Status Report on Instrumental Line Catalog and Blind CW Search

Keith Riles, Dave Chin

University of Michigan

Overview

Two related efforts:

- Building instrumental line noise catalog using engineering run data and DMT tools

   -> Some progress

- Setting "blind" upper limits on CW sources

   -> Just getting started

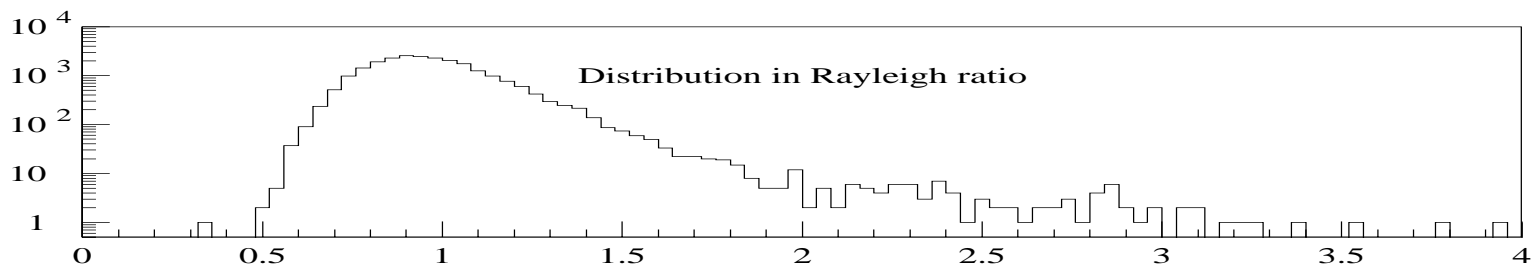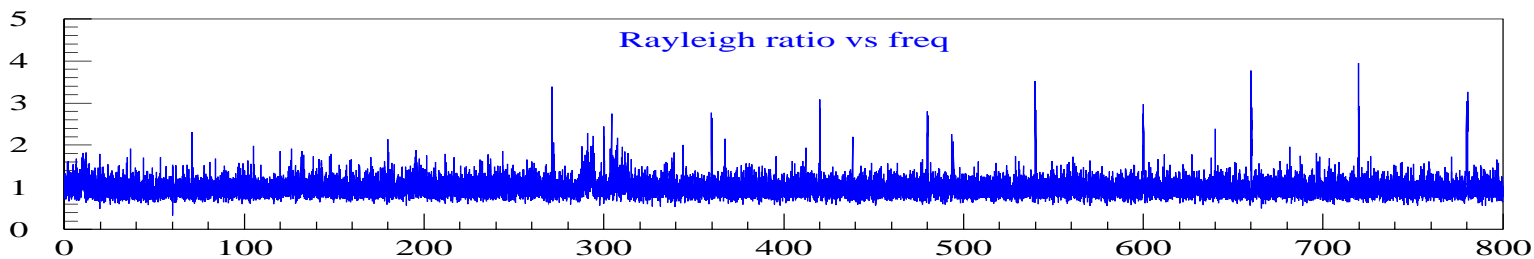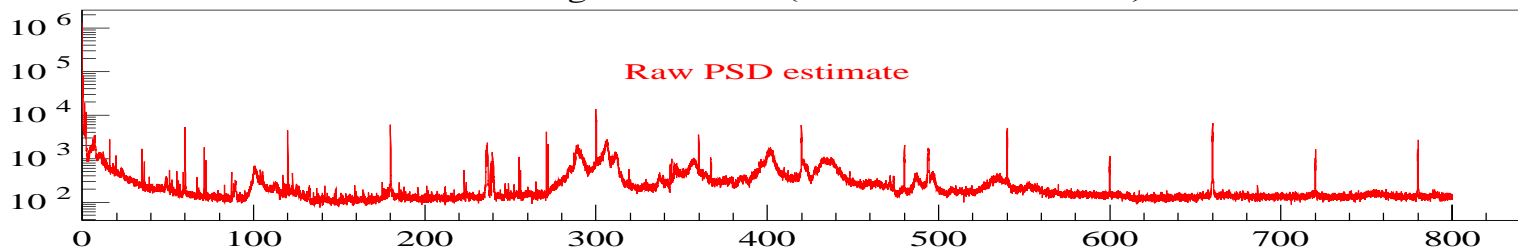LIGO-G010271-00-Z

Instrumental Lines

- **Known mechanical resonances (>150) in Hanford 2K inserted in meta-database early this year**
  - » Original list from M. Landry & D. Ottaway (LIGO-T000020-00)
  - » Basic entries:
    - Best known central frequency
    - Best known FWHM in frequency
    - Bit flag for additional info (e.g., phase for coherent lines)
  - » Sample entries for butterfly test mass resonance at 6747.5 Hz:
    Name=Line:H2:6747.5:freq0:mirror Value=6747.5
    Name=Line:H2:6747.5:fwid0:mirror Value=0.0052
    Name=Line:H2:6747.5:finfo:mirror   Value=0.0   (no addl info yet)
    (nominal line value used as common index in variable name)
  - » This naming scheme circulated to ASIS in December 2000 and CW group in March

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Instrumental Lines

- Now sorting through E4 (Livingston recombined) GW channel to find stochastic, coherent, and quasi-coherent lines (see sample plots)

- Will look at E5 (Hanford recycled) data soon

- Experimenting with varying time intervals for averaging, windowing, transient removal, Rayleigh measure, etc.

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Instrumental Lines

Looking at 0-800 Hz (15 minutes of E4 data)

Raw PSD estimate

Rayleigh ratio vs freq

Distribution in Rayleigh ratio

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Instrumental Lines

- Once criteria decided for stochastic line ID, insert next set into database (Plan: by Sept. 15)

- Coherent and quasi-coherent lines will require special attention – several tools available for tracking (Klimenko, Ottewill, Sintes)

- Will set up infrastructure for storing time-stamped database info on these lines, as seen in GW channel (e.g., amplitude, phase coefficients) during En runs, with n=4-5-?)

  (Plan: by Oct. 15)

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Blind CW Search

- Choose frequency binning for which "typical" 2-week Doppler modulation gives migration of O(1 bin)

- Take averaged power spectra over many short time intervals. Set limits empirically based on software-injected signals.

- Possible approaches to defining "signal":
  » Baseline noise set by neighboring frequency bins
  » Rayleigh measure
  » Time-interval chi-squared test
  » ??? (Use whatever works most reliably on real data!)

Blind CW Search

- Expect final signal criteria to be relatively simple and final run over data to be quick

- Laborious part will be determining sensitivity vs frequency and direction (and vs one spin-down parameter, if feasible)

  -> Monte Carlo, Monte Carlo, Monte Carlo!

- Hope to derive fairly smooth sensitivity parameterizations based on sampling

Blind CW Search

- ## Will "practice" on E4/E5 data

- ## LDAS, MDC's and all that…
  - » No plan to implement analysis in LDAS before xmas
  - » Bulk of analysis <u>IS</u> a mock data challenge
    (determining analysis sensitivity)

- ## Near-Term Plan:
  - » Try to leverage instrumental line noise analysis and work in parallel
  - » Set up skeleton Monte Carlo infrastructure by October 15
    - – Tempo (or Curt's LAL counterpart) for phase generation
    - – Dave's *detresponse* package (LAL) for antenna pattern

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Blind CW Search

- **Farther term:**
  - » Depends on manpower to help, may depend on CPU power
  - » Dave available to help in September if all goes well with current projects in DMT and LAL
  - » More help welcome! And suggestions!