Data Quality and Vetoes in Searches for Compact Binary Coalescences in LIGO's Fifth Science Run

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Searches for gravitational waves from compact binary coalescences (CBCs) are hindered by the presence of transient detector noise, which produces false alarms. The LSC has identified a variety of data artifacts, in both the gravitational wave and auxiliary channels, which are associated with false alarms. We find time intervals effected by these artifacts, and use them as vetoes for CBC searches in LIGO's fifth science run.

(1) Example of a Data Artifact:

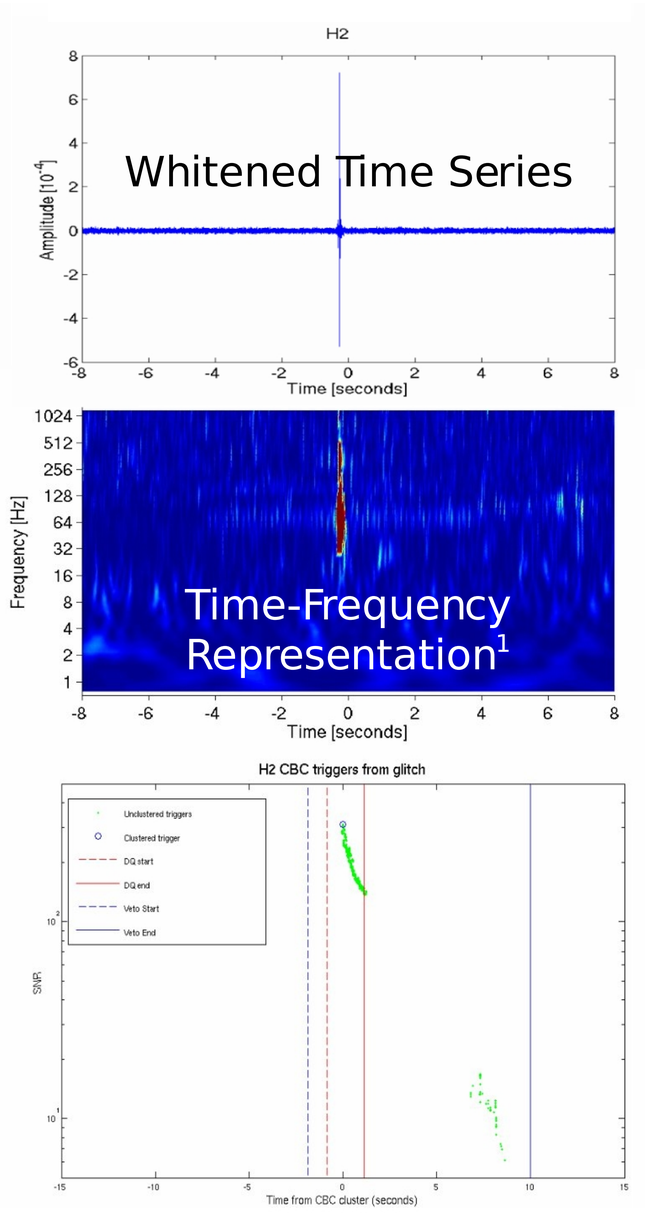
• Overflow in the Length Sensing and Control feedback loop, which causes a noise transient.

(2) Veto Windows for CBC Searches:

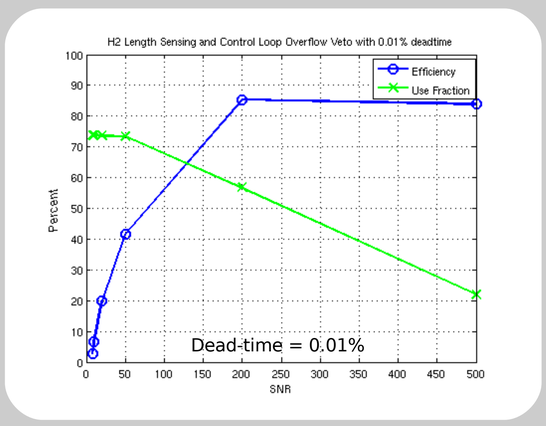
• Data Quality flags mark intervals of data that contain known artifacts in the gravitational wave channel.

• Triggers from CBC searches may occur seconds after the artifact, because they mark the apparent coalescence time of the binary system.

• We add time windows around the data quality flag to veto these triggers.



(3) Veto Evaluation:



• Efficiency is the percentage of the clustered triggers above a given Signal to Noise (SNR) threshold that are vetoed.

• Use fraction is the percentage of the veto windows containing at least one trigger.

• Dead-time is the percentage of the time analyzed that is removed by this veto.

(4) Veto Categories

Category 1 Vetoes:

•Detector not running in proper configuration.

Category 2 Vetoes:

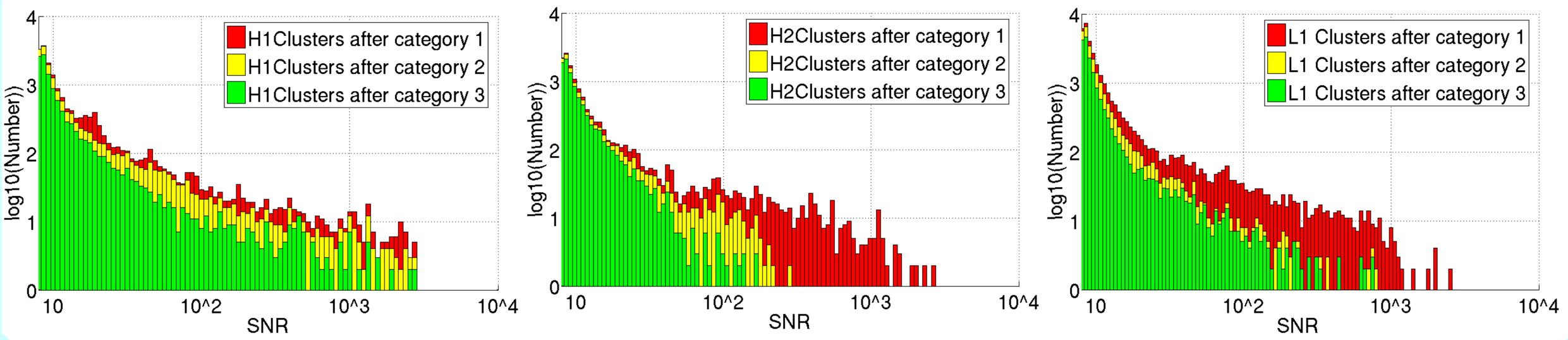
•Well understood instrumental problems with strong correlation to triggers (calibration issues, feedback loop overflows, and tests of injections of simulated signals).

•Generally incur small dead-time (~ 1%).

Category 3 Vetoes:

•Poorly understood data quality issues, but with a positive correlation to triggers (effects of seismic noise, high winds, dips in power in the arms).

•Incurred larger dead-time (~ 5%)



(5) Results:

We show histograms of single-interferometer triggers, clustered over 10 seconds by highest SNR. The distribution of clusters is not consistent with Gaussian noise. Vetoes greatly reduce the outliers, and thereby lower the background for detection likelihood as well as for upper limits. However, *all* detection candidates, including those in vetoed times, are followed up.

For information on follow-ups, see GWDAW12 talk by Romain Gouty, *Detection confidence tests for Burst and Inspiral Candidate Events*
For burst search veto efforts, see accompanying GWDAW12 poster by Lindy Blackburn, *The Role of Data Quality in S5 Burst Analyses*
For how to find artifacts, see GWDAW12 poster by Shantanu Desai et. all *The LSC Glitch Hunters: Monitoring noise transients during S5*

[1] Chatterji, S. Ph. D thesis, MIT, 2005

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