



**Weatherford**

**ARRAY INDUCTION  
SHALLOW FOCUSED  
ELECTRIC LOG**

COMPANY	WESTERN OPERATING COMPANY		
WELL	HELFRICH #1-6		
FIELD	HELFRICH		
PROVINCE/COUNTY	HAMILTON		
COUNTRY/STATE	U.S.A. / KANSAS		
LOCATION	1320' FSL & 1980' FEL		
SEC	TWP	RGE	Other Services
6	25S	42W	MPD/MDN
API Number	15-075-20865		MML
Permit Number			
Permanent Datum GL, Elevation	357.4 feet		
Log Measured From	KB		
Drilling Measured From	KB		
Date	04-JAN-2013		
Run Number	ONE		
Service Order	3537801		
Depth Driller	5400.00 feet		
Depth Logger	5394.00 feet		
First Reading	5391.00 feet		
Last Reading	840.00 feet		
Casing Driller	843.00 feet		
Casing Logger	840.00 inches		
Bit Size	7.875		
Hole Fluid Type	CHEMICAL	lb/USg	
Density / Viscosity	9.50 lb/USg	53.00 CP	
PH / Fluid Loss	10.00	10.00	
Sample Source	FLOWLINE		
Rm @ Measured Temp	1.26 @ 79.0	ohm-m	
Rmf @ Measured Temp	1.01 @ 79.0	ohm-m	
Rmc @ Measured Temp	1.51 @ 79.0	ohm-m	
Source Rmf / Rmc	CALC	CALC	
Rm @ BHT	0.85 @ 121.0	ohm-m	
Time Since Circulation	4 HOURS		
Max Recorded Temp	121.00	deg F	
Equipment / Base	13096	LIB	
Recorded By	ADAM SILL		
Witnessed By	PETER DEBENHAM		
JOB #	LB13-004		

Elevations:	feet
KB	3586.00
DF	3585.00
GL	3574.00

**BOREHOLE RECORD**

Last Edited: 04-JAN-2013 01:25

Bit Size inches	Depth From feet	Depth To feet
7.875	843.00	5400.00

**CASING RECORD**

Type	Size inches	Depth From feet	Shoe Depth feet	Weight pounds/ft
SURFACE	8.625	0.00	843.00	24.00

**REMARKS**

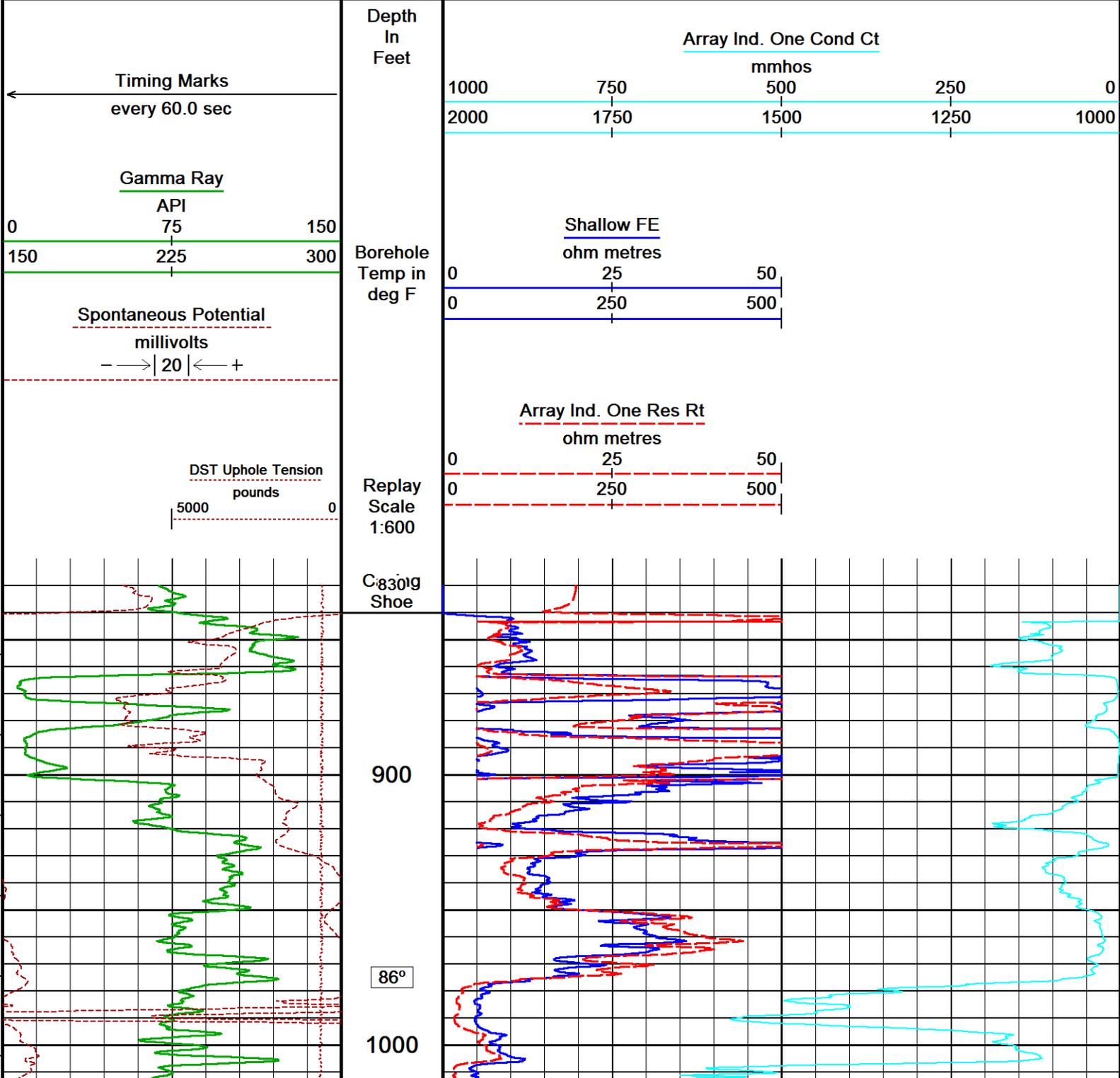
- SOFTWARE ISSUE: WLS 13.04.8492.
- MCG, MML, MDN, MPD, MFE, MAI RAN IN COMBINATION.
  - HARDWARE: DUAL BOWSPRING USED ON MDN.
  - 0.5 INCH STANDOFF USED ON MFE.
  - 0.5 INCH STANDOFF USED ON MAI.
- 2.71 G/CC LIMESTONE DENSITY MATRIX USED TO CALCULATE POROSITY.
- BOREHOLE RUGOSITY, TIGHT PULLS, AND WASHOUTS WILL AFFECT DATA QUALITY.
- ALL INTERVALS LOGGED AND SCALED PER CUSTOMER'S REQUEST.
- TOTAL HOLE VOLUME FROM TD TO SURFACE CASING: 1950 CU. FT.
- ANNULAR HOLE VOLUME WITH 5.5 INCH CASING FROM TD TO 2300 FT: 575 CU. FT.
- SERVICE ORDER # 3537801

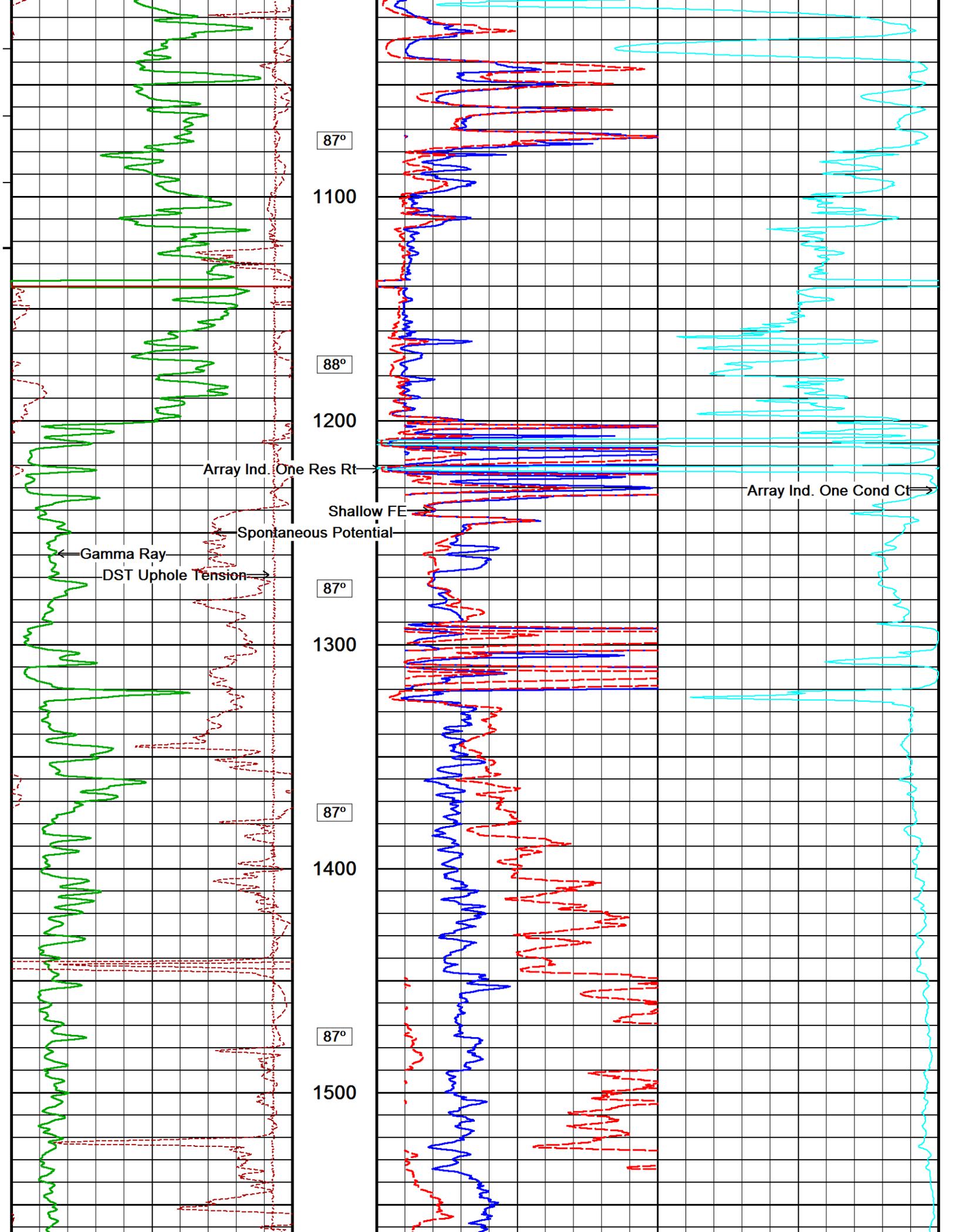
- RIG: MURFIN #25.  
 - ENGINEER: A. SILL.  
 - OPERATOR(S): M. STEGMAN.

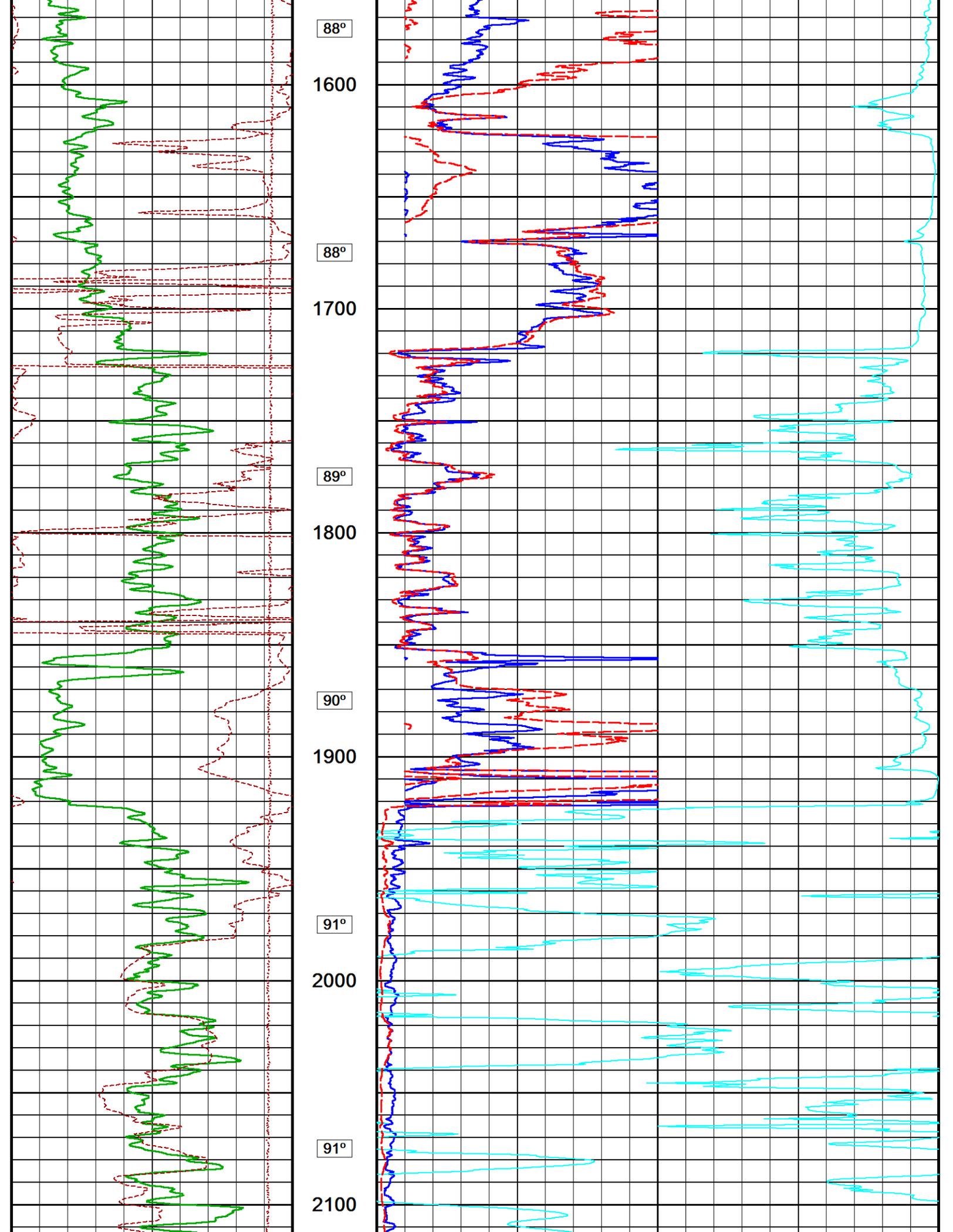
All interpretations are opinions based on inferences from electrical or other measurements and we cannot, and do not, guarantee the accuracy or correctness of any interpretations, and we shall not, except in the case of gross or wilful negligence on our part, be liable or responsible for any loss, costs, 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.

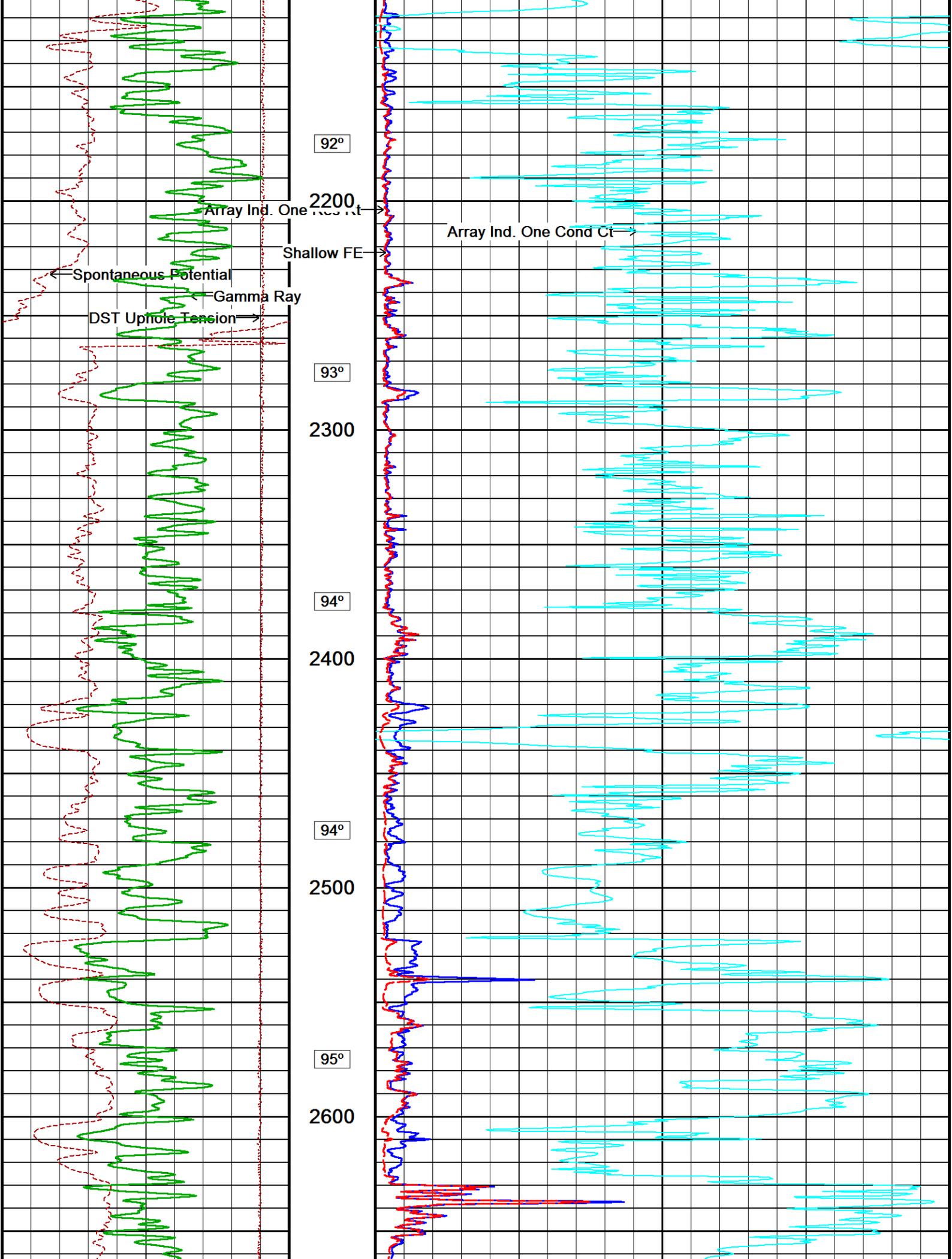
**2 INCH MAIN**

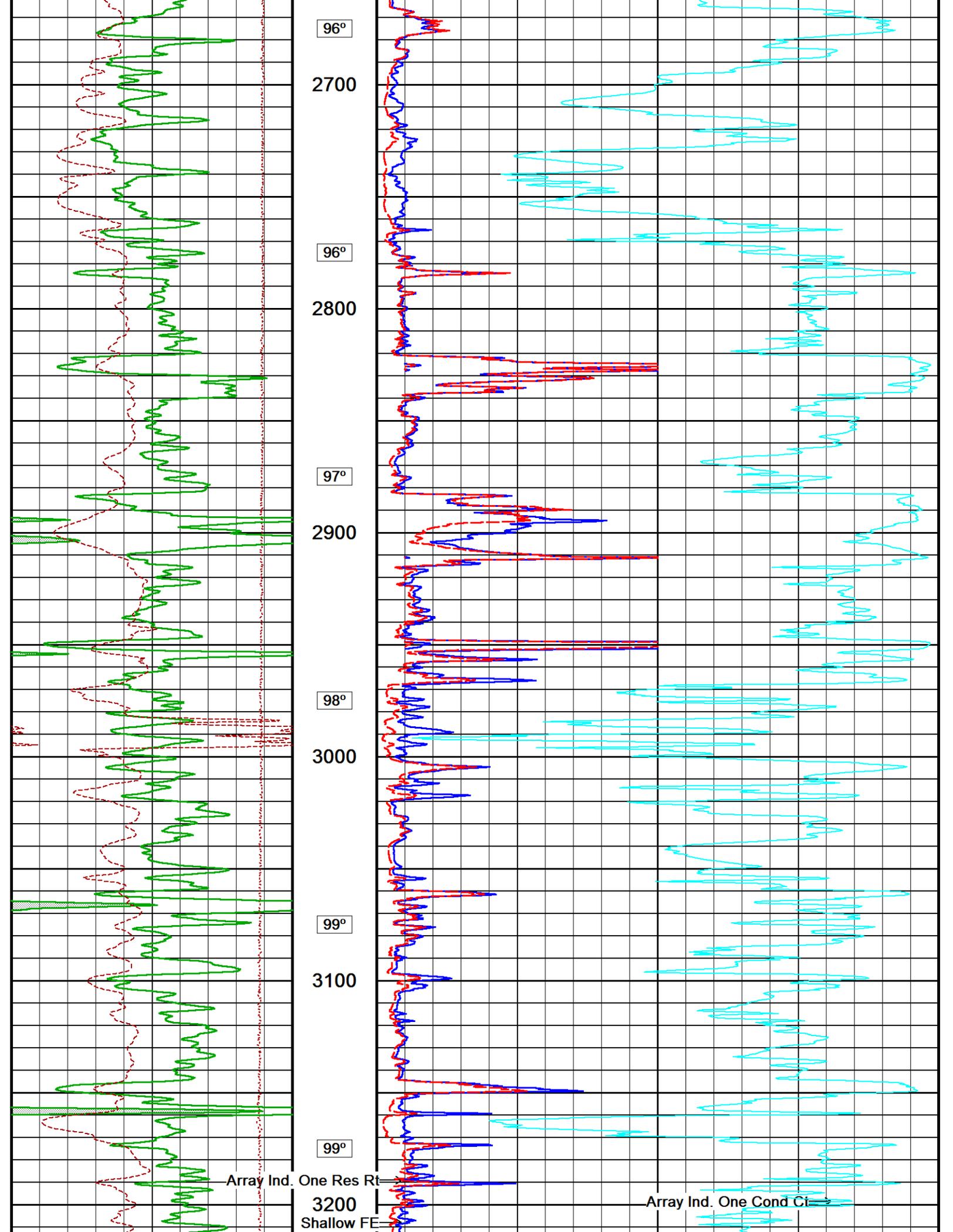
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 System Versions: Logged with 13.04.8492 Plotted with 13.05.8506

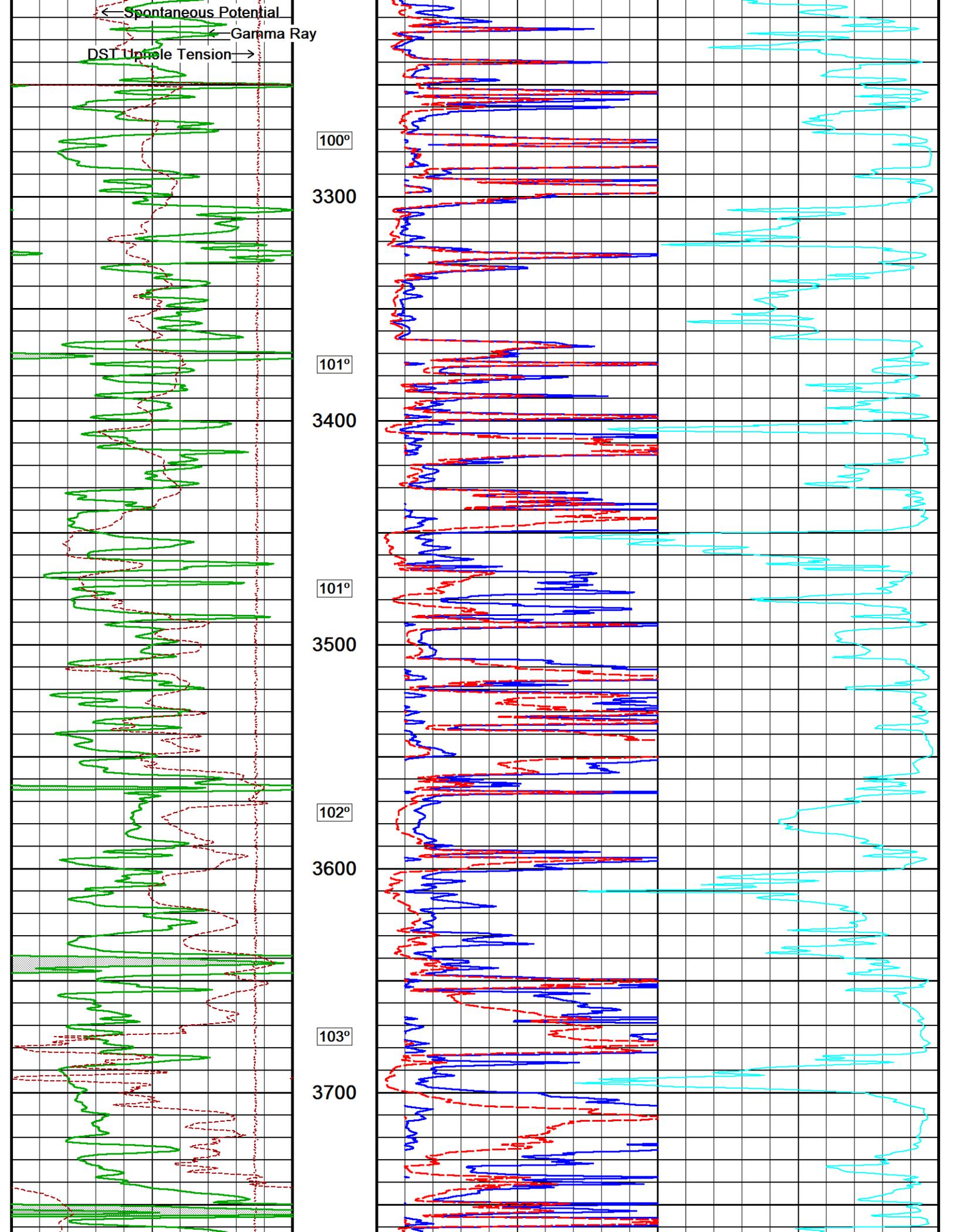


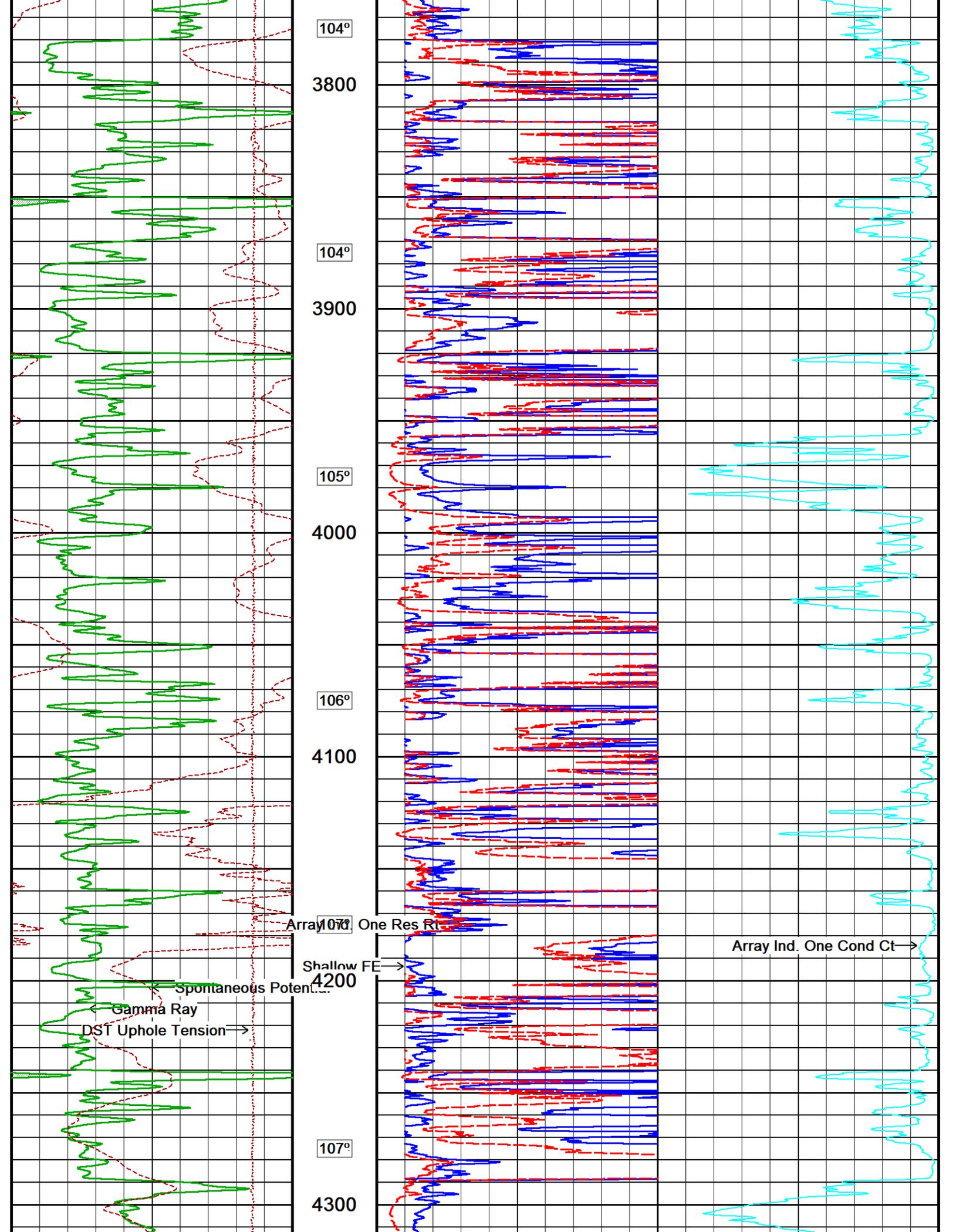


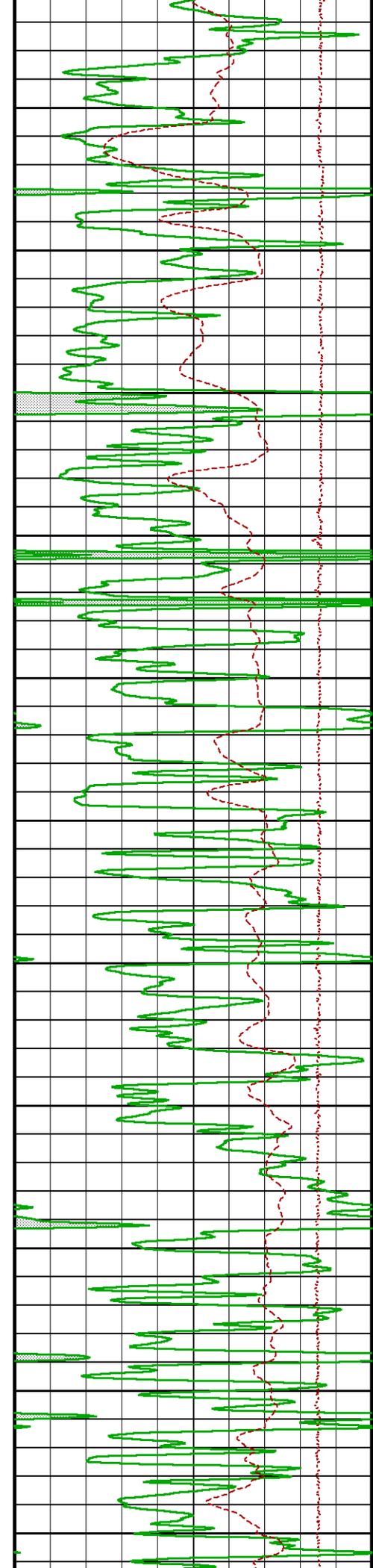












109°

4400

110°

4500

111°

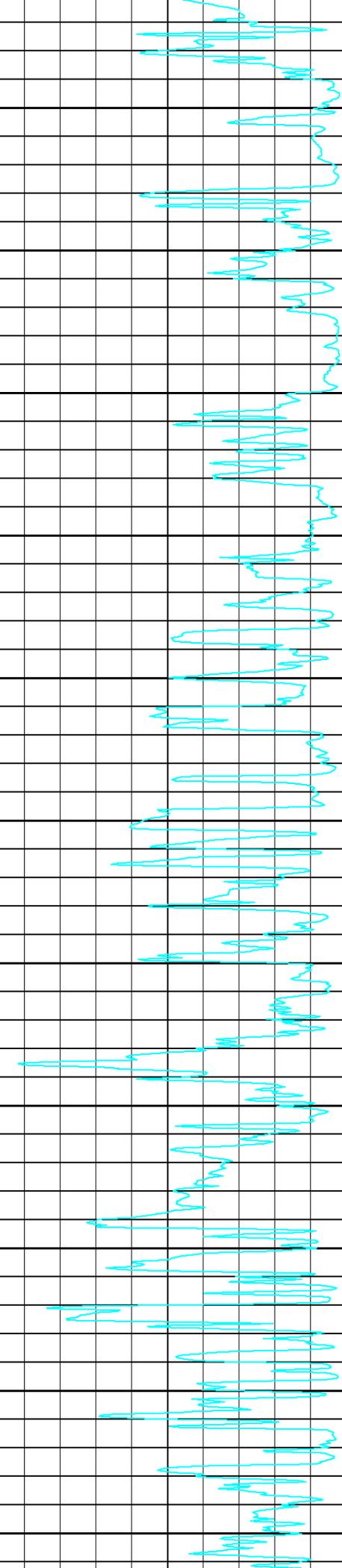
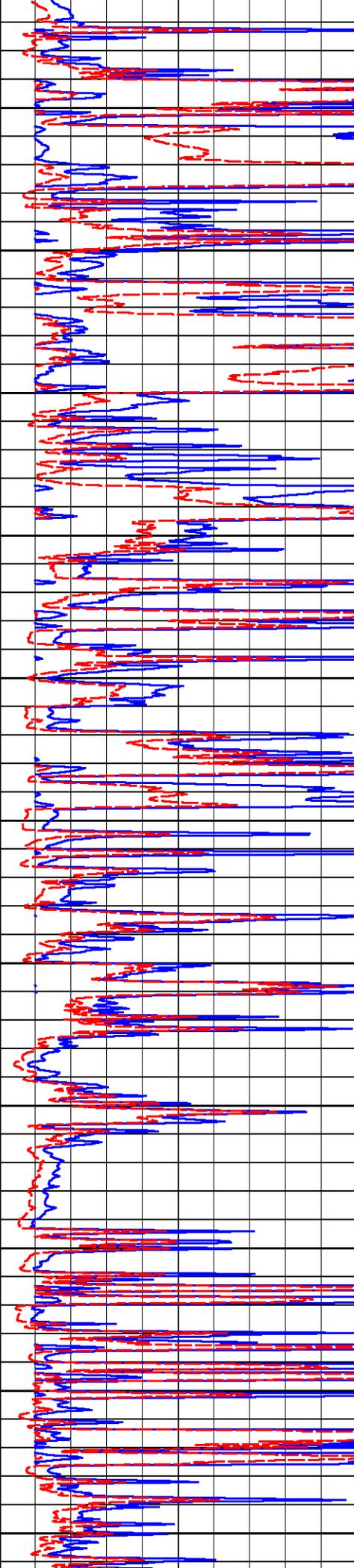
4600

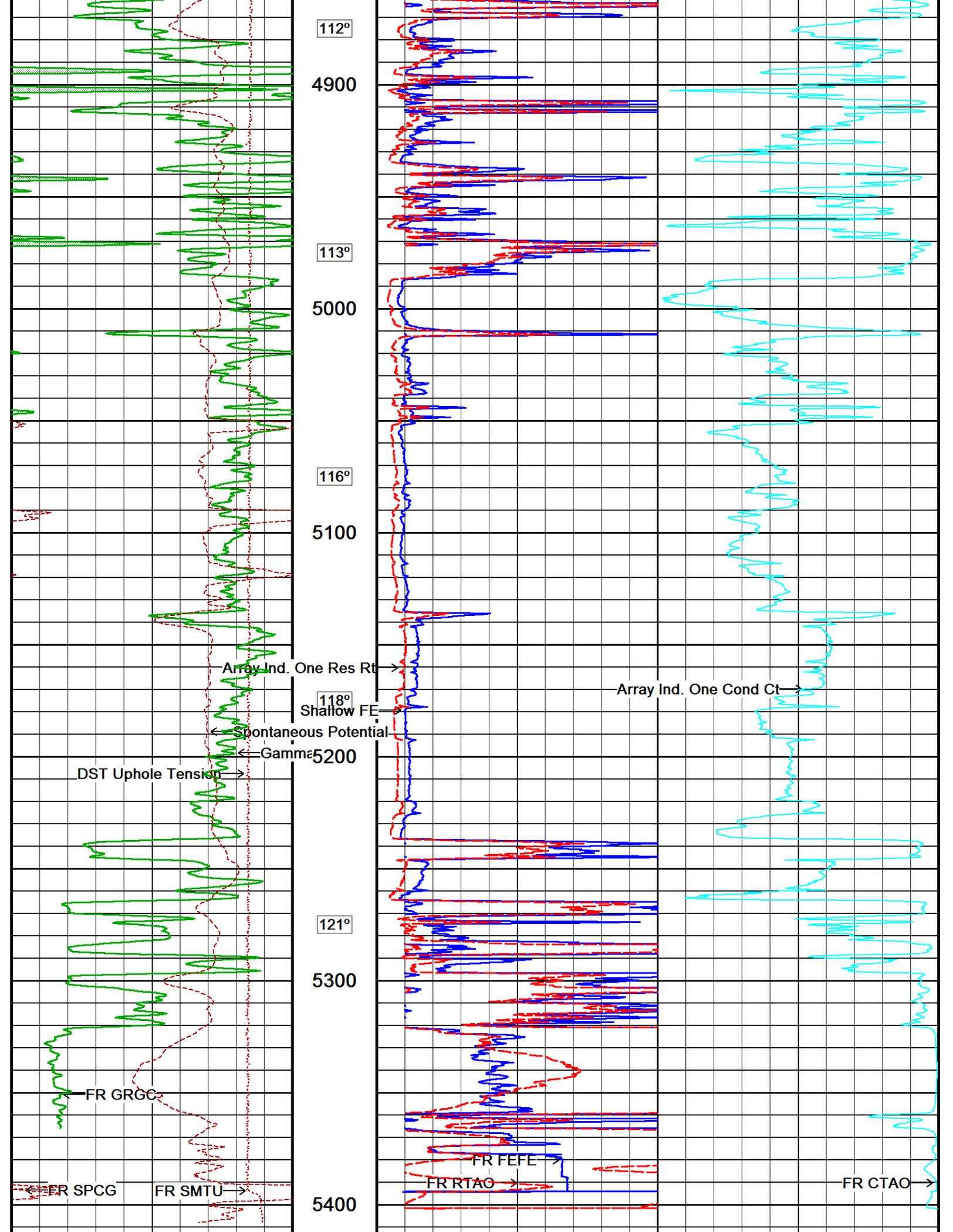
113°

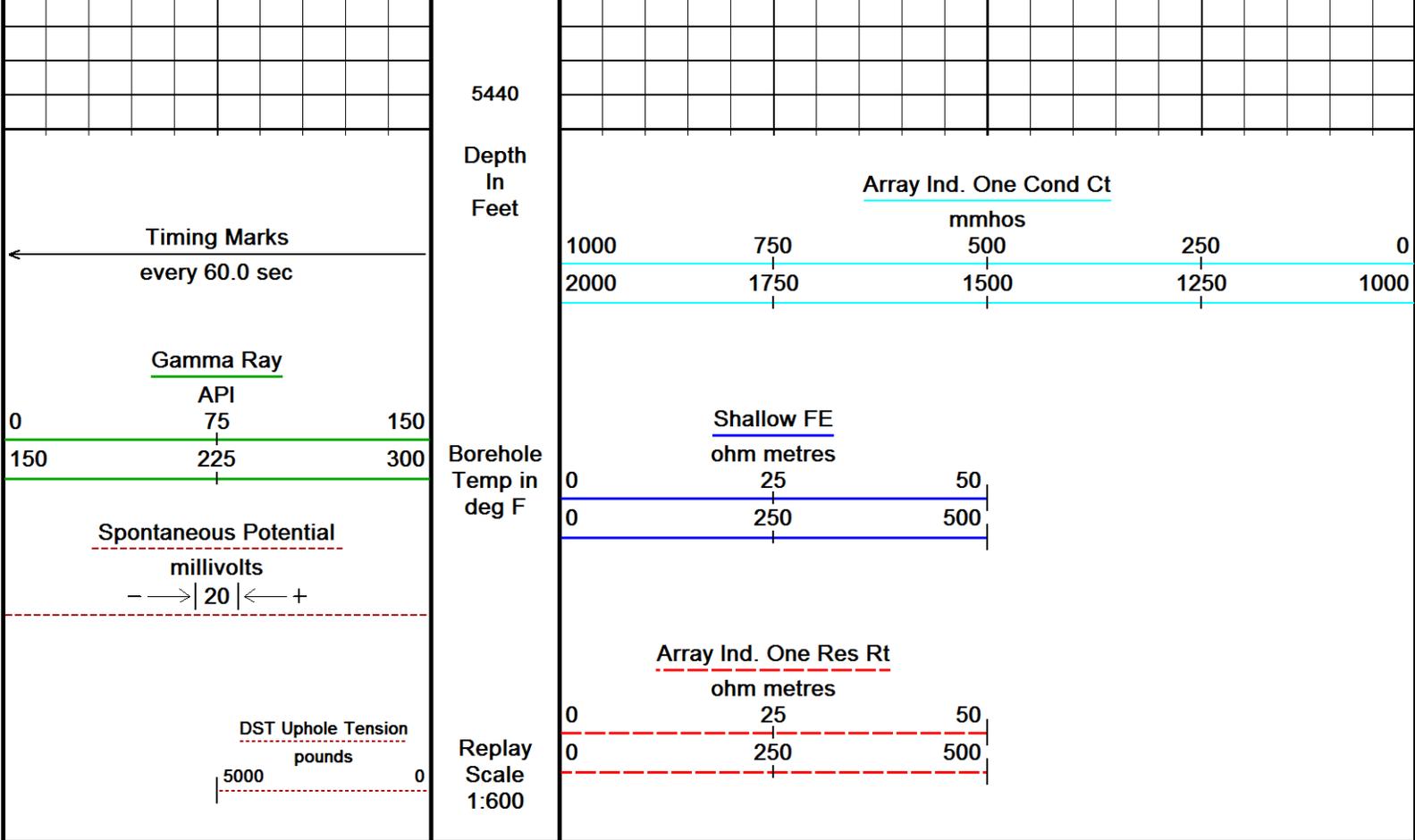
4700

112°

4800





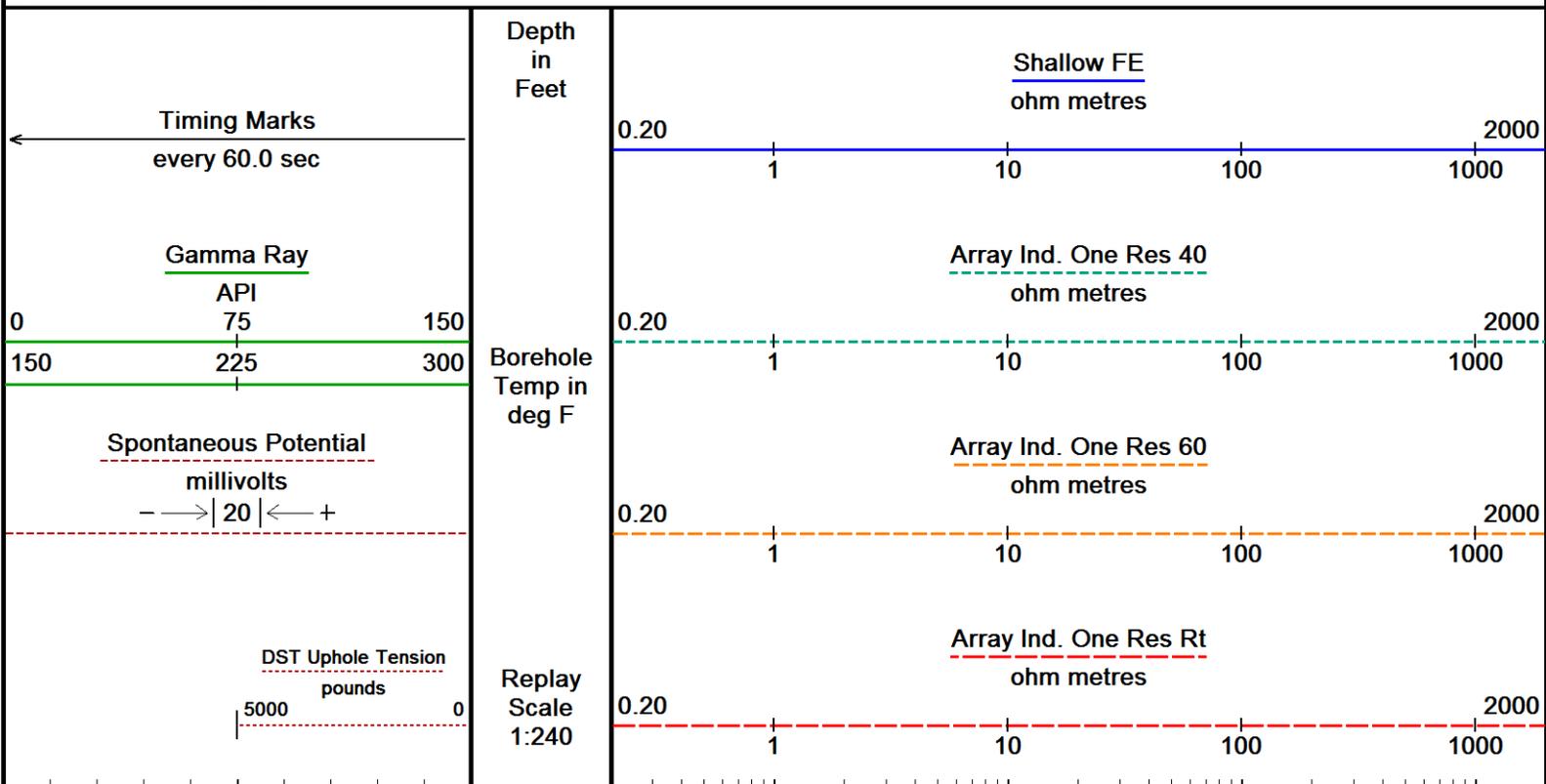


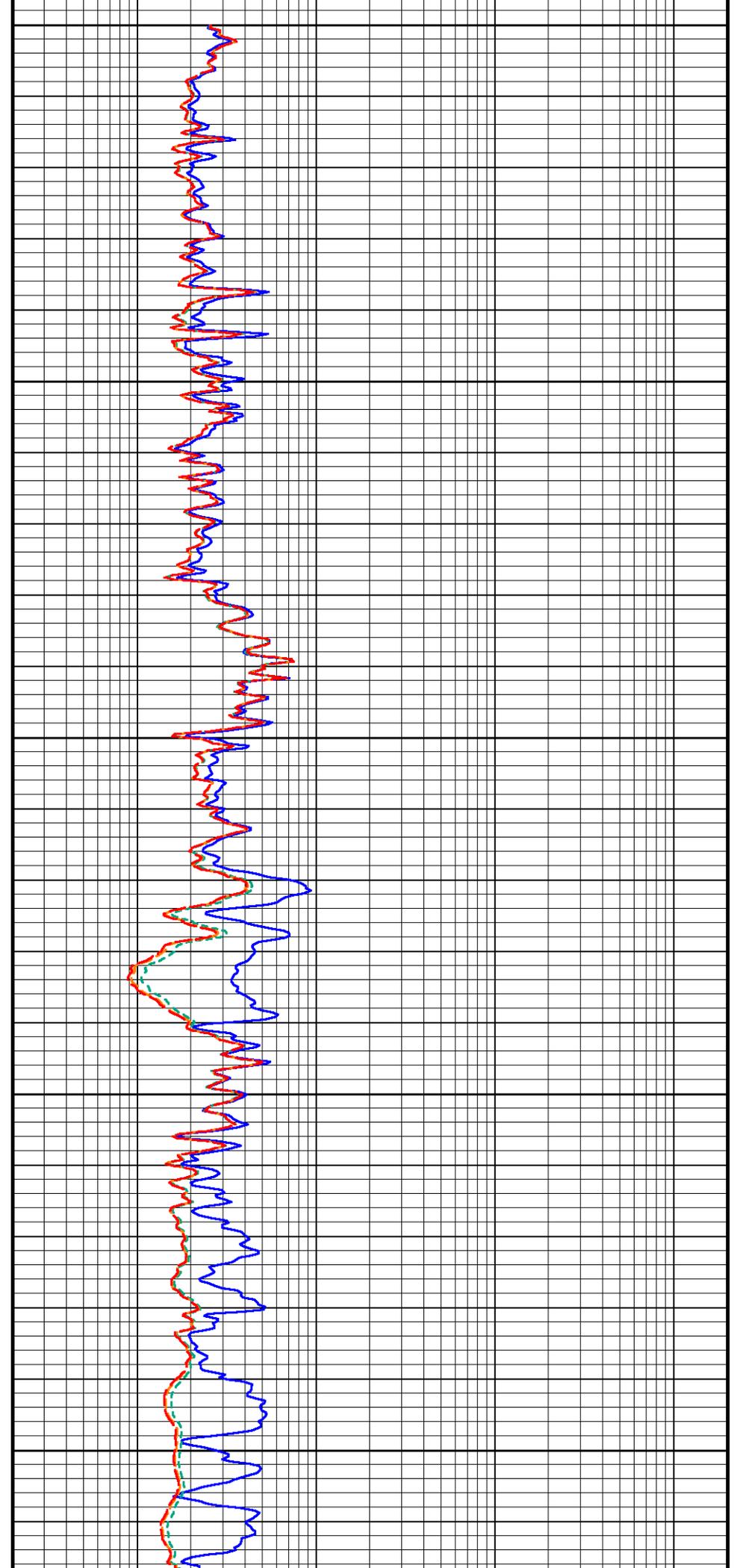
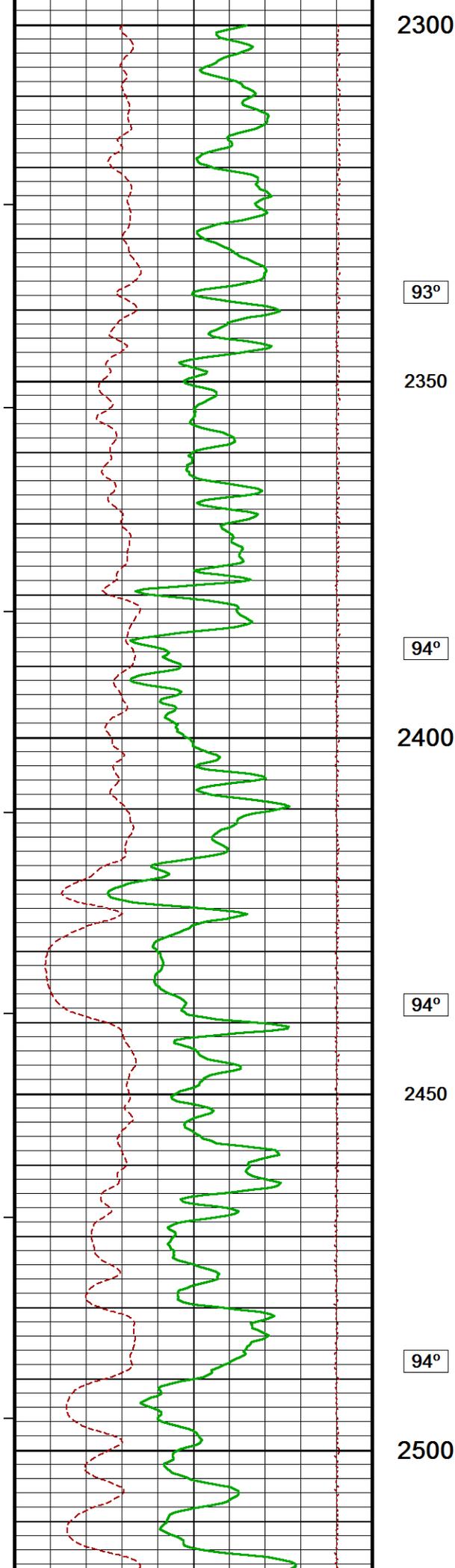
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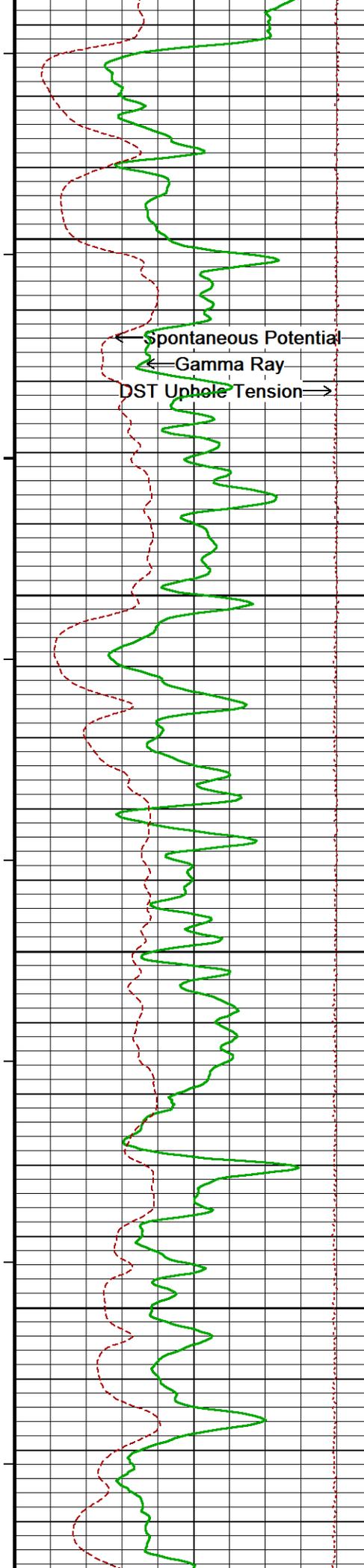
↑ 2 INCH MAIN ↑

↓ 5 INCH MAIN ↓

Depth Based Data - Maximum Sampling Increment 10.0cm Plotted on 10-JAN-2013 15:34  
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95°

2550  
Array Ind. One Res Rt  
Array Ind. One Res 60

Array Ind. One Res 40  
Shallow FE

95°

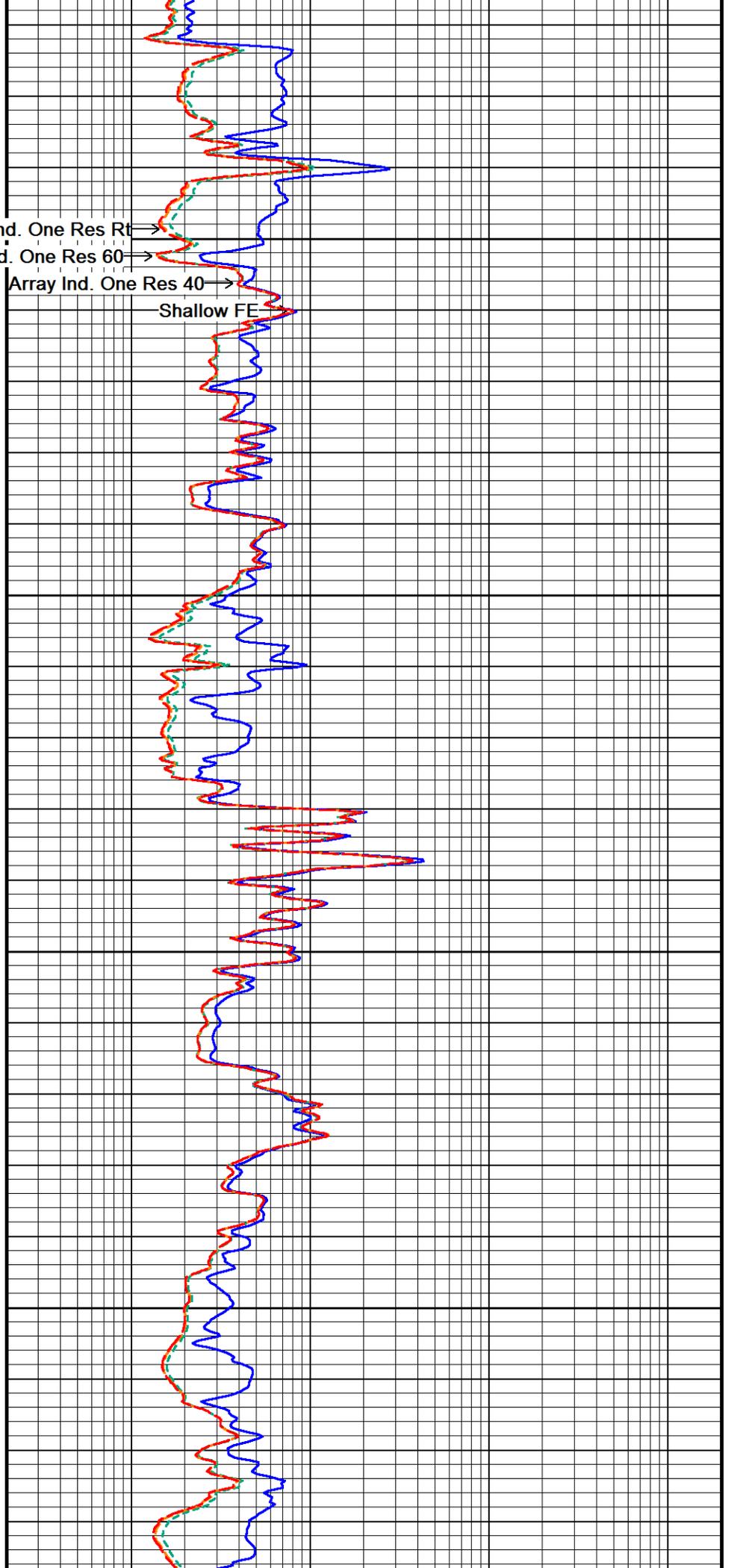
2600

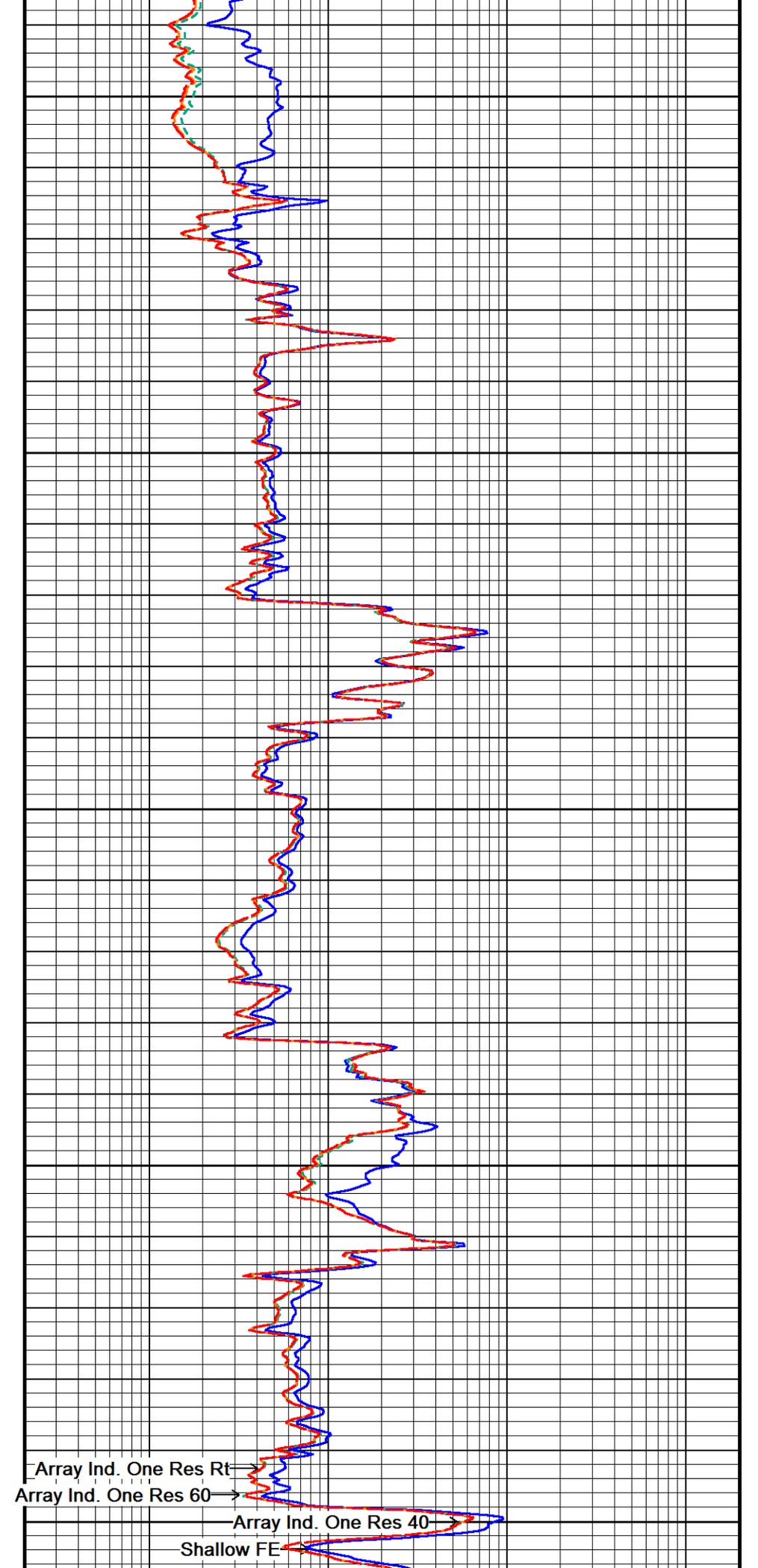
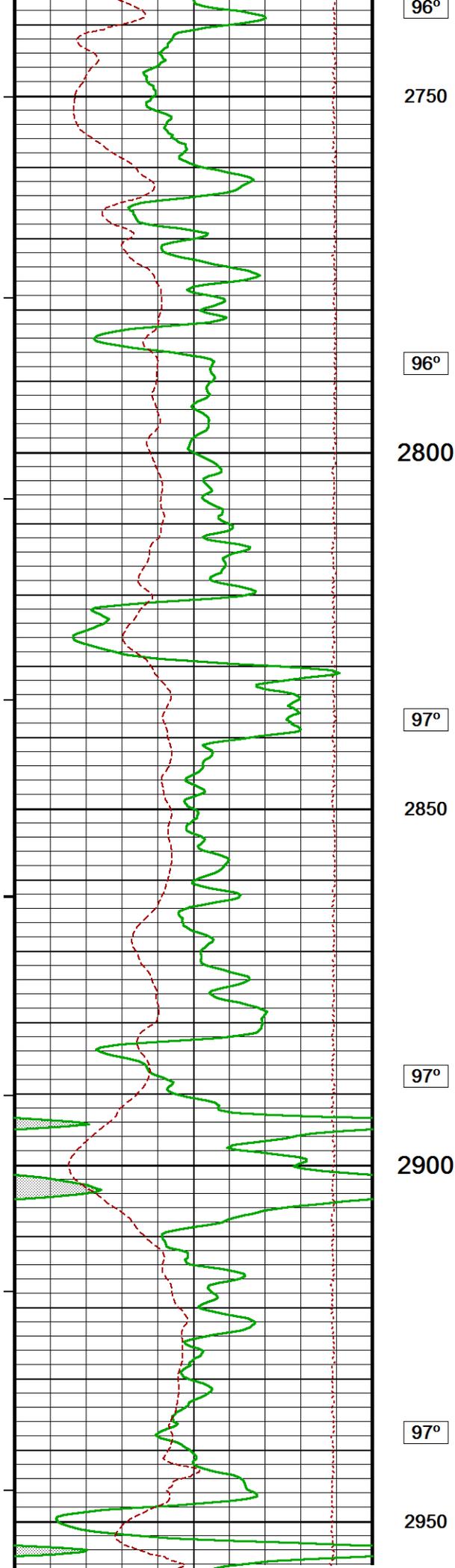
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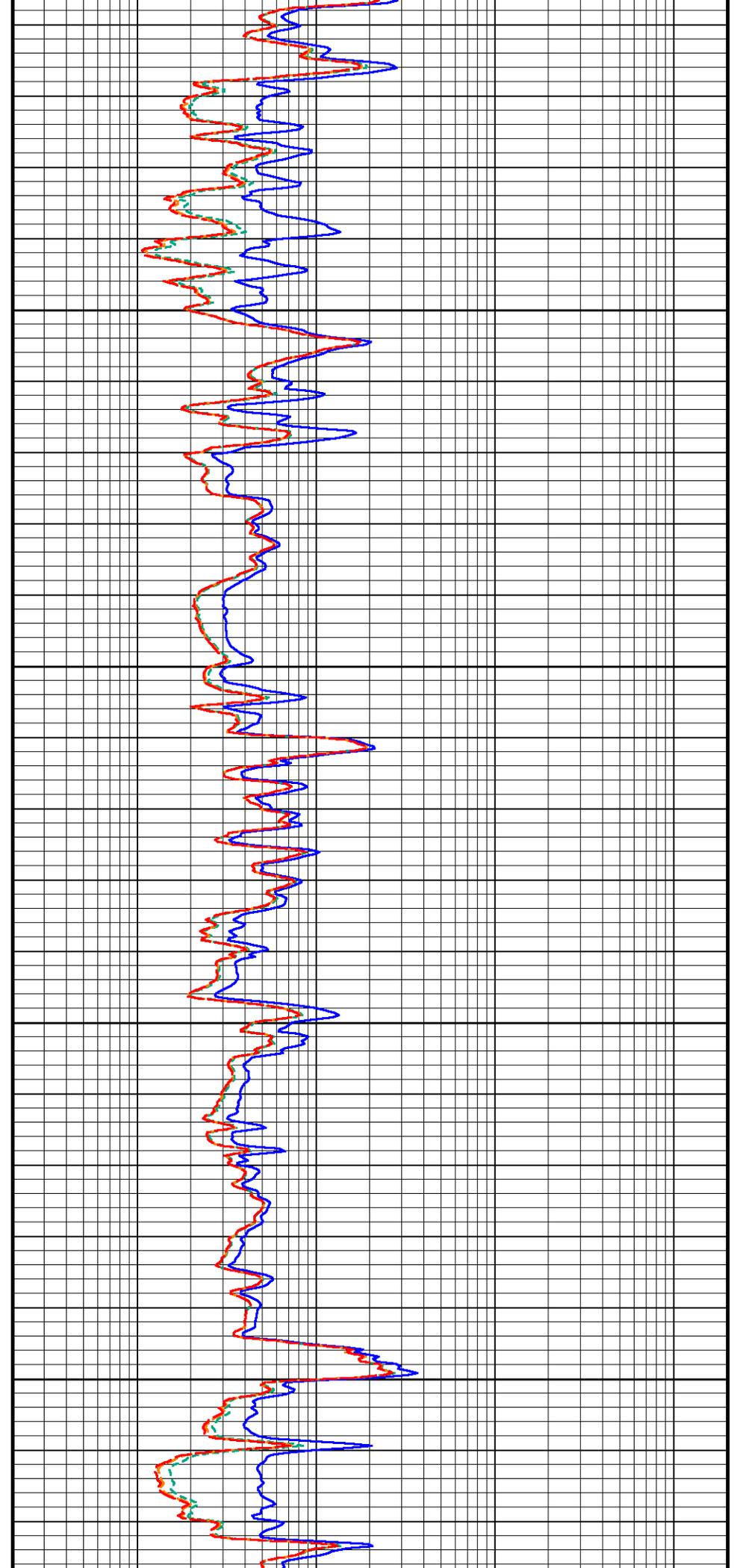
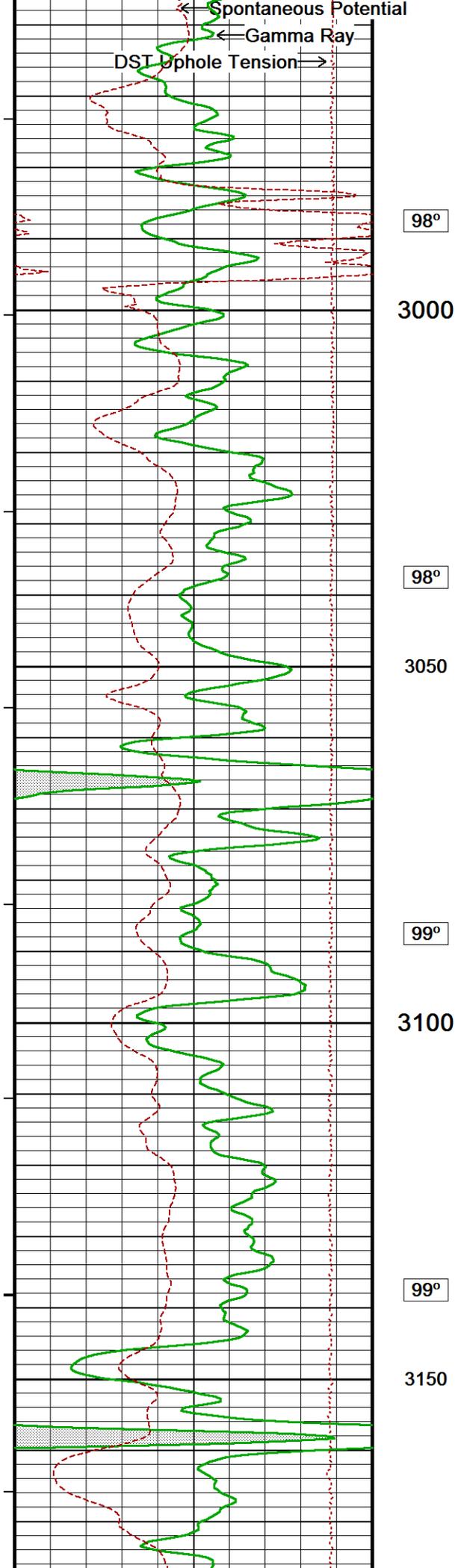
2650

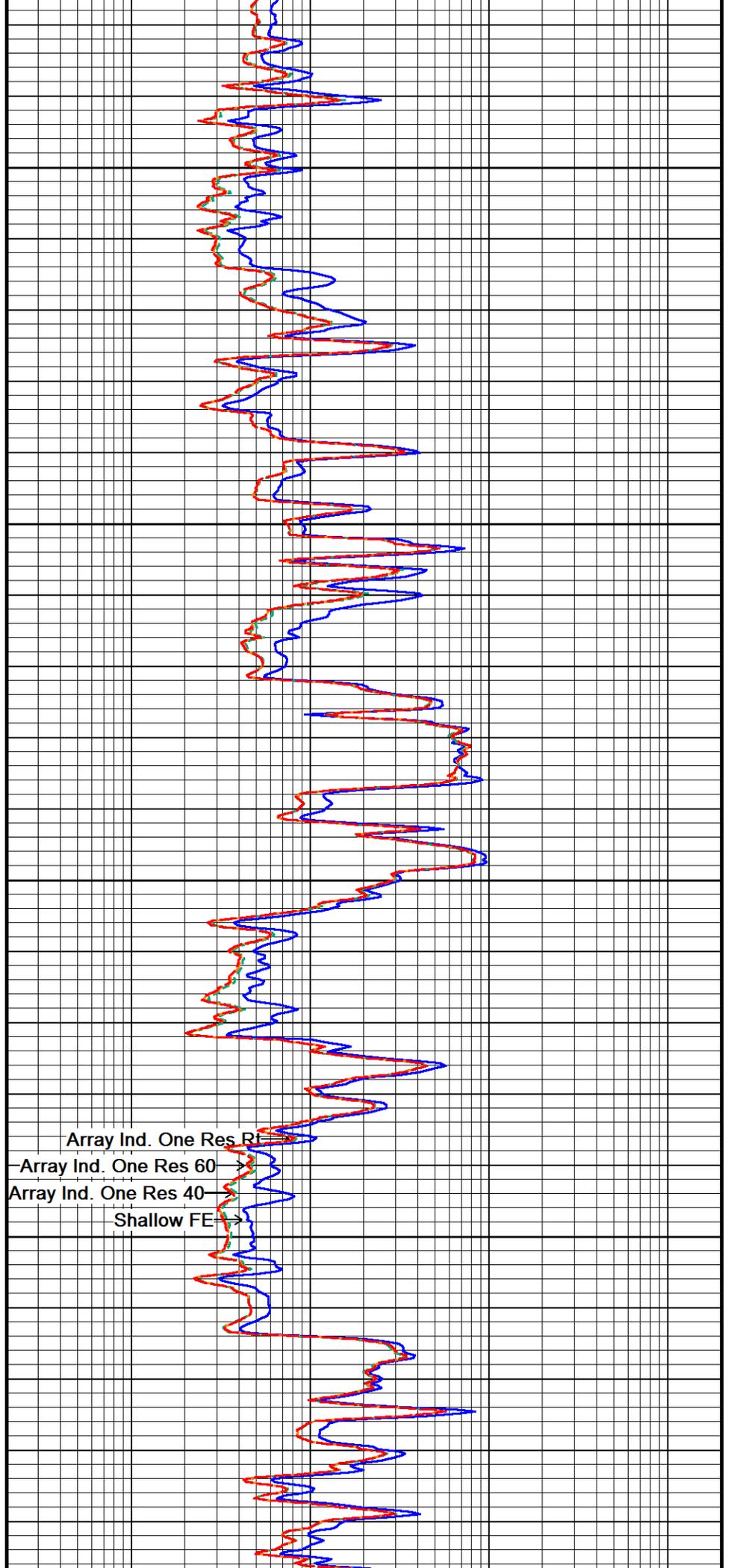
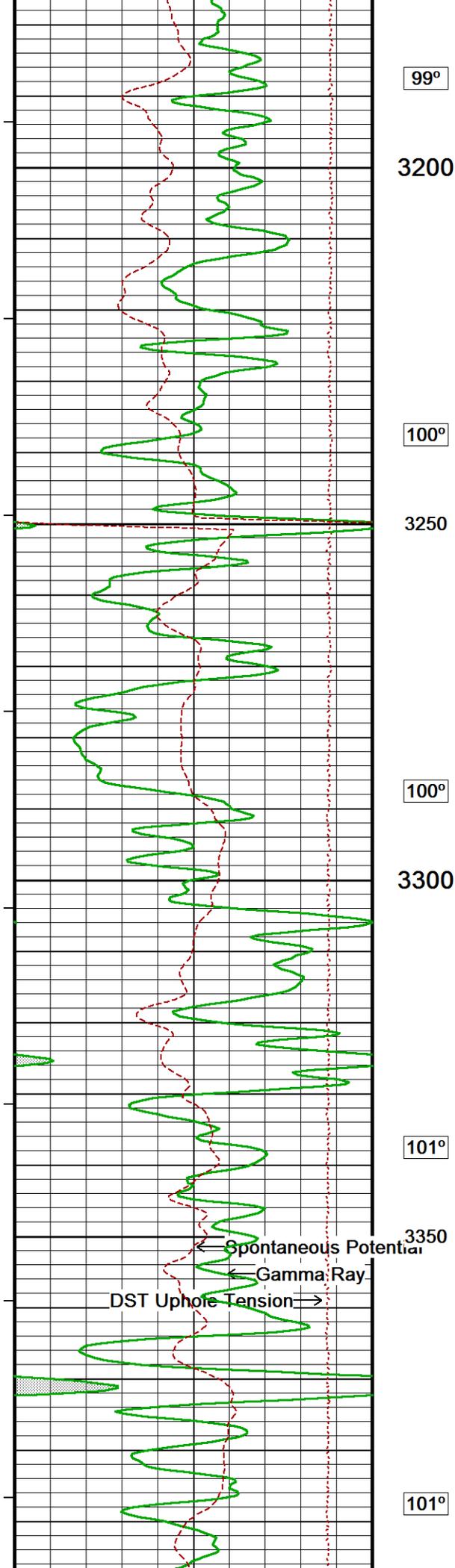
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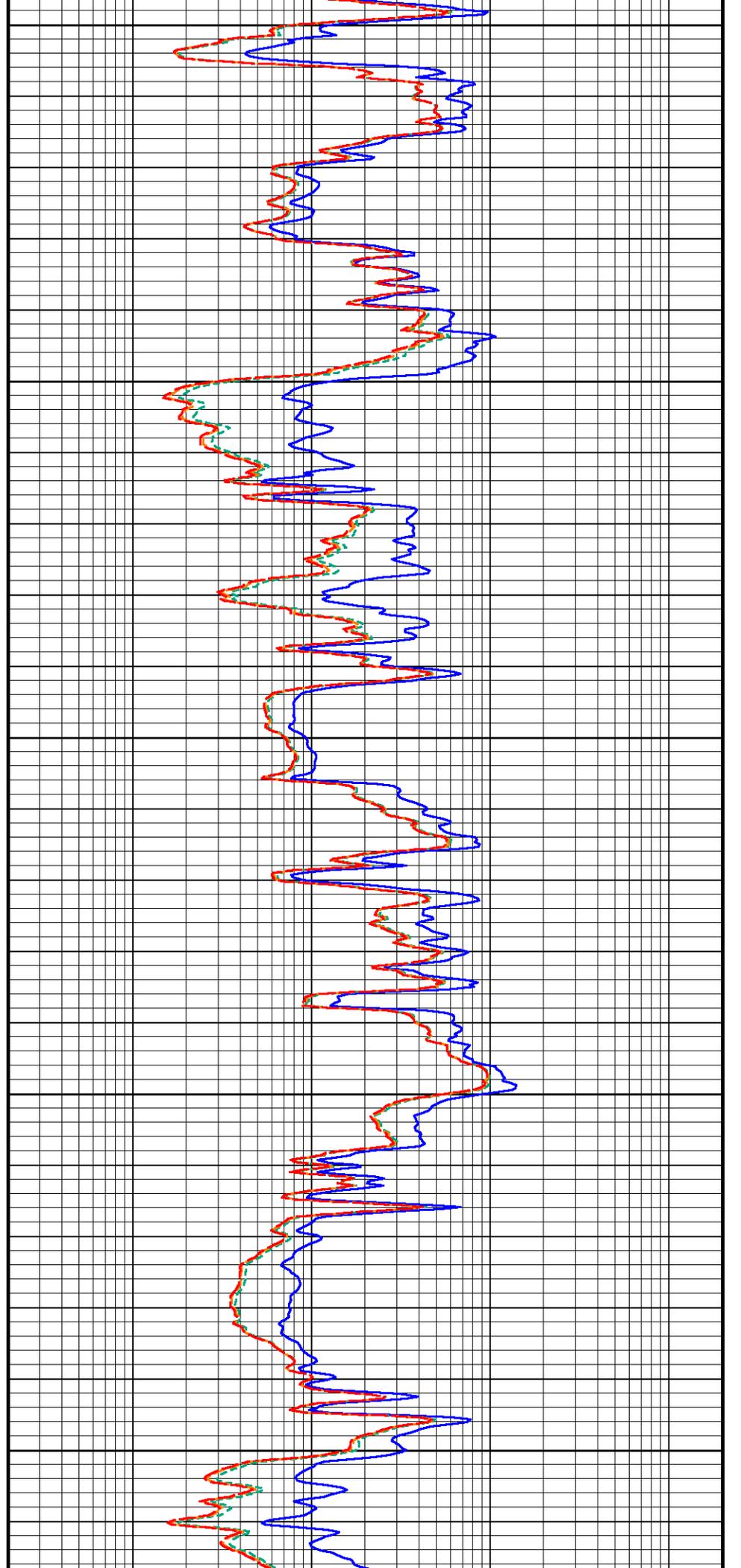
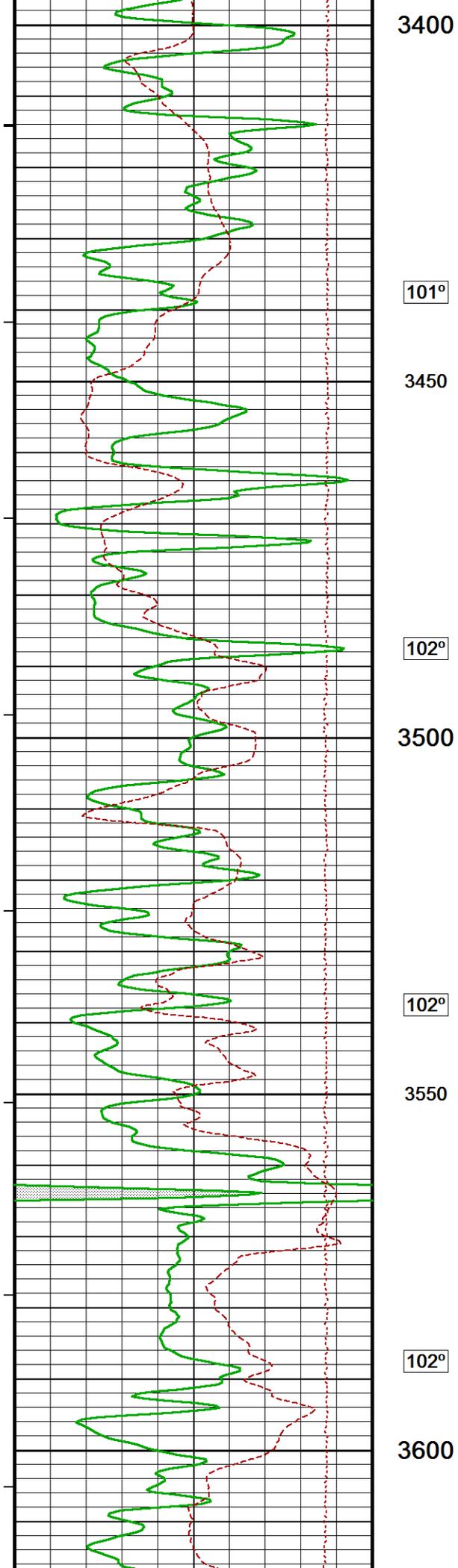
2700

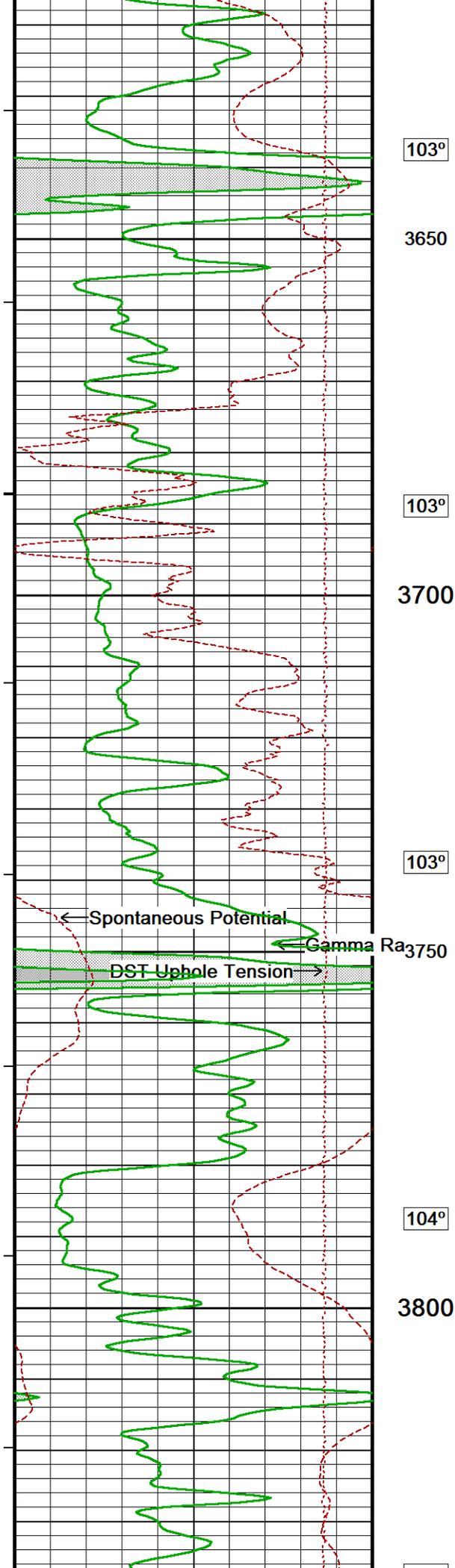












103°

3650

103°

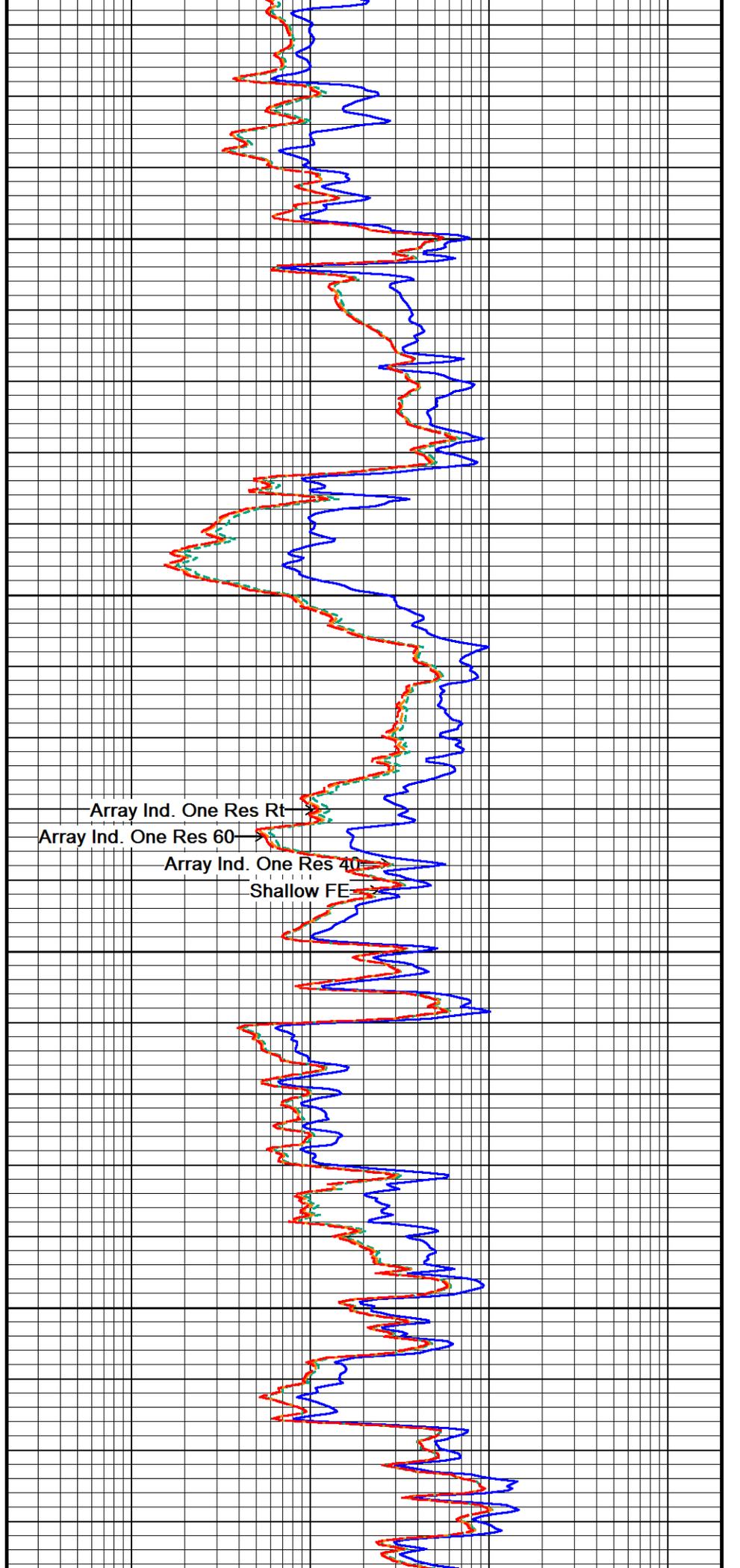
3700

103°

3750

104°

3800

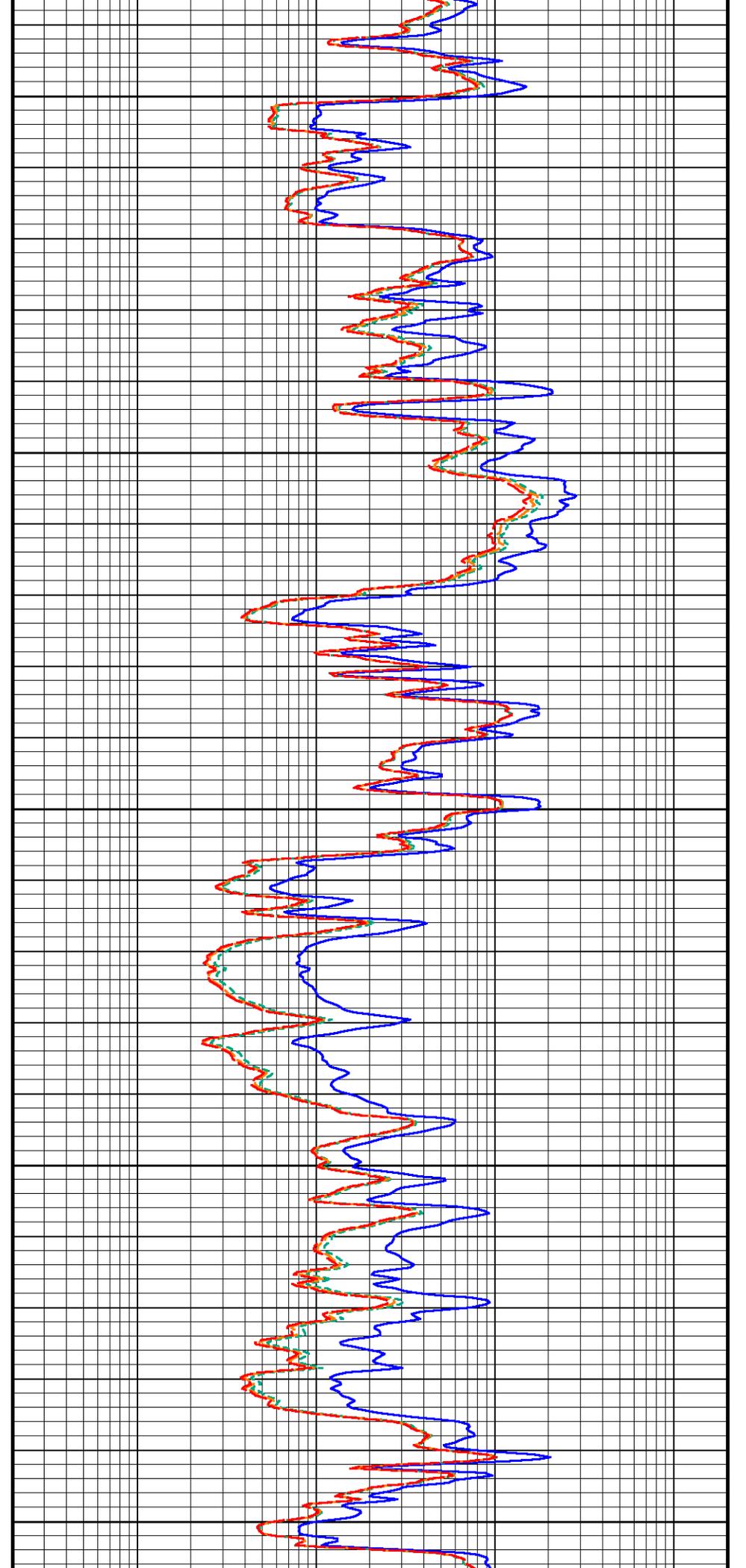
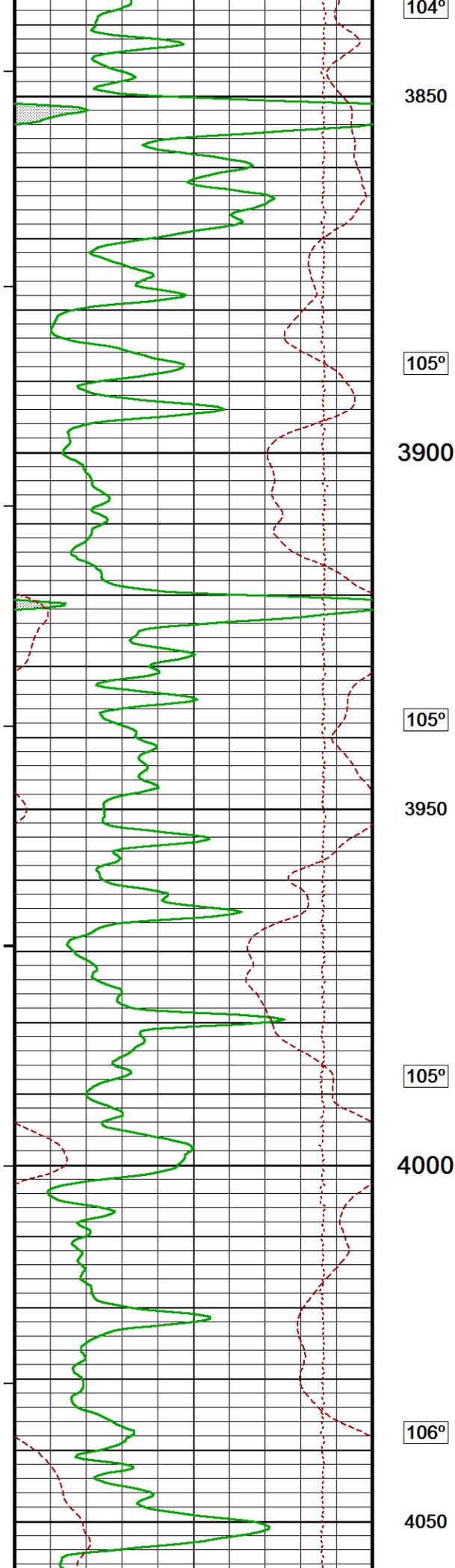


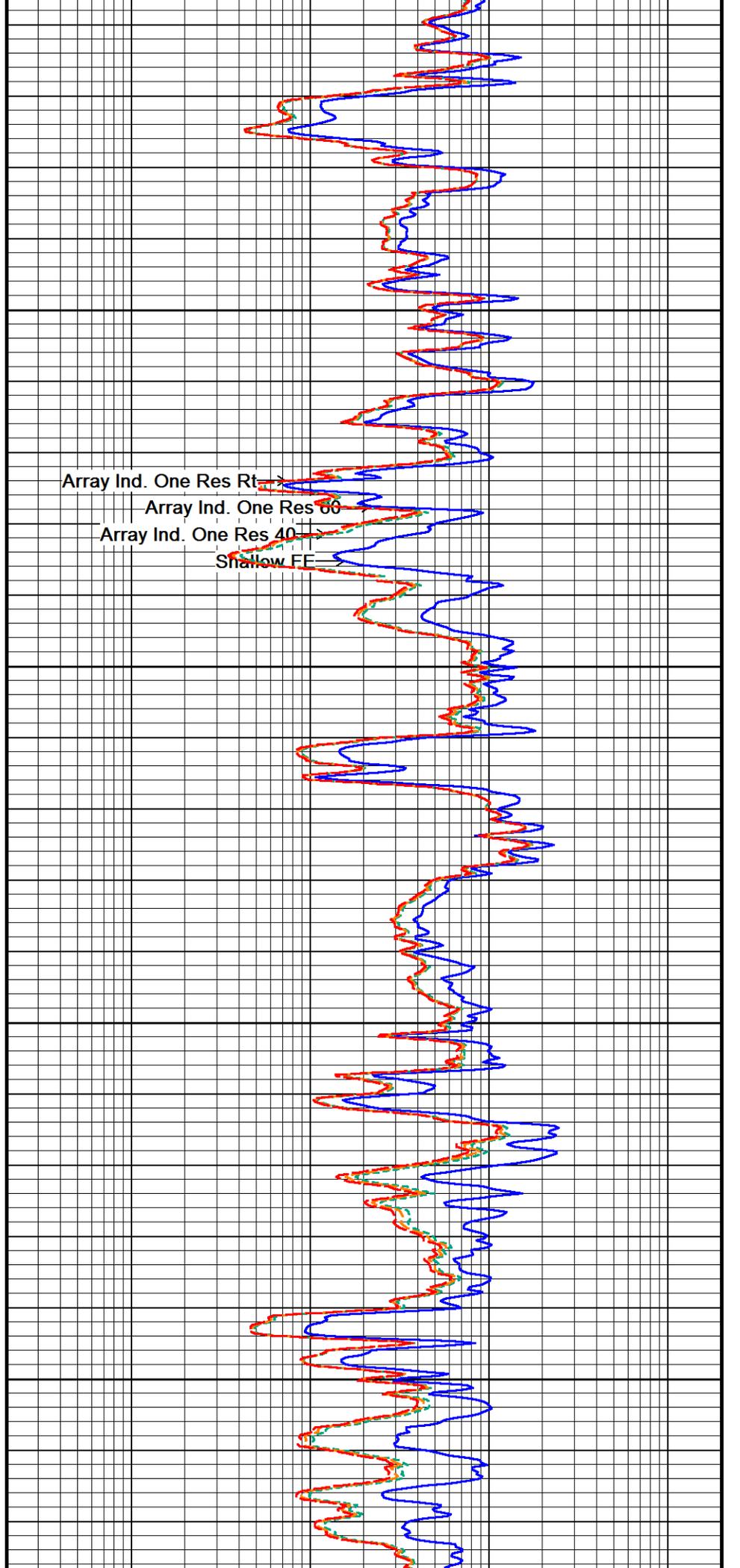
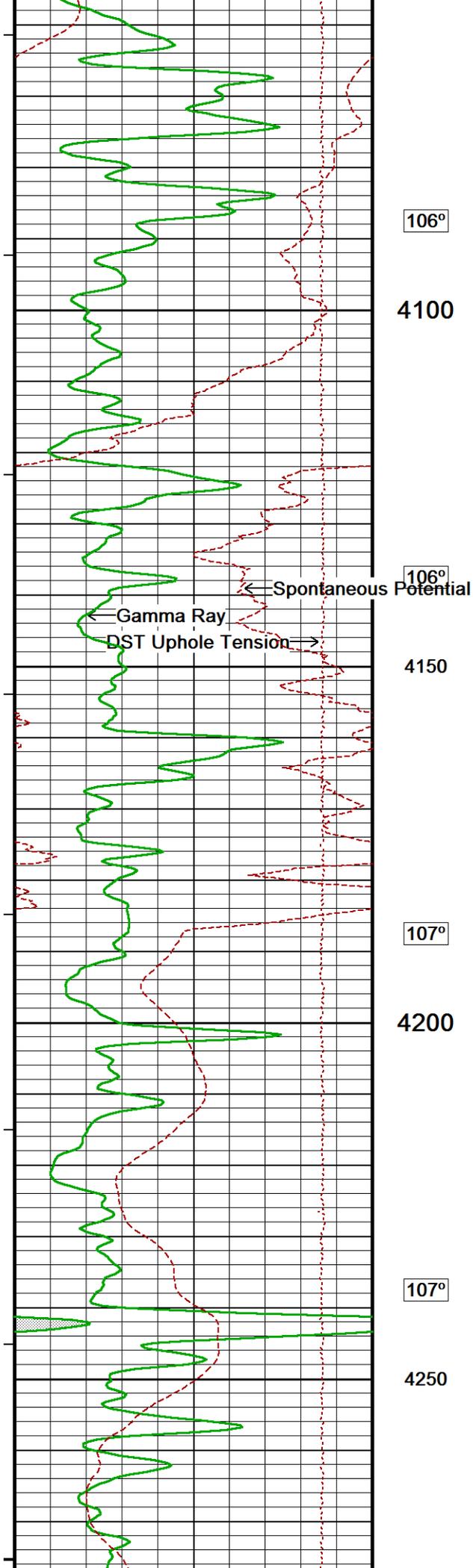
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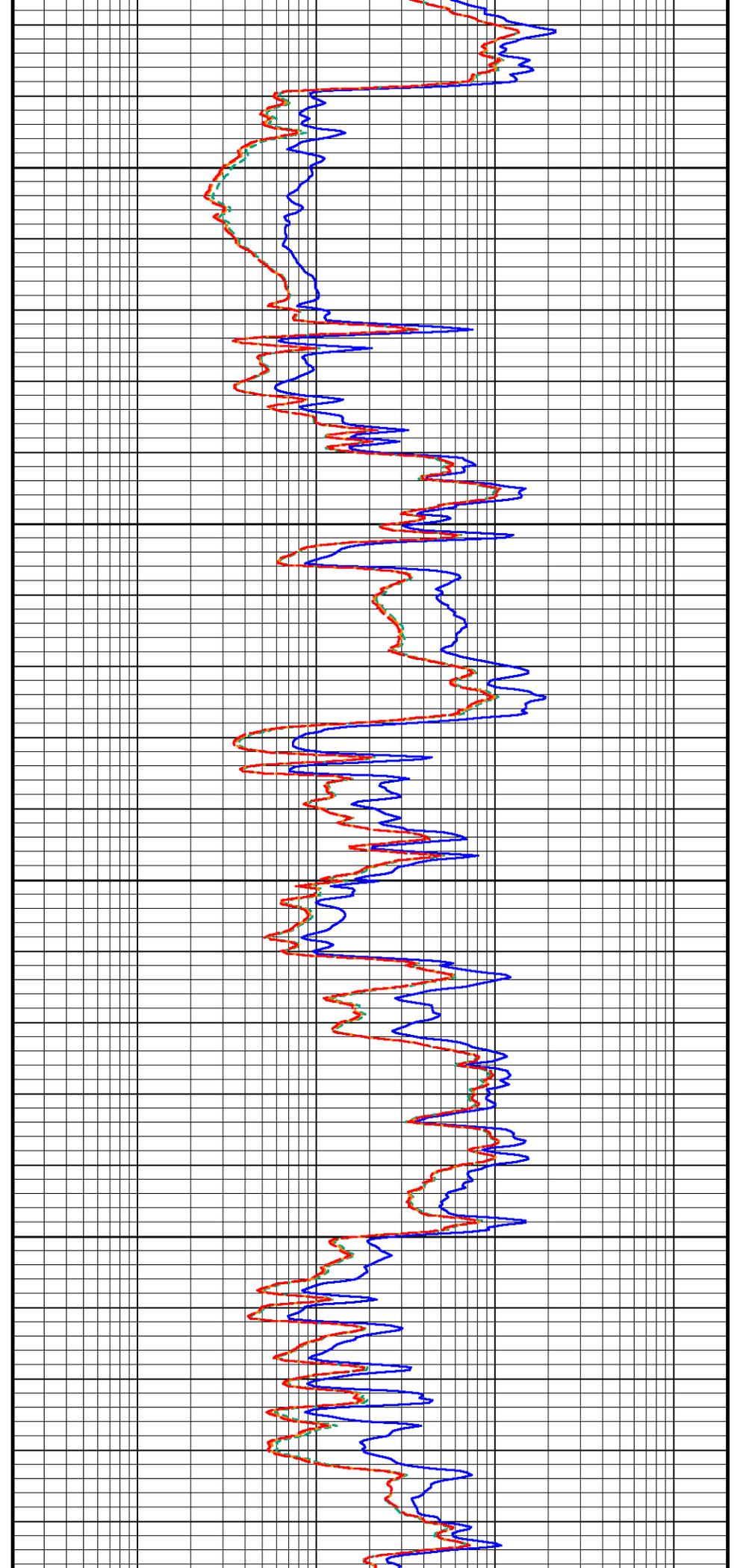
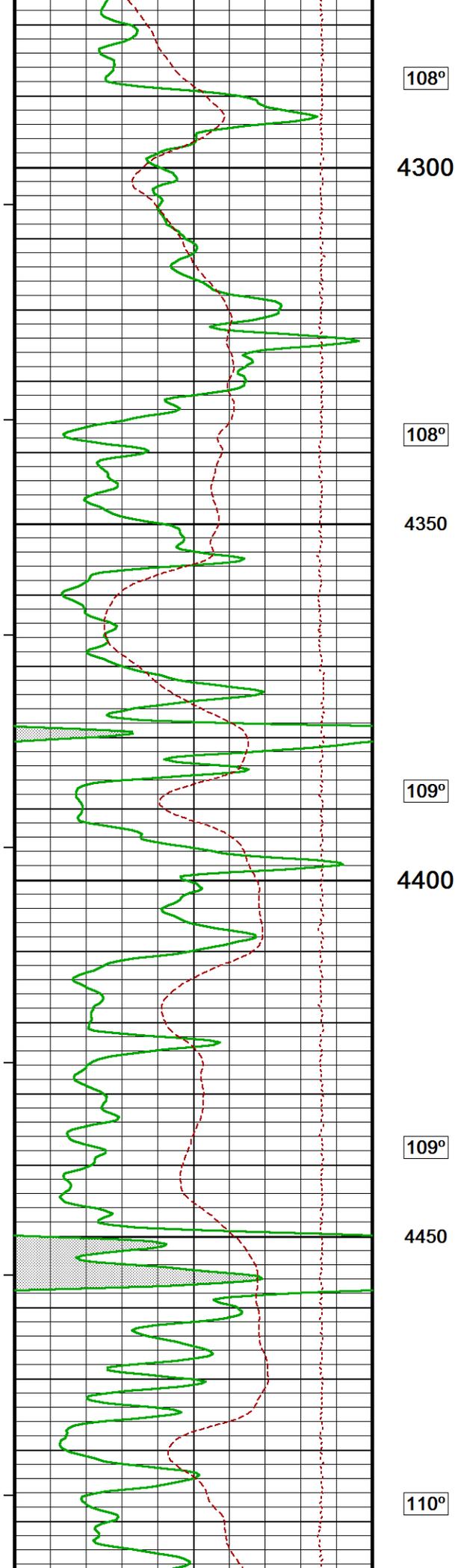
Array Ind. One Res 60

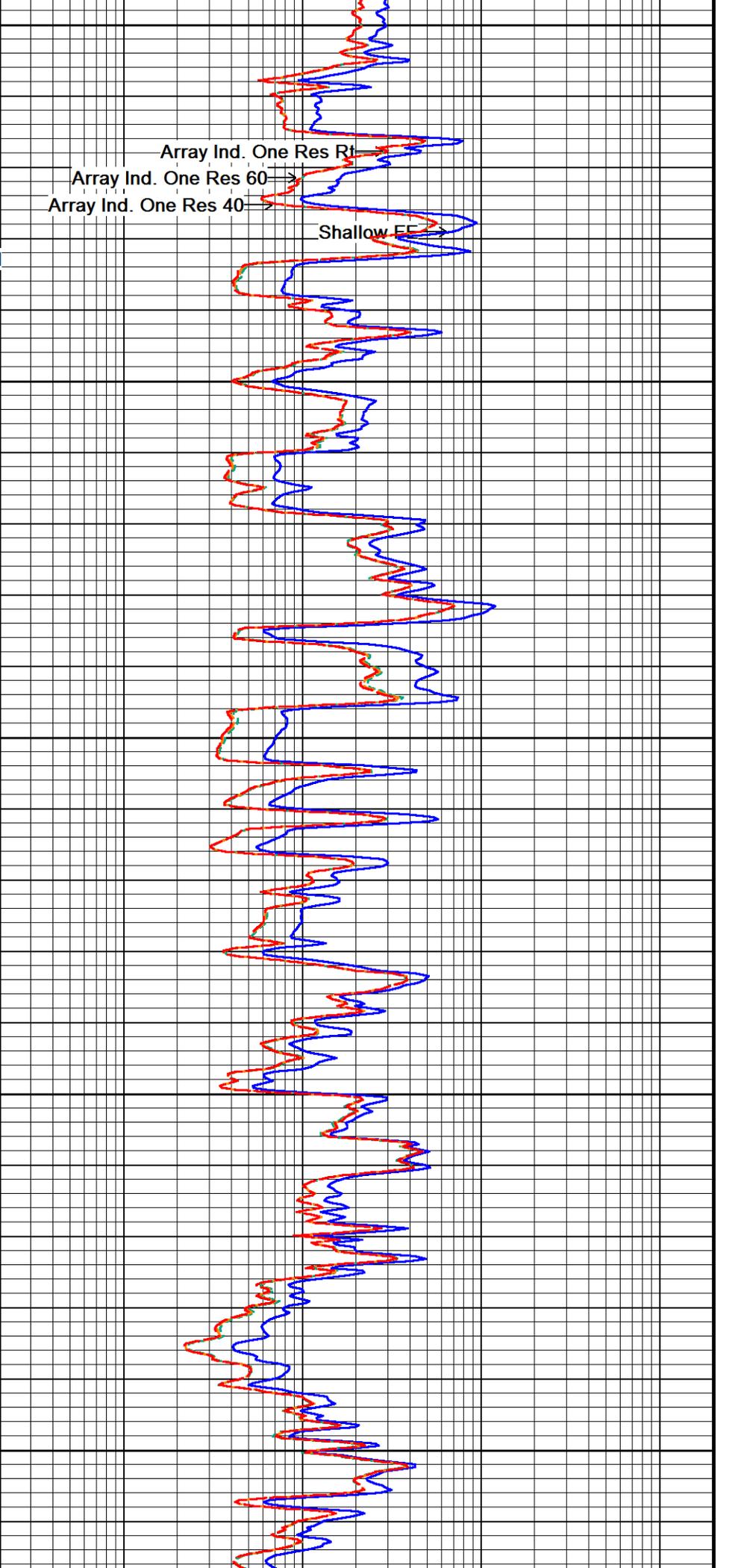
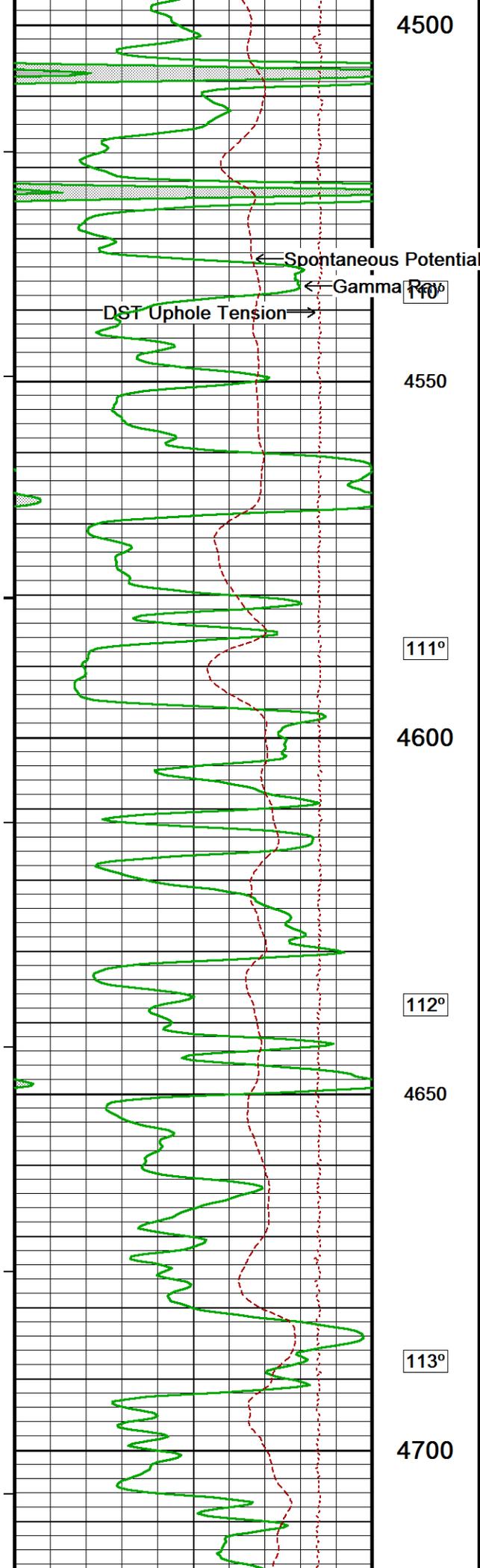
Array Ind. One Res 40

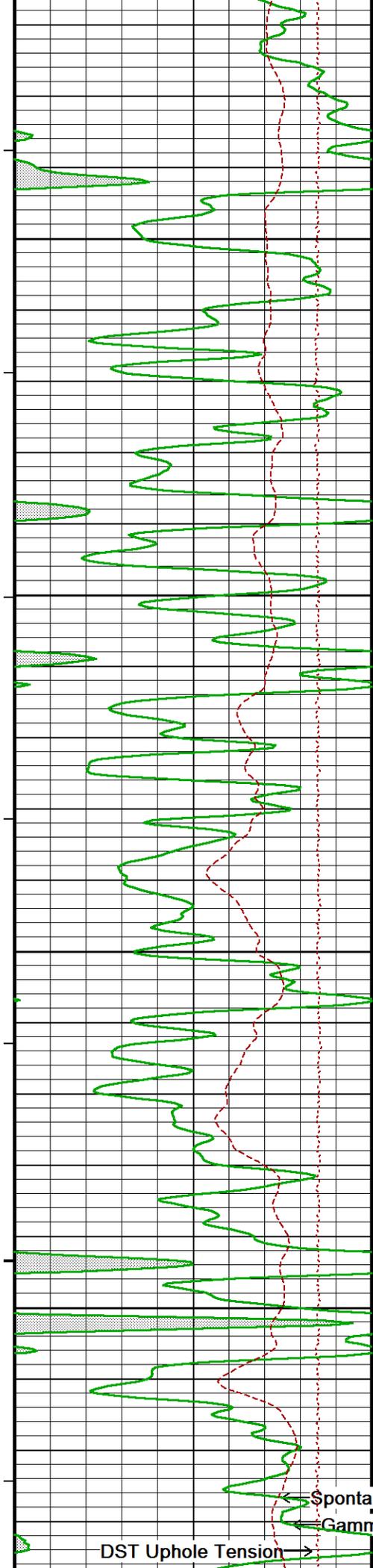
Shallow FE











112°

4750

112°

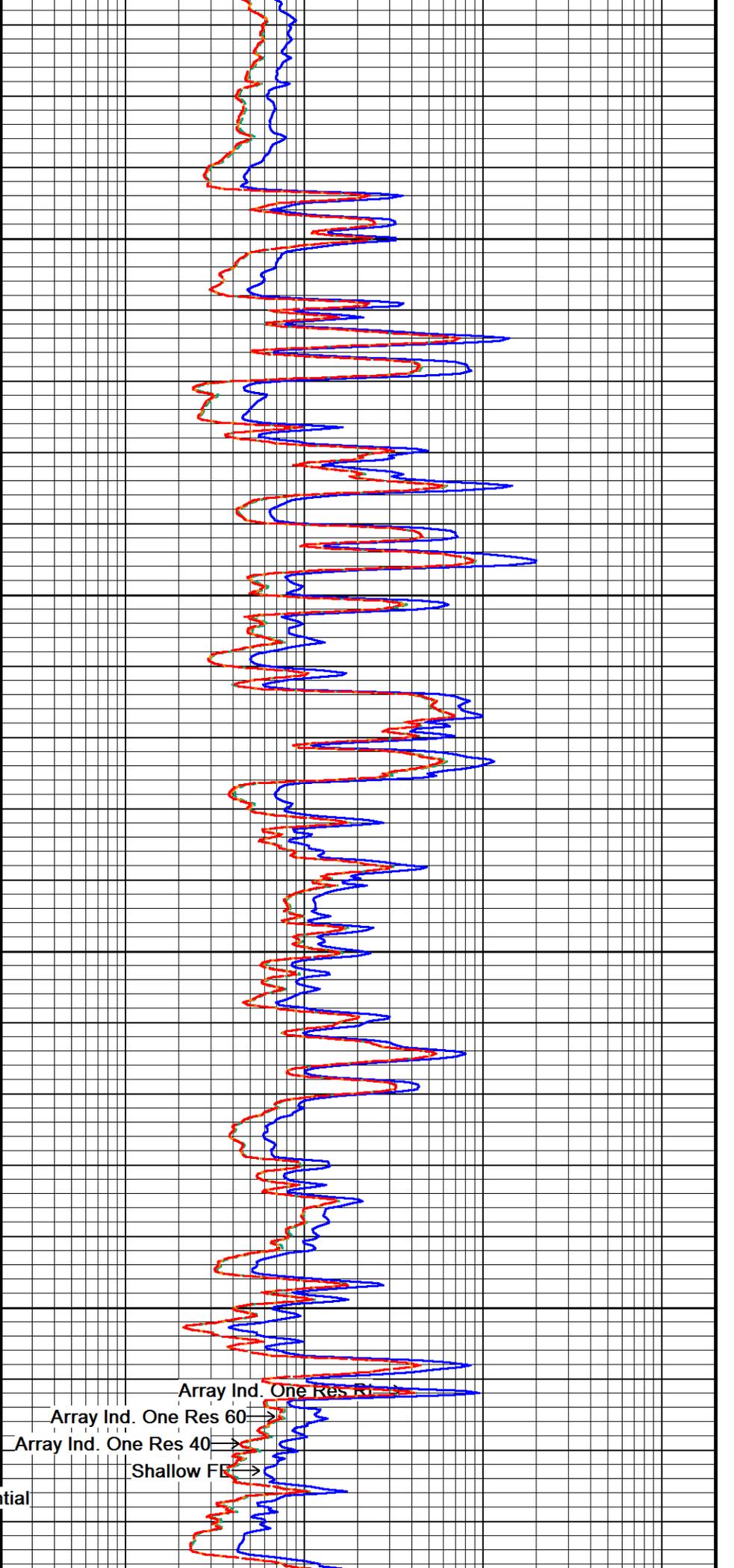
4800

112°

4850

112°

4900



Array Ind. One Res R1 →

Array Ind. One Res 60 →

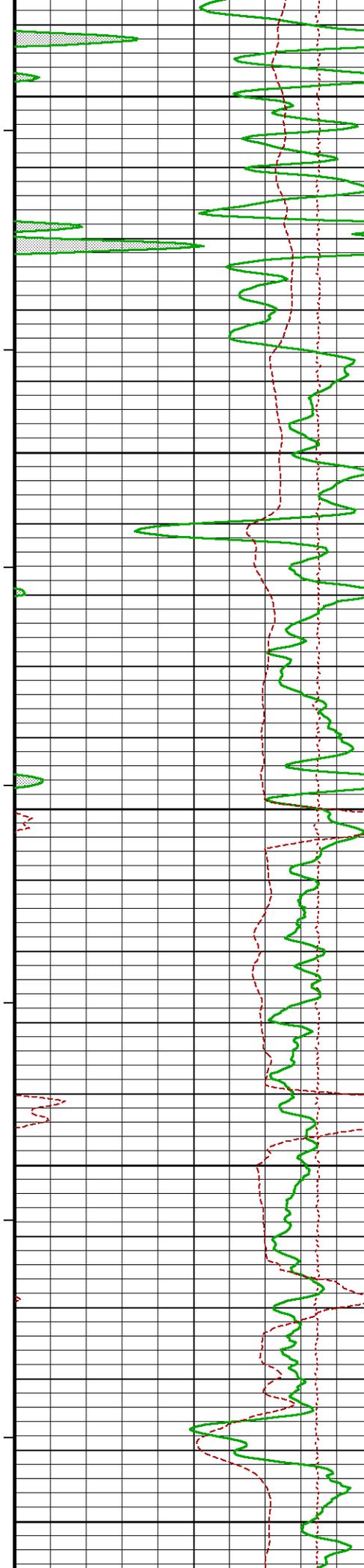
Array Ind. One Res 40 →

Shallow FR →

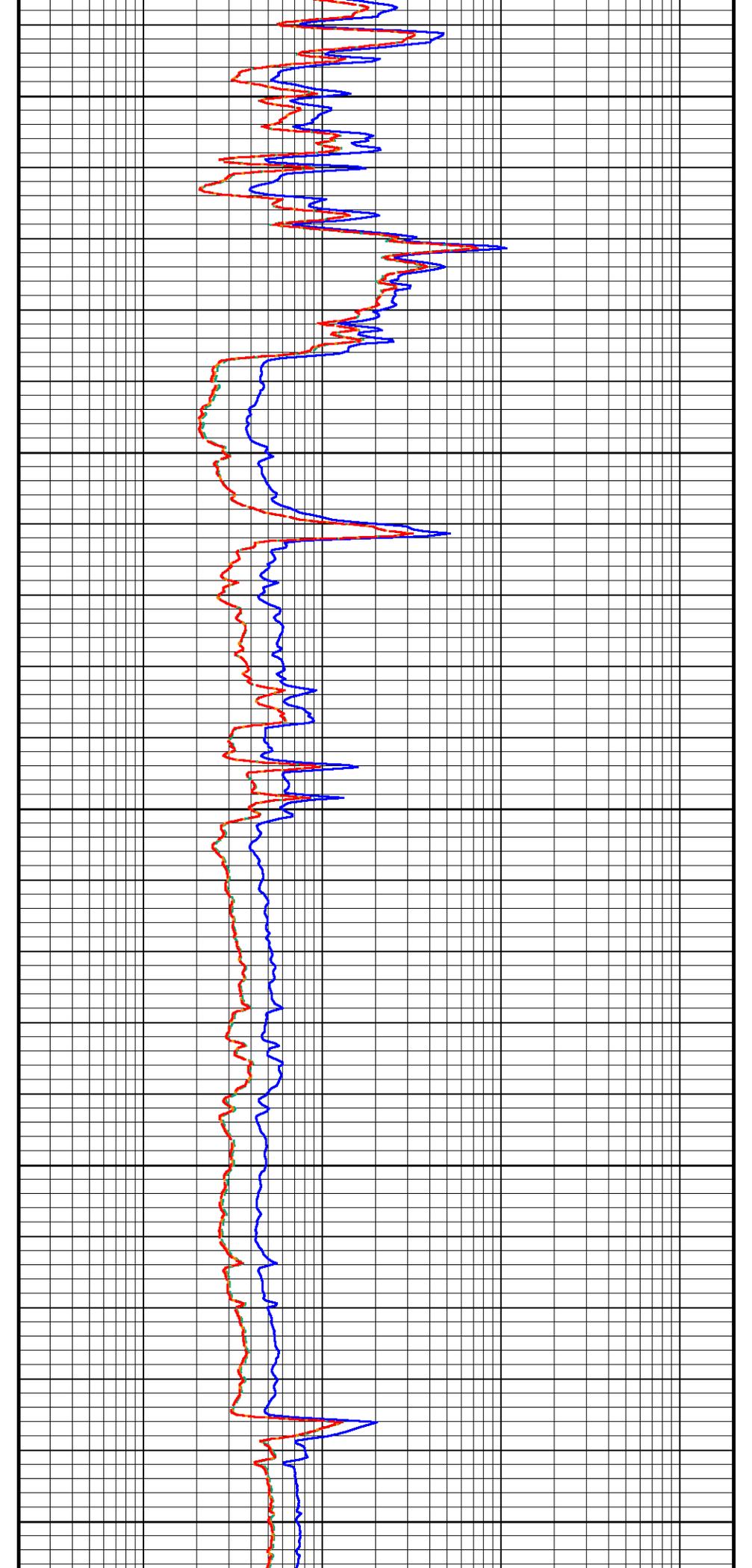
← Spontaneous Potential

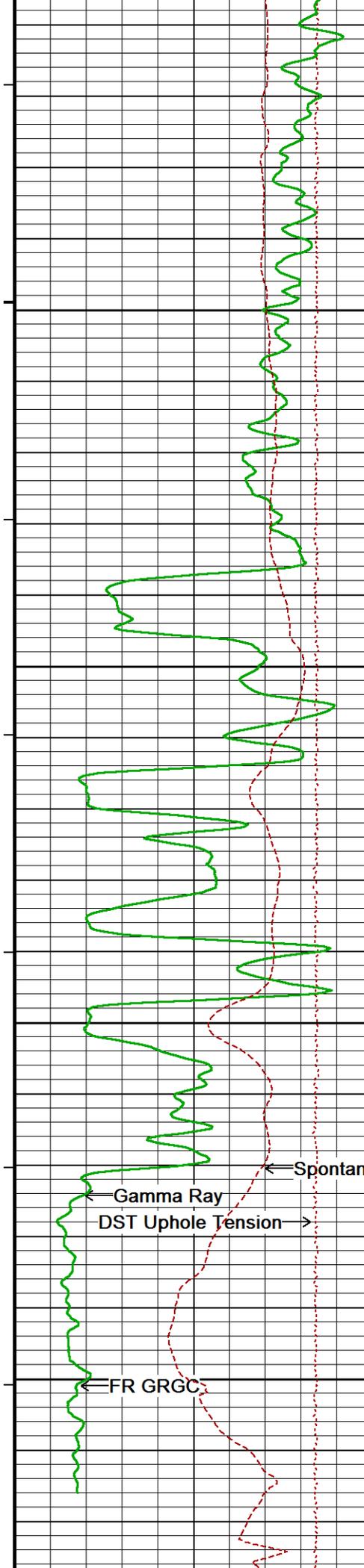
← Gamma Ray

DST Uphole Tension →



113°  
4950  
114°  
5000  
115°  
5050  
116°  
5100  
117°  
5150





119°

5200

120°

5250

121°

5300

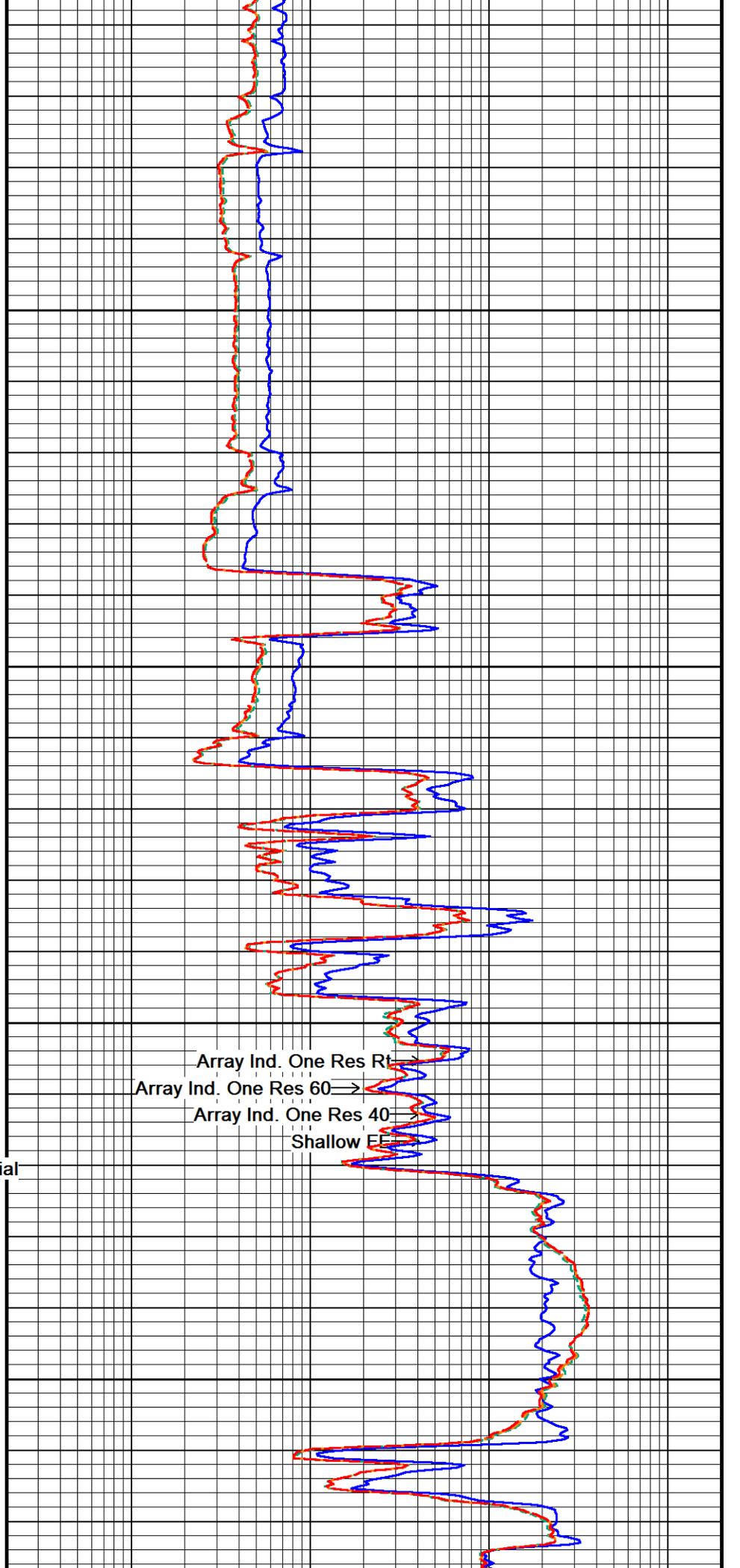
← Spontaneous Potential

← Gamma Ray  
DST Uphole Tension →

← FR GRGC

121°

5350

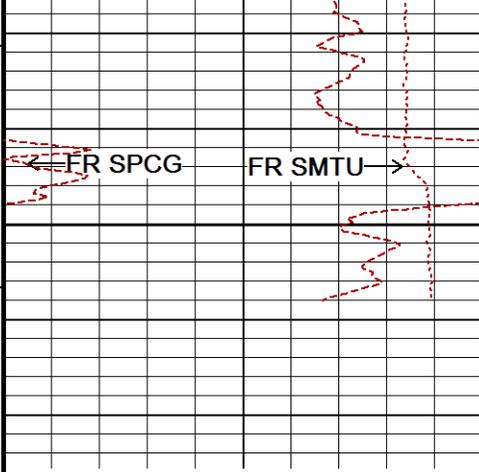


Array Ind. One Res Rt

Array Ind. One Res 60 →

Array Ind. One Res 40

Shallow FF



5400

5424  
Depth  
in  
Feet

Timing Marks  
every 60.0 sec

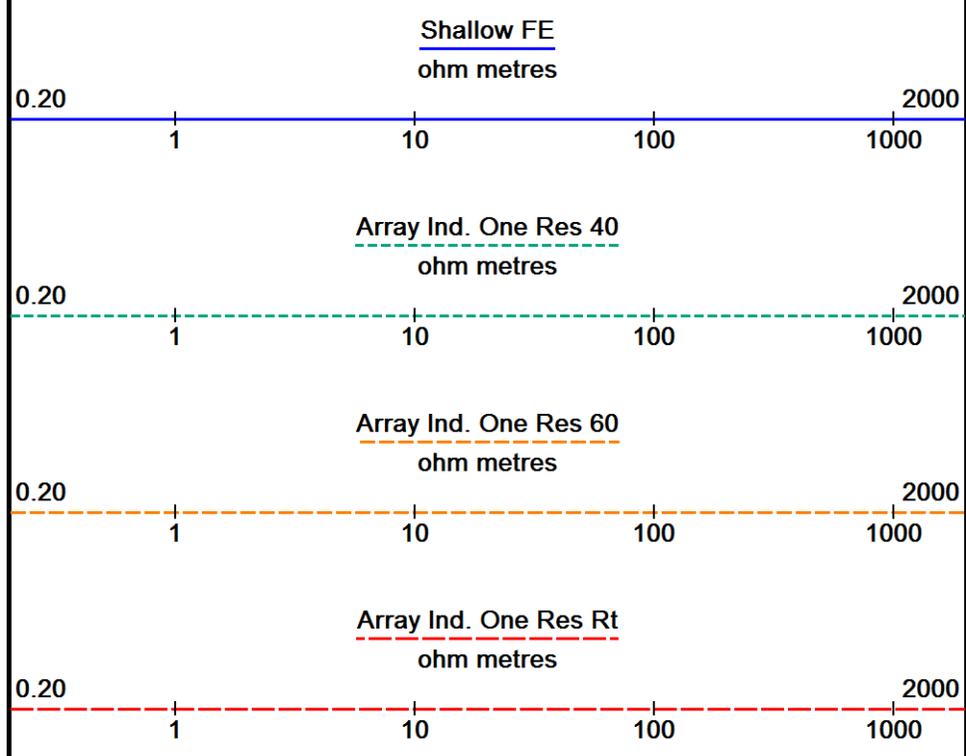
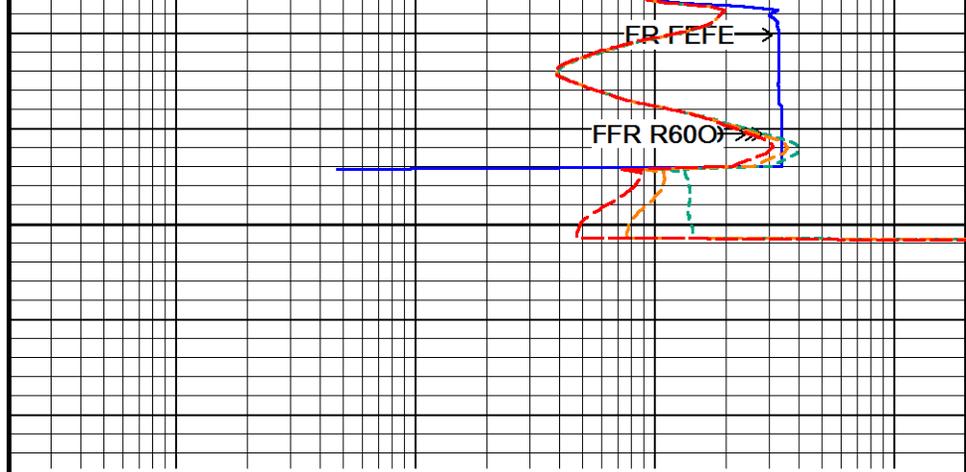
Gamma Ray  
API  
0 75 150  
150 225 300

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

DST Uphole Tension  
pounds  
5000 0

Borehole  
Temp in  
deg F

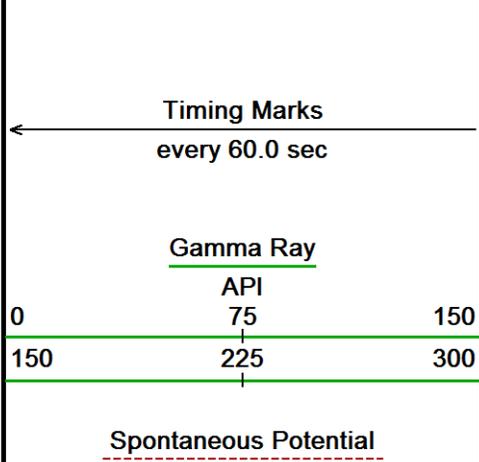
Replay  
Scale  
1:240



Depth Based Data - Maximum Sampling Increment 10.0cm Plotted on 10-JAN-2013 15:34  
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↑ 5 INCH MAIN ↑

↓ REPEAT SECTION ↓  
 Depth Based Data - Maximum Sampling Increment 10.0cm Plotted on 10-JAN-2013 15:34  
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 System Versions: Logged with 13.04.8492 Plotted with 13.05.8506



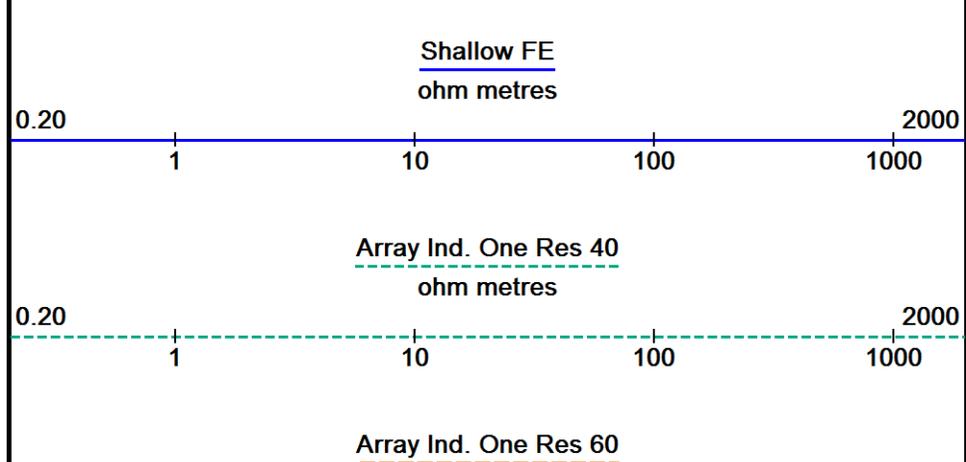
Depth  
in  
Feet

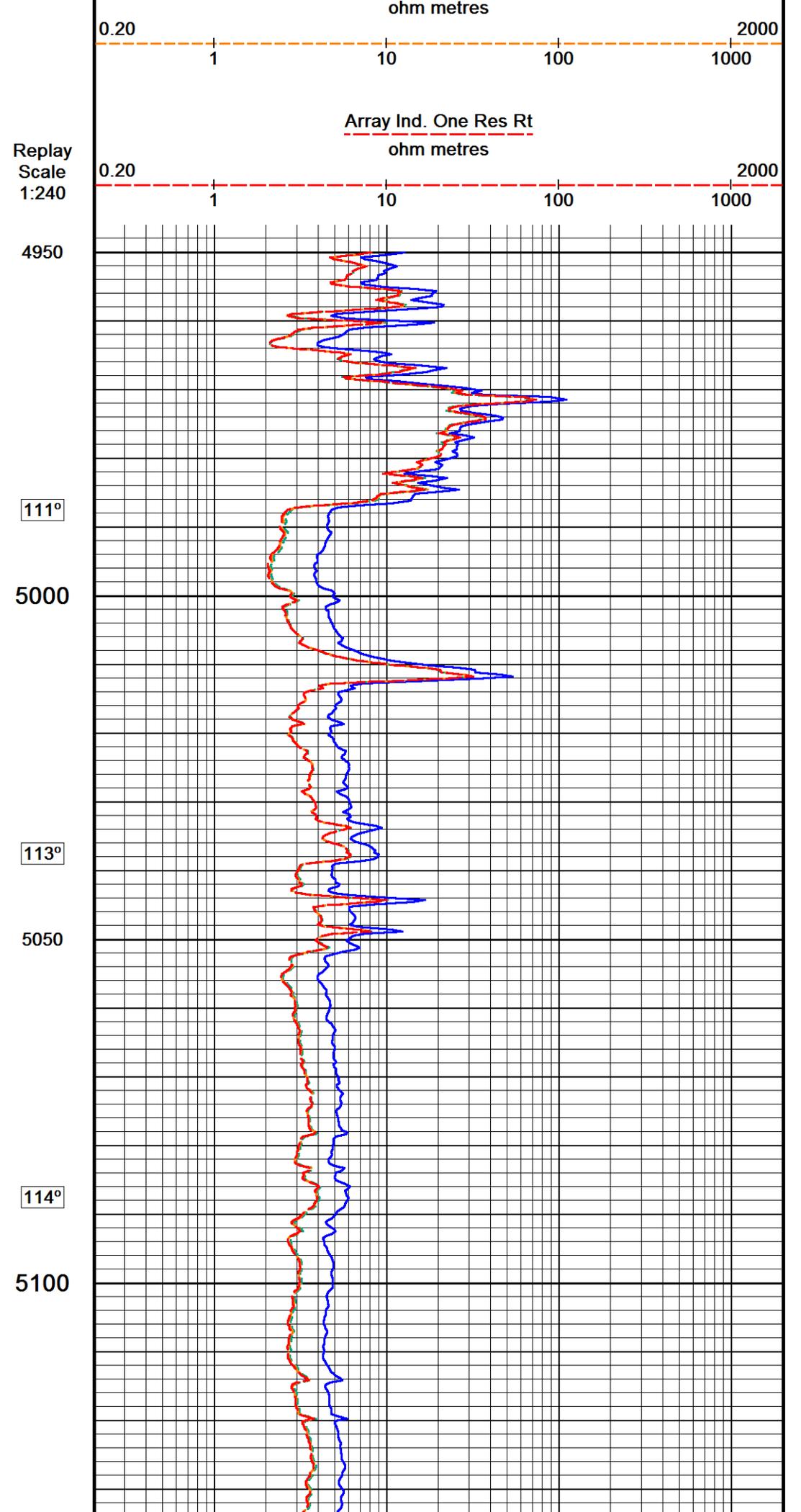
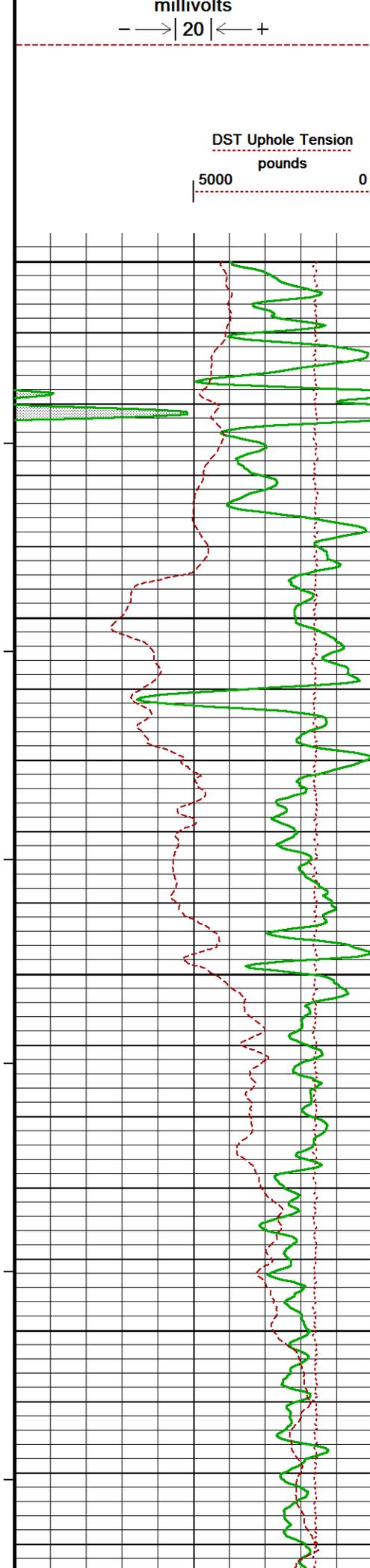
Timing Marks  
every 60.0 sec

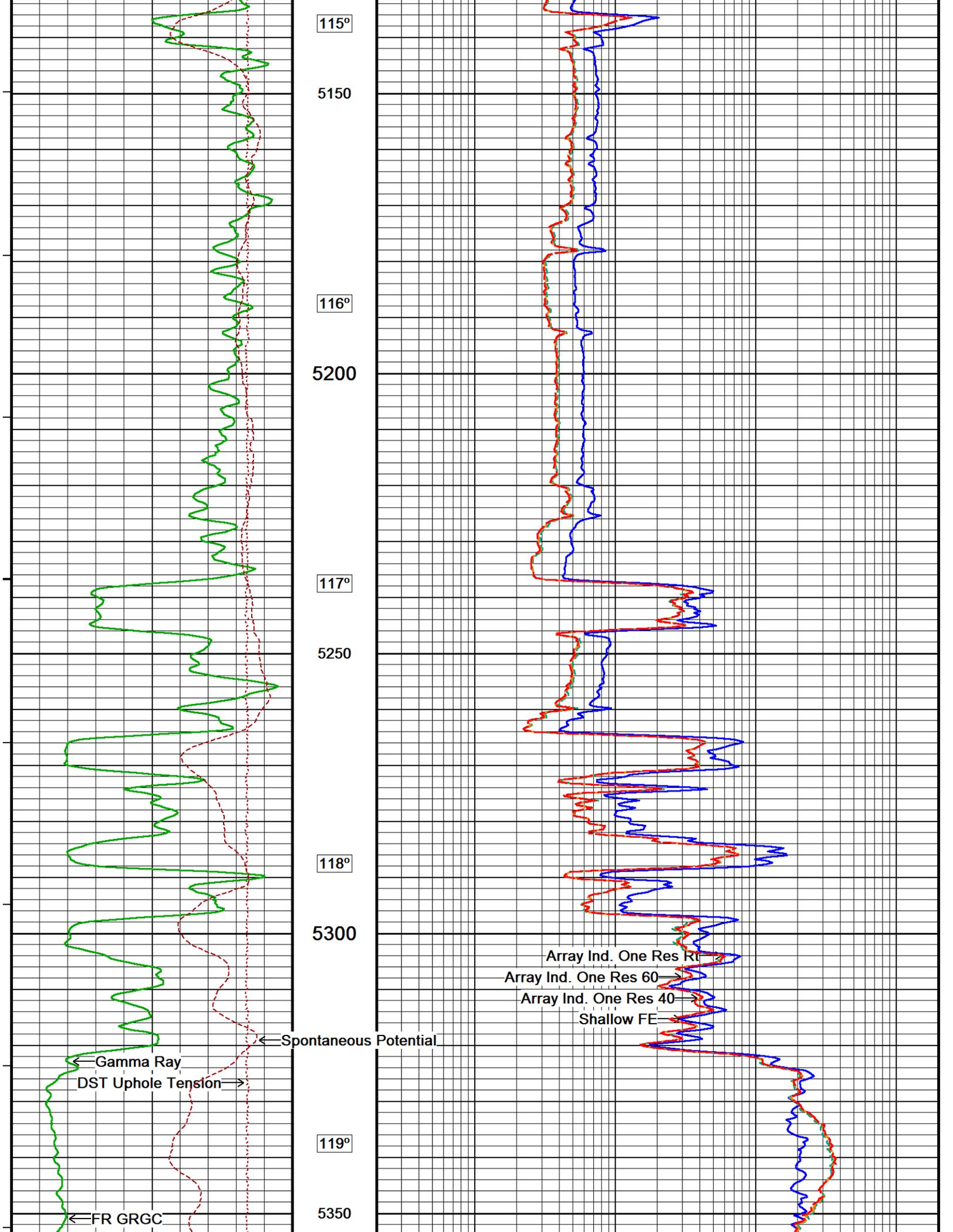
Gamma Ray  
API  
0 75 150  
150 225 300

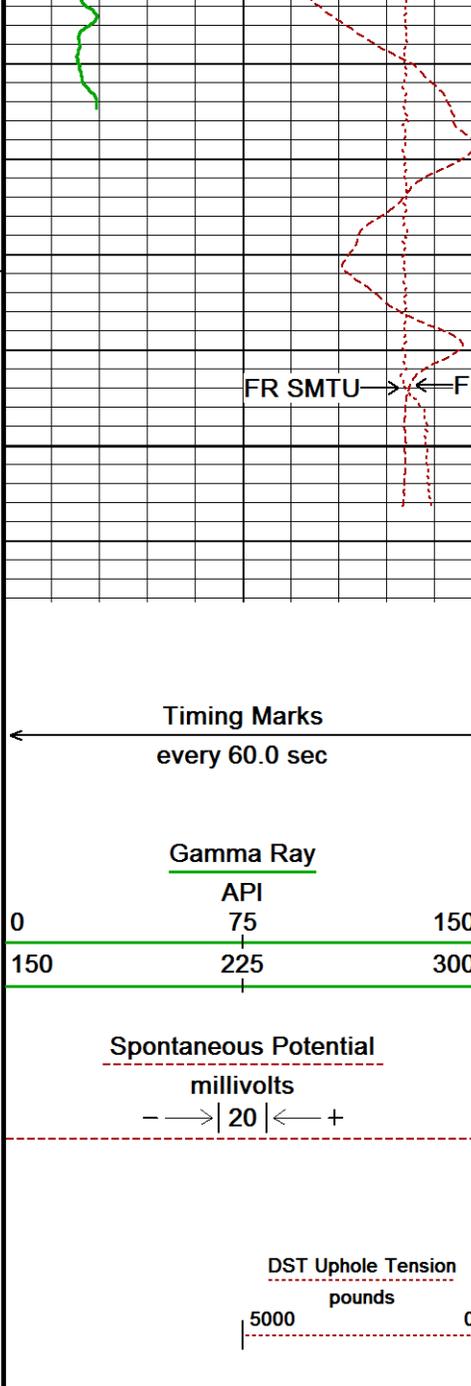
Spontaneous Potential  
millivolts

Borehole  
Temp in  
deg F









FR SMTU → ← FR SPCG

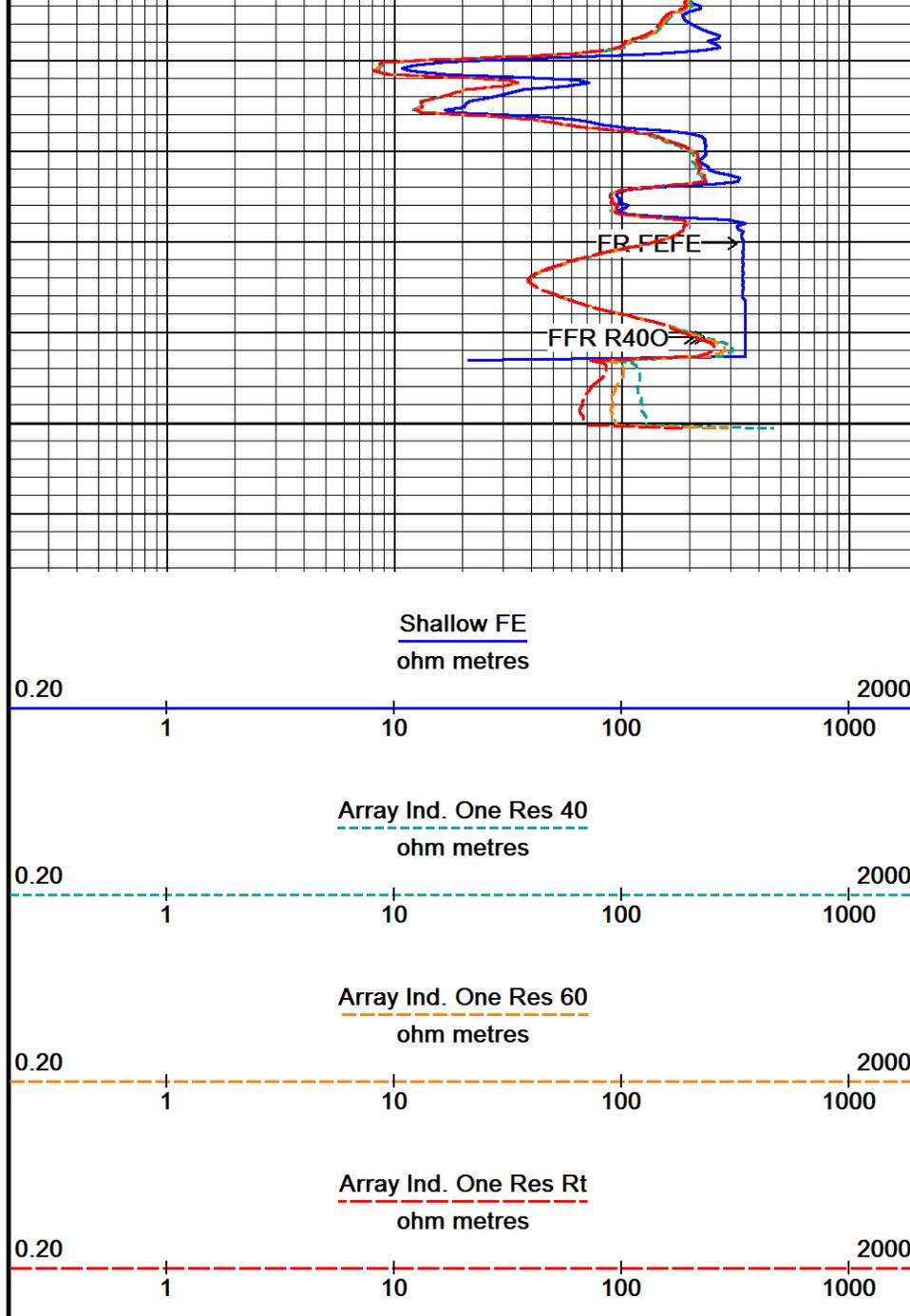
5400

5414

Depth in Feet

Borehole Temp in deg F

Replay Scale 1:240



Depth Based Data - Maximum Sampling Increment 10.0cm Plotted on 10-JAN-2013 15:34

Filename: C:\Users\E143235\AppData\Local\Temp\Weather...Western Operating Helfrich #1-6\_002.dta Recorded on 04-JAN-2013 06:48

System Versions: Logged with 13.04.8492 Plotted with 13.05.8506

↑ REPEAT SECTION ↑

### BEFORE SURVEY CALIBRATION

C:\Users\E143235\AppData\Local\Temp\Weatherford PreView2\8\Western Operating Helfrich #1-6\_005.dta

General Constants All 000 Last Edited on 04-JAN-2013,01:35

General Parameters

Mud Resistivity	1.260	ohm-metres
Mud Resistivity Temperature	79.000	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



4	19.8	2083.6
Deep	18.6	2050.9
Medium	42.3	3995.1
Shallow	42.8	5058.6

Array Temperature 61.9 Deg F

Induction Constants MAI-A.A 167

Last Edited on 04-JAN-2013,01:34

Induction Model	RtAP-WBM		
Caliper for Borehole Corr.	Density Caliper		
Hole Size for Borehole Correction	N/A	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	

**DOWNHOLE EQUIPMENT**

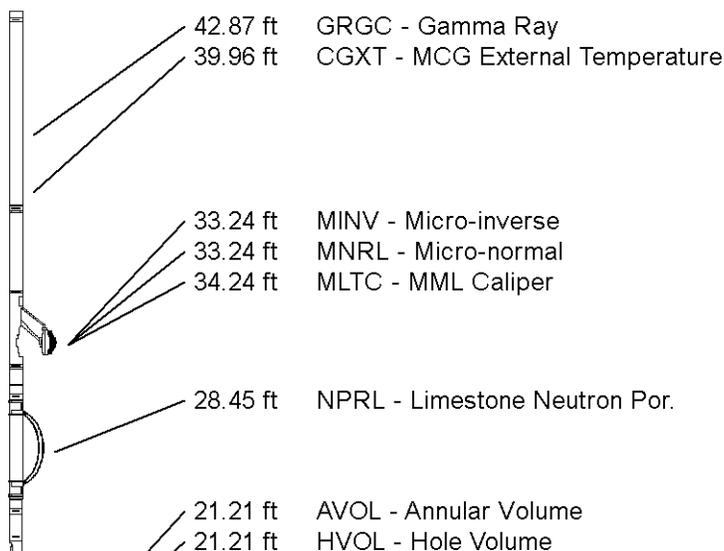
C:\Users\E143235\AppData\Local\Temp\Weatherford PreView2\8\Western Operating Helfrich #1-6\_005.dta

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

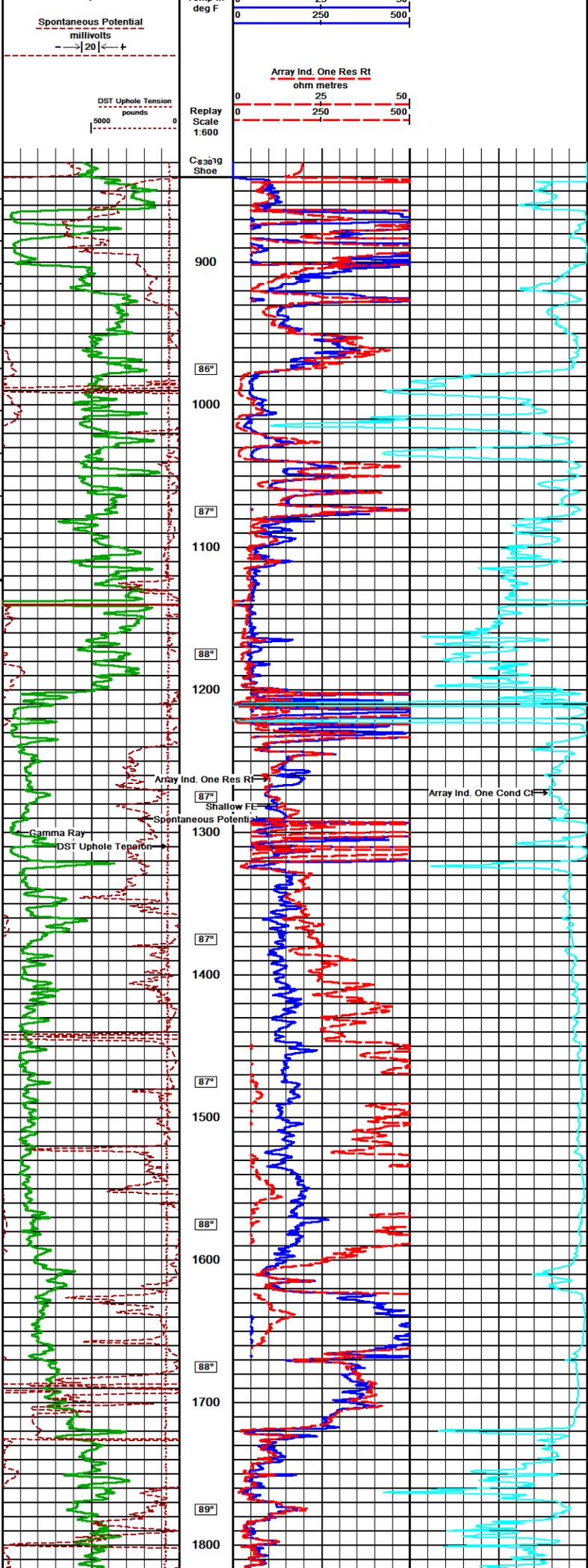
Compact Micro-log  
MML-A 16 LG: 7.97 ft WT: 81.6 lb OD: 2.24 in

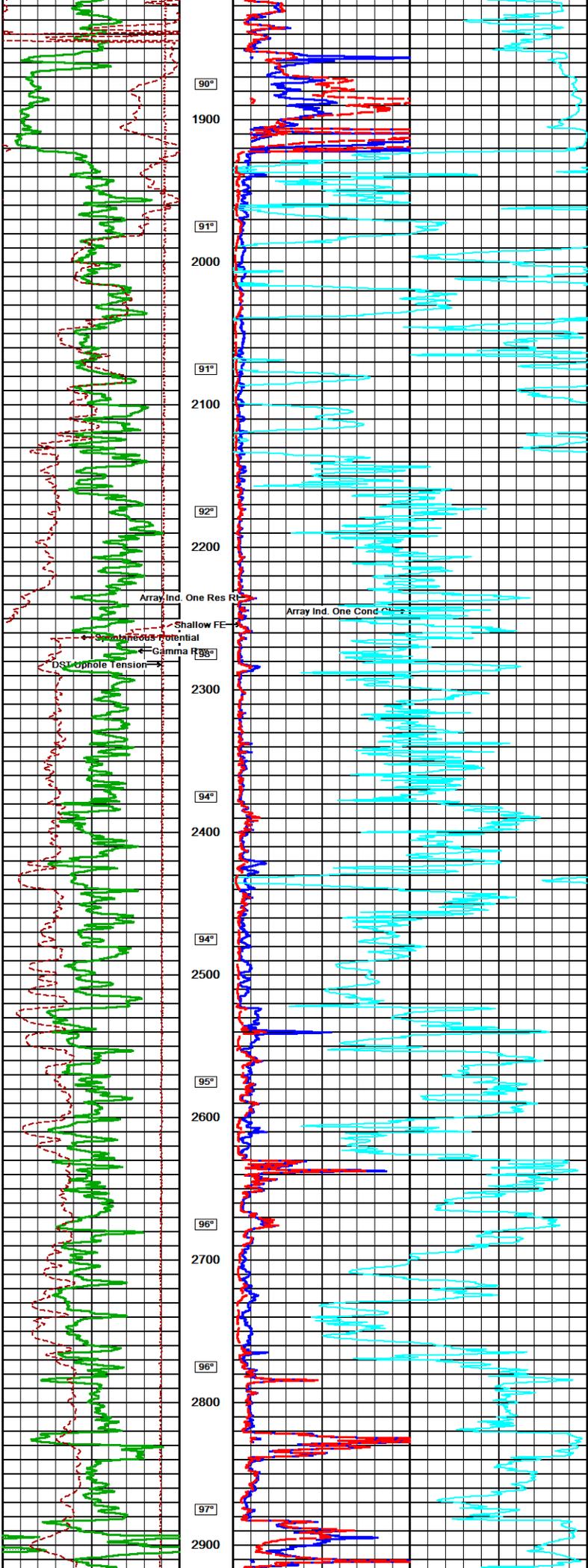
Compact Neutron  
MDN-A.B 66 LG: 5.04 ft WT: 50.7 lb OD: 2.24 in

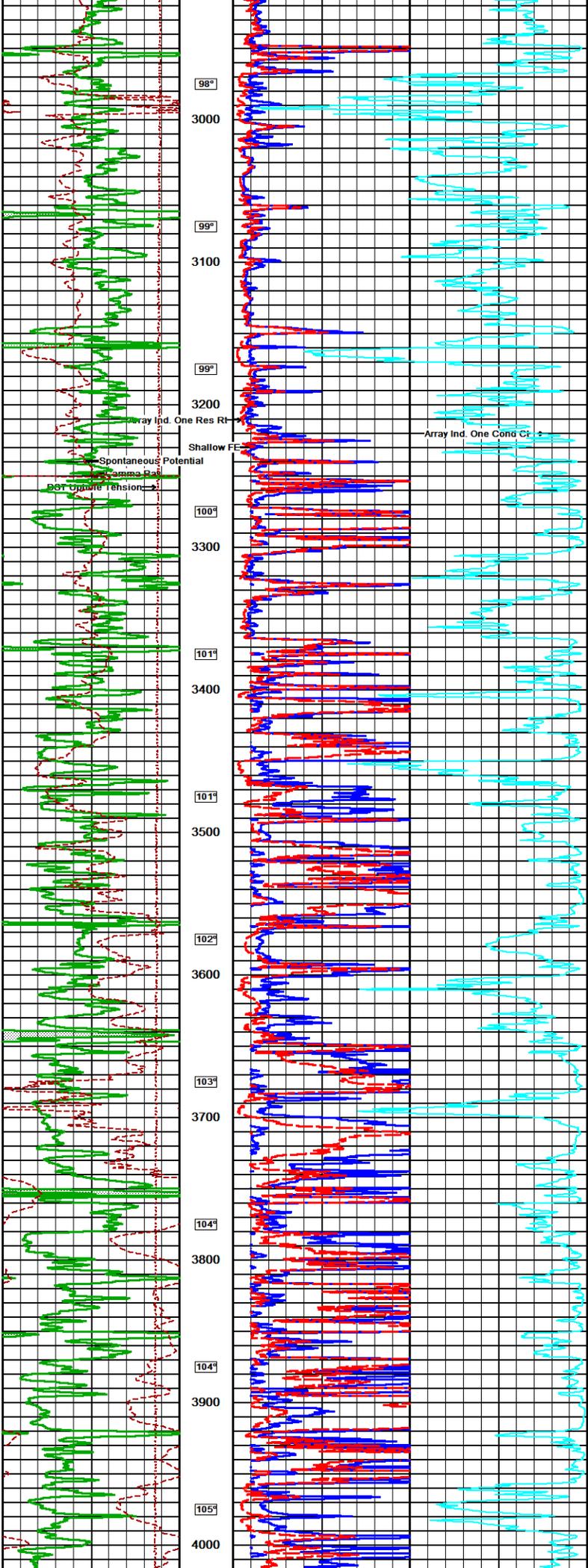
Compact Density/Caliper  
MPD-B 64 LG: 9.59 ft WT: 90.4 lb OD: 2.45 in

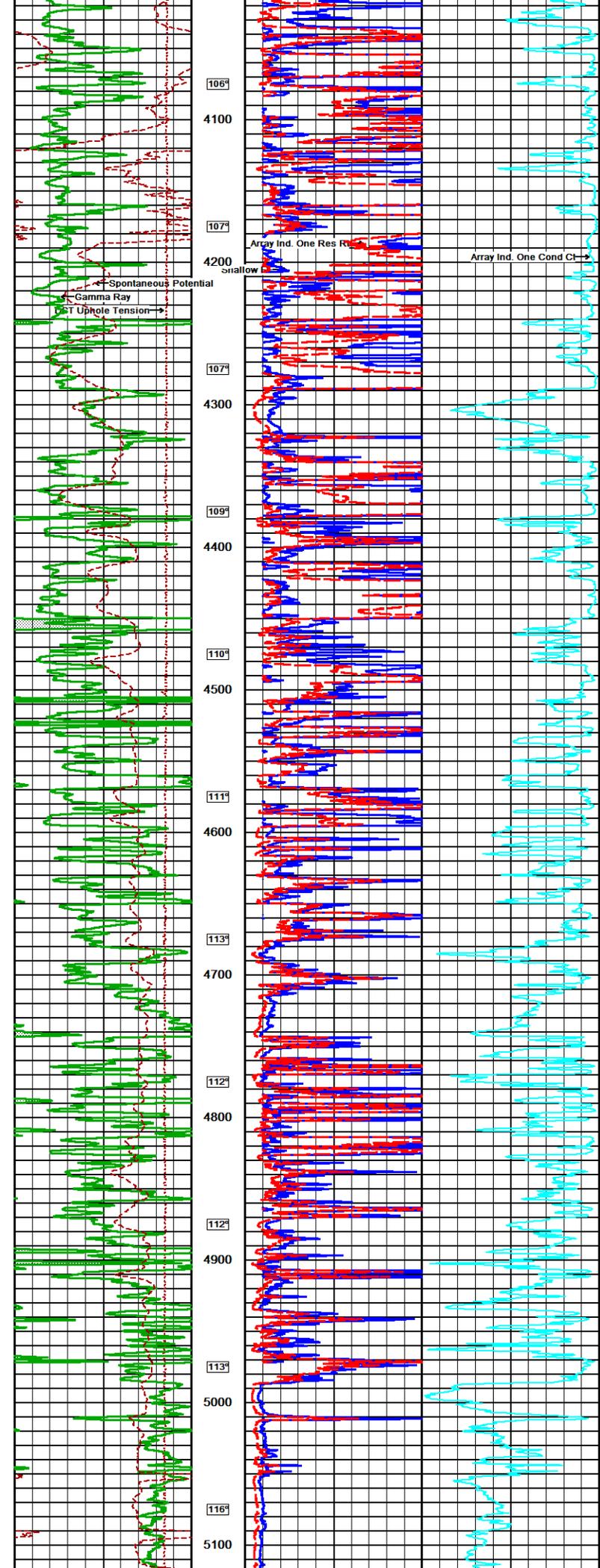


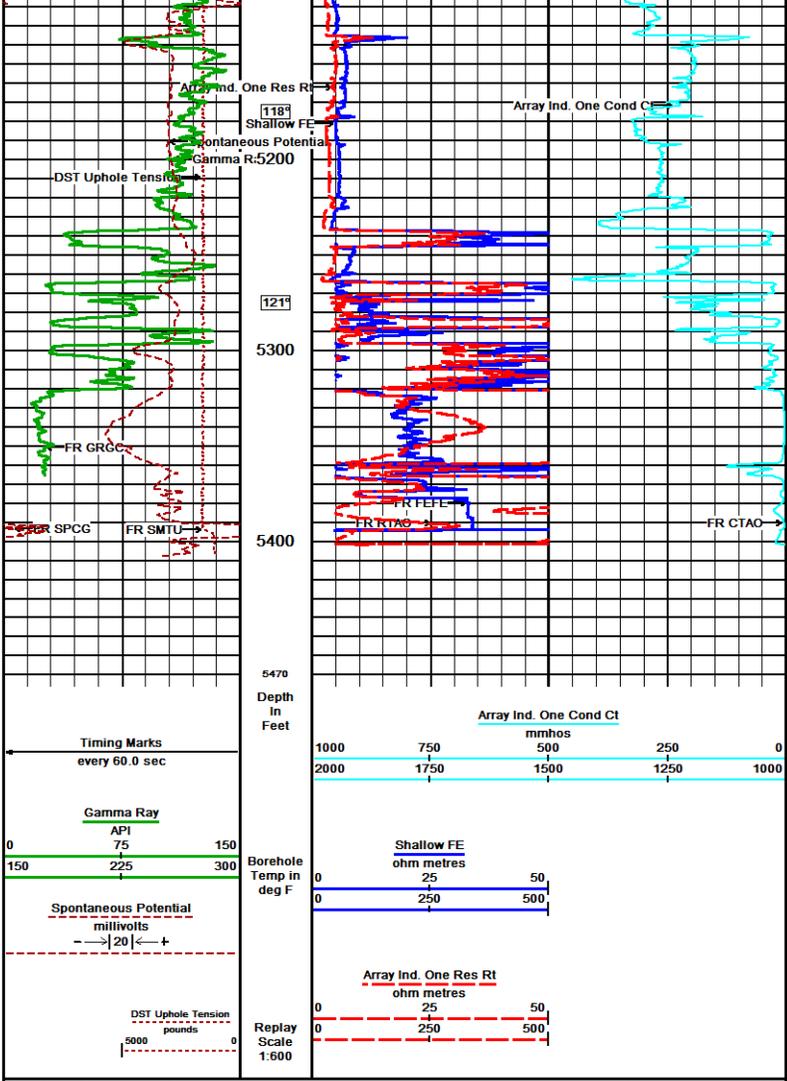












Depth Based Data - Maximum Sampling Increment 10.0cm  
 Plotted on 10-JAN-2013 15:34  
 Recorded on 04-JAN-2013 07:46  
 Filename: C:\Users\E143235\AppData\Local\Temp\Weatherford...\Western Operating Helfrich #1-6\_005.dta  
 System Versions: Logged with 13.04.8492 Plotted with 13.05.8506

1 INCH MAIN

COMPANY	WESTERN OPERATING COMPANY				
WELL	HELFRICH #1-6				
FIELD	HELFRICH				
PROVINCE/COUNTY	HAMILTON				
COUNTRY/STATE	U.S.A. / KANSAS				
Elevation Kelly Bushing	3586.00	feet	First Reading	5391.00	feet
Elevation Drill Floor	3585.00	feet	Depth Driller	5400.00	feet
Elevation Ground Level	3574.00	feet	Depth Logger	5394.00	feet
 <b>ARRAY INDUCTION</b> <b>SHALLOW FOCUSED</b> <b>ELECTRIC LOG</b>					