

Status of International Exchange and Comparison of Environmental Data

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GEO:

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What we're doing and why

- Continuously log **seismic, magnetic** and **power line** fluctuations
 - Log at multiple sites across the globe (especially GW detector sites)
- Collect data into one place; merge
- Search for correlations
 - Test hypothesis that GW detectors have uncorrelated noise
- *Also*, get practise exchanging and synchronising data

Where in the world ... ?



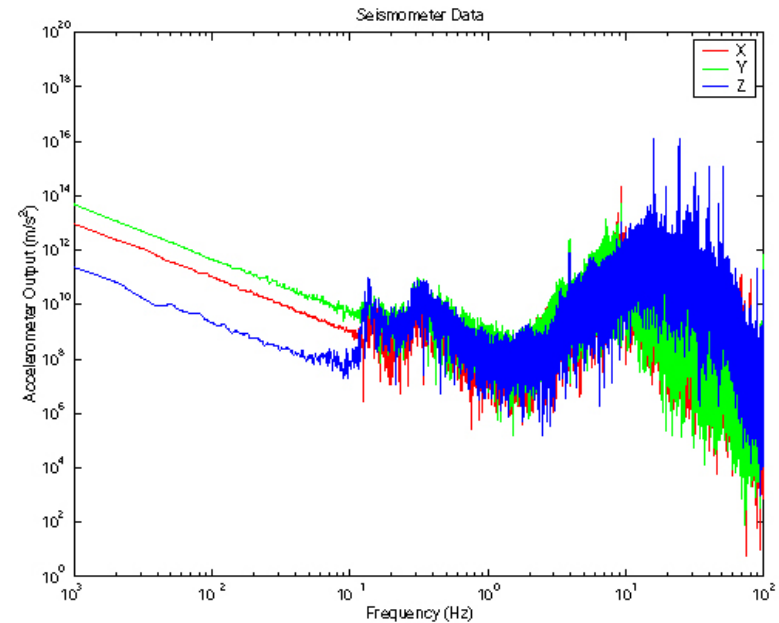
- Environment monitors logged by **LIGO (2), Virgo, GEO, ACIGA**
- Data collected by server at **Caltech**, frames merged.

Seismometers



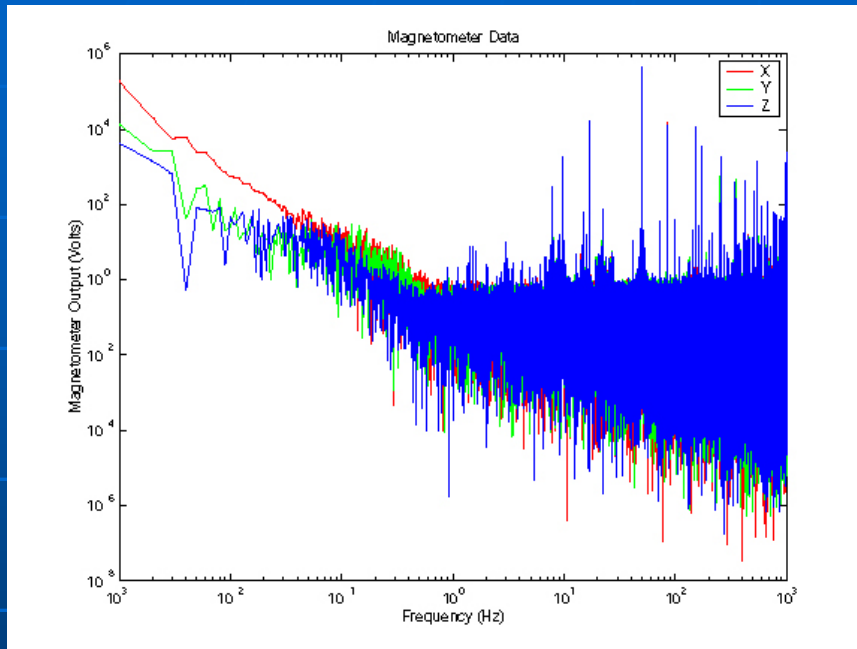
Guralp CMG 3

- 3 sgl-axis **seismometers**
- sensitive for $f < 10$ Hz
- running as accelerometers
- sample rate: 250 Hz



- Background continuum
- Stronger "burst" signals
- Seismic waves \sim speed of sound
- Different synchronisation signature to GW

Magnetometer

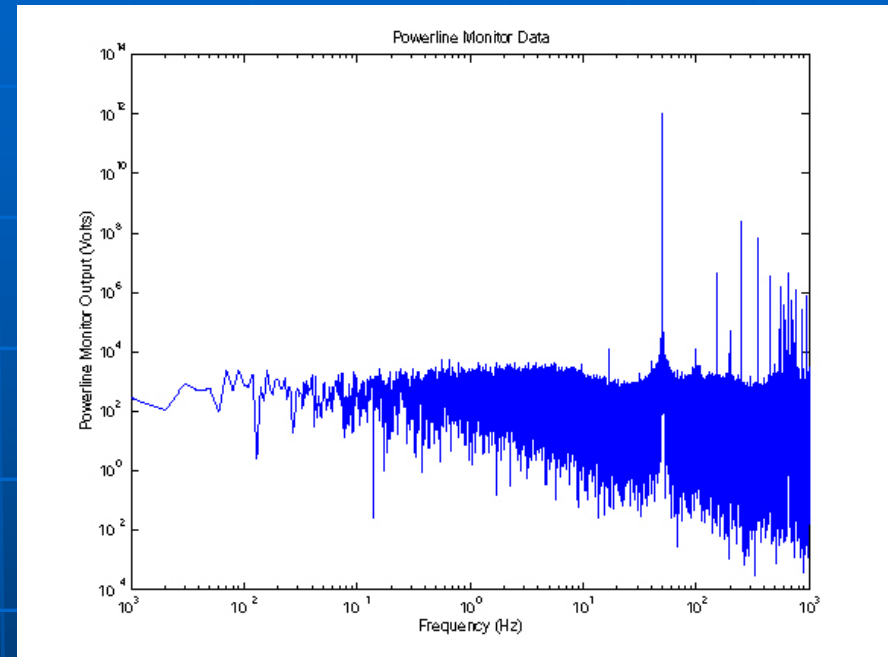
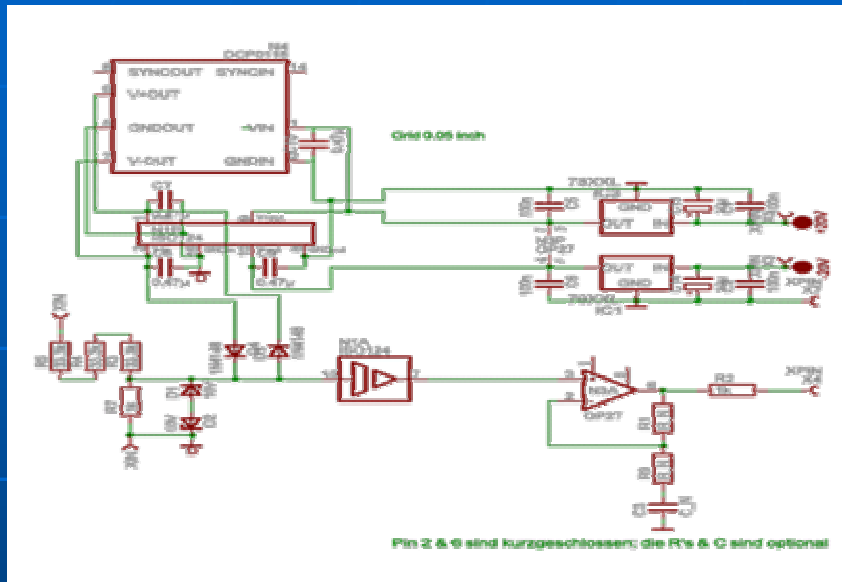


Stefan Mayer FL3-100

- triaxial fluxgate **magnetometer**
- sensitive for $f < 2$ kHz
- sample rate: 2000 Hz

- Global correlations caused by magnetic storms?
mutual induction of power grids?
- Magnetic influence \sim light speed
- Same synchronisation signature as GW

Power Line Monitor

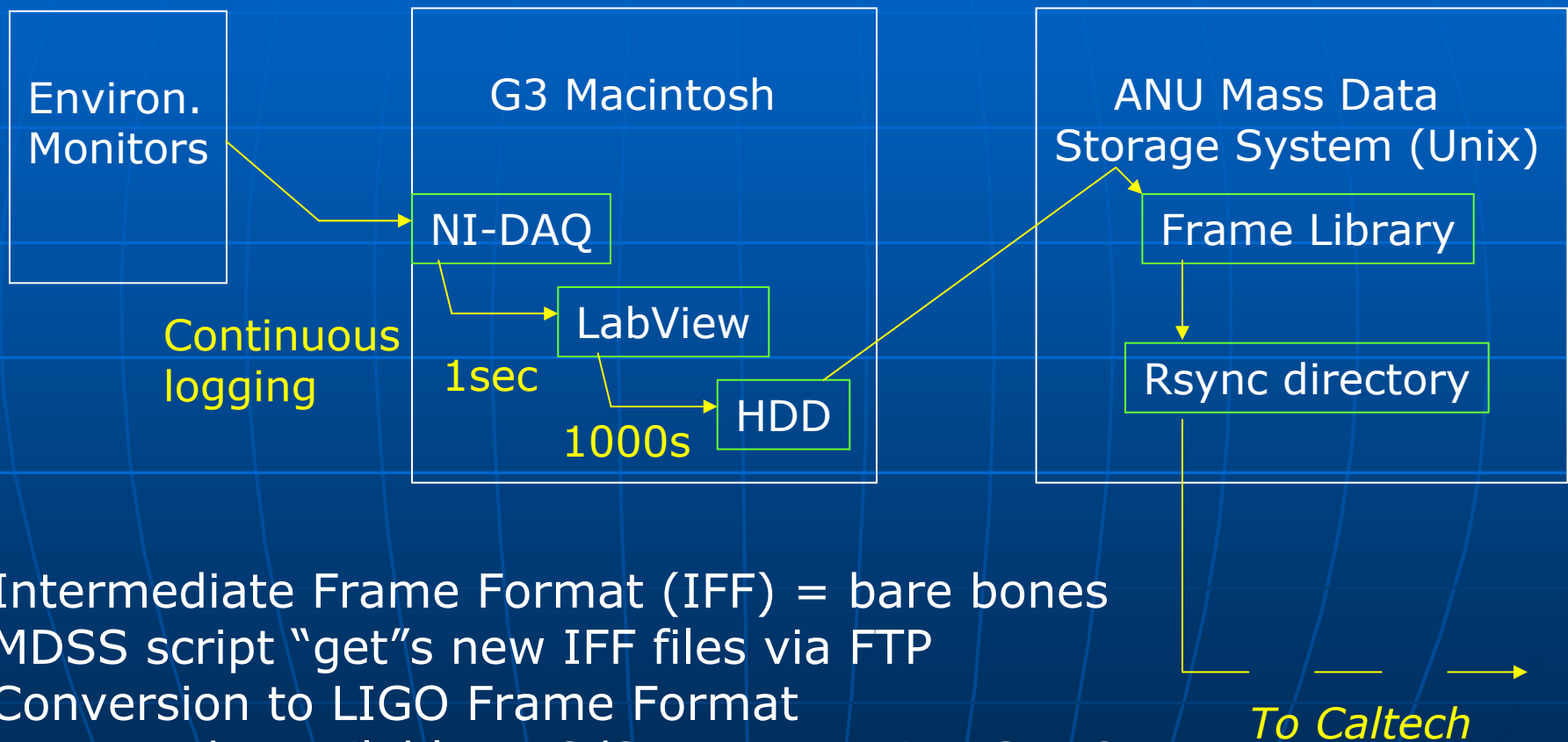


Powerline Monitor Circuit

- voltage divider followed by isolating amp. (GEO design)
- sample rate: 2000 Hz

- Log voltage from mains (240Vrms AC)
- Correlations induced along the same lines as in magnetometer case.

ACIGA Datalogging Setup



- Intermediate Frame Format (IFF) = bare bones
- MDSS script "get"s new IFF files via FTP
- Conversion to LIGO Frame Format
- Data made available to O/S partners via RSYNC
 - Automated script at CIT copies frames merges with frames from other sites

What data/details get logged?

- IFF file contains (for one channel):
 - Channel name eg "A0:SEISX"
 - Run no; Frame no (just book keeping...)
 - UTC time stamp (sync'd over internet)
 - Duration of file (= 1000 seconds)
 - Sample rate for that channel
 - 1000 seconds of data (of course)
- LIGO Frame Format has much more flexibility, many more fields:
 - Any no of channels, raw/processed data, frequency line info, quality info, list goes on

How well does the system work?

- ACIGA dataloggers running > 6wks
 - LIGO, Virgo online part-time ~ 6months
 - GEO joined recently, interest from TAMA
- Online > 90% of time
- Problem: DAQ card clock is imprecise:
 - Loses seconds over period of weeks
 - LIGO, Virgo use specialised devices
- Quality of Environmental Data?
 - sanity check required...

So, are there correlations?

- Jury is still out ...
- Isolated studies have been done
 - Inter-site seismic, intra-LIGO powerline
 - Time coherences, rumours ...
- No unifying work
- Still need to answer question:
“Are there any significant mechanisms that will produce false GW signals on multiple detectors?”

The Plan

- Focus on magnetic field correlations
- Compute correlation integral
 - $\text{PSD}\{\text{correlation}\} = \text{info on common lines}$
- Long term correlations simpler to calculate, only help for long signals
- Short term correlations difficult to do in general, need specific mechanism in mind