Imaging Dither Files with MMIRS

There are a number of "standard" dither patterns already available for use with the MMIRS instrument. These include random dithers of box sizes that do not exceed 15", 30", 120", 240" and 360". You can indicate which dither size and pattern you would like the queue observers to use in the *Notes* section of your catalog entry under the Observatory Manager webpage.

If you prefer a customized dither pattern, you will need to submit a file in the correct format to Joannah Hinz (jhinz@mmto.org) by the catalog submission deadline for the MMIRS queue to which you have been assigned.

Custom Format:
The format needed is shown by Example 1 below. It is tab delimited, and the RA/ Dec offsets are noted as "azoff" and "decoff". Emacs users will need to be careful, as sometimes the tab key can be interpreted as multiple tabs, which creates a problem when the file is loaded into the MMIRS software interface (just backspace to delete extra tabs). The line of hyphens is necessary before providing the dither values. The offsets are **actual offsets from the original target position** and are not relative to the last position commanded.

Integration Times/WFS Limitations:
In general for imaging programs the recommendation is to stay at the same dither position for 60 seconds so that wavefront sensing can be run while the science exposures are being collected. This should eliminate the need for any refocusing. Depending on the sky background, this might mean taking two or more exposures at the same dither position before moving on. There are existing random dither files available that allow for two or more exposures at each position with the same maximum dither sizes as indicated above.

You may consider adding other columns such as: "filter", "disperse" and "aperture". For imaging, disperse and aperture should be set to "open" and filter can be set to "J", "H", or "K" (for K-short, not to be confused with Kspec).

Gain Settings:
If you are taking long exposures, or taking full array images, acquiring data with the high dynamic range mode (gain=2.68) is recommended. This is necessary in order not to saturate all pixels or be in the non-linear regime. To set this in your dither file, you can add a column called "readmode" and provide the full path filenames with the proper gain. They are:

For gain=2.68:
/home/mmirs/Readout/Logain/ramp_4.426s_gain2.68.tab (4.426s up-the-ramp sampling)
/home/mmirs/Readout/Logain/ramp_1.475s_gain2.68.tab (1.475s up-the-ramp sampling)

For gain=0.95:
/home/mmirs/Readout/ramp_4.426s_gain0.95.tab (4.426s up-the-ramp sampling)

/home/mmirs/Readout/ramp_1.475s_gain0.95.tab (1.475s up-the-ramp sampling)

Example 1: Below is an example for a 15" random dither pattern:

```
● ● ●                    📄 random15.cat ∨
azoff  eloff  obstype
-----  -----  -------
0.00   0.00   object
-3.32  -3.30  object
5.65   2.11   object
2.40   -6.49  object|
-6.44  -2.29  object
7.17   6.12   object
-6.38  -0.12  object
-1.18  7.39   object
-1.28  -1.08  object
5.67   5.42   object
-3.03  -6.77  object
4.92   3.08   object
-1.76  -2.24  object
-4.55  5.11   object
-2.55  -6.74  object
-3.52  3.75   object
-1.46  -3.69  object
-5.78  7.44   object
1.91   4.42   object
0.52   -3.34  object
3.06   4.69   object
-6.66  4.94   object
-1.71  -6.92  object
4.93   0.01   object
-5.04  -5.19  object
-2.03  2.96   object
0.44   -4.04  object
-1.21  3.12   object
```

1. Every column must be tab-delimited
2. Keep obstype to 'object' for science observations
3. The second line must consists of hyphens to delineate the positions from the header

All offsets are relative to (0,0) center
If you wish to stay at the same position after each dither, the next row should have the same azoff and eloff as before.