Weatherford®

DUAL NEUTRON PHOTO-DENSITY

COMPANY	NGL ENERGY PARTNERS
WELL	SOUTH WELD SWD #1
FIELD	WATTENBERG
PROVINCE/COUNTY	WELD COUNTY
COUNTRY/STATE	USA/COLORADO
LOCATION	SHL: SWNE 1615 FNL 1713 FEL

SEC 30	TWP 1N	RGE 66W	Other Services
Latitude		40.025060	ARRAY INDUCTION
Longitude		-104.816540	
API Number		05-123-47682	

Permanent Datum GL, Elevation 4952 feet
Log Measured From KB, 25.00 feet above Permanent Datum
Drilling Measured From KB

Elevations:	feet
KB	4977.00
DF	4977.00
GL	4952.00

Date	15-FEB-2019		
Run Number	2		
Service Order	2938-234754042		
Depth Driller	11040.00 feet		
Depth Logger	11036.00 feet		
First Reading	11012.81 feet		
Last Reading	9161.00 feet		
Casing Driller	9162.00 feet		
Casing Logger	9161.00 feet		
Bit Size	6.750 inches		
Hole Fluid Type	WBM		
Density / Viscosity	8.70 lb/USg	37.00 sec/qt	
PH / Fluid Loss	8.70	8.30 ml/30Min	
Sample Source	FLOWLINE		
Rm @ Measured Temp	0.36 @ 75.0 ohm-m		
Rmf @ Measured Temp	0.27 @ 75.0 ohm-m		
Rmc @ Measured Temp	0.45 @ 75.0 ohm-m		
Source Rmf / Rmc	CALC	CALC	
Rm @ BHT	0.099 @288.0 ohm-m		
Time Since Circulation	12 HRS		
Max Recorded Temp	288.00 deg F		
Equipment / Base	13173	CASPER	
Recorded By	ARBER CUKU		
Witnessed By	WILLIAM GACHES		
RIG	PATTERSON 346		

BOREHOLE RECORD

Last Edited: 15-FEB-2019 20:40

Bit Size inches	Depth From feet	Depth To feet
9.875	1235.00	9166.00
6.750	9166.00	11040.00

CASING RECORD

Type	Size inches	Depth From feet	Shoe Depth feet	Weight pounds/ft
SURFACE	10.750	0.00	1235.00	40.50
CASING	7.625	0.00	9162.00	29.70

REMARKS

TOOL STRING RUN AS PER THE TOOL STRING DIAGRAM.

TOOLSTRING CONFIGURED FOR VERTICAL AND LOW DEVIATION TRAJECTORY.

PRIMARY SERVICES ACQUIRED:
MCG: GAMMA RAY
MDN: DUAL SPACED NEUTRON
MPD: PHOTO-DENSITY
MAI - MFE: ARRAY INDUCTION

HARDWARE USED:
MPD: 4 inch PROFILE PLATE
MPD: 0.5" STANDOFF OFFSET FOR TOOLS BELOW.
MMR: CALIPER ARM FOR DECENTRALIZATION ABOVE MDN.
MVC: USED FOR DECENTRALIZATION ABOVE MPD
MAI: 0.5" SPRING STANDOFF ASSEMBLY ON BOTTOM

2.68 G/CC MATRIX DENSITY USED TO CALCULATE POROSITY.

THIS IS THE SECOND RUN IN THIS WELL. LOG CORRELATED WITH THE FIRST "TRIPLE COMBO" LOG ON INTERMEDIATE SECTION LOGGED BY WEATHERFORD ON 04-FEB-2019.

BOREHOLE WASHOUTS AFFECT DENSITY CORRECTION IN INTERVALS: (11036 ft - 10490 ft), (9208 ft - 9161 ft).

ANNULAR HOLE VOLUME CALCULATED FOR FUTURE CASING SIZE OF 5.5 inches.

HOLE AND ANNULAR HOLE VOLUME CALCULATED FROM DENSITY CALIPER MEASUREMENTS.

5 INCH BULK DENSITY MAIN PASS

Depth Based Data - Maximum Sampling Increment 10.0cm
Filename: C:\LOGS\NGL\SOUTH WELD SWD #1 PILOT\Main Pass.dta
System Versions: Logged with 18.05.7089 Plotted with 18.05.7089

Plotted on 16-FEB-2019 00:17
Recorded on 15-FEB-2019 21:59

Timing Marks
every 60.0 sec

Depth in Feet

Compensated Density
grams/cc
2 | 2.25 | 2.50 | 2.75 | 3

Density Caliper
inches
4 | 9 | 14

MCG BH Corrected Gamma
API
0 | 75 | 150
150 | 225 | 300

Base Density Porosity
v/v
0.30 | 0.20 | 0.10 | 0.00 | -0.10

Borehole Temp in deg F

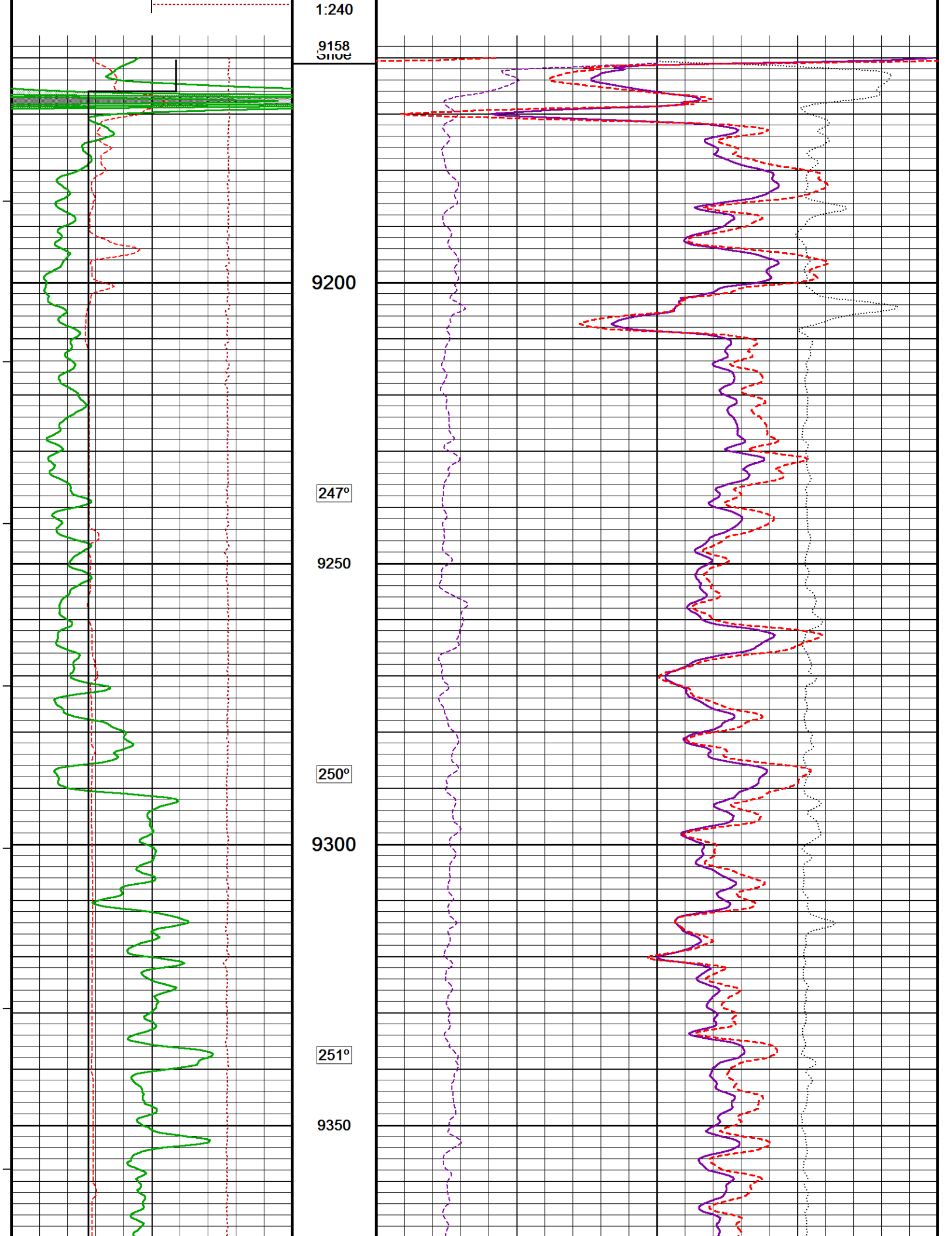
Bit Size
inches
4 | 9 | 14

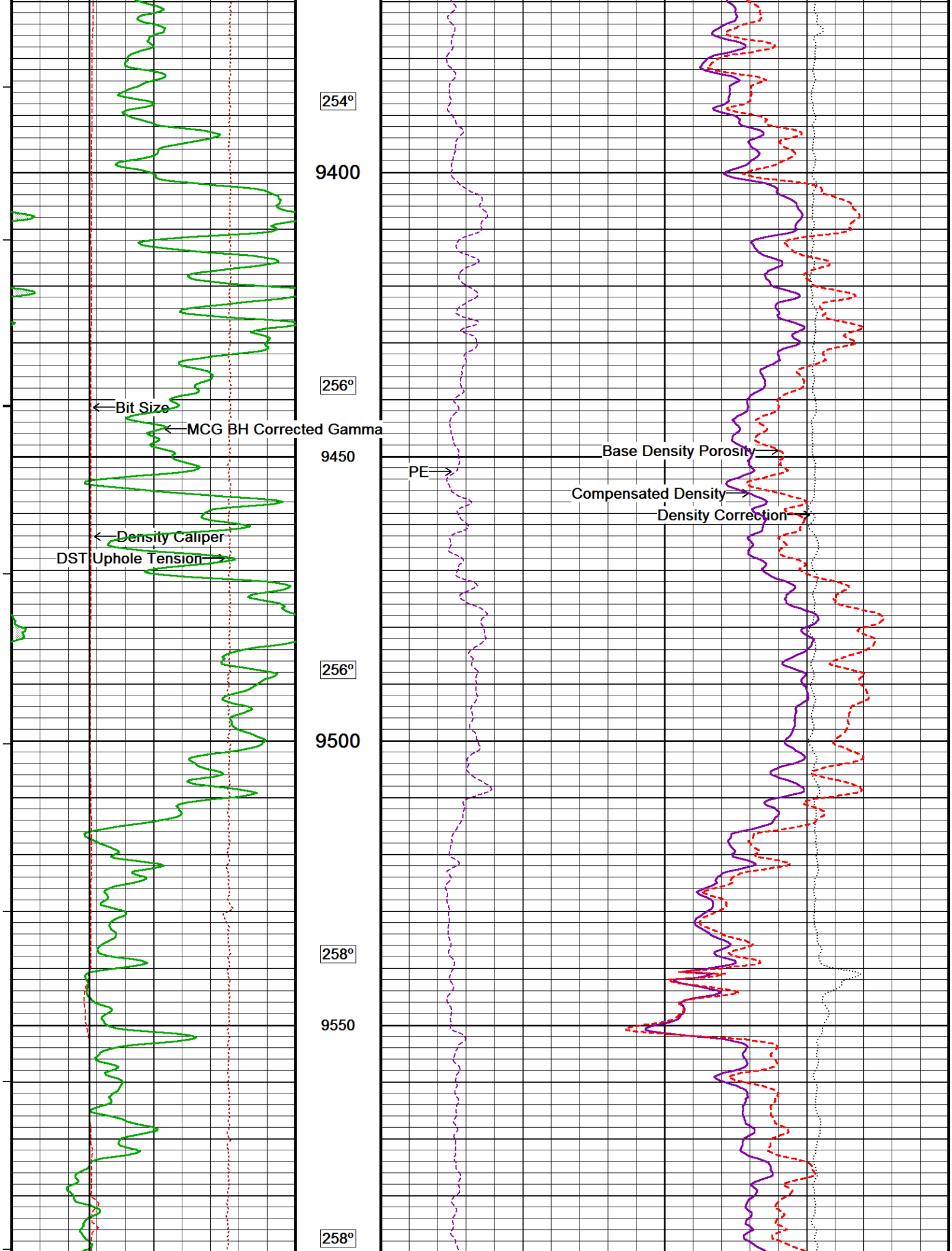
PE
barns/electron
0 | 5 | 10

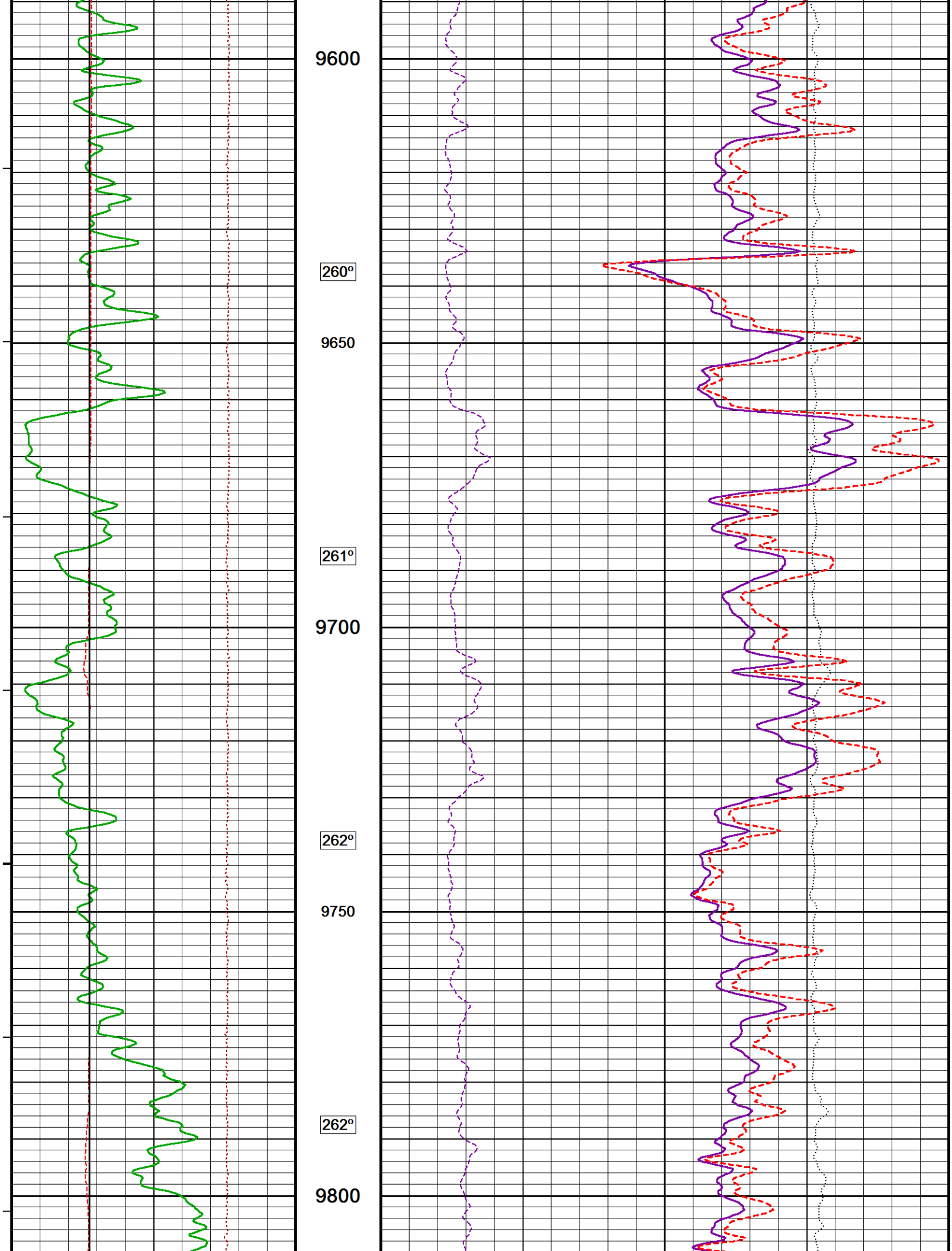
Density Correction
grams/cc
-0.50 | 0 | 0.50

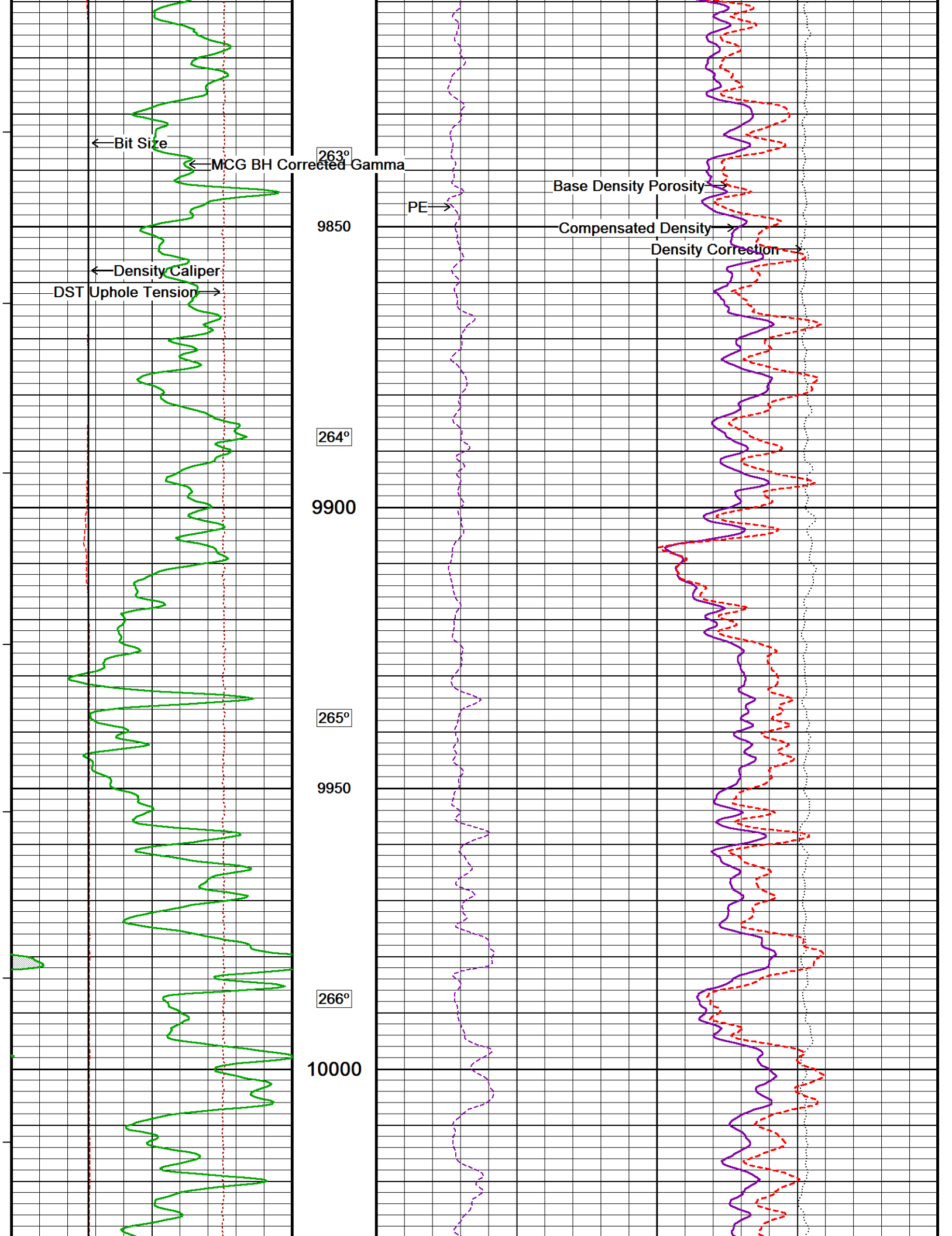
DST Uphole Tension
pounds
5000 | 0

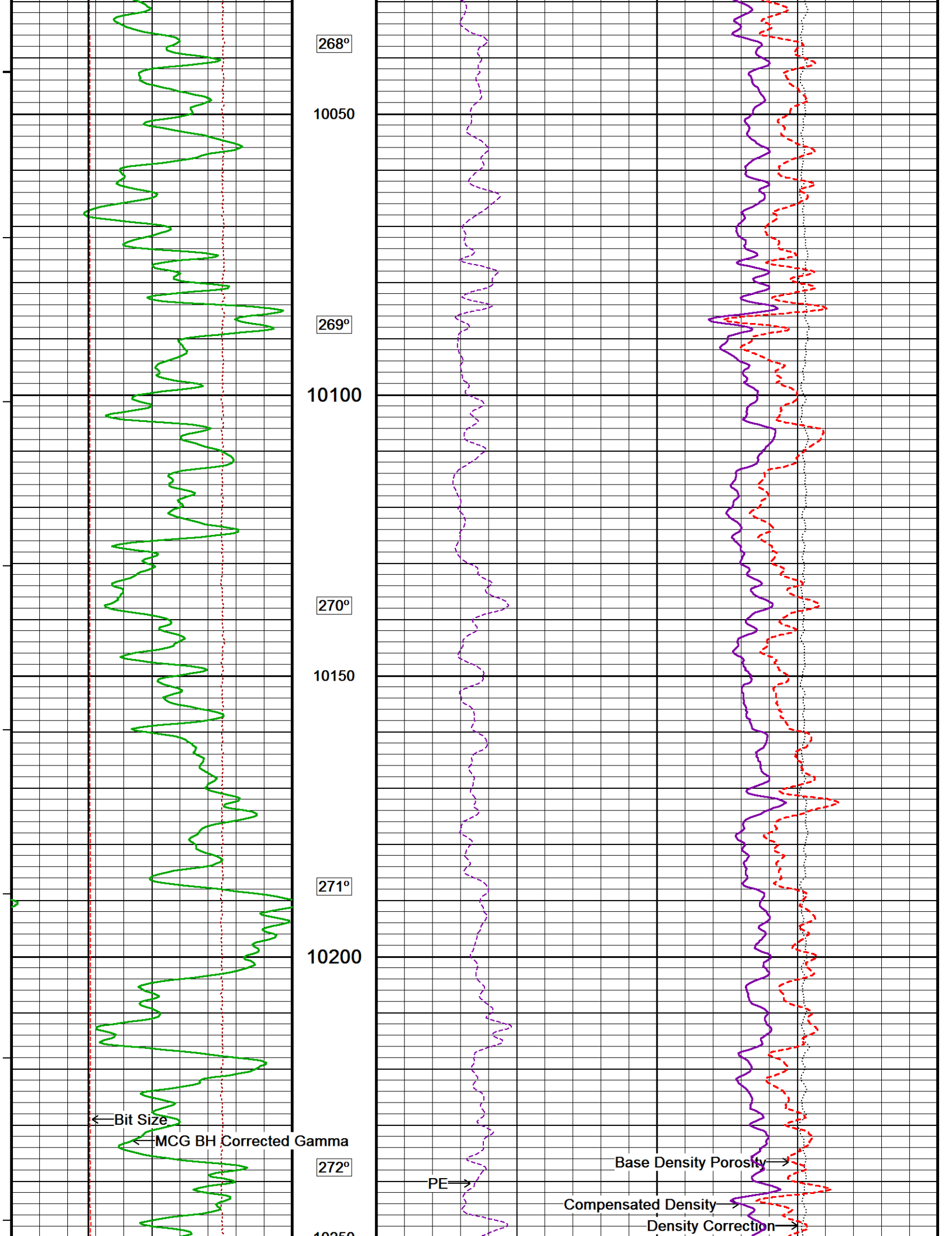
Replay Scale

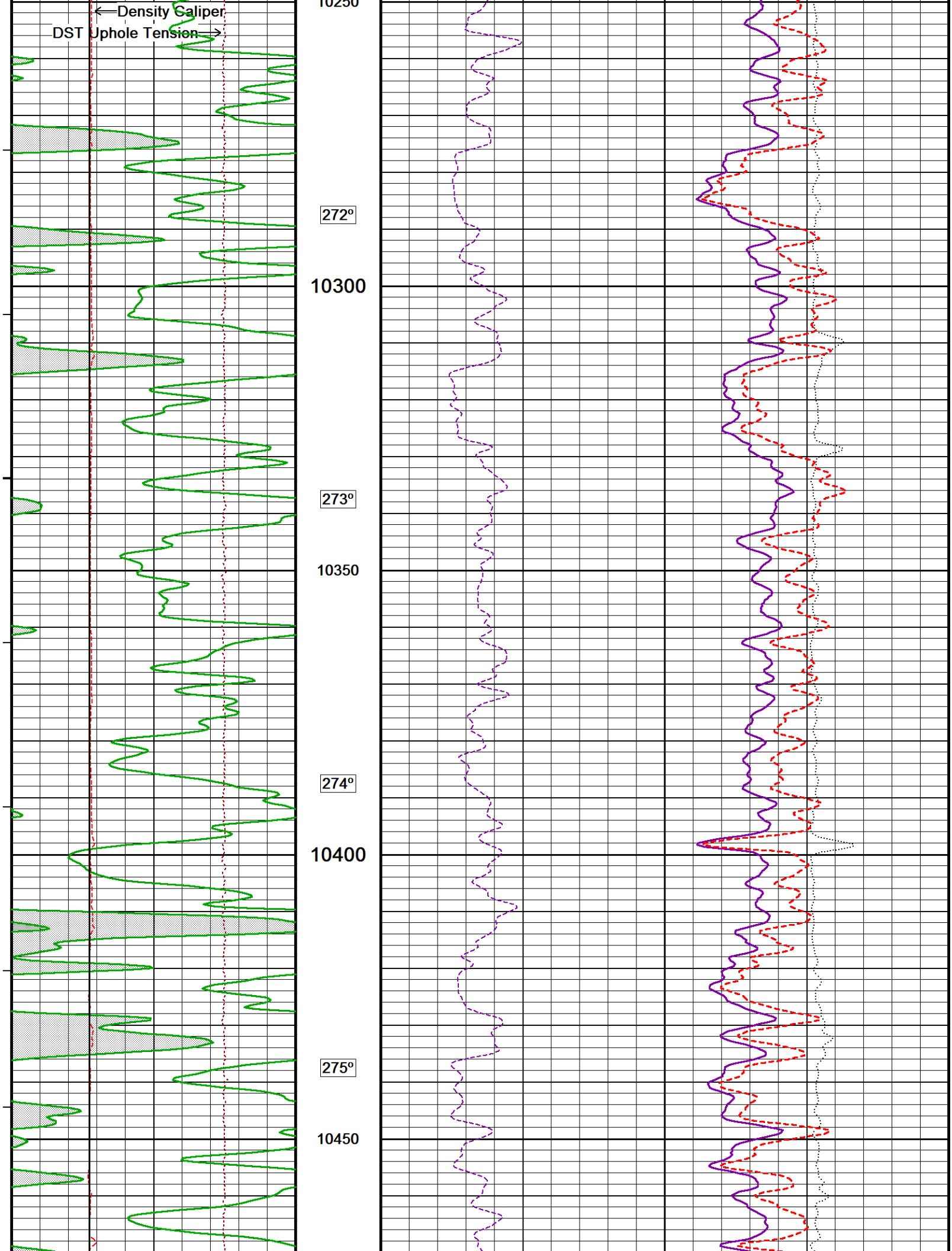

1:240
9158
Shoe
9200
247°
9250
250°
9300
251°
9350

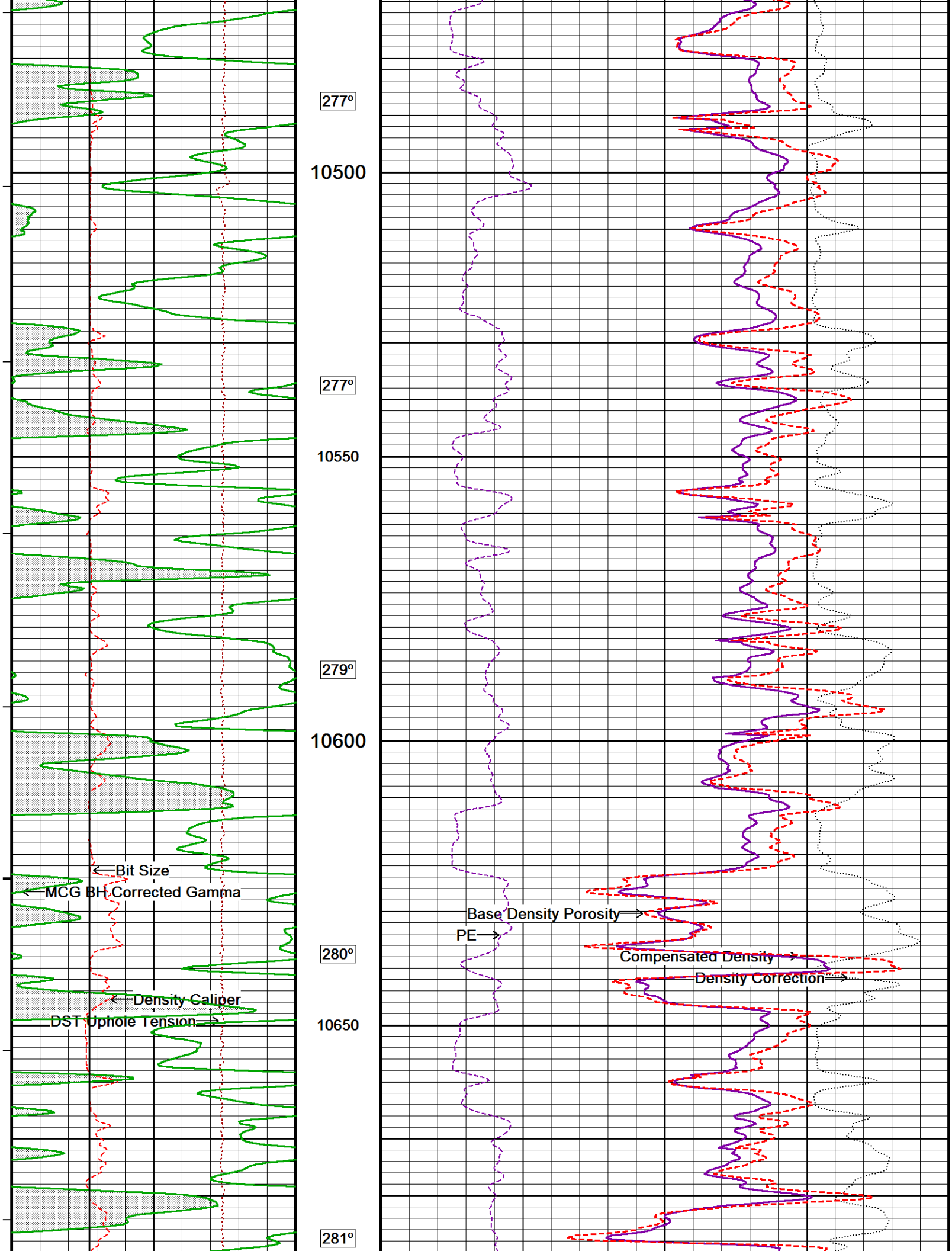

254°
9400
256°
Bit Size
MCG BH Corrected Gamma
9450
PE
Base Density Porosity
Compensated Density
Density Correction
Density Caliper
DST Uphole Tension
256°
9500
258°
9550
258°

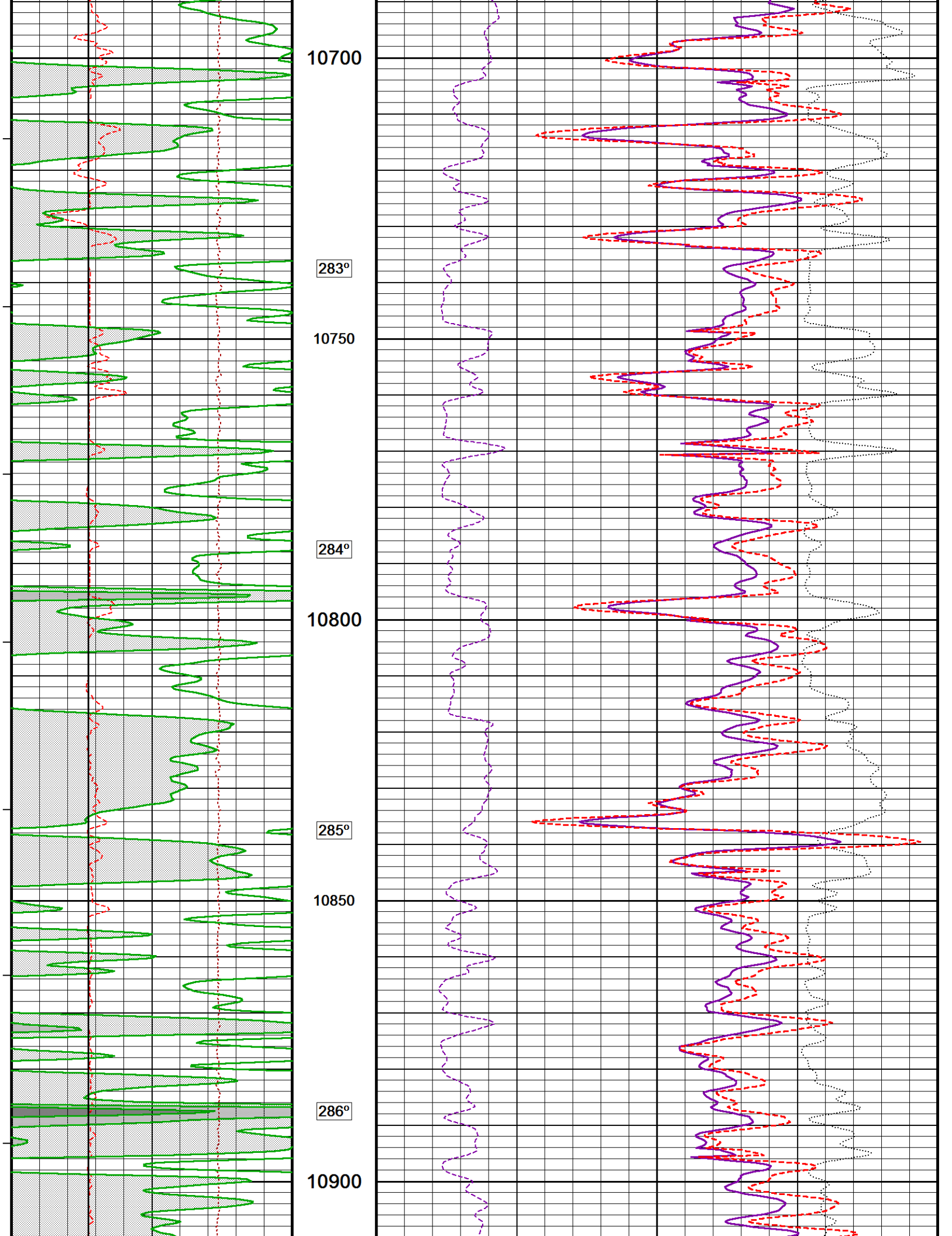

9600
260°
9650
261°
9700
262°
9750
262°
9800

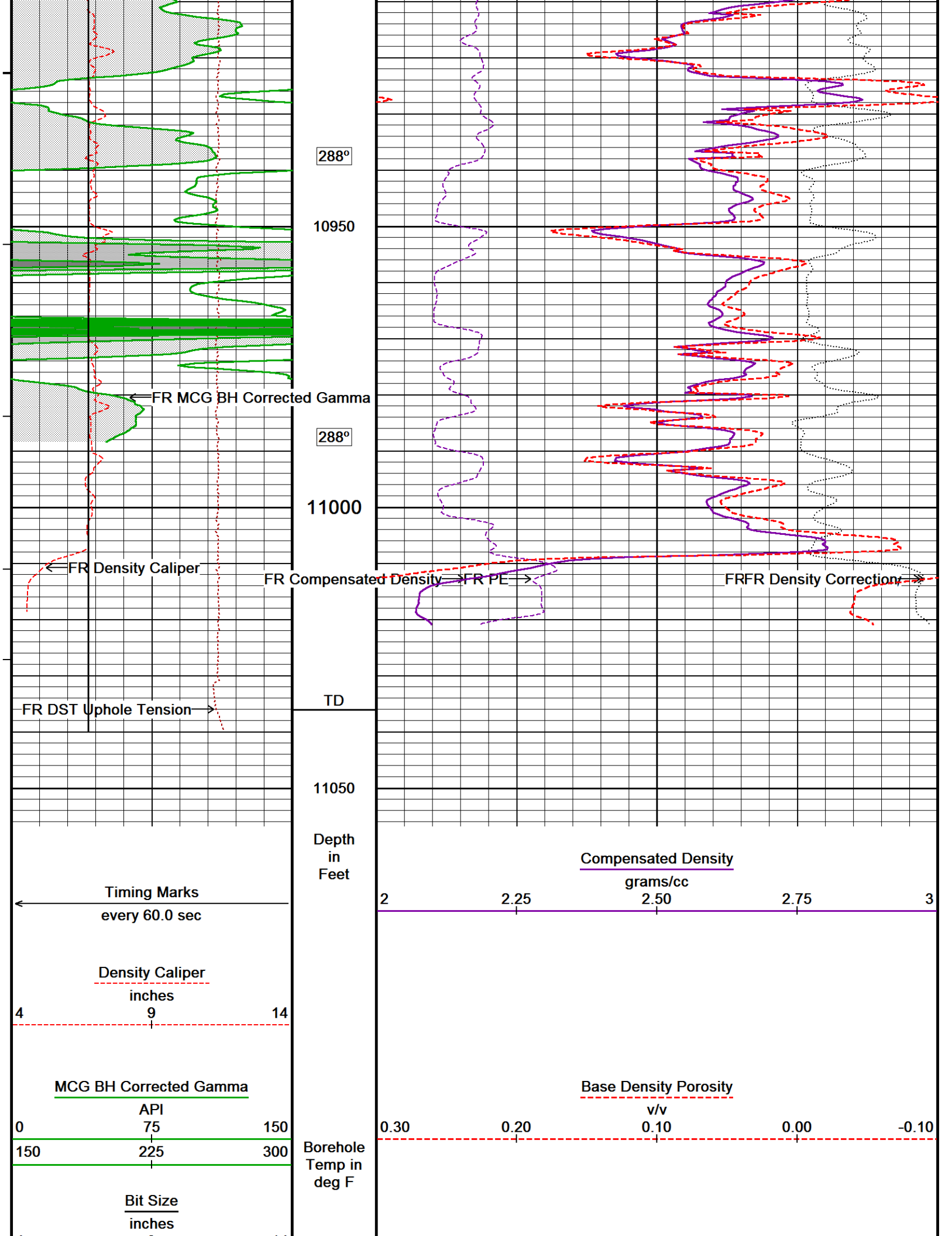

Bit Size
MCG BH Corrected Gamma
Density Caliper
DST Uphole Tension
263°
9850
264°
9900
265°
9950
266°
10000
PE
Base Density Porosity
Compensated Density
Density Correction

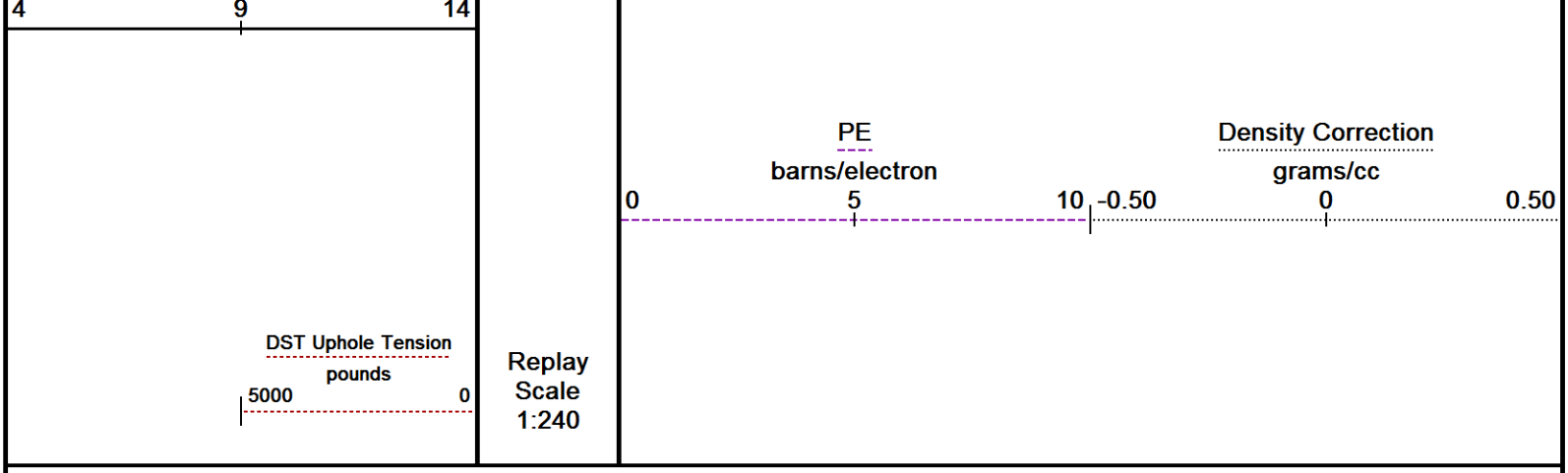

268º
10050
269º
10100
270º
10150
271º
10200
272º
Bit Size
MCG BH Corrected Gamma
PE
Base Density Porosity
Compensated Density
Density Correction


←Density Caliper
DST Uphole Tension→
10250
272°
10300
273°
10350
274°
10400
275°
10450


277°
10500
277°
10550
279°
10600
280°
10650
281°
←Bit Size
←MCG BH Corrected Gamma
←Density Caliber
DST Uphole Tension→
Base Density Porosity→
PE→
Compensated Density→
Density Correction→


10700
283°
10750
284°
10800
285°
10850
286°
10900


288°
10950
FR MCG BH Corrected Gamma
288°
11000
FR Density Caliper
FR Compensated Density
FR PE
FRFR Density Correction
TD
FR DST Uphole Tension
11050
Depth in Feet
Compensated Density
grams/cc
2
2.25
2.50
2.75
3
Timing Marks
every 60.0 sec
Density Caliper
inches
4
9
14
MCG BH Corrected Gamma
API
0
75
150
150
225
300
Base Density Porosity
v/v
0.30
0.20
0.10
0.00
-0.10
Borehole Temp in deg F
Bit Size
inches

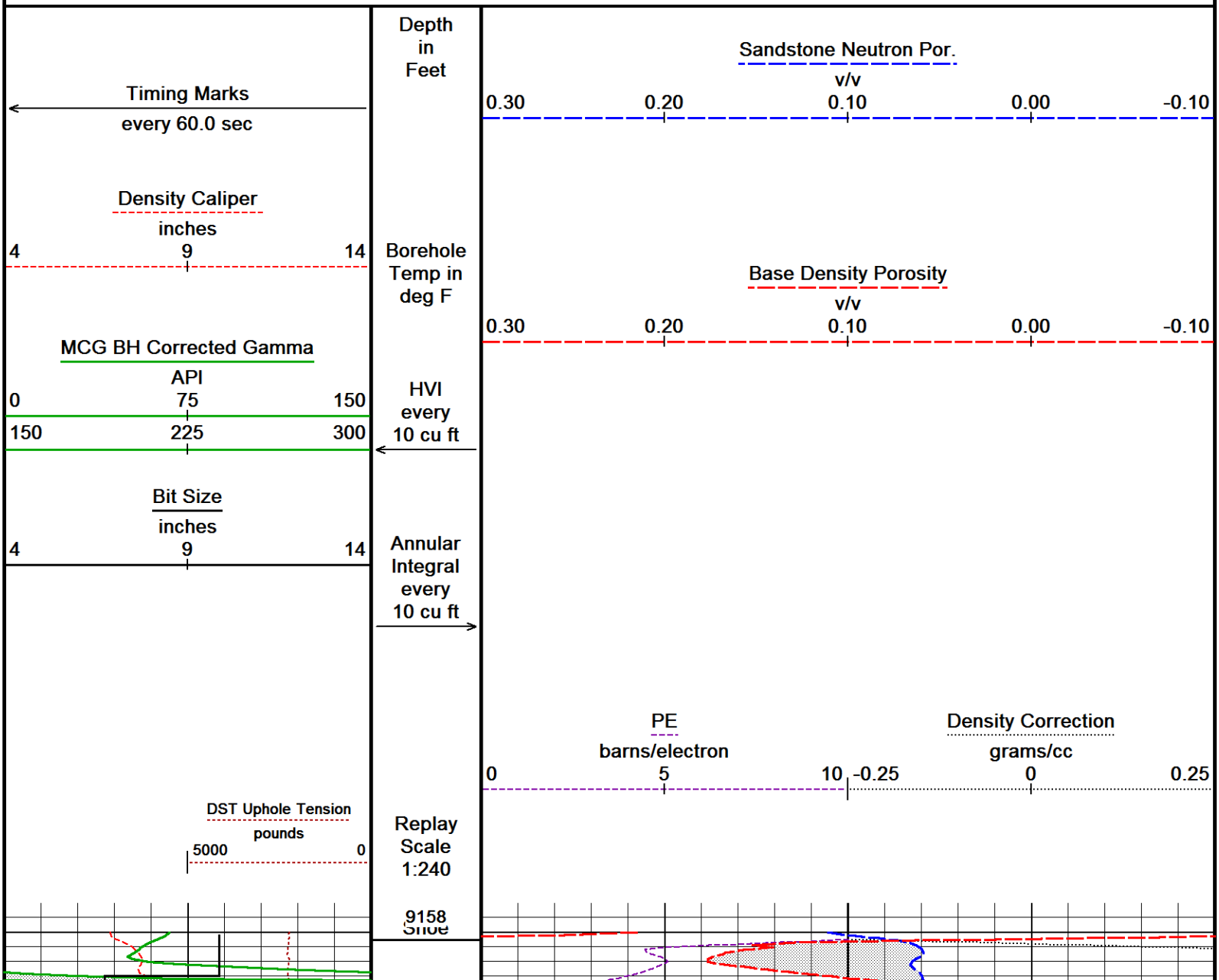


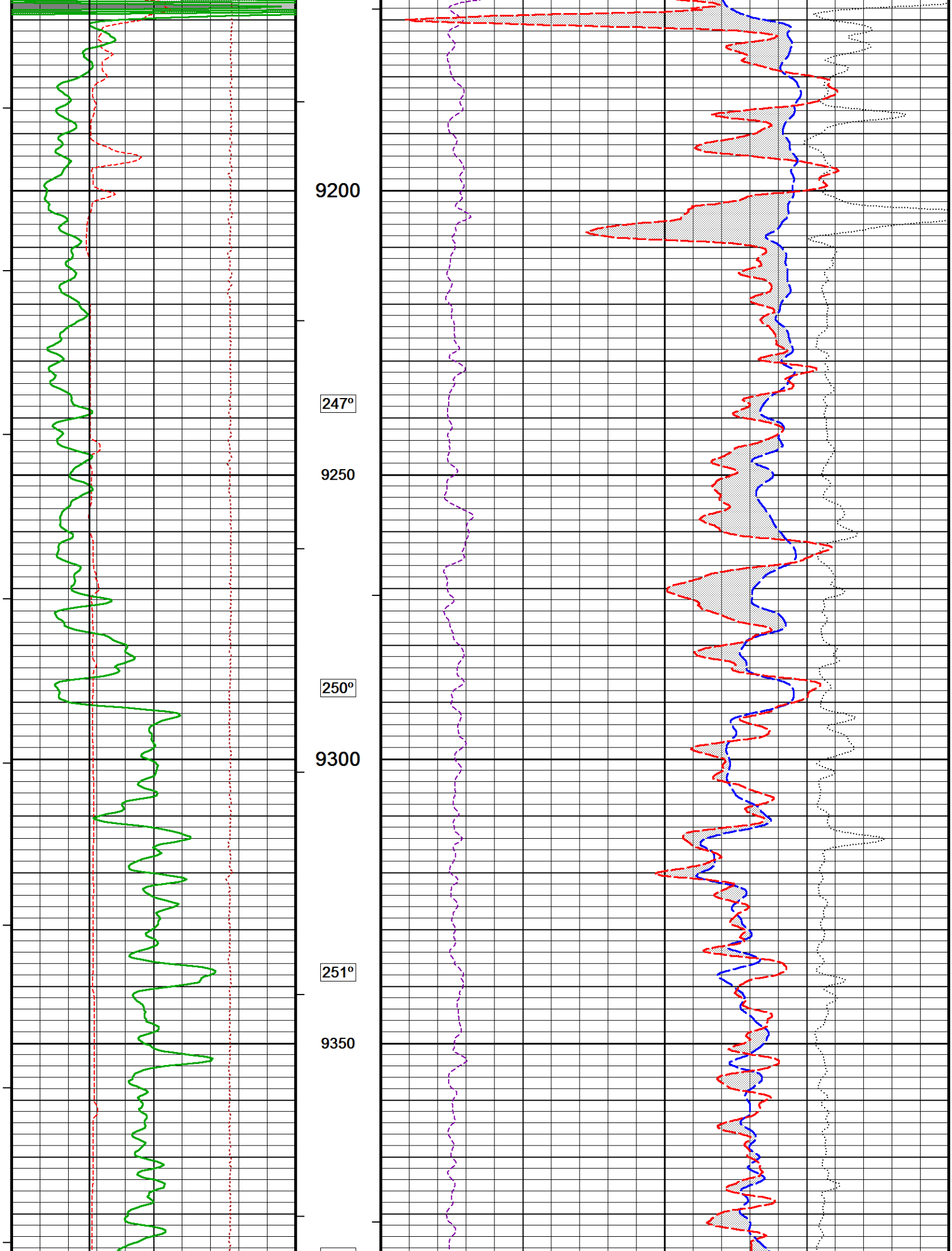
Depth Based Data - Maximum Sampling Increment 10.0cm
Plotted on 16-FEB-2019 00:17
Filename: C:\LOGS\NGL\SOUTH WELD SWD #1 PILOT\Main Pass.dta
Recorded on 15-FEB-2019 21:59
System Versions: Logged with 18.05.7089 Plotted with 18.05.7089

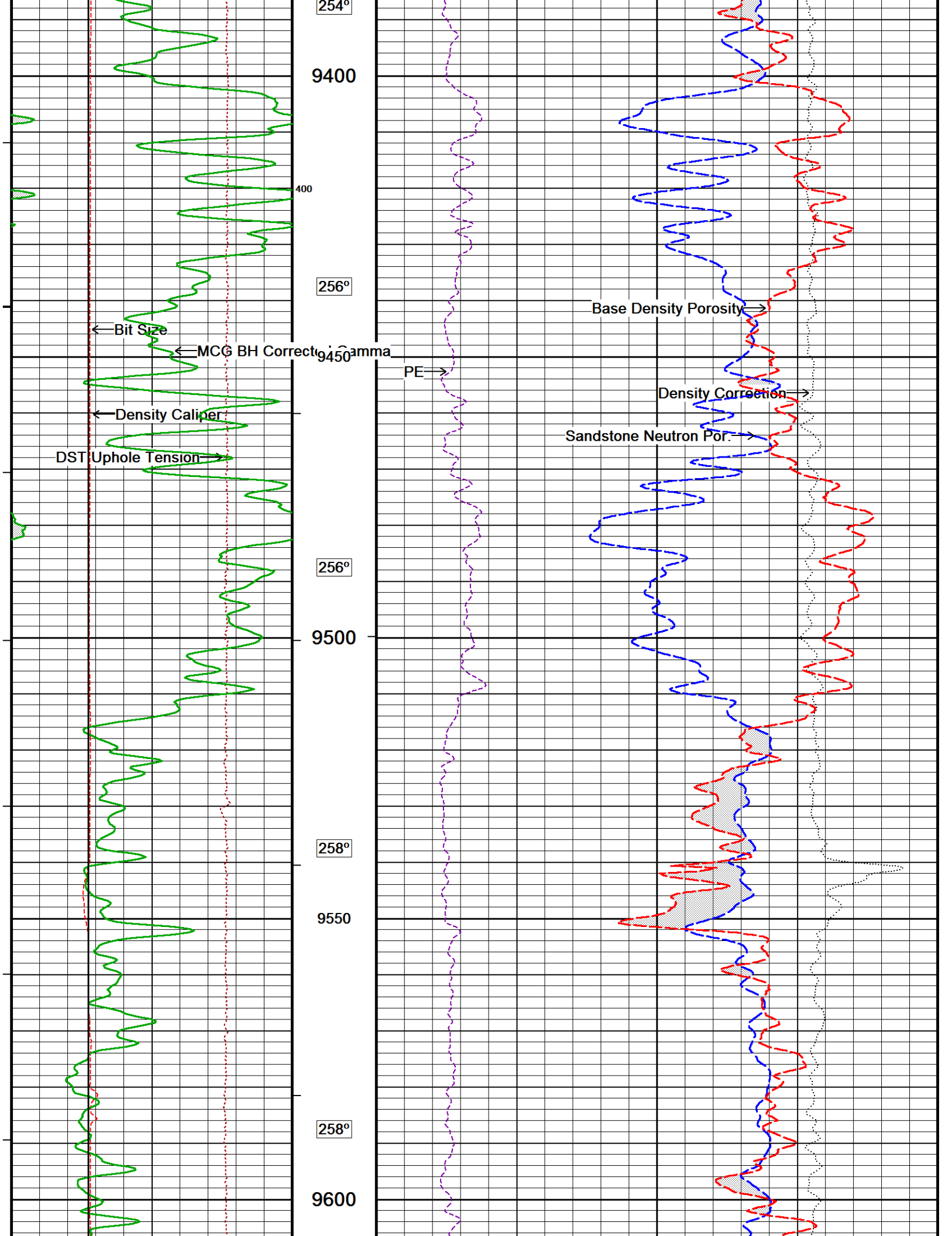
5 INCH BULK DENSITY MAIN PASS

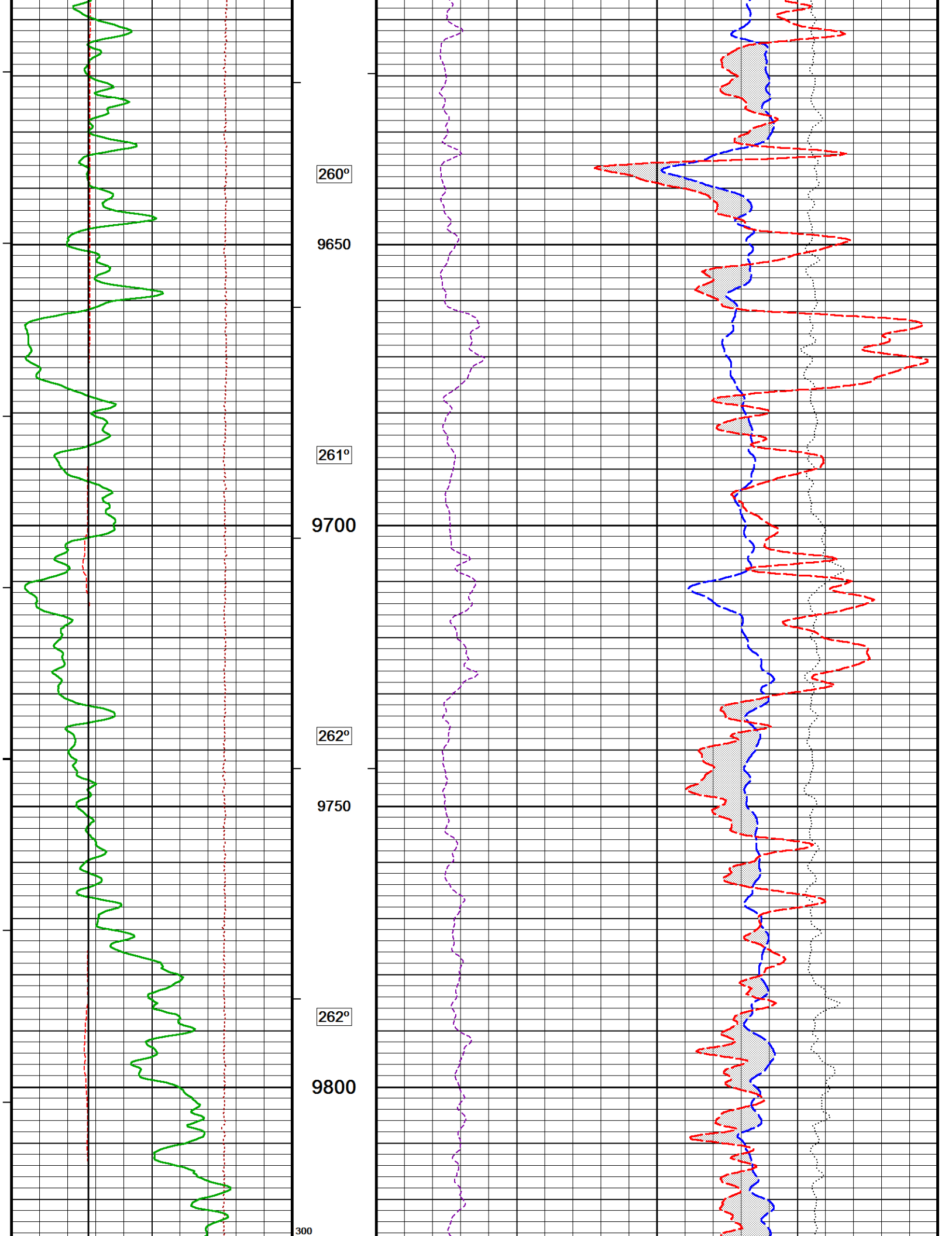
5 INCH POROSITY MAIN PASS

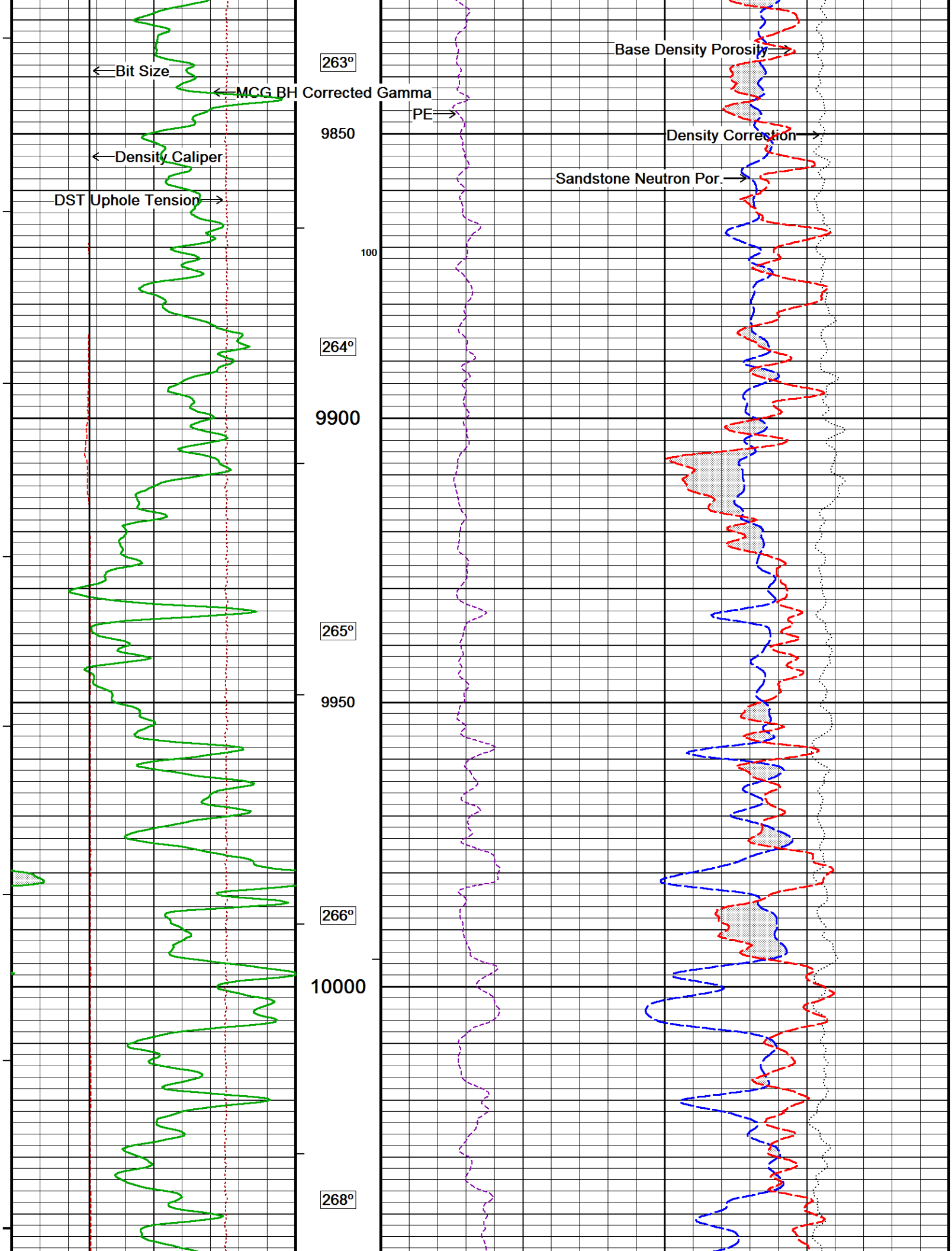
Depth Based Data - Maximum Sampling Increment 10.0cm
Plotted on 16-FEB-2019 00:17
Filename: C:\LOGS\NGL\SOUTH WELD SWD #1 PILOT\Main Pass.dta
Recorded on 15-FEB-2019 21:59
System Versions: Logged with 18.05.7089 Plotted with 18.05.7089

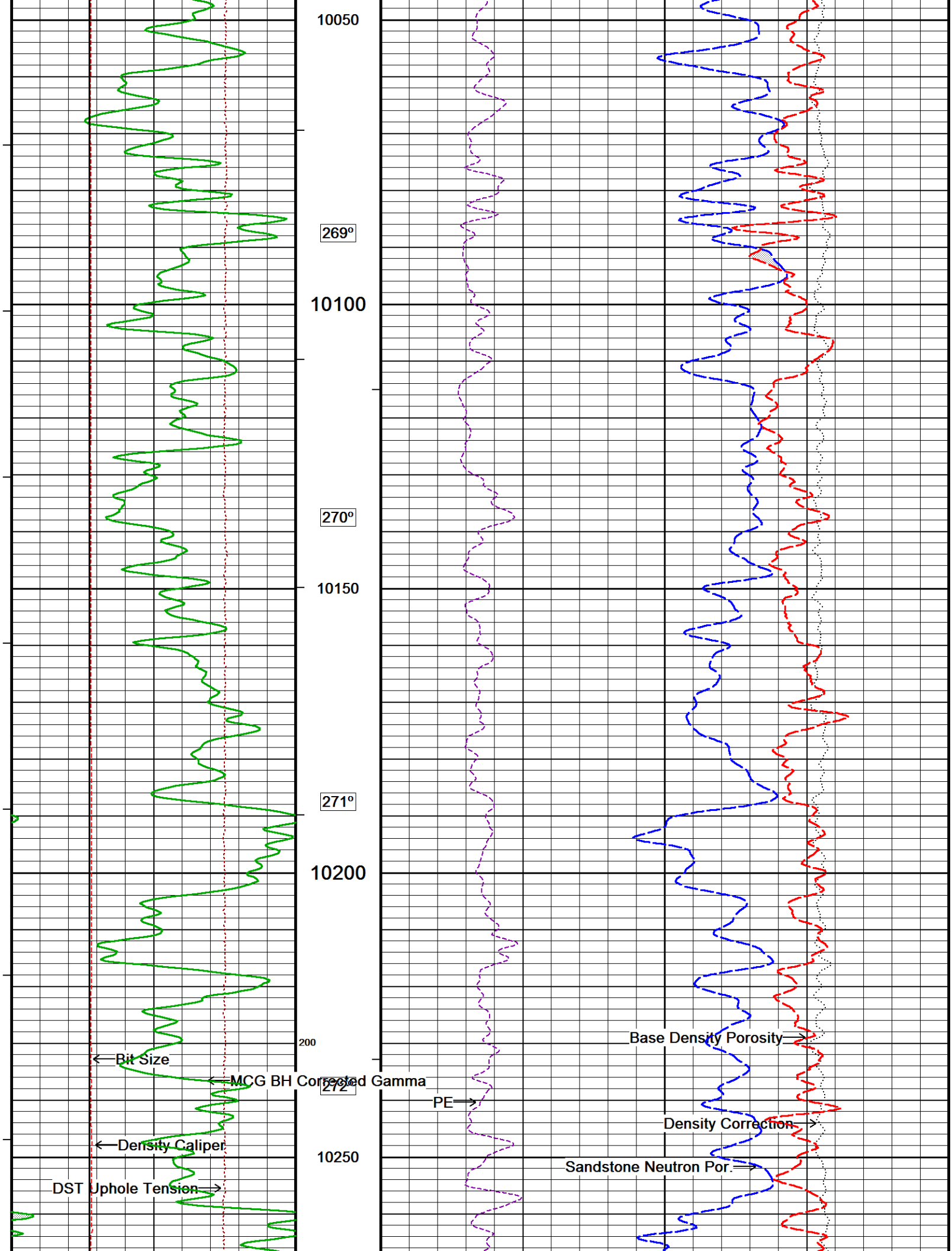


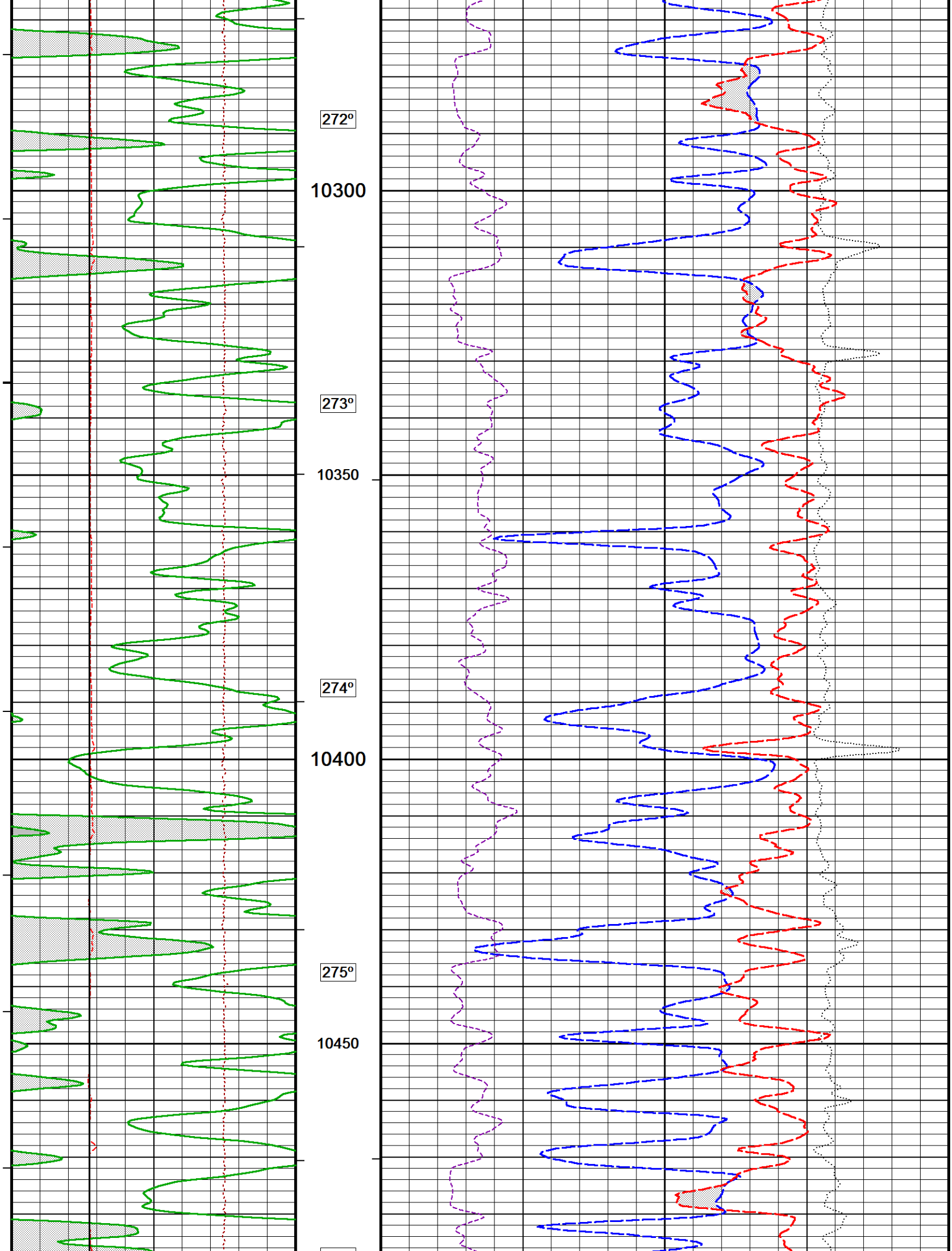

9200
247°
9250
250°
9300
251°
9350

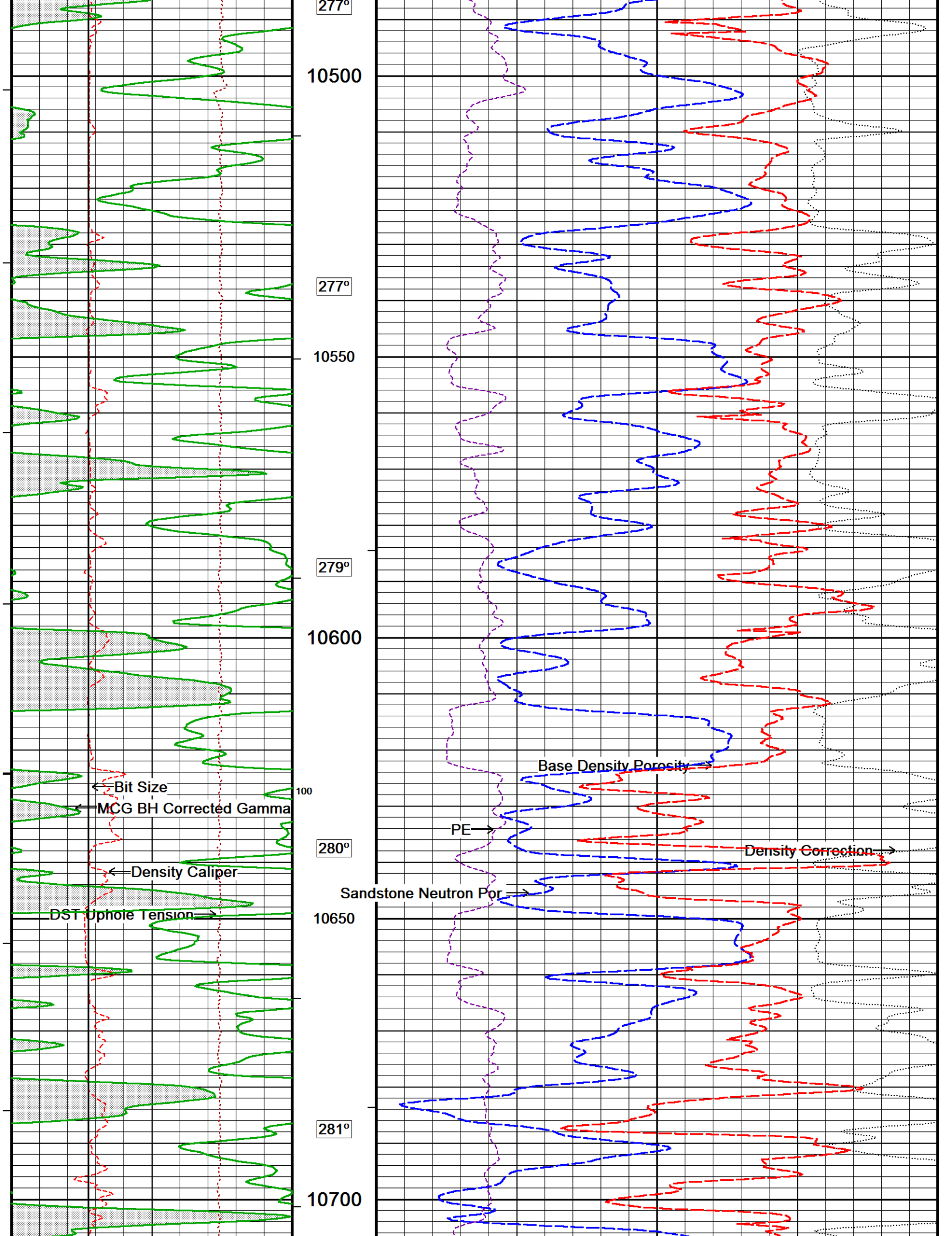

254°
9400
400
256°
Base Density Porosity
Bit Size
MCG BH Corrected Gamma
9450
PE
Density Caliper
Density Correction
Sandstone Neutron Por.
DST Uphole Tension
256°
9500
258°
9550
258°
9600

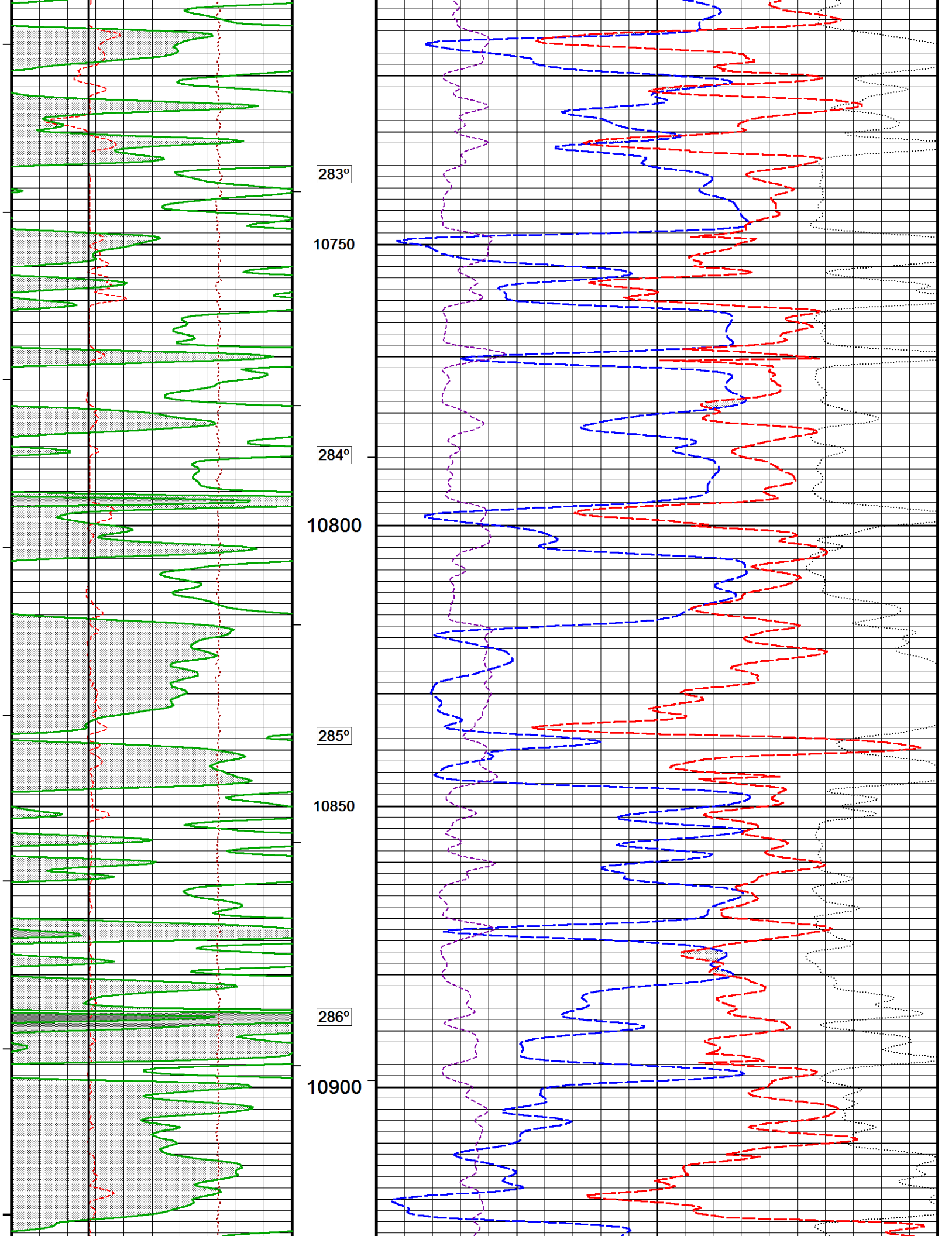

260°
9650
261°
9700
262°
9750
262°
9800
300

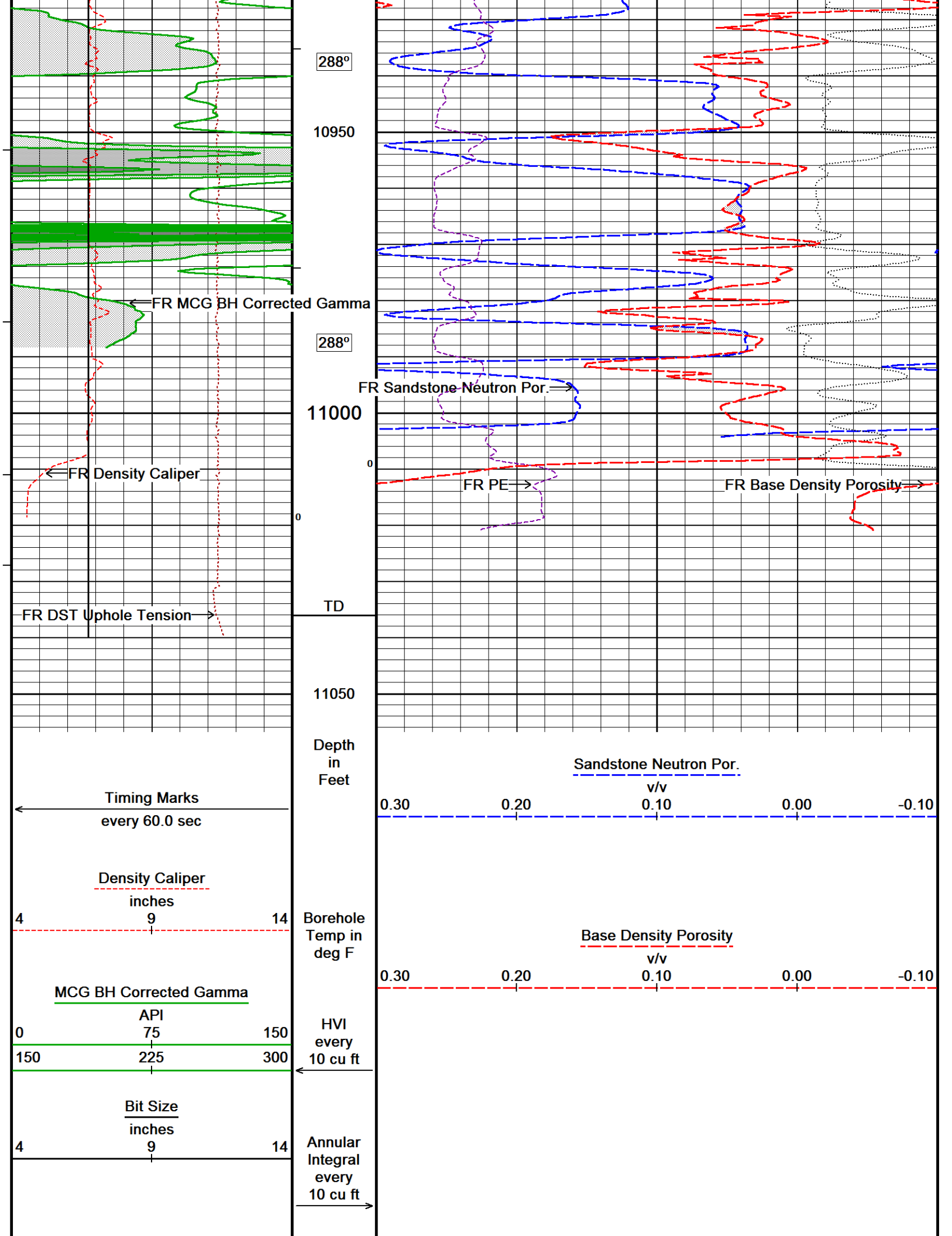

Bit Size
MCG BH Corrected Gamma
Density Caliper
DST Uphole Tension
263°
9850
264°
9900
265°
9950
266°
10000
268°
100
PE
Base Density Porosity
Density Correction
Sandstone Neutron Por.


10050
269°
10100
270°
10150
271°
10200
272°
10250
200
←Bit Size
←MCG BH Corrected Gamma
←Density Caliper
DST Uphole Tension→
PE→
Base Density Porosity→
Density Correction→
Sandstone Neutron Por.→


272°
10300
273°
10350
274°
10400
275°
10450


277°
10500
277°
10550
279°
10600
Bit Size
MCG BH Corrected Gamma
100
Density Caliper
280°
DST Uphole Tension
10650
281°
10700
Base Density Porosity
PE
Density Correction
Sandstone Neutron Por


283º
10750
284º
10800
285º
10850
286º
10900


288°
10950
FR MCG BH Corrected Gamma
288°
FR Sandstone Neutron Por.
11000
0
FR Density Caliper
FR PE
FR Base Density Porosity
0
TD
FR DST Uphole Tension
11050
Depth in Feet
Timing Marks
every 60.0 sec
Sandstone Neutron Por.
v/v
0.30
0.20
0.10
0.00
-0.10
Density Caliper
inches
4
9
14
Borehole Temp in deg F
Base Density Porosity
v/v
0.30
0.20
0.10
0.00
-0.10
MCG BH Corrected Gamma
API
0
75
150
150
225
300
HVI every 10 cu ft
Bit Size
inches
4
9
14
Annular Integral every 10 cu ft

PE
barns/electron
0 5 10

Density Correction
grams/cc
-0.25 0 0.25

DST Uphole Tension
pounds
5000 0

Replay
Scale
1:240

Depth Based Data - Maximum Sampling Increment 10.0cm
Plotted on 16-FEB-2019 00:17
Filename: C:\LOGS\NGL\SOUTH WELD SWD #1 PILOT\Main Pass.dta
Recorded on 15-FEB-2019 21:59
System Versions: Logged with 18.05.7089 Plotted with 18.05.7089

5 INCH POROSITY MAIN PASS

5 INCH POROSITY OVERLAY REPEAT PASS

Depth Based Data - Maximum Sampling Increment 10.0cm
Plotted on 16-FEB-2019 00:17
Filename: C:\LOGS\NGL\SOUTH WELD SWD #1 PILOT\Repeat Pass.dta
Recorded on 15-FEB-2019 21:22
Filename: C:\LOGS\NGL\SOUTH WELD SWD #1 PILOT\Main Pass.dta
Recorded on 15-FEB-2019 21:59
System Versions: Logged with 18.05.7089 Plotted with 18.05.7089

Depth
in
Feet

Timing Marks
every 60.0 sec

Sandstone Neutron Por.
v/v
0.30 0.20 0.10 0.00 -0.10

Density Caliper
inches
4 9 14

Base Density Porosity
v/v
0.30 0.20 0.10 0.00 -0.10

Borehole
Temp in
deg F

MCG BH Corrected Gamma
API
0 75 150
150 225 300

HVI
every
10 cu ft

Bit Size
inches
4 9 14

Annular
Integral
every
10 cu ft

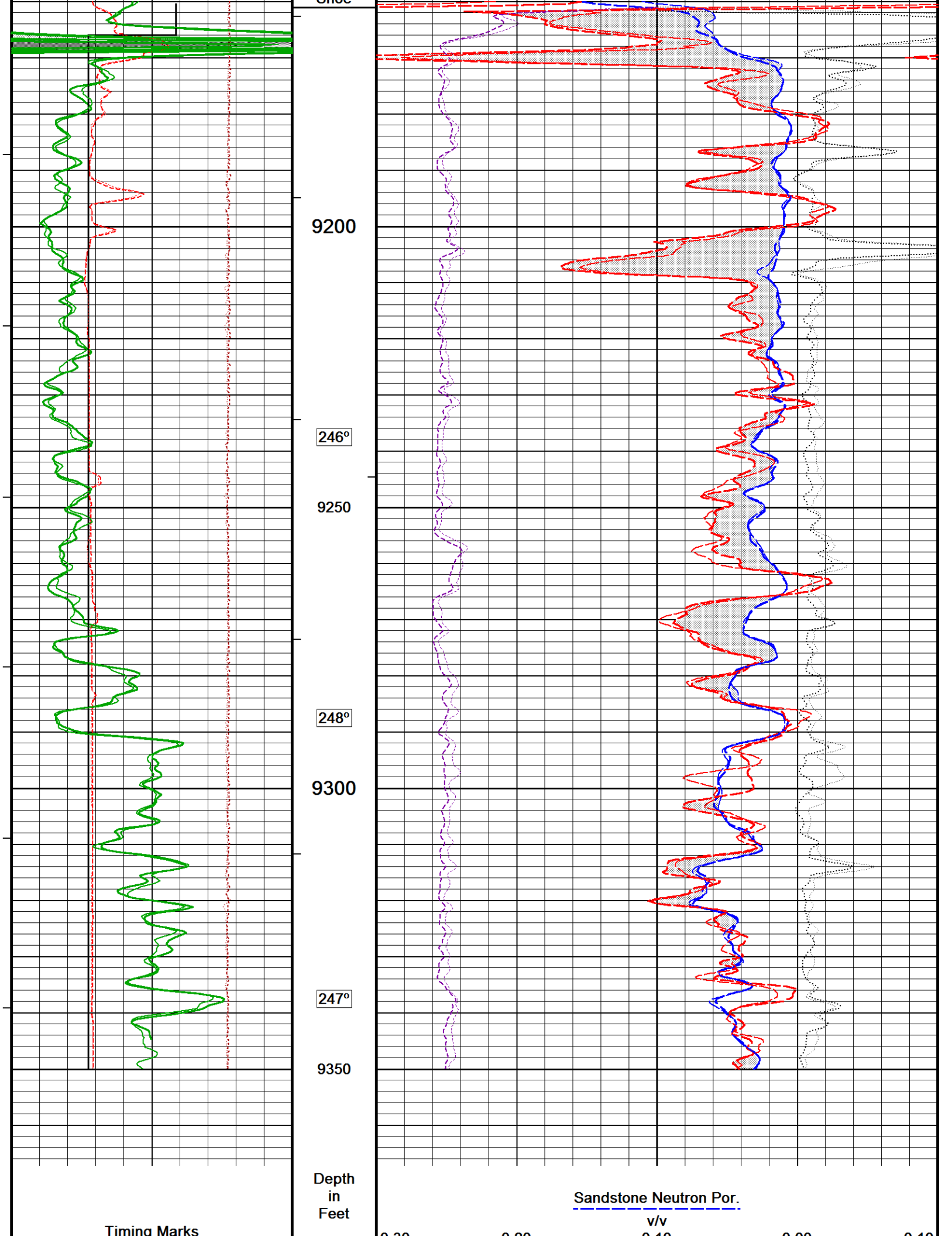
PE
barns/electron
0 5 10

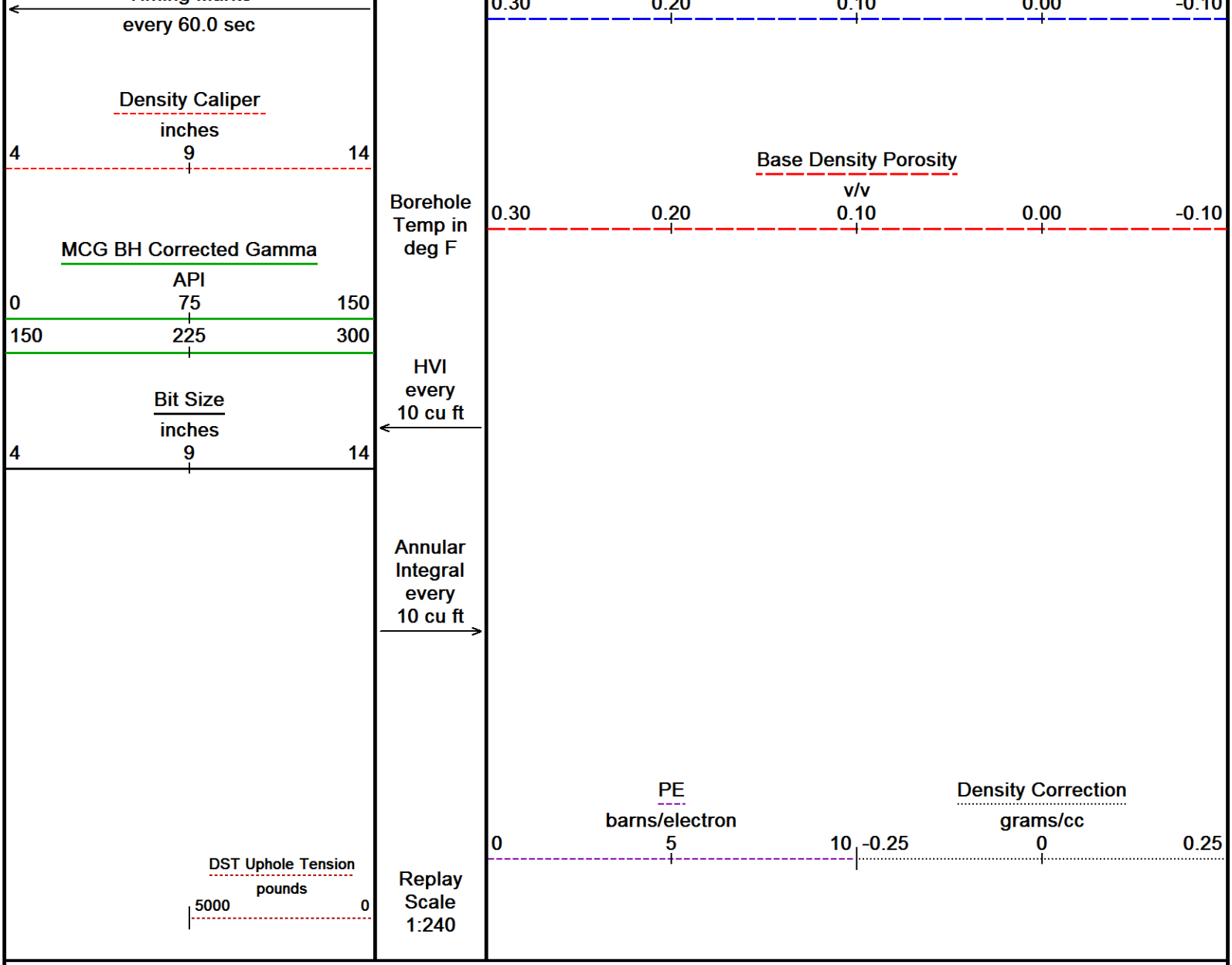
Density Correction
grams/cc
-0.25 0 0.25

DST Uphole Tension
pounds
5000 0

Replay
Scale
1:240

9158


Shoe
9200
246°
9250
248°
9300
247°
9350
Depth
in
Feet
Timing Marks
Sandstone Neutron Por.
v/v



Depth Based Data - Maximum Sampling Increment 10.0cm
Plotted on 16-FEB-2019 00:17
Filename: C:\LOGS\NGL\SOUTH WELD SWD #1 PILOT\Repeat Pass.dta
Recorded on 15-FEB-2019 21:22
Filename: C:\LOGS\NGL\SOUTH WELD SWD #1 PILOT\Main Pass.dta
Recorded on 15-FEB-2019 21:59
System Versions: Logged with 18.05.7089 Plotted with 18.05.7089

5 INCH POROSITY OVERLAY REPEAT PASS

BEFORE SURVEY CALIBRATION

C:\LOGS\NGL\SOUTH WELD SWD #1 PILOT\Main Pass.dta

General Constants All 000

Last Edited on 15-FEB-2019,20:26

General Parameters		
Mud Resistivity	0.360	ohm-metres
Mud Resistivity Temperature	75.000	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	5.500	inches
Caliper for Differential Caliper	Density Caliper	
Rwa Parameters		
Porosity used	Base Density Porosity	

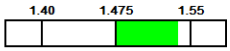
Resistivity used	Array Ind. Two Res Rt
RWA Constant A	0.620
RWA Constant M	2.150
SW/APOR Tool Source	0.000

Gamma Calibration MCG-E.A 588

Field Calibration on 15-FEB-2019 18:20

	Measured	Calibrated (API)
Background	96	62
Calibrator (Gross)	1058	688
Calibrator (Net)	963	626

Gamma Calibration Tolerances MCG-E.A 588

Ratio	1.538		Counts/API

Gamma Constants MCG-E.A 588

Last Edited on 15-FEB-2019,20:26

Gamma Calibrator Number	GRC051	
GRC-M Calibrator Jig in Use?	NO	
Inactive Background Jig in Use?	NO	
Mud Density	1.04	gm/cc
Caliper Source for Processing	Density Caliper	
Tool Position	Eccentred	
Potassium Equivalence	Chloride	
K Mud Concentration	0.00	%

High Resolution Temperature Calibration MCG-E.A 588

Field Calibration on 13-JAN-2019 22:00

	Measured	Calibrated(Deg F)
Lower	33.00	33.00
Upper	212.00	212.00

High Resolution Temperature Constants MCG-E.A 588

Last Edited on 26-DEC-2018 01:52

Pre-filter Length	11

Neutron Calibration MDN-C.A 514

Base Calibration on 01-FEB-2019 16:14
Field Check on 15-FEB-2019 18:35

Base Calibration

	Measured		Calibrated (cps)	
	Near	Far	Near	Far
	2907	89	3714	110
Ratio	32.744		33.764	

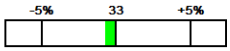
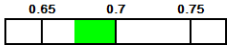
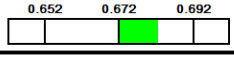
Field Calibrator at Base

	Calibrated (cps)	
	1302	1939
Ratio	0.672	

Field Check

	Calibrated (cps)	
	1499	2197
Ratio	0.682	

Neutron Calibration Tolerances MDN-C.A 514

Ratio	32.744	
Base Check	0.672	
Field Check	0.682	

Neutron Constants MDN-C.A 514

Last Edited on 15-FEB-2019,20:27

Neutron Source Id	P31131B	
Neutron Jig Number	6532NK	
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	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	

Photo Density Calibration MPD-D.A 472

Base Calibration on 01-FEB-2019 15:17
Field Check on 15-FEB-2019 18:31

Density Calibration

Base Calibration	Measured Near	Measured Far	Calibrated (sdu) Near	Calibrated (sdu) Far
Background	1042	1267		
Reference 1	51098	25098	59898	31131
Reference 2	20296	2381	24540	2525
Field Check at Base	1042.0	1266.6		
Field Check	1042.4	1280.6		

PE Calibration

Base Calibration	WS	Measured WH	Measured Ratio	Calibrated Ratio
Background	204	940		
Reference 1	23014	50933	0.456	0.369
Reference 2	6484	20185	0.326	0.271
Field Check at Base	204.1	940.3		
Field Check	203.8	941.1		

Photo Density Calibration Tolerances MPD-D.A 472

Near Density Ratio	2.60	-5% 2.52 +5%	Far Density Ratio	21.39	-5% 21.00 +5%
PE Calibration	0.123	0.089 0.110 0.131			
Near Den. Field Check	1042.4	-3% 1042.0 +3%	Far Den. Field Check	1280.6	-3% 1266.6 +3%
PE WS Field Check	203.8	-6% 204.1 +6%	PE WH Field Check	941.1	-6% 940.3 +6%

Density Constants MPD-D.A 472

Last Edited on 15-FEB-2019,20:27

Density Source Id	20720B	
Nylon Calibrator Number	DNCE 631	
Aluminium Calibrator Number	DACD 631	
Density Shoe Profile	4 inch	
Caliper Source for Processing	Density Caliper	
PE Correction to Density	Not Applied	
Mud Density	1.04	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	Applied	

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

Caliper Calibration MPD-D.A 472

Base Calibration on 01-FEB-2019 15:43
Field Calibration on 15-FEB-2019 18:25

Base Calibration

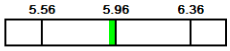
Reading No	Measured	Calibrator Size (in)
1	16640	4.00
2	24832	5.96
3	33503	7.98
4	41667	9.86
5	50976	11.91
6	N/A	N/A

Field Calibration

Measured Caliper (in)	Actual Caliper (in)
5.92	5.96

Caliper Calibration Tolerances MPD-D.A 472

Long Arm Field Cal. 5.92 in



DOWNHOLE EQUIPMENT

C:\LOGS\NGL\SOUTH WELD SWD #1 PILOT\Main Pass.dta

Cablehead, 11 pin
CBH-DB 202 LG: 2.40 ft WT: 24.3 lb OD: 2.240 in

Compact Swivel Head Adaptor
SHA-J.B 504 LG: 2.30 ft WT: 22.0 lb OD: 2.244 in

Compact Knuckle Joint
SKJ-E.B 614 LG: 2.17 ft WT: 24.3 lb OD: 2.244 in

Compact Comms Gamma
MCG-E.A 588 LG: 8.70 ft WT: 63.9 lb OD: 2.244 in

Compact Micro-Resistivity
MMR-C.A 242 LG: 8.59 ft WT: 81.6 lb OD: 2.244 in

Compact Neutron
MDN-C.A 514 LG: 5.04 ft WT: 50.7 lb OD: 2.244 in

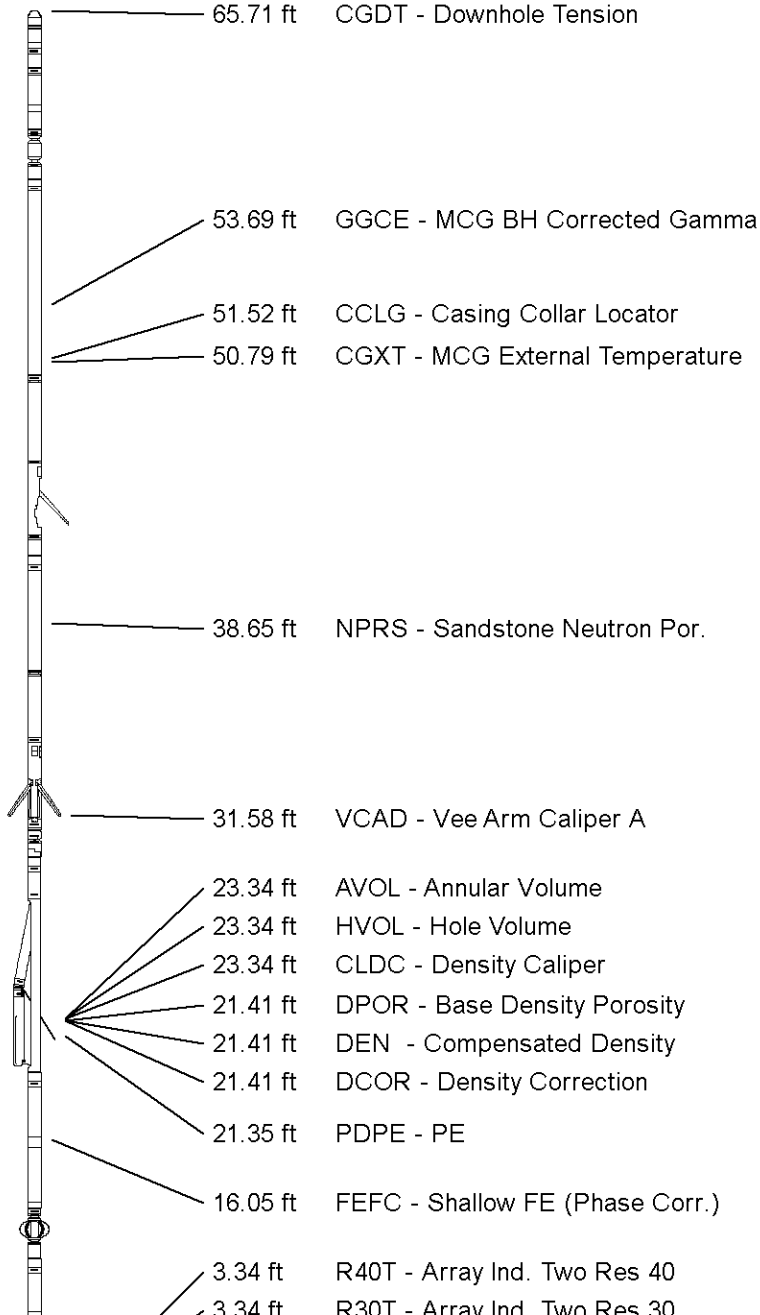
Compact Vee Arm Caliper
MVC-A.A 141 LG: 8.06 ft WT: 61.7 lb OD: 2.244 in

Compact Density/Caliper
MPD-D.A 472 LG: 9.59 ft WT: 90.4 lb OD: 2.244 in

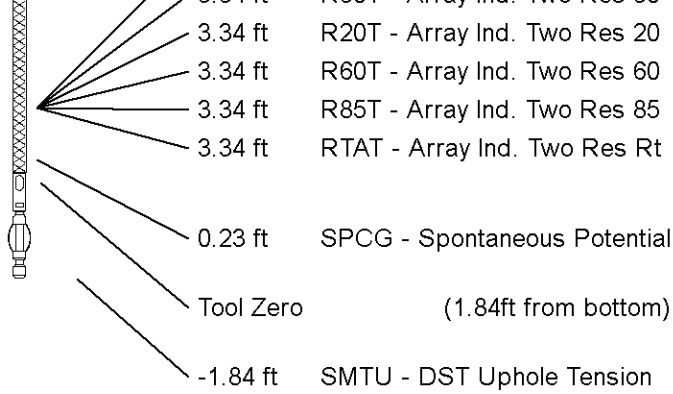
Compact Focussed Electric
MFE-C.A 381 LG: 6.05 ft WT: 48.5 lb OD: 2.244 in

Compact Inline Standoff sub
MIS-E.B 784 LG: 2.14 ft WT: 15.4 lb OD: 2.244 in

Compact Induction
MAI-C.A 494 LG: 12.52 ft WT: 48.5 lb OD: 2.240 in



Total Length: 67.55 ft Weight: 531.3 lb



All measurements relative to tool zero.

COMPANY	NGL ENERGY PARTNERS
WELL	SOUTH WELD SWD #1
FIELD	WATTENBERG
PROVINCE/COUNTY	WELD COUNTY
COUNTRY/STATE	USA/COLORADO

Elevation Kelly Bushing	4977	feet	First Reading	11012.81	feet
Elevation Drill Floor	4977	feet	Depth Driller	11040.00	feet
Elevation Ground Level	4952	feet	Depth Logger	11036.00	feet

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