14738 - A Far Ultraviolet Study of Globular Clusters in NGC 3115

Cycle: 24, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Dr. Arunav Kundu (PI) (Contact)	**Eureka Scientific Inc.**	**akundu@eurekasci.com**
Dr. Sangmo Tony Sohn (CoI)	Space Telescope Science Institute	tsohn@stsci.edu
Dr. Mark B. Peacock (CoI)	Michigan State University	mpeacock@msu.edu
Dr. Hyunjin Jeong (CoI)	Korea Astronomy and Space Science Institute (KASI)	hyunjin@kasi.re.kr
Prof. Stephen E. Zepf (CoI)	Michigan State University	zepf@pa.msu.edu

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) NGC-3115-POS1	ACS/SBC	4	29-Jul-2016 15:09:21.0	yes
02	(2) NGC-3115-POS2	ACS/SBC	4	29-Jul-2016 15:09:24.0	yes
03	(3) NGC-3115-POS3	ACS/SBC	4	29-Jul-2016 15:09:26.0	yes
04	(4) NGC-3115-POS4	ACS/SBC	4	29-Jul-2016 15:09:27.0	yes

16 Total Orbits Used

ABSTRACT

The far-ultraviolet (FUV) emission from old stellar systems shows a puzzlingly large factor of 100 variation in the ultraviolet-to-optical flux ratios. This effect is attributed to poorly understood differences between the underlying populations of extreme horizontal branch stars. Globular clusters, which are isolated systems with small internal dispersions in age and iron abundance, offer a promising avenue for understanding the FUV emission

in old stellar populations. A far ultraviolet HST study of the giant elliptical galaxy M87 has revealed an extraordinarily UV-bright globular cluster population that is significantly offset from all other globular cluster systems studied to date. We propose an ACS/SBC far-ultraviolet imaging study of the globular clusters in the nearby field S0 galaxy NGC 3115. These observations will fill the gap between the sparse far-ultraviolet studies of globular clusters in mostly local group spirals and M87. It will allow us to test several competing models that link the FUV emission in old stellar populations to Helium enrichment, galaxy environment, binary processes, or metallicity effects and enable us to place the unusually FUV luminous GCs of M87 in context. A better physical understanding of this far-ultraviolet feature in old stellar populations would be an invaluable tool for understanding the evolution of both nearby stellar systems and distant galaxies.

OBSERVING DESCRIPTION

The observational goal of this project is measure the far ultraviolet emission from globular clusters (GCs) in NGC 3115. This will be combined with archival ACS and WFPC2 optical studies of these GCs to measure the far UV excess and investigate the reasons behind the FUV upturn.

In order to study the Teff ~20,000 K stars of interest we need to select as blue a FUV bandpass as possible without including geocoronal lines and dayglow. The F140LP filter provides an efficient and effective compromise. Our target GCs are primarily very red objects that may host a modest hot FUV component so they do not pose any safety risks to the ACS/SBC detector. A more significant problem is the red leak which plagues UV filters, and is particularly problematic for the study of inherently red sources like old globular clusters. On-orbit HST calibration studies have discovered that the ACS-MAMA has a significantly larger red leak than expected from ground-based measurements, especially for solar type or later stars. Thus, following the strong recommendation in the ACS Handbook to take interleaving observations with two different SBC long pass filters we image the targets in a second long pass band, F165LP, in order to isolate the true FUV flux by using the difference between the two filters. We target each of the 4 target locations for 4 orbits. The observations in each filter are dithered in order to eliminate bad pixels by stacking. Orbits will be split into 4x650s in F140LP observations followed by 4xF165LP observations using the Default ACS-SBC-DITHER_BOX patern. This will obtain the total exposure required, while switching between the filters will allow for robust red-leak correction, even if it has temporal or orbital variations.

We have aranged our 4 SBC fields to optimize the number of candidate GCs in the FOV, based on locations determined from archival ACS optical observations. The Gaussian globular cluster luminosity function peaks at M_g=22.5 mag. We calculate that if these GCs have a strong UV upturn similar to that seen in some elliptical galaxies then all the GCs up to the peak can be detected with a S/N ~50 in 2 orbits. Even without a strong UV upturn the GCs at the peak of the GCLF should be detected with a S/N~10. Depending on the strength of the UV upturn we expect to detect 20-40 GCs in the FUV.

Assuming that they have a strong upturn even our brightest M_g ~ 19.5 mag targets give a count rate of 1.24 counts/s for the brightest pixel according to the ACS-SBC exposure time calculator (ACS.im.828315)). This is easily below the safety limits of the detector. The BOT has been run and does not identify any other dangerously bright sources in either the GSC or GALEX checks.

Visit

Proposal 14738, Visit 01 Fri Jul 29 19:09:28 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/SBC

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-SBC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.179 Line Spacing=0.116	Coordinate Frame=POS-TARG Pattern Orientation=20.02 Angle Between Sides=63.65 Center Pattern=false		(1), (2), (3), (4)

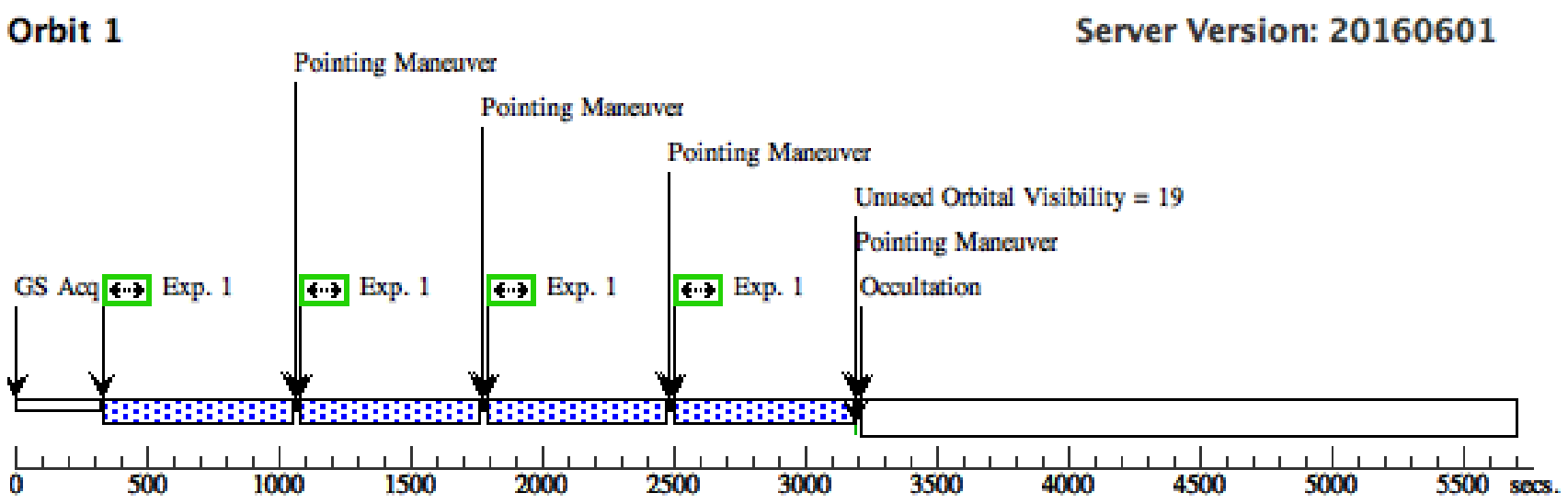
Fixed Targets

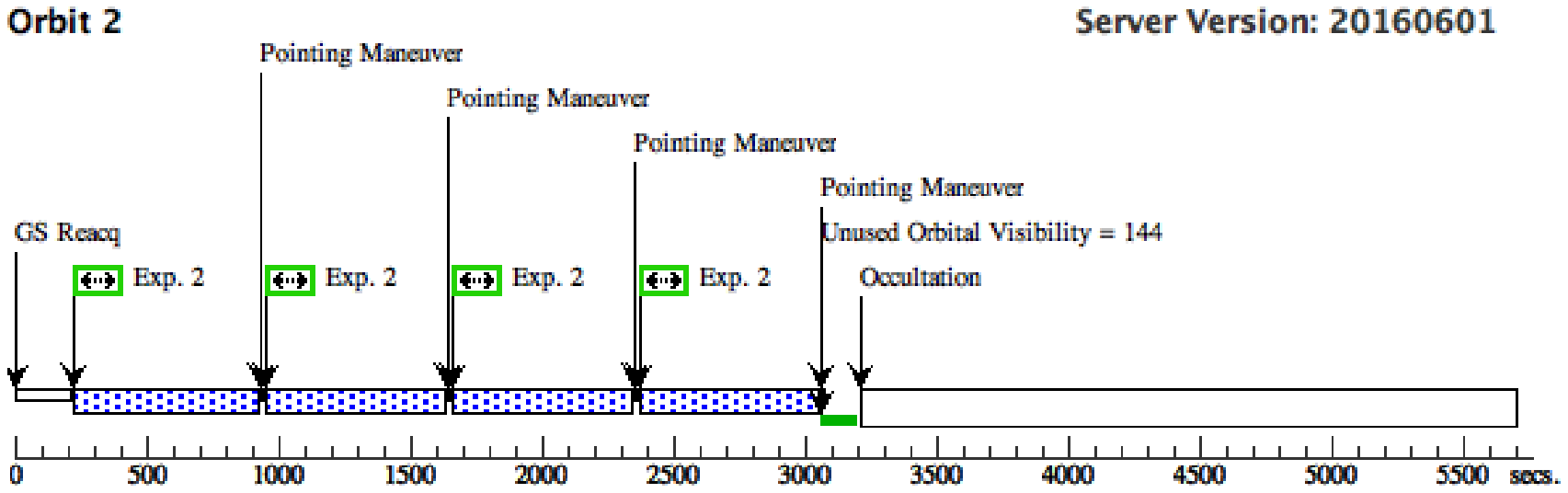
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	NGC-3115-POS1	RA: 10 05 19.5972 (151.3316550d) Dec: -07 41 48.38 (-7.69677d) Equinox: J2000		V=21	Reference Frame: SIMBAD

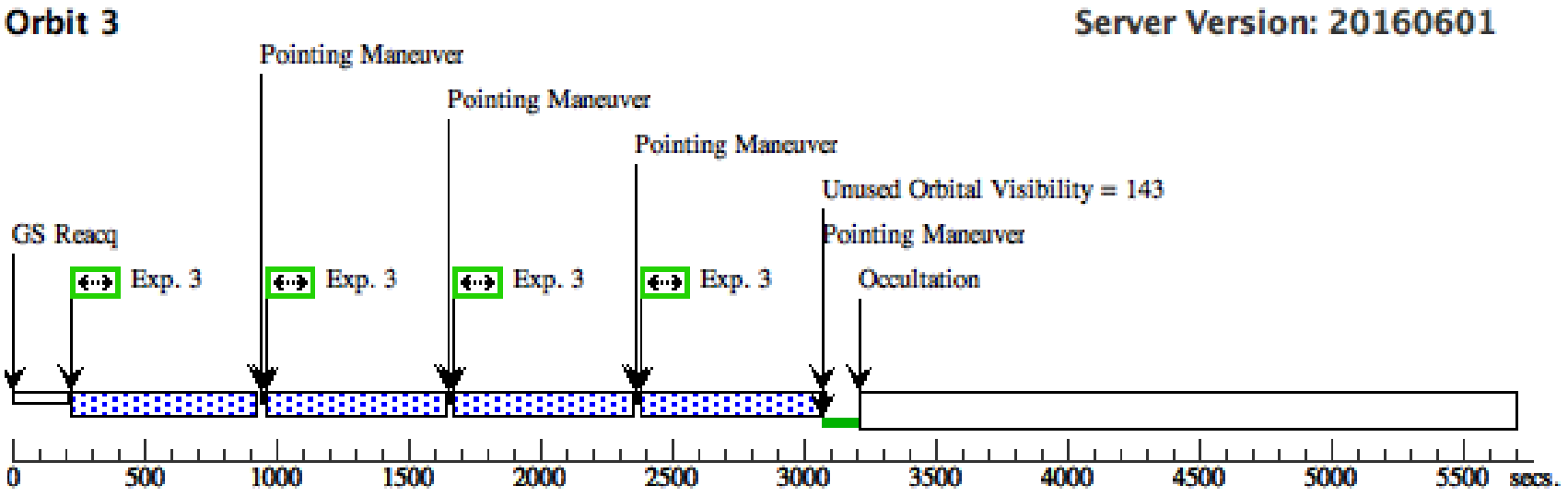
Exposures

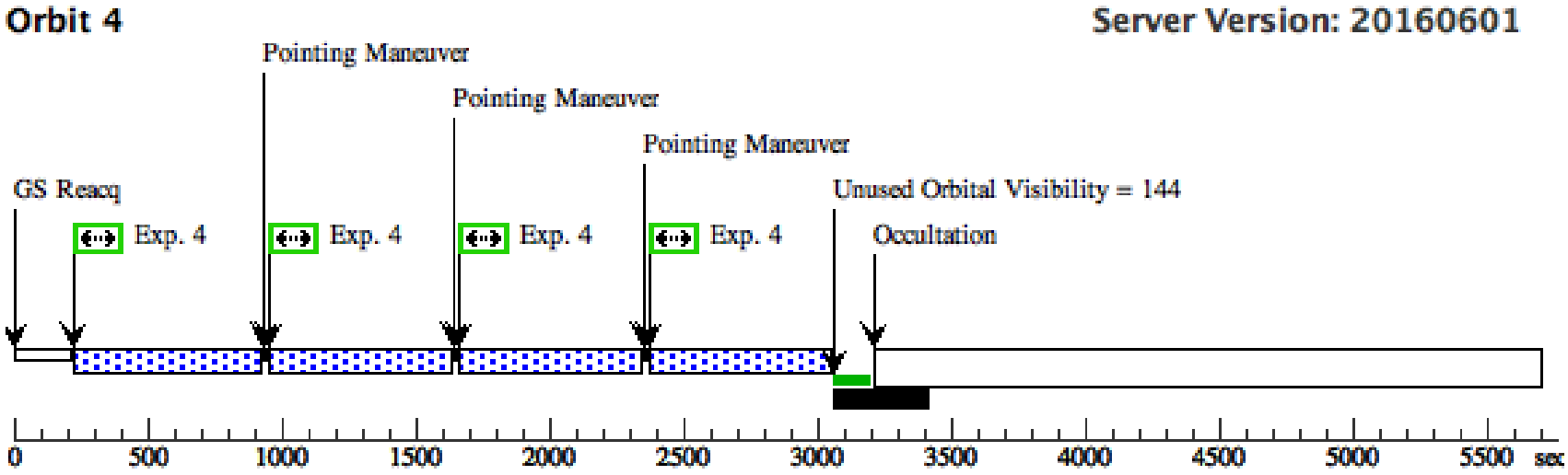
#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(ACS.im.827246)	(1) NGC-3115-POS1	ACS/SBC, ACCUM, SBC-FIX	F140LP			Pattern 1, Exps 1-1 in Visit 01 (1)	650 Secs (2600 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2	(ACS.im.827252)	(1) NGC-3115-POS1	ACS/SBC, ACCUM, SBC-FIX	F165LP			Pattern 1, Exps 2-2 in Visit 01 (1)	650 Secs (2600 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***
3	(ACS.im.827246)	(1) NGC-3115-POS1	ACS/SBC, ACCUM, SBC-FIX	F140LP			Pattern 1, Exps 3-3 in Visit 01 (1)	650 Secs (2600 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[3]***
4	(ACS.im.827252)	(1) NGC-3115-POS1	ACS/SBC, ACCUM, SBC-FIX	F165LP			Pattern 1, Exps 4-4 in Visit 01 (1)	650 Secs (2600 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[4]***

Orbit Structure






Orbit 3
Server Version: 20160601
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Unused Orbital Visibility = 143
Pointing Maneuver
GS Reacq
Exp. 3
Exp. 3
Exp. 3
Exp. 3
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.


Orbit 4
Server Version: 20160601
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Unused Orbital Visibility = 144
GS Reacq
Exp. 4
Exp. 4
Exp. 4
Exp. 4
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 14738, Visit 02 Fri Jul 29 19:09:29 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/SBC

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-SBC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.179 Line Spacing=0.116	Coordinate Frame=POS-TARG Pattern Orientation=20.02 Angle Between Sides=63.65 Center Pattern=false		(1), (2), (3), (4)

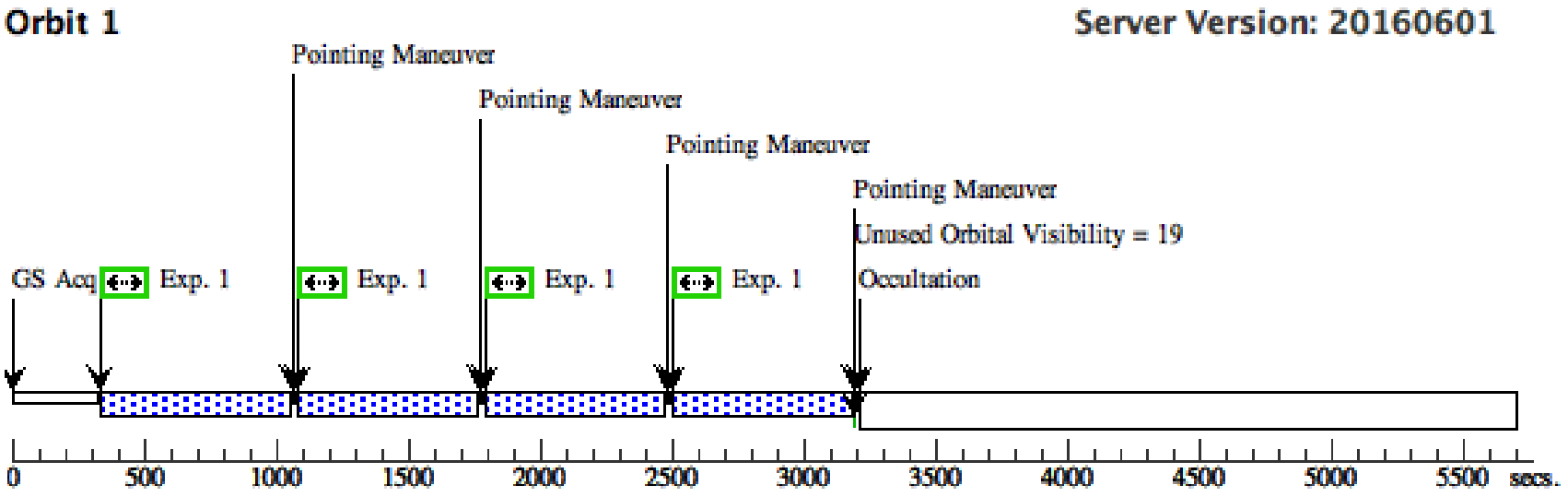
Fixed Targets

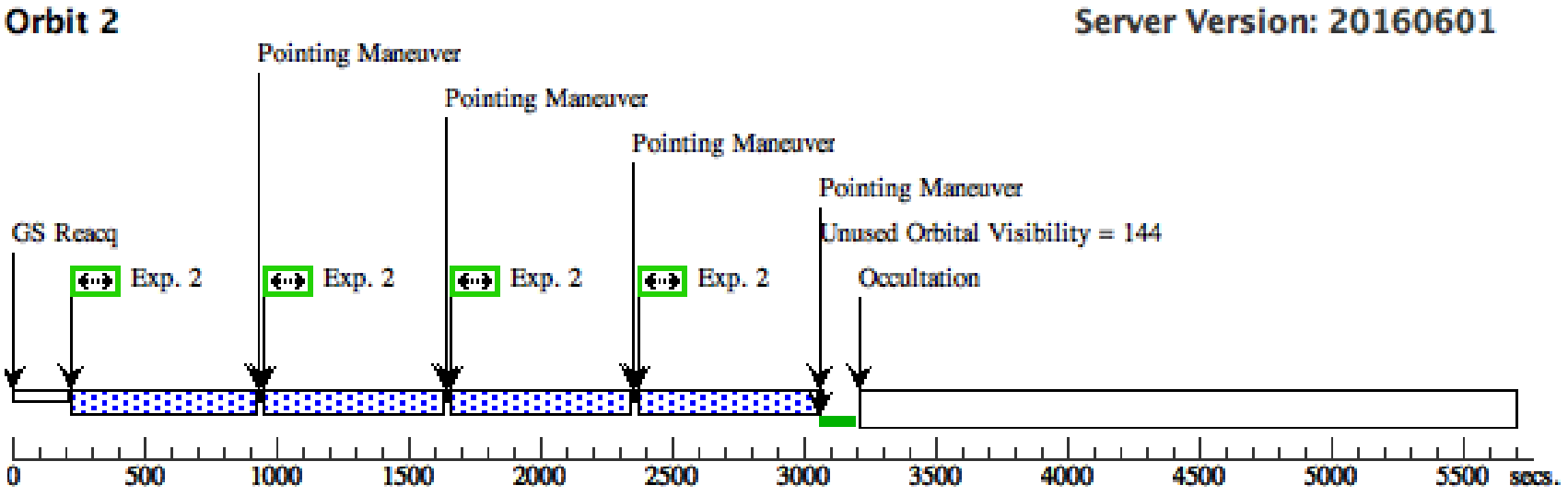
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	NGC-3115-POS2	RA: 10 05 16.5296 (151.3188733d) Dec: -07 42 12.98 (-7.70361d) Equinox: J2000		V=21	Reference Frame: SIMBAD

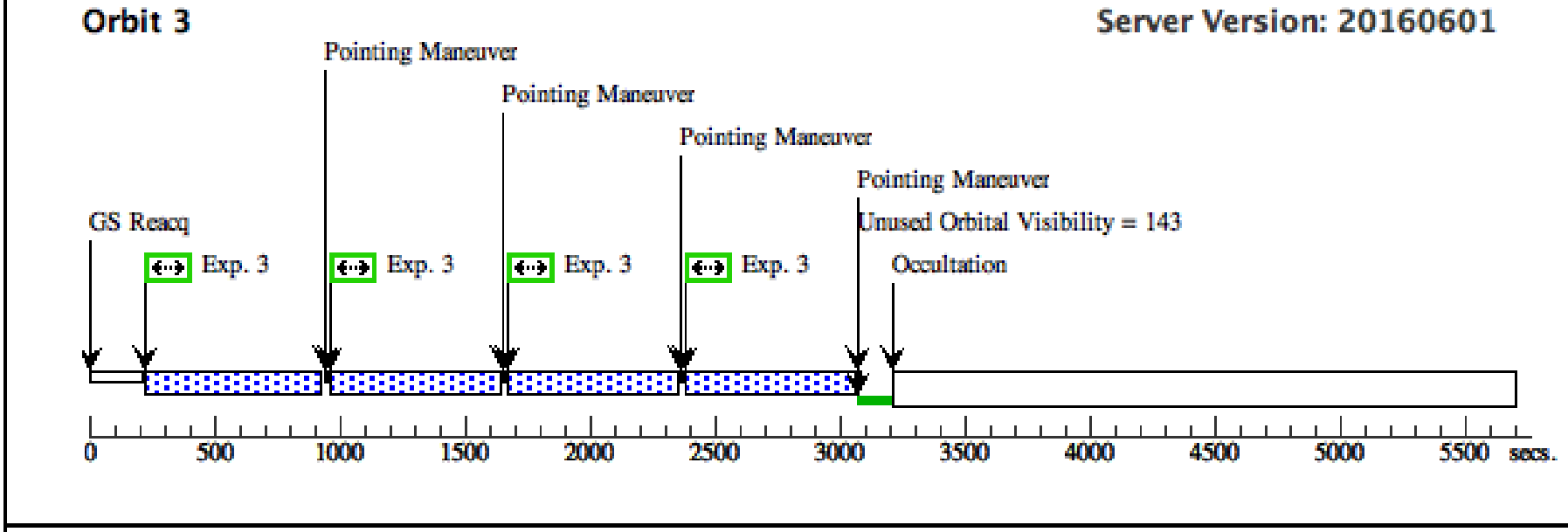
Exposures

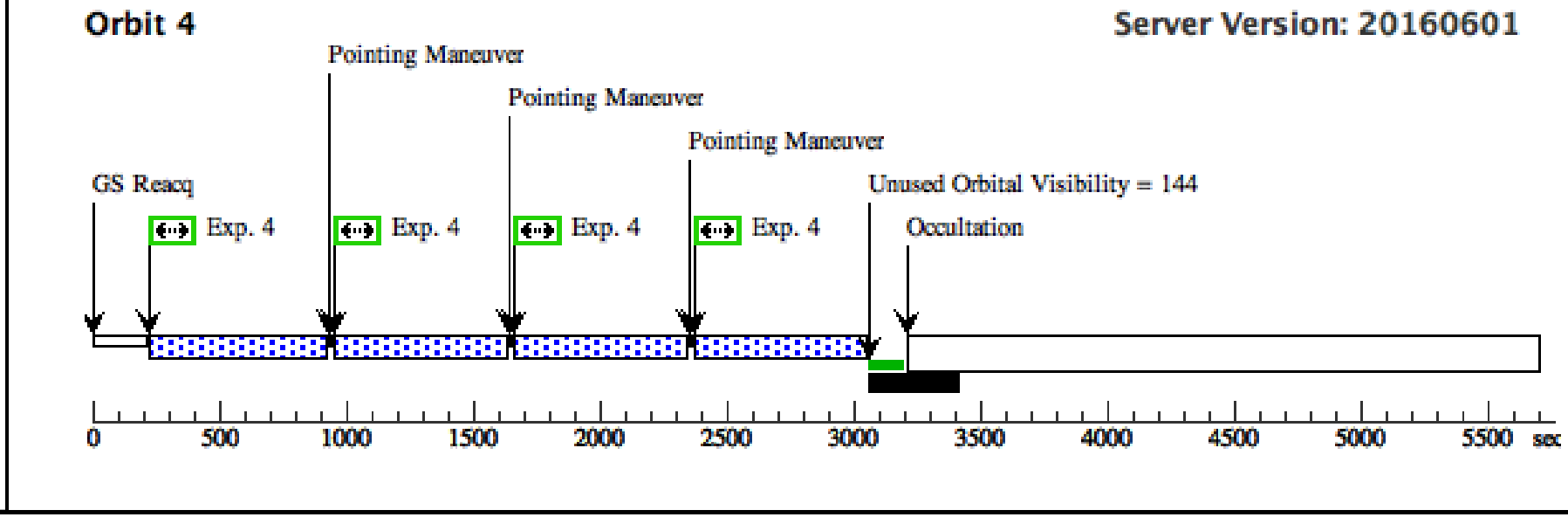
#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(ACS.im.827246)	(2) NGC-3115-POS2	ACS/SBC, ACCUM, SBC-FIX	F140LP			Pattern 1, Exps 1-1 in Visit 02 (1)	650 Secs (2600 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2	(ACS.im.827252)	(2) NGC-3115-POS2	ACS/SBC, ACCUM, SBC-FIX	F165LP			Pattern 1, Exps 2-2 in Visit 02 (1)	650 Secs (2600 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***
3	(ACS.im.827246)	(2) NGC-3115-POS2	ACS/SBC, ACCUM, SBC-FIX	F140LP			Pattern 1, Exps 3-3 in Visit 02 (1)	650 Secs (2600 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[3]***
4	(ACS.im.827252)	(2) NGC-3115-POS2	ACS/SBC, ACCUM, SBC-FIX	F165LP			Pattern 1, Exps 4-4 in Visit 02 (1)	650 Secs (2600 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[4]***

Orbit Structure






Orbit 3
Server Version: 20160601
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
GS Reacq
Exp. 3
Exp. 3
Exp. 3
Exp. 3
Unused Orbital Visibility = 143
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.


Orbit 4
Server Version: 20160601
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
GS Reacq
Exp. 4
Exp. 4
Exp. 4
Exp. 4
Unused Orbital Visibility = 144
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 14738, Visit 03 Fri Jul 29 19:09:29 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/SBC

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-SBC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.179 Line Spacing=0.116	Coordinate Frame=POS-TARG Pattern Orientation=20.02 Angle Between Sides=63.65 Center Pattern=false		(1), (2), (3), (4)

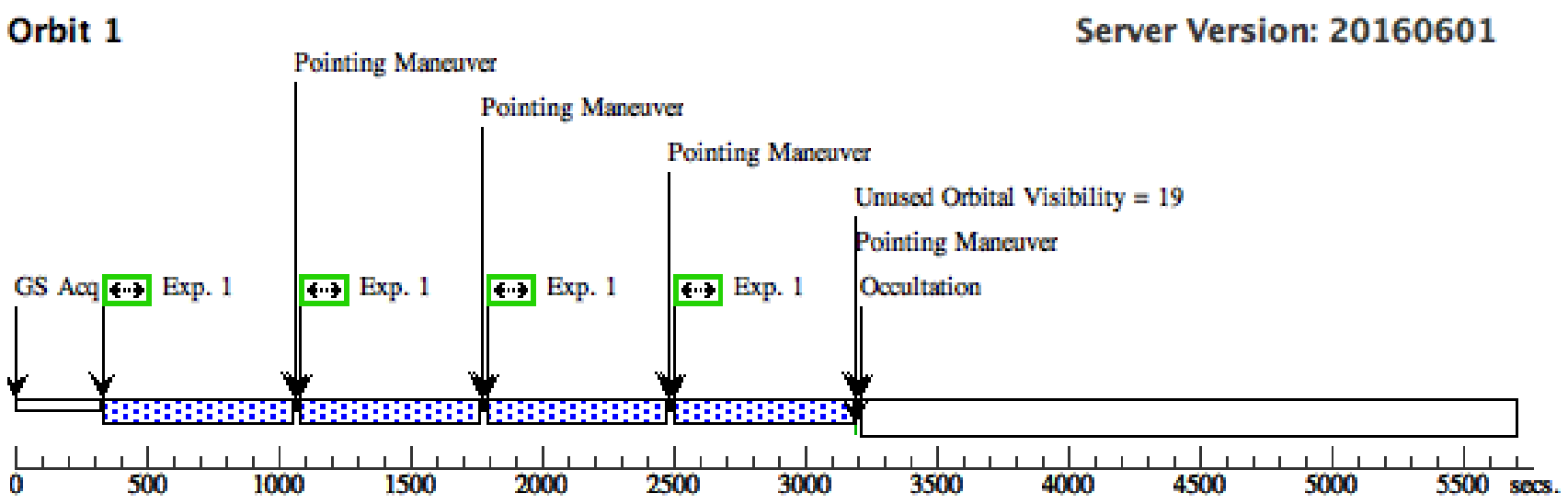
Fixed Targets

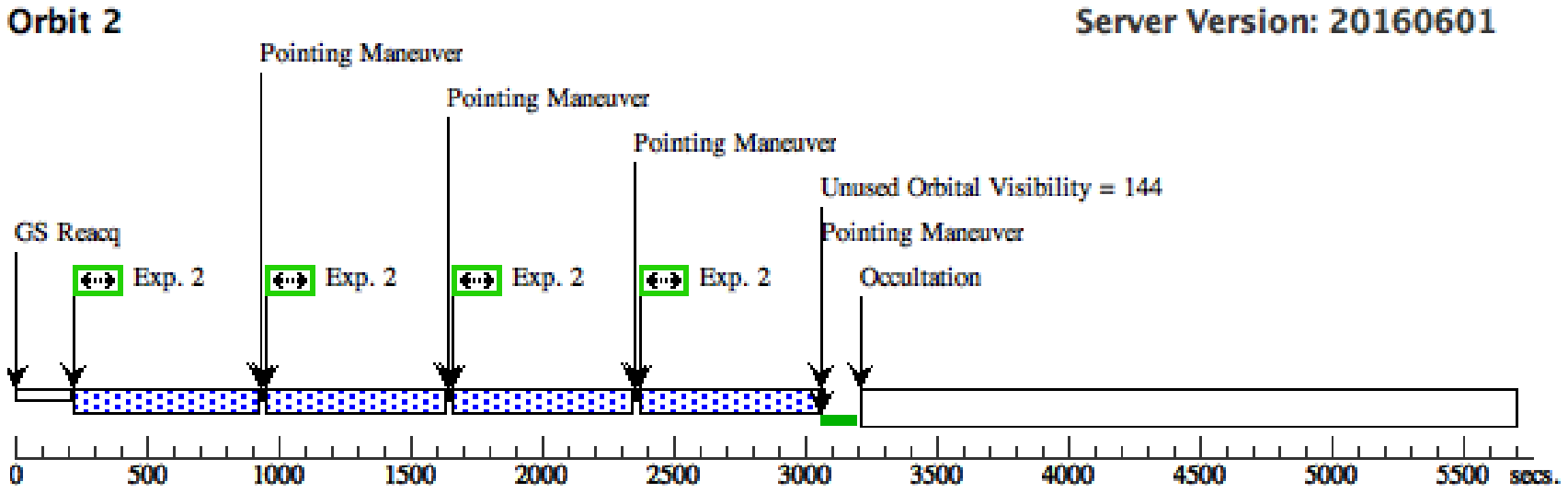
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	NGC-3115-POS3	RA: 10 05 16.2067 (151.3175279d) Dec: -07 43 0.28 (-7.71674d) Equinox: J2000		V=21	Reference Frame: SIMBAD

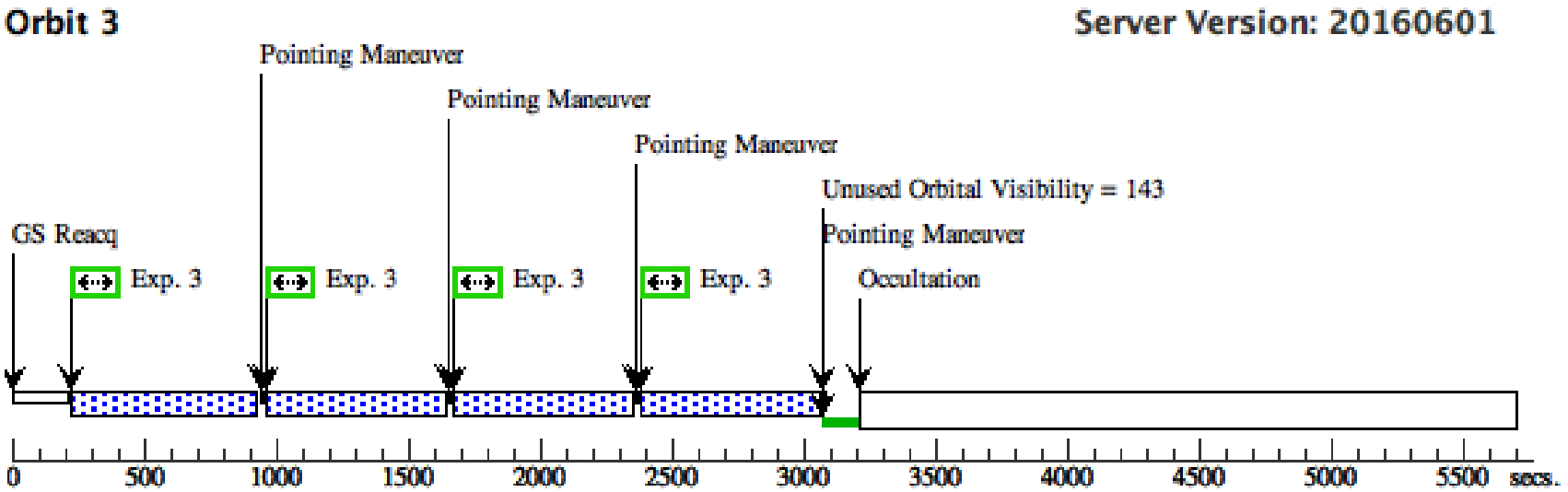
Exposures

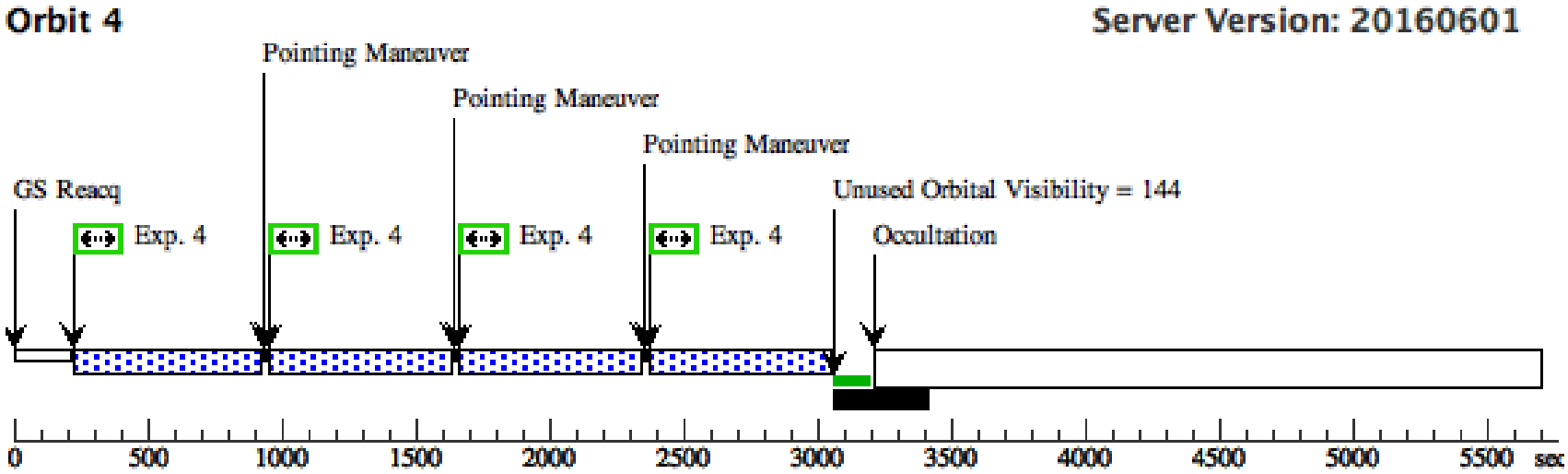
#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(ACS.im.827246)	(3) NGC-3115-POS3	ACS/SBC, ACCUM, SBC-FIX	F140LP			Pattern 1, Exps 1-1 in Visit 03 (1)	650 Secs (2600 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2	(ACS.im.827252)	(3) NGC-3115-POS3	ACS/SBC, ACCUM, SBC-FIX	F165LP			Pattern 1, Exps 2-2 in Visit 03 (1)	650 Secs (2600 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***
3	(ACS.im.827246)	(3) NGC-3115-POS3	ACS/SBC, ACCUM, SBC-FIX	F140LP			Pattern 1, Exps 3-3 in Visit 03 (1)	650 Secs (2600 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[3]***
4	(ACS.im.827252)	(3) NGC-3115-POS3	ACS/SBC, ACCUM, SBC-FIX	F165LP			Pattern 1, Exps 4-4 in Visit 03 (1)	650 Secs (2600 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[4]***

Orbit Structure






Orbit 3
Server Version: 20160601
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Unused Orbital Visibility = 143
Pointing Maneuver
GS Reacq
Exp. 3
Exp. 3
Exp. 3
Exp. 3
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.


Orbit 4
Server Version: 20160601
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Unused Orbital Visibility = 144
GS Reacq
Exp. 4
Exp. 4
Exp. 4
Exp. 4
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 14738, Visit 04 Fri Jul 29 19:09:29 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/SBC

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-SBC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.179 Line Spacing=0.116	Coordinate Frame=POS-TARG Pattern Orientation=20.02 Angle Between Sides=63.65 Center Pattern=false		(1), (2), (3), (4)

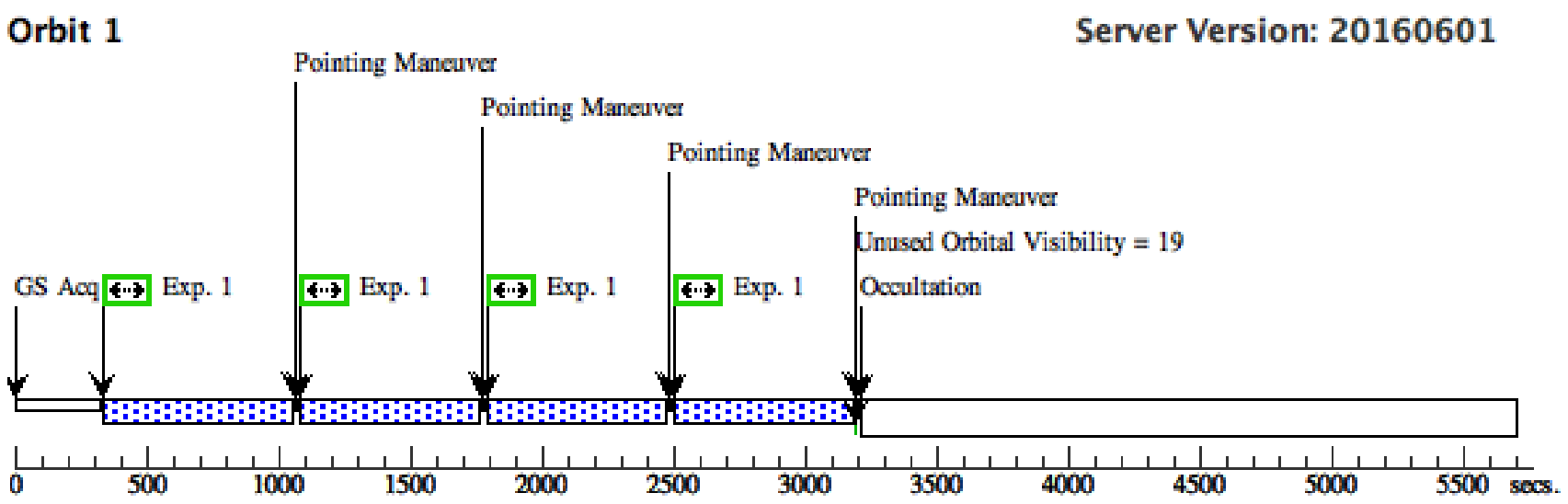
Fixed Targets

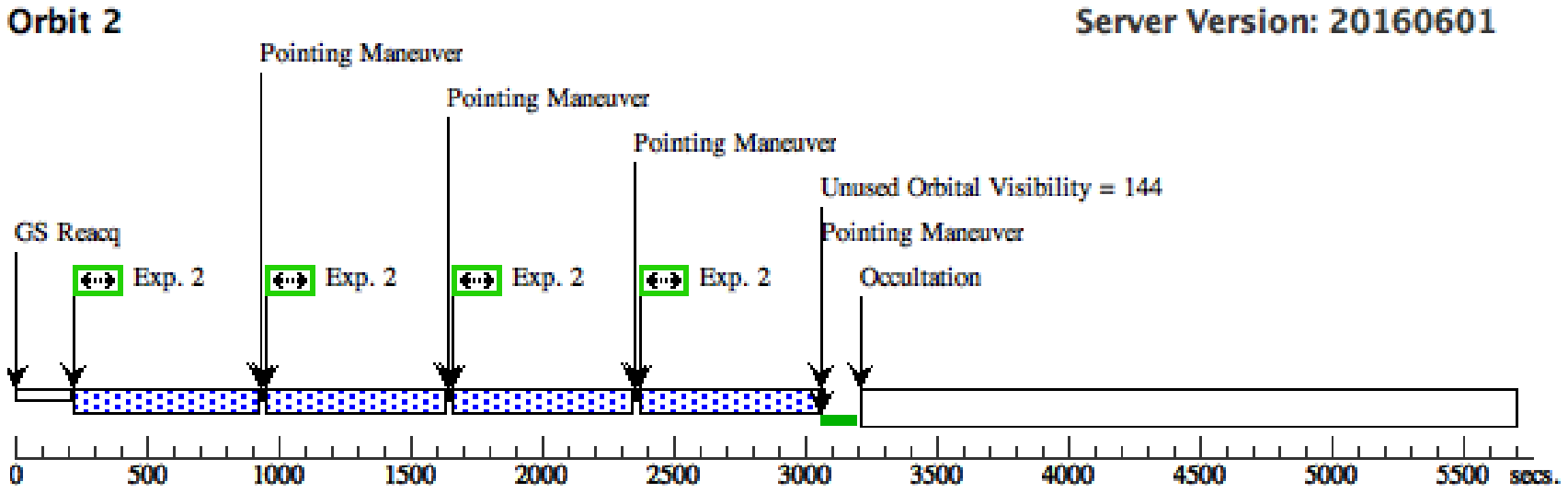
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	NGC-3115-POS4	RA: 10 05 12.8831 (151.3036796d) Dec: -07 44 0.78 (-7.73355d) Equinox: J2000		V=21	Reference Frame: SIMBAD

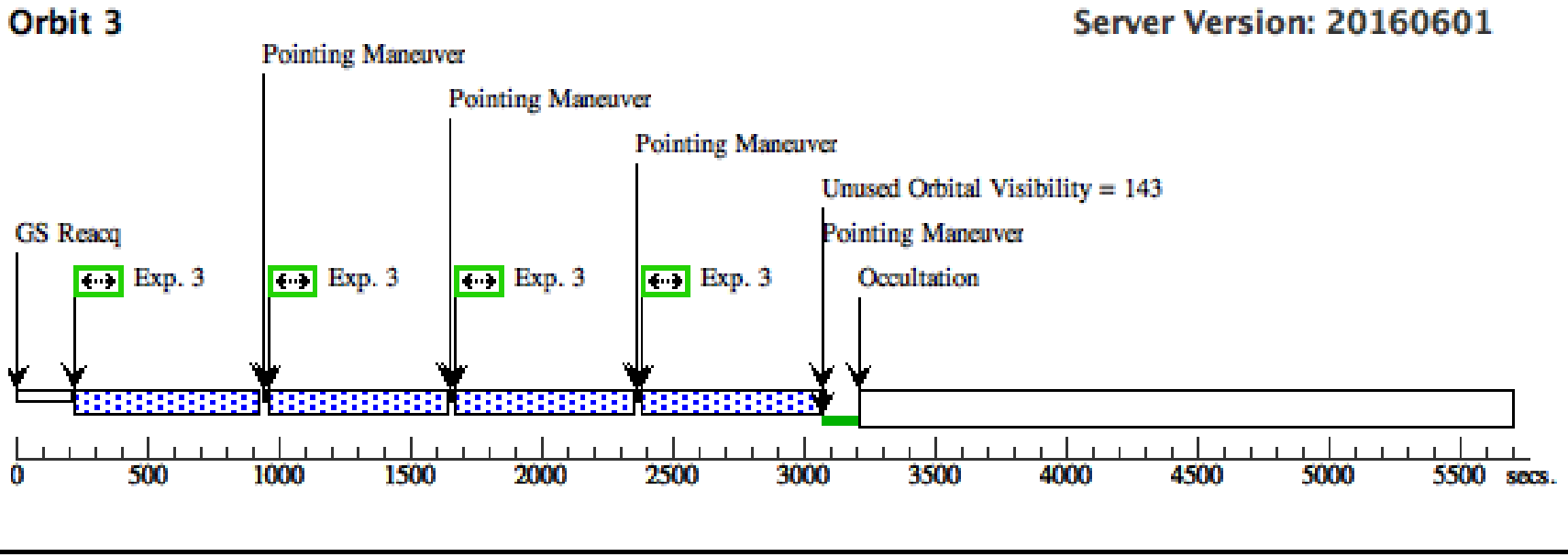
Exposures

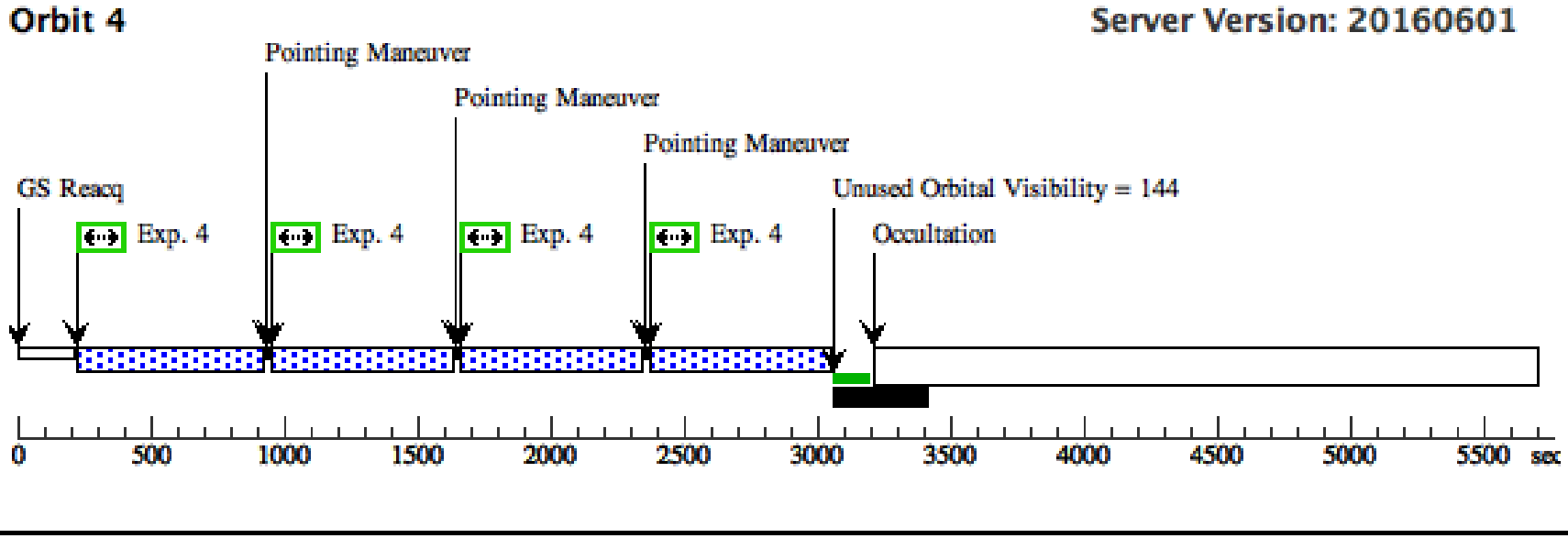
#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(ACS.im.827246)	(4) NGC-3115-POS4	ACS/SBC, ACCUM, SBC-FIX	F140LP			Pattern 1, Exps 1-1 in Visit 04 (1)	650 Secs (2600 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2	(ACS.im.827252)	(4) NGC-3115-POS4	ACS/SBC, ACCUM, SBC-FIX	F165LP			Pattern 1, Exps 2-2 in Visit 04 (1)	650 Secs (2600 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***
3	(ACS.im.827246)	(4) NGC-3115-POS4	ACS/SBC, ACCUM, SBC-FIX	F140LP			Pattern 1, Exps 3-3 in Visit 04 (1)	650 Secs (2600 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[3]***
4	(ACS.im.827252)	(4) NGC-3115-POS4	ACS/SBC, ACCUM, SBC-FIX	F165LP			Pattern 1, Exps 4-4 in Visit 04 (1)	650 Secs (2600 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[4]***

Orbit Structure






Orbit 3
Server Version: 20160601
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Unused Orbital Visibility = 143
Pointing Maneuver
GS Reacq
Exp. 3
Exp. 3
Exp. 3
Exp. 3
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.


Orbit 4
Server Version: 20160601
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
GS Reacq
Unused Orbital Visibility = 144
Exp. 4
Exp. 4
Exp. 4
Exp. 4
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec