Learnings from Impact and Implications of Signal-to-Noise in NMR T1-T2 Logging of Unconventional Reservoirs

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Abstract:

We study the impact of signal-to-noise ratio (SNR) on nuclear magnetic resonance (NMR) T1-T2 maps across data sets acquired in multiple wells of an unconventional field under various logging and processing conditions. Mean and standard deviation of NMR porosity error between continuous moving-pass and stationary measurements are used to obtain insights into impact of SNR on accuracy and precision.

In a proof-of-concept experiment, we introduce a novel semi-analytical smeared-peak (SASP) technique that compensates for the over-regularized smearing, due to poor SNR, of T1-T2 relaxation responses of different fluids. The SASP approximation, to de-smear volumes of different fluid types, is validated with field measurements from multiple wells. The uplift of the SASP technique in improving fluid volume interpretations is apparent in the in-situ calibration of low-SNR moving-pass NMR measurements with high-quality stationary measurements.

The learnings show that logging protocols that combine specific acquisition parameters with processing strategies within acceptable compromises, and are designed to increase SNR, are mandatory for reliable NMR characterization of unconventional reservoirs.

Bio:

Olabode (Bode) Ijasan is a petrophysics advisor with ExxonMobil. His expertise includes NMR petrophysics, borehole nuclear physics, inverse problems, integrated petrophysical/geophysical interpretation, and unconventional petrophysics. He received MS and PhD degrees in petroleum engineering from the University of Texas at Austin; and holds a BSc in electrical and electronics engineering from the University of Lagos, Nigeria. He is a recipient of the Best Oral Presentation Award at the 2014 SPWLA 55th Annual Symposium; and a recipient of the 2022/23 SPWLA Young Professional Technical Award.