14812 - Long-Term Ultraviolet Spectroscopy of a Tidal Disruption Event at only 90 Mpc

Cycle: 24, 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/NUV-MAMA	3	09-Nov-2016 12:20:15.0	yes
02	(1) ASASSN-14LI	STIS/CCD STIS/FUV-MAMA	3	09-Nov-2016 12:20:16.0	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/NUV-MAMA	3	09-Nov-2016 12:20:18.0	yes
04	(1) ASASSN-14LI	STIS/CCD STIS/FUV-MAMA	3	09-Nov-2016 12:20:19.0	yes

12 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

APT Revised 2016 10 20: per the recommendation of the STIS team lead, we have switched from ACCUM mode to TIME-TAG mode. We have replaced single 3-orbit ACCUM exposures with triple 1-orbit TIME-TAG exposures per visit. We have selected BUFFER TIME of 1500s for FUV and 1000s for NUV. We expect the instrumental total count rate to be background-dominated.

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. Cycle 23 data (epochs 1 and 2 of this program) show a similar spectral shape, but many broad emission lines fainter or disappeared.

For this program, we will be observing two UV STIS spectroscopic epochs in cycle 24 (epochs 3 and 4). We are expecting joint time from a recently-successful Chandra program (#17700613) as well, which will improve temporal coverage of the transient, as well as 2x10 ks observations

from XMM-Newton joint time in 2017. 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 24, the X-ray observatories may have better relative scheduling flexibility.

For epochs 3 and 4 (both in Cycle 24), we are (as was previously done for epochs 1 and 2 in Cycle 23) 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. 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).

In Cycle 23 we requested 12 seconds per acquisition to be conservative. Acquisition and saturation were not problems for the observations as-executed. For Cycle 24, we assume continuing flux decay, and base our acquisition exposure time on our Cycle 23 acquisition images.

Assuming UV flux from the STIS spectrum is due to a ~50,000 K blackbody, we infer (from the STIS ETC) the brightness of a 3x3 box covering the host nucleus. In a worst-case scenario, the transient will be negligible relative to the host galaxy. With a 35 second acquisition exposure, we reach SNR ~54 in a 3x3 box. From the Cycle 23 acquisition image, even with significant decay of the UV transient a 5-pixel checkbox should be sufficient for acquisition using the galactic nucleus. Saturation will not be an issue even at current brightness.

Epochs 3 and 4 consists of 6 orbits each. Each epoch 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 epoch 3 we have designated a window in Nov. 2016 - Jan. 2017. For epoch 4 we have designated a window in May - Aug. 2017.

Visit

Proposal 14812, ASASSN-14li Epoch 3 NUV (01), implementation Wed Nov 09 17:20:20 GMT 2016

Diagnostic Status: No Diagnostics

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

Special Requirements: BETWEEN 18-NOV-2016:00:00:00 AND 25-JAN-2017:00:00:00; GROUP 01,02 WITHIN 5D

Fixed Targets

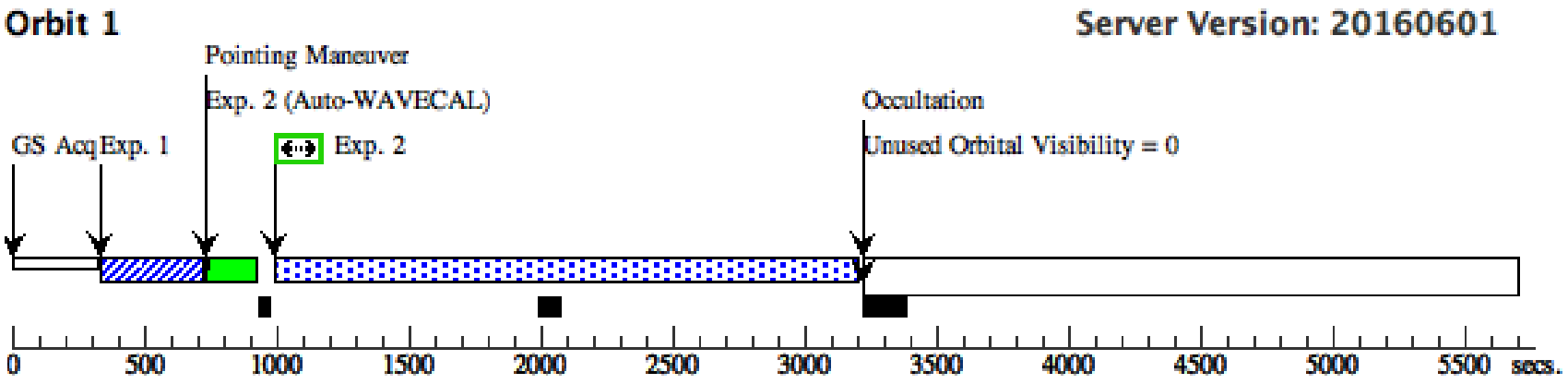
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	ASASSN-14LI Alt Name1: PGC-043234 Alt Name2: LEDA-43234	RA: 12 48 15.2300 (192.0634583d) Dec: +17 46 26.56 (17.77404d) Equinox: J2000		V=16.1 STIS data from the most recent cycle had NUV~17.7, and is expected to decay by ~1 magnitude or more in this time	Reference Frame: ICRS

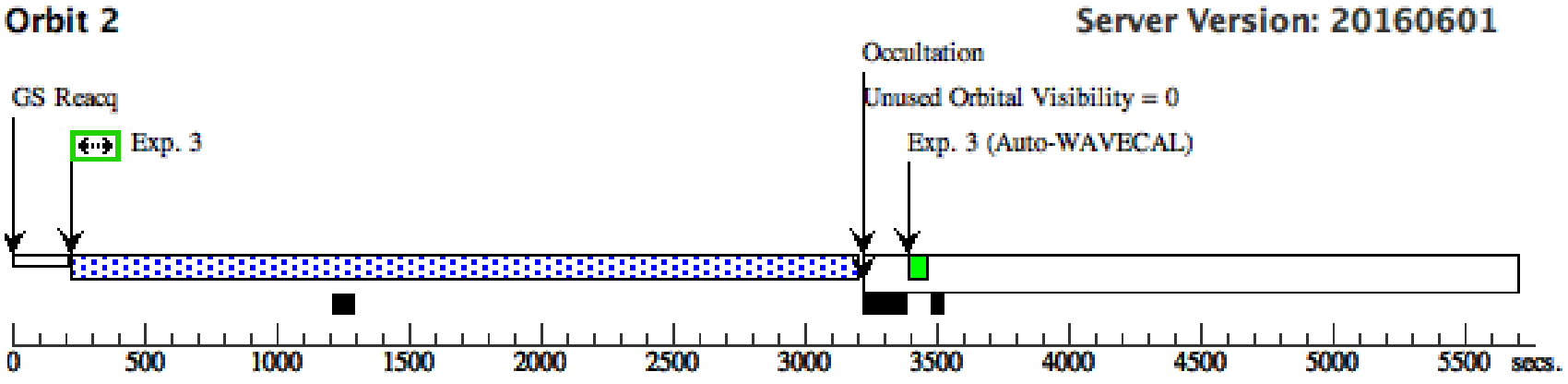
Comments: Coordinates determined from Keck AO imaging matched to SDSS.
Extended=NO

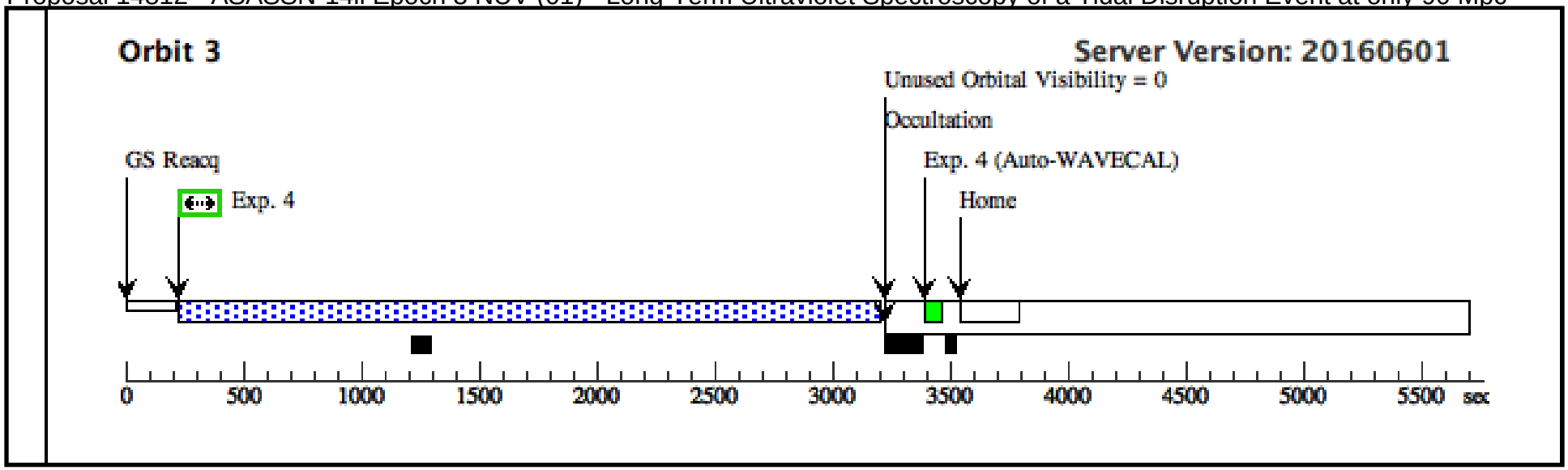
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	ASASSN-14li Epoch 3 Acquisition NUV	(1) ASASSN-14LI	STIS/CCD, ACQ, 50CCD	MIRROR	ACQTYPE=DIFFUSE; CHECKBOX=5; DIFFUSE-CENTER=FLUX-CENTROID			35 Secs (35 Secs) *[==>]*	***[1]***
2	ASASSN-14li Epoch 3 NUV Sci 1 (STIS.sp.73 3959)	(1) ASASSN-14LI	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230L 2376 A	BUFFER-TIME=1000			1000 Secs (2196 Secs) *[==>2196.0 Secs]*	***[1]***
3	ASASSN-14li Epoch 3 NUV Sci 2 (STIS.sp.73 3959)	(1) ASASSN-14LI	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230L 2376 A	BUFFER-TIME=1000			1000 Secs (2971 Secs) *[==>2971.0 Secs]*	***[2]***
4	ASASSN-14li Epoch 3 NUV Sci 3 (STIS.sp.73 3959)	(1) ASASSN-14LI	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230L 2376 A	BUFFER-TIME=1000			1000 Secs (2971 Secs) *[==>2971.0 Secs]*	***[3]***

Orbit Structure



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GS Reacq
Exp. 4
Exp. 4 (Auto-WAVECAL)
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2500
3000
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4000
4500
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5500
sec

Visit

Proposal 14812, ASASSN-14li Epoch 3 FUV (02), implementation Wed Nov 09 17:20:20 GMT 2016

Diagnostic Status: No Diagnostics

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

Special Requirements: BETWEEN 15-NOV-2016:00:00:00 AND 25-JAN-2017:00:00:00; GROUP 02,01 WITHIN 5D

Fixed Targets

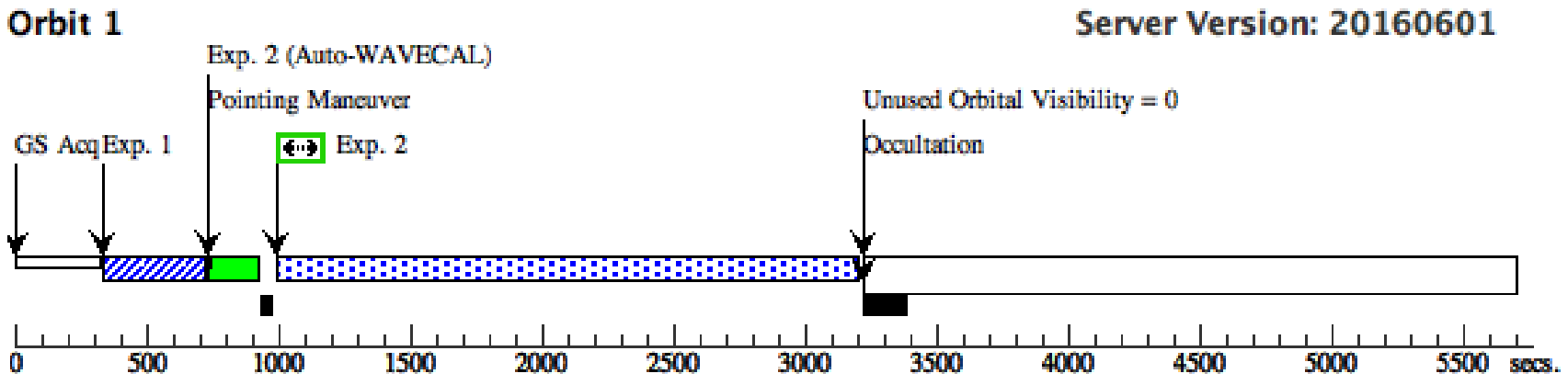
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	ASASSN-14LI Alt Name1: PGC-043234 Alt Name2: LEDA-43234	RA: 12 48 15.2300 (192.0634583d) Dec: +17 46 26.56 (17.77404d) Equinox: J2000		V=16.1 STIS data from the most recent c ycle had NUV~17.7, and is expected to decay by ~1 magnitude or more in this time	Reference Frame: ICRS

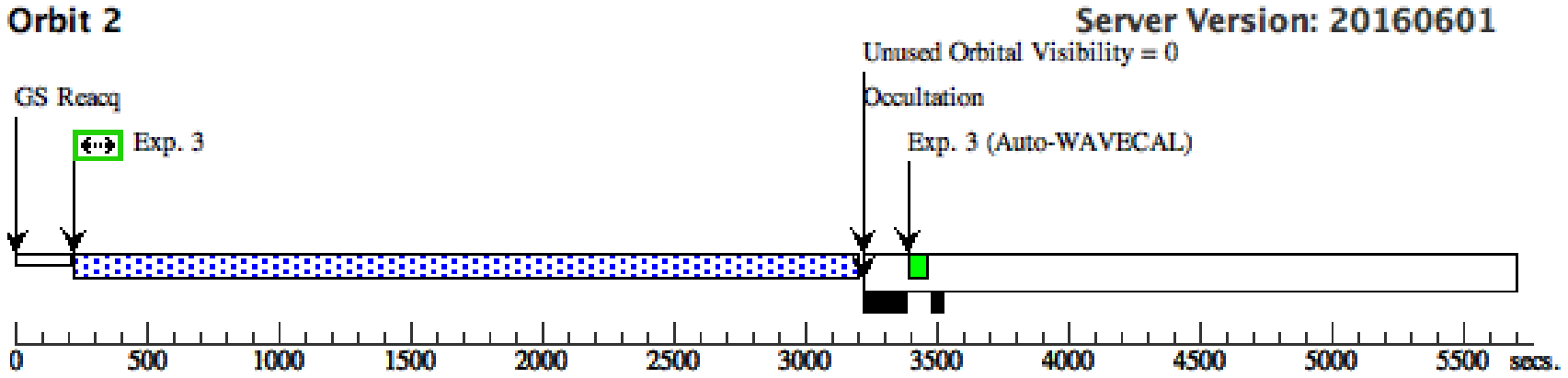
Comments: Coordinates determined from Keck AO imaging matched to SDSS.
Extended=NO

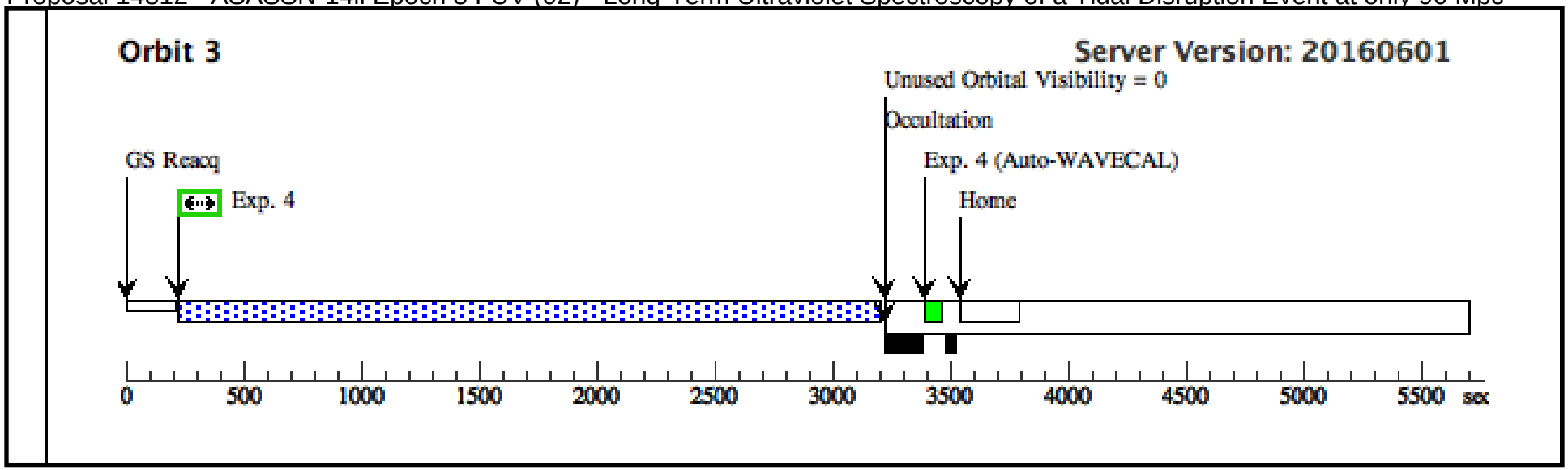
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	ASASSN-14 li Epoch 3 A cquisition F UV	(1) ASASSN-14LI	STIS/CCD, ACQ, 50CCD	MIRROR	ACQTYPE=DIFFU SE; CHECKBOX=5; DIFFUSE-CENTER =FLUX-CENTROID			35 Secs (35 Secs) *[==>]*	*[1]*
2	ASASSN-14 li Epoch 3 F UV Sci 1 (STIS.sp.73 3962)	(1) ASASSN-14LI	STIS/FUV-MAMA, TIME-TAG, 52X0.2	G140L 1425 A	BUFFER-TIME=15 00			1000 Secs (2196 Secs) *[==>2196.0 Secs]*	*[1]*
3	ASASSN-14 li Epoch 3 F UV Sci 2 (STIS.sp.73 3962)	(1) ASASSN-14LI	STIS/FUV-MAMA, TIME-TAG, 52X0.2	G140L 1425 A	BUFFER-TIME=15 00			1000 Secs (2971 Secs) *[==>2971.0 Secs]*	*[2]*
4	ASASSN-14 li Epoch 3 F UV Sci 3 (STIS.sp.73 3962)	(1) ASASSN-14LI	STIS/FUV-MAMA, TIME-TAG, 52X0.2	G140L 1425 A	BUFFER-TIME=15 00			1000 Secs (2971 Secs) *[==>2971.0 Secs]*	*[3]*

Orbit Structure



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Occultation
GS Reacq
Exp. 4
Exp. 4 (Auto-WAVECAL)
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1000
1500
2000
2500
3000
3500
4000
4500
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5500
sec

Visit

Proposal 14812, ASASSN-14li Epoch 4 NUV (03), implementation Wed Nov 09 17:20:20 GMT 2016

Diagnostic Status: No Diagnostics

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

Special Requirements: BETWEEN 20-MAY-2017:00:00:00 AND 10-AUG-2017:00:00:00; GROUP 03,04 WITHIN 5D

Fixed Targets

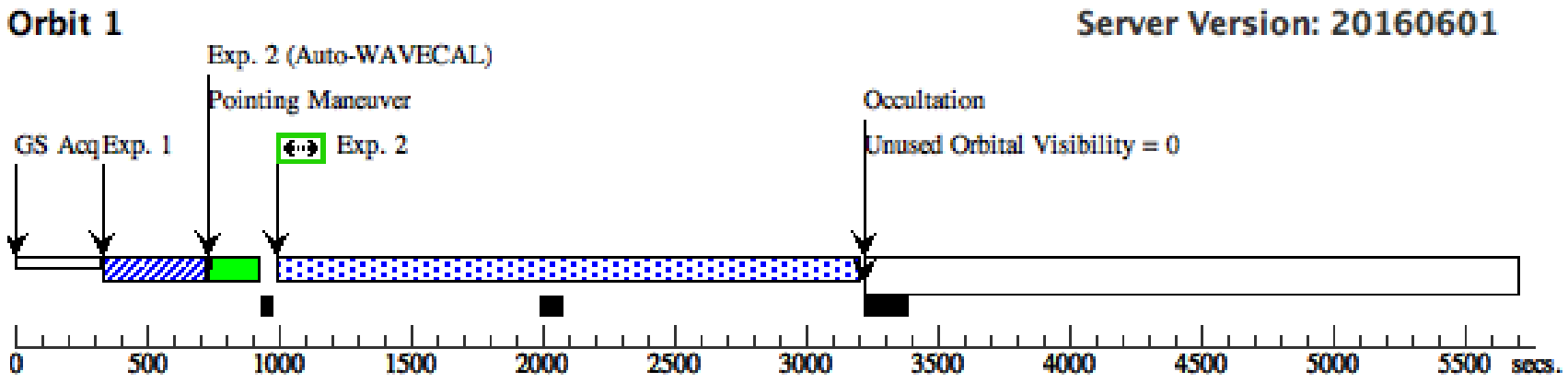
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	ASASSN-14LI Alt Name1: PGC-043234 Alt Name2: LEDA-43234	RA: 12 48 15.2300 (192.0634583d) Dec: +17 46 26.56 (17.77404d) Equinox: J2000		V=16.1 STIS data from the most recent c ycle had NUV~17.7, and is expected to decay by ~1 magnitude or more in this time	Reference Frame: ICRS

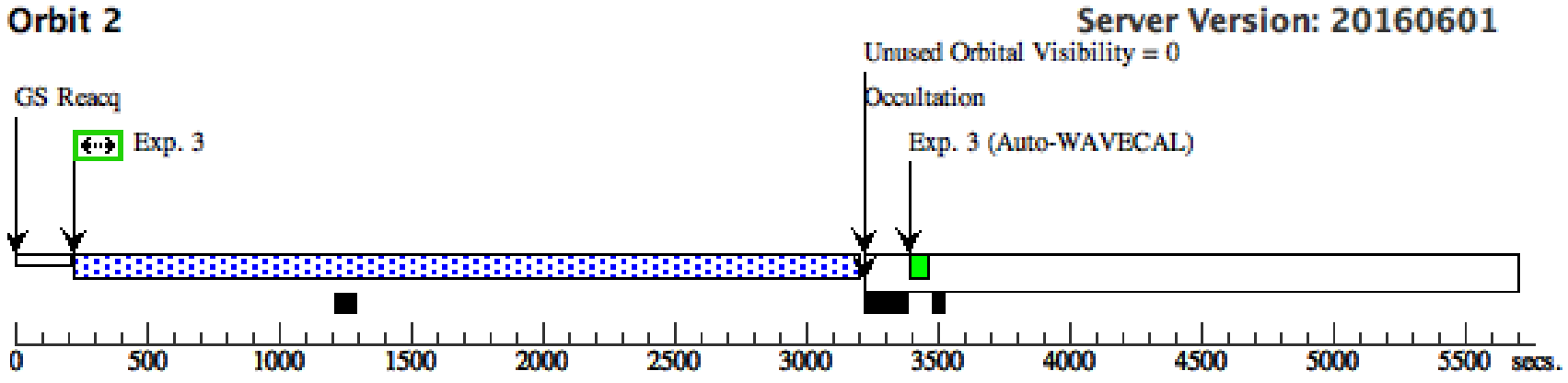
Comments: Coordinates determined from Keck AO imaging matched to SDSS.
Extended=NO

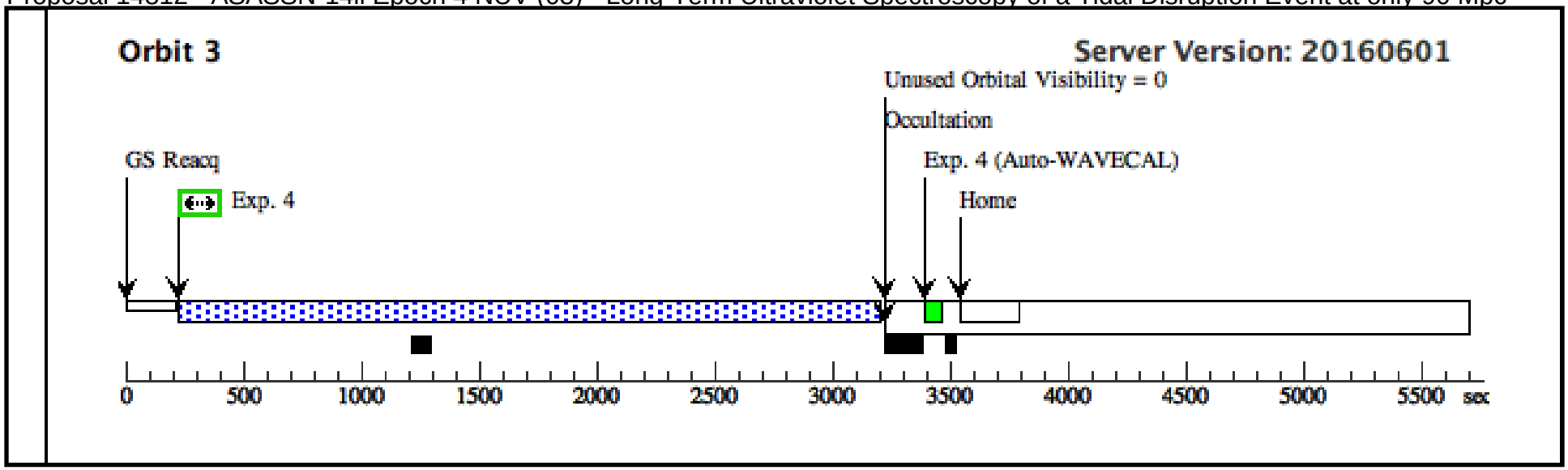
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	ASASSN-14 li Epoch 4 A cquisition N UV	(1) ASASSN-14LI	STIS/CCD, ACQ, 50CCD	MIRROR	ACQTYPE=DIFFU SE; CHECKBOX=5; DIFFUSE-CENTER =FLUX-CENTROID			35 Secs (35 Secs) *[==>]*	*[1]*
2	ASASSN-14 li Epoch 4 N UV Sci 1 (STIS.sp.73 3959)	(1) ASASSN-14LI	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230L 2376 A	BUFFER-TIME=10 00			1000 Secs (2196 Secs) *[==>2196.0 Secs]*	*[1]*
3	ASASSN-14 li Epoch 4 N UV Sci 2 (STIS.sp.73 3959)	(1) ASASSN-14LI	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230L 2376 A	BUFFER-TIME=10 00			1000 Secs (2971 Secs) *[==>2971.0 Secs]*	*[2]*
4	ASASSN-14 li Epoch 4 N UV Sci 3 (STIS.sp.73 3959)	(1) ASASSN-14LI	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230L 2376 A	BUFFER-TIME=10 00			1000 Secs (2971 Secs) *[==>2971.0 Secs]*	*[3]*

Orbit Structure



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sec

Visit

Proposal 14812, ASASSN-14li Epoch 4 FUV (04), implementation Wed Nov 09 17:20:20 GMT 2016

Diagnostic Status: No Diagnostics

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

Special Requirements: BETWEEN 20-MAY-2017:00:00:00 AND 10-AUG-2017:00:00:00; GROUP 04,03 WITHIN 5D

Fixed Targets

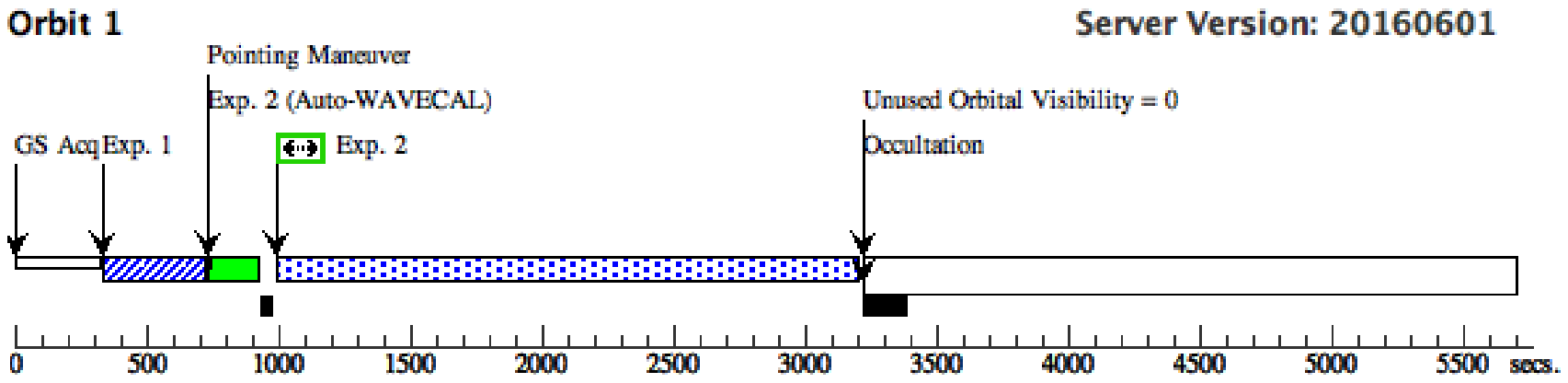
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	ASASSN-14LI Alt Name1: PGC-043234 Alt Name2: LEDA-43234	RA: 12 48 15.2300 (192.0634583d) Dec: +17 46 26.56 (17.77404d) Equinox: J2000		V=16.1 STIS data from the most recent c ycle had NUV~17.7, and is expected to decay by ~1 magnitude or more in this time	Reference Frame: ICRS

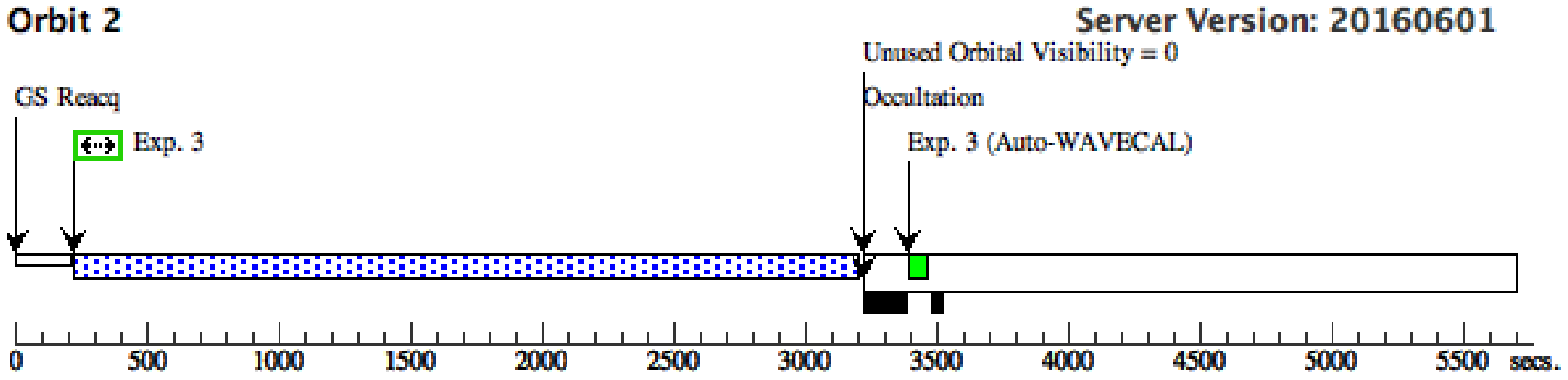
Comments: Coordinates determined from Keck AO imaging matched to SDSS.
Extended=NO

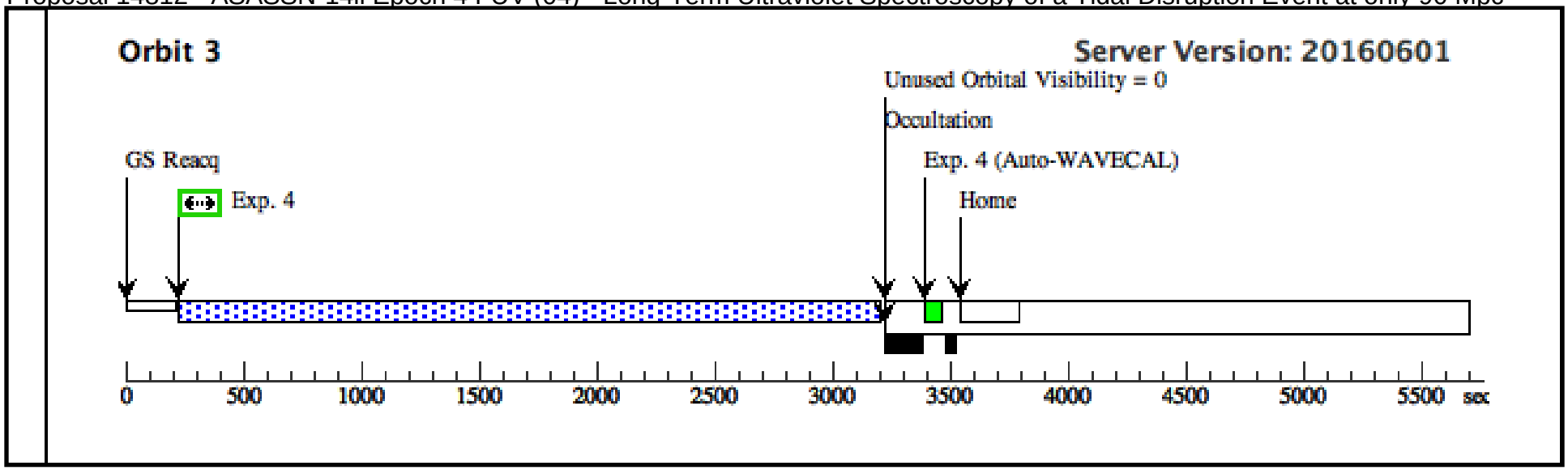
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	ASASSN-14 li Epoch 4 A cquisition F UV	(1) ASASSN-14LI	STIS/CCD, ACQ, 50CCD	MIRROR	ACQTYPE=DIFFU SE; CHECKBOX=5; DIFFUSE-CENTER =FLUX-CENTROID			35 Secs (35 Secs) *[==>]*	 ***[1]***
2	ASASSN-14 li Epoch 4 F UV Sci 1 (STIS.sp.73 3962)	(1) ASASSN-14LI	STIS/FUV-MAMA, TIME-TAG, 52X0.2	G140L 1425 A	BUFFER-TIME=15 00			1000 Secs (2196 Secs) *[==>2196.0 Secs]*	 ***[1]***
3	ASASSN-14 li Epoch 4 F UV Sci 2 (STIS.sp.73 3962)	(1) ASASSN-14LI	STIS/FUV-MAMA, TIME-TAG, 52X0.2	G140L 1425 A	BUFFER-TIME=15 00			1000 Secs (2971 Secs) *[==>2971.0 Secs]*	 ***[2]***
4	ASASSN-14 li Epoch 4 F UV Sci 3 (STIS.sp.73 3962)	(1) ASASSN-14LI	STIS/FUV-MAMA, TIME-TAG, 52X0.2	G140L 1425 A	BUFFER-TIME=15 00			1000 Secs (2971 Secs) *[==>2971.0 Secs]*	 ***[3]***

Orbit Structure



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