

SHARP data analysis memo of the IRAS 20126 data taken in 2007 (draft)

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- Initial data inspection and Pointing correction:

I first analyzed the data with `sharpinteg_2` with flags of `"-c -f 1 -w -sil"`. These options were chosen solely for the purpose to derive the pointing offsets. (The flag `"-w"` is for replacing blank pixels to good ones.) Firstly, I selected the data that are taken in proper condition (chop throw, chopper efficiency, data sections for different HWP angles, HWP angles, and saturation). After extracting the good data files, Darren's "fitgauss" is used to derive the pointing offsets of each data file. Options used were `"-p -d"` as all files include a bright peak feature. Pointing change was investigated carefully. Three different pointing correction methods were compared; one uses original pointing offsets derived using `fitgauss`, one uses smoothed pointing offsets, and one has a combination of smoothed pointing offsets (smoothed pointing correction method 1) and original pointing offsets (smoothed pointing correction method 2). Smoothed pointing correction method 1 is to use smoothed pointing offsets for all data by fitting a curve to the `fazo/fzao` derived by `fitgauss`. Smoothed pointing correction method 2 is to use smoothed pointing offsets for the data that show difference between smoothed offsets and original offsets (derived by `fitgauss`) are within 1 arcsec. For the data points that have difference between the smoothed offsets and original offsets greater than 1 arcsec, the original offsets were applied. Discussion of the pointing of this data set is found elsewhere.

- Sharpinteg

For science data reduction, I re-ran the `sharpinteg_2` with flags of `"-c -f 1 -sil"`. Three files are identified that generate "near saturation" warning message at different times. (In case if you are interested in looking into these files, please go to a web at puuoo.submm.caltech.edu/~hs/sharpsolve_errlog/) You'll find the four fits files along with the sharp error logs for each of these files.) This is leftover from `sharpsolve`. Larry confirmed that `sharpinteg` checks saturation prior to the tossing of bad pixels. Accordingly, these messages are generated even when all pixels used are actually fine. According to Darren, the threshold that he defined is 3.5V. As long as RGM marks bad pixels, final fits files should be good. And it turned out that RGM was blocking out all saturated pixels for this case. Accordingly, we used these three files to calculate the final results. The number of the files extracted are 141 in total for data analysis.

- sharp_combine

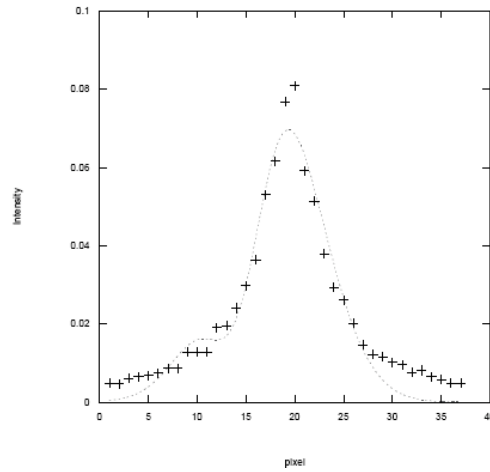
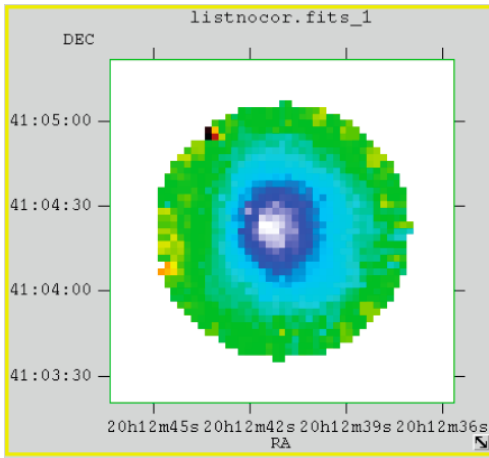
`sharp_combine v4.25` (last updated 2008 May 22) was used to process `polsharp4` to derive proper vectors angle/degree of polarization. The command used for this process is as follows:

```
sharp_combine listname listname.fits -hwp 93 -l 51 51 -ma 5 -sm 2 -ps 4.75 -pm 6.3 -q -
bg 30 0 -ip 0.0034 0.00017 0.0036 0.0
```

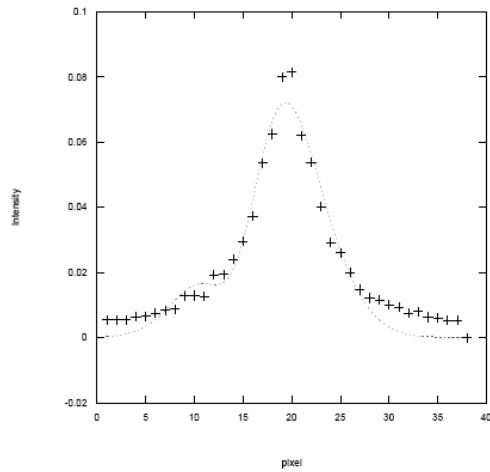
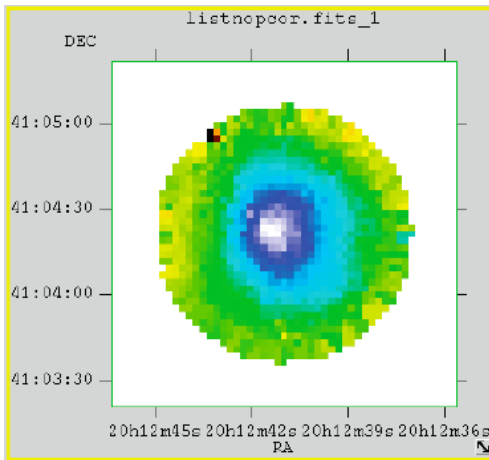
`Sharp_combine v5` is to be used to run Mike's `chi2` program.

Images processed with sharp_combine v4.25

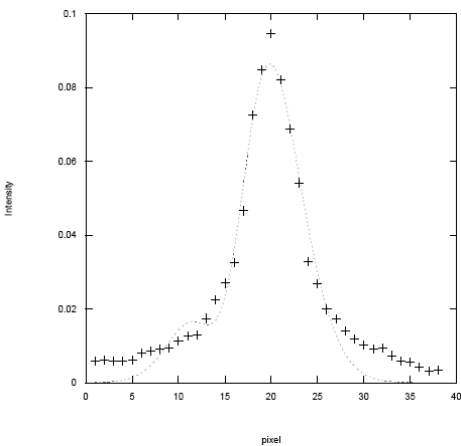
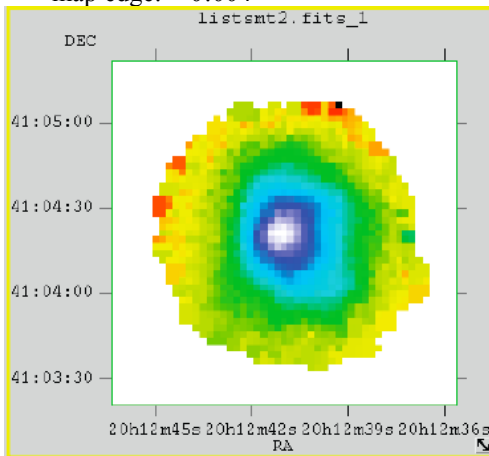
- No correction (both pointing and tau)
 - + peak 0.0809, + FWHM $\sim 3.92 \pm 0.80$ pixels
 - + map edge ~ 0.05



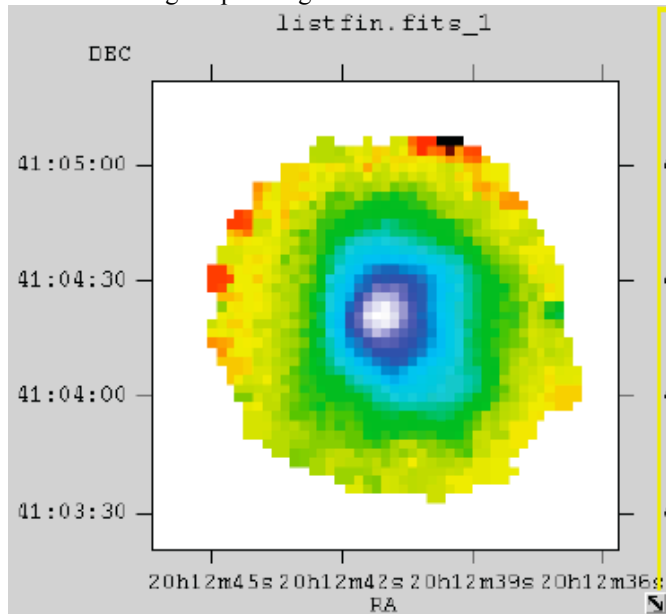
- No pointing correction and with tau correction
 - + peak 0.0815, + FWHM $\sim 3.85 \pm 0.74$ pixels
 - + map edge ~ 0.05



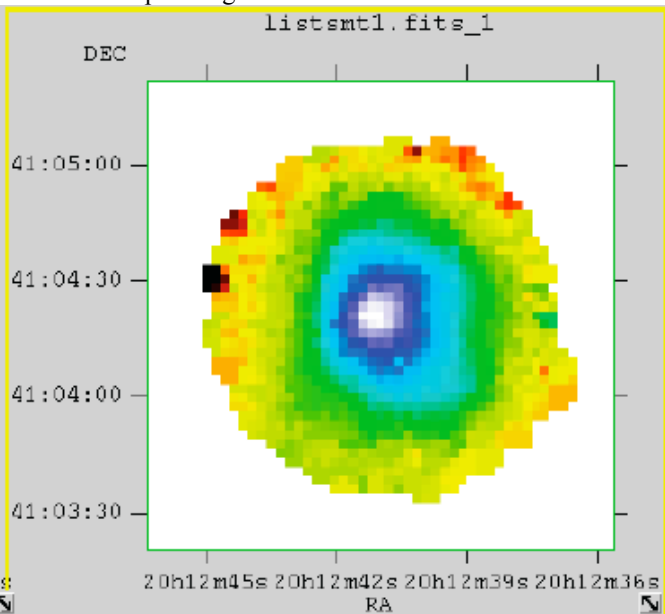
- Pointing/tau correction. Smoothed pointing correction with method 2.
 - + peak 0.0946, + FWHM 3.70 pixels ± 0.67 pixels
 - + map edge: ~ 0.004



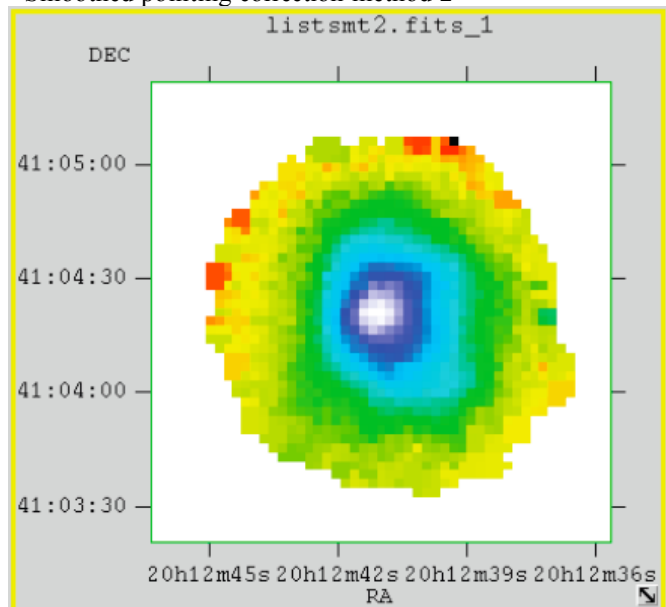
- No smoothing on pointing correction



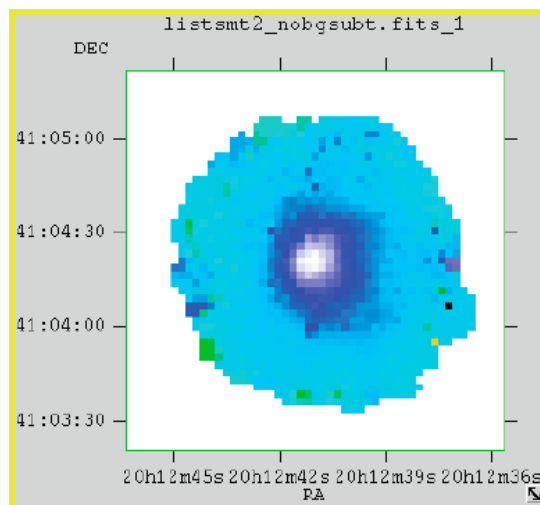
- Smoothed pointing correction method 1



- Smoothed pointing correction method 2



(- image without background subtraction)



- No smoothing on pointing correction

- + peak 0.967
- + map edge: ~ 0.004

- Smooth method 1

- + peak 0.0915
- + map edge: ~ 0.004

- Smooth method 2

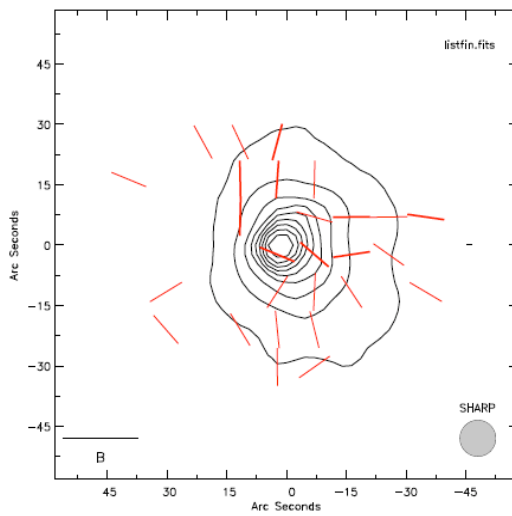
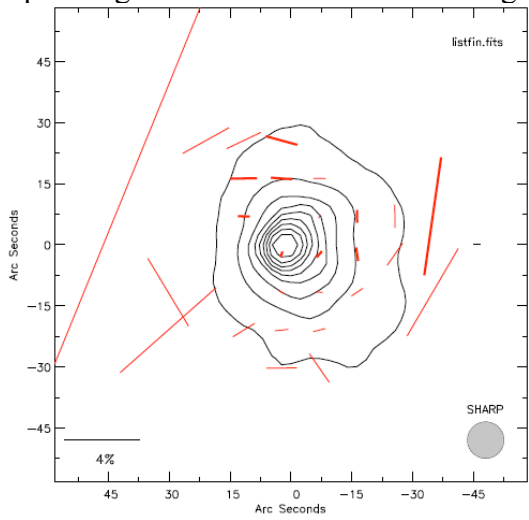
- + peak 0.0946
- + map edge: ~ 0.004

(Without background subtraction, peak ~ 0.095, noisy outskirts area.

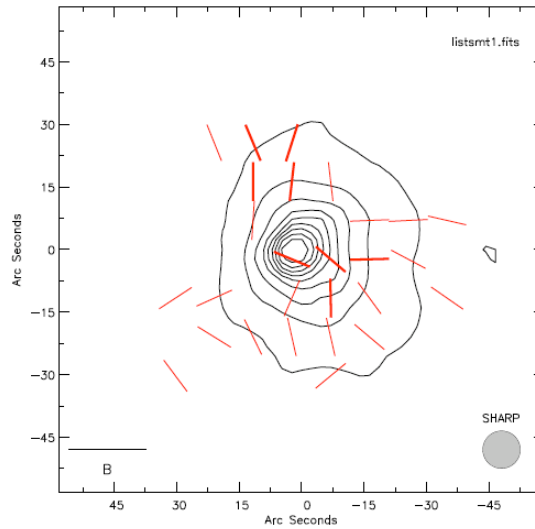
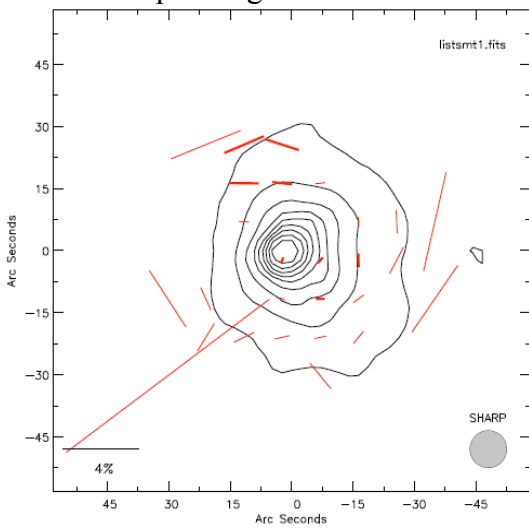
```
sharp_combine listname listname.fits -hwp 93 -l 51 51 -ma 5 -sm 2 -ps 4.75 -pm 6.3 -q -ip 0.0034 0.00017 0.0036 0.0 )
```

John's background subtraction routine built in sharp_combine helped increasing the signal to noise ratio significantly.

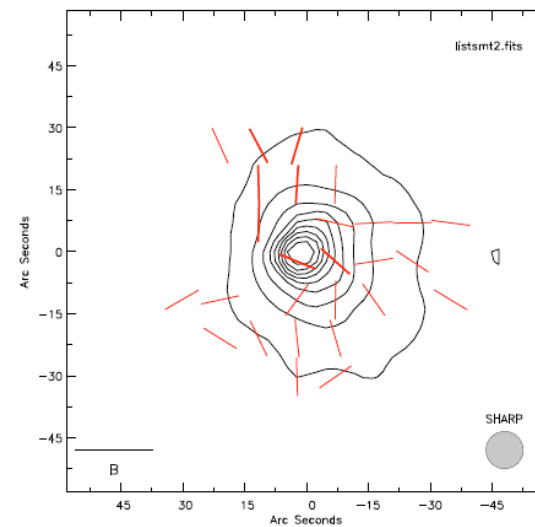
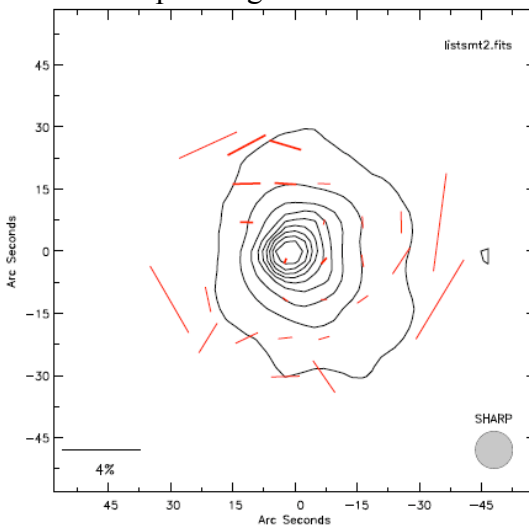
- pointing correction without smoothing



- smoothed pointing correction method 1



- smoothed pointing correction method 2

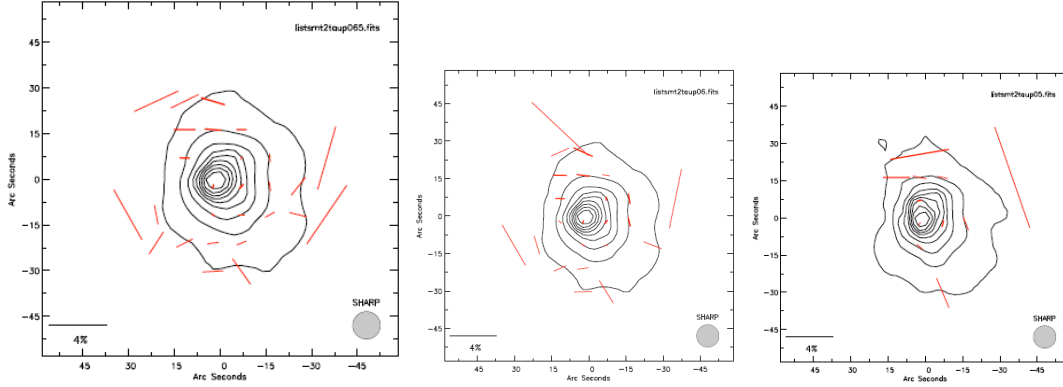


There was a clear tendency that the data taken under higher tau condition produced bigger errors. To check the reproducibility, the data were divided into multiple sections.

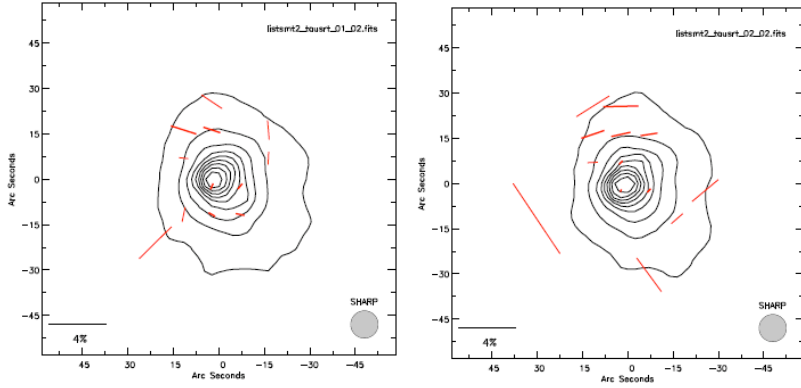
files tau < 0.065 ... 126 files total
files tau < 0.06 ... 97 files total
files tau < 0.05 ... 19 files total

E vectors for tau < 0.065 (above 2sigma); tau < 0.06;

tau < 0.05



Divide data into two sections (above 2.5 sigma)



Divide data into three sections (above 2.5 sigma)

