



11587 - Probing Population III Star Formation in a $z=7$ Galaxy

Cycle: 17, 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) IOK-1	WFC3/IR	5	01-Jul-2008 21:18:31.0	yes
02	(1) IOK-1	WFC3/IR	5	01-Jul-2008 21:18:39.0	yes

10 Total Orbits Used

ABSTRACT

Population III (Pop III) stars, the first generation, metal-free stars in the Universe, have been a main focus of the studies of early galaxy formation and reionization. HeII 1640 emission originates from energetic ionizing photons beyond 54.4eV, and is an ideal tracer of massive Pop III star formation with strong far-UV radiation. HeII has not yet been detected directly in individual galaxies at $z < 6.3$, indicating a small contribution of Pop III star formation at those redshifts. We propose to use WFC3 narrow-band imaging to measure the flux of HeII emission in galaxy IOK-1 ($z=6.96$),

the highest redshift spectroscopically confirmed galaxy to date. At this redshift, the HeII line is perfectly located in the WFC3 F130N filter passband. Our deep narrow-band imaging will detect a HeII flux down to 4×10^{-18} erg/s/cm² at the 5-sigma level, corresponding to a star formation rate from massive Pop III stars of $\sim 1 M_{\text{sun}}$ per year, a factor of ~ 5 improvement to the best ground-based results at lower redshift. Strong HeII emission, if detected, will provide the first direct evidence of significant Pop III formation in early galaxies at the end of the reionization epoch. We will also carry out short F125W broad-band observations to measure the rest-frame UV flux of this galaxy in order to constrain its total star formation rate and to provide continuum subtraction for narrow-band imaging.

OBSERVING DESCRIPTION

We will image in two filters with WFC3/IR: (1) 8-orbit exposure in F130N. (2) 2-orbit exposure in F125W.

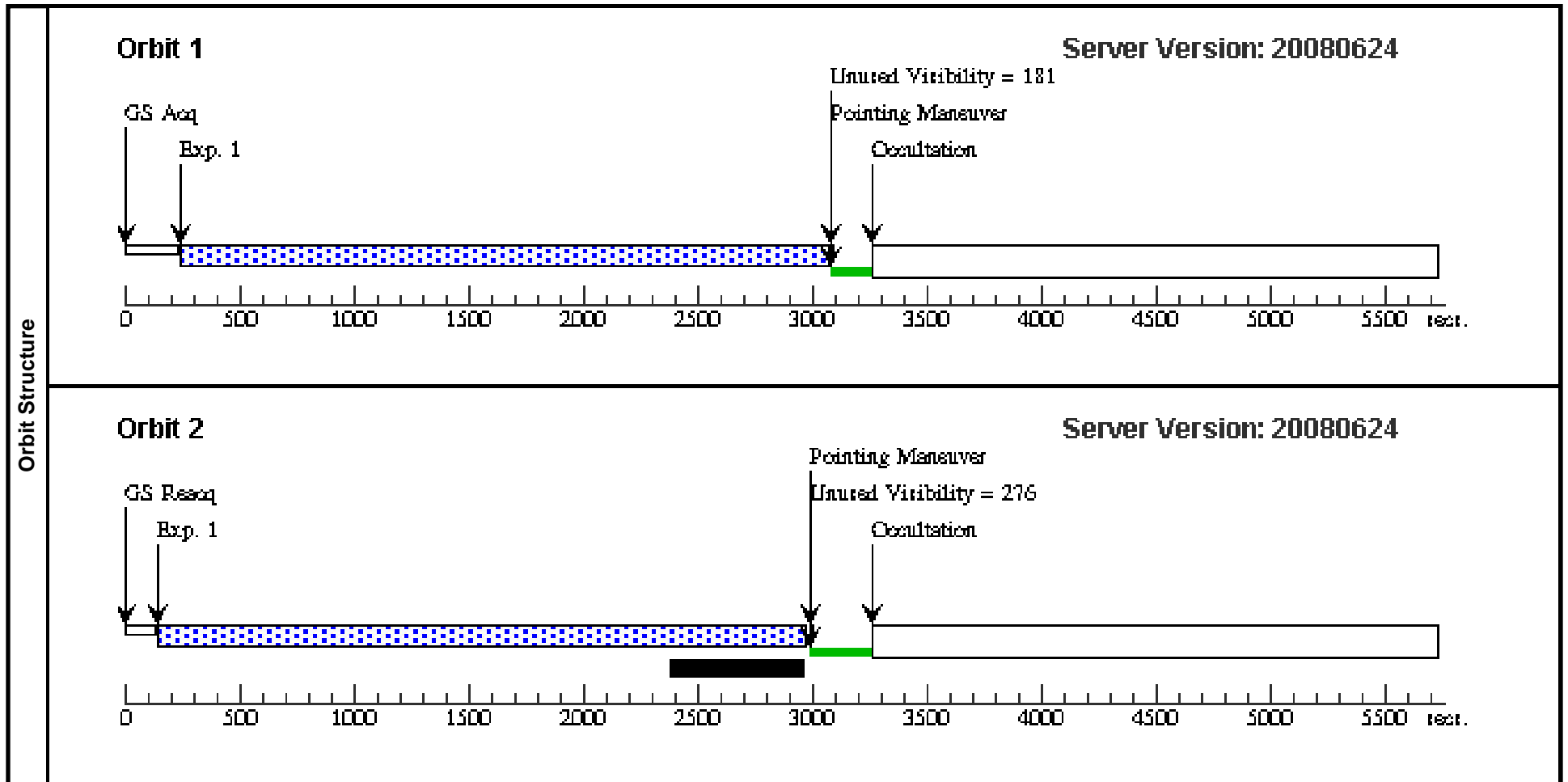
We will divide the program into two visits. In each visit, we will observe: (1) Four orbits in F130N. We will carry out a 4-point dither sequence with orbit-long (~ 2600) exposures in the narrow F130N band. This will bring the images to being background-limited. (2) One orbit in F125W. We will do the same 4-point dither sequence with ~ 650 sec exposures to populate one orbit.

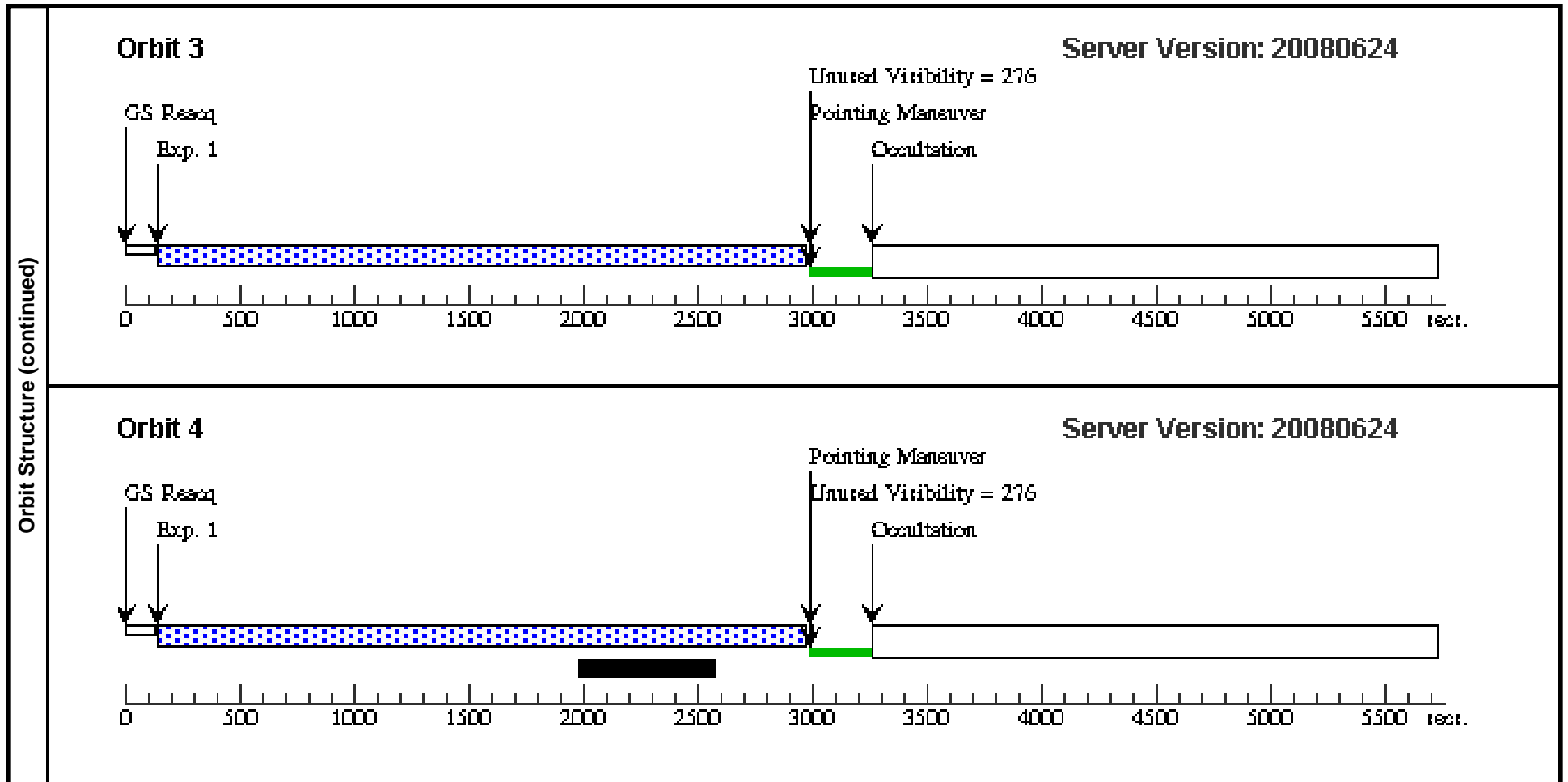
We will do a small POS-TARG offset for the second visit and repeat the same sequence.

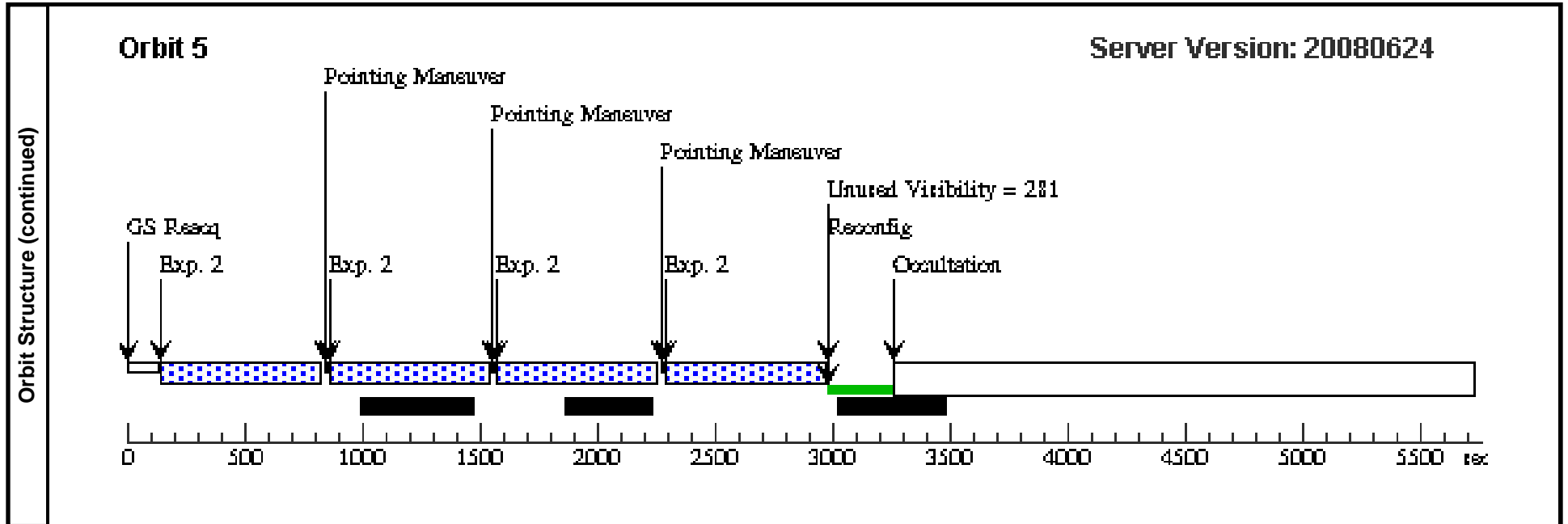
Proposal 11587 - Visit 01 - Probing Population III Star Formation in a z=7 Galaxy

Wed Jul 02 01:18:43 GMT 2008

Visit	Proposal 11587, Visit 01, implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR Special Requirements: (none) <i>Comments: IOK-1 4-point dither in F130N (4 orbits) and F125W (1 orbit)</i>									
	Patterns	#	Primary Pattern	Secondary Pattern	Exposures					
	(4)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.572 Line Spacing=0.365	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=false		(1), (2)					
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	IOK-1	RA: 13 23 59.8000 (200.9991667d) Dec: +27 24 55.80 (27.41550d) Equinox: J2000	Redshift: 6.96	V=(?) NB973 = 24.60; z_AB >27.05	Reference Frame: ICRS				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	F130N 4-poi nt dither-1	(1) IOK-1	WFC3/IR, MULTIACCUM, IR	F130N	SAMP-SEQ=SPARS 200; NSAMP=15	GS ACQ SCENARI O ONEB1B3	Pattern 1-1 (4)	[==>(Pattern 1)]	[1]
									[==>(Pattern 2)]	[2]
									[==>(Pattern 3)]	[3]
									[==>(Pattern 4)]	[4]
	2	F125W 4-po int dither-1	(1) IOK-1	WFC3/IR, MULTIACCUM, IR	F125W	SAMP-SEQ=SPARS 50; NSAMP=14		Pattern 2-2 (4)	[==>(Pattern 1)]	
								[==>(Pattern 2)]		
								[==>(Pattern 3)]		
								[==>(Pattern 4)]	[5]	







Proposal 11587 - Visit 02 - Probing Population III Star Formation in a z=7 Galaxy

Wed Jul 02 01:18:45 GMT 2008

Visit	Proposal 11587, Visit 02, implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR Special Requirements: (none) <i>Comments: IOK-1 4-point dither: F130N (4 orbits) and F125W (1 orbit), shifted by 17.25 pixels in X and Y from visit 1 for better flat-fielding</i>									
	Patterns	#	Primary Pattern			Secondary Pattern			Exposures	
		(4)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.572 Line Spacing=0.365	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=false					(1), (2)	
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	IOK-1	RA: 13 23 59.8000 (200.9991667d) Dec: +27 24 55.80 (27.41550d) Equinox: J2000	Redshift: 6.96	V=(?) NB973 = 24.60; z_AB >27.05	Reference Frame: ICRS				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	F130N 4-poi nt dither-2	(1) IOK-1	WFC3/IR, MULTIACCUM, IR	F130N	SAMP-SEQ=SPARS 200;	POS TARG 2.3374,2 .0890;	Pattern 1-1 (4)	[==>(Pattern 1)]	[1]
						NSAMP=15	GS ACQ SCENARI O ONEB1B3		[==>(Pattern 2)]	[2]
									[==>(Pattern 3)]	[3]
									[==>(Pattern 4)]	[4]
	2	F125W 4-po int dither-2	(1) IOK-1	WFC3/IR, MULTIACCUM, IR	F125W	SAMP-SEQ=SPARS 50;	POS TARG 2.3374,2 .0890	Pattern 2-2 (4)	[==>(Pattern 1)]	[5]
					NSAMP=14			[==>(Pattern 2)]		
								[==>(Pattern 3)]		
								[==>(Pattern 4)]		

