



# Weatherford

## ARRAY INDUCTION LOG

COMPANY

ENCANA

WELL

HERREN 1A-33H

FIELD

WATTENBERG

PROVINCE/COUNTY

WELD

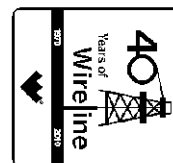
COUNTRY/STATE

U.S.A. / COLORADO

LOCATION

SHL: 246' FNL &amp; 253' FEL

BHL: 1320' FNL &amp; 460' FWL

**FIELD PRINT**

SEC

TWP

RGE

Other Services

33

3N

67W

MDN/MPD

API Number

05-123-33249-00

CMI

Permit Number

Permanent Datum G.L., Elevation 4824 feet

Log Measured From K.B. @ 12 FEET above Permanent Datum

Drilling Measured From KB

Date

15-JUN-2011

Elevations:

feet

KB

4836.00

DF

4824.00

GL

Run Number

ONE

Depth Driller

11643.00 feet

Depth Logger

11643.00 feet

First Reading

11622.00 feet

Last Reading

7438.00 feet

Casing Driller

7438.00 feet

Casing Logger

7438.00 feet

Bit Size

6.125

inches

Hole Fluid Type

WBM

Density / Viscosity

10.50 lb/USg

33.00 CP

PH / Fluid Loss

8.00

22.00 ml/30Min

Sample Source

FLOW LINE

Rm @ Measured Temp

1.62 @ 92.0 ohm-m

Rmf @ Measured Temp

1.30 @ 92.0 ohm-m

Rmc @ Measured Temp

1.94 @ 92.0 ohm-m

Source Rmf / Rmc

CALC

CALC

Rm @ BHT

0.69 @220.0

ohm-m

Time Since Circulation

0.5 HOURS

Max Recorded Temp

237.00

deg F

Equipment Name

COMPACT

Equipment / Base

13038

GD JCT

Recorded By

SLACKEY

BILL LaFORCE

### BOREHOLE RECORD

Last Edited: 15-JUN-2011 15:52

Bit Size  
inches

6.125

Depth From  
feet

7438.00

Depth To  
feet

11643.00

### CASING RECORD

Type

Size  
inchesDepth From  
feetShoe Depth  
feetWeight  
pounds/ft

SURFACE

9.625

0.00

832.00

40.00

INTERM

7.000

832.00

7438.00

26.00

### REMARKS

SOFTWARE VERSION USED: 11.02.3186

TOOLS CONVEYED VIA COMPACT WELL SHUTTLE.

HARDWARE USED: SEE TOOL DIAGRAM.

ALL DEPTHS RECORDED WITH WEATHERFORD TOTCO DEPTH SYSTEM.  
ALL DEPTHS CORRECTED TO DRILLER'S STRAP DEPTH.

4.5 INCH PRODUCTION CASING USED TO CALCULATE ANNULAR HOLE VOLUME.

ANNULAR HOLE VOLUME FROM T.D. TO INTER. CASING = 460 CUBIC FEET

TOTAL HOLE VOLUME FROM T.D. TO INTER. CASING = 910 CUBIC FEET

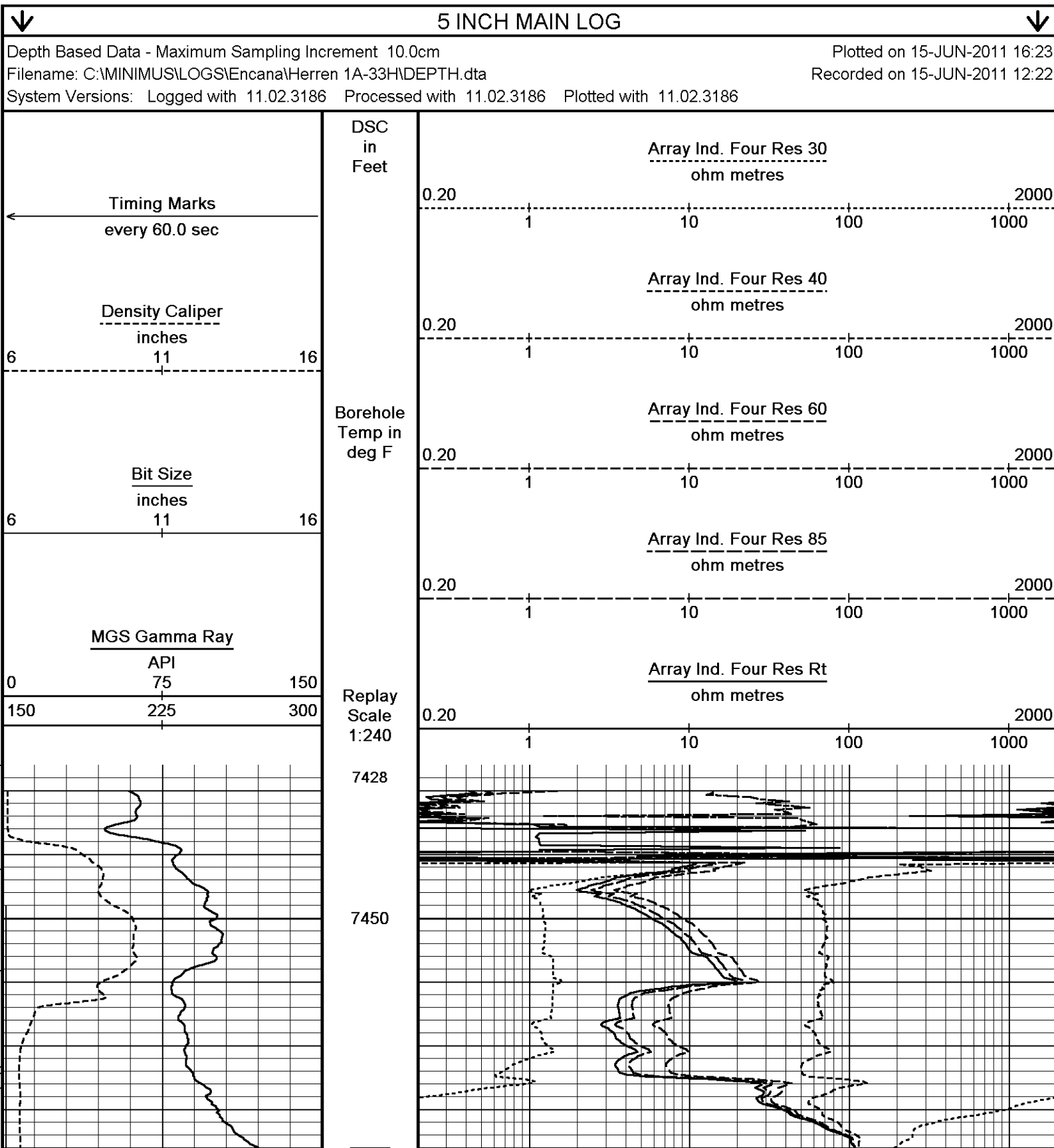
BOREHOLE SIZE AND RUGOSITY WILL AFFECT DATA QUALITY.

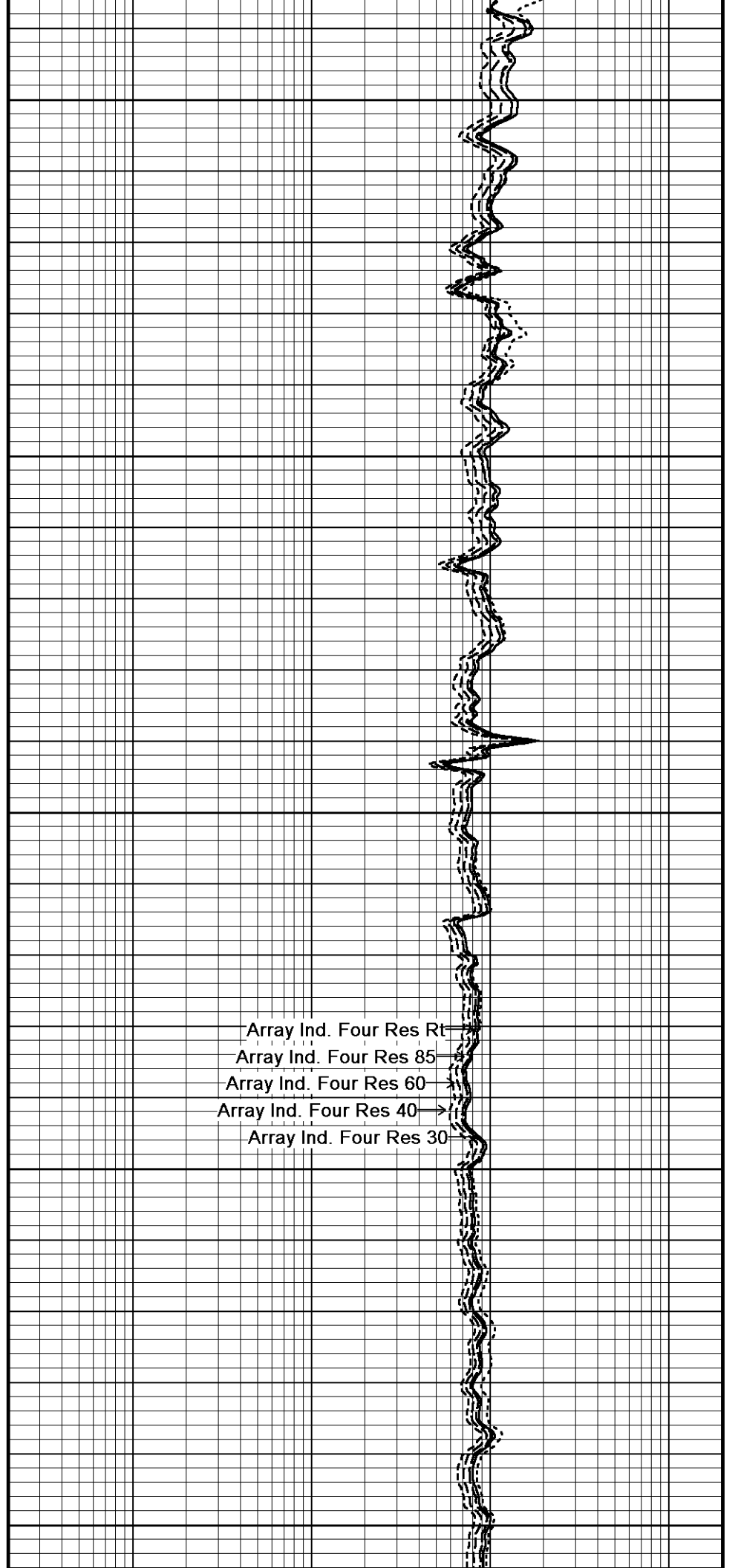
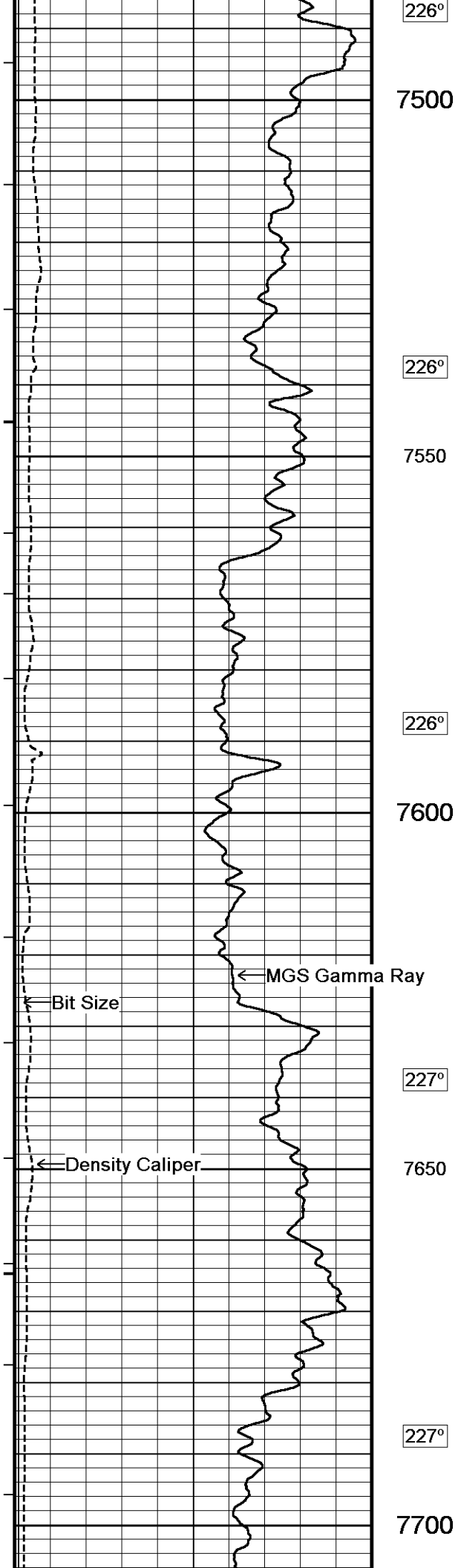
TIGHT PULLS WILL AFFECT DATA QUALITY.

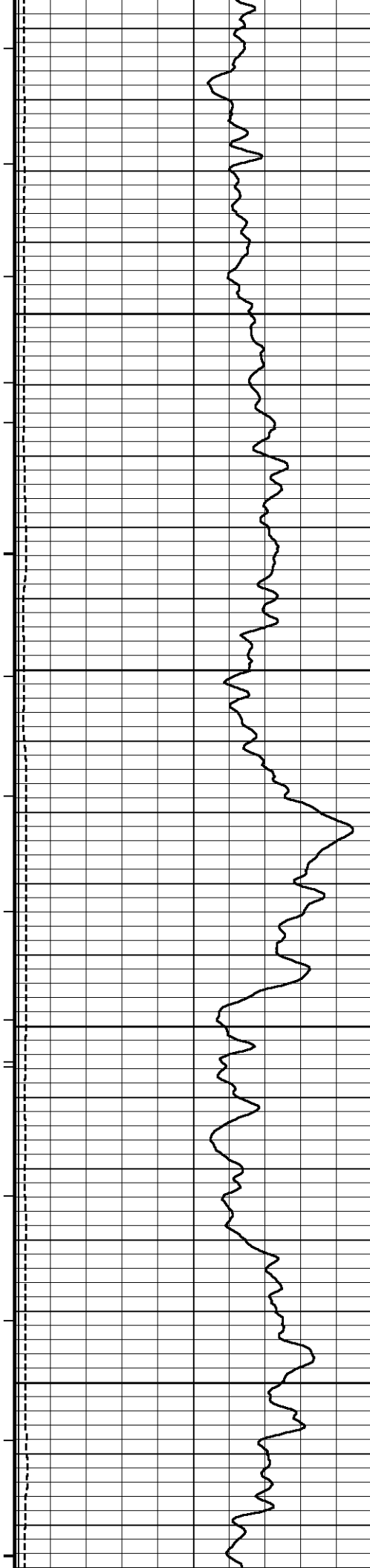
RIG: ENSIGN 135

SERVICE ORDER #3526186

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.







227°

7750

227°

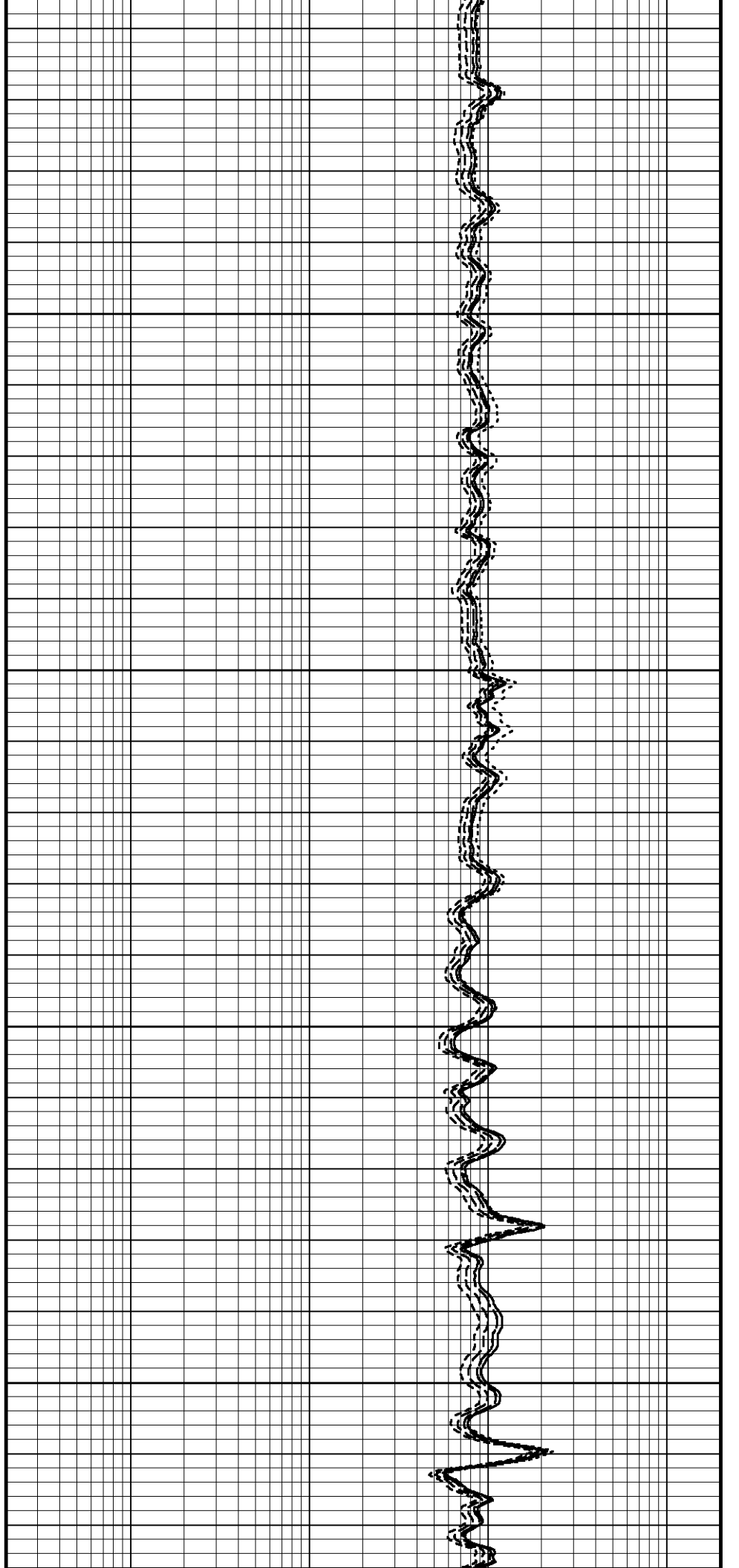
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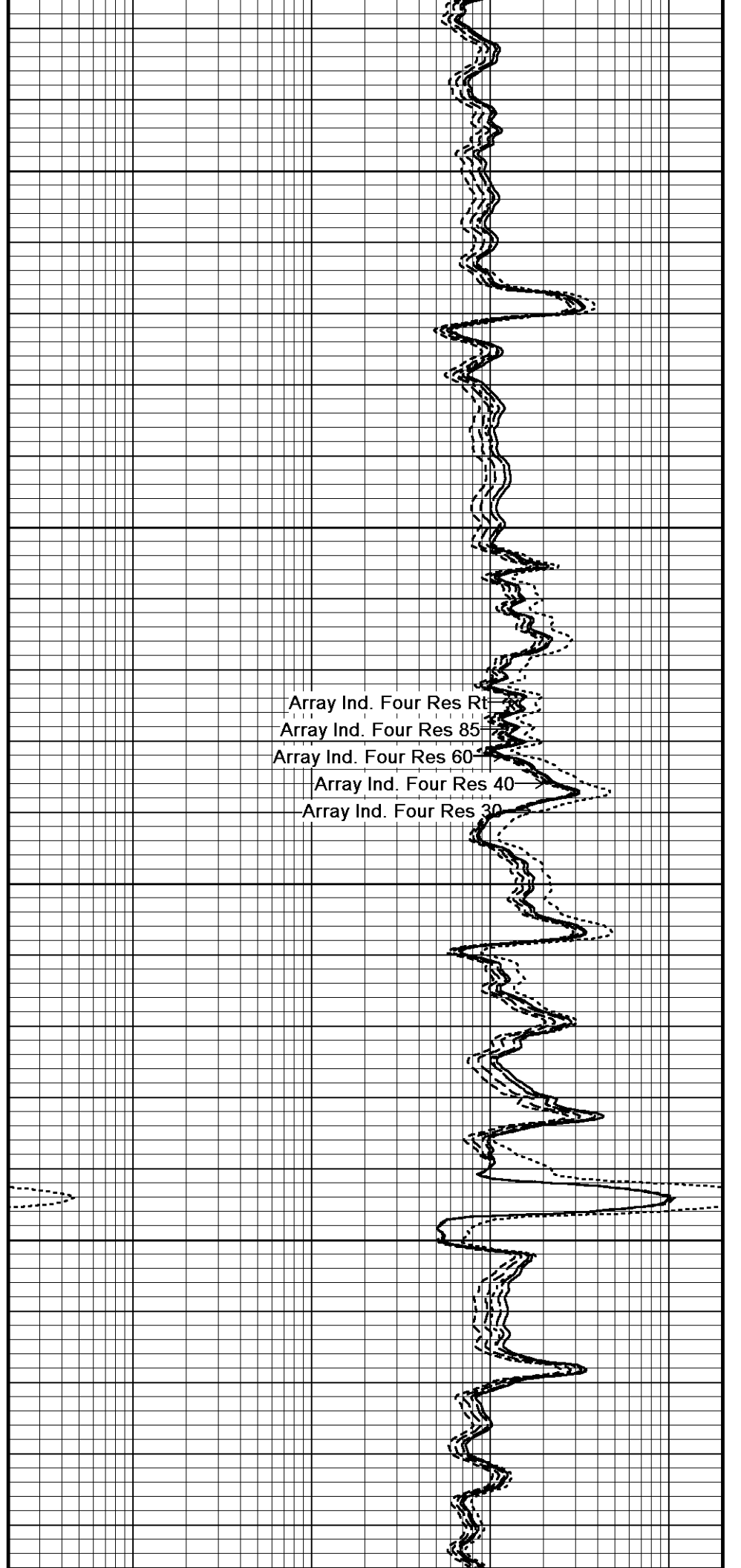
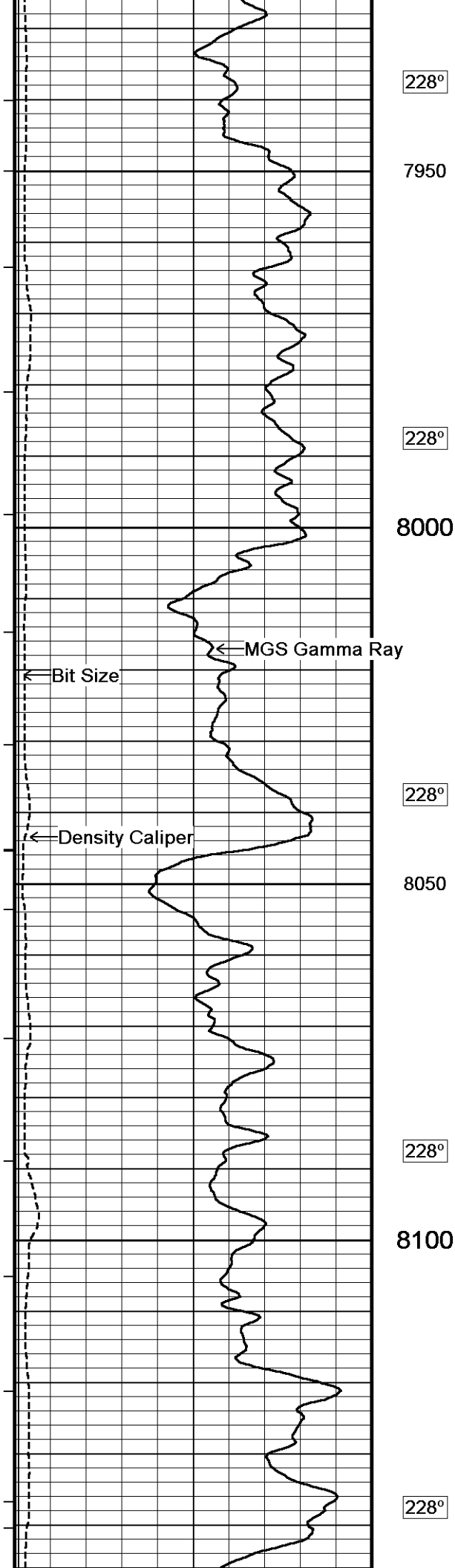
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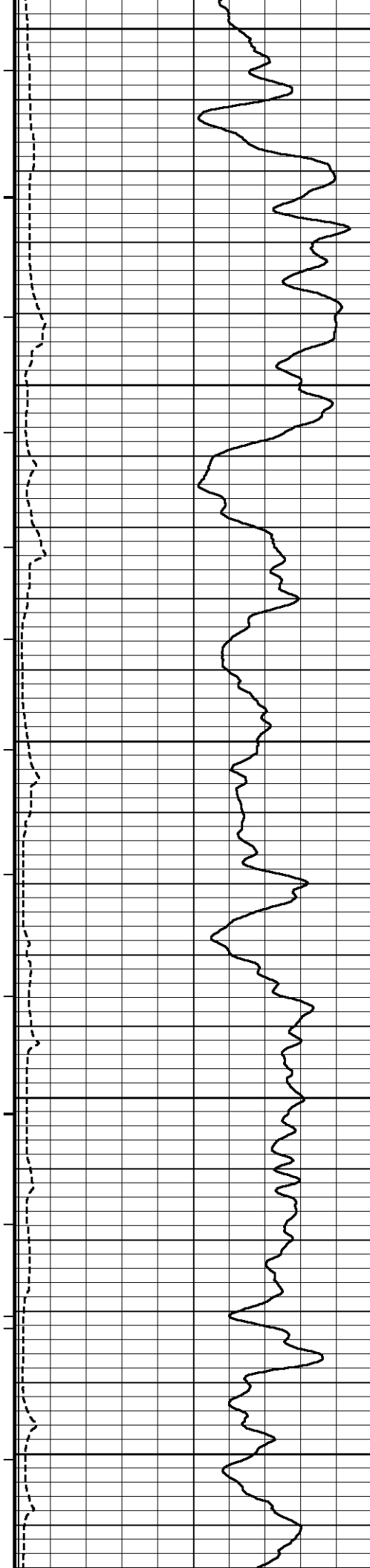
7850

228°

7900







8150

228°

8200

228°

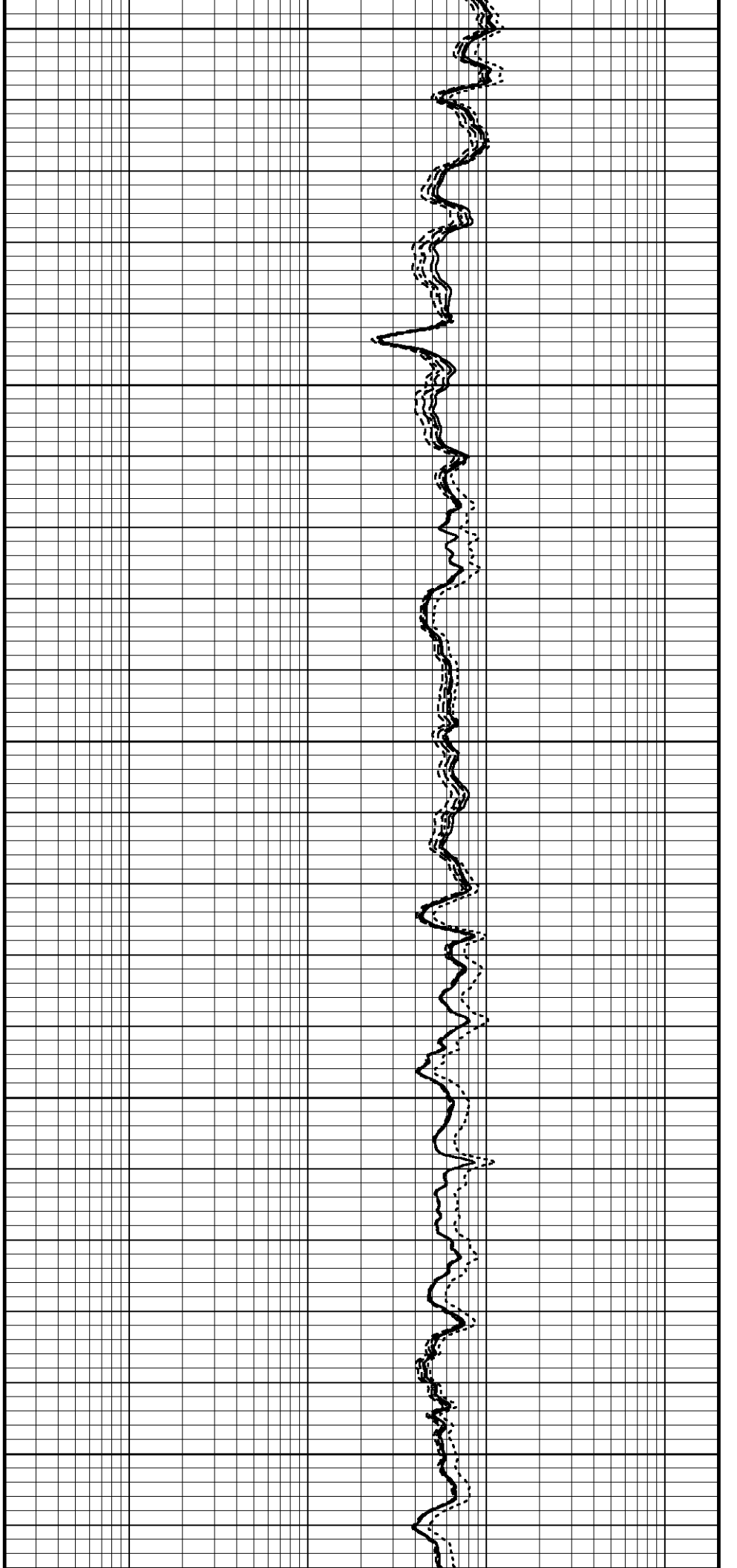
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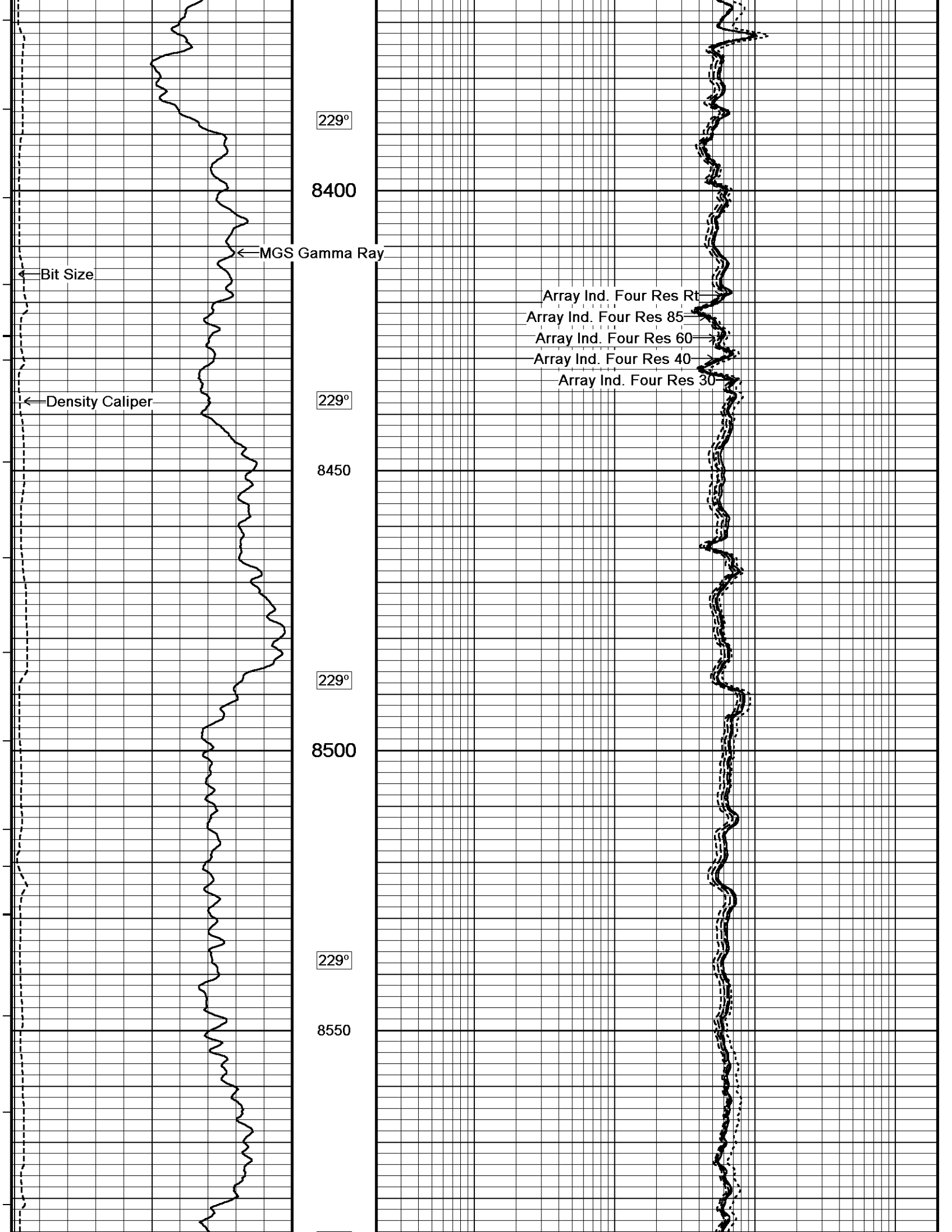
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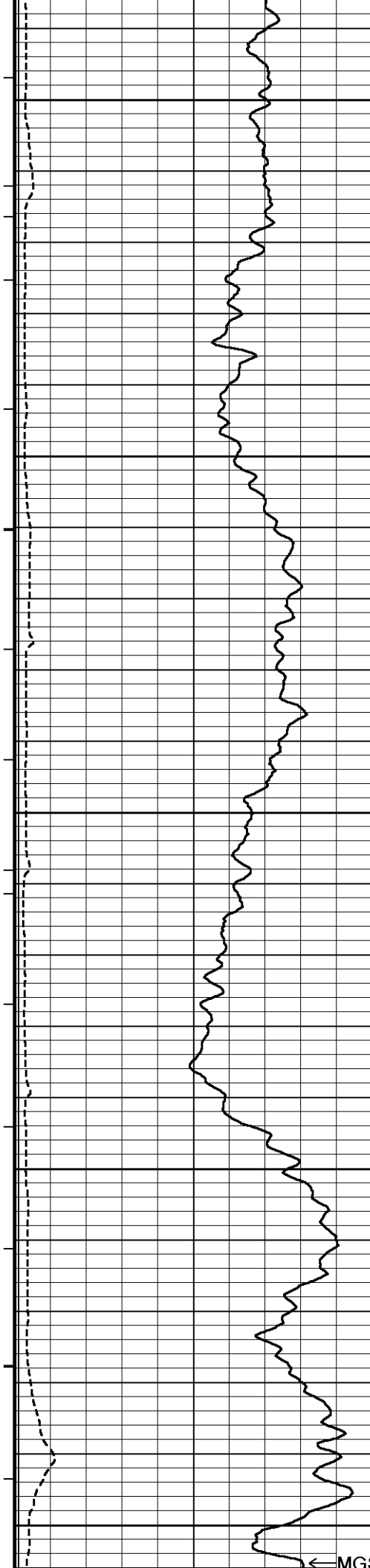
8300

229°

8350







229°

8600

229°

8650

229°

8700

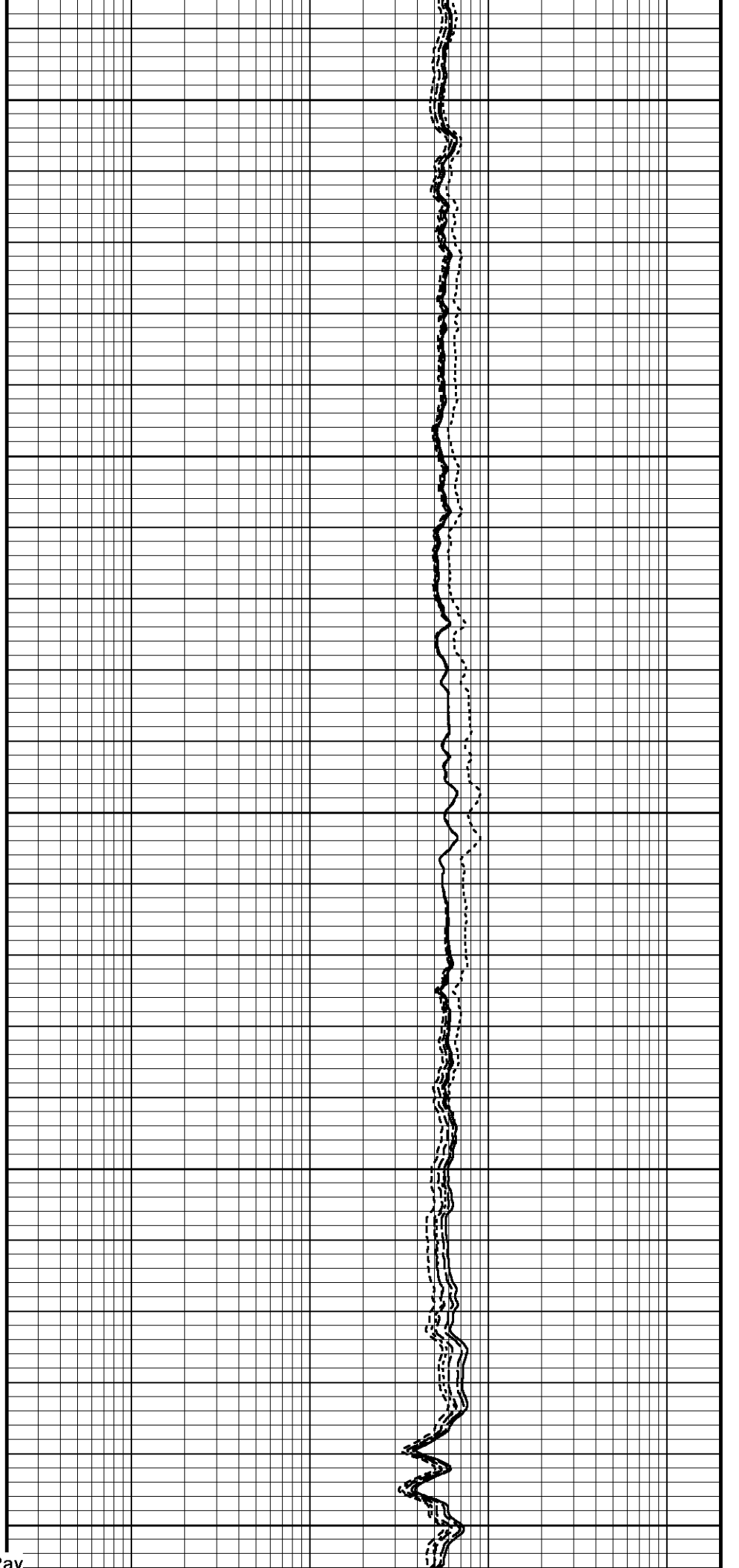
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8750

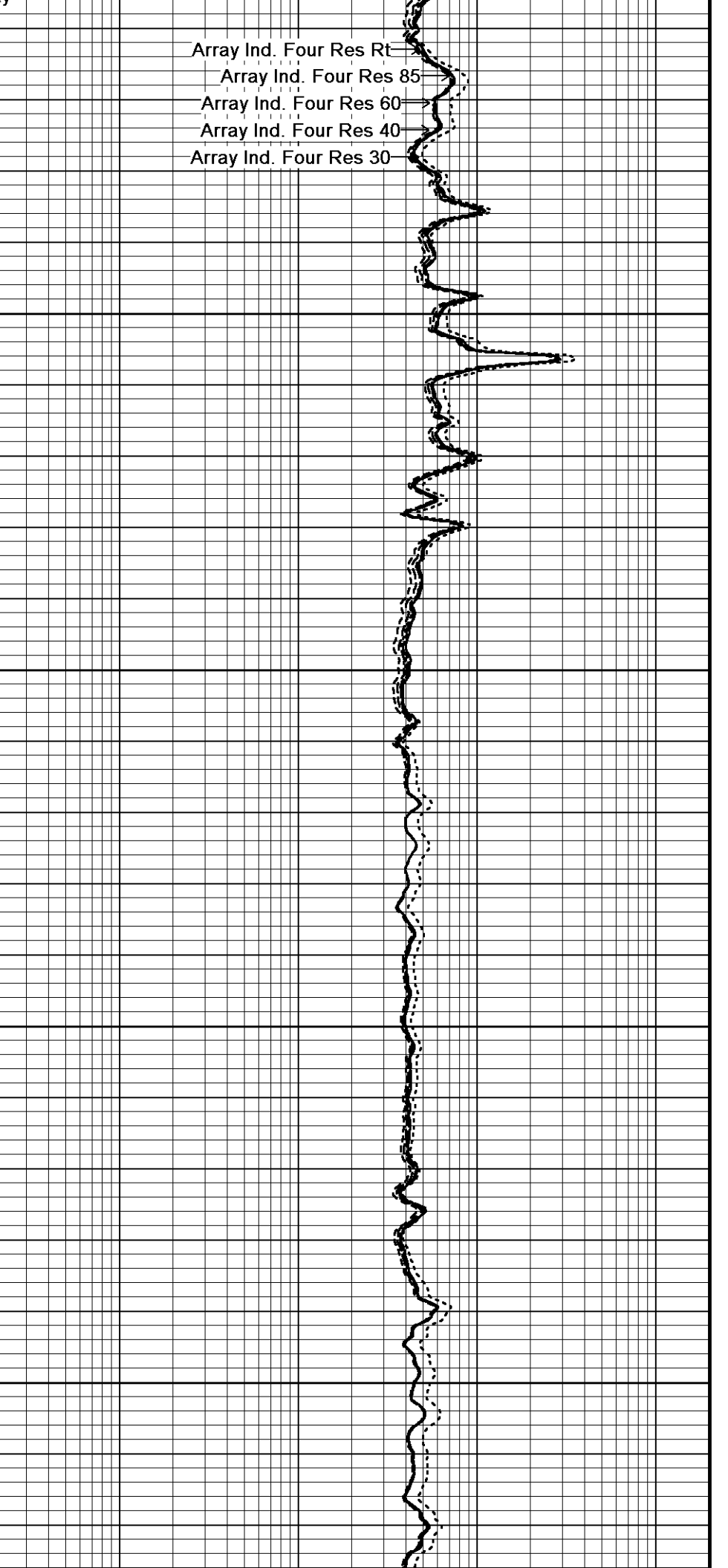
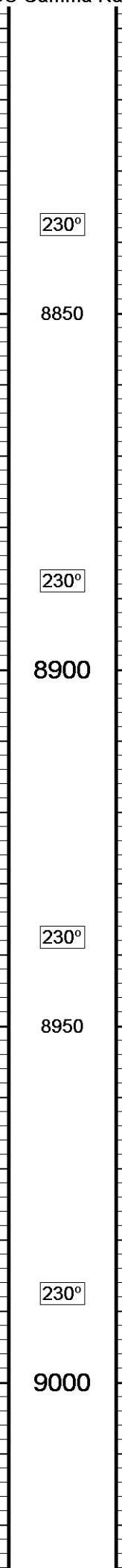
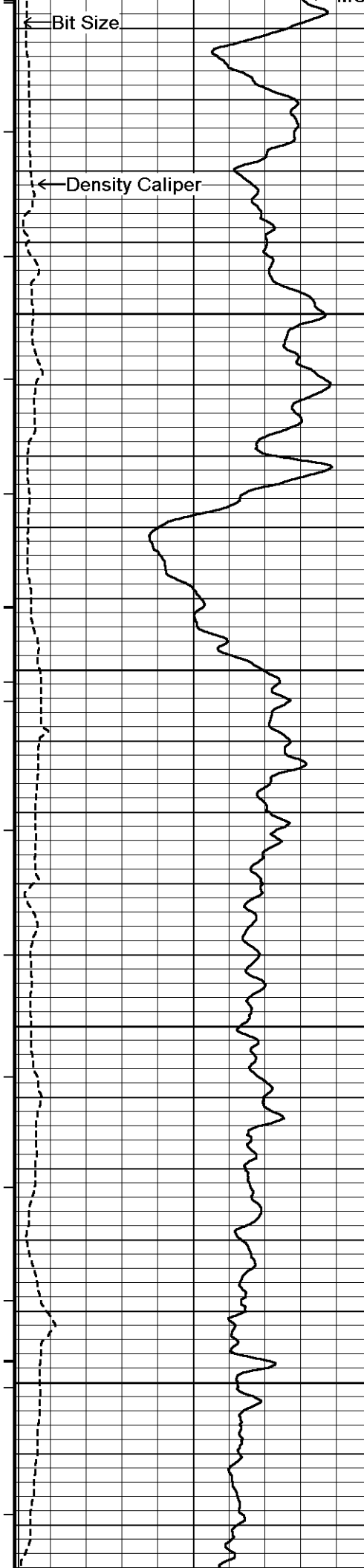
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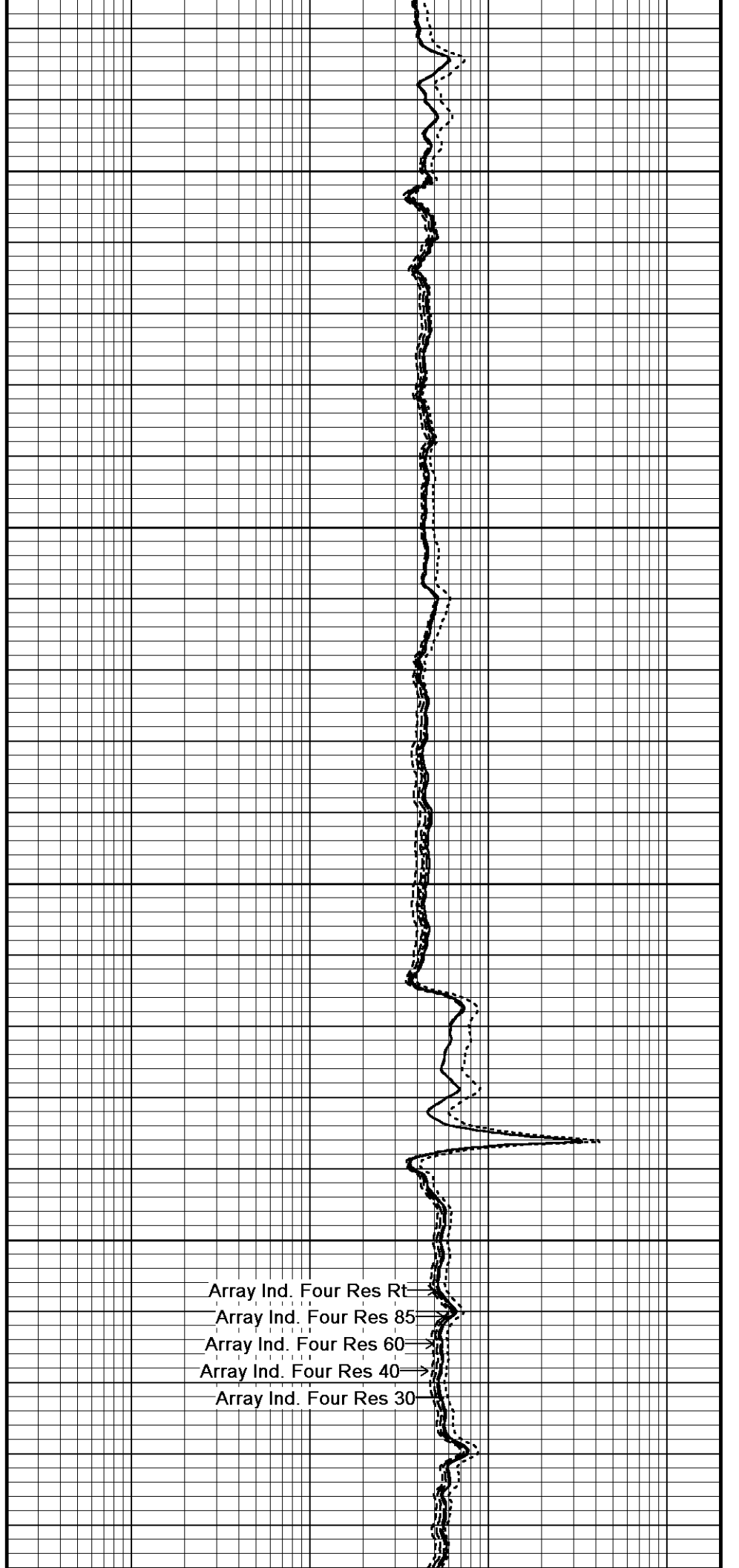
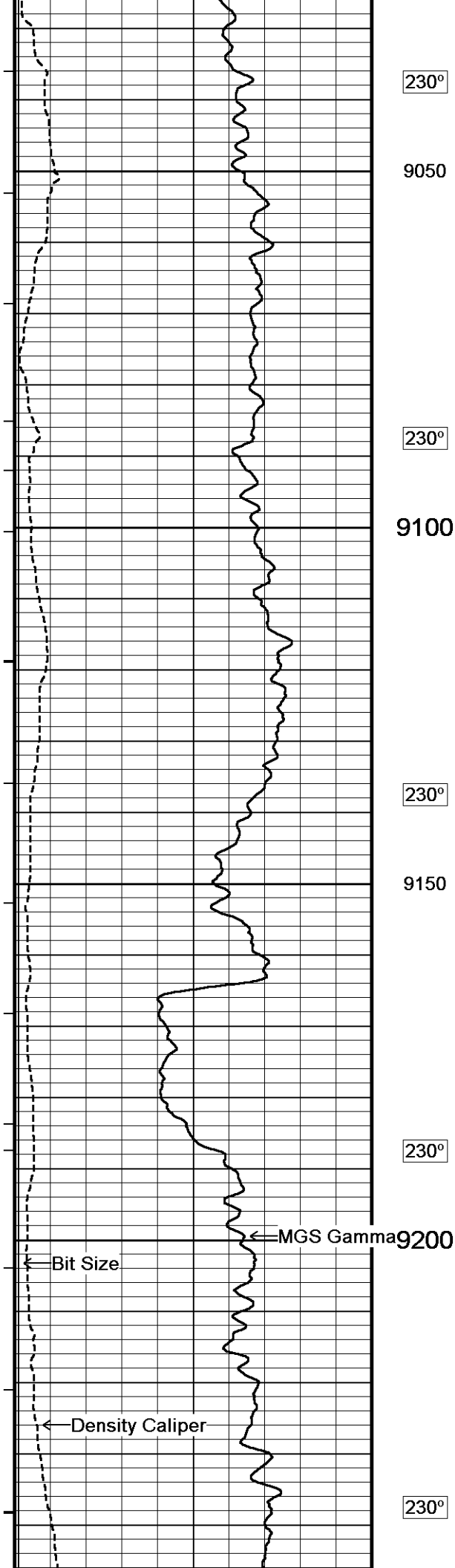
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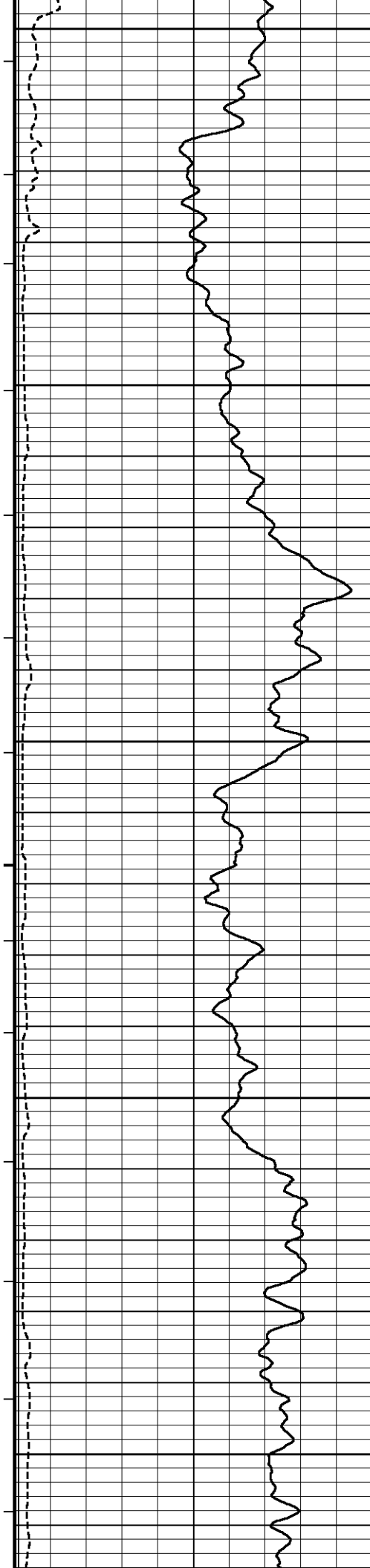
← MGS Gamma Ray











9250

230°

9300

230°

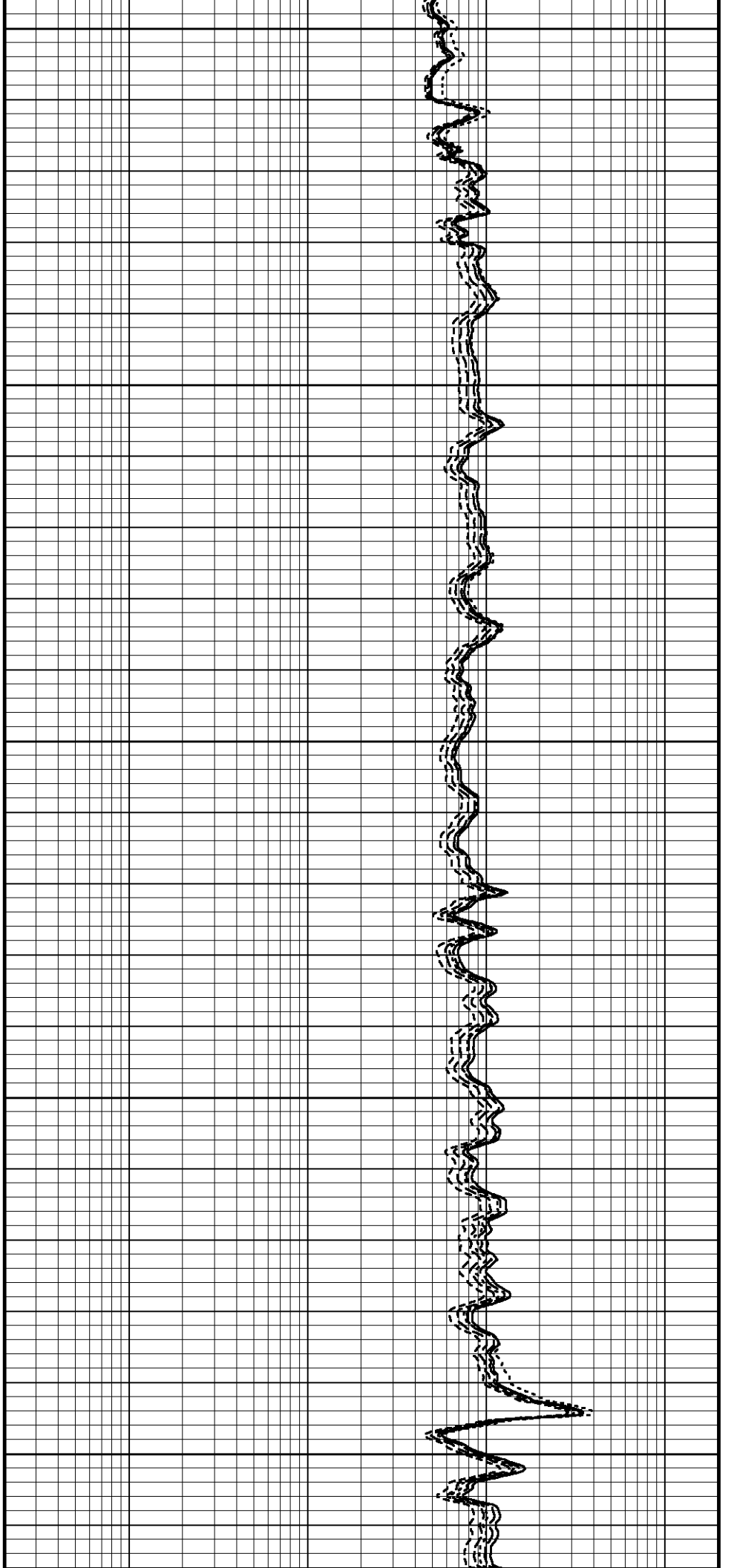
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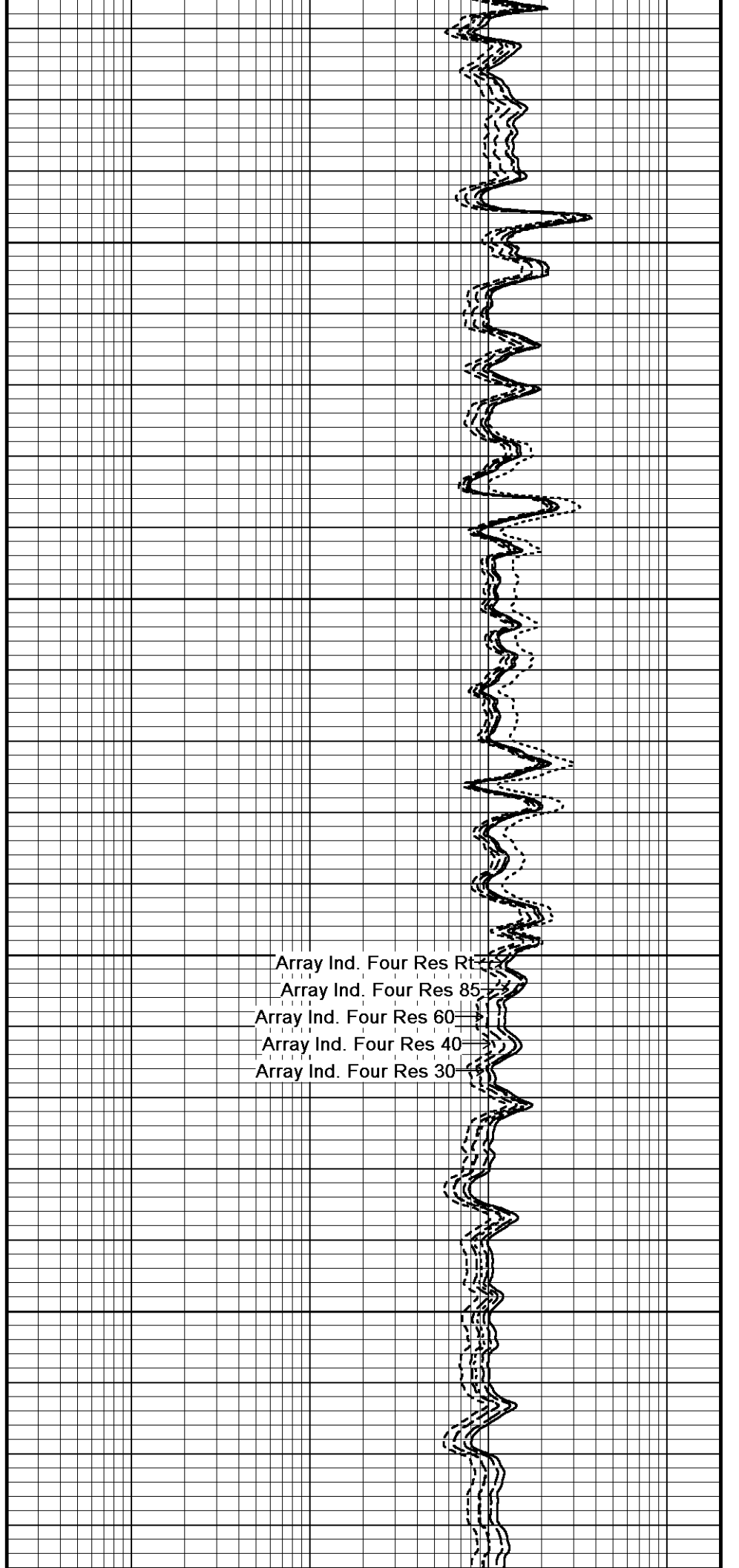
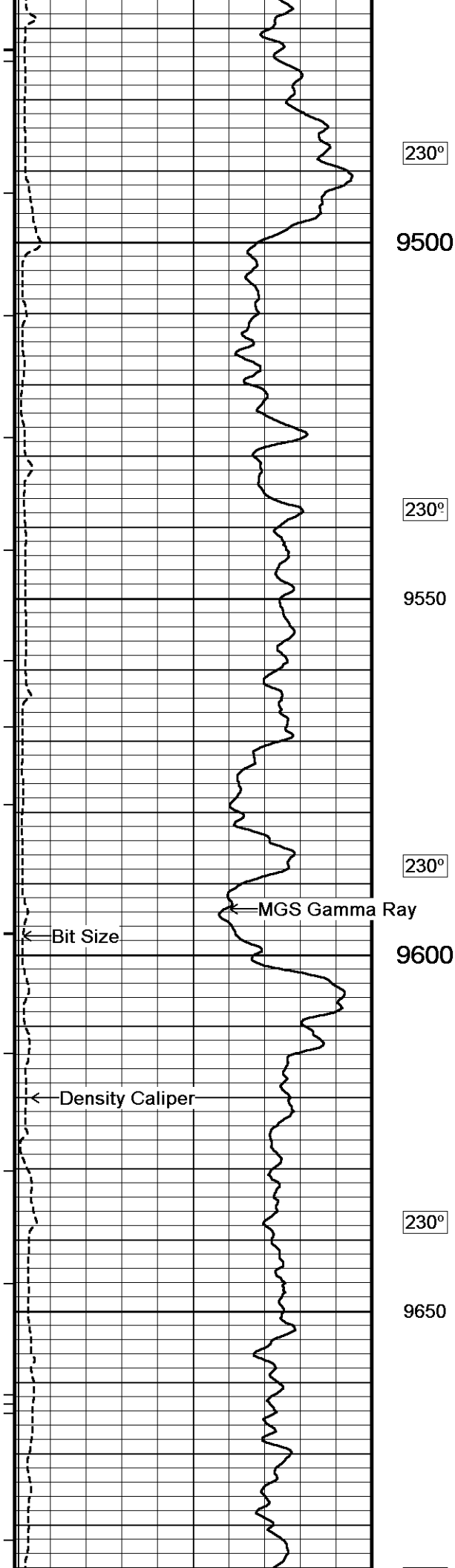
230°

9400

230°

9450







230°

9700

230°

9750

230°

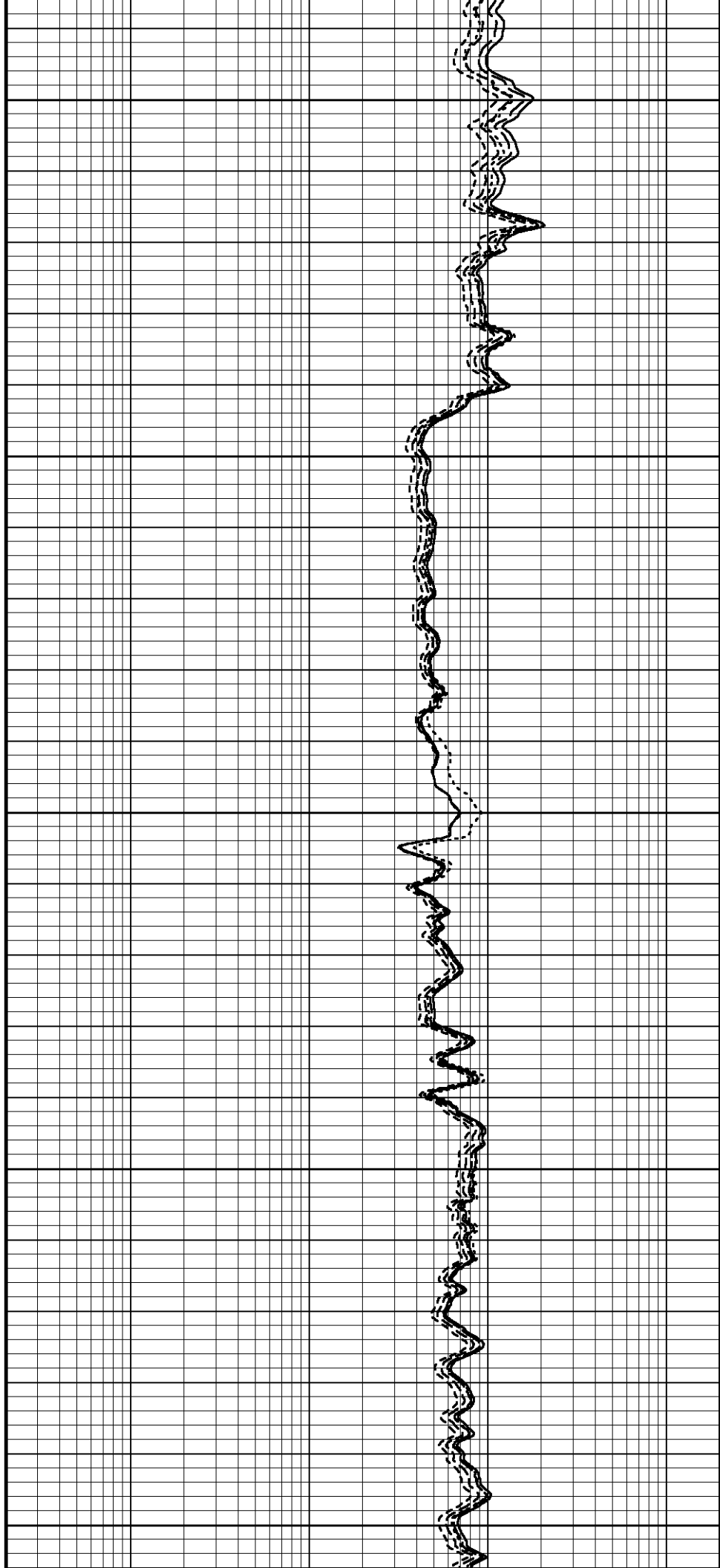
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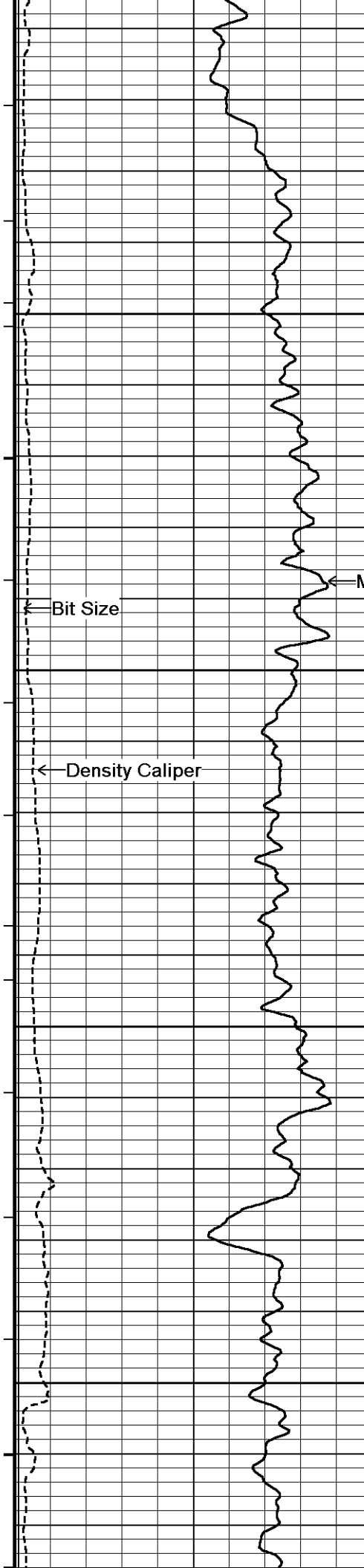
230°

9850

230°

9900





230°

9950

← MGS Gamma Ray

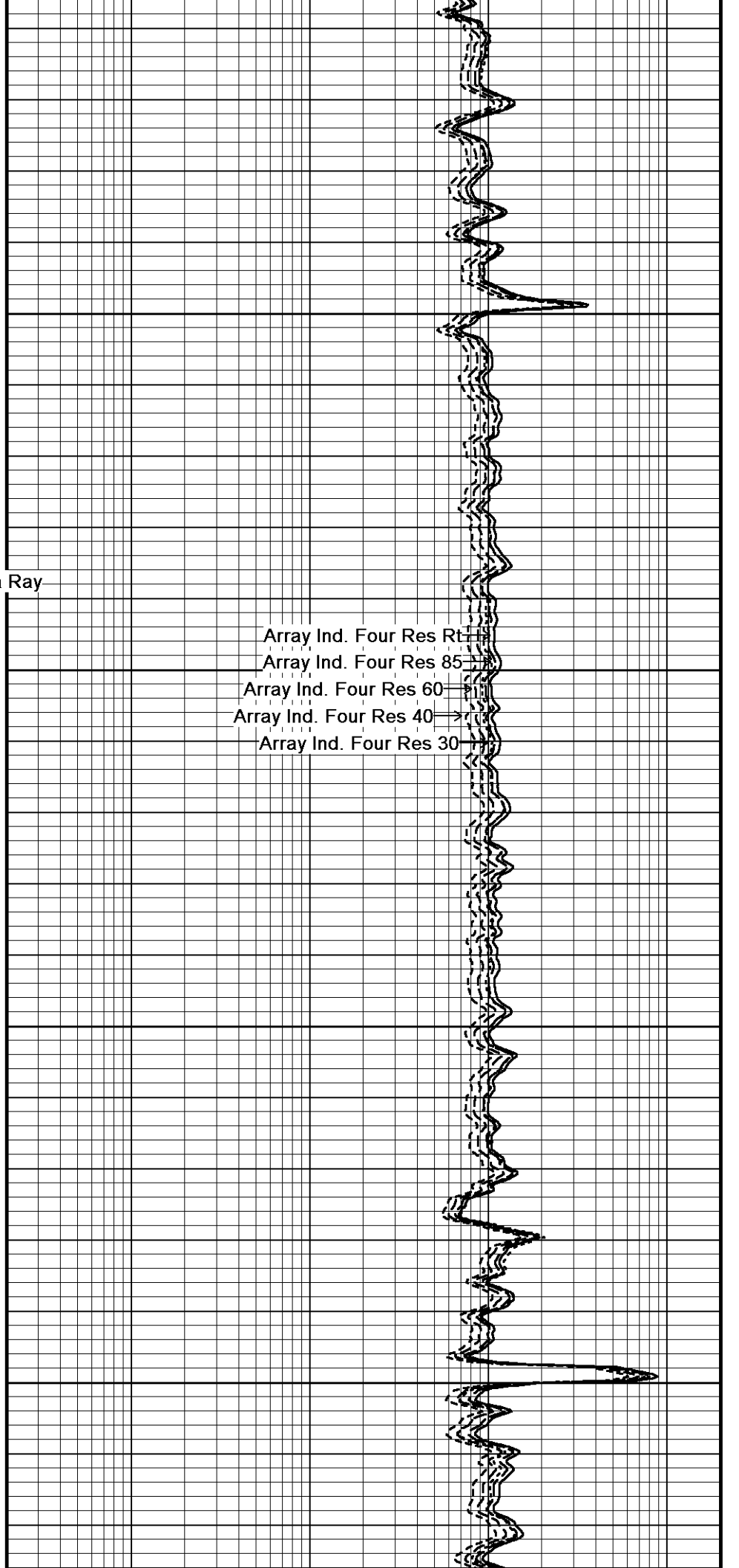
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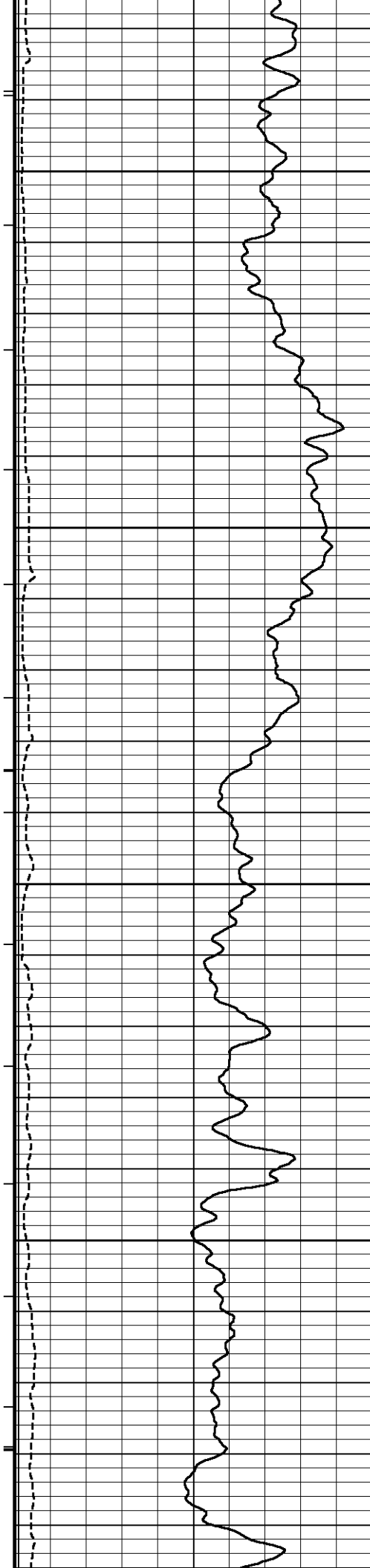
230°

10050

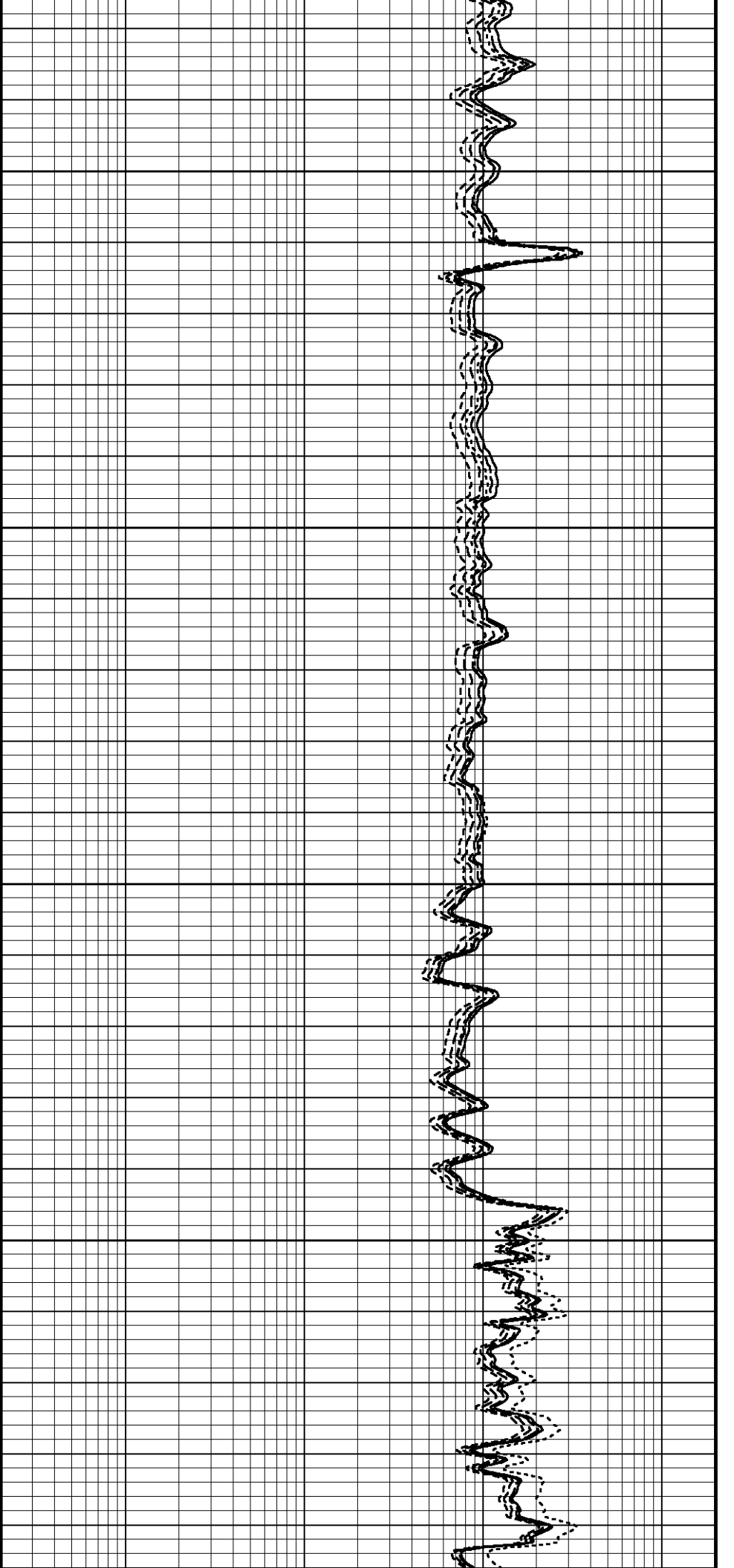
230°

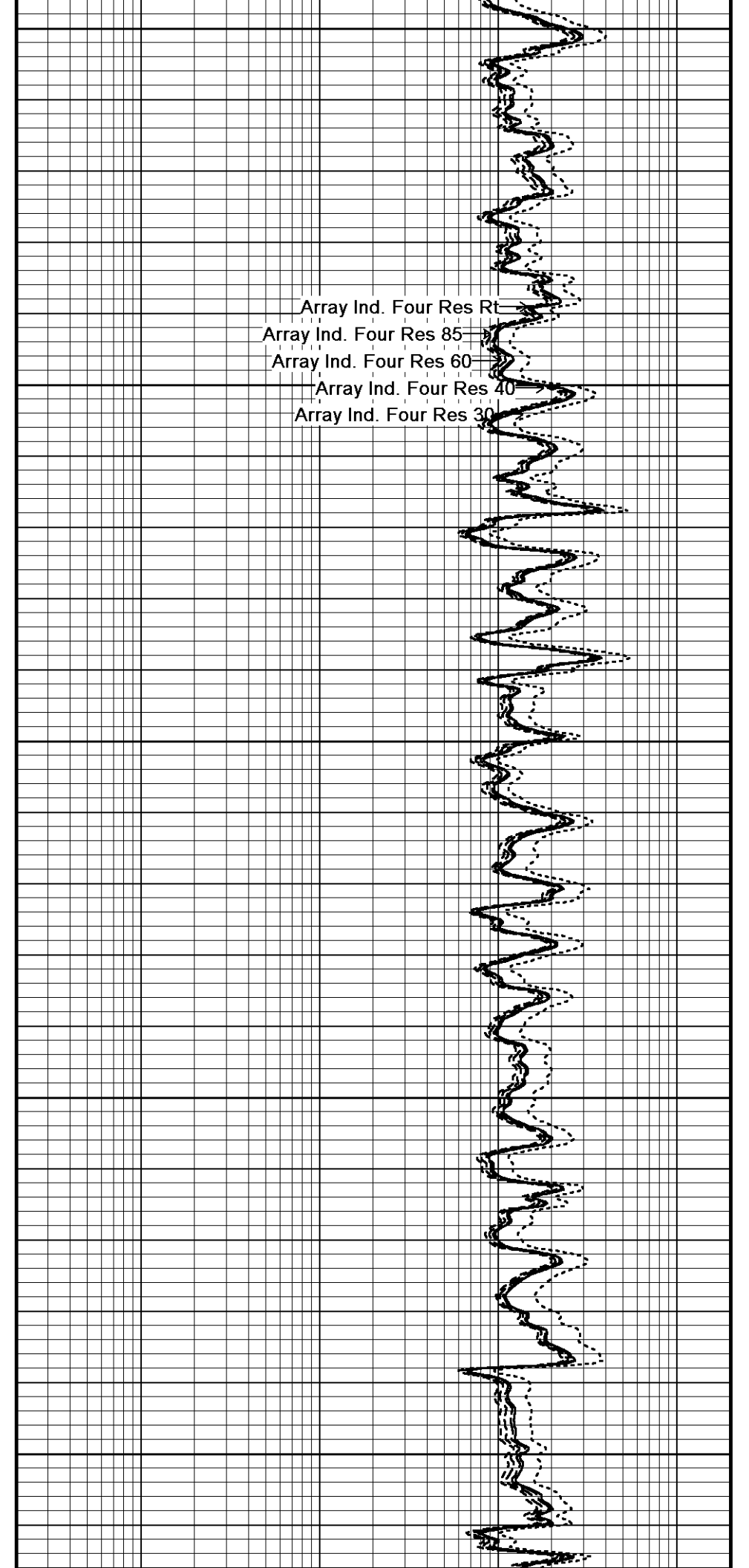
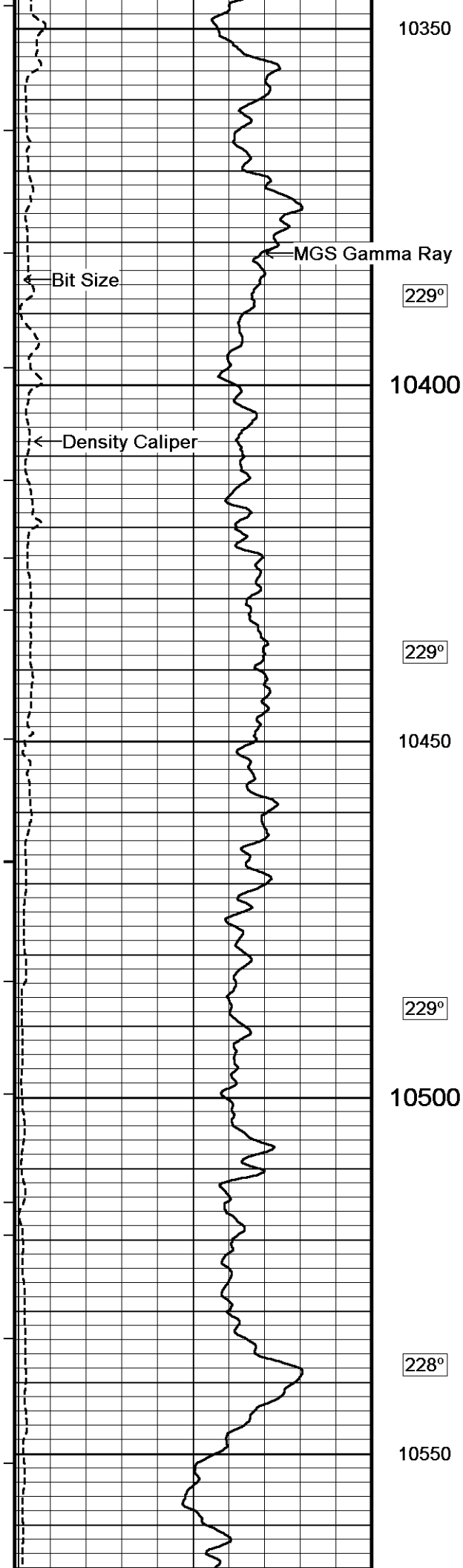
10100



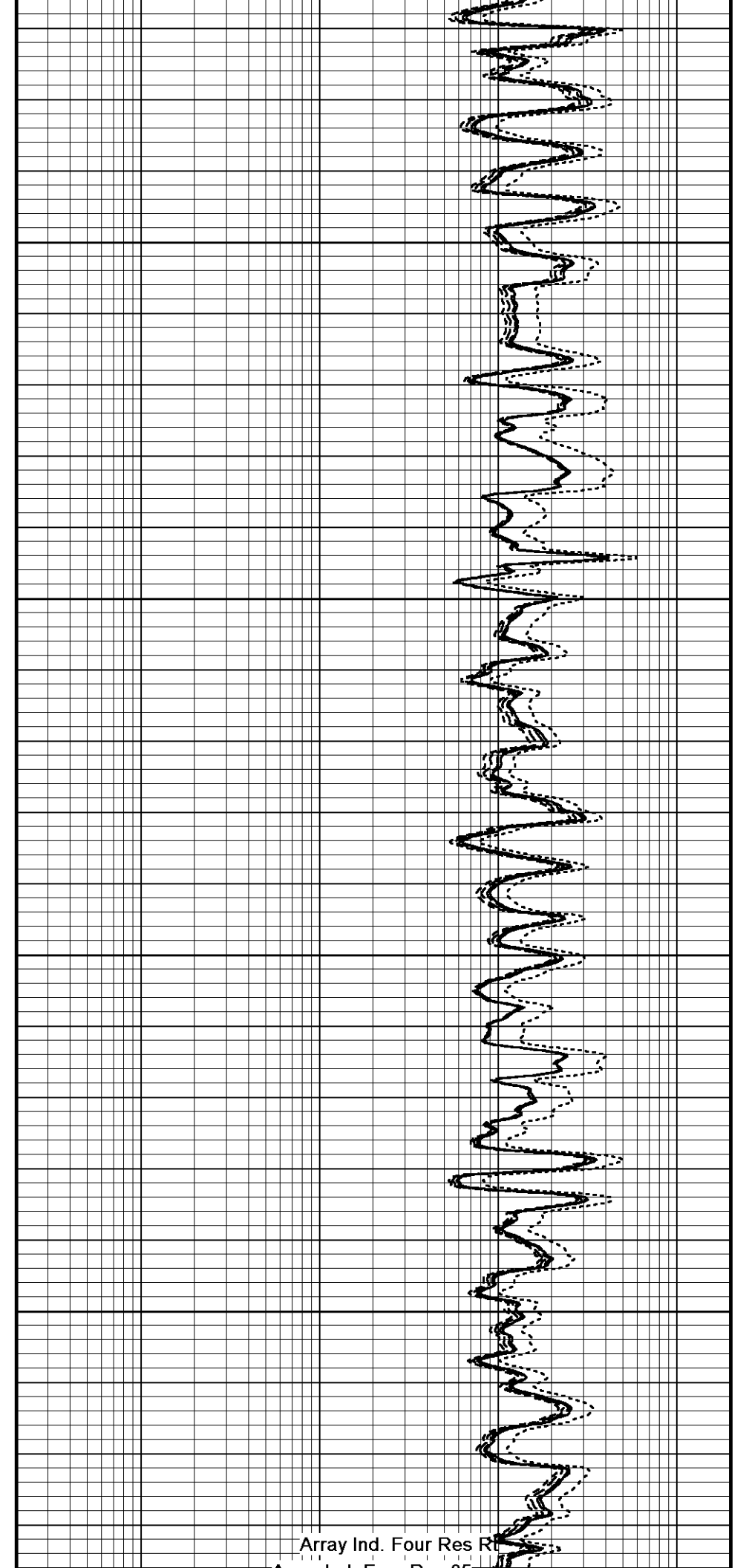
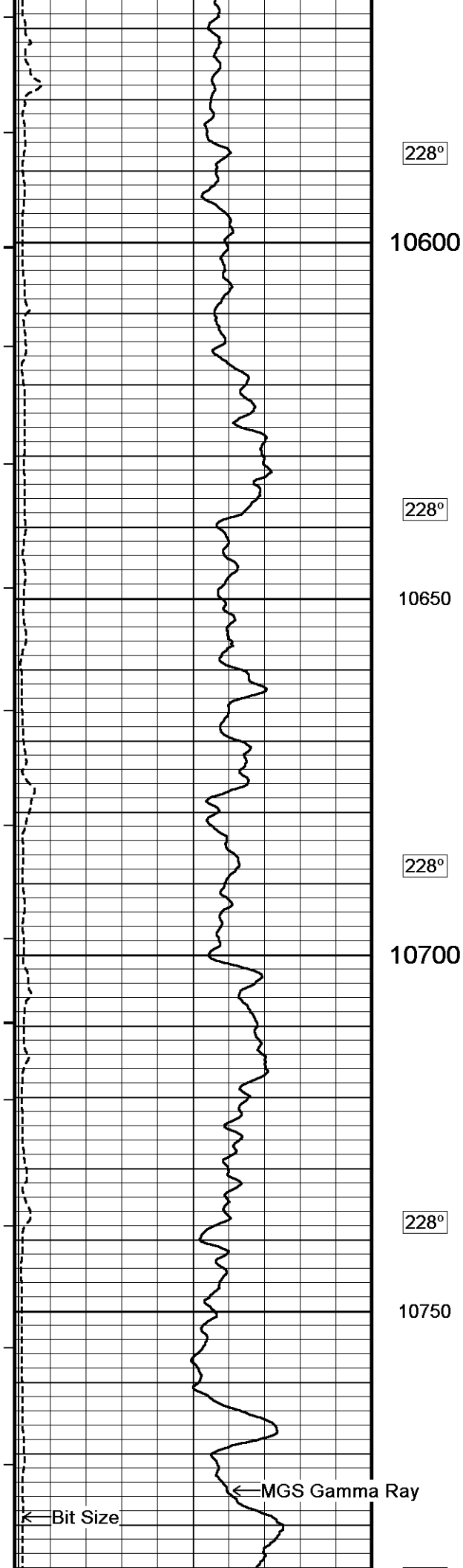


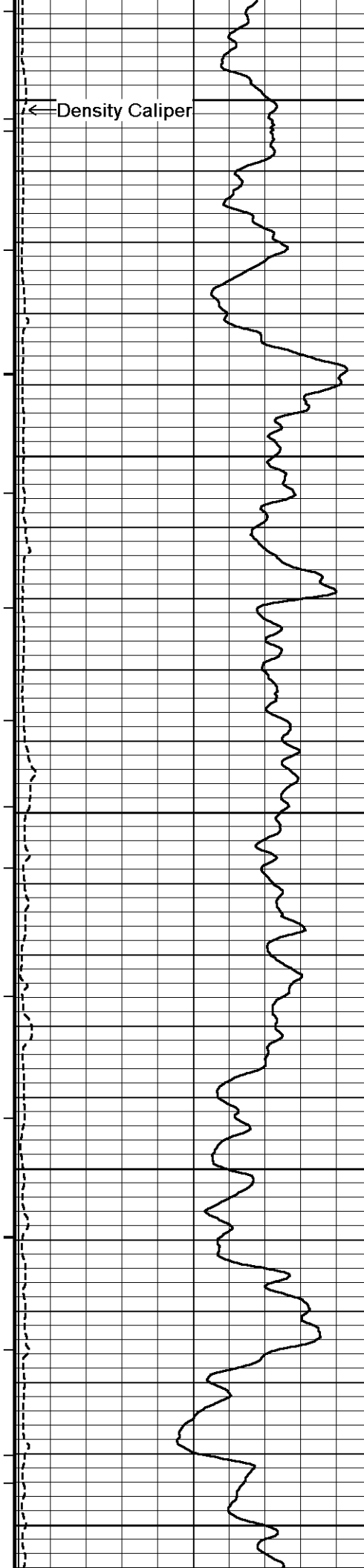
230°  
10150  
229°  
10200  
229°  
10250  
229°  
10300  
229°



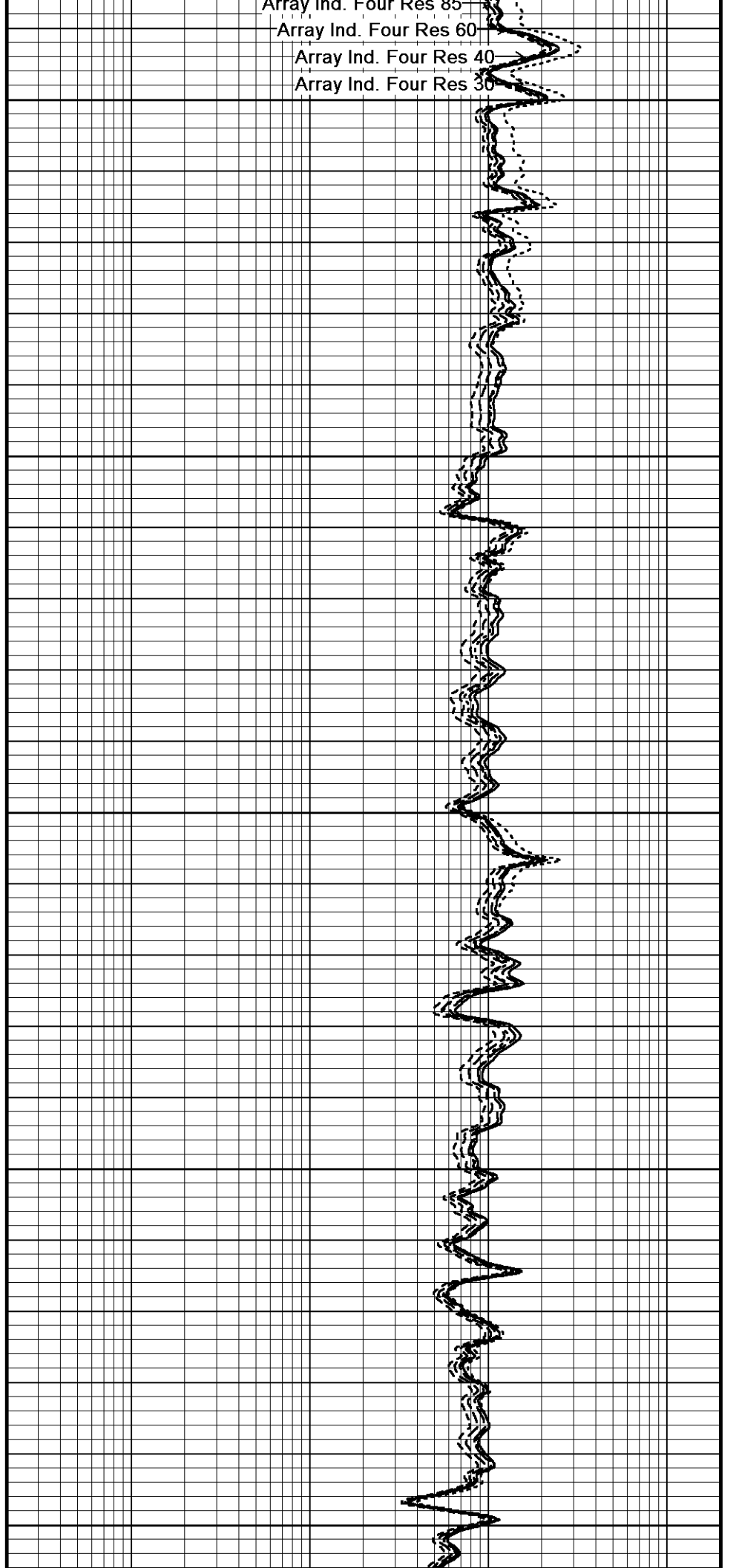


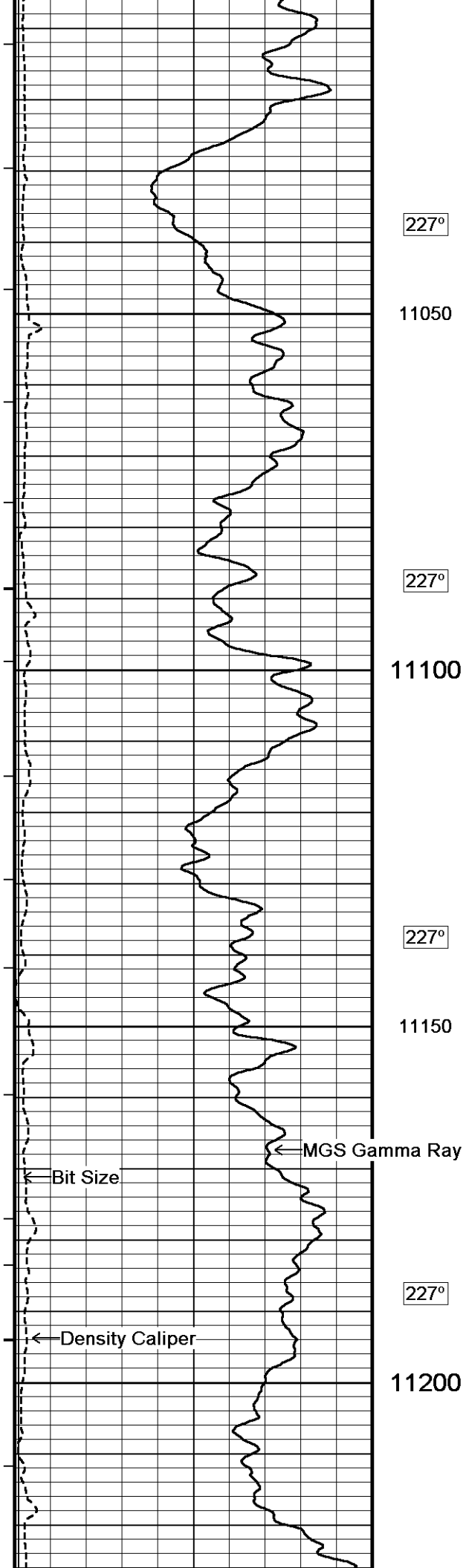






228°  
10800  
228°  
10850  
228°  
10900  
227°  
10950  
227°  
11000





$227^{\circ}$

11050

$227^{\circ}$

11100

$227^{\circ}$

11150

← MGS Gamma Ray

← Bit Size

← Density Caliper

$227^{\circ}$

11200

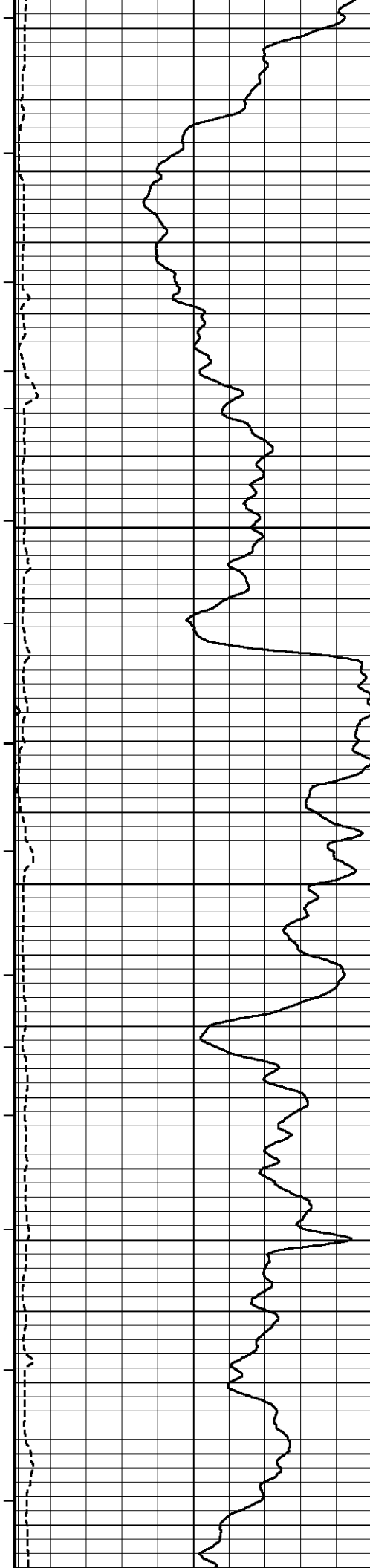
Array Ind. Four Res Rt

Array Ind. Four Res 85

Array Ind. Four Res 60

Array Ind. Four Res 40

Array Ind. Four Res 30



227°

11250

227°

11300

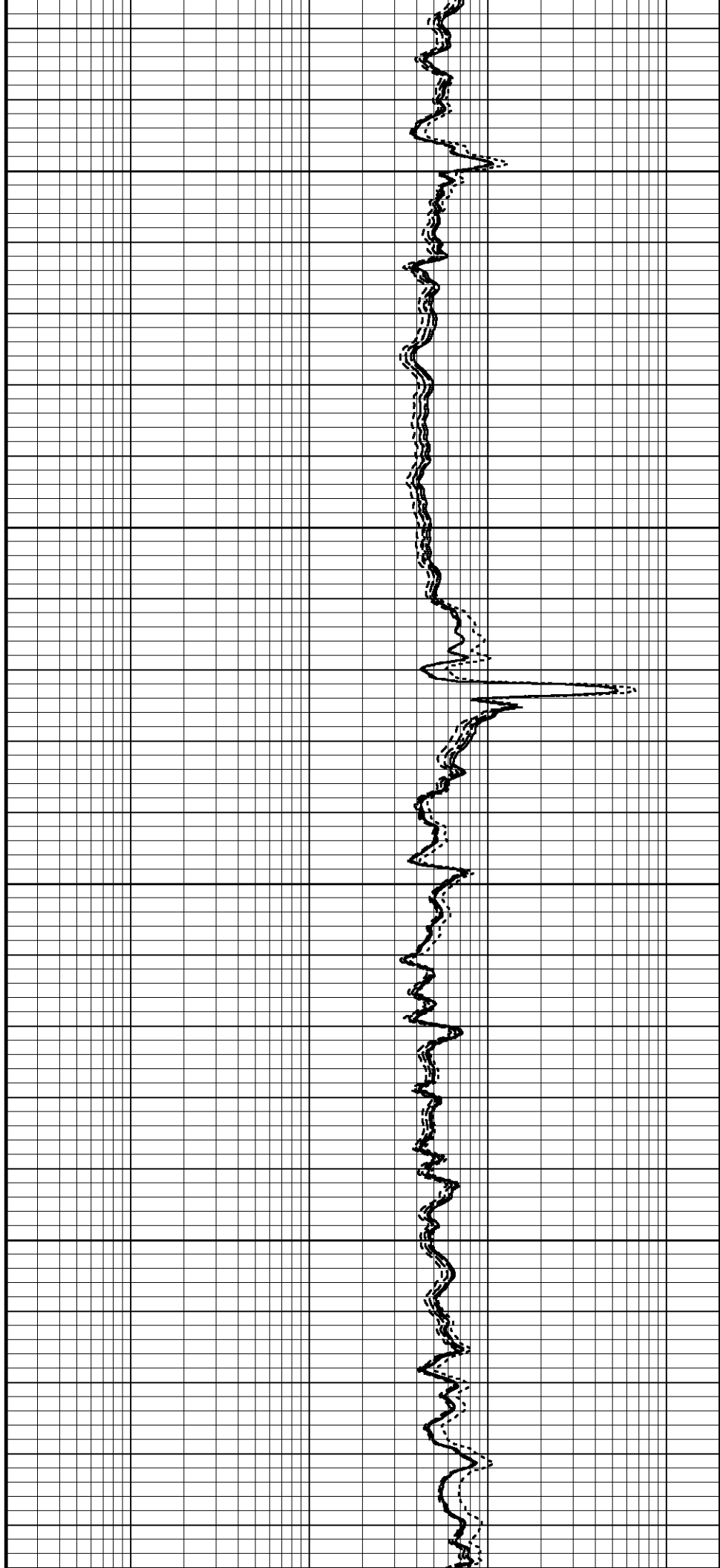
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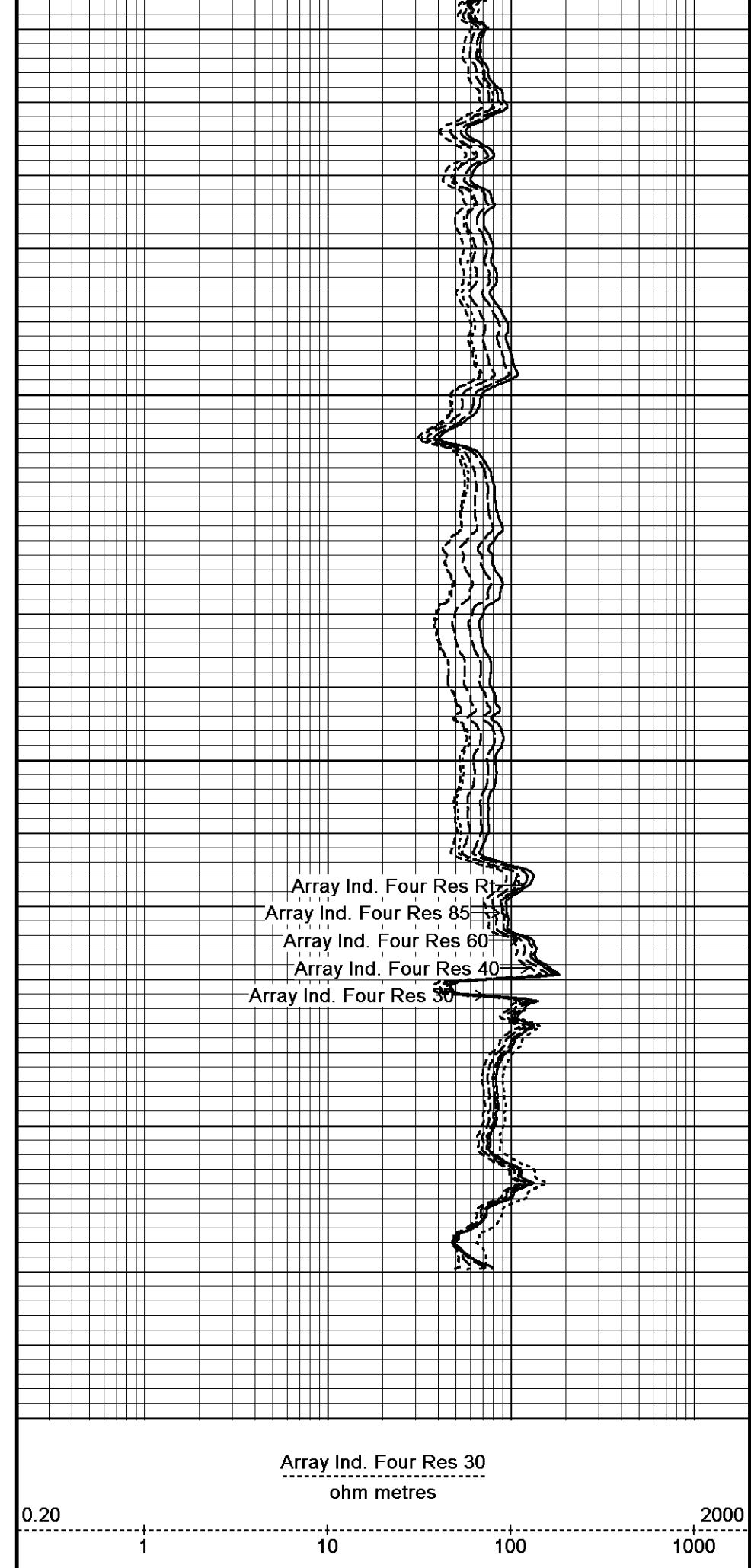
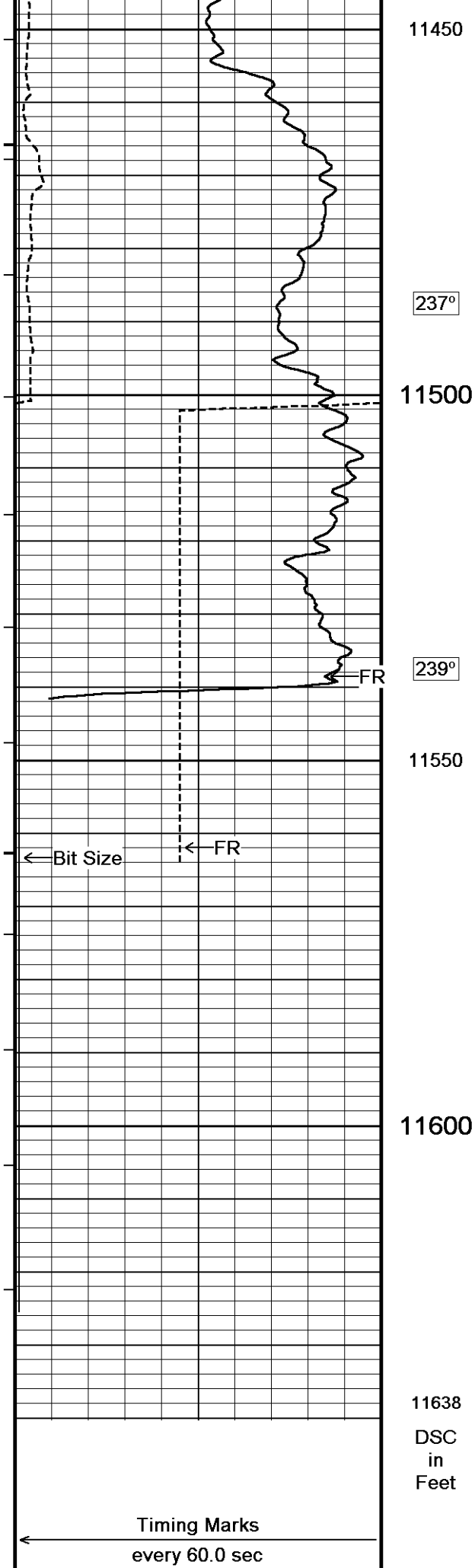
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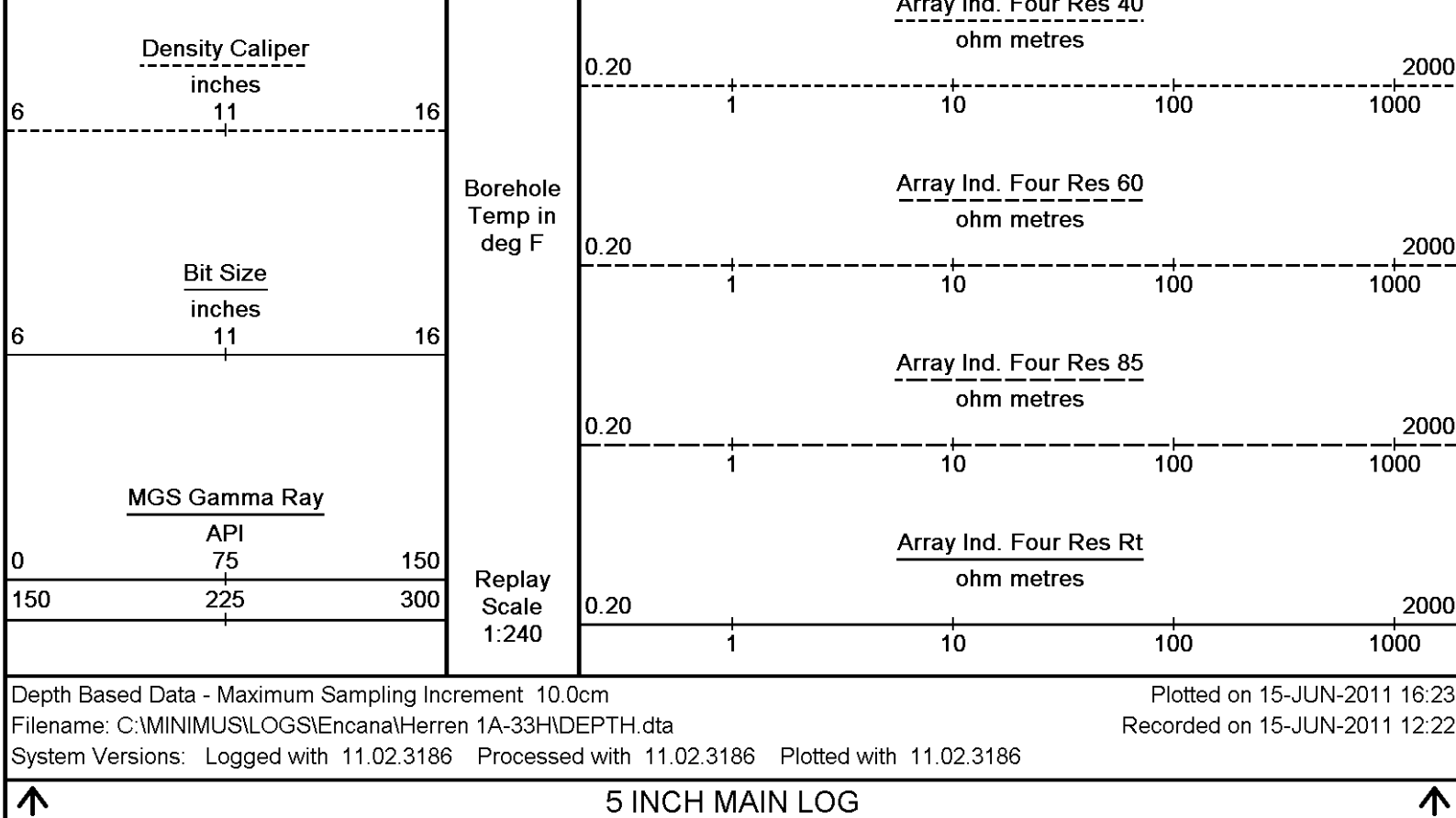
228°

11400

230°







BEFORE SURVEY CALIBRATION				C:\MINIMUS\LOGS\Encana\Herren 1A-33H\DEPTH.dta
General Constants All 000			Last Edited on 15-JUN-2011,13:48	
General Parameters				
Mud Resistivity	1.620	ohm-metres		
Mud Resistivity Temperature	92.000	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	4.500	inches		
Caliper for Differential Caliper	None			
Rwa Parameters				
Porosity used	Base Density Porosity			
Resistivity used	Array Ind. Four Res Rt			
RWA Constant A	0.610			
RWA Constant M	2.150			
Down-hole Tension Calibration SMS 0			Field Calibration on 10-MAY-2011 00:47	
Reading No	Measured	Calibrated (lbs)		
1	15586.83	0.00		
2	16481.04	390.00		
MMS Parameters MMS-E.B 151			Last Edited on 14-Jun-2011 09:53	
Logging Parameters				
Firmware Version	2v40			
Caliper Open On	MAI			
Caliper Open Delay	0.0	minutes		
Caliper Closed On	Unknown			
Caliper Closed Delay	N/A	minutes		
Sample Rate	1.00	seconds		

Sample Rate	100	seconds
Use Deep Sleep	Yes	
Delay Deep Sleep	No	
Deep Sleep Wake Time	480.0	minutes
Deep Sleep Wake on Temperature	No	
Deep Sleep Wake Temperature	N/A	degrees C
Deep Sleep Wake on Pressure	No	
Deep Sleep Wake Pressure	N/A	psi
MMI Pad Pressure	8.0	

#### Release Parameters

Pulse Duration Base Level	10.0	seconds
Pulse Duration Transition Time	5.0	seconds
Pulse Duration Status Pulse From	10.0	seconds
Pulse Duration Caliper Close From	35.0	seconds
Pulse Duration Caliper Open From	50.0	seconds
Pulse Duration Release Pulse From	70.0	seconds
Pulse Duration Release Pulse To	100.0	seconds
Pulse Release Duration	30.0	seconds
Pulse Discriminator Pressure Band	96.0	seconds
Pulse Pressure Discriminator	213.0	seconds
Use Negative Pulsing	No	
Good Status Reply Open Hole	65535.0	seconds
Good Status Reply Cased Hole	10.0	seconds
Bad Status Reply	25.0	seconds
Status Pulse To	15.0	seconds
Caliper Close To	0.0	seconds
Caliper Open To	55.0	seconds

#### Configuration

MMS,MGS,MDN,MPD,MPD,MIM,MIE,MAI

#### Gamma Calibration MGS-C.J 119

Field Calibration on 14-JUN-2011 07:55

	Measured	Calibrated (API)
Background	186	107
Calibrator (Gross)	1105	634
Calibrator (Net)	919	527

#### Gamma Constants MGS-C.J 119

Last Edited on

Gamma Calibrator Number	GRC-005	
Mud Density	1.00	gm/cc
Caliper Source for Processing	Bit Size	
Tool Position	Eccentred	
Concentration of KCl	0.00	kppm

#### SP Calibration MGS-C.J 119

Field Calibration on 15-JUN-2011,13:08

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

#### High Resolution Temperature Calibration MGS-C.J 119

Field Calibration on 15-JUN-2011,13:08

	Measured	Calibrated(Deg F)
Lower	-100.00	-100.00
Upper	100.00	100.00

#### High Resolution Temperature Constants MGS-C.J 119

Last Edited on 31-MAR-2011,23:25

Pre-filter Length	11
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#### Neutron Calibration MDN-B.A 296

Base Calibration on 15-JUN-2011,13:08

Field Check on

Base Calibration				
	Measured		Calibrated (cps)	
	Near	Far	Near	Far
	2880	88	3714	110
Ratio	32.660		33.764	

Field Calibrator at Base

Calibrated (cps)
1642
2424

Ratio		0.677	
Field Check		Calibrated (cps)	
		0	0
Ratio		0.000	
Neutron Constants MDN-B.A 296			Last Edited on 15-JUN-2011,13:08
Neutron Source Id	755		
Neutron Jig Number	6532		
Epithermal Neutron	No		
Caliper Source for Processing	Density Caliper		
Stand-off	0.00	inches	
Mud Density	1.00	gm/cc	
Limestone Sigma	7.10	cu	
Sandstone Sigma	4.26	cu	
Dolomite Sigma	4.70	cu	
Formation Pressure Source	None		
Formation Pressure	N/A	kpsi	
Temperature Source	None		
Temperature	N/A	degrees F	
Mud Salinity	0.00	kppm	
Formation Fluid Salinity Source	Constant Value		
Formation Fluid Salinity	0.00	kppm	
Barite Mud Correction	Not Applied		
Navigation Constants MIE-A.A 210			Last Edited on 14-JUN-2011,08:37
Magnetic Declination	0.00	degrees	East
Imager Pad Check MIE-A.A 210			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 210			Last Edited on 14-JUN-2011,08:37
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		
Magnetometer Parameters MIE-A.A 210			
Date Of Last Magnetometer Calibration	08-DEC-2010,17:49		
	X Magnetometer	Y Magnetometer	Z Magnetometer
Slope	-1.000000	-1.010840	-1.008324
Offset	0.011365	-0.015921	0.015296
Magnetometer Constants MIE-A.A 210			Last Edited on
Magnetometer Calibrator Number	000		
Accelerometer Parameters MIE-A.A 210			
Date Of Last Accelerometer Calibration	08-DEC-2010,11:49		
	X Accelerometer	Y Accelerometer	Z Accelerometer
Slope	-1.111578	-1.111209	-1.113349
Offset	0.003650	0.008008	0.005680
Accelerometer Constants MIE-A.A 210			Last Edited on 08-DEC-2010,17:50
Accelerometer Calibrator Number	000		
Accelerometer Temperature Characterisation			



## Accelerometer Temperature Characterisation

X Accelerometer  
 Serial Number 892  
 Calibration Date 11-Apr-2010  
 B0 B1 B2 B3  
 Bias(g) 0.00000e+000 -5.47566e-006 -2.70682e-008 4.45053e-010  
 SF0 SF1 SF2 SF3  
 Scale Factor(mA/g) 3.00000e+000 2.35337e-004 5.89919e-007 -4.69102e-011

Y Accelerometer  
 Serial Number 807  
 Calibration Date 01-Jan-1998  
 B0 B1 B2 B3  
 Bias(g) 0.00000e+000 1.30535e-005 6.25044e-009 5.21869e-011  
 SF0 SF1 SF2 SF3  
 Scale Factor(mA/g) 3.00000e+000 2.96965e-004 2.16414e-007 1.34927e-009

Z Accelerometer  
 Serial Number 832  
 Calibration Date 01-Jan-1998  
 B0 B1 B2 B3  
 Bias(g) 0.00000e+000 1.99502e-005 8.08101e-009 -1.79679e-010  
 SF0 SF1 SF2 SF3  
 Scale Factor(mA/g) 3.00000e+000 2.37288e-004 6.89664e-007 -1.79209e-010

## Caliper Calibration MIE-A.A 210

Base Calibration on 14-JUN-2011 07:08

Field Calibration on 14-JUN-2011 07:10

## Base Calibration

Reading No	Pads 1-5 Meas.	Pads 3-7 Meas.	Calibrator Size (in)
1	26213	26043	5.96
2	36998	36897	7.98
3	46794	46452	9.86
4	58094	57904	11.88
5	0	0	0.00

Reading No	Pad 2 Meas.	Pad 4 Meas.	Pad 6 Meas.	Pad 8 Meas.	Calibrator Size (in)
1	23890	25365	25318	24910	5.96
2	33581	34544	33774	33460	7.98
3	41758	42904	42139	41918	9.86
4	51339	52376	51736	51679	11.88
5	0	0	0	0	0.00

## Field Calibration

Measured		Measured		Actual	
Pads 1-5 Caliper(in)		Pads 3-7 Caliper(in)		Caliper(in)	
6.04		6.00		5.96	

Measured		Measured		Measured		Measured		Actual	
Pad 2 Caliper(in)		Pad 4 Caliper(in)		Pad 6 Caliper(in)		Pad 8 Caliper(in)		Caliper(in)	
3.07		3.02		2.94		2.97		5.96	

## Caliper Constants MIE-A.A 210

Last Edited on

Caliper Difference for BRKT 3.000 mm

## Induction Calibration MAI-B.A 286

Base Calibration on 15-JUN-2011,13:06

Field Check on

## Base Calibration

Test Loop Calibration Channel	Measured		Calibrated (mmho/m)	
	Low	High	Low	High
1	17.8	471.4	9.3	966.2
2	6.8	387.0	7.6	821.4
3	3.2	259.6	5.2	566.0
4	2.0	136.1	2.6	279.2

Array Temperature 75.2 Deg F

Channel	Base Check (mmho/m)		Field Check (mmho/m)	
	Low	High	Low	High
1	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0
Deep	0.0	0.0	0.0	0.0

Medium	0.0	0.0	0.0	0.0
Shallow	0.0	0.0	0.0	0.0
Array Temperature		0.0		0.0 Deg F

Induction Constants MAI-B.A 286	Last Edited on 15-JUN-2011,13:48			
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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		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.		MGS 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	

High Resolution Temperature Calibration MAI-B.A 286	Field Calibration on 28-MAR-2011,19:09			
	Measured	Calibrated(Deg F)		
Lower	50.00	50.00		
Upper	100.00	100.00		

High Resolution Temperature Constants MAI-B.A 286	Last Edited on			
Pre-filter Length	11			

Caliper Calibration MPD-C.A 297			Base Calibration on 13-JUN-2011 04:54
			Field Calibration on 13-JUN-2011 04:55
Base Calibration			
Reading No	Measured	Calibrator Size (in)	
1	16580	3.98	
2	24753	5.96	
3	33184	7.96	
4	41326	9.86	
5	50560	11.88	
6	N/A	N/A	
Field Calibration			
	Measured Caliper (in)	Actual Caliper (in)	
	7.94	7.96	

Photo Density Calibration MPD-C.A 297	Base Calibration on 15-JUN-2011,13:54 Field Check on			
Density Calibration				

Density Calibration		Measured		Calibrated (sdu)	
Base Calibration		Near	Far	Near	Far
Reference 1		54284	17816	53115	19186
Reference 2		25706	2716	25020	2536
Field Check at Base					
		1222.3	1407.4		
Field Check					
		0.0	0.0		

PE Calibration				
Base Calibration		Measured		Calibrated
	WS	WH	Ratio	Ratio
Background	220	1081		
Reference 1	19045	54076	0.355	0.320
Reference 2	7276	25549	0.288	0.272
Field Check at Base				
	220.5	1080.8		
Field Check				
	0.0	0.0		

## Density Constants MPD-C.A 297

Last Edited on 15-JUN-2011,13:07

Density Source Id	271	
Nylon Calibrator Number	507	
Aluminium Calibrator Number	507	
Density Shoe Profile	4 inch	
Caliper Source for Processing	Density Caliper	
PE Correction to Density	Not Applied	
Mud Density	1.26	gm/cc
Mud Density Z/A Multiplier	1.11	
Mud Filtrate Density	1.00	gm/cc
Dry Hole Mud Filtrate Density	1.00	gm/cc
DNCT	0.00	gm/cc
CRCT	0.00	gm/cc
Density Z/A Correction	Hybrid	
Matrix Density (gm/cc)	Depth (ft)	
2.71	0.00	
0.00	0.00	
0.00	0.00	
0.00	0.00	
0.00	0.00	
0.00	0.00	
0.00	0.00	
0.00	0.00	

## DOWNHOLE EQUIPMENT

C:\MINIMUS\LOGS\Encana\Herren 1A-33H\DEPTH.dta

Shuttle Running Tool 3.5" (SRT A)  
SRT-A 5 LG: 5.90 ft WT: 37.5 lb OD: 2.52 in

Compact Linker  
MLK-A 1 LG: 14.27 ft WT: 30.9 lb OD: 2.24 in

Compact Linker  
MLK-A 2 LG: 14.27 ft WT: 30.9 lb OD: 2.24 in

MBS-F.A 200v Compact Battery Sub  
MBS-F.A 119 LG: 17.06 ft WT: 123.5 lb OD: 2.24 in



Compact Memory Sub E.B

MMS-E.B 151 LG: 5.20 ft WT: 37.5 lb OD: 2.24 in

Compact Tool Isolator sub.

MTI-B.A 55 LG: 1.54 ft WT: 13.2 lb OD: 2.24 in

Compact Short Gamma

MGS-C.J 119 LG: 3.41 ft WT: 24.3 lb OD: 2.24 in

SKJ-E.A Compact Knuckle Joint

SKJ-E.A 154 LG: 2.17 ft WT: 24.3 lb OD: 2.24 in

SHA-F Compact Swivel Head Adaptor

SHA-F 25 LG: 2.74 ft WT: 26.5 lb OD: 2.24 in

MIS-D.A Compact Inline Bowspring sub

MIS-D.A 292 LG: 5.70 ft WT: 33.1 lb OD: 2.24 in

Compact Neutron

MDN-B.A 296 LG: 5.04 ft WT: 50.7 lb OD: 2.24 in

Compact Density/Caliper

MPD-C.A 297 LG: 9.59 ft WT: 90.4 lb OD: 2.24 in

MIS-D.A Compact Inline Bowspring sub

MIS-D.A 439 LG: 5.70 ft WT: 33.1 lb OD: 2.24 in

SHA-J.A Compact Swivel Head Adaptor

SHA-J.A 314 LG: 2.30 ft WT: 22.0 lb OD: 2.24 in

SKJ-E.A Compact Knuckle Joint

SKJ-E.A 260 LG: 2.17 ft WT: 24.3 lb OD: 2.24 in

MIS-E.A Compact Inline Standoff sub

MIS-E.A 365 LG: 2.14 ft WT: 15.4 lb OD: 2.24 in

SKJ-D.A Compact Knuckle Joint

SKJ-D.A 203 LG: 2.17 ft WT: 24.3 lb OD: 2.24 in

MIS-D.A Compact Inline Bowspring sub

MIS-D.A 296 LG: 5.70 ft WT: 33.1 lb OD: 2.24 in

Compact MMI Memory Section

MIM-A.A 210 LG: 4.65 ft WT: 26.5 lb OD: 2.24 in

Compact MMI Electrode Section

MIE-A.A 210 LG: 13.96 ft WT: 99.2 lb OD: 4.10 in

MIS-D.A Compact Inline Bowspring sub

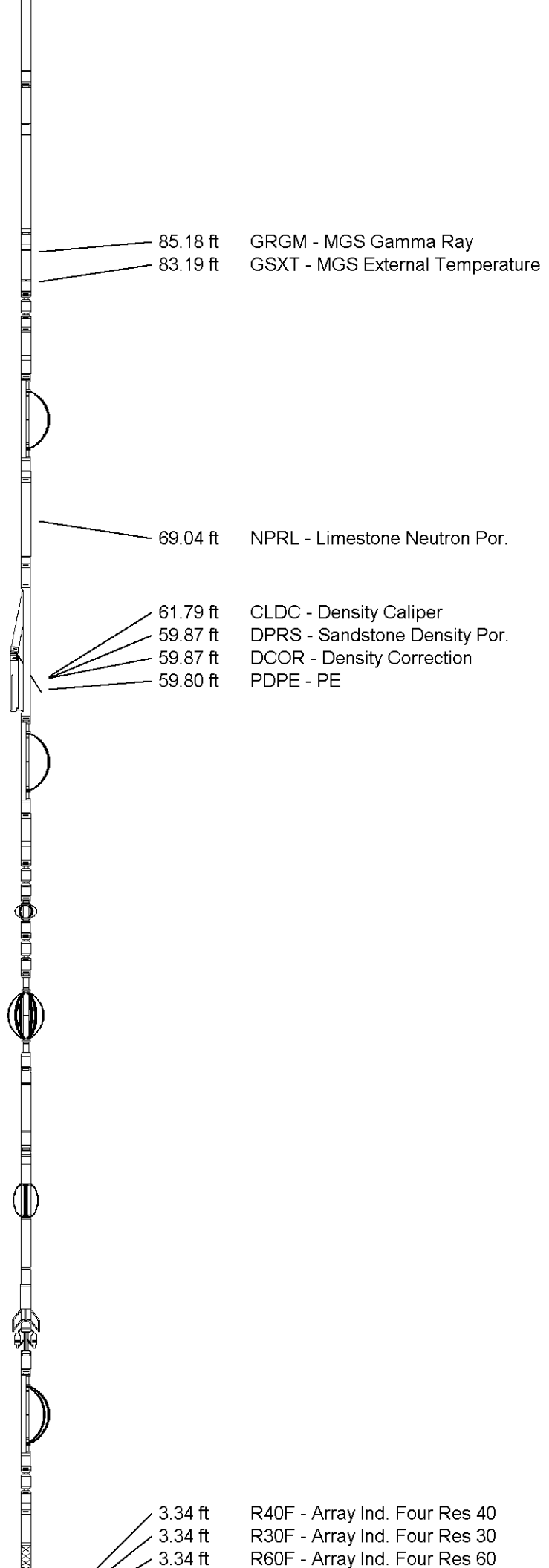
MIS-D.A 442 LG: 5.70 ft WT: 33.1 lb OD: 2.24 in

SKJ-D.A Compact Knuckle Joint

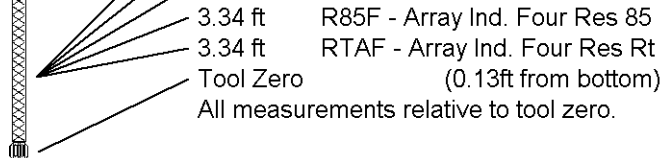
SKJ-D.A 66 LG: 2.17 ft WT: 24.3 lb OD: 2.24 in

Compact Induction

MAI-B.A 286 LG: 10.81 ft WT: 48.5 lb OD: 2.24 in



Total Length: 144.32 ft Weight: 906.1 lb



COMPANY ENCANA  
WELL HERREN 1A-33H  
FIELD WATTENBERG  
PROVINCE/COUNTY WELD  
COUNTRY/STATE U.S.A. / COLORADO

Elevation Kelly Bushing	4836.00	feet	First Reading	11622.00	feet
Elevation Drill Floor		feet	Depth Driller	11643.00	feet
Elevation Ground Level	4824.00	feet	Depth Logger	11643.00	feet



**Weatherford®**

ARRAY INDUCTION  
LOG

