



15125 - Galactic fireworks: detecting young stars formed in galactic outflows

Cycle: 25, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>	<i>E-Mail</i>
Dr. Francesco Belfiore (PI) (Contact)	University of California - Santa Cruz	fbelfior@ucsc.edu
Dr. Filippo Mannucci (CoI) (ESA Member)	Osservatorio Astrofisico di Arcetri	filippo@arcetri.astro.it
Dr. Giovanni Cresci (CoI) (ESA Member)	Osservatorio Astrofisico di Arcetri	gcresci@arcetri.astro.it
Dr. Roberto Maiolino (CoI) (ESA Member)	University of Cambridge	r.maiolino@mrao.cam.ac.uk
Dr. Santiago Arribas (CoI) (ESA Member)	Space Telescope Science Institute - ESA	arribas@stsci.edu
Dr. Bethan Lesley James (CoI) (ESA Member) (Contact)	Space Telescope Science Institute - ESA	bjames@stsci.edu
Dr. Helen R Russell (CoI) (ESA Member)	University of Cambridge	hrr27@ast.cam.ac.uk
Prof. Andrew C. Fabian (CoI) (ESA Member)	University of Cambridge	acf@ast.cam.ac.uk
Dr. Stefano Carniani (CoI) (ESA Member)	University of Cambridge	sc888@mrao.cam.ac.uk
Dr. Wako Ishibashi (CoI) (ESA Member)	Universitat Zurich	wako.ishibashi@physik.uzh.ch
Prof. Alessandro Marconi (CoI) (ESA Member)	Universita di Firenze	marconi@arcetri.astro.it
Dr. Eckhard Sturm (CoI) (ESA Member)	Max-Planck-Institut fur extraterrestrische Physik	sturm@mpe.mpg.de
Luis Colina Robledo (CoI) (ESA Member)	Centro de Astrobiologia (CSIC/INTA) Inst. Nac. de T ec. Aero.	colina@cab.inta-csic.es
Aldrin Flutsch (CoI) (ESA Member)	University of Cambridge	af618@mrao.cam.ac.uk

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) ESO-148-2-POINTING-1-INNER	COS/FUV COS/NUV	4	06-Nov-2017 10:01:52.0	yes
02	(1) ESO-148-2-POINTING-1-INNER	COS/FUV COS/NUV	4	06-Nov-2017 10:01:54.0	yes

8 Total Orbits Used

ABSTRACT

Recent observations have revealed massive galactic outflows of molecular gas, which may have the physical conditions required to form stars. Since outflows are complex, turbulent, multi-phase media, it has so far been challenging to conclusively identify star formation taking place in the flow via classical diagnostics. By exploiting high resolution, high sensitivity, broad band spectroscopy we have recently found evidence for star formation taking place in the fast galactic outflow of a nearby LIRG. We propose to obtain COS observations with two apertures sampling the outflow of this galaxy with the following goals: (1) obtain a direct detection of the hot, young stars formed in the outflow, which are expected to have the same velocity as the outflowing gas; (2) detect and measure the velocity of the young stars formed in the outer part of the outflow, where, according to models, they should form with velocities higher than the escape velocity; (3) determine the properties of the stars formed in the outflow, in particular their average temperature and metallicity; (4) measure the column density and metallicity of the outflowing gas, and thus constrain the amount of gas in the outflow and, therefore, the efficiency of star formation in this environment.

OBSERVING DESCRIPTION

We will observe IRAS2318-59 with an aperture centered on the brightest UV region associated with the southern nucleus (and sampling the inner region of the outflow).

We aim at obtaining very high quality spectra, similar or better than those obtained in James et al. (2014), which will enable: (1) a detailed analysis of the velocity profiles and velocity shift of the stellar and ISM absorption features; we plan to compare stellar and ISM kinematics both with each other and with the optical nebular emission and absorption lines tracing the outflow and stellar optical features; (2) disentangle the spectral features associated with the galaxy from the telluric absorption and emission features.

In order to achieve these goals we employ an observing strategy similar to James et al. (2014). We will adopt the G130M medium resolution grating

Proposal 15125 (STScI Edit Number: 2, Created: Monday, November 6, 2017 10:01:54 AM EST) - Overview

(central wavelength at 1291), which covers the CIII 1176 and OIV 1342 young stellar features (in the rest-frame of the galaxy). The medium resolution grating is selected in order to accurately determine the gas kinematics and enable decomposition of line profiles. Given that some of the UV emission is extended on scales of $\sim 1''$, this will result in to a degradation of the spectral resolution; however, thanks the medium resolution gratings, even with this degradation, the spectral resolution for this component will be still good enough (~ 60 km/s) to clearly associate the stellar kinematics with the outflow (velocity 300-500 km/s) or with the host galaxy. Also, the medium resolution grating ensures that the spectral features of interest are not blended with MW or telluric lines. The required setting will also enable us to observe numerous ISM lines from various elements in different ionization species and determine their column densities with uncertainties ~ 0.1 dex through a multi-component fitting technique. We will use the OI 1302 line to determine metallicity. If the line is saturated, we will instead use the SII triplet (1250, 1253, 1259).

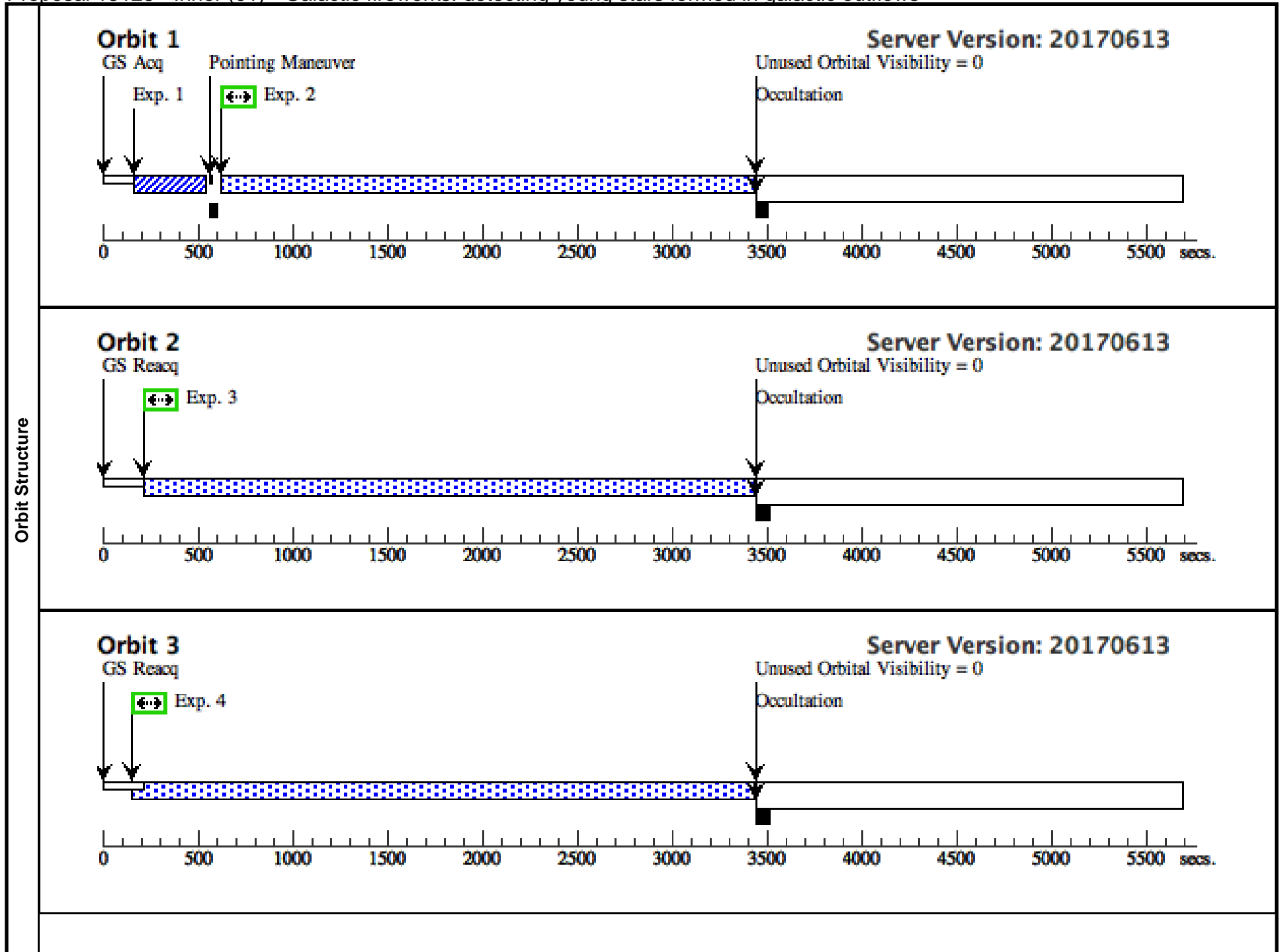
Based on the ACS F140LP image of the galaxy, the proposed COS aperture has flux $F(1500\text{\AA}) \sim 6 \times 10^{-16}$ erg/s/cm²/AA. In order to perform the detailed analysis discussed above, to disentangle the kinematics of stellar populations with different ages we need to achieve a S/N ~ 15 per spectral resolution element. For the S/N calculation we take as reference wavelengths 1228 AA (which is the observed wavelength of CIII 1176). By using the ETC (with an O9-like spectrum normalized to the fluxes reported above), assuming a point source, the required S/N implies an exposure of 24ks.

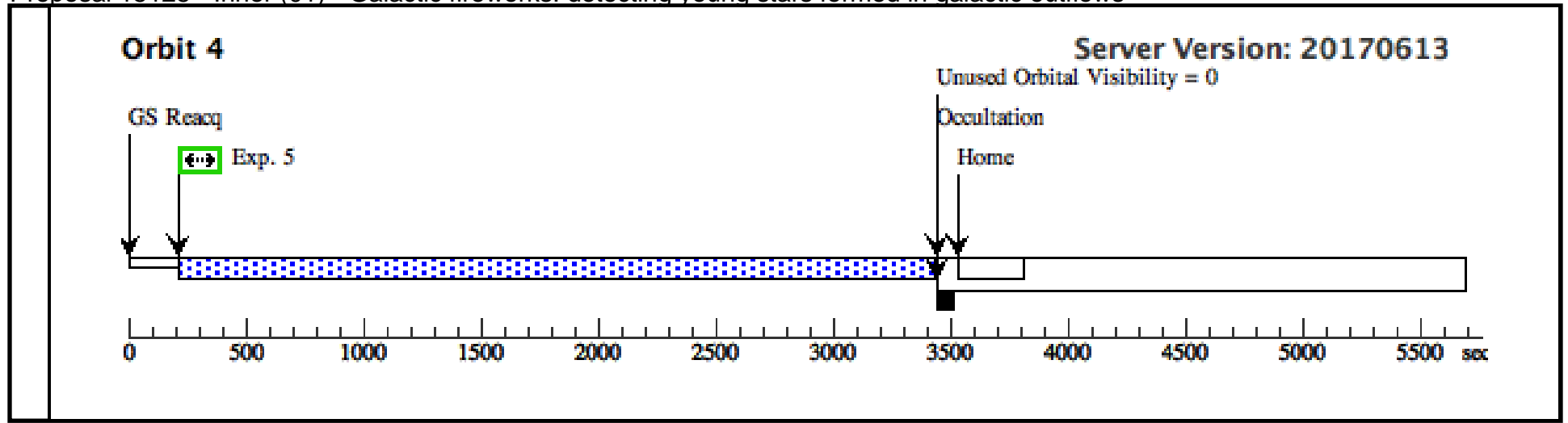
We use standard peak-up target acquisition (TA) in NUV imaging mode exploiting the bright central UV clump in the proposed aperture.

Proposal 15125 - Inner (01) - Galactic fireworks: detecting young stars formed in galactic outflows

Mon Nov 06 15:01:55 GMT 2017

Visit	Proposal 15125, Inner (01), implementation Diagnostic Status: Warning Scientific Instruments: COS/FUV, COS/NUV Special Requirements: (none)									
	(Inner (01)) Warning (Form): For the best data quality, it is strongly recommended that the maximum number of allowed FP-POS positions is used when observing at a given COS CENWAVE setting. See full description for details. (Inner (01)) Warning (Orbit Planner): INEFFICIENT ORDERING OF FP-POS POSITIONS (Inner G130M FPPOS3 (01.002)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details. (Inner G130M FPPOS4 (01.003)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details. (Inner G130M FPPOS3 (01.004)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details. (Inner G130M FPPOS4 (01.005)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.									
Diagnosics										
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	ESO-148-2-POINTING-1-INNER	RA: 23 15 46.9020 (348.9454250d) Dec: -59 03 14.56 (-59.05404d) Equinox: J2000		V=14.73	Reference Frame: ICRS				
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Extended=YES</i>										
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	Inner ACQ (COS.ta.101 1598)	(1) ESO-148-2-POINTING-1-INNER	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				80 Secs (80 Secs) [==>]	[1]
	2	Inner G130M FPPOS3 (COS.sp.100 9130)	(1) ESO-148-2-POINTING-1-INNER	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=3; FLASH=YES; BUFFER-TIME=5300			2646 Secs (2646 Secs) [==>2646.0 Secs]	[1]
	3	Inner G130M FPPOS4 (COS.sp.100 9130)	(1) ESO-148-2-POINTING-1-INNER	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=4; FLASH=YES; BUFFER-TIME=5400			3163 Secs (3163 Secs) [==>3163.0 Secs]	[2]
	4	Inner G130M FPPOS3 (COS.sp.100 9130)	(1) ESO-148-2-POINTING-1-INNER	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=3; FLASH=YES; BUFFER-TIME=5400			3163 Secs (3163 Secs) [==>3163.0 Secs]	[3]
	5	Inner G130M FPPOS4 (COS.sp.100 9130)	(1) ESO-148-2-POINTING-1-INNER	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=4; FLASH=YES; BUFFER-TIME=5400			3163 Secs (3163 Secs) [==>3163.0 Secs]	[4]





Proposal 15125 - Inner (02) - Galactic fireworks: detecting young stars formed in galactic outflows

Mon Nov 06 15:01:55 GMT 2017

Visit	Proposal 15125, Inner (02), implementation Diagnostic Status: Warning Scientific Instruments: COS/FUV, COS/NUV Special Requirements: (none)										
	(Inner (02)) Warning (Form): For the best data quality, it is strongly recommended that the maximum number of allowed FP-POS positions is used when observing at a given COS CENWAVE setting. See full description for details. (Inner (02)) Warning (Orbit Planner): INEFFICIENT ORDERING OF FP-POS POSITIONS (Inner G130M FPPOS3 (02.002)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details. (Inner G130M FPPOS4 (02.003)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details. (Inner G130M FPPOS3 (02.004)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details. (Inner G130M FPPOS4 (02.005)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.										
Diagnosics											
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous					
	(1)	ESO-148-2-POINTING-1-INNER	RA: 23 15 46.9020 (348.9454250d) Dec: -59 03 14.56 (-59.05404d) Equinox: J2000		V=14.73	Reference Frame: ICRS					
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Extended=YES											
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit	
	1	Inner ACQ (COS.ta.101 1598)	(1) ESO-148-2-POINTING-1-INNER	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				80 Secs (80 Secs)		
									[==>]	[1]	
	2	Inner G130M FPPOS3 (COS.sp.100 9130)	(1) ESO-148-2-POINTING-1-INNER	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=3; FLASH=YES; BUFFER-TIME=5400				2646 Secs (2646 Secs)	
									[==>2646.0 Secs]	[1]	
	3	Inner G130M FPPOS4 (COS.sp.100 9130)	(1) ESO-148-2-POINTING-1-INNER	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=4; FLASH=YES; BUFFER-TIME=5400				3163 Secs (3163 Secs)	
									[==>3163.0 Secs]	[2]	
4	Inner G130M FPPOS3 (COS.sp.100 9130)	(1) ESO-148-2-POINTING-1-INNER	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=3; FLASH=YES; BUFFER-TIME=5400				3163 Secs (3163 Secs)		
								[==>3163.0 Secs]	[3]		
5	Inner G130M FPPOS4 (COS.sp.100 9130)	(1) ESO-148-2-POINTING-1-INNER	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=4; FLASH=YES; BUFFER-TIME=5400				3163 Secs (3163 Secs)		
								[==>]	[4]		

