit

Proposal 14272, ASASSN-14li Epoch 1 (01) Sat Jul 25 03:23:21 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA, STIS/NUV-MAMA

Special Requirements: BETWEEN 01-AUG-2015:00:00:00 AND 01-FEB-2016:00:00:00

Fixed Targets

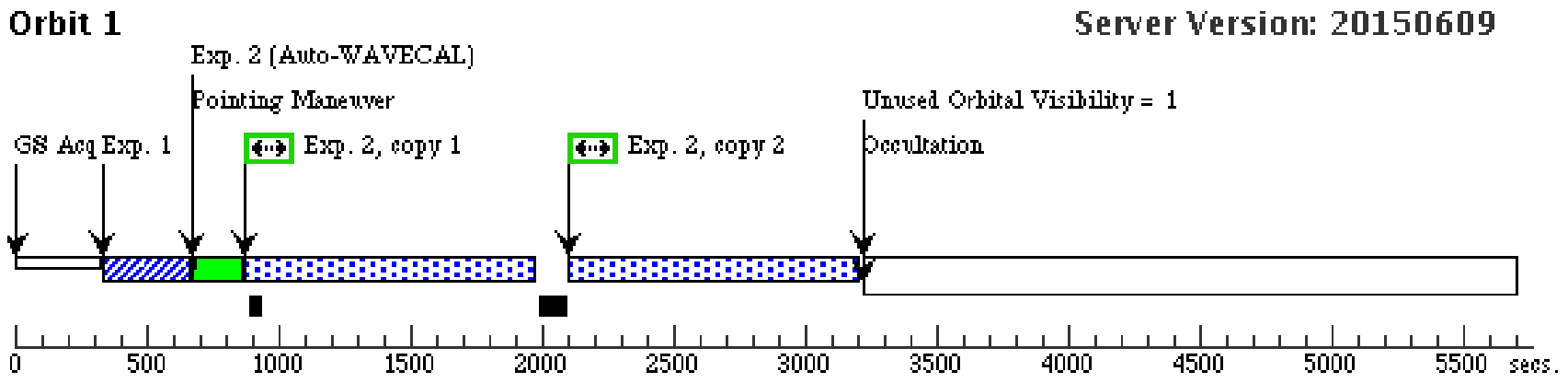
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	ASASSN-14LI Alt Name1: PGC-043234 Alt Name2: LEDA-43234	RA: 12 48 15.2300 (192.0634583d) Dec: +17 46 26.56 (17.77404d) Equinox: J2000		V=16.1 GALEX NUV is expected to decay from ~19.6 to ~21.5 over the period of interest	Reference Frame: ICRS

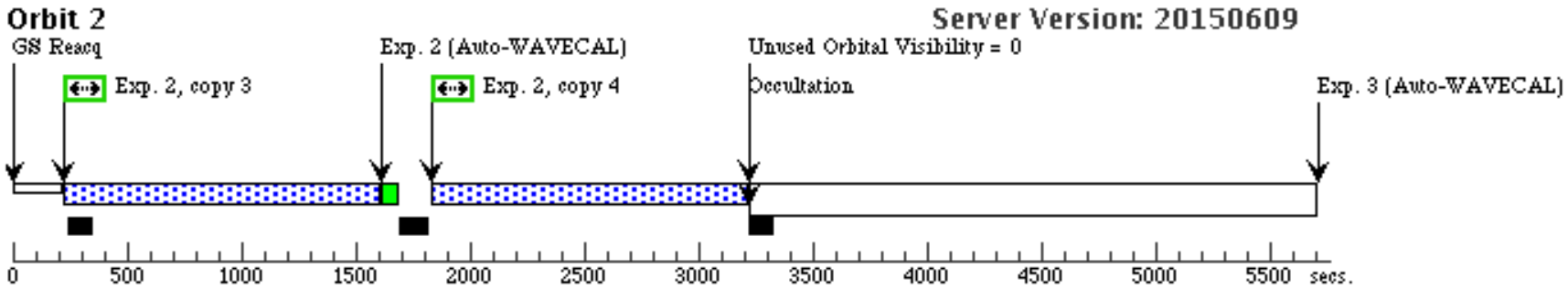
Comments: Coordinates determined from Keck AO imaging matched to SDSS.
Extended=NO

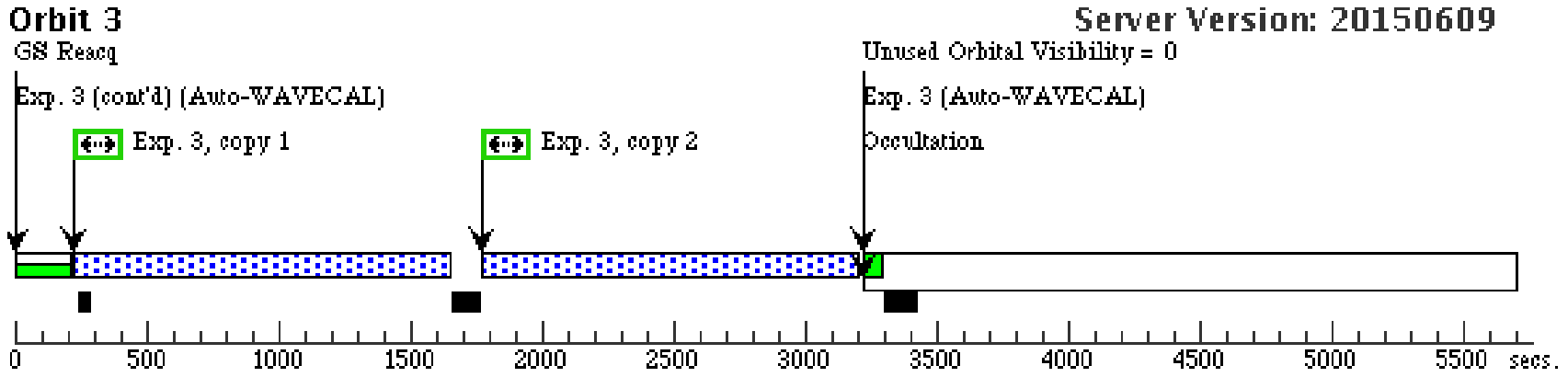
Exposures

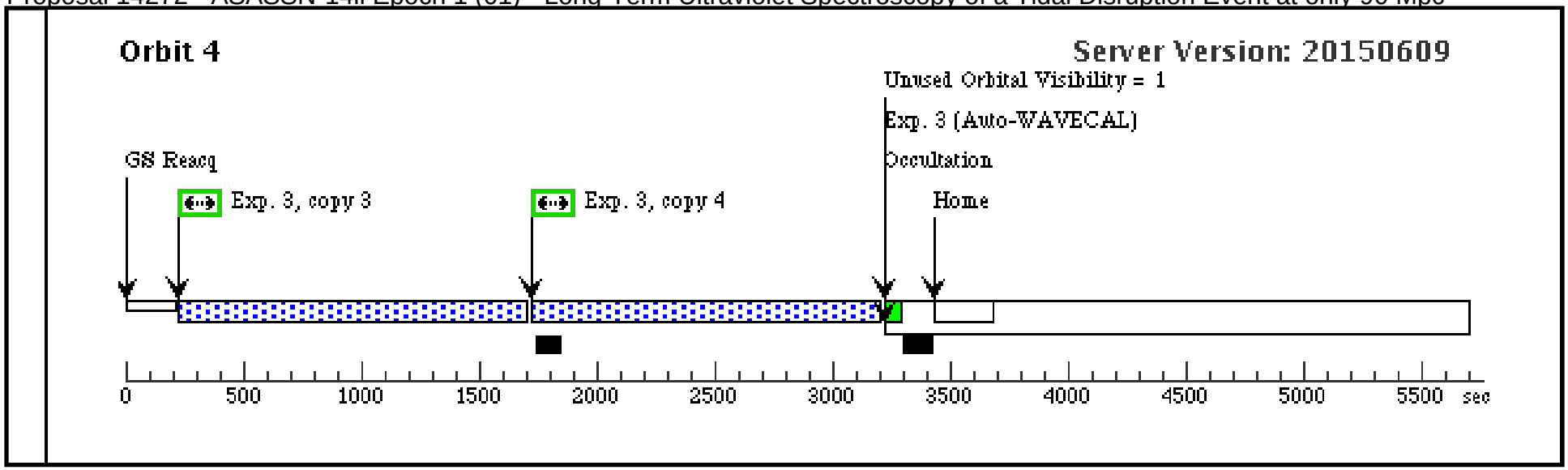
#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	ASASSN-14li Epoch 1 Acquisition	(1) ASASSN-14LI	STIS/CCD, ACQ, 50CCD	MIRROR	ACQTYPE=DIFFUSE; CHECKBOX=13; DIFFUSE-CENTER=FLUX-CENTROID			12 Secs (12 Secs) *[==>]*	 ***[1]***
2	ASASSN-14li Epoch 1 NUV (STIS.sp.73957)	(1) ASASSN-14LI	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				1000 Secs X 4 (4906 Secs) *[==>1090.0 Secs (Copy 1)]* *[==>1090.0 Secs (Copy 2)]* *[==>1363.0 Secs (Copy 3)]* *[==>1363.0 Secs (Copy 4)]*	 ***[1]*** ***[2]***
3	ASASSN-14li Epoch 1 FUV (STIS.sp.73954)	(1) ASASSN-14LI	STIS/FUV-MAMA, ACCUM, 52X0.2	G140L 1425 A				1000 Secs X 4 (5784 Secs) *[==>1418.0 Secs (Copy 1)]* *[==>1418.0 Secs (Copy 2)]* *[==>1474.0 Secs (Copy 3)]* *[==>1474.0 Secs (Copy 4)]*	 ***[3]*** ***[4]***

Orbit Structure





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sec

Visit

Proposal 14272, ASASSN-14li Epoch 2 NUV (02) Sat Jul 25 03:23:21 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/NUV-MAMA

Special Requirements: BETWEEN 10-MAY-2016:00:00:00 AND 20-JUN-2016:00:00:00; GROUP 02,03 WITHIN 5D

Fixed Targets

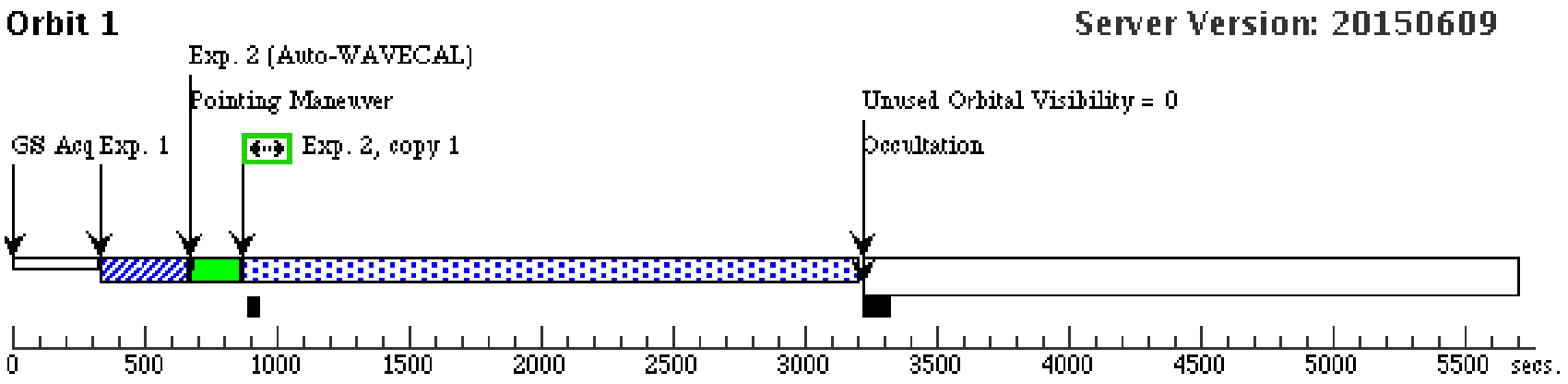
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	ASASSN-14LI	RA: 12 48 15.2300 (192.0634583d)		V=16.1	Reference Frame: ICRS
	Alt Name1: PGC-043234	Dec: +17 46 26.56 (17.77404d)		GALEX NUV is expected to decay from ~19.6 to ~21.5 over the period of interest	
	Alt Name2: LEDA-43234	Equinox: J2000			

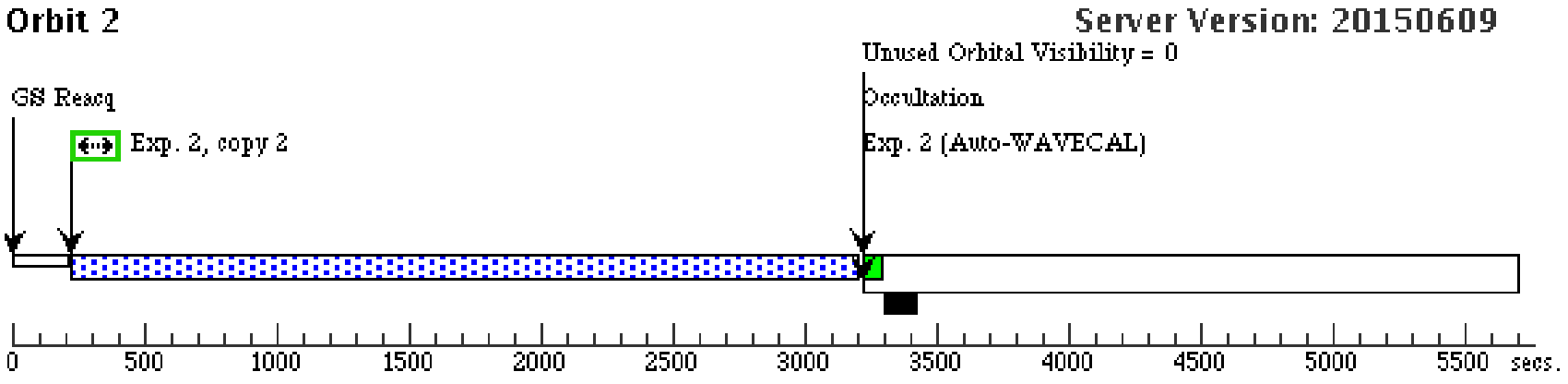
Comments: Coordinates determined from Keck AO imaging matched to SDSS.
Extended=NO

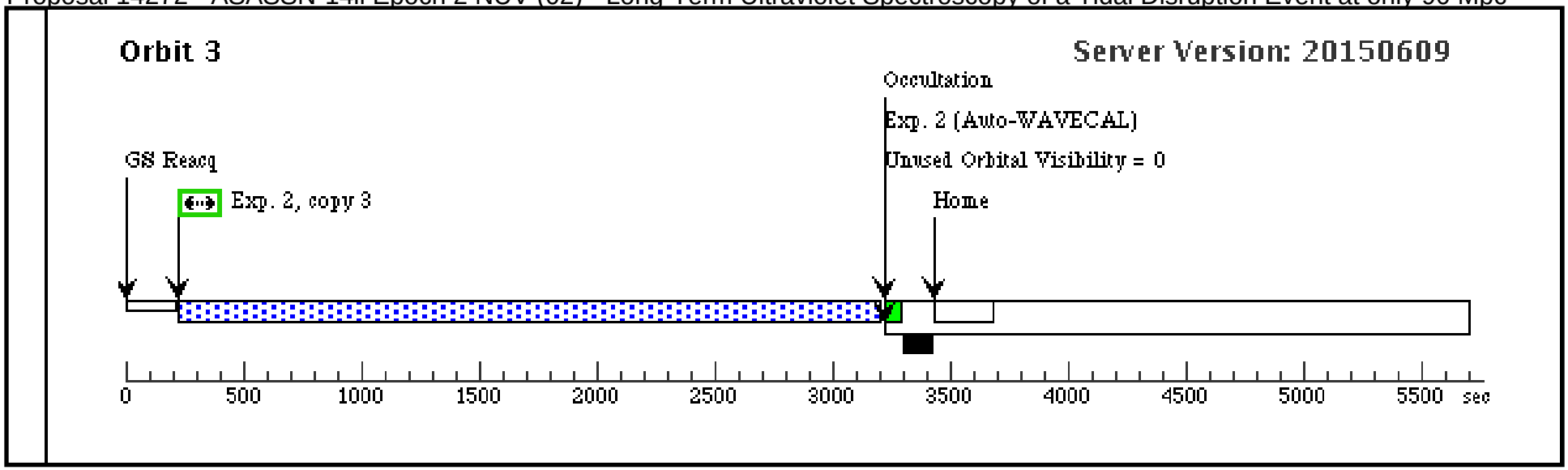
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	ASASSN-14li Epoch 2 Acquisition NUV	(1) ASASSN-14LI	STIS/CCD, ACQ, 50CCD	MIRROR	ACQTYPE=DIFFUSE; CHECKBOX=13; DIFFUSE-CENTER=FLUX-CENTROID			12 Secs (12 Secs)	
								[==>]	***[1]***
2	ASASSN-14li Epoch 2 NUV Sci (STIS.sp.73 3959)	(1) ASASSN-14LI	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				1000 Secs X 3 (8258 Secs)	
								[==>2316.0 Secs (Copy 1)]	***[1]***
								[==>2971.0 Secs (Copy 2)]	***[2]***
								[==>2971.0 Secs (Copy 3)]	***[3]***

Orbit Structure






Orbit 3
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Exp. 2 (Auto-WAVECAL)
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GS Reacq
Exp. 2, copy 3
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4000
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5000
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sec

Visit

Proposal 14272, ASASSN-14li Epoch 2 FUV (03) Sat Jul 25 03:23:21 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: BETWEEN 10-MAY-2016:00:00:00 AND 20-JUN-2016:00:00:00; GROUP 03,02 WITHIN 5D

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	ASASSN-14LI	RA: 12 48 15.2300 (192.0634583d)		V=16.1	Reference Frame: ICRS
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	Alt Name2: LEDA-43234	Equinox: J2000			

Comments: Coordinates determined from Keck AO imaging matched to SDSS.
Extended=NO

Exposures

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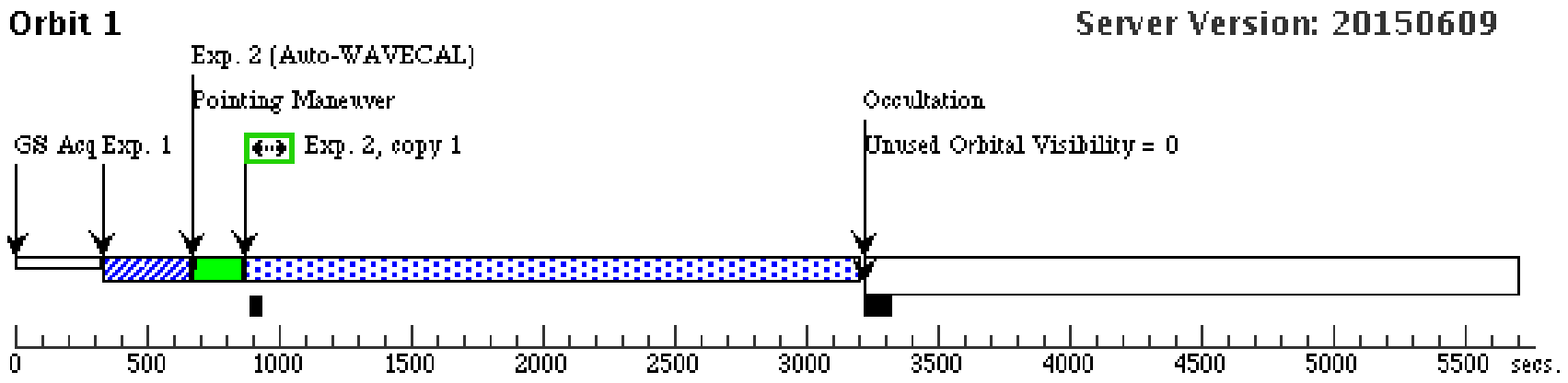
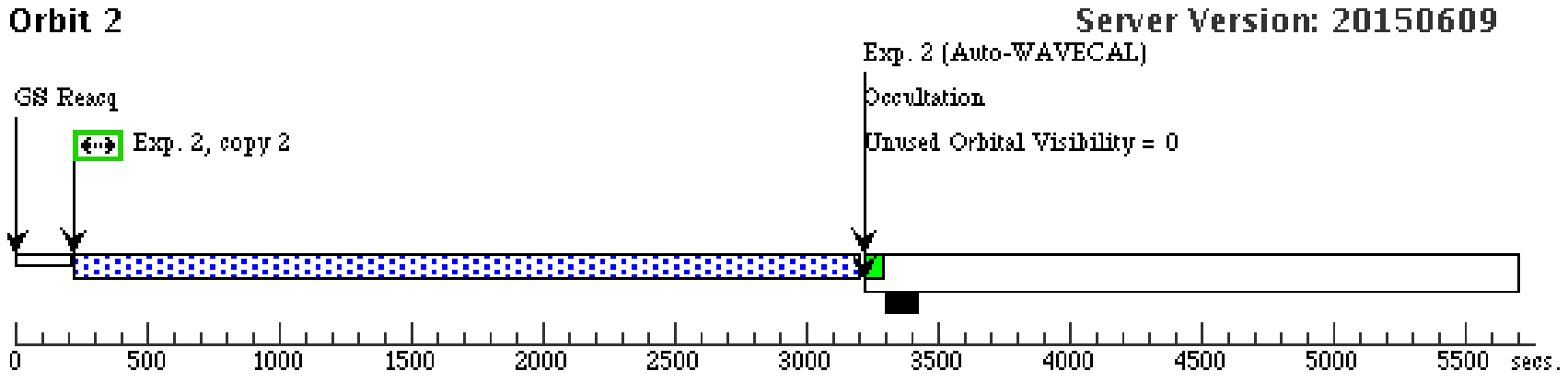
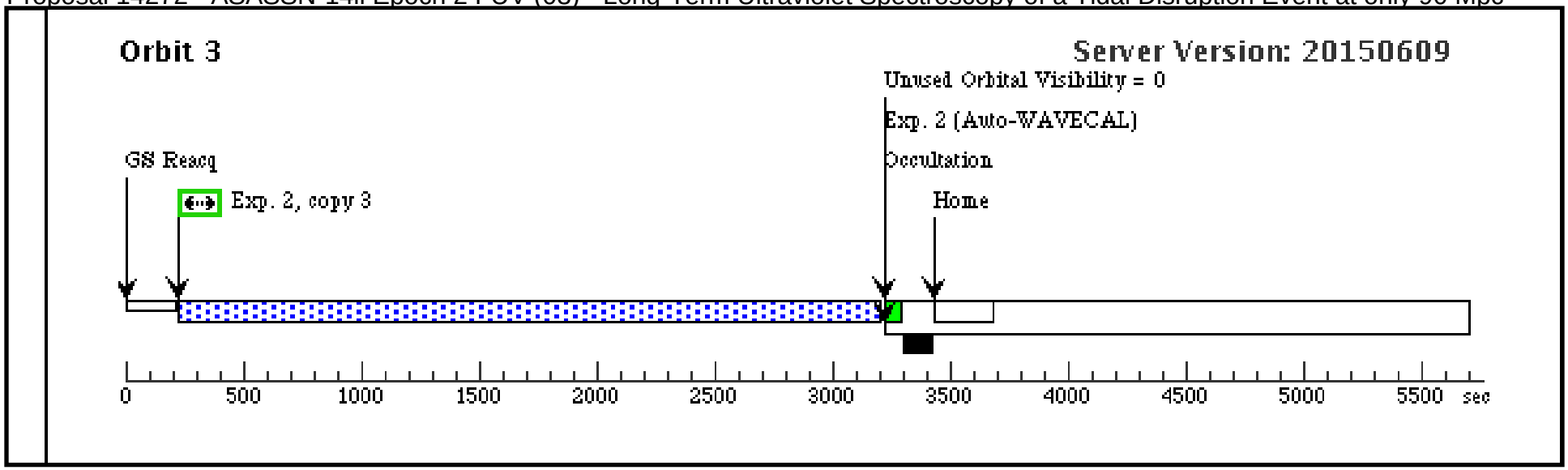
1	ASASSN-14li Epoch 2 Acquisition FUV	(1) ASASSN-14LI	STIS/CCD, ACQ, 50CCD	MIRROR	ACQTYPE=DIFFUSE; CHECKBOX=13; DIFFUSE-CENTER=FLUX-CENTROID			12 Secs (12 Secs)	
								[==>]	***[1]***
2	ASASSN-14li Epoch 2 FUV Sci (STIS.sp.73962)	(1) ASASSN-14LI	STIS/FUV-MAMA, ACCUM, 52X0.2	G140L 1425 A				1000 Secs X 3 (8258 Secs)	
								[==>2316.0 Secs (Copy 1)]	***[1]***
								[==>2971.0 Secs (Copy 2)]	***[2]***
								[==>2971.0 Secs (Copy 3)]	***[3]***

Orbit Structure



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Occultation
GS Reacq
Exp. 2, copy 3
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