DATA SHEET

HALLIBURTON

**Cased hole formation evaluation – Pulsed neutron logging**

FORMATION EVALUATION

# TMD3D™ (thermal multigate decay - 3 detector) logging tool

## Precise GasSat™ evaluation of hydrocarbon saturation

## BENEFITS

Flexible applications in formation evaluation and well diagnostics behind casing in new and re-entry wells:

- Provides gas evaluation in tight formations, such as unconventional reservoirs, in new well completion where openhole logs are not available
- Evaluates hydrocarbon saturations in mid-to-high water salinity environments
- Determines the lithology
- Enhances oil recovery monitoring for gas, steam, and $CO_2$ floods
- Locates water and low-density hydrocarbon zones in water floods and mixed-salinities formations
- Identifies bypassed gas reserves and pressure depletion
- Water conformance identifies water flow inside/outside casing and complex completions
- Detects leaking plugs and packers
- Verifies gravel pack integrity via silicon and aluminum activation

## ASSOCIATED ANSWER PRODUCTS

- SigmaSat™ sigma saturation analysis
- Chi Modeling® computation service
- GasSat™(3D) multidetector saturation analysis
- QW to calculate water-flow rate and velocity

The Halliburton TMD3D™ tool is an advanced new-generation multidetector pulsed neutron logging instrument. This tool measures pulse neutron-induced gamma ray counts and spectroscopy through inelastic, capture and activation radioactive interactions with formation and borehole. Using 3-detector measurements, the technology is primarily used to determine "fluid" saturations in reservoirs:

- With higher salinities and mid-to-high porosities, the traditional thermal neutron capture cross-sections (sigma) is measured to determine water saturation
- For low porosity and low/unknown salinities, the advanced multidetector measurements are designed for increased dynamic range and accuracy for gas saturation
- The technology also identifies bypassed gas in complex completions, estimates cased hole porosity and pressure depletion, and provides basic lithology indicators

Additional uses of this technology include reservoir monitoring and well diagnostics:

- Fluid saturations including $CO_2$ (gas) EOR (Enhanced Oil Recover) and carbon capture and sequestration (CCS) monitoring
- Oxygen activation to identify water flow inside/outside casings for conformance and silicon activation for gravel pack evaluation

| DIMENSIONS AND RATINGS | |
|---|---|
| Maximum OD | 1.69 in. (4.29 cm) |
| Maximum Temperature and Pressure | 300°F (150°C)*<br>15,000 psi (103.4 MPa)* |
| Minimum and Maximum Casing/Tubing ID | 2 in. (5.1 cm) minimum;<br>16 in. (40.6 cm) maximum |
| Length and Weight** | 14.25 ft (4.34m)<br>35 lb (16 Kg) |

* Flasks for higher temperature and pressures available

** With TTTC-U002 (GR/CCL) and XHU003 (crossover sub), the makeup is 23.55 ft (7.18 m) and 80 lb (36 kg)

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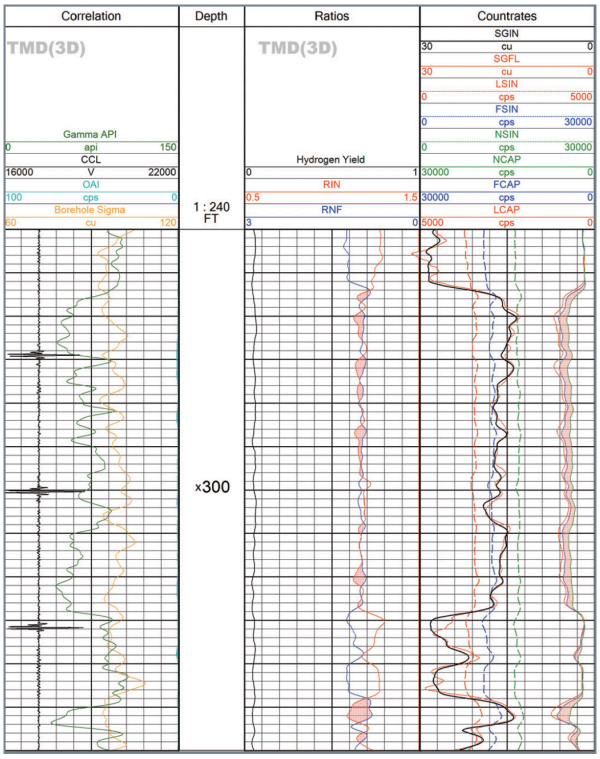
## Features

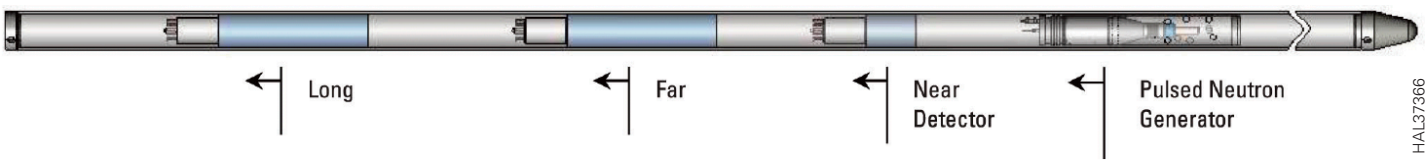
Best resolution for depth of investigation and dynamic range offered in small-diameter pulsed neutron, enabling greater amounts of information, faster logging speeds, higher accuracy, and reliable operations through:

- Fast-response, multichannel analyzer electronics for full-spectrum monitoring
- Rugged, large, dense, and fast-response gadolinium yttrium oxyorthosilicate (GYSO) detectors
- Optimal arrangement of source-to-detector spacing in a 1¹¹⁄₁₆-in. (49-mm) diameter running assembly
- Combinable with cement, casing, and production-evaluation tools




Precise gas evaluation in low-porosity unconventional reservoirs

| MEASUREMENT | |
|---|---|
| Range | 5 to 60 cu |
| Vertical Resolution (90%) | 24 in. (enhanced 18 in.) /61 cm (enhanced 46 cm) |
| Depth of Investigation (90%) | 10 to 14 in. (0.25 to 0.36 m) |
| Precision (1SD) and Accuracy | Precision (1SD): ± 1% of SGFM<br>Accuracy ± 5% of SGFM or ± 0.5 cu, whichever is greater |
| Output | Count rates and ratios, inelastic and capture yields of various elements and their ratios, formation capture cross section (sigma), cased hole porosity, and advanced multidetector (long) measurements |
| Recommended Maximum Logging Speed | 10 to 30 ft/min (3 to 9 m/min) Sigma Mode [formation- and salinity-dependent]<br>1 to 3 ft/min (0.3 to 0.9 m/min) advanced inelastic measurements [formation- and porosity-dependent] |
| Borehole Conditions: Type/Fluids | ☐ Open ■ Cased ■ Salt<br>■ Fresh ■ Oil ■ Air |
| Combinability | Cement, casing, and production-evaluation tools |




**For more information, contact your local Halliburton representative or visit us on the web at www.halliburton.com**



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