



18023 - Revealing the Iceberg: Mapping out the Emission Line Nebula in MS1455.0+2232

Cycle: 33, Proposal Category: GO
(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>
Prof. Michael A. McDonald (PI) (Contact)	Massachusetts Institute of Technology
Michael S. Calzadilla (CoI)	Smithsonian Institution Astrophysical Observatory
Prof. Massimo Gaspari (CoI) (ESA Member)	Universita degli Studi di Modena e Reggio Emilia

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) MS1455.0+2232	WFC3/UVIS	1	13-Nov-2025 13:00:13.0	yes
02	(1) MS1455.0+2232	WFC3/UVIS	1	13-Nov-2025 13:00:14.0	yes
03	(1) MS1455.0+2232	WFC3/UVIS	1	13-Nov-2025 13:00:14.0	yes
04	(1) MS1455.0+2232	WFC3/UVIS	1	13-Nov-2025 13:00:14.0	yes
05	(1) MS1455.0+2232	WFC3/UVIS	1	13-Nov-2025 13:00:14.0	yes
06	(1) MS1455.0+2232	WFC3/UVIS	1	13-Nov-2025 13:00:15.0	yes
07	(1) MS1455.0+2232	WFC3/UVIS	1	13-Nov-2025 13:00:15.0	yes

7 Total Orbits Used

ABSTRACT

Proposal 18023 (STScI Edit Number: 1, Created: Thursday, November 13, 2025, 1:00:15PM Eastern Standard Time) - Overview

In low-redshift clusters, such as Perseus and Abell 1795, the warm (10^4K), ionized phase is of critical importance to understanding thermal instabilities in the hot intracluster gas. Maps of H α and [O II] have been used for decades to understand how (and how not) cooling proceeds in the intracluster medium. This intermediate-temperature gas, which we think condenses out of the hot phase in areas that are locally out of thermodynamic equilibrium, retains a kinematic imprint of the hot gas, allowing us to probe the turbulence and bulk motion of the 10^8K gas by observing the "fluttering" of cool filaments in the same way that the motion of a flag provides insights into the wind speed and direction. To date there are only a small number (~ 4) of clusters in which we detect cool multi-phase gas on large enough scales ($>50\text{ kpc}$) that it can be used to provide insights into the details of cooling/feedback physics in the intracluster medium. We have recently discovered what may be the most extreme such system, MS1455.0+2232, which has a network of cool filaments that may extend on scales of $\sim 100\text{kpc}$, a factor of ~ 2 larger than the archetype system: the central galaxy in the Perseus cluster. Using a conveniently-located narrow band filter on WFC3-UVIS, we propose to obtain deep narrow-band images centered on the [O II] emission line, to make the first deep map of cool 10^4K gas in this system. This system will immediately join a small number of ~ 4 other clusters with extended emission line nebulae which each have proved critical in understanding cooling, feedback, turbulence in the intracluster medium.

OBSERVING DESCRIPTION

The goal of this observing program is to image the central galaxy in MS1455 in three filters: a narrow band centered on redshifted [O II] $\lambda 3727$ (F469N), and two broad bands centered on a line-free part of the blue continuum (F390W) and red continuum (F547M). In all cases, our goal is to optimize sensitivity to low surface brightnesses and fine details.

I have split the 4-orbit observation in F469N into 8 exposures, with a 2-point dither pattern during each orbit -- I am assuming that the re-acquisition is equivalent to an additional pixel-level dither and so this is really an 8-point pattern that will optimize PSF reconstruction and allow for robust cosmic ray rejection.

I have split the broadband observations into 3 exposures each, with ~ 1.5 orbits per band. This leads to a 2-point pattern for each, along with an orbit for which we just take a fixed-position observation in two bands.

In all cases, I have selected the FLASH level such that I do not receive warnings/errors from APT.

Everything of interest is located within $0.5'$ of the target location, and so we can handle any orientation.

Proposal 18023 - NarrowBand12 (01) - Revealing the Iceberg: Mapping out the Emission Line Nebula in MS1455.0+2232

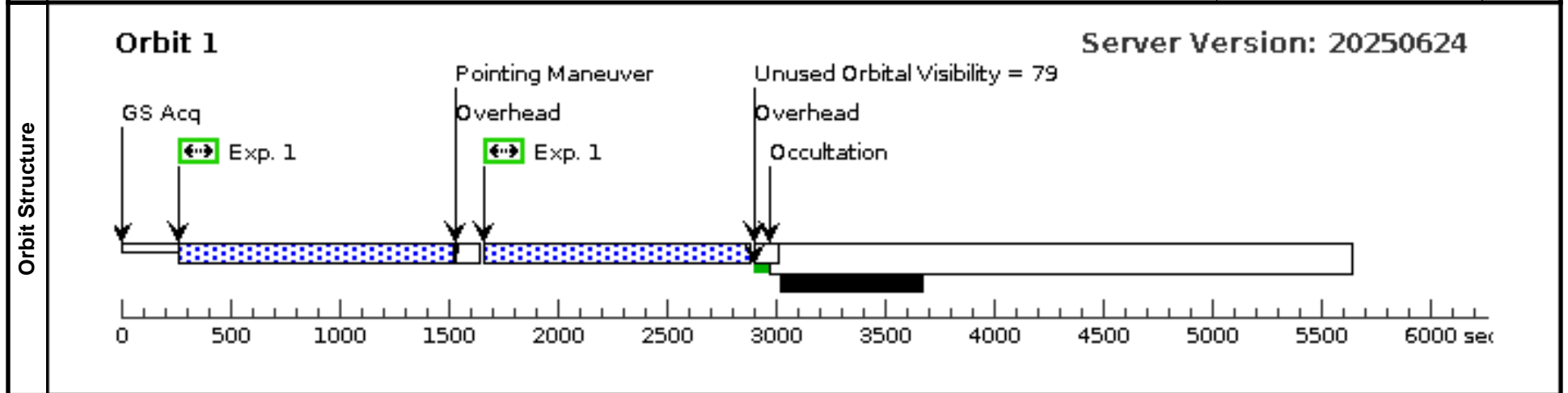
Thu Nov 13 18:00:15 GMT 2025

Visit	Proposal 18023, NarrowBand12 (01), implementation		
	Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: (none)		

Patterns	#	Primary Pattern	Secondary Pattern	Exposures
	(2)	Pattern Type=WFC3-UVIS-DITHER- LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false	

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	MS1455.0+2232	RA: 14 57 15.0826 (224.3128442d) Dec: +22 20 34.61 (22.34295d) Equinox: J2000		V=14	Reference Frame: ICRS
<i>Comments:</i> Category=GALAXY Description=[COOLING FLOW, ELLIPTICAL, EMISSION LINE NEBULA]						

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(1)	MS1455.0+2232	WFC3/UVIS, ACCUM, UVIS1	F469N	CR-SPLIT=NO; FLASH=20	GS ACQ SCENARI O ONEB1OR	Pattern 2, Exps 1-1 i n NarrowBand12 (01) (2)	500 Secs (2452 Secs) [==>1226.0 Secs (Pattern 1)] [==>1226.0 Secs (Pattern 2)]	[1]



Proposal 18023 - NarrowBand34 (02) - Revealing the Iceberg: Mapping out the Emission Line Nebula in MS1455.0+2232

Thu Nov 13 18:00:15 GMT 2025

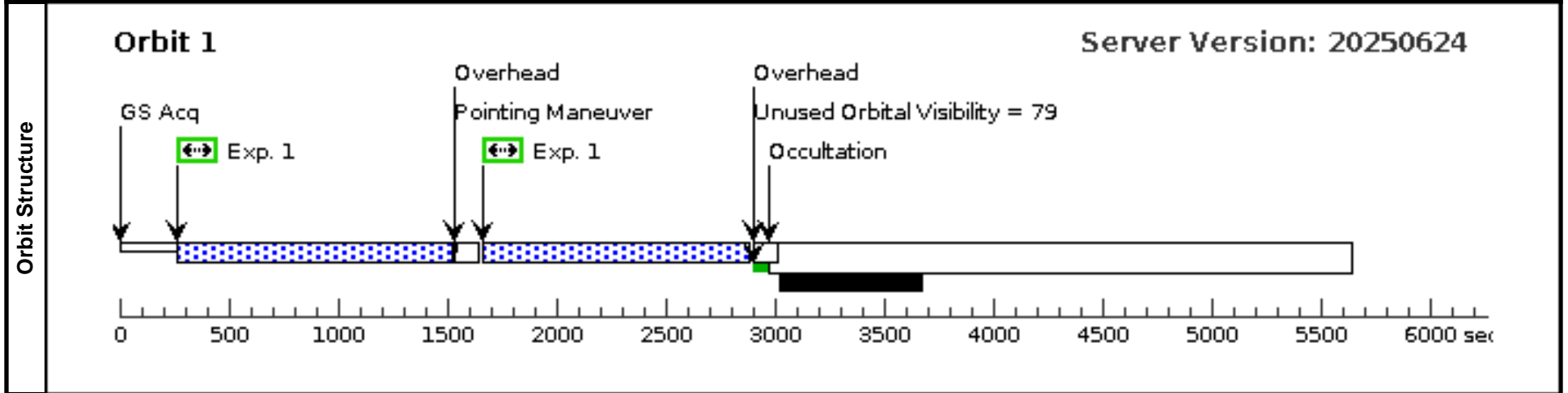
Visit	Proposal 18023, NarrowBand34 (02), implementation		
	Diagnostic Status: No Diagnostics		
	Scientific Instruments: WFC3/UVIS		
	Special Requirements: (none)		

Patterns	#	Primary Pattern	Secondary Pattern	Exposures
	(2)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false	

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	MS1455.0+2232	RA: 14 57 15.0826 (224.3128442d) Dec: +22 20 34.61 (22.34295d) Equinox: J2000		V=14	Reference Frame: ICRS

Comments:
 Category=GALAXY
 Description=[COOLING FLOW, ELLIPTICAL, EMISSION LINE NEBULA]

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(1) MS1455.0+2232	WFC3/UVIS, ACCUM, UVIS1	F469N	CR-SPLIT=NO; FLASH=20	GS ACQ SCENARI O ONEB1OR	Pattern 2, Exps 1-1 i n NarrowBand34 (02) (2)	500 Secs (2452 Secs) [==>1226.0 Secs (Pattern 1)] [==>1226.0 Secs (Pattern 2)]	[1]



Proposal 18023 - NarrowBand56 (03) - Revealing the Iceberg: Mapping out the Emission Line Nebula in MS1455.0+2232

Thu Nov 13 18:00:15 GMT 2025

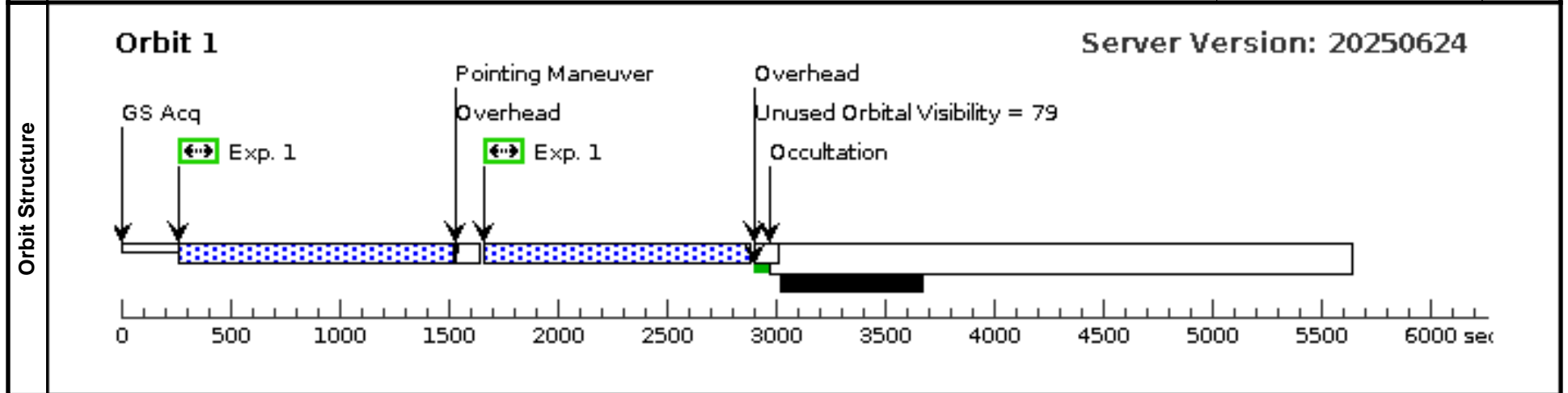
Visit	Proposal 18023, NarrowBand56 (03), implementation		
	Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: (none)		

Patterns	#	Primary Pattern	Secondary Pattern	Exposures
	(2)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false	

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	MS1455.0+2232	RA: 14 57 15.0826 (224.3128442d) Dec: +22 20 34.61 (22.34295d) Equinox: J2000		V=14	Reference Frame: ICRS

Comments:
 Category=GALAXY
 Description=[COOLING FLOW, ELLIPTICAL, EMISSION LINE NEBULA]

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(1) MS1455.0+2232	WFC3/UVIS, ACCUM, UVIS1	F469N	CR-SPLIT=NO; FLASH=20	GS ACQ SCENARI O ONEB1OR	Pattern 2, Exps 1-1 i n NarrowBand56 (03) (2)	500 Secs (2452 Secs) [==>1226.0 Secs (Pattern 1)] [==>1226.0 Secs (Pattern 2)]	[1]



Proposal 18023 - NarrowBand78 (04) - Revealing the Iceberg: Mapping out the Emission Line Nebula in MS1455.0+2232

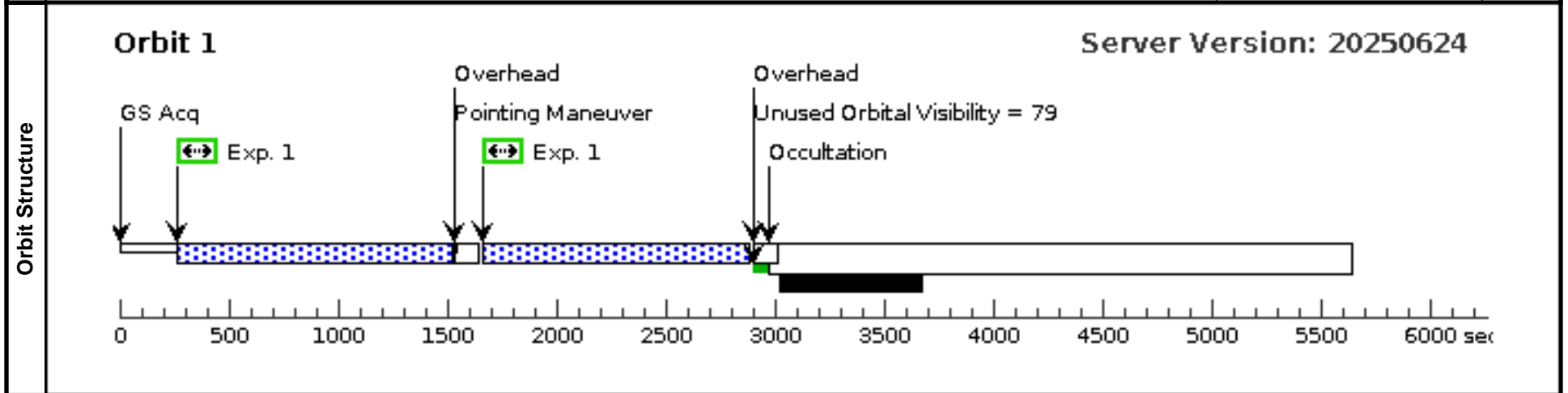
Thu Nov 13 18:00:15 GMT 2025

Visit	Proposal 18023, NarrowBand78 (04), implementation		
	Diagnostic Status: No Diagnostics		
	Scientific Instruments: WFC3/UVIS		
	Special Requirements: (none)		

Patterns	#	Primary Pattern	Secondary Pattern	Exposures
	(2)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false	

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	MS1455.0+2232	RA: 14 57 15.0826 (224.3128442d) Dec: +22 20 34.61 (22.34295d) Equinox: J2000		V=14	Reference Frame: ICRS
<i>Comments:</i> Category=GALAXY Description=[COOLING FLOW, ELLIPTICAL, EMISSION LINE NEBULA]						

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(1)	MS1455.0+2232	WFC3/UVIS, ACCUM, UVIS1	F469N	CR-SPLIT=NO; FLASH=20	GS ACQ SCENARI O ONEB1OR	Pattern 2, Exps 1-1 i n NarrowBand78 (04) (2)	500 Secs (2452 Secs) [==>1226.0 Secs (Pattern 1)] [==>1226.0 Secs (Pattern 2)]	[1]



Proposal 18023 - Broadband-Blue-12 (05) - Revealing the Iceberg: Mapping out the Emission Line Nebula in MS1455.0+2232

Thu Nov 13 18:00:15 GMT 2025

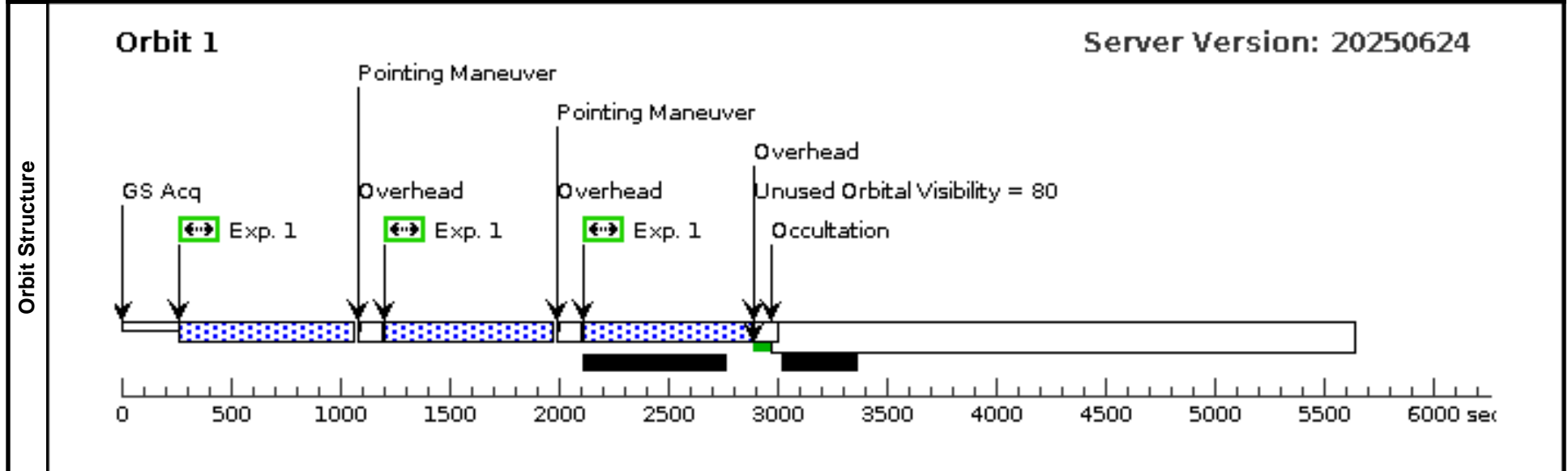
Visit	Proposal 18023, Broadband-Blue-12 (05), implementation		
	Diagnostic Status: No Diagnostics		
	Scientific Instruments: WFC3/UVIS		
	Special Requirements: (none)		

Patterns	#	Primary Pattern	Secondary Pattern	Exposures
	(3)	Pattern Type=WFC3-UVIS-DITHER- LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false	

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	MS1455.0+2232	RA: 14 57 15.0826 (224.3128442d) Dec: +22 20 34.61 (22.34295d) Equinox: J2000		V=14	Reference Frame: ICRS

Comments:
 Category=GALAXY
 Description=[COOLING FLOW, ELLIPTICAL, EMISSION LINE NEBULA]

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(1)	MS1455.0+2232	WFC3/UVIS, ACCUM, UVIS1	F547M	CR-SPLIT=NO; FLASH=8	GS ACQ SCENARI O ONEB1OR	Pattern 3, Exps 1-1 i n Broadband-Blue-1 2 (05) (3)	500 Secs (2322 Secs) [=>774.0 Secs (Pattern 1)] [=>774.0 Secs (Pattern 2)] [=>774.0 Secs (Pattern 3)]	[1]



Proposal 18023 - Broadband-Red-23 (06) - Revealing the Iceberg: Mapping out the Emission Line Nebula in MS1455.0+2232

Thu Nov 13 18:00:15 GMT 2025

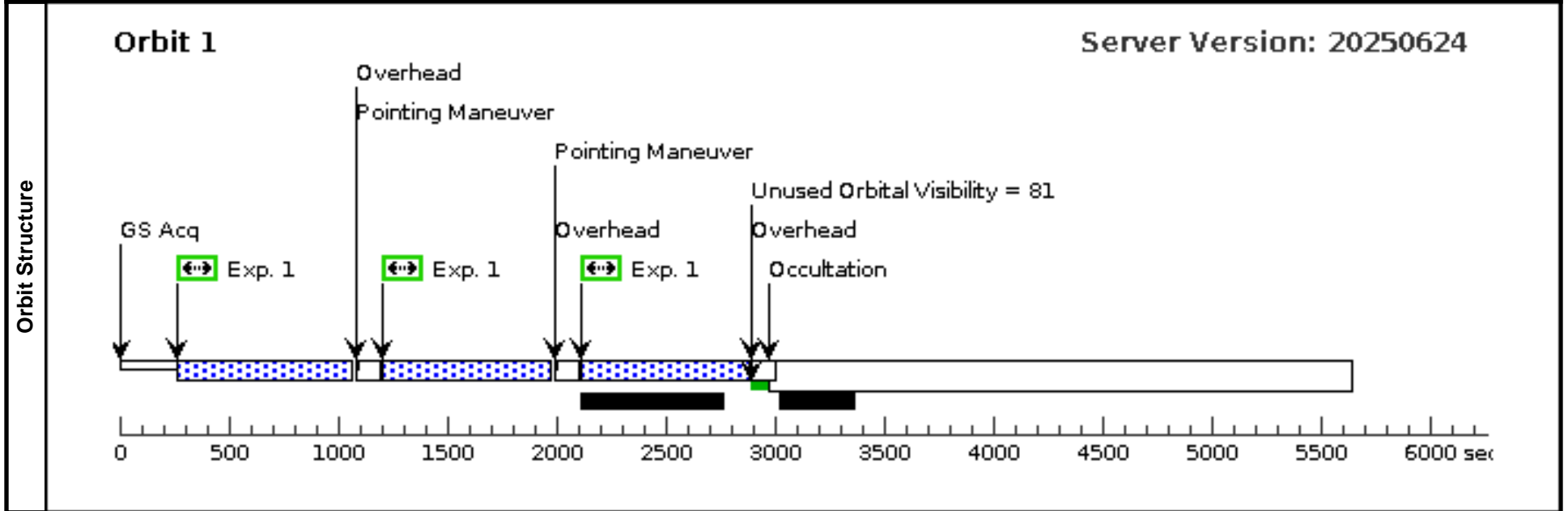
Visit	Proposal 18023, Broadband-Red-23 (06), implementation		
	Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: (none)		

Patterns	#	Primary Pattern	Secondary Pattern	Exposures
	(3)	Pattern Type=WFC3-UVIS-DITHER- LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false	

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	MS1455.0+2232	RA: 14 57 15.0826 (224.3128442d) Dec: +22 20 34.61 (22.34295d) Equinox: J2000		V=14	Reference Frame: ICRS

Comments:
 Category=GALAXY
 Description=[COOLING FLOW, ELLIPTICAL, EMISSION LINE NEBULA]

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(1)	MS1455.0+2232	WFC3/UVIS, ACCUM, UVIS1	F390W	CR-SPLIT=NO; FLASH=10	GS ACQ SCENARI O ONEB1OR	Pattern 3, Exps 1-1 i n Broadband-Red-23 (06) (3)	500 Secs (2319 Secs) [==>773.0 Secs (Pattern 1)] [==>773.0 Secs (Pattern 2)] [==>773.0 Secs (Pattern 3)]	[1]



Proposal 18023 - Broadband-Blue3-Red1 (07) - Revealing the Iceberg: Mapping out the Emission Line Nebula in MS1455.0+2232

Thu Nov 13 18:00:16 GMT 2025

Visit	Proposal 18023, Broadband-Blue3-Red1 (07), implementation				
	Diagnostic Status: No Diagnostics				
	Scientific Instruments: WFC3/UVIS				
	Special Requirements: (none)				

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	MS1455.0+2232	RA: 14 57 15.0826 (224.3128442d) Dec: +22 20 34.61 (22.34295d) Equinox: J2000		V=14	Reference Frame: ICRS
	<i>Comments:</i>					
	Category=GALAXY Description=[COOLING FLOW, ELLIPTICAL, EMISSION LINE NEBULA]					

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(1) MS1455.0+2232	(1) MS1455.0+2232	WFC3/UVIS, ACCUM, UVIS1	F547M	CR-SPLIT=NO; FLASH=8	GS ACQ SCENARI O ONEB1OR		100 Secs (765 Secs) [=>765.0 Secs]	[1]
	2	(1) MS1455.0+2232	(1) MS1455.0+2232	WFC3/UVIS, ACCUM, UVIS1	F547M	CR-SPLIT=NO; FLASH=8	POS TARG 0.135,nu II		100 Secs (765 Secs) [=>765.0 Secs]	[1]
	3	(1) MS1455.0+2232	(1) MS1455.0+2232	WFC3/UVIS, ACCUM, UVIS1	F390W	CR-SPLIT=NO; FLASH=15			100 Secs (765 Secs) [=>765.0 Secs]	[1]

