Status of the Crab search in the Milagro Data

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1   Introduction

Online data reconstruction began in mid June, 1999. From that time until the recent problems with kahuna in mid December, Milagro has recorded 57.8 days of uptime. The bulk of the down time was due to the 3 month shutdown for PMT repairs. The exposure before and after repairs is almost identical with 27.8 days of data recorded prior to the shutdown and 30.0 days recorded after the shutdown. Figure 1 is a plot of the Milagro live time fraction and gated trigger rate vs davified Julian day.
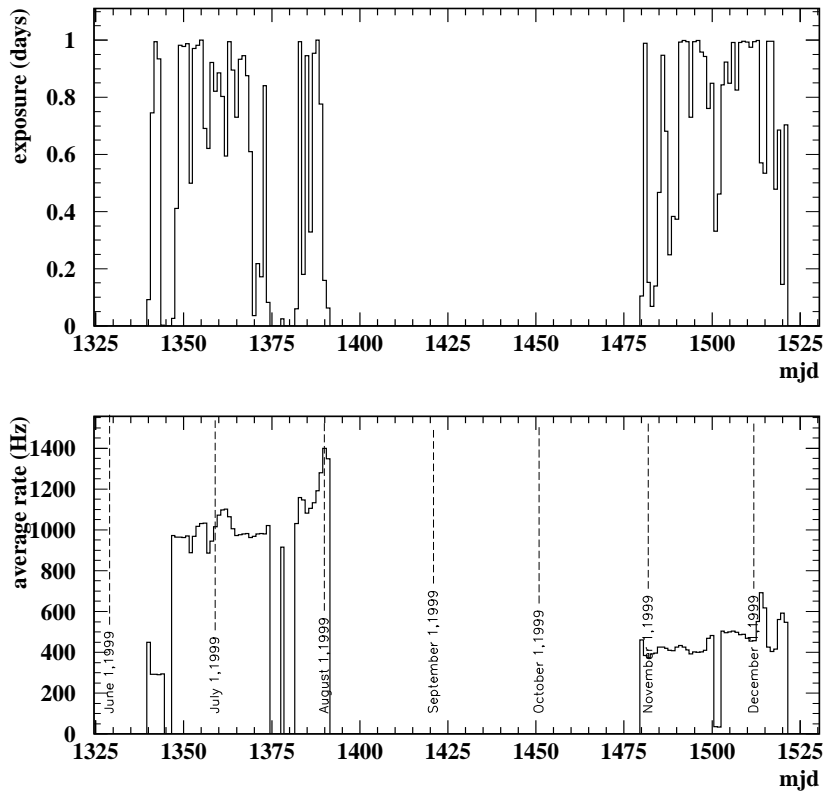

Figure 1: Milagro exposure

2   Data Analysis

This is a short update on the Moon and the Crab in Milagro data. In all plots, an NFIT>40 cut has been applied to the data and the binsize used is 1.5 deg full width square bin. These values were chosen as educated guesses, but have not been established as optimal. Figure 2 shows significance maps for the region in the vicinity of the crab for data collected prior to the repairs, after the repairs and all events combined. At the

position of the Crab, the excess is 1.4σ (S=102398,B=101964) prior to the repairs and 1.8σ (S=110813,B=110215) after the repairs and combine to give 2.3σ (S=213211,B=212179). The most notable feature of these plots is however not at the center, but about 1 degree offset to the higher RA. At the position 0.8 degrees to the right of the crab position, there is a 3.7σ (S=103030, B=101893) excess prior to the repairs, a 2.0σ (S=110674, B=110026.894989) excess after the repairs and a combined total of 4.0σ (S=213704, B=211919). This excess is quite compelling. The obvious next question is: is there evidence elsewhere in the data for a 1 deg pointing error.
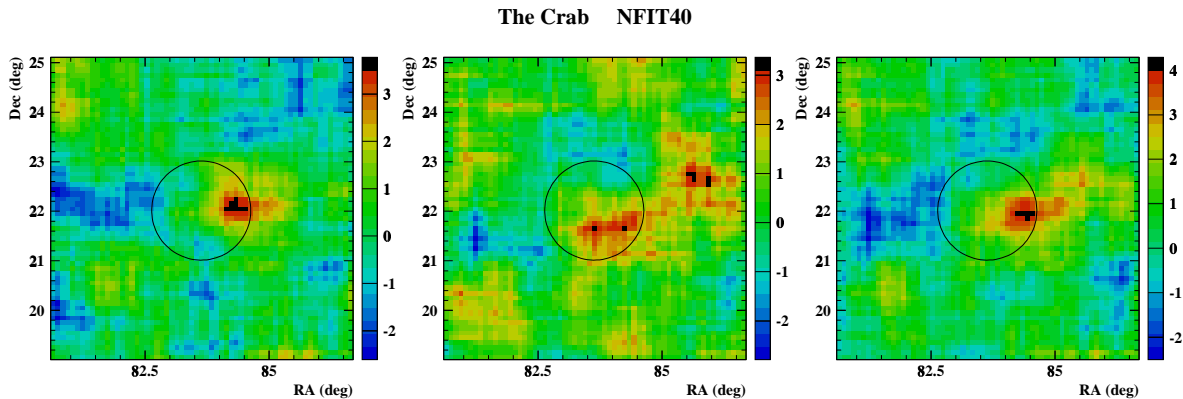
The Crab   NFIT40

Figure 2: Significance in the vicinity of the crab.

3   The Moon

Figure 3 shows the significance of the excess in the vicinity of the moon for the data collected prior to the repairs, after the repairs and combined. A declination offset which was observed in Milagrito and attributed to a systematic "$\delta\theta$ vs θ" error is clearly present in the data. In the absence of timing pedestals, the a pointing error in the north south direction could also give rise to such an offset. offset The RA offset is smaller than that of Milagrito. For the data collected prior to the shutdown the moon is not offset at all in RA. In Milagrito an offset of 0.5-1.0 deg was observed for the moon due to the magnetic field of the earth. For most of this data, the rate was higher than the nominal rate of Milagrito and therefore the energy threshold is lower. One would expect a larger offset in Milagro, not smaller. This shift is consistent in direction and magnitude with the offset of the 4σ peak observed near the crab.

4 x and y

A pointing error such as that observed should be visible in the ϕ distribution as well as the parameters $x = sin\theta cos\phi$ and $y = sin\theta sin\phi$. Figure 4 shows the x and y

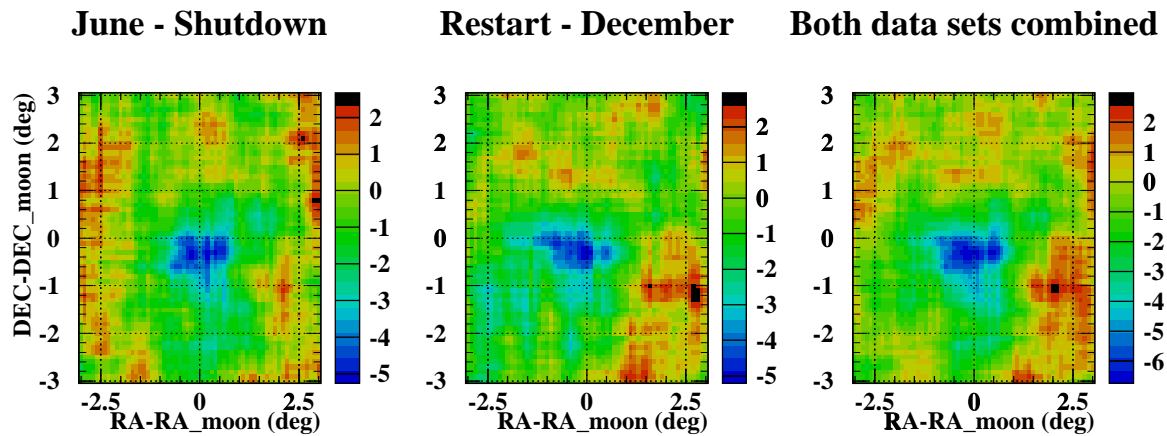**June - Shutdown**   **Restart - December**   **Both data sets combined**

Figure 3: Significance in the Moon.

distributions for the entire data set. Fits of the region -.3 to +.3 to a Gaussian give means of $(0.96 \pm 0.03) \times 10^{-3}$ for x and $(4.83 \pm 0.03) \times 10^{-3}$ for y. The offsets in x and y correspond to a tilt in the detector plane in radians. The mean in x and y therefore correspond to tilts of 0.05^o in x and 0.28^o in y. This finding is not consistent with the evidence for a pointing error described above.
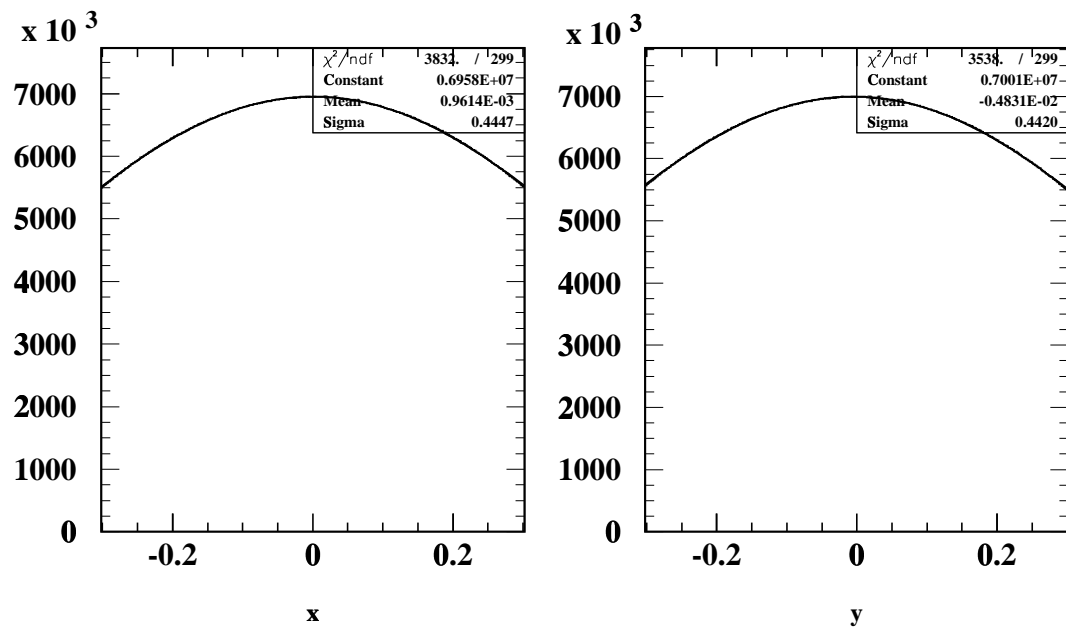
Figure 4: Distributions of x and y for Milagro data set.