NIRSPEC

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NIRSPEC Software Programming Note 24.01
User Algorithms for Slit Motion

1. Introduction

In general, moving an object up and down the NISPEC slits requires both an east-west and a north-south nod. The amount of motion along each axis is determined from a straightforward trigonometric calculation depending on the rotator's position and the current slit. It's our belief that for virtually all standard observing modes, the only parameters that should determine the position of the object on the slit are the desired number of nod positions and the slit length. For example, if the user selects a 15'' slit and 3 nod positions, than the slit should be divided into three equal 5'' sections and each of the three nod positions centered in one of these sections. Based on this simple premise, we have constructed this document to describe the procedure by which a user controls the object's position on the slit using the slit viewing camera and standardized observing scripts. The instrument coordinates in the DCS are for the slit viewing camera's rows and columns.

2. Slit Keywords

The NIRSPEC server maintains three keywords that describe the current slits center, and angle in the scam detector, plus the slit name and slit number which describe its length. Below is the table of this information by slit number. This information is stored in the slit_orientation structure within the nirspec.h include file (located in /kroot/kss/nirspec/keyword). The column headings are the NIRSPEC keyword names to access this information except for the length which has no direct keyword. The slitx and slity keywords are the SCAM pixel for the slit center. The repeatability of the slit centers is better than 0.5 pixels. The slitang is the counterclockwise angle of the slit measured from the x axis:
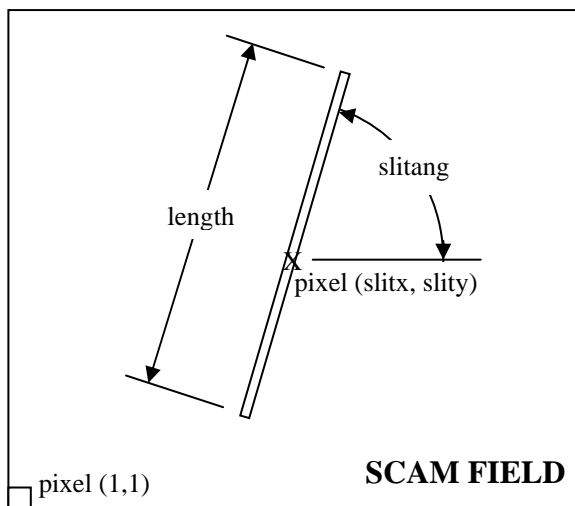
Within nirspec.h:

```c
typedef struct {
  double xcenter;              /* X-Center of the slit in scam pixels */
  double ycenter;              /* Y-Center of the slit in scam pixels */
  double angle;                /* CCW angle from the x axis of the slit.
*/
} slit_orientation;

static slit_orientation slit_orient[] = {
  129.0, 130.0, 11.1429,
  131.0, 130.0, 11.3099,
  133.0, 130.0, 12.1549,
  132.0, 130.0, 12.1549,
  130.0, 130.0, 11.3099,
  128.0, 128.0, 0.0,
  130.0, 130.0, 11.1429,
  130.0, 130.0, 11.1429,
  129.0, 130.0, 11.6460,
  129.0, 130.0, 84.3864,
  128.0, 129.0, 84.6290,
  129.0, 130.0, 84.4101,
};
.
.
.
/*
 *  Slit table
 */
static char *slit_table[] = {
    "0.144x12",
    "0.288x12",
    "0.432x12",
    "0.576x12",
    "0.720x12",
    "0.288x24",
    "0.432x24",
    "0.576x24",
    "0.720x24",
    "42x0.380",
    "42x0.570",
    "42x0.760"
};
#define NUM_POS_SLIT ( sizeof(slit_table) / sizeof(slit_table[0]) )
```

SLITPOS	SLITNAME	length(arcsec)	SLITX	SLITY	SLITANG
0	0.144x12	12"	129	130	11.1429
1	0.288x12	12"	131	130	11.3099
2	0.432x12	12"	133	130	12.1549
3	0.576x12	12"	132	130	12.1549
4	0.720x12	12"	130	130	11.3099
5	0.288x24	24"	128	128	?
6	0.432x24	24"	130	130	11.1429

7	0.576x24	24"	130	130	11.1429
8	0.720x24	24"	129	130	11.6560
9	42x0.380	42"	129	130	84.3864
10	42x0.570	42"	128	129	84.6290
11	42x0.760	42"	129	130	84.4101

3. Initial Object Positioning

To position the instrument at the proper sky location, first the user should ask the telescope operator to move the telescope to the coordinates of the object. The user then uses the slit viewing camera to place the center of the slit field of view. This should best be accomplished with the csh script centslit located in /kroot/kss/nirspec/ui/csh:

centslit:

```
#!/bin/csh -f
#
# Usage:  centslit xpix ypix
# Options:     none
# Note:        uses the slitx and slity keywords
# Purpose:     Center the object currently on scam pixel xpix, ypix
#        on the center of the slit.
# Created:     12Nov98, James E. Larkin
#-----------------------------------------------------------------

# Check that there are two arguments
if ( $#argv < 2 ) then
    echo "Usage:"
    echo "   centslit xpix, ypix"
    exit
endif

set slitx = `show -terse -s nirspec slitx`
set slity = `show -terse -s nirspec slity`
set xmotion = `echo "($slitx - $1)*0.19" | bc -l`
set ymotion = `echo "($slity - $2)*0.19" | bc -l`
modify -s dcs2 instxoff=$xmotion instyoff=$ymotion rel2curr=t
```

The centslit script can be run by hand at a UNIX prompt, but the quicklook can also invoke this command from the gaussian fitting routine. When you use the quicklook to fit a 2-d gaussian to a star or other object, the output data window has a button "center telescope" which moves the telescope so the fit gaussian center is moved to the (slitx, slity) position on the scam.

4. Positioning during nod sets

In the current positioning scheme, the observing scripts do not specify the slit angle, only the size of the motion along the slit. All EFS scripts know the slit length (because the EFS scripts set the slit position), and they assume the object has been centered before the observations. This also

requires them to return the telescope to the original (assumed centered) position at the end of the script. To simplify the observing scripts, a general purpose *slitmove* command is provided in /kroot/kss/nirspec/ui/csh that accepts a single parameter that is treated as an arcsecond move along the slit:

slitmove

```
Text of slitmove...
```

An observing scipt will assume that the object begins at the center of the slit field. It will then use *slitmove* commands to move the slit to the first nod position, then after each exposure move the slit to the next position, and finally after the last exposure, the script recenters the slit on the object. The magnitude of these slit moves is set by the number of nods and the slit length:

1st Example: 30'' slit with 3 nod positions.
> Rotation angle and integration time are specified by EFS or user.
> SCAM positions the slit on the center of the object.
> Script places a 30'' slit in the field.
> Script issues a "*slitmove 10*" which moves the slit such that the object is located 5'' from the top of the slit.
> Script starts first integration.
> When finished, script issues a "*slitmove –10*" which moves the slit 10'' up so that the object is returned to the center of the slit.
> Script starts second integration.
> When finished, script issues a "*slitmove –10*" again, which moves the slit 10'' up so the object is now 5'' from the bottom of the slit.
> Script starts third integration.
> When finished, script isses a "*slitmove 10*" command which moves the slit 10'' down so the object is returned to the center of the slit.

2nd Example: 15" slit with 2 nod positions.
> Rotation angle and integration time are specified by EFS or user.
> SCAM positions the slit on the center of the object.
> Script places a 15'' slit in the field.
> *Slitmove 3.75*
> *Integrate*
> *Slitmove –7.5*
> *Integrate*
> *Slitmove 3.75*

Note that *Integrate* is not a real command but is used to summarize all of the control commands of the exposures.