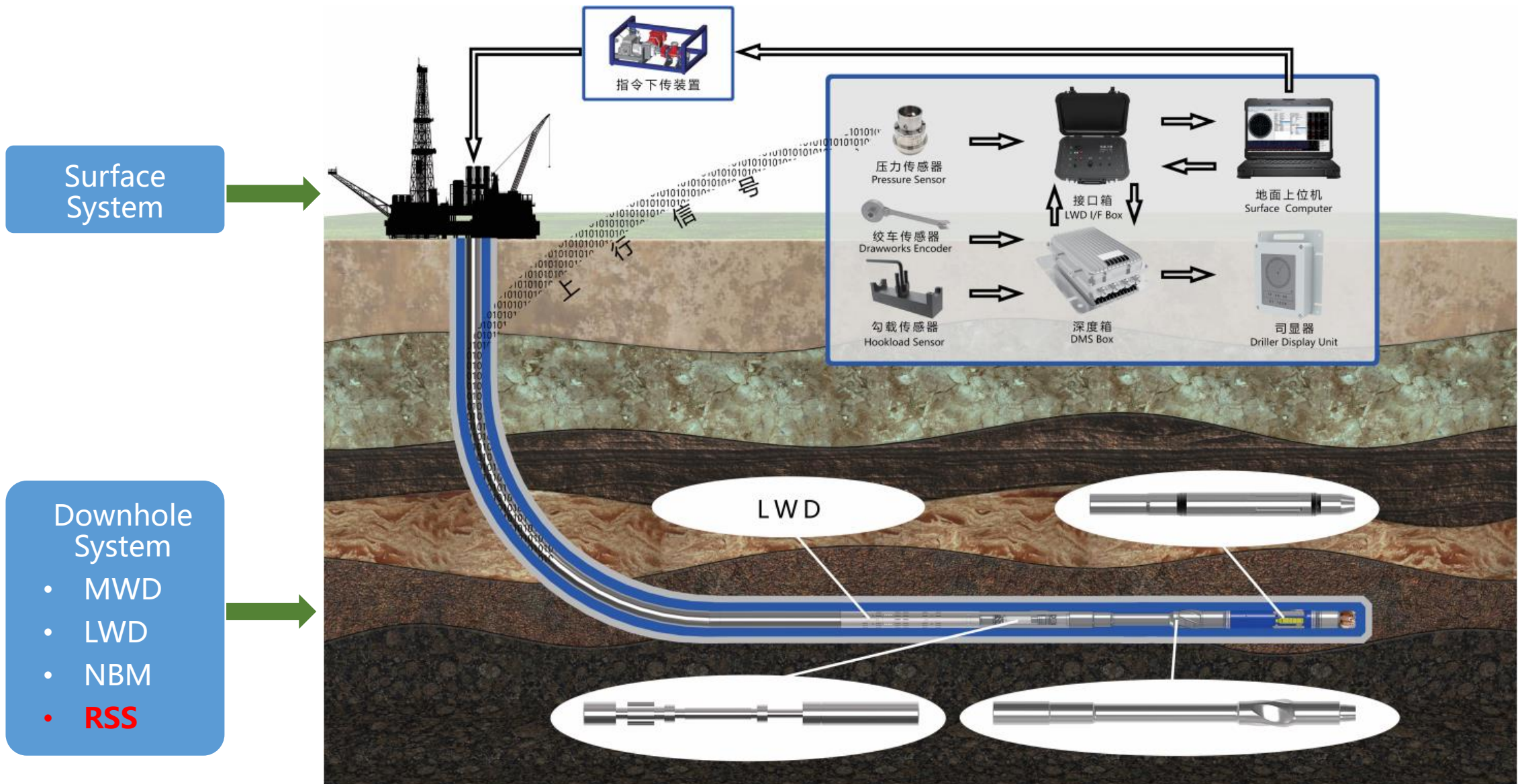


ROTARY STEERABLE SYSTEMS

The background of the slide features a photograph of an oil drilling rig in a desert landscape under a clear blue sky. A bright blue, glowing light effect emanates from the center of the rig, spreading outwards. The overall color scheme is dominated by shades of blue.

1 TECHNICAL SPECIFICATION

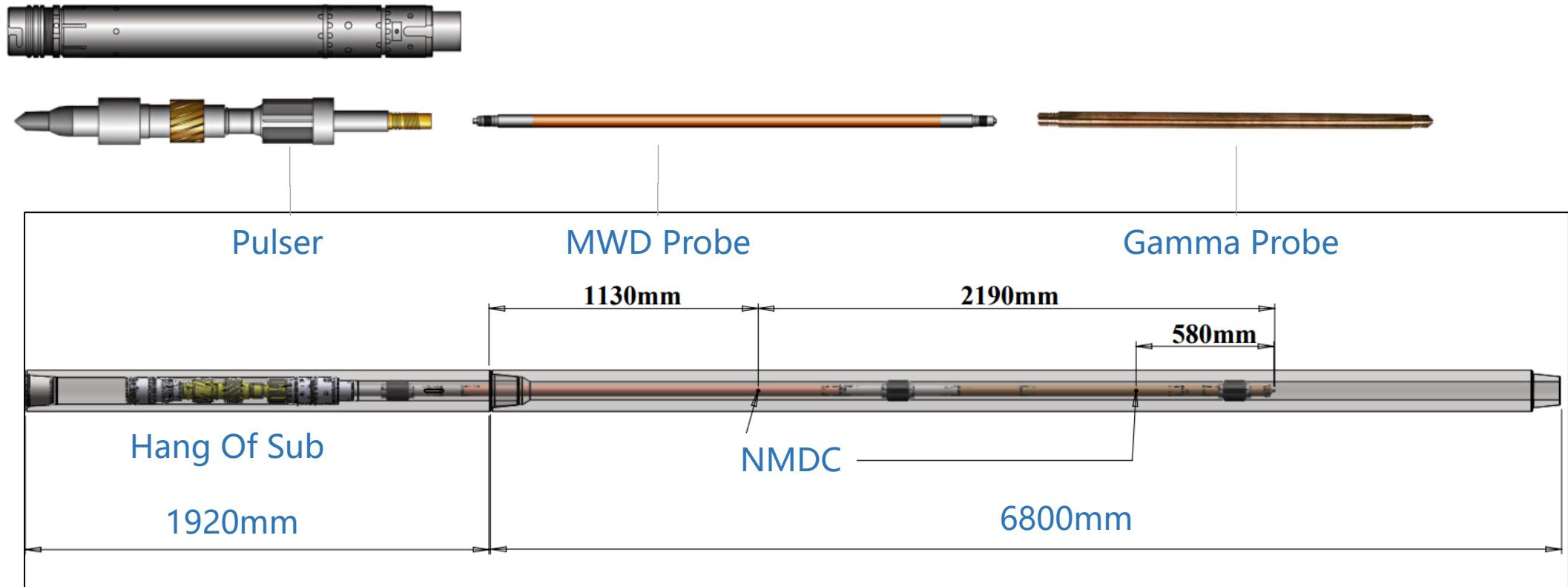
RSS



RSS

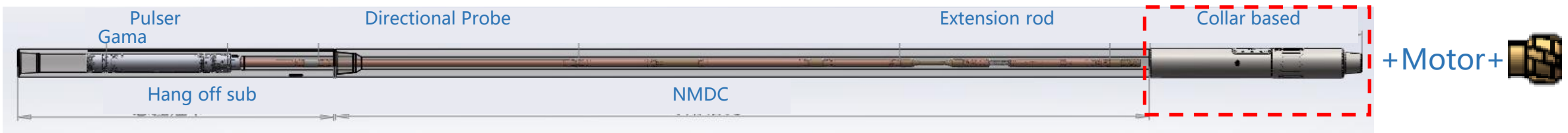
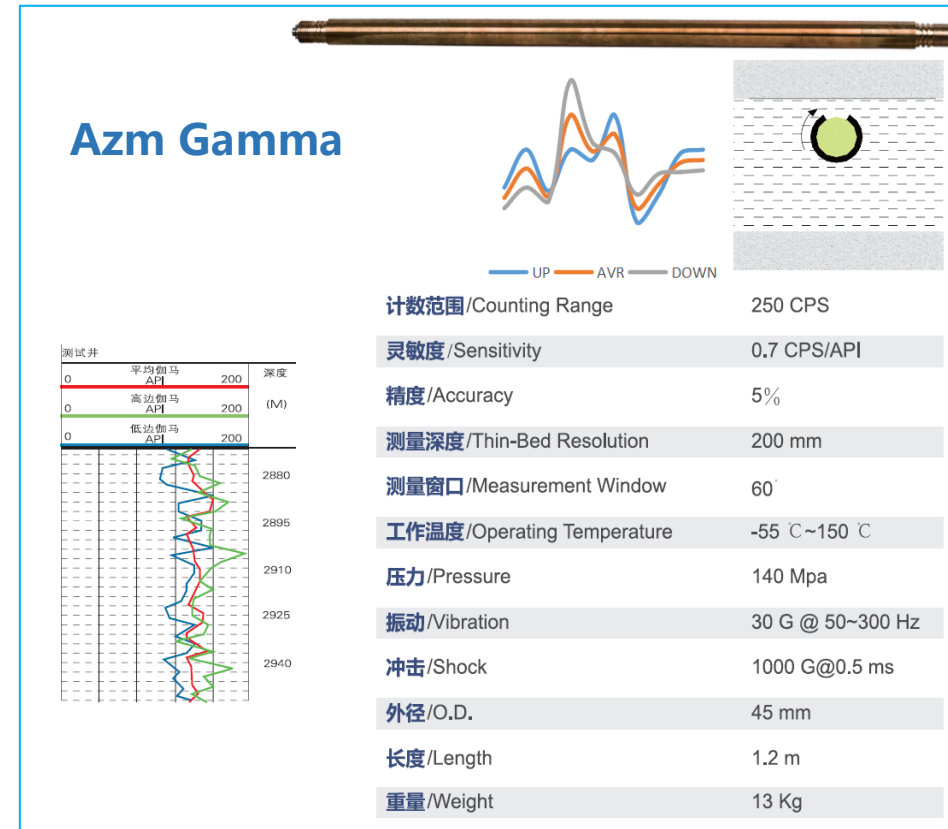
2.1 MWD System

- **Power by alternator**, environment friendly
- Circulation time last more than 300hrs
- Tool size: 3 1/2", 4 3/4", 6 3/4", 8 ", 9-1/2"
- **Compatible with Gamma, Resistivity, NBM, RSS**
- Pulser Type: **Positive pulser**
- **Stable and reliable**, circuit board with triple protection structure
- Dual anti-abrasive sub, **supereme NMDC material**



2.2 MWD with Gamma System

- **BHA: MWD+Gamma+Motor+Bit**
- Gamma sensor at top of motor
- Real-time image is available
- **Compatible with S&V, PWD**
- Geological identification formation layers especially for poor reservoir
- up/low/average gamma log

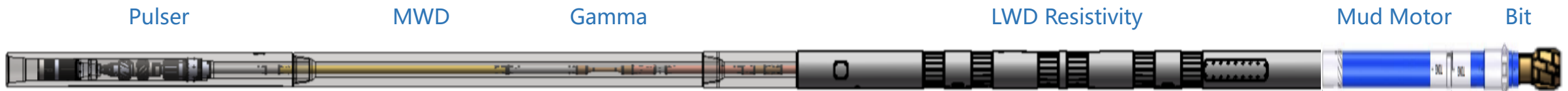
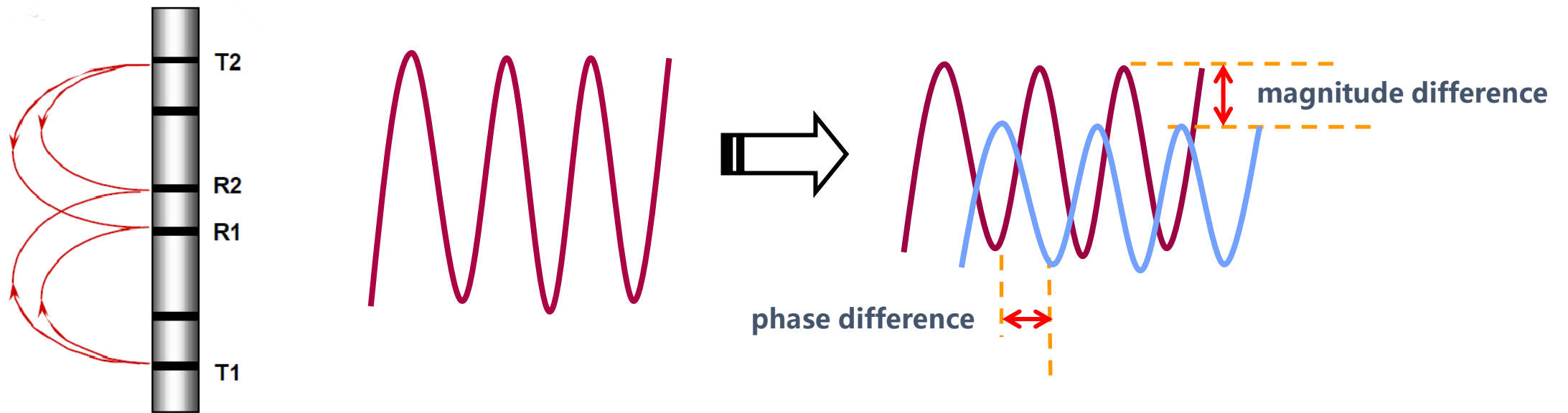


RSS

2.3 LWD System

Resistivity tool measurement Method: Four-wave, double-receiver, dual-frequency.

Electromagnetic wave is transmitted from transmit antenna, across through the formation and reach receivers in the middle. Due to the different conductivity of the formation, the phase difference and magnitude difference measured and can be used to determine the formation type.



2.3 LWD System: Tool Specification

Description \ Type	HT-MWD-200	HT-LWD-350 HT-MWD-350	HT-LWD-650 HT-MWD-650	HT-LWD-1200 HT-MWD-1200	
	OD	3 ½" (89mm)	4 ¾" (121mm)	6 ¾" (172mm)	8" (203mm)
ID	2.3" (58.4mm)	2.845" (72mm)	2.845-3.25" (72-82.55mm)	3.25" (82.55mm)	
Connection	2-3/8"IF	3-1/2"IF	4-1/2"IF	6-5/8"REG	7-5/8"REG
Flow Rate	90-200 GPM (5.7-12.6 L/S)	150-350 GPM (9.5-22.1 L/S)	225-650 GPM (14.2-41 L/S)	225-1200 GPM (22.1-75.7 L/S)	
Data Format	WITS, LAS				
Max Pressure	140Mpa (HT-200: 103Mpa)				
Max Downhole Temp.	150°C				
LCM	Non-fibrous material (eg. Fine-Medium walnut or KIWIK-SEAL) 20lb/bbl system maximum				

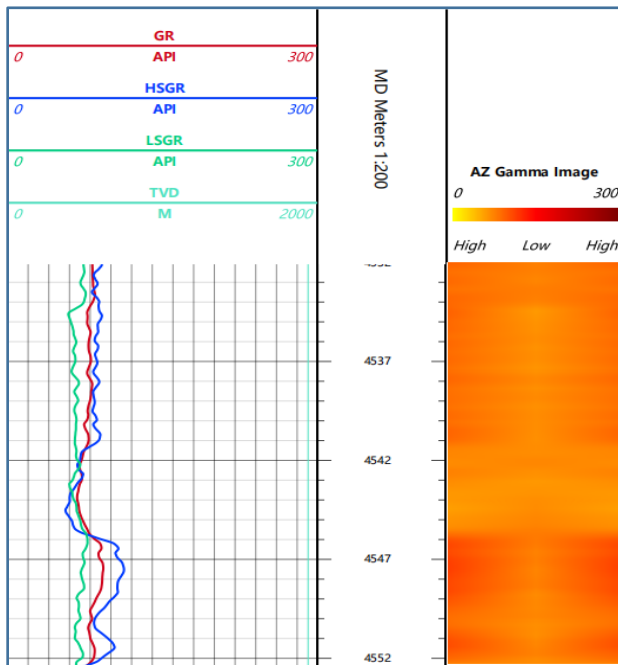
2.3 LWD System: Tool Specification

LWD Specification for Gamma and Resistivity					
GR/RES	Gamma Ray	2MHz Phase Resistivity	2MHz Attenuation Resistivity	400kHz Phase Resistivity	400kHz Attenuation Resistivity
Range (RT M/Load)	0-500API	0.1-400ohm-m	0.1-500ohm-m	0.1-1000ohm-m	0.1-200ohm-m
Accuracy	± 2.5API	± 1% (0.1-50ohm-m)	± 2% (0.1-25ohm-m)	± 1% (0.1-25ohm-m)	± 5% (0.1-10ohm-m)
Accuracy	@100API	± 0.5mmho/m (>50ohm-m)	± 1mmho/m (>25ohm-m)	± 1mmho/m (>25ohm-m)	± 5mmho/m (>10ohm-m)
Resolution	7.8"(20cm)	8"(20cm)	8"(20cm)	12"(30cm)	12" (30cm)

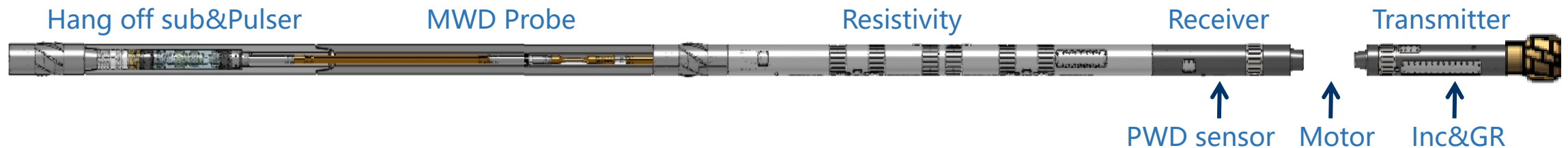
2.4 NBM System: Near Bit Gamma Image

BHA: MWD+LWD+NBM-Receiver+Motor+NBM-Transmitter+Bit

Features: Real-time GR image, near bit inclination offset=0.3m, GR&PWD offset=0.5m@top of Motor

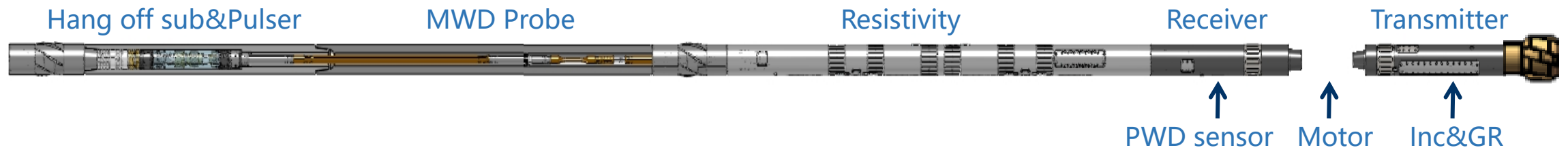


SIZE	HT-7" NBM-SYSTEM	HT-5¼" NBM-SYSTEM
TOOL OD	7" (178mm)	5¼" (135mm)
HOLE SIZE	8 3/8"-9 7/8" (214mm-251mm)	6 1/2" (165mm)
LENGTH	0.9m (RECEIVER)	
INC ACCURACY	±0.1°	
GR RANGE	0-250cps	
BIT RPM	30-300rpm	
CONNECTION	4-1/2" REG	3-1/2" REG
POWER	LITHIUM BATTERY	
MUD TYPE	OBM&WBM	



2.4 NBM System: Features of Gamma Image

- Data transmit by electromagnetic wave overlap mud motor, max transmit distance 18m
- Columnar antenna with asymmetrical structure, optimized transmit frequency and power
- 60° azimuth gamma scan sector, 6 nos of sector data recorded
- Smart drilling by self-identify&switch to slide or rotate drilling
- Max temperature: 150°C
- Application for well placement, geology identification
- Run in both OBM and WBM
- Optional function of S&V, PWD for drilling optimization and well control



RSS

2.5 Rotary Steerable System

BHA: MWD+LWD+Flex Joint+RSS Unit+Bit

Compatible with MWD/LWD, Azimuth gamma, Resistivity, PWD, S&V

TOOL SIZE	HT-4.75LWD&RSS	HT-6.75LWD&RSS	HT-9.5LWD&RSS
OD	4 ¾"	6 ¾"	9 ½"
ID	2.845"	2.845-3.25"	3.25 "
BTM CONNECTION	3-1/2" IF	4-1/2" IF	6-5/8" REG OR 7-5/8" REG
FLOW RATE	150-350GPM	225-650GPM	225-1200GPM
BR	10°/30m	8°/30m	6.5°/30m
PASSAGE/ROTATE	14°/30m	10°/30m	6°/30m
HOLE SIZE	6"、6.5"	8.5"、8.75"、9.5"	12.25"、13-1/8"、17.5"
MAX. SPP	140Mpa (20000psi)		
MAX. TEMP	150°C		

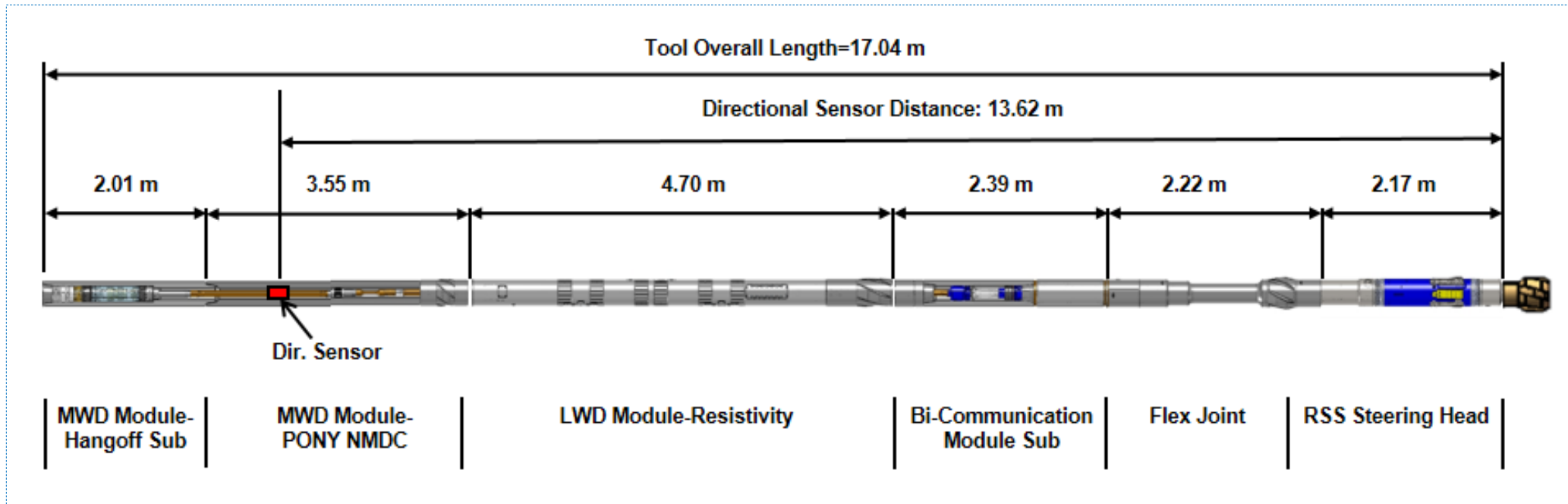


RSS

2.5 LWD+RSS System

BHA: LWD+Flex Joint+RSS Unit+Bit

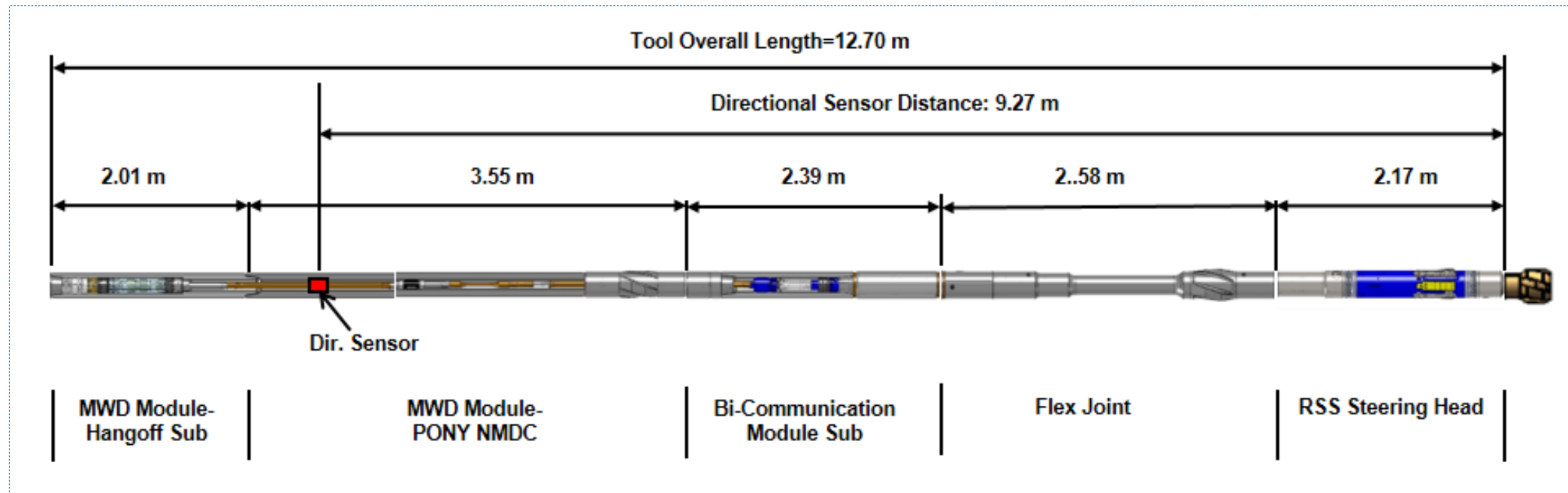
Measurement: MWD, Azimuth gamma, Resistivity, PWD, S&V



2.5 MWD+RSS System

BHA: MWD+Flex Joint+RSS Unit+Bit

Measurement: MWD, Azimuth gamma, PWD, S&V

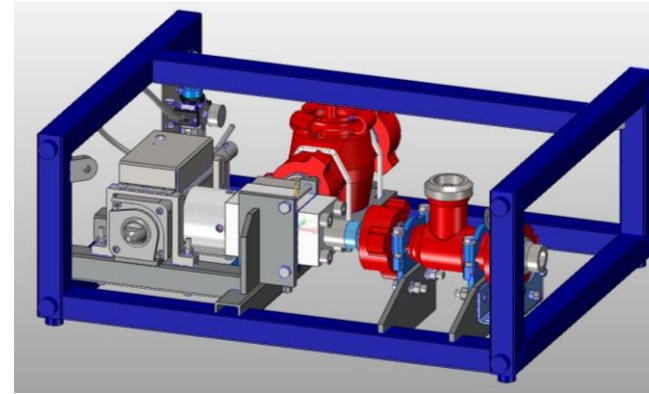


RSS

2.5 FEATHERS OF Rotary Steerable System

(1) BPA: Smart downlink while drilling

- Downlink by negative pulse, 10-15% mud flow is diverted from the bypass valve
- Downlink sending and confirm by computer
- More than 10,000 detailed downlink command, Inc increasement by 0.15deg
- Downlink while drilling in 3-5minutes, no need bit off bottom
- Reliable downlink, max to 8000m



COM: COM5 Open Mode: Field Simulator

Legacy

Select Downlink Group / Downlink

DLK Group: HTRSS

Downlink: > Walk Force + Target Inclination

Select Word(s)

Target Inclination: 90.18 deg

Walk Force: right 32.2581 %

BPC Status: Connection Load

Transmission: Downlink >

Simulator: Frequency Start Stop

Confirmation

Command	Nr. Valve Action	Start	Duration
Walk Force + Target Inclination	20.) Open	: 0:00	16 sec
	19.) Close	: 0:16	12 sec
	18.) Open	: 0:28	8 sec
	17.) Close	: 0:36	12 sec
	16.) Open	: 0:48	8 sec
	15.) Close	: 0:56	24 sec
	14.) Open	: 1:20	8 sec
	13.) Close	: 1:28	16 sec
	12.) Open	: 1:44	40 sec
	11.) Close	: 2:24	8 sec
	10.) Open	: 2:32	8 sec
	9.) Close	: 2:40	8 sec
	8.) Open	: 2:48	16 sec
	7.) Close	: 3:04	8 sec
	6.) Open	: 3:12	8 sec
	5.) Close	: 3:20	8 sec
	4.) Open	: 3:28	8 sec
	3.) Close	: 3:36	8 sec
	2.) Open	: 3:44	8 sec
	1.) Close	: 3:52	8 sec

Pressure I/O LOG BPA

Flow

Close

Open

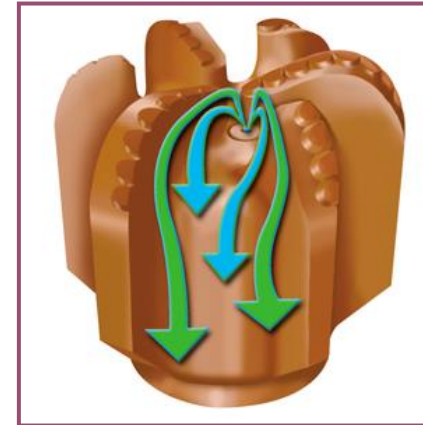
RSS

(2) NO bit pressure drop issue

Compared with other RSS with same rig equipment, can increase 10-15% flow rate, to ensure well cleaning and reduce pipe stuck and well kick risks.

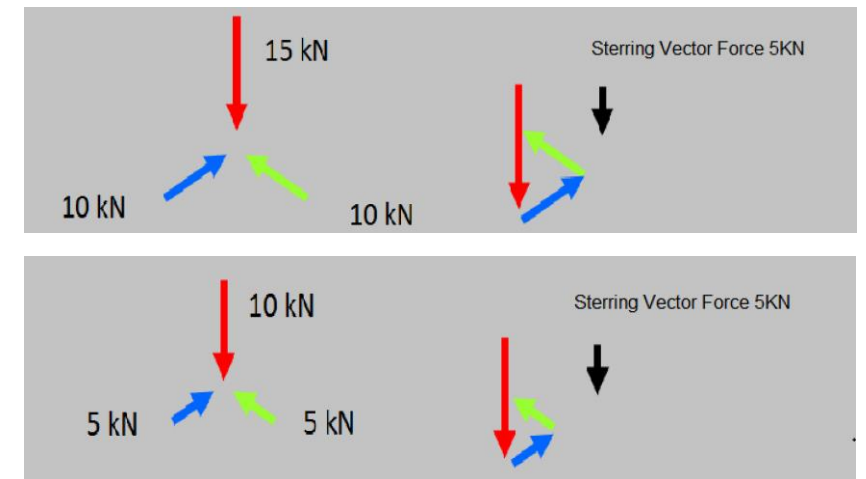
Steering without issue as:

- Flow rate change
- Mud properties change
- Bit nozzle plug/lost



(3) Efficient push force control mode

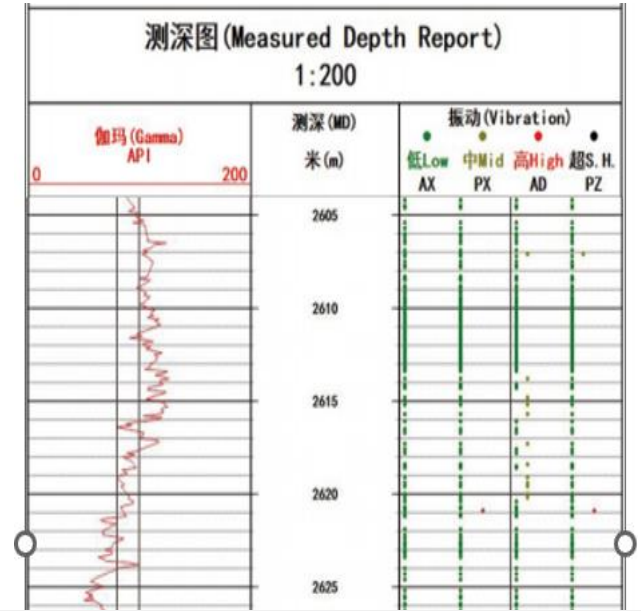
- To ensure the well trajectory control and increase ROP, it will auto adjust each steering rib push force and achieve even vector force.
- By downlink to on/off high efficiency control mode, up to 4 levels steering rib force can be reached in different formation.



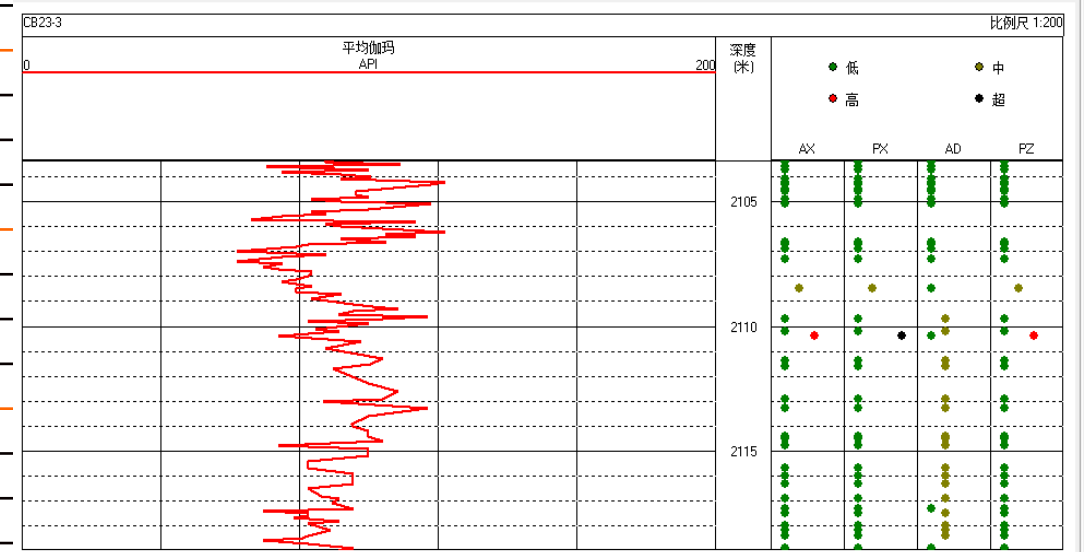
RSS

2.6 Shock&Vibration measurement

Vibration probe monitor the working condition of downhole tools through the vibration sensors placed in three direction of X, Y and Z, to real-time help monitor and optimize the drilling parameters.



Item	Interpretation	Range(g)	level	HLVibration code
AX	Avg X	0 - 3.1	Low	00
		3.2 - 6.1	Medium	01
		6.2 - 9.2	High	10
		>=9.2	SupHigh	
PX	Peak X	0-30	Low	
		31-55	Medium	
		56-105	High	
		>=106	SupHigh	
AD	AvgX-AvgY	0 - 1.1	Low	
		1.2 - 3.1	Medium	
		3.2 - 5.1	High	
		>5.2	SupHigh	
PZ	Peak Z	0 - 15	Low	
		16 - 30	Medium	
		31 - 45	High	
		>=46	SupHigh	



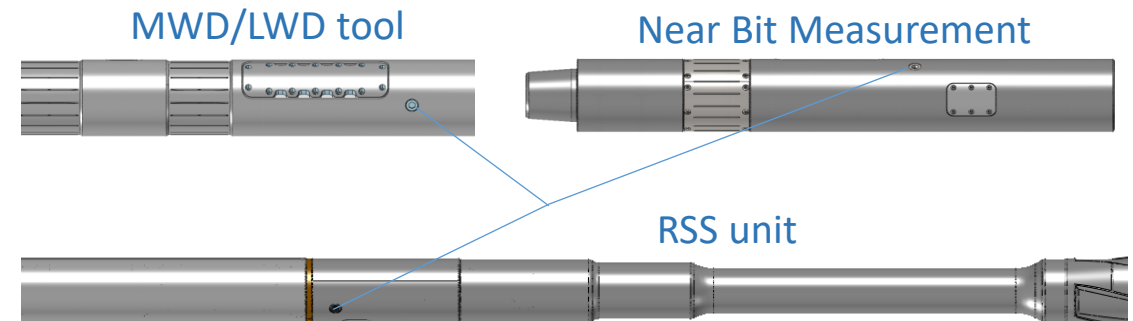
2.7 PWD: Pressure While Drilling measurement

PWD with memory and timer placed inside, measure and record pressure data of each pump-on and pump-off interval. It can transmit real-time data, record down hole continuous annulus pressure data, interval pressure change.

PWD Features and Application:

- Temperature compensation
- Hole-cleaning guidance
- Gas or fluid invasion alert
- Borehole washout condition monitor
- Optimize drilling parameters for well control

PWD sensor and application



2 TYPICAL CASES OF RSS SERVICES

RSS

Case2: RSS for Verti-Drilling

Well background and Challenges

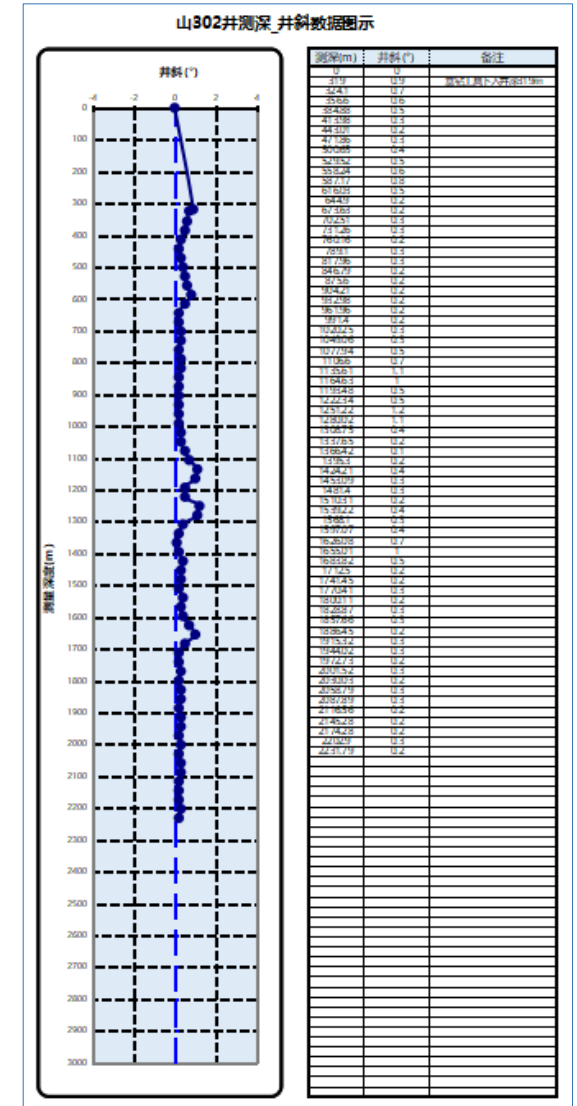
- Location: Qinghai Delingha, Holesize: 8-1/2"
- Date: July 2023
- Customer objective was to bring hole the vertical and drill to TD (From 319m to 2350m)
- Challenge: long vertical section with large dip angle and inclined formation

Solution

- Selected VertiDrill RSS tool with real time S&V monitor

Results achieved

After took over, reduce Inc from 0.9 to 0.2 degree very soon and control of the Inc less than 0.4 to TD, which was far better than well plan requirements.



Trip No.	Depth Start/m	Depth End/m	Footage/m	Drill Time/hr	Av. ROP
Trip 1	319	2151	1832	69.9	26.21 m/hr
Trip 2	2151	2350	199	28.6	6.96 m/hr
Total	/	/	2031m	98.5 hr	20.62m/hr

RSS

Case3: RSS for Exploration well

Well background and Challenges

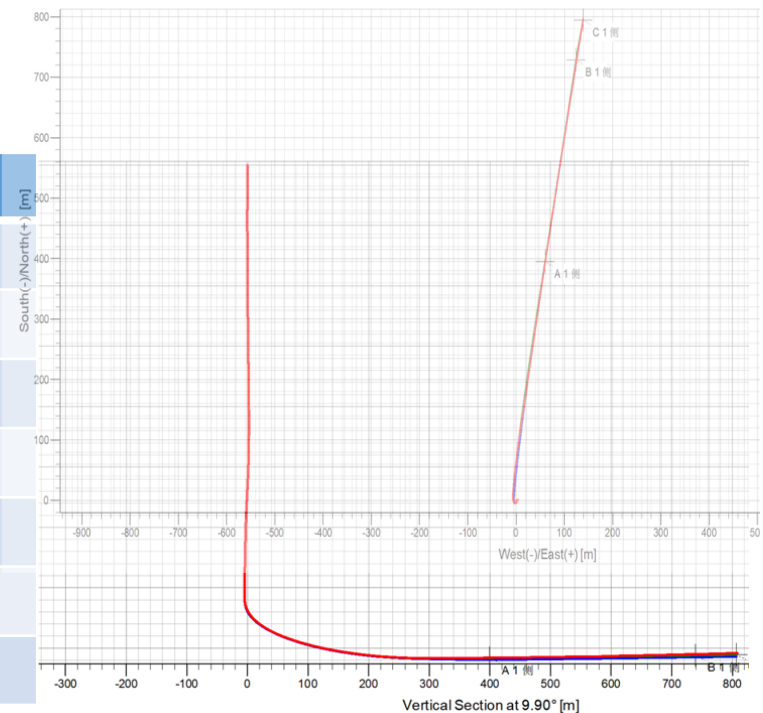
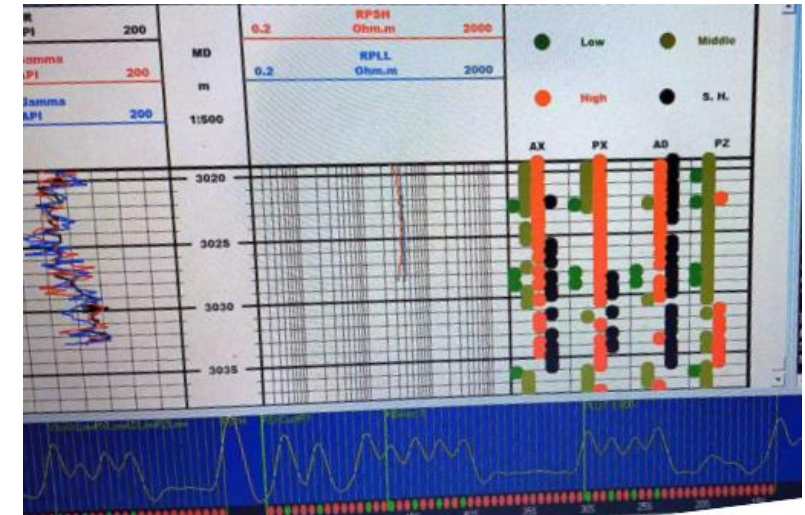
- Location: Hailar, Holesize: 8-1/2" Date: Sep 2023
- Challenge: Abrasive and hard formation, extreme high S&V
- Bit dull More trips for POOH change Bit

Solution

- Optimized BHA with RSS system, real time S&V monitor

Results achieved

One sidetrack, well TD as per of company order



Trip No.	Depth Start/m	Depth End/m	Footage/m	Drill Time/hr	Av. ROP
Trip 1	2954	3038	84	41	2.05 m/hr
Trip 2	3038	3201	163	27.5	5.93 m/hr
Trip 3	2932	2983	51	25	2.04 m/hr
Trip 4	2983	2983	0	/	Wiper Trip
Trip 5	2983	3092	109	27.6	3.95 m/hr
Trip 6	3092	3241	149	94	1.59 m/hr
Trip 7	3241	3339	98	35.5	2.76 m/hr