

Subgroup Report: Astrophysical Source Identification and Signature (ASIS)

Bruce Allen

LSC General Meeting

LIGO Livingston Observatory

March 16, 2000

People running ASIS

- Webmaster: Patrick Brady
- Meeting Organizer: Alan Wiseman
- Secretary (one-year term):
 - Warren Anderson (outgoing)
 - Alberto Vecchio (incoming)

Web Site: www.lsc-group.phys.uwm.edu/~lsc_asis/


http://www.lsc-group.phys.uwm.edu/~lsc_asis/ - Microsoft Internet Explorer

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Astrophysical Source Identification and Signatures

ASIS is a sub-group of the LSC ([LIGO Scientific Collaboration](#)). It was formed at the LSC collaboration meeting in March 1998. Its purpose is to advise the LSC on the following topics:

- Development of techniques to search for posited sources: templates, algorithms, and filters for:
 - Compact binary inspiral systems.
 - Impulsive sources: supernova core collapse, black hole formation.
 - Periodic sources.
 - Stochastic background sources
- Development of techniques to search for unknown sources.
- Source statistics - $\log(S)/\log(N)$ estimates.
- Determination of on-line and off-line functions.
- Establishment and maintenance of a [User Software Archive](#)

The other key roles of ASIS is to help determine the research and development priorities of the LSC, and to help establish roles and a program within the LSC, by coordinating the work of different LSC members.

Patrick Brady
Last modified: Sat Jan 22 23:45:00 CST 2000

ASIS home
Meetings
People
Documents
Software
Links
Mailing List/Archive

LSC Home
LIGO Home

Done Internet zone

3/17/2000

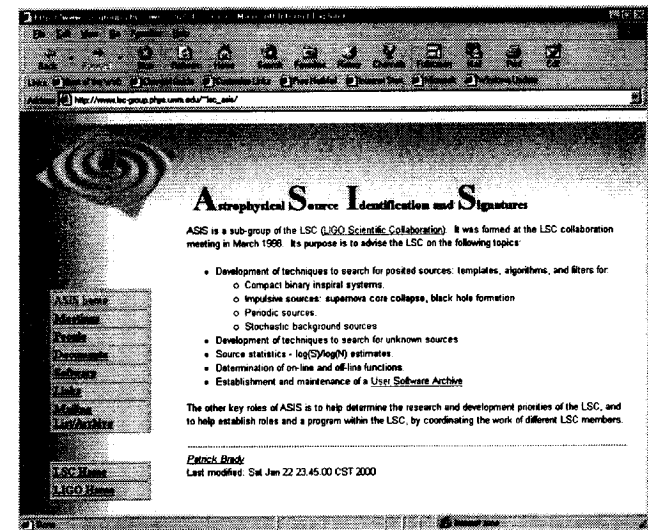
Web Site

- Redone January 2000 (Patrick Brady)

- Moved from Caltech host
- Documents/software/links
- Meetings/minutes/people

- Mailing list:

- March 12, 2000: 105 subscribers
- messages archived on web site



3/17/2000

6 ASIS meetings since July 1999

- Sept 23, 1999
Unmodeled sources conference call
- Sept 28, 1999
Inspirational search conference call
- Sept 30, 1999
Stochastic background conf call
- Oct 7, 1999
General meeting conference call

6 ASIS meetings since July 1999 (cont.)

- Oct 8, 1999
Conference call on CW Searches
- Feb 15, 2000
Conf call General Meeting (29 people)
AEI, Cardiff, Cornell, LIGO/CIT, LLO,
UFG, UM, UTB, UWM
- Minutes of meetings can be found on
ASIS web site

Future ASIS Meetings

- Following this LSC meeting: regular monthly telephone conferences
- 1/2 software development
1/2 general-interest ASIS science
- Main goal for next six months:
Track and encourage progress on software development milestones & LAL

Active Groups within ASIS

AEI

CFA

Michigan

UFG

Cardiff

LLO

Stanford

UTB

Caltech-TAPIR

LIGO-CIT

TAMA

UWM

ASIS Software Development

- July 1999: need for a working software/programming standard
- Hard work by LAL Software Committee & LAL Librarian
- Several groups are now writing code to LAL standard (demo of install/use in ASIS meeting)
Success!

ASIS Software Development (cont.)

- Unmodeled source searches
 - Time/Freq (Cardiff)
 - Power monitor (Cornell)
 - Two-site correlation (unassigned)
- CW (pulsar) searches
 - Source database (AEI)
 - Full sky Hough transform (AEI)
 - Directed known (LIGO Caltech)
 - Full sky FFT stack/slide (UWM)
 - Discriminators (Michigan)
 - Robust methods (Stanford)

ASIS Software Development (cont.)

- **Inspirational Signals**
 - Hierarchical search
Filtering (UWM)
Template & bank generation (Cardiff)
 - Multi-detector (unassigned)
- **Stochastic Background**
 - Correlation Statistic (UTB)
 - Robust method (Cornell)
 - Maximum likelihood (unassigned)

Pulsar Database (AEI)

- Vecchio
- Dec 15, 1999: catalog definition and basic coding completed
- March 15, 2000: add Taylor catalog, latest Parkes survey & multi-beam survey, globular clusters.
- Status report tomorrow.

Directed pulsar search (CIT)

- S. Anderson
- Initial pulse profiles/power spectra
 - frame data input (via GRASP)
 - output to “old” light-weight data format
- April 2000:
 - input changed to LDAS API
 - output changed to “new” light-weight data format

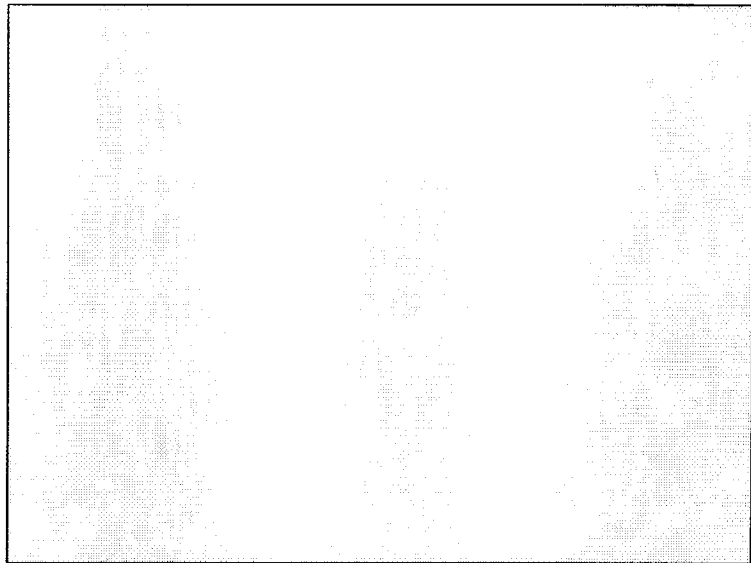
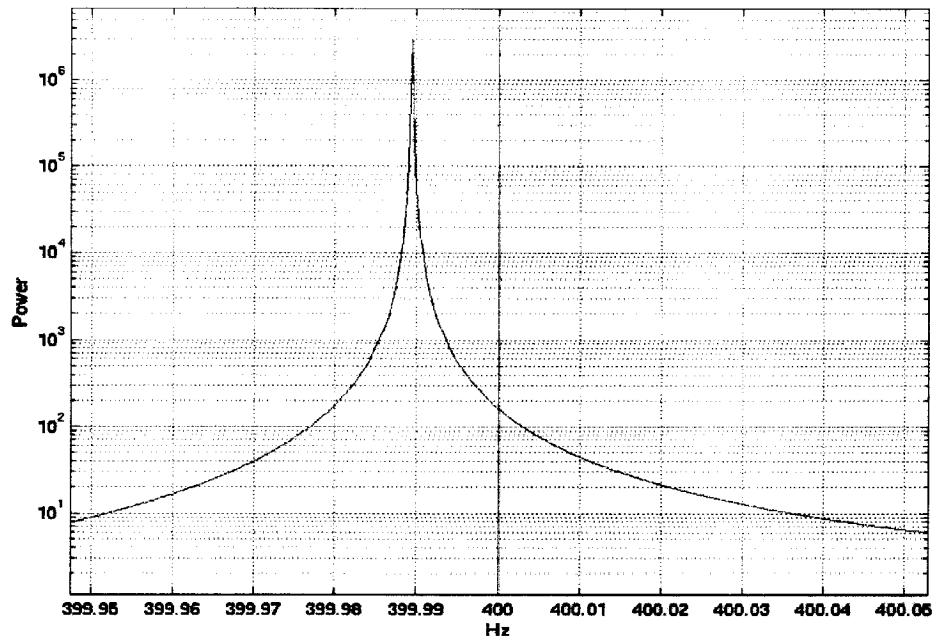
FFT stack/slide pulsar search (UWM)

- Brady, T. Creighton
- 15 Dec 1999, low pass filter code complete (in next LAL release)
- 15 Jan 2000, sum/slide routines: written, being converted to LAL
- 15 Feb 2000, TDC correction & re-sampling: coding almost completed
- 15 Mar 2000, metric for coarse gridding: harder than expected.

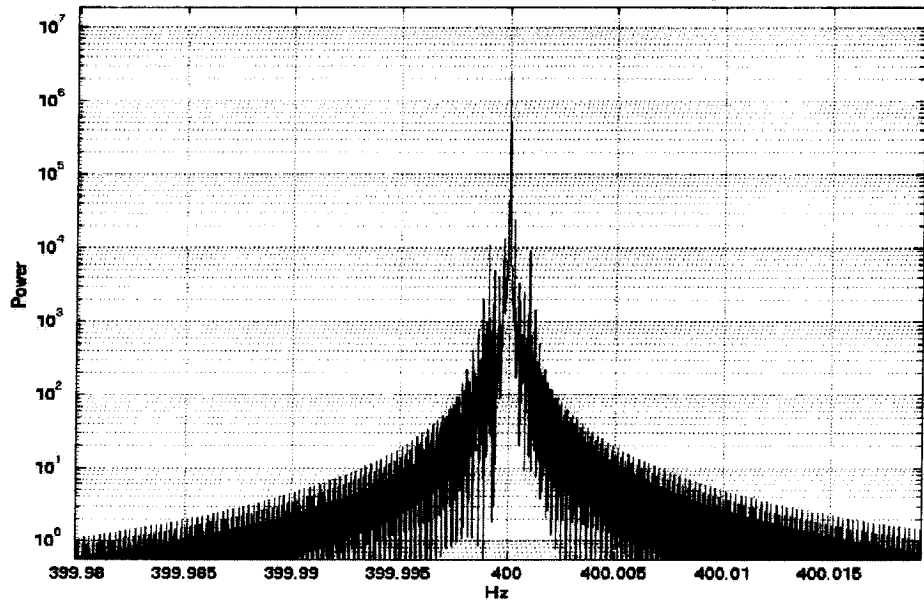
Hough-transform hierarchical pulsar search code (AEI)

- Cutler, Owen, Papa, Schutz, Sintes-Olives, Vecchio, Williams
- Dec 31, 1999: algorithm complete.
 - loop nesting orders, data flow
 - approximate time scales
 - coherent first/third stage filtering code written
- March 31, 2000: Hough transform code development starting

a SFT signal at $\alpha=0^\circ$, $\delta=0^\circ$



after Demod. combining 21 SFT, perfect matching



pectrum 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 -

CW discriminators (Michigan)

- Chin, Riles
- 31 Dec 1999, in-house algorithm for determining $h(t)$ of source
- 31 Mar 2000, LAL version of algorithm
- Status report tomorrow

Hierarchical Inspiral Search (UWM)

- Allen, Brown, J. Creighton
- Master/Slave design
- Code done to LAL standard
- Nov 31, 1999 Milestone: code for Master complete (3 weeks late)
- Feb 29, 2000 Milestone: code for Slave complete (will be about 1 month late)
- Next stage: extensive testing

Hierarchical Inspiral Search (Cardiff)

- Balasubramanian, Churches, Sathyaprakash
- Waveform & template bank generation
- Nov 31, 1999 milestone - time-domain Taylor and Pade approximants: submitted to LAL
- Feb 28, 2000 milestone - freq-domain Taylor approximant code: completed
Time-domain including eccentricity: about one month late.
- Next milestone: template bank generation

Time/Freq Line-Tracking (Cardiff)

- W. Anderson, Balasubramanian, Chassande-Mottin
- Nov 31, 1999: method to veto violin-modes and other line-like features: completed
- April 31, 2000: LAL-compatible version of Steger's line-tracking algorithm, code for Wigner-Ville, Windowed FFT, and Reassigned Spectrogram methods. Good progress: should meet milestone.

Power Monitoring (Cornell)

- Drasco, Flanagan
- Dec 31, 1999: re-write existing excess-power monitoring to LAL standard: should now be complete.

Wavelet transform method (UFG)

- Method being developed for detector characterization by Klimenko, Sazonov
- May be useful for blind signal searches
- Talk & ongoing discussion within ASIS group about possible applications

Stochastic Background Correlation Statistic (UTB)

- Romano
- 31 Dec 1999, overlap reduction function in current LAL release
- Main emphasis: training students to write code to LAL standards
- Will present revised set of milestones tomorrow

Stochastic Background: robust locally-optimal statistic (Cornell)

- Allen, J. Creighton, Drasco, Flanagan
- Locally-optimal method generalized to colored noise, non-coincident, non-co-aligned case
- March 31, 2000 milestone: code in LAL

Conclusions

- ASIS group is healthy and active
- A number of software development projects are now underway
- Several holes remain: volunteers needed
- Success of LAL standard is a very positive development

Note 1, Linda Turner, 05/09/00 09:29:32 AM
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