

# Pulsar

## Multifunction spectroscopy service

### APPLICATIONS

- Stand-alone formation evaluation for diagnosis of bypassed hydrocarbons, depleted reservoirs, and gas zones
- Differentiation of gas-filled porosity from water-filled porosity and very low porosity formations by using fast neutron cross section (FNXS) measurements
- Formation evaluation in old wells where modern openhole logs have not been run
- Elemental logs for well-to-well correlation and sequence stratigraphy
- Environment-independent reservoir saturation monitoring in any formation water salinity
- High-resolution determination of reservoir quality (RQ) and completion quality (CQ) for formation evaluation of unconventional reservoirs and other complex lithologies on the basis of detailed quantitative mineralogy, including total organic carbon (TOC)
- Detection of water entry and flow behind casing
- Gravel-pack quality determination by using elemental spectroscopy

### FEATURES

- Corrosion-resistant tool with housing qualified per the requirements of NACE MR0175
- Unlimited operation time for the 1.72-in-diameter tool at up to 175 degC without a flask

### Openhole-quality formation evaluation and reservoir monitoring

Pulsar\* multifunction spectroscopy service pairs multiple detectors with a high-output pulsed neutron generator in a slim tool with a diameter of only 1.72 in for ready through-tubing access in cased hole environments. The tool's integration of the high neutron output and fast detection of gamma rays with proprietary pulse processing electronics provides inelastic and capture spectral quality that is significantly better than that from any other pulsed neutron tool at any tool diameter.

### Stand-alone cased hole answers

Unlike conventional cased hole logging, no openhole data input is necessary to obtain a high-resolution volumetric petrographic interpretation, so rigless well logging can be conveniently conducted without disrupting drilling operations. Logging a well after it has been cased also negates well instability risks—especially in laterals and shale reservoirs.

### Rock and fluid content measurements

In addition to providing the conventional cased hole logging suite of neutron cross-capture section ( $\sigma$ ), hydrogen index (HI), and carbon/oxygen ratio at a higher logging speed and measurement precision, Pulsar service delivers an expanded set of elements including TOC and the new FNXS measurement that differentiates and quantifies gas-filled porosity from liquid-filled and tight zones.

Because Pulsar service does not depend on conventional resistivity-based approaches to rock and fluid identification, it accurately determines

- saturations in any formation water salinity across a wide range of well conditions
- mineralogy, lithology, and fluid content profiles at any well inclination: horizontal, deviated, and vertical
- hydrocarbon identification in low-resistivity pay.



*Pulsar multifunction spectroscopy service tool.*

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## Pulsar Service Measurement Specifications

<b>Acquisition</b>	Real time with surface readout
<b>Output</b>	
Time domain	Sigma (SIGM), porosity (TPHI), fast neutron cross section (FNXS)
Energy domain	Inelastic and capture yields of various elements, carbon/oxygen ratio, total organic carbon
<b>Logging speed<sup>†</sup></b>	
Inelastic capture mode	200 ft/h [61 m/h]
Inelastic gas, sigma, and hydrogen index (GSH) mode	3,600 ft/h [1,097 m/h]
Sigma lithology mode	1,000 ft/h [305 m/h]
<b>Range of measurement</b>	Porosity: 0 to 60 pu
<b>Mud type or weight limitations</b>	None
<b>Combinability</b>	Combinable with tools that use the PS Platform* production services platform's telemetry system and ThruBit* through-the-bit logging services
<b>Special application</b>	Qualified per the requirements of NACE MR0175 H <sub>2</sub> S and CO <sub>2</sub> resistance

<sup>†</sup> Logging speed determined using the tool planner

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## Pulsar Service Tool Mechanical Specifications

<b>Temperature rating</b>	350 degF [175 degC]
<b>Pressure rating</b>	15,000 psi [103.4 MPa]
<b>Casing size</b>	
Minimum	2 $\frac{3}{8}$ in [6.03 cm]
Maximum	9 $\frac{5}{8}$ in [24.45 cm]
<b>Outside diameter</b>	1.72 in [4.37 cm]
<b>Length</b>	18.3 ft [5.58 m]
<b>Weight</b>	88 lbm [40 kg]
<b>Tension</b>	10,000 lbf [44,480 N]
<b>Compression</b>	1,000 lbf [4,450 N]