

Milagro Collaboration Meeting
University of Maryland
March 27-28, 2003

Galactic Plane: Anti-X2 Study.

Peter Nemethy and Roman Fleysher

- Gamma = x2 (RF thesis);
- Hadron = AX2 = anti-X2 (new study)

Identical Analysis = Thesis Method on both sides of cut.
Data set = 14months of thesis.

Technical Problems of Memory and Alloc: AX2 running done as 3 independent runs by deterministic event selection, then summed.

- Run 1 (evt. 1,4,7...)
- Run 2 (evt. 2,5,8...)
- Run 3 (evt. 3,6,9...)

Expectations: X2 vs AX2.

Choice of Variables:

For Color Maps SIGNIFICANCE is good display.

But For Quantitative Comparisons, work with:

$$FR = (SIG - BG) / BG$$

Normalizes to exposure.

Expected Gamma FR Signal on two sides of cut:

MC: Dimensionless effective area ratio (G/H) is 4.5.

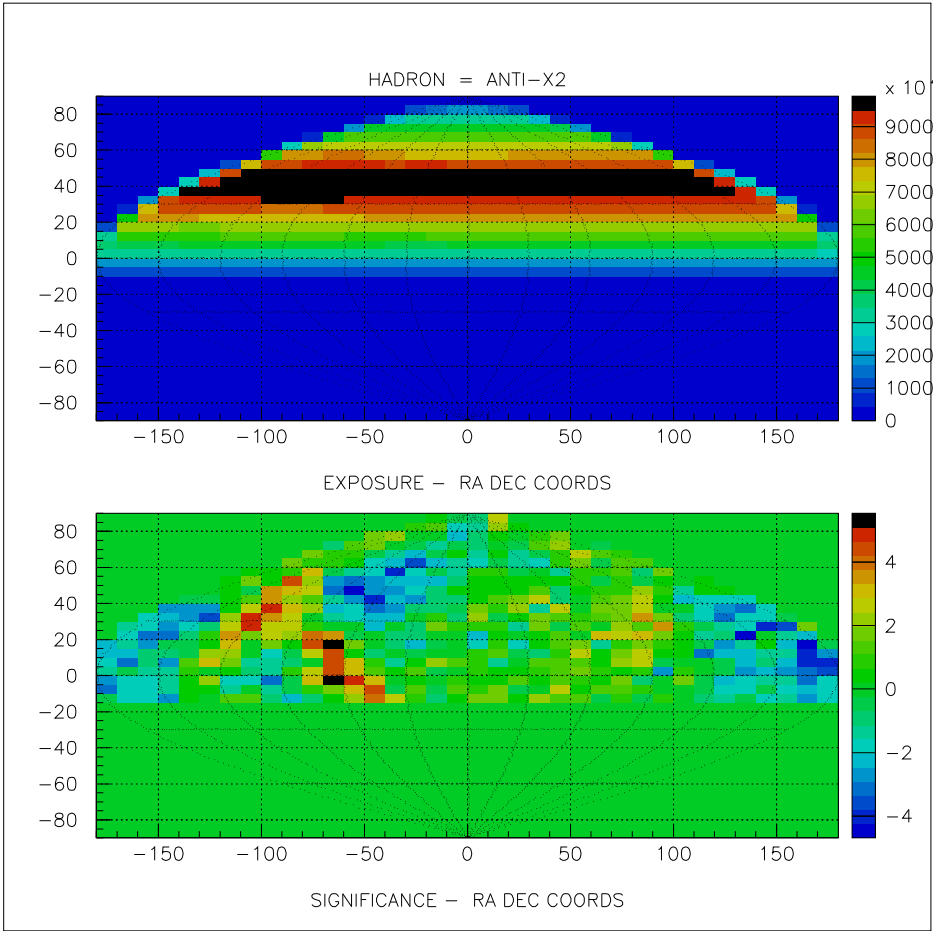
X2: keep 10% of BG and 45% of gammas.

AX2: keep 90% of BG and 55% of gammas.

Therefore, expected for a finite gamma signal:

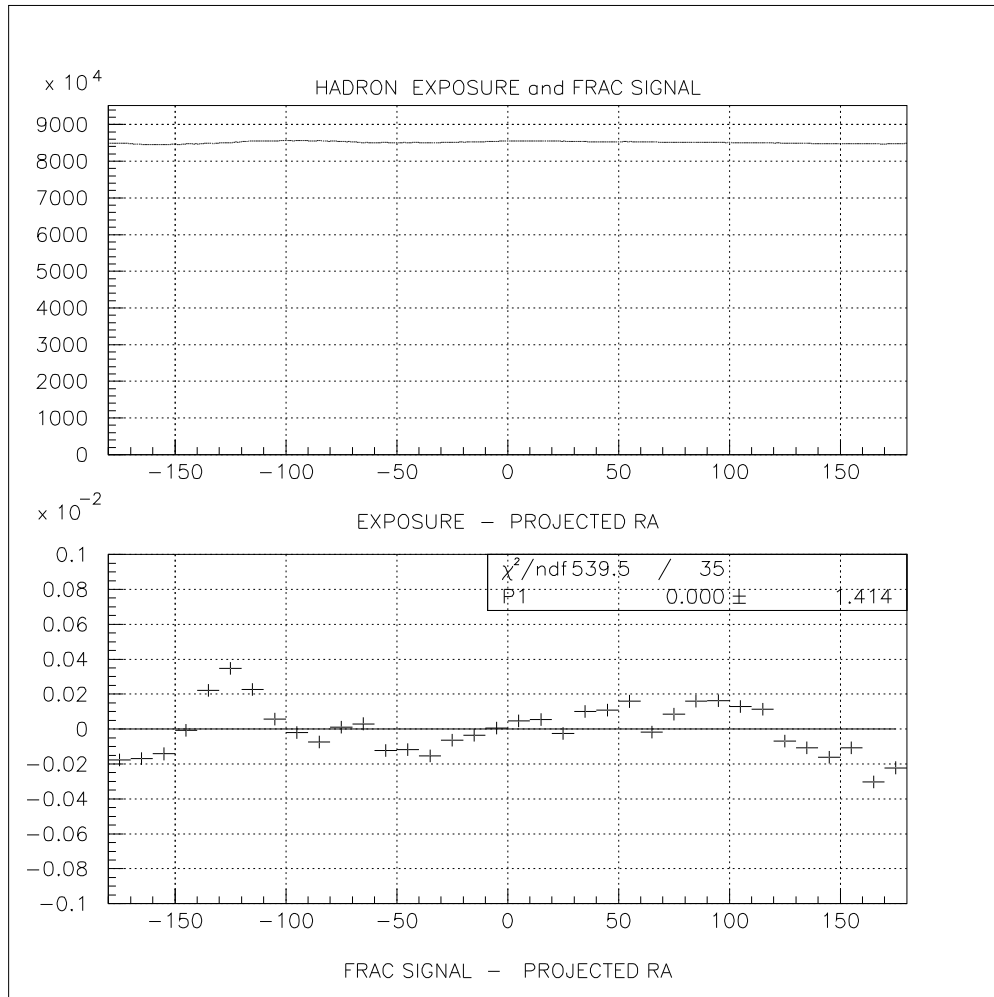
$$FR(\text{gamma}, AX2) = FR(\text{gamma}, X2) / 7.4$$

RA- DEC MAPS.



With 10 Times Statistics:
Clearly See Large-angular-scale Systematic Effects.

Quantitative: FR signal in RA .



Coherent large-angular-scale FR signals.
(Peaks same position as Erik's.)

ORIGIN of LARGE SCALE STRUCTURE?

Two Possible Origins:

A. Neglected Diurnal Effects.

B. Neglected Cosmic Ray Anisotropy in Bg.

Tool: the “Phileas Todd Effect”

(Ref. J. Verne: “Around the World in 80 days.”)

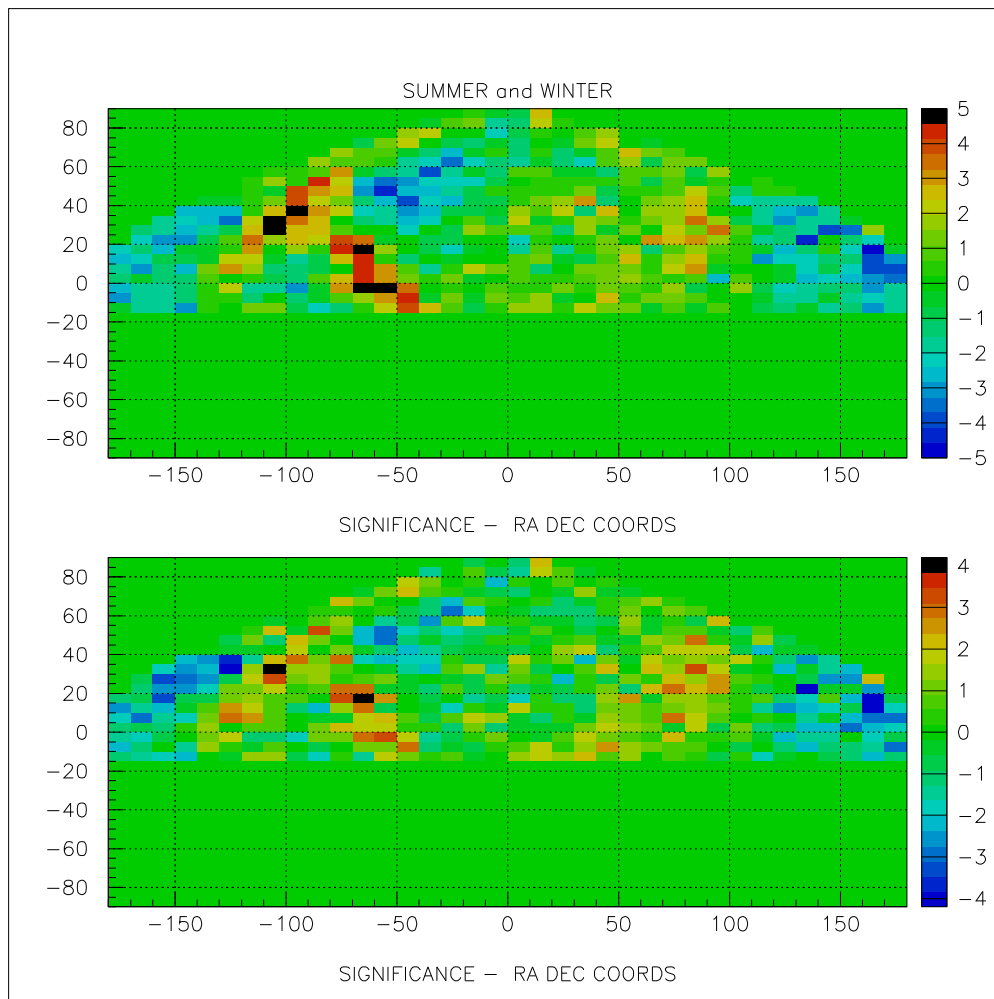
In one year Solar Day shifts 360deg wrt. Sidereal Day.

Examine Summer vs Winter in RA.

For possibility A.: Phase Shift by 180deg.

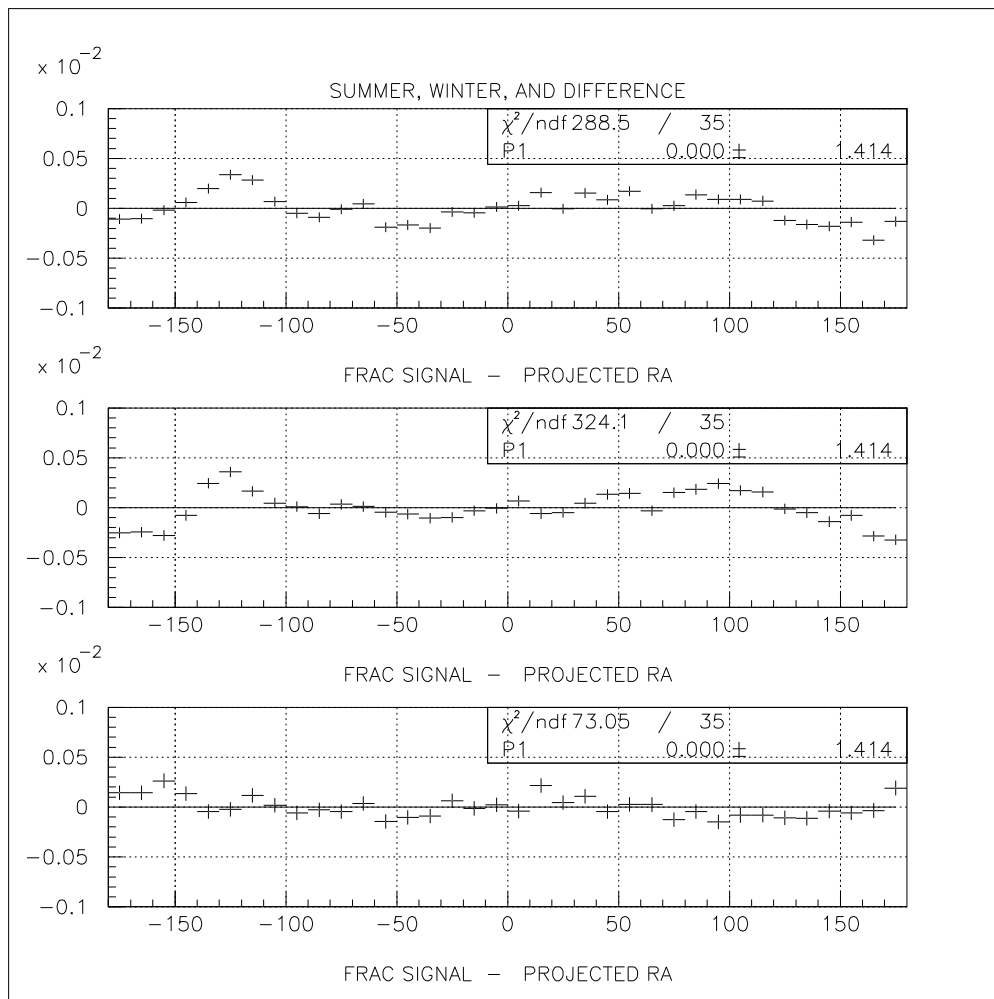
For possibility B.: Stay in Phase.

ORIGIN of LARGE SCALE STRUCTURE?



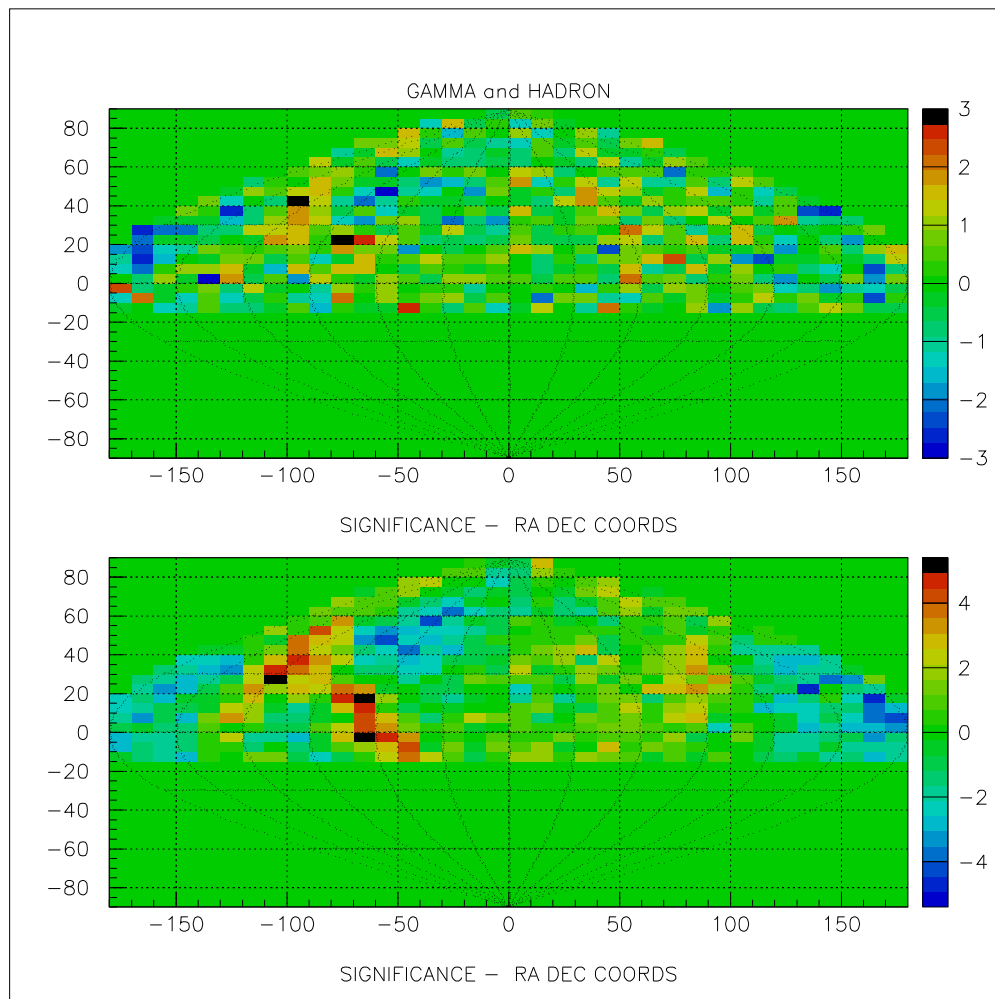
Summer and Winter have same dominant structure.

ORIGIN of LARGE SCALE STRUCTURE?



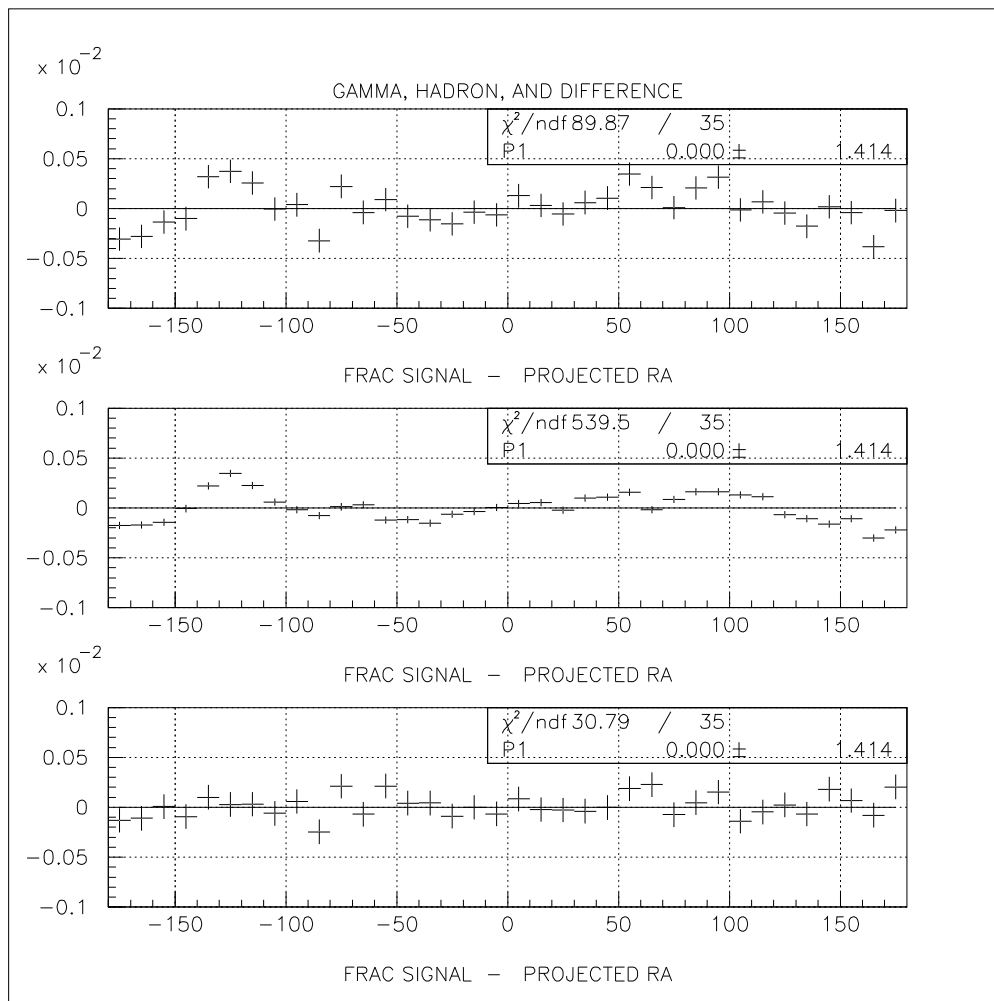
Summer and Winter have same dominant structure.
Dominant Systematic = neglected Anisotropies.

X2 vs AX2 Comparisons: RA DEC Map



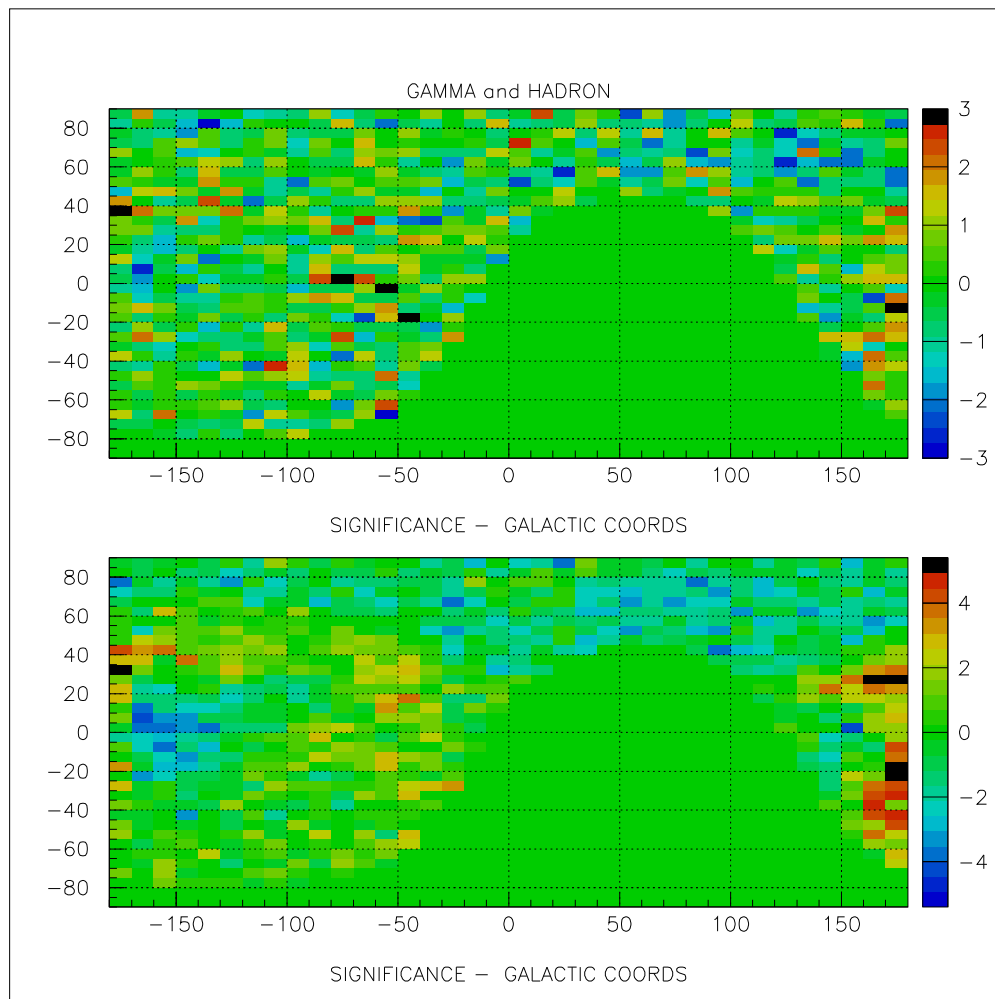
X2 and AX2 have similar dominant structure.

X2 vs AX2 Comparisons: RA



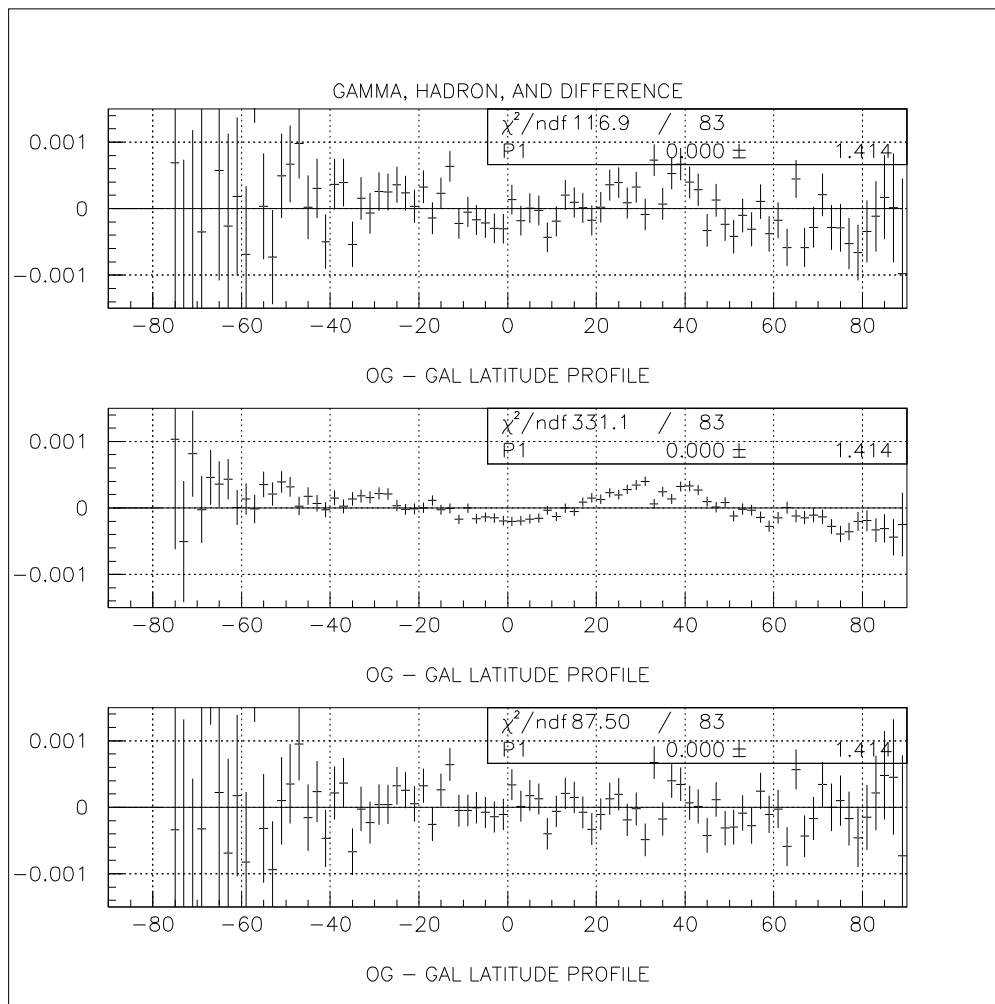
X2 and AX2 have similar dominant structure.

X2 vs AX2 Comparisons: Gal Coord Map

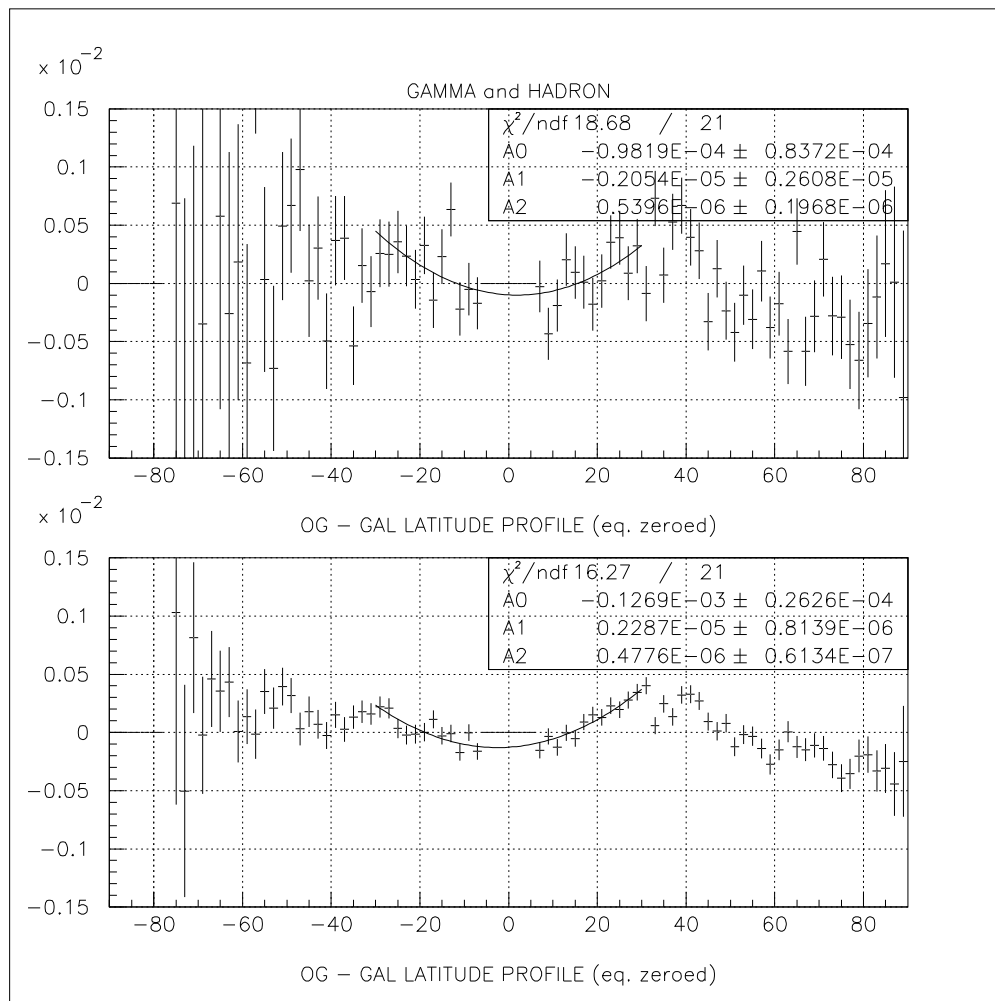


No Inner Galaxy Ridge in AX2.
Most structure is in Outer Galaxy.

X2 vs AX2 Comparisons: Gal Latitude Profiles

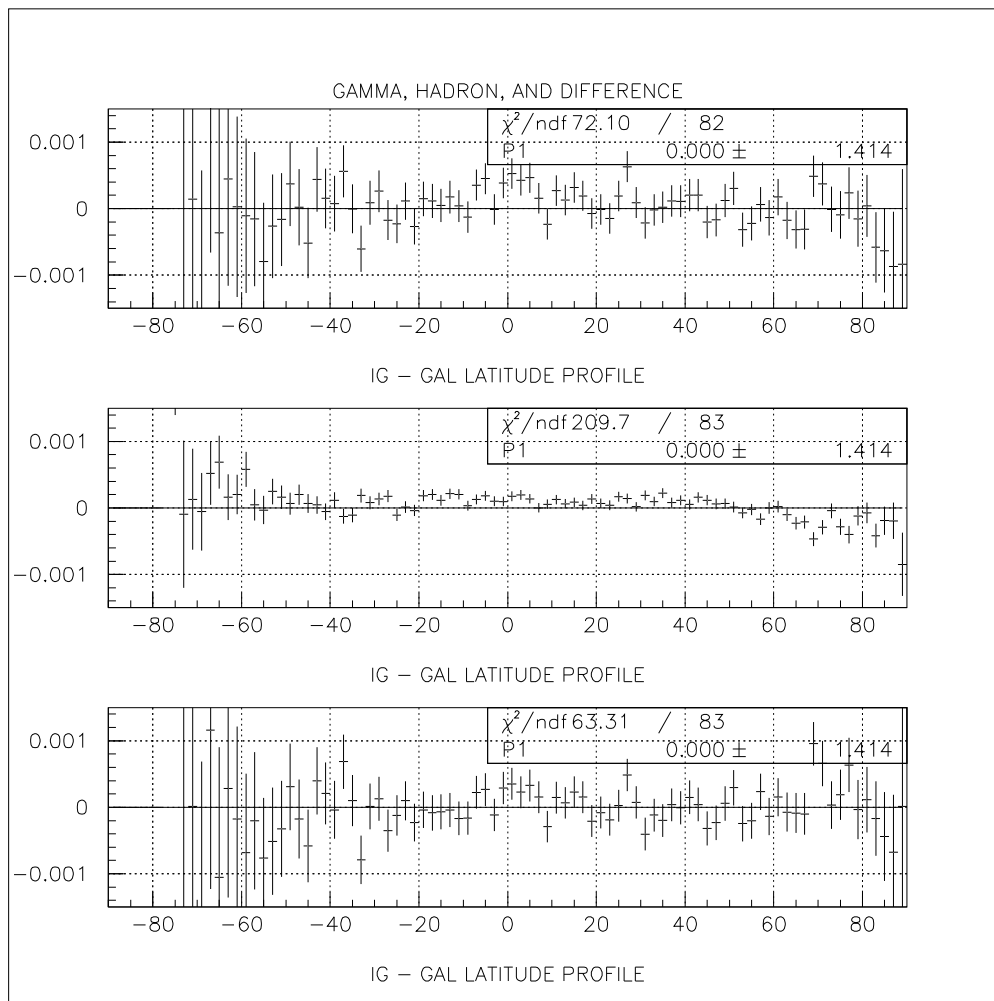


X2 vs AX2 Comparison: Gal Latitude Profiles

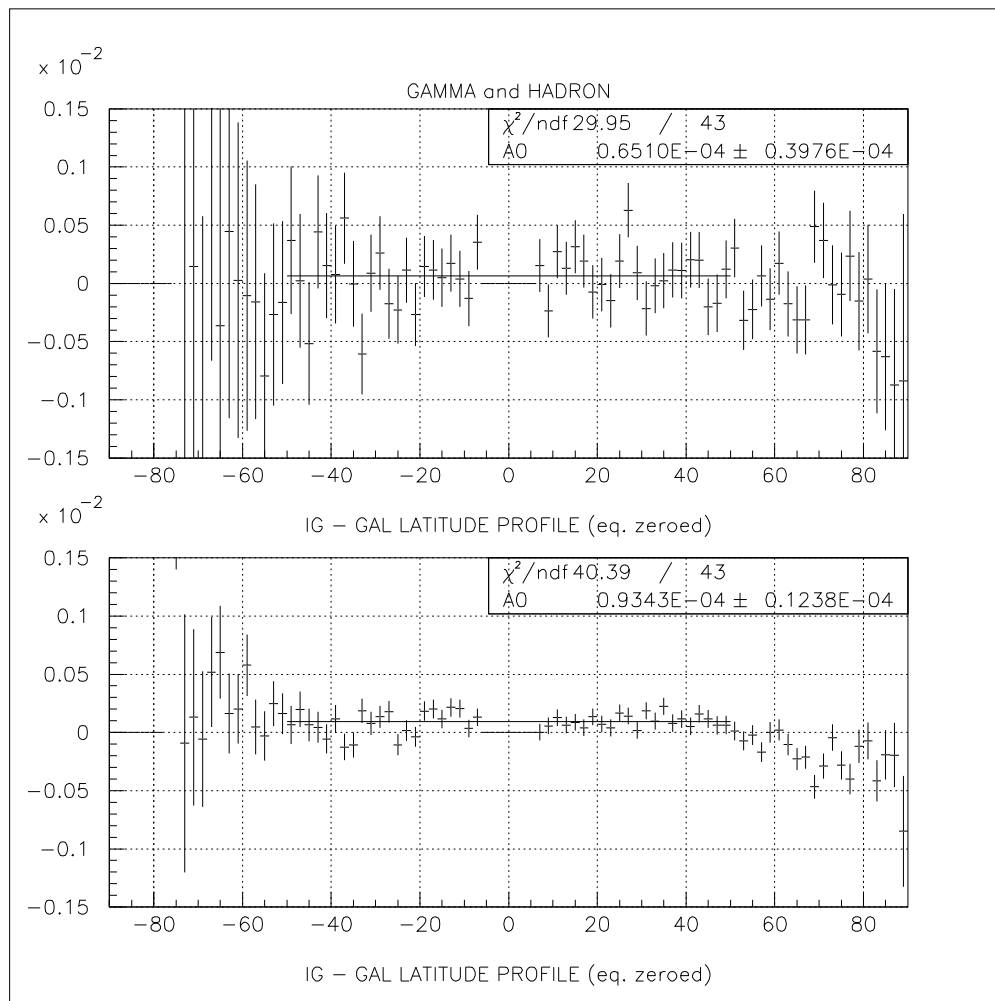


Loud: Needs finite region Quadratic Interpolation.

X2 vs AX2 Comparison: Gal Latitude Profiles



X2 vs AX2 Comparison: Gal Latitude Profiles



Quiet: flat linear interpolation fine.

Measured Floor Shifts

If we accept a common dominant large scale structures and therefore use same form for estimating floor shifts from data of last few transparencies (with all due qualifications... qualifications... qualifications; these are assumptions too):

FRACTIONAL FLOOR SHIFTS = S, units of 10^{*-4} .

REGION	AX2	X2
mil IG	+ 0.93 +/- 0.12	+0.65 +/- 0.40
mil OG	- 1.27 +/- 0.26	- 0.98 +/- 0.83

Statistically significant floor shifts in high statistics AX2 data. Floor shifts for X2 and AX2 are consistent, but consistency check has large statistical errors.

FRAC SIGNAL: INNER GALAXY

We tabulate the single bin fractional excess signals, for IG(+/-2deg) and IG(+/-5deg) regions, in units of 10^{*-4} , without and with a floor subtraction.

First Column is observed X2 signal.

Second Column is prediction for AX2 signal from data of First Column, and factor of 7.4 from start of talk, assuming that excess is due to a gamma signal.

Third Column is observed AX2 signal.

REGION	OBS. X2	PRED. AX2	OBS. AX2
+/-2: FR	+ 4.57 +/- 1.64	0.62 +/- 0.22	1.37 +/- 0.52
SIGNIF	+ 2.8 sigma		
+/-5 FR	+ 3.77 +/- 1.08	0.51 +/- 0.15	1.29 +/- 0.34
SIGNIF	+ 3.5 sigma		

FLOOR SUBTRACTED:

REGION	OBS. X2	PRED. AX2	OBS. AX2
+/-2: FR-S	+ 3.92 +/- 1.69	0.53 +/- 0.23	0.44 +/- 0.51
SIGNIF	+ 2.3 sigma		
+/-5: FR-S	+ 3.12 +/- 1.15	0.42 +/- 0.16	0.36 +/- 0.36
SIGNIF	+ 2.7 sigma		

Conclusion of this study: the AX2 Consistency Test of our observed IG gamma signal is passed with flying colors.

FRAC SIGNAL: OUTER GALAXY

We tabulate the single bin fractional excess signals, for OG(+/-2deg) and OG(+/-5deg) regions, in units of 10^{*-4} , without and with a floor subtraction.

First Column is observed X2 signal.

Second Column is observed AX2 signal.

REGION	OBS. X2	OBS. AX2
+/-2: FR	- 0.8 +/- 1.6	- 1.98 +/- 0.50
SIGNIF	- 0.5 sigma	
+/-5: FR	- 1.3 +/- 1.1	- 1.81 +/- 0.33
SIGNIF	- 1.2 sigma	

FLOOR SUBTRACTED:

REGION	OBS. X2	OBS. AX2
+/-2: FR-S	+ 0.2 +/- 1.8	0.71 +/- 0.56
SIGNIF	+ 0.1 sigma	
+/-5: FR-S	- 0.3 +/- 1.4	-0.54 +/- 0.42
SIGNIF	- 0.2 sigma	

As before, no evidence for a gamma signal in Outer Galaxy. Negative floor subtraction raises FRAC signals to comfort of physical.