Results of 2 Independent Searches for a Gamma-Ray Signal from the Galactic Plane

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This is short document listing our results from an analysis of the galactic plane region. The galactic plane regions are defined in Roman's thesis. Inner Galaxy (IG) is a longitude range of 20-100 degrees. The Outer Galaxy is a is a longitude range of 140-220 degrees. The result of two independent analyzes are presented here. The data is shared and similar methods were used to estimate the background, but no code was shared beyond the standard Milagro data tools. More details from both analyses will be presented at the upcoming collaboration meeting.

1 EB Analysis

I used a direct integration method to make background skymaps for the entire sky, with an 8 hour integration time. If the detector is stopped for more than 5 seconds, the map is stopped. I also required that maps be at least 30 minutes long. This cut removes any short "test" runs.

I applied an NFIT cut of 20. Two sets of maps were generated, one with an X2 cut of 2.5 and another without an X2 cut.

To generate my galaxy maps, the contents of every 0.1 degree bin in my skymap (RA/DEC) is translated and summed into the appropriate 1 degree galactic (long/lat) bin. Then, sums over the IG and OG regions are performed, with varying widths.

My results are in the tables below for 1 year (roughly corresponding to the data in Roman's thesis) and for $\sim$2.3 years (all REC data on disk at UMD) with an X2 cut. Results from data in the $\sim$2.3 years with no X2 cut are also below.

2 AS Analysis

I also used the direct integration method to estimate background with identical cuts to the EB analysis, but with a additional theta dependent "breathing" correction, and a different criteria for identification of bad runs. The breathing correction employed is statistically equivalent to performing many independent searches through the data, each pass performing an independent analysis of a different band in theta. This has the effect of loosening the constraint that the local coordinate distribution remain constant throughout the entire 8 hour direct integration period, to demand only that the phi distribution remain constant. The application of this correction can reduce the errors in the background estimation for periods of large rapid changes in the detector's operating conditions, such as ice days, but does not seem to have a substantial effect on the this analysis.

3 Results

Below are the results of the 2 analyzes described above. The significance of the excess/deficits are estimated assuming $\sigma_B = \sqrt{Background}$. No corrections for fluctuations of background estimate or the contribution of the signal bin to the background were made.

Also included is a figure showing the latitude and longitude profile plots from EB's analysis of $\sim$2.3 years with an X2 cut. No clear indication of an excess is seen.

Table 1: Table of EB galactic plane results - 1 year X2≥2.5

Region	ON	OFF	Excess	Significance
IG ±2°	46050925	46044227.6	6697.4	1.0
IG ±5°	114815690	114800883.2	14806.8	1.4
IG ±10°	227489196	227477385.3	11810.7	0.8
OG ±2°	49751547.0	49758369.9	-6822.9	-1.0
OG ±5°	124126433	124141495.4	-15062.4	-1.4
OG ±10°	246008367	246037239.3	-28872.3	-1.8

Table 2: Table of EB galactic plane results - 2.3 year X2≥2.5

Region	ON	OFF	Excess	Significance
IG ±2°	133575148	133550863	24284.7	2.1
IG ±5°	332992429	332958783	33645.2	1.8
IG ±10°	659632567	659609455	23111.9	0.9
OG ±2°	143300818	143322915	-22097.6	-1.8
OG ±5°	357538069	357594009	-55940	-2.9
OG ±10°	708681582	708783614	-102032.8	-3.8

Table 3: Table of EB galactic plane results - 2.3 year No X2 cut

Region	ON	OFF	Excess	Significance
IG ±2°	1191087316	1190978538	108778	3.2
IG ±5°	2970462360	2970218968	243391	4.5
IG ±10°	5892011575	5891664028	347546	4.5
OG ±2°	1282059529	1282243272	-183743	-5.1
OG ±5°	3198868777	3199343696	-474919	-8.4
OG ±10°	6343641214	6344487330	-846116	-10.7

Table 4: Table of AS galactic plane results - 1 year X2≥2.5

Region	ON	OFF	Excess	Significance
IG ±2°	44178905	44175818.9	3086.1	0.5
IG ±5°	110102668	110096249.1	6418.9	0.6
IG ±10°	218196081	218198260.4	-2179.4	-0.1
OG ±2°	47958347	47962932.6	-4585.6	-0.7
OG ±5°	119615937	119629573.2	-13636.2	-1.2
OG ±10°	237074387	237104401.5	-30014.5	-1.9

Table 5: Table of AS galactic plane results - 2.3 year X2≥2.5

Region	ON	OFF	Excess	Significance
IG ±2°	125268199	125243615.0	24584.0	2.2
IG ±5°	312148653	312111787.3	36865.7	2.1
IG ±10°	618507210	618460768.2	46441.8	1.9
OG ±2°	134217254	134224376.1	-7122.1	-0.6
OG ±5°	334772373	334797199.2	-24826.2	-1.4
OG ±10°	663563932	663614344.4	-50412.4	-2.0

Table 6: Table of AS galactic plane results - 2.3 year No X2 cut

Region	ON	OFF	Excess	Significance
IG ±2°	1131395269	1131301659	93609	2.8
IG ±5°	2820572018	2820380919	191099	3.6
IG ±10°	5595799060	5595567172	231888	3.1
OG ±2°	1216614503	1216700223	-85720	-2.5
OG ±5°	3034744265	3034994141	-249876	-4.5
OG ±10°	6018242199	6018714643	-472444	-6.1

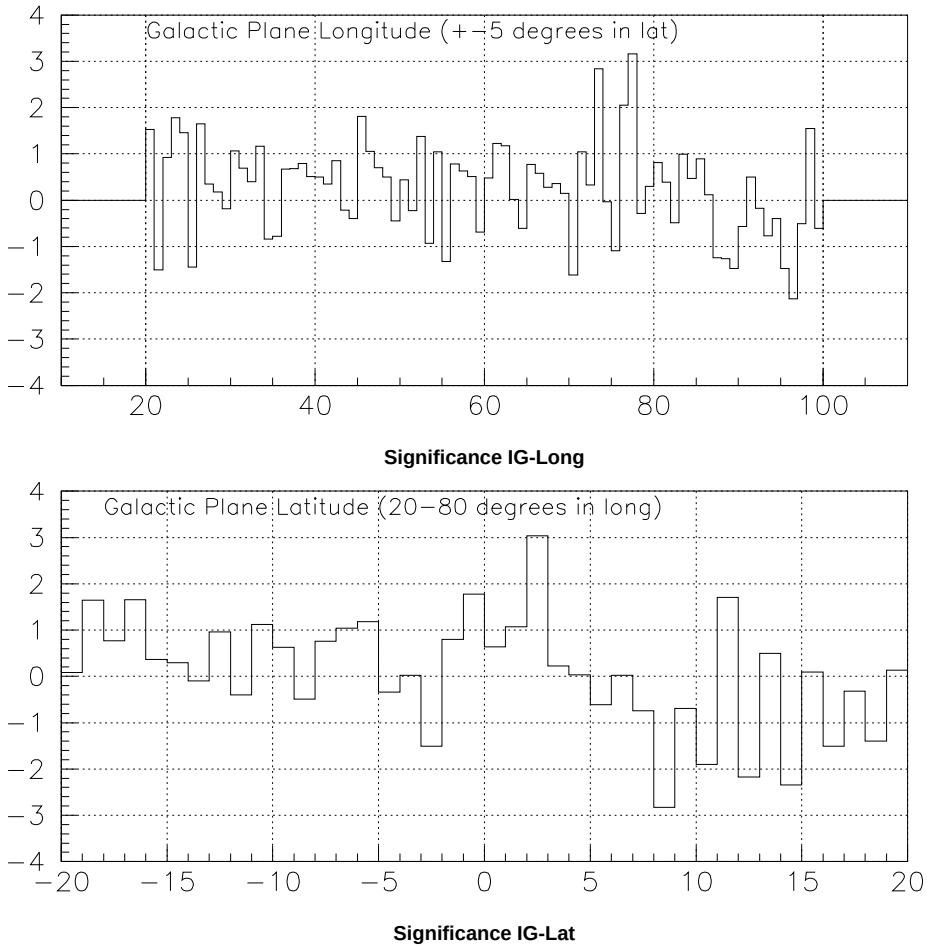

Figure 1: Latitude and longitude profiles of the IG. The profile in longitude is made by summing ±5 degree bands in latitude. The profile in latitude is made by summing bands of 20-80 degrees in longitude