A Search for Long Duration Emission from AGN

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Abstract

This is a brief memo describing the results of a search for emission from 32 AGN on timescales from 1 month to 1 year. The data set begins on Dec. 15, 2000 and stops on March 1, 2002. I start on 12/15/2000 because that is when we began using both the X2 criteria and the new core fitter online. I use only the REC files. The AGN list is from Costamante and Ghisellini [1]. To there list I have added the 4 Northern hemisphere AGN that have been detected by ACTs. With the exception of Mrk421 we have no evidence for emission from any of the other 31 AGN. In this dataset the Crab gives a significance of 2.9 sigma.

Procedure:

Using the standard sky mapping algorithms I have made weekly maps of the entire northern sky. Two sets of maps were examined for each timescale examined, one overlapping the other by 50% of the duration of the time interval. For example, the monthly maps where made by summing four weekly maps in the following fashion:

Month_1a = Week_1 + Week_2 + Week_3 + Week_4
Month_1b = Week_3 + Week_4 + Week_5 + Week_6
Month_2a = Week_5 + Week_6 + Week_7 + Week_8
Etc.

I made monthly maps, maps summed over 4 months and a map summed over the entire time period examined. I examined the entire sky and the 31 AGN. Distributions are shown for both results. The list of 32 AGNs is shown in Table 1. The AGN marked with an asterisk do not have good positions and the results should probably be ignored. I used the name to generate the position as I could not find accurate positions from NED for these sources. For all the other sources the positions were obtained from NED and are given in J2000 coordinates.

AGN Results:

The results are given as figures.

Figure 1 shows the excess distribution of the 32 AGN over the entire duration (15.5 months). The entry at 3.8 sigma is Mrk421. The next highest entry is Mrk501 at 1.4 sigma.

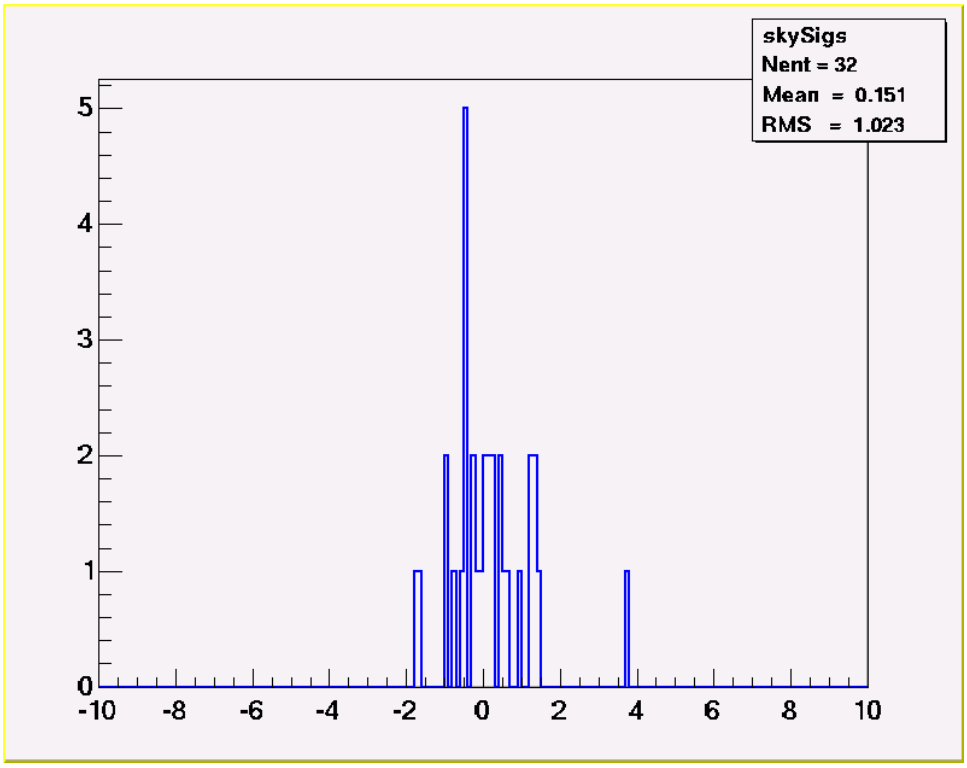

Figure 1 Distribution of excesses from the 32 AGN over the entire 15.5 month interval examined.

Figure 2 shows the distribution of excesses from the AGN over the 4 month interval.

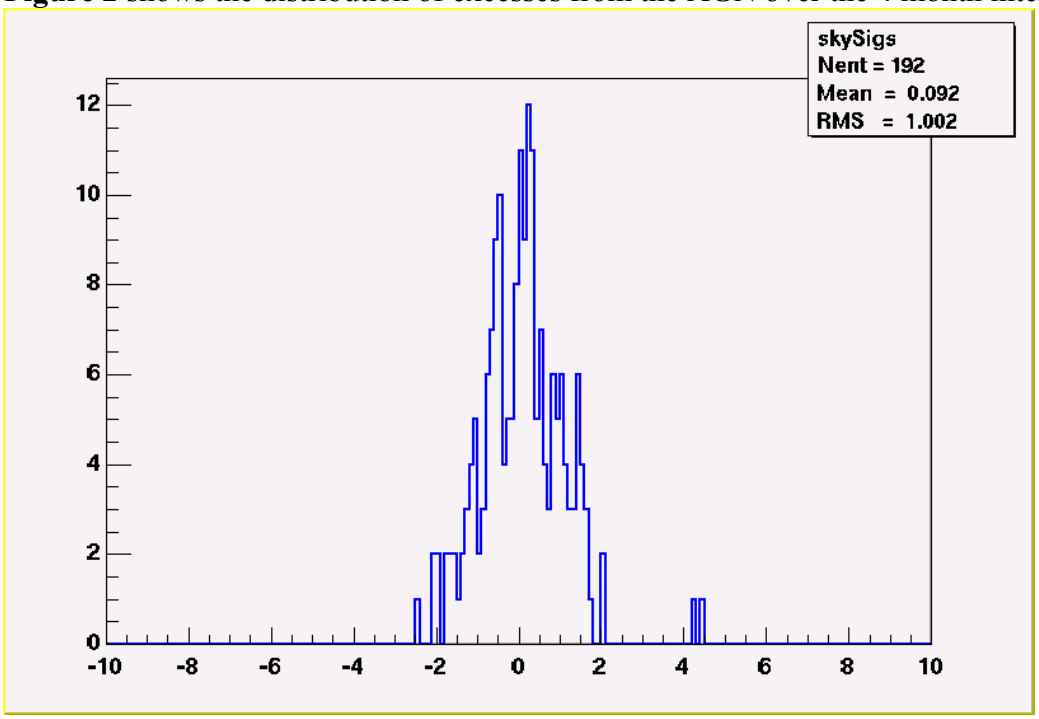

Figure 2 Distribution of excesses from the AGN over the 4-month interval

The two entries beyond 4 sigma are from Mrk421, from 2 consecutive (overlapping) intervals beginning on XXX.

Figure 3 shows the distribution of excesses from the 32 AGN for the one-month integration intervals.

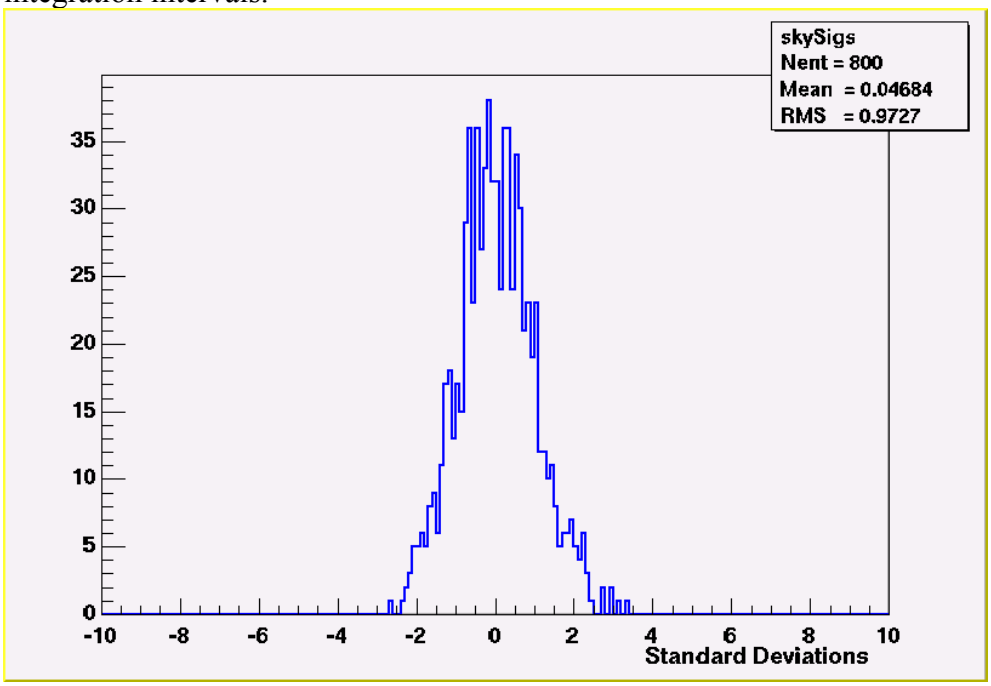

Figure 3 Distribution of excess from the 32 AGN for the 1-month integration.

Figures 4-9 shows the individual AGN distributions for the monthly time-scale. The title of each histogram is the AGN examined.

Figure 10-15 shows the individual AGN distributions for the 4-month time-scale. The title of each histogram is the AGN examined.

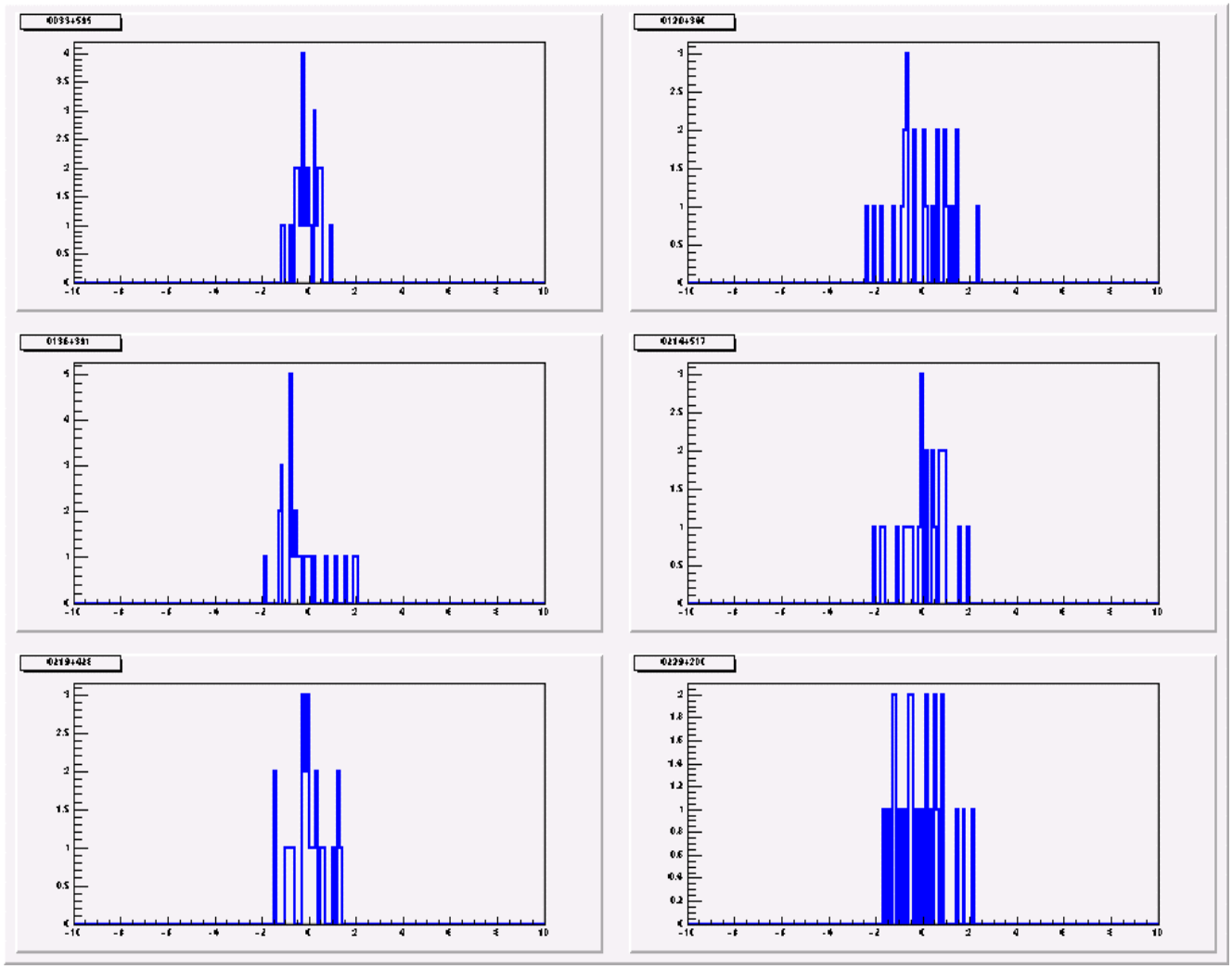

Figure 4 Monthly excess distribution for the AGN

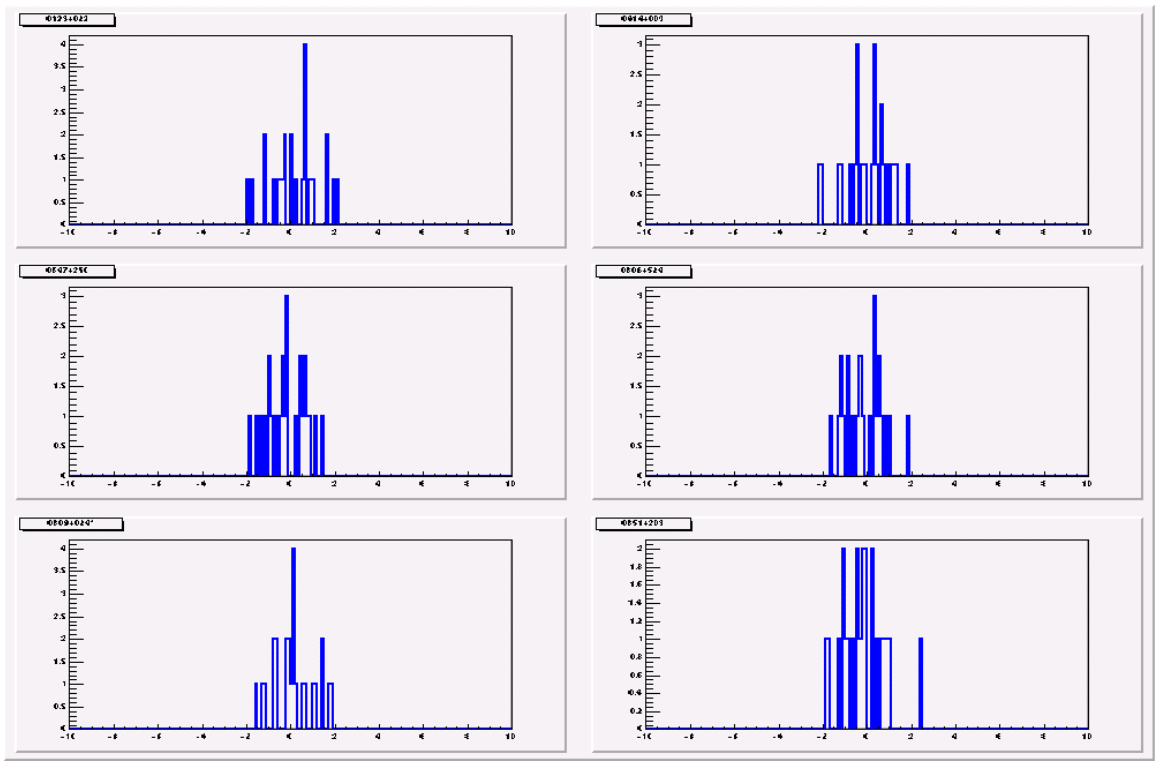

Figure 5 Monthly excess distribution for the AGN

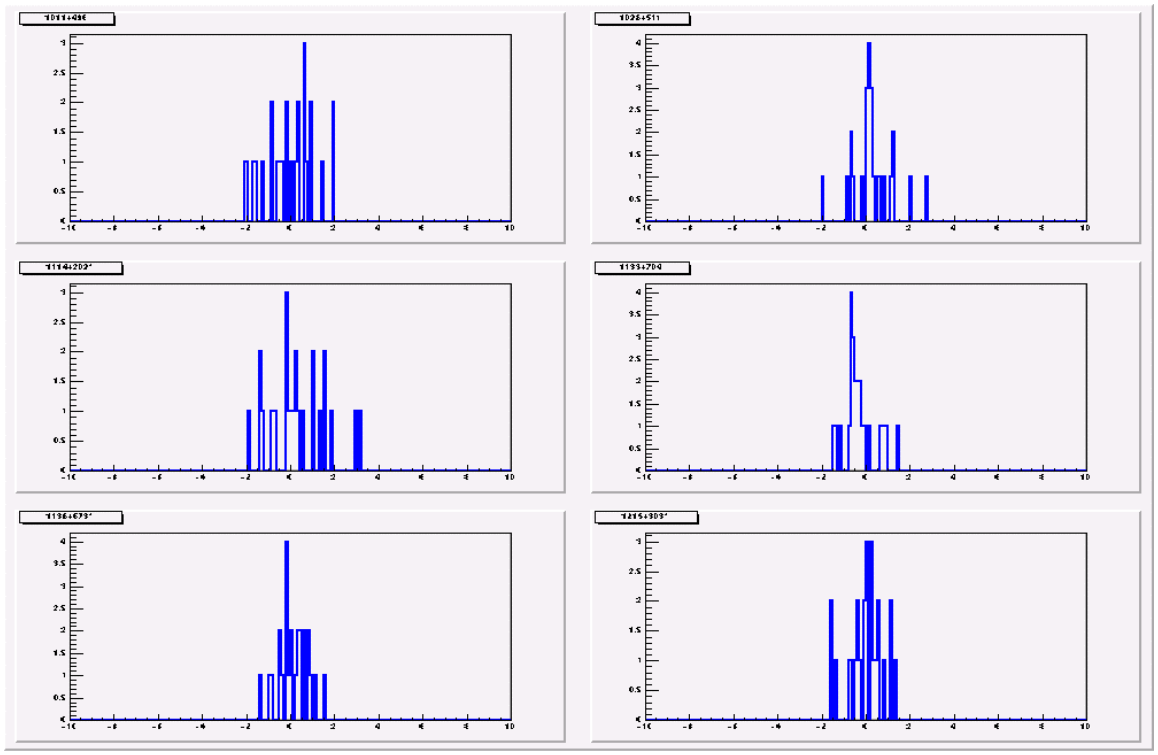

Figure 6 Monthly excess distribution for the AGN

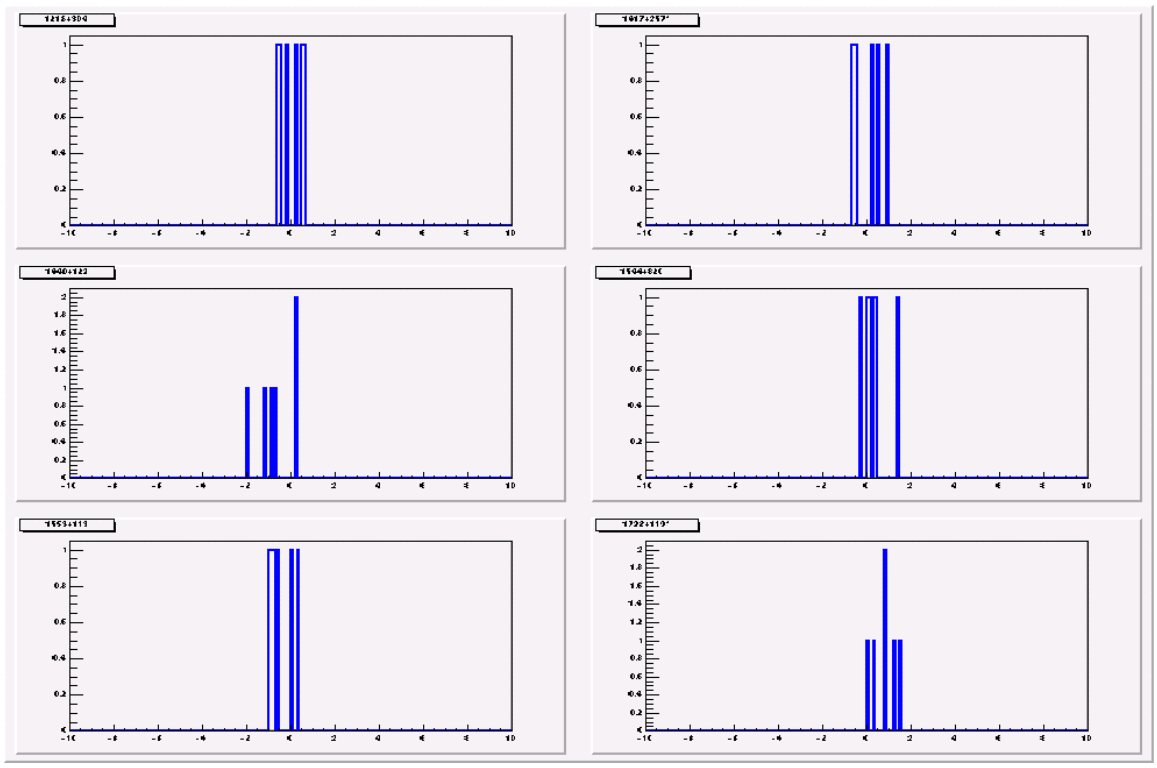

Figure 7 Monthly excess distribution for the AGN

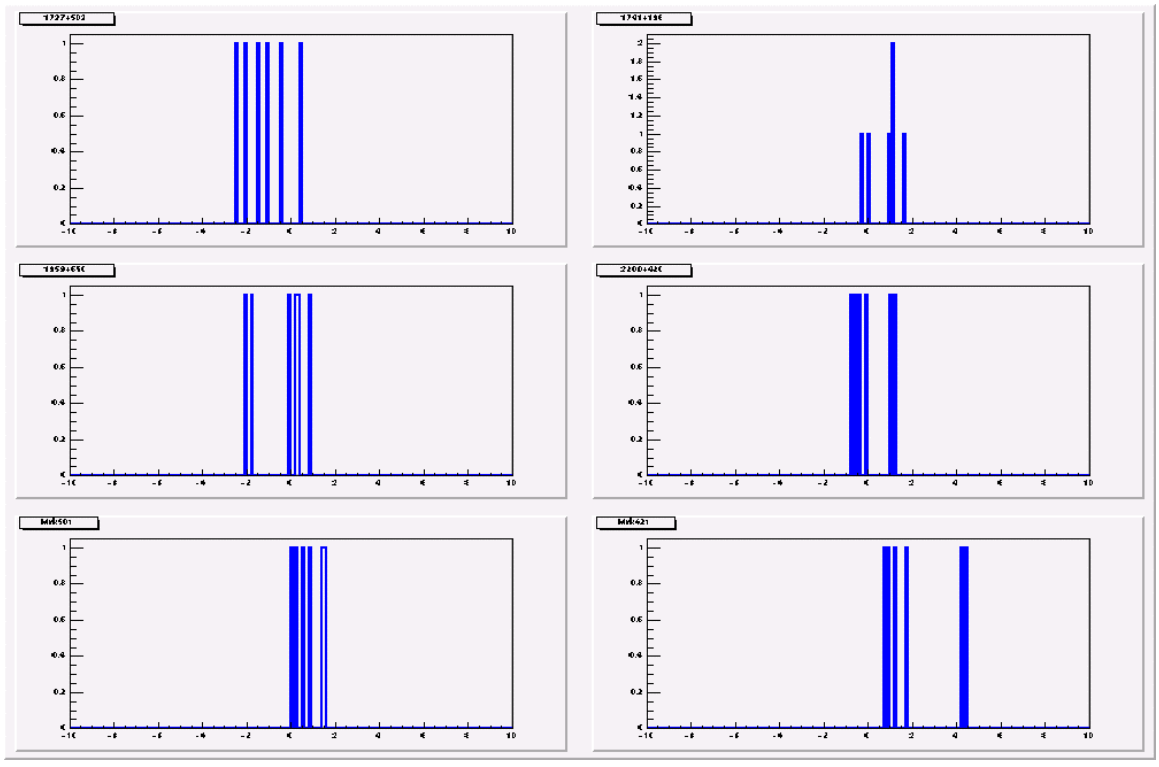

Figure 8 Monthly excess distribution for the AGN

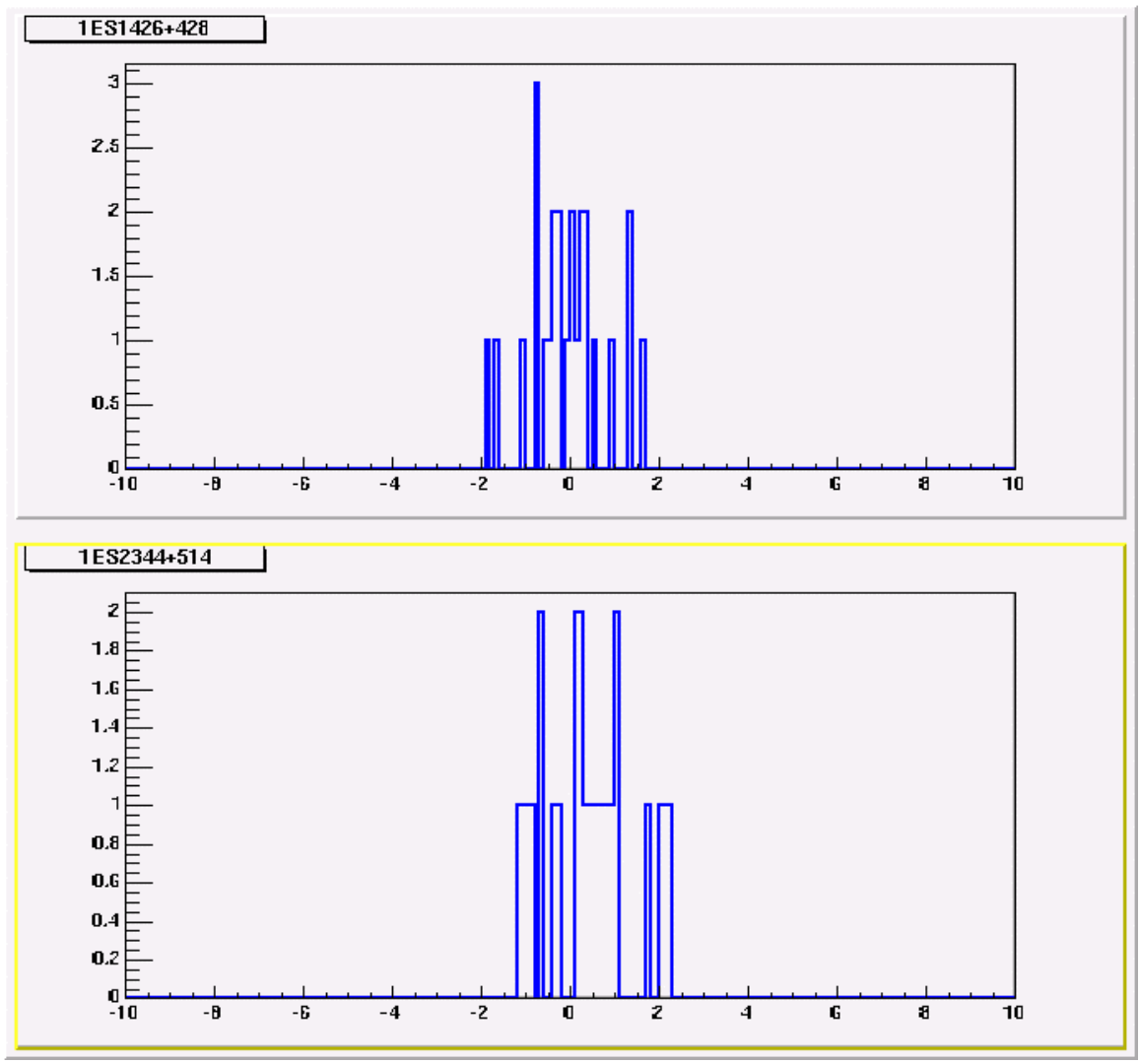

Figure 9 Monthly excess distribution for the AGN

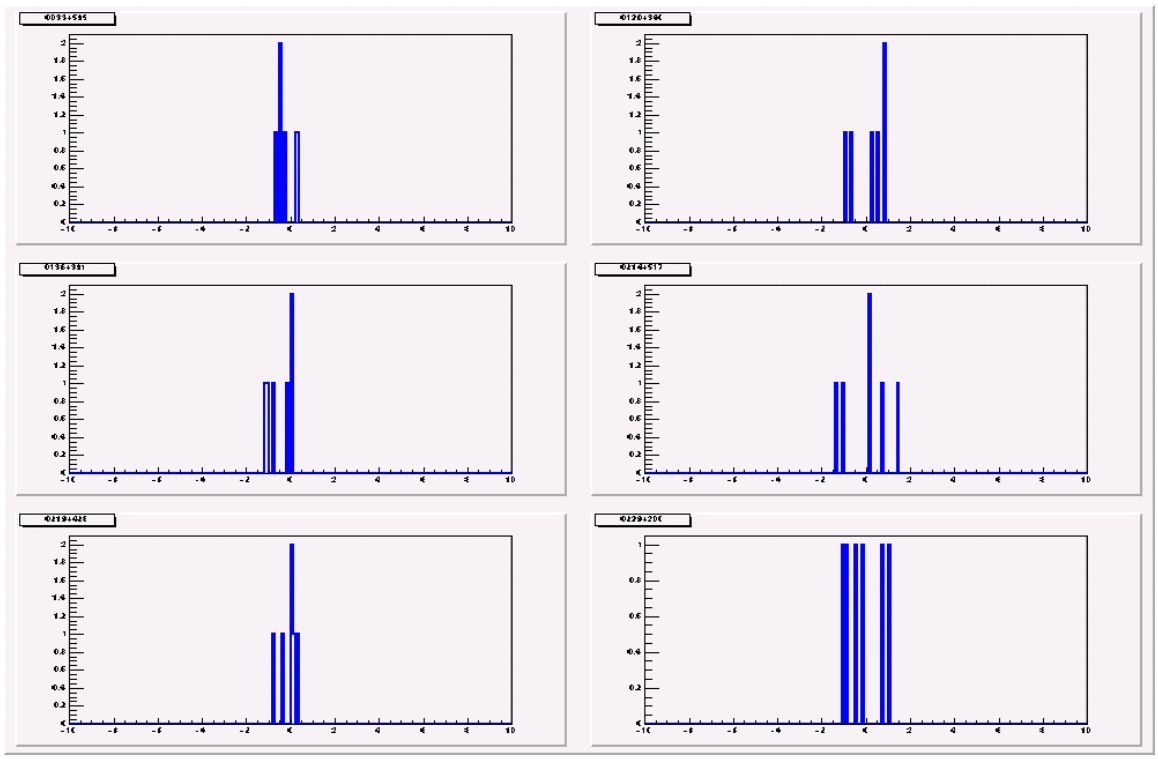

Figure 10

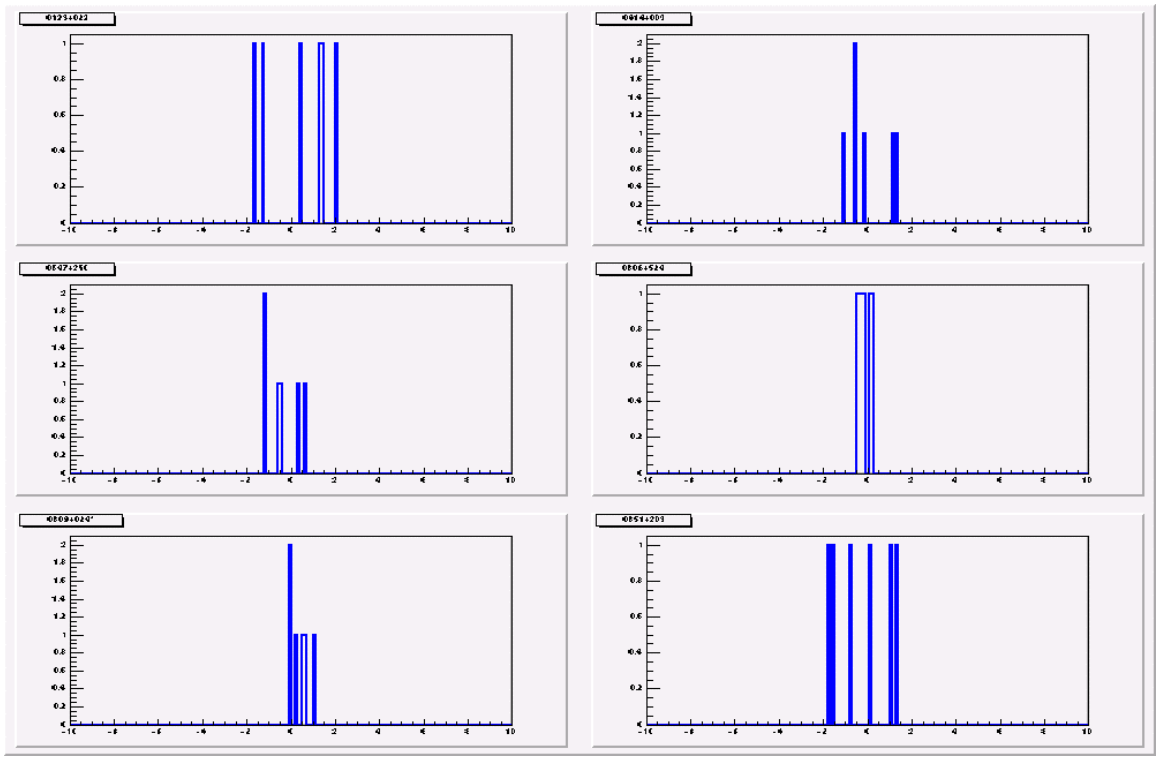

Figure 11

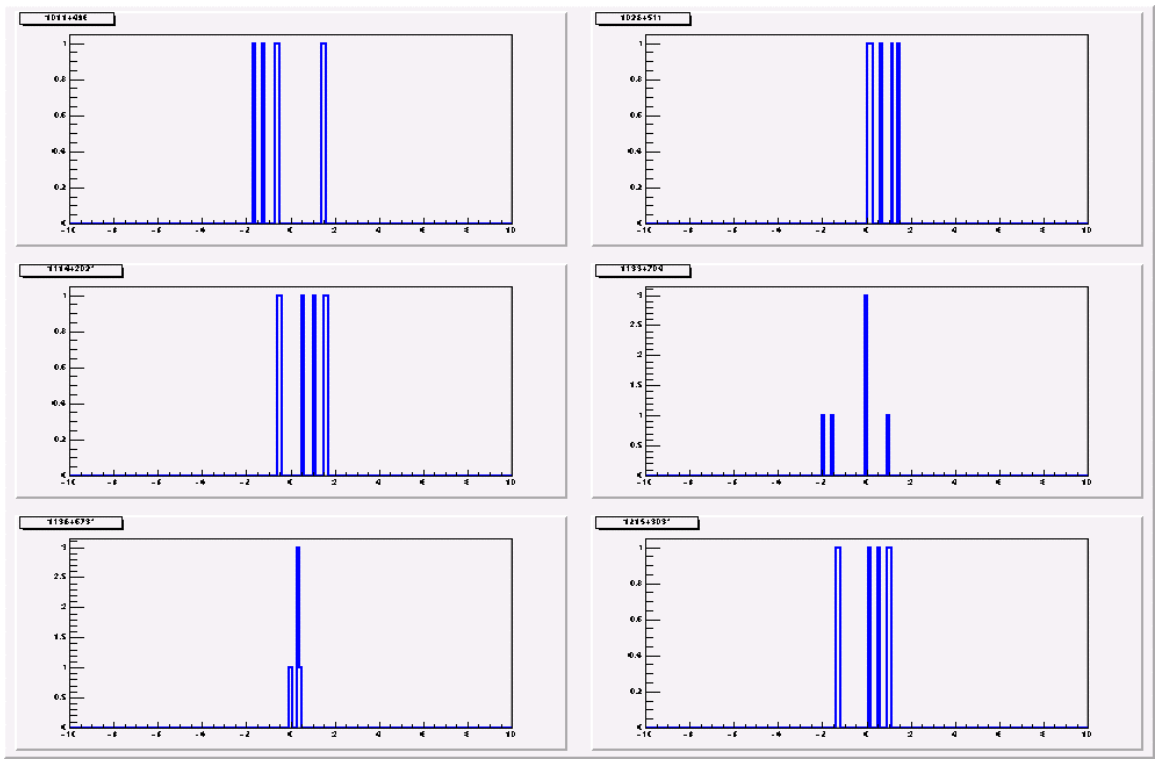

Figure 12

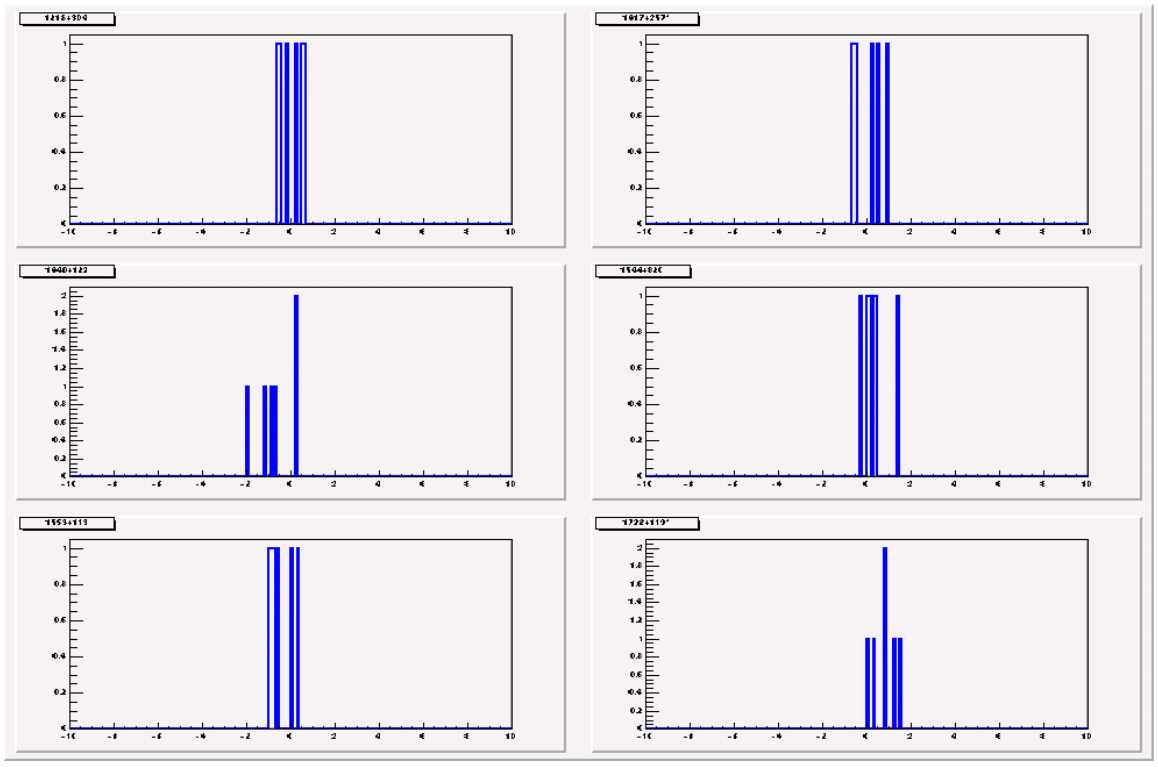

Figure 13

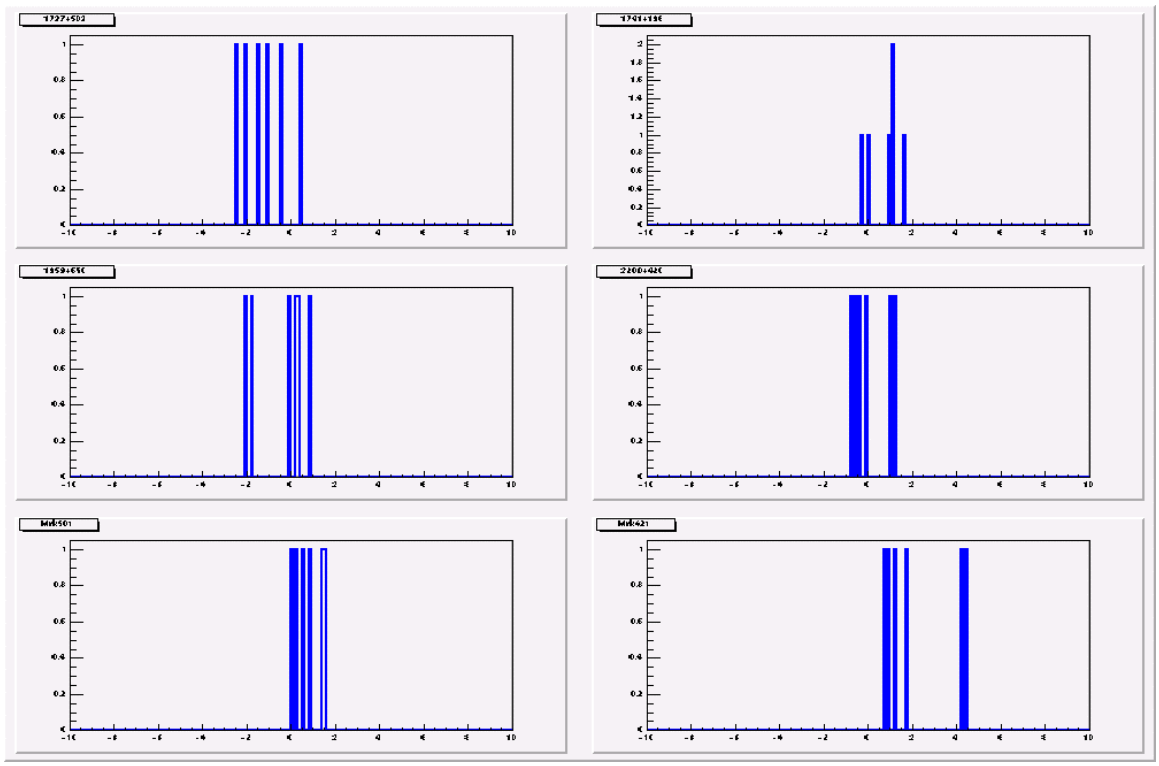

Figure 14

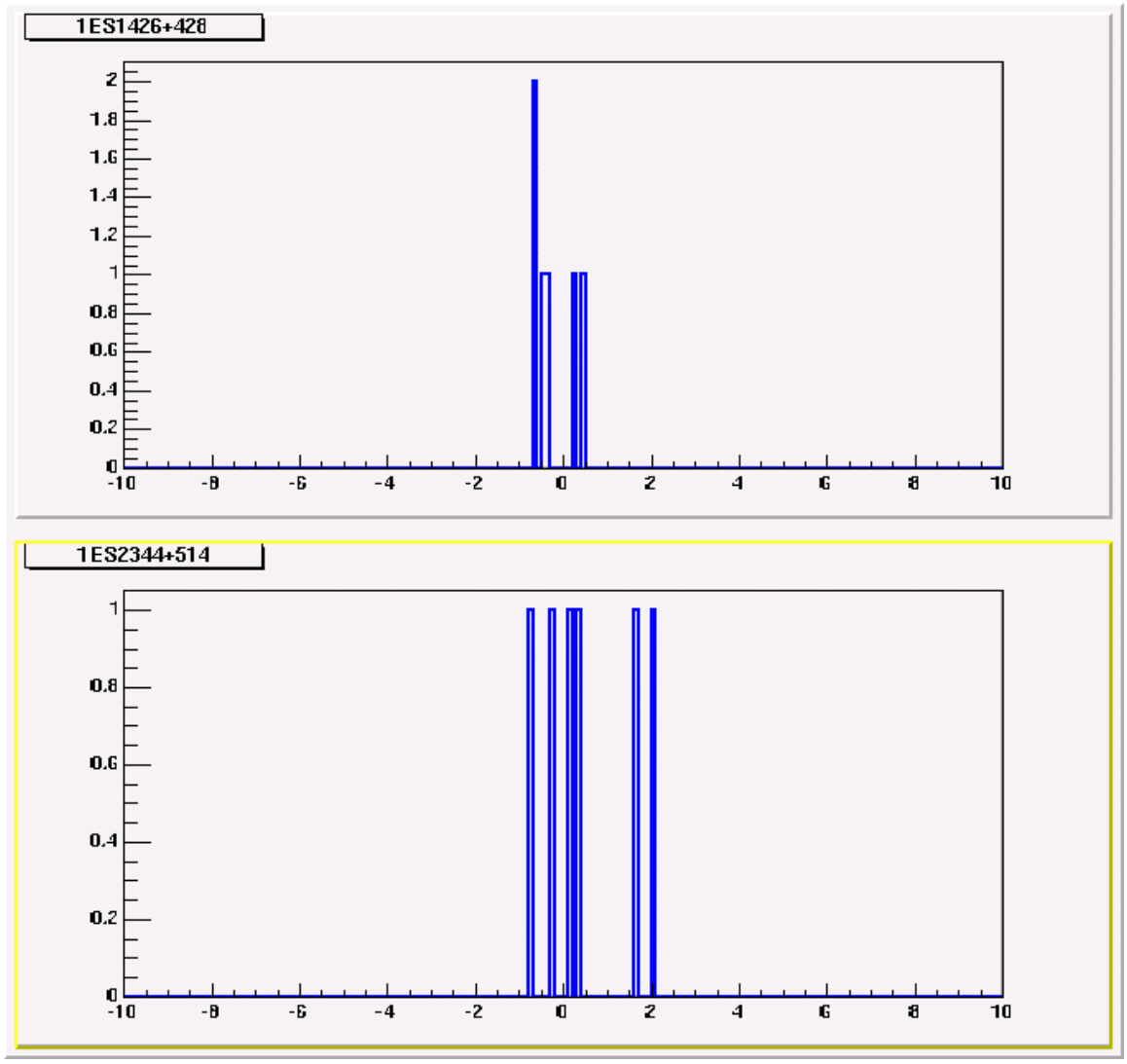

Figure 15

All-Sky Results:

Figure 16 shows the distribution of excesses from the entire sky over the entire 15.5 month period.

Figure 17 shows the distribution of excesses from the entire sky over 4 month intervals.

Figure 18 shows the distribution of excesses from the entire sky over 1 month intervals.

Figure 19 is the sky map over the entire 15.5 month period. I have circled all of the AGN searched and also the Crab. Note the "hottest" spot in the sky corresponds to Mrk421. It is actually not the highest significance of any tiny bin, but stands out because there a re the most hot bins next to it, perhaps indicating that our bin size is too small.

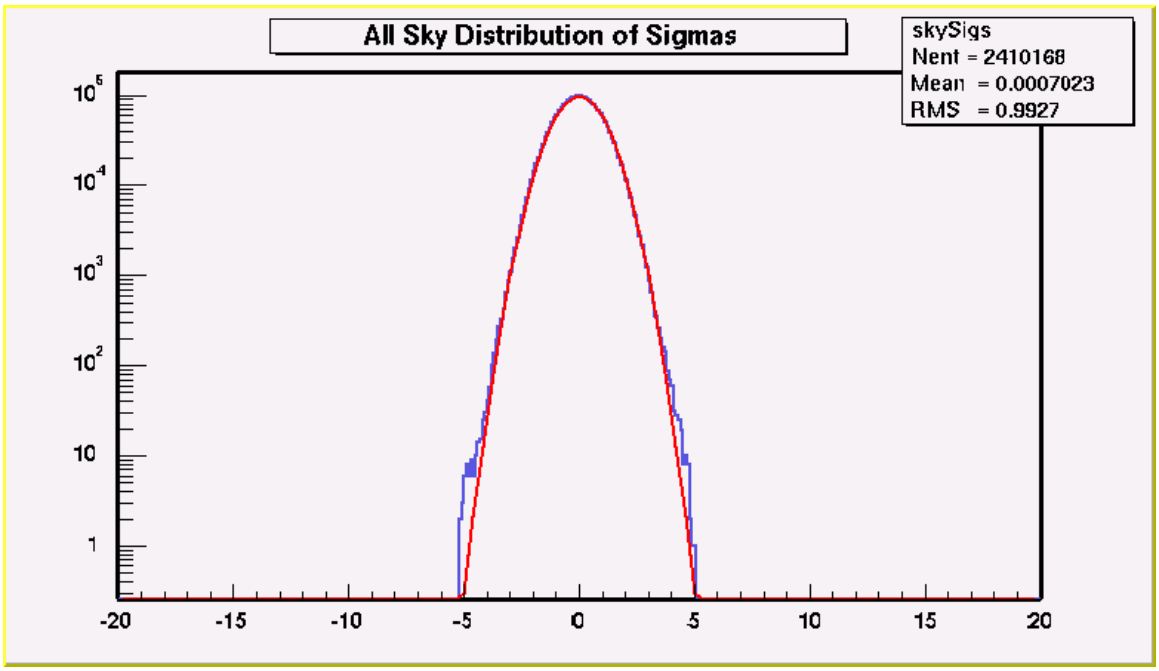

Figure 16 Distribution of excesses from the entire sky over the entire 15 month period.

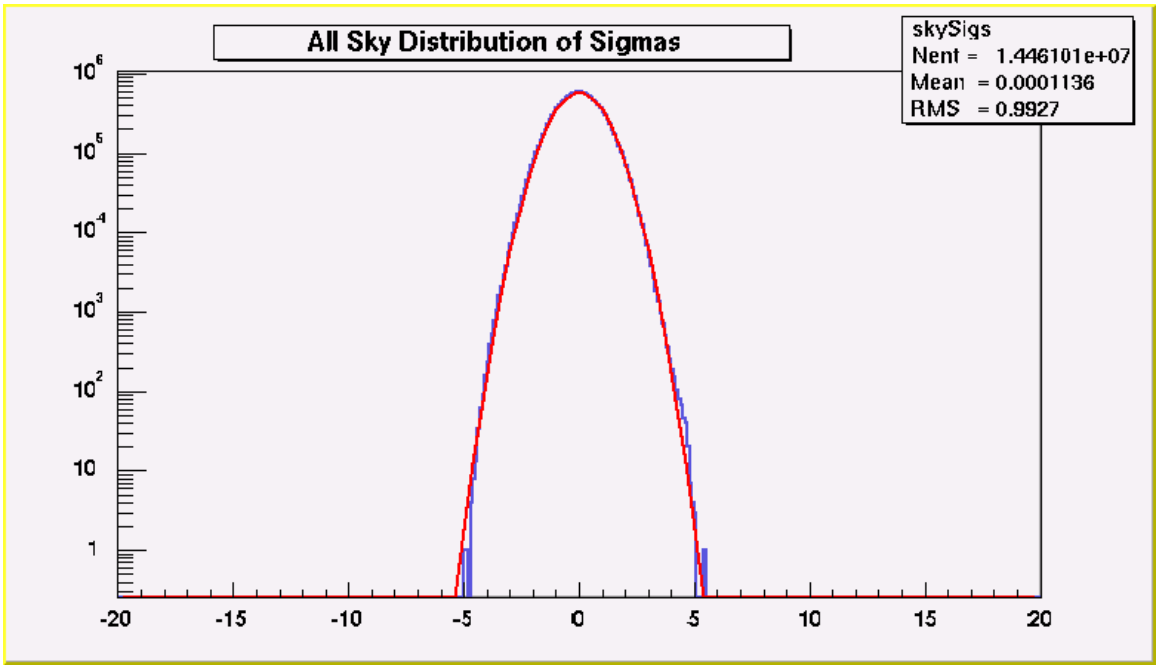

Figure 17

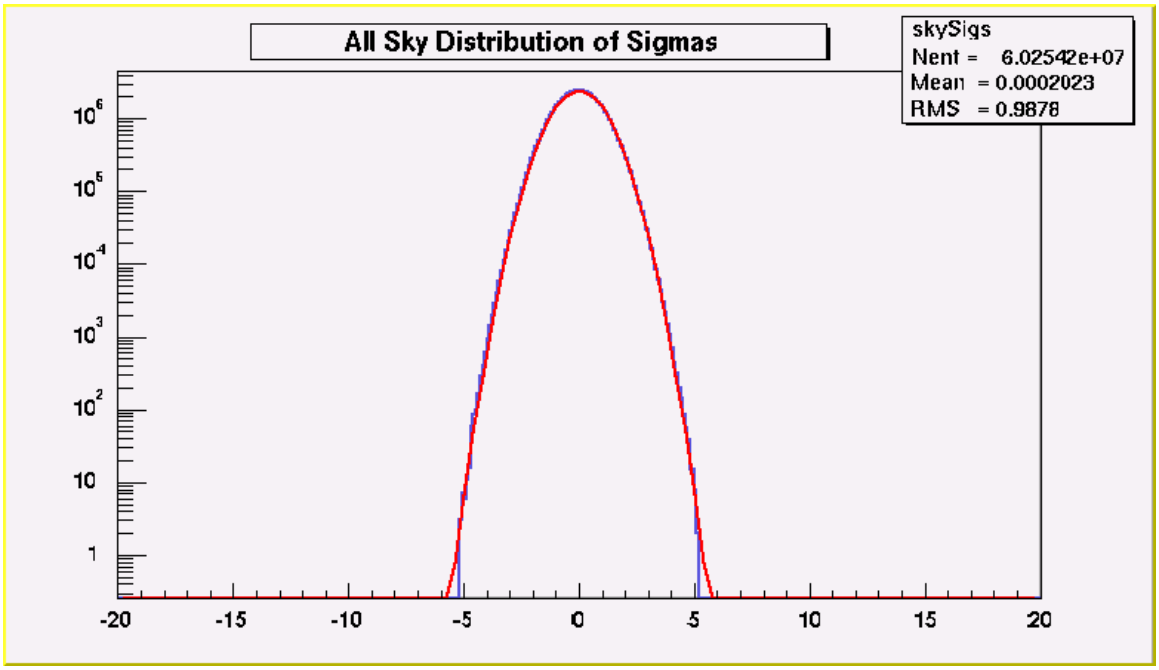
All Sky Distribution of Sigmas
skySigs
Nent = 6.02542e+07
Mean = 0.0002023
RMS = 0.9878
10^6
10^5
10^4
10^3
10^2
10
1
-20
-15
-10
-5
0
5
10
15
20

Figure 18

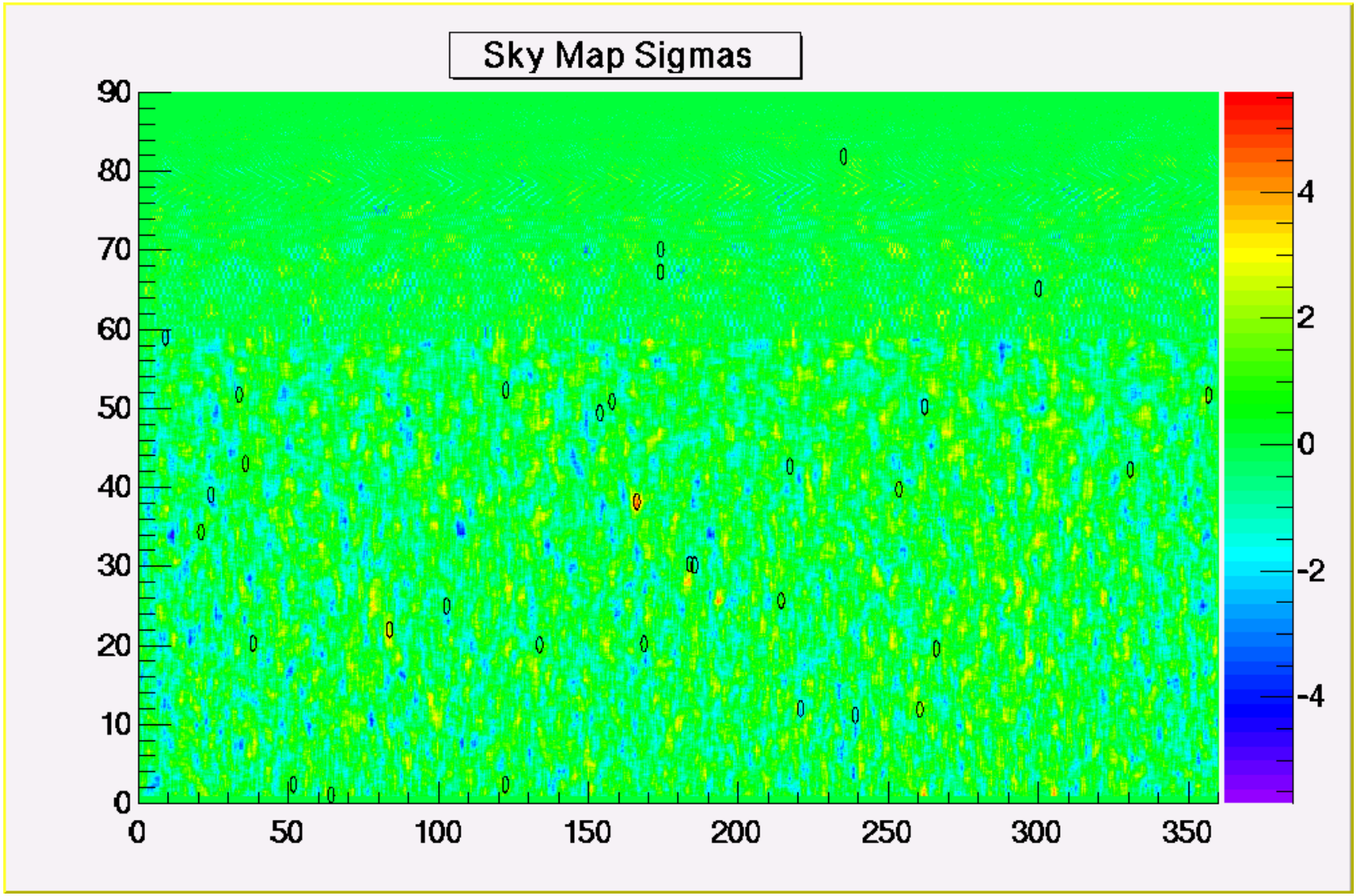
Sky Map Sigmas
90
80
70
60
50
40
30
20
10
0
0
50
100
150
200
250
300
350
4
2
0
-2
-4

Table 1 List of AGN examined. Results given are for the total 15.5 month interval.

Name	RA	Dec	ON	OFF	Sigma
0033+595	8.97	59.83	526272	526449.1	-0.25
0120+340	20.78	34.35	934523	934477.3	0.05
0136+391	24.14	39.1	963691	964413.6	-0.77
0214+517	33.57	51.75	737908	737759.4	0.18
0219+428	35.66	43.03	943497	943440.4	0.06
0229+200	38.2	20.29	601110	601489.8	-0.51
0323+022	51.56	2.42	180736	180539.9	0.48
0414+009	64.22	1.08	163832	163843.8	-0.03
0647+250	102.7	25	761021	761376.8	-0.42
0806+524	122.45	52.32	699373	699728.3	-0.44
0809+024*	122.28	2.4	176999	176747.1	0.62
0851+203	133.7	20.11	582166	582522.4	-0.49
1011+496	153.77	49.43	760948	761301.3	-0.42
1028+511	157.83	50.89	753771	752991.7	0.93
1114+202*	168.5	20.2	582895	581986.4	1.24
1133+704	174.11	70.16	265558	266011.4	-0.91
1136+673*	174	67.3	323034	322719.3	0.58
1215+303*	183.75	30.3	824210	824088.3	0.14
1218+304	185.34	30.18	824268	823909.8	0.41
1417+257*	214.25	25.7	772362	772190.3	0.2
1440+122	220.7	12.01	386384	387411.5	-1.72
1544+820	235.06	81.92	108009	107923.6	0.27
1553+113	238.93	11.19	366708	367263.5	-0.95
1722+119*	260.5	11.9	386717	385867	1.42
1727+502	262.08	50.22	796532	797949.4	-1.65
1741+196	265.99	19.59	583952	582972.3	1.33
1959+650	300	65.15	383976	384217.8	-0.41
2200+420	330.68	42.28	897221	897363.1	-0.16
Mrk501	253.47	39.76	951687	950401.3	1.37
Mrk421	166.11	38.21	949916	946415.6	3.74
1ES1426+428	217.13	42.67	943188	943451.4	-0.28
1ES2344+514	356.77	51.7	739452	738457.1	1.2
Crab	83.64	22.01	701777	699480.4	2.86

References:

1. Costamante, L. and Ghisellini, G., "TeV BL Lac Objects", A&A **384**, 56, 2002.