CONTINUOUS WAVES MILESTONES:
Target catalogue

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LSC Meeting, Livingston, March 15th – 18th 2000

- Overview
- Work done and in progress (milestones)
- Plans

LIGO-G000039-00-D

Overview

- **Goal**: To gather information about "interesting" targets for CW searches – sky areas and individual sources – and make them easily accessible:

  1. Data files with the relevant target parameters;
  2. Functions that retrieve the parameters;
  3. Extensive documentation.

- **Archives**:

  1. Astronomical Data Centre (ADC)
     http://adc.gsfc.nasa.gov/adc.html
  2. Princeton pulsar group
     anonymous ftp: pulsar.princeton.edu
  3. Parkes Multibeam survey
     http://wwwatnf.atnf.csiro.au/Research/pulsar
     http://www.jb.man.ac.uk/ fc/projects.html

Work completed/in progress

- Galactic sky areas:
  - Globular Clusters
  - Supernova Remnants
- LMC and SMC sky areas:
  - Globular clusters and supernova remnants data files;
  - functions in progress
- Radio pulsars
  - Taylor catalogue + Parkes survey
  - Routines in Fortran; they need to be converted into C
- **All codes are in C (not yet LAL)**

(3) ASIS

Summary/Future work

- About 1 month behind schedule
- Ready to code according to LAL standards (highest priority)
- Ready to code functions able to "manipulate" parameters

Continuous g.w. searches with the "Hough Hierarchical Algorithm"

Albert Einstein Institute, Golm-Potsdam

C.Cutler, B.Owen, M.A. Papa, B.Schutz, A.Sintes, A. Vecchio, P. Williams

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

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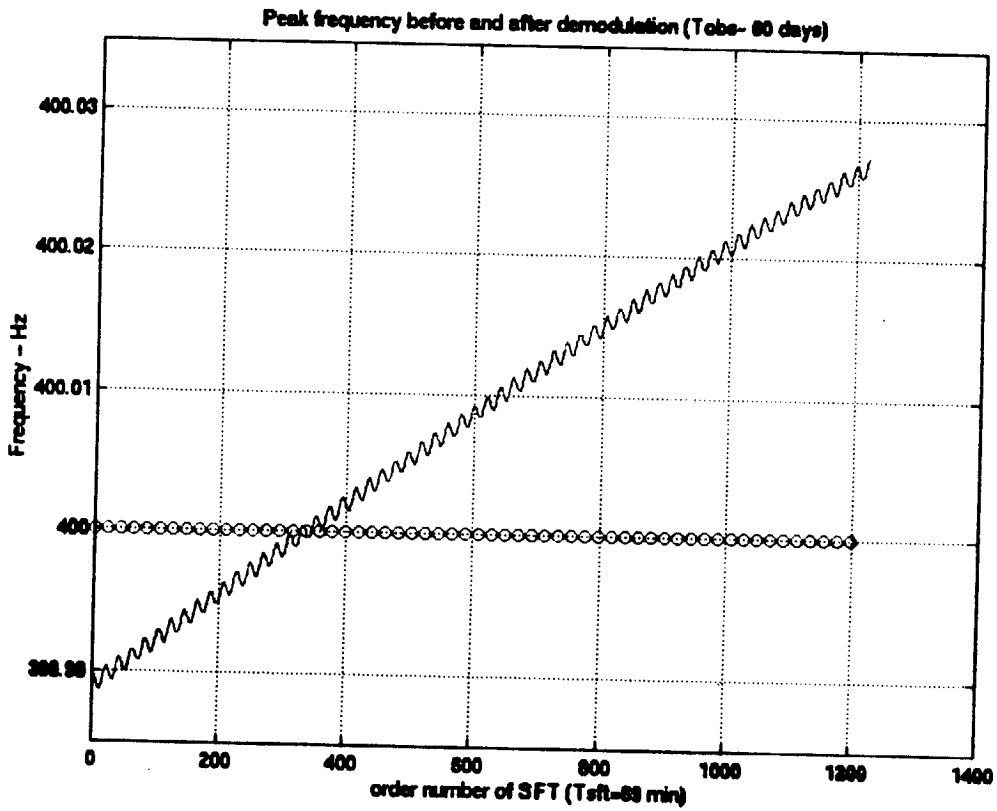
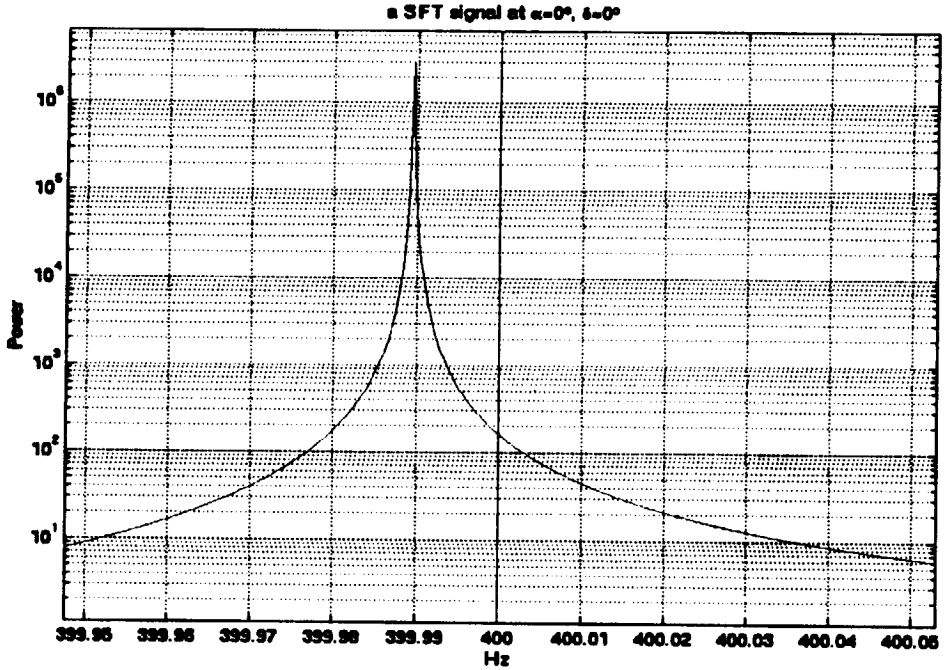
Demodulation: longer time baseline FFTs from shorter time baseline ones.



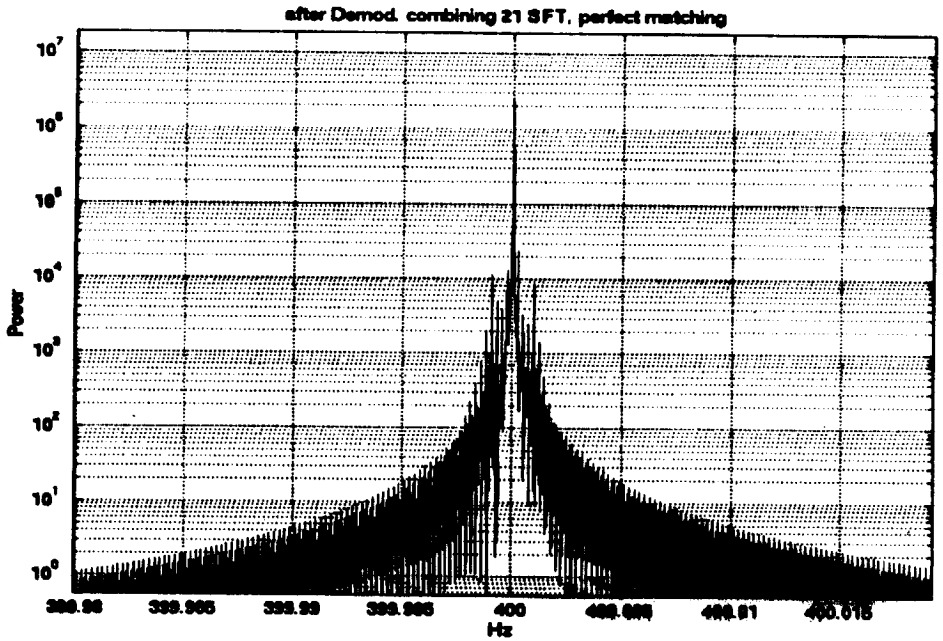
The **red line** is the instantaneous frequency of a signal, as measured in the SFTs (~ every 1 hour), over 60 days. The intrinsic frequency of the signal is 400 Hz.

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 Tc ~ 1 hour. The signal has f0 = 400Hz, the peak appears at a different freq. because of the Doppler modulation.



Spectrum of one of the demodulated FFTs with time baseline Tc ~ 21 hours. Since in this case there is perfect signal-template match there is no power loss and perfect shift of the peak to f0 = 400Hz.

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 ( )

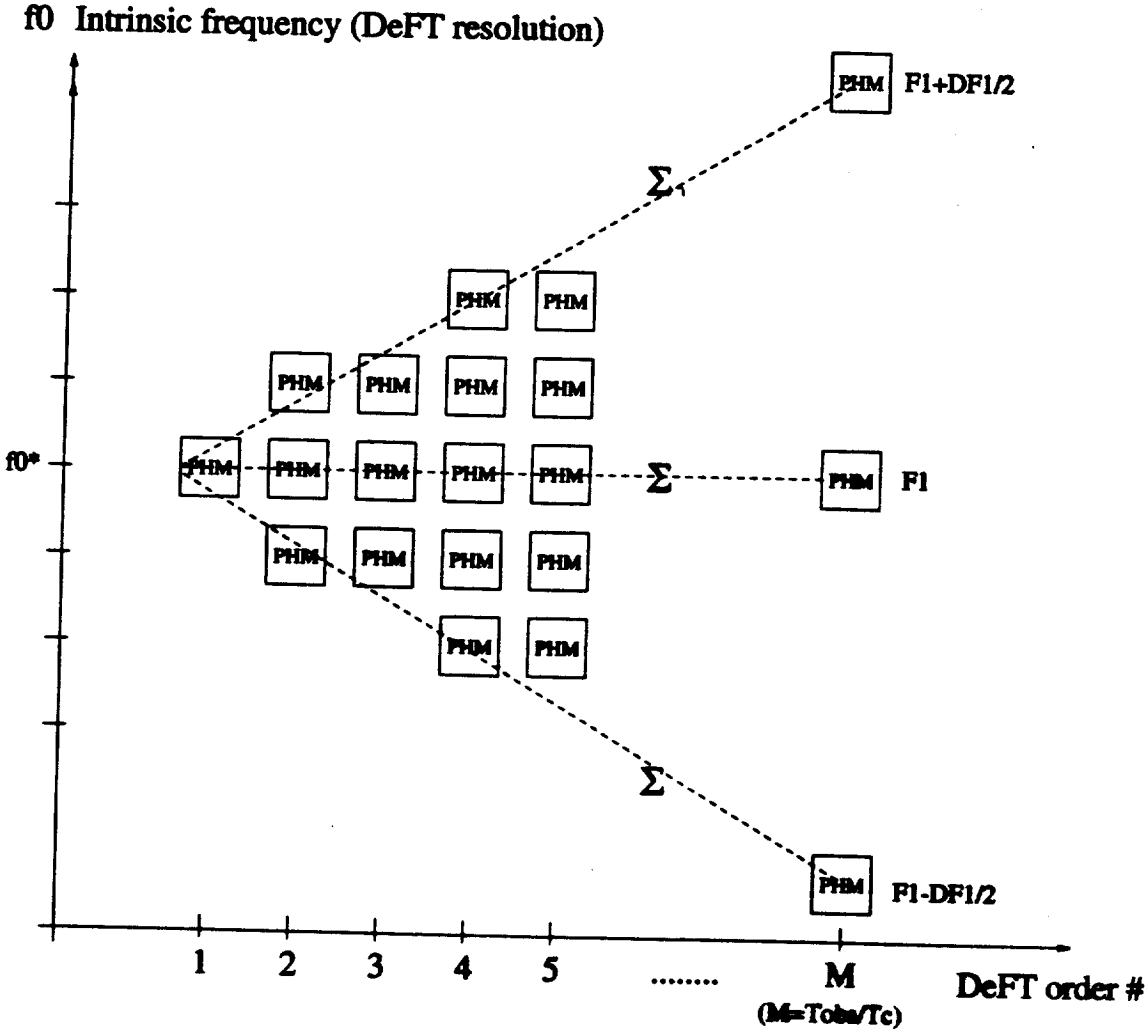
- The code consists in a series of nested loops, over the search parameters; this is the main( ).
- Given the input variables and parameters, a "Housekeeping" structure is filled by an initialize( ) function. This computes, once and for all, all the general purpose variables and checks their overall 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 chunck
                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)
```

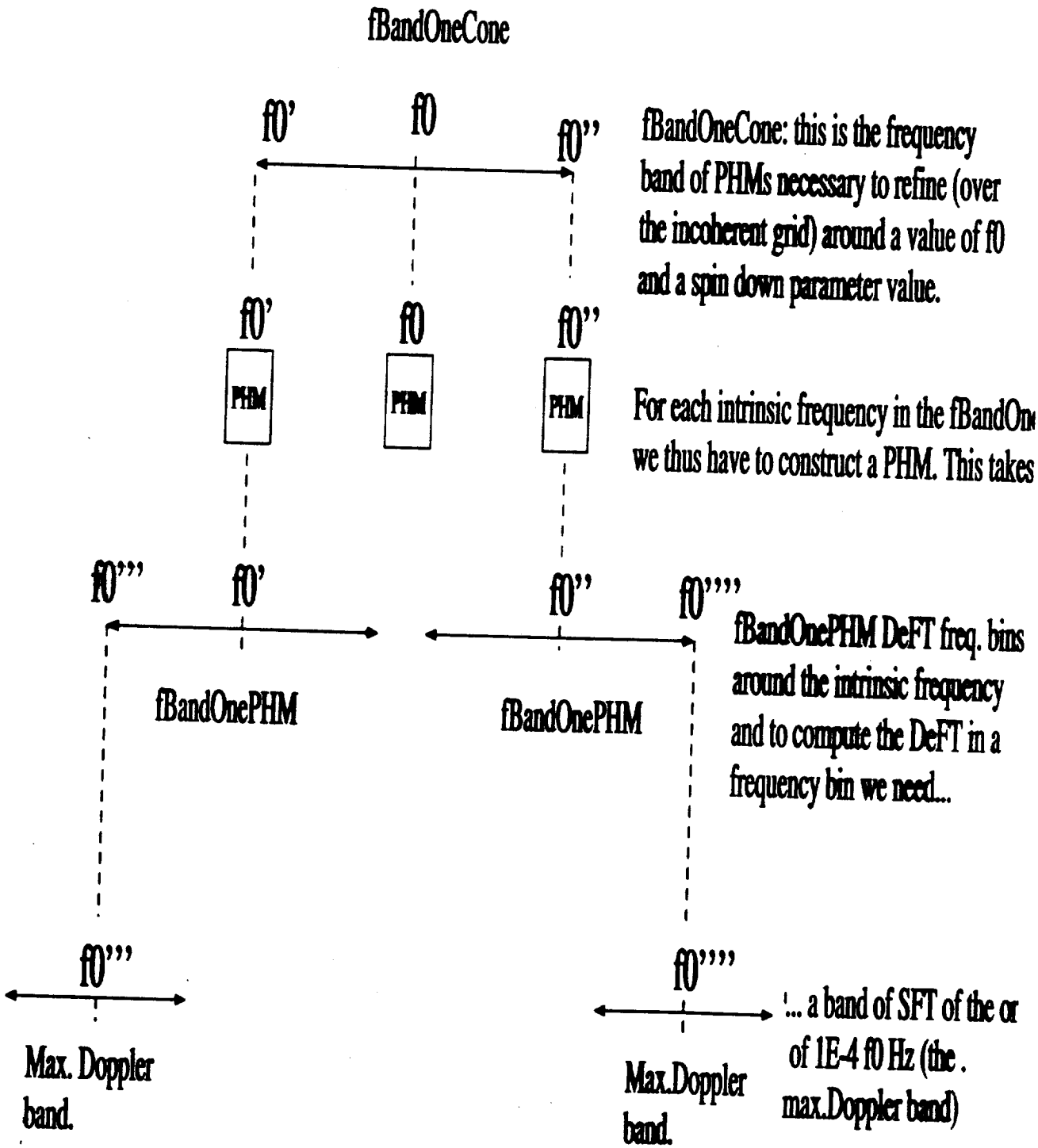
Incoherent search with Hough Trans.

Refinement in a coherent spindown parameter grid bin with HT.



This ensemble of Partial Hough Maps comes from a set of demodulated FFTs with timebaseline Tc, all demodulated according to a point in parameter space (say, α,δ , F1) . The grid of these points depends on Tc. By the Hough transform, performed by summing along different directions the PHMs, we refine the search around the parameters used for the demodulation.
The coordinates of the PHMs locate the position of the source in the sky. By summing along different directions one refines around F1.

How much SFT data is necessary to search for one intrinsic frequency (f0) ?



- general algorithm set up
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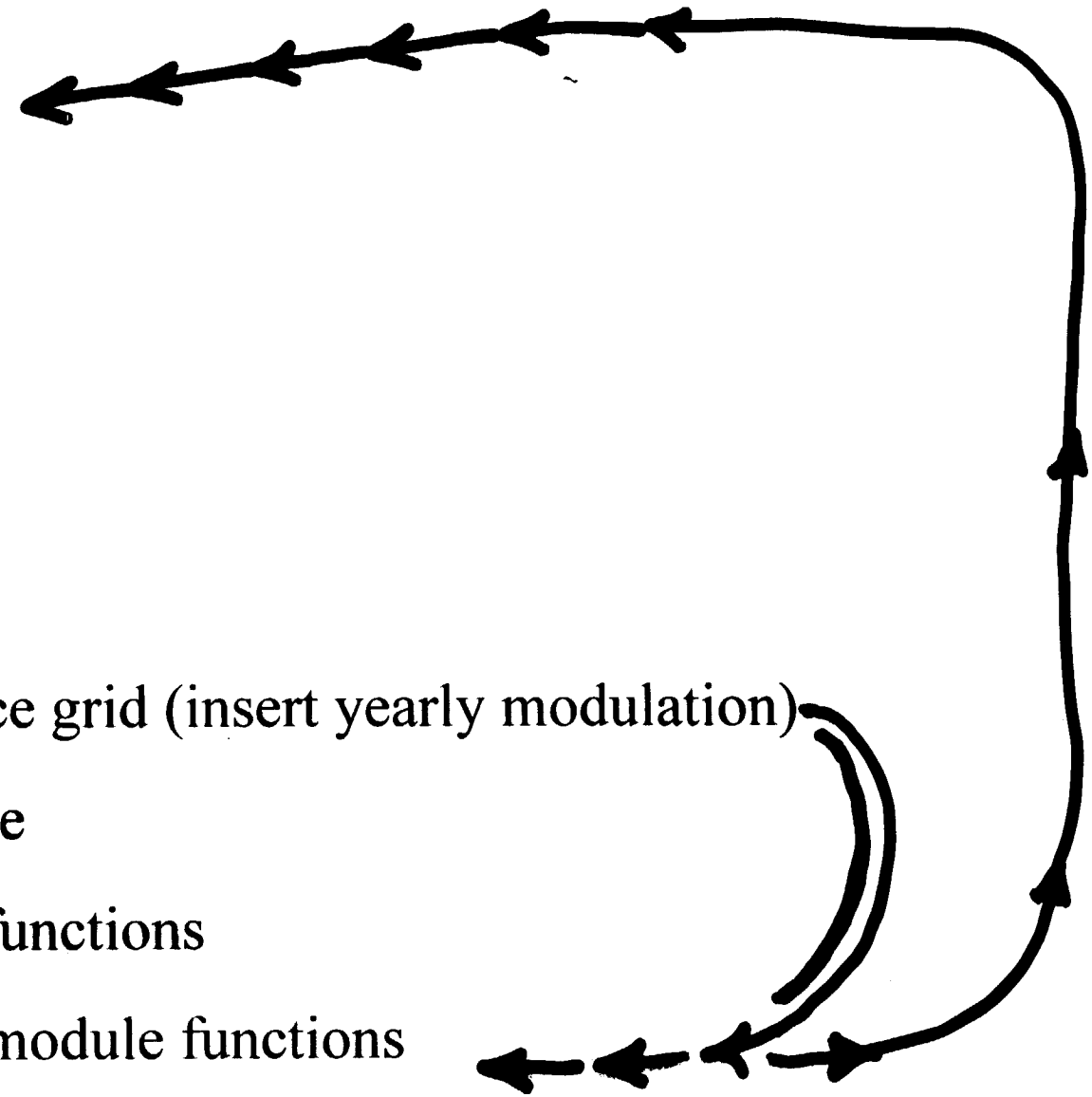
Next:

- 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.

Note 1, Linda Turner, 04/27/00 02:42:59 PM
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Note 1, Linda Turner, 04/27/00 02:48:09 PM
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