

**Weatherford****CALIPER
LOG**

COMPANY

EAST CHEYENNE GAS STORAGE LLC

WELL ECGS No 6-15 WPD002-1

FIELD PEETZ WEST

PROVINCE/COUNTY LOGAN

COUNTRY/STATE USA/COLORADO

LOCATION 1611' FNL & 999' FWL

SEC TWP RGE

6 11N 52W

Other Services

MAI

API Number 05-075-09401

MPD/MDN

Permit Number

CMI

Permanent Datum GL, Elevation 4556 feet

Log Measured From KB

Drilling Measured From KB

Date 13-NOV-2012

Run Number ONE

Depth Driller 5270.00 feet

Depth Logger 5265.00 feet

First Reading 5209.00 feet

Last Reading 1226.00 feet

Casing Driller 1228.00 feet

Casing Logger 1226.00 feet

Bit Size 8.750 inches

Hole Fluid Type WBM

Density / Viscosity 9.90 g/cc 53.00 CP

PH / Fluid Loss 9.00 7.20 ml/30Min

Sample Source FLOWLINE

Rm @ Measured Temp 3.10 @ 85.7 ohm-m

Rmf @ Measured Temp 2.48 @ 85.7 ohm-m

Rmc @ Measured Temp 3.72 @ 85.7 ohm-m

Source Rmf / Rmc CALC CALC

Rm @ BHT 1.70 @159.0 ohm-m

Time Since Circulation 4 HOURS

Max Recorded Temp 159.00 deg F

Equipment Name COMPACT

Equipment / Base 13037 RK SPR

Recorded By B.ROSSER

Witnessed By A. ASHBY

Elevations:
KB 4570.00
DF 4569.00
GL 4556.00**BOREHOLE RECORD**

Last Edited: 13-NOV-2012 08:43

Bit Size
inches

8.750

Depth From
feet

1226.00

Depth To
feet

5270.00

CASING RECORD

Type

Size
inches

9.625

Depth From
feet

0.00

Shoe Depth
feet

1226.00

Weight
pounds/ft

36.00

REMARKS

SOFTWARE VERSION 13.02.6600

TOOLS RUN: MCG, MDN, MPD, MIM, MIE, MFE, MAI RUN IN COMBINATION.

HARDWARE:

MPD: 8" PROFILE PLATE USED.

MAI: TWO 1 INCH STANDOFFS USED.

MDN: DUAL BOWSPRING USED.

MIM: CENTRALIZER BOWSPRING USED.

2.65 G/CC DENSITY MATRIX USED TO CALCULATE POROSITY FROM TD TO BOTTOM OF FORT HAYES FORMATION(TD TO 4700FT).

2.71 G/CC DENSITY MATRIX USED TO CALCULATE POROSITY IN FORT HAYES AND 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.

IMAGE LOG RAN OVER BOTTOM 500 FT.

LATITUDE: 40.95937

LONGITUDE: -103.22532

TOTAL HOLE VOLUME FROM TD TO SURFACE CASING =1720 CUBIC FEET

ANNULAR VOLUME WITH 7 INCH PRODUCTION CASING FROM TD TO SURFACE CASING =652 CUBIC FEET

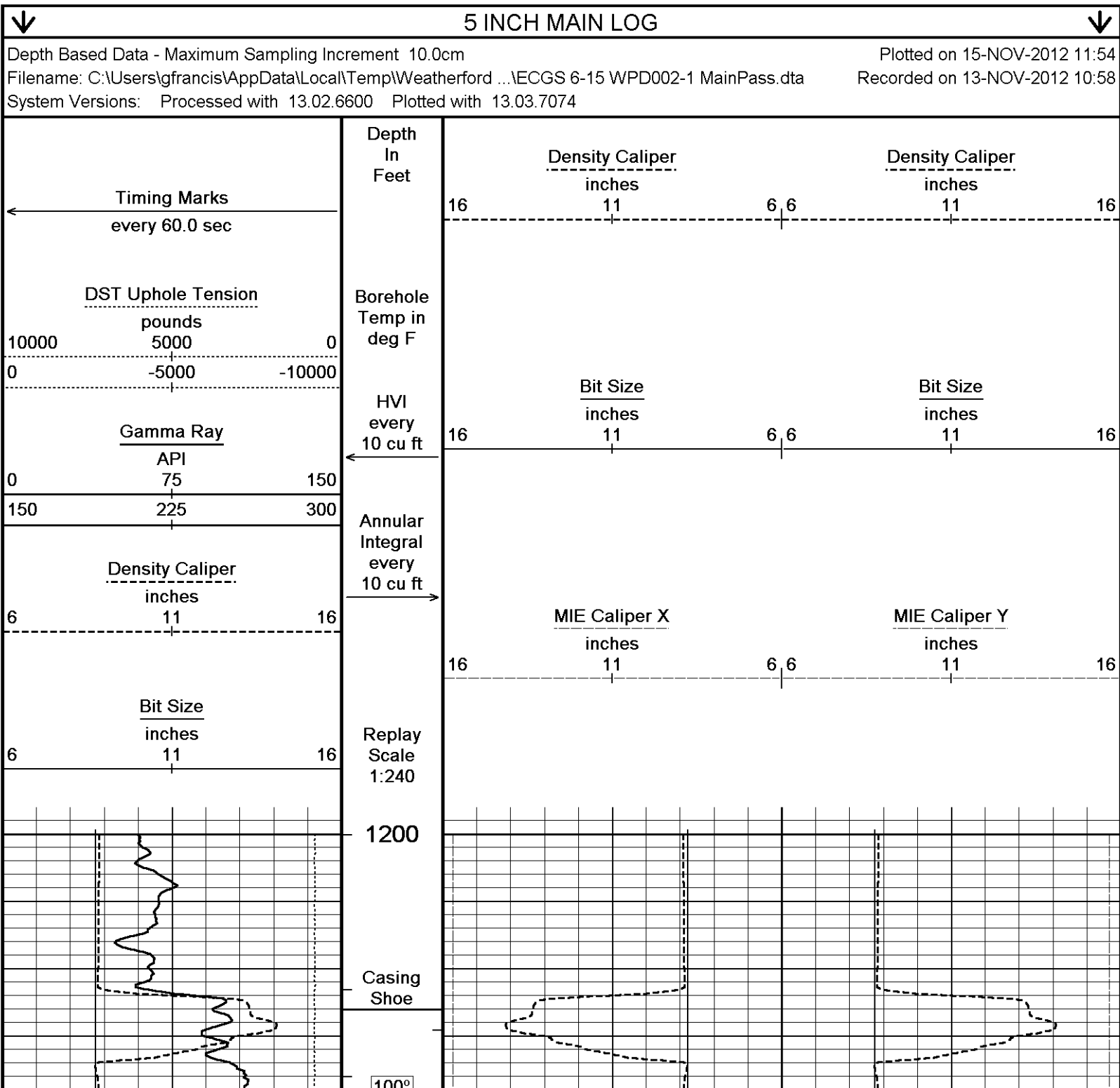
TOTAL VOLUME FROM TD TO 4200 FT =415 CUBIC FEET

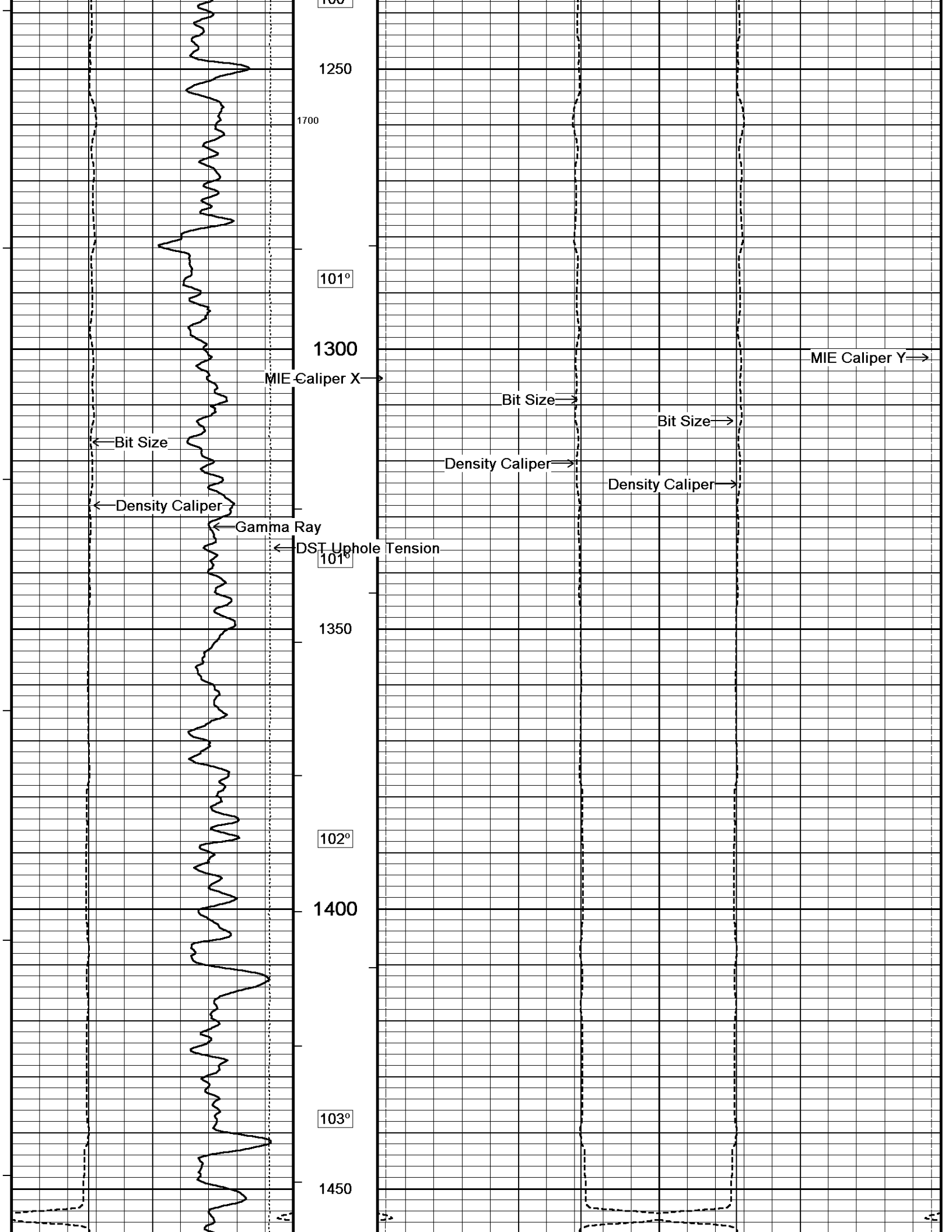
ANNULAR VOLUME WITH 7 INCH PRODUCTION CASING FROM TD TO 4200 FT =145 CUBIC FEET

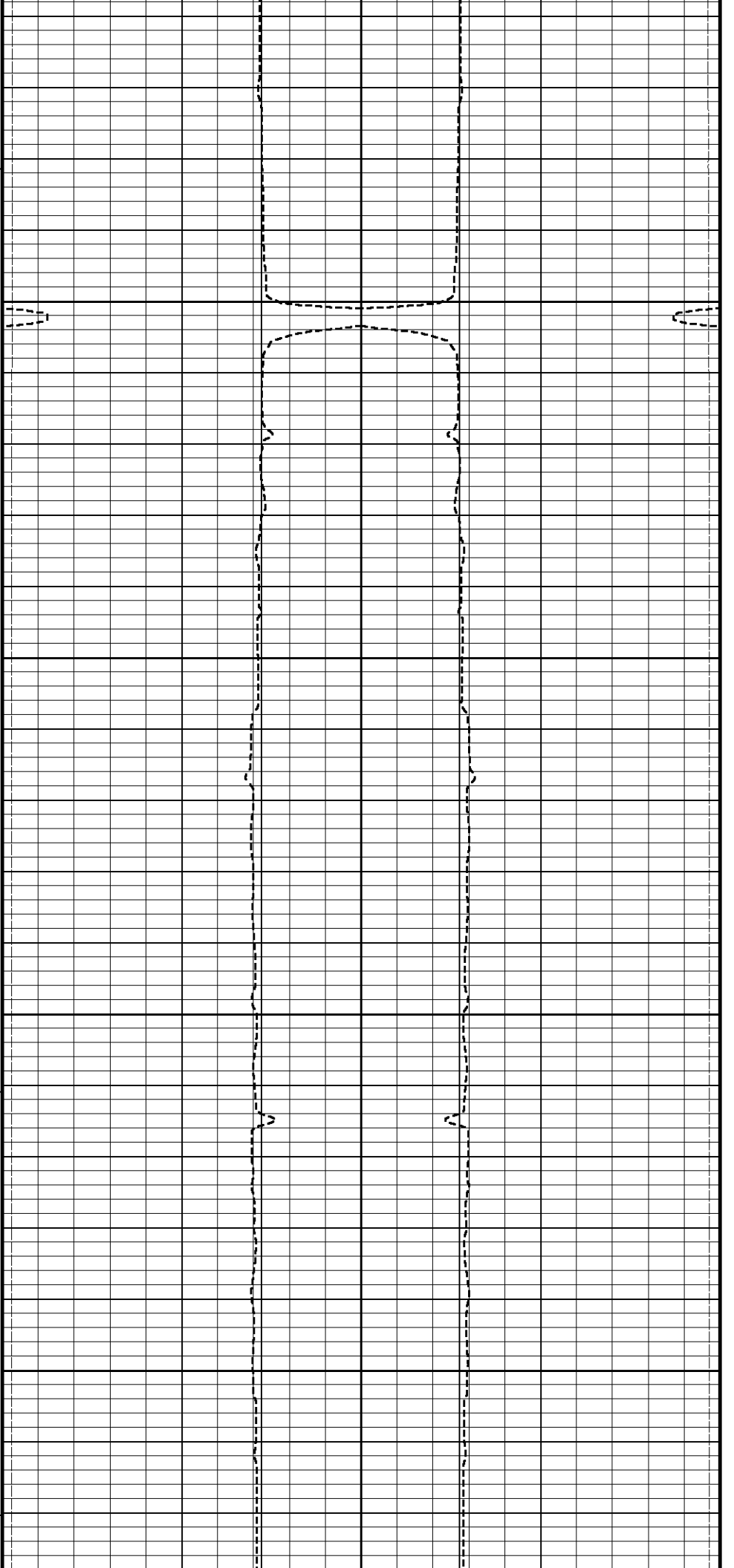
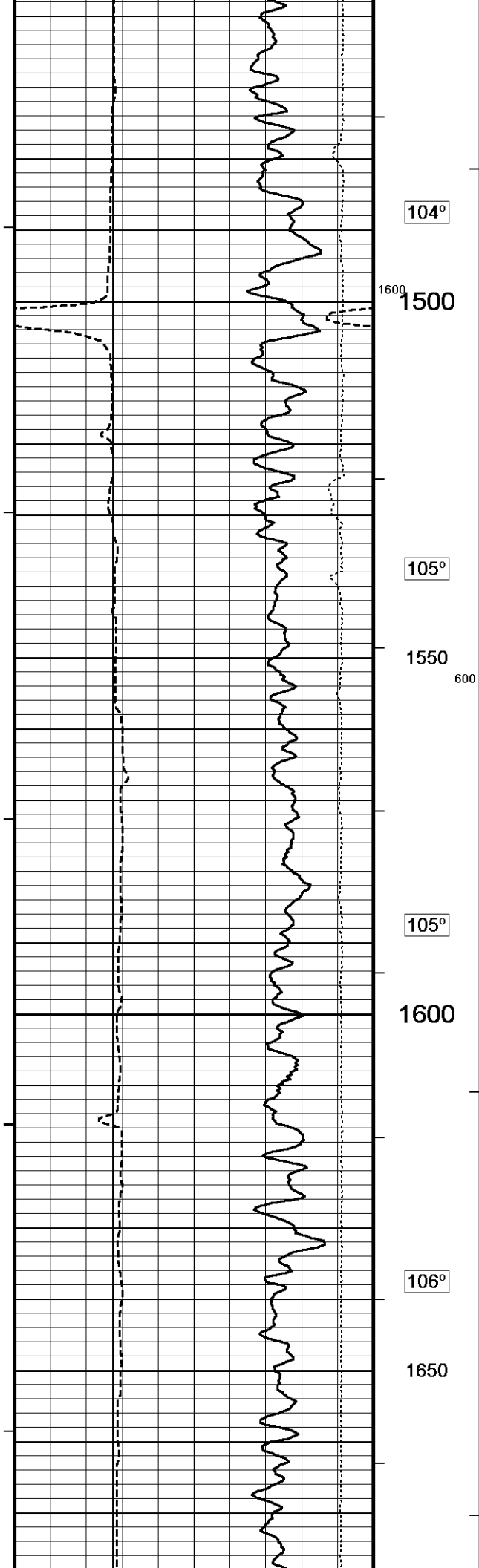
SERVICE ORDER: 3535305

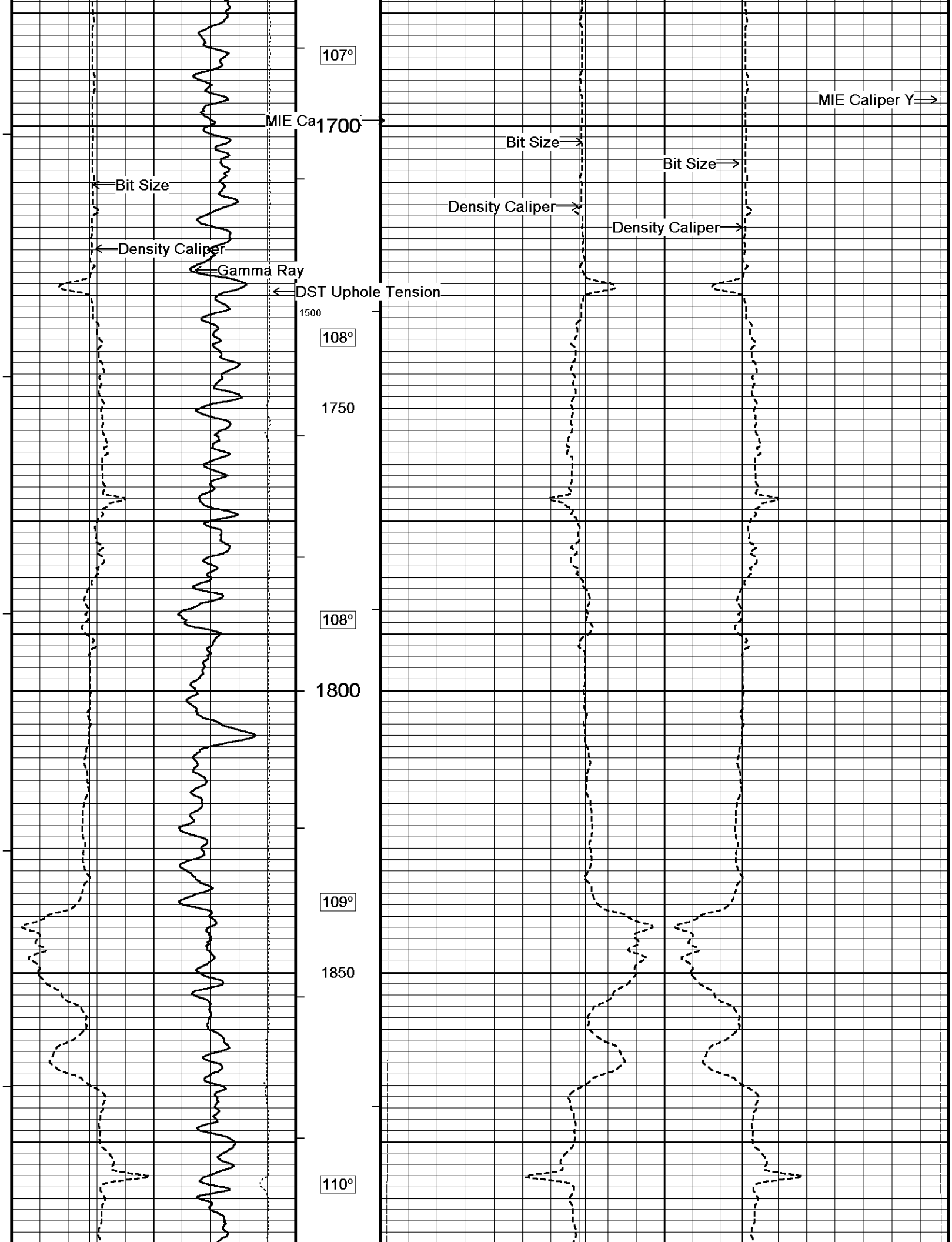
RIG: CADE 22

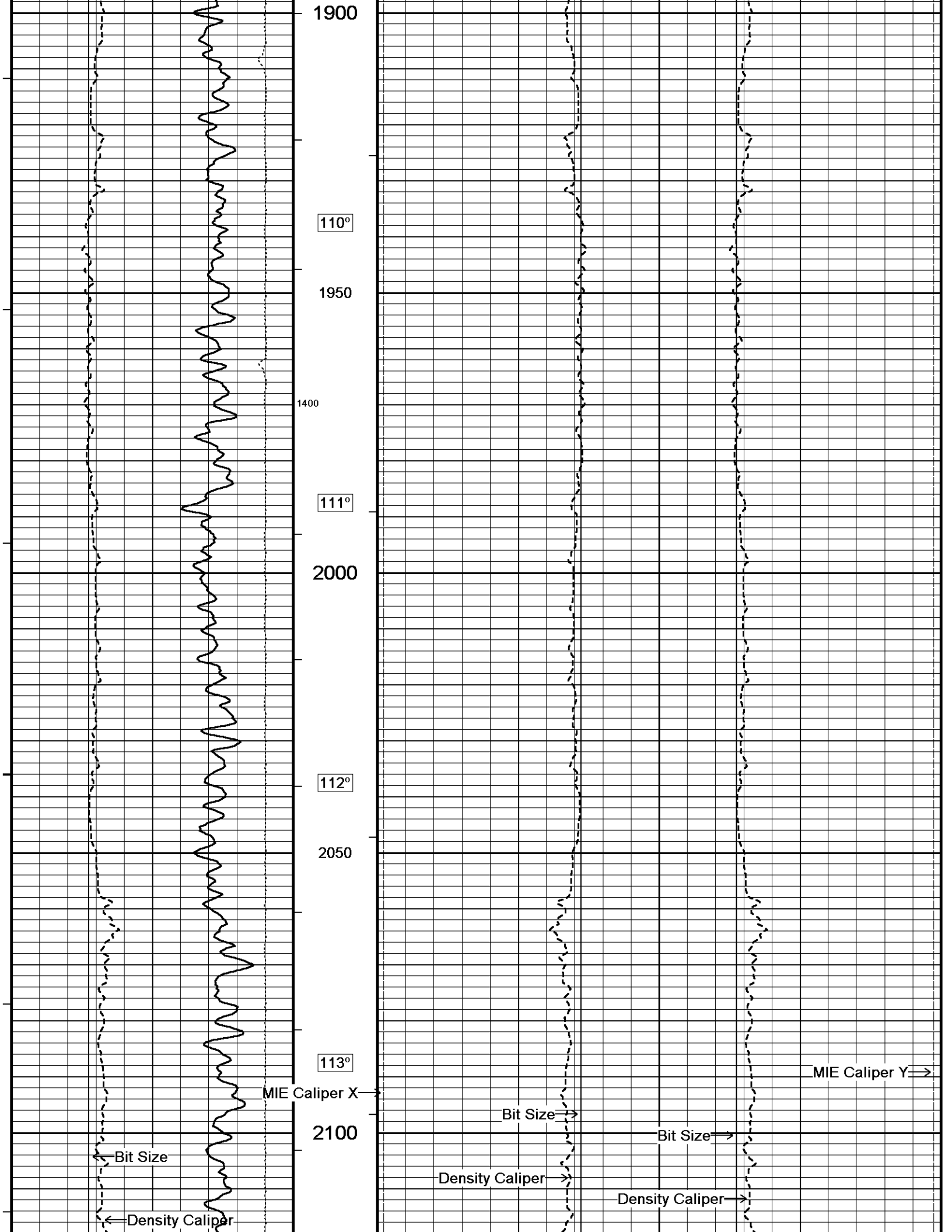
All interpretations are opinions based on inferences from electrical or other measurements and we cannot, and do not, guarantee the accuracy or correctness of any interpretations, and we shall not, except in the case of gross or wilful negligence on our part, be liable or responsible for any loss, costs,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

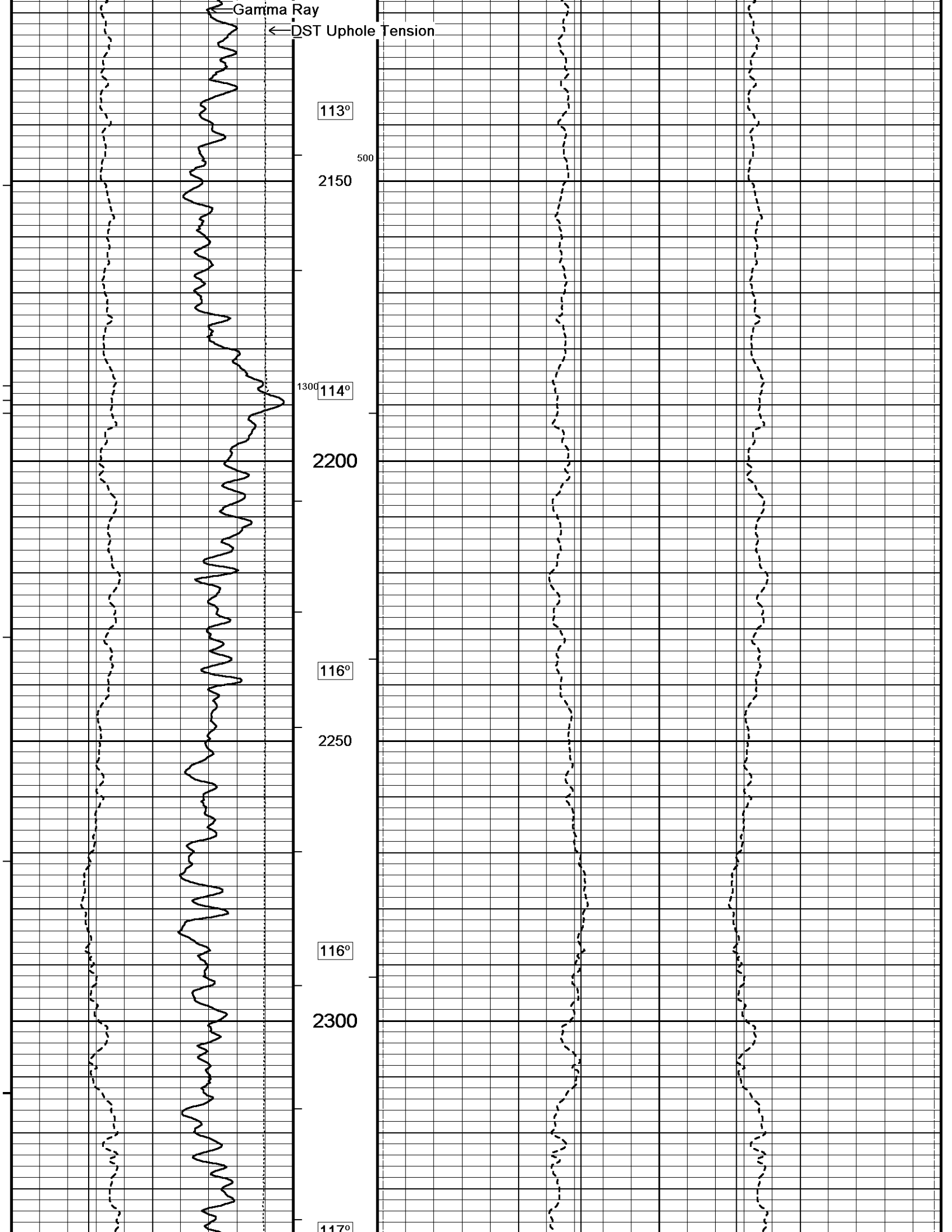


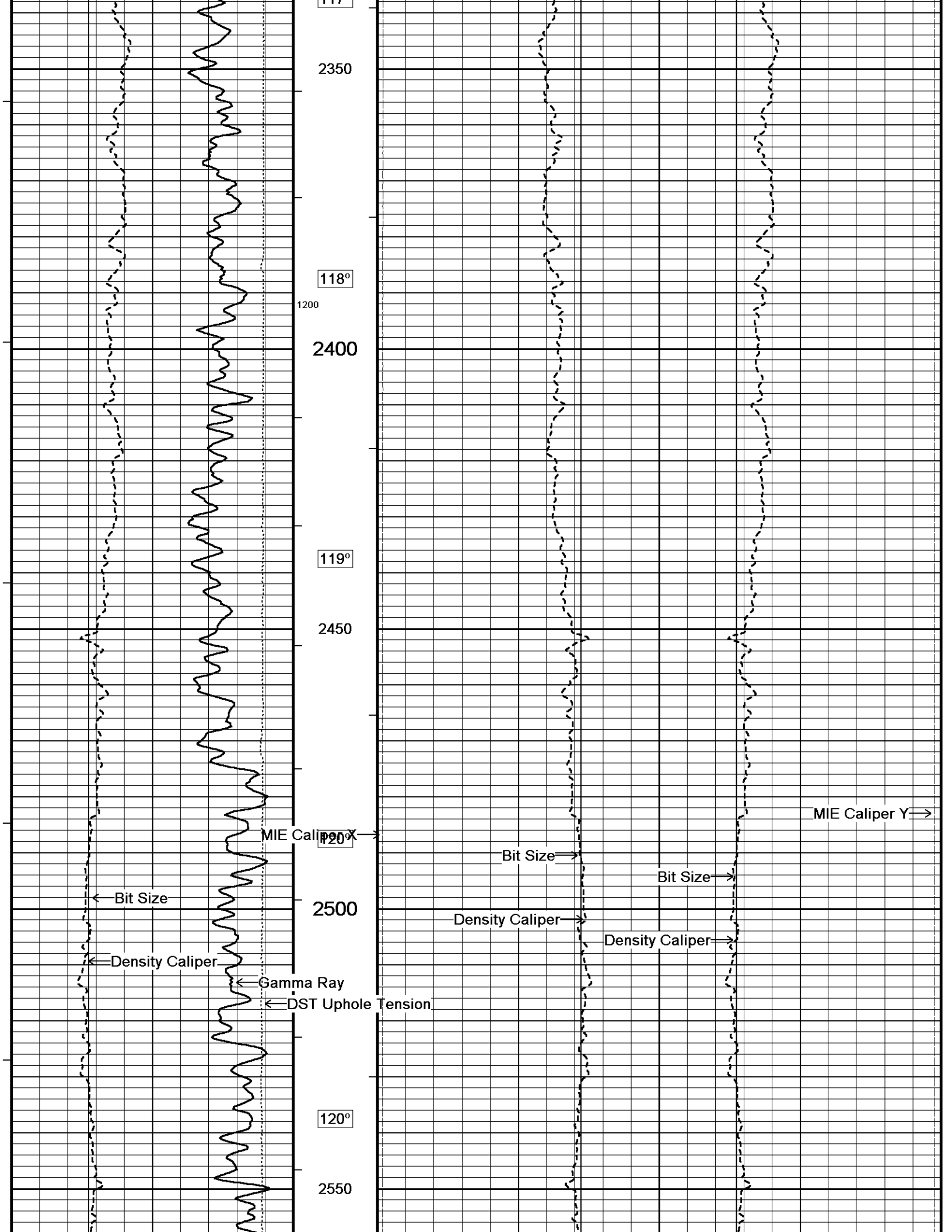


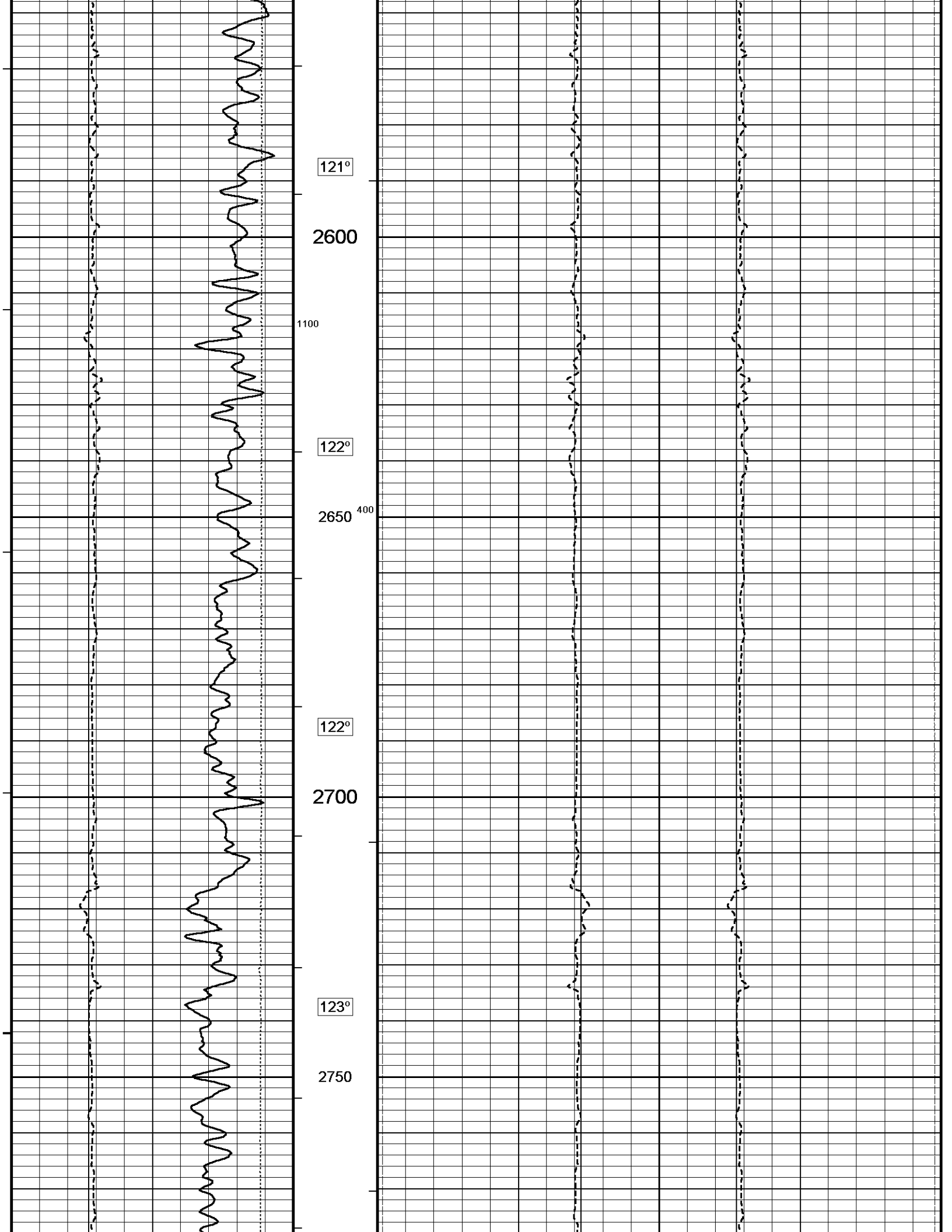


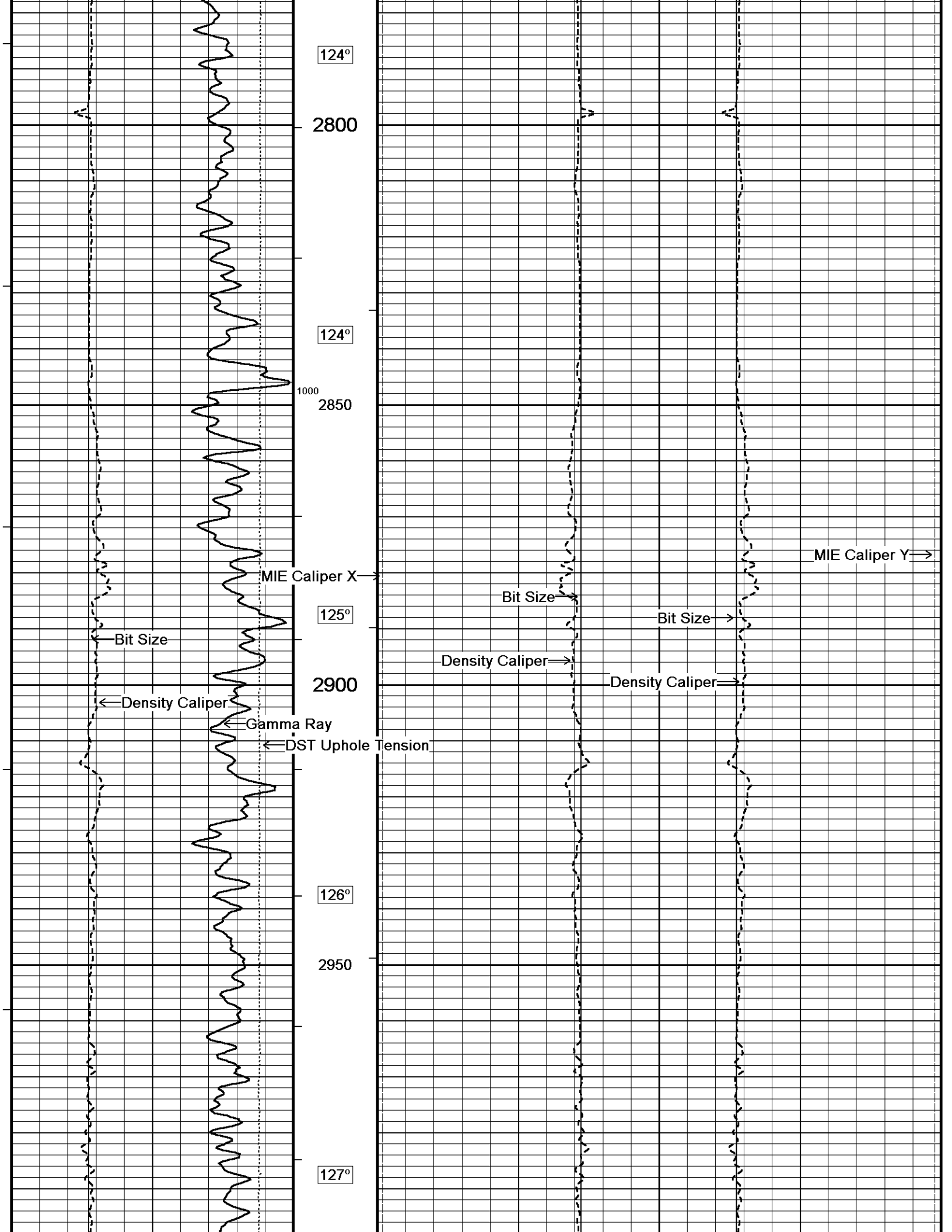


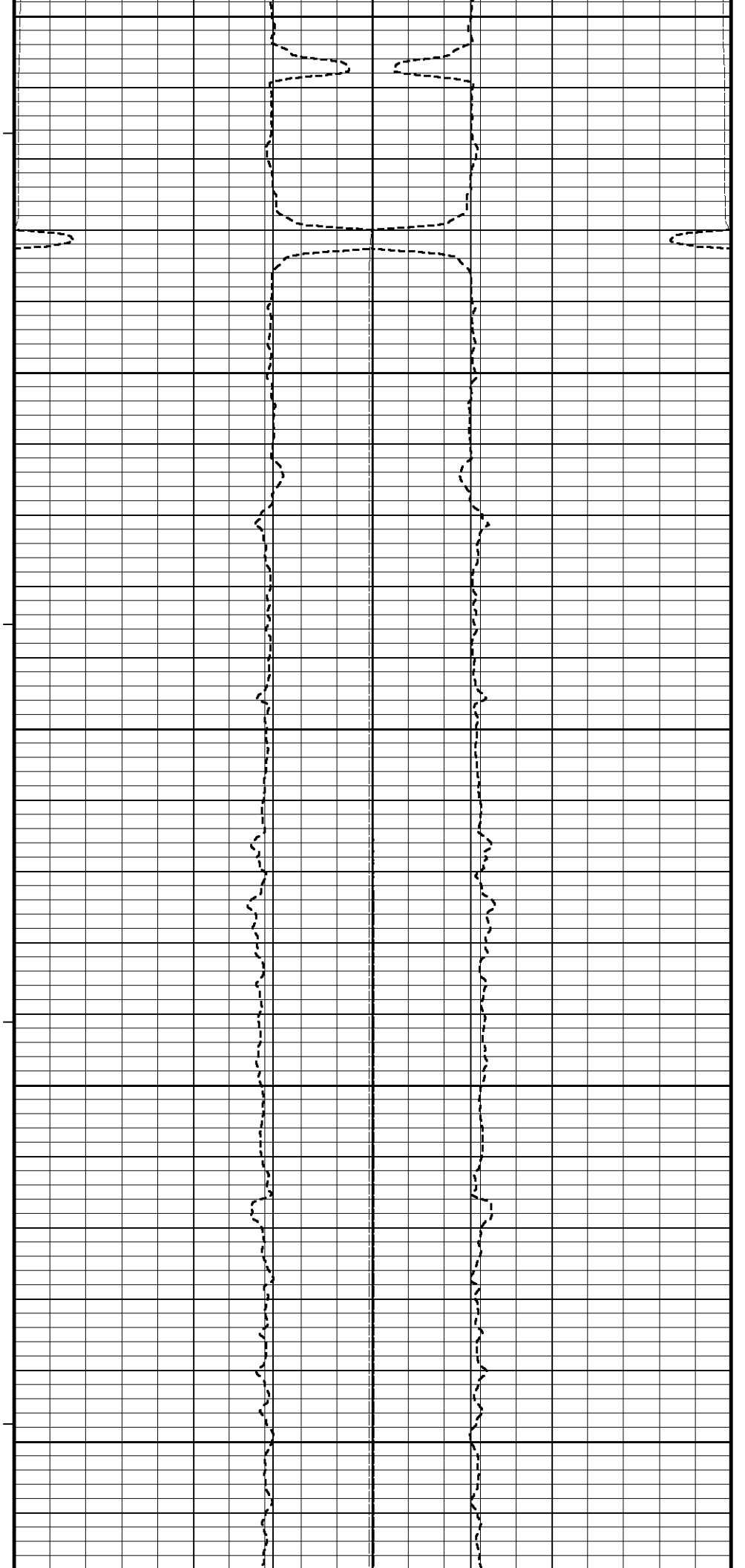
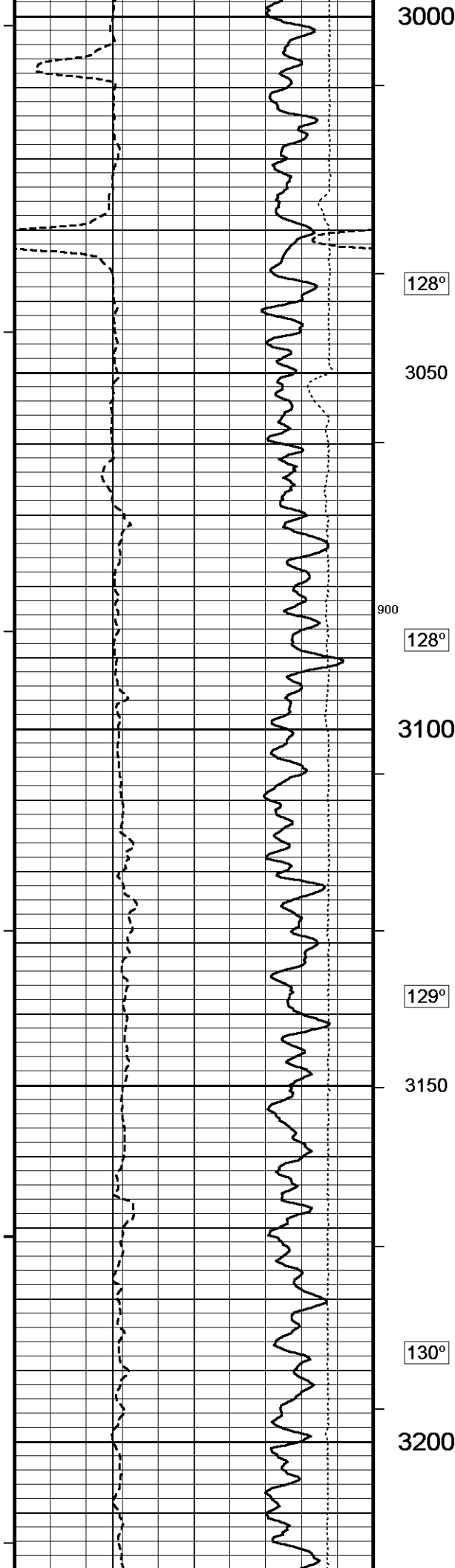


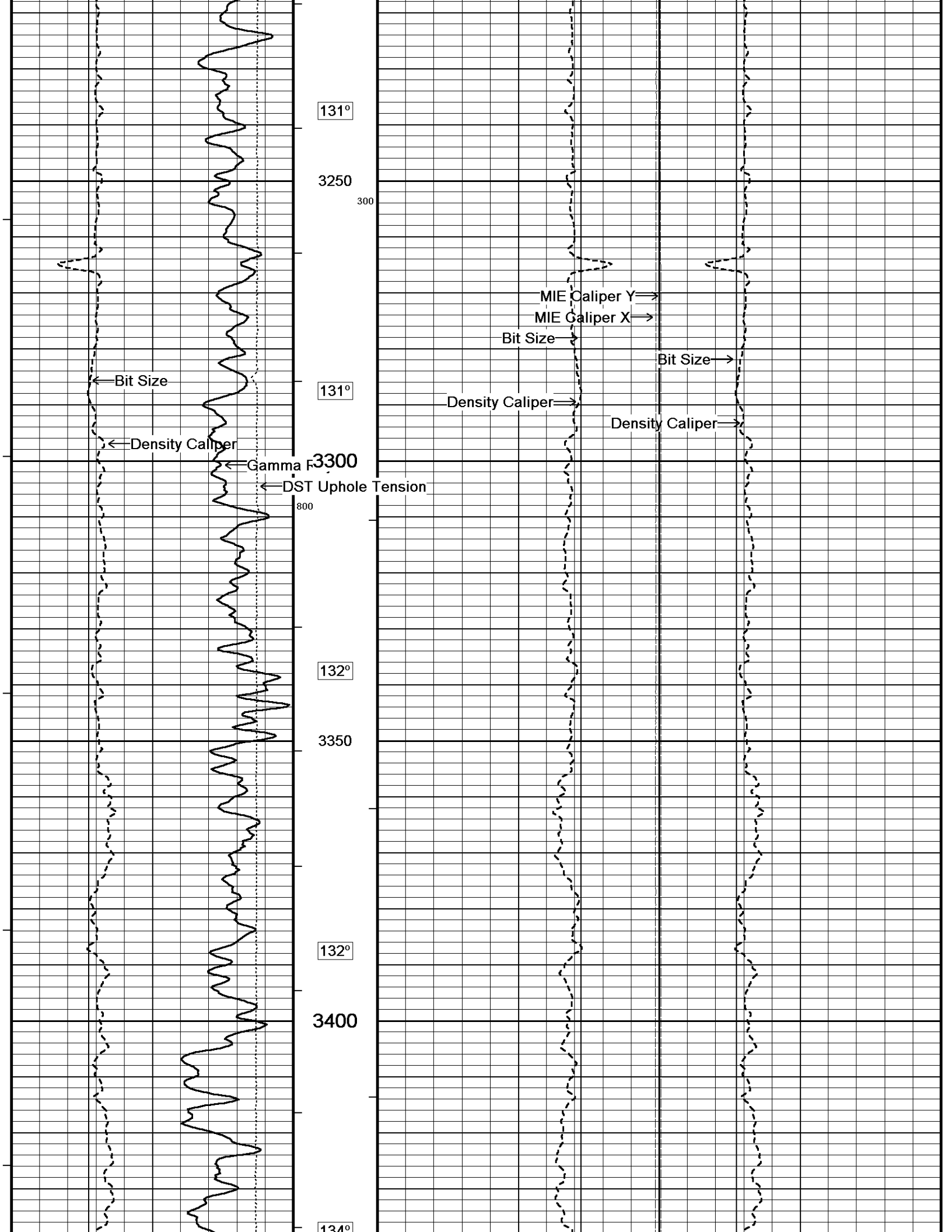


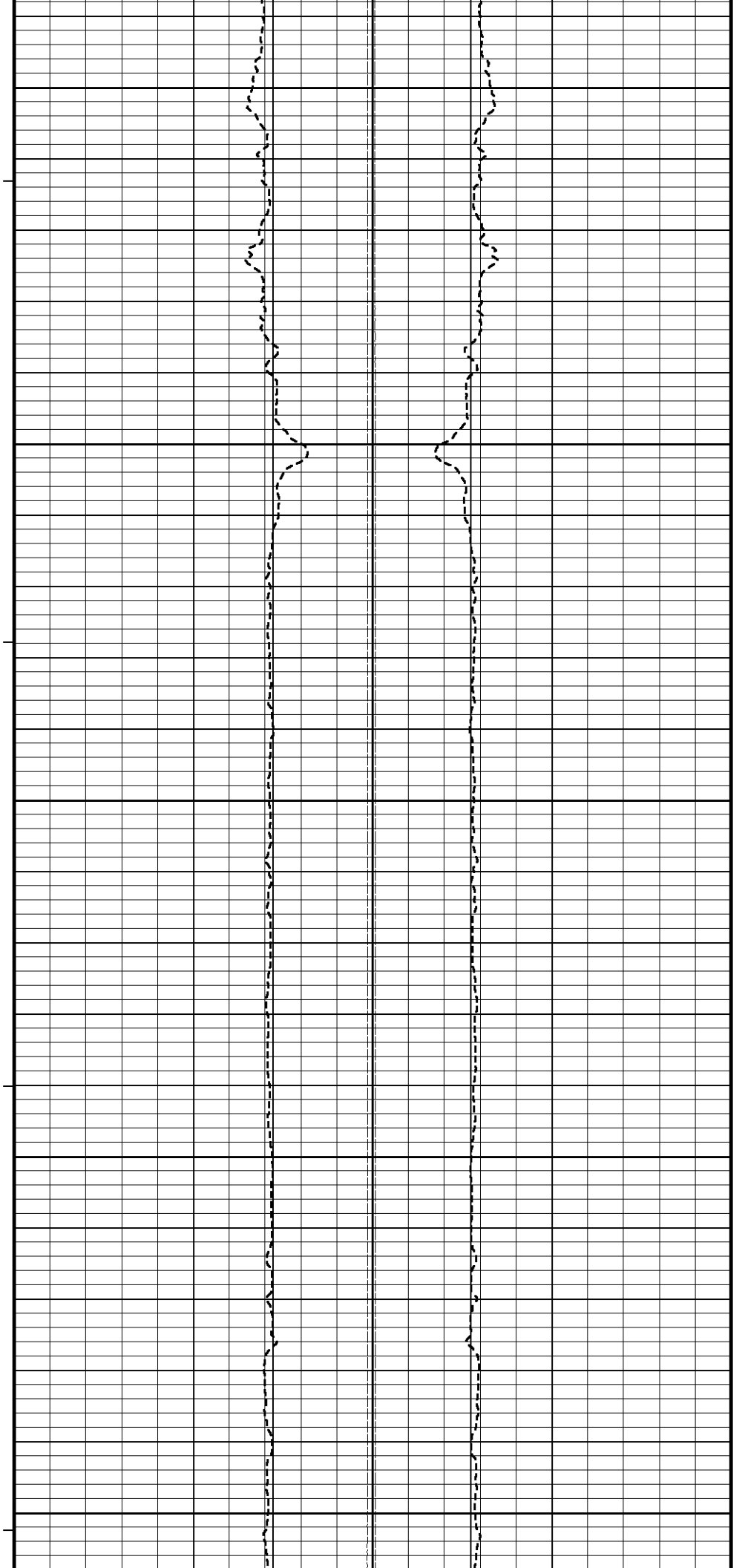
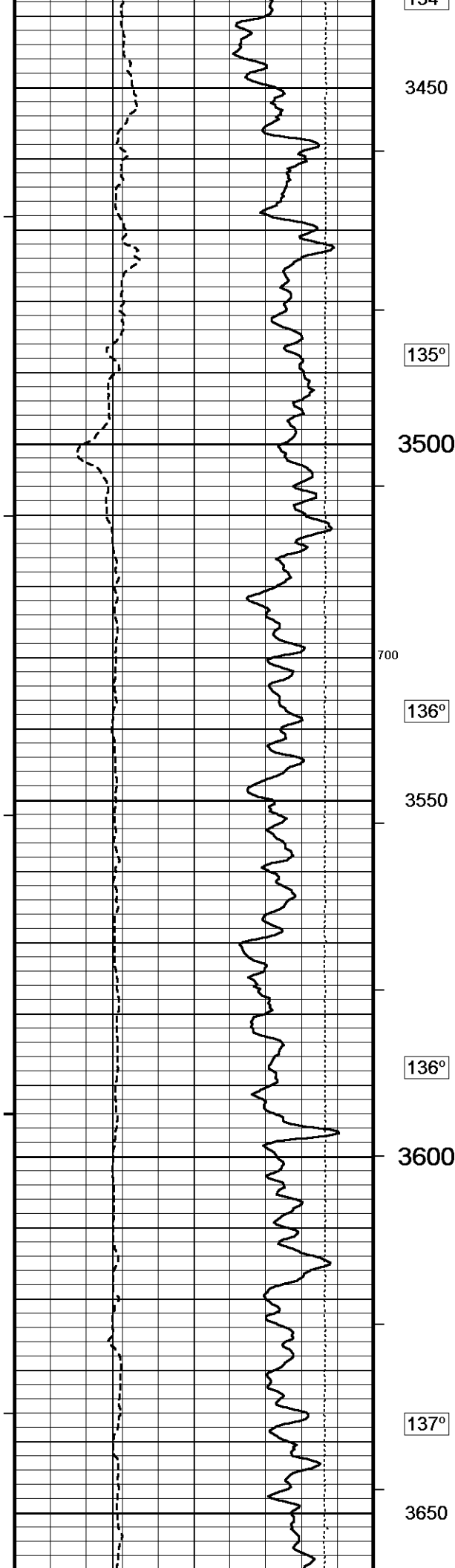


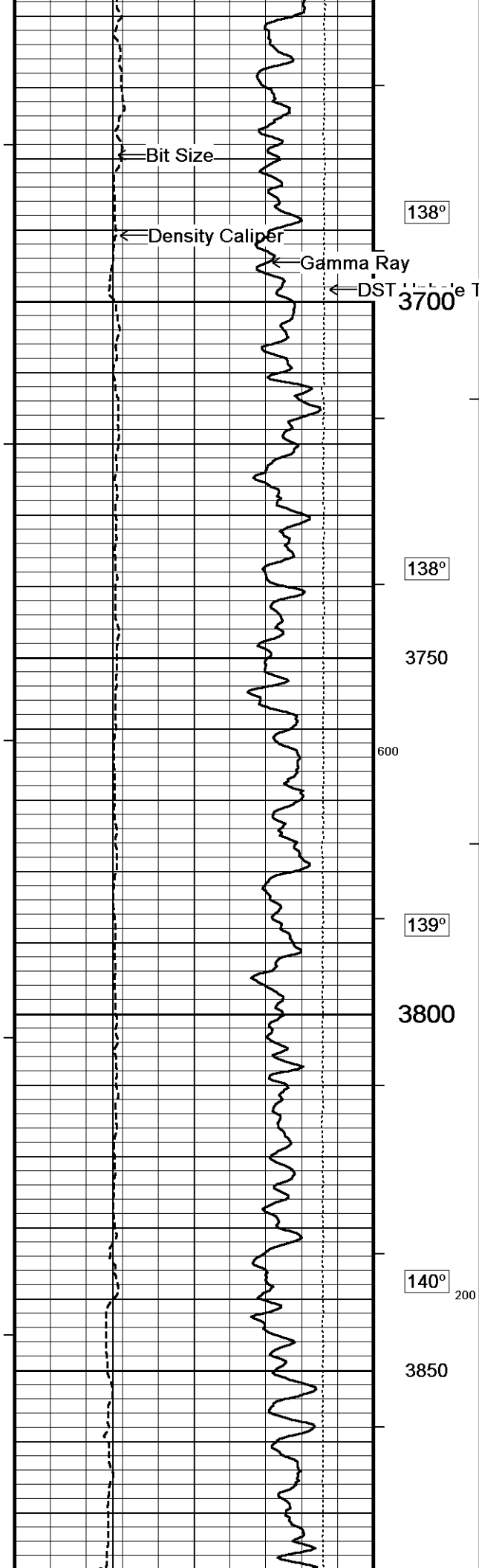










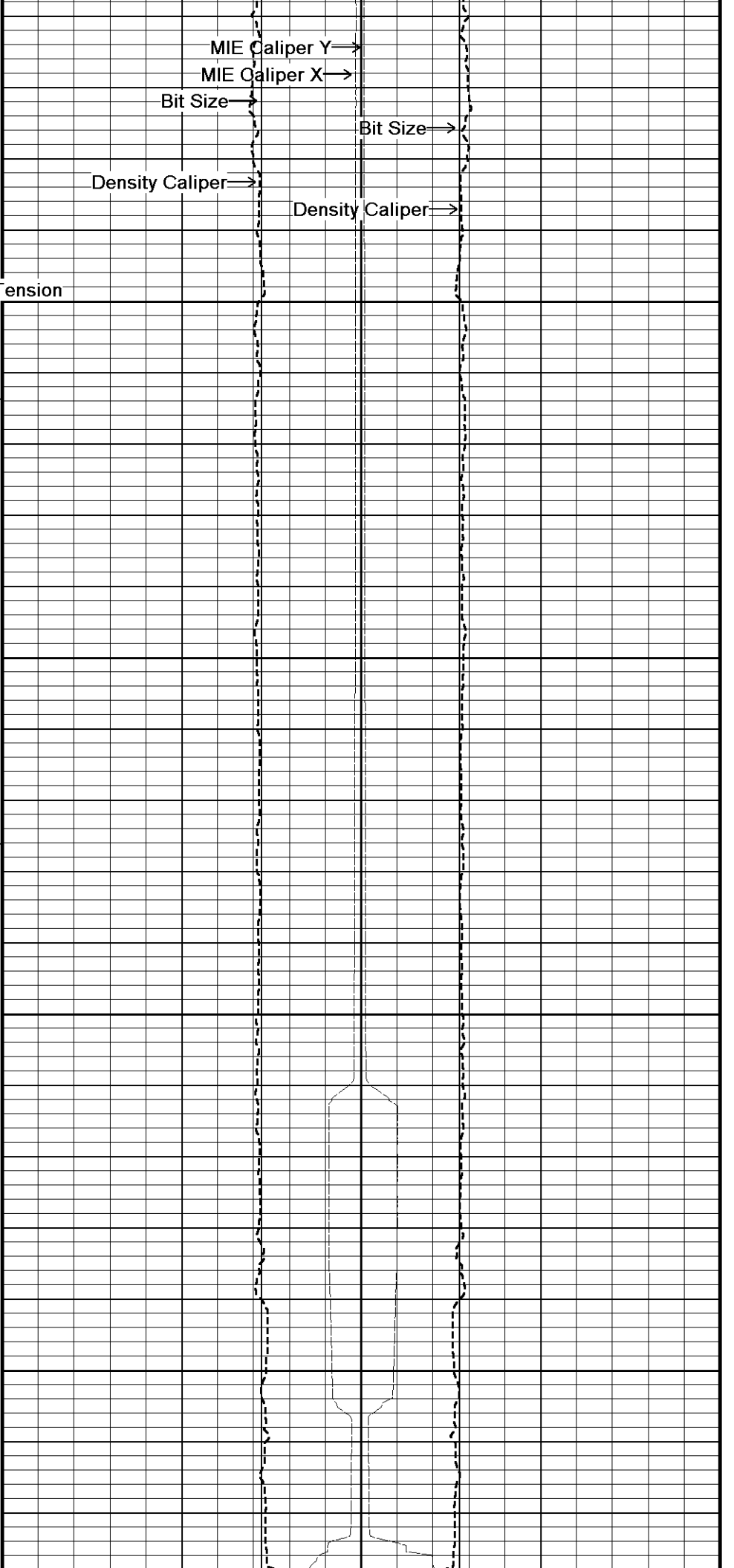


138°

138°

139°

140°



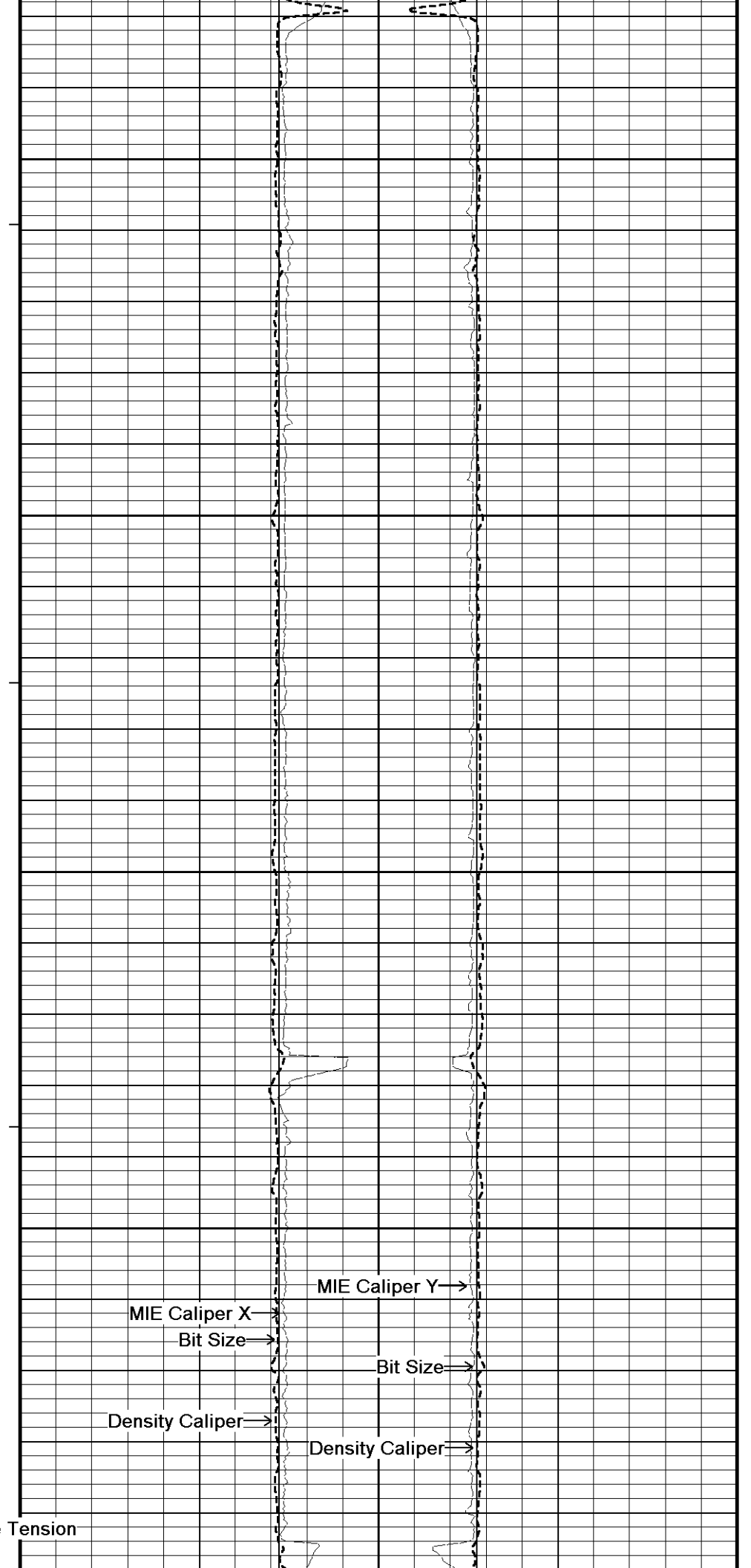
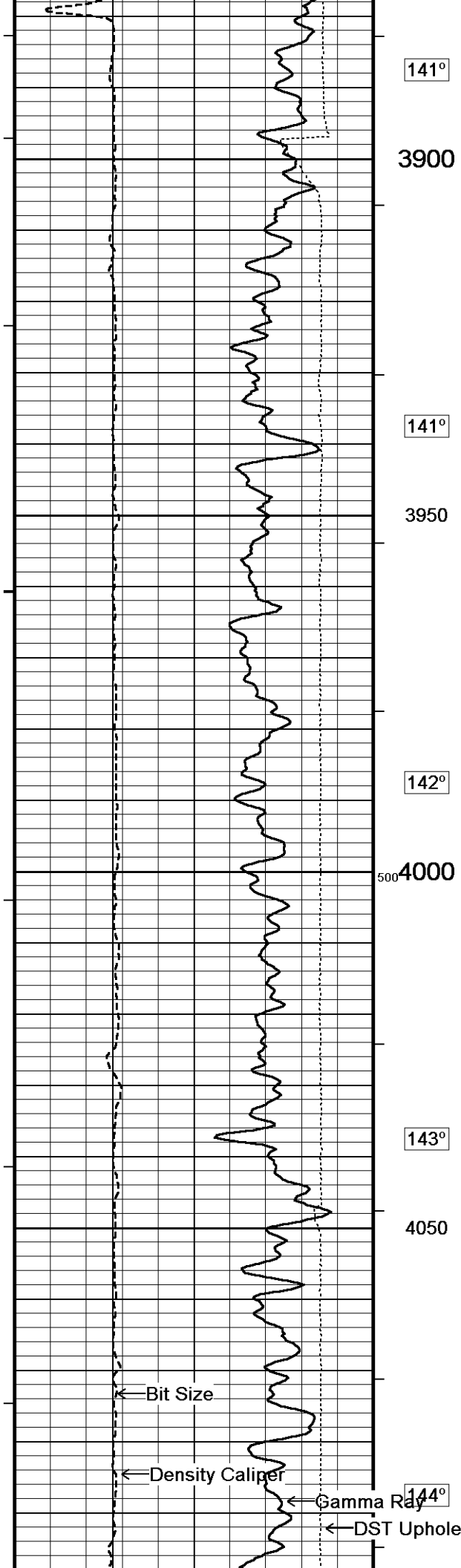
3700 e Tension

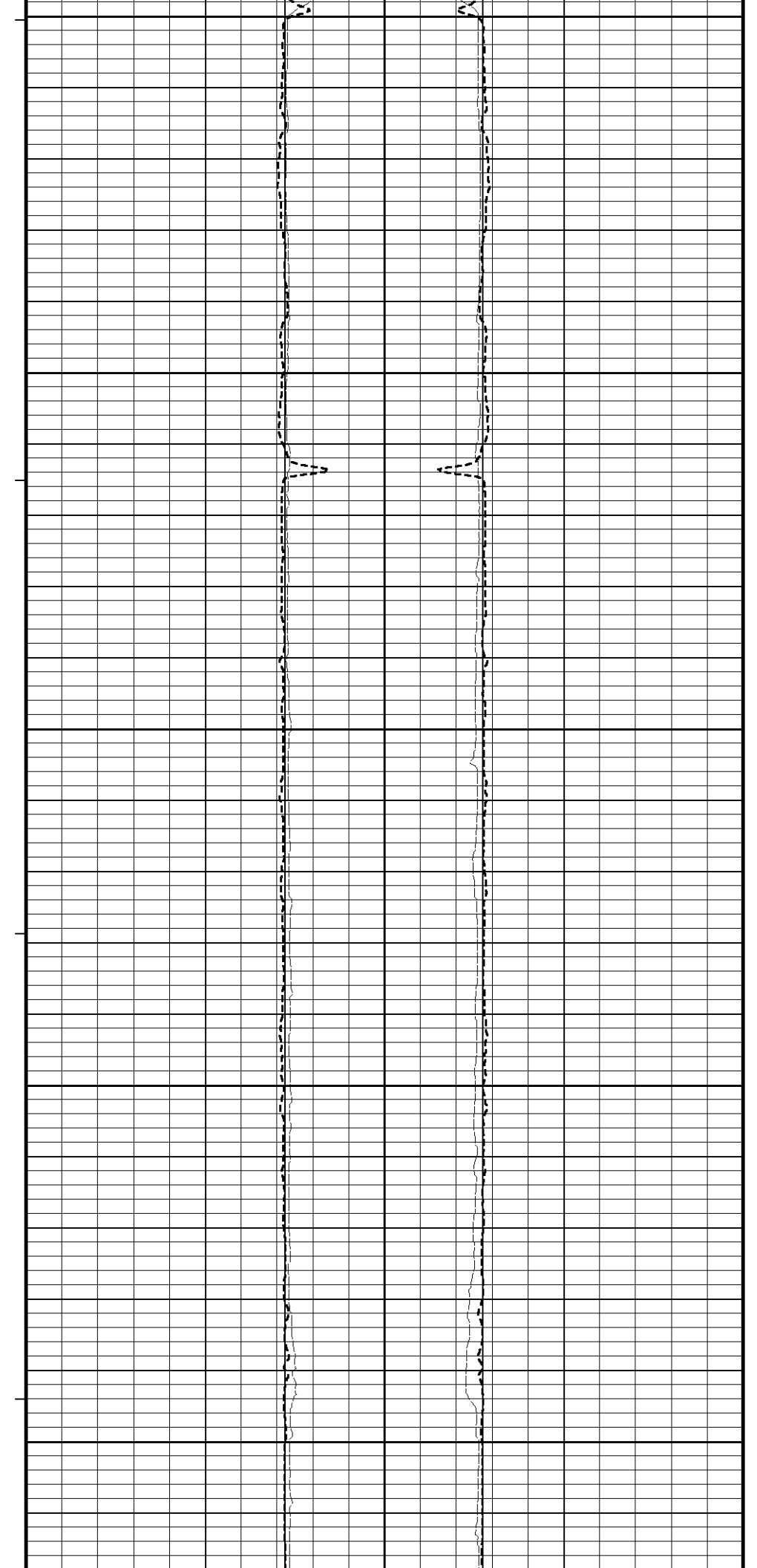
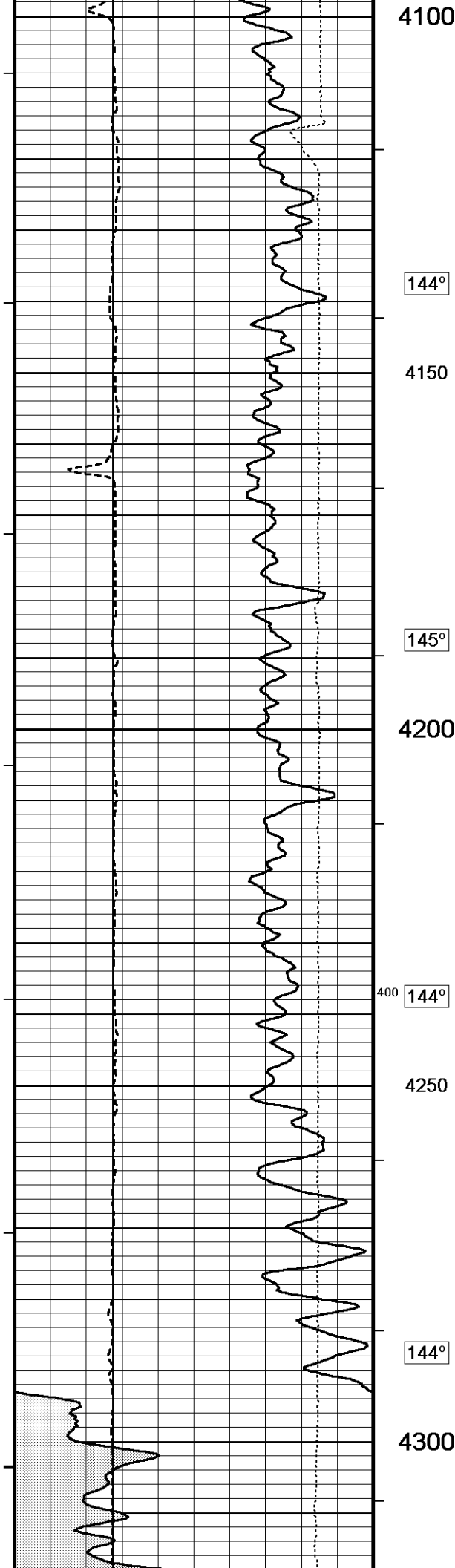
3750

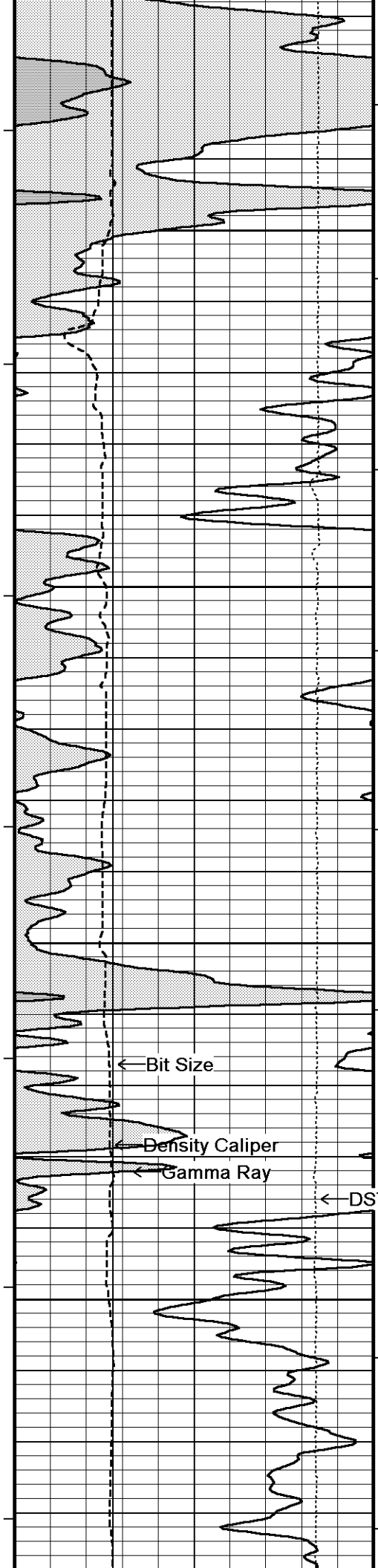
3800

3850

200







143°

4350

145°

4400

147°

4450

← Bit Size

← Density Caliper

← Gamma Ray

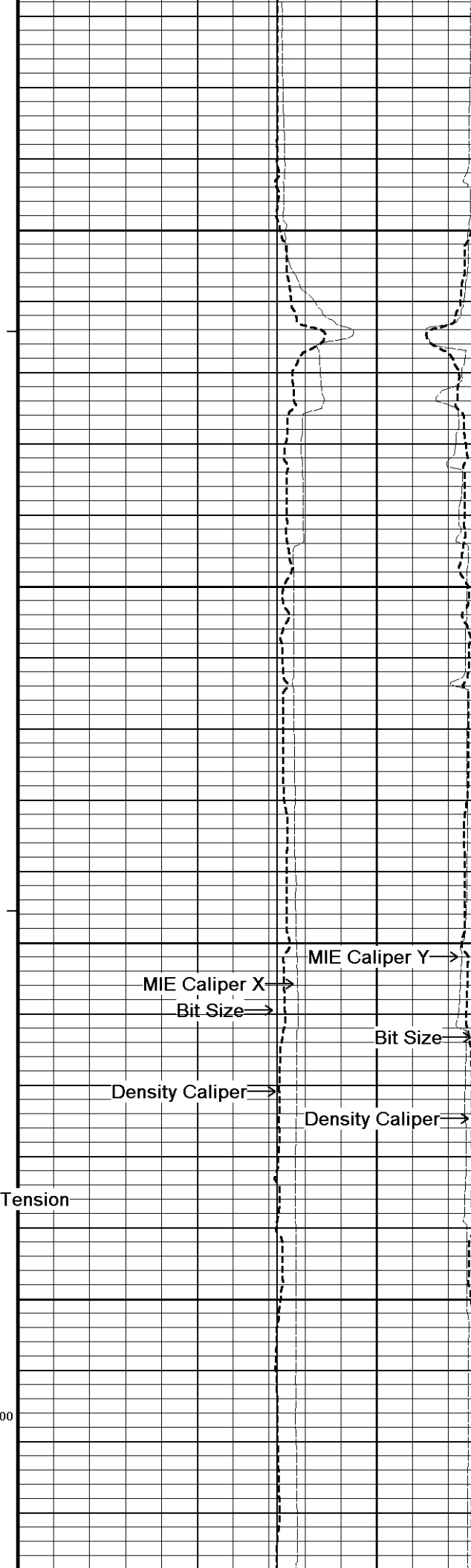
← DST Up-hole Tension

148°

4500

100

149°



MIE Caliper X →

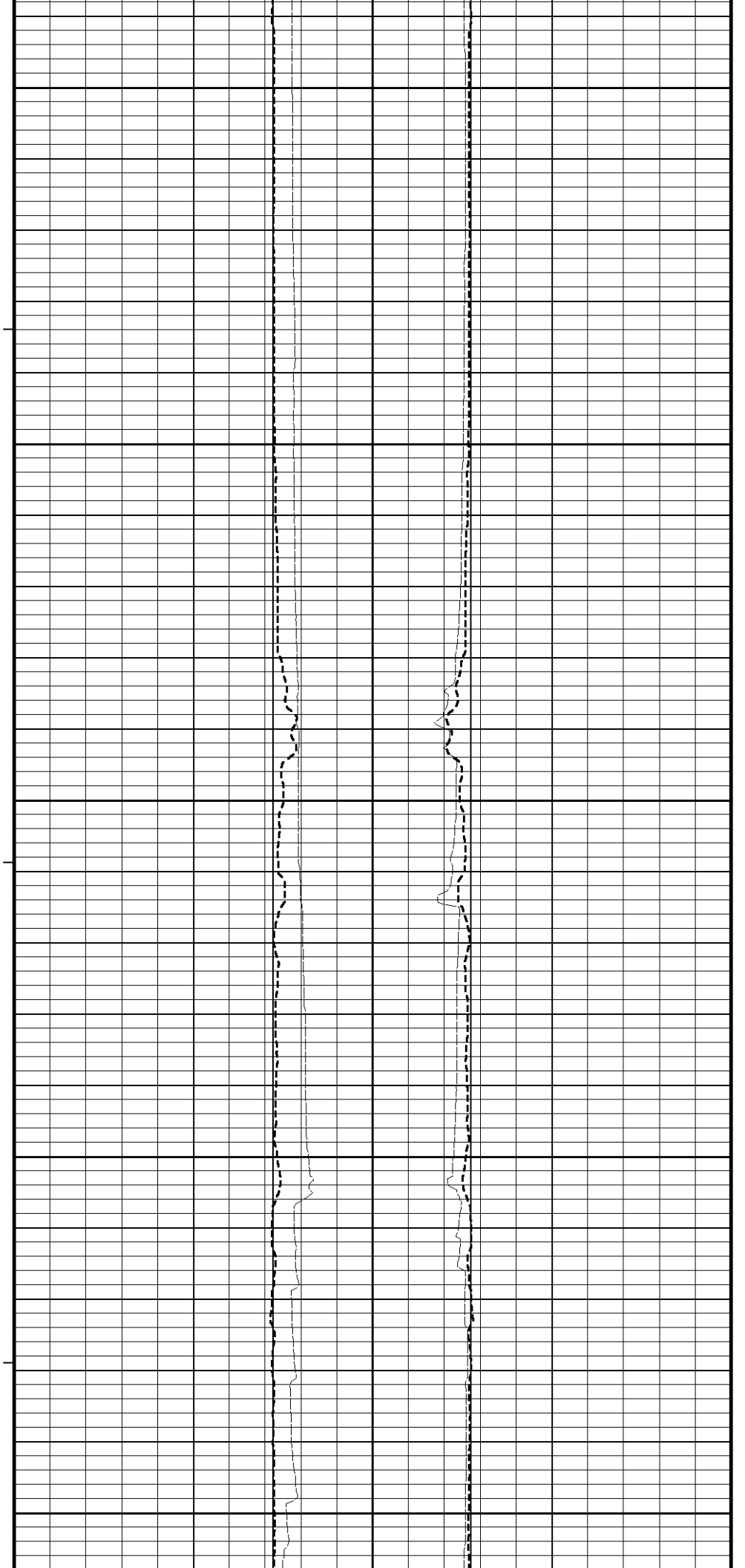
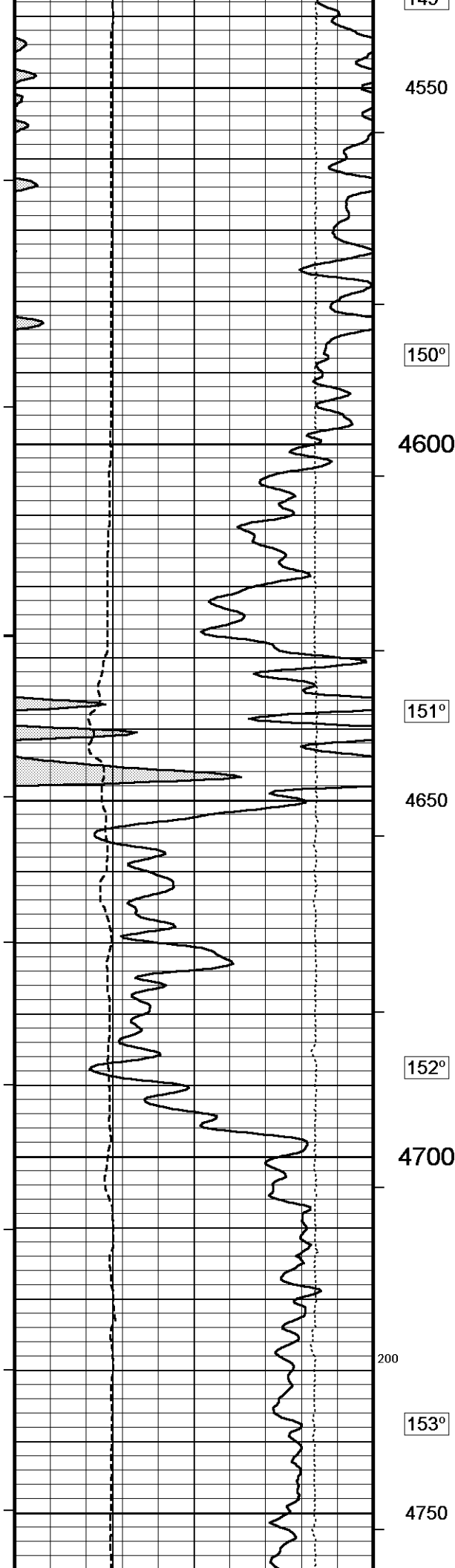
Bit Size →

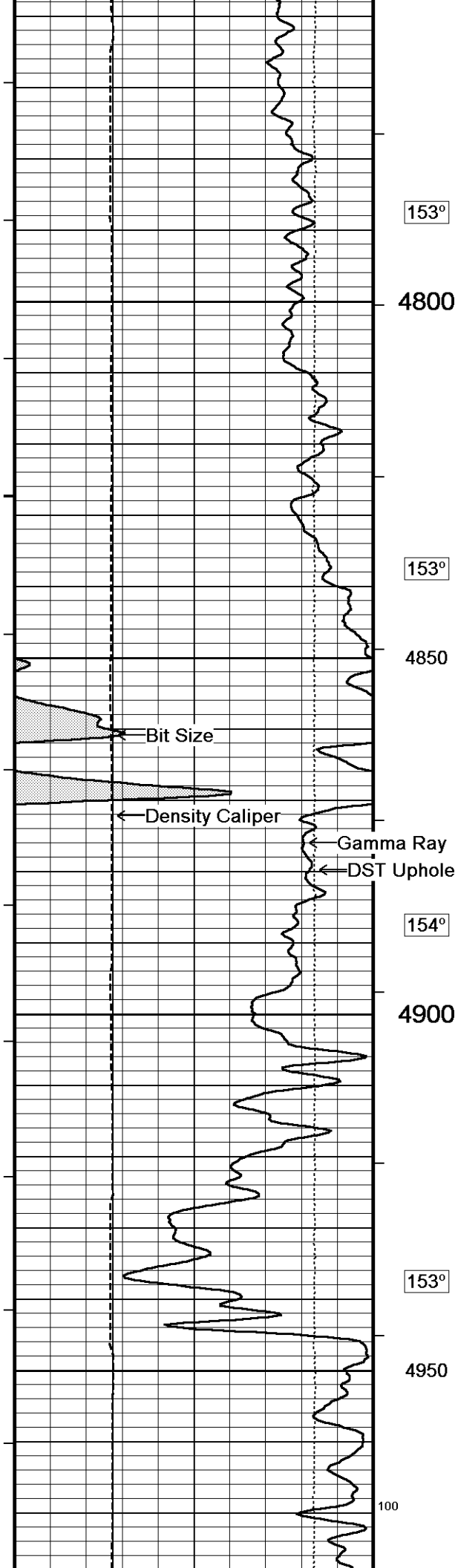
Density Caliper →

MIE Caliper Y →

Bit Size →

Density Caliper →





153°

4800

153°

4850

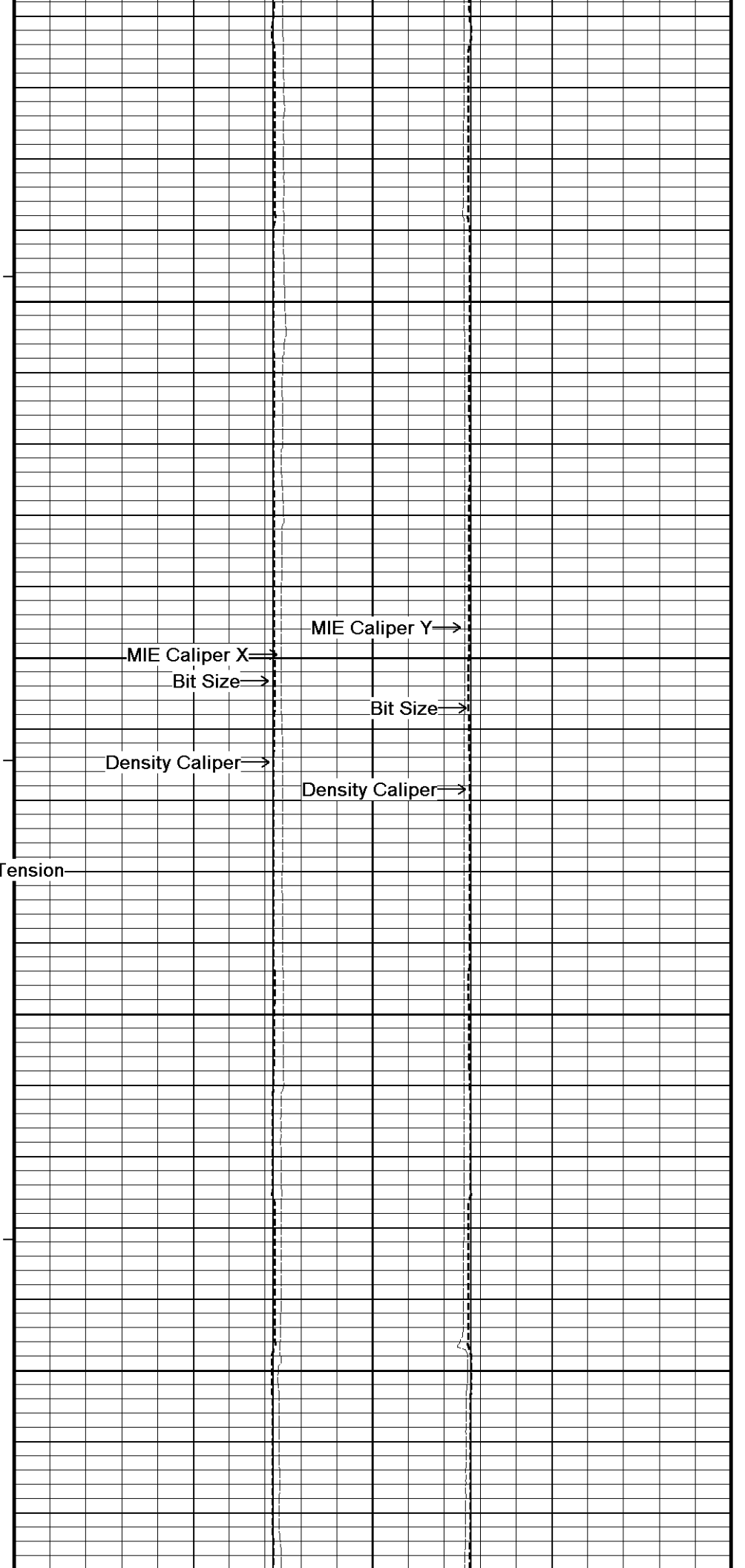
154°

4900

153°

4950

100



MIE Caliper Y

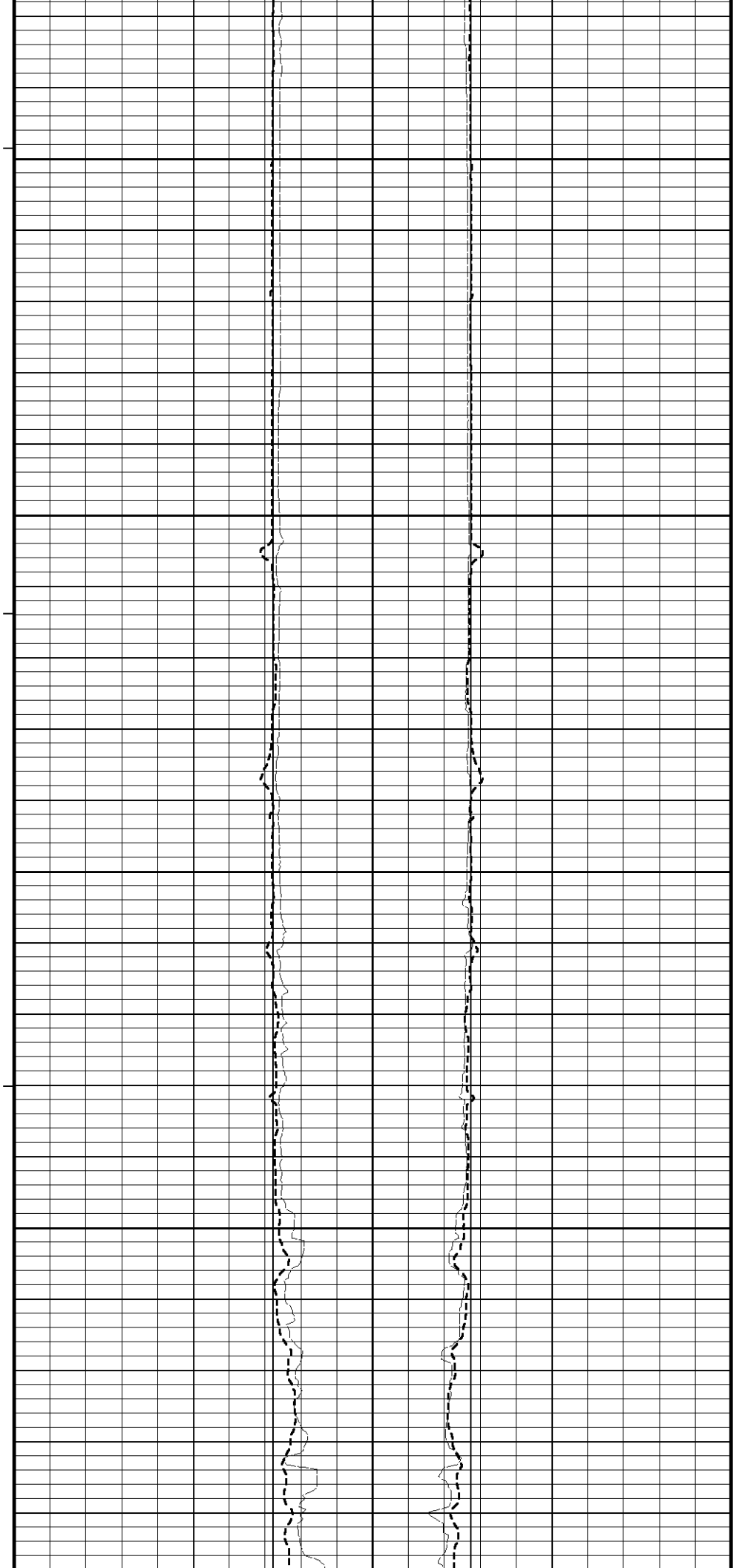
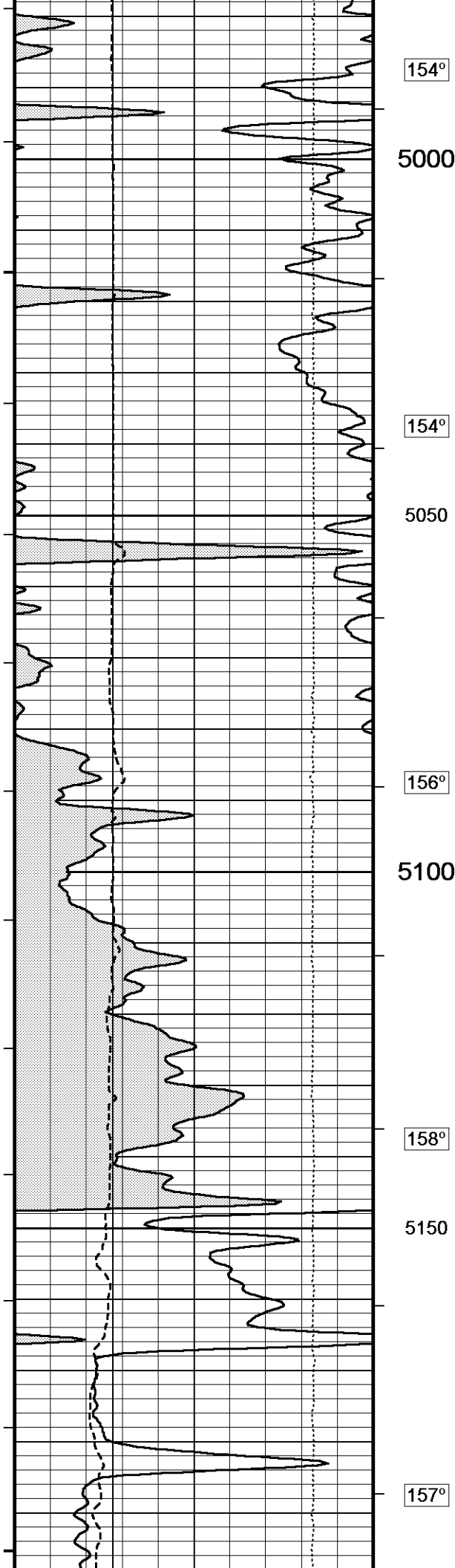
MIE Caliper X

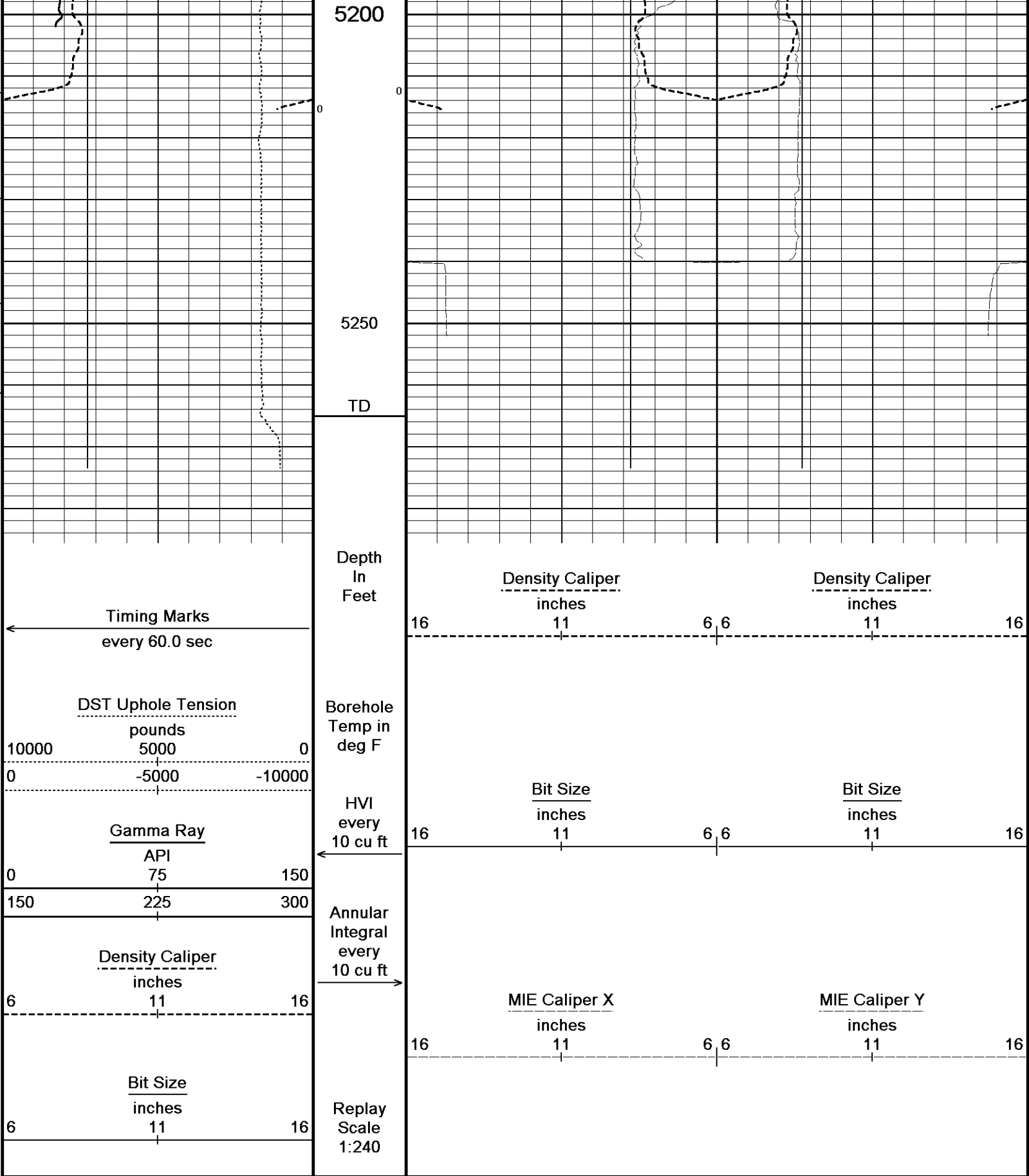
Bit Size

Bit Size

Density Caliper

Density Caliper





Depth Based Data - Maximum Sampling Increment 10.0cm Plotted on 15-NOV-2012 11:54
Filename: C:\Users\gfrancis\AppData\Local\Temp\Weatherford ... \ECGS 6-15 WPD002-1 MainPass.dta Recorded on 13-NOV-2012 10:58
System Versions: Processed with 13.02.6600 Plotted with 13.03.7074

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 13-NOV-2012,08:47		
General Parameters					
Mud Resistivity	3.100		ohm-metres		
Mud Resistivity Temperature	85.700		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 13-NOV-2012 08:18		
Reading No	Measured		Calibrated (lbs)		
1	15164.23		0.00		
2	16641.18		500.00		
High Resolution Temperature Calibration MCG-D.K 483			Field Calibration on 06-JUL-2012 14:06		
	Measured		Calibrated(Deg F)		
Lower	0.00		0.00		
Upper	0.00		0.00		
High Resolution Temperature Constants MCG-D.K 483			Last Edited on		
Pre-filter Length	11				
SP Calibration MCG-D.K 483			Field Calibration on 06-JUL-2012 14:06		
	Measured		Calibrated (mV)		
Reference 1	100.6		100.1		
Reference 2	-98.9		-100.1		
Gamma Calibration MCG-D.K 483			Field Calibration on 12-NOV-2012 13:13		
	Measured		Calibrated (API)		
Background	74		50		
Calibrator (Gross)	786		530		
Calibrator (Net)	712		480		
Gamma Constants MCG-D.K 483			Last Edited on 13-NOV-2012,04:36		
Gamma Calibrator Number GRCC-112					
Mud Density	1.00		gm/cc		
Caliper Source for Processing	Density Caliper				
Tool Position	Eccentred				
Concentration of KCl	0.00		kppm		
Neutron Calibration MDN-B.A 227			Base Calibration on 15-OCT-2012 15:48 Field Check on 12-NOV-2012 13:22		
Base Calibration					
	Measured		Calibrated (cps)		
	Near Far		Near Far		
	2896 90		3714 110		
Ratio	32.069		33.764		
Field Calibrator at Base			Calibrated (cps)		

Ratio	1658	2365	0.701	
Field Check	Calibrated (cps)			
Ratio	1633	2356	0.693	
Neutron Constants MDN-B.A 227			Last Edited on 13-NOV-2012,04:35	
Neutron Source Id	P44382B			
Neutron Jig Number	NEC43			
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	None			
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.A 174			Last Edited on 29-MAR-2010,02:58	
Magnetic Declination	0.00	degrees	East	
Magnetometer Parameters MIE-A.A 174				
Date Of Last Magnetometer Calibration	01-JAN-1998			
	X Magnetometer	Y Magnetometer	Z Magnetometer	
Slope	-1.000000	-1.010750	-0.999300	
Offset	0.009287	-0.020140	0.013025	
Magnetometer Constants MIE-A.A 174			Last Edited on	
Magnetometer Calibrator Number	000			
Accelerometer Parameters MIE-A.A 174				
Date Of Last Accelerometer Calibration	01-JAN-1998			
	X Accelerometer	Y Accelerometer	Z Accelerometer	
Slope	-1.108610	-1.104030	-1.096720	
Offset	0.005796	-0.001009	0.012654	
Accelerometer Constants MIE-A.A 174			Last Edited on 23-APR-2009,07:34	
Accelerometer Calibrator Number	000			
Accelerometer Temperature Characterisation				
X Accelerometer				
Serial Number	644			
Calibration Date	19-Aug-2008			
	B0	B1	B2	B3
Bias(g)	0.00000e+000	8.97681e-006	-1.88894e-008	1.27694e-010
	SF0	SF1	SF2	SF3
Scale Factor(mA/g)	3.00000e+000	2.72633e-004	2.24457e-007	1.11567e-009
Y Accelerometer				
Serial Number	679			
Calibration Date	24-Aug-2008			
	B0	B1	B2	B3
Bias(g)	0.00000e+000	2.76667e-005	-1.48113e-008	9.65949e-011
	SF0	SF1	SF2	SF3
Scale Factor(mA/g)	3.00000e+000	2.60693e-004	5.14448e-007	-1.83309e-010
Z Accelerometer				
Serial Number	687			

Serial Number	307			
Calibration Date	30-Aug-2008			
	B0	B1	B2	B3
Bias(g)	0.00000e+000	-2.68884e-005	4.88649e-009	-1.07028e-011
	SF0	SF1	SF2	SF3
Scale Factor(mA/g)	3.00000e+000	2.65798e-004	2.86695e-007	9.16986e-010

Caliper Calibration MIE-A.A 174				Base Calibration on 13-NOV-2012 03:57	
				Field Calibration on 13-NOV-2012 03:58	
Base Calibration					
Reading No	Pads 1-5 Meas.	Pads 3-7 Meas.	Calibrator Size (in)		
1	26539	26547	5.96		
2	36989	37140	7.99		
3	46454	46711	9.86		
4	55567	58265	11.93		
5	0	0	0.00		
Reading No	Pad 2 Meas.	Pad 4 Meas.	Pad 6 Meas.	Pad 8 Meas.	Calibrator Size (in)
1	26424	25773	25566	25741	5.96
2	35767	34710	33739	34118	7.99
3	43766	42899	41717	42151	9.86
4	51706	54174	52590	50282	11.93
5	0	0	0	0	0.00
Field Calibration					
	Measured	Measured	Actual		
	Pads 1-5 Caliper(in)	Pads 3-7 Caliper(in)	Caliper(in)		
	8.02	7.97	7.99		
	Measured	Measured	Measured	Measured	Actual
	Pad 2 Caliper(in)	Pad 4 Caliper(in)	Pad 6 Caliper(in)	Pad 8 Caliper(in)	Caliper(in)
	4.00	3.96	3.99	4.05	7.99

Caliper Constants MIE-A.A 174			Last Edited on 13-NOV-2012,03:53		
Caliper Difference for BRKT			0.120	inches	

Imager Pad Check MIE-A.A 174			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.A 174			Last Edited on 13-NOV-2012,04:35		
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		N/A	mAmp		
Image Processing		Enabled			

FE Calibration MFE-A.A 66			Base Calibration on 15-OCT-2012 13:42		
			Field Check on 12-NOV-2012 13:15		
Base Calibration					
	Measured	Calibrated (ohm-m)			
Reference 1	0.0	0.0			
Reference 2	997.0	126.8			
Base Check		272.6			
Field Check		272.7			

FE Constants MFE-A.A 66		Last Edited on 13-NOV-2012,04:34	
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	
FE Calibration MAI-A.A 165			Base Calibration on 12-FEB-2009 10:30 Field Check on 04-APR-2009 14:52
Base Calibration			
	Measured	Calibrated (ohm-m)	
Reference 1	0.0	0.0	
Reference 2	976.9	126.8	
Base Check		277.9	
Field Check		278.3	
FE Constants MAI-A.A 165			Last Edited on 04-APR-2009,15:12
Running Mode			
MFE K Factor			
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-A.A 165			Field Calibration on 10-OCT-2011,15:43
	Measured	Calibrated(Deg F)	
Lower	50.00	50.00	
Upper	75.00	75.00	
High Resolution Temperature Constants MAI-A.A 165			Last Edited on 15-OCT-2012,13:33
Pre-filter Length	11		
Induction Calibration MAI-A.A 165			Base Calibration on 15-OCT-2012,13:08 Field Check on 12-NOV-2012 13:09
Base Calibration			
Test Loop Calibration		Measured	Calibrated (mmho/m)
Channel	Low High	Low High	
1	17.2 469.6	9.3 966.2	
2	6.7 392.8	7.6 821.4	
3	4.2 262.3	5.2 566.0	
4	1.6 136.6	2.6 279.2	
Array Temperature	75.0	Deg F	
Channel		Base Check (mmho/m)	Field Check (mmho/m)
	Low High	Low High	
1	12.9 3869.0	11.7 3869.6	
2	28.4 3433.8	28.0 3434.9	
3	26.7 3021.4	26.5 3022.8	
4	19.7 2016.0	19.6 2017.1	
Deep	17.3 2011.3	17.2 2012.6	
Medium	37.6 3970.8	37.4 3972.6	
Shallow	41.2 5011.9	40.6 5012.9	
Array Temperature	69.2	53.8	Deg F
Induction Constants MAI-A.A 165			Last Edited on 13-NOV-2012,04:34
Induction Model			
Caliper for Borehole Corr.	RtAP-WBM		
Hole Size for Borehole Correction	Density Caliper		
Tool Centred	N/A	inches	
Stand-off Type	No		
Stand-off	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	0.0500	inches	
Borehole Corr. Rm Source	Temperature Corr		

Temp. for Rm Corr.	MCG External Temperature	0.0020	mhos/metre
Squasher Start		N/A	mhos/metre
Squasher Offset			
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.A 195

Base Calibration on 15-OCT-2012 13:53

Field Calibration on 12-NOV-2012 13:26

Base Calibration

Reading No	Measured	Calibrator Size (in)
1	15007	4.00
2	23645	5.96
3	32400	7.99
4	40464	9.86
5	49760	11.93
6	N/A	N/A

Field Calibration

Measured Caliper (in)	Actual Caliper (in)
7.94	7.99

Photo Density Calibration MPD-C.A 195

Base Calibration on 15-OCT-2012 14:12

Field Check on 12-NOV-2012 13:30

Density Calibration

Base Calibration	Measured		Calibrated (sdu)	
	Near	Far	Near	Far
Reference 1	38135	13267	52994	19128
Reference 2	18092	1824	25188	2558

Field Check at Base

670.1	775.1
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Field Check

670.6	777.0
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PE Calibration

Base Calibration	Measured		Calibrated
	WS	WH	Ratio
Background	122	602	
Reference 1	13157	38045	0.348
Reference 2	5216	18018	0.292

Field Check at Base

122.4	602.2
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Field Check

121.8	604.5
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Density Constants MPD-C.A 195

Last Edited on 13-NOV-2012,08:48

Density Source Id	2859GW	
Nylon Calibrator Number	527	
Aluminium Calibrator Number	527	
Density Shoe Profile	8 inch	
Caliper Source for Processing	Density Caliper	
PE Correction to Density	Not Applied	
Mud Density	1.18	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

DOWNHOLE EQUIPMENT

C:\Users\gfrancis\AppData\Local\Temp\Weatherford PreView\0\ECGS 6-15 WPD002-1 Repeat.dta

SHA-J.B Compact Swivel Head Adaptor

SHA-J.B 511 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.A 227 LG: 5.04 ft WT: 50.7 lb OD: 2.24 in

Compact Density/Caliper

MPD-C.A 195 LG: 9.59 ft WT: 90.4 lb OD: 2.45 in

MIS-D.B Compact Inline Bowspring sub

MIS-D.B 696 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

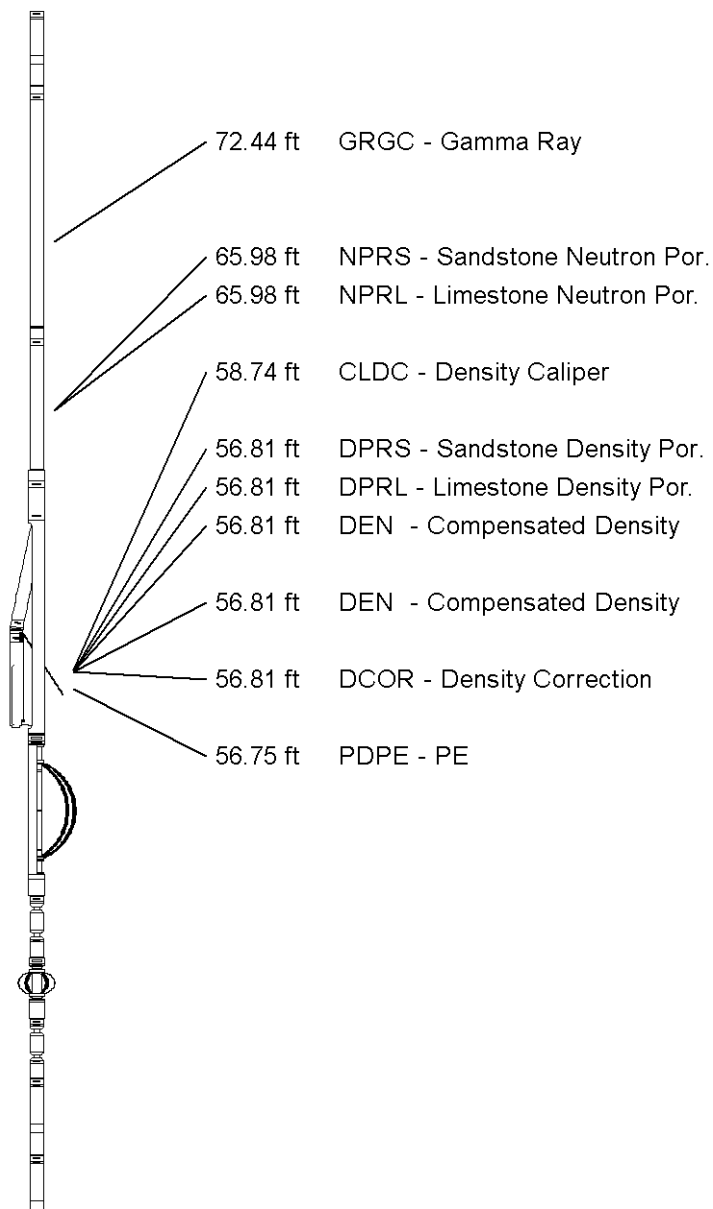
SHA-J.B 574 LG: 2.30 ft WT: 22.0 lb OD: 2.24 in

SHA-J.B Compact Swivel Head Adaptor

SHA-J.B 510 LG: 2.30 ft WT: 22.0 lb OD: 2.24 in

Compact MMI Memory Section

MIM-A.A 174 LG: 4.65 ft WT: 26.5 lb OD: 2.24 in



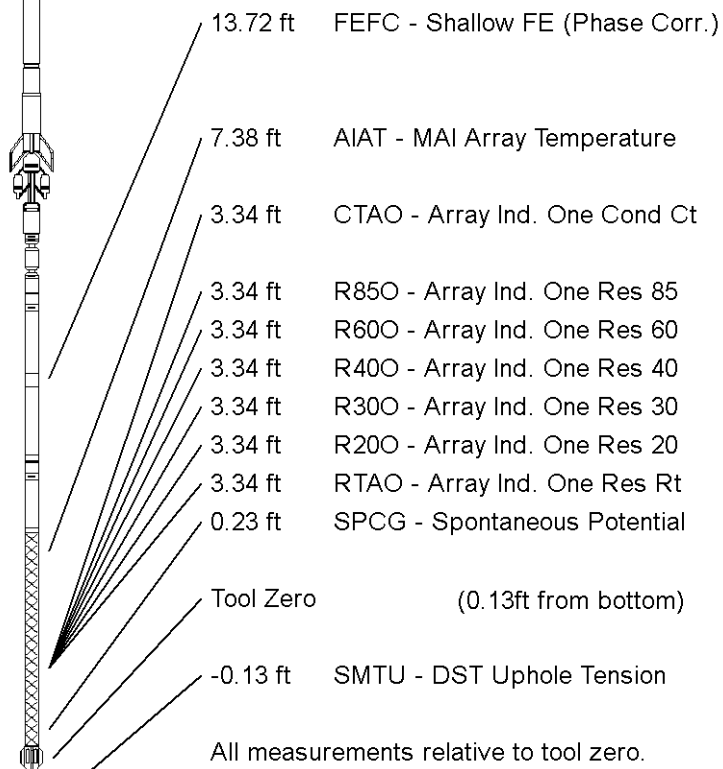
MMI-A.A 174 LG: 4.65 ft WT: 26.5 lb OD: 2.24 in
Compact MMI Electrode Section
MIE-A.A 174 LG: 13.96 ft WT: 99.2 lb OD: 4.09 in

SKJ-D.A Compact Knuckle Joint
SKJ-D.A 66 LG: 2.17 ft WT: 24.3 lb OD: 2.24 in

Compact Focussed Electric
MFE-A.A 66 LG: 6.05 ft WT: 48.5 lb OD: 2.24 in

Compact Induction
MAI-A.A 165 LG: 10.81 ft WT: 48.5 lb OD: 2.24 in

Total Length: 80.03 ft Weight: 615.1 lb



COMPANY	EAST CHEYENNE GAS STORAGE LLC
WELL	ECGS No 6-15 WPD002-1
FIELD	PEETZ WEST
PROVINCE/COUNTY	LOGAN
COUNTRY/STATE	USA/COLORADO

Elevation Kelly Bushing	4570.00	feet	First Reading	5209.00	feet
Elevation Drill Floor	4569.00	feet	Depth Driller	5270.00	feet
Elevation Ground Level	4556.00	feet	Depth Logger	5265.00	feet



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