14848 - Cracking the Conundrum of F Supergiant Coronae

Cycle: 24, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
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VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
A0	(1) HD36673	COS/FUV	2	17-Jan-2017 21:04:41.0	yes
B0	(2) HD80404	COS/FUV	2	17-Jan-2017 21:04:44.0	yes
C0	(3) HD159532	COS/FUV	2	17-Jan-2017 21:04:46.0	yes

6 Total Orbits Used

ABSTRACT

This is the HST part of a joint Chandra/HST program.

BACKGROUND: Mid-F supergiant Alpha Persei, of the eponymous young cluster, is a strong X-ray source, given its minimal FUV emission, with a narrow-line FUV spectrum unlike other yellow supergiants. A slight positional offset in a 1990's ROSAT image suggested that a hyperactive companion might be responsible for the X-ray anomaly. However, a recent Chandra pointing found that the source seen by ROSAT in fact is coincident with Alpha Per. Further, the related supergiant Canopus also exhibits the same X-ray and FUV peculiarities, with a surprising possible connection to Cepheid variables in their FUV low states.

THIS PROPOSAL: New X-ray and FUV observations of additional F supergiants could help decide whether the coronal anomalies of Alpha Per and

Canopus are due to unseen (unresolved) hyperactive dwarf companions, or instead are a normal attribute of this exotic class, at the extreme edge of convection. This is a key missing piece in the unfolding narrative of hot (1-10 MK) stellar coronae.

OBSERVING DESCRIPTION

FUV spectroscopy from HST's ultra-sensitive Cosmic Origins Spectrograph (COS) is a powerful complement to the coronal X-ray imaging by Chandra. The proposed three new F-supergiant targets are comparable in visual brightness to Alpha Persei, which was successfully observed by COS in Cycle 23. COS grating G130M can be used with two CENWAVEs -- 1291 and 1327 -- to help mitigate fixed pattern noise and bridge the detector gaps. The spectral range is 114-147 nm. The two settings allow continuous coverage of the important O I triplet region (130 nm); to hopefully catch the periods of spacecraft night when the oxygen skyglow is significantly diminished so that pristine profiles of the these important stellar chromospheric emissions can be recovered. A single two-orbit visit per target is sufficient, based on anticipated S/N ratios (in the F-star FUV continuum) deduced from COS Spectroscopic ETC runs. 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-1327, to accurately center these FUV-bright targets. CENWAVE 1327 is the reddest setting of G130M, so captures the highest intensity part of the F star photospheric continuum, which rises steeply toward longer wavelengths through the FUV region. Acquisition exposure times (to achieve S/N~40) were derived from the COS ETC using a Castelli-Kurucz F0I model, normalized to the individual visual magnitudes, as verified against IUE spectra (which tend to have best exposures for these stars in the 150-170 nm interval). The inferred ACQ exposure times then were boosted by factors of 7--10, to be on the safe side (since IUE FUV spectra of F-stars are contaminated to an unknown degree by scattered light). The chosen exposure times, 4.0-5.2 s, are similar to the 5 s that was used for cooler (F5I) Alpha Persei, and which produced a successful acquisition for that target. Following the centering process, a G130M-1327 spectrum is taken, with equal exposures at each of the four standard FP-POS steps, to fill out the first orbital visibility period. The second orbit is occupied by a G130M-1291 exposure, also split into standard FP-POS sub-exposures. Based on IUE and FUSE spectra, the three targets are similar in activity level to Alpha Per, so there is no issue with COS bright limits at Lyman Alpha (interstellar absorption also likely will strongly attenuate any intrinsic hydrogen emission from these stars).

Visit

Proposal 14848, Visit A0, implementation Wed Jan 18 02:04:47 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV

Special Requirements: (none)

Fixed Targets

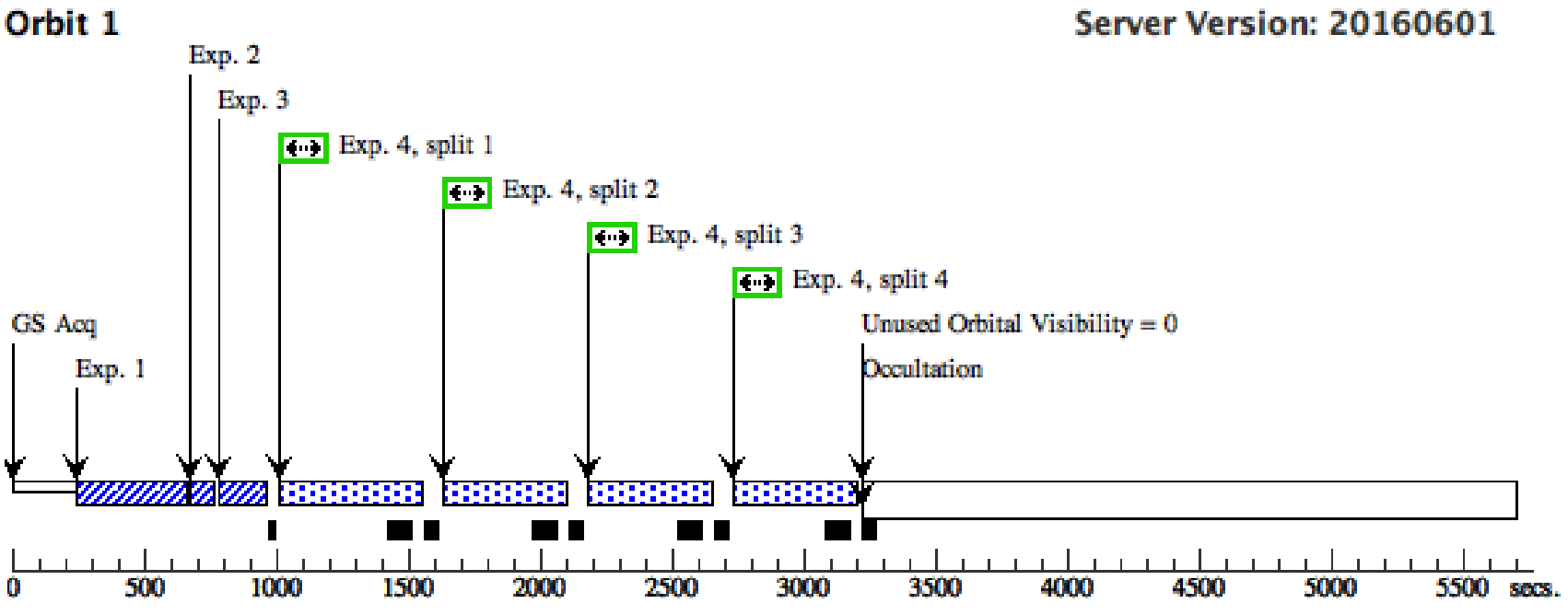
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HD36673	RA: 05 32 43.8160 (83.1825667d)	Proper Motion RA: +3.6 mas/yr	V=+2.57+/-0.1	Reference Frame: ICRS
	Alt Name1: ALP-LEP	Dec: -17 49 20.24 (-17.82229d)	Proper Motion Dec: +1.2 mas/yr		
		Equinox: J2000	Parallax: 0.0"		
			Epoch of Position: 2000		
			Radial Velocity: 0.0 km/sec		

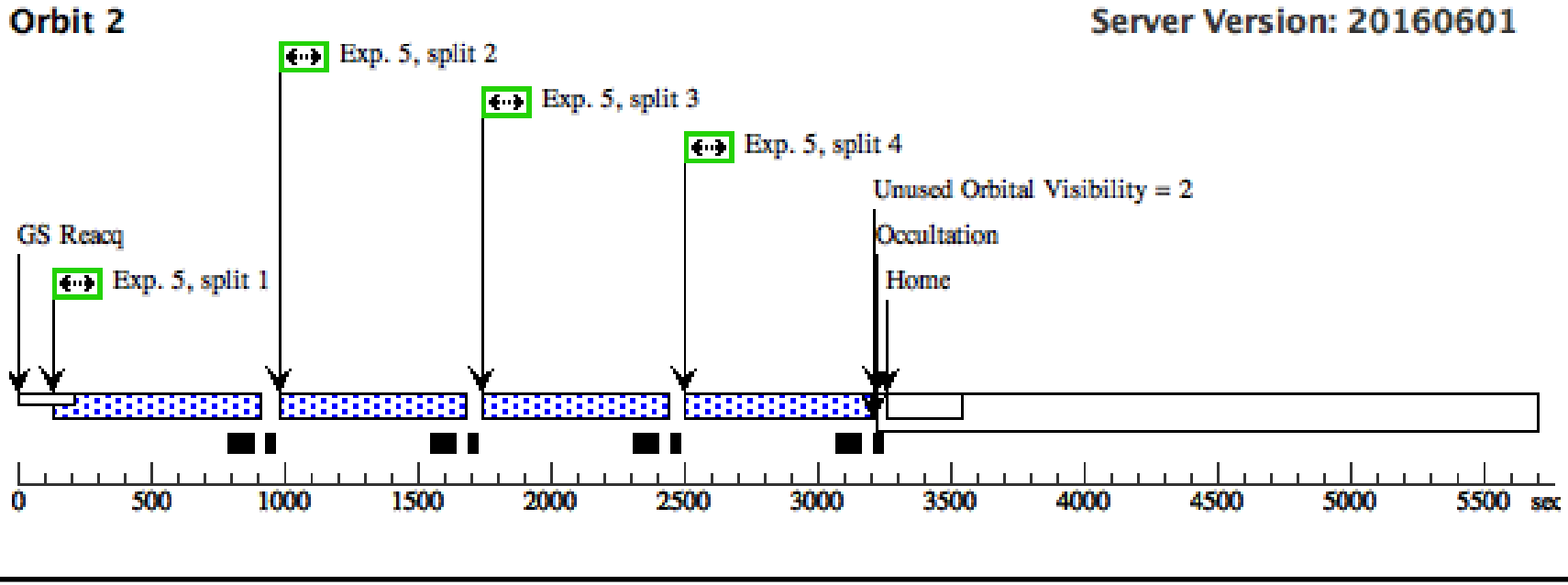
Comments: Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(COS.sa.828 691)	(1) HD36673	COS/FUV, ACQ/SEARCH, PSA	G130M 1327 A	SCAN-SIZE=3; STEP-SIZE=1.767; CENTER=FLUX-WT-FLR			5.2 Secs (5.2 Secs) *[==>]*	***[1]***
Comments: ETC predicts S/N~40 in 0.7 s. texp increased x7 for extra margin.									
2	(COS.sa.828 691)	(1) HD36673	COS/FUV, ACQ/PEAKXD, PSA	G130M 1327 A				5.2 Secs (5.2 Secs) *[==>]*	***[1]***
Comments: ETC predicts S/N~40 in 0.7 s. texp increased x7 for extra margin.									
3	(COS.sa.828 691)	(1) HD36673	COS/FUV, ACQ/PEAKD, PSA	G130M 1327 A	NUM-POS=5; STEP-SIZE=0.9; CENTER=FLUX-WT-FLR			5 Secs (5 Secs) *[==>]*	***[1]***
Comments: ETC predicts S/N~40 in 0.7 s. texp increased x7 for extra margin.									
4	(COS.sp.828 697)	(1) HD36673	COS/FUV, TIME-TAG, PSA	G130M 1327 A	BUFFER-TIME=308; FP-POS=ALL			418 Secs (1672 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	***[1]***
5	(COS.sp.828 699)	(1) HD36673	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=537; FP-POS=ALL			647 Secs (2588 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	***[2]***

Orbit Structure





Visit

Proposal 14848, Visit B0, implementation Wed Jan 18 02:04:47 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV

Special Requirements: (none)

Fixed Targets

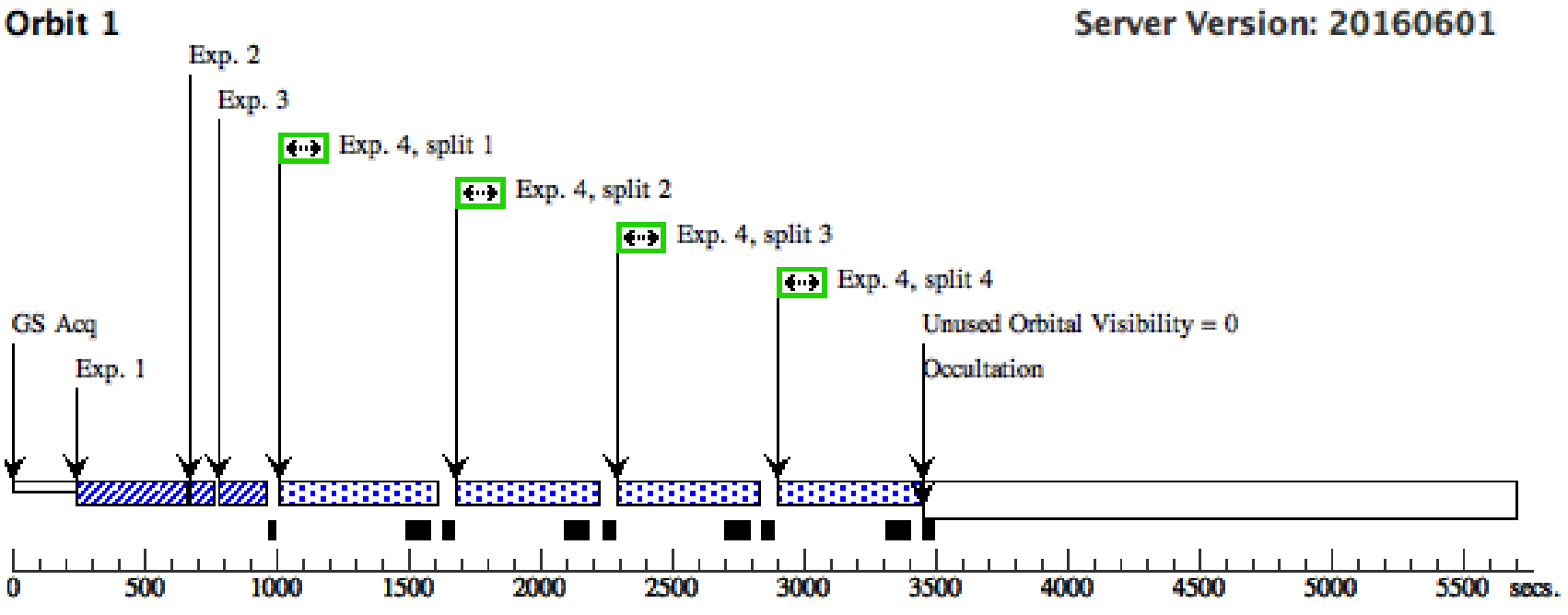
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	HD80404	RA: 09 17 5.4070 (139.2725292d)	Proper Motion RA: -18.9 mas/yr	V=+2.26+/-0.1	Reference Frame: ICRS
	Alt Name1: IOT-CAR	Dec: -59 16 30.84 (-59.27523d)	Proper Motion Dec: +12.0 mas/yr		
		Equinox: J2000	Parallax: 0.0"		
			Epoch of Position: 2000		
			Radial Velocity: 0.0 km/sec		

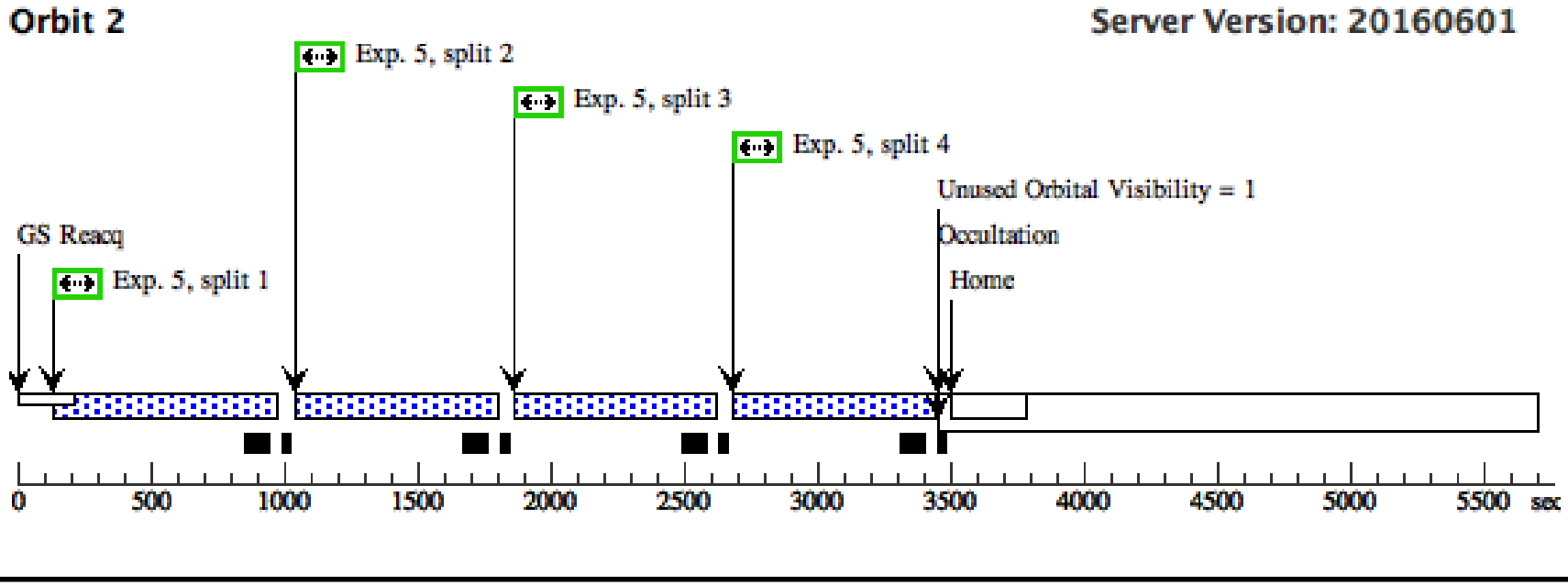
Comments: Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(COS.sa.828 692)	(2) HD80404	COS/FUV, ACQ/SEARCH, PSA	G130M 1327 A	SCAN-SIZE=3; STEP-SIZE=1.767; CENTER=FLUX-WT-FLR			5.2 Secs (5.2 Secs) *[==>]*	***[1]***
Comments: ETC predicts S/N~40 in 0.6 s. texp increased x8 for extra margin.									
2	(COS.sa.828 692)	(2) HD80404	COS/FUV, ACQ/PEAKXD, PSA	G130M 1327 A				5.2 Secs (5.2 Secs) *[==>]*	***[1]***
Comments: ETC predicts S/N~40 in 0.6 s. texp increased x8 for extra margin.									
3	(COS.sa.828 692)	(2) HD80404	COS/FUV, ACQ/PEAKD, PSA	G130M 1327 A	NUM-POS=5; STEP-SIZE=0.9; CENTER=FLUX-WT-FLR			5.2 Secs (5.2 Secs) *[==>]*	***[1]***
Comments: ETC predicts S/N~40 in 0.6 s. texp increased x8 for extra margin.									
4	(COS.sp.828 701)	(2) HD80404	COS/FUV, TIME-TAG, PSA	G130M 1327 A	BUFFER-TIME=374; FP-POS=ALL			484 Secs (1936 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	***[1]***
5	(COS.sp.828 700)	(2) HD80404	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=596; FP-POS=ALL			706 Secs (2824 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	***[2]***

Orbit Structure





Visit

Proposal 14848, Visit C0, implementation Wed Jan 18 02:04:47 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV

Special Requirements: (none)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	HD159532	RA: 17 37 19.1300 (264.3297083d)	Proper Motion RA: +5.5 mas/yr	V=+1.86+/-0.1	Reference Frame: ICRS
	Alt Name1: THETA-SCO	Dec: -42 59 52.18 (-42.99783d)	Proper Motion Dec: -3.1 mas/yr		
		Equinox: J2000	Parallax: 0.0"		
			Epoch of Position: 2000		
			Radial Velocity: 0.0 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.828 693)	(3) HD159532	COS/FUV, ACQ/SEARCH, PSA	G130M 1327 A	SCAN-SIZE=3; STEP-SIZE=1.767; CENTER=FLUX-WT-FLR			4.2 Secs (4.2 Secs) *[==>]*	***[1]***
	Comments: ETC predicts S/N~40 in 0.4 s. texp increased x10 for extra margin.								
2	(COS.sa.828 693)	(3) HD159532	COS/FUV, ACQ/PEAKXD, PSA	G130M 1327 A				4.0 Secs (4 Secs) *[==>]*	***[1]***
	Comments: ETC predicts S/N~40 in 0.4 s. texp increased x10 for extra margin.								
3	(COS.sa.828 693)	(3) HD159532	COS/FUV, ACQ/PEAKD, PSA	G130M 1327 A	NUM-POS=5; STEP-SIZE=0.9; CENTER=FLUX-WT-FLR			4.0 Secs (4 Secs) *[==>]*	***[1]***
	Comments: ETC predicts S/N~40 in 0.4 s. texp increased x10 for extra margin.								
4	(COS.sp.828 702)	(3) HD159532	COS/FUV, TIME-TAG, PSA	G130M 1327 A	BUFFER-TIME=341; FP-POS=ALL			451 Secs (1804 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	***[1]***
5	(COS.sp.828 703)	(3) HD159532	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=559; FP-POS=ALL			669 Secs (2676 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	***[2]***

Orbit Structure