

**Weatherford****PHOTO DENSITY
COMPENSATED NEUTRON
LOGS**

COMPANY EAST CHEYENNE GAS STORAGE LLC

WELL ECGS NO 6-14 WPD008-1

FIELD PEETZ WEST

PROVINCE/COUNTY LOGAN

COUNTRY/STATE USA/COLORADO

LOCATION NWNE 257' FNL & 1642' FEL

SEC	TWP	RGE	Other Services
6	11N	52W	MAI

API Number	WPD008-1	CMI
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Permit Number	05-075-09403
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Permanent Datum GL, Elevation 4544 feet

Log Measured From KB	Elevations: KB 4558.00 DF 4557.00 GL 4544.00
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Drilling Measured From KB	
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Date	30-SEP-2012
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Run Number	ONE
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Depth Driller	5265.00	feet
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Depth Logger	5267.00	feet
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First Reading	5213.00	feet
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Last Reading	1212.00	feet
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Casing Driller	1217.00	feet
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Casing Logger	1212.00	feet
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Bit Size	8.750	inches
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Hole Fluid Type	WBM
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Density / Viscosity	10.00 g/c3	38.00 CP
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PH / Fluid Loss	10.00	6.40 ml/10min
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Sample Source	FLOWLINE
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Rm @ Measured Temp	2.37 @ 93.5	ohm-m
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Rmf @ Measured Temp	1.896 @ 93.5	ohm-m
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Rmc @ Measured Temp	2.844 @ 93.5	ohm-m
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Source Rmf / Rmc	CALC	CALC
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Rm @ BHT	1.458 @154.0	ohm-m
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Time Since Circulation	4 HOURS
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Max Recorded Temp	154.00	deg F
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Equipment Name	COMPACT
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Equipment / Base	13144	RK SPR
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Recorded By	B. ROSSER	
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Witnessed By	J. ASHBY	T. BENICH
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BOREHOLE RECORD

Last Edited: 30-SEP-2012 07:16

Bit Size
inchesDepth From
feetDepth To
feet

8.750

1212.00

5267.00

CASING RECORD

Type

Size
inchesDepth From
feetShoe Depth
feetWeight
pounds/ft

SURFACE

9.625

0.00

1212.00

36.00

REMARKS

SOFTWARE VERSION 13.03.7779

TOOLS RUN: SHA, MCG, MDN, MPD, MIS-D, SKJ, MIS-E, SKJ, SHA, MIM, MIE, SKJ, MFE, MAI RUN IN COMBINATION.

HARDWARE: MPD: 8" PROFILE PLATE USED.
MAI: TWO 1 INCH STANDOFFS USED.
MFE: ONE 1 INCH STANDOFF USED.
MDN: DUAL BOWSPRING USED.
MIM: ONE NONMETALIC CENTRALIZING BASKET USED.
MIE: ONE 1 INCH STANDOFF USED

2.65 G/CC DENSITY MATRIX USED TO CALCULATE POROSITY FROM TD TO BOTTOM OF NIOBRARA FORMATION (5267 FT TO 4655 FT).

2.71 G/CC DENSITY MATRIX USED TO CALCULATE POROSITY IN NIOBRARA FORMATION (4655 FT TO 4200 FT).

TIGHT PULLS, BOREHOLE SIZE AND RUGOSITY WILL AFFECT REPEATABILITY AND DATA QUALITY.

ALL INTERVALS LOGGED AND SCALED PER CUSTOMER'S REQUEST

ALL INTERVALS LOGGED AND CORRECTED FOR CUSTOMER REQUEST.

LAT, LONG: 40.96288 N, 103.21683 W

TOTAL HOLE VOLUME FROM TD TO SURFACE CASING =1770 CUBIC FEET

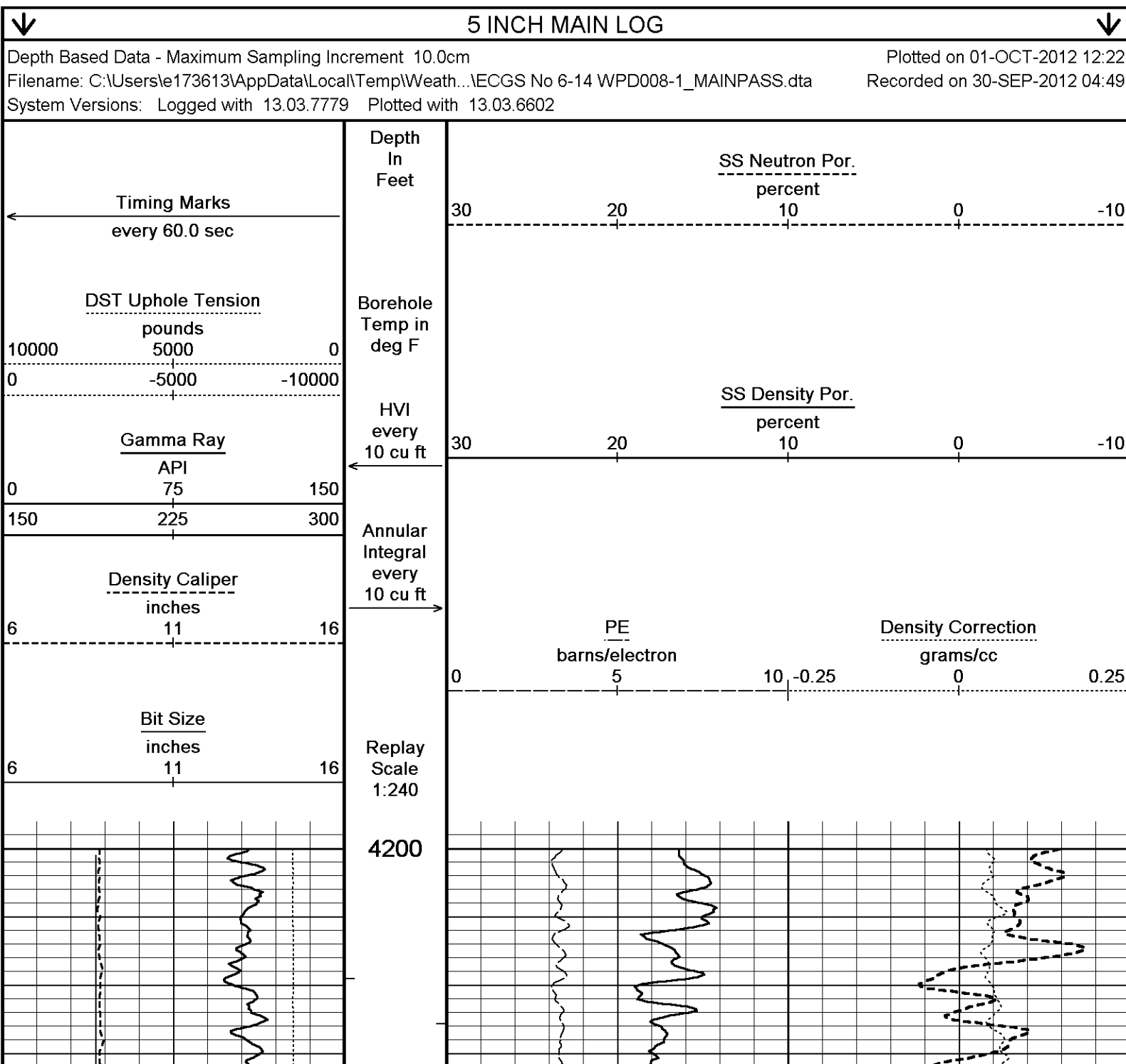
ANNULAR VOLUME WITH 7 INCH PRODUCTION CASING FROM TD TO SURFACE CASING = 700 CUBIC FEET

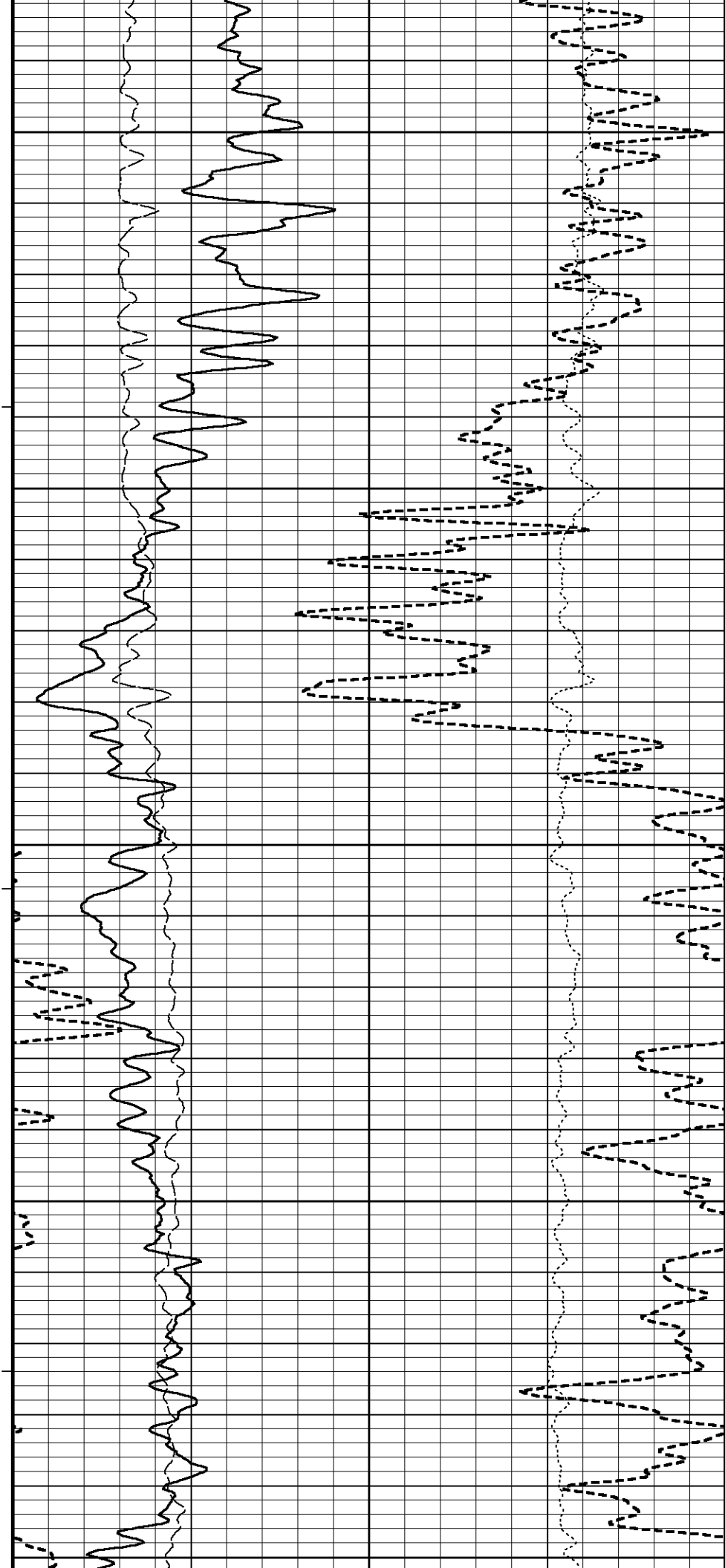
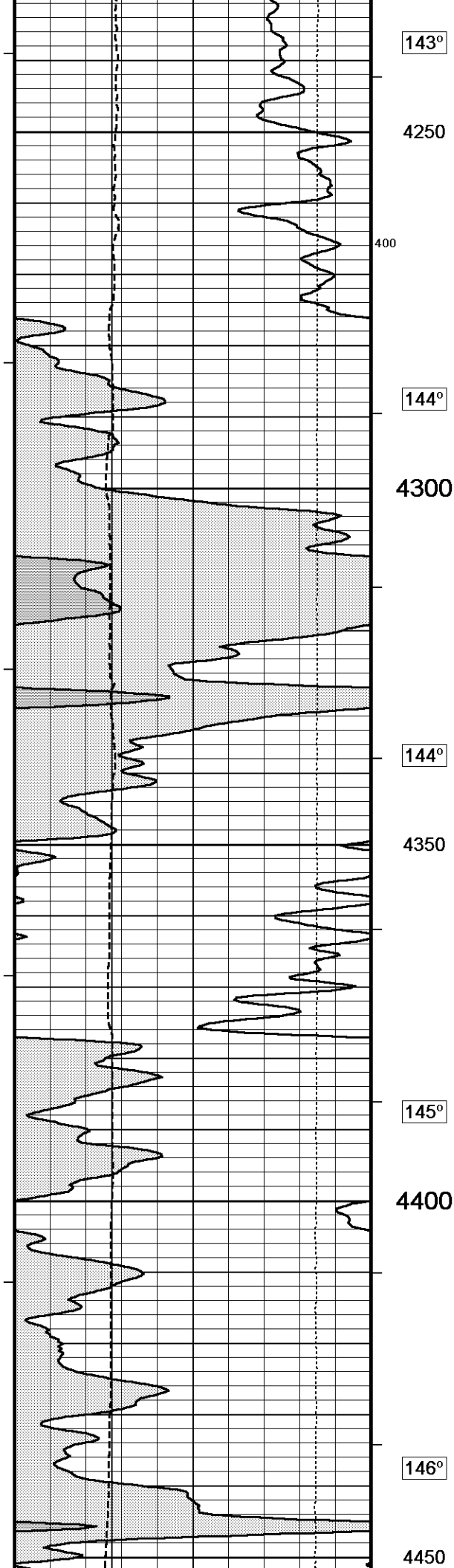
SERVICE ORDER: #3531928

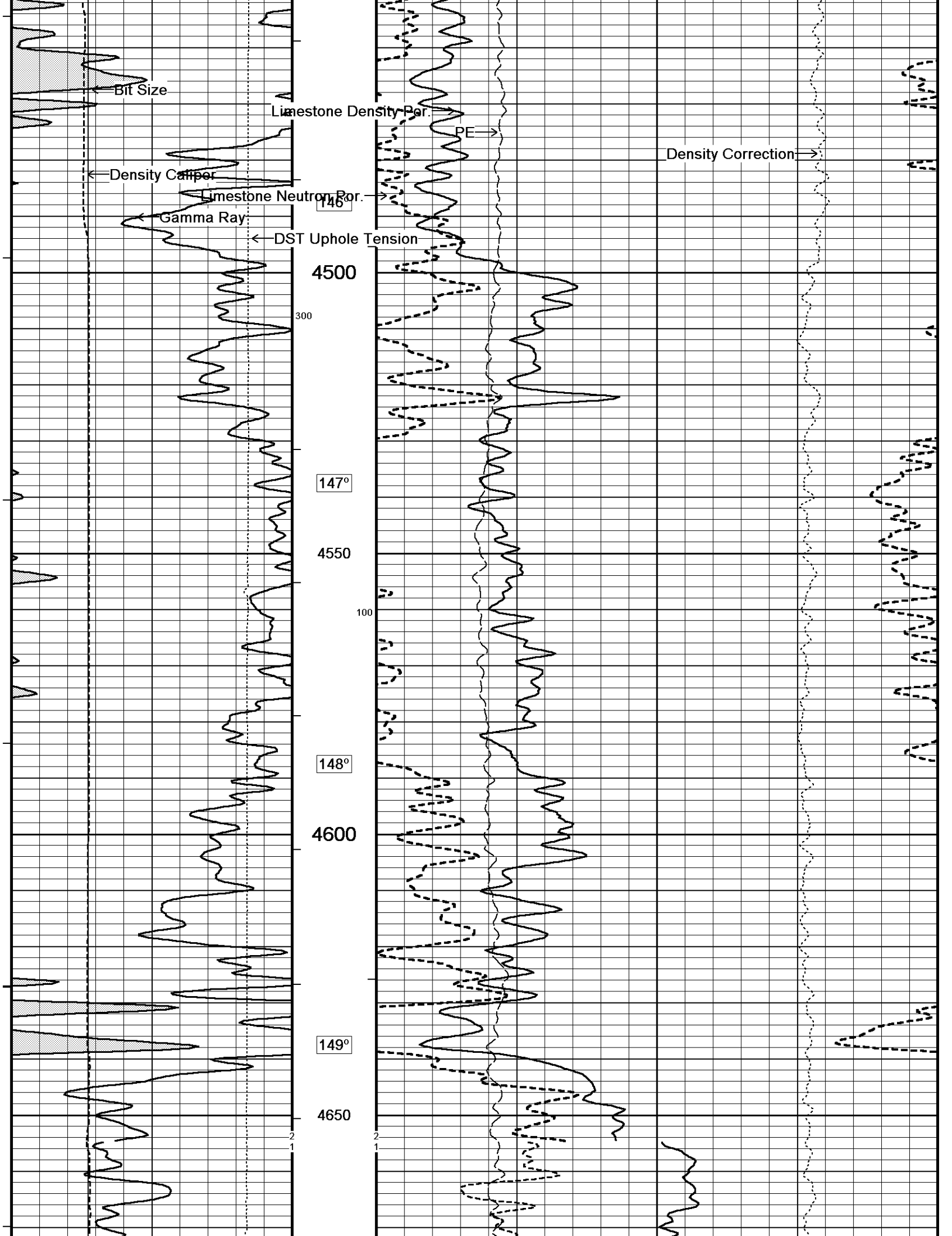
OPERATOR: D. SMITH
S.ELMORE

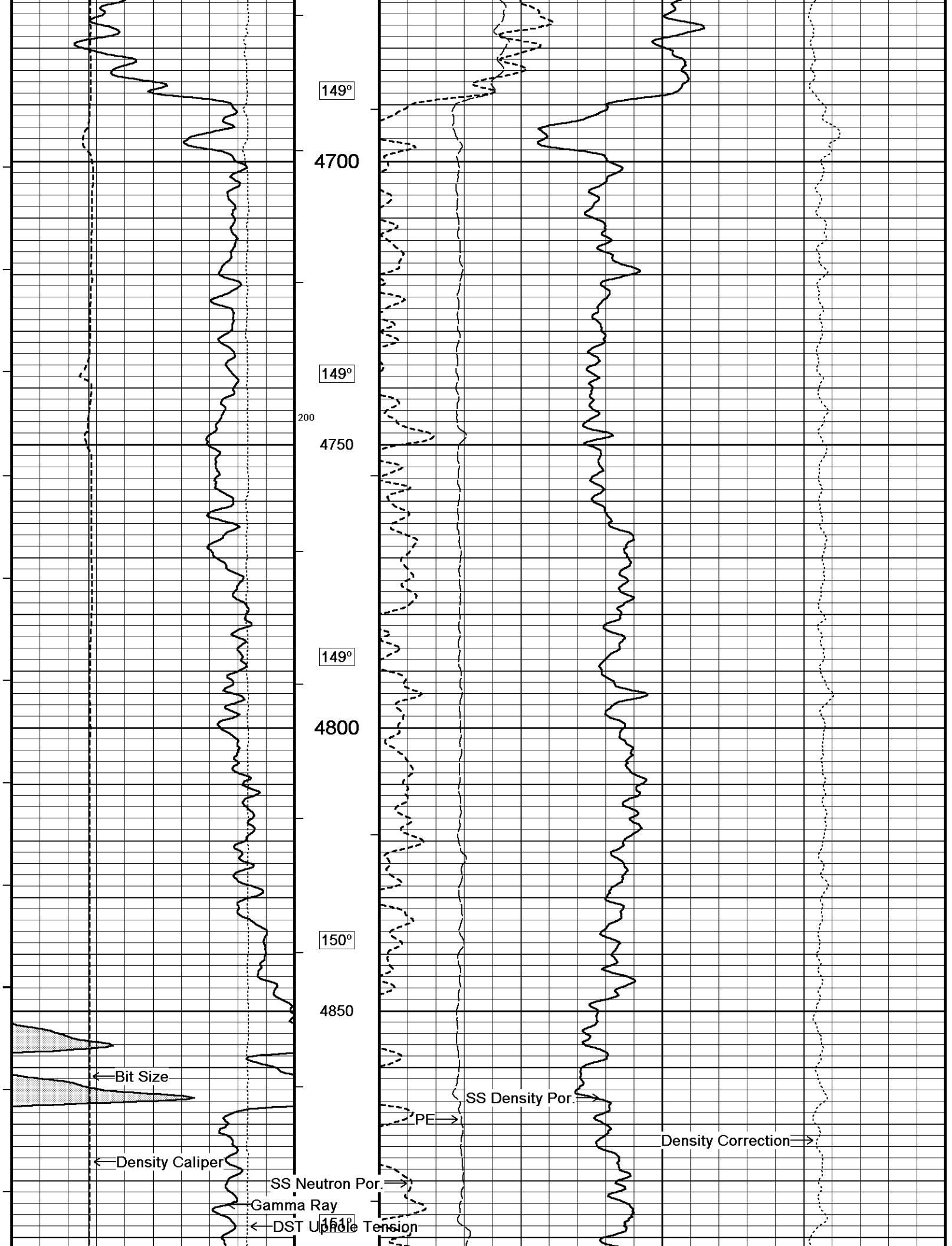
RIG: CADE 22

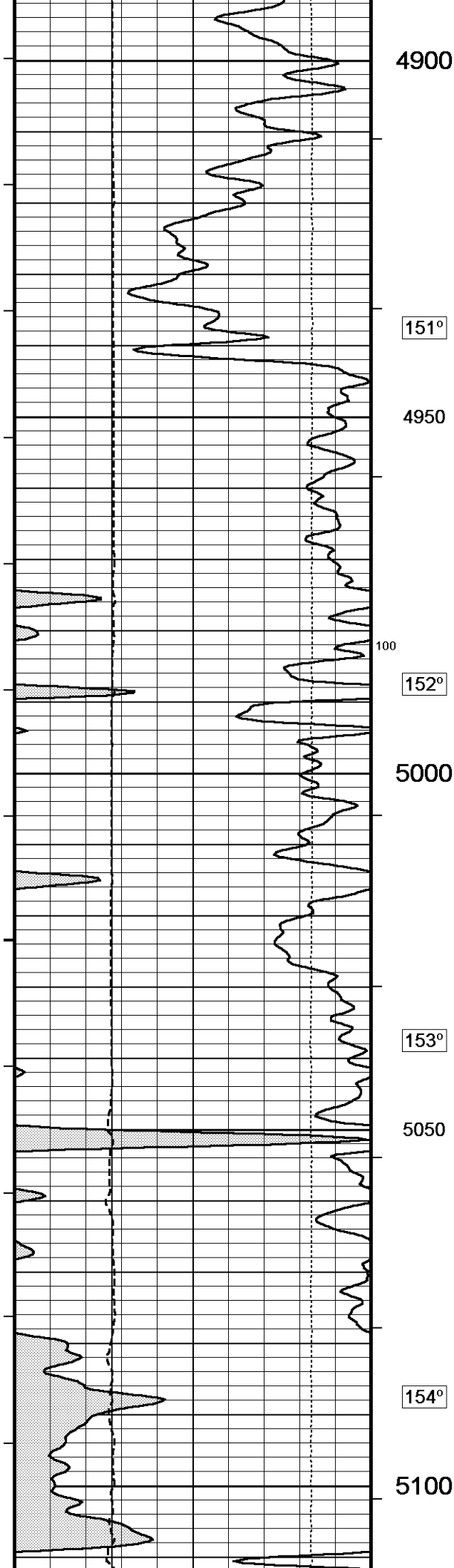
All interpretations are opinions based on inferences from electrical or other measurements and we cannot, and do not, guarantee the accuracy or correctness of any interpretations, and we shall not, except in the case of gross or wilful negligence on our part, be liable or responsible for any loss, costs,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











4900

151°

4950

100

152°

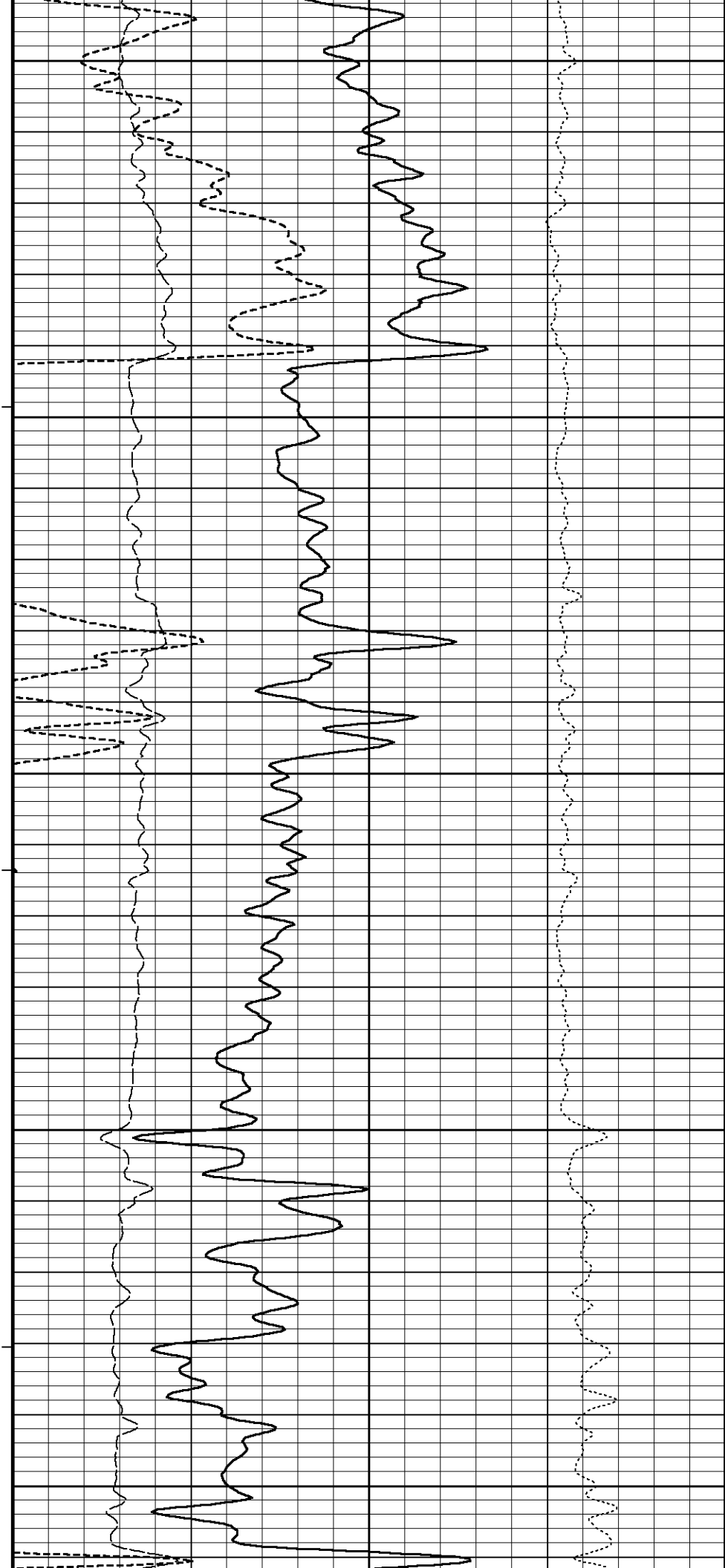
5000

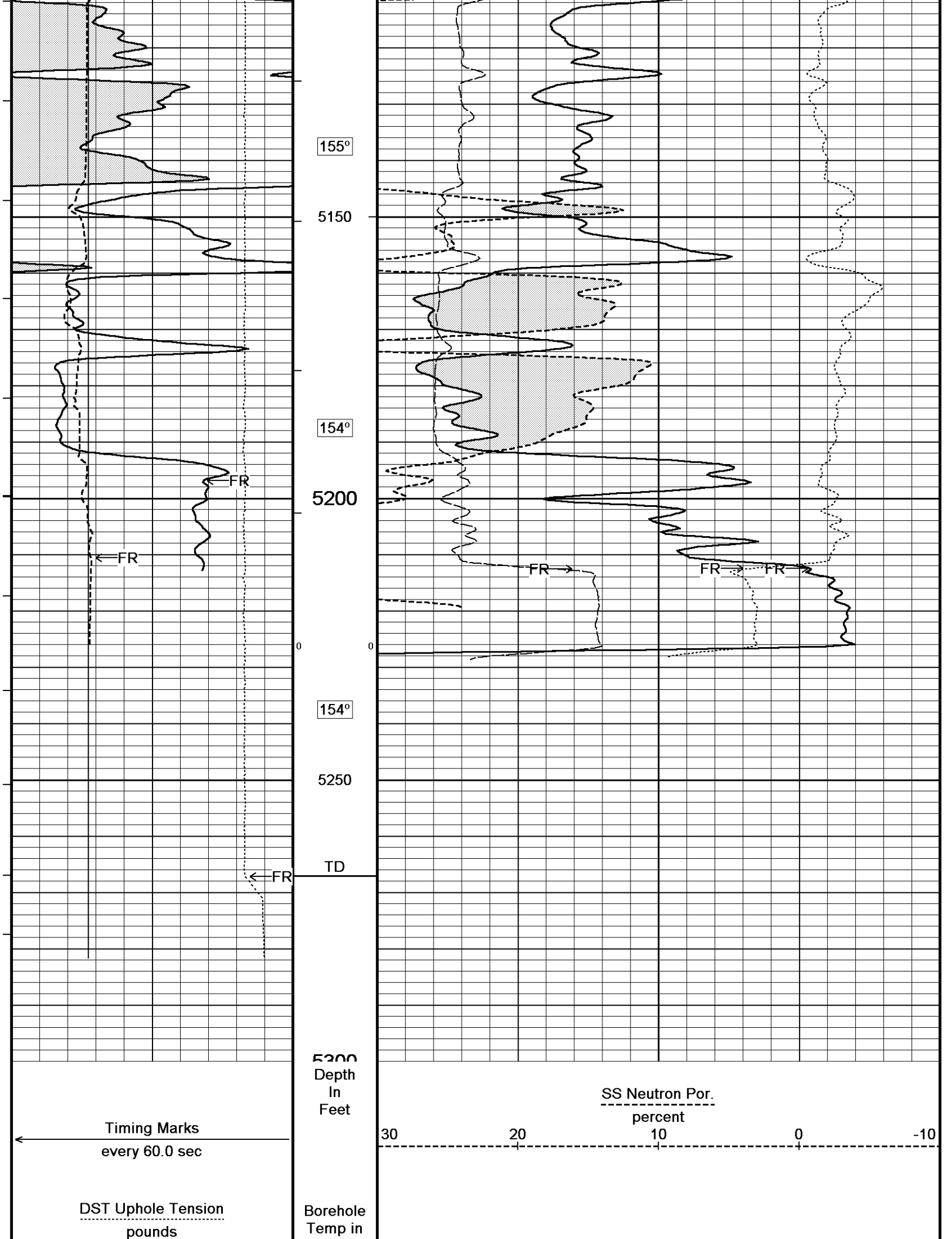
153°

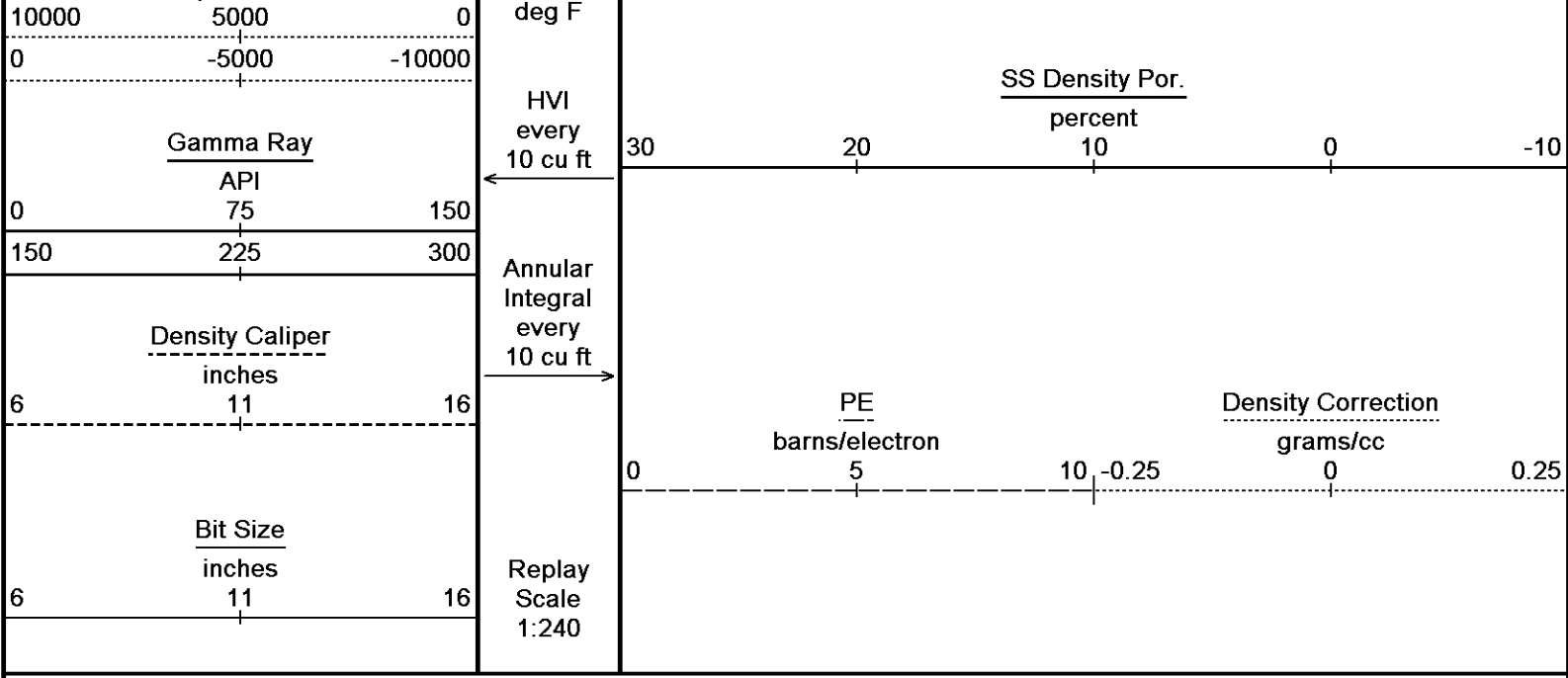
5050

154°

5100







Depth Based Data - Maximum Sampling Increment 10.0cm
Filename: C:\Users\le173613\AppData\Local\Temp\Weath...\IECGS No 6-14 WPD008-1_MAINPASS.dta
System Versions: Logged with 13.03.7779 Plotted with 13.03.6602

↑

5 INCH MAIN LOG

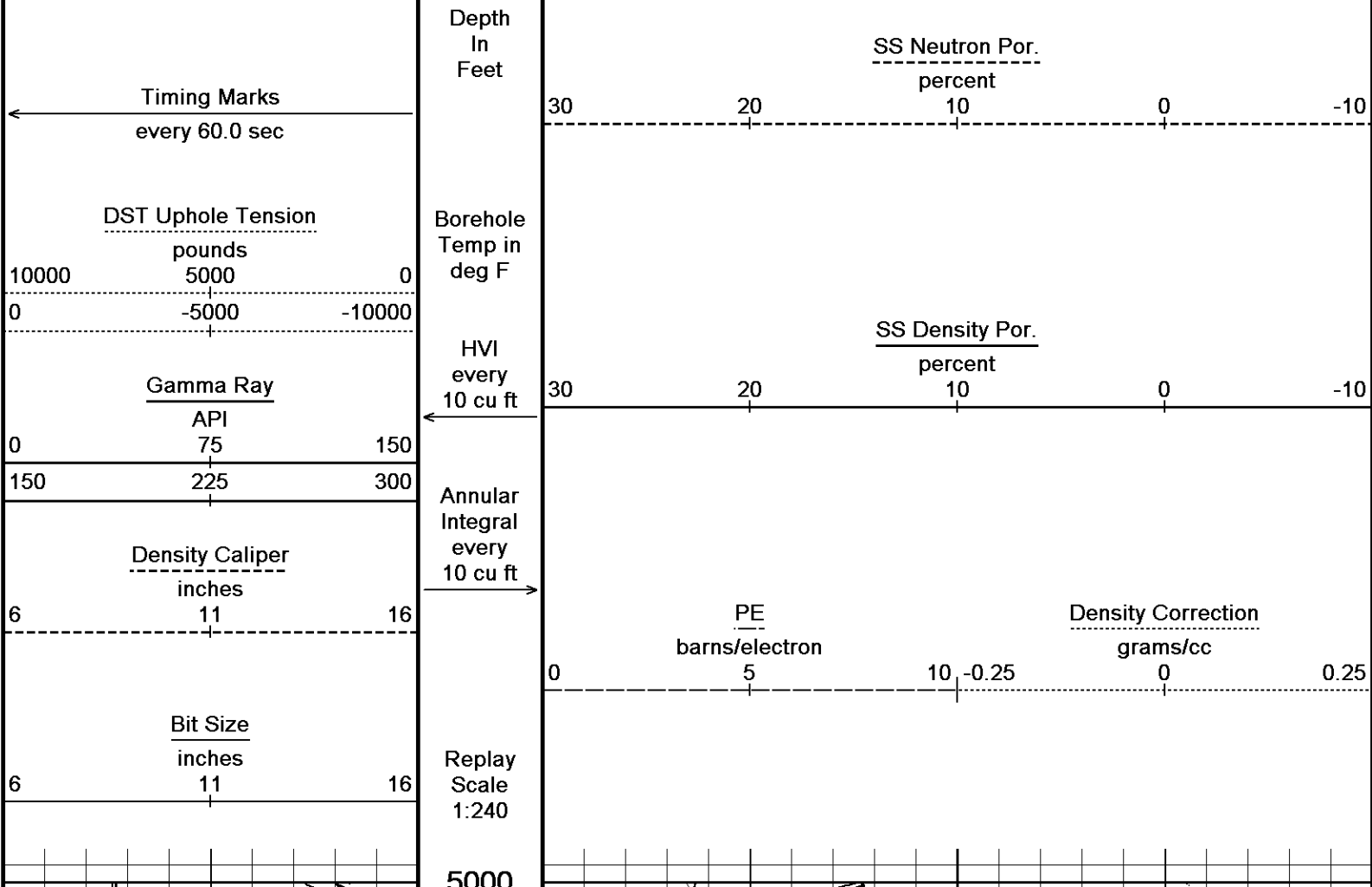
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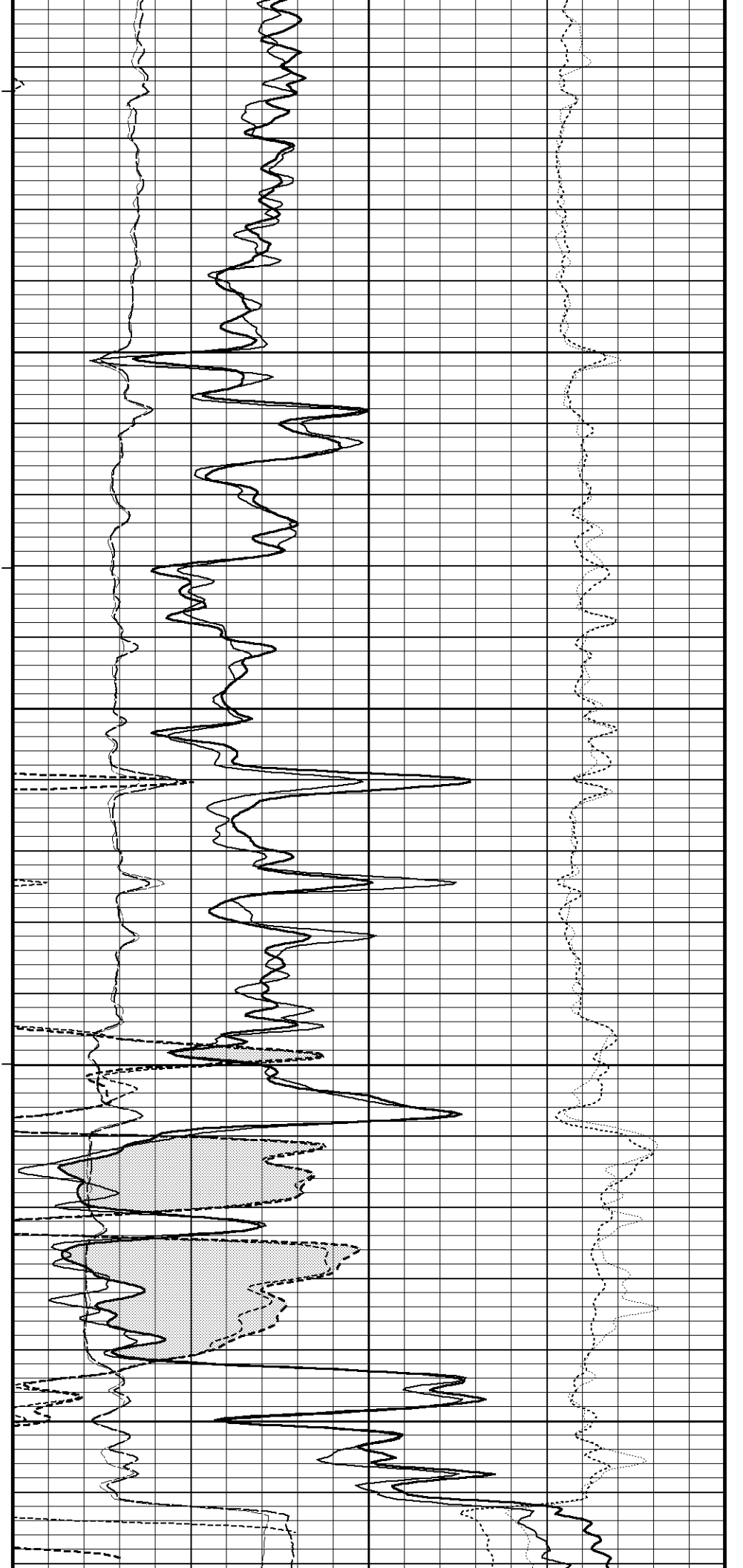
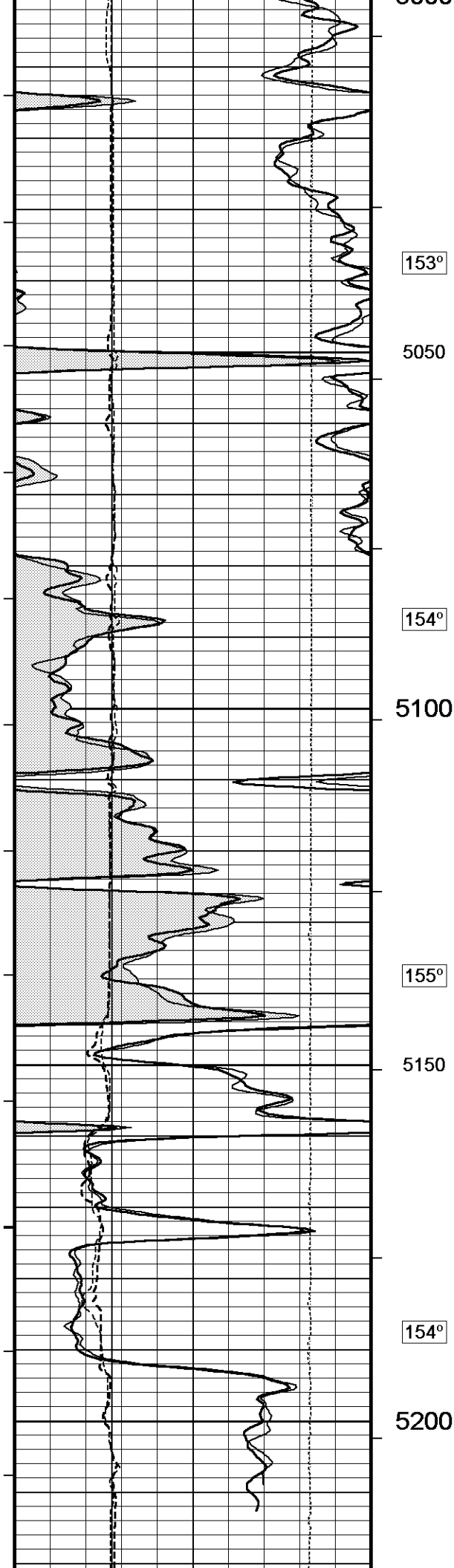
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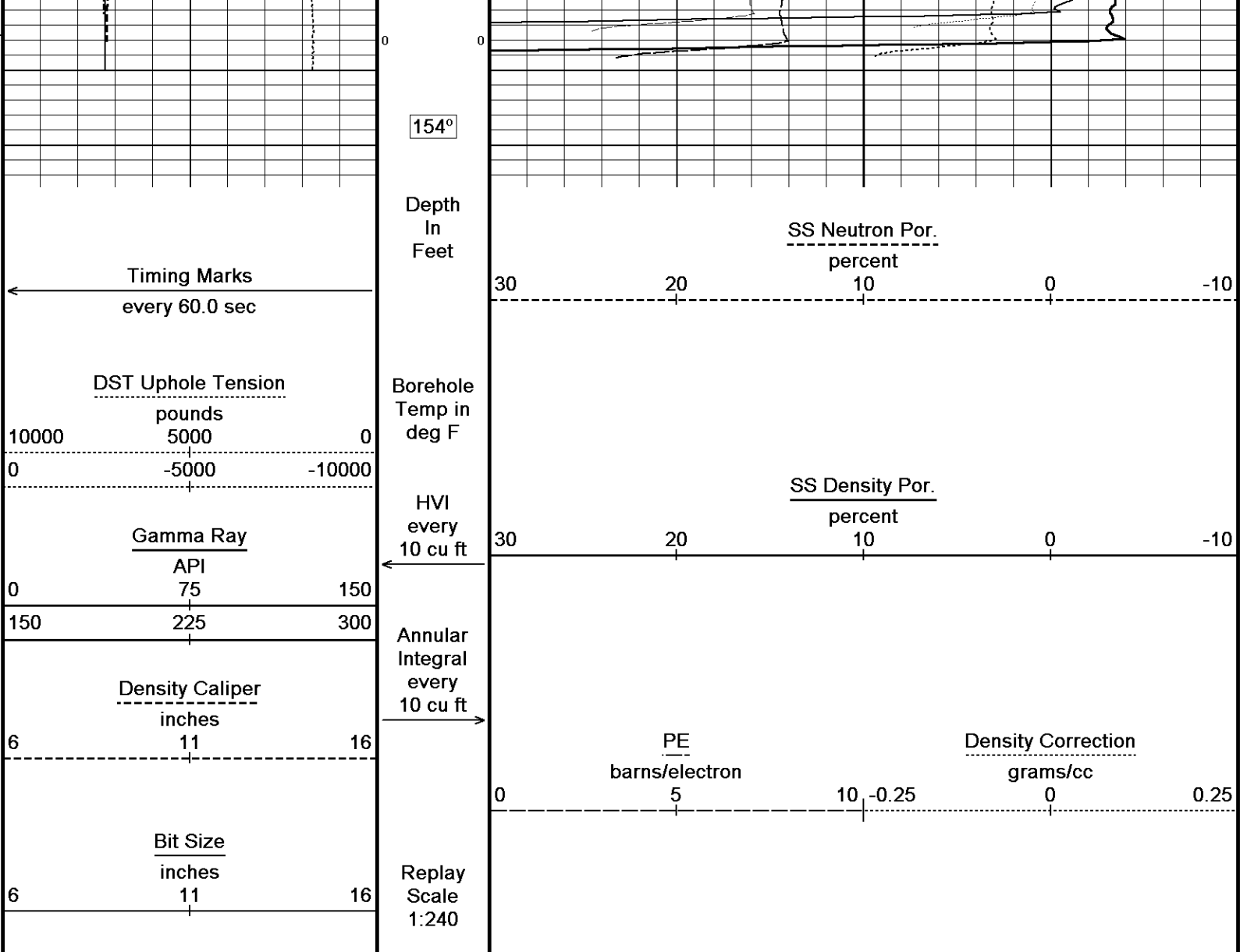
OVERLAY SECTION

↓

Depth Based Data - Maximum Sampling Increment 10.0cm
Filename: C:\Users\le173613\AppData\Local\Temp\Weath...\IECGS No 6-14 WPD008-1_MAINPASS.dta
Filename: C:\Users\le173613\AppData\Local\Temp\Weatherf...\IECGS No 6-14 WPD008-1_REPEAT.dta
System Versions: Logged with 13.03.7779 Plotted with 13.03.6602







Depth Based Data - Maximum Sampling Increment 10.0cm
Filename: C:\Users\le173613\AppData\Local\Temp\Weath...\IECGS No 6-14 WPD008-1_MAINPASS.dta
Filename: C:\Users\le173613\AppData\Local\Temp\Weatherf...\IECGS No 6-14 WPD008-1_REPEAT.dta
System Versions: Logged with 13.03.7779 Plotted with 13.03.6602

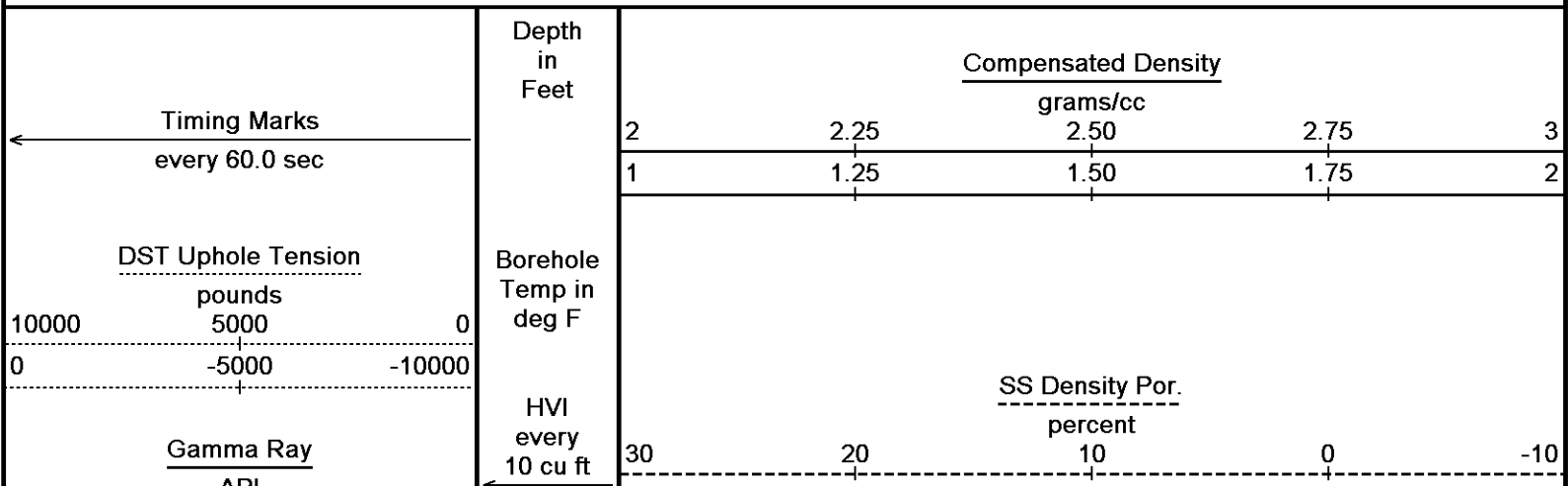
Plotted on 01-OCT-2012 12:23
Recorded on 30-SEP-2012 04:49
Recorded on 30-SEP-2012 04:33

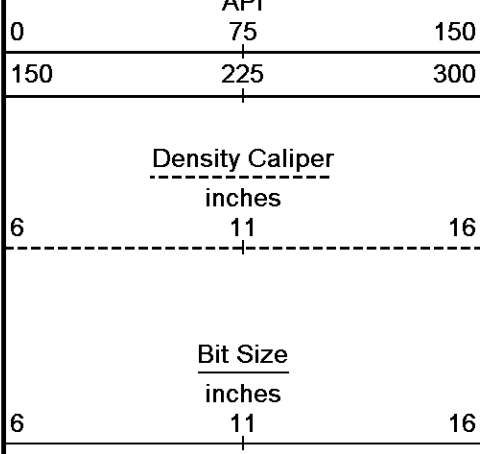
↑ OVERLAY SECTION ↑

↓ 5 INCH MAIN LOG ↓

Depth Based Data - Maximum Sampling Increment 10.0cm
Filename: C:\Users\le173613\AppData\Local\Temp\Weath...\IECGS No 6-14 WPD008-1_MAINPASS.dta
System Versions: Logged with 13.03.7779 Plotted with 13.03.6602

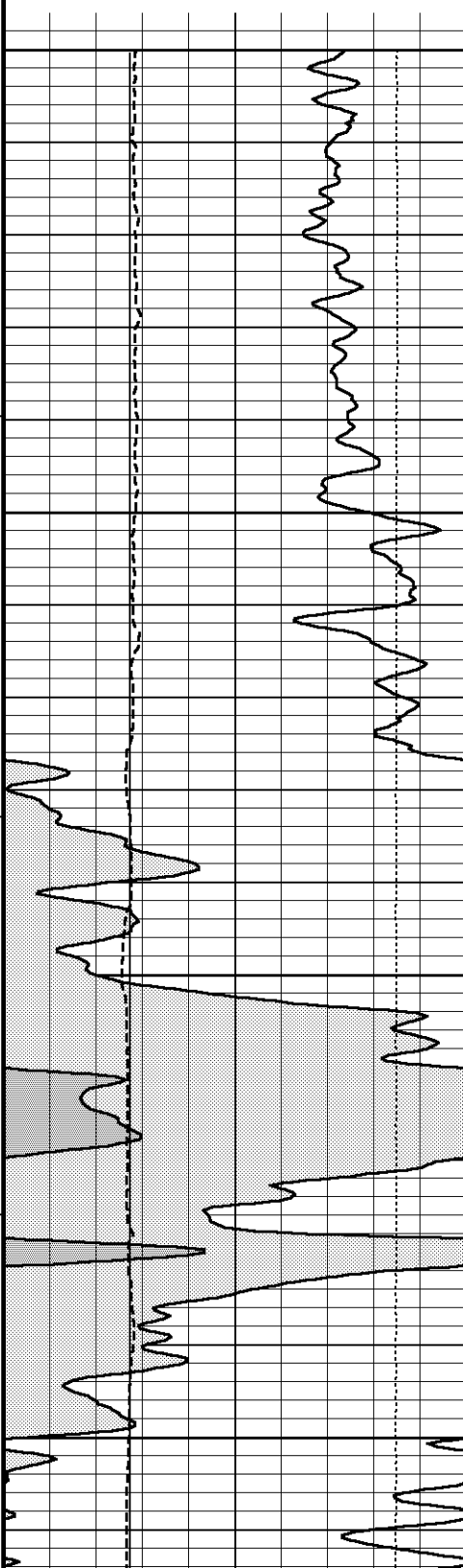
Plotted on 01-OCT-2012 12:23
Recorded on 30-SEP-2012 04:49





Annular
Integral
every
10 cu ft

Replay
Scale
1:240



4200

143°

4250

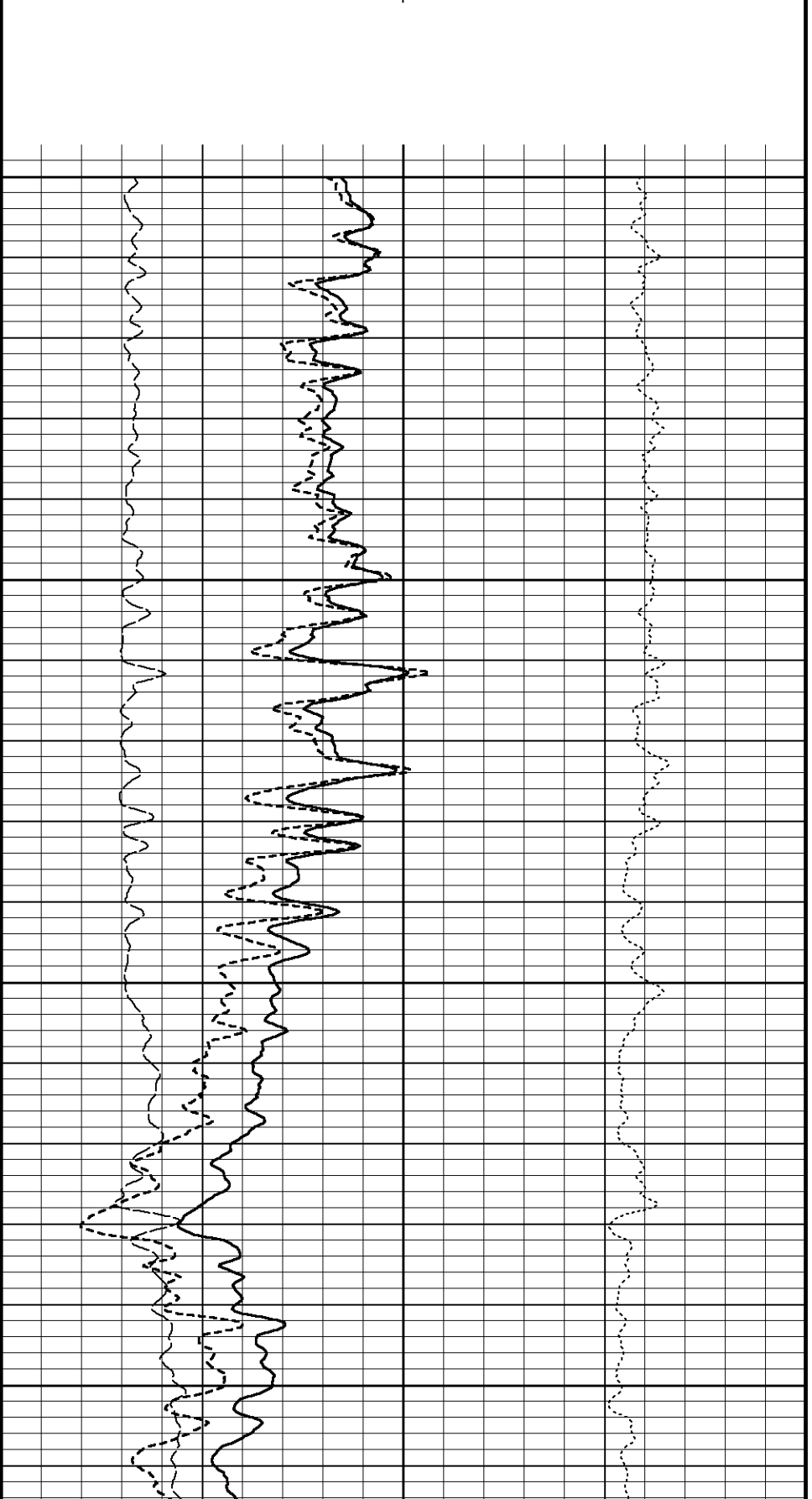
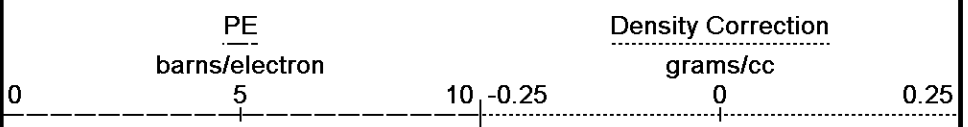
400

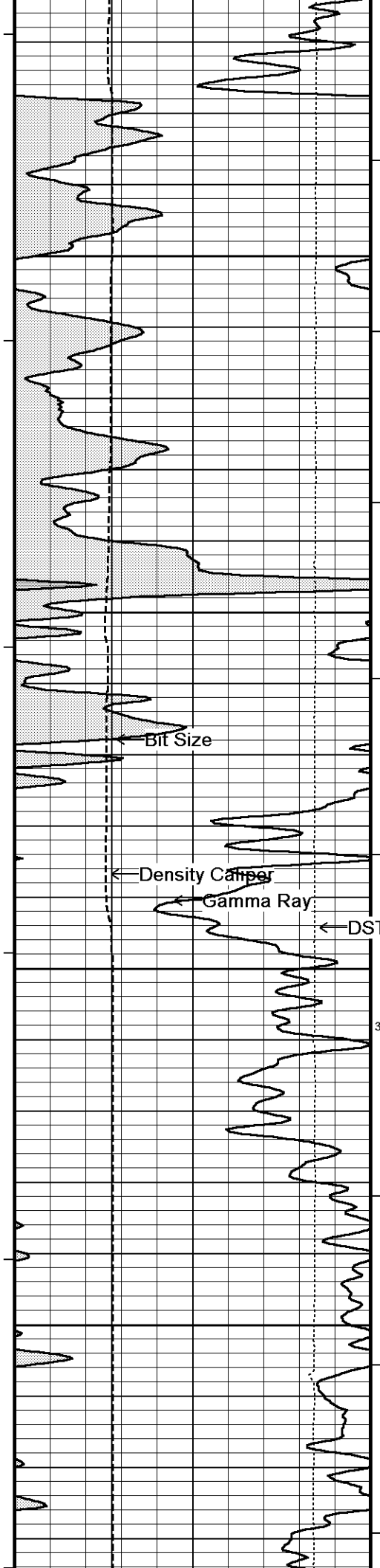
144°

4300

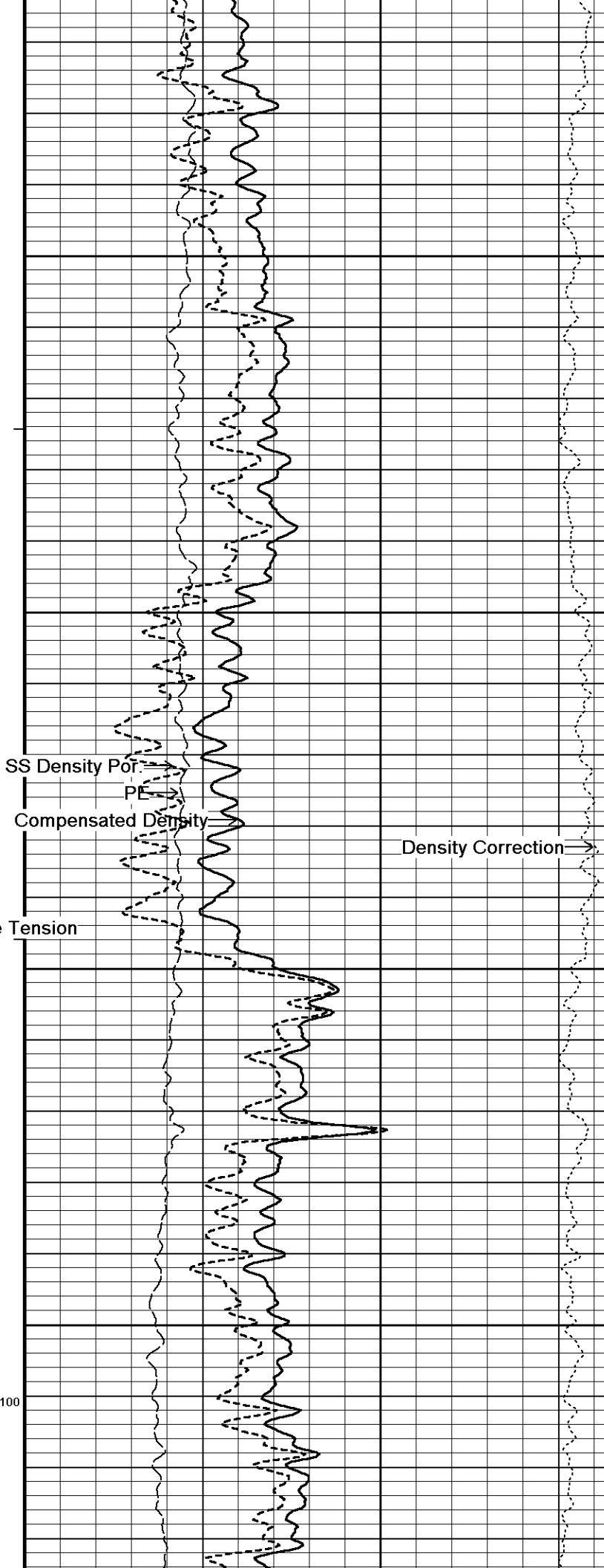
144°

4350





145°
4400
146°
4450
146°
4500
300
147°
4550
100



Bit Size

Density Caliper

Gamma Ray

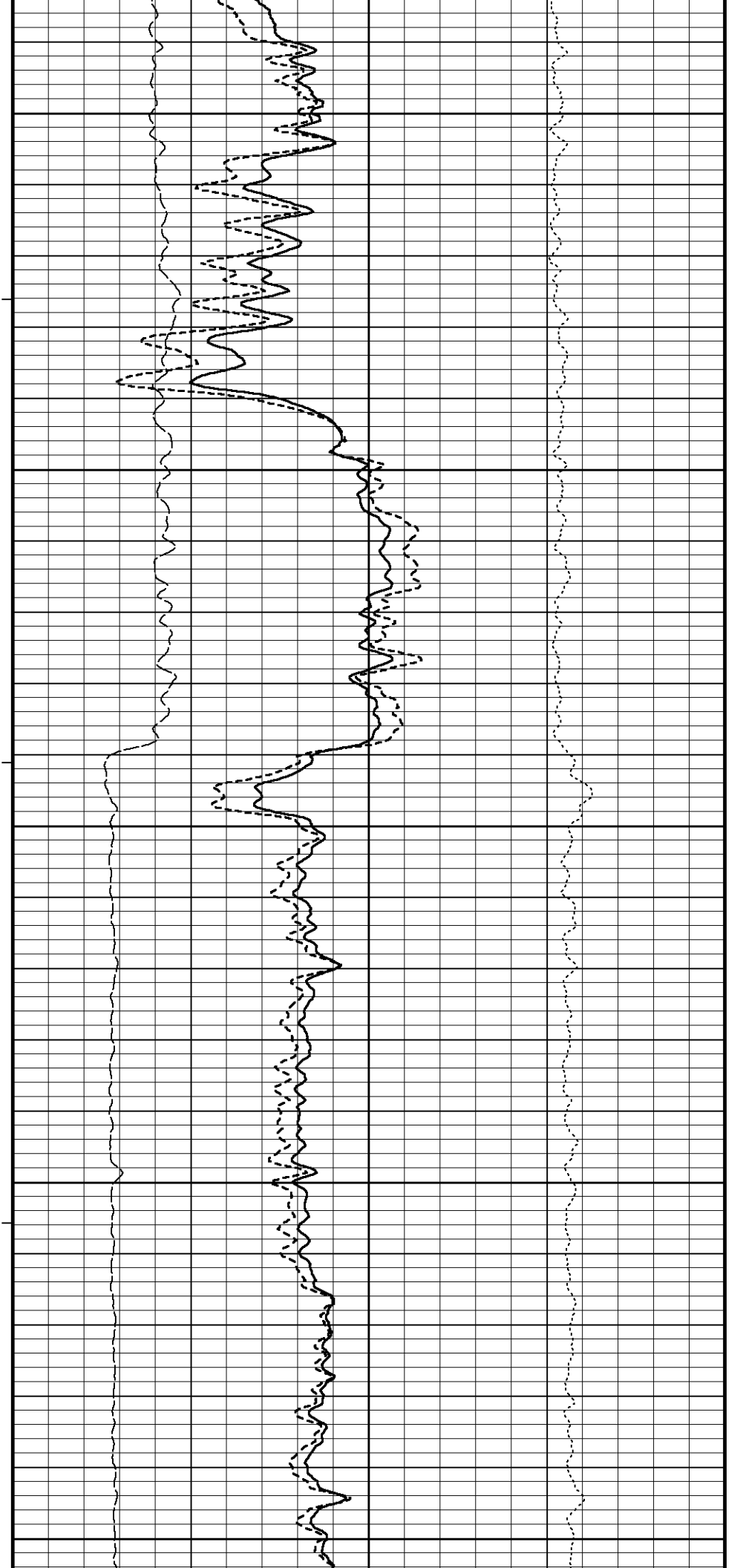
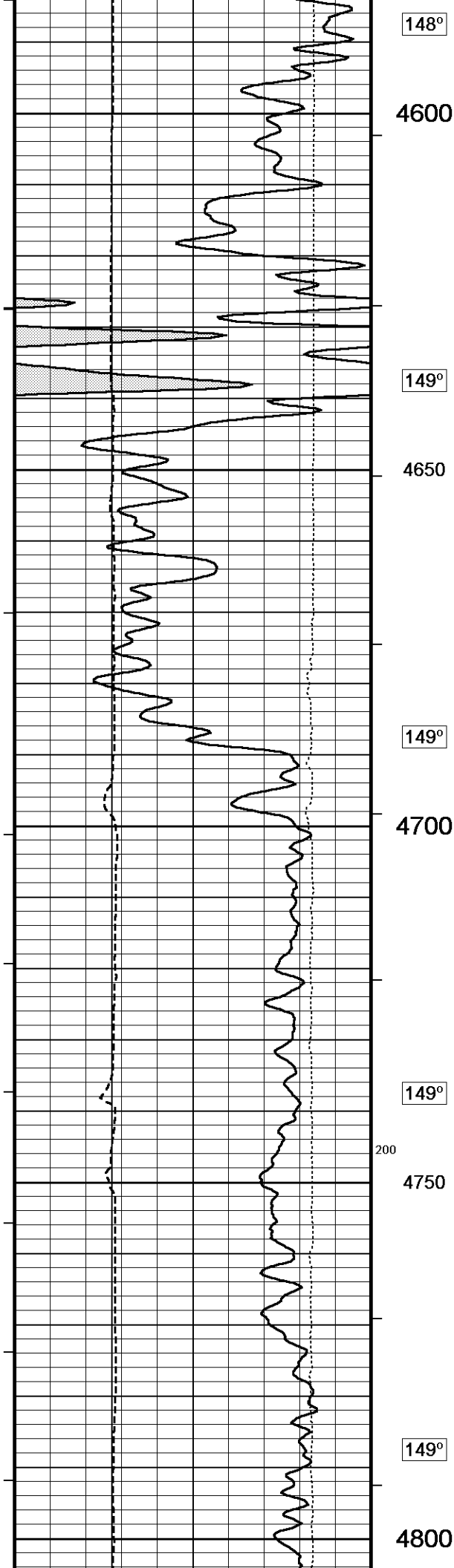
DST Uphole Tension

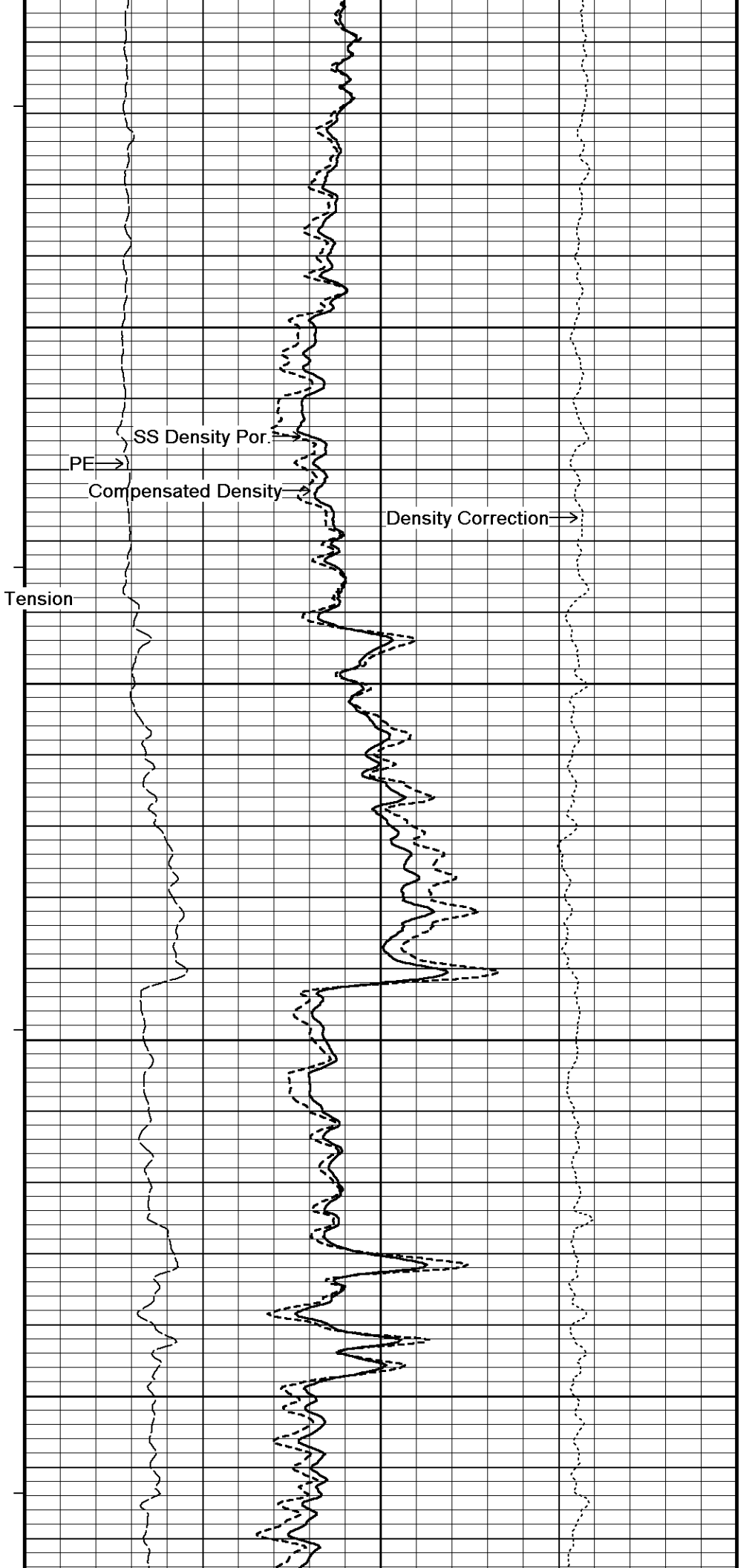
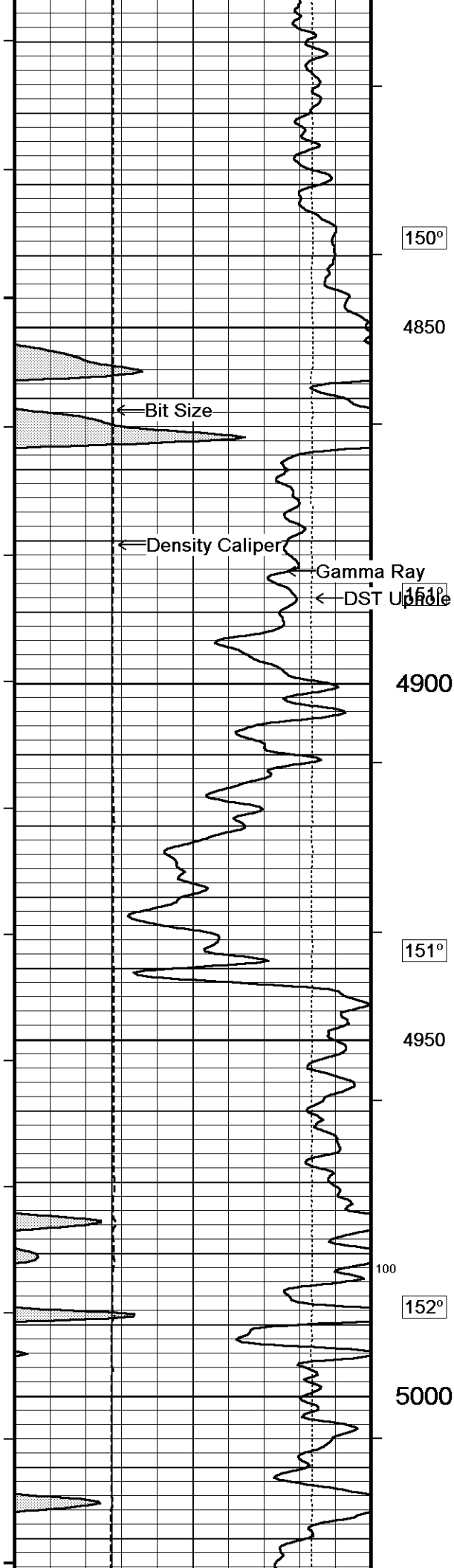
SS Density Por

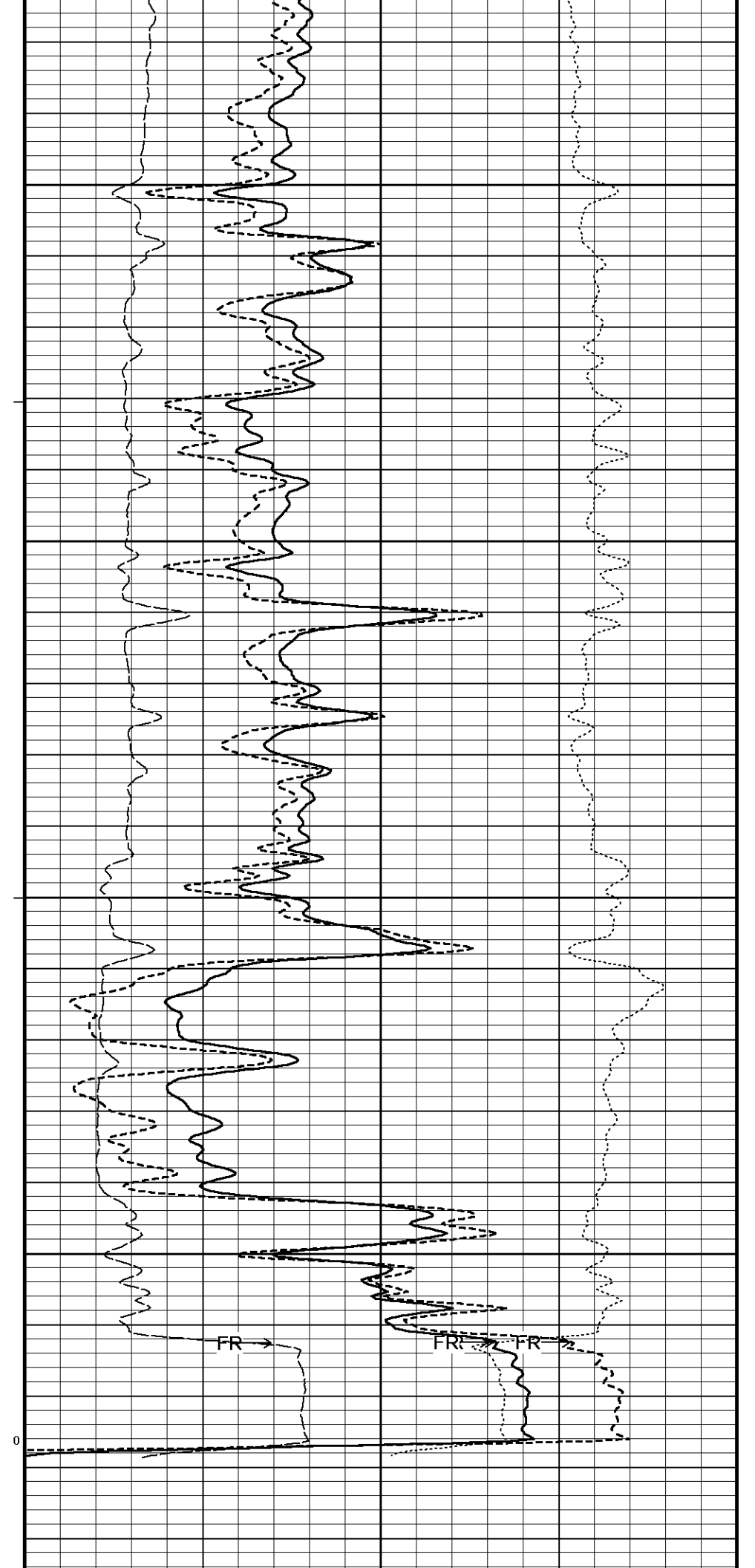
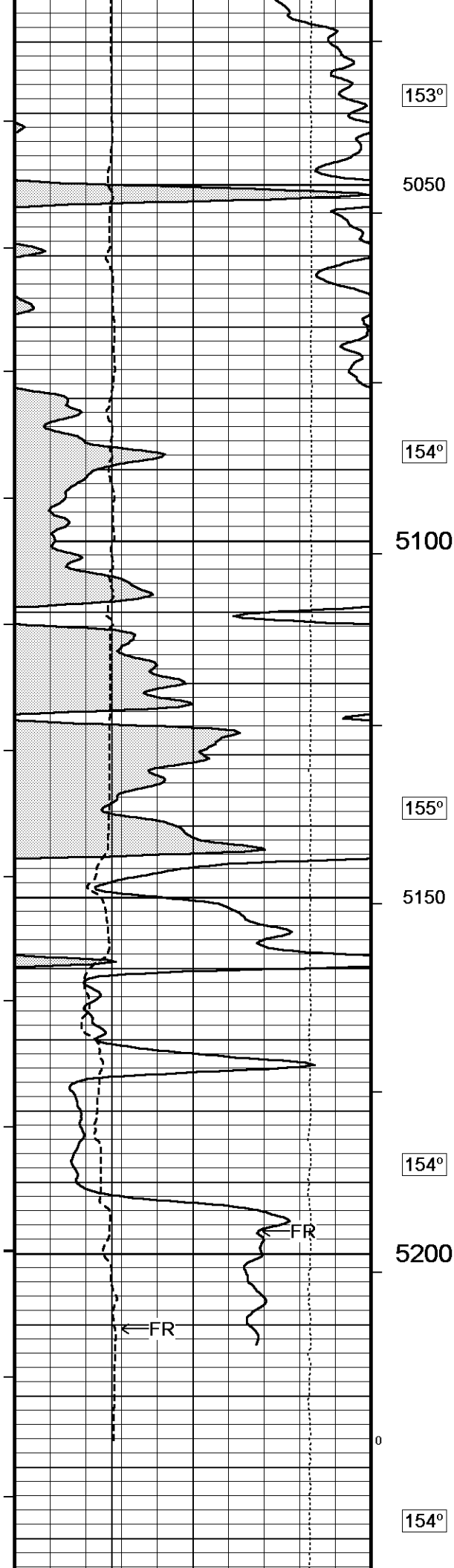
PE

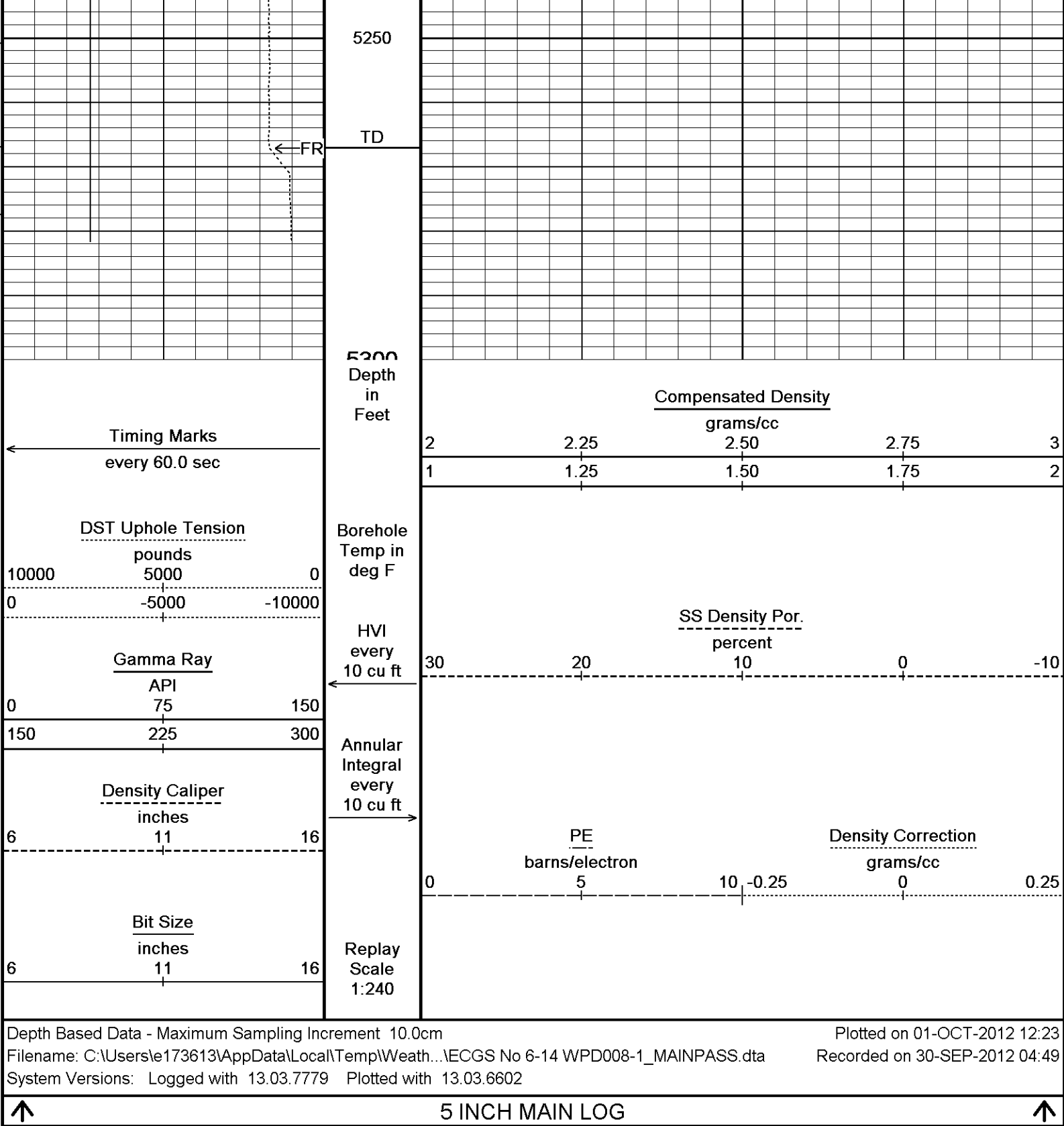
Compensated Density

Density Correction









Depth Based Data - Maximum Sampling Increment 10.0cm
Filename: C:\Users\le173613\AppData\Local\Temp\Weatherford PreView\0\IECGS No 6-14 WPD008-1_MAINPASS.dta
System Versions: Logged with 13.03.7779 Plotted with 13.03.6602

5 INCH MAIN LOG

BEFORE SURVEY CALIBRATION		
C:\Users\le173613\AppData\Local\Temp\Weatherford PreView\0\IECGS No 6-14 WPD008-1_MAINPASS.dta		
Down-hole Tension Calibration All 000		
Field Calibration on 24-OCT-2010 03:34		
Reading No	Measured	0
1	15659.85	0.00
2	15734.68	370.00
General Constants All 000		
Last Edited on 30-SEP-2012,04:08		
General Parameters		
Mud Resistivity	2.370	ohm-metres

Mud Resistivity Temperature	93.500	degrees F
Water Level	0.000	feet
Density/Neutron 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	7.000	inches
Caliper for Differential Caliper	Density Caliper	
Rwa Parameters		
Porosity used	Base Density Porosity	
Resistivity used	Array Ind. One Res Rt	
RWA Constant A	0.610	
RWA Constant M	2.150	
Down-hole Tension Calibration SMS 0		
		Field Calibration on 30-SEP-2012 03:26
Reading No	Measured	Calibrated (lbs)
1	15589.90	0.00
2	16735.70	480.00
Gamma Calibration MCG-D.K 483		
		Field Calibration on 29-SEP-2012 18:20
	Measured	Calibrated (API)
Background	74	50
Calibrator (Gross)	842	569
Calibrator (Net)	768	519
Gamma Constants MCG-D.K 483		
		Last Edited on 30-SEP-2012,01:50
Gamma Calibrator Number	GRCC119	
Mud Density	1.00	gm/cc
Caliper Source for Processing	Density Caliper	
Tool Position	Eccentred	
Concentration of KCl	0.00	kppm
SP Calibration MCG-D.K 483		
		Field Calibration on 23-SEP-2012,10:15
	Measured	Calibrated (mV)
Reference 1	100.0	100.0
Reference 2	-100.0	-100.0
High Resolution Temperature Calibration MCG-D.K 483		
		Field Calibration on 30-SEP-2012,04:09
	Measured	Calibrated(Deg F)
Lower	50.00	50.00
Upper	75.00	75.00
High Resolution Temperature Constants MCG-D.K 483		
		Last Edited on 30-SEP-2012,04:08
Pre-filter Length	11	
Neutron Calibration MDN-B.J 372		
		Base Calibration on 11-SEP-2012 10:37
		Field Check on 29-SEP-2012 18:42
Base Calibration		
	Measured	Calibrated (cps)
	Near Far	Near Far
	2935 90	3714 110
Ratio	32.738	33.764
Field Calibrator at Base		Calibrated (cps)
		2265 3365
Ratio		0.673
Field Check		Calibrated (cps)
		2313 3388
Ratio		0.683
Neutron Constants MDN-B.J 372		
		Last Edited on 30-SEP-2012,01:50
Neutron Source Id	P31115B	
Neutron Log Number	N15288	

Neutron Sig Number	N55299	No	
Epithermal Neutron			
Caliper Source for Processing	Density Caliper		
Stand-off	0.00	inches	
Mud Density	1.00	gm/cc	
Limestone Sigma	7.10	cu	
Sandstone Sigma	7.00	cu	
Dolomite Sigma	4.70	cu	
Formation Pressure Source	None		
Formation Pressure	N/A	kpsi	
Temperature Source	MCG External Temperature		
Temperature	N/A	degrees F	
Mud Salinity	0.00	kppm	
Salinity Correction	Not Applied		
Formation Fluid Salinity Source	None		
Formation Fluid Salinity	N/A	kppm	
Barite Mud Correction	Not Applied		

Navigation Constants MIE-A.J 241 Last Edited on 30-SEP-2012,01:56

Magnetic Declination	0.00	degrees	East
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Magnetometer Parameters MIE-A.J 241

Date Of Last Magnetometer Calibration	14-FEB-2012,20:54		
	X Magnetometer	Y Magnetometer	Z Magnetometer
Slope	-1.000000	-1.011676	-0.999264
Offset	0.001649	-0.018156	0.001398

Magnetometer Constants MIE-A.J 241 Last Edited on 30-SEP-2012,01:55

Magnetometer Calibrator Number	0
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Accelerometer Parameters MIE-A.J 241

Date Of Last Accelerometer Calibration	14-FEB-2012,19:26		
	X Accelerometer	Y Accelerometer	Z Accelerometer
Slope	-1.107927	-1.107152	-1.089726
Offset	-0.004165	0.008747	-0.006277

Accelerometer Constants MIE-A.J 241 Last Edited on 30-SEP-2012,01:54

Accelerometer Calibrator Number		000			
Accelerometer Temperature Characterisation					
X Accelerometer					
Serial Number		922			
Calibration Date		14-Nov-2010			
	B0	B1	B2	B3	
Bias(g)	0.00000e+000	1.98626e-005	-2.34772e-009	1.61466e-010	
	SF0	SF1	SF2	SF3	
Scale Factor(mA/g)	3.00000e+000	2.59314e-004	4.64734e-007	5.67183e-010	
Y Accelerometer					
Serial Number		970			
Calibration Date		19-Jan-2011			
	B0	B1	B2	B3	
Bias(g)	0.00000e+000	-4.23329e-006	-2.08894e-008	1.84400e-010	
	SF0	SF1	SF2	SF3	
Scale Factor(mA/g)	3.00000e+000	2.61643e-004	3.45088e-007	8.15526e-010	
Z Accelerometer					
Serial Number		1076			
Calibration Date		05-May-2011			
	B0	B1	B2	B3	
Bias(g)	0.00000e+000	-5.18602e-006	1.72429e-008	7.30746e-011	
	SF0	SF1	SF2	SF3	
Scale Factor(mA/g)	3.00000e+000	2.93462e-004	2.41183e-007	1.26400e-009	

Caliper Calibration MIE-A.J 241 Base Calibration on 28-SEP-2012 11:04
Field Calibration on 28-SEP-2012 11:06

Base Calibration			
Reading No	Pads 1-5 Meas.	Pads 3-7 Meas.	Calibrator Size (in)

1	25529	28507	5.97
2	35884	38819	7.96
3	45829	48887	9.87
4	57640	60711	11.92
5	0	0	0.00

Reading No	Pad 2 Meas.	Pad 4 Meas.	Pad 6 Meas.	Pad 8 Meas.	Calibrator Size (in)
1	24865	25887	25754	25884	5.97
2	34293	34905	33925	34009	7.96
3	42506	43163	42193	42341	9.87
4	52787	53107	51835	52240	11.92
5	0	0	0	0	0.00

Field Calibration

Measured Pads 1-5 Caliper(in)	Measured Pads 3-7 Caliper(in)	Actual Caliper(in)		
7.94	7.72	7.96		
Measured Pad 2 Caliper(in)	Measured Pad 4 Caliper(in)	Measured Pad 6 Caliper(in)	Measured Pad 8 Caliper(in)	Actual Caliper(in)
3.89	3.89	4.06	4.06	7.96

Caliper Constants MIE-A.J 241

Last Edited on 09-JUN-2012,12:33

Caliper Difference for BRKT 0.120 inches

Imager Pad Check MIE-A.J 241

Field Check on

Pad 1	Pad Not Tested	Pad 5	Pad Not Tested
Pad 2	Pad Not Tested	Pad 6	Pad Not Tested
Pad 3	Pad Not Tested	Pad 7	Pad Not Tested
Pad 4	Pad Not Tested	Pad 8	Pad Not Tested

Compact Micro Imager Constants MIE-A.J 241

Last Edited on 30-SEP-2012,01:56

Sonde Configuration	Imager Mode	degrees
Arm-Pad Kit	Normal Pads (12.25 in)	
Centre Pad 1 Rotational Offset	0.00	
Image/Borehole Ovality Reference	Azimuth of Pad 1	degrees
Non Active Buttons	Omit	feet
Search Angle	0.00	feet
Correlation Interval	3.28	mAmp
Correlation Step	1.64	mAmp
Current Offset	0.0000	
Squasher Start	0.0500	
Image Processing	Enabled	

FE Calibration MFE-A.A 76

Base Calibration on 10-SEP-2012 11:36

Field Check on 29-SEP-2012 18:21

Base Calibration	Measured	Calibrated (ohm-m)
Reference 1	0.0	0.0
Reference 2	964.4	126.8
Base Check		279.9
Field Check		280.1

FE Constants MFE-A.A 76

Last Edited on 30-SEP-2012,01:57

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	1.0	inches

High Resolution Temperature Calibration MAI-B.A 219

Field Calibration on 10-AUG-2011,00:10

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

Pre-filter Length

11

Induction Calibration MAI-B.A 219

Base Calibration on 08-MAY-2012,15:56

Field Check on 29-SEP-2012 18:14

Base Calibration

Test Loop Calibration

Measured

Calibrated (mmho/m)

Channel	Low	High	Low	High
1	17.4	478.1	9.3	966.2
2	5.8	380.3	7.6	821.4
3	3.5	258.5	5.2	566.0
4	1.9	136.0	2.6	279.2

Array Temperature 77.2 Deg F

Channel	Base Check (mmho/m)		Field Check (mmho/m)	
	Low	High	Low	High
1	0.0	0.0	12.4	3792.3
2	0.0	0.0	31.0	3535.9
3	0.0	0.0	28.7	3054.7
4	0.0	0.0	19.3	2027.5
Deep	0.0	0.0	16.5	1947.7
Medium	0.0	0.0	42.8	4086.8
Shallow	0.0	0.0	47.7	5281.8

Array Temperature 0.0 67.3 Deg F

Induction Constants MAI-B.A 219

Last Edited on 30-SEP-2012,02:04

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

1.00

inches

Number of Fins on Stand-off

6.0000

Stand-off Fin Angle

60.00

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-C.J 378

Base Calibration on 29-SEP-2012 18:35

Field Calibration on 29-SEP-2012 18:36

Base Calibration

Reading No	Measured	Calibrator Size (in)
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Reading No	Measured	Calibrator Size (in)
1	14193	3.99
2	22768	5.97
3	31248	7.96
4	39297	9.87
5	48452	11.92
6	N/A	N/A
Field Calibration	Measured Caliper (in)	Actual Caliper (in)
	7.91	7.96
Photo Density Calibration MPD-C.J 378		Base Calibration on 27-SEP-2012 12:49 Field Check on 29-SEP-2012 18:28
Density Calibration		
Base Calibration	Measured	Calibrated (sdu)
	Near	Far
Reference 1	39385	12332
Reference 2	18690	2207
	52994	19128
	25185	2558
Field Check at Base		
	1201.6	1277.5
Field Check		
	1202.3	1288.1
PE Calibration		
Base Calibration	Measured	Calibrated
	WS	WH
	Ratio	Ratio
Background	219	1074
Reference 1	13507	39225
Reference 2	5341	18558
	0.348	0.309
	0.293	0.274
Field Check at Base		
	219.0	1074.2
Field Check		
	219.4	1076.2
Density Constants MPD-C.J 378		Last Edited on 30-SEP-2012,01:52
Density Source Id	P15771B	
Nylon Calibrator Number	DNC-D-527	
Aluminium Calibrator Number	DAC-D-527	
Density Shoe Profile	8 inch	
Caliper Source for Processing	Density Caliper	
PE Correction to Density	Not Applied	
Mud Density	1.20	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)	
2.68		
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	

MCB-C.A.5 LG: 1.58 ft WT: 15.4 lb OD: 2.24 in

SHA-H Compact Swivel Head Adaptor

SHA-H 142 LG: 2.30 ft WT: 22.0 lb OD: 2.24 in

Compact Comms Gamma

MCG-D.K 483 LG: 8.70 ft WT: 63.9 lb OD: 2.24 in

Compact Neutron

MDN-B.J 372 LG: 5.04 ft WT: 50.7 lb OD: 2.24 in

Compact Density/Caliper

MPD-C.J 378 LG: 9.59 ft WT: 90.4 lb OD: 2.45 in

MIS-A.A Compact Inline Bowspring sub

MIS-A.A 70 LG: 5.70 ft WT: 33.1 lb OD: 2.24 in

SKJ-D.A Compact Knuckle Joint

SKJ-D.A 112 LG: 2.17 ft WT: 24.3 lb OD: 2.24 in

MIS-E.A Compact Inline Standoff sub

MIS-E.A 334 LG: 2.14 ft WT: 15.4 lb OD: 2.24 in

SKJ-E.A Compact Knuckle Joint

SKJ-E.A 143 LG: 2.17 ft WT: 24.3 lb OD: 2.24 in

SHA-J.B Compact Swivel Head Adaptor

SHA-J.B 574 LG: 2.30 ft WT: 22.0 lb OD: 2.24 in

Compact MMI Memory Section

MIM-A.J 241 LG: 4.65 ft WT: 26.5 lb OD: 2.24 in

Compact MMI Electrode Section

MIE-A.J 241 LG: 13.96 ft WT: 99.2 lb OD: 4.09 in

SKJ-E.B Compact Knuckle Joint

SKJ-E.B 583 LG: 2.17 ft WT: 24.3 lb OD: 2.24 in

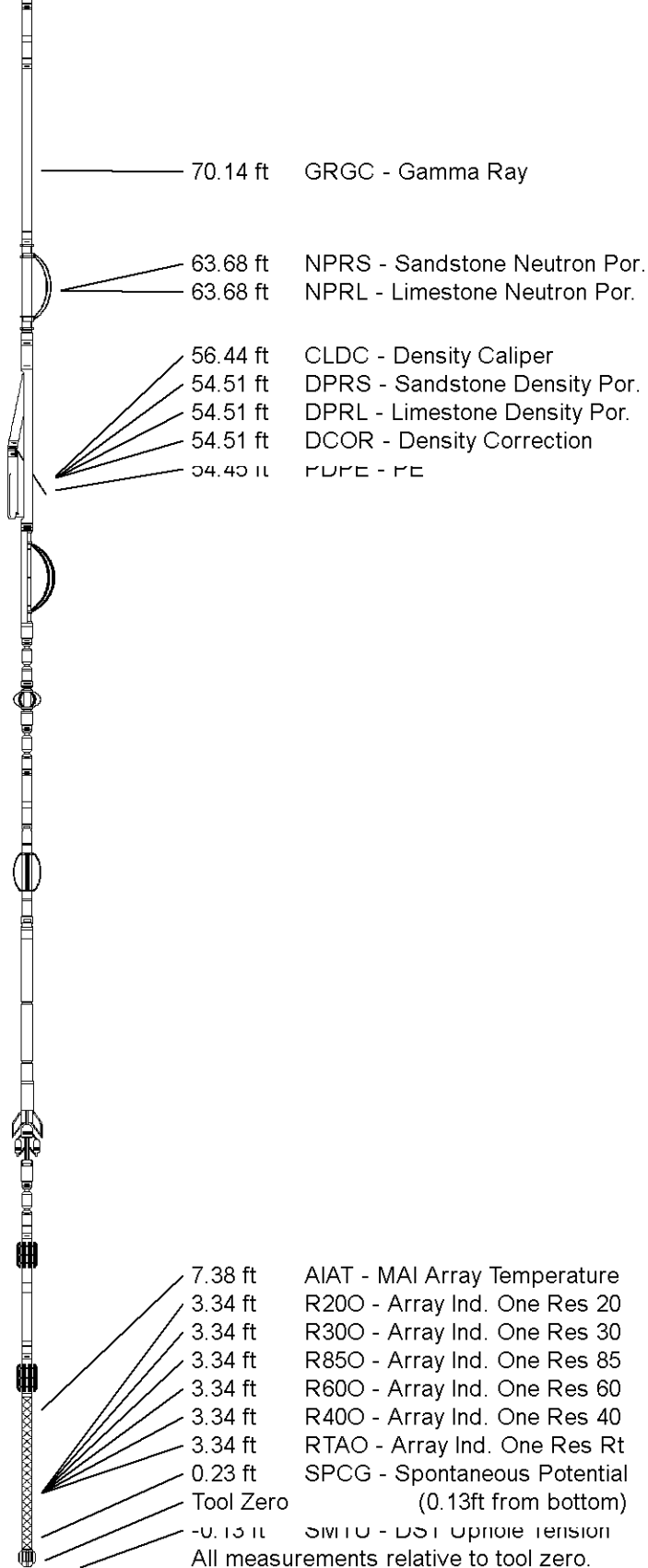
Compact Focussed Electric

MFE-A.A 76 LG: 6.05 ft WT: 48.5 lb OD: 2.24 in

Compact Induction

MAI-B.A 219 LG: 10.81 ft WT: 48.5 lb OD: 2.24 in

Total Length: 79.30 ft Weight: 608.5 lb



COMPANY

EAST CHEYENNE GAS STORAGE LLC

WELL

ECGS NO 6-14 WPD008-1

FIELD

PEETZ WEST

PROVINCE/COUNTY

LOGAN

COUNTRY/STATE

USA/COLORADO

Elevation Kelly Bushing 4558.00 feet

Elevation Drill Floor 4557.00 feet

First Reading 5213.00 feet

Depth Driller 5265.00 feet

Elevation Drill Floor 4557.00 feet
Elevation Ground Level 4544.00 feet

Depth Driller 5265.00 feet
Depth Logger 5267.00 feet



Weatherford®

PHOTO DENSITY
COMPENSATED NEUTRON
LOGS