

HALLIBURTON

SPECTRAL DENSITY
DUAL SPACED NEUTRON
LOG

COMPANY HERMAN L. LOEB, LLC				COMPANY HERMAN L. LOEB, LLC			
WELL YOST 4-28				WELL YOST 4-28			
FIELD/BLOCK EINSEL				FIELD/BLOCK EINSEL			
COUNTY KIOWA				COUNTY KIOWA			
STATE KANSAS				STATE KANSAS			
Permanent Datum		GL		API No. 15-097-21845-00-00		Other Services: GTET DSNT SDLT MICROLOG ACRT	
Log measured from		KB		Location (SHL) 1650' FSL & 1980' FWL S2 NE SW			
Drilling measured from		KB		Sect. 28 Twp. 27S Rge. 18W			
Date		12-Oct-18					
Run No.		ONE					
Depth - Driller		4840.0 ft					
Depth - Logger		4838.0 ft					
Bottom - Logged Interval		4816.0 ft					
Top - Logged Interval		3800.0 ft					
Casing - Driller		8.625 in @ 609.0 ft					
Casing - Logger		607.0 ft @					
Bit Size		7.875 in					
Type Fluid in Hole		Water Based Mud					
Density	Viscosity	9.1 cP	65.00 s/qt				
	Fluid Loss	10.50 pH	10.0 cpm				
Source of Sample		FLOWLINE					
Rm @ Meas. Temperature		0.56 ohmm @ 75.00 degF					
Rmf @ Meas. Temperature		0.45 ohmm @ 75.00 degF					
Rmc @ Meas. Temperature		0.67 ohmm @ 75.00 degF					
Source Rmf	Rmc	MEAS					
Rm @ BHT		0.36 ohmm @ 121.0 degF					
Time Since Circulation		04:21 hr					
Time on Bottom		12-Oct-18 22:56					
Max. Rec. Temperature		121.00 degF @ 4838.0 ft					
Equipment	Location	12156883 EL RENO, OK					
Recorded By		SEAN WOLTEMATH					
Witnessed By		JON CHRISTENSEN					

Service Ticket No.: 905191351						API No.: 15-097-21845-00-00						PGM Version: WL INSITE R5.8.9 (Build 6)													
CHANGE IN MUD TYPE OR ADDITIONAL SAMPLE										RESISTIVITY SCALE CHANGES															
Date		Sample No.										Type Log		Depth		Scale Up Hole		Scale Down Hole							
Depth-Driller																									
Type Fluid in Hole																									
Density		Viscosity																							
Ph		Fluid Loss																							
Source of Sample												RESISTIVITY EQUIPMENT DATA													
Rm @ Meas. Temp				@				@				Run No.		Tool Type & No.		Pad Type		Tool Pos.		Other					
Rmf @ Meas. Temp.				@				@				ONE		ACRT		N/A		ECEN.		N/A					
Rmc @ Meas. Temp.				@				@						I-11830684											
Source Rmf		Rmc										S-11830728													
Rm @ BHT				@				@																	
Rmf @ BHT				@				@																	
Rmc @ BHT				@				@																	
EQUIPMENT DATA																									
GAMMA						ACOUSTIC						DENSITY						NEUTRON							
Run No.		ONE				Run No.						Run No.		ONE				Run No.		ONE					
Serial No.		11013113				Serial No.						Serial No.		11213308				Serial No.		11019641					
Model No.		GTET				Model No.						Model No.		SDLT				Model No.		DSNT					
Diameter		3.625"				No. of Cent.						Diameter		5.5"				Diameter		3.625"					
Detector Model No.		GTET				Spacing						Log Type		GAM-GAM				Log Type		NEU-NEU					
Type		SCINT										Source Type		Cs-137				Source Type		Am241Be					
Length		8"				LSA [Y/N]						Serial No.		5475GW				Serial No.		DSN-436					
Distance to Source		10'				FWDA [Y/N]						Strength		1.78 Ci				Strength		15.0 Ci					
LOGGING DATA																									
GENERAL						GAMMA				ACOUSTIC				DENSITY						NEUTRON					
Run		Depth		Speed		Scale		Scale		Matrix		Scale		Matrix		Scale		Matrix							
No.		From		To		L		R				L				R				L		R			
ONE		TD		2800		REC		0		150				20		10		2.71 g/cc		20		10		TIME	

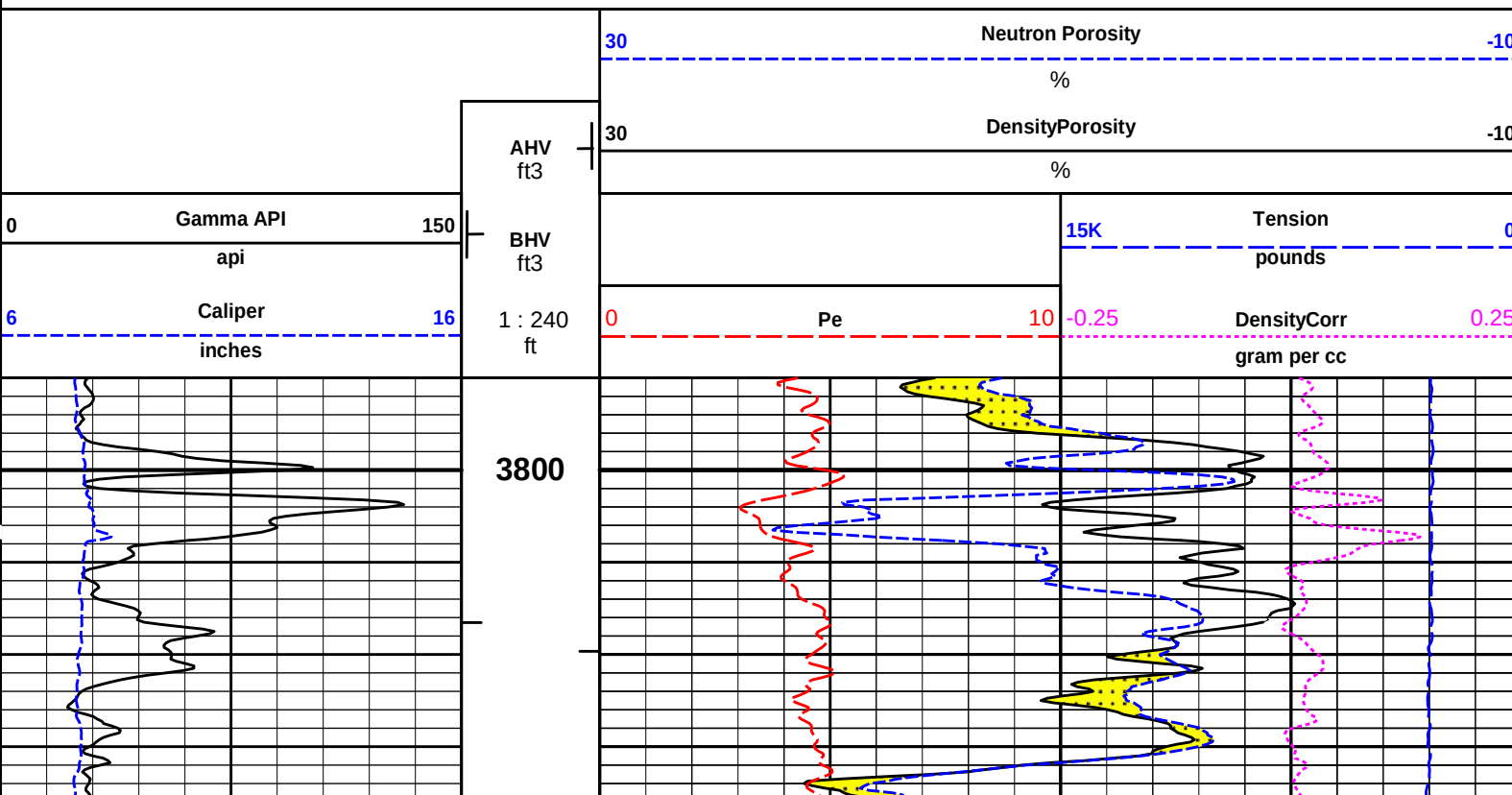
[illegible]

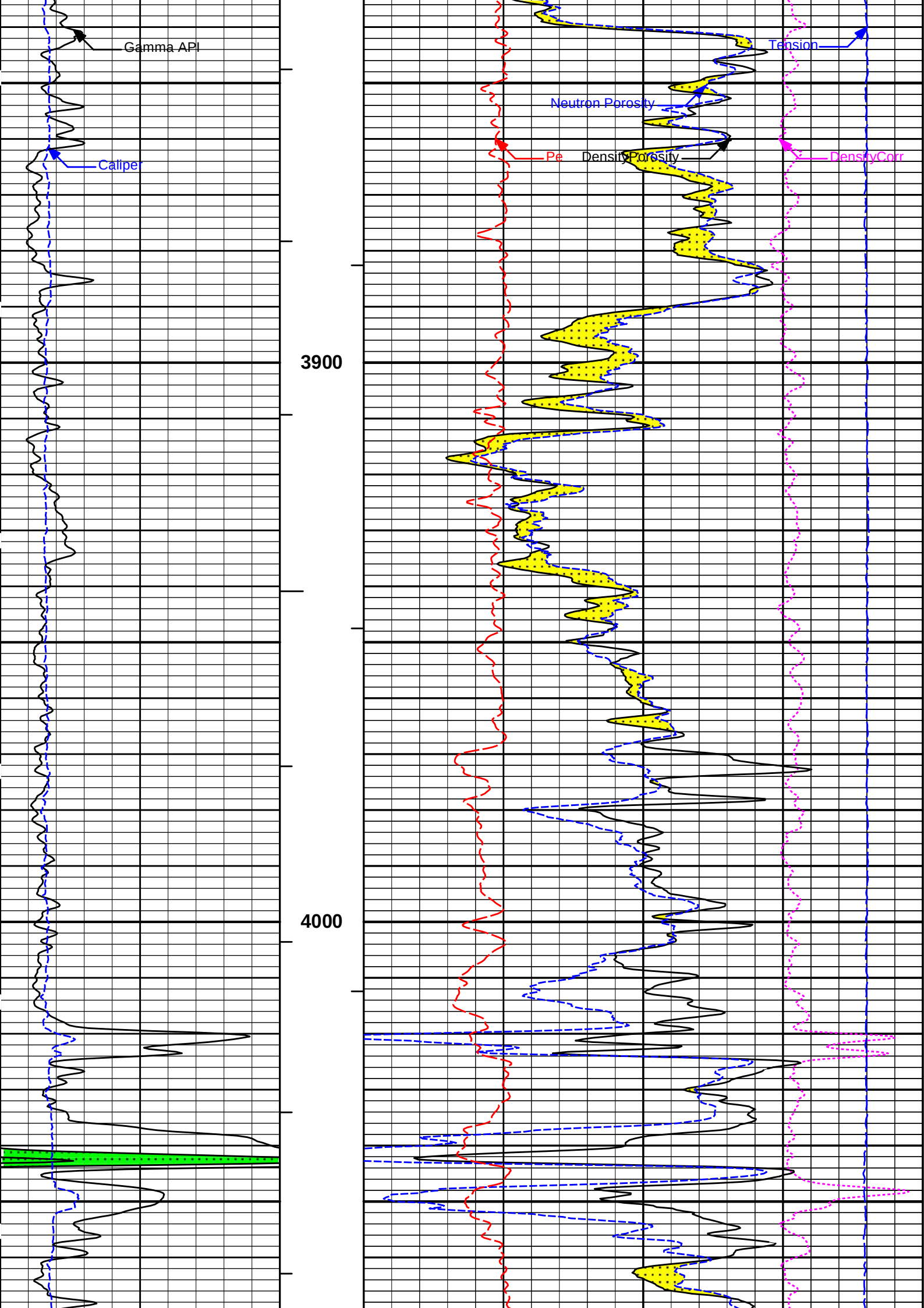
HALLIBURTON

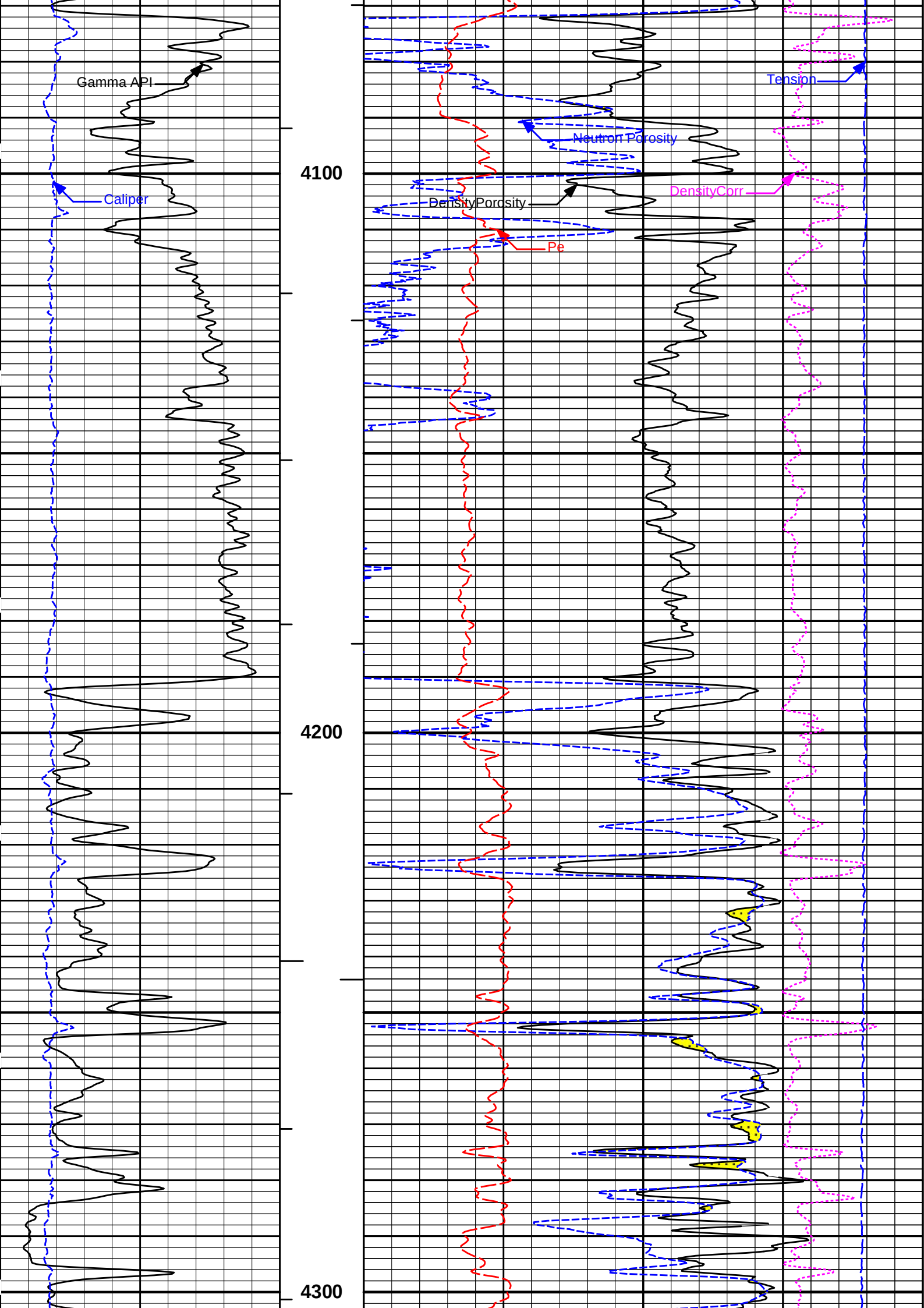
Plot Time: 13-Oct-18 01:35:28
Plot Range: 3790 ft to 4843.83 ft
Data: HERMAN_YOST4-28\Well Based\DETAILS\
Plot File: \\IPORO\Poro_IQ_5_MAIN

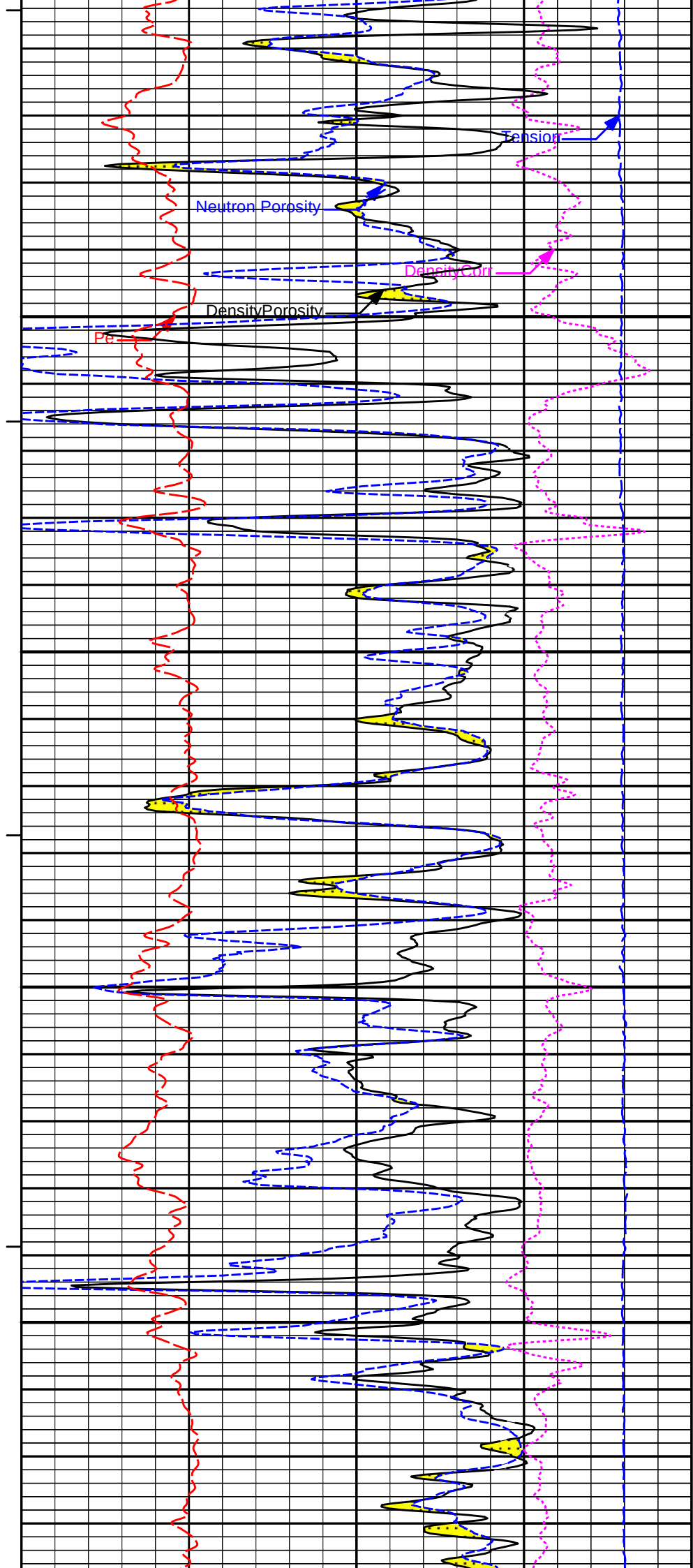
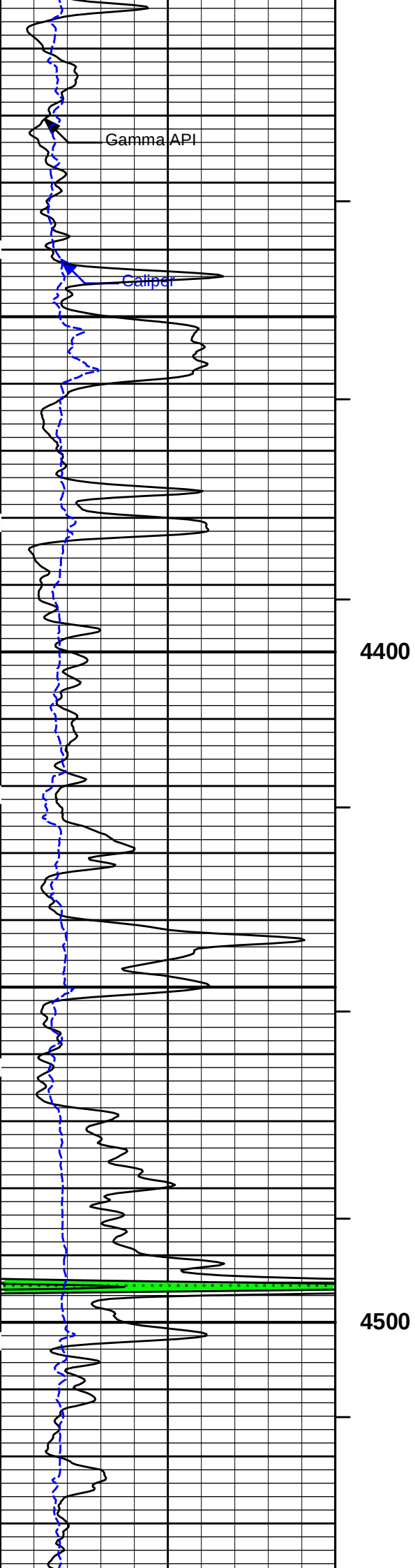
5 INCH MAIN LOG

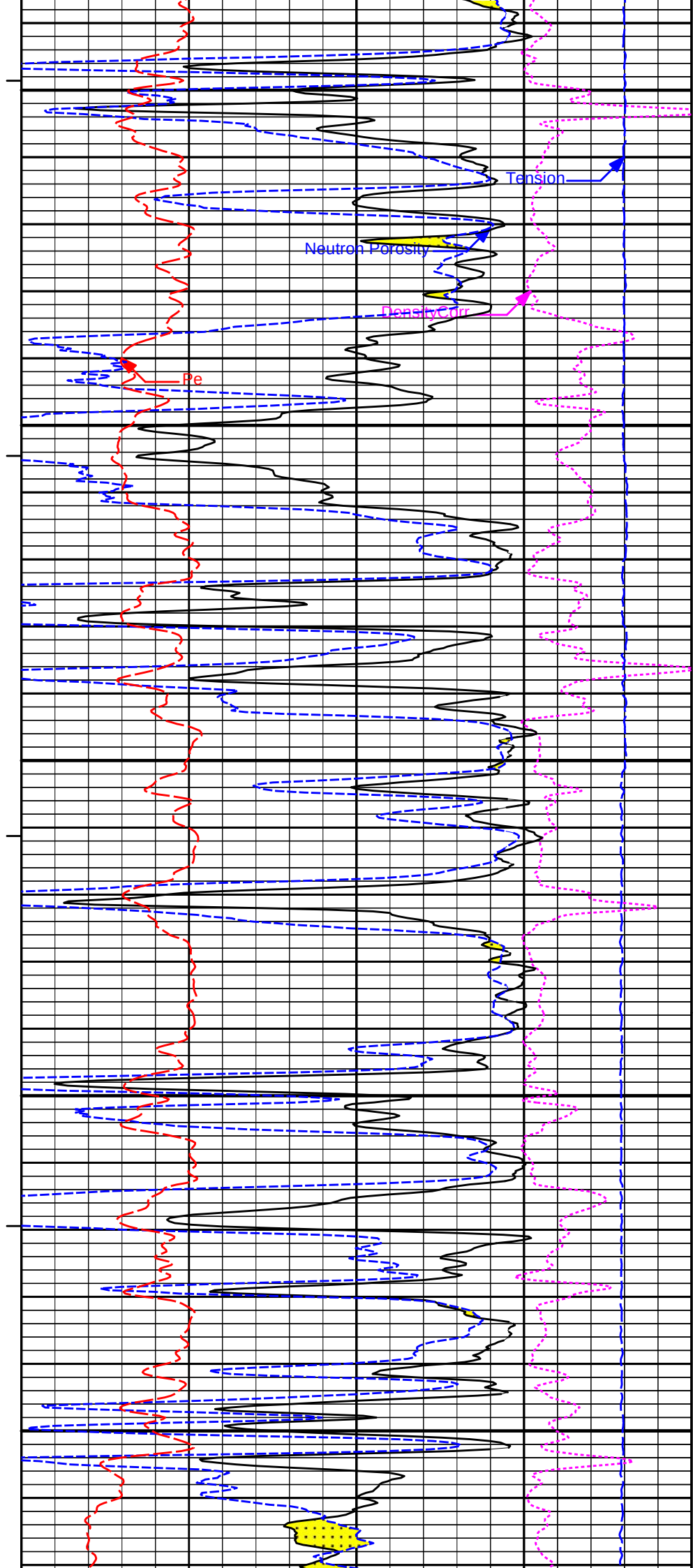
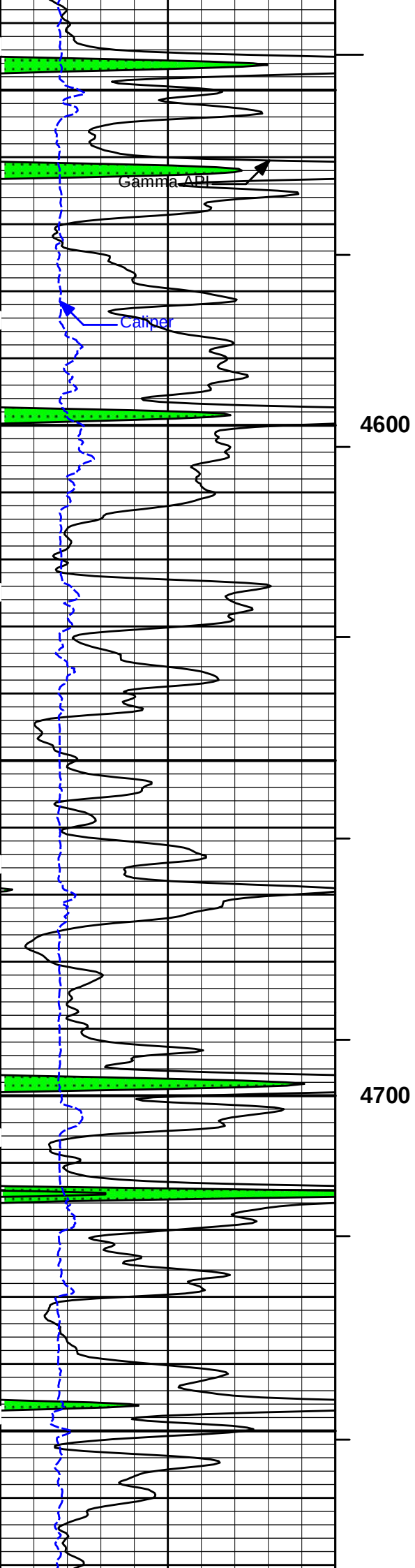
MAIN SECTION 5" PER 100'

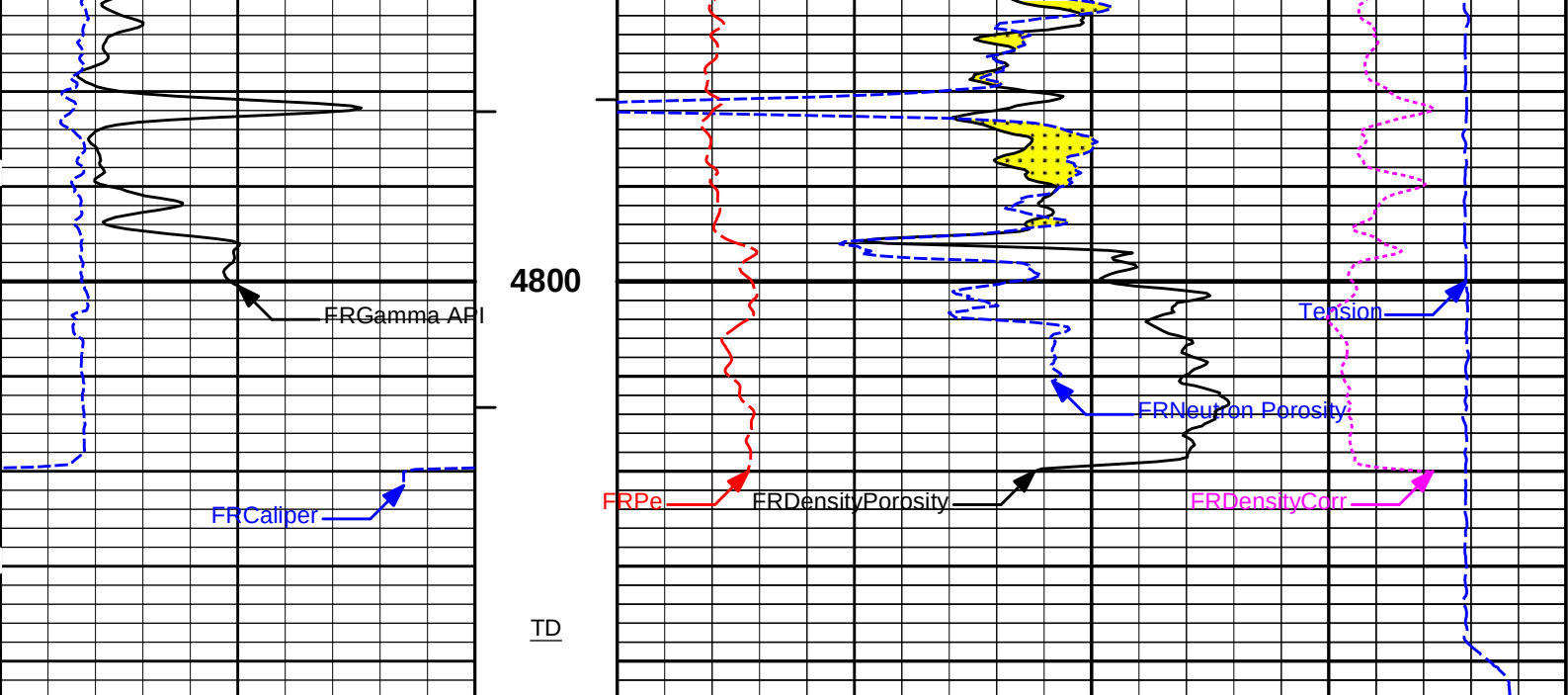












6	Caliper	16	1 : 240	0	Pe	10	-0.25	DensityCorr	0.25
	inches		ft					gram per cc	
0	Gamma API	150	BHV				15K	Tension	0
	api		ft3					pounds	
			AHV	30	DensityPorosity				-10
			ft3		%				
				30	Neutron Porosity				-10
					%				

HALLIBURTON

Plot Time: 13-Oct-18 01:35:30
Plot Range: 3790 ft to 4843.83 ft
Data: HERMAN_YOST4-28\Well Based\DETAILS\
Plot File: \\PORO\Poros_IQ_5_MAIN

5 INCH MAIN LOG

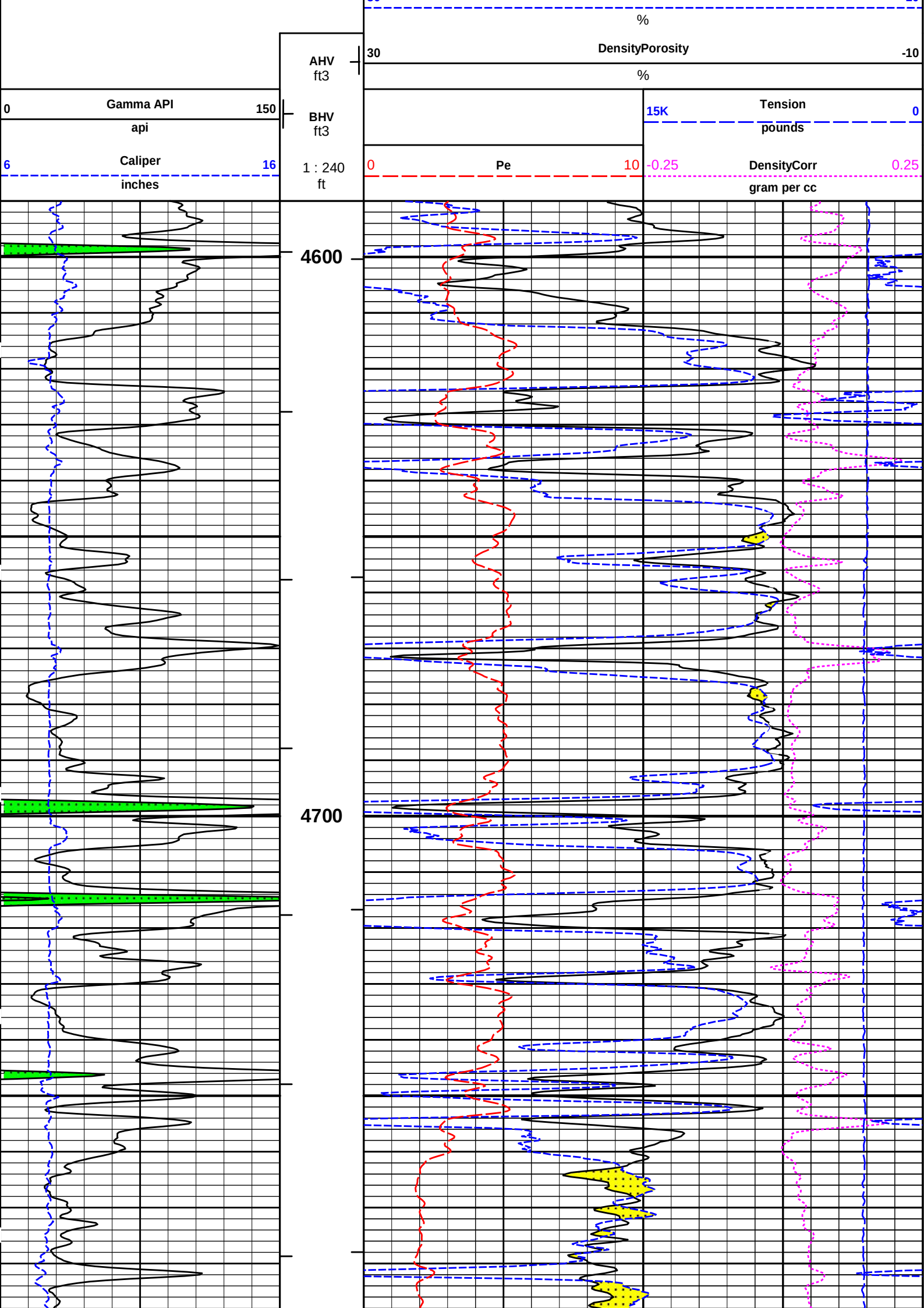
MAIN SECTION 5" PER 100'

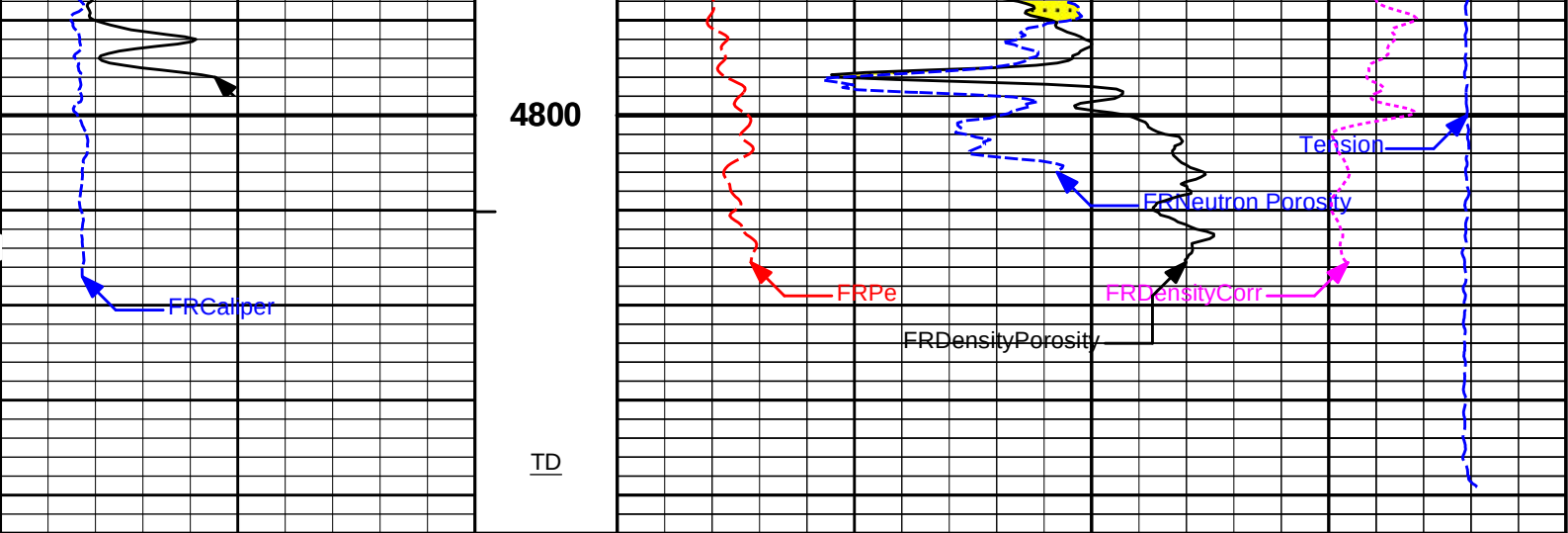
HALLIBURTON

Plot Time: 13-Oct-18 01:35:31
Plot Range: 4590 ft to 4844 ft
Data: HERMAN_YOST4-28\Well Based\REPEAT\
Plot File: \\PORO\Poros_IQ_5_REPEAT

5 INCH REPEAT LOG

REPEAT SECTION 5" PER 100'





6	Caliper	16	1 : 240	0	Pe	10	-0.25	DensityCorr	0.25
	inches		ft					gram per cc	
0	Gamma API	150	BHV				15K	Tension	0
	api		ft3					pounds	
			AHV	30	DensityPorosity				-10
			ft3					%	
				30	Neutron Porosity				-10
								%	

HALLIBURTON

Plot Time: 13-Oct-18 01:35:32
Plot Range: 4590 ft to 4844 ft
Data: HERMAN_YOST4-28\Well Based\REPEAT\
Plot File: \\PORO\Porosity_Q_5_REPEAT

5 INCH REPEAT LOG

REPEAT SECTION 5" PER 100'

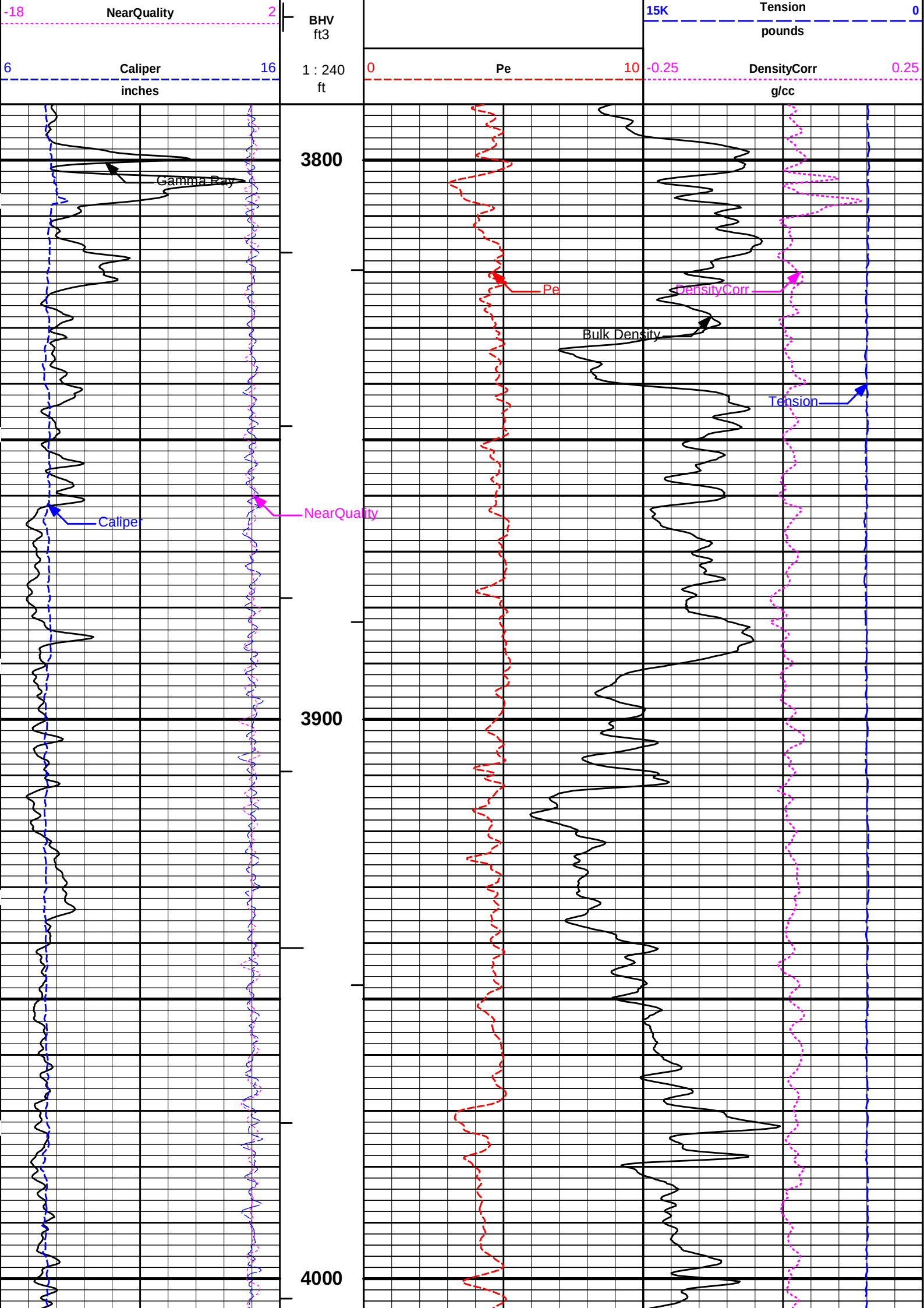
HALLIBURTON

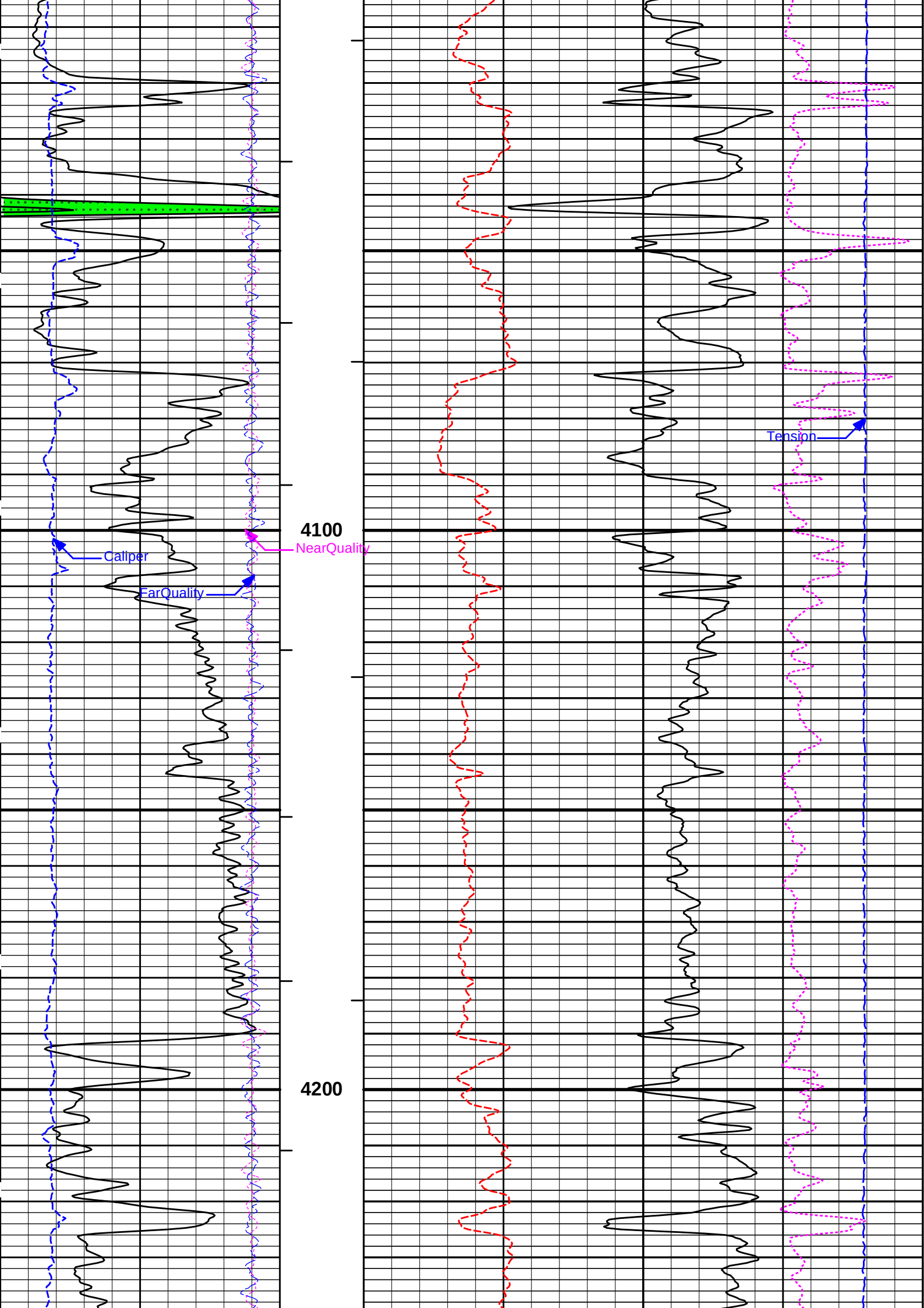
Plot Time: 13-Oct-18 01:35:32
Plot Range: 3790 ft to 4843.83 ft
Data: HERMAN_YOST4-28\Well Based\DETAILS\
Plot File: \\LOCAL-HERMAN_YOST4-28\Well Based\PORO\BULKD_5_MAIN

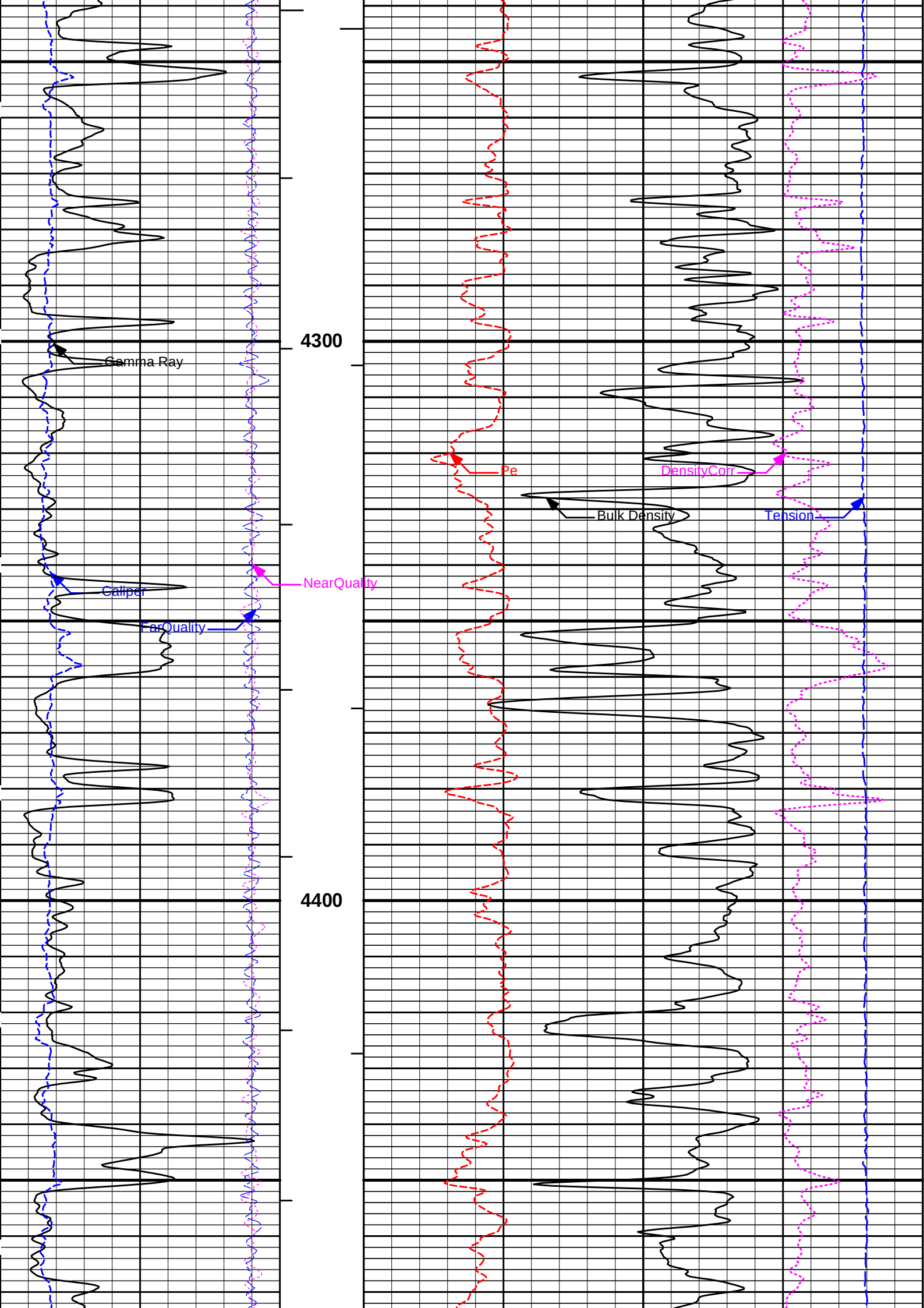
5 INCH MAIN LOG

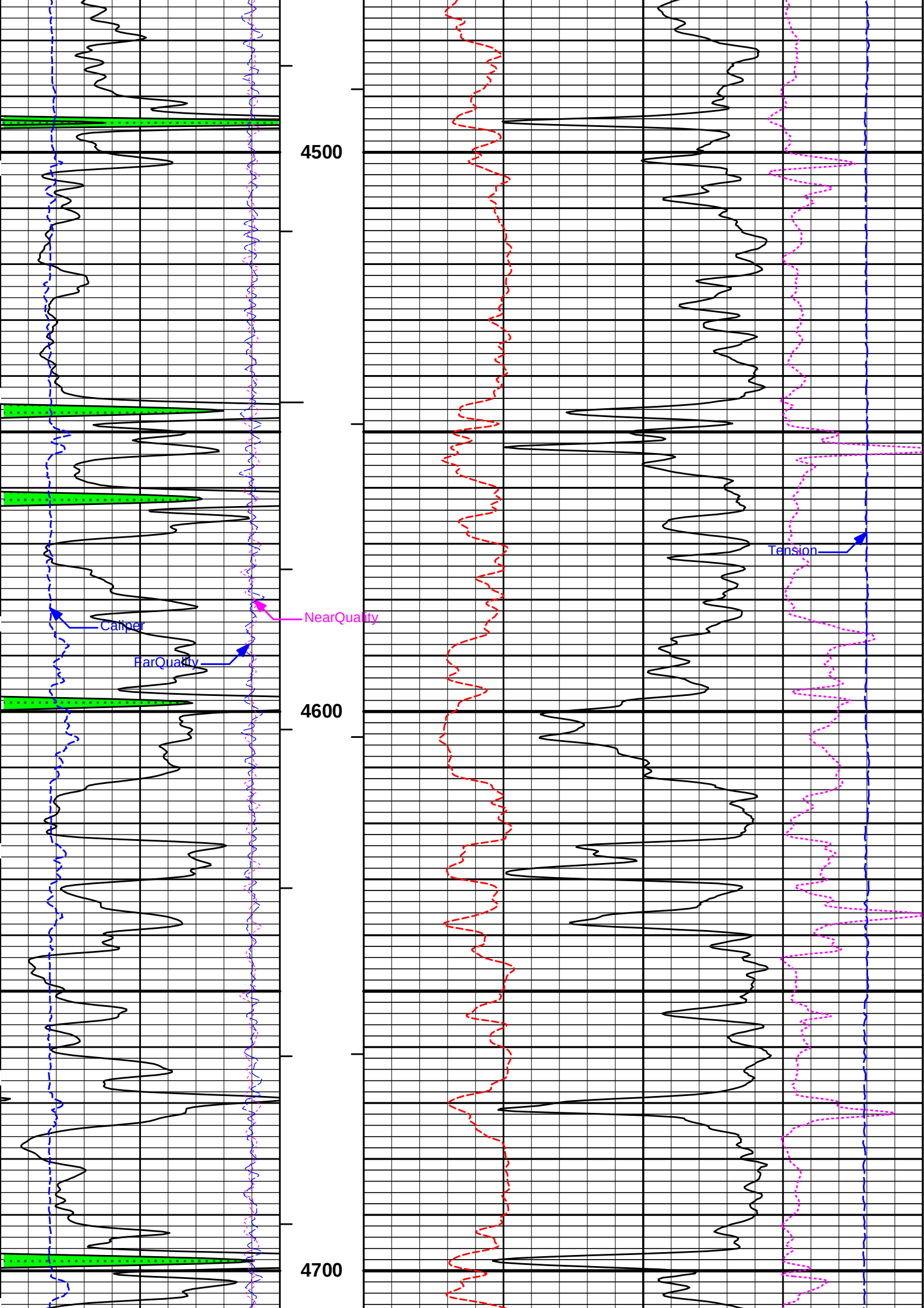
MAIN SECTION 5" PER 100'

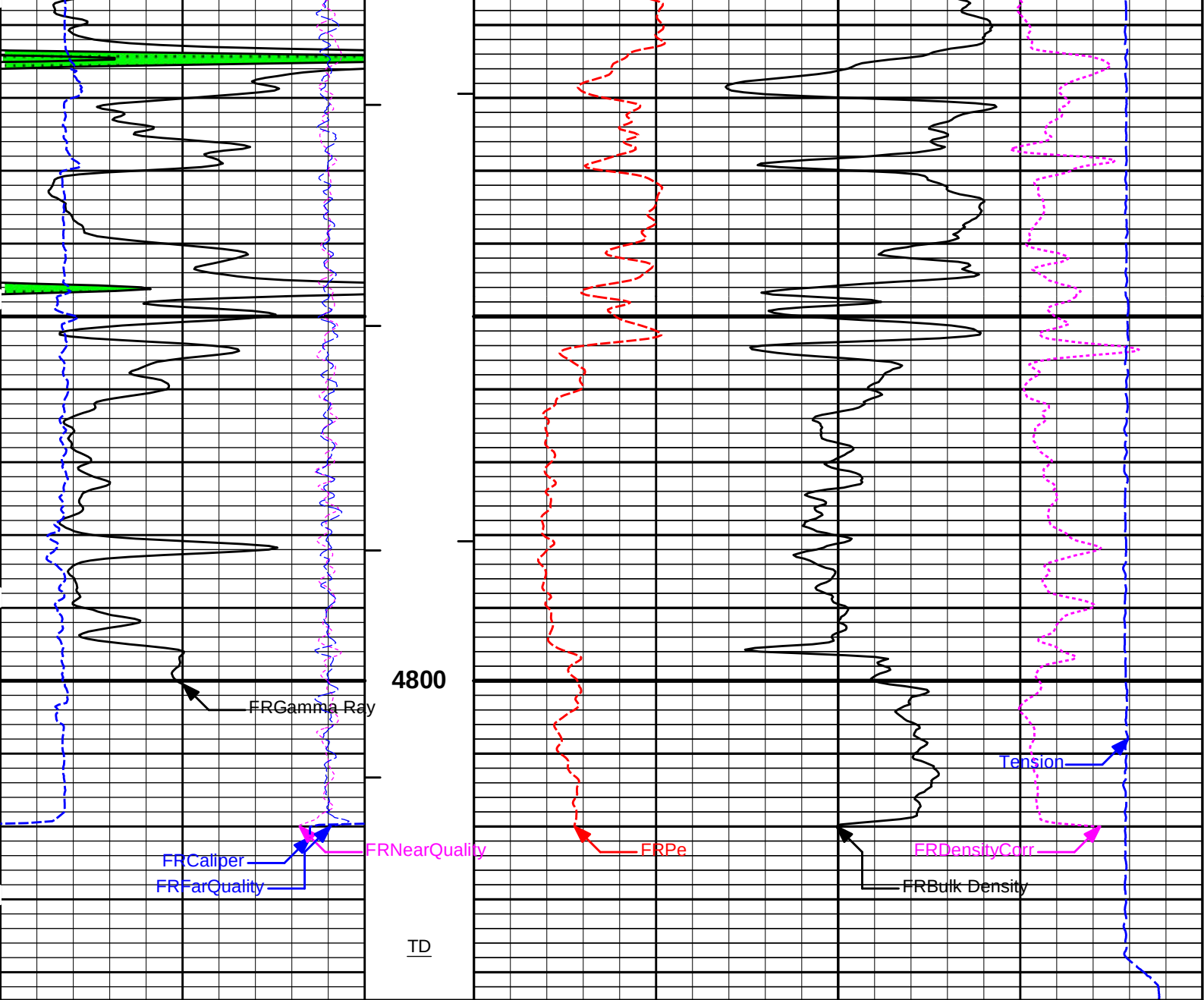
0	Gamma Ray	150		
	api			
18	FarQuality	-2	AHV	2
			ft3	Bulk Density
				g/cc
				3











6	Caliper	16	1 : 240	0	Pe	10	-0.25	DensityCorr	0.25
	inches		ft					g/cc	
-18	NearQuality	2	BHV				15K	Tension	0
			ft3					pounds	
18	FarQuality	-2	AHV	2	Bulk Density				3
			ft3		g/cc				
0	Gamma Ray	150							
	api								

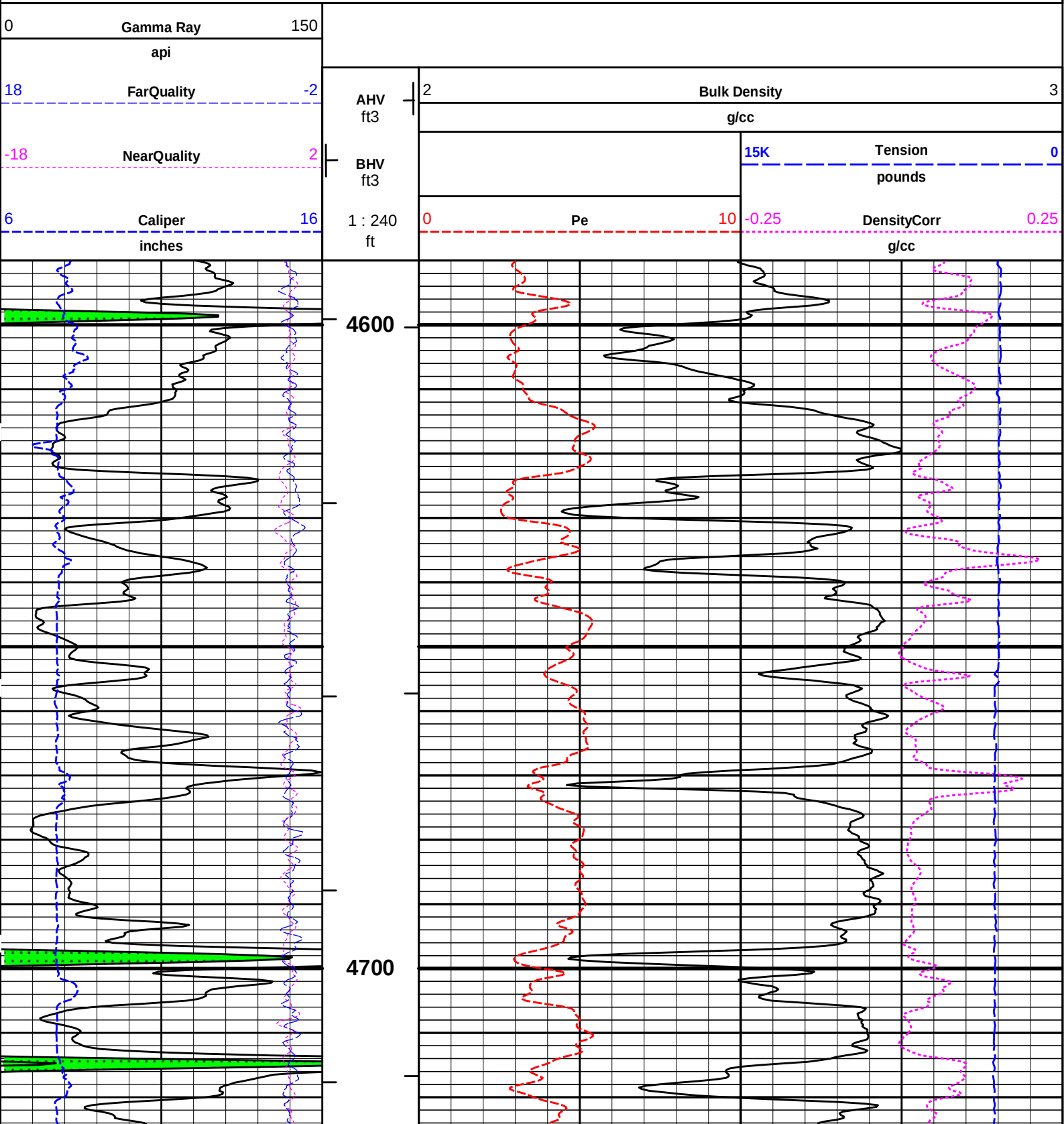
HALLIBURTON

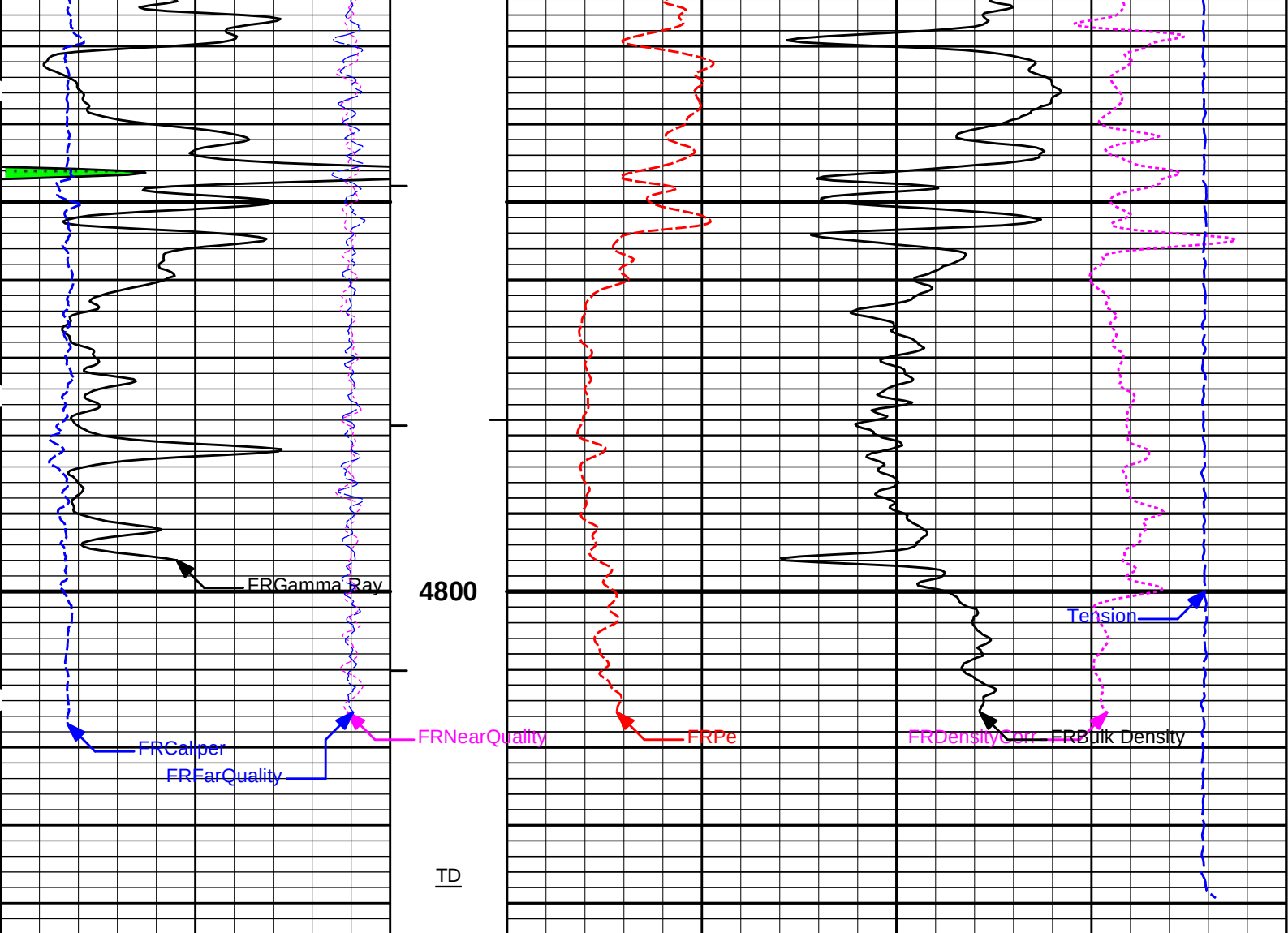
Plot Time: 13-Oct-18 01:35:34
 Plot Range: 3790 ft to 4843.83 ft
 Data: HERMAN_YOST4-28\Well Based\DETAILS\
 Plot File: \\LOCAL-HERMAN_YOST4-28\Well Based\PORO\BULKD_5_MAIN

5 INCH MAIN LOG

MAIN SECTION 5" PER 100'

REPEAT SECTION 5" PER 100'





6	Caliper	16	1 : 240	0	Pe	10	-0.25	DensityCorr	0.25
	inches		ft					g/cc	
-18	NearQuality	2	BHV				15K	Tension	0
			ft3					pounds	
18	FarQuality	-2	AHV	2	Bulk Density				3
			ft3		g/cc				
0	Gamma Ray	150							
	api								

HALLIBURTON

Plot Time: 13-Oct-18 01:35:36
Plot Range: 4590 ft to 4844 ft
Data: HERMAN_YOST4-28\Well Based\REPEAT\
Plot File: \\-LOCAL-\\HERMAN_YOST4-28\Well Based\PORO\BULKD_5_REPEAT

5 INCH REPEAT LOG

REPEAT SECTION 5" PER 100'

HALLIBURTON

PARAMETERS REPORT

Depth (ft)	Tool Name	Mnemonic	Description	Value	Units
TOP					
	SHARED	BS	Bit Size	7.875	in
	SHARED	UBS	Use Bit Size instead of Caliper for all applications.	No	
	SHARED	MDBS	Mud Base	Water	
	SHARED	MDWT	Borehole Fluid Weight	9.100	ppg
	SHARED	WAGT	Weighting Agent	Natural	
	SHARED	BSAL	Borehole salinity	0.00	ppm
	SHARED	FSAL	Formation Salinity NaCl	0.00	ppm
	SHARED	KPCT	Percent K in Mud by Weight?	0.00	%
	SHARED	RMUD	Mud Resistivity	2.000	ohmm
	SHARED	TRM	Temperature of Mud	75.0	degF
	SHARED	CSD	Logging Interval is Cased?	No	
	SHARED	ICOD	AHV Casing OD	5.500	in
	SHARED	CSTR	Compressive Strength	1000.00	psia
	SHARED	ST	Surface Temperature	75.0	degF
	SHARED	TD	Total Well Depth	4840.00	ft
	SHARED	BHT	Bottom Hole Temperature	120.0	degF
	SHARED	SVTM	Navigation and Survey Master Tool	NONE	
	SHARED	AZTM	High Res Z Accelerometer Master Tool	GTET	
	SHARED	TEMM	CBM Temperature Master Tool	GTET	
	SHARED	SOCI	Source of Casing Information	Parameters	
	SHARED	MSAL	Water-base mud filtrate salinity	0.00	ppm
	Rwa / CrossPlot	XPOK	Process Crossplot?	Yes	
	Rwa / CrossPlot	FCHO	Select Source of F	Automatic	
	Rwa / CrossPlot	AFAC	Archie A factor	0.6200	
	Rwa / CrossPlot	MFAC	Archie M factor	2.1500	
	Rwa / CrossPlot	RMFR	Rmf Reference	0.10	ohmm
	Rwa / CrossPlot	TMFR	Rmf Ref Temp	75.00	degF
	Rwa / CrossPlot	RWA	Resistivity of Formation Water	0.05	ohmm
	Rwa / CrossPlot	ADP	Use Air Porosity to calculate CrossplotPhi	No	
	Rwa / CrossPlot	BHSM	Borehole Size Source Tool	SDLT	
	Rwa / CrossPlot	ROIN	Input for RO Calculation	Rwa	
	GTET	GROK	Process Gamma Ray?	Yes	
	GTET	GEOK	Process Gamma Ray EVR?	No	
	GTET	TPOS	Tool Position for Gamma Ray Tools.	Eccentered	
	GTET	BHSM	Borehole Size Source Tool	SDLT	
	DSNT	DNOK	Process DSN?	Yes	
	DSNT	DEOK	Process DSN EVR?	No	
	DSNT	NLIT	Neutron Lithology	Limestone	
	DSNT	DNSO	DSN Standoff - 0.25 in (6.35 mm) Recommended	0.250	in
	DSNT	DNTT	Temperature Correction Type	None	
	DSNT	DPRS	DSN Pressure Correction Type	None	
	DSNT	SHCO	View More Correction Options	No	
	DSNT	UTVD	Use TVD for Gradient Corrections?	No	
	DSNT	LHWT	Logging Horizontal Water Tank?	No	
	DSNT	UCLA	Classic Neutron Parameter utilized?	No	
	DSNT	BHSM	Borehole Size Source Tool	SDLT	
	SDLT	CLOK	Process Caliper Outputs?	Yes	
	Microlog Pad	MLOK	Process MicroLog Outputs?	Yes	
	SDLT Pad	DNOK	Process Density?	Yes	
	SDLT Pad	DNOK	Process Density EVR?	No	

SDLT Pad	CB	Logging Calibration Blocks?	No	
SDLT Pad	SPVT	SDLT Pad Temperature Valid?	Yes	
SDLT Pad	DTWN	Disable temperature warning	No	
SDLT Pad	DMA	Formation Density Matrix	2.710	g/cc
SDLT Pad	DFL	Formation Density Fluid	1.000	g/cc
SDLT Pad	BHSM	Borehole Size Source Tool	SDLT	
ACRt Sonde	RTOK	Process ACRt?	Yes	
ACRt Sonde	MNSO	Minimum Tool Standoff	1.50	in
ACRt Sonde	TCS1	Temperature Correction Source	FP Lwr & FP Up	
ACRt Sonde	TPOS	Tool Position	Eccentered	
ACRt Sonde	RMOP	Rmud Source	Mud Cell	
ACRt Sonde	RMIN	Minimum Resistivity for MAP	0.20	ohmm
ACRt Sonde	RMAX	Maximum Resistivity for MAP	200.00	ohmm
ACRt Sonde	THQY	Threshold Quality	0.50	
ACRt Sonde	MRFX	Fixed mud resistivity	2000	ohmm
ACRt Sonde	BHSM	Borehole Size Source Tool	SDLT	
ACRt Sonde	MBFL	Apply Corkscrew Effect?	No	
BOTTOM				
Data: HERMAN_YOST4-28\0001 RWCH-SP-GTET-DSNT-SDLT-ACRT\004			12-Oct-18 22:56 Up @4844.3f	
			Date: 12-Oct-18 23:11:01	



CALIBRATION REPORT

NATURAL GAMMA RAY TOOL SHOP CALIBRATION

Tool Name: GTET - 11013113

Reference Calibration Date: 02-May-18 11:20:36

Engineer: WHITLOCK

Calibration Date: 05-Aug-18 09:58:00

Software Version: WL INSITE R5.6.3 (Build 4)

Calibration Version: 1

Calibrator Source S/N: TB-79

Calibrator API Reference:222.00 api

Equivalent Calibrator API Reference:225.9 api

Measurement	Measured	Calibrated	Units
Background	26.4	26.2	api
Background + Calibrator	253.6	252.1	api
Calibrator	227.2	225.9	api

NATURAL GAMMA RAY TOOL FIELD CALIBRATION

Tool Name: GTET - 11013113

Reference Calibration Date: 05-Aug-18 09:58:00

Engineer: SEAN WOLTEMATH

Calibration Date: 10-Oct-18 14:08:40

Software Version: WL INSITE R5.8.9 (Build 6)

Calibration Version: 1

Calibrator Source S/N: TB-79

Calibrator API Reference:222.00 api

Equivalent Calibrator API Reference:225.9 api

Field Verification	Shop	Field	Units
Background	26.2	21.3	api
Background + Calibrator	252.1	244.5	api
Calibrator	225.9	223.2	api

Shop	Field	Difference	Tolerance
225.9	223.2	2.7	+/- 9.00

DUAL SPACED NEUTRON SHOP CALIBRATION

Tool Name: DSNT - 11019641

Reference Calibration Date: 04-Aug-18 12:03:14

Engineer: SCHLIEM

Calibration Date: 04-Aug-18 12:26:27

Software Version: WL INSITE R5.6.3 (Build 4)		Calibration Version: 1																					
Logging Source S/N: DSN-436 Tank Serial Number: EL RENO HWT Reference value assigned to Tank: 56.100 Snow Block S/N: 12156883 Calibration Tank Water Temperature: 89 degF Min. Tool Housing Outside Diameter: 3.625 in																							
<table><tr><th colspan="4">CALIBRATION CONSTANTS</th></tr><tr><th>Measurement</th><th>Prev. Value</th><th>New Value</th><th>Control Limit On New Value</th></tr><tr><td>Gain:</td><td>0.97922</td><td>0.97742</td><td>0.900 - 1.100</td></tr></table>				CALIBRATION CONSTANTS				Measurement	Prev. Value	New Value	Control Limit On New Value	Gain:	0.97922	0.97742	0.900 - 1.100								
CALIBRATION CONSTANTS																							
Measurement	Prev. Value	New Value	Control Limit On New Value																				
Gain:	0.97922	0.97742	0.900 - 1.100																				
<table><tr><th colspan="5">WATER TANK SUMMARY (Horizontal Water Tank)</th></tr><tr><th>Measurement</th><th>Current Reading (Previous Coef.)</th><th>Calibrated (New Coef.)</th><th>Change</th><th>Control Limit On Change</th></tr><tr><td>Porosity (decp):</td><td>0.2364</td><td>0.2358</td><td>0.0006</td><td>+/- 0.0020</td></tr><tr><td>Calibrated Ratio:</td><td>10.5794</td><td>10.5599</td><td>0.019</td><td>+/- 0.050</td></tr></table>				WATER TANK SUMMARY (Horizontal Water Tank)					Measurement	Current Reading (Previous Coef.)	Calibrated (New Coef.)	Change	Control Limit On Change	Porosity (decp):	0.2364	0.2358	0.0006	+/- 0.0020	Calibrated Ratio:	10.5794	10.5599	0.019	+/- 0.050
WATER TANK SUMMARY (Horizontal Water Tank)																							
Measurement	Current Reading (Previous Coef.)	Calibrated (New Coef.)	Change	Control Limit On Change																			
Porosity (decp):	0.2364	0.2358	0.0006	+/- 0.0020																			
Calibrated Ratio:	10.5794	10.5599	0.019	+/- 0.050																			
<table><tr><th colspan="3">VERIFIER</th></tr><tr><th>Measurement</th><th>Value</th><th>Control Limit</th></tr><tr><td>Snow-Block Porosity (decp):</td><td>0.0667</td><td>0.02000 - 0.09000</td></tr></table>				VERIFIER			Measurement	Value	Control Limit	Snow-Block Porosity (decp):	0.0667	0.02000 - 0.09000											
VERIFIER																							
Measurement	Value	Control Limit																					
Snow-Block Porosity (decp):	0.0667	0.02000 - 0.09000																					
<table><tr><th colspan="2">PASS/FAIL SUMMARY</th></tr><tr><td>Background Check:</td><td>Passed</td></tr><tr><td>Gain-Range Check:</td><td>Passed</td></tr><tr><td>Snow-Block Check:</td><td>Passed</td></tr></table>				PASS/FAIL SUMMARY		Background Check:	Passed	Gain-Range Check:	Passed	Snow-Block Check:	Passed												
PASS/FAIL SUMMARY																							
Background Check:	Passed																						
Gain-Range Check:	Passed																						
Snow-Block Check:	Passed																						

DUAL SPACED NEUTRON FIELD CALIBRATION			
Tool Name:	DSNT - 11019641	Reference Calibration Date:	04-Aug-18 12:26:27
Engineer:	SEAN WOLTEMATH	Calibration Date:	10-Oct-18 14:28:25
Software Version:	WL INSITE R5.8.9 (Build 6)	Calibration Version:	1

Logging Source S/N: DSN-436 Snow Block S/N: 12156883																		
<table><tr><th colspan="5">NEUTRON FIELD-CHECK SUMMARY</th></tr><tr><th></th><th>Shop</th><th>Field</th><th>Difference</th><th>Control Limit On Change</th></tr><tr><td>Snow-Block Porosity (decp):</td><td>0.0667</td><td>0.0766</td><td>0.0099</td><td>+/- 0.0150</td></tr></table>				NEUTRON FIELD-CHECK SUMMARY						Shop	Field	Difference	Control Limit On Change	Snow-Block Porosity (decp):	0.0667	0.0766	0.0099	+/- 0.0150
NEUTRON FIELD-CHECK SUMMARY																		
	Shop	Field	Difference	Control Limit On Change														
Snow-Block Porosity (decp):	0.0667	0.0766	0.0099	+/- 0.0150														
<table><tr><th colspan="2">PASS/FAIL SUMMARY</th></tr><tr><td>Block Change Check:</td><td>Passed</td></tr><tr><td>Snow Block Stat Check:</td><td>Passed</td></tr><tr><td>Temperature Check:</td><td>Passed</td></tr></table>				PASS/FAIL SUMMARY		Block Change Check:	Passed	Snow Block Stat Check:	Passed	Temperature Check:	Passed							
PASS/FAIL SUMMARY																		
Block Change Check:	Passed																	
Snow Block Stat Check:	Passed																	
Temperature Check:	Passed																	

DENSITY CALIPER SHOP CALIBRATION			
Tool Name:	SDLT - 10960494	Reference Calibration Date:	01-Jan-70 00:00:00
Engineer:	SEAN WOLTEMATH	Calibration Date:	10-Oct-18 14:49:27
Software Version:	WL INSITE R5.6.3 (Build 4)	Calibration Version:	1
Host Tool Name:	DSNT - 11019641		

	CALIBRATION COEFFICIENTS			
	Measurement	Previous Value	New Value	Control Limit On New Value
	Pad Offset	-3977.11	-3977.11	-7000.00 - -1000.00
	Pad Gain	0.0003897	0.0003897	0.0002000 - 0.0006000
	Arm Offset	-3073.13	-3073.13	-5000.00 - 3000.00
	Arm Gain	0.0005210	0.0005210	0.000300 - 0.000700

Arm Power

-0.000005094

-0.000005094

-0.000010000 - 0.000010000

The ring diameter is computed from: DIAMETER = PAD EXTENSION + ARM EXTENSION + TOOL DIAMETER

Tool Diameter: 4.50 in

CALIBRATION RINGS				
Measurement	Current Reading (Previous Coeff.)	Calibrated (New Coeff.)	Change	Control Limit On New Value
PAD EXTENSION:				
Small Ring (in)	2.00	2.00	0.00	+/- 0.20
Medium Ring (in)	3.75	3.75	0.00	+/- 0.20
RING DIAMETER:				
Small Ring (in)	6.50	6.50	0.00	+/- 0.20
Medium Ring (in)	8.25	8.25	0.00	+/- 0.20
Large Ring (in)	15.00	15.00	0.00	+/- 0.20

PASS/FAIL SUMMARY	
Calibration-Coefficients Range Check:	Passed
Ring-Measurement Check:	Passed
PASS/FAIL SUMMARY	
Calibration-Coefficients Range Check:	Passed

SDLT CALIPER FIELD CALIBRATION

Tool Name:	SDLT - 10960494	Reference Calibration Date:	10-Oct-18 14:49:27
Engineer:	SEAN WOLTEMATH	Calibration Date:	10-Oct-18 15:10:30
Software Version:	WL INSITE R5.6.3 (Build 4)	Calibration Version:	1

MEASURED CALIPER VALUES				
Measurement	Shop	Field	Change	Control Limit On New Value
Pad Extension	3.75	3.79	0.04	+/- 0.10
Ring Diameter	8.25	8.25	-0.00	+/- 0.15

PASS/FAIL SUMMARY	
Pad Extension Check:	Passed
Diameter Check:	Passed

MICRO LOG SHOP CALIBRATION

Tool Name:	Microlog Pad - 10960494	Reference Calibration Date:	08-Jun-18 16:08:54
Engineer:	WHITLOCK	Calibration Date:	30-Sep-18 13:47:51
Software Version:	WL INSITE R5.8.9 (Build 6)	Calibration Version:	1
Host Tool Name:	DSNT - 11019641		

CALIBRATION COEFFICIENT SUMMARY					
Measurement	Micro Log Normal		Micro Log Lateral		Units
	Measured	Calibrated	Measured	Calibrated	
Tool Zero	-0.07	-0.14	-0.00	-0.01	ohmm
Calibration Point #1	0.07	0.00	0.00	0.00	ohmm
Calibration Point #2	20.01	20.00	19.95	20.00	ohmm
Internal Reference	19.84	19.83	19.92	19.97	ohmm
Measurement	Micro Log Normal Tool Value		Micro Log Lateral Tool Value		Units
Tool Zero	-0.08		0.35		V
Calibration Point #1	37.72		2.09		V
Calibration Point #2	5356.95		6956.77		V
Internal Reference	5312.51		6945.81		V

MICRO LOG FIELD CHECK

Tool Name:	Microlog Pad - 10960494	Reference Calibration Date:	30-Sep-18 13:47:51
------------	-------------------------	-----------------------------	--------------------

Engineer: SEAN WOLTEMATH			Calibration Date: 10-Oct-18 14:04:57			
Software Version: WL INSITE R5.8.9 (Build 6)			Calibration Version: 1			
	Measurement	Micro Log Normal		Micro Log Lateral		
		Shop	Field	Shop	Field	
	Tool Zero	-0.14	-0.14	-0.01	-0.01	
	Internal Reference	19.83	19.79	19.97	19.93	
	Summary					
	Signal	Shop	Field	Difference	Tolerance	
	Microlog Normal	19.83	19.79	0.04	+/- 0.80	
	Microlog Lateral	19.97	19.93	0.04	+/- 0.80	
	SPECTRAL DENSITY SHOP CALIBRATION					
	Tool Name: SDLT Pad - 11213308			Reference Calibration Date: 17-Sep-18 12:07:25		
Engineer: WHITLOCK			Calibration Date: 17-Sep-18 12:30:06			
Software Version: WL INSITE R5.6.3 (Build 4)			Calibration Version: 1			
Logging Source S/N: 5475GW						
Aluminum Block S/N: EL RENO			Density: 2.581g/cc		Pe: 3.170	
Magnesium Block S/N: EL RENO			Density: 1.687g/cc		Pe: 2.594	
DENSITY CALIBRATION SUMMARY						
Measurement		Previous Value		New Value		
				Control Limit		
Near Bar Gain		1.0089		1.0095		
Near Dens Gain		0.9949		0.9972		
Near Peak Gain		1.0098		1.0259		
Near Lith Gain		1.0052		1.0142		
Far Bar Gain		1.0078		1.0061		
Far Dens Gain		0.9950		0.9953		
Far Peak Gain		0.9901		0.9911		
Far Lith Gain		0.9745		0.9764		
Near Bar Offset		0.0471		0.0438		
Near Dens Offset		0.1758		0.1544		
Near Peak Offset		0.0270		-0.1077		
Near Lith Offset		0.0345		-0.0412		
Far Bar Offset		-0.0195		-0.0036		
Far Dens Offset		0.1103		0.1086		
Far Peak Offset		0.1339		0.1248		
Far Lith Offset		0.2115		0.1964		
Near Bar Background		945.62		947.60		
Near Dens Background		315.82		314.50		
Near Peak Background		136.57		137.87		
Near Lith Background		168.89		168.30		
Far Bar Background		482.51		480.15		
Far Dens Background		193.40		193.79		
Far Peak Background		78.35		78.65		
Far Lith Background		80.88		79.56		
CALIBRATION BLOCK SUMMARY						
Measurement		Current Reading (Previous Coef)		Calibrated (New Coef)		
				Change		
				Control Limit On Change		
MAGNESIUM						
Density (g/cc)		1.685		1.687		
Pe		2.557		2.563		
ALUMINUM						
Density (g/cc)		2.580		2.580		

Density (g/cc)	2.580	2.580	-0.000	+/- 0.01500
Pe	3.115	3.136	0.021	+/- 0.150

TOOL SUMMARY				
Measurement	Near Detector		Far Detector	
	Value	Control Limits	Value	Control Limits
QUALITY				
Background	0.0003	+/- 0.0110	0.0015	+/- 0.0140
Magnesium Block	0.0001	+/- 0.0110	-0.0007	+/- 0.0140
Aluminum Block	-0.0000	+/- 0.0110	-0.0006	+/- 0.0140
Resolution	9.24	6.00 - 11.50	9.28	6.00 - 11.50
Internal Verifier(B+D+P+L)	1568	1200 - 2700	832	800 - 1700

PASS/FAIL SUMMARY	
Background Quality Check:	Passed
Background Range Check:	Passed
Background Resolution Check:	Passed
Background Verification Check:	Passed
Magnesium Quality Check:	Passed
Aluminum Quality Check:	Passed
Gains Check:	Passed
Changes in Calibration Blocks:	Passed

SPECTRAL DENSITY FIELD CHECK			
Tool Name:	SDLT Pad - 11213308	Reference Calibration Date:	17-Sep-18 12:30:06
Engineer:	SEAN WOLTEMATH	Calibration Date:	10-Oct-18 14:13:05
Software Version:	WL INSITE R5.8.9 (Build 6)	Calibration Version:	1

Pad Temperature: 68.2 degF				
DENSITY FIELD CALIBRATION SUMMARY				
Measurement	Shop	Field	Change	Control Limit +/-
Near (B+D+P+L) cps	1568.269	1563.061	-5.208	15.935
Far (B+D+P+L) cps	832.156	829.464	-2.692	15.879
Near Resolution	9.24	9.27	0.030	0.50
Far Resolution	9.28	9.42	0.140	1.00

PASS/FAIL SUMMARY	
Bkg Quality Check:	Passed
Bkg Resolution Check:	Passed
Bkg Verification Check:	Passed

ARRAY COMPENSATED TRUE RESISTIVITY SHOP CALIBRATION			
Tool Name:	ACRt Sonde - 11830728	Reference Calibration Date:	23-Feb-18 10:15:37
Engineer:	WHITLOCK	Calibration Date:	06-Jun-18 13:24:46
Software Version:	WL INSITE R5.6.3 (Build 4)	Calibration Version:	1
Host Tool Name:	ACRt Instrument - 11830684		

TYPICAL GAIN RANGE									
Subarray	R12KHz			R36KHz			R72KHz		
	Lower	(mmho/m)	Upper	Lower	(mmho/m)	Upper	Lower	(mmho/m)	Upper
A1 (80")	0.95	1.0279	1.05	0.95	1.0076	1.05	0.95	0.9997	1.05
A2 (50")	0.95	1.0334	1.05	0.95	1.0139	1.05	0.95	1.0097	1.05
A3 (29")	0.95	1.0346	1.05	0.95	1.0146	1.05	0.95	1.0081	1.05
A4 (17")	0.95	1.0279	1.05	0.95	1.0063	1.05	0.95	1.0018	1.05
A5 (10")	N/A	N/A	N/A	0.95	1.0001	1.05	0.95	0.9950	1.05
A6 (6")	N/A	N/A	N/A	0.95	0.9869	1.05	0.95	0.9818	1.05

SONDE OFFSET									
Subarray	R12KHz			R36KHz			R72KHz		
	(mmho/m)			(mmho/m)			(mmho/m)		
A1 (80")	0.315			-4.964			-5.711		
A2 (50")	0.409			-3.450			-5.485		
A3 (29")	-11.648			-3.720			-3.783		
A4 (17")	-90.980			-28.724			-23.707		
A5 (10")	N/A			-76.200			-37.537		
A6 (6")	N/A			280.488			149.005		
TRANSMITTER CURRENT GAIN					R-MUD VERIFICATION				
Signal	Lower	R	Upper	Signal	Lower (ohm-m)	Measured (ohm-m)	Upper (ohm-m)		
12K	0.6	0.82	1.3	Mud Cell	0.95	0.99	1.05		
36K	1.0	1.80	2.0						
72K	1.0	1.05	2.0						
PASS/FAIL SUMMARY									
GAIN RANGE CHK					PASS				
SONDE OFFSET CHK					PASS				
TOOL OK TO LOG									

QUALITY CHECK SHOP CALIBRATION

Tool Name: ACRt Sonde - 11830728

Engineer: WHITLOCK

Software Version: WL INSITE R5.6.3 (Build 4)

Host Tool Name: ACRt Instrument - 11830684

Reference Calibration Date: 23-Feb-18 10:21:17

Calibration Date: 06-Jun-18 14:01:20

Calibration Version: 1

STANDARD DEVIATIONS									
	R12KHz			R36KHz			R72KHz		
	Measured (mmho/m)	Expected (mmho/m)	Pass/Fail	Measured (mmho/m)	Expected (mmho/m)	Pass/Fail	Measured (mmho/m)	Expected (mmho/m)	Pass/Fail
A1 (80")	0.000	< 0.750	Pass	0.000	< 0.750	Pass	0.000	< 0.750	Pass
A2 (50")	0.000	< 0.750	Pass	0.000	< 0.750	Pass	0.000	< 0.750	Pass
A3 (29")	0.000	< 0.750	Pass	0.000	< 0.750	Pass	0.000	< 0.750	Pass
A4 (17")	0.000	< 0.750	Pass	0.000	< 0.750	Pass	0.000	< 0.750	Pass
A5 (10")	0.000	< 0.750	Pass	0.000	< 0.750	Pass	0.000	< 0.750	Pass
A6 (6")	0.000	< 0.750	Pass	0.000	< 0.750	Pass	0.000	< 0.750	Pass

AVERAGES									
	R12KHz			R36KHz			R72KHz		
	Measured (mmho/m)	Expected (mmho/m)	Pass/Fail	Measured (mmho/m)	Expected (mmho/m)	Pass/Fail	Measured (mmho/m)	Expected (mmho/m)	Pass/Fail
A1 (80")	0.000	< 0.500	Pass	-0.001	> -0.500	Pass	-0.006	> -0.500	Pass
A2 (50")	0.000	< 0.500	Pass	-0.001	> -0.500	Pass	-0.005	> -0.500	Pass
A3 (29")	-0.000	< 0.500	Pass	-0.001	> -0.500	Pass	-0.003	> -0.500	Pass
A4 (17")	-0.002	> -0.500	Pass	-0.006	> -0.500	Pass	-0.022	> -0.500	Pass
A5 (10")	-0.010	> -0.500	Pass	-0.017	> -0.500	Pass	-0.036	> -0.500	Pass
A6 (6")	0.014	< 0.500	Pass	0.063	< 0.500	Pass	0.138	< 0.500	Pass

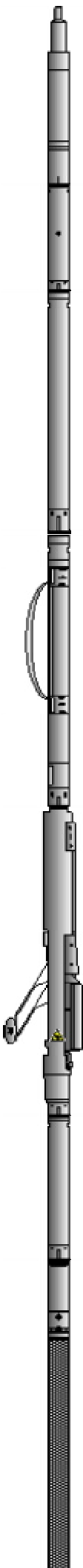
GAIN TOLERANCE									
R12KHz									
	Measured	Last Month	Difference	Tolerance		Measured	Last Month	Difference	Tolerance

	Measured (mmho/m)	Last Month (mmho/m)	Difference (mmho/m)	Tolerance (mmho/m)	Pass/Fail
A1 (80")	-213173456.000	-213653808.000	480352.000	10682690.400	Pass
A2 (50")	-205651744.000	-206143280.000	491536.000	10307164.000	Pass
A3 (29")	-200817664.000	-201197776.000	380112.000	10059888.800	Pass
A4 (17")	-200193568.000	-200629872.000	436304.000	10031493.600	Pass
A5 (10")	-200252336.000	-200678960.000	426624.000	10033948.000	Pass
A6 (6")	-199820688.000	-200219344.000	398656.000	10010967.200	Pass
R36KHz					
	Measured (mmho/m)	Last Month (mmho/m)	Difference (mmho/m)	Tolerance (mmho/m)	Pass/Fail
A1 (80")	48114080.000	48477272.000	363192.000	2423863.600	Pass
A2 (50")	33966292.000	34324412.000	358120.000	1716220.600	Pass
A3 (29")	28032378.000	28346680.000	314302.000	1417334.000	Pass
A4 (17")	27853682.000	28207516.000	353834.000	1410375.800	Pass
A5 (10")	27373208.000	27716930.000	343722.000	1385846.500	Pass
A6 (6")	26035236.000	26360300.000	325064.000	1318015.000	Pass
R72KHz					
	Measured (mmho/m)	Last Month (mmho/m)	Difference (mmho/m)	Tolerance (mmho/m)	Pass/Fail
A1 (80")	-92927656.000	-93022904.000	95248.000	4651145.200	Pass
A2 (50")	-90501024.000	-90617752.000	116728.000	4530887.600	Pass
A3 (29")	-88192472.000	-88292832.000	100360.000	4414641.600	Pass
A4 (17")	-88397088.000	-88515880.000	118792.000	4425794.000	Pass
A5 (10")	-86957704.000	-87076952.000	119248.000	4353847.600	Pass
A6 (6")	-87976216.000	-88080696.000	104480.000	4404034.800	Pass
PASS/FAIL SUMMARY Std Deviation Verification Pass Average Verification Pass Gain Tolerance Verification Pass					

CALIBRATION SUMMARY						
Sensor	Shop	Field	Post	Difference	Tolerance	Units
GTET-11013113						
Gamma Ray Calibrator	225.9	223.2	-----	2.7	+/- 9.00	api
DSNT-11019641						
Snow-Block Porosity	0.0667	0.0766	-----	-0.0099	+/- 0.0150	decp
SDLT-10960494						
Pad Extension	3.75	3.79	-----	-0.04	+/-0.10	in
Ring Diameter	8.25	8.25	-----	0.00	+/-0.15	in
Microlog Pad-10960494						
MicroLog Normal	19.83	19.79	-----	0.04	+/-0.80	ohmm
MicroLog Lateral	19.97	19.93	-----	0.04	+/-0.80	ohmm
SDLT Pad-11213308						
Near(B+D+P+L)	1568.269	1563.061	-----	5.208	+/-15.935	cps
Far(B+D+P+L)	832.156	829.464	-----	2.692	+/-15.879	cps
ACRt Sonde-11830728						
Mud Cell	0.99	-----	-----	0	-----	ohm-m
Data: HERMAN_YOST4-28\0001 RWCH-SP-GTET-DSNT-SDLT-ACRT\IDLE					Date: 12-Oct-18 23:13:27	

HALLIBURTON	
TOOL STRING DIAGRAM REPORT	

Description	Depth	Depth	Depth	Depth	Depth	Accumulated
-------------	-------	-------	-------	-------	-------	-------------

Description	Overbody Description	O.D.	Diagram	Sensors @ Delays	Length	Accumulated Length
					58.59 ft	
RWCH-12345678 135.00 lbs		Ø 2.310 in →		← Fishing Neck @ 57.71 ft		
		Ø 3.625 in →		← Load Cell @ 54.91 ft ← BH Temperature @ 54.34 ft	6.25 ft	
	Weak Point Solid-00000025 0.01 lbs	Ø 0.010 in* →				52.34 ft
SP Sub-11812437 60.00 lbs		Ø 3.625 in →		← SP @ 50.56 ft	3.74 ft	
				← Z-Accelerometer @ 48.15 ft		48.60 ft
GTET-11013113 165.00 lbs		Ø 3.625 in →		← GammaRay @ 42.54 ft	8.52 ft	
						40.08 ft
DSNT-11019641 174.00 lbs	DSN Decentralizer-11019641 6.60 lbs	Ø 5.000 in* → Ø 3.625 in →		← DSN Far @ 33.15 ft ← DSN Near @ 32.40 ft	9.69 ft	
						30.40 ft
SDLT-10960494 360.00 lbs	SDLT Pad-11213308 65.00 lbs Microlog Pad-10960494 8.00 lbs RAM-Cs137-00005475 1.00 lbs	Ø 4.500 in → Ø 4.500 in* → Ø 4.750 in* → Ø 0.800 in* →		← Microlog @ 22.58 ft ← SDL Caliper @ 22.40 ft ← SDL @ 22.39 ft	10.81 ft	
						19.58 ft
ACRt Instrument-11830684 50.00 lbs		Ø 3.625 in →			5.03 ft	
				← Mud Resistivity @ 13.19 ft		14.55 ft
ACRt Sonde-11830728 200.00 lbs		Ø 3.625 in →		← ACRt @ 9.21 ft	14.22 ft	

Bull Nose-00000001
5.00 lbs

Ø 2.750 in →



0.33 ft
0.33 ft
0.00 ft

Mnemonic	Tool Name	Serial Number	Weight (lbs)	Length (ft)	Accumulated Length (ft)	Max.Log. Speed (fpm)
RWCH	Releasable Wireline Cable Head	12345678	135.00	6.25	52.34	300.00
WPSS	Weak Point Solid	00000025	0.01	0.01	*	52.34 300.00
SP	SP Sub	11812437	60.00	3.74	48.60	300.00
GTET	Gamma Telemetry Tool	11013113	165.00	8.52	40.08	60.00
DSNT	Dual Spaced Neutron	11019641	174.00	9.69	30.40	60.00
DCNT	DSN Decentralizer	11019641	6.60	5.13	*	33.73 300.00
SDLT	Spectral Density Tool	10960494	360.00	10.81	19.58	60.00
SDLP	Density Insite Pad	11213308	65.00	2.55	*	21.79 60.00
Cs137	Logging Source, SDLT-I, 1.78 Ci - Cs137	00005475	1.00	0.80	*	22.02 300.00
MICP	Microlog Pad	10960494	8.00	1.00	*	22.08 60.00
ACRt	Array Compensated True Resistivity Instrument Section	11830684	50.00	5.03	14.55	120.00
ACRt	Array Compensated True Resistivity Sonde Section	11830728	200.00	14.22	0.33	120.00
BLNS	Bull Nose	00000001	5.00	0.33	0.00	300.00
Total			1,229.61	58.59		
* Not included in Total Length and Length Accumulation.						
Data: HERMAN_YOST4-28\0001 RWCH-SP-GTET-DSNT-SDLT-ACRT\004 12-Oct-18 22:56 Up @4844.3f					Date: 12-Oct-18 23:08:40	

COMPANY HERMAN L. LOEB, LLC

WELL YOST 4-28

FIELD EINSEL

COUNTY KIOWA STATE KANSAS

HALLIBURTON

SPECTRAL DENSITY
DUAL SPACED NEUTRON
LOG