Status of the ET mock data

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Goal

- Generate data with expected ET sensitivity
- Include simulation of the expected BNS foreground
- Use the data as a mock data challenge, attempting to pull signals out with current (and future?) codes

Simulation of the signals

- Using ET_Mdc code
  - Modified version of BNSSeries.c LALApps code

```
Noa:ETmdc taniaregimbau$ ./BNS -h
Usage: pipeline [options] Options:
 -h                    print this message
 -v                    display version
 --verbose             verbose mode
 --ascii               write to ascii files
 --catalog             write source parameters to files
 -s                    seed for coalescence times
 -S                    seed for source parameters
 --noise-seed          seed for noise generation
 -j                    job number
 -n                    number of nodes
 -t                    start time of the series
 -d                    duration of the time series
 -r                    sampling rate of the time series
 -p                    time interval between successive coalescences, 13.7 for
   zmax=6
 -f                    minimal frequency
 -z                    maximal redshift
 -i                    ifo name
 -a                    first arm, 1, 2 or 3
```

Distributions

- **coalescence time** (Poisson process):

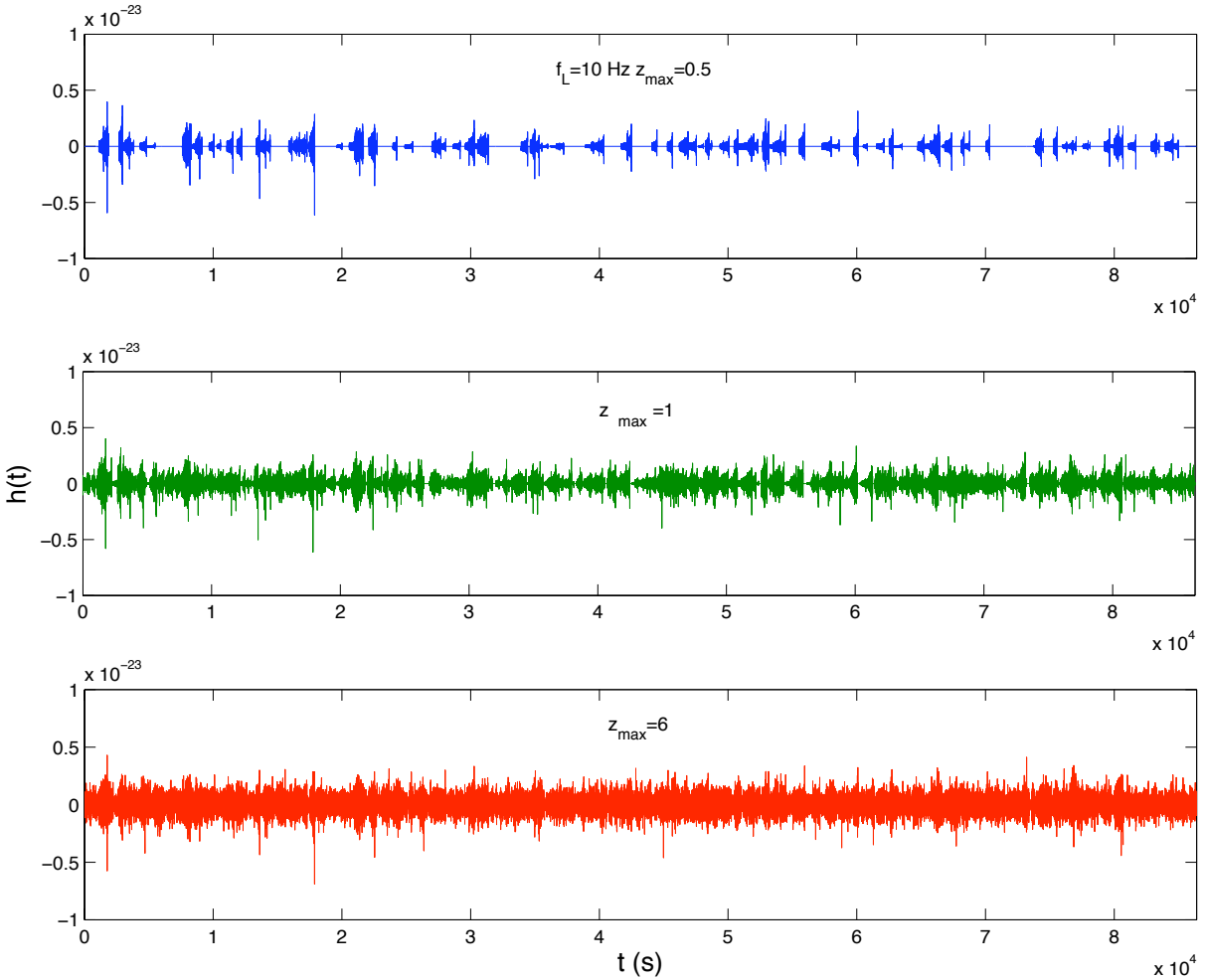
$$p(\Delta t) \propto \exp(-\Delta t / \lambda) \text{ with } \lambda = \left[\int_{z_{\min}}^{z_{\max}} \frac{dR_c^o}{dz}(z)\, dz \right]^{-1}$$

- **masses**: gaussian distribution
- **redshift:** $p(z) \propto \frac{dR_c^o}{dz}(z)$
- **position in the sky:** uniform distribution
- **polarization:** uniform distribution
- **phase at the last stable orbit:** uniform distribution

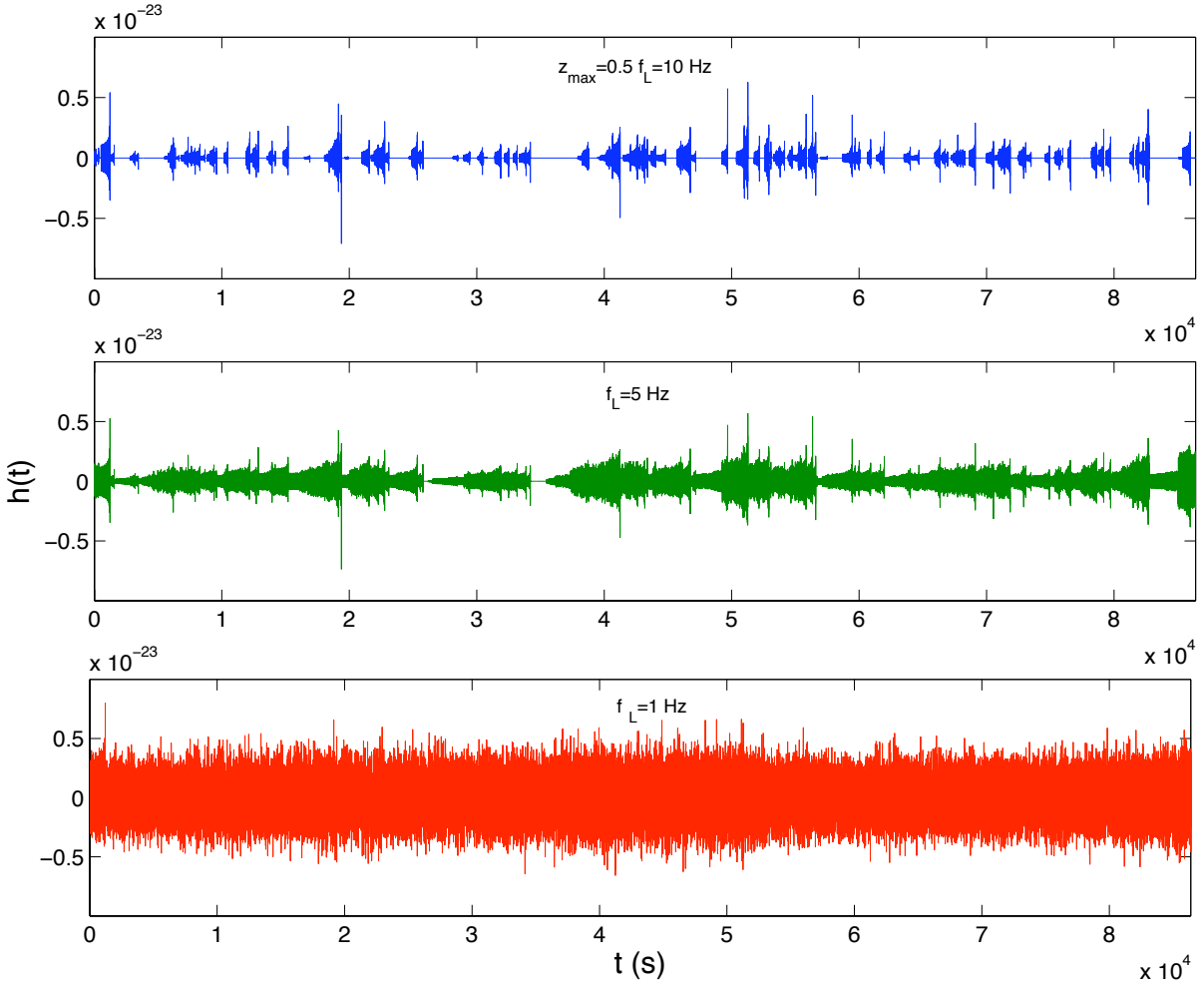
Signal duration

f_l(Hz)	1.4+1.4	1+1
10	16.7m	29.3m
5	1.8h	3.1h
3	6.9h	12.1h
1	5.4d	9.4d

Evolution with z_{max}



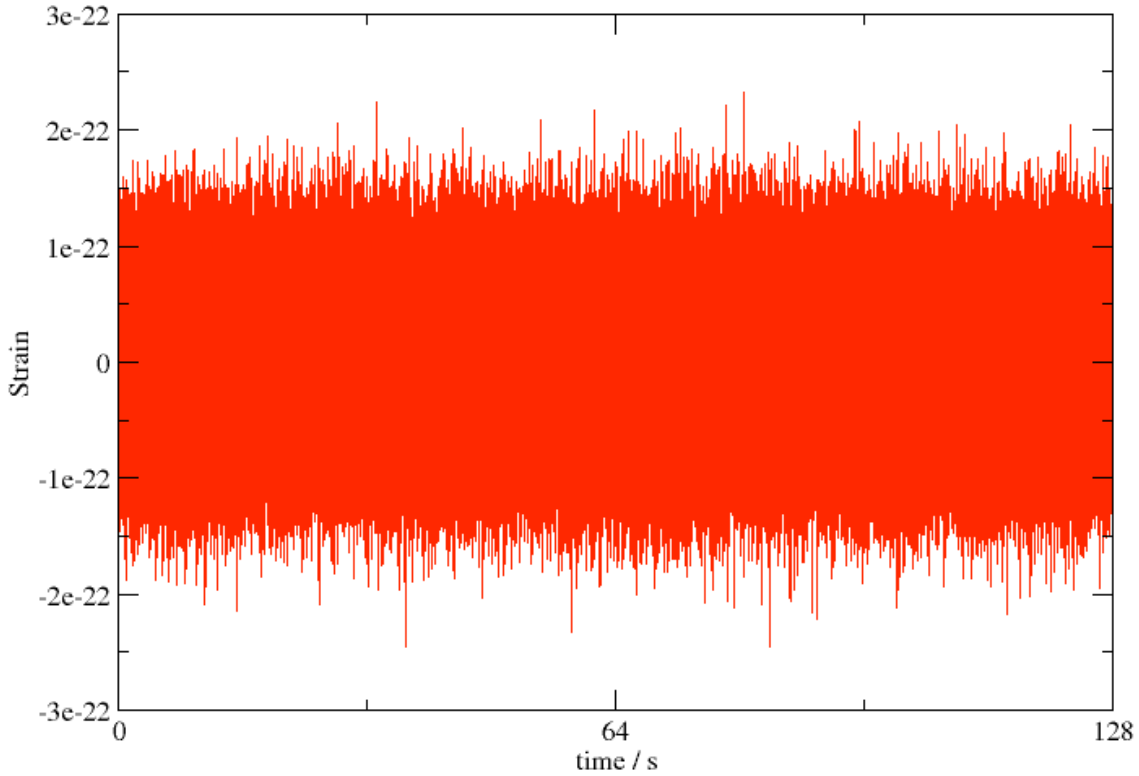
Evolution with f_L



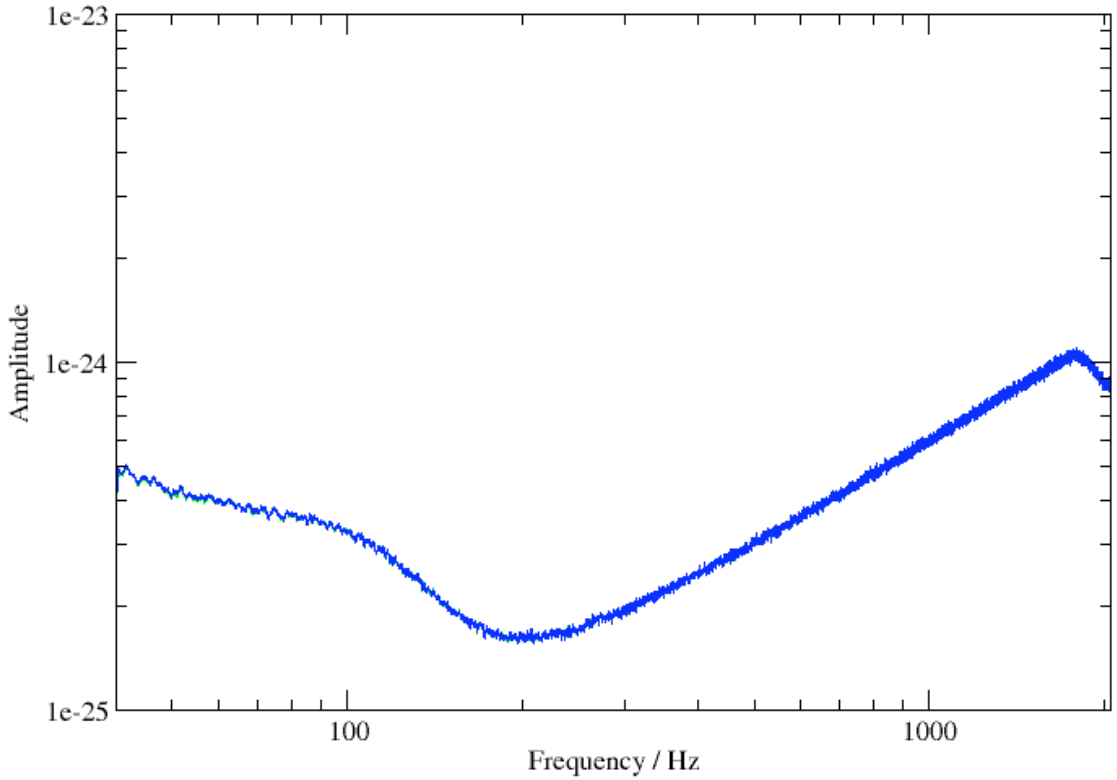
Noise background

- Noise generated according to projected ET noise curve
- Noise generated in frequency domain, and then inverse FFT'd
- Gaussian noise – no glitches
- Below f_l, and above f_h, PSD gradually tapered to zero

Noise time-series



Spectrum according to lalapps_tmpltbank



Status of data generation

- Small set of triple-coincident data (~ day) been generated using ET noise spectrum and signals up to z ~ 6
- f_l chosen to be 40Hz for the purposes of this test
- Data written to standard frame file format
  - Same as LIGO/Virgo data
- Data has been (more-or-less…) successfully run through standard LIGO/Virgo CBC pipeline with minimal modification (although a few fudge-factors needed!)
- Assuming all is well, a larger set of data can be generated with a lower f_l in pretty short order

Next steps

- Generate full set of data down to 10Hz (and below) for the 3 detectors
- Analyze the data using the existing LIGO/Virgo codes
- Develop methods to extract individual sources from confusion background
  - Could techniques developed in the context of LISA be useful here?