GWTools

A many-core gravitational wave data analysis toolkit

A project status report

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on behalf of GWTools developers

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Content

- This is not a complete presentation just a reminder and a short status update.
- What is GWTools, what this project is about ?
- The GWTools web site: http://gwtools.org
- A gadget app - gwt-inspiral-spectrum
- A performance app - GWTools's findchirp implementation
- Future plans

The GWTools project

This presentation is an extract of the web site containing much more information:

http://gwtools.org

You can find much more documentation, explanation, description, installation instructions and even a tutorial there.

Developers:

Gergely Debreczeni

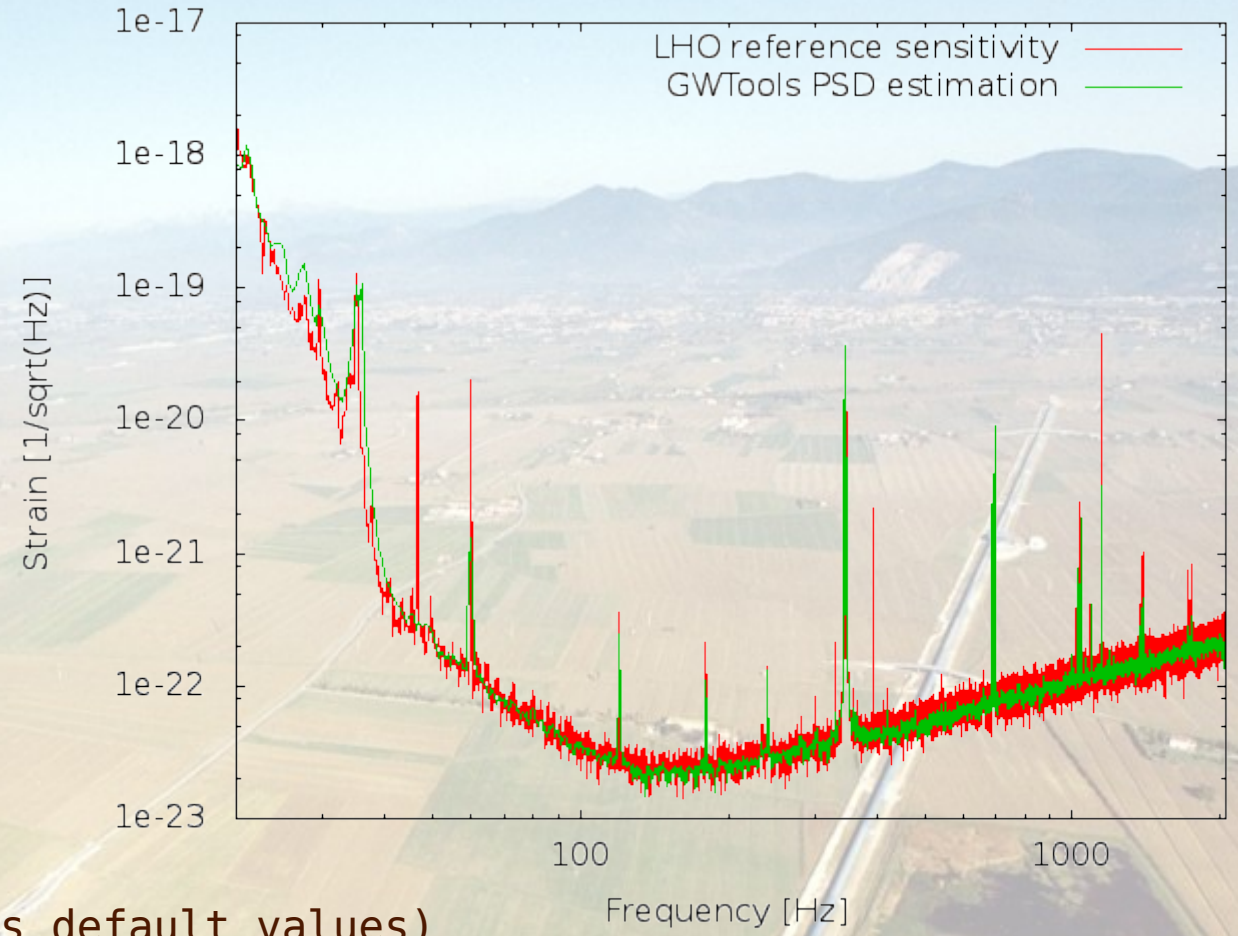
Tito dal Canton

Badris Krishnan

Karsten Wiesner

A gadget app : gwt-inspiral-spectrum

- Small utility for obtaining spectra
- Part of gwtools-inspiral package
- Read a frame-cache file and outputs the PSD on the required sampling rate
- Useful for quick testing (see Stephen's mail last week on DASWG)



- Usage (many of the flags has default values)

```
gdebrecz@gpudev6: gwt-inspiral-spectrum --debug-level 5 --frame-cache
/home/gdebrecz/testcache.cache --spectrum-file mypsd.dat --spectrum-type average
--channel-name H1:LSC-STRAIN --dynamic-range-exponent 16 --segment-length 128
--gps-start-time 865543903 --gps-end-time 865544927 --sampling-rate 4096
```

A performance app: GWTool's „findchirp” application

GWTool's „findchirp”:

- Implements the standard findchirp (matched-filter) algorithm
- Data preconditioning
- Template generation
- SNR time series
- 16-band chi2 time series of SNR is above the threshold
- Clustering and maximum finding
- Input and output is compatible with lalapps_inspiral
- Can be plugged into any ihope pipeline

Configuration file:

```
frame-cache = ./ninja2.cache
channel-name = H1:LDAS-STRAIN
gps-start-time = 871148452
gps-end-time = 871150500
#bank-file = ./bank_11678.xml.gz
bank-file = ./bank_100.xml.gz
snr-threshold = 5.5
chisq-threshold = 10.0
chisq-bins = 16
chisq-delta = 0.2
dynamic-range-exponent = 69.0
pad-data = 8
sample-rate = 4096
enable-high-pass = 30.0
low-frequency-cutoff = 40.0
spectrum-type = median
segment-length = 1048576
segment-overlap = 524288
inverse-spec-length = 16
ifo-tag = FIRST
trig-start-time = 0
trig-end-time = 0
cluster-method = template
```

Findchirp current results

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```

Timing numbers:

```
11/18 16:19:46 DEBUG [main] Template 98 sigma 17.980
11/18 16:19:46 DEBUG [main] Template 99 sigma 17.136
11/18 16:19:46 INFO  [main] Found 860 triggers
11/18 16:19:46 INFO  [main] Writing output XML file
11/18 16:19:46 INFO  [main] Total execution time:      36.4 s, 100%
11/18 16:19:46 INFO  [main] Data conditioning:         27.5 s, 75.6%
11/18 16:19:46 INFO  [main]
11/18 16:19:46 INFO  [main] TIMING INFO WITHOUT PRECONDITIONING:
11/18 16:19:46 INFO  [main] Waveform generation:       0.2 s,  2.1%
11/18 16:19:46 INFO  [main] Variance calculation:      0.2 s,  2.4%
11/18 16:19:46 INFO  [main] Matched filter:            2.2 s, 25.2%
11/18 16:19:46 INFO  [main]     Overlap calculation:   0.6 s,  6.8%
11/18 16:19:46 INFO  [main]     Inverse FFT:           1.6 s, 18.3%
11/18 16:19:46 INFO  [main] Normalisation:             0.1 s,  0.7%
11/18 16:19:46 INFO  [main] (Re)initialisation:        0.4 s,  5.0%
11/18 16:19:46 INFO  [main] Chi^2 band calculation:    0.0 s,  0.5%
11/18 16:19:46 INFO  [main] Chi^2 test:                4.1 s, 46.2%
11/18 16:19:46 INFO  [main]     Array operations:      1.6 s, 17.7%
11/18 16:19:46 INFO  [main]     Data copy around:      0.0 s,  0.0%
11/18 16:19:46 INFO  [main]     FFT:                   2.0 s, 22.8%
11/18 16:19:46 INFO  [main]     Chi^2 calculation:     0.5 s,  5.7%
11/18 16:19:46 INFO  [main] Thresholding:              1.0 s, 11.0%
11/18 16:19:46 INFO  [main] Copying data:              0.1 s,  0.6%
11/18 16:19:46 INFO  [main] Clustering:                0.5 s,  5.9%
11/18 16:19:46 INFO  [main] Maximize over bank:        0.0 s,  0.0%
11/18 16:19:46 INFO  [main] Disk I/O:                  0.0 s,  0.4%
11/18 16:19:46 INFO  [main] OTHER:
11/18 16:19:46 INFO  [main] Segments filtered:         1500,   100%
11/18 16:19:46 INFO  [main] Chi2 filtered segments:    173,   11.5%
11/18 16:19:46 INFO  [main] Performance:              11.3 template/sec
```

Compared to lalapps_inspiral it is c.c. x120 times faster ->

Status, future plans:

- Currently the fine tuning of the algorithms are happening
- Thanks to its uniq OpenCL code base, GWTools **does run** on
  - Nvidia & AMD GPUs,
  - any CPUs,
  - Intel Phi,
  - Altera FPGA,
  - HSA Architectures such as AMD's Kaveri
- Aligned spinning template waveforms are inplemented
- Analysis for aligned spin binaries are on the way...
- More unit and stress testing to be done
- First scientific results to be expected in the following month....