Weatherford

# COMPACT PHOTO DENSITY COMPENSATED NEUTRON MICRORESISTIVITY LOG

| | |
|---|---|
| COMPANY | SHAKESPEARE OIL CO., INC. |
| WELL | ZANOBIA #1-21 |
| FIELD | WILDCAT |
| PROVINCE/COUNTY | LOGAN |
| COUNTRY/STATE | U.S.A. / KANSAS |
| LOCATION | 2285' FSL & 1420' FWL |

| SEC | TWP | RGE | Other Services |
|---|---|---|---|
| 21 | 15S | 33W | MAI/MFE MSS |

API Number 15-109-21141
Permit Number

Permanent Datum GL, Elevation 2855 feet
Log Measured From KB
Drilling Measured From KB

| Elevations: | feet |
|---|---|
| KB | 2867.00 |
| DF | 2865.00 |
| GL | 2855.00 |

| | | | | |
|---|---|---|---|---|
| Date | 27-NOV-2012 | | | |
| Run Number | ONE | | | |
| Service Order | 3537784 | | | |
| Depth Driller | 4600.00 | feet | | |
| Depth Logger | 4601.00 | feet | | |
| First Reading | 4569.00 | feet | | |
| Last Reading | 3600.00 | feet | | |
| Casing Driller | 225.00 | feet | | |
| Casing Logger | 222.00 | inches | | |
| Bit Size | 7.875 | | | |
| Hole Fluid Type | CHEMICAL | lb/USg | | |
| Density / Viscosity | 9.10 lb/USg | 52.00 CP | | |
| PH / Fluid Loss | 10.50 | 10.50 | | |
| Sample Source | MUDPIT | | | |
| Rm @ Measured Temp | 0.72 @ 78.0 | ohm-m | | |
| Rmf @ Measured Temp | 0.58 @ 78.0 | ohm-m | | |
| Rmc @ Measured Temp | 0.86 @ 78.0 | ohm-m | | |
| Source Rmf / Rmc | CALC | CALC | | |
| Rm @ BHT | 0.52 @110.0 | ohm-m | | |
| Time Since Circulation | 4 HOURS | | | |
| Max Recorded Temp | 110.00 | deg F | | |
| Equipment / Base | 13096 | LIB | | |
| Recorded By | ADAM SILL | | | |
| Witnessed By | TIM PRIEST | | | |
| JOB # | LB12-311 | | | |

## BOREHOLE RECORD

Last Edited: 27-NOV-2012 22:17

| Bit Size inches | Depth From feet | Depth To feet |
|---|---|---|
| 7.875 | 225.00 | 4600.00 |

## CASING RECORD

| Type | Size inches | Depth From feet | Shoe Depth feet | Weight pounds/ft |
|---|---|---|---|---|
| SURFACE | 8.625 | 0.00 | 225.00 | 24.00 |

## REMARKS

- SOFTWARE ISSUE: WLS 13.04.8492.
- MCG, MML, MDN, MPD, MFE, MSS, MAI RAN IN COMBINATION.
  - HARDWARE: DUAL BOWSPRING USED ON MDN.
  0.5 INCH STANDOFF USED ON MFE.
  TWO 0.5 INCH STANDOFFS USED ON MSS.
  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.
- ANNULAR HOLE VOLUME WITH 4.5 INCH CASING FROM TD TO 3600 FT: 280 CU. FT.
- SERVICE ORDER # 3537784.

- RIG: H-D DRILLING #2.

- ENGINEER: A. SILL.

- OPERATOR(S): N. ADAME, R. VENEGAS.



## 5 INCH MAIN

Depth Based Data - Maximum Sampling Increment 10.0cm — Plotted on 28-NOV-2012 04:23

Filename: C:\Minimus 13.04.8492\Data\...\Shakespeare Oil Co. Zanobia #1-21_003 spooled section.dta — Recorded on 28-NOV-2012 03:46

System Versions: Logged with 13.04.8492 Processed with 13.04.8492 Plotted with 13.04.8492

Timing Marks
every 60.0 sec

Gamma Ray
API
0 75 150
150 225 300

Density Caliper
inches
6 11 16

Bit Size
inches
6 11 16

DST Uphole Tension
pounds
5000 0

Depth in Feet

Borehole Temp in deg F

HVI every 10 cu ft

Annular Integral every 10 cu ft

Replay Scale 1:240

Limestone Neutron Por.
percent
30 20 10 0 -10

Limestone Density Por.
percent
30 20 10 0 -10

PE
barns/electron
0 5 10

Micro-normal
ohm metres
0 20

Micro-inverse
ohm metres
0 20

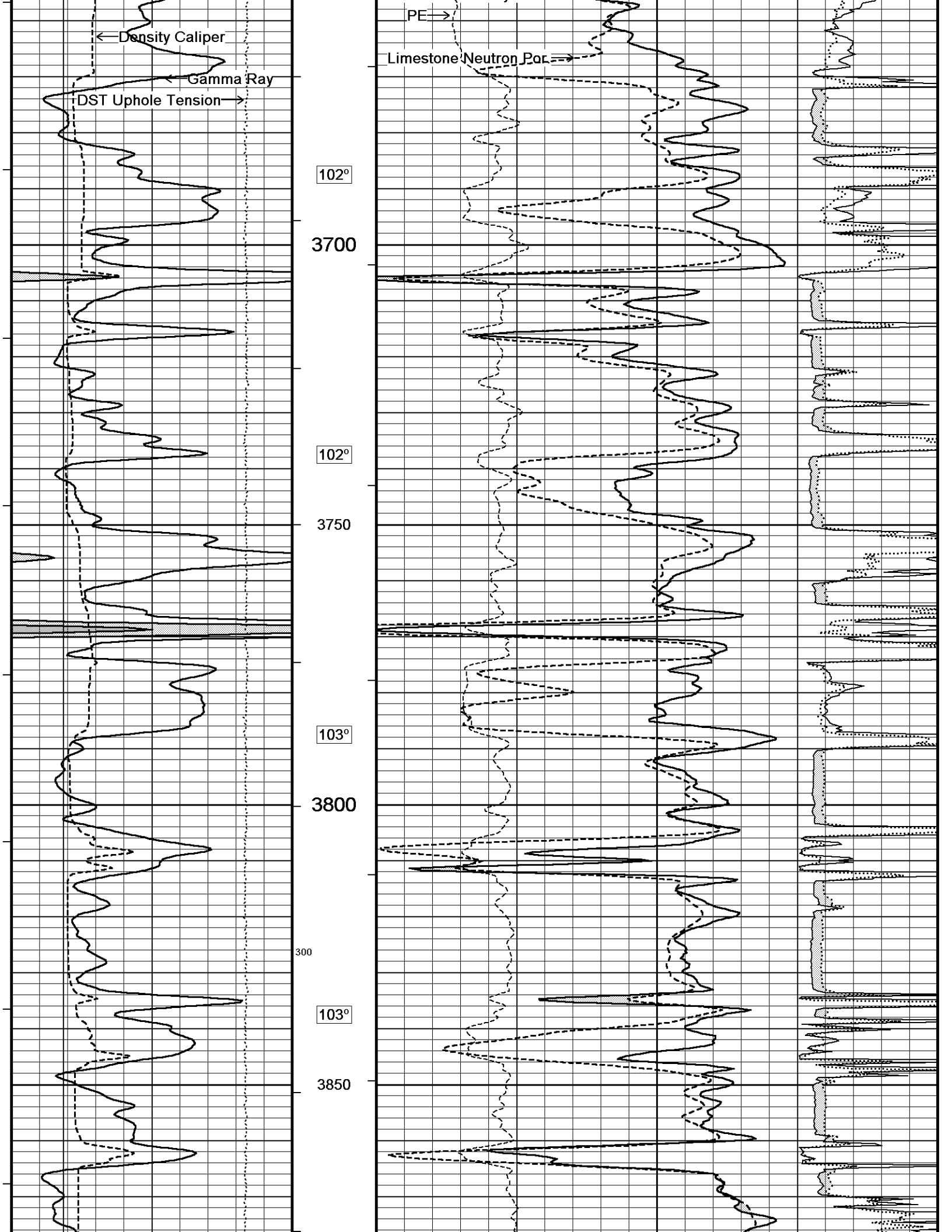
3600

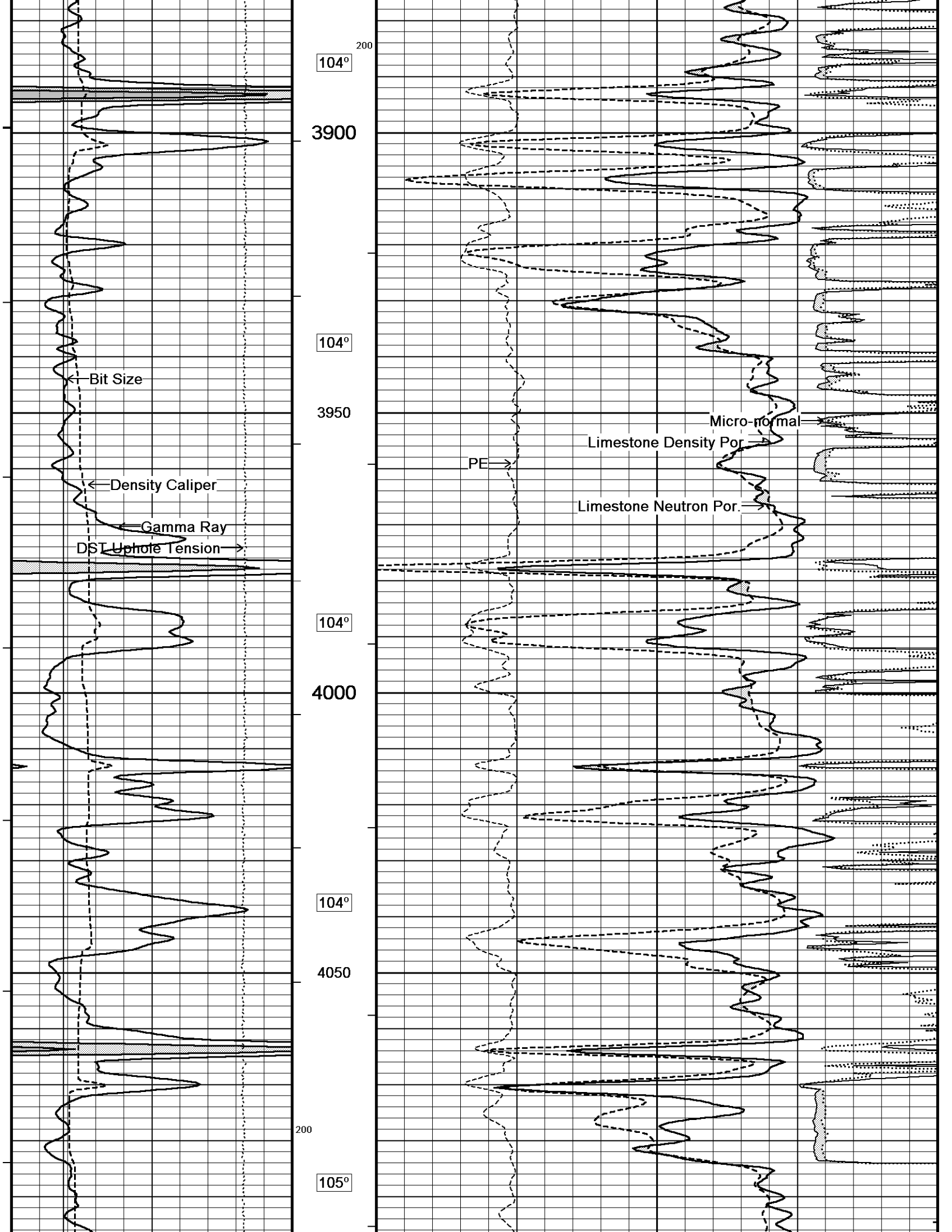
102°

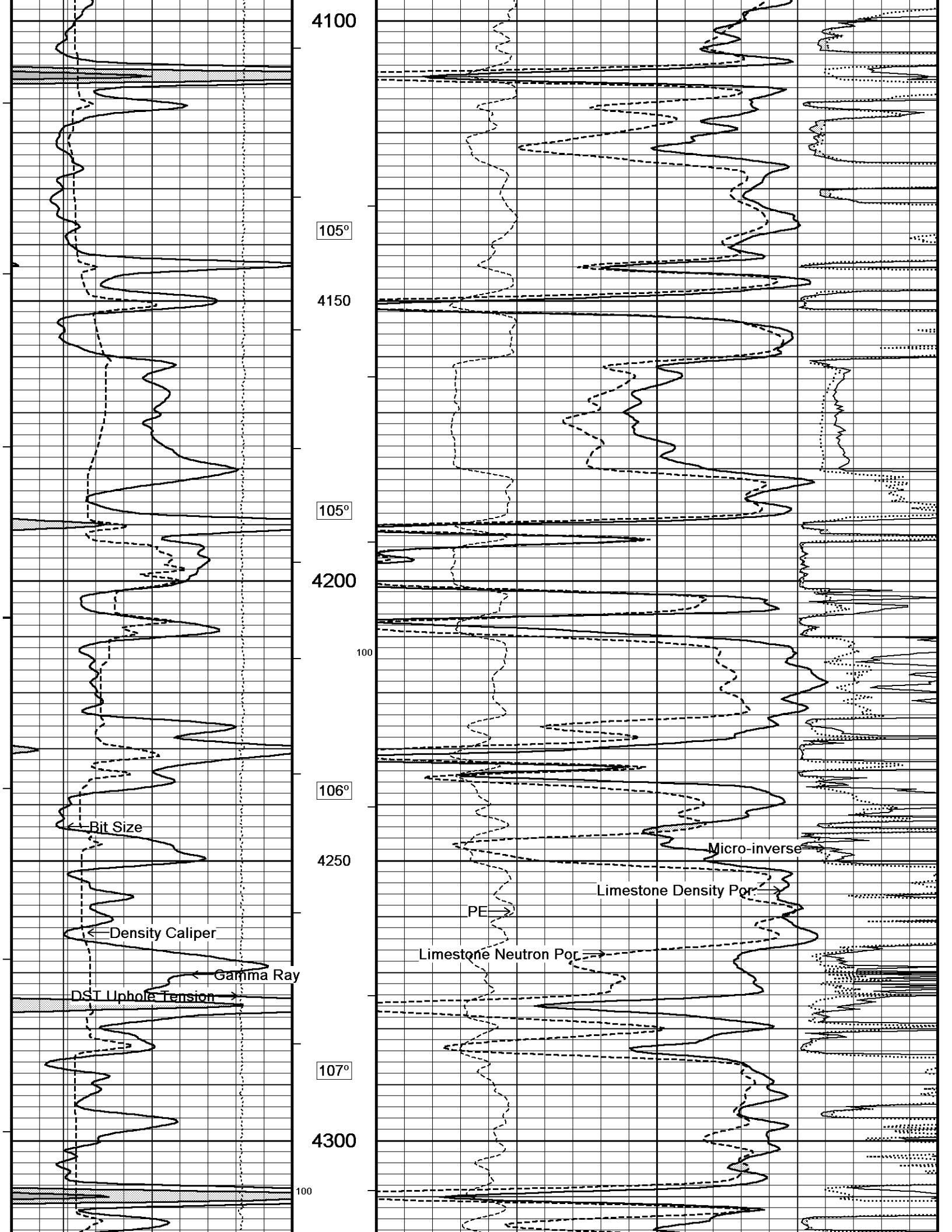
Bit Size

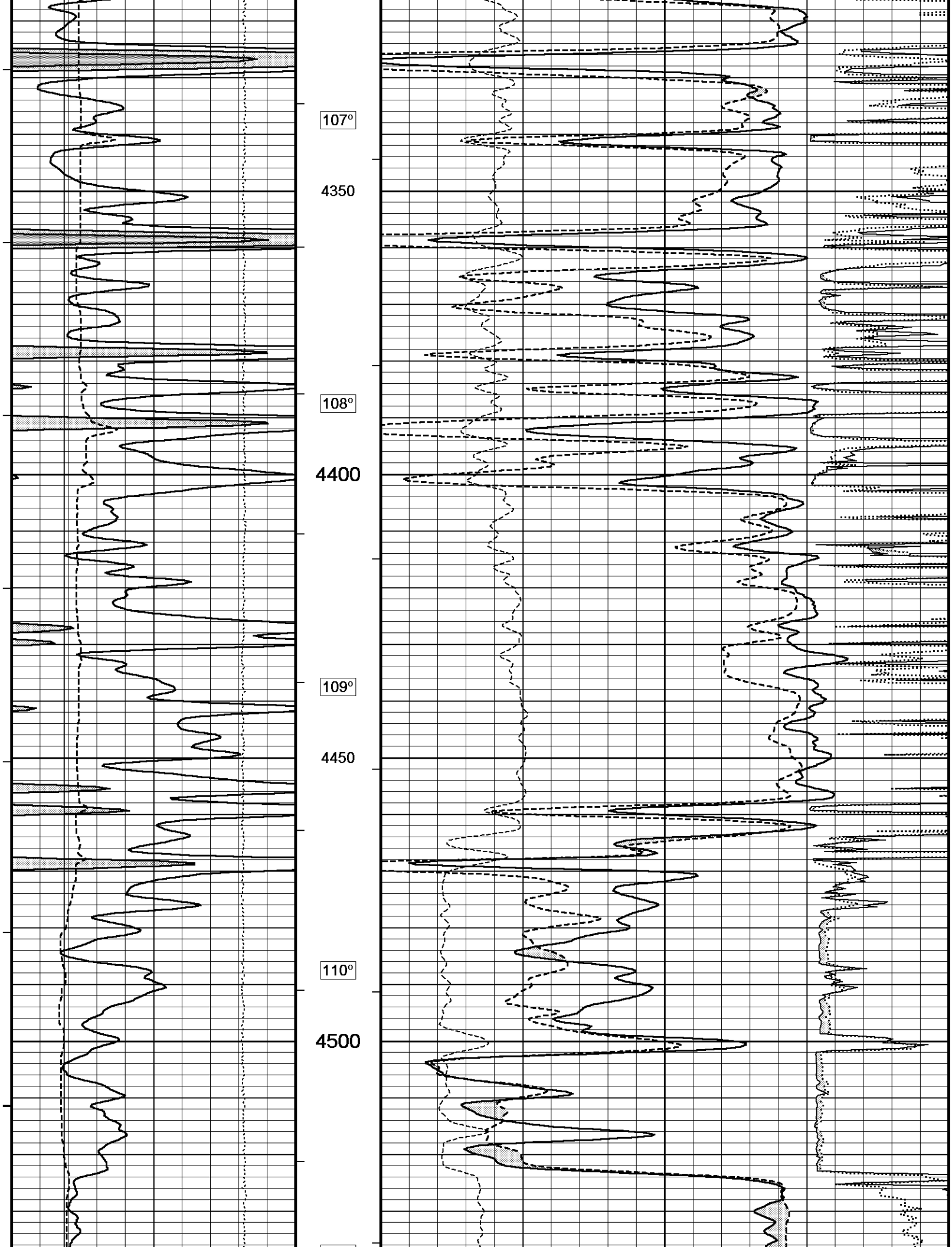
3650

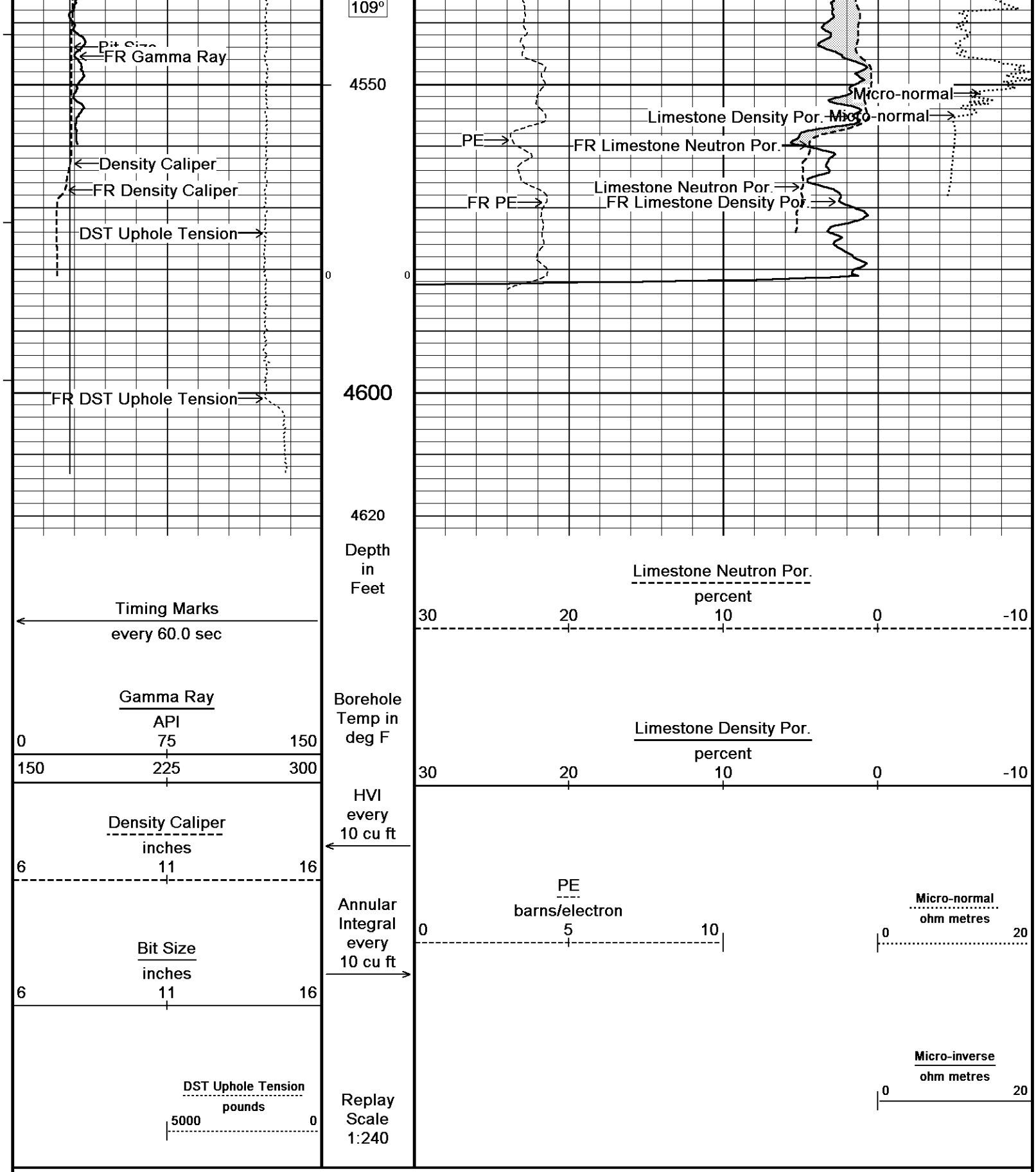
Limestone Density Por.


Density Caliper
Gamma Ray
DST Uphole Tension
PE
Limestone Neutron Por
102°
3700
102°
3750
103°
3800
300
103°
3850


200
104°
3900
104°
Bit Size
3950
Micro-normal
Limestone Density Por.
PE
Density Caliper
Limestone Neutron Por.
Gamma Ray
DST Uphole Tension
104°
4000
104°
4050
200
105°


4100
105°
4150
105°
4200
100
106°
Bit Size
4250
Micro-inverse
Limestone Density Por
PE
Density Caliper
Limestone Neutron Por
Gamma Ray
DST Uphole Tension
107°
4300
100


107°
4350
108°
4400
109°
4450
110°
4500



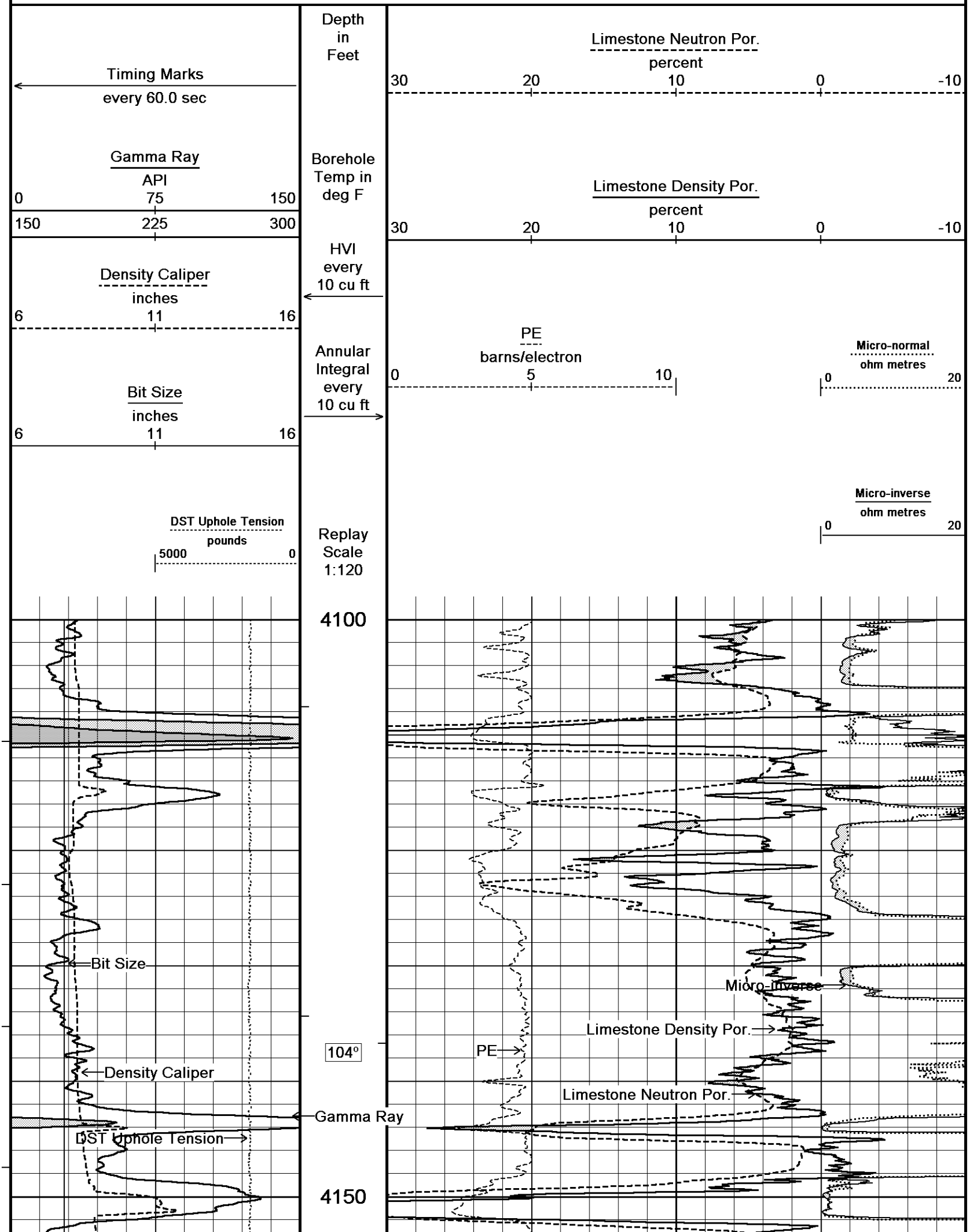

Depth Based Data - Maximum Sampling Increment 10.0cm
Plotted on 28-NOV-2012 04:23
Filename: C:\Minimus 13.04.8492\Data\...\Shakespeare Oil Co. Zanobia #1-21_003 spooled section.dta
Recorded on 28-NOV-2012 03:46
System Versions: Logged with 13.04.8492 Processed with 13.04.8492 Plotted with 13.04.8492

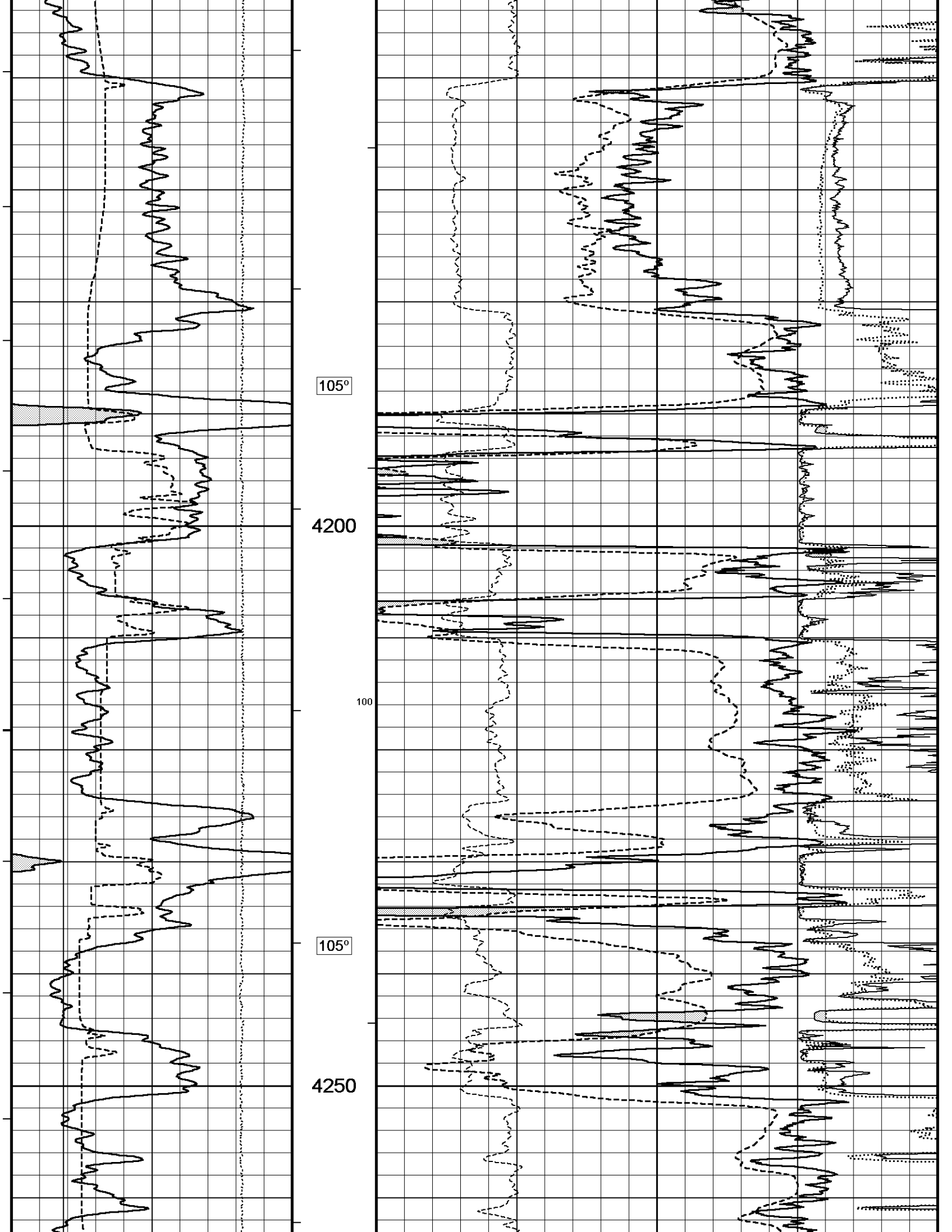
5 INCH MAIN

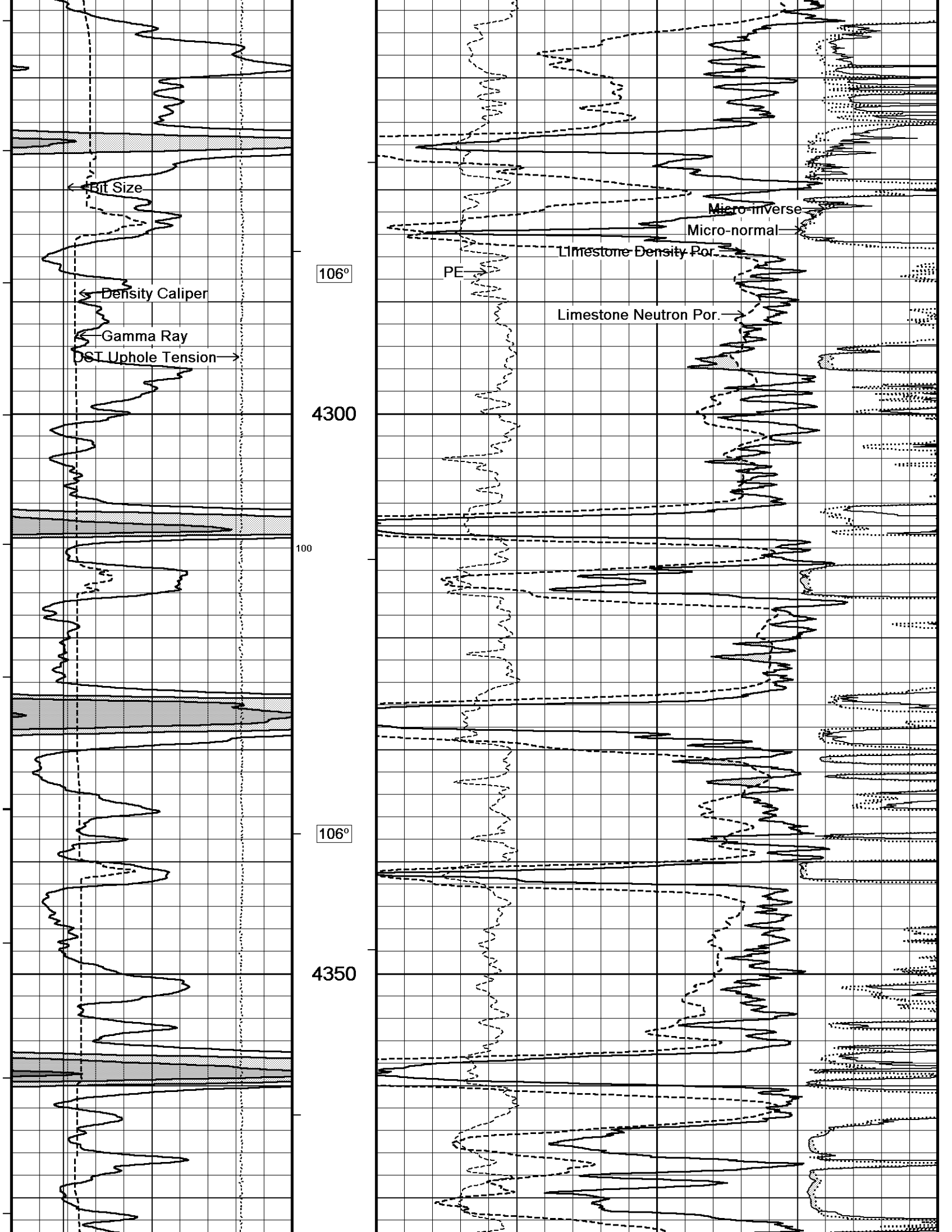
10 INCH HI RES

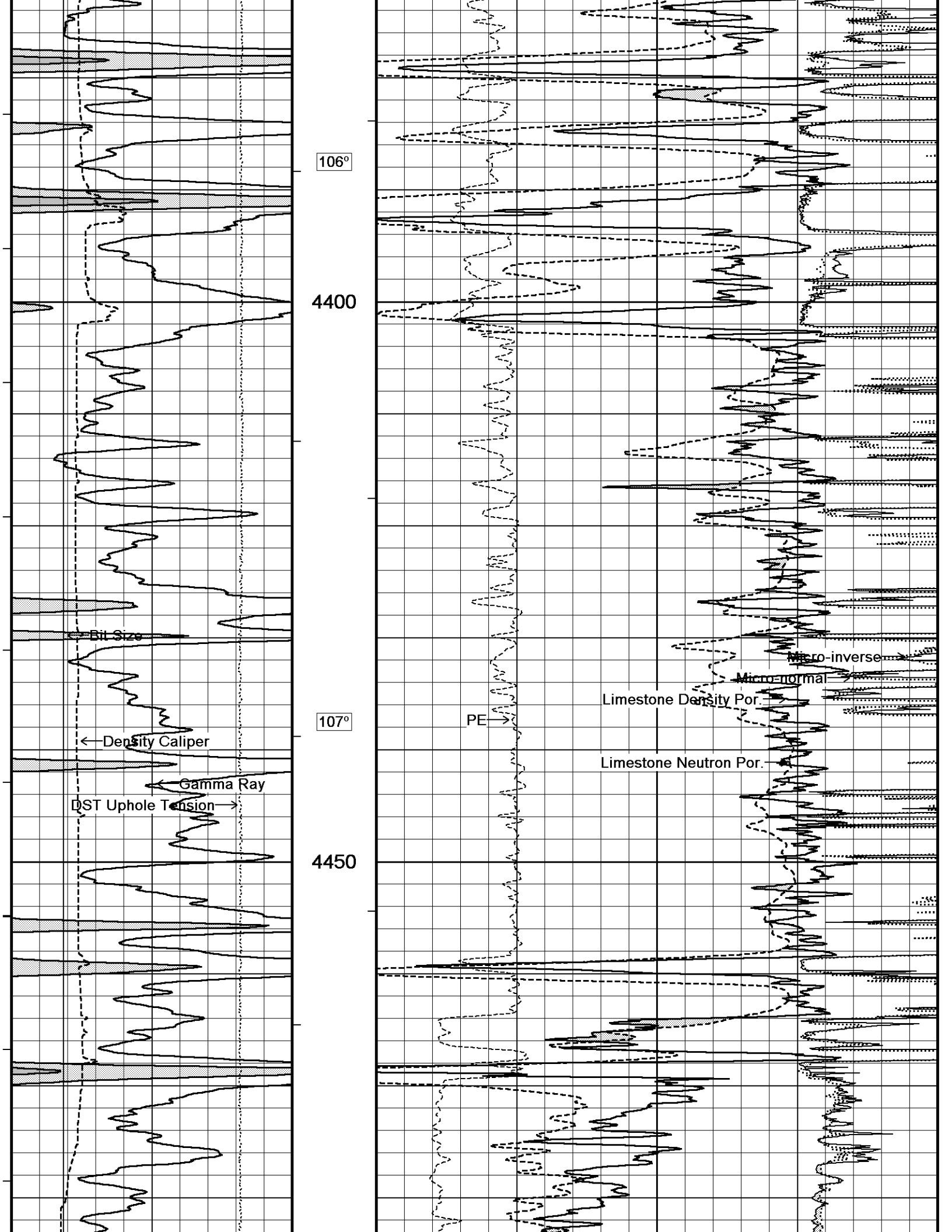
Depth Based Data - Maximum Sampling Increment 2.5cm
Plotted on 28-NOV-2012 04:23

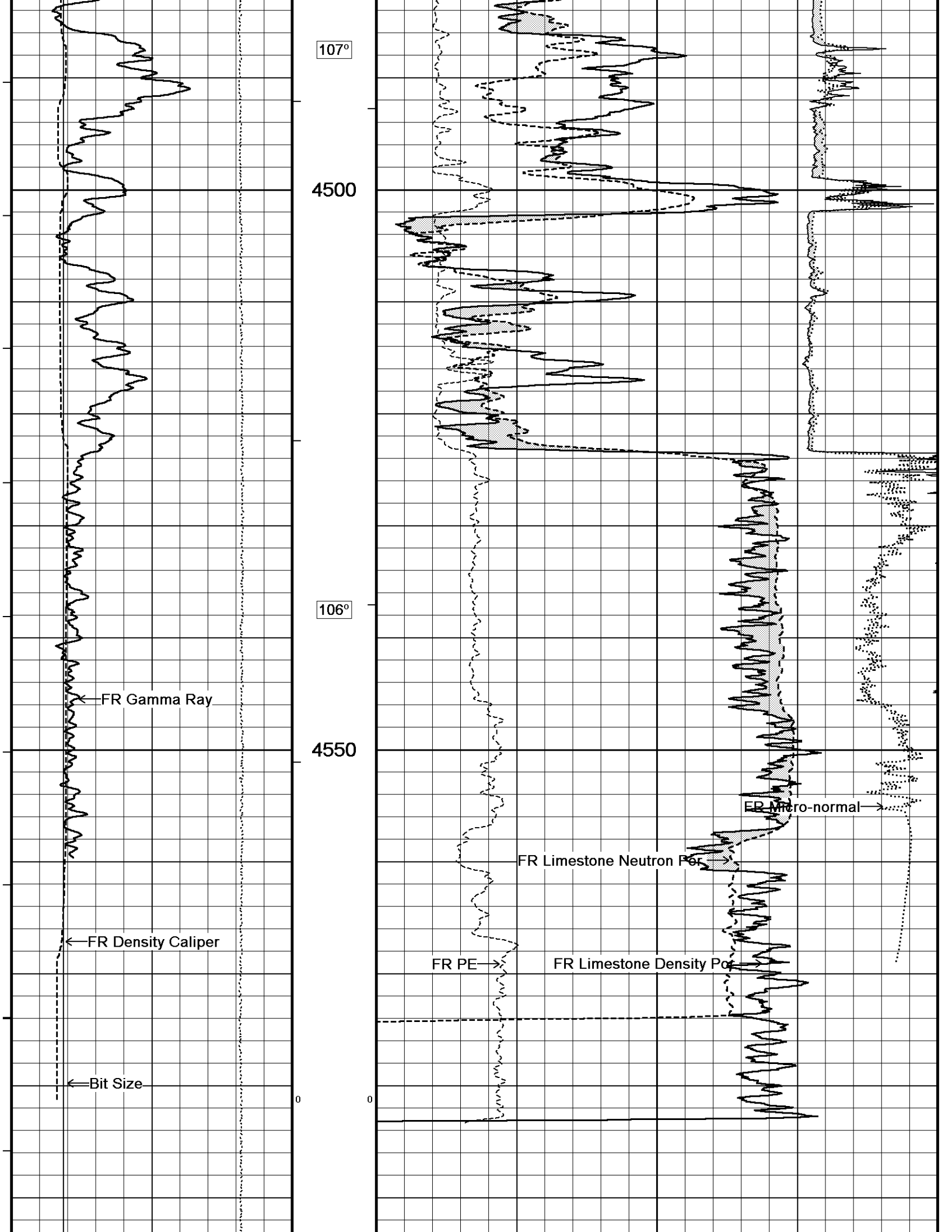
Filename: C:\Minimus 13.04.8492\Data\Shakespeare Oil...\Shakespeare Oil Co. Zanobia #1-21_001.dta Recorded on 28-NOV-2012 01:41
System Versions: Logged with 13.04.8492 Plotted with 13.04.8492

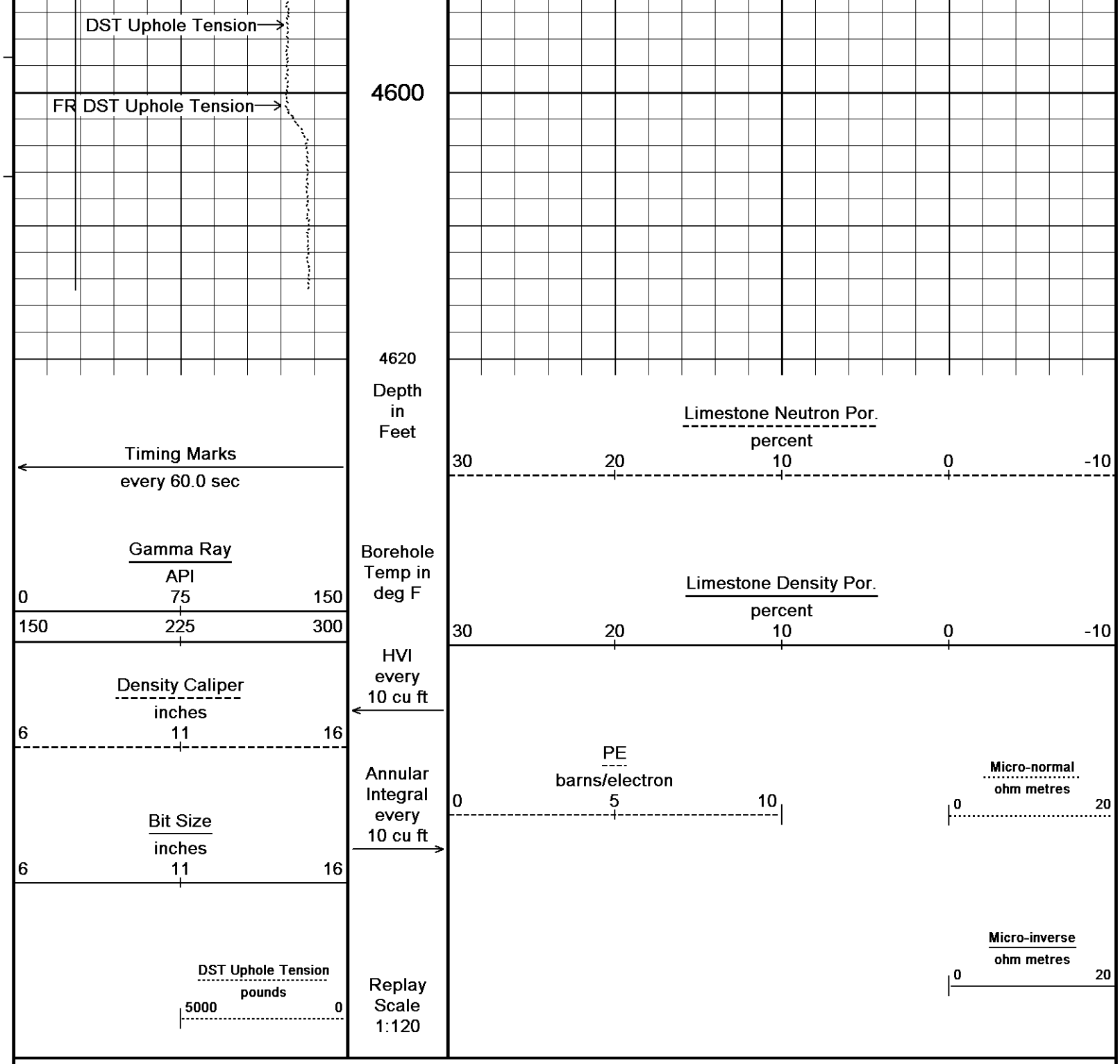



105°
4200
100
105°
4250


Bit Size
Density Caliper
Gamma Ray
DST Uphole Tension
106°
4300
100
106°
4350
Micro-inverse
Micro-normal
Limestone Density Por.
PE
Limestone Neutron Por.


106°
4400
107°
4450
Bit Size
Density Caliper
Gamma Ray
DST Uphole Tension
PE
Micro-inverse
Micro-normal
Limestone Density Por.
Limestone Neutron Por.


107°
4500
106°
4550
FR Gamma Ray
FR Density Caliper
Bit Size
FR PE
FR Limestone Neutron Por
FR Limestone Density Por
FR Micro-normal
0
0

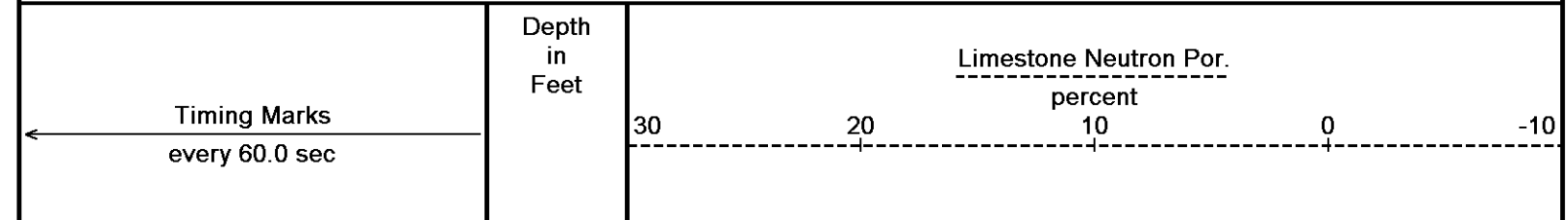


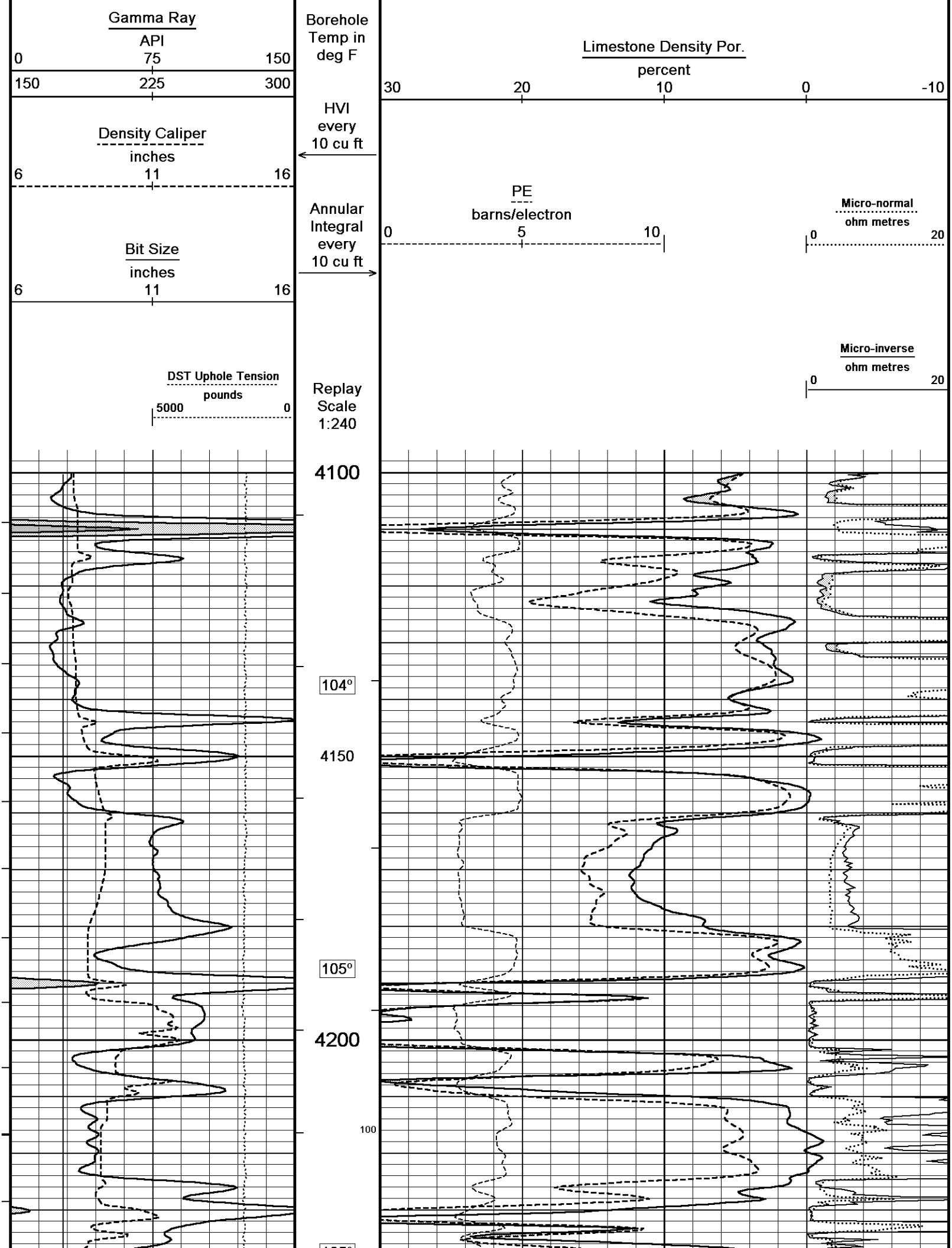

Depth Based Data - Maximum Sampling Increment 2.5cm
Plotted on 28-NOV-2012 04:23
Filename: C:\Minimus 13.04.8492\Data\Shakespeare Oil...\Shakespeare Oil Co. Zanobia #1-21_001.dta
Recorded on 28-NOV-2012 01:41
System Versions: Logged with 13.04.8492 Plotted with 13.04.8492

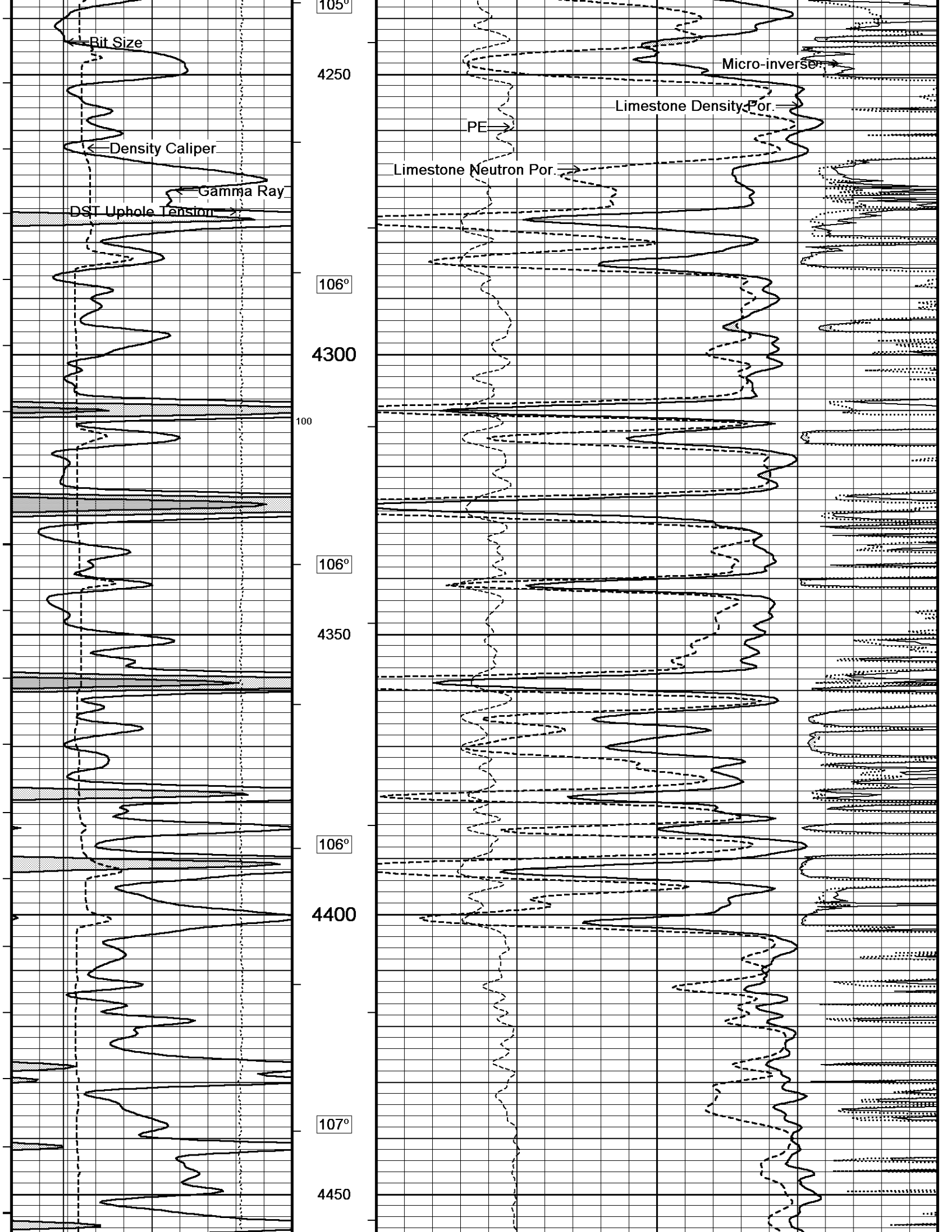
10 INCH HI RES

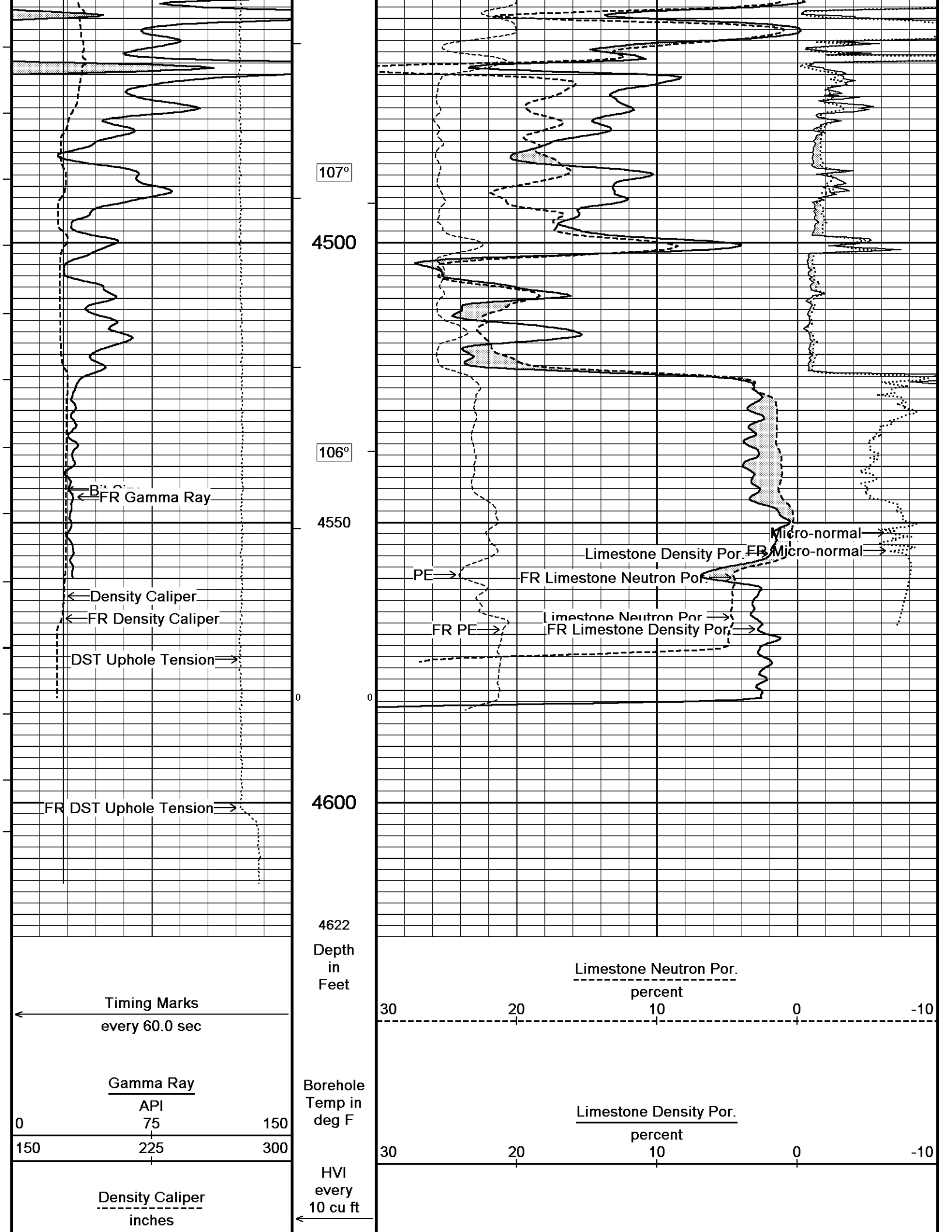
REPEAT SECTION

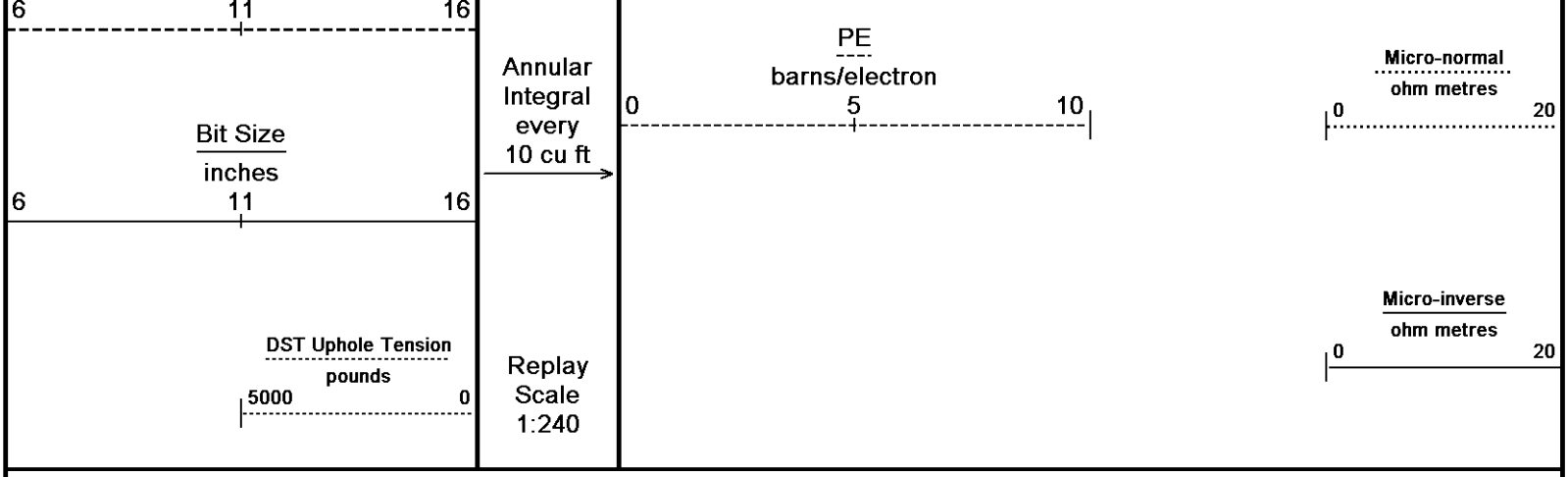
Depth Based Data - Maximum Sampling Increment 10.0cm
Plotted on 28-NOV-2012 04:23
Filename: C:\Minimus 13.04.8492\Data\Shakespeare Oil...\Shakespeare Oil Co. Zanobia #1-21_002.dta
Recorded on 28-NOV-2012 01:41
System Versions: Logged with 13.04.8492 Processed with 13.04.8492 Plotted with 13.04.8492




Gamma Ray
API
0
75
150
150
225
300
Density Caliper
inches
6
11
16
Bit Size
inches
6
11
16
DST Uphole Tension
pounds
5000
0
Borehole Temp in deg F
HVI every 10 cu ft
Annular Integral every 10 cu ft
Replay Scale 1:240
Limestone Density Por.
percent
30
20
10
0
-10
PE
barns/electron
0
5
10
Micro-normal
ohm metres
0
20
Micro-inverse
ohm metres
0
20
4100
104°
4150
105°
4200
100


Bit Size
Density Caliper
Gamma Ray
DST Uphole Tension
Micro-inverse
Limestone Density Por.
PE
Limestone Neutron Por.
105°
4250
106°
4300
100
106°
4350
106°
4400
107°
4450


107°
4500
106°
4550
4600
4622
Depth in Feet
Bit Size
FR Gamma Ray
Density Caliper
FR Density Caliper
DST Uphole Tension
FR DST Uphole Tension
PE
FR PE
Micro-normal
FR Micro-normal
Limestone Density Por.
FR Limestone Neutron Por.
Limestone Neutron Por.
FR Limestone Density Por.
Timing Marks
every 60.0 sec
Gamma Ray
API
0
75
150
150
225
300
Density Caliper
inches
Borehole Temp in deg F
HVI
every 10 cu ft
Limestone Neutron Por.
percent
30
20
10
0
-10
Limestone Density Por.
percent
30
20
10
0
-10

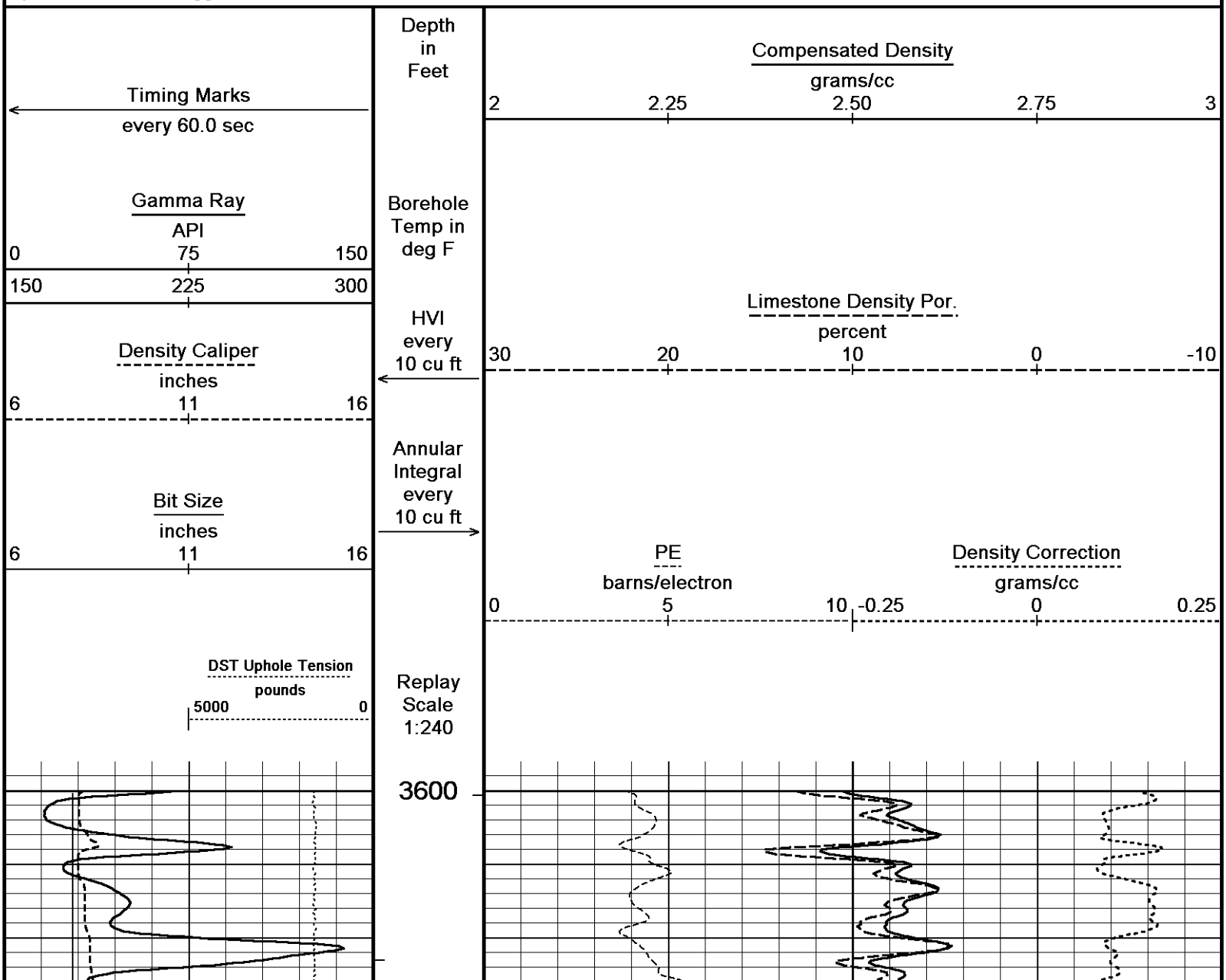


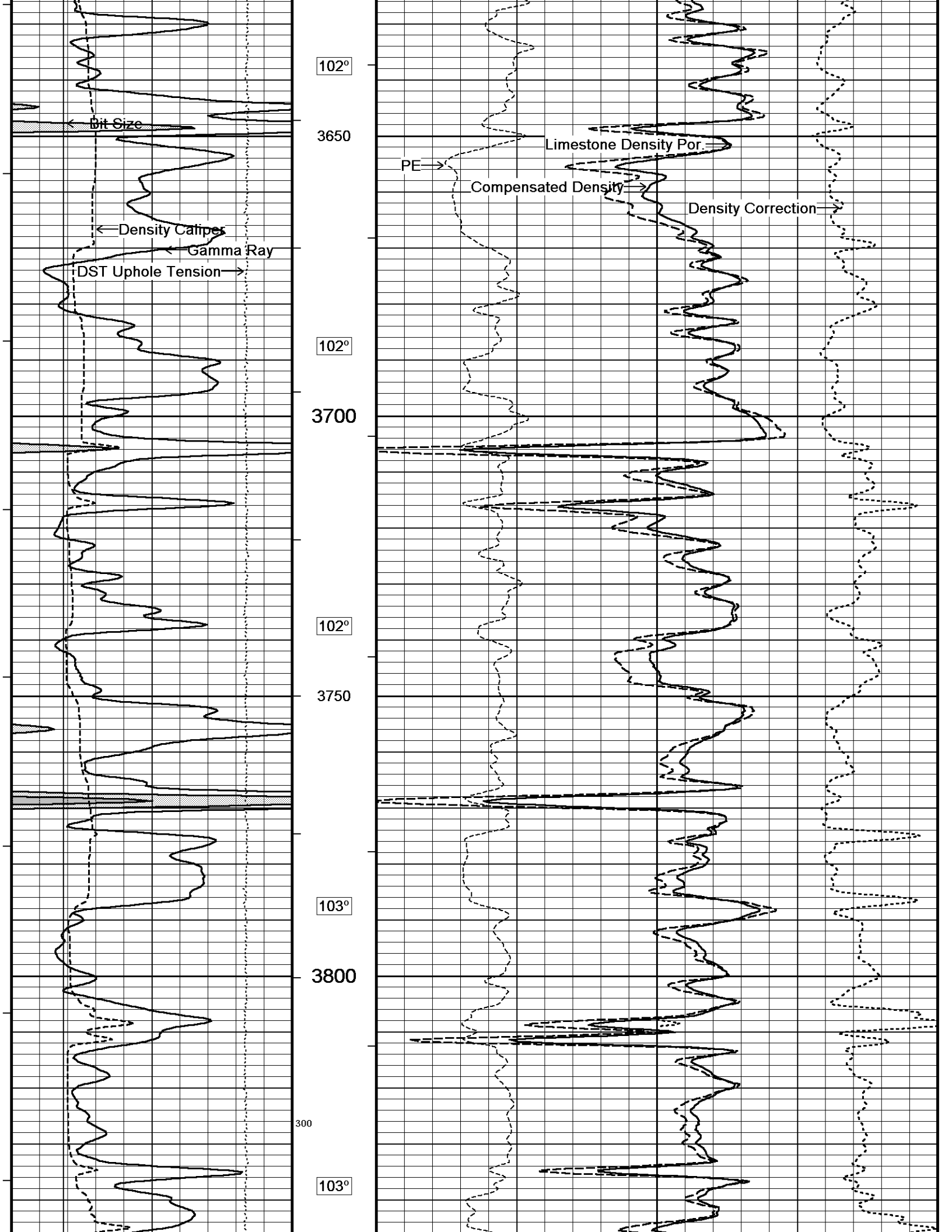

Depth Based Data - Maximum Sampling Increment 10.0cm — Plotted on 28-NOV-2012 04:23
Filename: C:\Minimus 13.04.8492\Data\Shakespeare Oil...\Shakespeare Oil Co. Zanobia #1-21_002.dta — Recorded on 28-NOV-2012 01:41
System Versions: Logged with 13.04.8492 Processed with 13.04.8492 Plotted with 13.04.8492

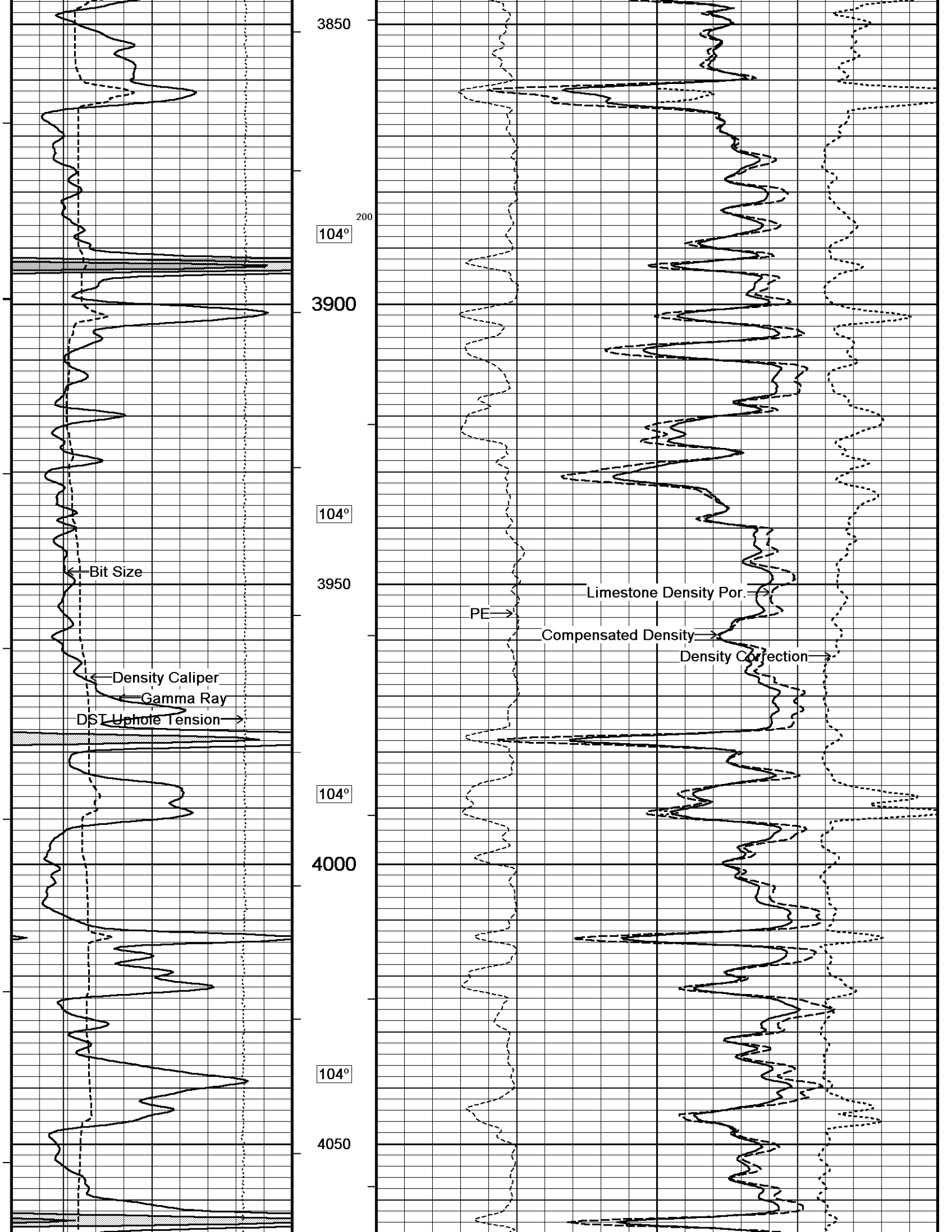
REPEAT SECTION

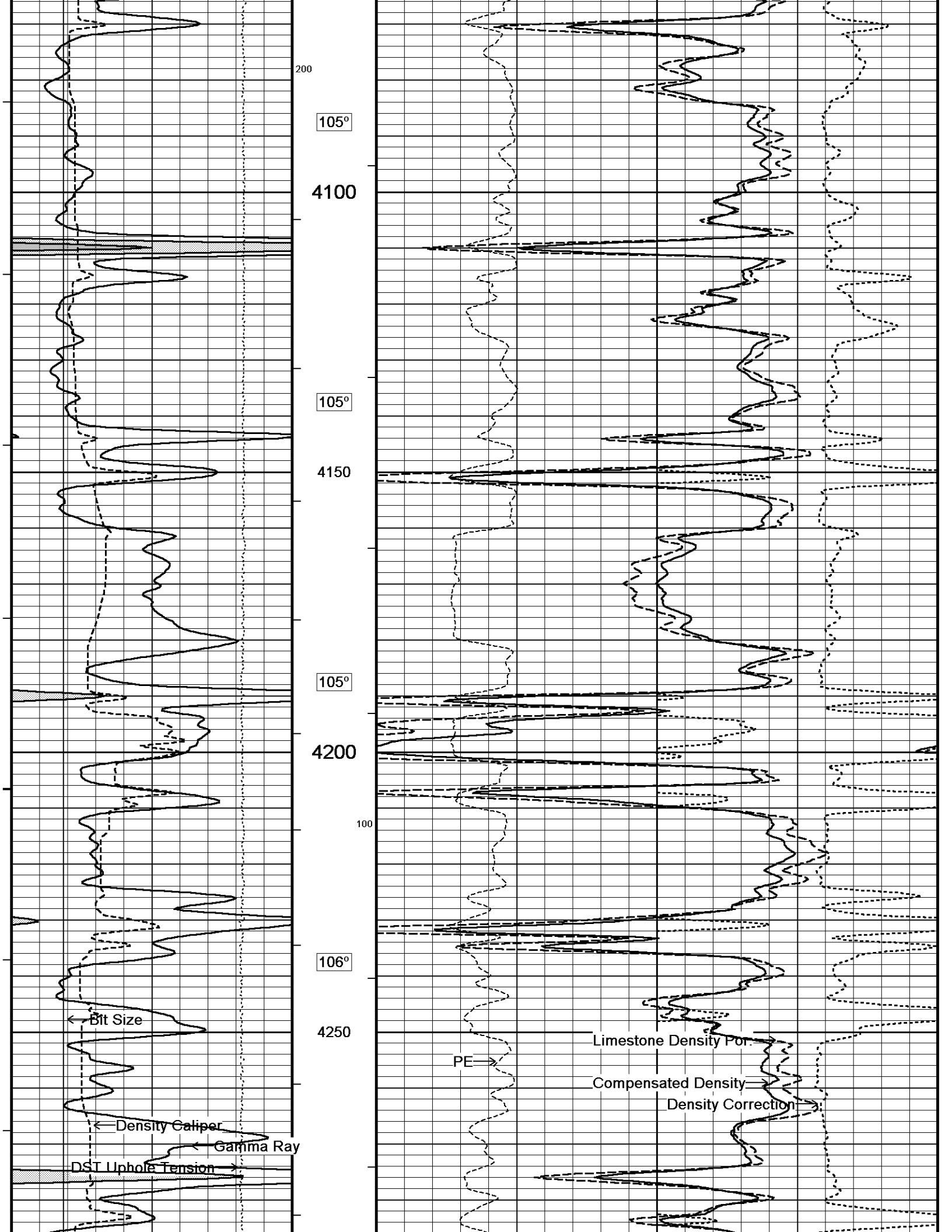
## 5 INCH MAIN

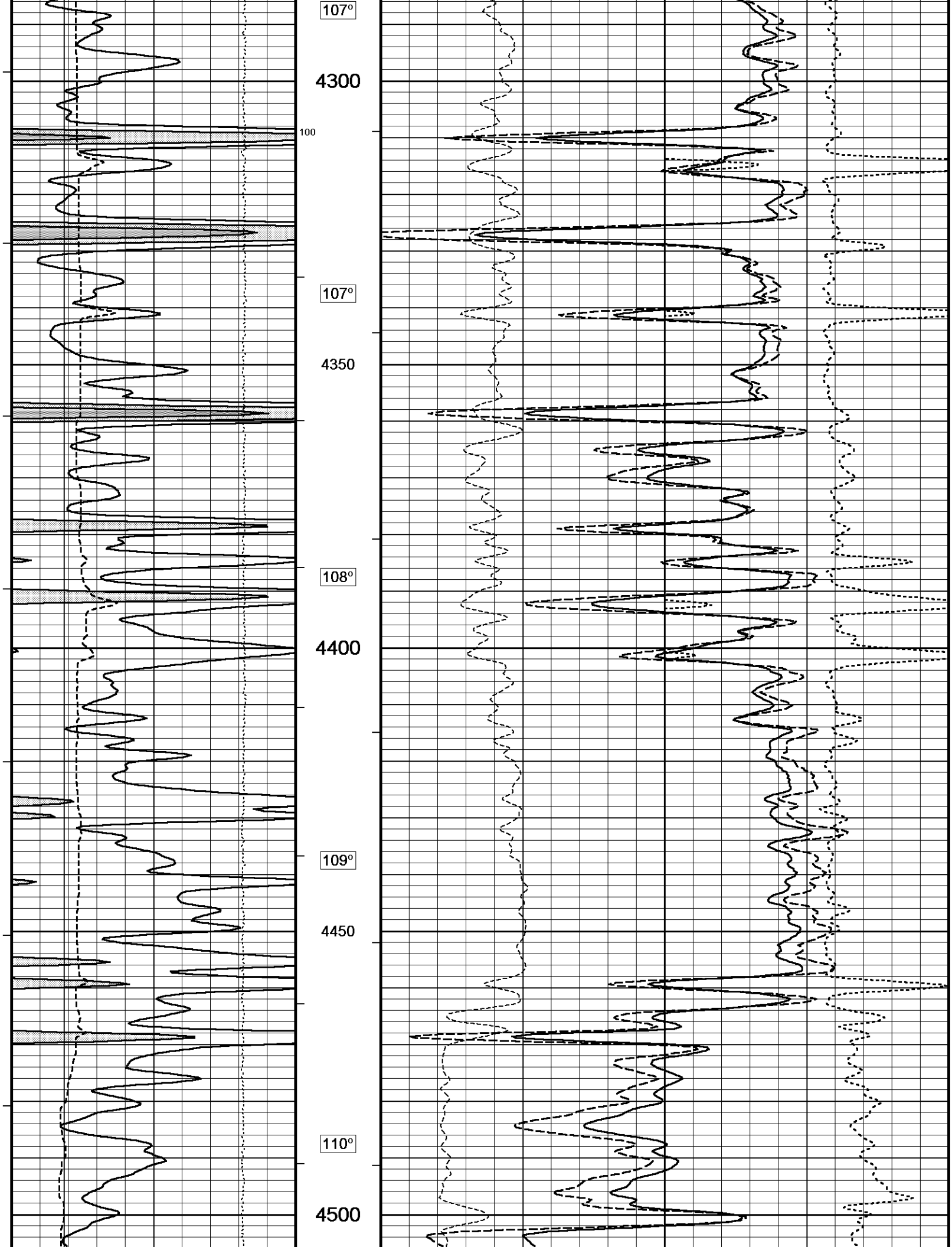
Depth Based Data - Maximum Sampling Increment 10.0cm — Plotted on 28-NOV-2012 04:23
Filename: C:\Minimus 13.04.8492\Data\...\Shakespeare Oil Co. Zanobia #1-21_003 spooled section.dta — Recorded on 28-NOV-2012 03:46
System Versions: Logged with 13.04.8492 Processed with 13.04.8492 Plotted with 13.04.8492

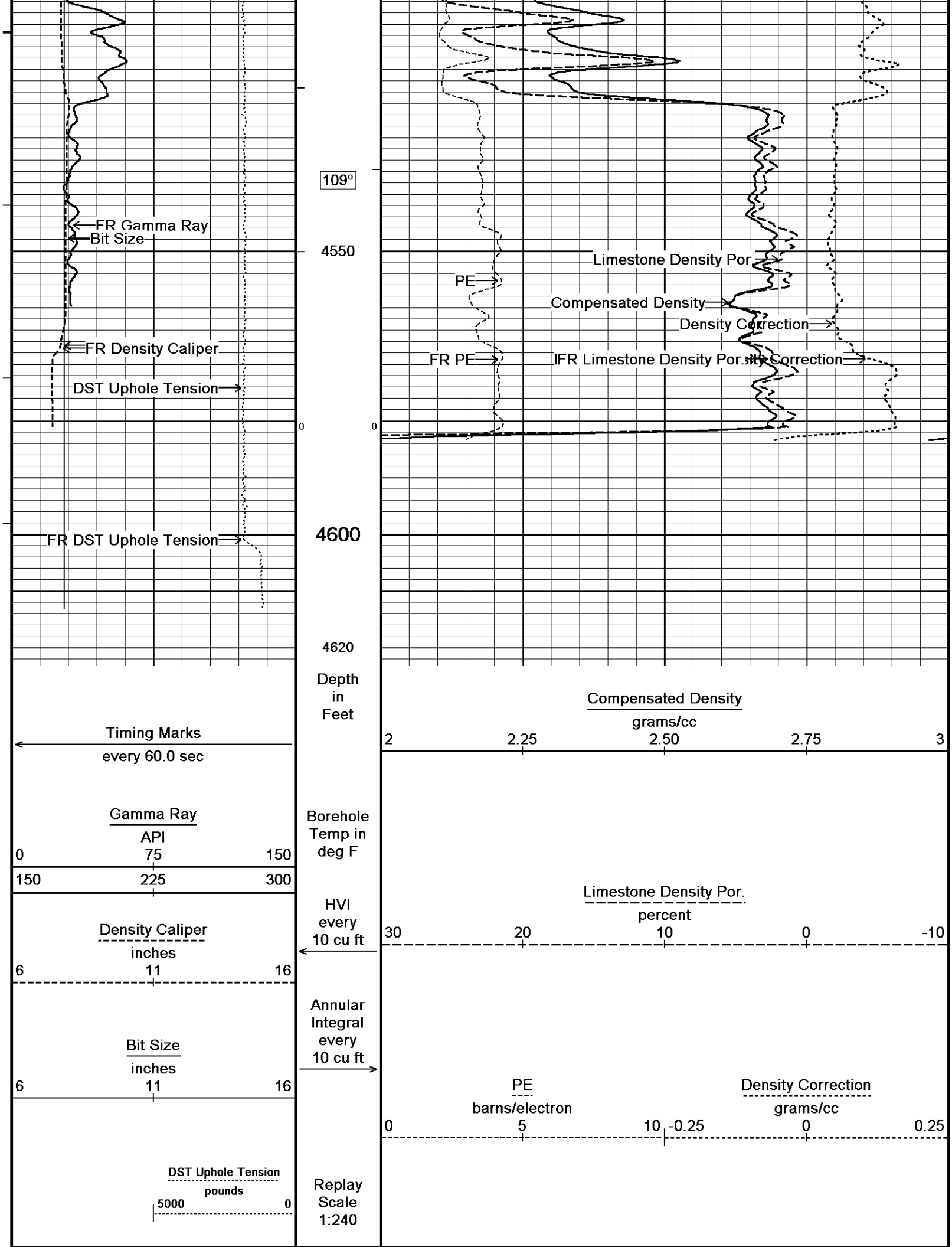



Bit Size
Density Caliper
Gamma Ray
DST Uphole Tension
102°
3650
102°
3700
102°
3750
103°
3800
103°
300
Limestone Density Por
PE
Compensated Density
Density Correction


3850
200
104°
3900
104°
Bit Size
3950
Limestone Density Por.
PE
Compensated Density
Density Correction
Density Caliper
Gamma Ray
DST Uphole Tension
104°
4000
104°
4050


200
105°
4100
105°
4150
105°
4200
100
106°
4250
Bit Size
Density Caliper
Gamma Ray
DST Uphole Tension
PE
Limestone Density Por.
Compensated Density
Density Correction


107°
4300
100
107°
4350
108°
4400
109°
4450
110°
4500

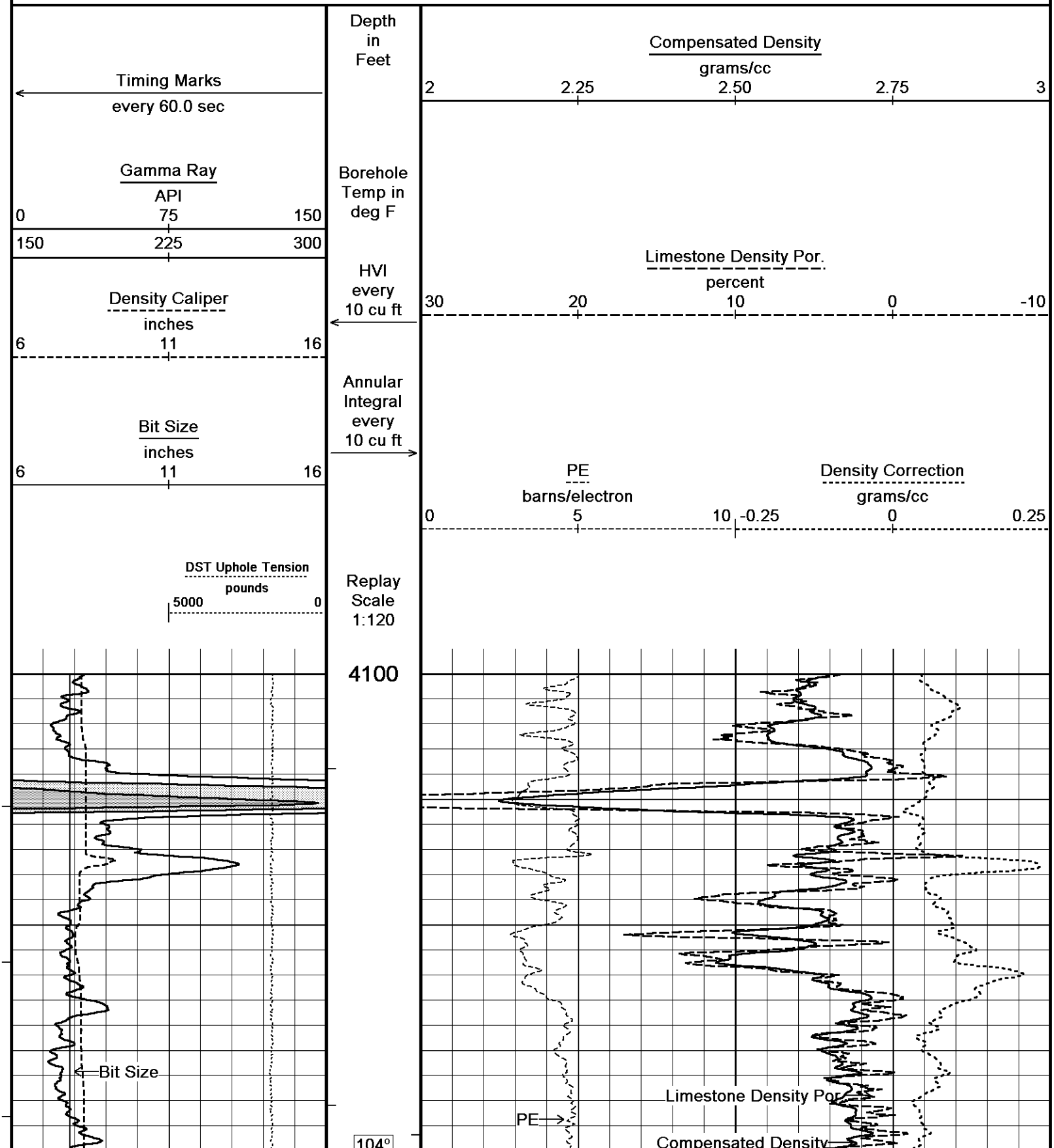

109°
FR Gamma Ray
Bit Size
4550
Limestone Density Por
PE
Compensated Density
Density Correction
FR Density Caliper
FR PE
IFR Limestone Density Por.
IFR Correction
DST Uphole Tension
0
0
FR DST Uphole Tension
4600
4620
Depth in Feet
Compensated Density
grams/cc
2
2.25
2.50
2.75
3
Timing Marks
every 60.0 sec
Gamma Ray
API
0
75
150
Borehole Temp in deg F
150
225
300
Limestone Density Por.
percent
HVI every 10 cu ft
30
20
10
0
-10
Density Caliper
inches
6
11
16
Annular Integral every 10 cu ft
Bit Size
inches
6
11
16
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

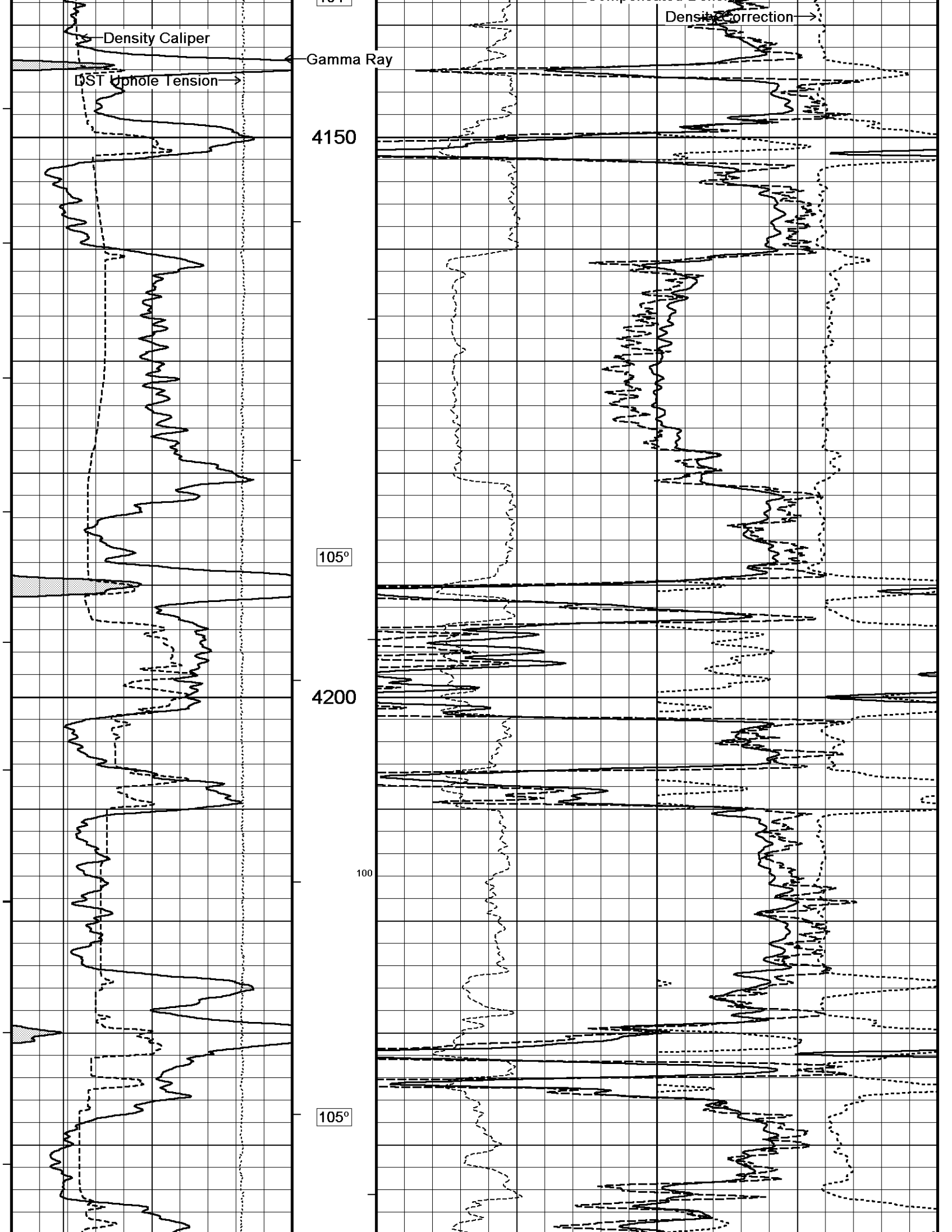
Depth Based Data - Maximum Sampling Increment 10.0cm
Plotted on 28-NOV-2012 04:23
Filename: C:\Minimus 13.04.8492\Data\...\Shakespeare Oil Co. Zanobia #1-21_003 spooled section.dta
Recorded on 28-NOV-2012 03:46
System Versions: Logged with 13.04.8492 Processed with 13.04.8492 Plotted with 13.04.8492

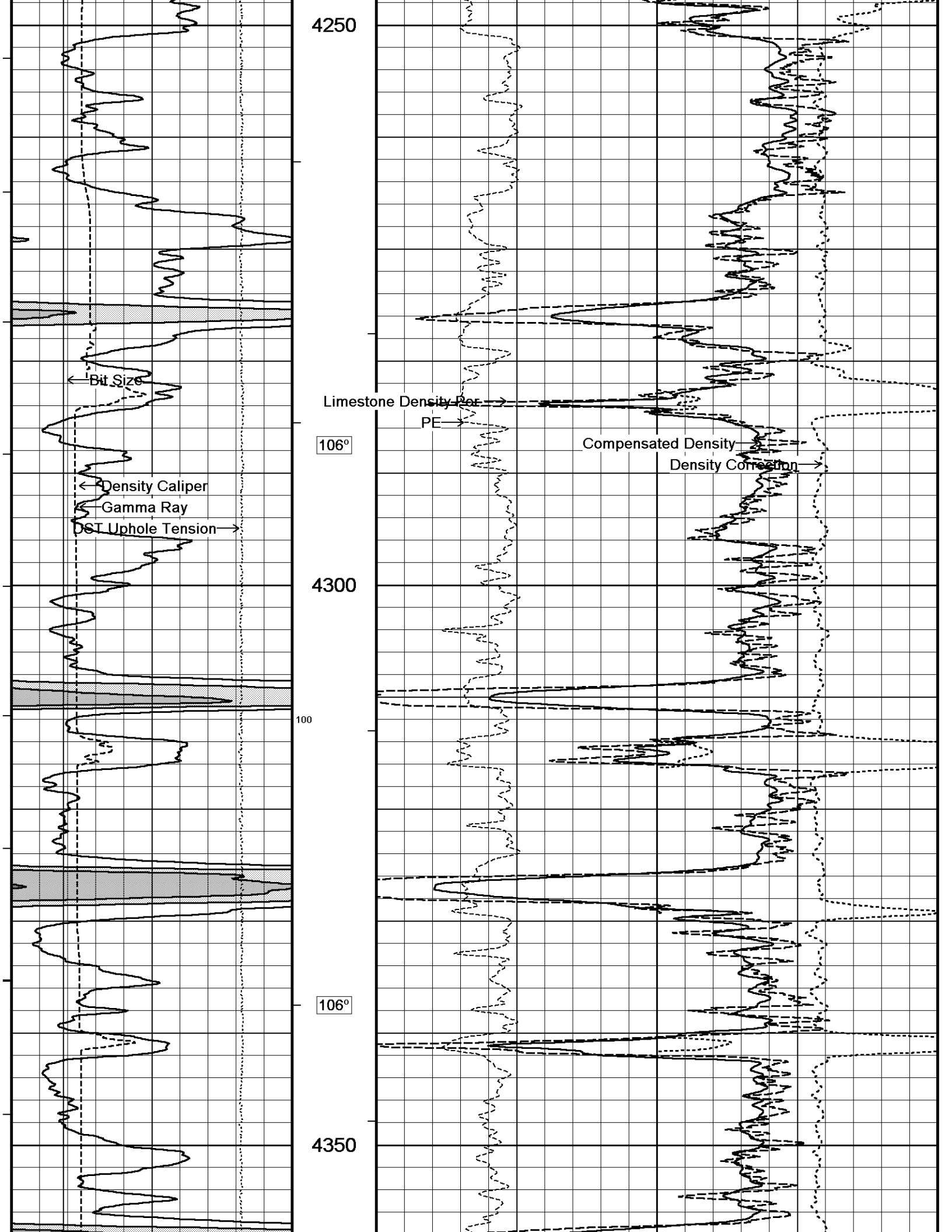
## 5 INCH MAIN

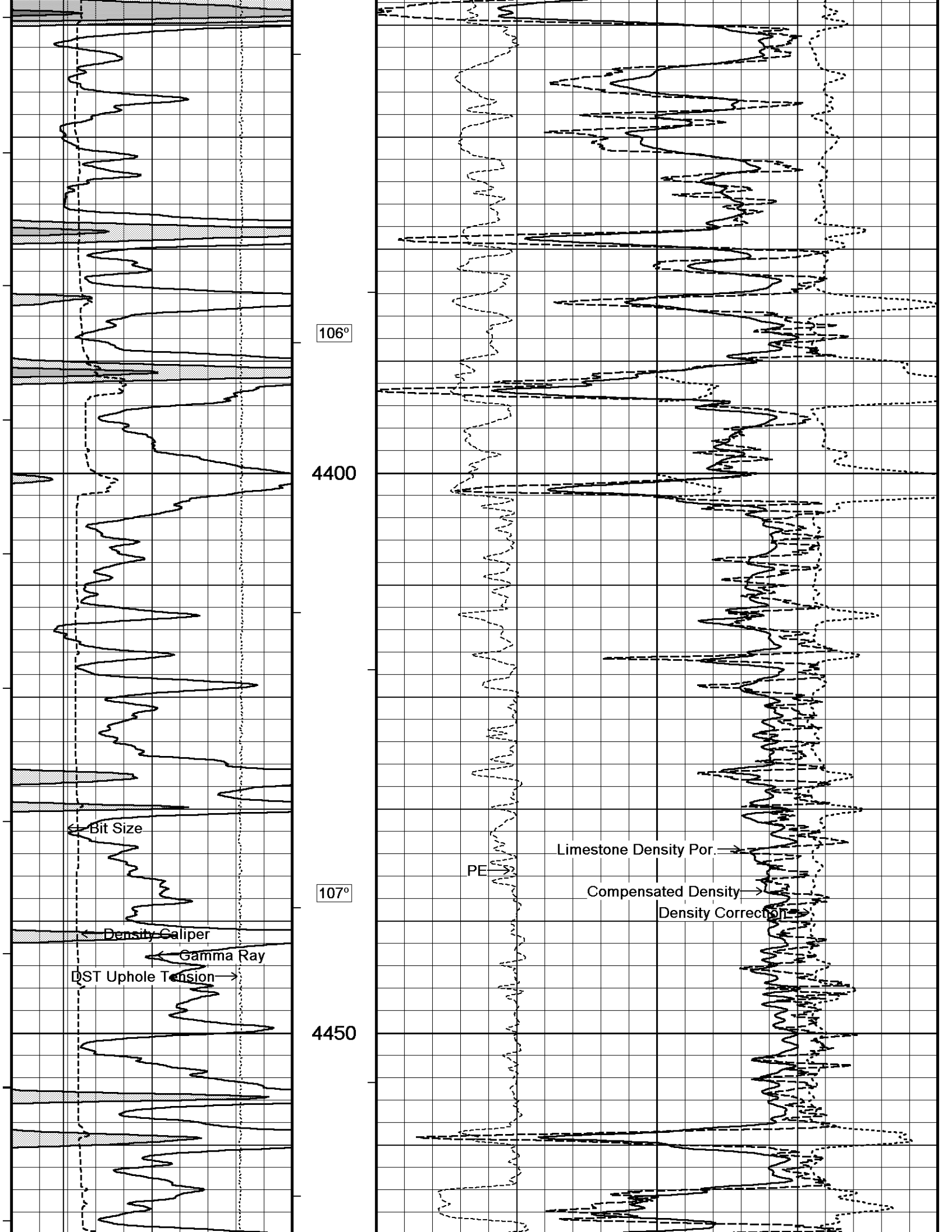
## 10 INCH HI RES

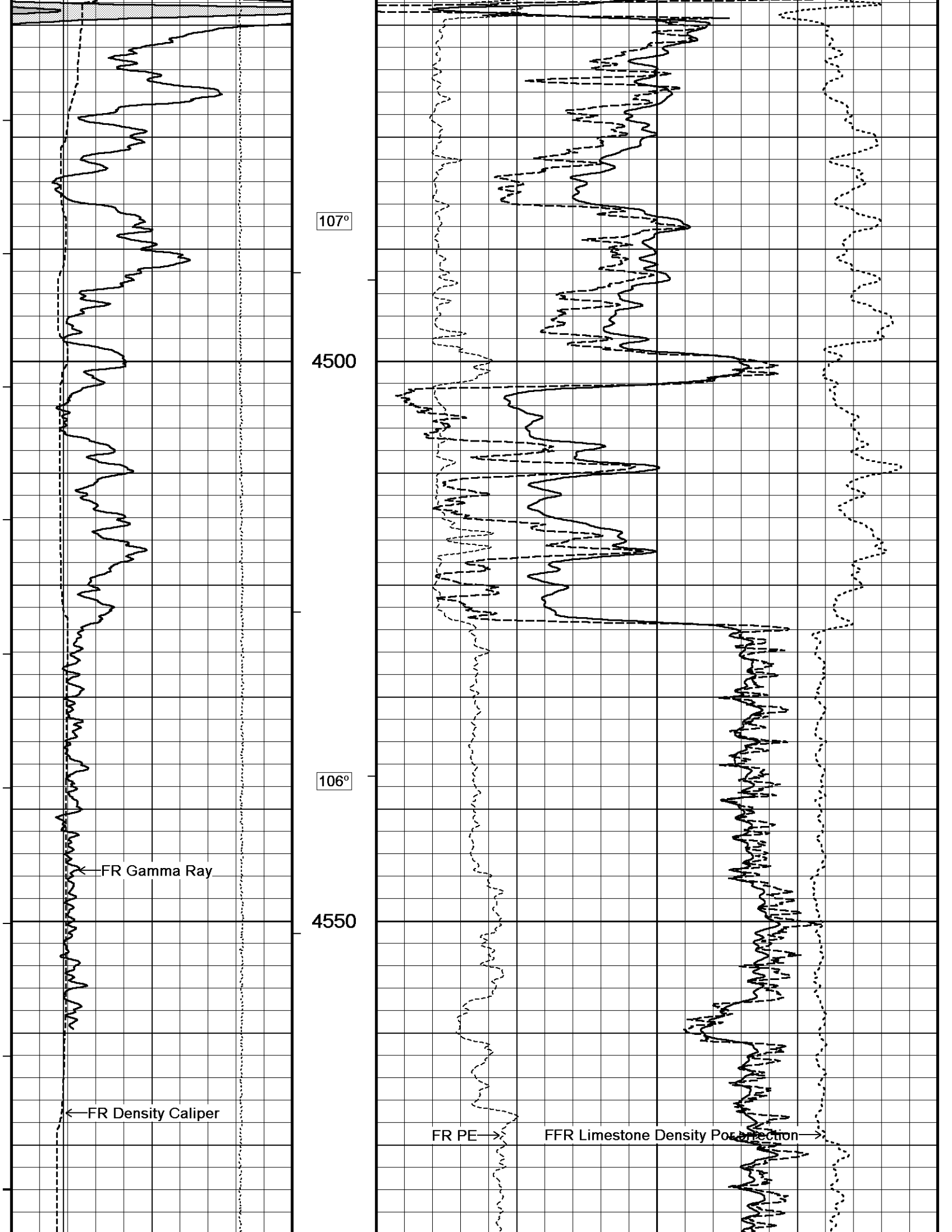
Depth Based Data - Maximum Sampling Increment 2.5cm
Plotted on 28-NOV-2012 04:23
Filename: C:\Minimus 13.04.8492\Data\Shakespeare Oil...\Shakespeare Oil Co. Zanobia #1-21_001.dta
Recorded on 28-NOV-2012 01:41
System Versions: Logged with 13.04.8492 Plotted with 13.04.8492

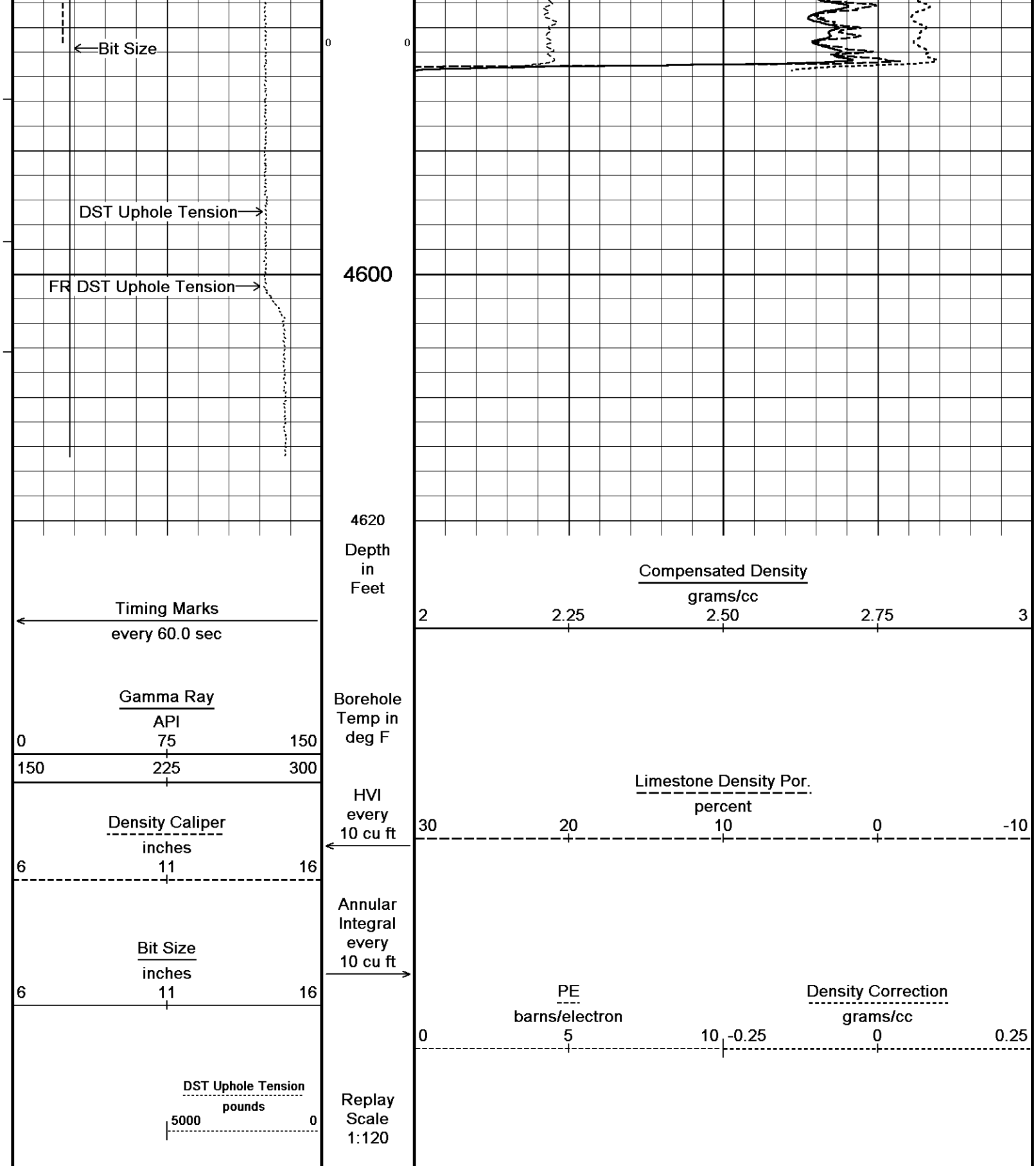



Density Caliper
Gamma Ray
DST Uphole Tension
Density Correction
4150
105°
4200
100
105°


4250
Bit Size
Limestone Density Por
PE
106°
Compensated Density
Density Correction
Density Caliper
Gamma Ray
DST Uphole Tension
4300
100
106°
4350


106°
4400
107°
4450
Bit Size
Density Caliper
Gamma Ray
DST Uphole Tension
PE
Limestone Density Por.
Compensated Density
Density Correction


107°
4500
106°
4550
FR Gamma Ray
FR Density Caliper
FR PE
FFR Limestone Density Porosity



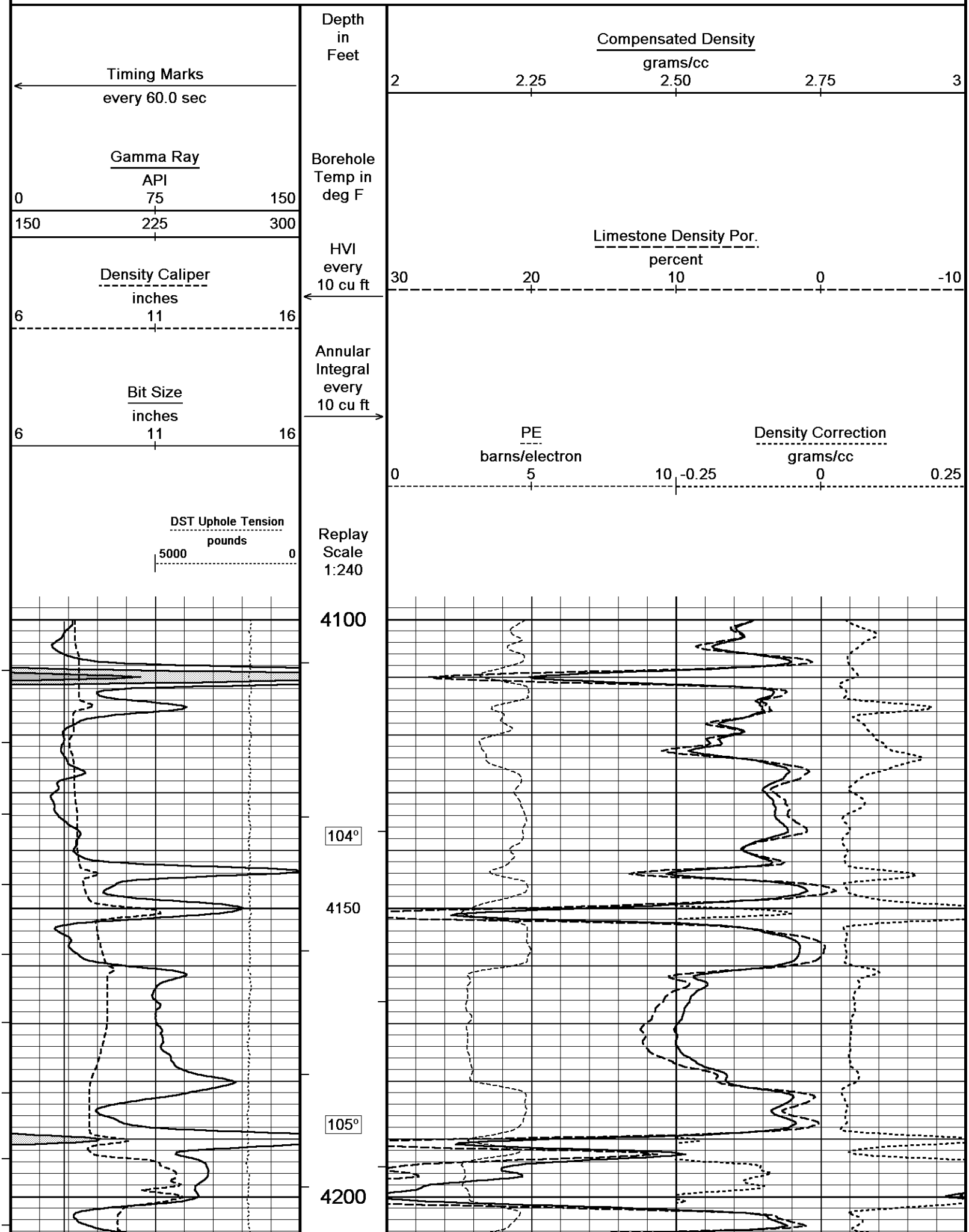

Depth Based Data - Maximum Sampling Increment 2.5cm
Plotted on 28-NOV-2012 04:23
Filename: C:\Minimus 13.04.8492\Data\Shakespeare Oil...\Shakespeare Oil Co. Zanobia #1-21_001.dta
Recorded on 28-NOV-2012 01:41
System Versions: Logged with 13.04.8492 Plotted with 13.04.8492

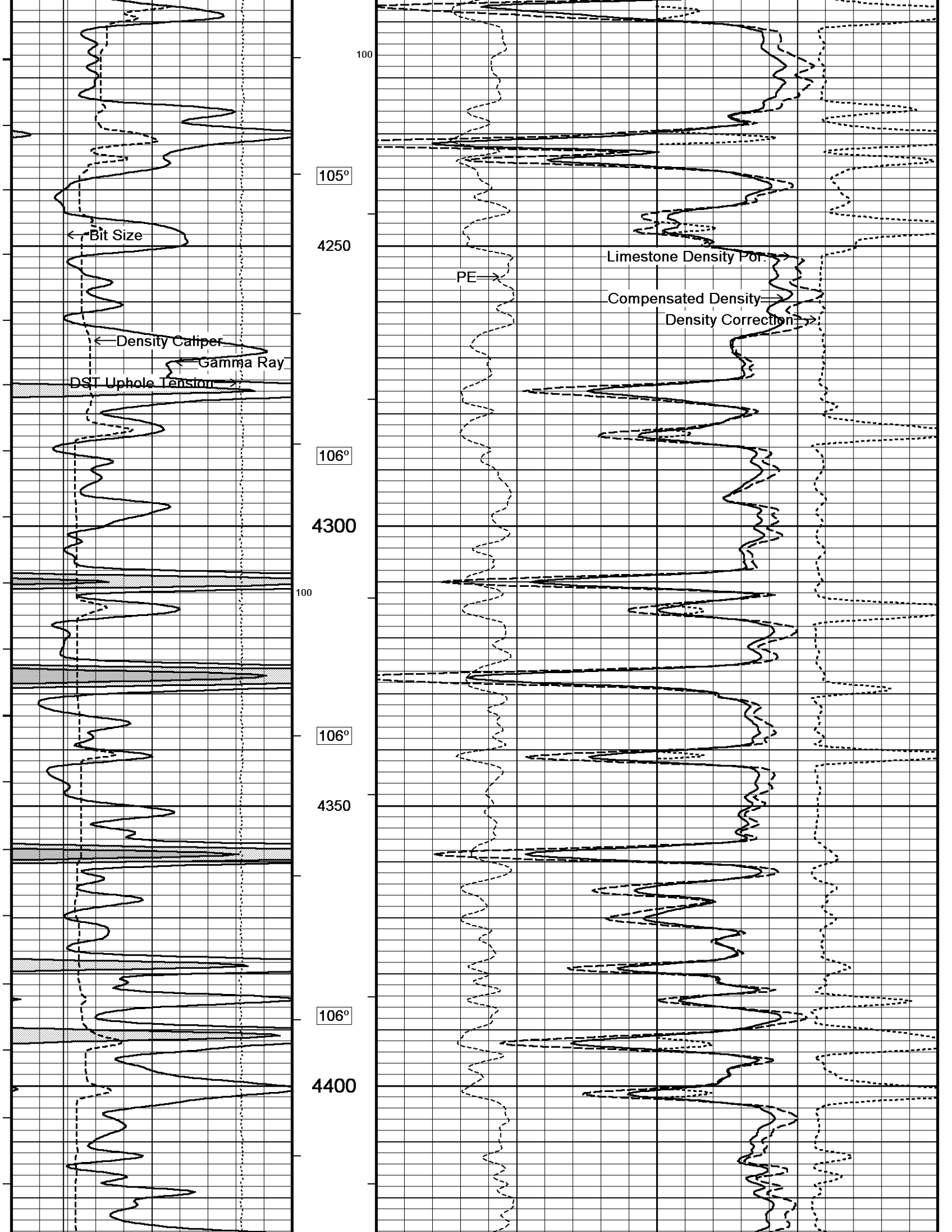
10 INCH HI RES

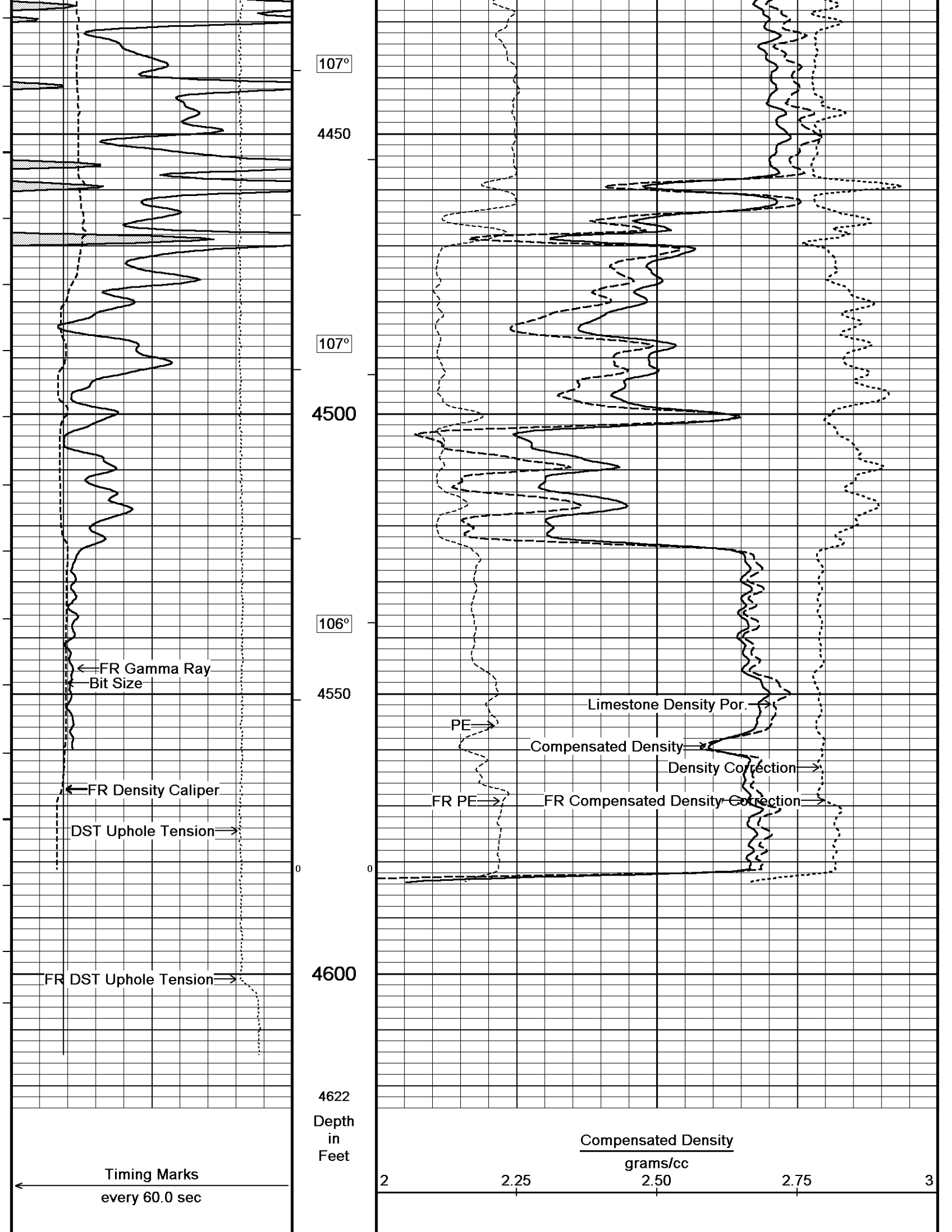
REPEAT SECTION

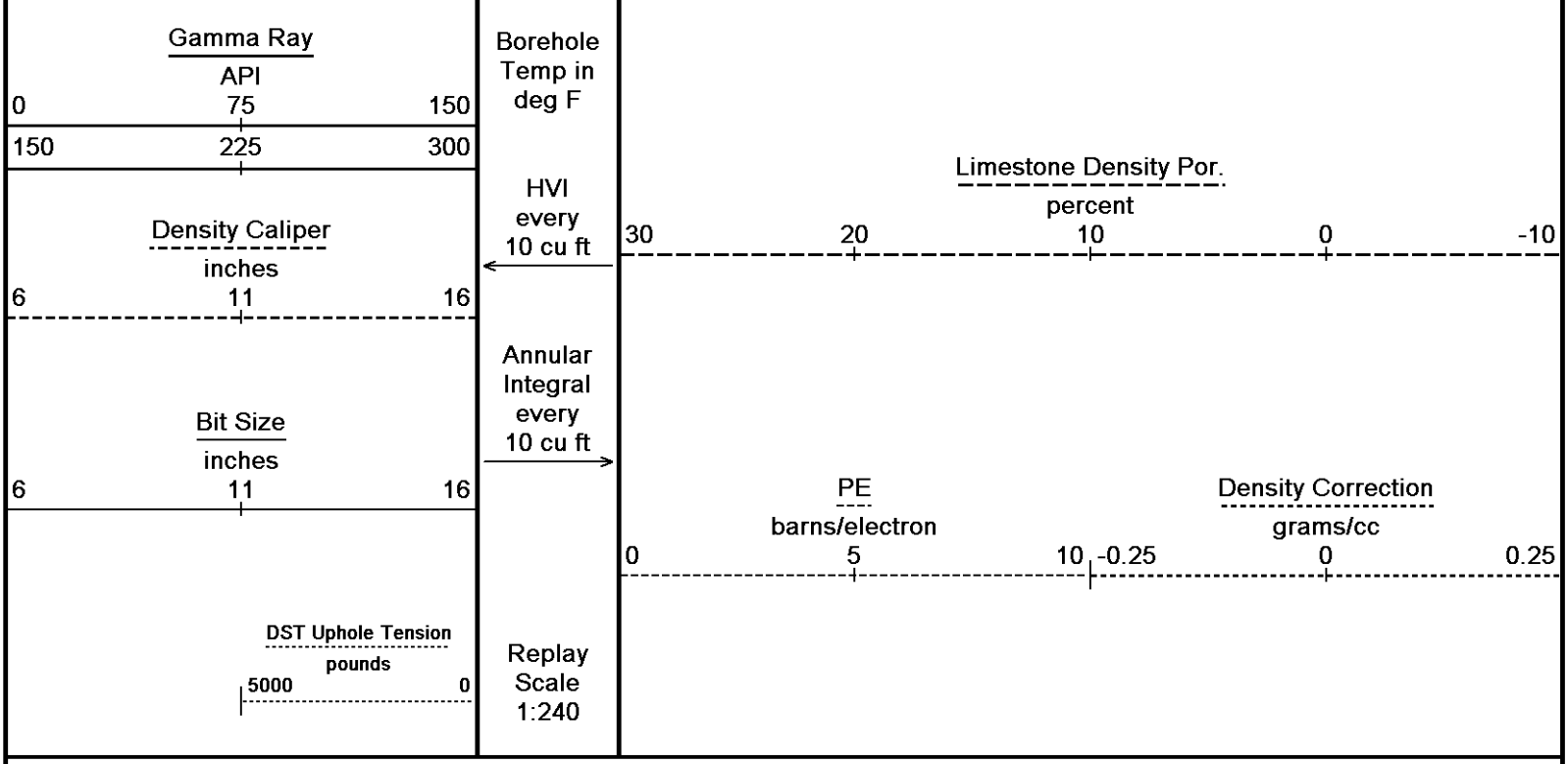
Depth Based Data - Maximum Sampling Increment 10.0cm
Plotted on 28-NOV-2012 04:23

Filename: C:\Minimus 13.04.8492\Data\Shakespeare Oil...\Shakespeare Oil Co. Zanobia #1-21_002.dta Recorded on 28-NOV-2012 01:41
System Versions: Logged with 13.04.8492 Processed with 13.04.8492 Plotted with 13.04.8492




100
105°
Bit Size
4250
Limestone Density Por.
PE
Compensated Density
Density Correction
Density Caliper
Gamma Ray
DST Uphole Tension
106°
4300
100
106°
4350
106°
4400


107°
4450
107°
4500
106°
4550
4600
4622
Depth
in
Feet
FR Gamma Ray
Bit Size
FR Density Caliper
DST Uphole Tension
FR DST Uphole Tension
0
0
PE
Limestone Density Por.
Compensated Density
Density Correction
FR PE
FR Compensated Density Correction
Timing Marks
every 60.0 sec
Compensated Density
grams/cc
2
2.25
2.50
2.75
3




Depth Based Data - Maximum Sampling Increment 10.0cm — Plotted on 28-NOV-2012 04:23

Filename: C:\Minimus 13.04.8492\Data\Shakespeare Oil...\Shakespeare Oil Co. Zanobia #1-21_002.dta — Recorded on 28-NOV-2012 01:41

System Versions: Logged with 13.04.8492 Processed with 13.04.8492 Plotted with 13.04.8492

REPEAT SECTION

## BEFORE SURVEY CALIBRATION

C:\Minimus 13.04.8492\Data\Shakespeare Oil Co. Zanobia #1-21\Shakespeare Oil Co. Zanobia #1-21_002.dta

### General Constants All 000

Last Edited on 27-NOV-2012,22:25

| | | |
|---|---|---|
| **General Parameters** | | |
| Mud Resistivity | 0.720 | ohm-metres |
| Mud Resistivity Temperature | 78.000 | 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 | Base Density Porosity | |
| Resistivity used | Array Ind. Four Res Rt | |
| RWA Constant A | 1.000 | |
| RWA Constant M | 2.000 | |

### High Resolution Temperature Calibration MCG-D.K 442

Field Calibration on 08-NOV-2012,09:48

| | Measured | Calibrated(Deg F) |
|---|---|---|
| Lower | 50.00 | 50.00 |
| Upper | 100.00 | 100.00 |

### High Resolution Temperature Constants MCG-D.K 442

Last Edited on 08-NOV-2012,09:48

| | |
|---|---|
| Pre-filter Length | 11 |

### Gamma Calibration MCG-D.K 442

Field Calibration on 27-NOV-2012 16:06

| | Measured | Calibrated (API) |
|---|---|---|
| Background | 70 | 47 |
| Calibrator (Gross) | 1147 | 772 |

| | | |
|---|---|---|
| Calibrator (Gross) | 1147 | 772 |
| Calibrator (Net) | 1077 | 725 |

## Gamma Constants MCG-D.K 442

Last Edited on 27-NOV-2012,22:19

| | | |
|---|---|---|
| Gamma Calibrator Number | GRC38 | |
| Mud Density | 1.09 | gm/cc |
| Caliper Source for Processing | Density Caliper | |
| Tool Position | Eccentred | |
| Concentration of KCl | 0.00 | kppm |

## Caliper Calibration MPD-B 64

Base Calibration on 14-NOV-2012 10:10
Field Calibration on 27-NOV-2012 15:59

Base Calibration

| Reading No | Measured | Calibrator Size (in) |
|---|---|---|
| 1 | 12782 | 3.99 |
| 2 | 21549 | 5.98 |
| 3 | 30053 | 7.97 |
| 4 | 38387 | 9.86 |
| 5 | 47704 | 11.92 |
| 6 | N/A | N/A |

Field Calibration

| Measured Caliper (in) | Actual Caliper (in) |
|---|---|
| 5.88 | 5.98 |

## Photo Density Calibration MPD-B 64

Base Calibration on 14-NOV-2012 10:35
Field Check on 27-NOV-2012 15:54

Density Calibration

| Base Calibration | Measured | | Calibrated (sdu) | |
|---|---|---|---|---|
| | Near | Far | Near | Far |
| Reference 1 | 59022 | 32914 | 59556 | 30836 |
| Reference 2 | 24784 | 2905 | 24941 | 2541 |

Field Check at Base

| | |
|---|---|
| 1182.0 | 1367.8 |

Field Check

| | |
|---|---|
| 1179.1 | 1369.8 |

PE Calibration

| Base Calibration | Measured | | | Calibrated |
|---|---|---|---|---|
| | WS | WH | Ratio | Ratio |
| Background | 214 | 1053 | | |
| Reference 1 | 22259 | 58821 | 0.382 | 0.371 |
| Reference 2 | 6702 | 24646 | 0.275 | 0.272 |

Field Check at Base

| | |
|---|---|
| 214.3 | 1053.1 |

Field Check

| | |
|---|---|
| 212.2 | 1049.9 |

## Density Constants MPD-B 64

Last Edited on 27-NOV-2012,22:19

| | | |
|---|---|---|
| Density Source Id | 18235B | |
| 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 | 1.09 | gm/cc |
| Mud Density Z/A Multiplier | 1.11 | |
| Mud Filtrate Density | 1.00 | gm/cc |
| Dry Hole Mud Filtrate Density | 1.00 | gm/cc |
| DNCT | 0.00 | gm/cc |
| CRCT | 0.00 | gm/cc |
| Density Z/A Correction | Hybrid | |

| Matrix Density (gm/cc) | Depth (ft) |
|---|---|
| 2.71 | |
| 0.00 | 0.00 |
| 0.00 | 0.00 |

| | |
|---|---|
| 0.00 | 0.00 |
| 0.00 | 0.00 |
| 0.00 | 0.00 |
| 0.00 | 0.00 |
| 0.00 | 0.00 |

## DOWNHOLE EQUIPMENT

C:\Minimus 13.04.8492\Data\Shakespeare Oil Co. Zanobia #1-21\Shakespeare Oil Co. Zanobia #1-21_002.dta

Compact Comms Gamma
MCG-D.K 442 LG: 8.70 ft WT: 63.9 lb OD: 2.24 in

Compact Micro-log
MML-A 16 LG: 7.97 ft WT: 81.6 lb OD: 2.24 in

Compact Neutron
MDN-A.B 66 LG: 5.04 ft WT: 50.7 lb OD: 2.24 in

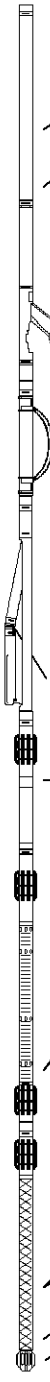
Compact Density/Caliper
MPD-B 64 LG: 9.59 ft WT: 90.4 lb OD: 2.45 in

Compact Focussed Electric
MFE-B.J 353 LG: 6.05 ft WT: 48.5 lb OD: 2.24 in

Compact Sonic
MSS-A.A 126 LG: 12.52 ft WT: 72.8 lb OD: 2.24 in

Compact Induction
MAI-A.A 167 LG: 10.81 ft WT: 48.5 lb OD: 2.24 in

Total Length: 60.68 ft Weight: 456.4 lb



| | |
|---|---|
| 55.39 ft | GRGC - Gamma Ray |
| 52.48 ft | CGXT - MCG External Temperature |
| 45.76 ft | MINV - Micro-inverse |
| 45.76 ft | MNRL - Micro-normal |
| 46.76 ft | MLTC - MML Caliper |
| 40.97 ft | NPRL - Limestone Neutron Por. |
| 33.73 ft | AVOL - Annular Volume |
| 33.73 ft | HVOL - Hole Volume |
| 33.73 ft | CLDC - Density Caliper |
| 31.80 ft | DPRL - Limestone Density Por. |
| 31.80 ft | DEN - Compensated Density |
| 31.80 ft | DCOR - Density Correction |
| 31.74 ft | PDPE - PE |
| 26.24 ft | FEFE - Shallow FE |
| 12.96 ft | DT35 - 3-5' Compensated Sonic |
| 12.96 ft | SPRL - Wyllie Lime. Sonic Por. |
| 3.34 ft | R40O - Array Ind. One Res 40 |
| 3.34 ft | RTAO - Array Ind. One Res Rt |
| 3.34 ft | R60O - Array Ind. One Res 60 |
| 0.23 ft | SPCG - Spontaneous Potential |
| Tool Zero | (0.13ft from bottom) |
| -0.13 ft | SMTU - DST Uphole Tension |

All measurements relative to tool zero.

| | |
|---|---|
| COMPANY | SHAKESPEARE OIL CO., INC. |
| WELL | ZANOBIA #1-21 |
| FIELD | WILDCAT |
| PROVINCE/COUNTY | LOGAN |
| COUNTRY/STATE | U.S.A. / KANSAS |

| | | | | | |
|---|---|---|---|---|---|
| Elevation Kelly Bushing | 2867.00 | feet | First Reading | 4569.00 | feet |

| | | | | | |
|---|---|---|---|---|---|
| Elevation Drill Floor | 2865.00 | feet | Depth Driller | 4600.00 | feet |
| Elevation Ground Level | 2855.00 | feet | Depth Logger | 4601.00 | feet |

Weatherford®

# COMPACT PHOTO DENSITY
# COMPENSATED NEUTRON
# MICRORESISTIVITY LOG