15098 - Calibrating ACS-SBC Using STIS at Lyman Alpha (121.567 nm)

Cycle: 25, Proposal Category: GO

(Calibration)

(Availability Mode: SUPPORTED)

INVESTIGATORS

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VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(2) SKY-NEAR-MARS	ACS/SBC	1	07-Dec-2017 02:00:17.0	yes
02	(2) SKY-NEAR-MARS WAVE	STIS/FUV-MAMA	1	07-Dec-2017 02:00:19.0	yes

2 Total Orbits Used

ABSTRACT

This short calibration program is needed to correctly interpret existing STIS and ACS data on the exospheres of several solar system objects. It will allow us to calibrate observations of planetary exospheres, and to quantitatively determine the atmospheric escape flux, from Mars, Uranus, Titan and other solar system objects, and to contribute to the calibration of the MAVEN IUVS instrument. The need for added calibration is driven by the large uncertainty in the sensitivity of ACS/SBC images at H Lyman alpha (121.6 nm) and also by the lack of a Lyman alpha flat field for STIS G140L long aperture spectra, in both cases for diffuse emissions. The STIS instrument sensitivity is well calibrated at Lyman alpha in the G140L mode through calibration star observations, but there is no flat field specifically at Lyman alpha for diffuse emissions filling the aperture. The ACS/SBC F115 mode is calibrated for a mean wavelength in the bandpass, but as an imaging instrument the specific sensitivity at Lyman alpha has not been measured.

These calibrations could be obtained through observations of the geocoronal Lyman alpha emission, comparing the count rates of STIS G140L and ACS/SBC for the same diffuse source brightness, and obtaining the STIS Lyman alpha flat field from the observations of diffuse emission. This study will be beneficial for both the planetary and the astrophysics community as hydrogen is the most abundant element in our universe and Lyman alpha is the most probable transition in H atoms. The flat field for STIS in Lyman alpha will benefit the analysis of past and future GO program data and will be delivered to STScI for use by the observational community.

OBSERVING DESCRIPTION

We propose to take ACS/SBC F115LP and STIS UV-MAMA observations of the geocorona + interplanetary hydrogen (IPH) in the G140L grating mode with the 52" x 2" slit in order to calibrate ACS SBC at Lyman alpha. This observing campaign will be executed in 2 HST orbits with the first one involving observations with ACS and the second one involving observations only with STIS. The ACS orbit will utilize the F115LP (clear) filter to image the geocorona+IPH, which allows all FUV wavelengths up to 115 nm including Lyman alpha (121.6 nm). The STIS orbit will observe the geocorona + IPH with the G140L grating. This will allow us to compare the brightness of the same diffuse Lyman alpha emission (geocorona + IPH) using both STIS (whose sensitivity at Lyman alpha is known) and ACS thereby making it possible for us to calculate the absolute calibration of the ACS/SBC detector at Lyman alpha. One important thing to note about this observation is that it has to be conducted in conjunction with the second visit of another proposal selected for this cycle (#15097). Proposal #15097 is to observe Mars with the ACS-SBC detector and they require background calibration images of the geocorona + IPH with ACS-SBC, which are critical for the analysis of those images. Those calibration images would be provided by the ACS orbit executed in this proposal which will image the sky background 5 arcminutes away from Mars and has to be executed immediately after the Mars observation orbit from visit 2 of proposal #15097.

Most of the ACS observations will be conducted in the Earth's shadow to minimize the count rate from Lyman alpha photons scattered by the geocorona. The expected sky background count rate with Lyman alpha will be well below the limit of 200,000 counts/sec, and the local count rate limits will also not be exceeded. Our earlier observations of the geocorona with ACS had maximum count rates of ~70,000 counts/sec which is well below the maximum limit of 200,000 counts/sec for solar maximum conditions. For the proposed observations, the solar Lyman alpha flux would be lower as the solar cycle is in its minimum and the HST-Sun angle would not go below 50 degrees.

The STIS observations will be conducted looking at the same part of the sky as ACS with the G140L grating and with the 52" x 2' aperture. It is important to observe the same part of the sky as ACS in order to calibrate ACS using STIS, because the sky background which is mainly the geocorona is changing constantly with HST's orbit and cannot be modeled accurately. The exposure time for STIS would be close to 40 minutes so as to allow us to construct a flat field for STIS with reduced noise fluctuations in the signal. This will help in the analysis of HST data of Uranus obtained through a previous proposal (GO-10502) to the HST program.

Proposal 15098 - Visit 01 - Calibrating ACS-SBC Using STIS at Lyman Alpha (121.567 nm)

Visit

Proposal 15098, Visit 01, implementation Thu Dec 07 07:00:20 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/SBC

Special Requirements: ORIENT 283D TO 290 D

Comments: To be executed just after the Mars observing orbit of visit 2 of GO-15097.

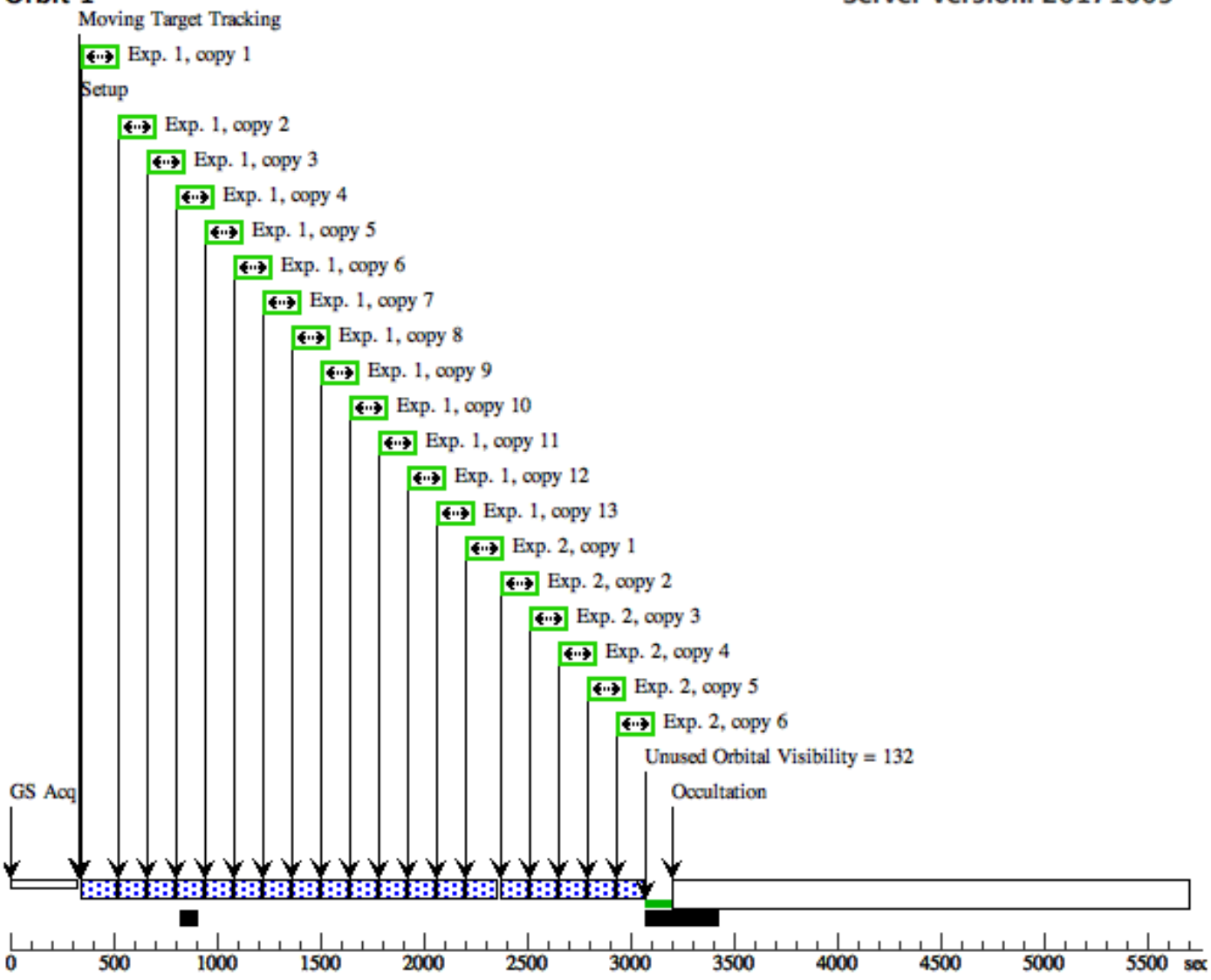
Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(2)	SKY-NEAR-MARS	STD=MARS	TYPE=POS_ANGLE,RAD=295,ANG =0,REF=NORTH			EARTH

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(0)	(2) SKY-NEAR-MARS	ACS/SBC, ACCUM, SBC	F115LP				100 Secs X 13 (1300 Secs)	
								[==>(Copy 1)]	
								[==>(Copy 2)]	
								[==>(Copy 3)]	
								[==>(Copy 4)]	
								[==>(Copy 5)]	
								[==>(Copy 6)]	
								[==>(Copy 7)]	***[1]***
								[==>(Copy 8)]	
								[==>(Copy 9)]	
								[==>(Copy 10)]	
								[==>(Copy 11)]	
								[==>(Copy 12)]	
								[==>(Copy 13)]	
2	(0)	(2) SKY-NEAR-MARS	ACS/SBC, ACCUM, SBC	F140LP				100 Secs X 6 (600 Secs)	
								[==>(Copy 1)]	
								[==>(Copy 2)]	
								[==>(Copy 3)]	***[1]***
								[==>(Copy 4)]	
								[==>(Copy 5)]	
								[==>(Copy 6)]	

Orbit Structure



Visit

Proposal 15098, Visit 02, implementation

Thu Dec 07 07:00:20 GMT 2017

Diagnostic Status: Warning

Scientific Instruments: STIS/FUV-MAMA

Special Requirements: ORIENT 283D TO 290 D; AFTER 01 BY 0.5 Orbits TO 1.5 Orbits

Comments: To be executed just after the Mars observing orbit of visit 2 of GO-15097.

Diagnostics

(Visit 02) Warning (Form): A target acquisition should probably be performed before doing spectroscopy or coronography with STIS or COS.

Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(2)	SKY-NEAR-MARS	STD=MARS	TYPE=POS_ANGLE,RAD=295,ANG =0,REF=NORTH			EARTH

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.sp.10 38672)	(2) SKY-NEAR-MA RS	STIS/FUV-MAMA, TIME-TAG, 52X2	G140L 1425 A	BUFFER-TIME=44 5; WAVECAL=NO			2714 Secs (2714 Secs)	
								[==>]	*[1]*
2		WAVE	STIS/FUV-MAMA, ACCUM, 52X0.05	G140L 1425 A				*[==>]*	*[1]*

Orbit Structure