



MTD and MFC Well Integrity Log Interpretation

Well	
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Logging Engineer	
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Version	

Client	
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Introduction

- Magnetic Thickness Detector (MTD) and 56 Arms Multi Finger Caliper Tool were run in well Suban-4 from 2055 m to surface.
- The data acquired with Magnetic Thickness Detector (MTD) and 56 Arms Multi Finger Caliper tool is of good quality and fit for purpose of interpretation.
- The MTD-MFC data was correlated to GR log dated 13/08/2010 provided by the client.

Objective

- Magnetic Thickness Detector (MTD) and 56 Arms Multi Finger Caliper Tool were run in well Suban-4 to evaluate the 9 5/8" Casing and the 13 3/8" Casing behind it.

Interpretation Results

- MFC data shows a groove type feature in the 9 5/8" casing evident at many places throughout the logged interval of the 9 5/8" casing. MFC shows the maximum measured ID of 8.928" at depth 1304.86m (providing 36.1% penetration rate reference quoted nominal for the 9 5/8" casing 53.5lb/ft). Otherwise, penetration rates throughout the surveyed interval of the 9 5/8" casing predominantly less than 25%. *(Please refer to figures 2-16, pages 11-37 and casing evaluation tables by MFC pages 51-55.)*
- An area of a minor pipe distortion within the 9 5/8" casing was ascertained by MFC at around depth 1137m. *(Please refer to figures 9a-9c, pages 23-24)*. Over the pipe distortion area the minimum and maximum radii curves tend to separate from each other.
- MFC log identified one joint in the 9 5/8" casing located at 1845.79-1857.79m with different higher ID and hence apparently different weight than the quoted nominal. This is also supported by the MTD readings showing reduction in metal thickness over the exact length of the aforementioned joint. *(Please refer to figures 15a-15c and 23, pages 34-35, 44)*
- According to MTD interpretation results shows wall loss in the 9 5/8" casing mostly less than 10%. The Maximum wall loss observed at 2031.6m with 12.32%. *(Please refer to Figures 22-25, pages 43-46 and 9 5/8" Casing Evaluation Table, pages 47-51.)*
- MTD data suggest mostly uniform pipe wall thinning throughout the 13 3/8" casing string. And maximum calculated wall loss in the 13 3/8" casing is up to 11.13% at depth 565m, according to MTD interpretation. *(Please refer to Figures 17-21, pages 38-42 and 13 3/8" Casing Evaluation Table, pages 56-58.)*
- Table 1 specifies categories in which metal loss can be classified in order to evaluate integrity of tubular. Table 2 specifies categories in which penetration can be classified in order to evaluate integrity of tubular.

Metal Loss Classification & Interpretation Sub Zones

Grade	Maximum Wall Loss	Level
A	0-3%	Very Light
B	3%-5%	Light
C	5%-10%	Moderate
D	10-15%	Significant
E	>=15%	Intensive
G	<0%	Special Higher Weight Joint

Table 1- MTD Metal Loss Classification

Grade	Maximum Penetration	Level
A	<10%	Very Light
B	10>-25%	Light
C	25>-50%	Moderate
D	50>-75%	Significant
E	>75%	Intensive
G	<0%	< Nominal IR

Table 2- MFC Penetration Classification

Intervals	Interval 1	Interval 2	Interval 3
Start Depth(m)	0	258.5	1256.8
End Depth(m)	258.5	1256.8	2055
Tubular size & weight	9.625" CSG-0.545"@53.5ppf	9.625" CSG-0.545"@53.5ppf	9.625" CSG-0.545"@53.5ppf
	13.375"- 0.514"@72ppf	13.375"- 0.514"@72ppf	/
	20"- 0.438"@94ppf	/	/

Table 3- Tubing and Casing Specification across Logged Interval

Joints with Highest Metal Loss (MTD) and Highest Penetration Rates (MFC)

Top Body (m)	Bottom Body (m)	Body Length (m)	Nom Thk (in)	Min Thk (in)	Max Loss Depth (m)	Max Loss (%)	Grade
1846.0	1857.7	11.7	0.545	0.407	1856.4	25.37	Casing Weight Changed
1858.6	1870.3	11.6	0.545	0.490	1869.5	10.03	D
1971.3	1983.3	12.0	0.545	0.487	1982.6	10.61	D
2020.9	2032.4	11.5	0.545	0.478	2031.6	12.32	D

Table 2- Highest Metal Loss in 9 5/8" casing from MTD Log

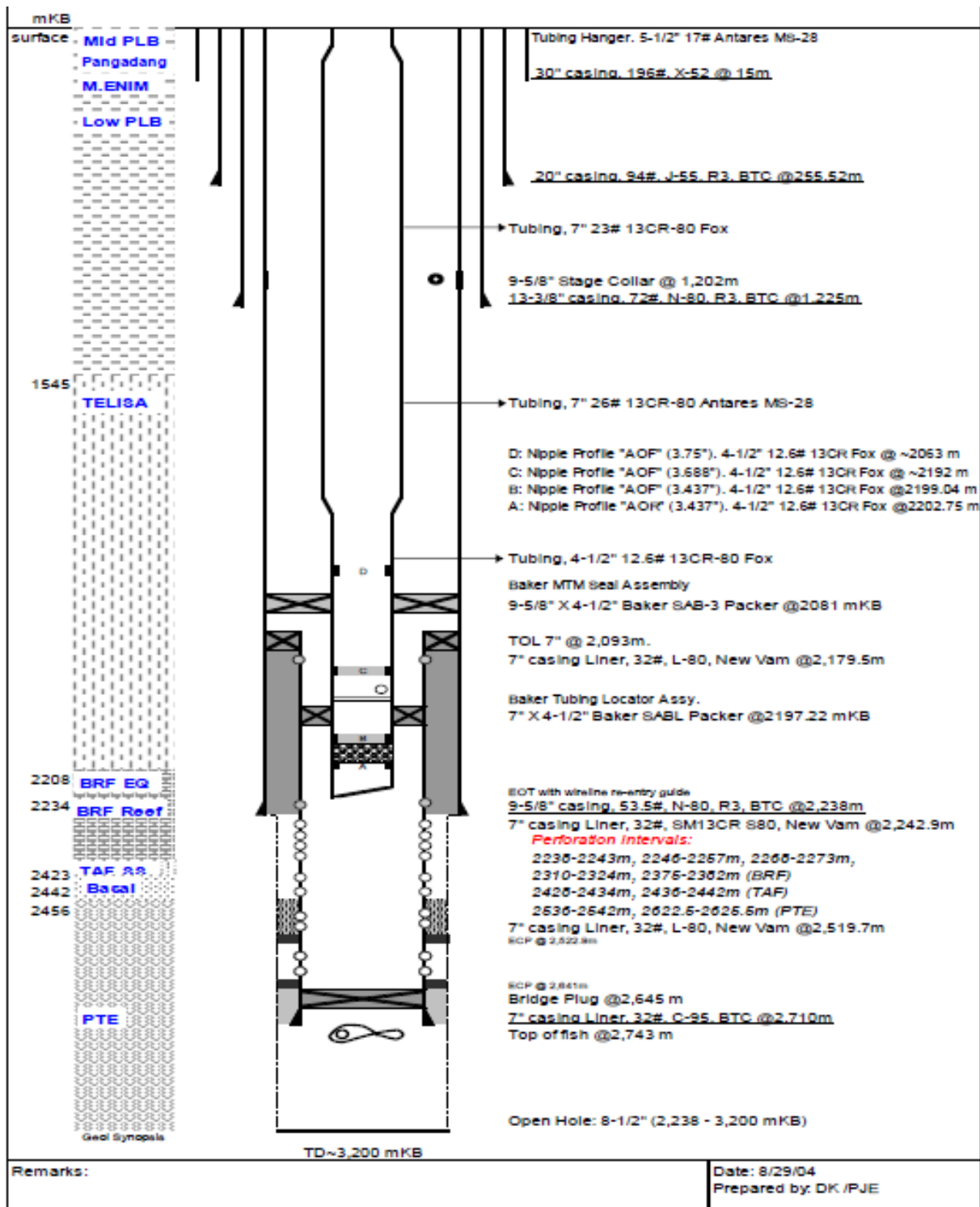
Top Body (m)	Bottom Body (m)	Body Length (m)	Max Pen Depth (m)	Max Pen (in)	Max Pen (%)	Grade
39.44	52.13	12.70	40.02	8.827	26.8	C
168.12	180.83	12.71	180.81	8.854	29.3	C
181.28	193.69	12.41	191.84	8.912	34.6	C
194.14	206.73	12.59	194.92	8.910	34.4	C
207.18	219.35	12.17	207.36	8.926	35.9	C
219.80	232.09	12.29	219.89	8.810	25.2	C
474.36	486.95	12.59	486.95	8.816	25.8	C
642.14	654.25	12.11	643.22	8.811	25.3	C
730.13	741.46	11.33	739.47	8.831	27.2	C
817.40	829.51	12.11	817.82	8.833	27.3	C
869.73	882.50	12.77	869.76	8.812	25.4	C
960.53	972.52	11.99	969.31	8.836	27.6	C
972.97	985.56	12.59	974.42	8.847	28.6	C
1011.97	1024.38	12.41	1023.48	8.813	25.5	C
1204.41	1215.76	11.35	1214.64	8.830	27.1	C
1216.26	1228.57	12.32	1218.63	8.809	25.1	C
1291.67	1303.86	12.20	1302.69	8.894	32.9	C
1304.36	1316.30	11.94	1304.86	8.928	36.1	C
1316.80	1328.98	12.18	1324.25	8.878	31.5	C
1329.48	1341.90	12.42	1340.13	8.911	34.5	C
1342.40	1354.52	12.12	1353.06	8.877	31.4	C
1467.65	1479.71	12.06	1477.86	8.875	31.2	C
1591.59	1603.89	12.30	1595.99	8.815	25.7	C
1845.79	1857.79	11.99	1856.60	8.878	31.5	C Casing Weight Changed

Table 3- Highest penetration rates in 9 5/8" casing from MFC Log

Top Body (m)	Bottom Body (m)	Body Length (m)	Nom Thk (in)	Min Thk (in)	Max Loss Depth (m)	Max Loss (%)	Grade
561.1	573.2	12.1	0.514	0.457	565.0	11.13	D
612.6	624.2	11.5	0.514	0.462	615.4	10.08	D
638.1	650.2	12.1	0.514	0.461	639.4	10.33	D

Table 6- Highest Metal Loss across 13 3/8" casing from MTD Log

Well Sketch



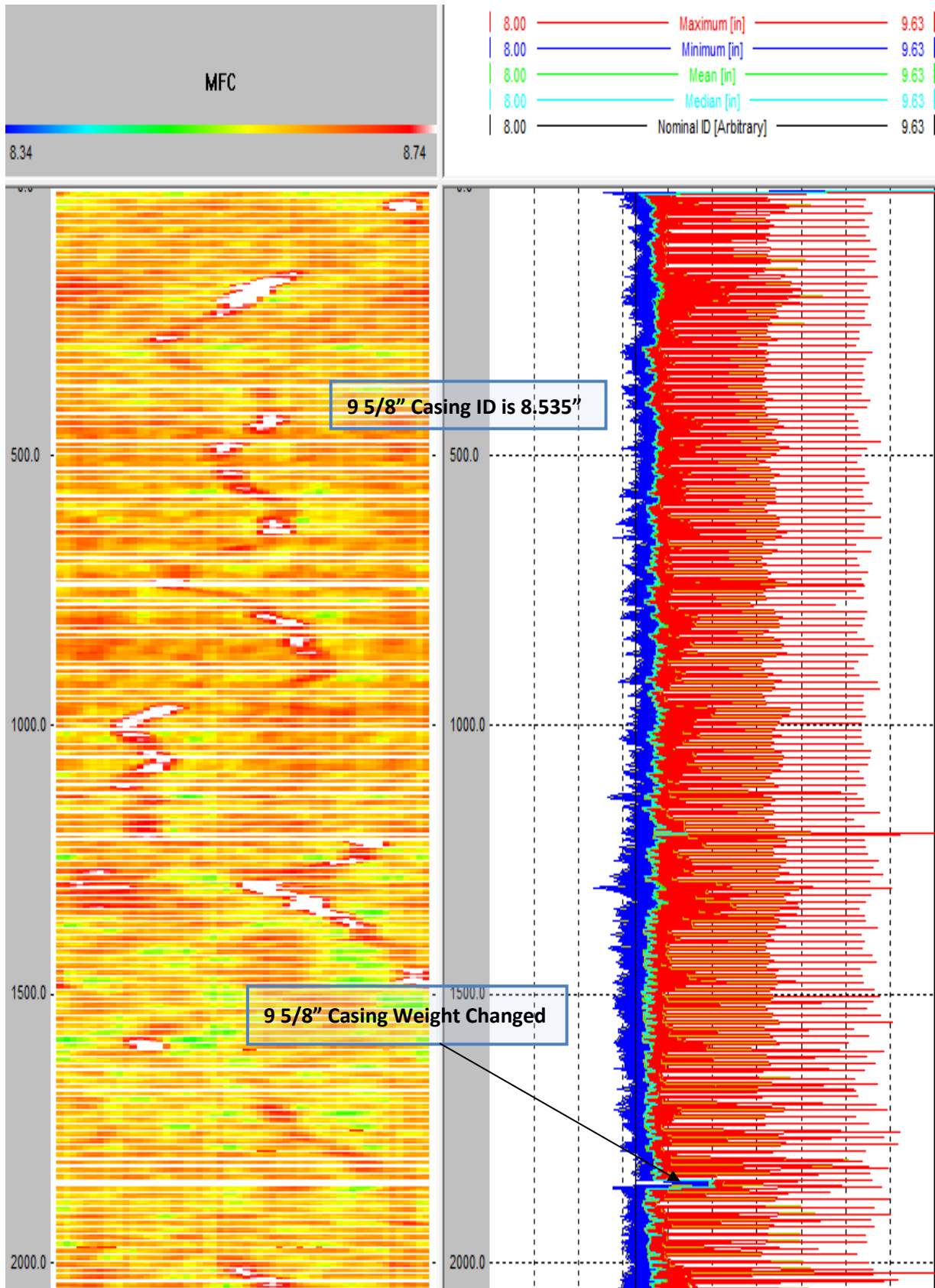


Figure 1_a- MFC data plot, entire survey interval

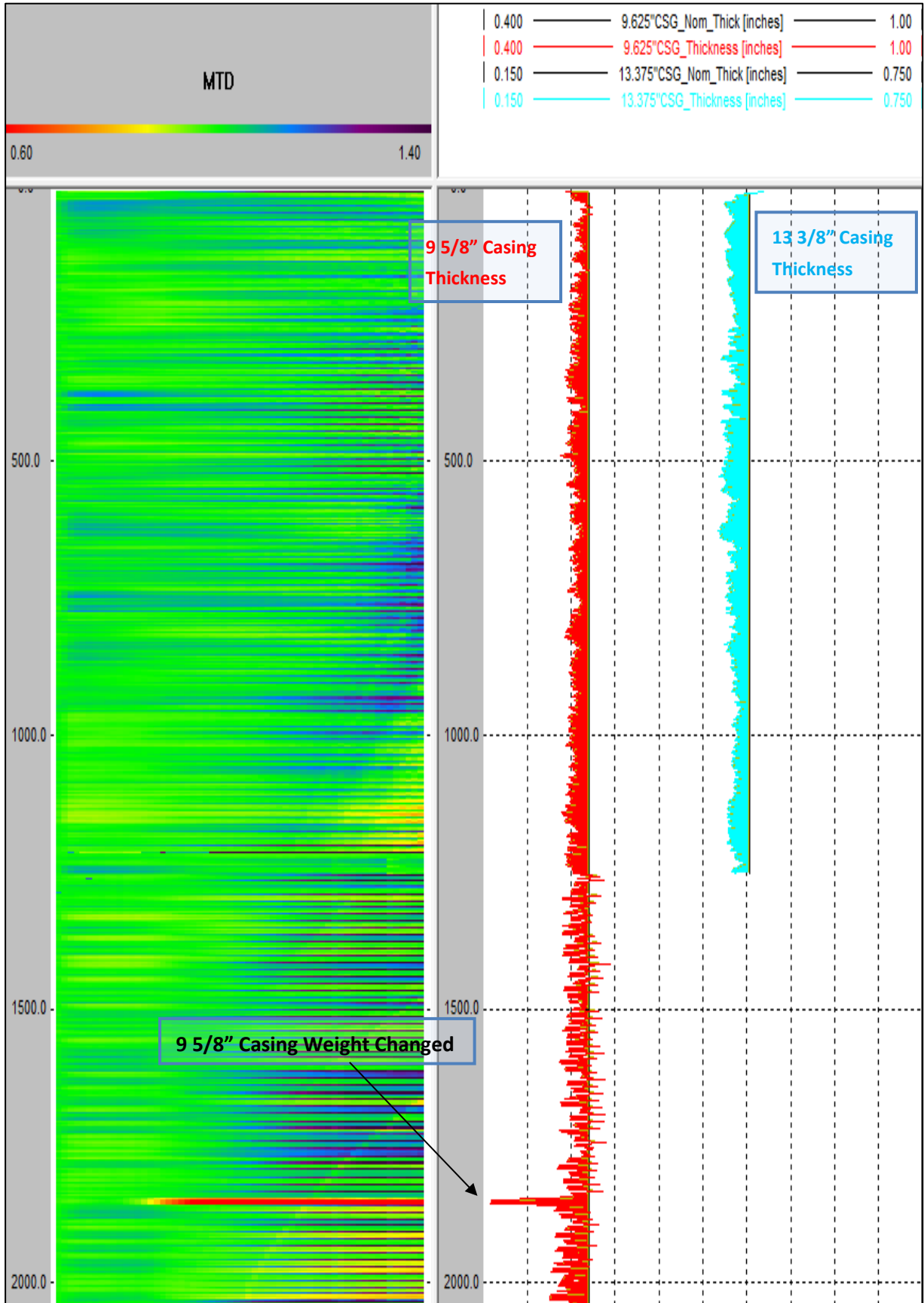


Figure 1_b- MTD data plot, entire survey interval

MFC Log Results in 9 5/8" Casing

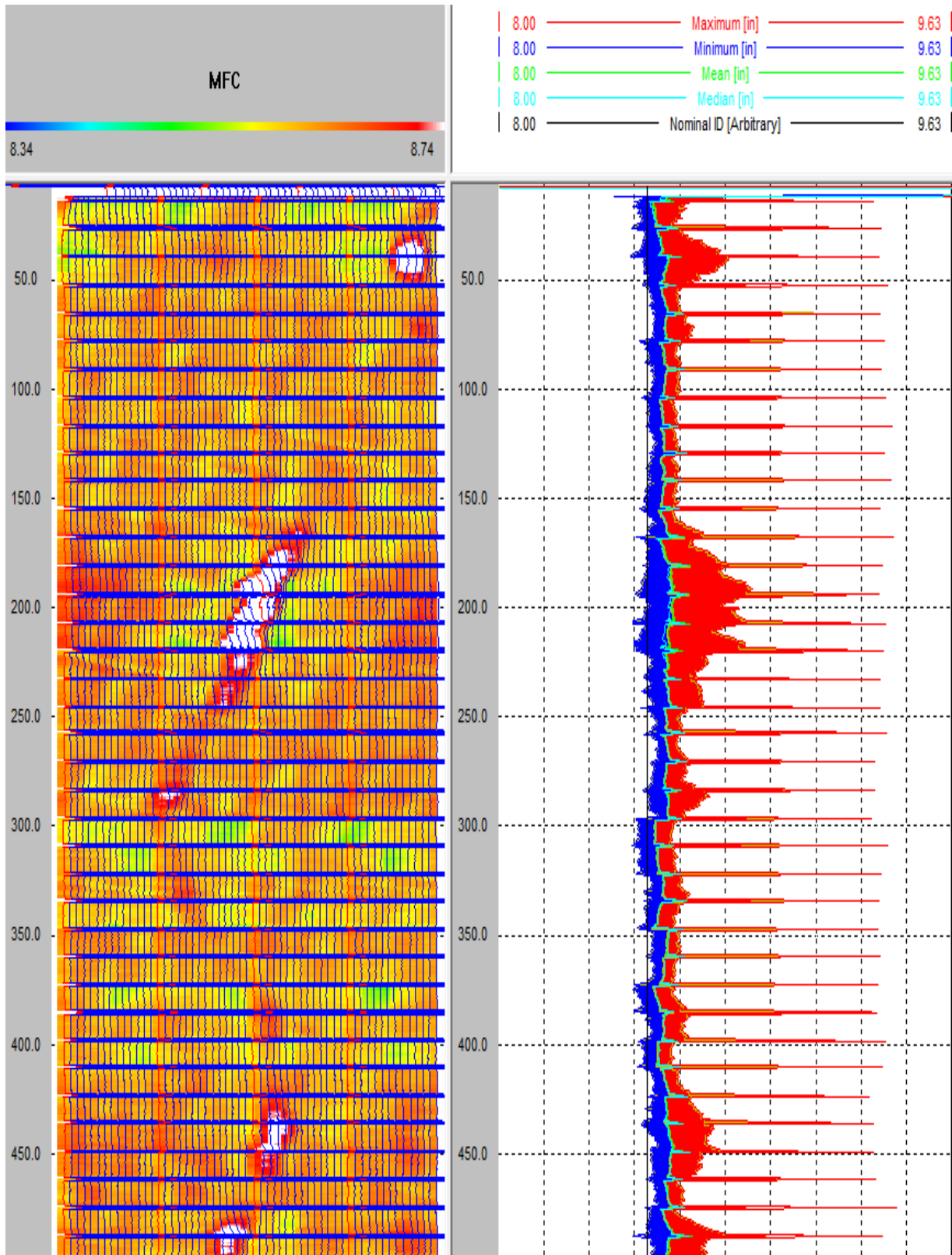


Figure 2_MFC data interval surface to 500m

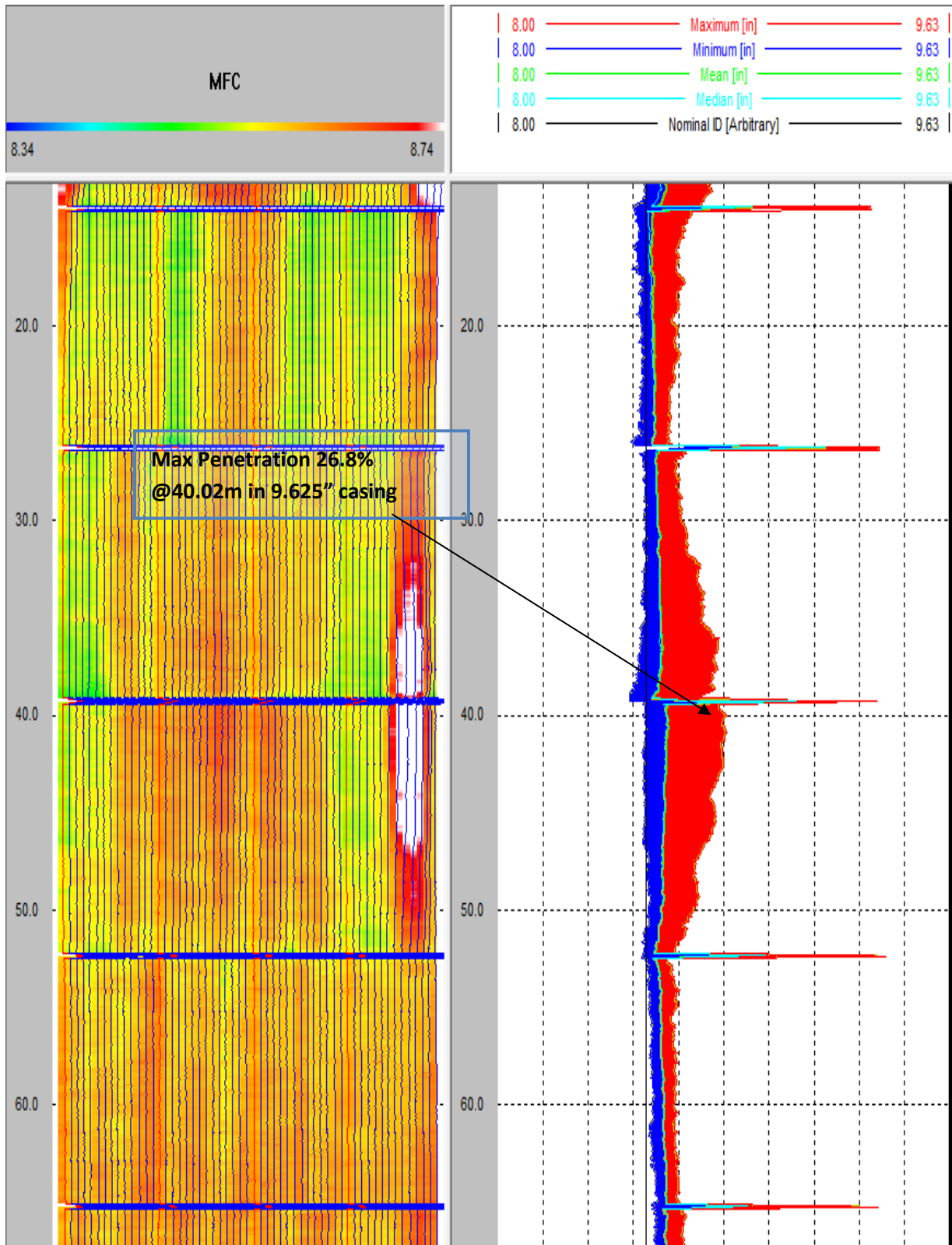


Figure 3_a - MFC data interval 12-67m- Zoom in

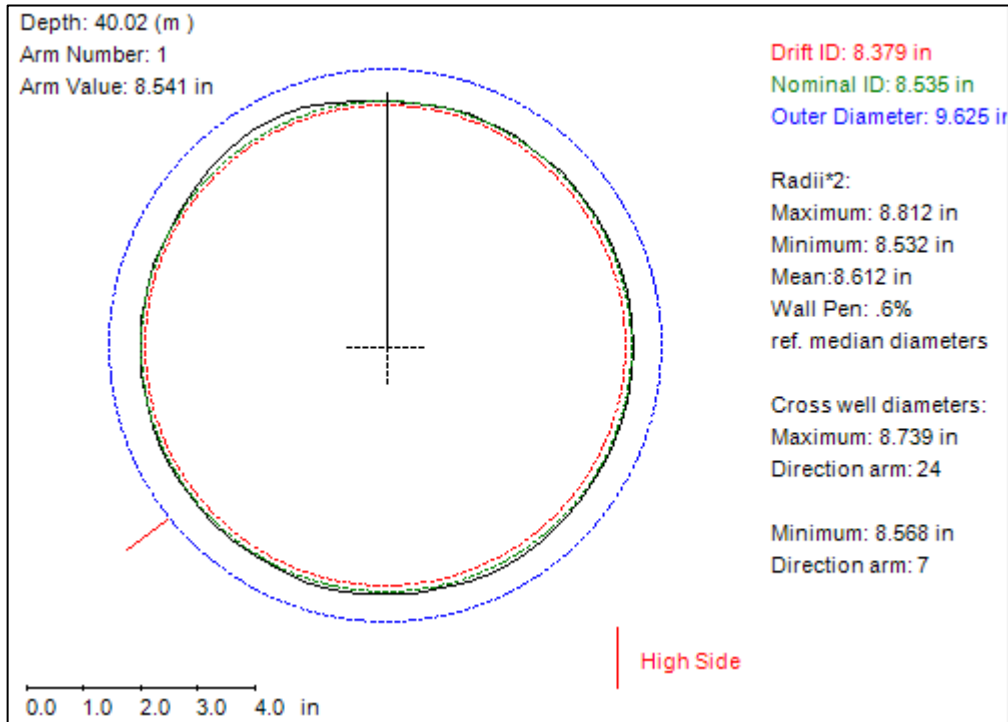


Figure 3_b- MFC data Cross-Section view at the depth 40.02m

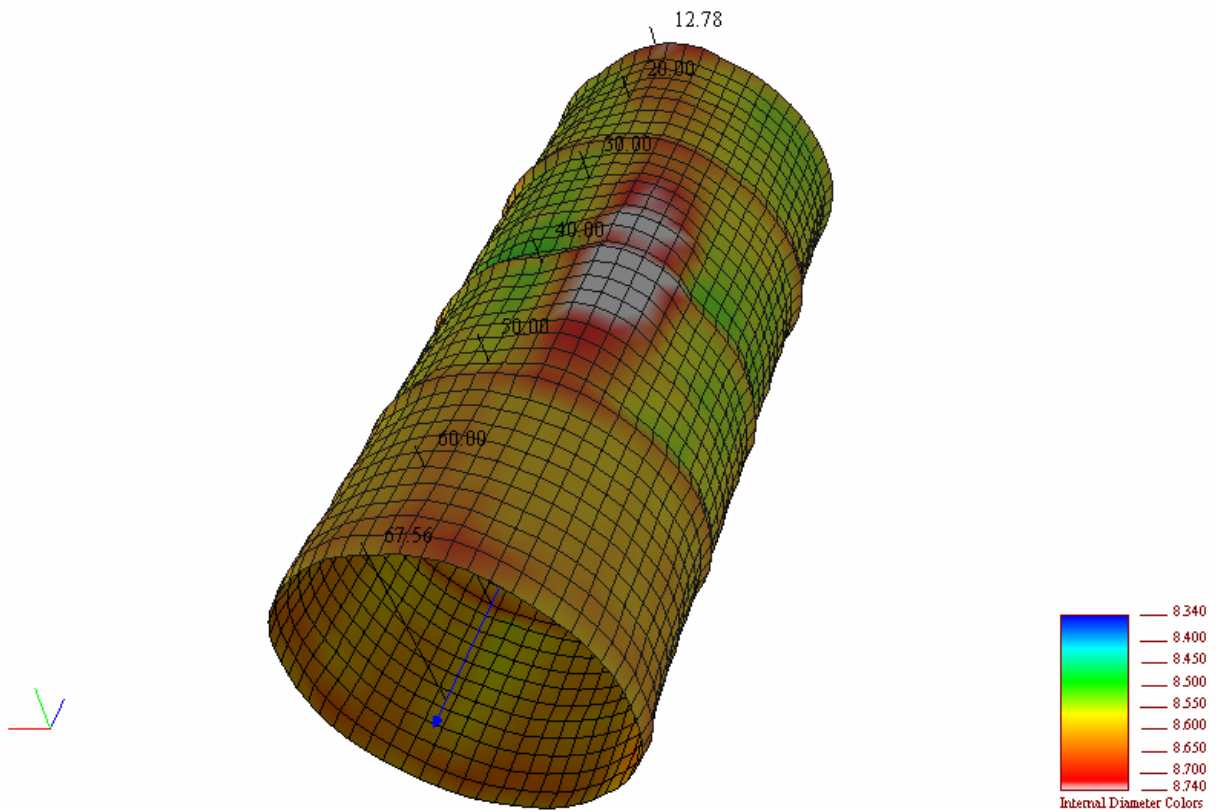


Figure 3_c- MFC data 3D visualization within the interval 12-67m

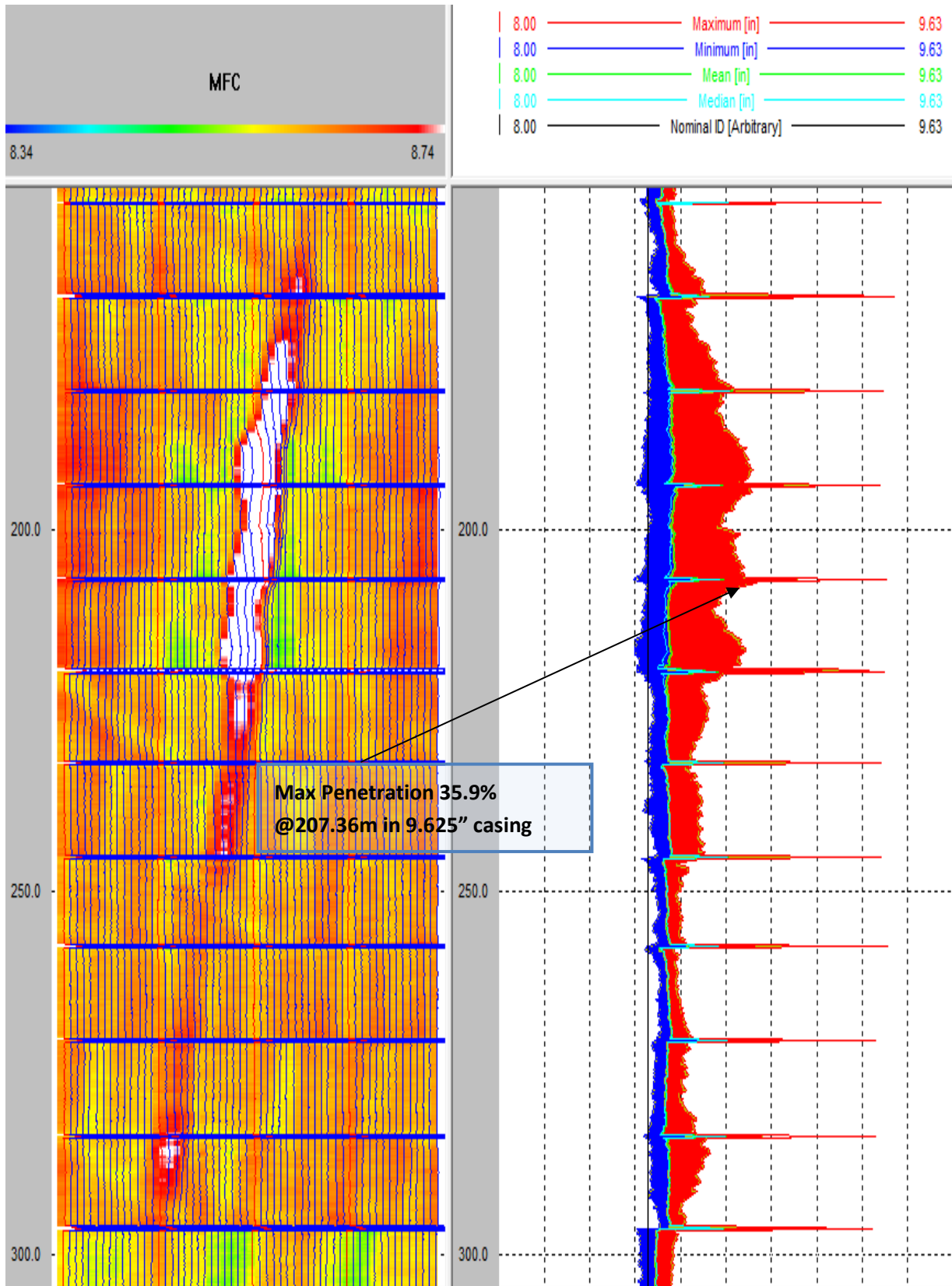


Figure 4_a - MFC data interval 153-305m- Zoom in

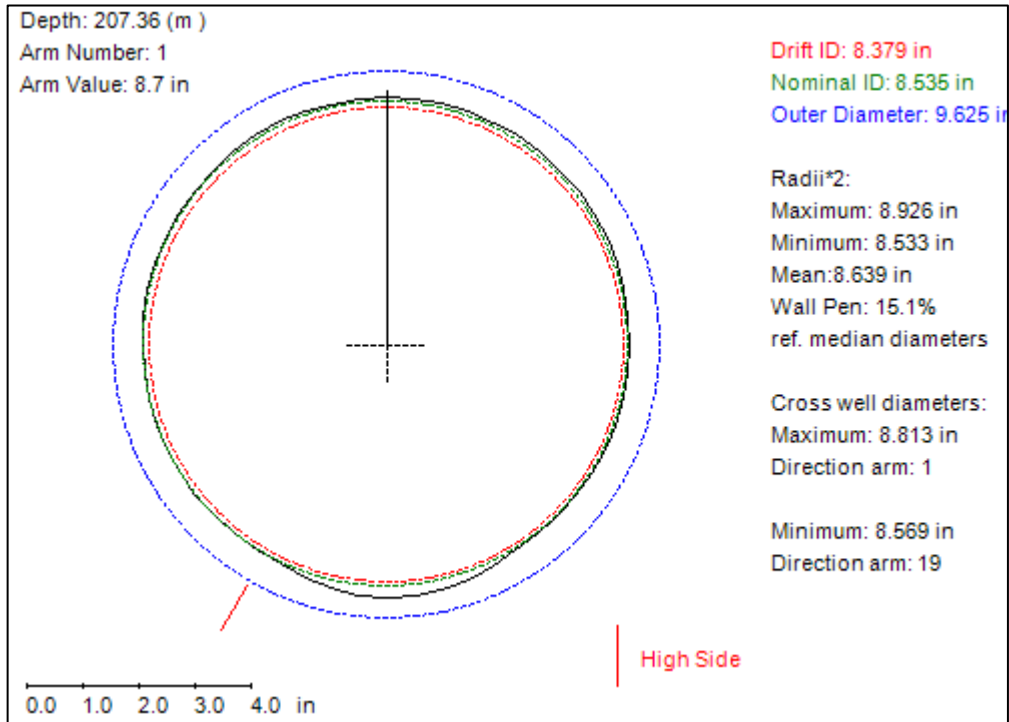


Figure 4_b- MFC data Cross-Section view at the depth 207.36m

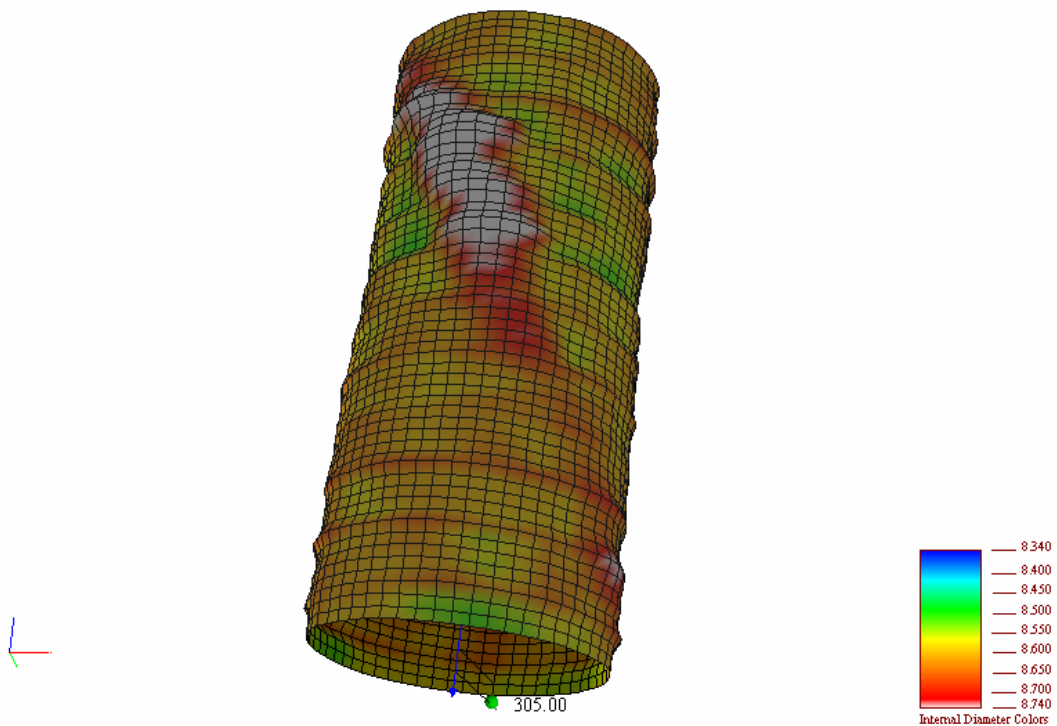


Figure 4_c- MFC data 3D visualization within the interval 153-305m

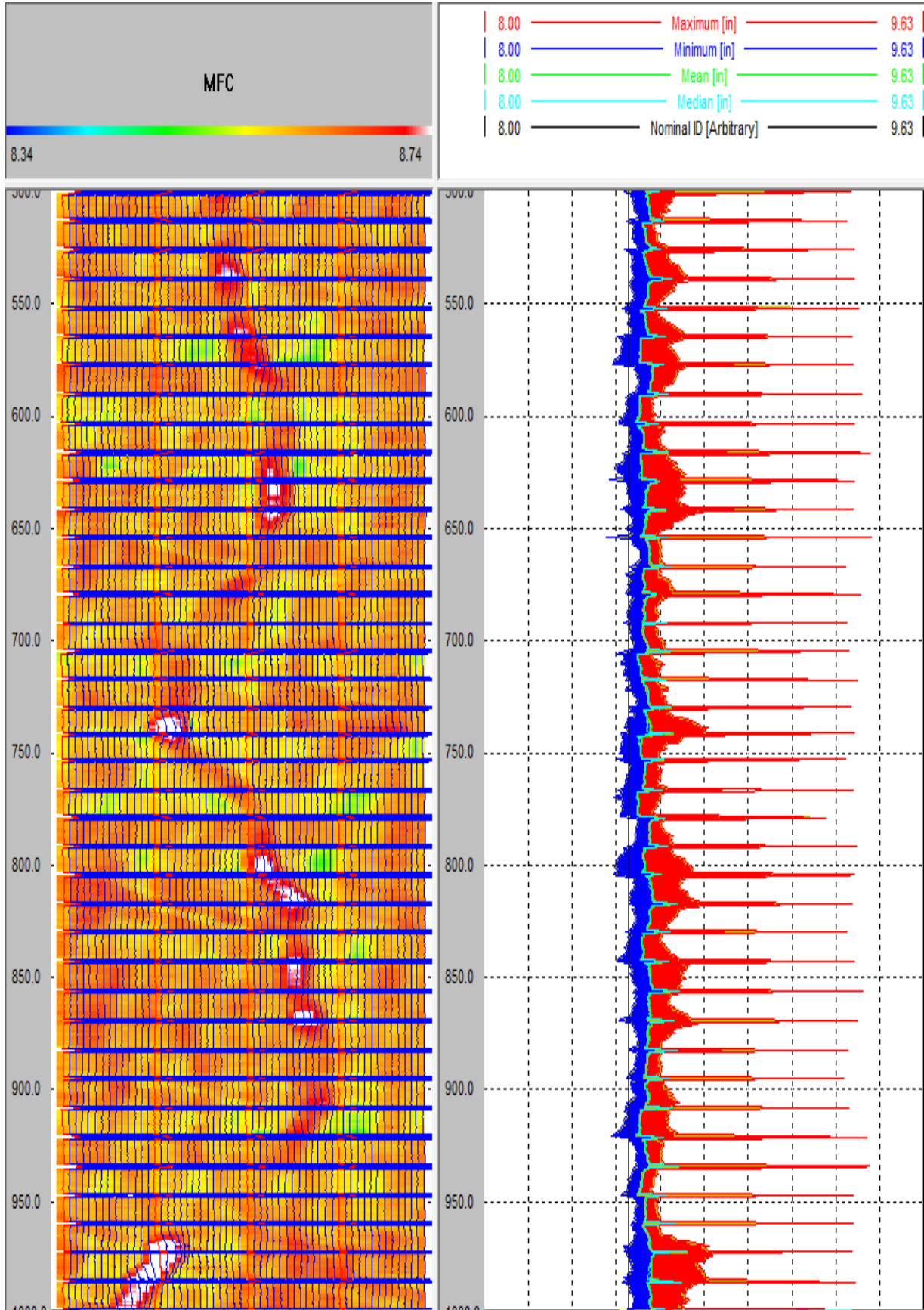


Figure 5_MFC data interval 500m to 1000m

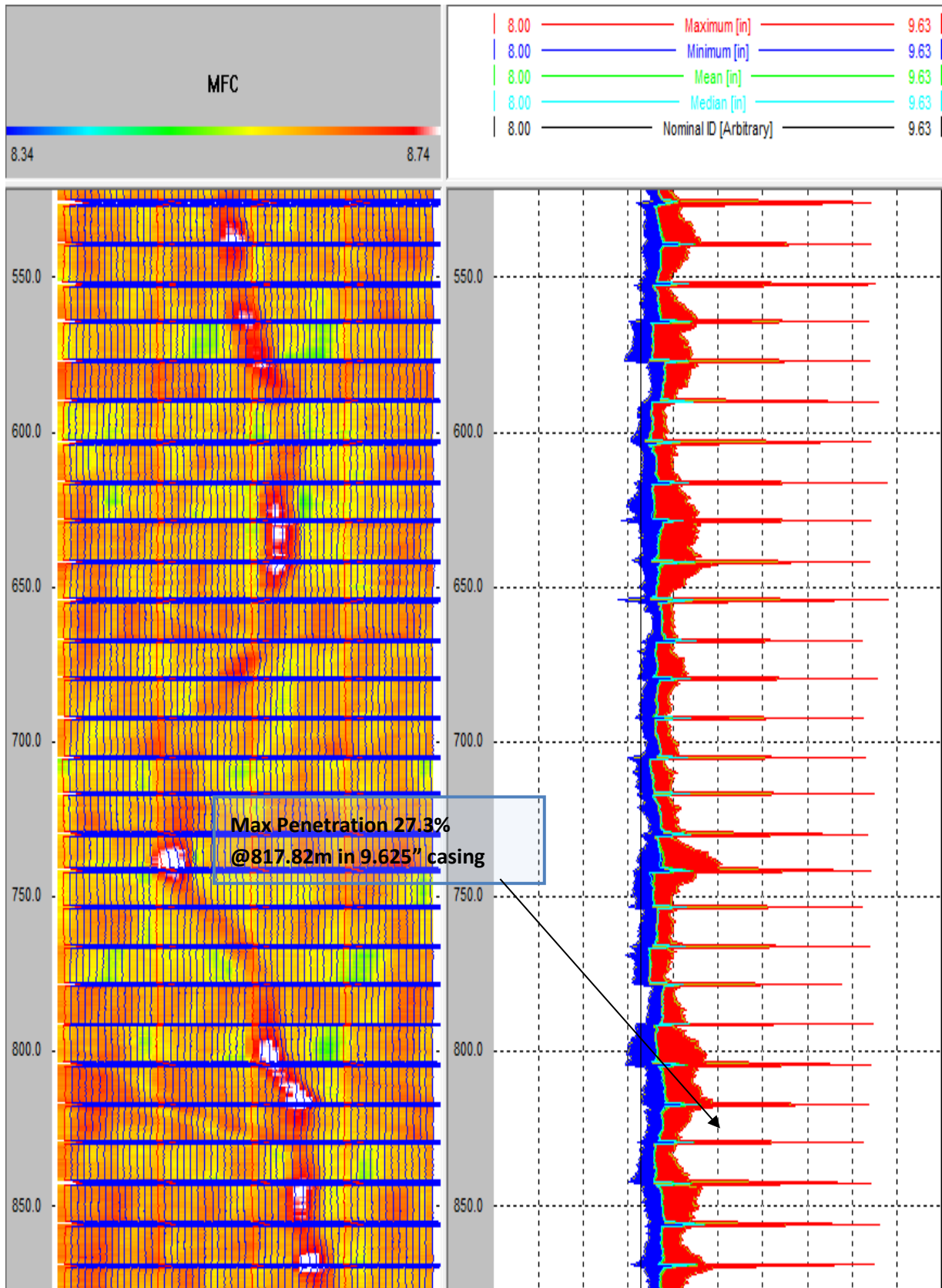


Figure 6_a - MFC data interval 522-879m- Zoom in

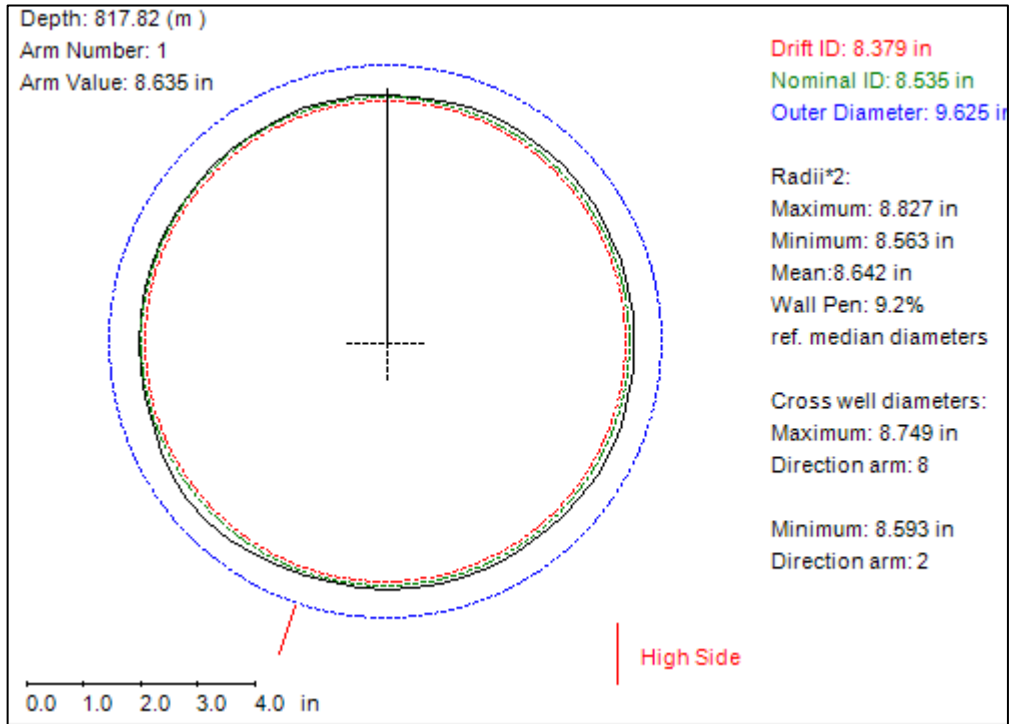
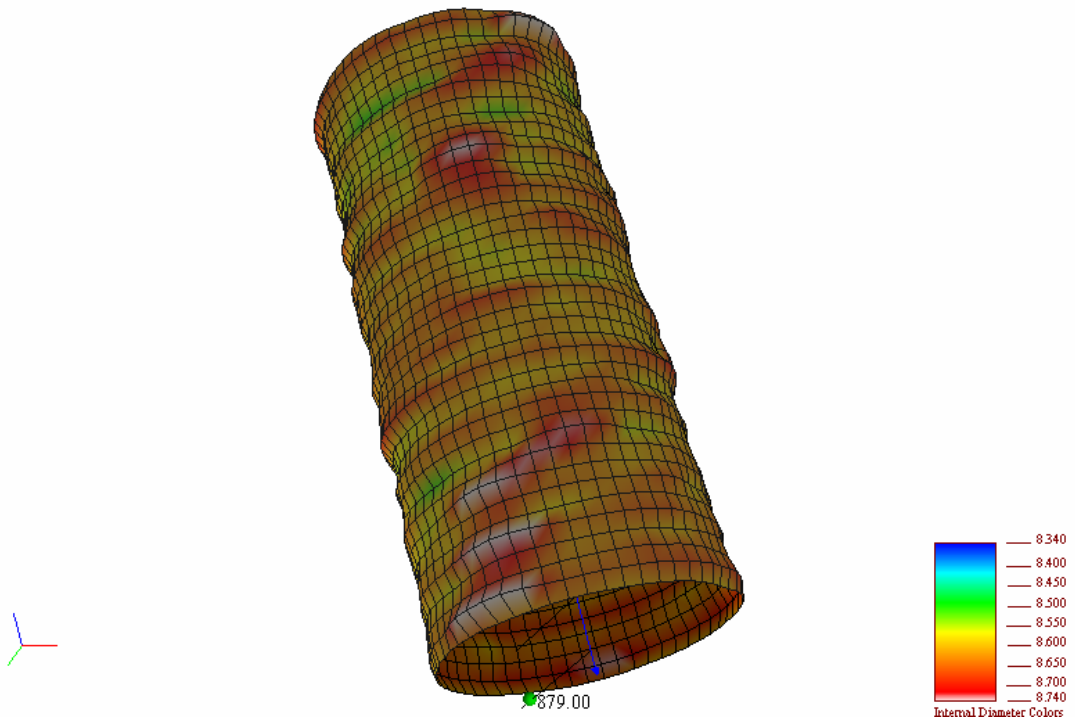


Figure 6_b- MFC data Cross-Section view at the depth 817.82m



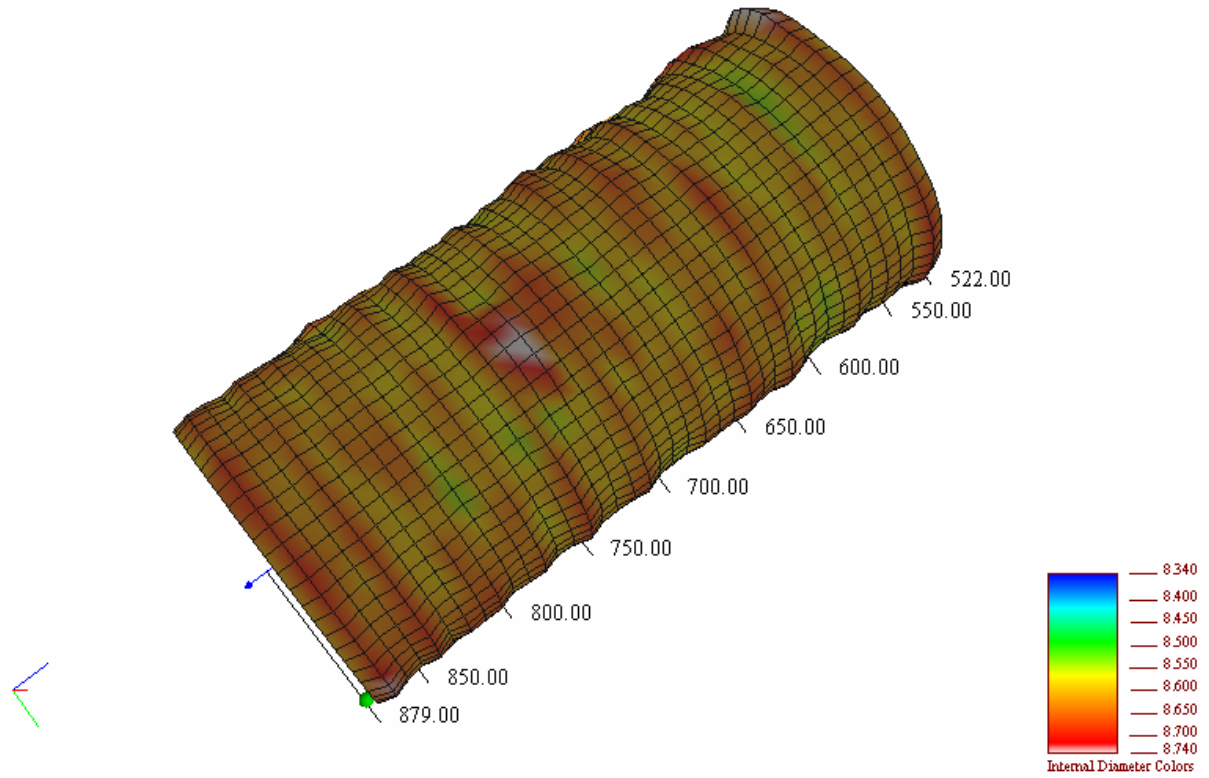


Figure 6_c– MFC data 3D visualization within the interval 522-879m

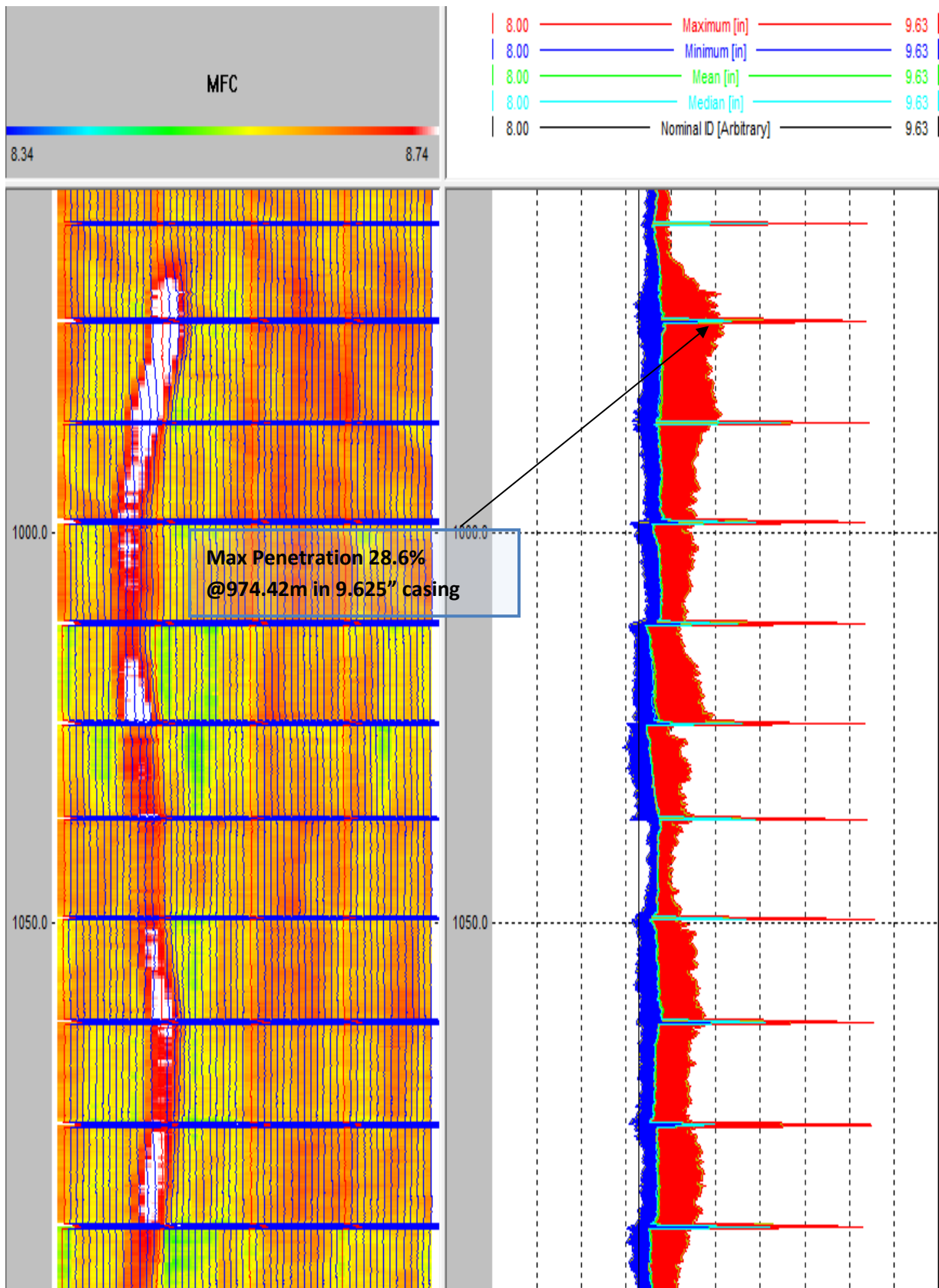


Figure 7_a - MFC data interval 956-1098m- Zoom in

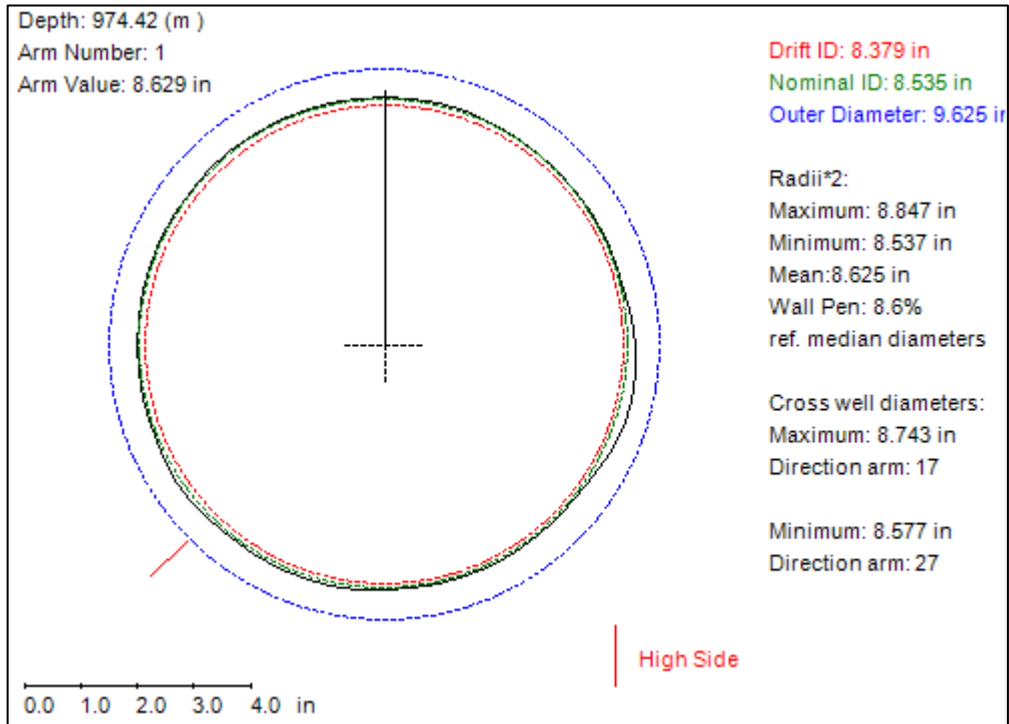


Figure 7_b- MFC data Cross-Section view at the depth 974.42m

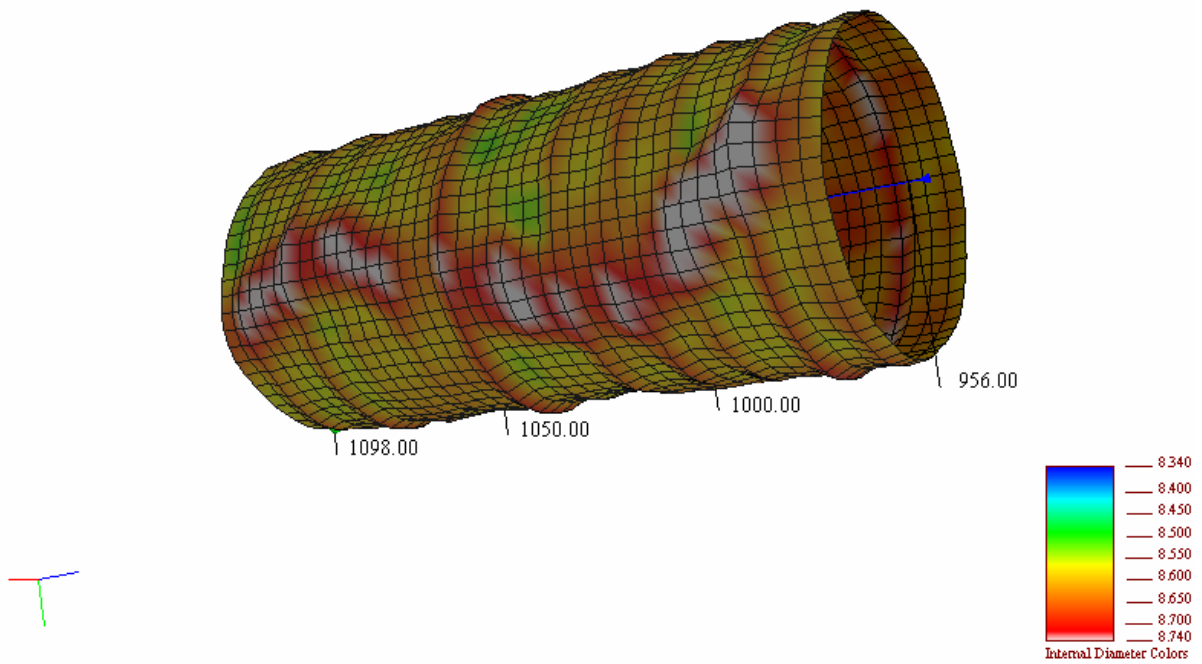


Figure 7_c- MFC data 3D visualization within the interval 956-1098m

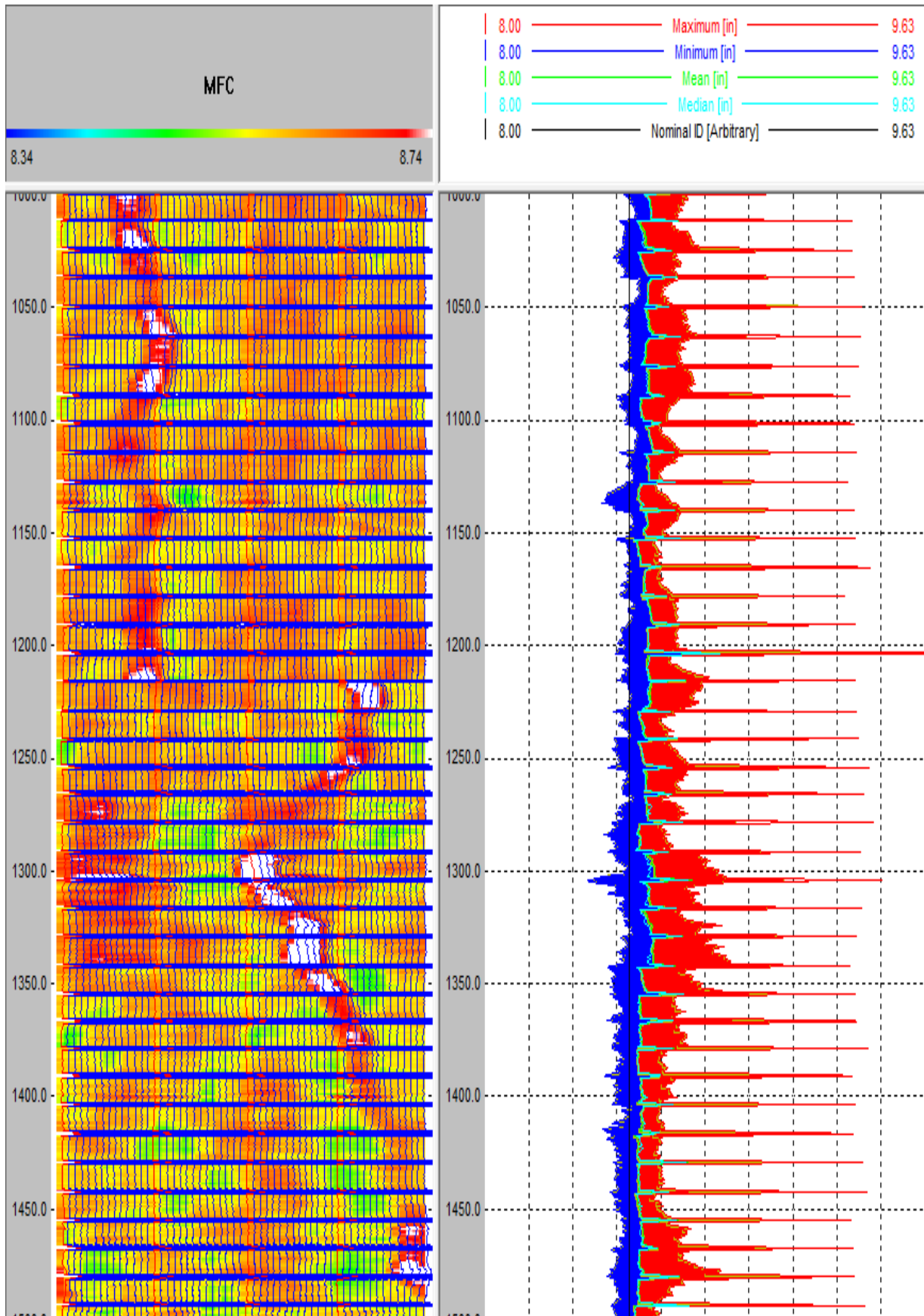


Figure 8_MFC data interval 1000m to 1500m

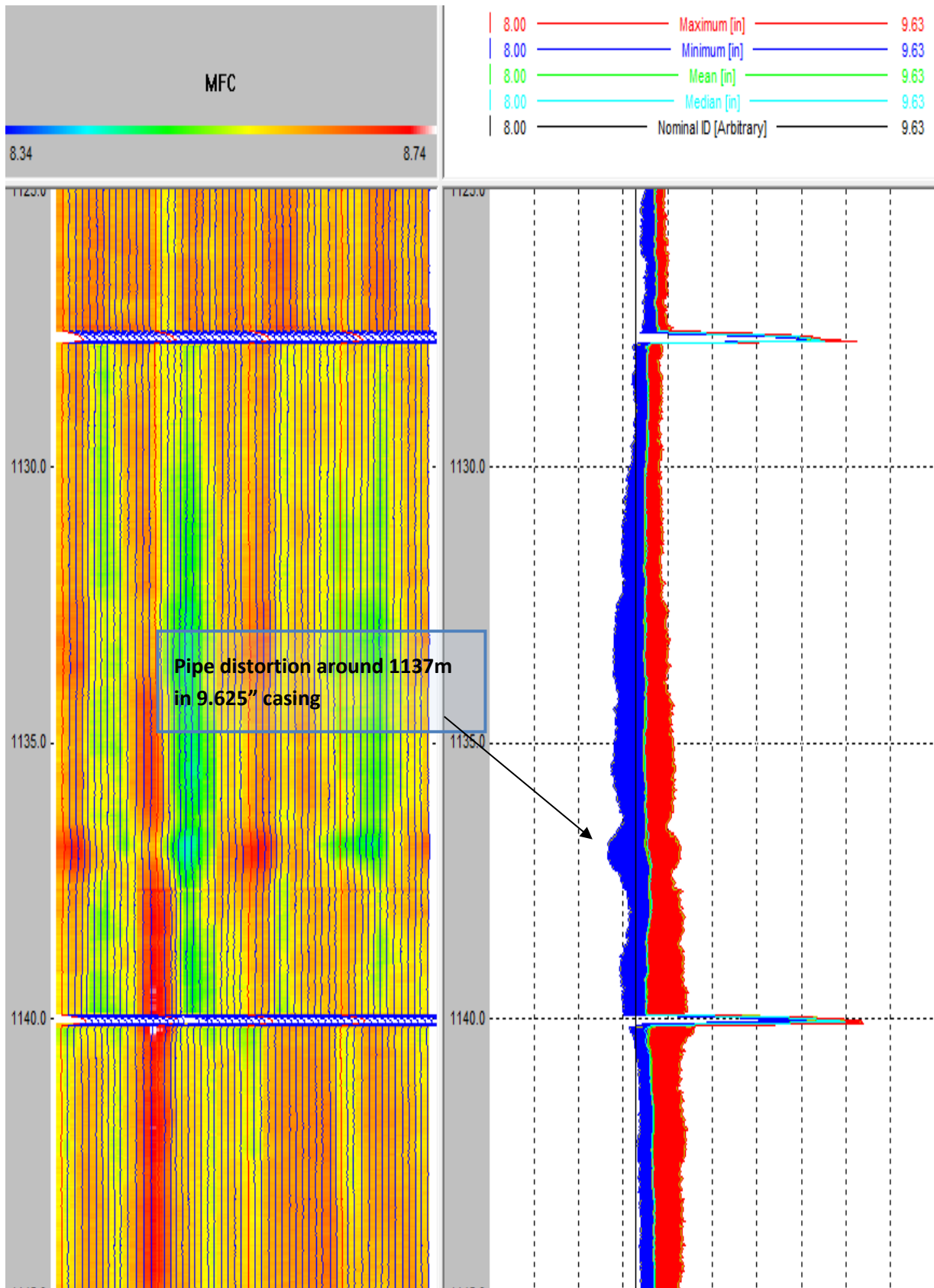


Figure 9_a - MFC data interval 1125-1145m- Zoom in

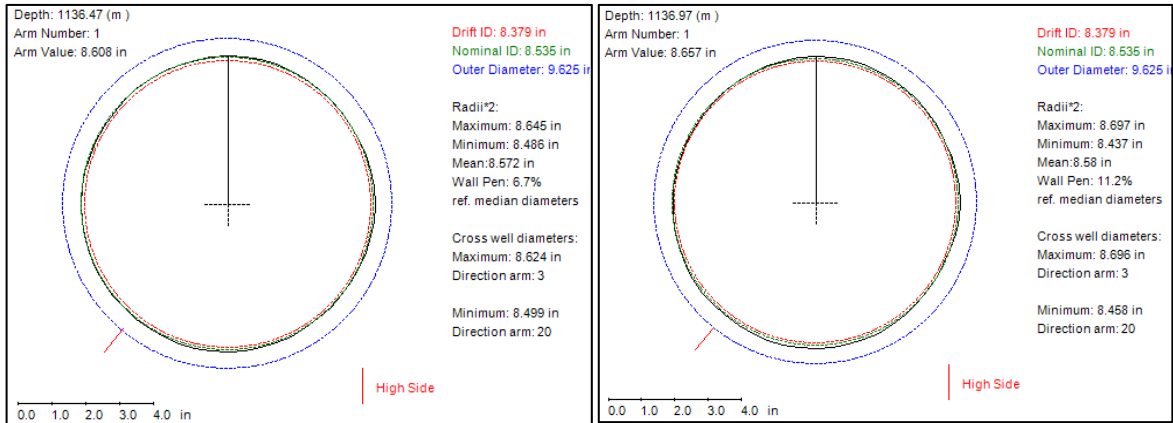


Figure 9_b- MFC data Cross-Section view at the depth 1136.47 and 1136.97m

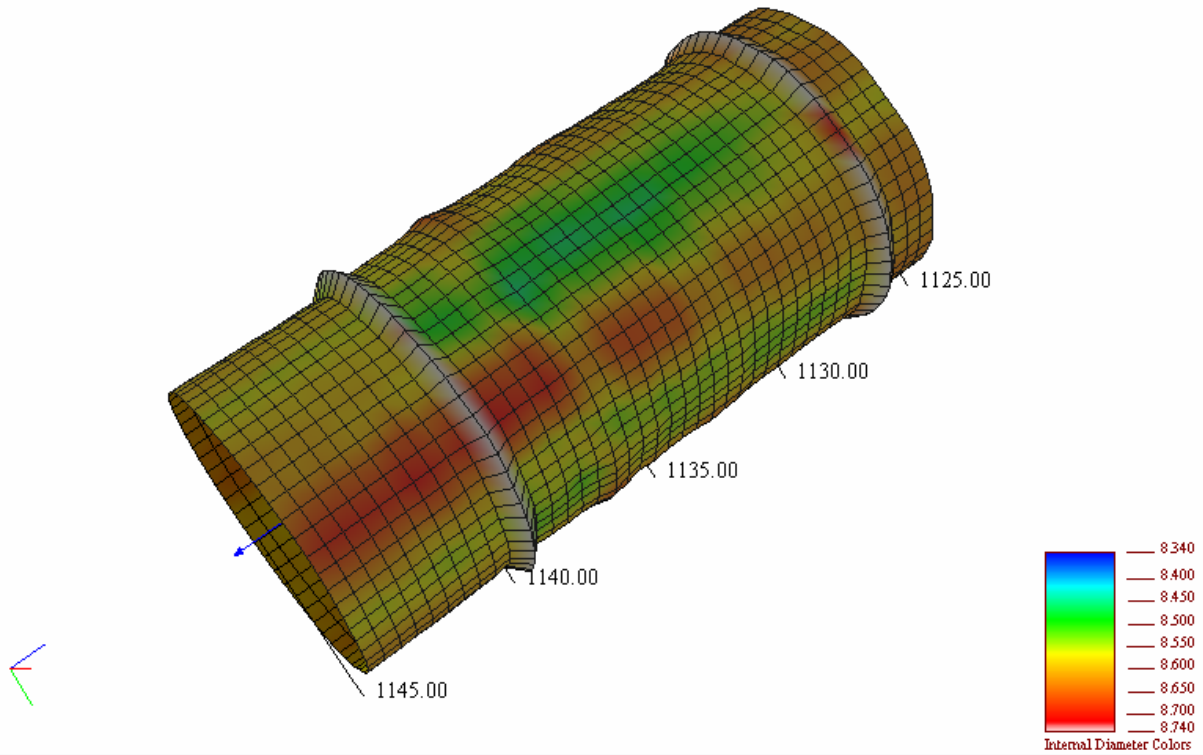


Figure 9_c- MFC data 3D visualization within the interval 1125-1145m

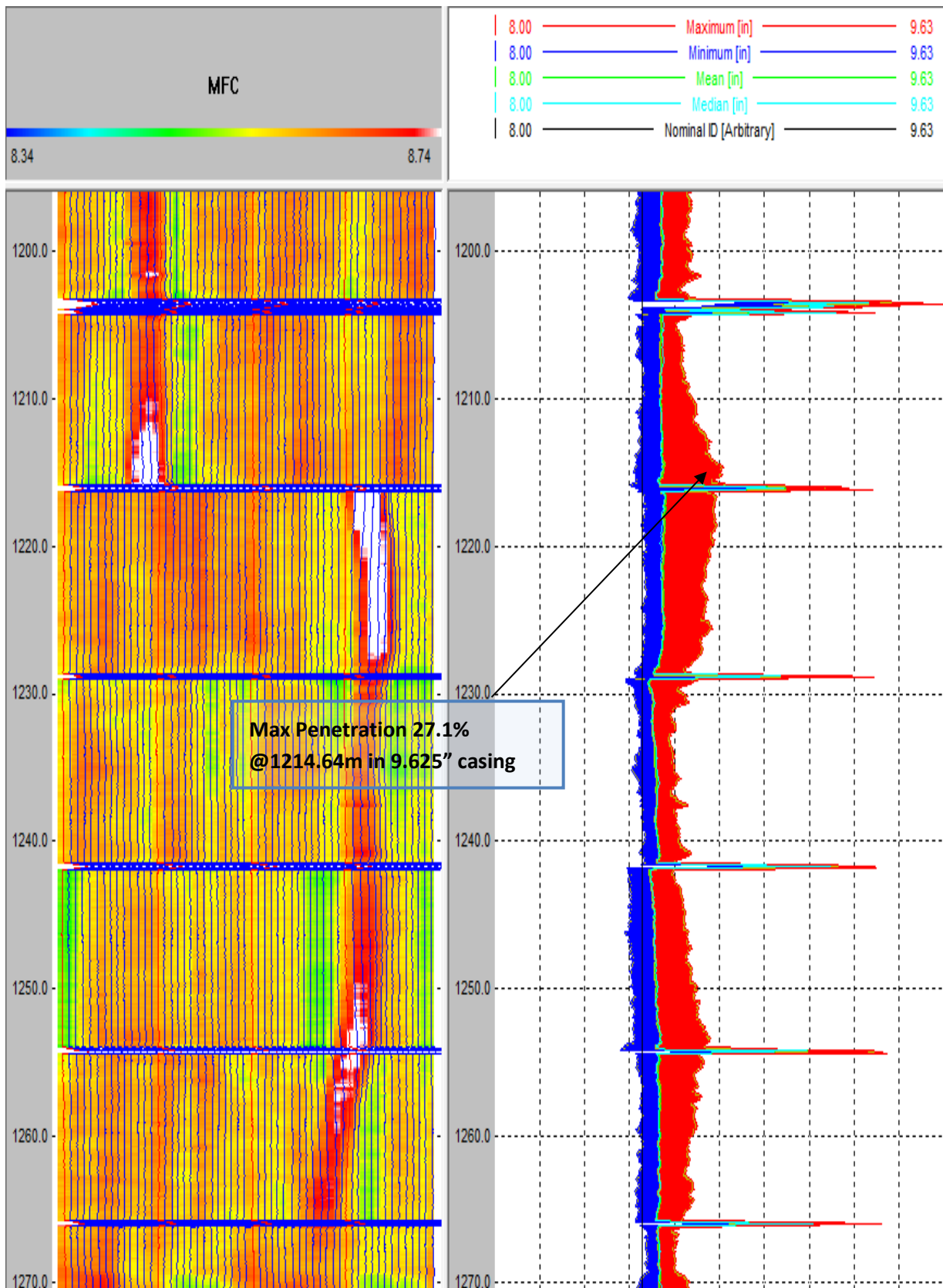


Figure 10_a - MFC data interval 1196-1271m - Zoom in

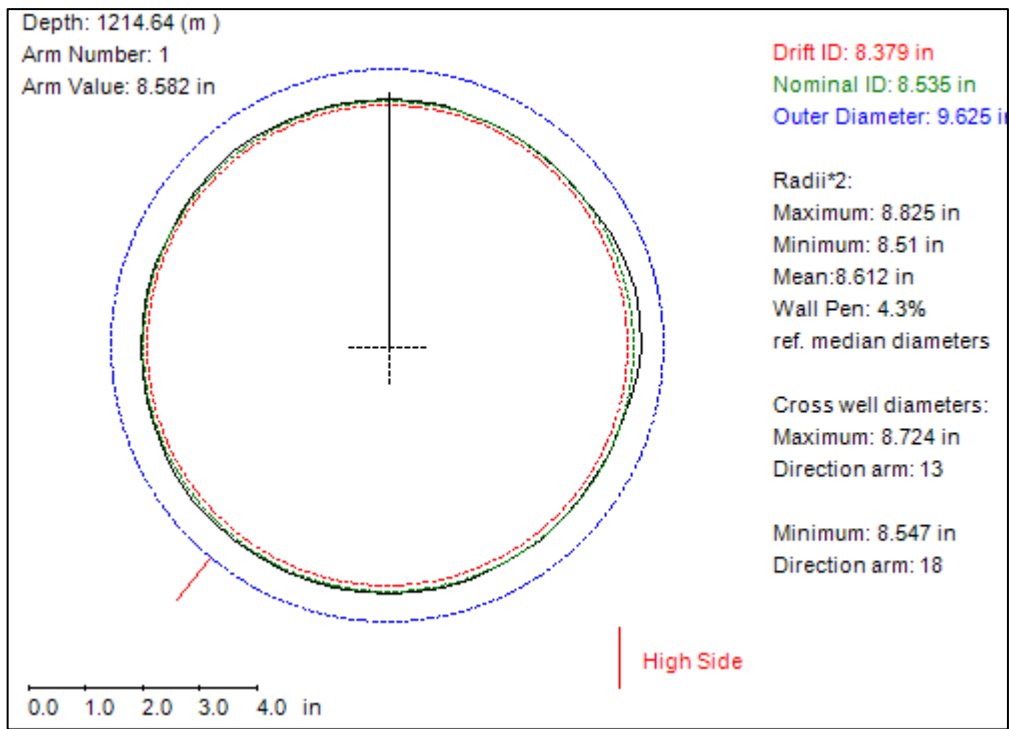


Figure 10_b- MFC data Cross-Section view at the depth 1214.64m

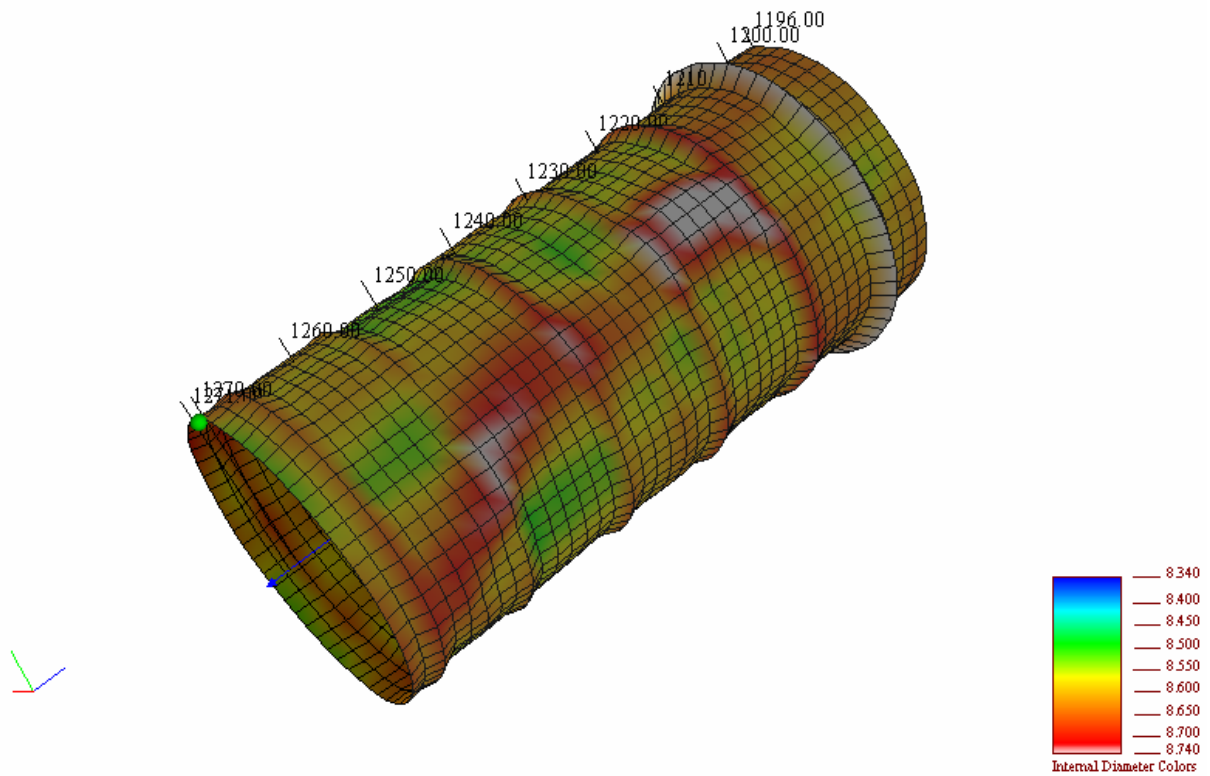


Figure 10_c – MFC data 3D visualization within the interval 1196-1271m

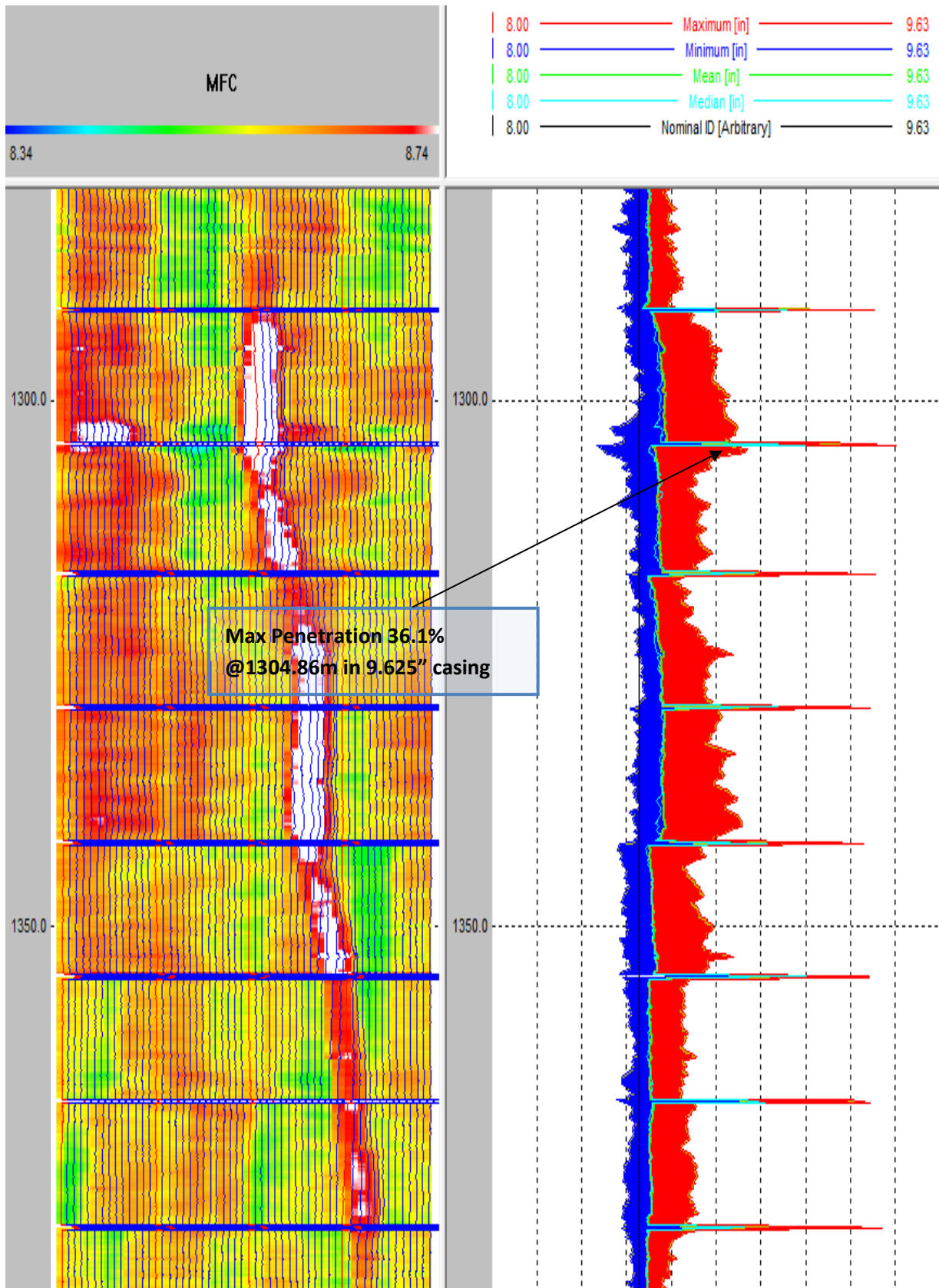


Figure 11_a - MFC data interval 1280-1385m- Zoom in

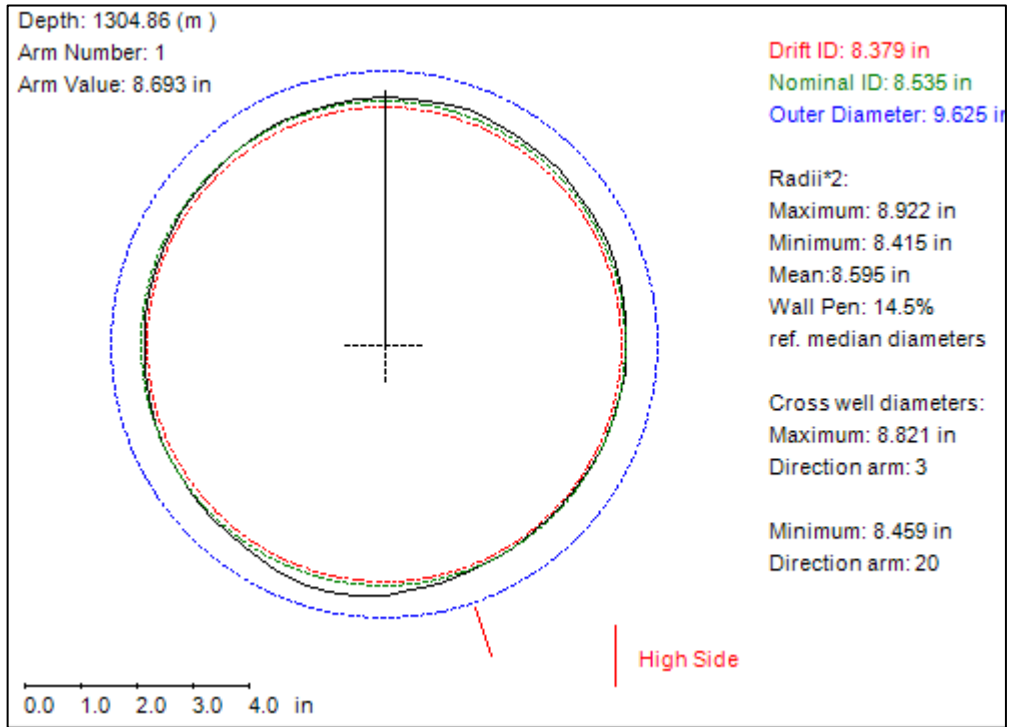


Figure 11_b- MFC data Cross-Section view at the depth 1304.86m

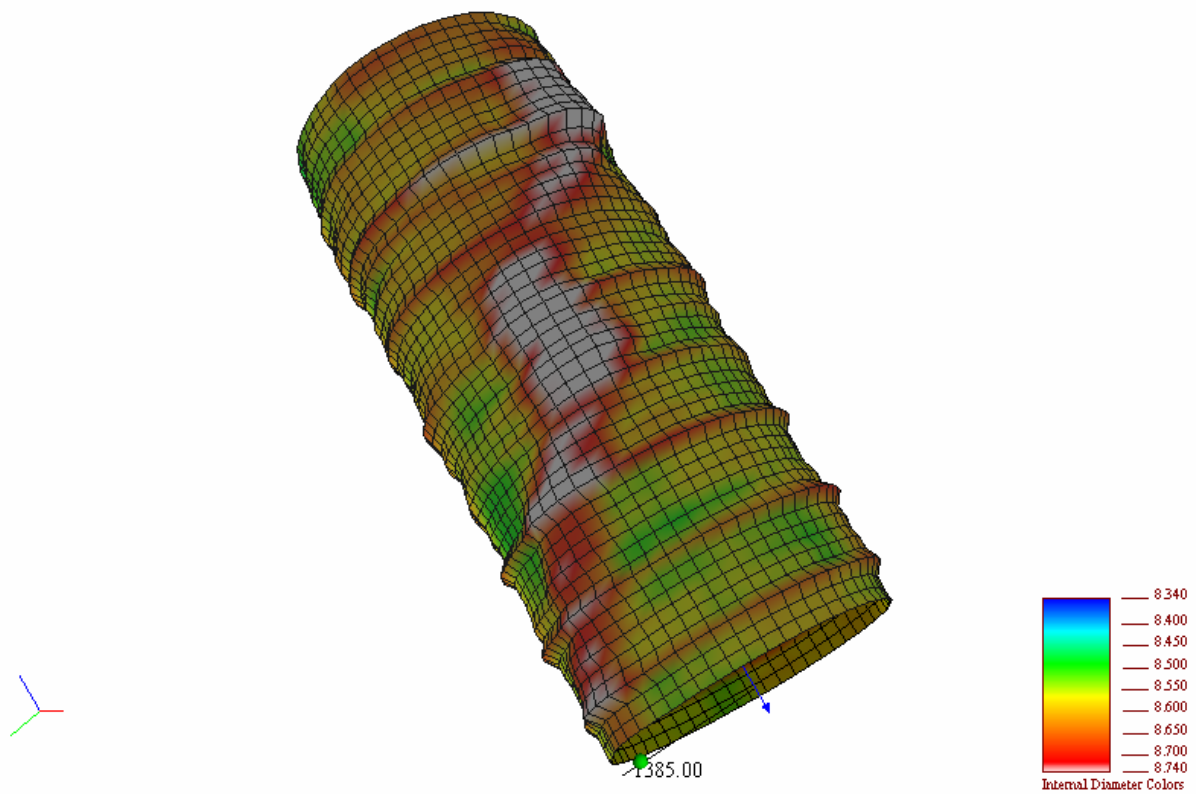


Figure 11_c- MFC data 3D visualization within the interval 1280-1385m

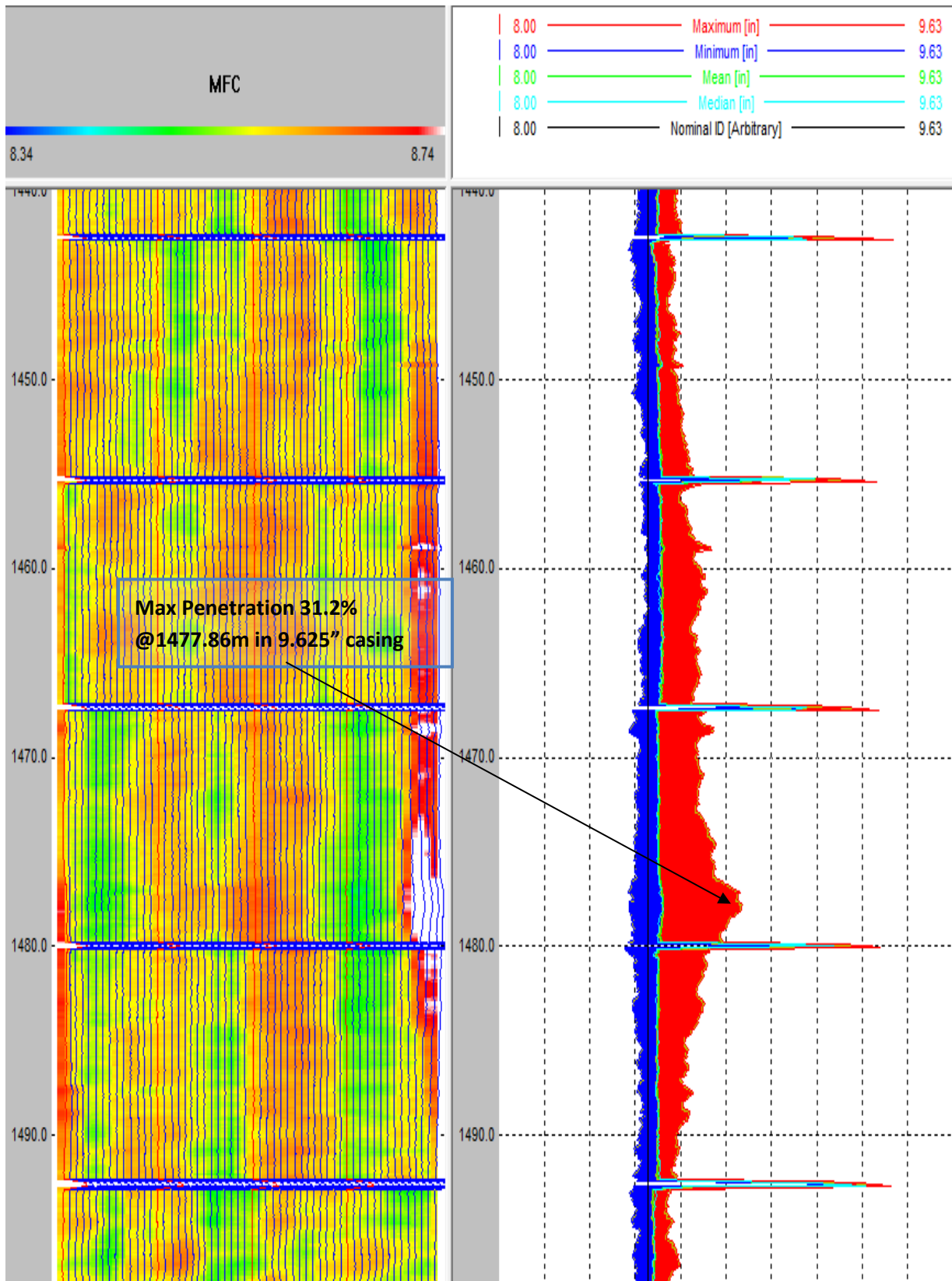


Figure 12_a - MFC data interval 1440-1498m- Zoom in

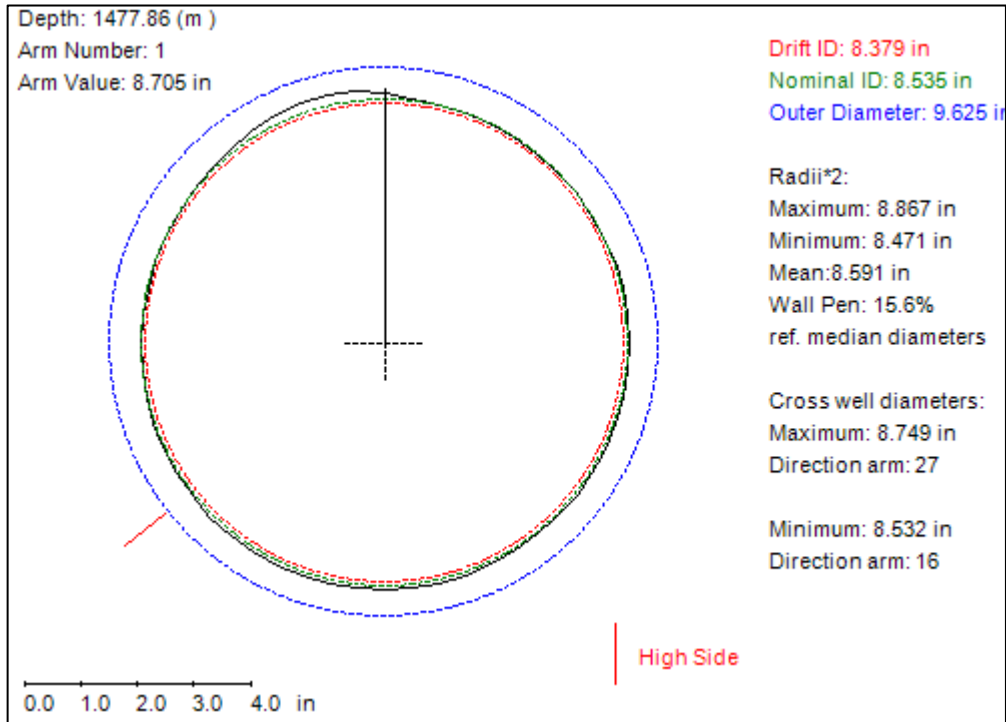


Figure 12_b- MFC data Cross-Section view at the depth 1477.86m

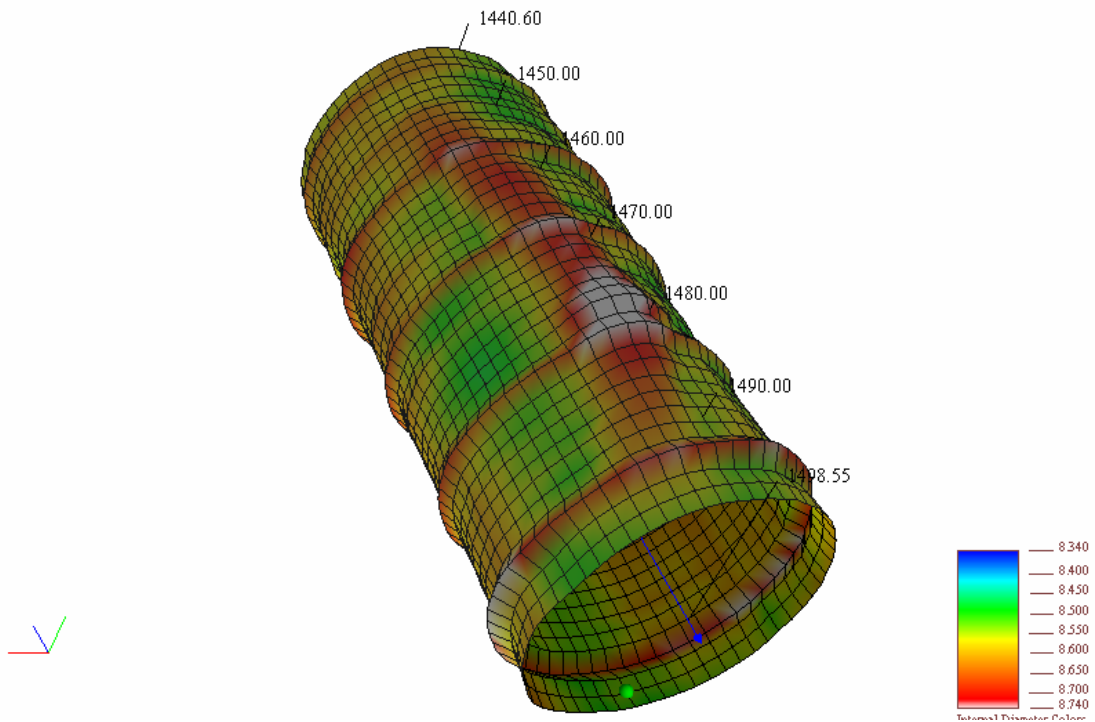


Figure 12_c- MFC data 3D visualization within the interval 1440-1498m

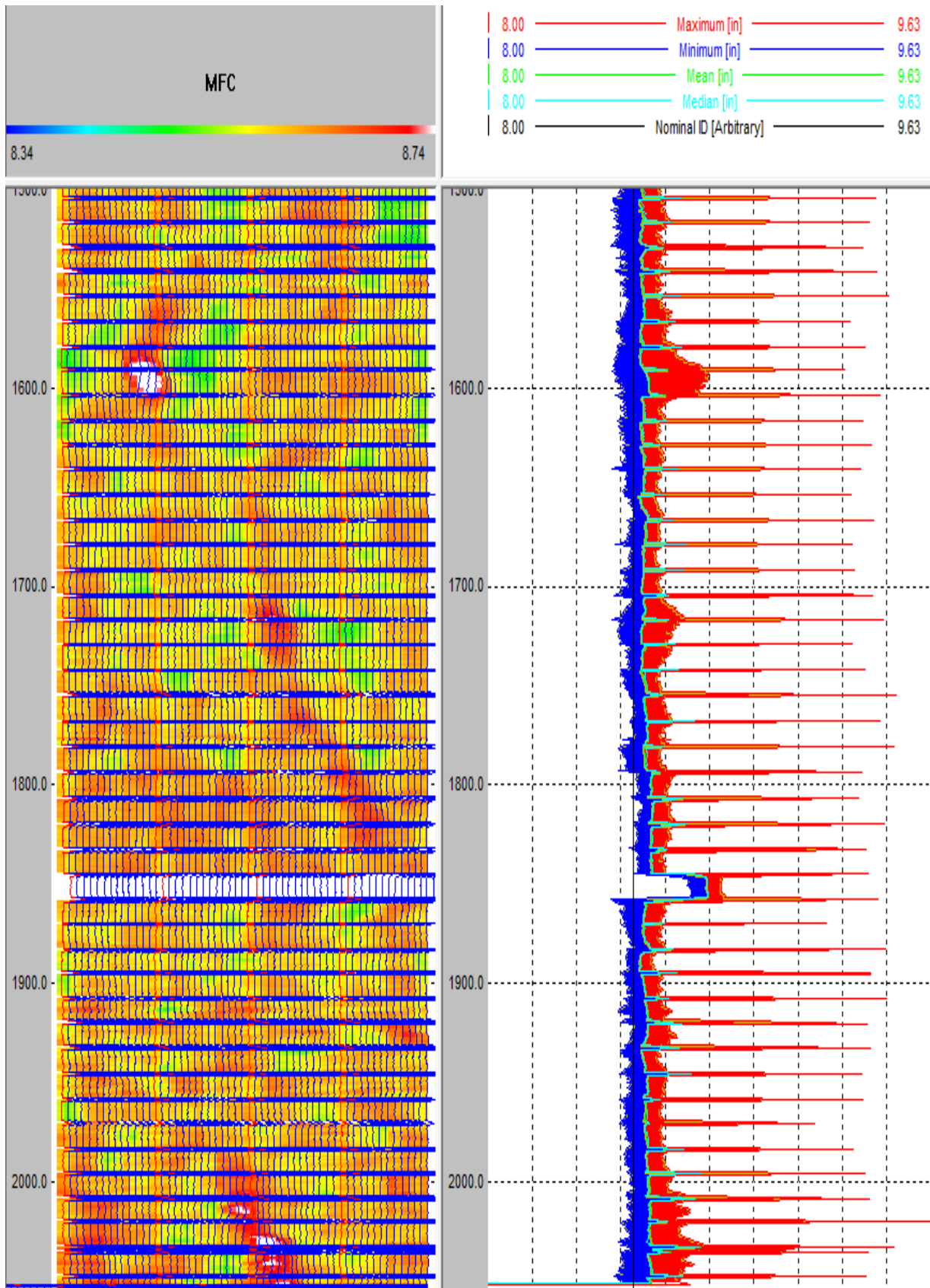


Figure 13_MFC data interval 1500m to 2055m

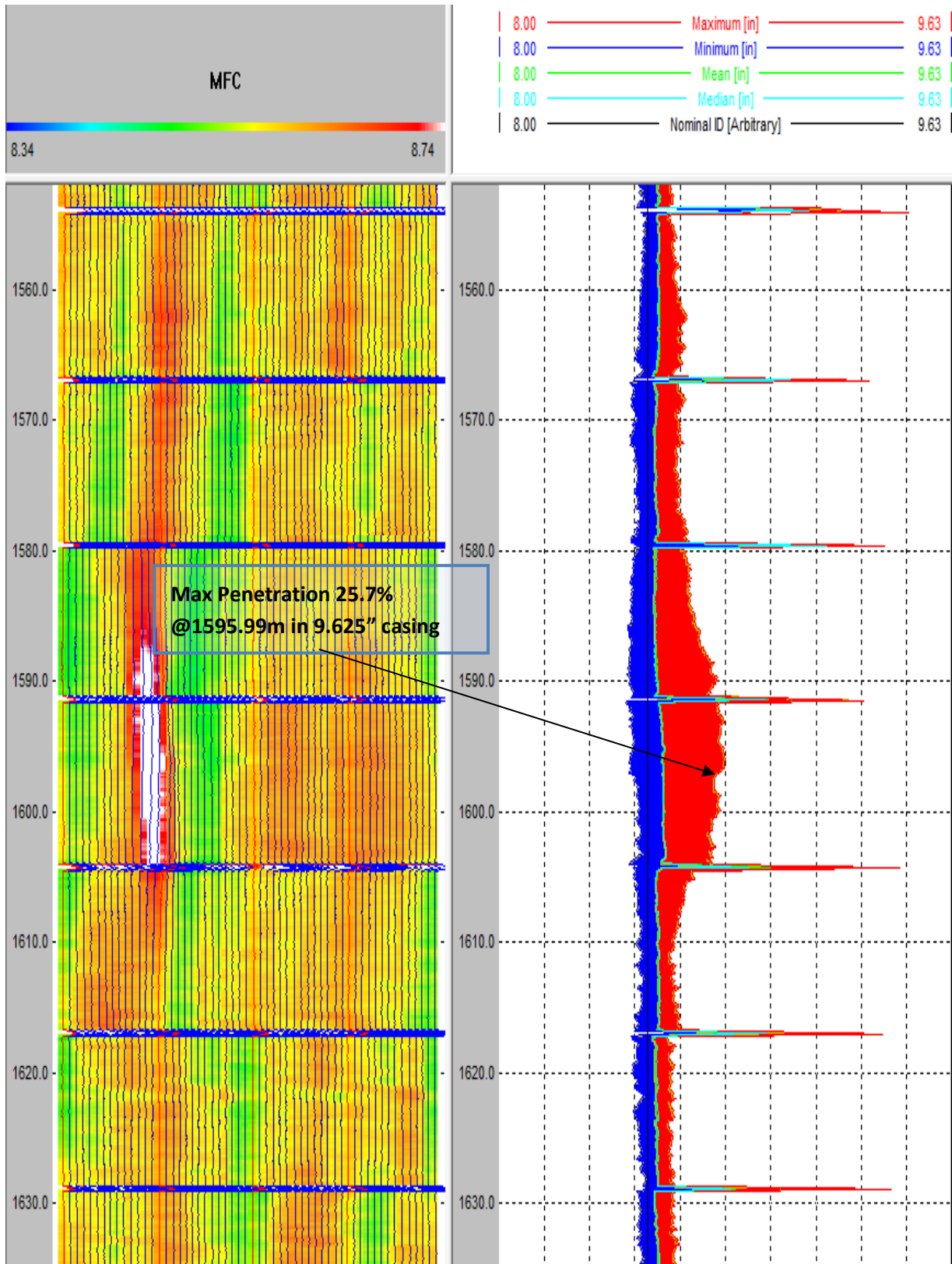


Figure 14_a – MFC data interval 1552-1635m- Zoom in

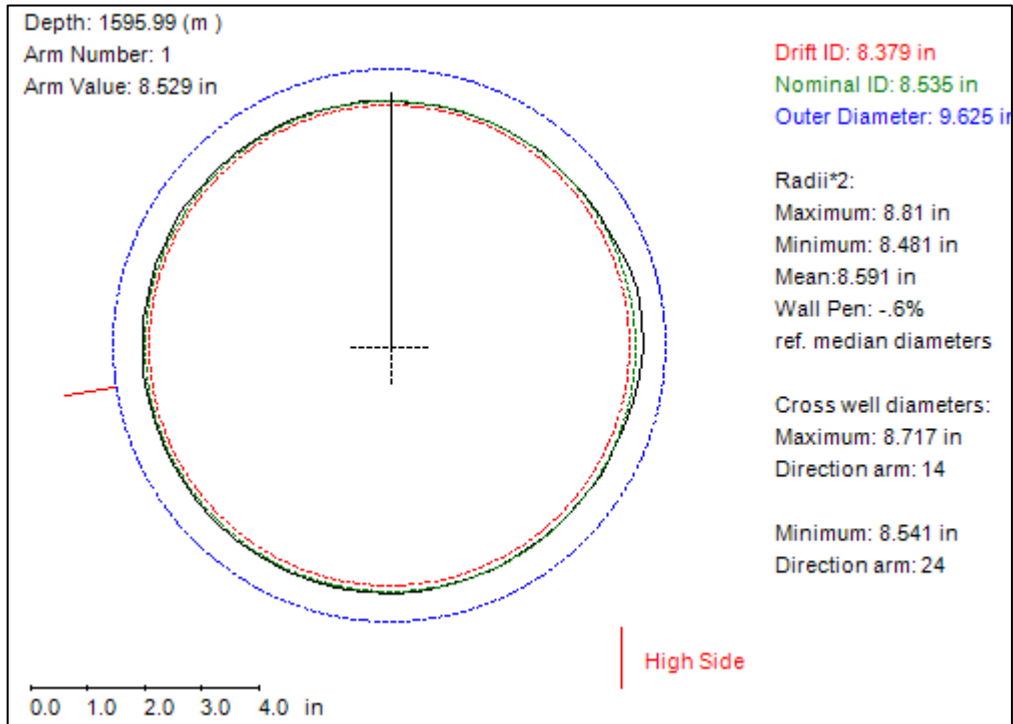


Figure 14_b- MFC data Cross-Section view at the depth 1595.99m

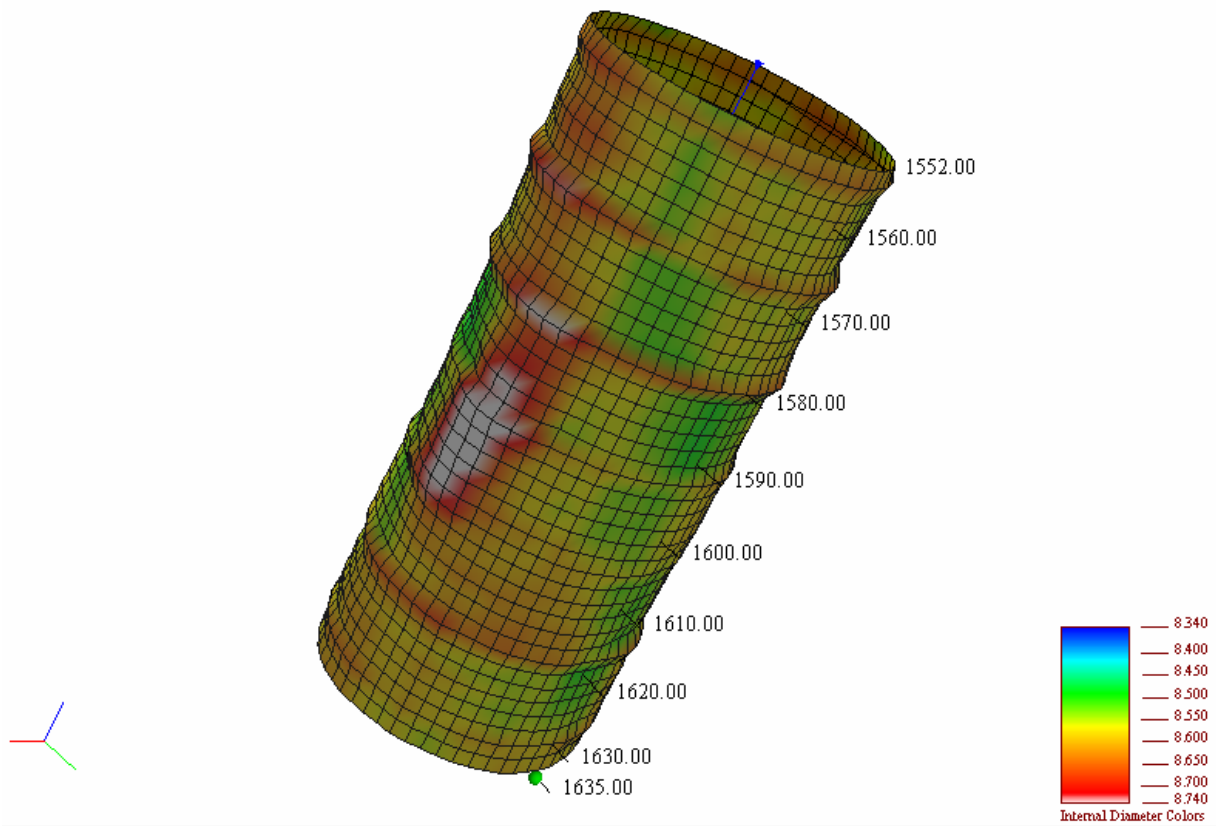


Figure 14_c- MFC data 3D visualization within the interval 1552-1635m

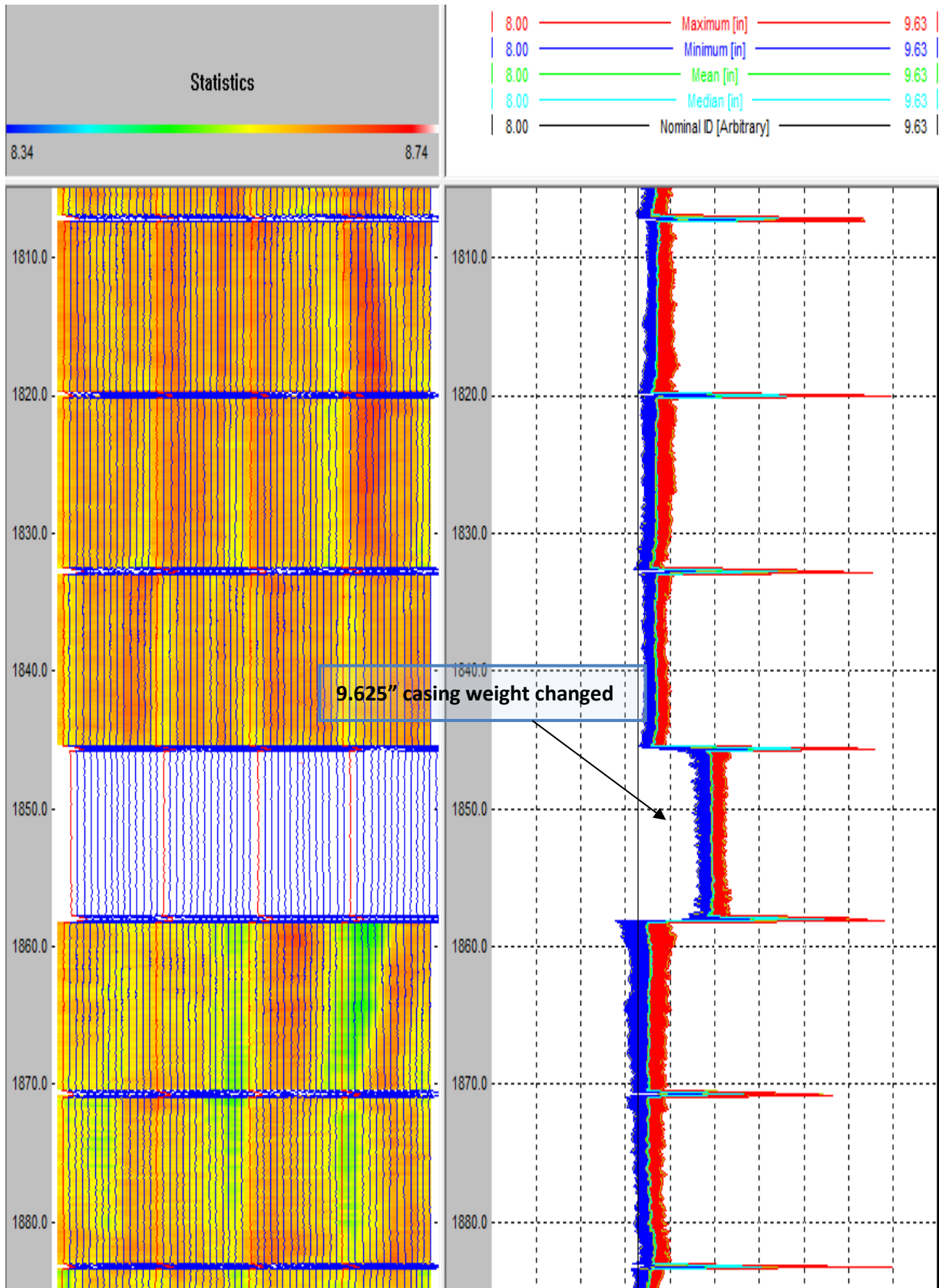


Figure 15_a- MFC data interval 1810-1880m- Zoom in

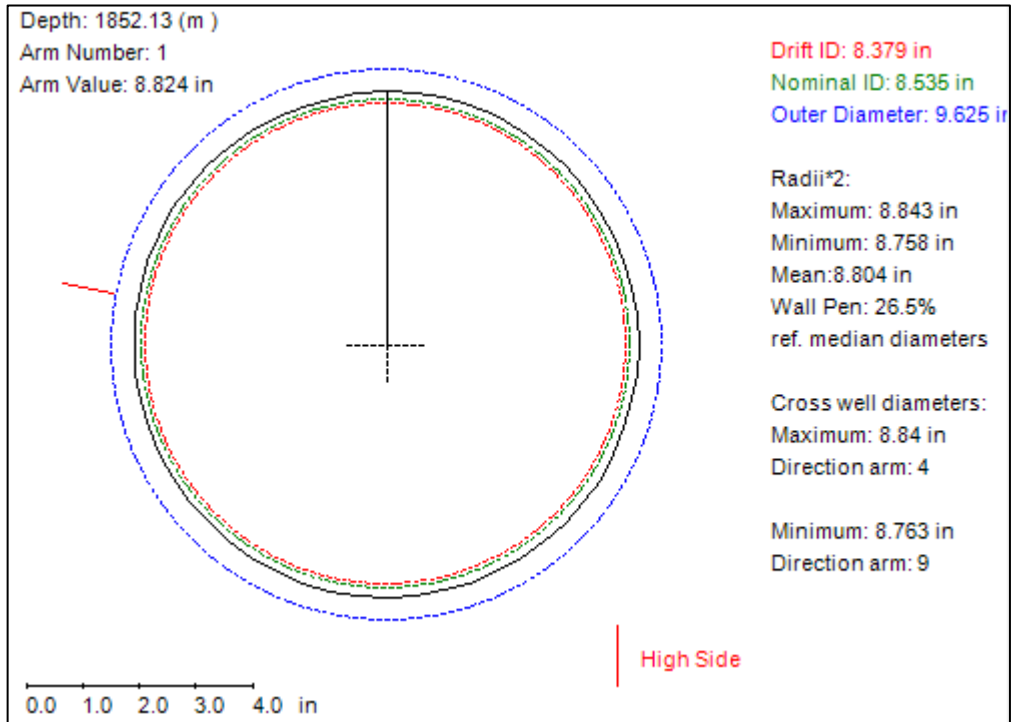


Figure 15_b- MFC data Cross-Section view at the depth 1852.13m

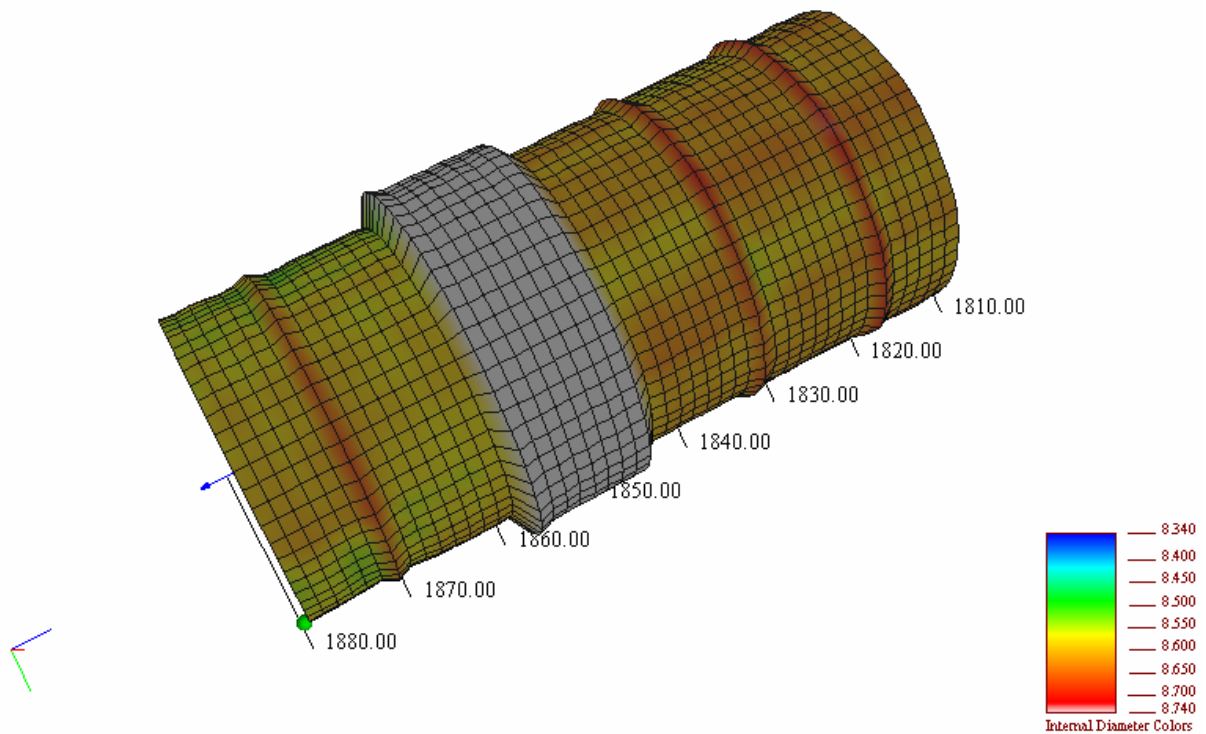


Figure 15_c- MFC data 3D visualization within the interval 1810-1880m

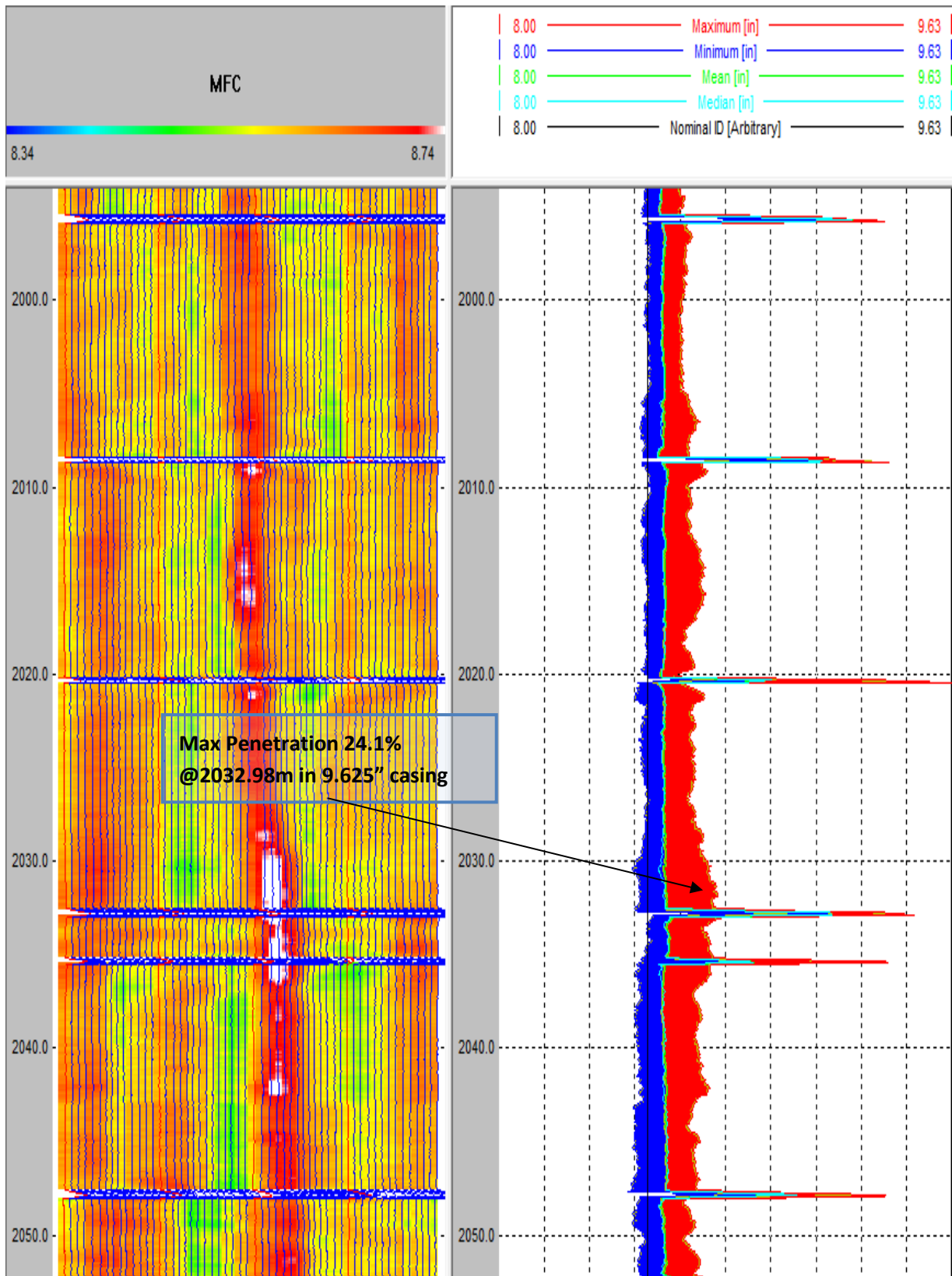


Figure 16_a– MFC data interval 1995-2050m- Zoom in

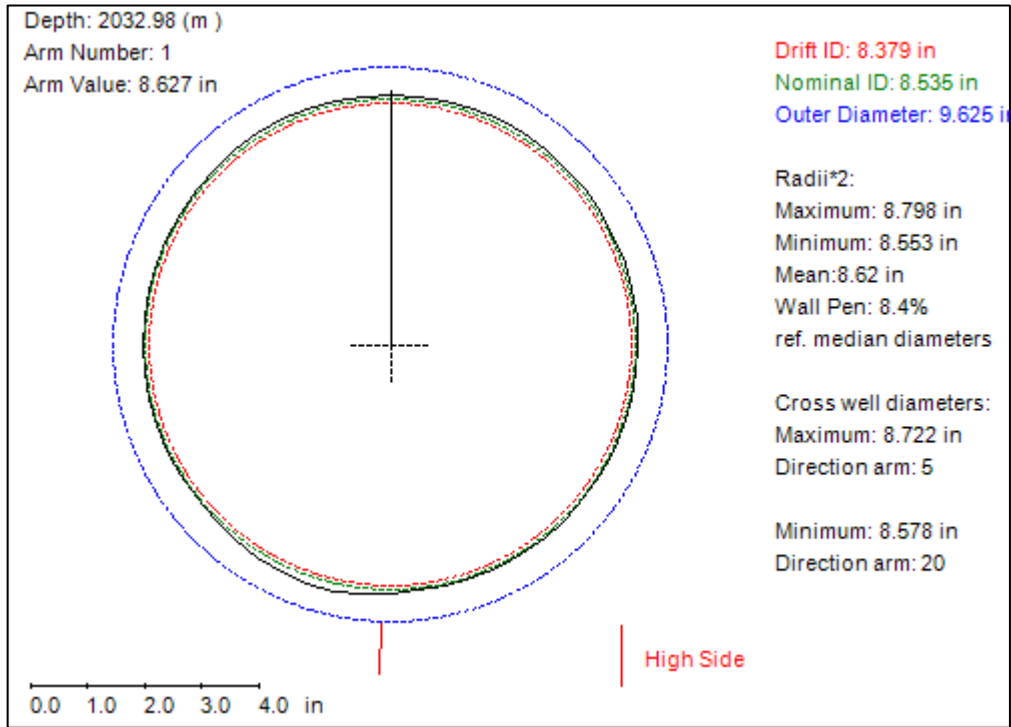


Figure 16_b- MFC data Cross-Section view at the depth 2032.98m

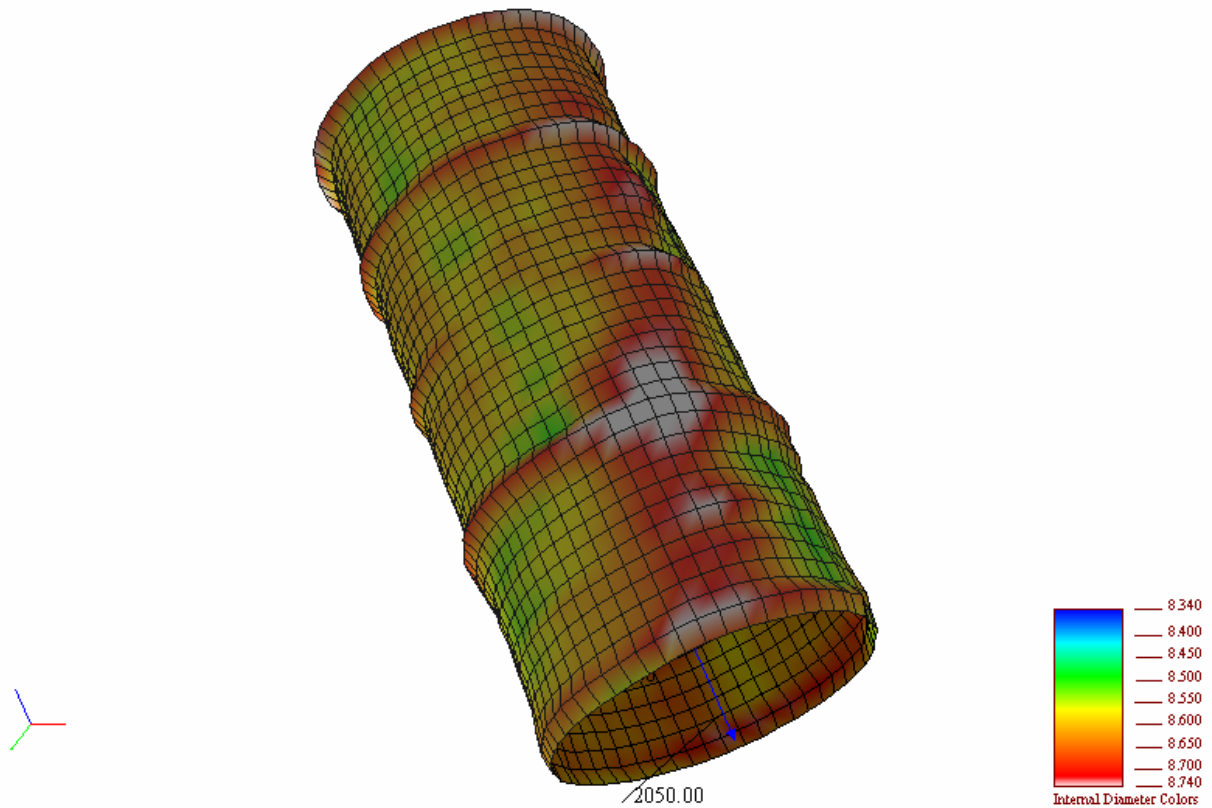


Figure 16_c- MFC data 3D visualization within the interval 1995-2050m

MTD Log Results in 9 5/8" Casing and 13 3/8" Casing

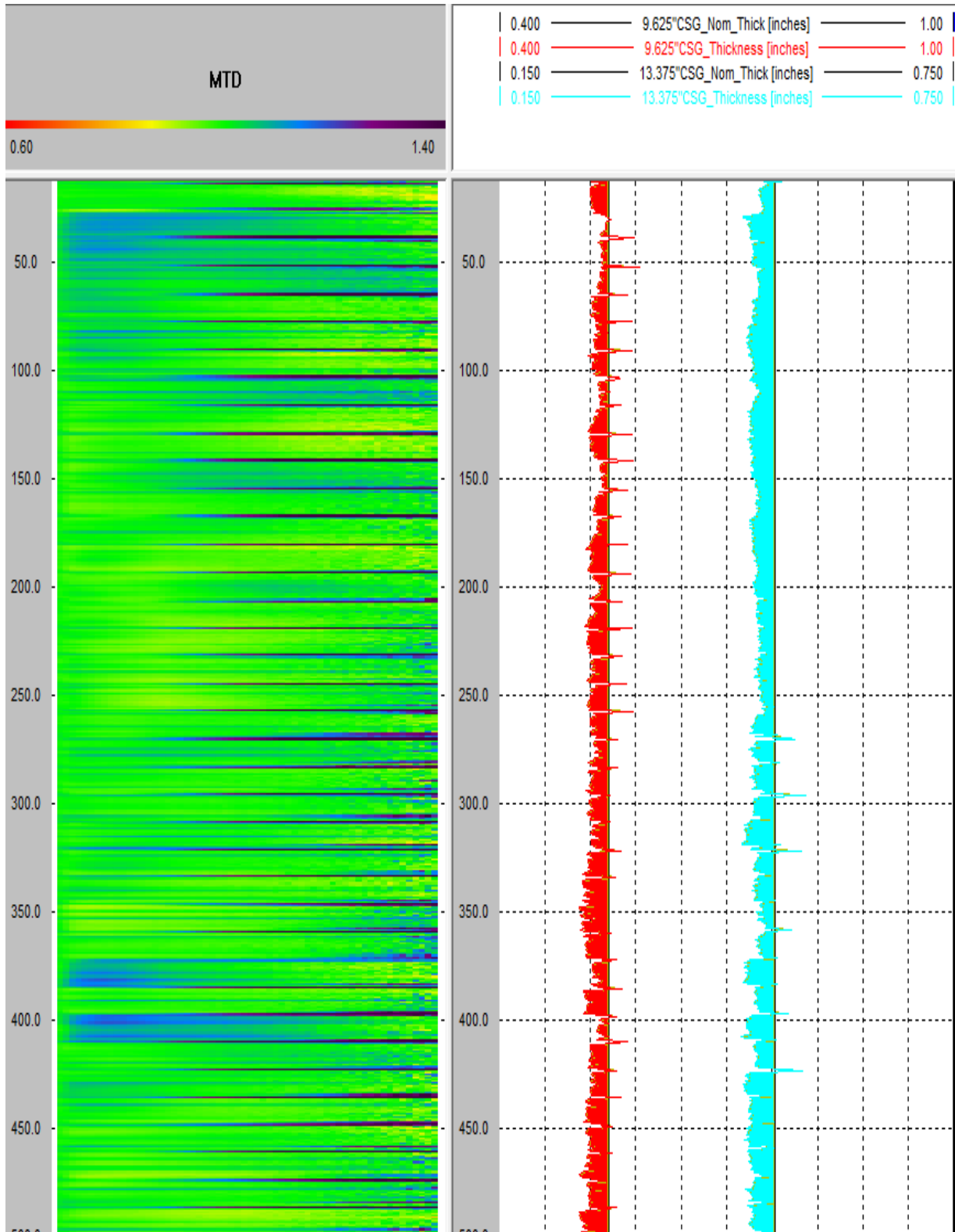


Figure 17_MTD data interval Surface to 500m

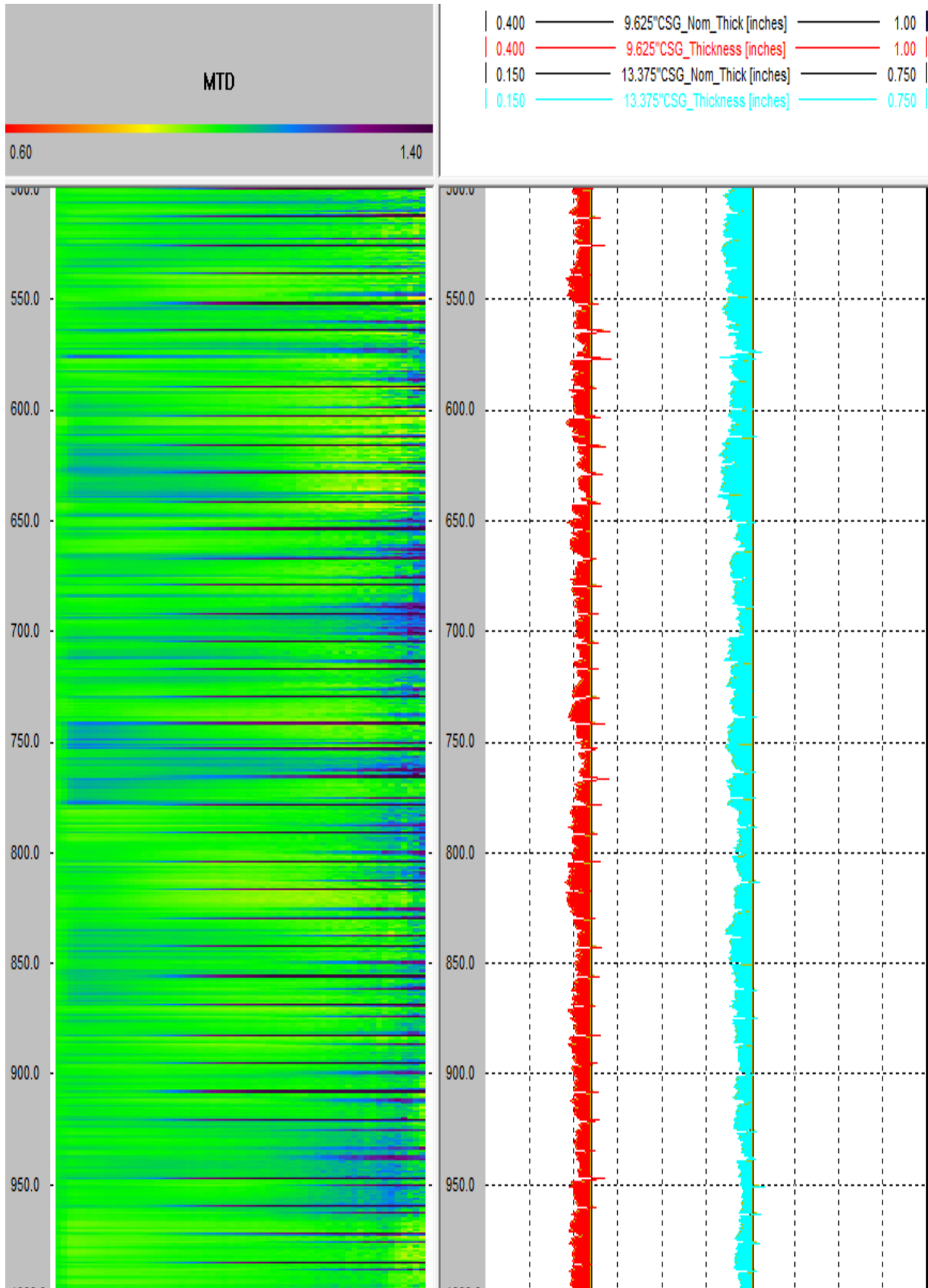


Figure 18_MTD data interval 500m to 1000m

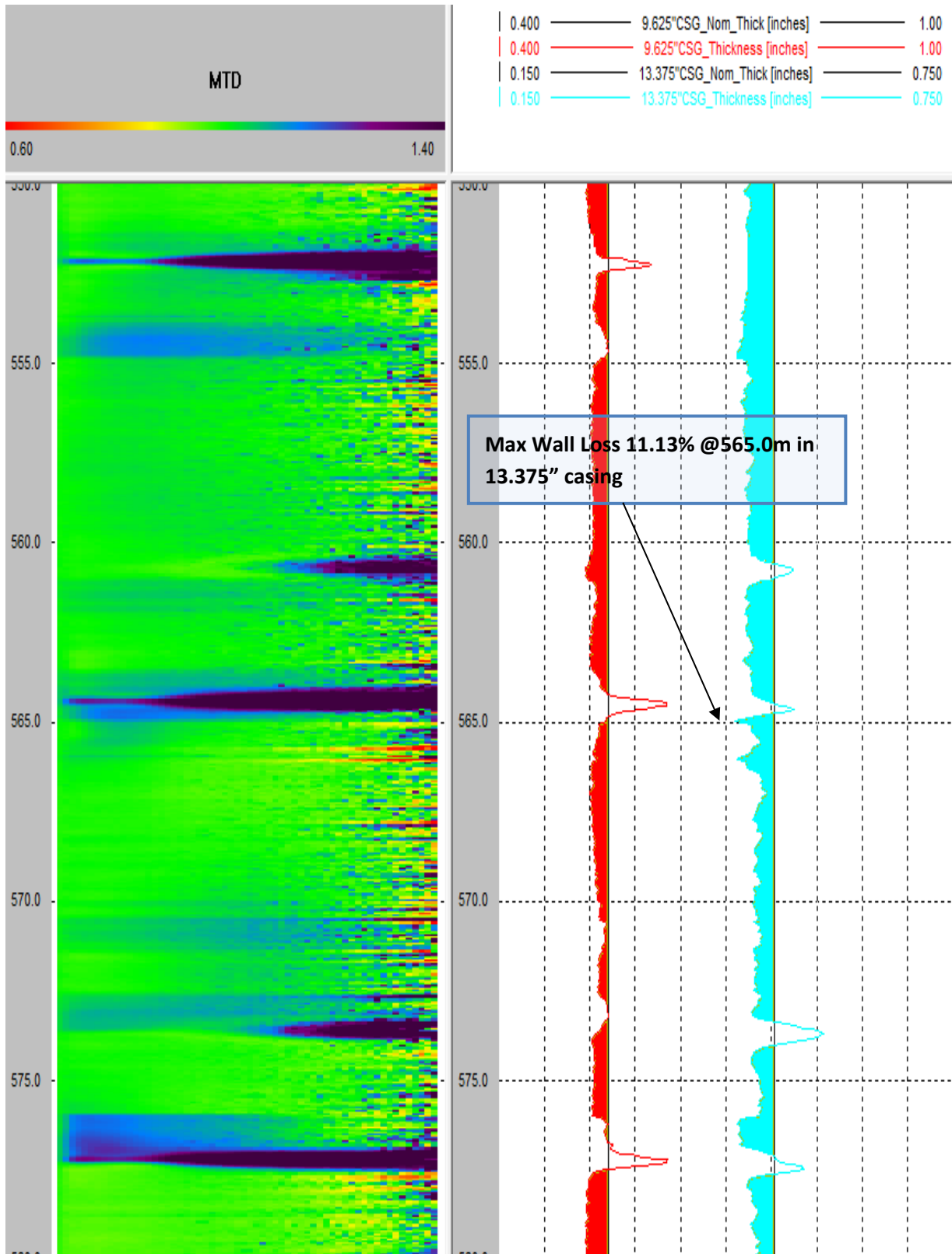


Figure 19 – MTD data interval 555-575m-Zoom in

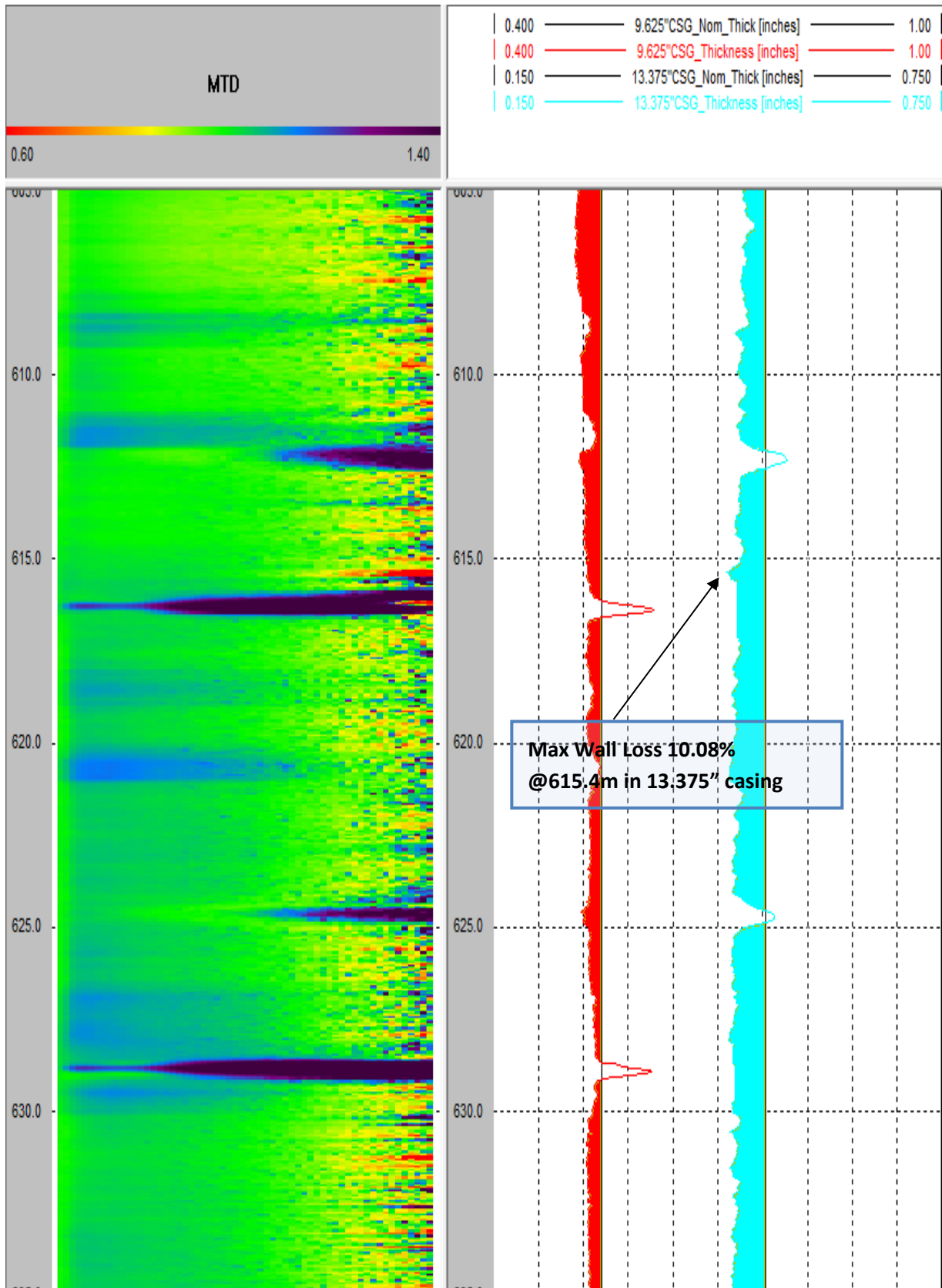


Figure 20 – MTD data interval 610-630m- Zoom in

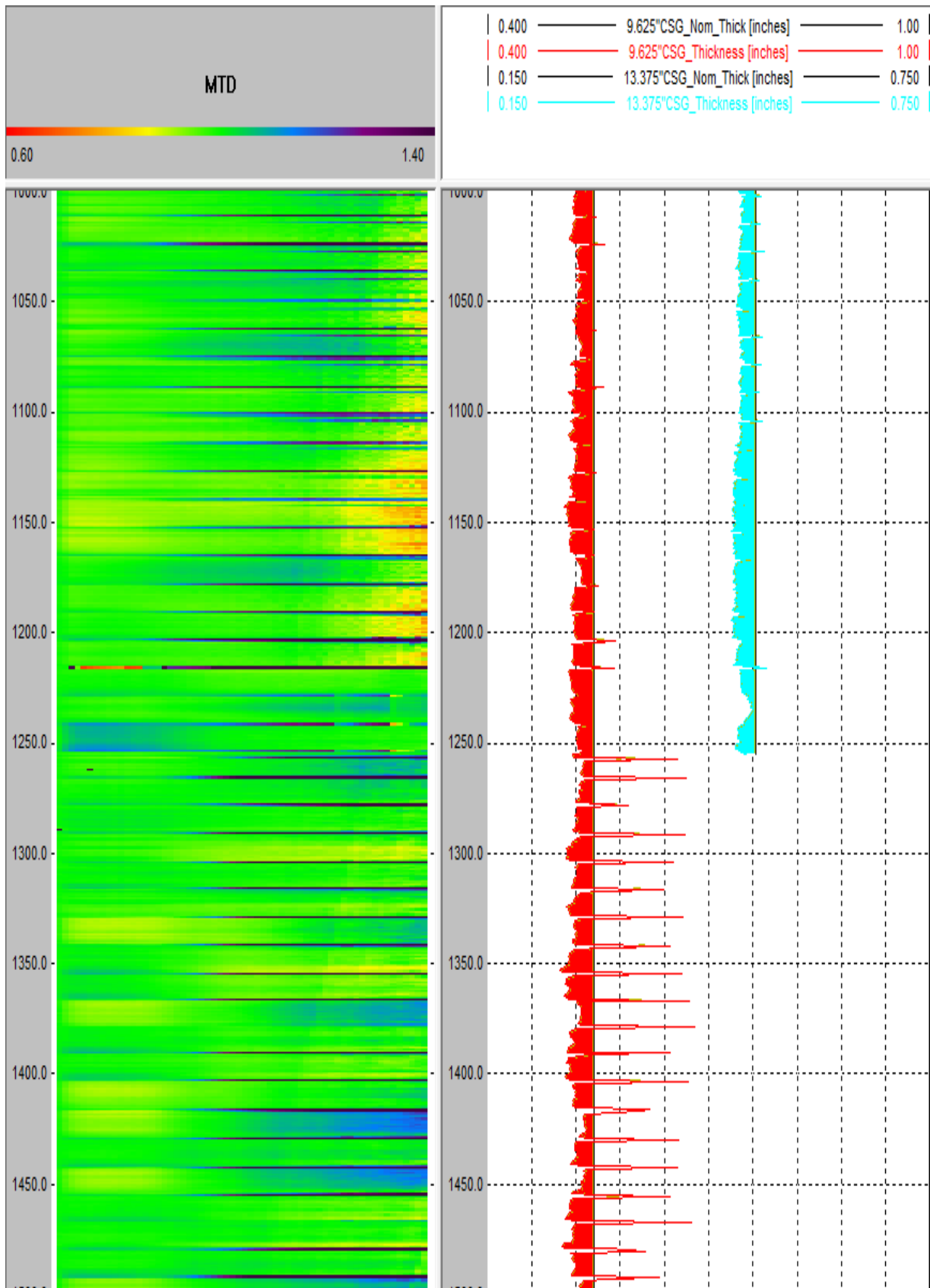


Figure 21_MTD data interval 1000m to 1500m

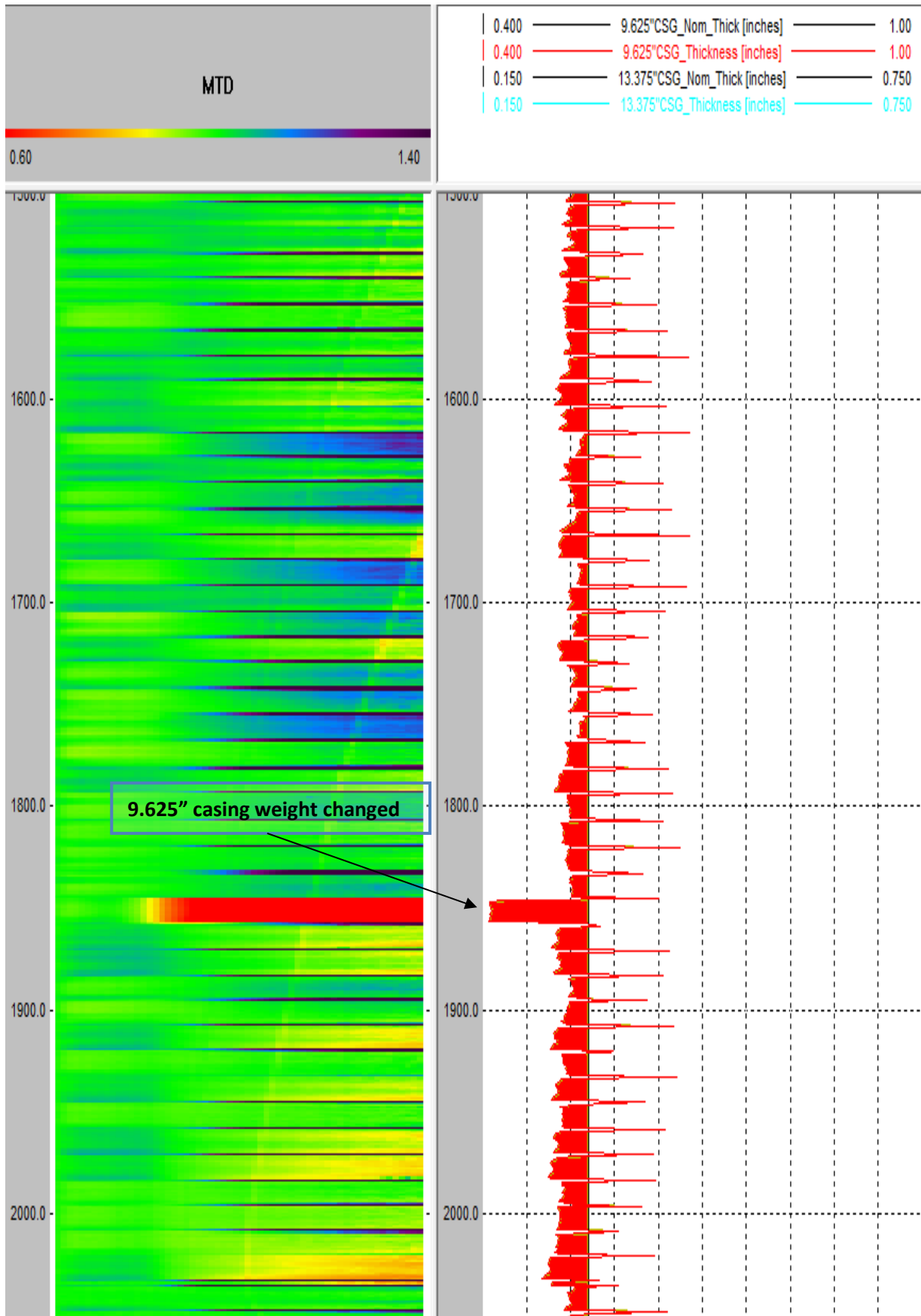


Figure 22_MTD data interval 1500m to 2000m

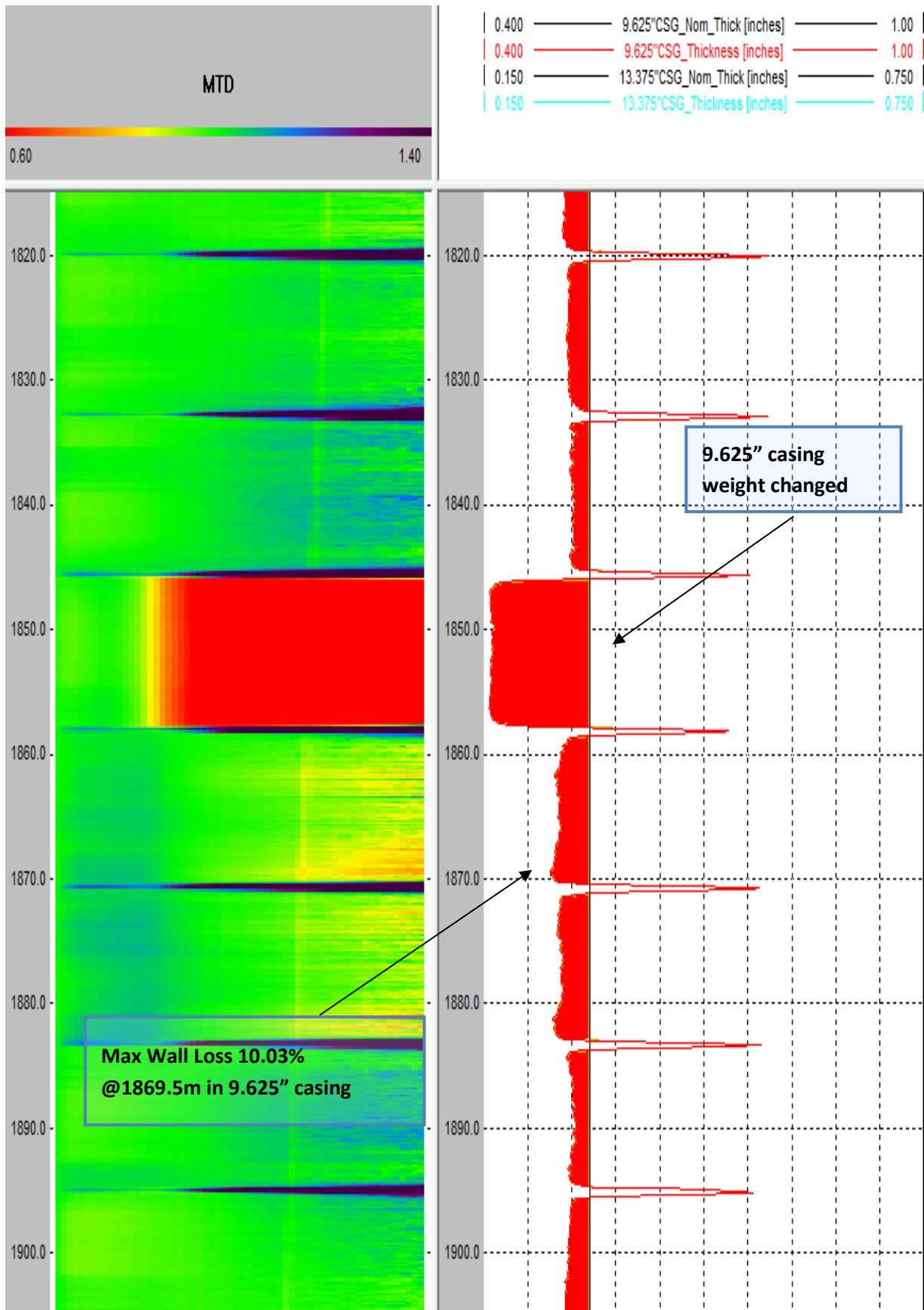


Figure 23 – MTD data interval 1820-1900m- Zoom in

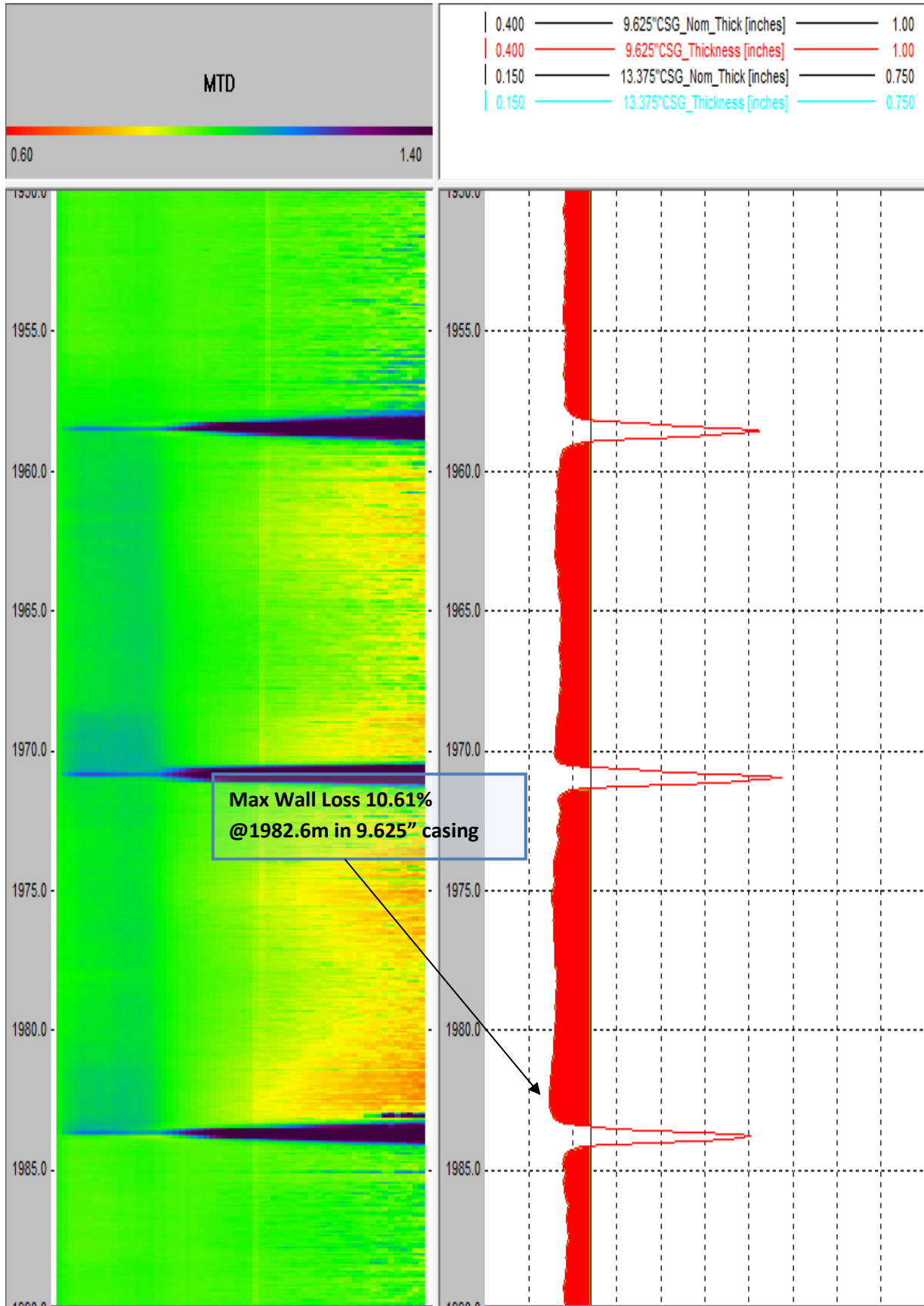


Figure 24 – MTD data interval 1955-1985m - Zoom in

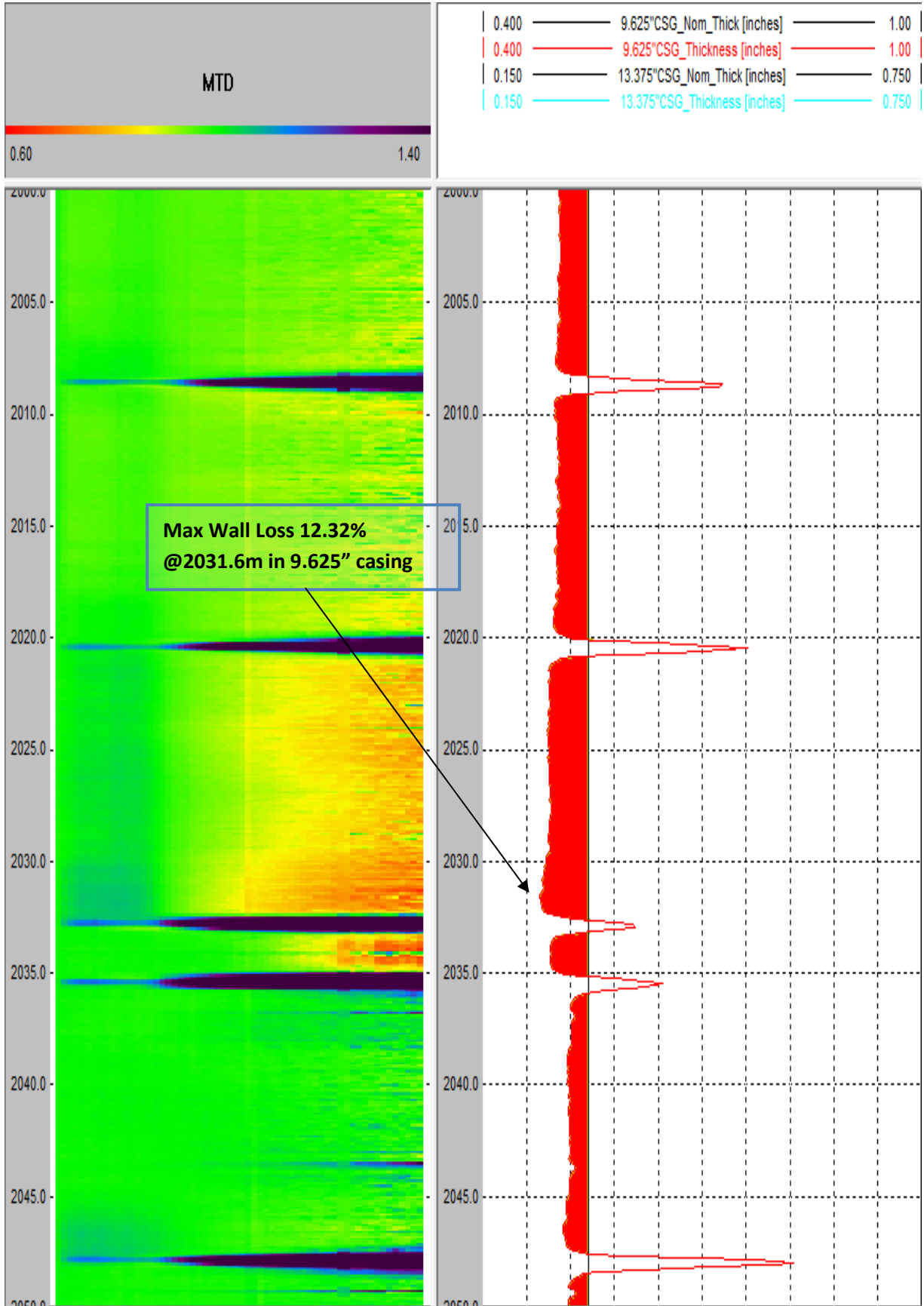


Figure 25 – MTD data interval 2005-2045m- Zoom in

9 5/8" Casing Joint Summary Listing from MTD Log

Top Body (m)	Bottom Body (m)	Body Length (m)	Nom Thk (in)	Min Thk (in)	Max Loss Depth (m)	Max Loss (%)	Grade
14.4	25.8	11.4	0.545	0.518	15.1	4.96	B
26.6	38.9	12.2	0.545	0.518	27.5	4.96	B
39.7	51.9	12.3	0.545	0.523	41.1	4.08	B
52.7	64.8	12.0	0.545	0.525	61.5	3.67	B
65.6	77.6	12.0	0.545	0.516	74.5	5.31	C
78.4	90.8	12.5	0.545	0.521	87.5	4.49	B
91.6	103.3	11.6	0.545	0.514	93.2	5.72	C
104.1	116.4	12.4	0.545	0.527	116.2	3.36	B
117.2	129.0	11.8	0.545	0.515	128.6	5.51	C
129.8	141.4	11.6	0.545	0.515	131.3	5.51	C
142.2	154.7	12.4	0.545	0.529	144.2	2.85	A
155.5	167.5	12.0	0.545	0.519	167.5	4.79	B
168.3	180.5	12.2	0.545	0.512	180.5	6.02	C
181.3	193.4	12.1	0.545	0.511	182.3	6.23	C
194.2	206.5	12.3	0.545	0.513	205.7	5.82	C
207.3	219.1	11.8	0.545	0.508	217.8	6.74	C
219.9	231.9	12.0	0.545	0.512	225.3	6.12	C
232.7	244.9	12.2	0.545	0.512	243.8	6.12	C
245.7	257.0	11.3	0.545	0.512	255.6	6.12	C
257.8	270.1	12.3	0.545	0.517	263.9	5.15	C
270.9	283.3	12.4	0.545	0.513	281.4	5.81	C
284.1	296.1	12.0	0.545	0.509	294.2	6.58	C
296.9	308.6	11.7	0.545	0.512	304.8	6.15	C
309.4	321.4	12.0	0.545	0.516	319.5	5.36	C
322.2	333.6	11.4	0.545	0.505	332.7	7.37	C
334.4	346.6	12.2	0.545	0.504	345.6	7.47	C
347.4	359.4	12.0	0.545	0.503	358.4	7.68	C
360.2	372.2	12.0	0.545	0.505	371.2	7.26	C
373.0	385.0	12.0	0.545	0.517	376.6	5.18	C
385.8	397.8	12.0	0.545	0.508	397.0	6.85	C
398.6	410.1	11.5	0.545	0.524	409.6	3.83	B
410.9	423.1	12.3	0.545	0.511	421.8	6.22	C
423.9	435.6	11.6	0.545	0.515	434.9	5.49	C
436.4	448.2	11.9	0.545	0.508	447.7	6.81	C
449.0	460.9	11.9	0.545	0.511	452.0	6.26	C
461.7	473.8	12.1	0.545	0.501	471.8	8.13	C

Top Body (m)	Bottom Body (m)	Body Length (m)	Nom Thk (in)	Min Thk (in)	Max Loss Depth (m)	Max Loss (%)	Grade
474.6	486.8	12.2	0.545	0.513	477.0	5.82	C
487.6	499.7	12.0	0.545	0.502	497.7	7.80	C
500.5	512.5	12.1	0.545	0.509	510.5	6.59	C
513.3	525.5	12.2	0.545	0.518	521.5	4.93	B
526.3	538.8	12.5	0.545	0.510	536.1	6.48	C
539.6	551.8	12.2	0.545	0.507	540.9	6.92	C
552.6	564.0	11.4	0.545	0.513	560.7	5.82	C
564.8	576.9	12.0	0.545	0.520	567.0	4.62	B
577.6	589.8	12.2	0.545	0.511	586.6	6.21	C
590.6	603.0	12.4	0.545	0.511	591.4	6.21	C
603.8	615.9	12.2	0.545	0.507	606.8	6.89	C
616.7	628.6	11.8	0.545	0.517	624.6	5.18	C
629.4	641.6	12.2	0.545	0.524	631.5	3.93	B
642.4	654.0	11.6	0.545	0.506	650.7	7.12	C
654.8	666.9	12.1	0.545	0.511	663.1	6.32	C
667.7	679.2	11.5	0.545	0.510	676.3	6.44	C
680.0	692.1	12.1	0.545	0.514	689.0	5.64	C
692.9	704.9	11.9	0.545	0.515	701.6	5.53	C
705.7	716.8	11.2	0.545	0.514	714.3	5.64	C
717.6	729.5	11.8	0.545	0.511	726.6	6.32	C
730.3	741.3	11.0	0.545	0.506	738.8	7.12	C
742.1	753.2	11.1	0.545	0.519	750.7	4.84	B
754.0	766.1	12.1	0.545	0.521	763.4	4.39	B
766.9	778.3	11.4	0.545	0.516	775.5	5.30	C
779.1	791.4	12.4	0.545	0.507	788.2	7.00	C
792.2	804.0	11.7	0.545	0.510	800.9	6.44	C
804.8	816.8	12.0	0.545	0.501	813.4	8.03	C
817.6	829.3	11.7	0.545	0.507	818.0	7.00	C
830.1	842.5	12.4	0.545	0.516	831.1	5.30	C
843.3	855.9	12.6	0.545	0.516	849.9	5.30	C
856.7	869.1	12.4	0.545	0.512	861.8	5.98	C
869.9	882.4	12.5	0.545	0.510	870.9	6.44	C
883.2	895.2	12.0	0.545	0.506	887.0	7.23	C
896.0	908.0	12.0	0.545	0.515	900.1	5.53	C
908.8	921.0	12.2	0.545	0.512	912.8	5.98	C
921.8	934.2	12.4	0.545	0.517	931.2	5.07	C
935.0	947.3	12.2	0.545	0.520	938.7	4.62	B
948.1	960.0	11.9	0.545	0.511	950.8	6.32	C
960.8	972.4	11.6	0.545	0.511	971.1	6.21	C

Top Body (m)	Bottom Body (m)	Body Length (m)	Nom Thk (in)	Min Thk (in)	Max Loss Depth (m)	Max Loss (%)	Grade
973.2	985.6	12.4	0.545	0.509	976.3	6.66	C
986.4	998.3	11.9	0.545	0.510	989.2	6.44	C
999.1	1011.4	12.3	0.545	0.514	1002.2	5.75	C
1012.2	1024.1	11.9	0.545	0.509	1021.3	6.55	C
1024.9	1036.2	11.4	0.545	0.517	1027.6	5.18	C
1037.0	1049.1	12.1	0.545	0.517	1040.7	5.18	C
1049.9	1062.4	12.5	0.545	0.512	1058.9	5.98	C
1063.2	1075.6	12.4	0.545	0.516	1066.3	5.30	C
1076.4	1088.8	12.4	0.545	0.509	1078.9	6.55	C
1089.6	1101.2	11.6	0.545	0.507	1091.6	7.00	C
1102.0	1114.1	12.1	0.545	0.508	1110.6	6.78	C
1114.9	1127.4	12.5	0.545	0.514	1126.2	5.75	C
1128.2	1139.6	11.4	0.545	0.504	1129.6	7.46	C
1140.4	1152.6	12.2	0.545	0.499	1142.7	8.37	C
1153.4	1165.1	11.7	0.545	0.508	1154.8	6.78	C
1165.9	1178.3	12.4	0.545	0.516	1167.2	5.30	C
1179.1	1190.6	11.4	0.545	0.511	1187.9	6.21	C
1191.4	1203.1	11.8	0.545	0.511	1192.2	6.32	C
1204.6	1215.8	11.2	0.545	0.511	1204.9	6.32	C
1216.6	1228.5	11.9	0.545	0.507	1217.9	7.06	C
1229.3	1241.3	12.1	0.545	0.508	1230.3	6.70	C
1242.1	1253.9	11.7	0.545	0.519	1248.4	4.80	B
1254.7	1265.6	10.9	0.545	0.511	1254.7	6.25	C
1266.4	1277.9	11.5	0.545	0.518	1277.2	4.90	B
1278.7	1291.2	12.4	0.545	0.513	1289.3	5.92	C
1292.0	1303.9	12.0	0.545	0.504	1303.3	7.61	C
1304.7	1316.2	11.4	0.545	0.511	1315.7	6.21	C
1317.0	1328.9	11.9	0.545	0.504	1324.2	7.48	C
1329.7	1341.8	12.1	0.545	0.513	1340.6	5.94	C
1342.6	1354.4	11.8	0.545	0.496	1352.9	8.99	C
1355.2	1366.4	11.1	0.545	0.502	1365.8	7.86	C
1367.2	1378.5	11.3	0.545	0.518	1368.0	4.92	B
1379.3	1390.6	11.4	0.545	0.507	1389.6	7.06	C
1391.4	1403.3	11.9	0.545	0.498	1400.9	8.61	C
1404.1	1416.4	12.3	0.545	0.513	1411.5	5.79	C
1417.2	1429.4	12.2	0.545	0.521	1429.1	4.35	B
1430.2	1442.2	11.9	0.545	0.510	1441.7	6.39	C
1443.0	1455.0	12.0	0.545	0.512	1454.4	6.14	C
1455.8	1467.0	11.2	0.545	0.504	1465.7	7.55	C

Top Body (m)	Bottom Body (m)	Body Length (m)	Nom Thk (in)	Min Thk (in)	Max Loss Depth (m)	Max Loss (%)	Grade
1467.8	1479.7	11.9	0.545	0.499	1478.2	8.44	C
1480.5	1492.2	11.7	0.545	0.511	1481.1	6.29	C
1493.0	1504.0	11.0	0.545	0.512	1503.0	6.12	C
1504.8	1516.4	11.6	0.545	0.505	1514.7	7.36	C
1517.2	1528.9	11.7	0.545	0.507	1528.4	7.00	C
1529.7	1541.0	11.3	0.545	0.504	1539.4	7.58	C
1541.8	1553.6	11.7	0.545	0.506	1545.0	7.11	C
1554.4	1566.6	12.2	0.545	0.508	1556.1	6.78	C
1567.4	1579.3	11.9	0.545	0.508	1578.6	6.71	C
1580.1	1591.0	10.9	0.545	0.501	1590.6	7.99	C
1591.8	1603.8	12.0	0.545	0.496	1602.5	9.04	C
1604.6	1616.7	12.1	0.545	0.501	1615.5	7.99	C
1617.5	1628.5	11.1	0.545	0.525	1628.3	3.71	B
1629.3	1641.1	11.7	0.545	0.504	1639.8	7.56	C
1641.9	1654.1	12.2	0.545	0.514	1653.4	5.65	C
1654.9	1666.5	11.6	0.545	0.504	1665.7	7.51	C
1667.3	1679.1	11.8	0.545	0.502	1671.9	7.96	C
1679.9	1691.9	11.9	0.545	0.526	1691.2	3.56	B
1692.7	1704.5	11.8	0.545	0.514	1703.7	5.62	C
1705.3	1717.1	11.8	0.545	0.521	1712.8	4.41	B
1717.9	1729.2	11.3	0.545	0.500	1721.5	8.31	C
1730.0	1742.3	12.3	0.545	0.514	1730.7	5.64	C
1743.1	1754.6	11.5	0.545	0.513	1754.3	5.88	C
1755.4	1767.8	12.4	0.545	0.528	1764.6	3.09	B
1768.6	1781.1	12.5	0.545	0.510	1776.7	6.51	C
1781.9	1793.6	11.7	0.545	0.494	1792.6	9.45	C
1794.4	1806.8	12.5	0.545	0.511	1794.8	6.24	C
1807.6	1819.7	12.1	0.545	0.503	1808.3	7.71	C
1820.5	1832.6	12.1	0.545	0.512	1826.5	6.10	C
1833.4	1845.2	11.8	0.545	0.516	1844.1	5.37	C
1846.0	1857.7	11.7	0.545	0.407	1856.4	25.37	
1858.6	1870.3	11.6	0.545	0.490	1869.5	10.03	D
1871.2	1883.0	11.8	0.545	0.493	1881.4	9.57	C
1883.8	1894.8	11.0	0.545	0.513	1884.5	5.93	C
1895.6	1907.1	11.5	0.545	0.503	1906.4	7.65	C
1907.9	1919.8	11.9	0.545	0.491	1919.0	9.86	C
1920.7	1932.5	11.8	0.545	0.504	1921.5	7.44	C
1933.3	1945.2	11.9	0.545	0.492	1944.1	9.64	C
1946.0	1958.2	12.2	0.545	0.503	1946.5	7.63	C

Top Body (m)	Bottom Body (m)	Body Length (m)	Nom Thk (in)	Min Thk (in)	Max Loss Depth (m)	Max Loss (%)	Grade
1959.0	1970.5	11.5	0.545	0.494	1970.1	9.33	C
1971.3	1983.3	12.0	0.545	0.487	1982.6	10.61	D
1984.1	1995.4	11.3	0.545	0.503	1994.0	7.78	C
1996.2	2008.3	12.0	0.545	0.499	2007.7	8.53	C
2009.1	2020.1	11.0	0.545	0.496	2019.1	9.03	C
2020.9	2032.4	11.5	0.545	0.478	2031.6	12.32	D
2033.2	2035.1	1.8	0.545	0.492	2034.0	9.80	C
2035.9	2047.5	11.7	0.545	0.496	2046.5	8.91	C
2048.3	2052.9	4.5	0.545	0.501	2051.4	8.14	C

Table 7- 9 5/8" Casing Joint Summary Listing from MTD Log

9 5/8" Casing Joint Summary Listing from MFC Log

Top Body (m)	Bottom Body (m)	Body Length (m)	Max Pen Depth (m)	Max Pen (in)	Max Pen (%)	Grade
14.32	26.07	11.74	14.39	8.697	14.9	B
26.47	39.04	12.57	36.13	8.800	24.3	B
39.44	52.13	12.70	40.02	8.827	26.8	C
52.53	64.99	12.46	64.43	8.657	11.2	B
65.39	77.83	12.44	71.37	8.704	15.5	B
78.28	90.93	12.65	90.92	8.660	11.5	B
91.38	103.49	12.11	100.76	8.656	11.1	B
103.94	116.59	12.65	115.42	8.645	10.1	B
117.04	129.27	12.23	127.89	8.651	10.6	B
129.72	141.65	11.93	137.86	8.651	10.6	B
142.10	154.81	12.71	152.00	8.649	10.5	B
155.26	167.67	12.41	167.26	8.740	18.8	B
168.12	180.83	12.71	180.81	8.854	29.3	C
181.28	193.69	12.41	191.84	8.912	34.6	C
194.14	206.73	12.59	194.92	8.910	34.4	C
207.18	219.35	12.17	207.36	8.926	35.9	C
219.80	232.09	12.29	219.89	8.810	25.2	C
232.54	245.13	12.59	244.68	8.741	18.9	B
245.58	257.27	11.69	245.58	8.706	15.7	B
257.72	270.31	12.59	270.02	8.697	14.9	B
270.76	283.47	12.71	283.43	8.720	17.0	B
283.92	296.27	12.35	286.16	8.758	20.5	B
296.72	308.77	12.05	297.43	8.644	10.0	B

Top Body (m)	Bottom Body (m)	Body Length (m)	Max Pen Depth (m)	Max Pen (in)	Max Pen (%)	Grade
309.22	321.57	12.35	314.15	8.646	10.2	B
322.02	333.95	11.93	333.95	8.693	14.5	B
334.40	346.81	12.41	334.84	8.683	13.6	B
347.26	359.67	12.41	355.17	8.659	11.4	B
360.12	372.47	12.35	360.56	8.656	11.1	B
372.92	385.21	12.29	383.56	8.676	12.9	B
385.66	397.89	12.23	387.42	8.689	14.1	B
398.34	410.27	11.93	398.38	8.657	11.2	B
410.72	423.31	12.59	423.31	8.718	16.8	B
423.76	435.57	11.81	434.32	8.759	20.6	B
436.02	448.37	12.35	448.09	8.803	24.6	B
448.82	461.05	12.23	451.99	8.738	18.6	B
461.50	473.91	12.41	470.74	8.670	12.4	B
474.36	486.95	12.59	486.95	8.816	25.8	C
487.40	499.99	12.59	487.54	8.761	20.7	B
500.44	512.73	12.29	500.62	8.737	18.5	B
513.18	525.71	12.53	525.42	8.693	14.5	B
526.16	538.81	12.65	538.39	8.757	20.4	B
539.26	551.97	12.71	539.34	8.791	23.5	B
552.42	564.25	11.83	563.23	8.739	18.7	B
564.75	577.11	12.36	565.44	8.736	18.4	B
577.56	589.91	12.35	578.58	8.745	19.3	B
590.36	603.13	12.77	591.26	8.659	11.4	B
603.58	616.11	12.53	615.24	8.682	13.5	B
616.56	628.67	12.11	626.13	8.748	19.5	B
629.12	641.69	12.57	640.20	8.757	20.4	B
642.14	654.25	12.11	643.22	8.811	25.3	C
654.70	667.05	12.35	666.61	8.670	12.4	B
667.50	679.31	11.81	677.91	8.707	15.8	B
679.76	692.35	12.59	681.31	8.676	12.9	B
692.80	705.03	12.23	703.58	8.673	12.7	B
705.48	717.12	11.63	710.43	8.668	12.2	B
717.57	729.68	12.11	729.29	8.707	15.8	B
730.13	741.46	11.33	739.47	8.831	27.2	C
741.91	753.42	11.51	743.02	8.738	18.6	B
753.87	766.34	12.47	765.61	8.683	13.6	B
766.79	778.43	11.63	768.06	8.665	11.9	B
778.88	791.58	12.71	791.18	8.709	16.0	B
792.03	804.21	12.17	801.86	8.774	21.9	B
804.66	816.95	12.29	816.65	8.797	24.0	B

Top Body (m)	Bottom Body (m)	Body Length (m)	Max Pen Depth (m)	Max Pen (in)	Max Pen (%)	Grade
817.40	829.51	12.11	817.82	8.833	27.3	C
829.96	842.67	12.71	842.66	8.755	20.2	B
843.12	856.06	12.95	844.66	8.759	20.6	B
856.51	869.28	12.77	869.27	8.792	23.6	B
869.73	882.50	12.77	869.76	8.812	25.4	C
882.95	895.36	12.41	890.10	8.660	11.5	B
895.81	908.22	12.41	906.04	8.726	17.5	B
908.67	921.08	12.41	919.49	8.716	16.6	B
921.53	934.36	12.83	921.57	8.708	15.9	B
934.81	947.46	12.65	938.11	8.646	10.2	B
947.91	960.08	12.17	957.58	8.654	10.9	B
960.53	972.52	11.99	969.31	8.836	27.6	C
972.97	985.56	12.59	974.42	8.847	28.6	C
986.01	998.42	12.41	986.19	8.802	24.5	B
998.87	1011.52	12.65	1002.15	8.752	19.9	B
1011.97	1024.38	12.41	1023.48	8.813	25.5	C
1024.83	1036.28	11.45	1030.59	8.728	17.7	B
1036.92	1049.44	12.52	1036.96	8.738	18.6	B
1049.89	1062.60	12.71	1062.60	8.799	24.2	B
1063.05	1075.63	12.58	1063.06	8.774	21.9	B
1076.10	1089.03	12.93	1084.05	8.779	22.4	B
1089.50	1101.41	11.91	1090.42	8.721	17.1	B
1101.88	1114.21	12.33	1113.50	8.726	17.5	B
1114.68	1127.49	12.81	1114.73	8.753	20.0	B
1127.96	1139.81	11.85	1139.53	8.728	17.7	B
1140.28	1152.61	12.33	1140.28	8.742	19.0	B
1153.08	1165.29	12.21	1160.90	8.656	11.1	B
1165.76	1178.39	12.63	1177.48	8.695	14.7	B
1178.86	1190.83	11.97	1189.92	8.720	17.0	B
1191.30	1203.21	11.91	1201.62	8.749	19.6	B
1204.41	1215.76	11.35	1214.64	8.830	27.1	C
1216.26	1228.57	12.32	1218.63	8.809	25.1	C
1229.04	1241.49	12.45	1229.05	8.740	18.8	B
1241.96	1254.11	12.15	1253.38	8.782	22.7	B
1254.58	1265.84	11.25	1255.08	8.758	20.5	B
1266.31	1278.10	11.79	1274.60	8.751	19.8	B
1278.57	1291.20	12.63	1288.83	8.698	15.0	B
1291.67	1303.86	12.20	1302.69	8.894	32.9	C
1304.36	1316.30	11.94	1304.86	8.928	36.1	C
1316.80	1328.98	12.18	1324.25	8.878	31.5	C

Top Body (m)	Bottom Body (m)	Body Length (m)	Max Pen Depth (m)	Max Pen (in)	Max Pen (%)	Grade
1329.48	1341.90	12.42	1340.13	8.911	34.5	C
1342.40	1354.52	12.12	1353.06	8.877	31.4	C
1355.02	1366.55	11.52	1362.54	8.742	19.0	B
1367.05	1378.51	11.46	1377.38	8.753	20.0	B
1379.01	1390.71	11.70	1379.02	8.742	19.0	B
1391.21	1403.27	12.06	1391.22	8.782	22.7	B
1403.77	1416.49	12.72	1414.98	8.666	12.0	B
1416.99	1429.47	12.48	1421.13	8.656	11.1	B
1429.97	1442.27	12.30	1437.13	8.666	12.0	B
1442.77	1455.07	12.30	1454.83	8.698	15.0	B
1455.57	1467.15	11.58	1458.99	8.762	20.8	B
1467.65	1479.71	12.06	1477.86	8.875	31.2	C
1480.21	1492.39	12.18	1480.22	8.756	20.3	B
1492.89	1504.06	11.16	1496.71	8.650	10.6	B
1504.56	1516.38	11.82	1514.72	8.670	12.4	B
1516.88	1529.00	12.12	1528.68	8.662	11.7	B
1529.50	1541.14	11.64	1532.77	8.660	11.5	B
1541.64	1553.64	12.00	1548.18	8.647	10.3	B
1554.14	1566.68	12.54	1562.23	8.675	12.8	B
1567.18	1579.30	12.12	1579.30	8.686	13.9	B
1579.80	1591.09	11.28	1589.91	8.788	23.2	B
1591.59	1603.89	12.30	1595.99	8.815	25.7	C
1604.39	1616.75	12.36	1604.40	8.715	16.5	B
1617.25	1628.71	11.46	1617.96	8.637	9.4	A
1628.95	1641.06	12.10	1640.41	8.664	11.8	B
1641.71	1654.19	12.48	1645.48	8.639	9.5	A
1654.69	1666.73	12.04	1664.29	8.648	10.4	B
1667.23	1679.32	12.09	1678.48	8.641	9.7	A
1679.82	1691.96	12.14	1680.14	8.640	9.6	A
1692.46	1704.60	12.14	1693.60	8.654	10.9	B
1705.10	1717.10	11.99	1716.67	8.732	18.1	B
1717.60	1729.34	11.74	1717.60	8.713	16.3	B
1729.84	1742.43	12.59	1732.32	8.677	13.0	B
1742.93	1754.72	11.79	1754.48	8.645	10.1	B
1755.22	1767.91	12.69	1767.17	8.677	13.0	B
1768.41	1781.15	12.74	1769.43	8.683	13.6	B
1781.65	1793.64	11.99	1792.18	8.659	11.4	B
1794.14	1806.97	12.84	1794.70	8.700	15.1	B
1807.47	1819.71	12.24	1817.82	8.689	14.1	B
1820.21	1832.65	12.44	1826.95	8.677	13.0	B

Top Body (m)	Bottom Body (m)	Body Length (m)	Max Pen Depth (m)	Max Pen (in)	Max Pen (%)	Grade
1833.15	1845.29	12.14	1833.58	8.658	11.3	B
1845.79	1857.79	11.99	1856.60	8.878	31.5	C Casing Weight Changed
1858.29	1870.38	12.09	1859.38	8.678	13.1	B
1870.88	1883.02	12.14	1882.78	8.657	11.2	B
1883.52	1894.76	11.25	1883.71	8.631	8.8	A
1895.26	1907.20	11.94	1897.67	8.646	10.2	B
1907.70	1920.04	12.34	1914.30	8.675	12.8	B
1920.54	1932.64	12.09	1927.16	8.696	14.8	B
1933.14	1945.18	12.04	1944.77	8.663	11.7	B
1945.68	1958.22	12.54	1946.69	8.668	12.2	B
1958.72	1970.71	11.99	1970.43	8.671	12.5	B
1971.21	1983.40	12.19	1983.21	8.661	11.6	B
1983.90	1995.49	11.59	1994.62	8.667	12.1	B
1995.99	2008.32	12.33	2006.50	8.723	17.2	B
2008.85	2020.26	11.41	2009.11	8.753	20.0	B
2020.56	2032.61	12.05	2032.61	8.792	23.6	B
2032.97	2035.16	2.19	2032.98	8.798	24.1	B
2035.56	2047.68	12.11	2036.05	8.764	21.0	B
2048.06	2052.29	4.23	2051.35	8.726	17.5	B

Table 8- 9 5/8" Casing Joint Summary Listing from MFC Log

13 3/8" Casing Joint Summary Listing from MTD Log

Top Body (m)	Bottom Body (m)	Body Length (m)	Nom Thk (in)	Min Thk (in)	Max Loss Depth (m)	Max Loss (%)	Grade
15.7	27.9	12.2	0.514	0.476	27.6	7.34	C
28.7	40.3	11.6	0.514	0.468	29.6	8.90	C
41.1	52.9	11.8	0.514	0.478	49.7	7.07	C
53.7	65.3	11.7	0.514	0.483	57.3	6.11	C
66.1	78.3	12.2	0.514	0.470	75.9	8.53	C
79.1	91.4	12.3	0.514	0.471	86.8	8.28	C
92.2	103.2	11.0	0.514	0.473	92.5	8.04	C
104.0	116.0	12.0	0.514	0.473	104.9	8.00	C
116.8	129.0	12.2	0.514	0.473	118.4	8.04	C
129.8	142.0	12.2	0.514	0.469	133.5	8.78	C
142.8	154.6	11.8	0.514	0.470	143.5	8.60	C
155.4	167.5	12.1	0.514	0.482	165.8	6.26	C
168.3	180.3	12.0	0.514	0.467	169.1	9.07	C
181.1	193.0	11.9	0.514	0.476	183.9	7.37	C
193.8	205.1	11.3	0.514	0.480	202.8	6.53	C
205.8	217.5	11.7	0.514	0.484	217.3	5.91	C
218.4	230.0	11.7	0.514	0.483	218.6	5.95	C
230.9	242.7	11.8	0.514	0.479	233.6	6.84	C
243.5	255.0	11.5	0.514	0.484	243.6	5.75	C
255.9	268.3	12.4	0.514	0.475	265.5	7.62	C
269.1	281.0	11.9	0.514	0.476	275.4	7.39	C
281.8	293.9	12.1	0.514	0.468	287.5	8.87	C
294.7	306.4	11.7	0.514	0.475	306.1	7.57	C
307.2	319.1	12.0	0.514	0.464	318.8	9.69	C
319.9	332.0	12.1	0.514	0.475	320.9	7.59	C
332.8	345.0	12.2	0.514	0.476	340.5	7.31	C
345.8	357.7	11.9	0.514	0.481	346.5	6.34	C
358.5	370.8	12.3	0.514	0.480	362.9	6.63	C
371.6	383.6	12.0	0.514	0.465	376.1	9.50	C
384.4	396.4	12.1	0.514	0.472	384.6	8.22	C
397.2	409.2	11.9	0.514	0.464	399.1	9.76	C
410.0	421.9	12.0	0.514	0.477	421.9	7.26	C
422.7	434.4	11.7	0.514	0.463	429.9	9.86	C
435.2	447.1	11.8	0.514	0.470	441.3	8.53	C
447.9	458.8	10.9	0.514	0.467	455.5	9.16	C
459.6	471.4	11.8	0.514	0.468	460.3	8.96	C
472.2	484.3	12.1	0.514	0.470	478.6	8.66	C
485.1	497.1	12.0	0.514	0.473	494.0	7.98	C

Top Body (m)	Bottom Body (m)	Body Length (m)	Nom Thk (in)	Min Thk (in)	Max Loss Depth (m)	Max Loss (%)	Grade
497.9	510.3	12.4	0.514	0.470	503.8	8.55	C
511.1	522.7	11.6	0.514	0.465	522.6	9.58	C
523.5	535.6	12.1	0.514	0.467	528.6	9.16	C
536.4	547.7	11.3	0.514	0.471	536.6	8.33	C
548.5	560.3	11.8	0.514	0.464	554.7	9.79	C
561.1	573.2	12.1	0.514	0.457	565.0	11.13	D
574.0	585.8	11.8	0.514	0.464	576.2	9.75	C
586.6	599.0	12.4	0.514	0.476	592.7	7.40	C
599.8	611.8	12.0	0.514	0.470	602.1	8.59	C
612.6	624.2	11.5	0.514	0.462	615.4	10.08	D
625.0	637.3	12.4	0.514	0.464	628.1	9.81	C
638.1	650.2	12.1	0.514	0.461	639.4	10.33	D
651.0	662.8	11.8	0.514	0.480	658.4	6.61	C
663.6	675.8	12.2	0.514	0.478	675.0	7.04	C
676.6	688.5	11.9	0.514	0.481	687.9	6.35	C
689.3	701.2	11.9	0.514	0.488	694.1	5.01	C
702.0	713.7	11.6	0.514	0.471	713.5	8.30	C
714.5	726.1	11.6	0.514	0.474	725.8	7.74	C
726.9	738.1	11.3	0.514	0.477	730.8	7.12	C
738.9	750.5	11.5	0.514	0.473	746.5	8.04	C
751.3	762.9	11.6	0.514	0.471	752.7	8.35	C
763.7	775.3	11.6	0.514	0.474	770.7	7.83	C
776.1	787.7	11.6	0.514	0.477	777.6	7.28	C
788.5	800.2	11.7	0.514	0.481	798.2	6.45	C
801.0	812.9	11.9	0.514	0.483	802.9	5.96	C
813.7	825.9	12.1	0.514	0.480	816.1	6.53	C
826.7	837.8	11.1	0.514	0.472	835.8	8.24	C
838.6	849.5	11.0	0.514	0.476	838.8	7.42	C
850.3	861.5	11.2	0.514	0.481	851.0	6.37	C
862.3	874.3	12.0	0.514	0.481	867.5	6.48	C
875.1	886.6	11.5	0.514	0.481	875.4	6.36	C
887.4	899.5	12.1	0.514	0.487	887.9	5.35	C
900.3	912.4	12.1	0.514	0.483	905.7	5.96	C
913.2	925.3	12.1	0.514	0.480	923.0	6.56	C
926.1	938.1	12.0	0.514	0.487	928.6	5.17	C
938.9	950.5	11.6	0.514	0.488	939.9	5.03	C
951.3	963.1	11.8	0.514	0.492	961.9	4.36	B
963.9	975.8	11.9	0.514	0.485	974.3	5.59	C
976.6	988.6	12.0	0.514	0.485	987.5	5.66	C

Top Body (m)	Bottom Body (m)	Body Length (m)	Nom Thk (in)	Min Thk (in)	Max Loss Depth (m)	Max Loss (%)	Grade
989.4	1001.6	12.2	0.514	0.487	1000.5	5.20	C
1002.4	1014.6	12.2	0.514	0.485	1013.2	5.73	C
1015.4	1027.1	11.7	0.514	0.489	1016.2	4.94	B
1027.9	1040.2	12.3	0.514	0.482	1034.7	6.20	C
1041.0	1053.1	12.1	0.514	0.480	1052.9	6.57	C
1053.9	1065.8	11.8	0.514	0.485	1056.7	5.63	C
1066.6	1078.6	12.0	0.514	0.488	1068.8	5.05	C
1079.4	1091.1	11.8	0.514	0.487	1079.8	5.23	C
1091.9	1104.1	12.1	0.514	0.487	1100.7	5.27	C
1104.9	1116.6	11.7	0.514	0.482	1116.0	6.32	C
1117.4	1129.3	11.9	0.514	0.478	1126.7	7.00	C
1130.1	1142.3	12.2	0.514	0.473	1141.6	8.01	C
1143.1	1154.5	11.4	0.514	0.477	1154.1	7.29	C
1155.3	1166.8	11.5	0.514	0.478	1164.6	6.93	C
1167.6	1178.9	11.3	0.514	0.481	1177.4	6.43	C
1179.7	1191.7	12.0	0.514	0.479	1180.1	6.89	C
1192.5	1204.4	12.0	0.514	0.476	1192.6	7.40	C
1205.2	1217.6	12.4	0.514	0.478	1215.0	7.08	C
1218.4	1229.9	11.5	0.514	0.488	1218.5	5.00	C
1230.7	1242.9	12.2	0.514	0.490	1242.9	4.71	B
1243.7	1256.7	13.0	0.514	0.485	1251.9	5.71	C

Table 9- 13 3/8" Casing Joint Summary Listing from MTD Log

MTD-MFC Tools Information and Specification

MTD Tool Specifications

General	MTD
Working Temperature	-20°C~177°C(-4°F~350°F)
Working Pressure	≤100MPa(14,503psi)
Working Voltage	18~38Volts(Pegasus),90Volts(Conventional MFC)
Working Current	350mA@18Volts(Pegasus),100mA@90Volts(Conventional MFC)
OD	φ43mm(1.69")
Length	1125mm (44.3in.)
Weight	5kg
Max. Logging Speed	10m/min(32ft/min)
Pipe String Measuring Range	60mm~473.1mm (2.362in. ~18.625in.)
Metallurgy	17-4SST,Titanium&Al-Bonze
Total Pipe Thickness	38.1mm (1.5in.)
Combinability	Pegasus Series and PegasusStar
Relative Bearing Measurement	
Measuring Range	0°~360°
Accuracy	±5° (deviation≥5°)
Sensitivity	±0.1° (deviation≥5°)
Deviation Measurement	
Measuring Range	0°~180°
Accuracy	±5°
Sensitivity	±0.1°

MFC Tool Specifications

Type	MFC24C	MFC40C	MFC56C
O.D.	43 mm (1 11/16")	73mm) 2 7/8" (90mm) 3 1/2")
Working Temperature	-20- 175°C(-40-350°F)		
Working Pressure	≤100MPa (15,000 PSI)		
Working Voltage	90V±2		
Working Current	37mA±3		
Measurement Range	45-180mm (1 3/4"-7 1/12")	80-210mm (3 1/8"-8 1/4" (100-245mm (3 15/16"- 9 13/20") 100-350mm (3 15/16"-13 4/5" with eXtension fingers)
Measurement Accuracy	±0.5mm (±0.02")		
Resolution	0.1mm(0.004")		
Deviation Range	0-180°		
Deviation Accuracy	±5°		
Deviation Sensitivity	0.1°		
Relative Azimuth Range	0-360°		
Relative Azimuth Accuracy	±5°		
Relative Azimuth Sensitivity	0.1°		
Transmission Mode	Mono-conductor		
Speed	≤600 m/h (1968ft/h)		
	(Vertical Resolution =8mm or 5/16")		

MTD-MFC Tool String Diagram

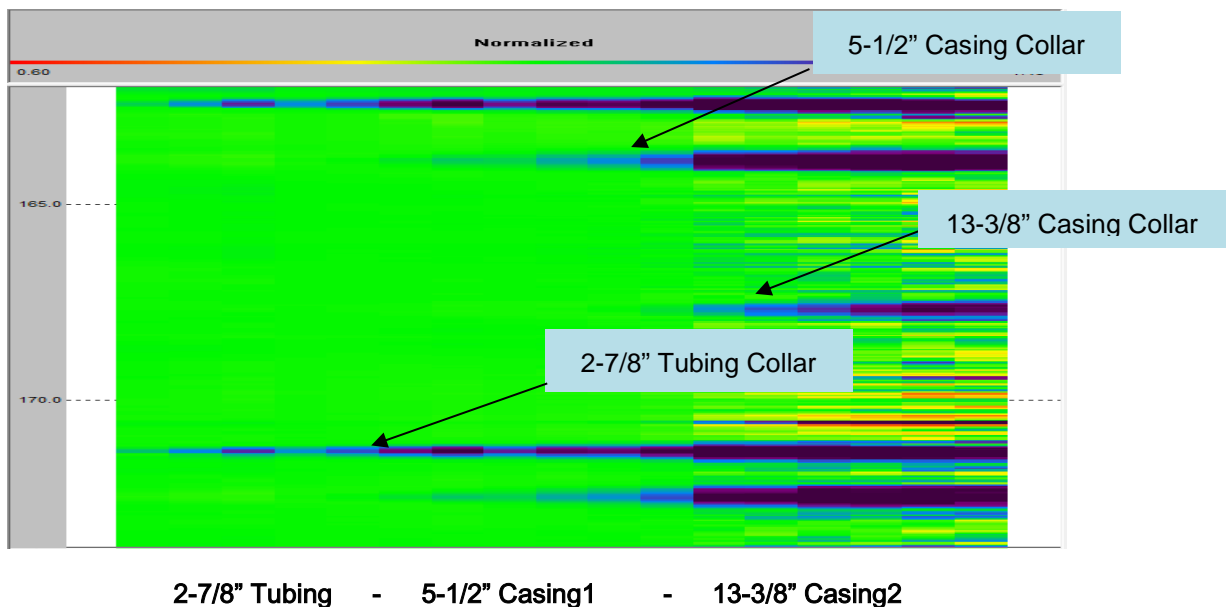
Sensor	Offset (ft)	Schematic	Description	Length (ft)	O.D. (in)	Weight (lb)	
TotalErr	18.76		WTS-43C-C (10001)	2.13	1.69	7.72	
WTS_ACCZ	16.63		SWC-43C-K GOWell GO Connection Crossover - GOWell 13 Pin Connection to GOWell 4-Pin connection	0.51	1.69	2.20	
WTS_ACCY	16.63						
WTS_ACCX	16.63						
TelCirT	16.63						
WTS_OT	16.63						
WTS_PT	16.63						
WTS_ET	16.63						
TelHeadV	16.63						
TelTemp	16.63						
Meas	11.83			MFC-56C-E (10006) GOWell 56 Arms Caliper - Pegasus	6.68	3.54	136.69
Aux1	10.89						
ECENTSTAT	9.44						
ECENT1	9.44						
ECENTV	9.44						
MTEC_CNOIS	7.62			MTD-43C-E (10001) GOWell Magnetic Thickness Detector (E type, GOWell 4-Pin connection) - Pegasus	3.69	1.69	12.13
MTEC_CI	7.62						
MTEC_COFS	7.62						
MTEC_CNSMP	7.62						
MTEC_CDEC	7.62						
MTEC_ANOIS	6.39						
MTEC_AI	6.39						
MTEC_AOFS	6.39						
MTEC_ANSMP	6.39						
MTEC_ADEC	6.39						
MTEC_ACCZ	6.39			PGT-43C (10001) GOWell GR_Temp (GOWell 4-Pin connection) - Pegasus	2.49	1.69	7.72
MTEC_ACCY	6.39						
MTEC_ACCX	6.39						
MTEC_TEMP	5.75						
MTEC_MODE	5.75						
MTEC_ET2	5.75						
MTEC_ET1	5.75						
MTEC_RES1	5.75		CTL-43C-F (12003) GoWell Roller Centralizer(4-Conductor Slip Ring connection)	2.73	1.69	12.13	
MTEC_TYPE	5.75						
PGT_GR	5.07						
PGT_WTemp	3.49						
PGT_CCL	3.26		BNT-43C (13005) GOWell Bull Nose - Pegasus	0.52	1.69	1.10	
		Dataset:	GOWell PegasusStar - SRO with WTS				
		Total length:	18.76 ft				
		Total weight:	179.68 lb				
		O.D.:	3.54 in				

MTD Data Processing/Data Display

MTD Log Interpretation and Presentation

The MTD makes multiple voltage measurements at various times during the decay of the received signal. Each measurement being sensitive to a different 'depth of investigation' of the surrounding tubing and/or casing (s). Early time points (or channels) relate to thickness of the inner tubular, and later time is related to the thickness of outer tubular.

The figure below shows visualization of the responses in a color VDL type map where the nominal response for each channel is colored green, positive values (thicker than nominal) are blue and negative values (thinner than nominal) are yellow to red. The VDL is then displayed with early-time channels in the left most position and late-time channels in the right most position.

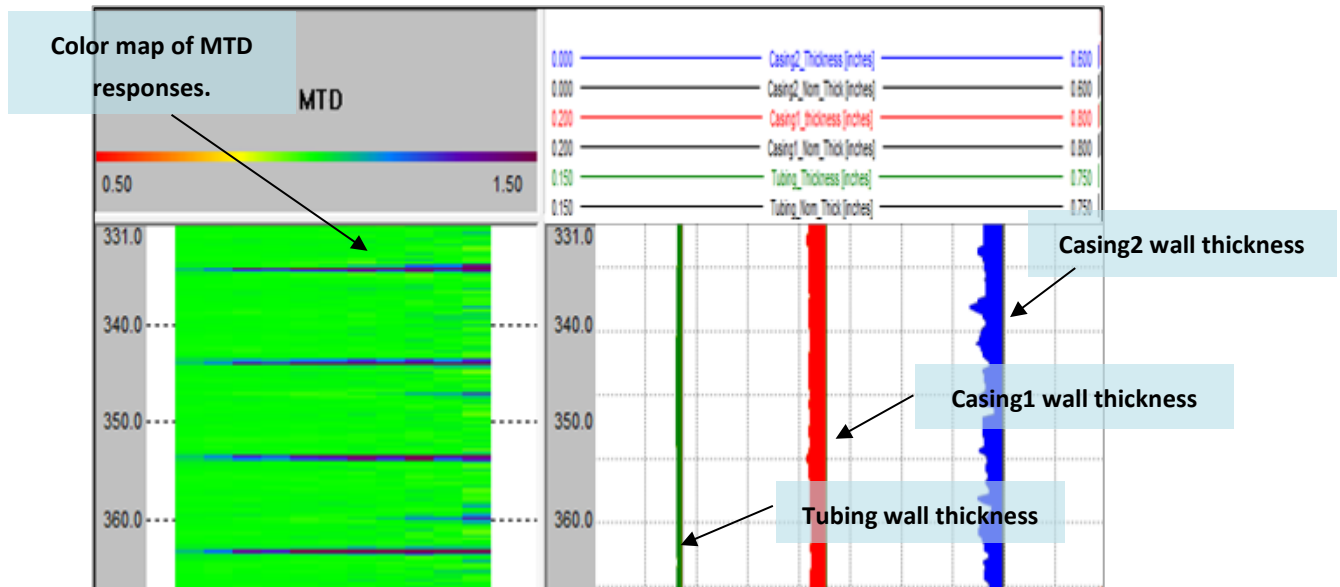


While the color VDL provides a user-friendly visual identification of pipe anomalies, this display is not quantitative.

The next step in log processing involves generating thickness values for the inner and outer tubular, typically the tubing and casing. As indicated in the figure above, the early time channels are not affected by an outer pipe much and are only sensitive to inner pipe thickness variations approximately. Thus by choosing channels in this early time region an inner pipe thickness is computed independently of any outer pipes present. The steps to compute an outer pipe thickness are similar, late time channels are chosen such that pipe collars are clearly detectable.

The figure below shows a typical presentation of MTD data interpretation: Track 1 - visualization of the responses in a color VDL type map; Track 2 - wall thickness curves for the tubing, casing1 and casing2 - with green shaded area between computed tubing wall thickness and nominal tubing wall thickness, red shaded area between computed casing1 wall thickness and nominal casing1 wall thickness and blue shaded area between computed casing2 wall thickness and nominal casing2 wall thickness (hence changes to the left of the nominal thickness line represent metal loss or thickness reduction).

Description of Post Processed Presentation



Presentation of MTD data interpretation

It should be noted that in contrast to a multi-finger caliper tool that measures diameters to form a 360 degree image of the internal pipe wall, the MTD tool is an omnidirectional device that responds as an average around the pipe circumference. The VDL type color map from a MTD tool can be considered radially not azimuthal sensitive (the early time channels sensitive to inner pipe thickness and later time channels sensitive to outer pipe thickness).