



13839 - The Lyman Alpha Extended Halo of a Quasar at $z > 6$

Cycle: 22, 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) J1429+5447	WFC3/IR	3	24-Jul-2014 22:00:22.0	yes
02	(1) J1429+5447	WFC3/IR	3	24-Jul-2014 22:00:24.0	yes

6 Total Orbits Used

ABSTRACT

The formation of quasars at $z > 6$, when the Universe is less than 1Gyr old, require enormous reservoirs of gas to feed the black hole growth on such a short time scale. The only effective way to map the presence of this key ingredient of the galaxy formation at high- z is through the detection of the extended and diffuse Ly-Alpha emission that is powered by the star-formation and by the UV emission of the quasar. We here propose to observe the extended Ly-Alpha emission associated to the most powerful radio-loud high-redshift quasar known so far (J1429+5447, $z=6.18$). Radio-loud quasars are expected to be extremely biased tracers of the most massive dark matter halos and to be the precursor of the massive elliptical galaxies

observed at $z=0$. The grism spectroscopy mode of the WFC3/IR camera provides the unique opportunity to directly investigate the properties of the Ly-Alpha ionized gas associated to the first quasars, putting strong constraints on the processes involved in the formation of the first galaxies at the end of the Cosmic reionization.

OBSERVING DESCRIPTION

Observing Description for HST Cycle 22 Proposal 13839

The Lyman Alpha Extended Halo of a Quasar at $z>6$

PI: Emanuele Paolo Farina - emanuele.paolo.farina@gmail.com

Goal of the observations

This proposal aims to map the Ly-alpha emission in the immediate environment of the radio-loud quasar J1429+5447 at $z=6.18$ using slitless spectroscopy with the WFC3-IR G102 grism.

The central goal of the programme is the detection of the extended Ly-alpha halo that surround the quasar's host galaxy. This diffuse emission is redshifted to 8730Ang. and it is expected to occur on scale of ~ 7 arcsec (in diameter) with a line surface flux of $\sim 9e-17$ erg/s/cm²/arcsec². Coincidentally the CIV emission line fall within the spectral range covered by the G102 grism (at 11100Ang.), and will allow to set constraints on the metal enrichment and on the physical status of the nebula.

The discovery spectra of the quasar (blue solid line), the SDSS quasar template shifted at $z=6.18$ (gray dashed line), and the throughput curve of the G102 grism (red shaded area) are shown here:

<https://www.dropbox.com/s/jler96akskmeums/spectra.eps>

This observations have the additional promise to resolve the interstellar medium of the quasar's host galaxy

on scales <1 arcsec and to reveal -- through their Ly-alpha emission -- faint companion galaxies present in the vicinity of quasar.

A total of 6 orbits are scheduled for this project, that will be splitted in two different visit with two different orientation angles (see below).

Observing strategy

** Orbit / visit strategy:

We consider to obtain the observations at two different roll angles (2 visits of 3 orbits each) which lead to different inter-object contamination and allow to accurately separate the single contributions.

In each visit, we use 6 dither positions. At each position, we take a short direct F105W reference image and two long grism G102 science exposures. The reference images are mandatory to accurately locate the position and the size of the sources in the field of view, making the data easier to reduce. In the first visit, the direct exposures are ~ 150 sec long (SPARS25 x NSAMP=7) and the grism exposures are ~ 1300 sec (SPARS100 x NSAMP=14) or ~ 1400 sec long (SPARS100 x NSAMP=15) when the shorter time used for pointing the telescope in the 2nd and 3rd orbits allows to increase the integration time. During the second visit the visibility is limited by the considered orientation angle, thus the direct exposures are ~ 150 sec long (SPARS25 x NSAMP=7) or ~ 130 sec long (SPARS25 x NSAMP=6) and the grism exposures are ~ 1300 sec (SPARS100 x NSAMP=14) or ~ 1200 sec long (SPARS100 x NSAMP=13). The order of exposures within an orbit is: grism, direct, direct, grism.

** Dithering:

We use POS-TARG offsets to make the dithers. Each direct image -grism pair has the same set of POS-TARG

offsets. The 6 point-dither pattern we consider in each visit is similar to the pre-defined patterns

WFC3-IR WFC3-IR-DITHER-LINE-3PT and WFC3-IR-DITHER-LIN combined together, i.e. we make use of

WFC3-IR WFC3-IR-DITHER-LINE-3PT two times shifted of +3.5 -3.5 between each others:

x-pixel	y-pixel	x-POS-TARG	y-POS-TARG
0.00	0.00	0.000	0.000
3.33	3.33	0.450	0.403
6.67	6.67	0.900	0.806
10.17	3.17	1.373	0.384
6.83	-0.17	0.922	-0.021
3.50	-3.50	0.473	-0.424

where x-POS-TARG y-POS-TARG are given in arcsec.

**** Position Angle:**

We set two different position angle, one for each visit, to obtain different inter-object contamination and to separate the single contributions. The angles are selected to avoid the superposition from of the spectrum of J1429+5447 with those of close by stars and galaxies (for details see comments on the single visits and the figure here: https://www.dropbox.com/s/9bcwgvtn9md9vba/J1429p5447_cont.jpeg).

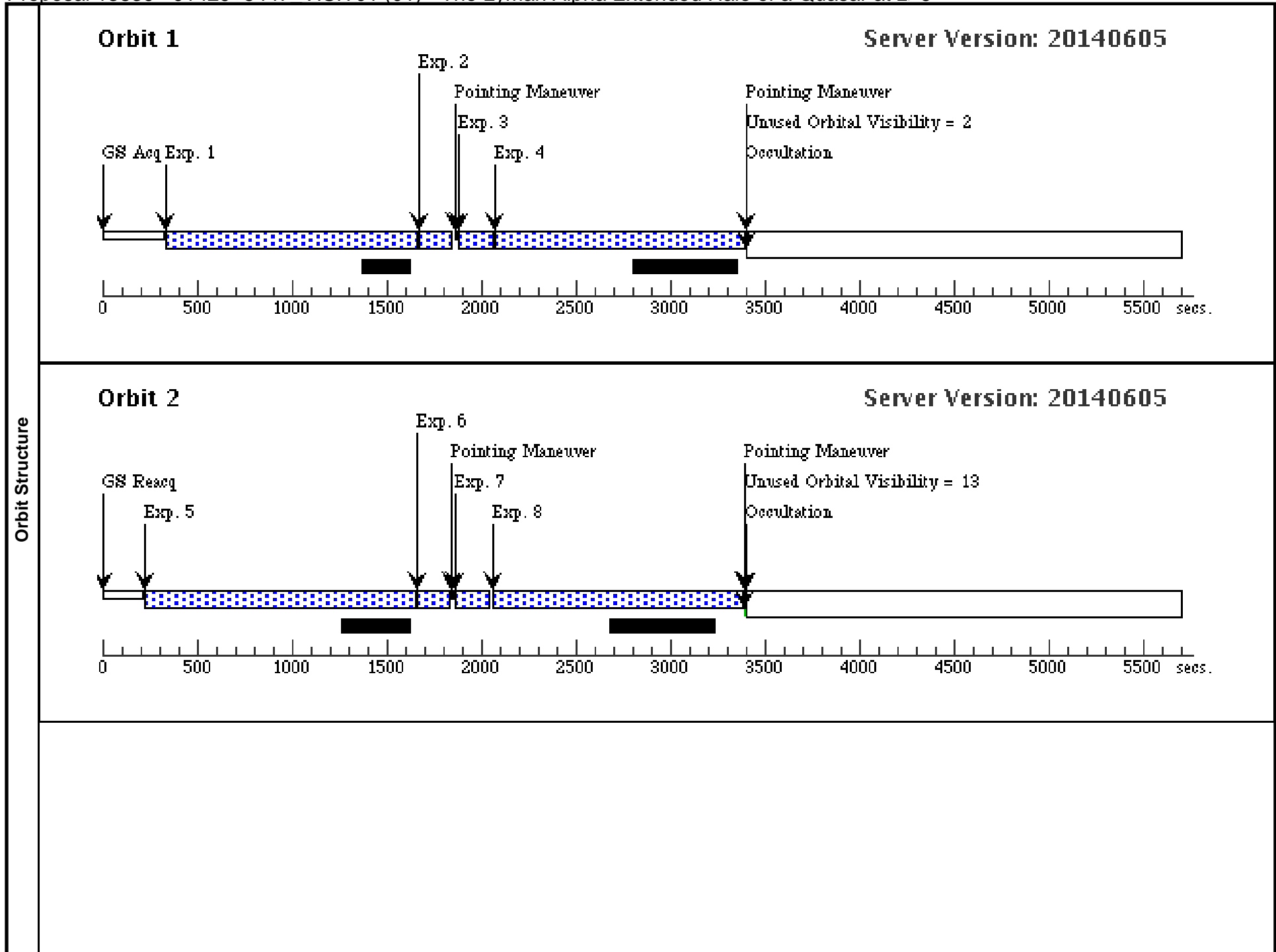
Proposal 13839 - J1429+5447 VISIT01 (01) - The Lyman Alpha Extended Halo of a Quasar at $z > 6$

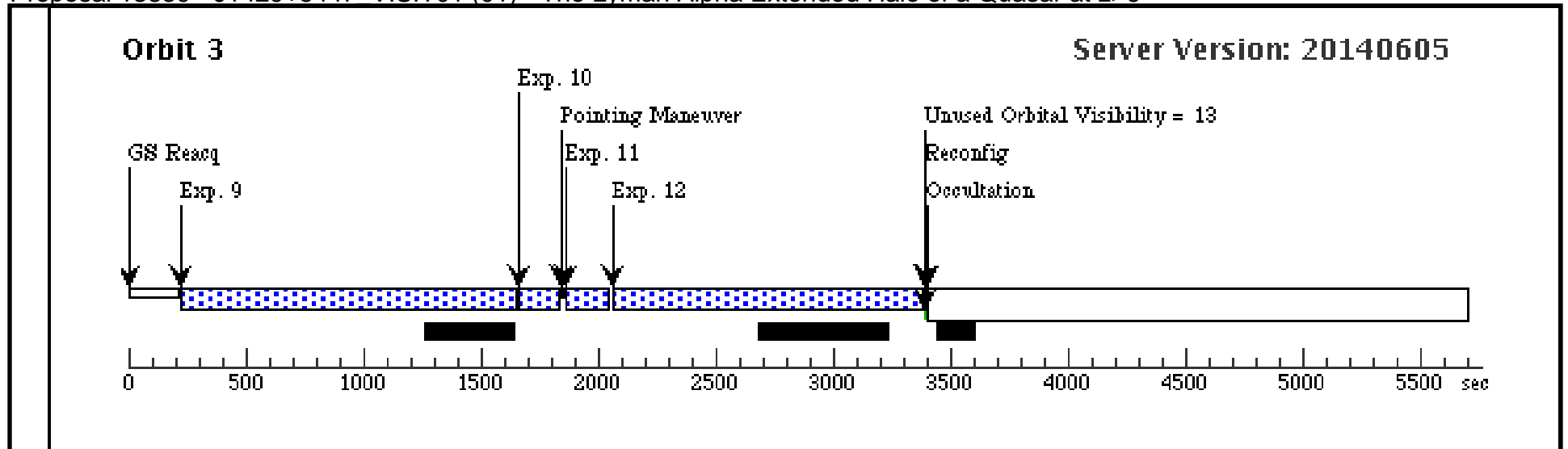
Fri Jul 25 02:00:26 GMT 2014

Visit	<p>Proposal 13839, J1429+5447_VISIT01 (01), implementation</p> <p>Diagnostic Status: No Diagnostics</p> <p>Scientific Instruments: WFC3/IR</p> <p>Special Requirements: ORIENT 171.0D TO 186.4 D</p> <p>Comments: 3 orbits observation of J1429+5447.</p> <p>The orientation angle is setted in order to avoid possible 0th and 1st order contamination from the bright sources present in archival F105W-band HST images of J1429+5447. These objects are marked with yellow (0th order) and green (1st order) circles in the finding chart: https://www.dropbox.com/s/9bcwgvtn9md9vba/J1429p5447_cont.jpeg</p> <p>We limit the magnitude of the possible contaminats to: $m(F105W) < 21$ for the 0th order (5 objects at an angular separation from J1429+5447 of $40\text{arcsec} < \text{ad} < 60\text{arcsec}$); $m(F105W) < 23$ for the 1st order (8 objects at an angular separation from J1429+5447 of $\text{ad} < 27\text{arcsec}$).</p> <p>In order to avoid contamination from these objects the dispersion axis should fall within 305.2D and 320.6D in the first visit and within 220.3D and 230.8D in the second visit. All the position angles are calculated from North through East (counterclockwise) from the position of J1429+5447. Taking the offset angle between the U3 direction and the +X axis of 225.18D listed in Table 7.4 of the HST Cycle 22 Phase II Proposal Instructions, the allowed ORIENTATION angle are thus: VISIT01: ORIENT from 171.0D to 186.4D VISIT02: ORIENT from 86.1D to 96.1D</p> <p>These angles are highlighted with blue dashed vectors in the finding chart: https://www.dropbox.com/s/9bcwgvtn9md9vba/J1429p5447_cont.jpeg</p> <p>Coupled to each grism exposure, we consider to take a direct image of the field with the same ORIENT and POS TARG. The observing plan of each orbit is thus: grism-direct-direct-grism</p>																												
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Proposal 13839 - J1429+5447 VISIT01 (01) - The Lyman Alpha Extended Halo of a Quasar at z>6

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	science1300_dit01 (WFC3IR.sp .618629)	(1) J1429+5447	WFC3/IR, MULTIACCUM, GRISM1024	G102	SAMP-SEQ=SPARS 100; NSAMP=14	POS TARG 0.000,0. 000		1302.93649 Secs (1302.936 Secs) [==>]	[1]
2	reference15_0_dit01	(1) J1429+5447	WFC3/IR, MULTIACCUM, GRISM1024	F105W	NSAMP=7; SAMP-SEQ=SPAR S25	POS TARG 0.000,0. 000		152.935381 Secs (152.935 Secs) [==>]	[1]
<i>Comments: Direct image of J1429+5447 with the filter F105W, ancillary to the grism G102 observations.</i>									
3	reference15_0_dit02	(1) J1429+5447	WFC3/IR, MULTIACCUM, GRISM1024	F105W	NSAMP=7; SAMP-SEQ=SPAR S25	POS TARG 0.450,0. 403		152.935381 Secs (152.935 Secs) [==>]	[1]
<i>Comments: Direct image of J1429+5447 with the filter F105W, ancillary to the grism G102 observations.</i>									
4	science1300_dit02 (WFC3IR.sp .618629)	(1) J1429+5447	WFC3/IR, MULTIACCUM, GRISM1024	G102	SAMP-SEQ=SPARS 100; NSAMP=14	POS TARG 0.450,0. 403		1302.93649 Secs (1302.936 Secs) [==>]	[1]
5	science1400_dit03 (WFC3IR.sp .618629)	(1) J1429+5447	WFC3/IR, MULTIACCUM, GRISM1024	G102	SAMP-SEQ=SPARS 100; NSAMP=15	POS TARG 0.900,0. 807		1402.936813 Secs (1402.937 Secs) [==>]	[2]
6	reference15_0_dit03	(1) J1429+5447	WFC3/IR, MULTIACCUM, GRISM1024	F105W	NSAMP=7; SAMP-SEQ=SPAR S25	POS TARG 0.900,0. 807		152.935381 Secs (152.935 Secs) [==>]	[2]
<i>Comments: Direct image of J1429+5447 with the filter F105W, ancillary to the grism G102 observations.</i>									
7	reference15_0_dit04	(1) J1429+5447	WFC3/IR, MULTIACCUM, GRISM1024	F105W	NSAMP=7; SAMP-SEQ=SPAR S25	POS TARG 1.373,0. 384		152.935381 Secs (152.935 Secs) [==>]	[2]
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8	science1300_dit04 (WFC3IR.sp .618629)	(1) J1429+5447	WFC3/IR, MULTIACCUM, GRISM1024	G102	SAMP-SEQ=SPARS 100; NSAMP=14	POS TARG 1.373,0. 384		1302.93649 Secs (1302.936 Secs) [==>]	[2]
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10	reference15_0_dit05	(1) J1429+5447	WFC3/IR, MULTIACCUM, GRISM1024	F105W	NSAMP=7; SAMP-SEQ=SPAR S25	POS TARG 0.922,-0 .021		152.935381 Secs (152.935 Secs) [==>]	[3]
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11	reference15_0_dit06	(1) J1429+5447	WFC3/IR, MULTIACCUM, GRISM1024	F105W	NSAMP=7; SAMP-SEQ=SPAR S25	POS TARG 0.473,-0 .424		152.935381 Secs (152.935 Secs) [==>]	[3]
<i>Comments: Direct image of J1429+5447 with the filter F105W, ancillary to the grism G102 observations.</i>									
12	science1300_dit06 (WFC3IR.sp .618629)	(1) J1429+5447	WFC3/IR, MULTIACCUM, GRISM1024	G102	SAMP-SEQ=SPARS 100; NSAMP=14	POS TARG 0.473,-0 .424		1302.93649 Secs (1302.936 Secs) [==>]	[3]





Proposal 13839 - J1429+5447 VIST02 (02) - The Lyman Alpha Extended Halo of a Quasar at z>6

Fri Jul 25 02:00:26 GMT 2014

Visit	<p>Proposal 13839, J1429+5447_VIST02 (02), implementation</p> <p>Diagnostic Status: No Diagnostics</p> <p>Scientific Instruments: WFC3/IR</p> <p>Special Requirements: ORIENT 86.1D TO 96.1 D</p> <p>Comments: 3 orbits observation of J1429+5447.</p> <p>The orientation angle is setted in order to avoid possible 0th and 1st order contamination from the bright sources present in archival F105W-band HST images of J1429+5447. These objects are marked with yellow (0th order) and green (1st order) circles in the finding chart: https://www.dropbox.com/s/9bcwgvtn9md9vba/J1429p5447_cont.jpeg</p> <p>We limit the magnitude of the possible contaminats to: $m(F105W) < 21$ for the 0th order (5 objects at an angular separation from J1429+5447 of $40\text{arcsec} < \text{ad} < 60\text{arcsec}$); $m(F105W) < 23$ for the 1st order (8 objects at an angular separation from J1429+5447 of $\text{ad} < 27\text{arcsec}$).</p> <p>In order to avoid contamination from these objects the dispersion axis should fall within 305.2D and 320.6D in the first visit and within 220.3D and 230.8D in the second visit. All the position angles are calculated from North through East (counterclockwise) from the position of J1429+5447. Taking the offset angle between the U3 direction and the +X axis of 225.18D listed in Table 7.4 of the HST Cycle 22 Phase II Proposal Instructions, the allowed ORIENTATION angle are thus: VISIT01: ORIENT from 171.0D to 186.4D VISIT02: ORIENT from 86.1D to 96.1D</p> <p>These angles are highlighted with blue dashed vectors in the finding chart: https://www.dropbox.com/s/9bcwgvtn9md9vba/J1429p5447_cont.jpeg</p> <p>Coupled to each grism exposure, we consider to take a direct image of the field with the same ORIENT and POS TARG. The observing plan of each orbit is thus: grism-direct-direct-grism</p>																								
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Proposal 13839 - J1429+5447 VIST02 (02) - The Lyman Alpha Extended Halo of a Quasar at z>6

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2	reference15_0_dit01	(1) J1429+5447	WFC3/IR, MULTIACCUM, GRISM1024	F105W	NSAMP=7; SAMP-SEQ=SPAR S25	POS TARG 0.000,0. 000		152.935381 Secs (152.935 Secs) [==>]	[1]
<i>Comments: Direct image of J1429+5447 with the filter F105W, ancillary to the grism G102 observations.</i>									
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Exposures

