

GLOBAL DIAGNOSTICS SYSTEM

LSC meeting

LIGO Hanford Observatory

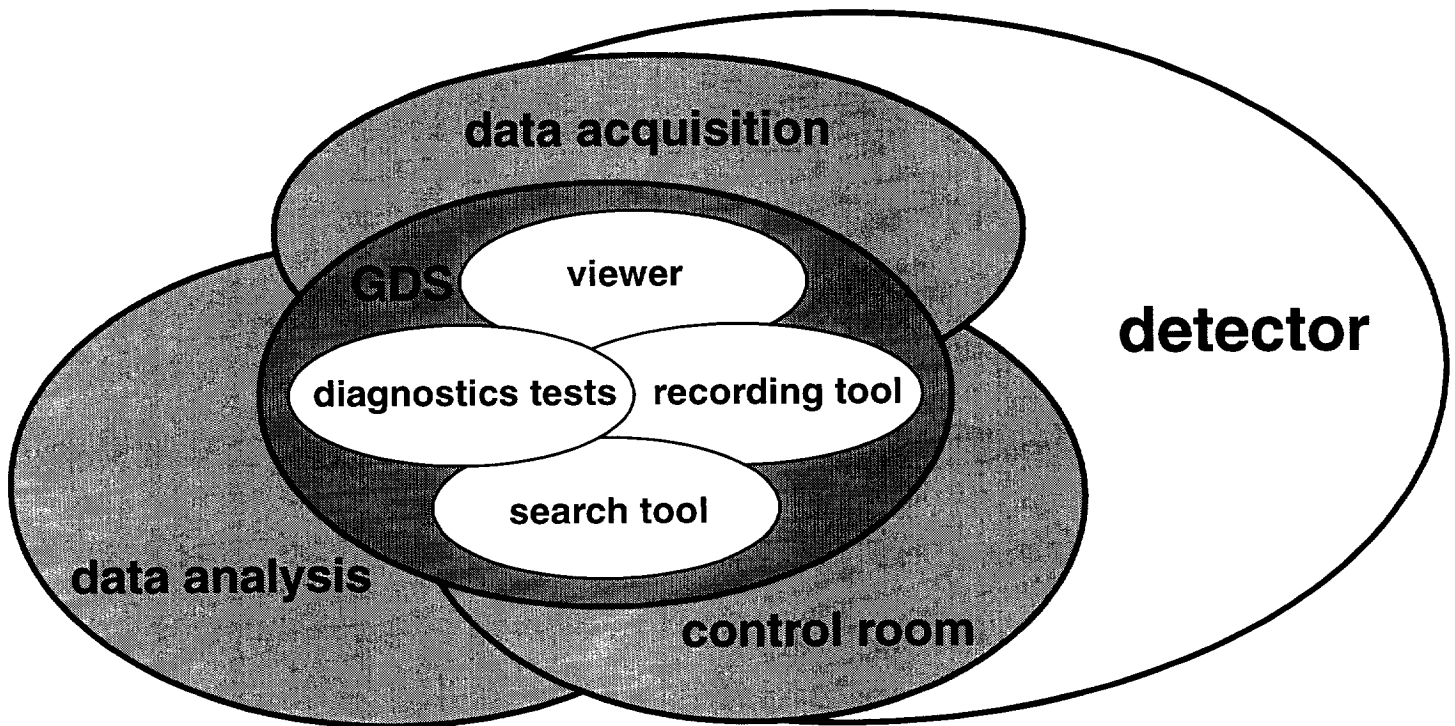
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GOALS

- Assist the operators in the control room and in the experimental areas to successfully run the experiment.
- Provide immediate answers:
 - What is the quality of the GW data written to disk?
 - Are all of the subsystems working properly?
- Establish & automate diagnostics procedures.
- Give assistance to:
 - learn about the behavior of the instrument,
 - classify abnormal environmental events,
 - identify the exact machine state,
 - correlate the signals of different sensors and,
 - ultimately, reduce the large amount of measured data to a set of relevant and comprehensible statistical quantities.

OVERVIEW

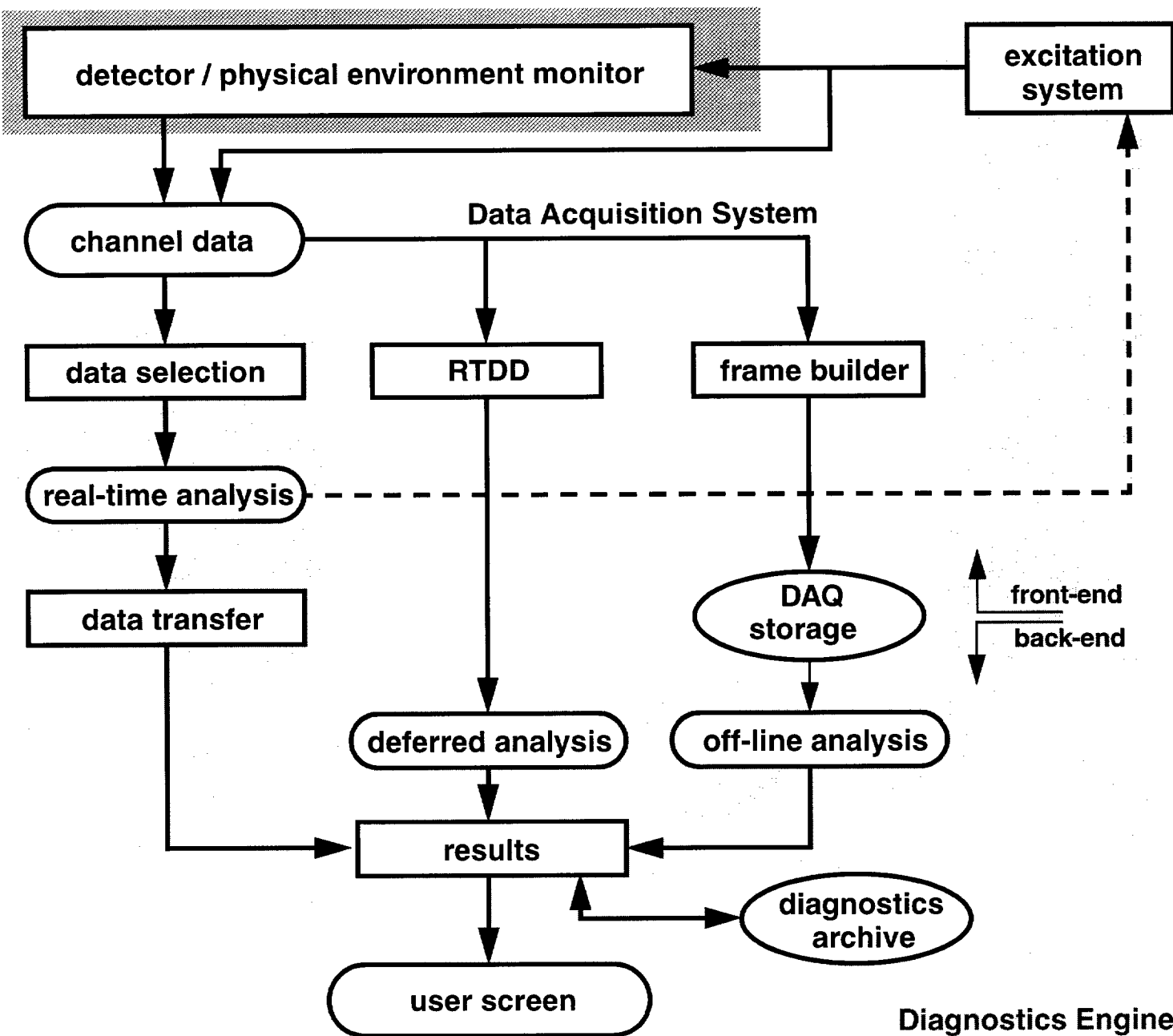


- Viewing tool (part of DAQS)
- Recording tool (trend frames)
- Diagnostics test tool
- Search tool

DIAGNOSTICS TEST EXAMPLES

- Coupling of laser frequency noise into the gravitational wave band
- Parasitic Interferometers
- Coupling of beam jitter into the GW band
- Optimization of the modulation depth
- Mode matching into the interferometer
- Determining the alignment sensitivity matrix
- Cavity ring-down measurements
- Sensitivity to seismic, acoustic, magnetic, etc.
- Determining wire resonances
- Beam centering
- Pendulum coupling of vertical to horizontal
- Diagonalize servo feedback paths

DIAGNOSTICS TEST ENGINE



Diagnostics Engine

DIAGNOSTICS TEST TEMPLATES

- Time series measurement
- Power spectrum measurement
- Sine response
- Swept sine response
- Triggered pulse response
- Two-tone intermodulation test
- Harmonic distortion
- Pseudo-random stimulus / power spectrum measurement
- Pseudo-random stimulus / cross spectrum measurement
- Parameter sweep
- Parameter optimization

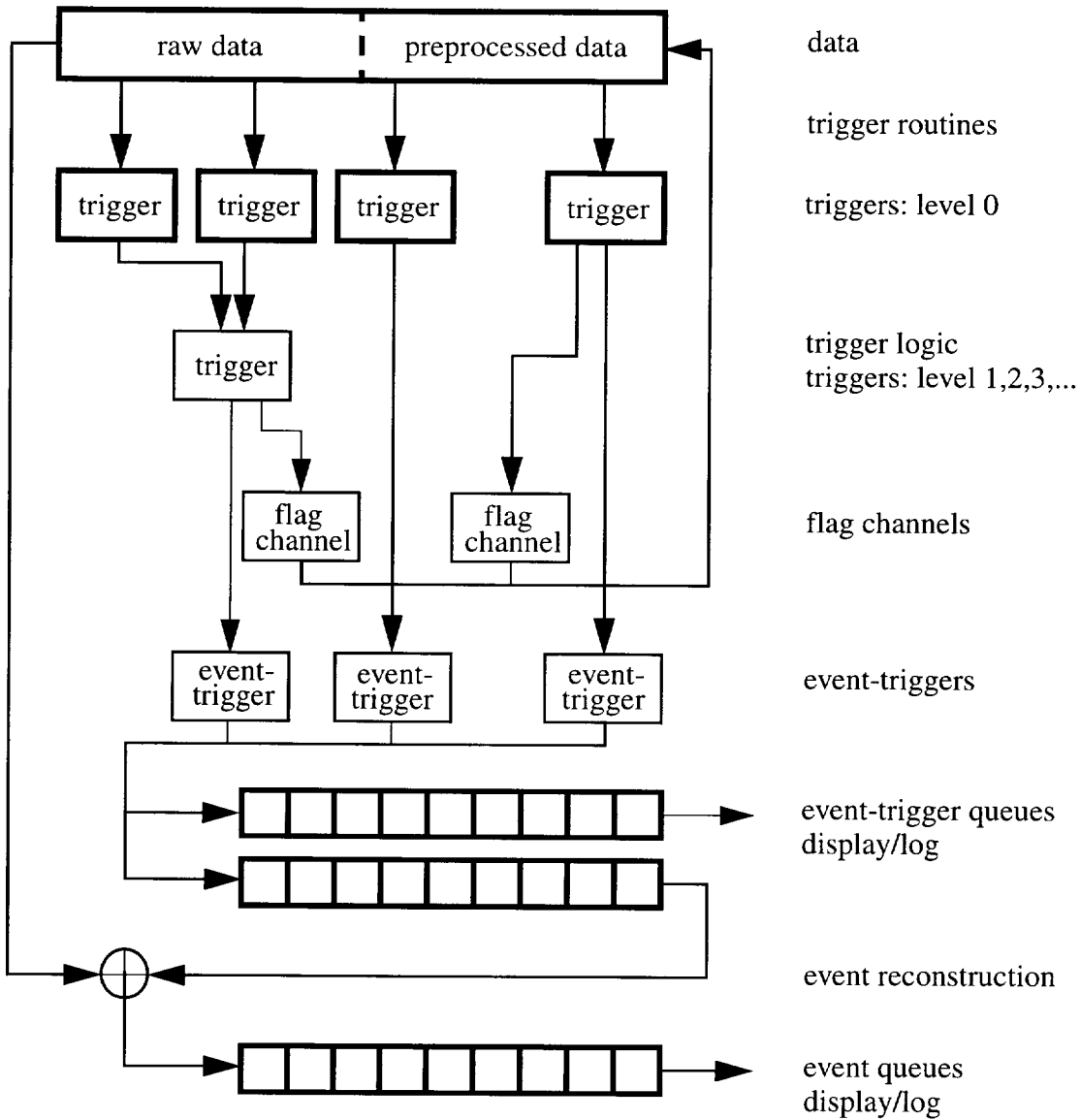
SEARCH TOOL

- Fast access to raw data
- Compute engine for FFTs
- Channel monitoring
 - Time trace signal level
 - Band limited power
 - New spectral features
 - Time trace rate of change
 - Dead channel (RMS)
- Triggering & Flag channels
 - Highly configurable
 - Simple to complex trigger logic and dependency
 - Flag channels written back to DAQ for archival
 - Event triggers
 - Event queues & reconstruction
- Data capture & analysis

TRIGGER EXAMPLES

- Excess GW noise
- Beam intensity
- Laser source AM & FM noise
- Modulation depths & frequencies
- Servo control & error signals
- Narrow band features
- Actuator saturation
- Photodiode temperature, bias & dark current
- Earthquake
- Vibration
- Weather
- Excitation system off?

DIAGNOSTICS SEARCH ENGINE



DIAGNOSTICS ARCHIVE

Trend frames

Parameter files

- Channel monitoring thresholds
- Trigger bank configuration
- Diagnostic test operating parameters

Diagnostics tests

- transient data for deferred analysis
- test descriptions & results

Diagnostic events

- Complete reference
- Data or parameterization

Other data

- Video
- Oscilloscope traces

Note 1, Linda Turner, 04/20/98 03:54:53 PM
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