FRAMATOME TECHNOLOGIES

OTSG IGA SIZING TECHNIQUE

APPENDIX H QUALIFICATION

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Framatome Technologies, Inc.
155 Mill Ridge Road
Lynchburg, VA 24502

PREPARED BY: J. C. Griffith DATE: 9/5/96

REVIEWED BY: J. C. Brown DATE: 9/5/96

APPROVED BY: W. M. Boudreaux DATE: 09/09/96

RECORD OF REVISION

Revision No.	Date	Description of Change
0	08/6/96	Original issue.
1	09/4/96	Added reference to EDDY TOOL Deleted reference to 0.540 probe Revised regression coefficients To eliminate Oconee data Revised RMSE value Added Regression Input Variable Tests Added Regression Test Data Added Regression Tool Testing Added Normalization Correction Testing Added Blind Test Result Added Probability of Detection Revised Regression Plot Revised Technique Sheet

PURPOSE:

The purpose of this document is to provide a brief description of a technique which can be used to size Intergranular Attack (IGA) indications in Once Through Steam Generators (OTSG's).

BACKGROUND:

There have been several attempts to qualify a sizing technique for IGA. The Appendix H document for IGA detection in 0.750" and 0.875" tubing contains a plot for bobbin coil estimated depth versus truth. This data in Figure 1 shows an Root Mean Square Error (RMSE) of 29 % and a correlation coefficient of 0.23. Crystal River also evaluated sizing for a different data set as shown in Figure 2 with an RMSE of 27 % and a correlation coefficient of 0.25. Both of these cases fall short of the 25 % RMSE sizing limit specified in Appendix H.

PROJECT APPROACH:

A project was defined to work on improving the RMSE of IGA sizing. The starting point for this work was the collection of data on all OTSG pulled tubes containing IGA defects with destructive examination (DE) results. The data was first reviewed to confirm the correlation of the eddy current (EC) indications with the correct DE location and result. Although some problems were identified, a high confidence correlation was established to link the EC calls with the correct DE flaws.

After establishing the correlation of non destructive examination (NDE) indications to DE results, the accuracy of the EC percent through wall (% TW) calls was reviewed. It was found that the original field calls, excluding signal to noise (S/N) calls, had a fair RMSE (22.6%) when used by themselves, but there were not enough of these calls (13) to establish a good statistical sample. The main problem with this situation is that the indications which were originally dispositioned as S/N now have to be sized. When conventional phase based eddy current sizing estimates are forced on the original S/N indications, the RMSE of the sizing becomes unacceptable.

REGRESSION CONCEPT:

The regression concept is based on the premise that multiple types of measurements taken on an indication will contain more information than just a single measurement. For example, if one can measure the peak to peak voltage and associated phase angles on three different frequencies, this additional data may allow a more accurate sizing. There is an obvious physical reasoning that different frequencies with different skin depths and fields of view should provide some information about defect depth. However, the actual relationship is very difficult to determine without regression techniques due to interaction of the measurements.

A multiple regression technique will mathematically calculate the relationships between multiple measurements (independent variables) and the actual defect depth by DE (dependant variable). Although it may be difficult to explain the relationship, it has become obvious that the use of two independent variables on the complete data set can produce a sizing estimate with an RMSE < 25 %. The use of a single input measurement cannot produce an RMSE below 25 %.

JUSTIFICATION FOR REGRESSION:

As discussed above, the use of two or more measurements has shown to provide enough additional information to provide a distinct improvement on both the RMSE and on the correlation coefficient.

The multiple frequency eddy current mix algorithm used for analysis of code examination data is based on a multiple parameter regression solution. In the case of a mix, the independent variables are the vertical and horizontal components of each frequency chosen for the mix. For a repression mix, the dependant variable is '0'. Ideally, we want to have the coefficients of the mix produce a '0' residual signal. The ideal solution is not practical, but the best fit solution is valuable. In the case of enhancing a signal, we seek the coefficients which will produce the output signal which is a copy of the signal to be enhanced.

Thus a multiple regression mix algorithm is routinely used to produce a signal which is measured and used to predict code examination depth estimates.

The IGA sizing effort uses the same type of mathematical solution for multiple input variables to obtain the best prediction of a known depth.

DATA REANALYSIS:

The original field data from the pulled tubes containing IGA defects was reanalyzed using a standard analysis guideline shown in Figure 3. Initially, there was no basis for selection of the measurements which should be used as input to the regression. Multiple measurements of phase angles, voltages and depth estimates were made using peak to peak, max rate and vert max measurement modes for each frequency available. The reanalysis was done consistently between pulled tubes to provide more accurate input data for the regression.

PULLED TUBE DATA:

Appendix A (8 pages) is a spreadsheet which lists the specific OTSG IGA pulled tube defects which have DE results along with the plant, date and original NDE result. Only the indications detected by bobbin coil ECT were reanalyzed. In several cases of the Crystal River data, it was necessary to separate some of the DE flaws which had been reported as a grouping into separate eddy current detections. The reanalysis of the data reported multiple indications within a grouping of DE flaws. A review of the data showed that the real DE positions corresponded well with the reanalysis call positions.

All of the available DE and reanalysis information for detected indications was combined into a single spreadsheet file to allow multiple parameter regression evaluation. A copy of this spreadsheet is contained in Appendix B (20 pages).

By performing a linear multiple regression on the data with the true depth as the dependant variable, coefficients are calculated for each independent input variable. Similar measurements on unknown defects are then combined with the calculated coefficients to provide a 'trained' estimate of the unknown depth.

QUALIFICATION PACKAGE:

This document describes the method which can be used to size IGA defects within 25 % RMSE.

The qualification package includes the raw eddy current data files, a tabulation of the flaws and their locations, the analysis guidelines, the analyzed data used for input to the regression, a description of the regression, and the regression testing. A cal group listing is in Appendix C.

The initial field implementation will be an EDDYNET95 EDDY TOOLS widget which measures the selected parameters and calculates the regression call using a single command button.

ACQUISITION:

The data acquisition would be the same as in the past, with differential data acquired on 200, 400 and 600 KHZ frequencies with a 510 HF probe. The calibration standard will have to contain the four 20 % FBH's for a normalization reference. The regression includes data acquired with a range of probe sizes from 0.500" to 0.510". The regression also includes data from medium frequency (MF) and high frequency (HF) probes.

ANALYSIS SETUP:

The analysis setup would be to set the 100 % TW hole to 40 degrees as normal. The voltage normalization can be consistent with current analysis guidelines as long as a correction factor is used for the regression analysis. When normalized, the normalization must be stored to other channels. Specifically, if the 600 khz is used to normalize, that normalization factor should be stored to the 400 and 200 khz differential channels.

Analysis must measure the response of the 20 % flat bottom hole (FBH) after normalization. The regression was based on this value being set to 4 V on the 400 Khz differential channel. If a different normalization is used, then all voltage measurements must be multiplied by a factor which will correct the 400 Khz differential peak to peak voltage on the four 20 % FBH's to 4 V. This correction factor must be applied before the voltages are entered in the regression calculations. For example, if the official normalization is set for 6 V on the 4 100% holes for 600 Khz diff, and the 20 % FBH measure at 5 volts on the 400 KHZ with this normalization, then all voltage readings (or coefficients) should be multiplied by 0.8 (4/5) before applying the regression formula.

ANALYSIS PARAMETERS:

Testing today has concentrated on evaluating regressions with a single measurement technique on the three channels of differential data (600, 400 and 200 khz). The max rate, peak to peak and vert max measurement modes were evaluated. There was no clear difference so the peak to peak mode was chosen for the best cases. Limiting the regression to a single measurement technique does degrade the performance of the regression slightly and we are continuing to review other formulas. Multiple measurements and the use of absolute data or motorized rotating pancake coil (MRPC) measurements should improve the accuracy. The current regression requires the following measurements which could be made by a single call on each of 3 frequencies:

200 KHZ	peak to peak phase	peak to peak voltage
400 KHZ	peak to peak phase	peak to peak voltage
600 KHZ	peak to peak phase	peak to peak voltage

REGRESSION VARIABLES:

A single phase angle or depth measure seems to work well above 60 % true depth and would be acceptable if such indications could remain in service. However, below that true depth, a combination of measurements is necessary to allow any degree of accuracy in the estimated depth. By taking a combination of these variables measured on a number of pulled tube defects, coefficients can be calculated which allow a better estimate of actual max depth.

The variables are designated as follows:

200 KHZ	peak to peak phase - D200PPP	peak to peak voltage - D200PPV
400 KHZ	peak to peak phase - D400PPP	peak to peak voltage - D400PPV
600 KHZ	peak to peak phase - D600PPP	peak to peak voltage - D600PPV

The three voltages must be multiplied by a correction factor of (4 / p-p voltage of four 20 % FBH @ 400 Khz) before continuing with the regression calculations.

Some modified values are calculated from these values to improve the regression model:

PPP200	=	SIN((D200PPP+50)*3.1416/180)
PPP400	=	SIN((D400PPP+50)*3.1416/180)
PPP600	=	SIN((D600PPP+50)*3.1416/180)

The above three variables convert the phase angle to a single valued function of depth.

PWR2	=	D200PPV ^ .25
PWR4	=	D400PPV ^ .25
PWR6	=	D600PPV ^ .25

The above three variables reduce the exponential response of voltage versus depth.

R24	=	PWR2 / PWR4
R46	=	PWR4 / PWR6
R26	=	PWR2 / PWR6

The above variables are ratios of voltage responses at different frequencies.

Figure 4 (2 pages) is a tabulation of the reanalysis measurements, the above parameters, the regression calculation and the RMSE calculation. Figure 5 shows a graphical comparison of the EC regression estimated depth versus the true DE value.

REGRESSION FORMULA:

The above variables are combined as follows to estimate the depth:

Estimated depth = 361.14

- 553.38	* PWR6
+924.72	* PWR4
- 391.12	* PWR2
- 513.00	* R46
+138.64	* R26
+ 32.67	* PPP400
+ 0.180	* D600PPP
+ 0.176	* D200PPP

REGRESSION PERFORMANCE:

The regression was trained on all available OTSG pulled tube DE and EC data points. Laboratory grown IGA, such as the Babcock and Wilcox Owner's Group (BWOG) tube integrity samples, was not used. Their EC voltage responses were very high compared to the pulled tube data, and significantly degraded the model response. Although the RMSE may have still been acceptable, it was found that the model performance was worse on the lower amplitude signals which are more characteristic of actual OTSG IGA data.

The RMSE is 8.5 and the correlation coefficient is 0.81 which indicates a good fit. Figure 4 is a tabulation of the regression data. Figure 5 is a plot of the regression results. The technique sheets are contained on pages 21 through 24.

TESTING OF DIFFERENT REGRESSION INPUT VARIABLES:

During development of the regression formula, several tests were performed using different input variables. Below is a discussion of these tests.

USE OF 600 KHZ DEPTH CALLS ONLY

The use of the 600 Khz depth calls only produces a reasonable accuracy for calls above 60 % TW true depth. This is the reason that the field analysis calls (without S/N and NQI calls) had a reasonable RMSE. However, for defects smaller than 60 % true depth, the depth calls based on a phase calibration curve range from 0 to 95 %.

If the actual 600 Khz depth calls are compared to the actual defect depths, the correlation coefficient is 0.05 for the tube pull data set. If the uninterpolated 600 Khz phase angles are compared to the actual defect depths, the correlation coefficient is 0.03. Both of these tests indicate that the 600 Khz phase angle provides a poor measure of real IGA depth for defects below 60 %.

ELIMINATION OF 200 KHZ INPUT FROM REGRESSION:

Several tests were conducted to determine if the 200 Khz input could be eliminated from the regression. The tests are tabulated below with the correlation coefficient, standard error (related to RMSE) and the number of significant input variables.

Input variable group	Correlation coefficient	Std. Error	Variables
All 600 and 400 Khz Measures	0.83	9.5	11
400 and 600 P-P only Depth, V and phase	0.77	10.6	9
400 and 600 P-P only V and phase	0.72	11.5	7
Current Regression 200,400,600 P-P V and phase	0.81	8.5	8
Current - 200 KHZ input	0.62	12.7	3

The above table shows that the 200 Khz information does add some intelligence to the regression sizing. It also shows that the current regression formula provides a good correlation with a reasonable number of input variables.

TESTING OF REGRESSION ON PARTIAL DATA SET:

Partial data sets were used to train the regression coefficients. Each partial set consisted of approximately 70 % of the pulled tube data points selected at random. The remaining data points served as a test for the regression formula. The table below lists the number of calculated points, maximum and minimum error as well as the RMSE for the test case.

Test Case	Number of Points	Max Error	Min Error	RMSE
1	12	+ 22	- 10	13.2
2	13	+ 28	- 21	12.6
3	15	+ 37	- 26	16.1
4	13	+ 30	- 25	14.1
5	19	+ 15	- 15	9.8
6	17	+ 27	- 8	8.8
7	13	+ 30	- 21	14.3

TESTING OF EDDYNET 95 REGRESSION TOOL:

Zetec has programmed an EDDY TOOL to automatically perform the regression sizing calculation. This tool was tested on a group of indications in tube 90-28. Since there could be some variation in the setting of the phase angle for the calibration setup, the phase angle was set using the P-P measurement which gave different results from the data used to train the regression. The result of the initial test of the regression tool are tabulated below:

Digitized Point Location	Original Regression Call	Eddynet Tool Call	DE depth
23643	50	54	49
23669	48	34	30
23705	52	51	62
23722	46	60	49
23749	35	33	53
23783	36	41	45
23814	42	49	45
23826	52	50	60
23862	47	41	46
23870	58	53	53
23963	61	62	50
24019	52	56	56

The data shows that the regression tool demonstrated reasonable agreement with the original regression call despite some differences in the initial calibration phase angle setting. The regression tool properly sized the depths within the required accuracy.

TESTING OF NORMALIZATION CORRECTION FACTOR:

The regression tool was developed to allow a different normalization setup to be adjusted for use with the regression. The regression development was based on setting the 4 - 20 % TW FBH to 4 volts on the 400 Khz channel. This was done since some of the older tube pull data did not have 4 - 100% TW holes for normalization. Current practice requires normalization references other than that used for the regression development.

The calibration setup was performed with a second set of 100 % TW holes set to 6 volts on the 600 KHZ channel. The 4 - 20 % FBH response was measured on 400 Khz to be 4.44 volts P - P. The correction factor of 4 / 4.44 = 0.9 was entered into the regression tool setup to correct for the different normalization method. The results of the test are shown in the table below:

Digitized Location	Original Volts 600 Khz	400 Khz	New Volts 600 Khz	400 Khz	Old Call	New Call
23643	0.99	0.70	1.09	0.77	54 %	54 %
23669	0.15	0.12	0.17	0.14	34 %	34 %

This test demonstrates the proper operation of the regression tool normalization correction.

BLIND TEST OF REGRESSION SIZING:

Due to an oversight, two DE locations in tube 109 - 30 were omitted from the regression development training and testing. The DE results were not included in charts with the other tube pull results and it was not obvious that the data had been omitted until the oversight was discovered during a subsequent review. It was decided that this tube would be a good candidate for a blind test of the regression tool since it has not been previously analyzed as part of the IGA sizing task.

Three measurements were performed on the two DE locations. The first measurement was performed with the original regression values which contained some training information from Oconee. The second analysis was done with the regression parameters developed without the Oconee data. The third test was performed by an analyst who had never used the regression tool and had no prior knowledge of the DE result. The results of this test are tabulated below:

Location	Analysis 1	Analysis 2	Blind Analysis	DE Depth
10.0-10.06	33	38	38	40
8.38-8.46	43	44	48	50

This test shows that the regression is capable of a reasonable predication in a blind test case.

PROBABILITY OF DETECTION:

As part of the supporting documentation for this project, the POD for IGA detection by bobbin coil in an OTSG was evaluated. The results of the POD evaluation are documented in FTI drawing 1260216 A. The POD for bobbin coil detection of IGA in an OTSG for a defect depth of 40 % TW or greater is 0.838 with a confidence level of 90 %.

CONCLUSION:

The method described is one technique which can size IGA indications in OTSG's. The regression equation was chosen to minimize the analysis time required to make the multiple calls. Alternative measurements could provide a more accurate depth estimate at the cost of increased analysis time. The single bobbin coil input was chose to minimize acquisition time. Preliminary testing has shown that additional MRPC length, width and amplitude information can provide substantial improvements to the accuracy of predicted depth.

This method should be used to size IGA defects during future OTSG inspections. The accuracy of this method should be tested with all future OTSG DE IGA flaws. This method should be refined as desired as future information becomes available.

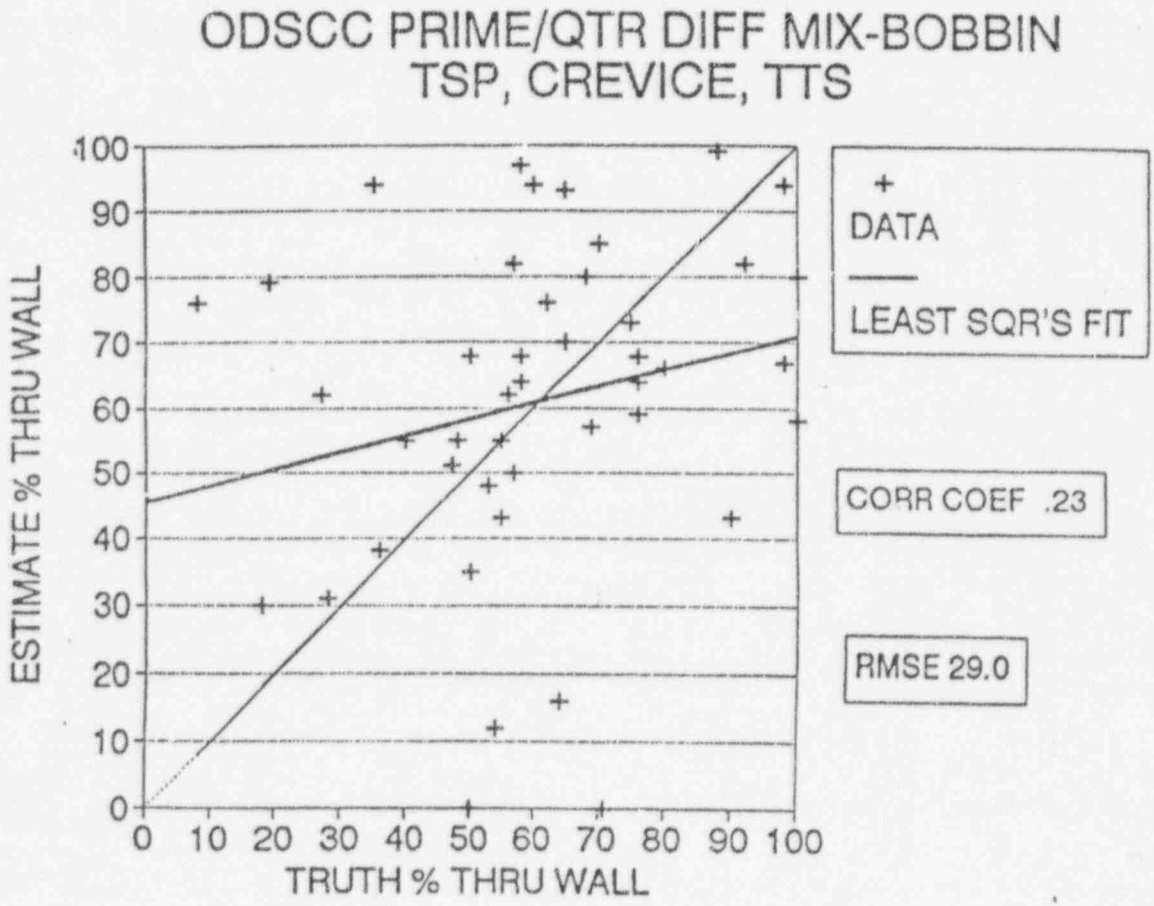

Figure 1 - 0.750 and 0.875 IGA Sizing Accuracy

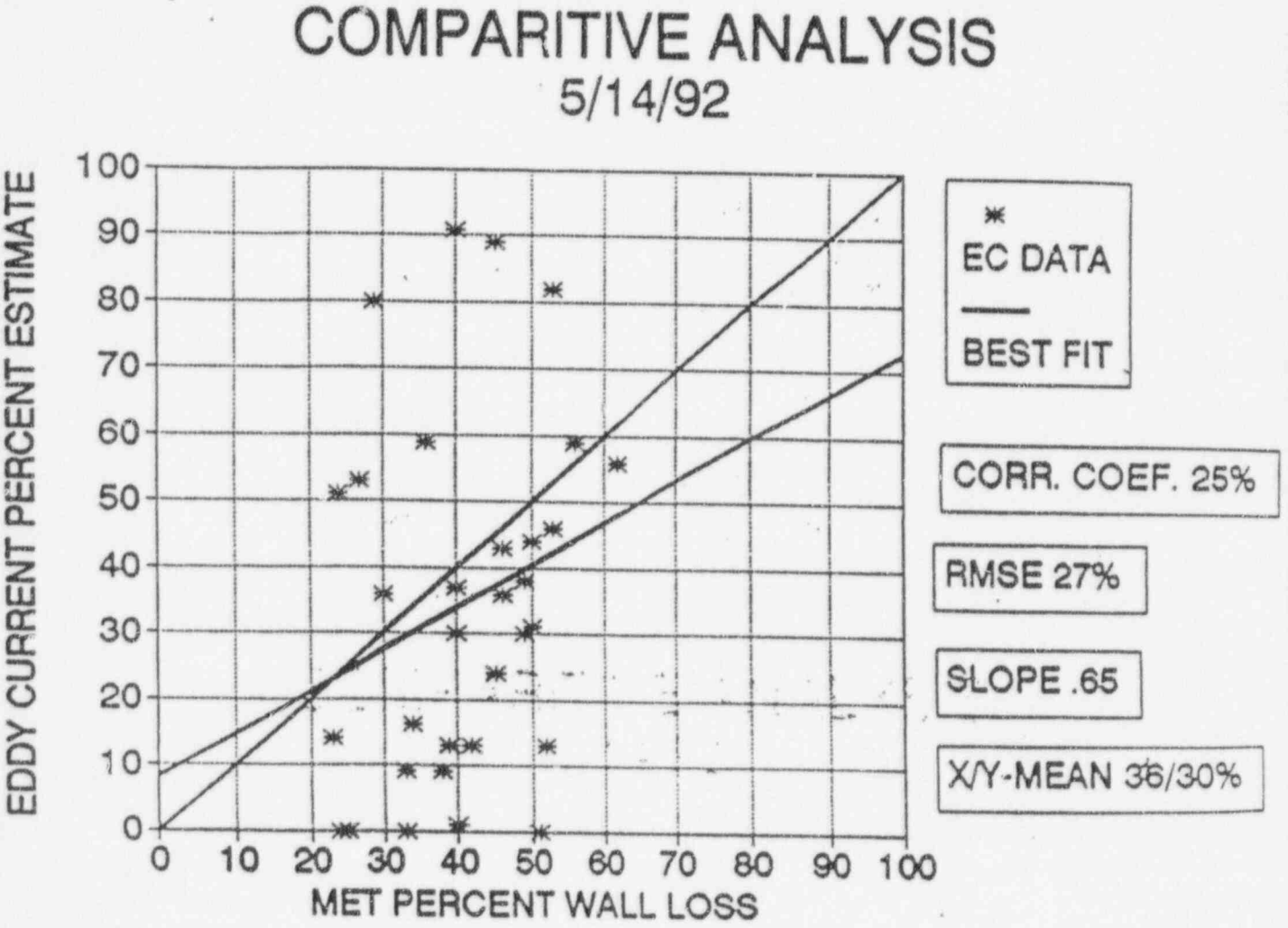

Figure 2 - Crystal River IGA Sizing Accuracy

IGA Reanalysis Guidelines

1) Setup 400/200 diff P1 TSP mix, and 600/200 diff P2 TSP mix.
2) Rotate <u>all</u> ch's, even 35 kHz, as follows: 1x100% @ 40 deg; use maxrate for diff ch's, use peaktopeak for abs ch's.
3) Normalize 4x20%'s @ 4.00 V on 400 kHz diff, save & store all ch's.
4) Do phase curves for <u>all</u> ch's; use maxrate for diff ch's, use peaktopeak for abs ch's.
5) On abs calls, catch the earliest base excursion.
6) TURN ON VERT MAX ANGLE IN CONFIG!
7) Save setup, analyze as primary (erase any previous calls).

Report

1) Make message calls describing:
   cal group,
   probe type and size,
   unit & outage,
   configuration. (list each CH, ex.: Ch1,600d; Ch2,600a; Ch3,400d; ...)
2) Call <u>IGA flaws</u> only:

V_{PP}
V_{MR} } x <u>all</u> channels & mixes
V_{VM}

   Always first call Vpp, then V_{MR}, then V_{VM}.
   Designate Vpp, Vmr, or Vvm in the extent field. so we know which is which.
   Ex. <u>one</u> flaw would have <u>30</u> calls if using a 4 freq setup, with diff and abs on each Ch.
3) Leave % TW's.
4) Open window wide on Vpp and Vvm. Close window down on Vmr.
5) Click call on each Ch (do not carry ball placement from other channel), where possible.

Figure 3 - Analysis Guideline for Regression Testing

PLAW	DE Depth	PLAW	DE Depth	D600PPV	D600PPP	D480PPV	D400PPP	D300PPV	D300PPP	PPP300	PPP400
2	100	2	100	1.05	50	2.06	62	1.11	64	0.91	0.93
3	100	3	100	1.06	76	2.14	81	1.13	69	0.87	0.75
4	100	4	100	1.18	72	2.71	78	1.63	77	0.80	0.79
5	70	5	70	0.29	105	0.59	103	0.29	88	0.67	0.47
6	100	6	100	8.49	54	11.8	54	7.38	52	0.98	0.97
7	20	7	20	0.20	35	0.68	92	0.43	83	0.73	0.62
11	33	11	33	8.49	160	8.31	133	8.21	80	0.77	-0.03
13	33	13	53	0.32	151	0.20	128	0.08	90	0.64	0.03
14	40	14	40	0.22	119	0.30	71	0.32	38	1.00	0.86
16	45	16	45	0.46	67	0.47	65	0.30	55	0.97	0.91
17	52	17	52	0.92	164	0.73	121	0.42	90	0.64	0.16
18	53	18	53	8.51	79	0.70	75	0.51	63	0.91	0.82
19	34	19	34	1.81	174	0.71	161	0.31	108	0.37	-0.52
22	49	22	49	0.99	177	0.72	161	0.27	146	-0.28	-0.51
23	30	23	30	0.13	131	0.18	78	0.18	78	0.79	0.79
25	62	25	62	0.45	104	0.64	88	0.38	65	0.91	0.67
26	49	26	49	1.14	135	1.05	114	0.60	82	0.34	0.28
27	53	27	53	0.30	21	0.32	43	0.30	37	0.96	1.00
29	45	29	45	0.54	142	0.46	119	0.26	79	0.78	0.19
30	45	30	45	0.97	156	0.60	116	0.23	72	0.85	0.24
31	60	31	60	0.32	126	0.48	75	0.32	62	0.93	0.82
33	46	33	46	0.41	123	0.35	100	0.16	96	0.69	0.50
34	33	34	33	0.96	144	0.90	101	0.47	83	0.73	0.48
35	50	35	50	1.54	128	1.53	108	0.80	79	0.78	0.37
36	36	36	36	0.90	113	0.56	86	0.62	70	0.87	0.69
37	34	37	34	0.72	116	0.76	91	0.48	66	0.90	0.63
38	48	38	48	0.98	27	0.89	35	0.55	58	0.95	1.00
40	46	40	46	0.65	119	0.60	95	0.35	64	0.91	0.57
41	36	41	36	0.88	91	0.99	73	0.61	59	0.95	0.84
43	29	43	29	0.23	72	0.22	63	0.14	55	0.97	0.91
50	22	50	22	0.31	121	0.38	96	0.29	62	0.93	0.56
51	36	51	36	0.69	19	0.33	32	0.29	68	0.99	0.99
53	39	53	39	0.36	37	0.39	39	0.21	43	1.00	1.00
54	31	54	31	0.36	136	0.46	115	0.26	74	0.83	0.26
56	46	56	46	0.64	166	0.64	103	0.31	88	0.67	0.45
57	42	[illegible]	42	0.47	137	0.48	109	0.30	90	0.64	0.34
58	36	[illegible]	36	0.20	52	0.21	60	0.14	38	1.00	1.00
60	40	[illegible]	40	0.53	153	0.52	126	0.29	88	0.67	0.07
61	38	61	38	0.43	162	0.37	134	0.30	101	0.48	-0.07
62	29	62	29	0.20	76	0.38	72	0.28	61	0.93	0.85
63	40	63	40	0.35	129	0.34	92	0.27	52	0.98	0.62
64	23	64	23	0.38	22	0.39	31	0.21	30	0.98	0.99
65	[illegible]	65	18	0.63	178	0.50	136	0.34	92	0.62	-0.10
66	[illegible]	66	51	0.89	177	0.59	163	0.10	36	1.00	-0.54
67	[illegible]	67	49	0.83	136	0.77	110	0.46	83	0.73	0.34
70	15	70	15	0.70	183	0.77	162	0.52	116	0.34	-0.53
71	31	71	31	0.92	192	0.95	163	0.71	112	0.31	-0.54
75	37	75	37	0.82	131	0.77	113	0.42	87	0.68	0.29
76	30	76	30	0.60	37	0.50	57	0.37	57	0.96	0.96
77	55	77	55	0.81	133	0.75	112	0.41	90	0.64	0.31
78	35	78	35	0.36	84	0.36	81	0.21	74	0.83	0.75
79	28	79	28	0.56	123	0.84	105	0.47	80	0.77	0.42
80	40	80	40	0.33	105	0.45	102	0.34	73	0.84	0.47

Regression Output:

Constant	Constant	361.12999						
Std Err of Y Est	Std Err of Y Est	9.17389572						
R Squared	R Squared	0.80801563						
No. of Observations	No. of Observations	53						
Degrees of Freedom	Degrees of Freedom	44						
X Coefficient(s)	X Coefficient(s)	-553.3304	924.7160	-391.1238	-313.0018	138.6390	12.6702	0.1799	0.1739
Std Err of Coef.	Std Err of Coef.	117.9595	341.7428	211.6368	211.2781	186.7715	7.8853	0.0606	0.1023

Figure 4 - Regression Tabular Result and RMSE

FLAW	DE Depth	D100PPP	PPP200	PPP400	PPP600	PWR2	PWR4	PWR6	R34	R46	R26	REGI	ERROR	ERR BQ
1	100	64	0.91	0.93	0.98	1.03	1.10	1.01	0.86	1.18	1.01	91.22	-6.68	75.34
3	100	69	0.87	0.75	0.81	1.03	1.21	1.02	0.85	1.19	1.01	94.22	-3.78	33.44
4	100	77	0.80	0.79	0.83	1.13	1.28	1.04	0.88	1.23	1.09	99.01	-0.98	0.96
5	70	88	0.67	0.47	0.42	0.73	0.88	0.73	0.84	1.19	1.00	54.13	-13.87	231.88
6	100	52	0.98	0.97	0.97	1.66	1.85	1.71	0.90	1.09	0.97	109.25	9.25	85.56
7	20	83	0.73	0.62	0.97	0.81	0.91	0.67	0.89	1.36	1.21	29.94	9.94	98.87
11	33	40	0.77	-0.03	-0.50	0.68	0.75	0.84	0.91	0.89	0.81	19.74	-13.26	175.87
13	33	90	0.64	0.03	-0.36	0.33	0.67	0.75	0.80	0.89	0.71	41.34	8.34	69.63
14	40	38	1.00	0.86	0.19	0.64	0.74	0.68	0.93	1.08	1.00	39.01	-0.99	0.97
16	43	53	0.97	0.91	0.89	0.74	0.83	0.82	0.89	1.01	0.90	41.75	-3.25	10.58
17	52	90	0.64	0.16	-0.56	0.61	0.91	0.98	0.87	0.94	0.82	39.28	-12.72	161.82
18	33	65	0.91	0.82	0.78	0.83	0.91	0.85	0.92	1.08	1.00	64.57	-8.43	71.01
19	34	108	0.37	-0.52	-0.69	0.75	0.92	1.06	0.81	0.92	0.74	30.29	-3.71	13.77
22	49	146	-0.28	-0.52	-0.73	0.72	0.92	1.00	0.78	0.92	0.72	46.15	-2.85	8.14
23	30	78	0.79	0.79	-0.02	0.65	0.65	0.60	1.00	1.98	1.98	33.33	3.33	11.19
25	62	65	0.91	0.67	0.44	0.79	0.89	0.82	0.88	1.09	0.96	52.58	-9.42	88.79
26	45	82	0.74	0.28	-0.09	0.88	1.01	1.03	0.87	0.98	0.85	64.39	-4.61	21.21
27	53	57	0.96	1.00	0.95	0.67	0.75	0.74	0.89	1.02	0.90	35.89	-17.11	292.89
29	43	79	0.78	0.19	-0.22	0.71	0.83	0.86	0.87	0.96	0.83	37.51	-7.49	56.08
30	45	72	0.83	0.24	-0.44	0.71	0.88	0.99	0.80	0.89	0.71	41.70	-3.30	10.89
31	60	62	0.93	0.82	0.97	0.75	0.83	0.75	0.90	1.11	1.00	51.69	-8.31	69.04
33	46	86	0.69	0.50	0.12	0.63	0.77	0.80	0.82	0.96	0.79	52.27	6.27	39.29
34	53	83	0.73	0.48	-0.24	0.83	0.97	0.99	0.85	0.98	0.84	57.72	4.72	22.30
35	50	79	0.78	0.37	0.03	0.95	1.11	1.11	0.85	1.00	0.85	57.91	7.91	62.60
36	56	70	0.87	0.69	0.29	0.89	0.99	0.97	0.89	1.02	0.91	52.73	-3.27	10.68
37	34	66	0.90	0.63	0.34	0.83	0.93	0.92	0.89	1.01	0.90	47.56	-6.44	41.51
38	48	58	0.93	1.00	0.97	0.86	0.97	0.99	0.89	0.98	0.87	38.69	-9.31	86.66
40	46	64	0.91	0.57	0.19	0.77	0.88	0.90	0.87	0.98	0.84	44.60	-1.40	1.97
41	54	59	0.95	0.84	0.63	0.88	1.00	0.97	0.89	1.03	0.91	54.22	0.22	0.05
43	29	55	0.97	0.91	0.85	0.61	0.68	0.69	0.89	0.99	0.88	39.33	10.33	106.71
50	22	63	0.93	0.56	0.16	0.73	0.79	0.75	0.93	1.05	0.98	34.72	12.72	161.88
51	36	48	0.99	0.99	0.93	0.73	0.85	0.91	0.86	0.94	0.81	34.34	-1.66	2.74
53	39	43	1.00	1.00	1.00	0.68	0.79	0.77	0.86	1.02	0.87	43.16	4.16	17.27
54	31	74	0.83	0.26	-0.44	0.71	0.82	0.87	0.87	0.95	0.83	40.27	9.27	86.02
56	46	88	0.67	0.43	-0.39	0.75	0.81	0.81	0.92	1.00	0.92	45.91	-0.09	0.01
57	43	90	0.64	0.36	-0.45	0.74	0.83	0.83	0.89	1.01	0.89	47.16	5.16	26.66
58	36	38	1.00	1.00	0.98	0.61	0.68	0.67	0.90	1.01	0.91	34.03	-1.97	3.88
60	40	88	0.67	0.07	-0.39	0.72	0.81	0.85	0.86	1.00	0.86	41.13	1.13	1.33
61	38	101	0.48	-0.07	-0.33	0.67	0.78	0.81	0.86	0.97	0.83	38.08	0.08	0.01
62	29	61	0.93	0.83	0.81	0.73	0.79	0.67	0.93	1.17	1.09	33.20	4.20	17.67
63	40	52	0.98	0.62	-0.16	0.72	0.76	0.77	0.94	0.99	0.94	34.57	-5.43	29.44
64	23	50	0.98	0.99	0.95	0.68	0.79	0.79	0.86	1.01	0.86	40.86	17.86	231.50
65	18	92	0.62	-0.10	-0.74	0.76	0.84	0.89	0.91	0.94	0.86	26.46	8.46	71.55
66	51	36	1.00	-0.54	-0.73	0.56	0.88	0.97	0.64	0.90	0.58	51.89	0.89	0.79
67	49	83	0.73	0.34	-0.10	0.82	0.94	0.95	0.88	0.98	0.86	43.45	-5.55	30.84
70	15	116	0.24	-0.53	-0.82	0.85	0.94	0.91	0.91	1.02	0.93	28.76	13.76	189.29
71	31	112	0.31	-0.54	-0.28	0.92	0.99	0.98	0.93	1.01	0.94	22.33	-8.67	75.21
75	37	87	0.68	0.29	-0.01	0.81	0.94	0.95	0.86	0.98	0.85	46.61	9.61	92.29
76	30	57	0.96	0.96	0.96	0.78	0.84	0.80	0.93	1.06	0.98	38.63	8.63	74.76
77	55	90	0.64	0.31	-0.05	0.80	0.93	0.95	0.86	0.98	0.84	47.29	-7.71	59.51
78	35	74	0.83	0.75	0.71	0.68	0.77	0.70	0.87	1.11	0.97	44.46	9.46	89.53
79	28	80	0.77	0.42	0.13	0.83	0.96	0.96	0.86	1.00	0.86	49.69	21.69	470.63
80	40	73	0.84	0.47	0.42	0.76	0.82	0.76	0.93	1.08	1.01	32.80	-7.20	51.77

Regression Output:

Constant			
Std Err of Y Est			
R Squared			
No. of Observations			
Degrees of Freedom			
X Coefficient(s)	32.6702	0.1799	0.1759
Std Err of Coef.	7.8853	0.0606	0.1023

SUM	3784.33
COUNT	53.00
AVG_BQ	71.40
RMSE	8.45
Max	21.69
Min	-17.11
Avg	0.00
Std	8.45

Figure 4 (cont.) - Regression Tabular Result and RMSE

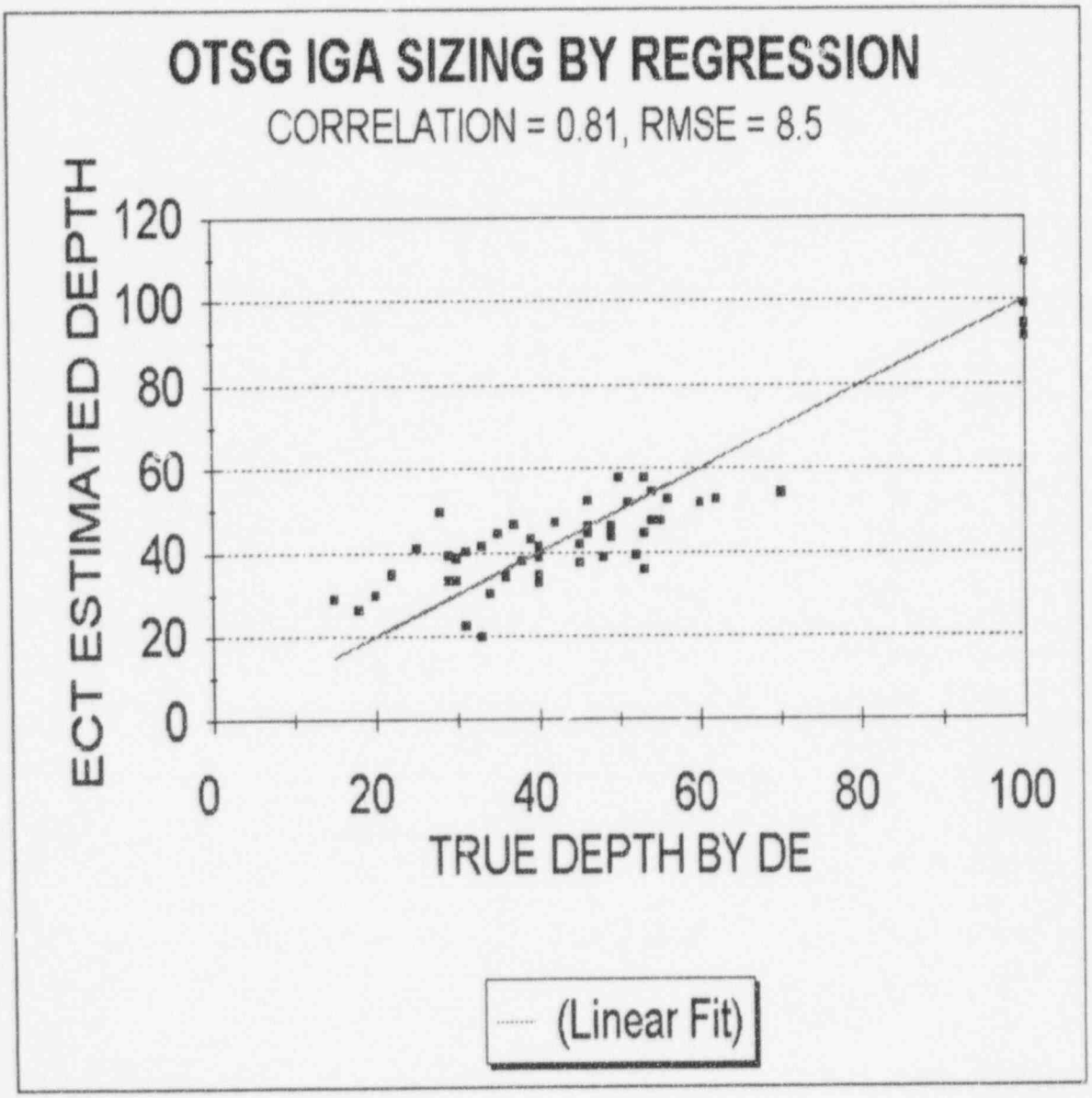

Figure 5 - Plot of Sizing Technique vs Depth by DE

FRAMATOME TECHNOLOGIES

Examination Technique Specification Sheet			
ETSS # Bobbin_otsg_iga_qual		Page 1 of 4	
TUBING			
Material: Inconel 600		OD: 0.625"	Wall: 0.037"
Test Application: This technique applies to detection and sizing of volumetric intergranular attack (IGA) found in freespan, mid support and tubesheet crevice areas of OTSG tubing. The technique is not qualified for detection or sizing of indications influenced by deposits, dents or support structure edges or where a mix is required for detection.			
ACQUISITION TECHNIQUE			
Bobbin Probe ___X___ Rotating Probe _____ Other _____			
DATA ACQUISITION			
Instrument		**Probe**	
Manufacturer: Zetec		Manufacturer: Zetec	
Model: Miz 18a, MIZ 30		Diameter: Fill factor =>82	
Acquisition System Software		Part Number: A-***-(M)/ULC HF	
Manufacturer: Zetec		Probe Cable Length: 100'	
Description or Title: EDDYNET EDDYNET95		**Analog Probe Extension**	
		Manufacturer: Zetec	
Version/Revision: Revision 2 or equiv.		Length: 50'	
Frequencies/Coil Excitation Modes			
Differential Mode		Absolute Mode	
Channels/Frequencies/Gain/Volt		**Channels/Frequencies**	
1 600 / 1 / 11 Khz	5 200 / 1 / 11 Khz	1_____Khz	5_____Khz
2_____Khz	6_____Khz	2_____Khz	6_____Khz
3 400 / 1 / 11 Khz	7_____Khz	3_____Khz	7_____Khz
4_____Khz	8_____Khz	4_____Khz	8_____Khz
Data Recording Equipment			
Manufacturer: any		Model: digital	

FRAMATOME TECHNOLOGIES

Examination Technique Specification Sheet

ETSS # Bobbin_otsg_iga_qual — Page 2 of 4

Digitizing Rate, Scan Direction & Scan Pattern

Bobbin Probe	Rotating Probe
Digitizing Rate Min (DR):30 sam/inch	Digitizing Rate Min (DR)
Sample Rate Min (SR) 400	Sample Rate Min (SR)
Probe Speed (PS) 12"/sec to 57"/sec	Withdrawal Speed Max (WS)
Scan Direction axial	Rotation Speed Max (RPM)
* Note: Digitizing rate applies in the axial direction. SR min = DR min x PS max	* Note: Digitizing rate applies in both the axial and circumferential directions; for the circumferential direction, SR = DR min x (1/RPM) x (1/tube diameter) x 19.09

DATA ANALYSIS

Instrument	Analysis System Software
Manufacturer: HP	Manufacturer: Zetec
Model: 300/400/700 Series	Description or Title: EDDYNET
	Revision: Revision 3 or equiv.

Analysis Channels

Single Frequency	Channels 1, 3, 5	Channel	Channel
Span Setting	100% @ 50 % fsh		
Phase Rotation	100% @ 40 deg using max rate		
Calibration Std.	ASME		
Calibration Curve	Phase 20,60,100%		
Volts	4 V @ 400KHz on 4 * 20 % FBH (or equivalent conversion)		

FRAMATOME TECHNOLOGIES

Examination Technique Specification Sheet

ETSS # Bobbin_otsg_iga_qual | Page 3 of 4

Analysis Channels (Cont'd)

Process Channels	Channel Diff/Abs	Channel Diff Abs	Channel Diff/Abs
Span Setting			
Phase Rotation			
Calibration Std.			
Calibration Curve			
Volts			
Mixing Frequencies			
Filtering			

Analysis Guidelines:

This technique applies only to the detection and sizing of volumetric intergranular attack (IGA) found in freespan, mid support and tubesheet crevice areas of OTSG tubing. The technique is not qualified for detection or sizing of indications influenced by deposits, dents or support structure edges or where a mix is required for detection.

Detection of indications is based on analysis screening of 400 kHz lissajous data on a span setting equal to or lower than the setup on page 2. Detected indications should be reviewed on the 600 and 200 kHz data for proper OD flaw like characteristics. If the indication exhibits OD flaw like response, and the indication can be classified as a volumetric IGA then the lissajous window should be adjusted for proper signal measurement. Press the regression tool button in EDDYNET and verify the proper `ball placement' on the lissajous signals. If necessary, the signals may be measured individually for each channel. Once the call is correct, press the `Report Regression' key to record the call.

The three channels of peak to peak measurements are used as inputs to the formula defined on the attached page.

Technique Performance

Detection Probability at 40 % TW (90% CL)	RMSE Sizing Error, % through-wall
0.82	8.45 , % TW

FRAMATOME TECHNOLOGIES

Examination Technique Specification Sheet

ETSS # Bobbin otsg iga qual

Analysis Guidelines:

The variables are designated as follows:

200 KHZ peak to peak phase	D200PPP	peak to peak voltage	D200PPV
400 KHZ peak to peak phase	D400PPP	peak to peak voltage	D400PPV
600 KHZ peak to peak phase	D600PPP	peak to peak voltage	D600PPV

These voltages must be multiplied by a correction factor of (4 / peak to peak voltage of four 20 % FBH measured at 400 Khz).

Some modified values are calculated from these values to improve the regression model:

PPP200 = SIN((D200PPP+50)*3.1416/180)
PPP400 = SIN((D400PPP+50)*3.1416/180)
PPP600 = SIN((D600PPP+50)*3.1416/180)

These convert the phase angle to a single valued function of depth.

PWR2 = D200PPV ^ .25
PWR4 = D400PPV ^ .25
PWR6 = D600PPV ^ .25

These reduce the exponential response of voltage versus depth.

R24 = PWR2 / PWR4
R46 = PWR4 / PWR6
R26 = PWR2 / PWR6

These variables are ratios of voltage responses at different frequencies.

REGRESSION FORMULA:

The above variables are combined as follows to estimate the depth:

Estimated depth = 361.14
- 553.38 * PWR6
+924.72 * PWR4
- 391.12 * PWR2
- 513.00 * R46
+138.64 * R26
+ 32.67 * PPP400
+ 0.180 * D600PPP
+ 0.176 * D200PPP

APPENDIX A

List of all Pulled Tube OTSG IGA Defects

ANO Pulled Tube list	1 page
CR-3 Pulled Tube list	7 pages

ANO ONE PULLED TUBE IGA RESULTS

Flaw Identification						DE Results		Field (Pre-pull) ECT Depth Call and Tape No.							Lab (Post-pull) ECT Depth Call		
								500 Bobbin			510 Bobbin		540 Bobbin				
Flaw Label	Plant S/G	Date Pulled	Row-Tube	Section	Location	Max Depth	Ave Depth	Call %TW	EPRI %TW	Tape No.	Call %TW	Tape No.	Call %TW	Tape No.	500	510	540
1	ANO-1A	07/78	77-17	Piece 1, area b	UTSF + 0.63	100	-	75	-	1A	-	-	-	-	70	-	-
2	ANO-1B	11/82	73- 8	Piece 2, area 1	UTSF + 5.50	100	-	84	84	194	-	-	-	-	92	-	-
3	ANO-1B	11/82	73- 8	Piece 2, area 2	UTSF + 5.00	100	-	84	63	194	-	-	-	-	88	-	-
4	ANO-1B	11/82	73- 8	Piece 2, area 3	UTSF + 4.60	100	-	60	60	194	-	-	-	-	83	-	-
5	ANO-1B	11/82	73- 8	Piece 2, area 4&5	UTSF + 3.50	70	-	36	36	194	-	-	-	-	NQI	-	-
6	ANO-1B	11/82	73- 8	Piece 2, area 6	UTSF + 0.50	100	-	84	84	194	-	-	-	-	100	-	-
7	ANO-1B	11/82	112-19	Piece 4, area 1	15TH - 2.25	20	-	63	63	?	-	-	-	-	NDD	-	-
8	ANO-1A	03/84	77-34	?	UTSF	100	-	ODI	C3	?	-	-	-	-	?	-	-

- Not applicable
? Not researched or not found
UTSM Upper Tubesheet Secondary face by More than 1/4 inch
UTSF Upper Tubesheet Secondary Face, within +/- 1/4 inch
LTSM Lower Tubesheet Secondary face by More than 1/4 inch
LTSF Lower Tubesheet Secondary Face, within +/- 1/4 inch

References:

1) 51-1143771-00, Assessment of ANO-1 OTSG Conditon for Arkansas Power and Light Company, 06-23-83.
(Data for flaws 2 through 7).

2) RDD:84:5303-04:02, Exmanination of OTSG Tubes B73-8 and B112-19 from ANO-1, 06-10-83.
(Data for flaws 2 through 7).

3) Performance Demonstration Database, Chapter 7, Pulled Tube Database, June, 1994.
(EPRI %TW for flaws 2 through 8; DE data for flaws 2,7; their report stating that there was no field call for flaw 3 is inaccurate, and their reanalysis is dismissed.)

4) Tuban database reports.
(Superceding source for Field Call %TW for flaws 1 through 8.)

5) 1190991A-2, OTSG Pulled Tube Catalog, 06/02/95.
(Data here for ANO flaws conflicts with ref 1, 2 and 4. This source considered inaccurate and is not used for the ANO flaws.)

6) 51-1141742-00, ANO-1 OTSG Tube Preliminary Assessment for Arkansas Power and Light Company, 03-25-83.
(Source not used. Duplicates ref 1 and 2. Listed here to note that Field calls for flaws 3 and 4 were reversed in the Detailed Summary, but correct in the Appendix Table.)

7) LR:78:6206-01:4, Final Report on Tube 77-17 From Arkansas Nuclear One, 07-24-78.
(DE and lab data for flaw 1.)

Regression Data for Flaws 1 through 7.
X axis: Field 500 Bobbin Call
Y axis: DE Max Depth

Regression Output (Y-Intercept computed):	
Constant	29.302
Std Err of Y Est	29.563
R Squared	0.216
No. of Observations	7
Degrees of Freedom	5
X Coefficient(s)	0.792
Std Err of Coef.	0.675

Regression Output (Y-Intercept set at 0) :	
Constant	0
Std Err of Y Est	27.967
R Squared	0.158
No. of Observations	7
Degrees of Freedom	6
X Coefficient(s)	1.191
Std Err of Coef.	0.148

SUMXMY2 is	5998
div by 7 is	856.857
RSME is	29.272

See Graph ANO-1.1

Regression Data for Flaws 1 through 6.
X axis: Field 500 Bobbin Call
Y axis: DE Max Depth

Regression Output (Y-Intercept computed):	
Constant	55.928
Std Err of Y Est	6.641
R Squared	0.765
No. of Observations	6
Degrees of Freedom	4
X Coefficient(s)	0.554
Std Err of Coef.	0.154

Regression Output (Y-Intercept set at 0) :	
Constant	0
Std Err of Y Est	16.015
R Squared	-0.710
No. of Observations	6
Degrees of Freedom	5
X Coefficient(s)	1.301
Std Err of Coef.	0.090

SUMXMY2 is	4149
div by 6 is	691.500
RSME is	26.296

See Graph ANO-1.2

Notes:
1) DE Max depths for flaw 5 areas were 70 %TW for area 4 and 60 %TW for area 5.
2) A 1978 ANO EC call sheet reports flaw 1 as 70 %TW. Reference 7 reports the flaw 1 field EC call as 80 %TW. A 1982 ANO EC history reports the flaw 1 field EC call as 75 %TW. Tuban records the flaw 1 field EC call as 75 %TW, the accepted value.

CR-3 PULLED TUBE IGA RESULTS

Flaw Identification							DE Results		Field (Pre-pull) ECT Depth Call and Tape No.										
									Tuban 510HF Bobbin 600KHz					Tuban 520 RPC 200KHz pancake					
Flaw Label	Plant S/G	Date Pulled	Row-Tube	Section	Table 3-1 Flaw ID	Table 3-1 Loc LTSF+"	Table 2-9 Max Depth	Table 3-1 Ave Depth	Call %TW	Loc LTSF+"	Phase	Volts	Tape No.	Call %TW	Loc LTSF+(I/II)	Phase(I)	Volts(I)	Phase(II)	Volts(II)	Tape (I/II)
9	CR-3B	06/92	52-51	2	X	16.5"	32	32	NDD	-	-	-	8	-	- / -	-	-	-	-	120/126
10	CR-3B	06/92	52-51	2	U	15.3"	26	26	NDD	-	-	-	8	-	- / -	-	-	-	-	120/126
11	CR-3B	06/92	52-51	2	S	14.7"	33	33	NDD	-	-	-	8	-	- / -	-	-	-	-	120/126
12	CR-3B	06/92	52-51	2	R	14.1"	18	18	NDD	-	-	-	8	-	- / -	-	-	-	-	120/126
13	CR-3B	06/92	52-51	2	P	13.1"	33	33	NDD	-	-	-	8	-	- / -	-	-	-	-	120/126
14	CR-3B	06/92	52-51	2	N1,N2	12.4"	40	30	NDD	-	-	-	8	-	- / -	-	-	-	-	120/126
15	CR-3B	06/92	52-51	2	L	11.4"	13	13	NDD	-	-	-	8	-	- / -	-	-	-	-	120/126
16	CR-3B	06/92	52-51	2	K1,K2	11.0"	45	45	S/N	10.12"	75	0.47	8	S/N	10.00"/10.57"	142	0.14	70	0.90	120/126
17	CR-3B	06/92	52-51	2	I1,I2	10.0"	52	42	S/N	9.22"	149	0.95	8	S/N	9.25"/9.75"	52	0.12	30	1.61	120/126
18	CR-3B	06/92	52-51	2	F,G	8.9"	53	47	S/N	8.03"	78	0.52	8	S/N	8.01"/8.47"	57	0.24	45	2.42	120/126
19	CR-3B	06/92	52-51	2	D	6.5"	34	34	S/N	5.79"	148	0.98	8	S/N	5.90"/6.22"	108	0.17	108	1.83	120/126
20	CR-3B	06/92	52-51	2	B	-1.0"	38	38	LCB	0.00"	-	-	8	NDD	0.00"/0.00"	-	-	-	-	120/126
21	CR-3B	06/92	90-28	2	AF	17.2"	51	51	NDD	-	-	-	52	-	- / -	-	-	-	-	120/126
22	CR-3B	06/92	90-28	2	AD1,AD2	16.1"	49	37	NDD	-	-	-	52	-	- / -	-	-	-	-	120/126
23	CR-3B	06/92	90-28	2	AB	15.5"	30	30	NDD	-	-	-	52	-	- / -	-	-	-	-	120/126
24	CR-3B	06/92	90-28	2	Z	15.1"	30	30	NDD	-	-	-	52	-	- / -	-	-	-	-	120/126
25	CR-3B	06/92	90-28	2	X1,X2	14.6"	62	43	NDD	-	-	-	52	-	- / -	-	-	-	-	120/126
26	CR-3B	06/92	90-28	2	V1,V2	14.0"	49	48	NDD	-	-	-	52	-	- / -	-	-	-	-	120/126
27	CR-3B	06/92	90-28	2	T1,T2	13.2"	53	50	NDD	-	-	-	52	-	- / -	-	-	-	-	120/126
28	CR-3B	06/92	90-28	2	S1,S2	12.9"	28	28	NDD	-	-	-	52	-	- / -	-	-	-	-	120/126
29	CR-3B	06/92	90-28	2	Q	12.3"	45	45	NDD	-	-	-	52	-	- / -	-	-	-	-	120/126
30	CR-3B	06/92	90-28	2	O	11.8"	45	43	NDD	-	-	-	52	-	- / -	-	-	-	-	120/126
31	CR-3B	06/92	90-28	2	M,N	11.5"	60	43	NDD	-	-	-	52	-	- / -	-	-	-	-	120/126
32	CR-3B	06/92	90-28	2	K	10.8"	18	18	NDD	-	-	-	52	-	- / -	-	-	-	-	120/126
33	CR-3B	06/92	90-28	2	H,I	10.3"	46	49	NDD	-	-	-	52	-	- / -	-	-	-	-	120/126
34	CR-3B	06/92	90-28	2	G	10.0"	53	49	S/N	10.35"	119	1.07	52	S/N	9.12"/10.15"	57	0.31	54	2.70	120/126
35	CR-3B	06/92	90-28	2	E	7.8"	50	50	46	7.88"	121	1.73	52	S/N	7.95"/7.79"	22	0.23	15	3.93	120/126
36	CR-3B	06/92	90-28	2	B,C	6.1"	56	41	S/N	6.38"	107	1.00	52	S/N	6.21"/6.33"	12	0.41	85	2.09	120/126
37	CR-3B	06/92	97-91	2	W	14.1"	54	54	62	14.28"	106	0.71	86	S/N	14.84"	57	0.36	57	0.36	127
38	CR-3B	06/92	97-91	2	S,T,U	11.5"	48	46	NDD	-	-	-	86	S/N	12.15"	43	0.21	43	0.21	127
39	CR-3B	06/92	97-91	2	R1	9.3"	4	4	NDD	-	-	-	86	NDD	-	-	-	-	-	127
40	CR-3B	06/92	97-91	2	P	8.4"	46	50	S/N	8.56"	110	0.65	86	S/N	8.95"	72	0.17	72	0.17	127
41	CR-3B	06/92	97-91	2	O	8.0"	54	50	76	8.28"	90	0.88	86	S/N	8.66"	82	0.35	82	0.35	127
42	CR-3B	06/92	97-91	2	M	7.1"	16	16	NDD	-	-	-	86	NDD	-	-	-	-	-	127
43	CR-3B	06/92	97-91	2	K	6.6"	29	29	NDD	-	-	-	86	NDD	-	-	-	-	-	127
44	CR-3B	06/92	97-91	2	I	5.6"	4	4	NDD	-	-	-	86	NDD	-	-	-	-	-	127
45	CR-3B	06/92	97-91	2	G	3.3"	5	5	NDD	-	-	-	86	NDD	-	-	-	-	-	127
46	CR-3B	06/92	97-91	2	D,E1,E2	2.8"	8	6	NDD	-	-	-	86	NDD	-	-	-	-	-	127
47	CR-3B	06/92	97-91	2	b	1.1"	6	6	NDD	-	-	-	86	NDD	-	-	-	-	-	127

CR-3 PULLED TUBE IGA RESULTS

Flaw Identification							DE Results		Lab (Post-pull) ECT Depth Call									
					Table 3-1	Table 3-1	Table 2-9	Table 3-1	Lab 510HF Bobbin 600KHz					Tuban 520 RPC 200KHz pancake				
Flaw Label	Plant S/G	Date Pulled	Row-Tube	Section	Flaw ID	Loc LTSF+"	Max Depth	Ave Depth	Call %TW	BTM+"	Loc LTSF+"	Phase	Volts	Call %TW	BTM+"	Loc LTSF+"	Phase	Volts
9	CR-3B	06/92	52-51	2	X	16.5"	32	32	NDD	-	-	-	-	NDD	-	-	-	-
10	CR-3B	06/92	52-51	2	U	15.3"	26	26	NDD	-	-	-	-	NDD	-	-	-	-
11	CR-3B	06/92	52-51	2	S	14.7"	33	33	S/N	16.97	14.37	107	0.35	NDD	-	-	-	-
12	CR-3B	06/92	52-51	2	R	14.1"	18	18	NDD	-	-	-	-	NDD	-	-	-	-
13	CR-3B	06/92	52-51	2	P	13.1"	33	33	NDD	-	-	-	-	NDD	-	-	-	-
14	CR-3B	06/92	52-51	2	N1,N2	12.4"	40	30	NDD	-	-	-	-	NDD	-	-	-	-
15	CR-3B	06/92	52-51	2	L	11.4"	13	13	NDD	-	-	-	-	NDD	-	-	-	-
16	CR-3B	06/92	52-51	2	K1,K2	11.0"	45	45	NDD	-	-	-	-	S/N	13.00	10.40	125	0.35
17	CR-3B	06/92	52-51	2	I1,I2	10.0"	52	42	S/N	12.21	9.61	130	1.02	NDD	-	-	-	-
18	CR-3B	06/92	52-51	2	F,G	8.9"	53	47	S/N	10.91	8.31	87	0.79	S/N	10.68	8.08	64	1.13
19	CR-3B	06/92	52-51	2	D	6.5"	34	34	S/N	8.64	6.04	154	0.97	S/N	8.14	5.54	103	0.88
20	CR-3B	06/92	52-51	2	B	-1.0"	38	38	NDD	-	-	-	-	NDD	-	-	-	-
21	CR-3B	06/92	90-28	2	AF	17.2"	51	51	NDD	-	-	-	-	NDD	-	-	-	-
22	CR-3B	06/92	90-28	2	AD1,AD2	16.1"	49	37	S/N	23.66	16.16	164	1.08	S/N	23.27	15.77	45	0.76
23	CR-3B	06/92	90-28	2	AB	15.5"	30	30	NDD	-	-	-	-	NDD	-	-	-	-
24	CR-3B	06/92	90-28	2	Z	15.1"	30	30	NDD	-	-	-	-	NDD	-	-	-	-
25	CR-3B	06/92	90-28	2	X1,X2	14.6"	62	43	S/N	21.92	14.42	91	0.65	S/N	21.28	13.78	52	0.58
26	CR-3B	06/92	90-28	2	V1,V2	14.0"	49	48	S/N	21.39	13.89	130	1.12	NDD	-	-	-	-
27	CR-3B	06/92	90-28	2	T1,T2	13.2"	53	50	NDD	-	-	-	-	NDD	-	-	-	-
28	CR-3B	06/92	90-28	2	S1,S2	12.9"	28	26	NDD	-	-	-	-	NDD	-	-	-	-
29	CR-3B	06/92	90-28	2	Q	12.3"	45	45	S/N	19.72	12.22	143	0.66	NDD	-	-	-	-
30	CR-3B	06/92	90-28	2	O	11.8"	45	43	S/N	18.99	11.49	132	1.07	NDD	-	-	-	-
31	CR-3B	06/92	90-28	2	M,N	11.5"	60	43	S/N	18.61	11.11	116	0.46	S/N	18.54	11.04	76	1.47
32	CR-3B	06/92	90-28	2	K	10.8"	18	18	NDD	-	-	-	-	NDD	-	-	-	-
33	CR-3B	06/92	90-28	2	H,I	10.3"	46	49	S/N	17.65	10.15	100	0.48	NDD	-	-	-	-
34	CR-3B	06/92	90-28	2	G	10.0"	53	49	S/N	17.21	9.71	126	1.06	S/N	17.25	9.75	70	0.71
35	CR-3B	06/92	90-28	2	E	7.8"	50	50	36	14.78	7.28	122	1.66	S/N	14.89	7.39	86	0.92
36	CR-3B	06/92	90-28	2	B,C	6.1"	56	41	S/N	13.32	5.82	99	0.91	S/N	13.22	5.72	91	0.96
37	CR-3B	06/92	97-91	2	W	14.1"	54	54	52	21.89	14.39	103	0.93	S/N	21.88	14.38	71	1.41
38	CR-3B	06/92	97-91	2	a,T,U	11.5"	48	46	62	19.19	11.69	91	0.64	S/N	19.17	11.67	69	1.74
39	CR-3B	06/92	97-91	2	R1	9.3"	4	4	NDD	-	-	-	-	NDD	-	-	-	-
40	CR-3B	06/92	97-91	2	P	8.4"	46	50	S/N	15.82	8.32	124	0.79	S/N	15.82	8.32	117	1.09
41	CR-3B	06/92	97-91	2	O	8.0"	54	50	44	15.54	8.04	113	0.75	S/N	15.51	8.01	114	1.00
42	CR-3B	06/92	97-91	2	M	7.1"	16	16	NDD	-	-	-	-	NDD	-	-	-	-
43	CR-3B	06/92	97-91	2	K	6.6"	29	29	NDD	-	-	-	-	NDD	-	-	-	-
44	CR-3B	06/92	97-91	2	I	5.6"	4	4	NDD	-	-	-	-	NDD	-	-	-	-
45	CR-3B	06/92	97-91	2	G	3.3"	5	5	NDD	-	-	-	-	NDD	-	-	-	-
46	CR-3B	06/92	97-91	2	D,E1,E2	2.8"	8	6	NDD	-	-	-	-	NDD	-	-	-	-
47	CR-3B	06/92	97-91	2	b	1.1"	6	6	NDD	-	-	-	-	NDD	-	-	-	-

Flaw Identification							DE Results		Field (Pre-pull) ECT Depth Call and Tape No.											
									Tuban 510HF Bobbin 600KHz					Tuban 520 RPC 200KHz pancake						
Flaw Label	Plant S/G	Date Pulled	Row-Tube	Section	Table 3-1 Flaw ID	Table 3-1 Loc LTSF+"	Table 2-9 Max Depth	Table 3-1 Ave Depth	Call %TW	Loc LTSF+"	Phase	Volts	Tape No.	Call %TW	Loc LTSF+(I/II)	Phase(I)	Volts(I)	Phase(II)	Volts(II)	Tape (I/II)
48	CR-3B	06/92	105-32	2	BF,BG	16.6"	17	15	NDD	-	-	-	5	NDD	- / -	-	-	-	-	121/127
49	CR-3B	06/92	106-32	2	BC,BD	15.6"	31	31	NDD	-	-	-	5	NDD	- / -	-	-	-	-	121/127
50	CR-3B	06/92	106-32	2	AZ,BA,BB	14.9"	22	20	NDD	-	-	-	5	NDD	- / -	-	-	-	-	121/127
51	CR-3B	06/92	106-32	2	AY	14.6"	36	36	S/N	14.34"	110	0.30	5	NDD	- / -	-	-	-	-	121/127
52	CR-3B	06/92	106-32	2	AX	14.3"	32	32	NDD	-	-	-	5	NDD	- / -	-	-	-	-	121/127
53	CR-3B	06/92	108-32	2	AU,AV	13.5"	39	34	NDD	-	-	-	5	NDD	- / -	-	-	-	-	121/127
54	CR-3B	06/92	106-32	2	AT	13.2"	31	31	S/N	12.82"	162	0.57	5	S/N	12.12"/13.41"	41	0.12	76	0.13	121/127
55	CR-3B	06/92	106-32	2	AR	12.3"	19	19	NDD	-	-	-	5	NDD	- / -	-	-	-	-	121/127
56	CR-3B	06/92	106-32	2	AQ1,AQ2	11.7"	46	35	S/N	11.24"	131	0.34	5	S/N	10.78"/11.88"	45	0.13	61	0.14	121/127
57	CR-3B	06/92	106-32	2	AO,AP	11.2"	42	27	S/N	10.91"	147	0.48	5	NDD	- / -	-	-	-	-	121/127
58	CR-3B	06/92	106-32	2	AM123,AN	10.8"	36	27	NDD	-	-	-	5	NDD	- / -	-	-	-	-	121/127
59	CR-3B	06/92	106-32	2	AL1,AL2	10.5"	16	11	NDD	-	-	-	5	NDD	- / -	-	-	-	-	121/127
60	CR-3B	06/92	106-32	2	AK	10.0"	40	39	S/N	9.48"	156	0.55	5	S/N	9.09"/10.13"	87	0.20	93	0.27	121/127
61	CR-3B	06/92	106-32	2	AJ	9.7"	38	39	NDD	-	-	-	5	NDD	- /9.81"	-	-	80	0.12	121/127
62	CR-3B	06/92	106-32	2	AH	8.9"	29	35	NDD	-	-	-	5	NDD	- / -	-	-	-	-	121/127
63	CR-3B	06/92	106-32	2	AG1,AG2	8.7"	40	35	S/N	8.22"	138	0.34	5	S/N	8.17"/8.85"	101	0.25	8	0.19	121/127
64	CR-3B	06/92	106-32	2	AC2,AD,AE	7.7"	25	24	NDD	-	-	-	5	NDD	- / -	-	-	-	-	121/127
65	CR-3B	06/92	106-32	2	AB,AC1	7.4"	18	18	NDD	-	-	-	5	NDD	- / -	-	-	-	-	121/127
66	CR-3B	06/92	106-32	2	Z,AA	7.0"	51	34	NDD	-	-	-	5	NDD	- / -	-	-	-	-	121/127
67	CR-3B	06/92	106-32	2	X1,X2,Y	6.4"	49	28	S/N	5.76"	135	0.84	5	S/N	5.77"/6.35"	101	0.32	92	0.37	121/127
68	CR-3B	06/92	106-32	2	V2	5.3"	14	14	NDD	-	-	-	5	NDD	- / -	-	-	-	-	121/127
69	CR-3B	06/92	106-32	2	q	-0.6"	7	7	NDD	-	-	-	5	-	- / -	-	-	-	-	121/127
70	CR-3B	06/92	106-32	2	N	-1.8"	15	15	NDD	-	-	-	5	-	- / -	-	-	-	-	121/127
71	CR-3B	06/92	105-32	2	H,I,J,K,l	-2.3"	31	14	NDD	-	-	-	5	-	- / -	-	-	-	-	121/127
72	CR-3B	06/92	106-32	2	F	-3.4"	9	9	NDD	-	-	-	5	-	- / -	-	-	-	-	121/127
73	CR-3B	06/92	106-32	2	E	-3.9"	23	23	NDD	-	-	-	5	-	- / -	-	-	-	-	121/127
74	CR-3B	06/92	106-32	2	c	-5.4"	7	7	NDD	-	-	-	5	-	- / -	-	-	-	-	121/127
75	CR-3B	06/92	41-44	2B11	-	15.5	37	32	NDD	-	-	-	7	NDD	-	-	-	-	-	126
76	CR-3B	06/92	41-44	2B10	-	13.6	30	30	NDD	-	-	-	7	S/N	13.37"	72	1.61	-	-	126
77	CR-3B	06/92	41-44	2B8	-	11.5	55	55	S/N	12.06	117	0.88	7	S/N	11.89"	29	2.59	-	-	126
78	CR-3B	06/92	41-44	2B6	-	8.8	35	33	NDD	-	-	-	7	NDD	-	-	-	-	-	126
79	CR-3B	06/92	41-44	2B4	-	7.5	28	19	NDD	-	-	-	7	S/N	7.20"	125	2.06	-	-	126
80	CR-3B	06/92	41-44	2B2	-	5.0	40	40	S/N	6.66"	118	0.89	7	S/N	4.99"	115	1.44	-	-	126
81	CR-3B	04/94	68-46	3	-	-0.6	75	68	LCB	-	-	-	59	-	-	-	-	-	-	-
82	CR-3B	04/94	72-49	2	-	0.0	19	19	LCB	-	-	-	2	-	-	-	-	-	-	-

CR-3 PULLED TUBE IGA RESULTS

Flaw Identification							DE Results		Lab (Post-pull) ECT Depth Call									
					Table 3-1	Table 3-1	Table 2-9	Table 3-1	Lab 510HF Bobbin 600KHz					Tuban 520 RPC 200KHz pancake				
Flaw Label	Plant S/G	Date Pulled	Row-Tube	Section	Flaw ID	Loc LTSF+"	Max Depth	Ave Depth	Call %TW	BTM+"	Loc LTSF+"	Phase	Volts	Call %TW	BTM+"	Loc LTSF+"	Phase	Volts
48	CR-3B	06/92	106-32	2	BF,BG	16.6"	17	15	-	-	-	-	-	-	-	-	-	-
49	CR-3B	06/92	106-32	2	BC,BD	15.6"	31	31	-	-	-	-	-	-	-	-	-	-
50	CR-3B	06/92	106-32	2	AZ,BA,BB	14.9"	22	20	-	-	-	-	-	-	-	-	-	-
51	CR-3B	06/92	106-32	2	AY	14.6"	36	36	-	-	-	-	-	-	-	-	-	-
52	CR-3B	06/92	106-32	2	AX	14.3"	32	32	-	-	-	-	-	-	-	-	-	-
53	CR-3B	06/92	106-32	2	AU,AV	13.5"	39	34	-	-	-	-	-	-	-	-	-	-
54	CR-3B	06/92	106-32	2	AT	13.2"	31	34	-	-	-	-	-	-	-	-	-	-
55	CR-3B	06/92	106-32	2	AR	12.3"	19	19	-	-	-	-	-	-	-	-	-	-
56	CR-3B	06/92	106-32	2	AQ1,AQ2	11.7"	46	35	-	-	-	-	-	-	-	-	-	-
57	CR-3B	06/92	106-32	2	AO,AP	11.2"	42	27	-	-	-	-	-	-	-	-	-	-
58	CR-3B	06/92	106-32	2	AM123,AN	10.8"	36	27	-	-	-	-	-	-	-	-	-	-
59	CR-3B	06/92	106-32	2	AL1,AL2	10.5"	16	11	-	-	-	-	-	-	-	-	-	-
60	CR-3B	06/92	106-32	2	AK	10.0"	40	39	-	-	-	-	-	-	-	-	-	-
61	CR-3B	06/92	106-32	2	AJ	9.7"	38	39	-	-	-	-	-	-	-	-	-	-
62	CR-3B	06/92	106-32	2	AH	8.9"	29	35	-	-	-	-	-	-	-	-	-	-
63	CR-3B	06/92	106-32	2	AG1,AG2	8.7"	40	35	-	-	-	-	-	-	-	-	-	-
64	CR-3B	06/92	106-32	2	AC2,AD,AE	7.7"	25	24	-	-	-	-	-	-	-	-	-	-
65	CR-3B	06/92	106-32	2	AB,AC1	7.4"	18	18	-	-	-	-	-	-	-	-	-	-
66	CR-3B	06/92	106-32	2	Z,AA	7.0"	51	34	-	-	-	-	-	-	-	-	-	-
67	CR-3B	06/92	106-32	2	X1,X2,Y	6.4"	49	28	-	-	-	-	-	-	-	-	-	-
68	CR-3B	06/92	106-32	2	V2	5.3"	14	14	-	-	-	-	-	-	-	-	-	-
69	CR-3B	06/92	106-32	2	q	-0.6"	7	7	-	-	-	-	-	-	-	-	-	-
70	CR-3B	06/92	106-32	2	N	-1.8"	15	15	-	-	-	-	-	-	-	-	-	-
71	CR-3B	06/92	106-32	2	H,I,J,K,I	-2.3"	31	14	-	-	-	-	-	-	-	-	-	-
72	CR-3B	06/92	106-32	2	F	-3.4"	9	9	-	-	-	-	-	-	-	-	-	-
73	CR-3B	06/92	106-32	2	E	-3.9"	23	23	-	-	-	-	-	-	-	-	-	-
74	CR-3B	06/92	106-32	2	c	-5.4"	7	7	-	-	-	-	-	-	-	-	-	-
75	CR-3B	06/92	41-44	2B11	-	15.5	37	32	?	?	?	?	?	?	?	?	?	?
76	CR-3B	06/92	41-44	2B10	-	13.6	30	30	?	?	?	?	?	?	?	?	?	?
77	CR-3B	06/92	41-44	2B8	-	11.5	55	55	?	?	?	?	?	?	?	?	?	?
78	CR-3B	06/92	41-44	2B6	-	8.8	35	33	?	?	?	?	?	?	?	?	?	?
79	CR-3B	06/92	41-44	2B4	-	7.5	28	19	?	?	?	?	?	?	?	?	?	?
80	CR-3B	06/92	41-44	2B2	-	5.0	40	40	?	?	?	?	?	?	?	?	?	?
81	CR-3B	04/94	68-46	3	-	-0.6	75	68	?	?	?	?	?	?	?	?	?	?
82	CR-3B	04/94	72-49	2	-	0.0	19	19	?	?	?	?	?	?	?	?	?	?

CR-3 PULLED TUBE IGA RESULTS

-	Not applicable
?	Not researched or not found
UTSM	Upper Tubesheet Secondary face by More than 1/4 inch
UTSF	Upper Tubesheet Secondary Face, within +/- 1/4 inch
LTSM	Lower Tubesheet Secondary face by More than 1/4 inch
LTSF	Lower Tubesheet Secondary Face, within +/- 1/4 inch
S/N	Signal to Noise less than 5 (Ref 12, p.B-1).
Flaw ID's	UPPERCASE ARE IGA; lowercase are pits.

References:

4) Tuban database reports.
(Superceding source for all flaws' Field Bobbin and RPC: Call %TW, Loc LTSF+", and Tape No. For flaws 75-82: Field Bobbin and RPC: Phase, and Volts.)

12) TR-103756, Examination of Crystal River Unit 3 Steam Generator Tube Sections, April 1994.
(For flaws 9-74: Table 2-9 used for Max Depth, Table 3-1 used for Flaw Identification, Ave Depth, Field and Lab 510 Bobbin calls.)

13) 1217887A-0, Eddy Current Examination of Pulled Steam Generator Tubes, Crystal River Unit 3, 9/8/92.
(For flaws 9-74: Field Bobbin and RPC: Phase, and Volts; and all Lab ECT data.)

14) TR-106483, Analysis of Steam Generator Tubing from Crystal River Unit 3, Draft of Final Report, April 1996.
(For flaws 75-82: Tables 5-2 and 4-1 used for Flaw Identification, and Max and Ave depths. Text on p. 4-5 was used for depths of flaw 81 in tube 68-46.)

15) 1237899A-0, Eddy Current Tube Pull Examination for Florida Power Corporation, Crystal River Unit 3, 6/30/94.
(For flaws 75-82: Not used yet.)

Notes:

1) Some flaw ID's were grouped as one flaw, as in Table 3-1 of Ref 12. Some of these grouped flaws in Table 3-1 were split and listed as separate flaws to match separate EC calls. These split flaws keep their combined average depth.
2) Flaw 30 and 31 (O and M,N) was split from the single entry in Table 3-1, using Reference 12, Figure 2-37 on p 2-67, to better correlate EC calls.
3) Flaw 33 and 34 (H,I and G) was split from the single entry in Table 3-1, using Reference 12, Figure 2-37 on p 2-67, to better correlate EC calls.
4) Flaw 40 and 41 (P and O) was split from the single entry in Table 3-1, using Reference 12, Figure 2-37 on p 2-67, to better correlate EC calls.
5) Flaw 53 and 54 (AU,AV and AT) was split from the single entry in Table 3-1, using Reference 12, Figure 2-37 on p 2-67, to better correlate reanalysis EC calls.
6) Flaw 60 and 61 (AK and AJ) was split from the single entry in Table 3-1, using Reference 12, Figure 2-37 on p 2-67, to better correlate reanalysis EC calls.
7) Flaw 62 and 63 (AH and AG1,AG2) was split from the single entry in Table 3-1, using Reference 12, Figure 2-37 on p 2-67, to better correlate reanalysis EC calls.
8) Flaws 37, 38, 40, and 41 have only one pair of Field RPC entries (Phase and Volts), but they are repeated in each Tape's columns (Phase I & II, Volts I & II).
9) Flaw 38's Lab RPC call at 19.17" corresponds to flaw U (48 %TW). The call at 19.27" (68deg, 0.51V), which corresponds to flaw T (44 %TW), is omitted from the table.

CR-3 PULLED TUBE IGA RESULTS

Regression Data for Flaws 35,37,41
X axis: Field 510HF Bobbin Call
Y axis: DE Max Depth

46	50	-4
62	54	8
76	54	22

@SUMSQ(above) is	564
div by 3 is	188
RSME is	13.71

Regression Output (Y-Intercept computed):

Constant	44.320
Std Err of Y Est	1.523
R Squared	0.783
No. of Observations	3
Degrees of Freedom	1
X Coefficient(s)	0.136
Std Err of Coef.	0.072

Regression Output (Y-Intercept set at 0) :

Constant	0
Std Err of Y Est	10.691
R Squared	-20.431
No. of Observations	3
Degrees of Freedom	2
X Coefficient(s)	0.831
Std Err of Coef.	0.099

See Graph CR-3.1

Regression Data for Flaws 35,37,38,41
X axis: Lab 510HF Bobbin Call
Y axis: DE Max Depth

36	50	-14
52	54	-2
62	48	14
44	54	-10

@SUMSQ(above) is	496
div by 4 is	124
RSME is	11.14

Regression Output (Y-Intercept computed):

Constant	55.553
Std Err of Y Est	3.494
R Squared	0.096
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	-0.084
Std Err of Coef.	0.181

Regression Output (Y-Intercept set at 0) :

Constant	0
Std Err of Y Est	12.815
R Squared	-17.248
No. of Observations	4
Degrees of Freedom	3
X Coefficient(s)	1.018
Std Err of Coef.	0.130

See Graph CR-3.2

FRAMATOME TECHNOLOGIES

APPENDIX C

OTSG PULLED TUBE CAL GROUPS

Cal Group	Plant	Tubes	Probe Type
tape001A.cal00	ANO-1	77-17	0.500 MF
tape34B.cal01	ANO-1	77-54	0.500 MF
tape34Bcal01a	ANO-1	112-19, 73-08	0.500 MF
tape34Bcal02	CR-3	106-32	0.510 HF
tape34Bcal03	CR-3	52-51	0.510 HF
tape34Bcal04	CR-3	90-28	0.510 HF
tape34Bcal05	CR-3	97-91	0.510 HF
tape007A.cal01	CR-3	41-44	0.510 HF
SGB3HCAL00018	CR-3	68-46, 72-49	0.510 HF
SGB3HCAL00057	CR-3	68-46, 72-49	0.540 HF
SGB_HCAL00101	ONS	All	0.510 MF
SGB_HCAL00104	ONS	All	0.540 MF

APPENDIX B

Page	Reanalysis Data
1-2	600 Khz Diff
3-4	600 Khz Abs
5-6	400 Khz Diff
7-8	400 Khz Abs
9-10	200 Khz Diff
11-12	200 Khz Abs
13-14	35 Khz Diff
15-16	35 Khz Abs
17-18	400/200 Khz Diff Mix
19-20	600/200 Khz Diff Mix

ROW	TUBE	DATA POINT	flaw	Maximum Depth	600 KHz Diff									
						VPP			MXR			VMX		
					LOC	Volts	deg	%TW	Volts	deg	%TW	Volts	deg	%TW
77	17	+29343	1	100	-	-	-	-	-	-	-	-	-	-
73	8	+20366	2	100	UTS+5.77	1.05	50	93	1.05	46	96	0.82	56	88
73	8	+20353	3	100	UTS+5.39	1.08	76	73	1.08	75	74	1.05	76	73
73	8	+20339	4	100	UTS+4.87	1.18	72	76	1.18	72	76	1.12	72	76
73	8	+20300	5	70	UTS+3.58	0.29	105	51	0.29	107	49	0.28	105	51
73	8	+20216	6	100	UTS+0.83	8.49	54	90	8.49	52	91	6.87	54	90
112	19	+18540	7	20	015 -1.44	0.20	55	89	0.20	76	73	0.17	55	89
77	34	+ 2830	8	100	-	-	-	-	-	-	-	-	-	-
52	51	+ 22745	11	33	+ 14.34	0.49	160	0	0.49	150	9	0.18	156	0
52	51	+ 22802	13	33	+ 12.77	0.32	151	7	0.32	151	7	0.16	151	7
52	51	+ 22831	14	40	+ 11.96	0.22	119	52	0.22	119	52	0.19	119	52
52	51	+ 22880	16	45	+ 10.55	0.46	67	89	0.46	74	85	0.42	67	89
52	51	+ 22911	17	52	+ 9.68	0.92	164	0	0.92	149	11	0.40	152	5
52	51	+ 22955	18	53	+ 8.45	0.51	79	83	0.51	77	84	0.50	79	83
52	51	+ 23034	19	34	+ 6.20	1.01	174	0	1.01	147	15	0.41	151	7
90	28	+ 23643	22	49	+ 16.43	0.99	177	0	0.99	171	0	0.23	164	0
90	28	+ 23669	23	30	+ 15.68	0.13	131	35	0.13	131	35	0.10	131	35
90	28	+ 23705	25	62	+ 14.77	0.45	104	64	0.45	116	53	0.43	104	64
90	28	+ 23722	26	49	+ 14.29	1.14	135	30	1.14	129	38	0.84	130	37
90	28	+ 23749	27	53	+ 13.57	0.30	21	53	0.30	41	100	0.17	43	99
90	28	+ 23783	29	45	+ 12.68	0.54	143	17	0.54	153	0	0.32	143	17
90	28	+ 23814	30	45	+ 11.85	0.97	156	0	1.32	136	28	0.47	152	0
90	28	+ 23826	31	60	+ 11.51	0.32	126	42	0.32	113	56	0.32	97	70
90	28	+ 23862	33	46	+ 10.57	0.41	123	45	0.41	93	73	0.34	123	45
90	28	+ 23870	34	53	+ 10.33	0.96	144	15	0.96	121	48	0.74	125	43
90	28	+ 23963	35	50	+ 7.87	1.54	128	39	1.54	122	47	1.23	123	45
90	28	+ 24019	36	56	+ 6.37	0.90	113	56	0.90	108	61	0.85	108	61
97	91	+ 23049	37	54	+ 14.67	0.72	116	54	0.72	107	64	0.67	112	59
97	91	+ 23137	38	48	+ 12.17	0.98	27	68	0.98	350	100	0.58	53	96
97	91	+ 23251	40	46	+ 8.98	0.65	119	50	0.65	111	60	0.57	119	50

ROW	TUBE	DATA POINT	flaw	Maximum Depth	600 KHz Diff LOC	VPP Volts	VPP deg	VPP %TW	MXR Volts	MXR deg	MXR %TW	VMX Volts	VMX deg	VMX %TW
97	91	+ 23260	41	54	+ 8.72	0.88	91	77	0.88	90	78	0.88	91	77
97	91	+ 23315	43	29	+ 7.18	0.23	72	88	0.23	75	87	0.22	72	88
106	32	+22128	50	22	+ 14.80	0.31	121	50	0.31	108	62	0.27	121	50
106	32	+22138	51	36	+ 14.51	0.69	19	48	0.69	13	33	0.34	49	96
106	32	+22171	53	39	+ 13.53	0.36	37	93	0.36	30	75	0.22	42	99
106	32	+22180	54	31	+ 13.30	0.56	156	1	0.61	165	0	0.35	136	33
106	32	+22234	56	46	+ 11.74	0.44	166	0	0.44	131	39	0.23	138	30
106	32	+22246	57	42	+ 11.39	0.47	157	0	0.47	150	12	0.27	136	33
106	32	+22261	58	36	+ 10.93	0.20	52	95	0.20	30	75	0.16	52	95
106	32	+22294	60	40	+ 10.00	0.53	153	7	0.53	157	0	0.24	153	7
106	32	+22303	61	38	+ 9.74	0.42	162	0	0.42	150	12	0.14	155	3
106	32	+22329	62	29	+ 8.96	0.20	76	83	0.20	73	85	0.19	76	83
106	32	+22337	63	40	+ 8.76	0.35	139	29	0.35	139	29	0.29	120	51
106	32	+22362	64	25	+ 8.04	0.38	22	55	0.38	23	58	0.17	34	85
106	32	+22376	65	18	+ 7.63	0.63	178	0	0.63	165	0	0.18	157	0
106	32	+22400	66	51	+ 6.97	0.89	177	0	0.89	176	0	0.11	168	0
106	32	+22420	67	49	+ 6.36	0.83	136	33	0.83	138	30	0.58	136	33
106	32	+22686	70	15	-1.27	0.70	185	0	0.70	195	0	0.13	15	38
106	32	+22728	71	31	-2.47	0.92	192	0	0.92	200	0	0.23	18	45
41	44	+ 22541	75	37	+ 15.59	0.82	131	38	0.82	127	43	0.61	130	39
41	44	+ 22619	76	30	+ 13.37	0.40	57	93	0.40	62	91	0.34	57	93
41	44	+ 22678	77	55	+ 11.69	0.81	133	35	0.81	116	55	0.59	133	35
41	44	+ 22780	78	35	+ 8.78	0.24	84	80	0.24	107	63	0.24	84	80
41	44	+ 22845	79	28	+ 6.90	0.84	123	48	0.84	119	52	0.71	123	48
41	44	+ 22891	80	40	+ 5.61	0.33	105	65	0.33	122	49	0.32	105	65
50	13	+ 22849	85	6	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
134	58	+ 22160	91	47	013+ 8.38	0.05	111	47	0.05	99	58	0.05	111	47
134	58	+ 22175	92	47	013+ 8.76	0.07	117	41	0.07	113	45	0.06	117	41
134	58	+ 22201	93	47	013+ 9.42	0.10	100	57	0.11	114	44	0.10	100	57
134	58	+ 22616	94	21	013+19.89	0.02	56	90	0.02	18	45	0.02	56	90

ROW	TUBE	DATA POINT	flaw	Maximum Depth	600 KHz Abs LOC LTS+	VPP Volts	VPP deg	VPP %TW	MXR Volts	MXR deg	MXR %TW	VMX Volts	VMX deg	VMX %TW
77	17	+29343	1	100	-	-	-	-	-	-	-	-	-	-
73	8	+20366	2	100	-	-	-	-	-	-	-	-	-	-
73	8	+20353	3	100	-	-	-	-	-	-	-	-	-	-
73	8	+20339	4	100	-	-	-	-	-	-	-	-	-	-
73	8	+20300	5	70	-	-	-	-	-	-	-	-	-	-
73	8	+20216	6	100	-	-	-	-	-	-	-	-	-	-
112	19	+18540	7	20	-	-	-	-	-	-	-	-	-	-
77	34	+ 2830	8	100	-	-	-	-	-	-	-	-	-	-
52	51	+ 22745	11	33	+ 14.48	0.36	116	66	0.36	124	59	0.33	116	66
52	51	+ 22802	13	33	+ 12.88	0.40	157	12	0.40	142	38	0.17	142	38
52	51	+ 22831	14	40	+ 12.04	0.46	43	100	0.46	43	100	0.32	46	99
52	51	+ 22880	16	45	+ 10.64	0.10	284	0	0.10	284	0	0.04	167	0
52	51	+ 22911	17	52	+ 9.77	0.71	149	27	0.71	150	26	0.36	149	27
52	51	+ 22955	18	53	+ 8.53	0.86	51	98	0.86	57	96	0.67	51	98
52	51	+ 23034	19	34	+ 6.31	0.79	162	0	0.79	179	0	0.34	108	72
90	28	+ 23643	22	49	+ 16.56	0.39	141	26	0.39	158	0	0.27	135	36
90	28	+ 23669	23	30	+ 15.82	0.79	13	33	0.79	20	50	0.22	20	50
90	28	+ 23705	25	62	+ 14.88	0.36	118	57	0.36	106	68	0.33	112	63
90	28	+ 23722	26	49	+ 14.40	1.00	157	0	1.00	163	0	0.39	157	0
90	28	+ 23749	27	53	+ 13.62	0.32	36	90	0.32	42	99	0.21	42	99
90	28	+ 23783	29	45	+ 12.76	0.33	96	75	0.33	96	75	0.33	96	75
90	28	+ 23814	30	45	+ 11.93	0.40	158	0	0.40	133	39	0.22	137	33
90	28	+ 23826	31	60	+ 11.67	0.35	58	94	0.35	58	94	0.30	58	94
90	28	+ 23862	33	46	+ 10.70	0.71	150	7	0.71	148	12	0.36	150	7
90	28	+ 23870	34	53	+ 10.44	0.68	148	12	0.68	140	28	0.42	119	56
90	28	+ 23963	35	50	+ 7.97	1.51	152	2	1.51	133	39	0.76	142	24
90	28	+ 24019	36	56	+ 6.45	0.62	113	62	0.62	111	64	0.57	113	62
97	91	+ 23049	37	54	+ 14.75	0.49	90	87	0.49	107	78	0.49	90	87
97	91	+ 23137	38	48	+ 12.26	2.50	168	0	2.50	167	0	0.51	168	0
97	91	+ 23251	40	46	+ 9.09	1.08	165	0	1.08	161	0	0.34	160	0

ROW	TUBE	DATA POINT	flaw	Maximum Depth	600 KHz Abs									
						VPP			MXR			VMX		
					LOC LTS+	Volts	deg	%TW	Volts	deg	%TW	Volts	deg	%TW
97	91	+ 23260	41	54	+ 8.81	0.78	138	46	0.78	138	46	0.57	126	62
97	91	+ 23315	43	29	+ 7.24	0.52	5	13	0.52	12	30	0.08	12	30
106	32	+22128	50	22	+ 14.89	0.40	163	0	0.40	163	0	0.12	163	0
106	32	+22138	51	36	+ 14.63	0.41	173	0	0.41	180	0	0.06	172	0
106	32	+22171	53	39	+ 13.62	0.26	158	6	0.26	156	11	0.12	144	31
106	32	+22180	54	31	+ 13.42	0.18	169	0	0.18	169	0	0.06	140	37
106	32	+22234	56	46	+ 11.85	0.34	52	97	0.34	54	96	0.29	62	93
106	32	+22246	57	42	+ 11.51	0.47	136	42	0.47	133	46	0.33	136	42
106	32	+22261	58	36	+ 11.02	0.50	169	0	0.50	180	0	0.10	169	0
106	32	+22294	60	40	+ 10.15	0.60	23	56	0.60	16	39	0.60	16	39
106	32	+22303	61	38	+ 9.86	0.35	49	98	0.35	40	98	0.27	49	98
106	32	+22329	62	29	+ 9.02	0.76	31	76	0.76	42	100	0.39	31	76
106	32	+22337	63	40	+ 8.85	0.56	15	37	0.56	20	49	0.14	20	49
106	32	+22362	64	25	+ 8.10	0.11	153	16	0.11	153	16	0.05	153	15
106	32	+22376	65	18	+ 7.75	0.31	148	25	0.31	151	20	0.17	148	25
106	32	+22400	66	51	+ 6.85	0.24	177	0	0.24	177	0	0.13	70	90
106	32	+22420	67	49	+ 6.48	0.82	165	0	0.82	160	2	0.23	162	0
106	32	+22686	70	15	-1.15	1.11	191	0	1.11	191	0	0.18	190	0
106	32	+22728	71	31	-2.39	0.65	202	0	0.65	195	0	0.27	30	73
41	44	+ 22541	75	37	+ 15.79	1.31	174	0	1.51	173	0	0.34	157	11
41	44	+ 22619	76	30	+ 13.51	0.63	171	0	0.63	176	0	0.12	167	0
41	44	+ 22678	77	55	+ 11.86	0.63	141	34	0.63	126	50	0.40	141	34
41	44	+ 22780	78	35	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
41	44	+ 22845	79	28	+ 7.04	0.77	162	2	0.77	175	0	0.36	149	23
41	44	+ 22891	80	40	+ 5.73	0.27	142	32	0.27	142	32	0.20	93	75
50	13	+ 22849	85	6	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
134	58	+ 22160	91	47	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
134	58	+ 22175	92	47	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
134	58	+ 22201	93	47	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
134	58	+ 22616	94	21	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF

ROW	TUBE	DATA POINT	flaw	Maximum Depth	400 KHz Diff									
						VPP			MXR			VMX		
					LOC	Volts	deg	%TW	Volts	deg	%TW	Volts	deg	%TW
77	17	+29343	1	100	UTS+0.67	7.35	69	72	7.35	69	72	6.95	72	69
73	8	+20366	2	100	UTS+5.77	2.06	62	77	2.06	58	81	1.81	62	77
73	8	+20353	3	100	UTS+5.39	2.14	81	55	2.14	75	62	2.12	81	55
73	8	+20339	4	100	UTS+4.87	2.71	78	59	2.71	80	57	2.65	78	59
73	8	+20300	5	70	UTS+3.58	0.59	102	31	0.59	100	33	0.58	102	31
73	8	+20216	6	100	UTS+0.83	11.8	54	85	11.8	52	87	10.2	65	73
112	19	+18540	7	20	015 -1.36	0.68	92	43	0.68	86	50	0.68	92	43
77	34	+ 2830	8	100	UTS+0.12	3.55	50	88	3.55	50	88	2.98	57	80
52	51	+ 22745	11	33	+ 14.31	0.31	132	0	0.31	128	0	0.24	127	0
52	51	+ 22802	13	33	+ 12.74	0.20	128	0	0.20	135	0	0.16	128	0
52	51	+ 22831	14	40	+ 11.93	0.30	71	79	0.30	75	76	0.28	71	79
52	51	+ 22880	16	45	+ 10.55	0.47	65	84	0.47	75	76	0.42	65	84
52	51	+ 22911	17	52	+ 9.71	0.73	121	2	0.73	122	0	0.63	121	2
52	51	+ 22955	18	53	+ 8.45	0.70	75	76	0.70	83	68	0.68	75	76
52	51	+ 23034	19	34	+ 6.23	0.71	161	0	0.71	114	20	0.51	114	20
90	28	+ 23643	22	49	+ 16.48	0.72	161	0	0.72	165	0	0.28	131	0
90	28	+ 23669	23	30	+ 15.73	0.18	78	74	0.18	75	76	0.16	81	71
90	28	+ 23705	25	62	+ 14.77	0.64	88	64	0.64	93	57	0.64	88	64
90	28	+ 23722	26	49	+ 14.29	1.05	114	20	1.05	98	50	1.01	103	42
90	28	+ 23749	27	53	+ 13.57	0.32	43	99	0.32	41	100	0.21	45	97
90	28	+ 23783	29	45	+ 12.66	0.46	119	7	0.46	110	29	0.44	107	35
90	28	+ 23814	30	45	+ 11.85	0.60	116	15	0.78	111	27	0.54	116	15
90	28	+ 23826	31	60	+ 11.53	0.48	75	77	0.48	80	72	0.47	75	77
90	28	+ 23862	33	46	+ 10.60	0.35	100	47	0.35	63	86	0.34	100	47
90	28	+ 23870	34	53	+ 10.36	0.90	101	46	0.90	98	50	0.89	101	46
90	28	+ 23963	35	50	+ 7.87	1.53	108	33	1.53	103	42	1.45	108	33
90	28	+ 24019	36	56	+ 6.37	0.98	86	66	0.98	88	64	0.97	86	66
97	91	+ 23049	37	54	+ 14.67	0.76	91	55	0.76	87	62	0.76	91	55
97	91	+ 23137	38	48	+ 12.17	0.89	35	88	0.89	341	100	0.67	68	83
97	91	+ 23251	40	46	+ 8.98	0.60	95	48	0.60	82	68	0.60	95	48

ROW	TUBE	DATA POINT	flaw	Maximum Depth	400 KHz Diff LOC	VPP Volts	VPP deg	VPP %TW	MXR Volts	MXR deg	MXR %TW	VMX Volts	VMX deg	VMX %TW
97	91	+ 23260	41	54	+ 8.72	0.99	73	78	0.99	76	75	0.95	73	78
97	91	+ 23315	43	29	+ 7.21	0.22	65	85	0.22	48	96	0.21	81	70
106	32	+22128	50	22	+ 14.80	0.38	96	49	0.38	90	56	0.37	96	49
106	32	+22138	51	36	+ 14.54	0.53	32	80	0.53	22	55	0.34	45	97
106	32	+22171	53	39	+ 13.53	0.39	39	98	0.39	39	98	0.24	39	98
106	32	+22180	54	31	+ 13.33	0.46	115	18	0.46	117	14	0.45	107	32
106	32	+22234	56	46	+ 11.74	0.44	103	39	0.44	94	51	0.43	103	39
106	32	+22246	57	42	+ 11.39	0.48	109	29	0.48	121	6	0.46	109	29
106	32	+22261	58	36	+ 10.93	0.21	40	100	0.21	34	85	0.18	72	76
106	32	+22294	60	40	+ 10.03	0.52	126	0	0.52	125	0	0.43	123	1
106	32	+22303	61	38	+ 9.71	0.37	134	0	0.37	119	10	0.27	134	0
106	32	+22329	62	29	+ 8.96	0.38	72	76	0.38	68	79	0.36	72	76
106	32	+22337	63	40	+ 8.76	0.34	92	54	0.34	117	14	0.34	92	54
106	32	+22362	64	25	+ 8.04	0.39	31	78	0.39	23	58	0.22	43	98
106	32	+22376	65	18	+ 7.66	0.50	136	0	0.50	136	0	0.39	111	25
106	32	+22400	66	51	+ 6.94	0.59	163	0	0.59	188	0	0.29	133	0
106	32	+22420	67	49	+ 6.36	0.77	110	27	0.77	110	27	0.72	110	27
106	32	+22686	70	15	-1.27	0.77	162	0	0.77	159	0	0.29	157	0
106	32	+22728	71	31	-2.47	0.95	163	0	0.95	155	0	0.36	156	0
41	44	+ 22541	75	37	+ 15.59	0.77	113	22	0.77	112	24	0.72	110	28
41	44	+ 22619	76	30	+ 13.37	0.50	57	90	0.50	56	90	0.42	57	90
41	44	+ 22678	77	55	+ 11.66	0.75	112	24	0.75	78	72	0.07	112	24
41	44	+ 22780	78	35	+ 8.78	0.36	81	69	0.36	83	67	0.37	90	59
41	44	+ 22845	79	28	+ 6.93	0.84	105	37	0.84	96	51	0.81	105	37
41	44	+ 22891	80	40	+ 5.61	0.45	102	42	0.45	110	28	0.44	102	42
50	13	+ 22849	85	6	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
134	58	+ 22160	91	47	013+ 8.36	0.14	80	53	0.14	90	45	0.14	92	42
134	58	+ 22175	92	47	013+ 8.76	0.18	99	32	0.18	108	17	0.18	9?	32
134	58	+ 22201	93	47	013+ 9.42	0.31	93	33	0.31	103	26	0.31	9?	33
134	58	+ 22616	94	21	013+19.89	0.06	72	68	0.06	63	78	0.05	72	68

ROW	TUBE	DATA POINT	flaw	Maximum Depth	400 KHz Abs LOC LTS+	VPP Volts	VPP deg	VPP %TW	MXR Volts	MXR deg	MXR %TW	VMX Volts	VMX deg	VMX %TW
77	17	+29343	1	100	-	-	-	-	-	-	-	-	-	-
73	8	+20366	2	100	-	-	-	-	-	-	-	-	-	-
73	8	+20353	3	100	-	-	-	-	-	-	-	-	-	-
73	8	+20339	4	100	-	-	-	-	-	-	-	-	-	-
73	8	+20300	5	70	-	-	-	-	-	-	-	-	-	-
73	8	+20216	6	100	-	-	-	-	-	-	-	-	-	-
112	19	+18540	7	20	-	-	-	-	-	-	-	-	-	-
77	34	+ 2830	8	100	-	-	-	-	-	-	-	-	-	-
52	51	+ 22745	11	33	+ 14.45	0.35	124	6	0.35	146	0	0.33	100	51
52	51	+ 22802	13	33	+ 12.85	0.39	148	0	0.39	146	0	0.21	148	0
52	51	+ 22831	14	40	+ 12.04	0.40	31	76	0.40	33	80	0.19	33	80
52	51	+ 22880	16	45	+ 10.64	0.10	36	88	0.10	36	88	0.04	157	0
52	51	+ 22911	17	52	+ 9.79	0.62	119	18	0.62	107	41	0.55	119	18
52	51	+ 22955	18	53	+ 8.53	0.96	47	97	0.96	45	98	0.70	47	97
52	51	+ 23034	19	34	+ 6.31	0.31	97	55	0.31	97	55	0.30	97	55
90	28	+ 23643	22	49	+ 16.56	0.41	111	17	0.41	116	0	0.38	111	17
90	28	+ 23669	23	30	+ 15.82	0.98	11	28	0.98	18	45	0.23	17	43
90	28	+ 23705	25	62	+ 14.88	0.39	90	63	0.39	101	44	0.39	90	63
90	28	+ 23722	26	49	+ 14.42	1.13	141	0	1.13	136	0	0.71	141	0
90	28	+ 23749	27	53	+ 13.70	0.31	18	45	0.31	23	58	0.12	40	100
90	28	+ 23783	29	45	+ 12.79	0.44	74	80	0.44	85	69	0.42	74	80
90	28	+ 23814	30	45	+ 11.96	0.47	153	0	0.47	155	0	0.21	153	0
90	28	+ 23826	31	60	+ 11.64	0.32	81	74	0.32	84	70	0.32	81	74
90	28	+ 23862	33	46	+ 10.73	0.77	148	0	0.77	153	0	0.44	143	0
90	28	+ 23870	34	53	+ 10.44	0.46	121	0	0.46	109	23	0.39	121	0
90	28	+ 23963	35	50	+ 8.00	1.47	132	0	1.47	115	1	1.10	125	0
90	28	+ 24019	36	56	+ 6.48	0.84	66	86	0.84	72	82	0.78	78	77
97	91	+ 23049	37	54	+ 14.75	0.74	56	96	0.74	73	90	0.61	56	96
97	91	+ 23137	38	48	+ 12.29	1.97	158	100	1.97	153	0	0.78	156	100
97	91	+ 23251	40	46	+ 9.09	0.94	148	0	0.94	140	0	0.53	137	0

ROW	TUBE	DATA POINT	flaw	Maximum Depth	400 KHz Abs LOC LTS+	VPP Volts	VPP deg	VPP %TW	MXR Volts	MXR deg	MXR %TW	VMX Volts	VMX deg	VMX %TW
97	91	+ 23260	41	54	+ 8.81	0.65	101	64	0.65	88	80	0.64	101	64
97	91	+ 23315	43	29	+ 7.43	0.91	163	100	0.91	164	100	0.27	163	100
106	32	+22128	50	22	+ 14.92	0.26	131	0	0.26	131	0	0.22	121	8
106	32	+22138	51	36	+ 14.57	0.51	173	0	0.51	167	0	0.11	157	0
106	32	+22171	53	39	+ 13.65	0.14	142	0	0.14	135	0	0.10	90	67
106	32	+22180	54	31	+ 13.42	0.23	81	76	0.23	81	76	0.23	87	70
106	32	+22234	56	46	+ 11.83	0.39	59	91	0.39	59	91	0.34	59	91
106	32	+22246	57	42	+ 11.51	0.37	123	1	0.37	119	14	0.33	117	20
106	32	+22261	58	36	+ 11.04	0.15	135	0	0.15	153	0	0.11	128	0
106	32	+22294	60	40	+ 10.12	0.69	40	100	0.69	46	98	0.45	40	100
106	32	+22303	61	38	+ 9.86	0.35	70	85	0.35	57	92	0.33	70	85
106	32	+22329	62	29	+ 9.05	0.64	40	100	0.64	43	99	0.41	40	100
106	32	+22337	63	40	+ 8.82	0.56	27	68	0.56	33	83	0.25	27	68
106	32	+22362	64	25	+ 8.18	0.10	90	67	0.10	90	67	0.10	90	67
106	32	+22376	65	18	+ 7.72	0.37	105	46	0.37	106	45	0.36	105	46
106	32	+22400	66	51	+ 7.08	0.50	163	0	0.50	166	0	0.14	163	0
106	32	+22420	67	49	+ 6.48	0.60	133	0	0.60	126	0	0.43	133	0
106	32	+22686	70	15	-1.18	0.81	172	0	0.81	176	0	0.14	167	0
106	32	+22728	71	31	-2.39	0.48	158	0	0.48	170	0	0.23	146	0
41	44	+ 22541	75	37	+ 15.76	0.82	147	0	1.10	151	0	0.52	150	0
41	44	+ 22619	76	30	+ 13.51	0.61	153	0	0.91	157	0	0.40	154	0
41	44	+ 22678	77	55	+ 11.88	0.90	131	0	0.90	124	0	0.68	131	0
41	44	+ 22780	78	35	+ 8.89	0.57	20	49	0.61	19	46	0.28	28	68
41	44	+ 22845	79	28	+ 7.07	0.73	107	41	0.73	144	0	0.70	107	41
41	44	+ 22891	80	40	+ 5.76	0.36	135	0	0.36	135	0	0.29	118	14
50	13	+ 22849	85	6	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
134	58	+ 22160	91	47	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
134	58	+ 22175	92	47	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
134	58	+ 22201	93	47	013+ 9.29	0.35	101	39	0.35	68	78	0.34	101	39
134	58	+ 22616	94	21	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF

ROW	TUBE	DATA POINT	flaw	Maximum Depth	200 KHz Diff LOC	Volts	VPP deg	%TW	Volts	MXR deg	%TW	Volts	VMX deg	%TW
77	17	+29343	1	100	-	-	-	-	-	-	-	-	-	-
73	8	+20366	2	100	UTS+5.77	1.11	64	48	1.11	61	54	1.00	64	48
73	8	+20353	3	100	UTS+5.39	1.13	69	39	1.13	69	39	1.06	69	39
73	8	+20339	4	100	UTS+4.87	1.65	77	25	1.65	77	25	1.60	77	25
73	8	+20300	5	70	UTS+3.58	0.29	88	7	0.29	85	12	0.29	88	7
73	8	+20216	6	100	UTS+0.83	7.58	52	73	7.58	49	79	6.01	52	73
112	19	+18540	7	20	015 -1.40	0.43	83	15	0.43	77	25	0.43	83	15
77	34	+ 2830	8	100	UTS+0.12	1.63	56	68	1.63	60	60	1.41	74	32
52	51	+ 22745	11	33	+ 14.34	0.21	80	32	0.21	77	40	0.19	86	13
52	51	+ 22802	13	33	+ 12.77	0.08	90	0	0.08	79	35	0.08	90	0
52	51	+ 22831	14	40	+ 11.93	0.22	38	95	0.22	42	98	0.13	43	97
52	51	+ 22880	16	45	+ 10.55	0.30	55	82	0.30	57	79	0.24	66	64
52	51	+ 229 1	17	52	+ 9.71	0.42	90	0	0.42	84	20	0.42	90	0
52	51	+ 22955	18	53	+ 8.45	0.51	65	66	0.51	67	62	0.46	65	66
52	51	+ 23034	19	34	+ 6.23	0.31	108	0	0.31	81	29	0.29	108	0
90	28	+ 23643	22	49	+ 16.46	0.27	146	0	0.27	118	0	0.20	114	0
90	28	+ 23669	23	30	+ 15.73	0.18	78	33	0.18	90	0	0.17	78	33
90	28	+ 23705	25	62	+ 14.80	0.38	65	64	0.38	72	49	0.34	70	53
90	28	+ 23722	26	49	+ 14.32	0.60	82	20	0.60	74	44	0.59	82	20
90	28	+ 23749	27	53	+ 13.59	0.20	57	78	0.20	41	99	0.17	57	78
90	28	+ 23783	29	45	+ 12.68	0.26	79	30	0.26	72	49	0.26	79	30
90	28	+ 23814	30	45	+ 11.85	0.25	72	49	0.28	74	44	0.25	90	0
90	28	+ 23826	31	60	+ 11.59	0.32	62	70	0.32	62	70	0.28	62	70
90	28	+ 23862	33	46	+ 10.62	0.16	86	5	0.16	70	53	0.16	86	5
90	28	+ 23870	34	53	+ 10.36	0.47	83	17	0.47	70	53	0.47	83	17
90	28	+ 23963	35	50	+ 7.87	0.80	79	30	0.80	75	41	0.79	79	30
90	28	+ 24019	36	56	+ 6.37	0.62	70	53	0.62	68	58	0.57	73	46
97	91	+ 23049	37	54	+ 14.64	0.48	66	65	0.48	66	65	0.44	66	65
97	91	+ 23137	38	48	+ 12.17	0.55	58	81	0.55	68	60	0.47	63	72
97	91	+ 23251	40	46	+ 9.00	0.35	64	70	0.35	61	76	0.31	66	65

ROW	TUBE	DATA POINT	flaw	Maximum Depth	200 KHz Diff LOC	VPP Volts	VPP deg	VPP %TW	MXR Volts	MXR deg	MXR %TW	VMX Volts	VMX deg	VMX %TW
97	91	+ 23260	41	54	+ 8.72	0.61	59	80	0.61	58	81	0.52	59	80
97	91	+ 23315	43	29	+ 7.24	0.14	55	86	0.14	63	72	0.12	63	72
106	32	+22128	50	22	+ 14.83	0.29	62	69	0.29	58	76	0.25	62	69
106	32	+22138	51	36	+ 14.54	0.29	48	90	0.29	30	75	0.22	50	88
106	32	+22171	53	39	+ 13.56	0.21	43	97	0.21	38	95	0.14	43	97
106	32	+22180	54	31	+ 13.33	0.26	74	45	0.26	84	17	0.25	74	45
106	32	+22234	56	46	+ 11.74	0.31	88	3	0.31	77	37	0.31	88	3
106	32	+22246	57	42	+ 11.39	0.30	90	0	0.30	87	7	0.30	90	0
106	32	+22261	58	36	+ 10.93	0.14	38	95	0.14	38	95	0.12	48	90
106	32	+22294	60	40	+ 10.03	0.29	88	3	0.29	87	7	0.29	88	3
106	32	+22303	61	38	+ 9.77	0.20	101	0	0.20	95	0	0.19	101	0
106	32	+22329	62	29	+ 9.02	0.28	61	71	0.28	66	62	0.24	61	71
106	32	+22337	63	40	+ 8.76	0.27	52	85	0.27	60	73	0.22	72	49
106	32	+22362	64	25	+ 8.10	0.21	50	88	0.21	48	90	0.14	50	88
106	32	+22376	65	18	+ 7.69	0.34	92	0	0.34	93	0	0.34	92	0
106	32	+22400	66	51	+ 7.20	0.10	36	90	0.10	45	94	0.06	45	94
106	32	+22420	67	49	+ 6.36	0.46	83	20	0.46	76	40	0.46	83	20
106	32	+22686	70	15	-1.29	0.52	116	0	0.52	117	0	0.47	116	0
106	32	+22728	71	31	-2.50	0.71	112	0	0.71	103	0	0.66	112	0
41	44	+ 22541	75	37	+ 15.62	0.42	87	10	0.42	81	29	0.42	87	10
41	44	+ 22619	76	30	+ 13.40	0.37	57	78	0.37	45	94	0.31	57	78
41	44	+ 22678	77	55	+ 11.66	0.41	90	0	0.41	66	63	0.41	90	0
41	44	+ 22780	78	35	+ 8.78	0.21	74	46	0.21	78	37	0.20	74	46
41	44	+ 22845	79	28	+ 6.93	0.47	80	31	0.47	79	34	0.47	80	31
41	44	+ 22891	80	40	+ 5.64	0.34	73	49	0.34	90	0	0.34	92	0
50	13	+ 22849	85	6	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
134	58	+ 22160	91	47	013+ 8.36	0.16	73	31	0.16	71	36	0.16	73	31
134	58	+ 22175	92	47	013+ 8.76	0.22	87	0	0.22	74	29	0.22	87	0
134	58	+ 22201	93	47	013+ 9.42	0.39	84	5	0.39	82	10	0.39	84	5
134	58	+ 22616	94	21	013+19.89	0.08	60	60	0.08	54	72	0.07	60	60

ROW	TUBE	DATA POINT	flaw	Maximum Depth	200 KHz Abs LOC LTS+	VPP Volts	VPP deg	VPP %TW	MXR Volts	MXR deg	MXR %TW	VMX Volts	VMX deg	VMX %TW
77	17	+29343	1	100	-	-	-	-	-	-	-	-	-	-
73	8	+20366	2	100	-	-	-	-	-	-	-	-	-	-
73	8	+20353	3	100	-	-	-	-	-	-	-	-	-	-
73	8	+20339	4	100	-	-	-	-	-	-	-	-	-	-
73	8	+20300	5	70	-	-	-	-	-	-	-	-	-	-
73	8	+20216	6	100	-	-	-	-	-	-	-	-	-	-
112	19	+18540	7	20	-	-	-	-	-	-	-	-	-	-
77	34	+ 2830	8	100	-	-	-	-	-	-	-	-	-	-
52	51	+ 22745	11	33	+ 14.45	0.24	63	71	0.24	70	58	0.24	71	56
52	51	+ 22802	13	33	+ 12.88	0.11	148	0	0.11	129	0	0.06	148	0
52	51	+ 22831	14	40	+ 12.07	0.20	38	95	0.20	38	95	0.12	38	95
52	51	+ 22880	16	45	+ 10.64	0.08	27	68	0.08	27	68	0.02	63	71
52	51	+ 22911	17	52	+ 9.85	0.34	82	27	0.34	68	62	0.34	82	27
52	51	+ 22955	18	53	+ 8.56	0.72	41	99	0.72	39	98	0.47	41	99
52	51	+ 23034	19	34	+ 6.31	0.24	35	88	0.24	35	88	0.21	65	68
90	28	+ 23643	22	49	+ 16.56	0.28	88	0	0.28	126	0	0.28	88	0
90	28	+ 23669	23	30	+ 15.87	0.55	32	80	0.55	25	63	0.30	32	80
90	28	+ 23705	25	62	+ 14.91	0.23	61	78	0.23	56	85	0.20	61	78
90	28	+ 23722	26	49	+ 14.45	0.36	136	0	0.36	183	100	0.28	123	0
90	28	+ 23749	27	53	+ 13.70	0.18	42	99	0.18	48	94	0.12	42	99
90	28	+ 23783	29	45	+ 12.76	0.37	57	84	0.37	48	94	0.31	57	84
90	28	+ 23814	30	45	+ 11.96	0.08	129	0	0.08	129	0	0.07	81	14
90	28	+ 23826	31	60	+ 11.67	0.21	36	90	0.21	22	55	0.15	47	95
90	28	+ 23862	33	46	+ 10.70	0.39	125	0	0.39	124	0	0.32	125	0
90	28	+ 23870	34	53	+ 10.44	0.12	84	0	0.12	84	0	0.12	84	0
90	28	+ 23963	35	50	+ 8.00	0.59	80	20	0.59	80	20	0.58	80	20
90	28	+ 24019	36	56	+ 6.45	0.50	52	90	0.50	61	78	0.42	61	78
97	91	+ 23049	37	54	+ 14.78	0.56	42	97	0.56	49	91	0.37	42	97
97	91	+ 23137	38	48	+ 12.31	0.65	139	100	0.65	133	0	0.65	133	0
97	91	+ 23251	40	46	+ 9.12	0.31	103	0	0.31	107	0	0.30	103	0

ROW	TUBE	DATA POINT	flaw	Maximum Depth	200 KHz Abs LOC LTS+	Volts	VPP deg	%TW	Volts	MXR deg	%TW	Volts	VMX deg	%TW
97	91	+ 23260	41	54	+ 8.81	0.31	56	83	0.31	56	83	0.25	56	83
97	91	+ 23315	43	29	+ 7.43	0.34	147	100	0.34	152	100	0.19	147	100
106	32	+22128	50	22	+ 14.95	0.12	53	89	0.12	51	91	0.10	53	89
106	32	+22138	51	36	+ 14.43	0.56	214	100	0.56	212	100	0.33	36	90
106	32	+22171	53	39	+ 13.68	0.10	83	20	0.10	90	0	0.10	83	20
106	32	+22180	54	31	+ 13.42	0.14	52	90	0.14	69	64	0.11	52	90
106	32	+22234	56	46	+ 11.88	0.33	60	80	0.33	51	91	0.31	65	72
106	32	+22246	57	42	+ 11.54	0.24	87	0	0.24	78	40	0.24	87	0
106	32	+22261	58	36	+ 10.90	0.16	189	100	0.16	198	100	0.05	18	45
106	32	+22294	60	40	+ 10.12	0.57	48	93	0.57	44	97	0.45	52	90
106	32	+22303	61	38	+ 9.86	0.27	51	91	0.27	54	87	0.20	51	91
106	32	+22329	62	29	+ 9.14	0.46	47	94	0.46	58	83	0.34	52	90
106	32	+22337	63	40	+ 8.85	0.45	29	73	0.45	34	85	0.22	29	73
106	32	+22362	64	25	+ 8.18	0.05	76	47	0.05	76	47	0.05	76	47
106	32	+22376	65	18	+ 7.78	0.36	86	4	0.36	80	33	0.36	86	4
106	32	+22400	66	51	+ 7.05	0.16	157	0	0.16	162	0	0.13	110	0
106	32	+22420	67	49	+ 6.48	0.27	87	0	0.27	103	0	0.27	87	0
106	32	+22686	70	15	-1.15	0.56	141	0	0.56	127	0	0.36	135	0
106	32	+22728	71	31	-2.39	0.55	123	0	0.55	114	0	0.47	114	0
41	44	+ 22541	75	37	+ 15.76	0.47	136	0	0.47	120	0	0.36	121	0
41	44	+ 22619	76	30	+ 13.51	0.36	134	0	0.36	90	0	0.25	134	0
41	44	+ 22678	77	55	+ 11.83	0.48	115	0	0.48	92	0	0.43	110	0
41	44	+ 22780	78	35	+ 8.86	0.36	20	50	0.36	24	60	0.17	24	60
41	44	+ 22845	79	28	+ 7.07	0.44	81	34	0.44	45	97	0.43	81	34
41	44	+ 22891	80	40	+ 5.73	0.25	73	59	0.25	87	2	0.26	63	78
50	13	+ 22849	85	6	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
134	58	+ 22160	91	47	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
134	58	+ 22175	92	47	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
134	58	+ 22201	93	47	013+ 9.29	0.51	77	34	0.51	90	0	0.50	77	34
134	58	+ 22616	94	21	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF

ROW	TUBE	DATA POINT	flaw	Maximum Depth	35 KHz Diff									
						VPP			MXR			VMX		
					LOC LTS+	Volts	deg	%TW	Volts	deg	%TW	Volts	deg	%TW
77	17	+29343	1	100	-	-	-	-	-	-	-	-	-	-
73	8	+20366	2	100	-	-	-	-	-	-	-	-	-	-
73	8	+20353	3	100	-	-	-	-	-	-	-	-	-	-
73	8	+20339	4	100	-	-	-	-	-	-	-	-	-	-
73	8	+20300	5	70	-	-	-	-	-	-	-	-	-	-
73	8	+20216	6	100	-	-	-	-	-	-	-	-	-	-
112	9	+18540	7	20	-	-	-	-	-	-	-	-	-	-
77	34	+ 2830	8	100	-	-	-	-	-	-	-	-	-	-
52	51	+ 22745	11	33	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
52	51	+ 22802	13	33	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
52	51	+ 22831	14	40	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
52	51	+ 22880	16	45	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
52	51	+ 22911	17	52	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
52	51	+ 22955	18	53	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
52	51	+ 23034	19	34	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
90	28	+ 23643	22	49	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
90	28	+ 23669	23	30	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
90	28	+ 23705	25	62	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
90	28	+ 23722	26	49	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
90	28	+ 23749	27	53	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
90	28	+ 23783	29	45	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
90	28	+ 23814	30	45	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
90	28	+ 23826	31	60	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
90	28	+ 23862	33	46	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
90	28	+ 23870	34	53	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
90	28	+ 23963	35	50	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
90	28	+ 24019	36	56	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
97	91	+ 23049	37	54	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
97	91	+ 23137	38	48	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
97	91	+ 23251	40	46	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF

ROW	TUBE	DATA POINT	flaw	Maximum Depth	35 KHz Diff LOC LTS+	VPP Volts	VPP deg	VPP %TW	MXR Volts	MXR deg	MXR %TW	VMX Volts	VMX deg	VMX %TW
97	91	+ 23260	41	54	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
97	91	+ 23315	43	29	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22128	50	22	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22138	51	36	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22171	53	39	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22180	54	31	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22234	56	46	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22246	57	42	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22261	58	36	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22294	60	40	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22303	61	38	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22329	62	29	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22337	63	40	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22362	64	25	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22376	65	18	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22400	66	51	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22420	67	49	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22686	70	15	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22728	71	31	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
41	44	+ 22541	75	37	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
41	44	+ 22619	76	30	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
41	44	+ 22678	77	55	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
41	44	+ 22780	78	35	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
41	44	+ 22845	79	28	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
41	44	+ 22891	80	40	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
50	13	+ 22849	85	6	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
134	58	+ 22160	91	47	013+ 8.33	0.02	76	0	0.02	104	0	0.02	76	0
134	58	+ 22175	92	47	013+ 8.68	0.05	40	100	0.05	76	0	0.03	68	0
134	58	+ 22201	93	47	013+ 9.32	0.08	54	5	0.08	51	15	0.07	54	5
134	58	+ 22616	94	21	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF

ROW	TUBE	DATA POINT	flaw	Maximum Depth	35 KHz Abs LOC	Volts	VPP deg	%TW	Volts	MXR deg	%TW	Volts	VMX deg	%TW
77	17	+29343	1	100	-	-	-	-	-	-	-	-	-	-
73	8	+20366	2	100	UTS+5.77	0.15	48	55	0.15	50	100	0.11	48	55
73	8	+20353	3	100	UTS+5.39	0.14	179	100	0.14	179	100	0.11	92	100
73	8	+20339	4	100	UTS+4.87	0.36	62	100	0.36	60	100	0.32	62	100
73	8	+20300	5	70	UTS+3.58	0.16	73	100	0.16	86	100	0.16	80	100
73	8	+20216	6	100	UTS+0.83	4.68	260	100	4.68	289	100	4.61	80	100
112	19	+18540	7	20	015 -1.44	0.11	345	100	0.11	0	0	0.06	132	100
77	34	+ 2830	8	100	-	-	-	-	-	-	-	-	-	-
52	51	+ 22745	11	33	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
52	51	+ 22802	13	33	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
52	51	+ 22831	14	40	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
52	51	+ 22880	16	45	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
52	51	+ 22911	17	52	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
52	51	+ 22955	18	53	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
52	51	+ 23034	19	34	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
90	28	+ 23643	22	49	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
90	28	+ 23669	23	30	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
90	28	+ 23705	25	62	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
90	28	+ 23722	26	49	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
90	28	+ 23749	27	53	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
90	28	+ 23783	29	45	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
90	28	+ 23814	30	45	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
90	28	+ 23826	31	60	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
90	28	+ 23862	33	46	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
90	28	+ 23870	34	53	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
90	28	+ 23963	35	50	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
90	28	+ 24019	36	56	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
97	91	+ 23049	37	54	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
97	91	+ 23137	38	48	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
97	91	+ 23251	40	46	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF

ROW	TUBE	DATA POINT	flaw	Maximum Depth	35 KHz Abs LOC	Vclts	VPP deg	%TW	Volts	MXR deg	%TW	Volts	VMX deg	%TW
97	91	+ 23260	41	54	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
97	91	+ 23315	43	29	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22128	50	22	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22138	51	36	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22171	53	39	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22180	54	31	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22234	56	46	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22246	57	42	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22261	58	36	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22294	60	40	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22303	61	38	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22329	62	29	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22337	63	40	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22362	64	25	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22376	65	18	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22400	66	51	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22420	67	49	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22686	70	15	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
106	32	+22728	71	31	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
41	44	+ 22541	75	37	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
41	44	+ 22619	76	30	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
41	44	+ 22678	77	55	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
41	44	+ 22780	78	35	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
41	44	+ 22845	79	28	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
41	44	+ 22891	80	40	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
50	13	+ 22849	85	6	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
134	58	+ 22160	91	47	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
134	58	+ 22175	92	47	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
134	58	+ 22201	93	47	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF
134	58	+ 22616	94	21	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF	NDF

ROW	TUBE	DATA POINT	flaw	Maximum Depth	400/200 KHz Diff Mix (CH P1)									
						VPP			MXR			VMX		
					LOC LTS+	Volts	deg	%TW	Volts	deg	%TW	Volts	deg	%TW
77	17	+29343	1	100	-	-	-	-	-	-	-	-	-	-
73	8	+20366	2	100	UTS+5.77	1.78	32	92	1.65	32	92	0.95	32	92
73	8	+20353	3	100	UTS+5.39	1.68	47	73	1.68	50	69	1.29	51	67
73	8	+20339	4	100	UTS+4.87	2.27	40	82	2.27	44	77	1.46	40	82
73	8	+20300	5	70	UTS+3.58	0.41	71	35	0.41	64	47	0.38	71	35
73	8	+20216	6	100	UTS+0.83	9.62	27	98	9.62	29	96	5.34	37	86
112	19	+18540	7	20	015 -1.36	0.51	47	73	0.51	45	76	0.41	55	62
77	34	+ 2830	8	100	UTS+0.12	3.97	35	92	3.97	35	92	2.42	38	87
52	51	+ 22745	11	33	+ 14.31	0.14	142	0	0.14	151	0	0.08	142	0
52	51	+ 22802	13	33	+ 12.74	0.10	144	0	0.10	172	0	0.06	144	0
52	51	+ 22831	14	40	+ 11.93	0.15	72	76	0.15	90	56	0.15	72	76
52	51	+ 22880	16	45	+ 10.55	0.31	56	90	0.31	47	96	0.25	58	88
52	51	+ 22911	17	52	+ 9.71	0.35	142	0	0.35	128	0	0.27	124	0
52	51	+ 22955	18	53	+ 8.45	0.43	60	87	0.43	60	87	0.38	60	87
52	51	+ 23034	19	34	+ 6.23	0.41	161	0	0.41	126	0	0.28	126	0
90	28	+ 23643	22	49	+ 16.48	0.36	166	0	0.36	143	0	0.16	143	0
90	28	+ 23669	23	30	+ 15.76	0.14	45	97	0.14	49	95	0.10	45	97
90	28	+ 23705	25	62	+ 14.77	0.39	90	59	0.39	90	59	0.39	90	59
90	28	+ 23722	26	49	+ 14.32	0.68	116	13	0.68	101	43	0.64	105	36
90	28	+ 23749	27	53	+ 13.57	0.26	41	99	0.26	37	93	0.17	41	99
90	28	+ 23783	29	45	+ 12.66	0.29	110	26	0.29	121	0	0.27	110	26
90	28	+ 23814	30	45	+ 11.85	0.40	133	0	0.58	125	0	0.30	136	0
90	28	+ 23826	31	60	+ 11.53	0.33	65	84	0.33	74	76	0.31	74	76
90	28	+ 23862	33	46	+ 10.60	0.25	108	30	0.25	62	86	0.23	108	30
90	28	+ 23870	34	53	+ 10.36	0.57	104	38	0.57	100	45	0.55	104	38
90	28	+ 23963	35	50	+ 7.87	0.95	111	24	0.95	107	32	0.89	111	24
90	28	+ 24019	36	56	+ 6.37	0.64	79	71	0.64	89	60	0.63	79	71
97	91	+ 23049	37	54	+ 14.67	0.42	95	51	0.42	90	59	0.42	95	51
97	91	+ 23137	38	48	+ 12.17	0.74	31	78	0.74	356	0	0.42	44	98
97	91	+ 23251	40	46	+ 8.98	0.35	101	41	0.35	85	65	0.35	101	41

ROW	TUBE	DATA POINT	flaw	Maximum Depth	400/200 KHz Diff Mix (CH P1) LOC LTS+	VPP Volts	VPP deg	VPP %TW	MXR Volts	MXR deg	MXR %TW	VMX Volts	VMX deg	VMX %TW
97	91	+ 23260	41	54	+ 8.70	0.61	75	76	0.61	79	72	0.59	75	76
97	91	+ 23315	43	29	+ 7.18	0.13	52	93	0.13	30	75	0.10	77	74
106	32	+22128	50	22	+ 14.80	0.25	67	78	0.25	69	76	0.23	81	61
106	32	+22138	51	36	+ 14.51	0.44	35	88	0.44	17	43	0.25	35	88
106	32	+22171	53	39	+ 13.56	0.31	36	90	0.31	35	88	0.19	37	93
106	32	+22180	54	31	+ 13.30	0.30	106	15	0.30	120	0	0.29	106	15
106	32	+22234	56	46	+ 11.74	0.31	79	64	0.31	77	67	0.30	79	64
106	32	+22246	57	42	+ 11.39	0.30	95	39	0.30	90	48	0.30	95	39
106	32	+22261	58	36	+ 10.93	0.16	36	90	0.16	35	88	0.10	42	99
106	32	+22294	60	40	+ 10.00	0.29	123	0	0.29	124	0	0.24	123	0
106	32	+22303	61	38	+ 9.74	0.20	128	0	0.20	107	13	0.16	128	0
106	32	+22329	62	29	+ 8.96	0.29	55	89	0.29	49	94	0.24	55	89
106	32	+22337	63	40	+ 8.73	0.28	47	95	0.28	69	76	0.22	54	90
106	32	+22362	64	25	+ 8.07	0.38	27	68	0.38	26	65	0.18	37	93
106	32	+22376	65	18	+ 7.66	0.25	151	0	0.23	27	68	0.23	81	61
106	32	+22400	66	51	+ 6.97	0.45	174	0	0.45	197	0	0.17	139	0
106	32	+22420	67	49	+ 6.36	0.47	105	18	0.47	105	18	0.46	105	18
106	32	+22686	70	15	-1.27	0.27	170	0	0.27	171	0	0.07	143	0
106	32	+22728	71	31	-2.47	0.35	190	0	0.35	208	0	0.12	27	68
41	44	+ 22541	75	37	+ 15.59	0.37	111	18	0.37	100	39	0.35	111	18
41	44	+ 22619	76	30	+ 13.40	0.43	34	85	0.30	34	85	0.24	38	95
41	44	+ 22678	77	55	+ 11.63	0.36	110	20	0.36	65	81	0.34	96	45
41	44	+ 22780	78	35	+ 8.78	0.22	77	70	0.22	79	67	0.22	77	70
41	44	+ 22845	79	28	+ 6.93	0.41	109	22	0.38	88	56	0.38	88	56
41	44	+ 22891	80	40	+ 5.59	0.30	56	89	0.29	66	80	0.20	45	97
50	13	+ 22849	85	6	014 -1.01	0.15	14	35	0.15	14	35	0.04	18	45
134	58	+ 22160	91	47	013+ 8.38	0.10	65	73	0.10	75	60	0.09	65	73
134	58	+ 22175	92	47	013+ 8.76	0.10	80	53	0.10	104	13	0.10	80	53
134	58	+ 22201	93	47	013+ 9.42	0.17	69	68	0.17	65	73	0.16	77	57
134	58	+ 22616	94	21	013+19.87	0.04	63	75	0.04	63	75	0.04	63	75

ROW	TUBE	DATA POINT	flaw	Maximum Depth	600/200 KHz Diff Mix (CH P2) LOC LTS+	VPP Volts	VPP deg	VPP %TW	MXR Volts	MXR deg	MXR %TW	VMX Volts	VMX deg	VMX %TW
77	17	+29343	1	100	-	-	-	-	-	-	-	-	-	-
73	8	+20366	2	100	UTS+5.77	1.15	45	54	1.07	41	62	0.81	45	54
73	8	+20353	3	100	UTS+5.39	1.24	51	44	1.24	47	51	0.97	51	44
73	8	+20339	4	100	UTS+4.87	1.69	57	34	1.69	57	34	1.43	60	29
73	8	+20300	5	70	UTS+3.58	0.32	64	23	0.32	65	21	0.29	69	16
73	8	+20216	6	100	UTS+0.83	8.39	33	79	8.39	29	88	4.51	33	79
112	19	+18540	7	20	015 -1.36	0.44	69	16	0.41	64	23	0.41	69	16
77	34	+ 2830	8	100	-	-	-	-	-	-	-	-	-	-
52	51	+ 22745	11	33	+ 14.34	0.39	158	0	0.39	168	0	0.16	146	0
52	51	+ 22802	13	33	+ 12.74	0.29	152	0	0.29	152	0	0.13	152	0
52	51	+ 22831	14	40	+ 11.93	0.29	54	94	0.29	54	94	0.23	54	94
52	51	+ 22880	16	45	+ 10.55	0.57	50	96	0.57	55	93	0.46	59	91
52	51	+ 22911	17	52	+ 9.71	0.70	163	0	0.70	142	0	0.38	143	0
52	51	+ 22955	18	53	+ 8.45	0.68	57	92	0.68	56	93	0.57	57	92
52	51	+ 23034	19	34	+ 6.23	0.83	175	0	0.83	144	0	0.38	147	0
90	28	+ 23643	22	49	+ 16.46	0.92	182	0	0.92	186	0	0.13	62	90
90	28	+ 23669	23	30	+ 15.76	0.18	12	30	0.18	12	30	0.11	52	95
90	28	+ 23705	25	62	+ 14.77	0.38	94	70	0.38	109	56	0.38	94	70
90	28	+ 23722	26	49	+ 14.29	0.95	134	23	0.95	127	34	0.71	128	33
90	28	+ 23749	27	53	+ 13.54	0.36	22	55	0.36	41	100	0.20	45	98
90	28	+ 23783	29	45	+ 12.66	0.42	146	0	0.42	157	0	0.23	145	2
90	28	+ 23814	30	45	+ 11.85	0.86	161	0	0.86	142	9	0.36	145	2
90	28	+ 23826	31	60	+ 11.56	0.45	43	99	0.45	9	23	0.32	58	92
90	28	+ 23862	33	46	+ 10.57	0.36	124	38	0.36	93	70	0.31	114	51
90	28	+ 23870	34	53	+ 10.33	0.78	143	7	0.78	118	46	0.65	122	41
90	28	+ 23963	35	50	+ 7.87	1.29	126	36	1.29	120	44	1.07	121	42
90	28	+ 24019	36	56	+ 6.37	0.75	108	57	0.75	104	61	0.74	101	64
97	91	+ 23049	37	54	+ 14.67	0.60	102	61	0.60	98	65	0.59	102	61
97	91	+ 23137	38	48	+ 12.17	1.12	28	70	1.12	357	100	0.61	46	98
97	91	+ 23251	40	46	+ 8.98	0.53	113	47	0.53	105	58	0.49	113	47

ROW	TUBE	DATA POINT	flaw	Maximum Depth	600/200 KHz Diff Mix (CH P2)									
						VPP			MXR			VMX		
					LOC LTS+	Volts	deg	%TW	Volts	deg	%TW	Volts	deg	%TW
97	91	+ 23260	41	54	+ 8.70	0.83	80	80	0.83	83	78	0.82	80	80
97	91	+ 23315	43	29	+ 7.18	0.22	69	87	0.22	68	88	0.21	69	87
106	32	+22128	50	22	+ 14.80	0.42	18	45	0.42	6	15	0.25	90	64
106	32	+22138	51	36	+ 14.51	0.80	24	80	0.80	17	43	0.39	39	98
106	32	+22171	53	39	+ 13.56	0.45	36	90	0.45	30	75	0.27	41	99
106	32	+22180	54	31	+ 13.30	0.44	158	0	0.44	171	0	0.31	125	14
106	32	+22234	56	46	+ 11.74	0.26	98	56	0.26	96	58	0.25	98	56
106	32	+22246	57	42	+ 11.39	0.30	124	16	0.30	137	0	0.28	105	47
106	32	+22261	58	36	+ 10.93	0.29	22	55	0.29	15	38	0.18	45	97
106	32	+22294	60	40	+ 10.00	0.34	145	0	0.34	151	0	0.19	145	0
106	32	+22303	61	38	+ 9.74	0.28	155	0	0.28	135	0	0.12	148	0
106	32	+22329	62	29	+ 8.96	0.32	47	96	0.32	39	98	0.23	47	96
106	32	+22337	63	40	+ 8.73	0.45	20	50	0.45	20	50	0.29	97	57
106	32	+22362	64	25	+ 8.07	0.49	25	63	0.49	27	68	0.22	33	83
106	32	+22376	65	18	+ 7.66	0.46	174	0	0.46	160	0	0.18	121	22
106	32	+22400	66	51	+ 6.91	0.87	186	0	0.87	191	0	0.20	40	100
106	32	+22420	67	49	+ 6.36	0.63	122	20	0.63	127	10	0.52	117	29
106	32	+22686	70	15	-1.29	0.40	182	0	0.40	183	0	0.06	16	40
106	32	+22728	71	31	-2.47	0.51	195	0	0.51	185	0	0.14	16	40
41	44	+ 22541	75	37	+ 15.56	0.60	118	31	0.60	111	42	0.53	118	31
41	44	+ 22619	76	30	+ 13.40	0.66	39	98	0.83	30	75	0.42	39	98
41	44	+ 22678	77	55	+ 11.69	0.60	123	22	0.60	78	77	0.50	123	22
41	44	+ 22780	78	35	+ 8.78	0.34	36	90	0.28	73	81	0.25	62	88
41	44	+ 22845	79	28	+ 6.93	0.67	108	46	0.67	101	54	0.65	102	53
41	44	+ 22891	80	40	+ 5.61	0.35	76	78	0.35	93	63	0.34	76	78
50	13	+ 22849	85	6	014 -1.01	0.09	18	45	0.09	13	33	0.04	45	97
134	58	+ 22160	91	47	013+ 8.38	0.05	90	59	0.05	79	70	0.05	90	59
134	58	+ 22175	92	47	013+ 8.76	0.05	104	42	0.05	99	49	0.05	90	59
134	58	+ 22201	93	47	013+ 9.42	0.11	72	76	0.11	73	75	0.11	72	76
134	58	+ 22616	94	21	013+19.89	0.03	53	91	0.03	34	85	0.02	53	91