Crab Update
8/29/2000

Since the June collaboration meeting, the Crab data set has been reconstructed using improved software and calibrations that were incorporated in reconstruction code version 44. Version 44 contains new calibrations with improved hi−PE extrapolation and corresponding sampling corrections and angle fitter weights. The data was reconstructed twice since the meeting. I denote the 2 reconstructions A and B:

A: v44 reconstruction, curvature correction increased from 0.04ns/m to 0.07ns/m.
B: v44 reconstruction, curvature correction increased from 0.04ns/m to 0.07ns/m, Greg's off pond core fitter, Gus's g/h separation, David's optimized Muon finder

Presented here are the results of the most recent reconstruction, version B. The results of reconstruction A are not presented here, but are consistent with B. The data set consists of 1,698,867,386 events collected since online reconstruction began last summer. The data considered was all collected within +/− 3.3 hours of when the Crab transited through Milagro's meridian. The total number of days of exposure to the crab is 259. Because the trigger threshold varied over the last year, the total number of high rate crab days equivalent is closer to ~225.

In the analysis presented here, 3 Nfit (20,80,150) cuts and 3 gamma/hadron cuts were employed. The 3 g/h cuts are: (1) The Muon fitter optimized by David, (2) Gaurang's "x" cut, denoted GBY, and (3) Gus's modified version of Gaurang's cut, denoted GUS. The fraction of events in the data sample passing each of the cuts is listed below.

	No g/h cut	*Muon cut*	*GBY>5*	*GUS>2.5*
Nfit >= 20	93.00%	31.10%	10.00%	8.10%
Nfit >= 80	23.80%	8.30%	1.30%	2.94%
Nfit >= 150	7.80%	3.90%	0.11%	0.49%

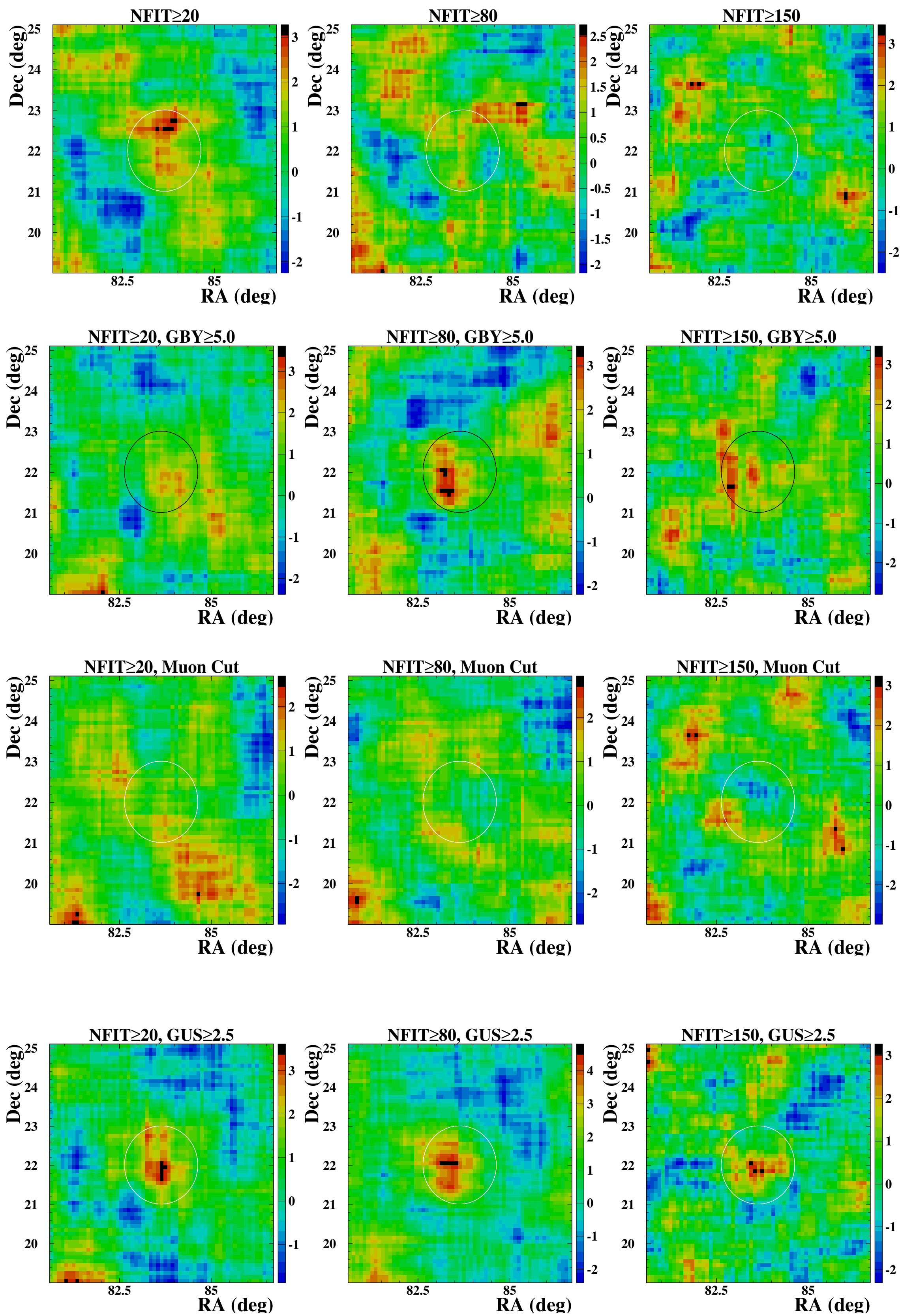
The estimation of the significance of an excess/deficit is done in the standard way. Direct integration was used to estimate the background and the significance of the excess was estimated using the method of Li and Ma. The optimal bin sizes for the 3 Nfit cuts were estimated prior to the analysis to be 2.1, 1.7 and 1.1 deg full width square bins. The table below gives the calculated significance for all the cuts.

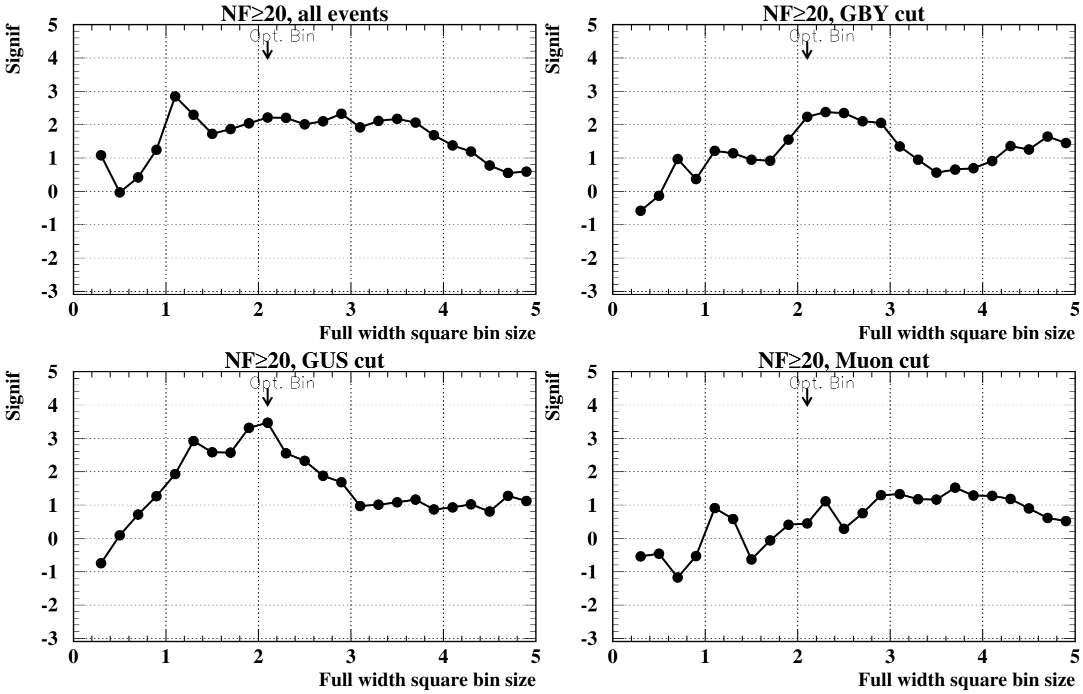
	No g/h cut	*Muon cut*	*GBY>5*	*GUS>2.5*
Nfit>=20 (2.1)	2.21	0.45	2.23	3.47
Nfit>=80 (1.7)	1.21	−0.13	2.05	3.74
Nfit>=150(1.1)	−0.46	−1.12	2.25	2.32

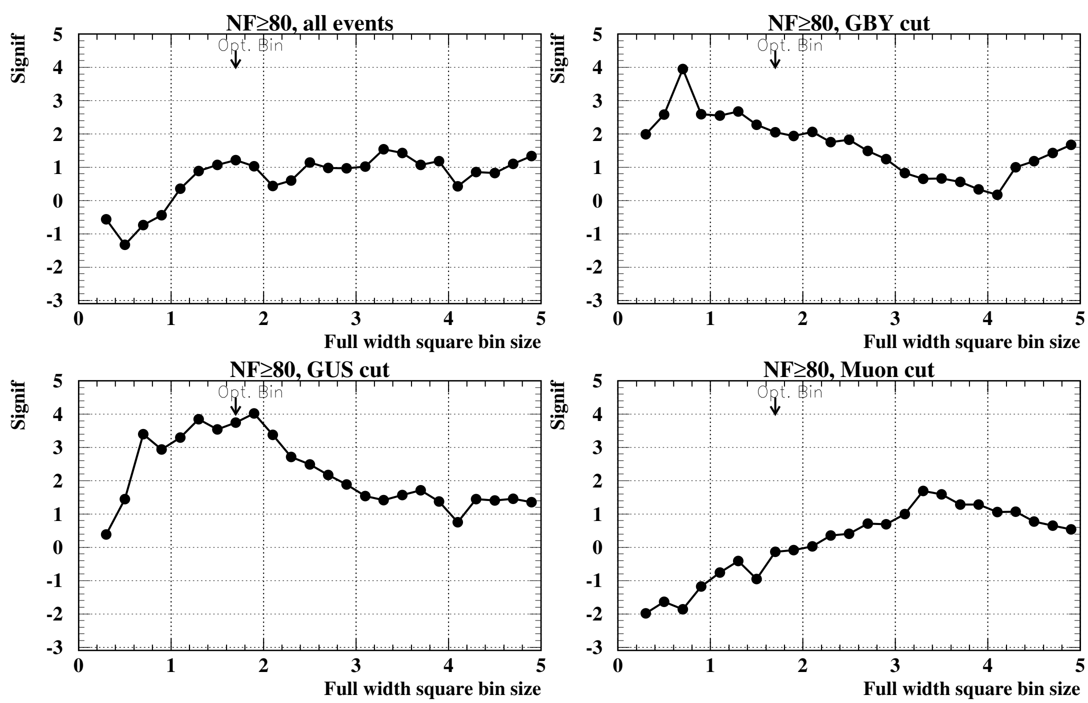
The plots on the following page are the maps for the region in the vicinity of the Crab for the 12 combinations of Nfit cut and g/h cut. The plots on the following page show the significance at the Crab position for bin sizes ranging from 0.3 to 5.0 deg. Again, 12 plots are shown, one for each combination of g/h and Nfit cut. On the following page is a plot of the number of accumulated events and significance plotted as a function of time. Outages due to the 1999 repairs, the Christmas DAQ problems and the fire are visible. The final page contains a plot of the distribution of significance measurements in the vicinity of the Crab.

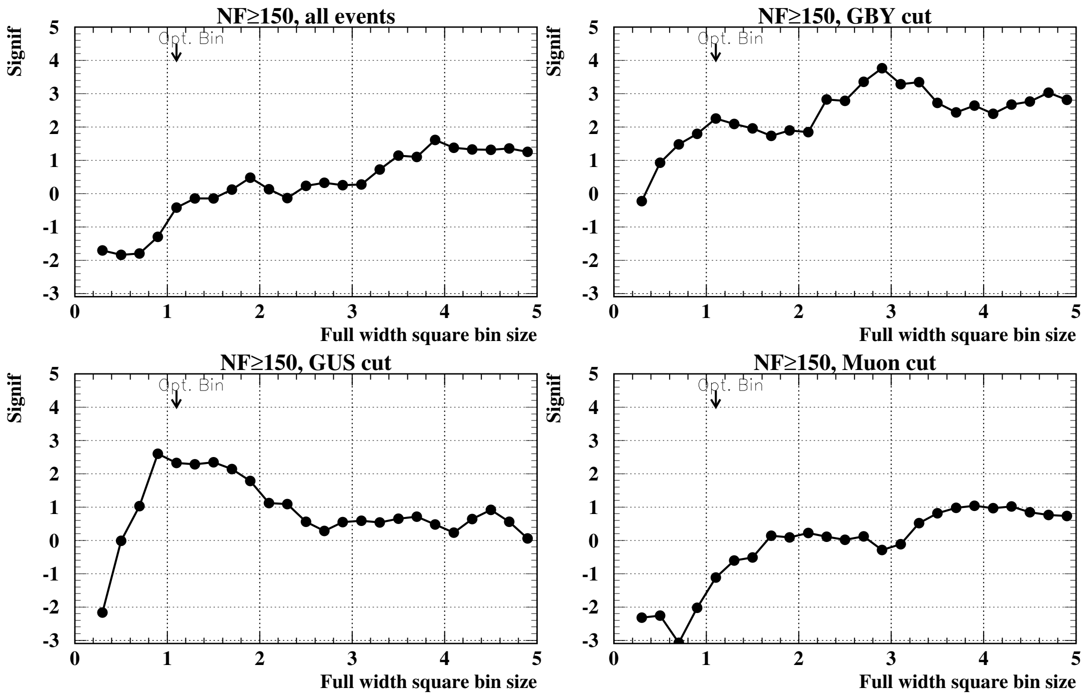
Conclusion:

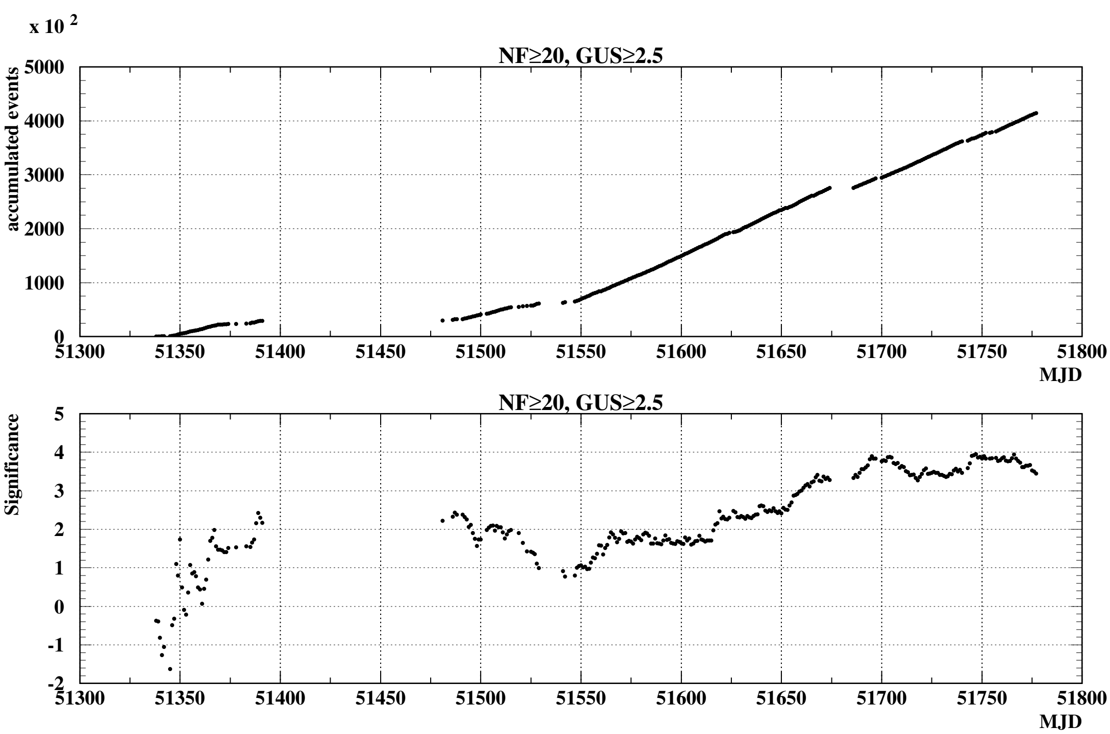
Evidence for the crab at the >2 sigma level is observed in the Nfit>=20 data with no g/h cuts, but the "signal" is not increased with harder Nfit cuts. The Muon cut always decreases the observed significance at the crab. This should be checked more carefully. The GBY cut increase the significance to ~2 sigma for all Nfit cuts. The GUS cut produces >~3.5 sigma for Nfit>=20 and Nfit>=80, and 2.3 sigma for Nfit>=150. The significance measurements quoted were calculated using preselected bin sizes.

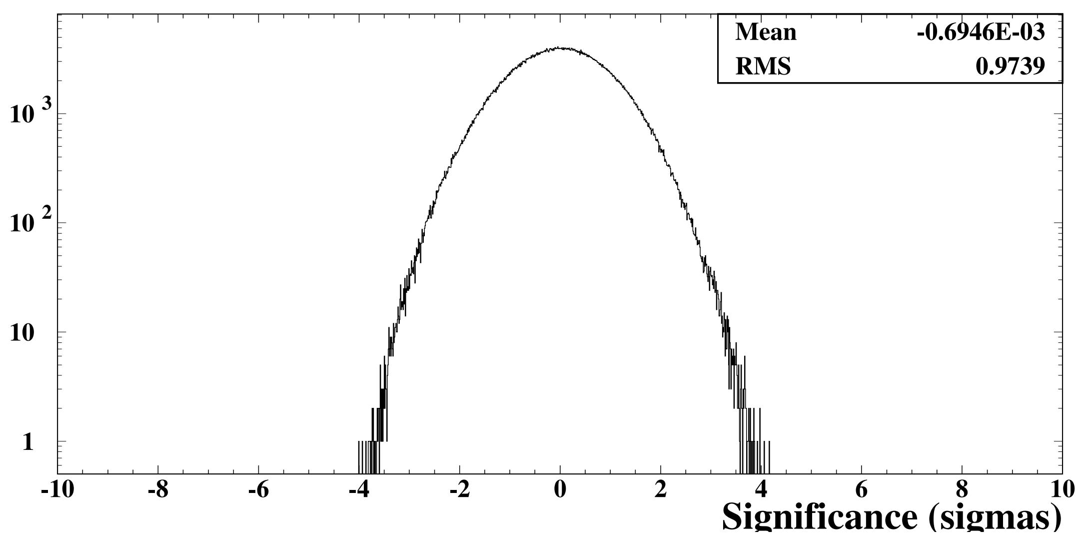

NFIT≥20
NFIT≥80
NFIT≥150
NFIT≥20, GBY≥5.0
NFIT≥80, GBY≥5.0
NFIT≥150, GBY≥5.0
NFIT≥20, Muon Cut
NFIT≥80, Muon Cut
NFIT≥150, Muon Cut
NFIT≥20, GUS≥2.5
NFIT≥80, GUS≥2.5
NFIT≥150, GUS≥2.5
Dec (deg)
RA (deg)
82.5
85
20
21
22
23
24
25


NF≥20, all events
NF≥20, GBY cut
NF≥20, GUS cut
NF≥20, Muon cut
Opt. Bin
Signif
Full width square bin size


NF≥80, all events
NF≥80, GBY cut
NF≥80, GUS cut
NF≥80, Muon cut
Opt. Bin
Signif
Full width square bin size


NF≥150, all events
NF≥150, GBY cut
NF≥150, GUS cut
NF≥150, Muon cut
Signif
Opt. Bin
Full width square bin size


x 10 2
NF≥20, GUS≥2.5
accumulated events
MJD
NF≥20, GUS≥2.5
Significance
MJD


Mean -0.6946E-03
RMS 0.9739
10 3
10 2
10
1
-10
-8
-6
-4
-2
0
2
4
6
8
10
Significance (sigmas)