



**Weatherford**<sup>®</sup>

**MICRORESISTIVITY LOG**

COMPANY **SHAKESPEARE OIL COMPANY**  
 WELL **NIGHTINGALE #1-28**  
 FIELD **WILDCAT**  
 PROVINCE/COUNTY **SCOTT**  
 COUNTRY/STATE **UNITED STATES / KANSAS**  
 LOCATION **985' FNL & 335' FEL**  
**NW SE NE NE**

SEC	TWP	RGE	Other Services	Elevations:
28	16W	34	MPD/MDN	KB 3140.00
API Number	15-171-20930		MA/MFE	DF 3138.00
Permit Number			MSS	GL 3130.00
Permanent Datum G.L., Elevation feet				
Log Measured From KB				
Drilling Measured From K.B. @ 10 FEET				
Date	30-MAR-2013			
Run Number	ONE			
Service Order	3539880			
Depth Driller	4875.00 feet			
Depth Logger	4873.00 feet			
First Reading	4827.00 feet			
Last Reading	3700.00 feet			
Casing Driller	265.00 feet			
Casing Logger	263.00 inches			
Bit Size	7.880			
Hole Fluid Type	CHEMICAL			
Density / Viscosity	9.30 lb/USg	lb/USg		59.00 CP
PH / Fluid Loss	10.00			10.00
Sample Source	MUDPIT			
Rm @ Measured Temp	0.49 @ 72.0		ohm-m	
Rmf @ Measured Temp	0.39 @ 72.0		ohm-m	
Rmc @ Measured Temp	0.59 @ 72.0		ohm-m	
Source Rmf / Rmc	CALC	CALC		
Rm @ BHT	0.32 @109.0		ohm-m	
Time Since Circulation	4 HOURS			
Max Recorded Temp	109.00	deg F		
Equipment / Base	13057	LIB		
Recorded By	W. STAMBAUGH		J. LAPOINT	
Witnessed By	TIM PRIEST			
JOB #	LB13-084			

**BOREHOLE RECORD**

Last Edited: 30-MAR-2013 10:38

Bit Size inches	Depth From feet	Depth To feet
7.875	263.00	4875.00

**CASING RECORD**

Type	Size inches	Depth From feet	Shoe Depth feet	Weight pounds/ft
SURFACE	8.625	0.00	263.00	8.63

**REMARKS**

- SOFTWARE ISSUE: WLS 13.04.8492.
- MCG, MML, MDN, MPD, MFE, MSS, MAI RAN IN COMBINATION.
  - HARDWARE: DUAL BOWSPRING USED ON MDN.
  - 0.5 INCH STANDOFF USED ON MFE.
  - TWO 0.5 INCH STANDOFFS USED ON MSS.
  - 0.5 INCH STANDOFF USED ON MAI.
- 2.71 G/CC LIMESTONE DENSITY MATRIX USED TO CALCULATE POROSITY.
- BOREHOLE RUGOSITY, TIGHT PULLS, AND WASHOUTS WILL AFFECT DATA QUALITY.
- ALL INTERVALS LOGGED AND SCALED PER CUSTOMER'S REQUEST.
- TOTAL HOLE VOLUME FROM TD TO SURFACE CASING: 2420 CU. FT.
- ANNULAR HOLE VOLUME WITH 5.5 INCH PRODUCTION CASING FROM TD TO 2000 FEET: 290 CU. FT.

- SERVICE ORDER # 3539880.

- RIG: HD RIG #2

- ENGINEER: W. STAMBAUGH, J. LAPOINT

- OPERATOR(S): K. RINEHART.

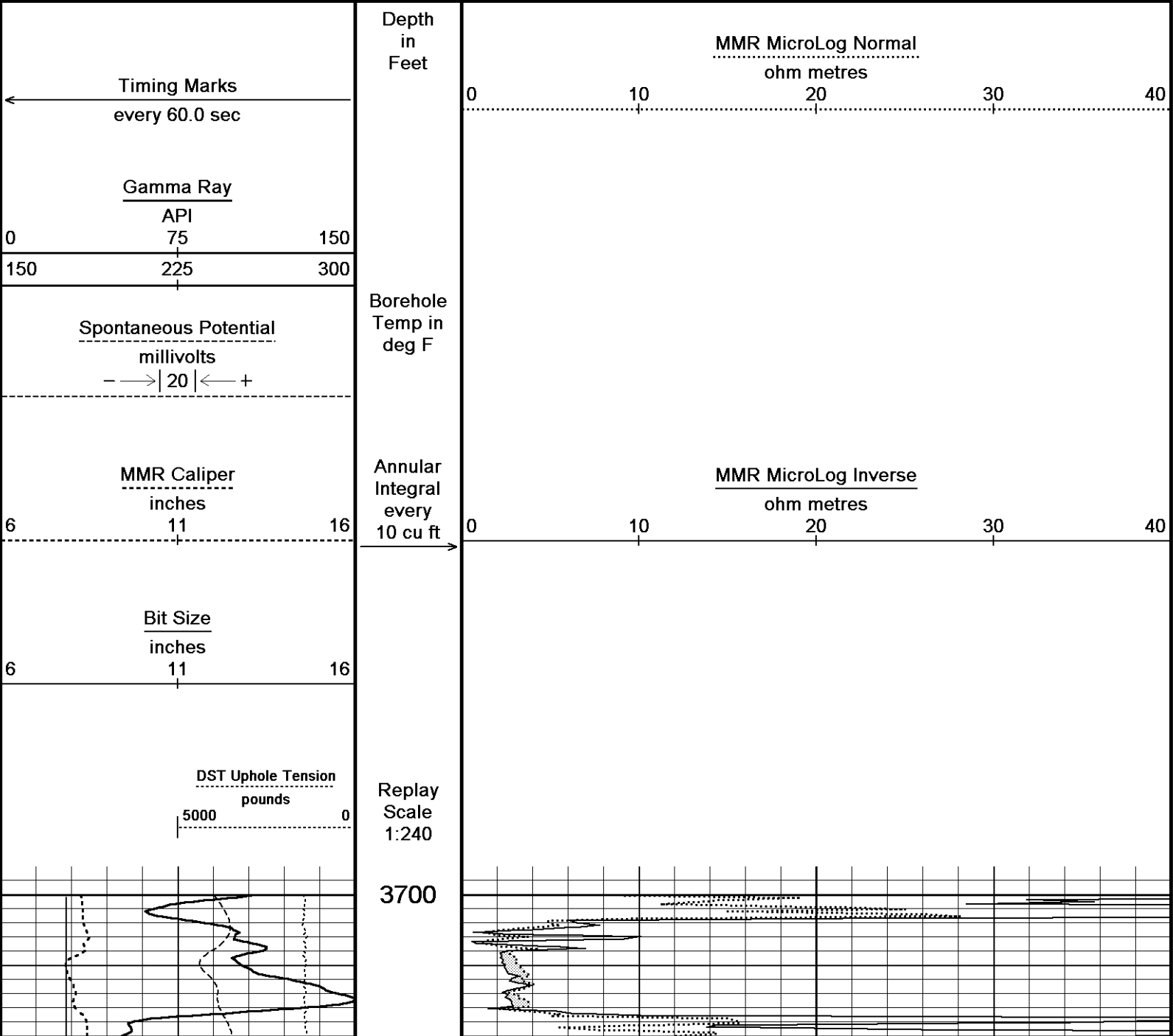
\*\*\*\* SOFTWARE ISSUE CHANGED FLUID LOSS TO MATCH PH. FLUID LOSS SHOULD BE 8.8 ML/30MIN. \*\*\*\*

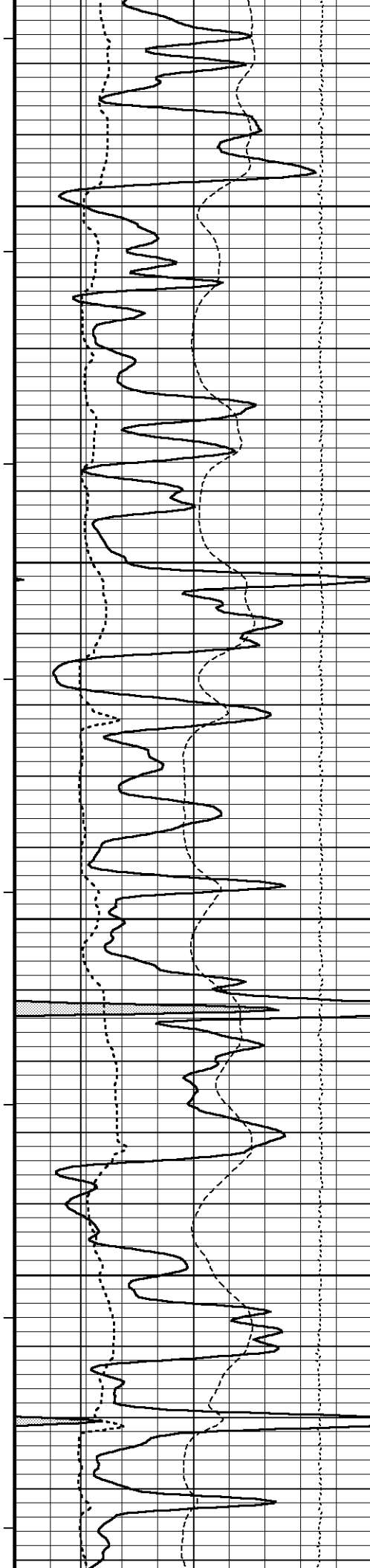
\*\*\*\*HIGH RESOLUTION INTERVAL FROM 4550 FEET TO 4400 FEET.\*\*\*\*

All interpretations are opinions based on inferences from electrical or other measurements and we cannot, and do not, guarantee the accuracy or correctness of any interpretations, and we shall not, except in the case of gross or wilful negligence on our part, be liable or responsible for any loss, costs, damages or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees. These interpretations are also subject to our general terms and conditions in our price schedule.

5 INCH MAIN

Depth Based Data - Maximum Sampling Increment 10.0cm  
Plotted on 30-MAR-2013 15:10  
Filename: C:\Minimus 13.04.8492\Data\Shakespeare Nighte...\Shakespeare Nightengale #1-28\_003.dta  
Recorded on 30-MAR-2013 12:03  
System Versions: Logged with 13.04.8492 Plotted with 13.04.8492





102°

3750

103°

3800

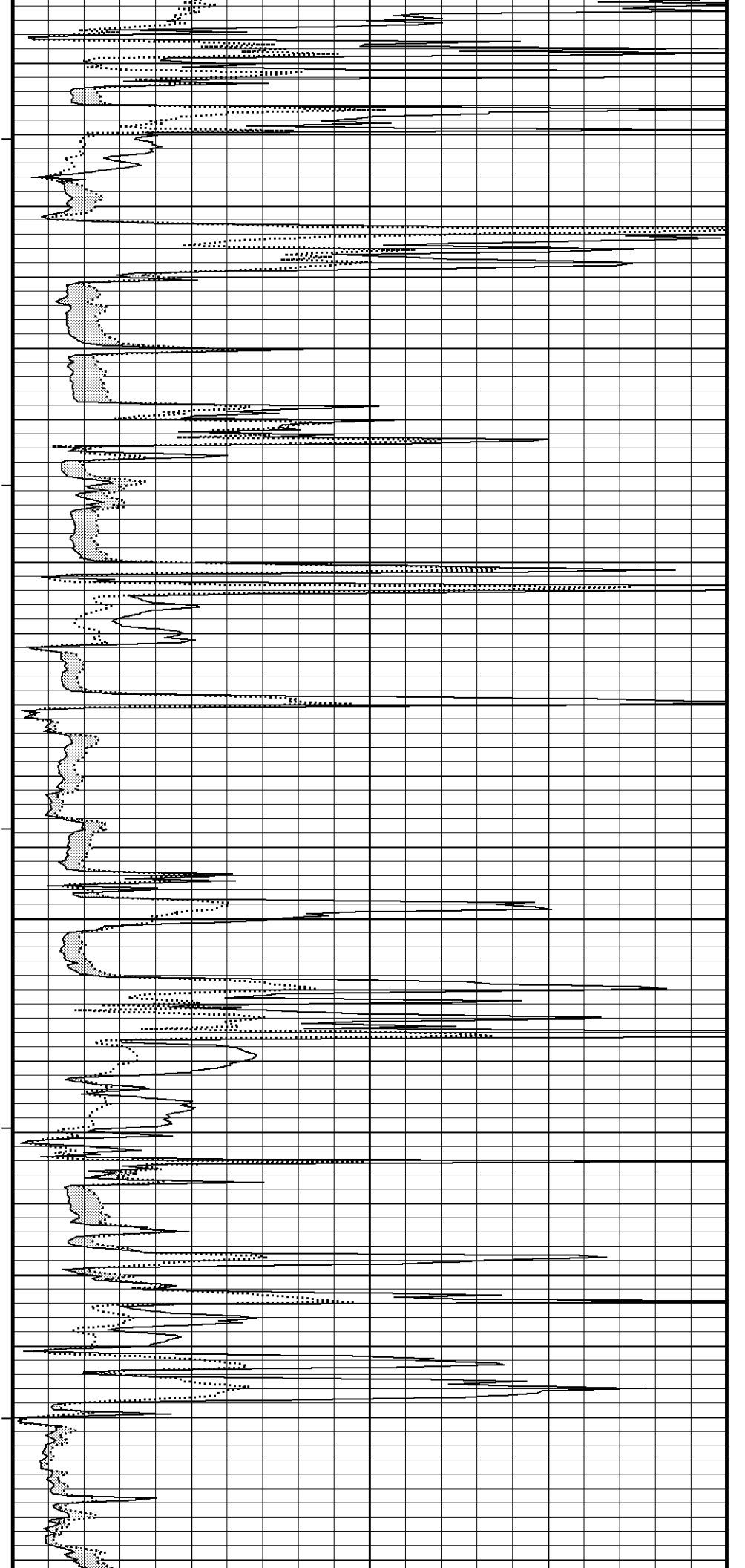
103°

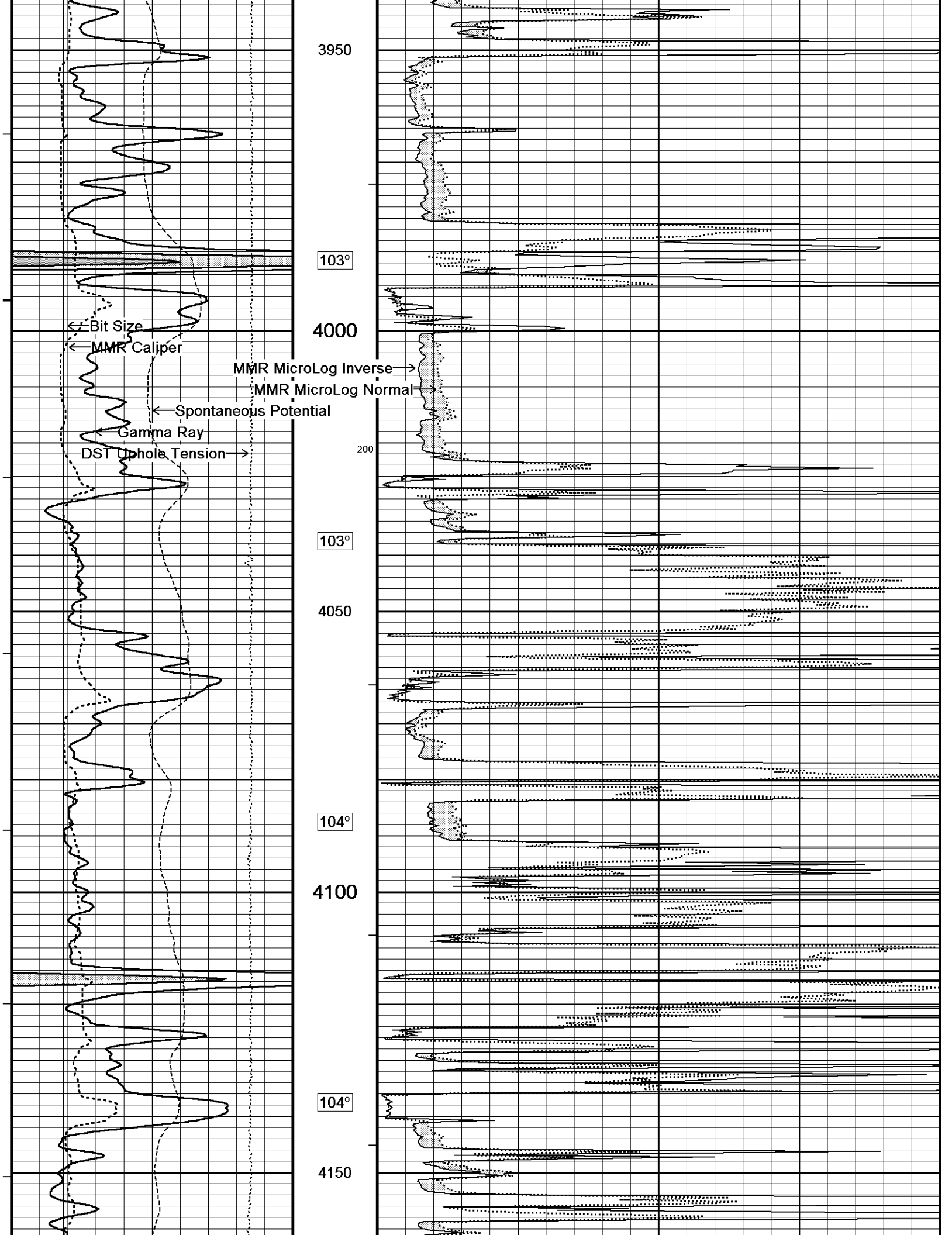
3850

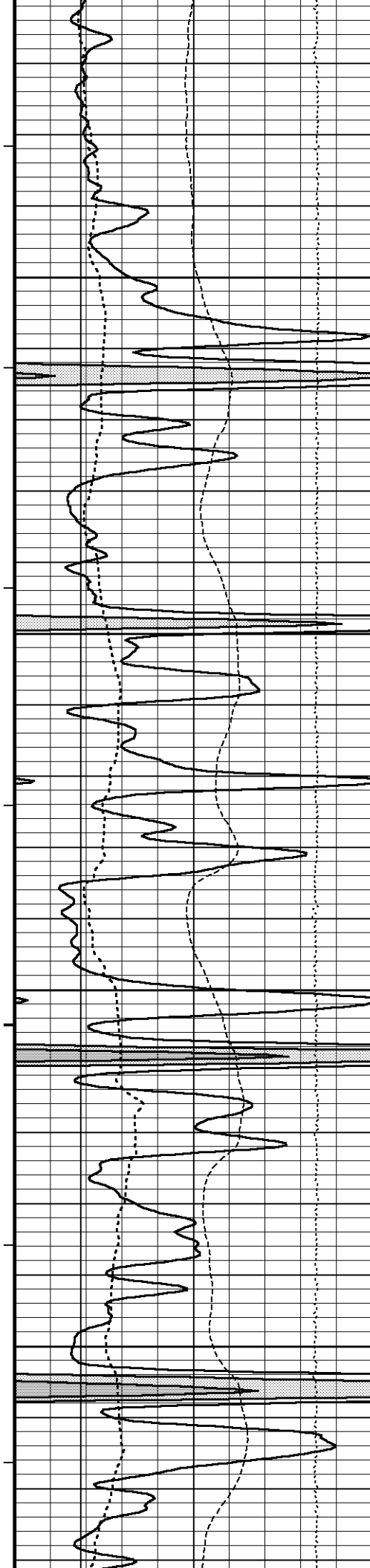
103°

3900

103°







104°

4200

105°

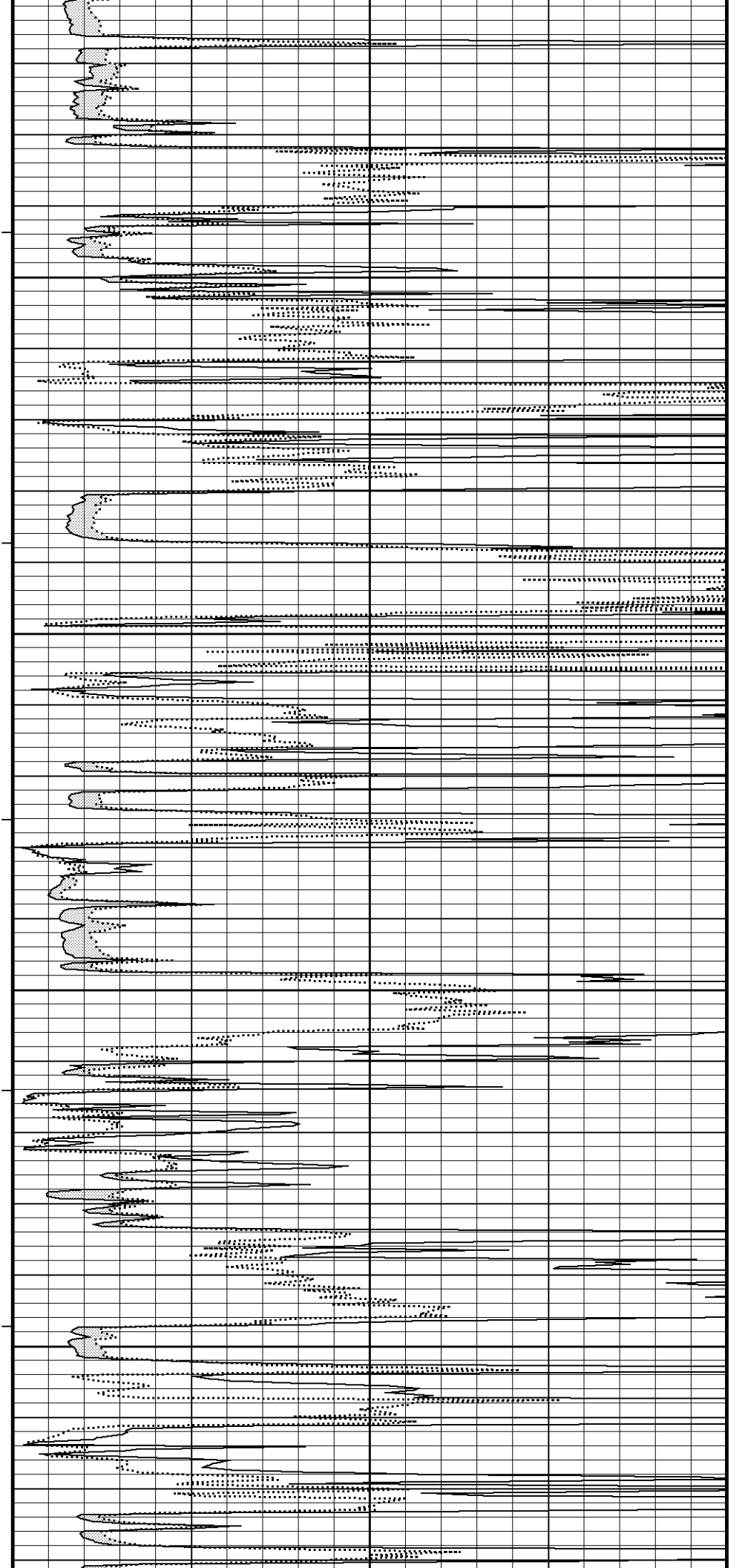
4250

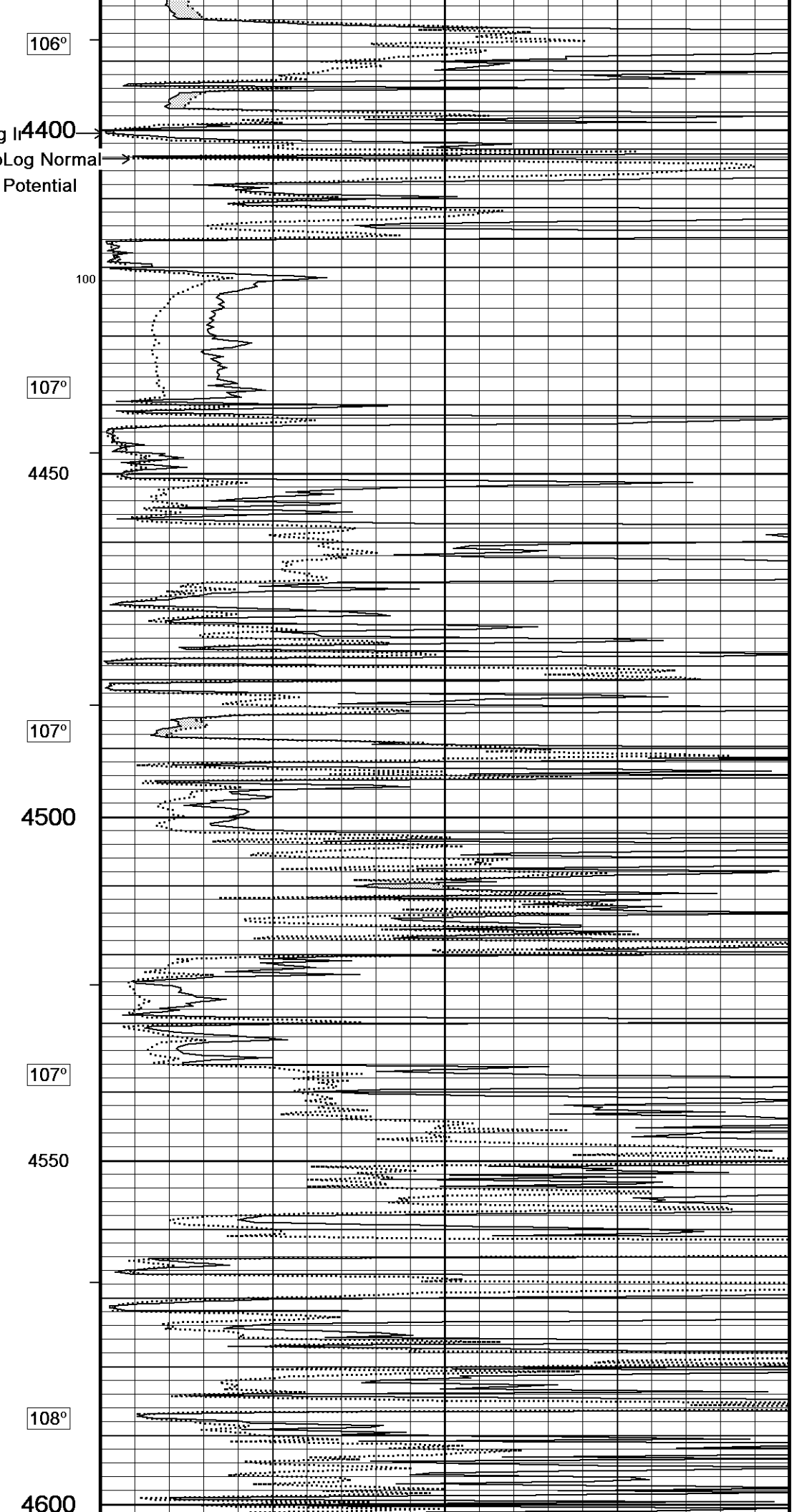
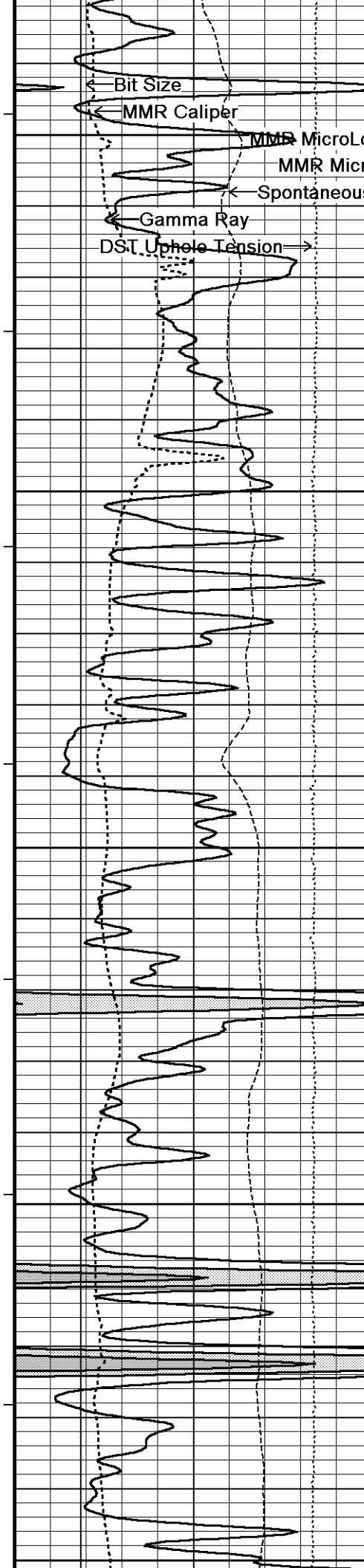
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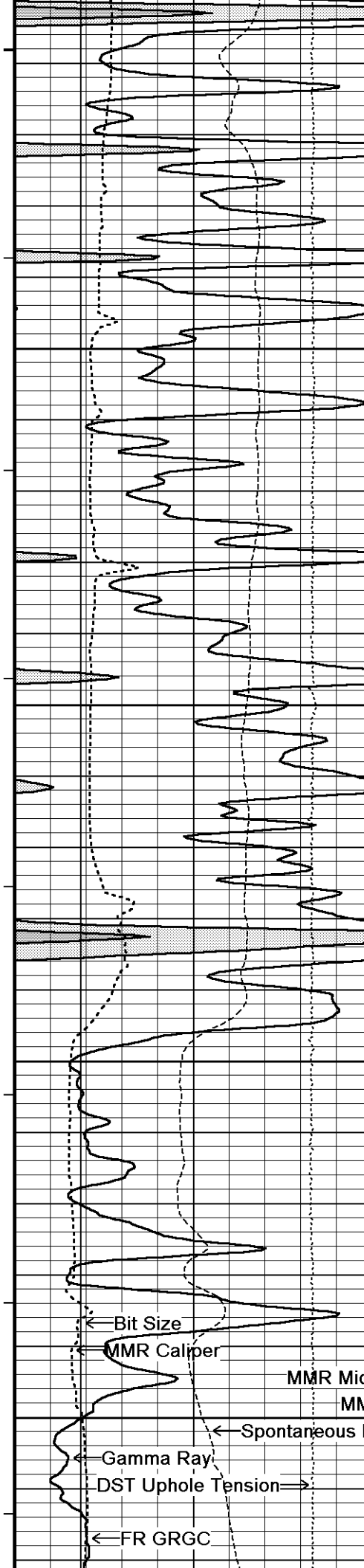
4300

106°

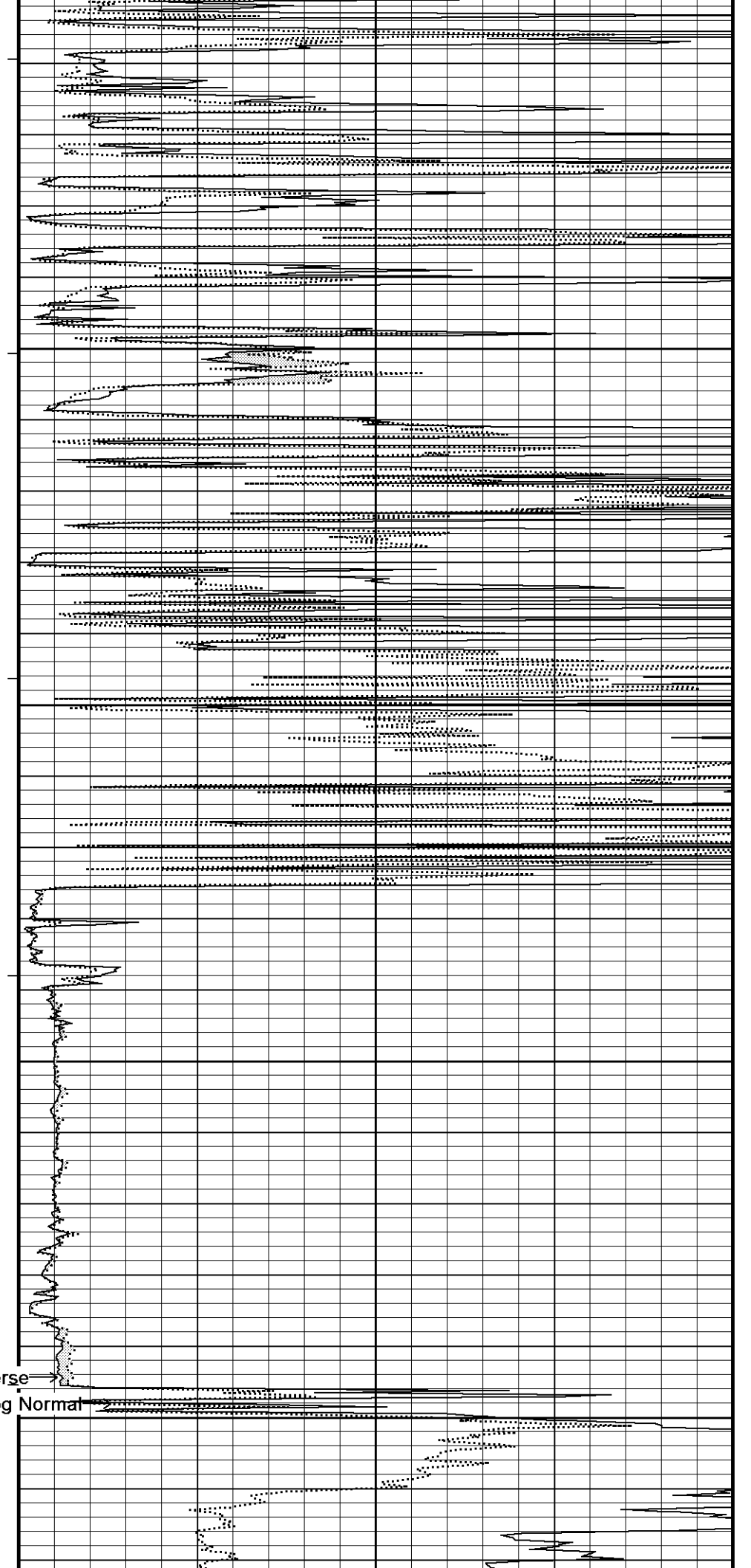
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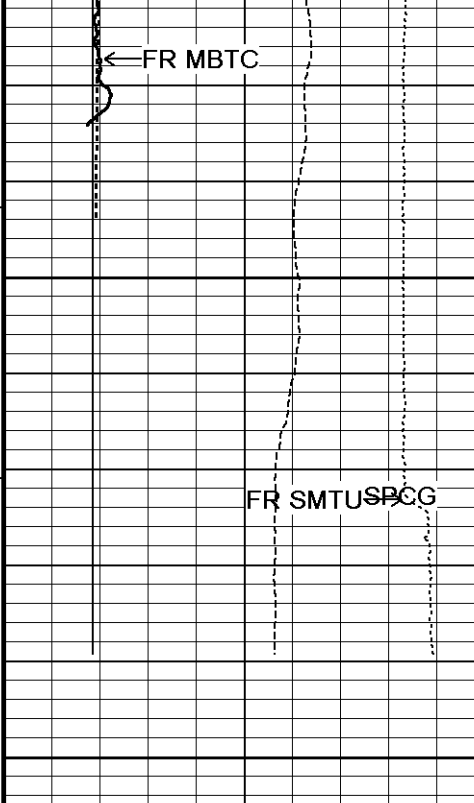






108°  
 4650  
 109°  
 4700  
 108°  
 4750  
 107°  
 4800





4850

4900

Depth  
in  
Feet

← Timing Marks  
every 60.0 sec

Gamma Ray  
API  
0 75 150  
150 225 300

Spontaneous Potential  
millivolts  
- -> | 20 | <- +

MMR Caliper  
inches  
6 11 16

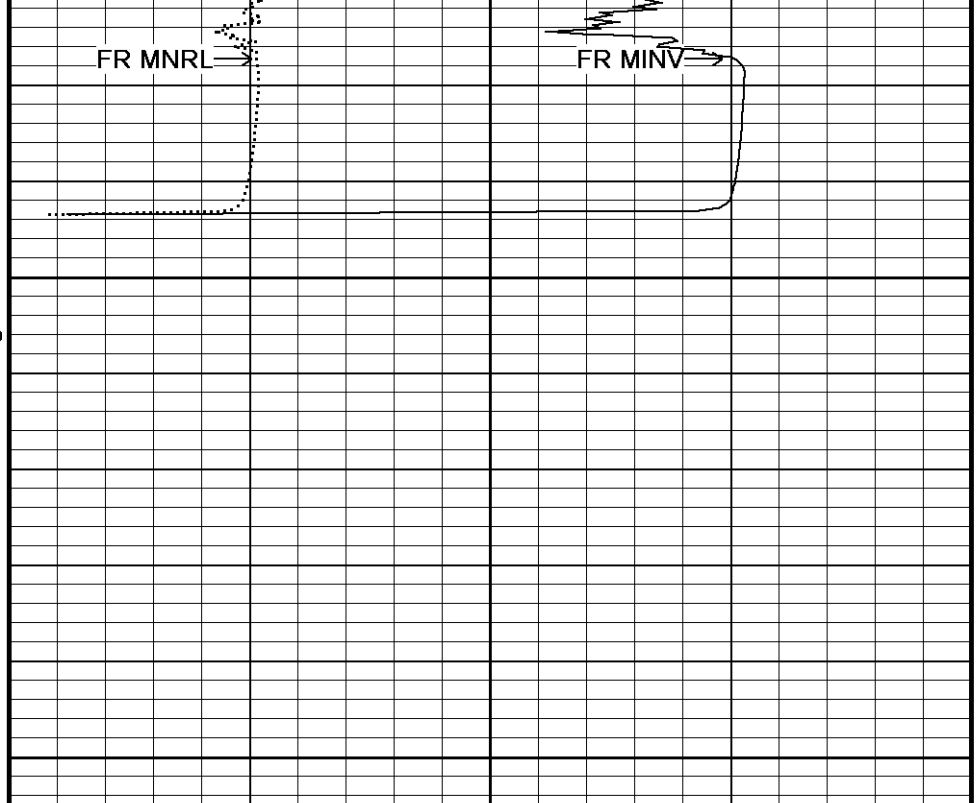
Bit Size  
inches  
6 11 16

DST Uphole Tension  
pounds  
5000 0

Borehole  
Temp in  
deg F

Annular  
Integral  
every  
10 cu ft

Replay  
Scale  
1:240



0 10 20 30 40

0 10 20 30 40



REPEAT SECTION

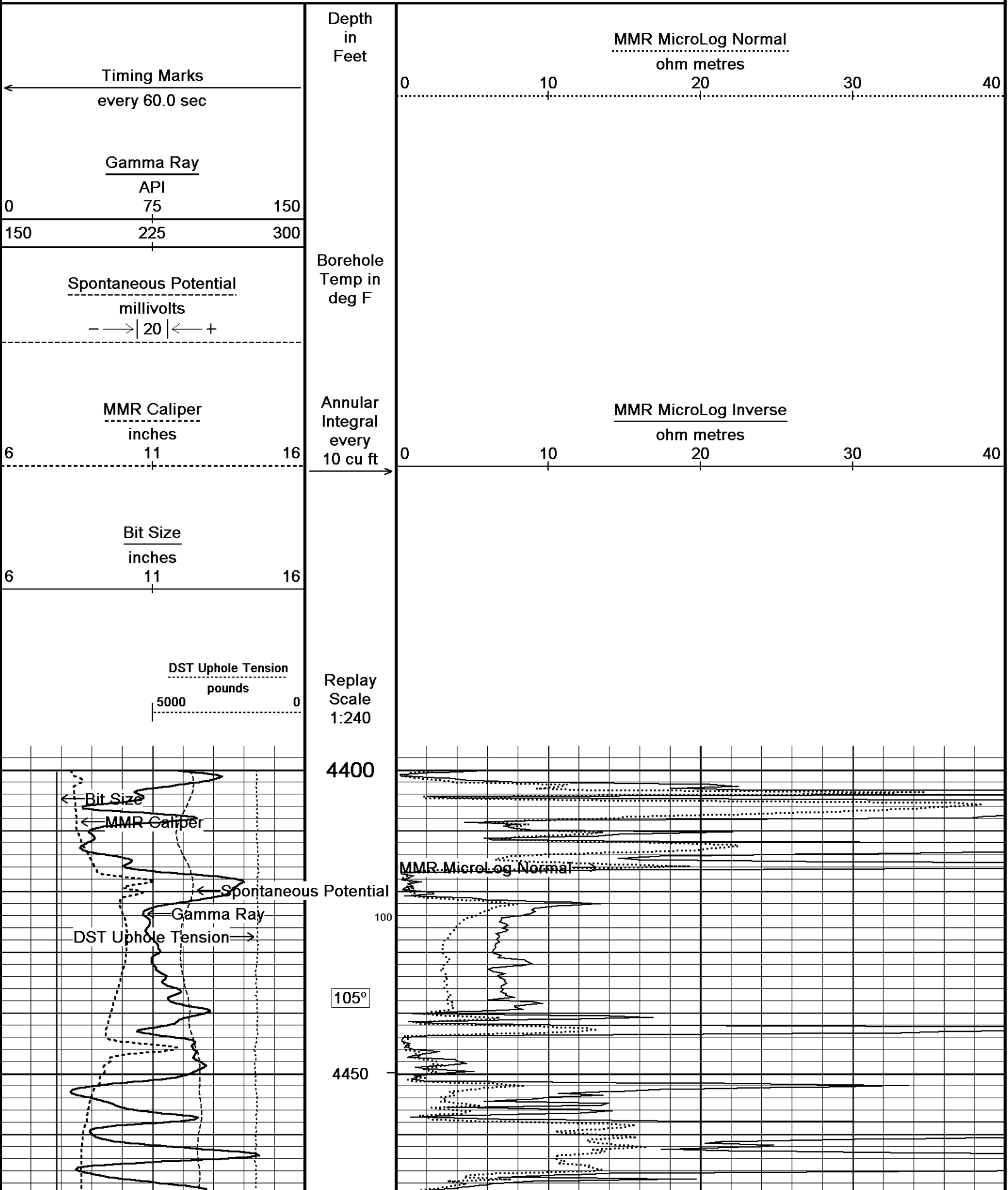
Depth Based Data - Maximum Sampling Increment 10.0cm

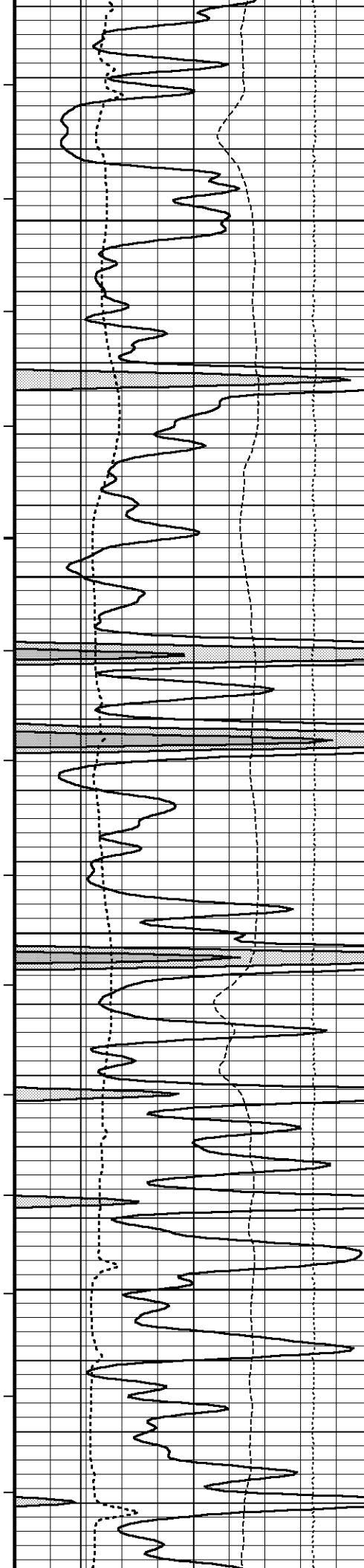
Plotted on 30-MAR-2013 15:10

Filename: C:\Minimus 13.04.8492\Data\Shakespeare Nighte...\Shakespeare Nightengale #1-28\_002.dta

Recorded on 30-MAR-2013 11:03

System Versions: Logged with 13.04.8492 Processed with 13.04.8492 Plotted with 13.04.8492





105°

4500

105°

4550

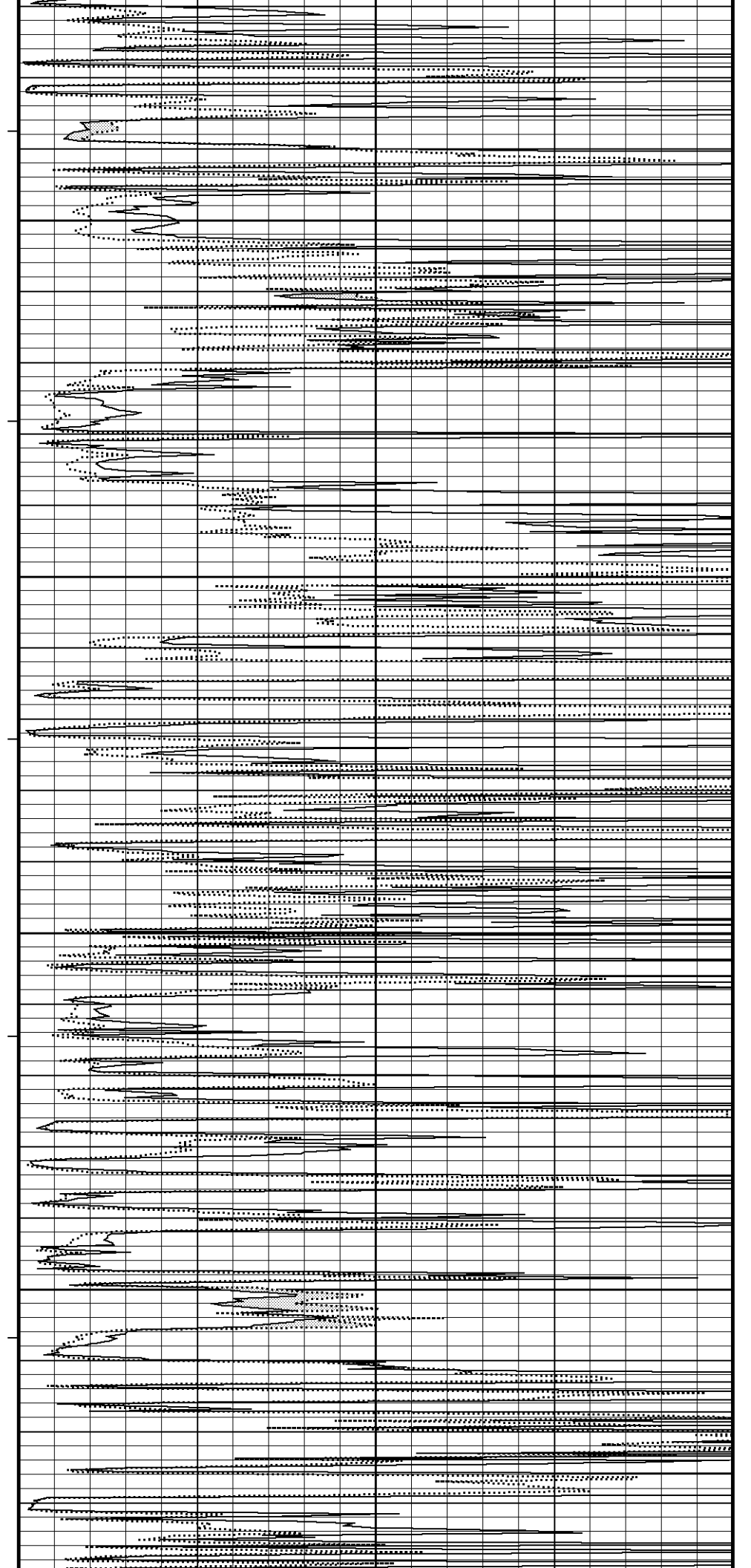
105°

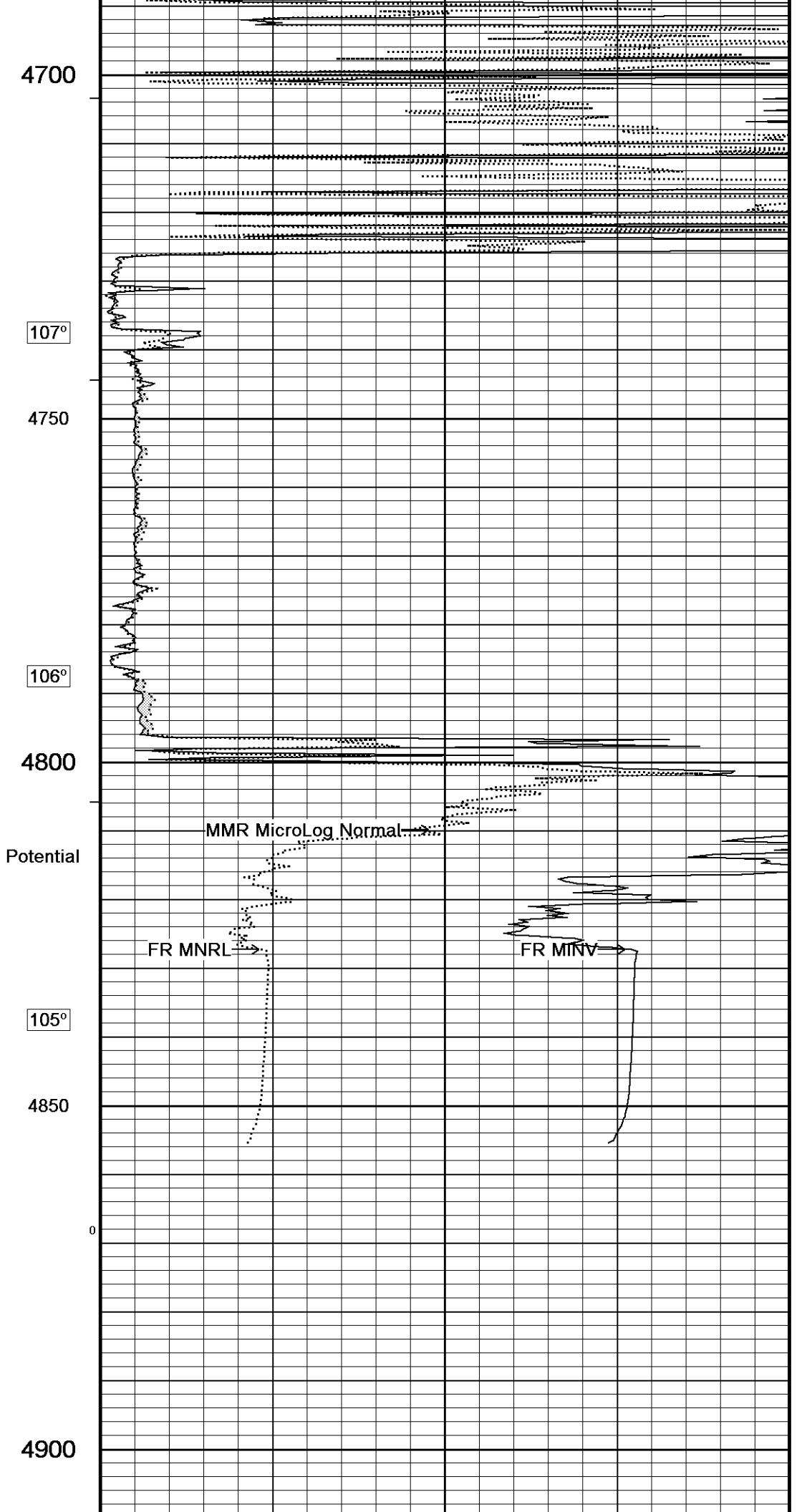
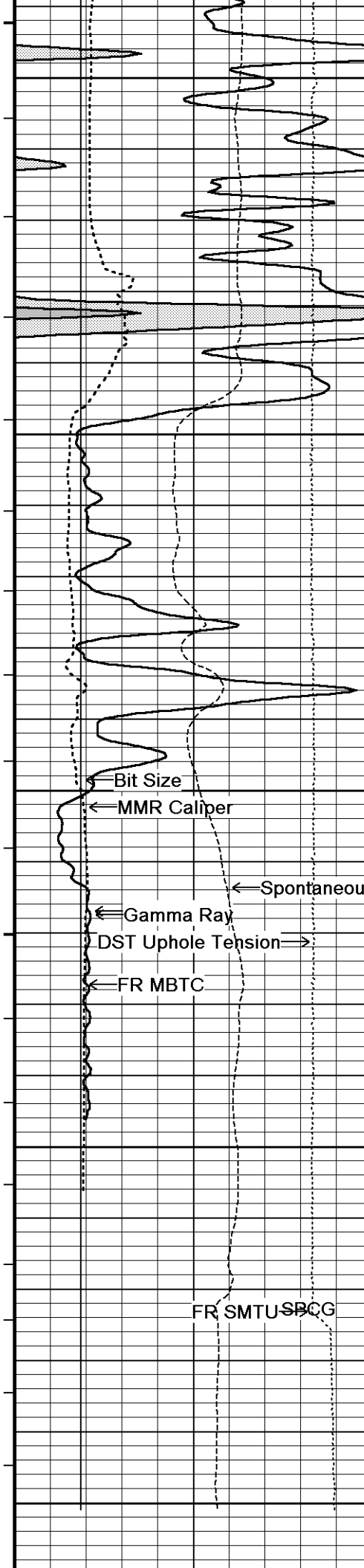
4600

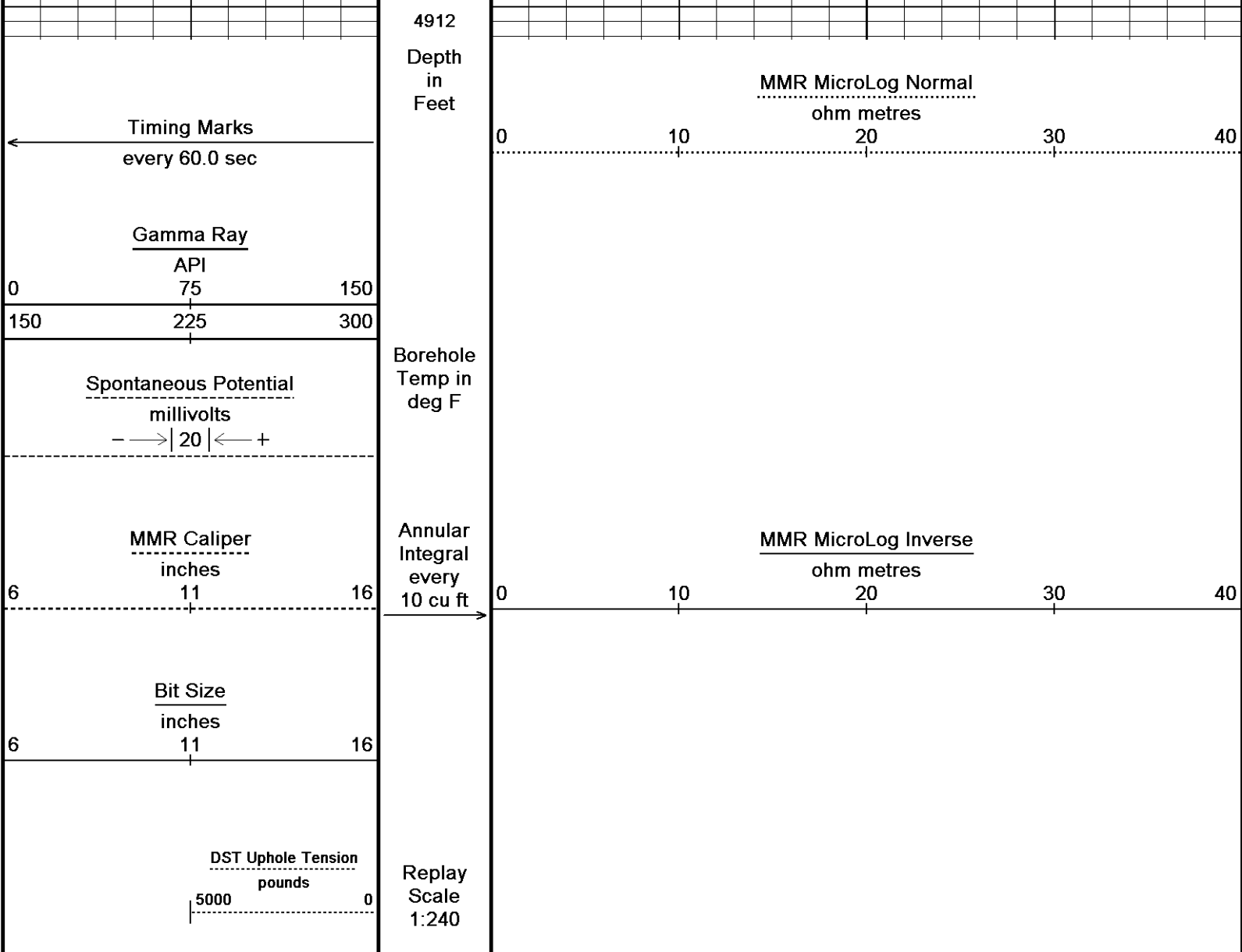
106°

4650

107°







Depth Based Data - Maximum Sampling Increment 10.0cm Plotted on 30-MAR-2013 15:10  
 Filename: C:\Minimus 13.04.8492\Data\Shakespeare Nighte...\Shakespeare Nightengale #1-28\_002.dta Recorded on 30-MAR-2013 11:03  
 System Versions: Logged with 13.04.8492 Processed with 13.04.8492 Plotted with 13.04.8492

↑ REPEAT SECTION ↑

**BEFORE SURVEY CALIBRATION**  
 C:\Minimus 13.04.8492\Data\Shakespeare Nightengale #1-28\Shakespeare Nightengale #1-28\_002.dta

General Constants All 000 Last Edited on 30-MAR-2013,09:17

General Parameters  
 Mud Resistivity 0.490 ohm-metres  
 Mud Resistivity Temperature 72.000 degrees F  
 Water Level 0.000 feet  
 Borehole Fluid Processing Wet Hole

Hole/Annular Volume and Differential Caliper Parameters  
 HVOL Method Single Caliper  
 HVOL Caliper 1 Density Caliper  
 HVOL Caliper 2 N/A  
 Annular Volume Diameter 5.500 inches  
 Caliper for Differential Caliper Density Caliper

Rwa Parameters  
 Porosity used Base Density Porosity  
 Resistivity used Array Ind. Six Res Rt  
 RWA Constant A 1.000

## Down-hole Tension Calibration SMS 0

Field Calibration on 29-MAR-2013 11:57

Reading No	Measured	Calibrated (lbs)
1	13764.62	0.00
2	14299.14	460.00

## Gamma Calibration MCG-B 34

Field Calibration on 28-MAR-2013 11:13

	Measured	Calibrated (API)
Background	71	49
Calibrator (Gross)	1120	774
Calibrator (Net)	1049	725

## Gamma Constants MCG-B 34

Last Edited on 30-MAR-2013,09:13

Gamma Calibrator Number	GR38	
Mud Density	1.11	gm/cc
Caliper Source for Processing	Density Caliper	
Tool Position	Eccentred	
Concentration of KCl	0.00	kppm

## SP Calibration MCG-B 34

Field Calibration on 29-MAR-2013,12:58

	Measured	Calibrated (mV)
Reference 1	101.0	100.0
Reference 2	-99.0	-100.0

## High Resolution Temperature Calibration MCG-B 34

Field Calibration on 29-MAR-2013,12:58

	Measured	Calibrated(Deg F)
Lower	50.00	50.00
Upper	75.00	75.00

## High Resolution Temperature Constants MCG-B 34

Last Edited on 29-MAR-2013,12:58

Pre-filter Length	11
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## Micro Laterolog Calibration MMR-A 11

Base Calibration on 31-DEC-1999 00:00

Field Check on 31-DEC-1999 00:00

Base Calibration		Measured		Calibrated (ohm-m)	
	Ref 1	Ref 2	Ref 1	Ref 2	
	0.0	0.0	0.0	0.0	
	Base Check (ohm-m)		Field Check (ohm-m)		
	0.0		0.0		

## Micro Laterolog Constants MMR-A 11

Last Edited on

Pad Type	6 in Solid Nylon B23059	
Micro Laterolog K Factor	0.0128	
Standoff Offset	0.0000	inches
Mudcake Thickness Correction Constants		
Mud Cake Source	Constant Value	
Mud Cake Thickness	0.4000	inches
Mud Cake Thickness Caliper		
Mud Cake Resistivity	0.1500	ohm-m
Mud Cake Resistivity Temp.	20.00	Degrees C
Mud Cake Resistivity Source	Constant Value	
Temp. Source Rmc Correc.	MCG External Temperature	

## Micro Normal and Micro Inverse Calibration MMR-A 11

Base Calibration on 08-MAR-2013 17:36

Field Check on 28-MAR-2013 11:05

Base Calibration		Measured		Calibrated (ohm-m)	
Channel	Resistor 1	Resistor 2	Resistor 1	Resistor 2	
Micro Normal	12.4	60.0	5.0	25.0	
Micro Inverse	15.5	77.5	5.0	25.0	
Channel	Base Check (ohm-m)		Field Check (ohm-m)		
Micro Normal	76.3		76.3		
Micro Inverse	50.7		50.7		

## Micro Normal and Micro Inverse Constants MMR-A 11

Last Edited on 05-NOV-2012,13:54

Pad Type 8-12 in Soft Rubber Inflatable 006-9011-159  
 Micro Normal K Factor 1.0000  
 Micro Inverse K Factor 1.0000  
 Standoff Offset 0.0000 inches

## Caliper Calibration MMR-A 11

Base Calibration on 08-MAR-2013 17:30

Field Calibration on 28-MAR-2013 11:03

## Base Calibration

Reading No	Measured	Calibrator Size (in)
1	13647	5.98
2	16765	7.97
3	19976	9.86
4	23885	11.92
5	0	0.00
6	N/A	N/A

## Field Calibration

Measured Caliper (in)	Actual Caliper (in)
6.02	5.98

## Neutron Calibration MDN-A.B 65

Base Calibration on 13-MAR-2013 16:17

Field Check on 28-MAR-2013 11:17

## Base Calibration

	Measured		Calibrated (cps)	
	Near	Far	Near	Far
	2980	92	3714	110
Ratio	32.499		33.764	

## Field Calibrator at Base

Calibrated (cps)	
1736	2464
Ratio 0.705	

## Field Check

Calibrated (cps)	
1736	2470
Ratio 0.688	

## Neutron Constants MDN-A.B 65

Last Edited on 29-MAR-2013,11:23

Neutron Source Id	PN-521	
Neutron Jig Number	5824NE	
Epithermal Neutron	No	
Caliper Source for Processing	Density Caliper	
Stand-off	0.00	inches
Mud Density	1.00	gm/cc
Limestone Sigma	7.10	cu
Sandstone Sigma	4.26	cu
Dolomite Sigma	4.70	cu
Formation Pressure Source	None	
Formation Pressure	0.00	kpsi
Temperature Source	None	
Temperature	20.00	degrees F
Mud Salinity	0.00	kppm
Salinity Correction	Not Applied	
Formation Fluid Salinity Source	None	
Formation Fluid Salinity	0.00	kppm
Barite Mud Correction	Not Applied	

## FE Calibration MFE-B.J 352

Base Calibration on 16-JAN-2013 10:20

Field Check on 28-MAR-2013 11:02

## Base Calibration

	Measured	Calibrated (ohm-m)
Reference 1	0.0	0.0
Reference 2	964.3	126.8

Base Check	281.2
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Field Check	281.5
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## FE Constants MFE-B.J 352

Last Edited on 29-MAR-2013,11:23

Running Mode	No Sleeve	
MFE K Factor	0.1268	
Caliper Source for FE correction	Density Caliper	
Caliper Value for FE correction	N/A	inches
Rm Source for FE correction	Temperature Corr	
Temp. for Rm Corr.	MCG External Temperature	
Stand-off	0.5	inches

Sonic Constants MSS-C.K 330

Last Edited on 29-MAR-2013,11:23

Maximum Boundary Contrast	100.00	micro-sec/ft
Fluid Transit Time	189.00	micro-sec/ft
Limestone Transit Time	47.50	micro-sec/ft
Sandstone Transit Time	55.50	micro-sec/ft
Dolomite Transit Time	43.50	micro-sec/ft
Sonic used for Porosities	3-5' Compensated Sonic	
Correction for Sonde Skew	Applied	
Cycle Stretch Algorithm	Applied	
MN3FT	N/A	micro-sec
MX3FT	N/A	micro-sec
Hunt-Raymer Constant	83.13	micro-sec/ft

Sonde Mode	Compensated
Hole Type	Open Hole

Sonde Parameters

	Measured	Calibrated
Offset	N/A	0.0000
Free Pipe	N/A	N/A
Peak Amplitude Source		N/A

Waveform	Start Time (micro-sec)	Width (micro-sec)	Pre Gain	Start Gain	Discriminator (mV)
3'	N/A	N/A	N/A	N/A	N/A
4'	N/A	N/A	N/A	N/A	N/A
5'	N/A	N/A	N/A	N/A	N/A
6'	N/A	N/A	N/A	N/A	N/A

Processed Fixed Gate Parameters

Waveform Used For Processing	N/A			
Start Time (micro-sec)	End Time (micro-sec)	Discriminator (mV)	N/A	
N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A

Full Waveform Parameters

Use 3' Waveform to derive TR	N/A
Use 4' Waveform to derive TR	N/A
Use 5' Waveform to derive TR	N/A
Use 6' Waveform to derive TR	N/A
3' Waveform Discriminator Level	N/A mV
4' Waveform Discriminator Level	N/A mV
5' Waveform Discriminator Level	N/A mV
6' Waveform Discriminator Level	N/A mV
3' Waveform Filter	N/A
4' Waveform Filter	N/A
5' Waveform Filter	N/A
6' Waveform Filter	N/A
Semblance Level	N/A
Semblance Window Width	N/A micro-sec
Sonic 1 Despiker	N/A
Sonic 2 Despiker	N/A

High Resolution Temperature Calibration MAI-A.A 45

Field Calibration on 13-DEC-2012,10:54

Measured	Calibrated(Deg F)
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Lower 50.00 50.00  
Upper 75.00 75.00

High Resolution Temperature Constants MAI-A.A 45

Last Edited on 29-MAR-2013,12:59

Pre-filter Length 11

Induction Calibration MAI-A.A 45

Base Calibration on 26-JUL-2012,09:22  
Field Check on 28-MAR-2013 11:01

Base Calibration

Test Loop Calibration

Channel	Measured		Calibrated (mmho/m)	
	Low	High	Low	High
1	14.4	472.6	9.3	966.2
2	5.7	374.0	7.6	821.4
3	3.4	261.2	5.2	566.0
4	2.5	133.9	2.6	279.2

Array Temperature 78.4 Deg F

Channel	Base Check (mmho/m)		Field Check (mmho/m)	
	Low	High	Low	High
1			18.3	3850.9
2			31.7	3628.9
3			28.6	3048.9
4			18.3	2078.8
Deep			16.0	1910.7
Medium			42.5	4060.0
Shallow			49.5	5482.7

Array Temperature 58.1 Deg F

Induction Constants MAI-A.A 45

Last Edited on 29-MAR-2013,12:59

Induction Model RtAP-WBM  
 Caliper for Borehole Corr. Density Caliper  
 Hole Size for Borehole Correction 2.500 inches  
 Tool Centred No  
 Stand-off Type Fins  
 Stand-off 0.50 inches  
 Number of Fins on Stand-off 8.0000  
 Stand-off Fin Angle 45.00 degrees  
 Stand-off Fin Width 0.5000 inches  
 Borehole Corr. Rm Source Temperature Corr  
 Temp. for Rm Corr. MCG External Temperature  
 Squasher Start 0.0020 mhos/metre  
 Squasher Offset N/A mhos/metre

Borehole Normalisation

DRM1	0.0000	DRC1	0.0000
DRM2	0.0000	DRC2	0.0000
MRM1	0.0000	MRC1	0.0000
MRM2	0.0000	MRC2	0.0000
SRM1	0.0000	SRC1	0.0000
SRM2	0.0000	SRC2	0.0000

Calibration Site Corrections

Channel 1	0.00	mmhos/metre
Channel 2	0.00	mmhos/metre
Channel 3	0.00	mmhos/metre
Channel 4	0.00	mmhos/metre

Apparent Porosity and Water Saturation Constants

Archie Constant (A) 1.00  
 Cementation Exponent (M) 2.00  
 Saturation Exponent (N) 2.00  
 Saturation of Water for Apor 100.00 percent  
 Resistivity of Water for Apor and Sw 0.05 ohm-m  
 Resistivity of Mud Filtrate for Sw 0.00 ohm-m  
 Source for Rt 0.00  
 Source for Rxo 0.00

Caliper Calibration MPD-B 31

Base Calibration on 28-MAR-2013 13:43  
Field Calibration on 28-MAR-2013 13:47



## Base Calibration

Reading No	Measured	Calibrator Size (in)
1	16832	3.99
2	24690	5.98
3	33328	7.97
4	41600	9.86
5	50976	11.92
6	N/A	N/A

## Field Calibration

Measured Caliper (in)	Actual Caliper (in)
6.02	5.98

## Photo Density Calibration MPD-B 31

Base Calibration on 13-MAR-2013 15:17  
Field Check on 28-MAR-2013 13:51

## Density Calibration

Base Calibration	Measured		Calibrated (sdu)	
	Near	Far	Near	Far
Reference 1	46119	23502	59556	30836
Reference 2	19149	1933	24941	2541

## Field Check at Base

681.1      838.4

## Field Check

679.6      841.1

## PE Calibration

Base Calibration	WS	Measured		Calibrated
		WH	Ratio	Ratio
Background	125	604		
Reference 1	19219	46004	0.421	0.371
Reference 2	5674	19062	0.301	0.272

## Field Check at Base

125.1      603.7

## Field Check

125.6      602.3

## Density Constants MPD-B 31

Last Edited on 30-MAR-2013,09:12

Density Source Id	254	
Nylon Calibrator Number	DNCE695	
Aluminium Calibrator Number	DACD698	
Density Shoe Profile	8 inch	
Caliper Source for Processing	Density Caliper	
PE Correction to Density	Not Applied	
Mud Density	1.11	gm/cc
Mud Density Z/A Multiplier	1.11	
Mud Filtrate Density	1.00	gm/cc
Dry Hole Mud Filtrate Density	1.00	gm/cc
DNCT	0.00	gm/cc
CRCT	0.00	gm/cc
Density Z/A Correction	Hybrid	
Matrix Density (gm/cc)	Depth (ft)	
2.71	0.00	
0.00	0.00	
0.00	0.00	
0.00	0.00	
0.00	0.00	
0.00	0.00	
0.00	0.00	
0.00	0.00	
0.00	0.00	

## DOWNHOLE EQUIPMENT

C:\Minimus 13.04.8492\Data\Shakespeare Nightengale #1-28\Shakespeare Nightengale #1-28\_002.dta

Compact Comms Gamma  
MCG-B 34 LG: 8.70 ft WT: 63.9 lb OD: 2.24 in

Compact Micro-Resistivity  
MMR-A 11 LG: 8.59 ft WT: 81.6 lb OD: 4.88 in

Compact Neutron  
MDN-A.B 65 LG: 5.04 ft WT: 50.7 lb OD: 2.24 in

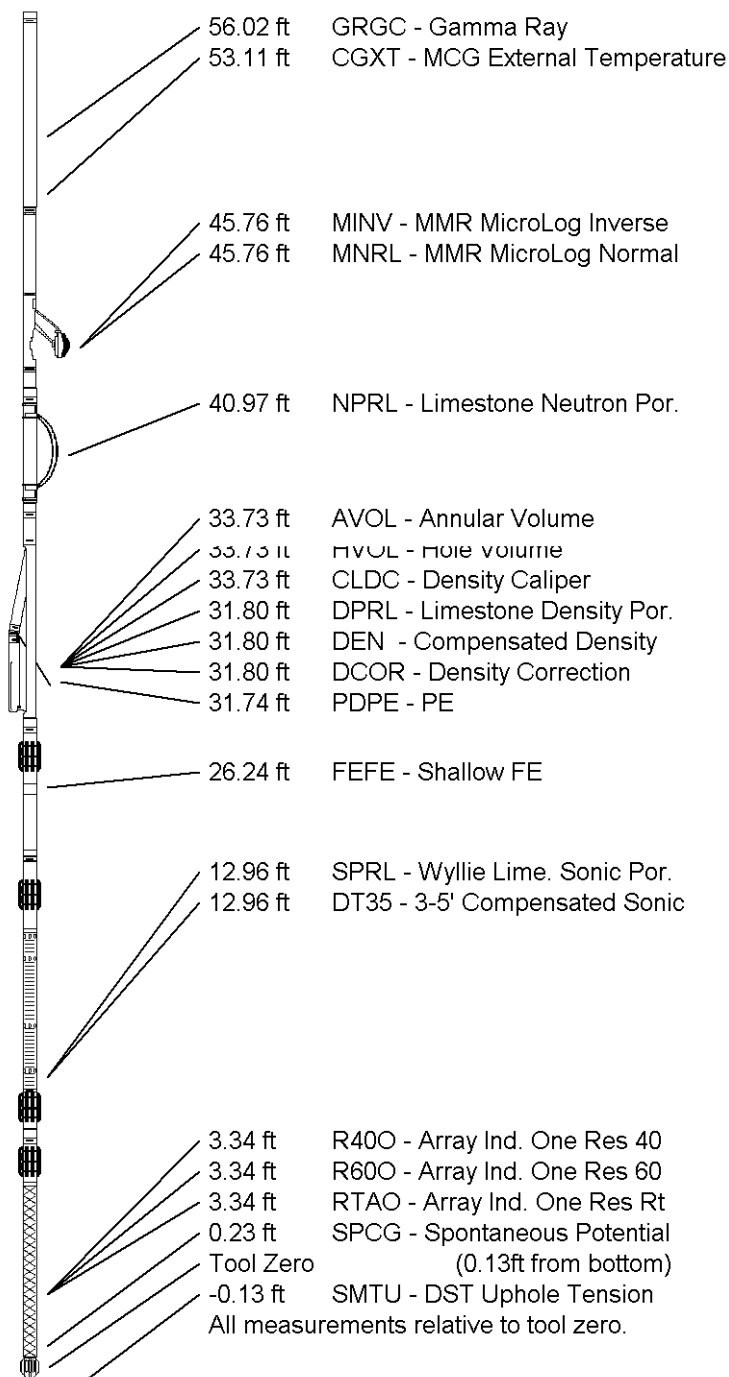
Compact Density/Caliper  
MPD-B 31 LG: 9.59 ft WT: 90.4 lb OD: 2.45 in

Compact Focussed Electric  
MFE-B.J 352 LG: 6.05 ft WT: 48.5 lb OD: 2.24 in

Compact Sonic  
MSS-C.K 330 LG: 12.52 ft WT: 72.8 lb OD: 2.24 in

Compact Induction  
MAI-A.A 45 LG: 10.81 ft WT: 48.5 lb OD: 2.24 in

Total Length: 61.30 ft Weight: 456.4 lb



**COMPANY** SHAKESPEARE OIL COMPANY  
**WELL** NIGHTINGALE #1-28  
**FIELD** WILDCAT  
**PROVINCE/COUNTY** SCOTT  
**COUNTRY/STATE** UNITED STATES / KANSAS

Elevation Kelly Bushing	3140.00	feet	First Reading	4827.00	feet
Elevation Drill Floor	3138.00	feet	Depth Driller	4875.00	feet
Elevation Ground Level	3130.00	feet	Depth Logger	4873.00	feet



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