Introduction to RayleighMonitor

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Outline of Talk

- Introduction to RayleighMonitor
- Reading Rayleighgrams
- Running RayleighMonitor
RayleighMonitor

- DMT monitor that produces scrolling time-frequency plots of the mean and variability of the power in a specified channel:

\[ \frac{\text{st.dev.(PSD)}}{\text{mean(PSD)}} \quad \text{mean(PSD)} \]
Rayleigh Monitor Algorithm

- Makes a set of short-time power spectra.
- Calculates the mean $\mu$ and the standard deviation $\sigma$ of the power spectrum in each frequency bin.
- Ratio $R := \sigma/\mu$ is an interesting statistic:
  - $R = 1$ is what you expect for Gaussian noise.
  - $R < 1$ indicates coherent variation (lines).
  - $R > 1$ indicates glitchy data.
Example: Whitened PSD

“Whitened” power spectrum of H1 AS_Q data (-whiten option)

The noise power in (200,300)Hz and in 60Hz line has dropped since the monitor started.
How to read a Rayleighgram

Same data, Rayleighgram.

Sub-second glitches (not obvious in power spectrum)

Coherent noise around 150, 180Hz.
Example: L1 in S5

look pretty clean, but …
Example

“whitened” PSD shows non-stationarity on few-seconds scale
Running RayleighMonitor

- Instructions under S5 homepage
- From a control room computer at LLO:
  - `xhost +`
  - `ssh gui@delaronde.ligo-la.caltech.edu` (password on back of whiteboard).
  - Once on delaronde:
    - `cd Rayleigh_L1`
    - `./start` (to start RayleighMonitor)
    - `./stop` (to stop RayleighMonitor)
The config files for setting parameters are simple (there’s also help documentation!)

RMconfig.txt looks like:

0.125000  \[\text{length of each data segment (s)} = \frac{1}{\text{freq. resolution}}\]
8  \[\text{number of segments to average per pixel}\]
999999  \[\text{run this many time steps before quitting}\]
1
L1:LSC-AS_Q  32.00000  512.000000

channel  low freq.  high freq.
If you’re really interested…

- RayleighMonitor would really benefit from a few additional features:
  1. Ability to automatically locate old data at the sites and run on requested GPS times. Currently, if you want to run on past data, you have to locate it yourself (this feature could be based on the FrameCacheQuery command).
  2. Special code for –fast plots is unstable. It would be great if the instability could be removed.
  3. Better yet would be speeding up the much more versatile -slow plotting code (in which case the beer’s on me).

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