



13048 - The First Unambiguous Detection of a Distinct Metal-poor Stellar Halo in a Massive Early-type Galaxy

Cycle: 20, 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) NGC-3115-1	ACS/WFC WFC3/IR	4	05-Jul-2012 21:50:05.0	yes
02	(1) NGC-3115-1	ACS/WFC WFC3/IR	3	05-Jul-2012 21:50:22.0	yes
03	(2) NGC-3115-2	ACS/WFC WFC3/IR	4	05-Jul-2012 21:50:39.0	yes
04	(2) NGC-3115-2	ACS/WFC WFC3/IR	3	05-Jul-2012 21:50:53.0	yes
05	(3) NGC-3115-3	ACS/WFC WFC3/IR	4	05-Jul-2012 21:51:12.0	yes

<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>
06	(3) NGC-3115-3	ACS/WFC WFC3/IR	3	05-Jul-2012 21:51:25.0	yes
07	(2) NGC-3115-2	ACS/WFC WFC3/IR	4	05-Jul-2012 21:51:40.0	yes
08	(2) NGC-3115-2	ACS/WFC WFC3/IR	3	05-Jul-2012 21:51:54.0	yes

28 Total Orbits Used

ABSTRACT

It is well-established that many spiral galaxies, such as the Milky Way and M31, host metal-poor stellar halos. The properties of these halos place important constraints on the hierarchical formation and assembly histories of these galaxies. Observations of old globular clusters in early-type galaxies find ubiquitous evidence for bimodal color distributions (blue and red), suggesting the presence of two underlying populations of field stars: metal-poor and metal-rich. However, no direct evidence has been found for bimodal stellar populations, nor specifically for a distinct metal-poor stellar halo, in any massive early-type galaxy. We propose a study of red giant branch (RGB) stellar metallicities in the halo of NGC 3115, a nearby (9 Mpc) lenticular that is among the closest normal massive early-type galaxies, and which hosts a particularly well-characterized bimodal color distribution of globular clusters. Our proposed observations, across three fields extending out to the distant outer halo of the galaxy, will provide the first unambiguous test for the presence of a metal-poor stellar halo in a massive early-type galaxy, and in addition will measure the stellar halo density and metallicity gradients with galactocentric radius.

OBSERVING DESCRIPTION

Our goals are to detect a bimodal metallicity distribution in the stellar halo of NGC 3115, and to measure the gradients with radius of the amplitudes and mean metallicities of the bimodal peaks. We will observe three fields near the minor axis: one in the "near" halo, a middle field where we expect the contribution from metal-poor and metal-rich stars to be approximately equal, and a distant field where very few metal-rich stars should be present. These pointings are located at projected radii of 6, 12, and 18 arcmin (~16, 32, 47 kpc). We observe along the minor axis because the metal-poor globular clusters (GCs) have a rounder spatial distribution than the metal-rich GC system (which is elongated along the major axis), so the metal-poor red giants are expected to "emerge" sooner along the minor than major axis.

Proposal 13048 (STScI Edit Number: 3, Created: Thursday, July 5, 2012 8:52:02 PM EST) - Overview

To do this as efficiently as possible, we will observe simultaneously with ACS (F606W) and WFC3 (F110W), doing half of the observations with two visits, then when HST has rolled to the opposite side, doing the other half of the observations in two more visits. The middle field gets twice the exposure time of the other two fields, as is necessary to distinguish the two metallicity peaks of nearly equal amplitude that are expected in this field.

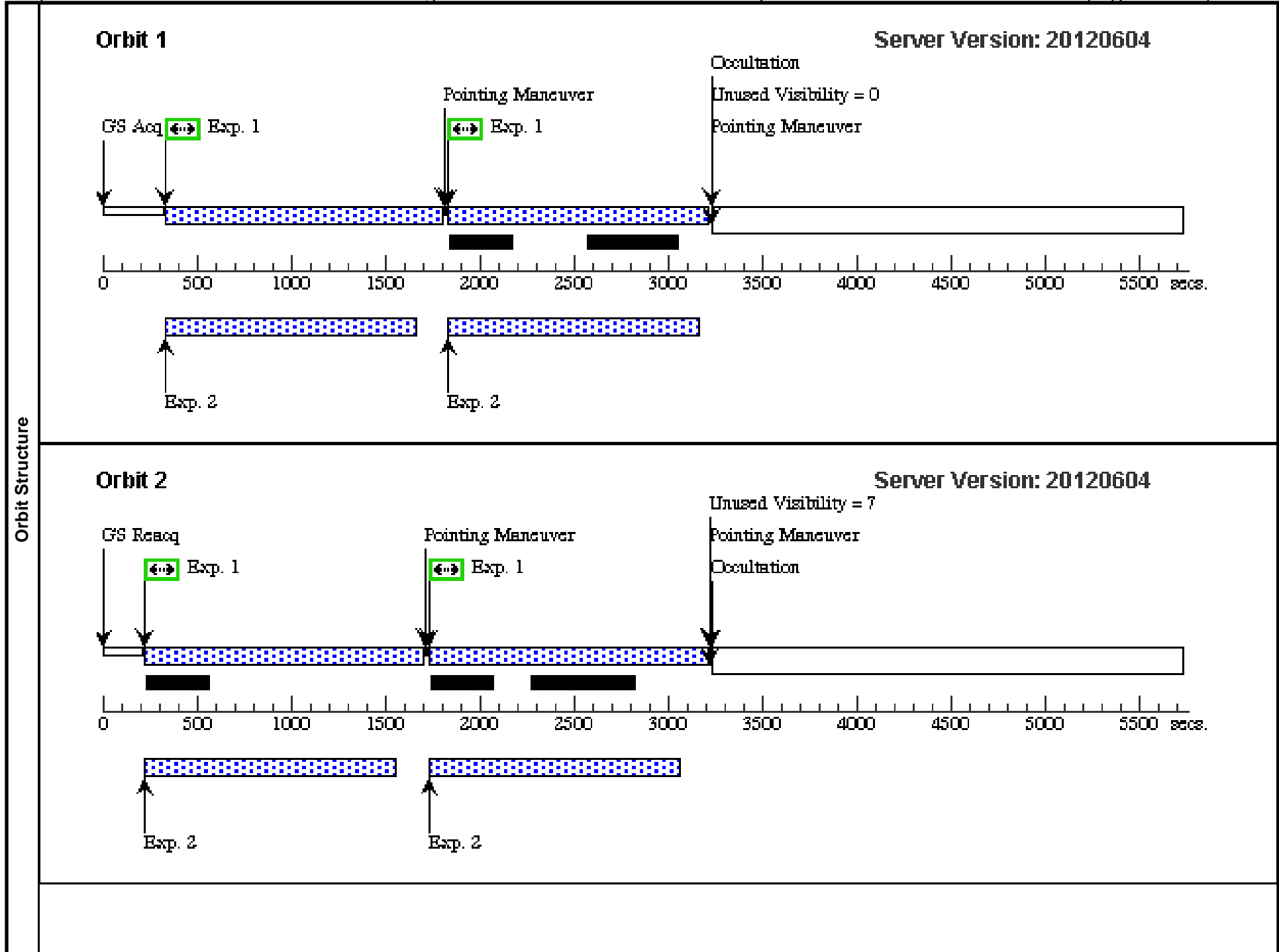
The choice of filters is motivated by the requirements of a wide wavelength baseline (to separate out the metallicity peaks as much as possible), and matching between instrumental efficiency and red giant branch spectral energy distributions. Previous work on this topic has focused on the F606WF814W combination (similar to VI), but the advent of the F110W filter with its redder wavelength and wide bandpass allows for significant improvements in measuring metallicity distributions. The limiting factor in the observations is the exposure time in F606W, which needs to go deep enough to reach even the reddest red giant branch stars.

Our goal for the long, middle pointing is to obtain the complete metallicity distribution function in this region, allowing for metallicities up to $[Fe/H] = 0.2$, which we detect with $S/N=5$ per star. For the other two, shallower pointings, the primary objective is to characterize the metal-poor peak, which does not require reaching the most metal-rich end of the distribution. At the distance and foreground reddening of NGC 3115 the brightest of these metal-rich giants will have $F606W \sim 29.2$, which by the ACS ETC and previous observations requires 31500 sec of exposure time to reach.

Proposal 13048 - Visit 01 - The First Unambiguous Detection of a Distinct Metal-poor Stellar Halo in a Massive Early-type Galaxy

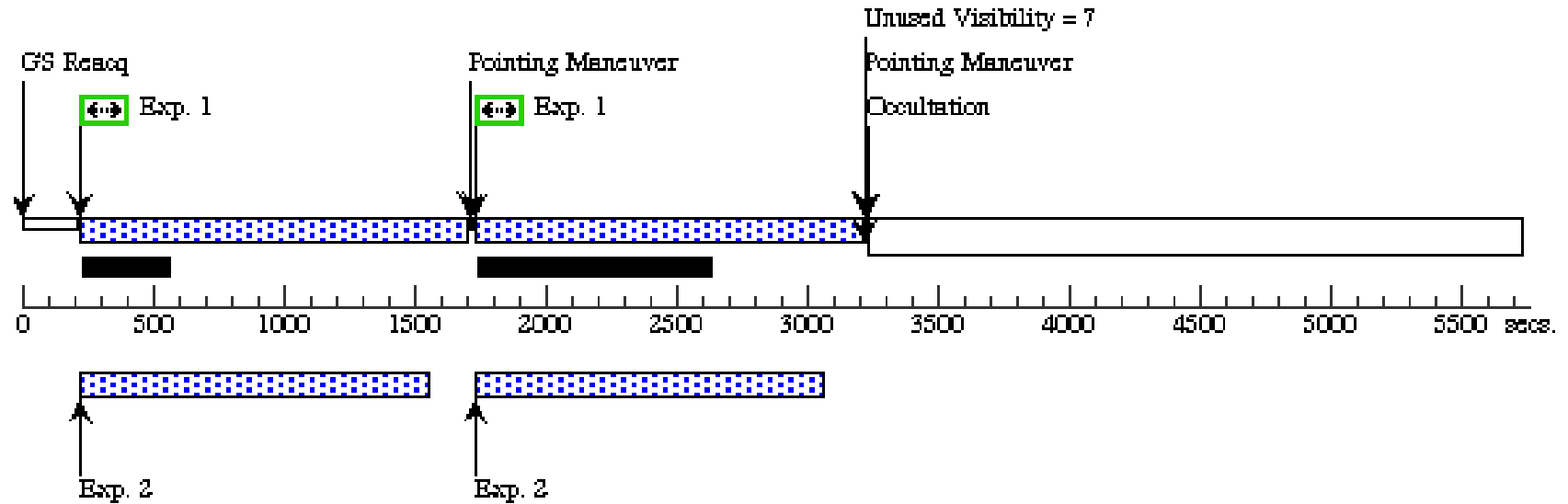
Fri Jul 06 01:52:02 GMT 2012

Visit	Proposal 13048, Visit 01, implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR, ACS/WFC Special Requirements: ORIENT 275D TO 275 D									
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Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	NGC-3115-1	RA: 10 04 55.4000 (151.2308333d) Dec: -07 38 48.00 (-7.64667d) Equinox: J2000		V=9.9	Reference Frame: ICRS				
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1		(1) NGC-3115-1	ACS/WFC, ACCUM, WFCENTER	F606W			GS ACQ SCENARI O BASE1B3	Pattern 3, Exps 1-2 in Visit 01 (3) Prime + Parallel Group 1-2 in Pattern 3, Exps 1-2 in Visit 01	1200 Secs [==>1261.0 Secs (Pattern 1,1)] [==>1261.0 Secs (Pattern 1,2)] [==>1354.0 Secs (Pattern 1,3)] [==>1354.0 Secs (Pattern 1,4)] [==>1354.0 Secs (Pattern 2,1)] [==>1354.0 Secs (Pattern 2,2)] [==>1354.0 Secs (Pattern 2,3)] [==>1354.0 Secs (Pattern 2,4)]
2		(1) NGC-3115-1	WFC3/IR, MULTIACCUM, IR-FIX	F110W		SAMP-SEQ=SPARS 100; NSAMP=14		Pattern 3, Exps 1-2 in Visit 01 (3) Prime + Parallel Group 1-2 in Pattern 3, Exps 1-2 in Visit 01	[==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 1,3)] [==>(Pattern 1,4)] [==>(Pattern 2,1)] [==>(Pattern 2,2)] [==>(Pattern 2,3)] [==>(Pattern 2,4)]	[1] [2] [3] [4]



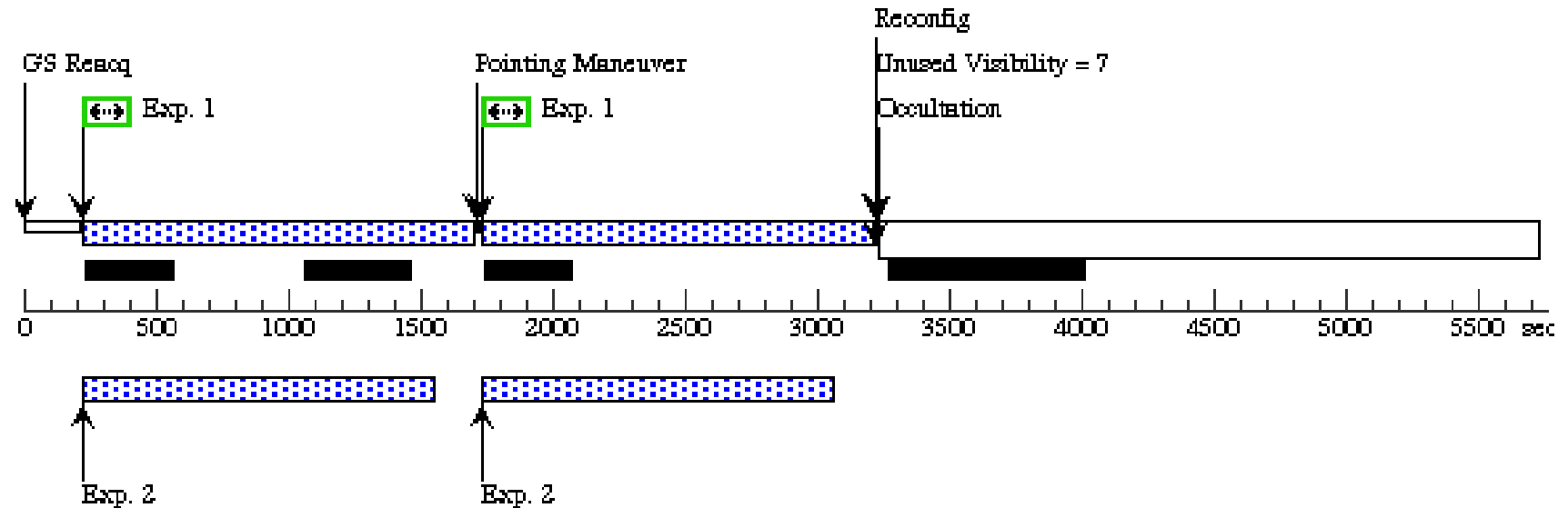
Orbit 3

Server Version: 20120604



Orbit 4

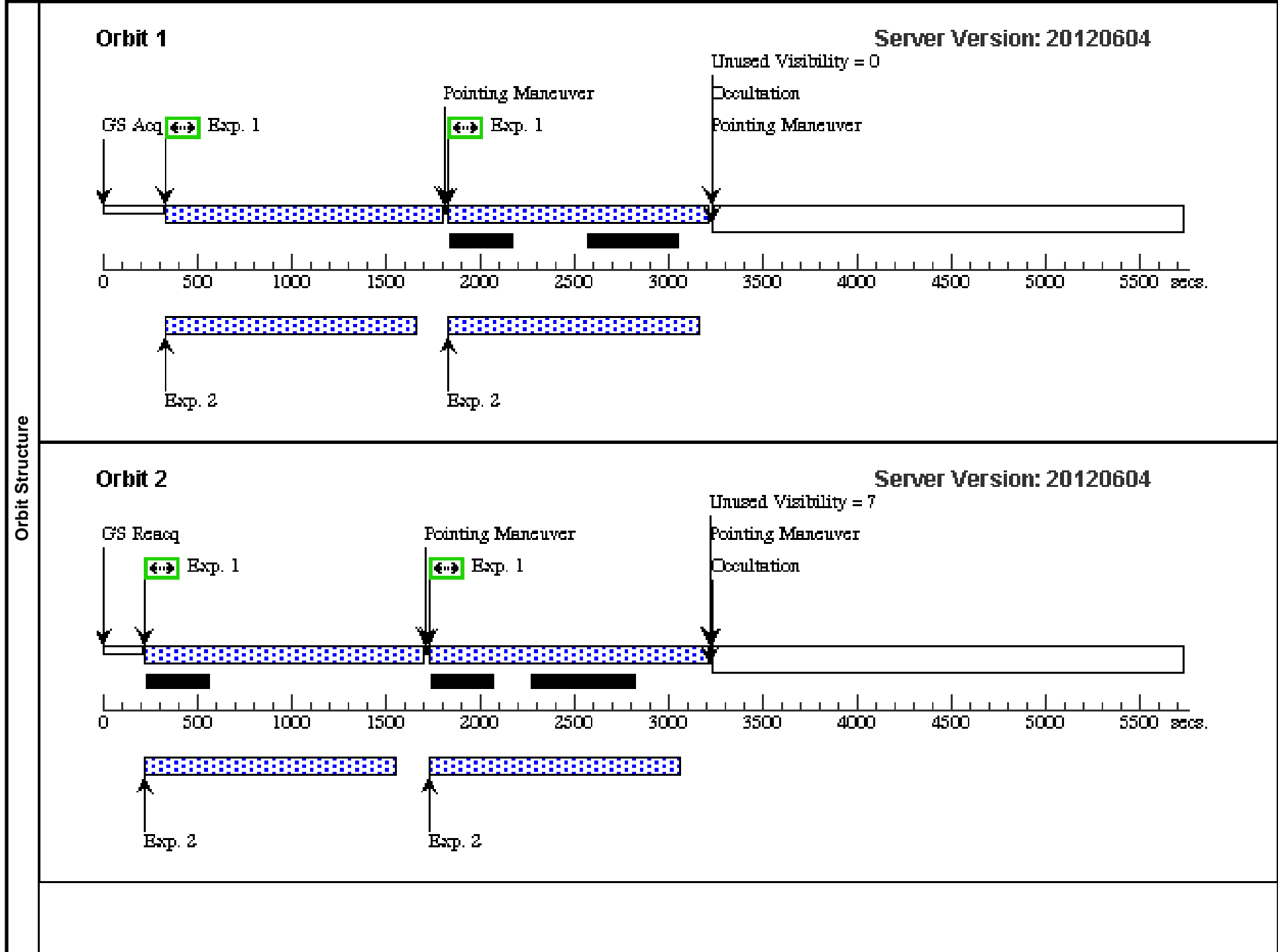
Server Version: 20120604

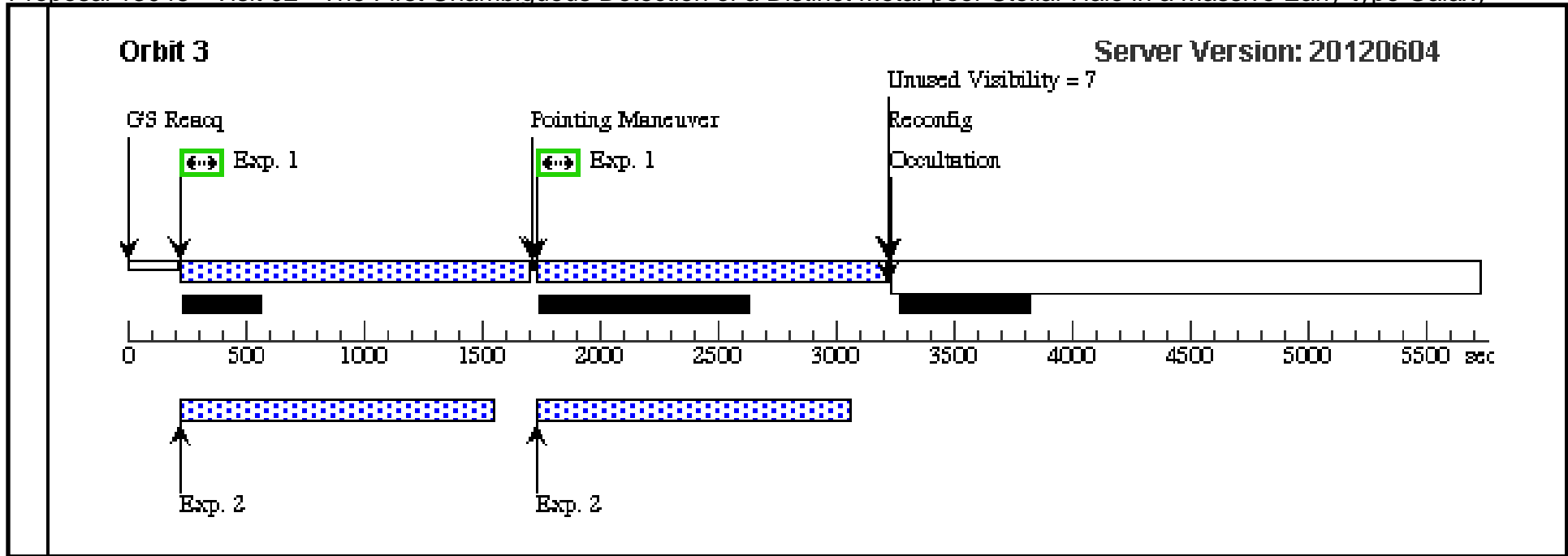


Proposal 13048 - Visit 02 - The First Unambiguous Detection of a Distinct Metal-poor Stellar Halo in a Massive Early-type Galaxy

Fri Jul 06 01:52:08 GMT 2012

Visit	Proposal 13048, Visit 02, implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR, ACS/WFC Special Requirements: ORIENT 275D TO 275 D									
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Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	NGC-3115-1	RA: 10 04 55.4000 (151.2308333d) Dec: -07 38 48.00 (-7.64667d) Equinox: J2000		V=9.9	Reference Frame: ICRS				
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1		(1) NGC-3115-1	ACS/WFC, ACCUM, WFCENTER	F606W			GS ACQ SCENARI O BASE1B3	Pattern 2, Exps 1-2 in Visit 02 (2) Prime + Parallel Group 1-2 in Pattern 2, Exps 1-2 in Visit 02	1200 Secs [==>1261.0 Secs (Pattern 1,1)] [==>1261.0 Secs (Pattern 1,2)] [==>1352.0 Secs (Pattern 1,3)] [==>1352.0 Secs (Pattern 2,1)] [==>1354.0 Secs (Pattern 2,2)] [==>1354.0 Secs (Pattern 2,3)]
2		(1) NGC-3115-1	WFC3/IR, MULTIACCUM, IR-FIX	F110W		SAMP-SEQ=SPARS 100; NSAMP=14		Pattern 2, Exps 1-2 in Visit 02 (2) Prime + Parallel Group 1-2 in Pattern 2, Exps 1-2 in Visit 02	[==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 1,3)] [==>(Pattern 2,1)] [==>(Pattern 2,2)] [==>(Pattern 2,3)]	[1] [2] [3]

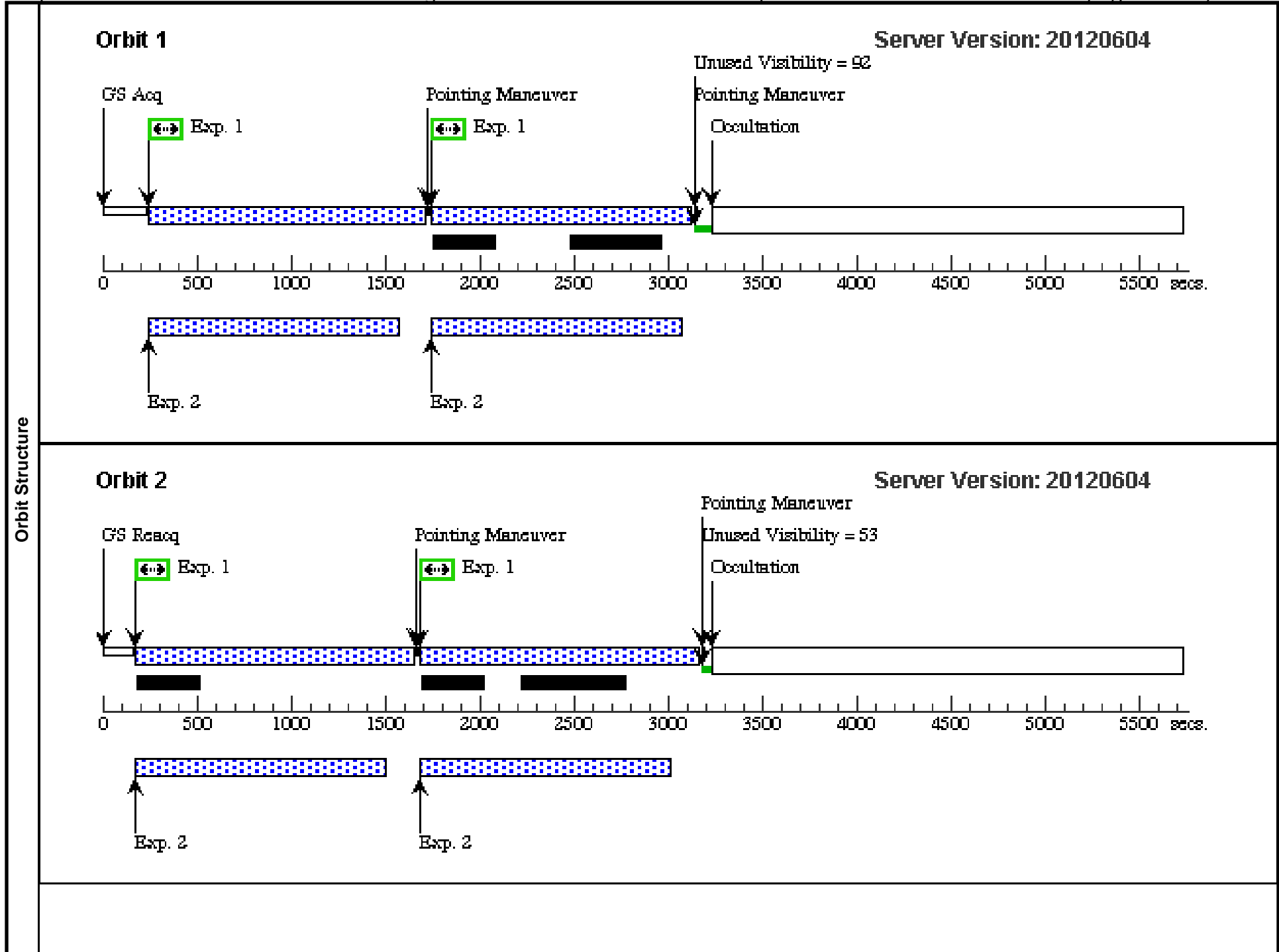




Proposal 13048 - Visit 03 - The First Unambiguous Detection of a Distinct Metal-poor Stellar Halo in a Massive Early-type Galaxy

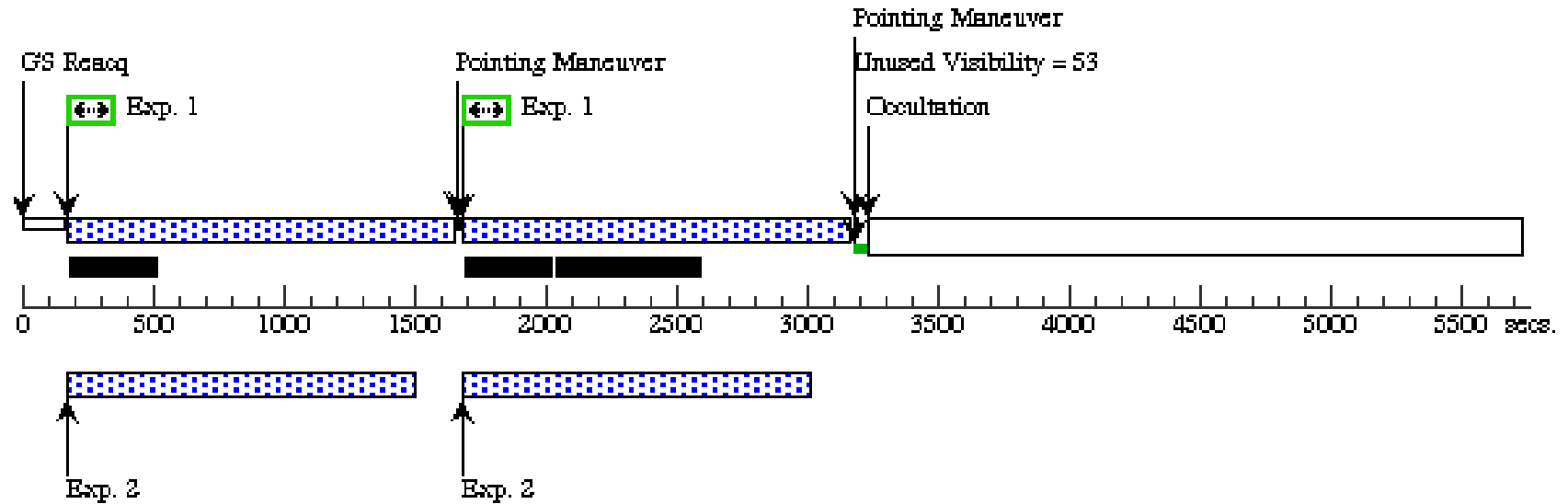
Fri Jul 06 01:52:11 GMT 2012

Visit	Proposal 13048, Visit 03, implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR, ACS/WFC Special Requirements: ORIENT 275D TO 275 D									
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Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(2)	NGC-3115-2	RA: 10 04 40.1130 (151.1671375d) Dec: -07 34 11.10 (-7.56975d) Equinox: J2000		V=9.9	Reference Frame: ICRS				
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1		(2) NGC-3115-2	ACS/WFC, ACCUM, WFCENTER	F606W			GS ACQ SCENARI O SINGLE	Pattern 3, Exps 1-2 in Visit 03 (3) Prime + Parallel Group 1-2 in Pattern 3, Exps 1-2 in Visit 03	1200 Secs [==>1261.0 Secs (Pattern 1,1)] [==>1261.0 Secs (Pattern 1,2)] [==>1354.0 Secs (Pattern 1,3)] [==>1354.0 Secs (Pattern 1,4)] [==>1354.0 Secs (Pattern 2,1)] [==>1354.0 Secs (Pattern 2,2)] [==>1354.0 Secs (Pattern 2,3)] [==>1354.0 Secs (Pattern 2,4)]
2		(2) NGC-3115-2	WFC3/IR, MULTIACCUM, IR-FIX	F110W		SAMP-SEQ=SPARS 100; NSAMP=14		Pattern 3, Exps 1-2 in Visit 03 (3) Prime + Parallel Group 1-2 in Pattern 3, Exps 1-2 in Visit 03	[==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 1,3)] [==>(Pattern 1,4)] [==>(Pattern 2,1)] [==>(Pattern 2,2)] [==>(Pattern 2,3)] [==>(Pattern 2,4)]	[1] [2] [3] [4]



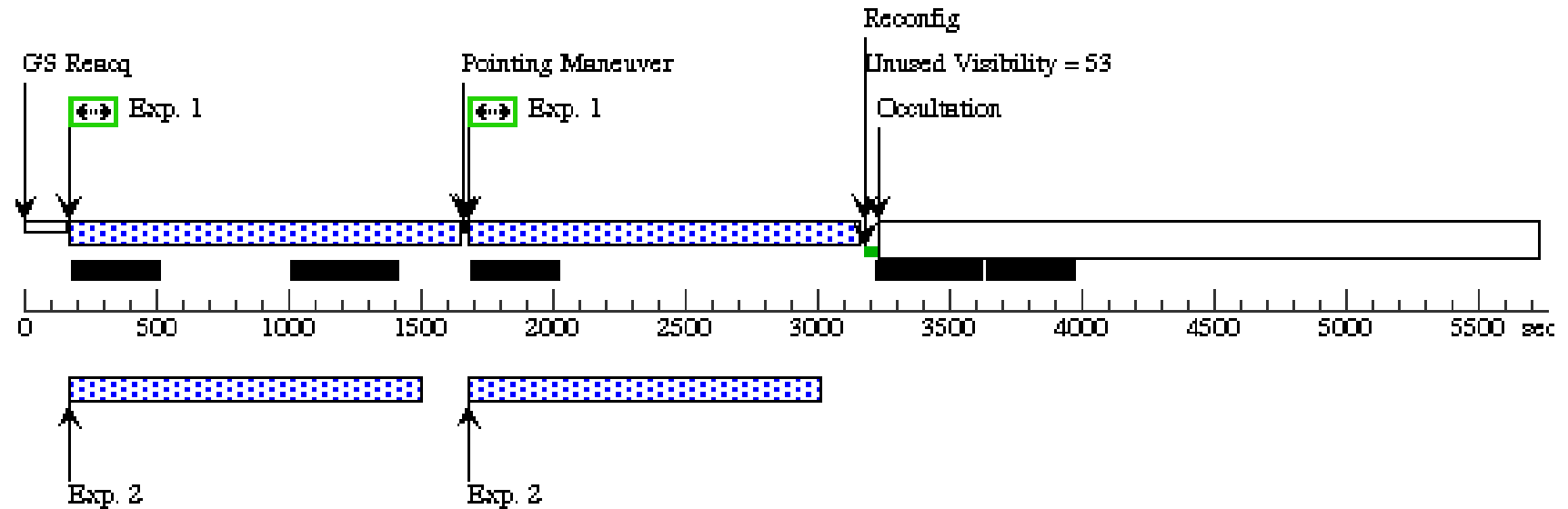
Orbit 3

Server Version: 20120604



Orbit 4

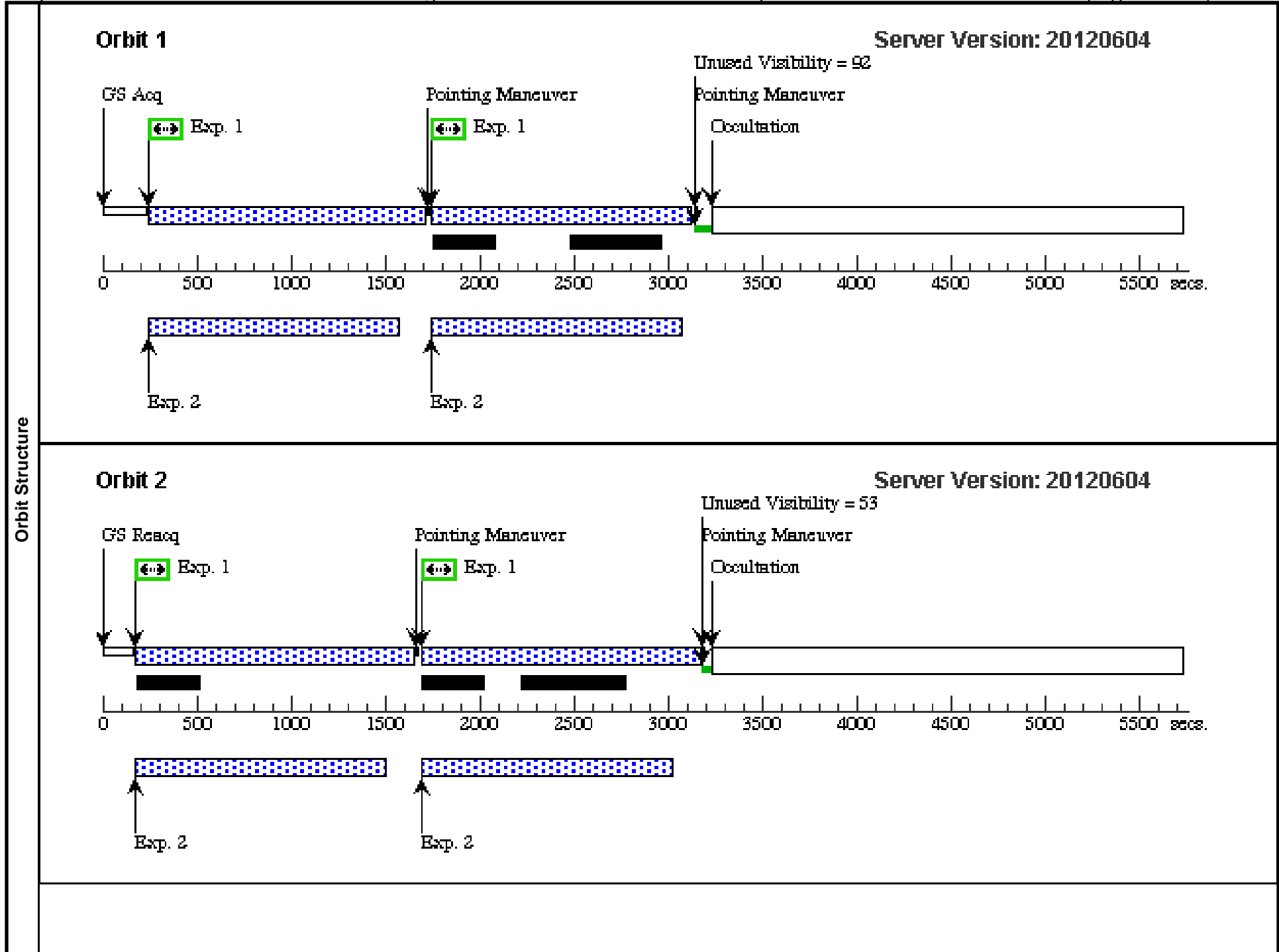
Server Version: 20120604

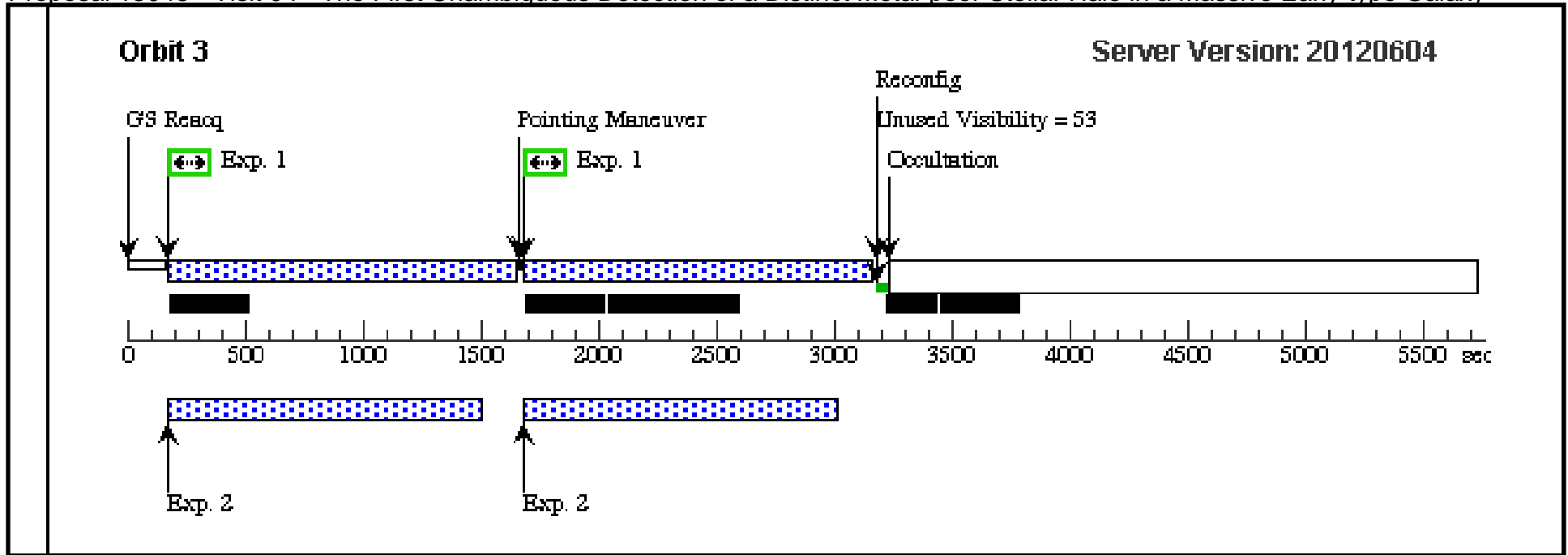


Proposal 13048 - Visit 04 - The First Unambiguous Detection of a Distinct Metal-poor Stellar Halo in a Massive Early-type Galaxy

Fri Jul 06 01:52:15 GMT 2012

Visit	Proposal 13048, Visit 04, implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR, ACS/WFC Special Requirements: ORIENT 275D TO 275 D									
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Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(2)	NGC-3115-2	RA: 10 04 40.1130 (151.1671375d) Dec: -07 34 11.10 (-7.56975d) Equinox: J2000		V=9.9	Reference Frame: ICRS				
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	(2) NGC-3115-2	ACS/WFC, ACCUM, WFCENTER	F606W			GS ACQ SCENARIO SINGLE	Pattern 2, Exps 1-2 in Visit 04 (2) Prime + Parallel Group 1-2 in Pattern 2, Exps 1-2 in Visit 04	1200 Secs [==>1261.0 Secs (Pattern 1,1)] [==>1261.0 Secs (Pattern 1,2)] [==>1352.0 Secs (Pattern 1,3)] [==>1352.0 Secs (Pattern 2,1)] [==>1354.0 Secs (Pattern 2,2)] [==>1354.0 Secs (Pattern 2,3)]	[1] [2] [3]
2	(2) NGC-3115-2	WFC3/IR, MULTIACCUM, IR-FIX	F110W			SAMP-SEQ=SPARS100; NSAMP=14	Pattern 2, Exps 1-2 in Visit 04 (2) Prime + Parallel Group 1-2 in Pattern 2, Exps 1-2 in Visit 04	[==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 1,3)] [==>(Pattern 2,1)] [==>(Pattern 2,2)] [==>(Pattern 2,3)]	[1] [2] [3]	

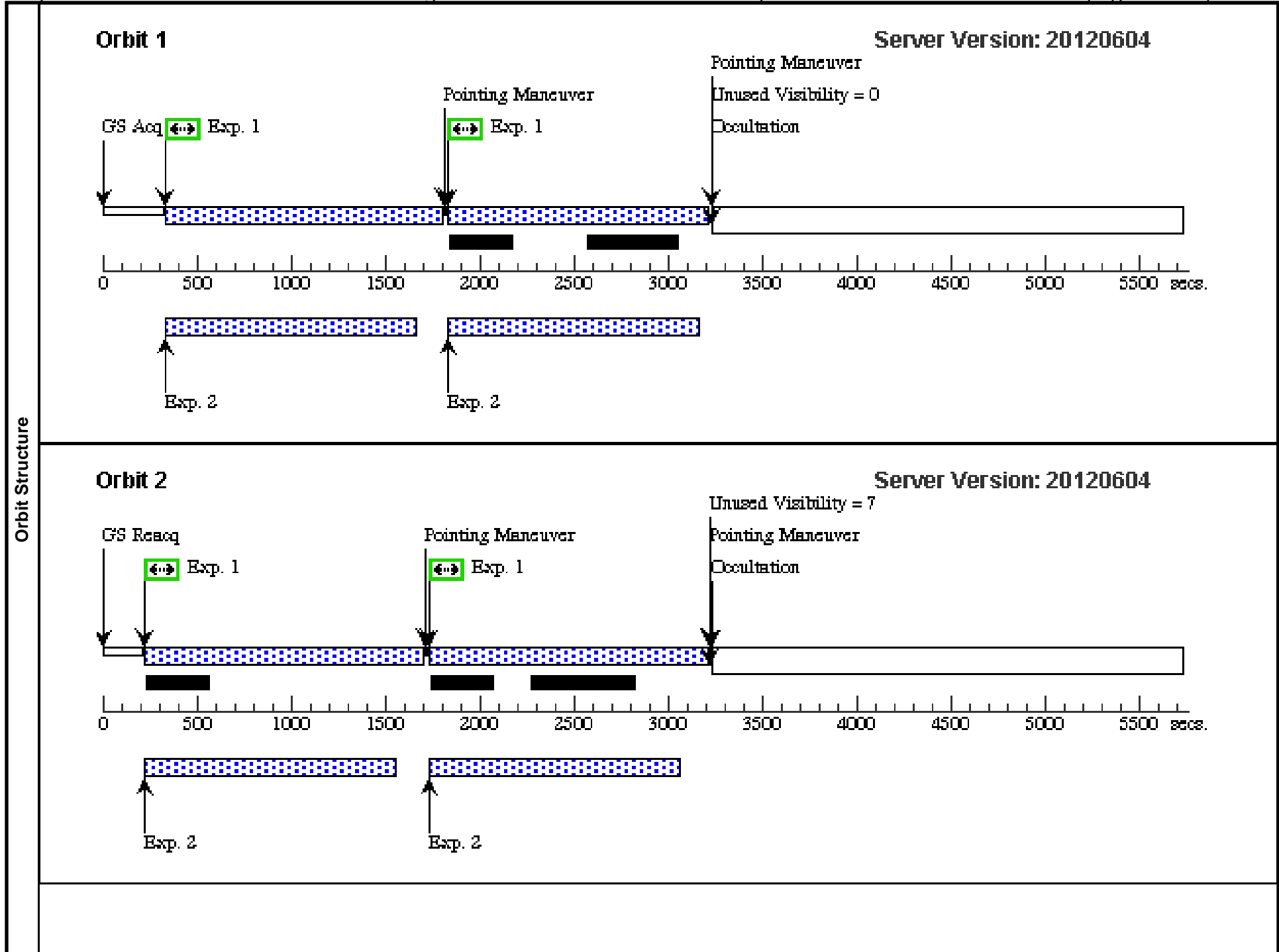




Proposal 13048 - Visit 05 - The First Unambiguous Detection of a Distinct Metal-poor Stellar Halo in a Massive Early-type Galaxy

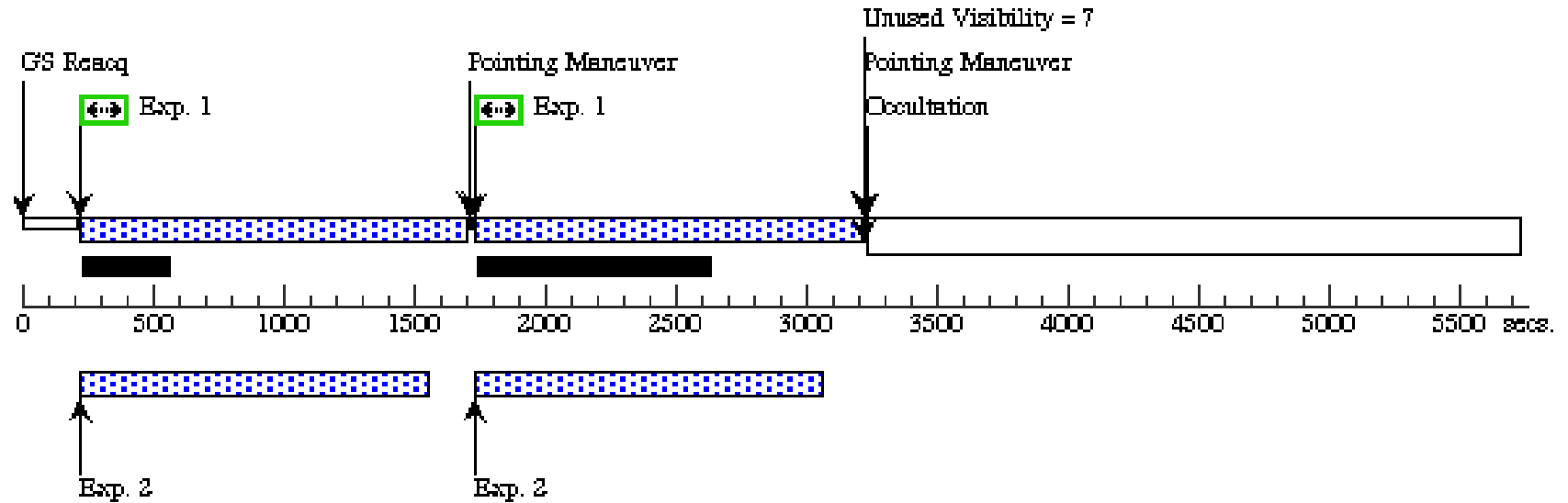
Fri Jul 06 01:52:18 GMT 2012

Visit	Proposal 13048, Visit 05, implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR, ACS/WFC Special Requirements: ORIENT 94D TO 94 D									
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	(3)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=3.011 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.28 Angle Between Sides= Center Pattern=false	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.265 Line Spacing=0.187	(1-2)					
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(3)	NGC-3115-3	RA: 10 04 24.8540 (151.1035583d) Dec: -07 29 29.41 (-7.49150d) Equinox: J2000		V=9.9	Reference Frame: ICRS				
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1		(3) NGC-3115-3	ACS/WFC, ACCUM, WFCENTER	F606W				Pattern 3, Exps 1-2 in Visit 05 (3) Prime + Parallel Group 1-2 in Pattern 3, Exps 1-2 in Visit 05	1200 Secs [==>1261.0 Secs (Pattern 1,1)] [==>1261.0 Secs (Pattern 1,2)] [==>1354.0 Secs (Pattern 1,3)] [==>1354.0 Secs (Pattern 1,4)] [==>1354.0 Secs (Pattern 2,1)] [==>1354.0 Secs (Pattern 2,2)] [==>1354.0 Secs (Pattern 2,3)] [==>1354.0 Secs (Pattern 2,4)]
2		(3) NGC-3115-3	WFC3/IR, MULTIACCUM, IR-FIX	F110W		SAMP-SEQ=SPARS 100; NSAMP=14		Pattern 3, Exps 1-2 in Visit 05 (3) Prime + Parallel Group 1-2 in Pattern 3, Exps 1-2 in Visit 05	[==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 1,3)] [==>(Pattern 1,4)] [==>(Pattern 2,1)] [==>(Pattern 2,2)] [==>(Pattern 2,3)] [==>(Pattern 2,4)]	[1] [2] [3] [4]



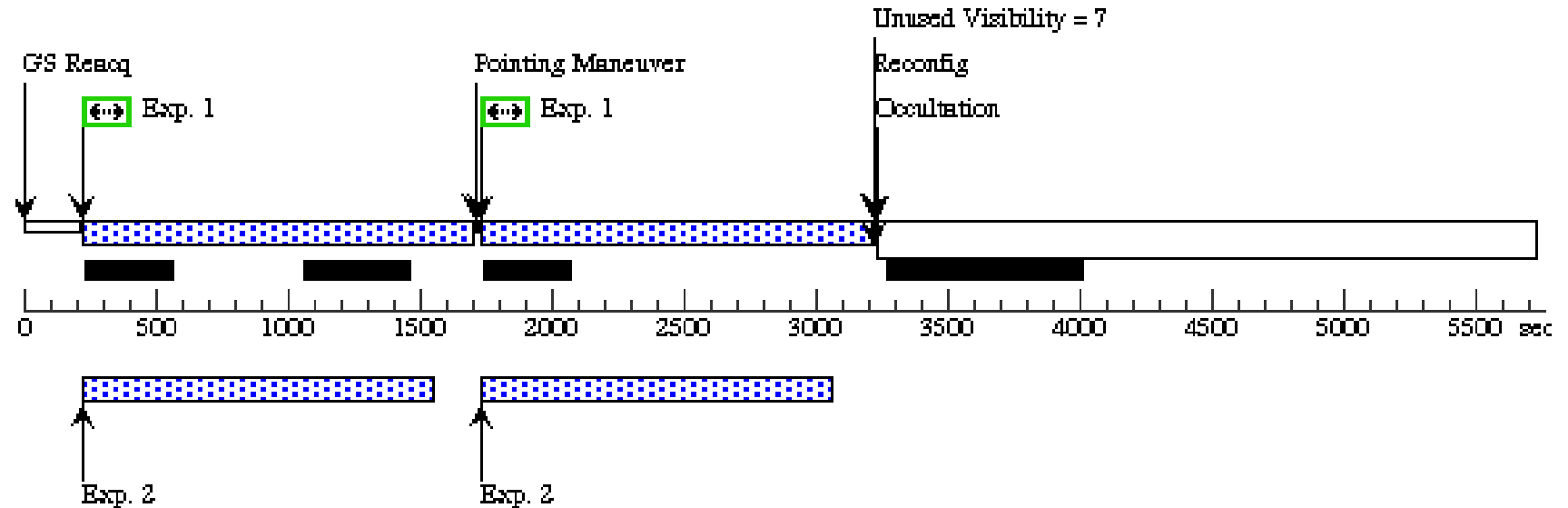
Orbit 3

Server Version: 20120604



Orbit 4

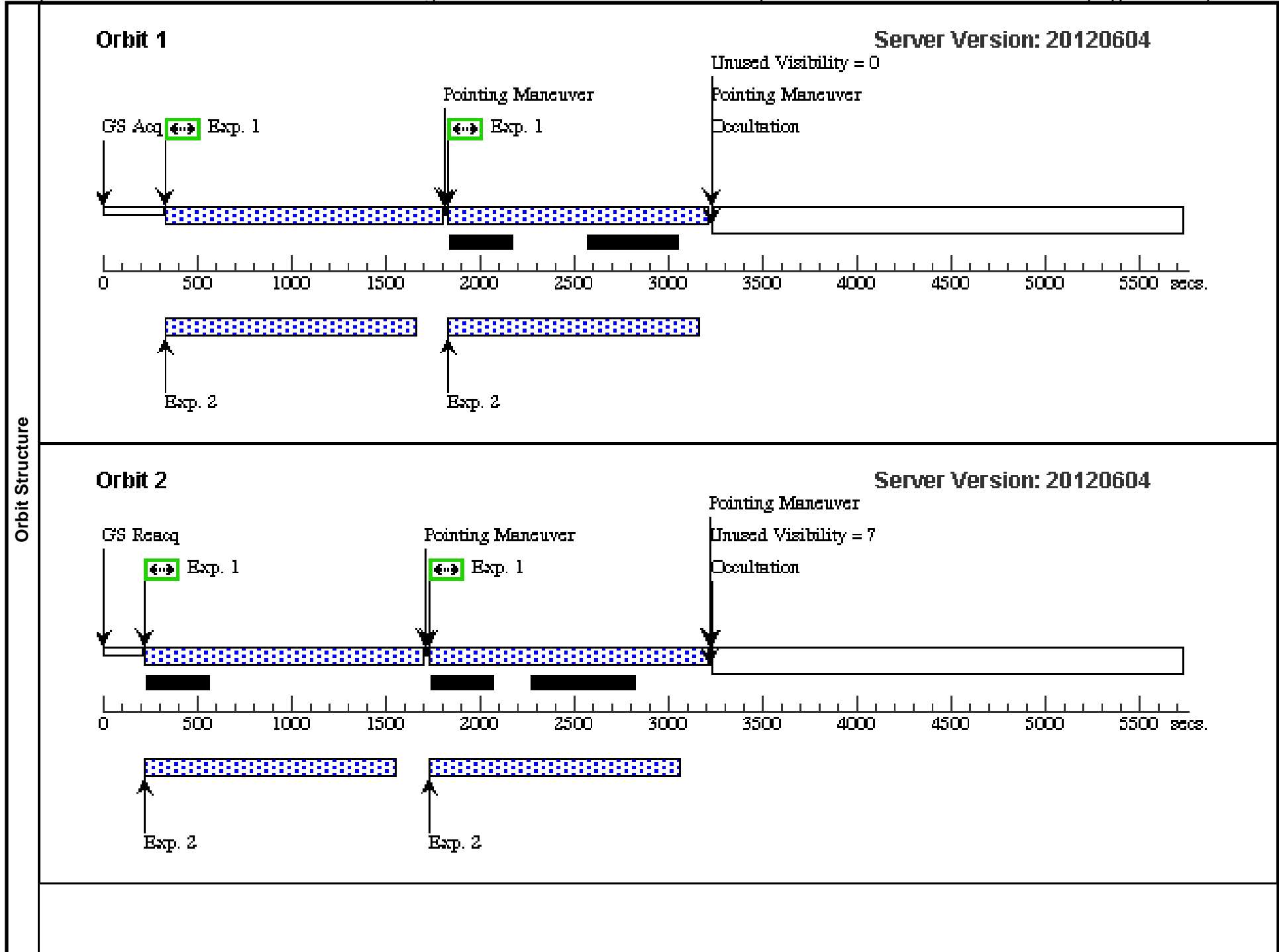
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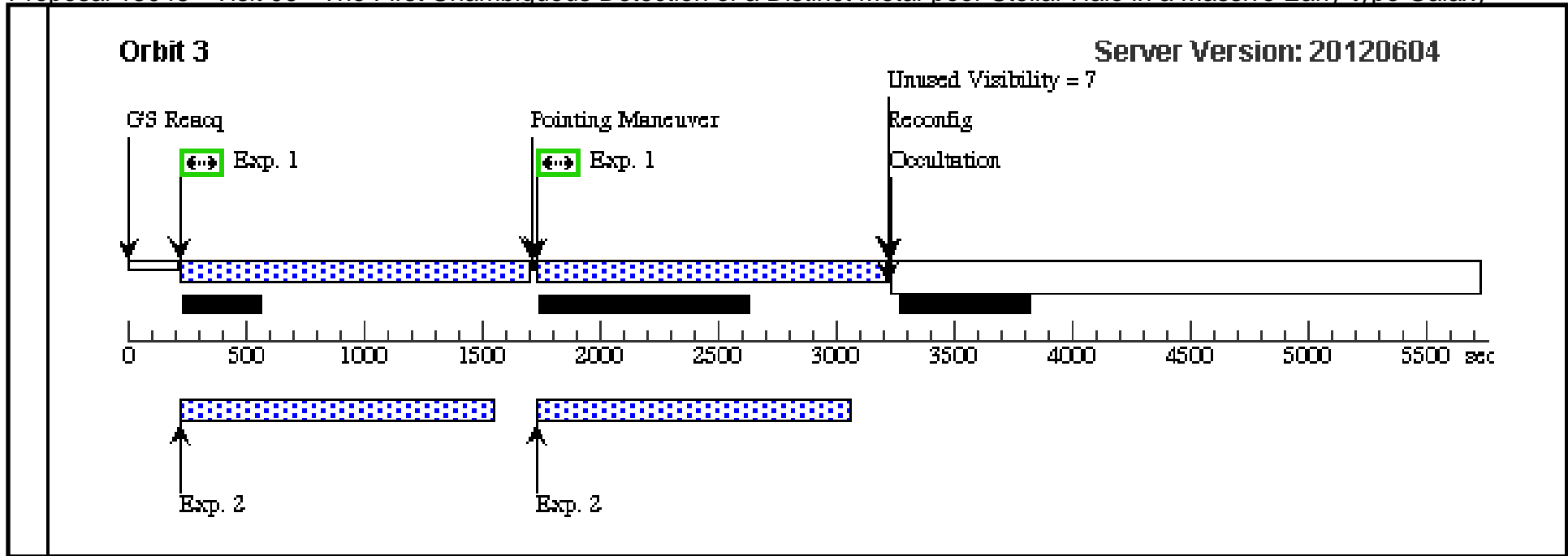


Proposal 13048 - Visit 06 - The First Unambiguous Detection of a Distinct Metal-poor Stellar Halo in a Massive Early-type Galaxy

Fri Jul 06 01:52:21 GMT 2012

Visit	Proposal 13048, Visit 06, implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR, ACS/WFC Special Requirements: ORIENT 94D TO 94 D									
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Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(3)	NGC-3115-3	RA: 10 04 24.8540 (151.1035583d) Dec: -07 29 29.41 (-7.49150d) Equinox: J2000		V=9.9	Reference Frame: ICRS				
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1		(3) NGC-3115-3	ACS/WFC, ACCUM, WFCENTER	F606W				Pattern 2, Exps 1-2 in Visit 06 (2) Prime + Parallel Group 1-2 in Pattern 2, Exps 1-2 in Visit 06	1200 Secs [==>1261.0 Secs (Pattern 1,1)] [==>1261.0 Secs (Pattern 1,2)] [==>1352.0 Secs (Pattern 1,3)] [==>1352.0 Secs (Pattern 2,1)] [==>1354.0 Secs (Pattern 2,2)] [==>1354.0 Secs (Pattern 2,3)]
2		(3) NGC-3115-3	WFC3/IR, MULTIACCUM, IR-FIX	F110W		SAMP-SEQ=SPARS100; NSAMP=14		Pattern 2, Exps 1-2 in Visit 06 (2) Prime + Parallel Group 1-2 in Pattern 2, Exps 1-2 in Visit 06	[==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 1,3)] [==>(Pattern 2,1)] [==>(Pattern 2,2)] [==>(Pattern 2,3)]	[1] [2] [3]

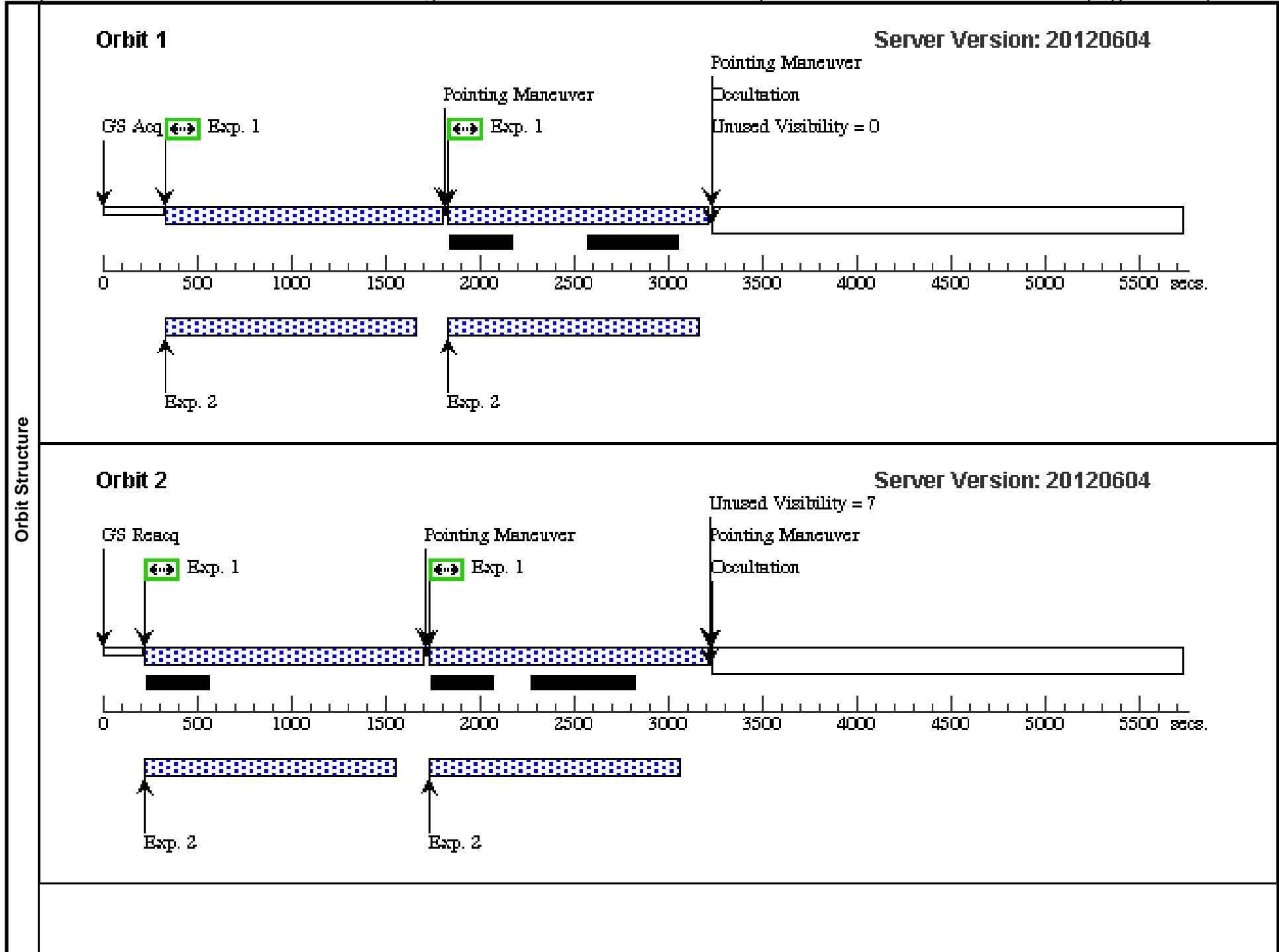




Proposal 13048 - Visit 07 - The First Unambiguous Detection of a Distinct Metal-poor Stellar Halo in a Massive Early-type Galaxy

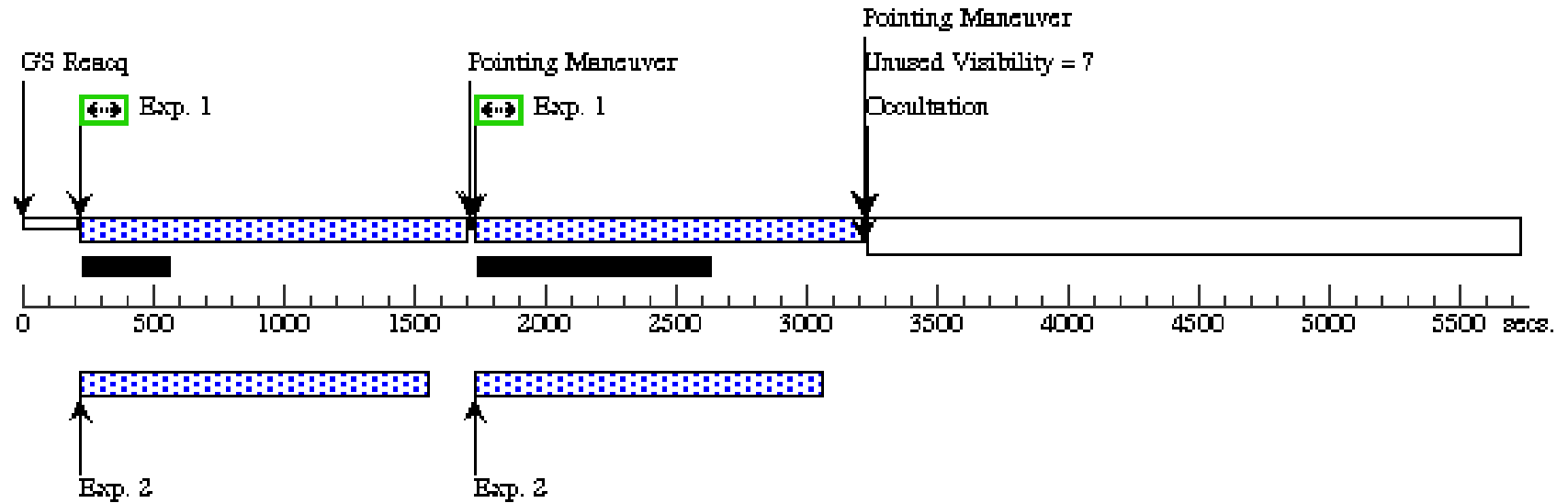
Fri Jul 06 01:52:23 GMT 2012

Visit	Proposal 13048, Visit 07, implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR, ACS/WFC Special Requirements: ORIENT 94D TO 94 D									
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		(3)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=3.011 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.28 Angle Between Sides= Center Pattern=false	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.265 Line Spacing=0.187	(1-2)				
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(2)	NGC-3115-2	RA: 10 04 40.1130 (151.1671375d) Dec: -07 34 11.10 (-7.56975d) Equinox: J2000		V=9.9	Reference Frame: ICRS				
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1		(2) NGC-3115-2	ACS/WFC, ACCUM, WFCENTER	F606W				Pattern 3, Exps 1-2 in Visit 07 (3) Prime + Parallel Group 1-2 in Pattern 3, Exps 1-2 in Visit 07	1200 Secs [==>1261.0 Secs (Pattern 1,1)] [==>1261.0 Secs (Pattern 1,2)] [==>1354.0 Secs (Pattern 1,3)] [==>1354.0 Secs (Pattern 1,4)] [==>1354.0 Secs (Pattern 2,1)] [==>1354.0 Secs (Pattern 2,2)] [==>1354.0 Secs (Pattern 2,3)] [==>1354.0 Secs (Pattern 2,4)]
2		(2) NGC-3115-2	WFC3/IR, MULTIACCUM, IR-FIX	F110W		SAMP-SEQ=SPARS 100; NSAMP=14		Pattern 3, Exps 1-2 in Visit 07 (3) Prime + Parallel Group 1-2 in Pattern 3, Exps 1-2 in Visit 07	[==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 1,3)] [==>(Pattern 1,4)] [==>(Pattern 2,1)] [==>(Pattern 2,2)] [==>(Pattern 2,3)] [==>(Pattern 2,4)]	[1] [2] [3] [4]



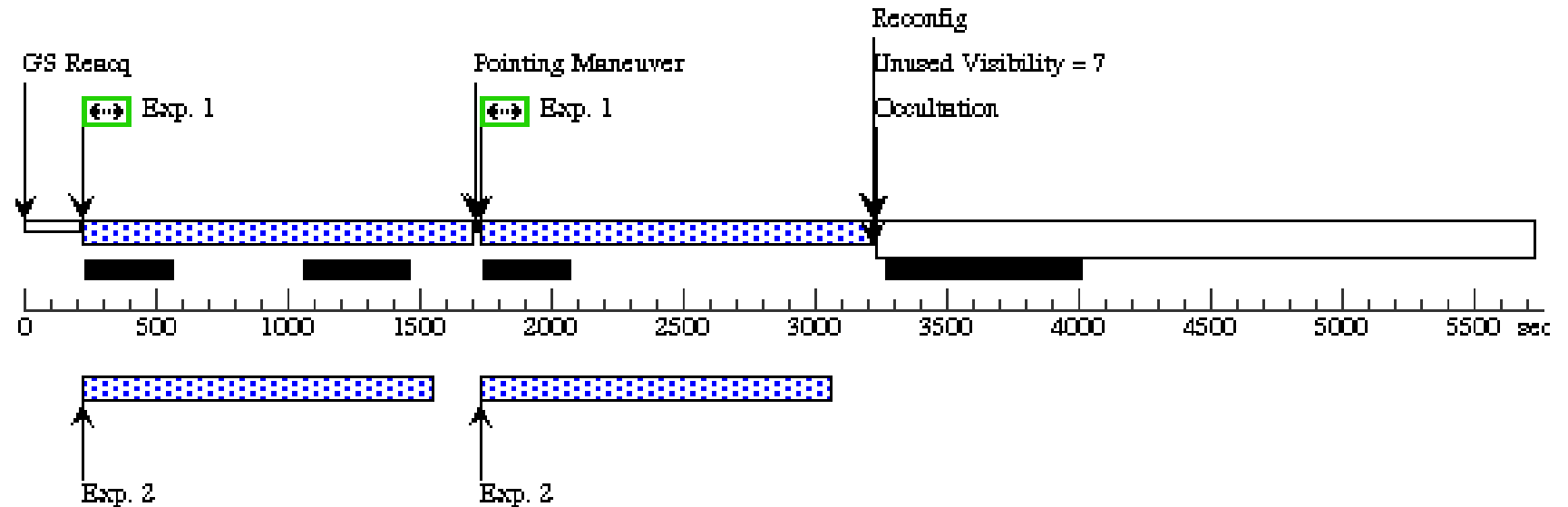
Orbit 3

Server Version: 20120604



Orbit 4

Server Version: 20120604



Proposal 13048 - Visit 08 - The First Unambiguous Detection of a Distinct Metal-poor Stellar Halo in a Massive Early-type Galaxy

Fri Jul 06 01:52:27 GMT 2012

Visit	Proposal 13048, Visit 08, implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR, ACS/WFC Special Requirements: ORIENT 94D TO 94 D									
	Patterns	#	Primary Pattern	Secondary Pattern	Exposures					
	(2)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=3.011 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.28 Angle Between Sides= Center Pattern=false	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=0.170 Line Spacing=	(1-2)					
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(2)	NGC-3115-2	RA: 10 04 40.1130 (151.1671375d) Dec: -07 34 11.10 (-7.56975d) Equinox: J2000		V=9.9	Reference Frame: ICRS				
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1		(2) NGC-3115-2	ACS/WFC, ACCUM, WFCENTER	F606W				Pattern 2, Exps 1-2 in Visit 08 (2) Prime + Parallel Group 1-2 in Pattern 2, Exps 1-2 in Visit 08	1200 Secs [==>1261.0 Secs (Pattern 1,1)] [==>1261.0 Secs (Pattern 1,2)] [==>1352.0 Secs (Pattern 1,3)] [==>1352.0 Secs (Pattern 2,1)] [==>1354.0 Secs (Pattern 2,2)] [==>1354.0 Secs (Pattern 2,3)]
2		(2) NGC-3115-2	WFC3/IR, MULTIACCUM, IR-FIX	F110W		SAMP-SEQ=SPARS 100; NSAMP=14		Pattern 2, Exps 1-2 in Visit 08 (2) Prime + Parallel Group 1-2 in Pattern 2, Exps 1-2 in Visit 08	[==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 1,3)] [==>(Pattern 2,1)] [==>(Pattern 2,2)] [==>(Pattern 2,3)]	[1] [2] [3]

