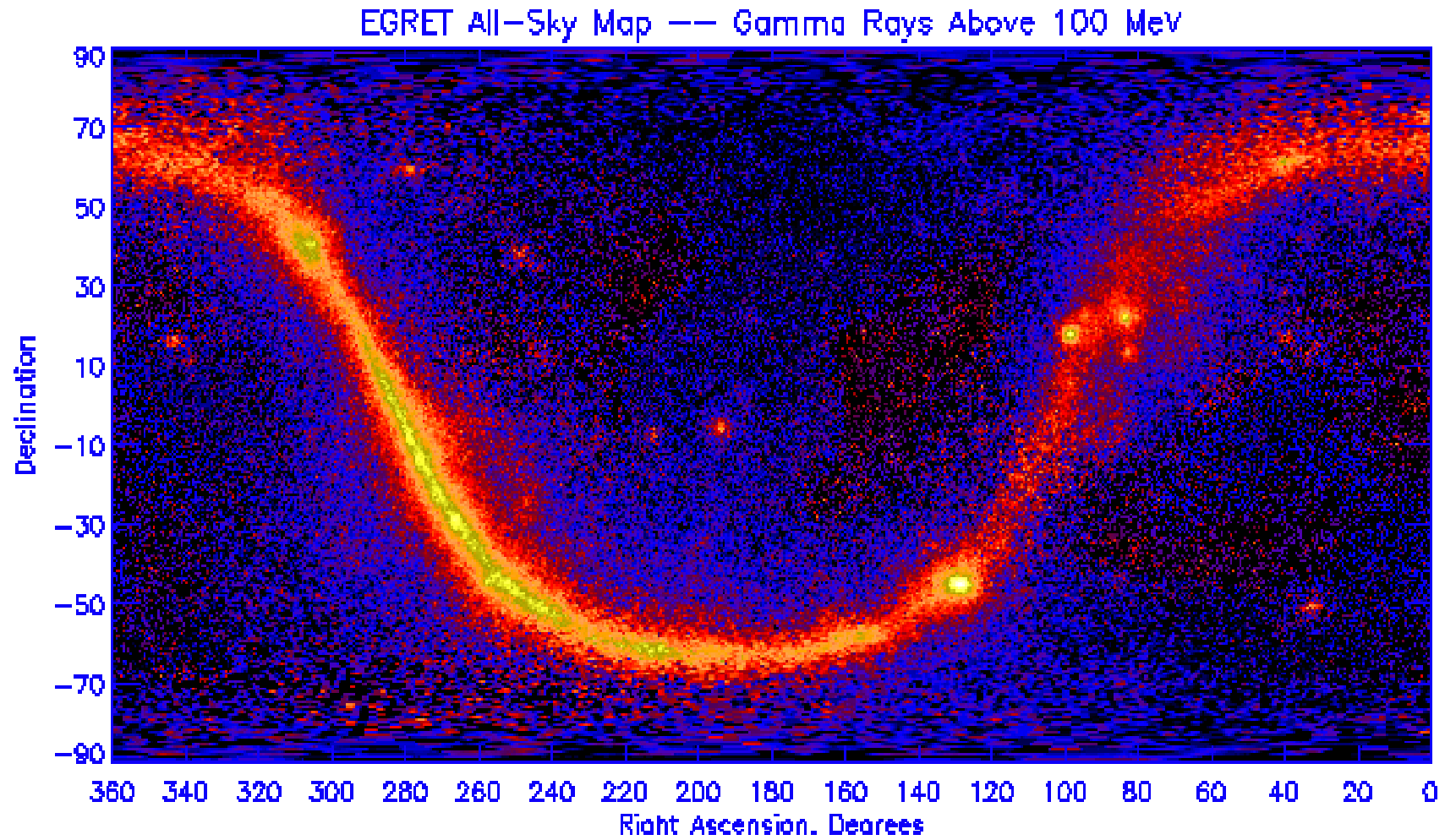


Search for a Galactic Plane Signal

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Milagro March 2003 Meeting



Purpose

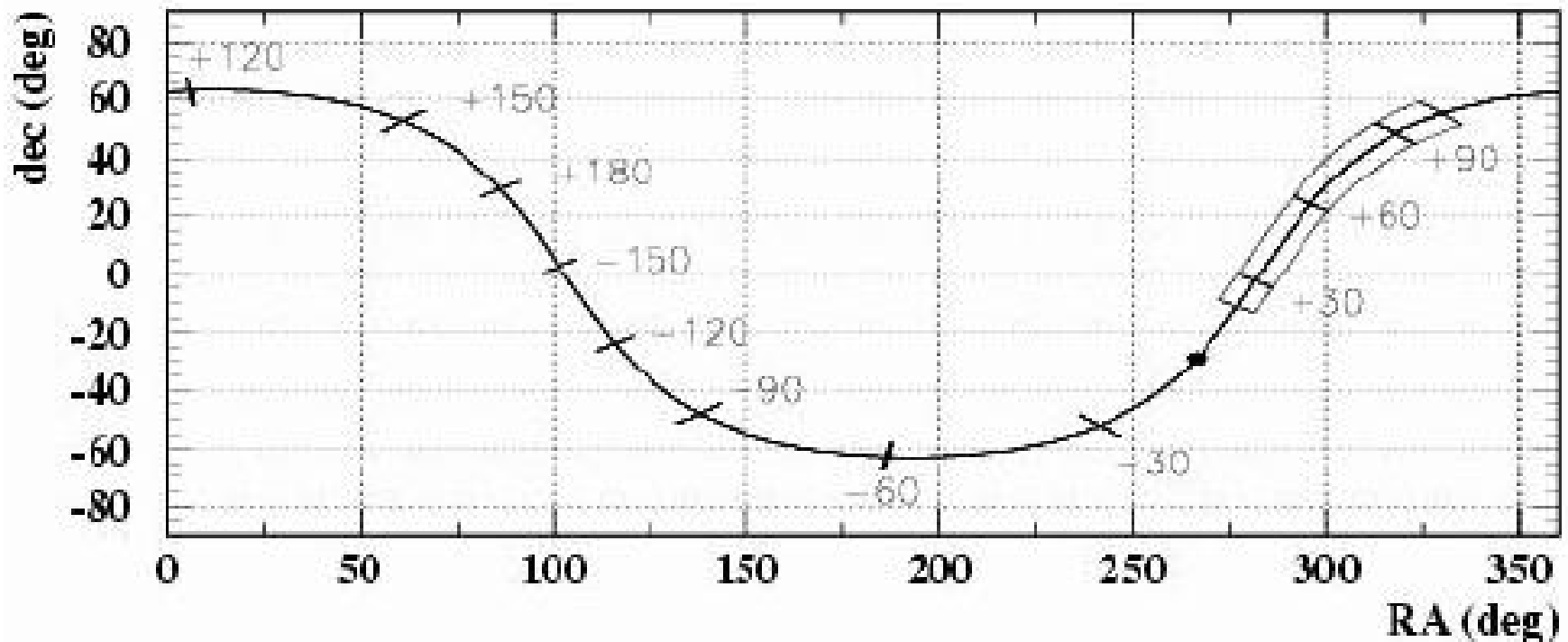
- Provide an alternate analysis in the search for emission from the region of the galactic plane.
 - Two time periods considered:
 - Same data period as Roman's result
 - Extended time period, covering ~2.3 years
 - Look for systematics...
 - Simulated skymap and emission from galaxy
 - Simulate effects of breathing.
- Andy also has done an analysis.

What I did...

- I generated skymaps using the method of direct integration. (from Long Burst code)
 - 8hr integration time.
 - Corrected binning (int vs. rintf())
 - 0.1 degree binning in RA/Dec
- Each 0.1 degree bin in RA/Dec was translated into the appropriate 1.0 degree bin in galactic coordinates.
 - Sums made over IG and OG regions

Galactic Regions

- Galactic regions taken using Roman's definitions:
 - Inner Galaxy (IG): Longitude 20-100 degrees
 - Outer Galaxy (OG): Longitude 140-220 degrees
 - Widths of +/- 2, +/- 5, +/- 10 considered.

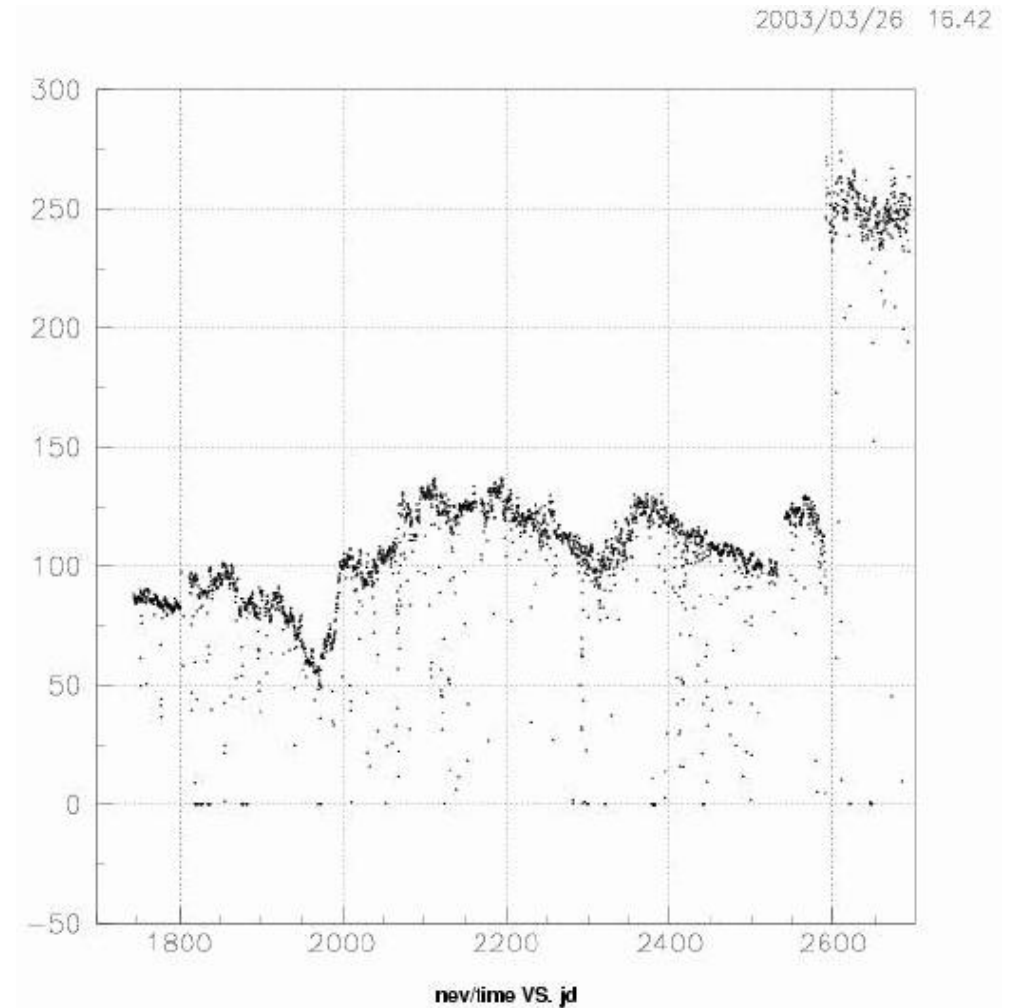


Data sets used

- Two data sets:
 - Both start when X2 went online.
 - Andy's Zenith align performed, bad time/date events removed, NFIT cut of 20.
 - No zenith “breathing” correction made
 - 1 year of data
 - Roughly corresponds to data in Roman's thesis for ease of comparison
 - JD: 1746 - 2170 (Runs: 2386-3279, July 00- Sept 01)
 - 352.2 days livetime after map selection
 - 2.3 years of data
 - JD: 1746 – 2694 (Runs: 2386-4841, July 00- Feb 2003)
 - 808.4 days livetime after map selection

Map Selection

- Detector status vector saved with each map, used to remove periods of unstable operation.
 - Map > 30 minutes
 - $50 < \text{SaveRate} < 300$ Hz
 - RawRate > 1000 Hz
 - $80 < \text{AvgNHitAS} < 150$
 - Badclock rate < 0.2 Hz



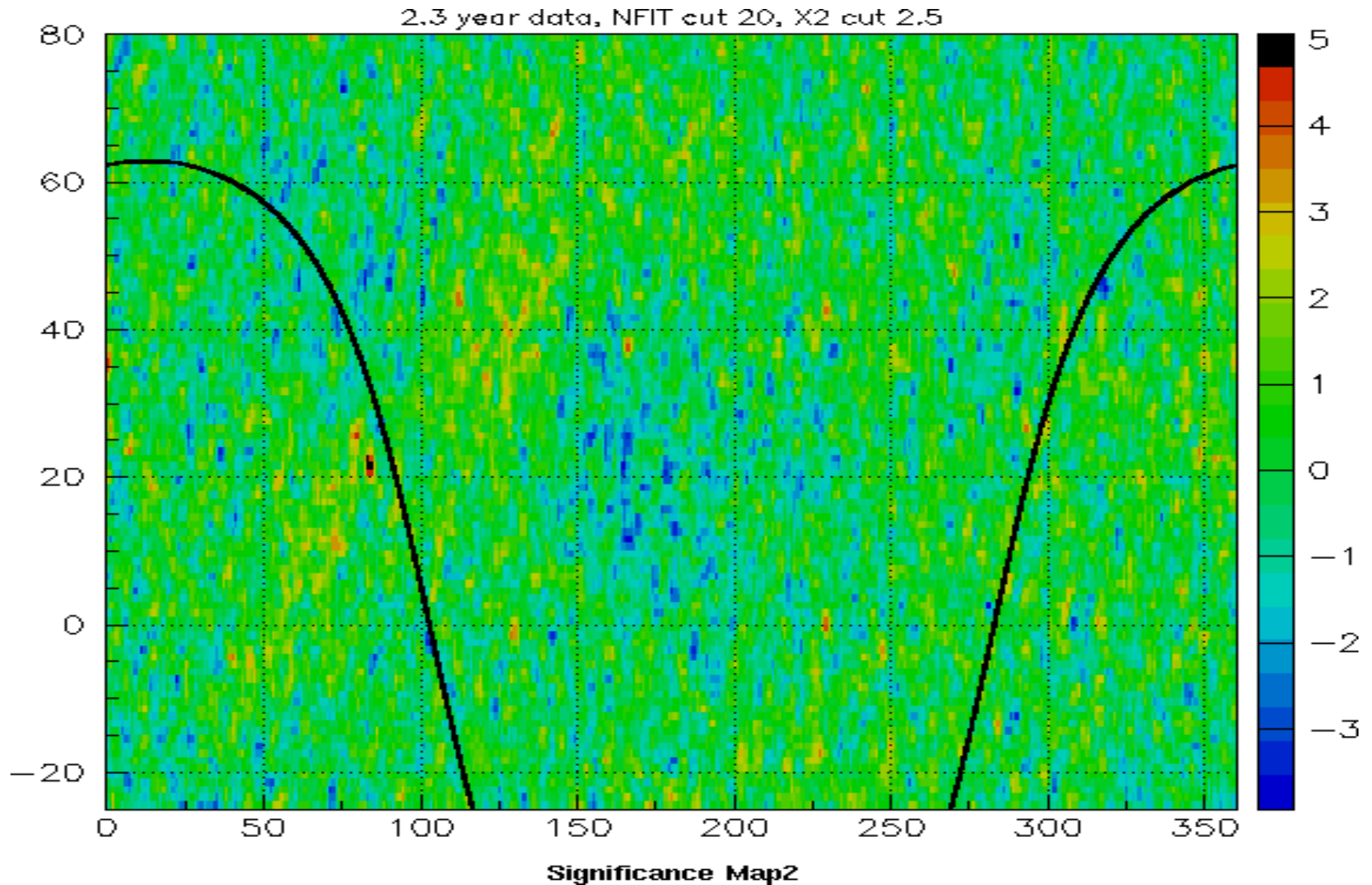
IG Numerical Results- Region Sum

Region	On	Off	Excess	Sigmas
2.3 year, X2>2.5 cut				
IG +/-2 deg	128477128	128447642	29485	2.6
IG +/-5 deg	320309634	320267886	41748	2.3
IG +/-10 deg	634699036	634671308	27727	1.1
1 year, X2>2.5 cut				
IG +/-2 deg	43473321	43468307	5013	0.8
IG +/-5 deg	108404067	108386611	17455	1.7
IG +/-10 deg	214832227	214818655	13571	0.9
2.3 year, No X2 cut				
IG +/-2 deg	1125913954	1125785730	128223	3.8
IG +/-5 deg	2807975551	2807728913	246637	4.6
IG +/-10 deg	5570309343	5569955183	354159	4.7

OG Numerical Results- Region Sum

Region	On	Off	Excess	Sigmas
2.3 year, X2>2.5 cut				
OG +/-2 deg	134503435	134525478	-22043	-1.9
OG +/-5 deg	335631243	335689223	-57980	-3.2
OG +/-10 deg	665587016	665682392	-95376	-3.7
2.3 year, No X2 cut				
OG +/-2 deg	1186789822	1186949370	-159548	-4.6
OG +/-5 deg	2961371074	2961741410	-370336	-6.8
OG +/-10 deg	5873819673	5874478699	-659026	-8.6

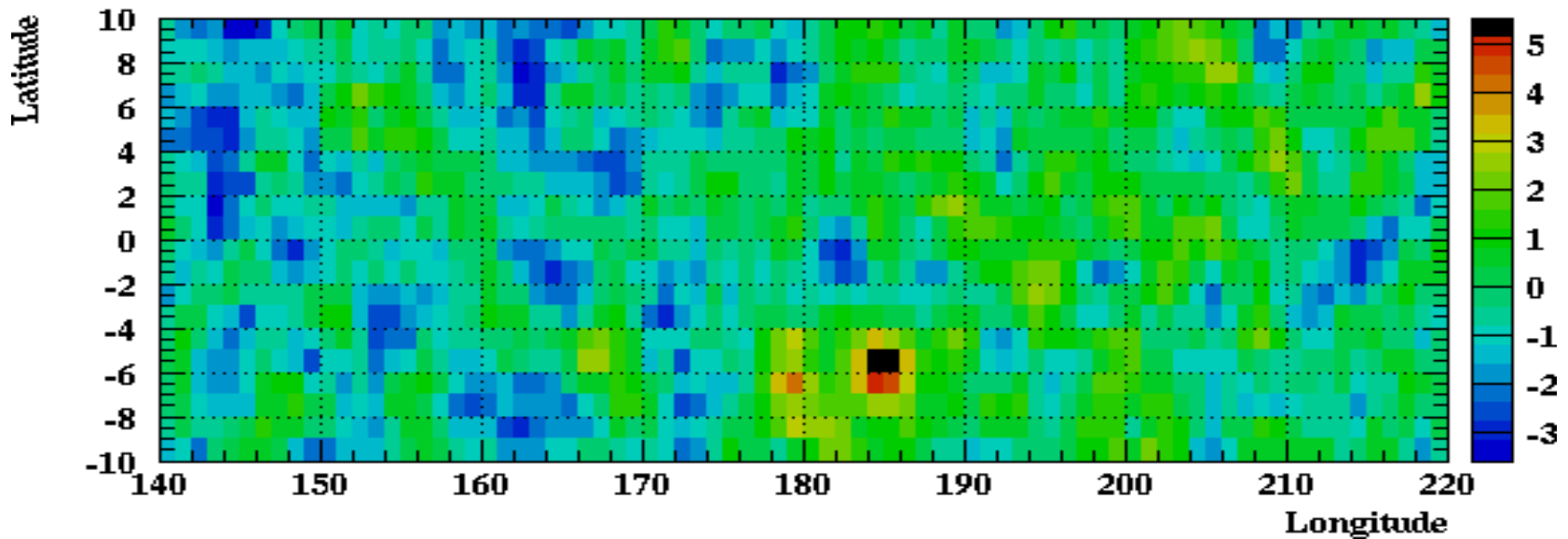
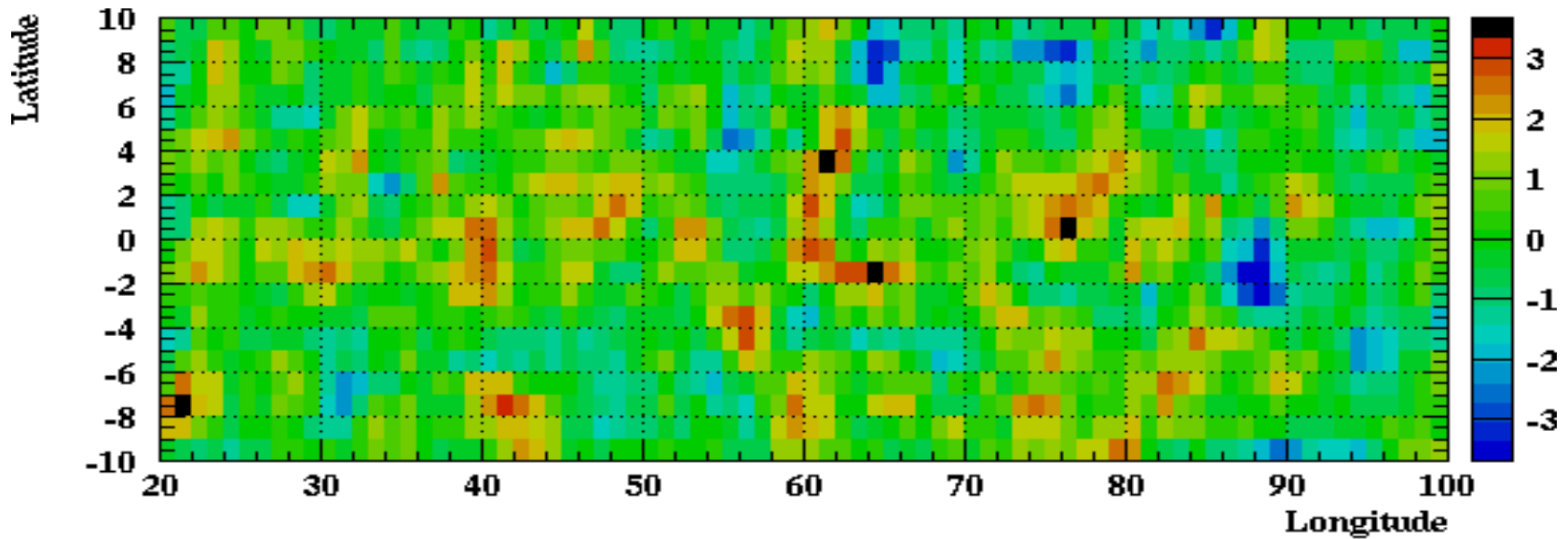
My SkyMap- Running Hot and Cold



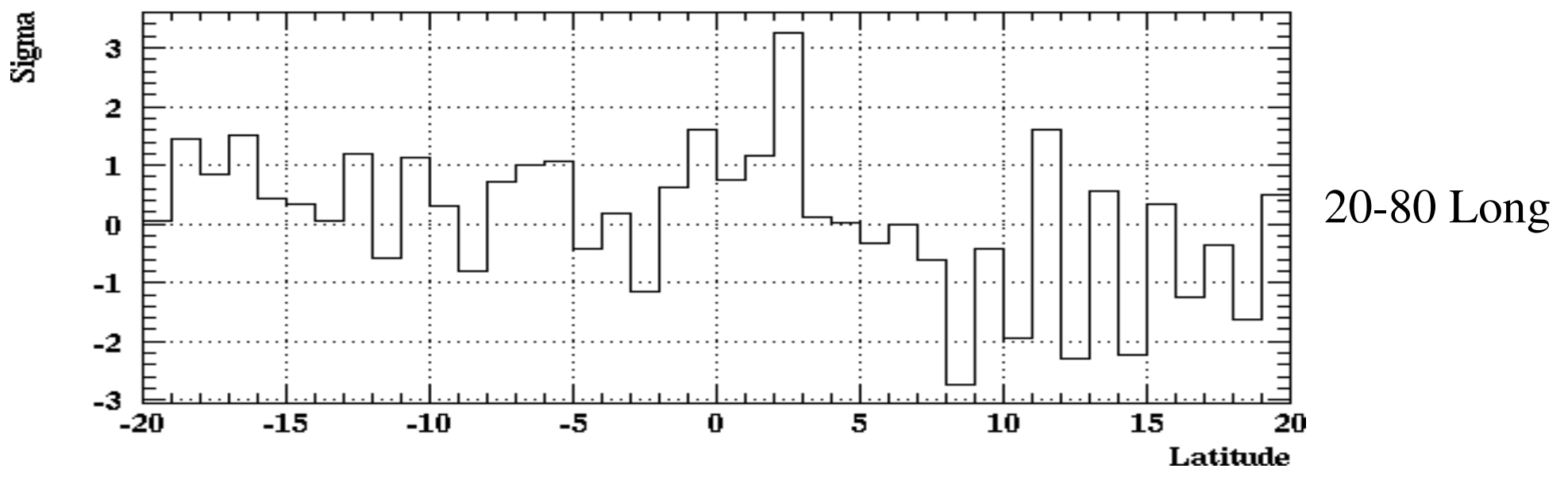
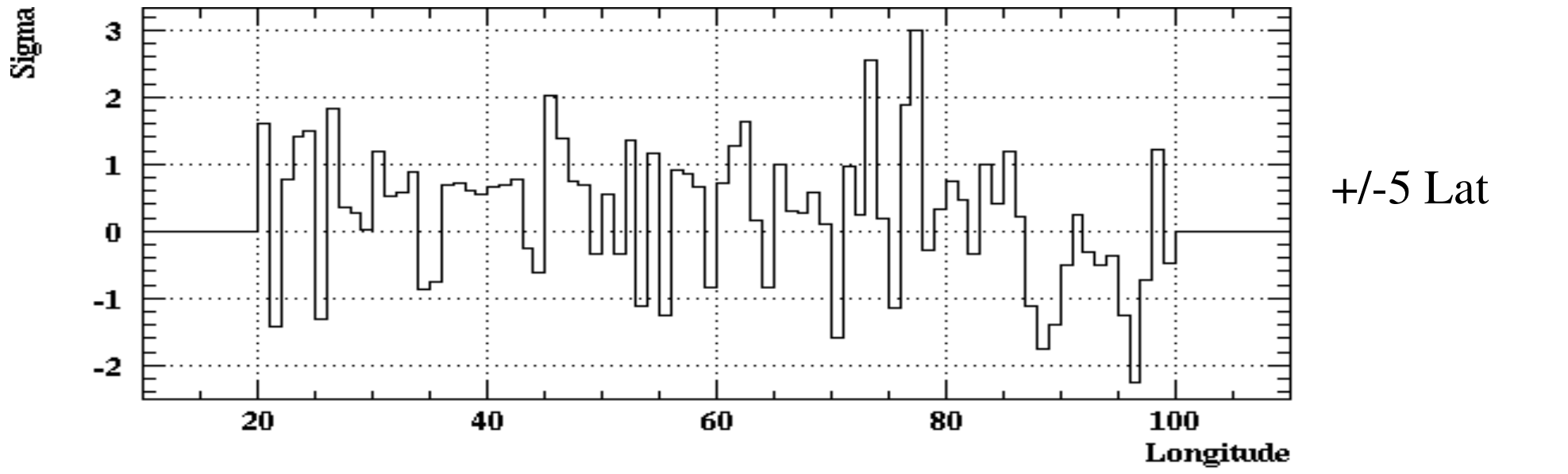
Large Anisotropies seen....

- SkyMap seems to have large regions of excesses and deficits visible with 8hr integrations.
 - IG galaxy region seems to be in a relatively stable area
 - OG region spans a large “cold” region
- Without an X2 cut, excesses/deficits are larger
 - Andy will talk some about this next.

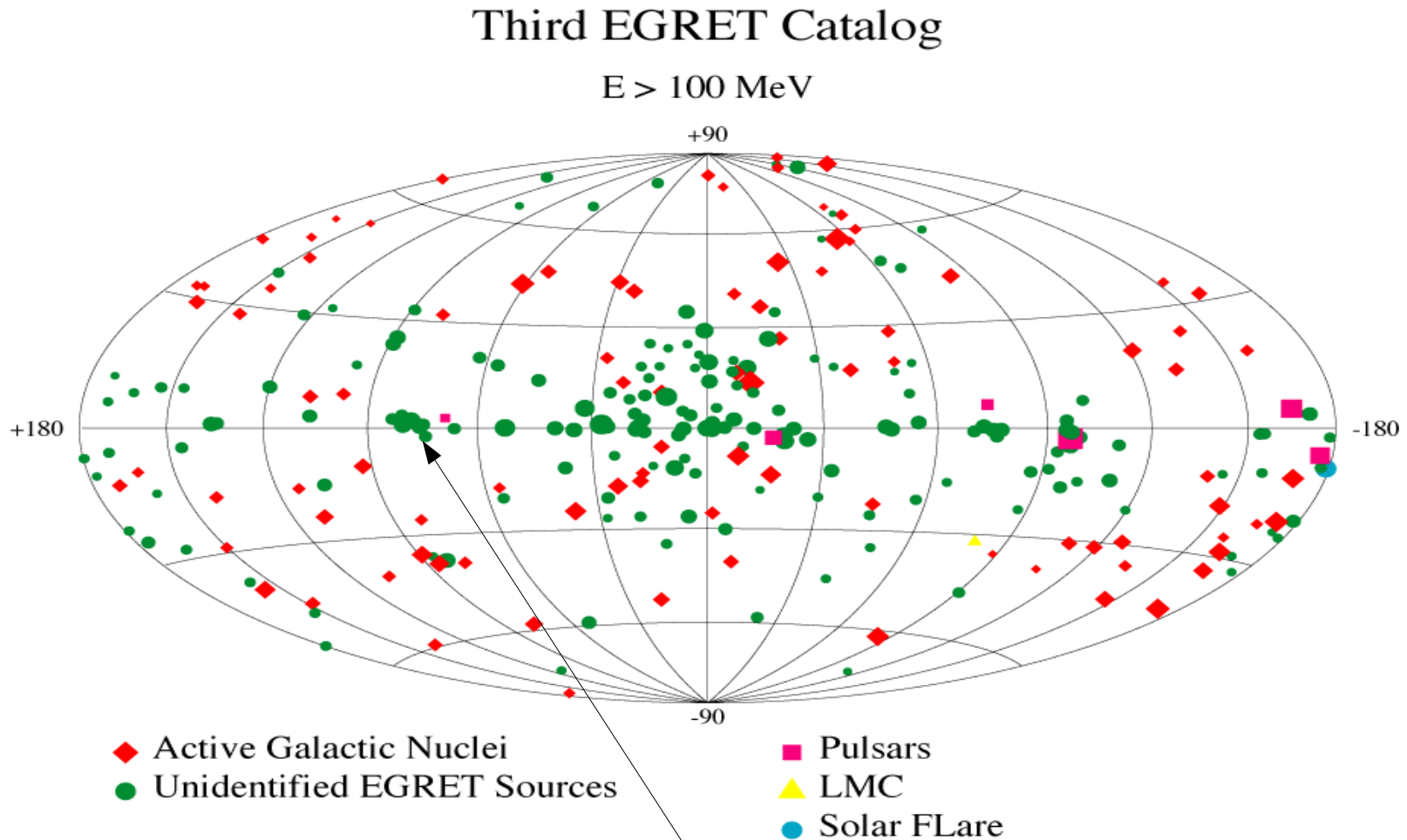
IG and OG regions (3 deg. sums)



IG Latitude/Longitude Projections



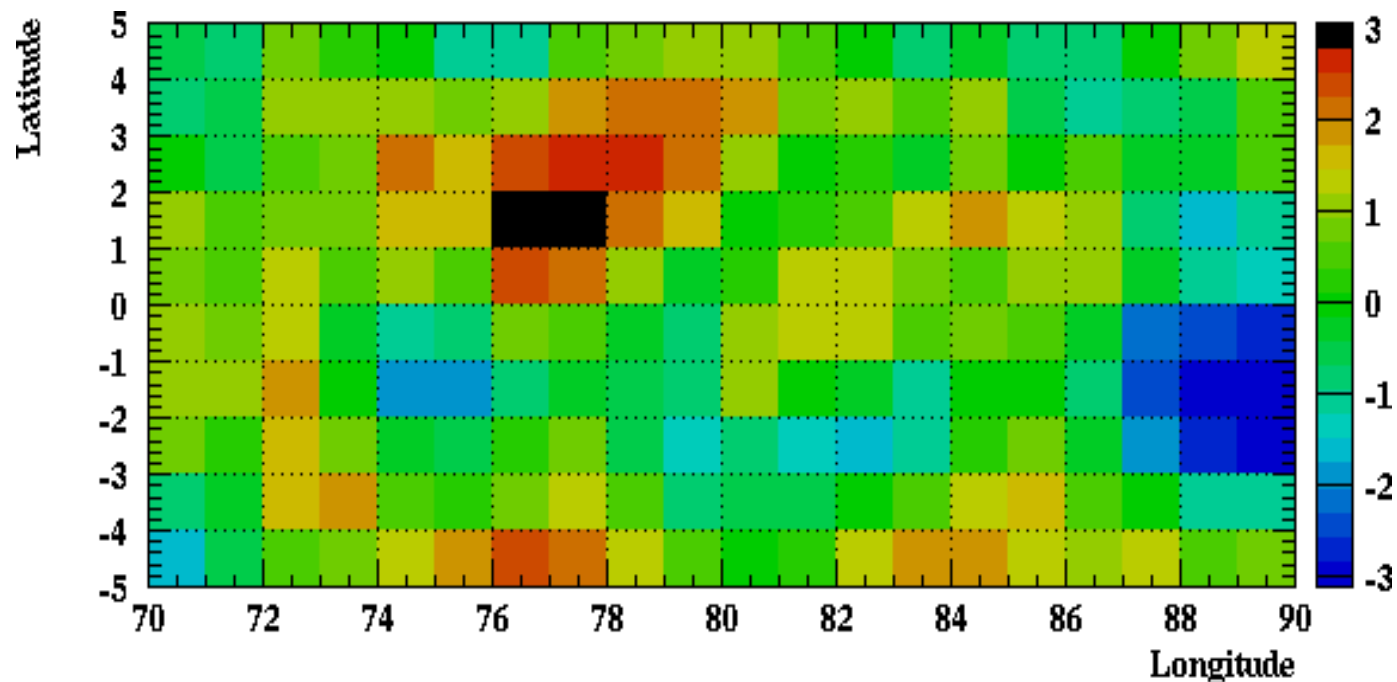
What about a single, smaller region?



Cygnus region
(excess seen in Egret data above 10GeV)

Cygnus region results

- Long: 70-90 degrees Lat: +/- 2 degrees
 - On: 52908200 Off: 52905891
 - Excess: 2308 Sigma: 0.3
- Long 70-90 degrees Lat: +/- 5 degrees
 - On: 131703720 Off: 131688653
 - Excess: 15066 Sigma: 1.3



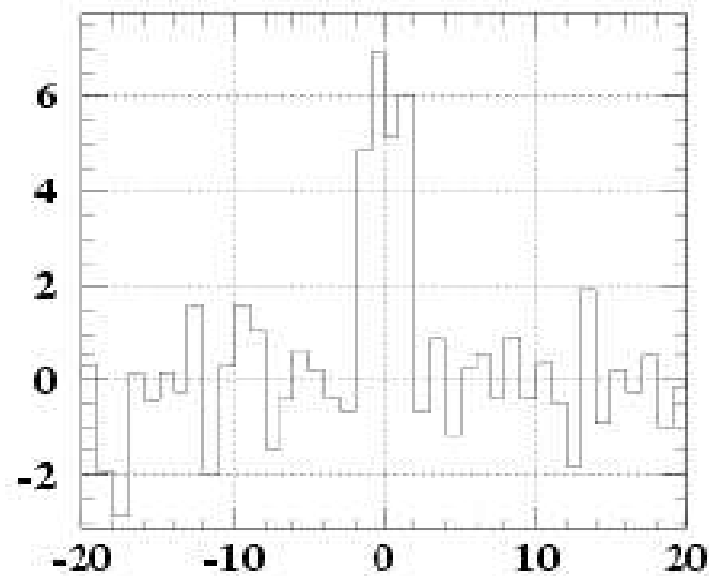
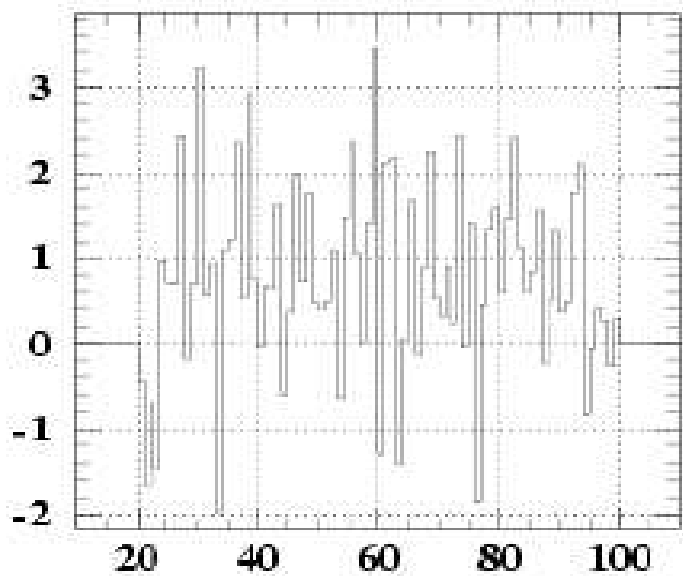
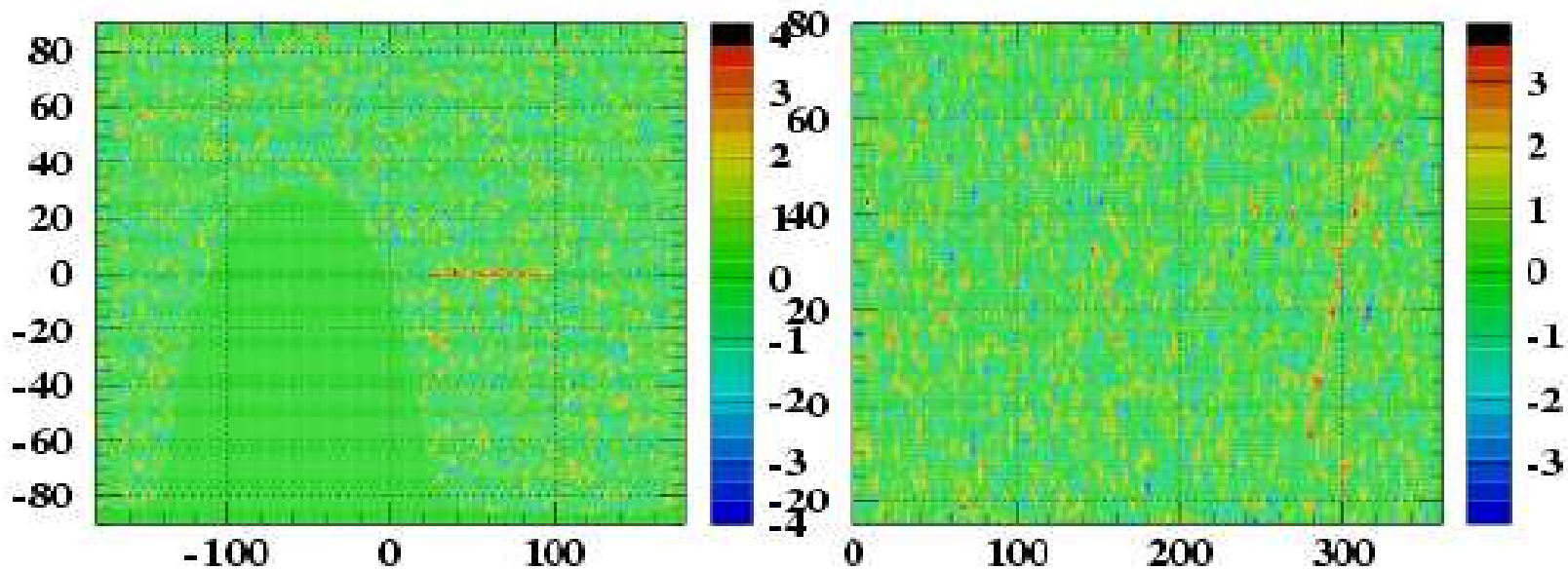
Sky Map Simulations

- Since no significant excess in the GP was found, but other excesses are seen, I thought it would be wise to investigate the method (direct integration) to make sure it would be sensitive to a signal and not introducing any excesses/deficits.
- Therefore I simulated the sky:
 - Throw background events on a \cos^5 distribution in zenith and flat in azimuth.
 - Random times during the day, and random days in a year. Find RA/Dec, then feed this to the Skymap.
 - Added a ~ 5 sigma/year uniform emission from IG.
 - Added a significant (2%) Diurnal variation to the bkg.

SkyMap Simulations II

- If only background is simulated, no large scale anisotropies are seen in skymaps.
- IG signal events added are recovered within the simulated statistics. A small signal loss is found from not excluding the signal area in background calculation ($\sim 5\%$).
- The presence of extreme diurnal variations does not mask galactic plane signal when looking at a full year of data.

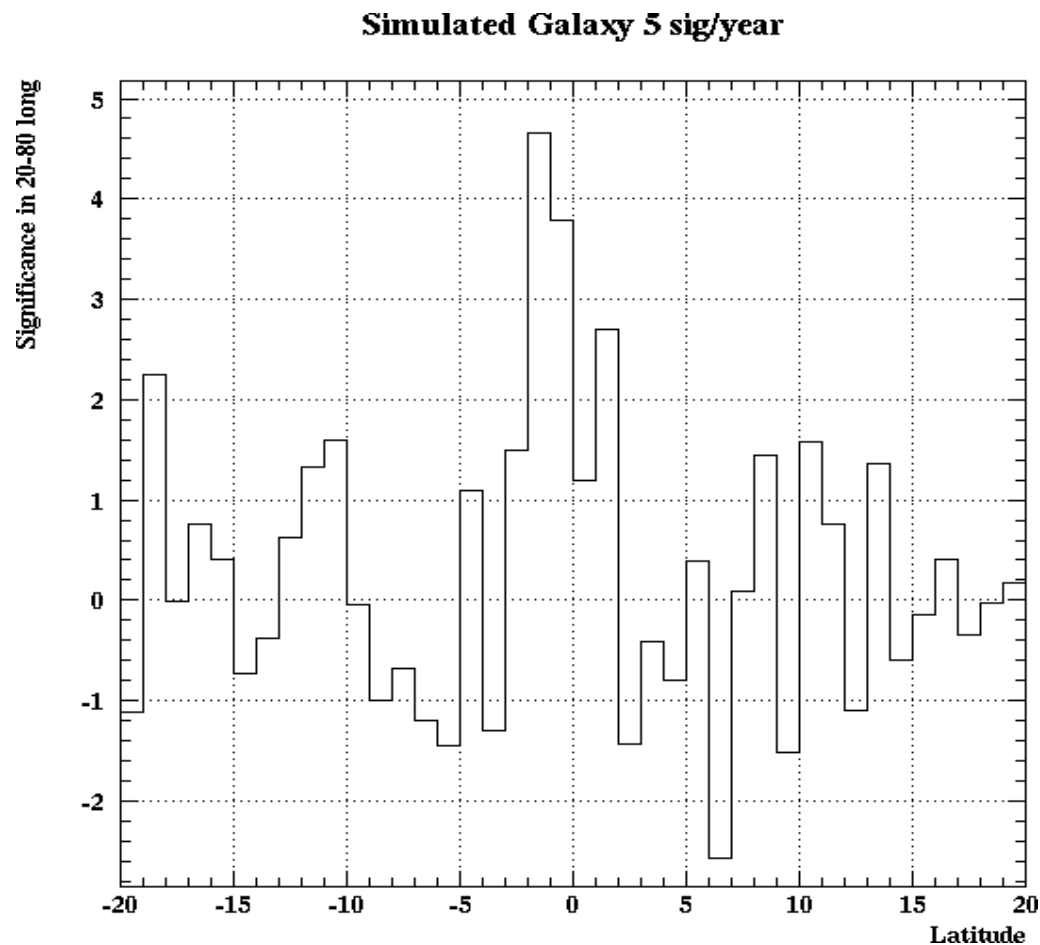
Simulated IG Results



Note: This is ~ 12 sigma/yr

A more realistic simulation

- A ~ 5 sigma/year uniform emission added
- Diurnal breathing included ($\sim 2\%$ level)



Conclusions

- No significant GP signal is found
- Evidence for large anisotropies in background seem to be found.
- Future:
 - Resolve differences in results from other GP analyses in the collaboration.
 - Add more data as available.
 - Egret sources in GP region. Do we see them? (Liz)
 - Additional statistics for my simulation of signal and breathing.
 - Understand background, and make a more sensitive search