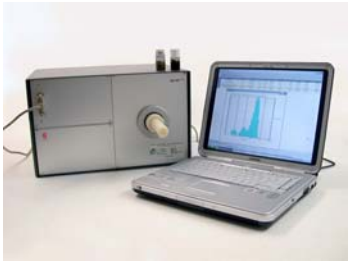
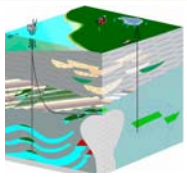


Magnetic Resonance Measurements for Mud Logging (MR-ML™)

KMS Technologies, KJT Enterprises, Inc.

KMS Technologies – KJT Enterprises Inc. and their alliance partner NMR Plus Inc. of Canada have developed new technology to evaluate rock and fluid properties in real time while drilling. The product is a mobile NMR relaxometer designed for NMR mud logging, water-cut, and on-site core analysis.
The approach is based on Low Field NMR (Nuclear Magnetic Resonance) measurements and is intended for faster and more reliable identifying of hydrocarbon-bearing reservoirs while drilling a well (mud logging). Drill cuttings and micro-samples of hydrocarbons delivered to the surface are used to make the measurements. The new NMR application provides better results when used in conjunction with conventional techniques.



Benefits:

- Formation evaluation and petrophysical parameters during mud logging
- Real time pore pressure prediction densities
- NMR log calibration parameters
- Low cost NMR log substitution
- Competitively priced NMR devices and software

Hardware:

The core of the technology is the new generation of portable magnetic resonance spectrometers (~25 kg) combining basic specifications of laboratory low-field relaxometers with unique features, making the MR-ML™ instrument adaptable to a variety of on-site measurements. The size of the sensitivity region is tailored to accommodate drill cuttings or core samples (approximately 4 cm by 5 cm). The system is designed to maximize "SNR/WEIGHT" ratio, and the NMR experiment parameters are automatically adjusted during calibration procedure, thus the measurement are automatically corrected for any instabilities and environmental changes.

Software:

- User friendly Windows-based interface
- Advanced inversion methodology for T_2 distribution
- Porosity, permeability, S_{wirr} on-site or in a laboratory
- One-button software for major applications (mud logging)
- Calibration and tune functions
- Full spectrometer acquisition software for ‘expert’ NMR applications
- NMR simulator, Bi-modal mode, multiple measurement set-up and execution (optional)

KMS Technologies

KJT Enterprises Inc.
6420 Richmond Ave., Suite 610
Houston, TX, 77057
USA
Tel.: +1.713.532.8144
Fax: +1.713.532.7776
Email: gang@kmstechnologies.com or info@kmstechnologies.com
http://www.kmstechnologies.com

Specification Sheet	MR-ML™ Instrument
Minimum Time to First Sampling Points on NMR Relaxation Curve, ms	0.16
Maximum Number of Sampling Points on NMR Relaxation Curve	5000
Maximum Duty Cycle of RF Transmitter	10 %
Wait Time, ms	50-40000
NMR Frequency (MHz)	1.5-2
Maximum Sample Size, inches	1.5
S/N, Full Size Water Sample	> 200
Maximum Warm-Up Time, min	< 20
Line Input Power	120 V, 6 A
Operating System	Windows 98, NT, XP
Communications	Parallel Port
Dimensions (can be mounted in 19" cabinets/racks), inches	Width-19, Height/Depth - 10.5
Weight, lb	50

We benchmarked the instruments many times to verify estimating errors. The error of estimating the total NMR signal amplitude A_s depends on the properties of the rock under study and of accepted measurement modes. The relative error of A_s routine measurements (δ) is less than ±1.5%.

Figure 1 and *2* display accuracy of the total porosity and permeability measurements.

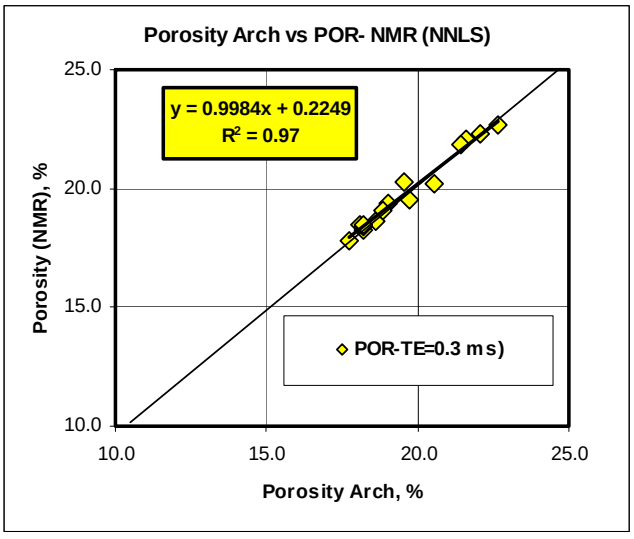


Figure 1: Archie Porosity versus Porosity NMR.

The figures compare porosity and permeability values obtained by NMR measurements with those resulting from conventional laboratory techniques.

Fully water-saturated rock cuttings provide the most preferable conditions for evaluating permeability from NMR measurements. The figures demonstrate high coefficients of correlation MNR measurements with a conventional method of porosity and permeability estimations.

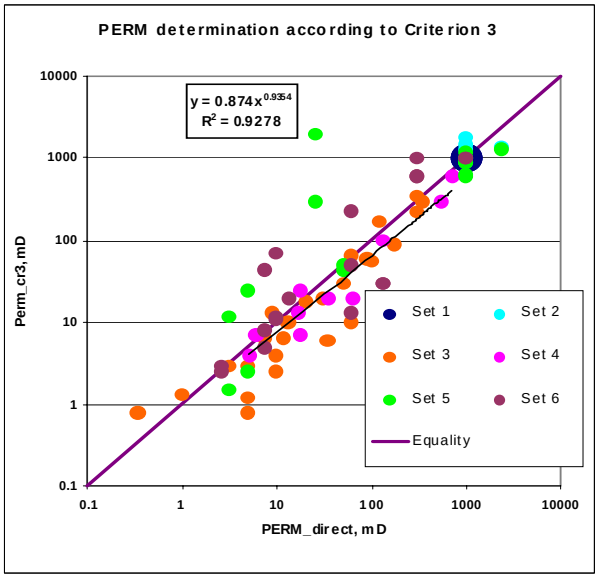


Figure 2: Permeability conventional versus Permeability NMR.