15088 - CIII]1909 imaging of three local starbursts

Cycle: 25, 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) ESO-350-IG-038	STIS/NUV-MAMA	4	20-Mar-2019 15:00:37.0	yes
02	(3) ESO-338-IG-004	STIS/NUV-MAMA	4	20-Mar-2019 15:00:39.0	yes
03	(2) NGC-2363A	STIS/NUV-MAMA	3	20-Mar-2019 15:00:40.0	yes
Z2	(3) ESO-338-IG-004	STIS/NUV-MAMA	4	20-Mar-2019 15:00:41.0	yes
Z3	(2) NGC-2363A	STIS/NUV-MAMA	3	20-Mar-2019 15:00:43.0	yes

18 Total Orbits Used

ABSTRACT

The CIII]1909 line is strongly detected in high redshift star-forming (SF) galaxies of low mass and metallicity, and has therefore been proposed as a new probe of galaxies close to the epoch of reionization. However, spectroscopic results at lower redshifts indicate that strong CIII] emission is not ubiquitous among distant SF galaxies. Observations show that galaxies of similarly modest stellar masses, low metallicities, and high ionization parameters can either be strong or weak CIII] emitters. This is contrary to expectations from photoionization models, which predict strong CIII] emission from such sources. Clearly, the dependence of the total integrated CIII] emission on such properties is not yet fully understood.

We propose to obtain CIII] imaging in two local SF galaxies (Haro 11 and Eso338-04) and one giant H II region (Mrk 71) in order to map the surface brightness of this emission with co-spatially inferred properties of individual SF regions. Our targets have a wealth of complementary HST imaging, and IFU data, allowing us to characterize each CIII] emitting region with properties like electron temperature and density, UV slope beta, and ionization parameter. We will quantify the interplay between integrated CIII] flux and flux inferred from individual regions, and compare to predictions from photoionization models. This will help disentangle the currently inconsistent observational results of CIII], and could potentially reconcile curiously weak CIII] emitters with their otherwise CIII]-boosting properties.

CIII] has recently been suggested as a diagnostic of possible Lyman Continuum (LyC) escape. We will test this on Haro 11, a confirmed LyC emitter.

OBSERVING DESCRIPTION

We need ~ 10000 sec exposure time in the STIS NUV MAMA F25CIII] filter for each target to reach the science goals outlined in phase 1. To ensure the continuum subtraction does not add noise, we need the S/N in the continuum filter to be >~3 times the S/N in the online filter.

For target Haro 11 and Eso338-04 we requested 4 orbits. We will use the NUV F25QTZ filter due to its higher throughput. We need at least 1500sec of exposure in this filter for both targets, which takes about 3/4 of an orbit. The remaining 3.25 orbits we will use on the online CIII] filter. We are using TIME-TAG mode as recommended for both of these targets and both filters.

For Mrk 71 we requested CVZ and therefore only 3 orbits. For this target we are using the NUV F25CN182 continuum filter, which has much lower throughput, and so the total exposure time for this filter is 5000 sec. We are of course using the same F25CIII] filter for the online exposures. Due to a high data volume warning, generated when using TIME-TAG, here we are using ACCUM mode.

Between all exposures we request small dither offsets of 0.245 arcsec to account for flatfielding uncertainties. For each target we split the observations in 4 exposures for on-line, and 3 exposures for off-line. The observations are further split in three visits of 4,4, and 3 orbits for Haro 11, Eso338-04, and Mrk 71, respectively, as motivated in phase-I.

We have performed a detailed analysis of the bright limit violations, reported by the APT/BOT for both continuum filters based on GALEX NUV magnitudes, and have shown that accounting for the objects not being point sources alleviates this concern and the objects are safe to observe. This is detailed for every object in the comment section for the continuum exposures. Additionally, we have provided the Contact Scientist, Daniel Welty, with a pdf file with further analysis of the magnitudes of all bright objects in the FoV.

Brief summary of our findings:
Mrk71: Continuum filter F25CN182. Even if assuming point source for the brightest clusters, no warnings are given by the STIS ETC for magnitudes in F170W, F336W, Galex NUV, F457M, under the assumption of a flat spectrum in fnu. The latter is a conservative assumption because the clusters are dominated by O type stars (less steep spectrum than flat in fnu). The worst case scenario is for GALEX NUV where we obtain 61.9 cts/sec/pix. We have also confirmed these results assuming an O5V spectrum in the ETC, where the worst case scenario is 61.496 cts/sec/pix.

Haro 11: Continuum filter F25QTZ. Cluster C may be of some concern, but the ETC indicates it is safe when accounting for the fact that it is not a point source. Normalizing a flat fnu spectrum by magnitude in F220W gives brightest pix cts/s =117.9 for point source (STIS.im.1010100) but 37.5 cts/s accounting for the fact that knot C is not a point source. Normalizing a flat fnu spectrum by magnitude in F336W gives brightest pix cts/s =127.4 for point source (STIS.im.1013915), but 53.1 cts/s accounting for the fact that knot C is not a point source. Using the instrument PSF scaled by the brightest pixel in F336W, one does get warnings (STIS.im.1013790) with count rate in the brightest pixel = 103.2 cts/s. However, we obtain 43.0 counts/s/pix in brightest pixel when accounting for the observed extended profile. Furthermore, using the distorted PSF that is more representative, and which is loaded in the ETC, we obtain 49.7 cts/s in the brightest pixel for point source (STIS.im.1009852). The situation is similar when using the F220W PSFs.

Eso338-04: Continuum filter F25QTZ. the bright cluster is F140LP=17.3 mag and F218W = 17.4 mag, which gives no warnings in ETC even when assuming a point source in F140LP (STIS.im.1010492) and F218W (STIS.im.1010511). The bright double star is invisible in a COS/NUV acquisition image at 2319.7AA of 40 seconds and hence is obviously fainter than clusters in Eso 338-04, which are readily visible in the same COS/NUV image and are nevertheless safe to observe with F25QTZ.

Visit

Proposal 15088, Haro11 (01), scheduling Wed Mar 20 19:00:43 GMT 2019

Diagnostic Status: Warning

Scientific Instruments: STIS/NUV-MAMA

Special Requirements: (none)

Diagnostics

(Haro11 (01)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Haro11 (01)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Haro11 (01)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Haro11 (01)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	ESO-350-IG-038	RA: 00 36 52.6992 (9.2195800d) Dec: -33 33 16.99 (-33.55472d) Equinox: J2000	Redshift: 0.02	V=13.8 +/-0.2 1.0e-13 erg/s/cm2 at 1909A	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the NED database.
Category=GALAXY
Description=[STAR FORMING REGION, STARBURST]
Extended=YES

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(1006635)	(1) ESO-350-IG-038	STIS/NUV-MAMA, ACCUM, F25CIII	MIRROR		POS TARG 0.0,0.0; GS ACQ SCENARIO BASE1B3		2900 Secs (2734 Secs) *[==>2734.0 Secs]*	 ***[1]***
2	(1006637)	(1) ESO-350-IG-038	STIS/NUV-MAMA, ACCUM, F25CIII	MIRROR		POS TARG 0.245,0.245		3100 Secs (2990 Secs) *[==>2990.0 Secs]*	 ***[2]***
3	(1006637)	(1) ESO-350-IG-038	STIS/NUV-MAMA, ACCUM, F25CIII	MIRROR		POS TARG -0.245,-0.245		3100 Secs (2990 Secs) *[==>2990.0 Secs]*	 ***[3]***
4	(1007178)	(1) ESO-350-IG-038	STIS/NUV-MAMA, ACCUM, F25CIII	MIRROR		POS TARG 0.49,0.49		1200 Secs (1286 Secs) *[==>1286.0 Secs]*	 ***[4]***
5	(1012755)	(1) ESO-350-IG-038	STIS/NUV-MAMA, ACCUM, F25QTZ	MIRROR		POS TARG 0.0,0.0		500 Secs (514 Secs) *[==>514.0 Secs]*	 ***[4]***

Comments: Observations of Haro11 with continuum filter F25QTZ give local health and safety warnings as well as saturation limit exceeded warnings in APT/BOT. However we have checked that the object should be safe to observe in this filter:

Checking with F220W (PI: Oestlin, PID: 10575, exp time: 1513sec) shows knot C in Haro 11 is clearly the brightest. Doing IRAF PHOT on knot C, aperture of r =0.2" gives F220W = 17.028, where the ZP for this image is 23.52845.
*ETC gives (ACS.im.1009657) brightest pixel e-/s = 71.644, but F220W measures max of 22.776 in knot C. This is a factor of 0.318 lower, accounting for marginally resolved nature of the source. Checking with STIS (STIS.im.1010100) brightest pix counts/s =117.905 for point source of mag 17.028. Accounting for non-point source: 117.905*0.318=37.493 counts/s for knot C, which does not violate limits.*

Checking F336W (PI: Oey, PID: 13702, obsID: ICLM03020, exp time: 1332sec)
*Knot C is brightest here too, doing IRAF PHOT on knot C (aperture of r=0.2", ZP = 24.58162) gives knot C F336W = 16.9364. ETC gives (WFC3UVIS.im.1009658) brightest pixel e-/s = 225.908, but F336W measures max of 94.133 in knot C. This is a factor of 0.417 lower because knot is marginally resolved. Checking with STIS (STIS.im.1013915) brightest pix counts/s =127.389 for point source of mag 16.936, Accounting for non-point source: 127.389 *0.417= 53.1212 counts/s for knot C, which does not violate limits.*

An additional point: Assuming a flat SED for knot C in the above estimates is reasonable, because the SED of Knot C is really flat between F140LP and F220W:
Knot C with 0.2" aperture measures fnu=5.6597e-27 erg/s/cm2/Hz in F140LP
Knot C with 0.2" aperture measures fnu=5.6075e-27 erg/s/cm2/Hz in F220W

where F140LP is from ACS/SBC, PI: Kunth, PID: 9470, obs ID: J8F705020, exptime 2700sec.

We have also performed an additional check with TinyTim PSFs to answer the question: Using the actual measured brightest pixel in F220W and F336W, and the TinyTim distorted PSFs for each instrument/chip/position, would the resulting point source be too bright in STIS NUV F25QTZ filter?

TinyTim WFC3 F336W, integrating to infinity, the growth curve of distorted PSF gives tot mag for knot C =17.958 in F336W. Checking with ETC (STIS.im.1009852), brightest pix counts/s = 49.698, which gives no warnings.

TinyTim ACS F220W, integrating to infinity, the growth curve of distorted PSF gives tot mag =18.344 in F220W. Checking with ETC (STIS.im.1009686), brightest pix counts/s = 34.829, which gives no warnings.

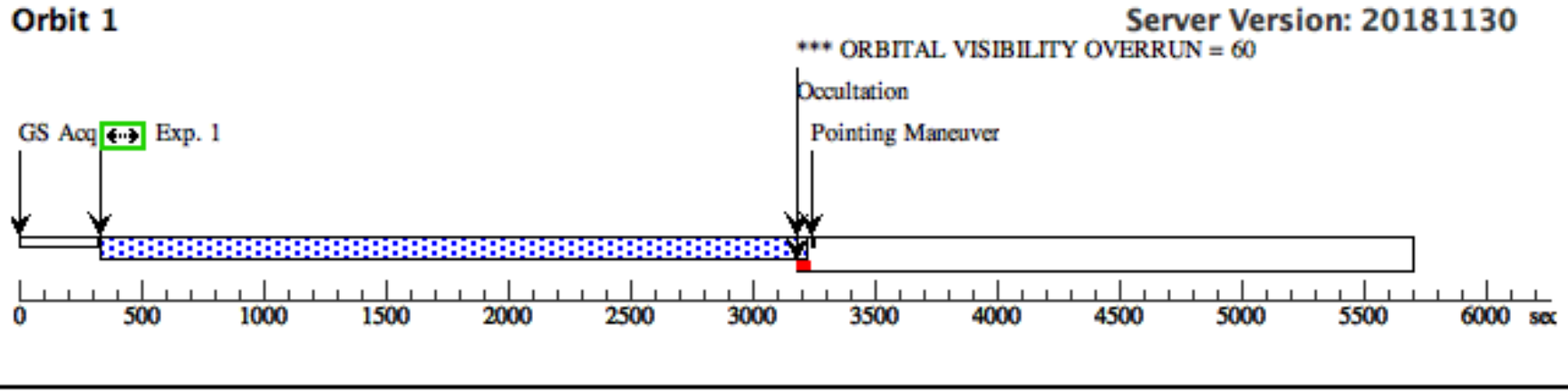
6	(1012755)	(1) ESO-350-IG-038	STIS/NUV-MAMA, ACCUM, F25QTZ	MIRROR		POS TARG 0.245,0.245		500 Secs (515 Secs) *[==>515.0 Secs]*	 ***[4]***

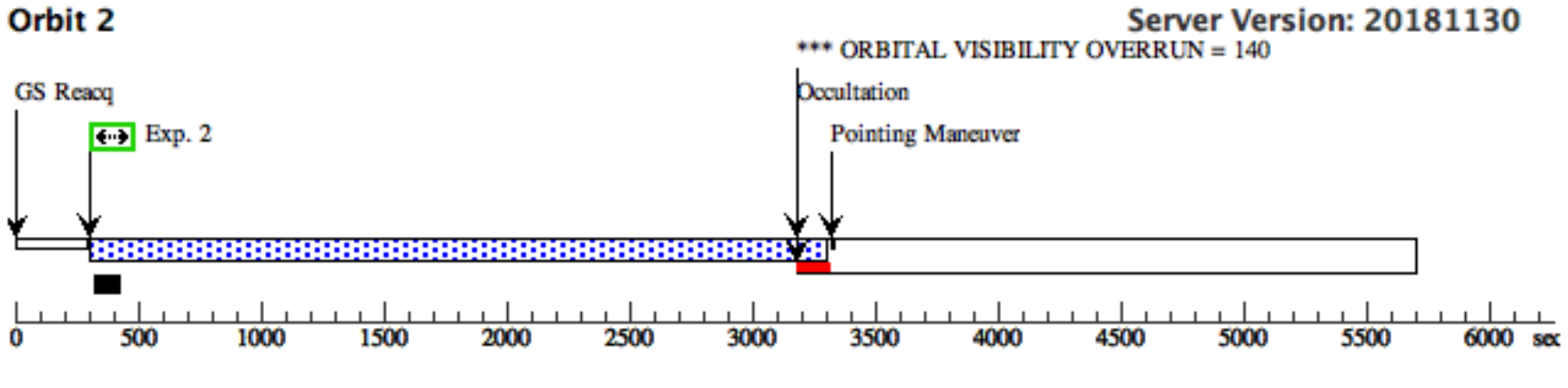
Comments: same comments apply as for Exposure 5

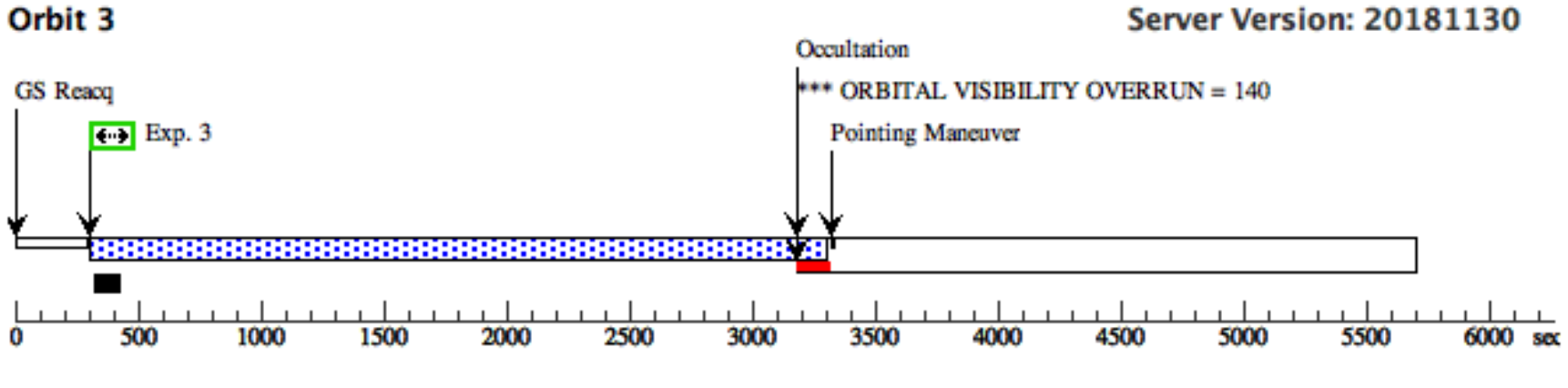
7	(1012755)	(1) ESO-350-IG-038	STIS/NUV-MAMA, ACCUM, F25QTZ	MIRROR		POS TARG -0.245,-0.245		500 Secs (515 Secs) *[==>515.0 Secs]*	 ***[4]***

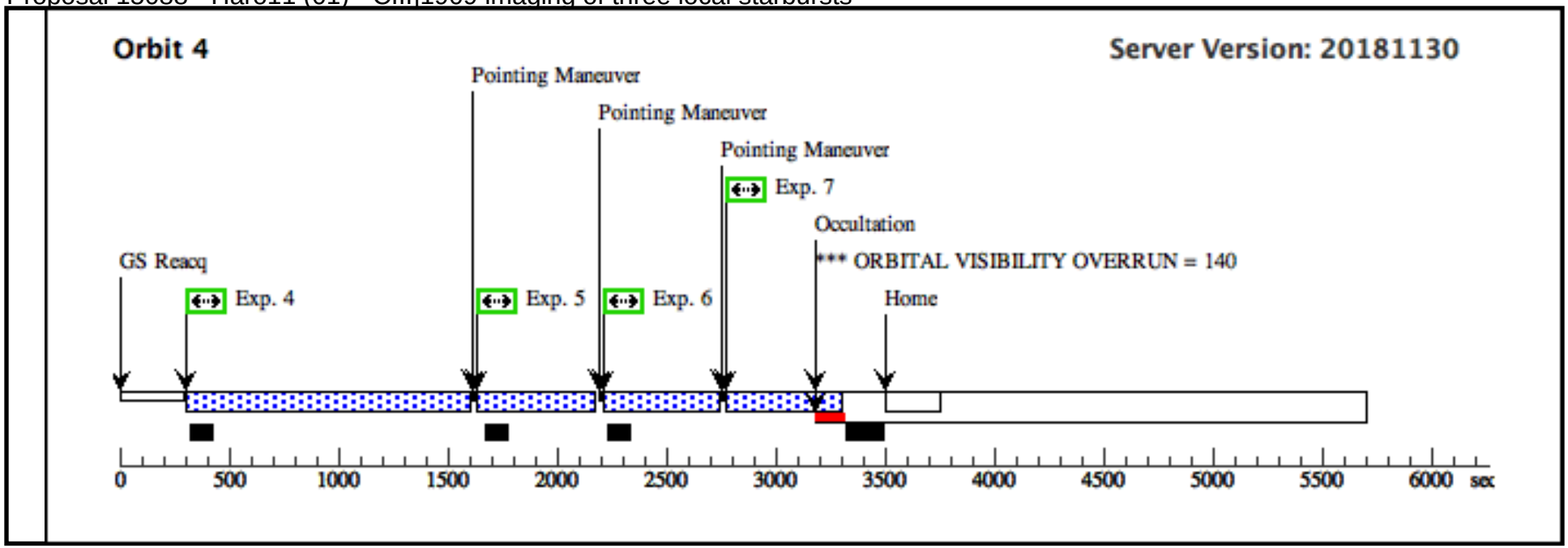
Comments: same comments apply as for Exposure 5

Orbit Structure





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GS Reacq
Exp. 4
Exp. 5
Exp. 6
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Visit

Proposal 15088, Eso338 (02), failed Wed Mar 20 19:00:43 GMT 2019

Diagnostic Status: Warning

Scientific Instruments: STIS/NUV-MAMA

Special Requirements: (none)

Diagnostics

(Eso338 (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Eso338 (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Eso338 (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Eso338 (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	ESO-338-IG-004	RA: 19 27 58.2879 (291.9928662d) Dec: -41 34 31.49 (-41.57541d) Equinox: J2000	Redshift: 0.0095	V=13.6+/-0.1 1.1e-13 erg/s/cm2 at 1909A	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the NED database.
Category=GALAXY
Description=[STAR FORMING REGION, STARBURST]
Extended=YES

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(1012740)	(3) ESO-338-IG-004	STIS/NUV-MAMA, ACCUM, F25CIII	MIRROR		POS TARG 0.0,0.0		2900 Secs (2792 Secs) *[==>2792.0 Secs]*	 ***[1]***
2	(1012743)	(3) ESO-338-IG-004	STIS/NUV-MAMA, ACCUM, F25CIII	MIRROR		POS TARG 0.245,0.245		3100 Secs (3048 Secs) *[==>3048.0 Secs]*	 ***[2]***
3	(1012743)	(3) ESO-338-IG-004	STIS/NUV-MAMA, ACCUM, F25CIII	MIRROR		POS TARG -0.245,-0.245		3100 Secs (3048 Secs) *[==>3048.0 Secs]*	 ***[3]***
4	(1012745)	(3) ESO-338-IG-004	STIS/NUV-MAMA, ACCUM, F25CIII	MIRROR		POS TARG 0.49,0.49		800 Secs (1112 Secs) *[==>1112.0 Secs]*	 ***[4]***

5	(1012749)	(3) ESO-338-IG-004	STIS/NUV-MAMA, ACCUM, F25QTZ	MIRROR	POS TARG 0.0,0.0	500 Secs (592 Secs)	
						[==>592.0 Secs]	***[4]***

Comments: Observations of Eso338 with continuum filter F25QTZ give local health and safety warnings as well as saturation limit exceeded warnings in APT/BOT. However we have checked that the object should be safe to observe in this filter:

Using data:
F439W, F555W (year 1996, PI: Ostlin, PID: 6708)
F336W (year 2000, PI Meurer, PID: 6639)
F140LP (PI: Kunth, PID: 9470, obsID:J8F730020, exptime:3000, year 2003)
F218W(PI: Ostlin, PID: 6708,obsID: U35R0106T,exptime 1000sec, year 1997)

Investigating one bright star near Eso338, and one bright cluster in Eso338.

Bright Star (double star):
NOTE: I cannot find any literature reference to this star ever being B=8 mag, as written in phase-I of the proposal. So that B=8 mag must be wrong.
NOTE: In an (R,G,B)=(F555W, F439W, F336W) image it is apparent that these are two stars, not one.

We have classified both stars to be some type of A class stars (the brighter one is likely A3V, the fainter one probably A7III), based on photometry in F140LP, F218W, F336W,F439W, F555W, and comparing to Pickles models. It is certain none of these stars is A or B type. We used TinyTim PSFs scaled by the peak pixel of each star, because stars are too close (0.317") for aperture photometry. The photometry of both stars gives:

star 1, F336W 17.729
star 1, F439W 16.333
star 1, F555W 16.468
star 1, F140LP 24.508
star 1, F218W 20.523

star 2, F336W 17.943
star 2, F439W 16.542
star 2, F555W 16.808
star 2, F140LP 24.943
star 2, F218W 23.068

Using the brightest available A1V type star in Table 14.40: the F555W magnitude should be fainter than 15.5 according to Table 14.40, which both of these stars are. Checking with STIS ETC (STIS.im.1010774) with brightest A model available (Pickles Models A0V 9549.93K) gives no warnings and brightest pixel counts/s: 39.763

Note that there are many comics in F336W, F439W, F555W. we have identified the position of the peaks from F555W, and applied the same positions to the F439W and F336W. Otherwise the peaks of both stars are not in the same position in all 3 images. We note that selecting the brightest pixels regarding of position, and scaling the PSFs with them, gives a star that is not consistent with any O,B,A class.

Additionally, in COS/NUV acquisition images (40 sec exptime) of Eso338-04 from PI: Ostlin, PID 14806, year 2017, no bright object is seen at the distance of the star (~12.56 arcsec from Eso 338) or in its vacinity, implying that this double star should be safe to observe in F25QTZ with STIS.

Checking bright cluster in Eso338-04:

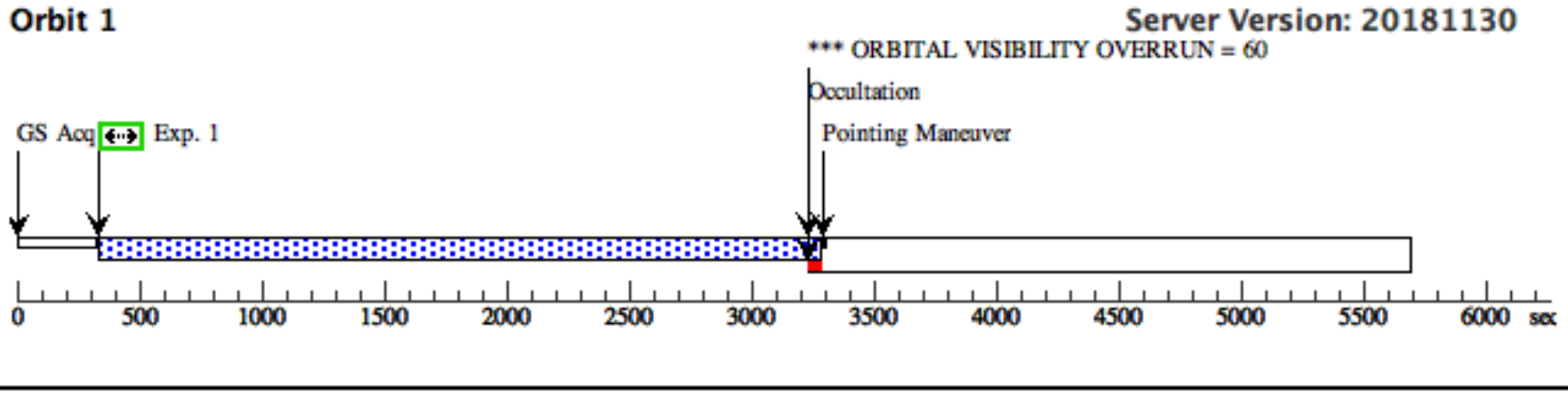
Checking with F140LP
ZP on this frame = 23.0878973
aperture 0.2" sum = 211.47943
F140LP (0.2") = 17.2747
ACS/SBC ETC (ACS.im.1010488) gives brightest pixel = 26.309 counts/s
measured brightest pixel on F140LP image: 10.001594
factor = 10.001594/26.309 = 0.38015
Checking with STIS ETC (STIS.im.1010492): no warnings, brightest pixel = 93.251 counts/s
*actual counts/s in brightest pixel= 93.251 * 0.38015 = 35.449 c/s, which doesn't violate local limits.*

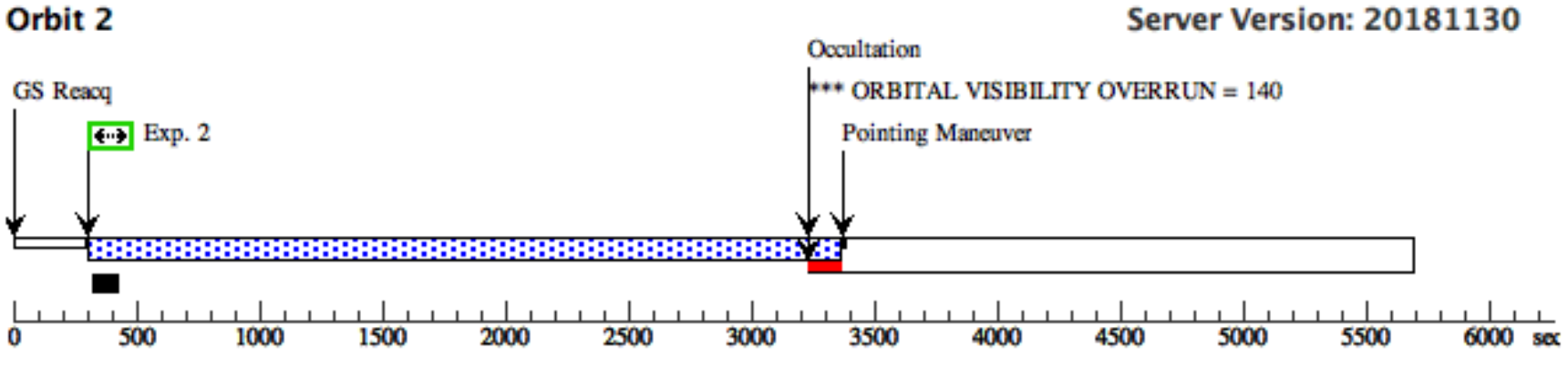
Checking F218W:
ZP on this frame = 18.3007583579
aperture 0.2" sum = 2.16253
F218W (0.2") = 17.4633
Can't check with WFPC2 ETC, doesn't seem to exist.
measured brightest pixel on F218W image: 0.762 counts/s
Instead, checking directly with STIS ETC (STIS.im.1010511), no warnings, brightest pixel =78.382 c/s
*Applying factor from F140LP, actual counts/s in brightest pixel = 78.382*0.38015 = 29.7969173*

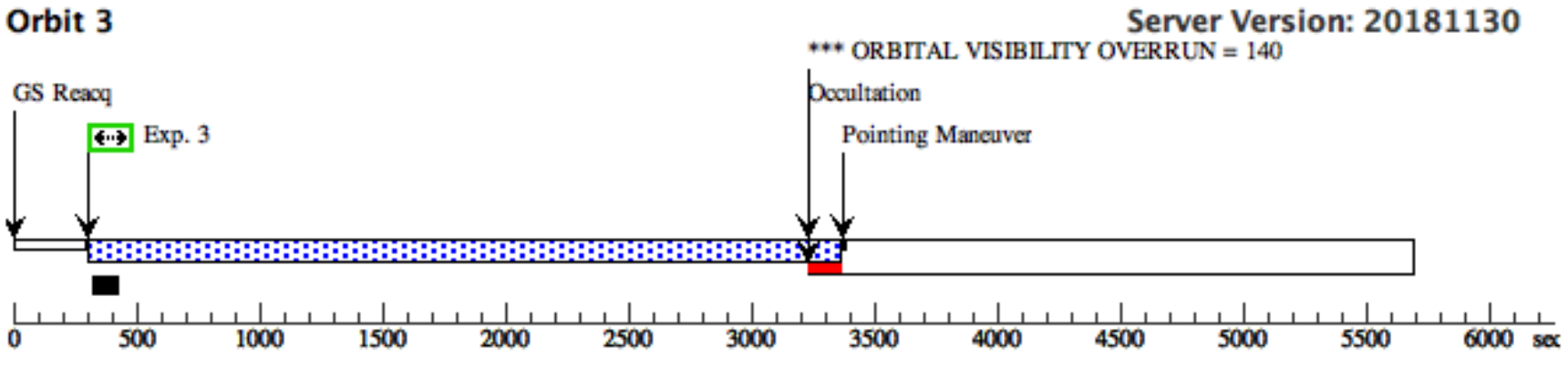
Is the SED of the cluster flat in fnu?
Inside aperture 0.2" fnu = 4.467958941465354e-27 erg/s/cm2/Hz in F140LP
Inside aperture 0.2" fnu = 3.755422446879729e-27 erg/s/cm2/Hz in F218W
fairly flat, yes, since that's a 0.18 mag brightening from F218W to F140LP. Above assumptions of flat spectrum in fnu should be fine.

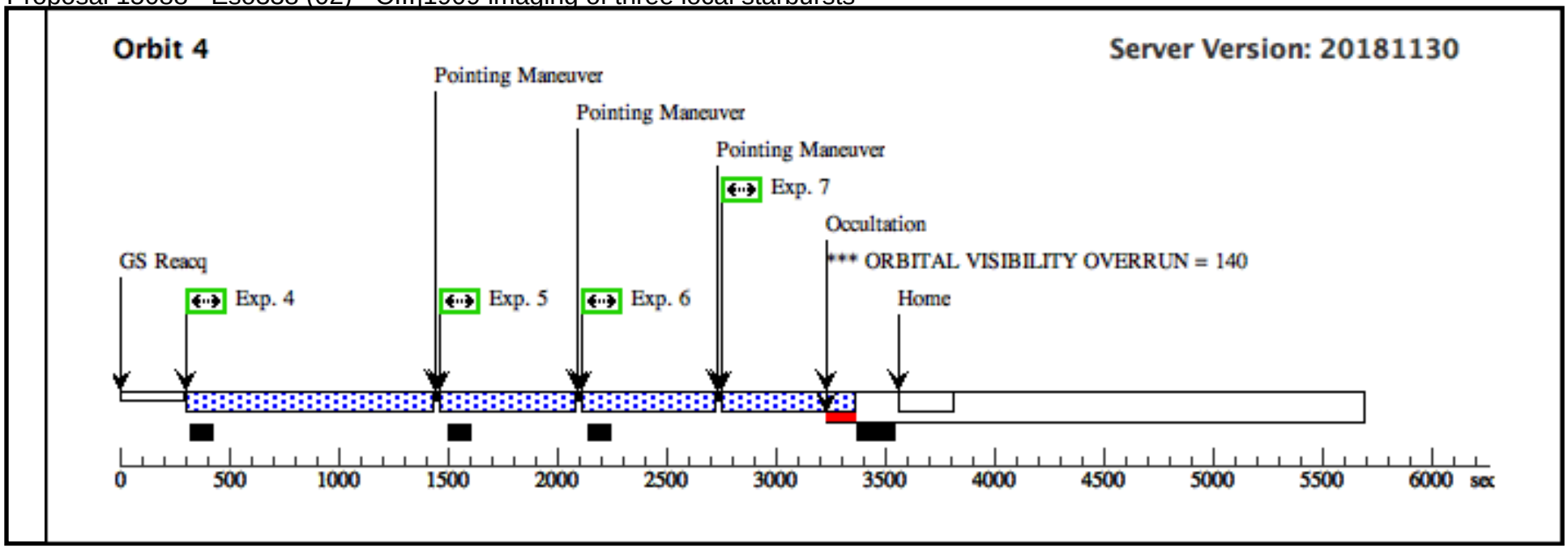
	6	(1012749)	(3) ESO-338-IG-004	STIS/NUV-MAMA, ACCUM, F25QTZ	MIRROR	POS TARG 0.245,0.245	500 Secs (592 Secs) *[==>592.0 Secs]*	 ***[4]***
	Comments: same comments apply as in Exposure 5							
	7	(1012749)	(3) ESO-338-IG-004	STIS/NUV-MAMA, ACCUM, F25QTZ	MIRROR	POS TARG -0.245,-0.245	500 Secs (592 Secs) *[==>592.0 Secs]*	 ***[4]***
	Comments: same comments apply as in Exposure 5							

Orbit Structure





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GS Reacq
Exp. 4
Exp. 5
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Visit

Proposal 15088, Mrk71 (03), failed Wed Mar 20 19:00:43 GMT 2019

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/NUV-MAMA

Special Requirements: CVZ

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	NGC-2363A	RA: 07 28 42.8000 (112.1783333d) Dec: +69 11 21.00 (69.18917d) Equinox: J2000	Redshift: 0.00036	V=15.5+/-0.2 5.16e-13 erg/s/cm2 at 1909A	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=GALAXY
Description=[STAR FORMING REGION, STARBURST]
Extended=YES

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(1007309)	(2) NGC-2363A	STIS/NUV-MAMA, ACCUM, F25CIII	MIRROR		POS TARG 0.0,0.0		3000 Secs (3000 Secs)	
								[==>]	***[1]***
2	(1007309)	(2) NGC-2363A	STIS/NUV-MAMA, ACCUM, F25CIII	MIRROR		POS TARG 0.245,0.245		3000 Secs (3000 Secs)	
								[==>]	***[1]***
3	(1007309)	(2) NGC-2363A	STIS/NUV-MAMA, ACCUM, F25CIII	MIRROR		POS TARG -0.245,-0.245		3000 Secs (3000 Secs)	
								[==>]	***[2]***
4	(1012760)	(2) NGC-2363A	STIS/NUV-MAMA, ACCUM, F25CIII	MIRROR		POS TARG 0.49,0.49		1900 Secs (1900 Secs)	
								[==>]	***[2]***

5	(1007329)	(2) NGC-2363A	STIS/NUV-MAMA, ACCUM, F25CN182	MIRROR	POS TARG 0.0,0.0	2000 Secs (2000 Secs)	
						[==>]	***[3]***

Comments: For the continuum filter F25CN182 the APT/BOT gives health and safety warnings (local counts/s in brightest pixel exceeded, saturation exceeded), however we have checked that the object should be safe to observe in this filter:

Mrk 71 has two bright knows and an LBV. The knots are not point sources as shown below, and the LBV is too faint.

Checking F336W of Mrk 71 (PI: James, obsID:IC0Q01010, exptime:300s):
Knot A is the brightest inside the 25"x25" STIS FoV centered on Mrk 71
ZP in this image: 24.70755
IRAF PHOT magnitudes, with aperture radius = 0.2 arcsec (=5.05 pixels in F336W):
Knot A= 18.066+/- 0.042, Knot B= 18.246+/- 0.045, LBV = 20.041+/- 0.103
Knot A is brightest: F336W= 18.066+/- 0.042 mag.
*In the ETC for WFC3/UVIS, using flat spectrum in Fnu, normalized to match 18.066 in F336W filter, gives brightest pixel counts :80.158 e-/s (ETC run: WFC3UVIS.im.1012650). But from the F336W image itself, the brightest pixel inside the knot A aperture measures 32.22 e-/s. This is a factor of 32.22/80.158=0.40195, representing the decrease in counts due to the fact that knot A is not a point source. Check for STIS ETC (STIS.im.1012654): no warning for point source with F336W = 18.066, and brightest pix counts/s = 6.225 c/s. Actual counts for marginally resolved cluster should be lower, 6.225*0.40195=2.502 counts/s in brightest pixel.*

Also doing this for knot B:
brightest pixel counts: 67.601 e-/s (ETC run:WFC3UVIS.im.1012664)
From F336W image brightest pixel in knot B aperture measures = 19.5956 e-/s
factor = 19.5956/ 67.601 = 0.28987

Checking F170W data of Mrk 71, brightest obejct is knot B. Photometry on knot B from the 6 images gives:
hst_07391_03_wfpc2_f170w_pc_drz.fits 17.975
hst_07391_04_wfpc2_f170w_pc_drz.fits 17.936
hst_08403_03_wfpc2_f170w_pc_drz.fits 17.811
hst_08403_04_wfpc2_f170w_pc_drz.fits 17.916
hst_08781_03_wfpc2_f170w_pc_drz.fits 17.916
hst_08781_04_wfpc2_f170w_pc_drz.fits 17.825
Average mag for knot B = 17.896+/-0.06. Test ETC with 17.896-0.06= 17.836 (STIS.im.1009052) gives no warnings for point source. Knot A is fainter here so should give no warnings either.

Checking GALEX NUV
Longest exposure time of 4312.1sec is for this run: 3241045956061298688 with PID:223, PI:Skillman
file: GI6_026010_NGC2366-nd-int.fits

The Galex NUV resolution of 1.5" is such that the clusters are overlapping, and the LBV, which is at a distance of 1.43" from knot B, in the same/next pixel as knot B. Modeling magnitudes of knots A and B with 2 Gaussians simultaneously gives NUV flux under Gaussian at knot A= 48.08310 counts, knot B+LBV=63.63398 counts. The point source model magnitudes of knots A and B are then:
*knot A NUV = -2.5*scipy.log10(48.08310)+20.08 = 15.875*
*knot B (+LBV) NUV = -2.5*scipy.log10(63.63398)+20.08 = 15.57*

*Checking ETC for Knot B+LBV with NUV=15.57 mag. Checking ETC(STIS.im.1009041) gives no warnings. Brightest pixel = 61.925 c/s for point source. Using factor for knot B, obtained from F336W data test, gives actual brightest pixel counts per second for knot B = 61.925*0.28987=17.9501 c/s. This is an overestimate for knot B because the LBV somewhat contributes to the modeled magnitude.*

Knot A will therefore likely be the brightest in NUV. Checking ETC (STIS.im.1009053) for Knot A with NUV= 15.875 mag gives no warnings. Brightest pixel = 46.810 c/s for point source. Actual counts for resolved source: 46.810 0.40195 = 18.8152 c/s*

Final check with F457M (V band, PI: James, PID: 13041):
ZP in this image is 24.77116
Knot A is brightest in this image, and measures: 18.331 in 0.2" aperture. This doesn't violate limits according to Table 14.40 in STIS-ihb.pdf

About the LBV:
As seen from F170W and F336W data, the LBV is not brighter than Knots A and B (even in GALEX NUV). The distance between the LBV and knot B is =1.43". From a F547M WFC3/UVIS image of Mrk 71 (PI James, obs ID: IC0Q01070, PID: 13041) I measure F547M=20.4mag, which means that it is fading since the measurement reported in Drissen et al. (1997), V = 17.88mag.

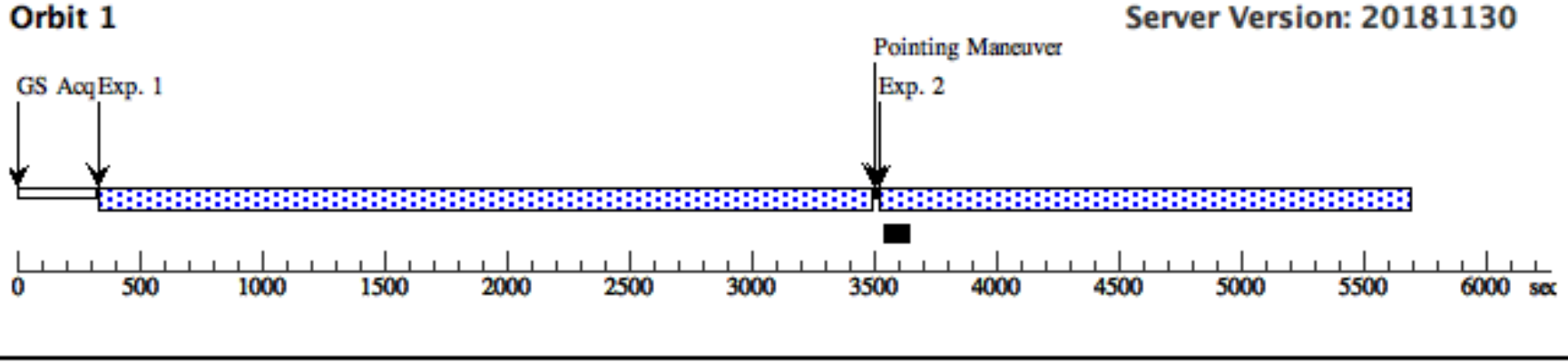
6	(1007329)	(2) NGC-2363A	STIS/NUV-MAMA, ACCUM, F25CN182	MIRROR	POS TARG 0.245,0.245	2000 Secs (2000 Secs)	
						[==>]	***[3]***

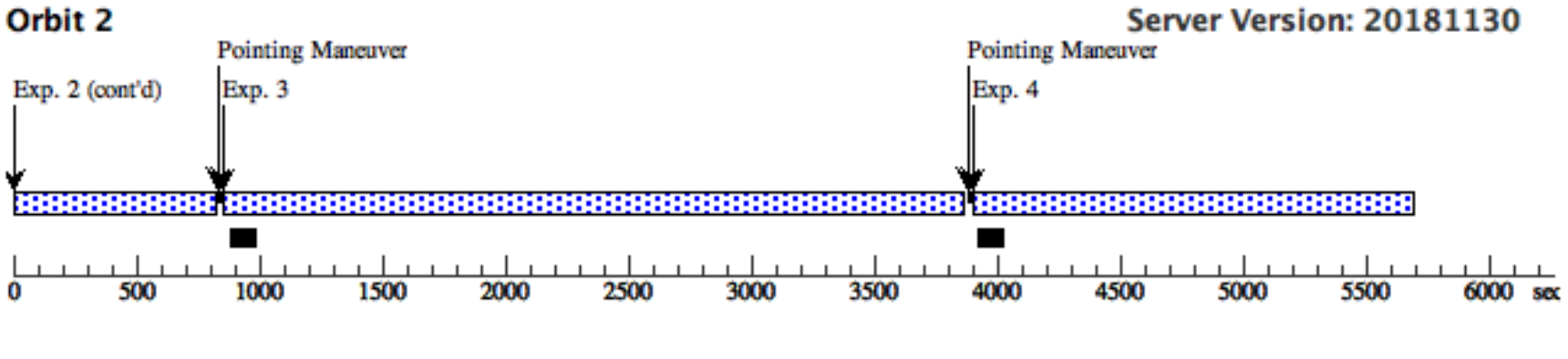
Comments: same comments apply here as for Exposure 5

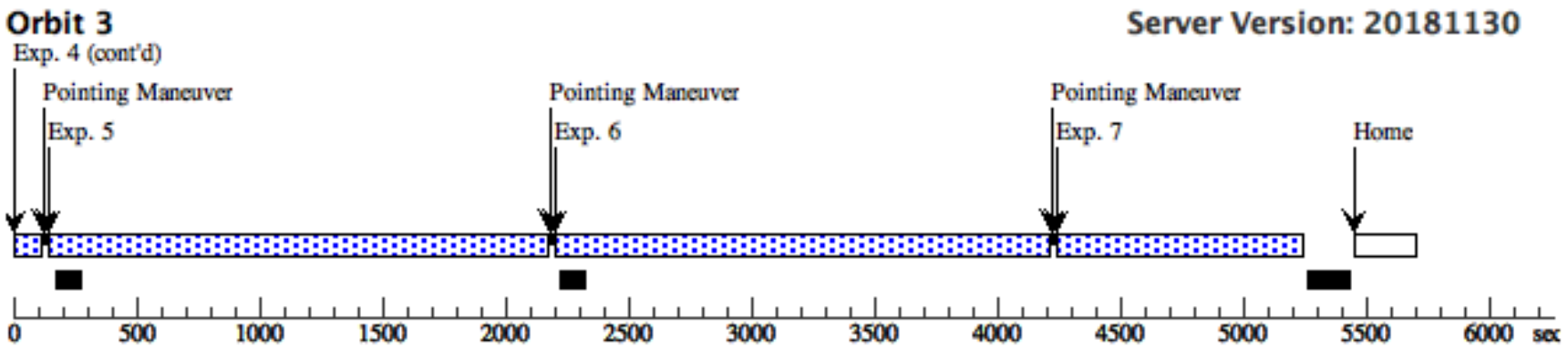
7	(1012763)	(2) NGC-2363A	STIS/NUV-MAMA, ACCUM, F25CN182	MIRROR	POS TARG -0.245,-0.245	988 Secs (988 Secs)	
						[==>]	***[3]***

Comments: same comments apply here as for Exposure 5

Orbit Structure







Visit

Proposal 15088, Eso338HOPR (Z2), completed Wed Mar 20 19:00:44 GMT 2019

Diagnostic Status: Warning

Scientific Instruments: STIS/NUV-MAMA

Special Requirements: (none)

Diagnostics

(Eso338HOPR (Z2)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Eso338HOPR (Z2)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Eso338HOPR (Z2)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Eso338HOPR (Z2)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	ESO-338-IG-004	RA: 19 27 58.2879 (291.9928662d) Dec: -41 34 31.49 (-41.57541d) Equinox: J2000	Redshift: 0.0095	V=13.6+/-0.1 1.1e-13 erg/s/cm2 at 1909A	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the NED database.
Category=GALAXY
Description=[STAR FORMING REGION, STARBURST]
Extended=YES

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(1012740)	(3) ESO-338-IG-004	STIS/NUV-MAMA, ACCUM, F25CIII	MIRROR		POS TARG 0.0,0.0		2900 Secs (2792 Secs)	
								[==>2792.0 Secs]	***[1]***
2	(1012743)	(3) ESO-338-IG-004	STIS/NUV-MAMA, ACCUM, F25CIII	MIRROR		POS TARG 0.245,0.245		3100 Secs (3048 Secs)	
								[==>3048.0 Secs]	***[2]***
3	(1012743)	(3) ESO-338-IG-004	STIS/NUV-MAMA, ACCUM, F25CIII	MIRROR		POS TARG -0.245,-0.245		3100 Secs (3048 Secs)	
								[==>3048.0 Secs]	***[3]***
4	(1012745)	(3) ESO-338-IG-004	STIS/NUV-MAMA, ACCUM, F25CIII	MIRROR		POS TARG 0.49,0.49		800 Secs (1112 Secs)	
								[==>1112.0 Secs]	***[4]***

5	(1012749)	(3) ESO-338-IG-004	STIS/NUV-MAMA, ACCUM, F25QTZ	MIRROR	POS TARG 0.0,0.0	500 Secs (592 Secs)	
						[==>592.0 Secs]	***[4]***

Comments: Observations of Eso338 with continuum filter F25QTZ give local health and safety warnings as well as saturation limit exceeded warnings in APT/BOT. However we have checked that the object should be safe to observe in this filter:

Using data:
F439W, F555W (year 1996, PI: Ostlin, PID: 6708)
F336W (year 2000, PI Meurer, PID: 6639)
F140LP (PI: Kunth, PID: 9470, obsID:J8F730020, exptime:3000, year 2003)
F218W(PI: Ostlin, PID: 6708,obsID: U35R0106T,exptime 1000sec, year 1997)

Investigating one bright star near Eso338, and one bright cluster in Eso338.

Bright Star (double star):
NOTE: I cannot find any literature reference to this star ever being B=8 mag, as written in phase-I of the proposal. So that B=8 mag must be wrong.
NOTE: In an (R,G,B)=(F555W, F439W, F336W) image it is apparent that these are two stars, not one.

We have classified both stars to be some type of A class stars (the brighter one is likely A3V, the fainter one probably A7III), based on photometry in F140LP, F218W, F336W,F439W, F555W, and comparing to Pickles models. It is certain none of these stars is A or B type. We used TinyTim PSFs scaled by the peak pixel of each star, because stars are too close (0.317") for aperture photometry. The photometry of both stars gives:

star 1, F336W 17.729
star 1, F439W 16.333
star 1, F555W 16.468
star 1, F140LP 24.508
star 1, F218W 20.523

star 2, F336W 17.943
star 2, F439W 16.542
star 2, F555W 16.808
star 2, F140LP 24.943
star 2, F218W 23.068

Using the brightest available A1V type star in Table 14.40: the F555W magnitude should be fainter than 15.5 according to Table 14.40, which both of these stars are. Checking with STIS ETC (STIS.im.1010774) with brightest A model available (Pickles Models A0V 9549.93K) gives no warnings and brightest pixel counts/s: 39.763

Note that there are many comics in F336W, F439W, F555W. we have identified the position of the peaks from F555W, and applied the same positions to the F439W and F336W. Otherwise the peaks of both stars are not in the same position in all 3 images. We note that selecting the brightest pixels regarding of position, and scaling the PSFs with them, gives a star that is not consistent with any O,B,A class.

Additionally, in COS/NUV acquisition images (40 sec exptime) of Eso338-04 from PI: Ostlin, PID 14806, year 2017, no bright object is seen at the distance of the star (~12.56 arcsec from Eso 338) or in its vacinity, implying that this double star should be safe to observe in F25QTZ with STIS.

Checking bright cluster in Eso338-04:

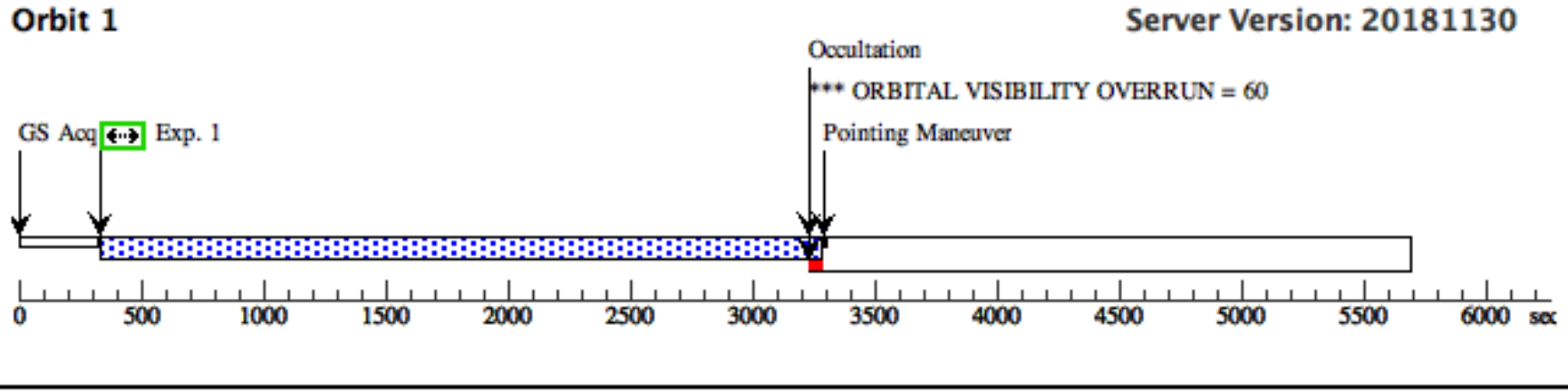
Checking with F140LP
ZP on this frame = 23.0878973
aperture 0.2" sum = 211.47943
F140LP (0.2") = 17.2747
ACS/SBC ETC (ACS.im.1010488) gives brightest pixel = 26.309 counts/s
measured brightest pixel on F140LP image: 10.001594
factor = 10.001594/26.309 = 0.38015
Checking with STIS ETC (STIS.im.1010492): no warnings, brightest pixel = 93.251 counts/s
*actual counts/s in brightest pixel= 93.251 * 0.38015 = 35.449 c/s, which doesn't violate local limits.*

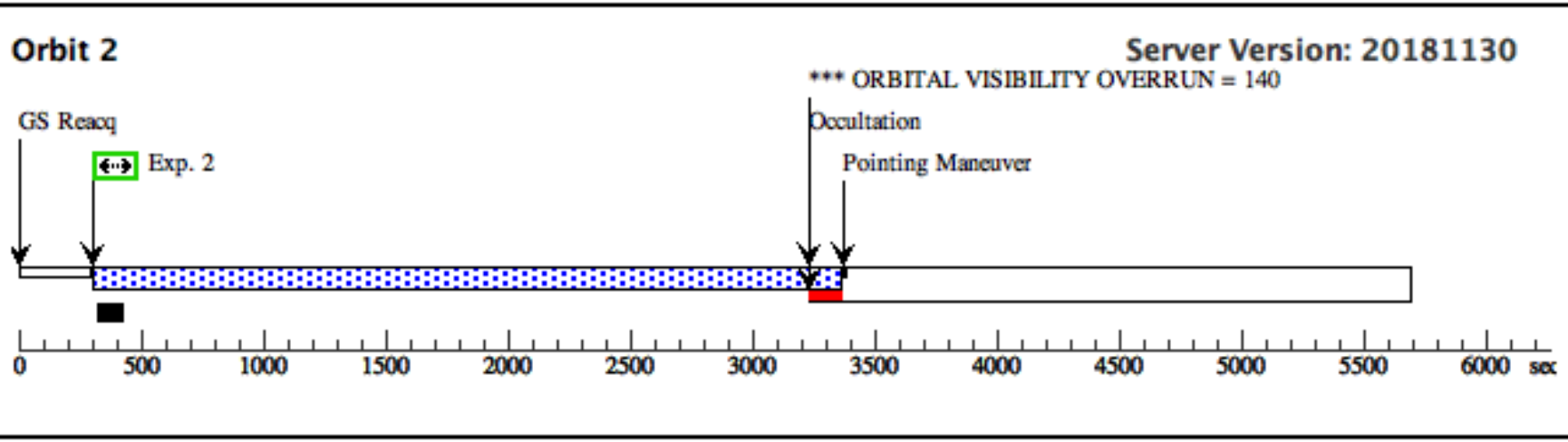
Checking F218W:
ZP on this frame = 18.3007583579
aperture 0.2" sum = 2.16253
F218W (0.2") = 17.4633
Can't check with WFPC2 ETC, doesn't seem to exist.
measured brightest pixel on F218W image: 0.762 counts/s
Instead, checking directly with STIS ETC (STIS.im.1010511), no warnings, brightest pixel =78.382 c/s
*Applying factor from F140LP, actual counts/s in brightest pixel = 78.382*0.38015 = 29.7969173*

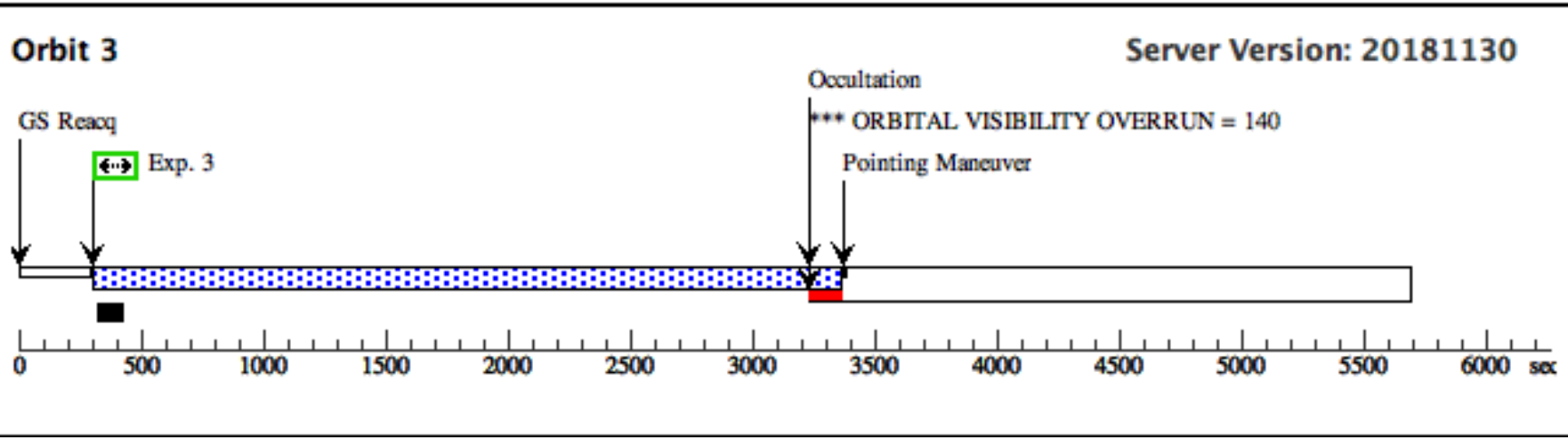
Is the SED of the cluster flat in fnu?
Inside aperture 0.2" fnu = 4.467958941465354e-27 erg/s/cm2/Hz in F140LP
Inside aperture 0.2" fnu = 3.755422446879729e-27 erg/s/cm2/Hz in F218W
fairly flat, yes, since that's a 0.18 mag brightening from F218W to F140LP. Above assumptions of flat spectrum in fnu should be fine.

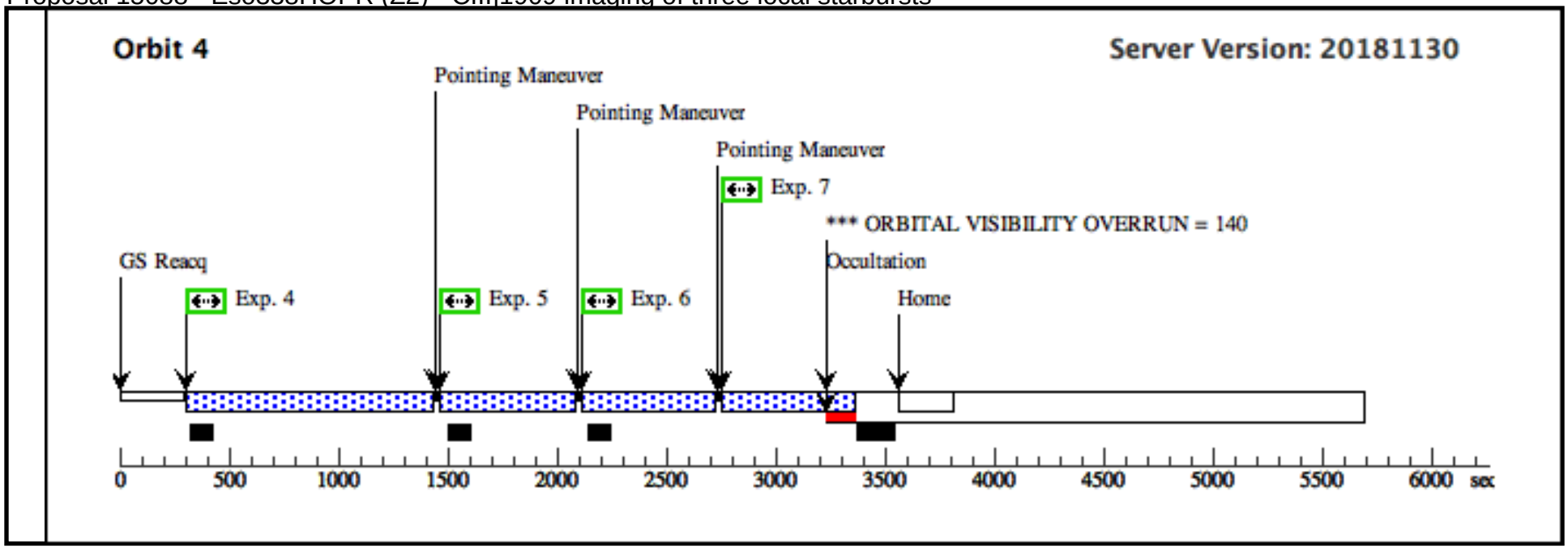
	6	(1012749)	(3) ESO-338-IG-004	STIS/NUV-MAMA, ACCUM, F25QTZ	MIRROR	POS TARG 0.245,0.245	500 Secs (592 Secs) *[==>592.0 Secs]*	 ***[4]***
	Comments: same comments apply as in Exposure 5							
	7	(1012749)	(3) ESO-338-IG-004	STIS/NUV-MAMA, ACCUM, F25QTZ	MIRROR	POS TARG -0.245,-0.245	500 Secs (592 Secs) *[==>592.0 Secs]*	 ***[4]***
	Comments: same comments apply as in Exposure 5							

Orbit Structure





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Exp. 7
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GS Reacq
Occultation
Exp. 4
Exp. 5
Exp. 6
Home
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Visit

Proposal 15088, Mrk71 (Z3) Wed Mar 20 19:00:44 GMT 2019

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/NUV-MAMA

Special Requirements: CVZ

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	NGC-2363A	RA: 07 28 42.8000 (112.1783333d) Dec: +69 11 21.00 (69.18917d) Equinox: J2000	Redshift: 0.00036	V=15.5+/-0.2 5.16e-13 erg/s/cm2 at 1909A	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=GALAXY
Description=[STAR FORMING REGION, STARBURST]
Extended=YES

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(1007309)	(2) NGC-2363A	STIS/NUV-MAMA, ACCUM, F25CIII	MIRROR		POS TARG 0.0,0.0		3000 Secs (3000 Secs) *[==>]*	 ***[1]***
2	(1007309)	(2) NGC-2363A	STIS/NUV-MAMA, ACCUM, F25CIII	MIRROR		POS TARG 0.245,0.245		3000 Secs (3000 Secs) *[==>]*	 ***[1]***
3	(1007309)	(2) NGC-2363A	STIS/NUV-MAMA, ACCUM, F25CIII	MIRROR		POS TARG -0.245,-0.245		3000 Secs (3000 Secs) *[==>]*	 ***[2]***
4	(1012760)	(2) NGC-2363A	STIS/NUV-MAMA, ACCUM, F25CIII	MIRROR		POS TARG 0.49,0.49		1900 Secs (1900 Secs) *[==>]*	 ***[2]***

5	(1007329)	(2) NGC-2363A	STIS/NUV-MAMA, ACCUM, F25CN182	MIRROR	POS TARG 0.0,0.0	2000 Secs (2000 Secs)	
						[==>]	***[3]***

Comments: For the continuum filter F25CN182 the APT/BOT gives health and safety warnings (local counts/s in brightest pixel exceeded, saturation exceeded), however we have checked that the object should be safe to observe in this filter:

Mrk 71 has two bright knows and an LBV. The knots are not point sources as shown below, and the LBV is too faint.

Checking F336W of Mrk 71 (PI: James, obsID:IC0Q01010, exptime:300s):
Knot A is the brightest inside the 25"x25" STIS FoV centered on Mrk 71
ZP in this image: 24.70755
IRAF PHOT magnitudes, with aperture radius = 0.2 arcsec (=5.05 pixels in F336W):
Knot A= 18.066+/- 0.042, Knot B= 18.246+/- 0.045, LBV = 20.041+/- 0.103
Knot A is brightest: F336W= 18.066+/- 0.042 mag.
*In the ETC for WFC3/UVIS, using flat spectrum in Fnu, normalized to match 18.066 in F336W filter, gives brightest pixel counts :80.158 e-/s (ETC run: WFC3UVIS.im.1012650). But from the F336W image itself, the brightest pixel inside the knot A aperture measures 32.22 e-/s. This is a factor of 32.22/80.158=0.40195, representing the decrease in counts due to the fact that knot A is not a point source. Check for STIS ETC (STIS.im.1012654): no warning for point source with F336W = 18.066, and brightest pix counts/s = 6.225 c/s. Actual counts for marginally resolved cluster should be lower, 6.225*0.40195=2.502 counts/s in brightest pixel.*

Also doing this for knot B:
brightest pixel counts: 67.601 e-/s (ETC run:WFC3UVIS.im.1012664)
From F336W image brightest pixel in knot B aperture measures = 19.5956 e-/s
factor = 19.5956/ 67.601 = 0.28987

Checking F170W data of Mrk 71, brightest obejct is knot B. Photometry on knot B from the 6 images gives:
hst_07391_03_wfpc2_f170w_pc_drz.fits 17.975
hst_07391_04_wfpc2_f170w_pc_drz.fits 17.936
hst_08403_03_wfpc2_f170w_pc_drz.fits 17.811
hst_08403_04_wfpc2_f170w_pc_drz.fits 17.916
hst_08781_03_wfpc2_f170w_pc_drz.fits 17.916
hst_08781_04_wfpc2_f170w_pc_drz.fits 17.825
Average mag for knot B = 17.896+/-0.06. Test ETC with 17.896-0.06= 17.836 (STIS.im.1009052) gives no warnings for point source. Knot A is fainter here so should give no warnings either.

Checking GALEX NUV
Longest exposure time of 4312.1sec is for this run: 3241045956061298688 with PID:223, PI:Skillman
file: GI6_026010_NGC2366-nd-int.fits

The Galex NUV resolution of 1.5" is such that the clusters are overlapping, and the LBV, which is at a distance of 1.43" from knot B, in the same/next pixel as knot B. Modeling magnitudes of knots A and B with 2 Gaussians simultaneously gives NUV flux under Gaussian at knot A= 48.08310 counts, knot B+LBV=63.63398 counts. The point source model magnitudes of knots A and B are then:
*knot A NUV = -2.5*scipy.log10(48.08310)+20.08 = 15.875*
*knot B (+LBV) NUV = -2.5*scipy.log10(63.63398)+20.08 = 15.57*

*Checking ETC for Knot B+LBV with NUV=15.57 mag. Checking ETC(STIS.im.1009041) gives no warnings. Brightest pixel = 61.925 c/s for point source. Using factor for knot B, obtained from F336W data test, gives actual brightest pixel counts per second for knot B = 61.925*0.28987=17.9501 c/s. This is an overestimate for knot B because the LBV somewhat contributes to the modeled magnitude.*

Knot A will therefore likely be the brightest in NUV. Checking ETC (STIS.im.1009053) for Knot A with NUV= 15.875 mag gives no warnings. Brightest pixel = 46.810 c/s for point source. Actual counts for resolved source: 46.810 0.40195 = 18.8152 c/s*

Final check with F457M (V band, PI: James, PID: 13041):
ZP in this image is 24.77116
Knot A is brightest in this image, and measures: 18.331 in 0.2" aperture. This doesn't violate limits according to Table 14.40 in STIS-ihb.pdf

About the LBV:
As seen from F170W and F336W data, the LBV is not brighter than Knots A and B (even in GALEX NUV). The distance between the LBV and knot B is =1.43". From a F547M WFC3/UVIS image of Mrk 71 (PI James, obs ID: IC0Q01070, PID: 13041) I measure F547M=20.4mag, which means that it is fading since the measurement reported in Drissen et al. (1997), V = 17.88mag.

6	(1007329)	(2) NGC-2363A	STIS/NUV-MAMA, ACCUM, F25CN182	MIRROR	POS TARG 0.245,0.245	2000 Secs (2000 Secs)	
						[==>]	***[3]***

Comments: same comments apply here as for Exposure 5

7	(1012763)	(2) NGC-2363A	STIS/NUV-MAMA, ACCUM, F25CN182	MIRROR	POS TARG -0.245,-0.245	988 Secs (988 Secs)	
						[==>]	***[3]***

Comments: same comments apply here as for Exposure 5

Orbit Structure