



**Weatherford**

**COMPENSATED DENSITY  
COMPENSATED NEUTRON  
LOG**

COMPANY			EAST CHEYENNE GAS STORAGE LLC		
WELL			ECGS No 6-21 WPD004-2		
FIELD			WEST PEETZ		
PROVINCE/COUNTY			LOGAN		
COUNTRY/STATE			U.S.A / COLORADO		
LOCATION			SHL: 1440' FSL & 2297' FWL		
SEC 6	TWP 11N	RGE 52W	Other Services		
Latitude		MFE/MAI			
Longitude					
API Number		0507509426-0000			
Permanent Datum GL, Elevation 4557 feet					
Log Measured From KB					
Drilling Measured From KB					
Date	18-OCT-2014				Elevations:
Run Number	1				KB 4567.00
Service Order	2577-100789597				DF 4566.00
Depth Driller	5440.00				feet 4557.00
Depth Logger	5440.00				feet
First Reading	5388.00				feet
Last Reading	1213.00				feet
Casing Driller	1220.00				feet
Casing Logger	1213.00				feet
Bit Size	8.750				inches
Hole Fluid Type	WBM				
Density / Viscosity	9.60 lb/USg		70.00 SEC/QT		
PH / Fluid Loss	8.00				
Sample Source	FLOWLINE				
Rm @ Measured Temp	2.21 @ 65.7		ohm-m		
Rmf @ Measured Temp	1.76 @ 65.7		ohm-m		
Rmc @ Measured Temp	2.65 @ 65.7		ohm-m		
Source Rmf / Rmc	FLOWLINE				
Rm @ BHT	0.89 @168.0		ohm-m		
Time Since Circulation	5 HOURS				
Max Recorded Temp	168.00		deg F		
Equipment / Base	13173		CASPER		
Recorded By	M.RICHINS				
Witnessed By	R.LYNDE				

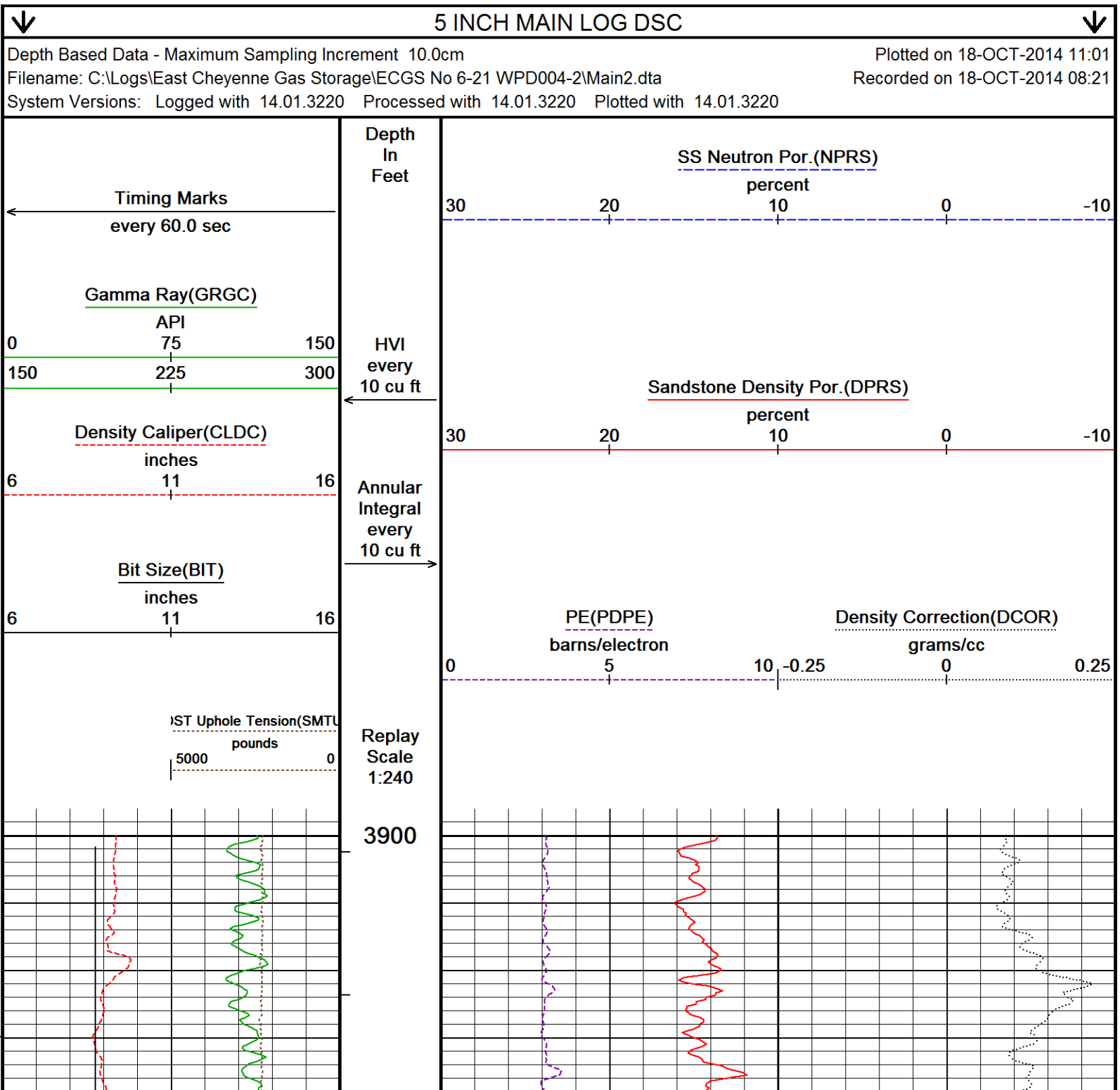
BOREHOLE RECORD					Last Edited: 17-OCT-2014 20:59
Bit Size inches		Depth From feet		Depth To feet	
8.750		1219.00		5260.00	
CASING RECORD					
Type	Size inches	Depth From feet	Shoe Depth feet	Weight pounds/ft	
Surface	9.625	0.00	1219.00	36.00	

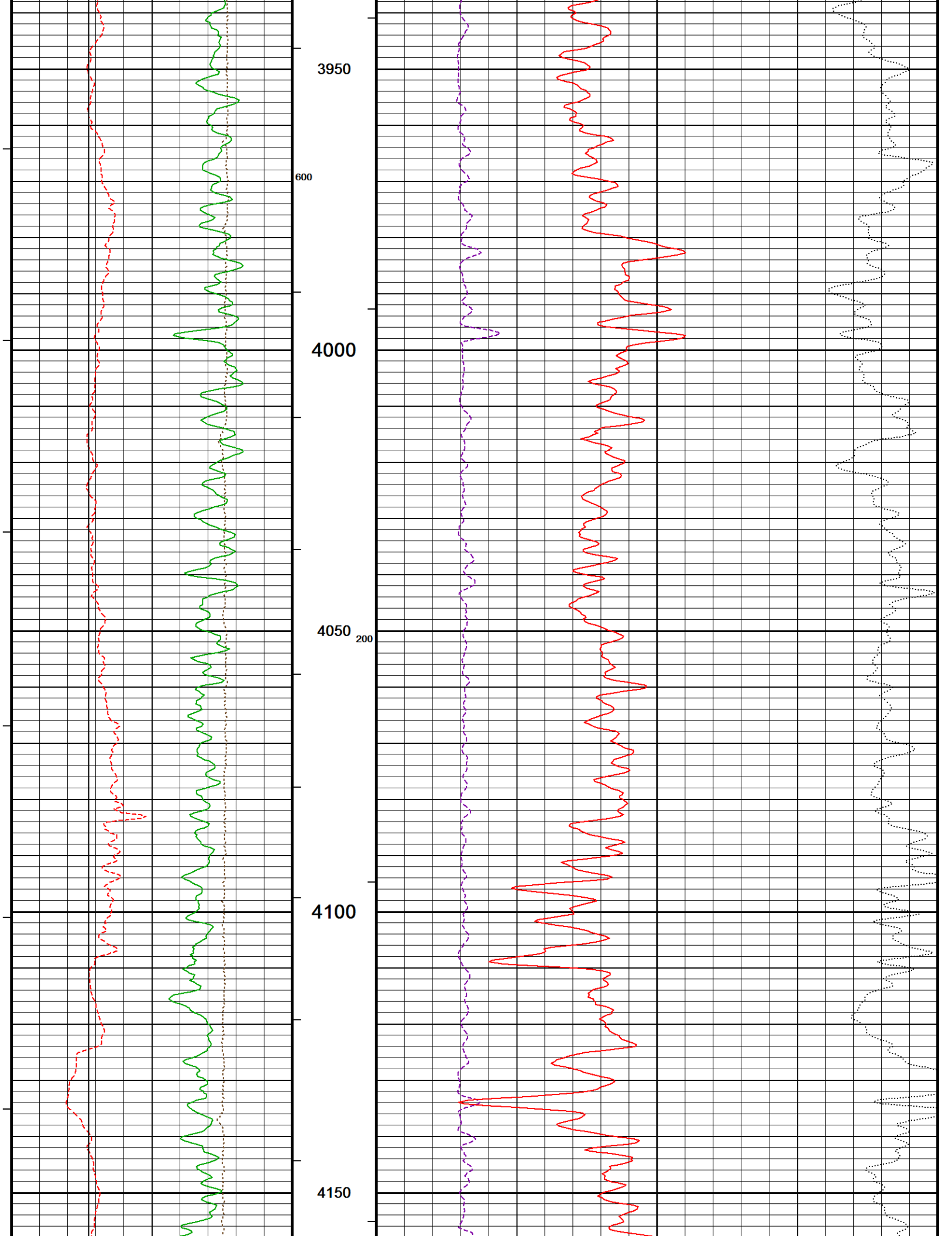
REMARKS
SOFTWARE VERSION: 14.01.3220
MCG, MDN, MPD, MFE, MIE, AND MAI RAN IN COMBINATION.
HARDWARE: MAI: 0.5" STAND OFF, SEE TOOL STRING.
TIGHT PULLS, BOREHOLE SIZE AND RUGOSITY WILL AFFECT REPEATABILITY AND DATA QUALITY.
ALL INTERVALS LOGGED AND SCALED PER CUSTOMER'S REQUEST.
IMAGE TOOL PACKED UP WITH MUD AND WELL DEBRIS. REPEAT PASS PRESENTED INSTEAD OF MAIN. IMAGE PULLED 300 FEET OFF BOTTOM.
POROSITY TOOLS PULLED TO 3900 FEET PER CUSTOMER REQUEST.
RESISTIVITY PULLED TO SURFACE CASING, AND GAMMA PULLED TO SURFACE.
TOTAL HOLE VOLUME FROM TD (5440 FEET) TO SURFACE CASING = 1840 CUBIC FEET

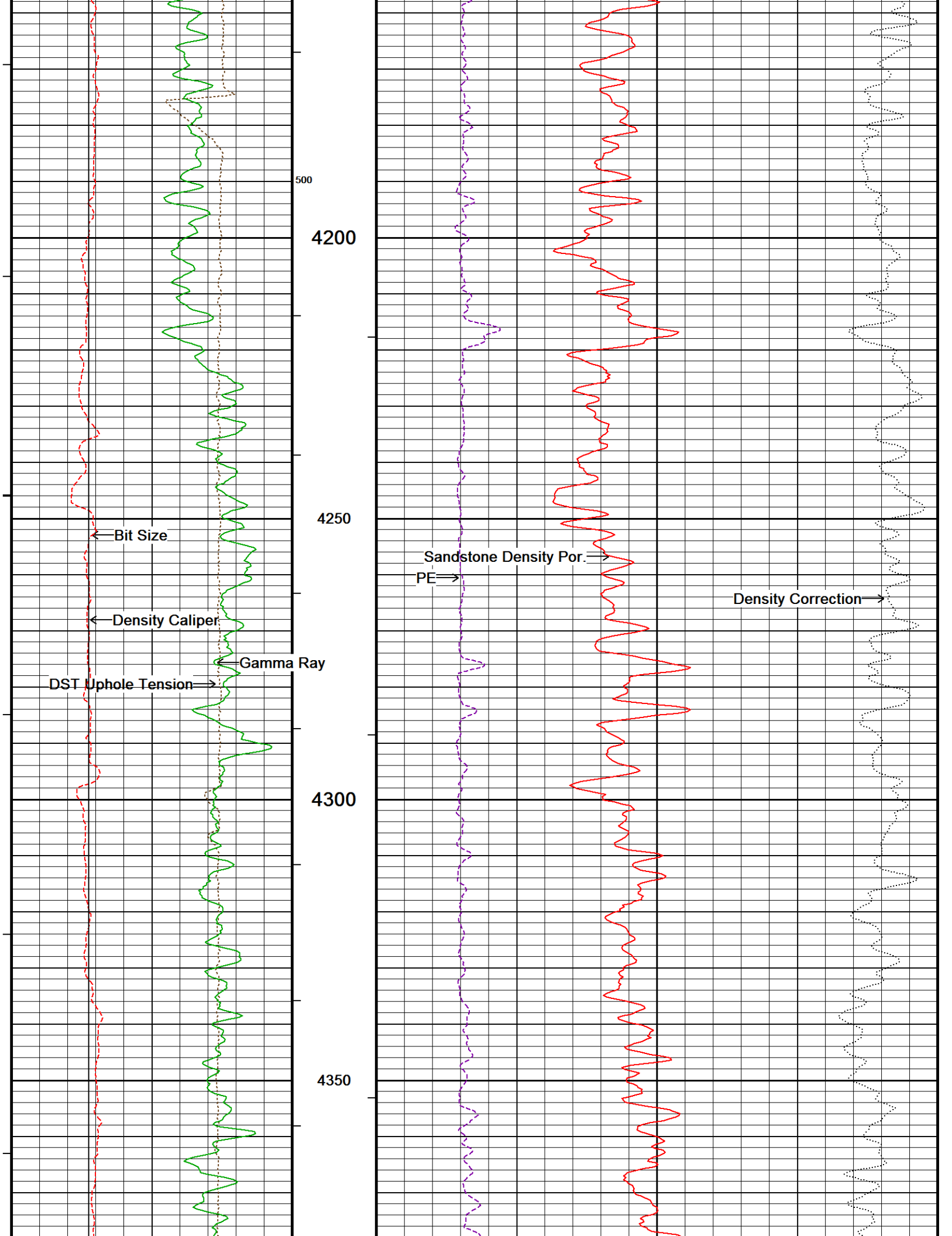
ANNUAL HOLE VOLUME FROM TD (5115 FEET) TO SURFACE CASING = 1010 CUBIC FEET.

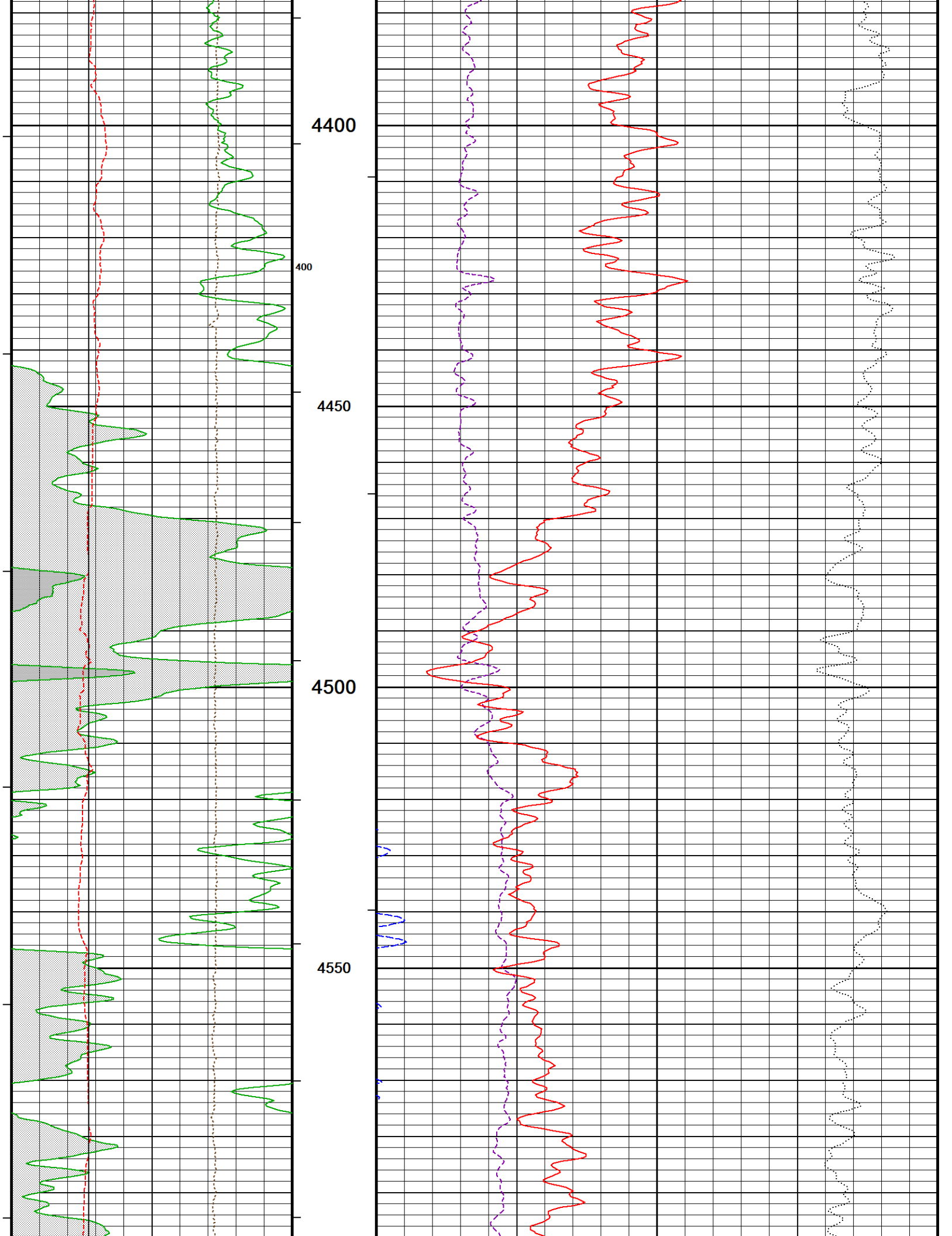
ANNULAR HOLE VOLUME WITH 7' CASING FROM TD TO SURFACE CASING = 720

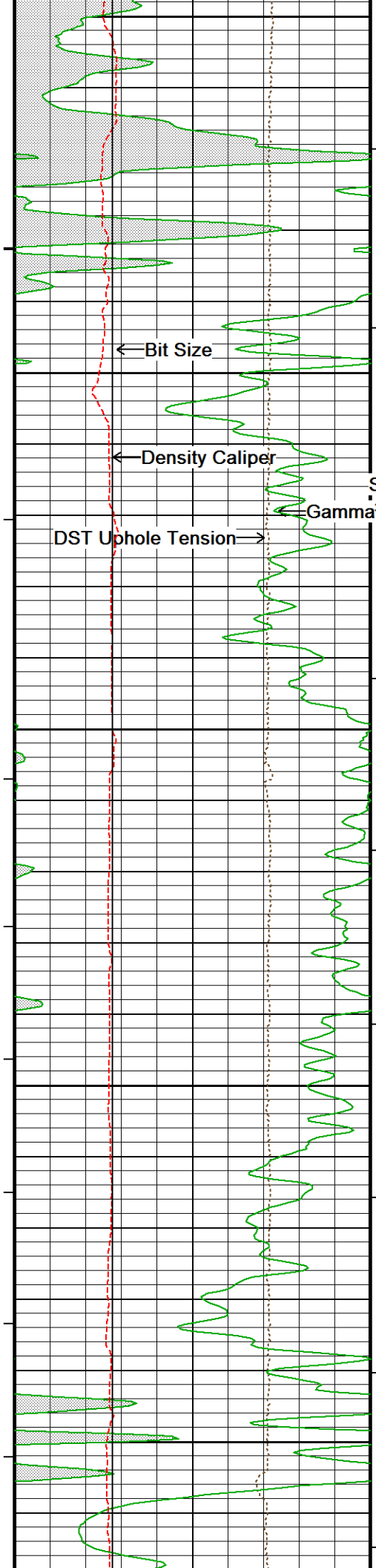
In interpreting, communicating or providing information and/or making recommendations, either written or oral, as to logs or test or other data, type or amount of material, or Work or other service to be furnished, or manner of performance, or in predicting results to be obtained, the Contractor will 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.











4600

4650

4700

4750

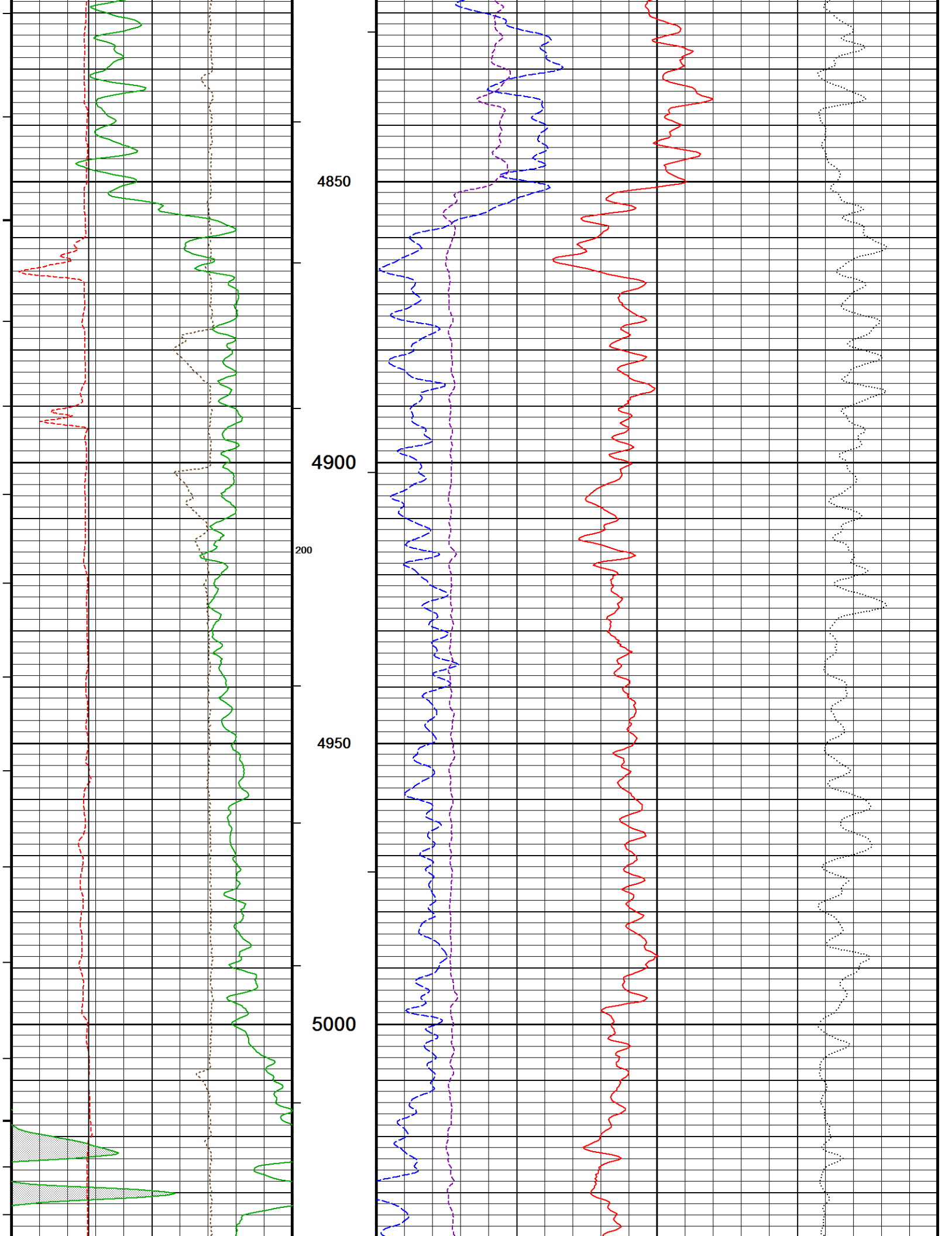
4800

Stone Density Por. →  
PE →

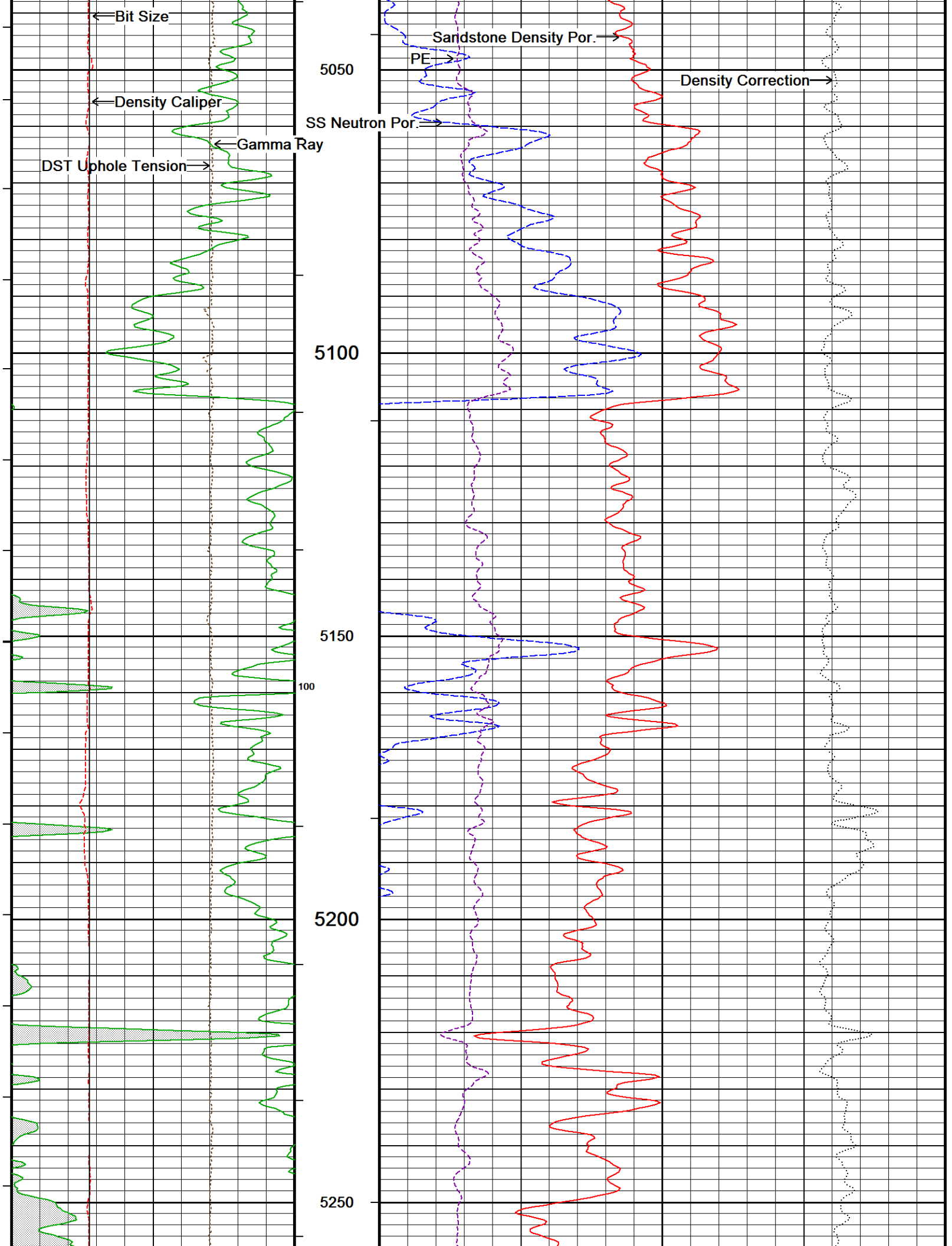
SS Neutron Por. →

100

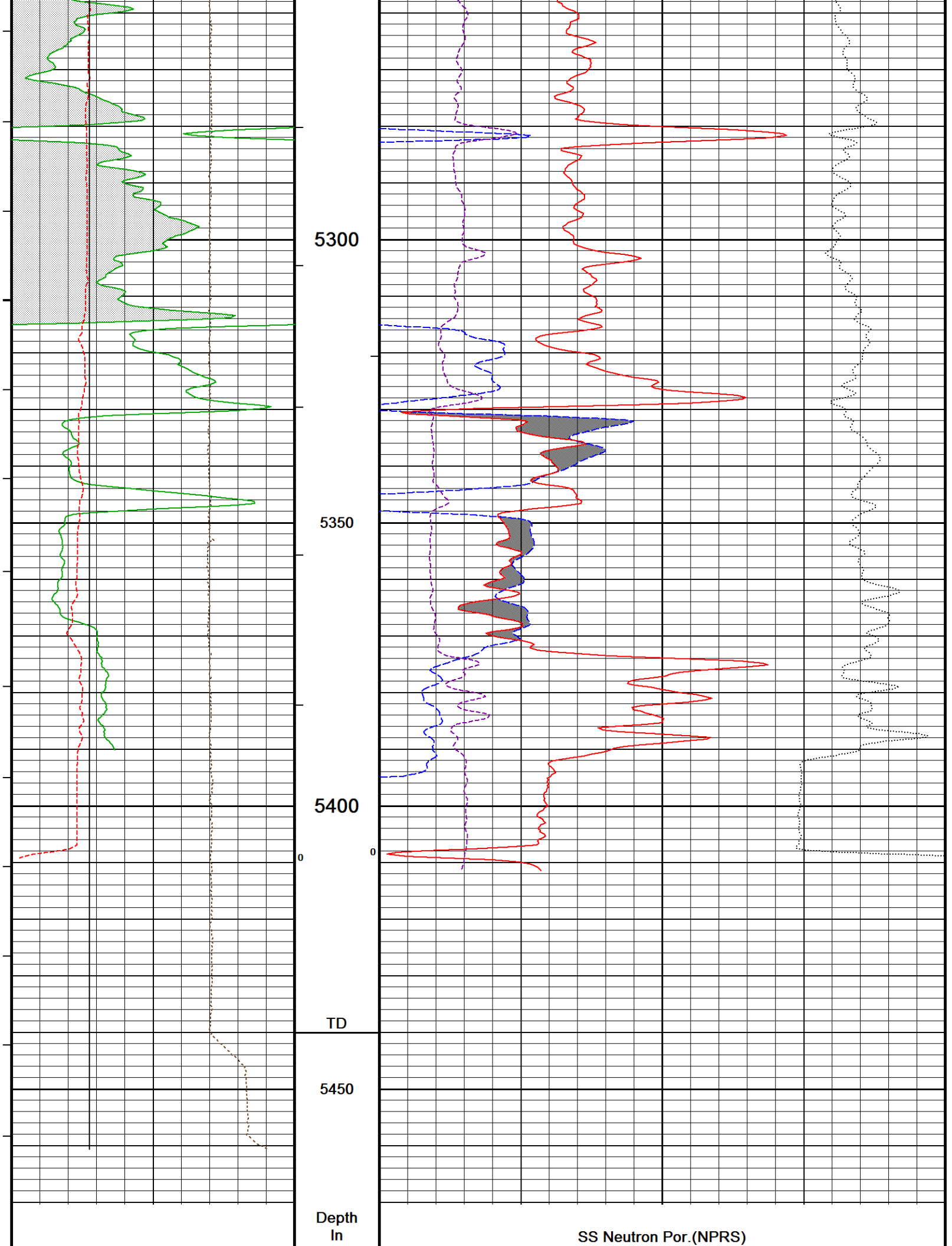
Density Correction →

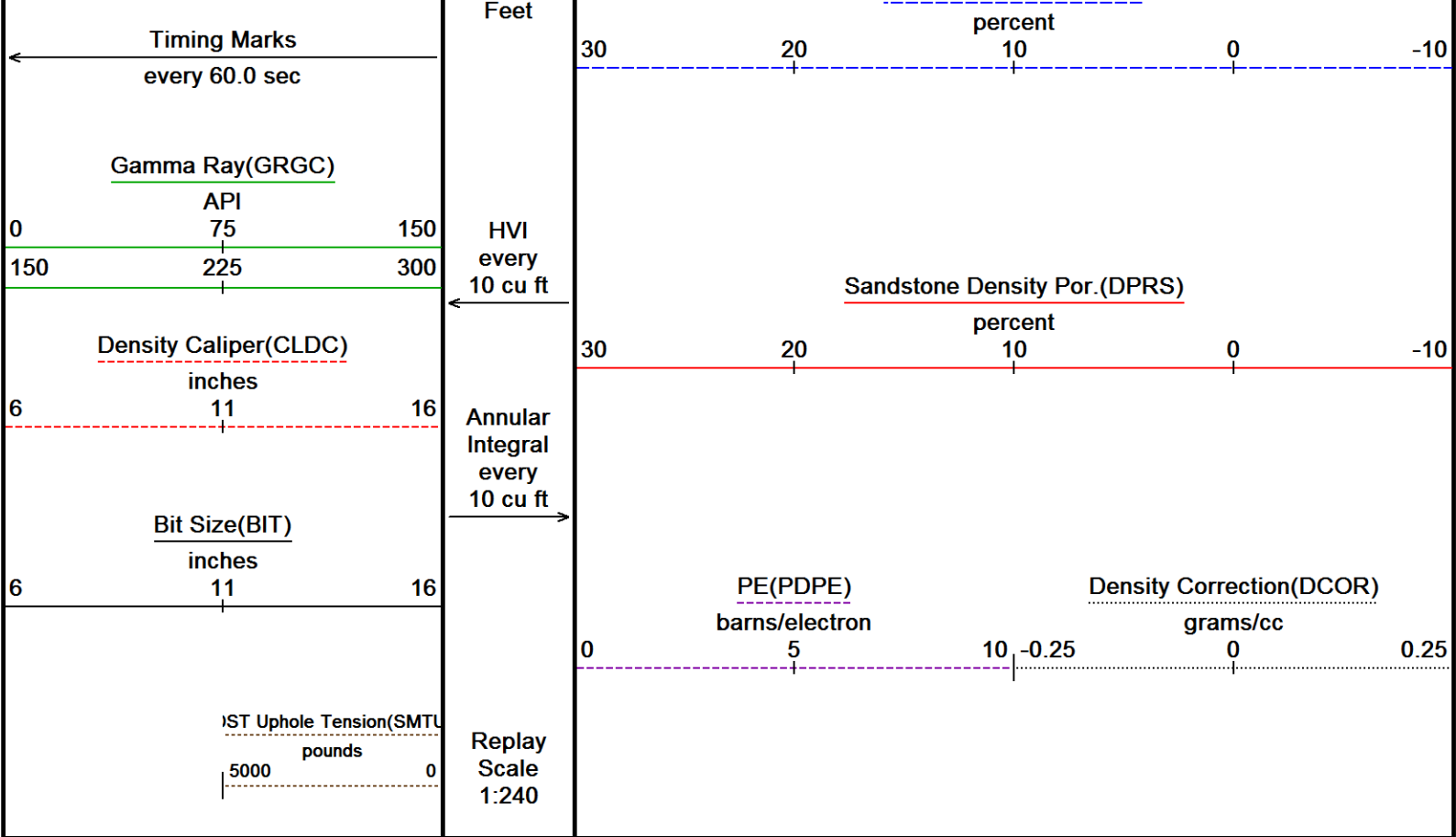








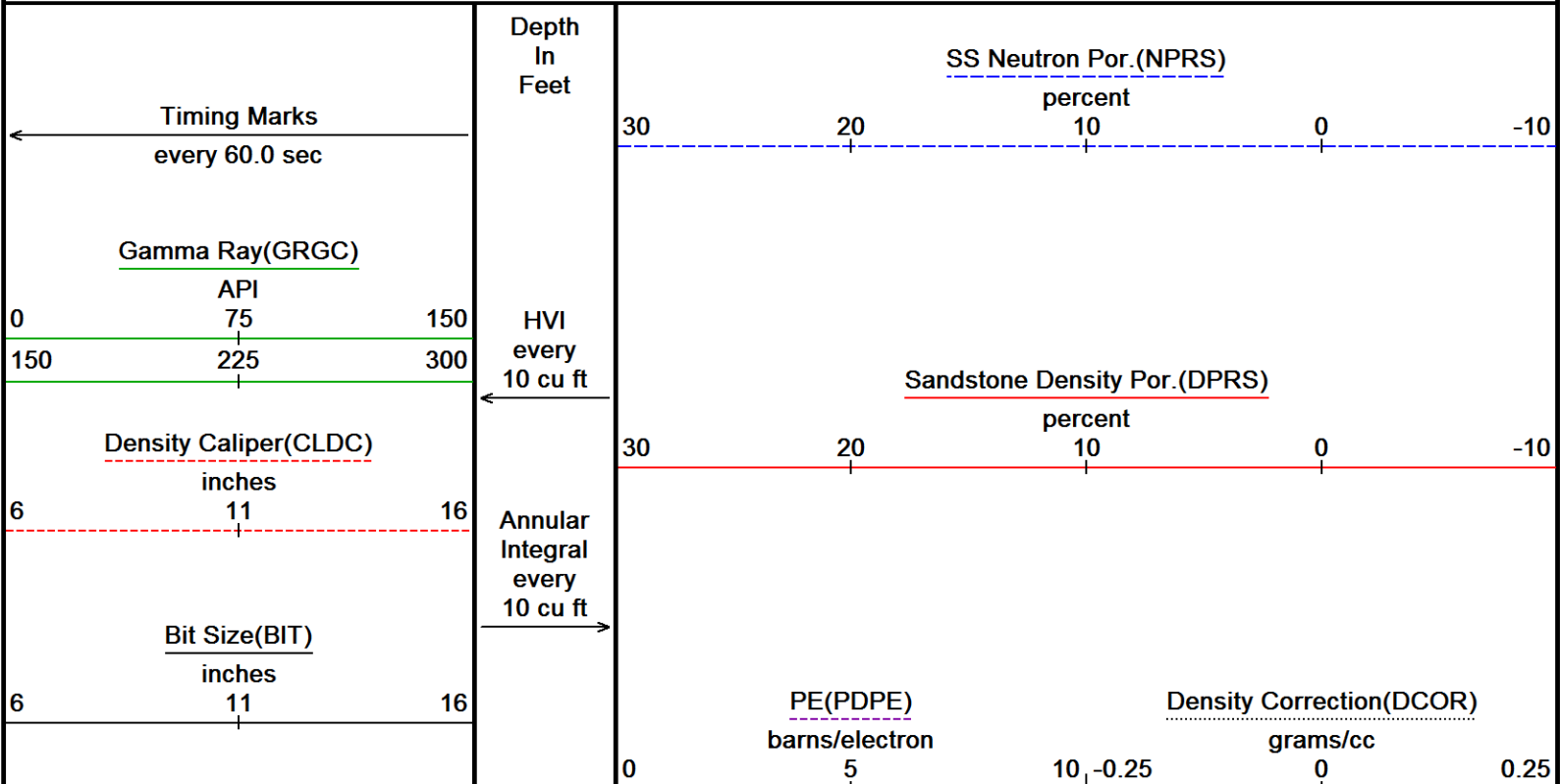




Depth Based Data - Maximum Sampling Increment 10.0cm	Plotted on 18-OCT-2014 11:01
Filename: C:\Logs\East Cheyenne Gas Storage\ECGS No 6-21 WPD004-2\Main2.dta	Recorded on 18-OCT-2014 08:21
System Versions: Logged with 14.01.3220 Processed with 14.01.3220 Plotted with 14.01.3220	

↑	5 INCH MAIN LOG DSC	↑
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↓	OVERLAY	↓
Depth Based Data - Maximum Sampling Increment 10.0cm		
Plotted on 18-OCT-2014 11:01		
Filename: C:\Logs\East Cheyenne Gas Storage\ECGS No 6-21 WPD004-2\Main2.dta		
Recorded on 18-OCT-2014 08:21		
Filename: C:\Logs\East Cheyenne Gas Storage\ECGS No 6-21 WPD004-2\Repeat.dta		
Recorded on 18-OCT-2014 05:42		
System Versions: Logged with 14.01.3220 Processed with 14.01.3220 Plotted with 14.01.3220		



IST Uphole Tension(SMTU)  
pounds  
5000 0

Replay  
Scale  
1:240

5236

5250

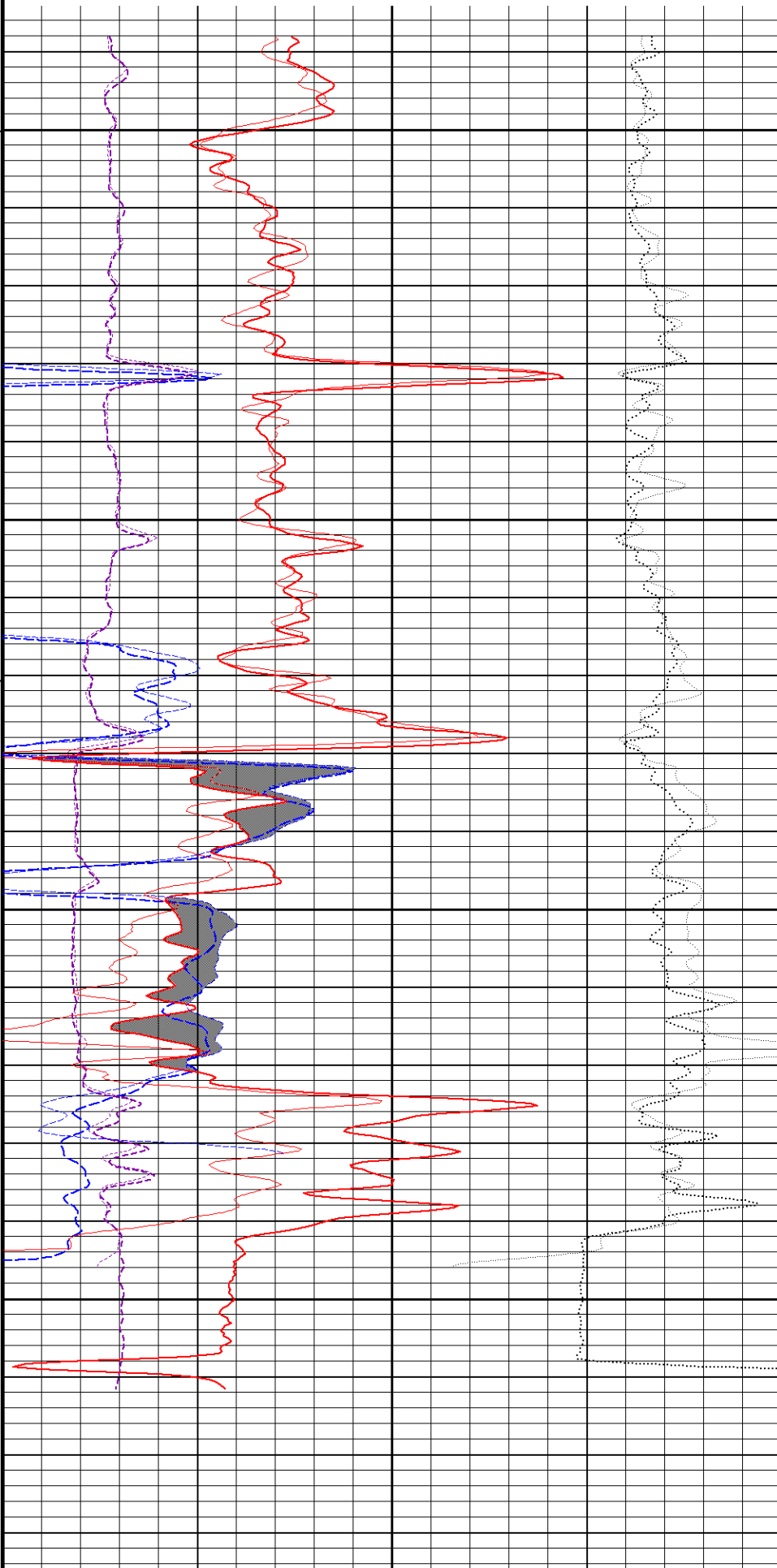
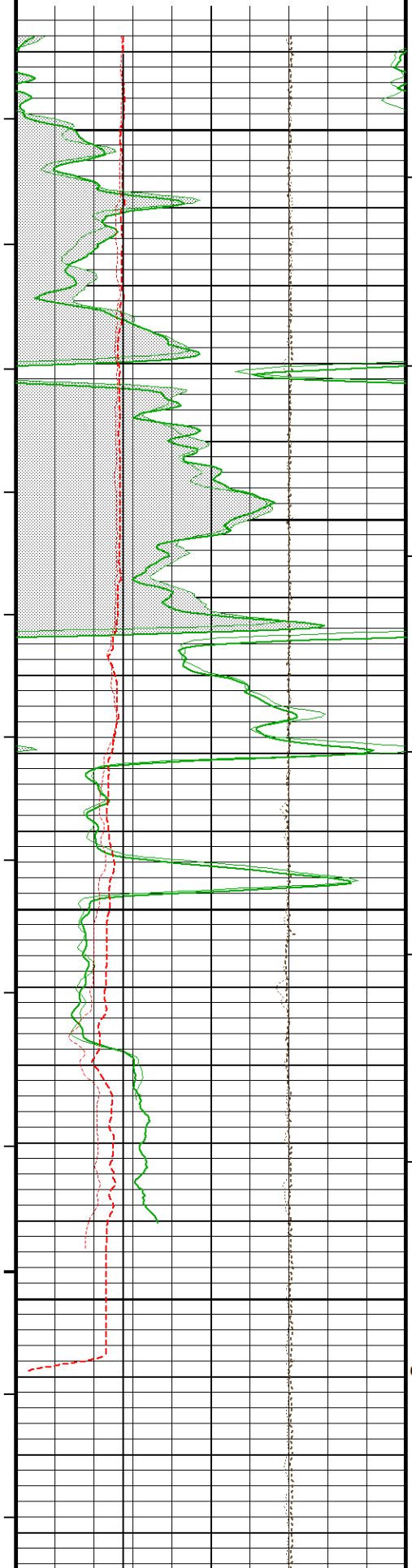
5300

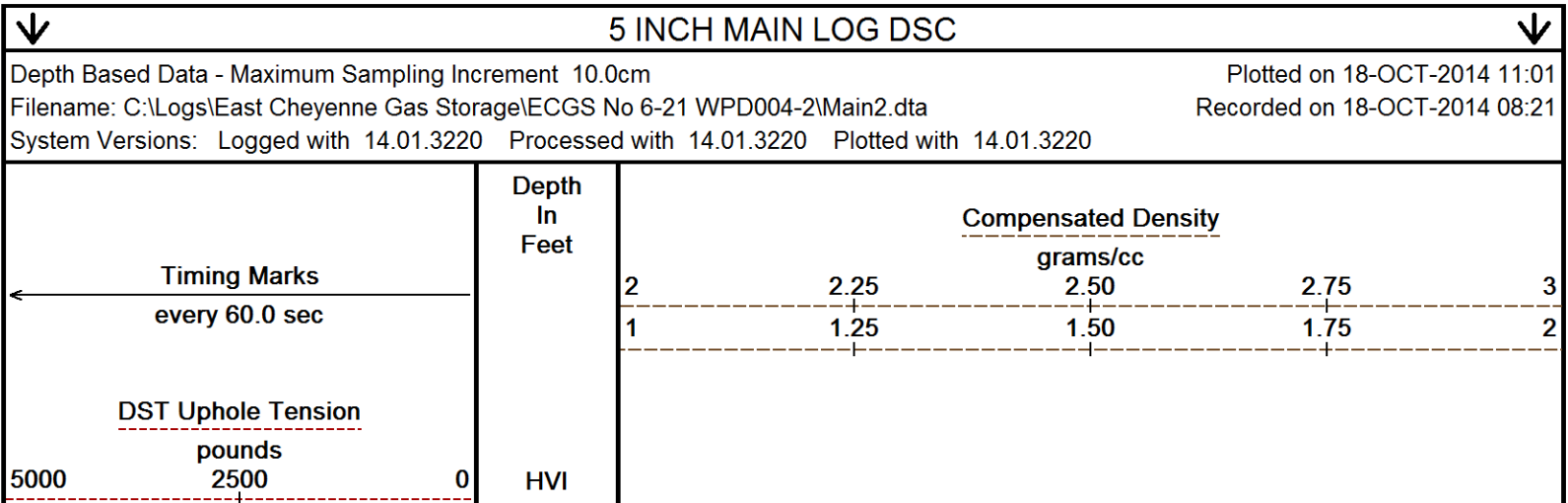
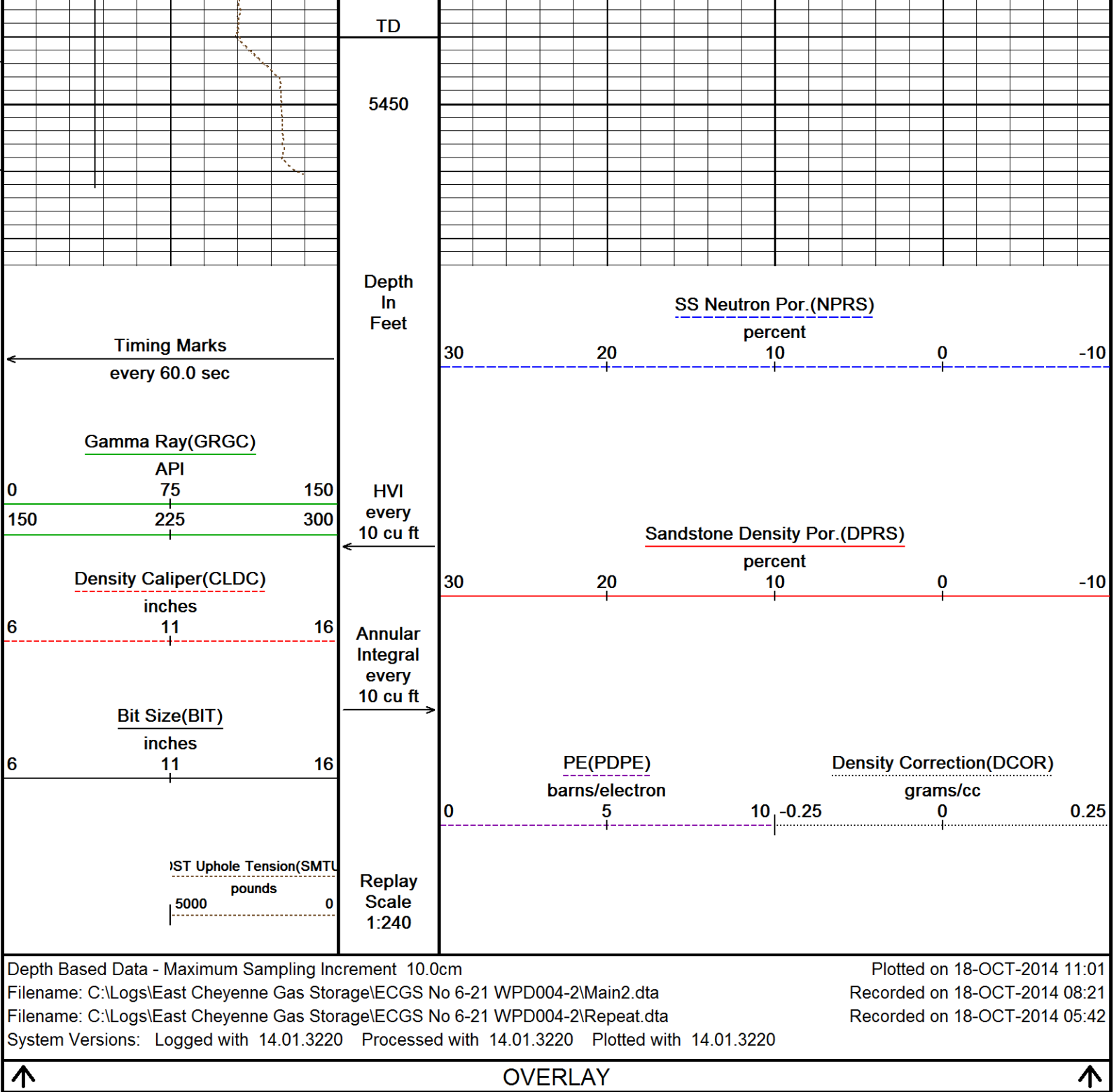
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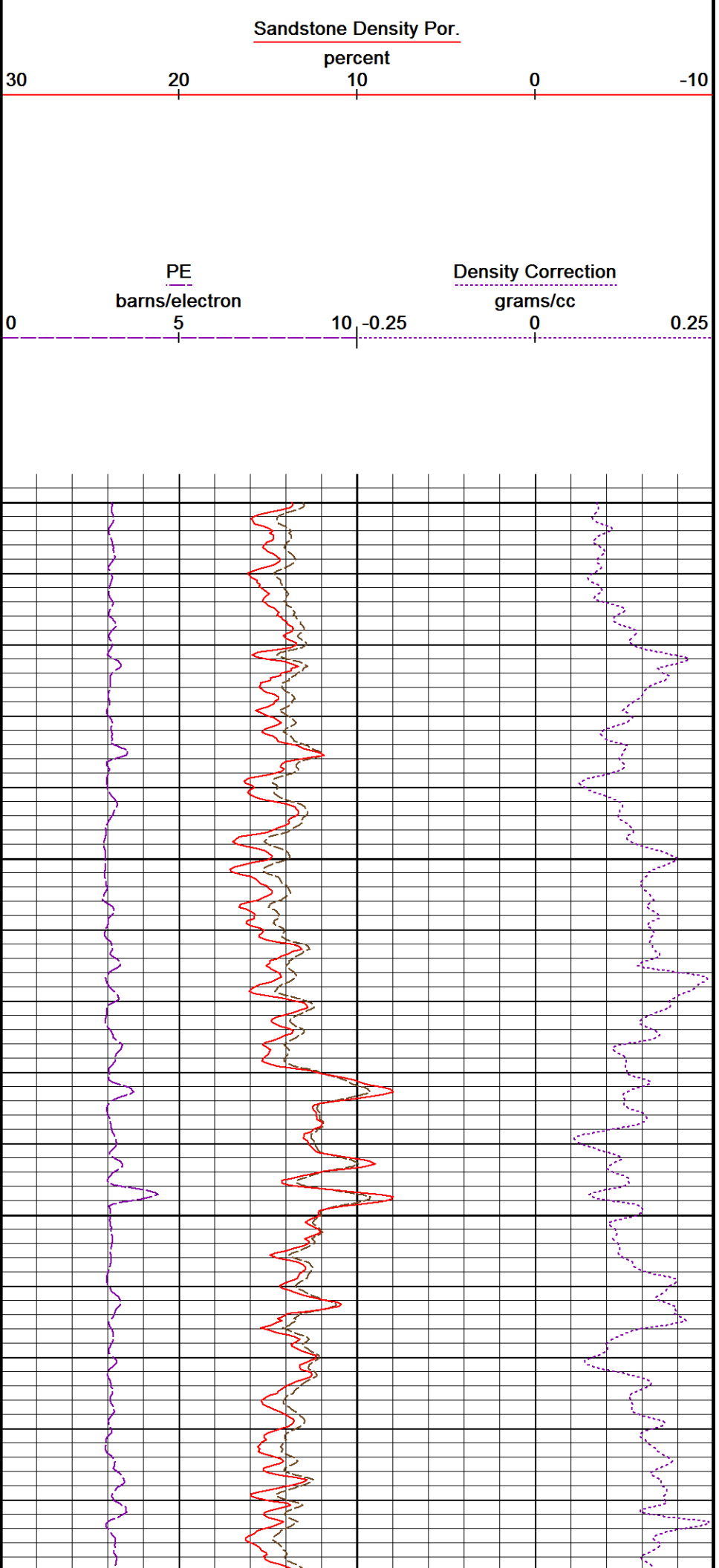
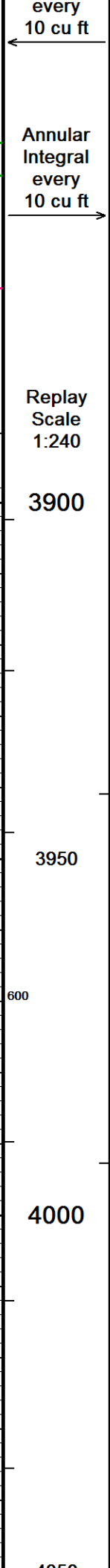
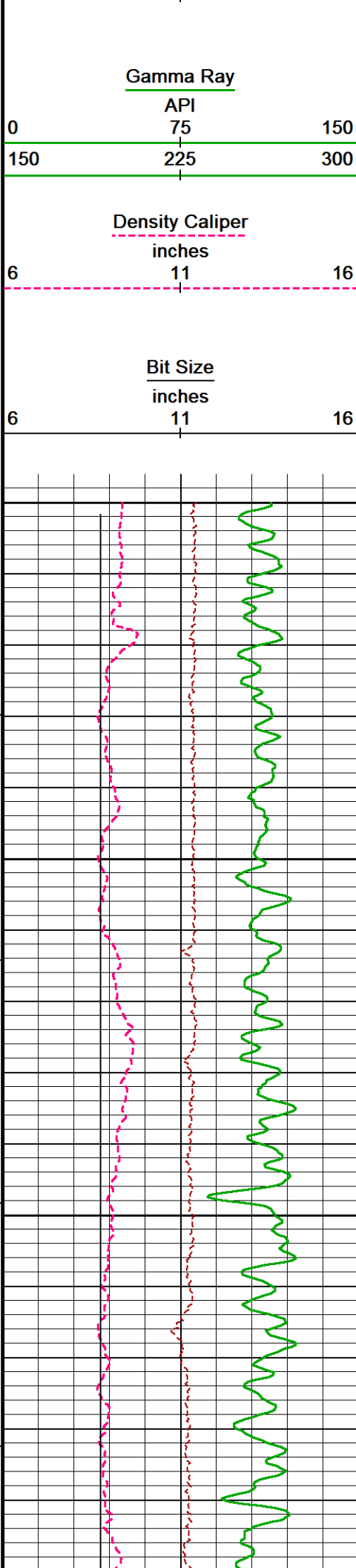
5400

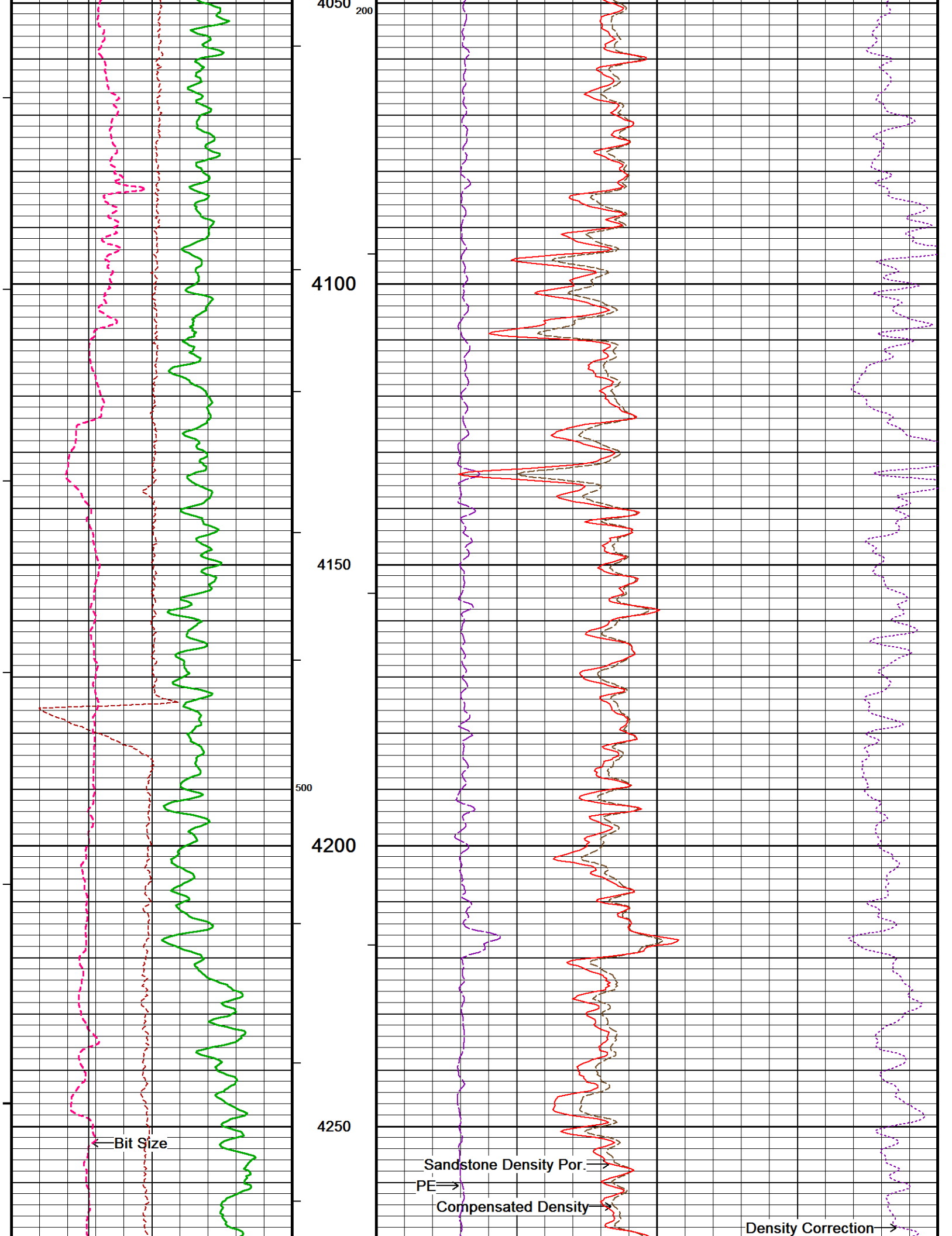
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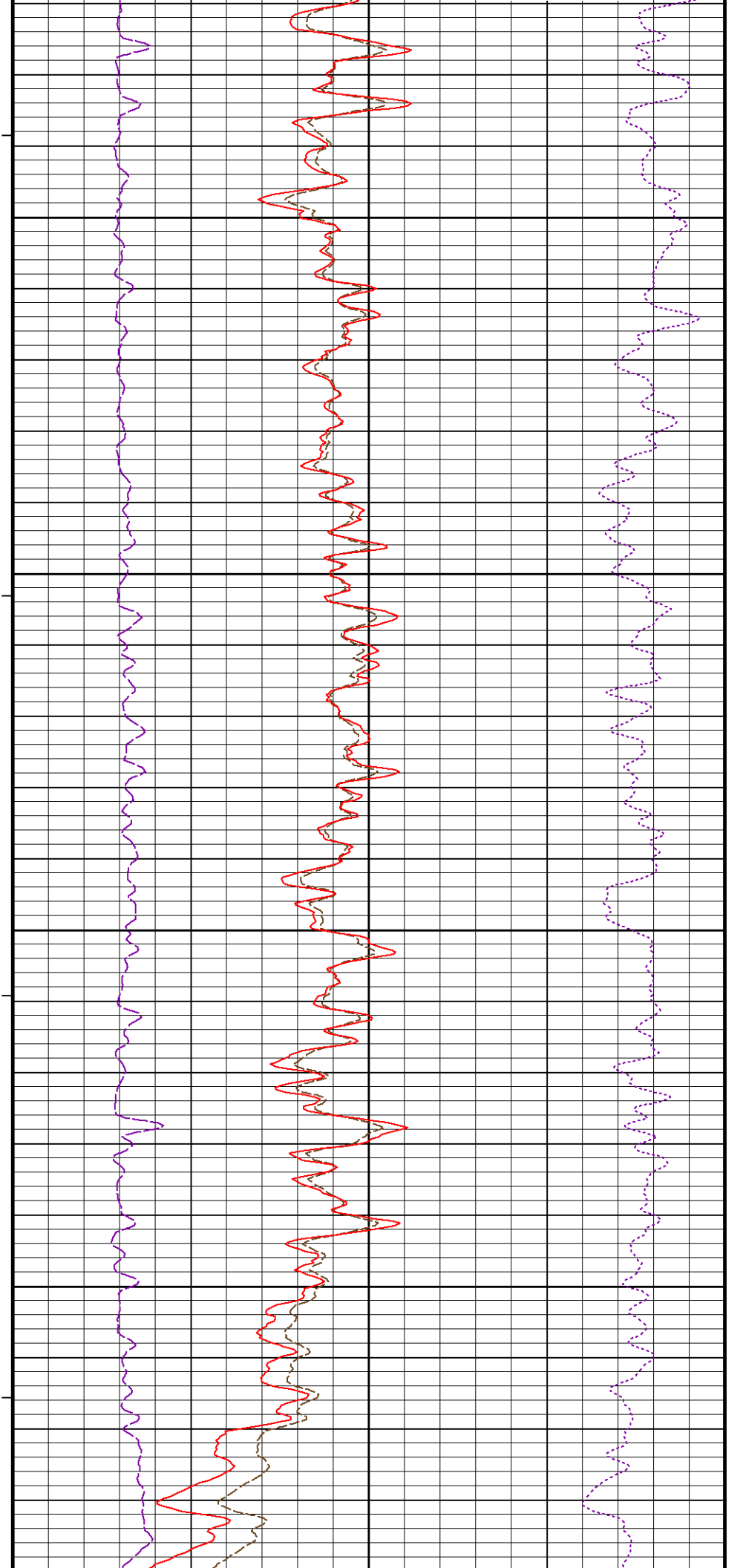
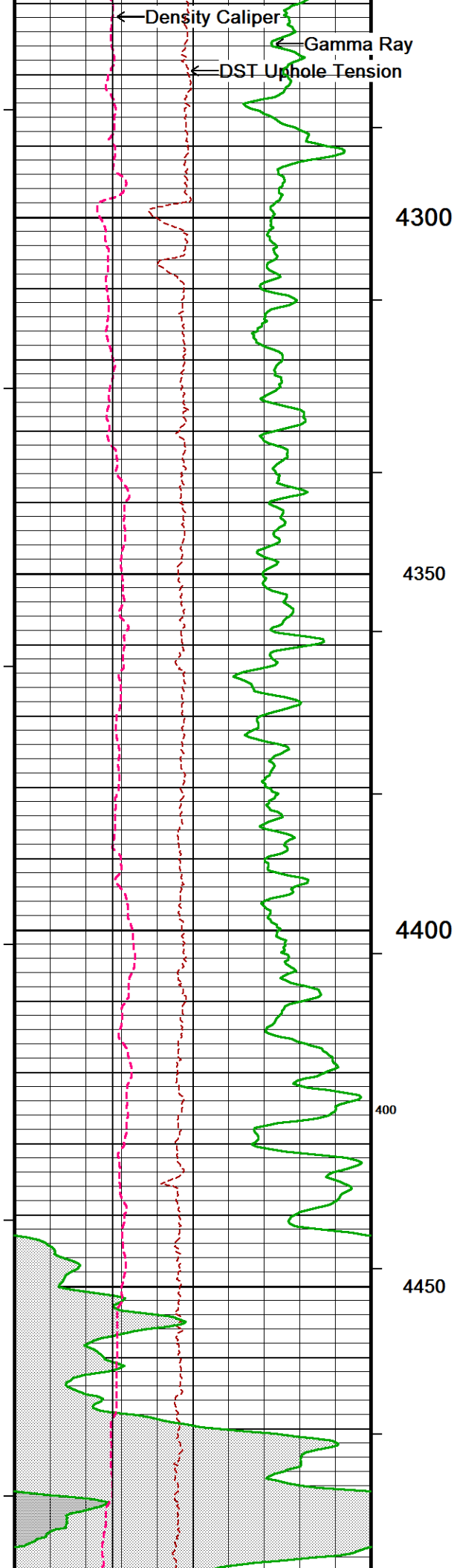
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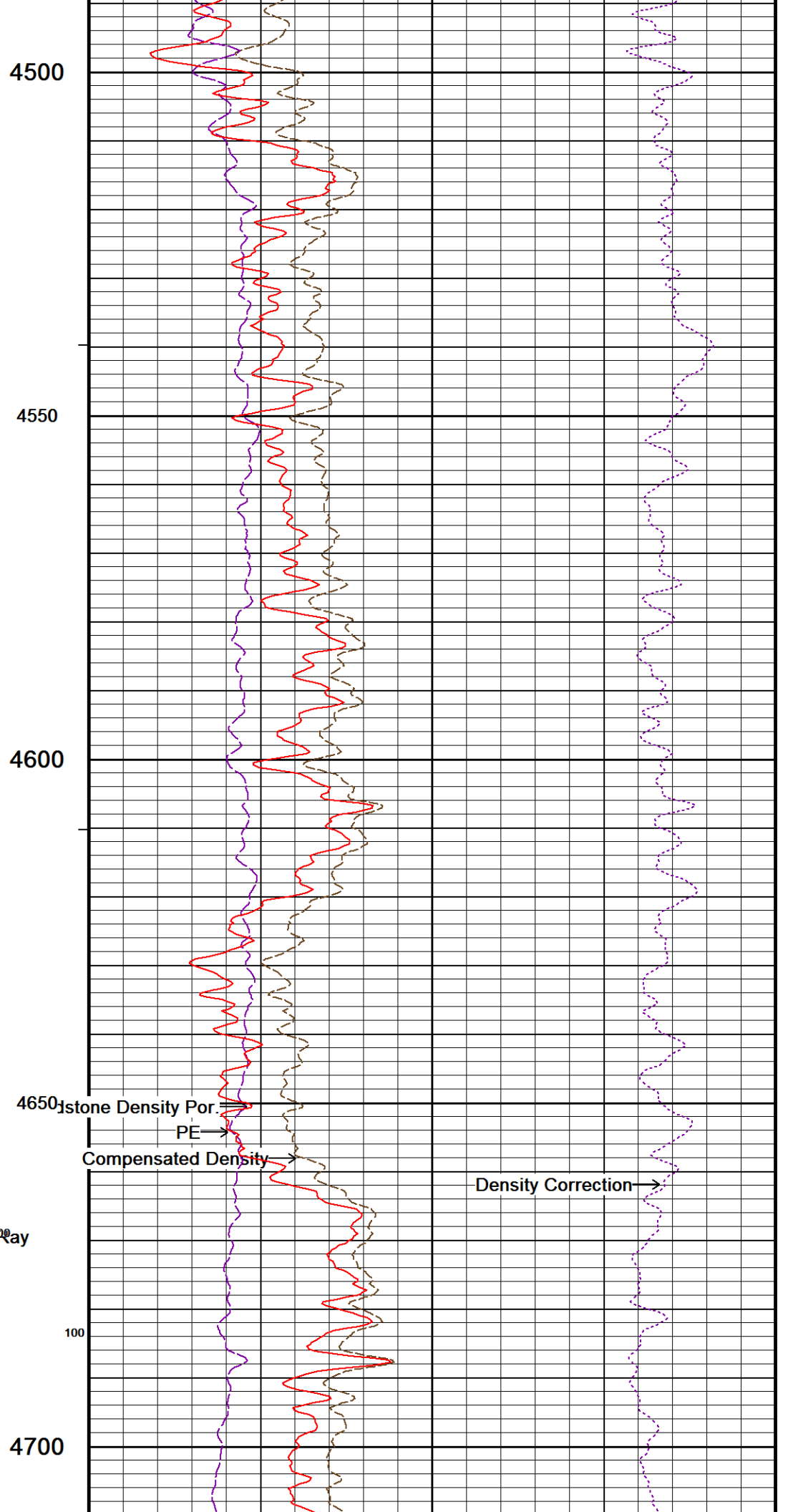
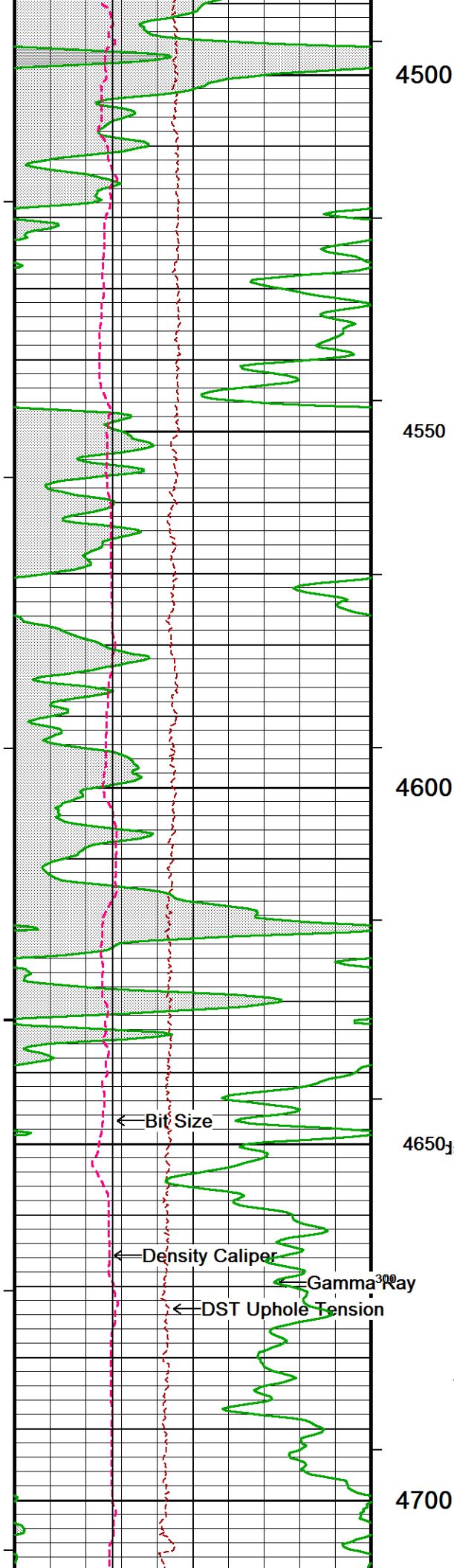


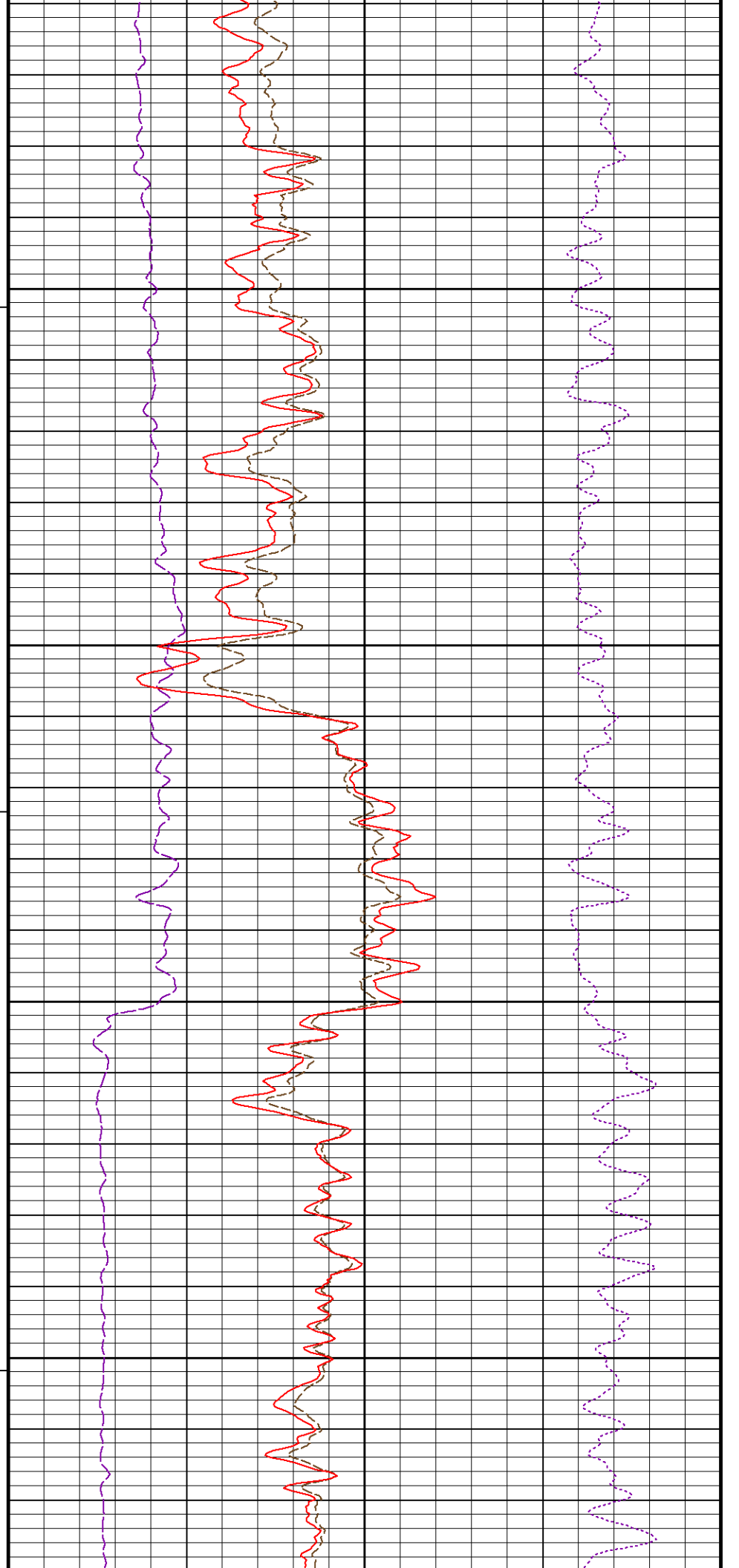
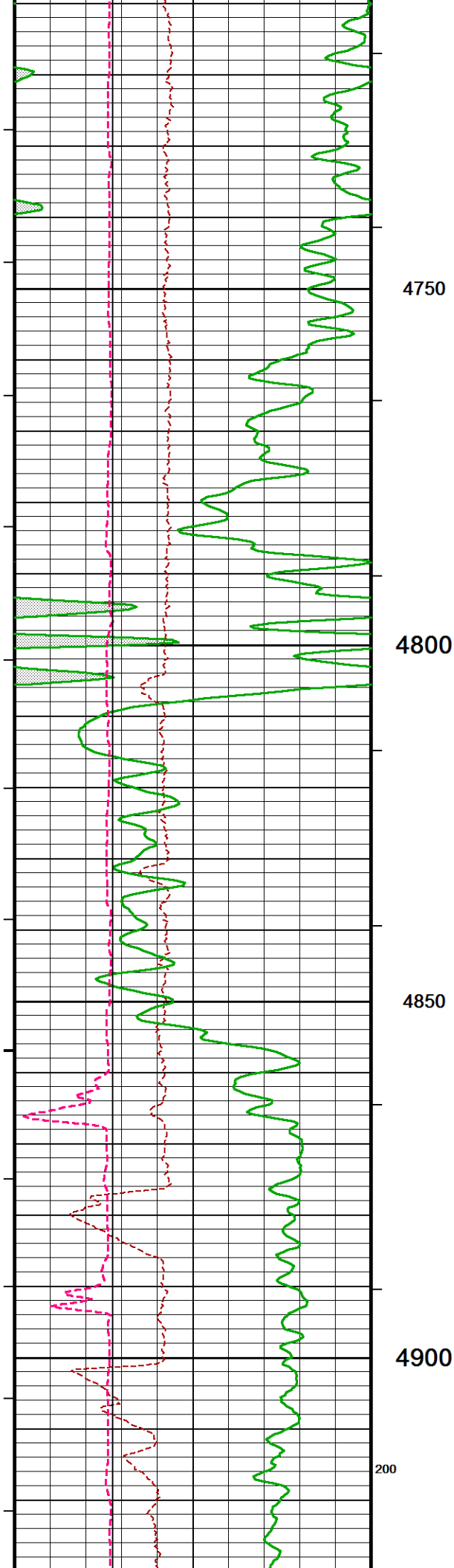


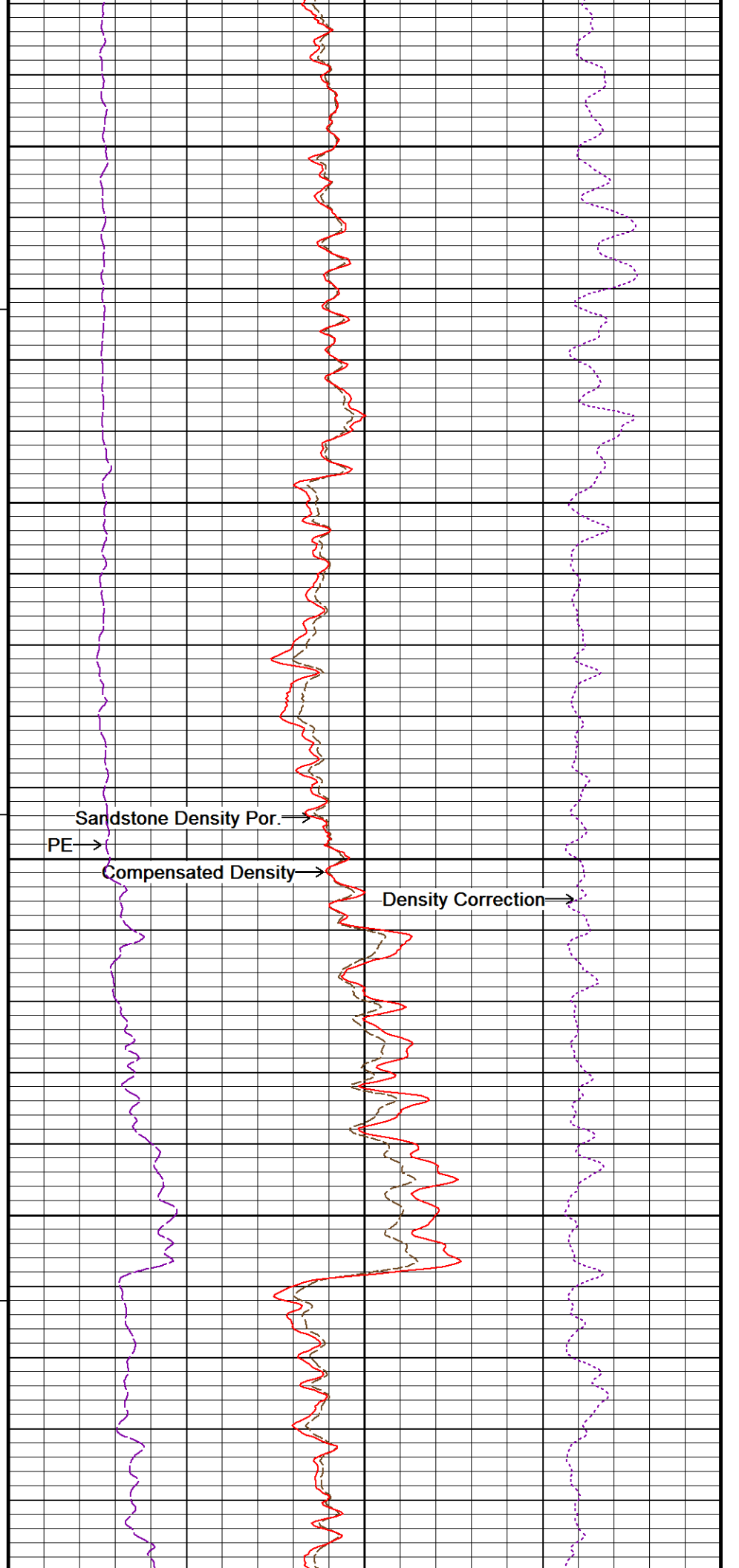
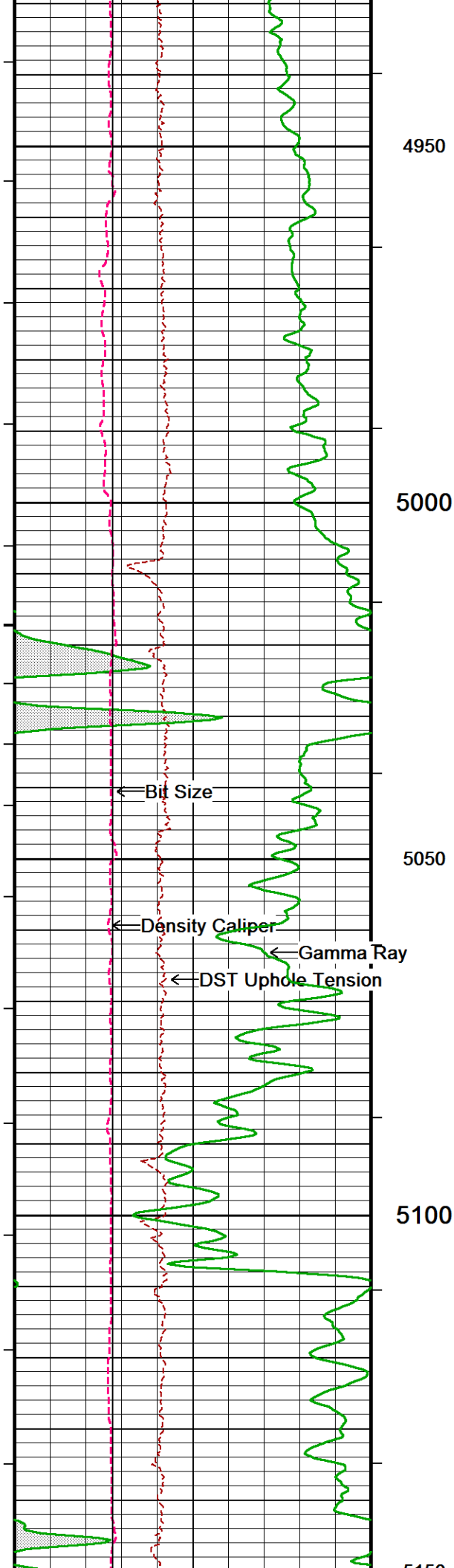


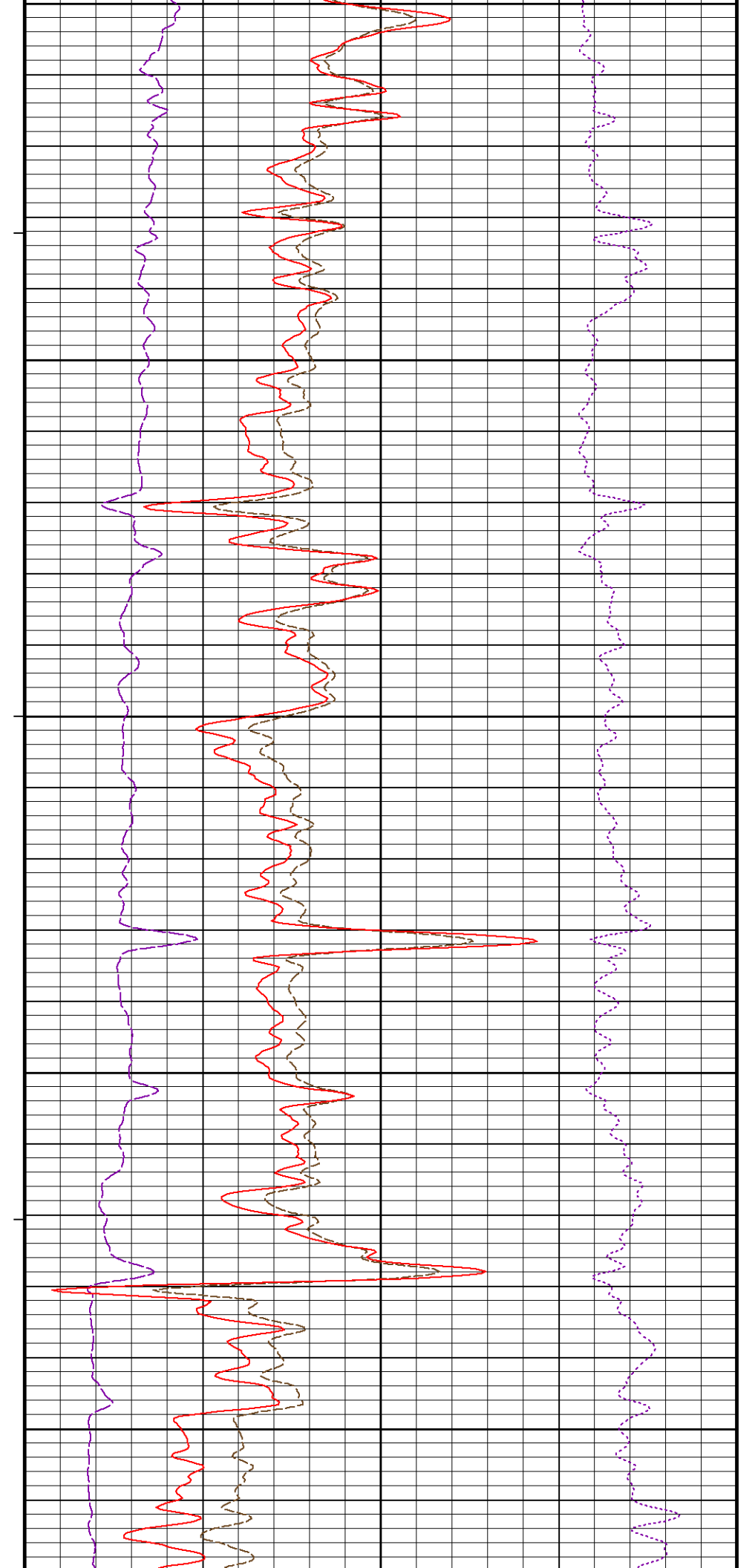
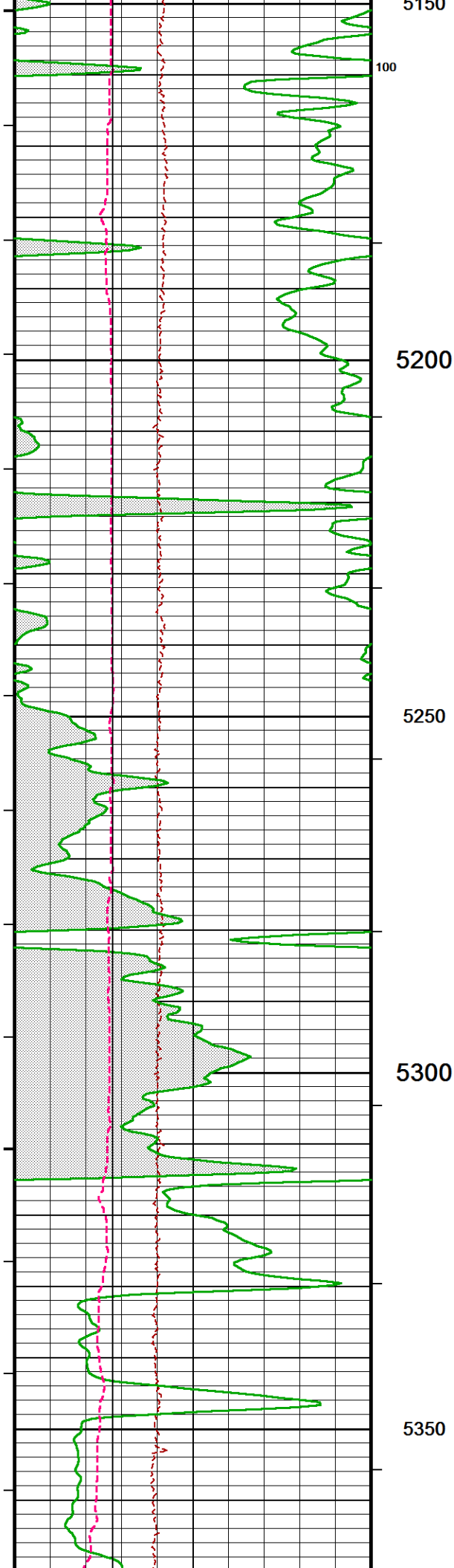


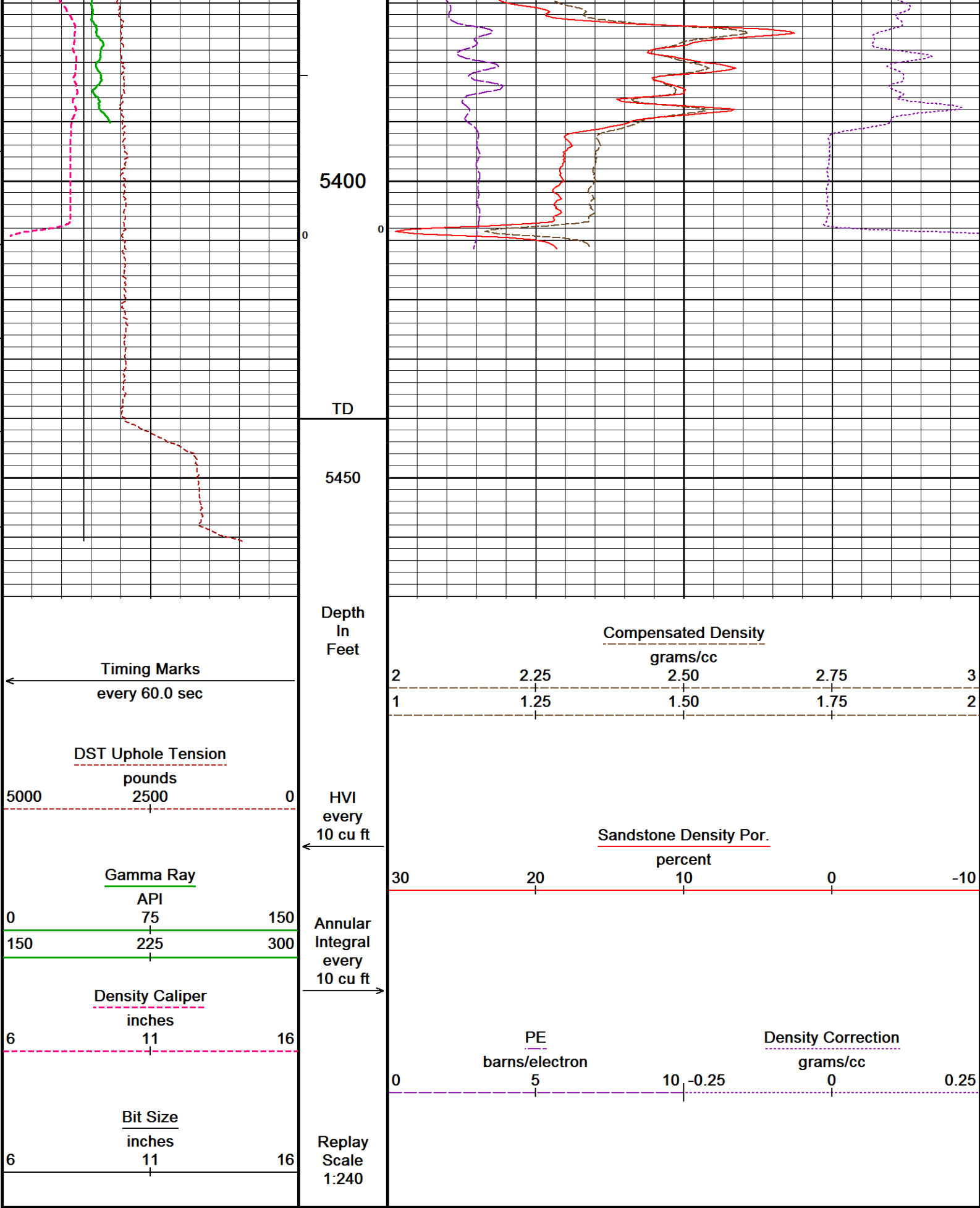












Depth In Feet

Timing Marks every 60.0 sec

DST Uphole Tension pounds

5000 2500 0

HVI every 10 cu ft

Gamma Ray API

0 75 150

150 225 300

Annular Integral every 10 cu ft

Density Caliper inches

6 11 16

Bit Size inches

6 11 16

Replay Scale 1:240

Compensated Density grams/cc

2 2.25 2.50 2.75 3

1 1.25 1.50 1.75 2

Sandstone Density Por. percent

30 20 10 0 -10

PE barns/electron

0 5 10 -0.25

Density Correction grams/cc

0 0.25

## BEFORE SURVEY CALIBRATION

C:\Logs\East Cheyenne Gas Storage\ECGS No 6-21 WPD004-2\Main2.dta

General Constants All 000

Last Edited on 18-OCT-2014,09:49

## General Parameters

Mud Resistivity	2.210	ohm-metres
Mud Resistivity Temperature	65.700	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	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
SW/APOR Tool Source	0.000

Gamma Calibration MCG-E.A 514

Field Calibration on 17-OCT-2014 21:37

	Measured	Calibrated (API)
Background	158	108
Calibrator (Gross)	1491	1020
Calibrator (Net)	1333	912

Gamma Constants MCG-E.A 514

Last Edited on 18-OCT-2014,09:49

Gamma Calibrator Number	GRC 72	
Mud Density	1.15	gm/cc
Caliper Source for Processing	Density Caliper	
Tool Position	Eccentred	
Concentration of KCl		kppm
K Mud Type	Chloride	
K Mud Concentration	0.09	%

Imager Pad Check MIE-A.J 244

Field Check on 14-OCT-2014 16:09

Pad 1	20/20 Buttons Verified	Pad 5	20/20 Buttons Verified
Pad 2	24/24 Buttons Verified	Pad 6	24/24 Buttons Verified
Pad 3	20/20 Buttons Verified	Pad 7	20/20 Buttons Verified
Pad 4	24/24 Buttons Verified	Pad 8	24/24 Buttons Verified

Compact Micro Imager Constants MIE-A.J 244

Last Edited on 07-JUN-2012 08:23

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	11111111.0000	mAmp
Image Processing	11111111	

Navigation Constants MIE-A.J 244

Last Edited on 11-JUL-2012 12:21

Magnetic Declination	0.00	degrees	East
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Magnetometer Parameters MIE-A.J 244

Data 25/04/2014 Magnetometer Calibration 02-MAR-2012 00:50

Date Of Last Magnetometer Calibration 22-AUG-2013,09:56					
	X Magnetometer	Y Magnetometer	Z Magnetometer		
Slope	-1.000000	-1.011965	-0.991340		
Offset	0.010303	-0.015788	0.008269		
Magnetometer Constants MIE-A.J 244					Last Edited on
Magnetometer Calibrator Number		000			
Accelerometer Parameters MIE-A.J 244					
Date Of Last Accelerometer Calibration		13-FEB-2013,14:31			
	X Accelerometer	Y Accelerometer	Z Accelerometer		
Slope	-1.103572	-1.107641	-1.103778		
Offset	-0.006989	0.006286	-0.003996		
Accelerometer Constants MIE-A.J 244					Last Edited on 14-OCT-2014,16:12
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	
Caliper Calibration MIE-A.J 244					Base Calibration on 14-OCT-2014 16:03 Field Calibration on 14-OCT-2014 16:04
Base Calibration					
Reading No	Pads 1-5 Meas.	Pads 3-7 Meas.	Calibrator Size (in)		
1	24598	25678	5.96		
2	34609	35979	7.97		
3	44567	45592	9.84		
4	55923	57146	11.91		
5	0	0	0.00		
Reading No	Pad 2 Meas.	Pad 4 Meas.	Pad 6 Meas.	Pad 8 Meas.	Calibrator Size (in)
1	24589	26958	24376	23838	5.96
2	33342	35325	33013	32430	7.97
3	41271	43620	41279	40227	9.84
4	51419	52989	50755	49959	11.91
5	0	0	0	0	0.00
Field Calibration					
	Measured	Measured	Actual		
	Pads 1-5 Caliper(in)	Pads 3-7 Caliper(in)	Caliper(in)		
	8.00	7.94	7.97		
	Measured	Measured	Measured	Measured	Actual
	Pad 2 Caliper(in)	Pad 4 Caliper(in)	Pad 6 Caliper(in)	Pad 8 Caliper(in)	Caliper(in)
	3.99	3.99	3.97	3.98	7.97
Caliper Constants MIE-A.J 244					Last Edited on 07-JUN-2012 08:23
Caliper Difference for BRKT		0.120 inches			



Base Calibration on 14-OCT-2014 10:20  
Field Calibration on 17-OCT-2014 21:07

Base Calibration		
Reading No	Measured	Calibrator Size (in)
1	18461	3.98
2	26997	5.96
3	35483	7.97
4	43651	9.84
5	53133	11.91
6	N/A	N/A

Field Calibration	Measured Caliper (in)	Actual Caliper (in)
	8.00	7.97

Base Calibration on 14-OCT-2014 14:09  
Field Check on 17-OCT-2014 21:12

Density Calibration		Measured		Calibrated (sdu)	
Base Calibration		Near	Far	Near	Far
Background	1298	1497			
Reference 1	57019	26155	59827	30835	
Reference 2	22831	2654	24869	2514	

Field Check at Base	1298.4	1497.0
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Field Check	1300.4	1513.3
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PE Calibration				
Base Calibration		Measured		Calibrated
	WS	WH	Ratio	Ratio
Background	247	1158		
Reference 1	24103	56800	0.429	0.367
Reference 2	6793	22680	0.304	0.269

Field Check at Base	247.0	1157.5
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Field Check	248.8	1160.9
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## Last Edited on 18-OCT-2014,09:51

Density Source Id	P50562B	
Nylon Calibrator Number	658	
Aluminium Calibrator Number	658	
Density Shoe Profile	8 inch	
Caliper Source for Processing	Density Caliper	
PE Correction to Density	Not Applied	
Mud Density	1.15	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	

[illegible]

# DOWNHOLE EQUIPMENT

C:\Logs\East Cheyenne Gas Storage\ECGS No 6-21 WPD004-2\Main2.dta

SHA-J.B Compact Swivel Head Adaptor  
SHA-J.B 587 LG: 2.30 ft WT: 22.0 lb OD: 2.244 in

Compact Comms Gamma  
MCG-E.A 514 LG: 8.70 ft WT: 63.9 lb OD: 2.244 in

Compact Neutron  
MDN-B.A 296 LG: 5.04 ft WT: 50.7 lb OD: 2.244 in

MIS-D.B Compact Inline Bowspring sub  
MIS-D.B 702 LG: 5.70 ft WT: 33.1 lb OD: 2.240 in

Compact Density/Caliper  
MPD-D.A 460 LG: 9.59 ft WT: 90.4 lb OD: 2.449 in

SKJ-D.A Compact Knuckle Joint  
SKJ-D.A 115 LG: 2.17 ft WT: 24.3 lb OD: 2.244 in

MIS-E.B Compact Inline Standoff sub  
MIS-E.B 786 LG: 2.14 ft WT: 15.4 lb OD: 2.244 in

SKJ-D.A Compact Knuckle Joint  
SKJ-D.A 88 LG: 2.17 ft WT: 24.3 lb OD: 2.244 in

Compact Focussed Electric  
MFE-B.A 219 LG: 6.05 ft WT: 48.5 lb OD: 2.244 in

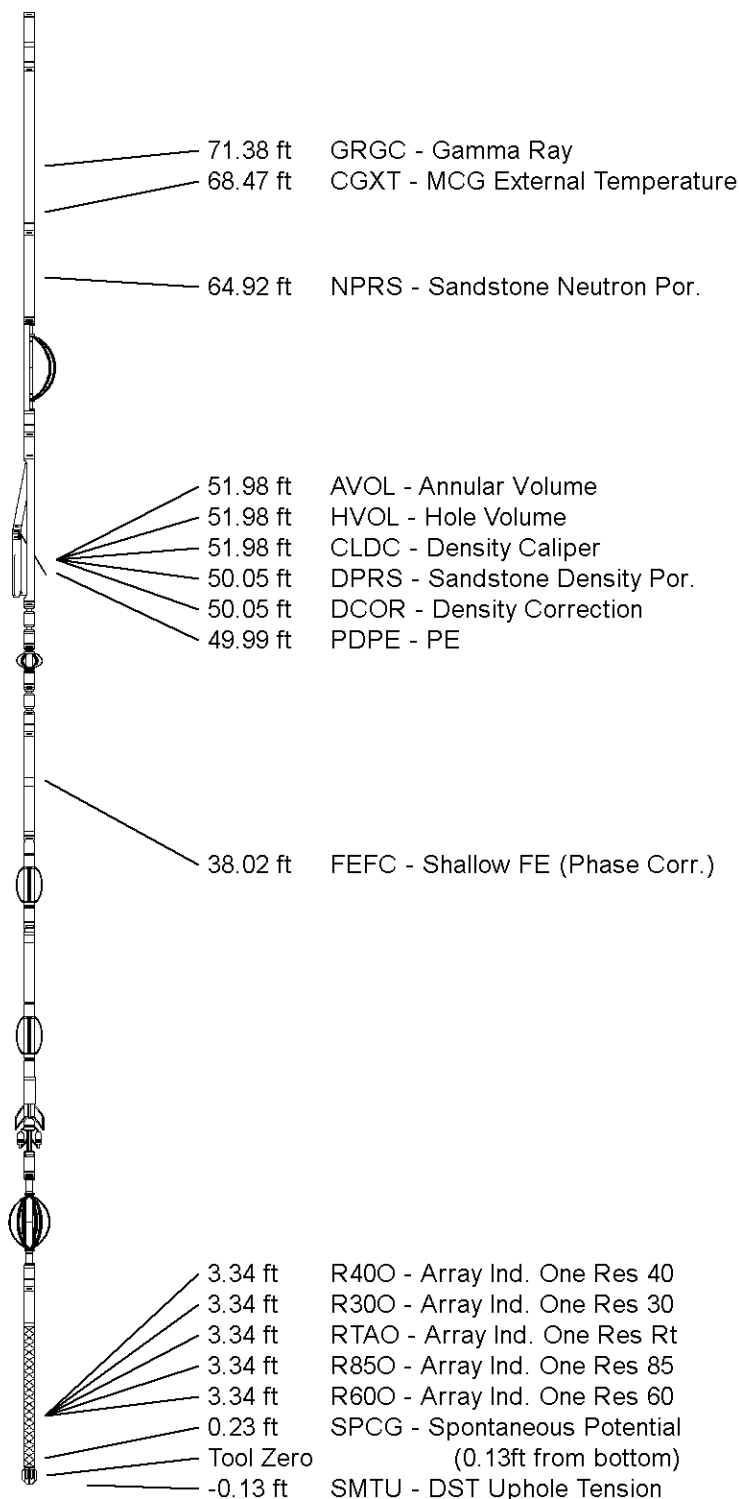
Compact MMI Memory Section  
MIM-A.J 244 LG: 4.65 ft WT: 26.5 lb OD: 2.244 in

Compact MMI Electrode Section  
MIE-A.J 244 LG: 13.96 ft WT: 99.2 lb OD: 4.094 in

MIS-D.B Compact Inline Bowspring sub  
MIS-D.B 730 LG: 5.70 ft WT: 33.1 lb OD: 2.240 in

Compact Induction  
MAI-B.A 269 LG: 10.81 ft WT: 48.5 lb OD: 2.240 in

Total Length: 78.96 ft Weight: 579.8 lb



COMPANY

EAST CHEYENNE GAS STORAGE LLC

WELL

ECGS No 6-21 WPD004-2

FIELD

WEST PEETZ

PROVINCE/COUNTY

LOGAN

COUNTRY/STATE

U.S.A / COLORADO

Elevation Kelly Bushing	4567.00	feet
Elevation Drill Floor	4566.00	feet
Elevation Ground Level	4557.00	feet

First Reading	5388.00	feet
Depth Driller	5440.00	feet
Depth Logger	5440.00	feet



COMPENSATED DENSITY



COMPENSATED DENSITY  
COMPENSATED NEUTRON  
LOG