

Company: Carrizo Oil &amp; Gas Inc

Well: WEP 4-28-11-3-64

Field: Wildcat

County: Adams State: Colorado

## Electron Capture Spectroscopy

County: Adams  
Field: Wildcat  
Location: Sec. 28, T3S, R64W  
Well: WEP 4-28-11-3-64  
Company: Carrizo Oil & Gas Inc

Location:		Sec. 28, T3S, R64W SHL: 369 FNL X 1164 FWL NWNW	Elev. K.B. 5595.00 ft G.L. 5579.00 ft D.F. 5594.00 ft
Permanent Datum:	Ground Level		Elev.: 5579.00 f
Log Measured From:	Kelly Bushing		16.00 ft above Perm. Datum
Drilling Measured From:	Kelly Bushing		
API Serial No.	Section: 28	Township: 3S	Range: 64W
005001097530000			

Logging Date 15-Dec-2012

Run Number 1

Depth Driller 8273.00 ft

Schlumberger Depth 8275.00 ft

Bottom Log Interval 8275.00 ft

Top Log Interval 3016.00 ft

Casing Driller Size @ Depth 9.625 in @ 3016.00 ft

Casing Schlumberger 3016 ft

Bit Size 8.75 in

Type Fluid In Hole Chemical Gel

Density 9.3 lbm/gal 41 s

Fluid Loss PH 7.9 cm3 10

MUD Source of Sample Active Tank

RM @ Meas Temp 1.03 ohm.m @ 58.6 degF

RMF @ Meas Temp 0.82 ohm.m @ 58.6 degF

RMC @ Meas Temp 1.23 ohm.m @ 58.6 degF

Source RMF RMC Calculated Calculated

RM @ BHT RMF @ BHT 0.33 @ 195.4 0.27 @ 195.4

Max Recorded Temperatures 195.4 degF

Circulation Stopped 15-Dec-2012 12:00:00

Logger on Bottom 15-Dec-2012 23:00:00

Unit Number Location: 2135 Fort Morgan

Recorded By Allison Johnston

Witnessed By Paul Fears

## Disclaimer

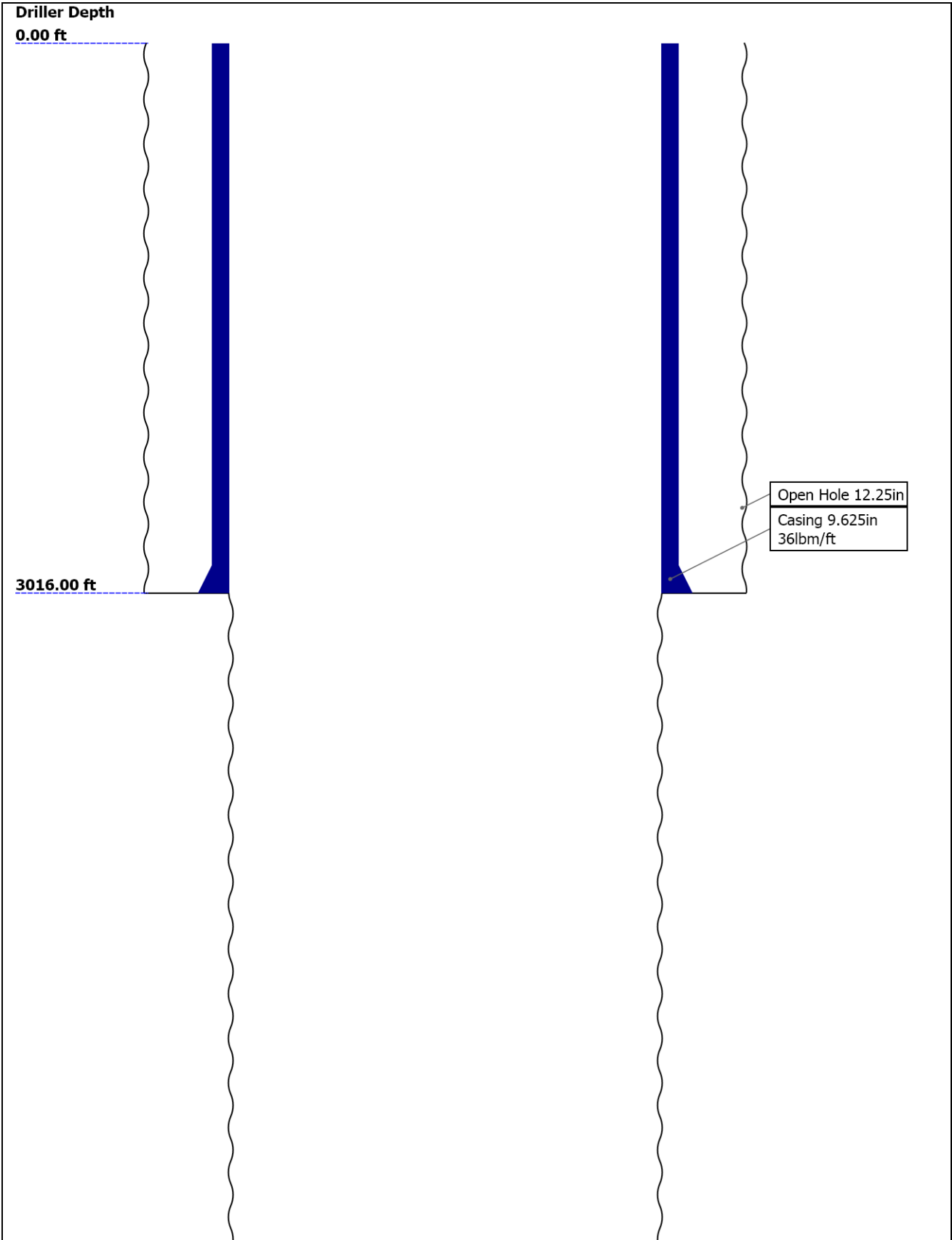
THE USE OF AND RELIANCE UPON THIS RECORDED-DATA BY THE HEREIN NAMED COMPANY (AND ANY OF ITS AFFILIATES, PARTNERS, REPRESENTATIVES, AGENTS, CONSULTANTS AND EMPLOYEES) IS SUBJECT TO THE TERMS AND CONDITIONS AGREED UPON BETWEEN SCHLUMBERGER AND THE COMPANY, INCLUDING: (a) RESTRICTIONS ON USE OF THE RECORDED-DATA; (b) DISCLAIMERS AND WAIVERS OF WARRANTIES AND REPRESENTATIONS REGARDING COMPANY'S USE AND RELIANCE UPON THE RECORDED-DATA; AND (c) CUSTOMER'S FULL AND SOLE RESPONSIBILITY FOR ANY INFERENCE DRAWN OR DECISION MADE IN CONNECTION WITH THE USE OF THIS RECORDED-DATA.

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Well Sketch



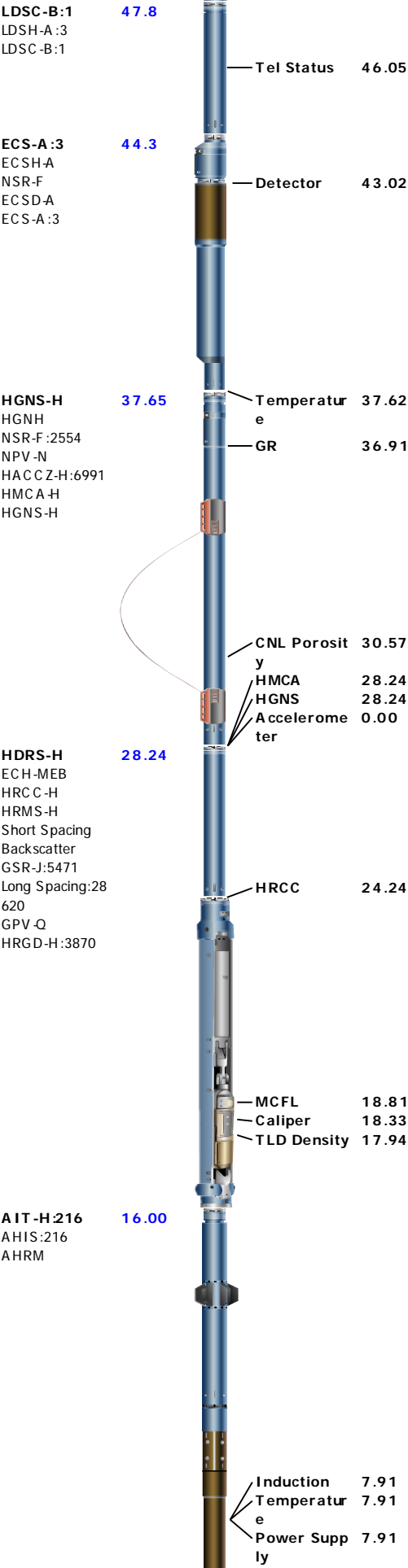


Borehole Size/Casing/Tubing Record

Bit						
Bit Size ( in )	12.25	8.75				
Top Driller ( ft )	0	3016				
Top Logger ( ft )	0	3016				
Bottom Driller ( ft )	3016	8273				
Bottom Logger ( ft )	3016	8275				
Casing						
Size ( in )	9.625					
Weight ( lbm/ft )	36					
Inner Diameter ( in )	8.914					
Top Driller ( ft )	0					
Top Logger ( ft )	0					
Bottom Driller ( ft )	3016					
Bottom Logger ( ft )	3016					

Remarks and Equipment Summary

Run 1: PEX-HNGS-ECS: Toolstring				Run 1: PEX-HNGS-ECS: Remarks	
Equip name	Length	MP name	Offset	Calculated on a sandstone matrix (2.68 g/cc) from TD to 7766'. Calculated on a limestone matrix from 7766' to casing. Caliper closed from 6640' to 6642' because of high tension.	
LEH-QT LEH-QT	65.41				
DTC-H ECH-KC DTC-H	62.49	CTEM HV	61.59 0.00		
HNGS-BA HEH-K:149 HNGS-BA	59.49	TelStatus ToolStatus	59.49 59.49		
		GR	56.51		
HNGC-B:250 HNGH-A:87 HNGC-B:250	51.3				
		Tel Status	49.55		





SP 0.08  
Mud Resistivity 0.00  
Head Tension  
TOOL\_ZERO

Lengths are in ft

Maximum Outer Diameter = 5.000 in

Line: Sensor Location, Value: Gating Offset

All measurements are relative to TOOL\_ZERO

## Depth Summary

Depth Control Parameters	Run 1: PEX-HNGS-ECS		
Conveyance Type	Wireline		
Rig Type	Land		
Depth Measuring Device	Run 1: PEX-HNGS-ECS		
Type	IDW-B		
Serial Number	6515A		
Calibration Date	23-Oct-2012		
Calibration Cable Type	7-46-PXS		
Wheel Correction 1	-7		
Wheel Correction 2	-5		
Tension Device	Run 1: PEX-HNGS-ECS		
Type	CMTD-B/A		
Serial Number	1919		
Calibration Date	10-Nov-2012		
Calibrator Serial Number	78135A		
Calibration Points	10		
Calibration RMS	6		
Calibration Peak Error	11		
Logging Cable	Run 1: PEX-HNGS-ECS		
Type	7-46P-XS		
Logging Cable Length ( ft )	24000.00		

Run 1: PEX-HNGS-ECS

ECS Spectrolith 5" = 100'

## Integration Summary

Output Channel(s)	Output Description	Input Parameter	Output Value	Unit
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## Pass Summary

Run Name	Pass Objective	Direction	Top	Bottom	Start	Stop	Depth Shift	Include Parallel Data
Run 1: PEX-HNGS-ECS	Log[5]:Up	Up	5131.37 ft	8297.35 ft	15-Dec-2012 11:30:28 PM	16-Dec-2012 1:00:07 AM	0.00 ft	true

All depths are referenced to toolstring zero

## Log









Run 1: PEX-HNGS-ECS: Log[5]:Up B4F53C2B-77C6-4CA8-8F86-1BFE44176650

Description: ECS Spectrolith Format: Log ( ECS Spectrolith ) Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 16-Dec-2012 10:19:05

Spectrolith LQC status image object (LQC\_SPEC) ECS-A

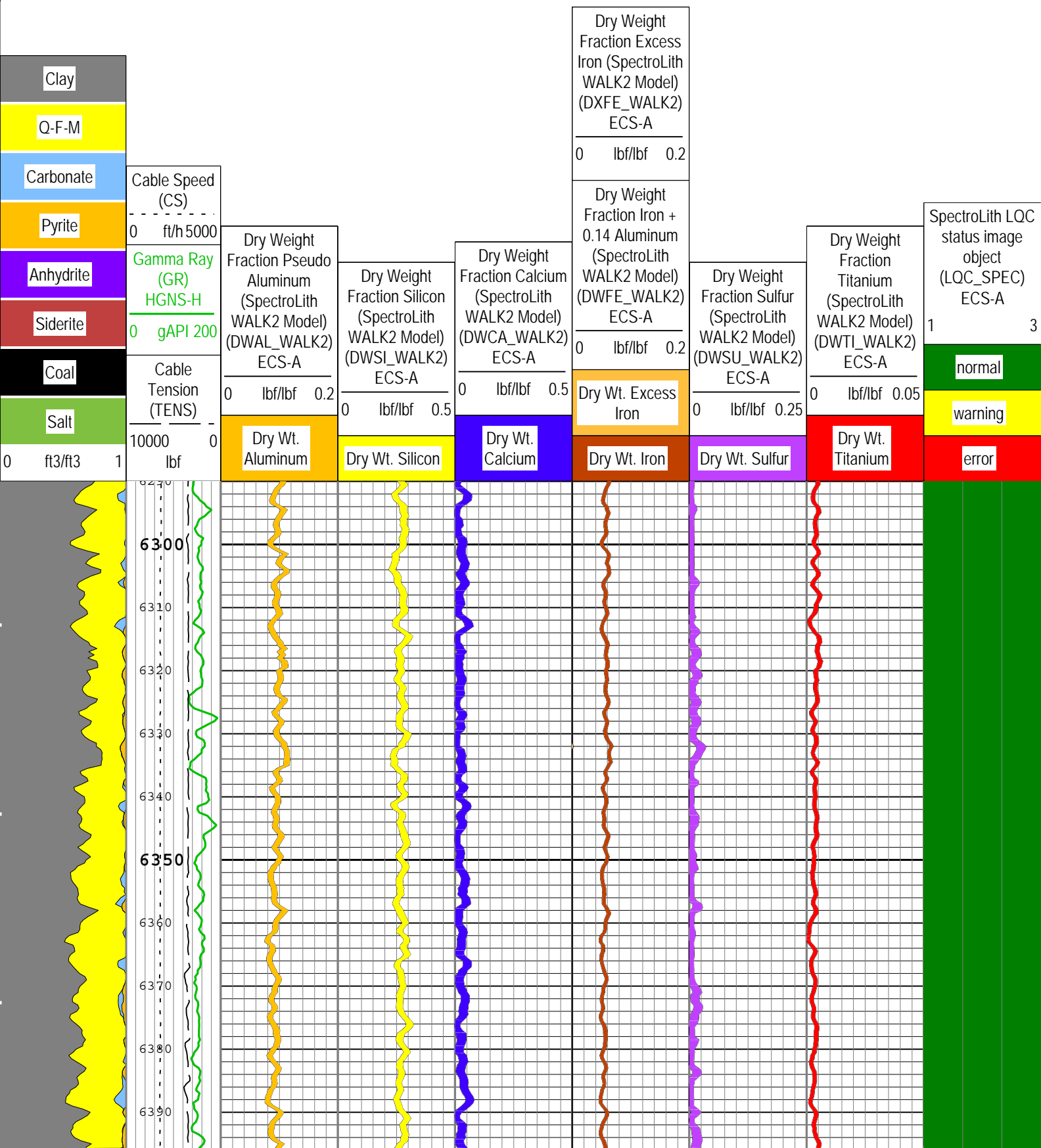
1 - Element Creation History: Gating Offset (ECSF\_WALKS)

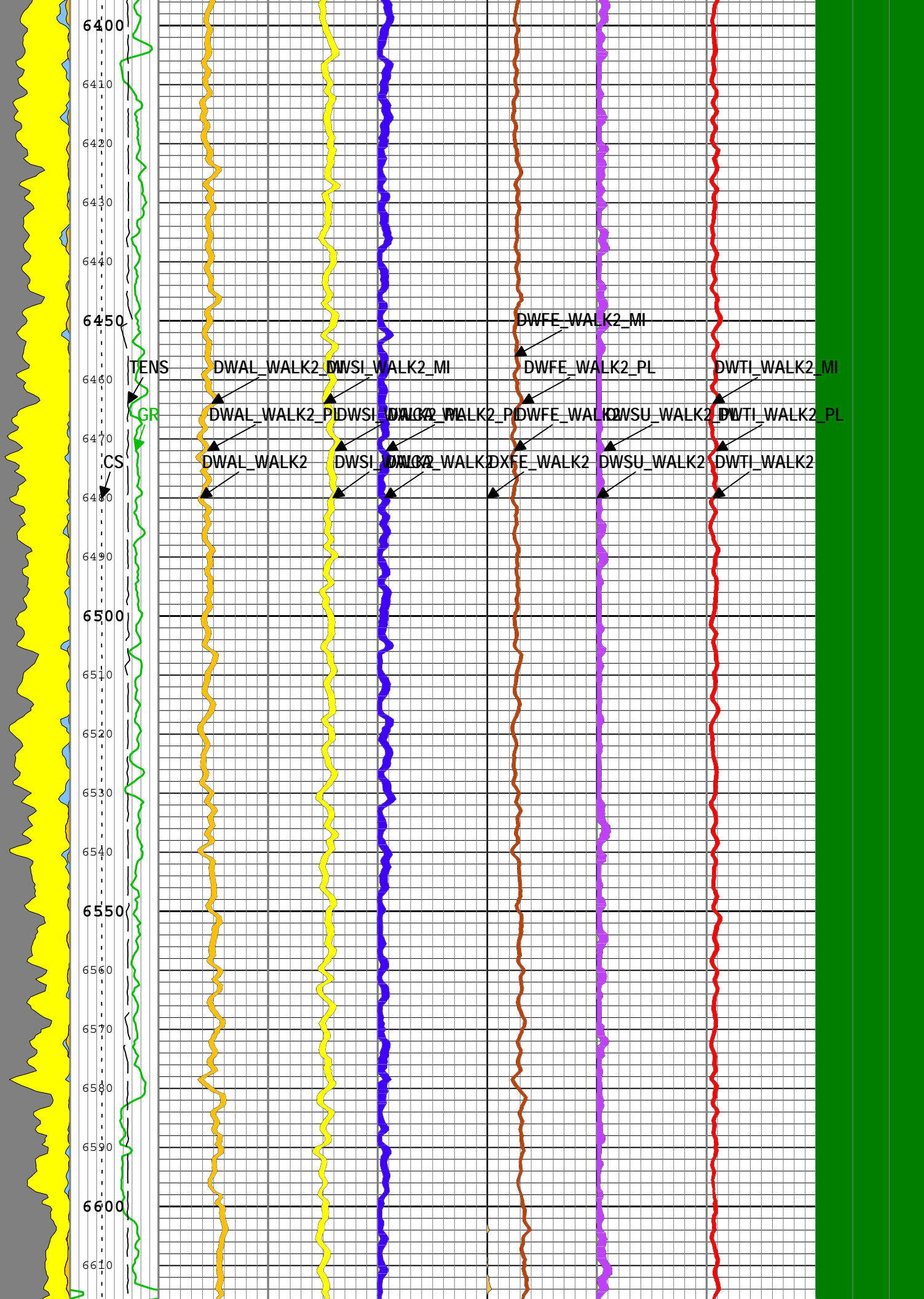
2 - Element Creation History: Gating Offset (ECSF\_WALKS)

-  Elemental Statistical Uncertainty Quality Check: Normal
-  Elemental Statistical Uncertainty Quality Check: Warning
-  Elemental Statistical Uncertainty Quality Check: Error
-  Temperature Quality Check < 40 °C
-  40 °C <= Temperature Quality Check < 70 °C
-  Temperature Quality Check >= 70 °C
-  Photomultiplier Status: Normal
-  Photomultiplier Status: Error (> 2.75)

### 3 - Photomultiplier Status (QCPMT) - :

TIME\_1900 - Time Marked every 60.00 (s)





6620  
6630  
6640  
6650  
6660  
6670  
6680  
6690  
6700  
6710  
6720  
6730  
6740  
6750  
6760  
6770  
6780  
6790  
6800  
6810  
6820  
6830

Caliper closed @ 6640-6642

TENS  
GR  
CS

DWAL\_WALK2 DWSI\_WALK2\_MI

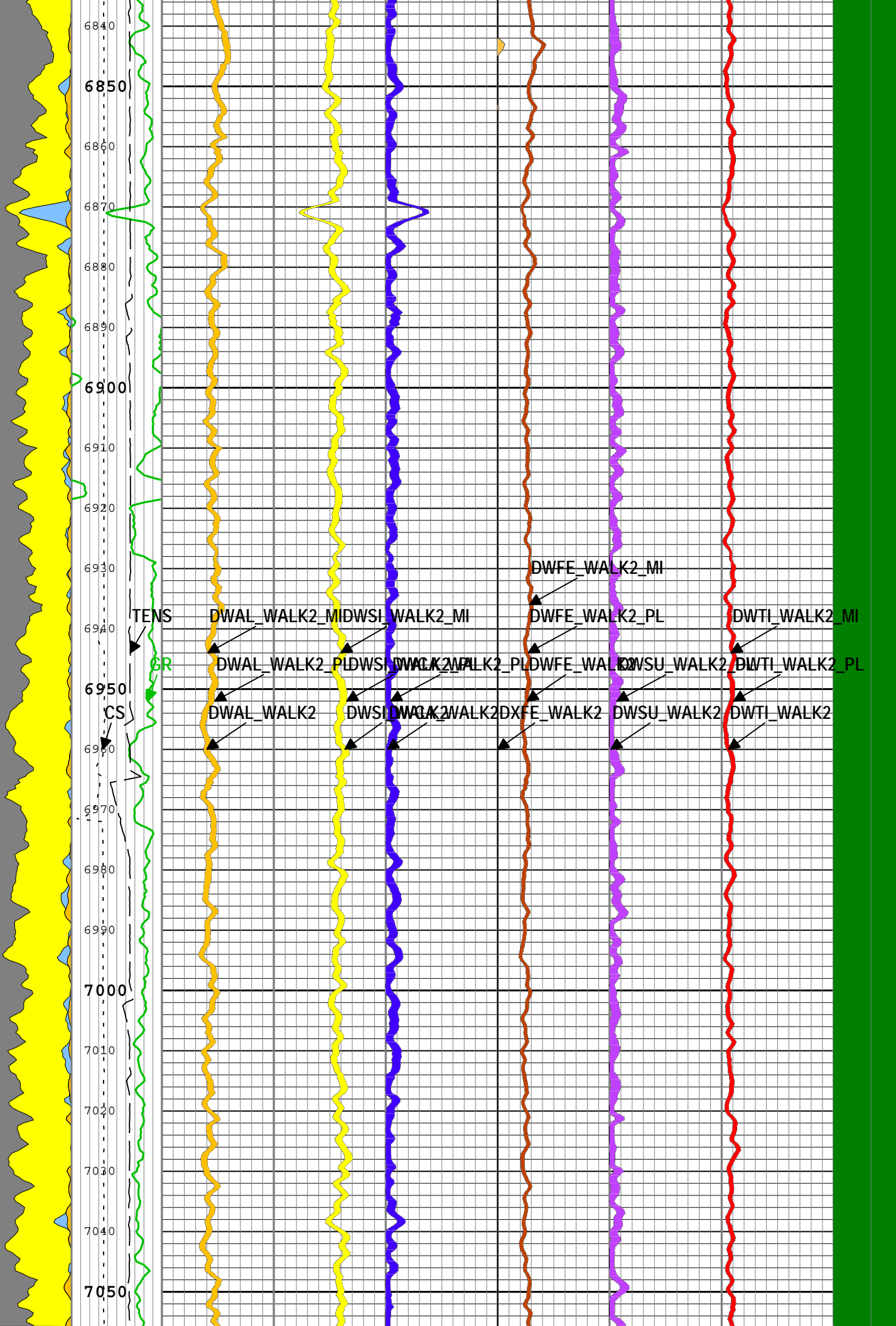
DWFE\_WALK2\_MI

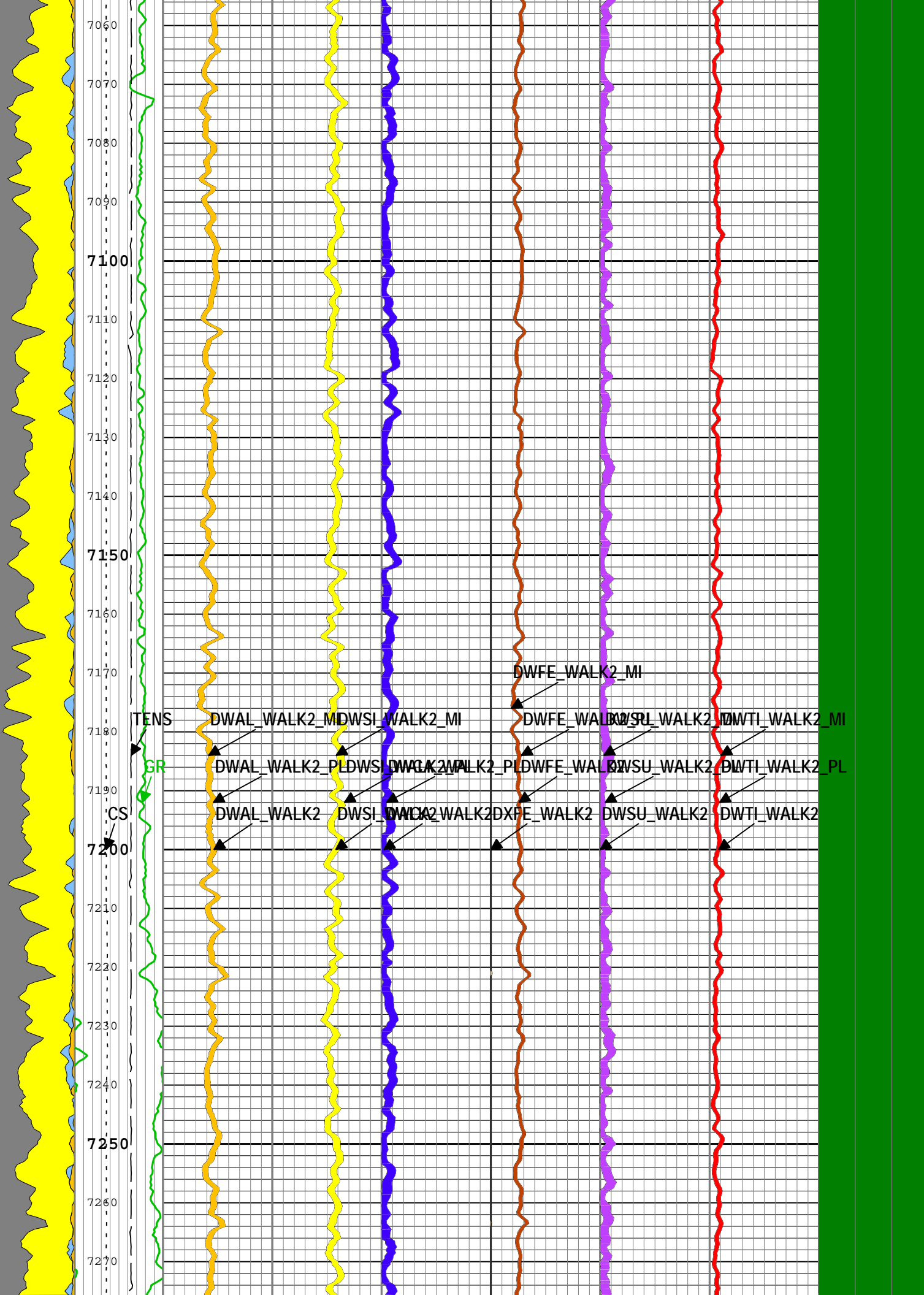
DWFE\_WALK2 MI DWTI\_WALK2\_MI

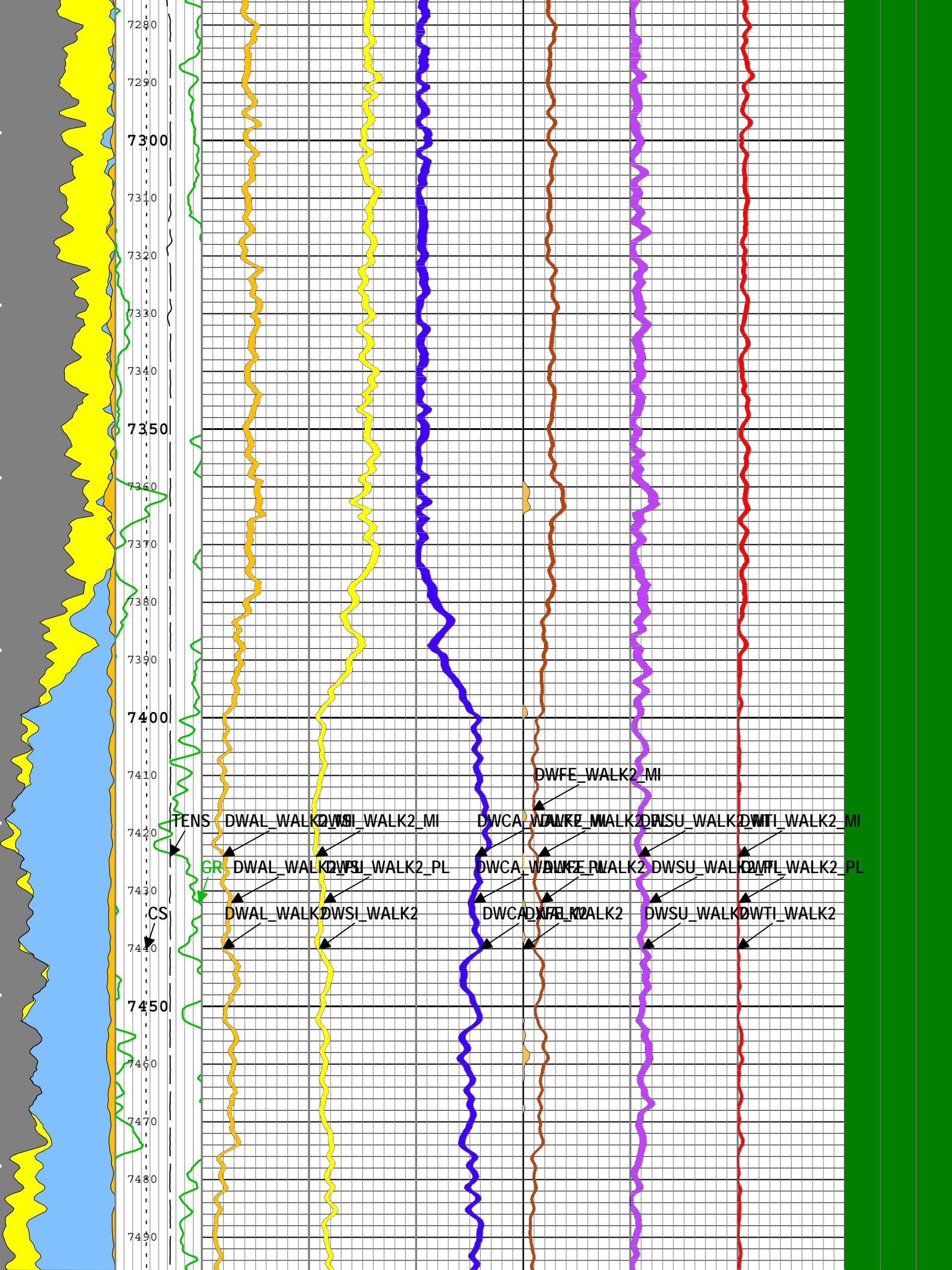
DWAL\_WALK2 DWSI\_WALK2 PL DWFE\_WALK2 MI DWSU\_WALK2 DWTI\_WALK2\_PL

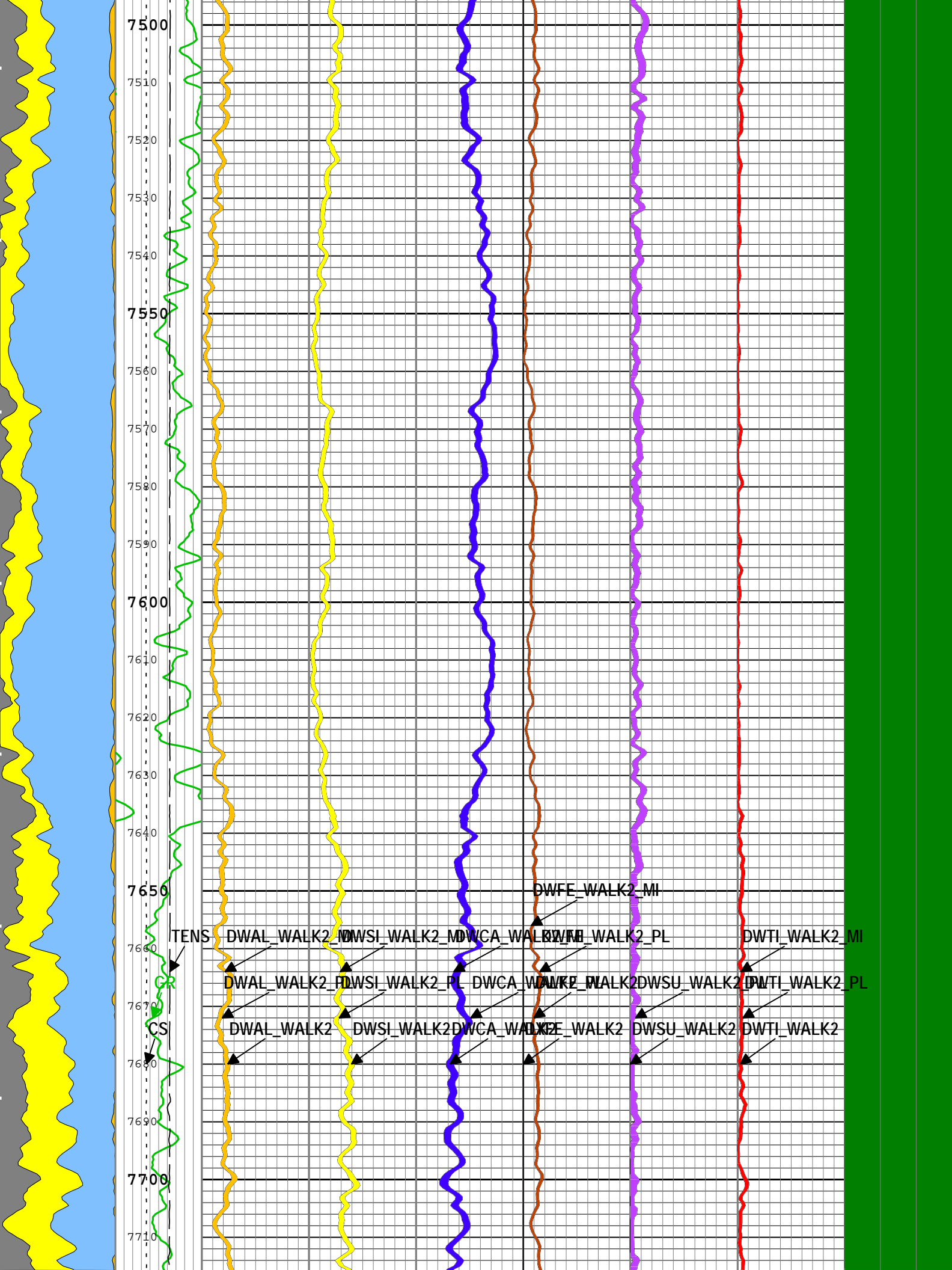
DWAL\_WALK2 DWSI\_WALK2 DWFE\_WALK2 DWSU\_WALK2 DWTI\_WALK2

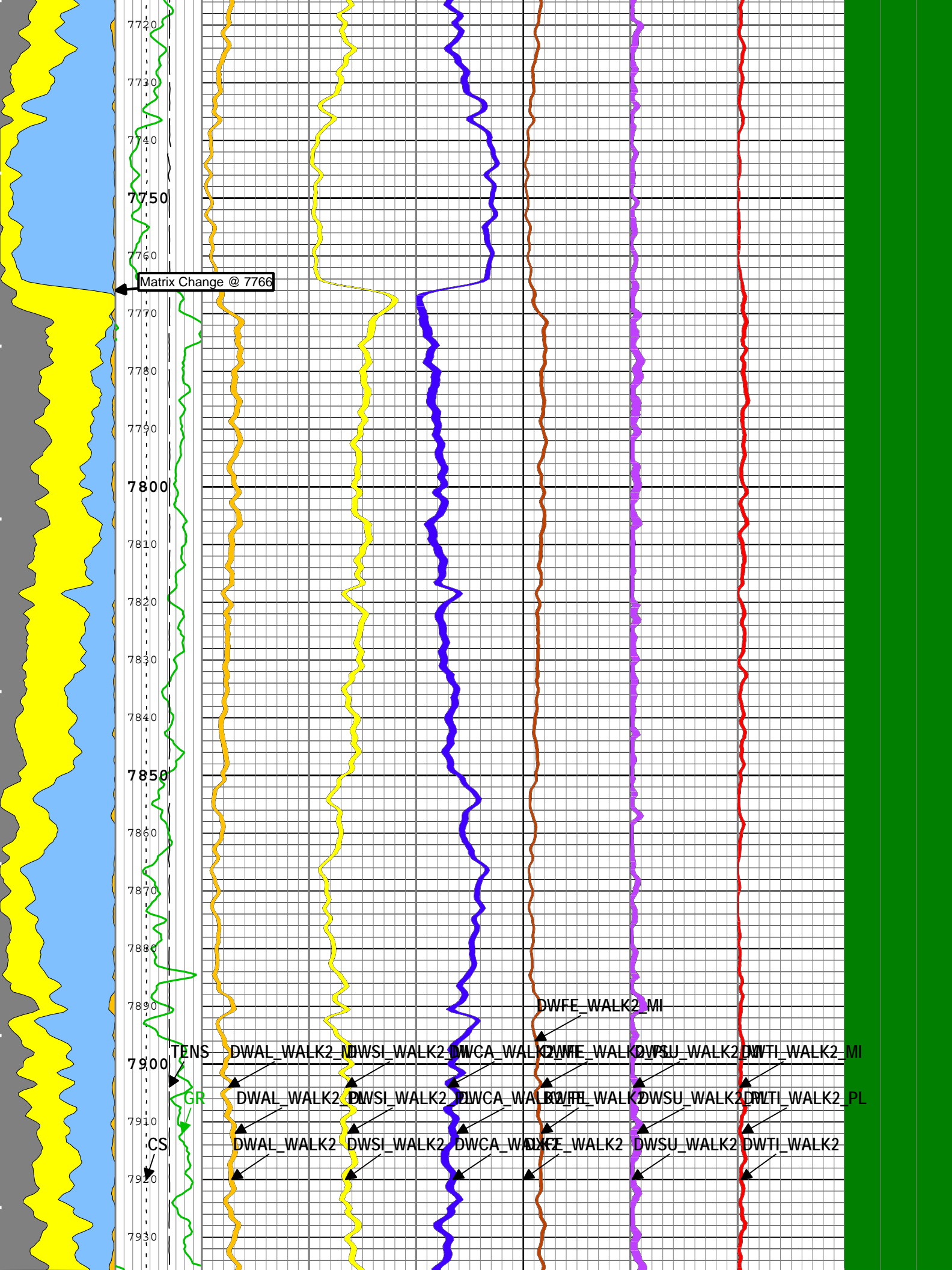


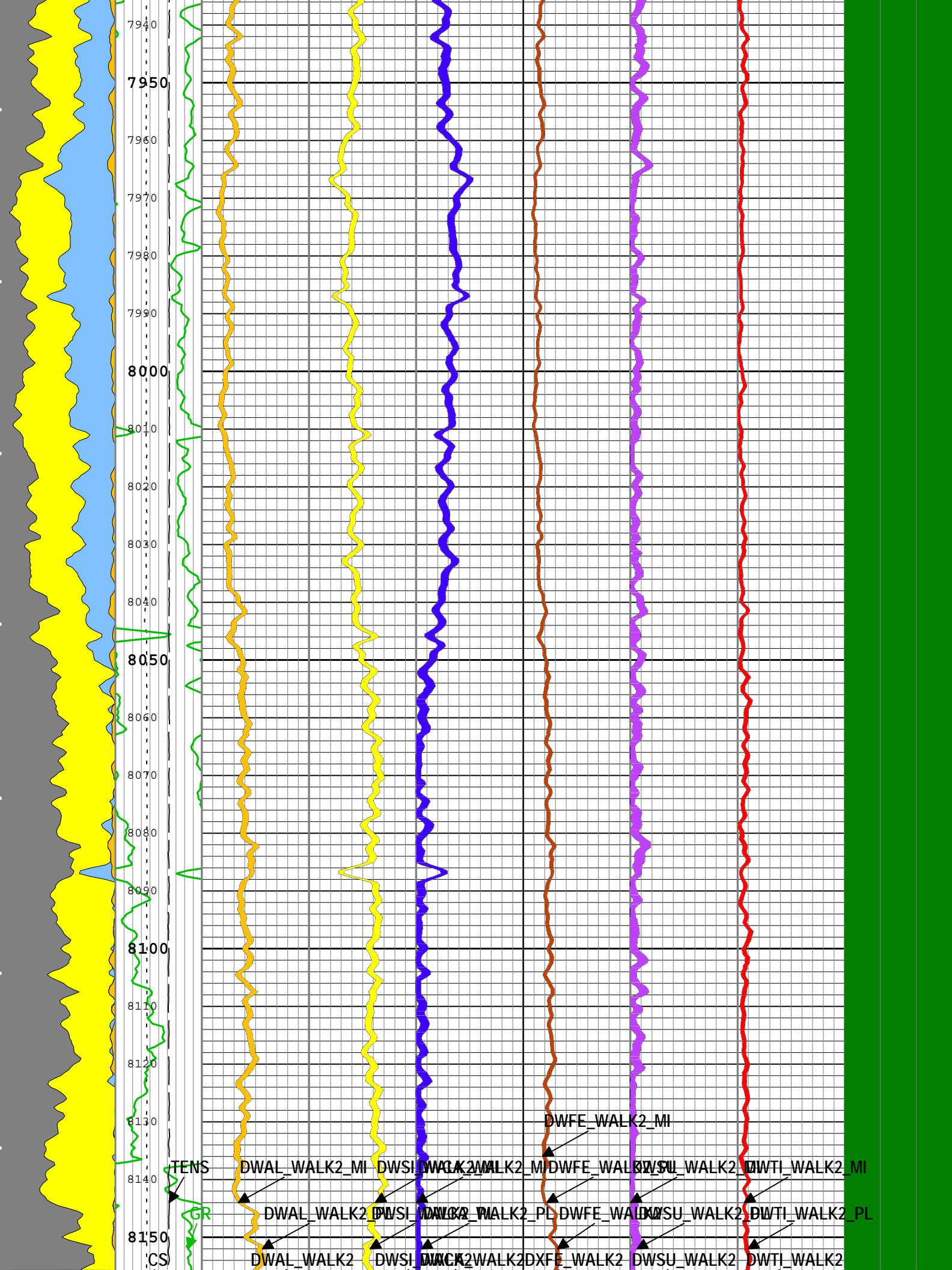




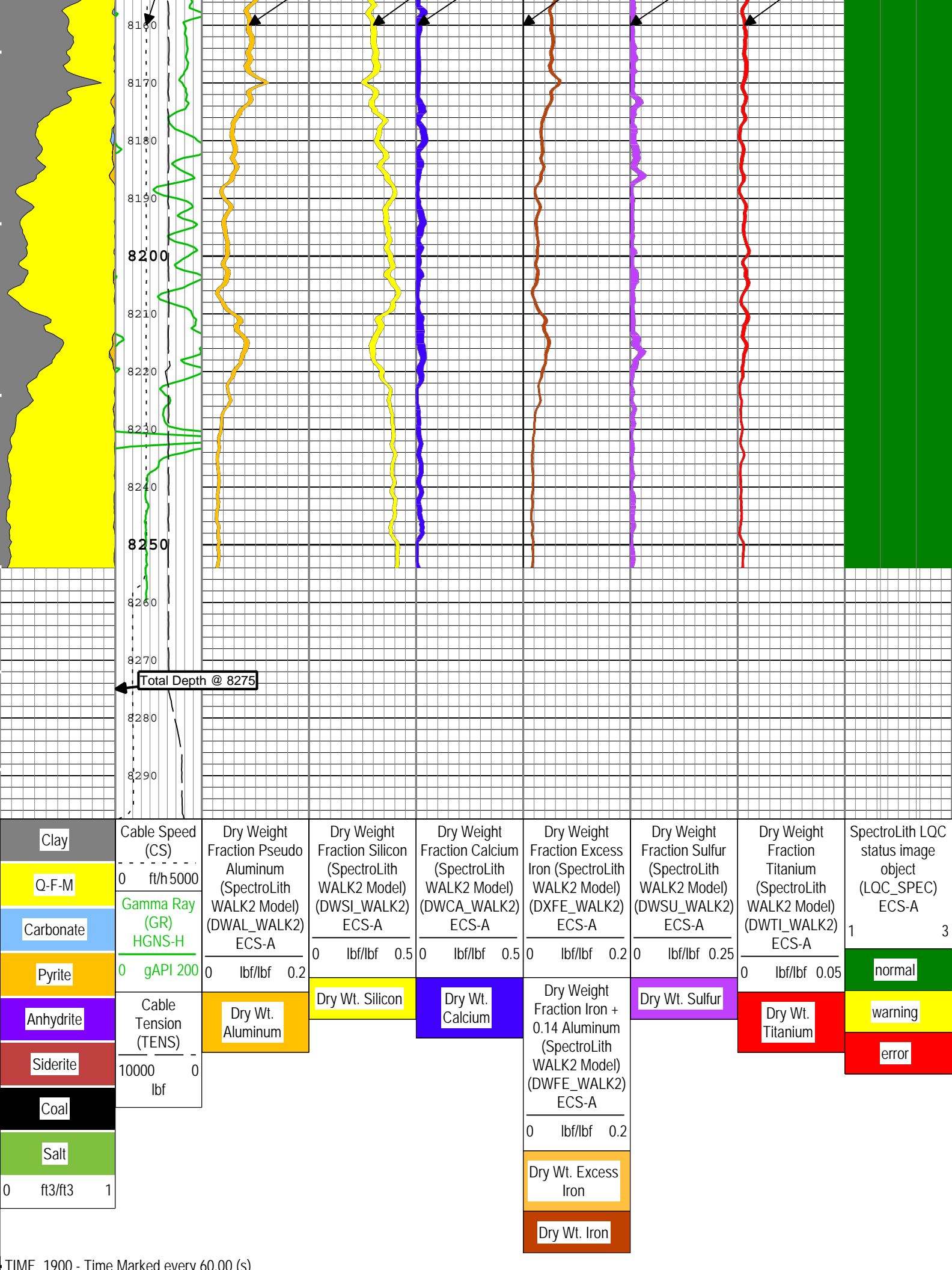








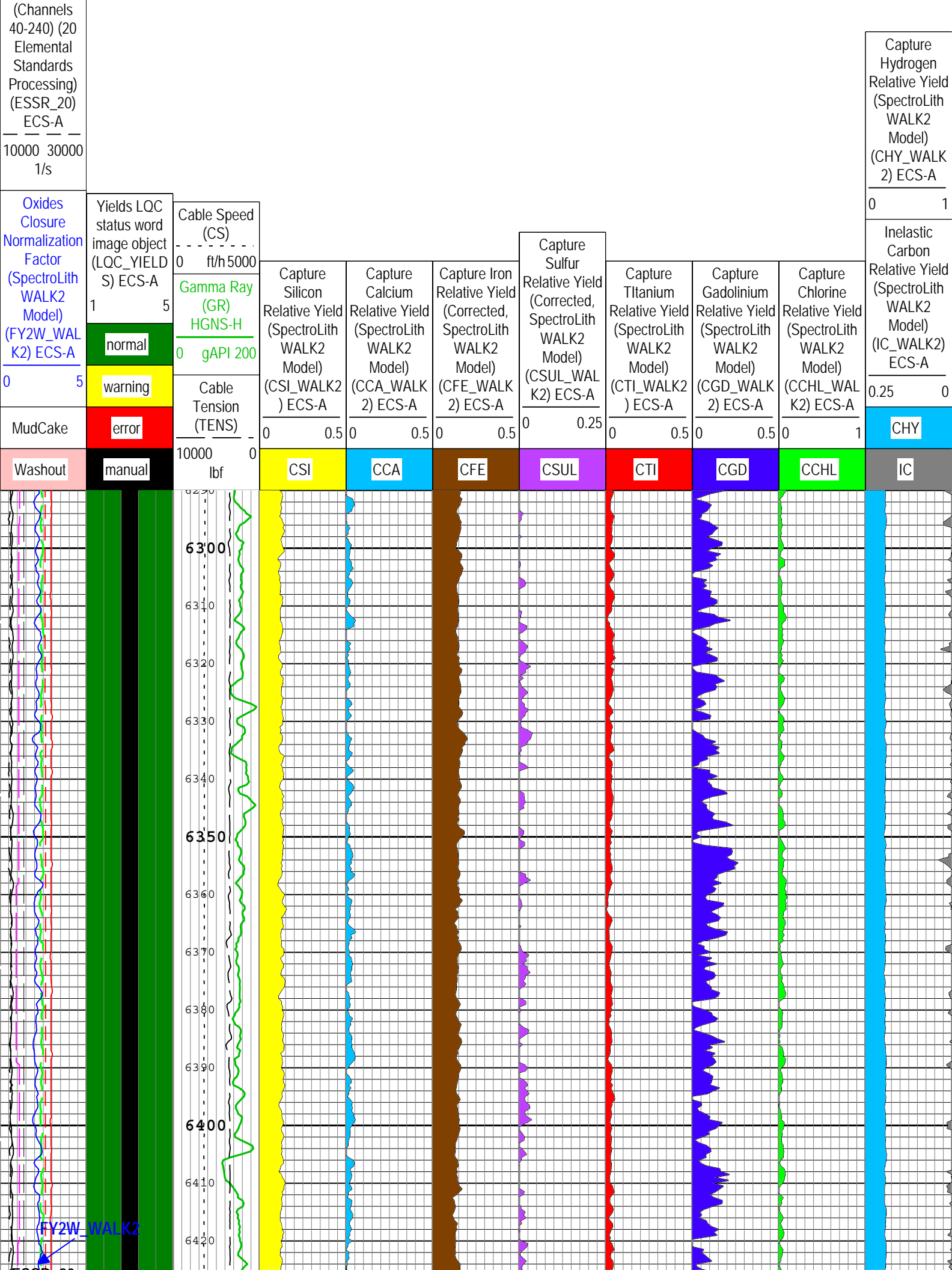


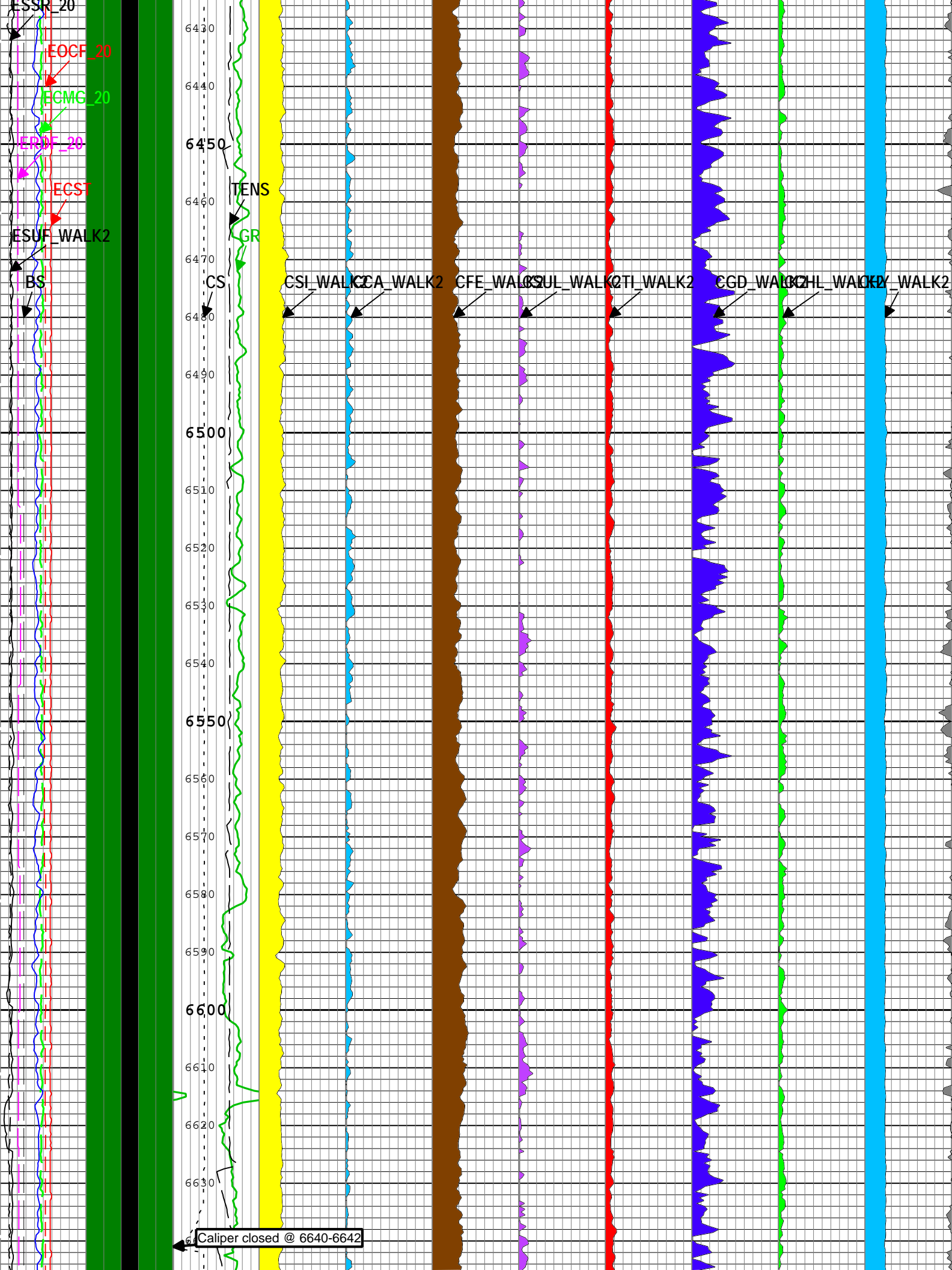


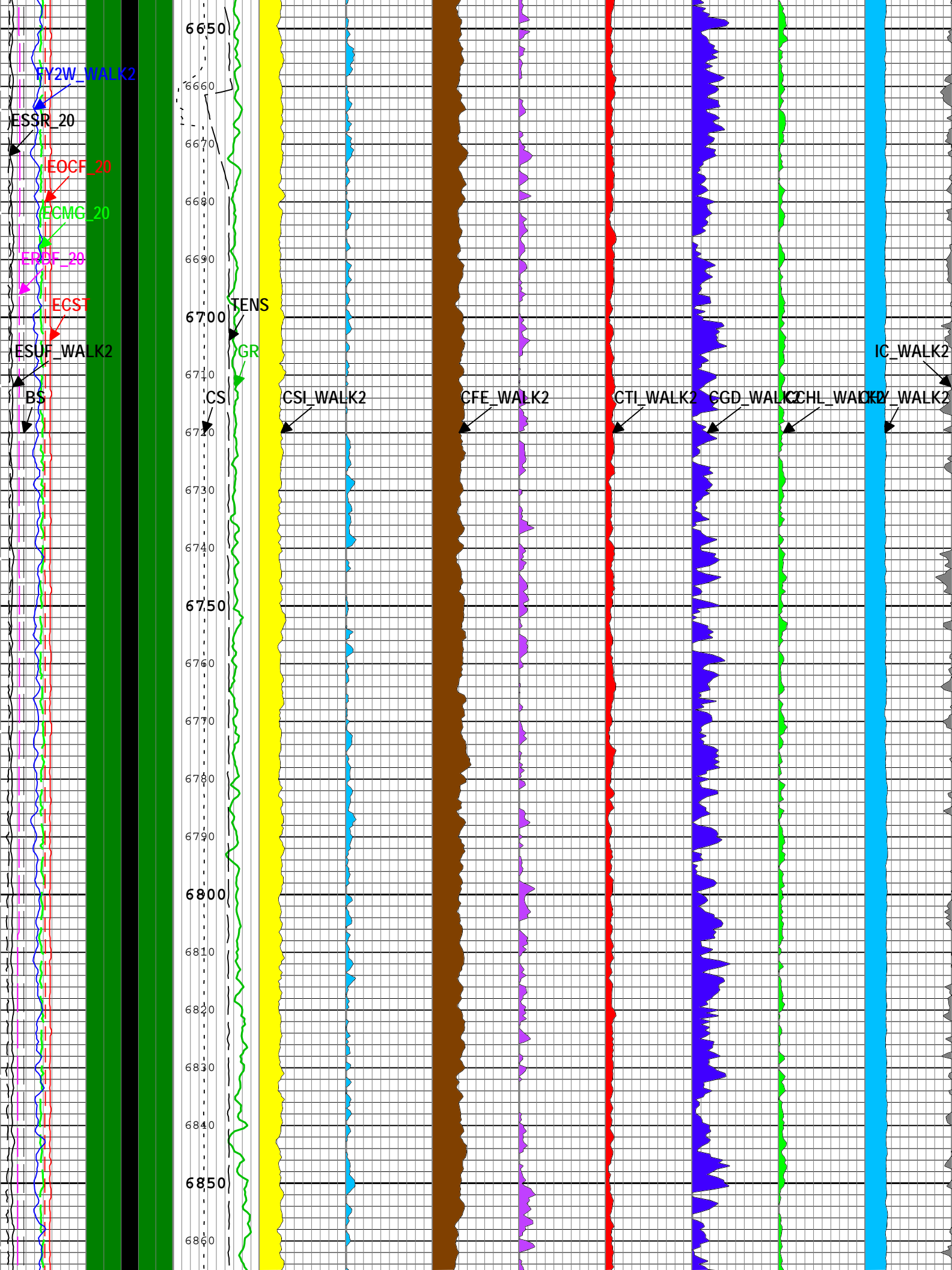


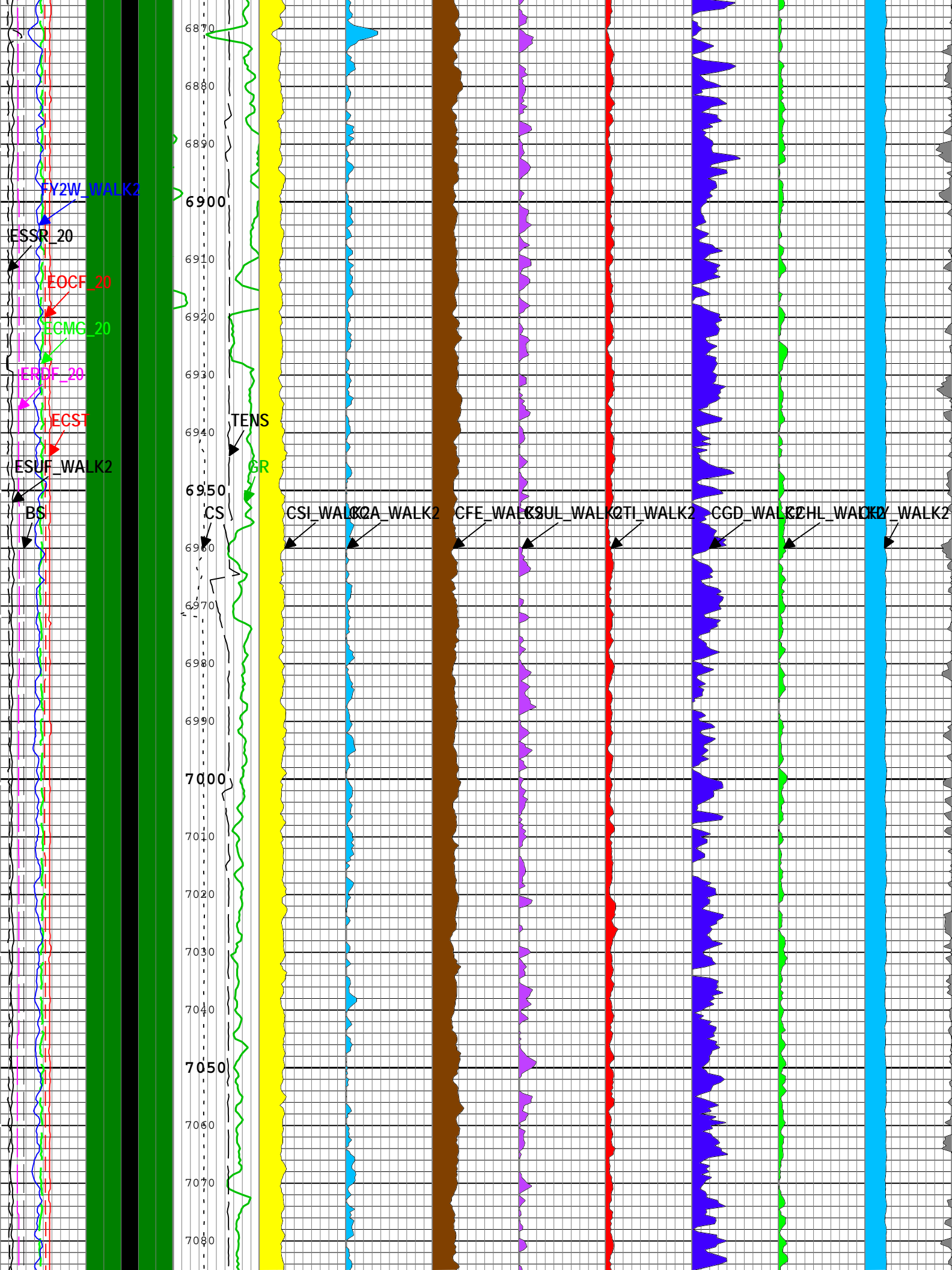


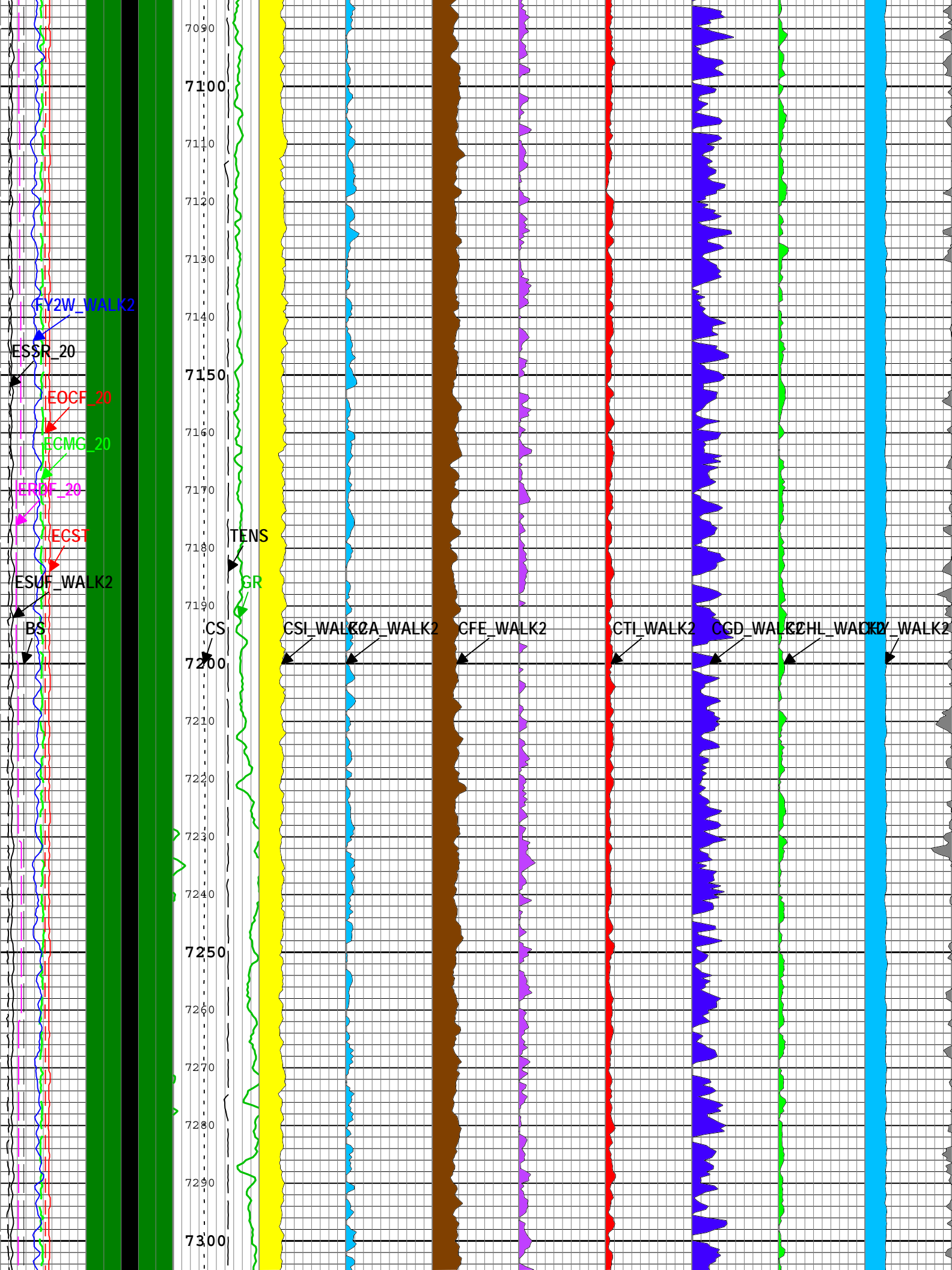
3 - Control Loop Status (HV Loop OR PSC Loop) - :	<div></div> Elemental Statistical Uncertainty Quality Check: Error
	<div></div> Control Loop Status (HV Loop OR PSC Loop): Normal
	<div></div> Control Loop (Status HV Loop OR PSC Loop): Warning
	<div></div> Control Loop Status (HV Loop OR PSC Loop): Error
	<div></div> Control Loop Status (HV Loop OR PSC Loop): Manual
4 - BGO Crystal Temperature Quality Check (ECST) - :	<div></div> Temperature Quality Check < 40 °C
	<div></div> 40 °C <= Temperature Quality Check < 70 °C
	<div></div> Temperature Quality Check >= 70 °C
5 - Photomultiplier Status (QCPMT) - :	<div></div> Photomultiplier Status: Normal
	<div></div> Photomultiplier Status: Error (> 2.75)
Bit Size (BS)	
6 in 16	
Elemental Statistical Uncertainty Factor (SpectroLith WALK2 Model) (ESUF_WALK2) ECS-A	
0 5	
ECS Temperature (ECST) ECS-A	
-20 degF 130	
Resolution Degradation Factor (20 Elemental Standards Processing) (ERDF_20) ECS-A	
0 10	
Gain from Frame by Frame Marquardt Solver (20 Elemental Standards Processing) (ECMG_20) ECS-A	
0.95 1.05	
Offset Correction Factor (20 Elemental Standards Processing) (EOCF_20) ECS-A	
-5 5	
Spectral Count Rate	

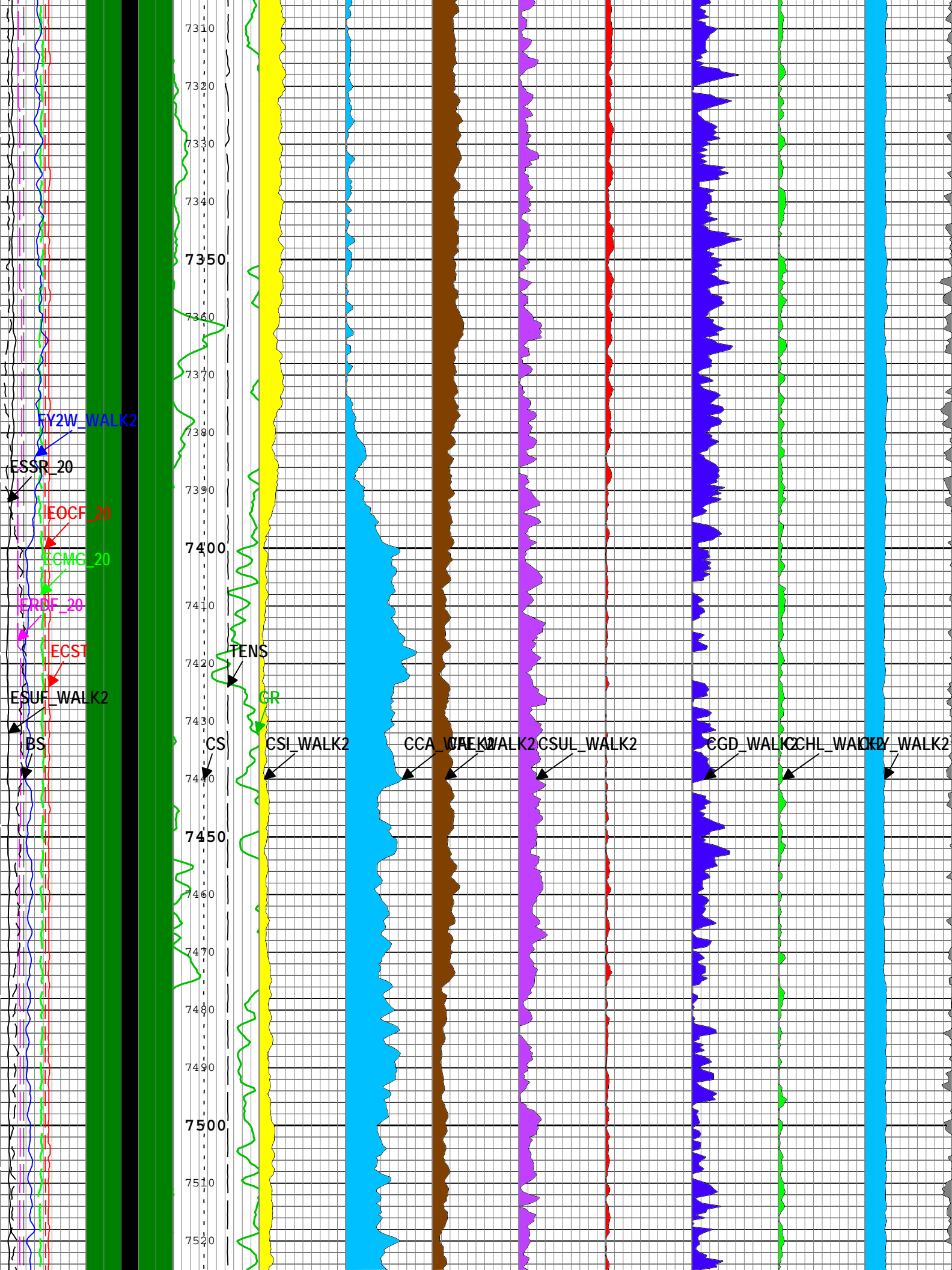


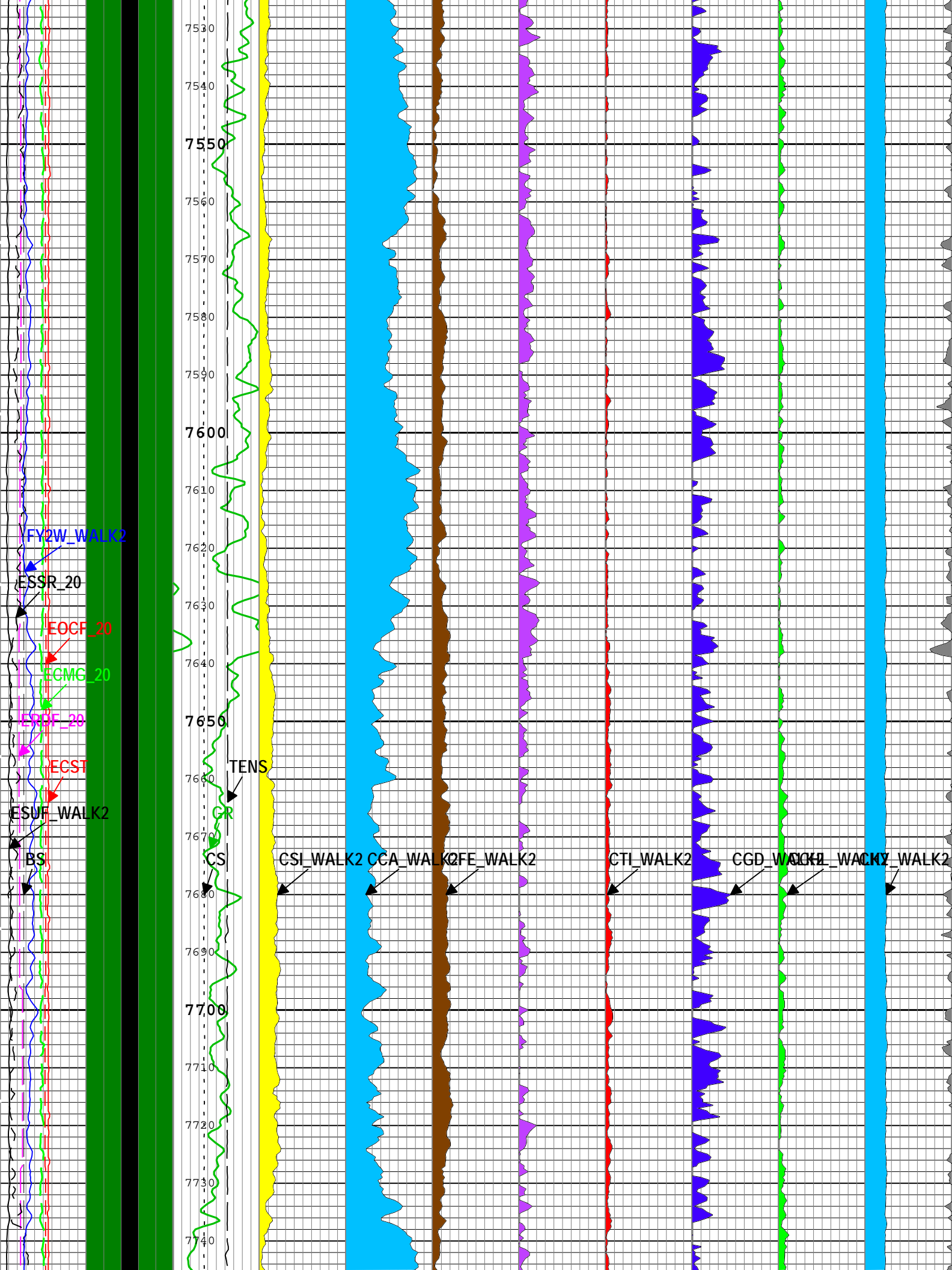




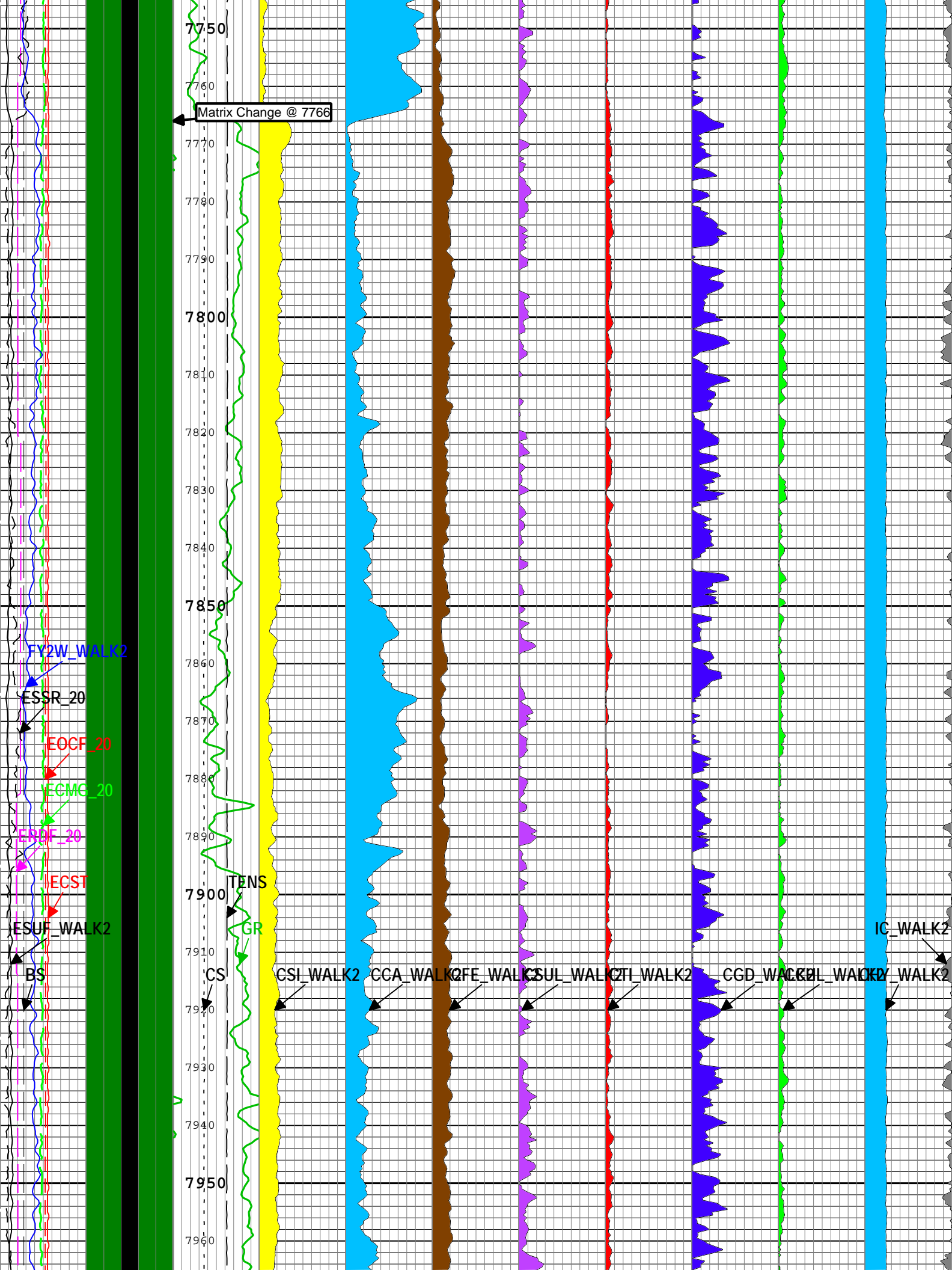


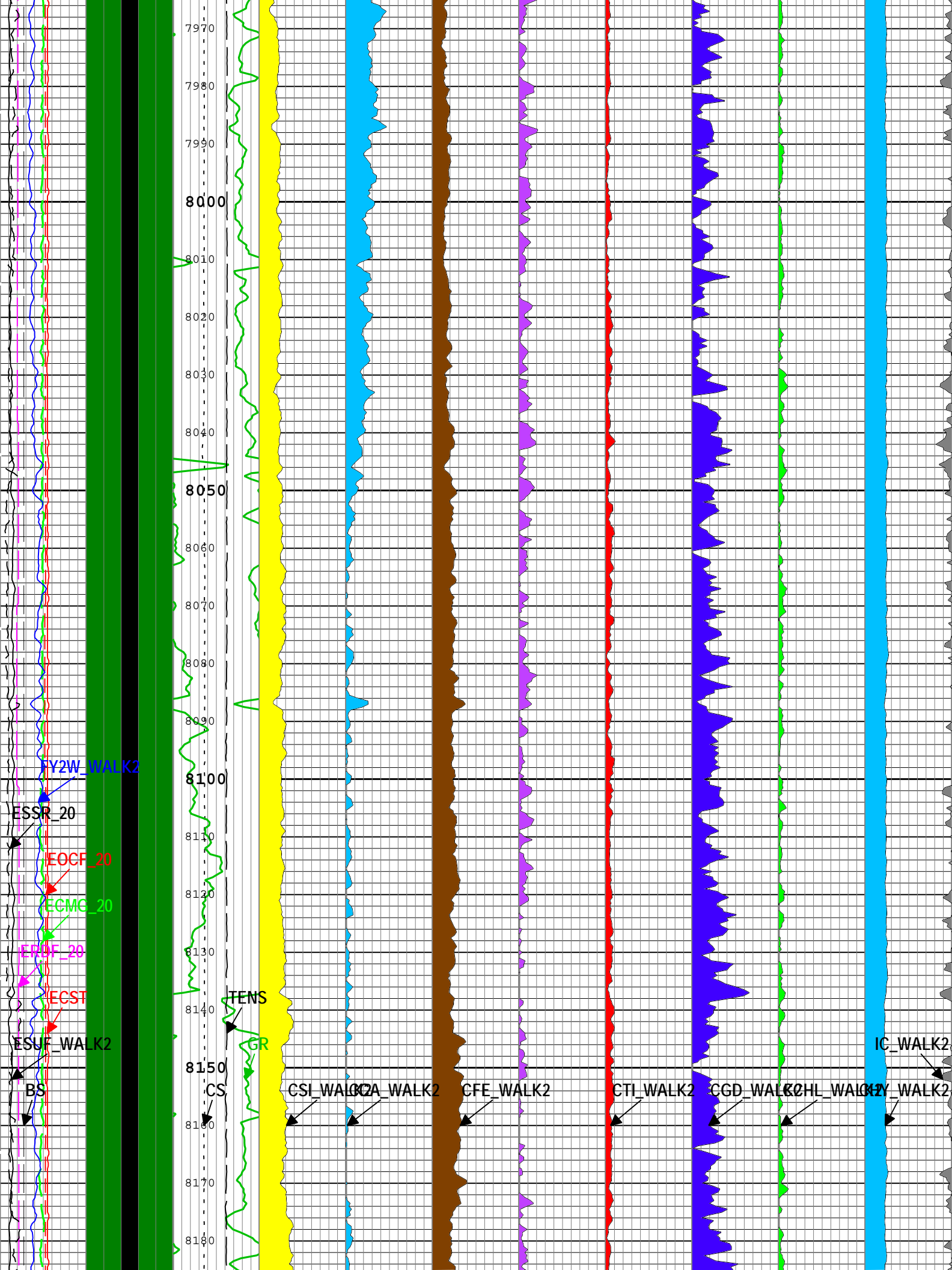


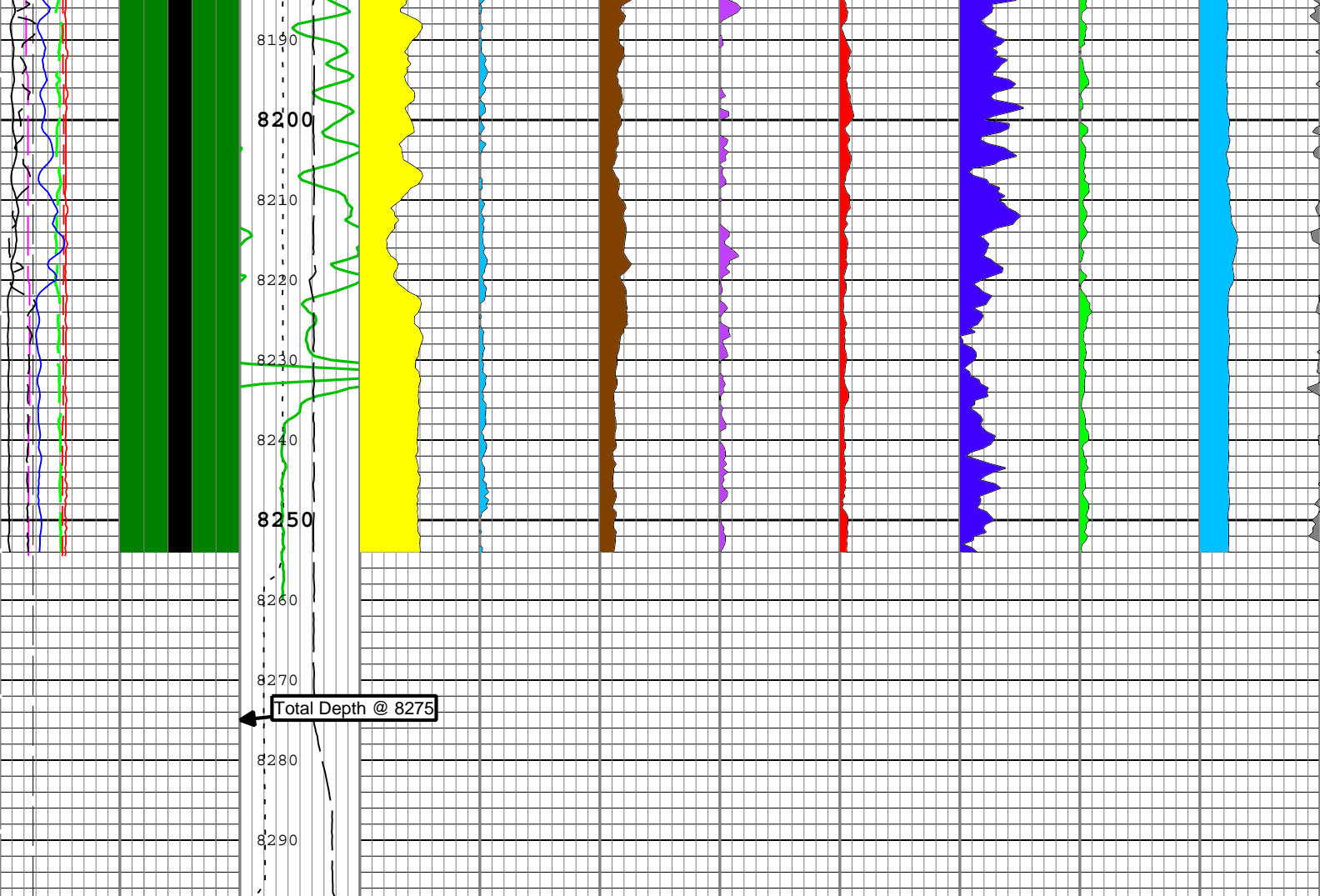


























Bit Size (BS) 6 in 16 Elemental Statistical Uncertainty Factor (SpectroLith WALK2 Model) (ESUF_WALK2) ECS-A 0 5 ECS Temperature (ECST) ECS-A -20 degF 130 Resolution Degradation Factor (20 Elemental Standards Processing) (ERDF_20) ECS-A 0 10 Gain from Frame by	Yields LQC status word image object (LQC_YIELDS) ECS-A 1 5 normal warning error manual	Cable Speed (CS) 0 ft/h 5000 Gamma Ray (GR) HGNS-H gAPI 200 Cable Tension (TENS) 10000 lbf	Capture Silicon Relative Yield (SpectroLith WALK2 Model) (CSI_WALK2) ECS-A 0 0.5 CSI	Capture Calcium Relative Yield (SpectroLith WALK2 Model) (CCA_WALK2) ECS-A 0 0.5 CCA	Capture Iron Relative Yield (Corrected, SpectroLith WALK2 Model) (CFE_WALK2) ECS-A 0 0.5 CFE	Capture Sulfur Relative Yield (Corrected, SpectroLith WALK2 Model) (CSUL_WALK2) ECS-A 0 0.25 CSUL	Capture Titanium Relative Yield (SpectroLith WALK2 Model) (CTI_WALK2) ECS-A 0 0.5 CTI	Capture Gadolinium Relative Yield (SpectroLith WALK2 Model) (CGD_WALK2) ECS-A 0 0.5 CGD	Capture Chlorine Relative Yield (SpectroLith WALK2 Model) (CCHL_WALK2) ECS-A 0 1 CCHL	Capture Hydrogen Relative Yield (SpectroLith WALK2 Model) (CHY_WALK2) ECS-A 0 1 Inelastic Carbon Relative Yield (SpectroLith WALK2 Model) (IC_WALK2) ECS-A 0.25 0 CHY IC
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Frame Marquardt Solver (20 Elemental Standards Processing) (ECMG_20) ECS-A ----- 0.95      1.05
Offset Correction Factor (20 Elemental Standards Processing) (EOCF_20) ECS-A ----- -5              5
Spectral Count Rate (Channels 40-240) (20 Elemental Standards Processing) (ESSR_20) ECS-A ----- 10000   30000 1/s
Oxides Closure Normalization Factor (SpectroLith WALK2 Model) (FY2W_WAL K2) ECS-A ----- 0              5
MudCake
Washout

Yields LQC status word image object (LQC\_YIELDS) ECS-A

- 1 - Marquardt Chi Squared Quality Check (EMC2) - :
- 2 - Elemental Statistical Uncertainty Quality Check (ESUF\_WALK2) - :
- 3 - Control Loop Status (HV Loop OR PSC Loop) - :
- 4 - BGO Crystal Temperature Quality Check (ECST) - :
- 5 - Photomultiplier Status (QCPMT) - :

-  Marquardt Chi Squared Quality Check: Normal
-  Marquardt Chi Squared Quality Check: Warning (> 3.0)
-  Elemental Statistical Uncertainty Quality Check: Normal
-  Elemental Statistical Uncertainty Quality Check: Warning
-  Elemental Statistical Uncertainty Quality Check: Error
-  Control Loop Status (HV Loop OR PSC Loop): Normal
-  Control Loop (Status HV Loop OR PSC Loop): Warning
-  Control Loop Status (HV Loop OR PSC Loop): Error
-  Control Loop Status (HV Loop OR PSC Loop): Manual
-  Temperature Quality Check < 40 °C
-  40 °C <= Temperature Quality Check < 70 °C
-  Temperature Quality Check >= 70 °C
-  Photomultiplier Status: Normal
-  Photomultiplier Status: Error (> 2.75)

Channel Processing Parameters				
Parameter	Description	ToolPath	Value	Unit
BARI	Barite Mud Presence Flag	Borehole	No	
BHS	Borehole Status (Open or Cased Hole)	Borehole	Open	
BS	Bit Size	COMPLETION	8.75	in
CALI_SHIFT	CALI Supplementary Offset	HDRS-H:HRCC-H:HRCC-H	0.21	in
CBLO	Casing Bottom (Logger)	COMPLETION	3016	ft
CDEN	Cement Density	HGNS-H:HGNS-H:HGNS-H	2	g/cm3
DFD	Drilling Fluid Density	Borehole	9.3	lbm/gal
GCSE_DOWN_PASS	Generalized Caliper Selection for WL Log Down Passes	Borehole	BS	
GCSE_UP_PASS	Generalized Caliper Selection for WL Log Up Passes	Borehole	CALI	
SOCO	Standoff Correction Option	HGNS-H:HGNS-H:HGNS-H	Yes	

Tool Control Parameters				
Parameter	Description	ToolPath	Value	Unit
MAX_LOG_SPEED	Toolstring Maximum Logging Speed	WLWorkflow	1800	ft/h

## Calibration Report

### ECS-A (Elemental Capture Spectroscopy Tool) Calibration - Run Run 1: PEX-HNGS-ECS

Primary Equipment :				
	The ECS sonde is used to measure elemental concentrations.	ECS-A	3	
Auxiliary Equipment :				
	Litho-Density Spectroscopy Cartridge	LDSC-B	1	
	Housing for the LDSC	LDSH-A	3	
	Housing to contain the ECS Sonde Assembly	ECSH-A		
	The gamma ray BGO detector is used to detect prompt capture gamma rays for spectroscopy measurement.	ECSD-A		
	The AmBe source provides neutrons for the prompt capture spectroscopy measurement.	NSR-F		

### ECS Background Measurement Check - ECS Calibration Check

Master:		Before (Measured):		23:06:43 09-Dec-2012		After:	
				Expired by 4 days			
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Detector resolution (20 DegC)	%	Master	13.000	11.200	NOT DONE	14.000	
		Before	13.000	11.200	12.015	14.000	
		After	13.000	11.200	NOT DONE	14.000	
		Before-Master	----	----	----	----	
		After-Before	----	----	----	----	

### ECS Spectral Calibration - ECS Spectral Calibration

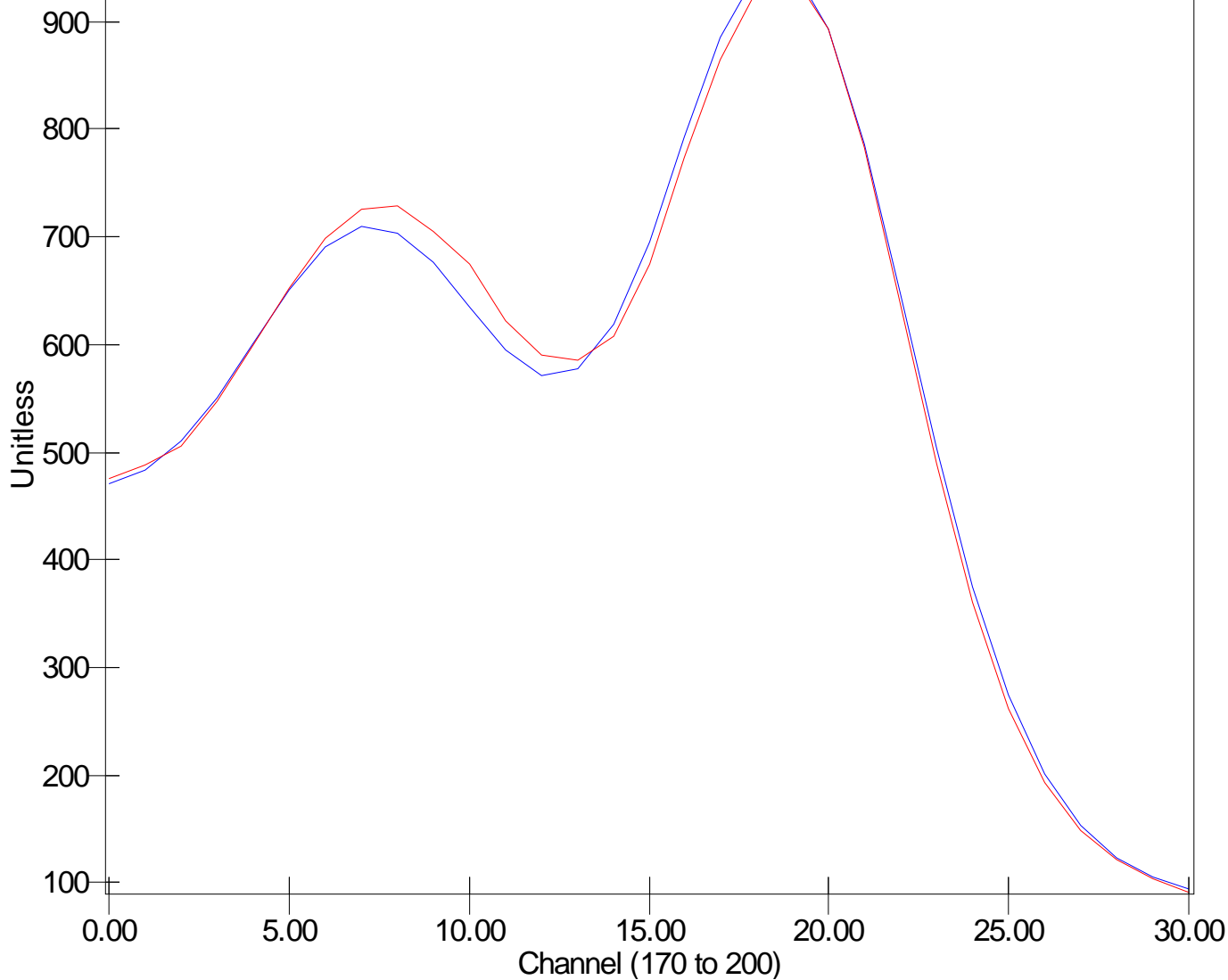
Master (EEPROM):		22:36:14 15-Dec-2012					
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Spectral Shift Factor		Master	1.000	-0.500	-0.344	1.500	

## Spectrum Without Shift Plot

### SHOP

— FITTED\_SPEC (FITTED\_SPEC)

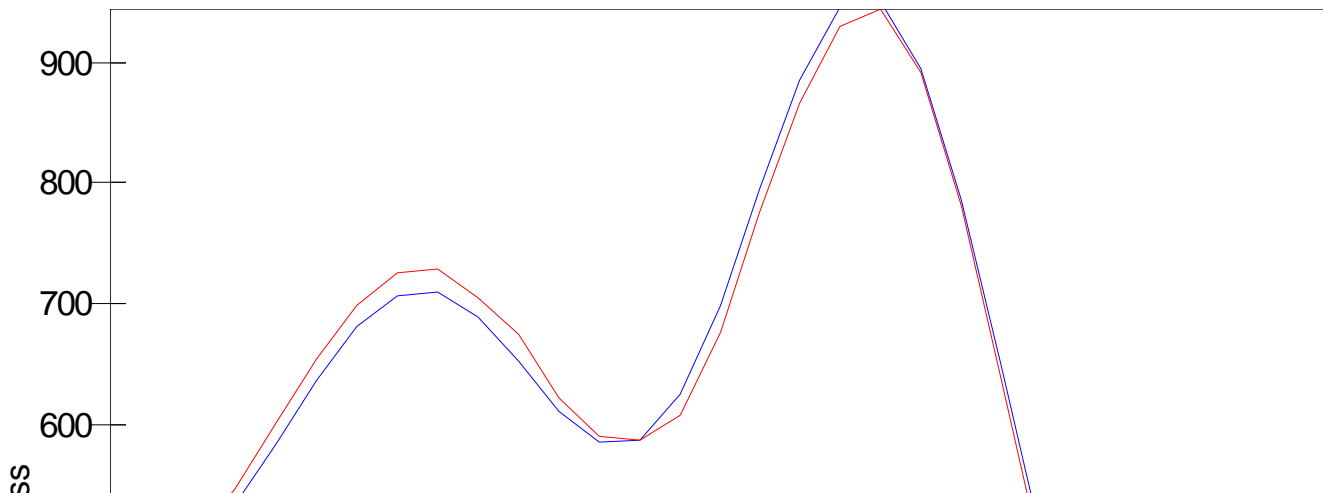
— DATA\_SPEC (DATA\_SPEC)

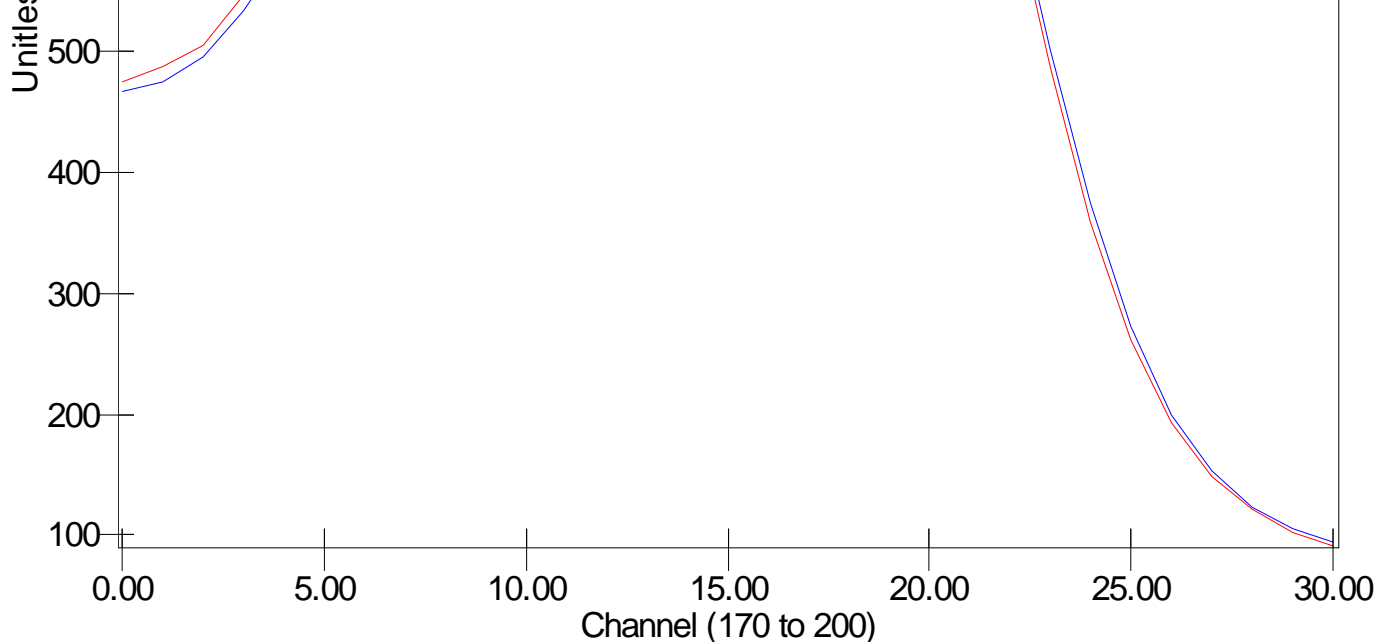


## Spectrum With Shift Plot

SHOP

- FITTED\_SPEC\_SF (FITTED\_SPEC\_SF)
- DATA\_SPEC\_SF (DATA\_SPEC\_SF)

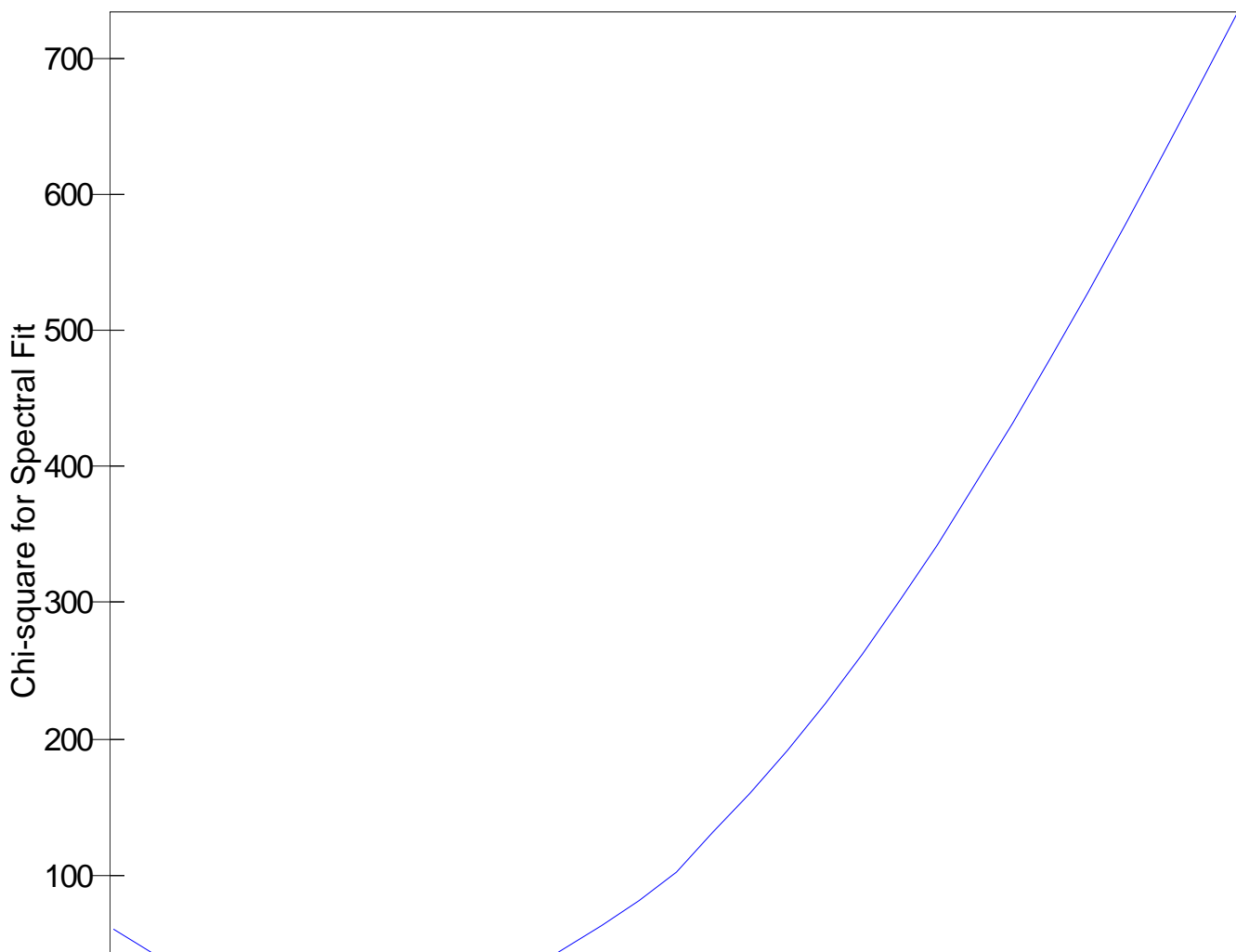


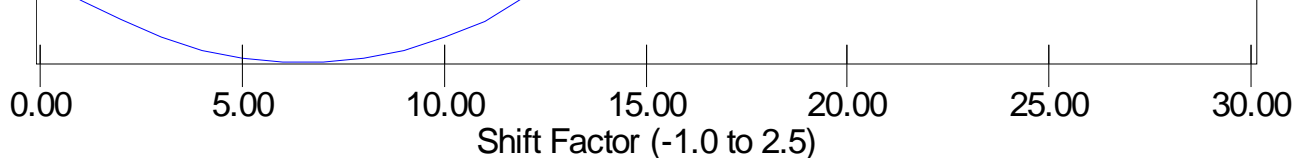


## Chi Square for Spectral Fit Plot

SHOP

— CHISQ\_SPEC\_FIT





Company:	Carrizo Oil & Gas Inc	Schlumberger
Well:	WEP 4-28-11-3-64	
Field:	Wildcat	
County:	Adams	
State:	Colorado	

Electron Capture Spectroscopy