12992 - Are Young Stars Condensing Out of the Rapidly-Cooling Intracluster Medium?

Cycle: 20, Proposal Category: GO

(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	(1) ABELL1795-FILAMENT	COS/FUV COS/NUV	6	11-Sep-2012 21:03:54.0	yes

6 Total Orbits Used

ABSTRACT

The delicate balance between cooling and feedback processes is responsible for the slow build-up of massive elliptical galaxies in the cores of galaxy clusters. In the absence of feedback, the intracluster medium (ICM) should deposit ~1000 Msun/yr of cool material onto the central galaxy, leading to massive, starburst galaxies - a stark contrast to the passive, red galaxies we observe. Understanding this balance between radiative cooling in the hot ICM and feedback, likely from AGN, is critical to understanding the evolution of galaxies in the cluster environment. Recent observations have found significant evidence for ongoing star formation in central cluster galaxies (~1 Msun/yr), suggesting that this balance may be slightly off in favor of cooling. However, it is not possible from the current observations to distinguish between young stars forming in situ, fueled by the cooling ICM, or if they have been stripped from infalling, gas-rich galaxies. We propose a simple test, using the strongly-cooling cluster Abell 1795, to

determine the origin of this young stellar population via far-UV COS spectroscopy. We show that, by combining these new data with our existing high spatial resolution, multi-wavelength dataset for this system, we will be able to a) identify intermediate-temperature gas, which would provide proof that the hot and cold phases are thermally coupled, and b) constrain, for the first time, the ages and metallicities of the stars in the extended, cooling filaments. This program will have a significant impact on our understanding of galaxy formation and cluster evolution, and may provide the first direct evidence of young stars condensing out of the ICM.

OBSERVING DESCRIPTION

We requested and were allocated 6 orbits to obtain UV spectroscopy of the star-forming filament in Abell1795 with COS.

While the star-forming filament has been observed in the far-UV with ACS/SBC by us, the uncertainty on the UV peak is still at the level of ~0.4" due to the wavelength-dependent pointing shifts of ACS/SBC observations. We have used XMM-OM, GALEX, and SDSS images in order to confirm the peak UV position to within ~0.5", but require an ACQ/SEARCH exposure in order to be 100% confident that we are centered on the brightest UV peak. We then use ACQ/IMAGE to center to higher accuracy. The bright object tool was run using the GALEX catalog and returned no warning.

All of our observations are done in TIME-TAG mode. This temporal sampling will allow us to exclude poor quality data and get improved thermal correction and background removal. We separate our exposures into six orbits, where each orbit uses one of four different FP_POS (1,2,3,4,2,3). This observing strategy is adopted to reduce the fixed pattern noise and fill up the wavelength hole produced by the chip gap without excessive overheads.

Since our targets are faint, we use a BUFFER-TIME equal to the exposure time, as suggested in the users manual.

Visit

Proposal 12992, Visit 01, implementation Wed Sep 12 01:04:04 GMT 2012

Diagnostic Status: Warning

Scientific Instruments: COS/NUV, COS/FUV

Special Requirements: (none)

Diagnostics

(Visit 01) Warning (Orbit Planner): INEFFICIENT ORDERING OF FP-POS POSITIONS

(Visit 01) Warning (Orbit Planner): VISIBILITY OVERRUN

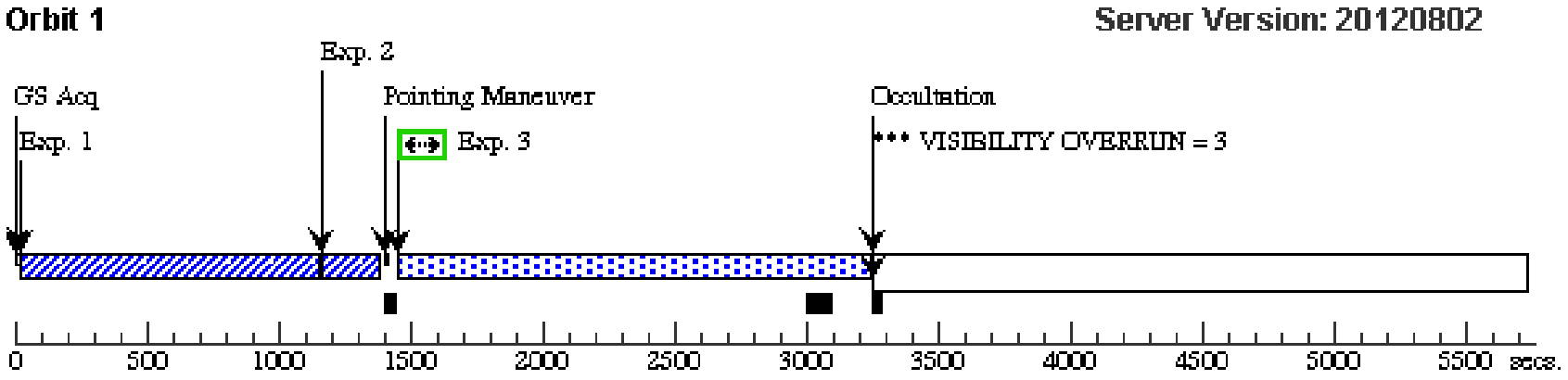
Fixed Targets

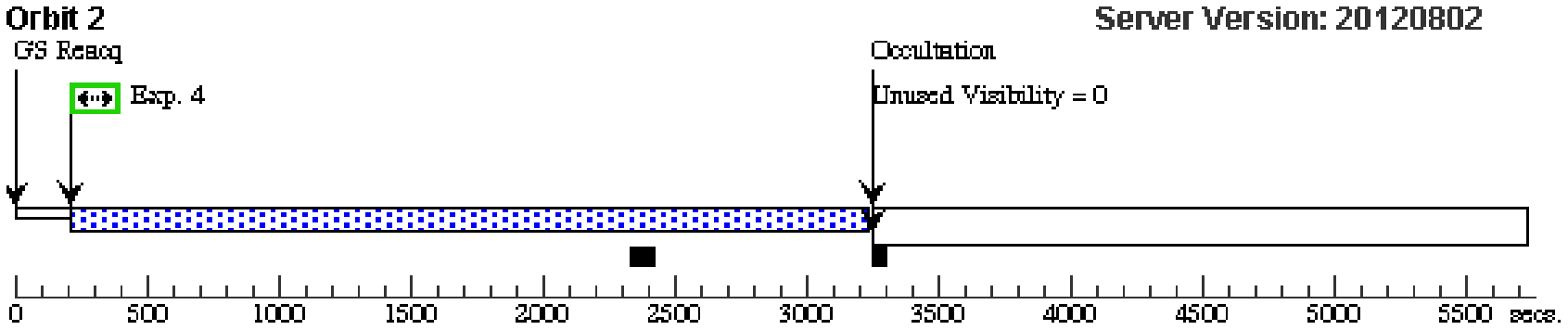
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	ABELL1795-FILAMENT	RA: 13 48 52.7808 (207.2199200d) Dec: +26 35 14.24 (26.58729d) Equinox: J2000		V=18.0 m_g = 19.9, m_FUV = 21.0	Reference Frame: ICRS

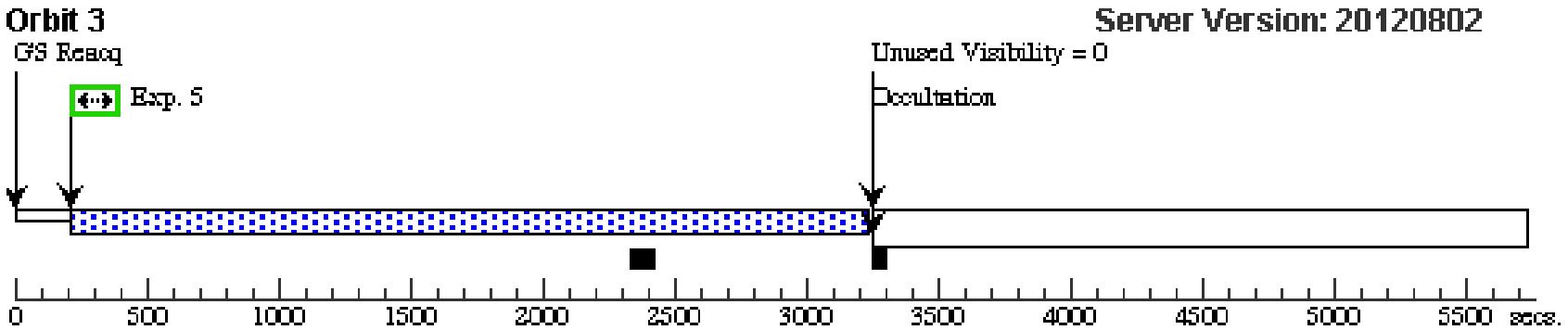
Exposures

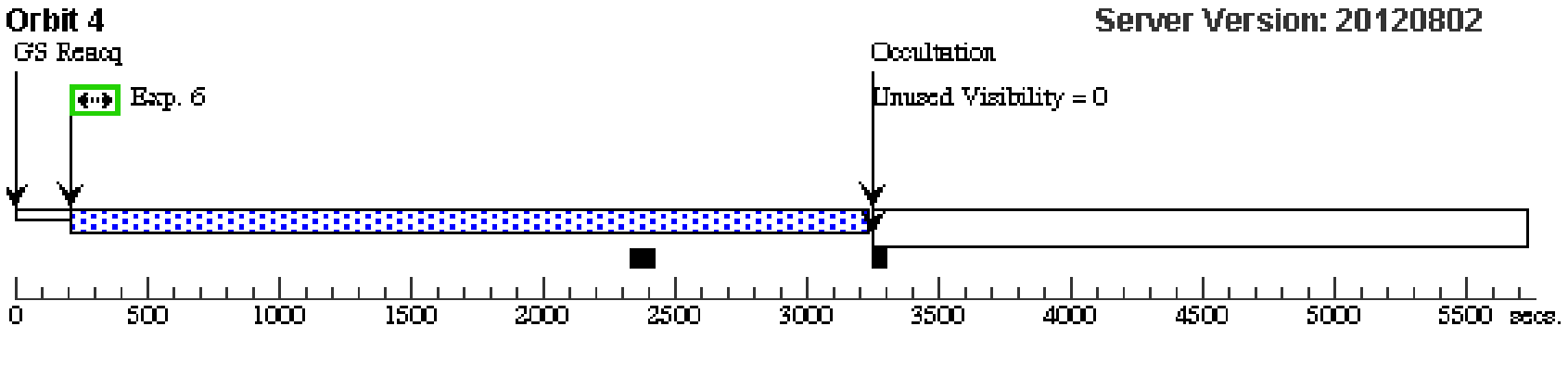
#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	(COS.ta.408772)	(1) ABELL1795-FILAMENT	COS/NUV, ACQ/SEARCH, PSA	MIRRORA	CENTER=BRIGHTEST; SCAN-SIZE=3; STEP-SIZE=1.767			60 Secs *[==>]*	***[1]***
2	(COS.ta.408772)	(1) ABELL1795-FILAMENT	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				60 Secs *[==>]*	***[1]***
3	(COS.sp.409299)	(1) ABELL1795-FILAMENT	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=1390; FLASH=YES; FP-POS=1			1500 Secs *[==>1607.0 Secs]*	***[1]***
4	(COS.sp.409299)	(1) ABELL1795-FILAMENT	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=2076; FLASH=YES; FP-POS=2			2186 Secs *[==>2967.0 Secs]*	***[2]***
5	(COS.sp.409299)	(1) ABELL1795-FILAMENT	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=2076; FLASH=YES; FP-POS=3			2186 Secs *[==>2967.0 Secs]*	***[3]***
6	(COS.sp.409299)	(1) ABELL1795-FILAMENT	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=2076; FLASH=YES; FP-POS=4			2186 Secs *[==>2967.0 Secs]*	***[4]***
7	(COS.sp.409299)	(1) ABELL1795-FILAMENT	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=2076; FLASH=YES; FP-POS=2			2186 Secs *[==>2967.0 Secs]*	***[5]***
8	(COS.sp.409299)	(1) ABELL1795-FILAMENT	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=2076; FLASH=YES; FP-POS=3			2186 Secs *[==>2967.0 Secs]*	***[6]***

Orbit Structure





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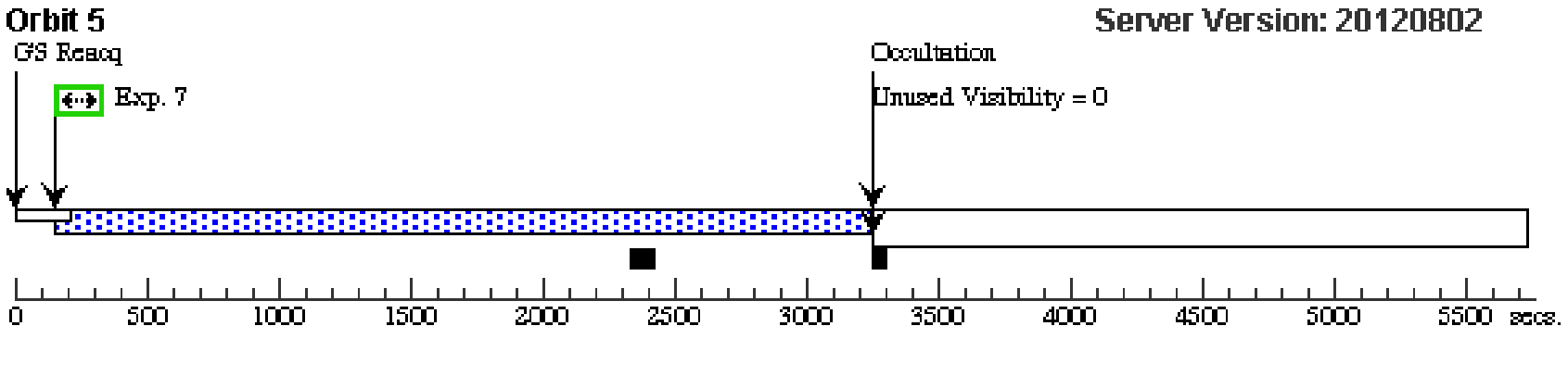
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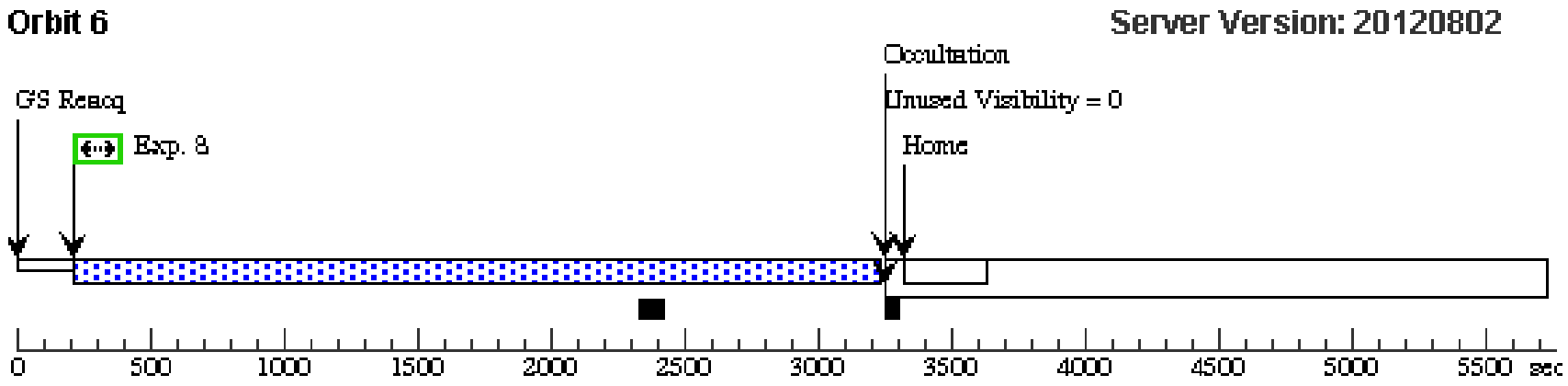
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sec