Hough Hierarchical Pulsar Search

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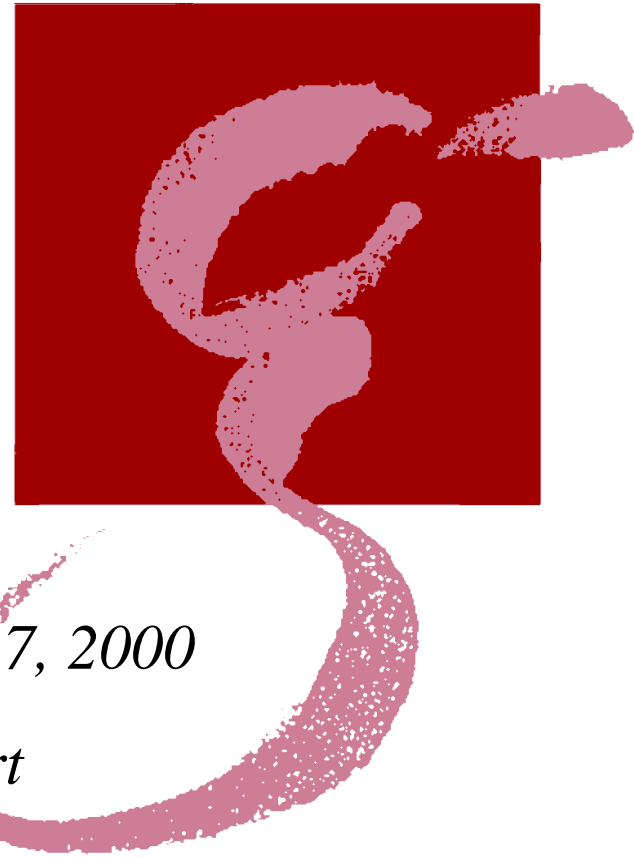
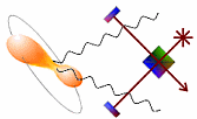papa@aei-potsdam.mpg.de

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ASIS – Milestones Report

How is the computational load distributed ?

Different nodes search different intrinsic frequency bands.

Since to search for a source emitting at a given f0, one needs only a small frequency range of data around that frequency *then* if one distributes the comp. load with respect to the intrinsic frequency search parameter, this induces a natural distribution of the data. Each node needs to keep on its HD between 400MB and 4GB of data (depending on the # of nodes), for a 4 months search over 500 Hz.
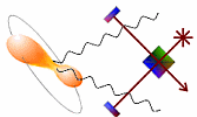
• input variables, same on every node (note: the search parameters can be given directly or "read" from sources DB)

• all processors run the same code, searching different intrinsic frequency bands. In principle very little inter-node communication is needed.

      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
      ……
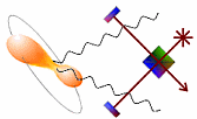
Algorithm set-up : the main ( )

• 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.
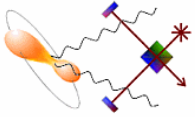
The structure of loops in Main ( )

```
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 – C.Cutler
                compute coefficients necessary for demodulation(isky_coh)
                for ispd_coh
                        for iTc
                                demodulate – S. Berukoff
                                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)
                                Hough Transform search – A. Sintes
                        end (if0)
                        coherent follow-up of Hough-candidates
                end (ispd_coh)
        end (isky_coh)
end(iband)
```
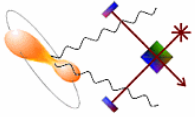
Repository of target parameters - A. Vecchio

- **<u>Radio pulsars</u>** (Taylor et al., 1995; http://pulsar.princeton.edu;Parkes multi-beam survey: http://www.atnf.csiro.au/~pulsar/psr/pmsurv/pmwww)

- **<u>Galactic Globular Clusters</u>** (Harris 1997; http://www.physics.mcmaster.ca/Globular.html)

- **<u>Galactic Supernovae Remnants</u>** (Green 1998, http://www.mrao.cam.ac.uk/surveys/snrs)

- The codes are currently being "LALed"

- **Extensive (but not yet complete) documentation available**

- **Functions to manipulate the parameters are under development**

Vicky Kalogera (CFA) is now also involved

The plan for the next months:

- • **Check for completeness**

- • **Keep the catalog up-to-date (monitoring IAU circulars, etc)**

- • **Web page with full information and links**

- • **Complete the catalogue with other potential targets**
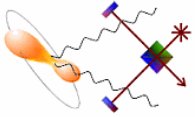
How are we doing with our milestones ?

- deliver routines that perform the conversion between **gps time** at the detector site and the corresponding **time at the solar system barycenter**. 🙂

- deliver the code that computes the **grid in parameter space for the coherent search** over, roughly, a one day timescale 😐

- deliver the code that computes the finer **grid in parameter space used by the incoherent search**. 🚫

- the completion of the latter two tasks will also allow us to **specify the final algorithm set up** (the current set up might be subject to revisions). 🚫

- we also plan to deliver the alfa version of the **catalogue of targets** (sky areas and individual sources) that may serve as search input parameters 🙂

- along with the catalogue, deliver the set of functions needed to **retrieve the information** 🙂

-deliver functions to **transform between different celestial coordinate systems** 😐

- **LAL-ing coherent demodulation routine**

- deliver the basic set of **functions needed for the Hough trasform module**, which means funtions to:

     - compute average spectrum from any given spectrum 🙂

     - compute ration of spectrum to its average 🙂

     - select spectrum peaks exceeding a given threshold 🙂   + some extra work on this by Allen, Papa, Schutz

     - determine, through the Hough transform master equation, the parameters of the circle in the sky determined by a registered peak (having specified a value of the intrinsic frequency) 🙂

     - enhance the number count in the appropriate portion of circle in the sky 🙂

     - set up the appropriate sky tilings to do this efficiently 🙂

     - produce a partial Hough map 🙂

     - sum partial hough maps and produce a total hough map. 🙂

Most of the functions will not completely comply to LAL standards before the end of the year. However, we are aware of these specifications and, indeed, we are structuring the functions to comply as much as it is reasonable given the stage of development (testing) of the overall search code

M.A. Papa   LSC meeting August 15-17, 2000