14166 - Whimper of a Bang: Documenting the Final Days of the Nearby Type Ia Supernova 2011fe

Cycle: 23, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Dr. Benjamin John Shappee (PI) (Contact)	**Carnegie Institution of Washington**	**bshappee@obs.carnegiescience.edu**
Dr. Krzysztof Z. Stanek (CoI)	The Ohio State University	kstanek@astronomy.ohio-state.edu
Dr. Chris S. Kochanek (CoI)	The Ohio State University	ckochanek@astronomy.ohio-state.edu
Dr. Peter M. Garnavich (CoI)	University of Notre Dame	pgarnavi@nd.edu
Jill R Gerke (CoI)	The Ohio State University	gerke@astronomy.ohio-state.edu

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) SN-2011FE-EPOCH1 ANY	ACS/WFC WFC3/IR WFC3/UVIS	4	07-Sep-2016 17:04:01.0	yes
02	(3) SN-2011FE-EPOCH2UVIS ANY	ACS/WFC WFC3/UVIS	4	07-Sep-2016 17:04:04.0	yes
03	(3) SN-2011FE-EPOCH2UVIS (4) SN-2011FE-EPOCH2IR ANY	ACS/WFC WFC3/IR WFC3/UVIS	5	07-Sep-2016 17:04:10.0	yes

13 Total Orbits Used

ABSTRACT

Even though SNe Ia are crucial to cosmological studies as distance indicators, the exact nature of these systems remains theoretically ambiguous and observationally elusive. However, there is a new hope. The very late-time lightcurves of SNe Ia harbor important clues to the natures of their progenitor systems. First, the ejecta from the SN will shock heat a non-degenerate companion, leaving it luminous and visible at very late times after the SN has faded . Second, due to nucleosynthetic effects during explosion, single and double degenerate SNe Ia models are predicted to produce vastly differing amounts of 57Co and 55Fe. 57Co and 55Fe dominate the power of the very late time light curves of SNe Ia after >1050 days after the initial explosion. Broadband observations of the bolometric luminosity at these epochs have the ability to measure the ratio of these two isotopes and thus discriminate between progenitor models. As the brightest SN Ia in nearly 40 years, SN 2011fe offers a prime opportunity to follow a SN Ia to such late epochs. Here we propose HST WFC3 optical and IR photometry of SN 2011fe to observe the transition from a 56Co to a 57Co powered lightcurve and to constrain a possible shock-heated companion. These observations will place unique constraints on progenitor systems of SNe Ia. SN 2011fe, having been already observed for more than 1300 days and a factor of a million in flux, is likely to remain the best studied normal SN Ia of our generation and if these observations are not made this cycle, they will likely never be done with Hubble.

OBSERVING DESCRIPTION

The goal of this proposal is to construct a quasi-bolometric light curve for the evolving transient, where the spectrum consists of (predominantly) line emission over a very broad range of wavelengths other than the UV (where there is little emission). We selected the F438W (B), F555W (V) and F600LP ($R + I$) filters for WFC3/UVIS and F110W (YJ) and F160W (H) for WFC3/IR. There are a number of reasons this filter combination is ideal for this project: 1) These filters cover 4000 to 17000\AA\ with no gaps and relatively uniform throughput. Our ground-based spectroscopy and photometry show there is little flux blueward of 4000 \AA{} so we forgo the F336W (U) and UV filters. 2) A single long pass filter would not be sufficient. Since the shape of the SN spectral energy distribution is known to be changing with ionization (\citealp{mcclelland13}, Shappee et al. in prep.), computing the bolometric luminosity with a single F350LP observation would be prone to a large uncertainties. Instead, we decided to use individual broad band filters to retain some spectral information without the added expense of taking a spectrum. Without this information, we could mistake a change in ionization state for a change in the bolometric luminosity. 3) Finally, the optical filter combination also attempts to evenly partition the optical energy. In the spectrum obtained 850 days after $t_{B {\rm max}}$, the wave-length ranges covered by B, V, R, and I, contained 48\%, 37\%, 21\%, 19\% of the optical energy.\footnote{The wave-length ranges covered by the Bessel filters have overlap, so the sum is greater than one.} Thus we have kept B and V as separate filters but F600LP covers

both the R and I wave-length ranges. Finally, we considered also asking for Spitzer observations, but SN~2011fe will be much too faint for mid-IR observations.

We estimated the number of orbits and exposures needed for our program using the depth requirements needed to distinguish between the models shown and Figure \ref{fig:lightcurve} and recommendations in the HST Primer. We propose obtaining 3 epochs separated by approximately 160 days to well-sample the transition in powering isotopes. The required exposure times in the optical are determined by first fitting the \citet{roepke12} models to the ground-based LBT data. To be conservative, we then take the fainter model as our fiducial model. The NIR, however, is not as simple because SN~2011fe has become too faint for ground-based observations. Here we base our exposure time calculations as if the NIR (1.0--1.7μm) had 10% the flux as the optical (4000--10000 \AA). If we detect nothing, we will know that the NIR is unimportant, otherwise we will have a measure of its contribution as well.

It is also important to note that because our measurement is the difference between points on the bolometric light curve, both the earlier and later observations with contribute to the statistical uncertainty in our measurement. Thus, it does not make sense to require the same signal-to-noise ratio (SNR) for the early observations, where it is inexpensive to increase the obtained SNR, and the later observations, where it is significantly more expensive to do so. Thus, we lower our required SNR as the SN fades. We require a SNR of 15, 12, and 10 for the optical filters and 10, 5, and 3 for the NIR upper limits for the 1st, 2nd, and 3rd epochs, respectively.

There is also the concern that crowding and confusion may inhibit our measurement. Luckily, SN~2011fe exploded in a sparse region of the outer disk of M101 where archival pre-explosion HST images existed. \citet{li11} use these images and Keck AO observations of SN~2011fe to constrain the progenitor system. They detect no counter-part at the location of the SN and place 2σ upper limits of F435W <27.87, F555W <27.49, and F814W < 26.81 at its position. These limits are more than a magnitude fainter than SN~2011fe is expected during our last epoch.\footnote{It is important to note that these limits were placed with F435W, F555W, and F814W exposure times of 900, 720, and 720 seconds, respectively. This raises the question:~~why are the proposed exposure times so much longer? The reason is these limits are simply for a detection (SNR ~ 1), whereas our SNR requirements are much more stringent.}

We then used the exposure time calculator to estimate the length of our required observations. Since zodiacal light is a significant background for the last epoch of observations we have slightly altered our requested date to take advantage of minimum of zodiacal light in the direction of M~101. The exposure time calculations for all of the observations include both their dates and coordinates to ensure that our estimated times are accurate. The estimates are also based on the observed optical spectra of SN~2011fe taken 850 days after $t_{B {\rm max}}$ which is calibrated to the expected

broad-band magnitudes for each epoch. Given the above constraints, the approximate exposure times we request for the first epoch in each filter are 3×500 sec in F438W, 3×400 sec in F555W, 3×1500 sec in F600LPW, 2×1000 sec in F110W, and 2×950 sec in F160W. The approximate exposure times we request for the second epoch in each filter are 3×850 sec in F438W, 3×700 sec in F555W, 3×1900 sec in F600LPW, 2×1000 sec in F110W, and 2×950 sec in F160W. Finally, the approximate exposure times we request for the third epoch in each filter are 3×1200 sec in F438W, 3×1200 sec in F555W, 3×3025 sec in F600LPW, 2×1075 sec in F110W, and 2×1075 sec in F160W.

Because of the charge transfer effects of WFC3 when there are few background photons, we will probably use the pre-flash mode for the first two epochs with 438 and 555. This can, however, be settled in Phase 2 and does not affect our current exposure time requirements.

No SN Ia has ever been observed at these epochs, so changes in the ionization state of SN~2011fe are possible and can not be predicted. This could conceivably significantly change what filters receive the largest portion of the SN flux. Thus, we plan to measure the light-curve of SN~2011fe soon after each observation is completed and use these measurements to inform how we distribute the next epoch's orbits among the filters.

Finally, because there is still a large and ongoing interest in SN 2011fe, we will waive our 1 year proprietary period and make the data immediately public.

Parallel Observations:

As the closest face-on Milky Way analogue, M~101 is an important nearby galaxy for many reasons. For example, \citet{shara13} have compiled a catalog of 10,000 Wolf-Rayet stars using extensive HST He II optical narrow-band imaging. There are also F435W/F555W/F814W mosaics covering most of the galaxy (GO 9490). We even have a study of Cepheids using archival ACS data that provides the distance which is currently popular for SN~2011fe (Shappee \& Stanek 2011) and we are surveying the entire galaxy for new Cepheids with the LBT. We include ACS in parallel mode to broaden the archival data base. We have used APT and Aladin to confirm it is possible to place the ACS detector (given the roll restrictions created by the timing of the observations) on the Cepheid fields as well as on lower metallicity regions missed by the F435W/F555W/F814W mosaics. However, because M101 is such and interesting and large galaxy, a ACS parallel observation at any roll angle would be interesting.

Visit

Proposal 14166, Fourth Epoch (01), completed Wed Sep 07 21:04:12 GMT 2016

Diagnostic Status: Warning

Scientific Instruments: WFC3/IR, WFC3/UVIS, ACS/WFC

Special Requirements: ORIENT 261D TO 271 D; BETWEEN 18-FEB-2016:00:00:00 AND 22-FEB-2016:00:00:00; VISIBILITY INTERVAL 3406 S

Diagnostics

(Fourth Epoch (01)) Warning (Orbit Planner): PATTERN AND COORDINATED PARALLEL MISMATCH

(Fourth Epoch (01)) Warning (Orbit Planner): PATTERN AND COORDINATED PARALLEL MISMATCH

(Fourth Epoch (01)) Warning (Orbit Planner): PATTERN AND COORDINATED PARALLEL MISMATCH

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1-6)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SN-2011FE-EPOCH1	RA: 14 03 2.4254 (210.7601058d) Dec: +54 16 58.53 (54.28292d) Equinox: J2000		V=26.3+/-1.0	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

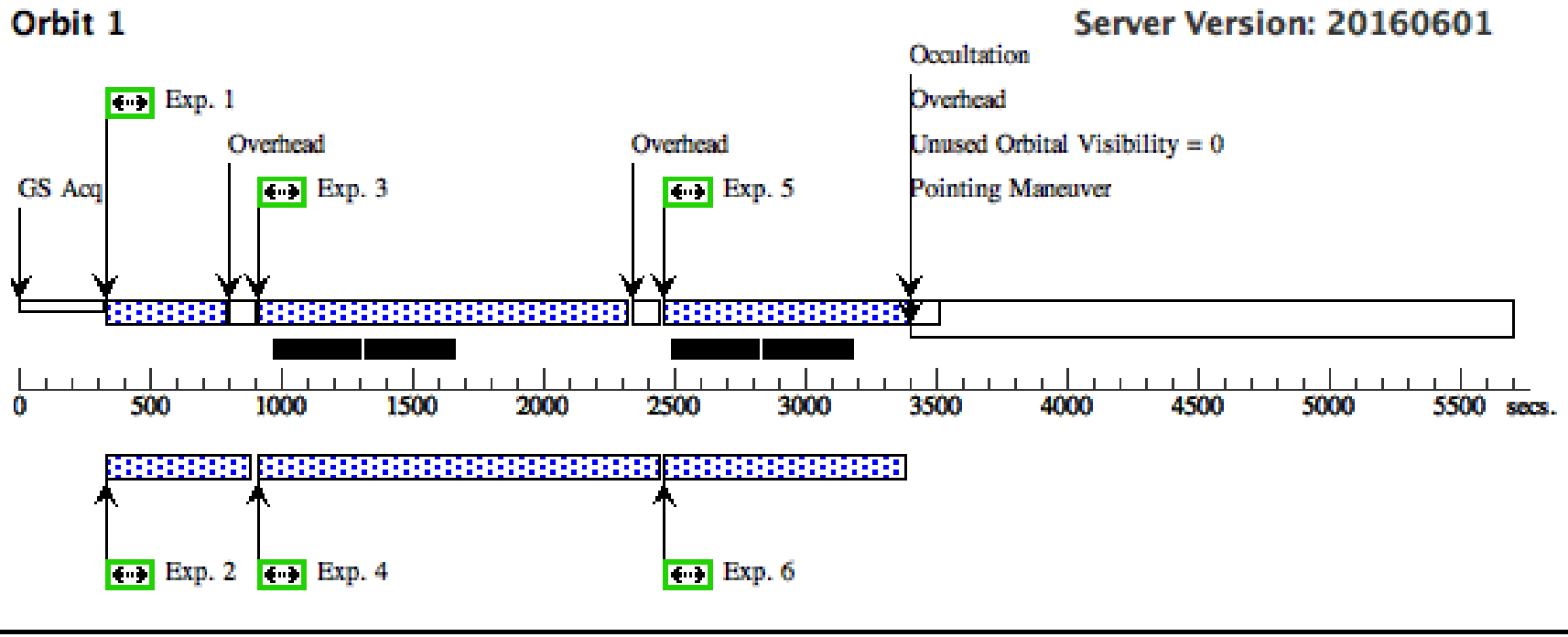
Exposures

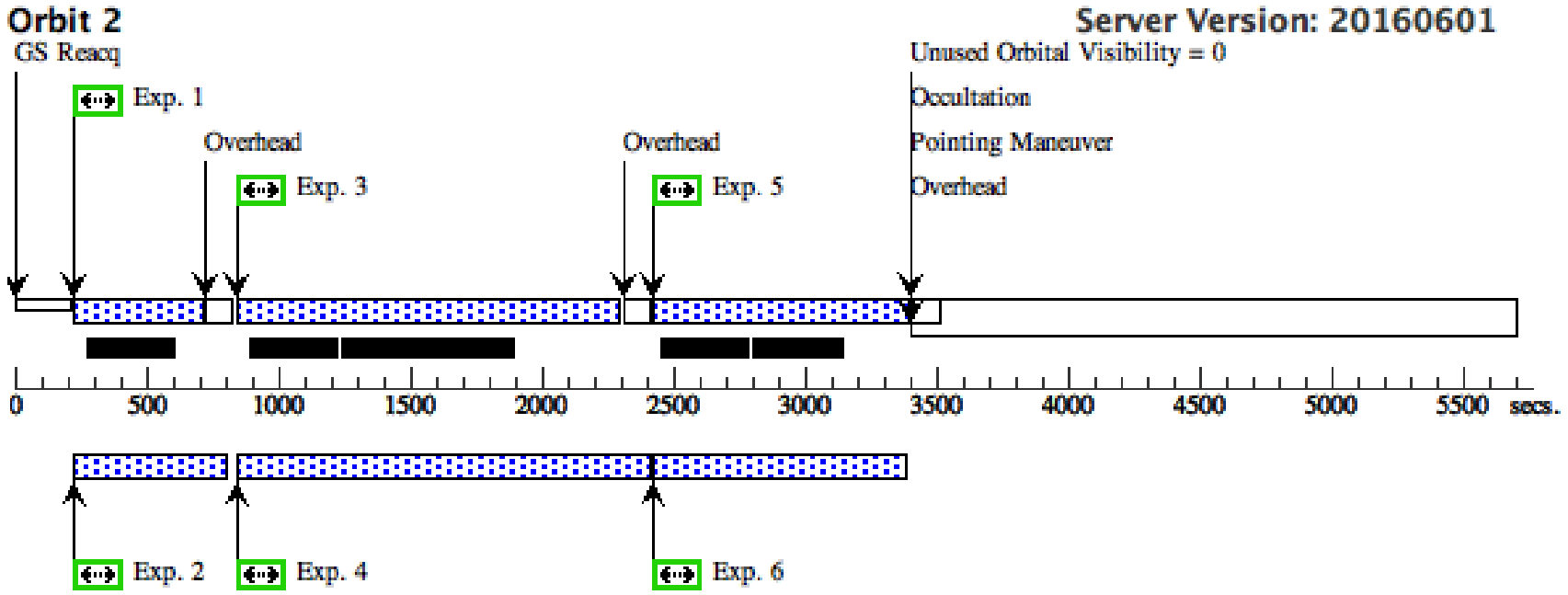
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	WFC3_F555W	(1) SN-2011FE-EPOCH1	WFC3/UVIS, ACCUM, UVIS	F555W			Pattern 1, Exps 1-6 in Fourth Epoch (01) (1) Prime + Parallel Group 1-2 in Pattern 1, Exps 1-6 in Fourth Epoch (01)	500 Secs (1362 Secs) *[==>426.0 Secs (Pattern 1)]* *[==>468.0 Secs (Pattern 2)]* *[==>468.0 Secs (Pattern 3)]*	 ***[1]*** ***[2]*** ***[3]***
2	ACS_F555W	ANY	ACS/WFC, ACCUM, WFC	F555W	FLASH=5		Pattern 1, Exps 1-6 in Fourth Epoch (01) (1) Prime + Parallel Group 1-2 in Pattern 1, Exps 1-6 in Fourth Epoch (01)	440 Secs (1170 Secs) *[==>340.0 Secs (Pattern 1)]* *[==>415.0 Secs (Pattern 2)]* *[==>415.0 Secs (Pattern 3)]*	 ***[1]*** ***[2]*** ***[3]***
3	WFC3-F600LP	(1) SN-2011FE-EPOCH1	WFC3/UVIS, ACCUM, UVIS	F600LP			Pattern 1, Exps 1-6 in Fourth Epoch (01) (1) Prime + Parallel Group 3-4 in Pattern 1, Exps 1-6 in Fourth Epoch (01)	700 Secs (4280 Secs) *[==>1400.0 Secs (Pattern 1)]* *[==>1440.0 Secs (Pattern 2)]* *[==>1440.0 Secs (Pattern 3)]*	 ***[1]*** ***[2]*** ***[3]***
4	ACS_F435W	ANY	ACS/WFC, ACCUM, WFC	F435W			Pattern 1, Exps 1-6 in Fourth Epoch (01) (1) Prime + Parallel Group 3-4 in Pattern 1, Exps 1-6 in Fourth Epoch (01)	1350 Secs (4160 Secs) *[==>1360.0 Secs (Pattern 1)]* *[==>1400.0 Secs (Pattern 2)]* *[==>1400.0 Secs (Pattern 3)]*	 ***[1]*** ***[2]*** ***[3]***
5	WFC3_F438W	(1) SN-2011FE-EPOCH1	WFC3/UVIS, ACCUM, UVIS	F438W	FLASH=4		Pattern 1, Exps 1-6 in Fourth Epoch (01) (1) Prime + Parallel Group 5-6 in Pattern 1, Exps 1-6 in Fourth Epoch (01)	450 Secs (2779 Secs) *[==>901.0 Secs (Pattern 1)]* *[==>939.0 Secs (Pattern 2)]* *[==>939.0 Secs (Pattern 3)]*	 ***[1]*** ***[2]*** ***[3]***
6	ACS_F814W	ANY	ACS/WFC, ACCUM, WFC	F814W			Pattern 1, Exps 1-6 in Fourth Epoch (01) (1) Prime + Parallel Group 5-6 in Pattern 1, Exps 1-6 in Fourth Epoch (01)	350 Secs (2138 Secs) *[==>779.0 Secs (Pattern 1)]* *[==>817.0 Secs (Pattern 2)]* *[==>542.0 Secs (Pattern 3)]*	 ***[1]*** ***[2]*** ***[3]***
7	WFC3-F160W	(1) SN-2011FE-EPOCH1	WFC3/IR, MULTIACCUM, IR	F160W	SAMP-SEQ=STEP100; NSAMP=13	POS TARG 0,0	Prime + Parallel Group 7-8 in Fourth Epoch (01)	699.232615 Secs (699.233 Secs) *[==>]*	 ***[4]***
8	ACS_F658N	ANY	ACS/WFC, ACCUM, WFC	F658N	FLASH=15		Prime + Parallel Group 7-8 in Fourth Epoch (01)	440 Secs (440 Secs) *[==>]*	 ***[4]***
9	WFC3-F110W	(1) SN-2011FE-EPOCH1	WFC3/IR, MULTIACCUM, IR	F110W	SAMP-SEQ=STEP100; NSAMP=14	POS TARG 0,0	Prime + Parallel Group 9-10 in Fourth Epoch (01)	799.232938 Secs (799.233 Secs) *[==>]*	 ***[4]***
10	ACS_F658N	ANY	ACS/WFC, ACCUM, WFC	F658N	FLASH=15		Prime + Parallel Group 9-10 in Fourth Epoch (01)	440 Secs (440 Secs) *[==>]*	 ***[4]***

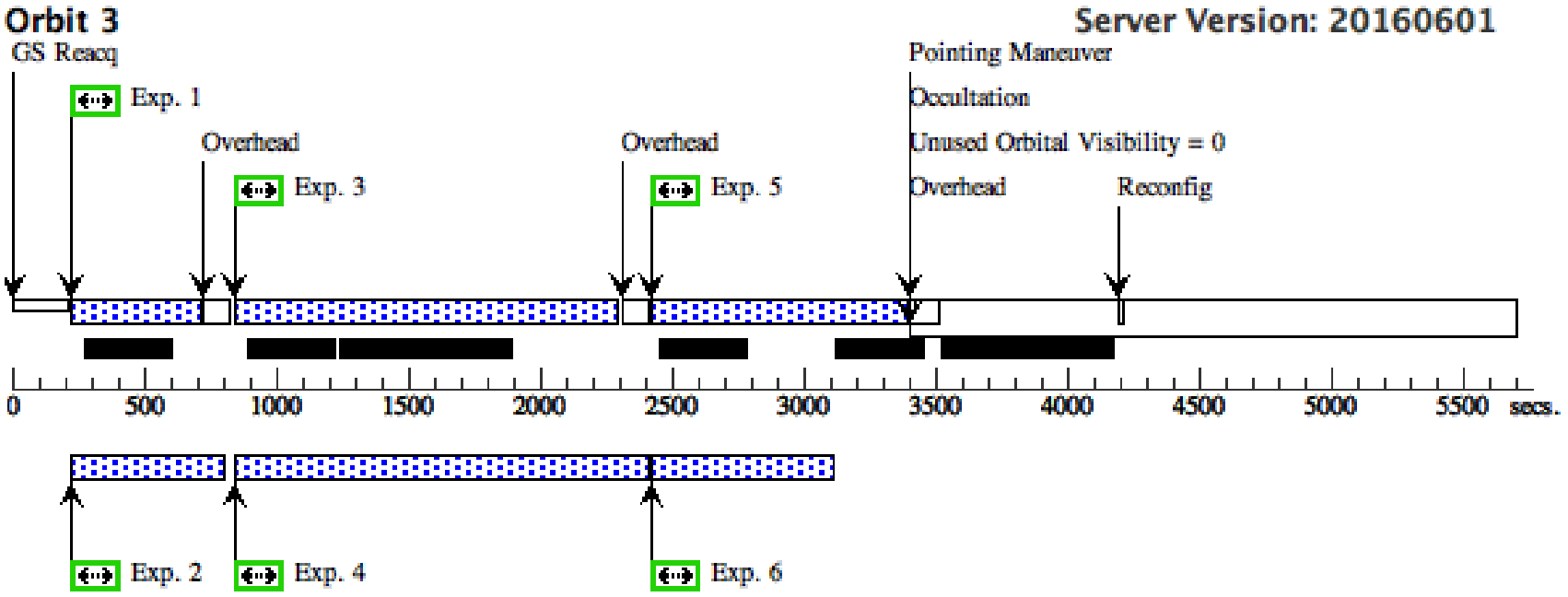
Comments: Add post flash as was recommended.

	11	WFC3-F110W	(1) SN-2011FE-EPOCH1	WFC3/IR, MULTIACCUM, IR	F110W	SAMP-SEQ=STEP100; NSAMP=14	POS TARG 0.474,0.424	Prime + Parallel Group 11-12 in Fourth Epoch (01)	799.232938 Secs (799.233 Secs) *[==>]*	 ***[4]***
	12	ACS_F658N	ANY	ACS/WFC, ACCUM, WFC	F658N	FLASH=15		Prime + Parallel Group 11-12 in Fourth Epoch (01)	440 Secs (440 Secs) *[==>]*	 ***[4]***
	Comments: Add post flash as was recommended.									
	13	WFC3-F160W	(1) SN-2011FE-EPOCH1	WFC3/IR, MULTIACCUM, IR	F160W	SAMP-SEQ=STEP100; NSAMP=13	SAME POS AS 11	Prime + Parallel Group 13-14 in Fourth Epoch (01)	699.232615 Secs (699.233 Secs) *[==>]*	 ***[4]***
	14	ACS_F658N	ANY	ACS/WFC, ACCUM, WFC	F658N	FLASH=15		Prime + Parallel Group 13-14 in Fourth Epoch (01)	440 Secs (440 Secs) *[==>]*	 ***[4]***

Orbit Structure



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Pointing Maneuver
Occultation
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Overhead
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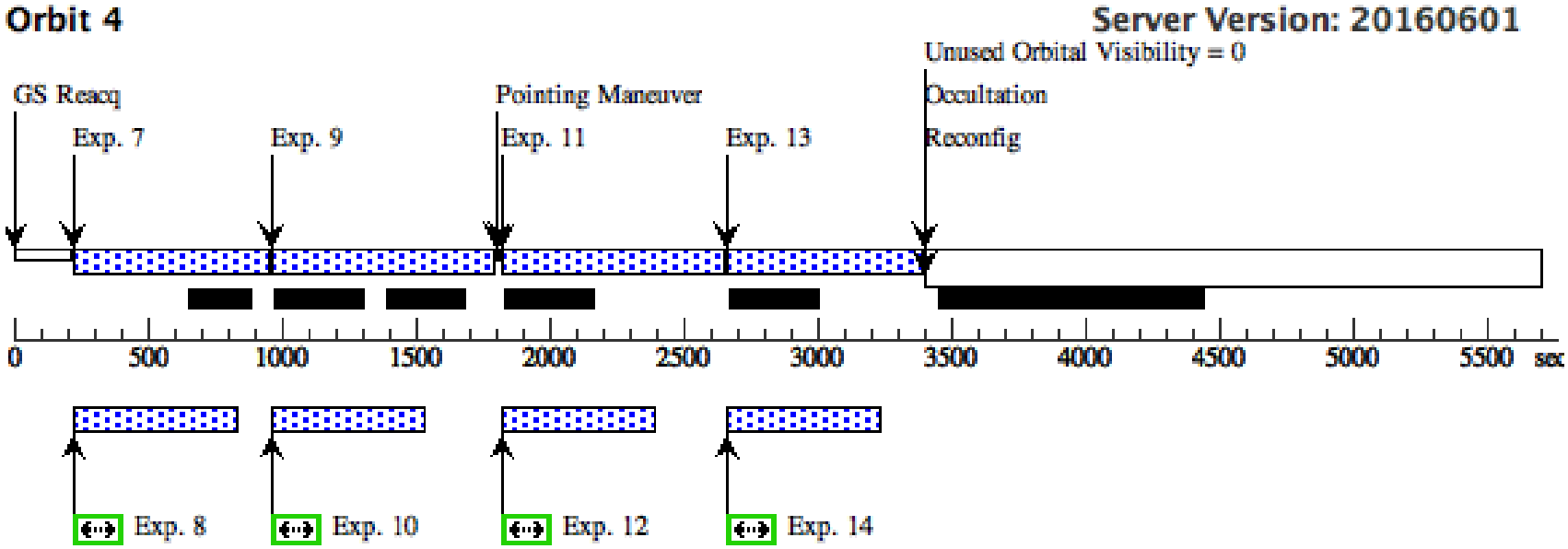
secs.
Exp. 2
Exp. 4
Exp. 6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Pointing Maneuver
Exp. 11
Exp. 13
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Reconfig
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500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec
Exp. 8
Exp. 10
Exp. 12
Exp. 14

Visit

Proposal 14166, Fifth Epoch (1st Visit) (02), implementation Wed Sep 07 21:04:12 GMT 2016

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: ORIENT 23D TO 40 D; BETWEEN 24-SEP-2016:00:00:00 AND 30-SEP-2016:00:00:00; ON HOLD

Comments: 9 orbits were not schedulable together, so we had to split the thrid epoch into two visits.

On Hold Comments: The exposure times for the third visit will be adjusted depending on the 1st visit's observations. It is not possible to know the SED at these times because no SN Ia has been observed this late.

Diagnostics

(Fifth Epoch (1st Visit) (02)) Warning (Orbit Planner): PATTERN AND COORDINATED PARALLEL MISMATCH

(Fifth Epoch (1st Visit) (02)) Warning (Orbit Planner): PATTERN AND COORDINATED PARALLEL MISMATCH

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(3)	Pattern Type=WFC3-UVIS-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=false		(1-4)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	SN-2011FE-EPOCH2UVIS	RA: 14 03 12.0161 (210.8000671d) Dec: +54 16 40.67 (54.27796d) Equinox: J2000		V=26.8+/-1.0	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

A is for F438W and F555W where CTE is more imporant so I put SN 2011fe closer to the edge.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	WFC3_F555W	(3) SN-2011FE-EPOCH2UVIS	WFC3/UVIS, ACCUM, UVIS	F555W			Pattern 3, Exps 1-4 in Fifth Epoch (1st Visit) (02) (3) Prime + Parallel Group 1-2 in Pattern 3, Exps 1-4 in Fifth Epoch (1st Visit) (02)	650 Secs X 2 (5200 Secs)	
								[==>(Pattern 1, Copy 1)] *[==>(Pattern 1, Copy 2)]*	***[1]***
								[==>(Pattern 2, Copy 1)] *[==>(Pattern 2, Copy 2)]*	***[2]***
								[==>(Pattern 3, Copy 1)] *[==>(Pattern 3, Copy 2)]*	***[3]***
								[==>(Pattern 4, Copy 1)] *[==>(Pattern 4, Copy 2)]*	***[4]***
2	ACS_F555W	ANY	ACS/WFC, ACCUM, WFC	F555W			Pattern 3, Exps 1-4 in Fifth Epoch (1st Visit) (02) (3) Prime + Parallel Group 1-2 in Pattern 3, Exps 1-4 in Fifth Epoch (1st Visit) (02)	600 Secs X 2 (4995 Secs)	
								[==>(Pattern 1, Copy 1)] *[==>630.0 Secs (Pattern 1, Copy 2)]*	***[1]***
								[==>(Pattern 2, Copy 1)] *[==>655.0 Secs (Pattern 2, Copy 2)]*	***[2]***
								[==>(Pattern 3, Copy 1)] *[==>655.0 Secs (Pattern 3, Copy 2)]*	***[3]***
								[==>(Pattern 4, Copy 1)] *[==>655.0 Secs (Pattern 4, Copy 2)]*	***[4]***
3	WFC3_F438W	(3) SN-2011FE-EPOCH2UVIS	WFC3/UVIS, ACCUM, UVIS	F438W			Pattern 3, Exps 1-4 in Fifth Epoch (1st Visit) (02) (3) Prime + Parallel Group 3-4 in Pattern 3, Exps 1-4 in Fifth Epoch (1st Visit) (02)	1350 Secs (6148 Secs)	
								[==>1447.0 Secs (Pattern 1)]	***[1]***
								[==>1567.0 Secs (Pattern 2)]	***[2]***
								[==>1567.0 Secs (Pattern 3)]	***[3]***
								[==>1567.0 Secs (Pattern 4)]	***[4]***
4	ACS_F658N	ANY	ACS/WFC, ACCUM, WFC	F658N	FLASH=4		Pattern 3, Exps 1-4 in Fifth Epoch (1st Visit) (02) (3) Prime + Parallel Group 3-4 in Pattern 3, Exps 1-4 in Fifth Epoch (1st Visit) (02)	1000 Secs (5548 Secs)	
								[==>1297.0 Secs (Pattern 1)]	***[1]***
								[==>1417.0 Secs (Pattern 2)]	***[2]***
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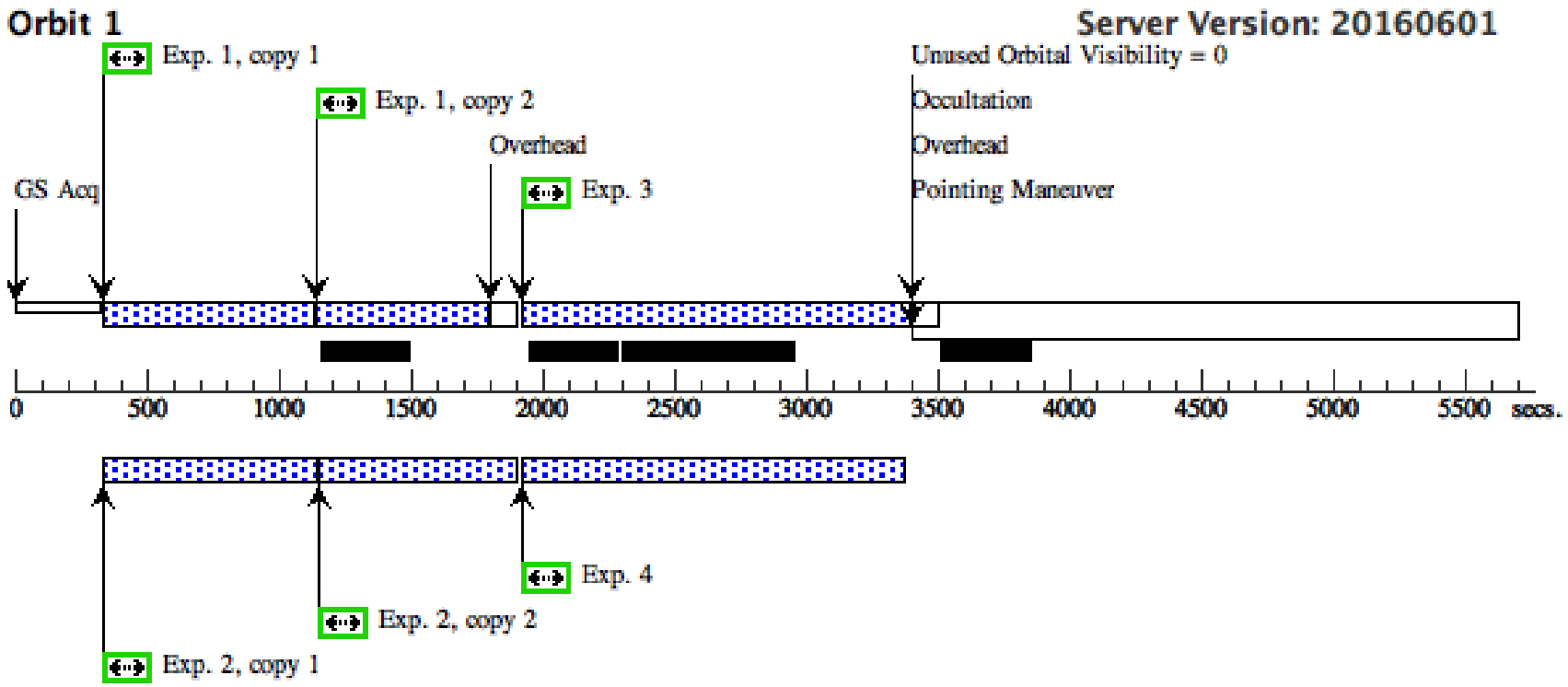
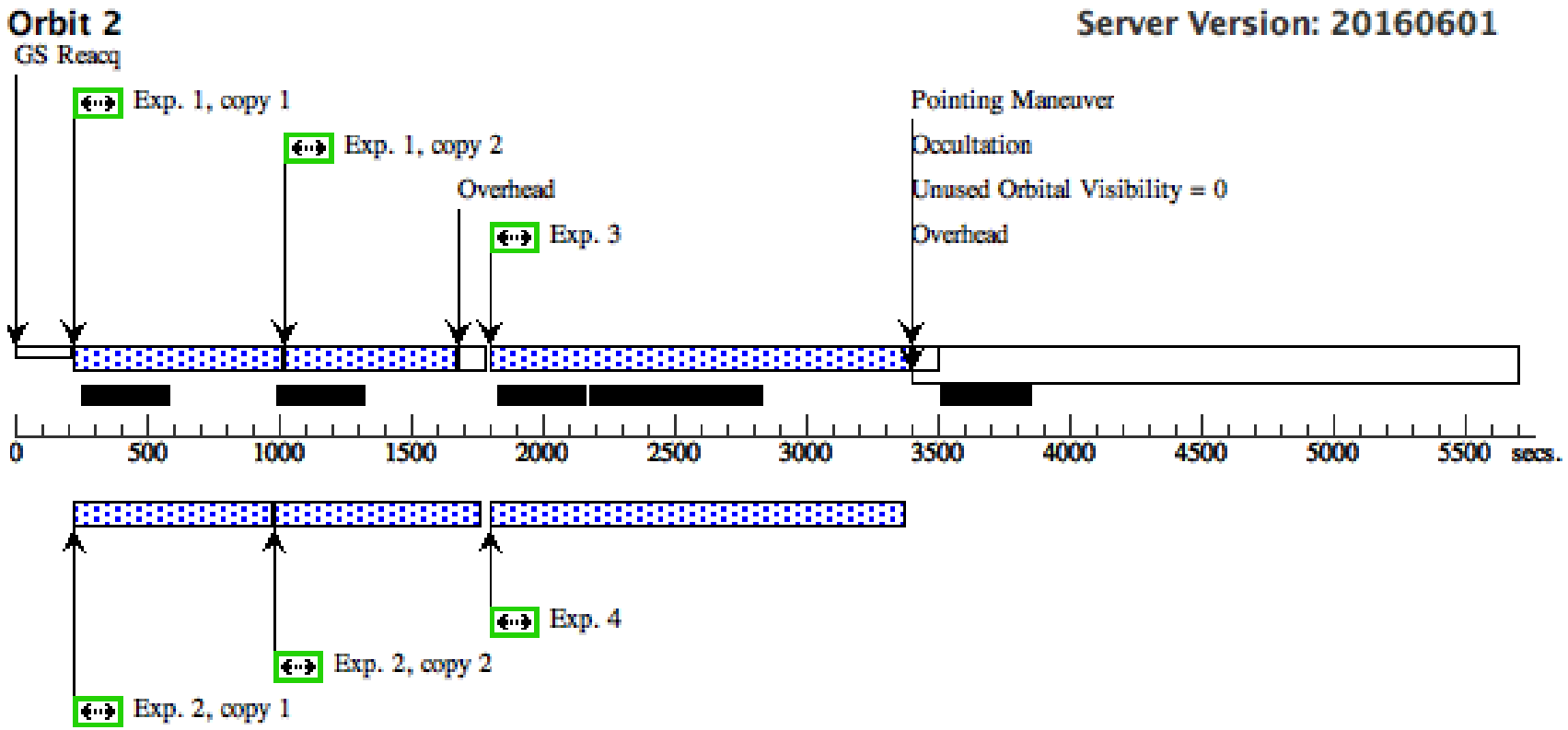
Orbit Structure

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Exp. 3
Pointing Maneuver
Occultation
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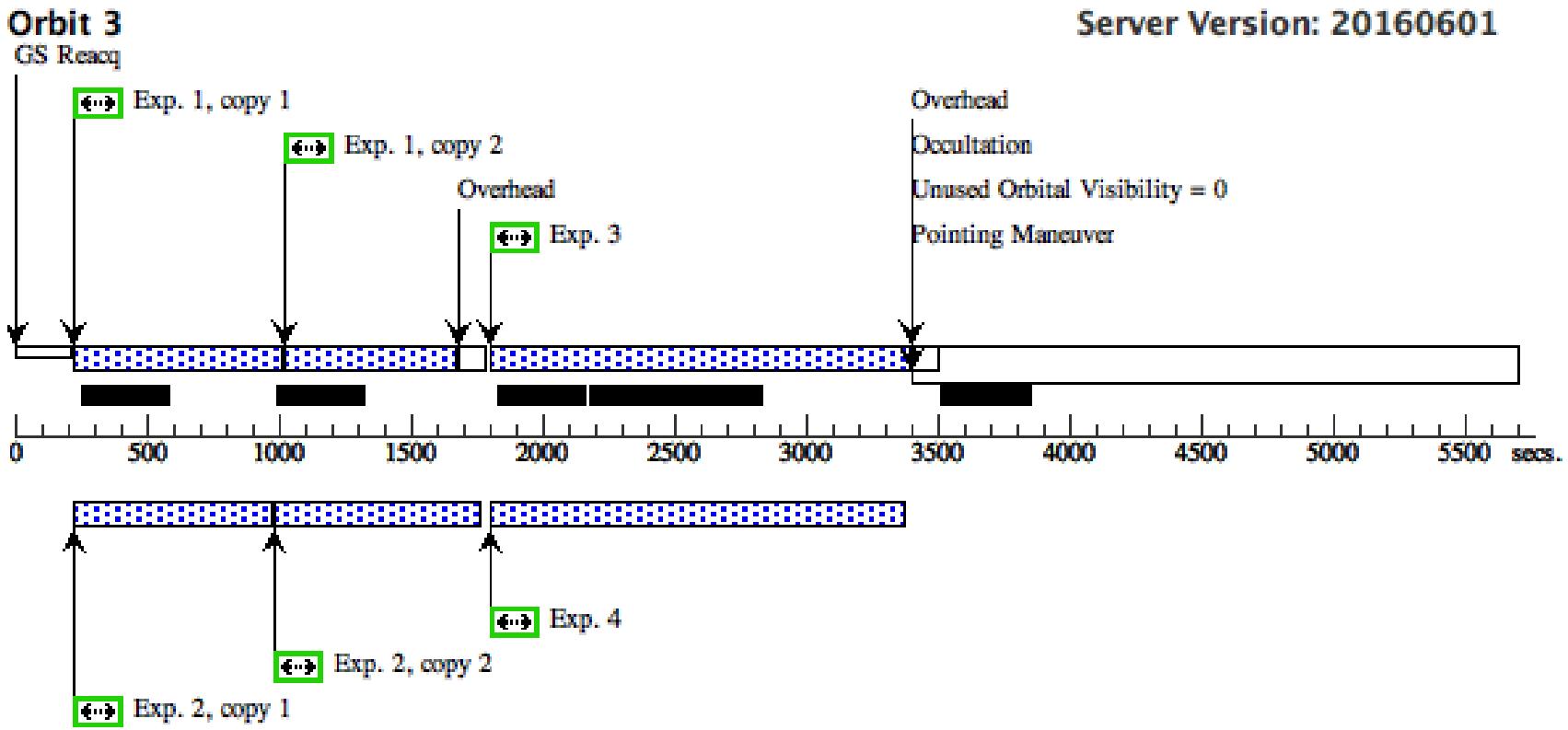
secs.
Exp. 4
Exp. 2, copy 2
Exp. 2, copy 1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Exp. 1, copy 2
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Exp. 3
Overhead
Occultation
Unused Orbital Visibility = 0
Pointing Maneuver
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secs.
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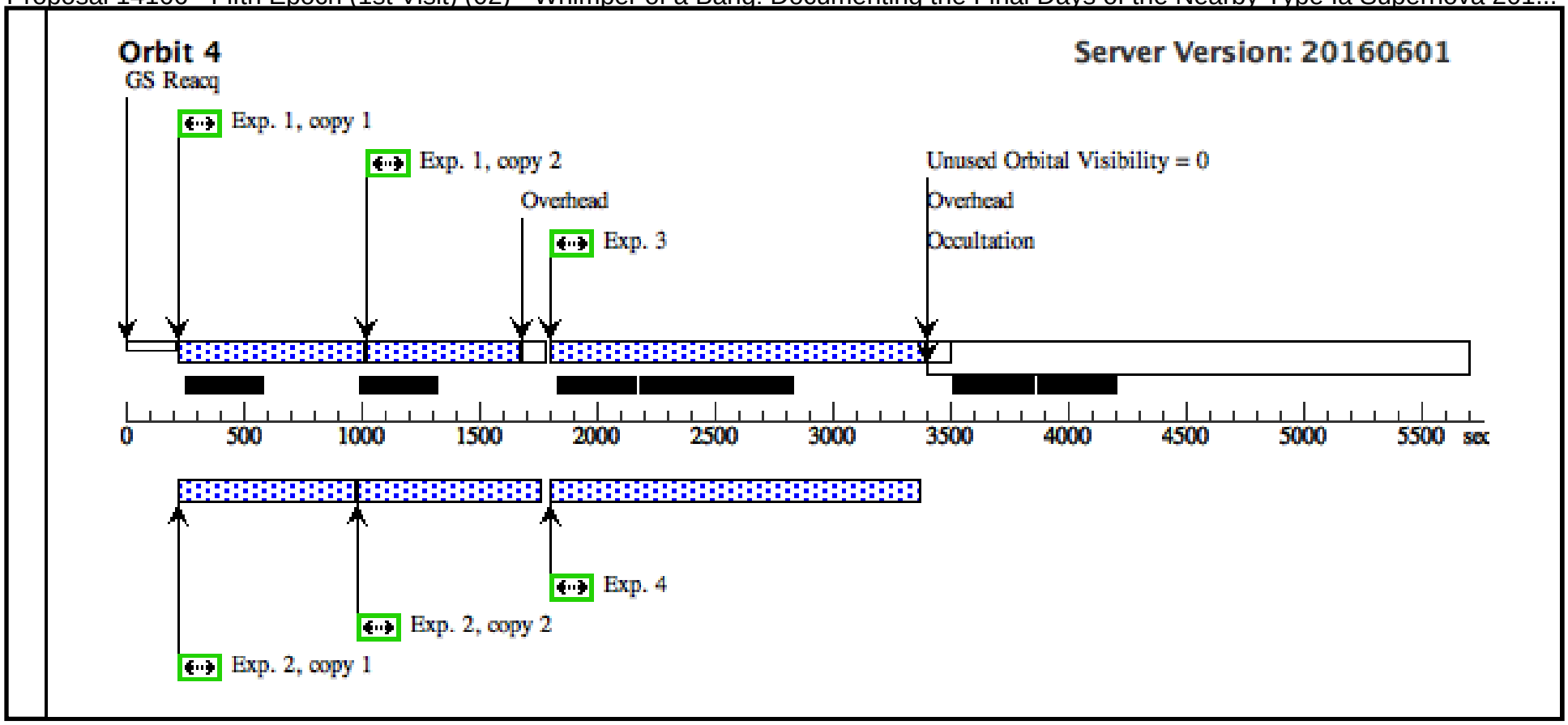
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GS Reacq
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Exp. 1, copy 2
Overhead
Exp. 3
Unused Orbital Visibility = 0
Overhead
Occultation
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1500
2000
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3500
4000
4500
5000
5500
sec
Exp. 4
Exp. 2, copy 2
Exp. 2, copy 1

Visit

Proposal 14166, Fifth Epoch (2nd Visit) (03), implementation Wed Sep 07 21:04:13 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR, WFC3/UVIS, ACS/WFC

Special Requirements: ORIENT 23D TO 40 D; BETWEEN 24-SEP-2016:00:00:00 AND 30-SEP-2016:00:00:00; ON HOLD ; VISIBILITY INTERVAL 86 M

Comments: 9 orbits were not schedulable together, so we had to split the thrid epoch into two visits.

I have extended the visibility window so that the F110W observations can be made at a specific portion of an orbit where there eath is not brightening the backgrounds.

On Hold Comments: The exposure times for the third visit will be adjusted depending on the 1st visit's observations. It is not possible to know the SED at these times because no SN Ia has been observed this late.

Patterns

#	Primary Pattern		Secondary Pattern		Exposures
(7)	Pattern Type=LINE	Coordinate Frame=POS-TARG	Pattern Type=LINE	Coordinate Frame=POS-TARG	(25-26)
	Purpose=DITHER	Pattern Orientation=46.84	Purpose=DITHER	Pattern Orientation=0	
	Number Of Points=3	Angle Between Sides=	Number Of Points=2	Angle Between Sides=	
	Point Spacing=0.135	Center Pattern=false	Point Spacing=0.021625	Center Pattern=false	
	Line Spacing=		Line Spacing=		

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	SN-2011FE-EPOCH2UVIS	RA: 14 03 12.0161 (210.8000671d) Dec: +54 16 40.67 (54.27796d) Equinox: J2000		V=26.8+/-1.0	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

A is for F438W and F555W where CTE is more imporant so I put SN 2011fe closer to the edge.

(4)	SN-2011FE-EPOCH2IR	RA: 14 03 6.0077 (210.7750321d) Dec: +54 16 25.06 (54.27363d) Equinox: J2000		V=26.8+/-1.0	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

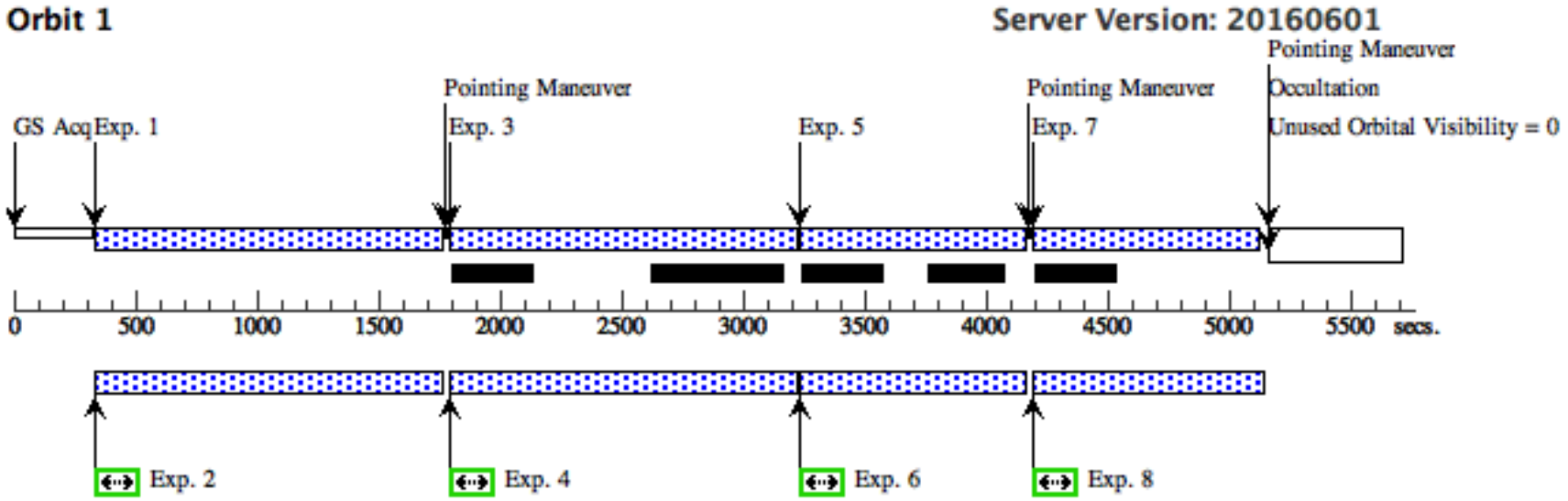
Exposures

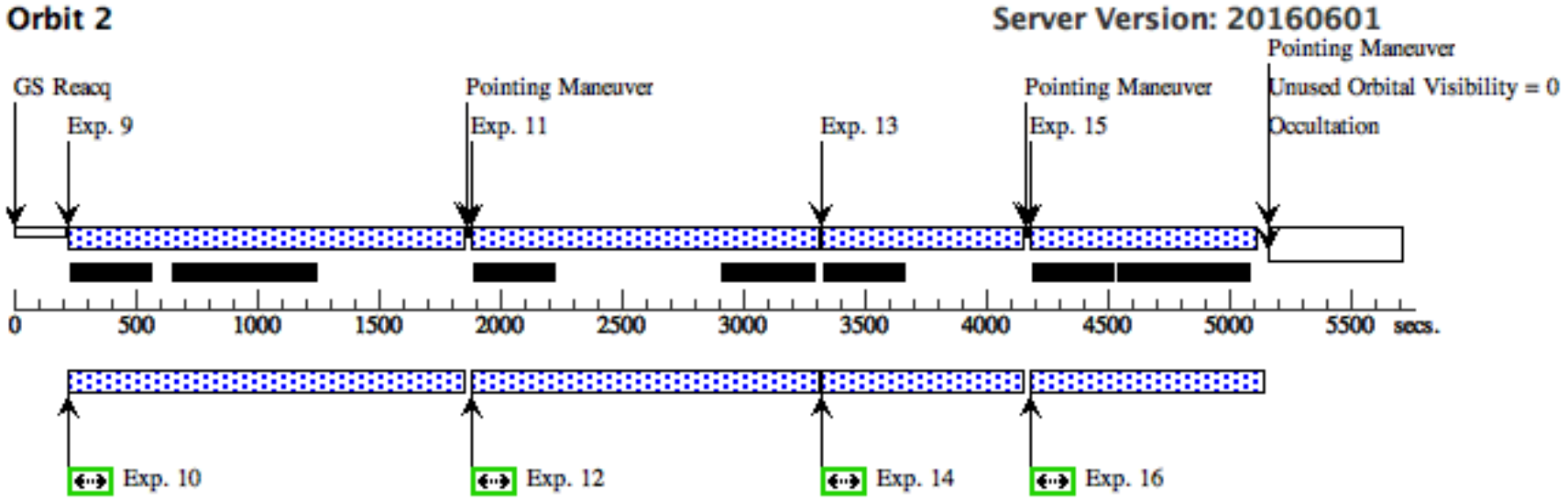
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	WFC3-F160W	(4) SN-2011FE-EPOCH2IR	WFC3/IR, MULTIACCUM, IR	F160W	SAMP-SEQ=STEP200; NSAMP=14	POS TARG 0.0,0.0	Prime + Parallel Group 1-2 in Fifth Epoch (2nd Visit) (03)	1399.231402 Secs (1399.231 Secs) *[==>]*	*[1]*
2	ACS_F814W	ANY	ACS/WFC, ACCUM, WFC	F814W			Prime + Parallel Group 1-2 in Fifth Epoch (2nd Visit) (03)	440 Secs (1221 Secs) *[==>1221.0 Secs]*	*[1]*
3	WFC3-F160W	(4) SN-2011FE-EPOCH2IR	WFC3/IR, MULTIACCUM, IR	F160W	SAMP-SEQ=STEP200; NSAMP=14	POS TARG 0.06775, 0.0	Prime + Parallel Group 3-4 in Fifth Epoch (2nd Visit) (03)	1399.231402 Secs (1399.231 Secs) *[==>]*	*[1]*
4	ACS_F814W	ANY	ACS/WFC, ACCUM, WFC	F814W			Prime + Parallel Group 3-4 in Fifth Epoch (2nd Visit) (03)	440 Secs (1303 Secs) *[==>1303.0 Secs]*	*[1]*
5	WFC3-F110W	(4) SN-2011FE-EPOCH2IR	WFC3/IR, MULTIACCUM, IR	F110W	SAMP-SEQ=STEP100; NSAMP=15	SAME POS AS 3	Prime + Parallel Group 5-6 in Fifth Epoch (2nd Visit) (03)	899.233261 Secs (899.233 Secs) *[==>]*	*[1]*
6	ACS_F814W	ANY	ACS/WFC, ACCUM, WFC	F814W			Prime + Parallel Group 5-6 in Fifth Epoch (2nd Visit) (03)	440 Secs (803 Secs) *[==>803.0 Secs]*	*[1]*
7	WFC3-F110W	(4) SN-2011FE-EPOCH2IR	WFC3/IR, MULTIACCUM, IR	F110W	SAMP-SEQ=STEP100; NSAMP=15	SAME POS AS 1	Prime + Parallel Group 7-8 in Fifth Epoch (2nd Visit) (03)	899.233261 Secs (899.233 Secs) *[==>]*	*[1]*
8	ACS_F814W	ANY	ACS/WFC, ACCUM, WFC	F814W			Prime + Parallel Group 7-8 in Fifth Epoch (2nd Visit) (03)	440 Secs (826 Secs) *[==>826.0 Secs]*	*[1]*
9	WFC3-F160W	(4) SN-2011FE-EPOCH2IR	WFC3/IR, MULTIACCUM, IR	F160W	SAMP-SEQ=STEP200; NSAMP=15	POS TARG 0.451,0.403	Prime + Parallel Group 9-10 in Fifth Epoch (2nd Visit) (03)	1599.231469 Secs (1599.231 Secs) *[==>]*	*[2]*
10	ACS_F814W	ANY	ACS/WFC, ACCUM, WFC	F814W			Prime + Parallel Group 9-10 in Fifth Epoch (2nd Visit) (03)	440 Secs (1503 Secs) *[==>1503.0 Secs]*	*[2]*
11	WFC3-F160W	(4) SN-2011FE-EPOCH2IR	WFC3/IR, MULTIACCUM, IR	F160W	SAMP-SEQ=STEP200; NSAMP=14	POS TARG 0.51875, 0.403	Prime + Parallel Group 11-12 in Fifth Epoch (2nd Visit) (03)	1399.231402 Secs (1399.231 Secs) *[==>]*	*[2]*
12	ACS_F814W	ANY	ACS/WFC, ACCUM, WFC	F814W			Prime + Parallel Group 11-12 in Fifth Epoch (2nd Visit) (03)	440 Secs (1303 Secs) *[==>1303.0 Secs]*	*[2]*
13	WFC3-F110W	(4) SN-2011FE-EPOCH2IR	WFC3/IR, MULTIACCUM, IR	F110W	SAMP-SEQ=STEP100; NSAMP=14	SAME POS AS 11	Prime + Parallel Group 13-14 in Fifth Epoch (2nd Visit) (03)	799.232938 Secs (799.233 Secs) *[==>]*	*[2]*
14	ACS_F814W	ANY	ACS/WFC, ACCUM, WFC	F814W			Prime + Parallel Group 13-14 in Fifth Epoch (2nd Visit) (03)	440 Secs (703 Secs) *[==>703.0 Secs]*	*[2]*
15	WFC3-F110W	(4) SN-2011FE-EPOCH2IR	WFC3/IR, MULTIACCUM, IR	F110W	SAMP-SEQ=STEP100; NSAMP=15	SAME POS AS 9	Prime + Parallel Group 15-16 in Fifth Epoch (2nd Visit) (03)	899.233261 Secs (899.233 Secs) *[==>]*	*[2]*
16	ACS_F814W	ANY	ACS/WFC, ACCUM, WFC	F814W			Prime + Parallel Group 15-16 in Fifth Epoch (2nd Visit) (03)	440 Secs (837 Secs) *[==>837.0 Secs]*	*[2]*
17	WFC3-F160W	(4) SN-2011FE-EPOCH2IR	WFC3/IR, MULTIACCUM, IR	F160W	SAMP-SEQ=STEP200; NSAMP=15	POS TARG 0.902,0.806	Prime + Parallel Group 17-18 in Fifth Epoch (2nd Visit) (03)	1599.231469 Secs (1599.231 Secs) *[==>]*	*[3]*

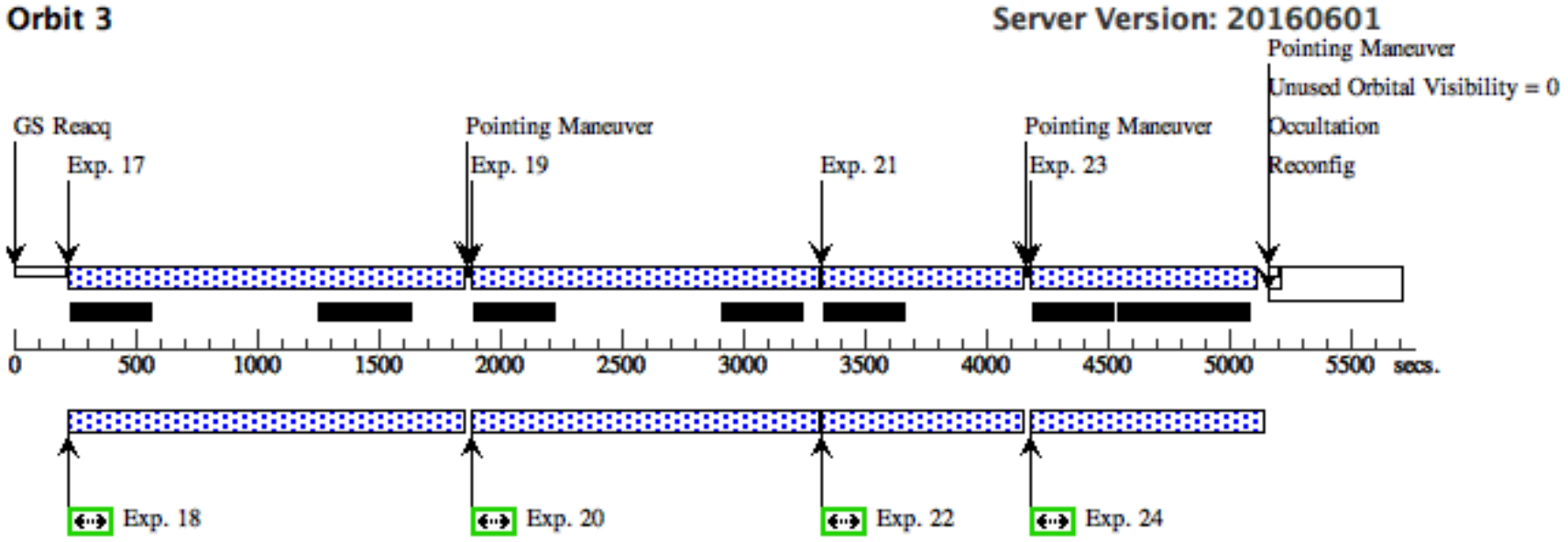
18	ACS_F814W	ANY	ACS/WFC, ACCUM, WFC	F814W			Prime + Parallel Group 17-18 in Fifth Epoch (2nd Visit) (03)	440 Secs (1503 Secs) *[==>1503.0 Secs]*	 ***[3]***
19	WFC3-F160W	(4) SN-2011FE-EPOCH2IR	WFC3/IR, MULTIACCUM, IR	F160W	SAMP-SEQ=STEP200; NSAMP=14	POS TARG 0.96975, 0.806	Prime + Parallel Group 19-20 in Fifth Epoch (2nd Visit) (03)	1399.231402 Secs (1399.231 Secs) *[==>]*	 ***[3]***
20	ACS_F814W	ANY	ACS/WFC, ACCUM, WFC	F814W			Prime + Parallel Group 19-20 in Fifth Epoch (2nd Visit) (03)	440 Secs (1303 Secs) *[==>1303.0 Secs]*	 ***[3]***
21	WFC3-F110W	(4) SN-2011FE-EPOCH2IR	WFC3/IR, MULTIACCUM, IR	F110W	SAMP-SEQ=STEP100; NSAMP=14	SAME POS AS 19	Prime + Parallel Group 21-22 in Fifth Epoch (2nd Visit) (03)	799.232938 Secs (799.233 Secs) *[==>]*	 ***[3]***
22	ACS_F814W	ANY	ACS/WFC, ACCUM, WFC	F814W			Prime + Parallel Group 21-22 in Fifth Epoch (2nd Visit) (03)	440 Secs (703 Secs) *[==>703.0 Secs]*	 ***[3]***
23	WFC3-F110W	(4) SN-2011FE-EPOCH2IR	WFC3/IR, MULTIACCUM, IR	F110W	SAMP-SEQ=STEP100; NSAMP=15	SAME POS AS 17	Prime + Parallel Group 23-24 in Fifth Epoch (2nd Visit) (03)	899.233261 Secs (899.233 Secs) *[==>]*	 ***[3]***
24	ACS_F814W	ANY	ACS/WFC, ACCUM, WFC	F814W			Prime + Parallel Group 23-24 in Fifth Epoch (2nd Visit) (03)	440 Secs (837 Secs) *[==>837.0 Secs]*	 ***[3]***
25	WFC3-F600LP	(3) SN-2011FE-EPOCH2UVIS	WFC3/UVIS, ACCUM, UVIS	F600LP	CR-SPLIT=2		Pattern 7, Exps 25-26 in Fifth Epoch (2nd Visit) (03) (7) Prime + Parallel Group 25-26 in Pattern 7, Exps 25-26 in Fifth Epoch (2nd Visit) (03)	1000 Secs (8091 Secs) *[==>709.0 Secs (Pattern 1,1, Split 1)]* *[==>709.0 Secs (Pattern 1,1, Split 2)]* *[==>709.0 Secs (Pattern 1,2, Split 1)]* *[==>709.0 Secs (Pattern 1,2, Split 2)]* *[==>709.0 Secs (Pattern 2,1, Split 1)]* *[==>709.0 Secs (Pattern 2,1, Split 2)]* *[==>618.0 Secs (Pattern 2,2, Split 1)]* *[==>618.0 Secs (Pattern 2,2, Split 2)]* *[==>700.0 Secs (Pattern 3,1, Split 1)]* *[==>618.0 Secs (Pattern 3,1, Split 2)]* *[==>618.0 Secs (Pattern 3,2, Split 1)]* *[==>665.0 Secs (Pattern 3,2, Split 2)]*	 ***[4]*** ***[5]***

	26	ACS_F435W	ANY	ACS/WFC, ACCUM, WFC	F435W	Pattern 7, Exps 25-26 in Fifth Epoch (2nd Visit) (03) (7) Prime + Parallel Group 25-26 in Pattern 7, Exps 25-26 in Fifth Epoch (2nd Visit) (03)	100 Secs (7835 Secs) *[==>1500.0 Secs (Pattern 1,1)]* *[==>1500.0 Secs (Pattern 1,2)]* *[==>1340.0 Secs (Pattern 2,1)]* *[==>1335.0 Secs (Pattern 2,2)]* *[==>1380.0 Secs (Pattern 3,1)]* *[==>780.0 Secs (Pattern 3,2)]*	 ***[4]*** ***[5]***

Orbit Structure






Orbit 3
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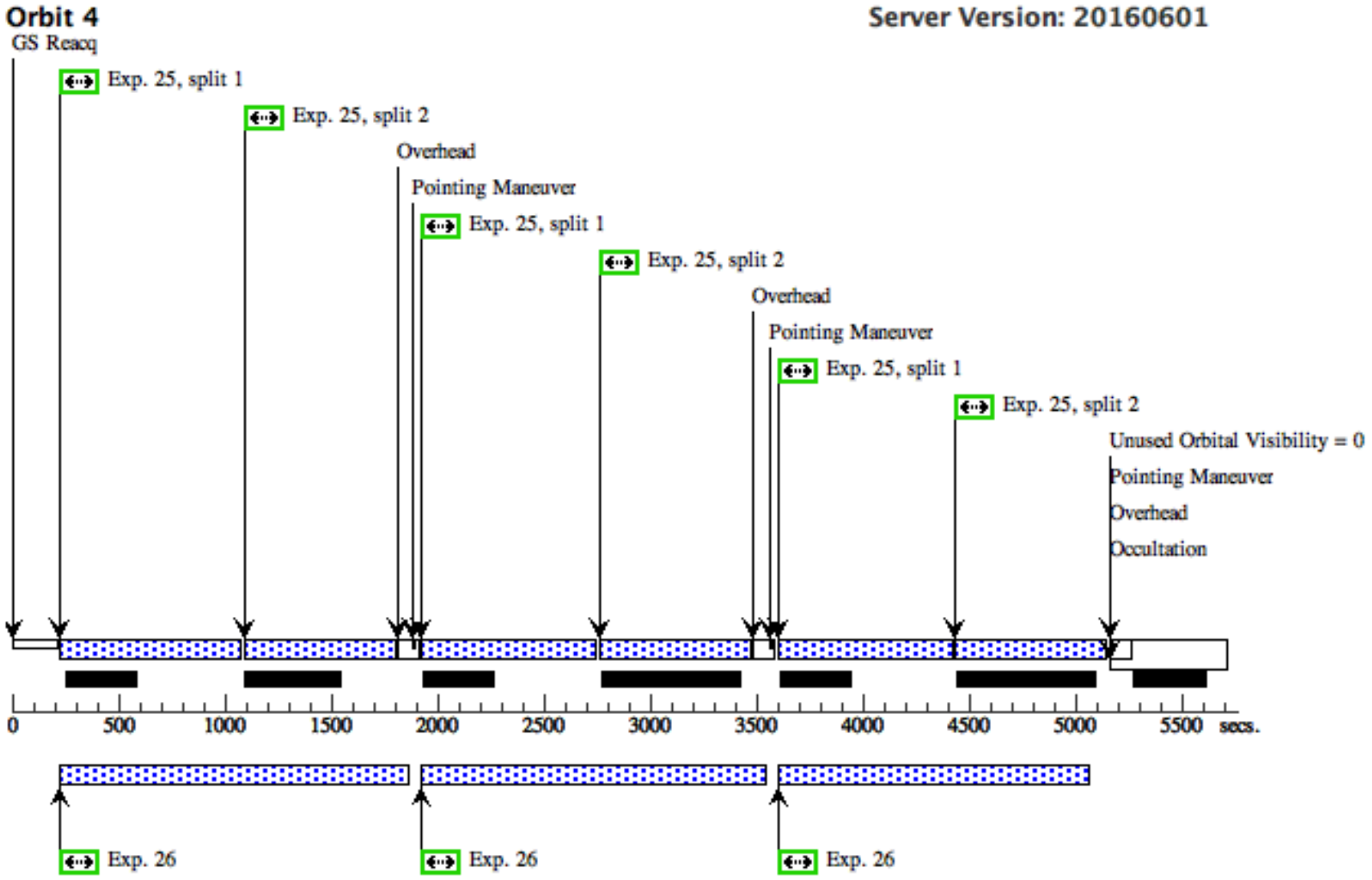
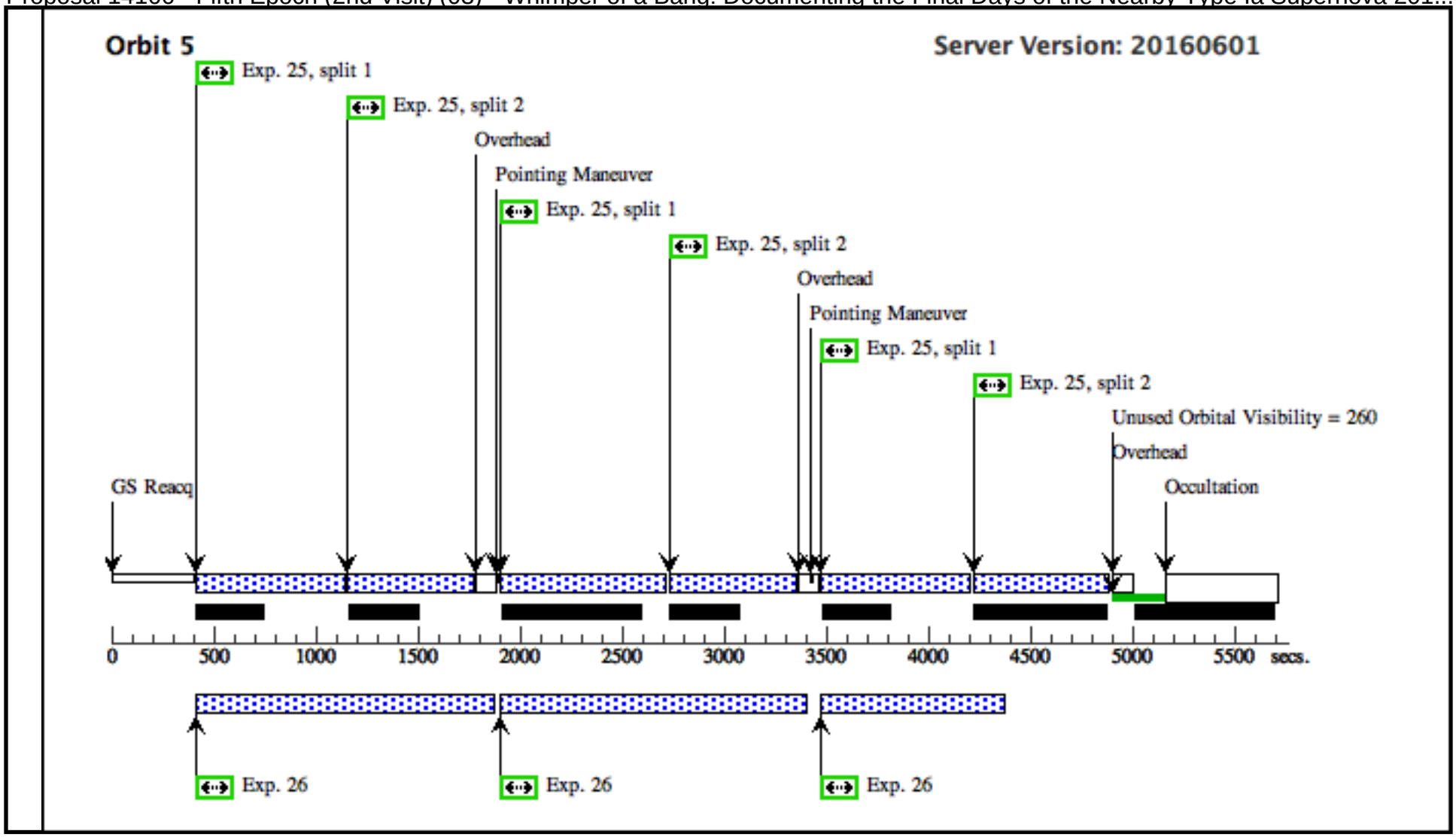
GS Reacq
Exp. 17
Pointing Maneuver
Exp. 19
Exp. 21
Pointing Maneuver
Exp. 23
Pointing Maneuver
Unused Orbital Visibility = 0
Occultation
Reconfig
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.
Exp. 18
Exp. 20
Exp. 22
Exp. 24


Orbit 4
Server Version: 20160601
GS Reacq
Exp. 25, split 1
Exp. 25, split 2
Overhead
Pointing Maneuver
Exp. 25, split 1
Exp. 25, split 2
Overhead
Pointing Maneuver
Exp. 25, split 1
Exp. 25, split 2
Unused Orbital Visibility = 0
Pointing Maneuver
Overhead
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.
Exp. 26
Exp. 26
Exp. 26


Orbit 5
Server Version: 20160601
Exp. 25, split 1
Exp. 25, split 2
Overhead
Pointing Maneuver
Exp. 25, split 1
Exp. 25, split 2
Overhead
Pointing Maneuver
Exp. 25, split 1
Exp. 25, split 2
Unused Orbital Visibility = 260
Overhead
Occultation
GS Reacq
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.
Exp. 26
Exp. 26
Exp. 26