MEXART: II. Sensitivity estimates using observations with the new receiver

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1 Observations

Observations with the new receiver has detected Crab nebula and Virgo-A with a sampling rate of 10 milli-seconds. Interference was present all through the duration of the observations seen as spikes. This obviously would affect the sensitivity estimates. So, attempt was made to clip these interferences using the following procedure. A curve of 'running mean' is obtained by fitting a Gaussian with constant offset ($A\,exp(-(x-\mu)^2/B^2)+C$) to the data over the time window of the source and extending that to nearby regions (thick line in the figures). Using this 'running mean', the rms of the noise, σ, was calculated over a time duration of about 12 minutes, on either side of the known transit time of the source. The samples which deviate from the 'running mean' by more than 4 σ were removed. Since the σ is also biased by the interference, same procedure is recursively applied to the data till the spikes are removed (eye fit). The examples are given below, for Crab and Virgo.

2 Sensitivity

For the best detected source, Crab nebula, a deviation from the offsource of about 0.038 and an rms of 0.006, the source is detected at about 6 σ level. For a flux density of 1200 Jy, the sensitivity is about 200 Jy. In the case of Virgo-A, the deviation is about 0.036 and the rms is about 0.007. The source is detected at 5 σ level and for the source flux density of 1200 Jy, the sensitivity is about 240 Jy. These values are closer to the expected value.

If one averages the signal to a sampling rate of 1 second, the sensitivity is expected to increase by a factor of 10. In this case, Crab nebula and Virgo-A should show 60 and 50 σ detection respectively. However this improvement is not seen. It is difficult to see this signal to noise ratio since the noise is still affected by the interferences that are still present (see figure). The table below summarises the sensitivity estimates.

Source	Detection S/N	ΔS_{rms} (Jy)
Crab nebula	6	200
Virgo-A	5	240

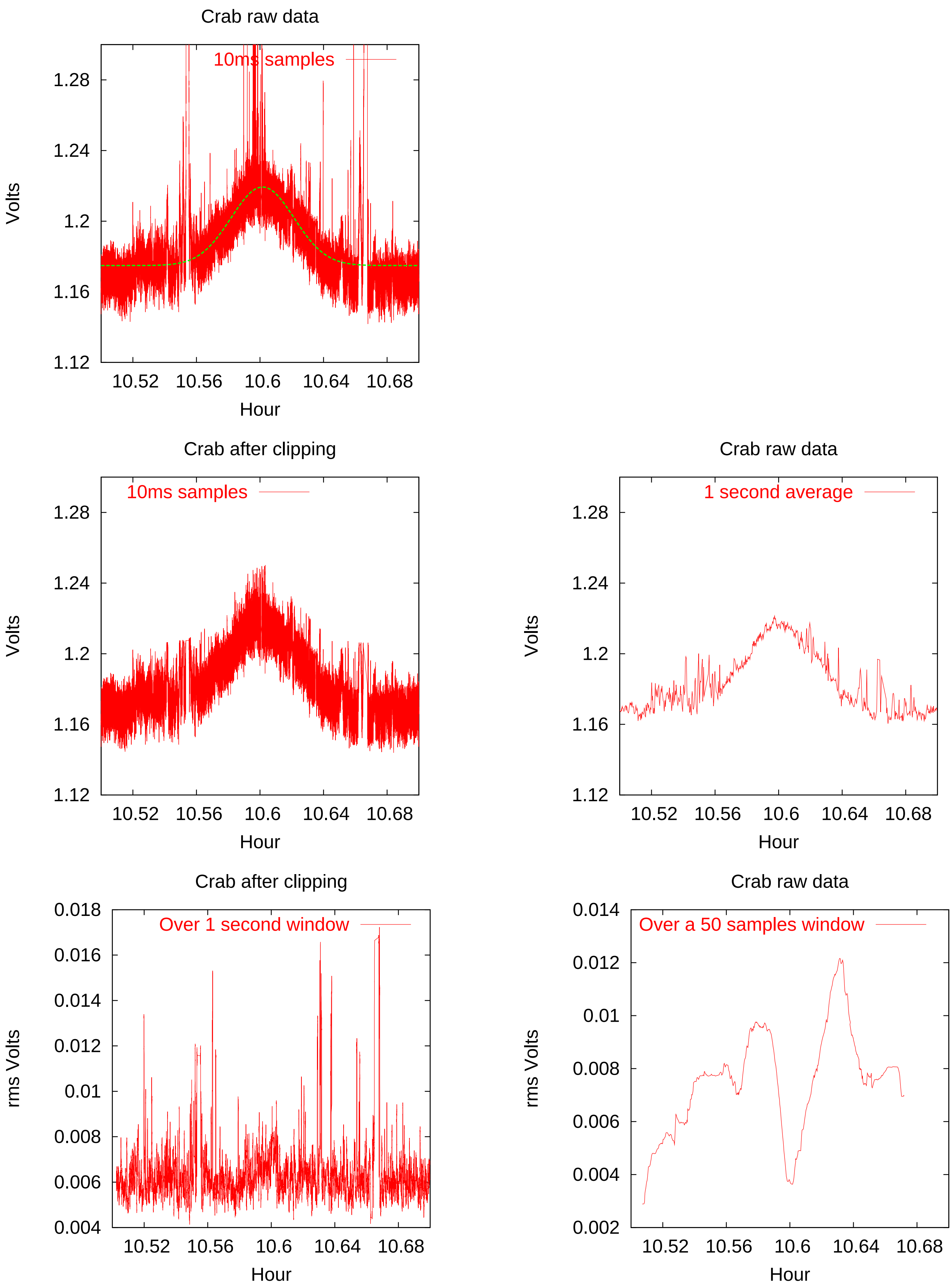

Figure 1: The thick line is the Gaussian fit. The titles carry the meaning of the plots. The right hand side panels are plotted by **NOT** using raw data as shown in the title, but using data after clipping.

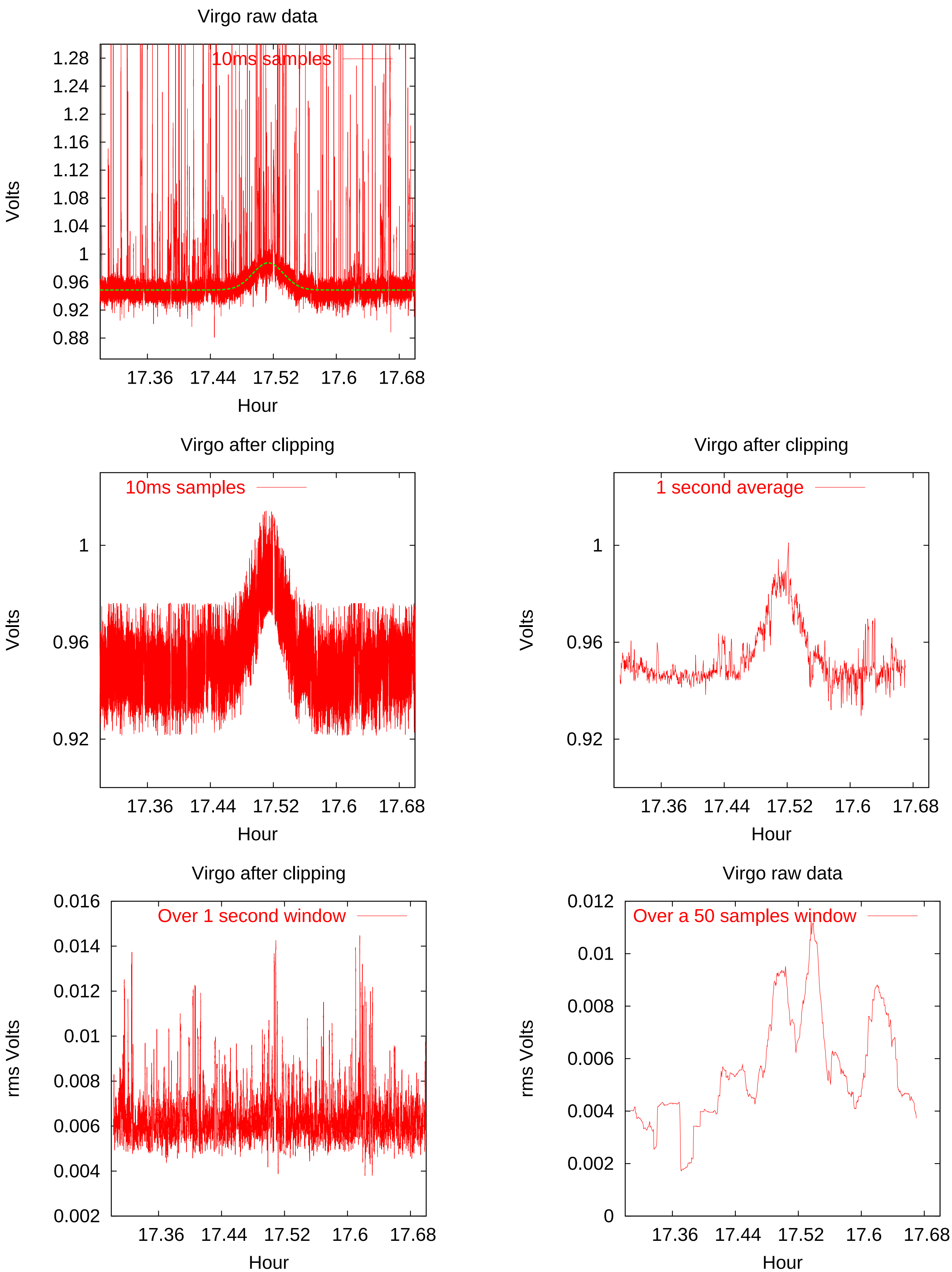

Figure 2: See the previous figure.