

# NMR Analysis

# Logic

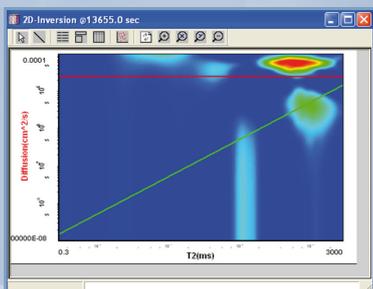
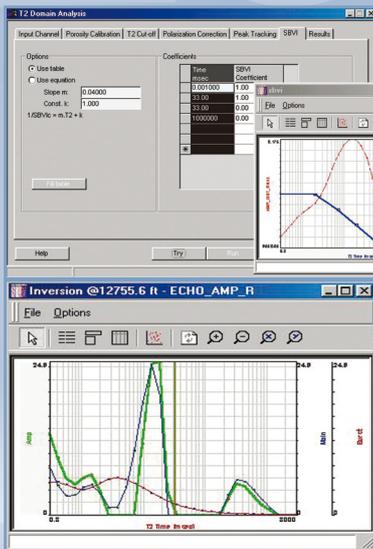
Nuclear Magnetic Resonance (NMR) logging is now established as part of the modern logging suite.

Nevertheless, while logging hardware has made major advancements, software for interpreting NMR data is not widely available. Logic is one of the few software packages available in the industry with full NMR log interpretation capability, and perhaps the only software having the ability to incorporate both NMR core analysis data and geological reasoning into the interpretation.

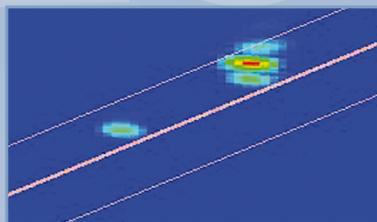
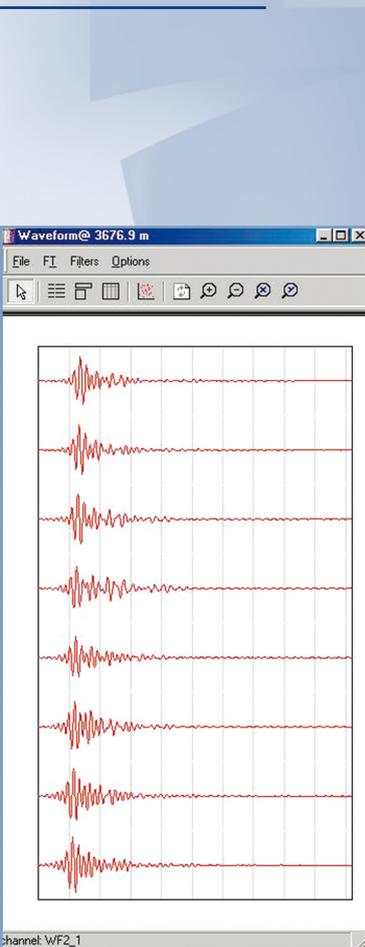
Logic is independent of any logging contractor, and can work with data from the NMR tools of Schlumberger, Baker, Halliburton and Weatherford, including the LWD tools (T1 and T2) and the new multi-frequency fluid analysis devices.

Logic allows users to prepare and quality control raw NMR data, try and apply different filters to the raw echoes, and invert using a robust version of the Butler-Reeds-Dawson algorithm. Standard and novel techniques for manipulation in the T2 domain allow calculation of the standard NMR results - total porosity, bound fluid, permeability etc.

Core data from NMR lab measurements can be imported and treated in an identical fashion to log data. This allows calibration and validation of the log data, which can be of great value when building confidence in the NMR results.



# Sonic Waveform Analysis



Sonics are run in almost every well, and the value of acquiring and processing array data is only now becoming generally appreciated.

Standard processing allows calculation of compressional, shear and Stoneley velocities, data which are used for standard formation evaluation, calculation of geo-mechanical properties and seismic applications.

As usual in LogIC, the emphasis of the sonic waveform analysis is on interactivity. LQC, filtering and validation are all essential preliminaries to successful processing, and point-and-click visualisation of waveform sets is the starting point, especially for dipole modes and in slow formations.

Coherence analysis is by semblance, nth root stack and correlation methods. Various resolutions and waveform combinations can be used. STC plane visualization allows tracking and identification of the various arrivals.

There are standard and user-defined equations for geo-mechanical properties - Poisson's ratio, shear, bulk and Young's moduli, strength estimates etc.

Power spectrum analysis allows for qualitative permeability estimation.

