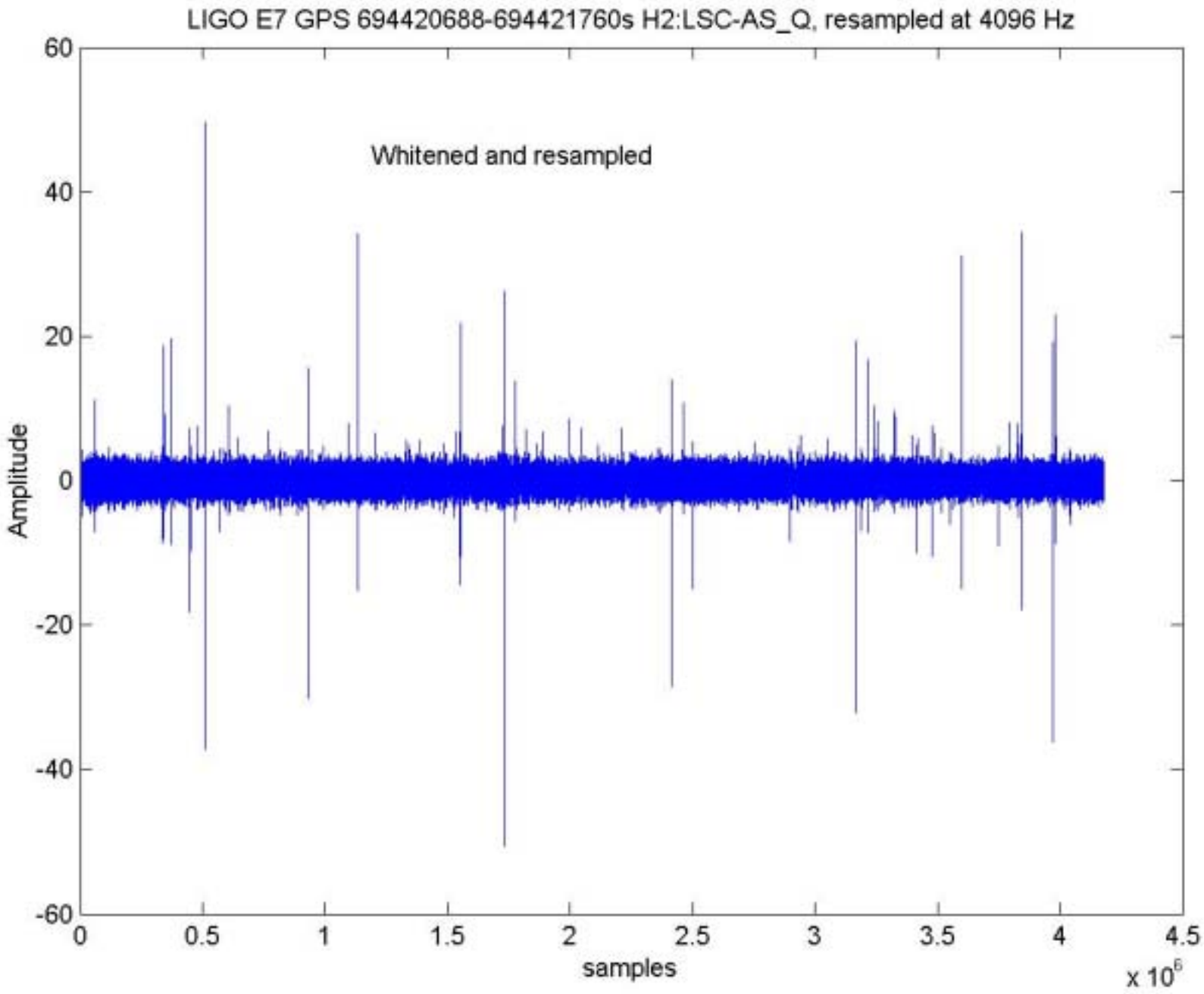
Automated classification of bursts with LIGO E7 data

Soma Mukherjee
Max Planck Institut fuer Gravitationsphysik
Golm, Germany

LSC, March 20-23, 2002, Livingston
LIGO Tech Doc # LIGO-G020038-00-Z

Details of data :

- LIGO E7 “Playground data” chosen.
- GPS times 694420688-694421768s.
- Channel analysed : H2:LSC-AS_Q
- Cleaning done by Median based line tracker (Mohanty 2002)
- Transients detected by PSD change detection algorithm (Mohanty 2000)


LIGO E7 GPS 694420688-694421760s H2:LSC-AS_Q, resampled at 4096 Hz
Whitened and resampled
Amplitude
samples
x 10^6
60
40
20
0
-20
-40
-60
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5

Variables :

- Duration of the burst
- Frequency span of the burst
- Starting frequency

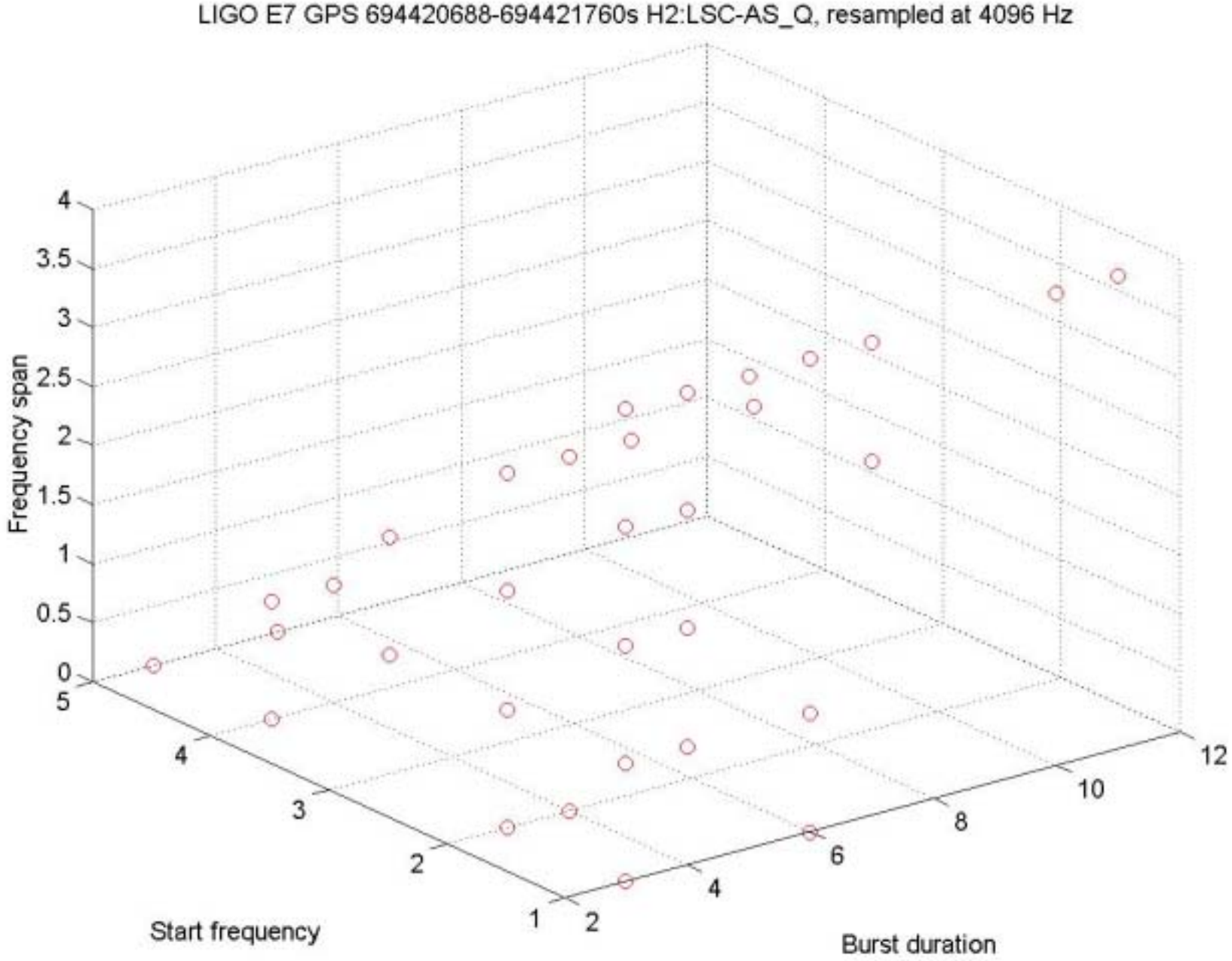
Statistics of the burst database

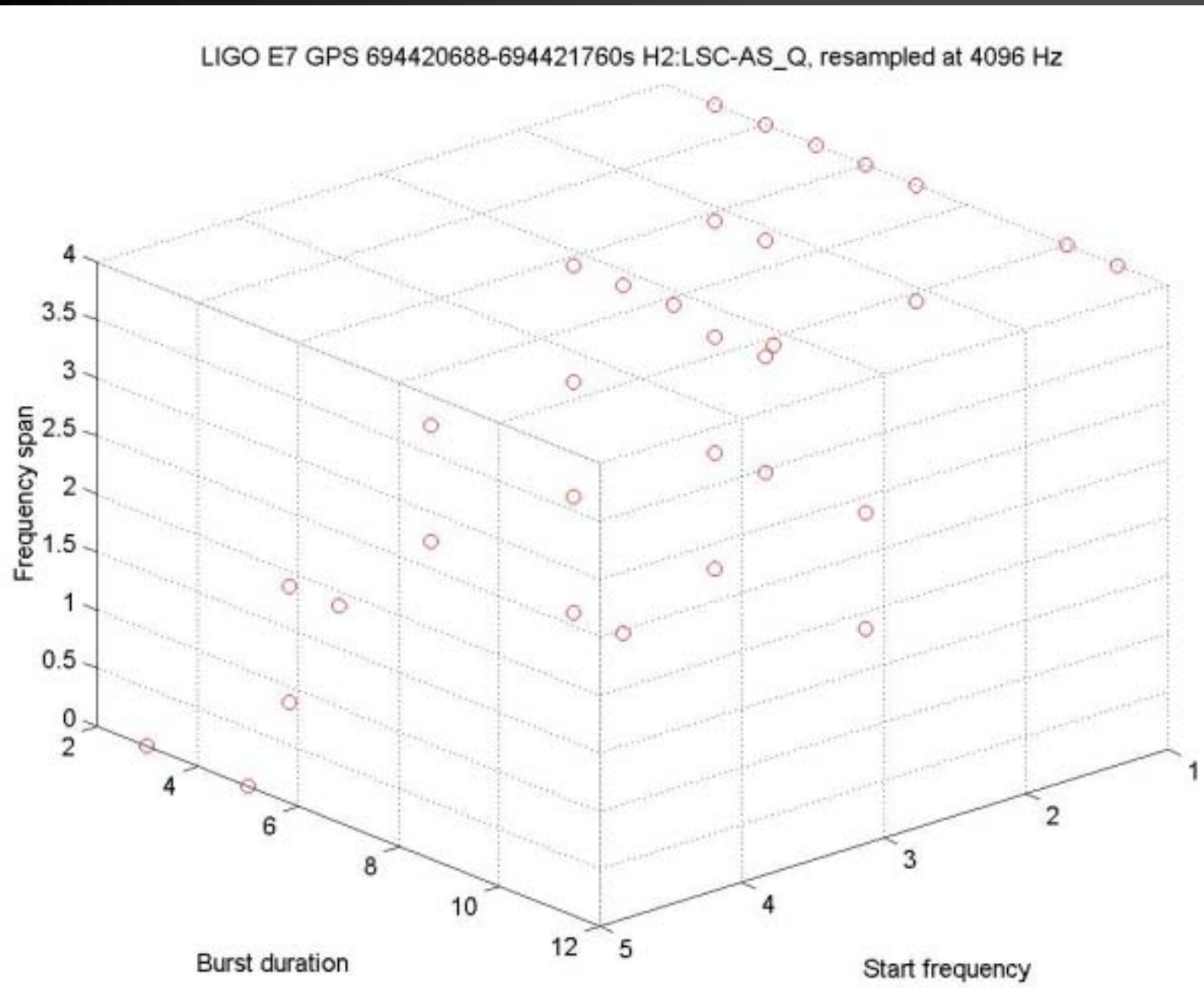
- Threshold set at 1.9
- 291 bursts detected in 1080 s data.
- False alarm estimated by passing Gaussian and exponentially distributed noise through the same filter.
- Estimated false alarms :

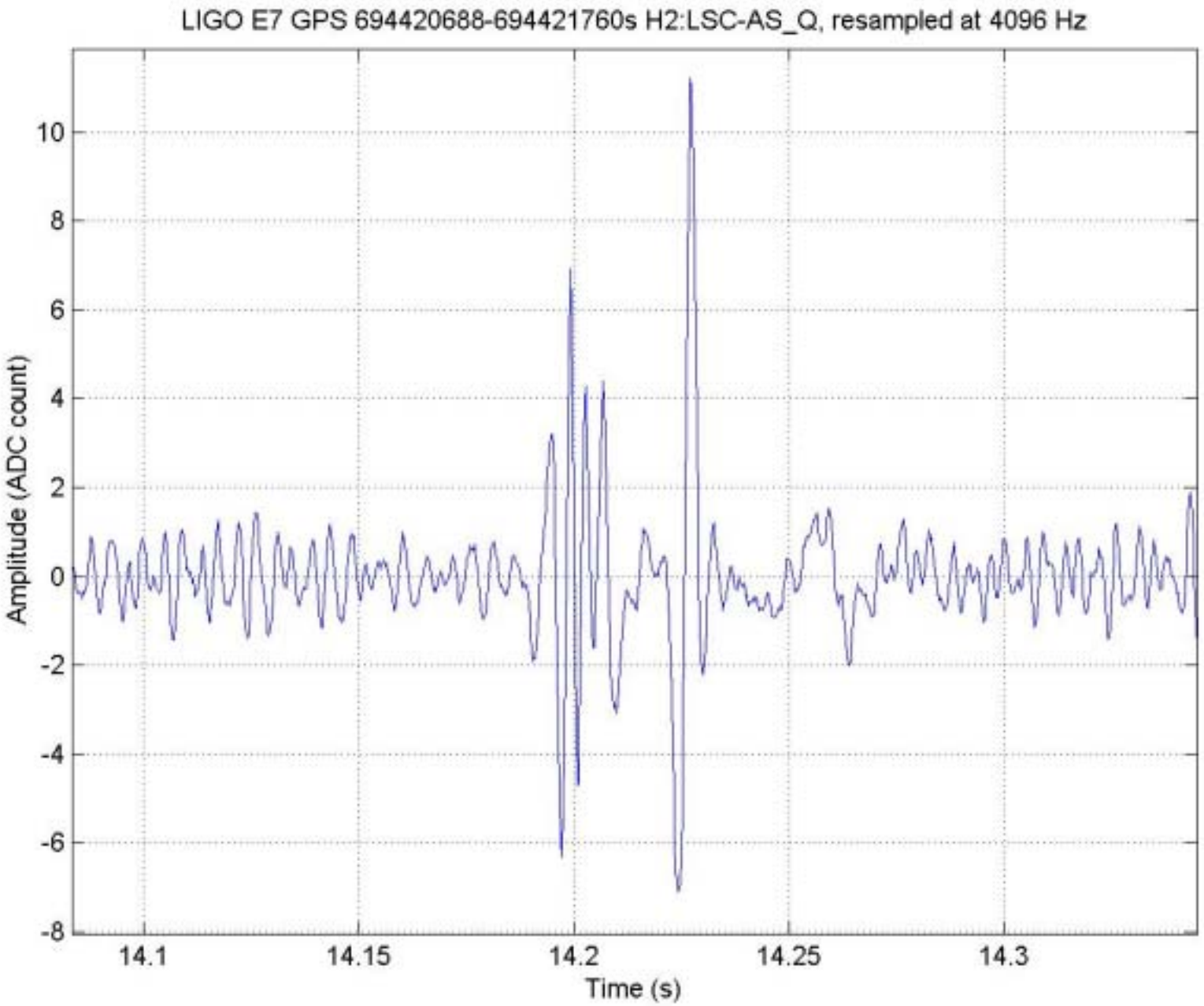
Gaussian noise = 41

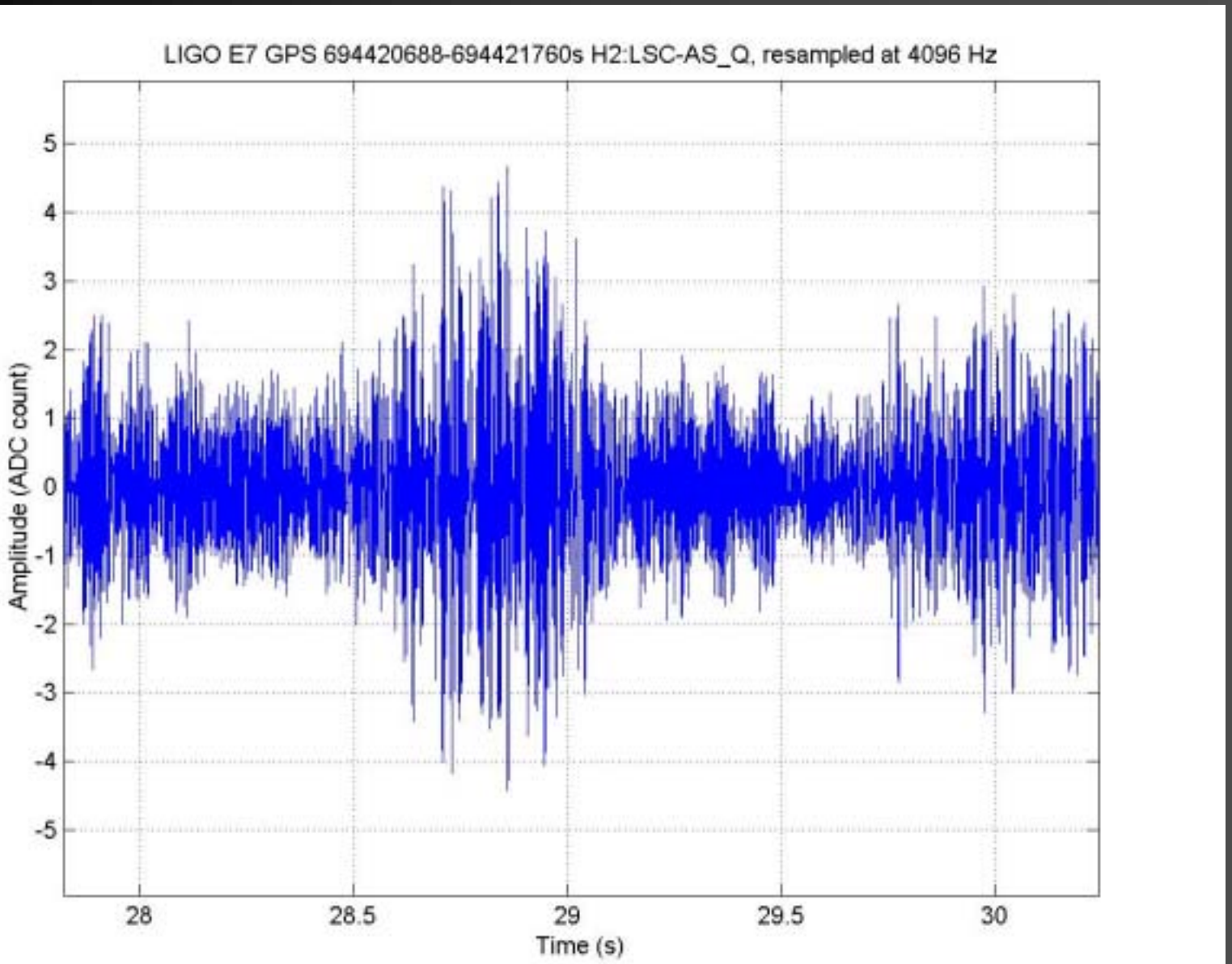
Exponential noise = 47

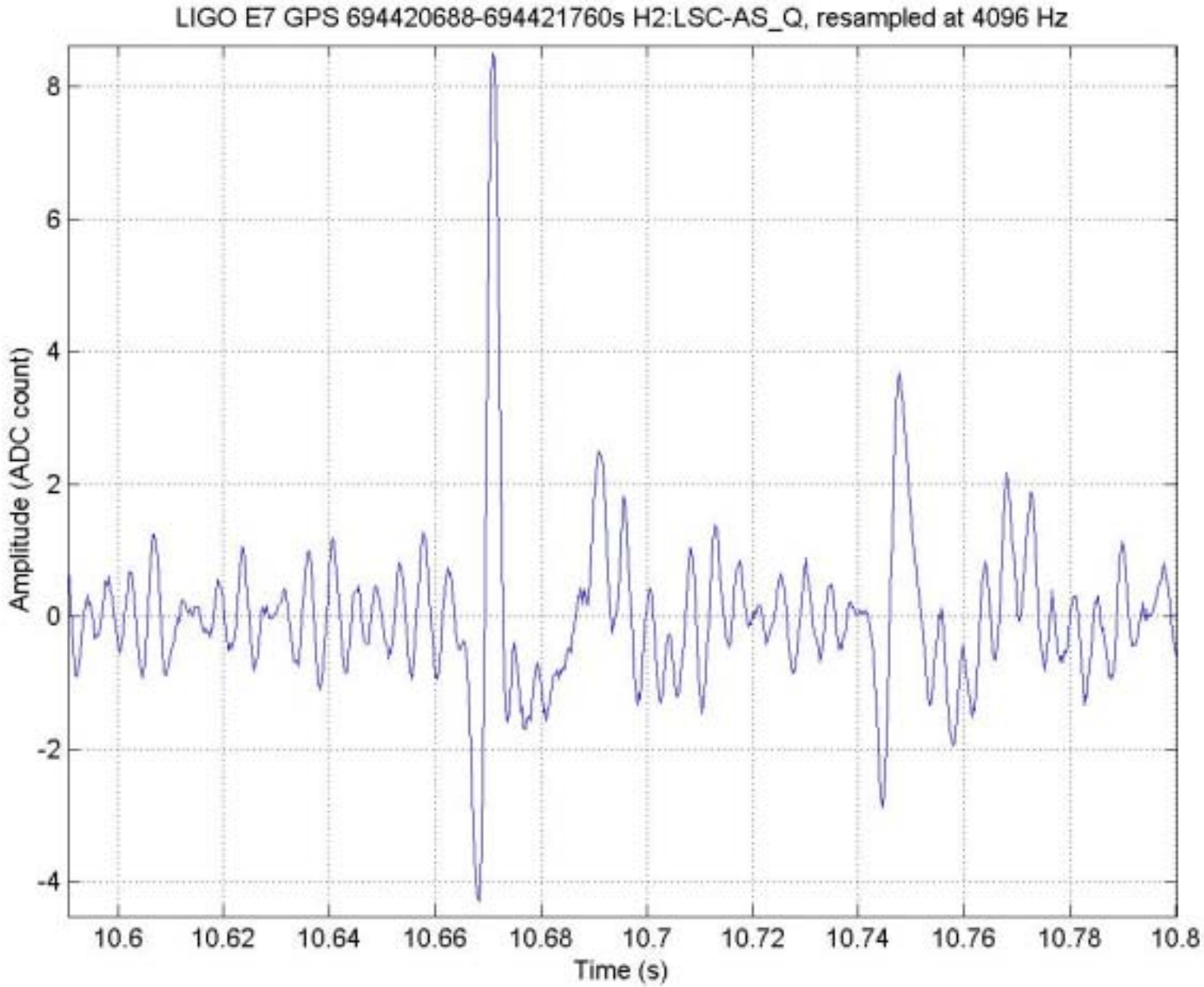
The detection algorithm is thus independent of the underlying noise statistics. Most of the detected bursts are significant.

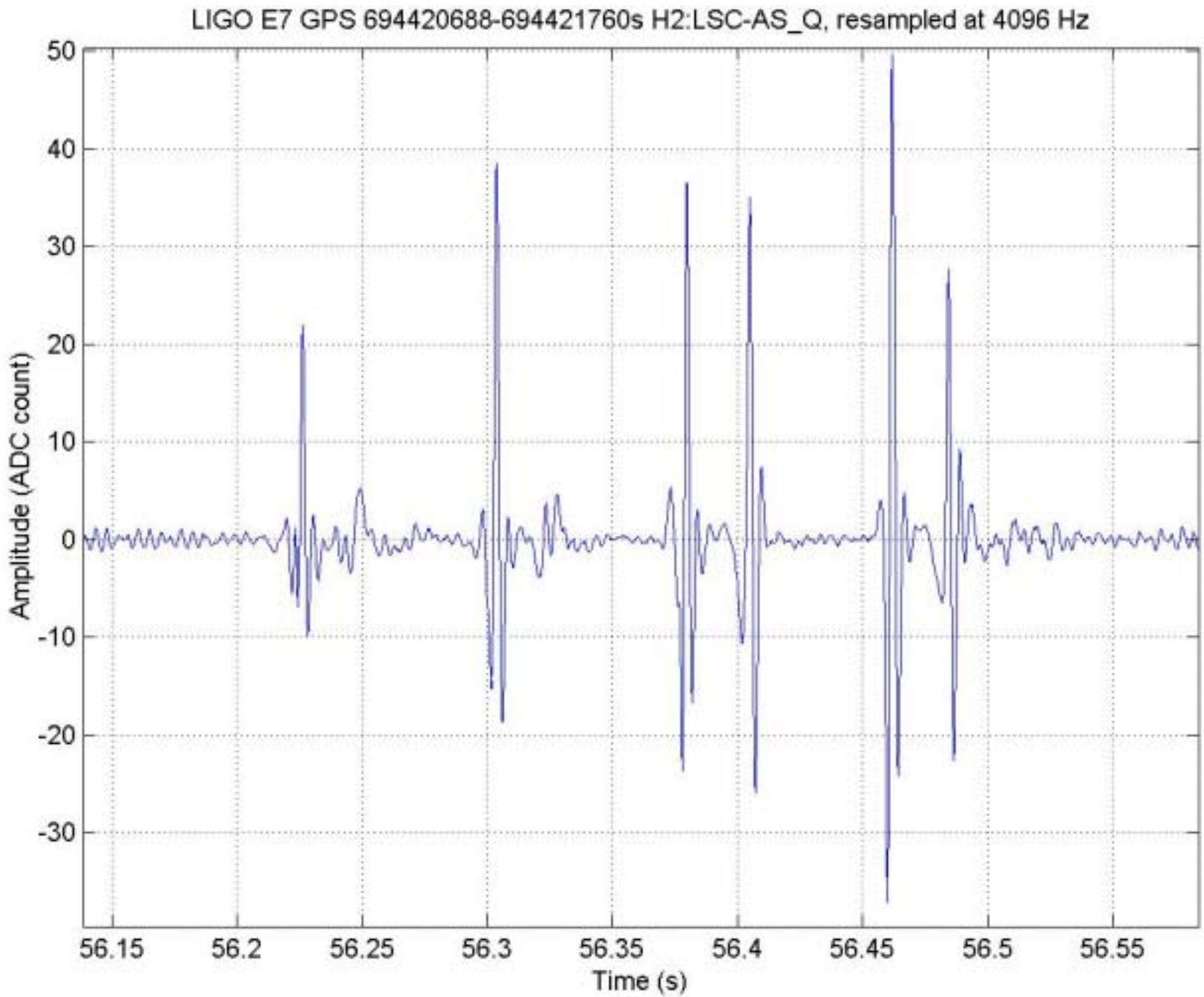

LIGO E7 GPS 694420688-694421760s H2:LSC-AS_Q, resampled at 4096 Hz
Frequency span
4
3.5
3
2.5
2
1.5
1
0.5
0
Start frequency
5
4
3
2
1
Burst duration
2
4
6
8
10
12

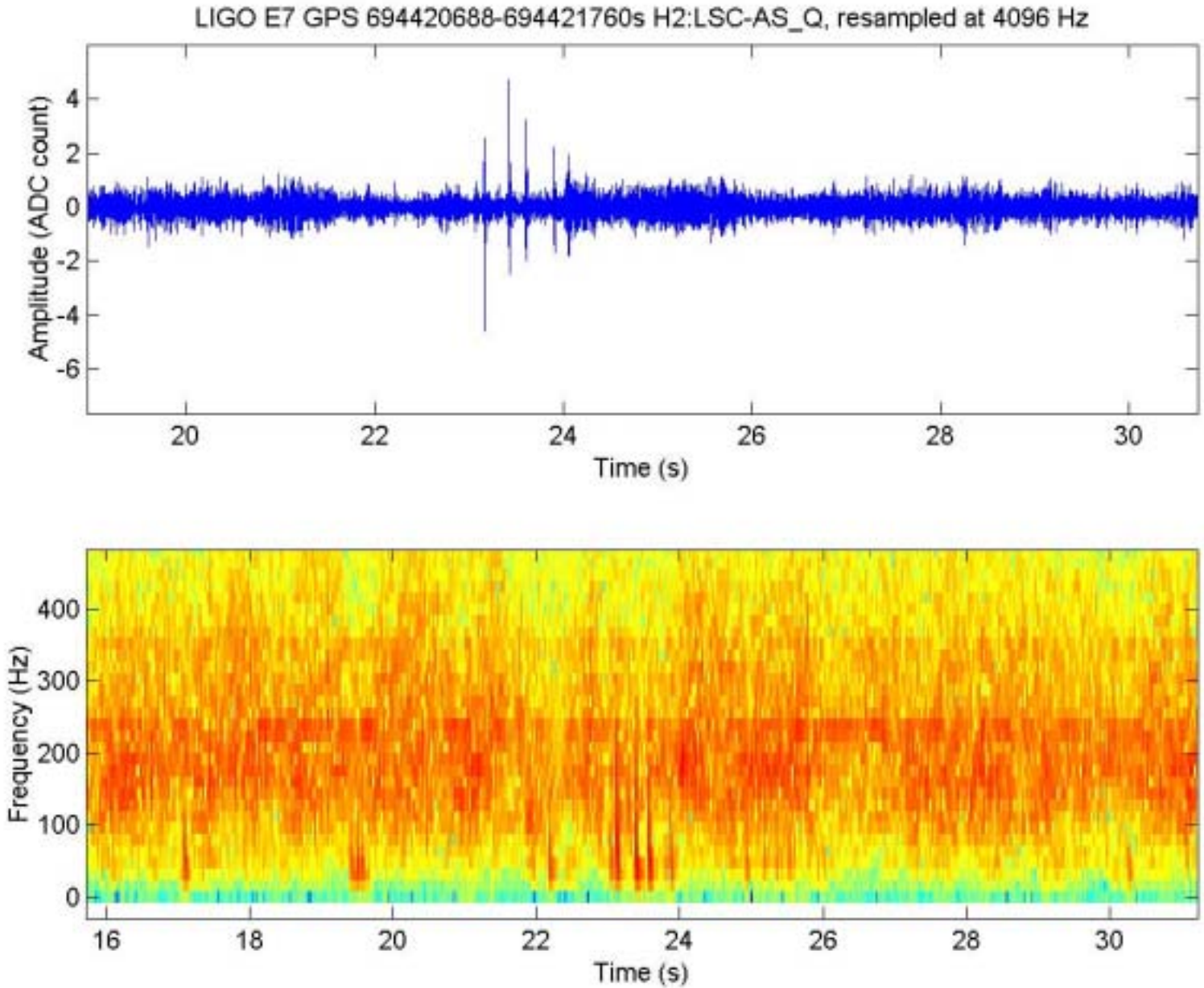

LIGO E7 GPS 694420688-694421760s H2:LSC-AS_Q, resampled at 4096 Hz
Frequency span
4
3.5
3
2.5
2
1.5
1
0.5
0
2
4
6
8
10
12
Burst duration
5
4
3
2
1
Start frequency

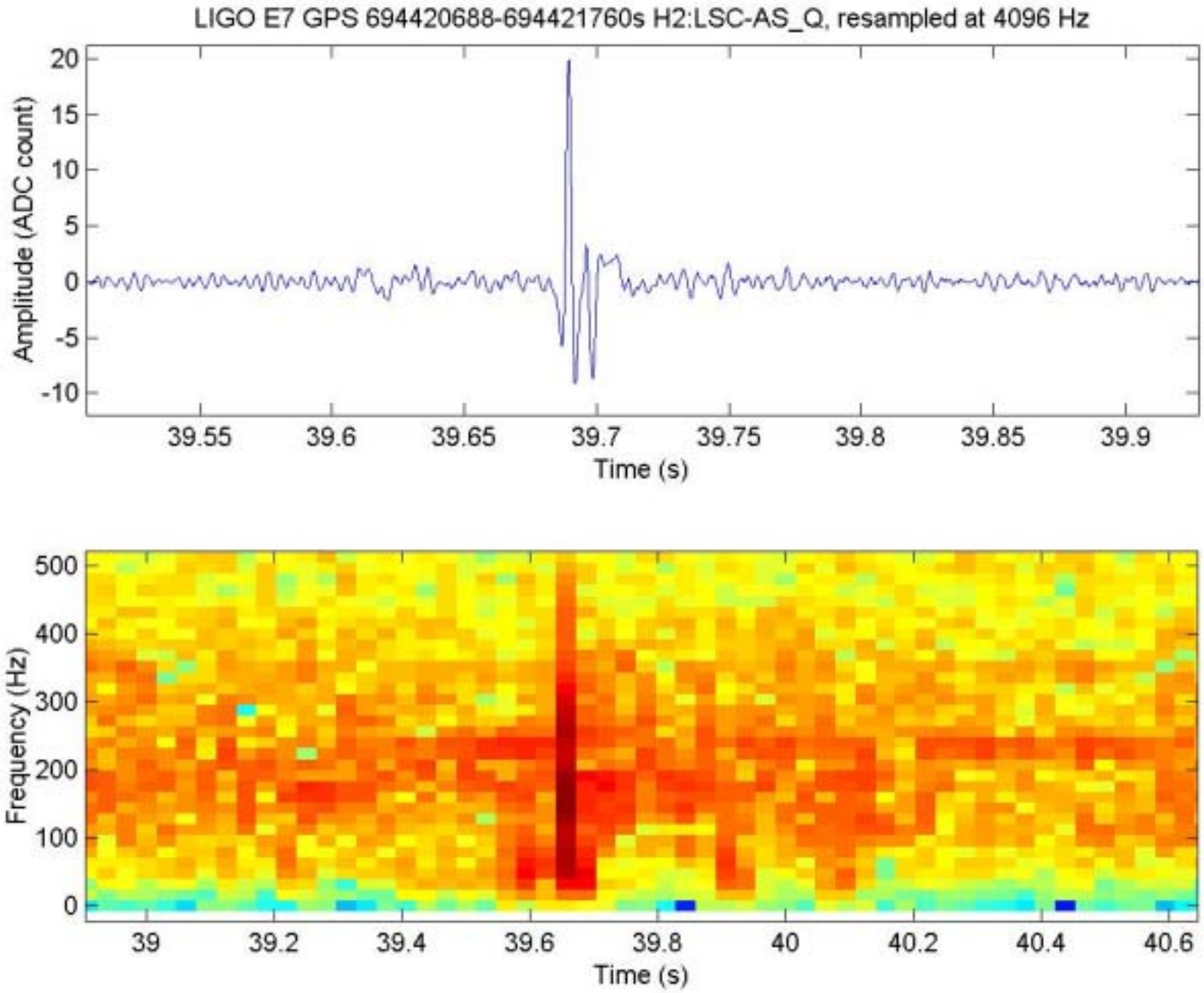

LIGO E7 GPS 694420688-694421760s H2:LSC-AS_Q, resampled at 4096 Hz
Amplitude (ADC count)
10
8
6
4
2
0
-2
-4
-6
-8
14.1
14.15
14.2
14.25
14.3
Time (s)


LIGO E7 GPS 694420688-694421760s H2:LSC-AS_Q, resampled at 4096 Hz
Amplitude (ADC count)
5
4
3
2
1
0
-1
-2
-3
-4
-5
28
28.5
29
29.5
30
Time (s)


LIGO E7 GPS 694420688-694421760s H2:LSC-AS_Q, resampled at 4096 Hz
Amplitude (ADC count)
8
6
4
2
0
-2
-4
10.6
10.62
10.64
10.66
10.68
10.7
10.72
10.74
10.76
10.78
10.8
Time (s)


LIGO E7 GPS 694420688-694421760s H2:LSC-AS_Q, resampled at 4096 Hz
Amplitude (ADC count)
50
40
30
20
10
0
-10
-20
-30
56.15
56.2
56.25
56.3
56.35
56.4
56.45
56.5
56.55
Time (s)


LIGO E7 GPS 694420688-694421760s H2:LSC-AS_Q, resampled at 4096 Hz
Amplitude (ADC count)
4
2
0
-2
-4
-6
20
22
24
26
28
30
Time (s)
Frequency (Hz)
400
300
200
100
0
16
18
20
22
24
26
28
30
Time (s)


LIGO E7 GPS 694420688-694421760s H2:LSC-AS_Q, resampled at 4096 Hz
Amplitude (ADC count)
20
15
10
5
0
-5
-10
39.55
39.6
39.65
39.7
39.75
39.8
39.85
39.9
Time (s)
Frequency (Hz)
500
400
300
200
100
0
39
39.2
39.4
39.6
39.8
40
40.2
40.4
40.6
Time (s)

Questions :

- Are these genuine clusters or are they artifacts of discrete data ?
- Is it possible to extract some amplitude and shape information from the existing algorithms to be included as additional classification parameters ?
- Are there algorithms that defines the parameter space more finely ?

Conclusions

- Statistically reliable clustering algorithms exist that gives significance of each cluster.
- It is possible to identify classes of bursts from statistically significant clusters and hence identify the source.
- Transient classification from multiple channels in progress.