



NIRSpec Technical Note NTN-2012-006

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Documentation for `sb_cmo_offset.pro`

Abstract:

This document describes the purpose and usage of the `sb_cmo_offset.pro` procedure. We also list the prerequisites necessary to run the program and provide a listing of its arguments and keywords.

1 INTRODUCTION

This document describes the `sb_cmo_offset.pro` procedure and how it is run and used. The purpose of this procedure is to determine the needed CMO adjustment in x- and y-coordinates in order to move a given source to a new position. This is achieved by selecting a source and a target position in count rate images and using transformation/distortion tables that were derived with the `sb_distortion.pro` procedure (see Birkmann 2012 for details).

In section 2 we list the necessary software to run the program. In section 3 we show how the procedure is run by means of an example. In appendix A a brief description of all the arguments and keywords of the procedure is given.

2 PREREQUISITES

In order to run `sb_cmo_offset.pro` the latest version of the NIRSpec Calibration Software and Database must be installed and correctly configured on your system. Please see Birkmann (2011) and Giardino & Sirianni (2011) for details on how to do this. Also make sure to have checked out the `Software/JWST_IDL/lib/nirspec/` and `Software/JWST_IDL/var/` folders recently to have the latest version of the program and support files.

The program can make use of the NIRSpec database and the exposures therein. If that functionality is wanted, it needs to have access to both.

As the program will display SCA images in a rather large window, a computer screen with decent size and resolution (≥ 1080 pixels in vertical direction) is recommended.

3 RUNNING THE PROGRAM

In this example we will determine the CMO coordinates needed to move a selected source (in this case the RCSS) to a selected position (here the center of the A_1600 slit). The data was obtained during the first calibration campaign with the NIRSpec FM in early 2011. We will use the exposures with the NIDs 4589 and 4577, both full frame exposures taken with the PREP_RCSS_SEARCH test sequence. In NID 4577 the RCSS in its bright IFS1 mode is imaged through the closed MSA. NID 4577 is a CAA/TEST source exposure where the fixed slits are nicely illuminated.

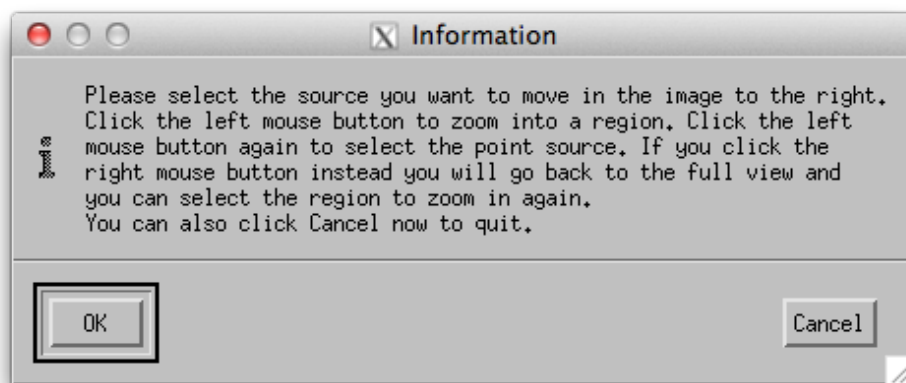
In addition to the exposures themselves, we also need the transformation/distortion information file that can be created using the `sb_distortion.pro` procedure. Please have a look at Birkmann (2012) on how this is done. For this example we will use a transformation/distortion file that was created using Instrument Performance Simulator (IPS) data. The transformation file is available on livelink via this link. Go to a working directory and download the file (“transform_FM.fits”), then start the NIRSpec IDL environment by typing

```
/> start_nirspec
```

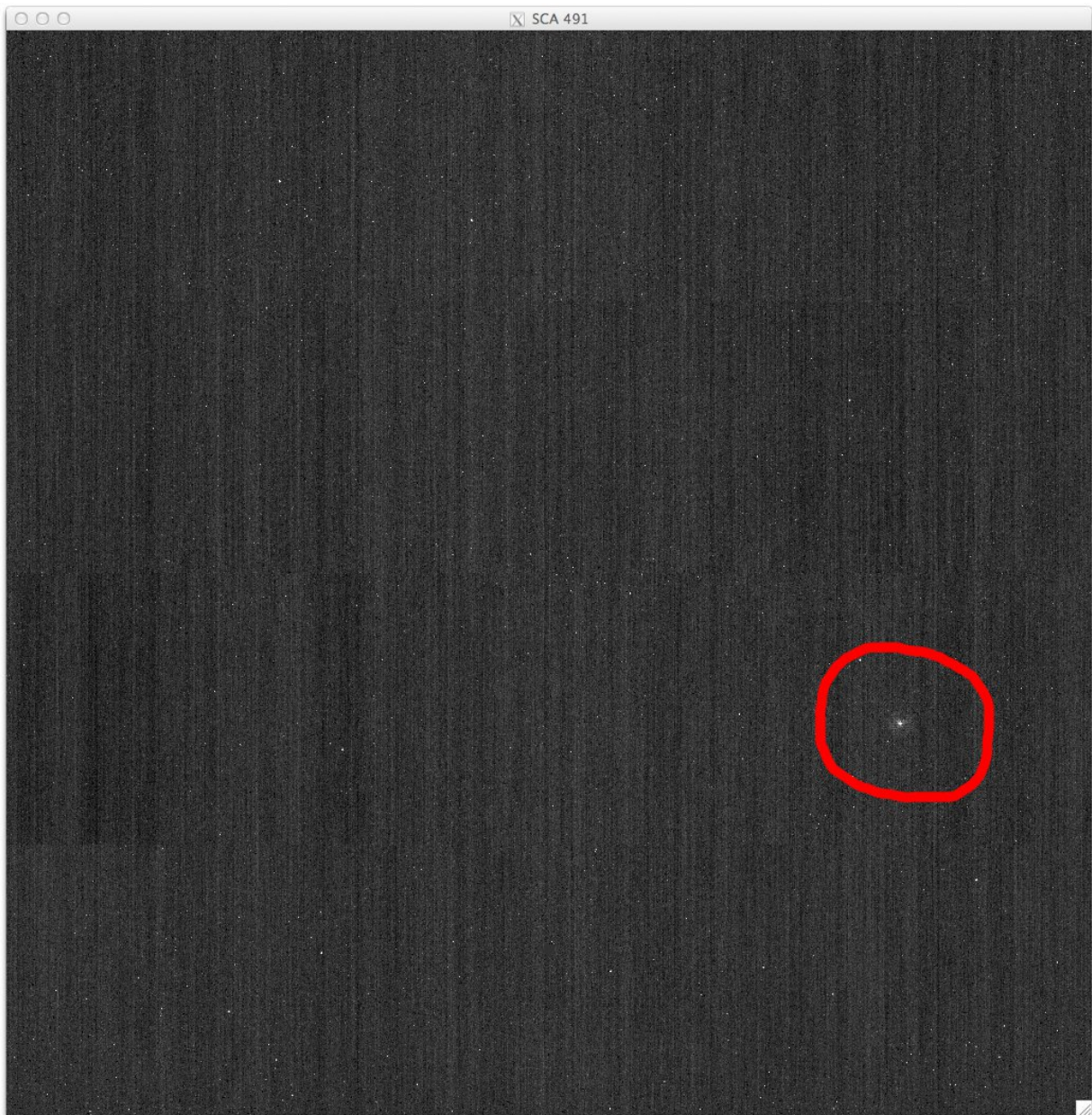
You should now see the NIRSpec> prompt. The next step is to invoke the `sb_cmo_offset` procedure with the appropriate input exposures and transformation/distortion file:

```
NIRSpec> sb_cmo_offset, 4589, 4577, 'transform_FM.fits'
```

It will take a few seconds while the program is locating and loading the first exposure. Then, you will see a large window showing the SCA 491 count rate image of exposure 4589 on the right, and a notification dialog giving instructions on how to proceed in the center of your screen. The latter window should look similar to this:

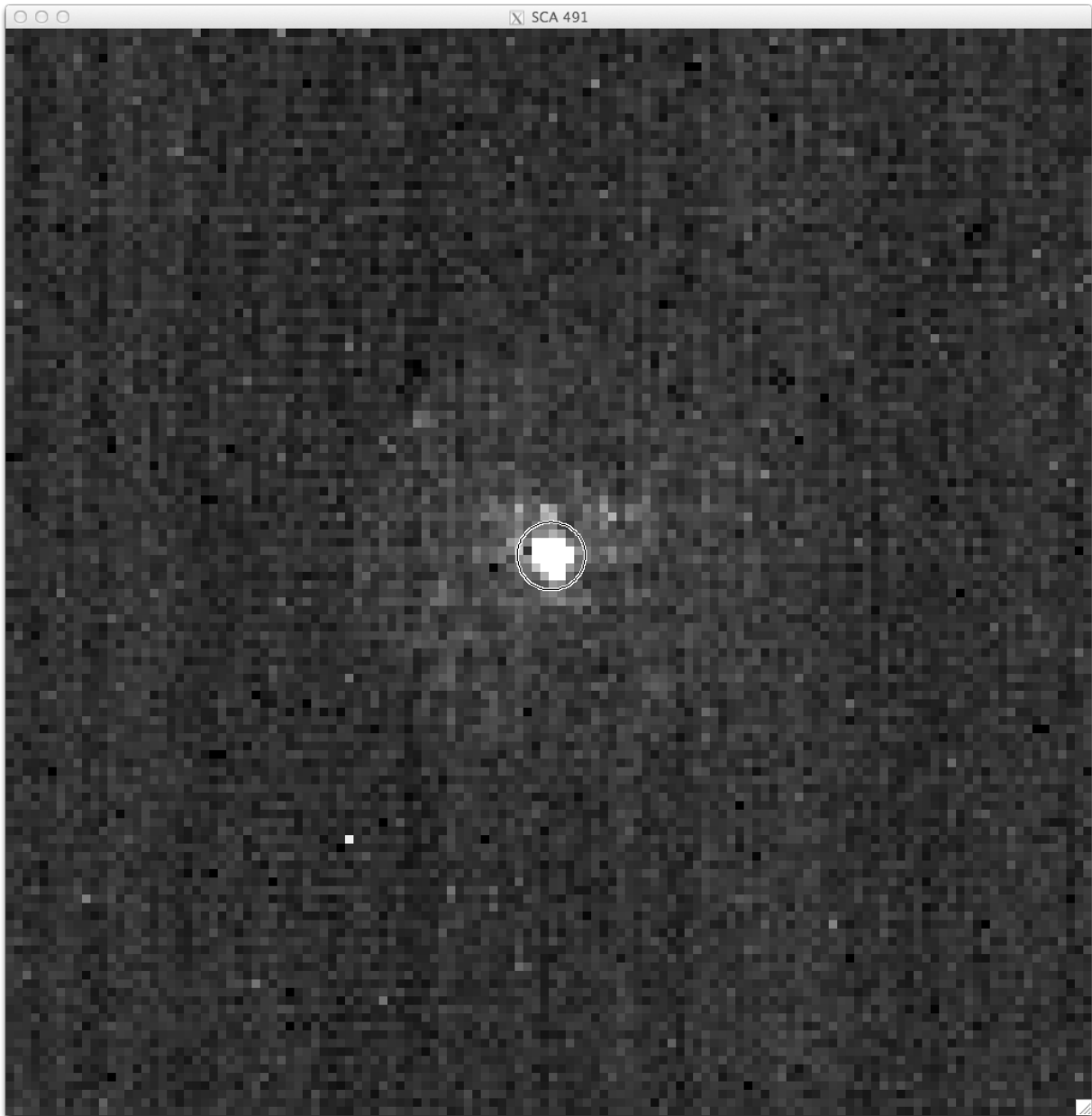


The SCA 491 count rate image on the right should be fairly empty, with the RCSS located in the lower right quadrant (here circled in red for clarity):

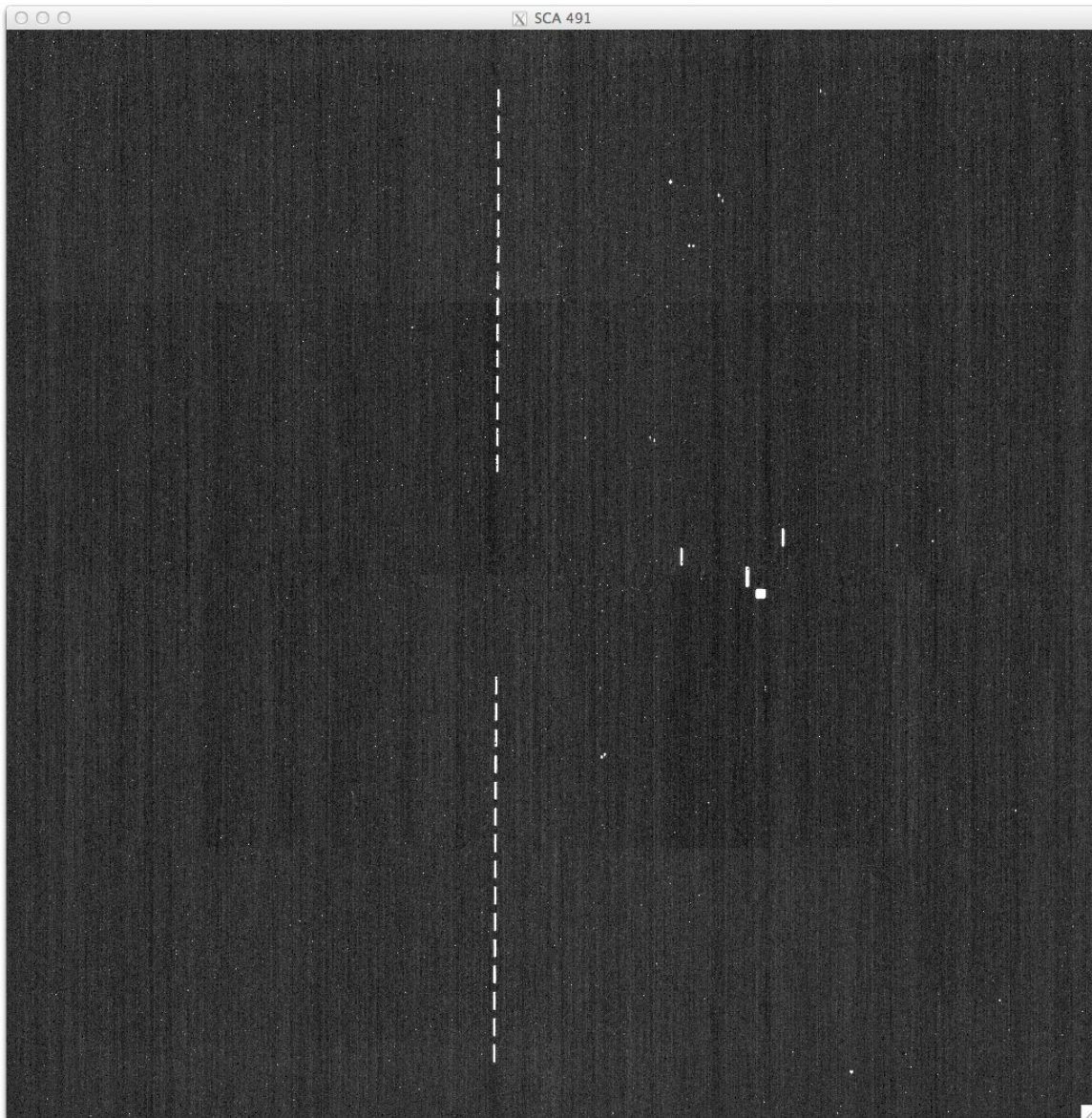
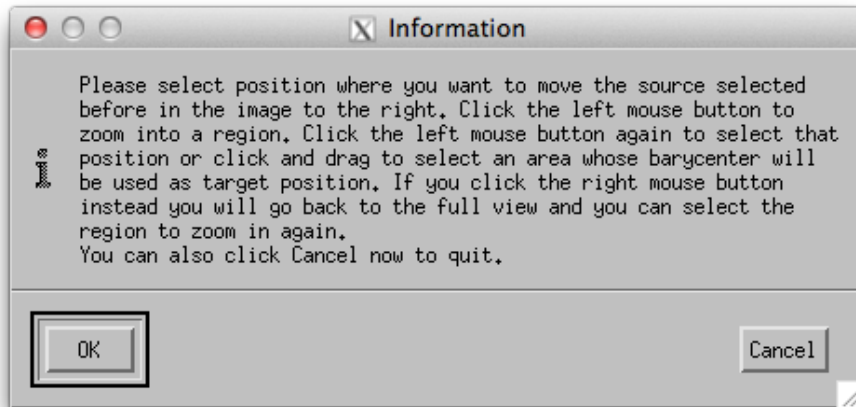


We want to select the RCSS image, so read the the instructions and close the notification window by clicking OK. Then left click in the vicinity of the RCSS image. This will zoom in on the region around it. Another click with the left mouse button and the program will determine the position of the point source under the cursor by means of fitting a 2D Gaussian to it. If you find the zoomed in region not suitable (e.g. because you mis-clicked somewhere) you can always go back to the full image view by clicking the right mouse button and start over.

Once you selected the point source it will be marked with a circle and the zoomed in image region should look similar to this:

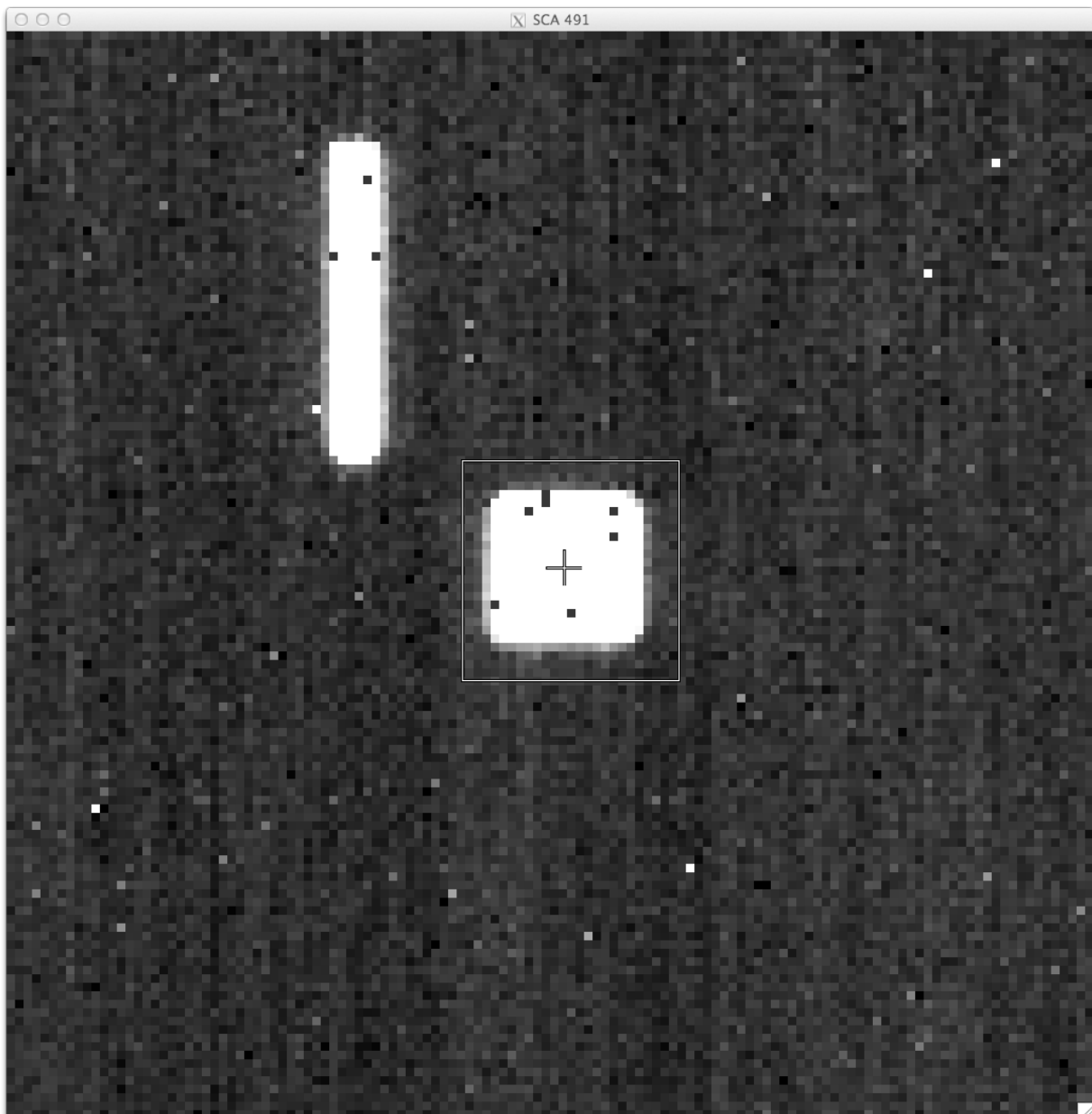


The program will then load the target image and display it on the right. Also, another notification window on how to proceed will pop up in the center. Please read the information in that window and proceed by clicking the OK when done. The notification window and count rate image should look like this:



Since we want to place the RCSS into the A_1600 slit, left click on it to zoom in. Then, left click and hold and drag to define a rectangle in which the barycenter of the count rate will be computed. Of course, this rectangle should include the illuminated A_1600 slit. You can also define the position completely manually by just left clicking (without dragging), the program will then use the exact position of the cursor then. Like above when selecting the point source you can go back to the full image by clicking the right mouse button if the zoomed in region was not suitable.

Once you marked the target region it will be denoted by a rectangle and the computed barycenter (or the position you clicked) will be marked by a cross. The zoomed in region should look similar to this:



The program will now compute the translation needed to move the source selected in step one to the position you selected here. For this the transformation and distortion between FPA and OTE plane is needed from the input transformation file (i.e. “transformation_FM.fits” in our case). When done, the program will print out the CMO position of the source exposure (“Old”), the computed adjustment, and the new CMO position that will put the source at the target location:

```
Old CMO position [mm]:    +0.0000    +0.0000
                        delta [mm]:  +17.8624   -16.6339
New CMO position [mm]:    +17.8624   -16.6339
```

This is the end of this example. If you are feeling adventurous you can try and re-run this example with a different source exposure, like NIDs 4590, 4591, and so on. For those exposures the CMO position was already different from 0, 0 and one can compare the computed new CMO positions. They should be fairly similar, but keep in mind that the transformation/distortion used here was derived from simulated data, not the as-built FM, so small differences can be expected.

4 REFERENCES

- Birkmann, S. 2011, Installing the NIRSpec Calibration Software and Database on Mac OS X 10.7 (Lion), NIRSpec Technical Note NTN-2011-007, ESA/ESTEC
- Birkmann, S. 2012, Documentation for sb_distortion.pro, NIRSpec Technical Note NTN-2012-003, ESA/ESTEC
- Giardino, G. & Sirianni, M. 2011, NIRSpec Archive and Database, NIRSpec Technical Note NTN-2011-003, ESA/ESTEC

A REFERENCE GUIDE

Syntax | Arguments | Keywords | Examples

sb_cmo_offset

The `sb_cmo_offset` procedure allows the user to determine the needed CMO adjustment in x- and y-coordinates in order to move a given source to a new position. The user has to select a point source image in an exposure `nidsource` and the target location in `nidtarget` and specify a coordinate transformation file derived using `sb_distortion.pro`.

Ideally, the used input images should be dark or background subtracted and flat fielded. This can be done relatively conveniently using the `BKGD_SRC/TGT` and `FLAT_SRC/TGT` keywords. If the procedure is called using the NID numbers to identify exposures, it needs the `start_nirspec` environment and access to the NIRSpec data base and exposures.

This routine is written in the IDL language. Its source code can be found in the file `sb_cmo_offset.pro` in the `Software/JWST_IDL/lib/nirspec/misc/` subdirectory of the NIRSpec Calibration Software and Database installation.

Syntax

```
sb_cmo_offset, nidsource, nidtarget, transform [, OUT=variable] [, SCA=value] [, BKGD_SRC
=scalar/string] [, BKGD_TGT=scalar/string] [, FLAT_SRC=scalar/string] [, FLAT_TGT=scalar
/string] [, IMG_OFFSET=value] [, IMG_SCALE=value] [, /VERBOSE] [, /NOMESSAGES]
```

Arguments

nidsource

An integer scalar giving the NID or a string giving the filename (including full path) of the input exposure that contains the source to be moved. If an NID is given the procedure uses the NIRSpec database to find and load the exposures.

nidtarget

An integer scalar giving the NID or a string giving the filename (including full path) of the input exposure that contains the source to be moved. If an NID is given the procedure uses the NIRSpec database to find and load the exposures.

transform

A string giving the file name (including full path) of the coordinate transformation file created with the `sb_distortion.pro` routine. If not given, the user will be prompted for it via a file select dialog.

Keywords

OUT

Set this keyword to a named variable that will contain a two-element vector giving the CMO x- and y-position in mm needed to move the source to the target position.

SCA

Set this keyword to an integer value or two-element vector containing the SCA(s) to be displayed when using NID values to specify input images. Default is to assume [491,491], i.e. the count rate image of SCA 491 will be displayed for source and target input files.

BKGD_SRC

Set this keyword to an integer scalar giving the NID or to a string giving the file name (including full path) of a background image to be subtracted from the nidsource image.

BKGD_TGT

Set this keyword to an integer scalar giving the NID or to a string giving the file name (including full path) of a background image to be subtracted from the nidtarget image.

FLAT_SRC

Set this keyword to an integer scalar giving the NID or to a string giving the file name (including full path) of an image to flat field the nidsource image. The flat field image will be normalized and low QE pixels masked out.

FLAT_TGT

Set this keyword to an integer scalar giving the NID or to a string giving the file name (including full path) of an image to flat field the nidtarget image. The flat field image will be normalized and low QE pixels masked out.

IMG_OFFSET

Set this keyword to a scalar value between 0 and 255 giving the grey value that the (clipped) mean of the input image will be displayed with. Default value is 50.

IMG_SCALE

Set this keyword to a scalar value greater not equal to zero giving the scaling of the input image from black to white in multiples of the (clipped) standard deviation of the input image displayed. Default value is 20. Use negative values for inverted scales (white to black).

/VERBOSE

Set this keyword to get details on the selected source and target positions.

/NOMESSAGES

Set this keyword to surpress the instruction messages that the procedure displays by default (for experienced users).

Examples

This example will derive the transformation and estimate the distortion using the (DM) exposures with NIDs 2208 and 2210 which have been subtracted by the background exposures with the NIDs 2209 and 2211, respectively.

```
NIRSpec> sb_cmo_offset, 4589, 4577, 'transform_FM.fits', /VERBOSE
```