The QL40-SGR 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) is performed on the recorded energy spectra. The FSA derives in real time the concentration of the three main radioisotopes $^{40}$K, $^{212}$Th and $^{238}$U and thus provides insight into the mineral composition of the formations.

The QL40 SGR is equipped with a scintillation BGO (Bismuth Germanium Oxyde) crystal. The BGO crystal has a high scintillation efficiency, good energy resolution and is mechanically strong.

The QL40-SGR is supplied as an inline sub. It can be combined with other logging tools of the QL40 (Quick Link) product line or can be operated as a standalone tool. It is compatible with Matrix, BBOX and ALTlogger acquisition systems.

### Application
- Recognition of radioactive materials
- Contamination studies
- Lithology characterization
- Well to well correlation
- Sedimentology - differentiation of facies and depositional environment
- Mineral composition

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**QL40 SGR Spectral Gamma Ray**

The QL40-SGR 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) is performed on the recorded energy spectra. The FSA derives in real time the concentration of the three main radioisotopes $^{40}$K, $^{212}$Th and $^{238}$U and thus provides insight into the mineral composition of the formations.

The QL40 SGR is equipped with a scintillation BGO (Bismuth Germanium Oxyde) crystal. The BGO crystal has a high scintillation efficiency, good energy resolution and is mechanically strong.

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### Application
- Recognition of radioactive materials
- Contamination studies
- Lithology characterization
- Well to well correlation
- Sedimentology - differentiation of facies and depositional environment
- Mineral composition

---

![QL40 SGR Spectral Gamma Ray](image)
Principle of measurement

The QL40 SGR is equipped with a BGO scintillation crystal. When exposed to gamma rays, the BGO 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 256 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 (40K, 238U, 232Th) or other man-made nuclides like 137Cs or 60Co. Corrections taking borehole diameter, rock density, casing type and thickness, tool position and borehole fluid conditions into account can be applied.

Measurements / Features

- 256 channels gamma ray energy spectrum
- Stabilized spectrum
- Total gamma counts
- Concentration of radioisotopes [Bq/kg or ppm]
- Concentration Error of radioisotopes [Bq/kg or ppm]

Operating Conditions

- Open or cased borehole
- Water filled or dry borehole

Technical Specifications

<table>
<thead>
<tr>
<th>Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>· Diameter : 40 mm (1.6&quot;)</td>
</tr>
<tr>
<td>· Length : 0.93 m (36.6&quot;)</td>
</tr>
<tr>
<td>· Weight : 6 kg (13 lbs)</td>
</tr>
<tr>
<td>· Max. Temp. : 70ºC (158 ºF)</td>
</tr>
<tr>
<td>· Max. Pressure : 200 bar (2900 psi)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sensor</th>
</tr>
</thead>
<tbody>
<tr>
<td>· BGO crystal - 2.22cm x 10.16 cm (0.875&quot; x 4.00)</td>
</tr>
<tr>
<td>· Measurement range: up to 3 MeV</td>
</tr>
</tbody>
</table>

Measurement range

- Measurement point : 0.21 m (8.29") from bottom
- Measurement range: up to 3 MeV

The specifications are not contractual and are subject to modification without notice.

1 The Full Spectrum Analysis (FSA) is developed by Medusa Systems BV in collaboration with the Nuclear Physics Institute of the University of Groningen (Netherlands).