12487 - Probing Population III Star Formation in a z=7 Galaxy

Cycle: 19, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Prof. Xiaohui Fan (PI)	**University of Arizona**	**fan@as.arizona.edu**
Mr. Zheng Cai (CoI)	University of Arizona	caiz@email.arizona.edu
Prof. Ann Zabludoff (CoI)	University of Arizona	azabludoff@as.arizona.edu
Dr. Yujin Yang (CoI) (ESA Member)	Max-Planck-Institut fur Astronomie, Heidelberg	yyang@mpia.de
Dr. Romeel Dave (CoI)	University of Arizona	rad@as.arizona.edu
Dr. Siang Peng Oh (CoI)	University of California - Santa Barbara	peng@physics.ucsb.edu
Dr. Linhua Jiang (CoI)	Arizona State University	ljiang@as.arizona.edu

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) BDF-521	WFC3/IR	4	11-Jul-2011 21:38:46.0	yes
02	(1) BDF-521	WFC3/IR	4	11-Jul-2011 21:38:53.0	yes
03	(1) BDF-521	WFC3/IR	4	11-Jul-2011 21:38:57.0	yes
04	(1) BDF-521	WFC3/IR	3	11-Jul-2011 21:39:01.0	yes

15 Total Orbits Used

ABSTRACT

We propose to carry out deep WFC-3/F132N narrow-band imaging of the galaxy BDF-521 (z = 7.008+/-0.002) to measure the strength of He II 1640 emission line in this young galaxy at the end of reionization epoch. He II 1640 emission, if detected, will provide the first direct evidence of massive

Population III (metal free) star formation in the early Universe. In a pilot program in Cycle-17, we obtained narrow-band imaging centered on HeII for the galaxy IOK-1 at z=6.96, and found the He II flux to be 1.2+/-1.0 x 10^-18 ergs s^-1 cm^-2, corresponding to a 1-sigma upper limit of 2 M_sun/yr in Pop-III star formation rate (SFR) assuming a top-heavy IMF. This sensitivity is 2.5x deeper than for the best previous ground-based measurement, and illustrates the power of HST narrow-band imaging in probing the earliest star formation. In this cycle, we will continue this effort by targeting galaxy BDF-521 at z=7.01 using F132N which covers the HeII emission at the galaxy redshift. The ground based photometry implies that BDF-521 has an extremely blue continuum slope with f_lambda ~ lambda^-4, the bluest among all confirmed galaxies at z>6, suggestive of either extremely low metallicity and/or a complete lack of dust. Therefore, BDF-521 is the most promising candidate for Pop-III detection. This new HST observations will be able to detect or place the most stringent upper limit of 0.6 M_sun/yr on the Pop-III SFR (1 sigma). We will also use short F125W and F160W broad-band observations to measure the rest-frame UV flux of BDF-521 in order to estimate its overall SFR, confirm the blue UV slope, and quantify the morphology, as well as provide continuum subtraction for narrow-band imaging.

OBSERVING DESCRIPTION

We will image in three filters with WFC3/IR: (1) 11-orbit exposure in F132N. (2) 2-orbit exposure in F125W. (3). 2-orbit exposure in F160W.

We will divide the program into four visits. In the first visit, we will observe: (1). Two orbits F125W. (2). Two orbits F160W. We will do the same 4-point dither sequence with ~1450sec exposures to populate the 2-orbit F125W and F160W observations. In the second and third visits, we will observe: Four orbits in F132N. We will carry out a 4-point dither sequence with orbit-long (~2800sec) exposures in the narrow F132N band. This will bring the images to being background-limited. In the fourth visit, we will do: three orbits in F132N. We will carry out a 3-point dither sequence with orbit-long(~2800sec) exposures in the narrow F132N band.

We will do a small POS-TARG offset for the third and the fourth visits and repeat the same sequence.

Visit

Proposal 12487, Visit 01 Tue Jul 12 01:39:05 GMT 2011

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	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)

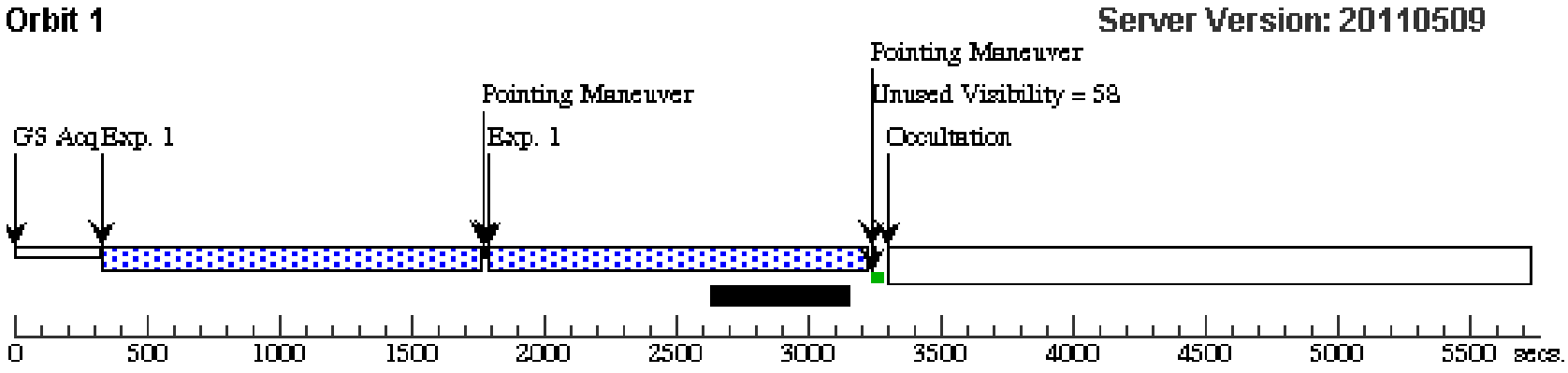
Fixed Targets

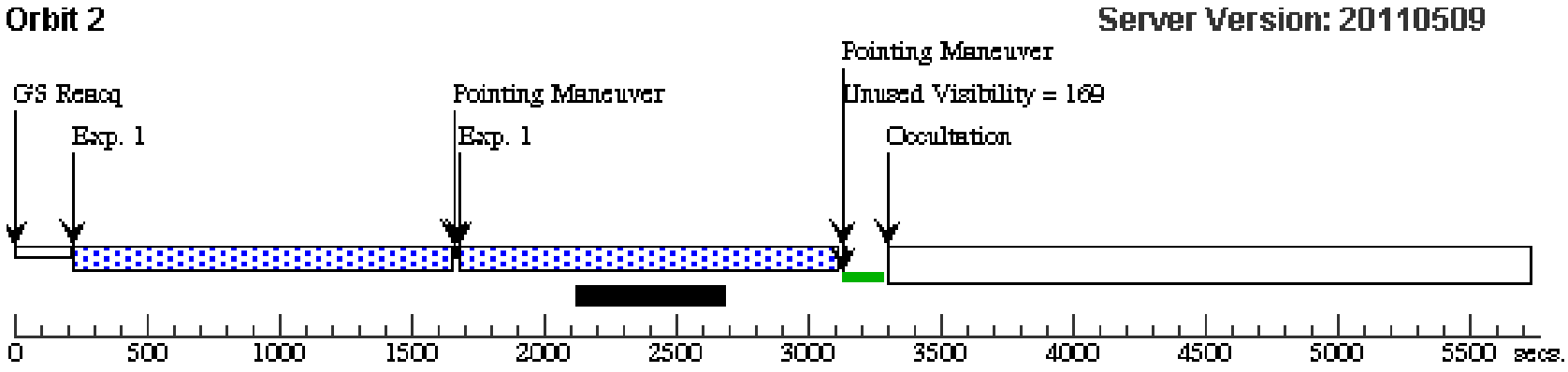
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	BDF-521	RA: 22 27 46.6560 (336.9444000d) Dec: -35 07 7.68 (-35.11880d) Equinox: J2000	Redshift: 7.008	V=(?) Y_AB=25.86; J_AB>26.5; K_AB>26.0	Reference Frame: ICRS

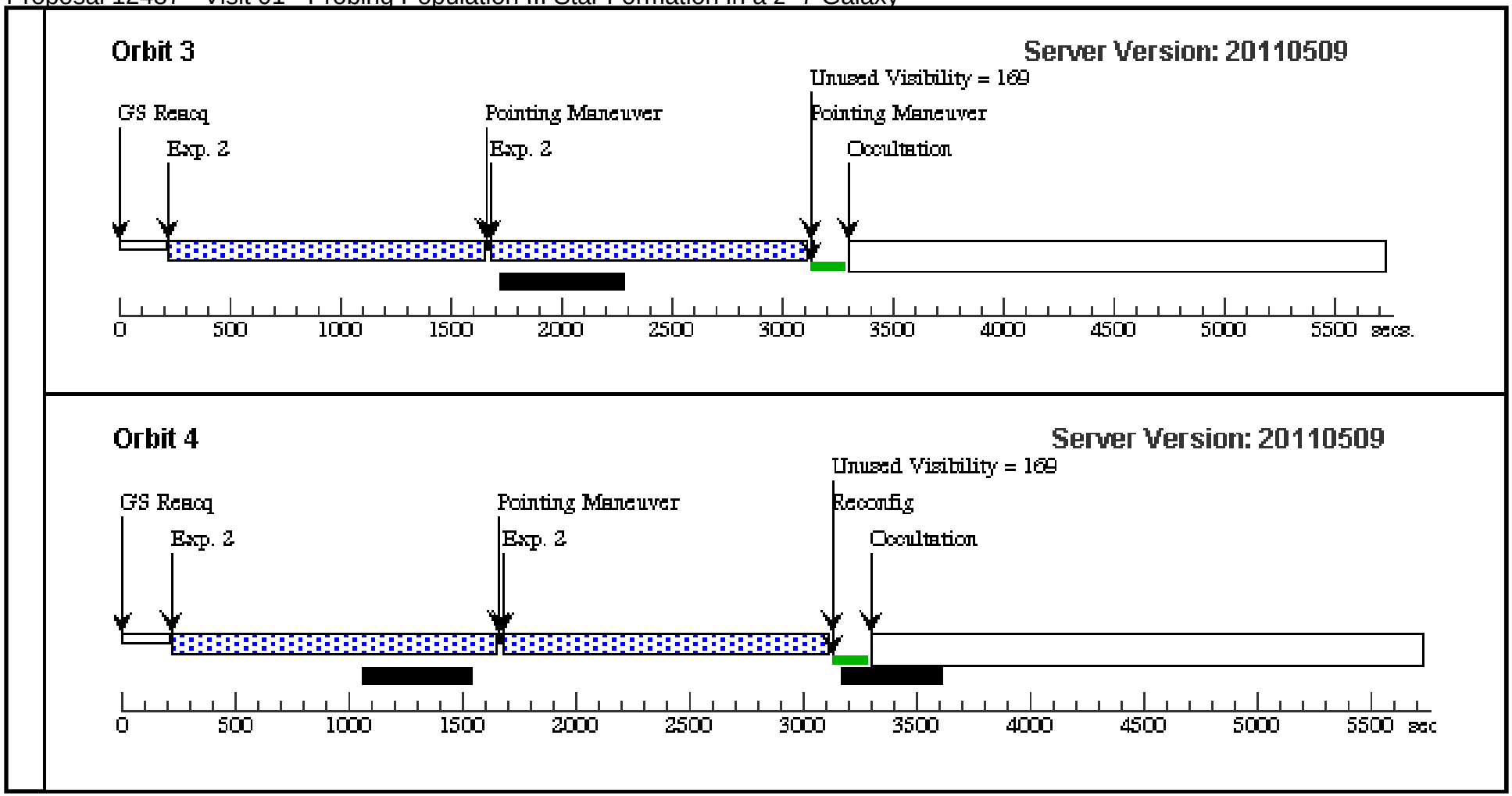
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) BDF-521	WFC3/IR, MULTIACCUM, IR	F125W	NSAMP=15; SAMP-SEQ=SPARS100		Pattern 1, Exps 1-1 in Visit 01 (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
								[==>(Pattern 3)] *[==>(Pattern 4)]*	***[2]***
2		(1) BDF-521	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=15; SAMP-SEQ=SPARS100		Pattern 1, Exps 2-2 in Visit 01 (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[3]***
								[==>(Pattern 3)] *[==>(Pattern 4)]*	***[4]***

Orbit Structure



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Exp. 2
Pointing Maneuver
Exp. 2
Pointing Maneuver
Occultation
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1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.
Orbit 4
Server Version: 20110509
Unused Visibility = 169
GS Reacq
Exp. 2
Pointing Maneuver
Exp. 2
Reconfig
Occultation
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500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 12487, Visit 02 Tue Jul 12 01:39:06 GMT 2011

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	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)

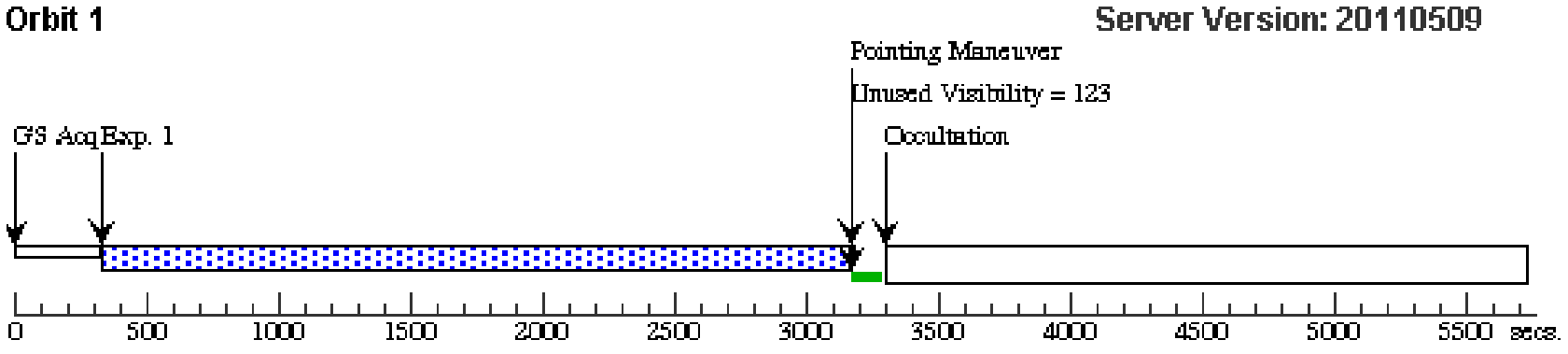
Fixed Targets

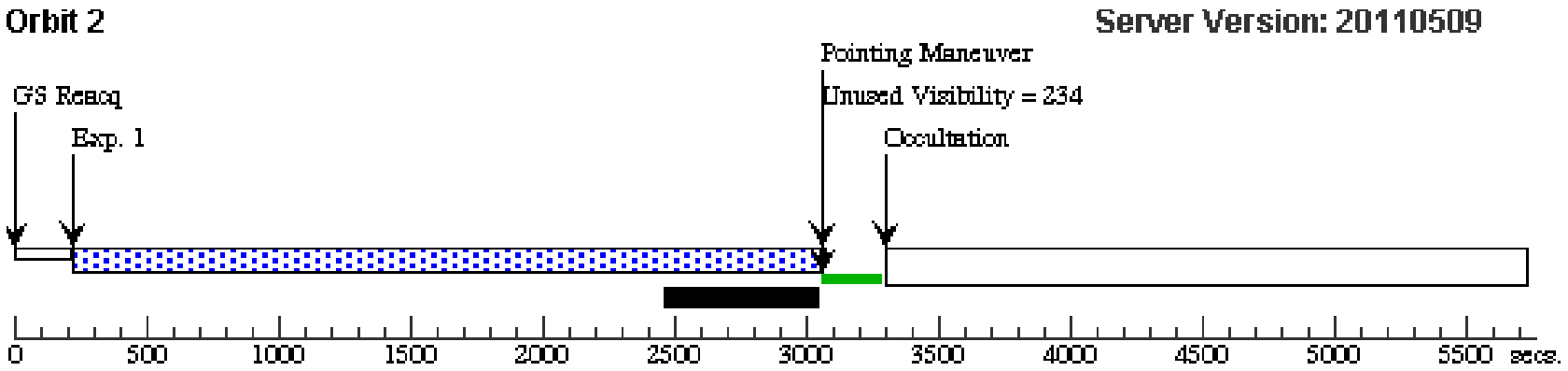
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	BDF-521	RA: 22 27 46.6560 (336.9444000d) Dec: -35 07 7.68 (-35.11880d) Equinox: J2000	Redshift: 7.008	V=(?) Y_AB=25.86; J_AB>26.5; K_AB>26.0	Reference Frame: ICRS

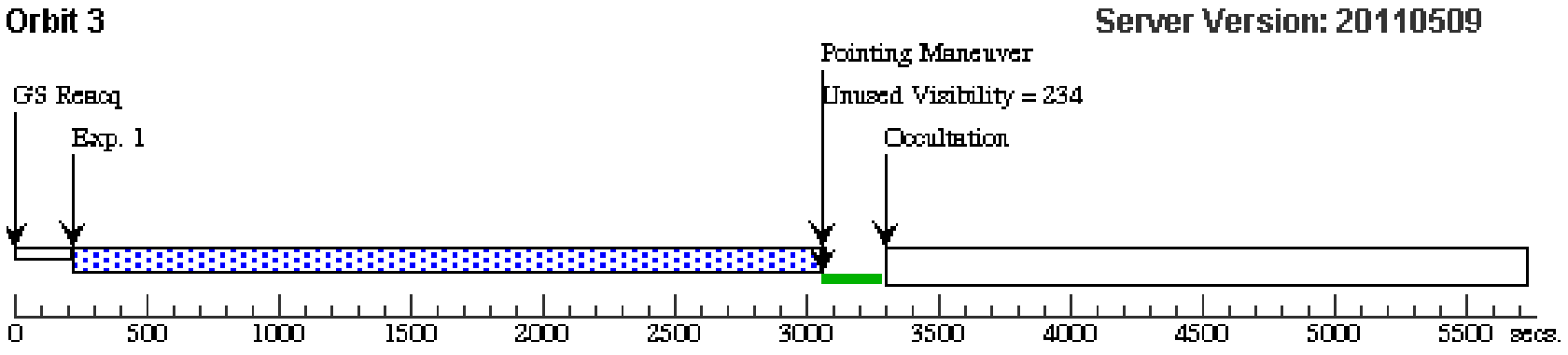
Exposures

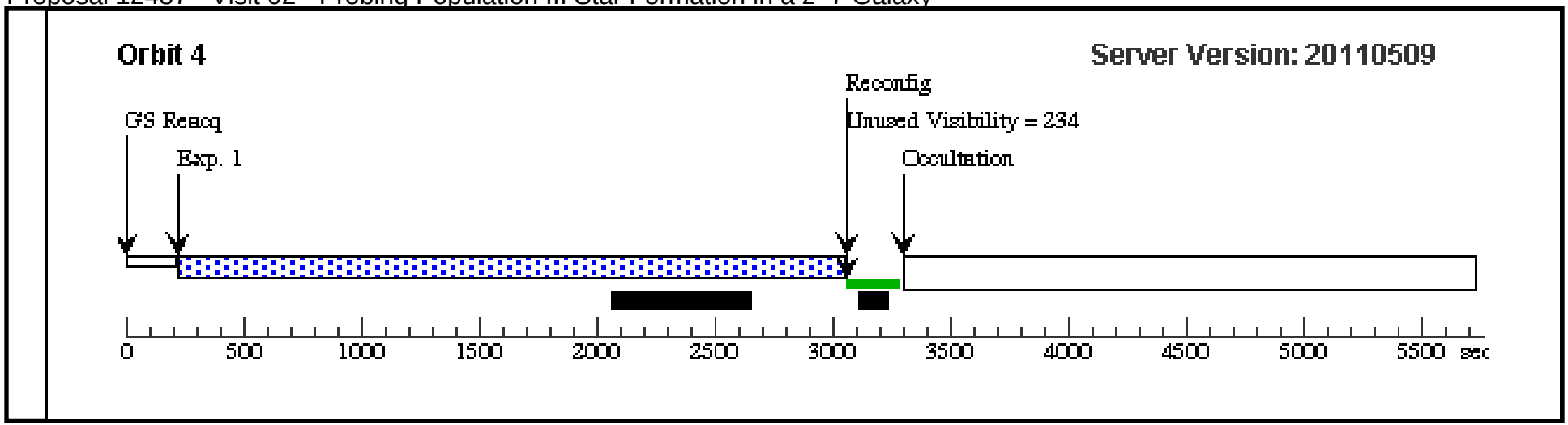
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) BDF-521	WFC3/IR, MULTIACCUM, IR	F132N	SAMP-SEQ=SPARS200; NSAMP=15		Pattern 1, Exps 1-1 in Visit 02 (1)	*[==>(Pattern 1)]*	***[1]***
								[==>(Pattern 2)]	***[2]***
								[==>(Pattern 3)]	***[3]***
								[==>(Pattern 4)]	***[4]***

Orbit Structure








Orbit 4
Server Version: 20110509
Reconfig
GS Reacq
Unused Visibility = 234
Exp. 1
Occultation
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1500
2000
2500
3000
3500
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4500
5000
5500
sec

Visit

Proposal 12487, Visit 03 Tue Jul 12 01:39:07 GMT 2011

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	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)

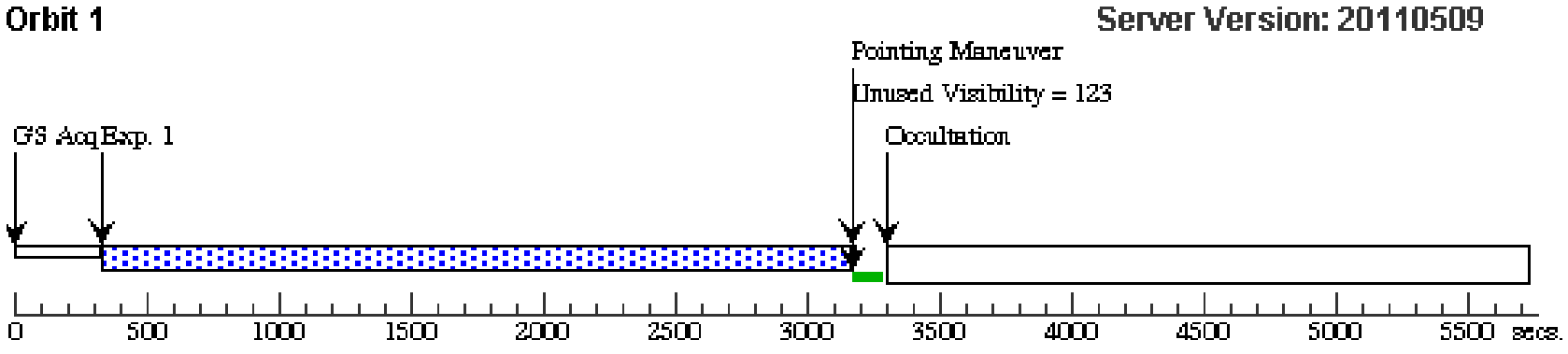
Fixed Targets

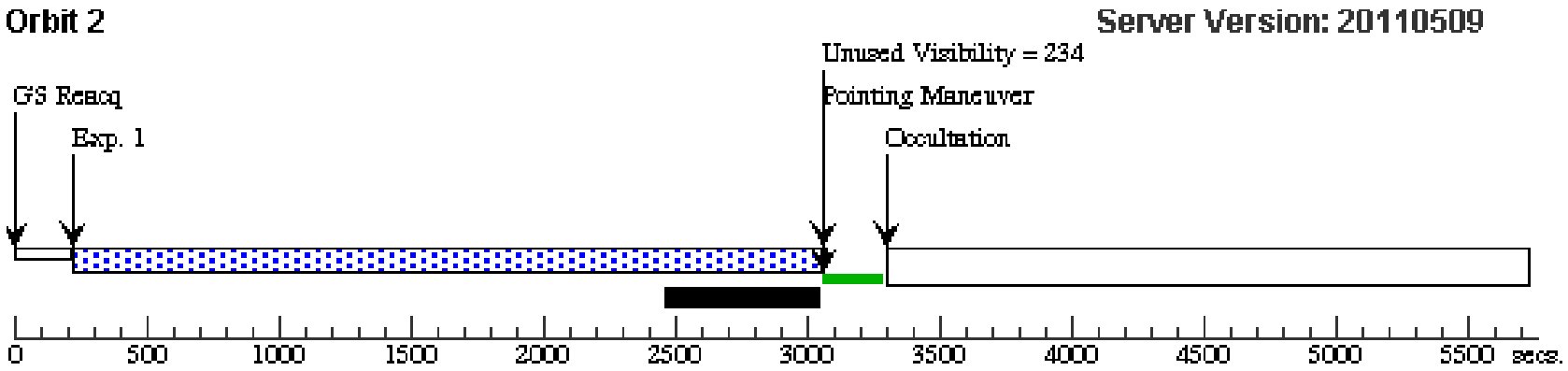
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	BDF-521	RA: 22 27 46.6560 (336.9444000d) Dec: -35 07 7.68 (-35.11880d) Equinox: J2000	Redshift: 7.008	V=(?) Y_AB=25.86; J_AB>26.5; K_AB>26.0	Reference Frame: ICRS

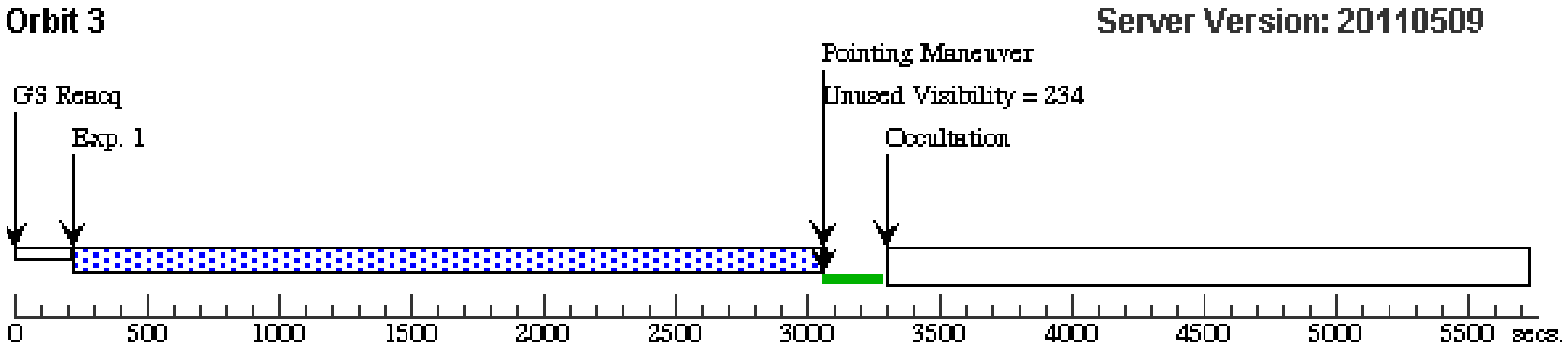
Exposures

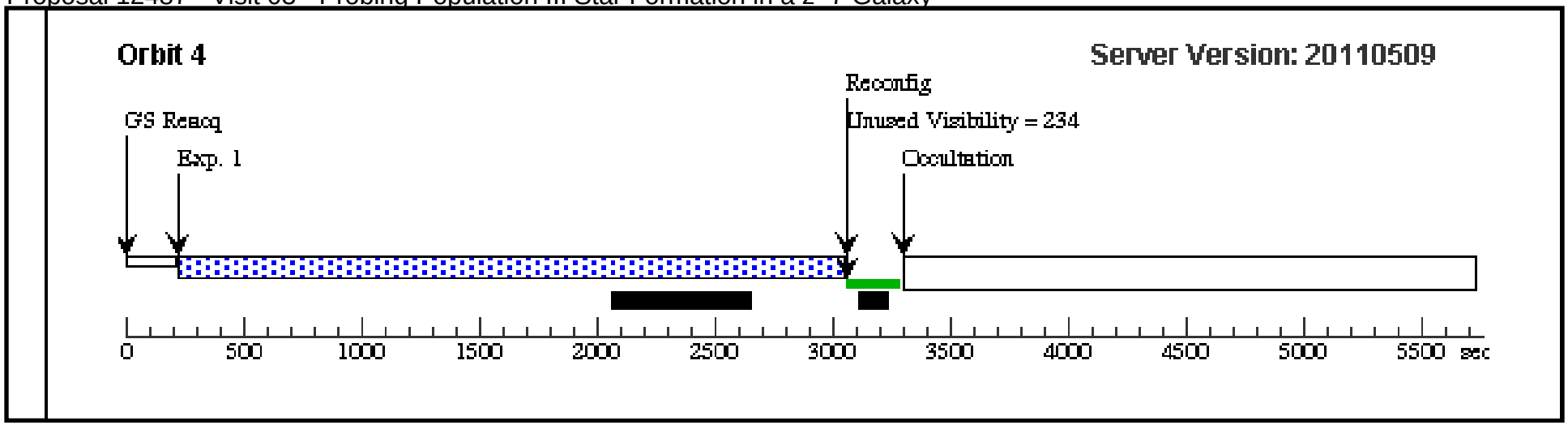
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) BDF-521	WFC3/IR, MULTIACCUM, IR	F132N	SAMP-SEQ=SPARS200; NSAMP=15	POS TARG 2.3374,2.0890	Pattern 1, Exps 1-1 in Visit 03 (1)	*[==>(Pattern 1)]*	***[1]***
								[==>(Pattern 2)]	***[2]***
								[==>(Pattern 3)]	***[3]***
								[==>(Pattern 4)]	***[4]***

Orbit Structure








Orbit 4
Server Version: 20110509
Reconfig
GS Reacq
Unused Visibility = 234
Exp. 1
Occultation
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3500
4000
4500
5000
5500
sec

Visit

Proposal 12487, Visit 04 Tue Jul 12 01:39:08 GMT 2011

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=WFC3-IR-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.605 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(1)

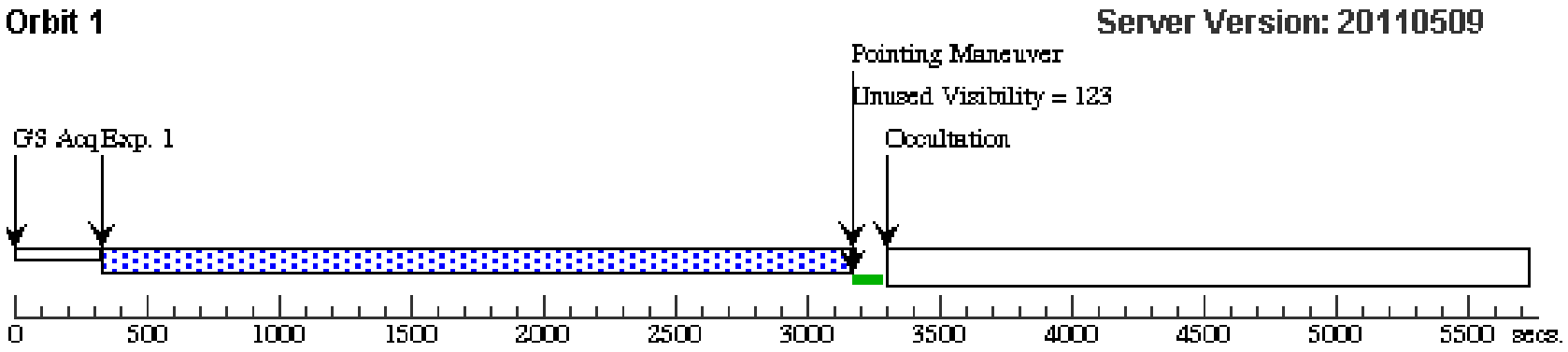
Fixed Targets

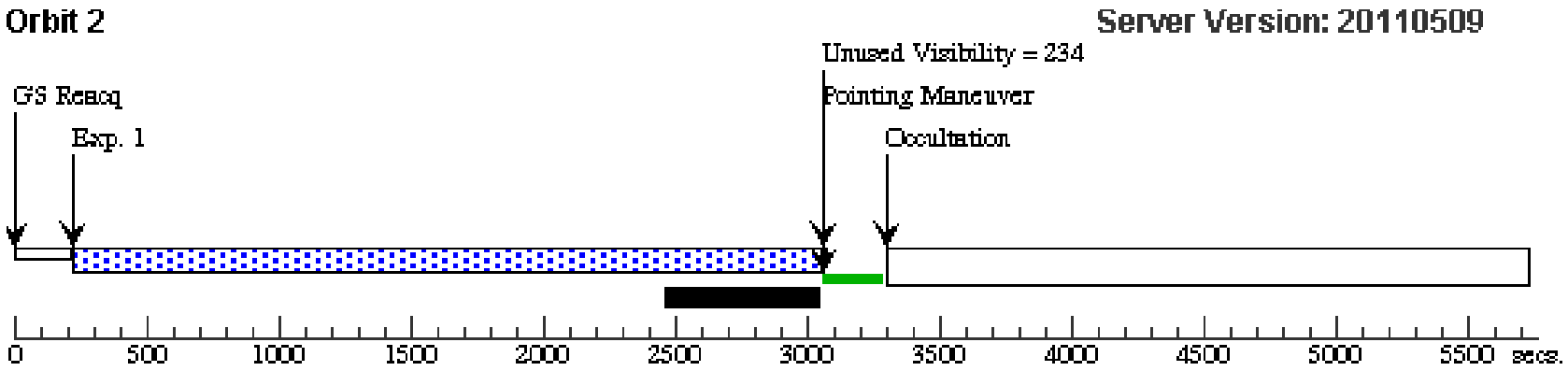
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	BDF-521	RA: 22 27 46.6560 (336.9444000d) Dec: -35 07 7.68 (-35.11880d) Equinox: J2000	Redshift: 7.008	V=(?) Y_AB=25.86; J_AB>26.5; K_AB>26.0	Reference Frame: ICRS

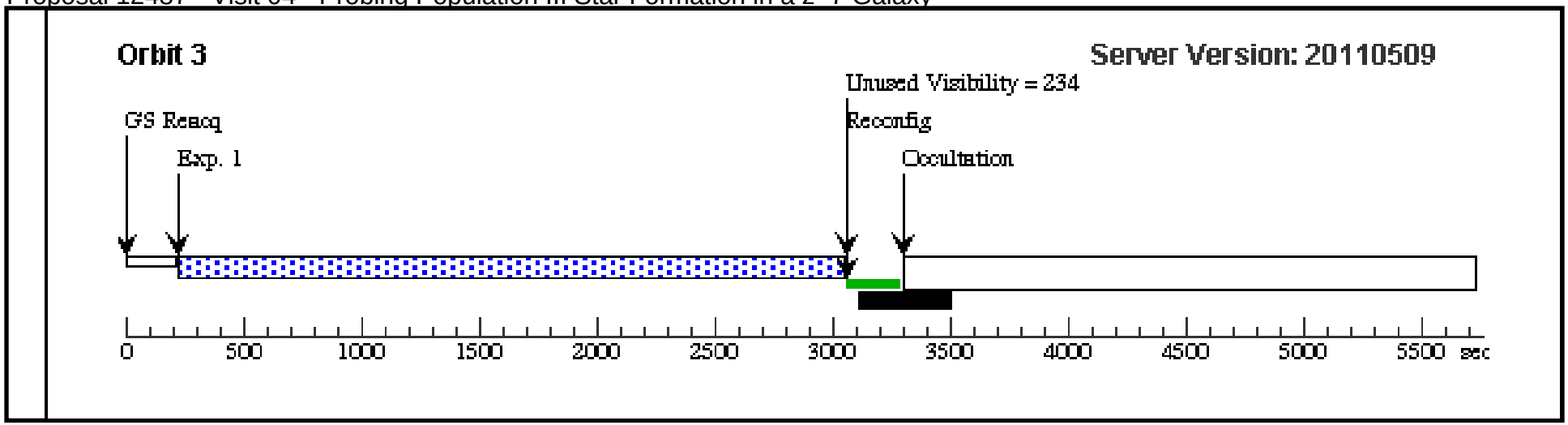
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) BDF-521	WFC3/IR, MULTIACCUM, IR	F132N	NSAMP=15; SAMP-SEQ=SPARS200	POS TARG -2.3374, 2.0890	Pattern 2, Exps 1-1 in Visit 04 (2)	*[==>(Pattern 1)]*	***[1]***
								[==>(Pattern 2)]	***[2]***
								[==>(Pattern 3)]	***[3]***

Orbit Structure



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Exp. 1
Reconfig
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