Some Thoughts on the 100 Tube Trigger Data on Nov 6 1997

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Our standard Nov 1997 solar flare plot includes the time history of the 100 tube trigger data. We claim in the paper that this rate also showed an increase, although not as significant as that seen in the scaler mode. This is clearly true from a visual inspection of the data, but I think that we should make a effort to quantify this.

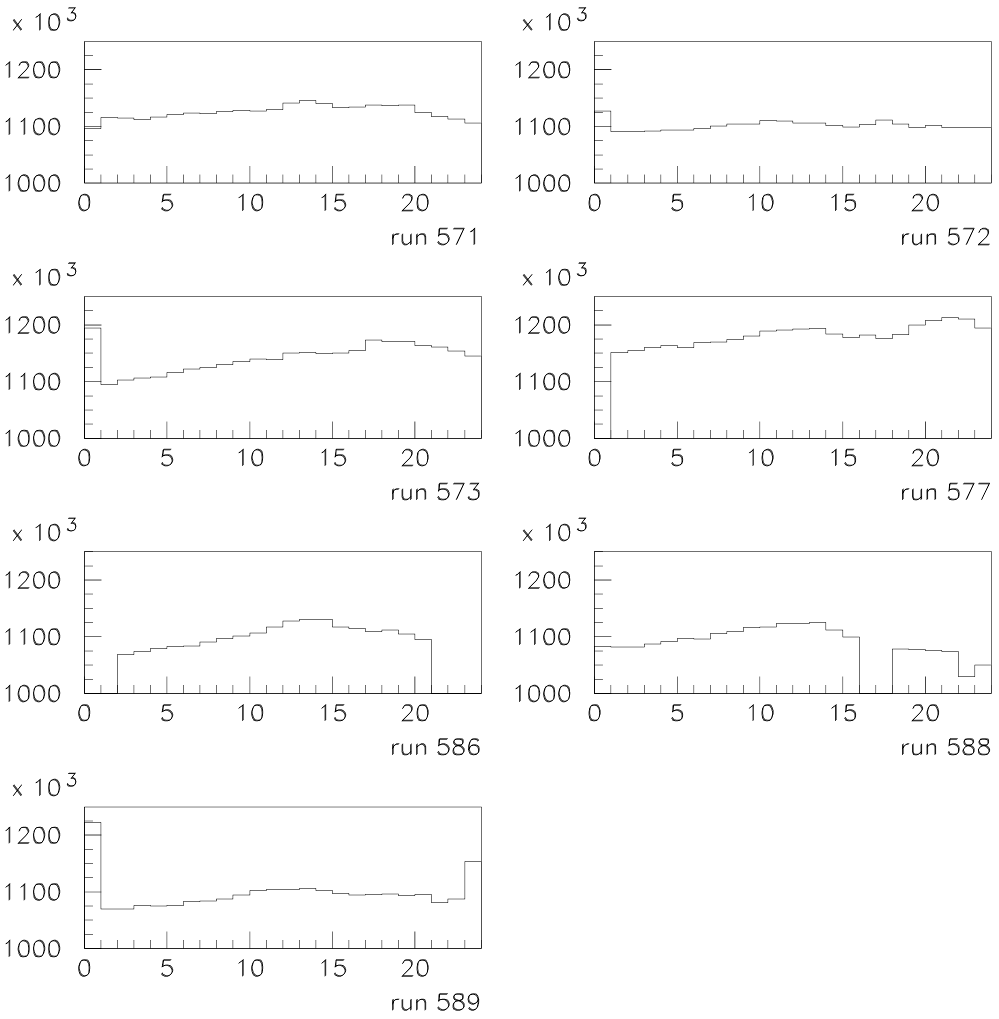

Figure 1: Number of triggered events per hour for 7 days in November. Run 571 (top left) was taken on Nov 6

I binned the triggered data into hour long time bins, and then looked for an excess starting at 12pm. To get a feel for what the typical fluctuations of our data were, I also did this for several other days in November. The time historys of several days in November are shown in Figure 1.

The Nov 6 data is shown in the top left panel of Figure 1. There is clearly an increase begining at 12 ut and lasting for 3 hours. This is similar to what we can see in the scaler and climax data. However, it is clear from looking at the data from other days, that fluctuations of this magnitude (and larger) on timescales of hours are rather common. I am not really too sure how to evaluate the significance of the increase. We are looking for an increased number of counts on top of a background which is varying in an unknown way.

To look at things a little more closely I considered each day between 10 ut and 17 ut. This might reduce the effect of systematic trends which occur at timescales much longer than we are interested in. Figure 2 shows the rate history for each run for this time period. I looked at the rms of these rates on each day to get a feel for the magnitude of the background fluctuations. These ranged from 4106 events (run 572) to 10000 events (run 573). Using these rms values as an estimate of the error, I can calculate the significance of the increase at 12 ut relative to the hour before.

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a: 11-12 ut - 1.12984e6 +- x events were collected
b: 12-13 ut - 1.14167e6 +- x events were collected

a - b = 11830 event excess

assuming the error (x) is 4106
error in (a-b) = sqrt(4106^2 +4102^2) = 5806.7
==> 2.04 sigma increase


assuming the error (x) is 10000
error in (a-b) = sqrt(10000^2 +10000^2) = 14142.1
==> 0.84 sigma increase
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Either way the increase for that hour is not significant or unusual given the typical level of fluctuations that we see in our experiment. I think that it is useful and interesting to think about systematic effects which could cause rate variations in the triggered data. However, I think that it would be better not to include this discussion in the paper, since we are not claiming the 100 tube excess as significant, or drawing any conclusions from it. It sounds a little like we are discussing an unusual rate increase in our data, when in fact such increases are usual, we just don't know why they happen. I think that it might be better just to make the statement that given the typical level of statistical and systematic fluctuations observed in our data, that the apparent increase seen at 12 ut in the 100 tube triggers is not significant.

This is all very well and good, however the significance we really need to calculate should consider the entire duration of the event. The flare in climmax and the scalers lasted for 3 hrs. This is also the duration seen in the 100 tube trigger data. If we were to consider the entire 3 hours it is clear that the significance of the 100 tube excess will

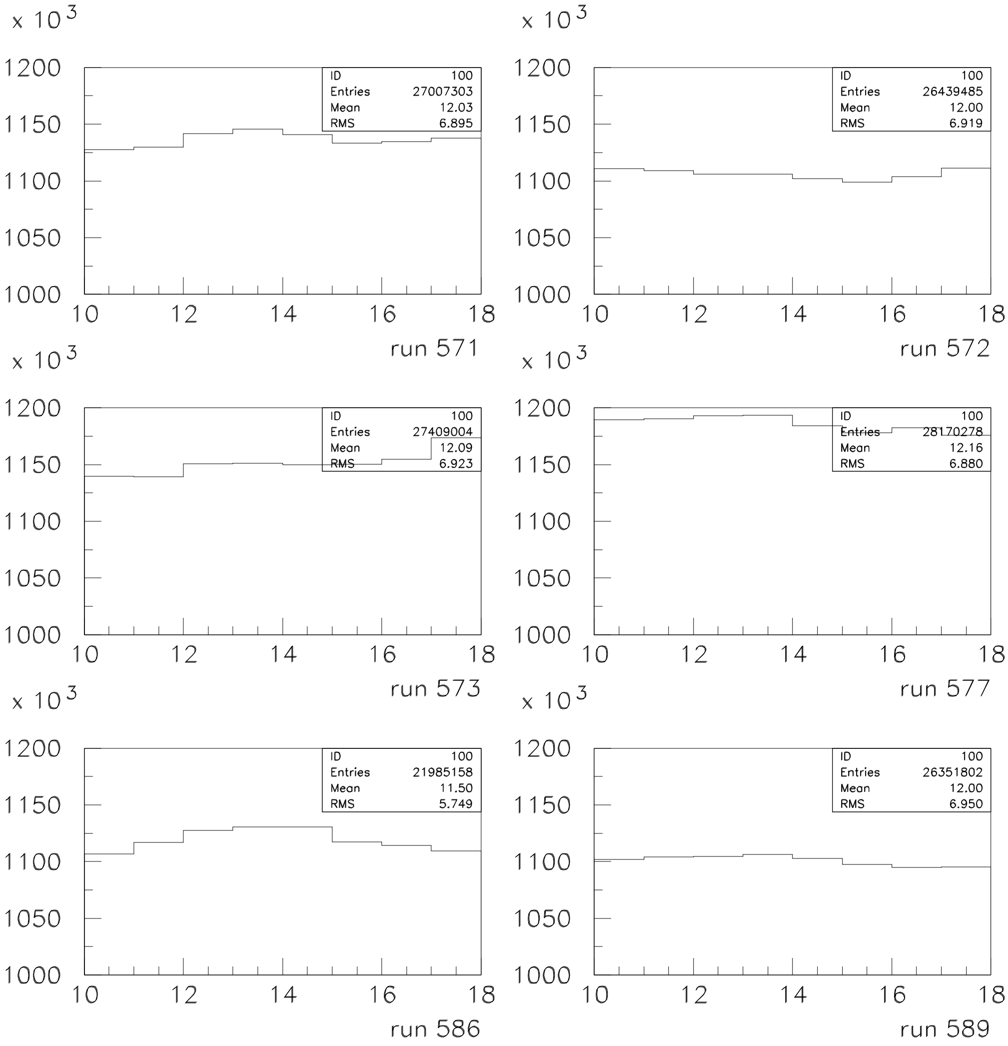

Figure 2: Number of triggered events per hour for 7 days in November. Run 571 (top left) was taken on Nov 6.

be quite a bit higher. It is possible that whatever caused the systematic fluctuations on the other days just happened to switch on during the time of the GLE. Abe has already discussed several possibilities in the paper.

In milagro we see increases in trigger rate correlated with increases in the electronics temperature (see Wisc. meeting notes). Most the the trigger rate increase are due to events which fail the fit. This is worryingly similar to excess we observed from the 100 tube trigger data during the nov 97 gle. Figure 4 shows the temperature of the analogue electronics crate for 971106 and 971108 (which correspond to runs 571 and 573 respectively). While there was an increase in the crate temperature, it did not start until 15 ut. My conclusion? The rate increase in the 100 tube data is marginally significant. The increase is unlikely

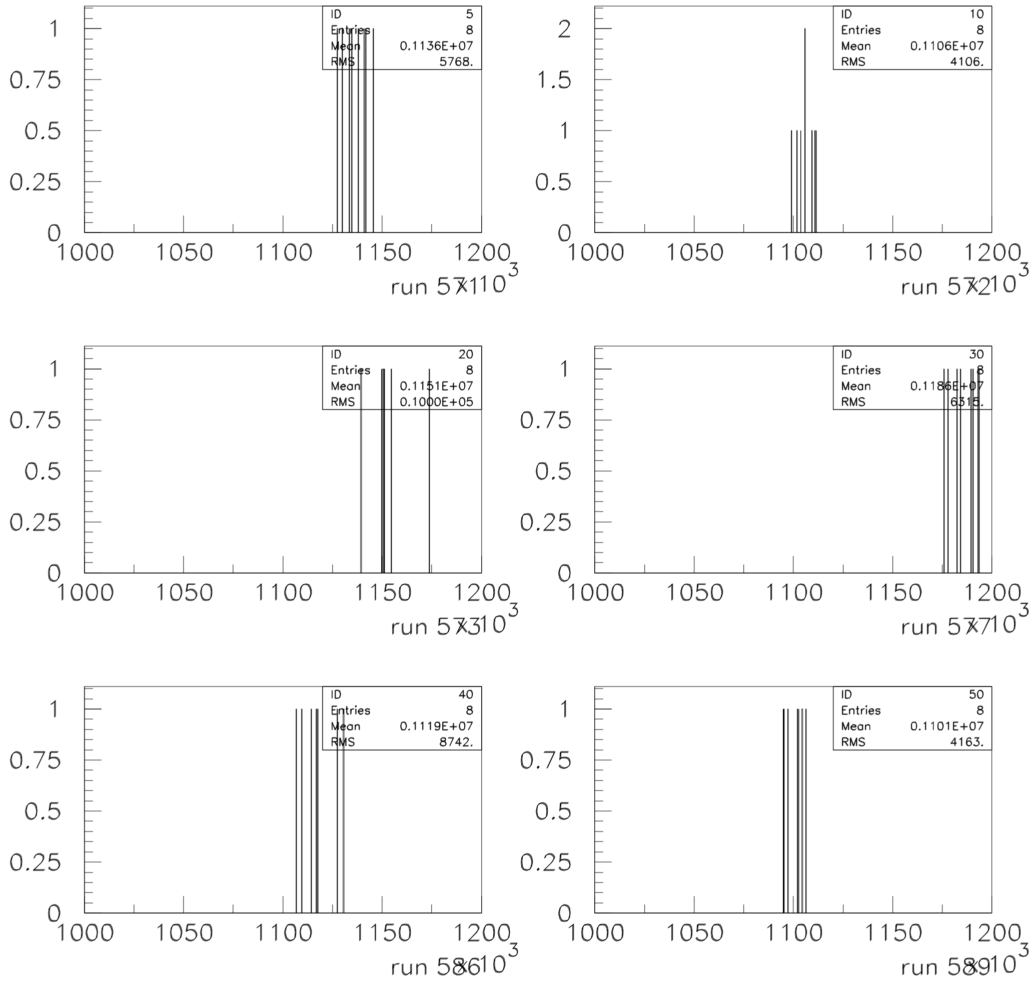

Figure 3: Distribution of events/hour for data from, 6 days in November 1997

to be related to temperature changes in the crate that I looked at.

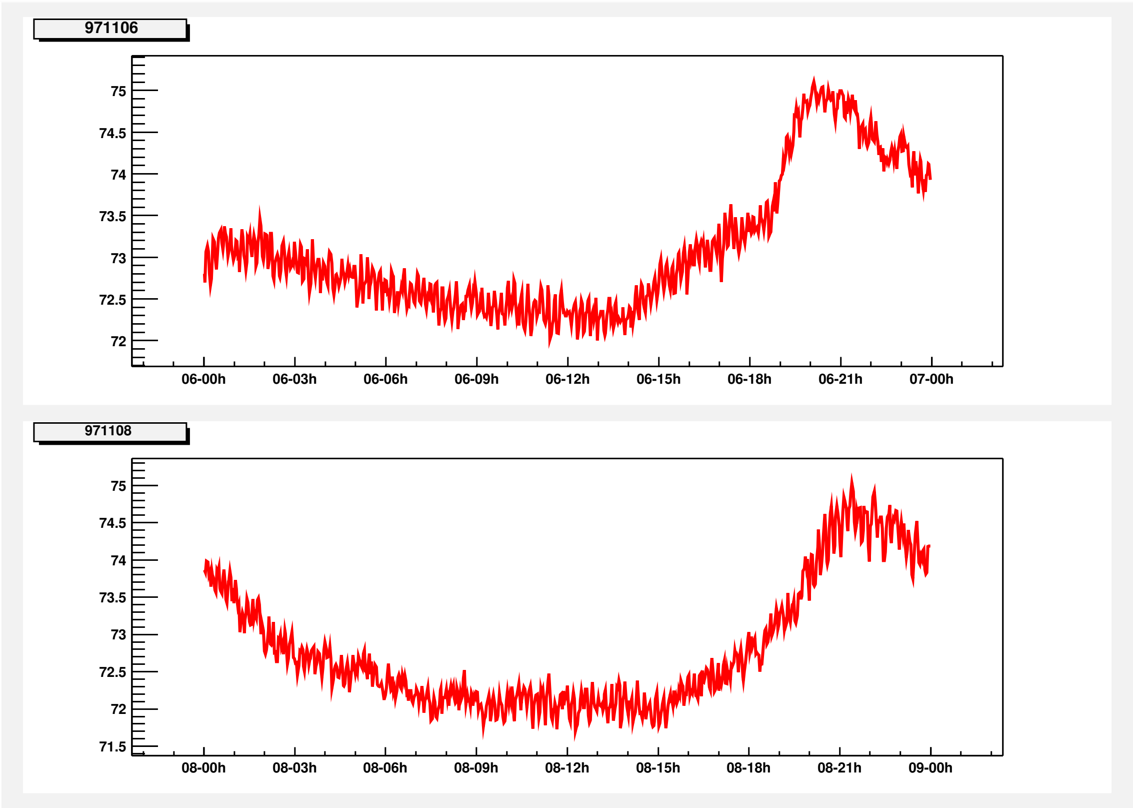

Figure 4: Temperature of analogue electronics on 971106 and 971108