ALFOSC Multi Object Spectroscopy
Staff User Manual

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April 6, 2005

Contents

1 List of changes

- 14/5 2002: Added description of how to make the mask image.
- 14/5 2002: Added description of fiducial holes in .ap files.
- 14/5 2002: Added note on relaxed autoguiding after alignment.
- 20/1 2003: Changed paths in the aquisition description for new florence.
- 28/5 2003: Added posibility of loading images directly from source directory.
- 29/10 2003: Added note on the fact that the .ap filed need to have 8 header lines.
- 6/4 2005: Changed the image path in the description.

2 Introduction

This manual describes all steps involved in making MOS plates for ALFOSC. Sections 1-4 gives the necessary instructions for observers while sections 5-8 gives operational procedures for staff. In addition to this manual, the NOT web-page gives information on how and where to run the related software.
To make a MOS plate, a `template image` of the field, obtained with ALFOSC, is required, because ALFOSC has some field distortion. When the template image is acquired, the observer or a staff member must produce a plate layout, which is written to a CNC file, using the `mosplate` program. After this has been completed, the MOS machine operator (a staff member) produces the MOS plate after having initialised the MOS machine. The manufacturing of a MOS plate can usually be completed within a couple of hours, but will have to be done during day time.

3 The template image:

The template exposure is used for defining the size and the positions of the slits. The template exposure should be obtained with ALFOSC through a broad band filter, approximately centered on the wavelength region corresponding to the grism which is going to be used for the MOS exposure. As a rule of thumb the exposure time should be of the order of 1-5% of the exposure time required to obtain the spectra, unless emission lines are studied. To avoid large slit losses due to differential atmospheric refraction it is desirable to obtain the template image at the parallactic angle. This requires careful planning of the MOS observations.
To optimise the use of observing time, the template images should, if at all possible, be obtained prior to the run. As the observing time required for doing this is limited, they may either be taken during a previous MOS observers observing run or by staff during technical/staff time. The `mosplate` program allows for (X,Y) pixel coordinate input from a file. For very faint objects or emission line objects, it is therefore possible to use a short template exposure to transform (Ra,Dec) or other coordinates to ALFOSC CCD coordinates. It is the task of the observer to provide this transformation, once the template image has been acquired.

4 Making the instruction file for the MOS milling machine

The program `mosplate` is used to define the layout of the MOS plate. It is running under IDL. Because the NOT wants to retain a full record of all MOS plates manufactured, it can only be run at the telescope. In addition to displaying the loaded template image, it can also calculate and display the layout of the spectra on the CCD, given the specified aperture layout. New apertures may either be added individually with the cursor or read from a simple ASCII file.
The `mosplate` program is fully controlled via a graphical user interface and is largely self explanatory. The user interface allows the user to control and adjust all relevant parameters for each slit. A few things are worth mentioning here. The program can be in two states, one state where no aperture is selected and another where an aperture is selected. When no aperture is selected, a click with the mouse in the un-zoomed image creates a new aperture. The positioning of the new aperture can be selected by the user to be either `centroid` of nearest point source or `cursor`. However, if there is an existing aperture within $5''$of the cursor position and the positioning mode is `centroid`, this aperture will be (re)selected rather than defining a new aperture. This allows the user to modify apertures previously defined. When a new aperture is defined, the state changes to `aperture selected mode`. In this mode, the complete definition of the selected aperture is displayed in the text area near the upper right corner of the `mosplate` window. The user may

now move, resize or delete this aperture. To return to the `no aperture selected` mode, press the cursor in the un-zoomed image, or if desired, delete the selected aperture.

```
# Template input file for mosplate
#
# The file must comply with the following rules:
#
# The first up to 100 lines may be a header with comments.
# Each comment line must contain at least one '#' character.
# All lines preceding the header defines the center of a slit (no empty lines!).
# Each slit definition line must give the number, X and Y center of a slit.
# Number, X and Y goes in first three white space separated columns.
# Only digits, decimal comma and white spaces are accepted.
# Additional data colums with (numerical) user relevant information are allowed.
#
# It is desirable but not required that users document the input file
# with a header, giving the date of writing, target, template image,
# content of columns etc.
#
# FIELD: M13
# WRITTEN: 99.07.08
# AUTHOR: Michael I. Andersen
# TEMPLATE: if230115
#
# ID      XCEN      YCEN     MAG
   1       90.52    848.96   15.83
   2      164.28    872.68   16.11
   3      494.23    783.02   18.91
   4      538.42    961.27   17.44
   5      625.91   1018.23   13.47
   6      931.18    913.91   19.02
   7      960.01    945.87   17.82
   8     1031.62    937.19   17.10
   9     1490.46    636.65   18.01
  10     1953.57   1024.74   15.33
  11     1906.53   1079.42   16.01
  12      228.98    868.92   16.90
  13      996.74    810.48   17.48
  14     1632.23    878.82   17.40
  15     2027.20    741.66   18.12
  16     1794.68    731.65   18.01
```

A sample ASCII coordinate input file for the `mosplate` program.

If a template image has been obtained well in advance of the observing run, the observer should before traveling to the NOT prepare an ASCII input file. The NOT staff does then have the possibility to manufacture the MOS plate before the observer arrives at the telescope, thereby saving travel days for the observer.
To get the plate aligned with the targets on the sky, at least three relatively bright acquisition stars should be selected. Make square apertures for these stars, $4''$ wide.

The template image must be in FITS format and have the extension '.fits'. ASCII input files must have the extension '.coo'. Below is given information on how to run `mosplate` and where to put the template images and input files. This information is also available on the NOT web pages.

4.1 How to start the `mosplate` program

- Log on to 'sandra' as user 'mos' with the password provided by the staff.
- type `bin/mosplate` to start the program.

4.2 Where to place template images for use in `mosplate`

Template images to be used for layout of MOS plates using the `mosplate` program must be copied to `sandra: mos/templates` and have extension `.fits` as stated above.

4.3 Where to place ASCII input coordinate files

The ASCII coordinate input files must be placed in `sandra:~mos/input_coords` and must have extension `.coo` as stated above.

4.4 The products of the `mosplate` program

When the layout of all the slits on the mosplate is done, the NC instruction file has to be produced. This is done by pressing the button labled *Write NC file* in the `mosplate` program. Pressing this button will produce the following products (files)

- The NC instruction file.
  The file will be in the directory `~mos/mosplate/nc`.
- An ASCII file listing the slits and their properties.
  The file will be in the directory `~mos/mosplate/ap`.
- A Postscript file containing a graphical representation of the layout of the MOS plate.
  The file will be in the directory `~mos/mosplate/ps`.

5 Target acquisition

The target aquisition is done using two IRAF tasks. The first task uses two images as input - one of the MOS mask illuminated by a calibration lamp and one of the astronomical object field. The image of the MOS mask should be made with the halogen calibration lamp, the calibration lens and a B filter. A one second exposure is sufficient.
The aperture files (.ap) *has* to contain the dimentions 4.0 as WIDTH and LENGTH. This is the only way for the task to identify a fiducial hole. And example of a correct ".ap" file:

```
Aperture    XCEN      YCEN     WIDTH    LENGTH
   #        [pix]     [pix]    [ " ]     [ " ]
   1       100.97    886.25     4.0       4.0
   2       570.46   1880.12     4.0       4.0
   3      1867.09   1811.33     4.0       4.0
   4       961.70    354.91     4.0       4.0
   5       292.55   1211.12     2.0      10.0
   6       786.51   1343.49     2.0      10.0
```

An example of a wrong ".ap" file:

Aperture	XCEN	YCEN	WIDTH	LENGTH
#	[pix]	[pix]	["]	["]
1	162.52	715.39	3.0	0.1
2	332.91	1270.09	3.0	0.1
3	1928.18	1701.38	3.0	0.1
4	893.50	488.20	3.0	0.1
5	1490.34	855.28	1.8	12.0
6	1363.45	740.50	1.8	12.0

Edit the ".ap" file be hand to comply to this restriction.

The ".ap" files also needs to have 8 header lines. They will have this by default when produced by the `mosplate` program.

The task then calculates the amount to offset and rotate the telescope in order to make the MOS mask coincide with the objects in the field. These two images and the aperture file must exist in the directory `florence:/var/guest/mosimages` in order to be found by the IRAF tasks described below (it has been tested that images also can be loaded directly from the mounted directory, which is `/data/alfosc`. If you do this there is no need to copy the images).
The second IRAF task moves the telescope based on the results found by the first IRAF task.
As with all IRAF tasks, the parameters can be given in different ways. They can all be written on the IRAF command line after the command. The command can be typed and the parameters can be given when IRAF prompts for them. Finally, the parameters can be edited using the `epar` IRAF command. This manual assumes a basic knowledge of IRAF.
The following is a complete description on how to do the target aquisition.

- Log in on the computer *florence* as user *guest*.
- Type '`cd iraf`'.
- Type '`ds9 &`' to start your favorite image display program.
- Type '`xgterm &`' to start a graphics capable xterm.
- In the *xgterm* type '`cl`' in order to start IRAF.
- Type '`cd ../mosimages`'.
- Make sure that the aperture definition file for the MOS mask in use is in this directory (`/var/guest/mosimages`). The name will be MOS00??.nc.ap, where ?? is a sequence number.
- Type `alfosc` to load the IRAF alfosc package.
- Type

  ```
  mostweak <mask-image> <objectfield-image> <aperturefile> 4.0
  ```

  ,where `<aperturefile>` is the file `MOS0020.nc.ap` if MOS mask 20 is in use. Please see the IRAF manual page of the `mostweak` task for a complete description.
- The mask image will be displayed and the slits marked with green circles.

- Position the cursor over the slit that is marked with a yellow circle. Press 'a'. When the statistics appear in the xgterm window press 'q' to move on to the next slit that will be marked with a yellow circle. Be aware that the circle and the slit in question will not always coincide completely, but it should be obvious which slit it is. The position found by the program will be marked by a small red circle.
- When all usefull slits are marked, the image of the object field is displayed and the first alignment star will be marked with a yellow circle. Position the cursor on that star and press 'a'. Press 'q' after the statistics appear in order to move on to the next usefull star. The position of the star found by the program will be marked with a small red circle. Also in this case the circles will not coincide complely with the stars so take care when identifying them.
- After the last star has been marked, the program displays the amount to offset the telescope in the pixel X and Y direction and how much to rotate the field.
- Apply these changes using the IRAF task `mosmove` in the following way. Type

  ```
  mosmove
  ```

  and the task will prompt you for the current TCS access code. The value of the access code has the default value from the last time the task was run, so if the access code has not changed you can just press enter. Please see the IRAF manual page of the `mosmove` task for a complete description.
- Turn on autoguiding as fast as possible using relaxed autoguiding (TCS command: ag-re-on).
- Make an image of the field through the MOS mask and check the alignment of the slits and corresponding objects.

This procedure will probably have to be iterated two times for the objects to be correctly aligned with the mask.

6 Manufacturing the MOS plate

The manufacture of the MOS plate requires a trained person and is therefore the responsibility of the staff. Users may therefore skip the remainder of the manual. The manufacture is done with a mini CNC milling machine, placed in the mechanical workshop. Starting up the MOS machine is done in the following steps;

1) Lubricate the machine by raising the plunger at the rear of the machine

2) Turn on the laptop used to control the milling machine. The laptop will present a startup menu. Choose 'MOS startup'. This will start the `servo` program, which controls the machine. (comment: It would be nice to use the DOS startup menu for the various applications this machine has, e.g. RGA, MOS, normal, ...)

3) When `servo` is running, you can turn on the milling machine. Pull the red switch on the right side of the control box up - the switch will then show "on".

4) Go to the pendant (the handset in front of the milling machine). Then wait until green status light at the [X],[Y],[Z] buttons are lit, and the yellow status light at the [SET] button is blinking. The turn knob should be around 100%. Then press the [SET] button, and the carriages will move to `home position`. Wait until the carriages have stopped moving.

5) The status light at the X button should now be lit - and not blinking. If it is blinking, read the section on known bugs. In the `servo` program, select the program `mos_init.nc`, using [F5]. Press [F8] to get into the CNC menu. Run the program, using [F8]. The machine now moves to it's reference position, from where it initialises the Z-axis on a Hall switch. When the Hall switch is reached, all axises are `zeroed`.

6) It is now time to load two plates into the plate holder. You find the plates in the plastic drawers. The lower plate (the cutting substrate) must be taken from one of the drawers in the mini-cabinet which are labeled with a thickness. For one initialisation of the machine, the same cutting substrate thickness must be used, in order to control the slit width. Make sure that the plate holder and plates are clean before loading the plates. Press the plates inwards, while you tighten the plate holder by pushing the black knob firmly inwards with the other hand.

7) Turn on the water cooling by releasing the red emergency stop button.

8) Select the program `mos_zero.nc`, using [ESC] to main menu, followed by [F5]. Press [F8] to get into the CNC menu again. Run the program, using [F8]. This will produce up to 10 slits of varying width, near the center of the plate. The tool should penetrate the widest 5-8 slits. If not, you may have to manually adjust the Z-axis zero point (see section 6.). Take the plates out of the holder. If they stick together, the tool has been melting the plastic, indicating that there are problems with the tool. Normally this would imply change of the tool. You may discard the cutting substrate, but by turning it upside down, you may actually use it once more.

9) Clean the upper plate with compressed air. Use a knife at the upwards edges to get rid of residuals from the milling. Inspect the slit plate under a magnifying glass to verify that the plate has been cleaned.

10) Mount it in the ALFOSC aperture wheel. Take an image using the BIAS script `mos_zero.run`. Use the program `mos_zero` to determine the correction to the Z-zeropoint of the milling machine. Go to the milling machine and set the Z-zeropoint. The `mos_zero` program will explain how to set the Z-zeropoint. For reference purposes the command is `G92 Z`.

You are now ready to cut MOS plates.

1) Load two black plastic plates into the plate holder. Press the plates inwards, while you tighten the plate holder by pushing the black knob firmly inwards with the other hand. Remember that the cutting substrate must be of same thickness as used during initialiation. Make sure that the plate holder and plates are clean before loading the plates.

2) Select the program for the MOS plate you want to cut, using [F5]. Press [F8] to get into the CNC menu. Run the program, using [F8]. Your MOS plate will now be cut. Take the aperture plates out of the holder. Discard the lower one (by turning it upside down, you may actually use it once more). Clean the upper plate with compressed air and afterwards with a knife under a magnifying glass.

It is a good idea to take an image of the plate with ALFOSC. Best way is to take a dome flat, which gives uniform illumination. You may now estimate the slit width and verify that all slits are good.

7 Changing tools in the milling machine

The tools are of a uniform length, 54.25 mm +0.0 mm -0.15 mm. Insert the tool all the way to the bottom of the collet and tighten the screw well. Before running any NC programs ensure that the tool will not reach the brass plate when the `mos_zero.nc` program is run. The lowest position is Z = -56.5 (March 2000) and with the Z axis at this position there should be about 0.5 mm space between the tool and the brass plate.
Begin with moving the brass base plate so that it is out of the way of the tool, but still so close that a judgement of the distance between the tool and the brass base plate can be made. Move the Z axis down in steps small enough to keep control of the distance between the tool and the brass plate until the position Z = -56.50 is reached. When this position is reached, check that there is still space between the tool and the brass plate. Move the brass plate back under the tool. Hold a feeler gauge of 0.5 mm flush on the brass plate and next to the tool and look if the tool is clear of it. Do NOT slide the feeler gauge in between the tool and the brass plate as this can destroy the tool.
If the tool is more than 0.5 mm from the brass plate, adjust the Z zeropoint manually by moving to a Z position that will bring the tool closer to the plate , i.e '`Z -0.3 G92 Z`' if the tool need to be 0.3 mm closer to the brass plate. The Z position of the new tool is now ready to be finetuned using the procedure described in section 5. step 8.
It should be noted that the first time after this procedure has been applied, the resulting `mos_zero` plate will probably not have any slits cut in it. As the `mos_zero` plate should have 6 slits though it, this means that the Z zeropoint can be moved a maximum of 6 $\times$ 0.05 mm down e.g 0.30 mm (this is only valid for slit substrates of 0.80 mm thickness, thicker substrates will have more slits through and thinner less)(see figure 1.).

7.1 Testing a new tool

When a new tool has been mounted in the milling machine, it should first be tested by making a `mos_zero` plate. Second, to get an estimate of the minimum slit width which can be manufactured with the new tool, a plate should be made using the `mos_lim.nc` program. This manufactures up to 10 slits in steps of 10μ tool depth. The resulting plate is analysed in exactly the same way as a `mos_zero` plate. The software takes care of identifying whether it is a plate cut with the `mos_zero.nc` or the `mos_lim.nc` program.

8 Setup of the MOSPLATE program

8.1 Parameter files

For the software related to the manufacturing of MOS plates, most relevant parameters are located in four different parameter files located in the `etc` directory below the main `mosplate` directory. These files are read by a generic parameter file reader. They must comply with the following format. A header of up to 100 lines, each header line beginning with a `#` character. The remainder of the file must contain parameter definition lines. The first 20 characters of a parameter definition line gives the parameter name. The next 20 characters give the value of the parameter. The rest of the line is used for an optional description of the parameter.

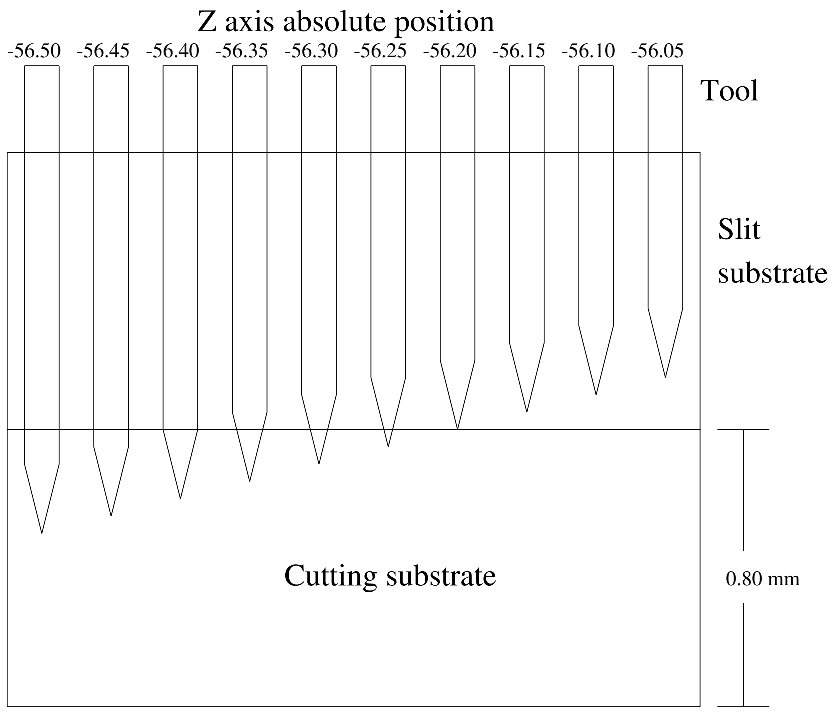

Figure 1: The layout of a plate cut with the "mos_zero.nc" program. The 7'th slit from the left is at the interface between the two plastic plates.

The four parameter files are

- `mosplate.par`: This file specifies parameters required by the `mosplate` program. There are default copies of this file for the NOT and the CUO installation (extensions .not and .cuo) included in the distribution.
- `cnc_setup.par`: This file specifies parameters specific to the CNC machine, including axis names. Also for this file, there are default copies for the NOT and CUO installations.
- `mos_zero.par`: This file specifies default parameters required when evaluating `mos_zero` plates.
- `pixel2mm_fit.par`: This file specifies parameters required for making the pixel to mmetric coordinate transformation.

The description of the parameters is in general sufficient to identify the purpose of the parameter. Be careful when editing the parameter files. Faulty files are likely to cause the software or milling machine to crash.

8.2 Coordinate system, coordinate transformation

With the purpose of making the software as general as possible, the actual milling machine dependent axis names are specified in the `cnc_setup.par` parameter file. The generic axis names used by `mosplate` is axis1, axis2 and axis3. The definition of these axis' is that axis1 is parallel to the slits, axis2 is parallel to the dispersion direction while axis3 is perpendicular to the slit plate. The origo of axis3 is at the interface between the two plastic plates. The sign of axis1 and axis2 is taken care

of in the coordinate transformation required for the specific machine. The sign of axis3 is defined through the sign of the `tool_angle` in the `cnc_setup.par`. Positive tool angle corresponds to the milling head moving away from the slit plate, when moving towards positive values.
The transformation from pixel coordinates to mmetric coordinates is obtained from an image of a pinhole matrix plate. This plate is manufactured by the .nc program `pix2mm.nc`. To measure the spot positions in the image, run DAOFIND within IRAF. To establish the coordinate transformation, copy the resulting output file to the directory `$MOS_DIR/coord_trfm/input_coords` and run the `pixel2mm_fit` IDL program from the directory $MOS_DIR/coord_trfm. You will be prompted for a unique identifier for the CCD and the name of the coordinate input file. To do a test fit, give the identifier `test`. To put the new transformation into effect, copy the coordinate transformation file (named `identifier.coef`) from the directory `$MOS_DIR/coord_trfm/trfm` to `$MOS_DIR/etc` and edit the file `mosplate.par` accordingly.

9 Known bugs

The following is a list of known bugs or short comings of the `mosplate` program and the milling machine. They are in general not affecting the operation.

- When editing an aperture while being in the `spectra` mode, the layout of the spectrum can become funny. The simple remedy is to go to `image` mode and then back to `spectra` mode. It is not easy to fix this problem.
- The numbering of apertures in the postscript hardcopy is messy.
- IDL colors is an inherent problem with IDL 5.0 and later. It is difficult to obtain a proper color transformation. This is a real problem, which has not yet been solved.
- The axis of the mini milling machine occasionally gets stuck at the initialisation position during the initialisation procedure, without the machine reaching the initialised state. The only known way to recover is to turn off the machine, unscrew the motor covers and manualy move each axis away from the `home position`.

A Listing of general .nc files

Listing of `mos_init.nc`. The machine first moved back over the software limits. It then starts searching for the hall switch in steps of $20mu$.

```
N10 G71                     (METRIC PROGRAMING
N20 G92 X Y Z               (ZERO POINT AT MACHINE ZERO POINT
N30 G0 X-16 Y-16 Z-14.8  (MOVE PAST X,Y,Z LIMITS, 0.2MM ABOVE HALL SWITCH I Z
N40 G91                     (INCREMENTAL PROGRAMING
N50 P02                     (CYCLE START
N60 G1 Z-0.02 E50           (0.02MM DOWN IN Z PER CYCLE
N70 G92 X Y Z               (ZERO X,Y,Z
N80 M211                    (STOP HERE WHEN HALL SWITCH TRIGGERED, Esc TO LEAVE
N90 P02100                  (JUMP BACK TO CYCLE START
```

Listing of `mos_zero.nc`. Make 10 slits in steps of 50μ tool depth.

```
N0001 ( DETERMINE TOOL CONSTANT
N0002 (
N0005 G01                       ( STRAIGHT LINE MODE
N0004 G40                       ( CUT DIAM. COMPENS. OFF
N0005 G71                       ( SET MMETRIC PROGRAMMING
N0006 G90                       ( ABOSLUTE COORDINATES
N0007 G71                       ( SET MMETRIC PROGRAMMING
N0008 F400 E400                 ( POSITIONING SPEED
N0009 (
N0010 (
N0013 (
N0014 X-202 Y-54 F800           ( MOVE TO PLATE CENTER
N0015 Z-52.3     E400           ( MOVE CLOSE TO PLATE
N0016 (
N0017 (
N0018 M03                       ( TURN ON SPINDEL
N0019 P02010                    ( MAKE 10 SLITS
N0020 M05                       ( TURN OFF SPINDEL
N0021 (
N0022 G00 X-125 Y-25 Z-20       ( GOTO PARK POSITION
N0023 M30                       ( RETURN TO START OF PROGRAM
N0024 (
N9200 P02                       ( MAKE SLITS
N9201 (
N9202 G91                       ( INCREMENTAL COORDINATES
N9203 Z-4.20 E25                ( MOVE DOWN IN PLATE
N9204 X+4 F25                   ( MAKE SLIT
N9205 X-4 F25                   ( ONCE AGAIN
N9206 Z+4.25 E200               ( MOVE UP
N9207 Y+2 F200                  ( MOVE TO NEXT SLIT
N9208 G90                       ( ABSOLUTE COORDINATES
N9209 M12                       ( RETURN, WHEN SIGNAL
```

Listing of `mos_lim.nc`. Make 10 slits in steps of 10μ tool depth.

```
N0001 ( DETERMINE TOOL CONSTANT
N0002 (
N0005 G01                         ( STRAIGHT LINE MODE
N0004 G40                         ( CUT DIAM. COMPENS. OFF
N0005 G71                         ( SET MMETRIC PROGRAMMING
N0006 G90                         ( ABOSLUTE COORDINATES
N0007 G71                         ( SET MMETRIC PROGRAMMING
N0008 F400 E400                   ( POSITIONING SPEED
N0009 (
N0010 (
N0013 (
N0014 X-202 Y-54 F800             ( MOVE TO PLATE CENTER
N0015 Z-52.3     E400             ( MOVE CLOSE TO PLATE
N0016 (
N0017 (
N0018 M03                         ( TURN ON SPINDEL
N0019 P02010                      ( MAKE 10 SLITS
N0020 M05                         ( TURN OFF SPINDEL
N0021 (
N0022 G00 X-125 Y-25 Z-20         ( GOTO PARK POSITION
N0023 M30                         ( RETURN TO START OF PROGRAM
N0024 (
N9200 P02                         ( MAKE SLITS
N9201 (
N9202 G91                         ( INCREMENTAL COORDINATES
N9203 Z-4.20 E25                  ( MOVE DOWN IN PLATE
N9204 X+4 F25                     ( MAKE SLIT
N9205 X-4 F25                     ( ONCE AGAIN
N9206 Z+4.25 E200                 ( MOVE UP
N9207 Y+2 F200                    ( MOVE TO NEXT SLIT
N9208 G90                         ( ABSOLUTE COORDINATES
N9209 M12                         ( RETURN, WHEN SIGNAL
```

B The mos_zero.run BIAS script

This is the contents of the mos_zero.run BIAS script, which is also included in the mosplate distribution.

```
# Script for making exposure of MOS slit test plate
#
# Use R-filter
# Open mirror cover.
# Use dome tungsten lamp on full power.
# Slit plate has to be offset -1400 steps from default
# position, i.e. for aperture wheel position #2,
# step pos 40000 becomes 38600.
#
# Set the filename to mosznnnn, where nnnn is the sequence number.
# For mos_lim plates, set the name to moslnnnn.
# Look in the binder with the mos_zero output sheets to see which is next.
#
# Written, Michael Andersen, 99.06.22
#
xsize 400
ysize 1000
xbeg 825
ybeg 525
exp 2.0
resetxy
#
# Remember to close mirror cover.
```

C Software overview / installation notes for the `mosplate` program

Not written yet.

D Software overview / installation notes for the `alfosc` IRAF package

Not written yet.

E Online help for IRAF package alfosc

E.1 The mostweak task

```
MOSTWEAK (December2000)           NOT          MOSTWEAK (December2000)



NAME
    mostweak -- find telescope tweak parameters from  two  images  taken
    with a mask and of the object field.


USAGE
    mostweak maskimage objectimage maskdefinitionfile holesize


PARAMETERS

    maskimage
        Name of the image taken WITH a mask of a calibration lamp.

    objectimage
        Name of the image taken WITHOUT a mask of the target field.

    maskdefinitionfile
        Name of the MOS mask definition file (.ap file).

    holesize
        The  diameter  of  the  fiducial holes in arcsec.  In this task,
        this parameter affects the centroid algorithm.


DESCRIPTION
    This task determines the centroid positions of  the  fiducial  stars
    and  the  fiducial holes on an image of the mask and an image of the
    target object field. To measure the pixel coordinates on  the  image
    the interactive task imexamine is used.

    The differences in the measured positions of the stars and the holes
    are then transformed into telescope tweak  parameters:  offsets  and
    rotation.  Ask somebody who knows about it (maybe yourself) to apply
    this tweak, which should bring the  fiducial  stars  closer  to  the
    centre of the fiducial holes of the mask.


EXAMPLES
    Take  an  image  of a calibration lamp (i.e. halogen) with the mask,
    at the required telescope position and rotator angle, and  an  image
    of the target astronomical field, and do
```

```
mostweak jc240011 jc240012 MOS0006.ap
```

Apply the recommended tweak (first the offset, then the rotation). This tweak should bring your fiducial stars closer to the centre of the mask holes.

THE INTERACTIVE PART OF THE TASK

This task will display the section of the mask image which contains the fiducial star slits; the slits are marked by a circle. The user is advised to adjust the colour scale of the image display tool such that the fiducial stars AND the fiducial holes are clearly visible. The object field image will be displayed in full size and the fiducial stars will be marked as described above.

The user has to point the cursor at the fiducial stars (slits) marked by a YELLOW circle, and has to press key -a- to activate the centroid algorithm. If key -a- is pressed more than once, the final press will be evaluated. Each press will be acknowledged by statistics appearing on the terminal that runs IRAF. To advance to the next star (slit), press -q-. To avoid a particular star (slit) to take part in the tweak fit, press -q- WITHOUT pressing -a- first.

On the image display the centroid positions of the slits and stars will be marked by a RED circle.

When all fiducial slits and fiducial stars have been marked by the user, the tweak will be computed.

If one of the centroid positions of the stars or holes seems wrong (judging from the RED circles), the task can be run again with the user discarding the star in the way described above.

A good tweak fit needs no less than 3 stars. Nevertheless, a tweak can be computed on only 2 stars.

TIME REQUIREMENTS

A lot less than doing it by hand.

BUGS

email Jacob W. Clasen (jclasen@not.iac.es), for bug reports and constructive remarks

SEE ALSO

mosmove

E.2 The mosmove task

NAME

mosmove -- Perform the move of the telescope in order to align the MOS mask with the object field.

USAGE

mosmove [TCS access code]

PARAMETERS

TCS accesscode

The access code for the TCS. This parameter is learned and the user is prompted for it if it is absent.

Verbose

Verbose yes/no. If set to 'no' no text output is generated. The parameter is hidden.

Inputfile

The absolute path of the file containing the values written by the mostweak task. This file will be written in the same directory as the 'ldsstweak' FORTRAN program used by the mostweak task. This is currently 'result.out'. The parameter is hidden.

Offset program

The absolute path to the program 'teloffset'. Normally found in '/usr/local/bin'. The parameter is hidden.

Rotation program

The absolute path to the program 'MOS-rotation'. Normally found in '/usr/local/bin'. The parameter is hidden.

IP address

The IP address of the TCS computer. Normally 161.72.5.7. The parameter is hidden.

DESCRIPTION

This task moves the telescope in RA and DEC and changes the field rotation. The amount of these movements are the ones found by the last run of the mostweak task. It is not necesary to to supply any information apart from the access code to this task. All the telescope movement values are stored in a file by the mostweak task and then read by this task. The task uses the UNIX command line programs 'teloffset' and 'MOS-rotation'. These programes must be present and the path to them set (see parameters).

EXAMPLES

Simply type the task name and press enter

```
mosmove
```

The task will prompt you for the TCS access code. If is has not changed just press enter.

TIME REQUIREMENTS

A lot less than doing it by hand.

BUGS

email Jacob W. Clasen (jclasen@not.iac.es),
for bug reports and constructive remarks

SEE ALSO

mostweak