



# 12863 - Determining the Redshift of the Blazar 3C 66A for Studies of the Extragalactic Background Light

Cycle: 20, Proposal Category: GO  
(Availability Mode: SUPPORTED)

## INVESTIGATORS

<i>Name</i>	<i>Institution</i>	<i>E-Mail</i>
<b>Ms. Amy Kathryn Furniss (PI) (Contact)</b>	<b>University of California - Santa Cruz</b>	<b>afurniss@ucsc.edu</b>
Dr. David A Williams (CoI)	University of California - Santa Cruz	daw@ucsc.edu
Dr. Jason X. Prochaska (CoI)	University of California - Santa Cruz	xavier@ucolick.org
Dr. Joel R. Primack (CoI)	University of California - Santa Cruz	joel@physics.ucsc.edu
Dr. Michele Fumagalli (CoI)	Carnegie Institution of Washington	mfumagalli@obs.carnegiescience.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>
01	(1) 3C-66A	COS/FUV	3	25-Sep-2012 21:14:27.0	yes

3 Total Orbits Used

## ABSTRACT

The extragalactic background light (EBL) is the accumulated and reprocessed radiation of all the starlight produced over the life of the Universe. As such, measurements of the intensity and evolution of the EBL offer a critical test of cosmology and structure formation. An accurate knowledge of this light density also plays an important role in the determination of the intergalactic magnetic field (IGMF) strength. The direct measurement of the EBL radiation field is hampered by the existence of foreground sources within our own solar system and Galaxy. This complication can be overcome by use of very high energy (VHE) emitting blazars. These sources produce gamma rays which interact with the EBL photons through pair

production, altering the observed VHE spectrum in a distance-dependent manner. The most promising blazar for such studies is 3C 66A, which has a putative redshift of  $z=0.44$ , a measurement based on a single line observed in a 40 year old spectrum. If confirmed, the observed VHE spectrum would negate the validity of one of the most comprehensive EBL models to date. Recent efforts to confirm the redshift with 10m-class telescopes have proven unsuccessful. We propose far-UV spectroscopy with HST/COS for 3C 66A to search for the signature of the  $z\sim 0$  Lyman alpha forest, to thereby confirm or refute the putative redshift. With 3 orbits of G160M spectra, we will firmly establish it to have  $z>0.2$  (or not) and if within  $z=0.2-0.45$  establish its redshift to a precision of 0.05 (90% confidence limit). If the redshift of 3C 66A is found to be greater than 0.53, all EBL models produced thus far will be nullified.

### **OBSERVING DESCRIPTION**

The three orbits granted will comprise of a single visit with initial target acquisition followed by three target exposures (FP\_POS positions 1, 2 and 3, respectively). The target acquisition involves a 120 second PEAKXD exposure followed by a series of five 80 second PEAKD exposures with 0.9 arcsecond steps, each onto the G160M grating at 1623 angstroms. The first target exposure will immediately follow the target acquisition and cover the remainder of the first orbit (1779s in FP\_POS 1). The second and third target exposures will use the remaining two orbits.

### **ADDITIONAL COMMENTS**

This target is a variable target, found to vary by +/- an optical magnitude in the R-band ([http://users.utu.fi/kani/1m/3C\\_66A.html](http://users.utu.fi/kani/1m/3C_66A.html)). GALEX measured a FUV magnitude of 17.7. In order to ensure that our measurement will be successful independent of state, we have calculated the proposed observing plan assuming that the target is in a faint state (FUV ~18.7 magnitude). With the safety of the instrument in mind, a check was made on each of the proposed exposures on the chance that the target will be in the brightest state during observation (FUV ~ 16.7). The exposures requested are found to produce no instrumental risk (see below for ETC run numbers). This visit sequence is requested independent of source magnitude at time of observation.

Exposure Time Calculator run with FUV magnitude of 16.7:

Exposure 1 ETC Run #: 413339

Exposure 2 ETC Run #: 413340

Exposure 3 ETC Run #: 413341

Exposure 4 ETC Run #: 413342

Exposure 4 ETC Run #: 413342

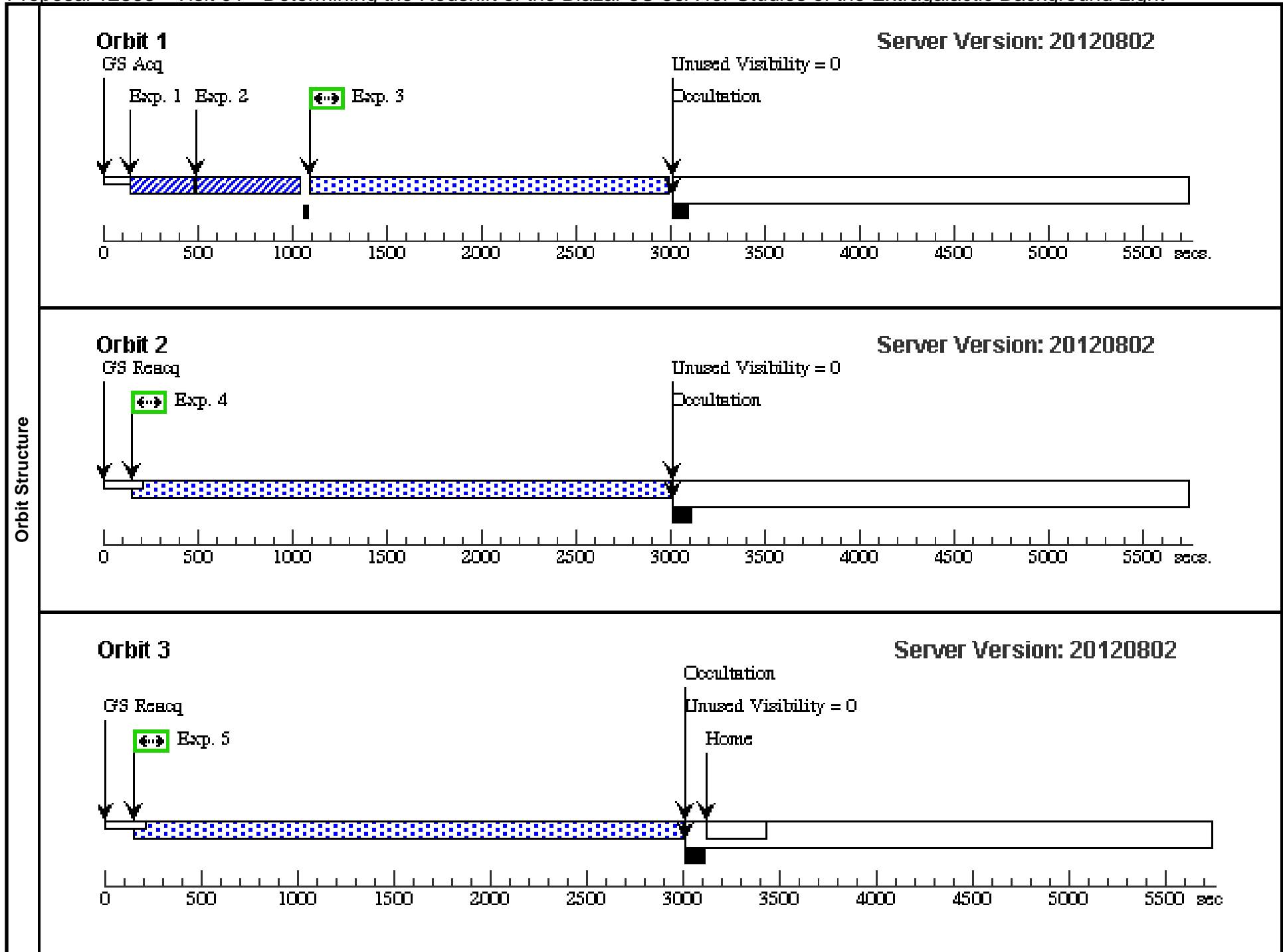
# Proposal 12863 - Visit 01 - Determining the Redshift of the Blazar 3C 66A for Studies of the Extragalactic Background Light

Wed Sep 26 01:14:36 GMT 2012

<b>Visit</b>	<p><b>Proposal 12863, Visit 01, implementation</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Scientific Instruments: COS/FUV</p> <p>Special Requirements: PCS MODE FINE; GYRO MODE 3GOBAD; SCHED 100%</p> <p><i>Comments: This target is a variable target, found to vary by +/- an optical magnitude in the R-band (<a href="http://users.utu.fi/kani/1m/3C_66A.html">http://users.utu.fi/kani/1m/3C_66A.html</a>). In order to ensure that our measurement will be successful independent of state, we have calculated the proposed observing plan assuming that the target is in the faintest state (FUV ~18.7 magnitude). With the safety of the instrument in mind, a check was made on proposed target acquisition exposures on the chance that the target will be in the brightest state during observation (FUV ~ 16.7). The exposures requested are found to produce no instrumental risk (see below for ETC run numbers). This visit sequence is requested independent of source magnitude at time of observation.</i></p> <p><i>Exposure Time Calculator run with FUV magnitude of 16.7:</i></p> <p><i>Exposure 1 ETC Run #: 413339</i></p> <p><i>Exposure 2 ETC Run #: 413340</i></p>																	
	<p><b>Diagnosics</b></p> <p>(Visit 01) Warning (Form): If the target coordinates are not known to 0.4" (or better) an ACQ/SEARCH should precede the ACQ/PEAKXD.</p> <p>(Visit 01) Warning (Form): For the best data quality, it is strongly recommended that all four FP-POS positions be used when observing at a given COS CENWAVE setting.</p>																	
<b>Fixed Targets</b>	<table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th>Targ. Coord. Corrections</th> <th>Fluxes</th> <th>Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(1)</td> <td>3C-66A</td> <td>RA: 02 22 39.6111 (35.6650462d) Dec: +43 02 7.80 (43.03550d) Equinox: J2000</td> <td></td> <td>V=15.5+/-1.0</td> <td>Reference Frame: ICRS</td> </tr> </tbody> </table> <p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i></p>						#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous	(1)	3C-66A	RA: 02 22 39.6111 (35.6650462d) Dec: +43 02 7.80 (43.03550d) Equinox: J2000		V=15.5+/-1.0	Reference Frame: ICRS
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Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit	
	1	(413100)	(1) 3C-66A	COS/FUV, ACQ/PEAKXD, PSA	G160M 1623 A	SEGMENT=BOTH		Sequence 1-3 Non-Int in Visit 01	120 Secs [==>]	[1]	
	2	(413102)	(1) 3C-66A	COS/FUV, ACQ/PEAKD, PSA	G160M 1623 A	CENTER=FLUX-W T-FLR; NUM-POS=5; SEGMENT=BOTH; STEP-SIZE=0.9		Sequence 1-3 Non-Int in Visit 01	80 Secs [==>]	[1]	
	3	(413336)	(1) 3C-66A	COS/FUV, TIME-TAG, PSA	G160M 1623 A	BUFFER-TIME=26 00; FLASH=YES; FP-POS=1; SEGMENT=BOTH		Sequence 1-3 Non-Int in Visit 01	2600 Secs [==>1779.0 Secs ]	[1]	
	<i>Comments: Three of the four FP-POS positions will be sufficient to account for detector imperfections.</i>										
	4	(413337)	(1) 3C-66A	COS/FUV, TIME-TAG, PSA	G160M 1600 A	BUFFER-TIME=30 00; FLASH=YES; FP-POS=2; SEGMENT=BOTH			3000 Secs [==>2724.0 Secs ]	[2]	
<i>Comments: Three of the four FP-POS positions will be sufficient to account for detector imperfections.</i>											
5	(413337)	(1) 3C-66A	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=30 00; FLASH=YES; FP-POS=3; SEGMENT=BOTH			3000 Secs [==>2724.0 Secs ]	[3]		
<i>Comments: Three of the four FP-POS positions will be sufficient to account for detector imperfections.</i>											



Orbit Structure