GEO Online Detector Characterization System

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GODCS ARCHITECTURE

GODCS MONITORS

Monitors process the various channels and look for glitches, line amplitude fluctuations, Band limited RMS fluctuations etc. They also measure linear and non linear coupling between any pair of channels.

RAW FRAME DATA

Main GW channel and other instrumental monitors and environmental channels.

MySQL Database

Events are recorded into tables like Glitch, powerTracker etc.

Interactive and visual data mining using TRIANA. Complex questions regarding the state of the detector can be translated to complex queries to the database. Involving multiple tables.
GODCS ARCHITECTURE

Monitor Overseer:
Oversees execution of monitors

Communicates With clients Using MPI Library
Distributes Data to clients And inserts Records given By the various clients

Frame Archive

Database

MPI

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MPI
GODCS TASK DEFINITION

- Purpose is to characterize the noise in the detector and to aid in obtaining reliable veto channels.
- To check if excess noise in the main GW channel can be related to any environmental source.
- Results are stored in a MySQL database which is a very systematic way of storing results.
- The database results are visualized using TRIANA which is a visual programming environment.
- Complex relationships amongst various channels can be translated to complex queries to the database.
Monitor Descriptions I

SaturationMon
Checks if any channel saturates the ADC

GlitchMon
Looks for Glitches in the data. Time domain algorithm.

PowerTrackerMon
Tracks band limited RMS averages for several frequency bands.

LineDetectMon
Identifies line sources of noise.
Monitor Descriptions II

CoherenceMon
Measures the coherence between any pair of channels at specific frequencies and records an excess coherence “event” into database.

BicoherenceMon
Measures Bicoherence/Cross Bicoherence between 2 channels with user defined frequency ranges.

InspiralSenseMon
Tracks the sensitivity of the detector to Inspiralling binary systems. This is done for 3 binary systems namely NS-NS, BH-BH and BH-NS.

HACRMon
GEO++ Implementation of TFCLUSTERS algorithm.

InspiralSearchMon
Uses matched filtering to search for Inspiralling binaries. (Uses LAL code)
InspiralSenseMon

Distance until which a Binary will be seen with $\text{snr}=8$

- Black = NS - NS binary
- Red = BH-BH binary
- Green = BH - NS binary

Distance in kpc

GPS time (secs)
HACRMon

Spectrogram for G115SC_M10_EP-P_HP starting at 715611635
Resolution of Map: 0.015625 secs by 6 Hz.
number of events = 51
Status

- Was operational during S1 and first week of S3
- LinedetectMon was useful in identifying lines and measuring shifts in frequency
- Could independently measure microseismic coupling into interferometer output.
- Ongoing effort to make dataminig more user friendly
Data Mining With Triana

- A visual Programming environment
- Interfaces to databases and frame data
- Graphers and other visualization units
- Data processing units to reproduce monitor results
- Can handle a wide variety of data types and hence and handle data mining tasks efficiently.