

# Quick look tool for long-slit spectroscopy

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## 1 Introduction

The Quick look tool for long-slit spectroscopy will allow you to take a first look at your data directly on site. This handbook will guide you how to run the Quick look tool. In Section 2 all preparations, which are necessary before running the Quick look tool for long-slit spectroscopy are explained. How to run the Quick look tool is described in Section 3 step by step, while section 4 is dedicated to the trouble shooting. Here you will find help in case the flat field fit or the line calibration is not satisfying.

## 2 Getting started

- Download the MIDAS programs from:  
“<http://www.ls.eso.org/lasilla/sciops/3p6/efosc/docs/qlook/index.html>” and place them in the `~/midwork/` directory.
- Create a directory containing the data you want to reduce. The directory should only contain raw data taken with the same settings, e.g, raw files taken with slit 1" and Grism #10 should be in the same directory, but no raw files with any other settings.
- Copy all necessary calibration files to this directory (HeAr calibration spectrum, flats - dome or internal flats - and bias).
- If you have observed a spectrophotometric standard and want to calculate the response function, you have to copy the spectrophotometric standard stars spectrum to the directory, too.

## 3 Quick look tool - step by step

Start midas: `inmidas`

1. type `@@ readme`: The readme program lists all the programs belonging to the Quick look tool with a short explanation what the program is doing.

2. run prepare by typing `@@ prepare`

- The program will ask for the Grism number.
- A list of the bias files is edited with `vi`, if the bias files are correct go on by typing `:q`. If not go to the wrong files and remove them by typing `d d`.
- The final bias will be displayed in a separated window, to continue highlight the window and click the right mouse button twice.
- A list of the flat fields is edited with `vi`. Check if all files are correct and remove wrong files before going on by typing `:q`.
- In the 'graph' window the flat field trace and the corresponding flat field fit will appear, while in the 'display' window the final master flat field frame is displayed. Exit from the display to continue.
- A list of the HeAr calibration spectra is edited with `vi`. Again check if the files are correct and remove wrong files. (Exit: `:q`)
- Different plots will be displayed, to go on click the right mouse button inside the 'graph' window. The last of the plots shows the wavelength calibration solution.

3. now run `@@ calib spectrum_name.fits`

NB: The `.fits` extension is critical!

Or in case there is more than one spectrum to reduce, create an image catalog `crea/icat catalog_name *.fits` and calibrate all spectra at once with `exec/cat @@ calib catalog_name.cat`.

4. Before running `exsingle` one has to determine the position of the sky and the spectrum within the data. Load one of the spectra.

```
load name
get/cursor
```

Now specify a lower sky window, an upper sky window and an object window, by clicking on the display. Each window is defined by two pixel positions. The next step is to copy the pixel values of the three windows to `obdef.dat`. Open the `obdef.dat` with an editor and replace the pixel values given there by the new ones. If the raw data contains two or more spectra at the same time, you have to run the command repeatedly with the corresponding sky and object windows. In this case you also have to change the parameter 'object number' in `obdef.dat`.

Now run: `@@ exsingle spectrum_name.bdf`  
NB: The `.bdf` extension is critical!  
The result is written to `spectrum_name_obj1.bdf`

If you took a spectrum of a spectrophotometric standard, you can calculate the response function.

5. Now run `@@ resplong`

This program will only work when you have chosen one of the spectrophotometric standard stars with a table in Midas format (see Appendix A).

Just follow the instructions written on the display. To delete go to the line you want to delete and press `d d`. To leave type `:wq`. At one point you will be asked to select the table of the spectrophotometric standard star. For each star there are two different tables available, choose the one which says “ctio” in the string because the flux calibration is better compared to the other table.

You can search for a string by typing `/string`. The cursor will go to the first line in which this string appears. Repeat the command to go to the next line in which the string appears. When you have selected the table you want to use you have to delete all the other lines in the list. Here is the fast way to do it.

Go to the line below the one you want to select. Press `d shift+g`. All lines towards the end will be deleted. Then go to the line above your selected one and type `d 1 shift+g`. All lines up to the first will be deleted.

6. Finally: `@@ fluxlong spectrum_name_obj1.bdf`

The result is written to `spectrum_name_obj1_flux.dbf`.

## 4 Troubles?

When running `@@ prepare` you might have realized the the flat field interpolation and/or the wavelength calibration is not optimal. To improve this you have to do the following. Remember after applying a change to the flat field fit you have to run `prepare` again, but remove all `*.bdf` files before doing so.

### 4.1 Bad flat field fit

To interpolate the flat field a polynomial function is used. To improve the flat field fit you can try to vary the degree of the polynomial function.

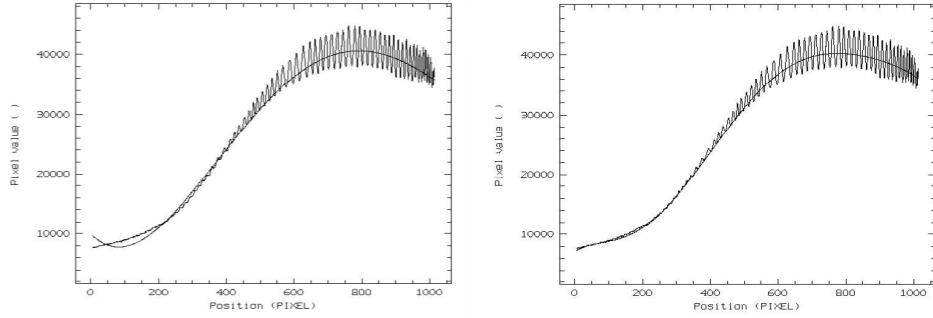


Figure 1: **Left:** The flat field fit is not optimal. **Right:** Improved flat field fit.

Type `show/long` to display the parameters used for the reduction. You will find the used fitting degree under point '3. Dark, Bias and Flat Field'

The command `normalize/flat medflat masterflat 0` will show you again the flat field fit. To change the fitting degree type `set/long fdeg=x`, where `x` is a integer between 2 and 7. To display the new fit do again `normalize/flat medflat masterflat 0`. Repeat the last two steps till you find the best fitting degree. Figure 1 shows an example of a good and a bad flat field fit.

The new fitting degree has to be stored in the `defaultpars*.prg` file in the `~/midwork/` directory. The '\*' stands for the respective Grism number. E.g., if you are reducing data taken with Grism #2 you have to edit `defaultpars2.prg`

## 4.2 Line calibration by hand

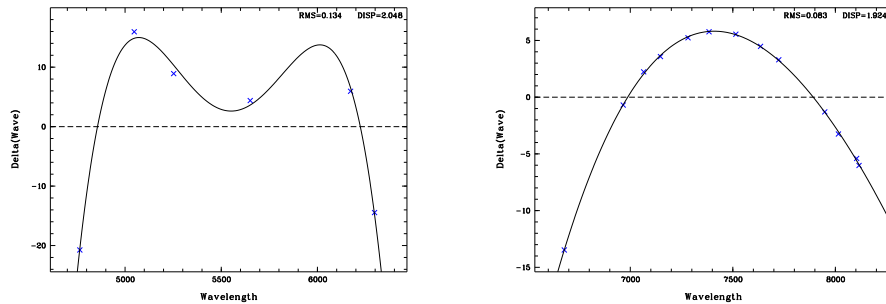


Figure 2: **Left:** Bad wavelength calibration solution. **Right:** Optimized wavelength calibration.

The line calibration is normally done by a guess session. In case the calibration is not satisfying (see Figure 2) it can be done by hand, but

you will need the Helium-Argon Atlas, which can be found in the EFOSC manual, to do so. Just do the following

```
- set/long wlcmtd=ident
- load masterhear.bdf cuts=0,20000
- ident/long ? ? ? 4
```

where “4” is the tolerance for the line identification.

The Helium-Argon spectrum will be displayed in the graph window. Select one of the emission lines to which the respective wavelength is given in the Helium-Argon Atlas and click on it. Midas will now ask you to enter the wavelength. Do this for four or five different lines distributed over the whole wavelength range and then leave by pressing the right mouse button.

Next type: `calib/long`

To check: `plot/delta`

Another way to check is to calibrate the HeAr spectrum itself. Make a copy of the Helium-Argon spectrum ( $\rightarrow$  `test_HeAr.fits`) and type `@@ calib test_HeAr.fits`. Then do `plot test_HeAr` and `center/gauss gcursor`. Now go to the graph window with the cursor and click once on the left and once on the right side of one of the emission lines. Midas will fit a Gaussian to the line and then returns among other things the central wavelength of the line. Furthermore you can check the calibration by displaying the calibrated HeAr spectrum itself (`load HeAr.bdf`). The calibration is good when the lines are straight (see Figure 3). Finally you have to save the new wavelength calibration.

```
save/long save_name
```

### 4.3 If you accidentally exit from Midas

Well! Bad luck. But don't worry, just do:

```
- inmidas
- set/context long
- init/long save_name
```

All former setting will be restored and you can continue. Note, that if the calibration obtained with the guess session is good and you did not do a new one, then the calibration file name “current”. So `init/long current` would restore the session parameters.

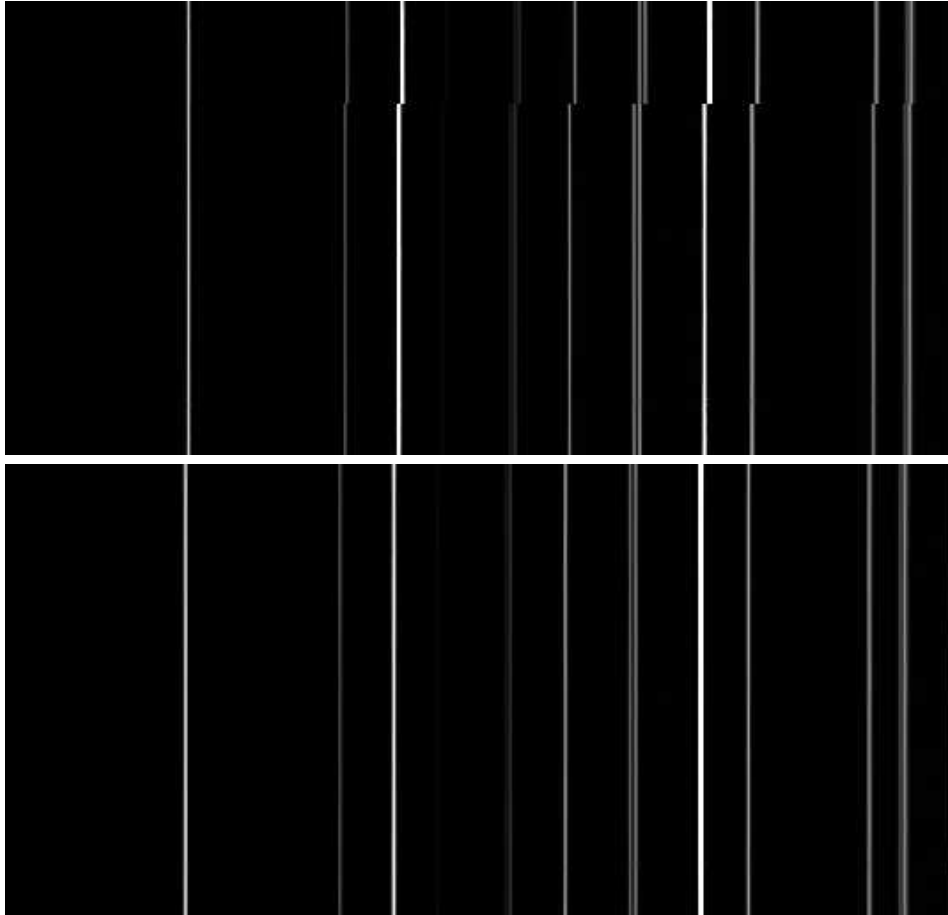


Figure 3: **Upper:** The Helium-Argon spectrum was calibrated using the not optimized wavelength calibration solution. One clearly sees that the lines are 'broken'. **Lower:** Calibration of the Helium-Argon spectrum using a optimized wavelength calibration solution.

## A Appendix

The following spectrophotometric standard stars (from Hamuy et al. 1992, PASP, 104, 533) will be recognized by Midas, and can be used to find the response function.

Star name	RA	Dec
HR9087	00 01 49.42	-03 01 39.0
LTT377	00 41 46.82	-33 39 08.2
LTT745	01 21 34.59	-41 39 23.0
LTT1020	01 54 49.68	-27 28 29.7
HR718	02 28 09.54	+08 27 36.2
EG21	03 10 30.98	-68 36 02.2
LTT1788	03 48 22.17	-39 08 33.6
HR1544	04 50 36.69	+08 54 00.7
LTT2415	05 56 24.30	-27 51 28.8
HILT600	06 45 13.33	+02 08 14.1
LTT3218	08 41 34.10	-32 57 00.1
HR3454	08 43 13.46	+03 23 55.1
LTT3864	10 32 13.90	-35 37 42.4
HR4468	11 36 40.91	-09 48 08.2
LTT4364	11 45 37.70	-64 50 25.1
Feige56	12 06 47.30	+11 40 13.0
LTT4816	12 38 50.94	-49 47 58.8
HR4963	13 09 56.96	-05 32 20.5
CD-32d9927	14 11 46.37	-33 03 14.3
HR5501	14 45 30.25	+00 43 02.7
LTT6248	15 39 00.02	-28 35 33.1
EG274	16 23 33.75	-39 13 47.5
LTT7379	18 36 26.29	-44 18 33.0
HR7596	19 54 44.80	+00 16 24.6
LTT7987	20 10 57.38	-30 13 01.2
HR7950	20 47 40.55	-09 29 44.7
HR8634	22 41 27.64	+10 49 53.2
LTT9239	22 52 40.88	-20 35 26.3
LTT9491	23 19 34.98	-17 05 29.8
Feige110	23 19 58.39	-05 09 55.8