

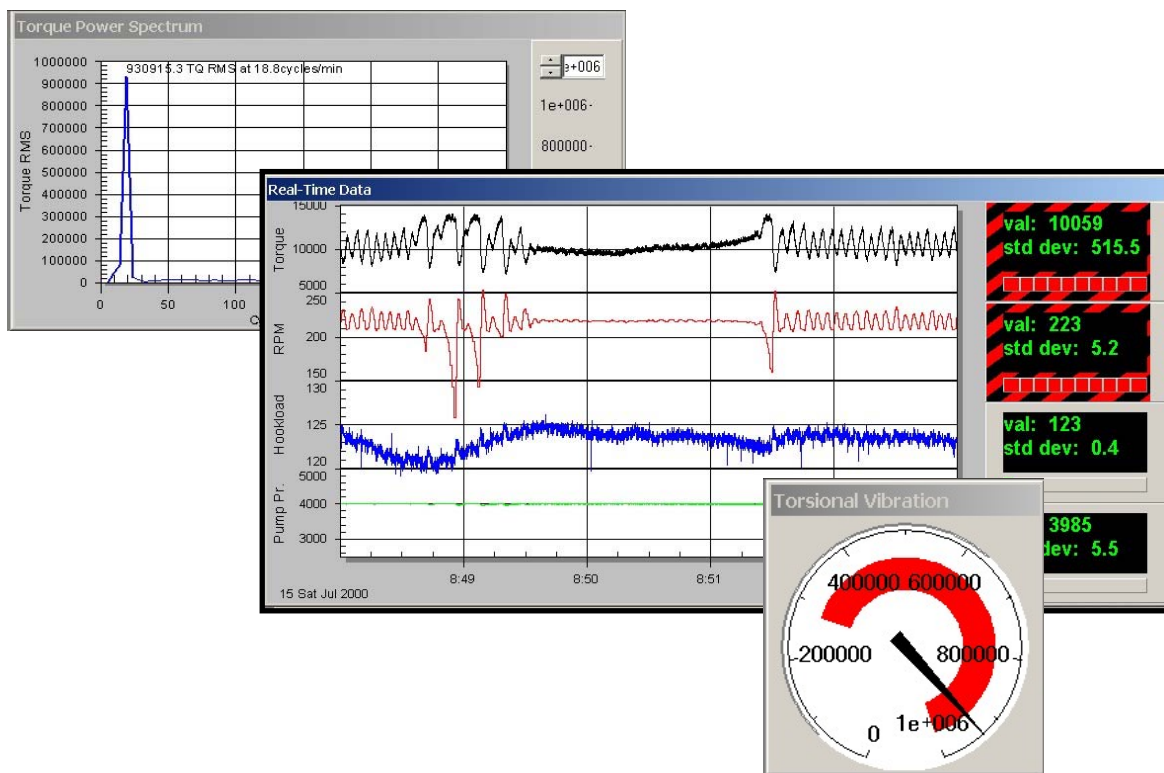
Drill String Vibration Analysis (DLS VibrA)

OVERVIEW

The Drill Logic System Vibration Analysis package is a tool designed to aid drilling personnel in the detection and suppression of harmful drill string vibrations common during harsh drilling conditions.

The DLS VibrA system is designed to detect and quantify the severity of torsional drill string vibration and provide immediate feedback about the results of remedial actions. The system allows the implementation of practical guidelines designed to suppress torsional vibration before it results in BHA failure.

By smoothing out downhole drilling conditions BHA components can expect to yield a longer life before failure thus bringing drilling operations closer to optimum.



The DLS VibrA Client displays provide a variety of visual elements to aid in detecting drill string vibrations and immediately determine the effects of remedial actions



Drill String Vibration Analysis (DLS VibrA)

VibrA Server

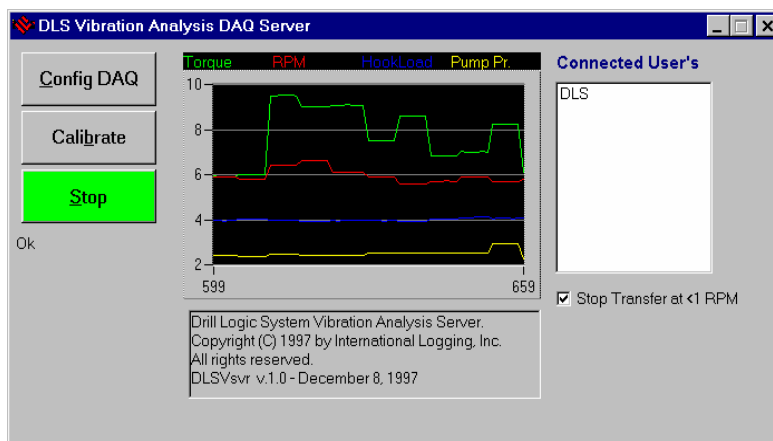
The VibrA DAQ Server acquires sensor data at the necessary rate to insure sufficient data quantity and quality is supplied to the VibrA Client Applications Digital Signal Processing functions.

The VibrA DAQ Server performs the following services:

- Sensor calibration
- Modify data acquisition parameters
- Acquire sensor data and convert to engineering units
- Manage connections for multiple network users

Typically, sensor signals are acquired at a rate of 10Hz which is sufficient for analyzing torsional drill string vibrations (typically observed in range of .5 to 2 Hz).

The VibrA DAQ Server sends full data packets, at the frequency specified by the operator, to all currently connected VibrA clients. VibrA clients connect to the VibrA DAQ server via a local or, network bandwidth permitting, wide area network. Windows 95 or Windows NT workstation may connect using NetBEUI or TCP/IP protocols. The VibrA DAQ server and VibrA Client communicate using Microsoft's Distributed Component Object Model (DCOM) to ensure fast and reliable asynchronous communications.



The DLS VibrA Server, located in the logging unit, controls data acquisition hardware configuration and calibration and sends real-time data to each DLS VibrA Client.

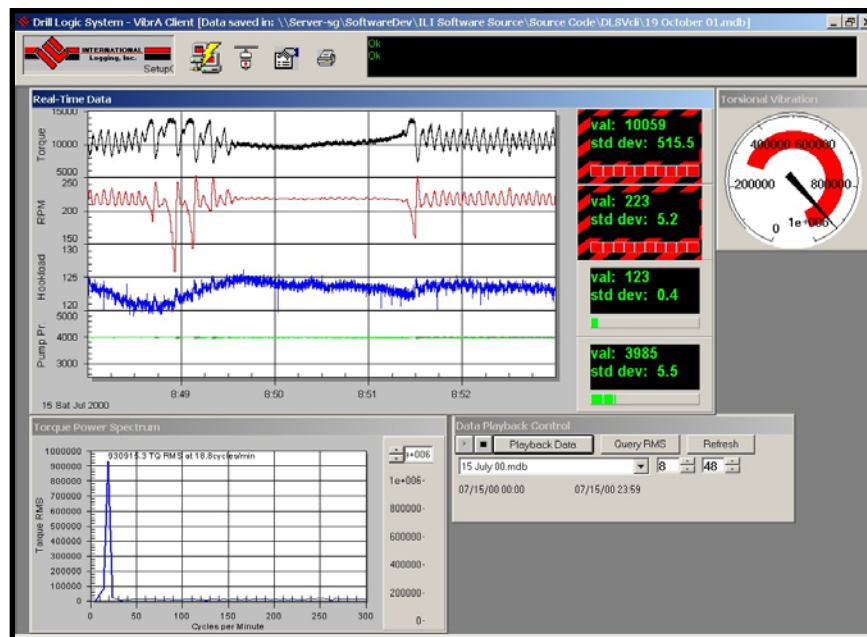


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VibrA Client

The VibrA Client software provides real-time display of rotary torque, rotary RPM, hookload, and stand pipe pressure at the frequency the VibrA DAQ server is acquiring data (usually 10 Hz). The real-time data display allows the driller, or other VibrA Client users on the network, to observe drill-string vibrations as they occur and the results of corrective actions.

Sophisticated digital signal processing routines perform complex Fast Fourier Transform (FFT) frequency analysis of the torque signal in real-time. The FFT result, implemented as a Power Spectrum, detects sinusoidal variations of the torque signal and analyzes those variations for frequency and magnitude. The displayed results, represented by the Power Spectrum graph and RMS (root mean squared, a measure of the magnitude of the variation) gauge provide a measure for the torsional vibration.



The DLS VibrA Client software may be installed on any workstation to distribute real-time drill string vibration to the appropriate parties.



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VibrA Client

Detailed post-drilling analysis is provided by querying the database to playback the raw data. Since data is saved at its acquisition rate (not averaged or smoothed or otherwise altered) the signals are displayed exactly as while drilling thus the torque signals power spectrum is analyzed for the presence and magnitude of the torsional vibration.

The DLS VibrA Client software will allow historical data playback while the real-time signals are saved to a database. In addition to the DLS VibrA playback capabilities, selected intervals may also be plotted in a strip log format with GeoPlot.

Alarms will alert the user to adverse drilling conditions based on the standard deviations of signals, paired signal standard deviation, or high torsional vibration.

The DLS VibrA software will run on Windows 98 or Windows 2000 workstations that can establish a network connection to the DLS VibrA server. Several DLS VibrA client workstations may connect to the VibrA server simultaneously to distribute real-time drill string vibration data at the rig site or company offices.



Drill String Vibration Analysis (DLS VibrA)

DLS VibrA Sample GeoPlot Log

