

Continuous g.w. searches with the ``Hough Hierarchical Algorithm''

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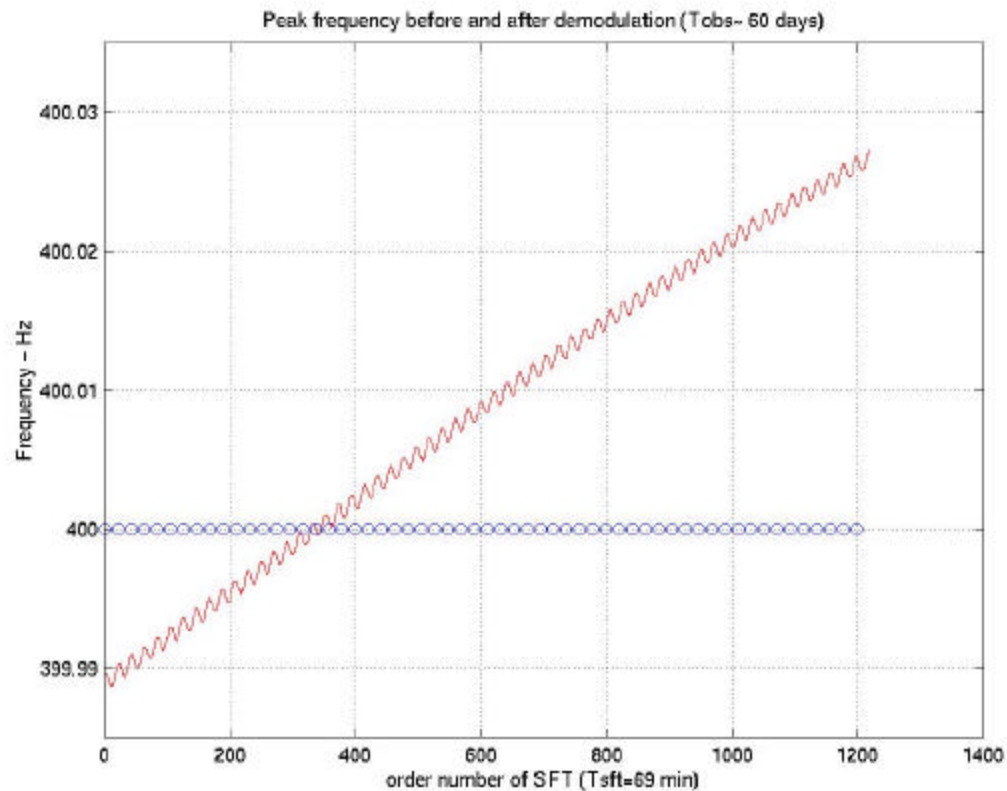
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Milestones Report to ASIS, March 2000 LSC Meeting, M.A. Papa

- general algorithm set up
- demodulation
- sources data base (Alberto Vecchio)
- grid in parameter space (Ben Owen)

We keep an internal working document under CVS, now ~ 100 pages

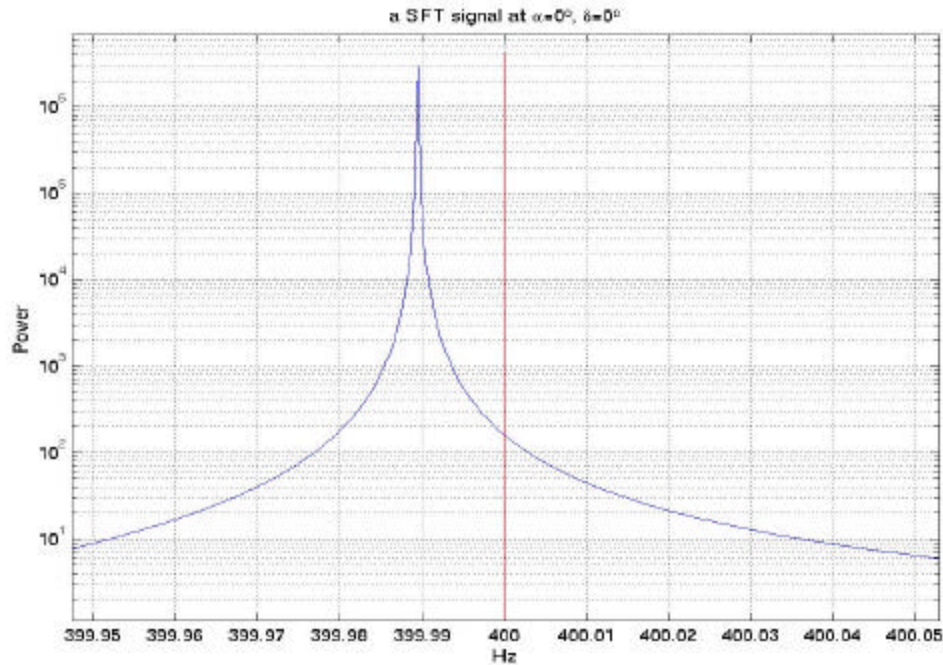
Demodulation: longer time baseline FFTs from shorter time baseline ones.



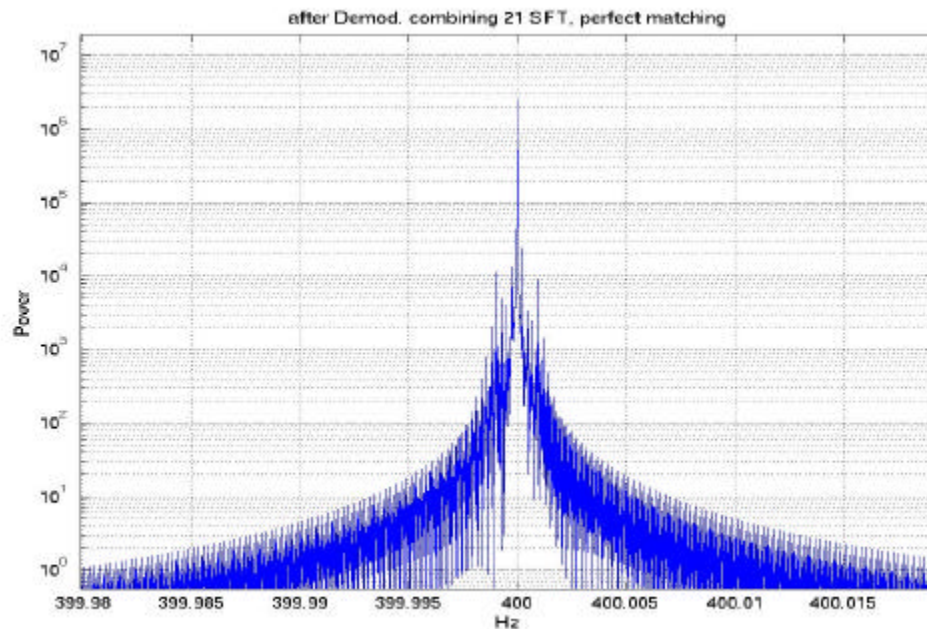
The **red line** is the instantaneous frequency of a signal, as measured in the SFTs (~ every 1 hour), over 60 days. The intrinsic frequency of the signal is 400 Hz.

The **blue circles** show the position of the peaks in the demodulated FFTs, time baseline ~ 21 hours: the peak now appears at 400 Hz.

by Peter Williams and MAP



Spectrum from one of the SFTs, with time baseline $T_c \sim 1$ hour. The signal has $f_0 = 400\text{Hz}$, the peak appears at a different freq. because of the Doppler modulation.



Spectrum of one of the demodulated FFTs with time baseline $T_c \sim 21$ hours. Since in this case there is perfect signal-template match there is no power loss and perfect shift of the peak to $f_0 = 400\text{Hz}$.

- AEI continuous signals search -

Algorithm set-up

- all processors run the same code, searching different intrinsic frequency bands. In principle very little inter-node communication is needed.
- input variables, same on every node (note: the search parameters can be given directly or “read” from sources DB)

B:	total band of search
f0_max:	maximum intrinsic frequency to be searched
tau_min:	spindown age of class of searched sources
A:	area in sky
Tobs:	total observation time
Tc:	coherent search time baseline
Ts:	SFT time baseline

- and some parameters:

iNode:	what node
nNodes	how many nodes there are
.....	

Algorithm set-up : the main ()

- The code consists in a series of nested loops, over the search parameters; this is the main().
- Given the input variables and parameters, a “Housekeeping” structure is filled by an initialize() function. This computes, once and for all, all the general purpose variables and checks their overall consistency.
- Each function has its own input structure and parameter structure and these are explicitly constructed before they are called.

The structure of loops in Main ()

```
initialize
generate template grid
for ibands=1,Nbands
  load sftdata(iband)
  for isky_coh
    compute T, Tdot at ssb for tgps=mid point in every SFT chunk
    compute coefficients necessary for demodulation(isky_coh)
    for ispd_coh
      for iTc
        demodulate
        compute spectrum of DeFT data
        compute freq. average spectrum
        compute ratio
        on the latter, select peaks
        delete spectrum
      end (iTc)
      for if0 (every intrinsic search frequency in iband)
        compute PHM cone
        for ispd_incoh
          sum PHM
          compute hough probability map
          threshold and select candidates
          store hough-candidates info
          store map on disk ?
        end (if0)
      end (if0)
      delete cone
      follow up hough-candidates
    end (ispd_coh)
  end (isky_coh)
end(iband)
```

*Incoherent
search with
Hough Trans.*

- general algorithm set up
- demodulation
- sources data base
- grid in parameter space

Next:

- complete parameter space grid (insert yearly modulation)
- from gps time to ssb time
- sources DB + ancillary functions
- some Hough transform module functions

Note: June 2000 milestone

- a complete three stage hierarchical search set up. I think we'll be able to meet this milestone.

Refinement in a coherent spindown parameter grid bin with HT.

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other types of printers.

How much SFT data is necessary to search for one intrinsic frequency (f_0) ?

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