



14349 - The High-Energy Environs of the Anomalous Coronal Source Alpha Persei

Cycle: 23, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>	<i>E-Mail</i>
Dr. Thomas R. Ayres (PI) (Contact)	University of Colorado at Boulder	thomas.ayres@colorado.edu

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>
10	(1) HD20902	COS/FUV	1	21-Oct-2015 21:28:02.0	yes
11	(1) HD20902	COS/FUV	1	21-Oct-2015 21:28:04.0	yes
12	(1) HD20902	WFC3/UVIS	1	21-Oct-2015 21:28:06.0	yes
13	(1) HD20902	WFC3/UVIS	1	21-Oct-2015 21:28:09.0	yes

4 Total Orbits Used

ABSTRACT

This is a joint Chandra/HST program to investigate the F-type supergiant Alpha Persei, brightest star in the young (50 Myr) open cluster that bears its name. The central question is whether the bright ROSAT X-ray source identified as Alpha Per truly is associated with the supergiant (which would make it quite an anomalous object in its class), or instead is due to a low-mass coronally active cluster member in the immediate vicinity of Alpha Per, but which has escaped detection owing to the glare of the very bright star nearby. In fact, the ROSAT LX is similar to that of active G dwarfs in the young cluster, and the X-ray source appears to be shifted slightly from the optical position of the bright star. Furthermore, a brief COS SNAPSHOT FUV spectrum of Alpha Per appeared to lack significant high-energy features (e.g., Si IV 140 nm) expected from a powerful X-ray source, although the bright FUV photospheric continuum of the warm supergiant was a major source of interference. The observational objectives of the HST part of the program are: (1) image the field with WFC3 to pin down positions of any faint, low-mass stars in the immediate vicinity of the supergiant

(chromospherically active dwarfs have a large contrast advantage, for example, at Mg II 280 nm); and (2) take a deeper COS FUV spectrum than was possible in the Cycle 17 SNAPshot program, including the important Lyman Alpha region, which was forbidden in the SNAP program owing to safety issues. We now know that the Lyman Alpha observation would be safe, and access to the G130M side-B spectrum would capture key "hot lines" like N V 124 nm, where the FUV continuum is weaker, to help characterize the activity levels of the iconic supergiant.

OBSERVING DESCRIPTION

The Alpha Per observing program consists of two parts: COS FUV spectroscopy and WFC3 imaging.

The COS spectroscopy is accomplished in two 1-orbit visits, at approximately orthogonal ORIENT angles to allow the potential separation of a doubled spectrum, if the putative low-mass active companion to Alpha Per happens to fall within an arcsecond, or so, of the bright star (which will be inaccessible to the WFC3 imaging owing to saturation of the bright star). In each visit, the initial acquisition is done via a 9-step spiral search, followed by a PEAKXD, and then by a PEAKD, all in dispersed light with G130M-1291 to accurately center this UV-bright target. Following the acquisition, a G130M-1291 spectrum is taken, with equal exposures at each of the four standard FP-POS steps, to fill out the single orbit. Based on the lower activity level of Alpha Per, inferred from the 2011 SNAPshot FUV observation, compared with existing STIS observations of similar F and G supergiants, there is no issue with COS bright limits at Lyman Alpha, which originally prevented use of G130M side B for the SNAP program.

(After review of the Phase2 submission by STScI, it was recommended that the second COS visit be done in a different CENWAVE from the first, in order to eliminate the spectral gap that otherwise would exist. This would be mainly for the archival value of the exposures, since for the original CENWAVE=1291, the gap between 1274-1292 Å does not contain any useful spectral diagnostics as far as the scientific objectives of the ALP-PER program are concerned. Accordingly, the second CENWAVE was changed to 1309, with a gap between 1293-1310 Å, covering the region of the chromospheric O I triplet lines, which, however, usually are severely contaminated by oxygen skyglow in FUV-faint objects like ALP-PER. The change in CENWAVE did not have any impact on the exposure duration or scheduling.)

The WFC3 part of the program also is straightforward. The objective is to image the near field of the bright star Alpha Per in the visible and near-UV, to ferret out any faint, low-mass dwarfs that might fall near the supergiant, either coincidentally or possibly as a wide binary companion. The environs around Alpha Per already have been mapped in H-Alpha from the ground (with the GIFS coronagraph on the APO 3.5 m) down to about 20" from the bright star: the inner region was blocked by GIF's occulting finger. Thus, the full FOV of WFC3/UVIS, which would be very inefficient owing to the short exposure times involved, is not needed. Instead, context imaging will be provided by the UVIS2-2K2C 1/4-subarray, to reduce the buffer transfer overhead and provide an 80"x80" FOV, entirely adequate for the purpose. Three narrow-band filters -- F280N (Mg II),

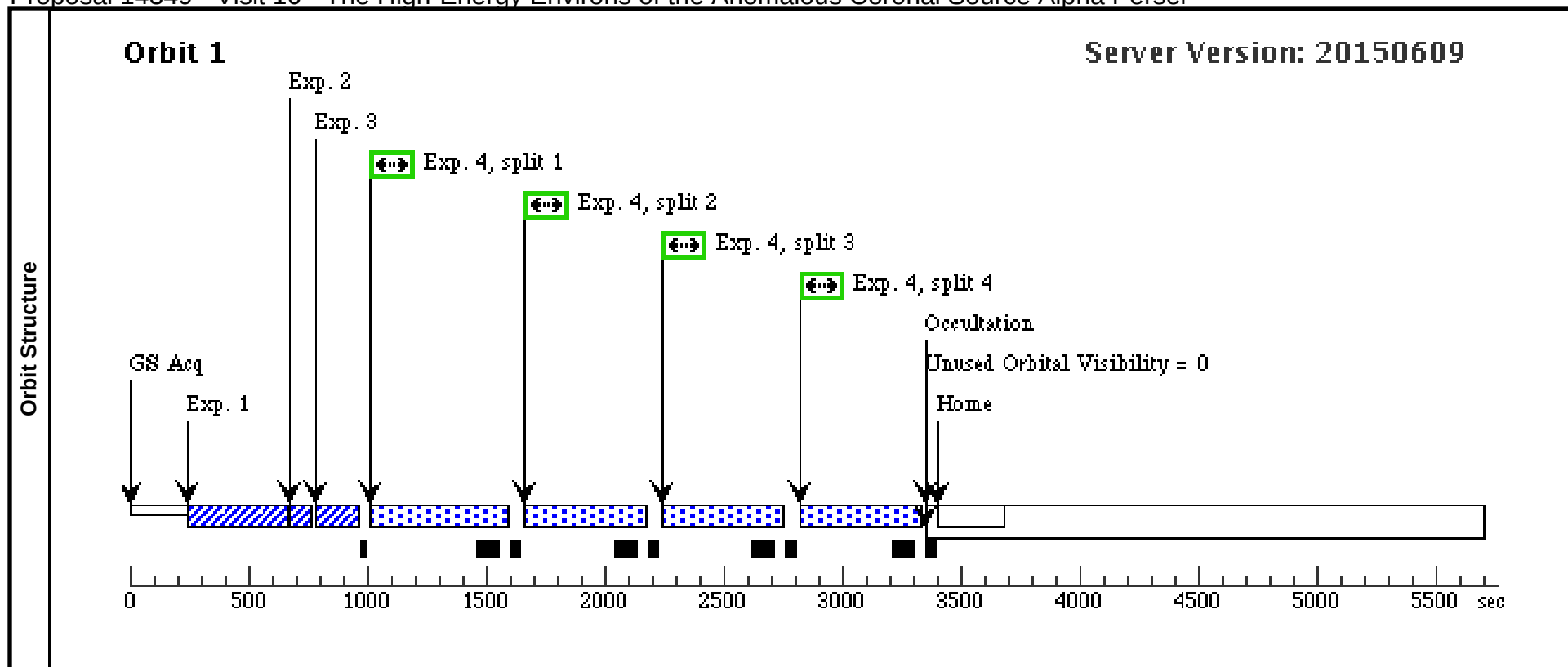
Proposal 14349 (STScI Edit Number: 1, Created: Wednesday, October 21, 2015 8:28:10 PM EST) - Overview

F395N (Ca II), and F656N (H-Alpha) -- were selected: an active low-mass star is expected to show enhanced chromospheric emission in these filters in contrast to the broad absorption features of the warm supergiant. Exposure times were selected for each filter to maintain about the same level of saturation of the bright star, and allow a nearby solar-spectrum companion with $V \sim 11$ (typical of G dwarfs in the Alpha Per cluster) to be imaged with $S/N \sim 150$. The context exposures were CR-slit into pairs for cosmic-ray mitigation. In addition, post-flashes of 12 e- were included to improve the CTE in these otherwise low-background images. In addition to the three context images, a second series of exposures are made in the UVIS2-C1K1C 1/8-subarray to focus in on the 40"x40" region close to Alp Per where the putative interloping X-ray source is most likely to be found. Use of the 1/8-subarrays forces the buffer transfer into the earth occultation, so that no exposure time is lost. The same three narrow filters are used, and with the same total exposure time for each, except that now the exposures are CR-split into 4, effectively halving the subexposure integrations, and improving cosmic-ray rejection. In the inner region covered by the 1/8-subarray, the total exposure is doubled compared with the broader context images. This hierarchical scheme is the most effective way to tie the Alp Per field into the existing astrometry provided by the GIFS imaging (which itself is tied into other astrometric systems), while achieving a high level of exposure in the central region without loss of time to buffer dumps. Since super high-precision astrometry is not required to achieve the scientific goals of the program, dithering was not used. A gross level of dithering, however, is accomplished by combining the 2K and 1K imaging, which have different centers on the UVIS2 chip.

Two WFC3 visits were specified. An ORIENT constraint was introduced in the first visit to place the putative low-mass active star (based on the PA deduced from the ROSAT offset) in approximately the same CCD row as the bright star, to minimize the influence of bleeding from the saturated image of the bright supergiant. A 30 degree rotation from the optimum orientation was imposed in the second visit to minimize the effect of diffraction spikes (and bleeding) on the overall field, especially in the event that any companion star was at a different PA than suggested by the ROSAT observation.

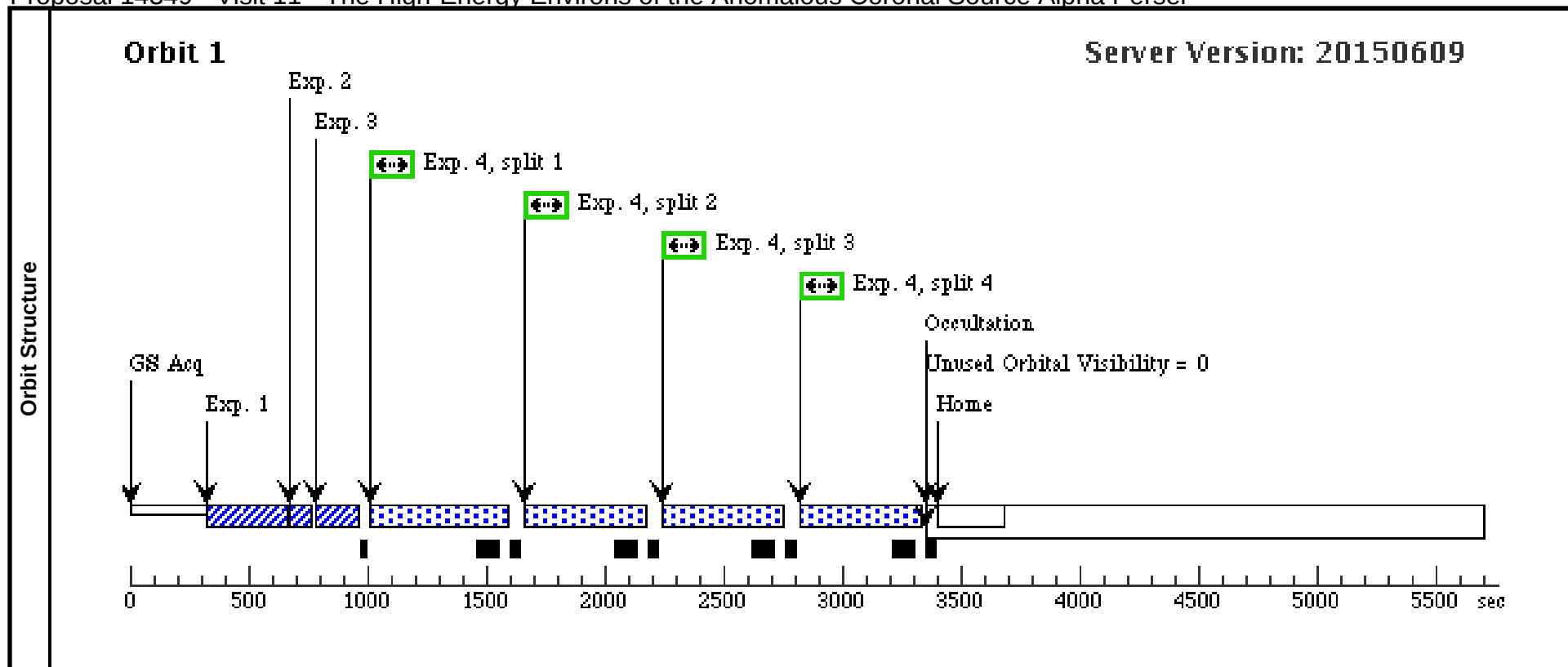
Proposal 14349 - Visit 10 - The High-Energy Environs of the Anomalous Coronal Source Alpha Persei

Visit	Proposal 14349, Visit 10, implementation									Thu Oct 22 01:28:10 GMT 2015
	Diagnostic Status: No Diagnostics									
	Scientific Instruments: COS/FUV									
	Special Requirements: ORIENT 0D TO 30 D; ORIENT 180D TO 210 D									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(1)	HD20902	RA: 03 24 19.3701 (51.0807088d)	Proper Motion RA: +0.02375 arcsec/yr		V=+1.79+/-0.1		Reference Frame: ICRS		
		Alt Name1: ALP-PER	Dec: +49 51 40.25 (49.86118d)	Proper Motion Dec: -0.02623 arcsec/yr						
			Equinox: J2000	Parallax: 0.006"						
	Epoch of Position: 2000									
	Radial Velocity: -2.0 km/sec									
	Comments: Extended=NO									
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(COS.sa.743 661)	(1) HD20902	COS/FUV, ACQ/SEARCH, PSA	G130M	SCAN-SIZE=3;			5 Secs (5 Secs)	
					1291 A	STEP-SIZE=1.767;			[==>]	[1]
						CENTER=FLUX-W				
						T-FLR				
	Comments: ETC predicts S/N~40 for segment A in 5 s, which exceeds recommended S/N~25.									
	2	(COS.sa.743 661)	(1) HD20902	COS/FUV, ACQ/PEAKXD, PSA	G130M				5 Secs (5 Secs)	
					1291 A				[==>]	[1]
	Comments: .									
	3	(COS.sa.743 661)	(1) HD20902	COS/FUV, ACQ/PEAKD, PSA	G130M	NUM-POS=5;			5 Secs (5 Secs)	
				1291 A	STEP-SIZE=0.9;			[==>]	[1]	
					CENTER=FLUX-W					
					T-FLR					
Comments: ETC predicts S/N~40 for segment A, which exceeds recommended S/N~25.										
4	(COS.sp.743 663)	(1) HD20902	COS/FUV, TIME-TAG, PSA	G130M	BUFFER-TIME=34				459 Secs (1836 Secs)	
				1291 A	9;				[==>(Split 1)]	[1]
					FP-POS=ALL				[==>(Split 2)]	
									[==>(Split 3)]	
									[==>(Split 4)]	



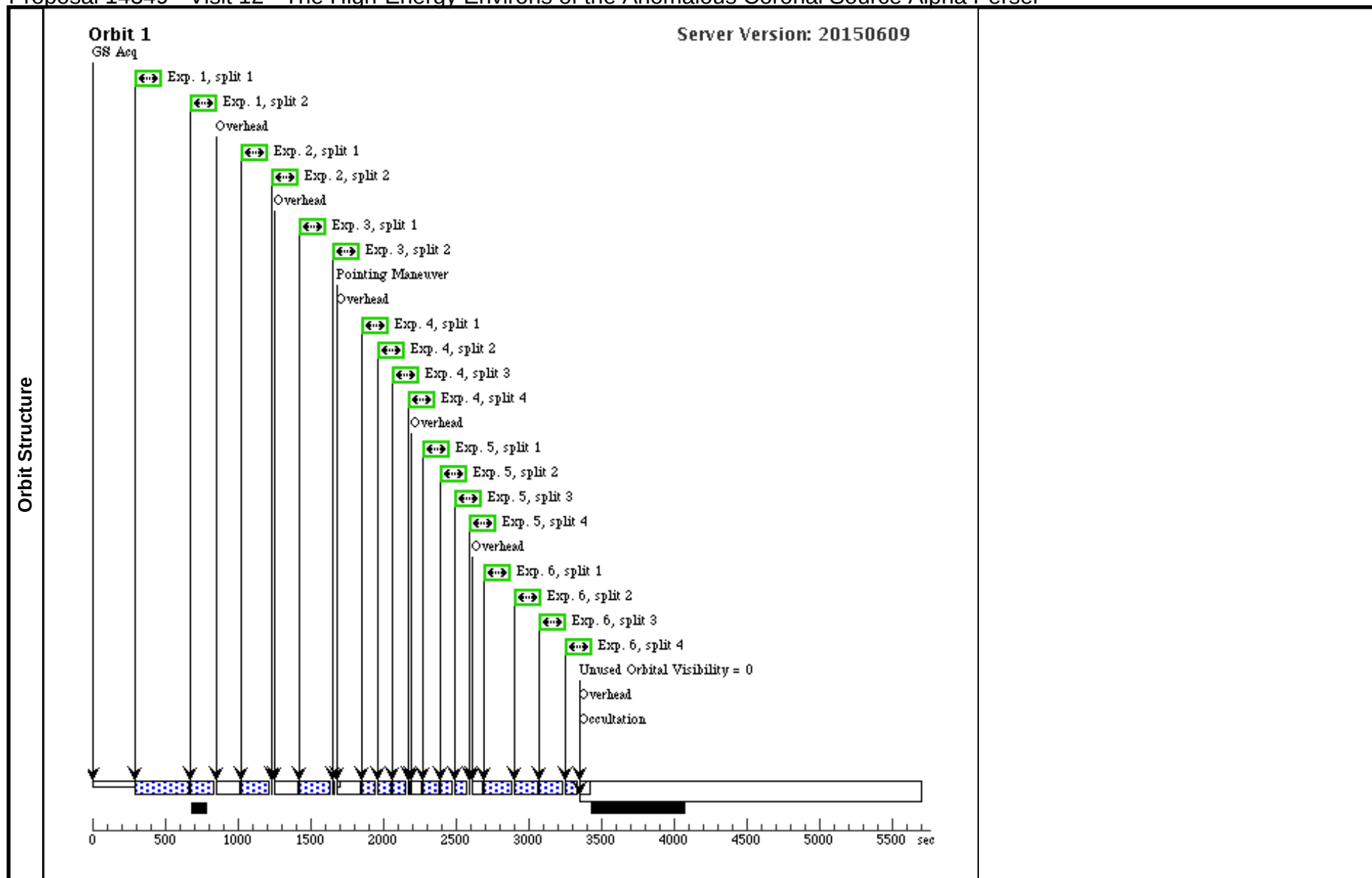
Proposal 14349 - Visit 11 - The High-Energy Environs of the Anomalous Coronal Source Alpha Persei

Visit	Proposal 14349, Visit 11, implementation									Thu Oct 22 01:28:10 GMT 2015
	Diagnostic Status: No Diagnostics									
	Scientific Instruments: COS/FUV									
	Special Requirements: ORIENT 90D TO 120 D; ORIENT 270D TO 300 D									
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous	
	(1)	HD20902	RA: 03 24 19.3701 (51.0807088d)		Proper Motion RA: +0.02375 arcsec/yr		V=+1.79+/-0.1		Reference Frame: ICRS	
		Alt Name1: ALP-PER	Dec: +49 51 40.25 (49.86118d)		Proper Motion Dec: -0.02623 arcsec/yr					
			Equinox: J2000		Parallax: 0.006"					
					Epoch of Position: 2000					
					Radial Velocity: -2.0 km/sec					
	Comments: Extended=NO									
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(COS.sa.743 661)	(1) HD20902	COS/FUV, ACQ/SEARCH, PSA	G130M	SCAN-SIZE=3;			5 Secs (5 Secs)	
					1309 A	STEP-SIZE=1.767;			[==>]	[1]
						CENTER=FLUX-W				
						T-FLR				
	Comments: ETC predicts S/N~40 for segment A in 5 s, which exceeds recommended S/N~25.									
	2	(COS.sa.743 661)	(1) HD20902	COS/FUV, ACQ/PEAKXD, PSA	G130M				5 Secs (5 Secs)	
					1309 A				[==>]	[1]
	Comments: .									
	3	(COS.sa.743 661)	(1) HD20902	COS/FUV, ACQ/PEAKD, PSA	G130M	NUM-POS=5;			5 Secs (5 Secs)	
				1309 A	STEP-SIZE=0.9;			[==>]	[1]	
					CENTER=FLUX-W					
					T-FLR					
Comments: ETC predicts S/N~40 for segment A, which exceeds recommended S/N~25.										
4	(COS.sp.743 663)	(1) HD20902	COS/FUV, TIME-TAG, PSA	G130M	BUFFER-TIME=34				459 Secs (1836 Secs)	
				1309 A	9;				[==>(Split 1)]	[1]
					FP-POS=ALL				[==>(Split 2)]	
									[==>(Split 3)]	
									[==>(Split 4)]	



Proposal 14349 - Visit 12 - The High-Energy Environs of the Anomalous Coronal Source Alpha Persei

Visit	Proposal 14349, Visit 12, implementation								Thu Oct 22 01:28:10 GMT 2015	
	Diagnostic Status: No Diagnostics									
	Scientific Instruments: WFC3/UVIS									
	Special Requirements: ORIENT 0D TO 15 D; ORIENT 345D TO 359.99 D; ORIENT 165D TO 195 D									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	HD20902	RA: 03 24 19.3701 (51.0807088d)	Proper Motion RA: +0.02375 arcsec/yr	V=+1.79+/-0.1	Reference Frame: ICRS				
		Alt Name1: ALP-PER	Dec: +49 51 40.25 (49.86118d)	Proper Motion Dec: -0.02623 arcsec/yr						
			Equinox: J2000	Parallax: 0.006"						
			Epoch of Position: 2000							
			Radial Velocity: -2.0 km/sec							
	Comments: Extended=NO									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(1) HD20902	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F280N	CR-SPLIT=2; FLASH=12				322 Secs (322 Secs)	
									[==>(Split 1)]	[1]
									[==>(Split 2)]	
	2	(1) HD20902	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F395N	CR-SPLIT=2; FLASH=12				8 Secs (8 Secs)	
									[==>(Split 1)]	[1]
									[==>(Split 2)]	
	3	(1) HD20902	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F656N	CR-SPLIT=2; FLASH=12				30 Secs (30 Secs)	
									[==>(Split 1)]	[1]
									[==>(Split 2)]	
	4	(1) HD20902	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F656N	CR-SPLIT=4; FLASH=12				30 Secs (30 Secs)	
									[==>(Split 1)]	[1]
									[==>(Split 2)]	
									[==>(Split 3)]	
									[==>(Split 4)]	
	5	(1) HD20902	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F395N	CR-SPLIT=4; FLASH=12				8 Secs (8 Secs)	
[==>(Split 1)]									[1]	
[==>(Split 2)]										
[==>(Split 3)]										
[==>(Split 4)]										
6	(1) HD20902	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F280N	CR-SPLIT=4; FLASH=12				322 Secs (322 Secs)		
								[==>(Split 1)]	[1]	
								[==>(Split 2)]		
								[==>(Split 3)]		
								[==>(Split 4)]		



Proposal 14349 - Visit 13 - The High-Energy Environs of the Anomalous Coronal Source Alpha Persei

Visit	Proposal 14349, Visit 13, implementation						Thu Oct 22 01:28:11 GMT 2015			
	Diagnostic Status: No Diagnostics									
	Scientific Instruments: WFC3/UVIS									
	Special Requirements: ORIENT 30D TO 60 D; ORIENT 195D TO 225 D									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	HD20902	RA: 03 24 19.3701 (51.0807088d)	Proper Motion RA: +0.02375 arcsec/yr	V=+1.79+/-0.1	Reference Frame: ICRS				
		Alt Name1: ALP-PER	Dec: +49 51 40.25 (49.86118d)	Proper Motion Dec: -0.02623 arcsec/yr						
			Equinox: J2000	Parallax: 0.006"						
			Epoch of Position: 2000							
			Radial Velocity: -2.0 km/sec							
	Comments: Extended=NO									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(1) HD20902	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F280N	CR-SPLIT=2; FLASH=12			322 Secs (322 Secs)	
									[==>(Split 1)]	[1]
									[==>(Split 2)]	
	2		(1) HD20902	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F395N	CR-SPLIT=2; FLASH=12			8 Secs (8 Secs)	
									[==>(Split 1)]	[1]
									[==>(Split 2)]	
	3		(1) HD20902	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F656N	CR-SPLIT=2; FLASH=12			30 Secs (30 Secs)	
									[==>(Split 1)]	[1]
									[==>(Split 2)]	
	4		(1) HD20902	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F656N	CR-SPLIT=4; FLASH=12			30 Secs (30 Secs)	
									[==>(Split 1)]	[1]
									[==>(Split 2)]	
									[==>(Split 3)]	
									[==>(Split 4)]	
	5		(1) HD20902	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F395N	CR-SPLIT=4; FLASH=12			8 Secs (8 Secs)	
									[==>(Split 1)]	[1]
									[==>(Split 2)]	
									[==>(Split 3)]	
									[==>(Split 4)]	
	6		(1) HD20902	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F280N	CR-SPLIT=4; FLASH=12			322 Secs (322 Secs)	
									[==>(Split 1)]	[1]
									[==>(Split 2)]	
									[==>(Split 3)]	
									[==>(Split 4)]	

