

**Weatherford**

PHOTO DENSITY
COMPENSATED NEUTRON
LOGS

COMPANY EAST CHEYENNE GAS STORAGE LLC
WELL ECGS NO 6-13 WPD007-2
FIELD PEETZ WEST
PROVINCE/COUNTY LOGAN
COUNTRY/STATE US/COLORADO
LOCATION NENW 283' FNL & 2275' FEL

SEC TWP RGE Other Services
6 11N 52W MAI
API Number 05-075-09411 CMI
Permit Number

Permanent Datum GL, Elevation 4550 feet
Log Measured From KB
Drilling Measured From KB

Elevations:
KB 4564.00
DF 4563.00
GL 4550.00

Date 06-OCT-2012

Run Number

ONE

Depth Driller

5265.00

feet

Depth Logger

5265.00

feet

First Reading

5213.00

feet

Last Reading

4200.00

feet

Casing Driller

1208.00

feet

Casing Logger

1222.00

feet

Bit Size

8.750

inches

Hole Fluid Type

WBM

Density / Viscosity

9.80 lb/USg

49.00 CP

PH / Fluid Loss

9.00

6.40 ml/10min

Sample Source

FLOWLINE

Rm @ Measured Temp

4.23 @ 84.7

ohm-m

Rmf @ Measured Temp

3.384 @ 84.7

ohm-m

Rmc @ Measured Temp

5.076 @ 84.7

ohm-m

Source Rmf / Rmc

CALC

CALC

Rm @ BHT

1.08 @166.0

ohm-m

Time Since Circulation

4 HOURS

Max Recorded Temp

166.00

deg F

Equipment Name

COMPACT

Equipment / Base

13144

RK SPR

Recorded By

J. PAULSON

T. BENICH

Witnessed By

J. ASHBY

L. CARRASCO

BOREHOLE RECORD

Last Edited: 06-OCT-2012 05:05

Bit Size inches	Depth From feet	Depth To feet
8.750	1222.00	5265.00

CASING RECORD

Type	Size inches	Depth From feet	Shoe Depth feet	Weight pounds/ft
SURFACE	9.625	0.00	1222.00	36.00

REMARKS

SOFTWARE VERSION 13.03.7779

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

HARDWARE: MPD: 8" PROFILE PLATE USED.
MAI: TWO 1 INCH STANDOFFS 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 (5265 FT TO 4700 FT)

2.71 G/CC DENSITY MATRIX USED TO CALCULATE POROSITY IN NIOBRARA FORMATION (4700 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.

LAT/ LONG: 40.96296 N/103.22070 W

TOTAL HOLE VOLUME FROM TD TO SURFACE CASING =1780 CUBIC FEET

ANNULAR VOLUME WITH 7 INCH PRODUCTION CASING FROM TD TO SURFACE CASING = 720 CUBIC FEET

TOTAL VOLUME FROM TD TO 4200 FT = 410 CUBIC FEET

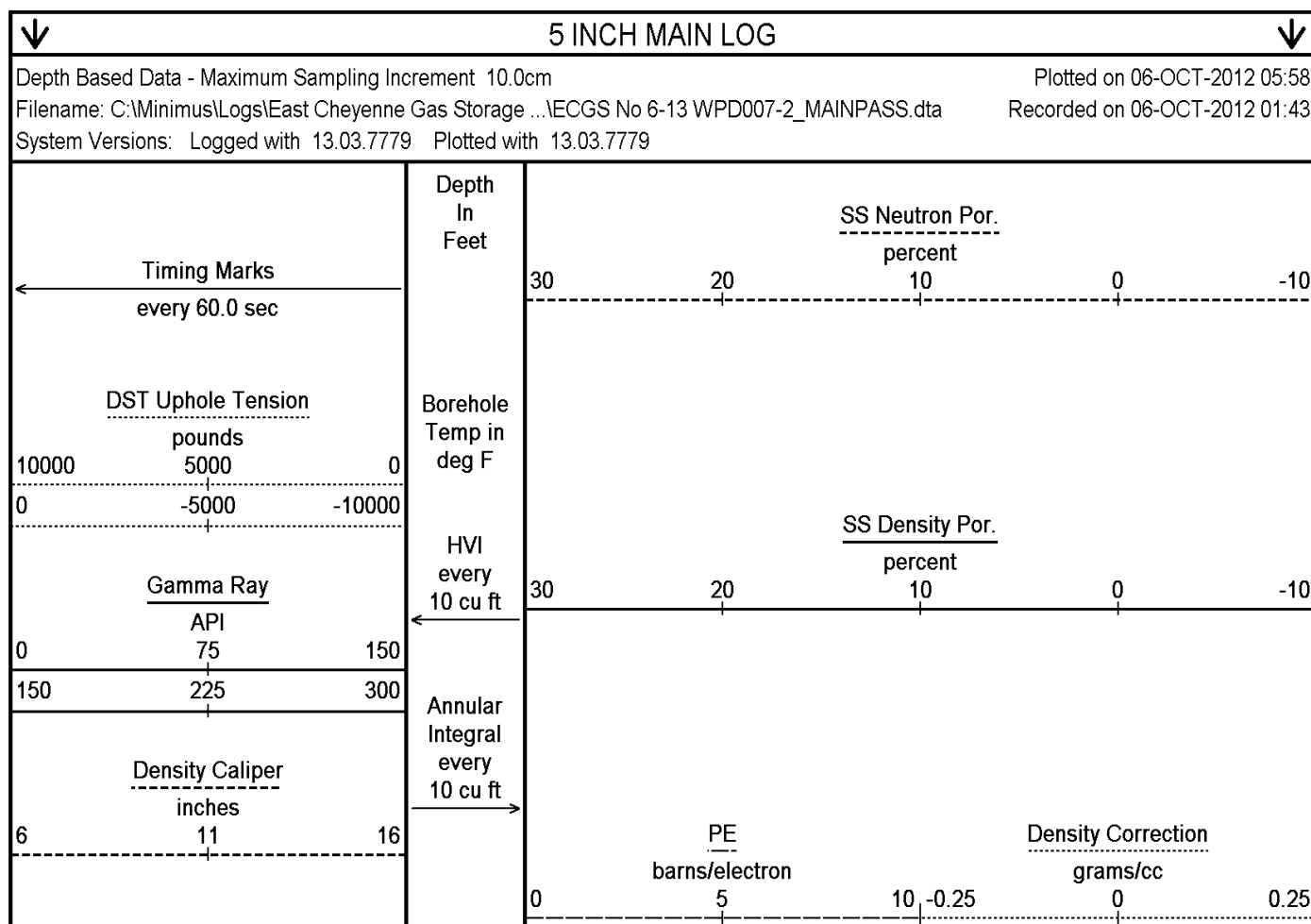
ANNULAR VOLUME WITH 7 INCH PRODUCTION CASING FROM TD TO 4200 FT = 140 CUBIC FEET

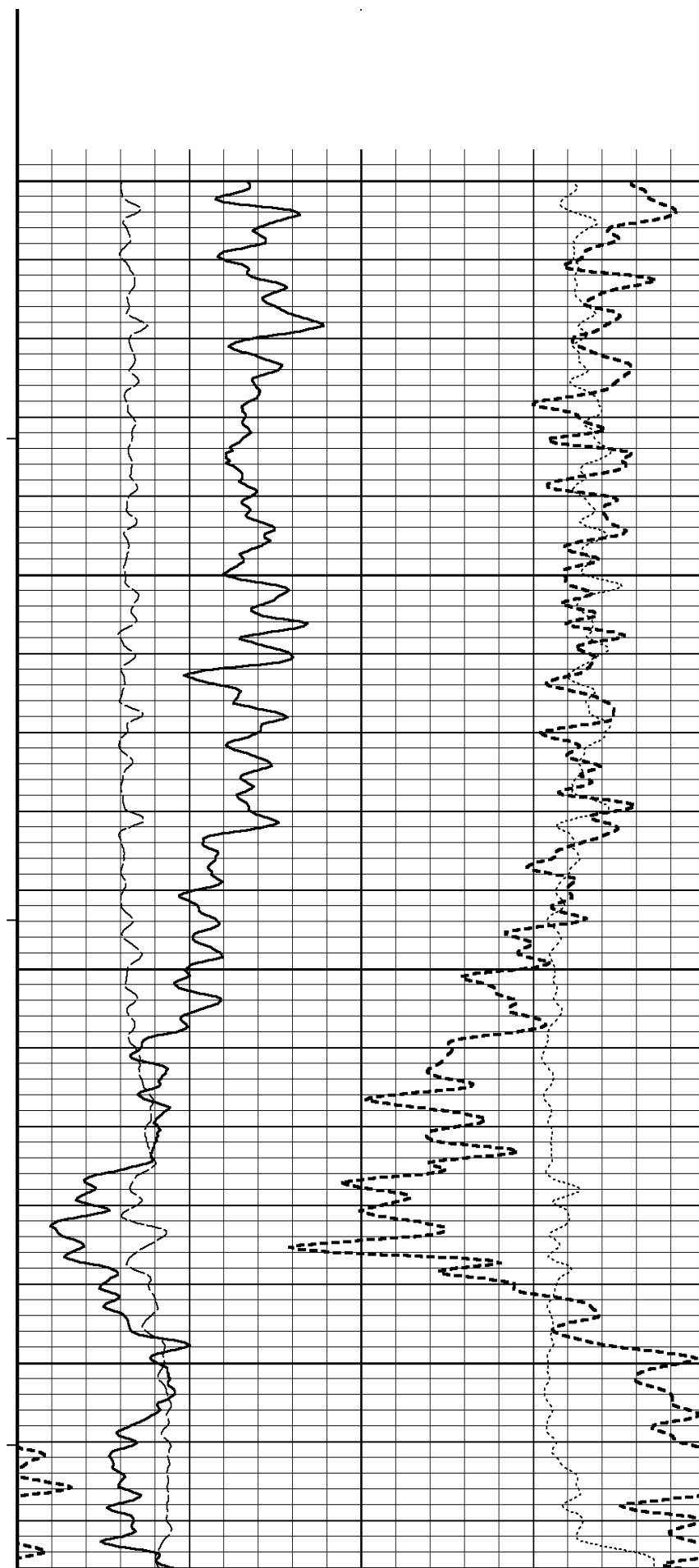
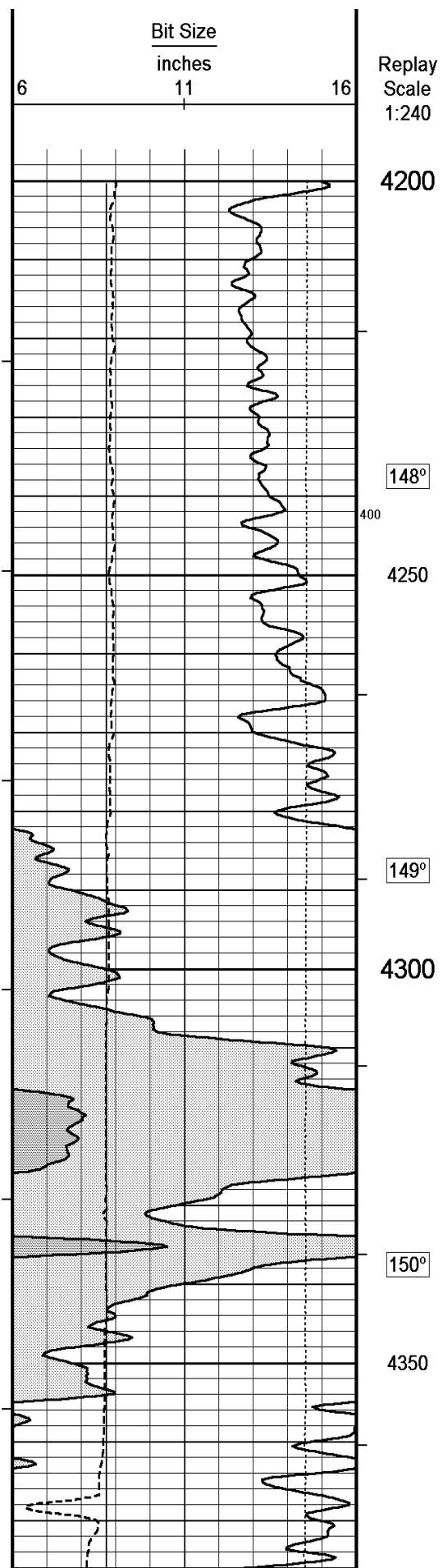
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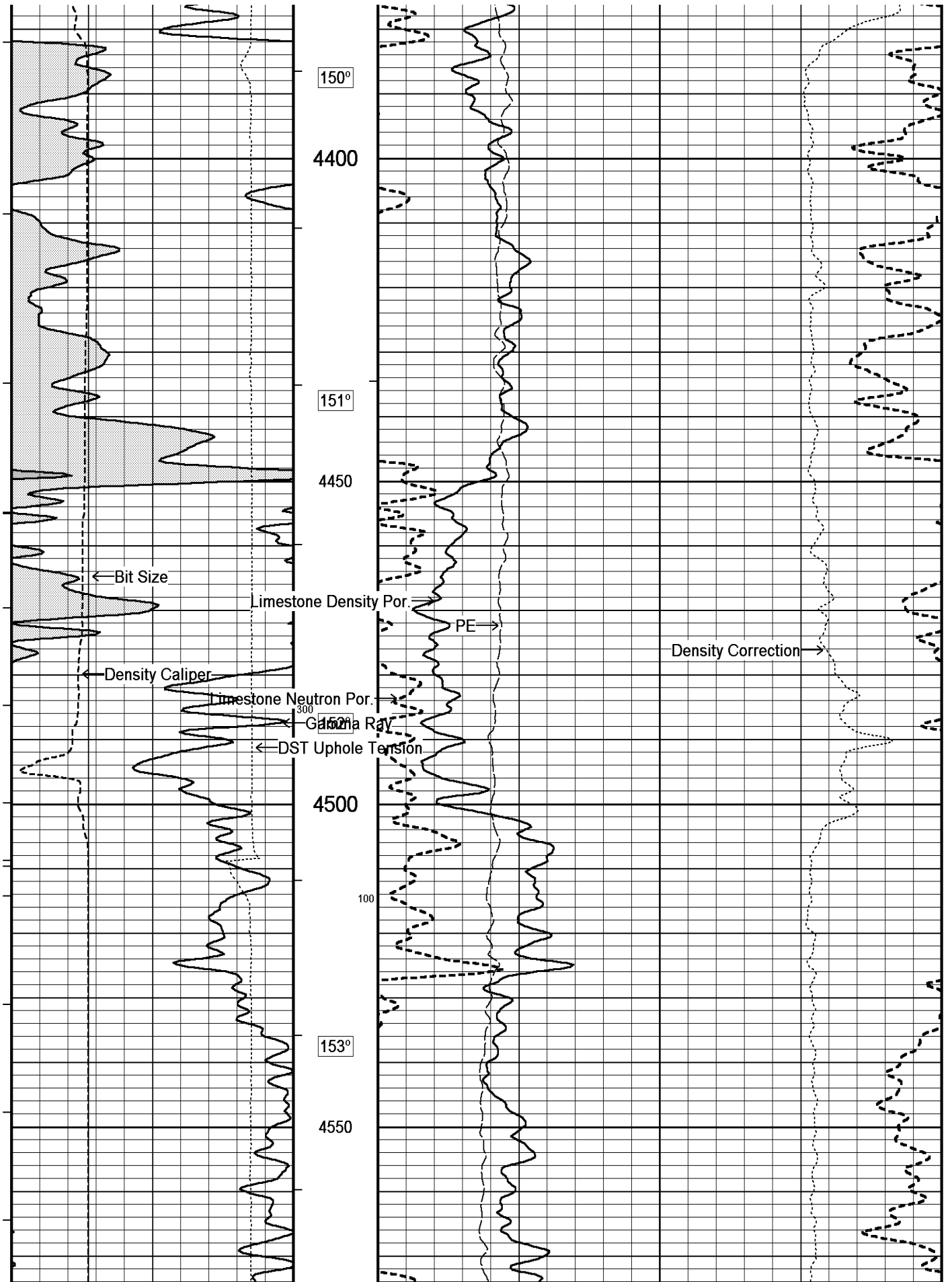
OPERATOR: M. LAMOREAUX
J. BAASSIRI

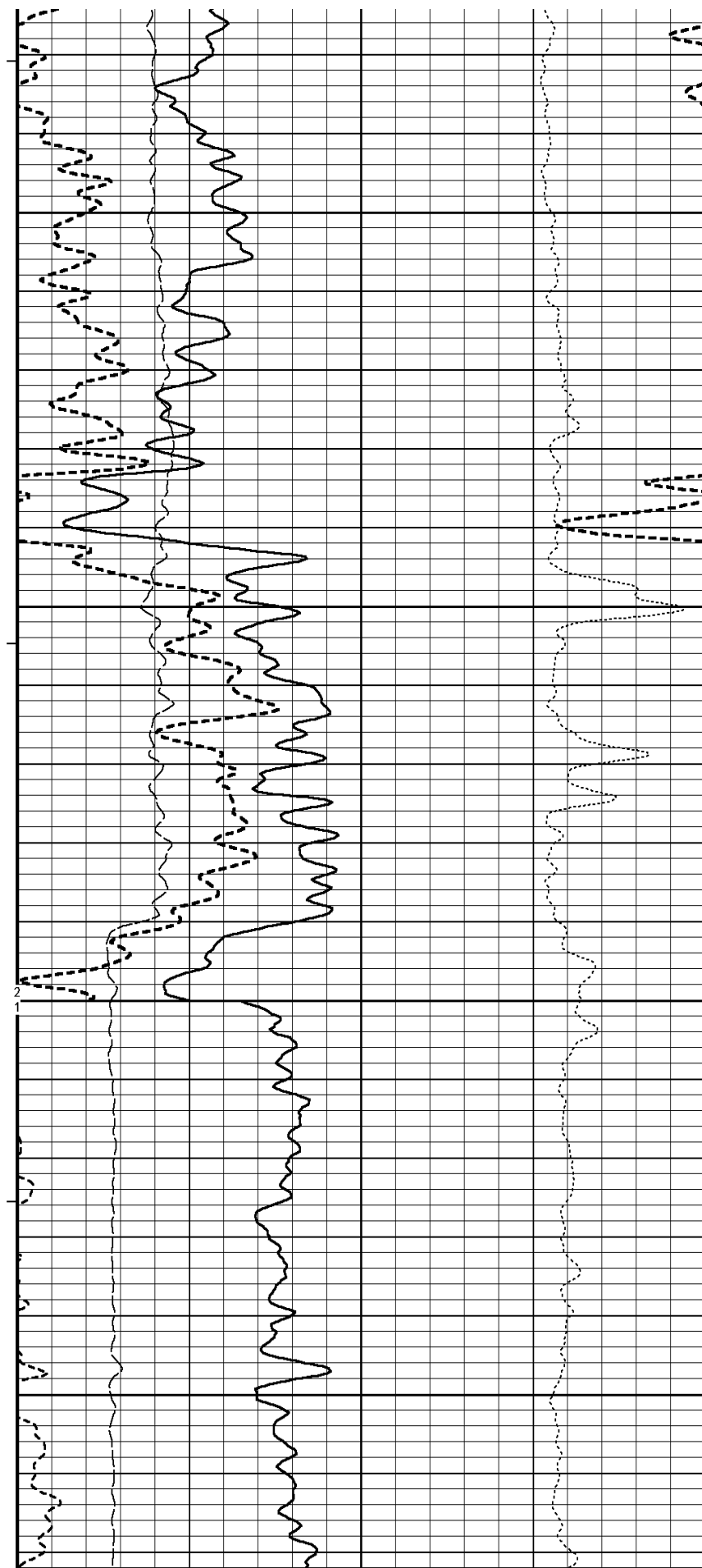
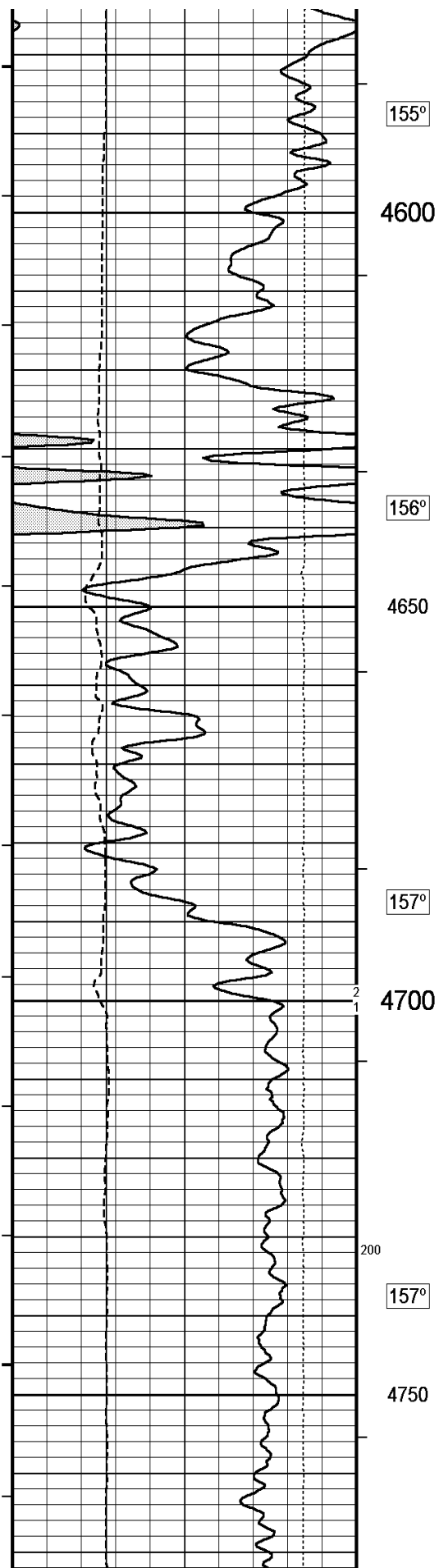
RIG: CADE 22

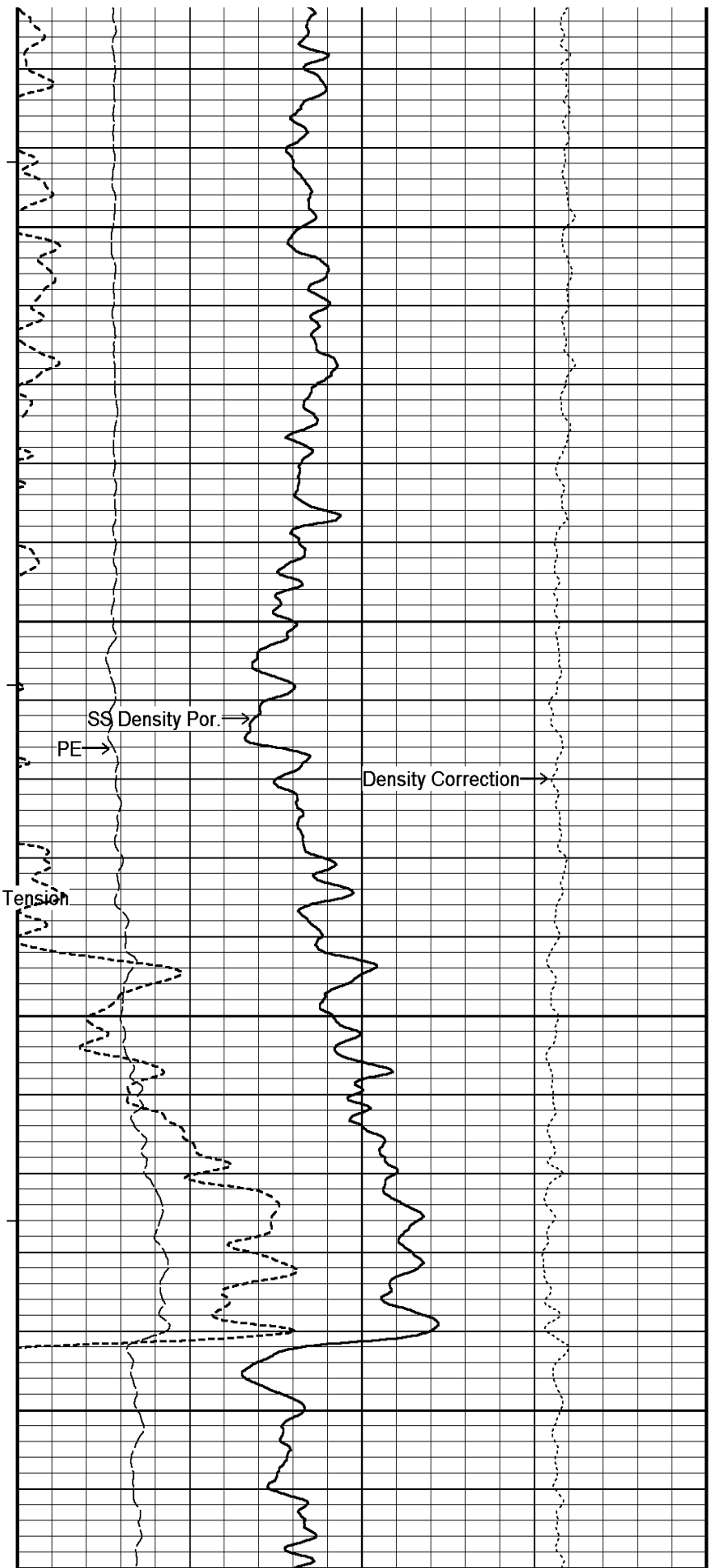
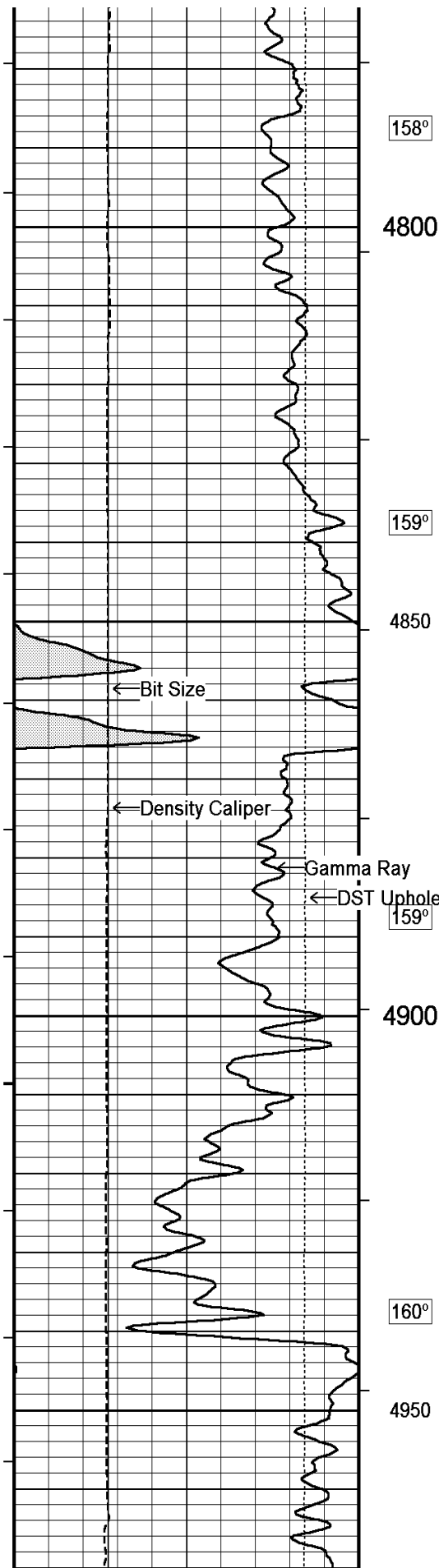
All interpretations are opinions based on inferences from electrical or other measurements and we cannot, and do not, guarantee the accuracy or correctness of any interpretations, and we shall not, except in the case of gross or wilful negligence on our part, be liable or responsible for any loss, costs,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

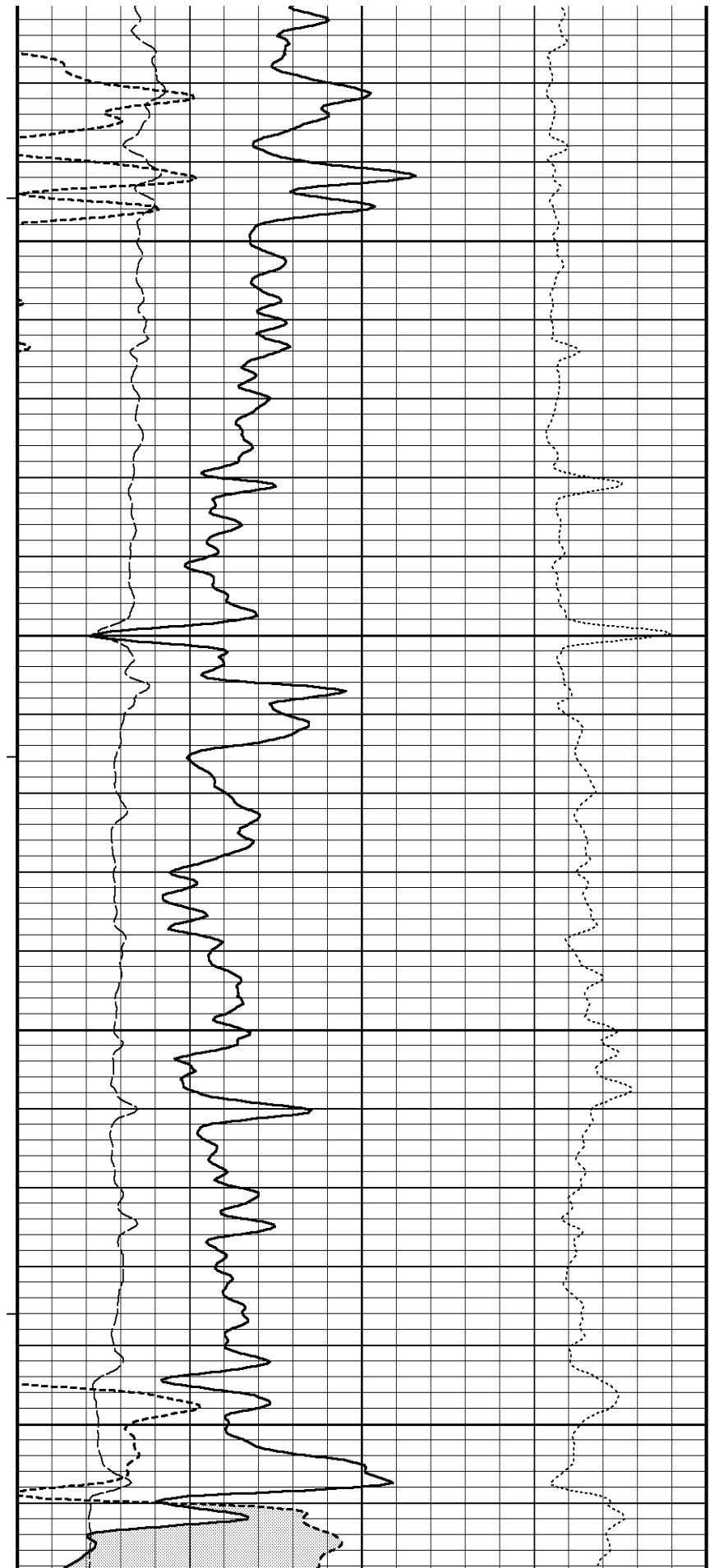
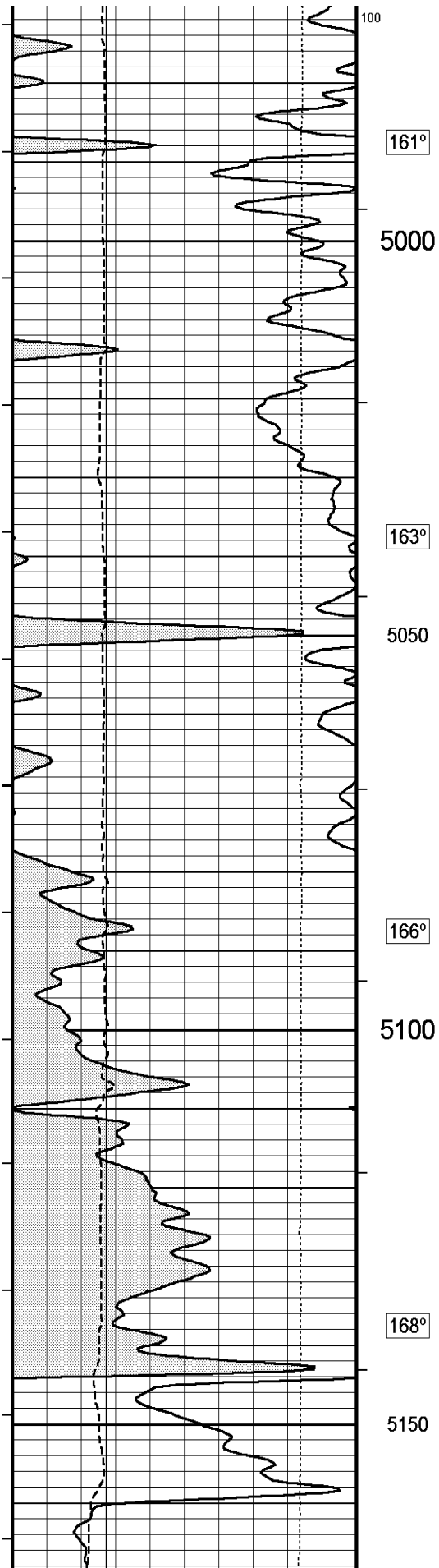


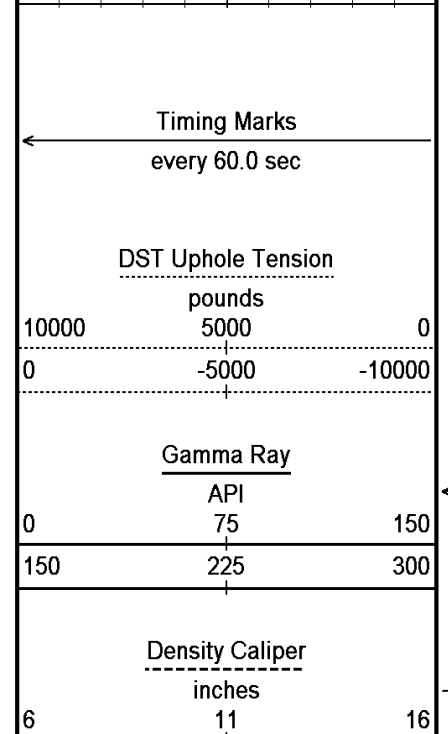
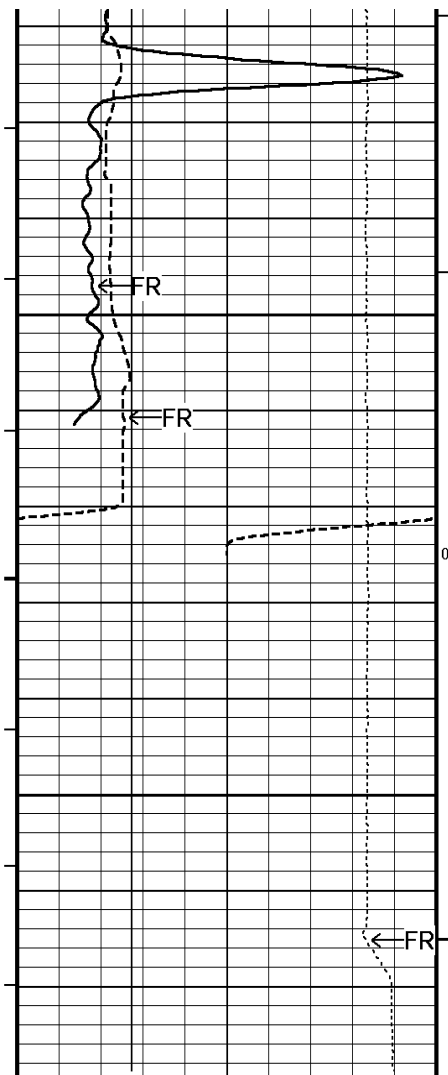










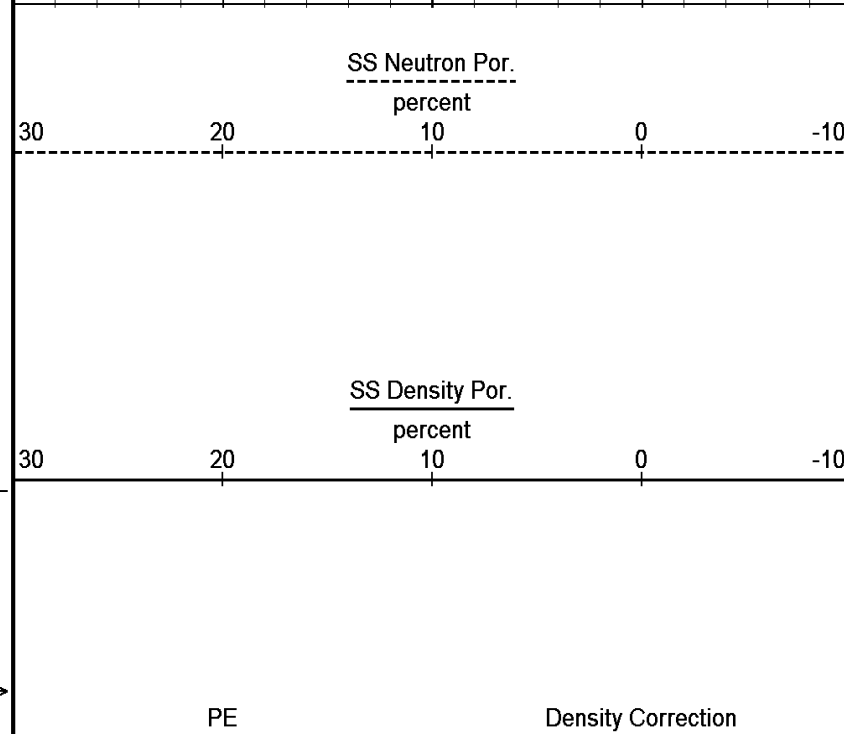
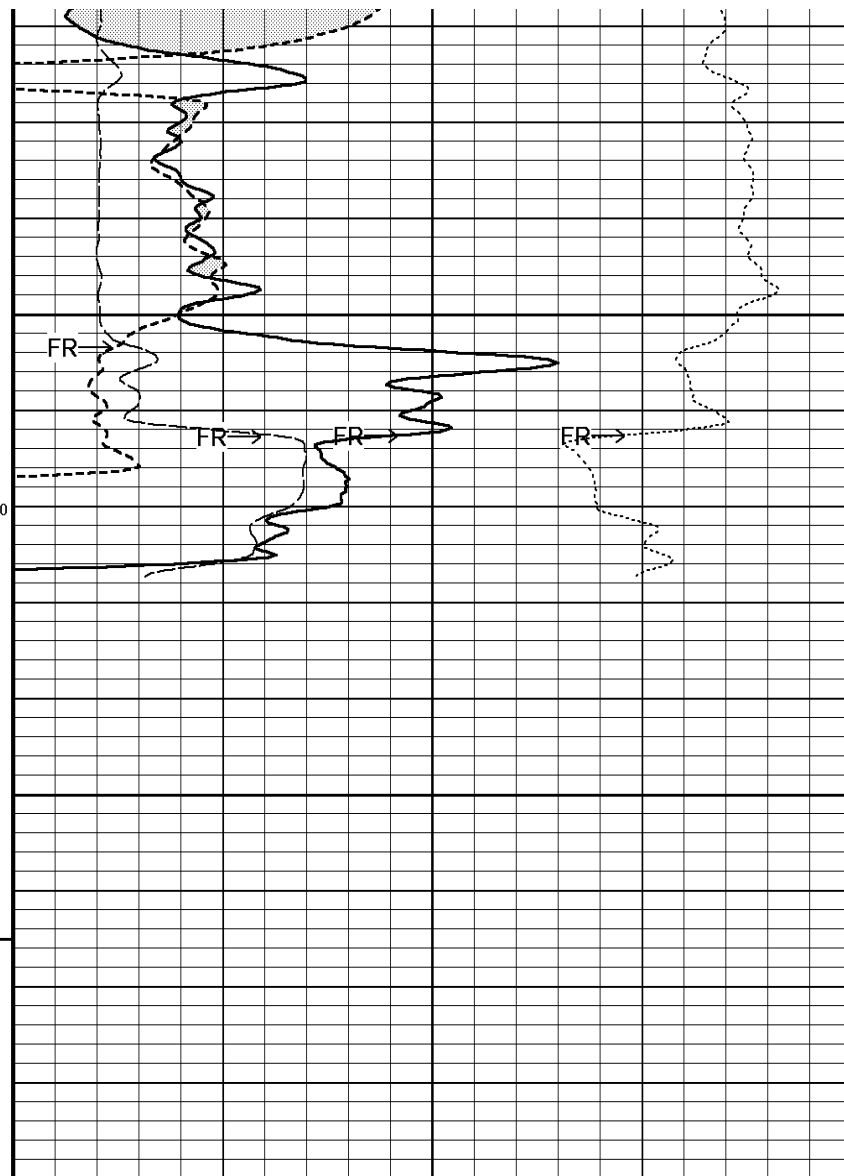


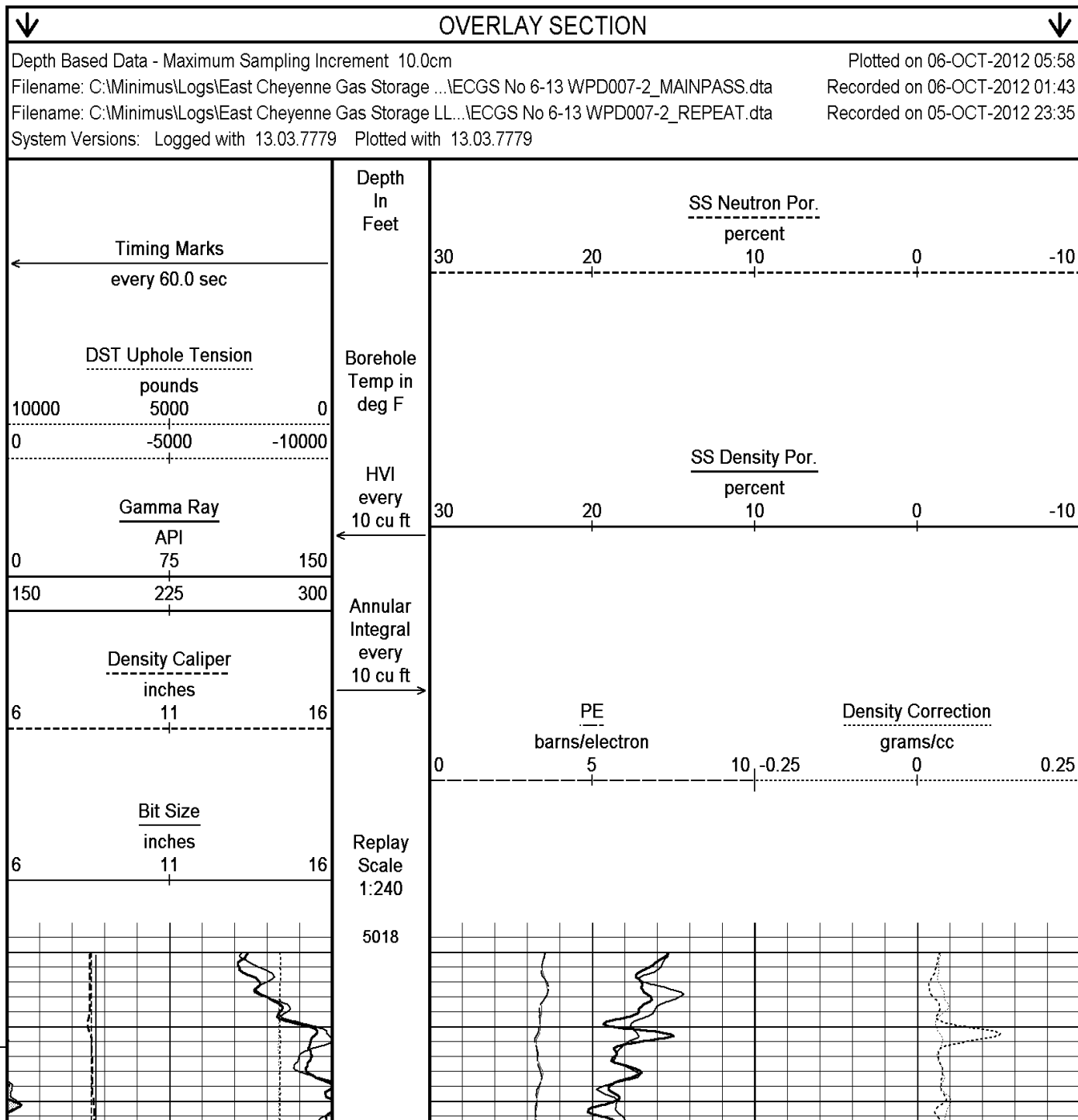
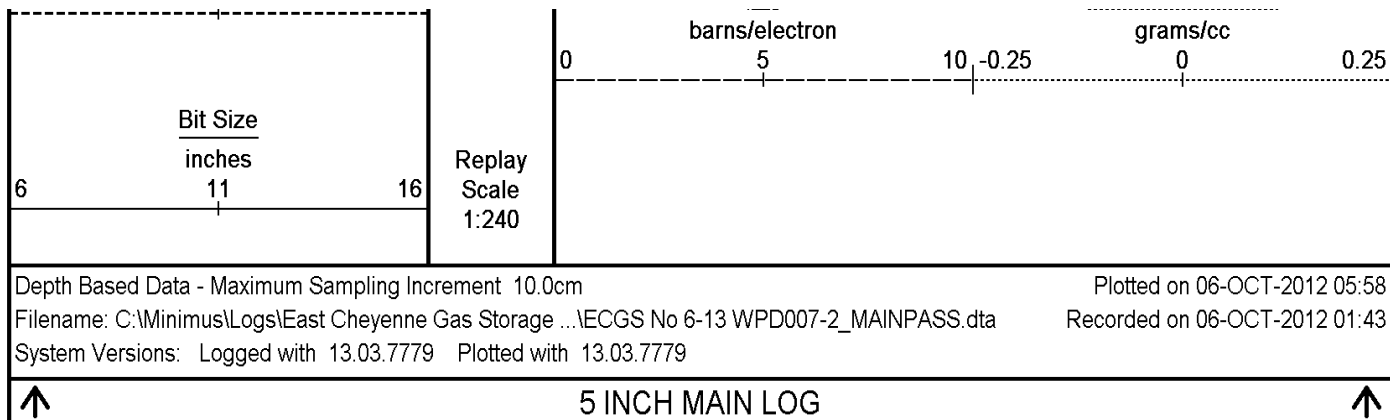
Depth
In
Feet

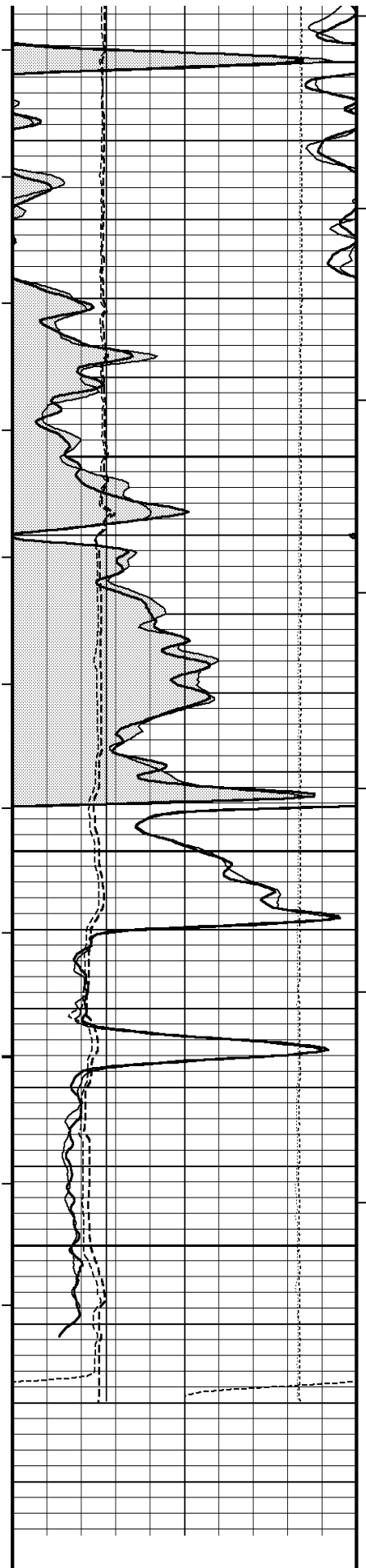
Borehole
Temp in
deg F

HVI
every
10 cu ft

Annular
Integral
every
10 cu ft







5050

166°

5100

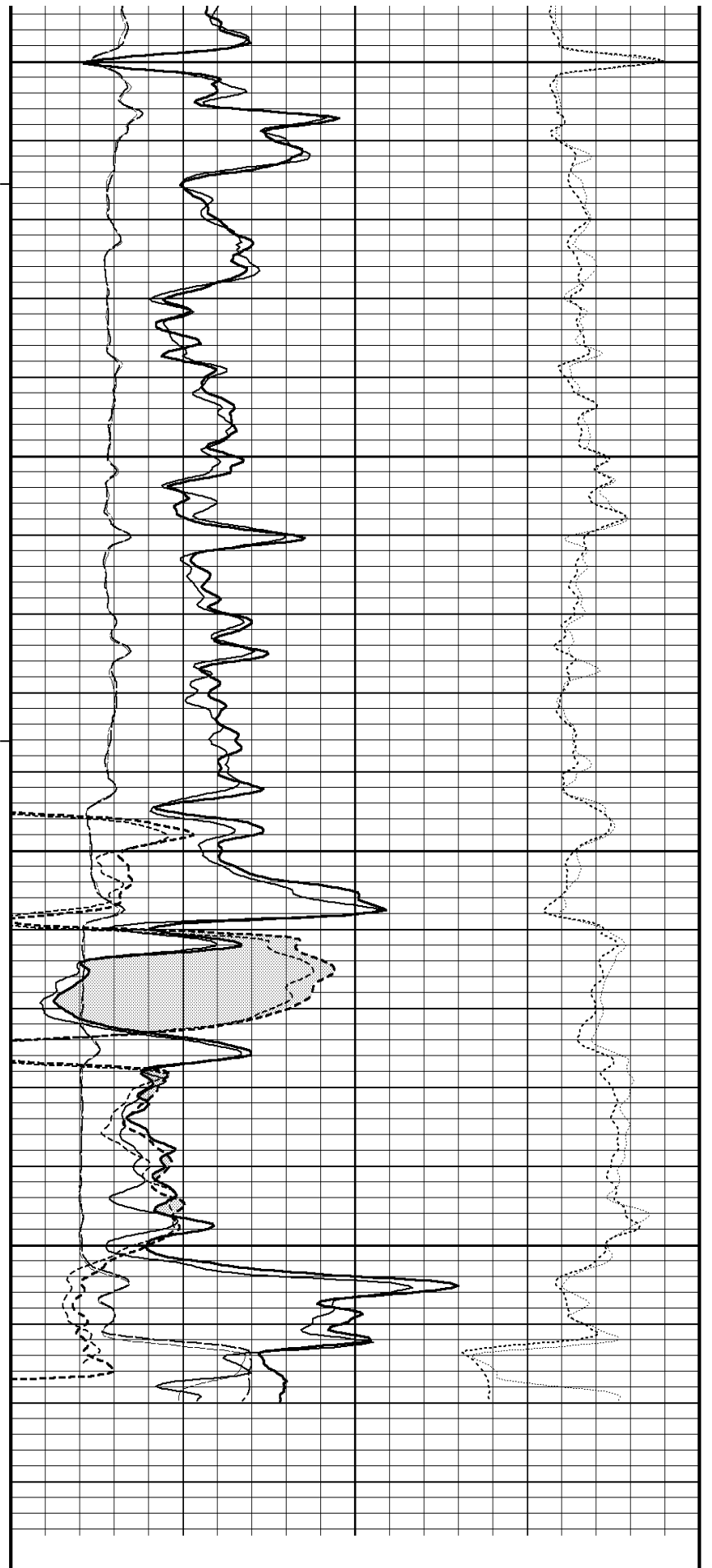
168°

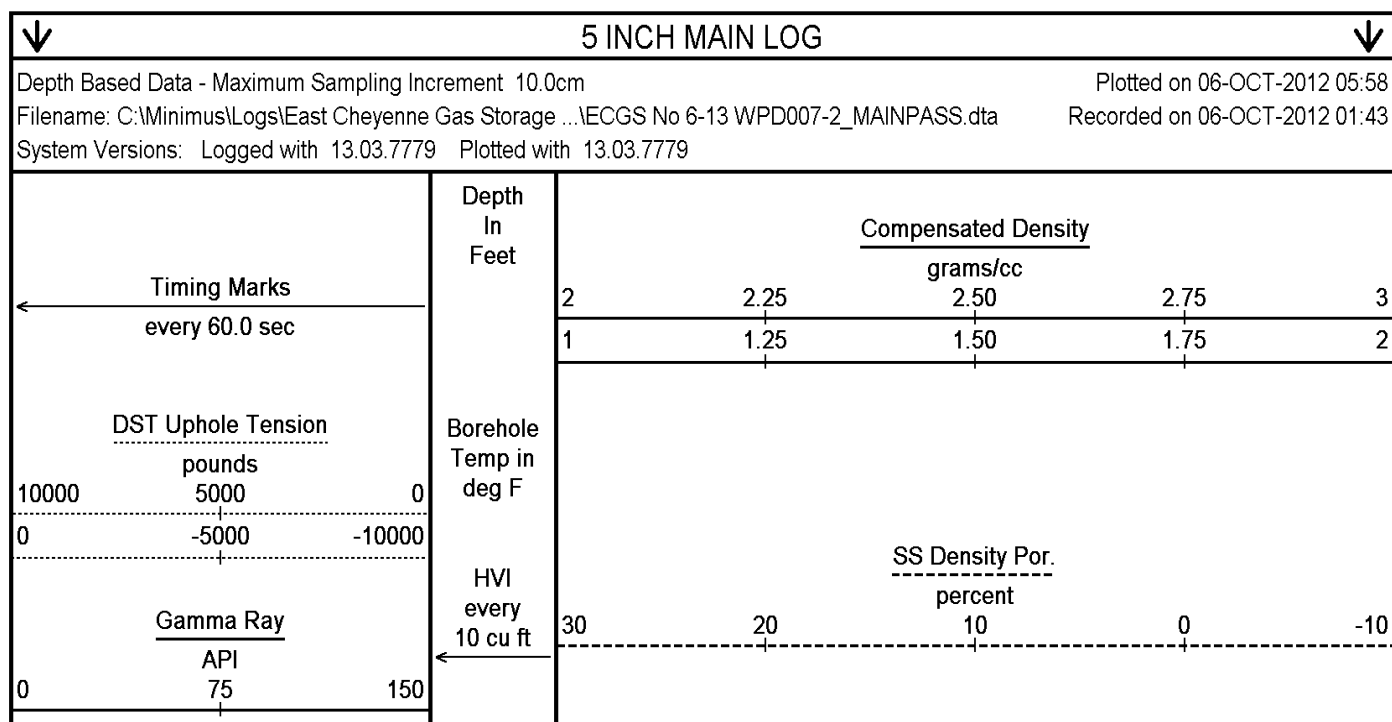
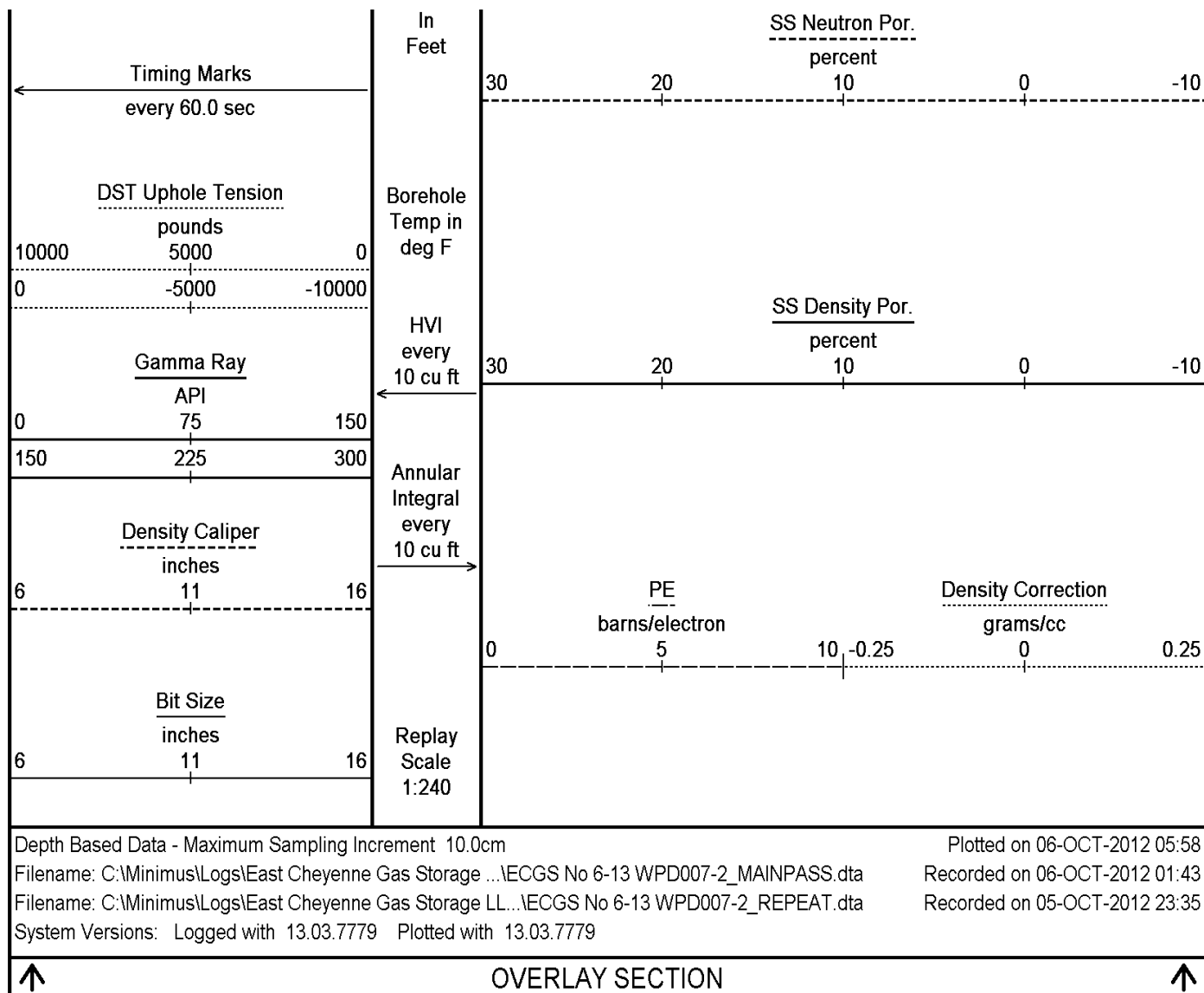
5150

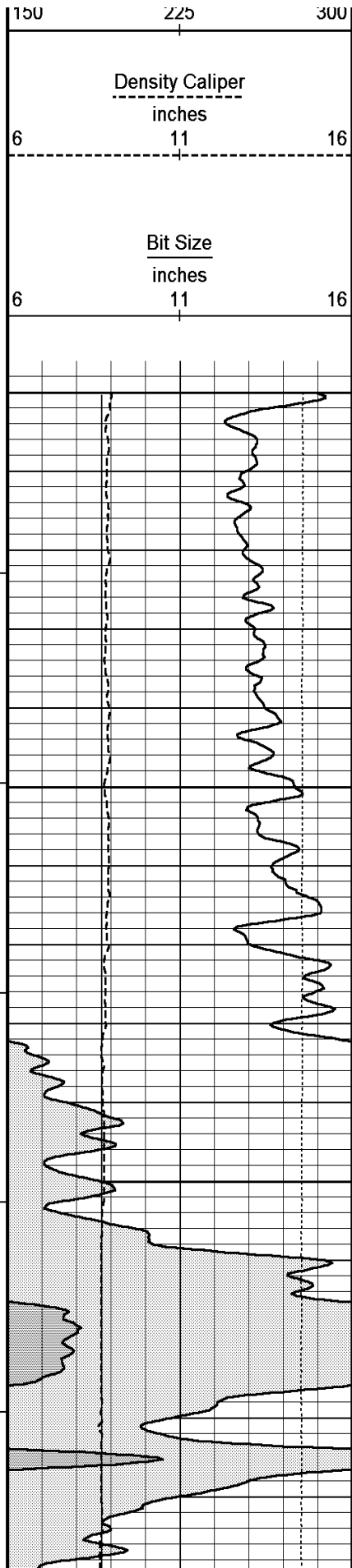
166°

5200

Depth

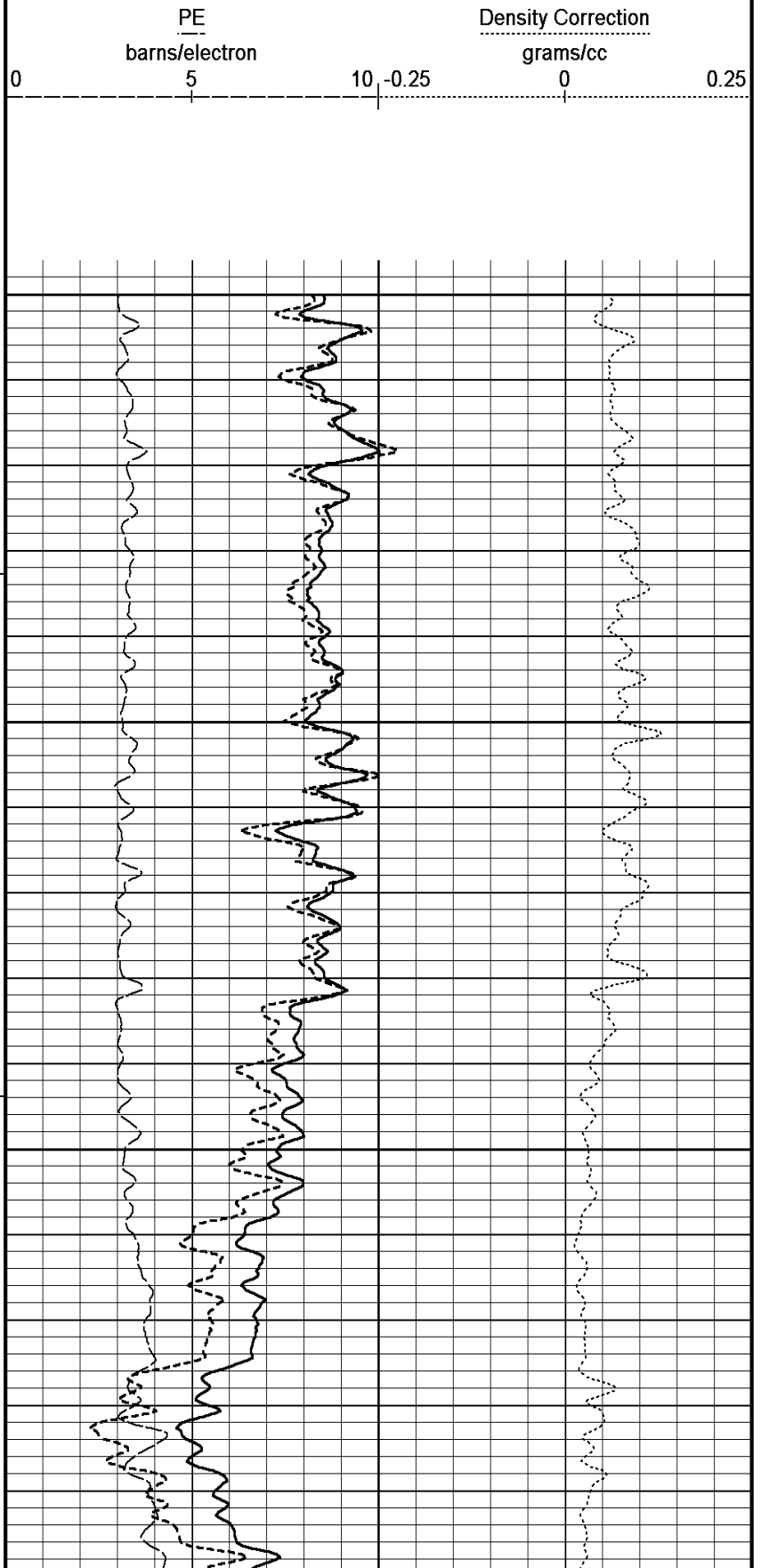


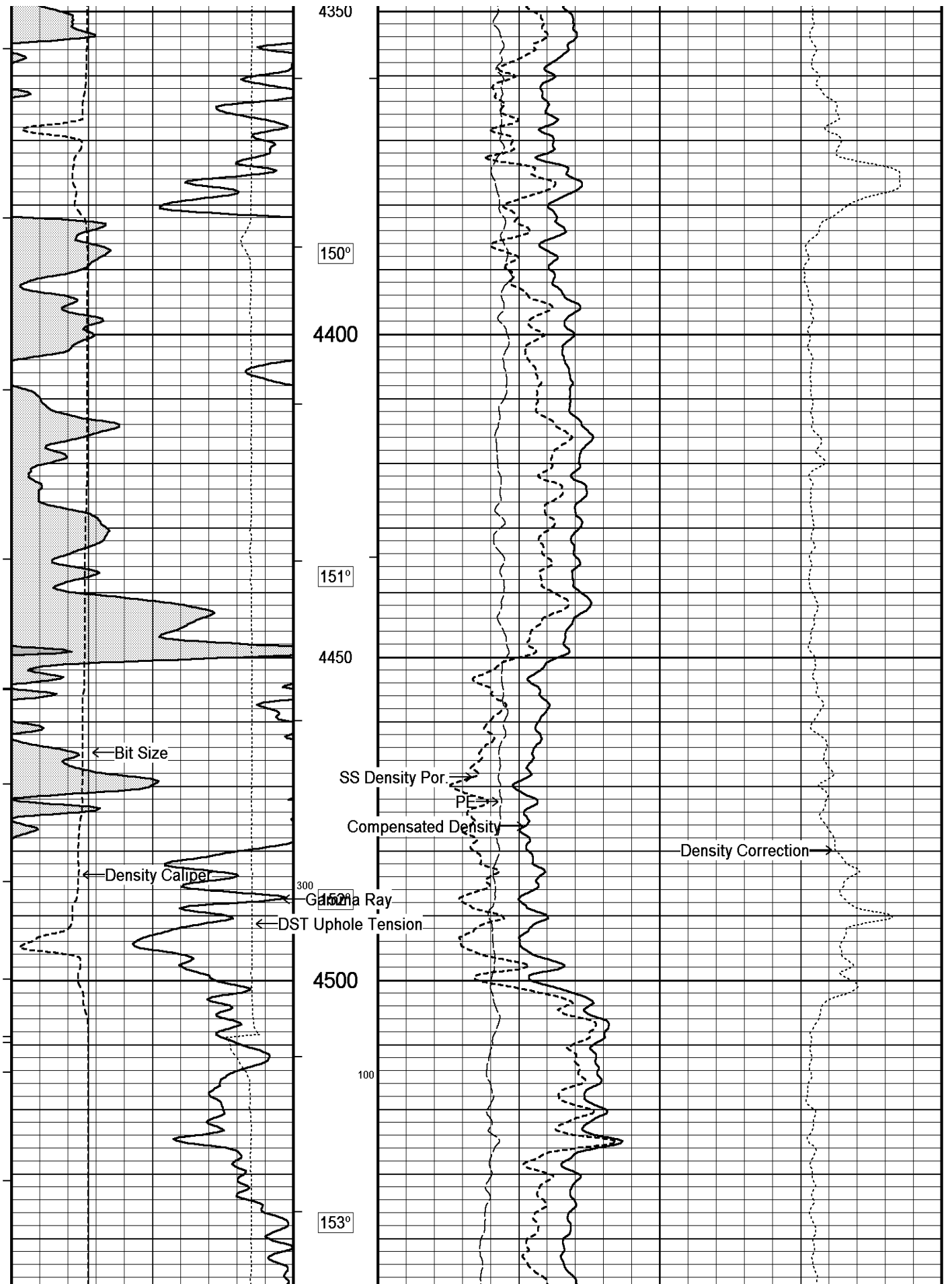


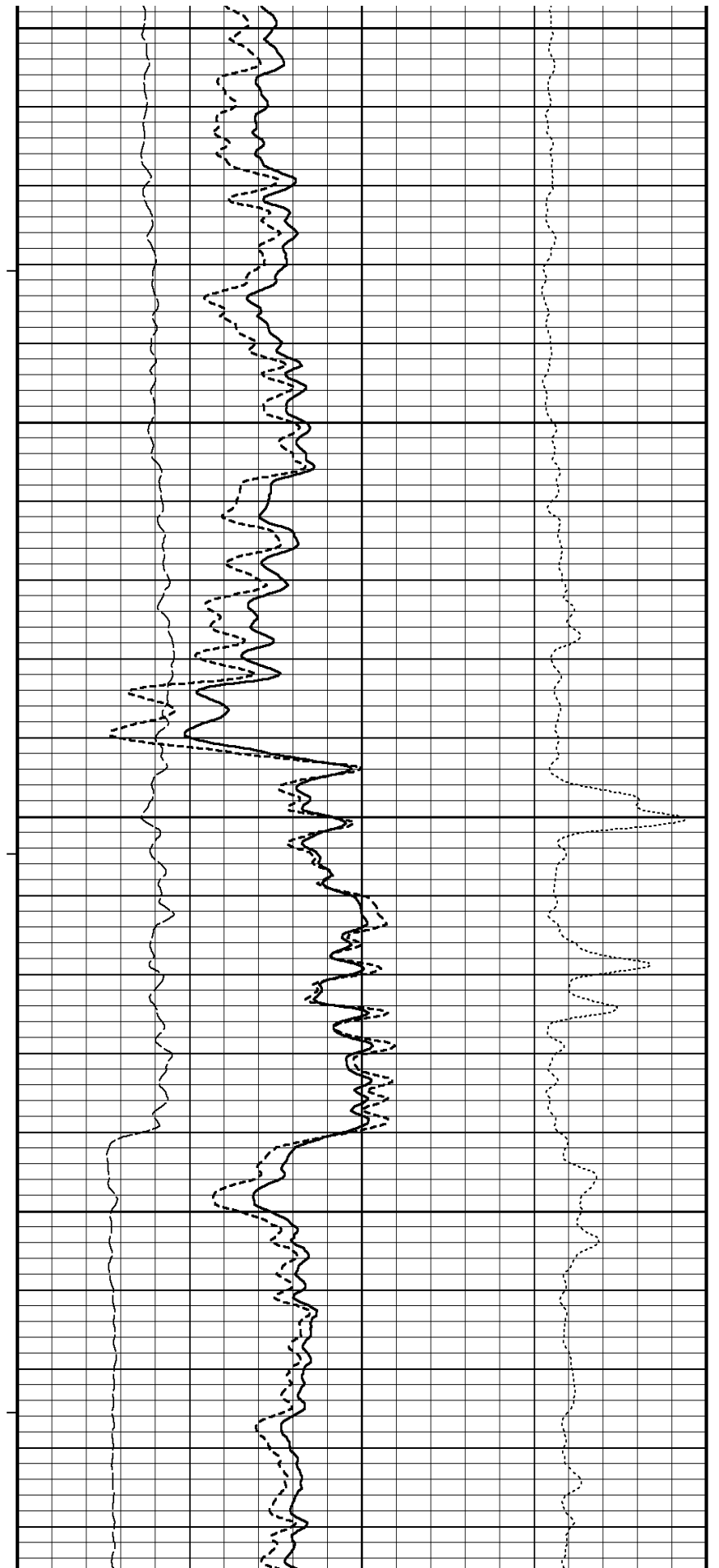
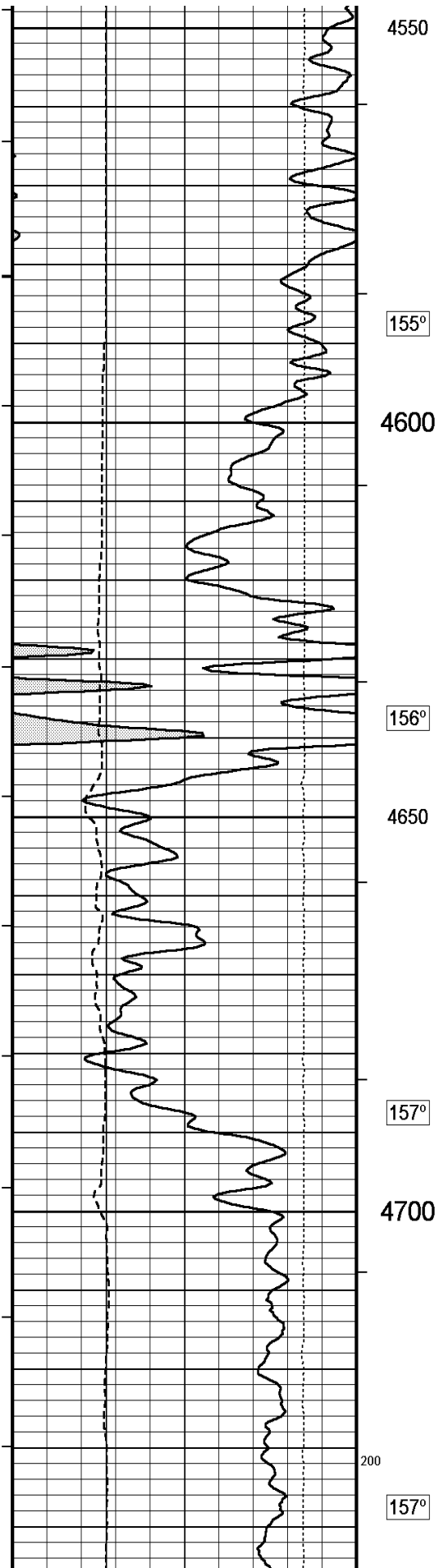


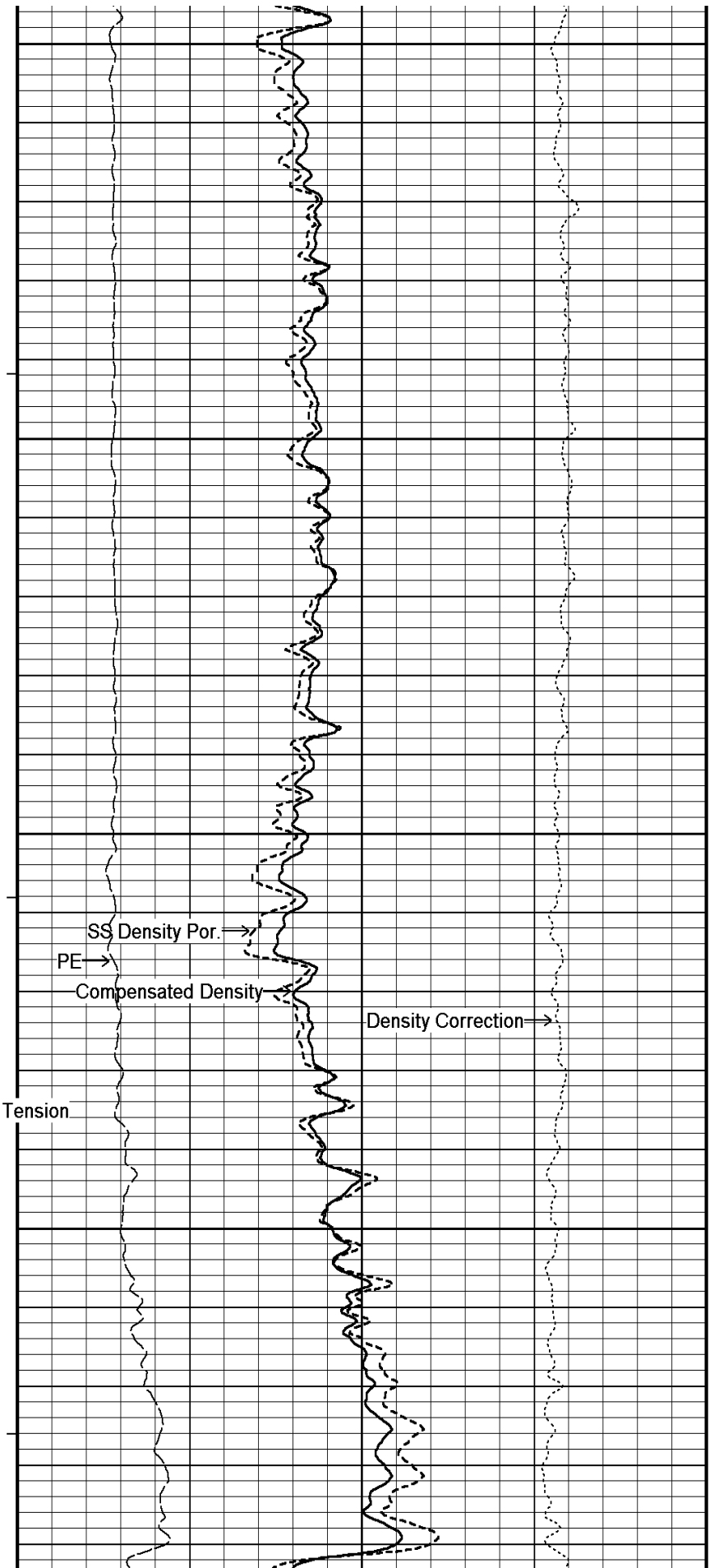
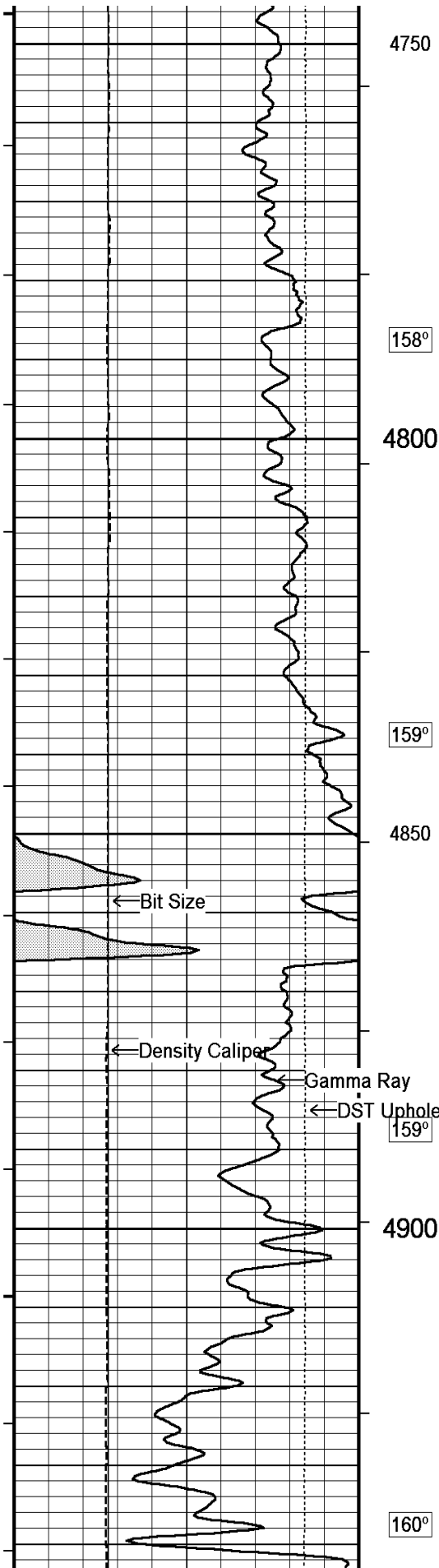
Annular
Integral
every
10 cu ft

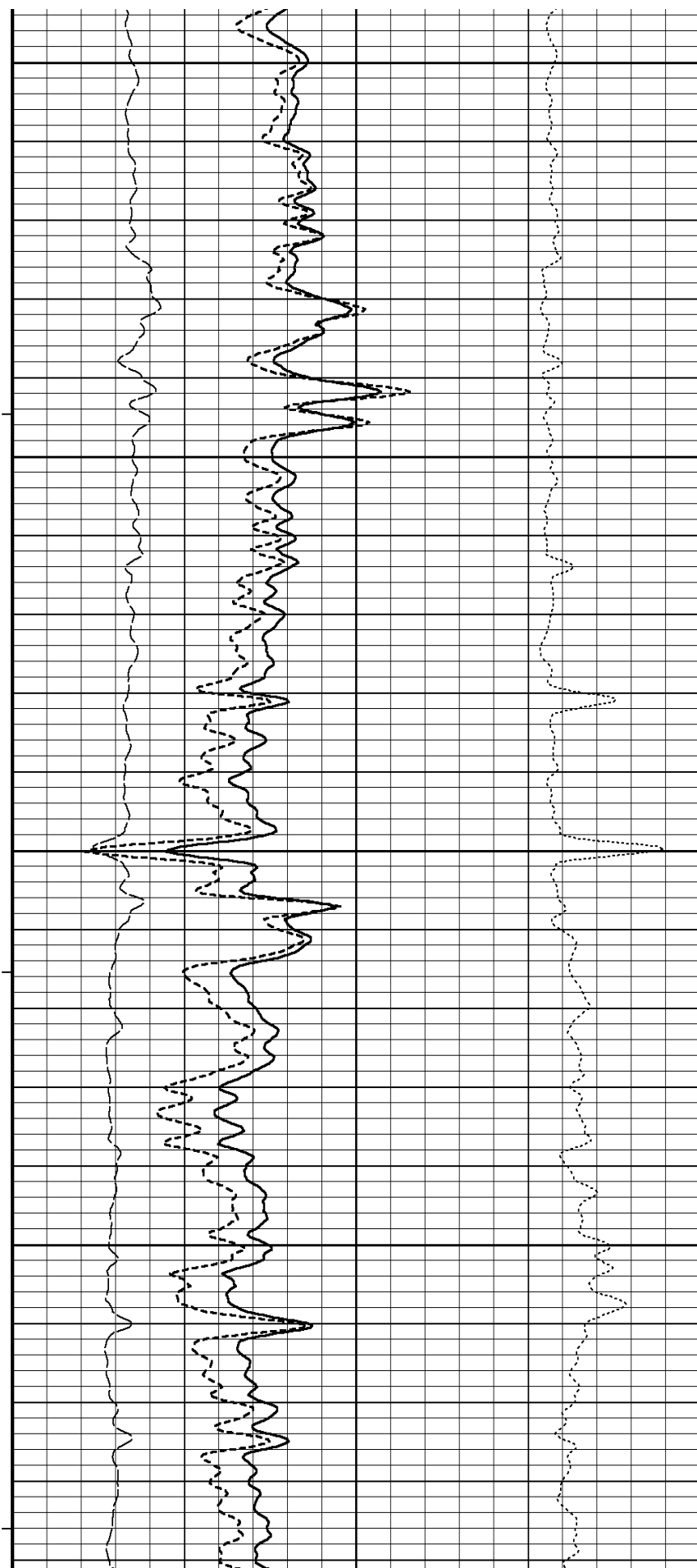
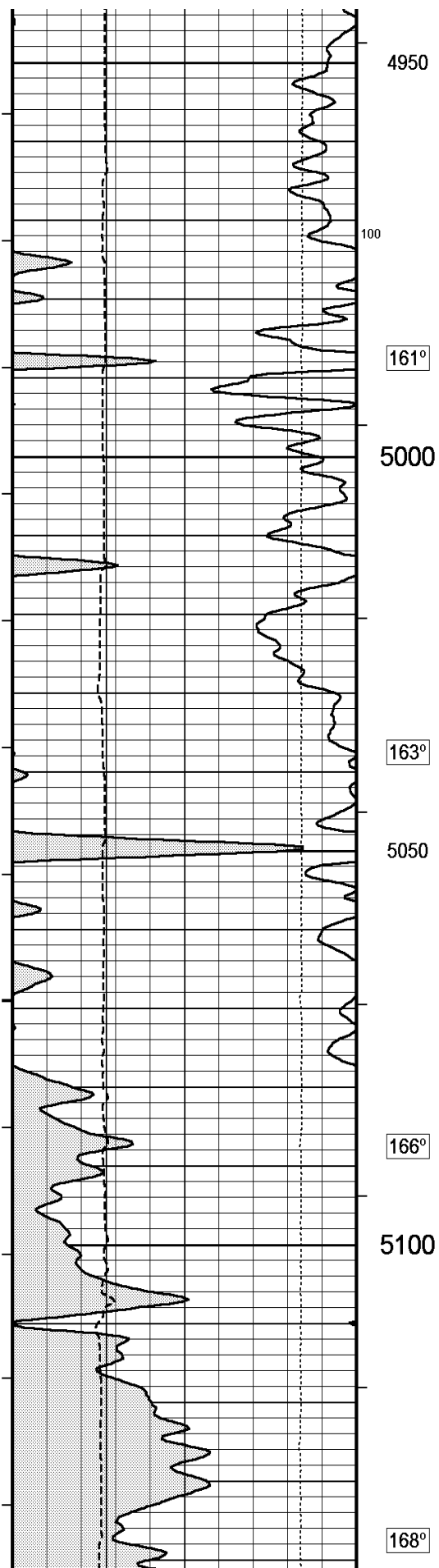
Replay
Scale
1:240

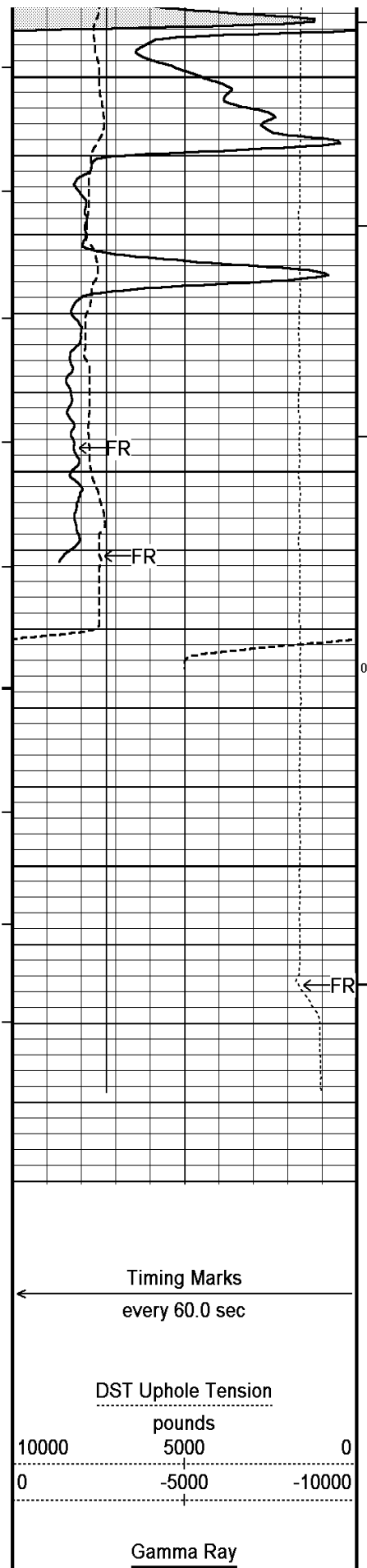












5150

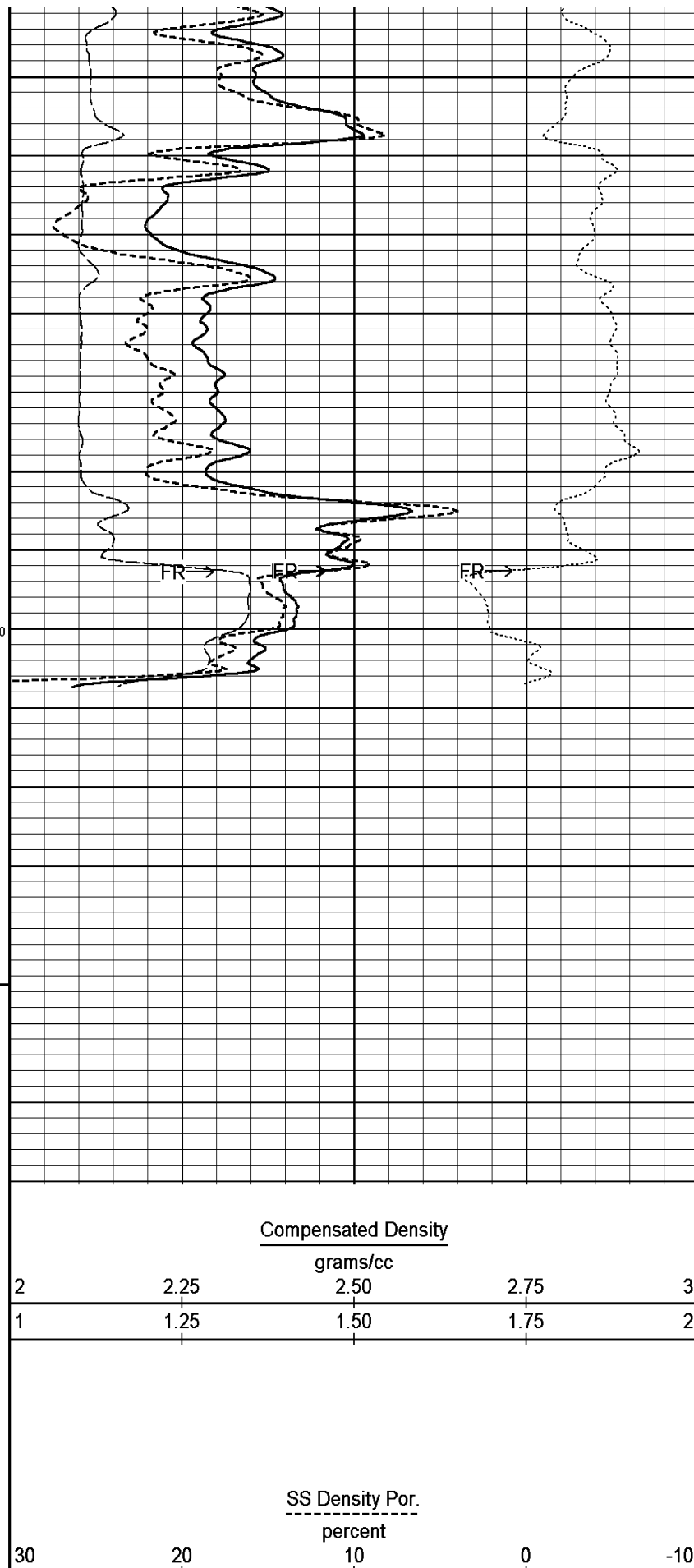
166°

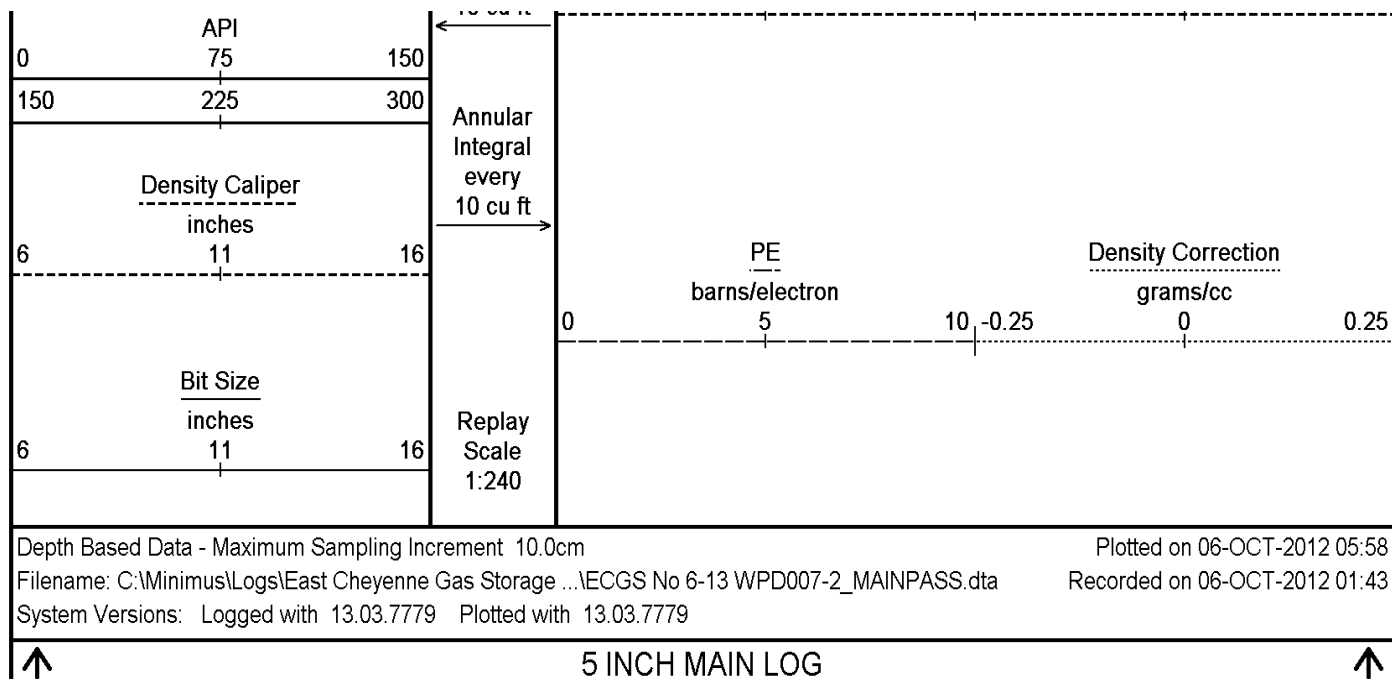
5200

166°

5250

TD

Depth
In
FeetBorehole
Temp in
deg FHVI
every
10 cu ft



BEFORE SURVEY CALIBRATION			
C:\Minimus\Logs\East Cheyenne Gas Storage LLC\IECGS No 6-13 WPD007-2\IECGS No 6-13 WPD007-2_MAINPASS.dta			
Down-hole Tension Calibration All 000			Field Calibration on 24-OCT-2010 03:34
Reading No	Measured		
1	15659.85	0.00	
2	15734.68	370.00	
General Constants All 000			Last Edited on 05-OCT-2012,17:12
General Parameters			
Mud Resistivity	4.230	ohm-metres	
Mud Resistivity Temperature	84.700	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 05-OCT-2012 16:38
Reading No	Measured	Calibrated (lbs)	
1	15464.68	0.00	
2	16668.93	515.00	
Gamma Calibration MCG-D.K 483			Field Calibration on 05-OCT-2012 04:32
	Measured	Calibrated (API)	
Background	76	51	

Calibrator (Gross)	851	570	
Calibrator (Net)	776	519	
Gamma Constants MCG-D.K 483			Last Edited on 05-OCT-2012,14:10
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 02-OCT-2012,09:19
Pre-filter Length	11		
Neutron Calibration MDN-B.J 372			Base Calibration on 11-SEP-2012 10:37 Field Check on 05-OCT-2012 04:43
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			
Neutron Constants MDN-B.J 372			Last Edited on 05-OCT-2012,14:11
Neutron Source Id	P31115B		
Neutron Jig Number	NJ5299		
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	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		
Accelerometer Parameters MIE-A.J 244			

Date Of Last Accelerometer Calibration		05-OCT-2012,13:09		
	X Accelerometer	Y Accelerometer	Z Accelerometer	
Slope	-1.102009	-1.108690	-1.102611	
Offset	-0.007164	0.008495	-0.004580	
Accelerometer Constants MIE-A.J 244			Last Edited on 05-OCT-2012,13:10	
Accelerometer Calibrator Number		000		
Accelerometer Temperature Characterisation				
X Accelerometer				
Serial Number	1016			
Calibration Date	12-Apr-2011			
	B0	B1	B2	B3
Bias(g)	0.00000e+000	1.93698e-005	-7.60293e-010	6.54727e-011
	SF0	SF1	SF2	SF3
Scale Factor(mA/g)	3.00000e+000	2.59257e-004	6.13375e-007	-3.90888e-010
Y Accelerometer				
Serial Number	973			
Calibration Date	19-Jan-2011			
	B0	B1	B2	B3
Bias(g)	0.00000e+000	1.95276e-005	-1.88058e-008	2.74122e-010
	SF0	SF1	SF2	SF3
Scale Factor(mA/g)	3.00000e+000	2.75268e-004	3.53140e-007	7.52116e-010
Z Accelerometer				
Serial Number	1032			
Calibration Date	18-Apr-2011			
	B0	B1	B2	B3
Bias(g)	0.00000e+000	-1.14960e-005	3.94288e-009	8.97135e-011
	SF0	SF1	SF2	SF3
Scale Factor(mA/g)	3.00000e+000	2.88058e-004	2.44833e-007	8.38007e-010
Magnetometer Parameters MIE-A.J 244				
Date Of Last Magnetometer Calibration		05-OCT-2012,13:13		
	X Magnetometer	Y Magnetometer	Z Magnetometer	
Slope	-1.000000	-1.000925	-0.993497	
Offset	0.008903	-0.008749	0.009457	
Magnetometer Constants MIE-A.J 244			Last Edited on	
Magnetometer Calibrator Number		000		
Compact Micro Imager Constants MIE-A.J 244				
Last Edited on				
Sonde Configuration		Imager Mode		
Arm-Pad Kit	Normal Pads (12.25 in)			
Arm-Pad Kit Serial Number				
Centre Pad 1 Rotational Offset	0.00	degrees		
Image/Borehole Ovality Reference	Azimuth of Pad 1			
Non Active Buttons	Omit			
Search Angle	0.00	degrees		
Correlation Interval	3.28	feet		
Correlation Step	1.64	feet		
Current Offset	0.0000	mAmp		
Squasher Start	0.0500	mAmp		
Image Processing	Enabled			
Caliper Calibration MIE-A.J 244			Base Calibration on 05-OCT-2012 13:33 Field Calibration on 05-OCT-2012 13:37	
Base Calibration				
Reading No	Pads 1-5 Meas.	Pads 3-7 Meas.	Calibrator Size (in)	
1	25476	26124	5.97	
2	25074	26070	7.06	

2	55871	55975	7.96		
3	44943	46748	9.87		
4	59347	57917	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	22282	27314	24804	22108	5.97
2	33535	36001	32513	31768	7.96
3	41769	44988	41324	39908	9.87
4	54189	52954	48629	51823	11.92
5	0	0	0	0	0.00
Field Calibration					
	Measured	Measured		Actual	
	Pads 1-5 Caliper(in)	Pads 3-7 Caliper(in)		Caliper(in)	
	8.47	7.99		7.96	
	Measured	Measured	Measured	Measured	Actual
	Pad 2 Caliper(in)	Pad 4 Caliper(in)	Pad 6 Caliper(in)	Pad 8 Caliper(in)	Caliper(in)
	4.26	3.72	3.77	4.34	7.96
Caliper Constants MIE-A.J 244				Last Edited on 05-OCT-2012,13:26	
Caliper Difference for BRKT		0.120	inches		
Navigation Constants MIE-A.J 244				Last Edited on 05-OCT-2012,14:15	
Magnetic Declination		7.85	degrees	East	
FE Calibration MFE-A.A 76				Base Calibration on 10-SEP-2012 11:36 Field Check on 05-OCT-2012 04:36	
Base Calibration		Measured	Calibrated (ohm-m)		
Reference 1		0.0	0.0		
Reference 2		964.4	126.8		
Base Check			279.9		
Field Check			280.3		
FE Constants MFE-A.A 76				Last Edited on 05-OCT-2012,14:15	
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			
High Resolution Temperature Constants MAI-B.A 219				Last Edited on 30-SEP-2012,04:08	
Pre-filter Length		11			
Induction Calibration MAI-B.A 219				Base Calibration on 08-MAY-2012,15:56 Field Check on 05-OCT-2012 04:26	
Base Calibration		Measured	Calibrated (mmho/m)		
Test Loop Calibration		Low	High	Low	High
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	11.5	3793.9
2	0.0	0.0	30.8	3537.8
3	0.0	0.0	28.6	3056.6
4	0.0	0.0	19.3	2028.9
Deep			16.5	1949.2
Medium			42.7	4089.1
Shallow			47.4	5284.2
Array Temperature		0.0	52.9	Deg F

Induction Constants MAI-B.A 219

Last Edited on 05-OCT-2012,14:16

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 05-OCT-2012 04:53

Base Calibration		
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)
	7.86	7.96
Photo Density Calibration MPD-C.J 378		Base Calibration on 27-SEP-2012 12:49 Field Check on 05-OCT-2012 04:51
Density Calibration		
Base Calibration	Measured	Calibrated (sdu)
	Near Far	Near Far
Reference 1	39385 12332	52994 19128
Reference 2	18690 2207	25185 2558
Field Check at Base	1201.6 1277.5	
Field Check	1197.1 1283.9	
PE Calibration		
Base Calibration	Measured	Calibrated
	WS WH Ratio	Ratio
Background	219 1074	
Reference 1	13507 39225 0.348	0.309
Reference 2	5341 18558 0.293	0.274
Field Check at Base	219.0 1074.2	
Field Check	220.3 1075.4	
Density Constants MPD-C.J 378		Last Edited on 05-OCT-2012,14:12
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	1.17	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	

DOWNHOLE EQUIPMENT

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3/8" Triple Cone Cable Head (MCB C A)

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-D.A Compact Knuckle Joint

SKJ-D.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.A 125 LG: 4.65 ft WT: 26.5 lb OD: 2.24 in

Compact MMI Electrode Section

MIE-A.J 244 LG: 13.96 ft WT: 99.2 lb OD: 4.09 in

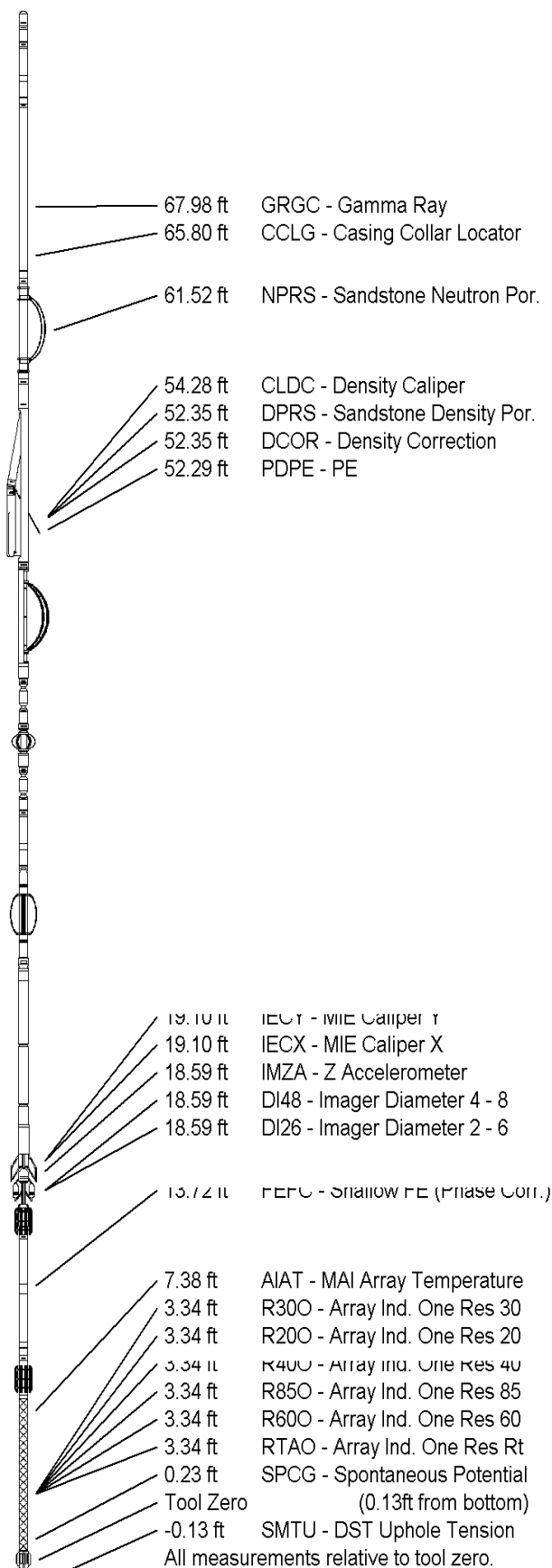
Compact Focussed Electric


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: 77.14 ft Weight: 584.2 lb



WELL		ECGS NO 6-13 WPD007-2			
FIELD		PEETZ WEST			
PROVINCE/COUNTY		LOGAN			
COUNTRY/STATE		USA/COLORADO			
Elevation Kelly Bushing	4564.00	feet	First Reading	5213.00	feet
Elevation Drill Floor	4563.00	feet	Depth Driller	5265.00	feet
Elevation Ground Level	4550.00	feet	Depth Logger	5265.00	feet
 Weatherford®		PHOTO DENSITY COMPENSATED NEUTRON LOGS			