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QL40-SGR2G-CeBr3

Spectral Gamma Ray

The QL40-SGR2G is the new generation of slimhole Spectral gamma Tool. The new system consists of a completely redesigned and ruggedised mechanical assembly, electronics and gamma module. It implements also the latest telemetry developments to enhance tool performances on long single and multi-conductor wirelines.

The QL40-SGR2G probe measures the total gamma counts in API as well as the full energy spectrum of the natural gamma radiations emitted naturally from within the formations.

A Full Spectrum Analysis (FSA)[1] is performed on the recorded energy spectra. The FSA derives in real time the concentration of the three main radioisotopes ^{40}K, ^{238}U, ^{212}Th and thus provides insight into the mineral composition of the formations[2].

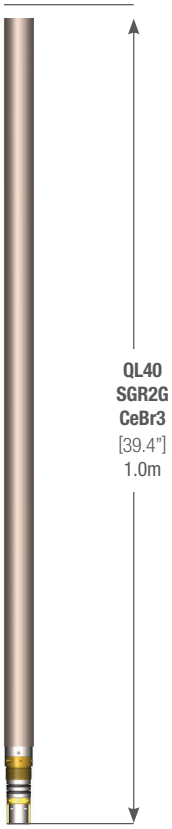
The QL40-SGR2G is a modular platform that can be equipped with a scintillation BGO (Bismuth Germanium Oxyde) crystal or with a scintillation CeBr3 (Cerium Bromide) crystal. This brochure refers to the QL40-SGR2G-CeBr3 version.

The QL40-SGR2G implementing the CeBr3 crystal is characterized by a very good spectral resolution and high sensitivity. The short dead time value of the system (less than 1 µs) combined with the latest design of the measuring electronics allows a perfect linearity of the total gamma count even in a high radiation context. It makes the tool ideal for ore grade analysis when a fine spectral resolution is required to identify radioisotopes with narrow energy bands.

The QL40-SGR2G is supplied as an inline sub. It can be combined with other logging tools of the QL product line or can be operated as a standalone tool.

Application

- Recognition of radioactive materials
- Mineral composition
- Uranium exploration
- Ore grade analysis
- Contamination studies
- Lithology characterization
- Well to well correlation



TOOL

Diameter	40mm (1.6")
Length	1.01m (39.4")
Weight	6kg (13lbs)
Max Temp	70°C (158°F)
Max. Pressure	200bar (2900psi)

Sensor

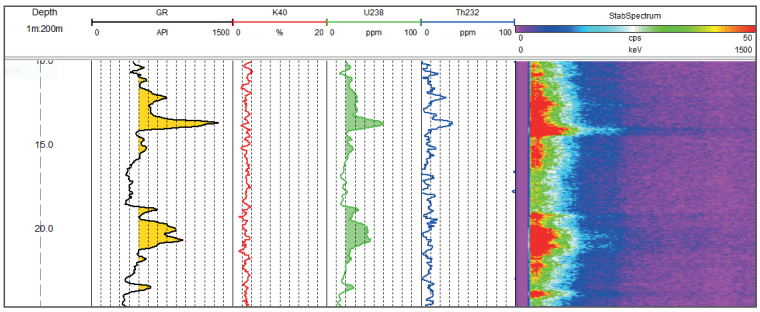
- Scintillation crystal : CeBr3 (Cerium Bromide)
- Dimensions : 20.0mm x 96.0mm (0.79" x 3.78")
- Sensitivity (compared to NaI crystal) : x 1,9
- Spectral Resolution @ Cs (%) : 6.2
- Dead Time (µs) : 0.8

OPERATING CONDITIONS

Cable type	Mono, multi-conductor, coax
Compatibility	Scout Pro / Opal (Scout / Bbox / Matrix)
Digital data transmission Telemetry	Variable baudrate telemetry according to cable length/type & surface system
Logging speed	2m/min
Centralisation	Recommended
Borehole conditions	Dry or fluid-filled borehole Open or cased borehole

Measurement range

- Measurement point : 0.25m (9.9") from bottom
- Measurement range : up to 3 MeV



Field record - Radioisotope concentrations and stabilized spectrum

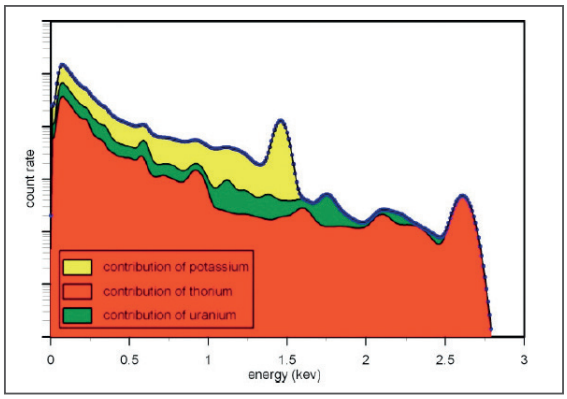
[1] The Full Spectrum Analysis (FSA) is developped by Medusa Systems BV in collaboration with the Nuclear Physics Institute of the University of Groningen (Netherlands).
[2] Other natural or man-made nuclides can be added into the FSA process upon request.

Principle of measurement

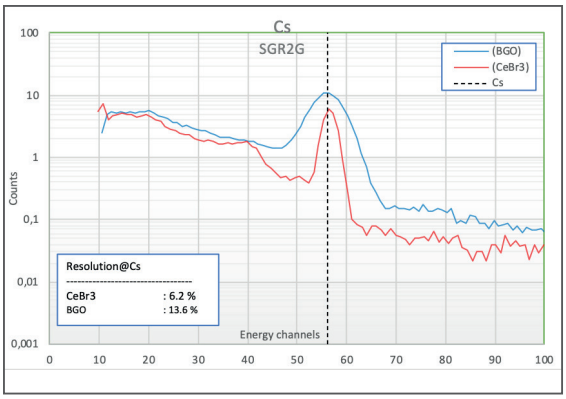
The QL40-SGR2G is equipped with a scintillation crystal. When exposed to gamma rays, the crystal emits light as a function of the gamma ray energies. The pulses of light are amplified by a photomultiplier tube and converted into electrical pulses which are distributed into discrete energy channels. Gamma ray analysis is performed in two steps.
First spectrum stabilization will be performed: each multichannel spectrum in the data set will be converted to a spectrum having all count peaks at the corresponding energy position. This process implies a close comparison with the reference spectra obtained during the calibration process of the spectral gamma tool at the Medusa calibration facility. In a second step the stabilized spectrum will be convoluted into concentrations of naturally occurring radionuclides (^{40}K, ^{238}U, ^{212}Th) or other man-made nuclides like ^{137}Cs or ^{60}Co. Corrections taking borehole diameter, rock density, casing type and thickness, tool position and borehole fluid conditions into account can be applied.

Measurements features

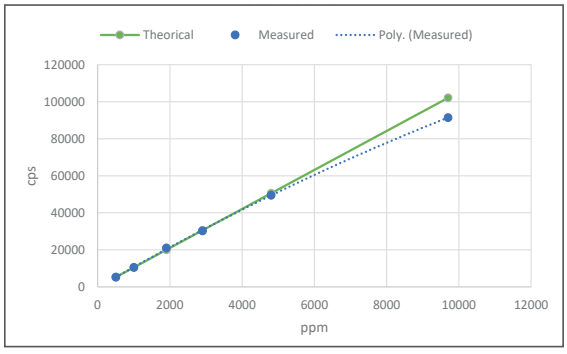
- 2048 channels gamma ray energy spectrum
- Full spectrum analysis and stabilized spectrum
- Total gamma counts [API]
- Concentration of radioisotopes [Bq/kg or ppm]
- Concentration error of radioisotopes [Bq/kg or ppm]



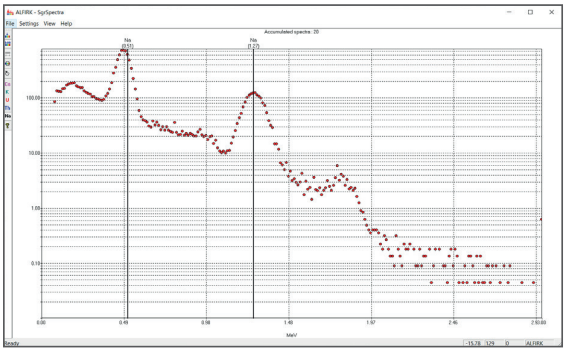
Full Spectrum Analysis by Medusa Systems BV



CeBr3 vs BGO crystal – Spectral resolution comparison (^{137}Cs isotope)



Total count (cps) vs concentration (ppm)



LoggerSuite – Real Time Spectrum (^{22}Na isotope)

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