



15283 - Witnessing the assembly of galaxies in an extended gas-rich structure at $z \sim 3.25$

Cycle: 25, Proposal Category: GO
(Availability Mode: SUPPORTED)

INVESTIGATORS

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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) DLA-15H3	WFC3/IR	3	01-Oct-2018 11:00:49.0	yes
51	(51) DLA-15H3-HOPR	WFC3/IR	1	01-Oct-2018 11:00:50.0	yes

4 Total Orbits Used

ABSTRACT

The direct study of star formation in Damped Lyman Alpha systems (DLAs), the reservoirs of the majority of neutral gas at high redshift, has previously been hampered by the lack of deep integral field spectroscopy for sensitive searches of faint host galaxies. Building on our successful HST "shot-in-the-dark" survey that has probed the in-situ star formation rate of $z \sim 2-3$ DLAs, we have initiated a MUSE follow-up of 6 DLA sightlines to overcome this bottleneck. In the first sightline we have studied, we have uncovered a ~ 40 kpc Lyman alpha emitting nebula, composed of two clumps within ~ 50 kpc of the DLA, suggestive of a merger or an extended protodisk. Within this structure, which is the largest nebula known to be associated with a $z \sim 3$ DLA, we also found a compact continuum source with spectrophotometry consistent with a Lyman Break Galaxy at the same redshift. Aside from the LBG, the rest of the Lyman alpha structure has no continuum counterpart in deep UV and visible imaging. The LBG alone seems unable to power the Lyman alpha nebula and the morphology supports our conclusion that, most likely, this structure is powered by in-situ star formation below detection limit. However, from the Lyman alpha alone the origin of this incredible structure remains ambiguous. With this proposal, we aim to acquire high resolution, deep infrared imaging with HST to probe the rest-frame optical emission to search for the underlying stellar emission of this object and to infer the stellar mass of the LBG. With the powerful combination of HST and MUSE data, we will unravel the nature of this unique system.

OBSERVING DESCRIPTION

We aim to detect the stellar light from a Lyman alpha emitting structure associated with a high column absorption line system at $z \sim 3$ detected in a nearby QSO. Our main requirements are to minimize the impact of the QSO and a nearby bright star on the photometry of the structure.

The QSO has $H(AB) = 18.33$ mag, several magnitude brighter compared to the targeted nebula counterparts which are estimated to be as faint as $m(F160W, AB) = 27.56$ mag at a separation of 2-6 arcsec. Given this magnitude contrast, it's critical the QSO isn't allowed to contaminate the structure either through diffraction spikes or by dithering the structure on to pixels affected by persistence from the bright quasar.

To minimise the impact of diffraction spikes, we select only ORIENT angles which place the diffraction spikes away from the structure identified in Lyman alpha emission. Additionally, there is a bright star with $H(AB) \sim 9.0$ mag at 45 arcsec away from the QSO and structure. The star is sufficiently bright that it would quickly saturate the detector and its extended PSF could contaminate the object of interest. We will offset the exposures from the default aperture such that the star falls outside the field of view. Because these offsets are in instrument coordinates we have also restricted the ORIENT angles to one single window so that there is no ambiguity in the direction of the offsets.

To improve the spatial sampling and aid PSF subtraction, we dither between ramps. To control for persistence, we have adopted the LINE dither pattern to move along the line separating the QSO and the structure. This way the structure never falls on pixels which the QSO has fallen on in past exposures.

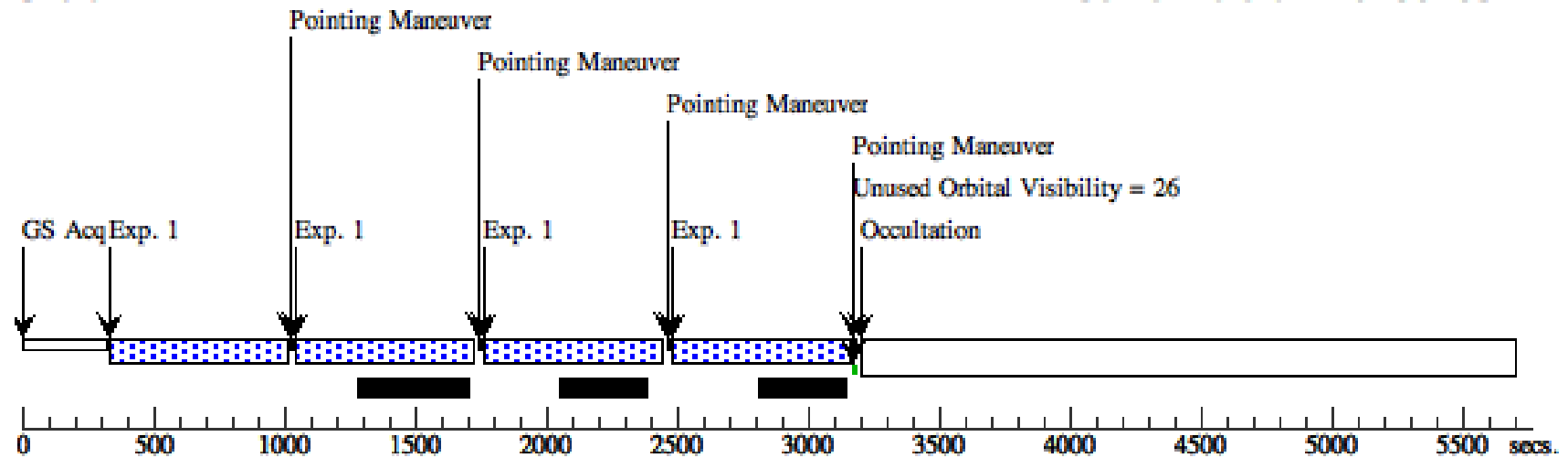
We will use the longest wavelength wide filter F160W. In order to maximize the S/N for any faint counterparts of the Lyman alpha nebula we have chosen SPARS50 sample sequences with NSAMP=14. With this configuration we can get 4 exposures per orbit with dithers in between. Because we wish to do one dither pattern over the whole visit with a dither in between each exposure, we have selected only one sampling configuration. This leaves us with just 300s unused over the 3 orbits. This strategy gives us the desired S/N of 4.25 for our targeted F160W=27.56 depth.

Proposal 15283 - Main Visit (01) - Witnessing the assembly of galaxies in an extended gas-rich structure at z~3.25

Visit	Proposal 15283, Main Visit (01), failed					Mon Oct 01 15:00:51 GMT 2018				
	Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR Special Requirements: ORIENT 267D TO 295 D Comments: Due to the proximity of the bright QSO (H_AB=18.33) and the potentially very faint continuum counterparts to the Lyman alpha nebula (F160W=27.56) it is critical the PSF of the QSO not contaminate the nebula or continuum galaxy, particularly the diffraction spikes which means restricting orient ranges. Initially we identified 4 orient ranges which would stop the diffraction spikes from overlapping the nebula. Additionally there is a very bright star close by (45 arcsec, H_AB=9.0) which must be dealt with by placing it outside the field of view. To do this we have offset the target with POS TARG. However because these offsets are in instrument coordinates they would change with different orient angles, and hence we have ultimately restricted the observation to 1 single orient range, the one which maximizes the time over which the visit can be executed.									
Patterns	#	Primary Pattern			Secondary Pattern			Exposures		
	(1)	Pattern Type=LINE Purpose=DITHER Number Of Points=12 Point Spacing=1.5 Line Spacing=		Coordinate Frame=POS-TARG Pattern Orientation=330 Angle Between Sides= Center Pattern=false				(1)		
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	DLA-15H3 Alt Name1: J025518.58+004847.6	RA: 02 55 18.7000 (43.8279167d) Dec: +00 48 49.31 (.81370d) Equinox: J2000	Redshift: 3.996	V=20.00+/-0.1 QSO H band = 18.33 (AB)	Reference Frame: ICRS				
Comments: The target is a z~4.0 quasar (H_AB=18.33) which was observed to host a Damped Lyman Alpha system at z~3.25 seen in absorption against the QSO continuum. This DLA was followed up with deep imaging and MUSE integral field spectroscopy to reveal an extended Lyman alpha emitting nebula at the same redshift as the DLA. A compact galaxy (I_AB=25.3) also likely embedded in the same structure. The nebula extends 2" to 6" from the QSO, the compact galaxy is 2.5" from the QSO. Category=GALAXY Description=[EMISSION LINE NEBULA, HIGH REDSHIFT GALAXY, LYMAN ALPHA CLOUD, QUASAR] Extended=YES										
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	Main Visit E (1) DLA-15H3 xposure (WFC3IR.i m.1006686)	(1) DLA-15H3	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPAR S50	POS TARG -18,37.5	Pattern 1, Exps 1-1 i n Main Visit (01) (1)	652.938154 Secs (7835.258 Secs)	
									[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]
									[==>(Pattern 5)] [==>(Pattern 6)] [==>(Pattern 7)] [==>(Pattern 8)]	[2]
									[==>(Pattern 9)] [==>(Pattern 10)] [==>(Pattern 11)] [==>(Pattern 12)]	[3]
	Comments: The goal of this proposal is to search for faint continuum counterparts to the Lyman alpha nebula associated with a DLA and to estimate the stellar mass of the compact galaxy. To accomplish the latter we use the longest wavelength wide filter, F160W. In order to maximize the S/N for any faint counterparts of the Lyman alpha nebula we have chosen SPARS50 sample sequences with NSAMP=14. With this configuration we can get 4 exposures per orbit with dithers in between. Because we wish to do one dither pattern over the whole visit with a dither in between each exposure we have selected only one sampling configuration, this leaves us with just 300s unused over the 3 orbits. This strategy gives us a S/N of 4.25 for our targeted F160W=27.56 depth.									

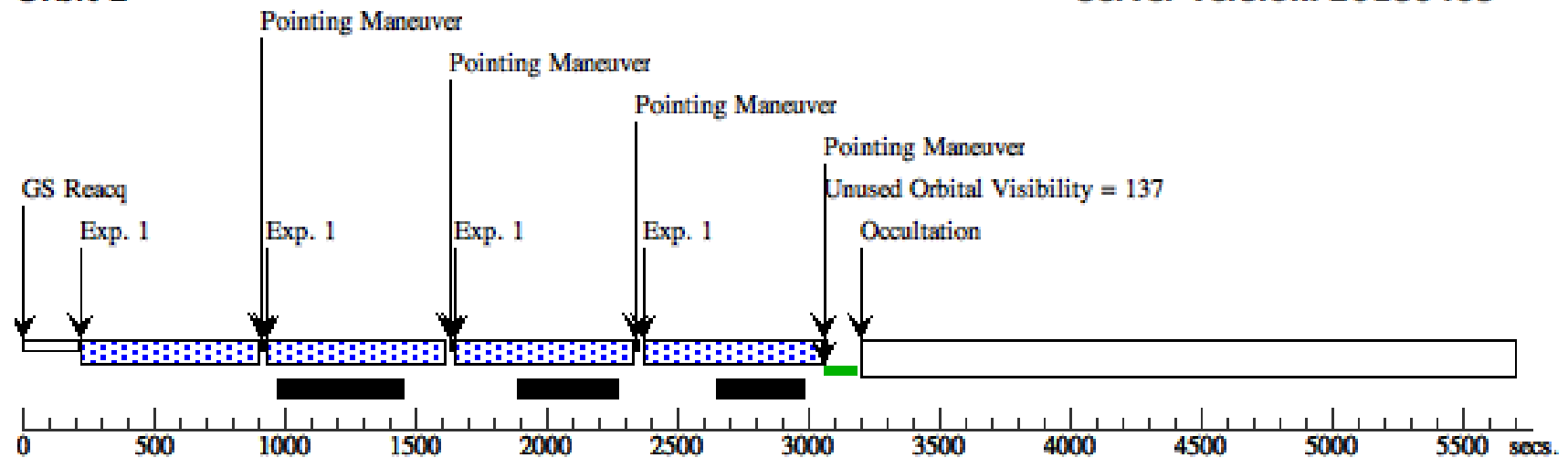
Orbit 1

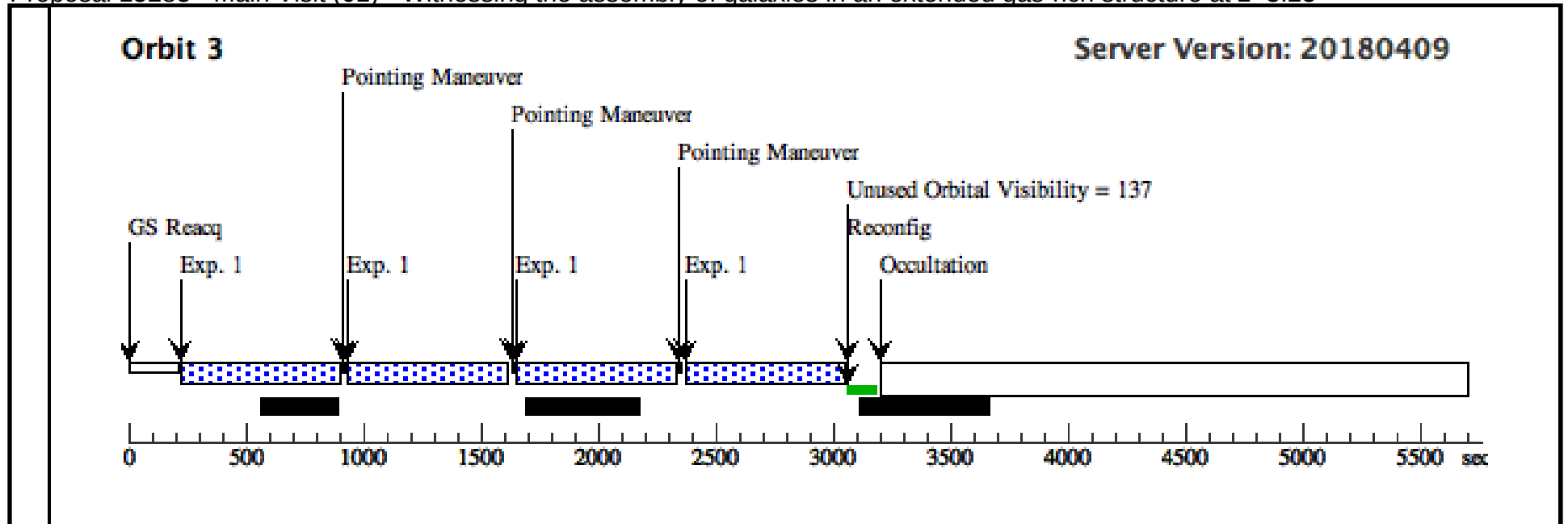
Server Version: 20180409



Orbit 2

Server Version: 20180409





Proposal 15283 - HOPR Orbit (51) - Witnessing the assembly of galaxies in an extended gas-rich structure at z~3.25

Visit	Proposal 15283, HOPR Orbit (51)										Mon Oct 01 15:00:51 GMT 2018		
	Diagnostic Status: No Diagnostics												
	Scientific Instruments: WFC3/IR												
	Special Requirements: ORIENT 274D TO 280 D												
Patterns	Comments: This is a repeat of the final orbit of our only visit, which failed due to the lock with the guide star being lost. We are attempting to detect faint galaxies near a quasar (H_AB=18.33), and so we have resticted the ORIENT to prevent the diffraction spikes affecting our targets and to ensure persistence from the quasar does not affect the target. We have also moved the center of the pointing again to further reduce a the affect of a nearby bright star, which was previouslly just outside the field of view.												
	Due to the proximity of the bright QSO (H_AB=18.33) and the potentially very faint continuum counterparts to the Lyman alpha nebula (F160W=27.56) it is critical the PSF of the QSO not contaminate the nebula or continuum galaxy, particularly the diffraction spikes which means restricting orient ranges. Initially we identified 4 orient ranges which would stop the diffraction spikes from overlapping the nebula. Additionally there is a very bright star close by (45 arcsec, H_AB=9.0) which must be dealt with by placing it outside the field of view. To do this we have offset the target with POS TARG. However because these offsets are in instrument coordinates they would change with different orient angles, and hence we have ultimately restricted the observation to 1 single orient range, the one which maximizes the time over which the visit can be executed.												
	#	Primary Pattern					Secondary Pattern					Exposures	
	(2)	Pattern Type=LINE Purpose=DITHER Number Of Points=4 Point Spacing=1.5 Line Spacing=					Coordinate Frame=POS-TARG Pattern Orientation=330 Angle Between Sides= Center Pattern=false					(1)	
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous				
	(51)	DLA-15H3-HOPR	RA: 02 55 19.9000 (43.8329167d)		Redshift: 3.996		V=20.00+/-0.1		Reference Frame: ICRS				
		Alt Name1: J025518.58+004847.6	Dec: +00 48 57.31 (.81592d) Equinox: J2000				QSO H band = 18.33 (AB)						
	Comments: The coordiates given are offset from the actual target. This is to move a bright star further from the FoV to limit the diffraction spikes.												
Exposures	The target is a z~4.0 quasar (H_AB=18.33) which was observed to host a Damped Lyman Alpha system at z~3.25 seen in absorption against the QSO continuum. This DLA was followed up with deep imaging and MUSE integral field spectroscopy to reveal an extended Lyman alpha emitting nebula at the same redshift as the DLA. A compact galaxy (I_AB=25.3) also likely embedded in the same structure. The nebula extends 2" to 6" from the QSO, the compact galaxy is 2.5" from the QSO.												
	Category=GALAXY												
	Description=[EMISSION LINE NEBULA, HIGH REDSHIFT GALAXY, LYMAN ALPHA CLOUD, QUASAR]												
	Extended=YES												
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit		
	1	HOPR Visit Exposure (WFC3IR.m.1006686)	(51) DLA-15H3-HO PR	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPAR S50	POS TARG -18.,37.5	Pattern 2, Exps 1-1 in HOPR Orbit (51) (2)	652.938154 Secs (2611.753 Secs)		[1]		
										[==>(Pattern 1)]			
										[==>(Pattern 2)]			
									[==>(Pattern 3)]				
									[==>(Pattern 4)]				
Comments: The goal of this proposal is to search for faint continuum counterparts to the Lyman alpha nebula associated with a DLA and to estimate the stellar mass of the compact galaxy. To accomplish the latter we use the longest wavelength wide filter, F160W. In order to maximize the S/N for any faint counterparts of the Lyman alpha nebula we have chosen SPARS50 sample sequences with NSAMP=14. With this configuration we can get 4 exposures per orbit with dithers in between. Because we wish to do one dither pattern over the whole visit with a dither in between each exposure we have selected only one sampling configuration, this leaves us with just 300s unused over the 3 orbits. This strategy gives us a S/N of 4.25 for our targeted F160W=27.56 depth.													

