Upper Limits on the Rate of Gravitational Wave Bursts from the First LIGO Science Run

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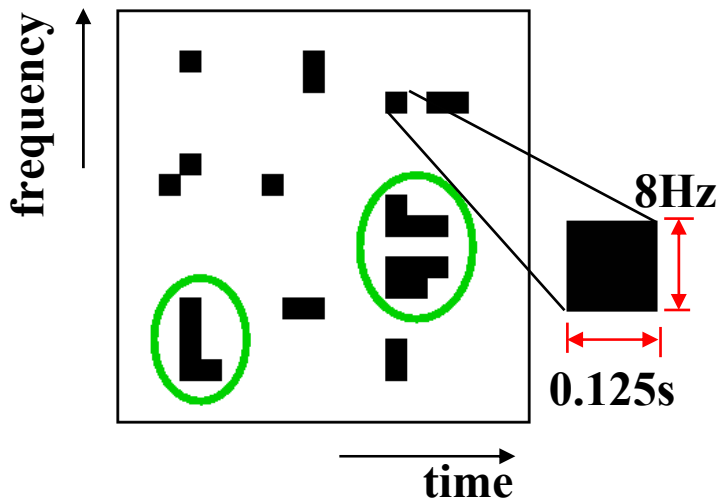
Searching for 'Unmodelled' Bursts

AIM **The LIGO burst group searches for waveforms from sources for which we cannot currently make an accurate prediction of the waveform shape.**

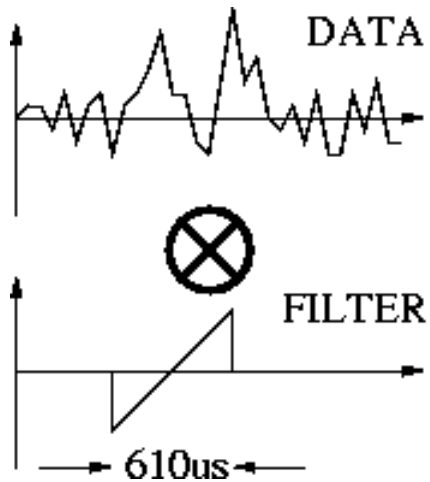
METHODS

'Raw Data' → Time-domain high pass filter

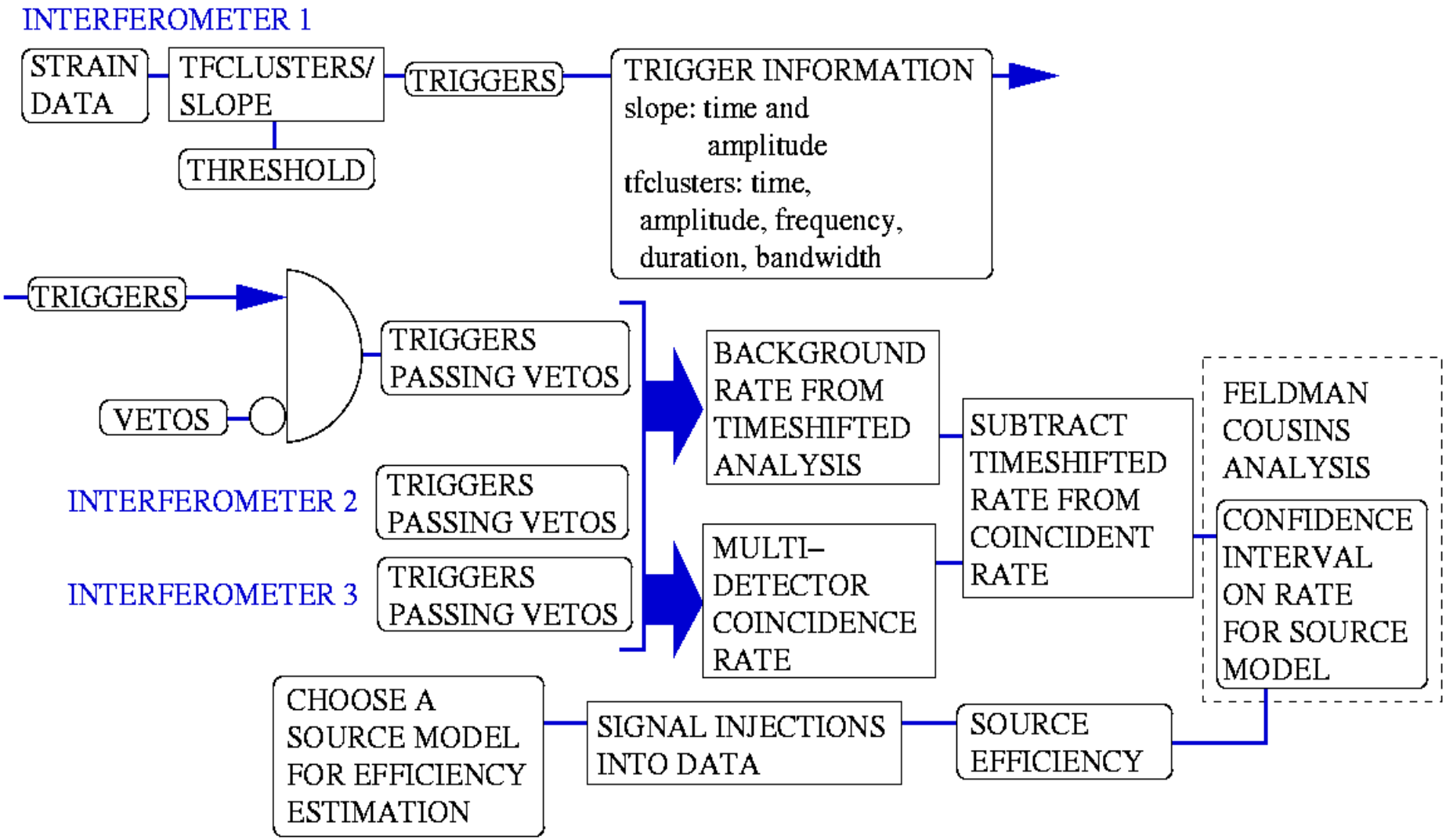
Time-Frequency Plane Search
'TFCLUSTERS'



Pure Time-Domain Search
'SLOPE'



The Analysis Pipeline

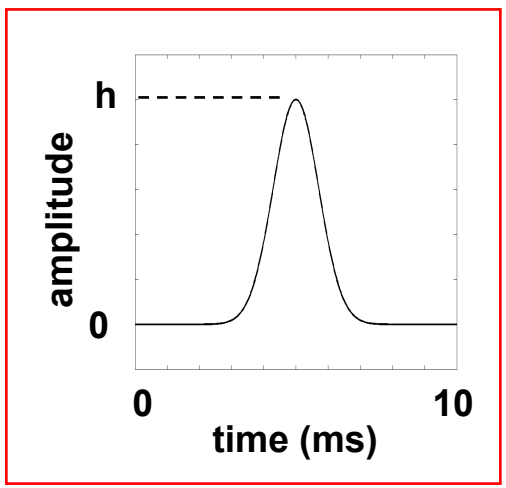


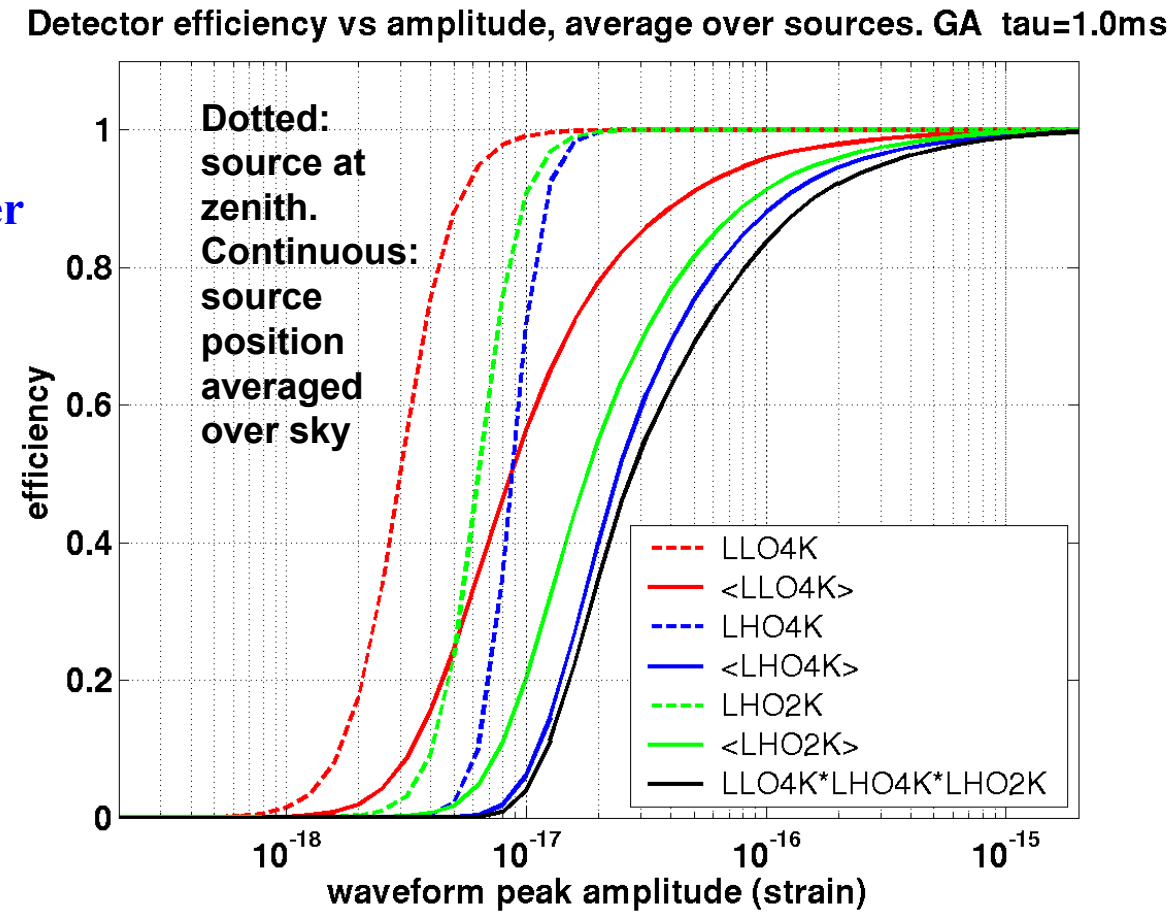
Determination of Efficiency

Efficiency measured for 'tfclusters' algorithm

To measure our efficiency, we must pick a waveform.

For this talk, we consider a 1ms Gaussian burst





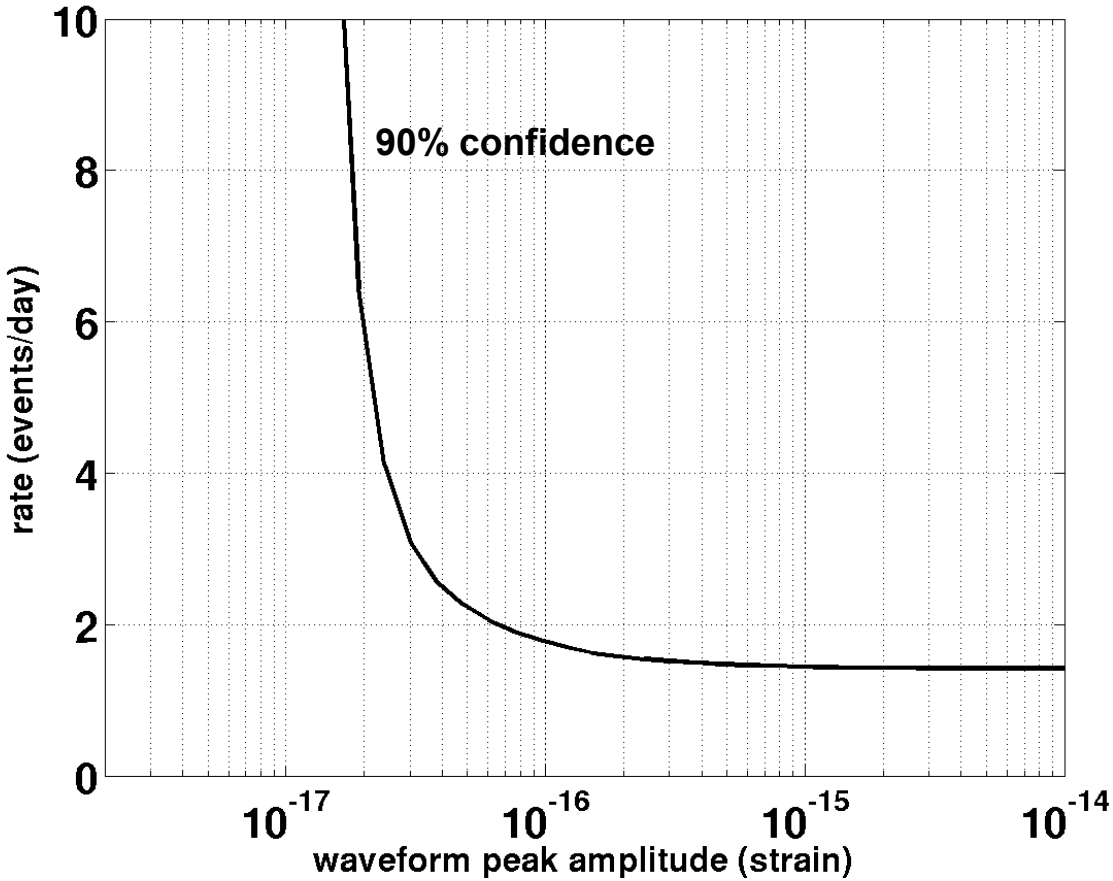
The ‘S1’ Science Run Data

- 96.0 hours triple coincidence, science locks
  - » 9.3 hours set aside as playground
- 86.7 hours
  - » 5.6 hours lost due to 360 sec granularity in burst search jobs
- 81.1 hours
  - » 26.5 hours cut by epoch veto (L1 H1 H2 combined)
- 54.6 hours
  - » 19.1 hours rejected because of poorly determined interferometer calibration

- 35.5 hours of data

LIGO Upper Limit for 1ms Gaussian Bursts

This result is derived from analysis using the 'TFCLUSTERS' algorithm



Upper limit in *strain* compared to prior (cryogenic bar) results:

- IGEC 2001 combined bar upper limit: < 1 events per day having $h=3\times10^{-21}$ per Hz of burst bandwidth. For a 1kHz bandwidth, limit is < 2 events/day at $h=3\times10^{-18}$
- Astone *et al.* (2002), report a one sigma excess of one event per day at strain level of $h \sim 2\times10^{-18}$

Conclusions and Future Work

The S1 dataset has served as a testing ground for many ideas in the analysis of gravitational wave data for bursts of gravitational waves whose exact waveform is not known.

There is a lot of work to do. For example:

- **Analyze the S2 data currently being taken. Sensitivity ~10 times that during S1.**
- **Tune our analysis to check the excess claim from Astone *et. al.***
- **Tighten time window for coincidence between triggers from different interferometers**
- **Use time domain waveform correlation as a test of coincident triggers.**