PULSED NEUTRON TOOL (PNT)

Brine-Hydrocarbon/gas interface Detection Tool for Solution Mining Cavities

FLODIM
Challenging the limits

OPERATING PRINCIPLE:

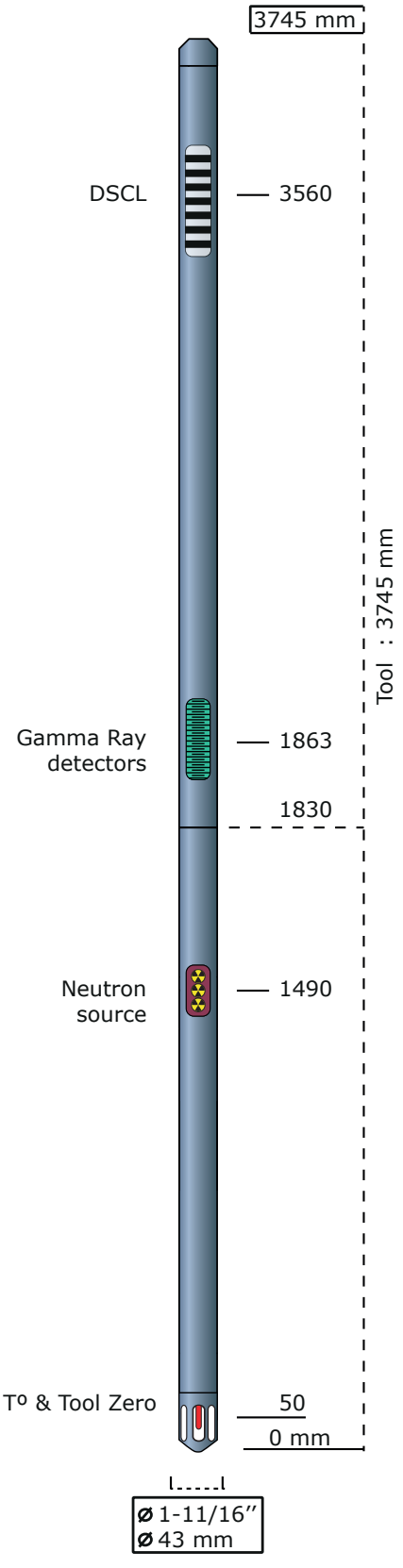
The Pulsed Neutron Tool allows material identification of boreholes. Both qualitative and quantitative interpretations of the logs are possible. The tool contains a neutron generator where, when activated, the 3H (d,n)4He reaction takes place, emitting high energy neutrons. This energy is high enough to produce inelastic collisions between the neutrons and the nuclei in the surrounding media.

By analyzing the gamma radiation during and immediately after the burst, it is possible to recognize certain elements (e.g. carbon, oxygen and iron).

Soon after the burst, neutrons are slowed down to thermal energy (0.025 eV) and can be captured by nuclei. Analyzing the gamma radiation later after the burst, those gamma rays produced by neutron capture events allow recognition of other elements such as calcium, silicon or hydrogen. Different elements have a different ability to capture neutrons. By analyzing the rate of capture, elements with very high capture probabilities (high capture cross-section) like chlorine and boron can be recognized.

In particular, the PNT can be used to detect brine -hydrocarbon or brine-gas interface in underground cavities. The number of detected Gamma Rays depends on the neutron capture cross-section of the medium surrounding. Brine, rich in Chlorine ions (Cl^-), has a much higher capture cross-section than hydrocarbons or gas and hence the interface is easily detected by the fast, efficient gamma ray detector within the tool. Statistic analysis on logs made at a speed of 5 m/min, allows an interface detection with an accuracy of +/- 50 mm from the reference log.

Flodim's PNT is also equipped with a Temperature sensor and a Dual Casing Collar Locator, allowing precise depth-correlation in multiple completion wells or cavities.



APPLICATIONS

- Brine-hydrocarbon interface location
- Brine-gas interface location
- Borehole Material Identification
- Formation lithology identification

BENEFITS

- Non-natural radioactive sources
- Safety
- Light Logistics
- Smart-Cost Logging

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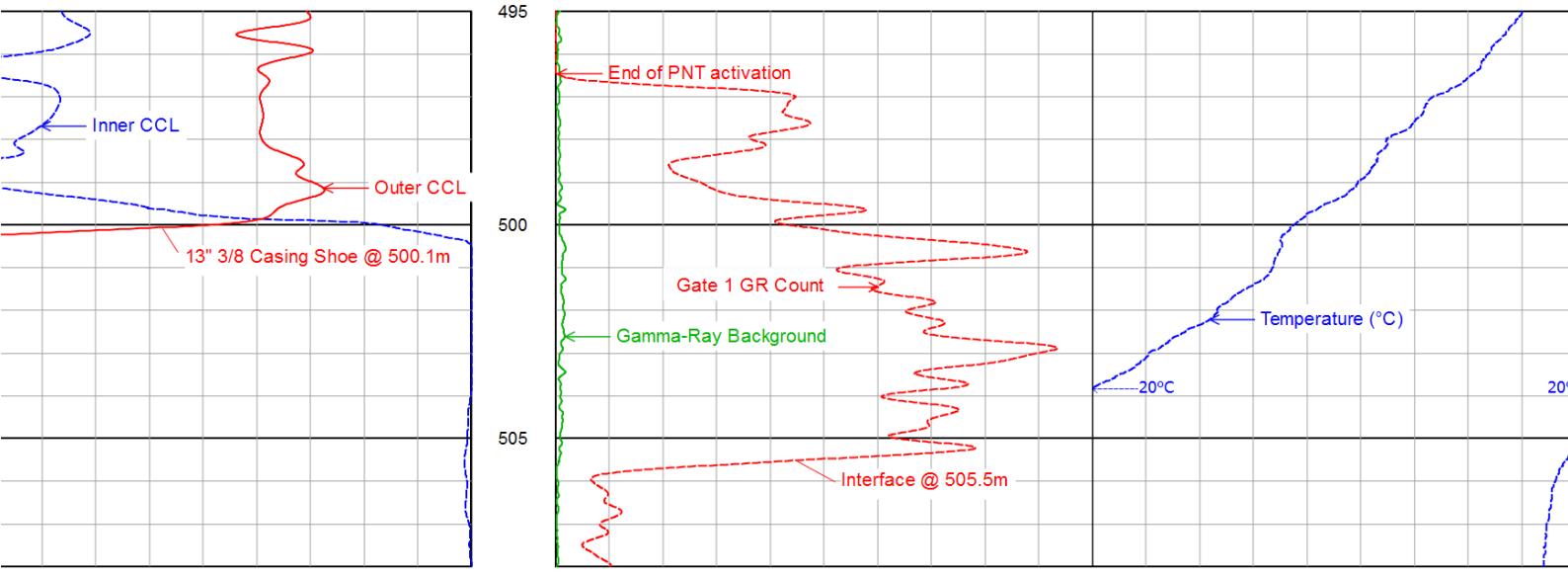

SPECIFICATIONS:

Technical Specifications	imperial	metric
Max. OD	1-11/16"	43 mm
Length	147,4"	3,745 m
Weight,	39,7 lb	18 kg
Max. Temperature	170º F	75º C
Max. Pressure	3.650/10.000 psi	250/700 bar

Logging Parameters	
Cable Compatibility	mono or multi-conductor
Logging Speed	9m/min with 100mm vertical resolution
Operating Voltage	150-165 VDC
Centralizers	none
Tool zero	Temperature Sensor (deadend 50 mm)

Measuring Parameters	
Hole Diameter Range	70-300 mm
Vertical Resolution	400 mm
Neutron Source Type	Neutron Deuterium with Tritium Target
Firing Frequency	20Hz
Neutron Output	10^8 n/s
Neutron Energy	14 MeV
Detector Type	NaJ
Number of Detectors	1
DSCL	Coil
DSCL Range	2 strings of casing, shoe of 3rd casing
DSCL Resolution	300 mm
Interface positioning	Statistic treatment
Interface position accuracy	+/- 5 cm

Measuring Points (from tool zero)	
DSCL	3390 mm
Gamma Ray detectors	1813 mm
Temperature	0 mm
Deadend	50 mm

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