



Weatherford

**COMPACT PHOTO DENSITY
COMPENSATED NEUTRON
MICRORESISTIVITY LOG**

COMPANY

SHAKESPEARE OIL CO., INC

WELL

OTTLEY 2-21

FIELD

CHALK BUTTES

PROVINCE/COUNTY LOGAN

COUNTRY/STATE USA / KANSAS

LOCATION 2050' FNL & 2490' FEL NW-SW-SW-NE

SEC 21 TWP 14S RGE 32W Other Services

Latitude 38.8249133 MAI/MFE

Longitude -100.8817901

API Number 15-109-21551

Permanent Datum GL, Elevation 2771 feet

Log Measured From KB, 12.00 feet above Permanent Datum

Drilling Measured From KB

Date 14-JUN-2018

Run Number ONE

Service Order 7055-216229097

Depth Driller 4511.00 feet

Depth Logger 4511.00 feet

First Reading 4490.00 feet

Last Reading 3511.00 feet

Casing Driller 267.00 feet

Casing Logger 266.00 feet

Bit Size 7.875 inches

Hole Fluid Type WBM

Density / Viscosity 9.40 lb/USg 59.00 sec/qt

PH / Fluid Loss 9.50 10.00 ml/30Min

Sample Source MUD TANK

Rm @ Measured Temp 0.60 @ 96.0 ohm-m

Rmf @ Measured Temp 0.48 @ 96.0 ohm-m

Rmc @ Measured Temp 0.72 @ 96.0 ohm-m

Source Rmf / Rmc CALC CALC

Rm @ BHT 0.50 @ 116.0 ohm-m

Time Since Circulation 5 HOURS

Max Recorded Temp 116.00 deg F

Equipment / Base 13096 LIB

Recorded By JUSTIN HICKS

Witnessed By WES HANSON

Elevations:
KB 2783.00 feet
DF 2781.00
GL 2771.00

BOREHOLE RECORD

Last Edited: 14-JUN-2018 22:07

Bit Size
inches

7.875

Depth From
feet

267.00

Depth To
feet

4511.00

CASING RECORD

Type

Size
inches

8.625

Depth From
feet

0.00

Shoe Depth
feet

267.00

Weight
pounds/ft

24.00

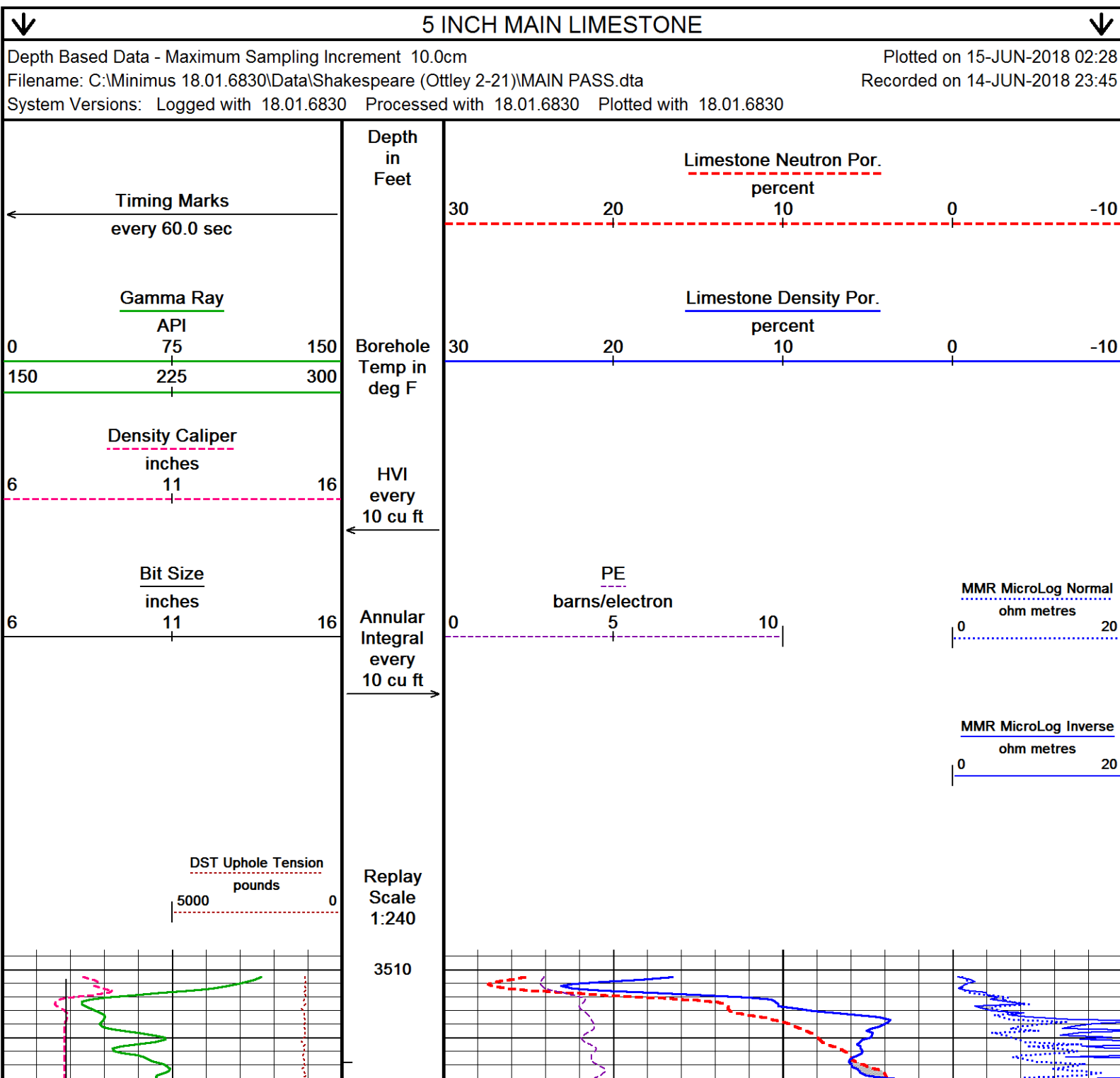
REMARKS

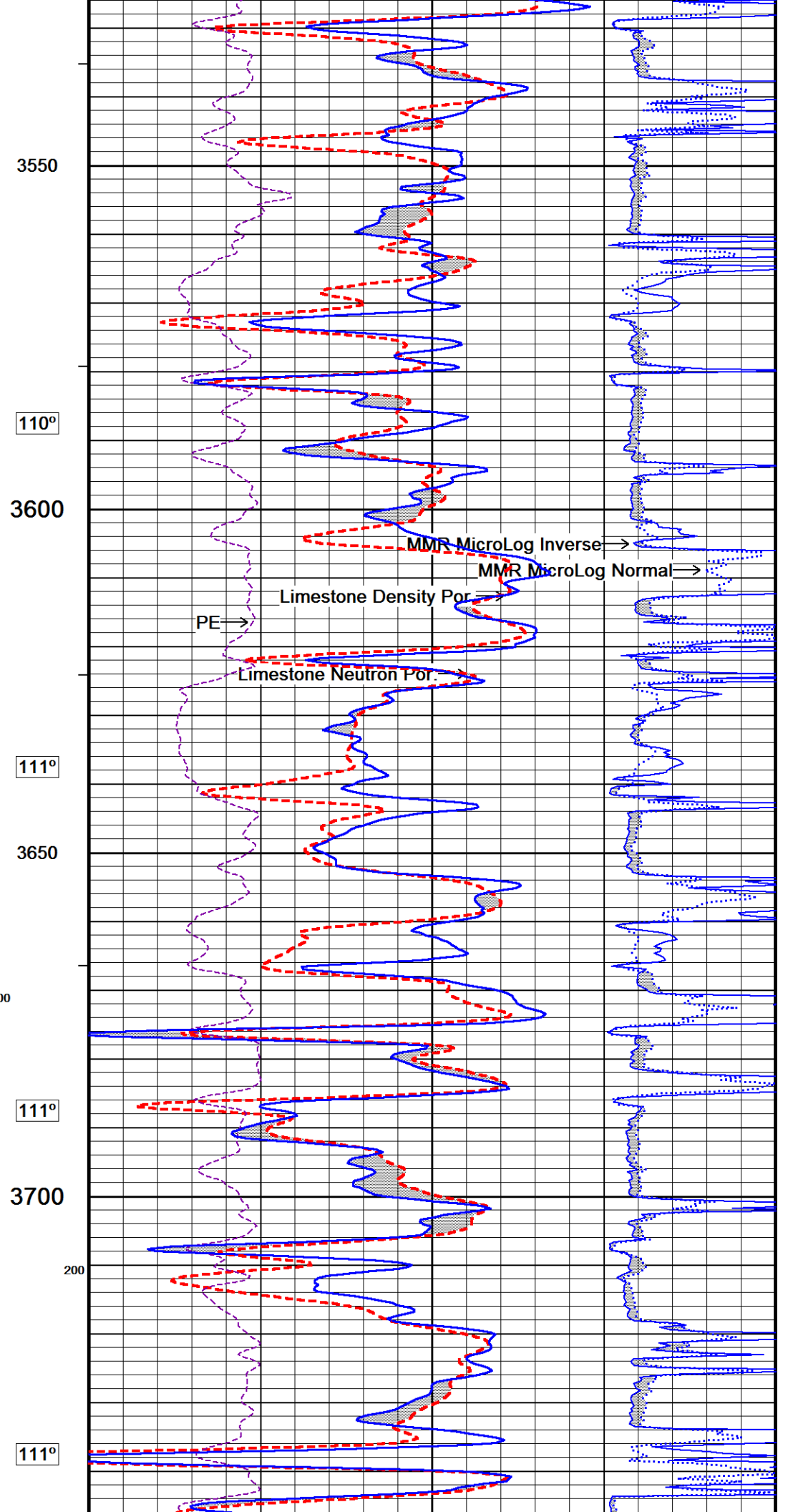
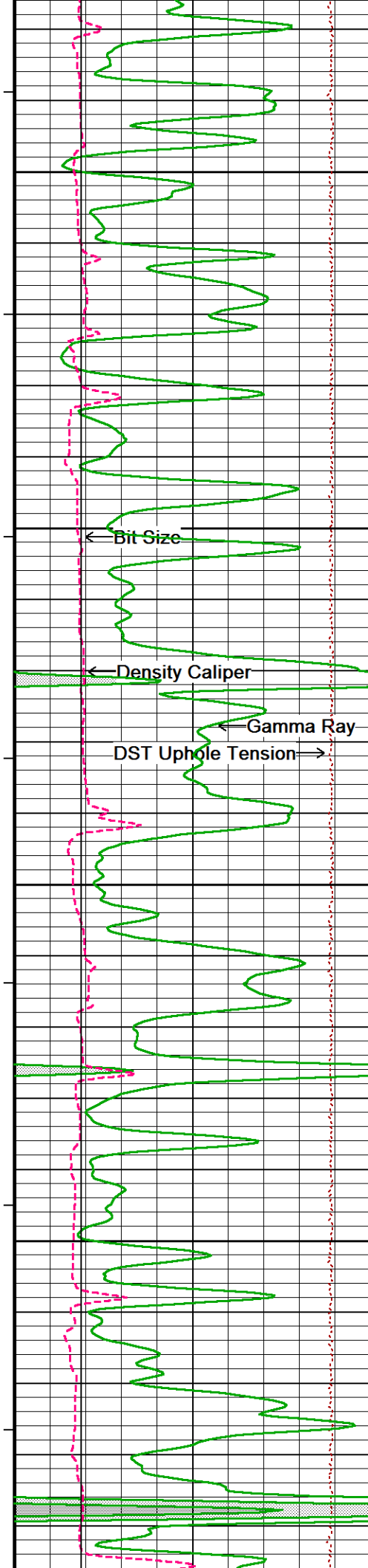
- RUN ONE: MCB, SHA, MCG, MML, MDN, MPD, SKJ, MFE, MSS, MAI RUN IN COMBINATION.
 - HARDWARE: DUAL BOWSPRING USED ON MDN.
 - 0.5 INCH STANDOFF USED ON MFE.
 - 0.5 INCH STANDOFF USED ON MAI.
- 2.71 G/CC LIMESTONE DENSITY MATRIX USED TO CALCULATE POROSITY.
- BOREHOLE RUGOSITY, TIGHT PULLS, AND WASHOUTS WILL AFFECT DATA QUALITY.
- ALL INTERVALS LOGGED AND SCALED PER CUSTOMER'S REQUEST.
- TOTAL HOLE VOLUME FROM TD TO SURFACE CASING: 1730 CU.FT.
- ANNULAR HOLE VOLUME WITH 4.5 INCH PRODUCTION CASING FROM TD TO SURFACE CASING: 1262 CU.FT.
- RIG: DUKE #1.

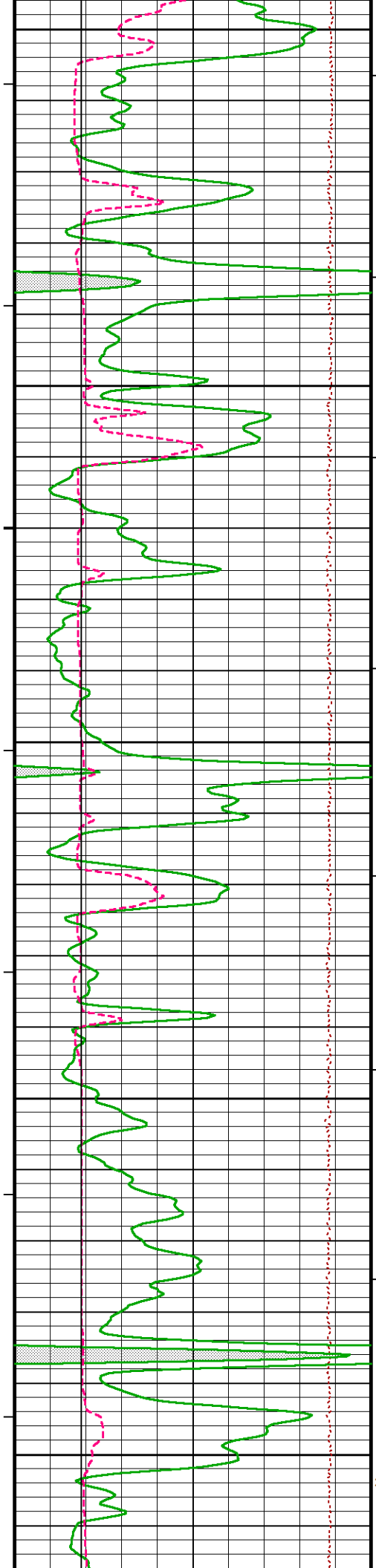
- ENGINEER: J. HICKS.

- OPERATOR: B. TOVAR, B. COPELAND.

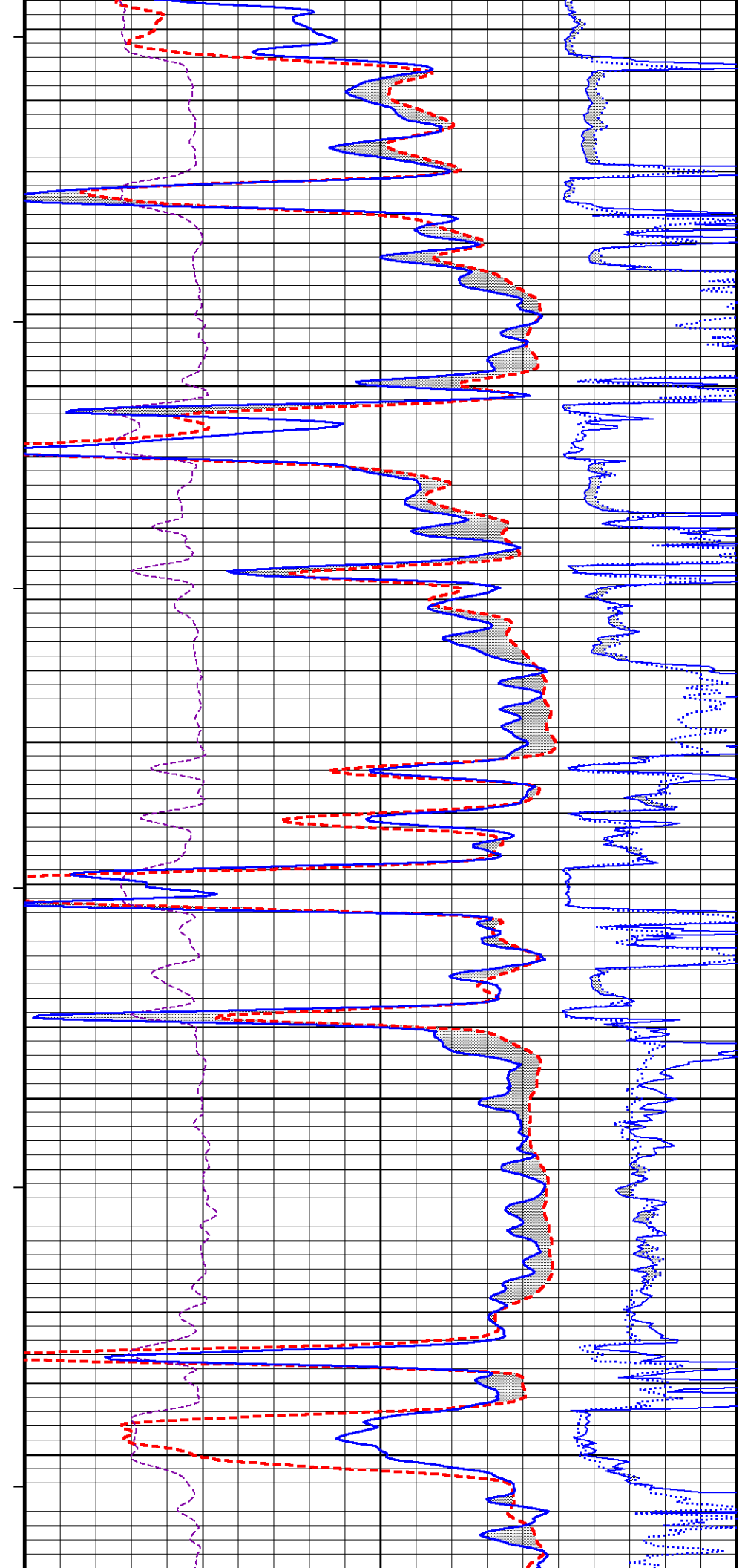
In interpreting, communicating or providing information and/or making recommendations, either written or oral, as to logs or test or other data, type or amount of material, or Work or other service to be furnished, or manner of performance, or in predicting results to be obtained, the Contractor will give the Company the benefit of the Contractor's best judgment based on its experience and will perform all such Work in a good and workmanlike manner. Any interpretation of test or other data, and any recommendation or reservoir description based upon such interpretations, are opinions based upon inferences from measurements and empirical relationships and assumptions, which inferences and assumptions are not infallible, and with respect to which professional engineers and analysts may differ. ACCORDINGLY ANY INTERPRETATION OR RECOMMENDATION RESULTING FROM THE SERVICES WILL BE AT THE SOLE RISK OF THE COMPANY, AND THE CONTRACTOR CANNOT AND DOES NOT WARRANT THE ACCURACY, CORRECTNESS OR COMPLETENESS OF ANY SUCH INTERPRETATION OR RECOMMENDATION, WHICH INTERPRETATIONS AND RECOMMENDATIONS SHOULD NOT, THEREFORE, UNDER ANY CIRCUMSTANCES BE RELIED UPON AS THE SOLE OR MAIN BASIS FOR ANY DRILLING, COMPLETION, WELL TREATMENT, PRODUCTION OR FINANCIAL DECISION, OR ANY PROCEDURE INVOLVING ANY RISK TO THE SAFETY OF ANY DRILLING ACTIVITY, DRILLING RIG OR ITS CREW OR ANY OTHER INDIVIDUAL. THE COMPANY HAS FULL RESPONSIBILITY FOR ALL DECISIONS CONCERNING THE SERVICES.

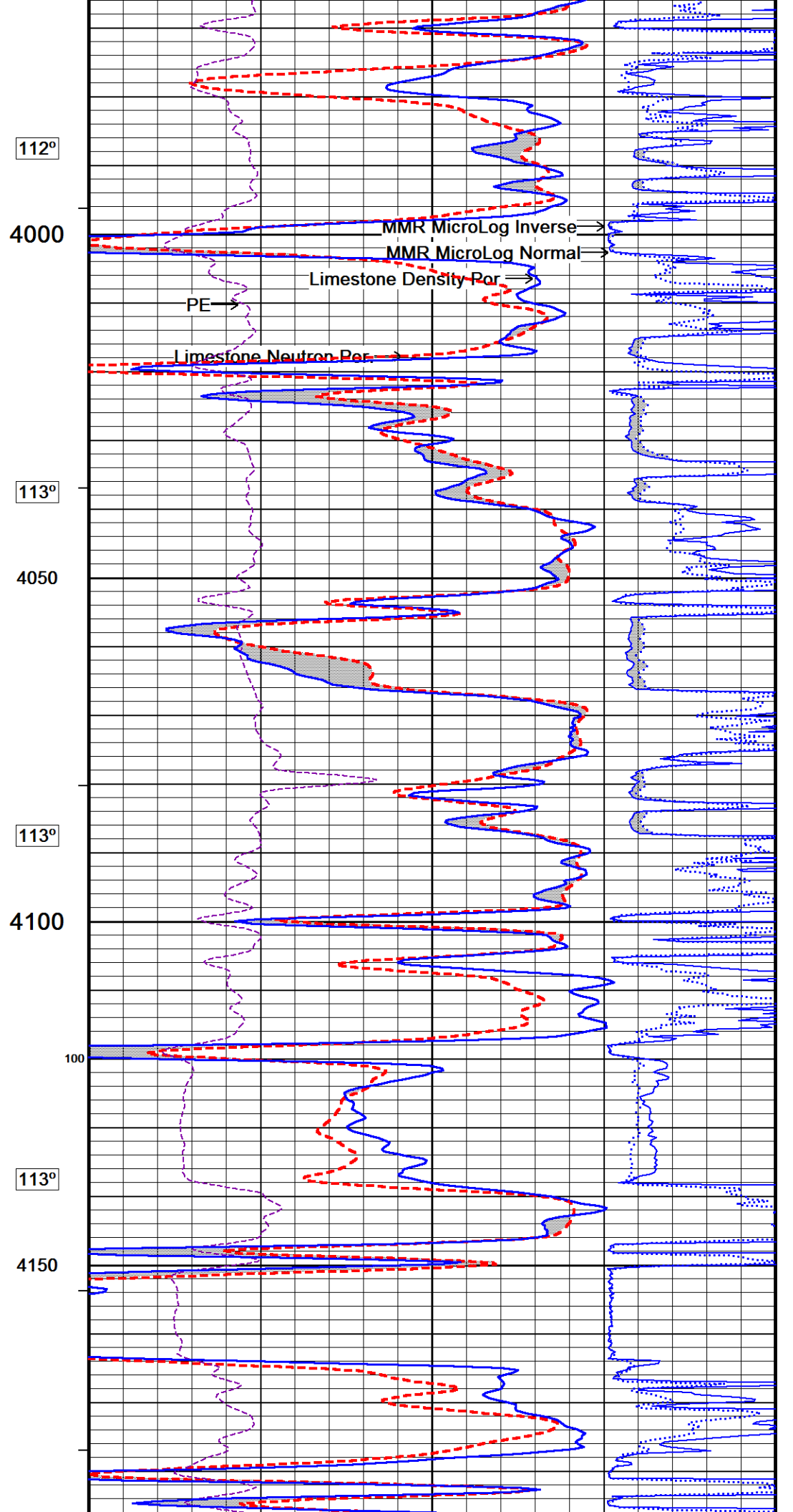
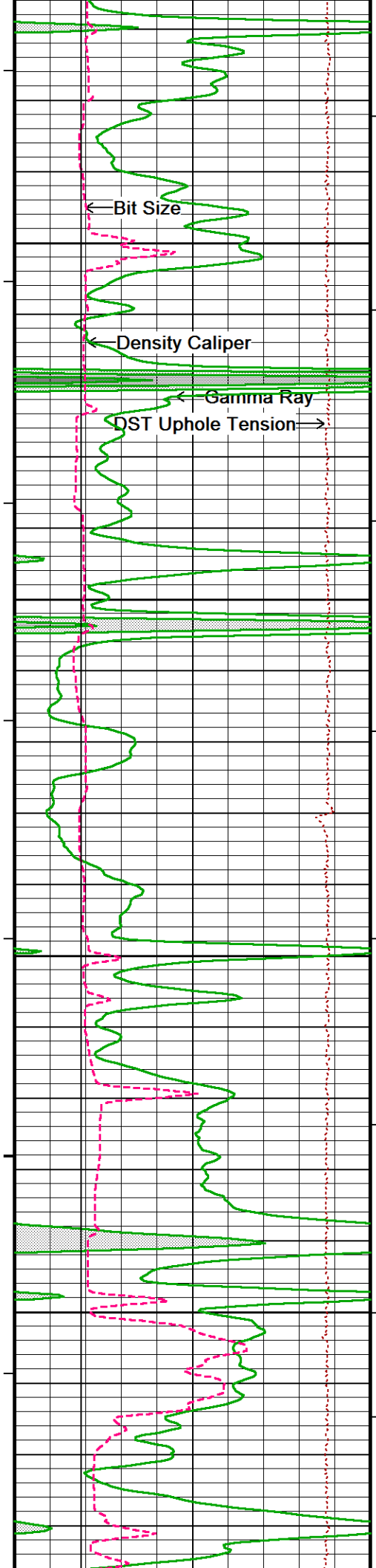


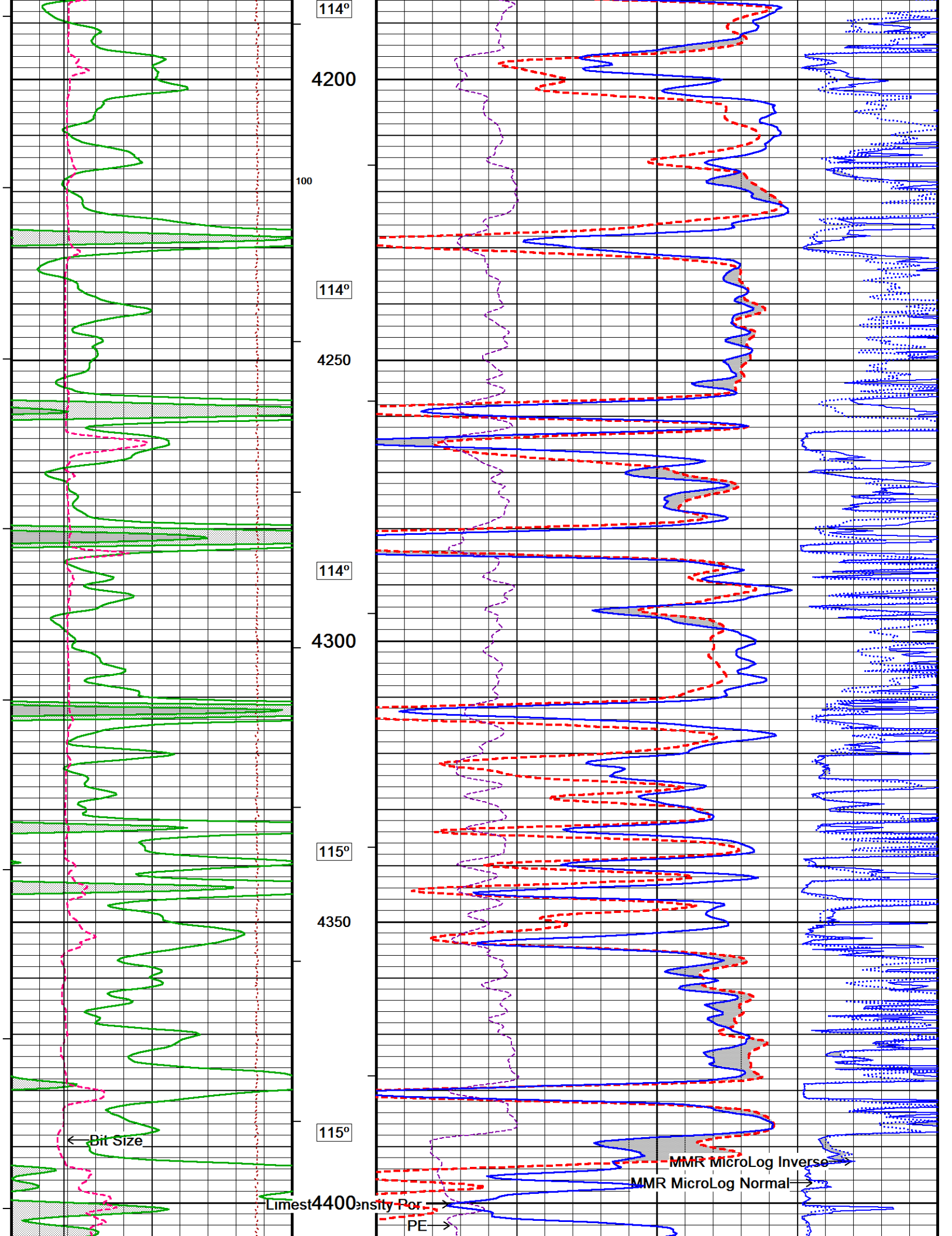


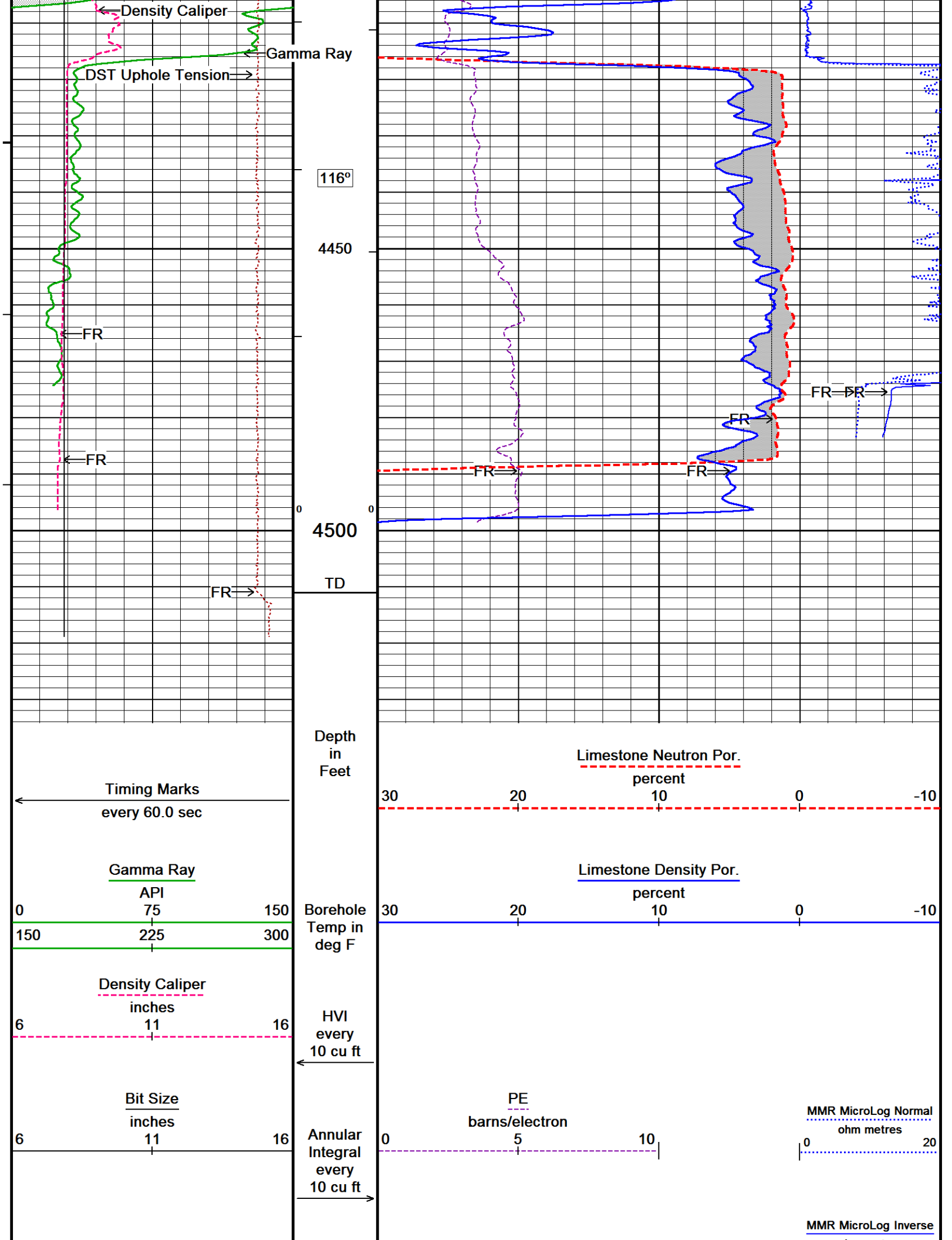


3750
111°
3800
112°
3850
112°
3900
112°
3950
200











Depth Based Data - Maximum Sampling Increment 10.0cm

Plotted on 15-JUN-2018 02:28

Filename: C:\Minimus 18.01.6830\Data\Shakespeare (Ottley 2-21)\MAIN PASS.dta

Recorded on 14-JUN-2018 23:45

System Versions: Logged with 18.01.6830 Processed with 18.01.6830 Plotted with 18.01.6830

5 INCH MAIN LIMESTONE

REPEAT SECTION

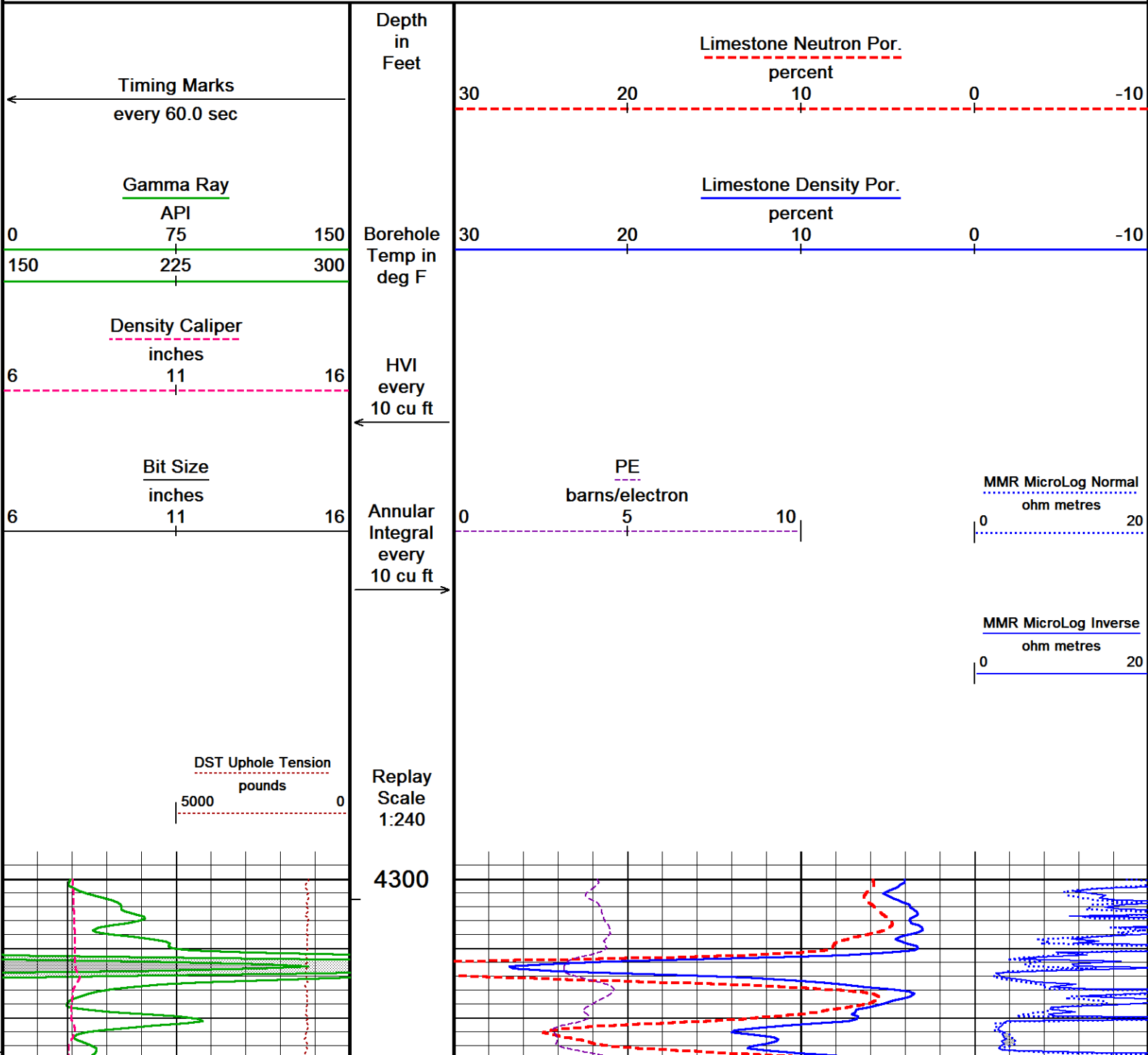
Depth Based Data - Maximum Sampling Increment 10.0cm

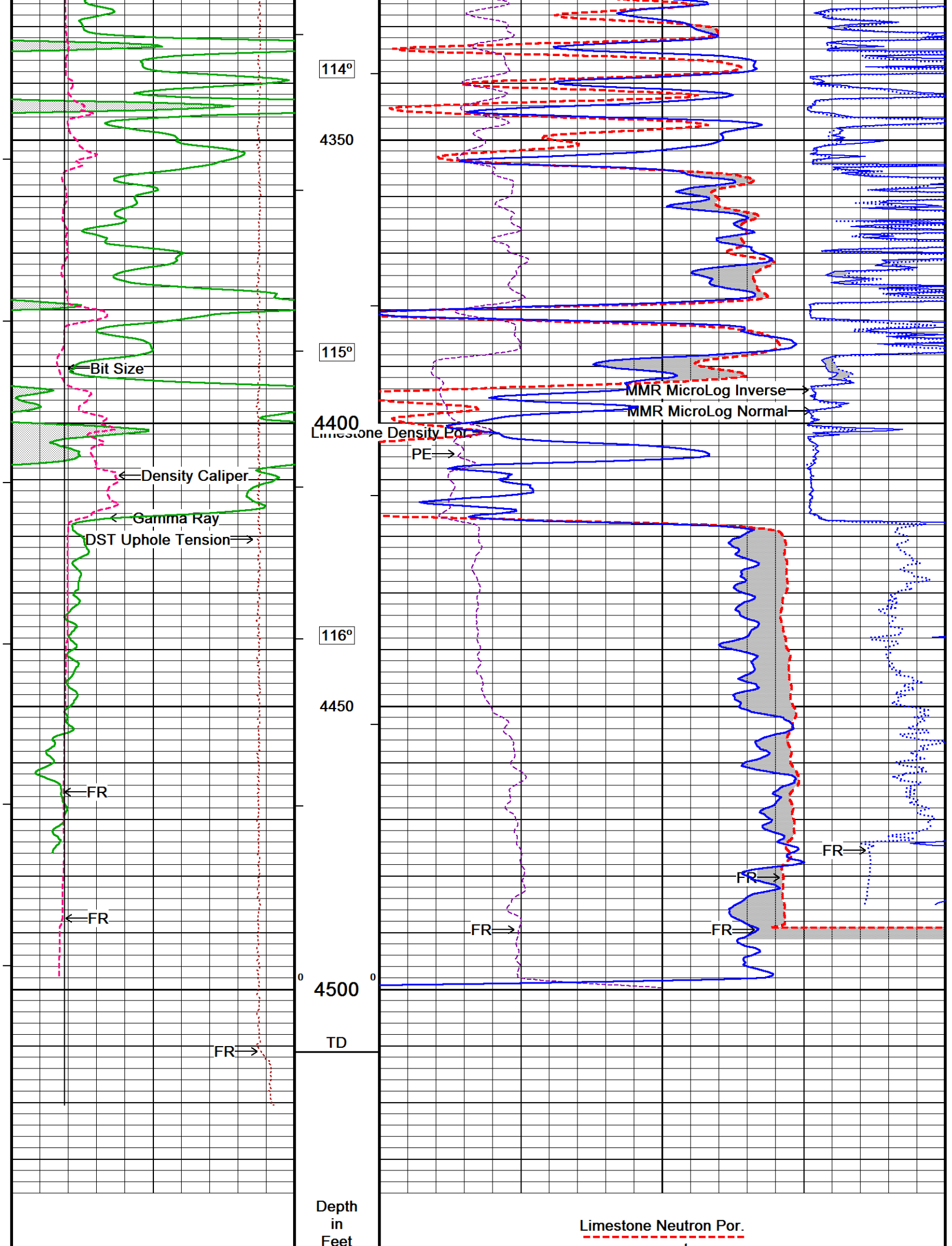
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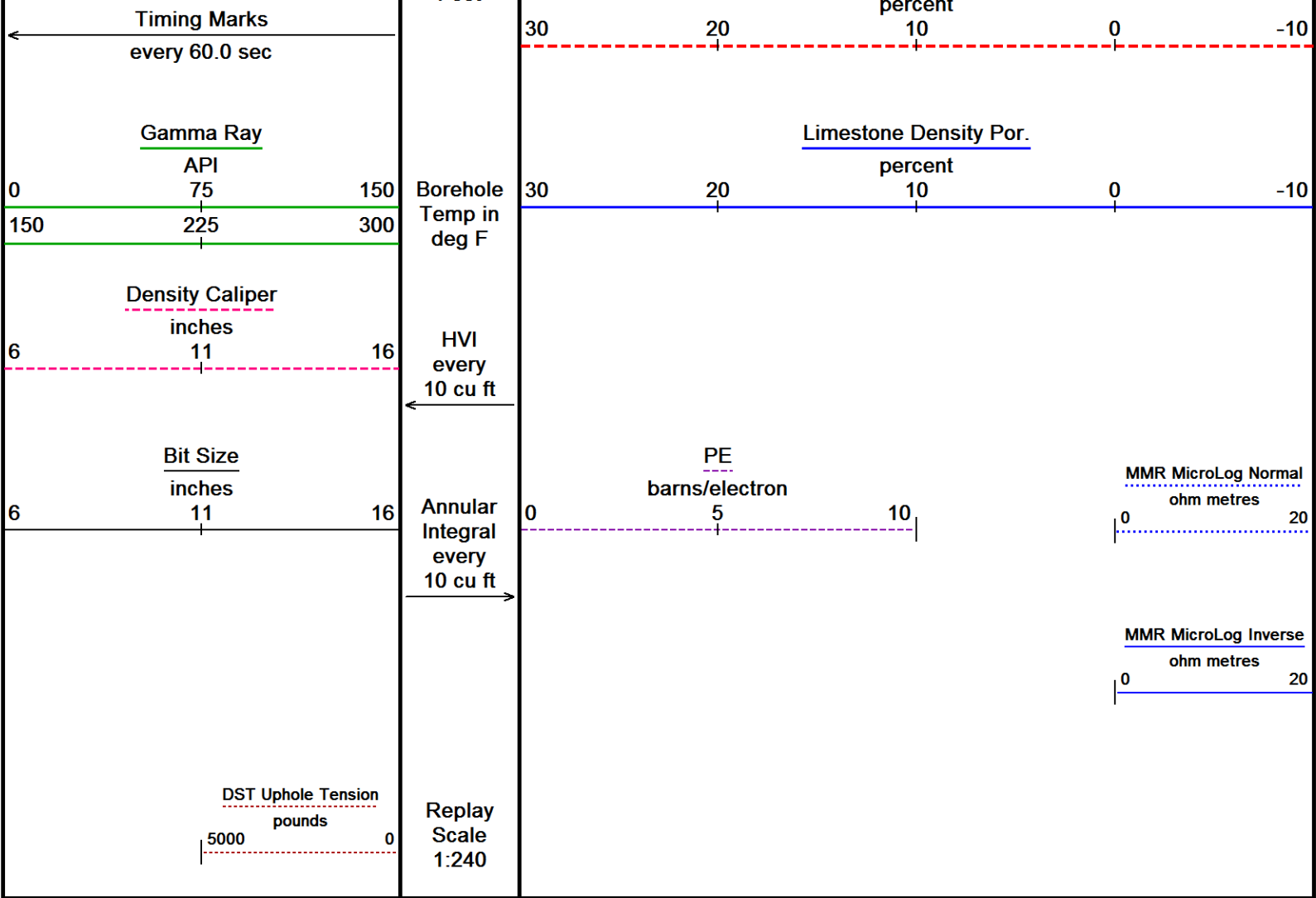
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Recorded on 14-JUN-2018 23:30

System Versions: Logged with 18.01.6830 Processed with 18.01.6830 Plotted with 18.01.6830







Depth Based Data - Maximum Sampling Increment 10.0cm

Plotted on 15-JUN-2018 02:28

Filename: C:\Minimus 18.01.6830\Data\Shakespeare (Ottley 2-21)\REPEAT PASS.dta

Recorded on 14-JUN-2018 23:30

System Versions: Logged with 18.01.6830 Processed with 18.01.6830 Plotted with 18.01.6830

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REPEAT SECTION

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5 INCH MAIN BULK DENSITY LIMESTONE

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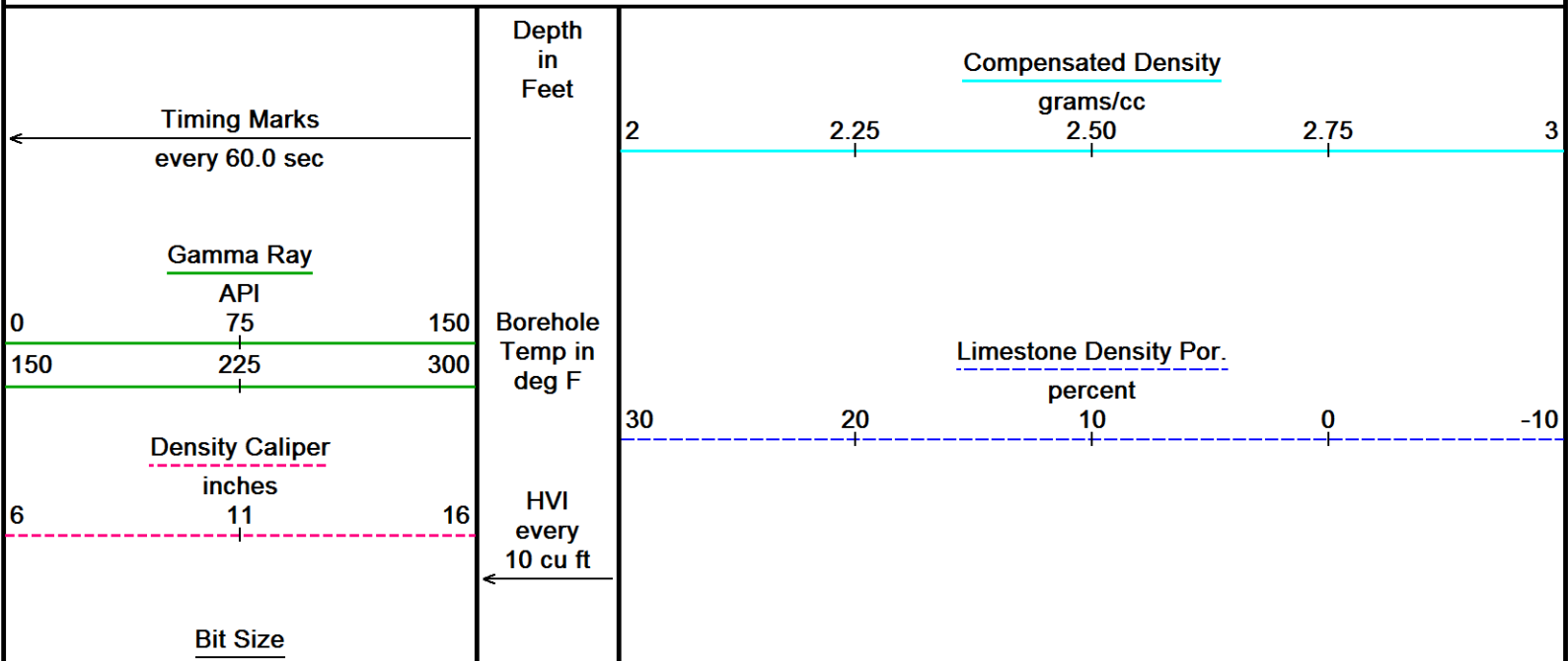
Depth Based Data - Maximum Sampling Increment 10.0cm

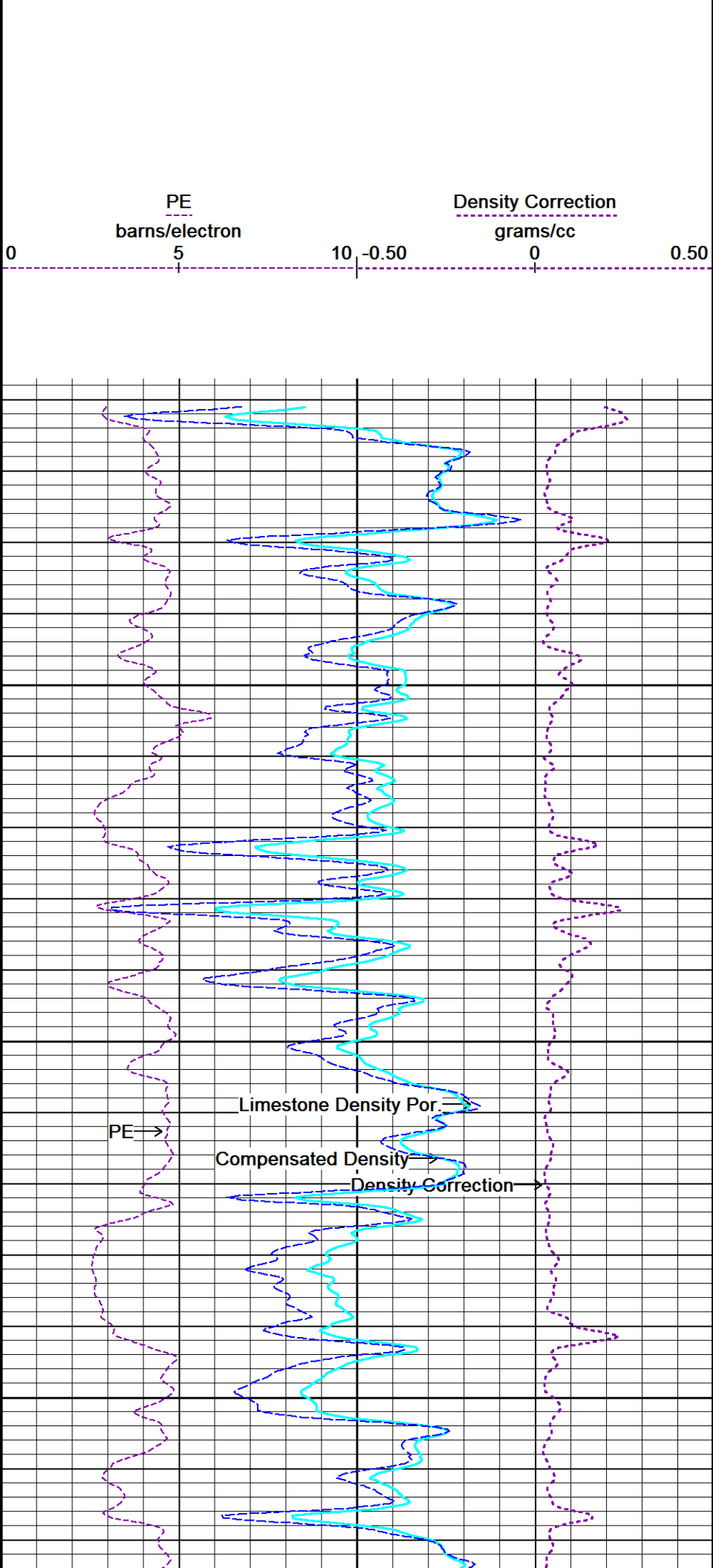
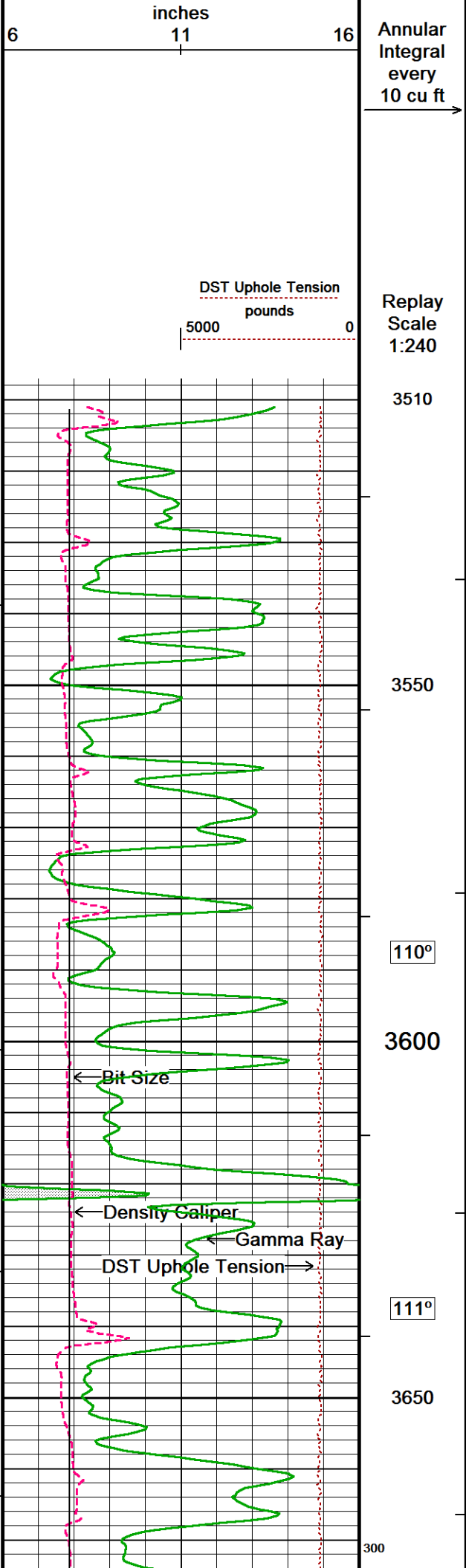
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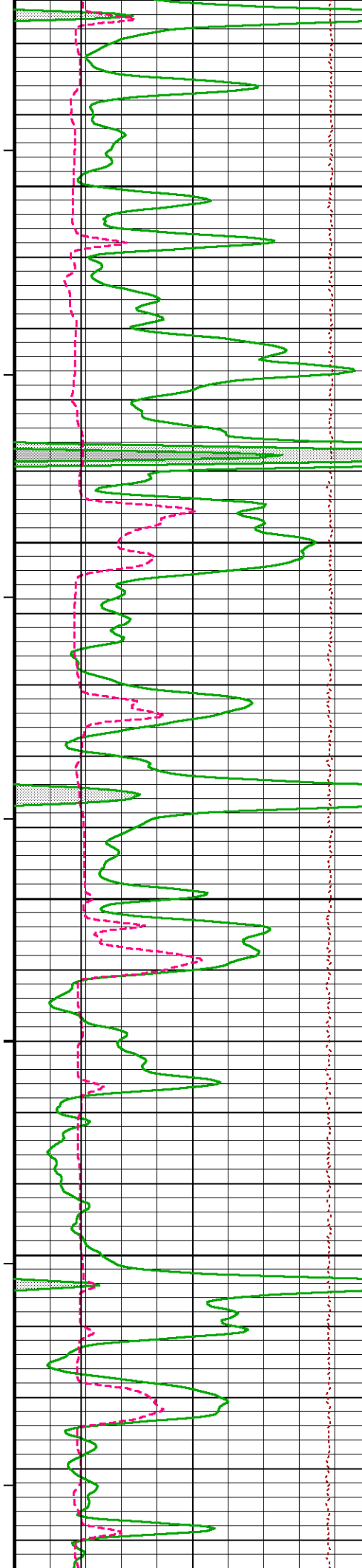
Filename: C:\Minimus 18.01.6830\Data\Shakespeare (Ottley 2-21)\MAIN PASS.dta

Recorded on 14-JUN-2018 23:45

System Versions: Logged with 18.01.6830 Processed with 18.01.6830 Plotted with 18.01.6830







111°

3700

200

111°

3750

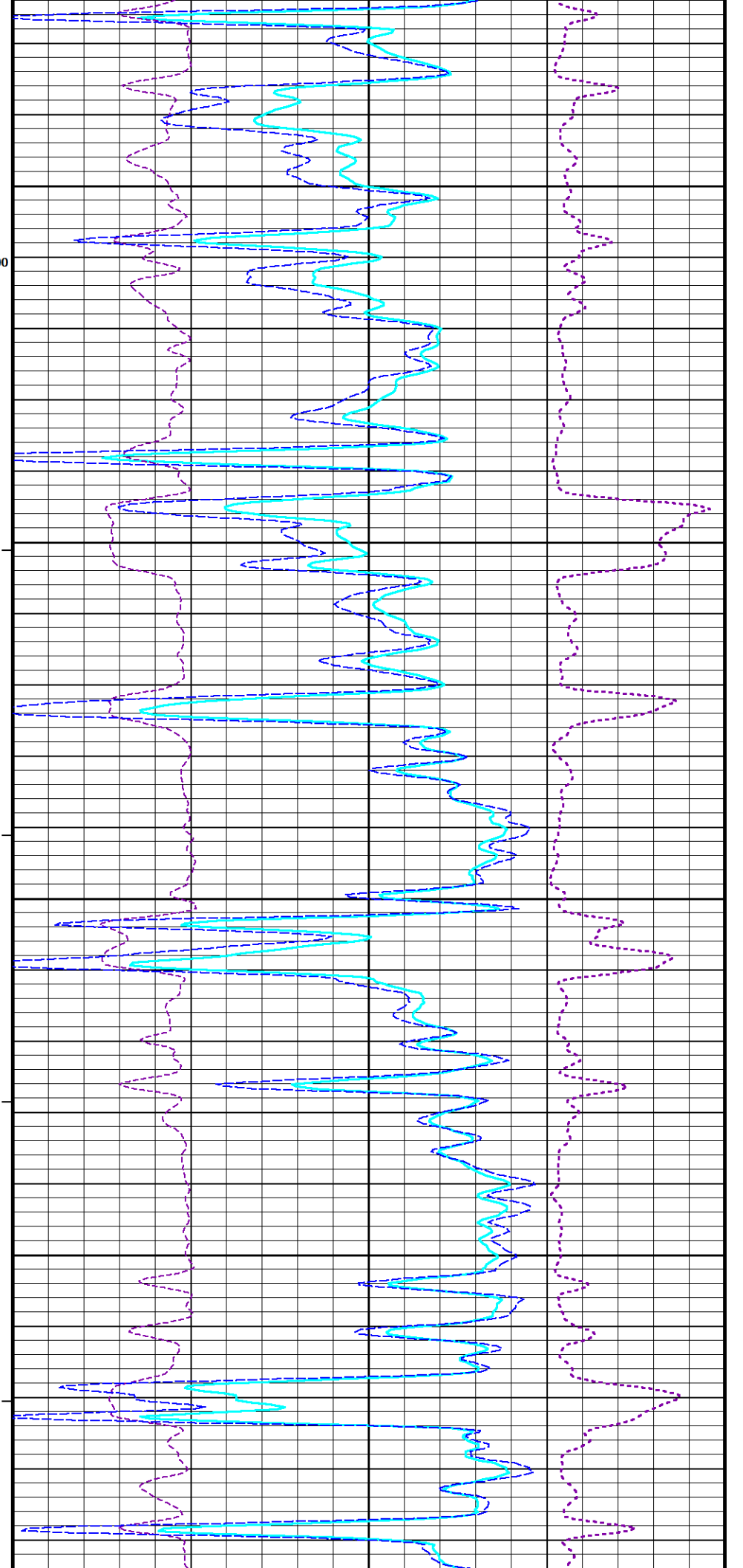
111°

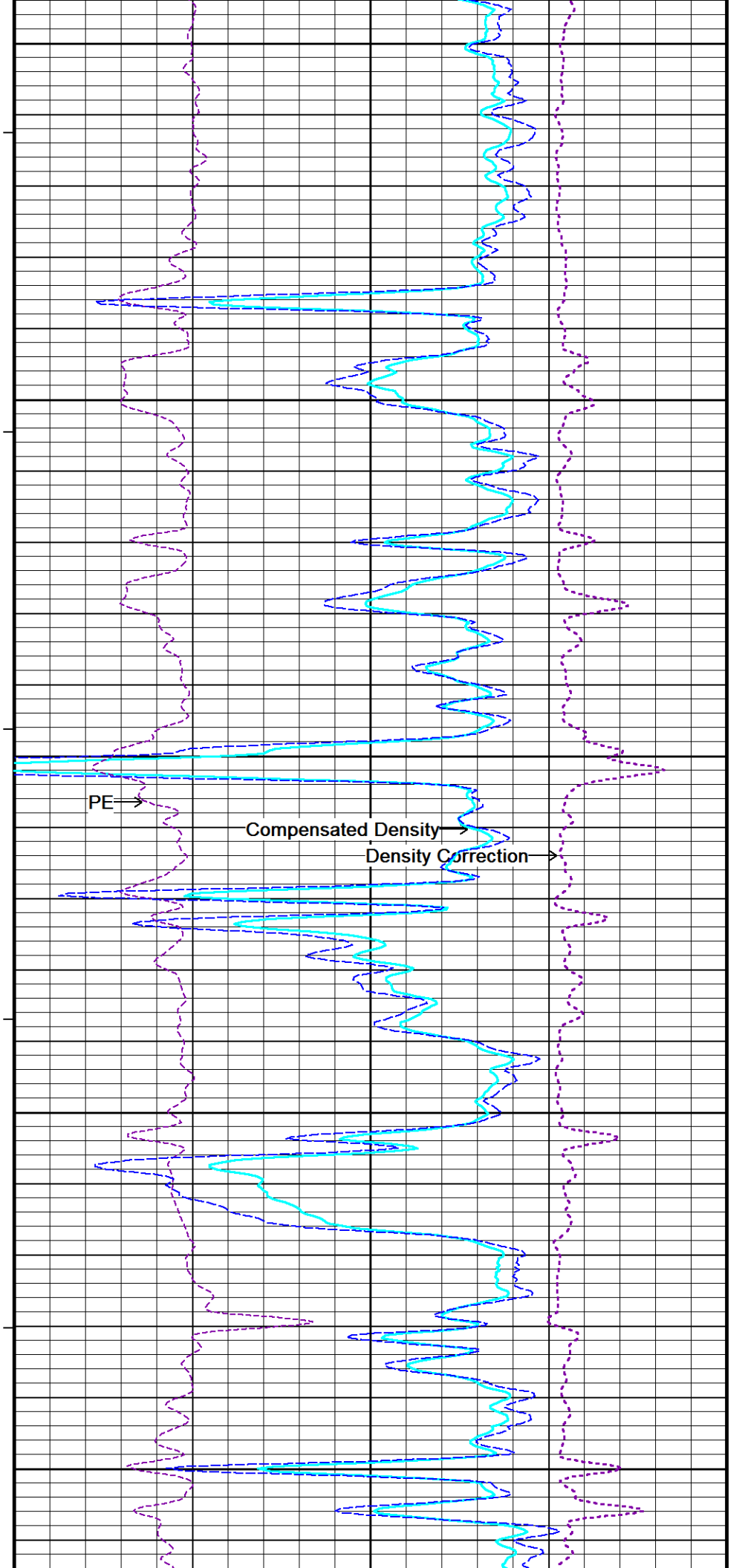
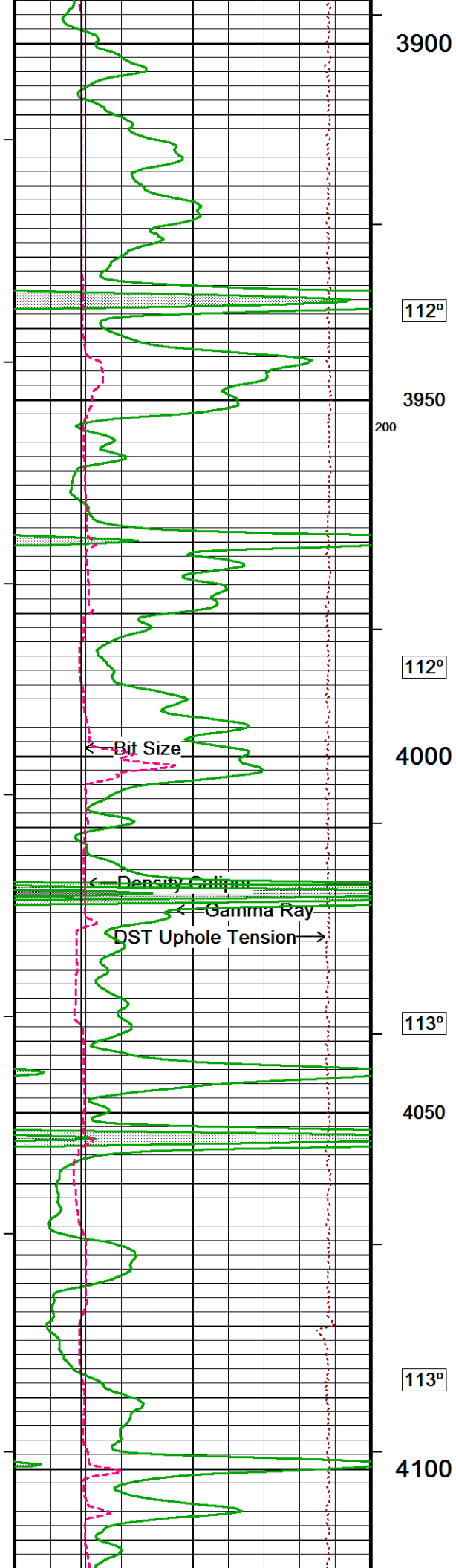
3800

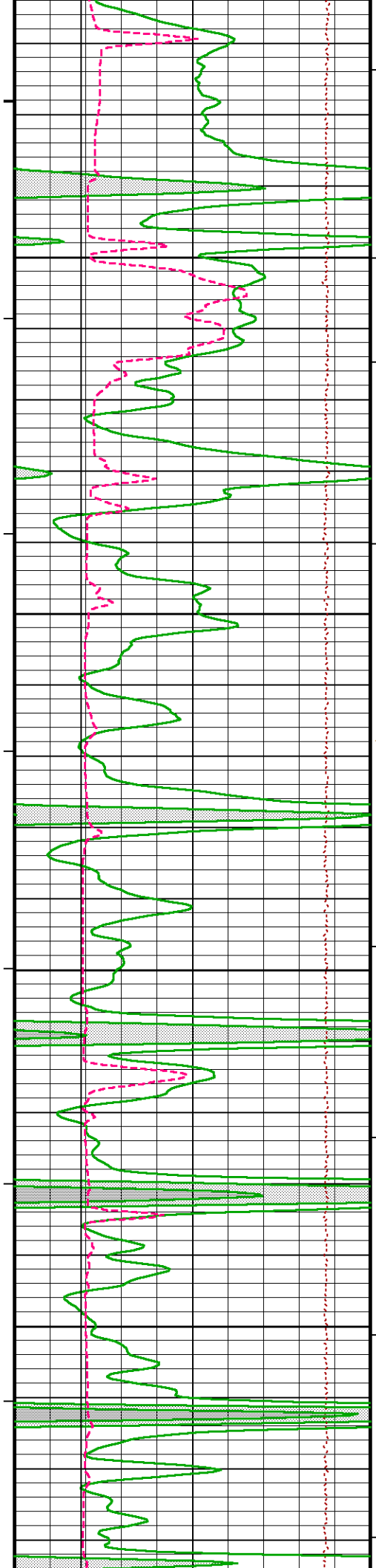
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3850

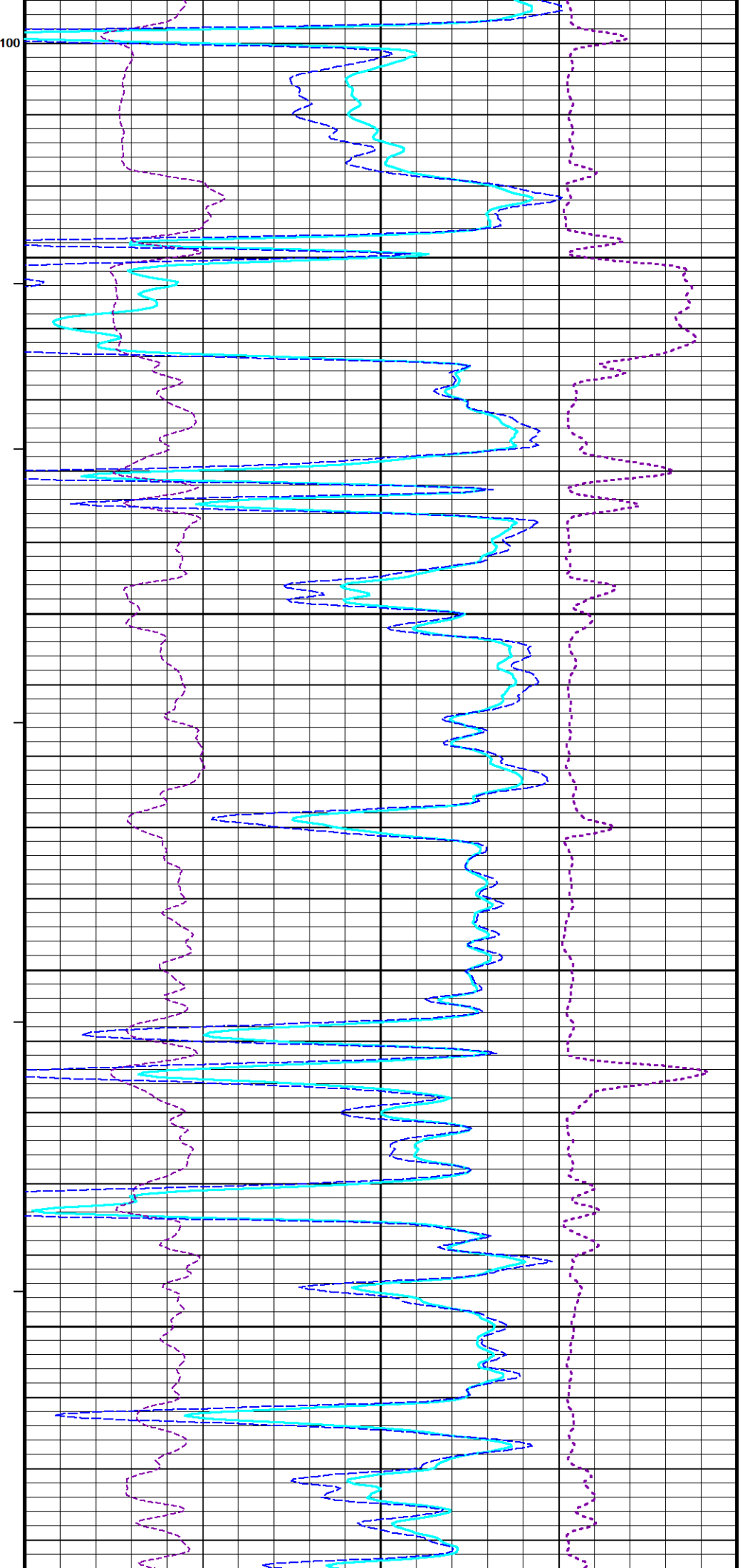
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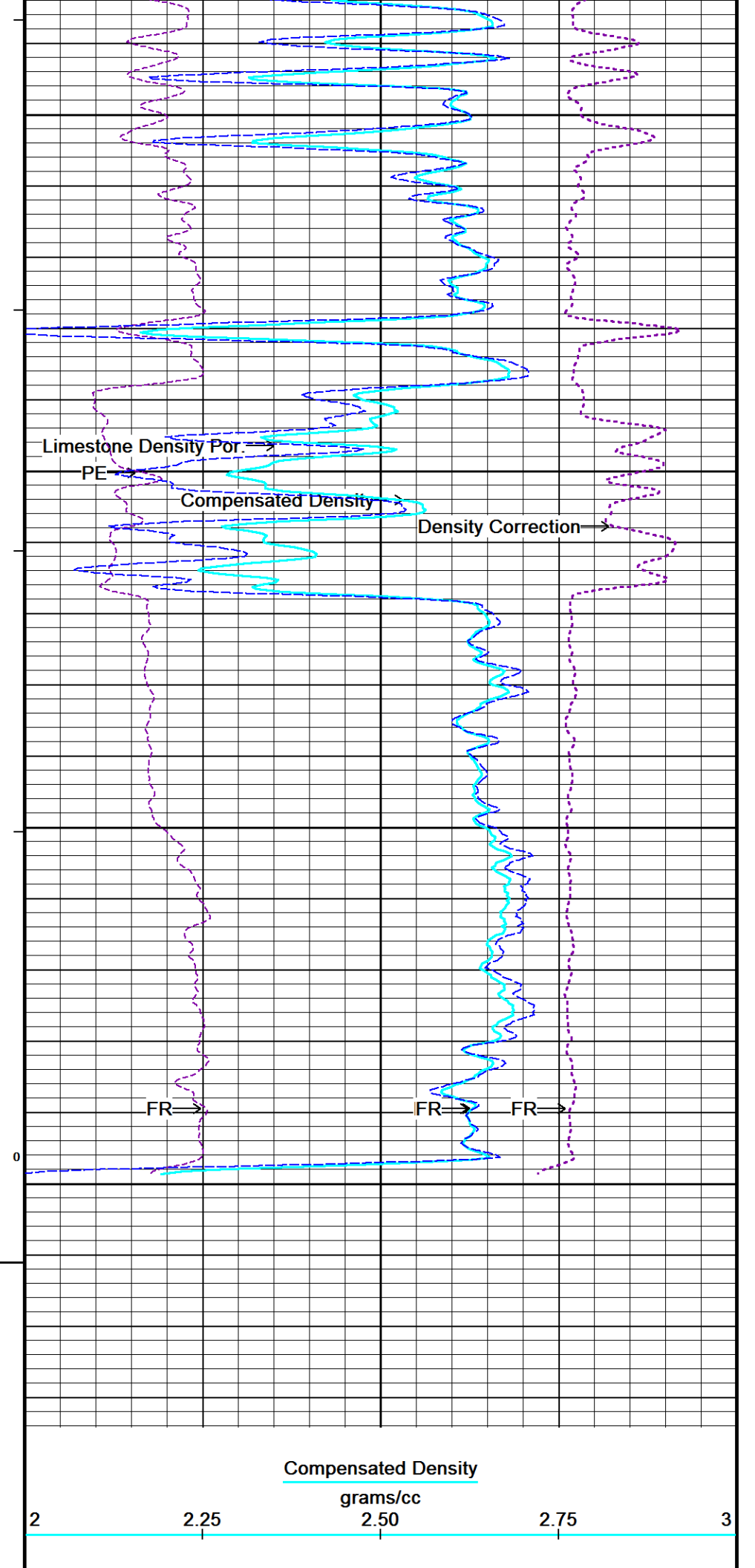
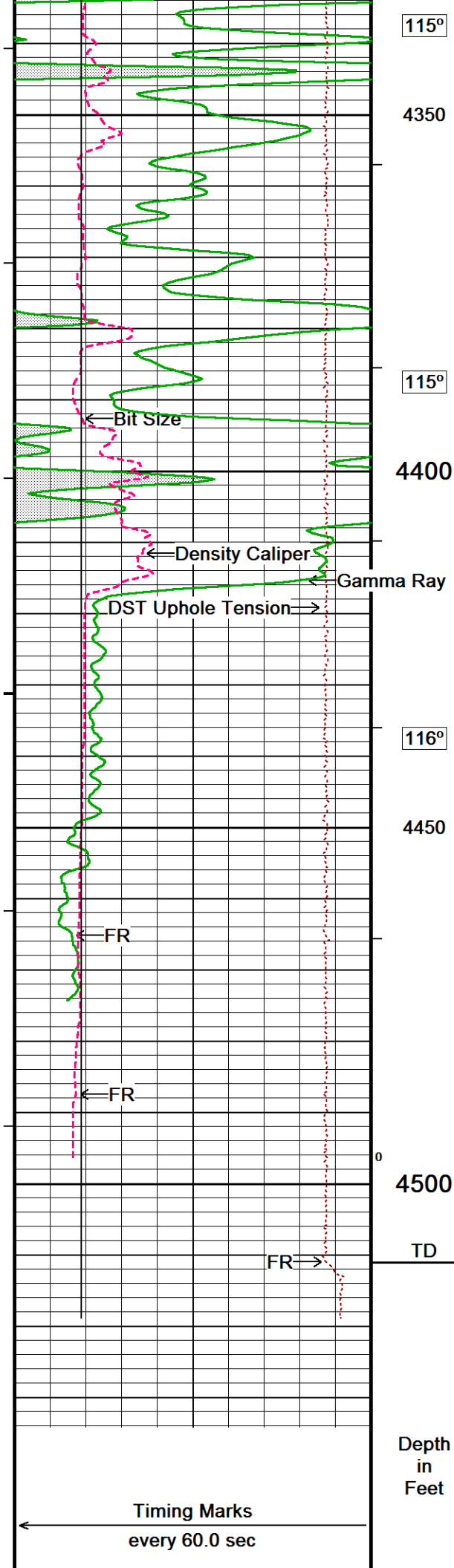


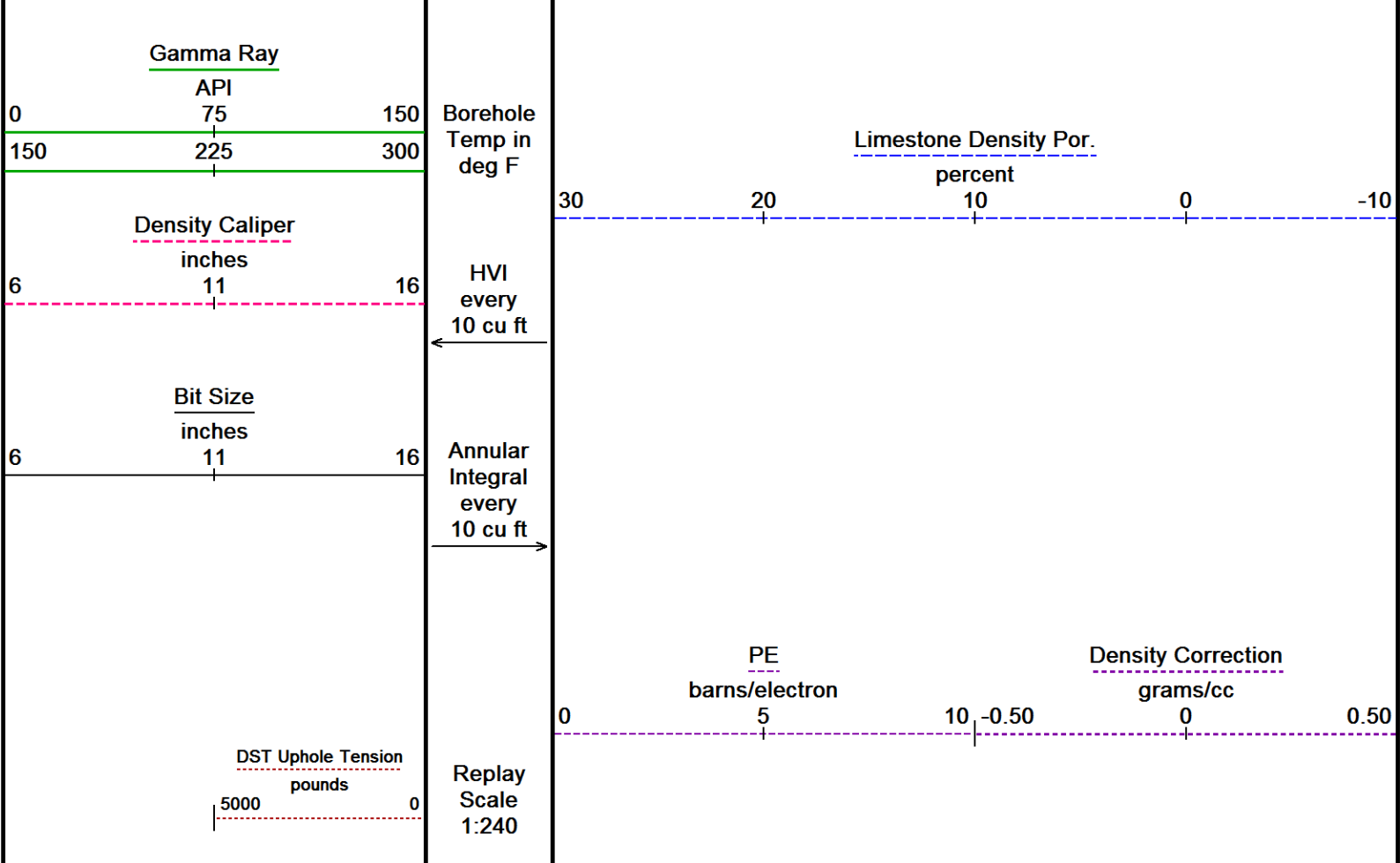




113°
4150
114°
4200
100
114°
4250
114°
4300



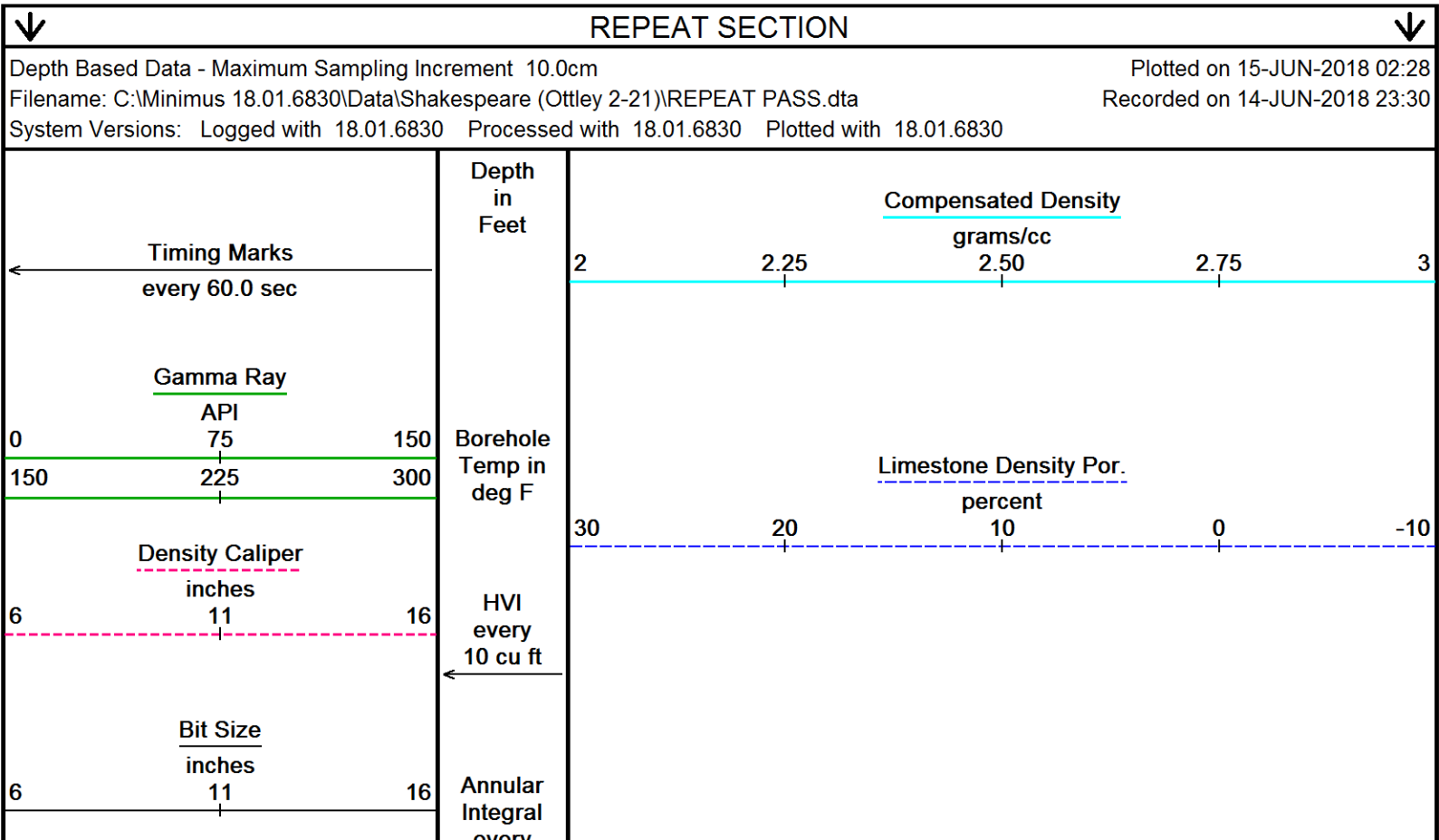


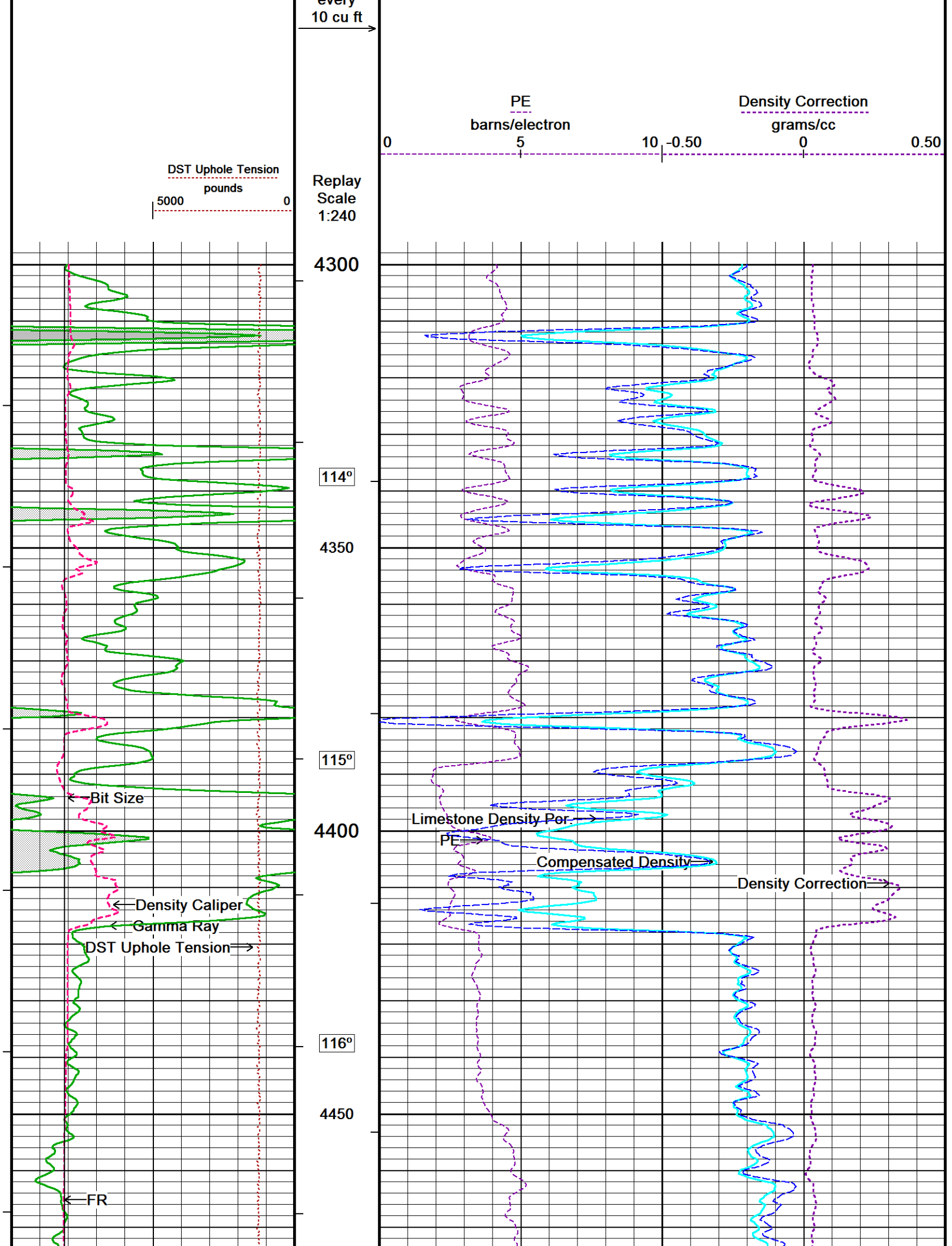


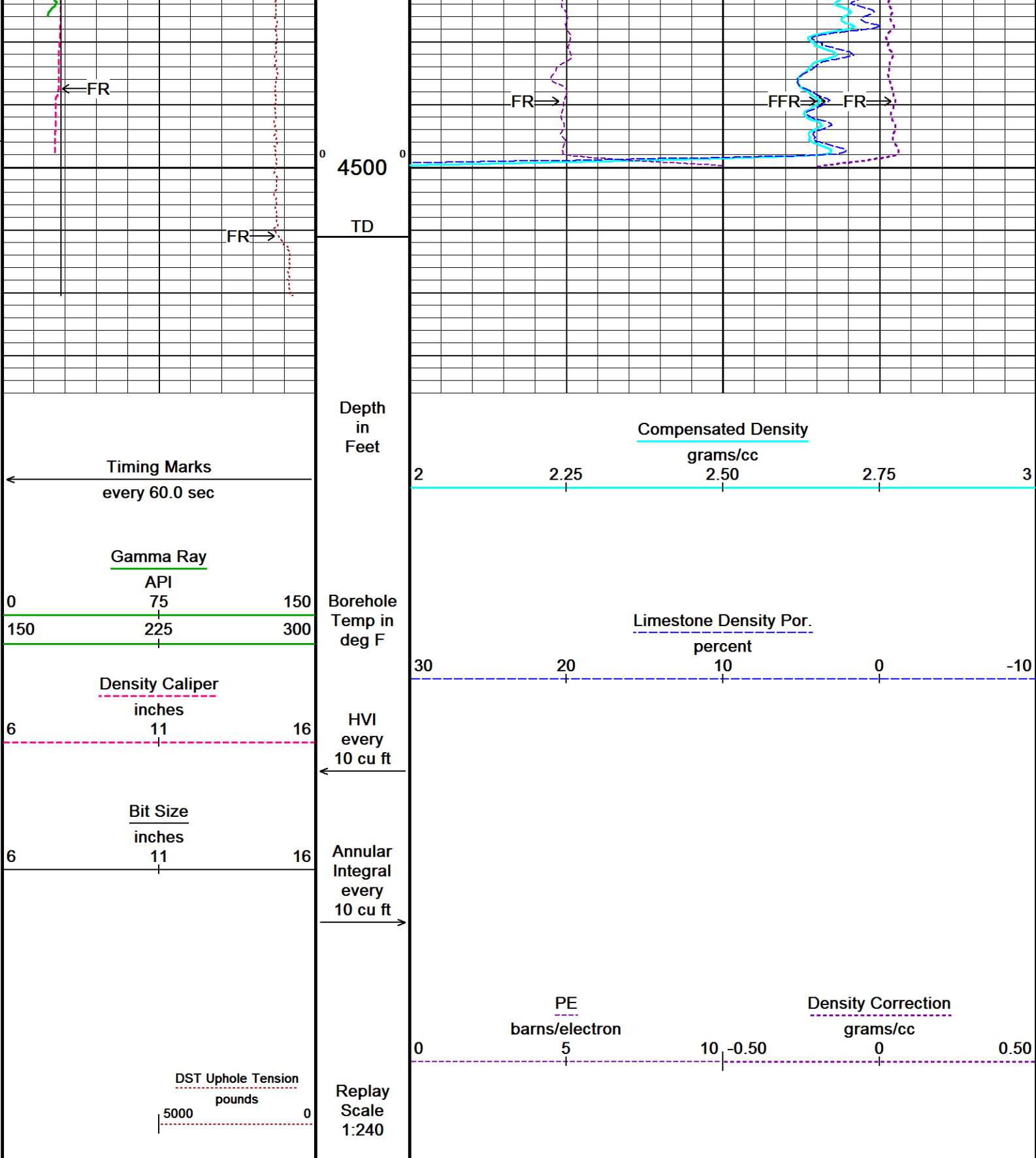
Depth Based Data - Maximum Sampling Increment 10.0cm
Filename: C:\Minimus 18.01.6830\Data\Shakespeare (Ottley 2-21)\MAIN PASS.dta
System Versions: Logged with 18.01.6830 Processed with 18.01.6830 Plotted with 18.01.6830

Plotted on 15-JUN-2018 02:28
Recorded on 14-JUN-2018 23:45

5 INCH MAIN BULK DENSITY LIMESTONE







Depth Based Data - Maximum Sampling Increment 10.0cm

Filename: C:\Minimus 18.01.6830\Data\Shakespeare (Ottley 2-21)\REPEAT PASS.dta

System Versions: Logged with 18.01.6830 Processed with 18.01.6830 Plotted with 18.01.6830

Plotted on 15-JUN-2018 02:28

Recorded on 14-JUN-2018 23:30

REPEAT SECTION

BEFORE SURVEY CALIBRATION

C:\Minimus 18.01.6830\Data\Shakespeare (Ottley 2-21)\MAIN PASS.dta

General Constants All 000

Last Edited on 15-JUN-2018 01:35

General Parameters			
Mud Resistivity	0.600	ohm-metres	
Mud Resistivity Temperature	96.000	degrees F	
Water Level	0.000	feet	
Borehole Fluid Processing	Wet Hole		
Hole/Annular Volume and Differential Caliper Parameters			
HVOL Method	Single Caliper		
HVOL Caliper 1	Density Caliper		
HVOL Caliper 2	N/A		
Annular Volume Diameter	4.500	inches	
Caliper for Differential Caliper	Density Caliper		
Rwa Parameters			
Porosity used	Crossplot Porosity		
Resistivity used	Array Ind. Two Res Rt		
RWA Constant A	0.620		
RWA Constant M	2.150		
SW/APOR Tool Source	0.000		

Down-hole Tension Calibration SMS 0			Field Calibration on 14-JUN-2018 22:36
Reading No	Measured	Calibrated (lbs)	
1	15468.14	0.00	
2	16556.59	454.20	

Gamma Calibration MCG-D.A 246			Field Calibration on 11-JUN-2018 15:07
	Measured	Calibrated (API)	
Background	75	51	
Calibrator (Gross)	743	507	
Calibrator (Net)	668	456	

Gamma Calibration Tolerances MCG-D.A 246			
Ratio	1.465	1.40 1.475 1.55	Counts/API

Gamma Constants MCG-D.A 246			Last Edited on 14-JUN-2018,22:06
Gamma Calibrator Number	MCGGRCC141		
GRC-M Calibrator Jig in Use?	NO		
Inactive Background Jig in Use?	NO		
Mud Density	1.13	gm/cc	
Caliper Source for Processing	Density Caliper		
Tool Position	Eccentred		
Potassium Equivalence	Chloride		
K Mud Concentration	0.00	%	

High Resolution Temperature Calibration MCG-D.A 246			Field Calibration on 07-JUN-2018,10:42
	Measured	Calibrated(Deg F)	
Lower	50.00	50.00	
Upper	212.00	212.00	

High Resolution Temperature Constants MCG-D.A 246			Last Edited on 07-JUN-2018,10:42
Pre-filter Length	11		

SP Calibration MCG-D.A 246			Field Calibration on 07-JUN-2018 11:07
	Measured	Calibrated (mV)	
Reference 1	103.5	100.0	
Reference 2	-96.9	-100.1	

Micro Normal and Micro Inverse Calibration MMR-B.A 91			Base Calibration on 07-JUN-2018 13:43
	Resistor 1 (ohm)	Resistor 2 (ohm)	Field Check on 11-JUN-2018 15:37
	10.0	50.0	
Base Calibration			
	Measured	Calibrated (ohm-m)	
Micro Normal	10.2 49.8	5.1 25.6	
Micro Inverse	9.9 49.4	3.4 16.9	

Micro Normal & Micro Inverse Calibration Tolerance MMR-B.A 91									
Micro Normal Res. 1	10.2	-5% 10.0 +5%	ohm	Micro Normal Res. 2	49.8	-5% 50.0 +5%	ohm		
Micro Inverse Res. 1	9.9	-5% 10.0 +5%	ohm	Micro Inverse Res. 2	49.4	-5% 50.0 +5%	ohm		
Micro Normal Base Check	93.9	-2% 93.39 +2%	ohm-m						
Micro Inverse Base Check	62.3	-2% 62.26 +2%	ohm-m						
Micro Normal Field Check	93.9	-2% 93.9 +2%	ohm-m						
Micro Inverse Field Check	62.3	-2% 62.3 +2%	ohm-m						

Caliper Calibration MMR-B.A 91		Base Calibration on 07-JUN-2018 13:30 Field Calibration on 11-JUN-2018 15:36	
Base Calibration			
Reading No	Measured	Calibrator Size (in)	
1	13946	5.98	
2	17303	7.97	
3	20607	9.86	
4	24616	11.92	
5	0	0.00	
6	N/A	N/A	
Field Calibration			
	Measured Caliper (in)	Actual Caliper (in)	
	8.00	7.97	

Micro-Resistivity Caliper Constants MMR-B.A 91					
Sonde Configuration		Resistivity Mode			
Micro Laterolog Calibration MMR-B.A 91				Base Calibration on 31-DEC-1999 00:00 Field Check on 31-DEC-1999 00:00	
Base Calibration	Resistor 1 (ohm)		Resistor 2 (ohm)		
	0.0		0.0		
	Measured		Calibrated (ohm-m)		
	Ref 1	Ref 2	Ref 1	Ref 2	
	0.0	0.0	0.0	0.0	
	Base Check (ohm-m)		Field Check (ohm-m)		
	0.0		0.0		

Micro Laterolog Constants MMR-B.A 91		
Pad Type	6 in Solid Nylon B23059	
Standoff Offset	0.0000	inches
Micro Laterolog K Factor	0.0128	
Micro Laterolog Rm K Factor	N/A	
Mudcake Thickness Correction Constants		
Mud Cake Source	Constant Value	
Mud Cake Thickness	0.4000	inches
Mud Cake Thickness Caliper		
Mud Cake Resistivity	0.1500	ohm-m
Mud Cake Resistivity T	0.0000	ohm-m

Mud Cake Resistivity Temp. 20.00 Degrees C
Mud Cake Resistivity Source Constant Value
Temp. for Rmc Corr. MCG External Temperature

Neutron Calibration MDN-B.A 292

Base Calibration on 15-MAY-2018 10:16
Field Check on 11-JUN-2018 15:13

Base Calibration

	Measured		Calibrated (cps)	
	Near	Far	Near	Far
	2945	91	3714	110
Ratio	32.304		33.764	

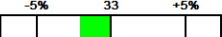
Field Calibrator at Base

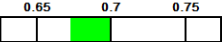
	Calibrated (cps)
	2179 3239
Ratio	0.673

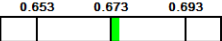
Field Check

	Calibrated (cps)
	2170 3215
Ratio	0.675

Neutron Calibration Tolerances MDN-B.A 292

Ratio 32.304 

Base Check 0.673 

Field Check 0.675 

Neutron Constants MDN-B.A 292

Last Edited on 14-JUN-2018,22:08

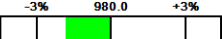
Neutron Source Id	P0204NN	
Neutron Jig Number	NJ5736	
Air Hole Processing	Modified Ratio	
Caliper Source for Processing	Density Caliper	
Stand-off	0.00	inches
Mud Density	1.00	gm/cc
Limestone Sigma	7.10	cu
Sandstone Sigma	4.26	cu
Dolomite Sigma	4.70	cu
Formation Pressure Source	None	
Formation Pressure	N/A	kpsi
Temperature Source	Constant Value	
Temperature	68.00	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	

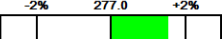
FE Calibration MFE-A.A 135

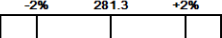
Base Calibration on 07-JUN-2018 13:53
Field Check on 11-JUN-2018 15:20

	Resistor 1 (ohm)	Resistor 2 (ohm)
	0.0	1000.0
Base Calibration		
	Measured	Calibrated (ohm-m)
Reference 1	0.0	0.0
Reference 2	962.0	126.8
Base Check		281.3
Field Check		281.2

FE Calibration Tolerances MFE-A.A 135

Reference 2 962.0  ohm

Base Check 281.3  ohm-m

Field Check 281.2  ohm-m

Running Mode No Sleeve
MFE K Factor 0.1268

Borehole Correction Constants

Sonde Position 0.5 inches
Hole Size Source Density Caliper
Hole Size Constant Value N/A inches
Rm Source Global Value: Temperature Corrected
Temp. for Rm Corr. MCG External Temperature

High Resolution Temperature Calibration MAI-A.A 111

Field Calibration on 23-FEB-2018,11:15

	Measured	Calibrated(Deg F)
Lower	10.00	10.00
Upper	100.00	100.00

High Resolution Temperature Constants MAI-A.A 111

Last Edited on 26-JUN-2014,15:06

Pre-filter Length 11

Induction Calibration MAI-A.A 111

Factory Loop Calibration 07-JUN-2018 14:52

Field Check on 11-JUN-2018 16:21

Factory Loop Calibration

High Conductivity Reference Resistor 3.3 ohm
Low Conductivity Reference Resistor 333.3 ohm

Array	Measured Signal (unitless)		Reference Conductivity (mmho/m)		Calibration	
	Low	High	Low	High	Gain	Offset
1 (near)	17.6	473.6	9.3	966.2	0.000	0.0
2	6.4	385.9	7.6	821.4	0.000	0.0
3	3.2	264.0	5.2	566.0	0.000	0.0
4 (far)	2.1	135.5	2.6	279.2	0.000	0.0
Array Temperature	23.0		Deg F			

Tool Checks

Array	Factory Reference (mmho/m)		Before Survey (mmho/m)		Deg F
	Low	High	Low	High	
1 (near)	11.4	3841.4	11.4	3842.9	99.3
2	29.4	3499.6	29.4	3500.4	
3	28.8	2996.9	28.7	2997.4	
4 (far)	18.9	2041.5	18.9	2041.9	
Array Temperature	83.6				

Induction Check Tolerances MAI-A.A 111

Low Array	Value	Tolerance Range	High Array	Value	Tolerance Range
Low Array 1	11.4	9.9 - 12.9	High Array 1	3842.9	3841.4 - 3844.4
Low Array 2	29.4	27.9 - 30.9	High Array 2	3500.4	3499.6 - 3501.2
Low Array 3	28.7	27.3 - 30.3	High Array 3	2997.4	2996.9 - 2997.9
Low Array 4	18.9	17.4 - 20.4	High Array 4	2041.9	2041.5 - 2042.3

Induction Constants MAI-A.A 111

Last Edited on 14-JUN-2018,22:05

Induction Model RtAP-WBM

Borehole Correction Constants

Tool Centred No
Hole Size Source Density Caliper
Hole Size Constant Value 2.500 inches
Stand-off Type Fins
Stand-off 0.50 inches
Number of Fins on Stand-off 8.0000
Stand-off Fin Angle 45.00 degrees
Stand-off Fin Width 0.5000 inches
Rm Source Global Value: Temperature Corrected
Temp. for Rm Corr. MCG External Temperature
Borehole Correction Method Default

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
Symmetrised Receiver Gains			
Receiver 1		1.00	
Receiver 2		1.00	
Receiver 3		1.00	
Receiver 4		1.00	
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 216

Base Calibration on 07-JUN-2018 14:09
Field Calibration on 11-JUN-2018 15:33

Base Calibration		
Reading No	Measured	Calibrator Size (in)
1	14245	3.99
2	22960	5.98
3	31650	7.97
4	39952	9.86
5	49231	11.92
6	N/A	N/A
Field Calibration		
	Measured Caliper (in)	Actual Caliper (in)
	7.93	7.97

Caliper Calibration Tolerances MPD-C.A 216

Long Arm Field Cal.	7.93	7.57 7.97 8.37	in
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Photo Density Calibration MPD-C.A 216

Base Calibration on 07-JUN-2018 14:35
Field Check on 11-JUN-2018 15:18

Density Calibration				
Base Calibration		Measured	Calibrated (sdu)	
	Near	Far	Near	Far
Background	1007	1198		
Reference 1	50088	24364	59556	30836
Reference 2	19851	2273	24941	2541
Field Check at Base				
	1006.9	1197.8		
Field Check				
	1004.3	1191.6		
PE Calibration				
Base Calibration		Measured	Calibrated	
	WS	WH	Ratio	Ratio
Background	184	903		

Reference 1	21030	49928	0.425	0.371
Reference 2	5765	19740	0.296	0.272

Field Check at Base

184.4	903.5
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Field Check

182.8	903.0
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Photo Density Calibration Tolerances MPD-C.A 216

Near Density Ratio	2.60	-5% 2.52 +5%
PE Calibration	0.120	0.089 0.110 0.131

Far Density Ratio	21.54	-5% 21.00 +5%
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Near Den. Field Check	1004.3	-3% 1006.9 +3%
PE WS Field Check	182.8	-6% 184.4 +6%

Far Den. Field Check	1191.6	-3% 1197.8 +3%
PE WH Field Check	903.0	-6% 903.5 +6%

Density Constants MPD-C.A 216

Last Edited on 14-JUN-2018,22:06

Density Source Id	P50557B
Nylon Calibrator Number	DNCE695
Aluminium Calibrator Number	DACD698
Density Shoe Profile	8 inch
Caliper Source for Processing	Density Caliper
PE Correction to Density	Not Applied
Mud Density	1.13 gm/cc
Mud Density Type	
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
Precision Enhanced Density Processing	Not Applied
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 18.01.6830\Data\Shakespeare (Ottley 2-21)\MAIN PASS.dta

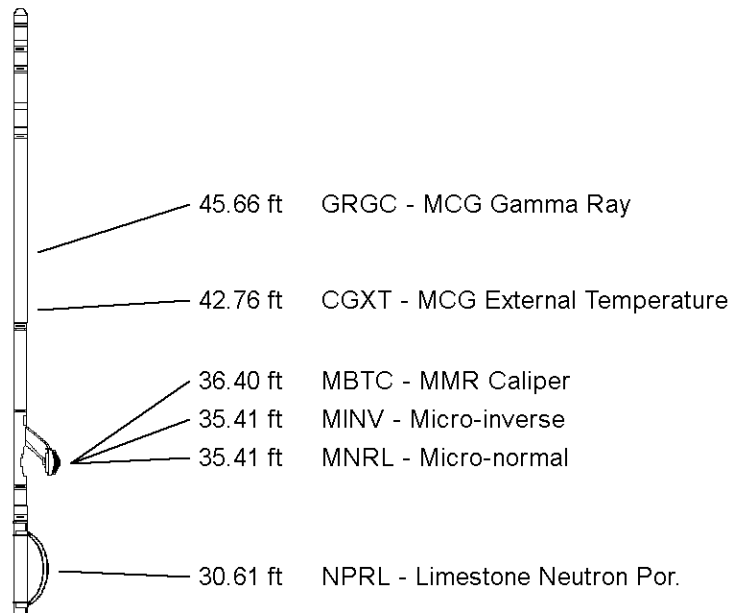
Cablehead, 11 pin
CBH-C 0 LG: 2.40 ft WT: 24.3 lb OD: 2.244 in

Compact Swivel Head Adaptor
SHA-J.B 724 LG: 2.30 ft WT: 22.0 lb OD: 2.244 in

Compact Comms Gamma
MCG-D.A 246 LG: 8.70 ft WT: 63.9 lb OD: 2.244 in

Compact Micro-Resistivity
MMR-B.A 91 LG: 8.59 ft WT: 81.6 lb OD: 4.882 in

Compact Neutron
MDN-B.A 292 LG: 5.04 ft WT: 50.7 lb OD: 2.244 in



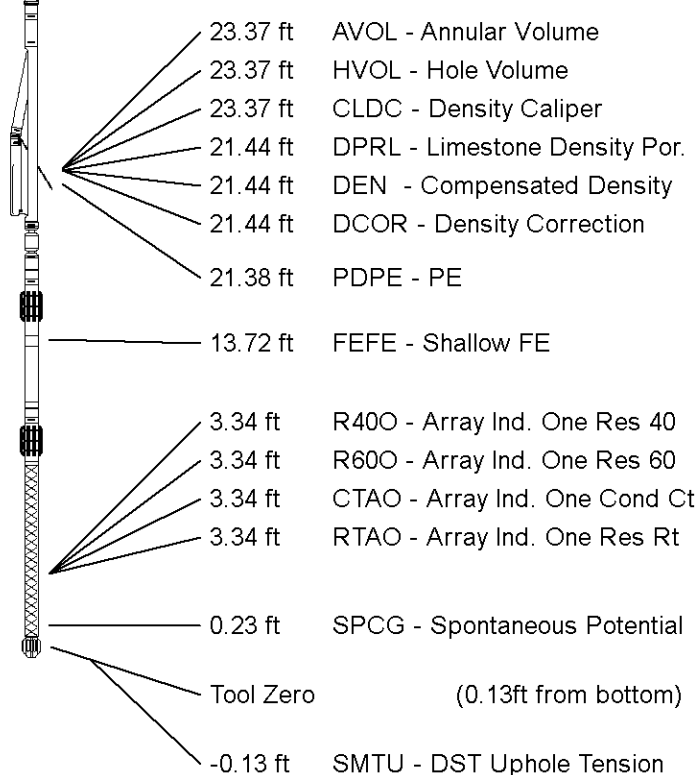
Compact Density/Caliper
MPD-C.A 216 LG: 9.59 ft WT: 90.4 lb OD: 2.913 in

Compact Knuckle Joint
SKJ-D.A 167 LG: 2.17 ft WT: 24.3 lb OD: 2.244 in

Compact Focussed Electric
MFE-A.A 135 LG: 6.05 ft WT: 48.5 lb OD: 2.244 in

Compact Induction
MAI-A.A 111 LG: 10.81 ft WT: 48.5 lb OD: 2.244 in

Total Length: 55.64 ft Weight: 454.2 lb



All measurements relative to tool zero.

COMPANY	SHAKESPEARE OIL CO., INC
WELL	OTTLEY 2-21
FIELD	CHALK BUTTES
PROVINCE/COUNTY	LOGAN
COUNTRY/STATE	USA / KANSAS

Elevation Kelly Bushing	2783	feet	First Reading	4490.00	feet
Elevation Drill Floor	2781	feet	Depth Driller	4511.00	feet
Elevation Ground Level	2771	feet	Depth Logger	4511.00	feet



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COMPACT PHOTO DENSITY
COMPENSATED NEUTRON
MICRORESISTIVITY LOG