QUBA – Pipeline – Pre-reduction.

PURPOSE: Pipeline to do pre-reductions steps for spectroscopy and photometry
DATE: 11th March 2009

PROGRAM NAMES:
qubareduorganize.py,
qubaprespec_v1.py,
qubaprephot_v1.py

-**qubareduorganize.py** - split data into spectroscopy and photometry directories (working for telescopes WHT,NOT,EKAR,TNG)

qubareduorganize.py @listimages -> qubaspectra/
qubaimages/

listimages = list of images (fits,fit,fts; one/multi-dimensional files)

-**qubaprespec_v1.py** - basic reduction procedures for spectroscopy

qubaprespec_v1.py @listfiles
options: -r reverse dispersion direction
-b no bias correction
-f no flat correction
-i interactively

(works for the Telescope setups
WHT/ISIS, TNG/Dolores, NOT/ALFOSC, Ekar/AFOSC, NTT+EFOSC?)

-**qubprephot_v1.py** - basic reduction procedures for photometry

qubaprephot_v1.py @listimages
options: -i interactive way (strongly suggested, give the possibility to check the flats,trim and overscan)
-b no bias correction
-f no flat correction
-F chose Flat (interactively)
-B chose Bias (interactively)

(works forTelescope setups.
WHT/AUX, TNG/Dolores, NOT/ALFOSC, Asiago/AFOSC)
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! WARNING !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
THIS IS A PIPELINE BUT SHOULD NOT TO BE USED ENTIRELY AS A BLACK BOX.

OFTEN TEST IMAGES ARE TAKEN DURING THE NIGHT AND SO YOU SHOULD ALWAYS CHECK THAT THE
CALIBRATION FILES THE PIPELINE USES ARE THE APPROPRIATE ONES. EVEN BETTER MOVE ANY
USELESS FILE INTO ANOTHER DIRECTORY

STEP by STEP

The following notes assume you are running the pipeline from QUB ARC computers.

Getting Started:

- You should source quba or set an alias in your .tcshrc file

source /home/sne/bin/qubastart_tcsh or export /home/sne/bin/qubastart_bash
eg. setting alias: alias quba source /home/sne/bin/qubastart_tcsh

You need to have only one nights observations in a directory in your scratch or home space.eg $USERPATH/data

ie. > cd $USERPATH/data/

Prior to running the main program, the following program should be used to separate
photometric and spectroscopic data.

- Create input list for qubareduorganize.py

> ls *.fits > lista
lista is the input file for qubareduorganize.py. It should contain only raw spectral frames. You should use iraf and imhead to check these files to remove and test images
that may have been taken during the night.
(also easy to use is eclipse dfits & fitsort)

QUBAREDUORGANIZE

- If quba sourced

>qubareduorganize @lista (or image1.fits,image2.fits,image3.fits…)

- OR if quba not sourced

> /home/sne/QUBA/site-packages/pipeline/bin/qubareduorganize.py lista

This separates the photometry and spectroscopy related files in to different folders. It also checks which files are good or not. If it doesn't recognise a file type it will display this in ds9 and ask you what type of file it is. You will get the options below:

BIAS [1] IMAGE [2] SPECTRUM [3] or NOT GOOD [4] ? [0] 4

mostly this occurs for images which are corrupt and best to use option 4.

- Do an 'ls' on your $USERPATH/data/ directory.

>ls $USERPATH/data/

Aside from the raw data files you should now have two directories qubaimages and qubaspectra. The reductions for each should be carried out in the appropriate directory. Bias frames are copied to both directories. This also removes any frames which cannot be opened by iraf eg. null frames.

on the screen:

ALsb210004.fits[1][200,2052][ushort]: HeNe
ok use first dimension of file ALsb210004.fits[1]
ALsb210005.fits[1][200,2052][ushort]: HeNe
ok use first dimension of file ALsb210005.fits[1]
...
TELESCOPE= NOT
3.0 Grism_4 200.0 2052.0
ALsb210004.fits[1] -> SPECTRUM
3.0 Grism_4 200.0 2052.0
ALsb210005.fits[1] -> SPECTRUM
....
ALsb210454.fits[1] -> qubaimages/qu_ALsb210454
ALsb210455.fits[1] -> qubaspectra/qu_ALsb210455
...

QUBAPRESPEC

> cd $USERPATH/data/qubaspectra

- Create input list for qubaprespec_v1.py

> ls *.fits > lista

lista is the input file for qubaprespec. It should contain only raw spectral frames.

- If quba sourced

> qubaprespec @lista

- OR if quba not sourced

> /home/sne/QUBA/site-packages/pipeline/bin/qubaprespec_v1.py lista

A log file is open and written to qubaccdreduc.log

STEP0: Check dimension
The program list all the file and check if the dimensions are different.
If files have different dimensions it will ask to go on or stop.
Sometimes NOT and WHT objects are trimmed, while bias not.

The pipeline should be able to go on also with different dimensions but please take a look the list of files before go on and eventually cancel from the list files you don't need.

On the screen:
qu_ALsb210467.fits[2198,2052][ushort]: 1510-089
qu_ALsb210468.fits[2198,2052][ushort]: 1510-089
Warning: images with different dimensions !!!
Do you want to go on [y/n] ? [y]

STEP1: Preparing lists

The program first checks all files are creates lists of flats, bias, arcs, science frames. The program also check if the images are all of te same size. If the spectra are trimmed, the program try to repeat the operation on the bias,flat,arc (if those are not trimmed).
In the early stages you should check that these are appropriate as they are organised using Keywords and these can be tempermental. These should produce files such as
arclist_[TELESCOPE]
flatlist_[TELESCOPE]
biaslist_[TELESCOPE]
objlist_[TELESCOPE]

on the screen:
STEP 1: Creating lists of flats, bias, arcs, science frames.....
TELESCOPE= WHT

If files have different dimension will check that there are bias,flat and arc with same dimensions than objects

on the screen:
check dimension arc, flat, bias .....
#######
dimension and window for objects = ['536,2350', '1071,4700', '611,2100', '1221,4200'] ['[500:1570,1:4700]', '[500:1570,1:4700]', '[460:1680,1:4200]', '[460:1680,1:4200]']
dimensnion bias = ['536,2350', '611,2100']
dimension flat = ['536,2350', '1071,4700', '611,2100', '1221,4200']
dimension arc = ['536,2350', '611,2100']
######
536,2350
######
arc with objects dimension .536,2350... ok
flat with objects dimension .... ok
bias with objects dimension .... ok
######
1221,4200
######
No bias with objects dimension 1221,4200 …
Try to cut bias ….
Do you want to try to cut [xx:yy,xx:yy] bias with dimension 2048,2048 [y] ?

STEP2: Preparing lists contd.

The flat and arc frames will then be split in to lists depending on the grism and slitwidths you should now have files such as
flatlist_[grism]
arclist_[grism]_[slitw]

The bias and flat field files are then split into files depending on time, as multiple groups of flats and biases can be taken during the night. Usually at the beginning and end. These are numbered 1 to x and you get something like:
biaslist_[TELESCOPE]_1
biaslist_[TELESCOPE]_2
flatlist_[grism]_1
flatlist_[grism]_2

This accounts for nodichroic and dichroic for the WHT and is recorded in the naming of the files.

On the screen:
STEP 2: Completed.
################Splitting bias files############################
First file: biaslist_20090222_NOT_1
################Split bias files############################
################Splitting flat files############################
flatlist_20090222_NOT
flatlist_Grism_4
First file: flatlist_Grism_4_1
Creating new file: flatlist_Grism_4_2
Creating new file: flatlist_Grism_4_3
################Split flat files############################

STEP3:Creating Masterbias

All bias files are used to create masterbiases. If the stddev is too large a file will be omitted. The biases are combined using the median. If there are less than 3 biases in the file you will be asked if you want to create a bias. This is up to you, generally these are test biases and not worth it. Default answer is n.

LESS THAN 3 BIASES DO YOU STILL WANT TO CONTINUE? [y/n]

On the screen:
STEP 3: Creating Masterbias.....
biaslist_20090222_NOT_1
2198,2052 20090222 #######
***********Creating masterbias***********
qu_ALsb210465.fits 366.3357 9.723936
qu_ALsb210466.fits 365.5299 13.60359
qu_ALsb210467.fits 365.0984 12.33536
qu_ALsb210468.fits 364.877 10.85242
removed qu_ALsb210456.fits
File stddev
masterbias_20090222_NOT_1.fits 367.745 7.983512

********** *masterbias created* **********

STEP4: Timming, debiasing, flatfielding

Once completed the object file will be read and for each object the code checks for wether or not there is a bias, arc and flat available in the directory with the same set up. You can have different outcomes:

STATUS=0) If there is an appropriate bias,arc and flat are available in the directory it will
carryout the reductions with theses

STATUS=1) if bias ,arc or flat are not available in the working directory but are available in the archive

STATUS=-1) If there is a bias and flat field in the directory but no arc with the same slit
it will say that there is an arc but with different slit and will display them for you to check if you want to use one.

Bias, Flat available in this directory !!
Warning: arc not available with the same slit
checking if arc available with a different slit.....
['LR-B']
arclist_LR-R_1.5_arcsec
arclist_20071216_TNG
arclist_VHR-V_1.5_arcsec
Do you want to use an arc from one of these lists [y/n]? [y]

if you answer n then it will check the archive if no appropriate arc is available it will not reduce the object but will create a file with [objname]_[grism]_[slitw]_x.fits. x being the number of the exposures for the object.

IF STATUS=0 it will select and trim the masterbias and create a masterflat.
It selects the closest in time masterbias frame to the observation.
It will tell you the default trim parameters and ask you if you want to change them.
trim = [70:2090,50:1200]
overscan = [1:2100,2060:2100]

Do you want to select different trim and overscan [y,n] ? [n]

If you enter 'y' it will display the frame and you can use iraf/imexam to check out the parameters you want. After using 'q' to exit imexam mode you will be asked to input new values. this must be done with the iraf format shown above.

If you enter 'n' it will trim everything with these values.
It first trims the masterbias and creates the file 't'+masterbias

Next it will search for the nearest in time file of flats. It will then combine these and create a masterflat unless one already exists with the same setup in the directory.

If the object has the same setup as the previous object it will just use the flat from that setup

if the next object has a different setup it will appear a ### 'NEW SETUP' and the trimming and overscan will be resetted as default.

After trimming and debiassing the flat it will ask you wether or not you wish to normalise the flat. For spectroscopy it is unwise not to.

DO YOU WISH TO NORMALISE THE MASTERFLAT (only say yes for spectra)[y/n] [y]

This brings you into iraf/response interactive mode. To change the order of the fit enter ':o xx' where xx is the order number. enter 'f' to fit the polynomial.
'q' to exit.

It will then trim, debias, and flatfield the object and nearest in time arc to the object with the trimmed masterbias and flatfield. If more arc are available the program asks which one to use (with also the possibility to use more than one arc)

The output is then the:
[objname]_[grism]_[slitw]_x.fits.
x being the number of the exposures for the object.
arc_[objname]_[grism]_[slitw]_x.fits

After each object you have the option to exit or not.

Do you want to pre-reduce next object [y/n] ? [y]
if 'y' then it will continue to reduce the next object.
if 'n' it will ask wether or not you wish to exit the program.
Do you want to terminate the reduction process [y/n] ? [y]

If you manage to exit cleanly you should obtain the following message:
END OF CCD REDUCTION

On the screen:
WAIT ....checking bias,flat,arc for each object

it can take couple of minutes
#################### SN2000ch SETUP: ['Grism_4', 'Slit_1.3']
Bias, Flat and Arc available in this directory !!
reduction possible without using archive data !!
Search for the bias or for the bias list
Search for the flat or for the flat list
Search for the arclist
…
###
OBJECT = qu_ALsb210441.fits
OBJECT NAME = BD332642
SETUP = ['Grism_4', 'Slit_1.3']
STATUS = 0
BIAS = masterbias_20090222_NOT_2.fits
NEW SETUP
Overscan (default)
trim = [10:190,1:2052]
overscan =
Do you want to select different trim and overscan [y,n] ? [n]
trim = [10:190,1:2052]
overscan =
masterbias_20090222_NOT_2.fits -> tmasterbias_20090222_NOT_2.fits
tmasterbias_20090222_NOT_2.fits: Mar 12 10:49 Trim data section is [10:190,1:2052]
Same configuration as previous object
USE SAME FLAT
TRIM OBJECT FILE: BD332642_Grism_4_Slit_1.3 qu_ALsb210441.fits
more than one lamp available
chose which one you want to use for the spectrum:
BD332642_Grism_4_Slit_1.3
lamps available
qu_ALsb210004.fits NeHe
qu_ALsb210005.fits NeHe
qu_ALsb210006.fits NeHe
closest one: qu_ALsb210006.fits NeHe
if you want to sum 2 arc report both separated by ","
which lamp do you want to use [qu_ALsb210006.fits] ?
qu_ALsb210441.fits -> BD332642_Grism_4_Slit_1.3_1.fits
BD332642_Grism_4_Slit_1.3_1.fits: Mar 12 10:49 Trim data section is [10:190,1:2052]
BD332642_Grism_4_Slit_1.3_1.fits: Mar 12 10:49 Zero level correction image is tmasterbias_20090222_NOT_2.fits
BD332642_Grism_4_Slit_1.3_1.fits: Mar 12 10:49 Flat field image is ntmasterflat_20090222_NOT_Grism_4_2.fits with scale=1.000075
#################### ARC FILE USED:qu_ALsb210006.fits
qu_ALsb210006.fits: Mar 12 10:49 Trim data section is [10:190,1:2052]
qu_ALsb210006.fits: Mar 12 10:49 Zero level correction image is tmasterbias_20090222_NOT_2.fits
qu_ALsb210006.fits: Mar 12 10:49 Flat field image is ntmasterflat_20090222_NOT_Grism_4_2.fits with scale=1.000075
OUTPUT -> BD332642_Grism_4_Slit_1.3_1.fits
###
next object = qu_ALsb210332.fits
Do you want to pre-reduce next object [y/n] ? [y]

QUBAPREPHOT

> cd $USERPATH/data/qubaimages

- Create input list for qubprephot_v1.py

> ls *.fits > lista

lista is the input file for qubaprephot. It should contain only raw imaging frames.

- If quba sourced

>qubaprephot @lista

- OR if quba not sourced

> /home/sne/QUBA/site-packages/pipeline/bin/qubaprephot_v1.py lista

A log file is open and written to qubaprephot.log

STEP1: Preparing lists
The program first checks all files are creates lists of flats, bias, and science frames. In the early stages you should check that these are appropriate as they are organised using Keywords and these can be tempermental. These should produce files such as
flatlist_[DATE]_[TELESCOPE]
biaslist_[DATE]_[TELESCOPE]
objlist_[DATE]_[TELESCOPE]

on the screen:
qu_ALra110167.fits[2198,2052][ushort]: skyflat
qu_ALra110168.fits[2198,2052][ushort]: skyflat
qu_ALra110169.fits[2198,2052][ushort]: skyflat
qu_ALra110170.fits[2198,2052][ushort]: skyflat
STEP 1: Creating lists of flats, bias, science frames.....
TELESCOPE= NOT

STEP2: Preparing lists contd.
The flat frames will then be split in to lists depending on the filter. You should now have files such as
flatlist_[filter]

The bias and flat field files are then split into files depending on time, as multiple groups of flats and biases can be taken during the night. Usually at the beginning and end. These are numbered 1 to x and you get something like:
biaslist_[DATE]_[TELESCOPE]_1
biaslist_[DATE]_[TELESCOPE]_2
flatlist_[filter]_1
flatlist_[filter]_2
on the screen:
STEP 2: Create list for each object setup based on filter.
########## Setting up lists for objlist_20080112_NOT##################
STEP 2: Completed.
################Splitting bias files############################
First file: biaslist_20080111_NOT_1
Creating new file: biaslist_20080111_NOT_2
################Split bias files############################
################Splitting flat files############################
Flatfile to split: flatlist_20080111_NOT
Flatfile to split: flatlist_B
First file: flatlist_B_1
Flatfile to split: flatlist_I
First file: flatlist_I_1
Creating new file: flatlist_I_2
Creating new file: flatlist_I_3
################Split flat files############################

STEP3:Creating Masterbias

All bias files are used to create masterbiases. If the stddev is too large a file will be omitted. The biases are combined using the median. If there are less than 3 biases in the file you will be asked if you want to create a bias. This is up to you, generally these are test biases and not worth it. Default answer is n.

LESS THAN 3 BIASES DO YOU STILL WANT TO CONTINUE? [y/n]

On the screen

STEP 3: Creating Masterbias.....
biaslist_20080111_NOT_2
***********Creating masterbias***********
qu_ALra110002.fits 357.3237 9.878704
qu_ALra110003.fits 362.1845 8.891912
qu_ALra110004.fits 365.6215 9.821987
qu_ALra110005.fits 368.6716 13.5901
qu_ALra110006.fits 370.6486 9.224317
removed qu_ALra110005.fits
File stddev
masterbias_20080111_NOT_1.fits 363.9546 8.219254
*********** masterbias created ***********
biaslist_20080111_NOT_1

STEP4: Timming, debiasing, flatfielding

Once completed the object file will be read and for each object the code checks for wether or not there is a bias, and flat available in the directory with the same set up. You can have different outcomes:

STATUS=0) If there is an appropriate bias and flat available in the directory it will carryout the reductions with these

STATUS=-1)If there no bias and flat field in the directory it will check the archive if no appropriate files are available it will not reduce the object but will create a file with [objname]_[filter]_x.fits. x being the number of the exposures for the object.

IF STATUS=0 it will select and trim the masterbias and create a masterflat.
It selects the closest in time masterbias frame to the observation.
It will tell you the default trim parameters and ask you if you want to change them.

trim = [70:2090,50:1200]
overscan = [1:2100,2060:2100]

Do you want to select different trim and overscan [y,n] ? [n]

If you enter 'y' it will display the frame and you can use iraf/imexam to check out the parameters you want. After using 'q' to exit imexam mode you will be asked to input new values. this must be done with the iraf format shown above.

If you enter 'n' it will trim everything with these values.
It first trims the masterbias and creates the file 't'+masterbias

Next it will search for the nearest in time file of flats. It will then combine these and create a masterflat unless one already exists with the same setup in the directory.
On the screen:

```
############################################################
#### OBJECT      =  qu_ALra110090.fits
#### OBJECT NAME =  SN2007uy_08D/V
#### SETUP       =  ['V']
#### STATUS      =    0
#### BIAS        =  masterbias_20080111_NOT_1.fits
#### trim        =  [55:2100,1:2037]
#### overscan    =  [3:50,1:2037]
masterbias_20080111_NOT_1.fits -> tmasterbias_20080111_NOT_1.fits
tmasterbias_20080111_NOT_1.fits: Mar 12 12:31 Trim data section is [55:2100,1:2037]
tmasterbias_20080111_NOT_1.fits: Mar 12 12:31 Overscan section is [3:50,1:2037] with mean=364.2956
### Same configuration as previous object
### USE SAME FLAT
### TRIM OBJECT FILE: SN2007uy_08D_20080112_V qu_ALra110090.fits
qu_ALra110090.fits -> SN2007uy_08D_20080112_V_3.fits
SN2007uy_08D_20080112_V_3.fits: Mar 12 12:31 Trim data section is [55:2100,1:2037]
SN2007uy_08D_20080112_V_3.fits: Mar 12 12:31 Overscan section is [3:50,1:2037] with mean=364.8301
SN2007uy_08D_20080112_V_3.fits: Mar 12 12:31 Zero level correction image is tmasterbias_20080111_NOT_1.fits
SN2007uy_08D_20080112_V_3.fits: Mar 12 12:31 Flat field image is tmasterflat_20080112_NOT_V_1.fits with
scale=17403.54
#### OUTPUT ->  SN2007uy_08D_20080112_V_3.fits
############################################
```

If option –i is selected it will show all the flat asking to accept or not the file.
If more set of flat are available will also print the first file of each set and ask which one to use (or all)
on the screen:

```
flat list: flatlist_V_1
z1=13829.36 z2=20300.
Is it this flat ok ? [y/n] [y] ?
z1=13013.91 z2=19221.
Is it this flat ok ? [y/n] [y] ?
z1=13136.68 z2=19446.
Is it this flat ok ? [y/n] [y] ?
#### masterflat  masterflat_20080112_NOT_V_1.fits
--------
################################
more than one set of flat available .... interactive chosen !!!
################################
### First flat of list flatlist_I_1 ####
###    skyflat  ###
z1=10635.07 z2=16124.
################################
more than one set of flat available .... interactive chosen !!!
################################
### First flat of list flatlist_I_2 ####
###    skyflat  ###
z1=429.4302 z2=654.7954
################################
more than one set of flat available .... interactive chosen !!!
################################
### First flat of list flatlist_I_3 ####
###    skyflat  ###
z1=9087.821 z2=13840.
flatlist_I (select this one to use all images)
```

flatlist_I_1
flatlist_I_2
flatlist_I_3
Which list do you want to use [flatlist_I_2]? flatlist_I_2
COMBINE FLAT FILES (without trim and bias)

If the object has the same setup as the previous object it will just use the flat from that setup

After trimming and debiassing the flat it will ask you wether or not you wish to normalise the flat. For spectroscopy it is unwise not to.

DO YOU WISH TO NORMALISE THE MASTERFLAT (only say yes for spectra)[y/n] [y]

This brings you into iraf/response interactive mode. To change the order of the fit enter ':o xx' where xx is the order number. enter 'f' to fit the polynomial. 'q' to exit.

It will then trim, debias, and flatfield the object with the trimmed masterbias and flatfield.

The output is then the [objname]_[filter]_x.fits. x being the number of the exposures for the object.

After each object you have the option to exit or not.

Do you want to pre-reduce next object [y/n] ? [y]
if 'y' then it will continue to reduce the next object.
if 'n' it will ask wether or not you wish to exit the program.
Do you want to terminate the reduction process [y/n] ? [y]

If you manage to exit cleanly you should obtain the following message:
END OF CCD REDUCTION

<u>TO DO:</u>

- Check gain and readnoise in headers are what you get from ratios of flats
- Spectral extractions optimum/average
- Additional options for reductions in qubaccdreduc and qubaprephot
qubaprephot:
- if only bias or only flat do reductions with these.
qubaccdreduc:
- if no arc use bias and flat.
- if no arc and flat use bias
- if no arc and bias use flat

- if no bias and flat use arc

- Note some problems with dome and skyflats. Need to be able to distinguish or choose which to use.

- tidy up on directories

- Dealing with different sized frames eg. asiago test directory.

A number of don'ts for observing:

This pipeline relies heavily on Keyword parameters. Below are a list of things to check for
while observing.

-The OBJECT keyword in a fits header generally contains the name you enter with the exposure
command at a telescope. This contain simply the object name and possibly filter,but should
NOT contain ' ', '.','/','\' or any other symbols which unix may have problem with for file

names. For example: objectname_filter or objectname-filter are acceptable

-The headers should contain as much info as possible in particular:
- Grism
- Central wavelength
- slit width
- Filter, if imaging
- Object name
- image type i.e arc,object,flat,bias,sky
- Exp time
- readnoise
- gain
- RA, DEC
- Julian Date
- Instrument
- Telescope

- test images should be removed or put in seperate directory if possible

Spectral reductions:

> cd $USERPATH/data/qubaspectra/

- Create input list for qubaspectraredu.py

  qubaccdreduc_v3.py created pre-reduced images with objects name e.g.:
  HZ44_LR-B_1.0_arcsec_1.fits
  HZ44_LR-R_1.0_arcsec_1.fits

HZ44_VHR-R_1.0_arcsec_1.fits
HZ44_VHR-V_1.0_arcsec_1.fits
SN2008aw_LR-B_1.0_arcsec_1.fits
SN2008aw_LR-R_1.0_arcsec_1.fits
SN2008ax_LR-B_1.0_arcsec_1.fits
SN2008ax_LR-R_1.0_arcsec_1.fits

The reducer should be able to disentangle the standard files and the SN files:

ls HZ*.fits > listastd (list of standard's files)
ls SN*.fits > listasn (list of supernova's files)

- Run qubaspectraredu.py first on the standard's files, then on the SNe files:

If quba sourced
> qubaspectraredu.py @listastd -i

OR if quba not sourced
> /home/sne/QUBA/site-packages/pipeline/bin/qubaspectraredu.py listastd –I

the option '–i' is to reduce the spectra in an interactive way (better to use it)

the program summarize the reduction status of each file: extraction, wavelength calibration, flux calibration, atmospheric features correction

```
##############################################################################
OBJECT        EXTRACTION      WAV_CAL  FLUX_CALIB      ATMOSPHERIC_FEATURES
HZ44_LR-B_1.0_arcsec_1.fits          none          none          none          none
HZ44_LR-R_1.0_arcsec_1.fits          none          none          none          none
HZ44_VHR-R_1.0_arcsec_1.fits          none          none          none          none
HZ44_VHR-V_1.0_arcsec_1.fits          none          none          none          none
##############################################################################
```

The program search first in the same directory, than in the archive, a sensible curve and an arc with the same setup of each file And summarize the sensible curve and the arc available for each object.

```
#########################################################################
OBJECT                        SENSITIVITY CURVE AVAILABLE          ARC AVAILABLE
HZ44_LR-B_1.0_arcsec_1.fits     Available in the archive           arc_HZ44_LR-B_1.0_arcsec_1.fits
HZ44_LR-R_1.0_arcsec_1.fits     Available in the archive           arc_HZ44_LR-R_1.0_arcsec_1.fits
HZ44_VHR-R_1.0_arcsec_1.fits    WARNING sens not found     arc_HZ44_VHR-R_1.0_arcsec_1.fits
HZ44_VHR-V_1.0_arcsec_1.fits    WARNING sens not found     arc_HZ44_VHR-V_1.0_arcsec_1.fits
#########################################################################
```

Starting from the first file of the list, the program asks if the object is a standard or not:

##

HZ44_LR-B_1.0_arcsec_1.fits

##

Is this object a standard [y/n] ? [y]

If the answer is ‘y’ the program will EXSTRACT the spectrum, wavelength CALIBRATE the spectrum, PRODUCE the SENSITIVITY curve , otherwise (if the object is not a standard) and the answer is ‘n’, The program will EXSTRACT, wavelength CALIBRATE, FLUX CALIBRATE and CORRECT for atmospheric features.

-EXTRATTION:
The extraction is performed using apall (optimizing the exstraction along the profile, subtracting the background and fitting the trace along the dispersion axis). If the option ‘–i’ is used all the parameters can be changed manually during the extraction.

- CALIBRATION 1:
the calibration is performed using the task reident and one arc file (with the same configuration) taken from archive (if more arc with the same configuration are available in the archive the closest in time is chosen)
##
WARNING: THE REDUCER HAS TO PRESS ‘f’ and ‘q’ to write the identification file in the database
##

if there are not arc file in the archive with the same configuration the program will use the task identify and the reducer has to identify all the lines manually.

-CALIBRATION CHECK:
 after the spectrum is wavelength calibrated, the program check the wavelength calibration:
        -if the object is a standard the calibration check is done using the atmospheric features. In particular, the program cut the atmospheric features from the standard spectrum and maximize the convolution with an archive file of amospheric features shifting back and forward the spectrum.

Warning: the wavelength calibration check is not performed for the blue arm of WHT since the spectrum does not extend enough in the red part (where the atmospheric features are prominent)

        -if the object is NOT a standard the check is performed using the skylines present in the 3th dimension of the object file. In this case the program maximize the convolution of the sky lines of the object with one file from the archive.

The shift in wavelength found by the check is applied only if request:

check wavelenght calibration

7817.58550844
SHIFT SPECTRUM OF 2
do you want to shift the spectrum [y/n] [y]?

- PRODUCE THE SENSITIVITY CURVE: