

Gordon Technologies'

# AZIMUTHAL GAMMA-RAY

## ECONOMICAL WELL PLACEMENT IMAGING SOLUTION FOR UNCONVENTIONAL RESERVOIRS

### OVERVIEW

Maximize production and minimize costs in unconventional wells with Gordon Technologies' Azimuthal Gamma-Ray (GT-AGR). The GT-AGR increases confidence in critical geo-steering decisions by providing high-quality logging measurements and wellbore images. The high-resolution images can aid in identifying faults, avoid unnecessary sliding and potentially costly sidetracks, and maximize reservoir contact.

### FEATURES

- » Highest contrast retrievable sensor on the market (23:1 Front-to-Back)
- » Optimized gamma window for improved resolution and count rates
- » Fully configurable imaging; 4 sectors real-time and 16 sectors in memory
- » Dual gamma sensors (one shielded and one unshielded) for bulk gamma redundancy (downhole reprogrammable)
- » Operational up to 356°F (180°C) and 25,000 psi (172 MPa)
- » Data compression for improved data density in standard temperature wells up to 302°F (150°C)

### MINIMIZE RISK WHILE IMPROVING RESERVOIR INTERPRETATION

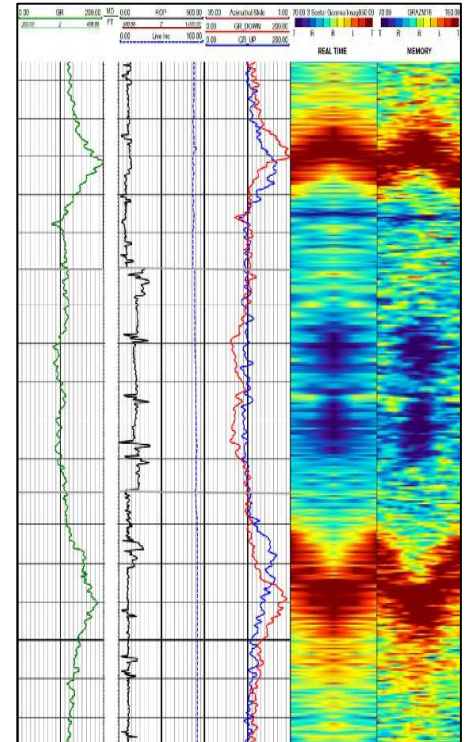
The GT-AGR is the only fully retrievable, high-contrast gamma ray imaging tool on the market. The modular probe-based design features an impressive 23 to 1 front-to-back ratio. The GT-AGR provides 4 sector azimuthal images in real-time (up to 8 sectors using data compression), and 16 sector azimuthal images from memory. The GT-AGR enhances details of the reservoir structure, even in low contrast formations.

Packaged using proprietary Shock Miser™ internal mounting, the GT-AGR's rugged design performs even in the harshest drilling environments. The tool can be run in tandem with a standard 360° bulk gamma or in combination with any GT-MWD or GT-LWD directional drilling services, allowing for maximum flexibility.

### DATA TRANSMISSION AND PRESENTATION

Gordon Technologies' unparalleled MWD telemetry speeds and proprietary data compression are the highway for high-quality, data-dense logs. Gordon Technologies' in-house imaging software provides log images on demand or a time-scheduled distribution. Gordon Technologies also provides live-data hub access enabling remote operators and geo-steering experts to monitor live data just as if they were at the rig site. GT-AGR services include full support from the GT-Data Center Support Team. With over 30 years of technical experience and reservoir insight, the data center experts welcome the opportunity to assist in log interpretation.

For more information, contact us at [www.gordontechnologiesllc.com](http://www.gordontechnologiesllc.com)



Sample log from the GT Azimuthal Gamma-Ray service showing detailed memory vs. real-time images

### BENEFITS

#### Drill to Produce

- » Place wells accurately with an enhanced view of the surrounding geology
- » Reduce uncertainty and improve well placement by clearly distinguishing between formation layers with low gamma-ray contrast

#### Enrich Reservoir Awareness

- » Increase well production with accurate geologic structural interpretations

#### Increase Target Formation Exposure

- » Active boundary monitoring provides immediate insights which help improve effective completion of the target zone

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6-3/4"	Sample BHA				
	BHA Component	Connection (Top Bttm.)	Nominal OD (inch)	Nominal ID (Top Bttm.) (inch)	MUT (Top Bttm.) (kft-lb)
<ul style="list-style-type: none"> <li>➤ Max Flow Rate: 740 GPM (flow area restricted)</li> <li>➤ Collar ID: 3 3/4"</li> <li>➤ Retrievable: Yes</li> <li>➤ Connection Compatibility: 4 1/2" IF</li> <li>➤ Features: High-Torque, Double-Shouldered Connections</li> </ul>	Rental NMDC	NC50   NC50	6-3/4	3-3/4   3-3/4	28   28
	AGR Fin Cutter Sub	NC50   XT54	6-3/4	3-3/4   3-3/4	28   55
	AGR NMDC	XT54   XT54	6-3/4	3-3/4   3-3/4	55   55
	AGR UBHO	XT54   NC50	6-3/4	4-1/8   2-1/2	55   33

5-1/4"	Sample BHA				
	BHA Component	Connection (Top Bttm.)	Nominal OD (inch)	Nominal ID (Top Bttm.) (inch)	MUT (Top Bttm.) (kft-lb)
<ul style="list-style-type: none"> <li>➤ Max Flow Rate: 400 GPM (flow area restricted)</li> <li>➤ Collar ID: 3 1/4"</li> <li>➤ Retrievable: Yes</li> <li>➤ Connection Compatibility: XT39</li> <li>➤ Features: High-Torque, Double-Shouldered Connections</li> </ul>	Rental NMDC	XT39   XT40	5-1/4	2-13/16   2-13/16	20   23.5
	AGR NMDC (BxB)	XT40   XT40	5-1/4	3-1/4   3-1/4	23.5   23.5
	AGR Pony (PxP)	XT40   XT40	5-1/4	2-13/16   2-13/16	23.5   20
	AGR UBHO	XT40   XT39	5-1/4	4-1/8   2-1/2	20   20

4-3/4"	Sample BHA				
	BHA Component	Connection (Top Bttm.)	Nominal OD (inch)	Nominal ID (Top Bttm.) (inch)	MUT (Top Bttm.) (kft-lb)
<ul style="list-style-type: none"> <li>➤ Max Flow Rate: 400 GPM (flow area restricted)</li> <li>➤ Collar ID: 3 1/4"</li> <li>➤ Retrievable: No</li> <li>➤ Connection Compatibility: 3 1/2" IF</li> <li>➤ Features: Slim-hole Size</li> </ul>	Rental NMDC	NC38   NC38	4-3/4	2-11/16   2-11/16	9   9
	AGR NMDC (BxB)	NC38   NC38	4-3/4	3-3/4   3-3/4	9   9
	AGR Pony (PxP)	NC38   NC38	4-3/4	2-11/16   2-11/16	9   9
	AGR UBHO	NC38   NC38	4-3/4	3-7/16   2-3/8	9   9

## ELECTRONICS

### Gamma Sensor

- » **Detector Type:** Scintillator crystal/photo- multiplier tube
- » **Operating Temperature:** -50°C to 180°C
- » **Survival Temperature:** 185°C
- » **Vibration Survivability:** 30G, 50 to 250 Hz random
- » **Sensitivity:** ~.37 ct/API
- » **Accuracy:** +/-3% count rate change over the full temperature scale
- » **Stabilization:** Open loop gain temperature compensation
- » **API calibrated**

### Azimuthal Controller

- » **Operating Temperature:** -25°C to 180°C
- » **Survival Temperature:** 185°C
- » **Communication:** qMix or CAN
- » **Memory:** 150-200 hours of continuous recording
- » **Inputs:** Up to 3 simultaneous gamma sensor inputs
- » **Dual-Use Controller:** Operates as both a DM and AGR controller
- » **Environmental Lifetime Tracking**
- » **HASS tested**

## DATA

### Real-Time Data

- » 4-sector image, up and down curves, and bulk gamma
- » Total gamma measurement
- » **Timing:** 60 seconds for a 4-sector image with bulk gamma (at 0.375 data rate)
- » **Logging:** Image plotting provided by dedicated software with customizable color palette
- » **Data Compression:** 3-sectors, average gamma, and a bulk gamma in 20 seconds (at a 0.375 data rate)

### Memory Data

- » **16-sector image**
- » **Resolution/Capture Frequency:** 10 seconds

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