



# 16984 - Betelgeuse: An Iconic and Surprising Red Supergiant

Cycle: 30, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

## INVESTIGATORS

<i>Name</i>	<i>Institution</i>
<b>Dr. Andrea Dupree (PI) (Contact)</b>	<b>Smithsonian Institution Astrophysical Observatory</b>
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Thomas Calderwood (CoI)	American Association Of Variable Star Observers
Prof. Klaus G Strassmeier (CoI) (ESA Member)	Leibniz-Institut für Astrophysik Potsdam (AIP)
Dr. Anita Richards (CoI) (ESA Member)	University of Manchester
Prof. Pierre Kervella (CoI) (ESA Member)	Observatoire de Paris
Dr. Kateryna Kravchenko (CoI) (ESA Member)	Max-Planck-Institut für extraterrestrische Physik
Dr. Sophie Van Eck (CoI) (ESA Member)	Universite Libre de Bruxelles
Dr. alain jorissen (CoI) (ESA Member)	Universite Libre de Bruxelles
Dr. Narsireddy Anugu (CoI)	University of Arizona
Dr. Thomas Granzer (CoI) (ESA Member)	Leibniz-Institut für Astrophysik Potsdam (AIP)
Dr. Gioia Rau (CoI)	NASA Goddard Space Flight Center
Dr. William T Thompson (CoI)	ADNET Systems, Inc
Dr. Lynn D Matthews (CoI)	Massachusetts Institute of Technology
Ms. Emily Cannon (CoI) (ESA Member)	Institute of Astronomy, KU Leuven
Dr. Andreas Quirrenbach (CoI) (ESA Member)	Landessternwarte Heidelberg

## 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) HD39801	STIS/CCD STIS/NUV-MAMA	4	25-Jul-2024 16:00:32.0	yes
02	(1) HD39801	STIS/CCD STIS/NUV-MAMA	4	25-Jul-2024 16:00:34.0	yes
03	(1) HD39801	STIS/CCD STIS/NUV-MAMA	4	25-Jul-2024 16:00:35.0	yes
04	(1) HD39801	STIS/CCD STIS/NUV-MAMA	4	25-Jul-2024 16:00:36.0	yes
05	(1) HD39801	STIS/CCD STIS/NUV-MAMA	4	25-Jul-2024 16:00:38.0	yes

20 Total Orbits Used

### **ABSTRACT**

Multiple ultraviolet spectra of the nearby red supergiant, Betelgeuse, using STIS will enable unique spatially resolved measures of photospheric and chromospheric structure and mass inflows and outflows. This follows the historic dimming of the star captured by HST/STIS in 2019-2020, and will probe the unusual atmospheric structure following the dimming event. An HST campaign of 2 cycles will be complemented by multi-frequency photometry, spectroscopy, interferometry and polarimetry at radio, infrared, and optical wavelengths in order to map surface structures and their variability, and the extended outer atmosphere over both the short (420-day) and long, secondary (2000-day) periods of this supergiant. These observations, coupled with detailed modeling and simulations, will probe the structure, dynamics, and mass loss from Betelgeuse to provide crucial insights into the atmospheric physics and wind-driving mechanisms of red supergiants.

### **OBSERVING DESCRIPTION**

During Cycle 29 (the first cycle of a two cycle program), we will make 5 visits of 4 orbits each to the red supergiant Betelgeuse; visits spread over the times of target accessibility. Using the smallest aperture (0.025X0.1") of STIS, the NUV-MAMA E230M (2707) setting, we propose to obtain spectra at 5 positions on the ultraviolet image: center pickup, +/-25 mas, and +/-50 mas offsets.

Exposure time at center: 2040 sec.

Proposal 16984 (STScI Edit Number: 6, Created: Thursday, July 25, 2024 at 3:00:38 PM Eastern Standard Time) - Overview

Exposure times at +/-25 mas: 2520 - 3000 sec

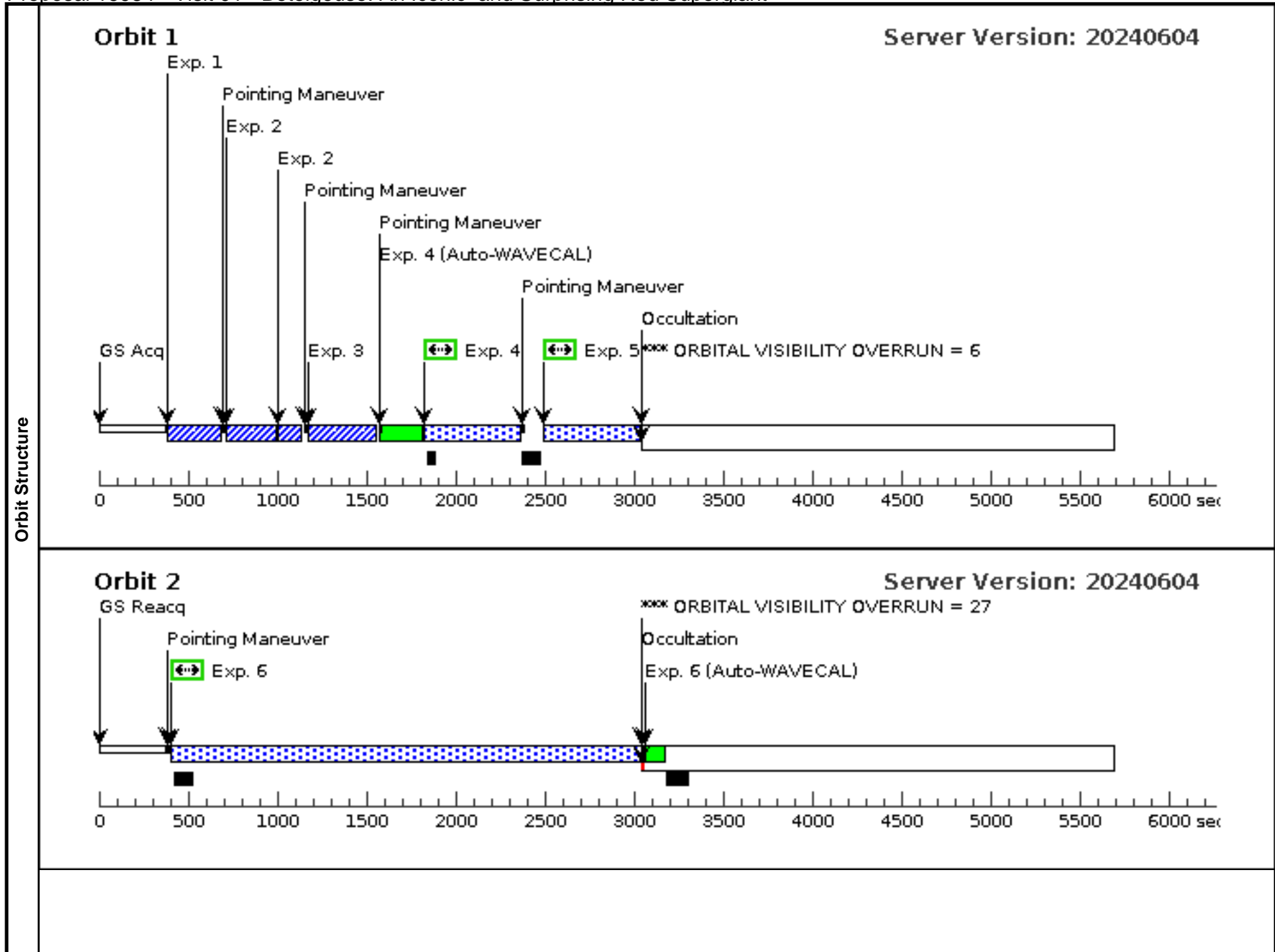
Exposure times at +/-50 mas: 600 sec

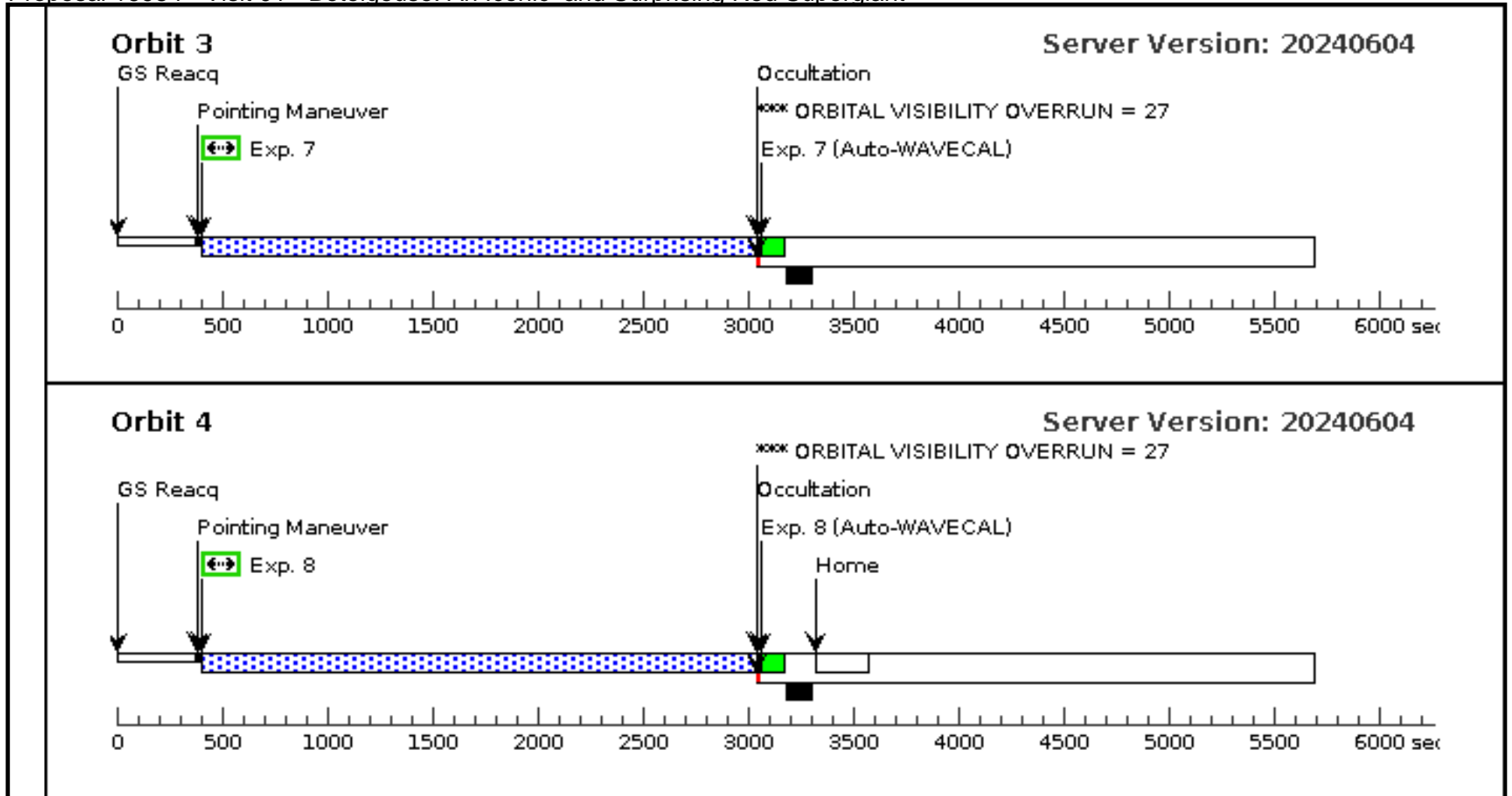
We plan a tomographic analysis of the absorption line spectra at center, +/-25 mas, so require S/N ~ 50 at those positions.

# Proposal 16984 - Visit 01 - Betelgeuse: An Iconic and Surprising Red Superqiant

Thu Jul 25 20:00:38 GMT 2024

Visit	<b>Proposal 16984, Visit 01, completed</b> <b>Diagnostic Status: Warning</b> Scientific Instruments: STIS/NUV-MAMA, STIS/CCD Special Requirements: SCHED 60%; AFTER 26-SEP-2022:00:00:00																																																																																																																																	
Diagnostics	(Visit 01) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN (Visit 01) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN (Visit 01) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN (Visit 01) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN (Visit 01) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE (Visit 01) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE (Visit 01) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE (Visit 01) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE (Visit 01) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE NO ORIENT (Visit 01) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE NO ORIENT (Visit 01) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE NO ORIENT (Visit 01) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE NO ORIENT																																																																																																																																	
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# Proposal 16984 - Visit 02 - Betelgeuse: An Iconic and Surprising Red Superqiant

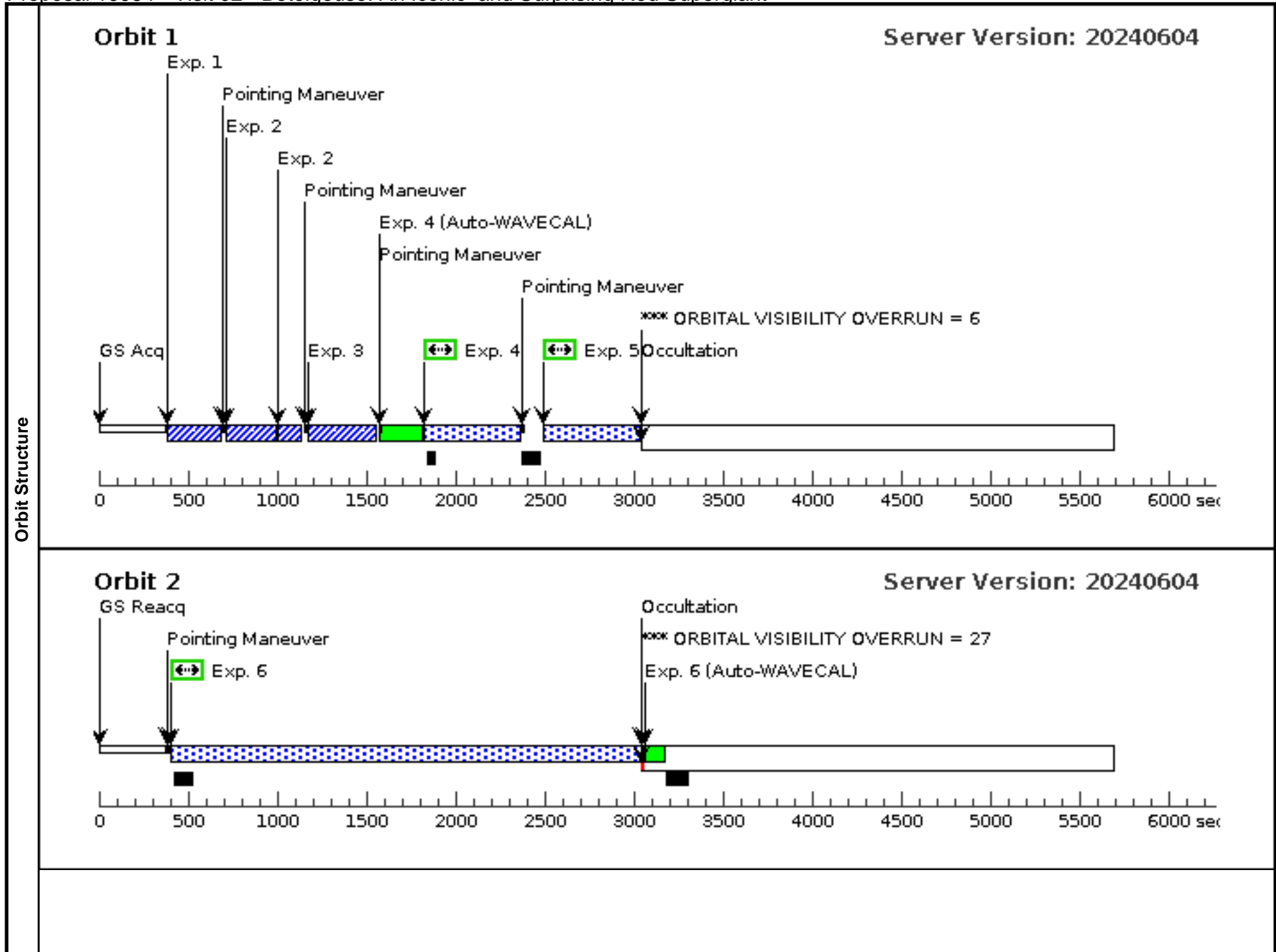
Thu Jul 25 20:00:38 GMT 2024

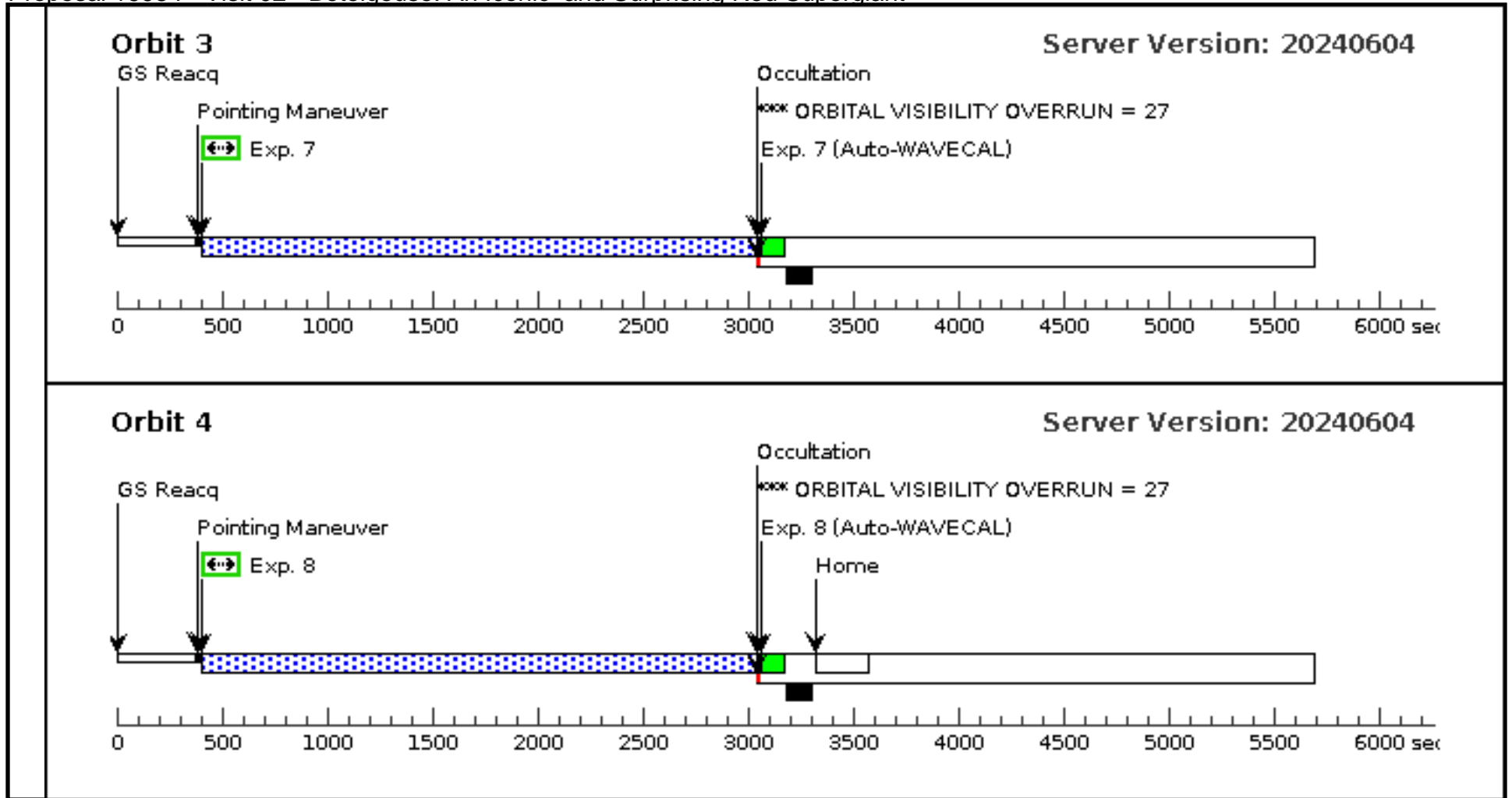
<b>Visit</b>	<b>Proposal 16984, Visit 02, completed</b>
	<b>Diagnostic Status: Warning</b>
	Scientific Instruments: STIS/NUV-MAMA, STIS/CCD
	Special Requirements: SCHED 60%; AFTER 01 BY 42 D TO 52 D

<b>Diagnostics</b>	(Visit 02) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN
	(Visit 02) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN
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#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HD39801	RA: 05 55 10.3341 (88.7930588d) Dec: +07 24 25.61 (7.40711d) Equinox: J2000	Proper Motion RA: 0.0018514500429161387 sec of time/yr Proper Motion Dec: 0.011300000000000001 arcsec/yr Epoch of Position: 2015.5	V=0.42+/-0.2	Reference Frame: ICRS
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. This object was generated by the targetselector and retrieved from the SIMBAD database. This object was generated by the targetselector and retrieved from the SIMBAD database.</i>					
Category=STAR					
Description=[M III-I]					

#	Label (ETC Run)	Target	Config, Mode, Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) HD39801	STIS/CCD, ACQ, F25ND5	MIRROR				1 Secs (1 Secs)	
								[==>]	[1]
2		(1) HD39801	STIS/CCD, ACQ/PEAK, 0.2X0.09	G230LB 2375 A				1 Secs (1 Secs)	
								[==>]	[1]
<i>Comments: 3 pt linear peakup; telescope returned to central dwell position.</i>									
3		(1) HD39801	STIS/CCD, ACQ/PEAK, 0.1X0.03	G230LB 2375 A				1 Secs (1 Secs)	
								[==>]	[1]
<i>Comments: Spiral in 0.1X0.03 aperature.</i>									
4	(1526014)	(1) HD39801	STIS/NUV-MAMA, ACCUM, 0.1X0.03	E230M 2707 A		POS TARG +0.050, null		567 Secs (524 Secs)	
								[==>524.0 Secs ]	[1]
5	(1526014)	(1) HD39801	STIS/NUV-MAMA, ACCUM, 0.1X0.03	E230M 2707 A		POS TARG -0.050, null		567 Secs (524 Secs)	
								[==>524.0 Secs ]	[1]
6	(1525642)	(1) HD39801	STIS/NUV-MAMA, ACCUM, 0.1X0.03	E230M 2707 A				2723 Secs (2637 Secs)	
								[==>2637.0 Secs ]	[2]
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7	(1525642)	(1) HD39801	STIS/NUV-MAMA, ACCUM, 0.1X0.03	E230M 2707 A		POS TARG +0.025, null		2723 Secs (2637 Secs)	
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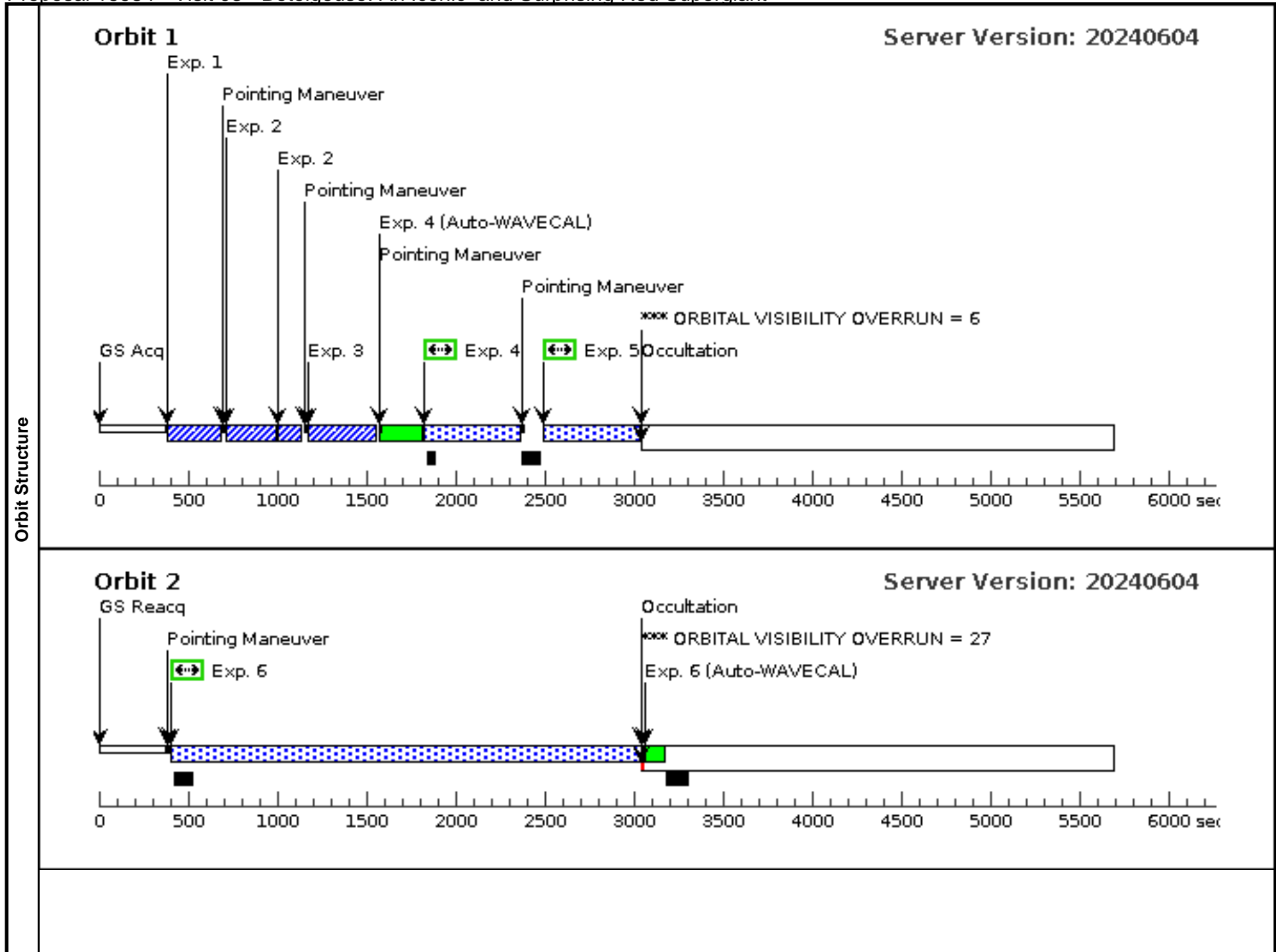


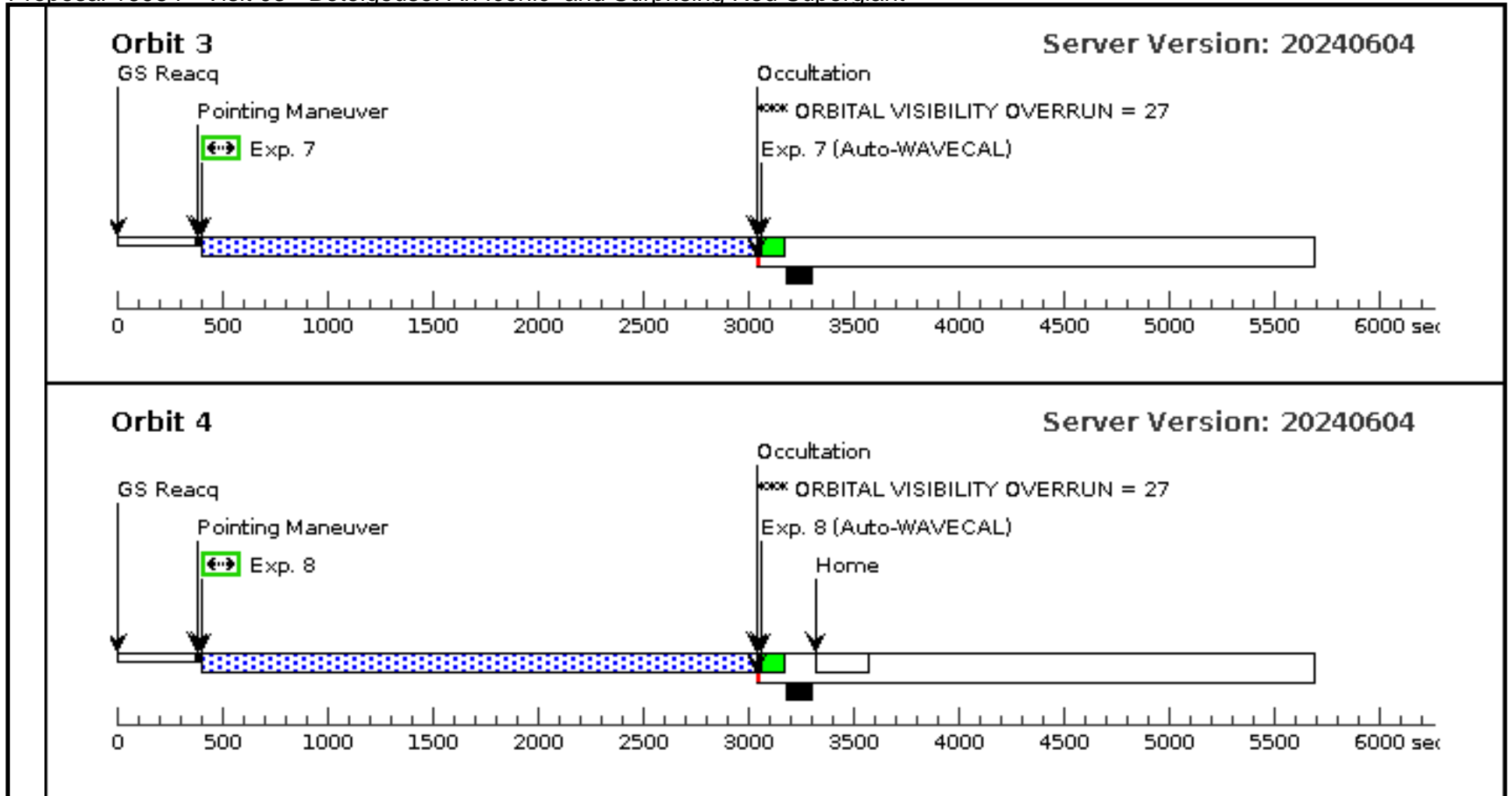


Proposal 16984 - Visit 03 - Betelgeuse: An Iconic and Surprising Red Superqiant

Thu Jul 25 20:00:39 GMT 2024

<b>Visit</b>	<b>Proposal 16984, Visit 03, completed</b> <b>Diagnostic Status: Warning</b> Scientific Instruments: STIS/NUV-MAMA, STIS/CCD Special Requirements: SCHED 60%: BEFORE 26-FEB-2024:00:00:00																																																																																																																																	
	(Visit 03) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN (Visit 03) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN (Visit 03) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN (Visit 03) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN (Visit 03) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE (Visit 03) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE (Visit 03) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE (Visit 03) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE (Visit 03) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE NO ORIENT (Visit 03) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE NO ORIENT (Visit 03) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE NO ORIENT (Visit 03) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE NO ORIENT																																																																																																																																	
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# Proposal 16984 - Visit 04 - Betelgeuse: An Iconic and Surprising Red Superqiant

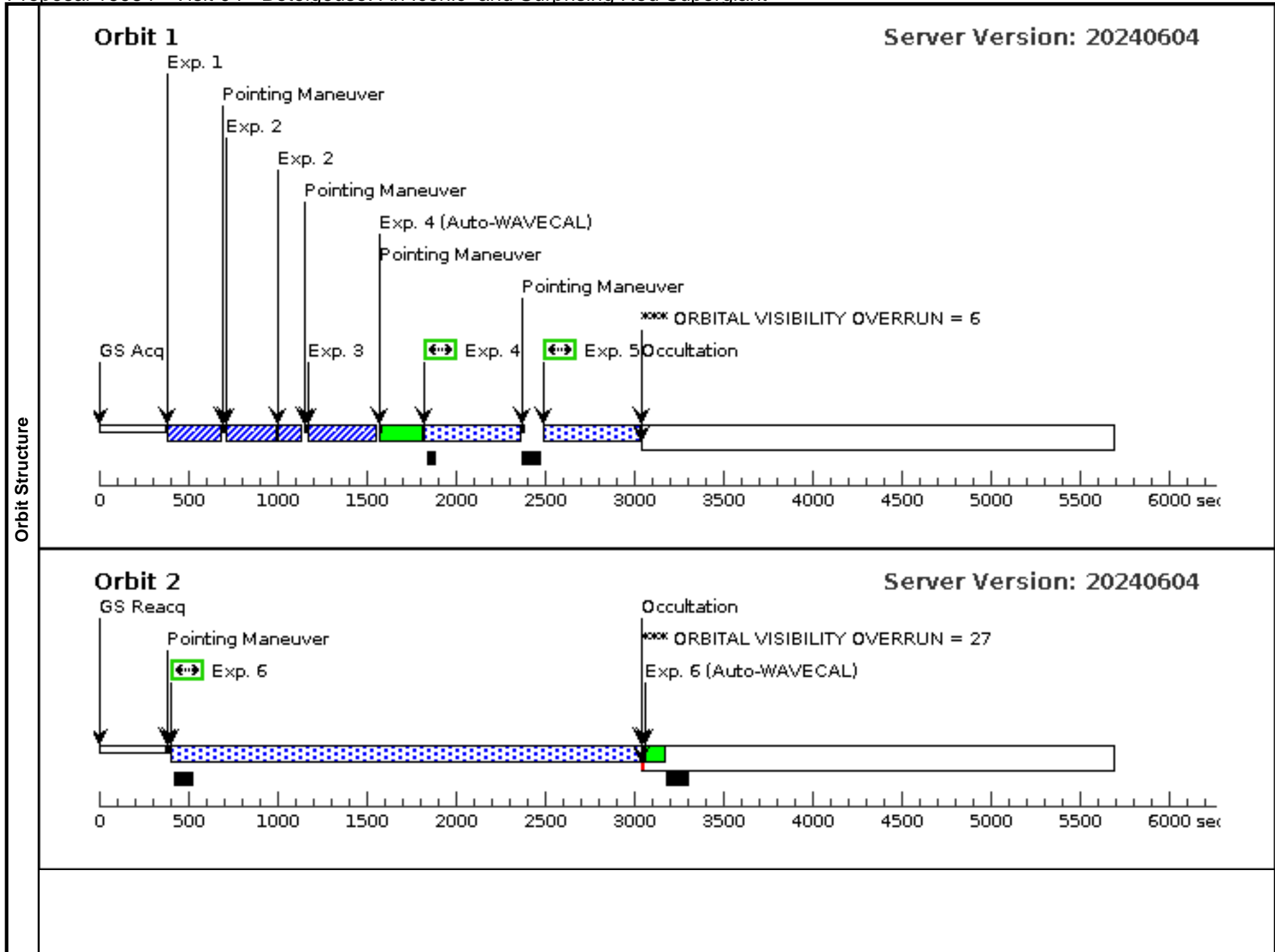
Thu Jul 25 20:00:39 GMT 2024

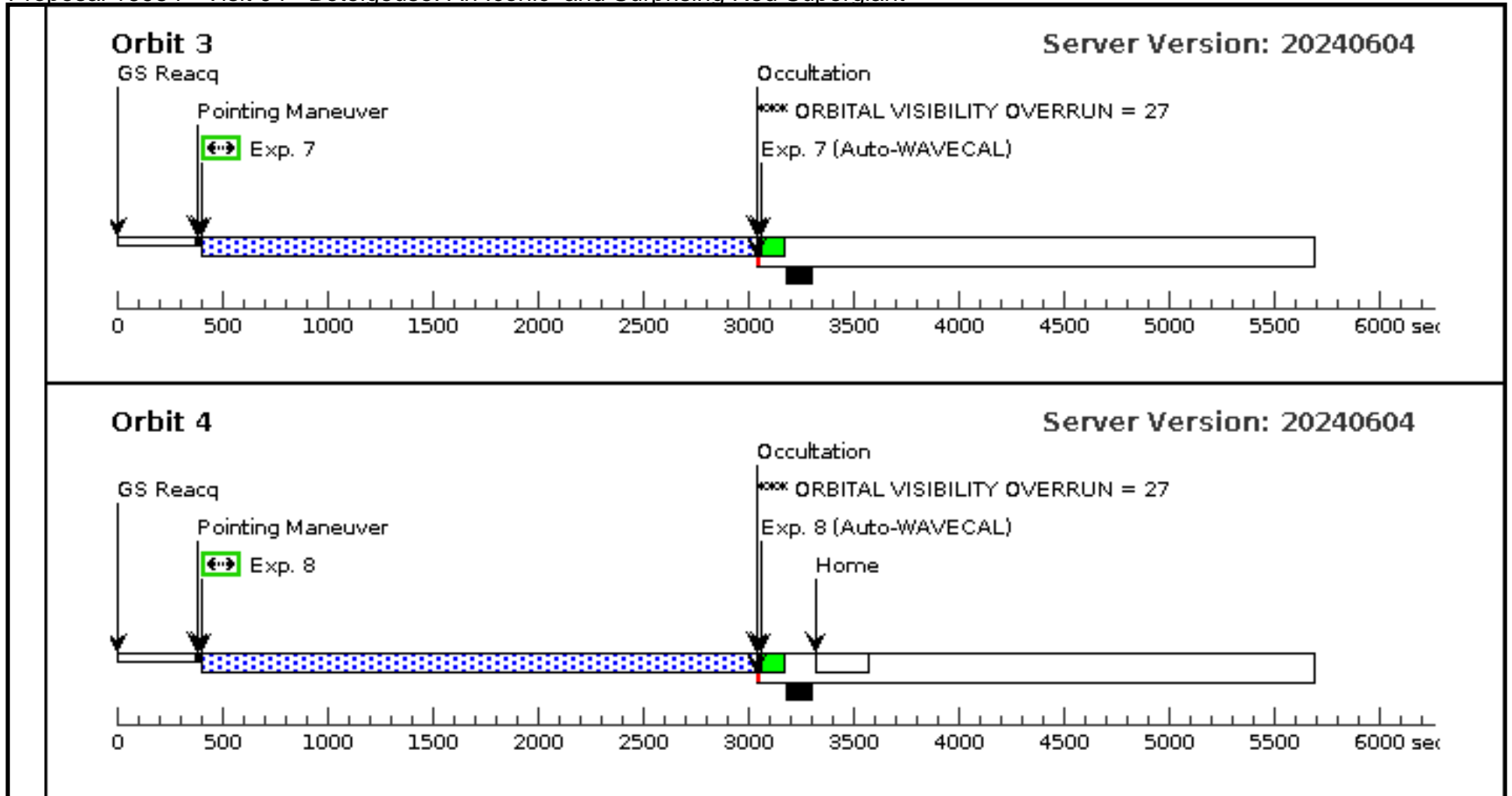
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	Scientific Instruments: STIS/NUV-MAMA, STIS/CCD
	Special Requirements: SCHED 60%; AFTER 03 BY 31 D TO 41 D

<b>Diagnostics</b>	(Visit 04) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN
	(Visit 04) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN
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#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HD39801	RA: 05 55 10.3341 (88.7930588d) Dec: +07 24 25.61 (7.40711d) Equinox: J2000	Proper Motion RA: 0.0018514500429161387 sec of time/yr Proper Motion Dec: 0.011300000000000001 arcsec/yr Epoch of Position: 2015.5	V=0.42+/-0.2	Reference Frame: ICRS
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. This object was generated by the targetselector and retrieved from the SIMBAD database. This object was generated by the targetselector and retrieved from the SIMBAD database. This object was generated by the targetselector and retrieved from the SIMBAD database.</i>					
Category=STAR					
Description=[M III-I]					

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) HD39801	STIS/CCD, ACQ, F25ND5	MIRROR				1 Secs (1 Secs)	
								[==>]	[1]
2		(1) HD39801	STIS/CCD, ACQ/PEAK, 0.2X0.09	G230LB 2375 A				1 Secs (1 Secs)	
								[==>]	[1]
<i>Comments: 3 pt linear peakup; telescope returned to central dwell position.</i>									
3		(1) HD39801	STIS/CCD, ACQ/PEAK, 0.1X0.03	G230LB 2375 A				1 Secs (1 Secs)	
								[==>]	[1]
<i>Comments: Spiral in 0.1X0.03 aperature.</i>									
4	(1526014)	(1) HD39801	STIS/NUV-MAMA, ACCUM, 0.1X0.03	E230M 2707 A		POS TARG +0.050, null		567 Secs (524 Secs)	
								[==>524.0 Secs ]	[1]
5	(1526014)	(1) HD39801	STIS/NUV-MAMA, ACCUM, 0.1X0.03	E230M 2707 A		POS TARG -0.050,n ull		567 Secs (524 Secs)	
								[==>524.0 Secs ]	[1]
6	(1525642)	(1) HD39801	STIS/NUV-MAMA, ACCUM, 0.1X0.03	E230M 2707 A				2723 Secs (2637 Secs)	
								[==>2637.0 Secs ]	[2]
<i>Comments: Center point</i>									
7	(1525642)	(1) HD39801	STIS/NUV-MAMA, ACCUM, 0.1X0.03	E230M 2707 A		POS TARG +0.025, null		2723 Secs (2637 Secs)	
								[==>2637.0 Secs ]	[3]
8	(1525642)	(1) HD39801	STIS/NUV-MAMA, ACCUM, 0.1X0.03	E230M 2707 A		POS TARG -0.025,n ull		2723 Secs (2637 Secs)	
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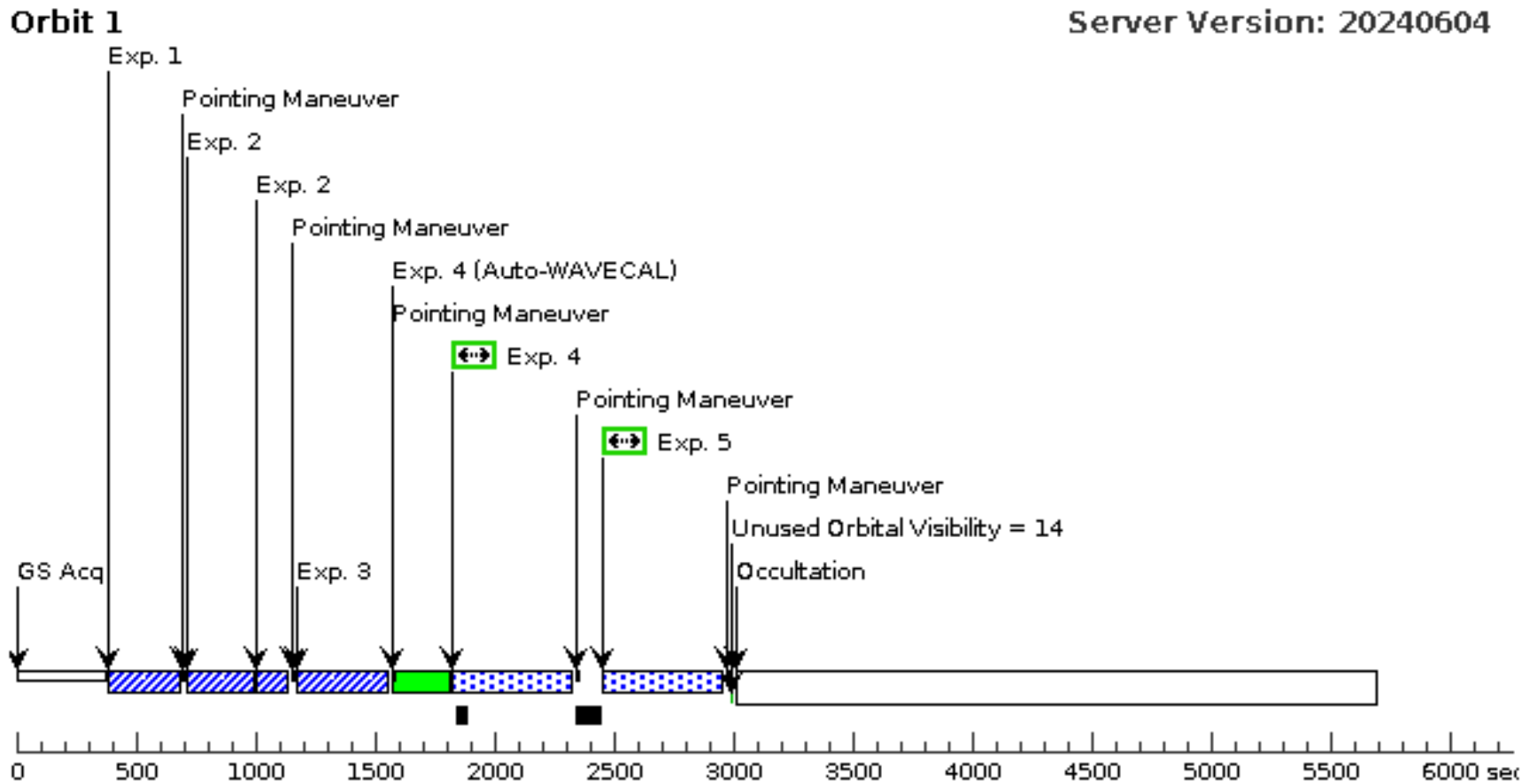


# Proposal 16984 - Visit 05 - Betelgeuse: An Iconic and Surprising Red Superqiant

Thu Jul 25 20:00:39 GMT 2024

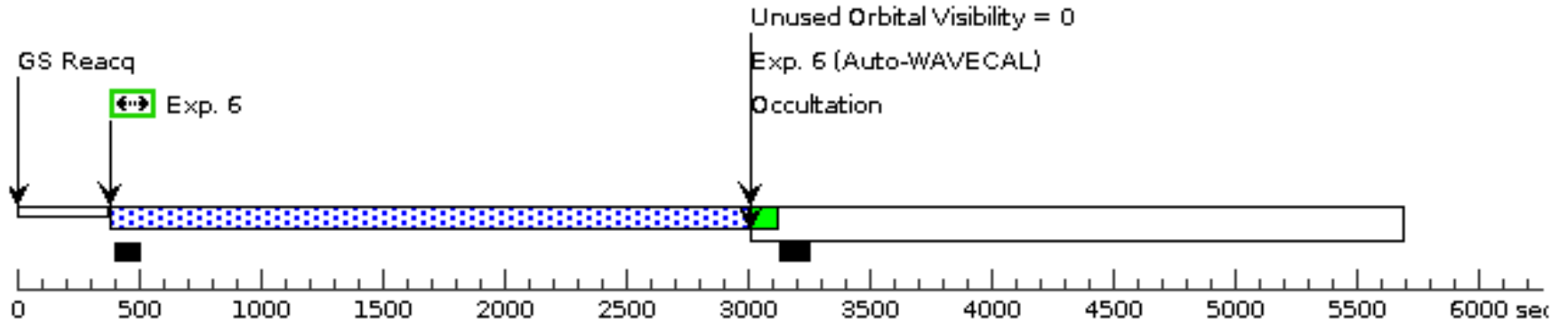
Visit	<b>Proposal 16984, Visit 05, implementation</b> <b>Diagnostic Status: Warning</b> Scientific Instruments: STIS/NUV-MAMA, STIS/CCD Special Requirements: BETWEEN 27-SEP-2024:00:00:00 AND 01-OCT-2024:00:00:00																																																																																																																																	
Diagnostics	(Visit 05) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE (Visit 05) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE (Visit 05) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE (Visit 05) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE (Visit 05) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE NO ORIENT (Visit 05) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE NO ORIENT (Visit 05) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE NO ORIENT (Visit 05) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE NO ORIENT																																																																																																																																	
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8	(1525642)	(1) HD39801	STIS/NUV-MAMA, ACCUM, 0.1X0.03	E230M 2707 A		POS TARG -0.025, null		2723 Secs (2580 Secs) [==>2580.0 Secs ]	[4]																																																																																																																									

Orbit Structure



### Orbit 2

Server Version: 20240604



### Orbit 3

Server Version: 20240604

