



# Throughput Updates to the WFC3/IR Grism Configuration Files

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## ABSTRACT

*We reduce grism calibration data on the two standard stars GD-71 and GD-153 with the grism reduction software **grizli**. We compare the extracted spectra to preexisting data from the XShooter Spectral Library to estimate required throughput changes to the IR Grism configuration files. We find required changes on the order of ...*

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## Introduction

WFC3 (Wide Field Camera 3) has three grisms (spectral elements combining a grating and prism to conduct slitless spectroscopy) for the UVIS and IR channels. For the IR grisms, filters G102 and G141, much work has gone into precisely calibrating their wavelength trace and throughput. Recently **grizli** – an open source reduction software (Brammer?) was created to extract grism observations and provide high quality WFC3/IR data. For this project we extract two sets of WFC3/IR grism observations of GD-71 and GD-153 and compare the WFC3 slitless spectroscopy to the existing spectroscopy both from STIS (the Space Telescope Imaging Spectrograph) and the XShooter Spectral Library. We take care to not only examine the first order fringes of the grism used for the bulk of science data, but to also extract second and negative first order grism fringes. (The distinction is shown in Figure 1.)

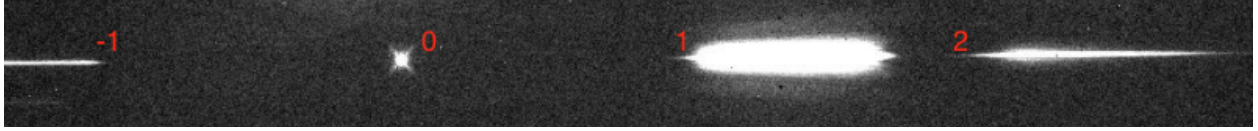


Fig. 1.—An example of a grism observation and the fringe orders. This image is of GSC 02581 – 02323 in the G14 filter. As numbered, the zeroth order is what’s left in the image of the original source. The first order is the brightest projection and the one used predominately for science. The second and negative first order are much fainter (often only visual for bright stars).

## Data

We began with two WFC3/IR grism data sets on standard calibrator stars GD-71 and GD-153 from the Barbara Mikulski Archive for Space Telescopes (MAST); both queries are linked. Each set of data includes grism exposures (G102 and G141) and corresponding direct exposures (F105, F098, F140, F160), dithered across the field of view. Tables 1 and 2 list the proposals and visits used for GD-71 and GD-153 respectively.

Proposal	Visit	Exposures	Filters	Obs. Date
11936	01	30	F098M, F105W, G102	2009-10-03
	02	30	F160W, F140W, G141	2009-09-21
	03	30	F098M, F105W, G102	2010-04-24
	04	30	F160W, F140W, G141	2010-04-24
11926	04	5	F140W, G141, +*	2009-10-05
	05	5	F140W, G141, +	2010-02-16
	06	5	F140W, G141, +	2010-02-16
	29	5	F140W, G141, +	2009-11-01
	30	5	F140W, G141, +	2009-11-25
12357	01	30	F098M, F105W, G102	2011-01-14
	02	30	F160W, F140W, G141	2010-12-24
12333	14	14	F098M, G102, F140W, G141	2010-11-17
12702	02	12	F098M, F105W, G102, F160, F140, G141	2011-12-31
14024	01	36	F098M, F105W, G102	2015-01-02
	02	36	F160W, F140M, G141	2015-02-08

Table 1: The above visits make up the body of data used for the GD-71 analysis. These exposures consist of grism observations (in G102 and G141) and the accompanying direct exposures in F105W or F098M for G102 and F140W and F160W for G141. The + indicates exposures with more filters were taken in the visit, but are not relevant to grism analysis. Note these visits and proposals consist of WFC3 grism calibration proposals.

### Grism Extraction with `grizli`

This set of 591 exposures was reduced using the grism reduction software `grizli`. The details of that extraction are documented in detail in a `grizli` cookbook available at (some

Proposal	Visit	Exposures	Filters	Obs. Date
11552	01	9	F098M, F105W, G102	2009-09-09
	04	9	F160W, F140W, G141	2009-09-09
	A1	3	F098M, F105W, G102	2009-09-09
	A4	3	F160W, F140W, G141	2009-09-09
12702	1A	48	F098M, F105W, G102	2012-06-23
	1B	42	F160W, F140W, G141	2012-05-18
	AA	9	F098M, F105W, G102, F160, F140, G141	2012-06-24
	AB	3	F160W, F140W, G141	2012-05-18
13092	1A	28	F098M, F105W, G102, F160, F140, G141	2013-06-01
13579	01	28	F098M, F105W, G102, F160, F140, G141	2014-06-24
	02	28	F098M, F105W, G102, F160, F140, G141	2014-07-05
14386	01	36	F098M, G102, F140W, G141	2016-05-02
	02	36	F160W, F140W, G141	2016-04-13

Table 2: *The above visits make up the body of data used for the GD-153 analysis.*

readthedocs), but in summary required:

- Matching visits by WCS orient and creating direct/grism filter pairs.
- Preprocessing and drizzling the calibrated FLT files.
- Creating a drizzled mosaic and a segmentation map of all of the data on each source.
- Correcting the segmentation map for proper motion of the main source (as the data spans multiple epochs).
- Resetting Data Quality flags that flag out grism traces.
- Extracting beams and model comparisons.

## Analysis

There are some flux profiles and sensitivity curves...

## Updates to Flux Extraction and Spectral Trace??

I'm honestly not sure at this point if our results will be – THESE ARE OUR discrepancies or – THESE ARE HOW WE FIXED THEM...

## Acknowledgements

Whoever edits this?

## REFERENCES

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## Appendix A