

UWM LSC Group

**Binary Inspiral
Templated Search Code**

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1. Overview of Status

Documentation enhanced and updated

Templated inspiral search code implemented as an LDAS Dynamic Shared Object (DSO)

Run successfully under LDAS pipeline during E7 engineering run

Simulation code implemented to allow testing and Monte Carlo

Currently concentrating on flat search code for initial E7 analysis, will return to hierarchical code after this is complete.

Code is ready to go to do full E7 analysis of playground data

Infrastructure ready at UWM to run code

2. E7 Online Search

Run on LDAS system at each site on [H1:LSC-AS_Q](#) and [L1:LSC-AS_Q](#)

E6 response function was used (unreliable phase information!)

Mass parameters were chosen outside range of UL work so as not to bias results of later analysis

$m_{\min} = 5.0$, $m_{\max} = 10.0$, minimal match 0.97

Generated 207 templates in bank

Jobs were run using the LDASJob package to submit jobs

Search run on 4 beowulf nodes

Results were stored in databases at sites

E7 Results

No jobs failed due to errors in inspiral shared object

Small percentage of jobs lost due to LDAS errors and loss of frames

435968 seconds of data analysed at LHO

521088 seconds of data analysed at LLO

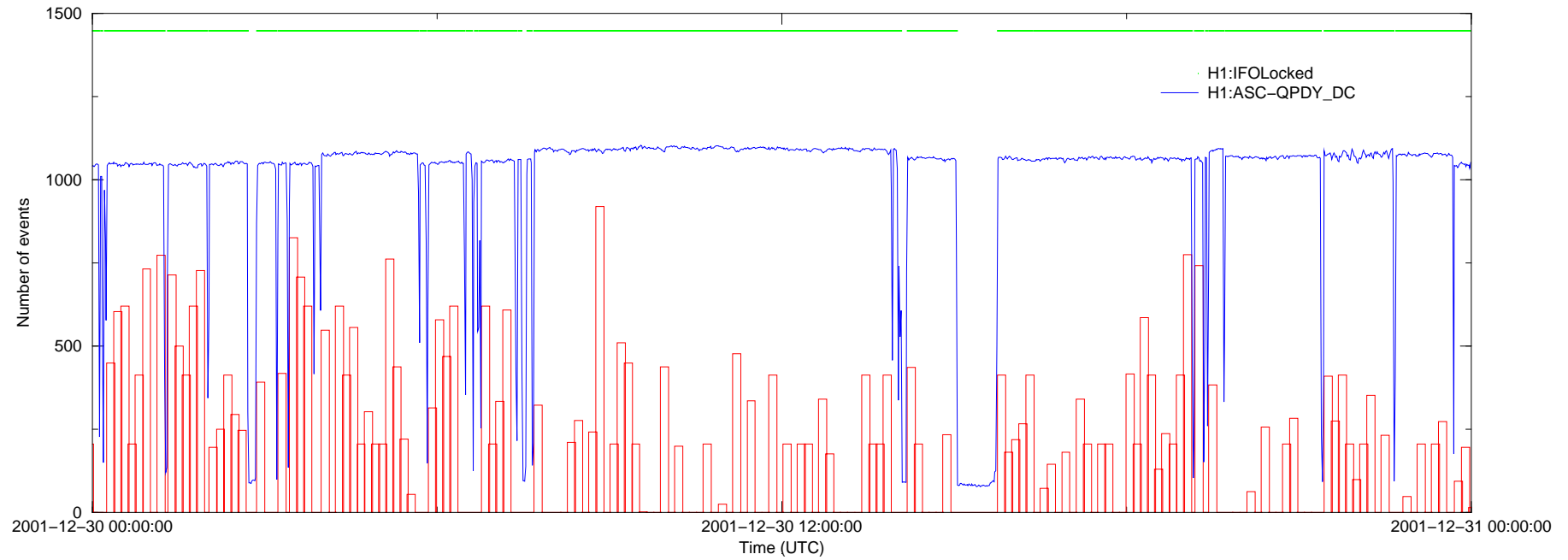
Signal to noise threshold of 8

χ^2 statistic computed and stored, but not used to veto

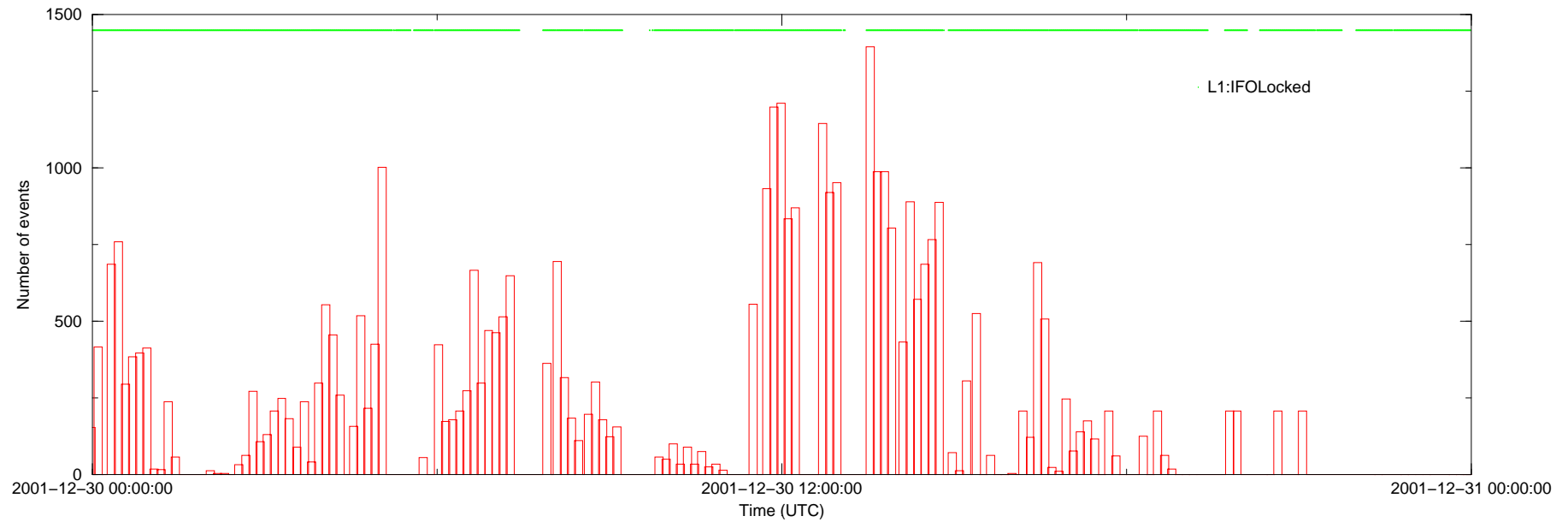
418512 events inserted into Idas-wa database

179288 events inserted into Idas-la database

Inspiral Events at LHO from 2001-12-30 00:00:00 UTC Sun to 2001-12-31 00:00:00 UTC Mon



Inspiral Events at LLO from 2001-12-30 00:00:00 UTC Sun to 2001-12-31 00:00:00 UTC Mon

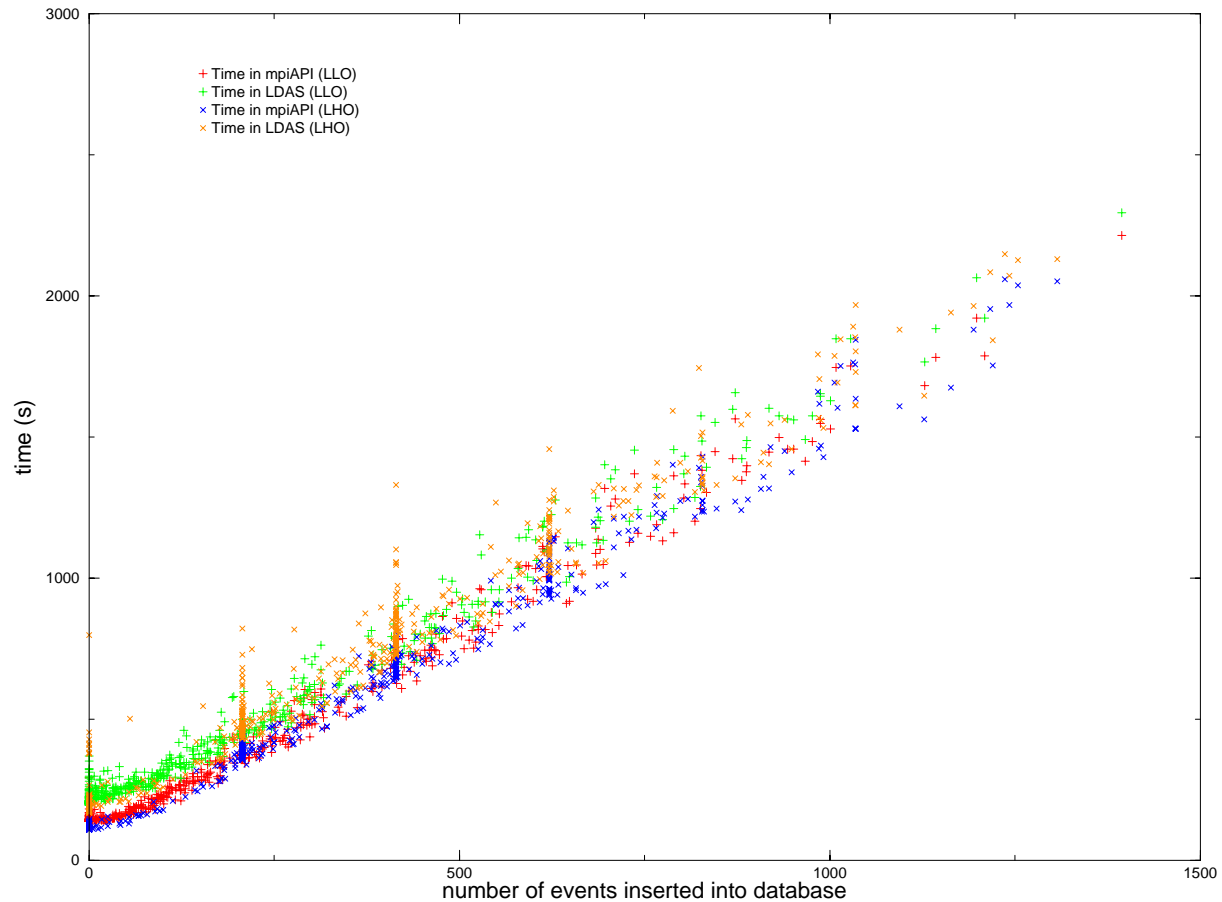


3. Problems Found

Search code could not keep up in real time due to bug in exchange of events

Loss of lock allowed code to catch up

Timing data for inspiral shared object



4. Developments since E7

Minor bug fixes implemented

Fixed efficiency bug

Implemented code in shared object to perform

- Bank Minimal Match
- Gaussian Noise Monte Carlo
- Waveform Injection Monte Carlo

Have been running these simulations at UWM under LDAS.

5. Simulations

Bank Minimal Match Simulations

Bank generated with simulated LIGO I power spectrum for IUL mass range

Good coverage of parameter space, no problems found

Gaussian Noise Simulations

Run for a single template and a trial bank

For a single template

$$P[\rho < \rho_*] = 1 - \exp(-\rho^2/2) \quad (1)$$

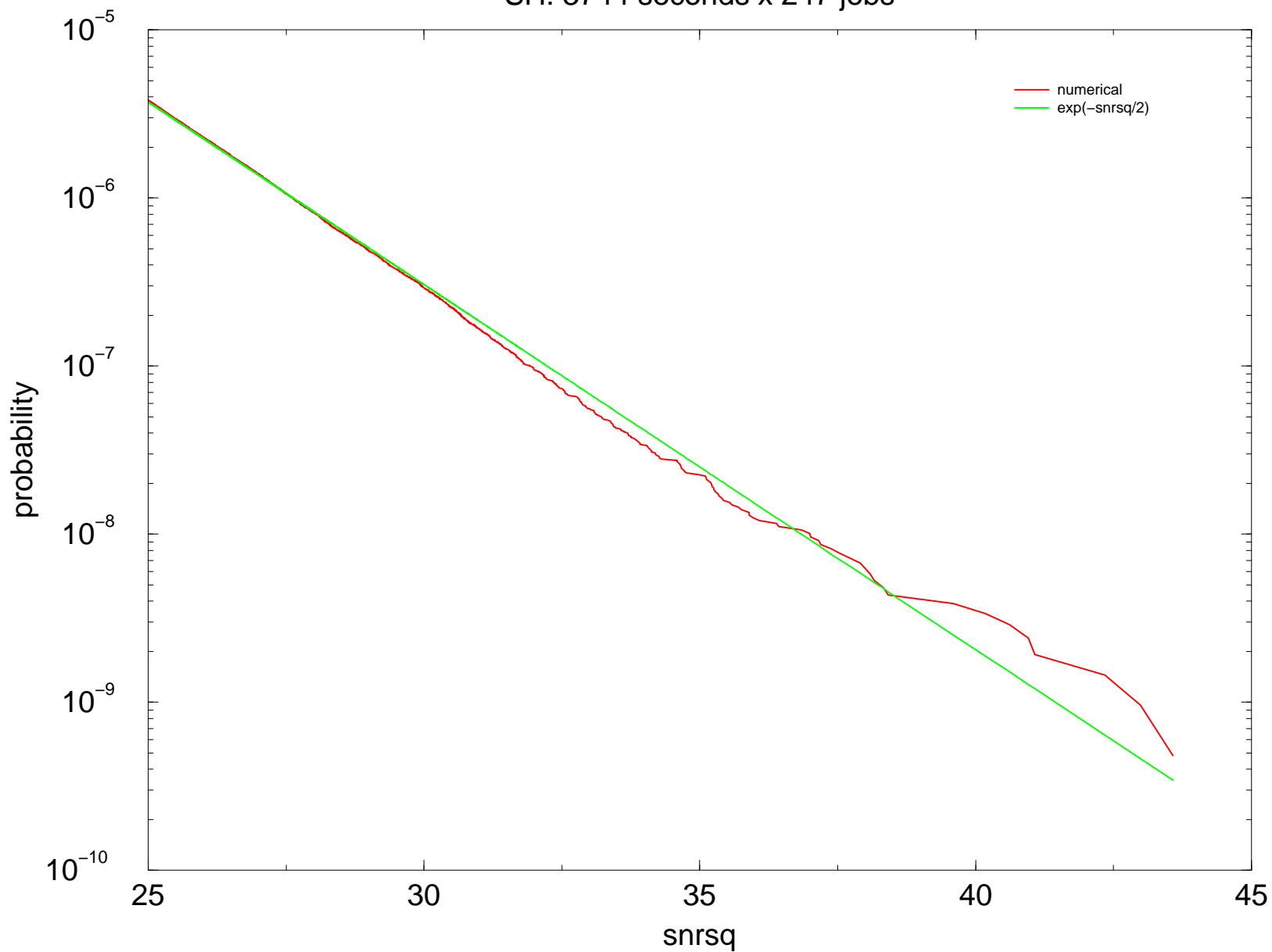
For a template bank, assuming statistical independence of templates

$$P[\rho < \rho_*] = \left(1 - \exp(-\rho^2/2)\right)^N \approx 1 - N \exp(-\rho^2/2) \quad (2)$$

Following graphs show $P[\rho > \rho_*]$.

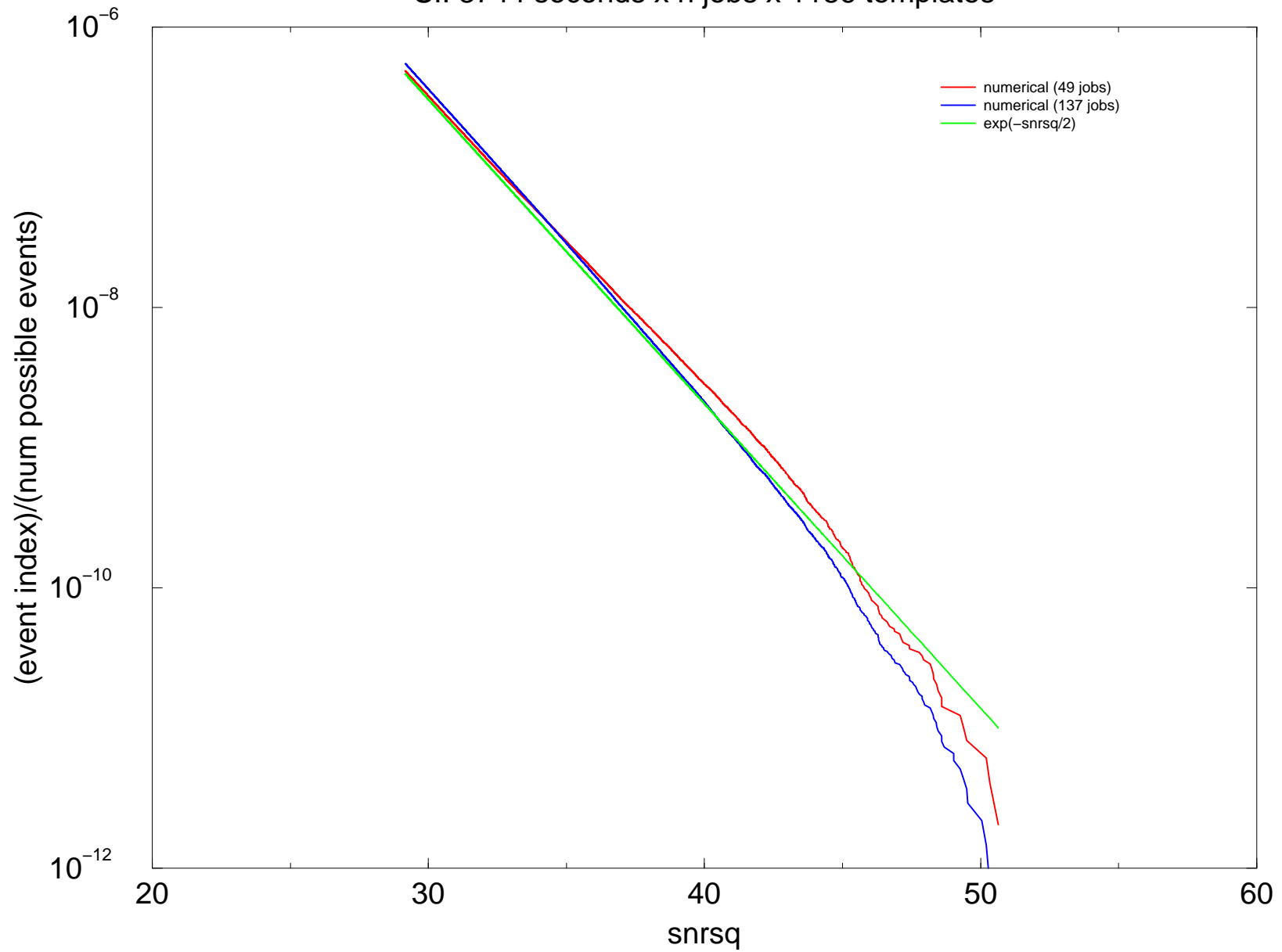
Gaussian noise simulation for (1.4,1.4)

SH: 3744 seconds x 247 jobs



Gaussian noise simulation for 1.1m – 3.0M @ 0.97

SI: 3744 seconds x n jobs x 1186 templates



6. What's next?

Now have all the E7 data on disk at UWM and E7 response function ready to do analysis

Modified bank code to allow use of real power spectra

Immediate targets:

- Generate bank using E7 PSD and check minimal match
- Run Gaussian noise simulations using E7 PSD to test thresholds
- Analyse all playground data and make results available to IUL detChar group

Ready for population data for injections

Longer Term:

- Scaling and performance testing
- Testing of Hierarchical code
- Implementation of different types of template waveform