LIC-11-0004
Enclosure 3

Wesdyne Report No. 1305120-Rpt.1

"Fort Calhoun RPV Outlet Nozzle Eddy Current Data Normalization"

Dated December 2010

WESDYNE INTERNATIONAL
A Westinghouse Electric Company

Fort Calhoun RPV Outlet Nozzle Eddy Current Data Normalization

Report No: 1305120-Rpt.1

OPPD Contract No. 00083453, Release 00097, dated 10/13/2010

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Reviewed By: [signature] for   Date: Dec. 15, 2010

Don Adamonis

General Manager Products and Application Engineering

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Windsor, CT

December 2010

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1) Summary

Eddy Current Testing (ECT) data collected with a pancake coil probe during the Fall 2009 Fort Calhoun Station refueling outage while inspecting Dissimilar Metal Butt Welds (DMBWs) on two Reactor Pressure Vessel (RPV) outlet nozzles was evaluated to define the level of local permeability changes. In work performed over a decade (from 1999 to 2010) on Control Element Drive Mechanism (CEDM) seal housings at Fort Calhoun Station these local permeability changes were successfully used to monitor material susceptibility conditions that lead to degradation along primary water wetted surfaces and produce stress corrosion cracking (SCC). The work performed on the CEDM seal housings was presented to the 2010 ASME PVP Conference in Seattle (Reference 1).

Measurements taken with a pancake coil probe during the 2009 Fort Calhoun Station refueling outage along two RV outlet nozzles, shop made DMBWs have shown low local permeability variations. These variations are all within ~100% of normalized ECT signal amplitude calculated from normalized average amplitude values. The normalized signal amplitude scale was derived as a response from a 0.030" deep reference Electro-Discharge Machined (EDM) notch, the same methodology used with the CEDM seal housings at Fort Calhoun Station. The actual data collected during the 2009 refueling outage used a 0.040" EDM notch, which was corrected to the standard 0.030" EDM notch, so that direct comparisons of the CEDM seal housing to the RV nozzle outlet DMBWs data could be made.

A low level of local permeability variation in both DMBWs (as evidenced by few color palette changes in the vertical signal amplitude of the three dimensional C-Scans) combined with no detected degradation from extensive Ultrasonic Testing (UT) and ECT define conditions, which are characteristic of isotropic materials with structural stability and continuous homogeneity. No cracking, indications of cracking or repair areas were found in either DMBW. However, it is clear that this combination of examination techniques is capable of finding indications, and even finding areas of repair as evidenced by the permeability changes found in the stainless steel cladding over the nozzle area.

In conclusion, ECT pancake coil data has characterized and compared the material condition of two RV outlet DMBWs at Fort Calhoun Station to the decade of work performed on the CEDM seal housings. Both the CEDM seal housings and the two RPV outlet DMBWs at Fort Calhoun Station show the same stable structure. The lack of any significant, locally high permeability changes (a known precursor to SCC, Reference 1) in the DMBWs of two outlet RPV nozzles at Fort Calhoun Station makes initiation of SCC prior to the 2014 refueling outage a very low probability event.

2) Introduction

In earlier experience with material condition monitoring on CEDM seal housings at OPPD Fort Calhoun Station, we have learned that monitoring local material permeability changes could be used as an indicator to detect susceptible locations where damage mechanism (PWSCC) could be initiated. Experience with CEDM seal housing has confirmed that local permeability changes measured with normalized amplitude method, using eddy current probe with the pancake type coil, has confirmed stable material structural conditions with local permeability changes deviations measured slightly above 150% of the normalized amplitude (signal amplitude normalized with 0.030" deep calibration notch).

The preferred eddy current probe used for these measurements is one with pancake type coil. Absolute test mode used with this probe and uniform directional detection sensitivity on the inspected surface, combined with relatively large phase angle separation between flaw signals and permeability signals, in the impedance plane at 100 kHz test frequencies, allow us accurate measurements of these permeability changes. This phase angle separation also allows graphic presentation of these changes with plotting vertical signal component in 3-D, C-scan presentation.

To apply this experience on DMBW on RPV outlet nozzles the test data acquired with the pancake coil probe during the 2009 outage was evaluated. This eddy current data acquired with pancake type coil during the 2009 outage at Fort Calhoun was processed with the purpose of assessing local permeability changes along the exposed area of DMBW on two (2) outlet nozzles (nozzles at 0^{0} and 180^{0} orientation on RPV).

To minimize the effects of much higher permeability in the adjacent surfaces with stainless steel cladding we have used the approach to define the average measured value for permeability changes across the fully exposed DMBW surface, and compared this value with local measurements. This approach provided an alternative method to realistically assess the local deviation of these changes along the DMBW surface. Based on earlier experience with CEDM seal housings conclusions were made that the changes, with the value of 150% of the normalized amplitude (normalized with 0.030" deep EDM calibration notch) haven't experienced surface degradation mechanisms.

Local permeability changes were measured with normalized signal amplitude method similar to the process used with CEDM seal housings. The field acquired data evaluated in this report was measured with normalized signal amplitude method where normalized values were defined as a percent value of the signal amplitude from the existing calibration standard notch with nominal depth of 0.040". To compare these values with earlier experience from seal housing data, which were normalized on 0.030" deep EDM notch, we have adjusted these measurements with correction factor defined with specially procured test block containing both 0.040" and 0.030" deep EDM notches. The correction factor is calculated as a ratio between signal responses at 100 KHz test frequency from 0.040" and 0.030" deep EDM notches. Measured values for normalized amplitudes wit 0.040" deep EDM notch were directly proportional corrected for the value of this ratio. These corrected values were used for comparisons with earlier data and observations with CEDM seal housings.

In addition to these data acquired with pancake probe the same nozzles were inspected with qualified NDE inspection techniques (UT and ECT) that have confirmed degradation free condition on these surfaces. No detectable degradations were observed.

During the local permeability measurements with pancake type probe we have noticed very low level of eddy current background noise on these surfaces. This phenomenon has produced the best resolution on the higher test frequency of 500 KHz. By observing the test data on this high frequency we were able to confirm earlier conclusions that there are no degradations present on DMBW surfaces.

This conclusion, that no degradations are present on these surfaces, has established a relatively good reference point to monitor and quantify surfaces permeability changes to identify potential locations with relatively large local permeability deviation . The characteristic of such a structurally sound surface, based on experience with CEDM seal housings, expects no major deviations for local permeability changes exceeding 150% of normalized amplitude value.

3) Local Permeability Variation (PV) Measurement

Measurements of these local permeability values on two outlet nozzle were performed along DMBW circumferential direction at intervals of approximately 15 circumferential degrees. The measured values are defined as the maximum predominantly vertical component of the lissajous signal bounded between two neighboring high permeability surfaces established with stainless steel cladding on both side of DMBW-s. The essential details for this measuring process are illustrated on Figure 11.

Normalized signal amplitude from 0.040" deep EDM notch (calibration standard used with field data acquisition in 2009) is shown on Figure 7. All individual local permeability values were measured with this normalized signal amplitude scale. Individual measurements for each of the 25 locations on two outlet nozzle are shown on Figures 1 and 4. Numerical measurement and combined lissajous and 3-D, C-scan presentation are included in Attachments A and B. These measurements were used to calculate the average value of local permeability along full circumferential extent for each DMBW on these two nozzles.

For each nozzle a total of 25 individual measurements were taken along even segments along each weld's full circumference. These absolute measurements are presented in Attachment A, for outlet nozzle at 0^{0} orientation (nozzle A), and in Attachment B, for outlet nozzle at 180^{0} orientation (nozzle B). Two graphs with local permeability measurements for two nozzles are shown on Figures 1 and 4.

To calculate the value for correction factor special test block made from inconel alloy 600 was procured containing EDM notches with 0.030" and 0.040" nominal depth. Characteristic signal responses from these two notches are shown on Figures 8 and 9.

Based on measurements of signal amplitude at 100 kHz test frequency the correction factor was calculated to be 1.27.

Individual measurements from field data for each of 25 locations along two outlet nozzles were adjusted with correction factor to normalized measurement signal amplitude scale equivalent to 0.030" deep EDM notch. From corrected measurements we have calculated average value for each nozzle and define local deviation for each of the measuring locations. Calculated average value is defined as an arithmetic average for all measurements along one nozzle. The results of this local deviation from calculated average value for permeability change are shown on Figures 2 and 5. These graphs are produced with corrected values for normalized signal amplitude to reflect the compliance with normalization process using the 0.030" deep EDM notch, the same normalization process used with CEDM seal housings.

4) Results and Observations

Results of local permeability variation along two outlet nozzles DMBW on RPV at Fort Calhoun have shown low level of deviation from normalized average value. This low level of permeability variation confirms material isotropic property along the DMBW. In addition to numerical measurements summarized in graphs on Figures 2 and 5, these properties are also visible on 3-D, C-scan presentation with vertical signal amplitude components displayed with color palette image. The presented color palette is associated with the maximum values of detected permeability (dark brown-red colors) along Stainless Steel (S/S) cladding on safe end, and minimum values (blue-green color) along DMBW surface. Slightly lover than maximum level permeability values are detected on S/S cladding on nozzle side (red-yellow colors). These 3-D, C-scans for both outlet nozzles are shown on Figures 3 and 6. From these 3-D, C-scans we can conclude on repeatable and homogenous material properties along DMBW and adjacent surfaces. Some local repair patches locations were detected along S/S cladding on nozzle sides. Based on manufacturing inspection report it appears that these areas were repaired with local grinding to remove shallow surface indications. These areas have shown lowered level of local permeability changes along S/S cladding surfaces in comparison with the as welded surface on the same material. These patches are visible in individual scan measurements in the enclosed attachments (yellow-green patches on red-orange surfaces and blue-green patches on yellow red surfaces along S/S cladding on nozzle sides).

Local permeability variations from calculated average value along DMBW–s have confirmed low level of deviations, lower than 150% of normalized amplitude with 0.030" deep EDM notch. Based on earlier experience with CEDM seal housings these level of deviations were associated with structure not affected with degradation mechanism. Very low level of permeability variation and consistency of similar properties along adjacent structure confirms that both DMBW-s on two outlet nozzle contain stable and homogenous structure characteristic for isotropic material structure along inspected surfaces. These results in conjunction with verified structurally sound integrity along DMBW, based on extensive and elaborate combination of NDE performed with qualified UT and similar ECT inspection techniques, provide the basis to characterize these two welds as a structure with minimal property variation and high homogeneity. Such uniform structure with relatively minimal local permeability variations (lower than 150% of normalized amplitudes) were known with earlier experience on CEDM seal housings as a surfaces with minimal susceptibility to the known degradation mechanisms on wetted surfaces.

5) References:

1) "DETERMINING THE ONSET OF STRESS CORROSION CRACKING IN AUSTENITIC STAINLESS STEEL WITH PERMEABILITY CHANGE" ,
Dr. Bob Lisowyj -OPPD, and Zoran Kuljis-Westinghouse Electric LLC
Proceedings of the ASME Pressure Vessels and Piping Conference July 18-22, 2010, Bellevue, Washington, USA

2) CEDM Seal Housing Inspection Reports from OPPD Fort Calhoun Station, for refueling outages from 1999 to 2009. Zoran Kuljis-Westinghouse Electric LLC

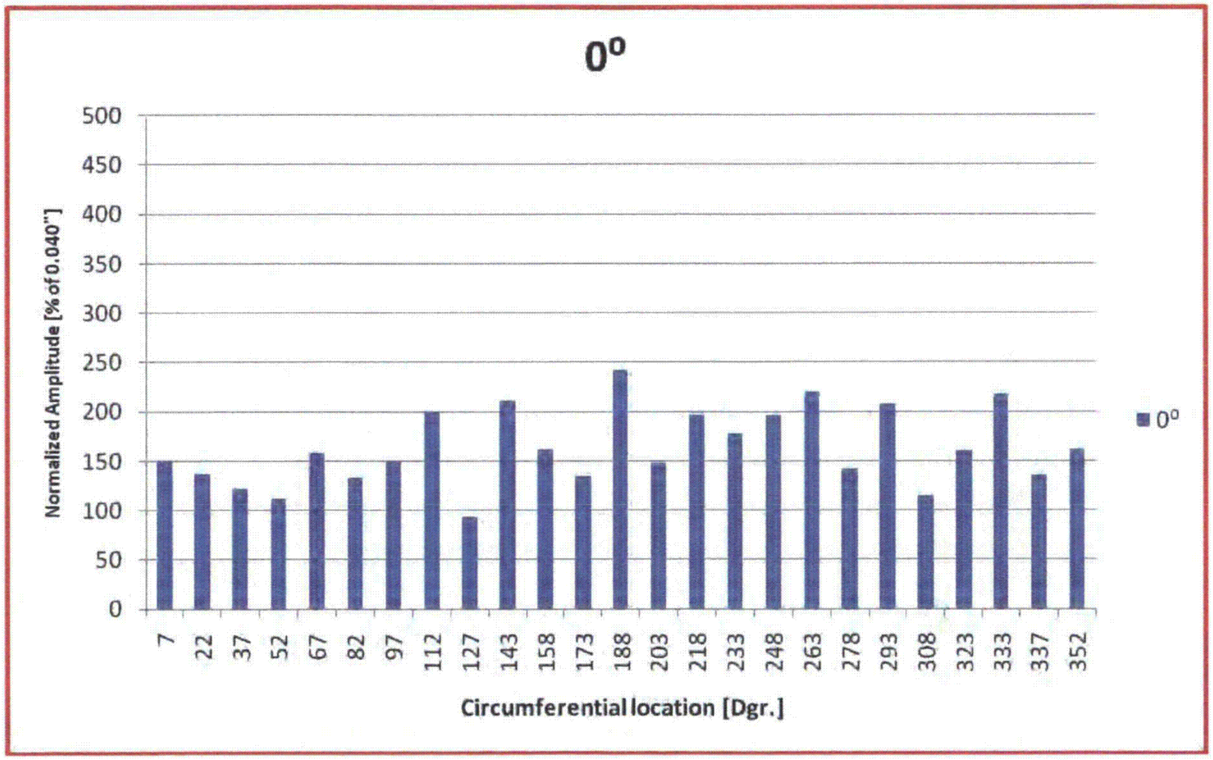

Fig. 1 - Normalized Local Permeability Measurements along DMBW in Outlet Nozzle at 0° Location on Fort Calhoun RPV

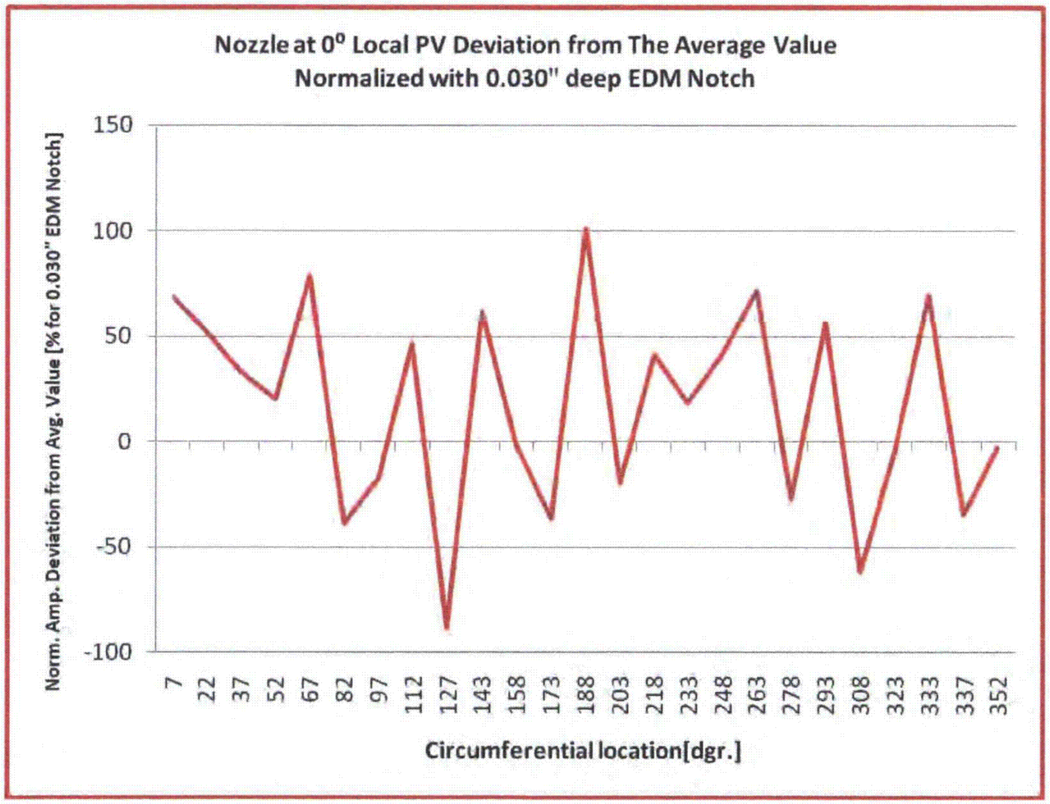

Fig. 2 - Normalized (0.030" notch) Local Permeability Deviation from Average value along DMBW

RPV Outlet Nozzle at 0^0 Location

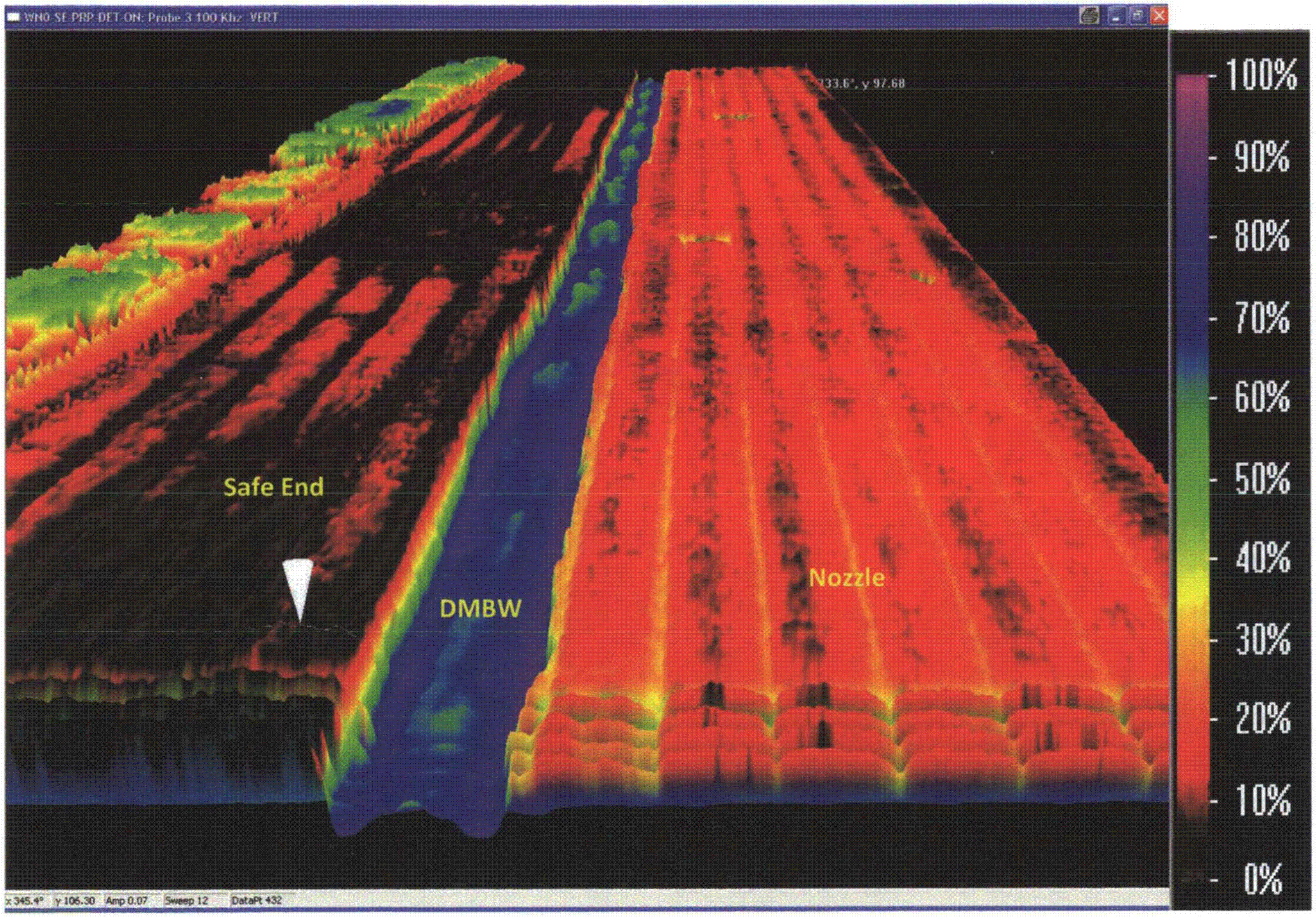

Fig. 3 - Eddy Current Data with Pancake Coil along DMBW in Outlet Nozzle at 0° Location on Fort Calhoun RPV

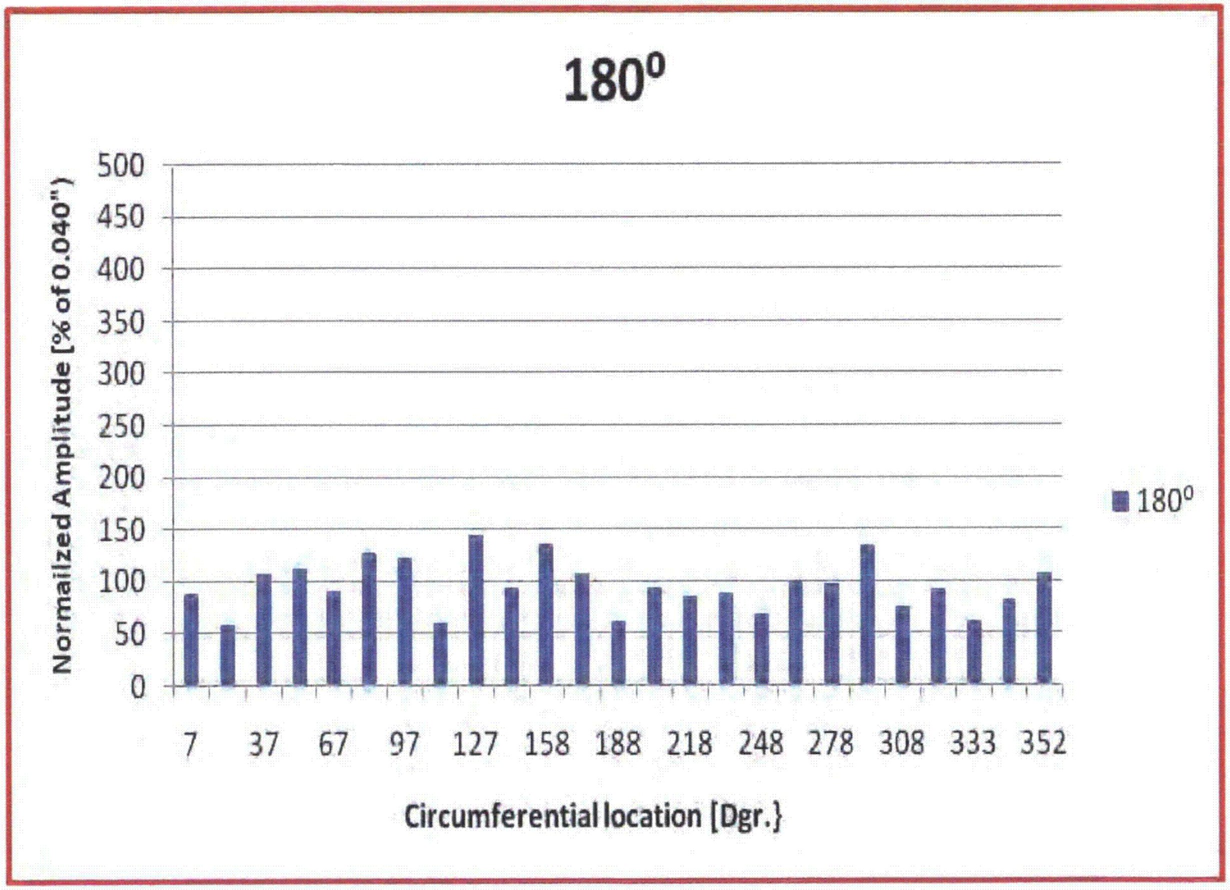

Fig. 4 - Normalized Local Permeability Measurements along DMBW in Outlet Nozzle at 180° Location on Fort Calhoun RPV

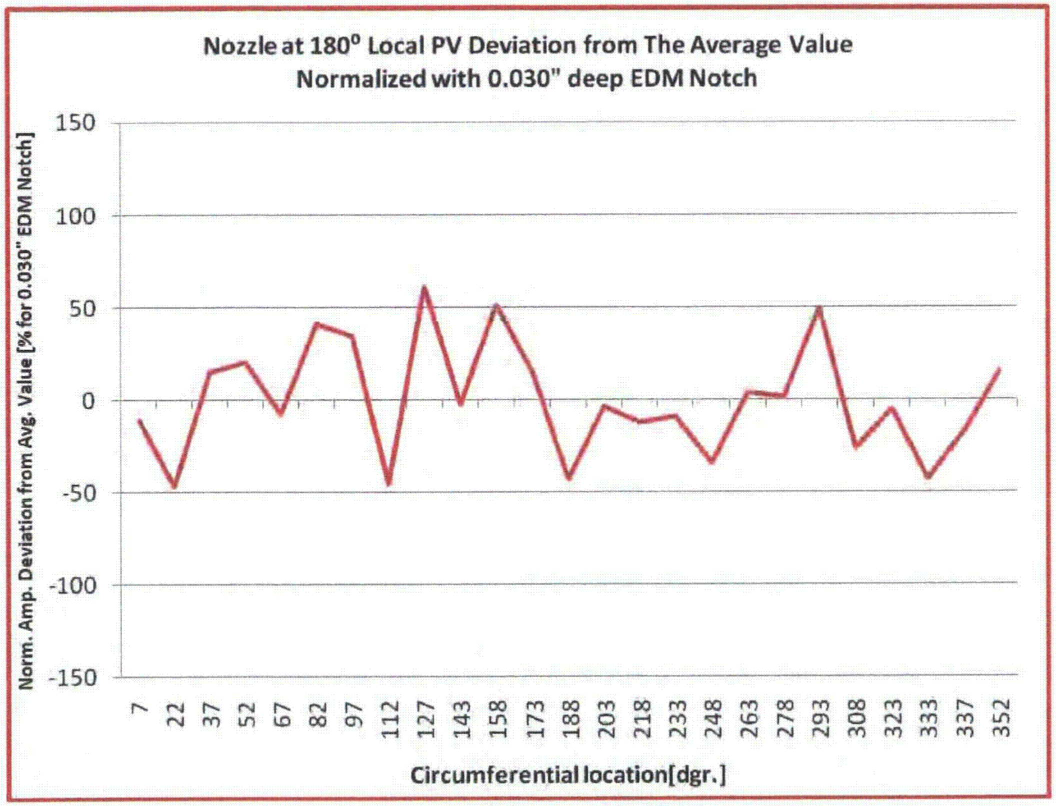

Fig. 5 - Normalized (0.030" notch) Local Permeability Deviation from Average value along DMBW

RPV Outlet Nozzle at 180° Location

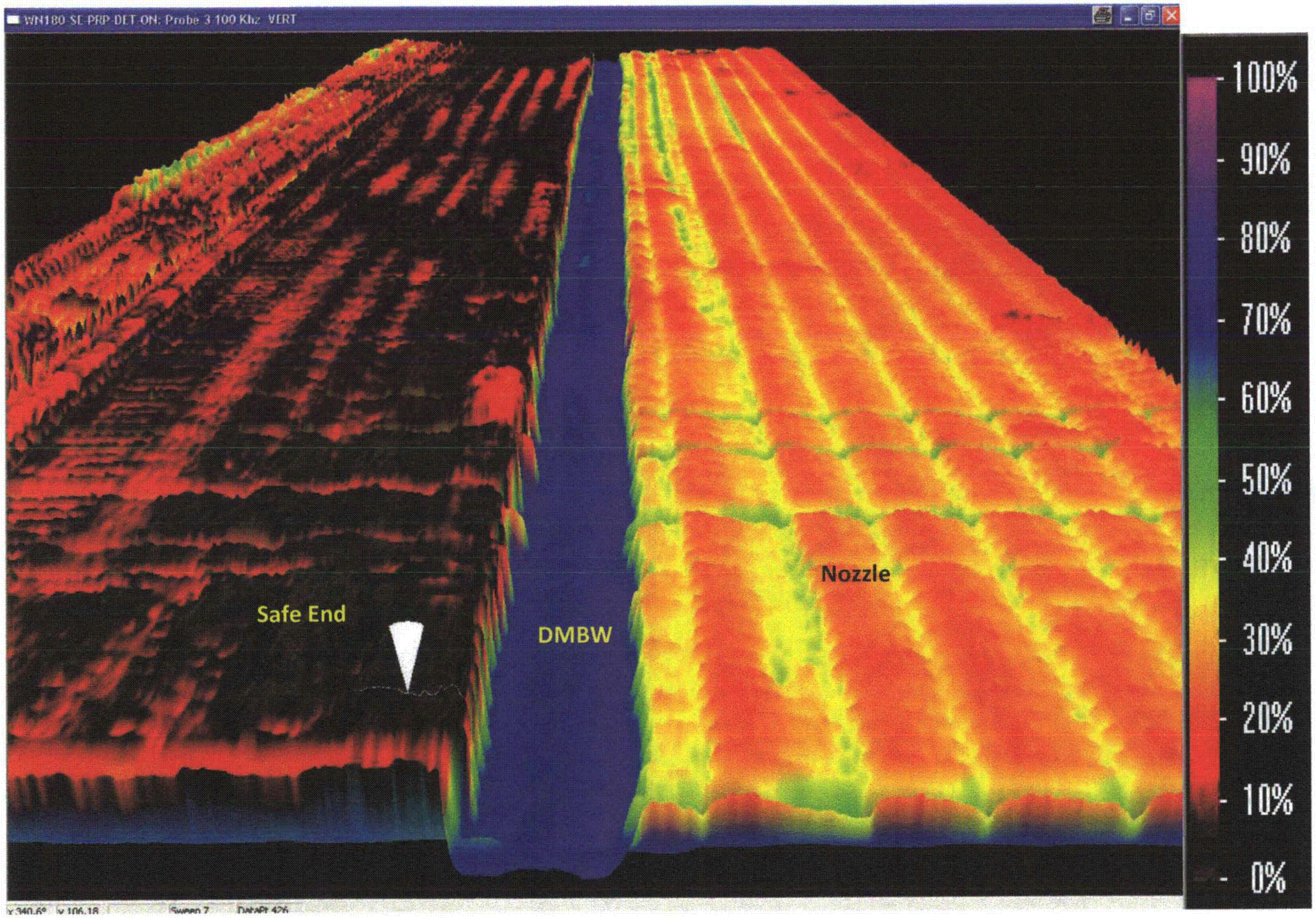

Fig. 6 - Eddy Current Data with Pancake Coil along DMBW in Outlet Nozzle at 180° Location on Fort Calhoun RPV

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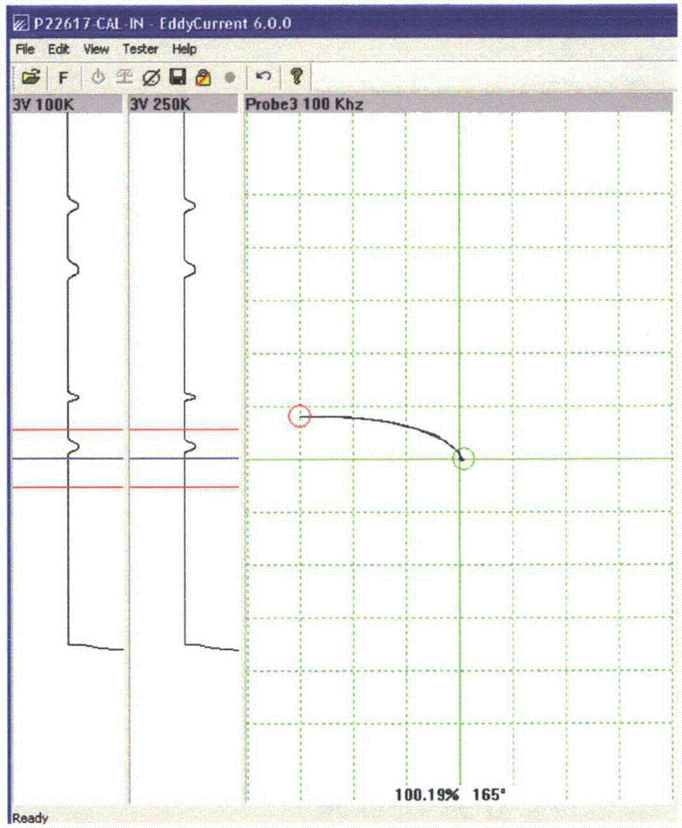

Fig. 7 – Normalized Eddy Current Signal Amplitude with 0.040" Deep EDM Notch used for Field Calibration

Normalized signal amplitude response with 0.040" deep EDM notch (100%)

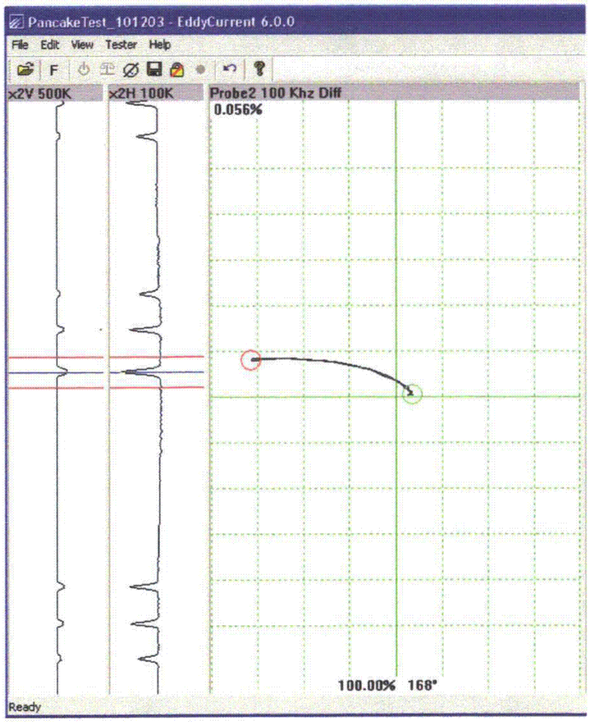

Fig. 8 - Response from 0.040" deep notch measures 100%

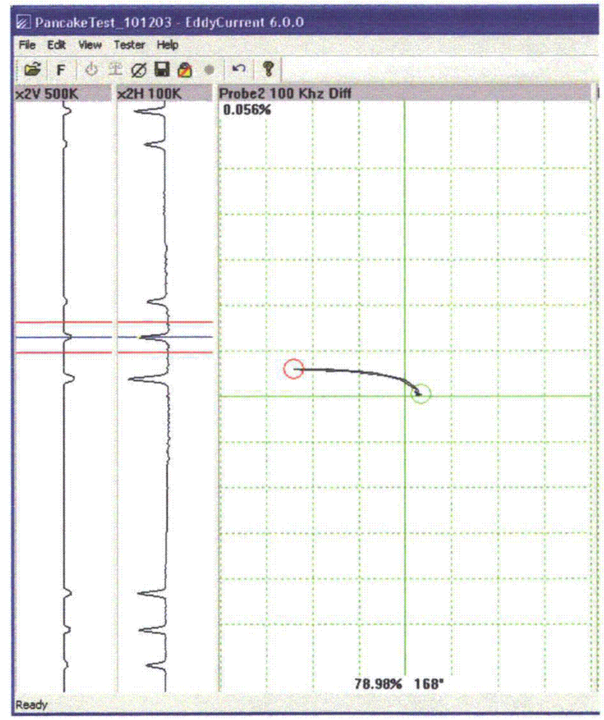

Fig. 9 - Response from 0.030" deep notch measures: 78.98% at 100 kHz test frequency

Correction factor for adjusting amplitude of normalized measurements from 0.040" to 0.030" deep notch is:

100/78.98= 1.27

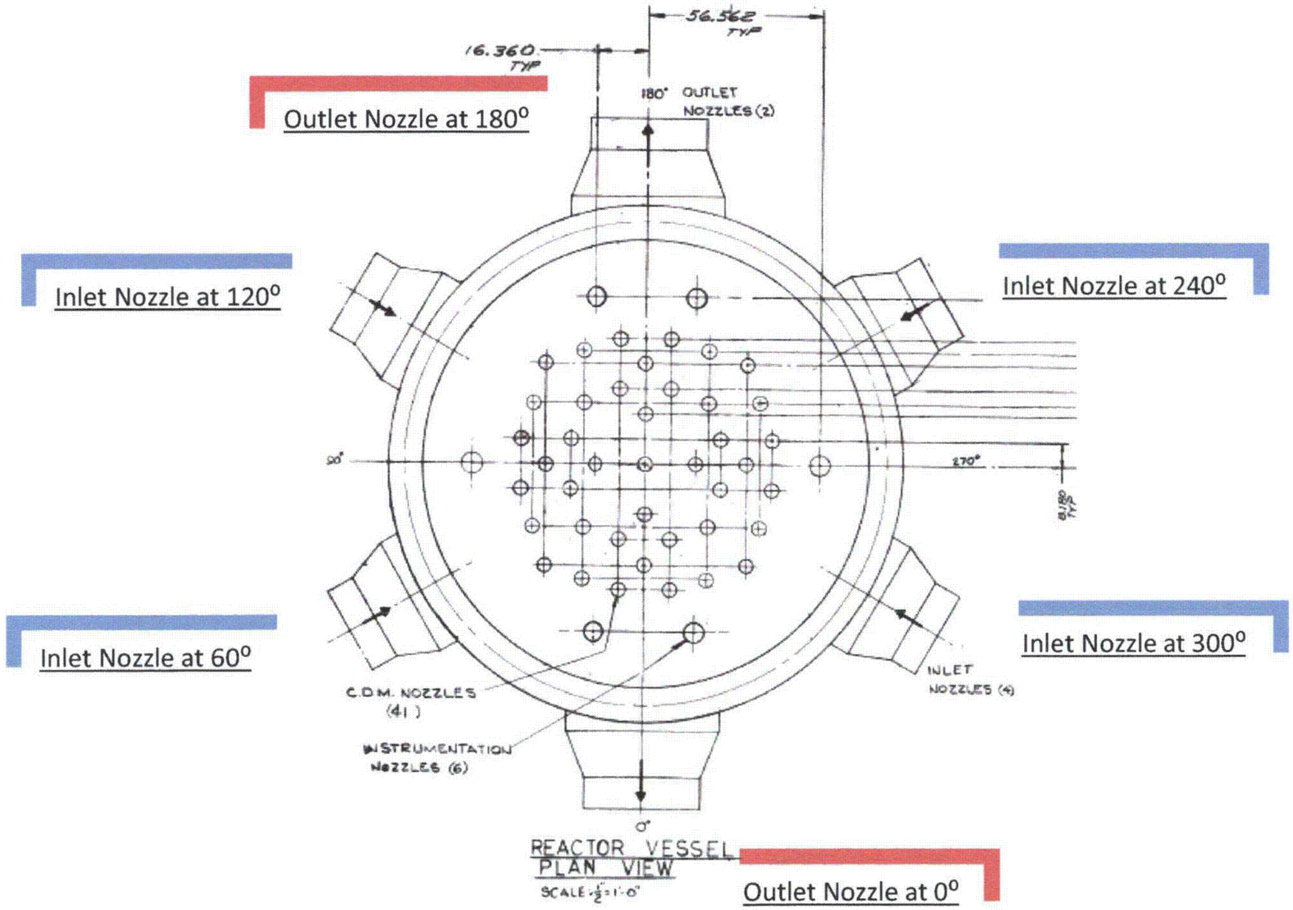

Fig. 10 - Fort Calhoun RPV Nozzles Configuration

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Measured Maximum deviation of PV across DMBW

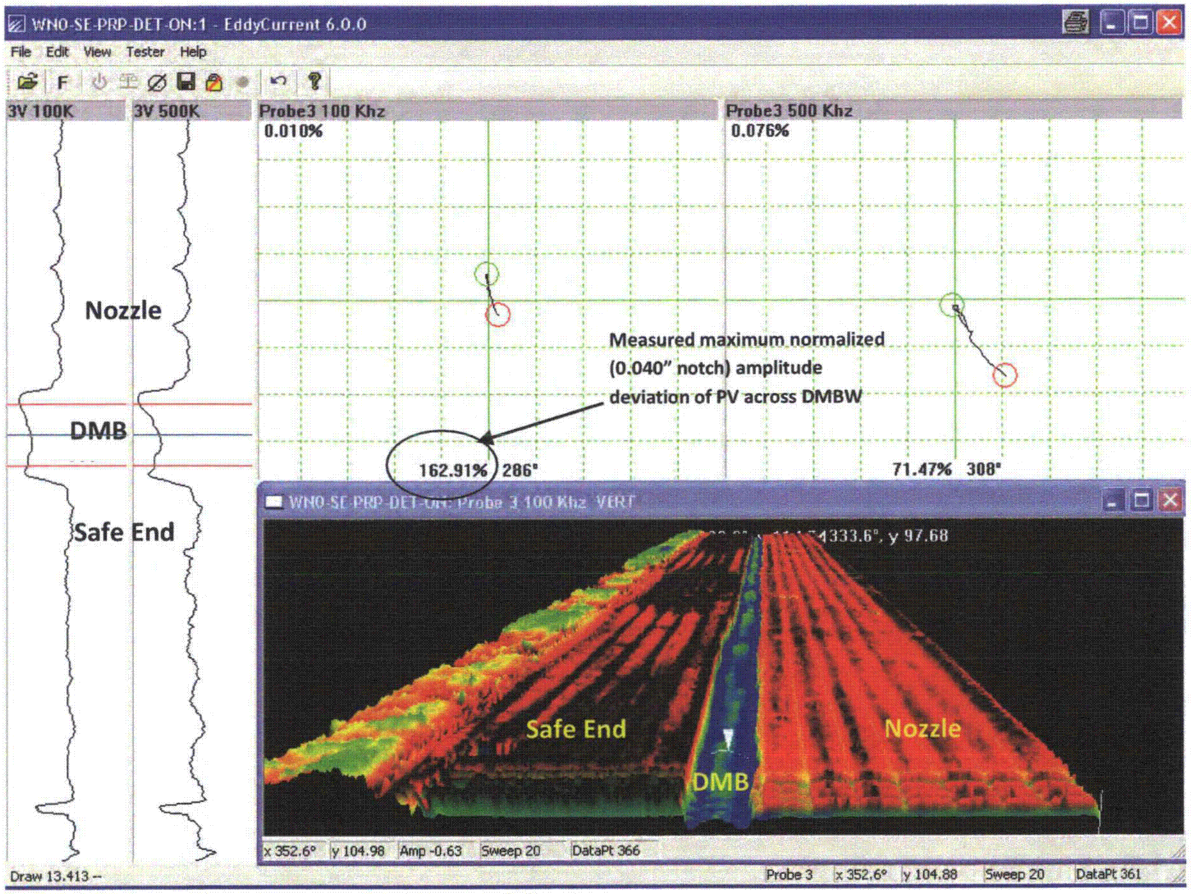

Fig. 11 - Fort Calhoun RPV Nozzles Measuring Local Permeability Variation across DMBW

Attachment A

Local Permeability Measurements with Normalized Signal Amplitude to 0.040" calibration Notch Nominal Depth for

Outlet Nozzle at 0^{0} Location on Fort Calhoun RPV

Circ. Loc	Nozzle 0° Normalized Ampl. 0.040" 100 kHz [%]	Nozzle 0° Corrected Normalized Ampl. 0.030" 100 kHz [%]
7	150	190.5
22	137	173.99
37	122	154.94
52	112	142.24
67	158	200.66
82	133	168.91
97	150	190.5
112	200	254
127	94	119.38
143	212	269.24
158	162	205.74
173	135	171.45
188	243	308.61
203	148	187.96
218	196	248.92
233	178	226.06
248	196	248.92
263	220	279.4
278	142	180.34
293	208	264.16
308	115	146.05
323	161	204.47
333	218	276.86
337	136	172.72
352	162	205.74
Avrg.	**163.52**	**207.6704**

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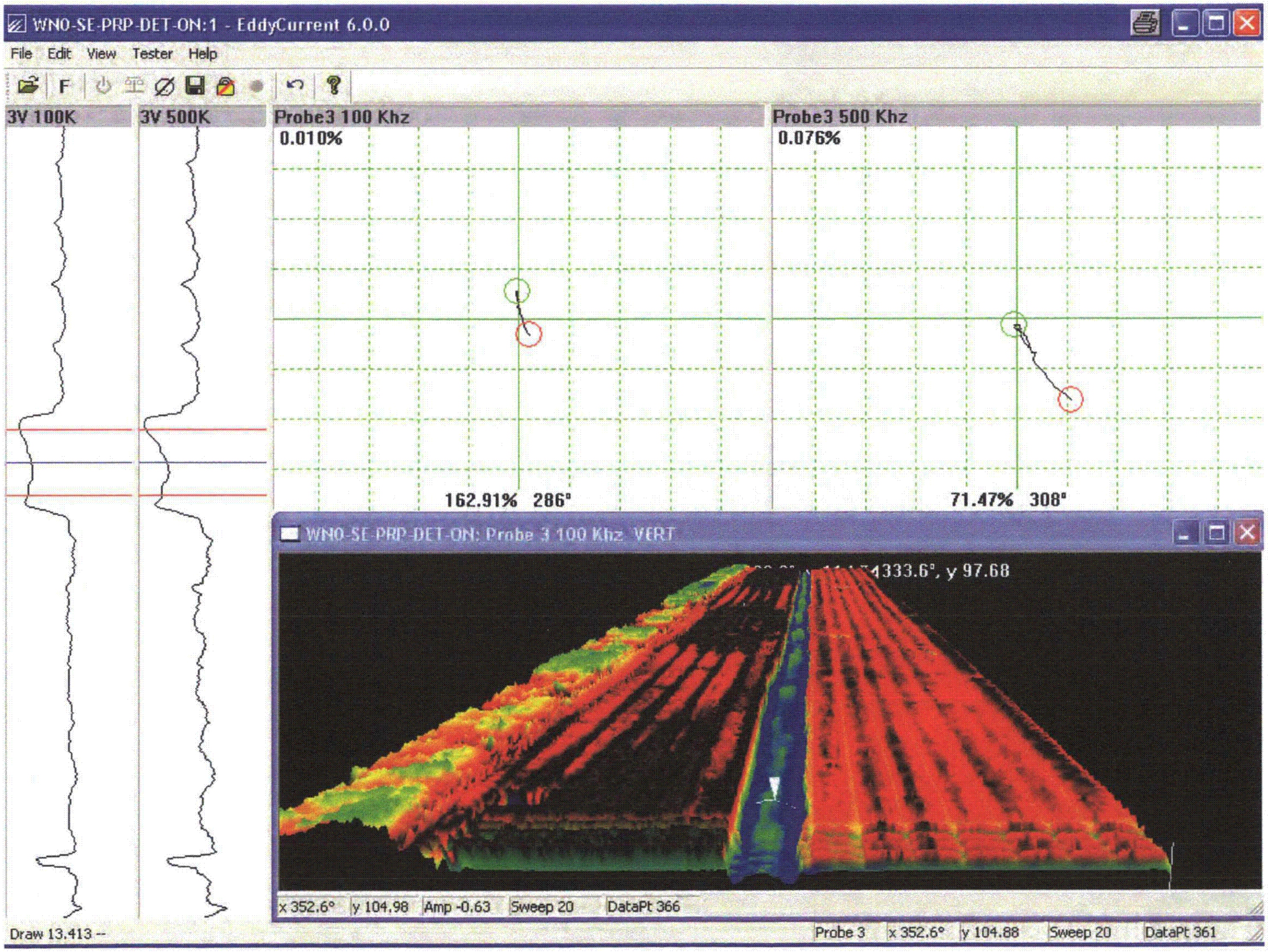

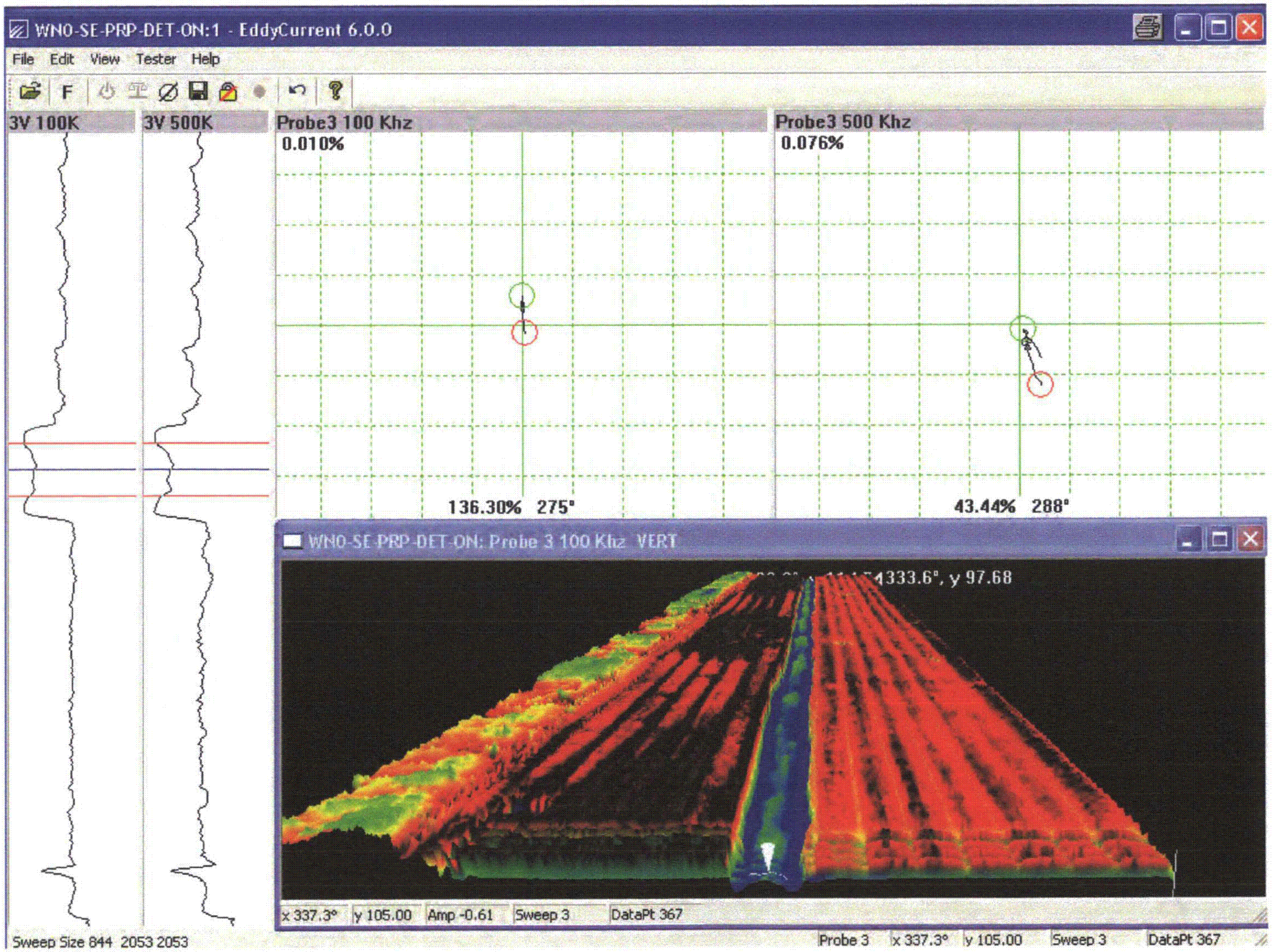
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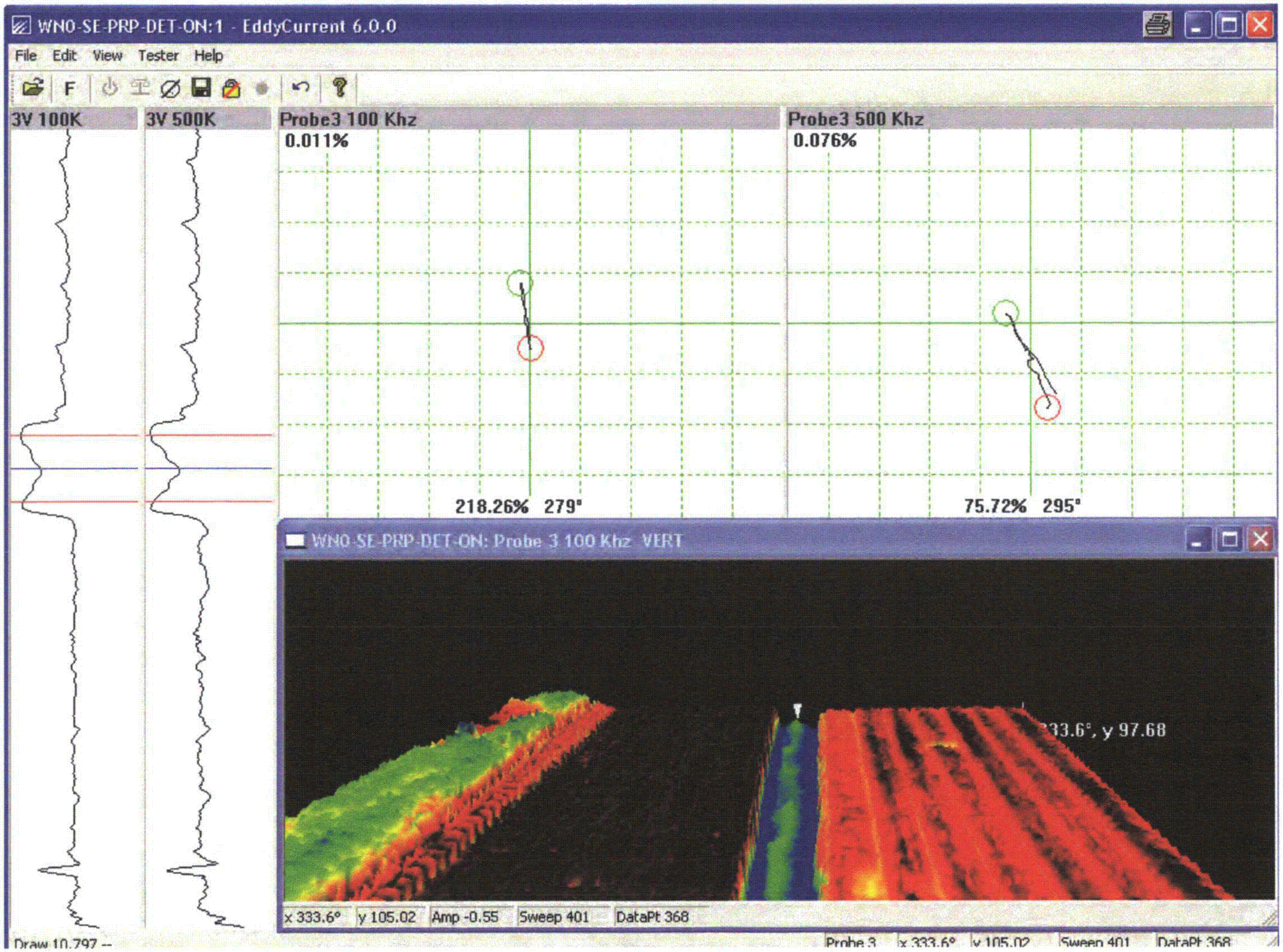
3V 100K
3V 500K
Probe3 100 Khz
0.010%
136.30% 275°
Probe3 500 Khz
0.076%
43.44% 288°
WNO-SE-PRP-DET-ON: Probe 3 100 Khz VERT
x 337.3° y 105.00 Amp -0.61 Sweep 3 DataPt 367
Sweep Size 844 2053 2053
Probe 3 x 337.3° y 105.00 Sweep 3 DataPt 367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218.26% 279°
Probe3 500 Khz
0.076%
75.72% 295°
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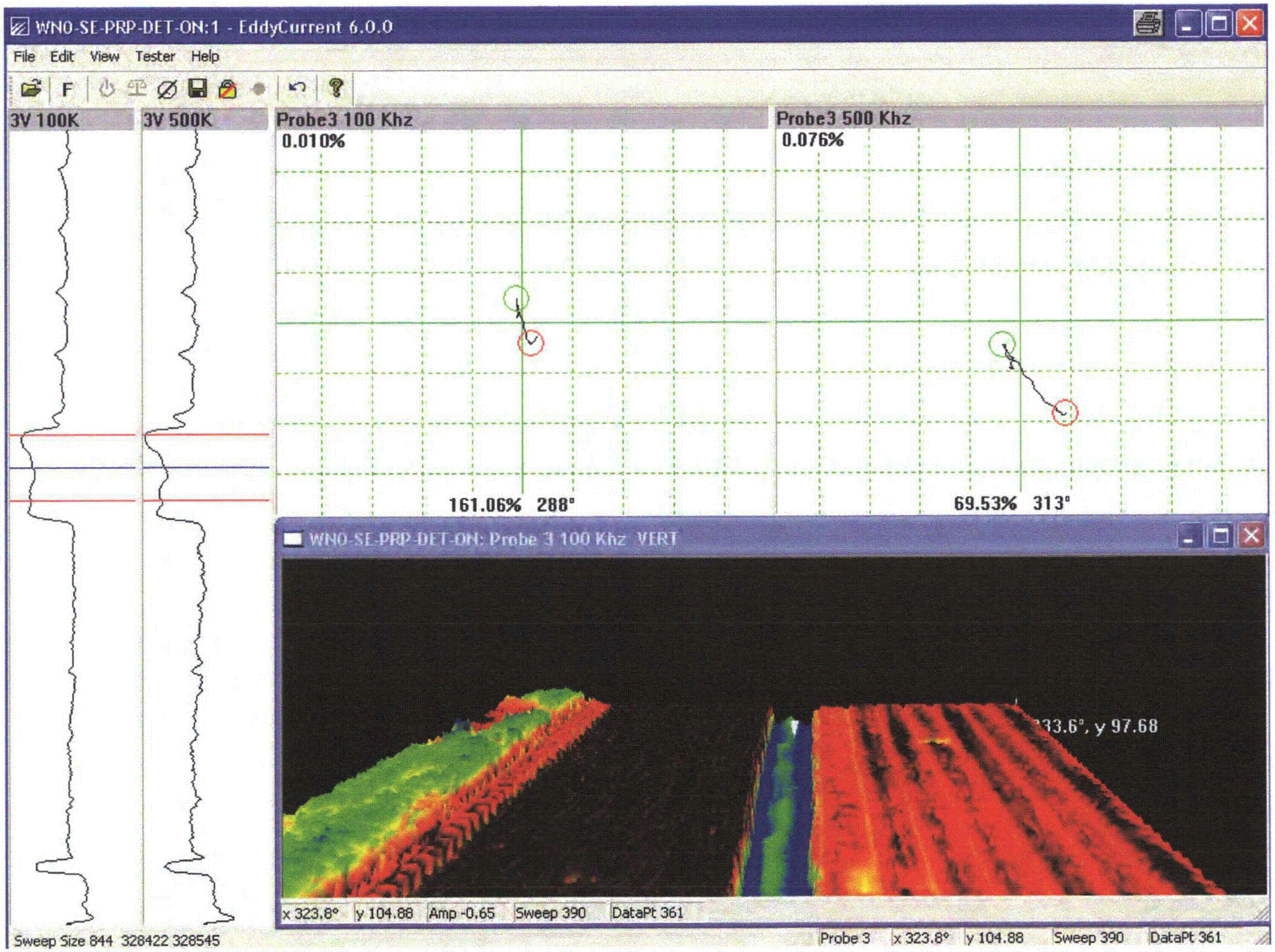
x 333.6° y 105.02 Amp -0.55 Sweep 401 DataPt 368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161.06% 288°
Probe3 500 Khz
0.076%
69.53% 313°
WN0-SE-PRP-DET-ON: Probe 3 100 Khz VERT
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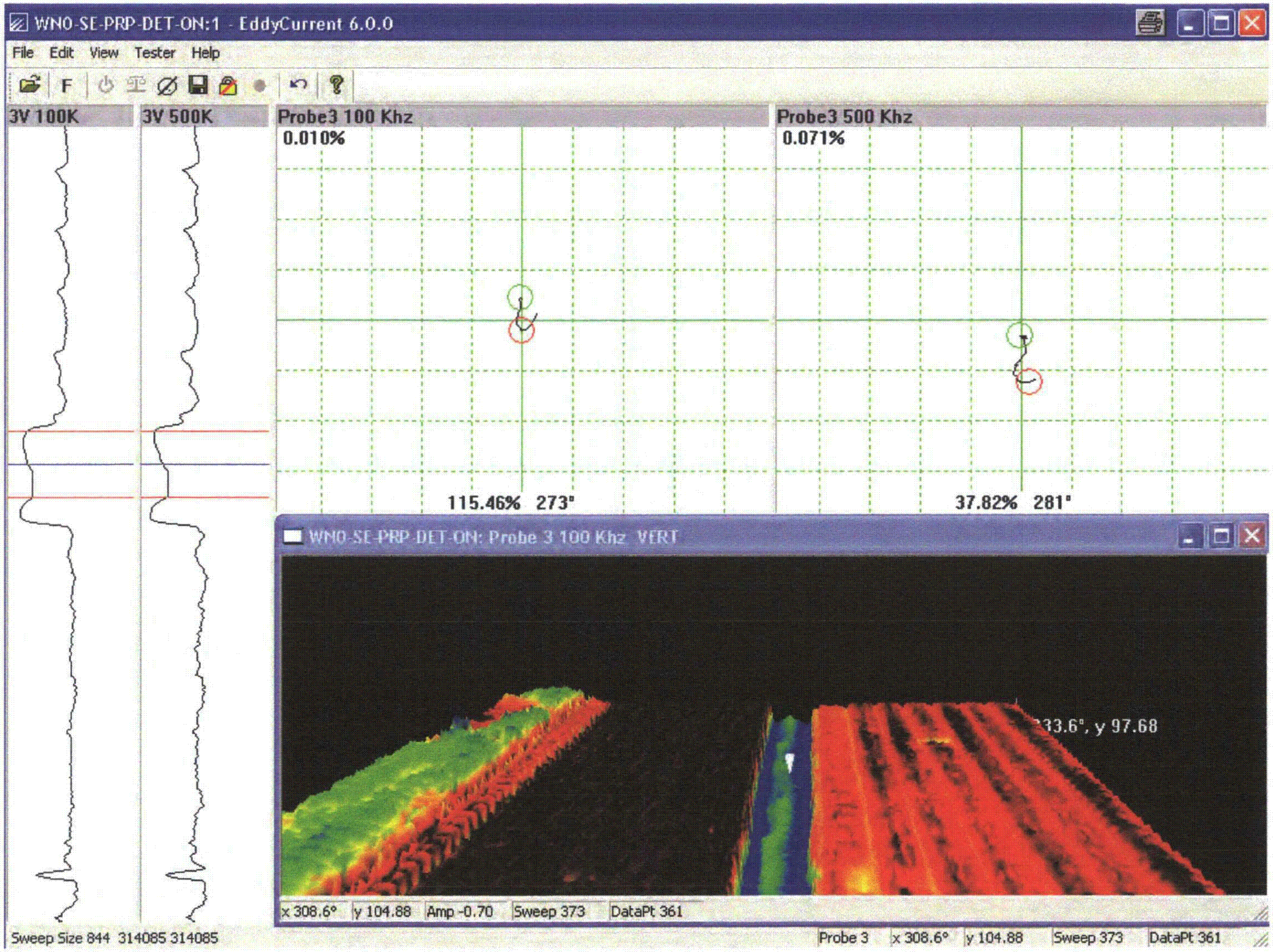

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115.46% 273°
Probe3 500 Khz
0.071%
37.82% 281°
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33.6°, y 97.68
x 308.6° y 104.88 Amp -0.70 Sweep 373 DataPt 361
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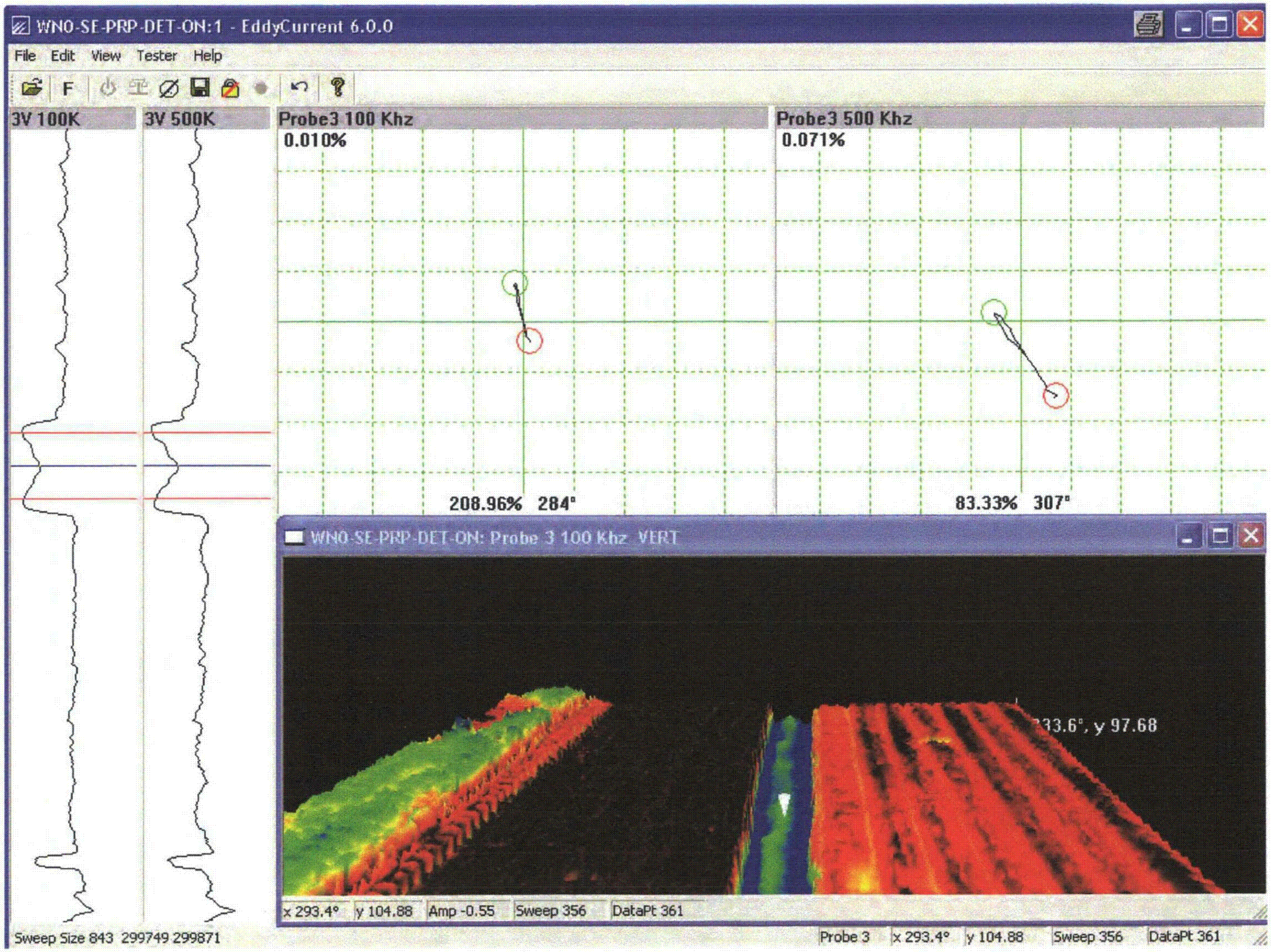
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3V 500K
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208.96% 284°
Probe3 500 Khz
0.071%
83.33% 307°
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x 293.4° y 104.88 Amp -0.55 Sweep 356 DataPt 361
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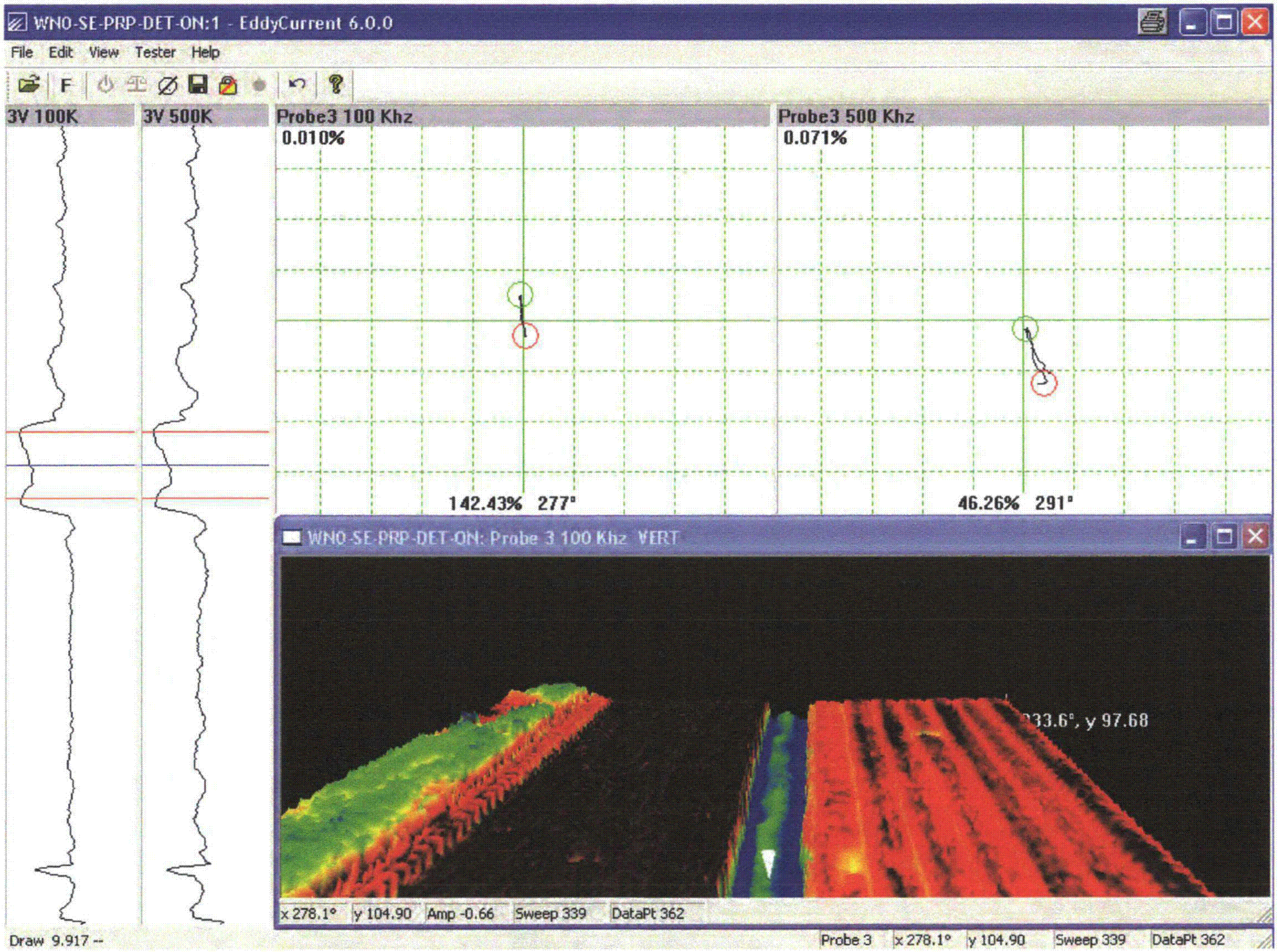
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0.071%
142.43% 277°
46.26% 291°
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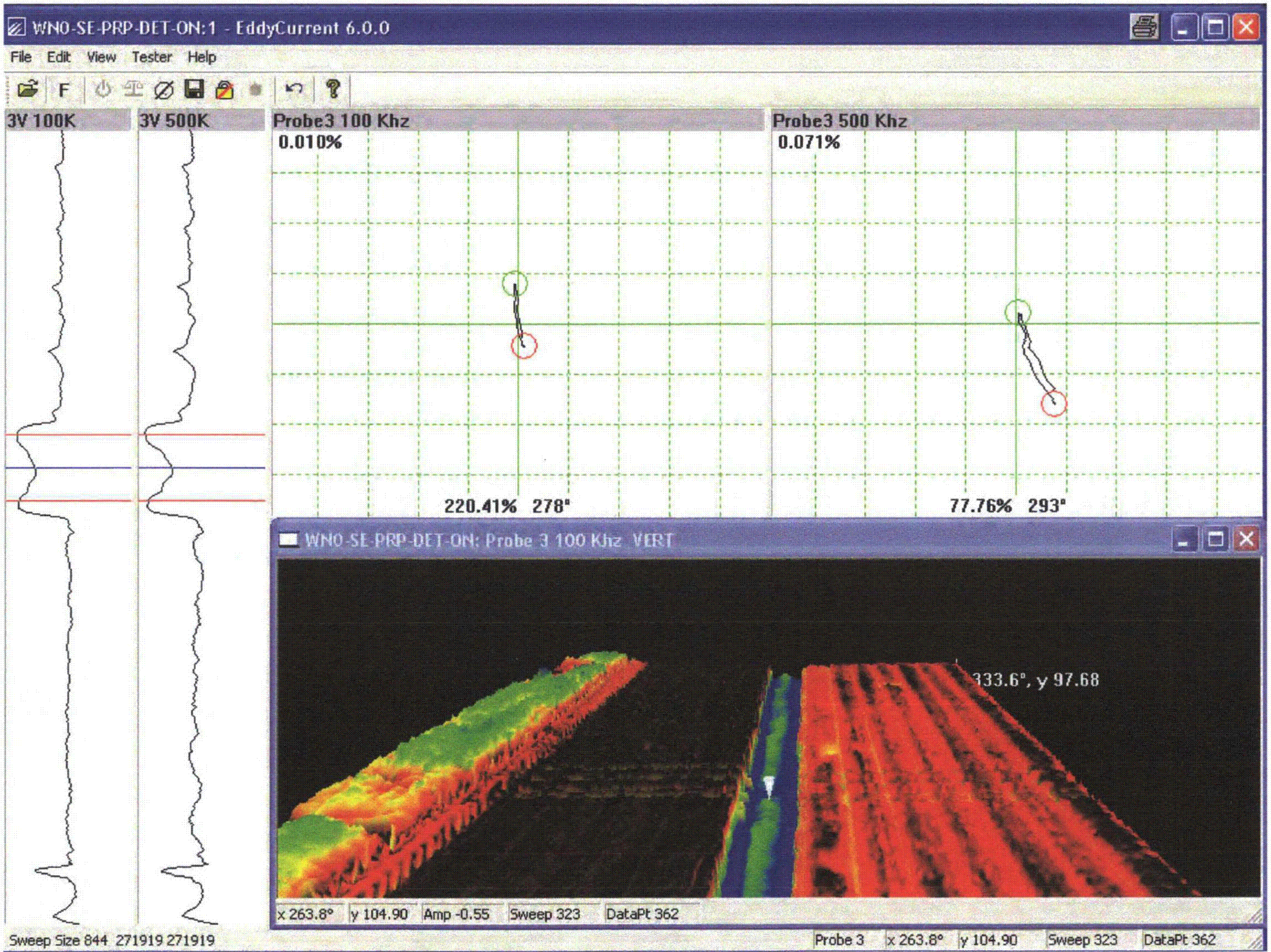
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220.41% 278°
Probe3 500 Khz
0.071%
77.76% 293°
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333.6°, y 97.68
x 263.8° y 104.90 Amp -0.55 Sweep 323 DataPt 362
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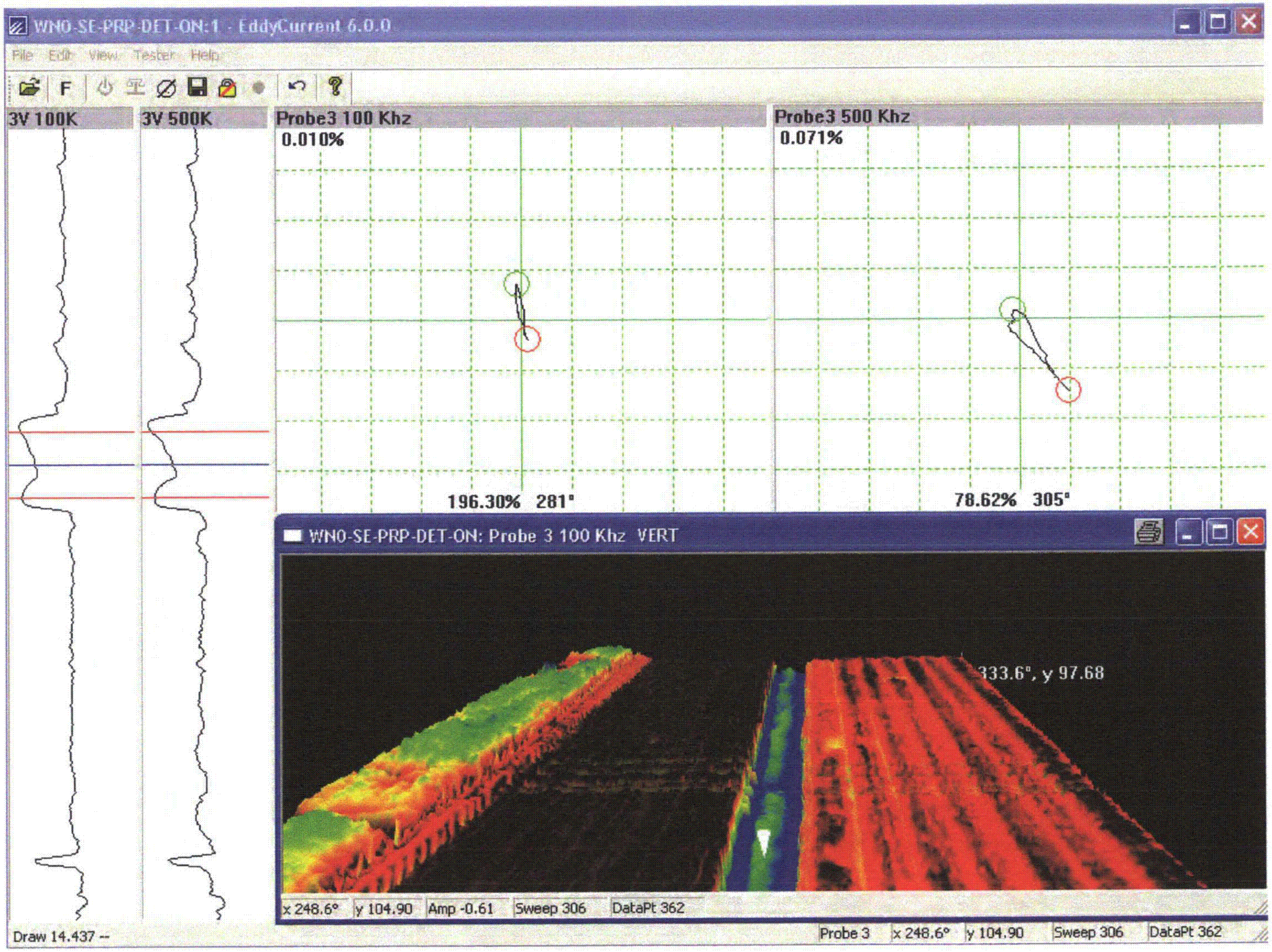

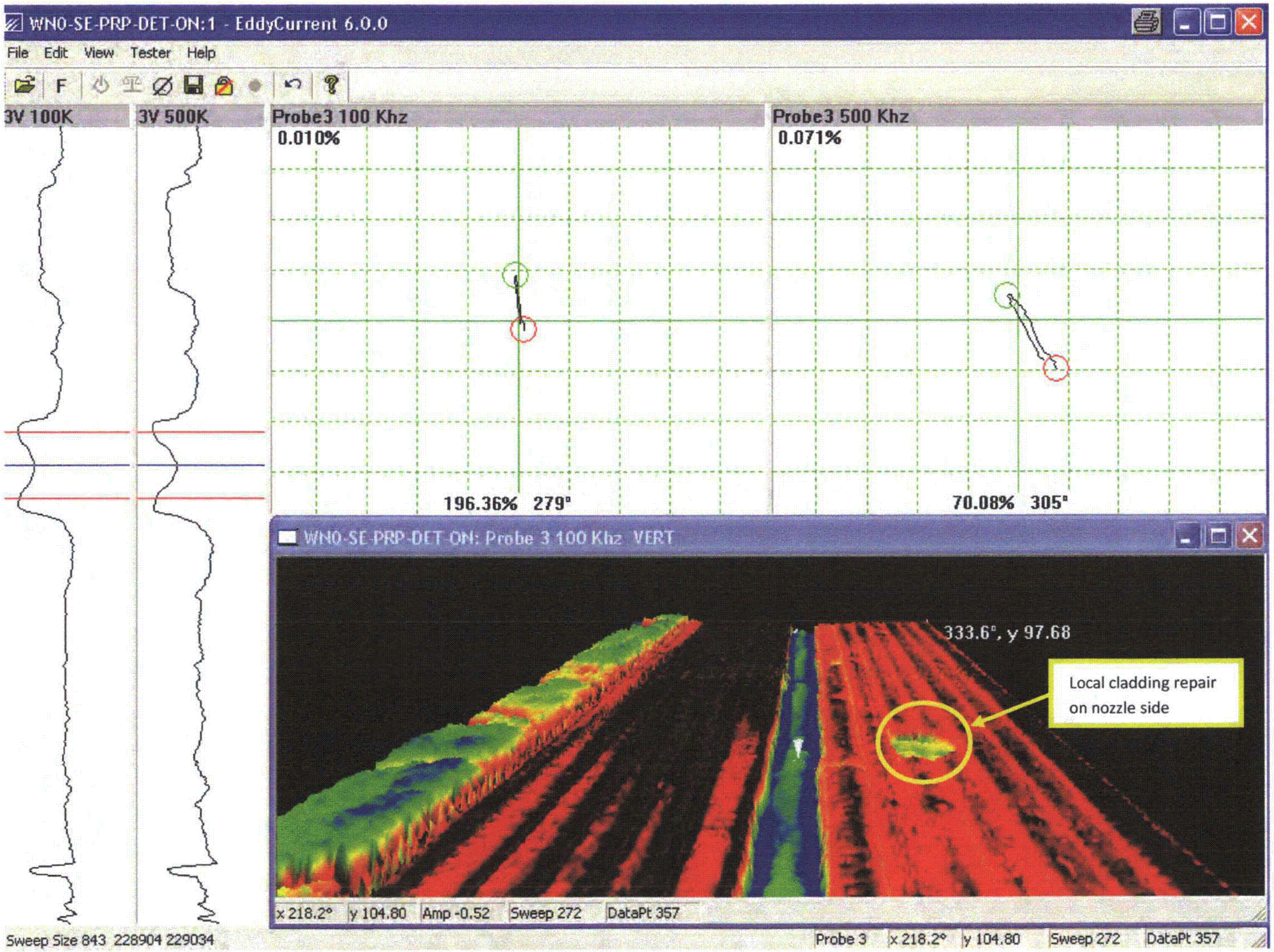
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196.36% 279°
Probe3 500 Khz
0.071%
70.08% 305°
WNO-SE-PRP-DET-ON: Probe 3 100 Khz VERT
333.6°, y 97.68
Local cladding repair on nozzle side
x 218.2° y 104.80 Amp -0.52 Sweep 272 DataPt 357
Sweep Size 843 228904 229034
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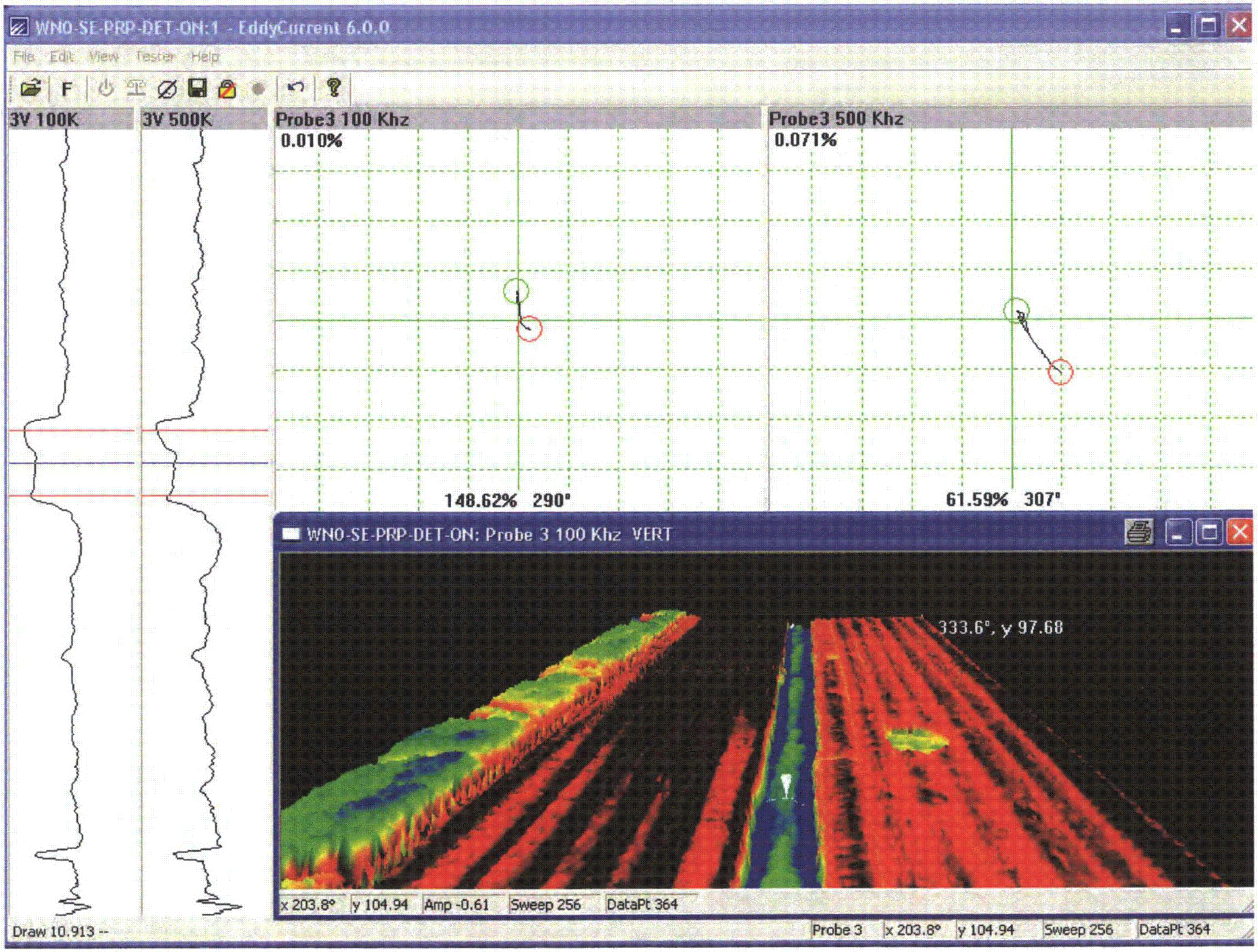
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148.62% 290°
Probe3 500 Khz
0.071%
61.59% 307°
WNO-SE-PRP-DET-ON: Probe 3 100 Khz VERT
333.6°, y 97.68
x 203.8° y 104.94 Amp -0.61 Sweep 256 DataPt 364
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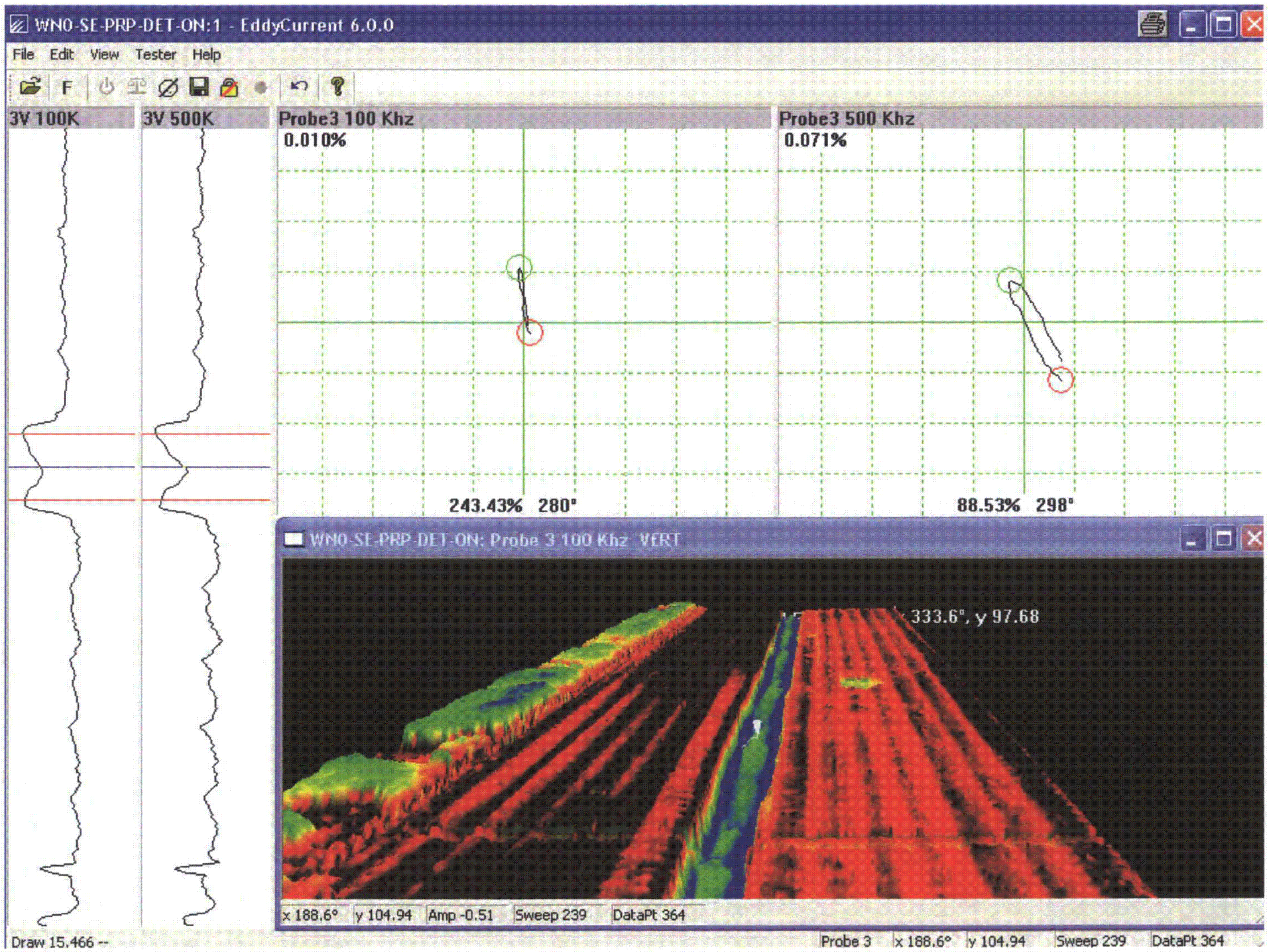

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Probe3 500 Khz
0.071%
88.53% 298°
WNO-SE-PRP-DET-ON: Probe 3 100 Khz VERT
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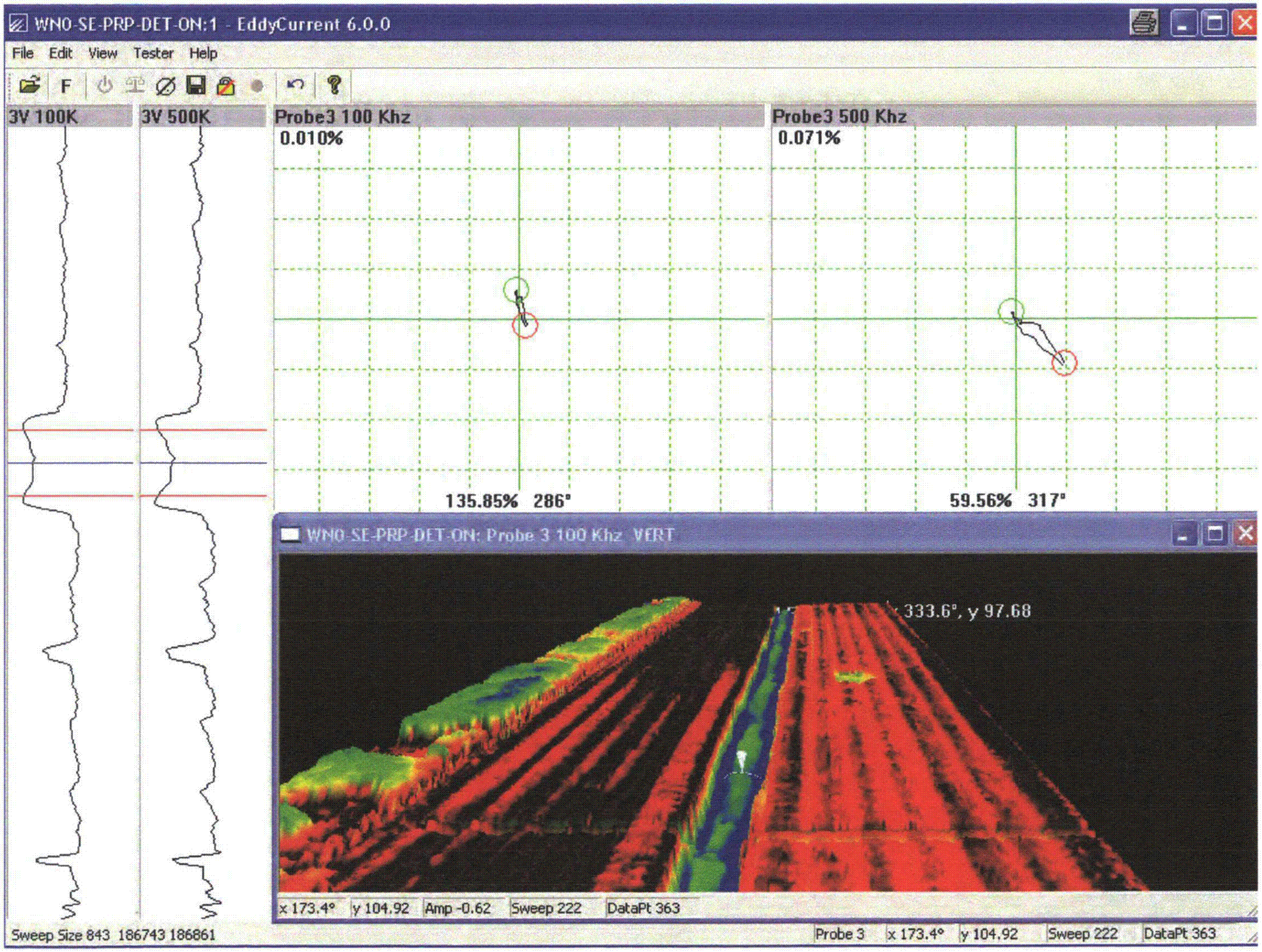
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File Edit View Tester Help
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3V 500K
Probe3 100 Khz
0.010%
135.85% 286°
Probe3 500 Khz
0.071%
59.56% 317°
WNO-SE-PRP-DET-ON: Probe 3 100 Khz VERT
333.6°, y 97.68
x 173.4° y 104.92 Amp -0.62 Sweep 222 DataPt 363
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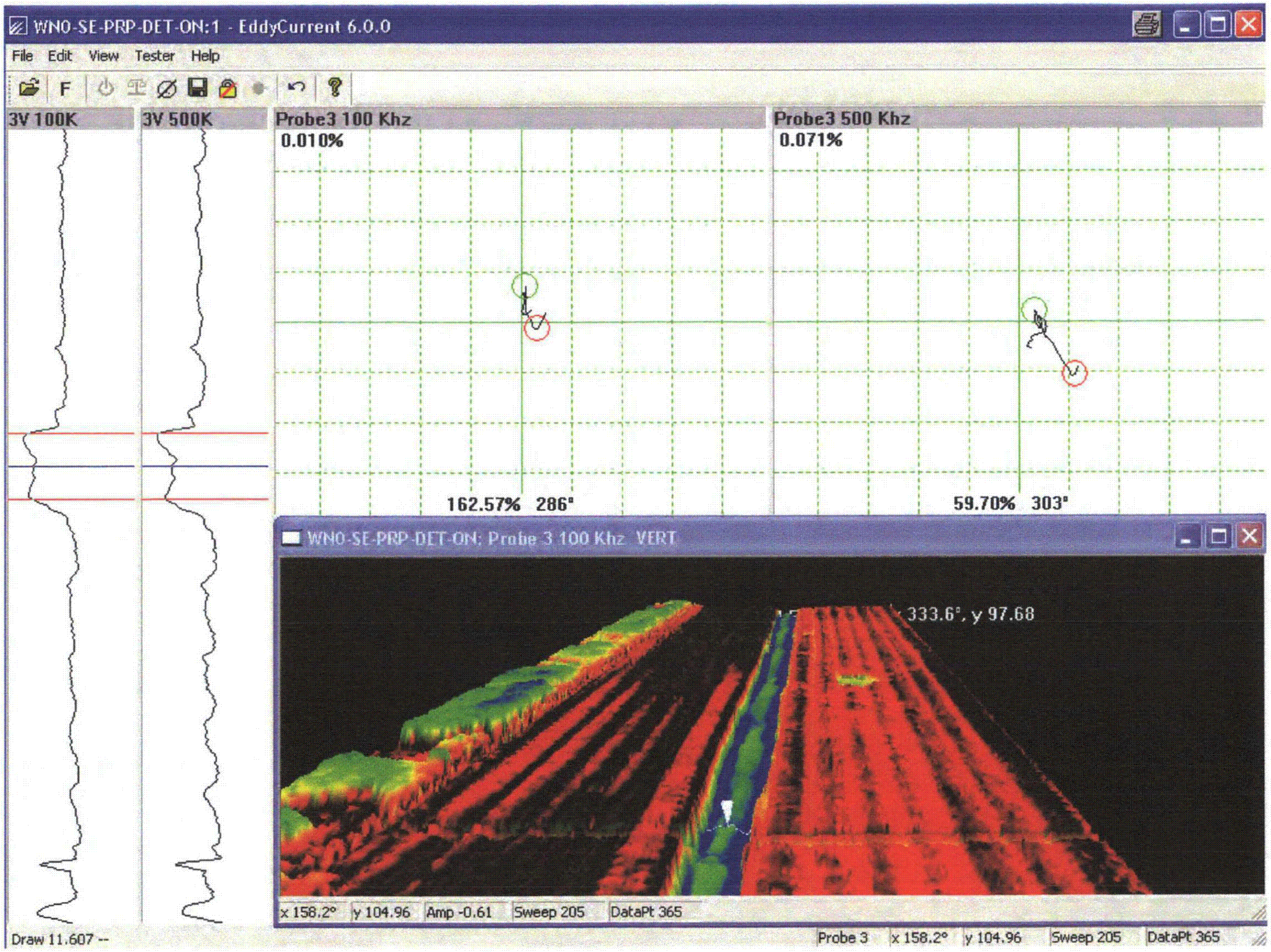
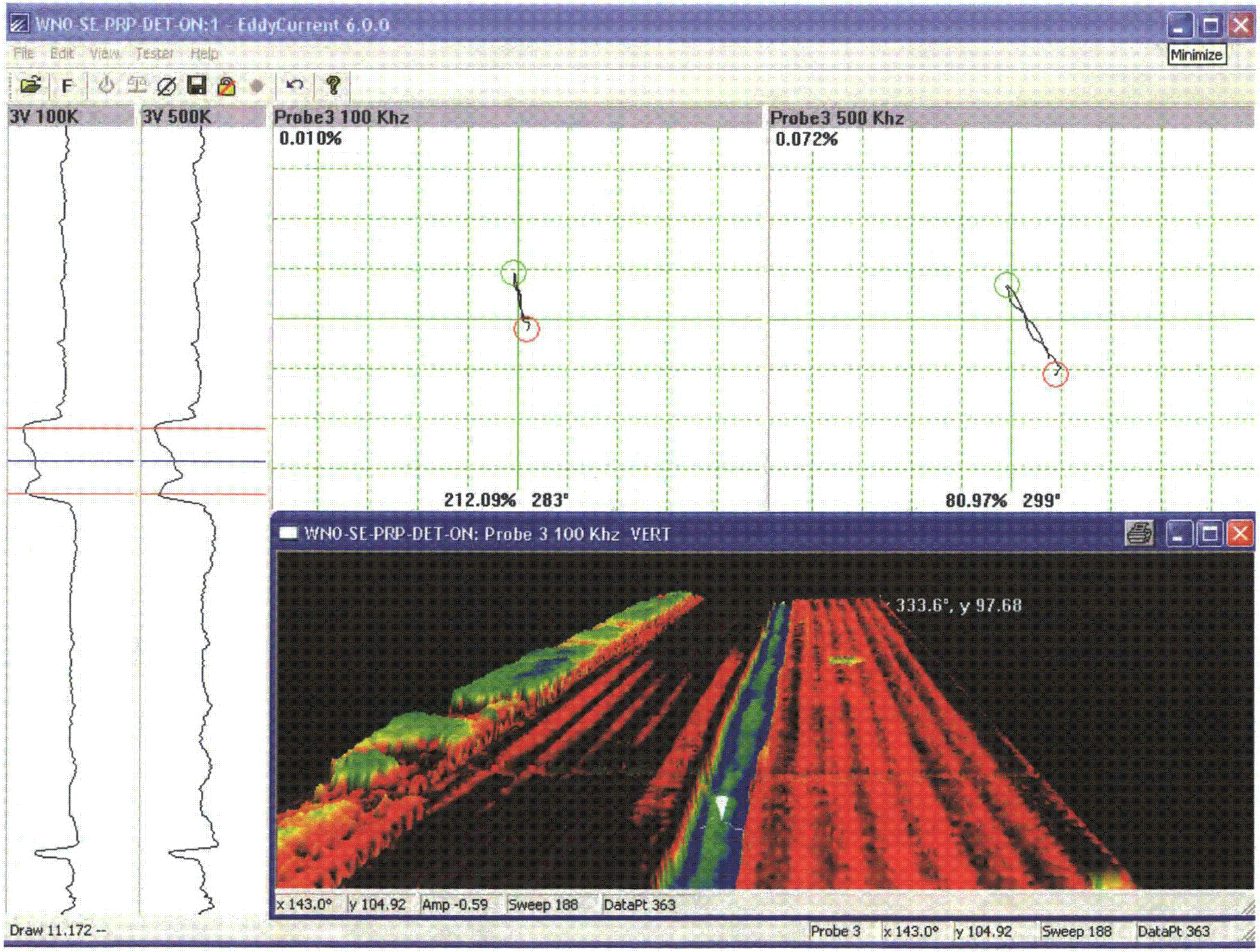
Probe 3 x 173.4° y 104.92 Sweep 222 DataPt 363


WN0-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.010%
162.57% 286°
Probe3 500 Khz
0.071%
59.70% 303°
WN0-SE-PRP-DET-ON: Probe 3 100 Khz VERT
333.6°, y 97.68
x 158.2° y 104.96 Amp -0.61 Sweep 205 DataPt 365
Draw 11.607 --
Probe 3 x 158.2° y 104.96 Sweep 205 DataPt 365



WNO-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
Minimize
3V 100K
3V 500K
Probe3 100 Khz
0.010%
212.09% 283°
Probe3 500 Khz
0.072%
80.97% 299°
WNO-SE-PRP-DET-ON: Probe 3 100 Khz VERT
333.6°, y 97.68
x 143.0° y 104.92 Amp -0.59 Sweep 188 DataPt 363
Draw 11.172 --
Probe 3 x 143.0° y 104.92 Sweep 188 DataPt 363

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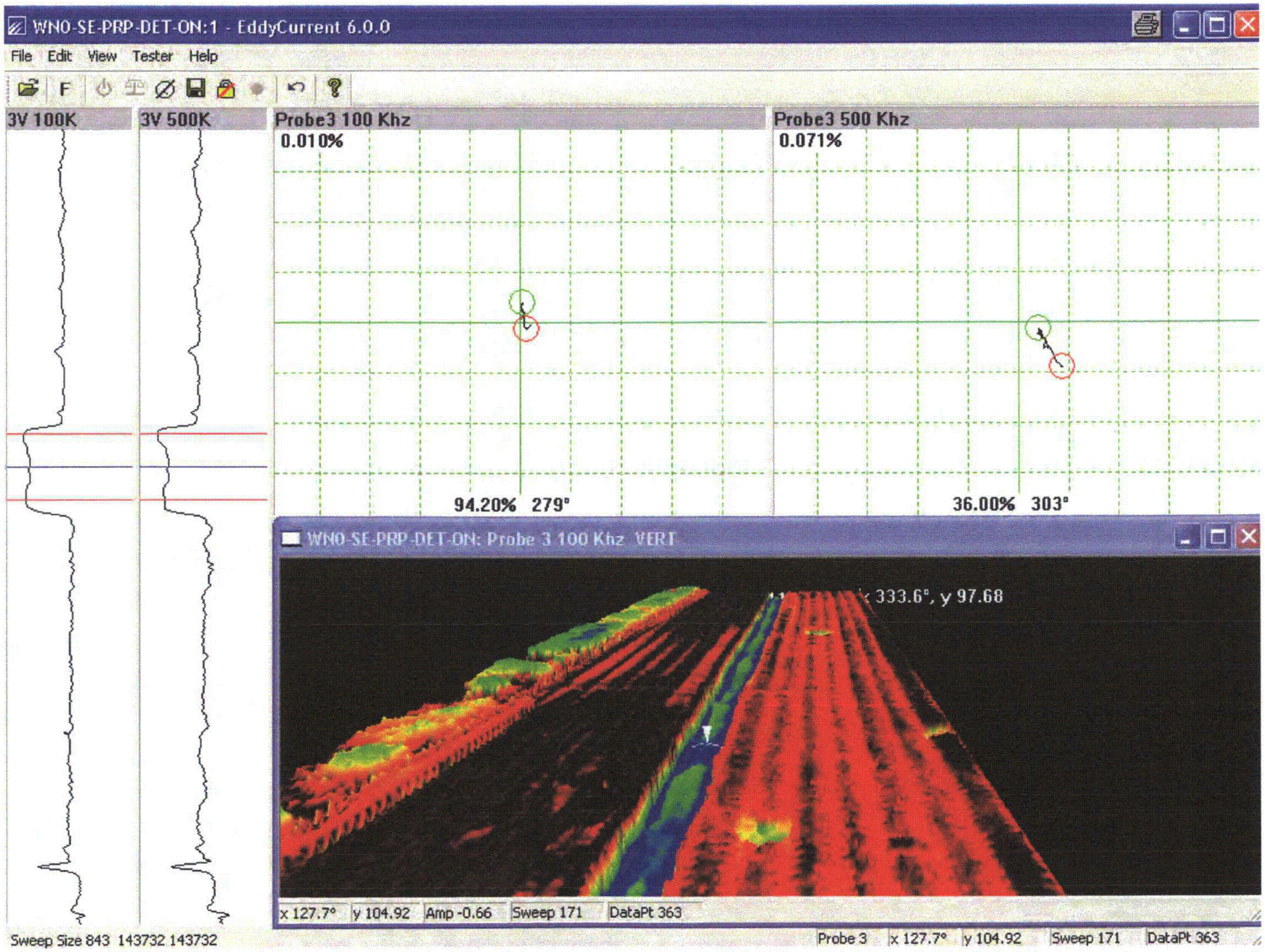

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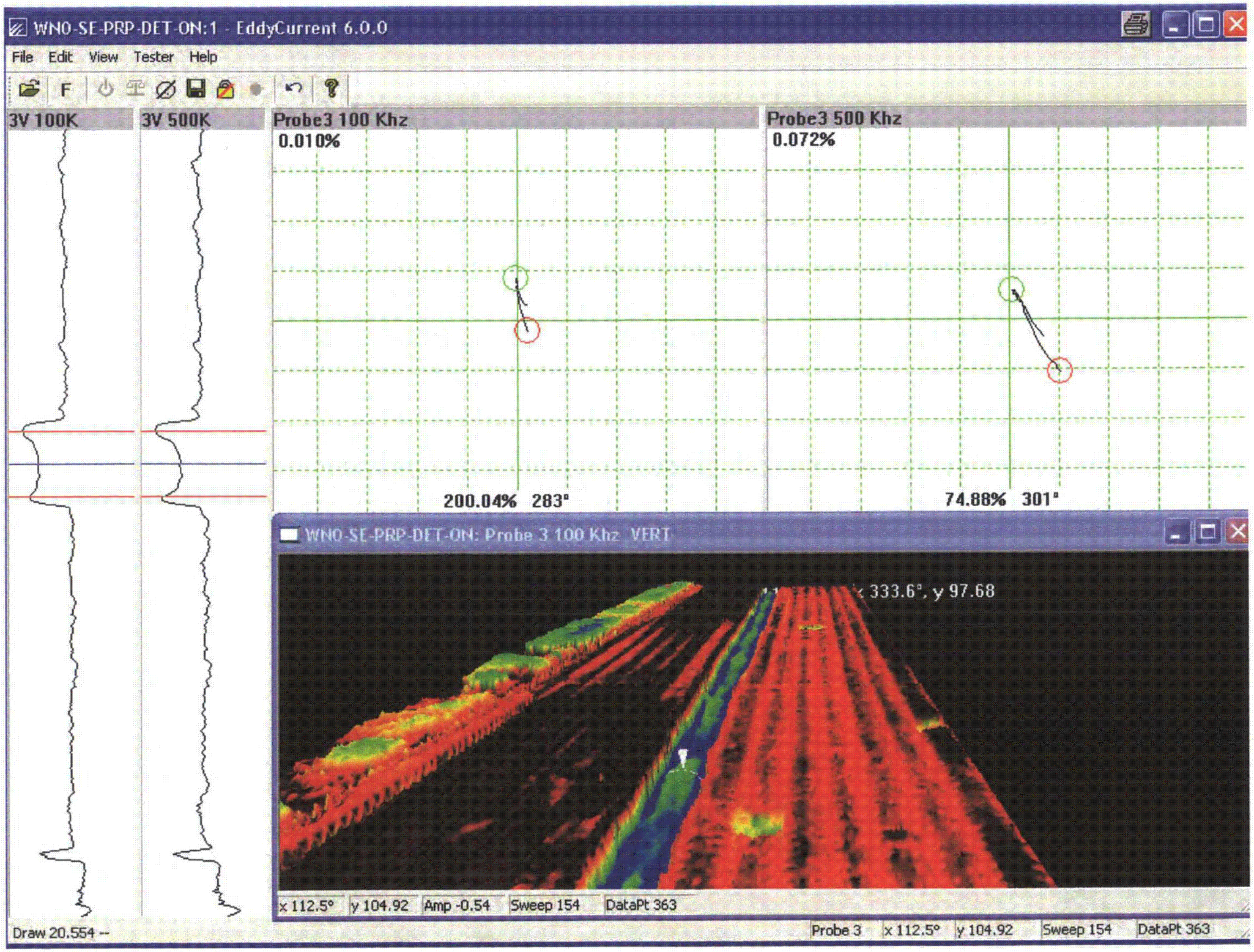
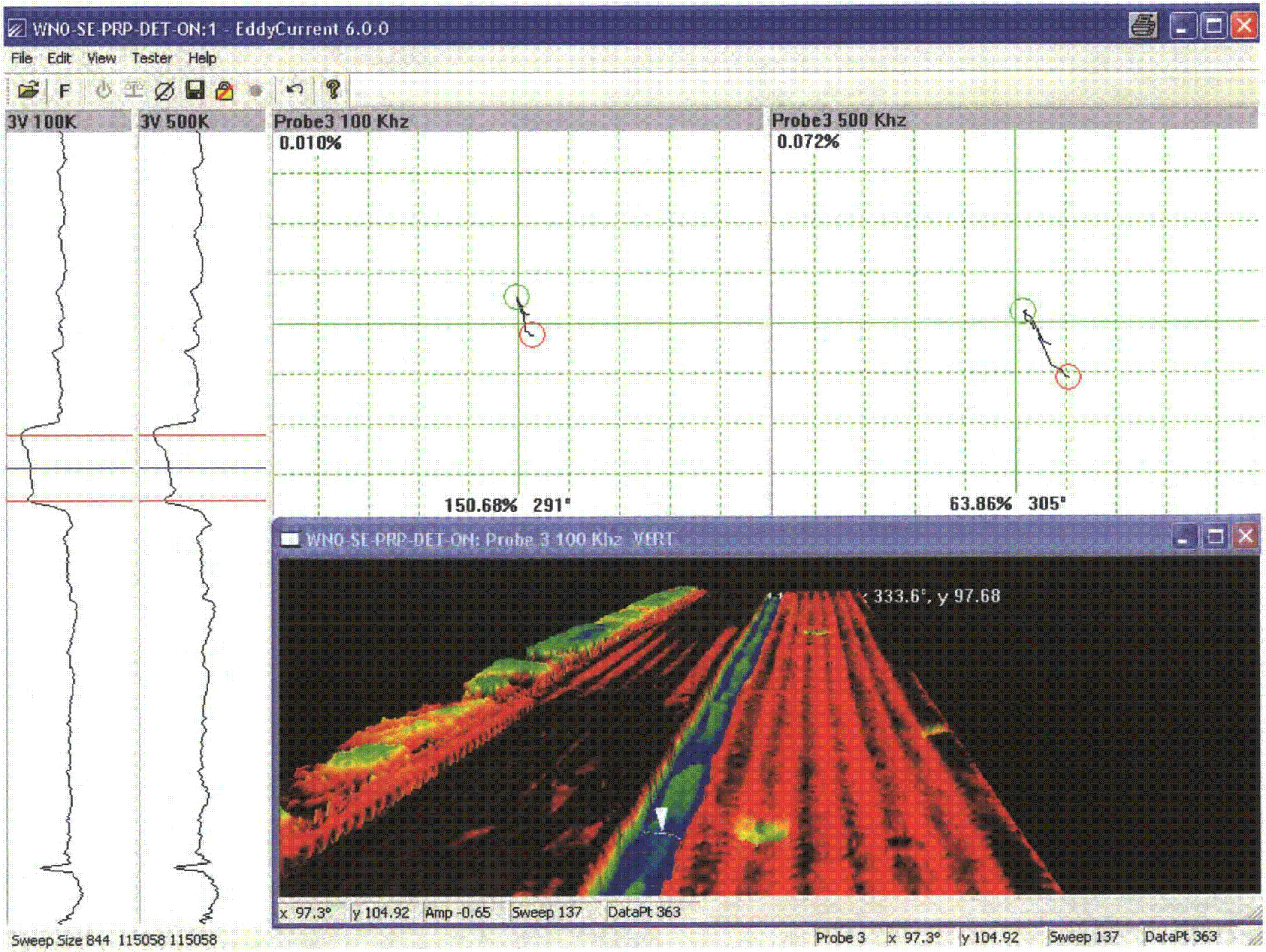
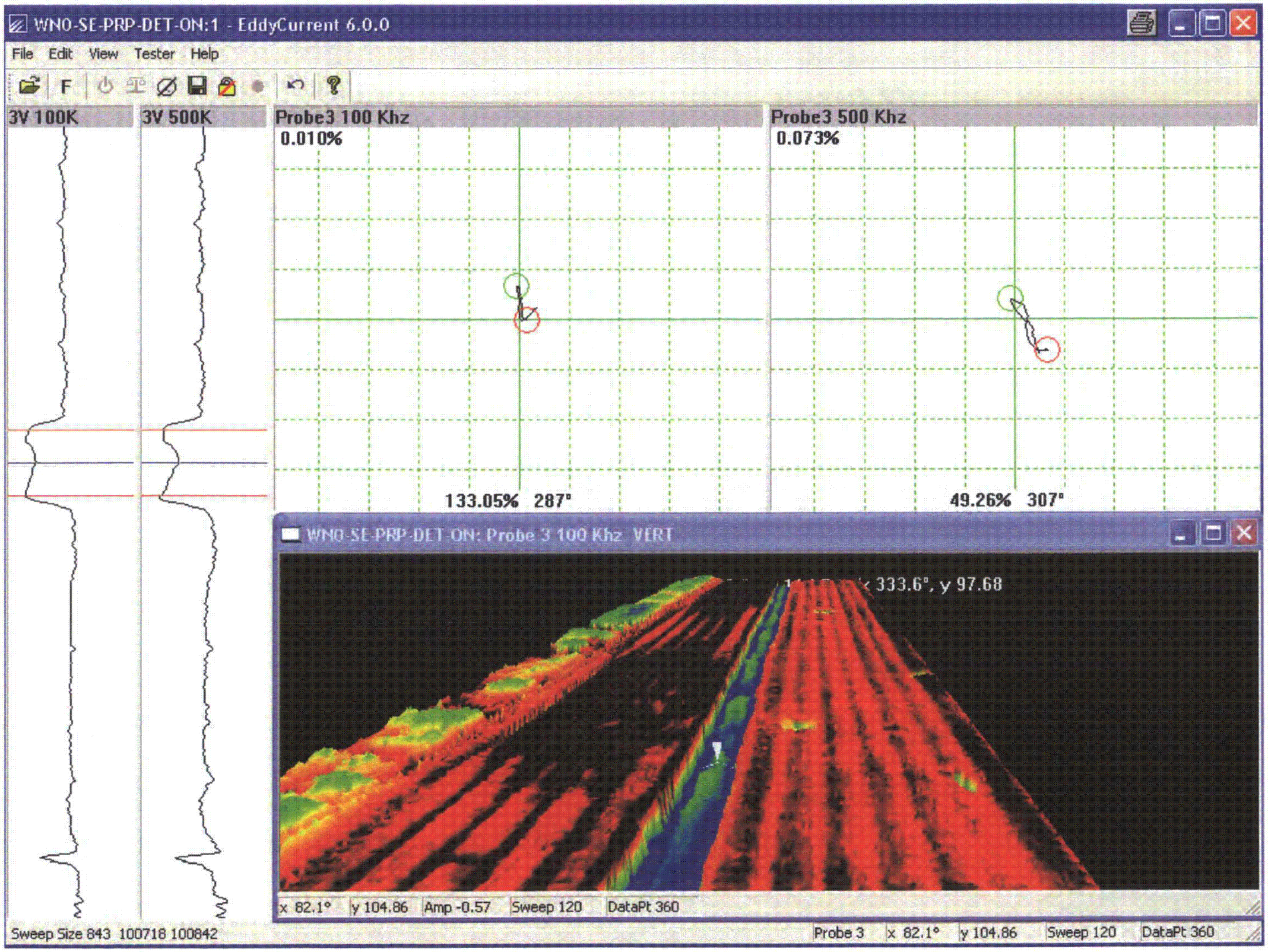
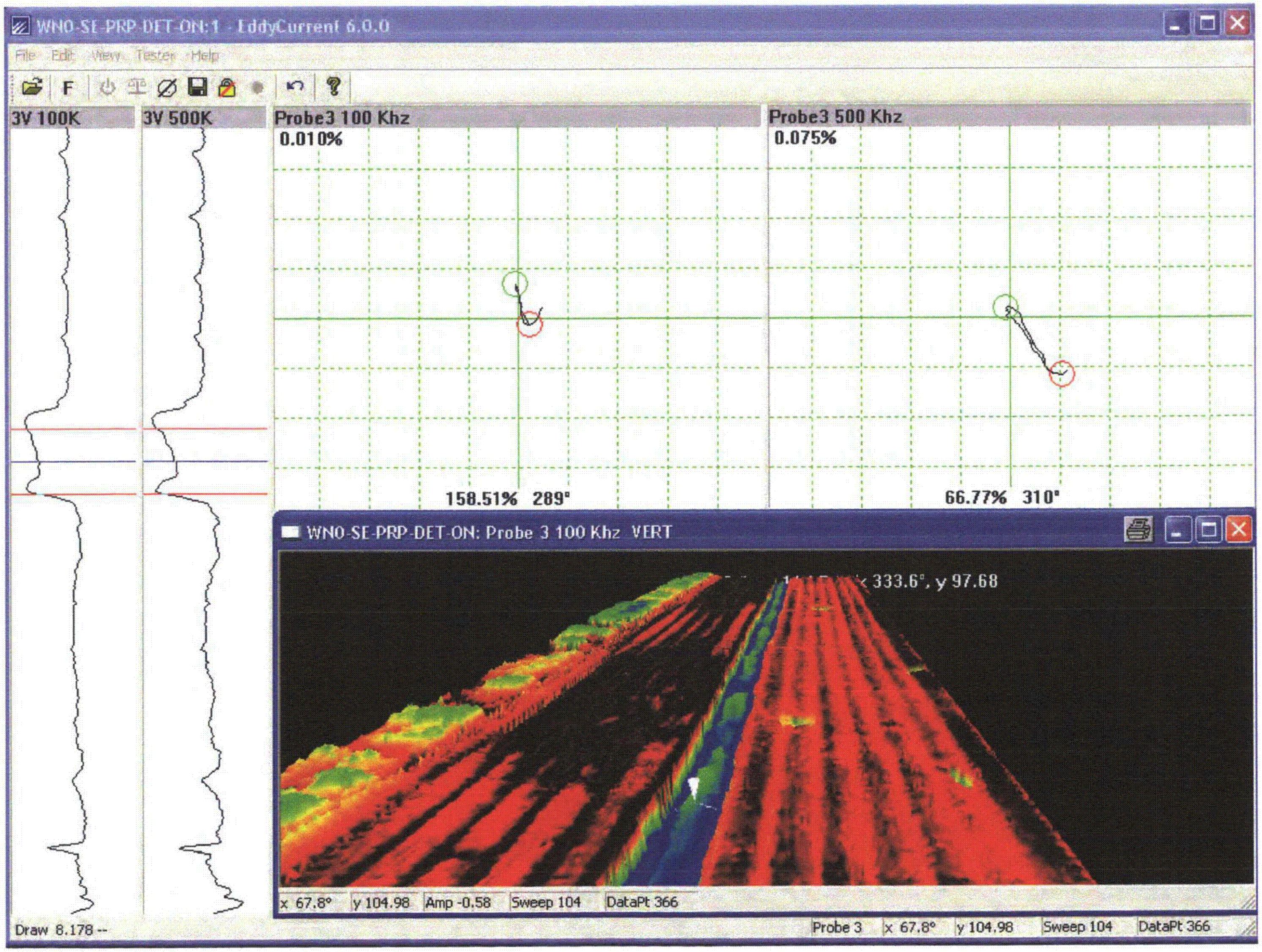
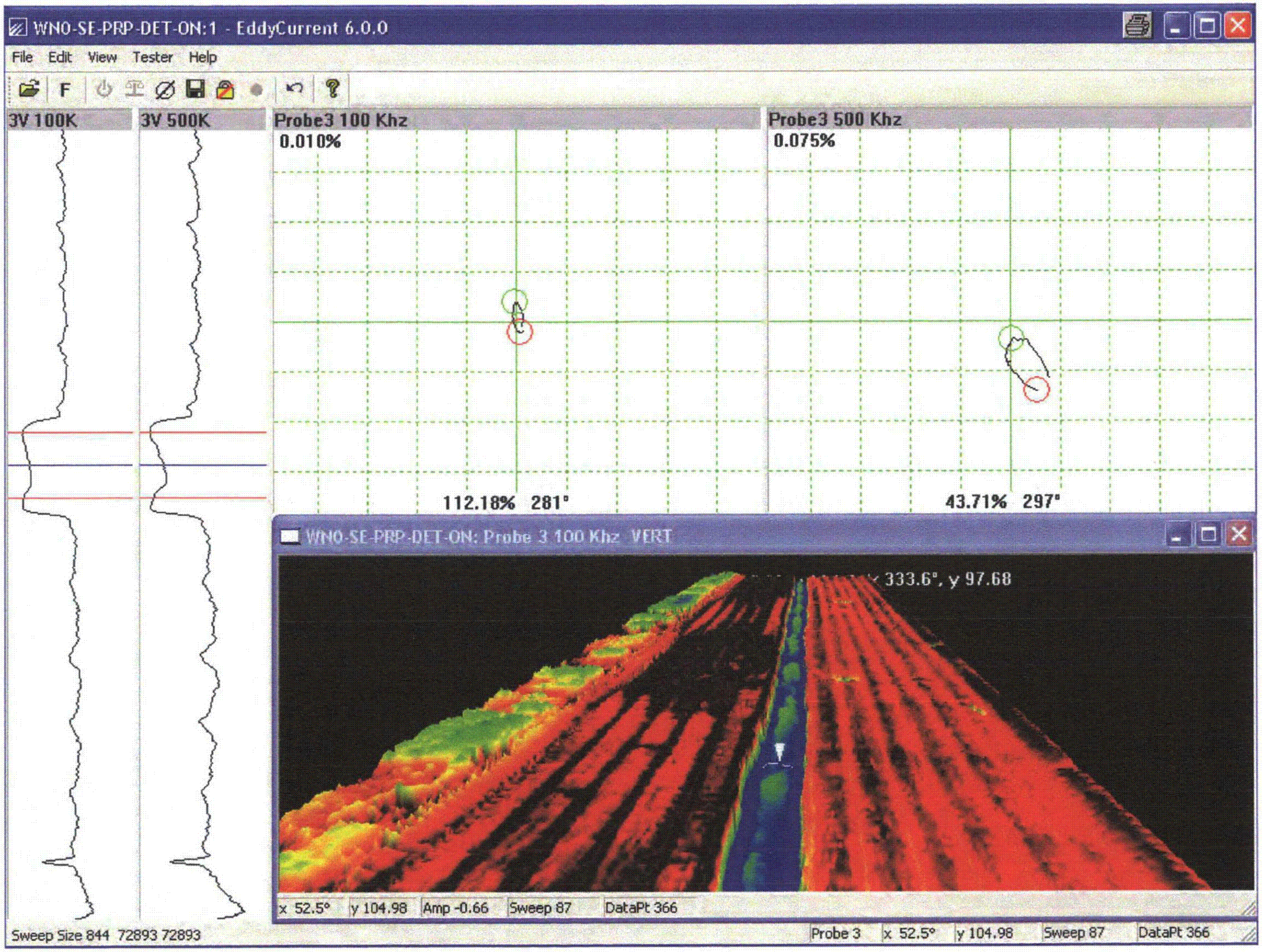


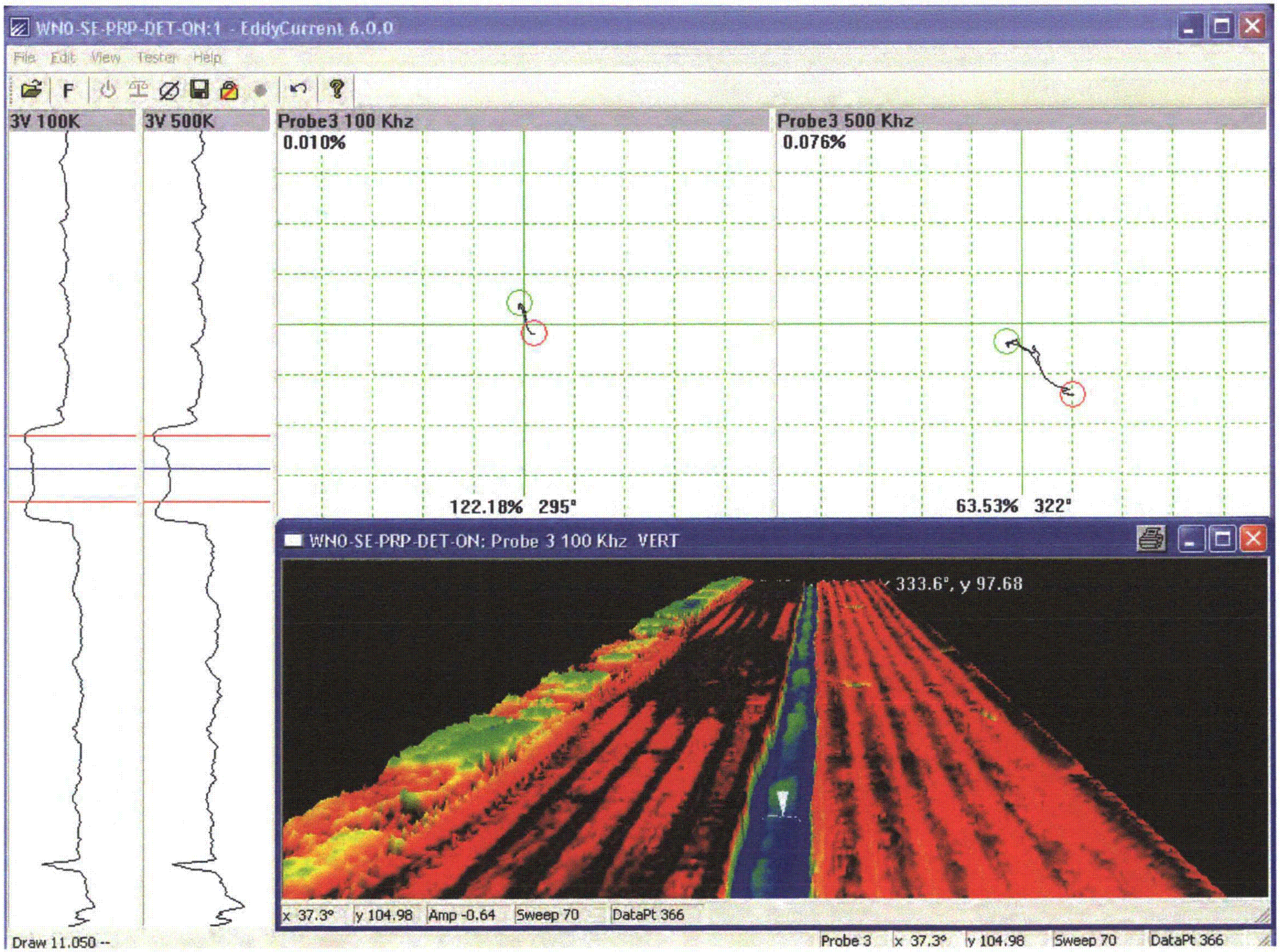

WNO-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.010%
150.68% 291°
Probe3 500 Khz
0.072%
63.86% 305°
WNO-SE-PRP-DET-ON: Probe 3 100 Khz VERT
x 333.6°, y 97.68
x 97.3° y 104.92 Amp -0.65 Sweep 137 DataPt 363
Sweep Size 844 115058 115058
Probe 3 x 97.3° y 104.92 Sweep 137 DataPt 363



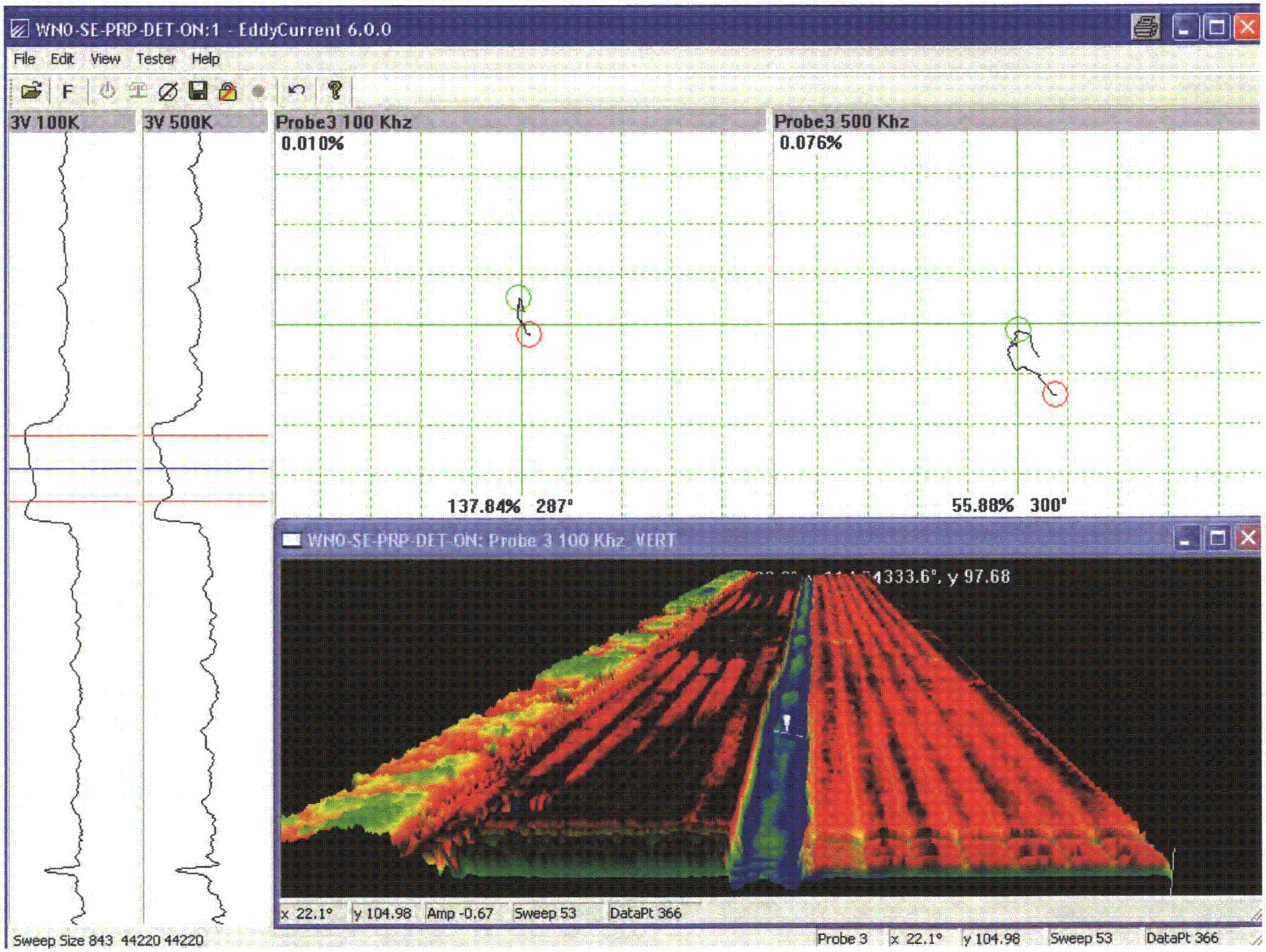
WNO-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.010%
133.05% 287°
Probe3 500 Khz
0.073%
49.26% 307°
WNO-SE-PRP-DET-ON: Probe 3 100 Khz VERT
x 333.6°, y 97.68
x 82.1° y 104.86 Amp -0.57 Sweep 120 DataPt 360
Sweep Size 843 100718 100842
Probe 3 x 82.1° y 104.86 Sweep 120 DataPt 360

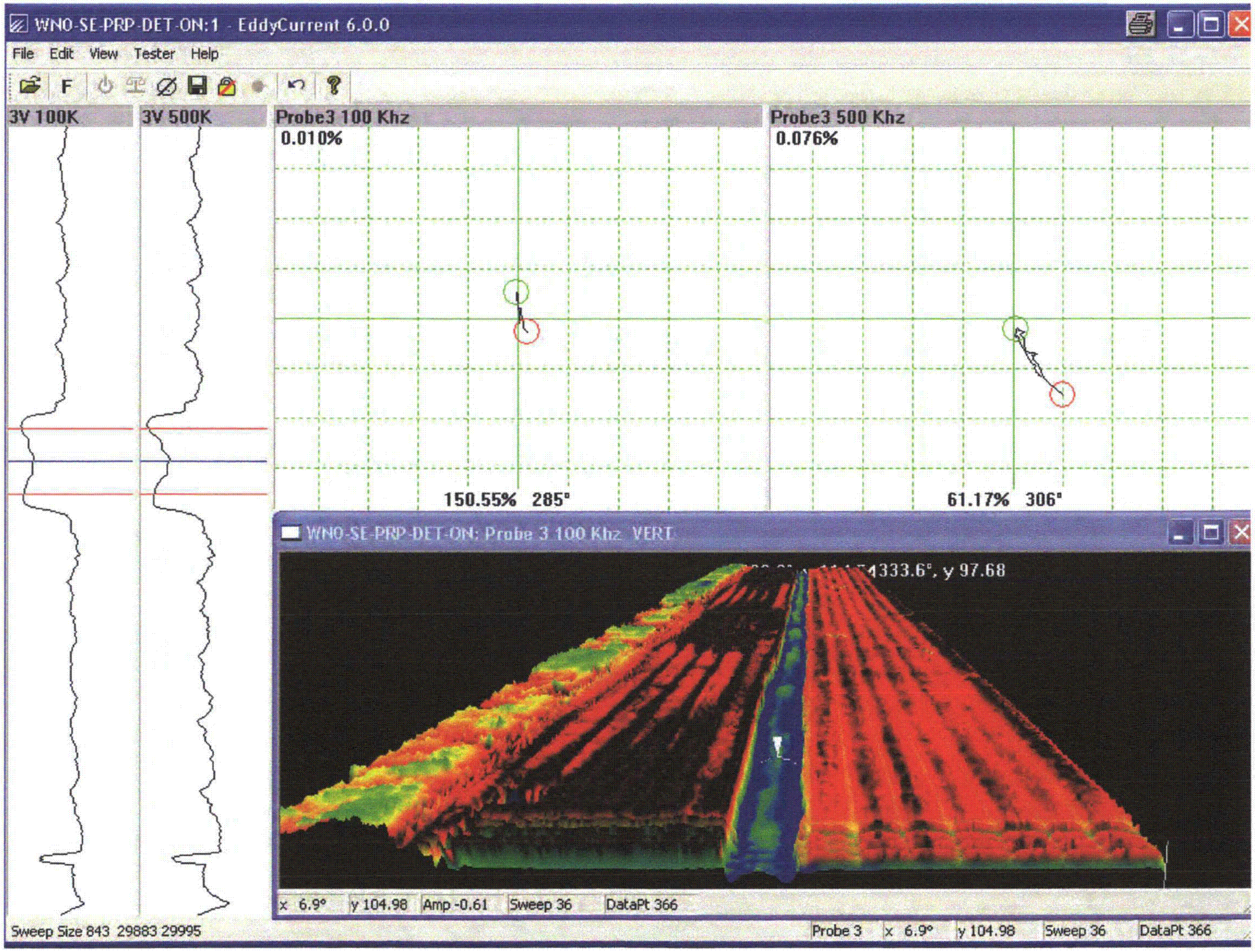

WNO-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.010%
158.51% 289°
Probe3 500 Khz
0.075%
66.77% 310°
WNO-SE-PRP-DET-ON: Probe 3 100 Khz VERT
x 333.6°, y 97.68
x 67.8° y 104.98 Amp -0.58 Sweep 104 DataPt 366
Draw 8.178 --
Probe 3 x 67.8° y 104.98 Sweep 104 DataPt 366


WNO-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.010%
112.18% 281°
Probe3 500 Khz
0.075%
43.71% 297°
WNO-SE-PRP-DET-ON: Probe 3 100 Khz VERT
x 333.6°, y 97.68
x 52.5° y 104.98 Amp -0.66 Sweep 87 DataPt 366
Sweep Size 844 72893 72893
Probe 3 x 52.5° y 104.98 Sweep 87 DataPt 366



WNO-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.010%
122.18% 295°
Probe3 500 Khz
0.076%
63.53% 322°
WNO-SE-PRP-DET-ON: Probe 3 100 Khz VERT
333.6°, y 97.68
x 37.3° y 104.98 Amp -0.64 Sweep 70 DataPt 366
Draw 11.050 --
Probe 3 x 37.3° y 104.98 Sweep 70 DataPt 366


WNO-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.010%
137.84% 287°
Probe3 500 Khz
0.076%
55.88% 300°
WNO-SE-PRP-DET-ON: Probe 3 100 Khz VERT
x 22.1° y 104.98 Amp -0.67 Sweep 53 DataPt 366
Sweep Size 843 44220 44220
Probe 3 x 22.1° y 104.98 Sweep 53 DataPt 366


WNO-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.010%
150.55% 285°
Probe3 500 Khz
0.076%
61.17% 306°
WNO-SE-PRP-DET-ON: Probe 3 100 Khz VERT
x 6.9° y 104.98 Amp -0.61 Sweep 36 DataPt 366
Sweep Size 843 29883 29995
Probe 3 x 6.9° y 104.98 Sweep 36 DataPt 366

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Attachment B

Local Permeability Measurements with Normalized Signal Amplitude to 0.040" calibration Notch Nominal Depth for

Outlet Nozzle at 180^0 Location on Fort Calhoun RPV

Circ. Loc	Nozzle at 180° Normalized Ampl. 0.040"	Nozzle 180° Corrected Normalized Ampl. 0.030" 100 kHz [%]
7	88	111.76
22	119	74.93
37	108	137.16
52	112	142.24
67	90	114.3
82	128	162.56
97	123	156.21
112	60	76.2
127	144	182.88
143	94	119.38
158	136	172.72
173	108	137.16
188	62	78.74
203	93	118.11
218	86	109.22
233	89	113.03
248	69	87.63
263	99	125.73
278	97	123.19
293	135	171.45
308	75	95.25
323	92	116.84
333	62	78.74
337	82	104.14
352	107	135.89
Avrg.	**95.92**	121.8184

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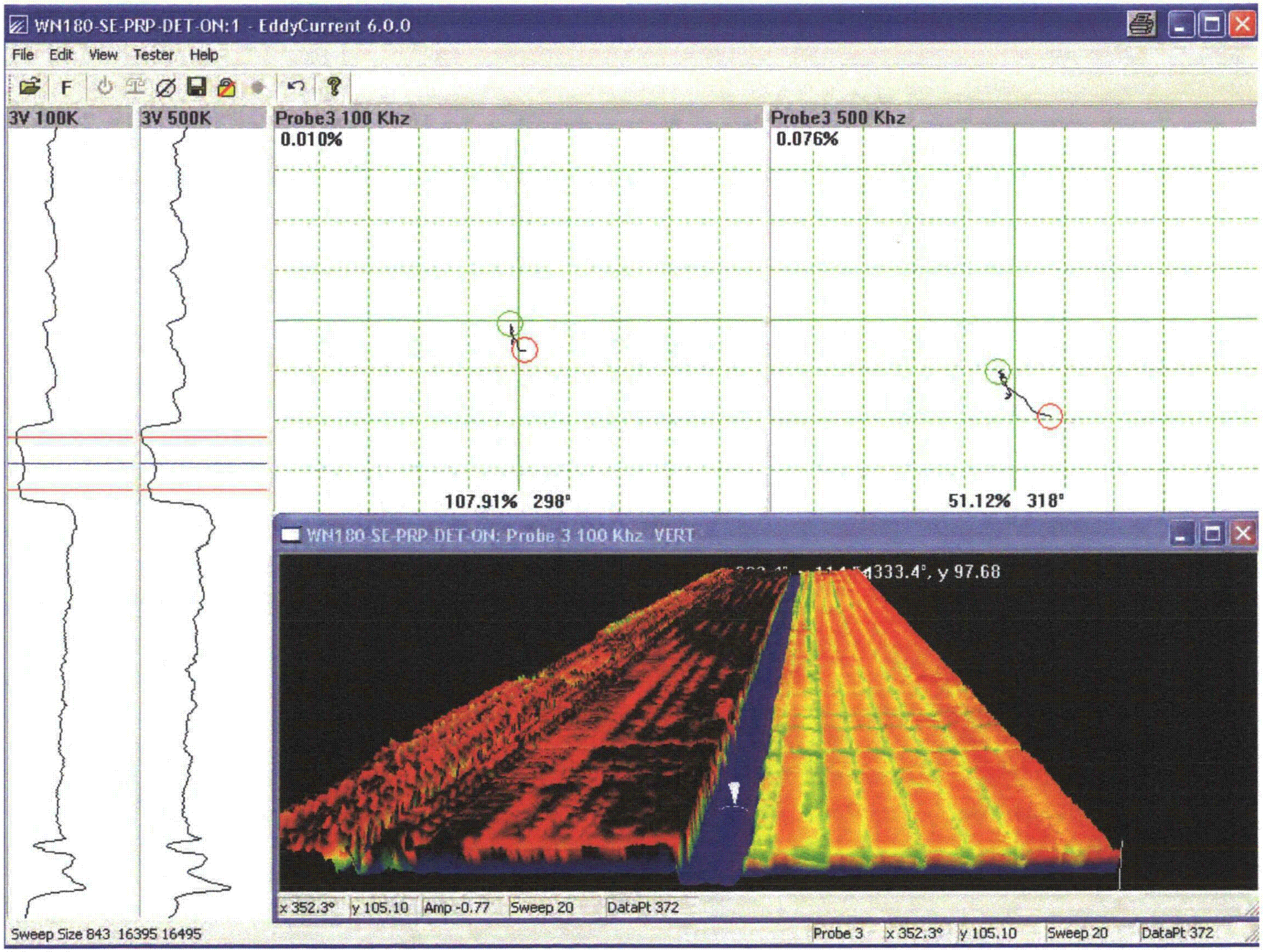
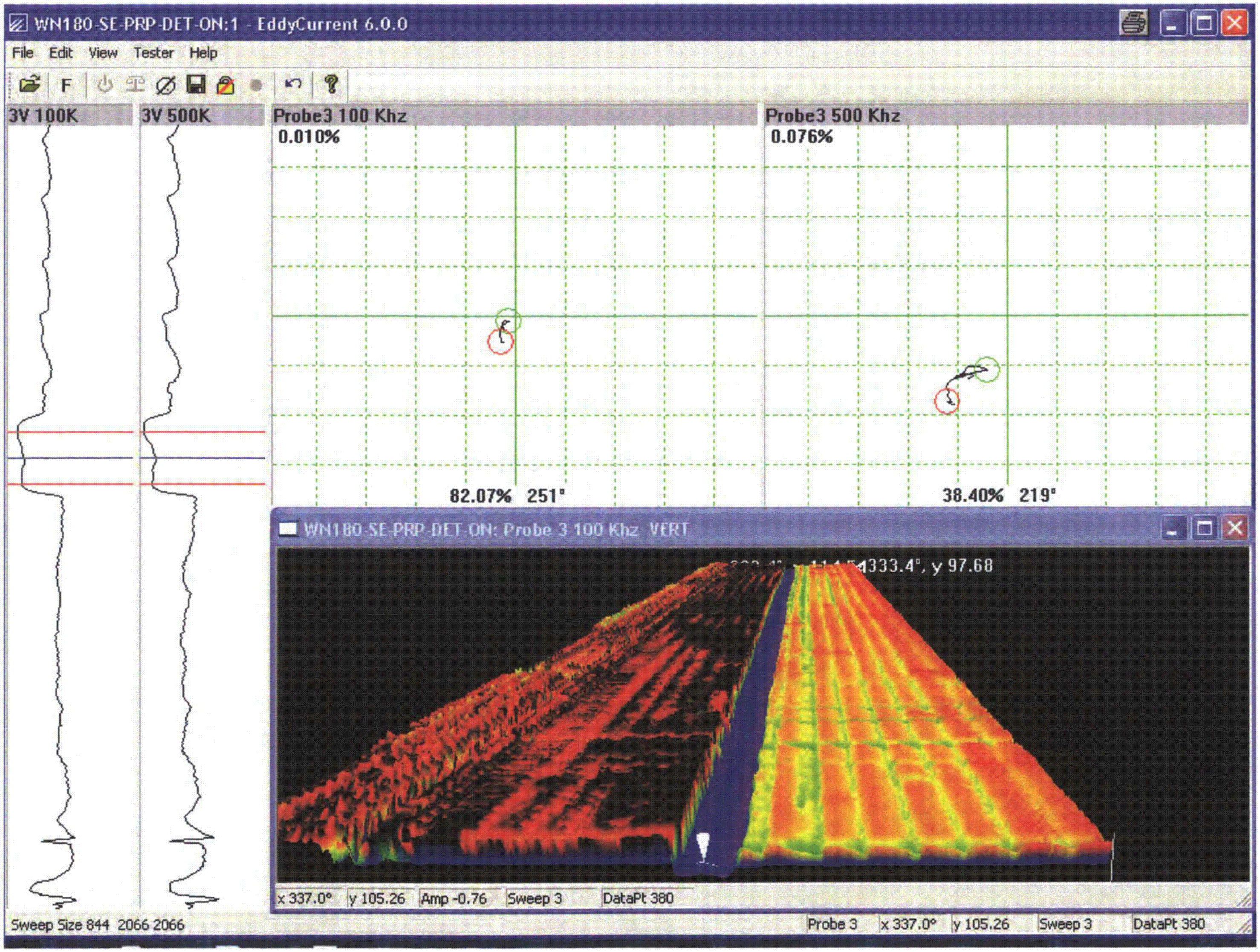
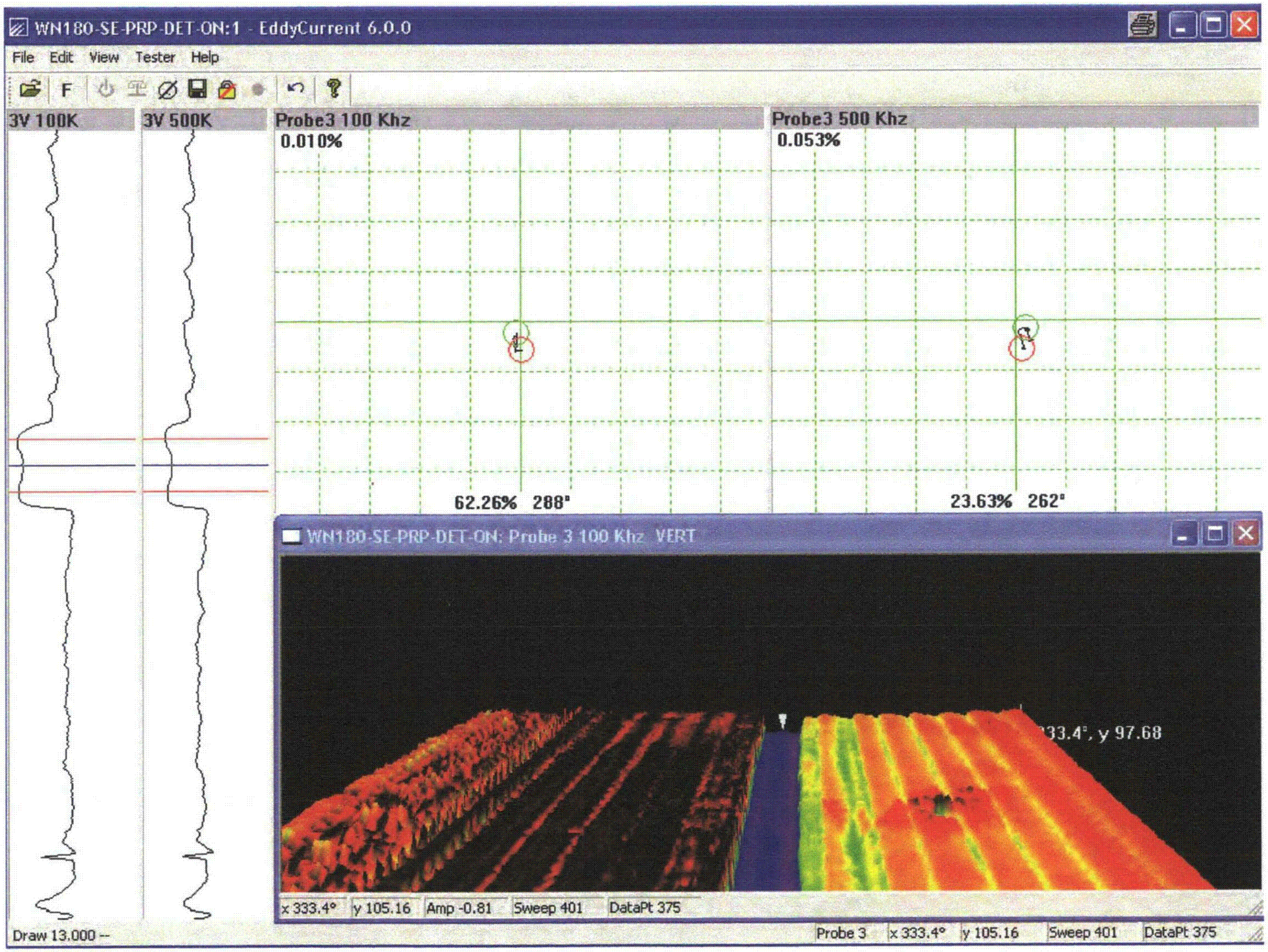
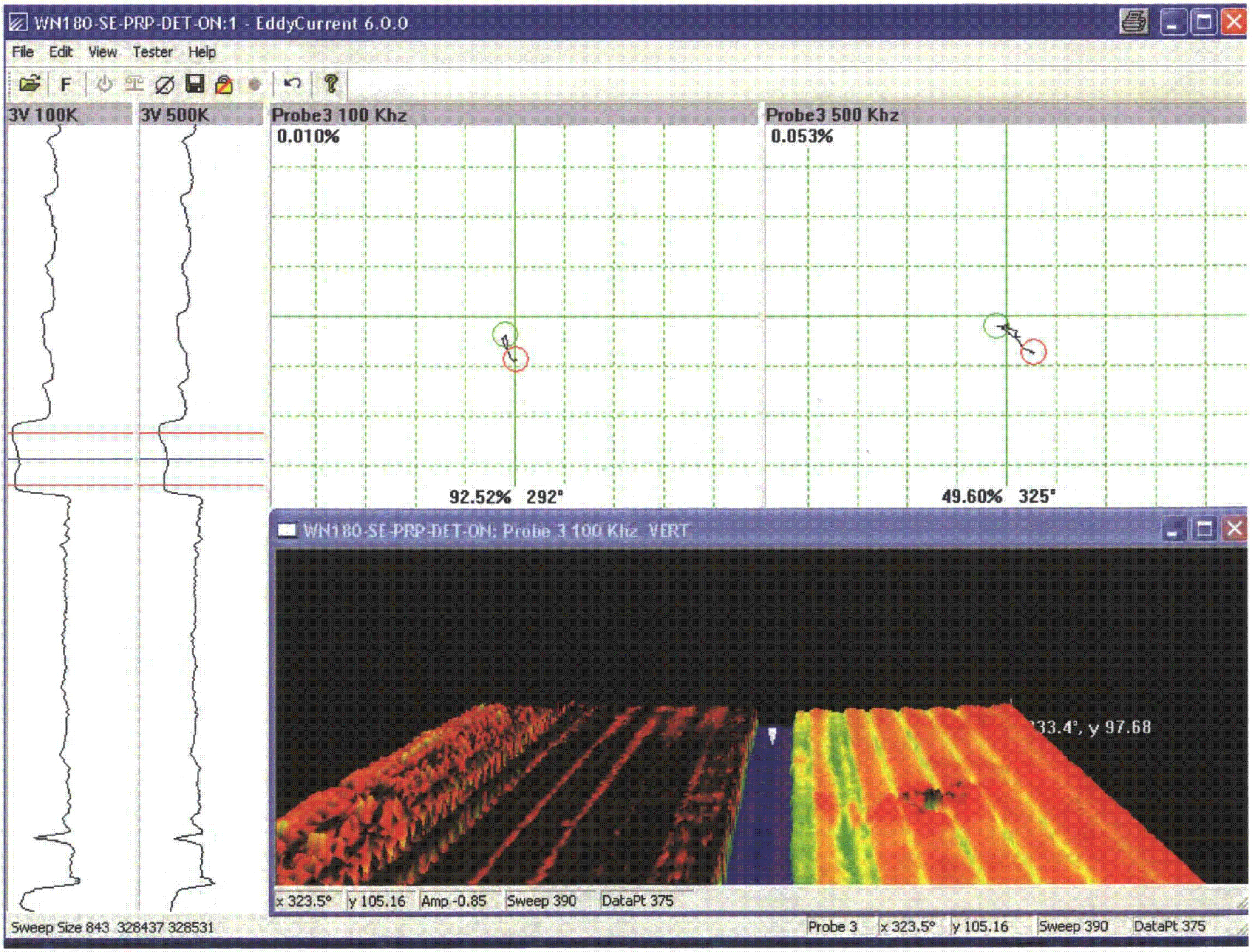
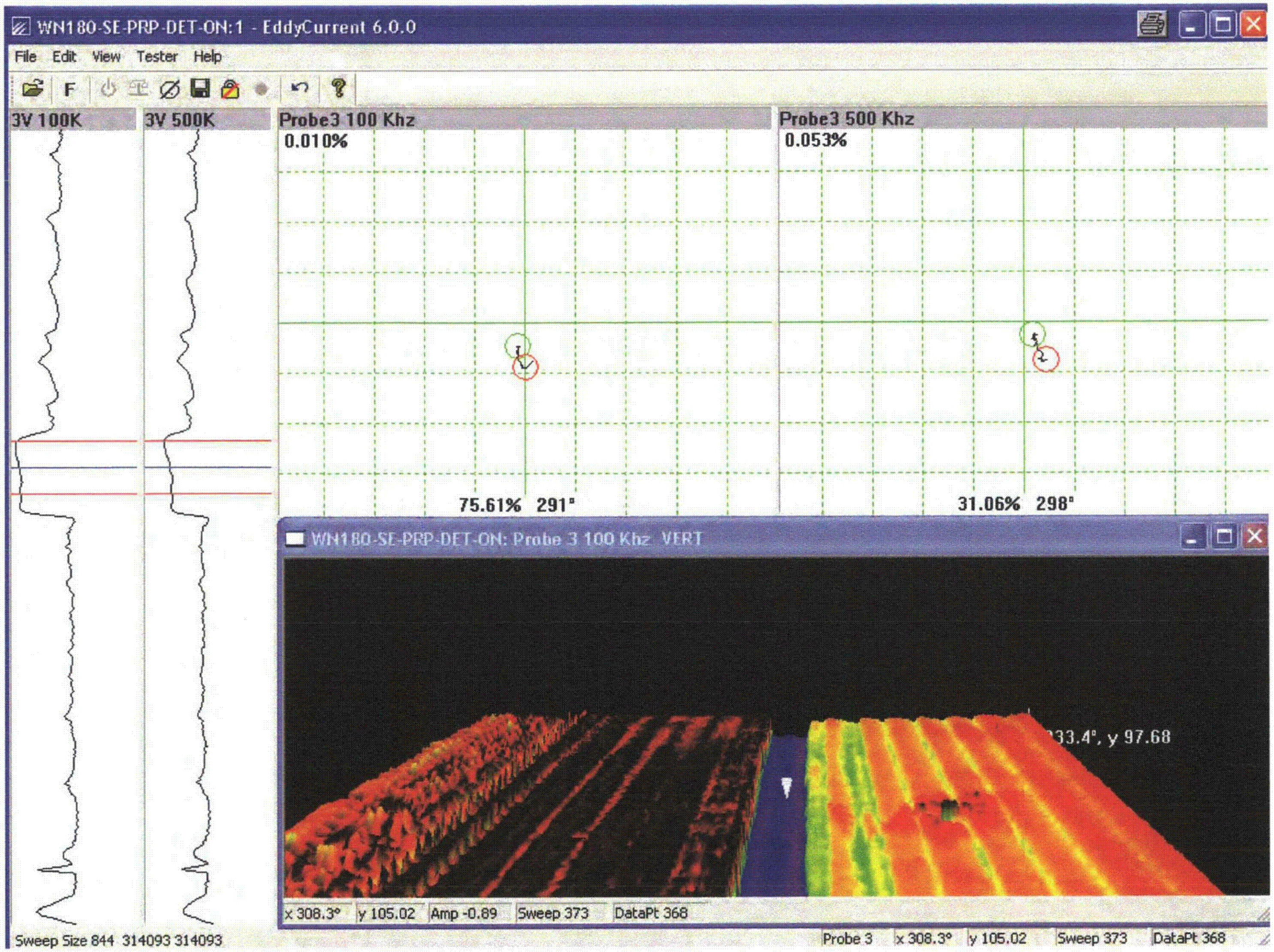



WN180-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.010%
82.07% 251°
Probe3 500 Khz
0.076%
38.40% 219°
WN180-SE-PRP-DET-ON: Probe 3 100 Khz VERT
x 337.0° y 105.26 Amp -0.76 Sweep 3 DataPt 380
Sweep Size 844 2066 2066
Probe 3 x 337.0° y 105.26 Sweep 3 DataPt 380

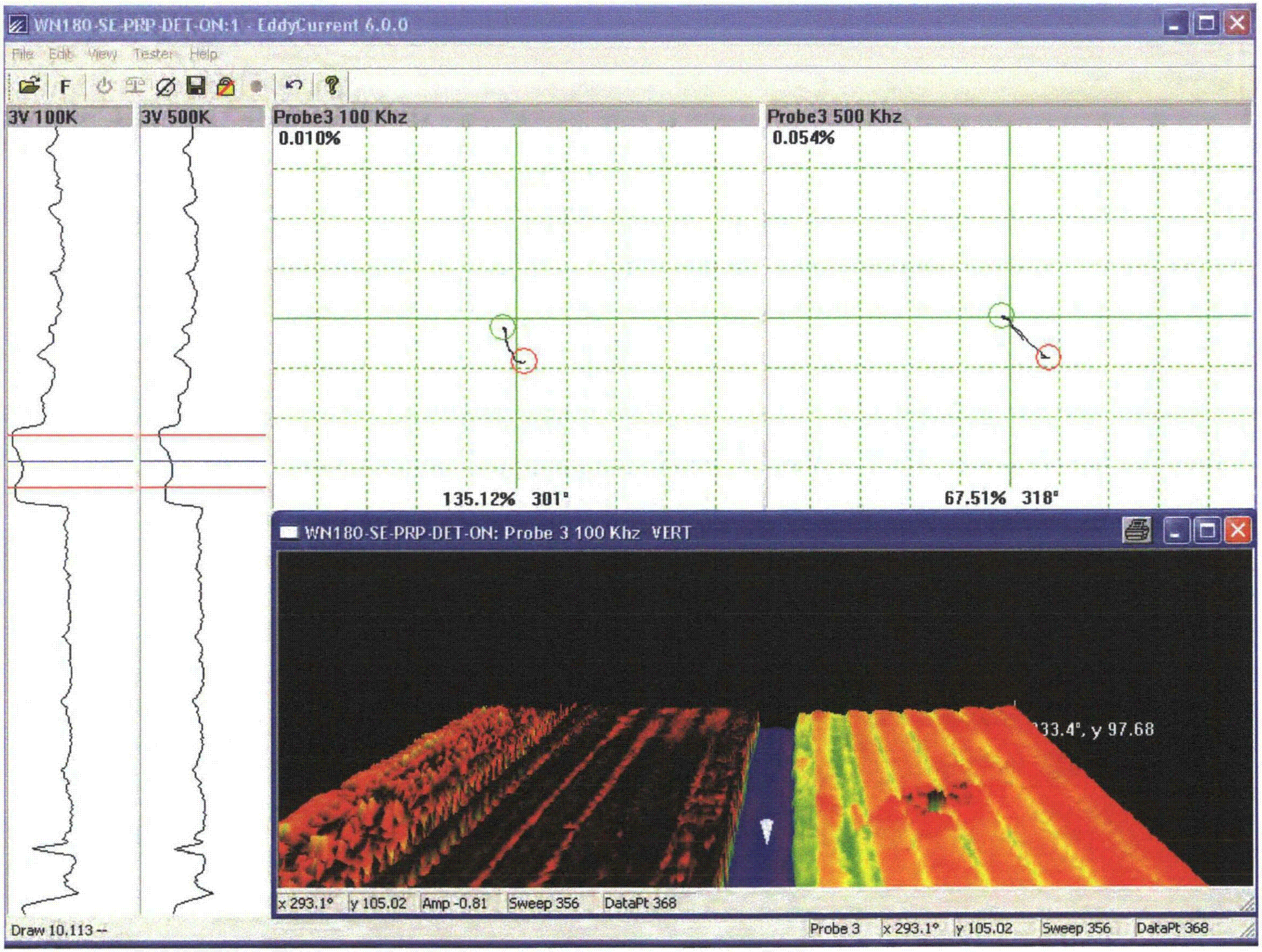

WN180-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.010%
62.26% 288°
Probe3 500 Khz
0.053%
23.63% 262°
WN180-SE-PRP-DET-ON: Probe 3 100 Khz VERT
33.4°, y 97.68
x 333.4° y 105.16 Amp -0.81 Sweep 401 DataPt 375
Draw 13.000 --
Probe 3 x 333.4° y 105.16 Sweep 401 DataPt 375



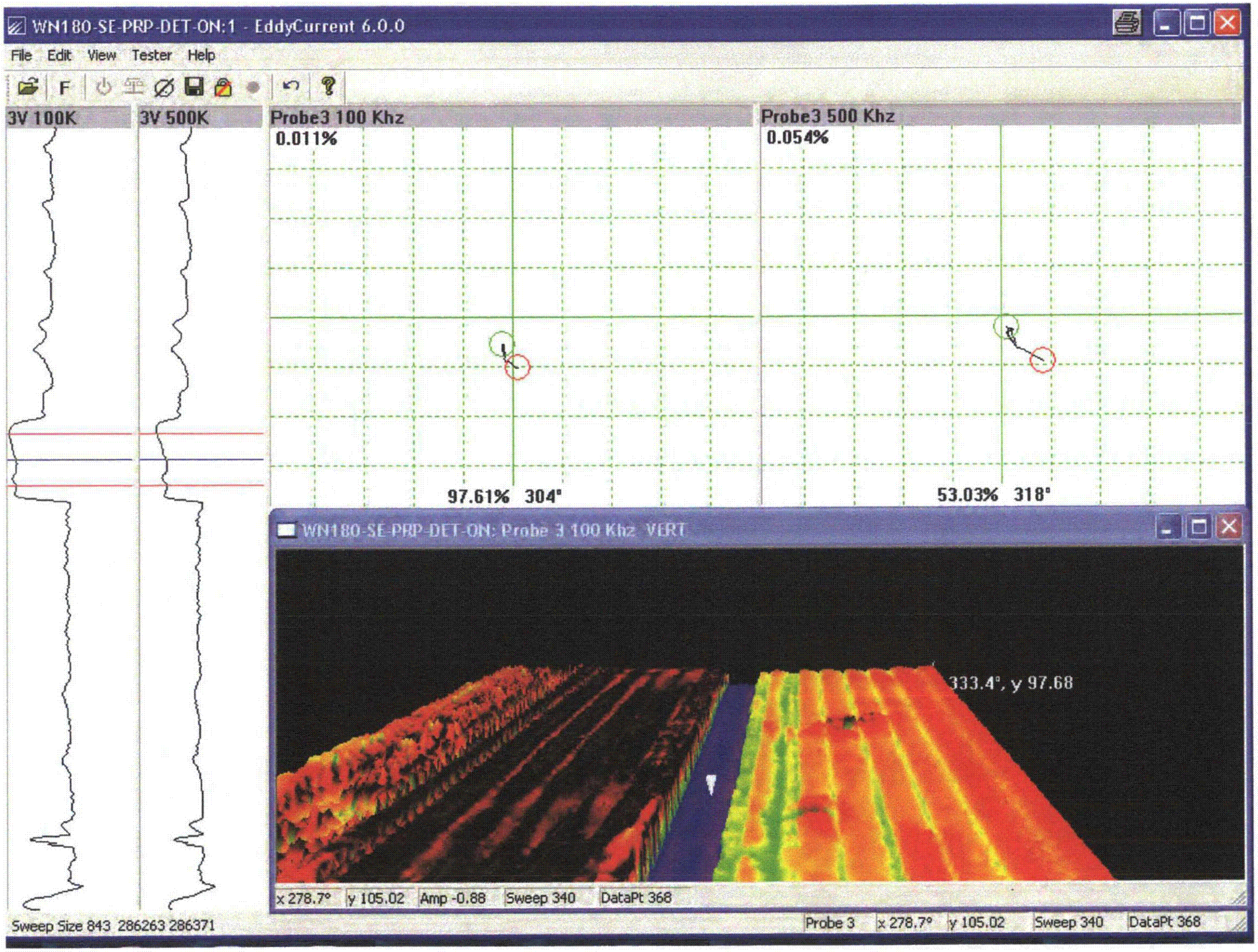
WN180-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.010%
92.52% 292°
Probe3 500 Khz
0.053%
49.60% 325°
WN180-SE-PRP-DET-ON: Probe 3 100 Khz VERT
33.4°, y 97.68
x 323.5° y 105.16 Amp -0.85 Sweep 390 DataPt 375
Sweep Size 843 328437 328531
Probe 3 x 323.5° y 105.16 Sweep 390 DataPt 375

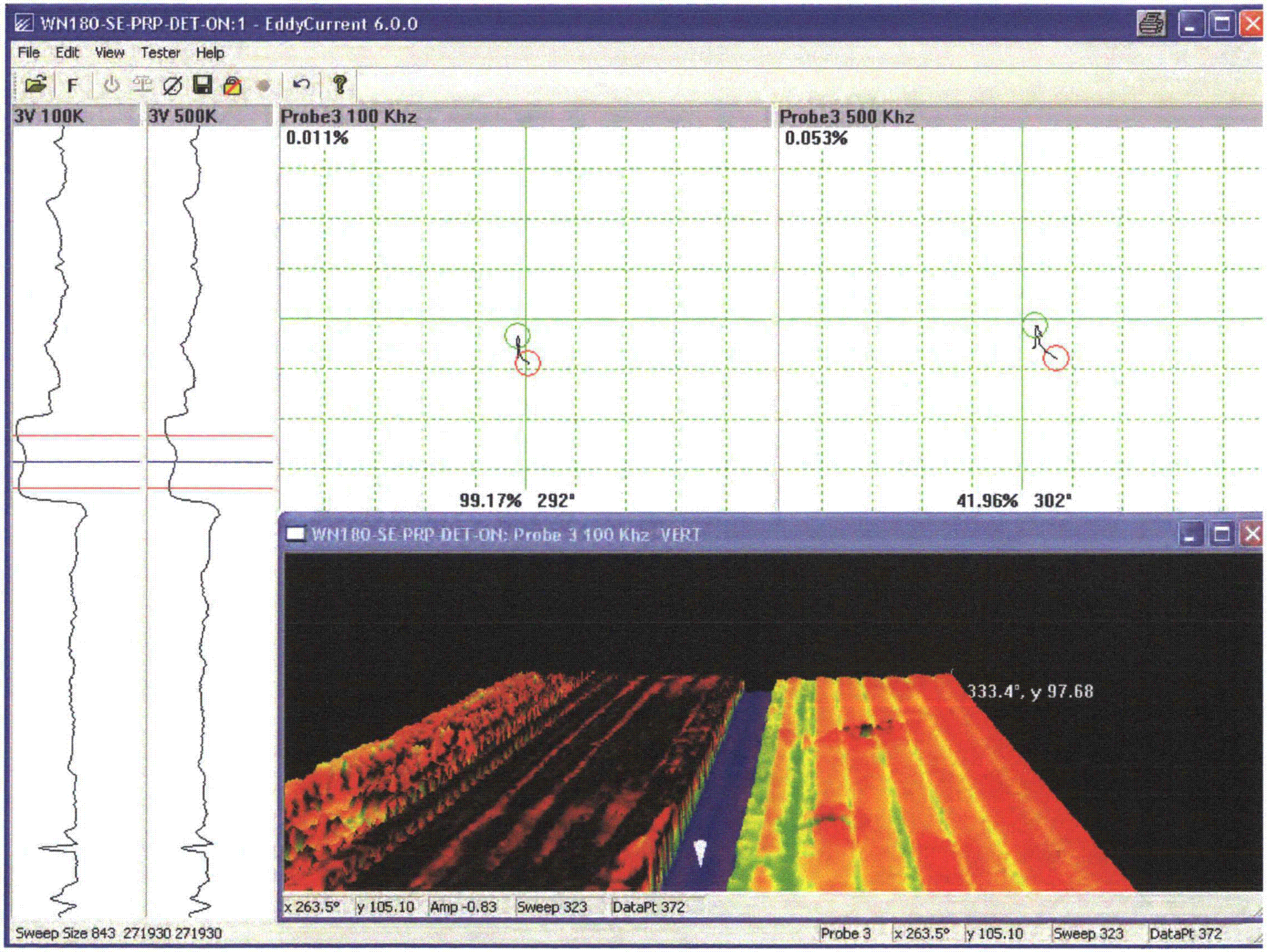


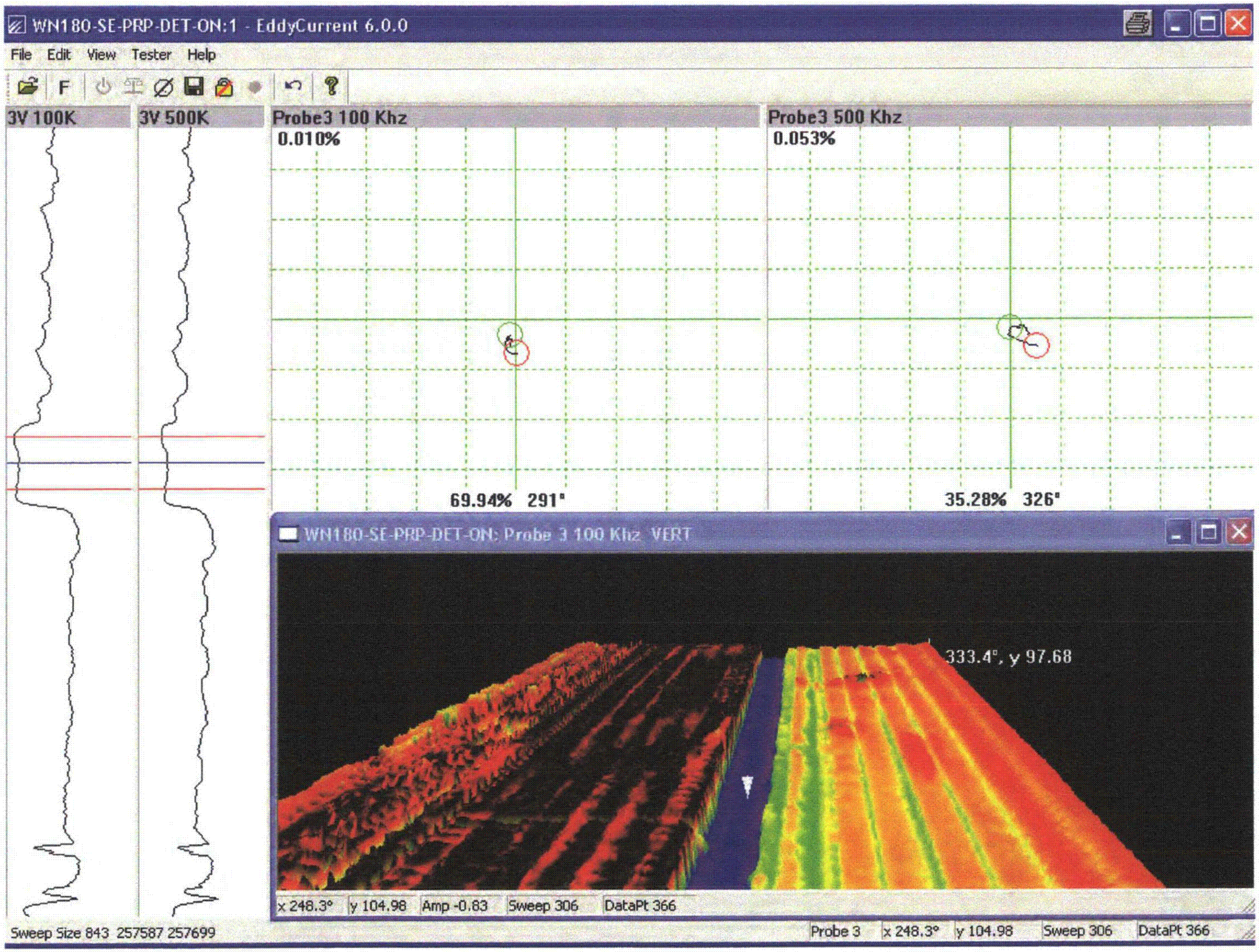
WN180-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.010%
75.61% 291°
Probe3 500 Khz
0.053%
31.06% 298°
WN180-SE-PRP-DET-ON: Probe 3 100 Khz VERT
x 308.3° y 105.02 Amp -0.89 Sweep 373 DataPt 368
Sweep Size 844 314093 314093
Probe 3 x 308.3° y 105.02 Sweep 373 DataPt 368

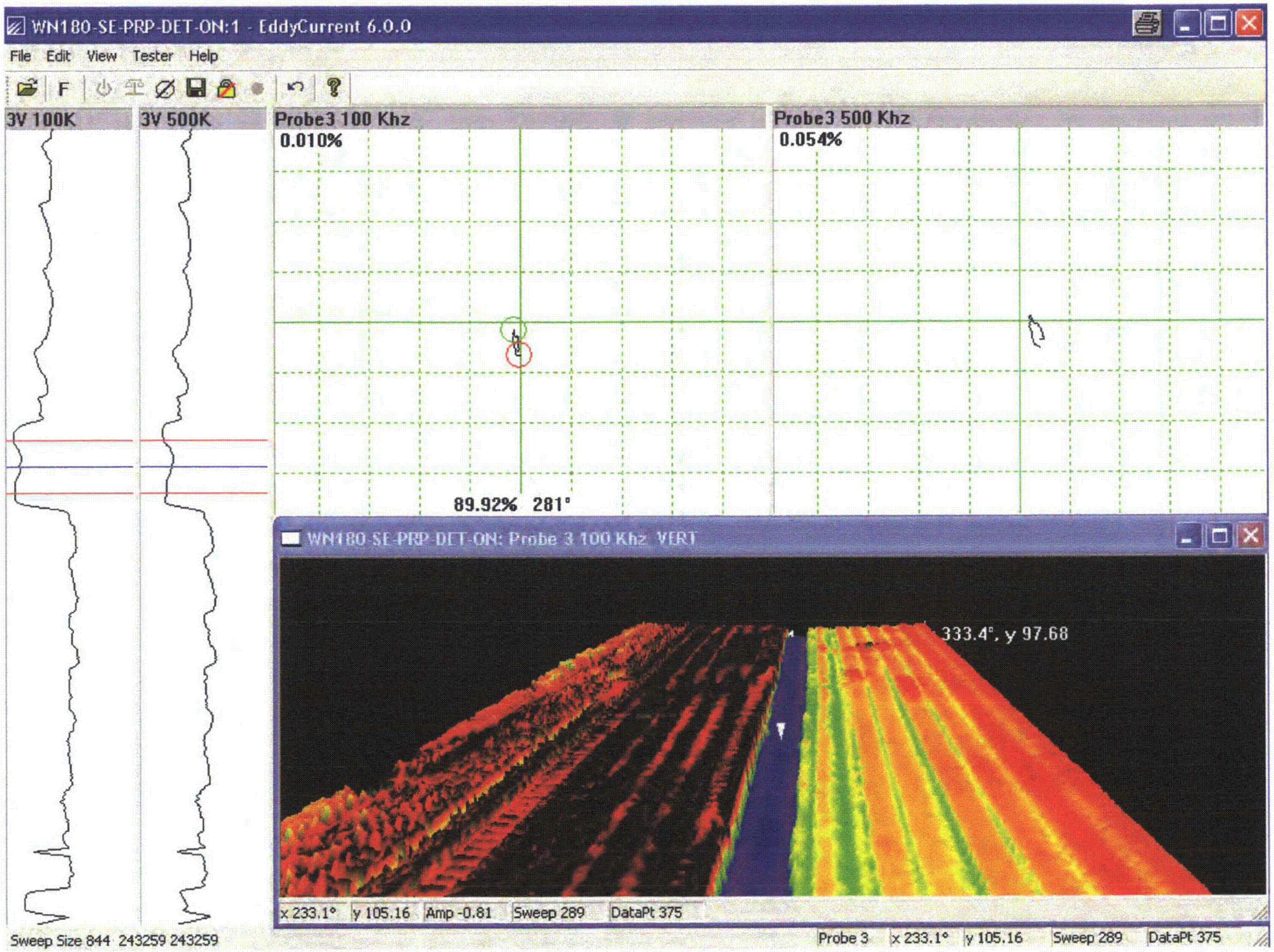


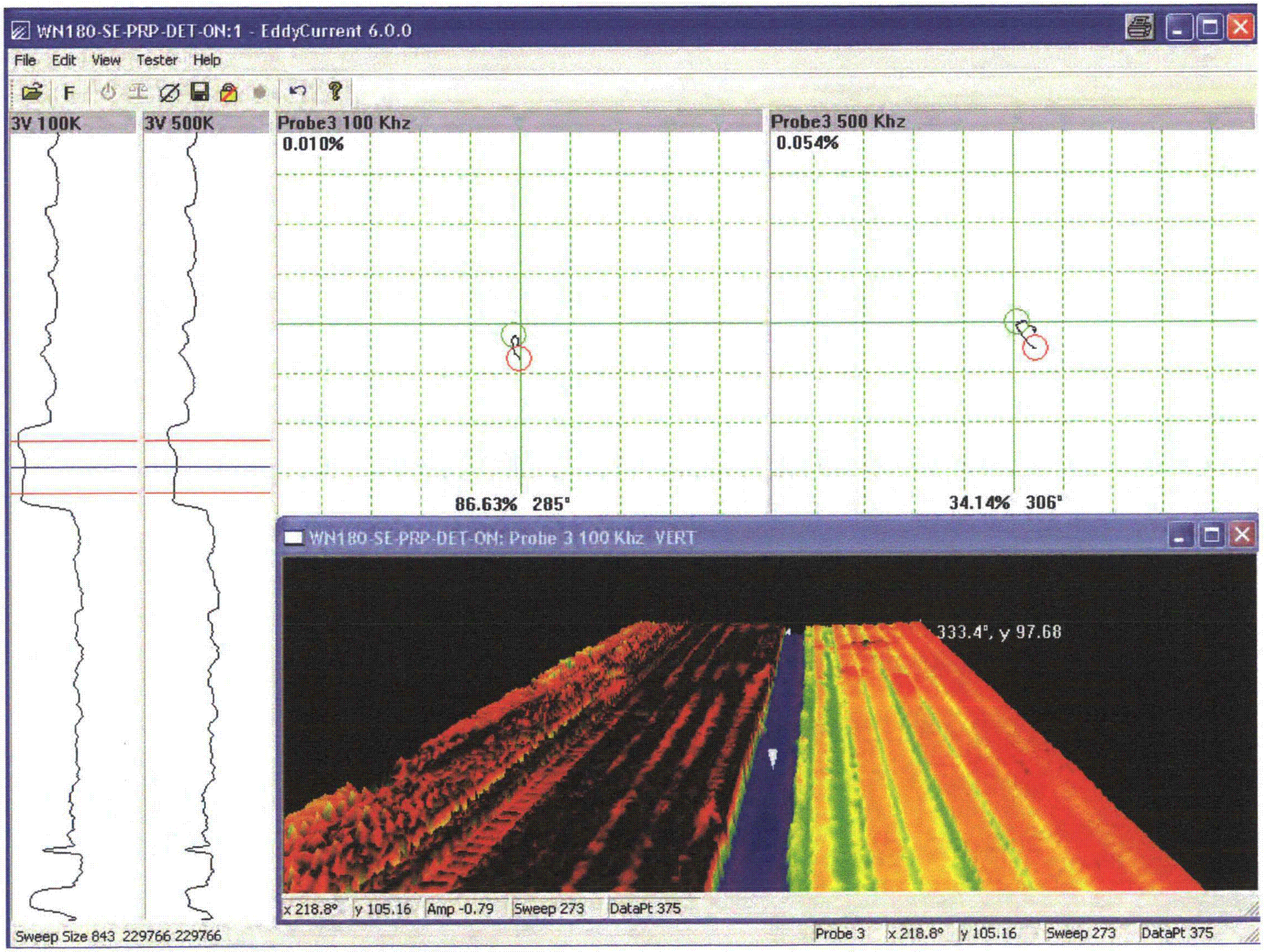
WN180-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.010%
135.12% 301°
Probe3 500 Khz
0.054%
67.51% 318°
WN180-SE-PRP-DET-ON: Probe 3 100 Khz VERT
33.4°, y 97.68
x 293.1° y 105.02 Amp -0.81 Sweep 356 DataPt 368
Draw 10,113 --
Probe 3 x 293.1° y 105.02 Sweep 356 DataPt 368

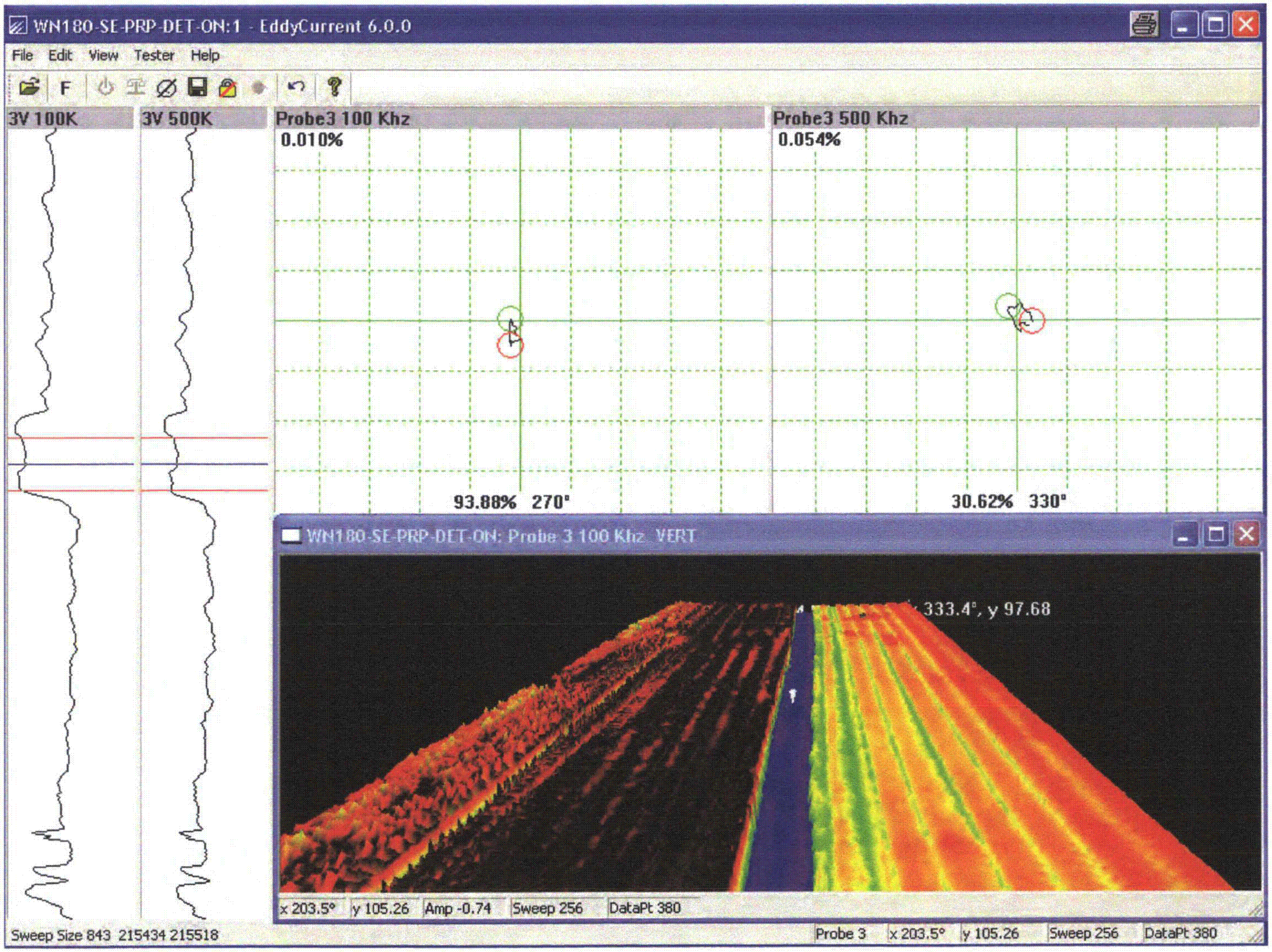

WN180-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.011%
97.61% 304°
Probe3 500 Khz
0.054%
53.03% 318°
WN180-SE-PRP-DET-ON: Probe 3 100 Khz VERT
333.4°, y 97.68
x 278.7° y 105.02 Amp -0.88 Sweep 340 DataPt 368
Sweep Size 843 286263 286371
Probe 3 x 278.7° y 105.02 Sweep 340 DataPt 368

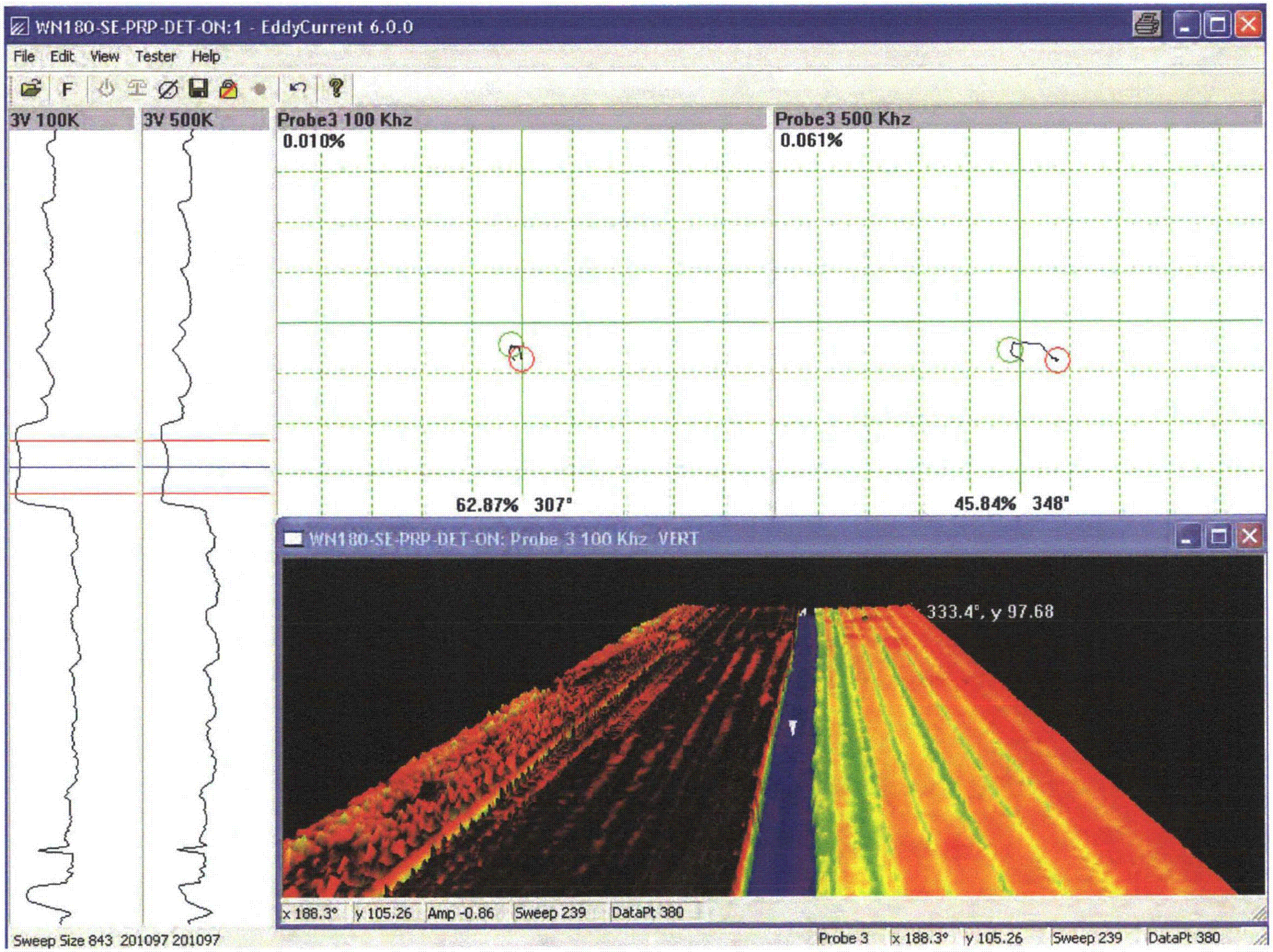

WN180-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.011%
99.17% 292°
Probe3 500 Khz
0.053%
41.96% 302°
WN180-SE-PRP-DET-ON: Probe 3 100 Khz VERT
333.4°, y 97.68
x 263.5° y 105.10 Amp -0.83 Sweep 323 DataPt 372
Sweep Size 843 271930 271930
Probe 3 x 263.5° y 105.10 Sweep 323 DataPt 372

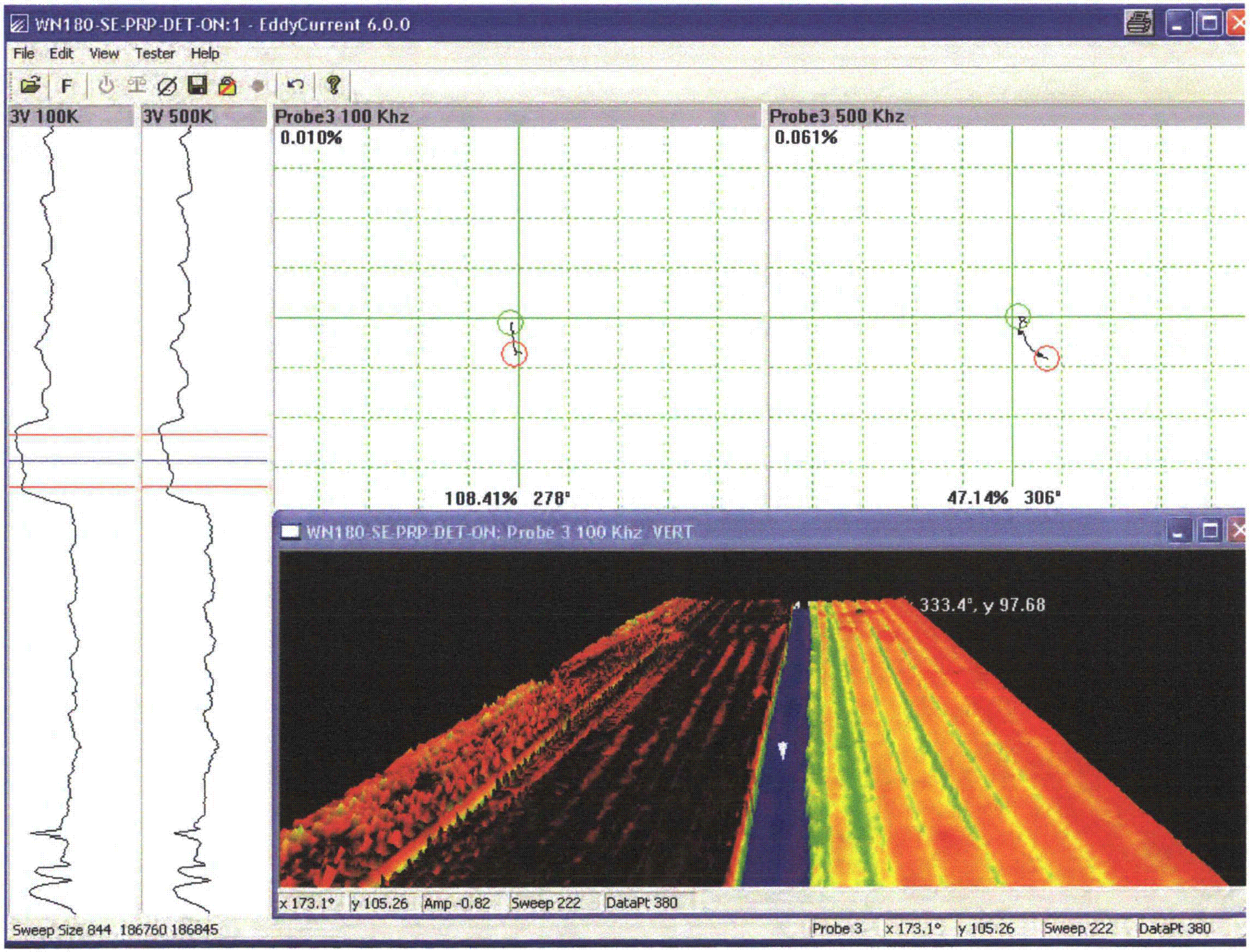

WN180-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.010%
69.94% 291°
Probe3 500 Khz
0.053%
35.28% 326°
WN180-SE-PRP-DET-ON: Probe 3 100 Khz VERT
333.4°, y 97.68
x 248.3° y 104.98 Amp -0.83 Sweep 306 DataPt 366
Sweep Size 843 257587 257699
Probe 3 x 248.3° y 104.98 Sweep 306 DataPt 366

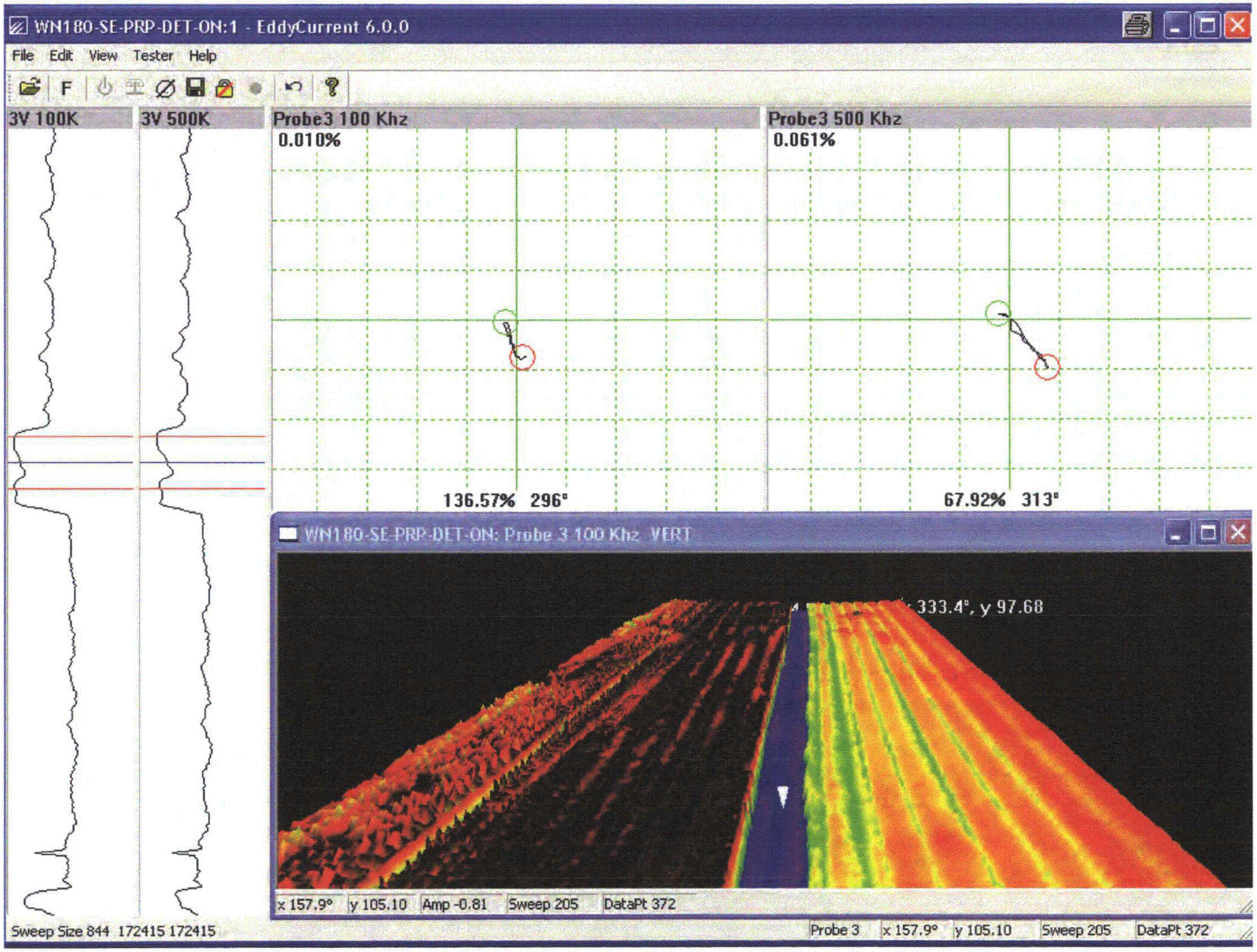

WN180-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.010%
Probe3 500 Khz
0.054%
89.92% 281°
WN180-SE-PRP-DET-ON: Probe 3 100 Khz VERT
333.4°, y 97.68
x 233.1° y 105.16 Amp -0.81 Sweep 289 DataPt 375
Sweep Size 844 243259 243259
Probe 3 x 233.1° y 105.16 Sweep 289 DataPt 375

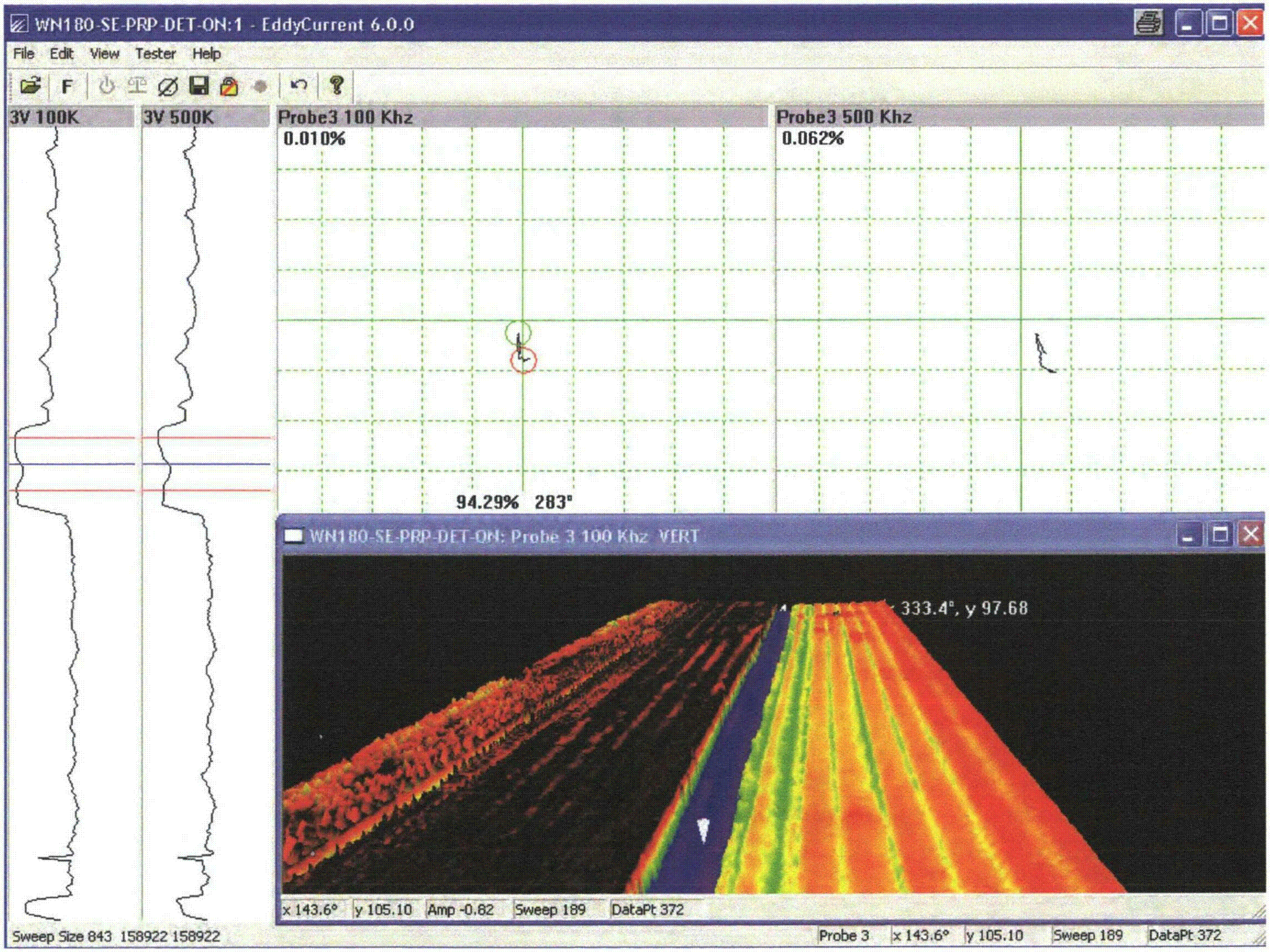

WN180-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.010%
86.63% 285°
Probe3 500 Khz
0.054%
34.14% 306°
WN180-SE-PRP-DET-ON: Probe 3 100 Khz VERT
333.4°, y 97.68
x 218.8° y 105.16 Amp -0.79 Sweep 273 DataPt 375
Sweep Size 843 229766 229766
Probe 3 x 218.8° y 105.16 Sweep 273 DataPt 375

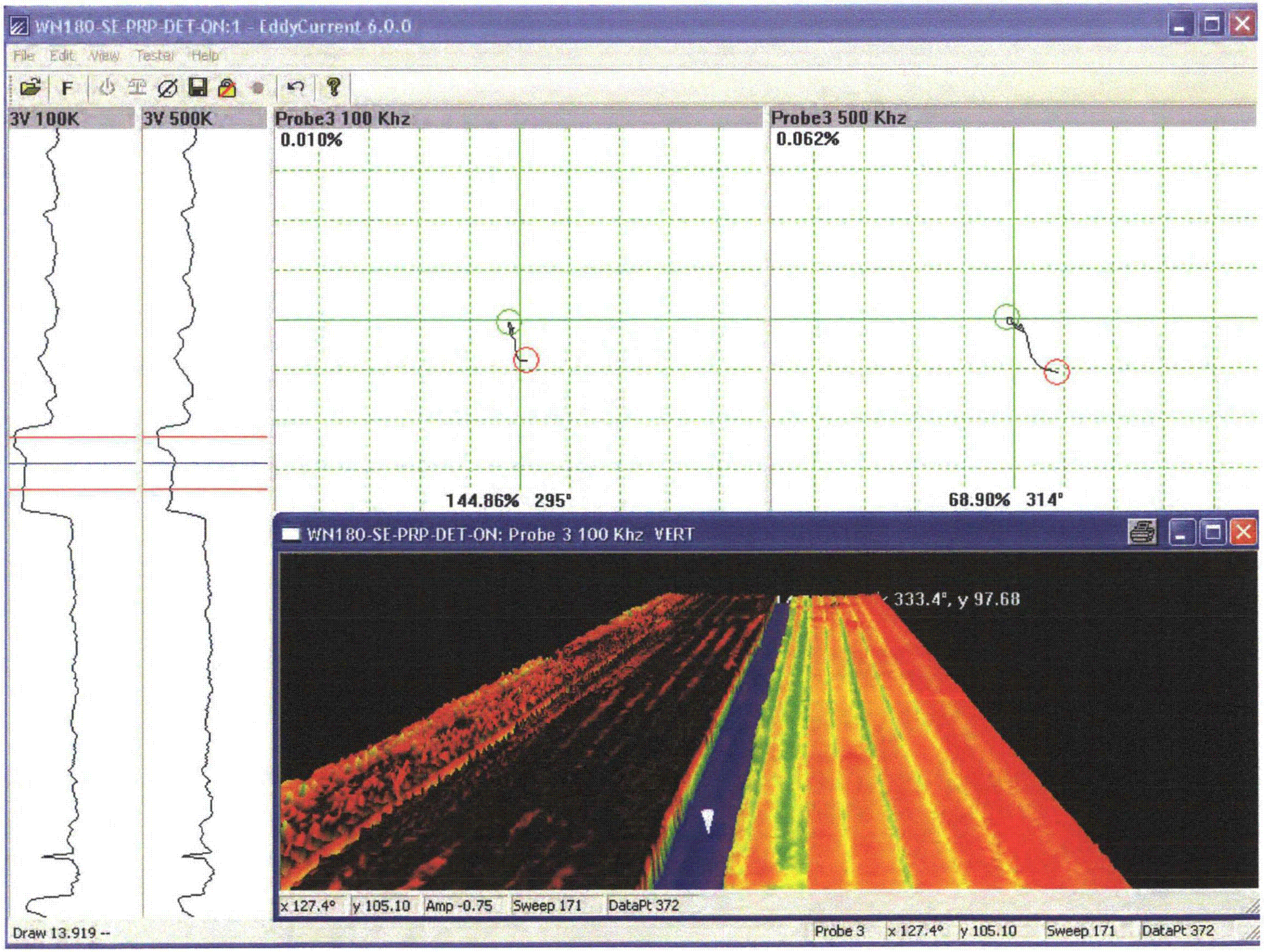

WN180-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.010%
93.88% 270°
Probe3 500 Khz
0.054%
30.62% 330°
WN180-SE-PRP-DET-ON: Probe 3 100 Khz VERT
333.4°, y 97.68
x 203.5° y 105.26 Amp -0.74 Sweep 256 DataPt 380
Sweep Size 843 215434 215518
Probe 3 x 203.5° y 105.26 Sweep 256 DataPt 380

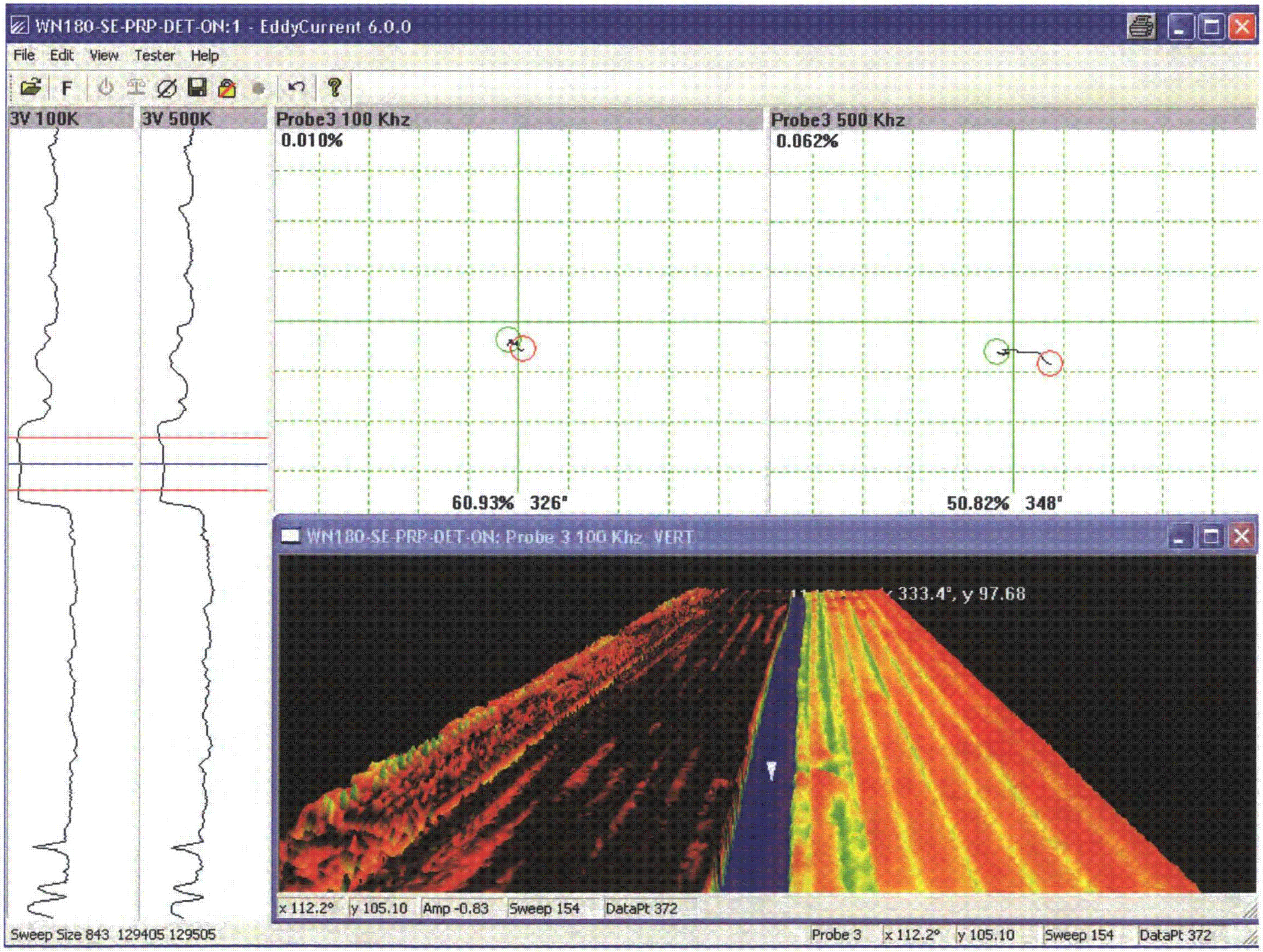

WN180-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.010%
62.87% 307°
Probe3 500 Khz
0.061%
45.84% 348°
WN180-SE-PRP-DET-ON: Probe 3 100 Khz VERT
333.4°, y 97.68
x 188.3° y 105.26 Amp -0.86 Sweep 239 DataPt 380
Sweep Size 843 201097 201097
Probe 3 x 188.3° y 105.26 Sweep 239 DataPt 380

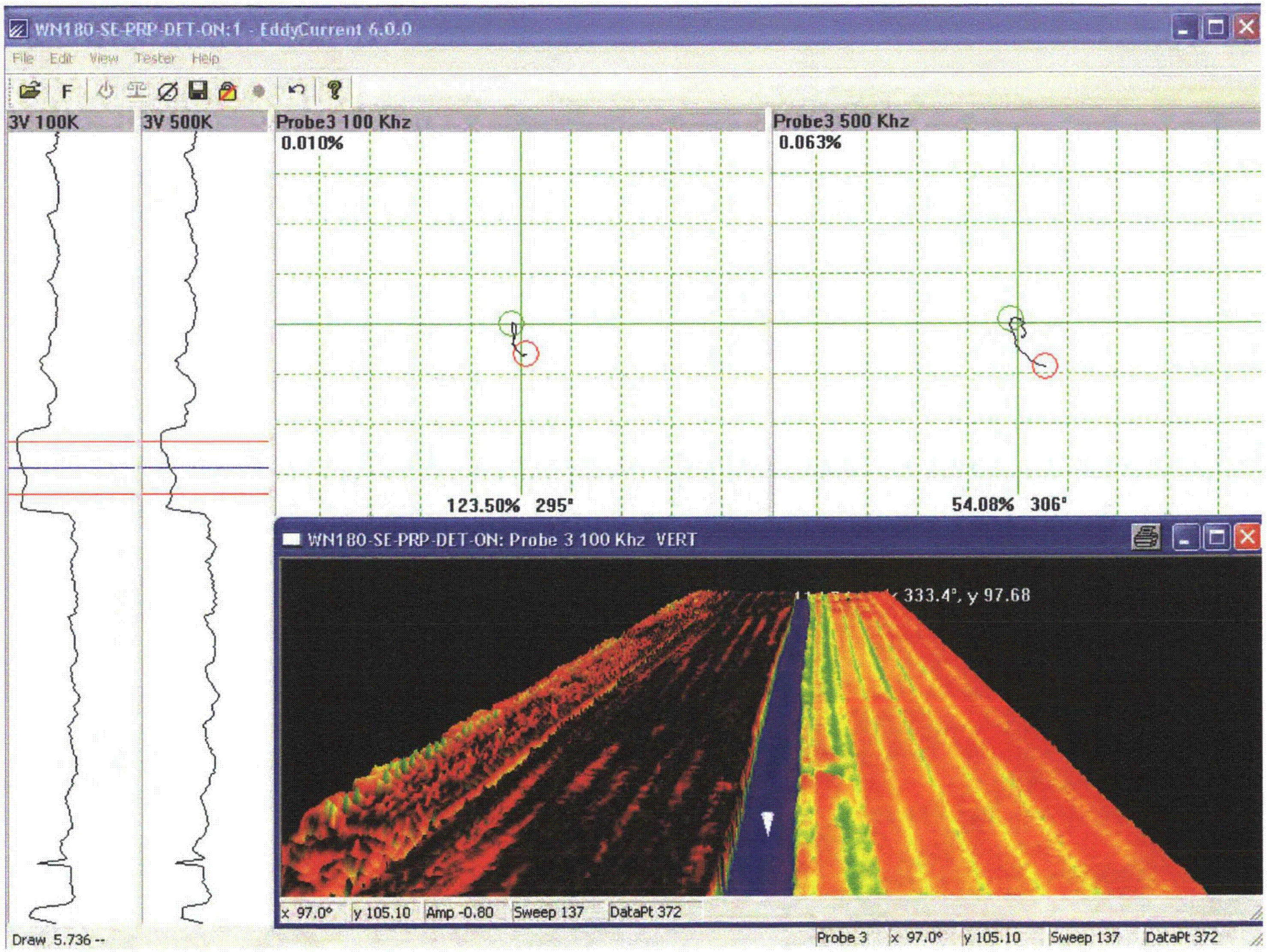

WN180-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.010%
108.41% 278°
Probe3 500 Khz
0.061%
47.14% 306°
WN180-SE-PRP-DET-ON: Probe 3 100 Khz VERT
333.4°, y 97.68
x 173.1° y 105.26 Amp -0.82 Sweep 222 DataPt 380
Sweep Size 844 186760 186845
Probe 3 x 173.1° y 105.26 Sweep 222 DataPt 380


WN180-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.010%
Probe3 500 Khz
0.061%
136.57% 296°
67.92% 313°
WN180-SE-PRP-DET-ON: Probe 3 100 Khz VERT
333.4°, y 97.68
x 157.9° y 105.10 Amp -0.81 Sweep 205 DataPt 372
Sweep Size 844 172415 172415
Probe 3 x 157.9° y 105.10 Sweep 205 DataPt 372

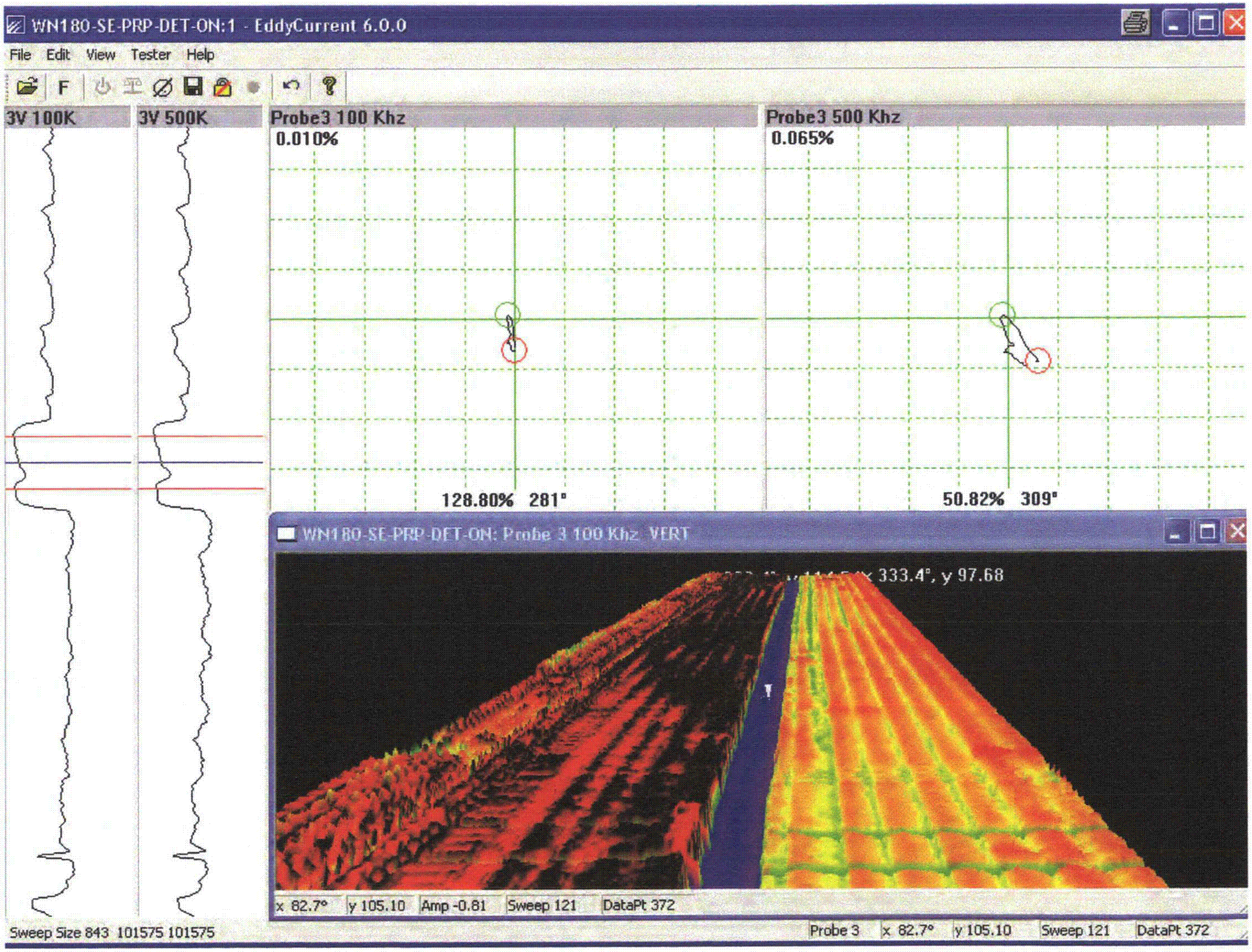

WN180-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.010%
Probe3 500 Khz
0.062%
94.29% 283°
WN180-SE-PRP-DET-ON: Probe 3 100 Khz VERT
333.4°, y 97.68
x 143.6° y 105.10 Amp -0.82 Sweep 189 DataPt 372
Sweep Size 843 158922 158922
Probe 3 x 143.6° y 105.10 Sweep 189 DataPt 372

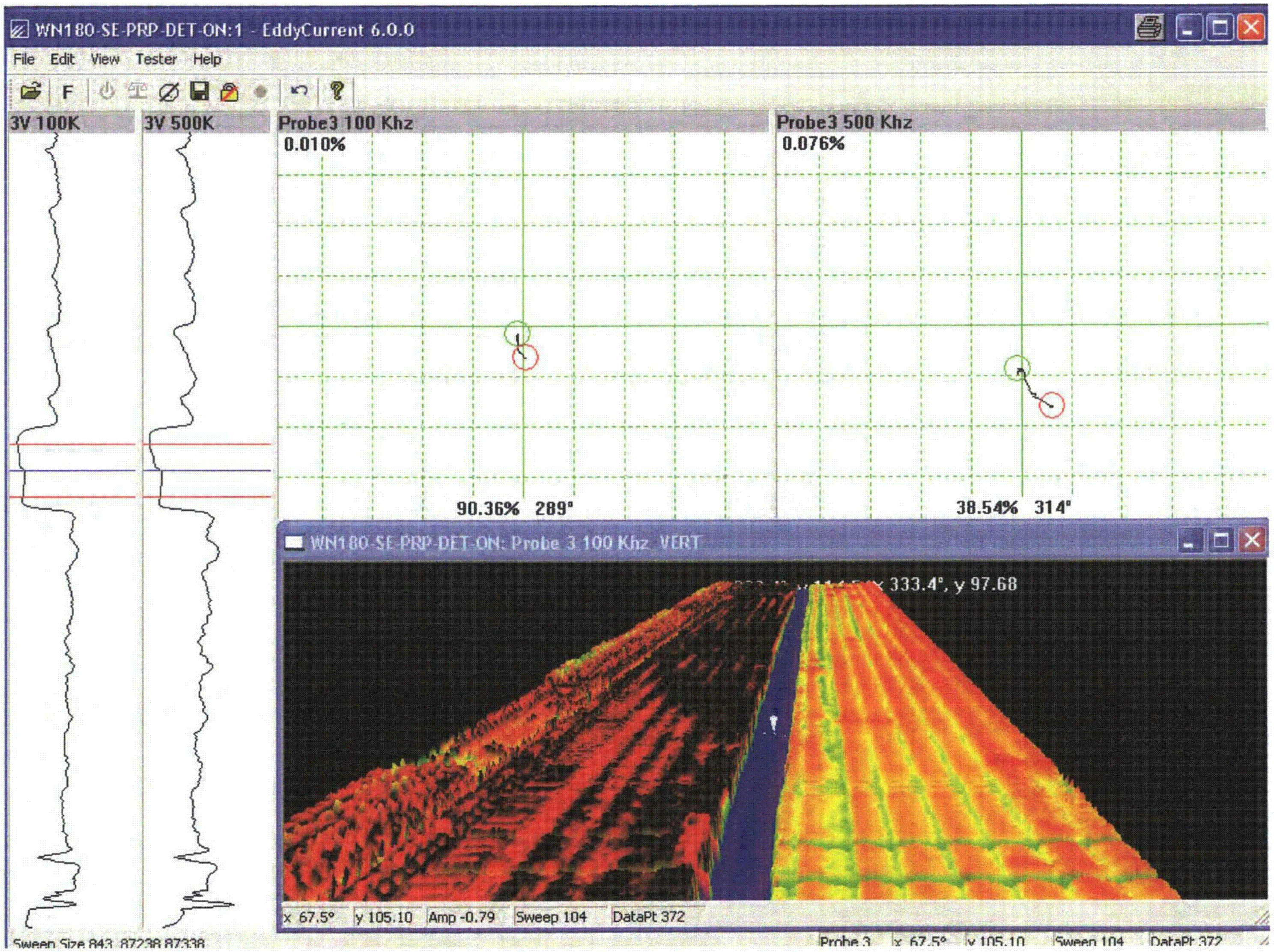

WN180-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.010%
144.86% 295°
Probe3 500 Khz
0.062%
68.90% 314°
WN180-SE-PRP-DET-ON: Probe 3 100 Khz VERT
x 333.4°, y 97.68
x 127.4° y 105.10 Amp -0.75 Sweep 171 DataPt 372
Draw 13.919 --
Probe 3 x 127.4° y 105.10 Sweep 171 DataPt 372

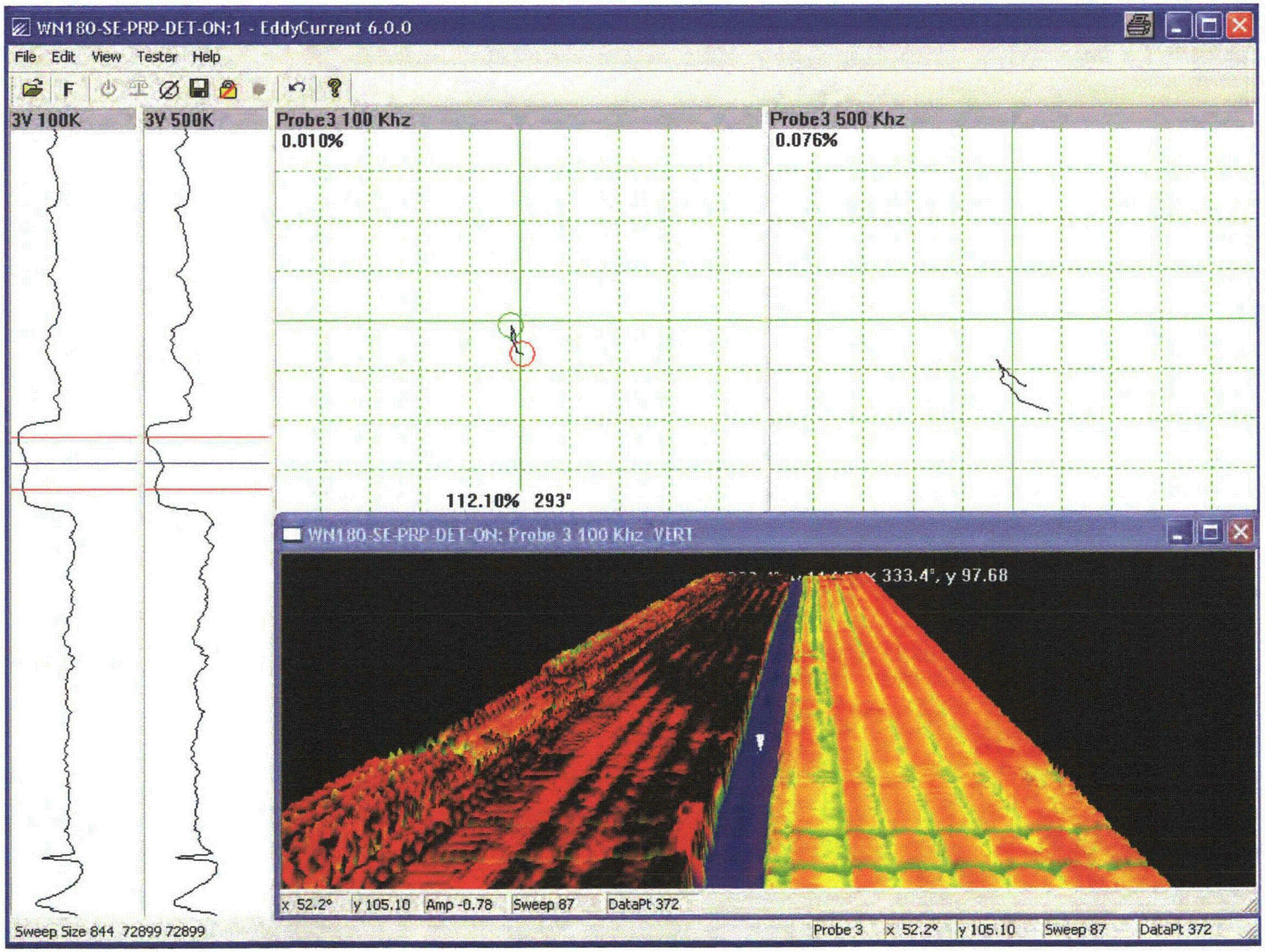

WN180-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.010%
60.93% 326°
Probe3 500 Khz
0.062%
50.82% 348°
WN180-SE-PRP-DET-ON: Probe 3 100 Khz VERT
333.4°, y 97.68
x 112.2° y 105.10 Amp -0.83 Sweep 154 DataPt 372
Sweep Size 843 129405 129505
Probe 3 x 112.2° y 105.10 Sweep 154 DataPt 372

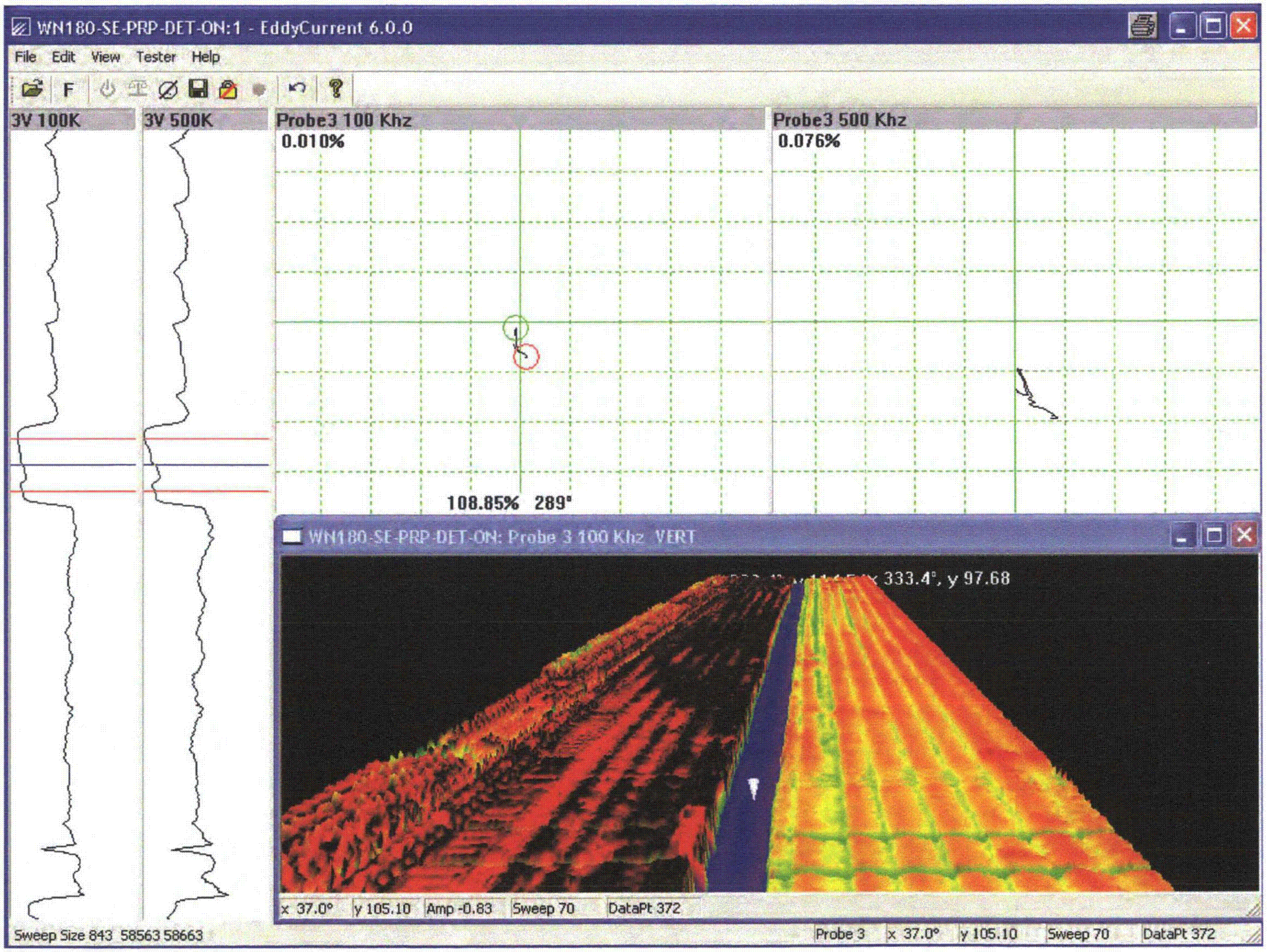


WN180-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.010%
123.50% 295°
Probe3 500 Khz
0.063%
54.08% 306°
WN180-SE-PRP-DET-ON: Probe 3 100 Khz VERT
333.4°, y 97.68
x 97.0° y 105.10 Amp -0.80 Sweep 137 DataPt 372
Draw 5.736 --
Probe 3 x 97.0° y 105.10 Sweep 137 DataPt 372


WN180-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.010%
128.80% 281°
Probe3 500 Khz
0.065%
50.82% 309°
WN180-SE-PRP-DET-ON: Probe 3 100 Khz VERT
x 333.4°, y 97.68
x 82.7° y 105.10 Amp -0.81 Sweep 121 DataPt 372
Sweep Size 843 101575 101575
Probe 3 x 82.7° y 105.10 Sweep 121 DataPt 372


WN180-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.010%
90.36% 289°
Probe3 500 Khz
0.076%
38.54% 314°
WN180-SE-PRP-DET-ON: Probe 3 100 Khz VERT
x 333.4°, y 97.68
x 67.5° y 105.10 Amp -0.79 Sweep 104 DataPt 372
Sweep Size 843 87238 87338
Probe 3 x 67.5° y 105.10 Sweep 104 DataPt 372


WN180-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.010%
Probe3 500 Khz
0.076%
112.10% 293°
WN180-SE-PRP-DET-ON: Probe 3 100 Khz VERT
x 333.4°, y 97.68
x 52.2° y 105.10 Amp -0.78 Sweep 87 DataPt 372
Sweep Size 844 72899 72899
Probe 3 x 52.2° y 105.10 Sweep 87 DataPt 372


WN180-SE-PRP-DET-ON:1 - EddyCurrent 6.0.0
File Edit View Tester Help
3V 100K
3V 500K
Probe3 100 Khz
0.010%
Probe3 500 Khz
0.076%
108.85% 289°
WN180-SE-PRP-DET-ON: Probe 3 100 Khz VERT
x 333.4°, y 97.68
x 37.0° y 105.10 Amp -0.83 Sweep 70 DataPt 372
Sweep Size 843 58563 58663
Probe 3 x 37.0° y 105.10 Sweep 70 DataPt 372

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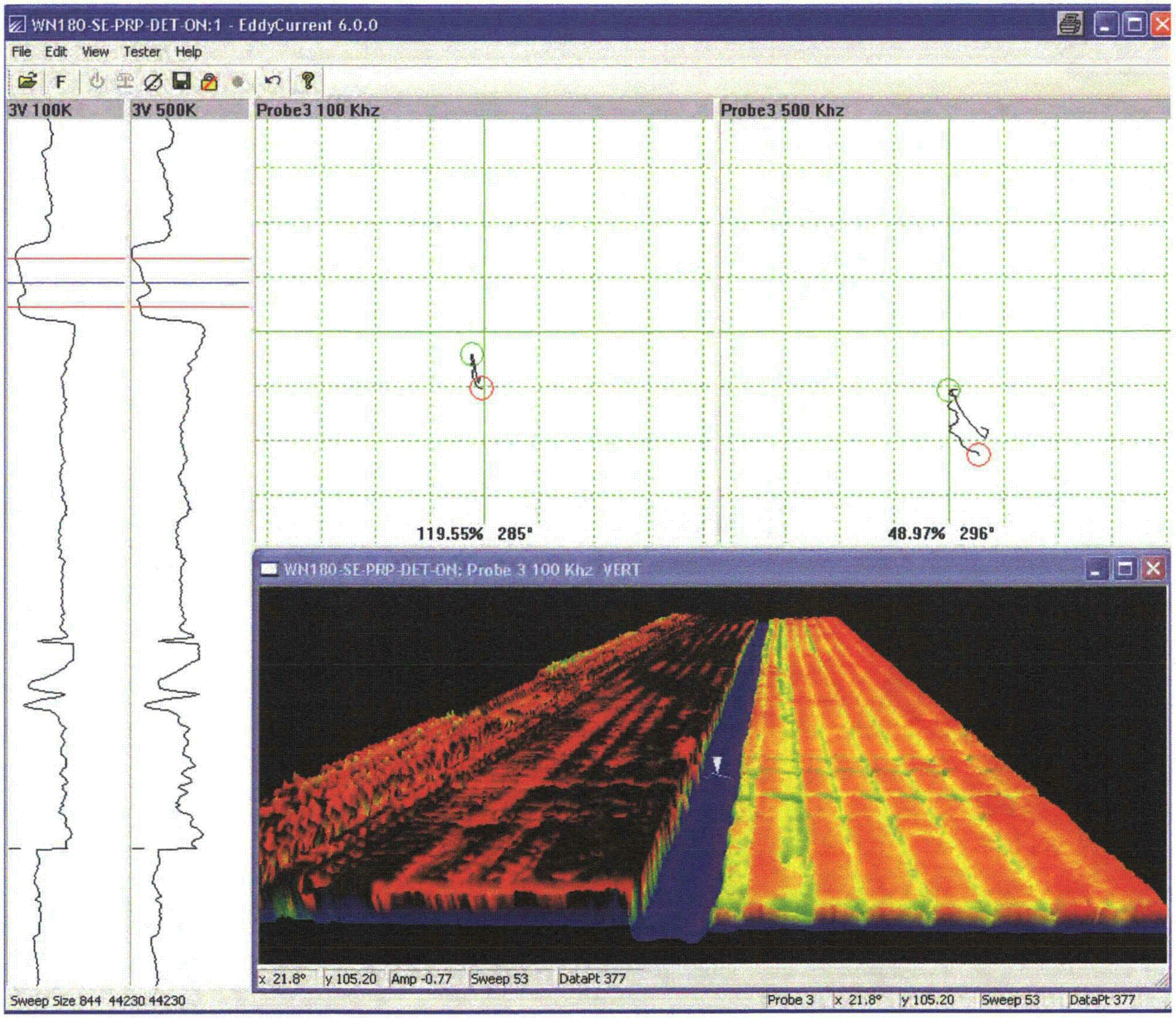
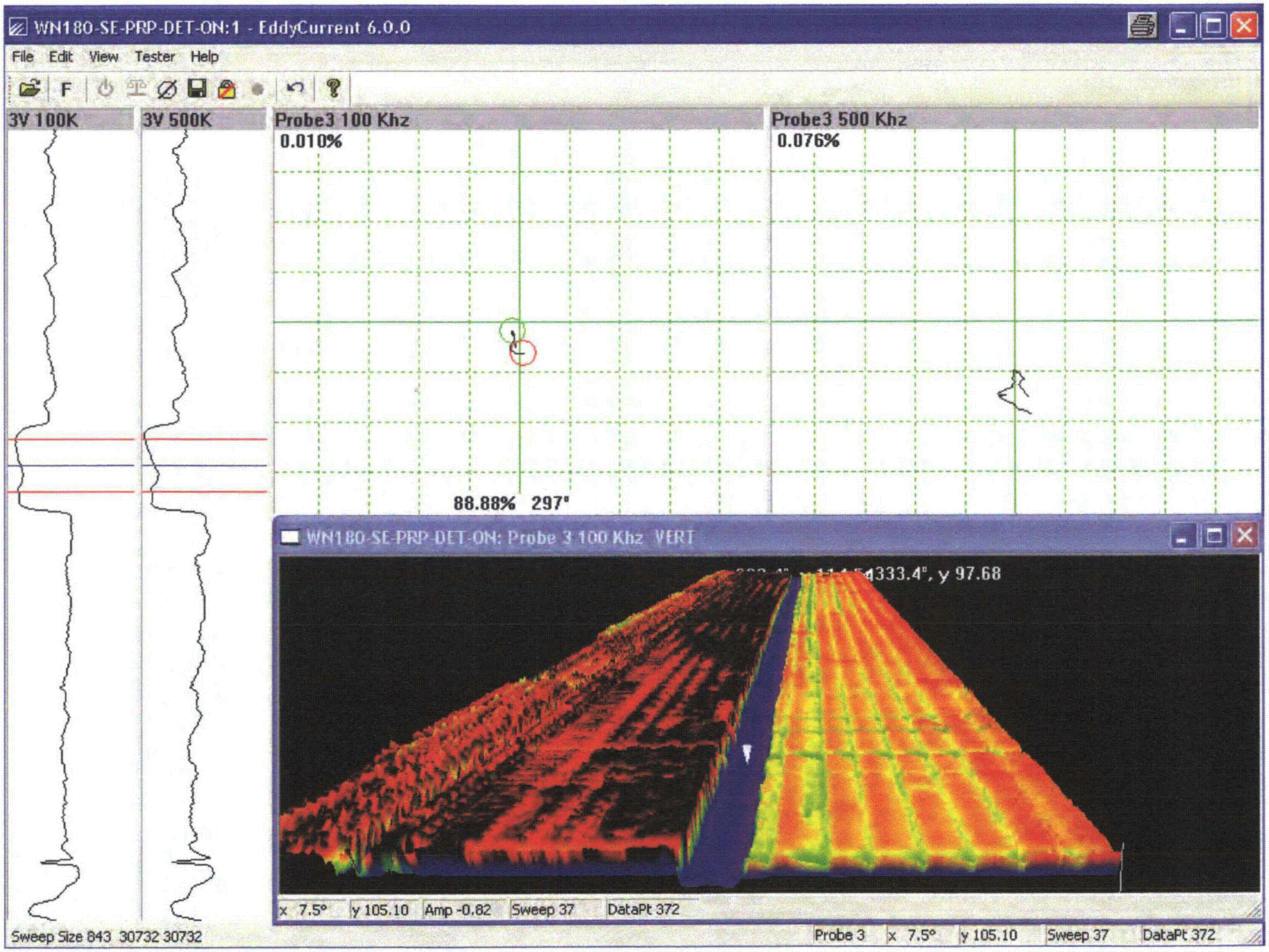


WESDYNE INTERNATIONAL
A Westinghouse Electric Company



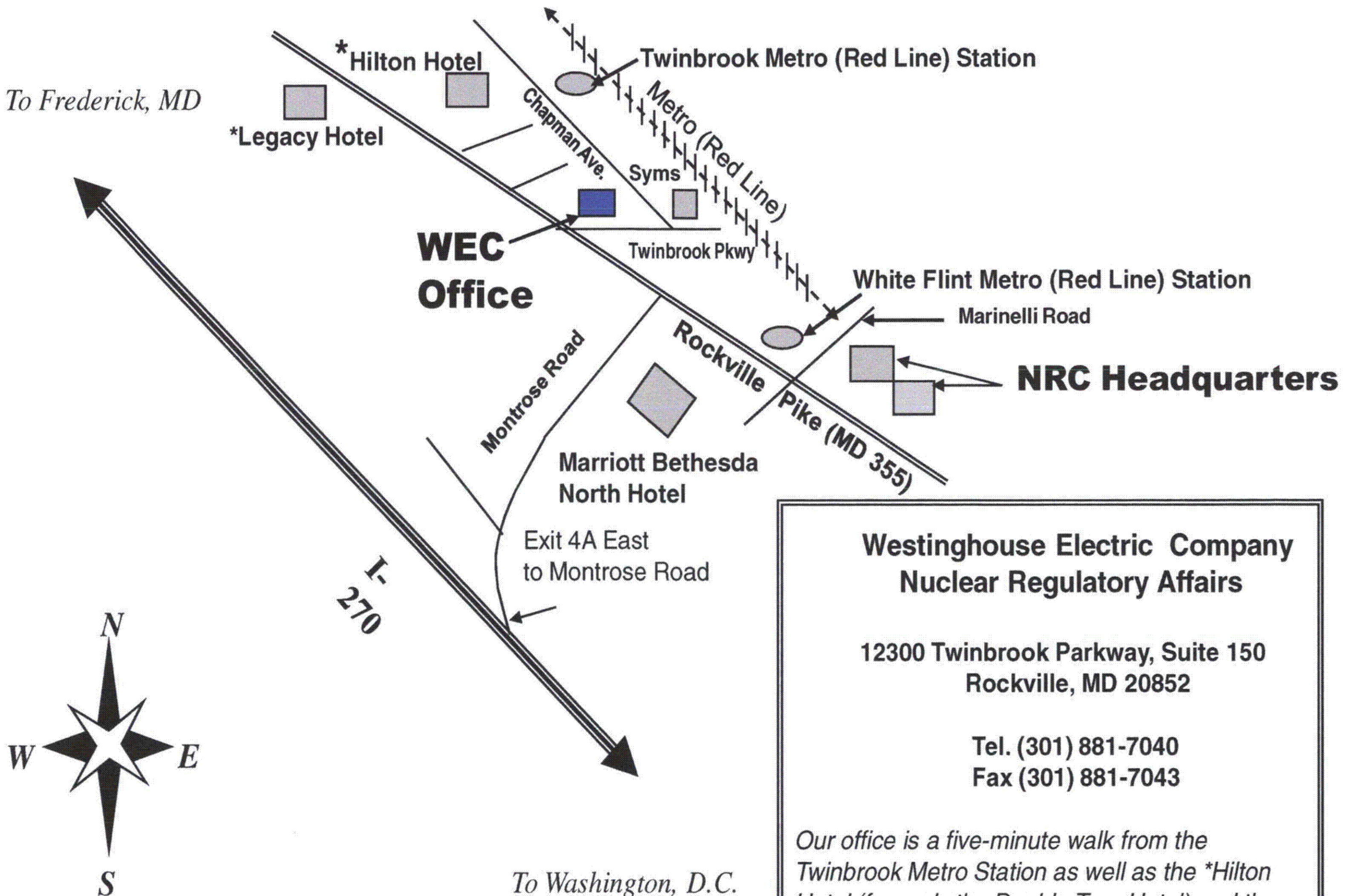
Map to

Westinghouse

Rockville, Maryland

Nuclear Regulatory Affairs Office

Westinghouse Nuclear Regulatory Affairs Office



Westinghouse Electric Company
Nuclear Regulatory Affairs

12300 Twinbrook Parkway, Suite 150
Rockville, MD 20852

Tel. (301) 881-7040
Fax (301) 881-7043

*Our office is a five-minute walk from the Twinbrook Metro Station as well as the *Hilton Hotel (formerly the Double Tree Hotel) and the *The Legacy Hotel (formerly the Ramada Inn).*

*Revised March 2010

2009 Weld Inspection Data

WesDyne International
Reactor Vessel Nozzle Weld Results Summary

Fort Calhoun Nuclear Power Station

WELD NO.	DESCRIPTION	COVERAGE
MRC-2/01	**Outlet Nozzle DM Weld @ 180°**	**100 %**
MRC-2/02	**Outlet Nozzle SE to Pipe Weld @ 180°**	**94.24% ***

LIMITATIONS NO [ ] YES [X] ***ID Configuration of Safe End to Pipe Weld.**

UT RESULTS NI [X] RI [ ] NO. OF UT INDICATIONS 0
STATUS N/A

ET RESULTS NI [X] RI [ ] NO. OF ET INDICATIONS 0
STATUS N/A

EXAM DOCUMENTATION	INDICATION DOCUMENTATION
[X] ANALYSIS LOG (UT/ET)	[ ] ASSESSMENT SHEET
[X] ACQUISITION LOG	[ ] PARAGON HARD COPY
[X] SCAN PRINTOUT	[ ] OTHER (specify)
[X] COVERAGE BREAKDOWN	

WESDYNE ANALYST / Level / Date [signature] III / 11-13-09

WesDyne International
Reactor Vessel Nozzle Weld Results Summary

Fort Calhoun Nuclear Power Station

WELD NO.	DESCRIPTION	COVERAGE
MRC-1/01	**Outlet Nozzle DM Weld @ 0°**	**100 %**
MRC-1/02	**Outlet Nozzle SE to Pipe Weld @ 0°**	**95.54% ***

LIMITATIONS NO [ ] YES [X] ***ID Configuration of Safe End to Pipe Weld.**

UT RESULTS NI [X] RI [ ] NO. OF UT INDICATIONS 0
STATUS N/A

ET RESULTS NI [X] RI [ ] NO. OF ET INDICATIONS 0
STATUS N/A

EXAM DOCUMENTATION	INDICATION DOCUMENTATION
[X] ANALYSIS LOG (UT/ET)	[ ] ASSESSMENT SHEET
[X] ACQUISITION LOG	[ ] PARAGON HARD COPY
[X] SCAN PRINTOUT	[ ] OTHER (specify)
[X] COVERAGE BREAKDOWN	

WESDYNE ANALYST / Level / Date (signature) III / 11-13-09

WESDYNE INTERNATIONAL

ANALYSIS LOG # DM-SE-0-1

Utility:	OMAHA PUBLIC POWER DISTRICT	Plant:	FORT CALHOUN	Unit:	1	Outage:	RO25
Procedure No:	PDI-ISI-254-SE					Procedure Rev. No.:	3
Weld No:	MRC-1/01, 1/02	Weld Type:	SE			Exam. Surface:	ID
Applicable Sensitivity Calibration Data Sheet No:	FC-SE-AX-DET FC-SE-CIRC-DET	Acquisition Log No:	DM-SE-0-1			PARAGON Anal. Release:	6.3.5
UT Examiner Signature:	(signature)			Level:	III	Date:	11/13/09

Data File Name	UT Channel No.	Beam Angle / Direction [in or out, CW or CCW]	NI	RI	Indication / Resolution / Comments / Limitations	Examiner ID / Date
WN0-SE-PRP-DET-ON	1	IN	X			CSW / 11/13/09
WN0-SE-PRP-DET-ON	2	OUT	X			CSW / 11/13/09
WN0-SE-PAR-DET-ON	1	CCW	X			CSW / 11/13/09
WN0-SE-PAR-DET-ON	2	CW	X			CSW / 11/13/09
WN0-SE-PAR-DET-ON	3	CCW	X		Counterbore Geometry – 91.09%	CSW / 11/13/09
WN0-SE-PAR-DET-ON	4	CW	X		Counterbore Geometry – 91.09%	CSW / 11/13/09

WESDYNE INTERNATIONAL

ET Analysis Log: DM-SE-0-1

Utility: OMAHA PUBLIC POWER DISTRICT	Plant: FORT CALHOUN	Unit: 1	Outage: RO25
Procedure No: WDI-STD-146		Procedure Rev. No.: 9	
Weld No. MRC-1/01, 1/02	Weld Type: DM SE		
Applicable Sensitivity Calibration Data Sheet No: ET-01		Acquisition Log No: DM-SE-0-1	
ET Examiner Signature: [signature]	Level III	Date : 11/13/09	

Data File Name	ET Probe No.	ET Probe Scan Direction (Axial/Circ.)	NI	RI	RI Resolution / Comments / Limitations	Examiner ID / Date
WN0-SE-PRP-DET-ON	1	AXIAL	X			CSW / 11/13/09
WN0-SE-PRP-DET-ON	2	AXIAL	X			CSW / 11/13/09
WN0-SE-PAR-DET-ON	1	CIRC	X			CSW / 11/13/09
WN0-SE-PAR-DET-ON	2	CIRC	X			CSW / 11/13/09

WESDYNE INTERNATIONAL

DATA ACQUISITION LOG # DM-SE-0-1

Utility: OPPD		Plant: Fort Calhoun				Unit: 1		Outage: RO25		
Procedure No: PDI-ISI-254-SE								Procedure Rev. No.: 3		
Applicable Sensitivity Calibration Data Sheet No: SE-CIRC-DET & SE-AX-DET										
UT Examiner Signature: Derrick Moreau [signature]						Level: II		Date: 11/13/2009		
Data File Name	Weld No.	Index Start	Scan Start	Total # of Sweeps	'AVE' Signal Amplitude	Gain Adj. (dB)	Operator Initials	Date (mm/dd/yy)	Time	Comments
WN0-SE-PRP-DET-ON	MRC-1/01 & 1/02	0 DEG	100.18"	402	10	0	DM	11/13/09	09:57	
WN0-SE-PRP-DET-ON	MRC-1/01 & 1/02	0 DEG	100.18"	402	15	0	DM	11/13/09	09:57	
WN0-SE-PAR-DET-ON	MRC-1/01 & 1/02	105.75"	0 DEG	73	17	0	DM	11/13/09	10:51	
WN0-SE-PAR-DET-ON	MRC-1/01 & 1/02	105.75"	0 DEG	73	15	+2	DM	11/13/09	10:51	
WN0-SE-PAR-DET-ON	MRC-1/01 & 1/02	105.75"	0 DEG	73	15	0	DM	11/13/09	10:51	
WN0-SE-PAR-DET-ON	MRC-1/01 & 1/02	105.75"	0 DEG	73	13	0	DM	11/13/09	10:51	

WesDyne International
Reactor Vessel Inservice Examination
Scan Parameter Execution

CUSTOMER .... OMAHA PUBLIC POWER DISTRICT
SITE .... FT. CALHOUN UNIT 1
OUTAGE RFO25
VESSEL TYPE .... CE 2-LOOP

WELD IDENTIFICATION - MRC-1-01-02

Weld and Scan Type = NOZZLE SAFE END PERPENDICULAR SCAN

Scan Data File Name = WNO-SE-PRP-DET-ONa

SCAN AREA PER THE ORIGINAL TECHNIQUES

UDRPS SCAN AREA DEFINITION		AZIMUTH (DEGREES)	DEPTH (IN)
START CW	:	0.00	100.18
END CCW	:	360.00	100.18
START CW	:	0.00	117.05
END CCW	:	360.00	117.05

Index Size (in) = 0.25
Number of Indexes Specified = 401
Number of Indexes Completed = 401

	Time	Date
Scan Started	08:44:43.008	11/13/09
Scan Completed	09:56:06.553	11/13/09

Robot Operator Signature [signature] DATE 11-13-09

PARAGON Operator Signature [signature] DATE 11-13-09

Comments Paragon Scan file is WNØ-SE-PRP-DET-ON

WesDyne International
Reactor Vessel Inservice Examination
Scan Parameter Execution

CUSTOMER .... OMAHA PUBLIC POWER DISTRICT
SITE .... FT. CALHOUN UNIT 1
OUTAGE RFO25
VESSEL TYPE .... CE 2-LOOP

WELD IDENTIFICATION - MRC-1-01-02

Weld and Scan Type = NOZZLE SAFE END PARALLEL SCAN

Scan Data File Name = WN0-SE-PAR-DET-ON

SCAN AREA PER THE ORIGINAL TECHNIQUES

UDRPS SCAN AREA DEFINITION		DEPTH (IN)	AZIMUTH (DEGREES)
START CW	:	105.75	0.00
END CCW	:	105.75	360.00
START CW	:	111.47	0.00
END CCW	:	111.47	360.00

Index Size (in) = 0.08
Number of Indexes Specified = 73
Number of Indexes Completed = 73

	Time	Date
Scan Started	10:04:32.962	11/13/09
Scan Completed	10:50:35.361	11/13/09

Robot Operator Signature [signature] DATE 11-13-09

PARAGON Operator Signature [signature] DATE 11-13-09

Comments ______________________

Fort Calhoun Nuclear Power Plant

RPV NOZZLE COVERAGE
ESTIMATE BREAKDOWNS

DIRECTION / ORIENTATION

PARALLEL SCANS CCW / CW
PERP. SCANS IN / OUT

WELD DESCRIPTION Outlet Nozzle to Safe End @ 0°

WELD NO. MRC-1/01

BEAM ANGLES

BEAM DIRECTION	70° L Dual	ET			
	EXAM VOLUME	EXAM VOLUME	EXAM VOLUME	EXAM VOLUME	EXAM VOLUME
CCW	100	100			
CW	100	100			
IN	100	100			
OUT	100	100			
UT COVERAGE = Combined Coverage (UT & ET) = 100% See exam volume EPP sheet 5 of 8	100%				

ANALYST [signature] III

Fort Calhoun Nuclear Power Plant

RPV NOZZLE COVERAGE
ESTIMATE BREAKDOWNS

DIRECTION / ORIENTATION

PARALLEL SCANS CCW / CW
PERP. SCANS IN / OUT

WELD DESCRIPTION Outlet Nozzle Safe End to Pipe @ 0°

WELD NO. MRC-1/02

BEAM ANGLES

BEAM DIRECTION	70° L Dual	ET			
	EXAM VOLUME	EXAM VOLUME	EXAM VOLUME	EXAM VOLUME	EXAM VOLUME
CCW	91.09	100			
CW	91.09	100			
IN	100	100			
OUT	100	100			
UT COVERAGE = Combined Coverage (UT & ET) = 100% See exam volume EPP sheet 5 of 8	95.54%				

ANALYST [signature]

WESDYNE INTERNATIONAL

ANALYSIS LOG # DM-SE-180-1

Utility:	OMAHA PUBLIC POWER DISTRICT	**Plant:**	FORT CALHOUN	**Unit:**	1	**Outage:**	RO25
Procedure No:	PDI-ISI-254-SE					**Procedure Rev. No.:**	3
Weld No:	MRC-2/01, 2/02		**Weld Type:**	SE		**Exam. Surface:**	ID
Applicable Sensitivity Calibration Data Sheet No:	FC-SE-AX-DET FC-SE-CIRC-DET		**Acquisition Log No:**	DM-SE-180-1		**PARAGON Anal. Release:**	6.3.5
UT Examiner Signature:	[signature]			**Level:**	III	**Date:**	11/13/09

Data File Name	UT Channel No.	Beam Angle / Direction [in or out, CW or CCW]	NI	RI	Indication / Resolution / Comments / Limitations	Examiner ID / Date
WN180-SE-PRP-DET-ON	1	IN	X			CSW / 11/13/09
WN180-SE-PRP-DET-ON	2	OUT	X			CSW / 11/13/09
WN180-SE-PAR-DET-ON	1	CCW	X			CSW / 11/13/09
WN180-SE-PAR-DET-ON	2	CW	X			CSW / 11/13/09
WN180-SE-PAR-DET-ON	3	CCW	X		Counterbore Geometry – 88.48%	CSW / 11/13/09
WN180-SE-PAR-DET-ON	4	CW	X		Counterbore Geometry – 88.48%	CSW / 11/13/09

WESDYNE INTERNATIONAL

ET Analysis Log: DM-SE-180-1

Utility: OMAHA PUBLIC POWER DISTRICT	Plant: FORT CALHOUN	Unit: 1	Outage: RO25
Procedure No: WDI-STD-146		Procedure Rev. No.: 9	
Weld No. MRC-2/01, 2/02	Weld Type: DM SE		
Applicable Sensitivity Calibration Data Sheet No: ET-01		Acquisition Log No: DM-SE-180-1	
ET Examiner Signature: [signature]	Level III	Date : 11/13/09	

Data File Name	ET Probe No.	ET Probe Scan Direction [Axial/Circ.]	NI	RI	RI Resolution / Comments / Limitations	Examiner ID / Date
WN180-SE-PRP-DET-ON	1	AXIAL	X			CSW / 11/13/09
WN180-SE-PRP-DET-ON	2	AXIAL	X			CSW / 11/13/09
WN180-SE-PAR-DET-ON	1	CIRC	X			CSW / 11/13/09
WN180-SE-PAR-DET-ON	2	CIRC	X			CSW / 11/13/09

Form 12-5

WESDYNE INTERNATIONAL

DATA ACQUISITION LOG # DM-SE-180-1

Utility:	OPPD	Plant:	Fort Calhoun	Unit:	1	Outage:	RO25
Procedure No:	PDI-ISI-254-SE					Procedure Rev. No.:	3
Applicable Sensitivity Calibration Data Sheet No:	SE-CIRC-DET & SE-AX-DET						
UT Examiner Signature:	Derrick Moreau [signature]			Level:	II	Date:	11/13/2009

Data File Name	Weld No.	Index Start	Scan Start	Total # of Sweeps	'AVE' Signal Amplitude	Gain Adj. (dB)	Operator Initials	Date (mm/dd/yy)	Time	Comments
WN180-SE-PAR-DET-ON	MRC-2/01 & 2/02	105.75"	0 DEG	73	13	0	DM	11/13/09	15:36	
WN180-SE-PAR-DET-ON	MRC-2/01 & 2/02	105.75"	0 DEG	73	16	+2	DM	11/13/09	15:36	
WN180-SE-PAR-DET-ON	MRC-2/01 & 2/02	105.75"	0 DEG	73	15	0	DM	11/13/09	15:36	
WN180-SE-PAR-DET-ON	MRC-2/01 & 2/02	105.75"	0 DEG	73	13	0	DM	11/13/09	15:36	
WN180-SE-PRP-DET-ON	MRC-2/01 & 2/02	0 DEG	100.18"	401	11	0	DM	11/13/09	16:40	
WN180-SE-PRP-DET-ON	MRC-2/01 & 2/02	0 DEG	100.18"	401	14	0	DM	11/13/09	16:40	

WesDyne International
Reactor Vessel Inservice Examination
Scan Parameter Execution

CUSTOMER .... OMAHA PUBLIC POWER DISTRICT
SITE .... FT. CALHOUN UNIT 1
OUTAGE RFO25
VESSEL TYPE .... CE 2-LOOP

WELD IDENTIFICATION - MRC-2-01-02

Weld and Scan Type = NOZZLE SAFE END PERPENDICULAR SCAN

Scan Data File Name = WN180-SE-PRP-DET-ON

SCAN AREA PER THE ORIGINAL TECHNIQUES

UDRPS SCAN AREA DEFINITION		AZIMUTH (DEGREES)	DEPTH (IN)
START CW	:	0.00	100.18
END CCW	:	360.00	100.18
START CW	:	0.00	117.05
END CCW	:	360.00	117.05

Index Size (in) = 0.25
Number of Indexes Specified = 401
Number of Indexes Completed = 401

	Time	Date
Scan Started	15:41:49.208	11/13/09
Scan Completed	16:37:44.775	11/13/09

Robot Operator Signature [signature] DATE 11/13/09

PARAGON Operator Signature [signature] DATE 11/13/09

Comments ____________________

WesDyne International
Reactor Vessel Inservice Examination
Scan Parameter Execution

CUSTOMER .... OMAHA PUBLIC POWER DISTRICT
SITE .... FT. CALHOUN UNIT 1
OUTAGE RFO25
VESSEL TYPE .... CE 2-LOOP

WELD IDENTIFICATION - MRC-2-01-02

Weld and Scan Type = NOZZLE SAFE END PARALLEL SCAN

Scan Data File Name = WN180-SE-PAR-DET-ON

SCAN AREA PER THE ORIGINAL TECHNIQUES

UDRPS SCAN AREA DEFINITION		DEPTH (IN)	AZIMUTH (DEGREES)
START CW	:	105.75	0.00
END CCW	:	105.75	360.00
START CW	:	111.47	0.00
END CCW	:	111.47	360.00

Index Size (in) = 0.08
Number of Indexes Specified = 73
Number of Indexes Completed = 73

	Time	Date
Scan Started	14:41:31.656	11/13/09
Scan Completed	15:35:05.861	11/13/09

Robot Operator Signature [signature] DATE 11-13-09

PARAGON Operator Signature [signature] DATE 11-13-09

Comments ____________________

Fort Calhoun Nuclear Power Plant

RPV NOZZLE COVERAGE
ESTIMATE BREAKDOWNS

DIRECTION / ORIENTATION

PARALLEL SCANS CCW / CW
PERP. SCANS IN / OUT

WELD DESCRIPTION Outlet Nozzle to Safe End @ 180°

WELD NO. MRC-2/01

BEAM ANGLES

BEAM DIRECTION	70° L Dual	ET			
	EXAM VOLUME	EXAM VOLUME	EXAM VOLUME	EXAM VOLUME	EXAM VOLUME
CCW	100	100			
CW	100	100			
IN	100	100			
OUT	100	100			
UT COVERAGE = Combined Coverage (UT & ET) = 100% See exam volume EPP sheet 5 of 8	100%				

ANALYST [signature] III

Fort Calhoun Nuclear Power Plant

RPV NOZZLE COVERAGE ESTIMATE BREAKDOWNS

DIRECTION / ORIENTATION

PARALLEL SCANS CCW / CW

PERP. SCANS IN / OUT

WELD DESCRIPTION Outlet Nozzle Safe End to Pipe @ 180°

WELD NO. MRC-2/02

BEAM ANGLES

BEAM DIRECTION	70° L Dual	ET			
	EXAM VOLUME	EXAM VOLUME	EXAM VOLUME	EXAM VOLUME	EXAM VOLUME
CCW	88.48	100			
CW	88.48	100			
IN	100	100			
OUT	100	100			
UT COVERAGE = Combined Coverage (UT & ET) = 100% See exam volume EPP sheet 5 of 8	94.24%				

ANALYST [signature] III

2003 Weld Scanning Information[1]

[1] Proprietary information not pertinent to the request has been redacted.

Weld 22

NOZZLE-TO-SAFE END (OUTLET @ 0 DEGREES): Weld No. MRC-1/01

NO RECORDABLE INDICATIONS

Weld 28

NOZZLE-TO-SAFE END (OUTLET @ 180 DEGREES): Weld No. MRC-2/01
NO RECORDABLE INDICATIONS

FORT CALHOUN
EXAMINATION COVERAGE FOR WELD: W22, W28

OUTLET NOZZLE-TO-SAFE END

SCAN PLAN DWG NO.: 6025824E-02

AGGREGATE COVERAGE OBTAINED: 100%

FORT CALHOUN WELD NOS:	
W22	W28
MRC-1/01	MRC-2/01
B5.10	B5.10

Zone Coverage Obtained

Weld & Adjacent Base Metal: 100% Near (ID) Surface: 100%

Examination Volume Definition

Weld Length: 100.48 in.

Area Measurement		Volume Calculation	
Weld & Adjacent Base Metal	20.55 sq. in.	Weld & Adjacent Base Metal	2064.864 cu. in.
Near Surface	10.14 sq. in.	Near Surface	1018.867 cu. in.

Examination Coverage Calculations

Weld & Adjacent Base Metal

Entry #	Exam. Angle (deg.)	Beam Direction	Area Examined (sq. in.)	Length Examined (in.)	Volume Examined (cu. in.)	Volume Required (cu. in.)	Percent Examined
1	[ ]	7&8	20.55	100.5	2064.9	2064.9	100%
2		7&8	20.55	100.5	2064.9	2064.9	100%
3		3	20.55	100.5	2064.9	2064.9	100%
4		4	20.55	100.5	2064.9	2064.9	100%
				Totals:	*8259.5*	*8259.5*	*100%*

Near Surface (ID)

Entry #	Exam. Angle (deg.)	Beam Direction	Area Examined (sq. in.)	Length Examined (in.)	Volume Examined (cu. in.)	Volume Required (cu. in.)	Percent Examined
1	[ ]	axial	10.14	100.5	1018.9	1018.9	100%
2		circ	10.14	100.5	1018.9	1018.9	100%
				Totals:	*2037.7*	*2037.7*	*100%*

FRAMATOME ANP

FRAMATOME ANP
NONDESTRUCTIVE EXAMINATION PROCEDURE

ID Automated Ultrasonic Examination of Austenitic and Dissimilar Metal Piping Welds for Detection and Length Sizing

Procedure Number
54-ISI-821-00

Issue Date: September 12, 2003

Prepared by: K. J. Hacker 9/12/03 Level III

Approved by: M. G. Hacker 9/12/03 Level III

1. Scope

1.1 This procedure shall govern the automated contact ultrasonic examination of full penetration dissimilar metal piping welds and wrought, austenitic piping welds and adjacent base material from the inside surface. Profiling of the surface configuration to aid in determining examination limitations is also addressed in the procedure.

1.2 This procedure has been demonstrated in accordance with the requirements of the American Society of Mechanical Engineers (ASME) Code, Section XI, Appendix VIII, Supplements 2 and 10, 1995 Edition with Editions and Addenda through 2000, as modified the Performance Demonstration Initiative (PDI) program. This demonstration was also conducted in accordance with the requirements of the Federal Register, Part II, Nuclear Regulatory Commission, 10 CFR Part 50, Industry Codes and Standards; Amended Requirements; Final Rule, Dated 26 September, 2002.

1.3 This procedure is applicable to diameter and thickness ranges specified in Table A.

Table A			
Min. Diameter	**Max. Diameter**	**Min. Thickness**	**Max. Thickness**
Supplement 2 – Austenitic Piping Welds			
24.0"	None	2.24"	3.04"
Supplement 10 – Dissimilar Metal Piping Welds			
24.0"	None	1.80"	3.66"

1.4 The objective of the examinations performed in accordance with this procedure is to accurately detect and length size inside surface connected service induced discontinuities within the specified examination area.

1.5 Where accessible, examinations shall be performed from both sides of the weld with the beam directed perpendicular and parallel to the weld.

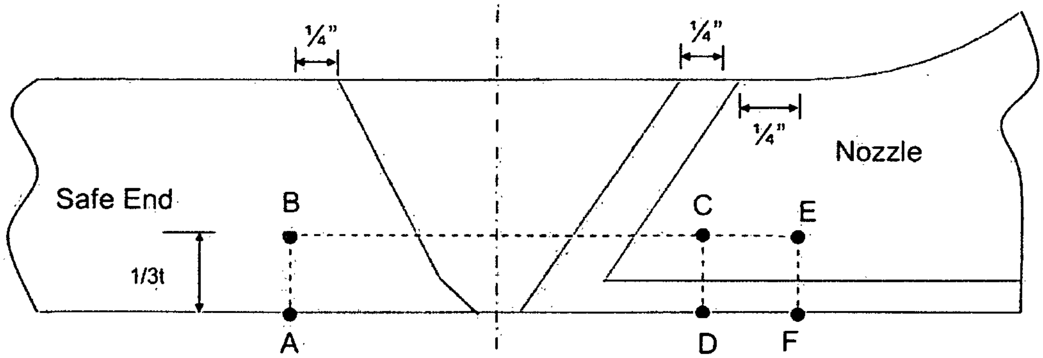
1.6 This procedure has been demonstrated by scanning the inside surface of both field and shop weld configurations containing inside surface counterbore, weld root, and smooth surface conditions. Limitations exist for weld configurations for the detection of axial flaws in welds that are not machined or ground smooth. This limitation applies both to field or shop weld configurations.

2. Surface Preparation

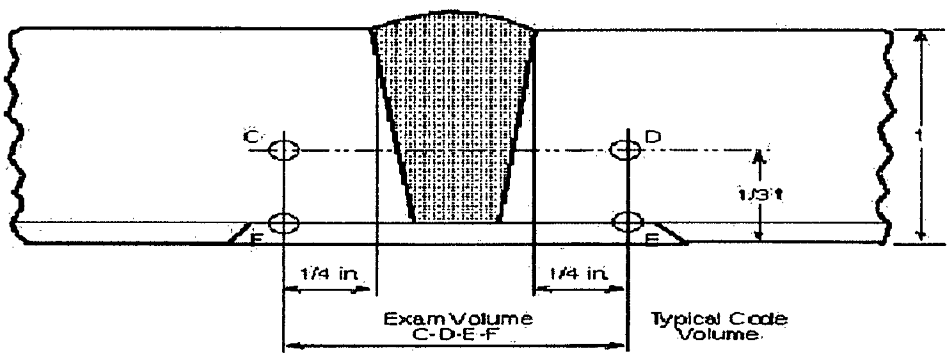
2.1 This procedure has been demonstrated using as-welded component configurations. However, if ultrasonic coverage of the required examination volume is limited due to surface conditions, the conditions shall be documented and reported to the owner for disposition.

Table E
UT System Parameters

System Parameter	Transducer		Comments
RF	No	No	
Threshold (RG)	5%	5%	This is the minimum amplitude that a peak must have to be recorded at *RUN* gain.
Gain Adjust	Dual	Dual	
Coincidence	1	1	This value establishes the number of sequential waveforms that will be compared point by point before feature extraction algorithms are applied.
Rect. Mode	FW	FW	
Threshold (CG)	0%	0%	This is the minimum gain normalized amplitude that a peak must have to be to be recorded.
Delay	0	0	This feature permits the insertion of a delay between subsequent pulses if it is determined that the pulse repetition rate is too high. The value is measured in ms. Normally; a value of 0 is used unless evidence of wrap-around is noted in the data. If wrap-around is noted, increase the delay value until the signal disappears.
PR Mode	Dual	Single	
Pulse Width	250	100	
Pulser Source	External		
Pulser Voltage	300		The pulser voltage for the surface profile scan may be adjusted lower to ensure that the surface response is not saturated.
Gain Boost	None		
Scan Speed	Maximum Speed 3" / sec.		The systems ability to keep up with recording UT data is a function of several variables and can be controlled by reducing the scan speed. The data analyst can determine during the analysis of the data file if the scan speed was to fast for the system to record the data of interest that are indicated as intermittent areas of no data along the scan line that is not contributed to coupling effects. If the analyst determines the data is unacceptable due to an excessive scan speed a rescan shall be performed at a slower scan speed.
Index Increment	0.05" axial	0.50" circ	Along the axis of the pipe.
Scan direction	Circumferential	Axial	
Index direction	Axial	Circ	
Sync. Interval	0.05"	0.02"	This is the interval at which data is collected along the scan line. The pulse repetition rate is a function of the speed at which the ACCUSONEX™ data acquisition system can be configured to take multi-channel data during automatic operation. The pulse repetition rate is set by the delay and length of the acquire window and the processing time for each A-scan. The pulse repetition rate is not available to the operator as an adjustable control on the system. For the circumferential directed probes, the sync. Interval shall be converted to degrees based on the largest diameter being scanned.
Active Channel	1, 2, 3, 4, 5, 6	7	Select the channels that are to be active during the scan.
Display Channel	5	7	Activates the channel to be displayed during acquisition.



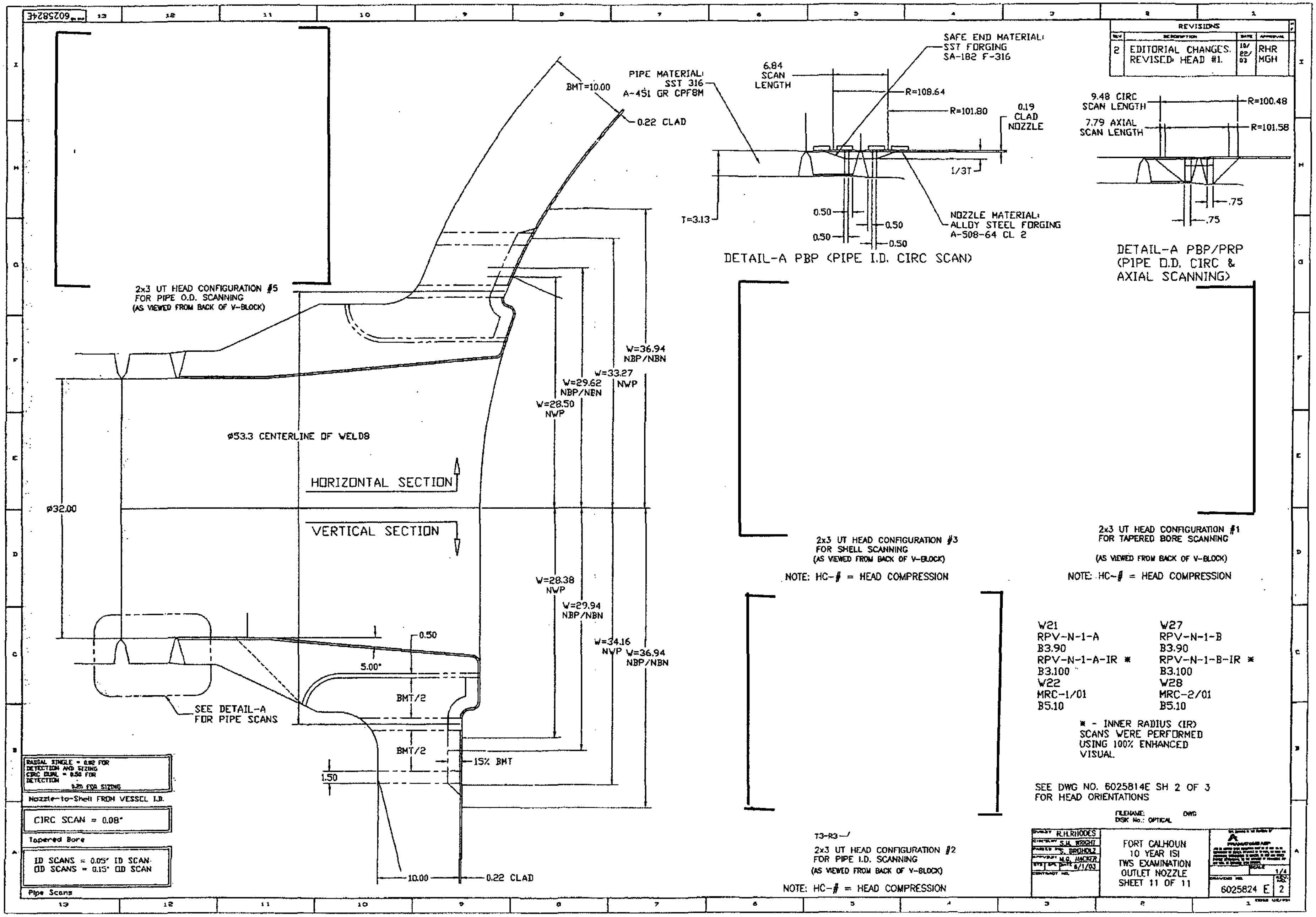
ASME Section XI Examination Volume for Dissimilar Metal Welds A-B-C-D
Additional Procedure Examination Volume Coverage A-B-E-F



ASME Section XI Examination Volume for Austenitic Piping Welds C-D-E-F

Figure 3 - Examination Volume

Figure 4
Typical Transducer Head Arrangement


REVISIONS
2 EDITORIAL CHANGES. REVISED HEAD #1. RHR MGH
PIPE MATERIAL: SST 316 A-451 GR CPF8M
BMT=10.00
0.22 CLAD
SAFE END MATERIAL: SST FORGING SA-182 F-316
6.84 SCAN LENGTH
R=108.64
R=101.80
0.19 CLAD NOZZLE
1/3T
T=3.13
0.50
NOZZLE MATERIAL: ALLOY STEEL FORGING A-508-64 CL 2
DETAIL-A PBP (PIPE I.D. CIRC SCAN)
9.48 CIRC SCAN LENGTH
R=100.48
7.79 AXIAL SCAN LENGTH
R=101.58
.75
DETAIL-A PBP/PRP (PIPE O.D. CIRC & AXIAL SCANNING)
2x3 UT HEAD CONFIGURATION #5 FOR PIPE O.D. SCANNING (AS VIEWED FROM BACK OF V-BLOCK)
W=36.94 NBP/NBN
W=33.27 NWP
W=29.62 NBP/NBN
W=28.50 NWP
ø53.3 CENTERLINE OF WELDS
HORIZONTAL SECTION
VERTICAL SECTION
ø32.00
W=28.38 NWP
W=29.94 NBP/NBN
W=34.16 NWP
W=36.94 NBP/NBN
0.50
5.00°
BMT/2
SEE DETAIL-A FOR PIPE SCANS
15% BMT
1.50
10.00
0.22 CLAD
2x3 UT HEAD CONFIGURATION #3 FOR SHELL SCANNING (AS VIEWED FROM BACK OF V-BLOCK)
NOTE: HC-# = HEAD COMPRESSION
2x3 UT HEAD CONFIGURATION #1 FOR TAPERED BORE SCANNING (AS VIEWED FROM BACK OF V-BLOCK)
NOTE: HC-# = HEAD COMPRESSION
W21 RPV-N-1-A B3.90 RPV-N-1-A-IR * B3.100 W22 MRC-1/01 B5.10
W27 RPV-N-1-B B3.90 RPV-N-1-B-IR * B3.100 W28 MRC-2/01 B5.10
* - INNER RADIUS (IR) SCANS WERE PERFORMED USING 100% ENHANCED VISUAL.
SEE DWG NO. 6025814E SH 2 OF 3 FOR HEAD ORIENTATIONS
RADIAL SINGLE = 0.92 FOR DETECTION AND SIZING CIRC DUAL = 0.50 FOR DETECTION 0.20 FOR SIZING
Nozzle-to-Shell FROM VESSEL I.D.
CIRC SCAN = 0.08"
Tapered Bore
ID SCANS = 0.05" ID SCAN OD SCANS = 0.15" OD SCAN
Pipe Scans
T3-R3
2x3 UT HEAD CONFIGURATION #2 FOR PIPE I.D. SCANNING (AS VIEWED FROM BACK OF V-BLOCK)
NOTE: HC-# = HEAD COMPRESSION
FILENAME: DWG DISK No.: OPTICAL
R.H.RHODES
S.H. WRIGHT
S. BRGHOLZ
M.G. HACKER
8/1/03
FORT CALHOUN 10 YEAR ISI TWS EXAMINATION OUTLET NOZZLE SHEET 11 OF 11
6025824 E 2
6025824E