16184 - Lyman-alpha Observations of a z=10.15 Powerful Radio Galaxy

Cycle: 28, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) GLEAMJ091734-001243	WFC3/IR	1	23-Nov-2020 09:00:18.0	yes
02	(1) GLEAMJ091734-001243	WFC3/IR	1	23-Nov-2020 09:00:19.0	yes
06	(1) GLEAMJ091734-001243	WFC3/IR	1	23-Nov-2020 09:00:20.0	yes
07	(1) GLEAMJ091734-001243	WFC3/IR	1	23-Nov-2020 09:00:21.0	yes
08	(1) GLEAMJ091734-001243	WFC3/IR	1	23-Nov-2020 09:00:22.0	yes

5 Total Orbits Used

ABSTRACT

Powerful radio galaxies have been unique probes of the distant Universe for many decades. This proposal requests WFC3 grism and imaging observations to characterize the Lyman-alpha break/emission line in a redshift 10.15 powerful radio galaxy. This detection would be by far the most distant super-massive black hole (SMBH) and active galactic nucleus (AGN) known. At this redshift the radio galaxy would lie at the centre of a highly ionised Stromgren sphere ionised by star-formation, inverse Compton emission from the jets, and possibly accretion onto the SMBH. As well as reafirming the redshift of the host, these observations will potentially reveal the complex interaction of this radio-loud AGN with its local environment. Due to the poor transmission of the Earth's atmosphere, Hubble is the only facility which can conduct these observations.

OBSERVING DESCRIPTION

The aim of this proposal is to confirm the redshift of a candidate ultra-high redshift radio galaxy via a deep WFC3/IR grism spectrum. Far-infrared spectroscopy from ALMA initially suggested that it lies at z=10.1. However, an ALMA DDT, accepted after the Cycle 28 deadline, did not see the same lines. Furthermore, we have discovered deep optical data covering this source from the Subaray HSC-wide survey in which our target remains undetected up to i>25.5 (AB). Hence our source has an order of magnitude continuum break between 0.9um (i-band) and 2.2um (K-band). If this is the Lyman-alpha break, as we suspect, then this source must lie at z>7.3.

Our proposal consists of:

(i) one orbit of WFC3/IR imaging with F105W which was designed to be shortward of the Lyman-alpha break from the original redhift, thereby confirming the break. This is the first visit labelled F105Wimaging.

(ii) four orbits of WFC3/IR spectroscopy with G141 (using F160W for preimaging) comprised of two orbits in two different orientations. This is to obtain the Lyman-alpha line. Each orbit is contained in a separate visit and the visits labelled OR1x or OR2x for each of the two orientations, where x=a and b.

While this was not part of the original proposal we request that the one orbit of F105W imaging be conducted first. Then our choice of grisms for the spectroscopy will depend on whether the host galaxy is detected in that deep image or not as follows:

(a) if the host is detected in the F105W image then we request the grism is changed to G102 to cover the possibility of a lower redshift,

(b) if the host is not detected in the F105W then we stay with the original selection of G141.

In our deep K-band imaging from VLT/HAWKI, the host radio galaxy has another source nearby (likely at a lower redshift due to its detection at shorter wavelengths). Hence, we request our two orientations are chosen to avoid this source contaminating the spectrum of the host galaxy.

The position angles (east from north) from our deep K-band image we which to restrict the orientations to are:

70<PA<165
250<PA<245

Additionally we wish the second orientation to be offset from the first, but still within these original constraints. This is to avoid contamination of the spectrum by fainter sources we have not detected yet. We currently have this offset from OR1 at 30 to 150.

Visit

Proposal 16184, F105Wimaging (01), completed Mon Nov 23 14:00:23 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Comments: One orbit of imaging with WFC3/IR F105W:
6min GS acquisition
47min science integration

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

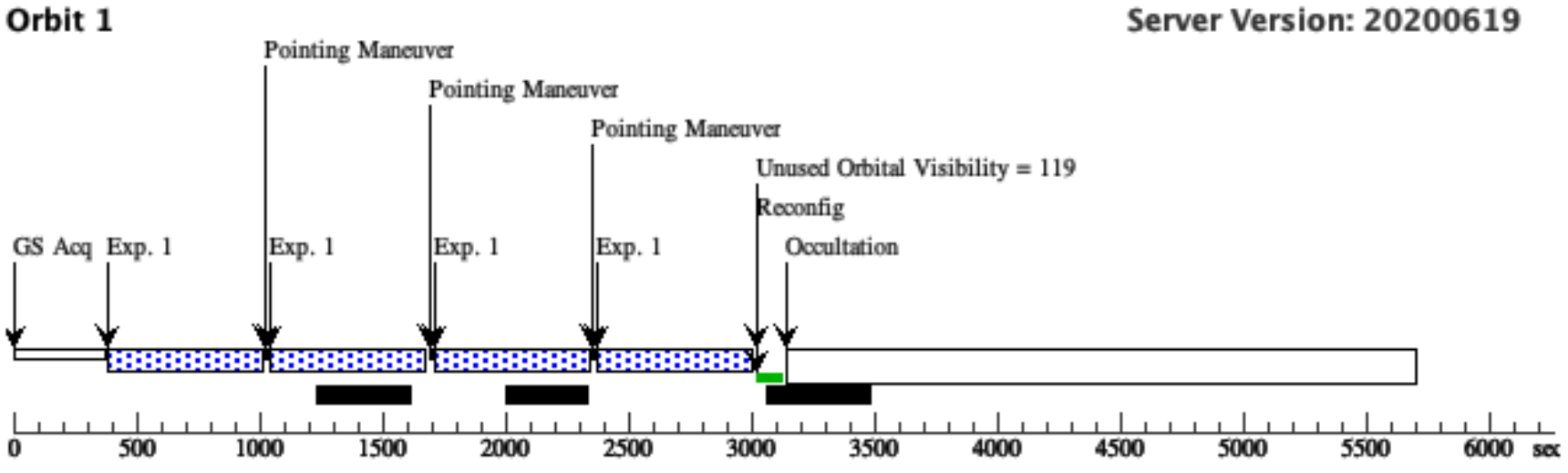
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	GLEAMJ091734-001243 Alt Name1: NVSS091734-001242	RA: 09 17 34.4300 (139.3934583d) Dec: -00 12 42.57 (-.21182d) Equinox: J2000		V=35 K_s(2.2um) = 3.07+/-0.12 uJy	Reference Frame: ICRS

Comments: K_s flux from dedicated deep VLT/HAWKI imaging
Redshift unknown, but at least z>7.3
Category=GALAXY
Description=[HIGH REDSHIFT GALAXY, RADIO GALAXY]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F105WImag	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	F105W	NSAMP=13; SAMP-SEQ=SPARS50		Pattern 1, Exps 1-1 in F105Wimaging (01) (1)	602.937703 Secs (2411.751 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	*[1]*

Orbit Structure



Visit

Proposal 16184, GRISM-OR1-V1 (02), implementation Mon Nov 23 14:00:23 GMT 2020

Diagnostic Status: Warning

Scientific Instruments: WFC3/IR

Special Requirements: ORIENT 70D TO 165 D; ORIENT 250D TO 345 D

Comments: Grism and pre-imaging orientation 1 visit 1
4x(100s preimaging + 500s grism)
order: preim, grism, preim, grism, grism, preim, grism, preim (to minimise HeI at end of orbit)
4 position dither pattern plus -1", -1" offset

Diagnostics

(GRISM-OR1-V1 (02)) Warning (Orbit Planner): SAME POS MAY NOT BE APPROPRIATE

(GRISM-OR1-V1 (02)) Warning (Orbit Planner): SAME POS MAY NOT BE APPROPRIATE

(GRISM-OR1-V1 (02)) Warning (Orbit Planner): SAME POS MAY NOT BE APPROPRIATE

(GRISM-OR1-V1 (02)) Warning (Orbit Planner): SAME POS MAY NOT BE APPROPRIATE

Fixed Targets

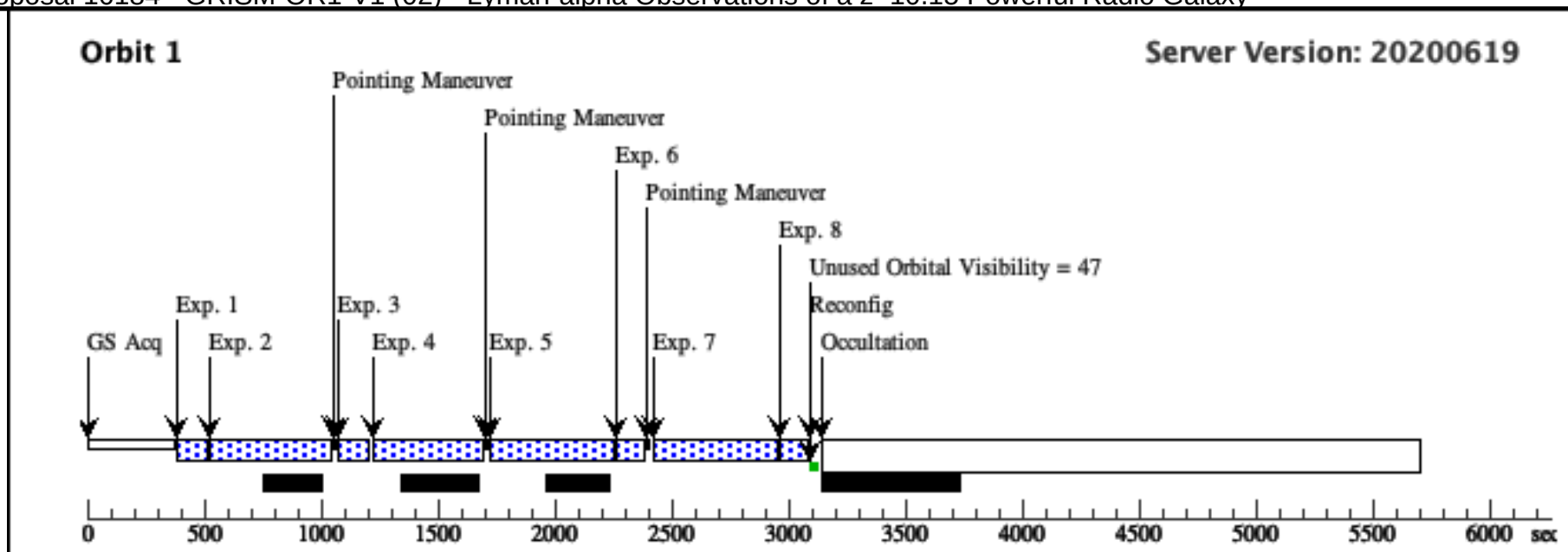
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	GLEAMJ091734-001243	RA: 09 17 34.4300 (139.3934583d)		V=35	Reference Frame: ICRS
	Alt Name1: NVSS091734-001242	Dec: -00 12 42.57 (-.21182d)		K_s(2.2um) = 3.07+/-0.12 uJy	
		Equinox: J2000			

Comments: K_s flux from dedicated deep VLT/HAWKI imaging
Redshift unknown, but at least z>7.3
Category=GALAXY
Description=[HIGH REDSHIFT GALAXY, RADIO GALAXY]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	GRISM-OR1-V1a-PREIM	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	F098M	NSAMP=5; SAMP-SEQ=SPARS25	POS TARG -1.0,-1.0		102.934351 Secs (102.934 Secs) *[==>]*	***[1]***
	Comments: Updated preimaging after results of V1								
2	GRISM-OR1-V1a-SPEC	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=11; SAMP-SEQ=SPARS50	SAME POS AS 1		502.936801 Secs (502.937 Secs) *[==>]*	***[1]***
	Comments: Updated grism after results of V1								
3	GRISM-OR1-V1b-PREIM	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	F098M	NSAMP=5; SAMP-SEQ=SPARS25	POS TARG 0.355,-0.576		102.934351 Secs (102.934 Secs) *[==>]*	***[1]***
4	GRISM-OR1-V1b-SPEC	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=10; SAMP-SEQ=SPARS50	SAME POS AS 3		452.93635 Secs (452.936 Secs) *[==>]*	***[1]***
	Comments: Updated grism after results of V1								
5	GRISM-OR1-V1c-SPEC	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=11; SAMP-SEQ=SPARS50	POS TARG -0.119,0.212		502.936801 Secs (502.937 Secs) *[==>]*	***[1]***
	Comments: Updated grism after results of V1								
6	GRISM-OR1-V1c-PREIM	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	F098M	NSAMP=5; SAMP-SEQ=SPARS25	SAME POS AS 5		102.934351 Secs (102.934 Secs) *[==>]*	***[1]***
	Comments: Updated preimaging after results of V1								
7	GRISM-OR1-V1d-SPEC	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=11; SAMP-SEQ=SPARS50	POS TARG -1.474,-0.218		502.936801 Secs (502.937 Secs) *[==>]*	***[1]***
	Comments: Updated grism after results of V1								
8	GRISM-OR1-V1d-PREIM	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	F098M	NSAMP=5; SAMP-SEQ=SPARS25	SAME POS AS 7		102.934351 Secs (102.934 Secs) *[==>]*	***[1]***
	Comments: Updated preimaging after results of V1								

Orbit Structure



Visit

Proposal 16184, GRISM-OR1-V2 (06), implementation Mon Nov 23 14:00:23 GMT 2020

Diagnostic Status: Warning

Scientific Instruments: WFC3/IR

Special Requirements: SAME ORIENT AS 02

Comments: Grism and pre-imaging orientation 1 visit 2
4x(100s preimaging + 500s grism)
order: preim, grism, preim, grism, grism, preim, grism, preim (to minimise HeI at end of orbit)
4 position dither pattern (same as visit 1) plus +1", +1" offset

Diagnostics

(GRISM-OR1-V2 (06)) Warning (Orbit Planner): SAME POS MAY NOT BE APPROPRIATE

(GRISM-OR1-V2 (06)) Warning (Orbit Planner): SAME POS MAY NOT BE APPROPRIATE

(GRISM-OR1-V2 (06)) Warning (Orbit Planner): SAME POS MAY NOT BE APPROPRIATE

(GRISM-OR1-V2 (06)) Warning (Orbit Planner): SAME POS MAY NOT BE APPROPRIATE

Fixed Targets

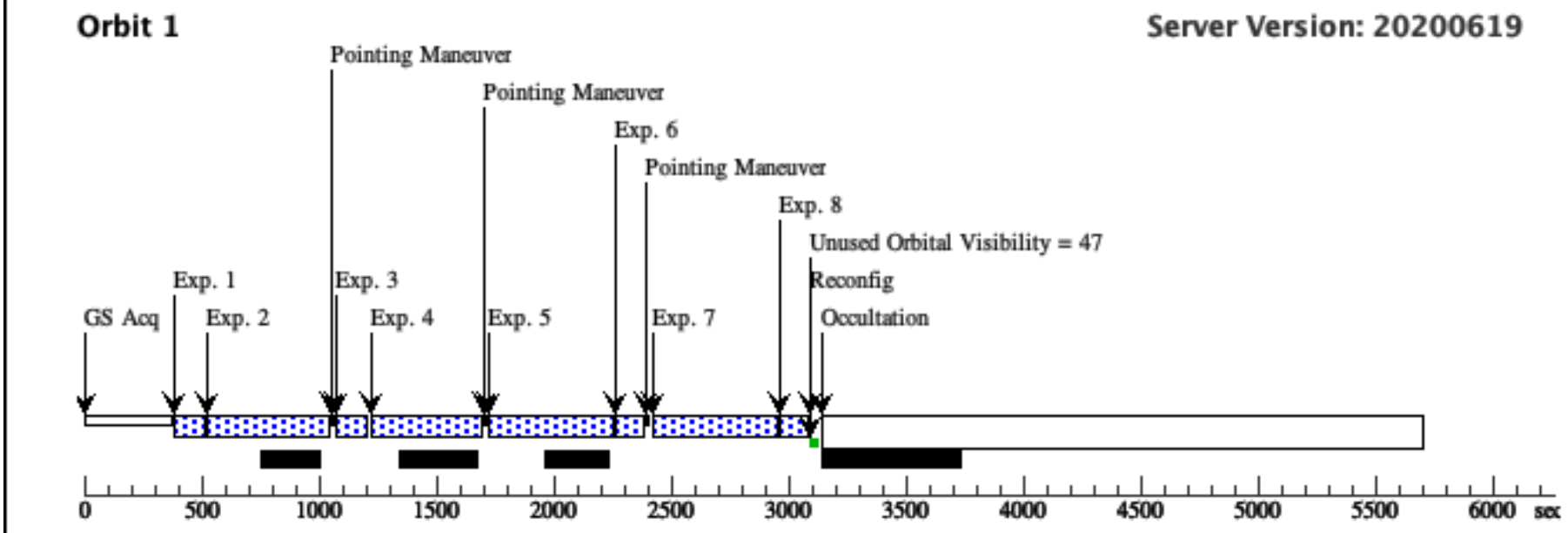
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	GLEAMJ091734-001243	RA: 09 17 34.4300 (139.3934583d)		V=35	Reference Frame: ICRS
	Alt Name1: NVSS091734-001242	Dec: -00 12 42.57 (-.21182d)		K_s(2.2um) = 3.07+/-0.12 uJy	
		Equinox: J2000			

Comments: K_s flux from dedicated deep VLT/HAWKI imaging
Redshift unknown, but at least z>7.3
Category=GALAXY
Description=[HIGH REDSHIFT GALAXY, RADIO GALAXY]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	GRISM-OR1-V2a-PREIM	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	F098M	NSAMP=5; SAMP-SEQ=SPARS25	POS TARG +1,+1		102.934351 Secs (102.934 Secs) *[==>]*	***[1]***
	Comments: Updated preimaging after results of V1								
2	GRISM-OR1-V2a-SPEC	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=11; SAMP-SEQ=SPARS50	SAME POS AS 1		502.936801 Secs (502.937 Secs) *[==>]*	***[1]***
	Comments: Updated grism after results of V1								
3	GRISM-OR1-V2b-PREIM	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	F098M	NSAMP=5; SAMP-SEQ=SPARS25	POS TARG 2.355,1.424		102.934351 Secs (102.934 Secs) *[==>]*	***[1]***
	Comments: Updated preimaging after results of V1								
4	GRISM-OR1-V2b-SPEC	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=10; SAMP-SEQ=SPARS50	SAME POS AS 3		452.93635 Secs (452.936 Secs) *[==>]*	***[1]***
	Comments: Updated grism after results of V1								
5	GRISM-OR1-V2c-SPEC	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=11; SAMP-SEQ=SPARS50	POS TARG 1.881,2.212		502.936801 Secs (502.937 Secs) *[==>]*	***[1]***
	Comments: Updated grism after results of V1								
6	GRISM-OR1-V2c-PREIM	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	F098M	NSAMP=5; SAMP-SEQ=SPARS25	SAME POS AS 5		102.934351 Secs (102.934 Secs) *[==>]*	***[1]***
	Comments: Updated preimaging after results of V1								
7	GRISM-OR1-V2d-SPEC	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=11; SAMP-SEQ=SPARS50	POS TARG 0.526,1.788		502.936801 Secs (502.937 Secs) *[==>]*	***[1]***
	Comments: Updated grism after results of V1								
8	GRISM-OR1-V2d-PREIM	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	F098M	NSAMP=5; SAMP-SEQ=SPARS25	SAME POS AS 7		102.934351 Secs (102.934 Secs) *[==>]*	***[1]***
	Comments: Updated preimaging after results of V1								

Orbit Structure



Visit

Proposal 16184, GRISM-OR2-V1 (07), implementation Mon Nov 23 14:00:23 GMT 2020

Diagnostic Status: Warning

Scientific Instruments: WFC3/IR

Special Requirements: ORIENT 30D TO 150D FROM 02

Comments: Grism and pre-imaging orientation 2 visit 1
4x(100s preimaging + 500s grism)
order: preim, grism, preim, grism, grism, preim, grism, preim (to minimise HeI at end of orbit)
4 position dither pattern plus -1", -1" offset

Diagnostics

(GRISM-OR2-V1 (07)) Warning (Orbit Planner): SAME POS MAY NOT BE APPROPRIATE

(GRISM-OR2-V1 (07)) Warning (Orbit Planner): SAME POS MAY NOT BE APPROPRIATE

(GRISM-OR2-V1 (07)) Warning (Orbit Planner): SAME POS MAY NOT BE APPROPRIATE

(GRISM-OR2-V1 (07)) Warning (Orbit Planner): SAME POS MAY NOT BE APPROPRIATE

Fixed Targets

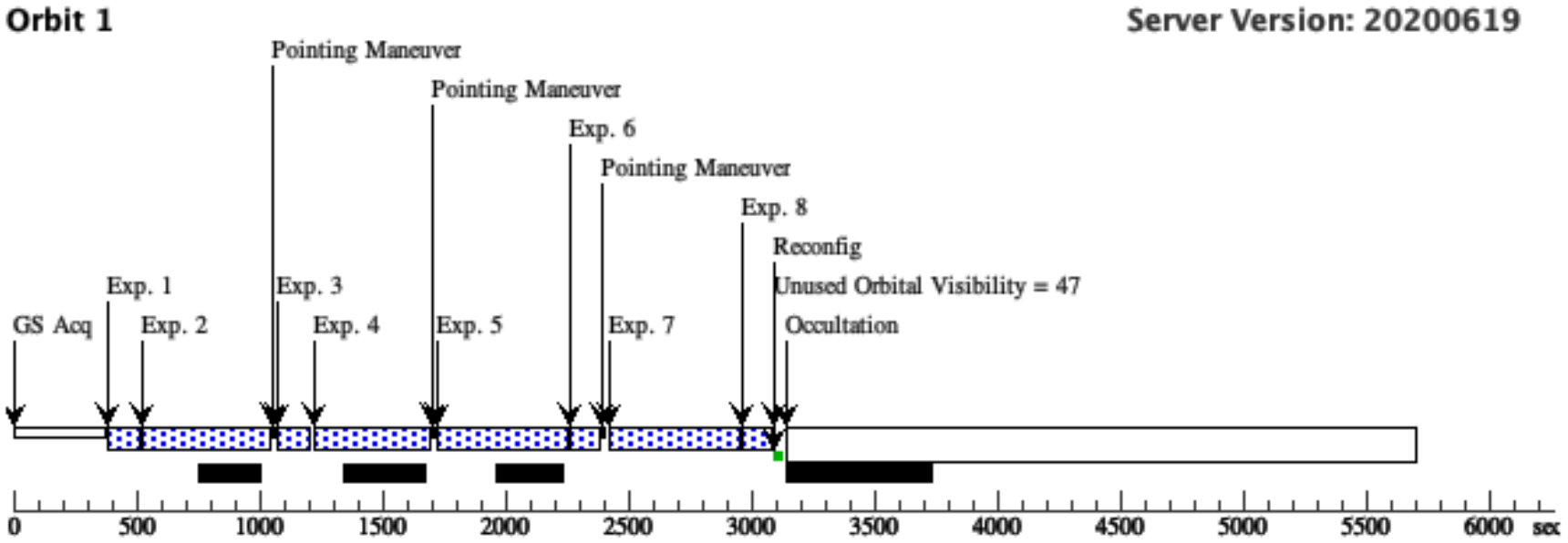
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	GLEAMJ091734-001243	RA: 09 17 34.4300 (139.3934583d)		V=35	Reference Frame: ICRS
	Alt Name1: NVSS091734-001242	Dec: -00 12 42.57 (-.21182d)		K_s(2.2um) = 3.07+/-0.12 uJy	
		Equinox: J2000			

Comments: K_s flux from dedicated deep VLT/HAWKI imaging
Redshift unknown, but at least z>7.3
Category=GALAXY
Description=[HIGH REDSHIFT GALAXY, RADIO GALAXY]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	GRISM-OR2-V1a-PREIM	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	F098M	NSAMP=5; SAMP-SEQ=SPARS25	POS TARG -1.0,-1.0		102.934351 Secs (102.934 Secs) *[==>]*	***[1]***
	Comments: Updated preimaging after results of V1								
2	GRISM-OR2-V1a-SPEC	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=11; SAMP-SEQ=SPARS50	SAME POS AS 1		502.936801 Secs (502.937 Secs) *[==>]*	***[1]***
	Comments: Updated grism after results of V1								
3	GRISM-OR2-V1b-PREIM	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	F098M	NSAMP=5; SAMP-SEQ=SPARS25	POS TARG 0.355,-0.576		102.934351 Secs (102.934 Secs) *[==>]*	***[1]***
	Comments: Updated preimaging after results of V1								
4	GRISM-OR2-V1b-SPEC	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=10; SAMP-SEQ=SPARS50	SAME POS AS 3		452.93635 Secs (452.936 Secs) *[==>]*	***[1]***
	Comments: Updated grism after results of V1								
5	GRISM-OR2-V1c-SPEC	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=11; SAMP-SEQ=SPARS50	POS TARG -0.119,0.212		502.936801 Secs (502.937 Secs) *[==>]*	***[1]***
	Comments: Updated grism after results of V1								
6	GRISM-OR2-V1c-PREIM	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	F098M	NSAMP=5; SAMP-SEQ=SPARS25	SAME POS AS 5		102.934351 Secs (102.934 Secs) *[==>]*	***[1]***
	Comments: Updated preimaging after results of V1								
7	GRISM-OR2-V1d-SPEC	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=11; SAMP-SEQ=SPARS50	POS TARG -1.474,-0.218		502.936801 Secs (502.937 Secs) *[==>]*	***[1]***
	Comments: Updated grism after results of V1								
8	GRISM-OR2-V1d-PREIM	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	F098M	NSAMP=5; SAMP-SEQ=SPARS25	SAME POS AS 7		102.934351 Secs (102.934 Secs) *[==>]*	***[1]***
	Comments: Updated preimaging after results of V1								

Orbit Structure



Visit

Proposal 16184, GRISM-OR2-V2 (08), implementation Mon Nov 23 14:00:23 GMT 2020

Diagnostic Status: Warning

Scientific Instruments: WFC3/IR

Special Requirements: SAME ORIENT AS 07

Comments: Grism and pre-imaging orientation 2 visit 2
4x(100s preimaging + 500s grism)
order: preim, grism, preim, grism, grism, preim, grism, preim (to minimise HeI at end of orbit)
4 position dither pattern (same as visit 1) plus +1", +1" offset

Diagnostics

(GRISM-OR2-V2 (08)) Warning (Orbit Planner): SAME POS MAY NOT BE APPROPRIATE

(GRISM-OR2-V2 (08)) Warning (Orbit Planner): SAME POS MAY NOT BE APPROPRIATE

(GRISM-OR2-V2 (08)) Warning (Orbit Planner): SAME POS MAY NOT BE APPROPRIATE

(GRISM-OR2-V2 (08)) Warning (Orbit Planner): SAME POS MAY NOT BE APPROPRIATE

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	GLEAMJ091734-001243	RA: 09 17 34.4300 (139.3934583d)		V=35	Reference Frame: ICRS
	Alt Name1: NVSS091734-001242	Dec: -00 12 42.57 (-.21182d)		K_s(2.2um) = 3.07+/-0.12 uJy	
		Equinox: J2000			

Comments: K_s flux from dedicated deep VLT/HAWKI imaging
Redshift unknown, but at least z>7.3
Category=GALAXY
Description=[HIGH REDSHIFT GALAXY, RADIO GALAXY]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	GRISM-OR2-V2a-PREIM	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	F098M	NSAMP=5; SAMP-SEQ=SPARS25	POS TARG +1,+1		102.934351 Secs (102.934 Secs) *[==>]*	***[1]***
	Comments: Updated preimaging after results of V1								
2	GRISM-OR2-V2a-SPEC	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=11; SAMP-SEQ=SPARS50	SAME POS AS 1		502.936801 Secs (502.937 Secs) *[==>]*	***[1]***
	Comments: Updated grism after results of V1								
3	GRISM-OR2-V2b-PREIM	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	F098M	NSAMP=5; SAMP-SEQ=SPARS25	POS TARG 2.355,1.424		102.934351 Secs (102.934 Secs) *[==>]*	***[1]***
	Comments: Updated preimaging after results of V1								
4	GRISM-OR2-V2b-SPEC	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=10; SAMP-SEQ=SPARS50	SAME POS AS 3		452.93635 Secs (452.936 Secs) *[==>]*	***[1]***
	Comments: Updated grism after results of V1								
5	GRISM-OR2-V2c-SPEC	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=11; SAMP-SEQ=SPARS50	POS TARG 1.881,2.212		502.936801 Secs (502.937 Secs) *[==>]*	***[1]***
	Comments: Updated grism after results of V1								
6	GRISM-OR2-V2c-PREIM	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	F098M	NSAMP=5; SAMP-SEQ=SPARS25	SAME POS AS 5		102.934351 Secs (102.934 Secs) *[==>]*	***[1]***
	Comments: Updated preimaging after results of V1								
7	GRISM-OR2-V2d-SPEC	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=11; SAMP-SEQ=SPARS50	POS TARG 0.526,1.788		502.936801 Secs (502.937 Secs) *[==>]*	***[1]***
	Comments: Updated grism after results of V1								
8	GRISM-OR2-V2d-PREIM	(1) GLEAMJ091734-001243	WFC3/IR, MULTIACCUM, GRISM1024	F098M	NSAMP=5; SAMP-SEQ=SPARS25	SAME POS AS 7		102.934351 Secs (102.934 Secs) *[==>]*	***[1]***
	Comments: Updated preimaging after results of V1								

Orbit Structure