13376 - The Star Formation History of Leo P

Cycle: 21, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Dr. Kristen McQuinn (PI) (Contact)	**University of Minnesota - Twin Cities**	**kmcquinn@astro.umn.edu**
Dr. Evan D. Skillman (CoI)	University of Minnesota - Twin Cities	skillman@astro.umn.edu
Dr. John M. Cannon (CoI)	Macalester College	jcannon@macalester.edu
Prof. Riccardo Giovanelli (CoI)	Cornell University	rg39@cornell.edu
Ms. Elizabeth Adams (CoI)	Cornell University	betsey@astro.cornell.edu
Prof. John J. Salzer (CoI)	Indiana University System	slaz@astro.indiana.edu
Dr. Katherine Rhode (CoI)	Indiana University System	rhode@astro.indiana.edu
Ms. Danielle Berg (CoI)	University of Minnesota - Twin Cities	berg@astro.umn.edu
Dr. Leo Girardi (CoI) (ESA Member)	Osservatorio Astronomico di Padova	leo.girardi@oapd.inaf.it
Prof. Martha Haynes (CoI)	Cornell University	haynes@astro.cornell.edu
Dr. Andrew Dolphin (CoI)	Raytheon Company	adolphin@raytheon.com

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) LEOP	ACS/WFC	2	22-Jan-2014 21:13:51.0	yes
02	(1) LEOP	ACS/WFC	2	22-Jan-2014 21:13:58.0	yes
03	(1) LEOP	ACS/WFC	2	22-Jan-2014 21:14:04.0	yes
04	(1) LEOP	ACS/WFC	2	22-Jan-2014 21:14:10.0	yes
05	(1) LEOP	ACS/WFC	2	22-Jan-2014 21:14:16.0	yes
06	(1) LEOP	ACS/WFC	2	22-Jan-2014 21:14:22.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
07	(1) LEOP	ACS/WFC	2	22-Jan-2014 21:14:27.0	yes
08	(1) LEOP	ACS/WFC	3	22-Jan-2014 21:14:35.0	yes

17 Total Orbits Used

ABSTRACT

The nearby (D = 1.7+/-0.3 Mpc), very low luminosity (M_V = -9.3+/-0.4mag), gas-rich star forming galaxy Leo P was discovered by its HI 21cm emission in the Arecibo ALFALFA survey. Follow-up optical spectroscopy of its single HII region revealed an oxygen abundance of 12+log(O/H)=7.16+/-0.04, making it the lowest metallicity star forming galaxy in the Local Volume (D < 5 Mpc) and commensurate with the metallicities of emission line galaxies I Zw 18 and DDO 68. Thus, Leo P presents us with a unique opportunity to understand the evolution of extremely metal deficient (XMD) galaxies. Specifically, an HST color magnitude diagram which reaches below the red clump stars will allow us to reconstruct the lifetime star formation history with reasonable time resolution.

The star formation history will answer two vital questions: (1) Did Leo P experience suppressed star formation during its early evolution like another isolated dwarf galaxy Leo A? and (2) What fraction of all newly created metals has Leo P been able to retain during its lifetime?

OBSERVING DESCRIPTION

The goal of this proposal is to reconstruct and interpret the star formation history (SFH) and chemical enrichment history of the newly discovered XMD dwarf galaxy Leo~P from a deep (I~27; V~28) color-magnitude diagram (CMD). Orbit allocation = 17 orbits.

Most visits span 2-orbits with the ACS; each orbit is split between one F475W and one F814W exposure (with no CR-splits). Small ditherings are performed between exposures in order to remove hot pixels and to smooth the detector response. We don't intend to cover the interchip gap. Ditherings are performed using POS-TARG, and following the basic UDF dither pattern, shifted around by 2-3 pix. The observations will complete a total of 4 uniquely positioned UDF dither patterns plus an additional set of F475W and F814W images with a POS-TARG offset of 0.05, 0.05.

The first visit is requested within a given range of orientations. This range has been chosen both to minimize the impact of a bright foreground star on the photometry of the galaxy and to maximize the areal coverage of both the main star-forming body and stellar halo of the galaxy. Subsequent visits are requested to be obtained with the same ORIENT as the first visit in order to maximize the sky area covered at full depth.

We request the visits to be executed sequentially within a maximum time span of 3 days. This will ensure optimal sampling of the light curves of short period variable stars such as RR Lyrae, which will provide an independent constraint on the SFH of the galaxy, the main science goal of our progam.

Visit

Proposal 13376, Visit 01 (01), implementation Thu Jan 23 02:14:45 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: ORIENT 80D TO 95 D; ORIENT 240D TO 270 D; SEQ 01,02,03,04,05,06,07,08 WITHIN 3 D

Comments: We request a range of orientations in this first visit and the same orientation in the subsequent visits. Visits are also requested to be executed sequentially within a 3 day period.

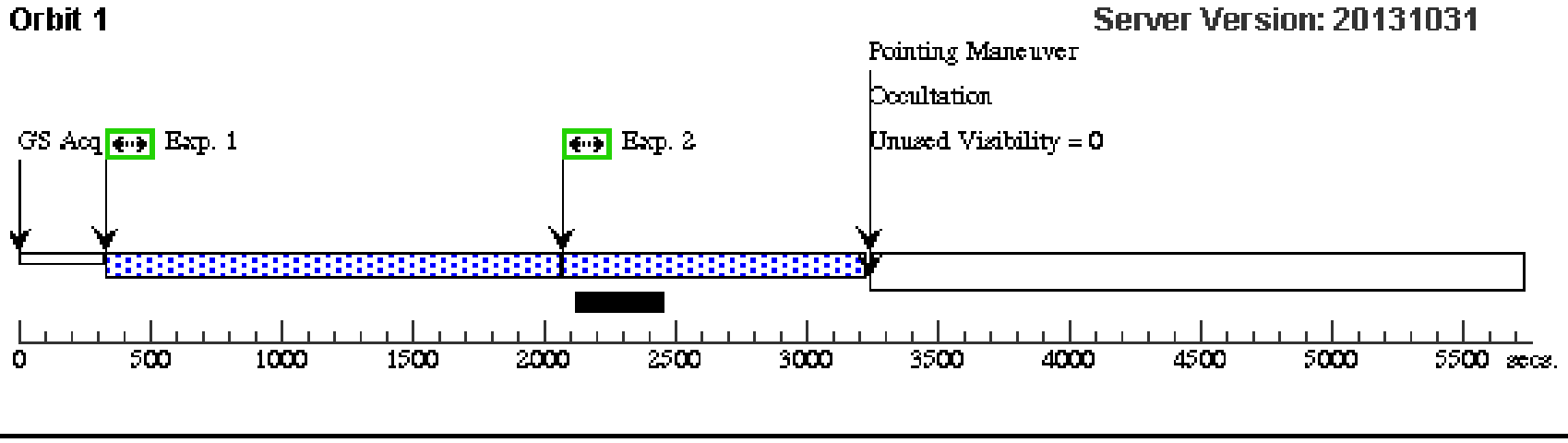
Fixed Targets

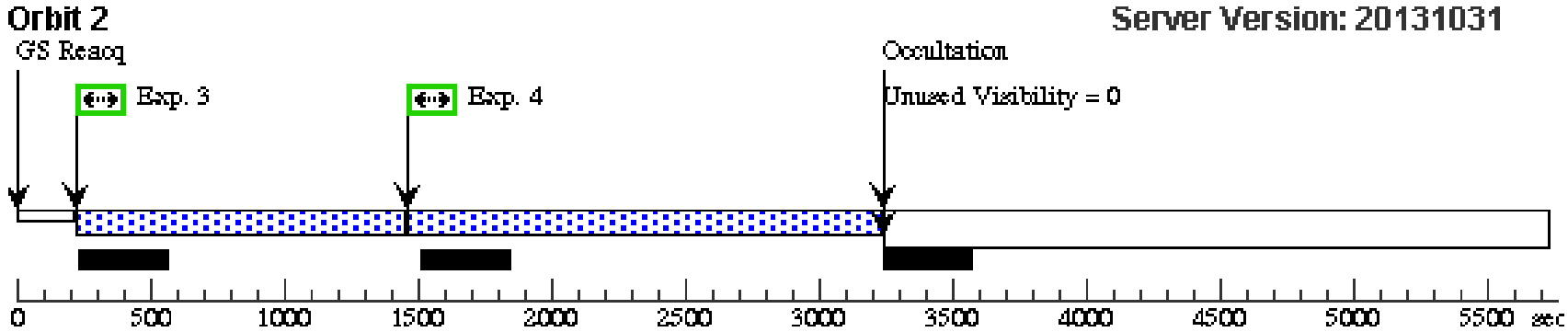
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LEOP Alt Name1: HI102144.7+180438 Alt Name2: AGC208583	RA: 10 21 48.0427 (155.4501779d) Dec: +18 05 36.07 (18.09335d) Equinox: J2000		V=16.9+/-0.1	Reference Frame: ICRS

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	LeoP-V1-B1 (ACS.im.510378)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F475W		GS ACQ SCENARIO BASE1B3		1465 Secs (1522 Secs) *[==>1522.0 Secs]*	 ***[1]***
2	LeoP-V1-I1 (ACS.im.509968)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F814W				935 Secs (992 Secs) *[==>992.0 Secs]*	 ***[1]***
3	LeoP-V1-I2 (ACS.im.509968)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F814W		POS TARG 0.148,0.086		935 Secs (1103 Secs) *[==>1103.0 Secs]*	 ***[2]***
4	LeoP-V1-B2 (ACS.im.510378)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F475W		POS TARG 0.148,0.086		1435 Secs (1603 Secs) *[==>1603.0 Secs]*	 ***[2]***

Orbit Structure





Visit

Proposal 13376, Visit 02 (02), implementation Thu Jan 23 02:14:47 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

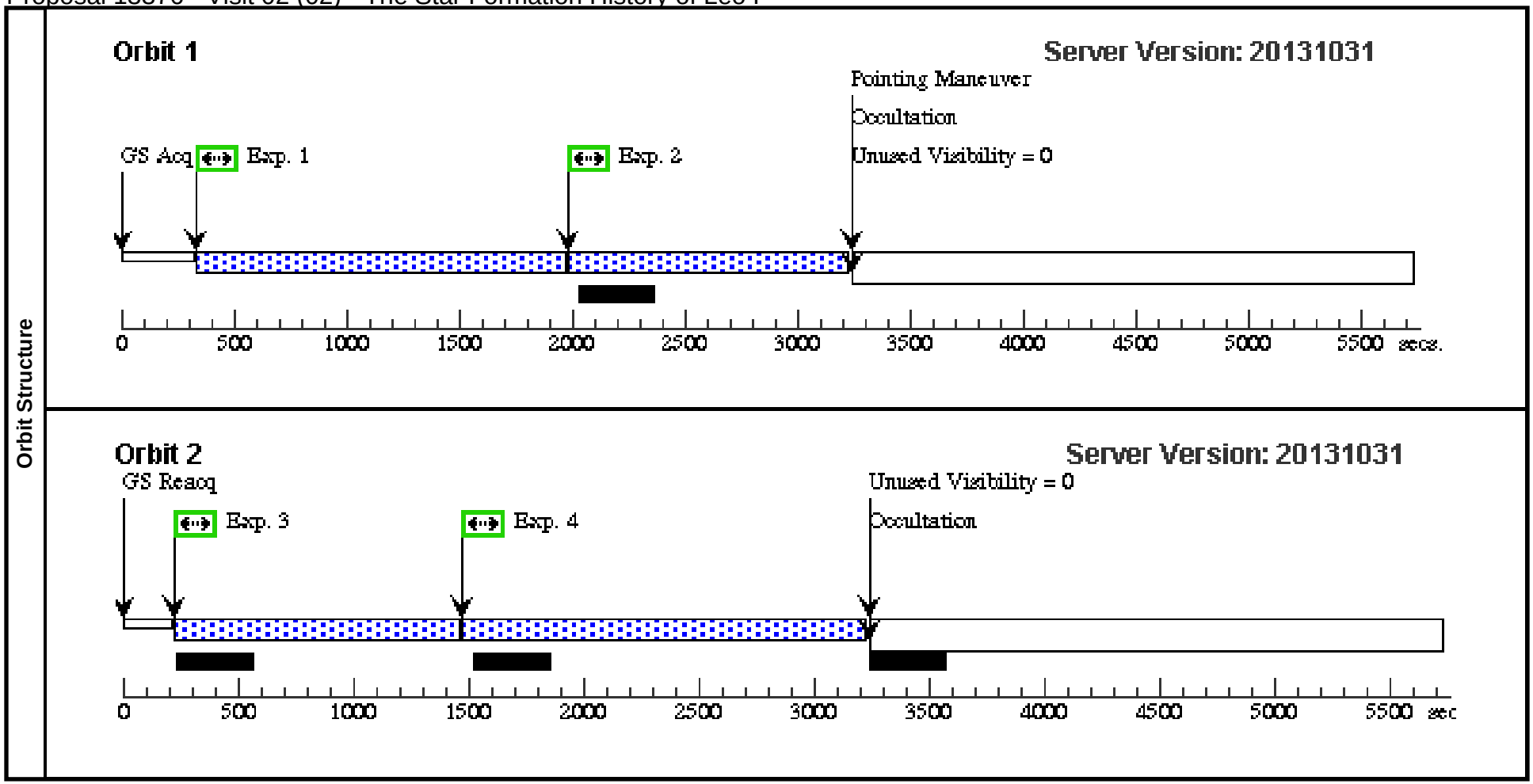
Special Requirements: SAME ORIENT AS 01; AFTER 01 BY 4 H TO 3 D

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LEOP Alt Name1: HI102144.7+180438 Alt Name2: AGC208583	RA: 10 21 48.0427 (155.4501779d) Dec: +18 05 36.07 (18.09335d) Equinox: J2000		V=16.9+/-0.1	Reference Frame: ICRS

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	LeoP-V2-B3 (ACS.im.51 0378)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F475W		POS TARG 0.222,0.240; GS ACQ SCENARIO BASE1B3		1435 Secs (1435 Secs) *[==>]*	 ***[1]***
2	LeoP-V2-I3 (ACS.im.50 9968)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F814W		POS TARG 0.222,0.240		965 Secs (1079 Secs) *[==>1079.0 Secs]*	 ***[1]***
3	LeoP-V2-I4 (ACS.im.50 9968)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F814W		POS TARG 0.074,0.154		965 Secs (1118 Secs) *[==>1118.0 Secs]*	 ***[2]***
4	LeoP-V2-B4 (ACS.im.51 0378)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F475W		POS TARG 0.074,0.154		1435 Secs (1588 Secs) *[==>1588.0 Secs]*	 ***[2]***


Orbit Structure
Orbit 1
Server Version: 20131031
Pointing Maneuver
Occultation
Unused Visibility = 0
GS Acq
Exp. 1
Exp. 2
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.
Orbit 2
Server Version: 20131031
GS Reacq
Unused Visibility = 0
Exp. 3
Exp. 4
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 13376, Visit 03 (03), implementation Thu Jan 23 02:14:48 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: SAME ORIENT AS 01; AFTER 02 BY 4 H TO 3 D

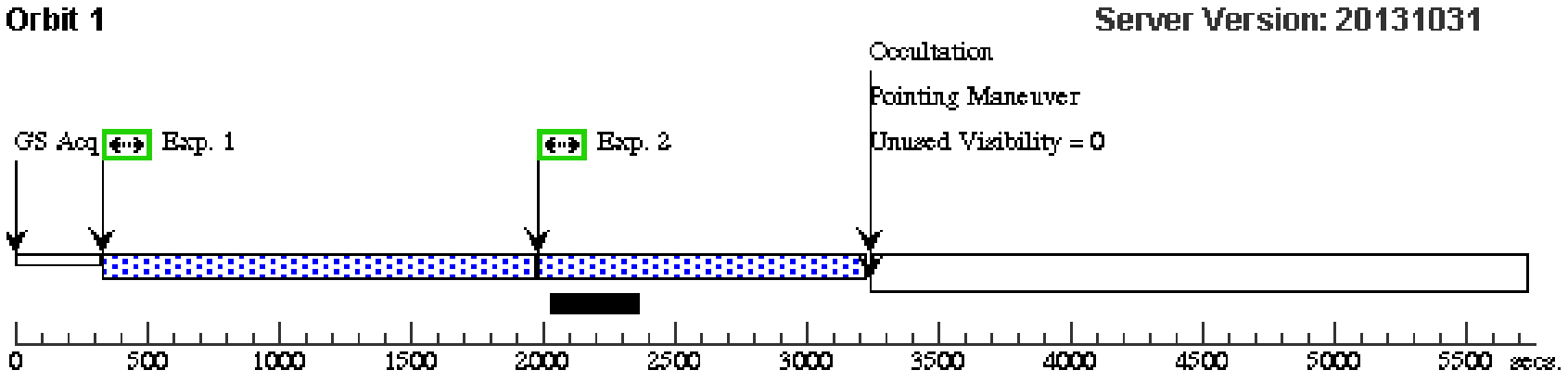
Fixed Targets

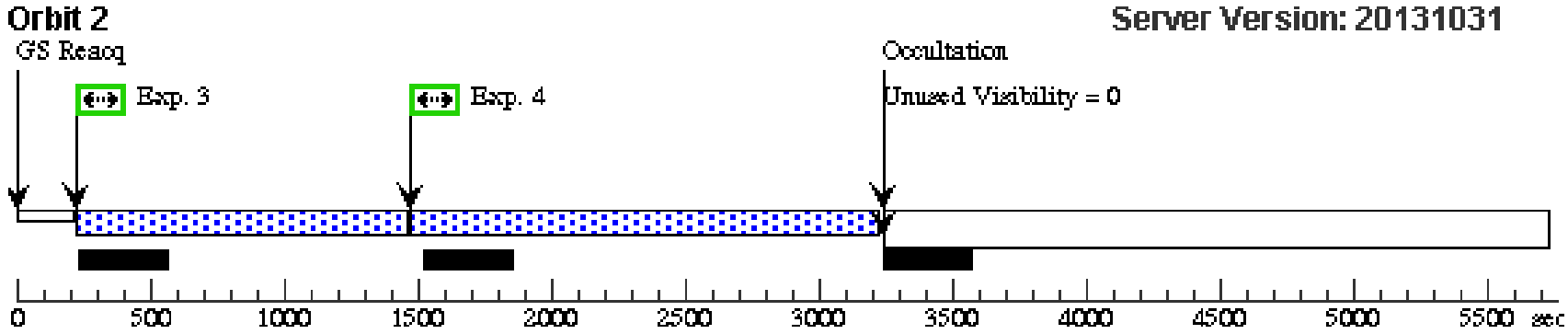
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LEOP Alt Name1: HI102144.7+180438 Alt Name2: AGC208583	RA: 10 21 48.0427 (155.4501779d) Dec: +18 05 36.07 (18.09335d) Equinox: J2000		V=16.9+/-0.1	Reference Frame: ICRS

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	LeoP-V3-B5 (ACS.im.51 0378)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F475W		POS TARG 0.085,0.105; GS ACQ SCENARIO BASE1B3		1435 Secs (1435 Secs) *[==>]*	*[1]*
2	LeoP-V3-I5 (ACS.im.50 9968)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F814W		POS TARG 0.085,0.105		965 Secs (1079 Secs) *[==>1079.0 Secs]*	*[1]*
3	LeoP-V3-I6 (ACS.im.50 9968)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F814W		POS TARG 0.233,0.191		965 Secs (1118 Secs) *[==>1118.0 Secs]*	*[2]*
4	LeoP-V3-B6 (ACS.im.51 0378)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F475W		POS TARG 0.233,0.191		1435 Secs (1588 Secs) *[==>1588.0 Secs]*	*[2]*

Orbit Structure





Visit

Proposal 13376, Visit 04 (04), implementation Thu Jan 23 02:14:49 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

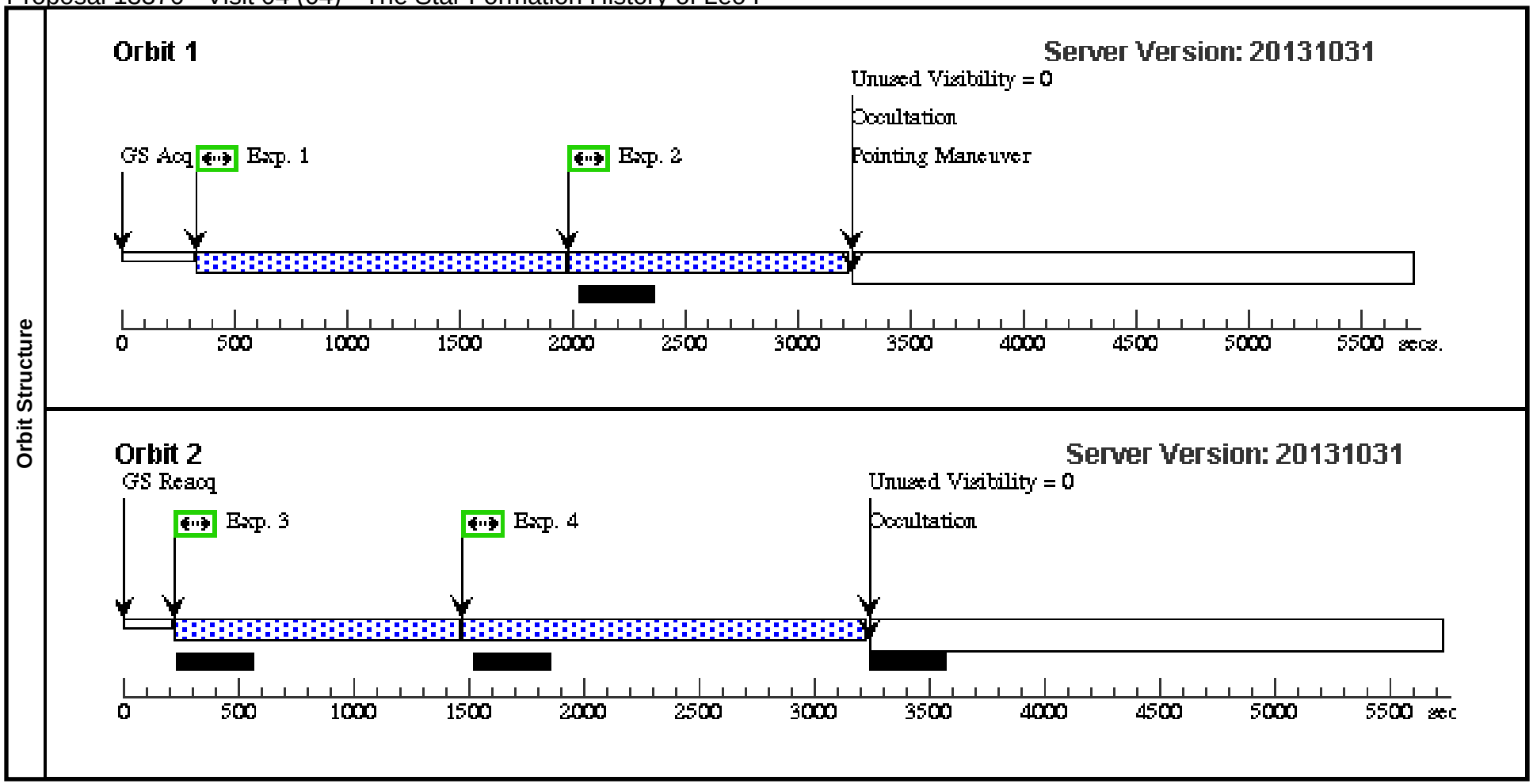
Special Requirements: SAME ORIENT AS 01; AFTER 03 BY 4 H TO 3 D

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LEOP Alt Name1: HI102144.7+180438 Alt Name2: AGC208583	RA: 10 21 48.0427 (155.4501779d) Dec: +18 05 36.07 (18.09335d) Equinox: J2000		V=16.9+/-0.1	Reference Frame: ICRS

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	LeoP-V4-B7 (ACS.im.510378)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F475W		POS TARG 0.307,0.345; GS ACQ SCENARIO BASE1B3		1435 Secs (1435 Secs) *[==>]*	 ***[1]***
2	LeoP-V4-I7 (ACS.im.509968)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F814W		POS TARG 0.307,0.345		965 Secs (1079 Secs) *[==>1079.0 Secs]*	 ***[1]***
3	LeoP-V4-I8 (ACS.im.509968)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F814W		POS TARG 0.159,0.259		965 Secs (1118 Secs) *[==>1118.0 Secs]*	 ***[2]***
4	LeoP-V4-B8 (ACS.im.510378)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F475W		POS TARG 0.159,0.259		1435 Secs (1588 Secs) *[==>1588.0 Secs]*	 ***[2]***


Orbit Structure
Orbit 1
Server Version: 20131031
Unused Visibility = 0
Occultation
Pointing Maneuver
GS Acq
Exp. 1
Exp. 2
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.
Orbit 2
Server Version: 20131031
GS Reacq
Unused Visibility = 0
Occultation
Exp. 3
Exp. 4
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 13376, Visit 05 (05), implementation Thu Jan 23 02:14:50 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

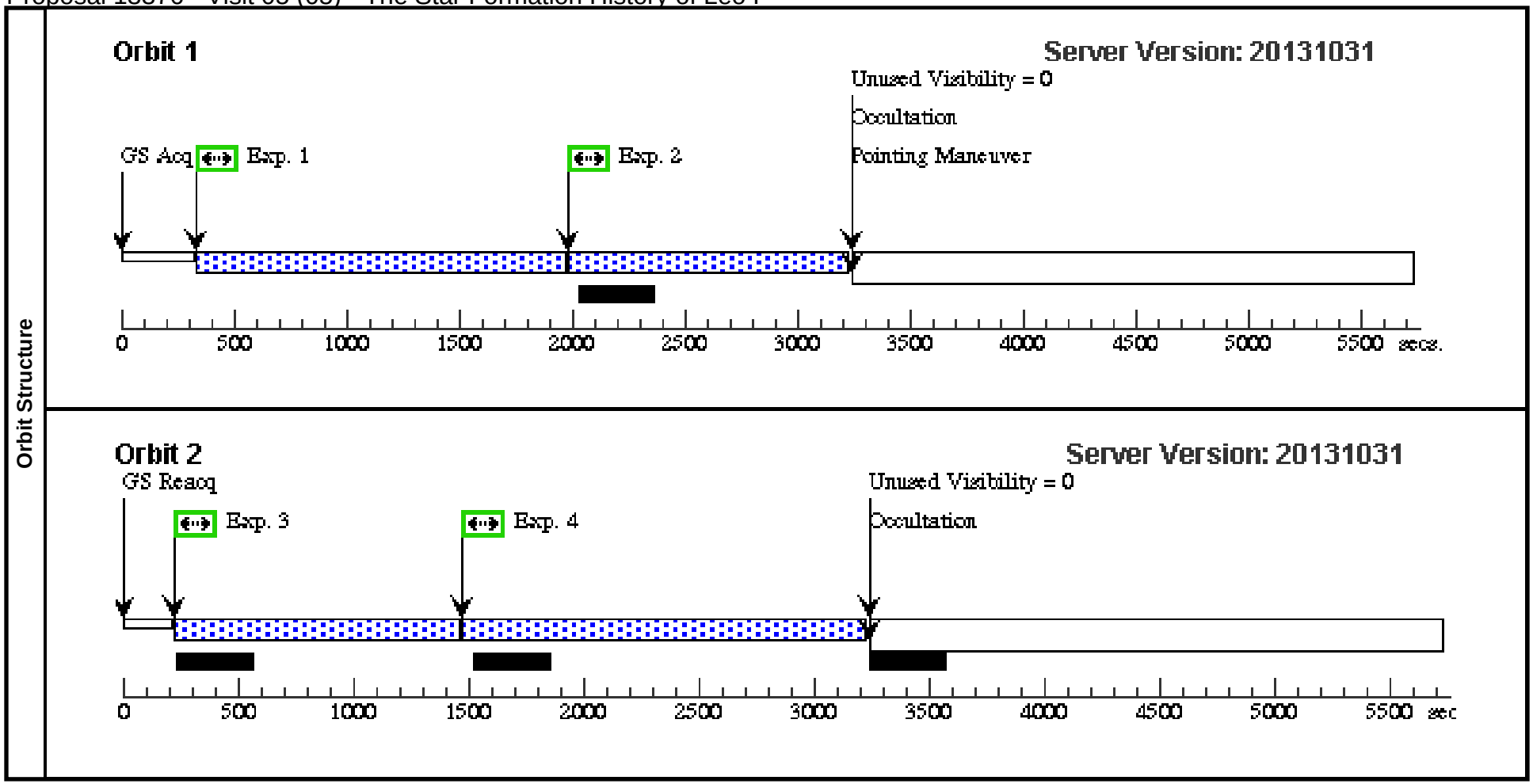
Special Requirements: SAME ORIENT AS 01; AFTER 04 BY 4 H TO 3 D

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LEOP Alt Name1: HI102144.7+180438 Alt Name2: AGC208583	RA: 10 21 48.0427 (155.4501779d) Dec: +18 05 36.07 (18.09335d) Equinox: J2000		V=16.9+/-0.1	Reference Frame: ICRS

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	LeoP-V5-B9 (ACS.im.510378)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F475W		POS TARG 0.085,0.0; GS ACQ SCENARIO BASE1B3		1435 Secs (1435 Secs) *[==>]*	***[1]***
2	LeoP-V5-I9 (ACS.im.509968)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F814W		POS TARG 0.085,0.0		965 Secs (1079 Secs) *[==>1079.0 Secs]*	***[1]***
3	LeoP-V5-I10 (ACS.im.509968)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F814W		POS TARG 0.233,0.086		965 Secs (1118 Secs) *[==>1118.0 Secs]*	***[2]***
4	LeoP-V5-B10 (ACS.im.510378)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F475W		POS TARG 0.233,0.086		1435 Secs (1588 Secs) *[==>1588.0 Secs]*	***[2]***


Orbit Structure
Orbit 1
Server Version: 20131031
Unused Visibility = 0
Occultation
Pointing Maneuver
GS Acq
Exp. 1
Exp. 2
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.
Orbit 2
Server Version: 20131031
GS Reacq
Unused Visibility = 0
Occultation
Exp. 3
Exp. 4
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 13376, Visit 06 (06), implementation Thu Jan 23 02:14:51 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

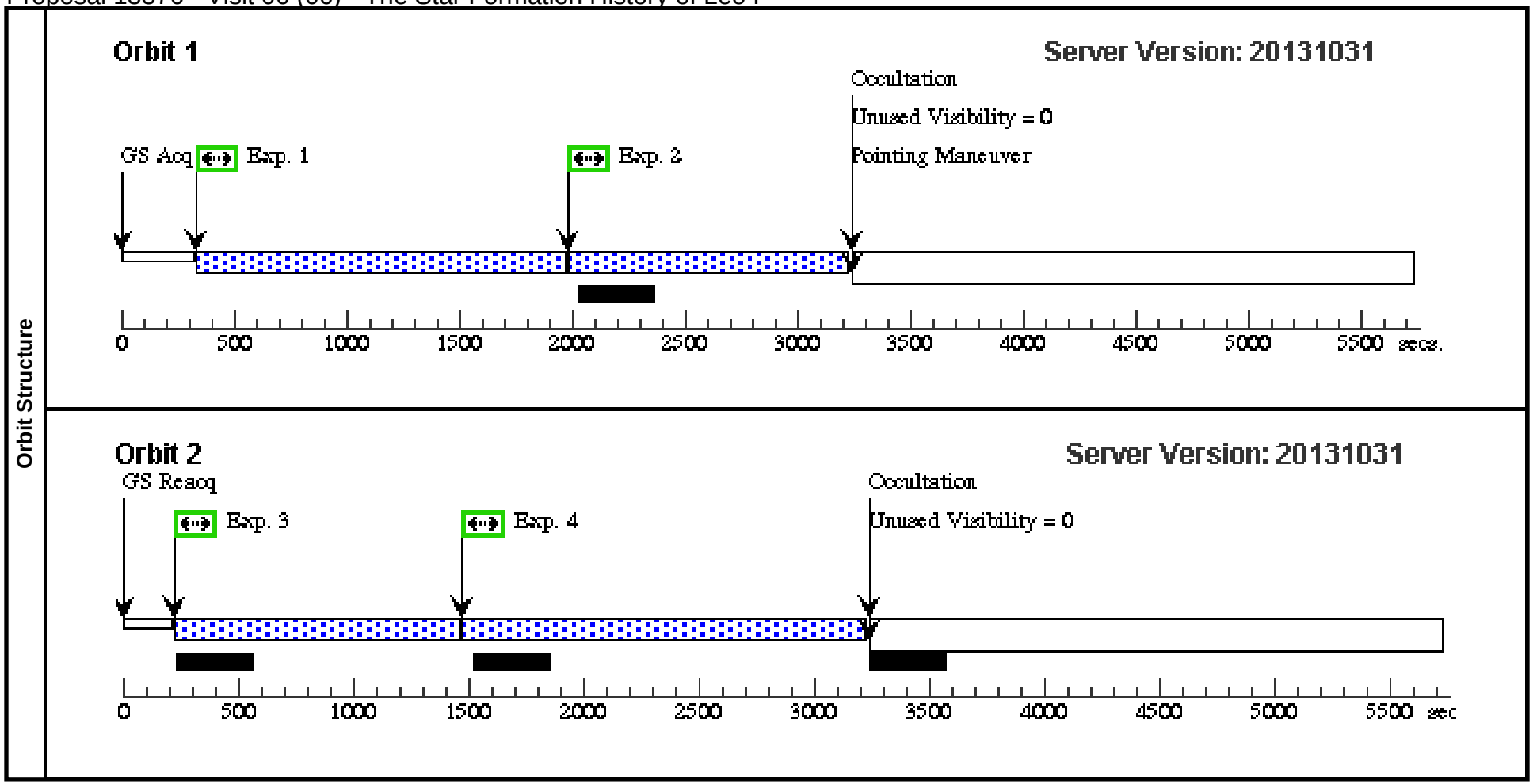
Special Requirements: SAME ORIENT AS 01; AFTER 05 BY 4 H TO 3 D

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LEOP Alt Name1: HI102144.7+180438 Alt Name2: AGC208583	RA: 10 21 48.0427 (155.4501779d) Dec: +18 05 36.07 (18.09335d) Equinox: J2000		V=16.9+/-0.1	Reference Frame: ICRS

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	LeoP-V6-B1 1 (ACS.im.51 0378)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F475W		POS TARG 0.307,0.240; GS ACQ SCENARIO BASE1B3		1435 Secs (1435 Secs) *[==>]*	 ***[1]***
2	LeoP-V6-I1 1 (ACS.im.50 9968)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F814W		POS TARG 0.307,0.240		965 Secs (1079 Secs) *[==>1079.0 Secs]*	 ***[1]***
3	LeoP-V6-I1 2 (ACS.im.50 9968)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F814W		POS TARG 0.159,0.154		965 Secs (1118 Secs) *[==>1118.0 Secs]*	 ***[2]***
4	LeoP-V6-B1 2 (ACS.im.51 0378)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F475W		POS TARG 0.159,0.154		1435 Secs (1588 Secs) *[==>1588.0 Secs]*	 ***[2]***


Orbit Structure
Orbit 1
Server Version: 20131031
Occultation
Unused Visibility = 0
Pointing Maneuver
GS Acq
Exp. 1
Exp. 2
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.
Orbit 2
Server Version: 20131031
GS Reacq
Occultation
Unused Visibility = 0
Exp. 3
Exp. 4
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 13376, Visit 07 (07), implementation Thu Jan 23 02:14:52 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

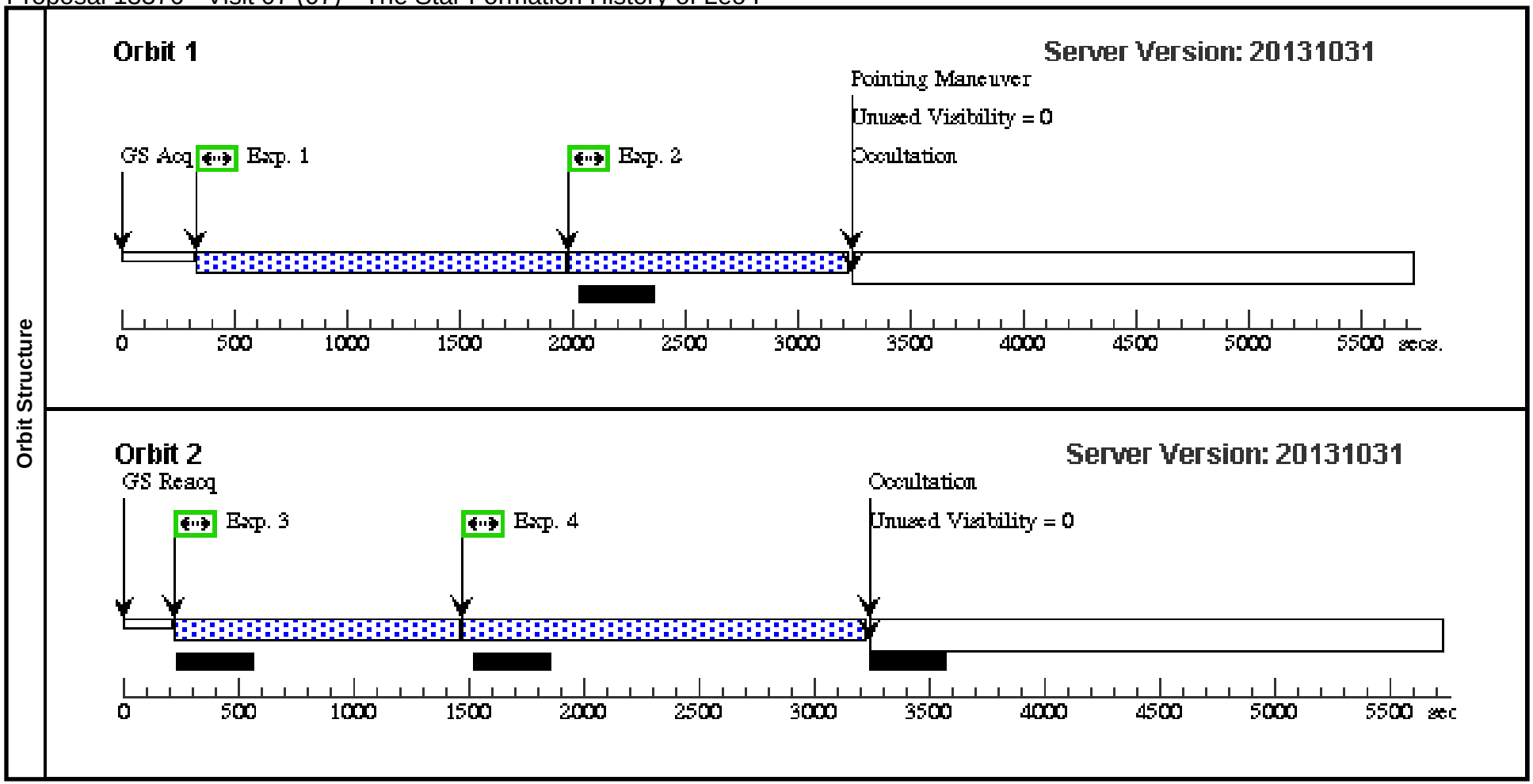
Special Requirements: SAME ORIENT AS 01; AFTER 06 BY 4 H TO 3 D

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LEOP Alt Name1: HI102144.7+180438 Alt Name2: AGC208583	RA: 10 21 48.0427 (155.4501779d) Dec: +18 05 36.07 (18.09335d) Equinox: J2000		V=16.9+/-0.1	Reference Frame: ICRS

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	LeoP-V7-B13 (ACS.im.510378)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F475W		POS TARG 0.0,0.105; GS ACQ SCENARIO BASE1B3		1435 Secs (1435 Secs) *[==>]*	***[1]***
2	LeoP-V7-I13 (ACS.im.509968)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F814W		POS TARG 0.0,0.105		965 Secs (1079 Secs) *[==>1079.0 Secs]*	***[1]***
3	LeoP-V7-I14 (ACS.im.509968)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F814W		POS TARG 0.148,0.191		965 Secs (1118 Secs) *[==>1118.0 Secs]*	***[2]***
4	LeoP-V7-B14 (ACS.im.510378)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F475W		POS TARG 0.148,0.191		1435 Secs (1588 Secs) *[==>1588.0 Secs]*	***[2]***


Orbit Structure
Orbit 1
Server Version: 20131031
Pointing Maneuver
Unused Visibility = 0
Occultation
GS Acq
Exp. 1
Exp. 2
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.
Orbit 2
Server Version: 20131031
GS Reacq
Occultation
Exp. 3
Exp. 4
Unused Visibility = 0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 13376, Visit 08 (08), implementation Thu Jan 23 02:14:53 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: SAME ORIENT AS 01; AFTER 07 BY 4 H TO 3 D

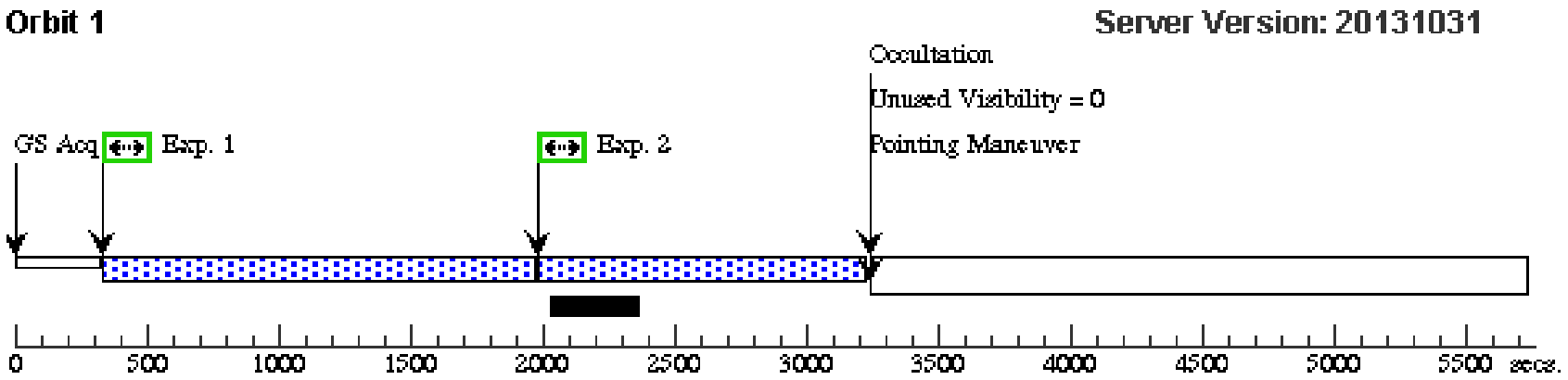
Fixed Targets

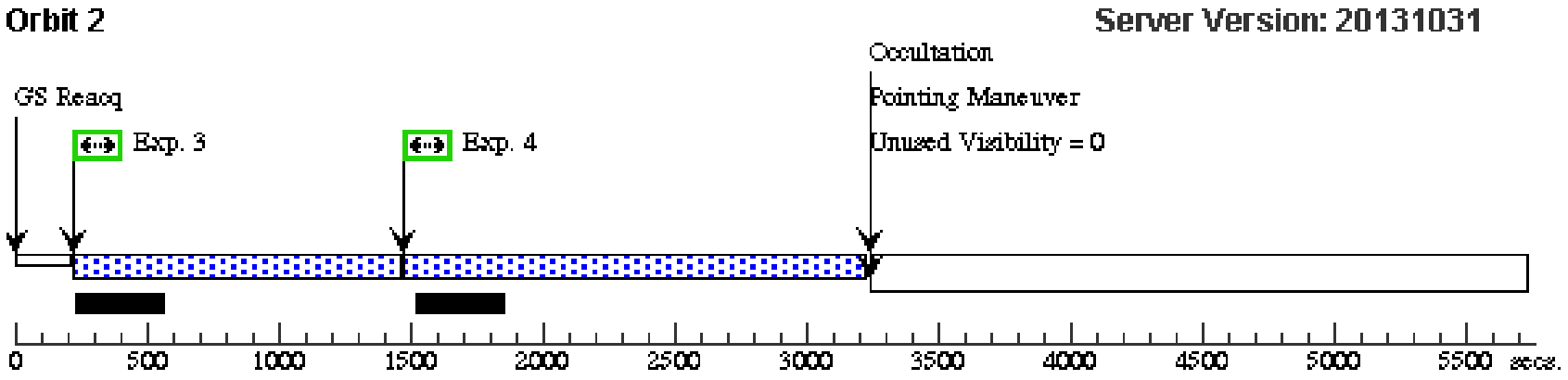
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LEOP Alt Name1: HI102144.7+180438 Alt Name2: AGC208583	RA: 10 21 48.0427 (155.4501779d) Dec: +18 05 36.07 (18.09335d) Equinox: J2000		V=16.9+/-0.1	Reference Frame: ICRS

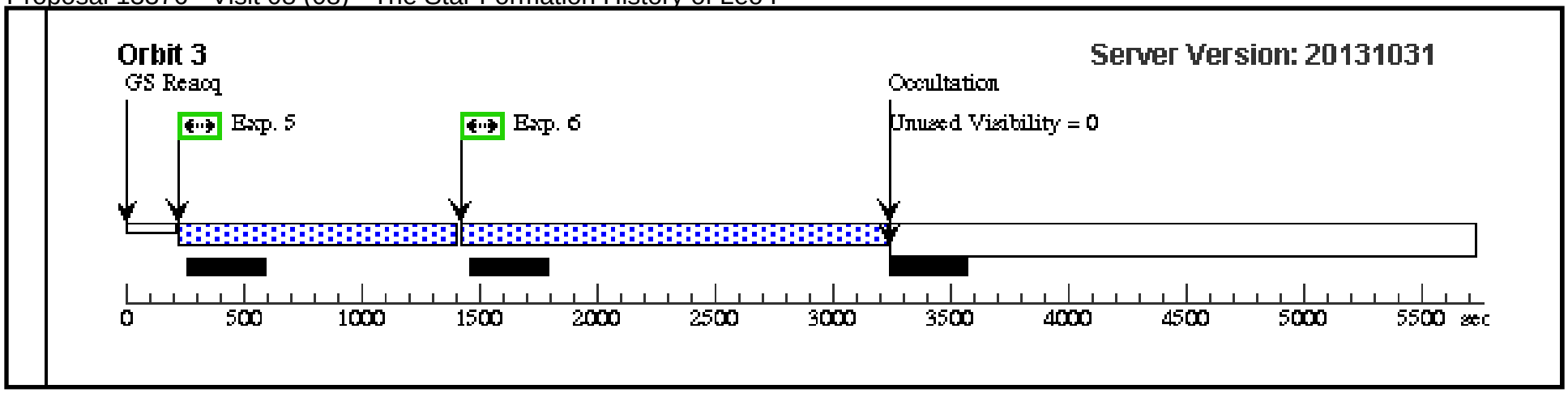
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	LeoP-V8-B15 (ACS.im.510378)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F475W		POS TARG 0.222,0.345; GS ACQ SCENARIO BASE1B3		1435 Secs (1435 Secs) *[==>]*	*[1]*
2	LeoP-V8-I15 (ACS.im.509968)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F814W		POS TARG 0.222,0.345		965 Secs (1079 Secs) *[==>1079.0 Secs]*	*[1]*
3	LeoP-V8-I16 (ACS.im.509968)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F814W		POS TARG 0.074,0.259		965 Secs (1118 Secs) *[==>1118.0 Secs]*	*[2]*
4	LeoP-V8-B16 (ACS.im.510378)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F475W		POS TARG 0.074,0.259		1435 Secs (1588 Secs) *[==>1588.0 Secs]*	*[2]*
5	LeoP-V8-I17 (ACS.im.509968)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F814W		POS TARG 0.05,0.05		965 Secs (1022 Secs) *[==>1022.0 Secs]*	*[3]*
6	LeoP-V8-B17 (ACS.im.510378)	(1) LEOP	ACS/WFC, ACCUM, WFCENTER	F475W		POS TARG 0.05,0.05		1435 Secs (1645 Secs) *[==>1645.0 Secs]*	*[3]*

Orbit Structure






Orbit 3
Server Version: 20131031
GS Reacq
Exp. 5
Exp. 6
Occultation
Unused Visibility = 0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec