

NUCLEAR MAGNETIC RESONANCE (NMR) PETROPHYSICS

GEP008

COURSE DESCRIPTION

Nuclear magnetic resonance (NMR) is a very useful tool to determine rock properties. The NMR response of the hydrogen contained within rocks can be related in a direct or indirect way to porosity, pore size distribution, rock permeability, capillary pressure, wettability and water saturation. Depending on the tool and the mode of operation, the type of fluid in the formation can be indicated whether it is gas, oil or water. All these can be achieved with an understanding of fundamentals and proper calibration of log data to laboratory NMR measurements on core samples.

This 5-day course covers the practical aspects of NMR as a valuable reservoir characterization tool such as, Determinations of T1 and T2 distribution; porosity and permeability; T2 cutoff for bound and free fluids; pore size distribution; fluid types and properties. Designed to focus on the NMR principle and its use in formation evaluation domain, it additionally gives highlight on the different tools and parameters for the different application. The trainer will focus more on data interpretation and how NMR is best used.

COURSE GOAL

To enhance the participants' knowledge, skills and abilities necessary for using NMR data in reservoir characterization workflows.

COURSE OBJECTIVES

This is a comprehensive summary of NMR logging including basic physics, signal processing, practical considerations and tool selection, job design, data processing, interpretation, quality control and log/core integration. Emphasis is on practical application and building of interpretation skills with dozens of real-world examples.

By the end of this course, participant will be able to:

- Acquire knowledge in the different NMR petrophysical properties (porosity, size permeability, T2 cutoff). distribution and fluid properties
- Gain knowledge on NMR corrections and quality control.

WHO SHOULD ATTEND

This course is recommended for Petrophysicists, senior exploration geologists, operations geologists, senior reservoir geologists, reservoir engineers, senior geophysicists, core analysts or anyone with high experience years in creating or using formation evaluation results.

COURSE DURATION

5 Working Days

COURSE OUTLINES

1. Introduction

- Introduction, why NMR??
- How NMR works ?
- Tool development history

2. NMR applications and physics

- Signal generation
- Nuclear spin and relaxation
- T1 & T2 Relaxation times
- Inversion and CPMG echo train
- Acquisition parameters-

3. Introduction to NMR petrophysics and interpretation

- What information NMR can achieve
- What affects the relaxation time
- Surface relaxivity
- Pore size vs relaxation time
- Exercises

4. Wireline Tools, Operations and Signal Processing

- Identifying bound (irreducible) fluid
- Identifying movable fluid (effective porosity)
- Determine permeability (through grain size distribution)
- Quantifying reservoir fluids like oil, gas, water
- Apply cut-off for free fluid and clay-bound fluid
- LWD NMR Tools and Operations
- Core analysis tools and operation
- NMR QC and corrections
- Parameters vs objectives
- Exercises

5. NMR Petrophysical Application

- Porosity and shale volume
- T2 cutoffs
- Porosity in gas reservoirs

- Permeability and capillary pressure assessment
 - Permeability models pros and cons
 - Capillary and pore size distribution
- Rock and fluid typing
 - Bound and free fluid
- Viscosity and wettability

6. Core NMR Analysis

- NMR value in core analysis compare to logging
- Measurement planning and value
- Example of a typical NMR core analysis program
- Core NMR and Log Calibration
- Porosity
- Permeability
- Capillary pressure
- NMR response examples
- Rock typing
- Highlight on NMR possible draw backs
- NMR in gas Reservoir Applications
- NMR in low resistivity pay reservoirs
- Shale gas

7. Case studies

- Example of the log response within these reservoirs and how to benefit from NMR to allow better understanding and assessment to reservoir properties, as well as how NMR can benefit from other logging tools to get the required answer.

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