



12204 - Probing the Ionized Gas in the Magellanic Stream

Cycle: 18, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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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) TONS210	COS/FUV COS/NUV	4	02-Jul-2010 21:11:19.0	yes
02	(2) B0117-2837	COS/FUV COS/NUV	5	02-Jul-2010 21:11:33.0	yes
03	(3) B0120-28	COS/FUV COS/NUV	5	02-Jul-2010 21:11:43.0	yes

14 Total Orbits Used

ABSTRACT

We propose a 14 orbit pilot study to investigate the ionized gas in the interface region between the cool neutral gas of the Magellanic Stream and the ambient hot gas of the Milky Way halo. We have chosen 3 bright QSOs clustered around a small (~ 1 sq. deg.) cloud associated with the Magellanic Stream. One of these QSOs (Ton S210) probes the neutral 21cm gas, while the other two lie just outside 21cm contours. Observations of Ton S210 will be used in conjunction with neutral and low-ionization absorption lines to set the metallicity of the gas. The outer two targets will be used to detect higher ionization states such as CIV, SiIV and NV, that typically trace warm ionized gas. The observed metallicity, gas temperature and line ratios will be used as inputs to modeling in order to determine the ionization state and physical conditions of the gas in the cool-hot interface region. Contingent on the success of this pilot program, we anticipate future observations to fully characterise the ionization state along the full length of the Magellanic Stream. These observations would be a significant advance in our understanding of the nature of Milky Way halo, the evolution of clouds in the halo, and the formation and ultimate fate of the Magellanic Stream. They will also have important implications for the interpretation of $z > 0$ QSO absorption-line studies.

OBSERVING DESCRIPTION

We will employ the COS medium-resolution FUV gratings G130M and G160M to obtain medium- to high-S/N observations of our 3 targets. The medium resolution gratings ($dv \sim 15\text{km/s}$) are required in order to separate the halo cloud absorption ($v_{\text{LSR}} \sim -200\text{km/s}$) from the strong MW disk absorption ($v_{\text{LSR}} \sim 0\text{km/s}$). Using both FUV gratings allows us to cover a host of neutral, low- and high-ionization species. Line ratios of multiple ionization states of the same element, such as SiII, SiIII, and SiIV will allow us to disentangle the ionization conditions of the gas, determining the metallicity, density and temperature of the neutral and ionized gas.

We have used the COS ETCs to estimate our time requirements as follows. In all cases, the overheads were set by the recommended acquisition strategy, combined with our experience in Cycle 17. For TonS210 we perform two separate calculations. In the first, we use the measured GALEX magnitudes, with the FOS QSO template at the measured redshift ($z_{\text{qso}} = 0.117$) to estimate the time required to achieve $S/N \sim 30$ at all points in the G130M grating, and $S/N > 25$ for the majority of the G160M wavelength range. The different S/N requirement is set by our need to detect weaker features in the G130M wavelength range, in order to provide an accurate metallicity measurement. The ETCs indicate these S/N requirements are met in 4600s for G130M (COS.A244561) and 4800s for G160M (COS.A244564). Since low S/N STIS data exist for this target, we can double-check these numbers using the same parameters, but normalizing by the observed flux in the STIS spectrum, {viz $3.0 \times 10^{-14} \text{ erg/cm}^2/\text{s}/\text{\AA}$ at 1310\AA (G130M; COS.A274426) and $2.3 \times 10^{-14} \text{ erg/cm}^2/\text{s}/\text{\AA}$ at 1544\AA (G160M; COS.A274446)}. We obtain consistent estimates using both techniques.

We have used 3 exposures for each grating and CENWAVE setting, but with different FP-POS settings in order to be able to remove the detector fixed pattern noise.

For our other two targets we adopt the same approach as above. The GALEX magnitudes are used to normalize the FOS QSO template and the redshifts set to $z_{\text{qso}} = 0.347$ and $z_{\text{qso}} = 0.4347$. Since our primary goal is to detect the ionized gas towards these sightlines, and ionized transitions such as CIV are typically stronger, the limiting equivalent width (and hence S/N requirements) can be relaxed. We aim to obtain $S/N > 10$ for these sightlines at all points along the spectra. The ETC indicates the required time is 4600s for the G130M grating (COS.A244109, COS.A244129) and 7200s for G160M (COS.A245621, COS.A245623). Since these two targets are fainter, and hence will have lower S/N, we employ only 2 FP-POS settings per grating/cenwave combination.

In all cases, our exposure times have been rounded up to the nearest whole orbit, to compensate for QSO fading and the COS time-dependent sensitivity drop.

ACQUISITIONS:

We have used the COS ETC to estimate the exposure times for ACQ/IMAGE acquisition (recommended for Cycle 18), using the measured GALEX NUV fluxes, which match closely to the COS NUV imaging bandpass. Since these acquisition times are typically short (~ 30 s or less), and to allow a "safety margin" in the case that the QSO fades, we calculate acquisition times half a magnitude fainter than the observed magnitude. This typical adds ~ 15 - 20 s to the acquisition time. As above, these calculations were done assuming an FOS QSO template, with the measured QSO redshift.

Proposal 12204 (STScI Edit Number: 0, Created: Friday, July 2, 2010 8:11:48 PM EST) - Overview

Visit	Proposal 12204, Visit 01, implementation Sat Jul 03 01:11:49 GMT 2010				
	Diagnostic Status: No Diagnostics Scientific Instruments: COS/NUV, COS/FUV Special Requirements: (none)				
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes
	(1)	TONS210	RA: 01 21 51.5100 (20.4646250d) Dec: -28 20 57.80 (-28.34939d) Equinox: J2000	Redshift: 0.117	V=15.19 Reference Frame: ICRS GALEX MAGS: m_FUV = 15.3 66 +/- 0.024; m_NUV = 15.241 +/- 0.013
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. The co-ordinates are taken from the 2MASS point-source catalogue. N.B. This object has been previously observed with STIS. The difference between the 2MASS ICRS co-ordinates, and those listed in the archive for the STIS observations are ~0.1arcsec.					

Proposal 12204 (STScI Edit Number: 0, Created: Friday, July 2, 2010 8:11:48 PM EST) - Overview

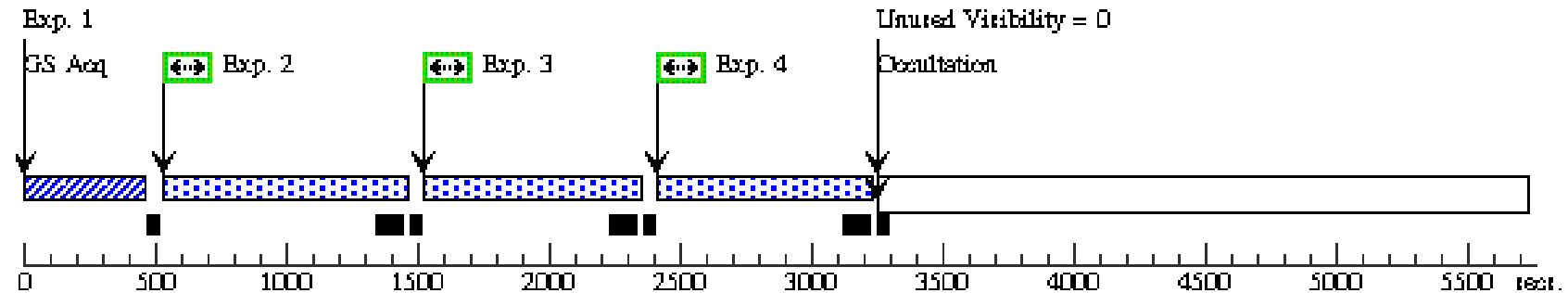
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	Target Acq	(1) TONS210	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				15.0 Secs	
									[==>]	[1]
	2		(1) TONS210	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=67 1; FLASH=YES; FP-POS=1			771 Secs	
									[==>]	[1]
	3		(1) TONS210	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=67 1; FLASH=YES; FP-POS=2			771 Secs	
									[==>]	[1]
	4		(1) TONS210	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=67 1; FLASH=YES; FP-POS=3			770 Secs	
									[==>]	[1]
	5		(1) TONS210	COS/FUV, TIME-TAG, PSA	G130M 1309 A	BUFFER-TIME=81 1; FLASH=YES; FP-POS=1			911 Secs	
									[==>]	[2]
	6		(1) TONS210	COS/FUV, TIME-TAG, PSA	G130M 1309 A	BUFFER-TIME=81 1; FLASH=YES; FP-POS=2			911 Secs	
									[==>]	[2]
	7		(1) TONS210	COS/FUV, TIME-TAG, PSA	G130M 1309 A	BUFFER-TIME=81 1; FLASH=YES; FP-POS=3			911 Secs	
									[==>]	[2]
	8		(1) TONS210	COS/FUV, TIME-TAG, PSA	G160M 1600 A	BUFFER-TIME=81 2; FLASH=YES; FP-POS=1			911 Secs	
									[==>]	[3]
	9		(1) TONS210	COS/FUV, TIME-TAG, PSA	G160M 1600 A	BUFFER-TIME=81 2; FLASH=YES; FP-POS=2			911 Secs	
									[==>]	[3]
	10		(1) TONS210	COS/FUV, TIME-TAG, PSA	G160M 1600 A	BUFFER-TIME=81 8; FLASH=YES; FP-POS=3			911 Secs	
									[==>]	[3]
	11		(1) TONS210	COS/FUV, TIME-TAG, PSA	G160M 1623 A	BUFFER-TIME=81 2; FLASH=YES; FP-POS=1			911 Secs	
									[==>]	[4]
	12		(1) TONS210	COS/FUV, TIME-TAG, PSA	G160M 1623 A	BUFFER-TIME=81 2; FLASH=YES; FP-POS=2			911 Secs	
									[==>]	[4]

Proposal 12204 (STScI Edit Number: 0, Created: Friday, July 2, 2010 8:11:48 PM EST) - Overview

	13	(1) TONS210	COS/FUV, TIME-TAG, PSA	G160M 1623 A	BUFFER-TIME=81 8; FLASH=YES; FP-POS=3	911 Secs	
						[==>]	[4]

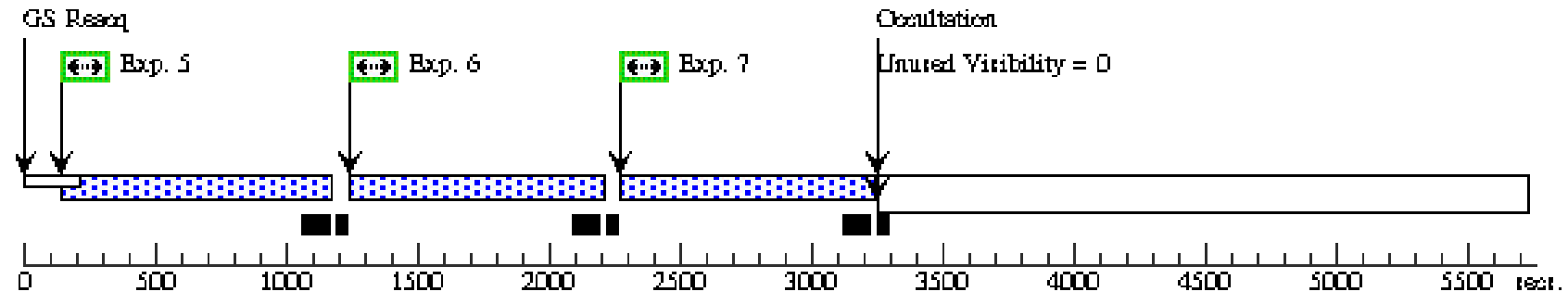
Orbit 1

Server Version: 20100505



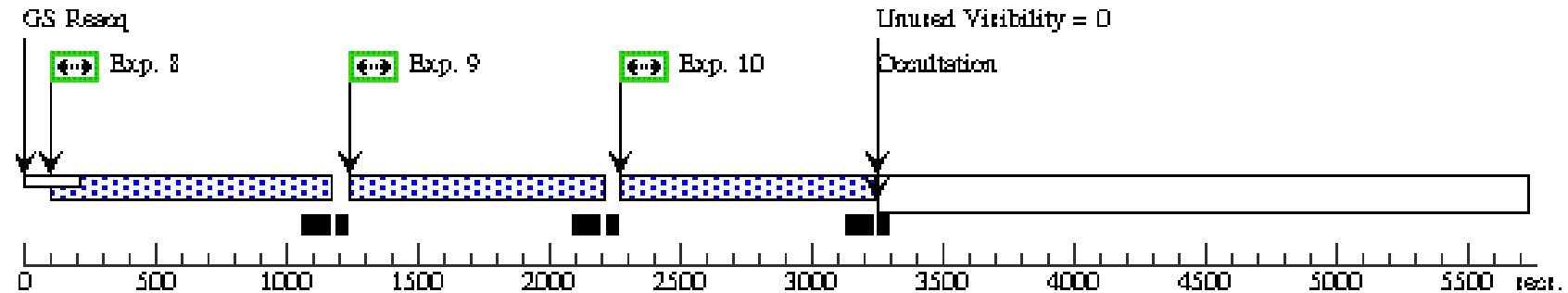
Orbit 2

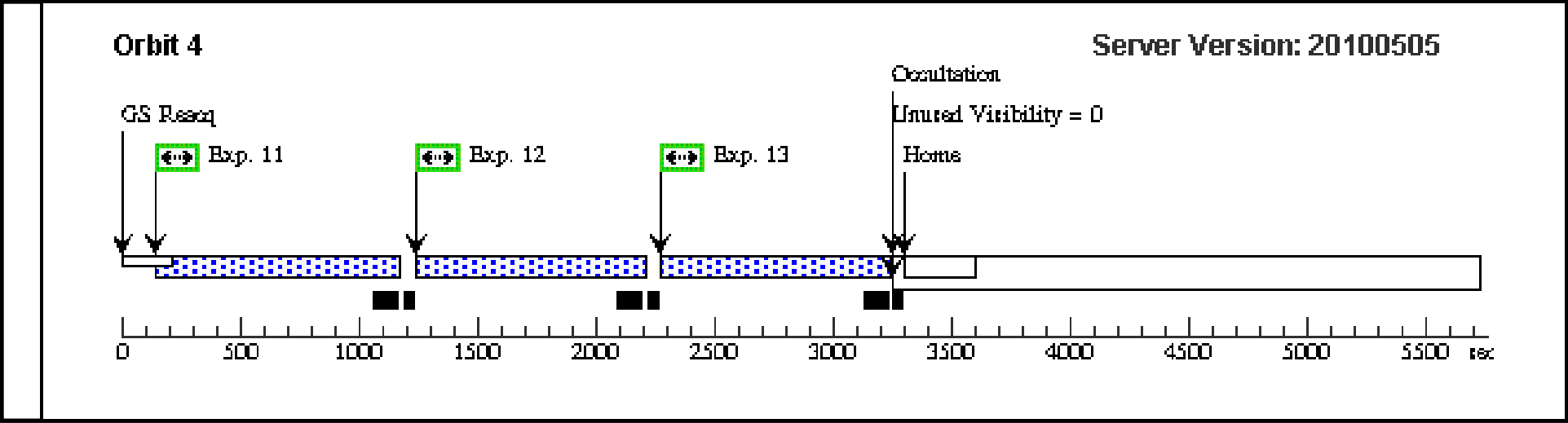
Server Version: 20100505



Orbit 3

Server Version: 20100505





Proposal 12204 - Visit 01 - Probing the Ionized Gas in the Magellanic Stream

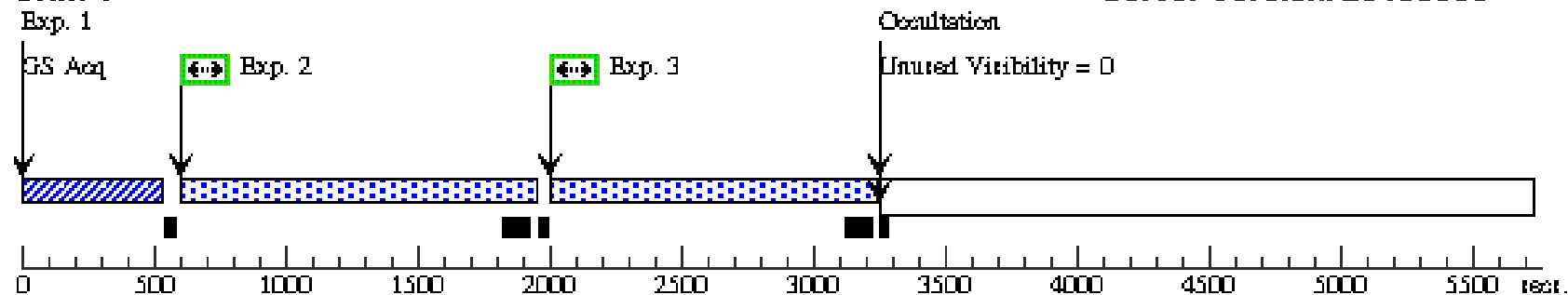
Visit	Proposal 12204, Visit 02, implementation Sat Jul 03 01:11:50 GMT 2010				
	Diagnostic Status: No Diagnostics Scientific Instruments: COS/NUV, COS/FUV Special Requirements: (none)				
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes
	(2)	B0117-2837	RA: 01 19 35.6966 (19.8987358d) Dec: -28 21 31.43 (-28.35873d) Equinox: J2000	Redshift: 0.347	V=14.989 GALEX MAGS: m_FUV = 16.8 15 +/- 0.042; m_NUV = 16.590 +/- 0.024
Comments: This object was generated by the targetselector and retrieved from the 2MASS database.					

Proposal 12204 - Visit 01 - Probing the Ionized Gas in the Magellanic Stream

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	Target Acq	(2) B0117-2837	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				50 Secs	
									[==>]	[1]
	2		(2) B0117-2837	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=10 85; FLASH=YES; FP-POS=3			1185 Secs	
									[==>]	[1]
	3		(2) B0117-2837	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=10 86; FLASH=YES; FP-POS=4			1186 Secs	
									[==>]	[1]
	4		(2) B0117-2837	COS/FUV, TIME-TAG, PSA	G130M 1309 A	BUFFER-TIME=13 31; FLASH=YES; FP-POS=3			1431 Secs	
									[==>]	[2]
	5		(2) B0117-2837	COS/FUV, TIME-TAG, PSA	G130M 1309 A	BUFFER-TIME=13 31; FLASH=YES; FP-POS=4			1431 Secs	
									[==>]	[2]
	6		(2) B0117-2837	COS/FUV, TIME-TAG, PSA	G160M 1600 A	BUFFER-TIME=13 31; FLASH=YES; FP-POS=2			1431 Secs	
									[==>]	[3]
	7		(2) B0117-2837	COS/FUV, TIME-TAG, PSA	G160M 1600 A	BUFFER-TIME=13 31; FLASH=YES; FP-POS=3			1431 Secs	
									[==>]	[3]
	8		(2) B0117-2837	COS/FUV, TIME-TAG, PSA	G160M 1600 A	BUFFER-TIME=12 97; FLASH=YES; FP-POS=4			1397 Secs	
									[==>]	[4]
	9		(2) B0117-2837	COS/FUV, TIME-TAG, PSA	G160M 1623 A	BUFFER-TIME=12 96; FLASH=YES; FP-POS=2			1396 Secs	
									[==>]	[4]
	10		(2) B0117-2837	COS/FUV, TIME-TAG, PSA	G160M 1623 A	BUFFER-TIME=13 31; FLASH=YES; FP-POS=3			1431 Secs	
									[==>]	[5]
	11		(2) B0117-2837	COS/FUV, TIME-TAG, PSA	G160M 1623 A	BUFFER-TIME=13 31; FLASH=YES; FP-POS=4			1431 Secs	
									[==>]	[5]

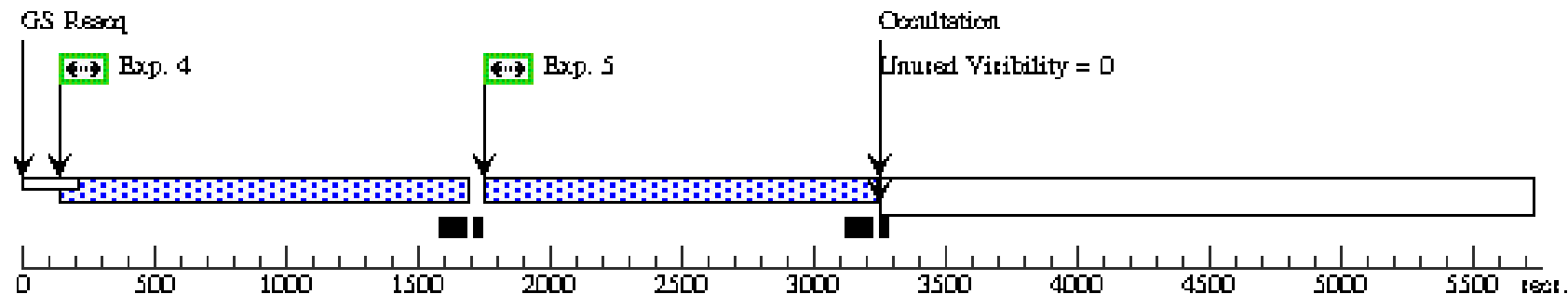
Orbit 1

Server Version: 20100505



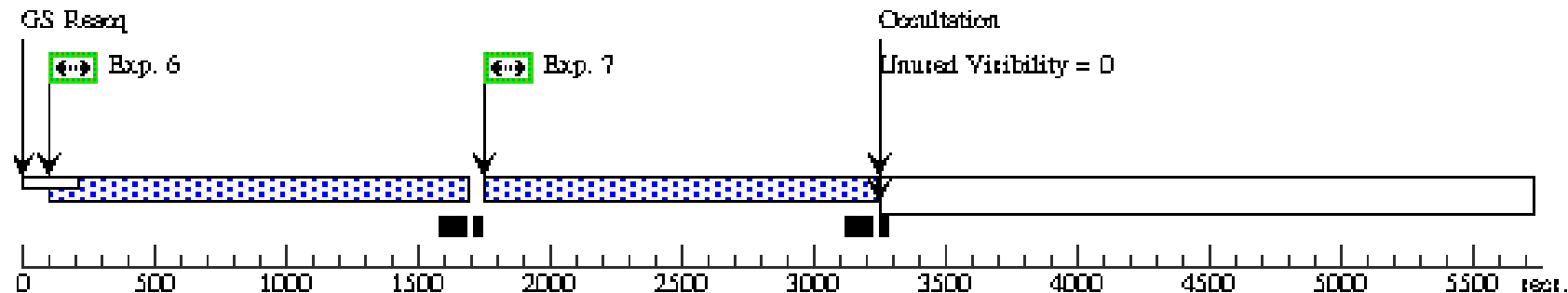
Orbit 2

Server Version: 20100505



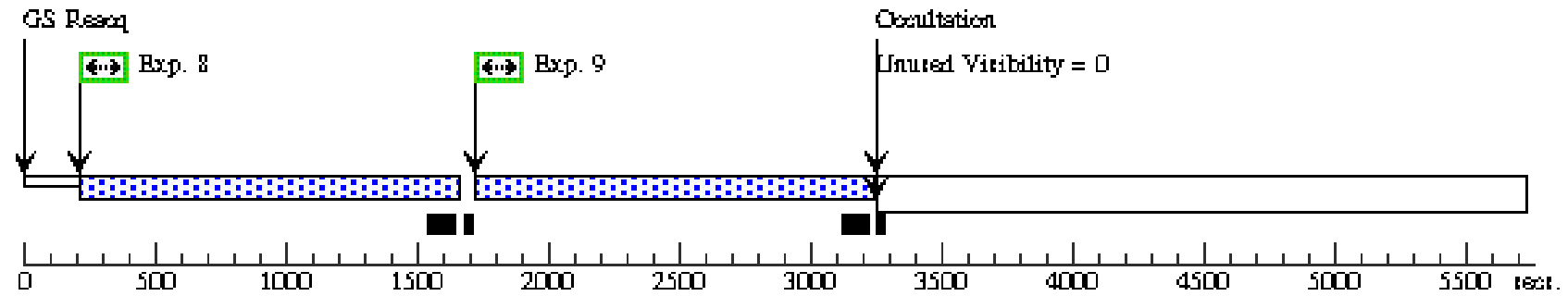
Orbit 3

Server Version: 20100505



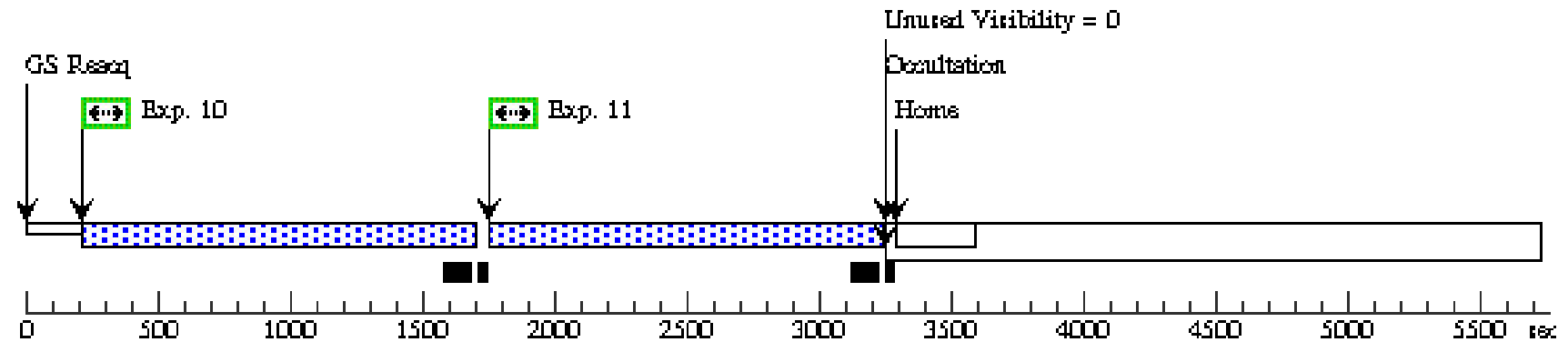
Orbit 4

Server Version: 20100505



Orbit 5

Server Version: 20100505



Proposal 12204 - Visit 02 - Probing the Ionized Gas in the Magellanic Stream

Visit	Proposal 12204, Visit 03, implementation Sat Jul 03 01:11:52 GMT 2010				
	Diagnostic Status: No Diagnostics Scientific Instruments: COS/NUV, COS/FUV Special Requirements: (none)				
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes
	(3)	B0120-28	RA: 01 22 36.7678 (20.6531992d) Dec: -28 43 21.37 (-28.72260d) Equinox: J2000	Redshift: 0.4347	V=15.479 Reference Frame: ICRS GALEX MAGS: m_FUV = 17.1 51 +/- 0.051; m_NUV = 16.925 +/- 0.028
Comments: This object was generated by the targetselector and retrieved from the 2MASS database.					

Proposal 12204 - Visit 02 - Probing the Ionized Gas in the Magellanic Stream

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	Target Acq	(3) B0120-28	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				75 Secs	
									[==>]	[1]
	2		(3) B0120-28	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=10 60; FLASH=YES; FP-POS=3			1160 Secs	
									[==>]	[1]
	3		(3) B0120-28	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=10 61; FLASH=YES; FP-POS=4			1161 Secs	
									[==>]	[1]
	4		(3) B0120-28	COS/FUV, TIME-TAG, PSA	G130M 1309 A	BUFFER-TIME=13 31; FLASH=YES; FP-POS=3			1431 Secs	
									[==>]	[2]
	5		(3) B0120-28	COS/FUV, TIME-TAG, PSA	G130M 1309 A	BUFFER-TIME=13 31; FLASH=YES; FP-POS=4			1431 Secs	
									[==>]	[2]
	6		(3) B0120-28	COS/FUV, TIME-TAG, PSA	G160M 1600 A	BUFFER-TIME=13 31; FLASH=YES; FP-POS=2			1431 Secs	
									[==>]	[3]
	7		(3) B0120-28	COS/FUV, TIME-TAG, PSA	G160M 1600 A	BUFFER-TIME=13 31; FLASH=YES; FP-POS=3			1431 Secs	
									[==>]	[3]
	8		(3) B0120-28	COS/FUV, TIME-TAG, PSA	G160M 1600 A	BUFFER-TIME=12 97; FLASH=YES; FP-POS=4			1397 Secs	
									[==>]	[4]
	9		(3) B0120-28	COS/FUV, TIME-TAG, PSA	G160M 1623 A	BUFFER-TIME=12 96; FLASH=YES; FP-POS=2			1396 Secs	
									[==>]	[4]
	10		(3) B0120-28	COS/FUV, TIME-TAG, PSA	G160M 1623 A	BUFFER-TIME=13 31; FLASH=YES; FP-POS=3			1431 Secs	
									[==>]	[5]
	11		(3) B0120-28	COS/FUV, TIME-TAG, PSA	G160M 1623 A	BUFFER-TIME=13 31; FLASH=YES; FP-POS=4			1431 Secs	
									[==>]	[5]

Orbit 1

Exp. 1

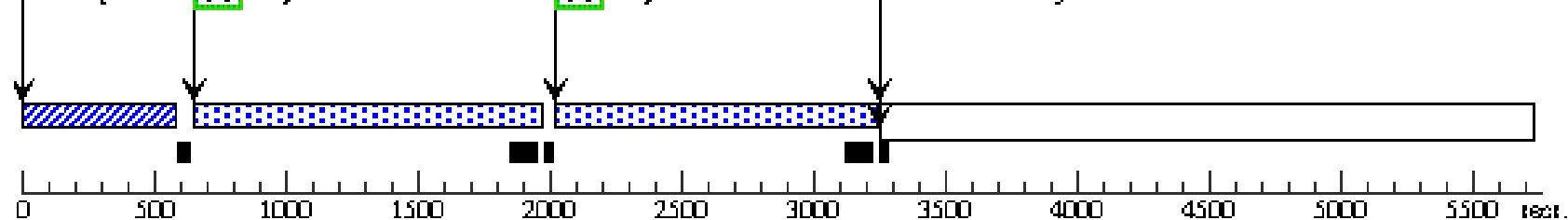
GS Acq

Exp. 2

Exp. 3

Occultation

Unused Visibility = 0



Server Version: 20100505

Orbit 2

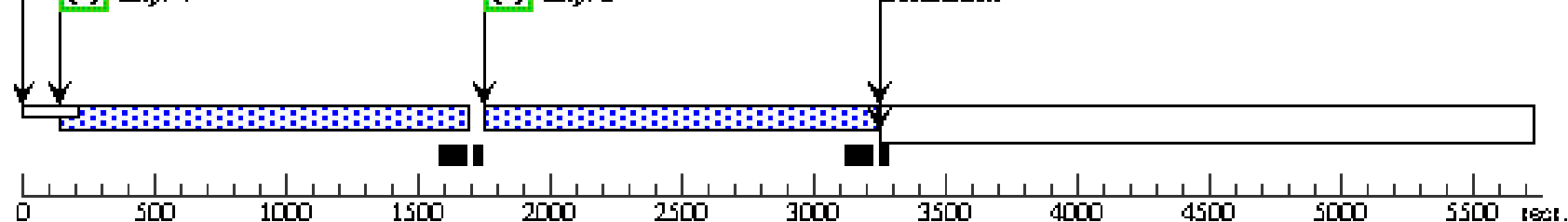
GS Reseq

Exp. 4

Exp. 5

Unused Visibility = 0

Occultation



Server Version: 20100505

Orbit 3

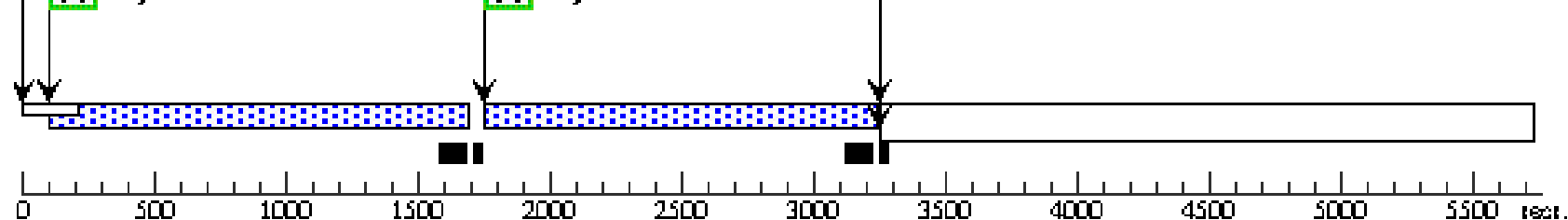
GS Reseq

Exp. 6

Exp. 7

Unused Visibility = 0

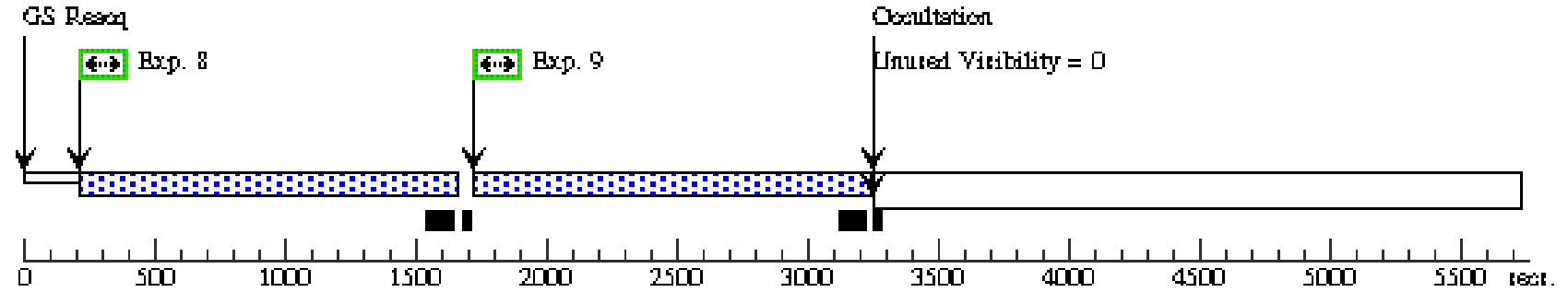
Occultation



Server Version: 20100505

Orbit 4

Server Version: 20100505



Orbit 5

Server Version: 20100505

