



RayleighMonitor Overview

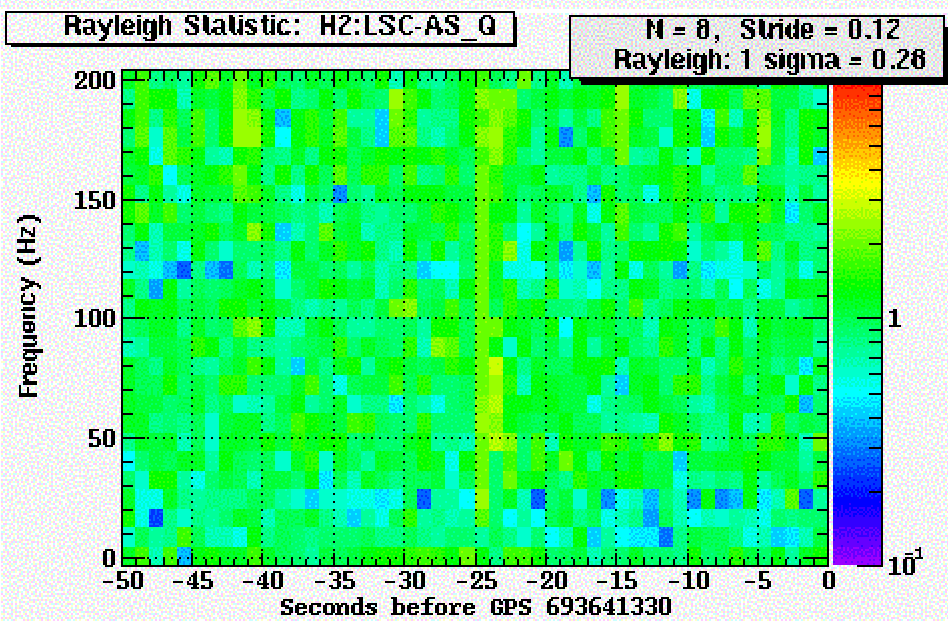
Patrick Sutton and Peter Saulson

Outline of Talk

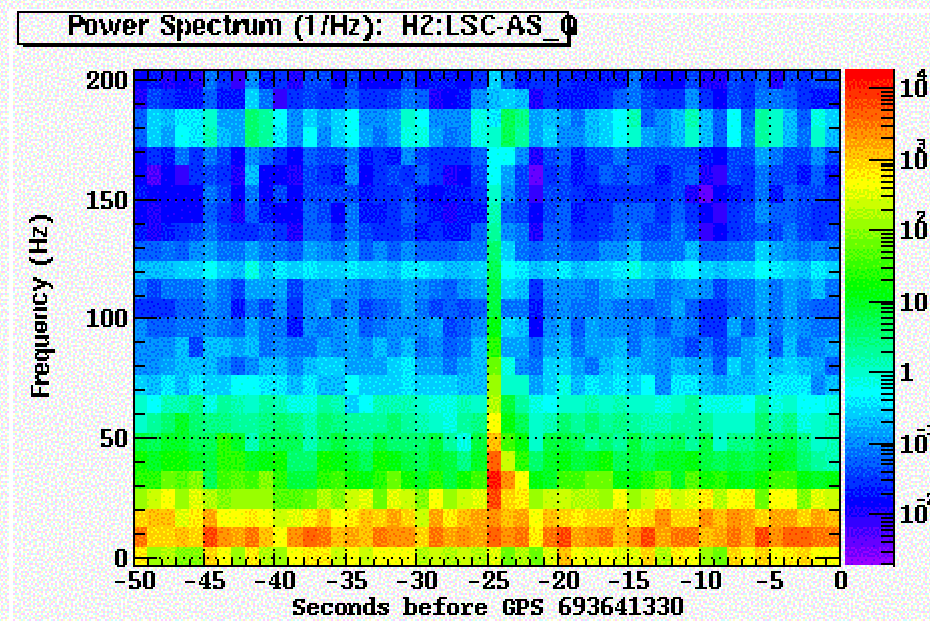
- Introduction to RayleighMonitor
- Reading Rayleighgrams
- Demonstration

RayleighMonitor

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



$\text{st.dev}(P)/\text{mean}(P)$

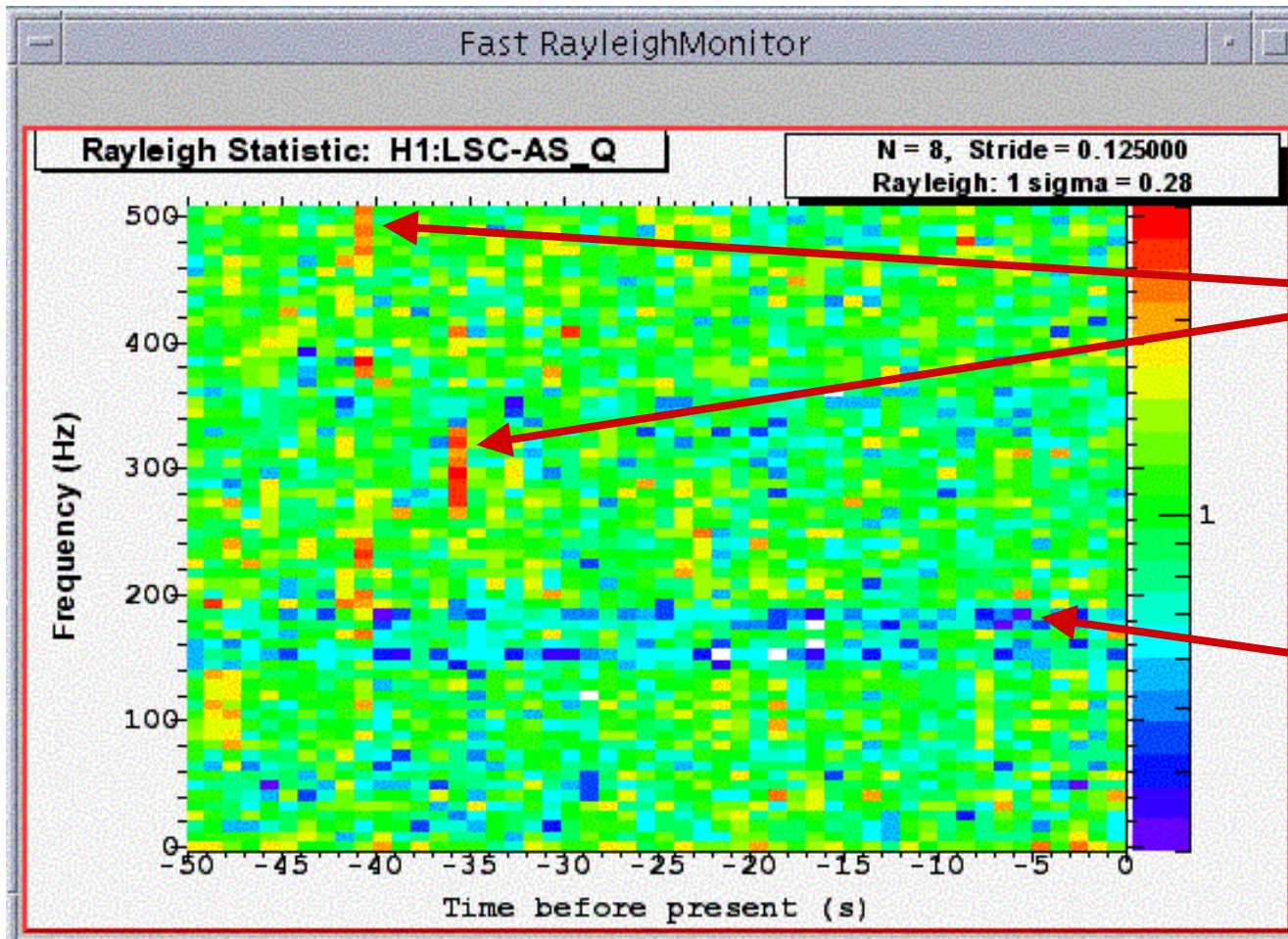


$\text{mean}(P)$

RayleighMonitor Algorithm

- Makes a set of short-time power spectra.
- Calculates the mean μ and the standard deviation σ 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.
 - » $R > 1$ indicates glitchy/ratty data.
- RayleighMonitor plots scrolling spectrograms (μ) and “Rayleighgrams” (R) for visual inspection of data characteristics.

How to read a Rayleighgram



Same data,
Rayleighgram.

Sub-second
glitches (not
obvious in
power
spectrum)

Coherent
noise around
150, 180Hz.

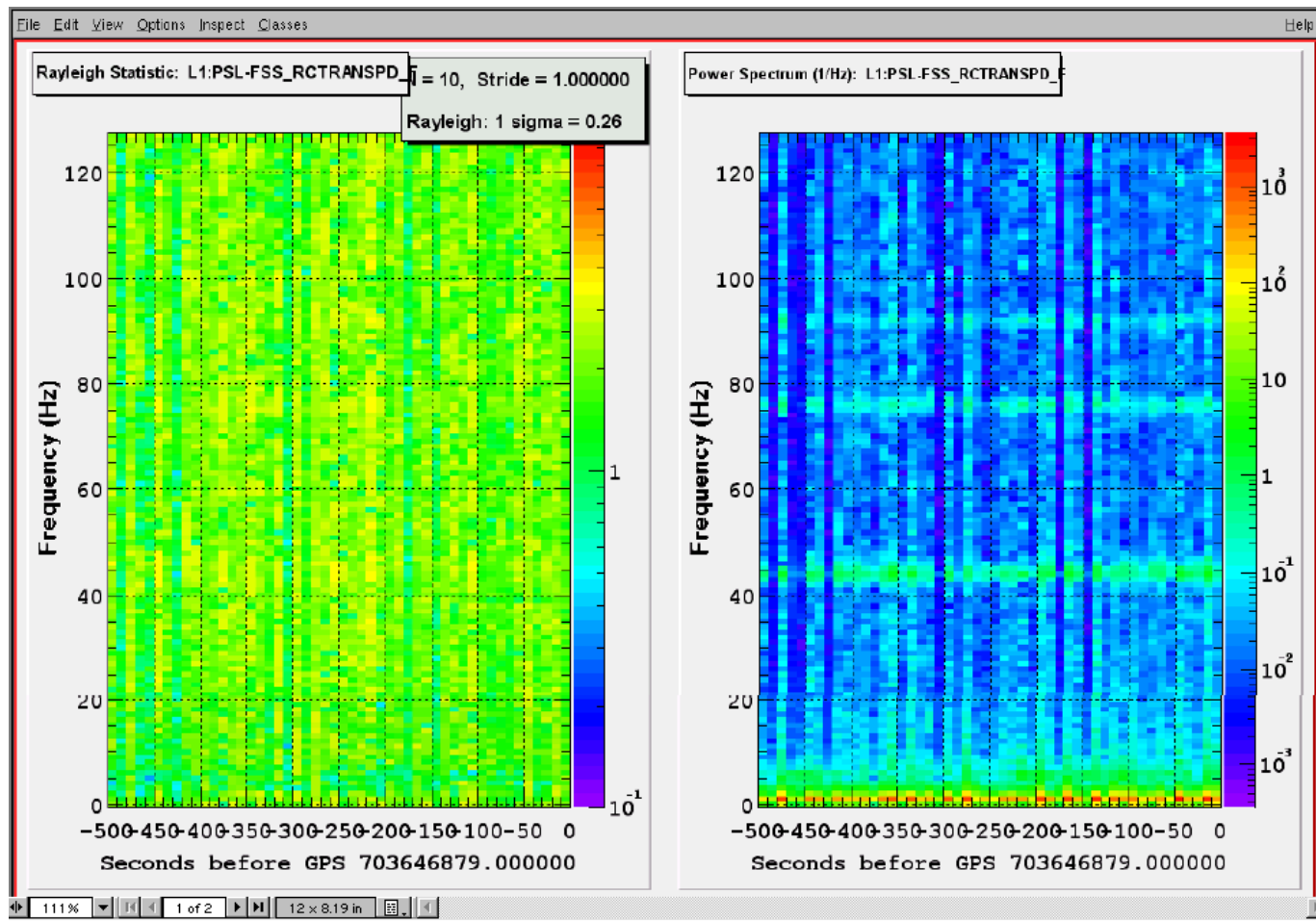


RayleighMonitor, looking at PSL ref cav transmitted light

r: spectrogram
l: Rayleighgram

Orange pixels $R = 3$ to 4: full of glitches.

Noise variations also visible in spectrogram.

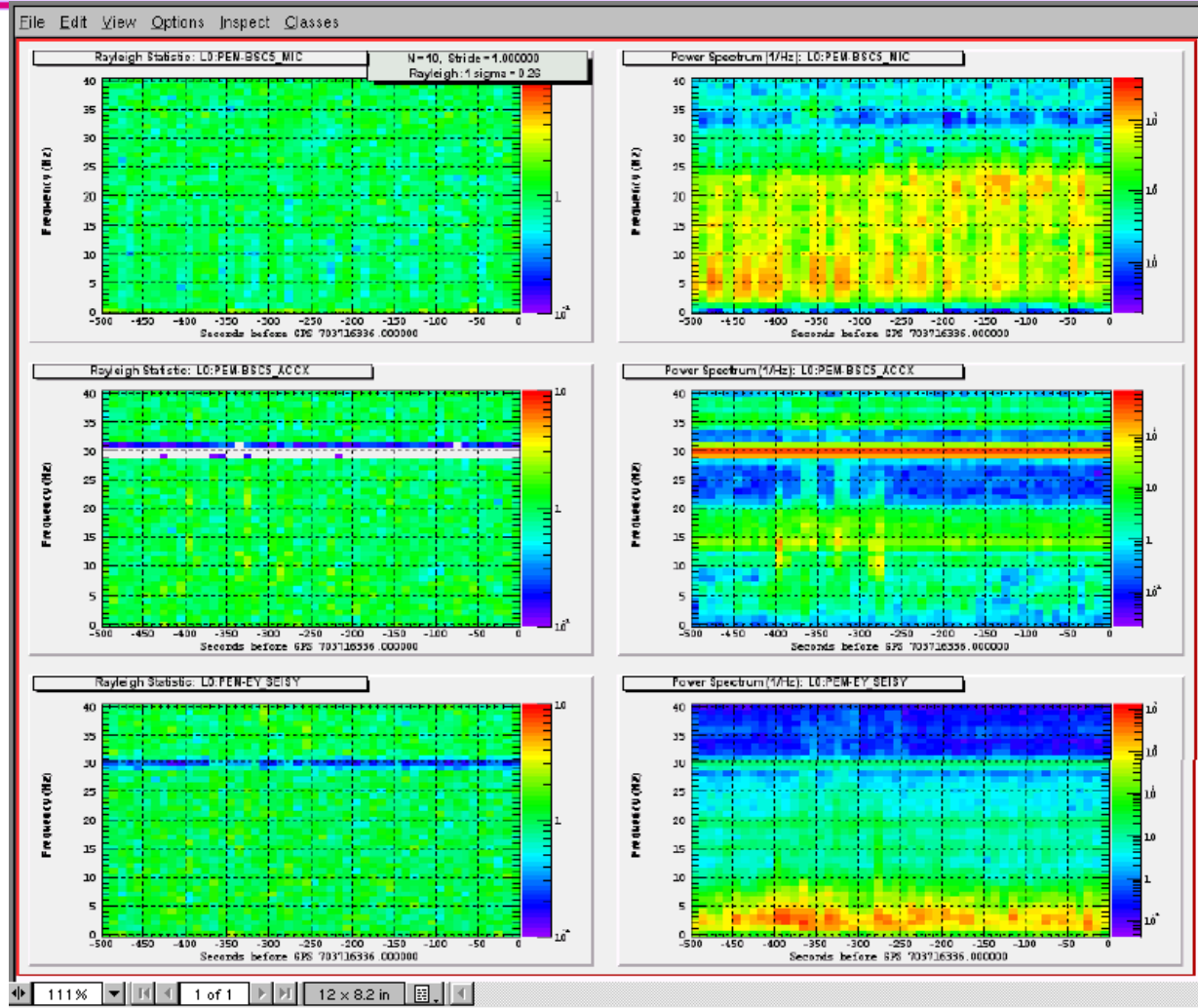




PEM signals from LLO EY: MIC, ACC, SEISY

Spectrograms show variability of noise.

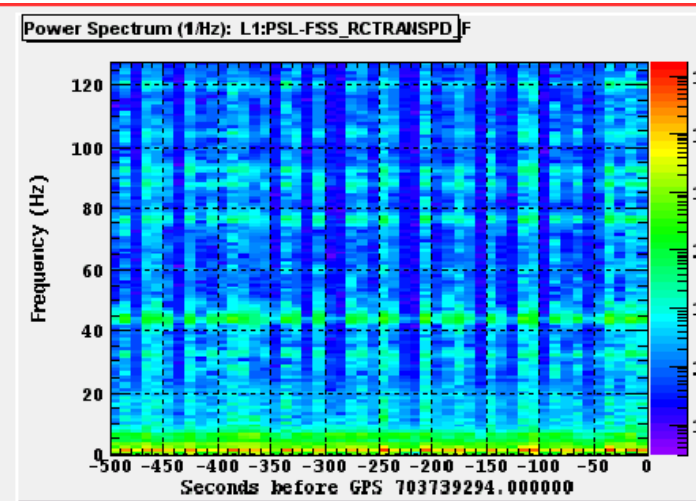
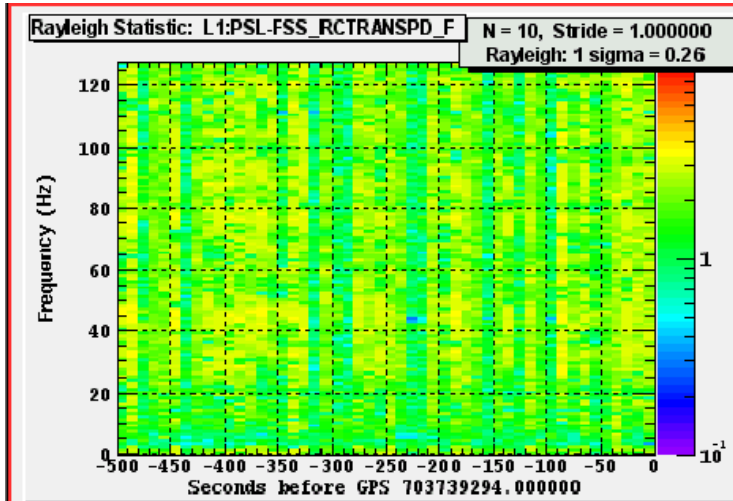
Rayleighgrams show coherent 30 Hz line (in ACC, SEISY), intermittent coherent noise (MIC).



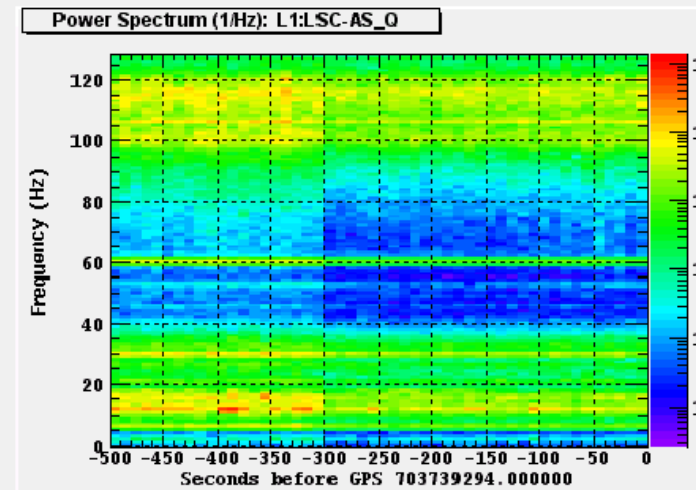
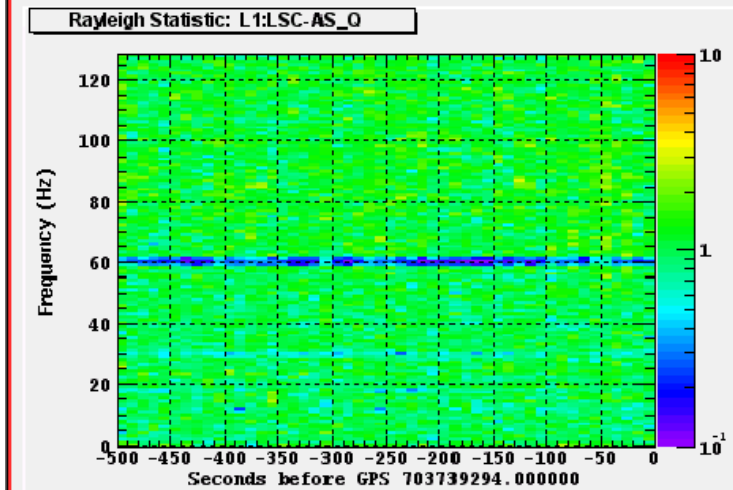


Studying PSL glitches vs. AS_Q

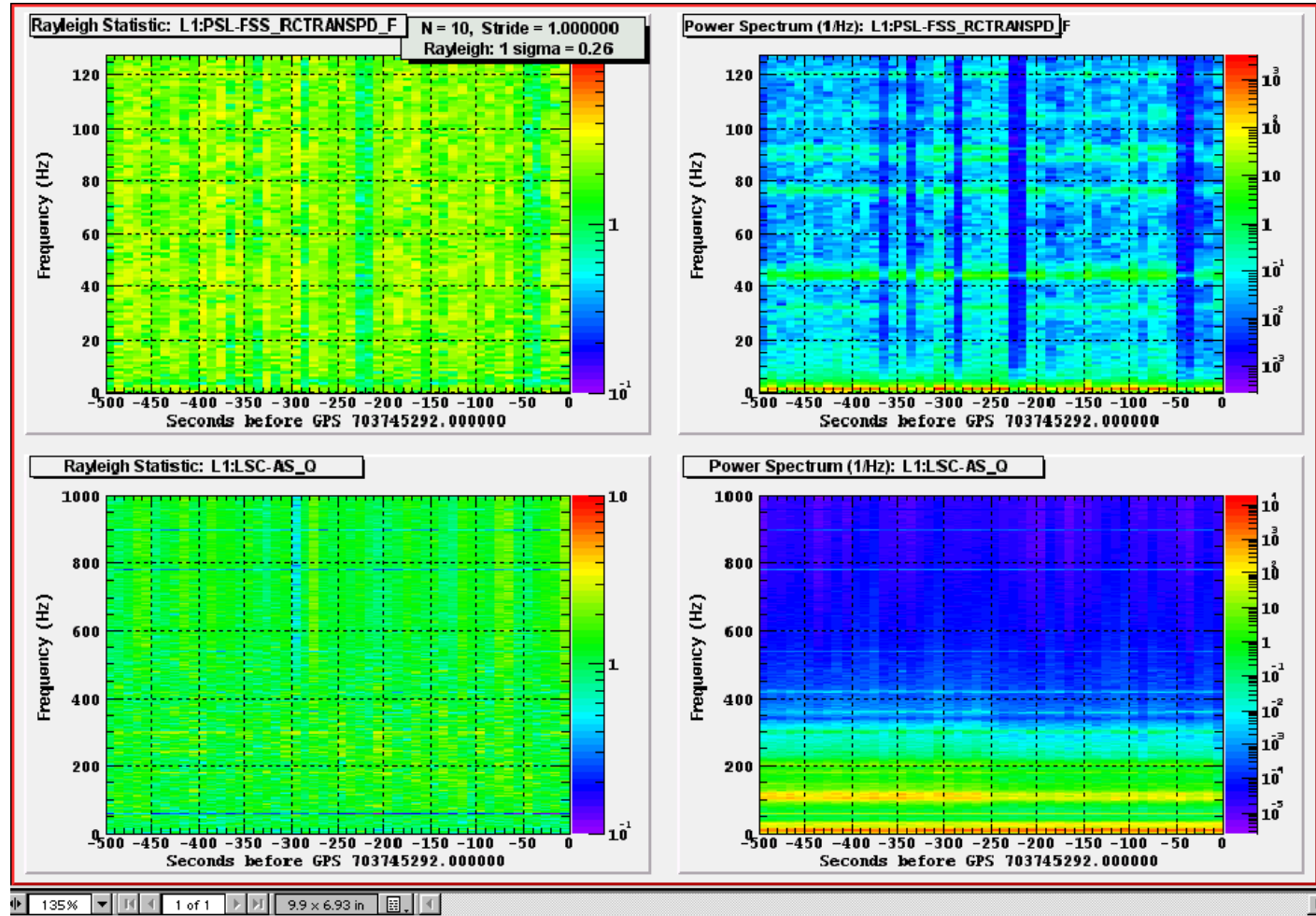
PSL
glitchy



AS_Q
pretty calm



PSL and AS_Q (wider band)



AS_Q
at high f , more
variability in
noise, R .

Modes of running RayleighMonitor

- Can control via GUI or configuration file.
 - » **-batch option:** No GUI (more stable).
- Two speeds: slow and fast.
 - » **-fast option (default, recommended):** Basic version for one channel only (can run multiple copies). Plots are non-interactive, can only save by hand using screen snapshots.
 - » **-slow:** Interactive plots, multiple channels, can save individual plots or entire plot output.

To launch RayleighMonitor today, I ...

- Launched my X-windows application (Exceed, in my case)
- ssh'ed into sand as ops
 - Password can be obtained in Control Room
- `setenv DISPLAY my.ip.num.ber:0`
- `cd Rayleigh_H1`
 - This is needed simply to take advantage of a pre-existing config file
- `RayleighMonitor -fast -batch -fixedrange &`

Two scrolling windows appear. One is spectrogram, the other is Rayleighgram

To end the job, need to find job id using `ps`, then use `kill` command.

See the documentation at

<http://gravity.psu.edu/~psutton/RayleighMonitor/RayleighMonitor.html>

Miscellany

- Common options “-fast,” “fixedrange” on by default.
- New (for S3) option “whiten” for whitening power spectrum; may help for spotting glitches.
Right now, -whiten isn’t working. (Causes program to crash.)
- The GUI windows have a help button which displays the up-to-date documentation; you can also get full documentation from the S3 page and from the DMT spi page (though the latter may only be available when the monitor is running!).

To GUI or not to GUI?

- GUI capability mainly enables you to set parameters (e.g. stride, freq range), but is too slow for most purposes for running the monitor itself.

Can someone fix that?

- The config files for setting parameters are simple.

```
0.125000
```

```
8
```

```
999999
```

```
1
```

```
H1:LSC-AS_Q 16384 0.000000 512.000000
```

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*).
- Contact psutton@ligo.caltech.edu

* [Patrick, not Peter]