

Status of MNFTmon

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LSC Detector Characterization Session August 16 2005

What does this monitor do ?

The monitor tracks variation or drifts (i.e. changes in the statistical characteristics) in the noise floor (i.e. component of interferometric data that is left behind after subtraction of lines and sharp transients).

This monitor is based on the ‘Median based noise floor tracker’ algorithm that has been presented earlier in LSC meetings. A paper has been published earlier in CQG .

(ref : Median based noise floor tracker (MNFT) : robust estimation of noise floor drifts in interferometric data, CQG, 20, 925-936 2003).

**Low pass and
resample**

**Estimate spectral
noise floor using
Running Median**

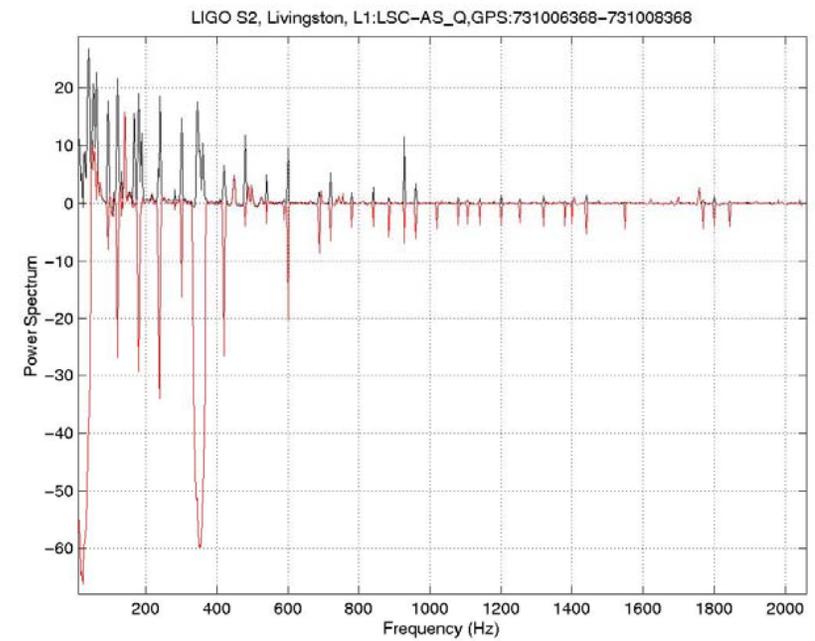
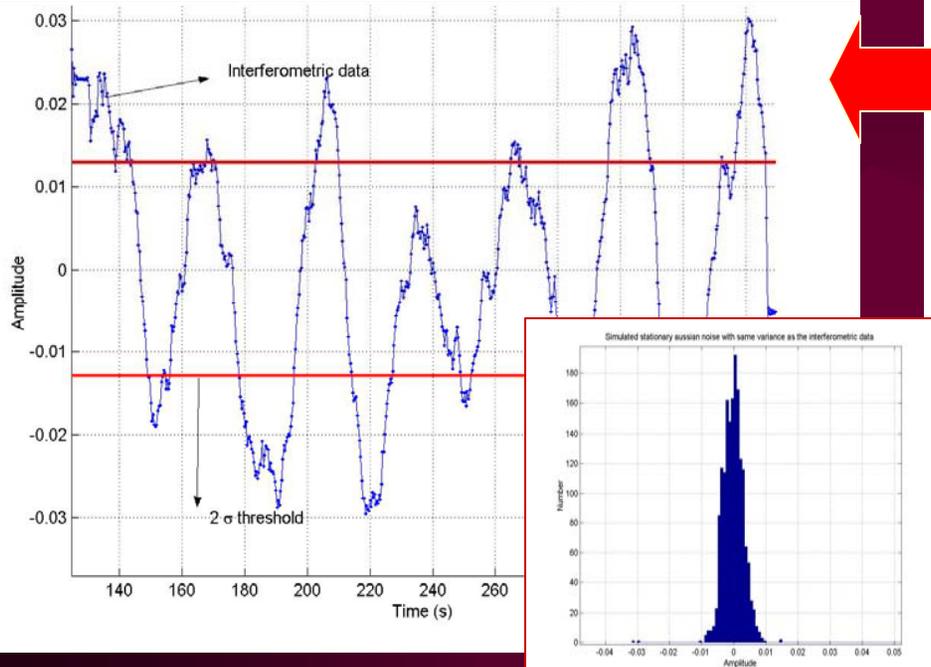
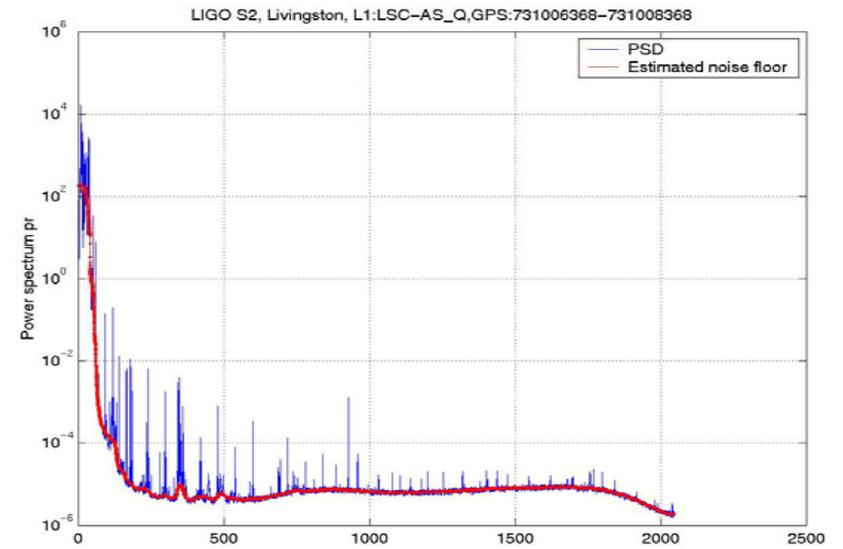
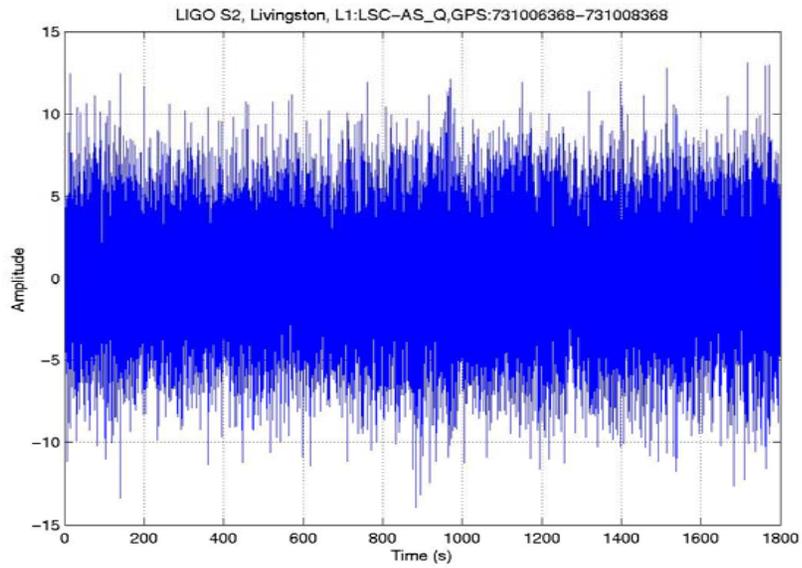
**Design FIR
Whitening filter.
Whiten data.**

**Thresholds set by
simulation using
Gaussian white
noise.**

**Compute Running
Median of the
squared
timeseries.**

**Clean lines.
(Optional
Highpass).**

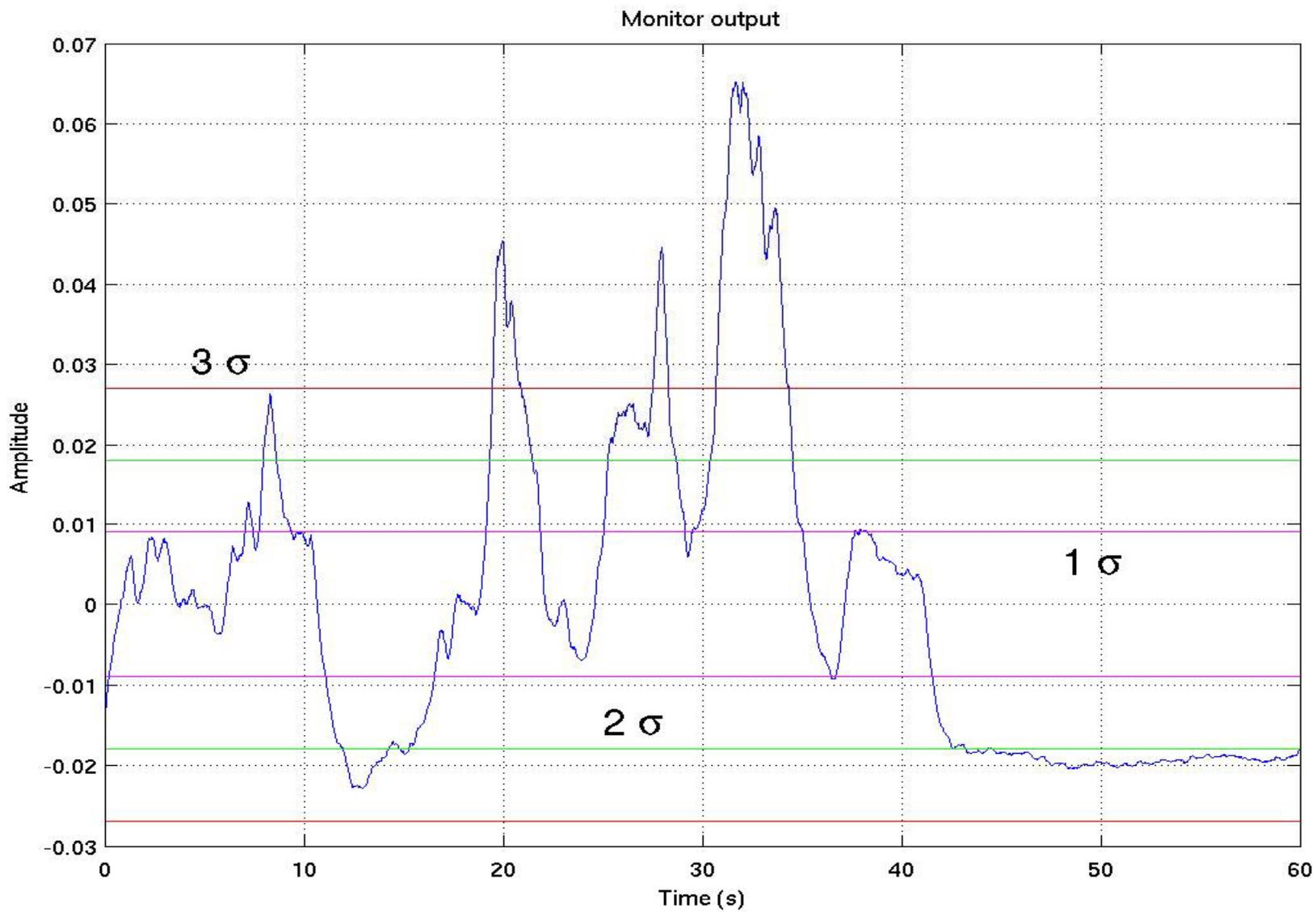
The chain of operations :



Comments on the Code

The monitor

- uses the complete DMT and root framework.
- uses fftw-3.0.1
- consists of a main class called NoiseFloorMonitor which is derived from the DatEnv, MonServer classes of the DMT and a set of classes and functions which are packed into a library which is called waves. This class carries out the following operations :
FIR filtering, non-linear filtering, FFT and convolution, psd, statistics (normally distributed random number generation).
- The output is viewed online as a timeseries, updated every 60 seconds .



Status

- The authors successfully tested the implementation of the code and online viewing of output at LLO last week.
- e2e testing done.
- Command line option to run the monitor with online data :
NoiseFloorMon -param parameter_file -freq frequency_file
parameter_file contains the configuration parameters
frequency_file contains frequency and bandwidth information of the lines to be removed.
- The present version runs on full band (0-4096 Hz).
- 60 seconds time strides used.
- Running Median uses a block length of 4 s.

However ...

- It is more interesting to see the trends in a band limited way – for example, 0-20 Hz, 20-100 Hz, 100-200 Hz and 200-4096 Hz.
- This part of the code to be tested in the coming weeks.
- The authors intend to work at the site next month again to test the final version of the band limited monitor before freezing the code before S5.

Goals

- To run the monitor continuously during S5.
- To flag sections of locked data stretches that show significant deviation i.e. venture out of the 3σ threshold.
- To recognize patterned behaviour in the monitor output, if any.
- To keep working on the development of a figure of merit for astrophysical searches based on the output of the monitor.

Figure of Merit

under development

SNR for any signal (say, a 1.4 1.4 solar mass binary inspiral, or sine-Gaussian etc.) using matched filter can be calculated first using a Gaussian stationary noise.

The output of the monitor can be accurately modeled using ARMA models (*ref : Mukherjee, S., Interferometric data modeling : Issues in realistic data generation, CQG, 21, 1783-1794, 2004*). SNR for the same signal can now be calculated using a sufficiently long realization of the modeled noise.

The deviation ratio can be plotted at each instant of time as a FOM to indicate the sensitivity of the searches.

Focus for S5

To have the monitor running through entire S5 and analyze the pattern of non-stationarity in S5 data.