TES

SIZING OF PWSCC INDICATIONS IN DENTED STEAM GENERATOR TUBES PULLED DURING DIABLO CANYON UNIT 1 SEVENTH REFUELING OUTAGE

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SUMMARY

This report contains the Nondestructive Examination results of indications reported during the Diablo Canyon Unit 1 seventh refueling outage in three tubes in Steam Generator 1-2. These three tubes are: R10C22, R14C69, and R21C43. After testing with several NDE methods and various equipment, the tubes were pulled for later destructive testing and analysis. This report documents the various analyses of the NDE data for comparison with future tube destructive test results.

1.0 INTRODUCTION

During the Diablo Canyon Unit 1 Seventh Refueling Outage (1R7) in October, 1995, PG&E pulled four tubes in Steam Generator 1-2 to examine primary water stress corrosion cracking (PWSCC) indications at dented tube to tube support plate (TSP) intersections. The four tubes are: R21C43, R10C22, R14C69, and R12C32.

R21C43 has two axial indications at the lowest TSP on the hot leg side (1H), R10C22 an axial indication at the second to the lowest TSP on the hot leg side (2H), R14C69 a circumferential indication at 1H, and R12C32 an axial indication at 1H. R21C43, R10C22, and R14C69 will be burst tested and destructively examined. R12C32 will be archived for future use, such as nondestructive examinations (NDE) with advanced techniques.

Prior to pulling, these four tubes, along with 14 other tubes, were reexamined with various NDE techniques including bobbin coil, rotating pancake coil (RPC), array coil, and ultrasonic testing (UT). Technical and Ecological Services (TES) of PG&E has sized using the RPC data four PWSCC indications in the three tubes that will be destructively examined.

PG&E also had three outside organizations size the PWSCC indications using the RPC data: Zetec, EPRI NDE Center, and Westinghouse. Zetec and EPRI NDE Center used the Zetec Eddynet 95 software for sizing, whereas TES and Westinghouse used the Westinghouse ANSER software for sizing. Using Eddynet 95, the depth of a circumferential crack can be measured around the tube circumference, i.e., depth vs. circumferential position.

The current industry practice is to repair a tube with any crack-like indication confirmed by RPC. It is because a crack-like indication, unlike a wear or thinning indication, is difficult to size. If accurate sizing can be demonstrated, it may be possible in the future to leave in service a crack-like indication of less than 40% through-wall depth. In order to qualify sizing techniques, however, samples of pulled tubes and lab induced cracks are required.

This report discusses in detail the results of sizing of four PWSCC indications in the three tubes that will be destructively examined. The RPC data was used for sizing. Also, the results of UT sizing are summarized in Appendix A.

2.0 DATA ACQUISITION

2.1 Equipment

RPC examinations were performed by Westinghouse using an R/D Tech TC-6700 eddy current instrument, a Westinghouse remote positioner, a Zetec RPC motor unit, and Zetec RPC probes. Three types of RPC probes were used: +Point, 3-Coil, and gimbaled +Point specially designed for dented TSPs.

2.2 +Point Probe

The +Point probe (Zetec D# 3531-1-A) was used throughout the 1R7 outage. It has three coils mounted around the probe body circumference, 120 degrees apart.

(1) 0.115 inch diameter mag-biased pancake coil (115MB),
(2) +Point coil (PP36), and
(3) 0.080 inch diameter shielded high frequency pancake coil (S80).

115MB coil has two post magnets for suppression of permeability variation.

2.3 3-Coil Probe

The 3-Coil probe (Zetec D# 2874-1-A) was used for tube pull candidates only. It has three coils mounted around the probe body circumference like a +Point probe.

(1) 0.115 inch diameter mag-biased pancake coil (115MB),
(2) circumferentially wound coil, sensitive to axially oriented flaw (Axial), and
(3) axially wound coil, sensitive to circumferentially oriented flaw (Circ.)

Axial and Circ. coils together are frequently referred to as "directional coils," since they are used to help determine the orientation of an indication.

2.4 Gimbaled +Point Probe

The gimbaled +Point probe (Zetec D# 3220-3-C) was used for tube pull candidates only. It has a single +Point coil (GPP36) mounted on the probe body. A specially designed mechanical device allows the coil to ride the surface exceptionally well.

2.5 Calibration Standard for RPC Examinations

A guide tube standard was used for RPC examinations. It contains a drilled hole and 12 EDM notches as follows:

Orientation	Origin	20%	40%	60%	80%	100%	Comments
Drilled hole						100%	0.067" diameter
Axial EDM	ID	22%	39%			100%	ID/OD same
Axial EDM	OD	19%	41%	60%		100%	ID/OD same
Circ. EDM	ID	20%	38%			100%	ID/OD same
Circ. EDM	OD	20%	42%	61%		100%	ID/OD same

(1) Guide tube standard serial number: Z-14219.
(2) The drilled hole diameter is the same as ASME diameter for 7/8 inch tubing.
(3) All EDM notches are 0.500 inch long and 0.005 inch max. wide.

2.6 Test Configurations

Test configuration for the +Point probe was as follows:

Frequency	115MB	Trigger	PP36 Ax.	PP36 Circ.	S80
800 kHz					Ch 11
600 kHz					Ch 12
300 kHz	Ch 7	Ch 14	Ch 1	Ch 2	Ch 13
200 kHz	Ch 8		Ch 3	Ch 4	
100 kHz	Ch 9		Ch 5	Ch 6	
10 kHz	Ch 10				

(1) PP36 Ax. - +Point coil data with axial indication going up.
(2) PP36 Circ. - +Point coil data with circ. indication going up.
(3) Trigger - Trigger channel for C-scan plotting.

Test configuration for the 3-Coil probe was as follows:

Frequency	115MB	Trigger	Axial	Circ.
400 kHz	Ch 1		Ch 2	Ch 3
300 kHz	Ch 4		Ch 5	Ch 6
200 kHz	Ch 7		Ch 8	Ch 9
100 kHz	Ch 10	Ch 11	Ch 12	Ch 13

Test configuration for the gimbaled +Point probe was as follows:

Frequency	GPP36 Ax.	GPP36 Circ.	Trigger
300 kHz	Ch 1	Ch 2	Ch 9
200 kHz	Ch 3	Ch 4	
100 kHz	Ch 5	Ch 6	
10 kHz	Ch 7	Ch 8	

(1) GPP36 Ax. - Gimbaled +Point coil data with axial indication going up.
(2) GPP36 Circ. - Gimbaled +Point coil data with circ. indication going up.

3.0 PARTICIPANTS FOR SIZING

Four organizations have participated in sizing the pulled tubes: PG&E, Zetec, EPRI NDE Center, and Westinghouse.

3.1 PG&E

Sizing was performed by TES in San Ramon, California. The 1R7 eddy current data which was being stored in data bank at the Westinghouse Waltz Mill Site was down loaded to ANSER 700 TC-6700 format. ANSER was used for sizing.

3.2 Zetec

Sizing was performed by Field Service Department in Issaquah, Washington. The field data was down loaded to ANSER 400 TC-6700 format. The data was then converted to Eddynet format. Eddynet 95 was used for sizing.

3.3 EPRI NDE Center

Sizing was performed by EPRI NDE Center in Charlotte, North Carolina. EPRI NDE Center was provided with the converted data. Eddynet 95 was used for sizing.

3.4 Westinghouse

Sizing was performed by Steam Generator Operations (SGO) at the Waltz Mill Site in Madison, Pennsylvania. ANSER was used for sizing.

4.0 SCOPE OF SIZING

4.1 The scope of sizing was as follows:

SG	R	C	%	TSP	Comments
12	21	43	MAI	1H	Pulled, to be burst tested, two axial indications
12	10	22	SAI	2H	Pulled, to be burst tested, a short axial indication
12	14	69	SCI	1H	Pulled, to be burst tested, a circumferential indication

(1) MAI - multiple axial indications.
(2) SAI - single axial indication.
(3) SCI - single circumferential indication.

4.2 Actual sizing performed by each participant is summarized below:

Test Coil	SG12 R21 C43	SG12 R10 C22	SG12 R14 C69
115MB coil of +Point probe	P, Z, E, W	P, Z, E, W	P, Z, E, W
PP36 coil of +Point probe	P, Z, E, W	P, Z, E, W	P, Z, E, W
S80 coil of +Point probe	P, Z, E, W	P, Z, E, W	P, Z, E, W
115MB coil of 3-Coil probe	P, W	P, W	P, W
Axial coil of 3-Coil probe	P	P	P
Circ. coil of 3-Coil probe	P	P	P
Gimbaled +Point probe	P, Z, W	P, Z, W	P, Z, W

(1) P - PG&E.
(2) Z - Zetec.
(3) E - EPRI NDE Center.
(4) W - Westinghouse.

5.0 SIZING TECHNIQUES

All four participants used phase angle for sizing.

5.1 Volts Scale

PG&E, EPRI NDE Center, and Westinghouse set a 100% axial notch to 20 volts for axial channel and a 100% circ. notch to 20 volts for circ. channel. On the other hand, Zetec set a 40% OD axial notch to 1 volt for axial channel and a 40% OD circ. notch to 1 volt for circ. channel. The Zetec method produces a higher voltage reading for an ID indication.

5.2 Phase Rotation

In general, the probe motion is set horizontal. With the probe motion set horizontal, it is easier to detect an indication in a vertical strip chart or C-scan plot. However, for good detection of a shallow ID indication, the probe motion may be slightly rotated up.

Phase rotation for sizing may be performed in several ways. Setting the probe motion horizontal is one method. With this method the phase angle of a 20% ID notch signal for a pancake coil is close to zero degree. A 100% notch is approximately 25 degrees. That is, the phase spread between a 0% and 100% notch is only about 25 degrees. Each degree represents 4% for an ID indication assuming a linear relationship between the phase angle and percent through-wall depth.

A second method is to set the phase angle of a 40% ID notch signal to 15 degrees for all coils, i.e., pancake and +Point. With this method the phase angle of a 100% notch is approximately 35 degrees. Each degree represents about 3% for an ID indication.

A third method is to set the phase angle of a 100% notch signal to 40 degrees. Each degree now represents 2.5% for an ID indication.

The second or third method should work well for a +Point coil with which probe motion is virtually nonexistent. The first or second method is acceptable for a pancake coil.

PG&E, EPRI NDE Center, and Westinghouse used combination of all three methods. On the other hand, Zetec used the second method exclusively.

5.3 Calibration Curve for Depth Measurement

In general, a three point curve is established for each orientation (axial or circ.) and origin (ID or OD). For example,

(1) For OD axial indication, use 100% axial, 60% OD axial, and 40% OD axial.
(2) For OD circ. indication, use 100% circ., 60% OD circ., and 40% OD circ.
(3) For ID axial indication, use 100% axial, 40% ID axial, and 20% ID axial.
(4) For ID circ. indication, use 100% circ., 40% ID circ., and 20% ID circ.

The features of Eddynet 95 analysis software include axial line filter for subtracting roll transition at top of the tubesheet and axial lissajous plot for a circ. indication for depth measurements around the tube circumference at certain intervals. Use of the axial lissajous feature provides greater consistency in measuring the arc length since it can detect the start and end of circ. indications, according to Zetec Memo, "Measurement of Circumferential Crack Depths," dated December 1, 1995.

5.4 Selection of Test Frequency for Sizing

In general, the prime test frequency is used for sizing. EPRI recommends the 300 kHz data for 115MB and PP36 coils, and the 600 kHz data for S80 coil, according to EPRI Memo, "ECT Data Collection for the Application of Crack Sizing Techniques," dated November 20, 1995.

The selection of test frequency for sizing by each participant is summarized below:

Test Coil	PG&E	Zetec	EPRI NDE Center	Westinghouse
115MB coil of +Point probe	300 kHz	300 kHz	300 kHz	300 kHz
PP36 coil of +Point probe	300 kHz	300 kHz	300 kHz	300 kHz
S80 coil of +Point probe	600 kHz	600 kHz	600 kHz	800 kHz
115MB coil of 3-Coil probe	400 kHz			
115MB coil of 3-Coil probe	300 kHz			300 kHz
Axial coil of 3-Coil probe	300 kHz			
Circ. coil of 3-Coil probe	300 kHz			
Gimbaled +Point probe	300 kHz	300 kHz		300 kHz

6.0 RESULTS OF SIZING

6.1 Tables 1, 2, and 3 summarize the results of sizing by each participant for each indication using 115 MB, PP36, and S80 coils, respectively, of the +Point probe.

6.2 Figures 1 through 16 are the corresponding depth profiles of the indications. Figures 1 through 4, 5 through 8, 9 through 12, and 13 through 16 are depth profiles produced by PG&E, Zetec, EPRI NDE Center, and Westinghouse, respectively.

6.3 Tables 4, 5, and 6 summarize the results of additional sizing by each participant for each indication using 115MB coil of the 3-Coil RPC probe, directional coils of the 3-Coil RPC probe, and GPP36 coil of the gimbaled +Point probe, respectively.

7.0 DISCUSSION

7.1 Both 115 mil and 80 mil pancake coils produce liftoff signals at a dented TSP intersection. As a result, phase angle measurements and thus percent through-wall depth measurements can be significantly affected by placement of the measurement balls. This can lead to inconsistent depth measurements.

7.2 On the other hand, a +Point coil such as PP36 or GPP36 minimizes liftoff signals caused by a dent. Therefore, use of a +Point coil allows more consistent depth measurements. The accuracy of sizing with a +Point coil, however, remains to be seen pending the destructive examination results of the pulled tubes.

7.3 A gimbaled +Point probe is effective for a severely dented tube. At this point, it doesn't seem necessary to use a gimbaled probe on a production basis at Diablo Canyon.

7.4 It appears that phase angle measurements at the start and end of a PWSCC indication are affected by fringe effect. Depth measurements at the start and end points seem to be highly conservative.

7.5 It also appears that length measurements are dependent upon the depth of a PWSCC indication. It seems that a shallow indication could possibly be underestimated and a deep indication overestimated.

7.6 For an axially oriented indication, depth measurements from the endpoints of the indication along the length of the tube are desired. For a circumferentially oriented indication, depth measurements from the endpoints of the indication around the tube circumference are desired. In addition, for SCI, the area affected by cracking is desired.

7.7 When the destructive examination results become available, the sizing guidelines will be reviewed and, if necessary, changes will be made.

Table 1

Sizing of Diablo Canyon 1R7 PWSCC Indications Using 0.115 inch MB Pancake Coil of Zetec +Point Probe (D# 3531-1-A)

Company	SG12 R21 C43 MAI @1H		SG12 R10 C22 SAI @2H		SG12 R14 C69 SCI @1H	
	Length	Depth	Length	Depth	Arc	Depth
PG&E	.90"	48.9%	NDD		84 deg.	66.3%
300 kHz	.27"	45.9%				
Zetec	1.08"	46.5%	NDD		54 deg.	72.8%
300 kHz	.49"	35.8%				
EPRI	1.10"	50.4%	.21"	39.1%	82 deg.	35.5%
300 kHz	.45"	52.3%				
Westinghouse	.94"	57.5%	NDD		95 deg.	86.5%
300 kHz	.30"	54.9%				

Length -- overall length in inch
Depth -- average depth in percent through-wall loss
Arc -- circumferential extent in degrees
NDD -- no degradation detected

R21C43 has two axial indications (MAI). Both of these were sized.

Table 2

Sizing of Diablo Canyon 1R7 PWSCC Indications Using +Point Coil of Zetec +Point Probe (D# 3531-1-A)

Company	SG12 R21 C43 MAI @1H		SG12 R10 C22 SAI @2H		SG12 R14 C69 SCI @1H	
	Length	Depth	Length	Depth	Arc	Depth
PG&E	1.00"	51.0%	.46"	29.8%	30 deg.	79.4%
300 kHz	.33"	42.3%				
Zetec	.83"	49.6%	.16"	27.8%	27 deg.	56.5%
300 kHz	.23"	37.8%				
EPRI	.97"	45.5%	.20"	33.4%	188 deg.	66.2%
300 kHz	.32"	33.3%				
Westinghouse	.97"	51.7%	.32"	30.1%	33 deg.	78.9%
300 kHz	.35"	45.8%				

Length -- overall length in inch
Depth -- average depth in percent through-wall loss
Arc -- circumferential extent in degrees
NDD -- no degradation detected

R21C43 has two axial indications (MAI). Both of these were sized.

Table 3

Sizing of Diablo Canyon 1R7 PWSCC Indications Using 0.080 inch HF Coil of Zetec +Point Probe (D# 3531-1-A)

Company	SG12 R21 C43 MAI @1H		SG12 R10 C22 SAI @2H		SG12 R14 C69 SCI @1H	
	Length	Depth	Length	Depth	Arc	Depth
PG&E	.90"	51.1%	.18"	22.7%	84 deg.	51.8%
600 kHz	.24"	42.2%				
Zetec	1.01"	46.8%	.26"	24.5%	51 deg.	42.3%
600 kHz	.29"	35.9%				
EPRI	1.03"	48.5%	.61"	11.6%	196 deg.	25.7%
600 kHz	.36"	39.0%				
Westinghouse	.90"	60.8%	.33"	48.9%	80 deg.	57.3%
800 kHz	.30"	60.2%				

Length – overall length in inch
Depth – average depth in percent through-wall loss
Arc – circumferential extent in degrees
NDD – no degradation detected

R21C43 has two axial indications (MAI). Both of these were sized.

Table 4

Sizing of Diablo Canyon 1R7 PWSCC Indications Using 0.115 inch MB Pancake Coil of Zetec 3-Coil Probe (D# 2874-1-A)

Company	SG12 R21 C43 MAI @1H		SG12 R10 C22 SAI @2H		SG12 R14 C69 SCI @1H	
	Length	Depth	Length	Depth	Arc	Depth
PG&E 400 kHz	.89"	54.7%	NDD		83 deg.	56.0%
	.26"	50.9%				
PG&E 300 kHz	.89"	54.2%	.12"	61.3%	84 deg.	66.8%
	.26"	42.7%				
Zetec	Sizing not performed.					
EPRI	Sizing not performed.					
Westinghouse 300 kHz	.90"	56.3%	.33"	36.6%	91 deg.	64.4%
	.29"	49.7%				

Length -- overall length in inch
Depth -- average depth in percent through-wall loss
Arc -- circumferential extent in degrees
NDD -- no degradation detected

R21C43 has two axial indications (MAI). Both of these were sized.

Table 5

Sizing of Diablo Canyon 1R7 PWSCC Indications Using Directional Coils of Zetec 3-Coil Probe (D# 2874-1-A)

Company	SG12 R21 C43 MAI @1H		SG12 R10 C22 SAI @2H		SG12 R14 C69 SCI @1H	
	Length	Depth	Length	Depth	Arc	Depth
PG&E	.89"	60.2%	.15"	32.2%	90 deg.	50.3%
300 kHz	.22"	37.6%				
	(using axial coil ch)		(using axial coil ch)		(using circ. coil ch)	
Zetec	Sizing not performed.					
EPRI	Sizing not performed.					
Westinghouse	Sizing not performed.					

Length -- overall length in inch
Depth -- average depth in percent through-wall loss
Arc -- circumferential extent in degrees
NDD -- no degradation detected

R21C43 has two axial indications (MAI). Both of these were sized.

Table 6

Sizing of Diablo Canyon 1R7 PWSCC Indications Using +Point Coil of Zetec Gimbaled +Point Probe (D# 3220-3-C)

Company	SG12 R21 C43 MAI @1H		SG12 R10 C22 SAI @2H		SG12 R14 C69 SCI @1H	
	Length	Depth	Length	Depth	Arc	Depth
PG&E	1.04"	56.0%	.47"	36.1%	34 deg.	63.3%
300 kHz	.40"	52.1%				
Zetec	.73"	51.1%	.10"	17.0%	29 deg.	39.8%
300 kHz	.21"	44.1%				
EPRI	Sizing not performed.					
Westinghouse	.95"	77.3%	.53"	39.1%	39 deg.	51.9%
300 kHz	.37"	75.5%				

Length -- overall length in inch
Depth -- average depth in percent through-wall loss
Arc -- circumferential extent in degrees
NDD -- no degradation detected

R21C43 has two axial indications (MAI). Both of these were sized.

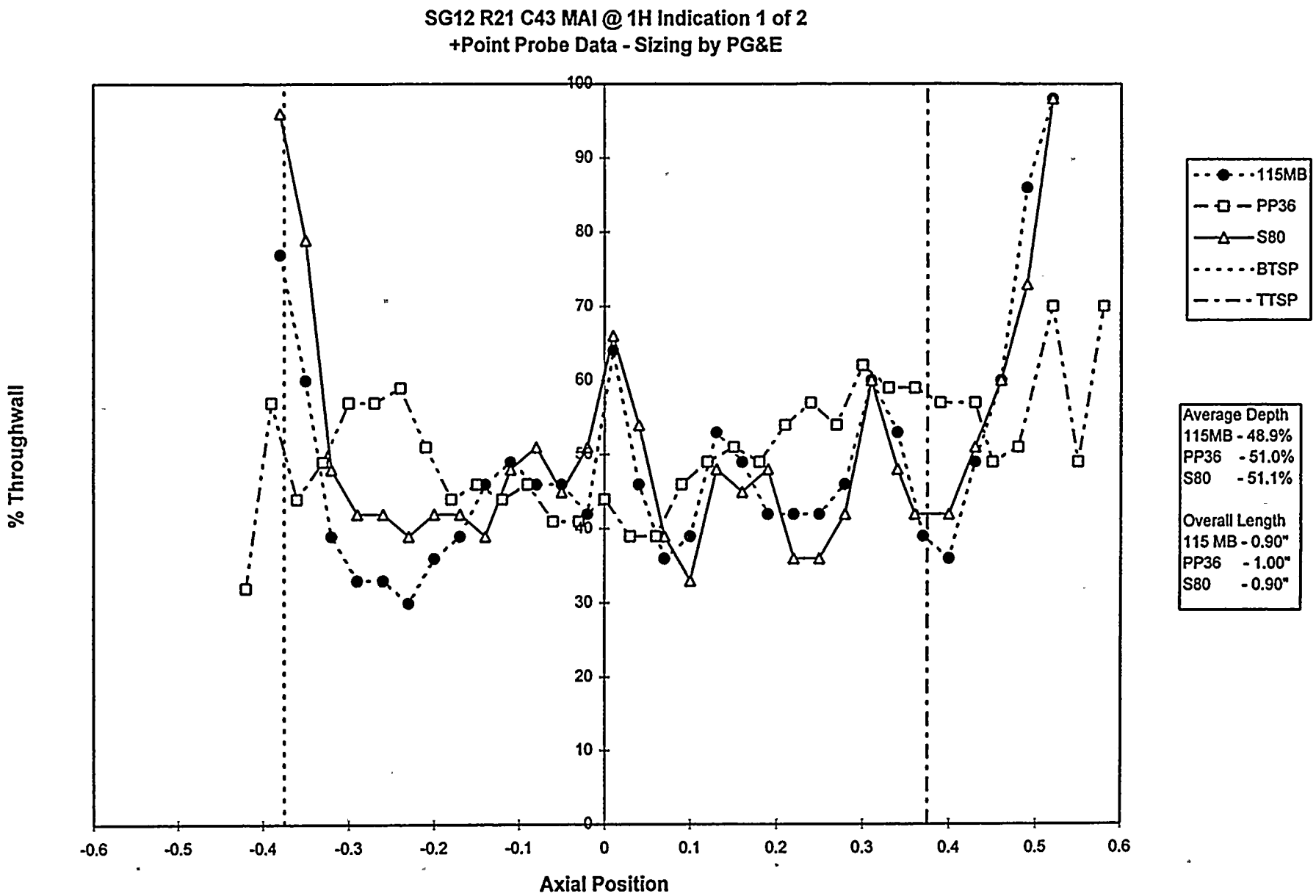

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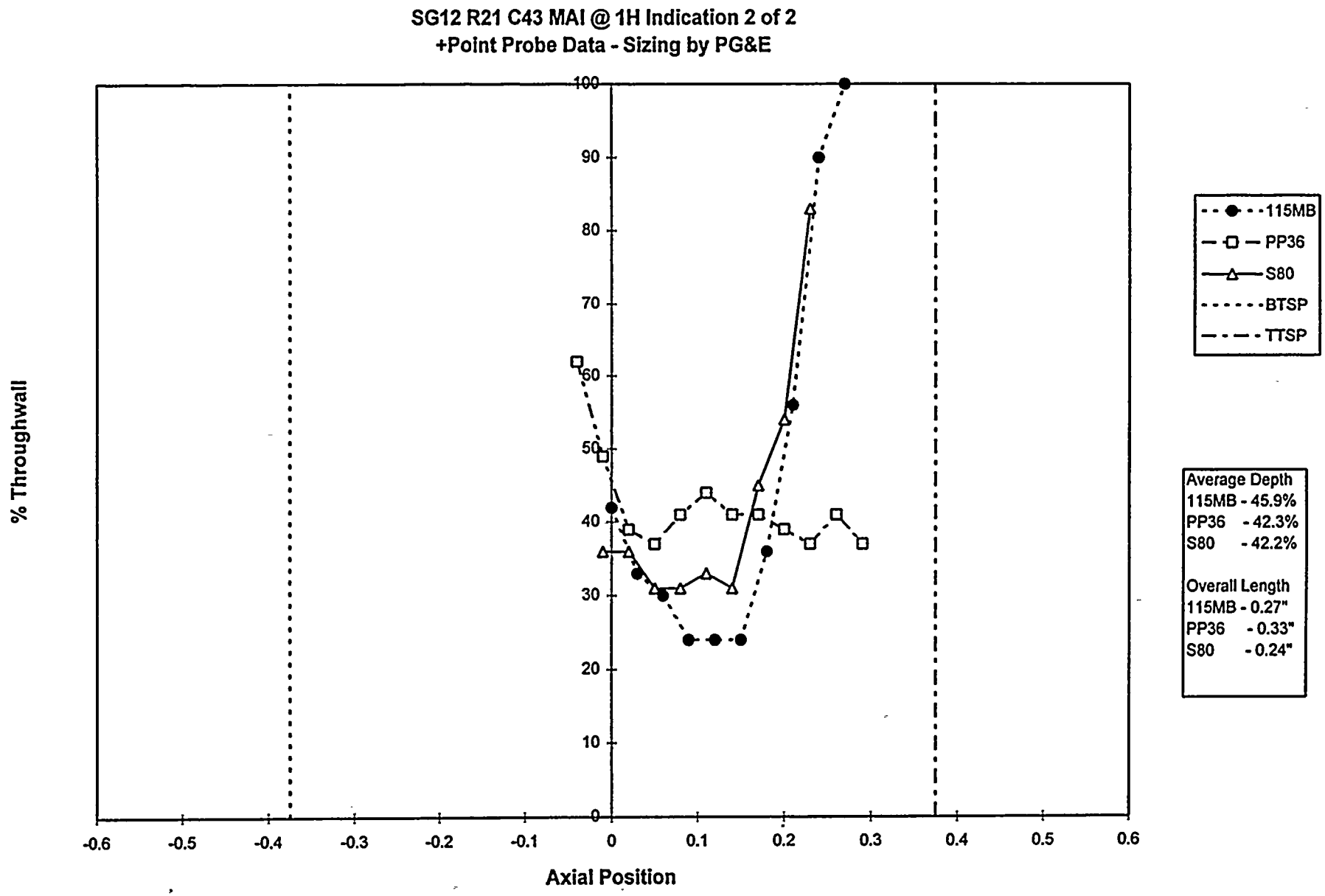
Figure 1



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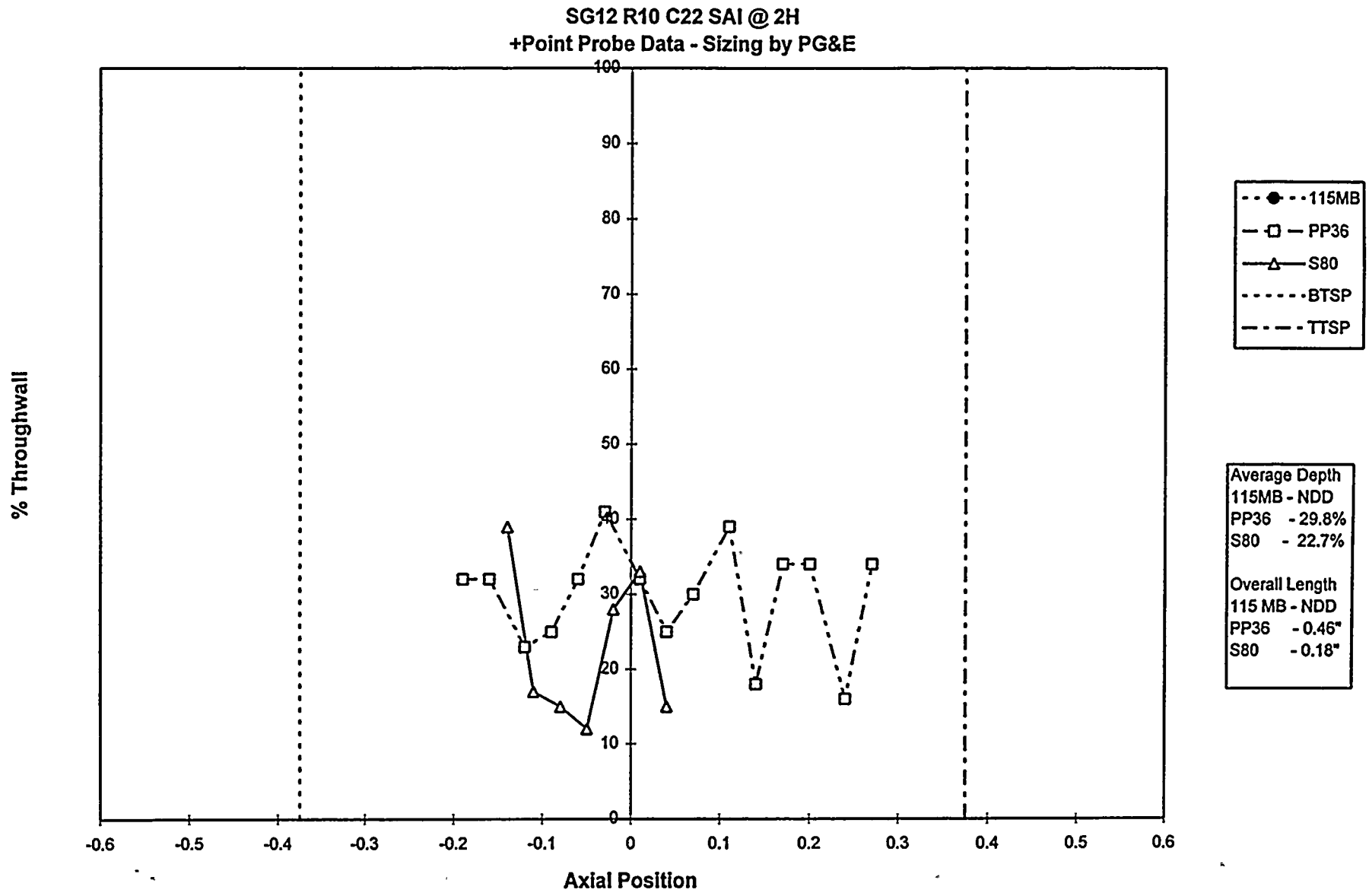

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Figure 3

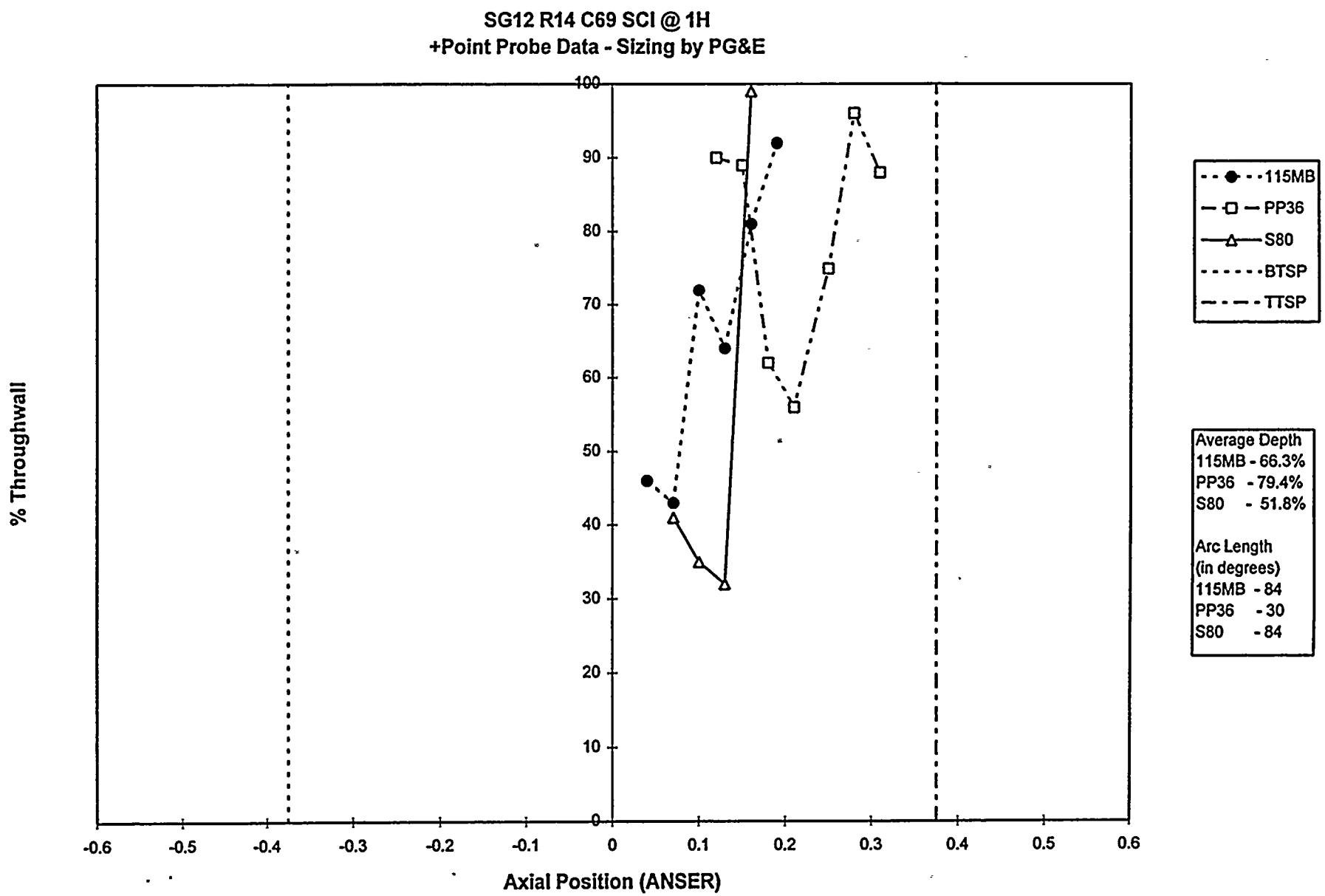

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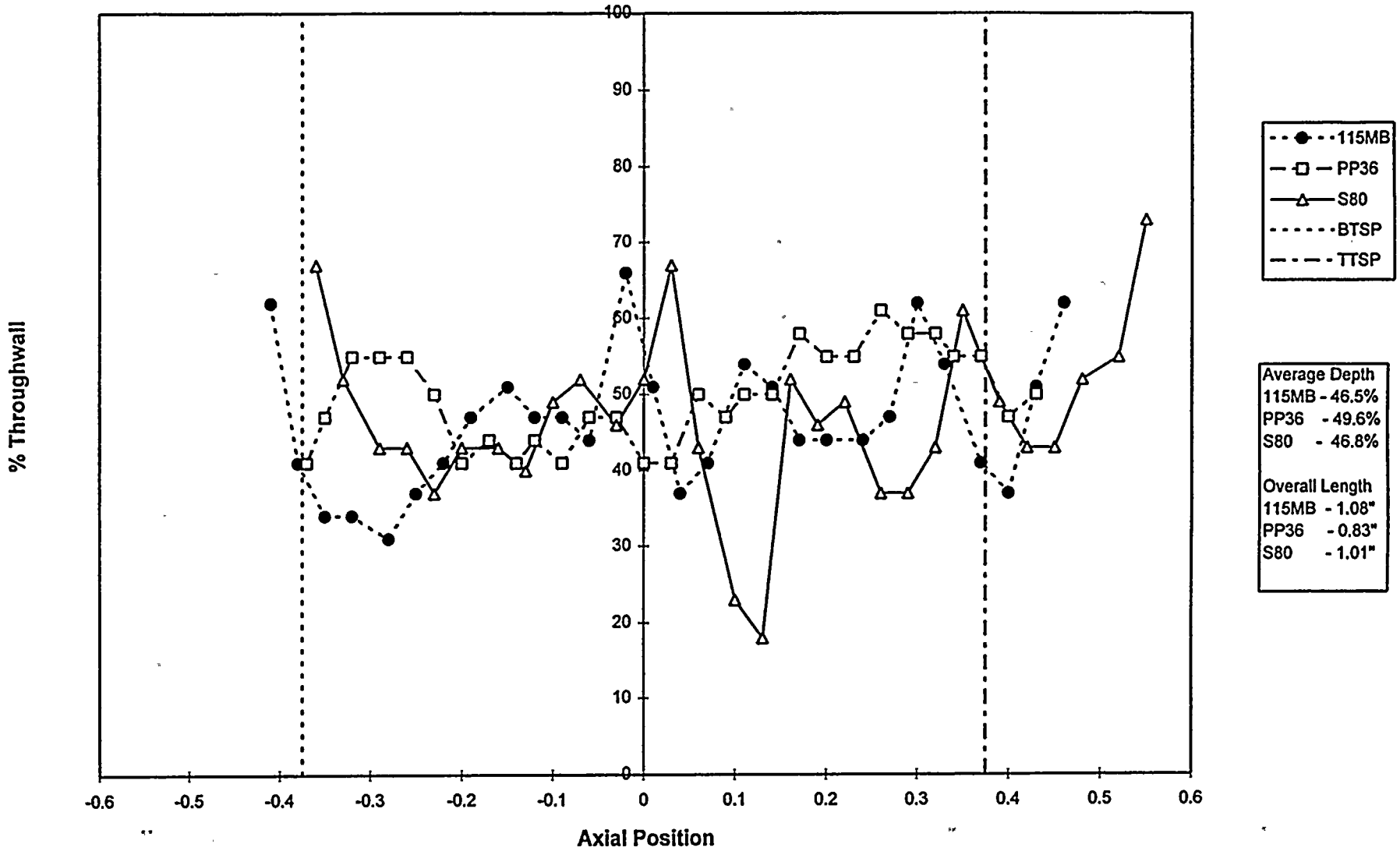
Figure 4

SG12 R21 C43 MAI @ 1H Indication 1 of 2
+Point Probe Data - Sizing by Zetec



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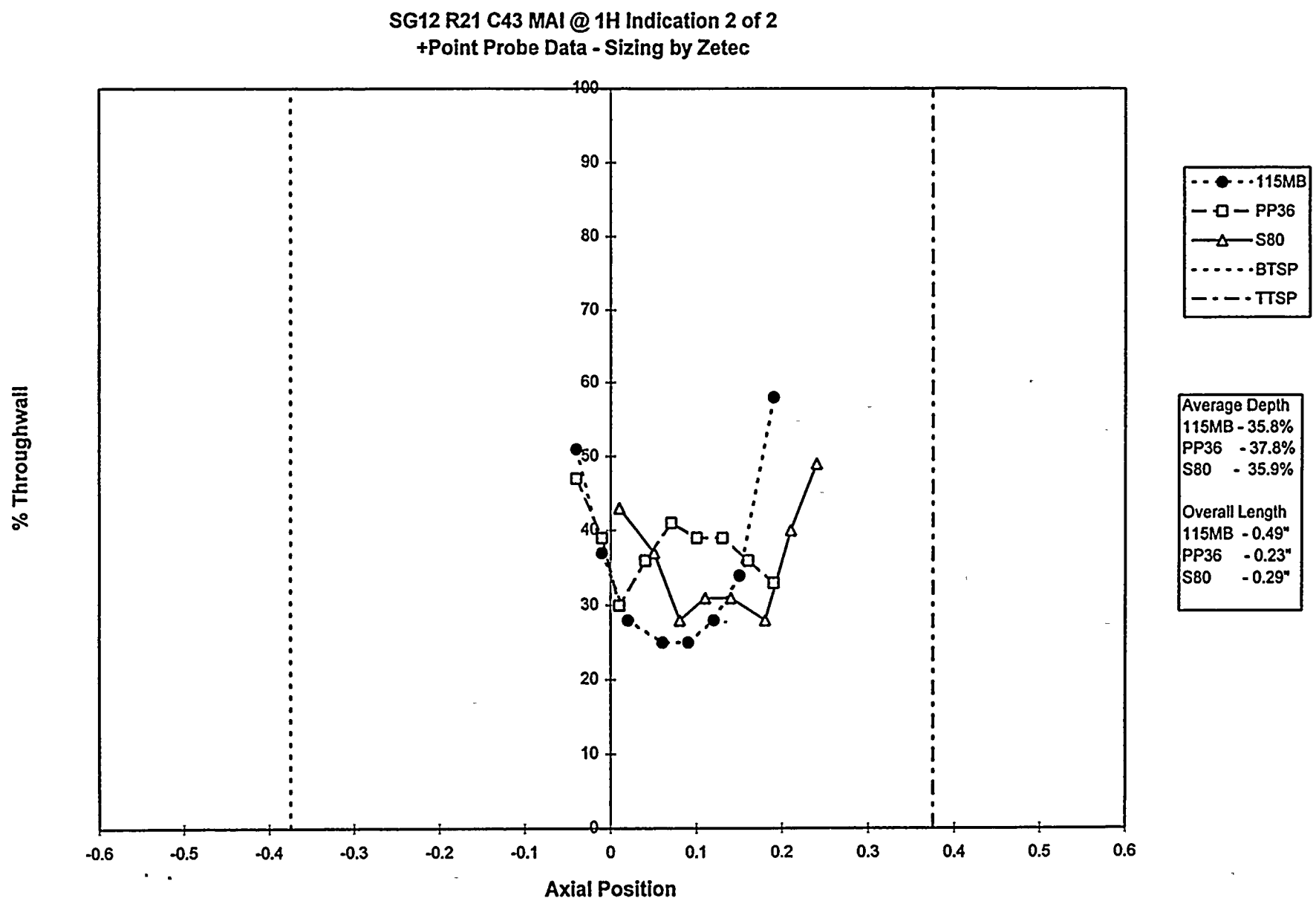

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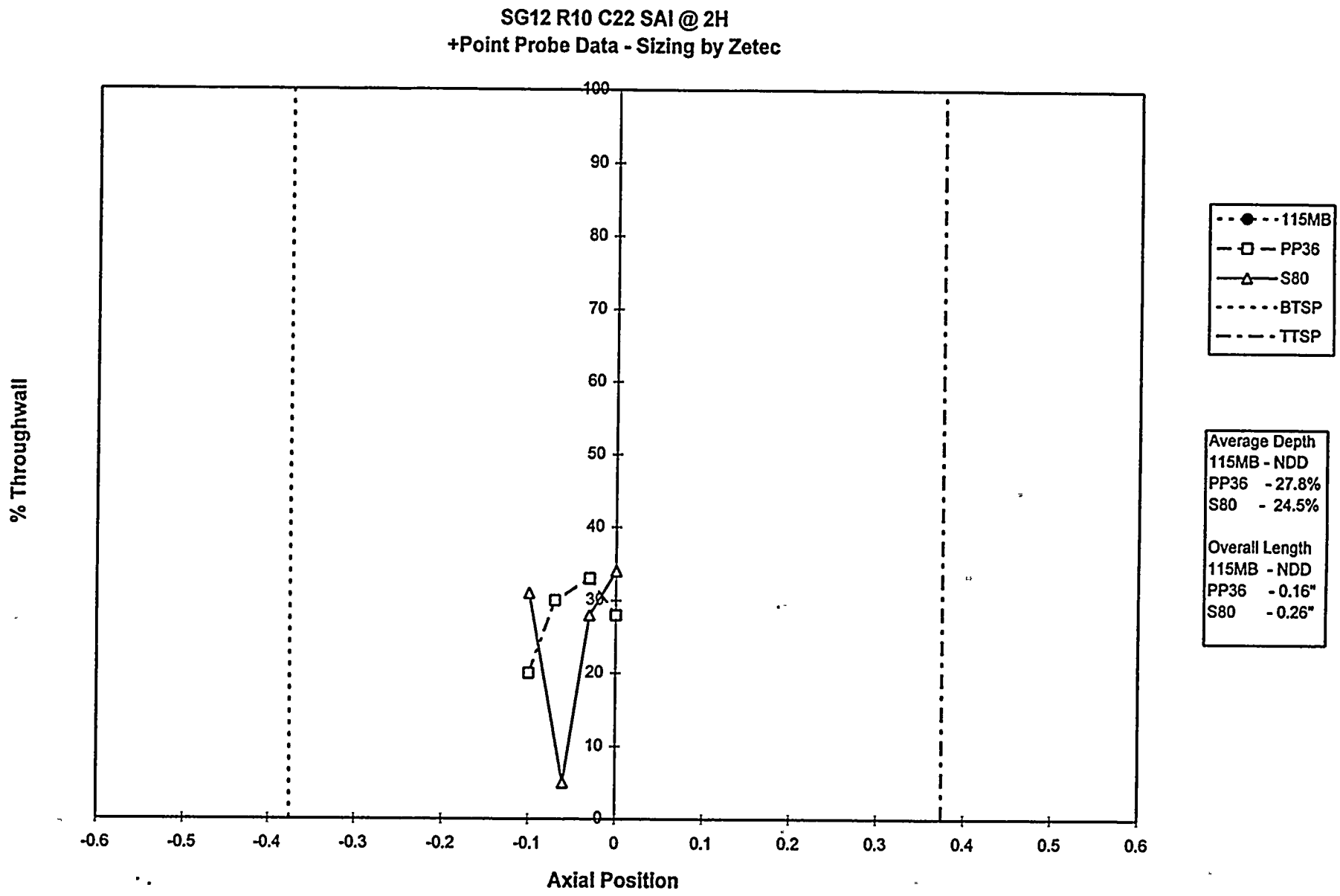

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Figure 7

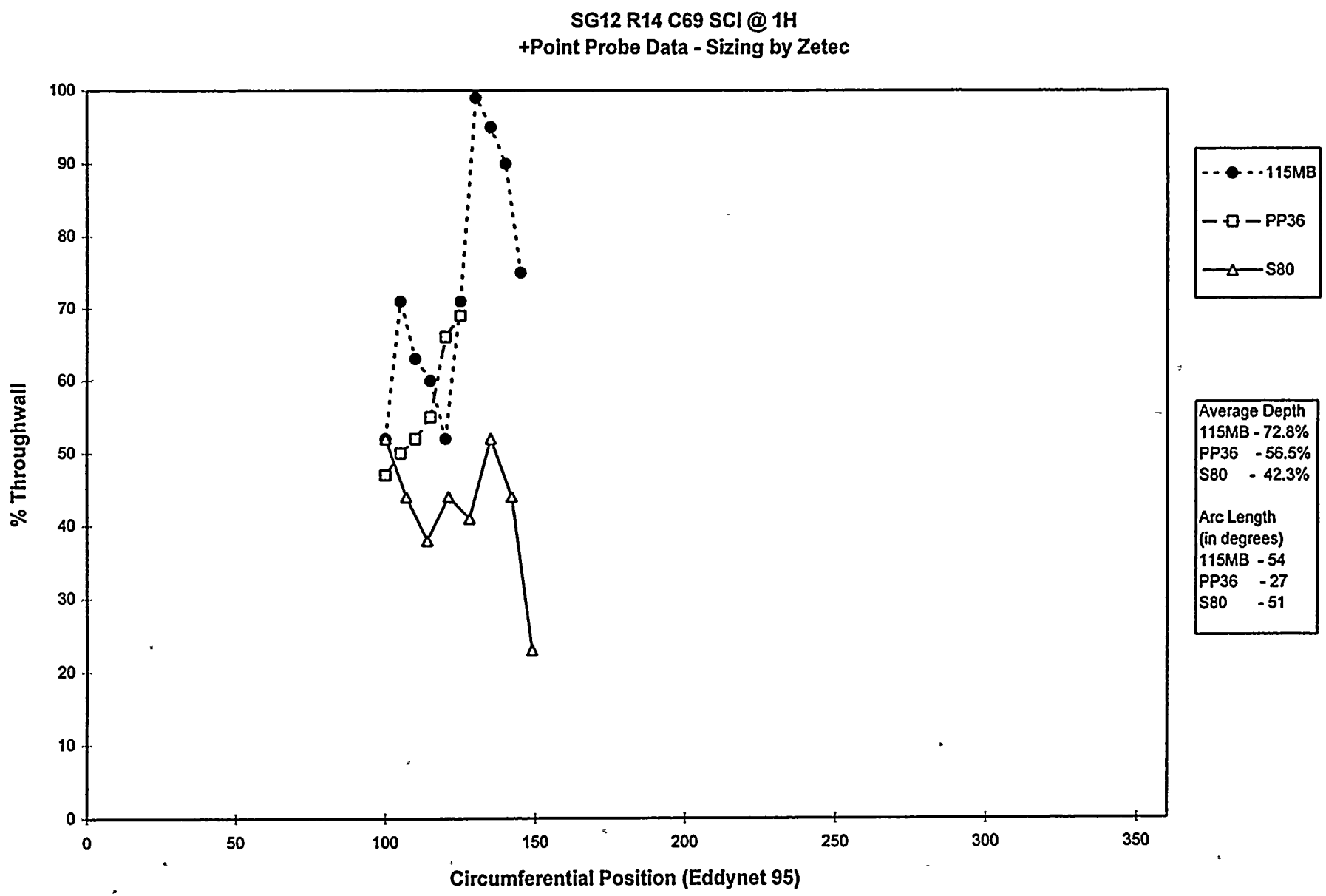

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Figure 8

SG12 R21 C43 MAI @ 1H Indication 1 of 2
+Point Probe Data - Sizing by EPRI NDE Center

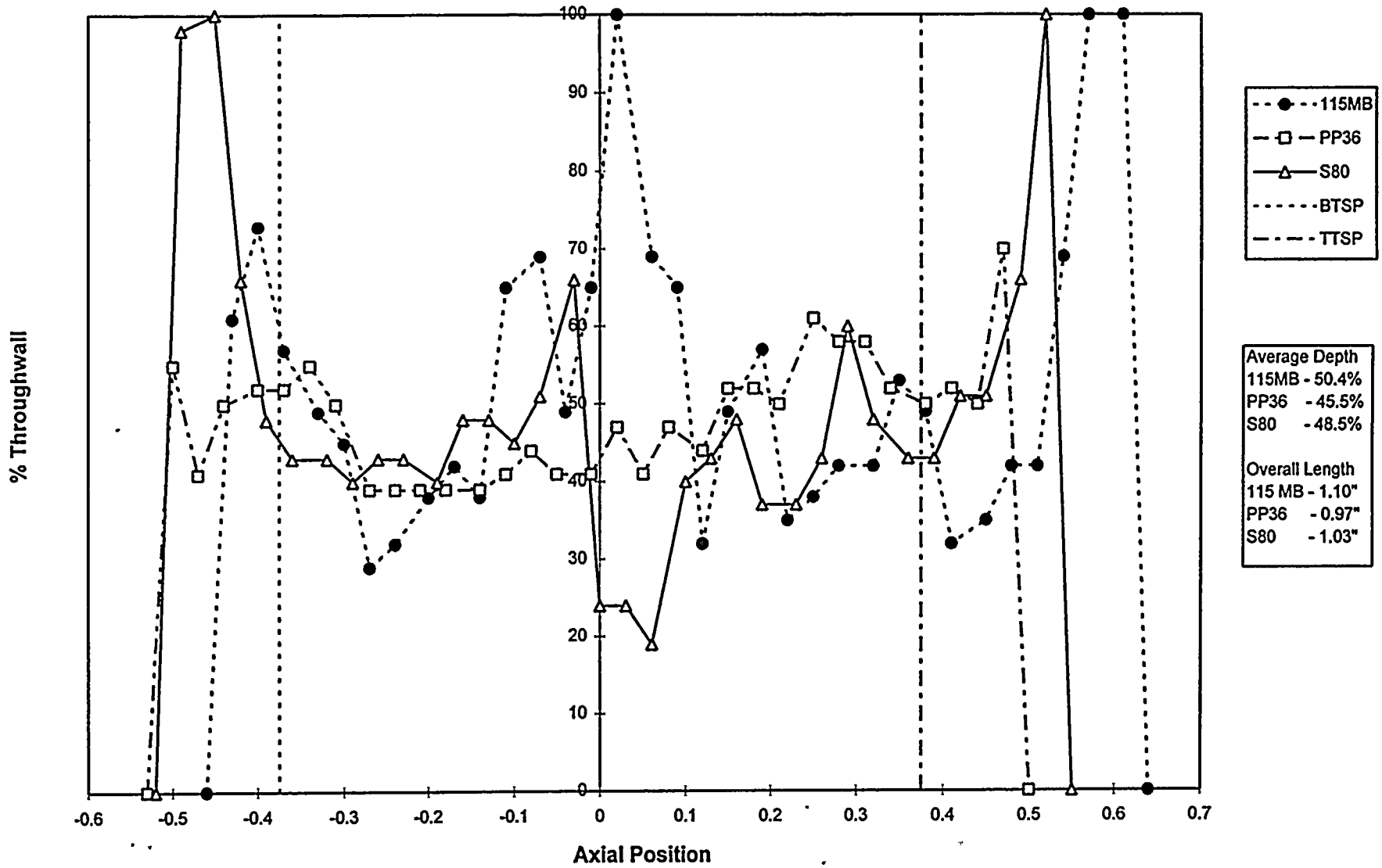

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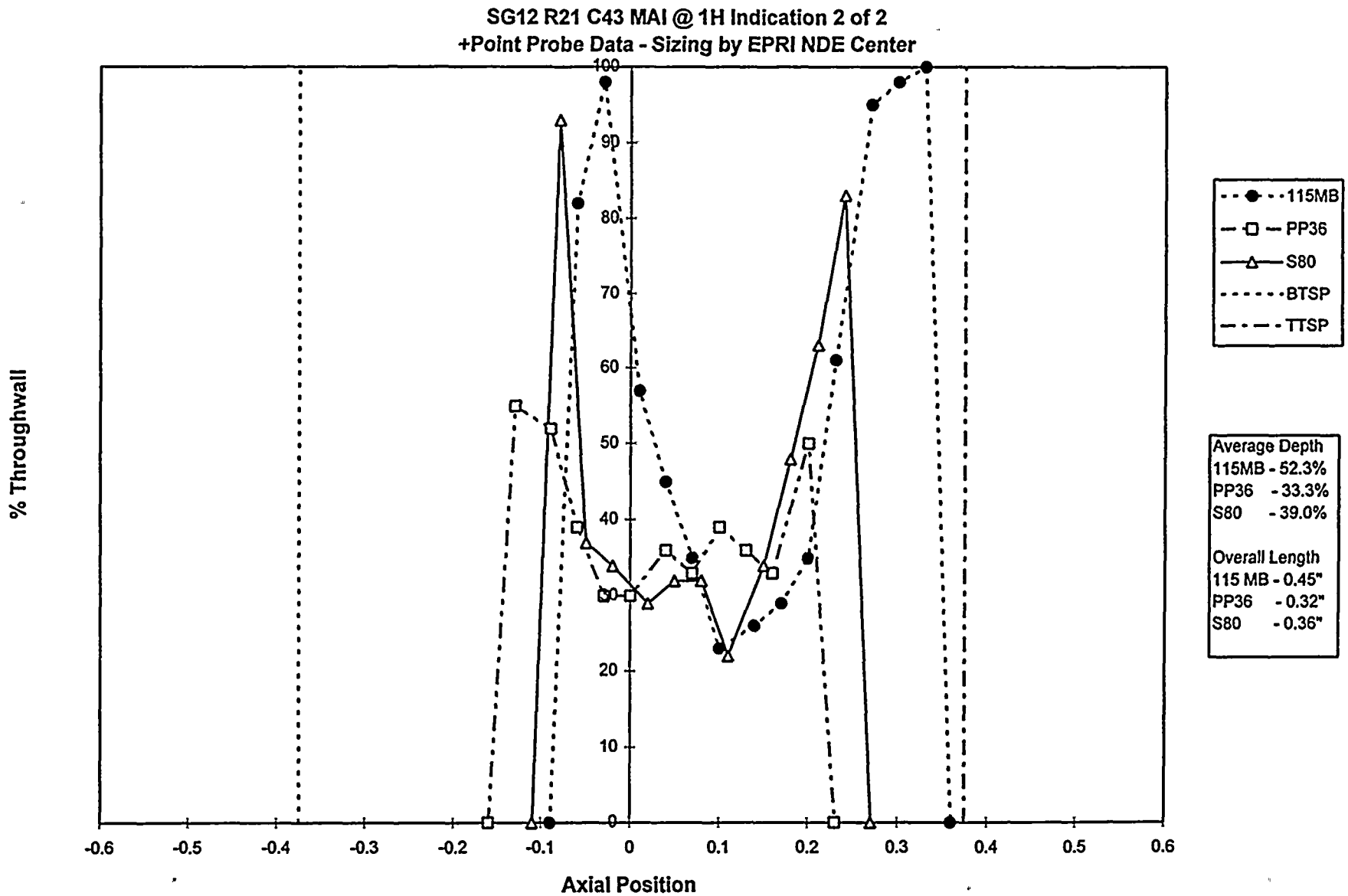
Figure 9



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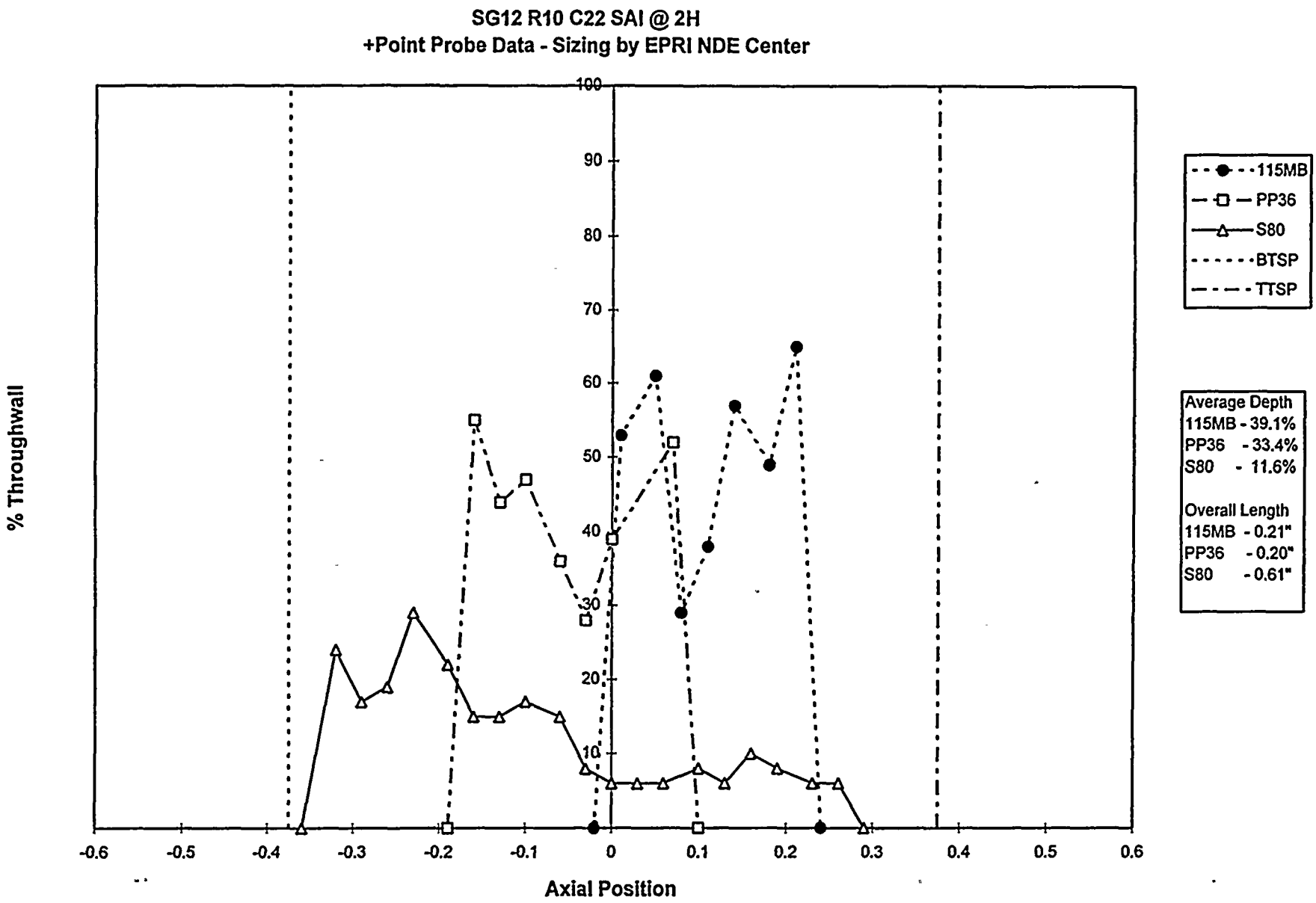

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Figure 11

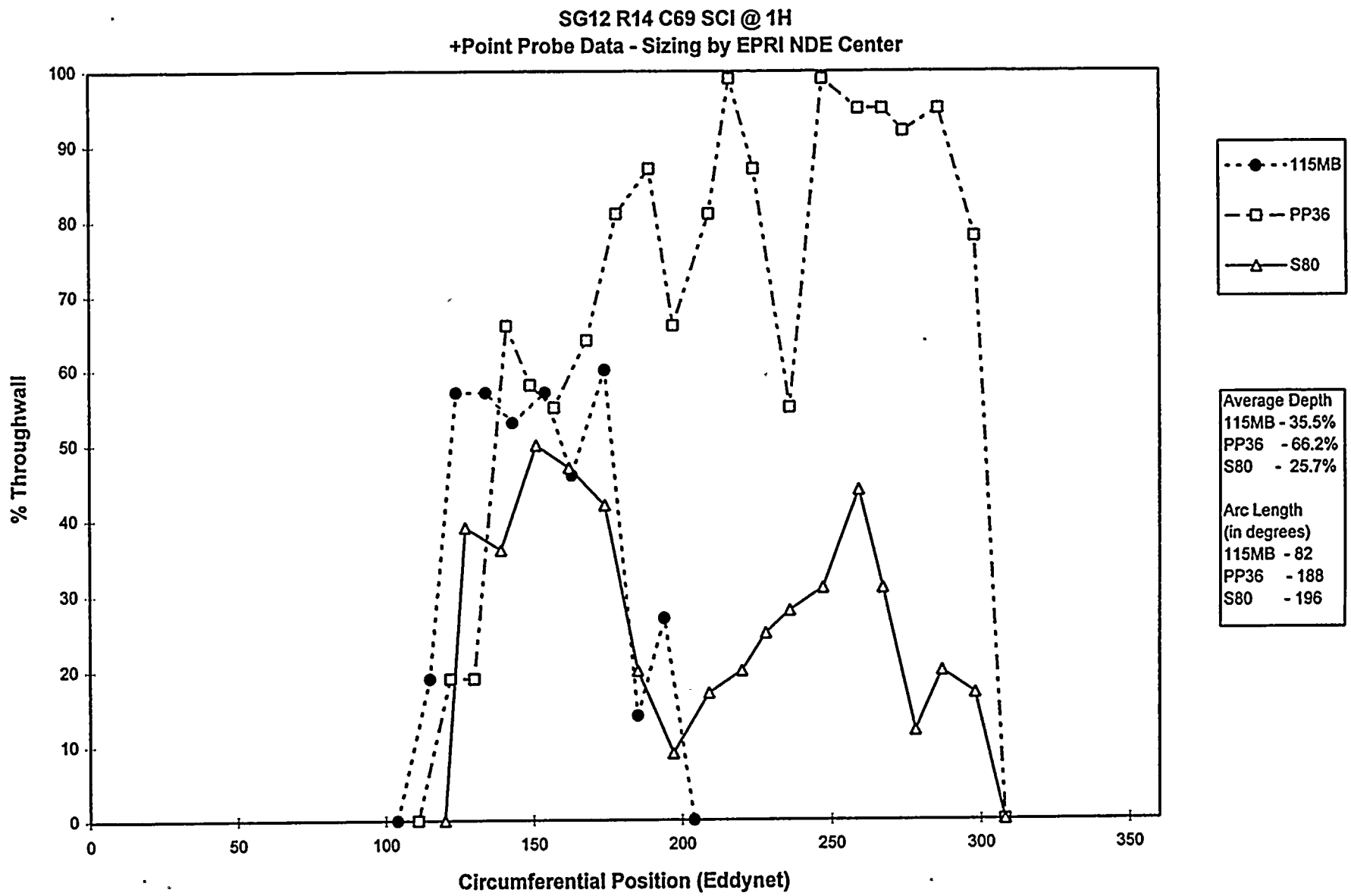

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Figure 12

SG12 R21 C43 MAI @ 1H Indication 1 of 2
+Point Probe Data - Sizing by Westinghouse

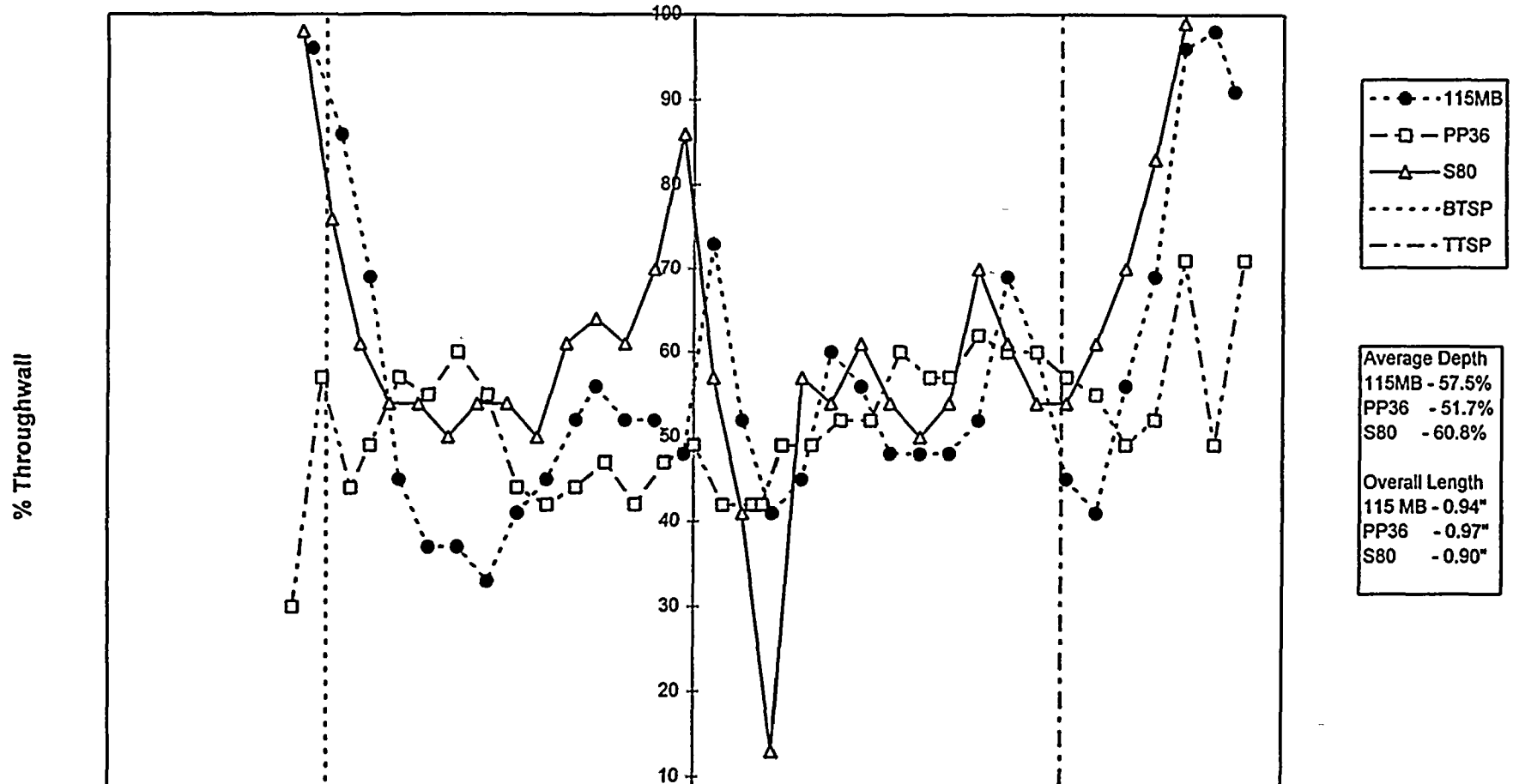

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Figure 13

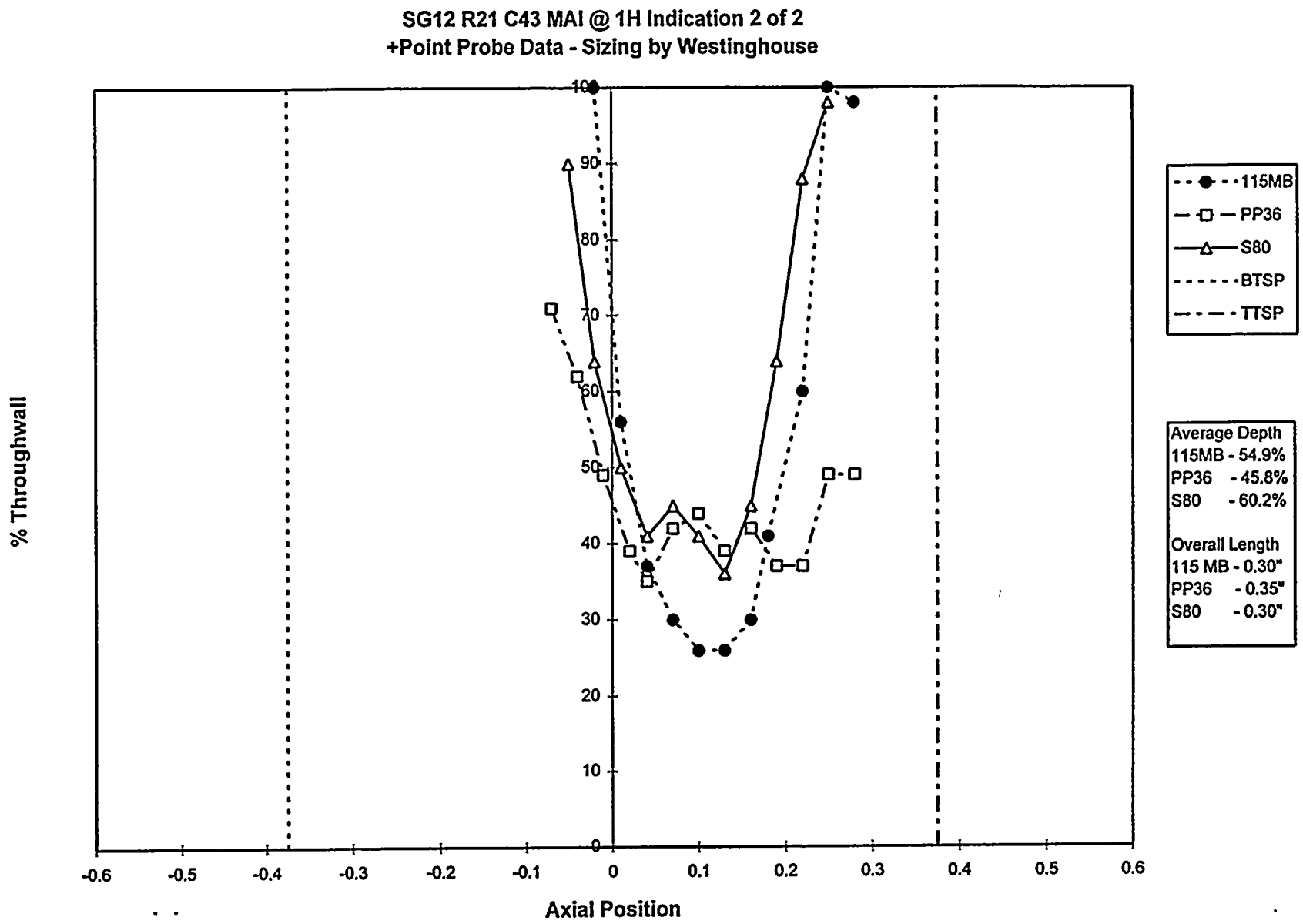

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Figure 14

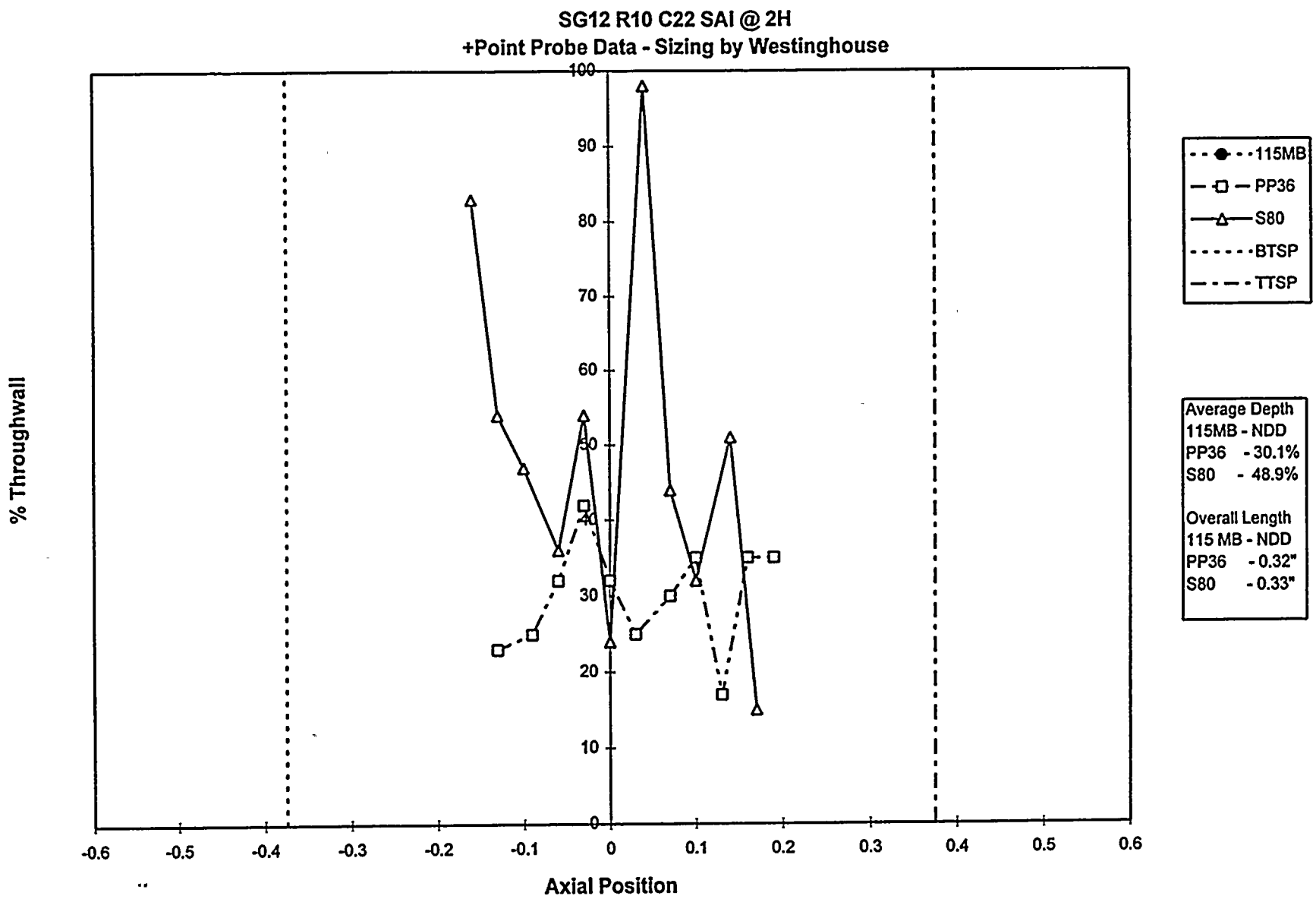

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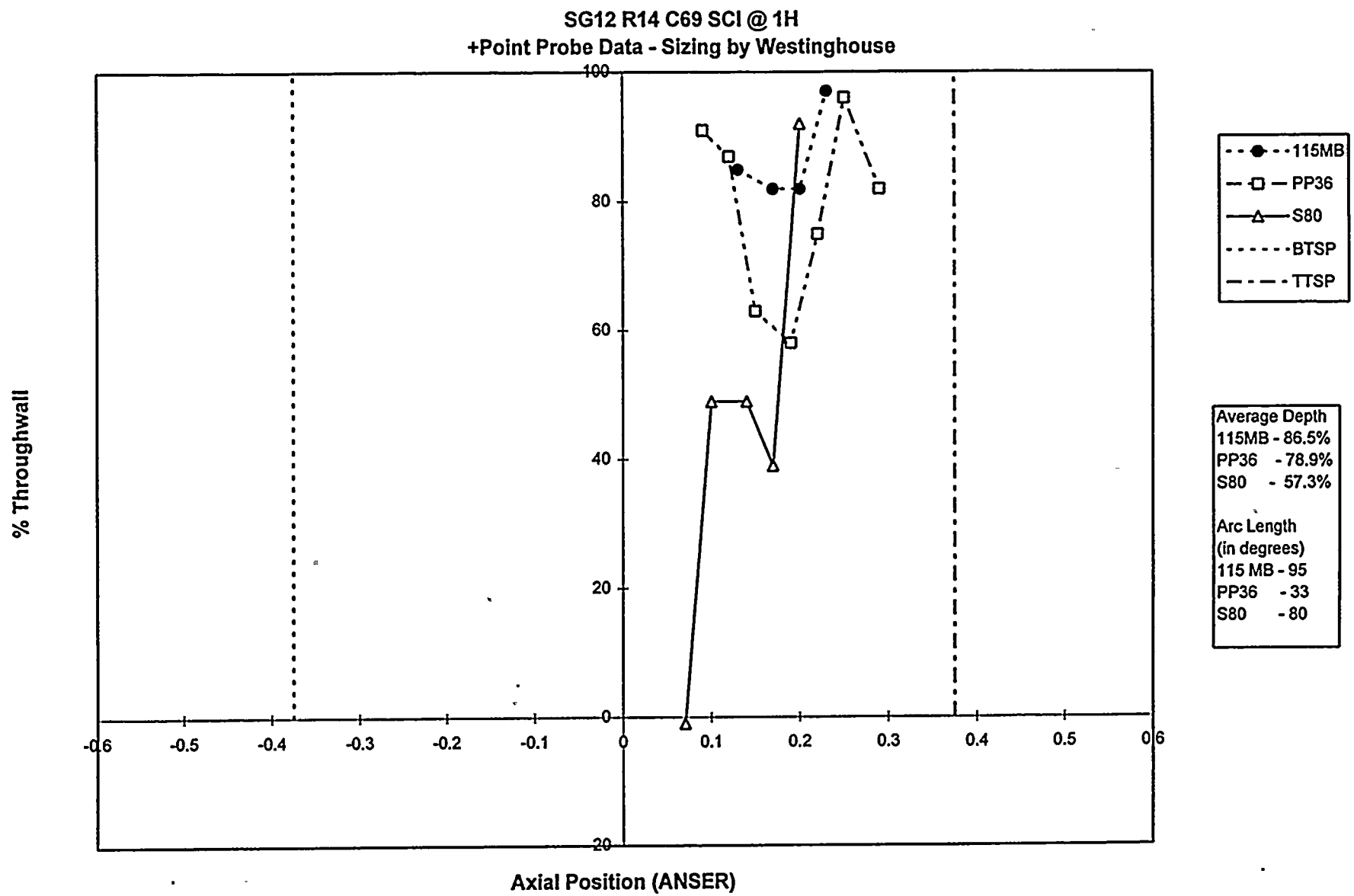
Figure 15



960103fig/fig16.xls/met/c:

Figure 16

APPENDIX A

SUMMARY OF UT SIZING

1.0 ULTRASONIC TESTING

Ultrasonic Testing (UT) of the tubes was performed using the Westinghouse UTEC probe assembly. This assembly consists of three different UT search units and an ET coil. The three UT signals simultaneously scan radially, circumferentially, and axially to detect (respectively) dent-geometry/wall thickness, axially-oriented flaws, and circumferentially-oriented flaws. The ET coil is used for detecting the TSP (Tube Support Plate) which determines the position of the UT assembly. All data is recorded digitally for later analysis.

The UTEC system is an inspection system used to provide detailed information of detected flaws. It is more cumbersome and requires more extensive setup and data acquisition and analysis time than ET inspection methods. The UTEC provides a different dimension of flaw data by means of its very focused beams of high-frequency ultrasound capable of detecting minute features of flaw geometry. As such, UT complements ET by sometimes resolving larger ET indications into a series of smaller similarly-oriented flaws, some having measurable separations referred to as ligaments.

2.0 ULTRASONIC DATA ANALYSIS

Westinghouse performed a preliminary analysis while at DCPP and reported initial results. More rigorous analysis of the UTEC data was done by both Westinghouse and PG&E-TES. The results of the Westinghouse analysis are presented in Table UT-1. Analyses of length/extent data between Westinghouse and TES basically agreed. TES analysis indicated through-wall depths may be 20% less than those reported by Westinghouse.

The UTEC analysis of tube R21C43 @ 1H resolved two areas of axial flaws (see Figure UT1). The first area showed MAII with an overall length of 1.15 inch and depth of 22% to 100%, resolved into three shorter SAII's (segments 4, 5, & 6), and one MAII (segment 7). The depth profile estimate for these segments is shown in Figure UT2, plotting through-wall depth from the ID versus length in relation to the top of the TSP. The other area is an SAII (segment 0) with length 0.32 inch and depth of 24% to 100%. The corresponding dent geometry is shown at the right side of Figure UT1.

The UTEC analysis of tube R10C22 @ 2H showed one axial SAII (see Figure UT3). The length is 0.14 inch and depth is 24% to 54%. The depth profile is shown in Figure UT4.

The UTEC analysis of tube R14C69 @ 1H resolved two areas of circumferential flaws (see Figure UT5). The first area showed SCII (segment 2) with a circumferential extent of 22° and depth of 20% to 50%. The depth profile estimate for this segment is shown in Figure UT6. The second area showed MCII (area 3) with a circumferential extent of 10° and depth of 25% to 45%.

TABLE UT-1. ULTRASONIC SIZING OF DCPP 1R7 PWSCC INDICATIONS USING WESTINGHOUSE UTEC EQUIPMENT

ROW-COLUMN-TSP	INDICATION	EXTENT	DEPTH (through-wall)
R21C43 @ 1H	MAII (4 segments)	1.15 inch	22-100%
	SAII	0.52 inch	28-100%
	SAII	0.48 inch	22-94%
	SAII	0.04 inch	24-32%
	MAII	0.39 inch	40-60%
	SAII	0.32 inch	24-100%
R10C22 @ 2H	SAII	0.14 inch	24-54%
R14C69 @ 1H	SCII	22°	20-50%
	MCII	10°	25-45%

SAII - Single Axial Indication ID
MAII - Multiple Axial Indications ID
SCII - Single Circumferential Indication ID
MCII - Multiple Circumferential Indication ID

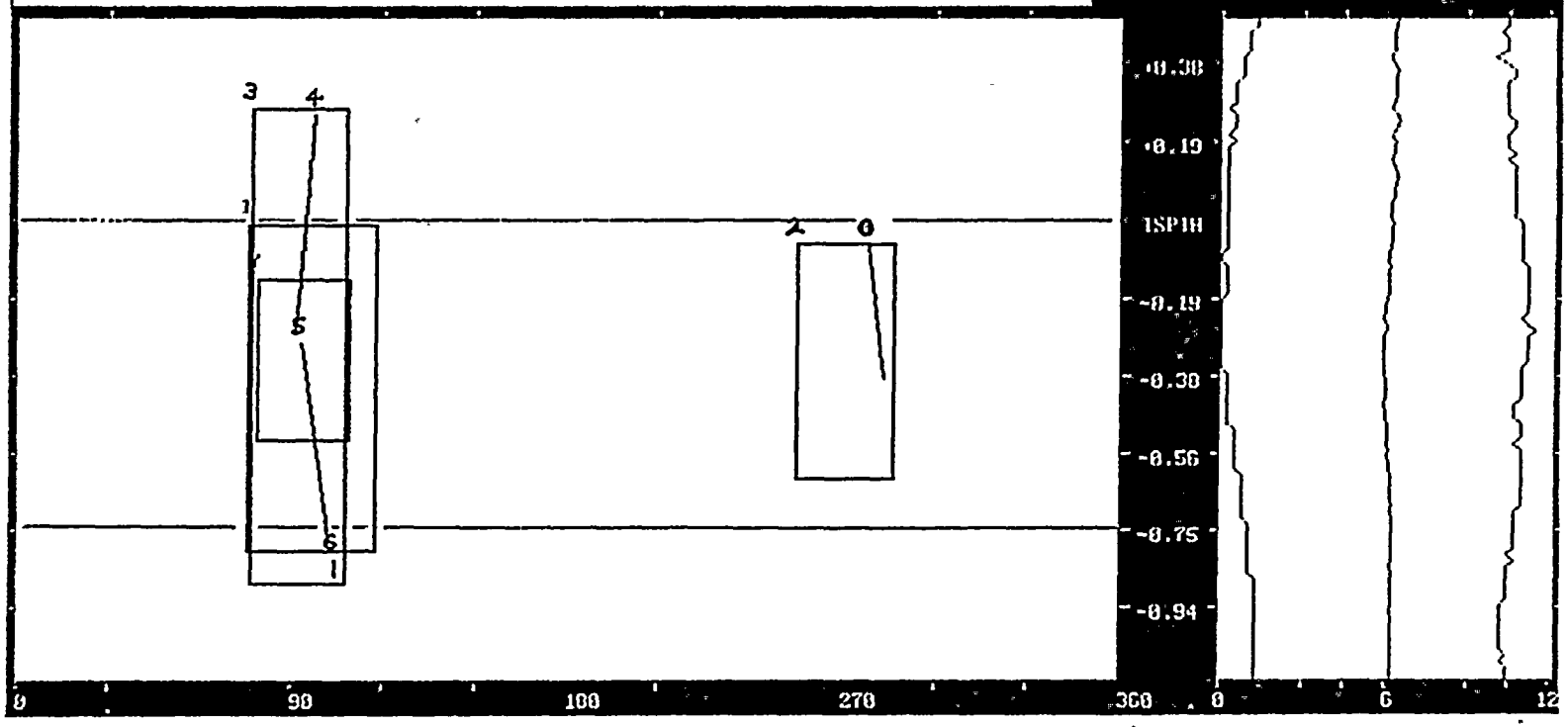
#	AXIAL LOC	CIRC LOC	LEN	DIR	DEPTH	XDCR	TYPE	#	AXIAL LOC	CIRC LOC	LEN	DIR	DEPTH	XDCR	TYPE
0	0.064	270	0.310	7	24-100	UT2	SAII								
1	-0.013	76	0.856	22	0- 0	UT1	DENT								
2	-0.057	255	0.623	23	0- 0	UT1	DENT								
3	0.266	77	1.177	12	22-100	UT2	NAII								
4	0.251	97	0.524	-5	28-100	UT2	SAII								
5	-0.300	90	0.402	0	22- 94	UT2	SAII								
6	0.029	104	0.037	0	24- 32	UT2	SAII								
7	-0.145	79	0.452	30	48- 60	UT2	NAII								

12/05/95 14:01:00
D 780082 A21431H_.N01

GRP RPT PRINT SAVE EXIT

0.38 inch

UT1	UT2
UT3	EC



WESTINGHOUSE ELECTRIC CORPORATION - NSD - NDE

CUSTOMER: PACIFIC GAS & ELECTRIC
SITE: DIABLO CANYON
OUTAGE: 1R7

ALPHA: PGE UNIT: 1 GEN: 2 LEG: H
FILE: 780082 A21431H_.N01

Figure UT1. UTEC information for tube R21C43 @ 1H.

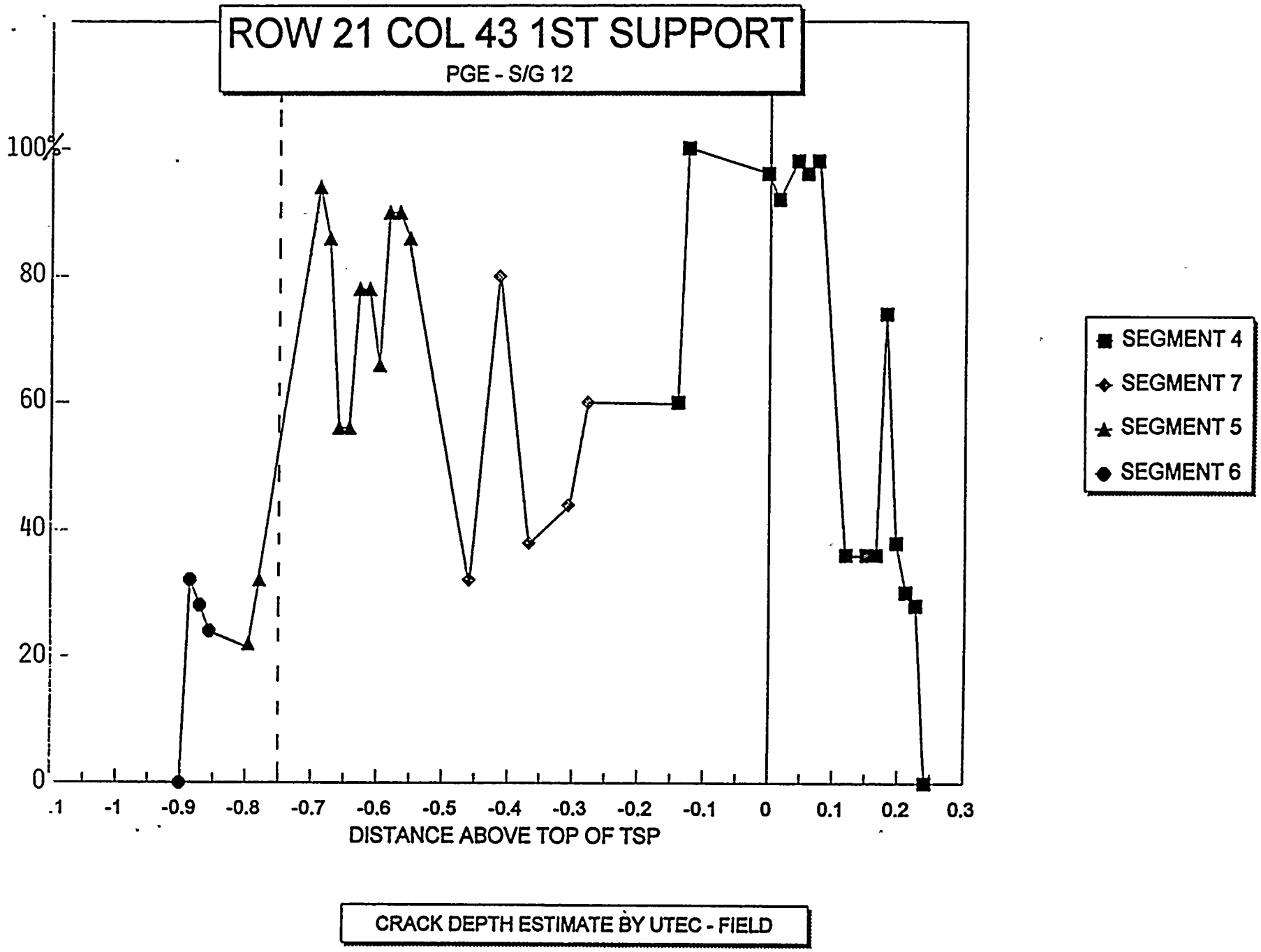


Figure UT2. UTEC depth profile for tube R21C43 @ 1H.

#	AXIAL LOC	CIRC LOC	LEN	DIR	DEPTH	XDCR	TYPE:
0	-0.344	104	0.141	-3	24- 54	UT2	SAII
1	0.023	164	0.078	24	0- 0	UT1	DENT

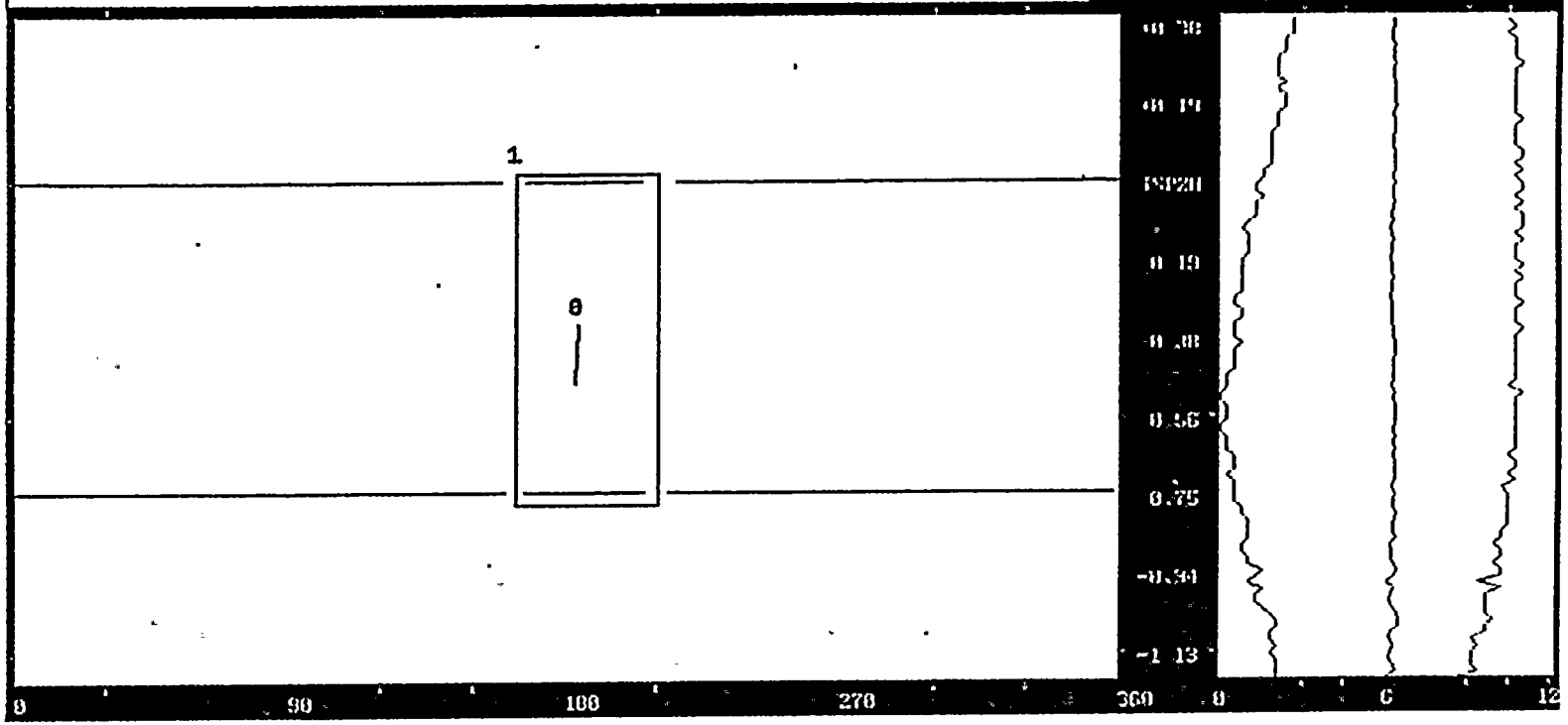
#	AXIAL LOC	CIRC LOC	LEN	DIR	DEPTH	XDCR	TYPE

12/07/95 00 00:20
D 780082 A10222H .N01

Printing Screen to Tek Please Wait

0.38 inch

UT1	UT2
UT3	EC



WESTINGHOUSE ELECTRIC CORPORATION - NSD - NDE

CUSTOMER: PACIFIC GAS & ELECTRIC
SITE: DIABLO CANYON
OUTAGE: 1R7

ALPHA: PGE UNIT: 1 GEN: 2 LEG: H
FILE: 780082 A10222H_.N01

Figure UT3. R10C22 @ 2H.

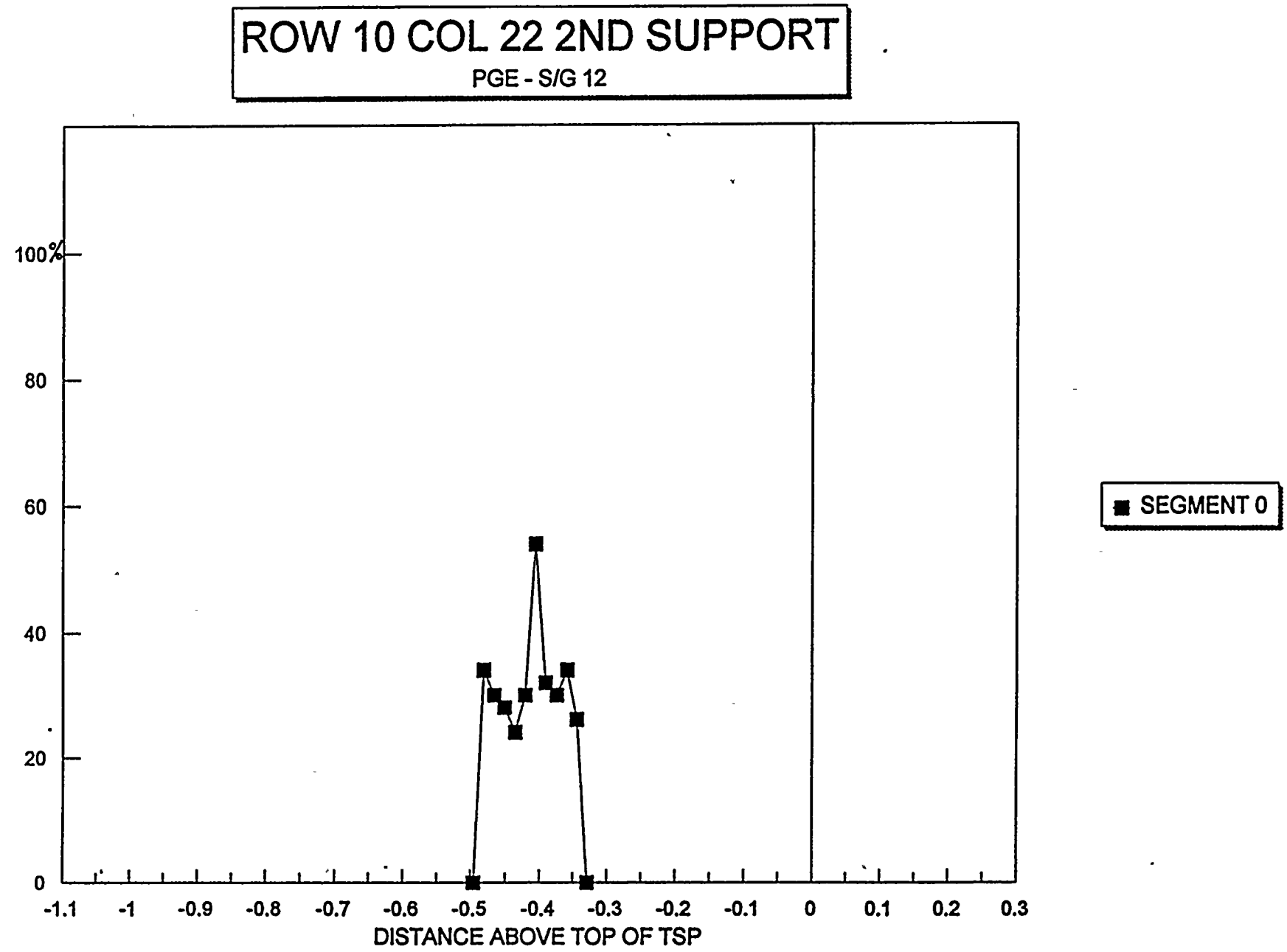
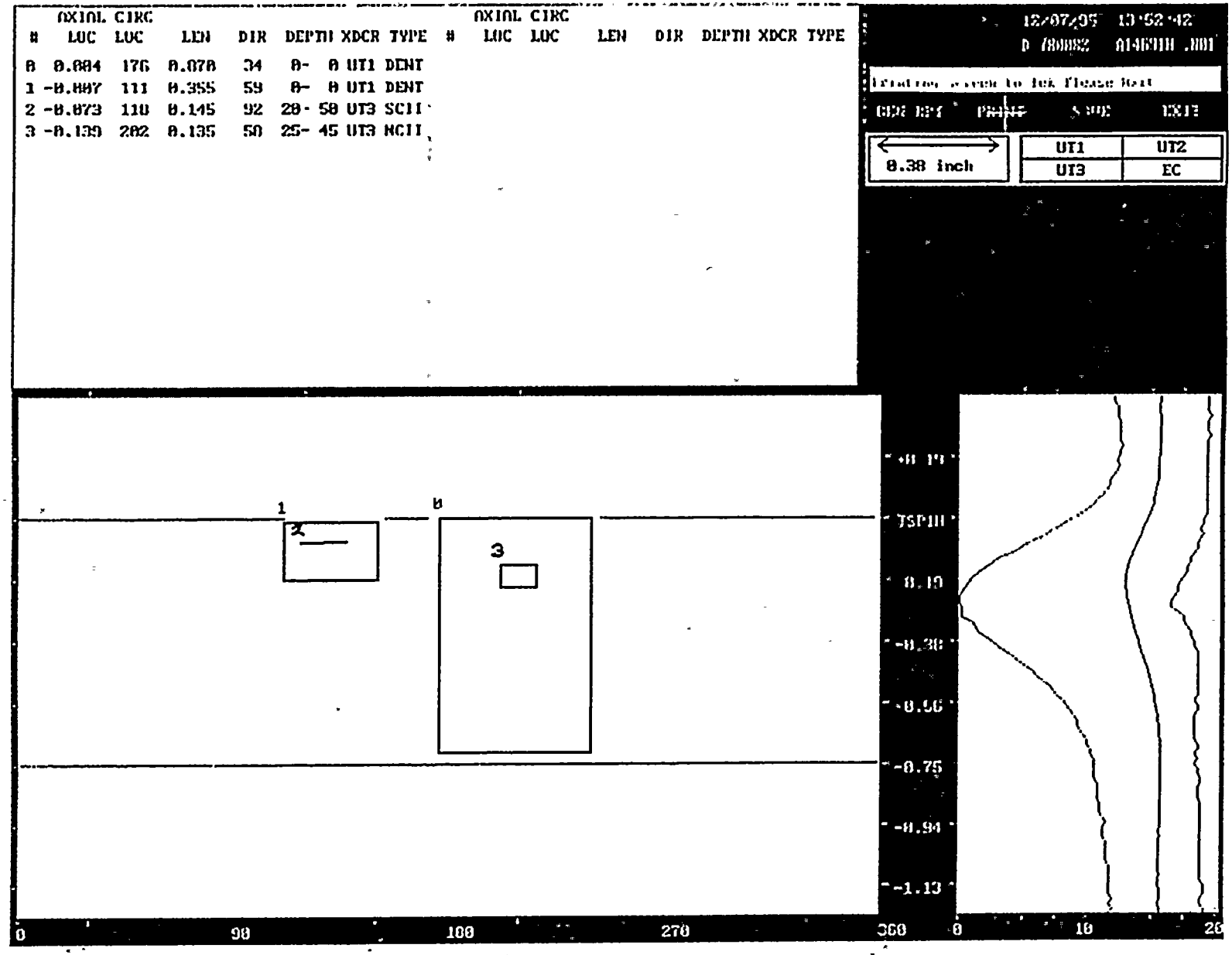


Figure UT4. R10C22 @ 2H.

#	AXIAL LOC	CIRC LOC	LEN	DIR	DEPTH	XDCR	TYPE	#	AXIAL LOC	CIRC LOC	LEN	DIR	DEPTH	XDCR	TYPE
0	0.004	176	0.078	34	0- 0	UT1	DENT								
1	-0.007	111	0.355	59	0- 0	UT1	DENT								
2	-0.073	110	0.145	92	20- 50	UT3	SCII								
3	-0.139	202	0.135	50	25- 45	UT3	NCII								



WESTINGHOUSE ELECTRIC CORPORATION - NSD - NDE

CUSTOMER: PACIFIC GAS & ELECTRIC
SITE: DIABLO CANYON
OUTAGE: 1R7

ALPHA: PGE UNIT: 1 GEN: 2 LEG: II
FILE: 780082 A14691H_.N01

Figure UT5. R14C69 @ 1H.

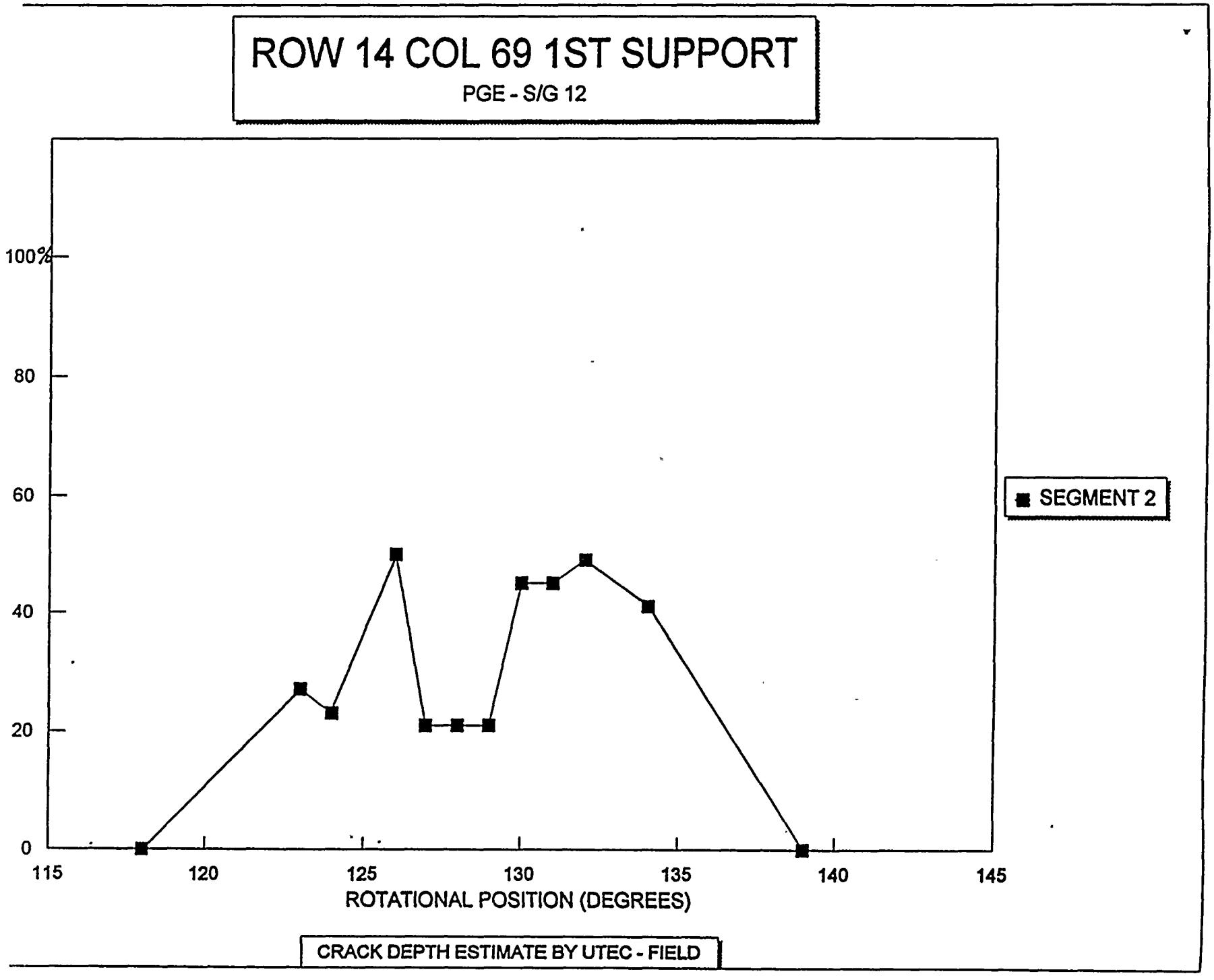


Figure UT6. R14C69 @ 1H.