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# Update on the Search for High Energy Diffuse Flux Neutrinos

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# The Cut Levels

**Level 2:** As processed by Zeuthen – cut on zenith(LH)  $> 80$ .  
Reconstructions added: mpe, downgoing Bayesian, line fit, dipole moment, tensor of inertia and cascade likelihood.

**Level 3:** Ty's xtalk cleaning added. 16 iteration upward and Bayesian downward reconstructions added. Cut made on likelihood ratio (up to down)  $> 25$ .

**Level 4:** Ignacio's xtalk cleaning added. 16 iteration upward and Bayesian downward reconstructions added. Quality cuts 1–3 (reject all cosmic ray bkgrd).

**Level 5:** Quality cuts 4–7 added.

**Level 5b:** Energy cut added.

# The Cuts

**Cut 1:** Likelihood up going fit to down going fit  $> 30$ .

**Cut 2:** Absolute value of smoothness of up going fit  $< 0.3$

**Cut 3:** Length between first direct b and last direct b hit  $> 125$  meters.

**Cut 4:** Difference between zenith up going and down going fits  $< 18$  \*  
Difference between the number of direct hits of up going and down going fits.

**Cut 5:** Center of gravity in the z direction  $< 150$  meters.

**Cut 6:** Zenith angle of the up going fit  $> 100$  degrees.

**Cut 7:** Likelihood of being a cascade event  $< 0.22$ .

# Data Reduction

Level	E <sup>-2</sup> MC	Atm. MC	Data
L2	?	?	?
L3	35.8	231.6	20096
L4	20	121.8	280
L5	11.6	92.5	93
L5b	5.1	13.5	22

# Data Quality

Quality	$E^{-2}$ MC	Atm. MC	Data
1	16.51	122.3	204
2	14.3	108.6	127
3	11.6	92.5	93
4	9	74.3	70
5	7.2	56.9	57

Quality 1: Loosened Cuts

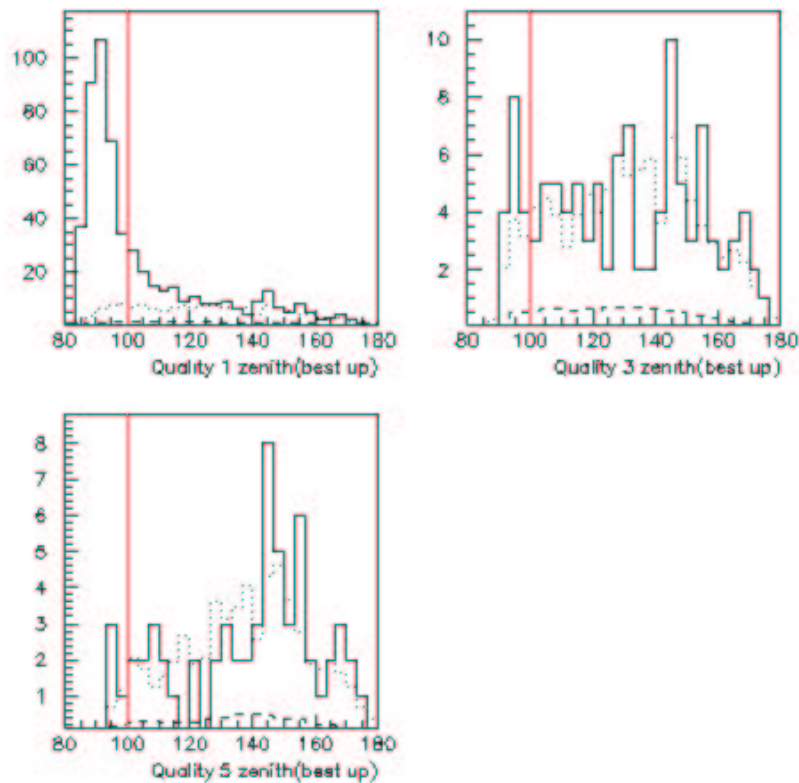
Quality 2: Slightly Loosened Cuts

Quality 3: My Cuts

Quality 4: Slightly Tightened Cuts

Quality 5: Tightened Cuts

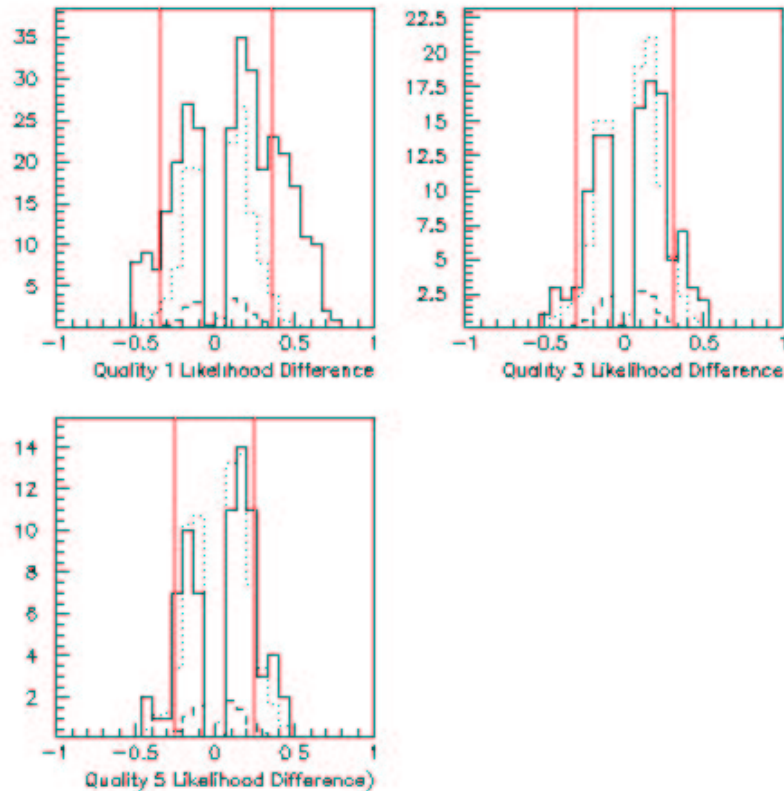
# N-1 Zenith Plot



**KEY:** *solid line* – Data  
*dashed line* –  $E^{-2}$  MC  
*dotted line* – Atm. MC  
*solid red line* – cut

**NOTE:** As we increase the quality beyond 3, the data retains its structure.

# N-1 Smoothness Plot



**KEY:** *solid line* – Data  
*dashed line* –  $E^{-2}$  MC  
*dotted line* – Atm. MC  
*solid red line* – cut

**NOTE:** Again, as we increase the quality beyond 3, the data retains its structure.

# Sensitivity – Nch

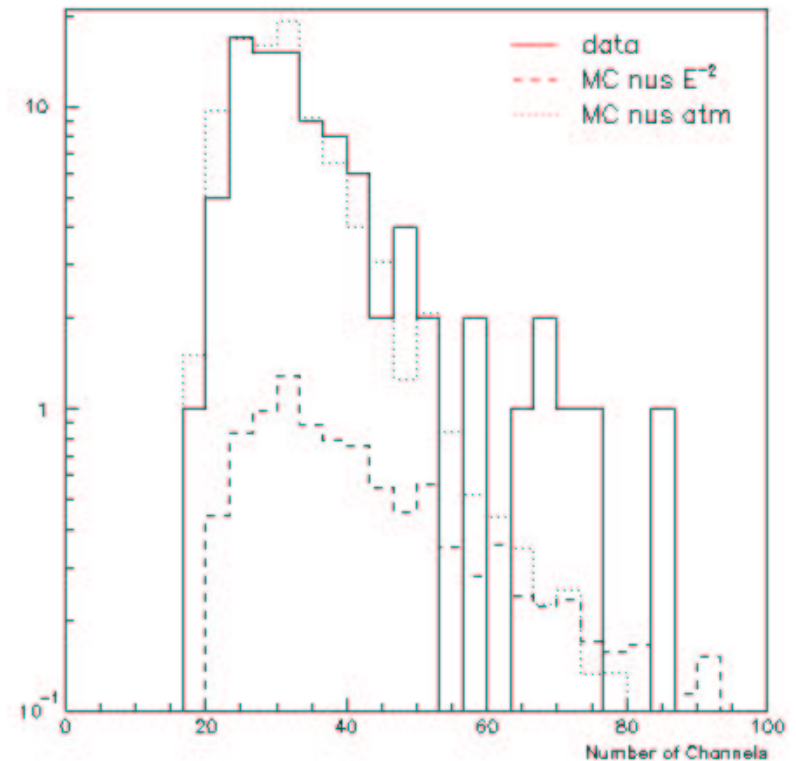
Sensitivity =  $1.4 \times 10^{-6}$

Best Cut:  $n_{ch} > 40$

Expected Signal = 5.05

Expected Bkgrd = 13.48

Number of data events to survive cuts = 22



# Channel Density – Sensitivity

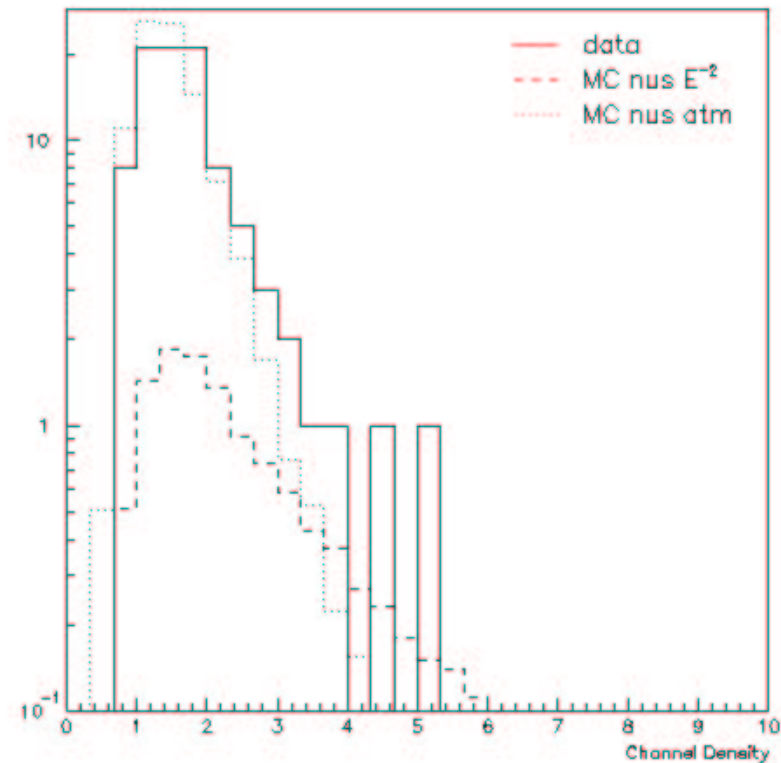
**Sensitivity** =  $1.3 \times 10^{-6}$

**Best cut:**  $(n_{ch}/l_{dirb}) * 10 > 3$

**Expected Signal** = 3.03

**Expected Bkgrd** = 1.90

**Number of data events to survive cuts** = 6



# Limit Derived from Nch

Expected Signal = 5.1

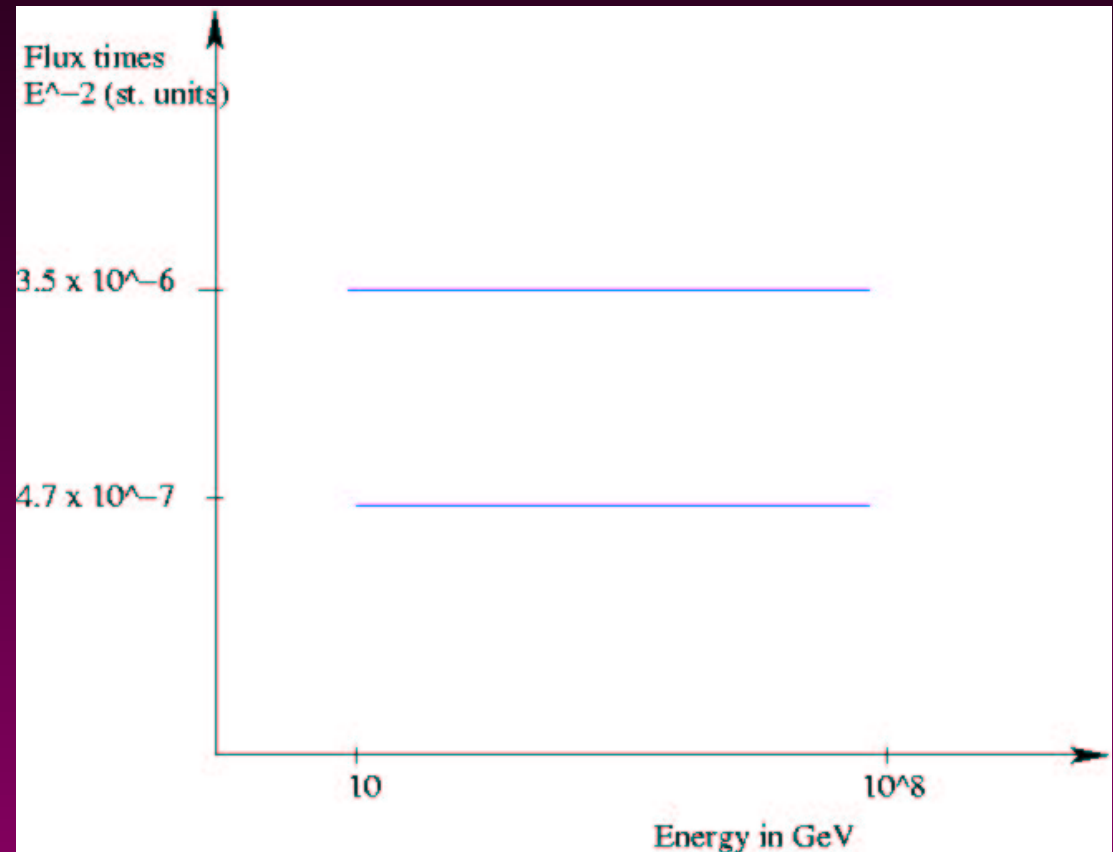
Expected Bkgrd = 13.5

Number observed = 22

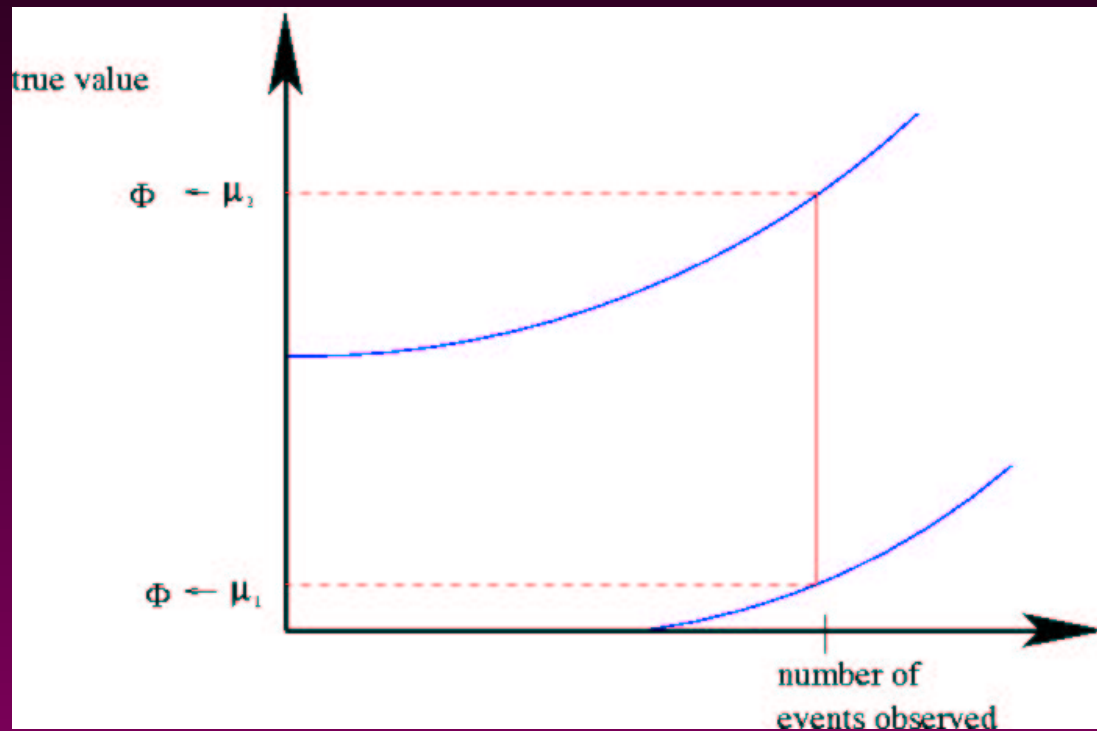
$$\mu_1 = 2.36$$

$$\mu_2 = 17.53$$

$$\Phi = \Phi_0 * \mu/n_{\text{expected signal}}$$



# Feldman and Cousins



What does this mean?

If the true value of the signal was indeed zero, there is a 10% chance of observing a vertical confidence band that does not include signal equal to zero.

# The Three Star Way :)

Francis, Albrecht and Jodi C. scanned the 22 events.

**Results:** 15 events with  $nch < 60$

7 events with  $nch > 60$

2 events  $nch < 60$  were double muons (zero stars)

1 event  $nch = 84$  received \*\*

19 events received \*\*\* (highest rating)

→ 13 with  $nch < 60$

→ 6 with  $nch > 60$

# Conclusions and Outlook

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- \* Need more background monte carlo.
- \* Need to run analysis using strictly Ignacio's cross talk filter.
- \* Need a **double muon filter**.
- \* Need to make available **50%** of data for **ALL nch** for diffuse analysis.
- \* An internal report with all diffuse analysis details is in the making.