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# On-line Tools

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# LIGO Tools

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- Easy data access
  - *Guild, Lidax, LARS*
- Interactive data viewing and quick diagnostics
  - *Data viewer, Diagnostics test tool, Time frequency plotting*
- Continuous monitoring
  - *Data monitor tool*
    - ❖ Environmental vetoes
    - ❖ Performance monitoring (detector sensitivity, system ID, etc.)
- Event-analysis and histograms
- Set of useful utilities
  - *Xlook, frame file utilities, Matlab/Mathematica interfaces, ROOT, grasp library, ...*



## LIGO Tools (2)

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- ❑ LIGOTOOLS home page:
  - <http://www.ldas-sw.ligo.caltech.edu/ligotools/index.html>
- ❑ Multi-platform support
  - Sparc/Solaris, Intel/Linux, Intel/Windows
  - Available from every machine at LIGO
- ❑ Source and binary distributions
- ❑ Installation tools
- ❑ Documentation



# Easy Data Access: Guild

guild Graphical User Interface to LIGO Databases

Current LDAS server: LHO  
Database name: default  
LDAS metadata database...  
Frame data...  
LDAS user command  
Utilities...  
Quit

Build query for table GDS\_TRIGGER

Build query for table GDS\_TRIGGER

Columns:  All   
 Selected:  
 Just count number of matching records  
 Count, grouping by column(s):

Order by column(s): start\_time, name, subtype  
Maximum number of records to fetch: 100

Qualifiers: Text comparisons are not case-sensitive

- trigger name is List
- trigger subtype is List
- site/interferometer is List
- start time
- duration (seconds)
- trigger priority
- trigger disposition
- event size
- event significance
- frequency

Built SQL query: Refresh

```
SELECT * FROM GDS_TRIGGER ORDER BY start_time, name, subtype  
FETCH FIRST 100 ROWS ONLY
```

Refresh & Submit Help Close main



# Easy Data Access: Lidax

The image shows two overlapping windows from the LIGO Data Access (LiDaX) software. The main window, titled "LIGO Data Access (LiDaX)", is a configuration interface with several sections:

- Source:** Server: single, Local tape drive/robot; UDN: /dev/rmt/1n -r CY1@1:7; Channels: L0-PEM-LVEA\_SEISZ; Start GPS: 668181923 sec, 0 nsec; UTC: 9/3/2001 dd/mm/yy, 14:05:10 hh:mm:ss; Duration: 400000 sec, 0 nsec; Keep: 0:30 hh:mm.
- Destination:** Client: single, Local file system; UDN: /export/raid1/sigg/1spetest@#3600; Channels: (empty); Format: Len: 120, Num: 5, Compr.: None.
- Progress:** Log file: /home/sigg/diag/addons/fantom/src/lidax.log; Web page: /home/sigg/diag/addons/fantom/src/lidax.html; e-mail: sigg@ligo.caltech.edu; Dialog box: checked.

Buttons include "Add...", "More...", "Select...", "Lookup...", "Now", "Clear", "Store...", "Restore...", "Monitors...", "Run...", and "Cancel".

The "Time Selection" window is a sub-dialog with a table and configuration options:

Seg	Start Date	Time	Stop Date	Time	Duration

Buttons: "Set start", "Set both", "Set stop".

**Selected:** Type:  Start/Duration,  Start/Stop,  Stop/Duration

Start GPS: 668181923 sec, 0 nsec; UTC: 9/3/2001 dd/mm/yy, 14:05:10 hh:mm:ss; Now

Stop GPS: 668581923 sec, 0 nsec; UTC: 14/3/2001 dd/mm/yy, 5:11:50 hh:mm:ss; Now

Duration: 400000 sec, 0 nsec

Buttons: "Ok", "Cancel".



# Data Viewer

**DATA VIEWER CONTROL**

Main View Help

Action: Stop [X] [Play] [Pause]

HO: PEM-LVEA\_WIND

Display Type: Time Sequence

Display Mode: Standard

No. of Chans: 1

Resolution: 128 Hz

Refresh Rate: 1 /Sec

X Axis: 8 Sec Delay: 0

Y Axis: Min -5 Max 5

Unit: m/s Scale: Linear

Auto Color: red

Trigger Enable: Ch 01

Above: [ ]

Global Settings Show Sel.

**Playback Control Panel**

Channels

- 01  11
- 02  12
- 03  13
- 04  14
- 05  15
- 06  16
- 07
- 08
- 09
- 10

X Axis Format

- Date/Time
- Total Time

Decimation

- Full Data
- Second Trend
- Minute Trend
- 10-min Trend
- Hour Trend

Graph Mode

- Standard
- Multiple
- Multiple Xmgr

Show Mean

Show Max

Show Min

Show X Grid

Show Y Grid

Style: Default

Auto Setting

Server

Frame File

IP: 10.1.0.26

YR MO Day HR MIN SEC GPS

01 4 26 17 52 18 572342751

Duration 300 [ ] [ ] [ ] [ ]

Stop Time [ ]

UTC  GPS

Quick Set

Execute Stop # [ ] Close



Diagnostics test tools – /opt/CDS/e/dtt/daniel/lock\_000218\_050748\_mca.xml

File Edit Measurement Utilities Help

Measurement Excitation Result Iterator Synchronization Environment Defaults

Measurement Selection

Fourier Tools  Swept Sine Response  Sine Response  Triggered Time Response

Channels 0 to 19  Channels 20 to 39  Channels 40 to 59  Channels 60 to 79  Channels 80 to 99

Measurement Channels

0	<input checked="" type="checkbox"/>	H2:LSC-AS_Q_TEMP	5	<input type="checkbox"/>		10	<input type="checkbox"/>		15	<input type="checkbox"/>	
1	<input checked="" type="checkbox"/>	H2:LSC-AS_L_TEMP	6	<input type="checkbox"/>		11	<input type="checkbox"/>		16	<input type="checkbox"/>	
2	<input checked="" type="checkbox"/>	H2:IOO-MCA_OUT_MON	7	<input type="checkbox"/>		12	<input type="checkbox"/>		17	<input type="checkbox"/>	
3	<input type="checkbox"/>		8	<input type="checkbox"/>		13	<input type="checkbox"/>		18	<input type="checkbox"/>	
4	<input type="checkbox"/>		9	<input type="checkbox"/>		14	<input type="checkbox"/>		19	<input type="checkbox"/>	

Fourier Tools

Start: 0 Hz Stop: 900 Hz BW: 0.062 Hz Settling Time: 0.0 %

Window: Hanning Overlap: 50.0 %  Remove mean Number of A channels: 3

Averages: 18 Average Type:  Fixed  Exponential  Accumulative

Start Time

Now

In the future: 0:00:00 hh:mm:ss

In the past: 0:00:00 hh:mm:ss

GPS: 636353298 sec 0 nsec

Date/Time: 6/3/2000 dd/mm/yy 4:48:05 hh:mm:ss UTC

Measurement Information

Measurement Time: 18/02/2000 05:08:04 UTC

Comment / Description:

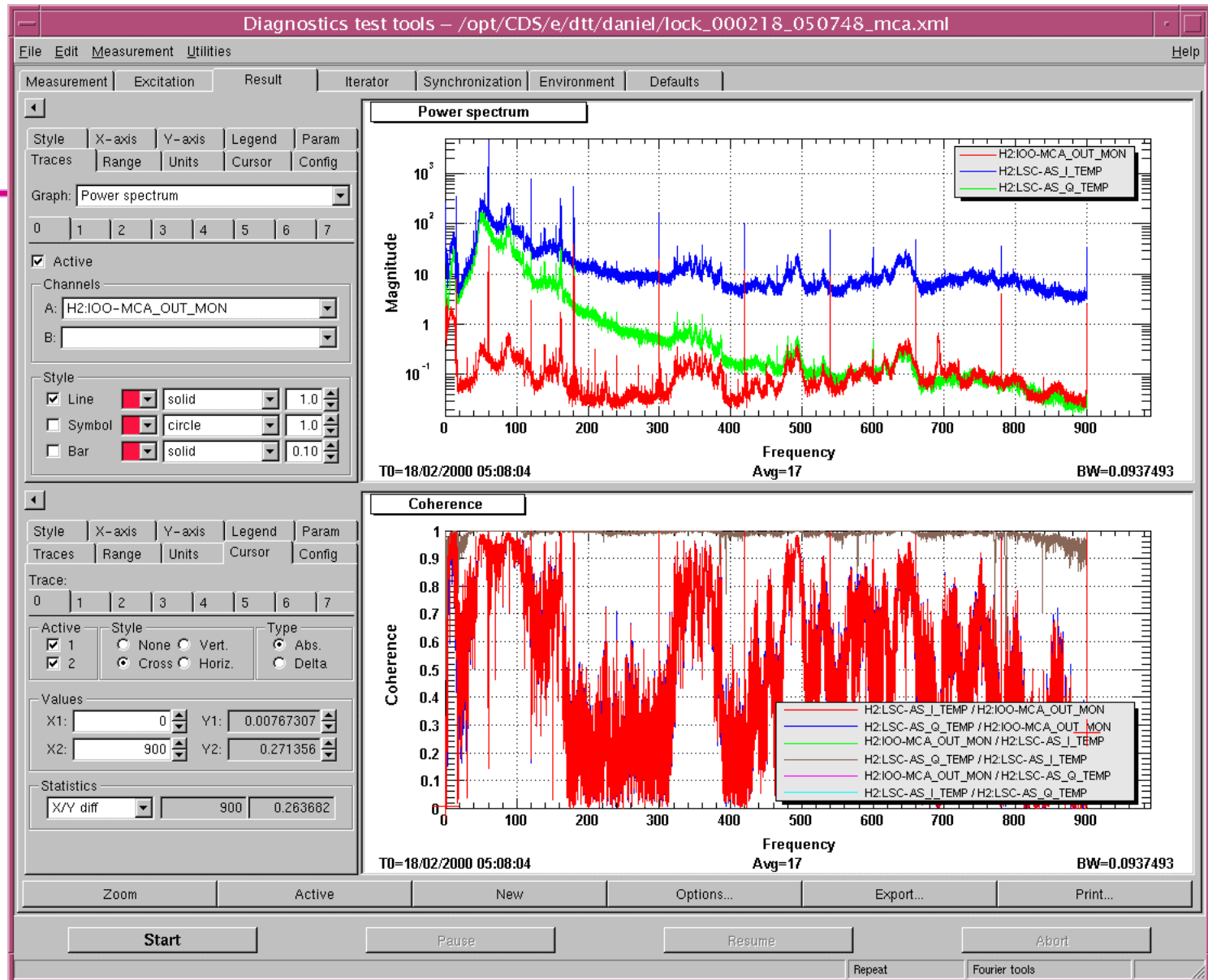
Start Pause Resume Abort

Repeat Fourier tools

- ❑ Diagnostic test tool (DTT)
  - Optional direct excitation, injecting calibration signals
  - Standard analysis tools (PSD, coherence, transfer function)
  - Data received directly from DAD
  - Graphical Interface



# Plot







# Data Monitor Tool

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- ❑ Detect and tag known signals and disturbances
  - Find and record transients
  - Correlate external effects to operational parameters
- ❑ Measure and summarize the running state
  - Noise spectra, average power, other operational parameters
  - Rate and magnitude of known transient signals
- ❑ Notify operators of faults or abnormal conditions
  - Increases in all or part of noise spectrum
  - Other device specific problems
- ❑ Support interactive testing and diagnosis



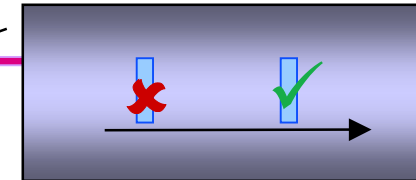
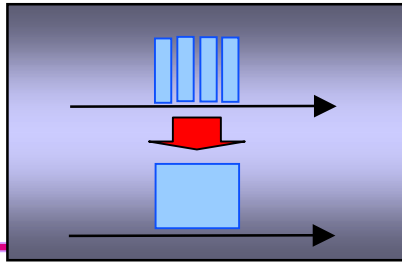
# Monitor Development

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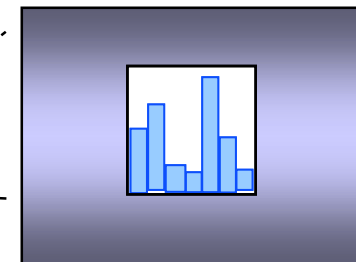
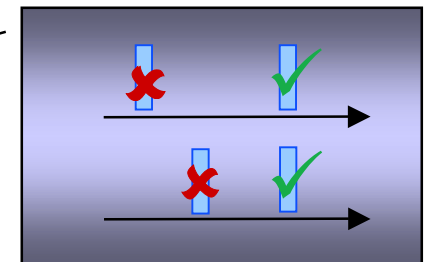
- **Detector characterization group**
  - Line tracking, transient detection, correlations, reduced data sets, noise characterization, time-frequency thresholds, etc.
- **Engineering run investigation teams**
  - Data integrity, loss-of-lock, calibration, environmental cross-correlation, identification of disturbances, etc.



# Event Analysis



- ❑ Fine selection/rejection of events
  - Selection of event types & cuts on event parameters
  - Adjust parameter values (normalization, calibration, derived quantities)
- ❑ Cluster analysis
  - Time window and multiplicity
  - Remove duplicate (closely space) triggers
  - Reclassification of clusters into a single event or veto
- ❑ Correlation (Trigger logic)
  - True and false (time shifted) coincidences
    - ❖ Detector/detector & between different sensors or event types
  - Veto one event type by another
  - Keep track of trigger uptime!
- ❑ Event data lookup
- ❑ Histogram generation
- ❑ Simple parallel processing paradigm: split in time





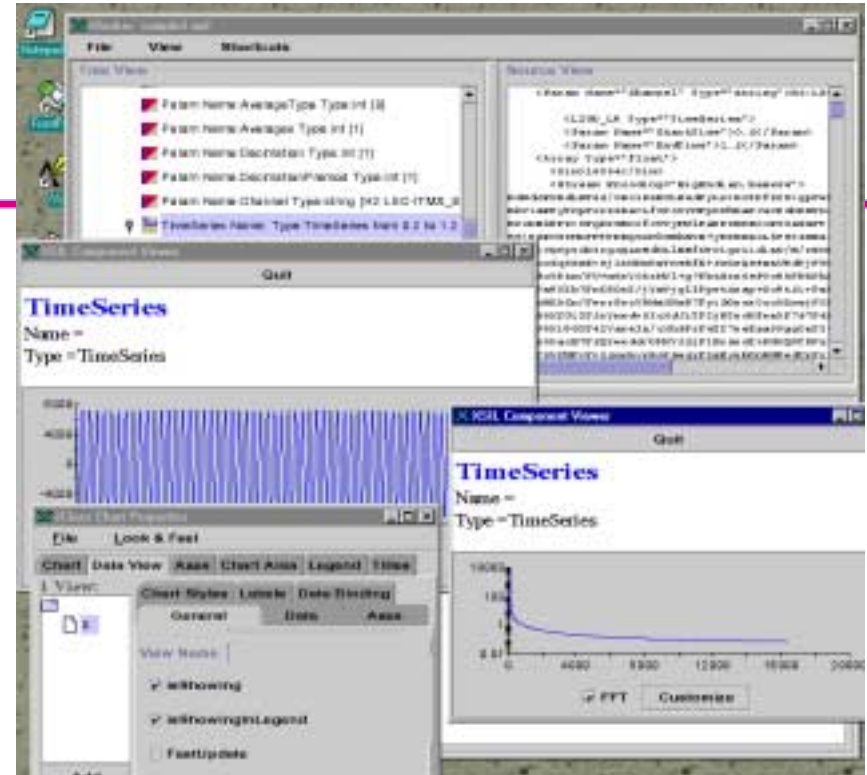
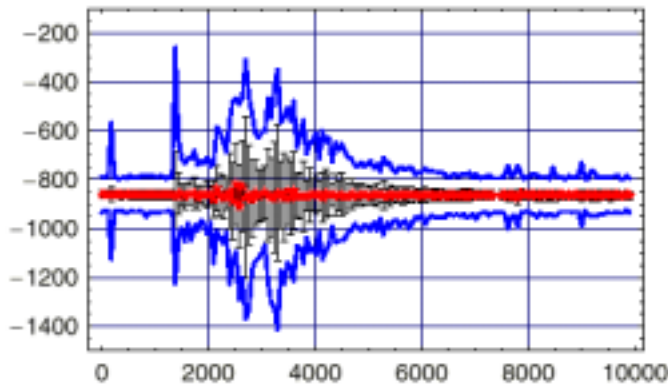
# Xlook

## Matlab/Mathematica

```

trace = 1;
MultipleListPlot[
  ({#[1], #[3]}, ErrorBar[#[4]] & /@ (trend[trace]),
  {#[1], #[5]} & /@ (trend[trace]),
  {#[1], #[6]} & /@ (trend[trace]),
  PlotRange -> {-1500, -100}, plotopt];

```



## Command line utilities

FrDump, FrSplit, FrMerge, fdir,  
finfo, fsettime, etc.



# Conclusions

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## Combination of

- High performance data acquisition system
- 24 hour disk cache
- New software and analysis tools

## has enabled

- Fast learning curve
- Emphasis on analysis rather than data gathering
- Greatly enhanced remote diagnostics