DGtau analysis procedure and results

Introduction and Results

I have reanalyzed the February 2007 dgtau data and combined it with the August 2007 data with the aim of subtracting off any residual DC offset in the data. I present here both the results for dgtau, and a general analysis procedure for removing the offsets from a point source by making use of the blank sky around the source.

The analysis was done by combining all of data into a single large file, and breaking the data into seven bins (Giles' five bins from the February data and two more from the August data) so that a reduced chi^2 could be computed. Final q and u values were calculated from the 7 bins and compared with the single file result as a sanity check. Results are given below.

Table 1

	q	q err	u	u err
uncorrected	-.13%	.49%	-1.02%	.50%
Single File	-.70%	.49%	-.10%	.50%
Weighted Average	-.63%	.50%	-.05%	.51%

The reduced chi squared before and after the correction are

Table 2

	Before Subtraction	After Subtraction
Q chisq	1.5254	1.1223
U chisq	1.4831	0.7781

Data Preparation

Ran sharpinteg_2 on all files with

Flags: "-r rgm2.dat -f 1 -w -sil -em -c"

For the February data I used FAZOs and FZAOs from Giles list. For August data I ran fitgauss on all of the files with flags "-p -b". In about one in 8 files, fitgauss would either not converge or had a low sigma on the fit. Any file with a sigma of less then 20 was checked manually to make sure the location of the peak was right, and FWHM was approximately right. If the fit was not accurate, it was refit with a forced FWHM, which worked for about half of the files. Any remaining files were assigned FAZOs and FZAOs interpolated from the files taken at the same time.

The interpolation was done by considering the other files in the same dither and either averaging the files on either side, or if it was on an edge, approximating a trend from the other files.

All the files that were used are posted in bl_tot. The list is broken into seven sub-lists with the first five being the same as Giles, and the last 2 being files 39700-39927 for group F and files 39938-39947 for group G. Then I ran sharp_combine_v5 on all groups (sub-lists), including the total group (bl_tot), with

Flags: "-hwp 91 -l 51 51 -sm 2 -ma 5 -ps 9.0 -pm 4.5 -q -bg 10 0 -ip 0.0034 0.00017 0.0036 0.0"

The last two groups were chosen so that each group has roughly equal statistical significance.

Analysis Procedure

Concept and Setup

The idea is to calculate a DC offset on the group by subtracting the average value of an annulus around the peak from the peak value. The flags -ps 9.0 and -pm 4.5 represent a smoothing FWHM of 9.0 arc seconds and a cut off mask radius of 4.5 arc seconds; note that these then have the same radius so that it is cut at one FWHM. The calculation of each sharp_combine point is only affected by mapped detector points with in 4.5 arc seconds.

The annulus is next set to have an inner radius of 4.5 sharp combine pixels or 10.35 arc seconds, so that no detector point can be inside the smoothing cut-off to affect both an annulus pixel and the center pixel.

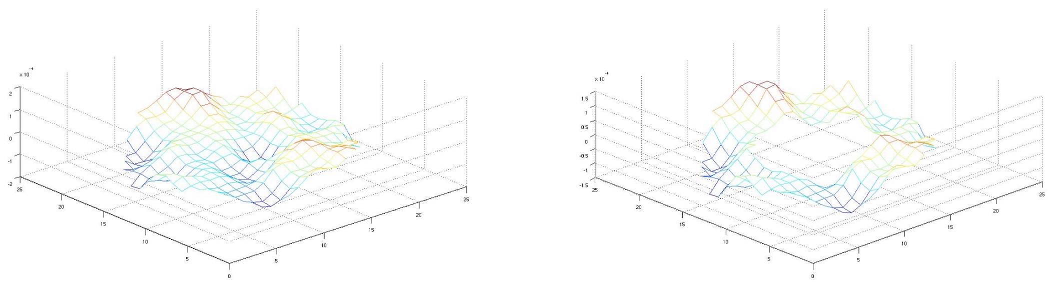

Figure 1: Q map corrected and Q map annulus.

The outer annulus radius is chosen so that the annulus has 10 times the area as the area of the mask for the center pixel calculation, so that the statistical error in the average value of annulus pixels is much lower then the error in the peak pixel value. Some simple math gives an outer radius of 8 sharp combine pixels. It is worth noting that as you move away from the center, the errors in the Q and U values start to go up very quickly, causing a trade-off between more pixels and a larger error per pixel, making a tighter annulus beneficial.

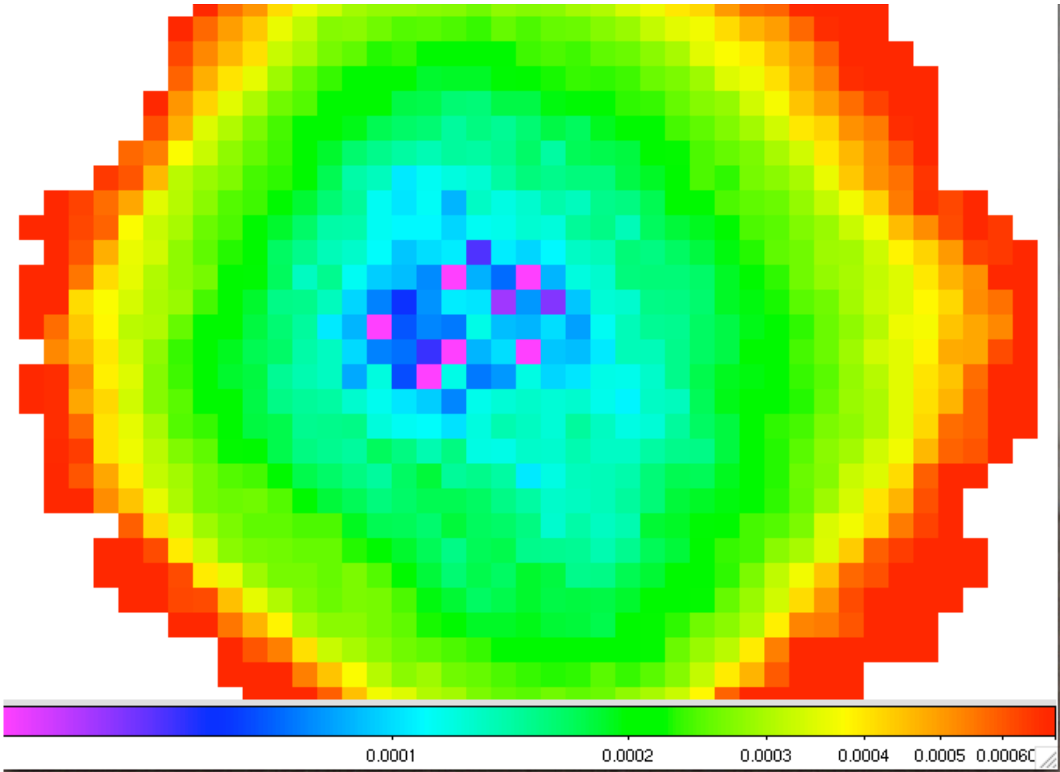

Figure 2: as can be seen the errors n Q grow very quickly with distance away from the center.

Subtraction/Correction

For each of the seven sub-groups, the total-group, and for I, Q, and U, the background DC offset is calculated from the annulus and subtracted from the center/peak value. The exact calculation is made by calculating the arithmetic mean and standard deviation from all points in the annulus, then any point that is more then 3 standard deviations away from the mean is rejected as an outlier. The mean and standard deviation is recalculated until there are no longer any outliers and those values are used (for none of the groups are there more then 2-3 outliers in an annulus.).

Some slight amount of care needs to be taken in calculating the final I, q, and u values. It is important to calculate the corrected q value from Q corrected and I corrected instead of dividing by uncorrected values.

Results

The method removes the DC offsets from the data, see table 3, and brings the sub-groups into closer agreement. This can be seen more mathematically with the reduced chi squared results in Table 1.

Table 3

	I	I corr	I err	q %	q corr	q err co	u	u corr	u err co
A	.0079	.0060	.0012	-0.01	-1.32	1.31	-0.03	-1.54	-1.54
B	.0042	.0055	.0009	-0.33	-2.11	1.15	-1.08	-0.15	-0.15
C	.0066	.0085	.0017	-1.92	-0.93	1.55	0.70	-1.18	-1.18
D	.0089	.0060	.0009	1.71	2.02	1.51	-2.73	1.30	1.30
E	.0056	.0062	.0006	-1.38	-0.37	1.56	-3.92	-0.98	-0.98

F	.0046	.0045	.0008	-4.40	-2.36	2.09	0.78	-0.72	-0.72
G	.0064	.0048	.0012	0.01	-1.04	1.54	0.07	1.91	1.91
WA		.0057		-0.13	-0.51	0.50	-1.02	-0.09	0.51
Total	.0065	.0057	.0003	-0.36	-0.80	0.49	-.092	-0.11	0.50