Attachment 1

MRP 2008-012

Ma, Jennifer

From: Ma, Jennifer
Sent: Thursday, February 21, 2008 1:16 PM
To: King, Christine
Subject: Examination Results on Nozzles from removed St Lucie Pressurizer

MRP 2008-012 Attachment.pdf (7...

February 21, 2008

MRP Letter 2008-012 (via email)

Dear MRP TAG Members:

In early 2007 as the NRC and industry were working to address questions regarding the possible existence of large circumferential indications in uninspected pressurizer nozzles, the potential knowledge to be gained from harvesting nozzles from either cancelled plants or retired pressurizers was studied carefully. Ultimately resolution of the immediate issues was accomplished without the direct evaluation of such nozzles but the EPRI NDE Center did acquire several nozzles from a cancelled plant and the NRC took custody of the nozzles from the St. Lucie 1 replaced pressurizer.

MRP has partnered with NRC Research in the initial evaluation of the St. Lucie nozzles by conducting dye penetrant (PT) exams of the nozzles (ID and OD) as well as phased array UT examinations. The phased-array UT examinations revealed multiple planar reflectors, which appear to be vertically stacked and extend from the ID surface to a significant through-wall depth in all three of the Safety nozzle DM welds. Under normal field NDE conditions these indications would likely be reported as 360° linear planar flaws. The approximate through-wall depths at the deepest points were 80% on the "A" Safety nozzle, 75% on the "B" Safety nozzle, and 69% on the "C" Safety nozzle. Additionally, one non-surface connected indication, indicative of lack of fusion was recorded on the Spray nozzle. No recordable indications were noted on the Relief or Surge nozzles, during the UT examinations.

MRP will work closely with NRC Research to define an appropriate plan for fully characterizing these indications. It is currently anticipated that additional NDE will be conducted, including the use of automated phased-array scans to more fully map the apparent flaws for comparison to any subsequent results from destructive analyses. These results will assist industry and NRC in refining the interpretation of NDE results from DM welds and in improving the understanding of the role of PWSCC in degradation of these materials.

The attached trip report provides further detail from these initial examinations and is provided for your information. As additional facts are developed, they will be communicated as well. If you have additional questions, please contact either Craig Harrington or Christine King.

Christine King
Program Manager
EPRI Materials Reliability Program
Office: 650-855-2605
Mobile: 650-283-4235

cc: MRP IIG

St. Lucie Pressurizer Nozzle DM Weld Examination Project
Internal Office Report

St. Lucie Pressurizer DM weld examinations

The scope of this project for EPRI was to oversee the examination of six dissimilar metal (DM) welds associated with the Combustion Engineering Pressurizer vessel that was recently removed from service from the St. Lucie Nuclear Power Station. The examinations were to include surface and volumetric examinations, specifically visible liquid dye penetrant (PT) examinations of both the outside (OD) surface and inside (ID) surface of each DM weld, and Phased-Array ultrasonic (UT) examination of the volume of each DM weld. The examination area and volume were to be the same as for a normal Inservice Inspection (ISI) examination of these welds.

EPRI contracted Structural Integrity Associates, Inc.(SIA) to perform the NDE, which also required a procedure expansion of the SIA phased-array UT procedure SI-UT-130.

Initial Visit to the Memphis Facility:

I first met with Kevin Butler and David Jennings, at the Studsvik/Race facility on President's Island in Memphis on January 25th, in order to look at the Pressurizer heads and to give the facility instructions on how to prepare the 6 associated dissimilar metal welds for examination. The as-found condition of the nozzles was that they were fully intact and in the same condition as they had come from the plant. The lower head piece contained one nozzle, which was the 14" Surge nozzle. This nozzle had a screen/filter associated with it, which was located on the inside surface of the head. The upper head piece contained five nozzles, which were the 3" Spray nozzle, the 4" Relief nozzle, and three 4" Safety nozzles. The Spray nozzle also had a nozzle associated with it on the opposite surface of the head, which had been internal to the Pressurizer during operation. Each of the 6 nozzles appeared to have end caps welded on them, and the external surface of both head pieces appeared to be coated with some sort of paint or protective coating.

Upper Head Piece showing five nozzles and the internal portion of the Spray nozzle

Cut line

Lower head containing the Surge nozzle ***Internal portion of Surge nozzle***

Cut line

During the initial visit to the facility, I explained a little bit about the examinations that we were going to be performing on the nozzles and why. I requested that the two internal nozzles be cut off of the head pieces, and that each end cap be completely removed, so that we would have access to the ID of each nozzle. I instructed them to remove any internal thermal sleeves that would interfere with our access to the inside surfaces of the welds, as well. I also requested that all paint, coatings, rust and scale be removed from all surfaces of the pieces, down to the bare metal. At that time, they expressed concern for their ability to remove the end cap from the Surge nozzle, due to the size of the weld. We discussed that it should only involve cutting along the weld at the edge of the cap, and that the cap should come off fairly easily. They also asked me if it would be a problem if the flanges on the Safety nozzles were damaged during the cutting, and I said that it was not a concern as long as the weld area of the nozzle was not affected.

The February 4th Week at the Memphis Facility:

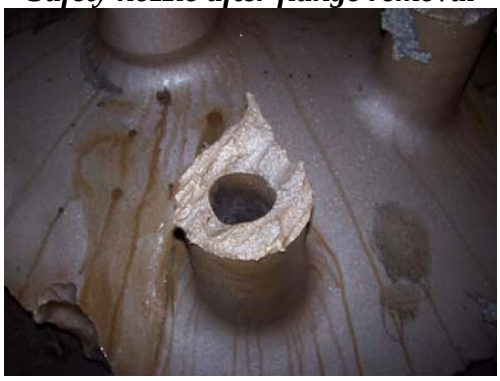
Upon arrival to the facility on Monday, February 4th, we received radiation worker training and facility safety training and were then allowed to dress out and enter the Sectional Shop, where the pieces were staged. The as-found condition of the upper head piece, at this time, was that the internal nozzle and end caps had been completely removed and the surfaces had been bead blasted with some sort of carbon steel metallic material, which had removed all paint and coatings but left the surface in a rough rusty looking condition. Even the stainless and inconel surfaces were rusty. Our assumption was that this was caused from carbon steel blast material being embedded into the surfaces. The flanges at the ends of the three Safety nozzles were completely removed along with the end caps. On the lower head piece, the DM weld on the Surge nozzle was actually damaged from the cutting and there were portions of the end plug still in place. When I inquired about this, they told me that the end cap had actually been a plug and that it had been very difficult to remove. I took one of the facilities cutting technicians out to the nozzle and showed him the portions of the plug that were still in place and asked him to carefully remove the weld around the edge of it, and that it would come out. He followed these instructions and was able to remove the remaining portion of the plug.

St. Lucie Pressurizer Nozzle DM Weld Examination Project
Internal Office Report

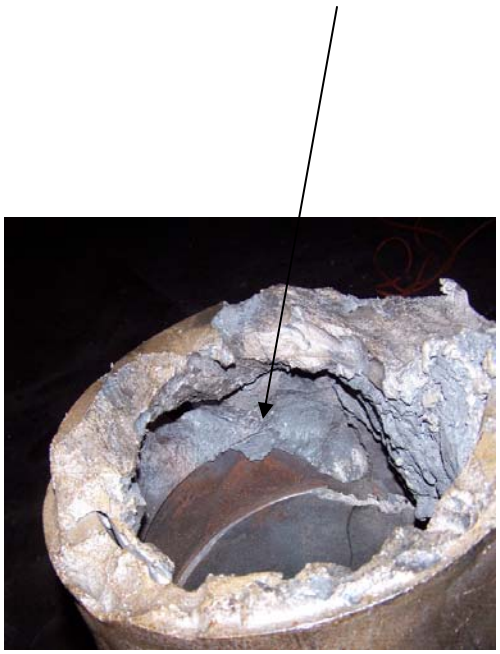
An assessment of the Surge nozzle, after complete plug removal showed that a great deal of the ID of the weld had been damaged by flame cutting.

Upper Head after initial prep work

Safety nozzle after flange removal

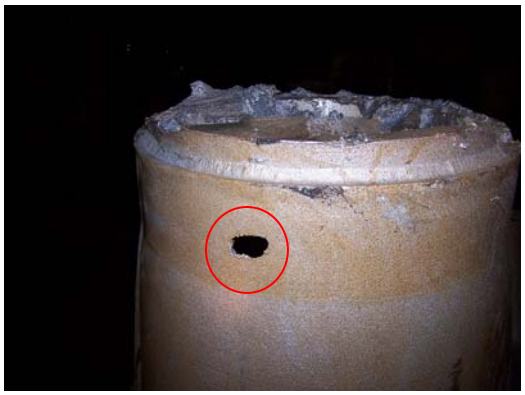


Surge nozzle after initial prep work (note ID damage caused by flame cutting)



Portions of the end plug still in place

Flame cut hole in the DM weld



We had brought our own side grinder and flapper wheels, so we proceeded to prepare the outside surfaces of the nozzle weld areas to remove the rust and smooth out the rough surfaces. By the end of the first day, we had managed to adequately prepare the outside surfaces of the welds for PT and UT examinations.

Upper head after flapping

Surge nozzle after flapping and plug removal

On Tuesday, we set up and performed liquid dye penetrant (PT) examinations of the OD surface of each DM welds. There were two small rounded indications noted during the OD PT exams. One was on the Relief nozzle, in the DM weld surface area. And the other was on the "C" Safety nozzle, also in the DM weld surface.

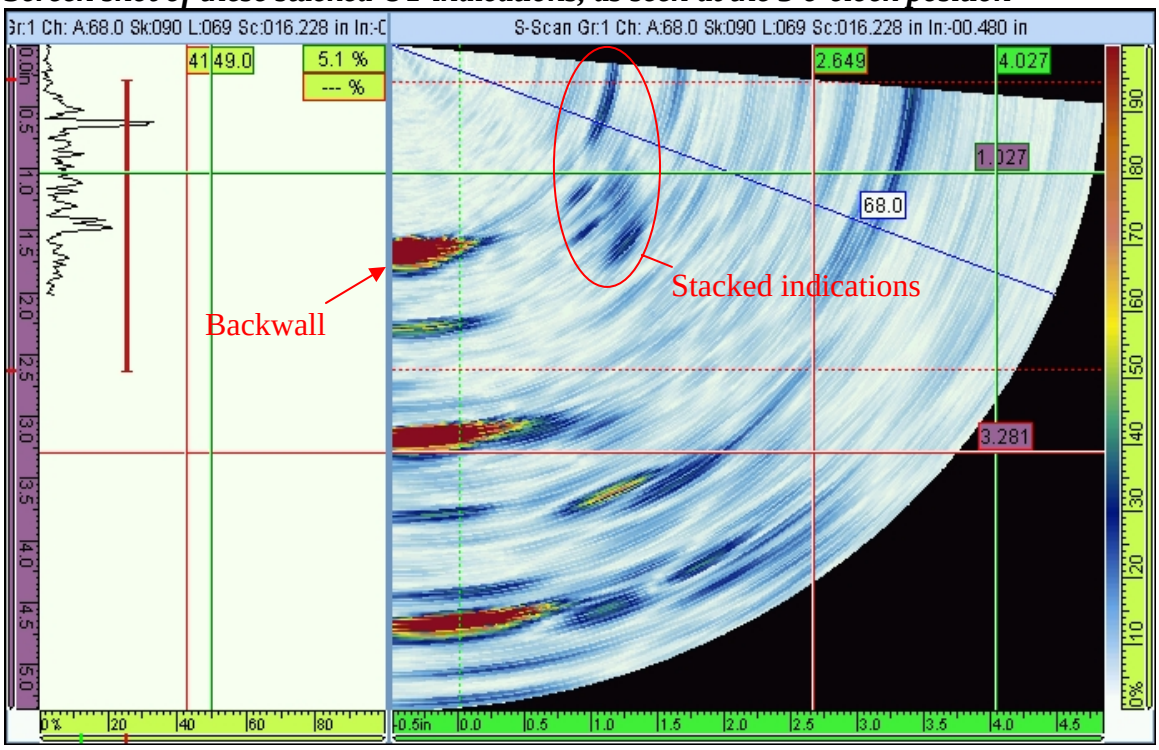
Relief Nozzle OD PT indication

"C" Safety nozzle OD PT indication

St. Lucie Pressurizer Nozzle DM Weld Examination Project
Internal Office Report

Tuesday afternoon, we began Phased-Array UT examination on the "A" Safety nozzle DM weld, using longitudinal ultrasonic sound beams projected from 0° to 80° angles. We immediately noted a large number of planar reflectors in the weld, which were stacked on top of each other and appeared to extend from the ID surface of the weld up to approximately 0.325" from the OD surface of the weld, at the deepest point. These reflectors were numerous and were present 360° around the circumference of the weld. When scanning across the tops of these indications, the UT sound beams that were projected normal to the surface (straight beams) did not pick up the indications, as you would expect them to if the indications were caused by internal inclusions. Under normal field examination conditions, these types of indications would have to be recorded and evaluated as one continuous linear planer flaw, seen 360° around the weld.

Screen shot of these stacked UT indications, as seen at the 3 o'clock position



On Wednesday, we continued UT examination of the remaining nozzles. The two other Safety nozzle DM welds also contained 360° linear planar indications. The "B" Safety DM weld indication was measured from the ID surface to within 0.396" of the outside surface. The "C" Safety nozzle DM weld indication was measured from the ID surface up to 0.495" of the outside surface. These indication exhibited the same features as that of the "A" Safety nozzle DM weld.

St. Lucie Pressurizer Nozzle DM Weld Examination Project
Internal Office Report

The Spray nozzle DM weld was found to contain one embedded planar indication that did not appear to be connected to the ID surface, and was indicative of a lack of fusion type flaw located along the upper bevel of the weld to base material interface. The Relief and Surge nozzles did not contain any recordable indications.

Wednesday evening, we purchased a die grinder and some abrasive wheels in order to prepare the ID surfaces of these DM welds for PT examination. On Thursday, we were able to use these new tools to prepare a suitable ID surface for examination on each nozzle DM weld. The PT of the inside surfaces the "A" and "C" Safety nozzles produced several aligned dotted indications within the weld material, which were very defined and easy to interpret as surface connected flaws. The "B" Safety nozzle had three very faint indications in one area of the weld inside surface, which were reproducible, but were not as definitive as on the other two Safety nozzles. Surprisingly, the Spray and Surge nozzles also had recordable PT indications on the ID surfaces, in the area of the DM weld. They, too, were aligned. The Surge nozzle indications were somewhat small and faint, similar to that of the "B" safety nozzle. However, the Spray nozzle indications were very defined and sizeable. We re-examined the Surge and Spray nozzle DM welds after the ID PT examinations, but were still unable to record UT indications associated with the PT indications.

Typical Safety nozzle aligned ID PT indications

Spray nozzle aligned ID PT indications

Faint ID PT indications on the Surge nozzle

Summary of NDE findings:

All six nozzle DM welds on the former St. Lucie Combustion Engineering Pressurizer vessel were successfully examined from both the OD and ID with liquid dye penetrant, and were volumetrically examined by the Phased-Array UT method, using Structural Integrity Associates PDI qualified procedure SI-UT-130. The only limitations to these examinations were on the Surge nozzle, where initial attempts to remove the end plug by flame cutting had resulted in extensive damage to the ID surface and in one area had resulted in a hole through the middle of the DM weld.

The OD surface PT examinations of these six nozzle welds resulted in two recordable indications. One small rounded indication was recorded in the Relief nozzle DM weld crown surface. One small rounded indication was recorded in the “C” Safety nozzle DM weld crown surface. Both of these indications were indicative of porosity-type indications, which may have been uncovered during the bead blasting and flapping processes. Further surface preparations were not performed in the areas of these indications to see if they could be removed.

The phased-array UT examinations of the nozzles resulted in multiple stacked planar indications being recorded in all three of the Safety nozzle DM welds, which under normal field NDE conditions would likely be reported as 360° linear planar flaws. The approximate through-wall depths of these indications at the deepest points were 80% on the “A” Safety nozzle, 75% on the “B” Safety nozzle, and 69% on the “C” Safety nozzle. Additionally, one non-surface connected indication, indicative of lack of fusion was

recorded on the Spray nozzle. No recordable indications were noted on the Relief or Surge nozzles, during the UT examinations.

The ID surface PT examinations of the nozzles resulted in multiple, well defined, aligned surface indications being recorded in the weld root area of the "A" and "C" Safety nozzles and the Spray nozzle. The "B" Safety nozzle and Surge nozzle each showed a few faint indications in the weld root area, which were not as well defined, but were recordable. The Relief nozzle did not reveal any ID surface indications. As with the OD surface indications that were noted, all of these ID connected indications could have been uncovered during the surface preparation activities. Further surface preparations were not attempted in the areas of any of these ID indications to see if they could be removed.

Conclusions

The two rounded indications recorded during the OD PT examinations are not unusual, during normal ISI surface examinations. Additional grinding would normally be prescribed to attempt to remove these indications. Surface Eddy Current examination could also be utilized to determine if these indications become linear underneath the surface.

The UT indications recorded on the three Safety nozzles contained multiple planar reflectors, which appear to be vertically stacked and extend from the ID surface to a significant through-wall depth. These indications are indicative of corrosion cracking, but could also be attributed to multiple stacked inclusions in the weld material, left over from construction. Performing automated UT on these three nozzle welds would allow for better flaw mapping and analysis. However, under normal field NDE conditions, these three welds would certainly be reported as containing 360° linear planar flaws of significant through-wall depth, which would require immediate repair.

The aligned ID PT indications noted on several of these nozzles could also be indicative of corrosion cracking. During many recent PT examinations of Reactor Upper Head penetration welds, PWSCC flaws were initially recorded as small aligned "snake bite" indications in the surface of the weld, which upon further surface grinding revealed linear cracking. However, it is also possible that the initial surface preparation of these welds uncovered inclusions in the weld material, which may have been removed upon further surface preparation. Surface Eddy Current examination could also be used to determine whether or not these indications are linked.

Attachment 2

MRP 2008-014

ELECTRIC POWER RESEARCH INSTITUTE

MRP **Materials Reliability Program**_____MRP 2008-014
(via email)

March 4, 2008

U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
Washington, DC 20555-0001
ATTN: Al Csontos and Bob Hardies

Reference: MRP 2008-012 "Examination Results on Nozzles from removed St Lucie Pressurizer with attachment St. Lucie Pressurizer Nozzle DM Weld Examination Project Internal Office Report"

Dear Al and Bob:

As you know during our manual examinations of the St Lucie nozzles we did acquire some rough profile information on "A" pressurizer safety nozzle dissimilar metal weld circumferential indication. Please find attached the results of that effort. It should be noted, however, that this profile was created by taking 19 individual depth measurements and extrapolating a straight line in between them, which is not fully representative of what was noted during the actual field examination. In order to obtain a more accurate three-dimensional representation of the indication, or indications, it is recommended that an automated ultrasonic system be employed to take continuous measurements of the entire circumference of the weld. If you have any questions, please contact Craig Harrington (charrington@epri.com, 817-897-1433) or Ronnie Swain (rswain@epri.com, 704-595-2014).

Sincerely,

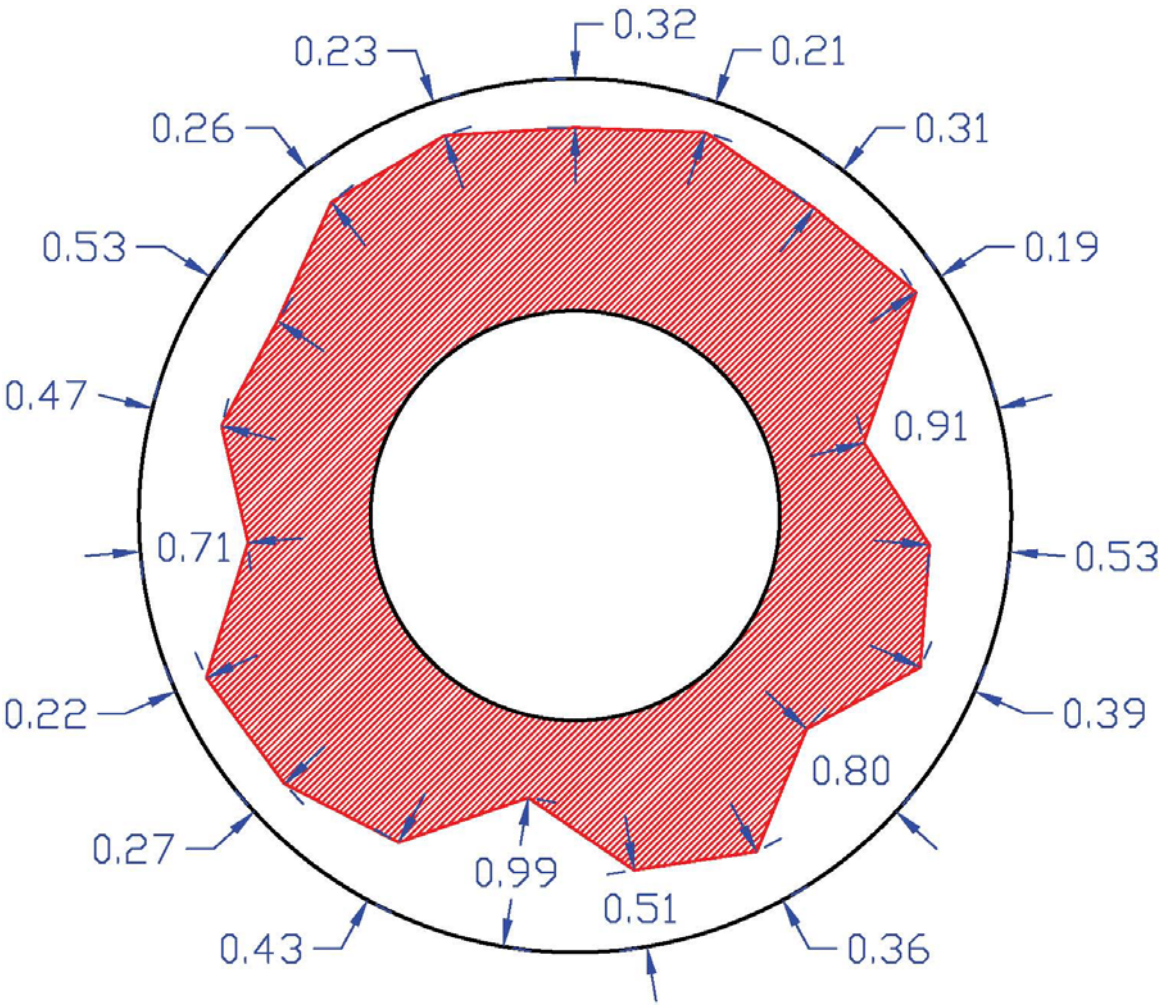
Christine King

Christine King
Program Manager
EPRI Materials Reliability Program

“A” Pressurizer Safety Nozzle Dissimilar Metal Weld
Circumferential Indication Profile

The graphic below represents a normalized side-view profile of the “A” Safety Nozzle DM Weld indication, based on ultrasonic depth measurements recorded at 1.0 inch increments around the circumference of the nozzle. The numbers, included below, represent the remaining ligament of material above the indication. The additional pages included with this graphic contain screen captures of each ultrasonic measurement location, as well as additional information that was used to derive the result.

The percentage of degraded material according to this graphic is estimated to be 64% of the total wall thickness. It should be noted, however, that this profile was created by taking 19 individual depth measurements and extrapolating a straight line in between them, which is not fully representative of what was noted during the actual field examination. In order to obtain a more accurate three-dimensional representation of the indication, or indications, it is recommended that an automated ultrasonic system be employed to take continuous measurements of the entire circumference of the weld.



“A” Safety Circumferential Indication Profile Data

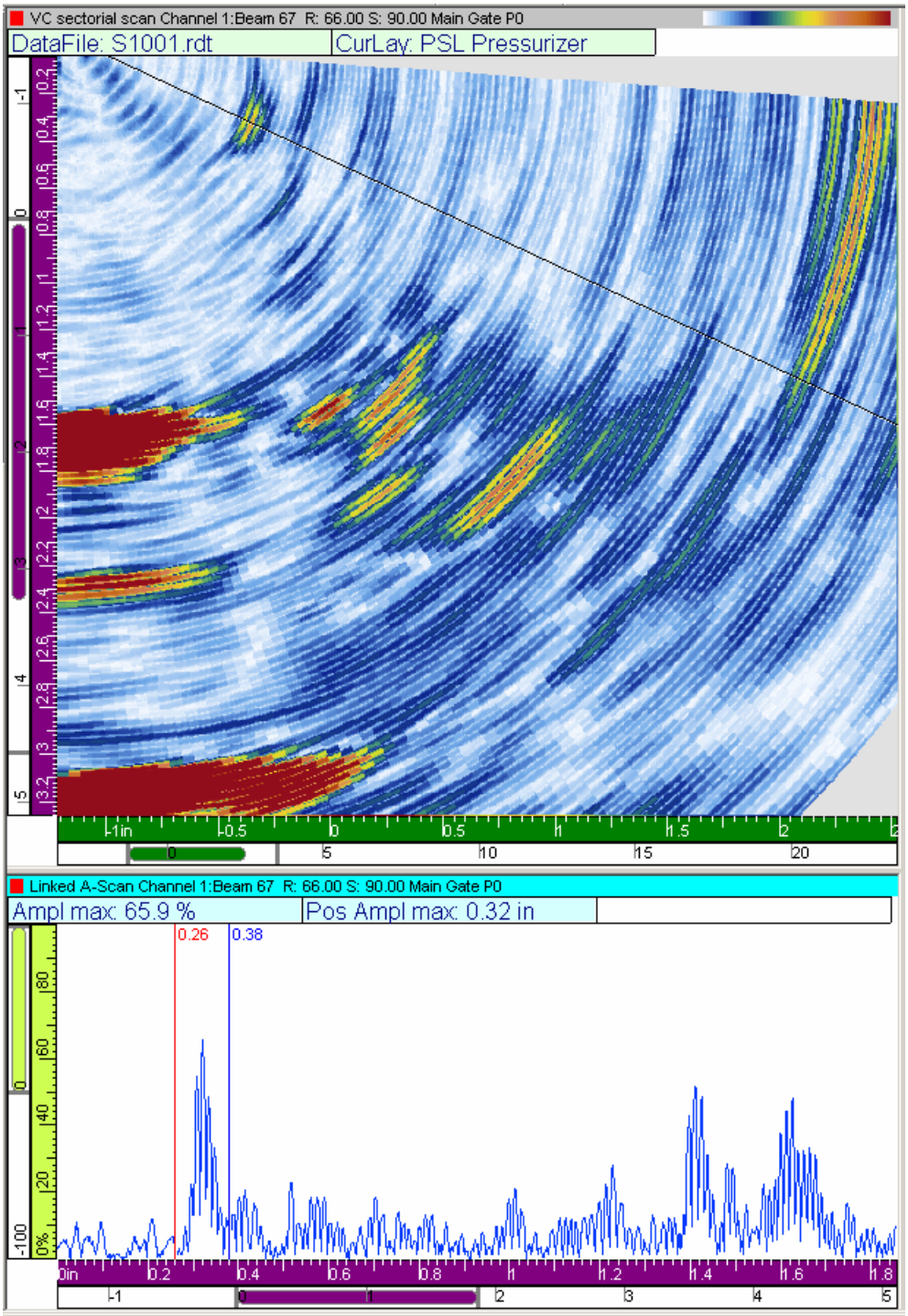
Location: At the “0” stamp (circumferential reference point)

Part Thickness used for calculation: 1.7 inches

Indication through-wall depth at this location: 1.38 inches

Estimated remaining ligament above the indication: 0.32 inches

Angle used for measurement: 67 degrees



<u>"A" Safety Circumferential Indication Profile Data</u>

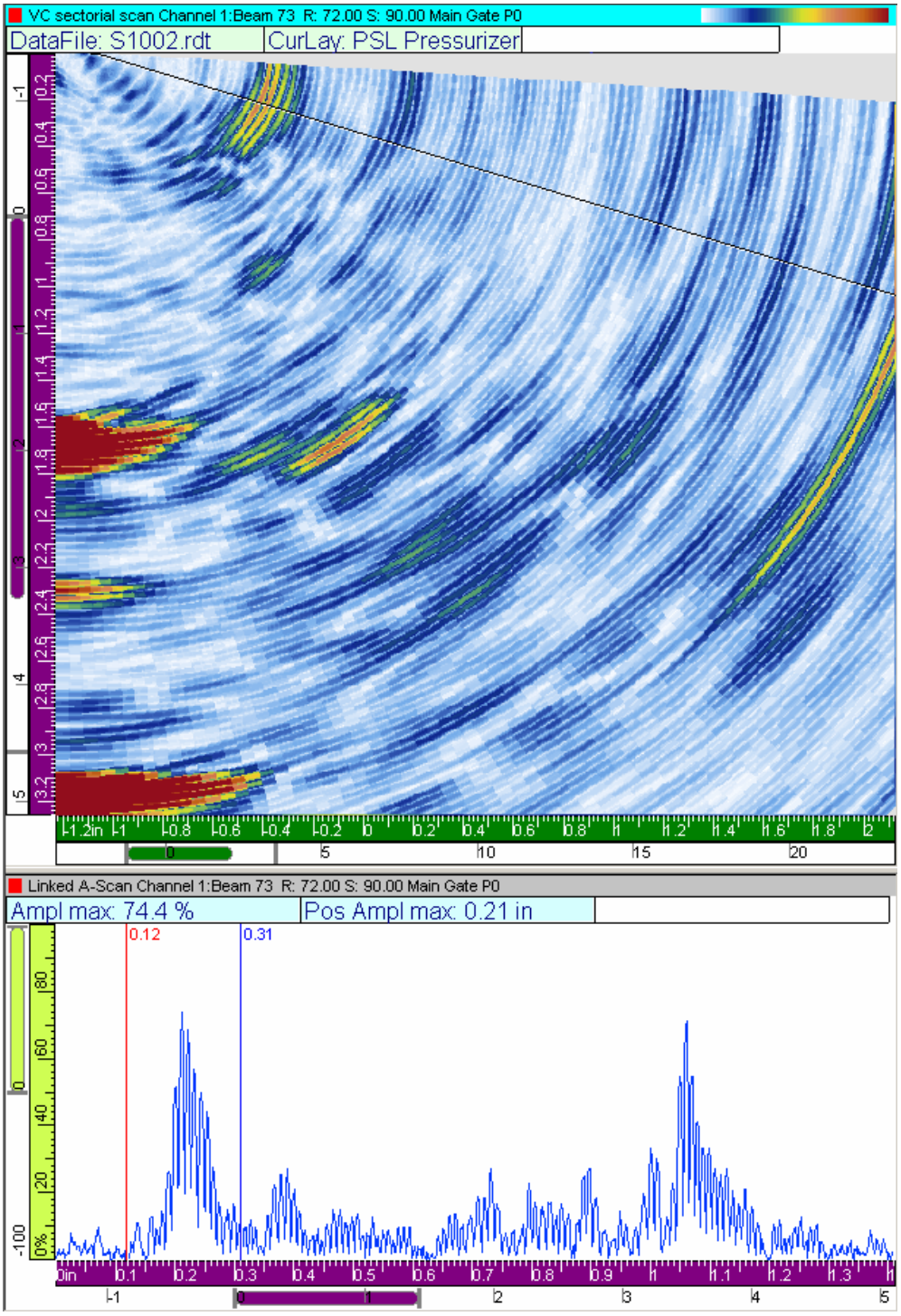
Location: 1 inch clockwise from "0" stamp

Part Thickness used for calculation: 1.7 inches

Indication through-wall depth at this location: 1.49 inches

Estimated remaining ligament above the indication: 0.21 inches

Angle used for measurement: 73 degrees


VC sectorial scan Channel 1:Beam 73 R: 72.00 S: 90.00 Main Gate P0
DataFile: S1002.rdt
CurLay: PSL Pressurizer
Linked A-Scan Channel 1:Beam 73 R: 72.00 S: 90.00 Main Gate P0
Ampl max: 74.4 %
Pos Ampl max: 0.21 in
0.12
0.31

“A” Safety Circumferential Indication Profile Data

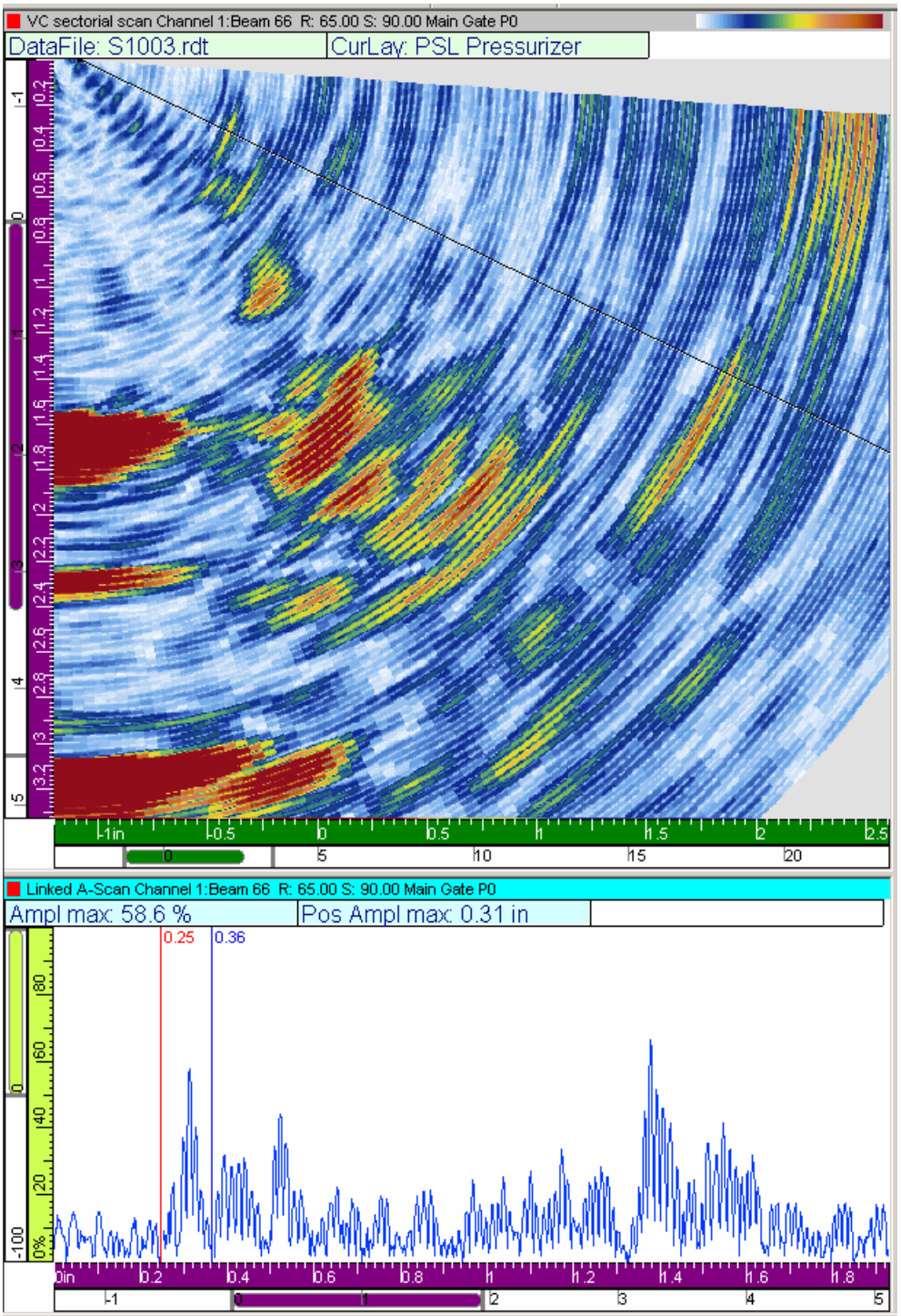
Location: 2 inches clockwise from “0” stamp

Part Thickness used for calculation: 1.7 inches

Indication through-wall depth at this location: 1.39 inches

Estimated remaining ligament above the indication: 0.31 inches

Angle used for measurement: 66 degrees



“A” Safety Circumferential Indication Profile Data

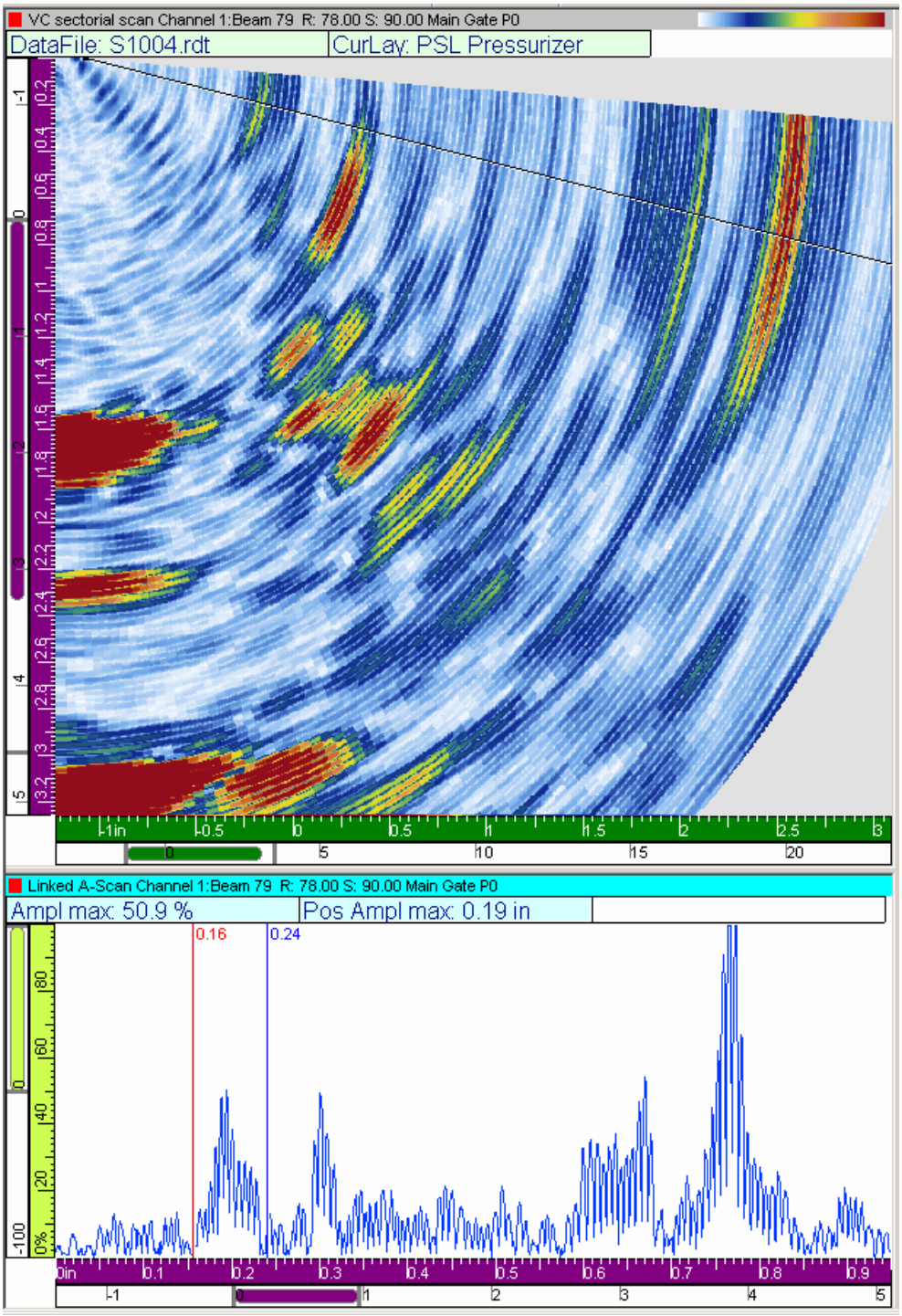
Location: 3 inches clockwise from “0” stamp

Part Thickness used for calculation: 1.7 inches

Indication through-wall depth at this location: 1.51 inches

Estimated remaining ligament above the indication: 0.19 inches

Angle used for measurement: 79 degrees



“A” Safety Circumferential Indication Profile Data

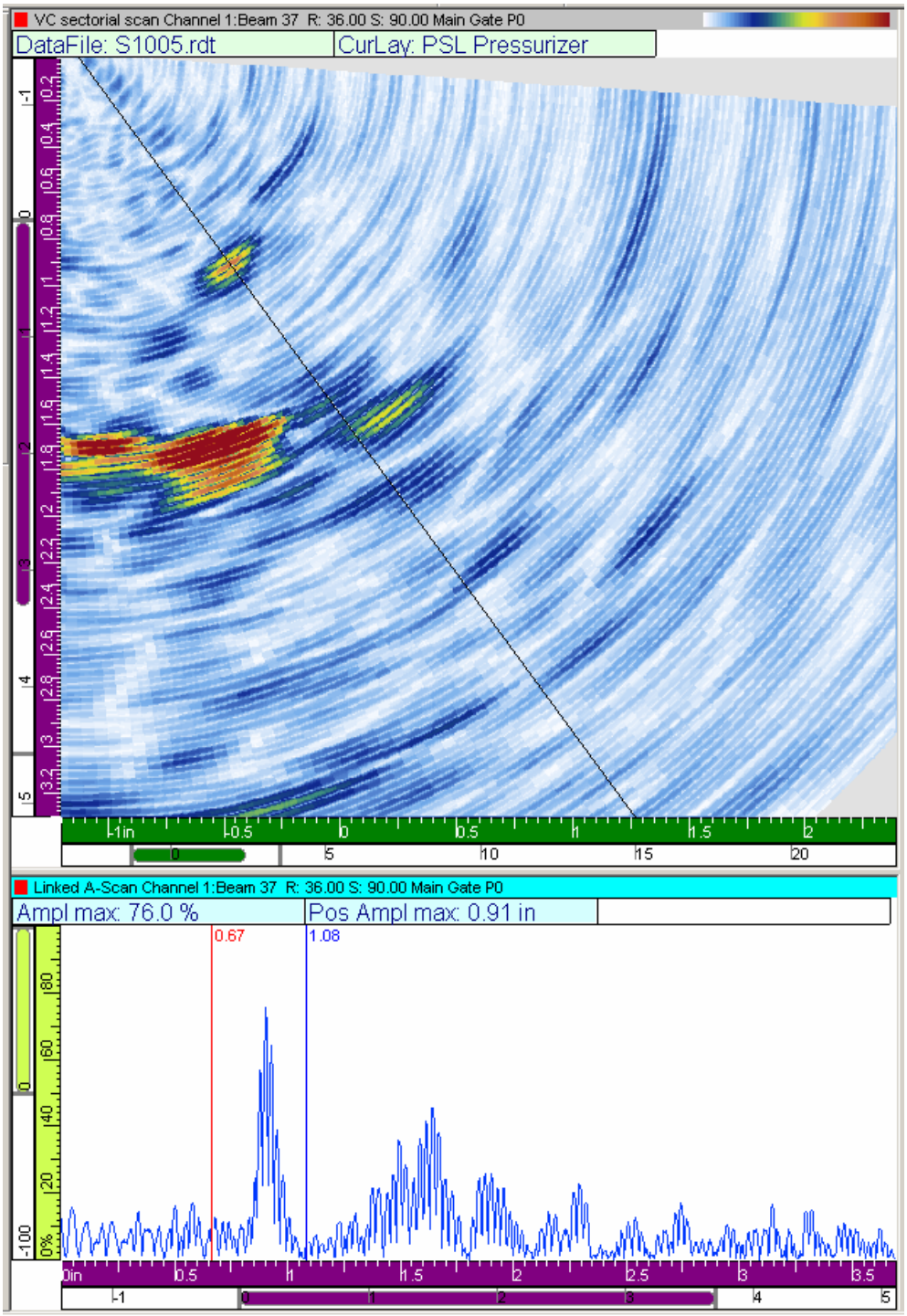
Location: 4 inches clockwise from “0” stamp

Part Thickness used for calculation: 1.7 inches

Indication through-wall depth at this location: 0.79 inches

Estimated remaining ligament above the indication: 0.91 inches

Angle used for measurement: 37 degrees



“A” Safety Circumferential Indication Profile Data

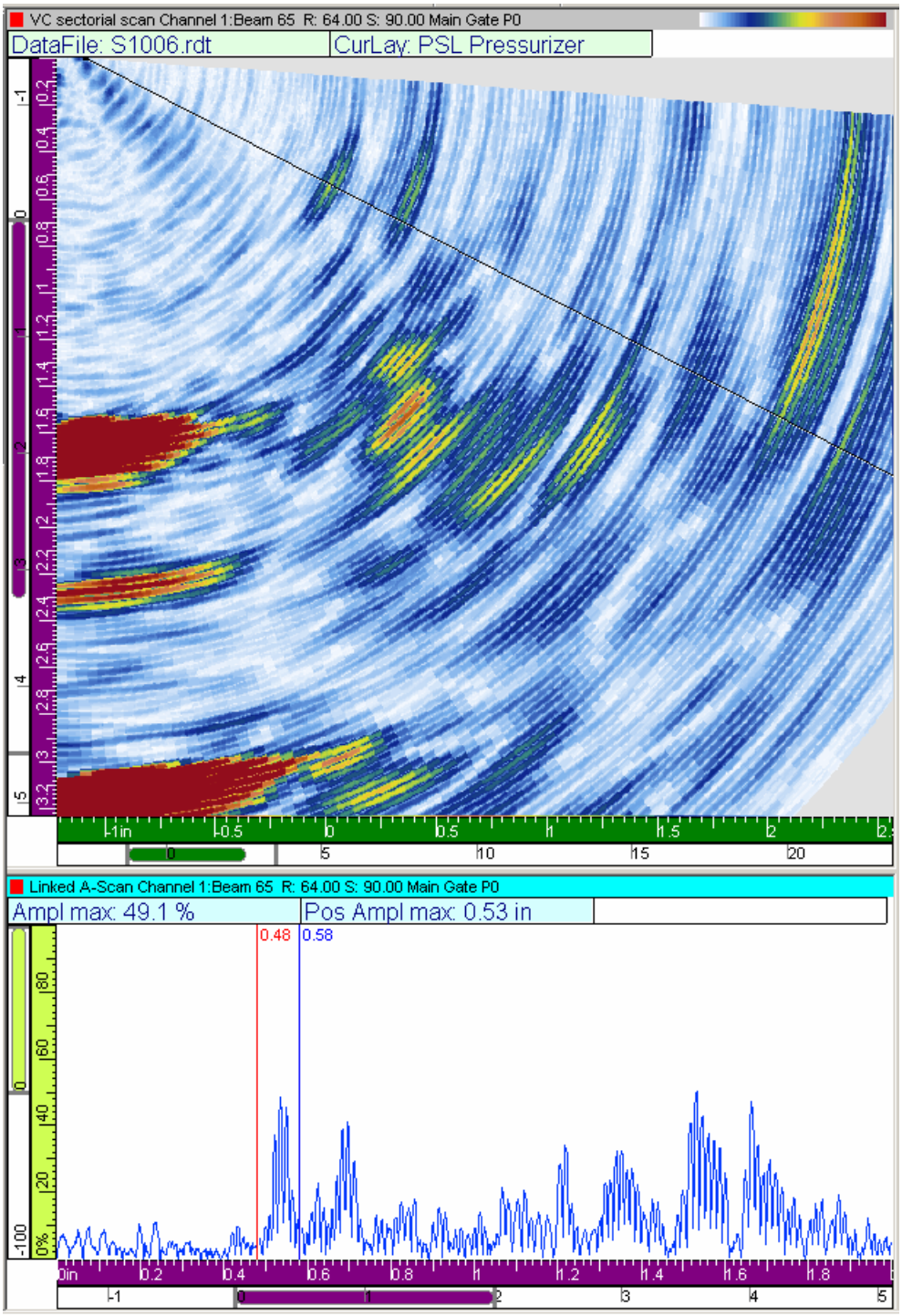
Location: 5 inches clockwise from “0” stamp

Part Thickness used for calculation: 1.7 inches

Indication through-wall depth at this location: 1.17 inches

Estimated remaining ligament above the indication: 0.53 inches

Angle used for measurement: 65 degrees



“A” Safety Circumferential Indication Profile Data

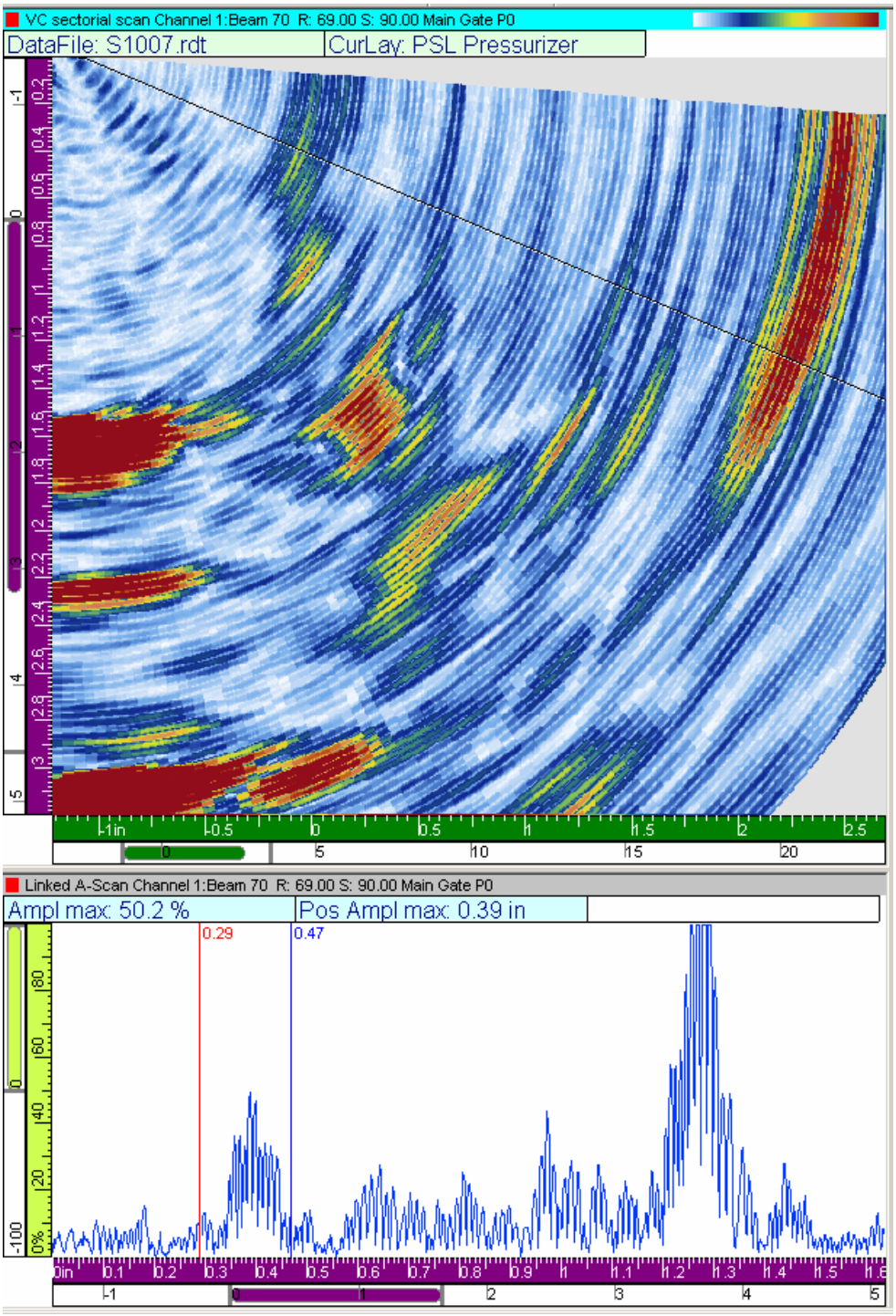
Location: 6 inches clockwise from “0” stamp

Part Thickness used for calculation: 1.7 inches

Indication through-wall depth at this location: 1.31 inches

Estimated remaining ligament above the indication: 0.39 inches

Angle used for measurement: 70 degrees



“A” Safety Circumferential Indication Profile Data

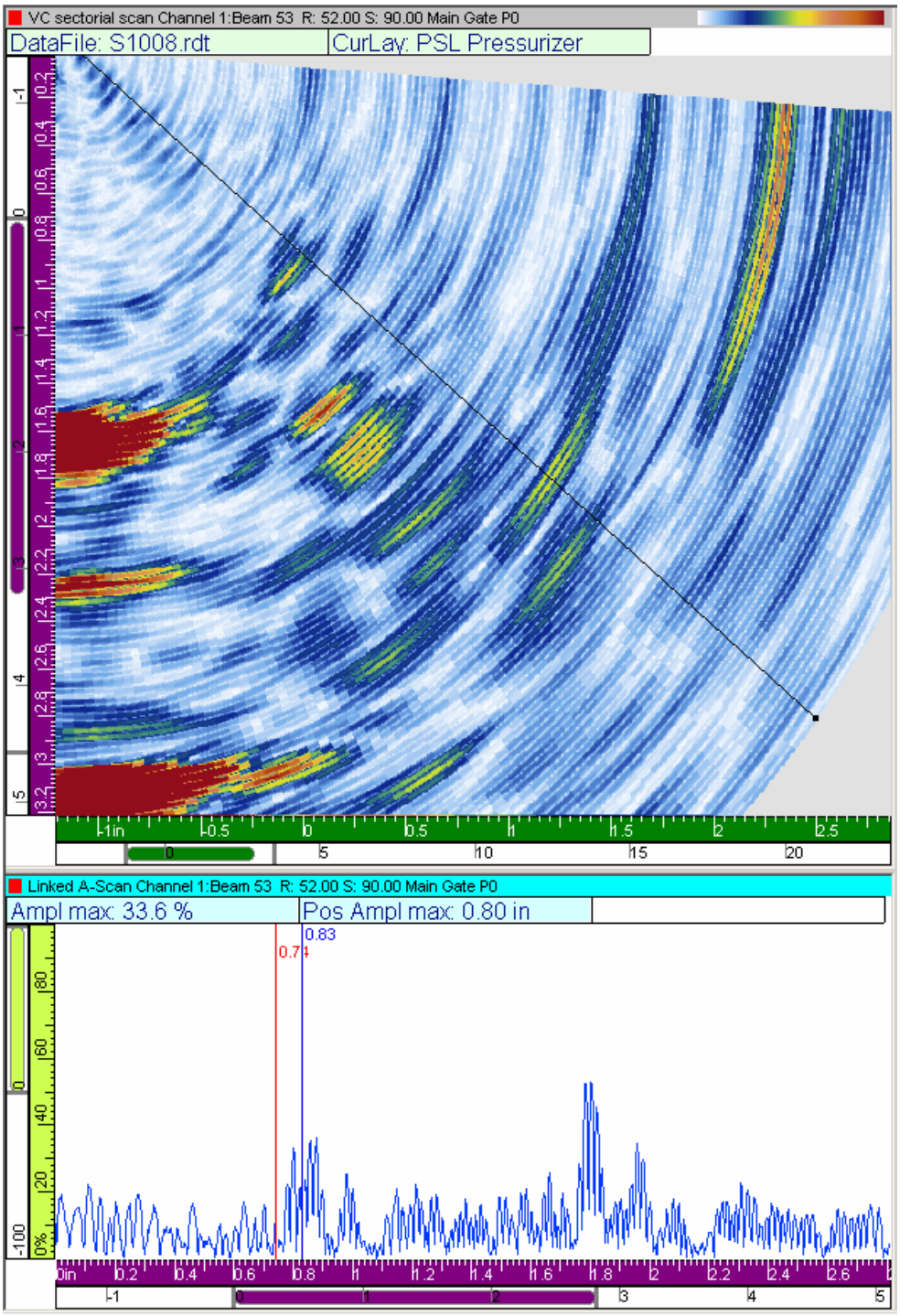
Location: 7 inches clockwise from “0” stamp

Part Thickness used for calculation: 1.7 inches

Indication through-wall depth at this location: 0.9 inches

Estimated remaining ligament above the indication: 0.80 inches

Angle used for measurement: 53 degrees



“A” Safety Circumferential Indication Profile Data

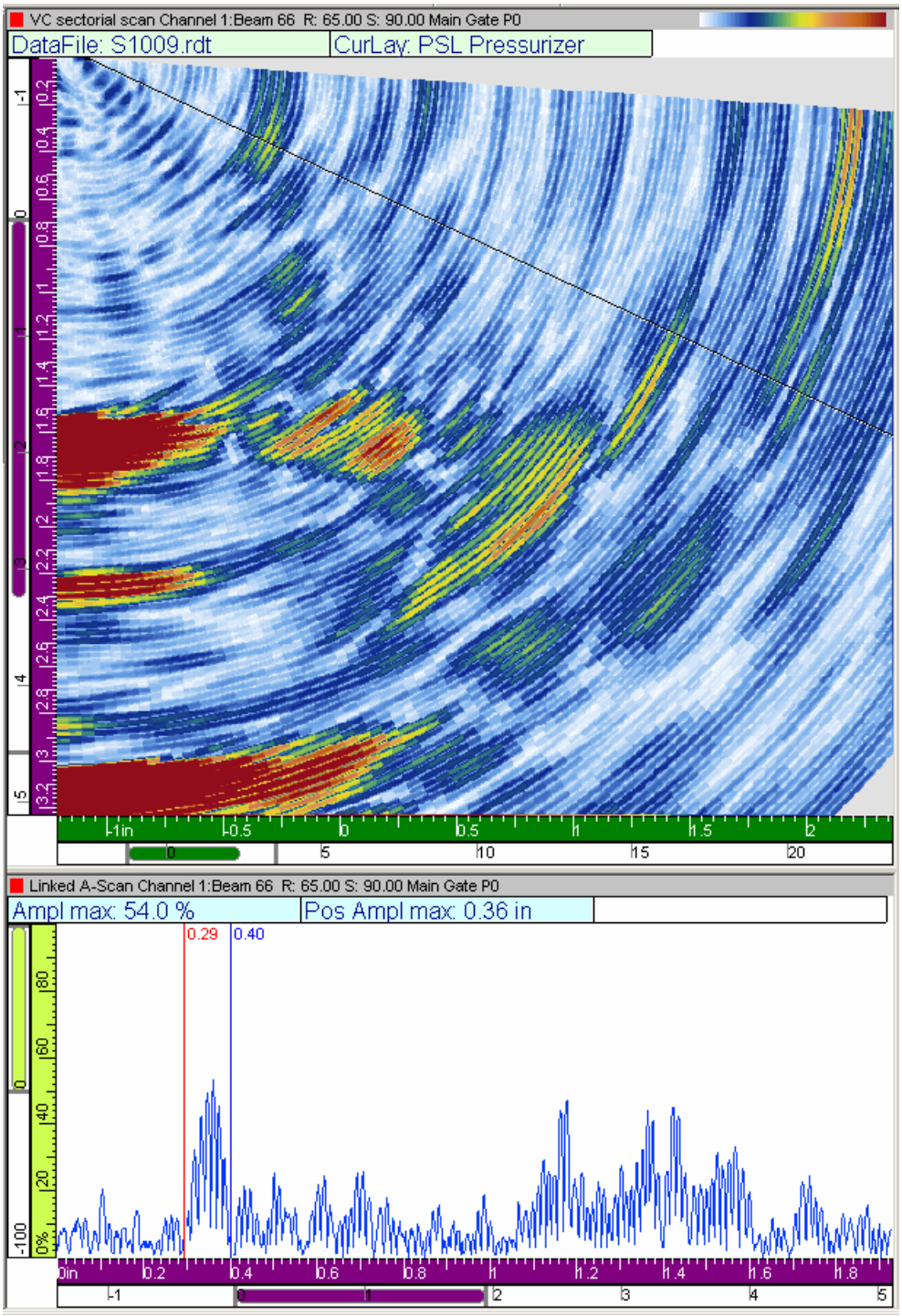
Location: 8 inches clockwise from “0” stamp

Part Thickness used for calculation: 1.7 inches

Indication through-wall depth at this location: 1.34 inches

Estimated remaining ligament above the indication: 0.36 inches

Angle used for measurement: 66 degrees



“A” Safety Circumferential Indication Profile Data

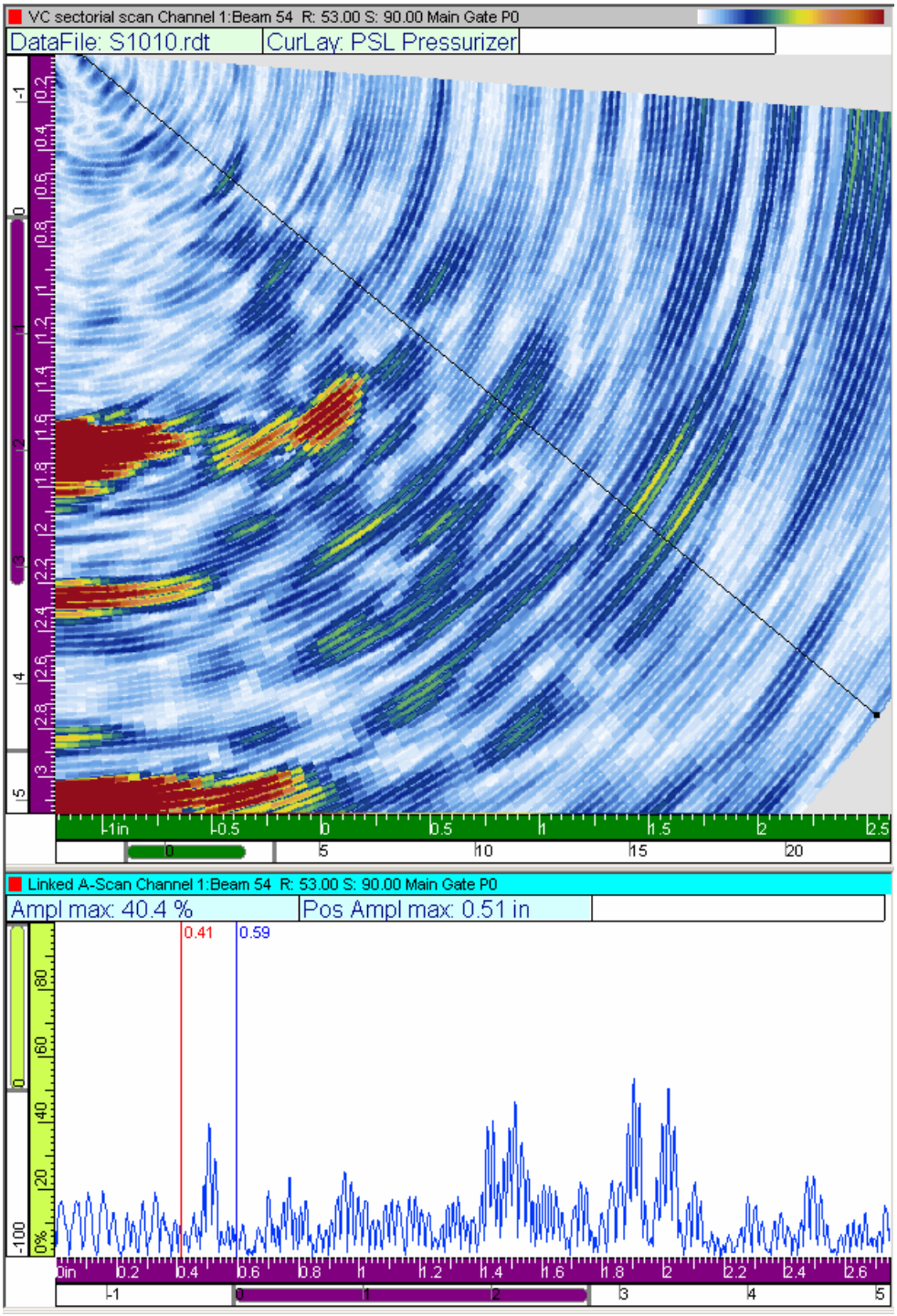
Location: 9 inches clockwise from “0” stamp

Part Thickness used for calculation: 1.7 inches

Indication through-wall depth at this location: 1.19 inches

Estimated remaining ligament above the indication: 0.51 inches

Angle used for measurement: 54 degrees



“A” Safety Circumferential Indication Profile Data

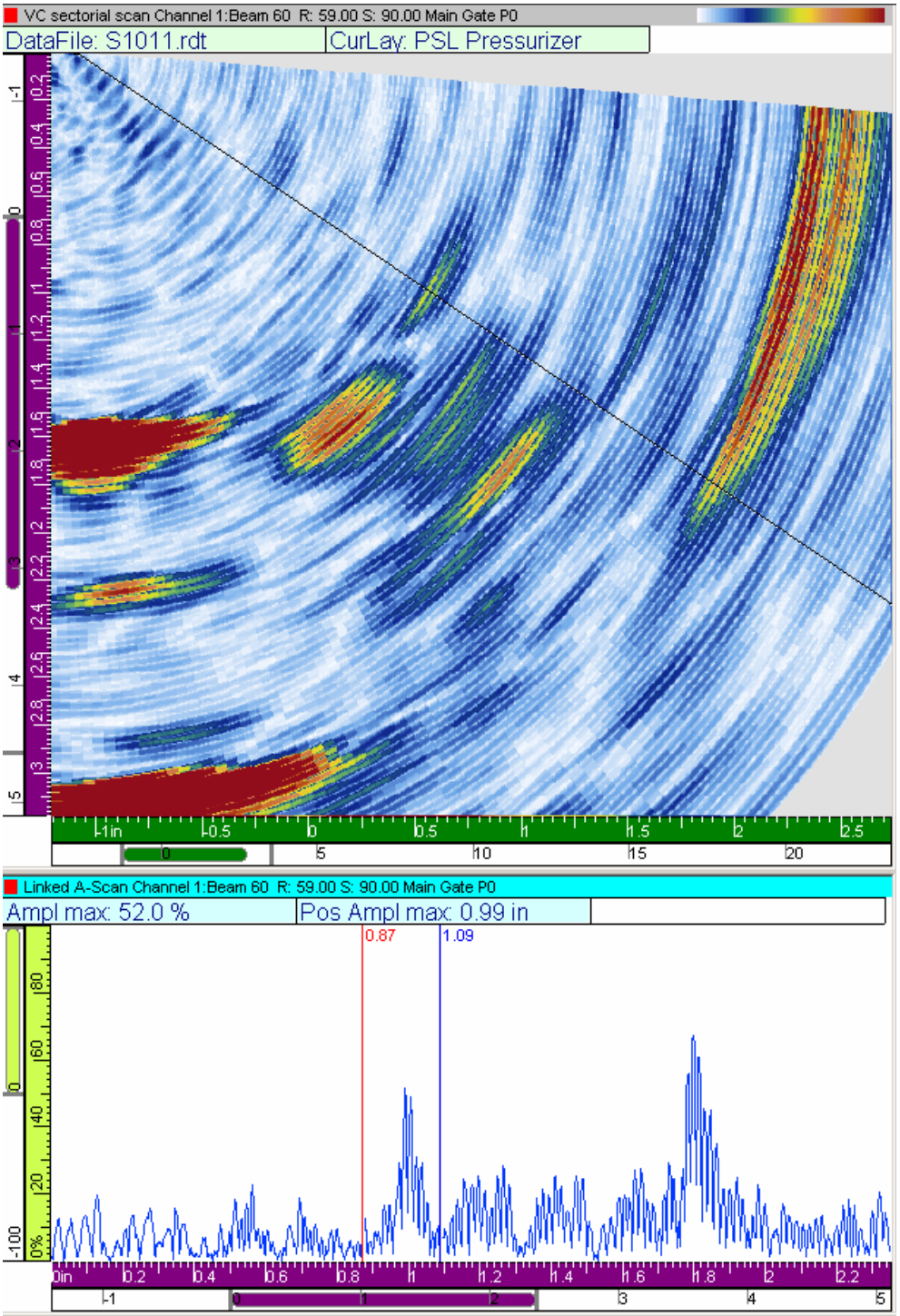
Location: 10 inches clockwise from “0” stamp

Part Thickness used for calculation: 1.7 inches

Indication through-wall depth at this location: 0.71 inches

Estimated remaining ligament above the indication: 0.99 inches

Angle used for measurement: 60 degrees



“A” Safety Circumferential Indication Profile Data

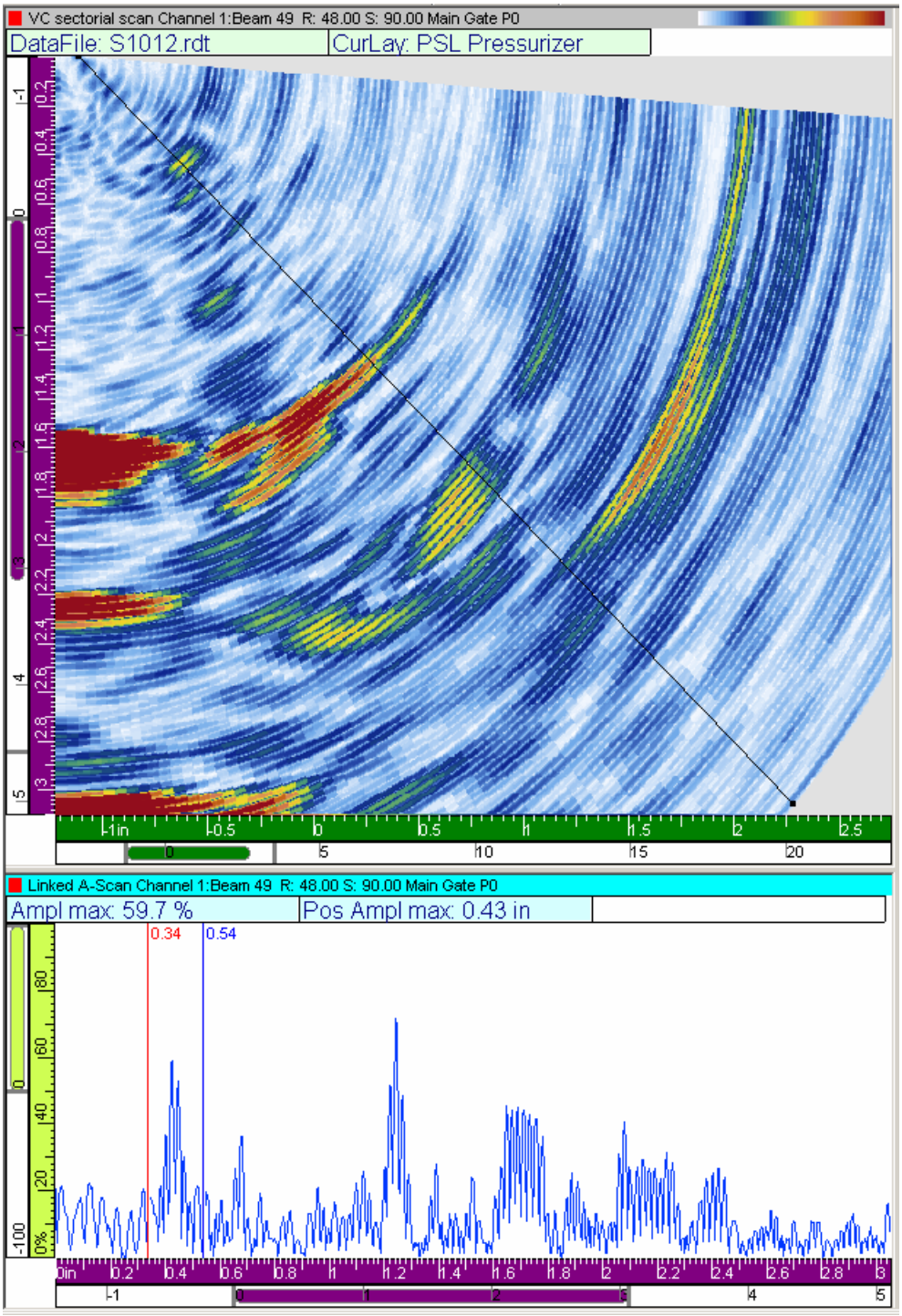
Location: 11 inches clockwise from “0” stamp

Part Thickness used for calculation: 1.7 inches

Indication through-wall depth at this location: 1.27 inches

Estimated remaining ligament above the indication: 0.43 inches

Angle used for measurement: 49 degrees



“A” Safety Circumferential Indication Profile Data

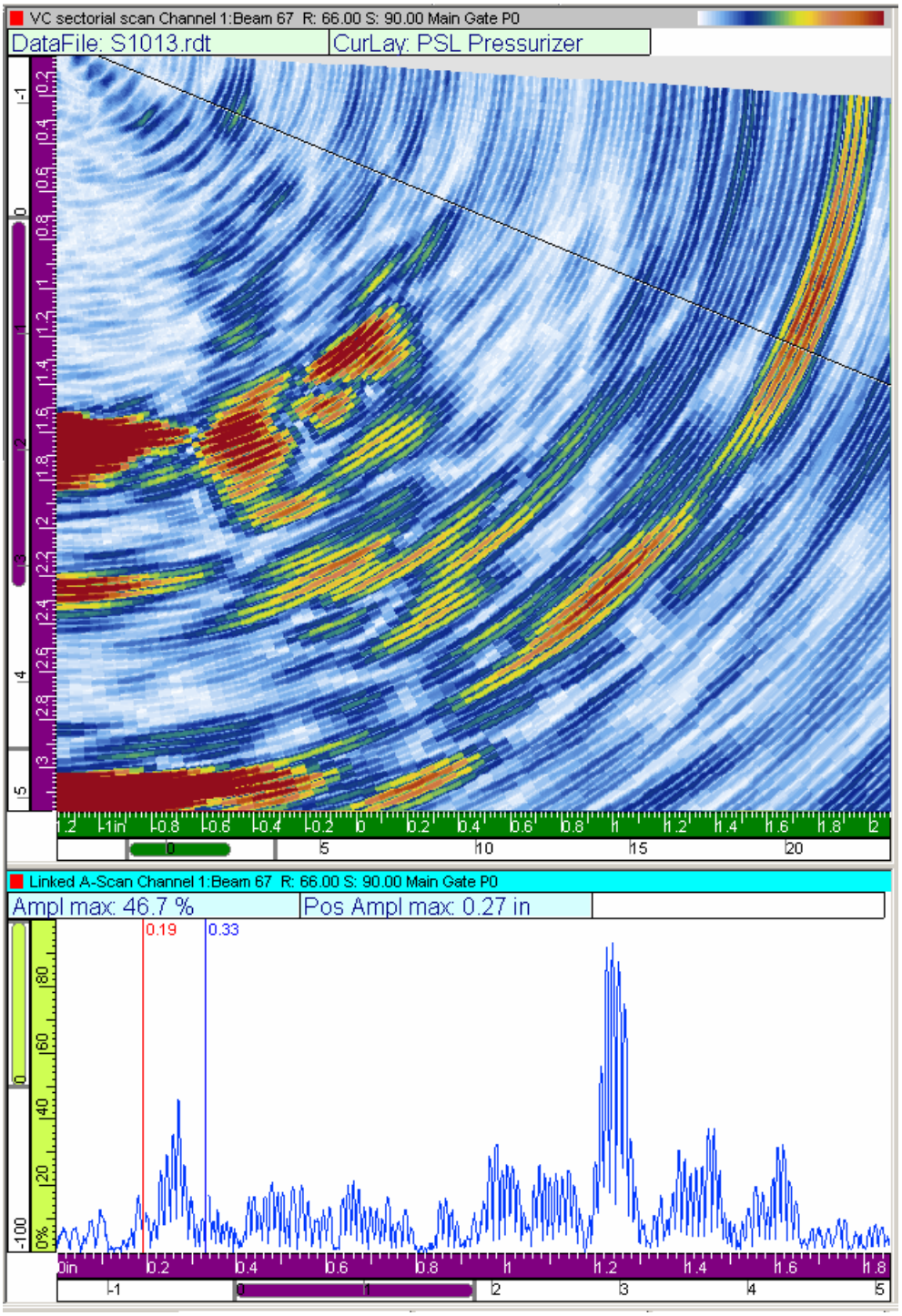
Location: 12 inches clockwise from “0” stamp

Part Thickness used for calculation: 1.7 inches

Indication through-wall depth at this location: 1.43 inches

Estimated remaining ligament above the indication: 0.27 inches

Angle used for measurement: 67 degrees



“A” Safety Circumferential Indication Profile Data

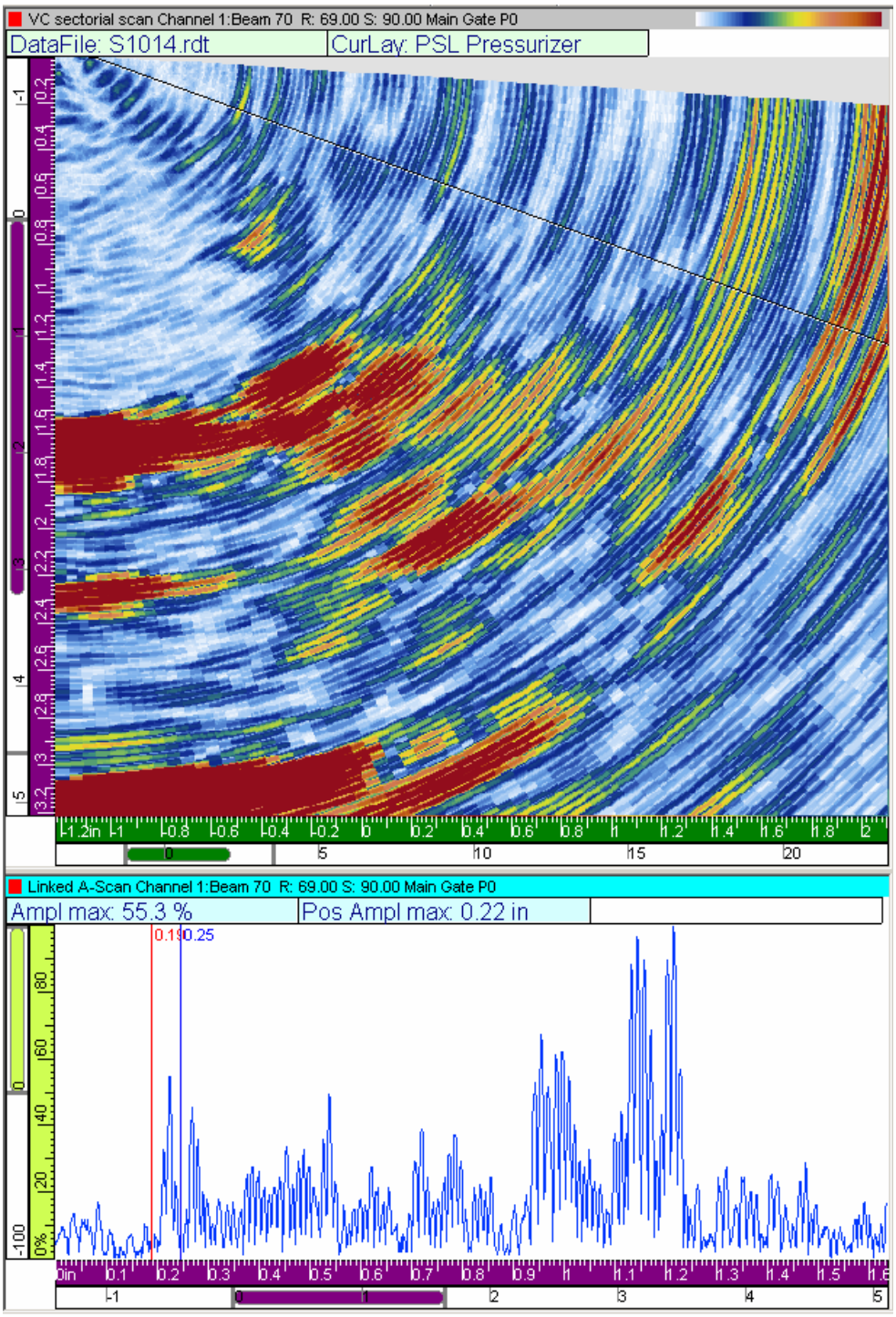
Location: 13 inches clockwise from “0” stamp

Part Thickness used for calculation: 1.7 inches

Indication through-wall depth at this location: 1.48 inches

Estimated remaining ligament above the indication: 0.22 inches

Angle used for measurement: 70 degrees



“A” Safety Circumferential Indication Profile Data

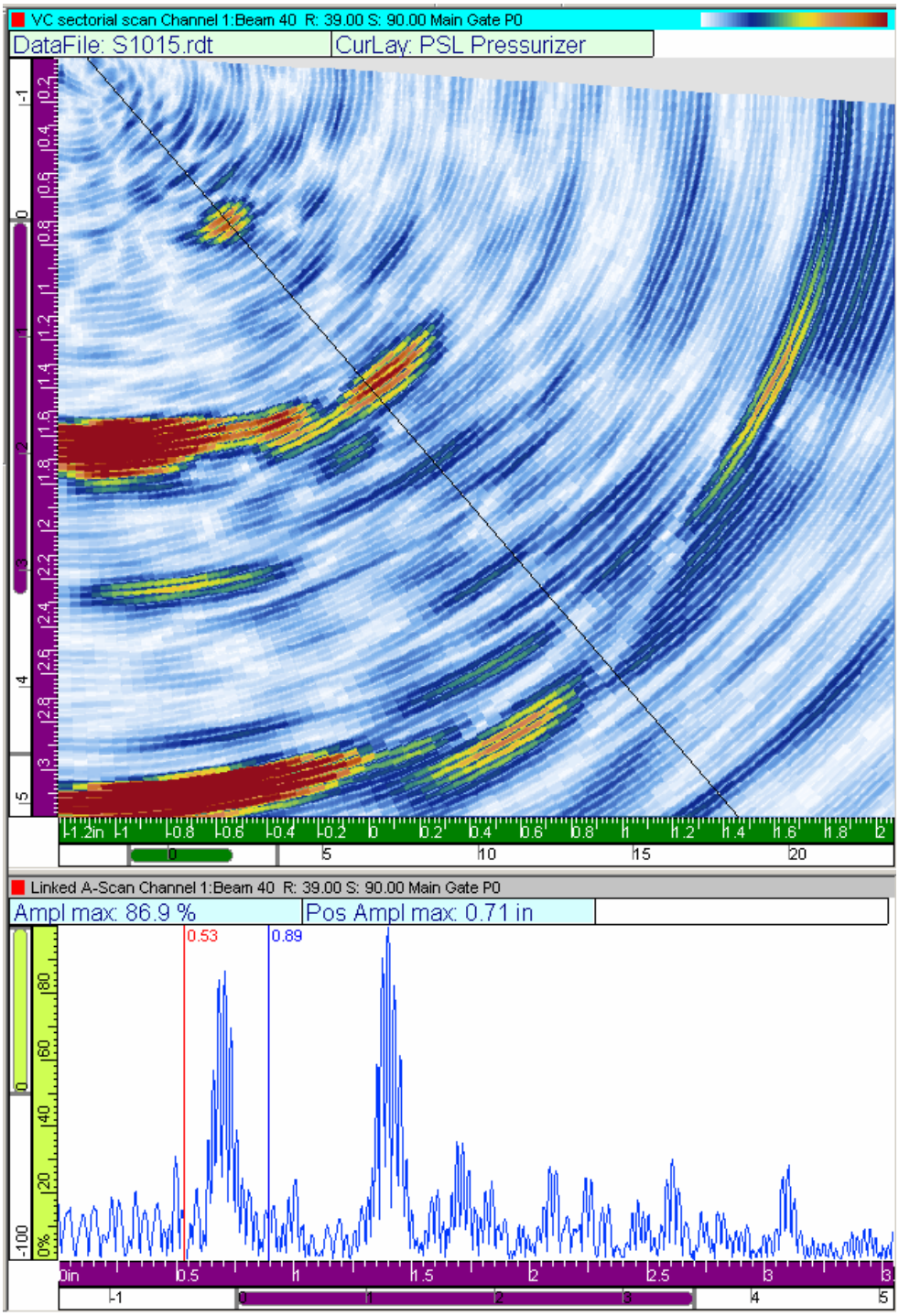
Location: 14 inches clockwise from “0” stamp

Part Thickness used for calculation: 1.7 inches

Indication through-wall depth at this location: 0.99 inches

Estimated remaining ligament above the indication: 0.71 inches

Angle used for measurement: 40 degrees



“A” Safety Circumferential Indication Profile Data

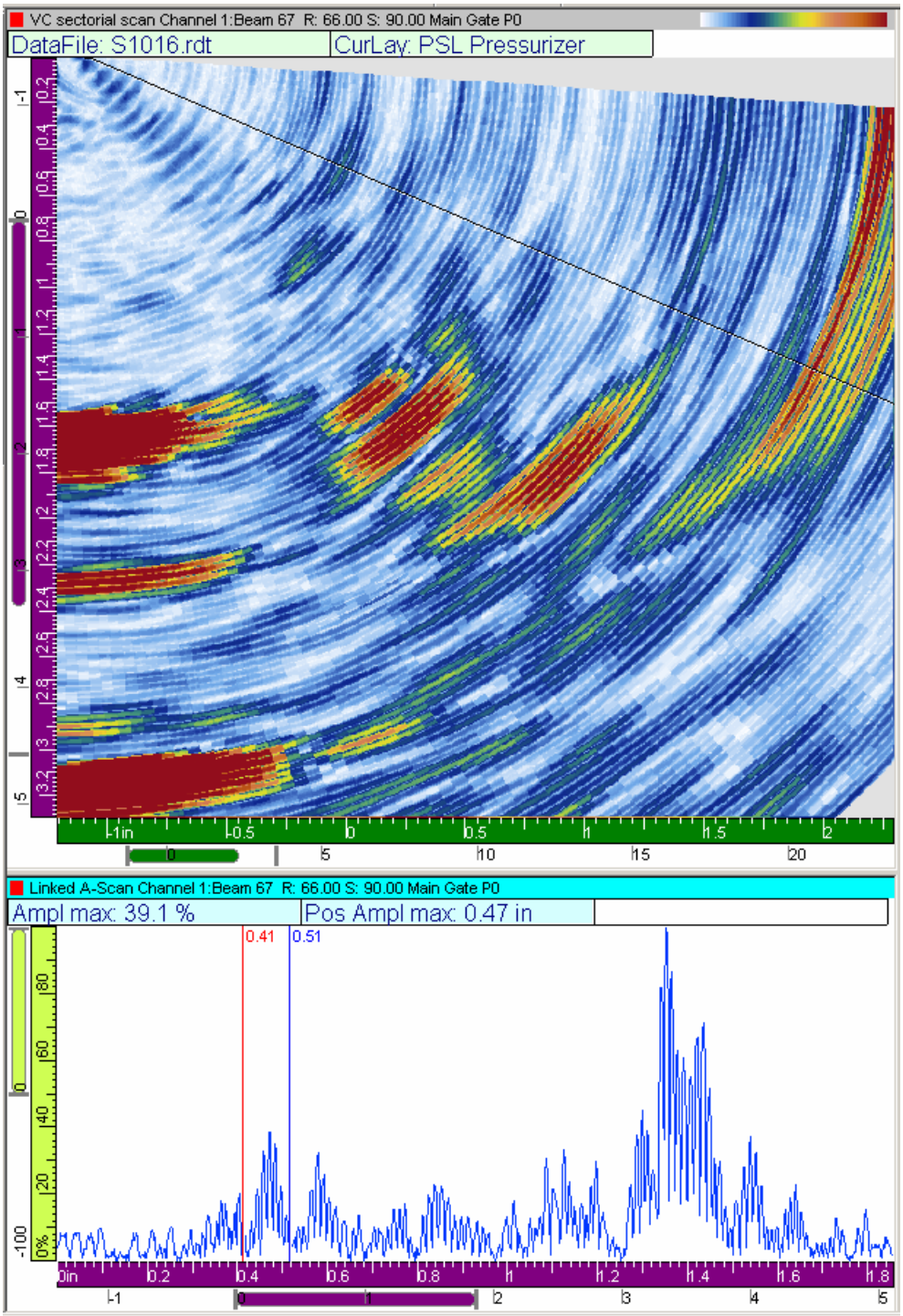
Location: 15 inches clockwise from “0” stamp

Part Thickness used for calculation: 1.7 inches

Indication through-wall depth at this location: 1.23 inches

Estimated remaining ligament above the indication: 0.47 inches

Angle used for measurement: 67 degrees



“A” Safety Circumferential Indication Profile Data

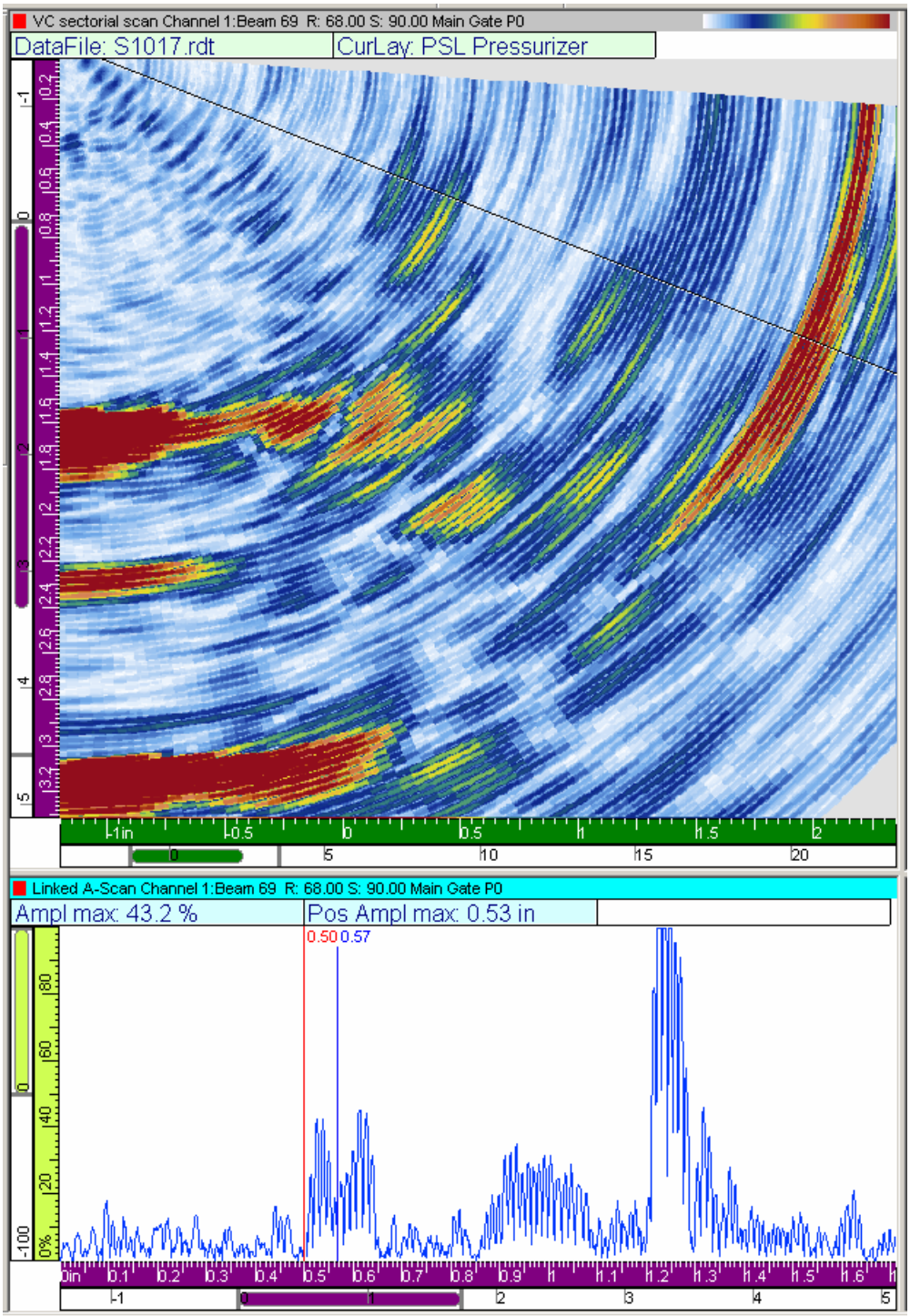
Location: 16 inches clockwise from “0” stamp

Part Thickness used for calculation: 1.7 inches

Indication through-wall depth at this location: 1.17 inches

Estimated remaining ligament above the indication: 0.53 inches

Angle used for measurement: 69 degrees



“A” Safety Circumferential Indication Profile Data

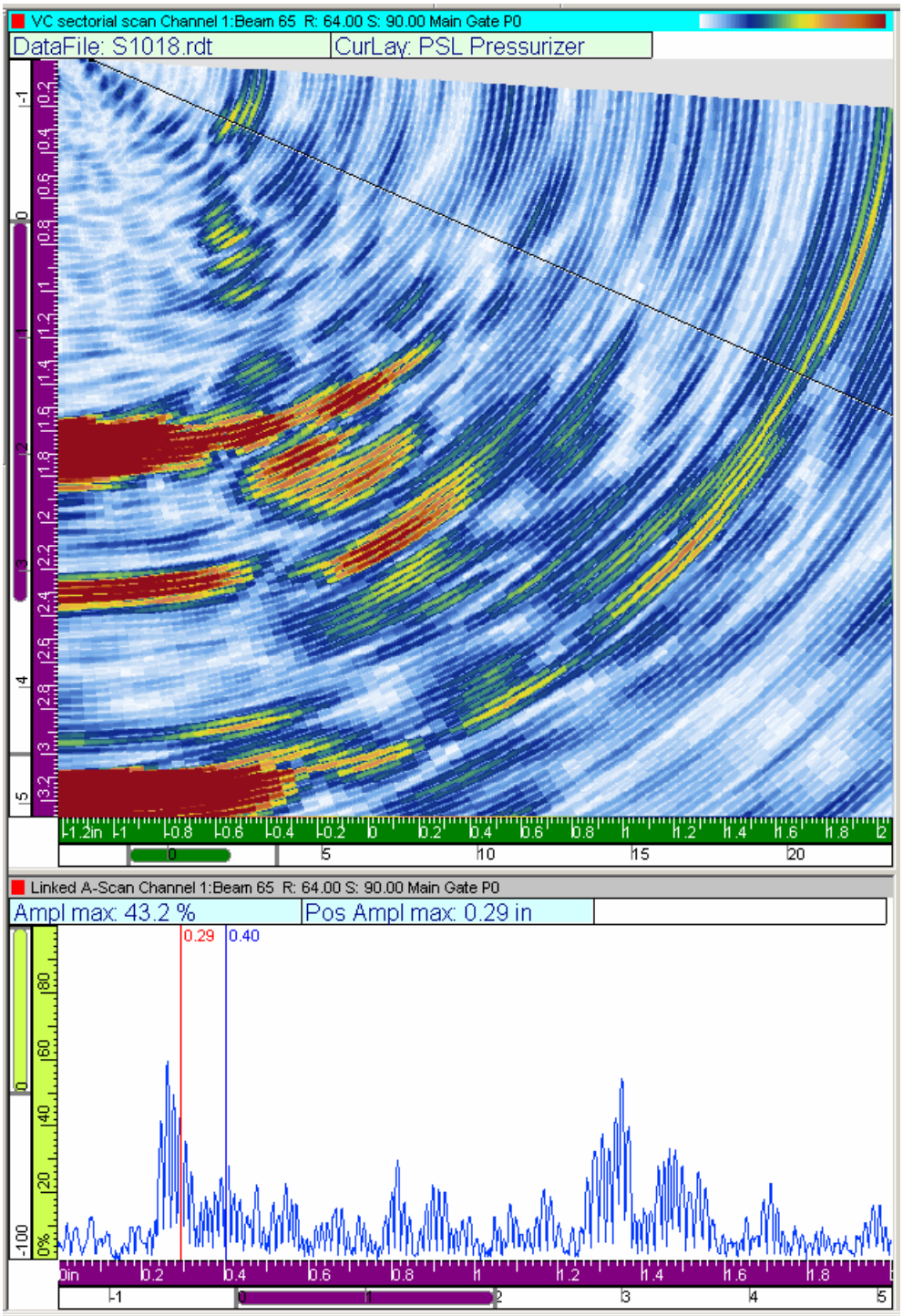
Location: 17 inches clockwise from “0” stamp

Part Thickness used for calculation: 1.7 inches

Indication through-wall depth at this location: 1.41 inches

Estimated remaining ligament above the indication: 0.29 inches

Angle used for measurement: 65 degrees



“A” Safety Circumferential Indication Profile Data

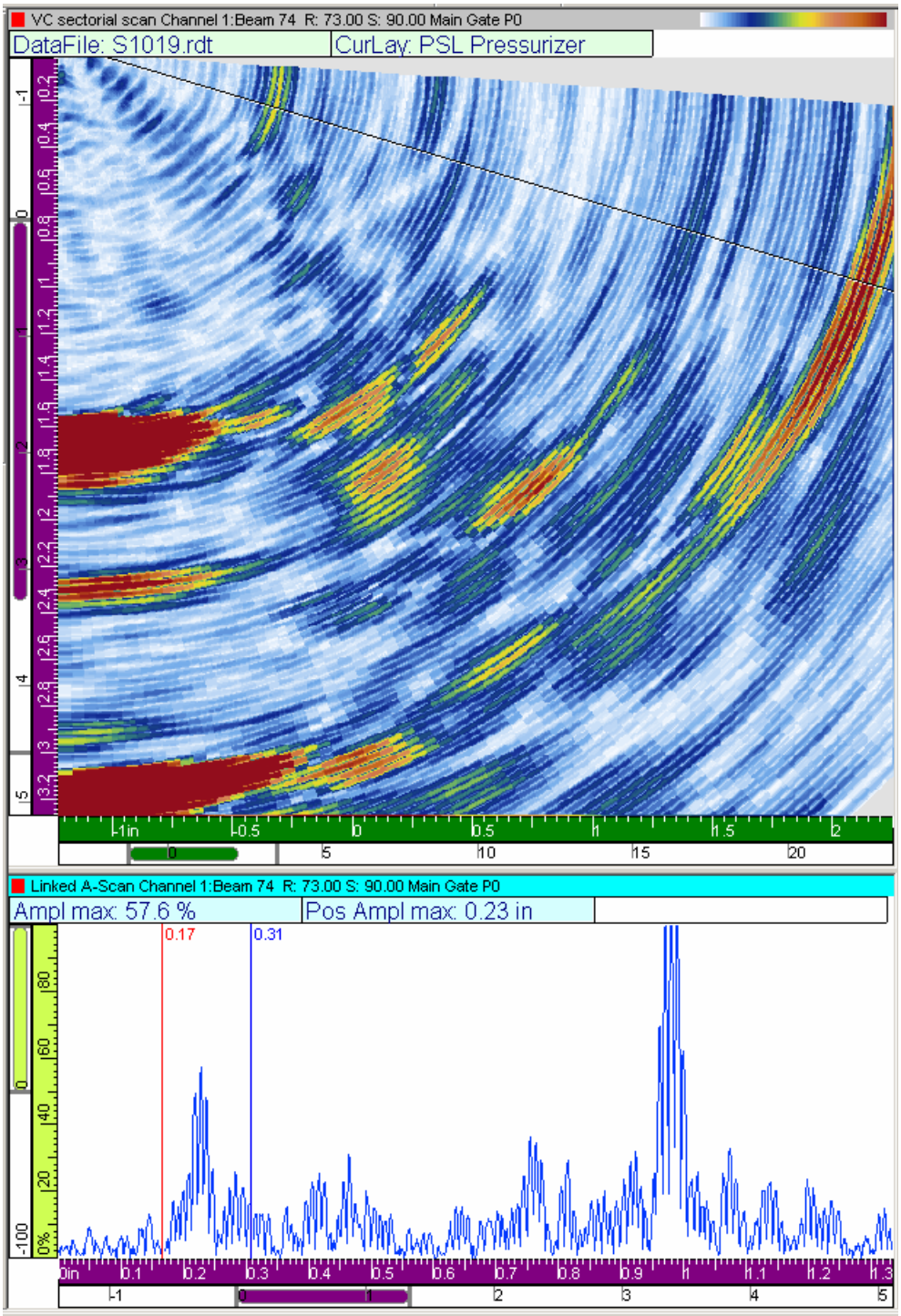
Location: 18 inches clockwise from “0” stamp

Part Thickness used for calculation: 1.7 inches

Indication through-wall depth at this location: 1.47 inches

Estimated remaining ligament above the indication: 0.23 inches

Angle used for measurement: 74 degrees



Attachment 3

UT Report

MARCH 15, 2008

REPORT SUMMARY

PSL FIELD REMOVED PRESSURIZER SAFETY NOZZLE TO FLANGE DISSIMILAR METAL WELDS

During the week of March 9th, 2008; LMT was requested to examine three Pressurizer Safety Nozzle to Flange Welds utilizing "The Procedure for Encoded, Manually Driven, Phased Array Ultrasonic Examination of Dissimilar Metal Piping Welds"; Zetec_OmniScanPA_03; Revision D; Addenda: 0. Variations to the procedure were required due to the unique configuration of the Port St. Lucie nozzles. The variations were successfully demonstrated to the EPRI Performance Demonstration Administrator in accordance with the ASME Boiler and Pressure Vessel Code, Section XI, Appendix VIII, Supplement 10. A formal Technical Justification documenting the demonstration was not complete at the time of this report but is forth coming.

The three safety nozzles were identified as 'A', 'B', and 'C'. The examination result for each nozzle is described below:

PSL Safety Nozzle 'A' (*Reference Report 'EPRI-PA-01'*)

Nine indications attributed to subsurface flaws resulting from the fabrication process were recorded. These flaws were characterized as embedded flaws that lie wholly beneath and are adequately separated from the ID / OD surface of the component.

PSL Safety Nozzle 'B' (*Reference Report 'EPRI-PA-02'*)

Five indications attributed to subsurface flaws resulting from the fabrication process were recorded. These flaws were characterized as embedded flaws that lie wholly beneath and are adequately separated from the ID / OD surface of the component.

PSL Safety Nozzle 'C' (*Reference Report 'EPRI-PA-03'*)

Seven indications attributed to subsurface flaws resulting from the fabrication process were recorded. These flaws were characterized as embedded flaws that lie wholly beneath and are adequately separated from the ID / OD surface of the component.

It should be noted that examinations were performed in the axial scan direction only by customer request as an aid to better resolve circumferential indications recorded with manual Phased Array techniques.

It should also be noted that flaw characterization and sizing methods utilized are qualified methods for surface connected planar flaws only. The full amplitude drop method was used to dimension these embedded flaws as it was felt to be the most conservative approach. Due to the severity of the possible industry implications concerning these particular welds, LMT felt that this approach was the appropriate one to take.

Jeff Devers
General Manager
LMT, Inc.

Figure 1 PSL Safety Nozzle 'A' Looking Into Head

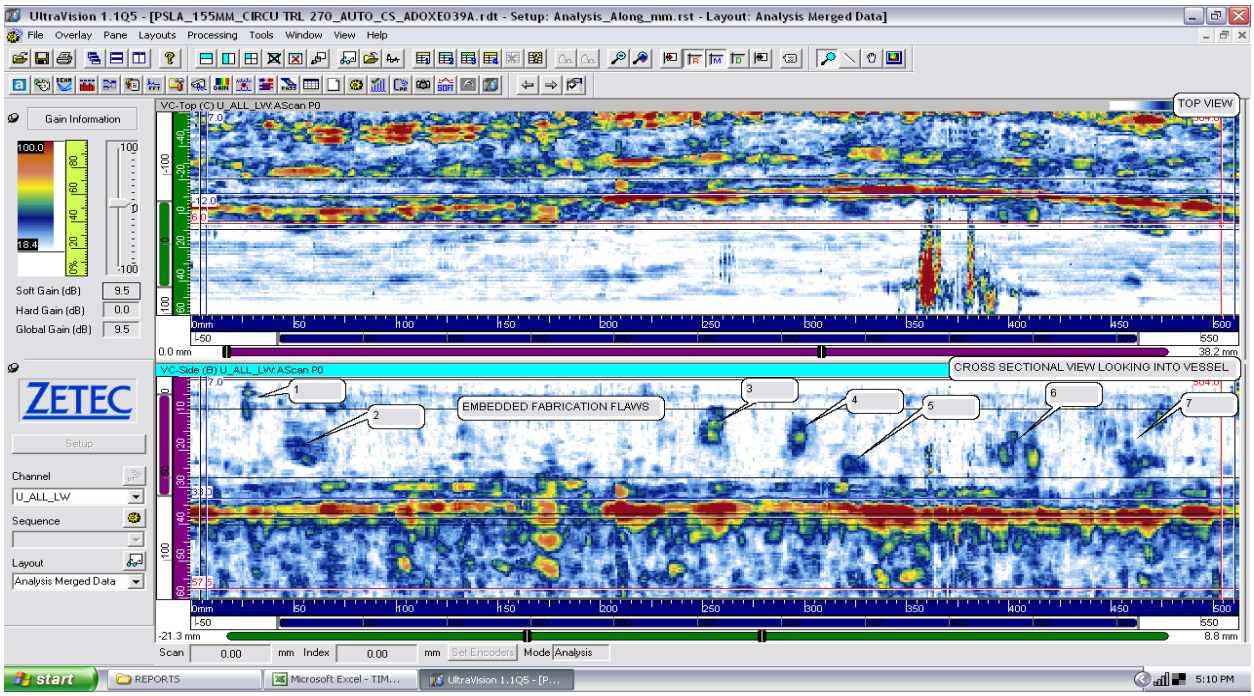


Figure 2 PSL Safety Nozzle 'A' Looking Away from Head

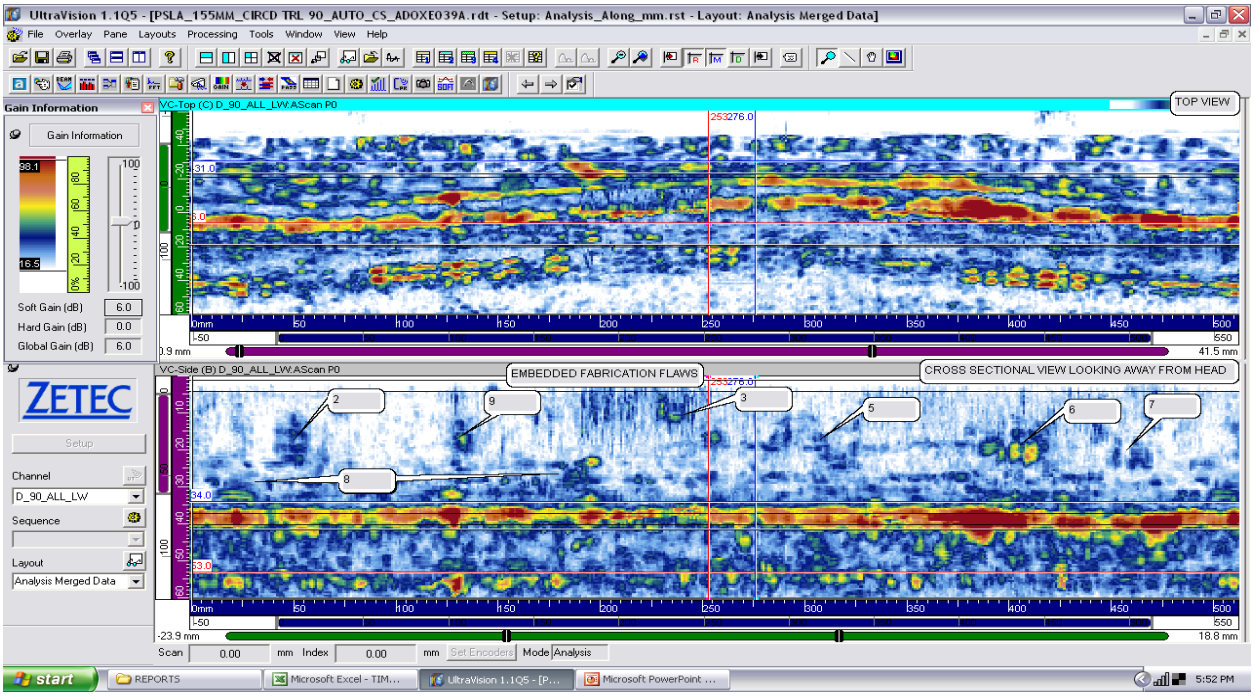


Figure 3 PSL Safety Nozzle 'B' Looking Into Head

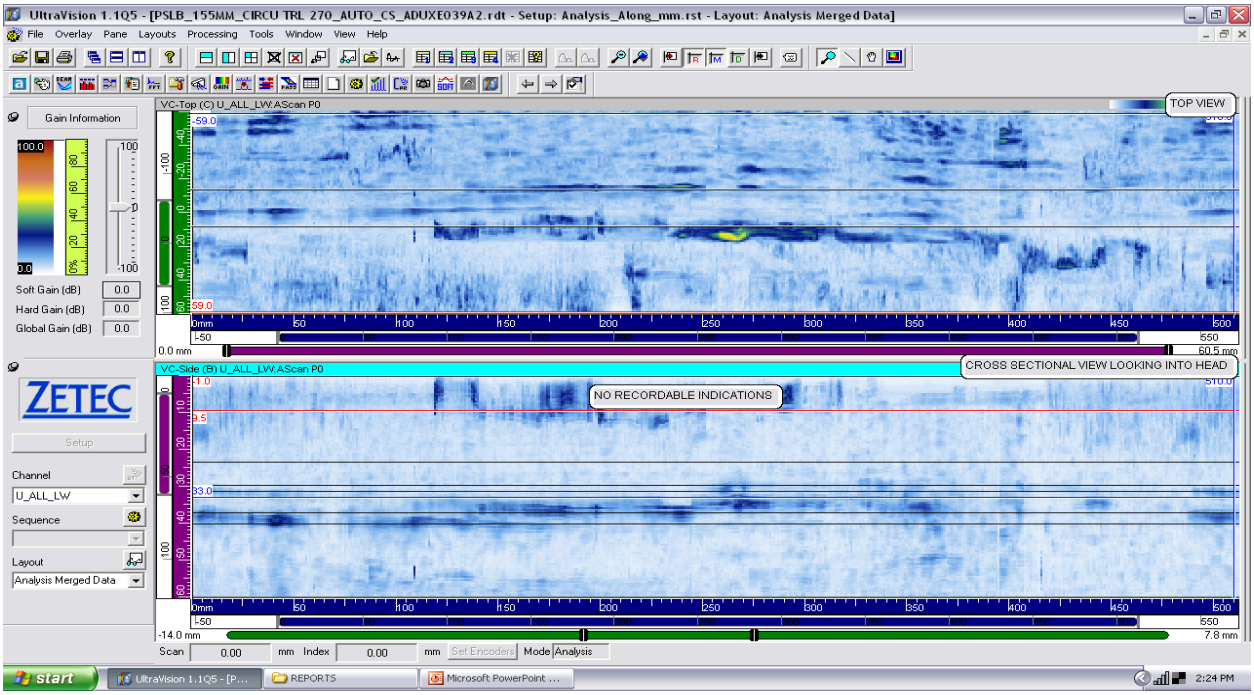


Figure 4 PSL Safety Nozzle 'B' Looking Away from Head

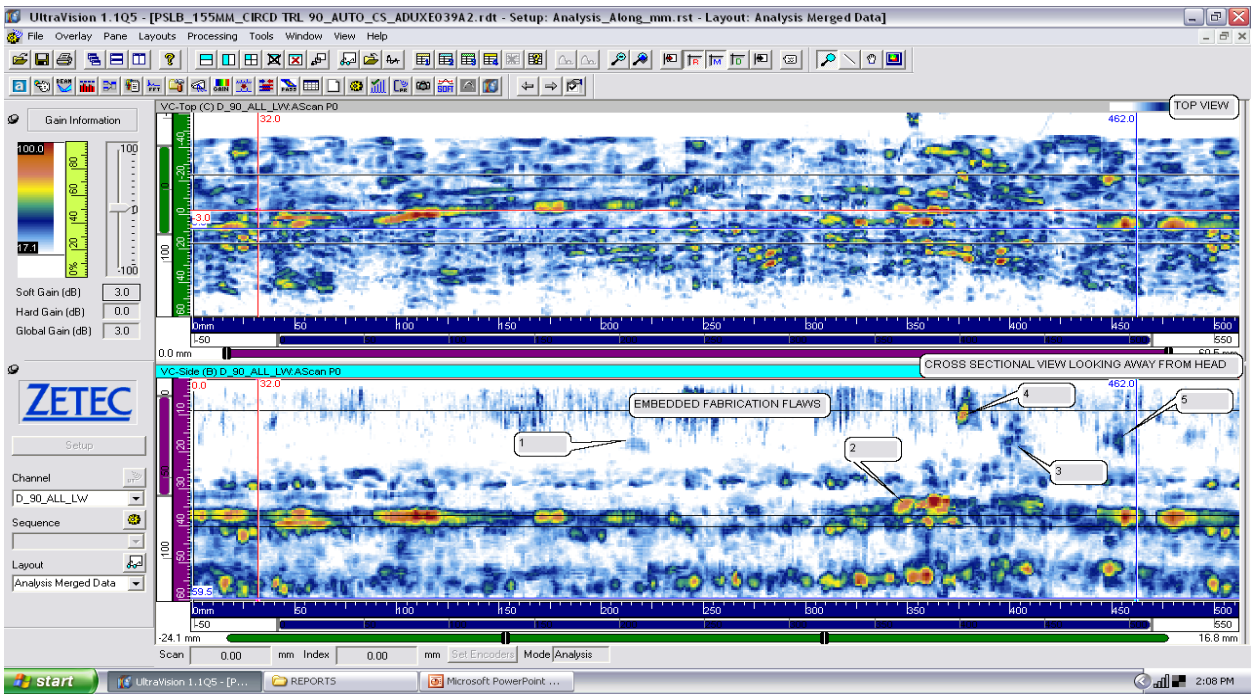


Figure 5 PSL Safety Nozzle 'C' Looking Into Head

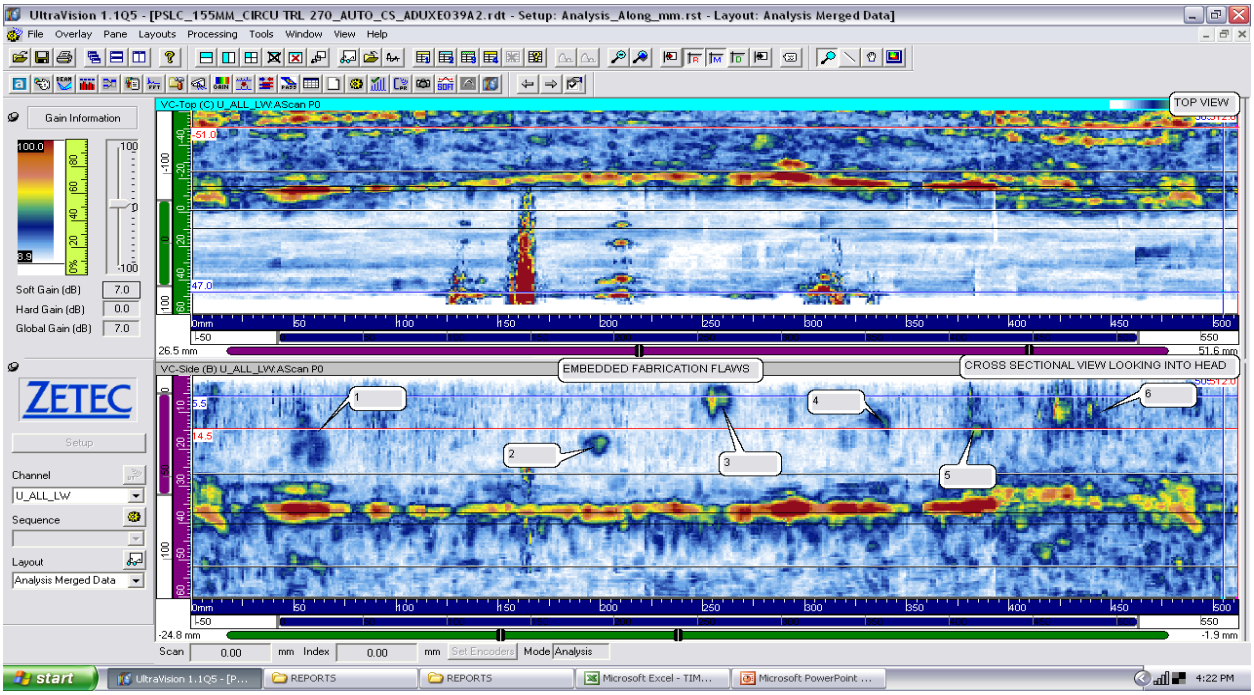
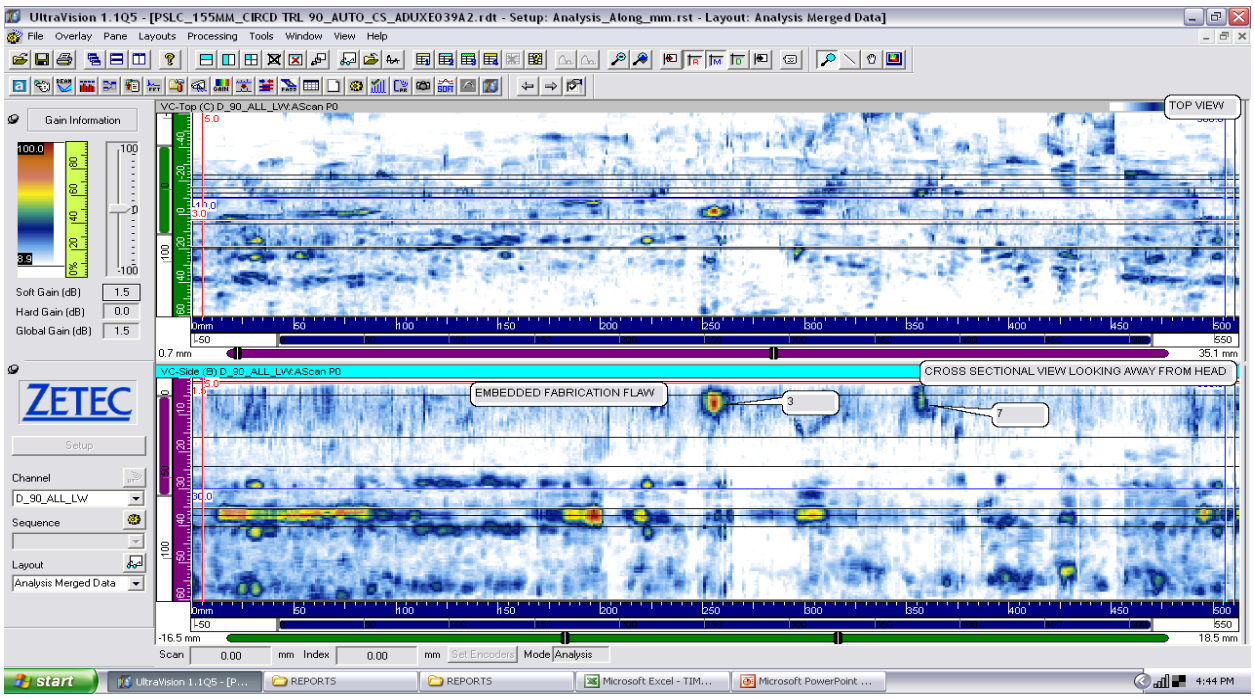


Figure 6 PSL Safety Nozzle 'C' Looking Away from Head



LINEARITY CHECK DATA SHEET

Equipment / module :	OMNI-MX/OMNI-M-PA32128PR
Serial number :	OMNI-Z-1012/OMNI-Z-6012
Calibration Due	11/21/08
Procedure :	TechDocE_OmniScanPA_SiteLinearityCheck_revA.doc

Phased array probe:	MODEL-AS SN-5135 G106
Reference block:	MEUXE005A
Verification:	PRE EXAMINATION

Gain Setting	*Gain Value* (dB)	*EA* (%FSH)	*EB* (%FSH)	*EA/2* (%FSH)
Nominal Gain	7.7	40	20	20
Nominal Gain + 6 dB	13.3	76	37.6	18.8
Nominal Gain - 6 dB	1.7	20	10	10

Test	*OK / NOK*
Vertical Amplification Linearity	OK
Amplitude Control Linearity	OK

Data Analyst : *Jeff Devers* JD

Date/Time : *3/8/2008-1720*

EPRI Review Date : 3/17/08

ANII Review Date : *N/A*

LMT Review *Todd Blechinger*

Date : *3/14/08*

Report # *EPRI-PA-01*

LINEARITY CHECK DATA SHEET

Equipment / module :	OMNI-MX/OMNI-M-PA32128PR
Serial number :	OMNI-Z-1012/OMNI-Z-6012
Calibration Due	21-Nov-08
Procedure :	TechDocE_OmniScanPA_SiteLinearityCheck_revA.doc

Phased array probe:	MODEL-AS SN-5135 G106
Reference block:	MEUXE005A
Verification:	POST EXAMINATION

Gain Setting	*Gain Value* (dB)	*EA* (%FSH)	*EB* (%FSH)	*EA/2* (%FSH)
Nominal Gain	7.7	40	20	20
Nominal Gain + 6 dB	13.3	76	37.6	18.8
Nominal Gain - 6 dB	1.7	20	10	10

Test	*OK / NOK*
Vertical Amplification Linearity	OK
Amplitude Control Linearity	OK

Data Analyst : *Jeff Devers* JD

Date/Time : *3/13/2008-1700*

EPRI Review Date : 3/17/08

ANII Review Date : *N/A*

LMT Review *Todd Blechinger*

Date : *3/14/08*

Report # *EPRI-PA-01*

PHASED ARRAY CALIBRATION DATA SHEET

Procedure : ZETEC_Omniscan PA_03_revD **Plant / Unit :** PSL/1

UT equipment : OMNI-M-PA32128PR **Ser. Number:** OMNI-Z-1012/OMNI-Z-6012

Probe Configuration	Serial No.	Active Channels	Wedge assembly	Calibration block	Reflector	Sens. (dB)	UT path (mm)	Date (dd/mm/yy)	Time (hh:mm)	Status	Operator (initials)
CS/ CIRCU TRL 270	5155A103 5155B105	ALL	ADUXE 039A	MEUXE015A	1.0"	32.5	35.6	3/9/08	0010	INITIAL	TPB
CS/ CIRCU TRL 270	5155A103 5155B105	ALL	ADUXE 039A	MEUXE015A	1.0"	32.5	35.6	3/9/08	0015	FINAL	TPB
CS/ CIRCD TRL 90	5155A103 5155B106	ALL	ADUXE 039A	MEUXE015A	1.0"	32.5	35.6	3/9/08	0205	INITIAL	TPB
CS/ CIRCD TRL 90	5155A103 5155B106	ALL	ADUXE 039A	MEUXE015A	1.0"	32.5	35.6	3/9/08	0210	FINAL	TPB

"Sens. (dB)" = gain setting (in dB) required to obtain echo amplitude of 80% SH on reference reflector

Data Analyst Jeff Devers JD
Date : 3/9/08

EPRI Review
Date : 3/17/08

ANII Review N/A
Date :

LMT Review Todd Blechinger
Date : 3/14/08

Report # EPRI-PA-01

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'A'

Menu item	Setting	Essential / Non-Essential / Not applicable
File		
File		
Destination	Storage Card	Non-Essential
Save Mode	A-Scan	Essential
File Name	***PSLA_155MM_CIRCD TRL 90_AUTO_CS_ADUXE039A***	Essential
Report		
Template	Complete	Non-Essential
File Name	***PSLA_155MM_CIRCD TRL 90_AUTO_CS_ADUXE039A***	Essential
Paper Size	Letter	Non-Essential
Format		
User field	Off	Non-Essential
Probe	Off	Non-Essential
Setup	On	Essential
Note	Off	Non-Essential
View	Current Layout	Non-Essential
User field		Not applicable
Notes		Not applicable
Reading		
Result		
Selector	List 1	Essential
Field 1	A% (Peak Amplitude in Gate)	Essential
Field 2	A^ (Half Path position in Gate)	Essential
Field 3	B%	Not applicable
Field 4	B^	Not applicable
Cursors		Not applicable
Table		Not applicable
Export		Not applicable
Utilities		
Pref.		
Units	Millimeters	Essential
Bright (%)	25	Non-Essential
Scheme	Indoor	Non-Essential
System		
Clock Set	*Set to correct time*	Essential
Date Set	*Set to correct date*	Essential
Time Zone	*Set to correct time zone*	Non-Essential
Daylight saving	On	Non-Essential
Select Key	F2	Non-Essential
Assign Key	Gain	Non-Essential
Service		Not applicable

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'A'

Options			Not applicable
Network	*Only for network saving*		Non-Essential
UT			
General			
Gain	33.7		Essential
Start	0		Essential
Range	113.09mm		Essential
Wedge delay	2.30		Essential
Velocity	5890 m/s		Essential
Pulser			
Pulser	1		Not applicable
Tx/Rx mode	PE		Essential
Freq	1.5		Essential
Voltage	High		Essential
PW	*Imported from LAW file (333 ns)*		Essential
PRF	25		Essential
Receiver			
Receiver	1		Not applicable
Filter	None		Essential
Rectifier	FW		Essential
Video Filter	Off		Essential
Receiver			
Averaging	1		Essential
Reject	0		Essential
Beam			
Gain Offset	*Imported from LAW file*		Essential
Scan Offset	*Imported from LAW file*		Essential
Index Offset	*Imported from LAW file*		Essential
Angle	*Imported from LAW file*		Essential
Skew	*Imported from LAW file*		Essential
Beam Delay	*Imported from LAW file*		Essential
Advanced			
dB Ref	Off		Essential
Points Qty	640		Essential
Scale Factor	6		Essential
Sum Gain	*Imported from LAW file*		Essential
Scan			
Encoder			
Encoder	1 (Scan)	2 (Index)	Essential
Polarity	Normal	Inverse	Essential
Type	Quad		Essential
Resolution	35.38	58.00	Essential
Origin	0		Essential
Synchro			

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'A'

Source	Both Axes	Essential
Scan	Encoder 1	Essential
Index	Encoder 2	Not applicable
Scan Speed	25 for scan resolution of 1 mm	Not applicable
Area		
Scan Start	0 mm	Essential
Scan End	512	
Scan Resolution	1.0 mm	Essential
Index start	-34.0 mm	Essential
Index end	40.3 mm	Essential
Index resolution	14.9 mm	Essential
Start		
Start Mode	Reset All	Essential
Pause	Off	Non-Essential
Data		
Storage	Last	Essential
Display		
Selection		
Display	A-S-C	Essential
C-Scan 1	A%	Non-Essential
Group	Current	Non-Essential
Projection	On	Not applicable
Rulers		
UT Unit	Sound Path	Essential
% Ruler	Linear(%)	Essential
Grid	Off	Non-Essential
DAC / TCG	Off	Essential
Gate	On	Essential
Cursor	On	Essential
Zoom		Not applicable
Color		
Select	Amplitude	Essential
Start (%)	0.0	Essential
End (%)	100.0	Essential
Properties		Not applicable
Probe/Part		
Select		
Group	1	Not applicable
Group Link	Off	Not applicable
Select	Select Tx/Rx	Essential
Select Probe	Unknown	Not applicable
Select Wedge	Contact / Contact	Not applicable
Auto Detect	Off	Essential
Scan Offset	0	Essential

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'A'

Index Offset	0			Essential
Skew	0			Essential
Characterize				Not applicable
Parts				Not applicable
Wizard				Not applicable
PGM Probe				
Configuration				
Group	1			Not applicable
Enable	Off			Not applicable
Scan Type	Custom			Essential
Connection P	1			Not applicable
Connection R	1			Not applicable
Aperture				Not applicable
Beam				Not applicable
Laws				
Auto Program	Off			Essential
Wizard				Not applicable
Gate/Alarm				
Gate				
Gate Select	Gate A	B	I	Essential
Gate Start	10	0	0	Essential
Width	End of time base	0	0	Non-Essential
Threshold	25	0	0	Essential
Mode	Positive			Not applicable
Synchro	Pulse			Essential
Alarms				Not applicable
Output				Not applicable
Gate/Alarm (ctd.)				
DAC / TCG				Not applicable
Thickness				Not applicable
Calibration				
Phased Array				Not applicable
Axis				Not applicable
TCG				Not applicable
Code				Not applicable
User				
Gain				Not applicable
Start				Not applicable
Range				Not applicable
Display				Not applicable
Gate				Not applicable

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'A'

Focal Law Calculator Inputs

Menu item	Setting	Essential / Non-Essential / Not applicable
Probe (CS) 90°		
Name	1.5M16x2E32-7(EWUXE083A)	Essential
Probe Skew Angle	90°	Essential
Probe Frequency	1.5 MHz	Essential
Number of elements on primary axis	16	Essential
Primary axis pitch	2 mm	Essential
Secondary axis width	7 mm	Essential
Pitch and Catch	Checked	Essential
Probe separation		Not applicable
Squint angle	"0.0°"	Essential
Reverse primary axis	Unchecked	Essential
Specimen		
Name	Memphis CS LW	Non-Essential
Specimen Type	"Pipe OD"	Essential
Wave type	"Longitudinal" for TRL	Essential
Sound velocity	90°-5890 m/s	Essential
Thickness	40 mm	Essential
Radius	77 mm	Essential
Wedge		
Name	ADUXE039A	Essential
Footprint	"Curvature along secondary axis"	Essential
Wedge angle	22.3	Essential
Roof angle	6.0	Essential
Sound velocity	"2330 m/s"	Essential
Height at the middle of the first element	"8.17 mm" for ADUXE039A	Essential
Primary axis offset of the middle of the first element	"8.43 mm" for ADUXE039A	Essential
Secondary axis offset of the middle of the first element	"7.74 mm" for ADUXE039A	Essential
Primary axis position of wedge reference	"-50.00 mm"	Essential
Secondary axis position of wedge reference	"-15.00 mm"	Essential
Wedge length	"50.00 mm"	Essential

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'A'

Distance between contact points (wedge width)	"30.00 mm"	Essential
Scan		
Type	"Linear"	Essential
Beam angles selection		
Primary steering angle		Not applicable
Secondary steering angle		Not applicable
Refracted angle	90°-30°,45°,60°,70°	Essential
Beam skew angle		Not applicable
Focal points selection		
Focusing type	Auto	Essential
Focal plane position		Not applicable
Emission focus position		Not applicable
Reception focus position		Not applicable
Elements selection		
Improved resolution	Checked	Essential
Pulser Start	" 1 "	Essential
Pulser Stop	9	Essential
Pulser Resolution	" 1 "	Essential
Receiver Start	" 1 "	Essential
Primary axis aperture	8	Essential
Pulser connection	" 1 "	Essential
Receiver connection	" 65 "	Essential
Hardware selection		
Type	"OmniScan 32/128"	Essential

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'A'

Menu item	Setting	Essential / Non-Essential / Not applicable
File		
File		
Destination	Storage Card	Non-Essential
Save Mode	A-Scan	Essential
File Name	***PSLA_155MM_CIRCU TRL 270_AUTO_CS_ADUXE039A***	Essential
Report		
Template	Complete	Non-Essential
File Name	***PSLA_155MM_CIRCU TRL 270_AUTO_CS_ADUXE039A***	Essential
Paper Size	Letter	Non-Essential
Format		
User field	Off	Non-Essential
Probe	Off	Non-Essential
Setup	On	Essential
Note	Off	Non-Essential
View	Current Layout	Non-Essential
User field		Not applicable
Notes		Not applicable
Reading		
Result		
Selector	List 1	Essential
Field 1	A% (Peak Amplitude in Gate)	Essential
Field 2	A^ (Half Path position in Gate)	Essential
Field 3	B%	Not applicable
Field 4	B^	Not applicable
Cursors		Not applicable
Table		Not applicable
Export		Not applicable
Utilities		
Pref.		
Units	Millimeters	Essential
Bright (%)	25	Non-Essential
Scheme	Indoor	Non-Essential
System		
Clock Set	*Set to correct time*	Essential
Date Set	*Set to correct date*	Essential
Time Zone	*Set to correct time zone*	Non-Essential
Daylight saving	On	Non-Essential
Select Key	F2	Non-Essential
Assign Key	Gain	Non-Essential

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'A'

Service			Not applicable
Options			Not applicable
Network	*Only for network saving*		Non-Essential
UT			
General			
Gain	32.7		Essential
Start	0		Essential
Range	110.78		Essential
Wedge delay	2.30		Essential
Velocity	5770 m/s		Essential
Pulser			
Pulser	1		Not applicable
Tx/Rx mode	PE		Essential
Freq	1.5		Essential
Voltage	High		Essential
PW	*Imported from LAW file (333 ns)*		Essential
PRF	25		Essential
Receiver			
Receiver	1		Not applicable
Filter	None		Essential
Rectifier	FW		Essential
Video Filter	Off		Essential
Receiver			
Averaging	1		Essential
Reject	0		Essential
Beam			
Gain Offset	*Imported from LAW file*		Essential
Scan Offset	*Imported from LAW file*		Essential
Index Offset	*Imported from LAW file*		Essential
Angle	*Imported from LAW file*		Essential
Skew	*Imported from LAW file*		Essential
Beam Delay	*Imported from LAW file*		Essential
Advanced			
dB Ref	Off		Essential
Points Qty	640		Essential
Scale Factor	6		Essential
Sum Gain	*Imported from LAW file*		Essential
Scan			
Encoder			
Encoder	1 (Scan)	2 (Index)	Essential
Polarity	Normal	Inverse	Essential
Type	Quad		Essential
Resolution	35.36	58.00	Essential
Origin	0		Essential

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'A'

Synchro		
Source	Both Axes	Essential
Scan	Encoder 1	Essential
Index	Encoder 2	Not applicable
Scan Speed	25 for scan resolution of 1 mm	Not applicable
Area		
Scan Start	0 mm	Essential
Scan End	512	
Scan Resolution	1.0 mm	Essential
Index start	-43.8 mm	Essential
Index end	36.0 mm	Essential
Index resolution	16 mm	Essential
Start		
Start Mode	Reset All	Essential
Pause	Off	Non-Essential
Data		
Storage	Last	Essential
Display		
Selection		
Display	A-S-C	Essential
C-Scan 1	A%	Non-Essential
Group	Current	Non-Essential
Projection	On	Not applicable
Rulers		
UT Unit	Sound Path	Essential
% Ruler	Linear(%)	Essential
Grid	Off	Non-Essential
DAC / TCG	Off	Essential
Gate	On	Essential
Cursor	On	Essential
Zoom		Not applicable
Color		
Select	Amplitude	Essential
Start (%)	0.0	Essential
End (%)	100.0	Essential
Properties		Not applicable
Probe/Part		
Select		
Group	1	Not applicable
Group Link	Off	Not applicable
Select	Select Tx/Rx	Essential
Select Probe	Unknown	Not applicable
Select Wedge	Contact / Contact	Not applicable
Auto Detect	Off	Essential

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'A'

Position				
Scan Offset	0			Essential
Index Offset	0			Essential
Skew	0			Essential
Characterize				Not applicable
Parts				Not applicable
Wizard				Not applicable
PGM Probe				
Configuration				
Group	1			Not applicable
Enable	Off			Not applicable
Scan Type	Custom			Essential
Connection P	1			Not applicable
Connection R	1			Not applicable
Aperture				Not applicable
Beam				Not applicable
Laws				
Auto Program	Off			Essential
Wizard				Not applicable
Gate/Alarm				
Gate				
Gate Select	Gate A	B	I	Essential
Gate Start	10	0	0	Essential
Width	End of time base	0	0	Non-Essential
Threshold	25	0	0	Essential
Mode	Positive			Not applicable
Synchro	Pulse			Essential
Alarms				Not applicable
Output				Not applicable
Gate/Alarm (ctd.)				
DAC / TCG				Not applicable
Thickness				Not applicable
Calibration				
Phased Array				Not applicable
Axis				Not applicable
TCG				Not applicable
Code				Not applicable
User				
Gain				Not applicable
Start				Not applicable
Range				Not applicable
Display				Not applicable
Gate				Not applicable

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'A'

Focal Law Calculator Inputs

Menu item	Setting	Essential / Non-Essential / Not applicable
Probe (CS) 270°		
Name	1.5M16x2E32-7(EWUXE083A)	Essential
Probe Skew Angle	270°	Essential
Probe Frequency	1.5 MHz	Essential
Number of elements on primary axis	16	Essential
Primary axis pitch	2 mm	Essential
Secondary axis width	7 mm	Essential
Pitch and Catch	Checked	Essential
Probe separation		Not applicable
Squint angle	"0.0°"	Essential
Reverse primary axis	Unchecked	Essential
Specimen		
Name	Memphis SS LW	Non-Essential
Specimen Type	"Pipe OD"	Essential
Wave type	"Longitudinal" for TRL	Essential
Sound velocity	270°-5770 m/s	Essential
Thickness	40 mm	Essential
Radius	77 mm	Essential
Wedge		
Name	ADUXE039A	Essential
Footprint	"Curvature along secondary axis"	Essential
Wedge angle	22.3	Essential
Roof angle	6.0	Essential
Sound velocity	"2330 m/s"	Essential
Height at the middle of the first element	"8.17 mm" for ADUXE039A	Essential
Primary axis offset of the middle of the first element	"8.43 mm" for ADUXE039A	Essential
Secondary axis offset of the middle of the first element	"7.74 mm" for ADUXE039A	Essential
Primary axis position of wedge reference	"-50.00 mm"	Essential
Secondary axis position of wedge reference	"-15.00 mm"	Essential
Wedge length	"50.00 mm"	Essential

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'A'

Distance between contact points (wedge width)	"30.00 mm"	Essential
Scan		
Type	"Linear"	Essential
Beam angles selection		
Primary steering angle		Not applicable
Secondary steering angle		Not applicable
Refracted angle	270°-30°,45°,60°,70°	Essential
Beam skew angle		Not applicable
Focal points selection		
Focusing type	Auto	Essential
Focal plane position		Not applicable
Emission focus position		Not applicable
Reception focus position		Not applicable
Elements selection		
Improved resolution	Checked	Essential
Pulser Start	" 1 "	Essential
Pulser Stop	9	Essential
Pulser Resolution	" 1 "	Essential
Receiver Start	" 1 "	Essential
Primary axis aperture	8	Essential
Pulser connection	" 1 "	Essential
Receiver connection	" 65 "	Essential
Hardware selection		
Type	"OmniScan 32/128"	Essential

OmniScan Report

Report Date	Report Version	Setup File name	Date of Inspection	Inspection Version	Save Mode
2008 / 03 / 09	1.4R3	PSLA_155MM_CIRCD TRL 90_AUTO_CS_ADOXE039A.opd	2008 / 03 / 09	1.4R3	A Scan
OmniScan Type	**OmniScan Serial #**	**Module Type**	**Module Serial #**	**Calibration Due**	**Data File name**
OmniScan MX	OMNI-Z-1012	OMNI-M-PA32128PR	OMNI-Z-6012	2008 / 11 / 21	PSLA_155MM_CIRCD TRL 90_AUTO_CS_ADOXE039A

Group 1

Setup

A:30.0 Sk:090 L:001

Beam Delay	Start (Half Path)	Range (Half Path)	PRF	Type	Averaging Factor
12.10 us	-0.02 mm	113.09 mm	25	PA	1
Scale Type	**Scale Factor**	**Video Filter**	**Pretrig**	**Rectification**	**Band Pass Filter**
Compression	6	Off	0.00 µs	FW	None (0.52 - 19 MHz)
Voltage	**Gain**	**Mode**	**Wave Type**	**Sound Velocity**	**Pulse Width**
High	33.70 dB	PC (Pitch And Catch)	User Defined	5890.0 m/s	332.50 ns
Scan Offset	**Index Offset**	**Skew**			
0.00 mm	0.00 mm	N/A			

Gate	Start	Width	Threshold	Synchro
I	0.01 mm	1.00 mm	0.00 %	Pulse
A	10.20 mm	122.48 mm	25.00 %	Pulse
B	0.01 mm	1.00 mm	0.00 %	Pulse

Law

Law File name	Scan Type
DM_155_CIRCD TRL 90_AUTO_CS_ADUXE039A.law	Custom

Part

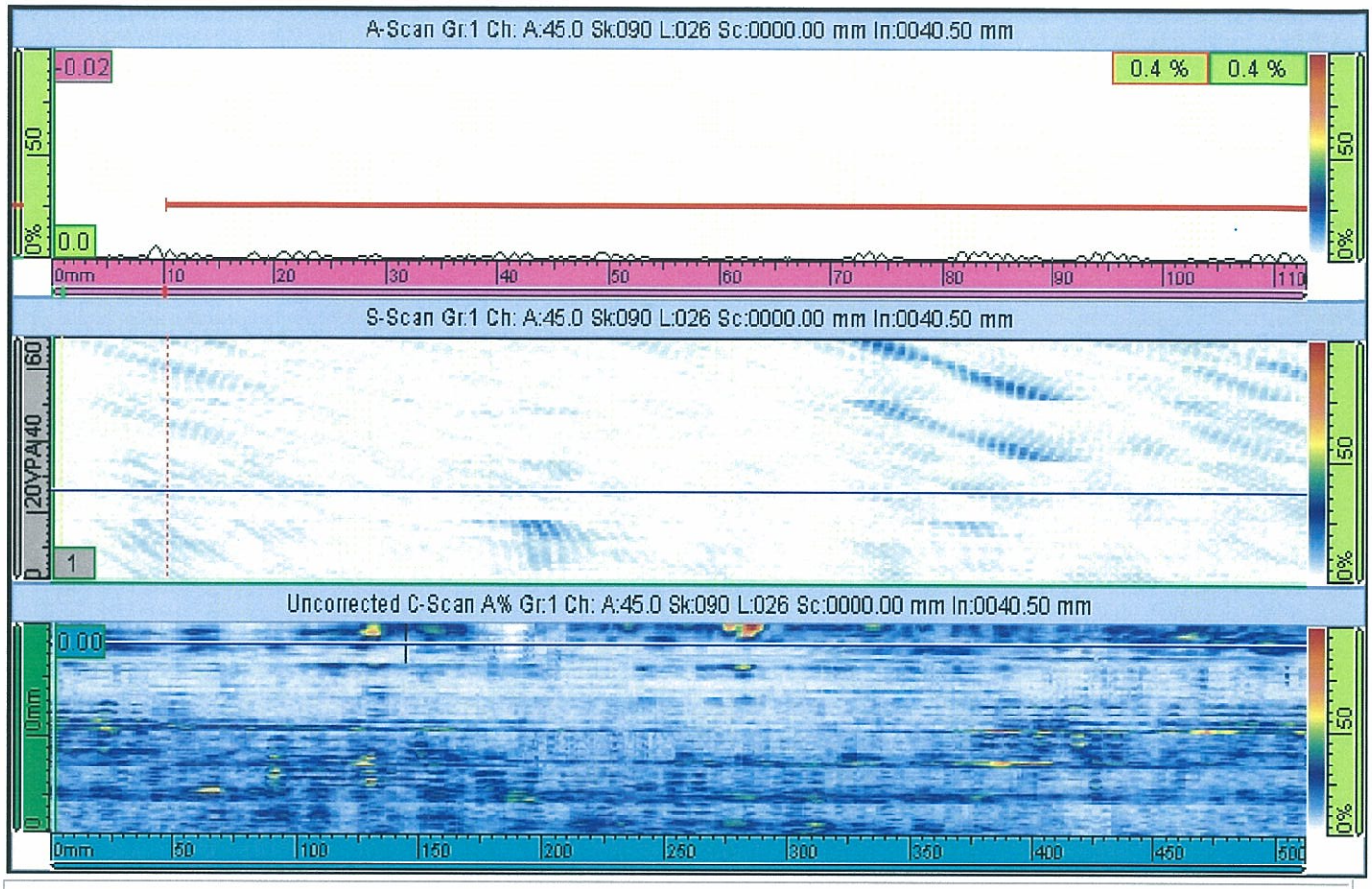
Material	Geometry	Thickness
STEEL MILD	Plate	50.00 mm

Scan Area

Scan Start	Scan Length	Scan Resolution	Index Start	Index Length	Index Resolution
0.00 mm	512.00 mm	1.00 mm	-34.00 mm	74.50 mm	14.90 mm
Synchro	**Max Scan Speed**				
Both Axis	25.00 mm/s				

Axis	Encoder	Encoder Type	Encoder Resolution	Polarity
Scan	1	Quadrature	35.36 step/mm	Normal
Index	2	Quadrature	58.00 step/mm	Inverse

A%	A^	B%	B^	None	None	None	None
11.4 %	--- mm	0.8 %	0.21 mm				



Technician Name Todd P. Blechinger

Technician Signature

Contractor LMT INC.

Date 3/9/08

OmniScan Report

Report Date	Report Version	Setup File name	Date of Inspection	Inspection Version	Save Mode
2008 / 03 / 09	1.4R3	PSLA_155MM_CIRCU TRL 270_AUTO_CS_ADOXE039A.opd	2008 / 03 / 09	1.4R3	A Scan
OmniScan Type	**OmniScan Serial #**	**Module Type**	**Module Serial #**	**Calibration Due**	**Data File name**
OmniScan MX	OMNI-Z-1012	OMNI-M-PA32128PR	OMNI-Z-6012	2008 / 11 / 21	PSLA_155MM_CIRCU TRL 270_AUTO_CS_ADOXE039A

Group 1

Setup

A:30.0 Sk:270 L:001

Beam Delay	Start (Half Path)	Range (Half Path)	PRF	Type	Averaging Factor
12.08 us	-0.02 mm	110.78 mm	25	PA	1
Scale Type	**Scale Factor**	**Video Filter**	**Pretrig**	**Rectification**	**Band Pass Filter**
Compression	6	Off	0.00 µs	FW	None (0.52 - 19 MHz)
Voltage	**Gain**	**Mode**	**Wave Type**	**Sound Velocity**	**Pulse Width**
High	32.70 dB	PC (Pitch And Catch)	User Defined	5770.0 m/s	332.50 ns
Scan Offset	**Index Offset**	**Skew**			
0.00 mm	0.00 mm	N/A			

Gate	Start	Width	Threshold	Synchro
I	-0.01 mm	0.98 mm	0.00 %	Pulse
A	9.97 mm	119.99 mm	25.00 %	Pulse
B	-0.01 mm	0.98 mm	0.00 %	Pulse

Law

Law File name	Scan Type
DM_155_CIRCU TRL 270_AUTO_CS_ADUXE039A.law	Custom

Part

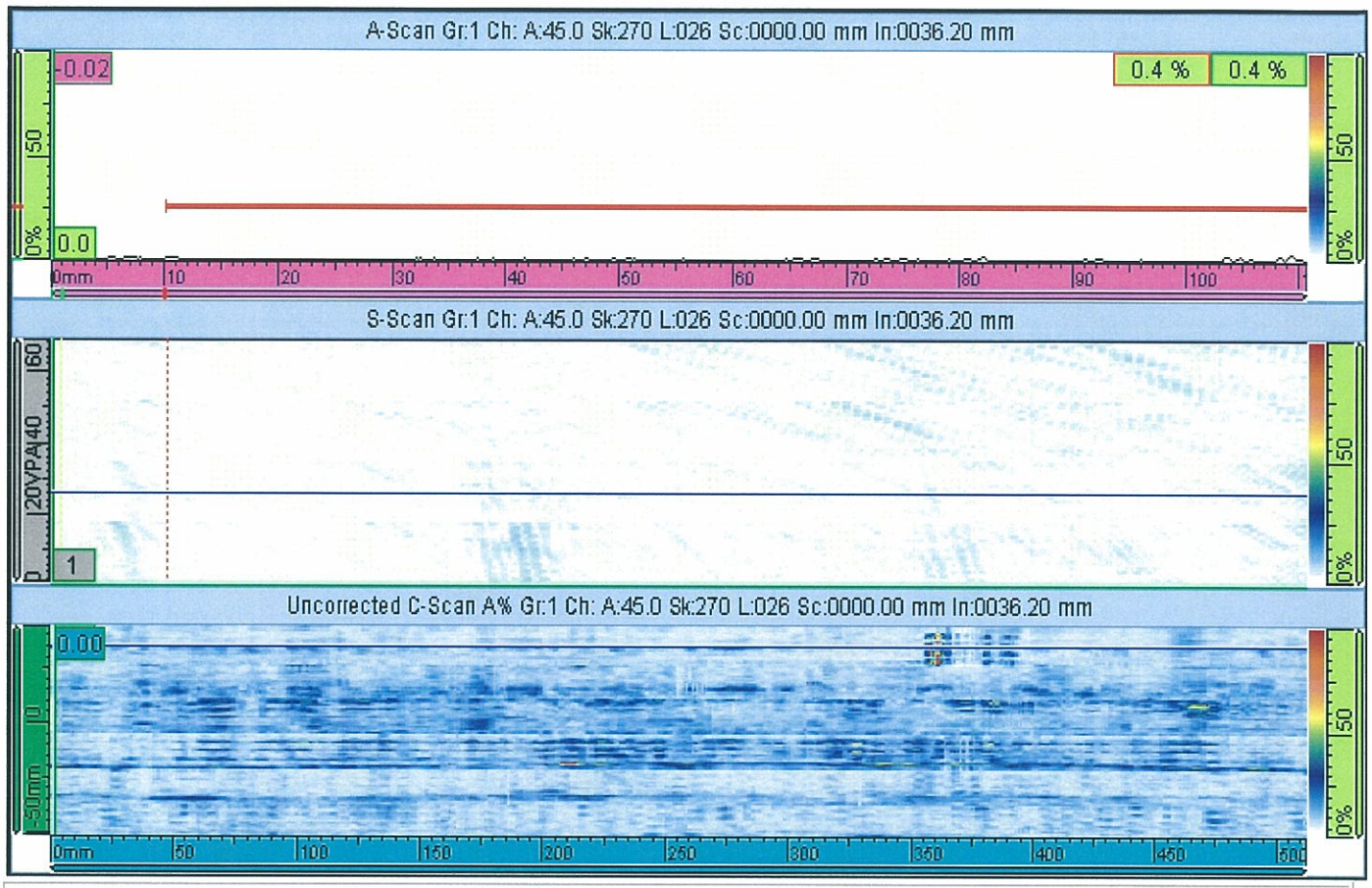
Material	Geometry	Thickness
STEEL MILD	Plate	50.00 mm

Scan Area

Scan Start	Scan Length	Scan Resolution	Index Start	Index Length	Index Resolution
0.00 mm	512.00 mm	1.00 mm	-43.80 mm	80.00 mm	16.00 mm
Synchro	**Max Scan Speed**				
Both Axis	25.00 mm/s				

Axis	Encoder	Encoder Type	Encoder Resolution	Polarity
Scan	1	Quadrature	35.36 step/mm	Normal
Index	2	Quadrature	58.00 step/mm	Inverse

A%	A^	B%	B^	None	None	None	None
6.7 %	--- mm	0.8 %	0.22 mm				



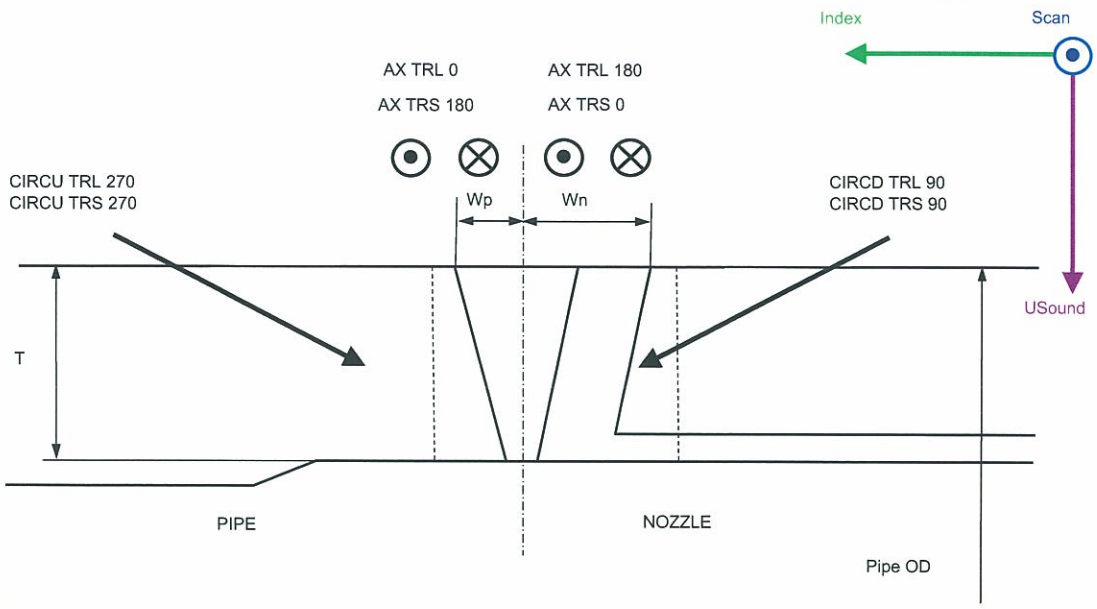
Technician Name Todd P. Blechinger

Technician Signature

Contractor LMT INC.

Date 3/9/08

SCAN PLAN



Procedure :	ZETEC_OmniScanPA_03_revD	**Pipe Thickness T :**	40.0 mm
Plant / Unit :	PSL/1	**Pipe OD :**	155.0 mm
Weld Id. :	PSL Safety Nozzle 'A', 'B', & 'C'	**Weld Extent Pipe Side Wp :**	20.0 mm
Dual Side Access :	yes	**Weld Extent Nozzle Side Wn :**	23.5 mm
Complete Pipe:	yes	**Access Limitation Pipe Side Lp :**	86.0 mm
		Access Limitation Nozzle Side Ln	84.0 mm
		Weld Length:	486.0 mm

SCANNING SEQUENCES CIRCUMFERENTIAL FLAWS

Focal law group	Probe Type	MinTB (mm)	MaxTB (mm)	# Data Points	Scan Start (mm)	Scan End (mm)	Scan Resol. (mm)	Index Start (mm)	Index End (mm)	Index Resol. (mm)	# Lines	Done ? (OK / NA)
CIRCD TRL 90	CS	100.0	125.0	640	0.0	511.9	1.0	-34.0	40.3	14.9	6	ok
CIRCU TRL 270	CS	100.0	125.0	640	0.0	511.9	1.0	-43.8	36.0	16.0	6	ok
CIRCD TRS 90	CS	100.0	125.0	800	0.0	511.9	1.0	-34.0	-16.3	18.5	1	N/A
CIRCU TRS 270	CS	100.0	125.0	800	0.0	511.9	1.0	12.8	36.0	11.6	3	N/A

SCANNING SEQUENCES AXIAL FLAWS

Focal law group	Probe Type	MinTB (mm)	MaxTB (mm)	# Data Points	Scan Start (mm)	Scan End (mm)	Scan Resol. (mm)	Index Start (mm)	Index End (mm)	Index Resol. (mm)	# Lines	
AX TRL 0	AS	75.2	94.0	640	0.0	511.9	1.0	-29.9	26.4	9.4	7	N/A
AX TRL 180	AS	75.2	94.0	640	0.0	511.9	1.0	-29.9	26.4	9.4	7	N/A
AX TRS 0	AS	75.2	94.0	1120	0.0	511.9	1.0	-29.9	26.4	9.4	7	N/A
AX TRS 180	AS	75.2	94.0	1120	0.0	511.9	1.0	-29.9	26.4	9.4	7	N/A
AX TRL 0												NA
AX TRL 180												NA

Data Analyst : Jeff Devers
Date : 3/9/08

LMT Review Todd Blechinger
Date : 3/14/08

EPRI Review
Date : 3/17/08

Report # EPRI-PA-01

ANII Review N/A
Date :

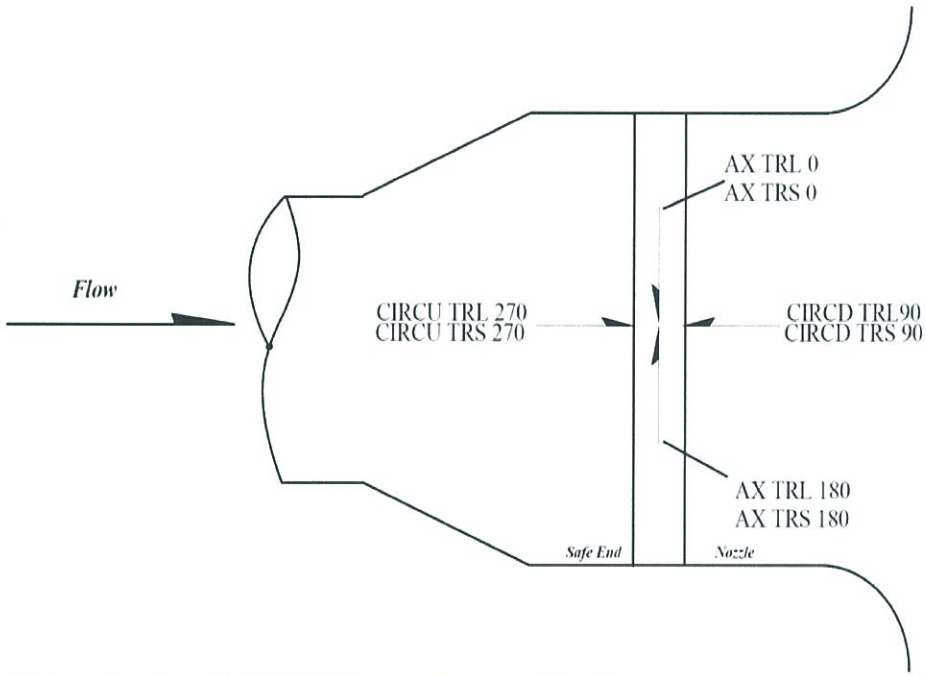
Report # EPRI-PA-01

Ultrasonic Phased Array Examination Report

Plant / Unit	PSL/1	OmniScan Software Version	1.4R3	Acquisition Tech. Todd Blechinger	Level III
Comp / System	Safety Nozzle 'A'	OmniScanConverter Software Version	1.7R5	Acquisition Tech. N/A	Level
Component Temp.	52°	UltraVision Software Revision	1.1Q5		
Procedure No.	Zetec_ OmniScanPA_03				
Revision#	rev.D				

Focal Law Group Used	Data File Identification	Results
CIRCD TRL 90	PSLA_155MM_CIRCD TRL 90_AUTO_CS_ADUXE039A	RI-See Attached
CIRCU TRL 270	PSLA_155MM_CIRCU TRL 270_AUTO_CS_ADUXE039A	RI-See Attached

Technique Referencing System



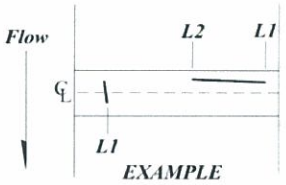
Comments:

See attached Phased Array Indication Data Tabulation Sheet for indication information.

Data Analyst Jeff Devers		Level III	Date 3/9/2008	LMT Review T.P. Blechinger		Level III	Date 3/14/08
EPRI REVIEW / DATE	3/17/08			ANII REVIEW / DATE			

Phased Array Indication Tabulation Sheet

Report # EPRI-PA-01



PLANT/ UNIT	PSL /1	REFERENCE LOCATION	0 Stamp / Weld Centerline
COMP / SYSTEM	Safety Nozzle 'A'	COMP THICKNESS	40mm
PROCEDURE NO.	Zetec_ OmniScanPA_03	WELD CROWN WIDTH	43.5mm
REV / CHANGE NO.	rev.D	WELD LENGTH	486mm

DATA ANALYST / LEVEL J.L. Devers / III

LMT REVIEW / LEVEL T.P. Blechinger / III

IND. #	Data File	Merged Data Group Used	Length Sizing Information			Thru Wall Sizing Information			Indication Position		Evaluation / Comments	Printout Page #
			Start (L1)	Stop (L2)	Length	T.W. Depth	Remain. Ligament	T.W. %	Upstream	Dnstream		
1	PSLA_155MM_CIRCU TRL 270_AUTO_CS_ ADUXE039A	CIRCU TRL 270	22mm	32mm	10mm	10mm- See Note 1	1.5mm	N/A		22mm	Embedded Fabrication Flaw	25of38
2	PSLA_155MM_CIRCU TRL 270_AUTO_CS_ ADUXE039A	CIRCU TRL 270	45mm	67mm	22mm	12mm- See Note 1	11.5mm	N/A	4mm		Embedded Fabrication Flaw	26of38
2	PSLA_155MM_CIRCD TRL 90_AUTO_CS_ ADUXE039A	CIRCD TRL 90	41mm	58mm	17mm	14.5mm- See Note 1	10mm	N/A	10mm		Embedded Fabrication Flaw	33of38
3	PSLA_155MM_CIRCU TRL 270_AUTO_CS_ ADUXE039A	CIRCU TRL 270	246mm	262mm	16mm	11.5mm- See Note 1	7mm	N/A		18mm	Embedded Fabrication Flaw	27of38
3	PSLA_155MM_CIRCD TRL 90_AUTO_CS_ ADUXE039A	CIRCD TRL 90	229mm	242mm	13mm	5mm- See Note 1	7mm	N/A		22mm	Embedded Fabrication Flaw	34of38

Comments: Note 1- Flaw sizing was conservatively measured using full dB drop method.

Data Analyst J.L. Devers Level III Date 3/9/2008

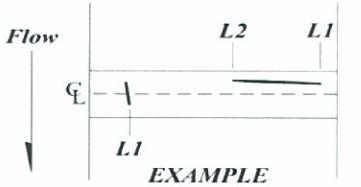
Further Evaluation Required? [ ] Yes [X] No

EPRI REVIEW / DATE 3/17/08

ANII REVIEW / DATE

Phased Array Indication Tabulation Sheet

Report # EPRI-PA-01



PLANT/ UNIT	PSL /1	REFERENCE LOCATION	0 Stamp / Weld Centerline
COMP / SYSTEM	Safety Nozzle 'A'	COMP THICKNESS	40mm
PROCEDURE NO.	Zetec_ OmniScanPA_03	WELD CROWN WIDTH	43.5mm
REV / CHANGE NO.	rev.D	WELD LENGTH	486mm

DATA ANALYST / LEVEL J.L. Devers / III

LMT REVIEW / LEVEL T.P. Blechinger / III

IND. #	Data File	Merged Data Group Used	Length Sizing Information			Thru Wall Sizing Information			Indication Position		Evaluation / Comments	Printout Page #
			Start (L1)	Stop (L2)	Length	T.W. Depth	Remain. Ligament	T.W. %	Upstream	Dnstream		
4	PSLA_155MM_CIRCU TRL 270_AUTO_CS_ ADUXE039A	CIRCU TRL 270	290mm	304mm	14mm	8.5mm- See Note 1	10mm	N/A		10mm	Embedded Fabrication Flaw	28of38
5	PSLA_155MM_CIRCU TRL 270_AUTO_CS_ ADUXE039A	CIRCU TRL 270	313mm	331mm	18mm	7.5mm- See Note 1	21mm	N/A		3mm	Embedded Fabrication Flaw	29of38
5	PSLA_155MM_CIRCD TRL 90_AUTO_CS_ ADUXE039A	CIRCD TRL 90	282mm	327mm	45mm	15mm- See Note 1	10.5mm	N/A		6mm	Embedded Fabrication Flaw	35of38
6	PSLA_155MM_CIRCU TRL 270_AUTO_CS_ ADUXE039A	CIRCU TRL 270	388mm	416mm	28mm	15mm- See Note 1	11.5mm	N/A	1mm		Embedded Fabrication Flaw	30of38
6	PSLA_155MM_CIRCD TRL 90_AUTO_CS_ ADUXE039A	CIRCD TRL 90	384mm	423mm	39.0mm	13mm- See Note 1	11.5mm	N/A		2mm	Embedded Fabrication Flaw	36of38

Comments: Note 1- Flaw sizing was conservatively measured using full dB drop method.

Data Analyst J.L. Devers Level III Date 3/9/2008

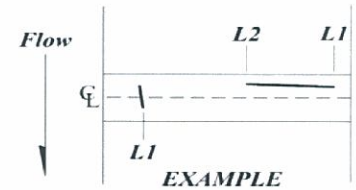
Further Evaluation Required? [ ] Yes [X] No

EPRI REVIEW / DATE 3/17/08

ANII REVIEW / DATE

Phased Array Indication Tabulation Sheet

Report # EPRI-PA-01



PLANT/ UNIT	PSL /1	REFERENCE LOCATION	0 Stamp / Weld Centerline
COMP / SYSTEM	Safety Nozzle 'A'	COMP THICKNESS	40mm
PROCEDURE NO.	Zetec_ OmniScanPA_03	WELD CROWN WIDTH	43.5mm
REV / CHANGE NO.	rev.D	WELD LENGTH	486mm

DATA ANALYST / LEVEI J.L. Devers / III JD

LMT REVIEW / LEVEL T.P. Blechinger / III

IND. #	Data File	Merged Data Group Used	Length Sizing Information			Thru Wall Sizing Information			Indication Position		Evaluation / Comments	Printout Page #
			Start (L1)	Stop (L2)	Length	T.W. Depth	Remain. Ligament	T.W. %	Upstream	Dnstream		
7	PSLA_155MM_CIRCU TRL 270_AUTO_CS_ ADUXE039A	CIRCU TRL 270	452mm	477mm	25mm	17.5mm- See Note 1	7.5mm	N/A	10mm		Embedded Fabrication Flaw	31of38
7	PSLA_155MM_CIRCD TRL 90_AUTO_CS_ ADUXE039A	CIRCD TRL 90	447mm	471mm	24mm	8.5mm- See Note 1	16mm	N/A	8mm		Embedded Fabrication Flaw	37of38
8	PSLA_155MM_CIRCD TRL 90_AUTO_CS_ ADUXE039A	CIRCD TRL 90	See Note 3	See Note 3	See Note 3	N/A	N/A	N/A		0mm	See Note 2	32of38
9	PSLA_155MM_CIRCD TRL 90_AUTO_CS_ ADUXE039A	CIRCD TRL 90	127mm	138mm	11mm	9mm- See Note 1	12mm	N/A	10.0mm		Embedded Fabrication Flaw	38of38

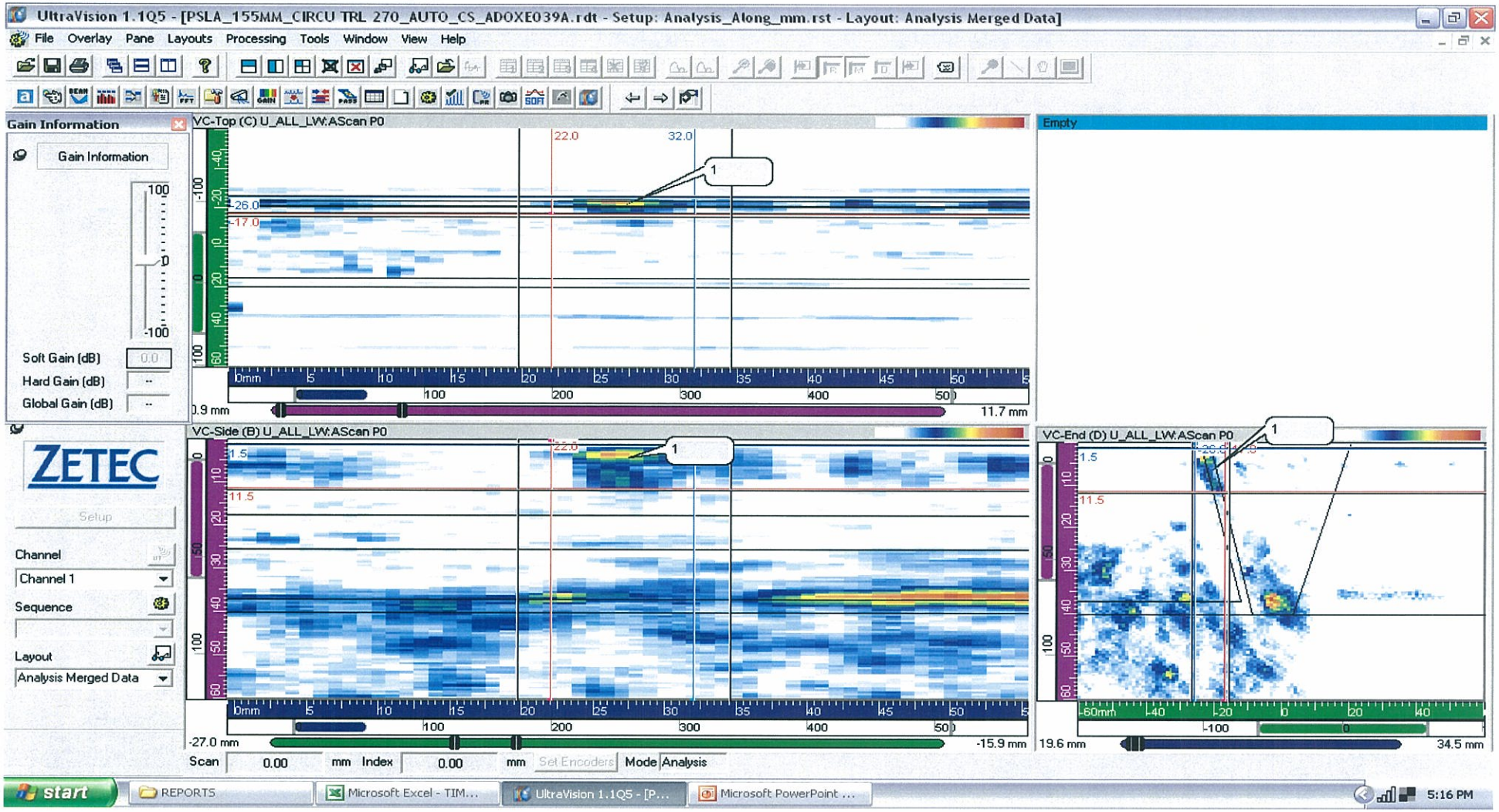
Comments: Note 1- Flaw sizing was conservatively measured using full dB drop method. Note 2- Indication seen intermittently along weld length possibly associated with small fabrication flaws in the Hot Pass region. Note 3- Indication seen intermittently along weld length.

Data Analyst J.L. Devers Level III Date 3/9/2008

Further Evaluation Required? ☐ Yes ☒ No

EPRI REVIEW / DATE 3/17/08

ANII REVIEW / DATE

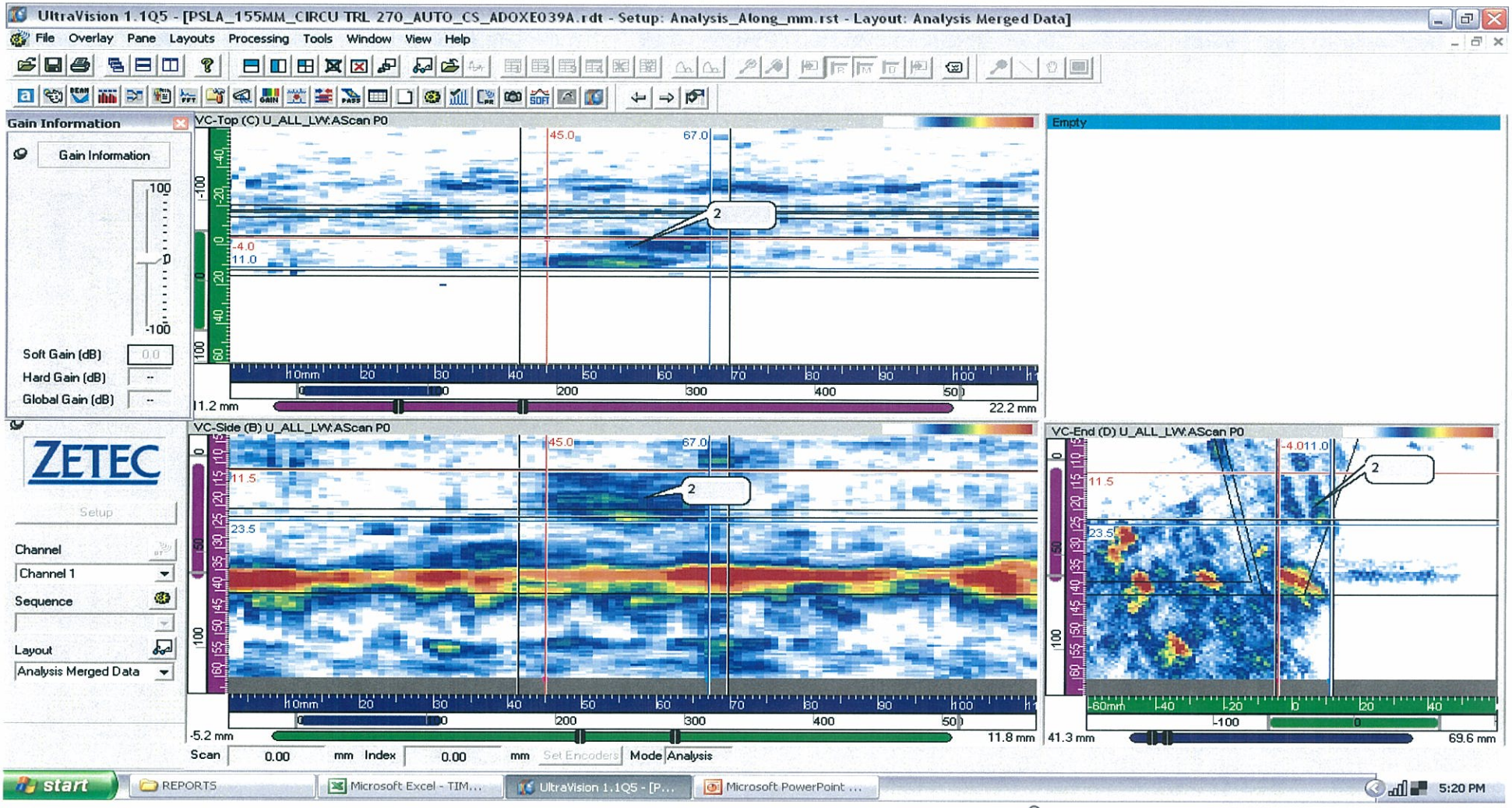


Data Analyst _____ Level III EPRI Review _____

J. L. Devers

LMT Review _____ Level III ANII Review N/A Report# EPRI-PA-01

T.P. Blechinger



Data Analyst _____ **Level** III

J. L. Devers

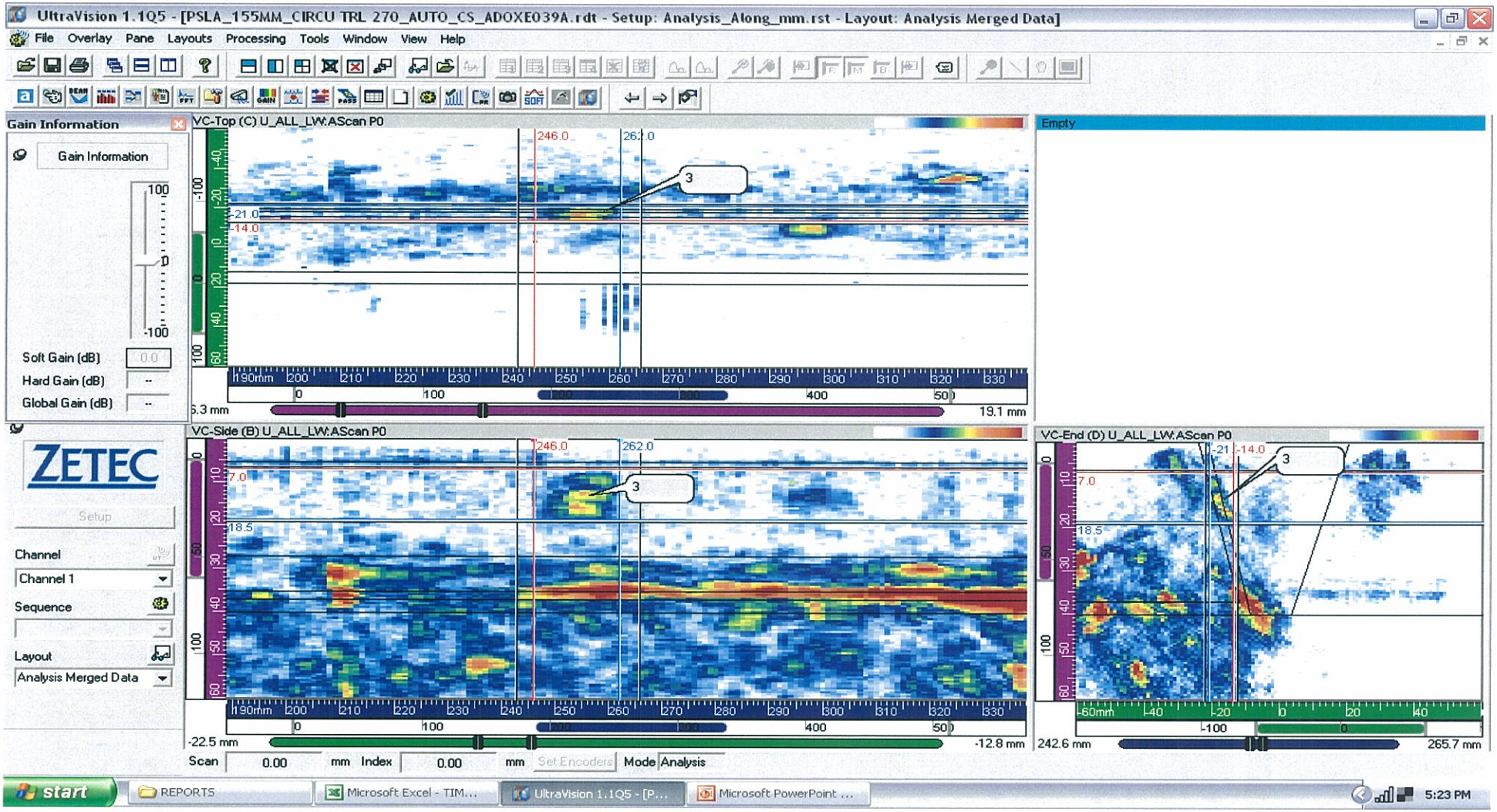
EPRI Review _____

LMT Review _____ **Level** III

T.P. Blechinger

ANII Review N/A

Report# EPRI-PA-01



Data Analyst JL Devers **Level** III

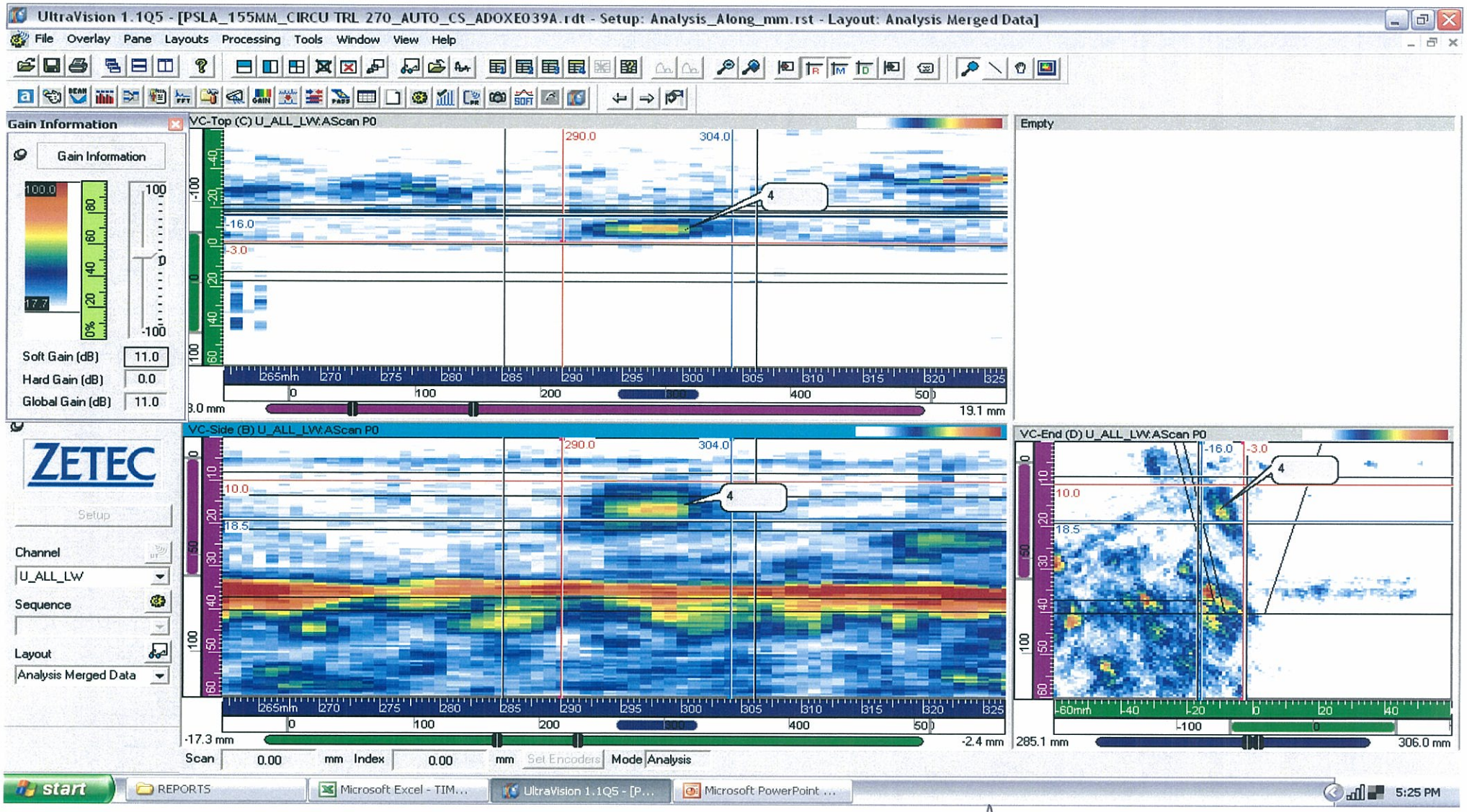
J. L. Devers

EPRI Review

LMT Review T.P. Blechinger **Level** III

ANII Review N/A

Report# EPRI-PA-01



Data Analyst _____ **Level** III

J. L. Devers

EPRI Review _____

LMT Review _____ **Level** III

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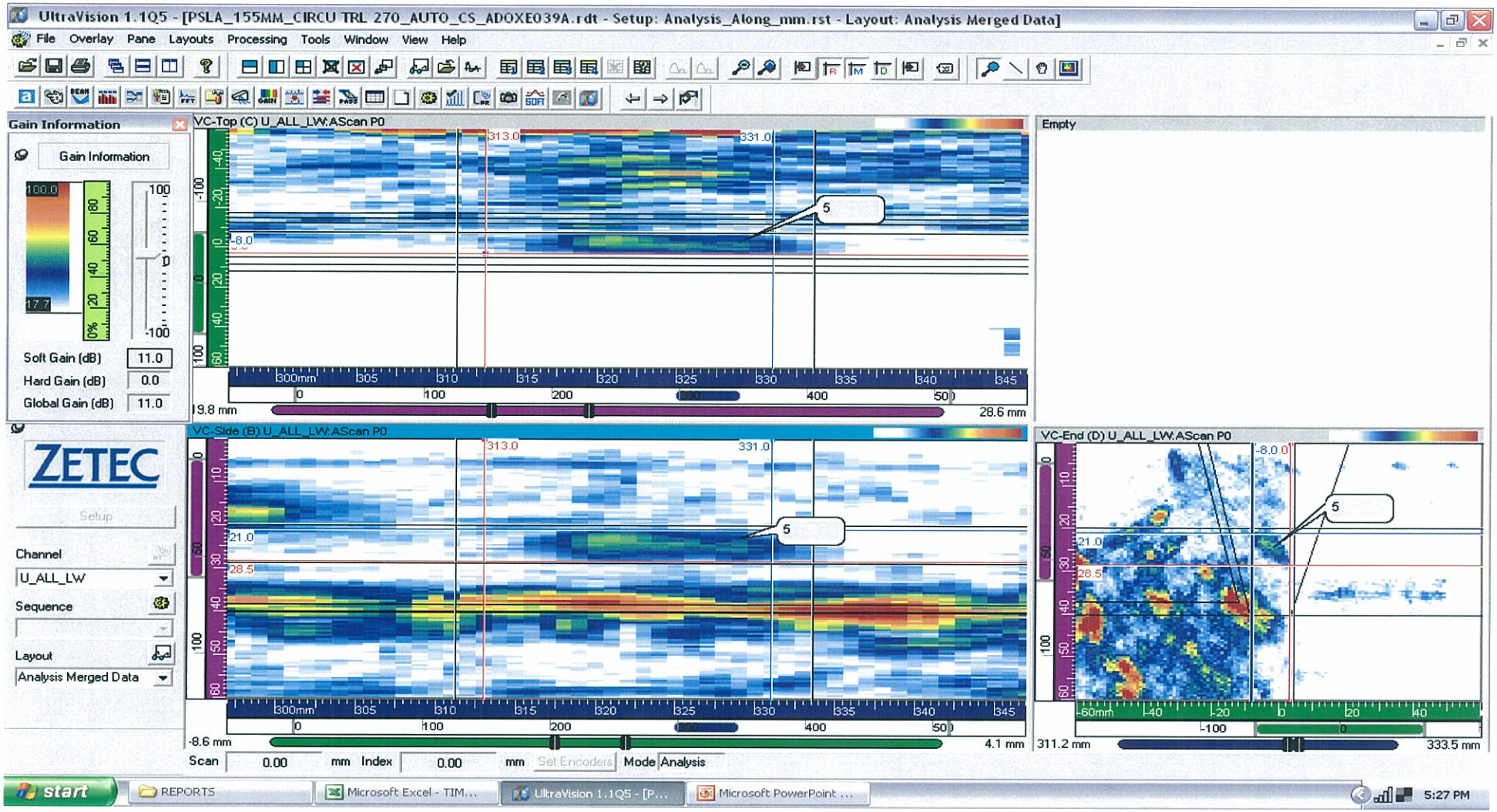
ANII Review N/A

Report# EPRI-PA-01



Data Analyst _____ **Level** III

J. L. Devers

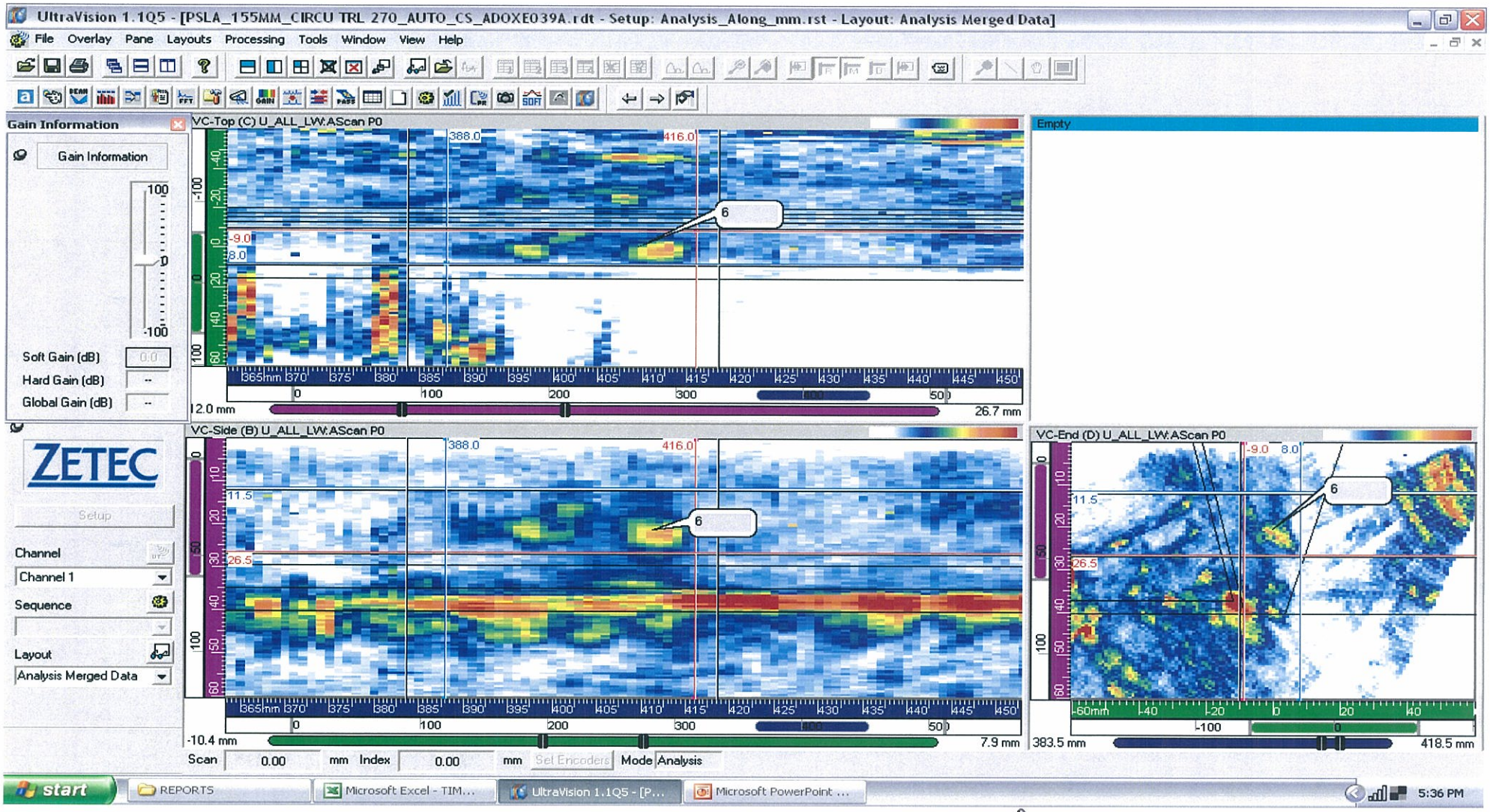
EPRI Review _____

LMT Review _____ **Level** III

T.P. Blechinger

ANII Review N/A

Report# EPRI-PA-01



Data Analyst _____ **Level** III

J. L. Devers

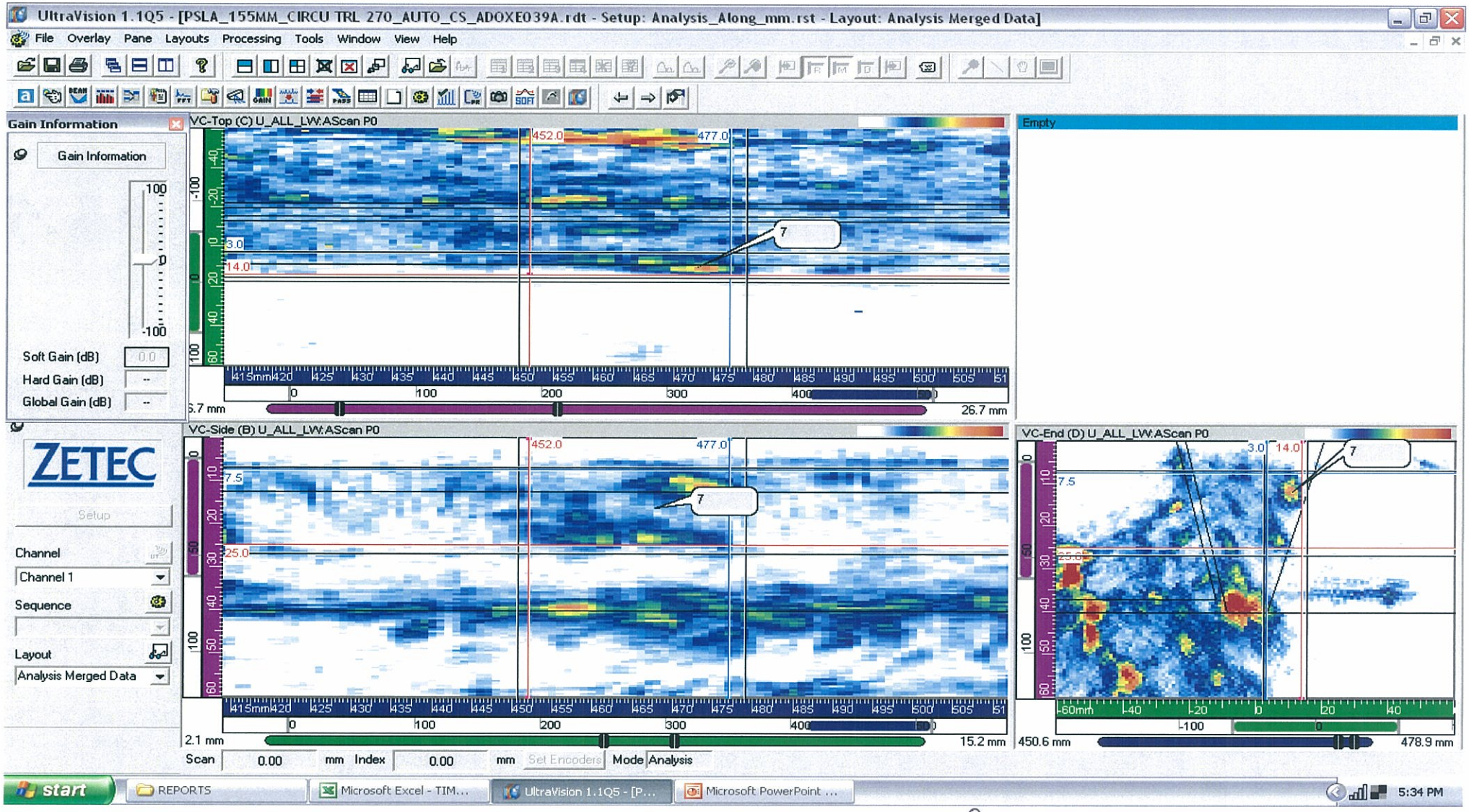
EPRI Review _____

LMT Review _____ **Level** III

T.P. Blechinger

ANII Review N/A

Report# EPRI-PA-01



Data Analyst _____ **Level** III

J. L. Devers

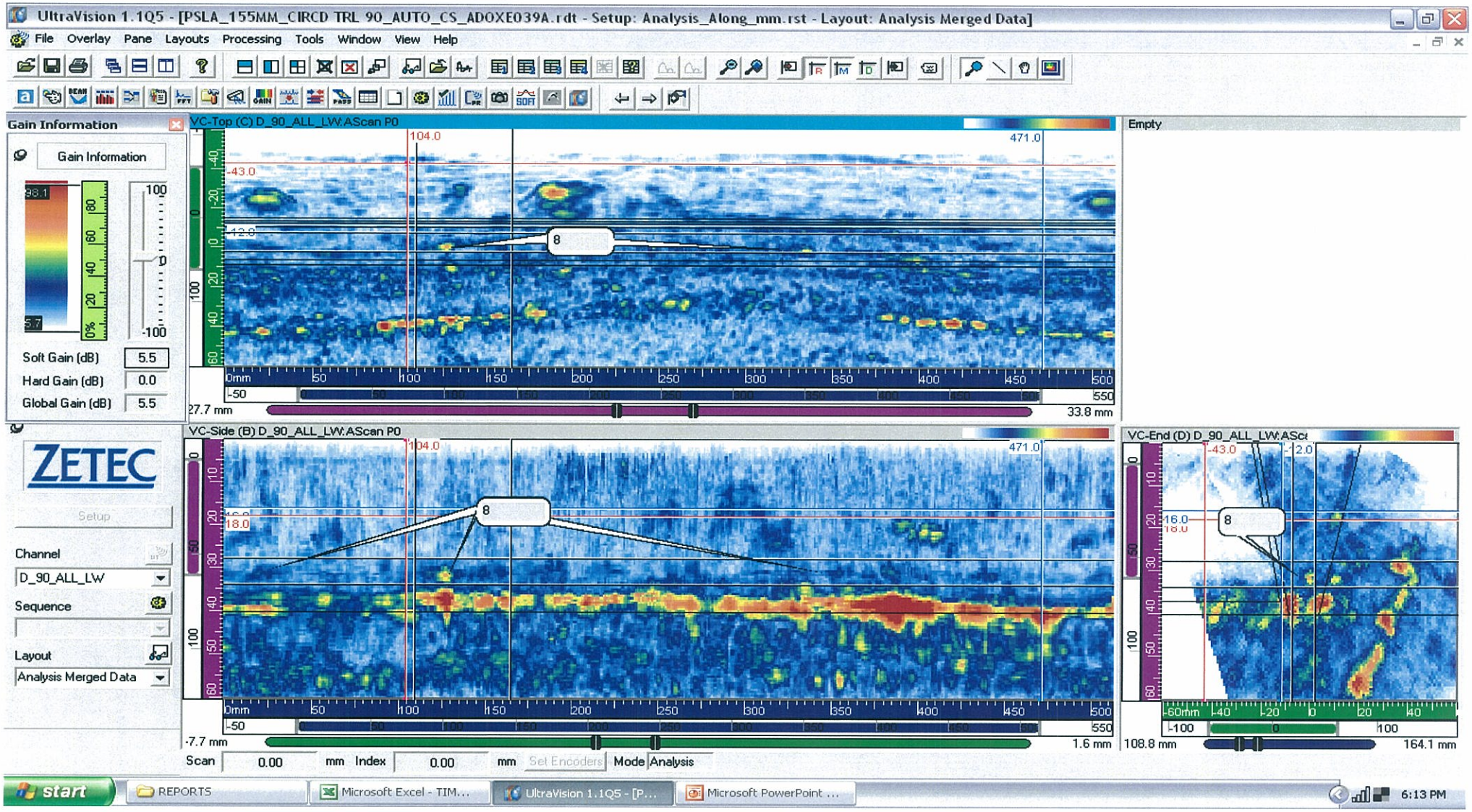
EPRI Review _____

LMT Review _____ **Level** III

T.P. Blechinger

ANII Review N/A

Report# EPRI-PA-01



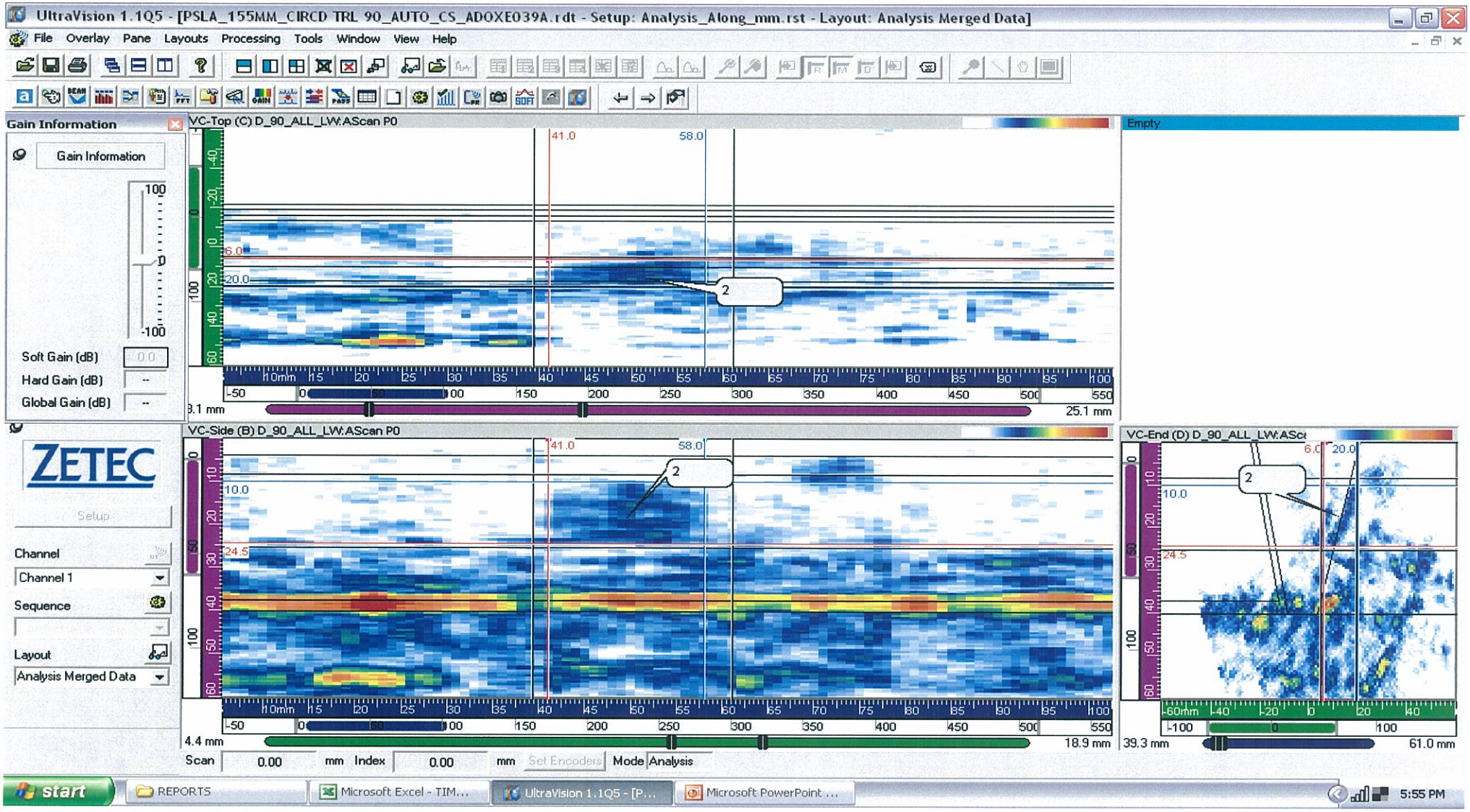
Data Analyst J. L. Devers **Level** III

EPRI Review

LMT Review T.P. Blechinger **Level** III

ANII Review N/A

Report# EPRI-PA-01

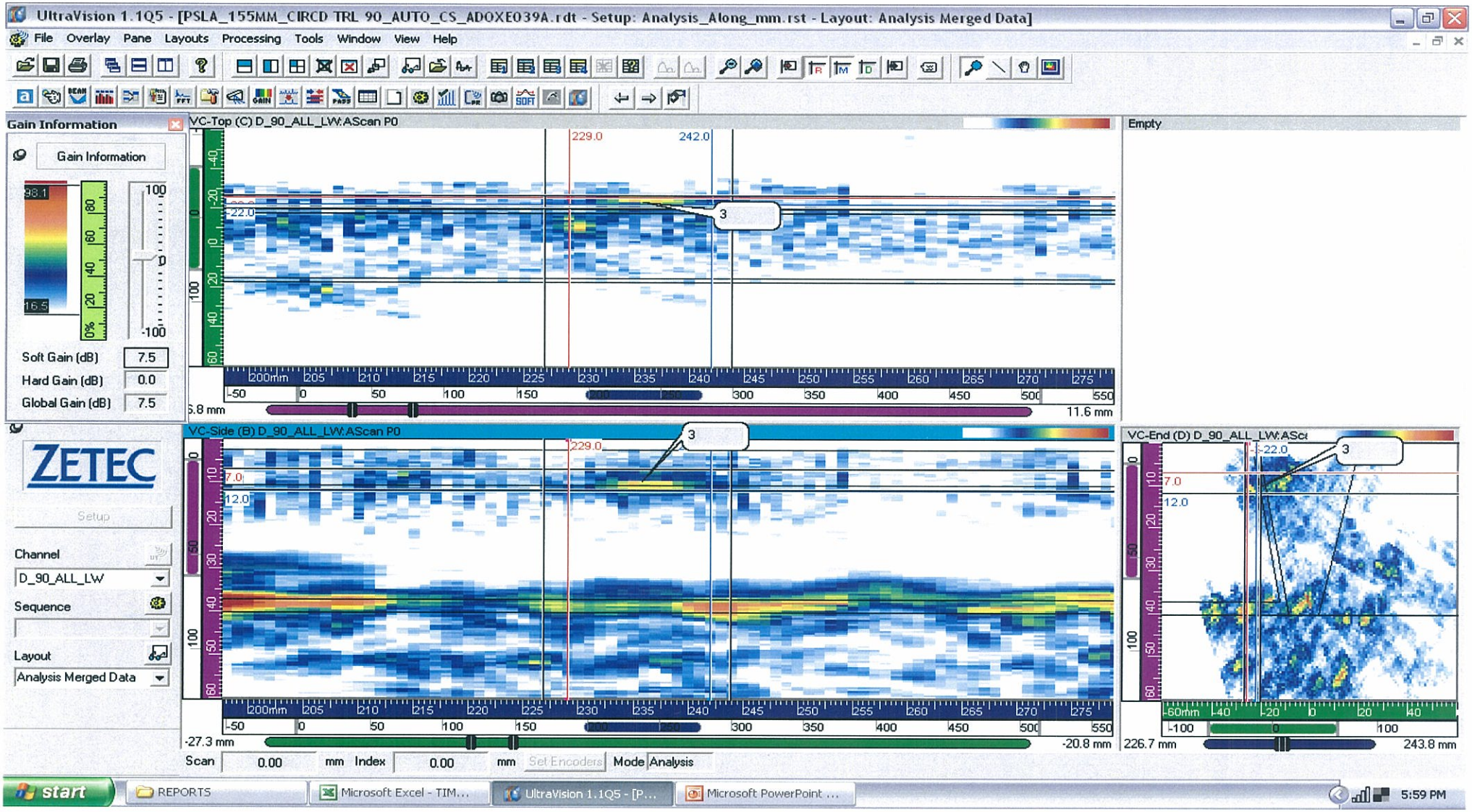


Data Analyst _____ **Level** III **EPRI Review** _____

J. L. Devers

LMT Review _____ **Level** III **ANII Review** N/A **Report#** EPRI-PA-01

T.P. Blechinger

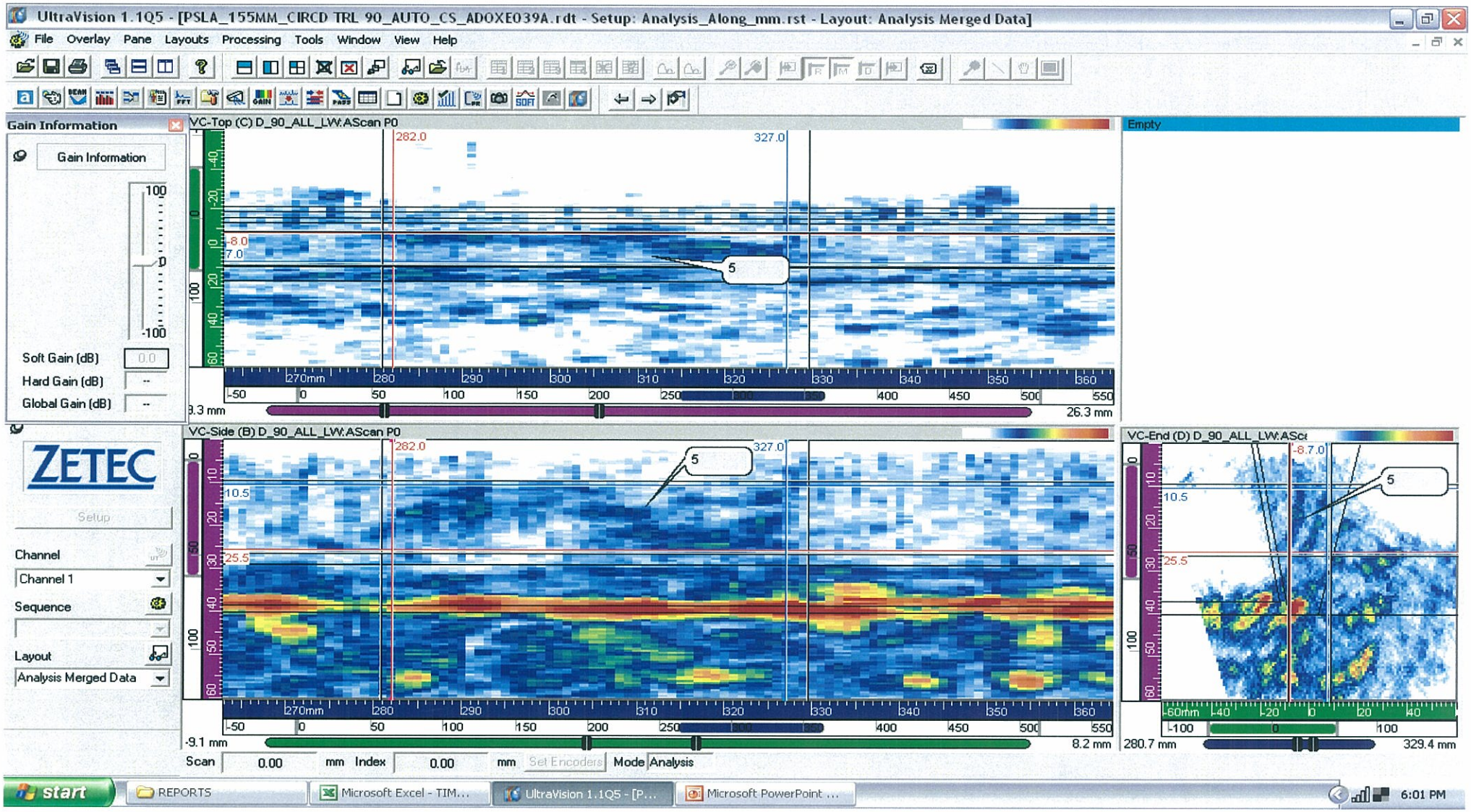


Data Analyst JL **Level** III **EPRI Review**

J. L. Devers

LMT Review **Level** III **ANII Review** N/A **Report#** EPRI-PA-01

T.P. Blechinger



Data Analyst _____ **Level** III

J. L. Devers

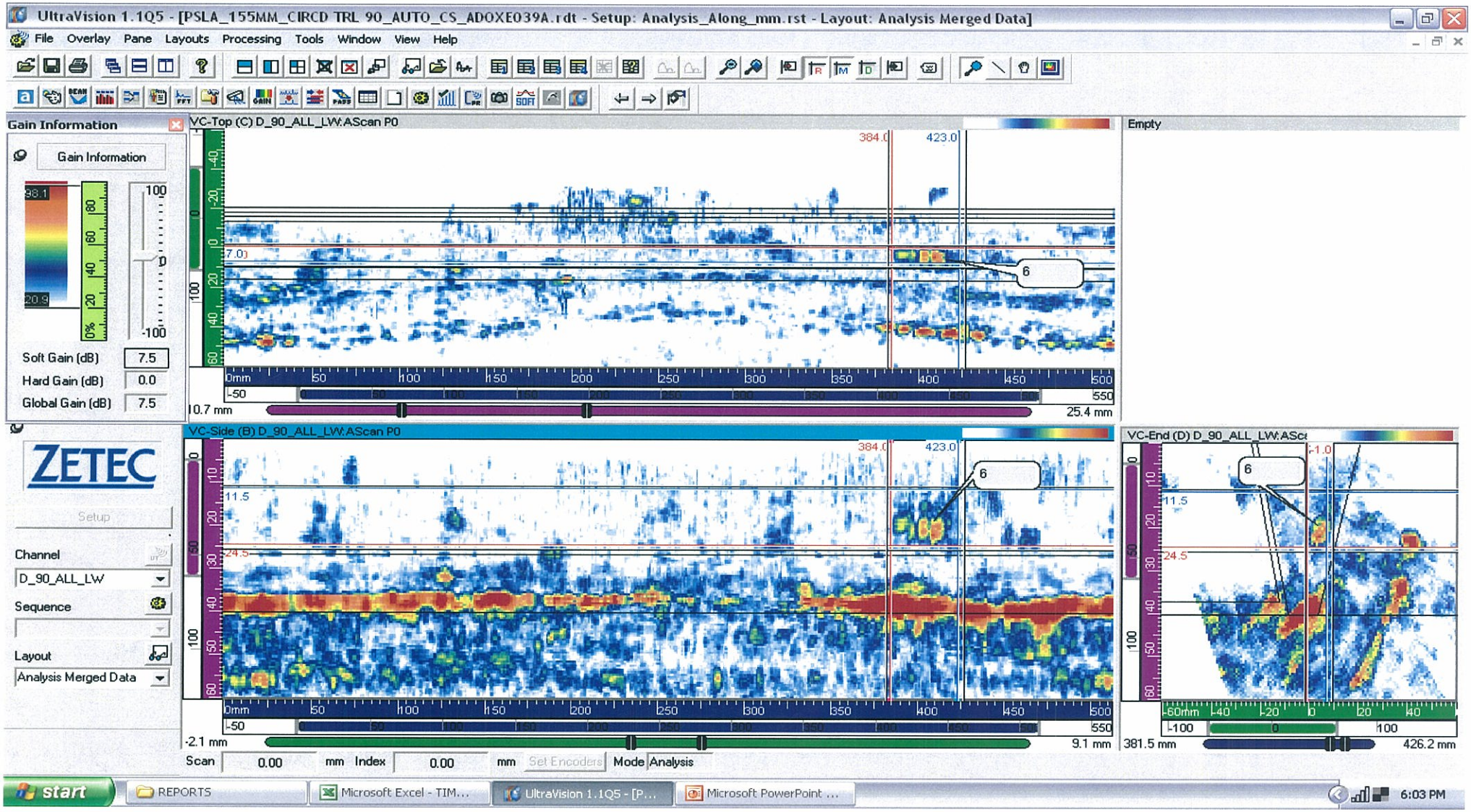
EPRI Review _____

LMT Review _____ **Level** III

T.P. Blechinger

ANII Review N/A

Report# EPRI-PA-01



Data Analyst _____ **Level** III

J. L. Devers

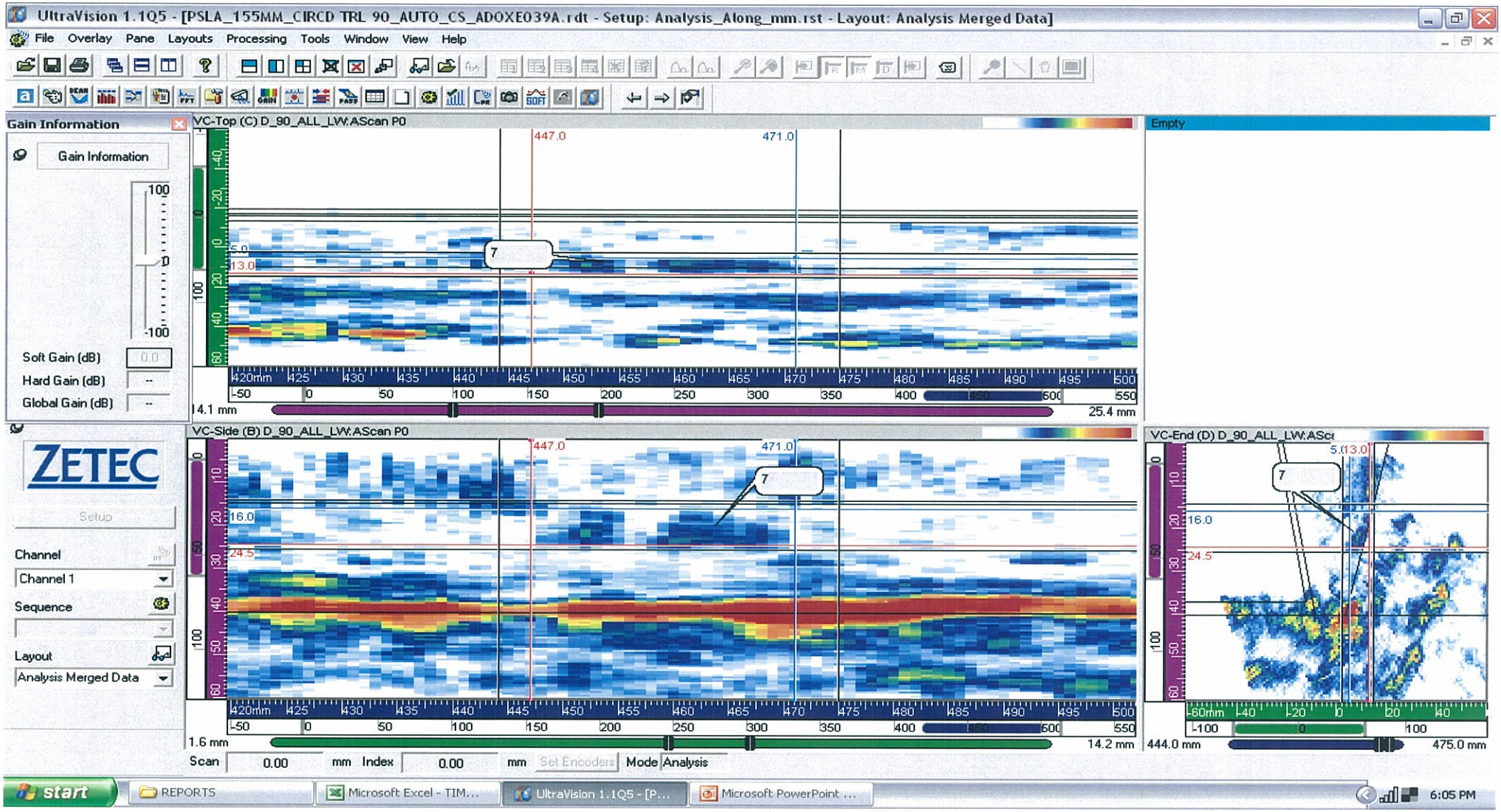
EPRI Review _____

LMT Review _____ **Level** III

T.P. Blechinger

ANII Review N/A

Report# EPRI-PA-01



Data Analyst _____ **Level** III

J. L. Devers

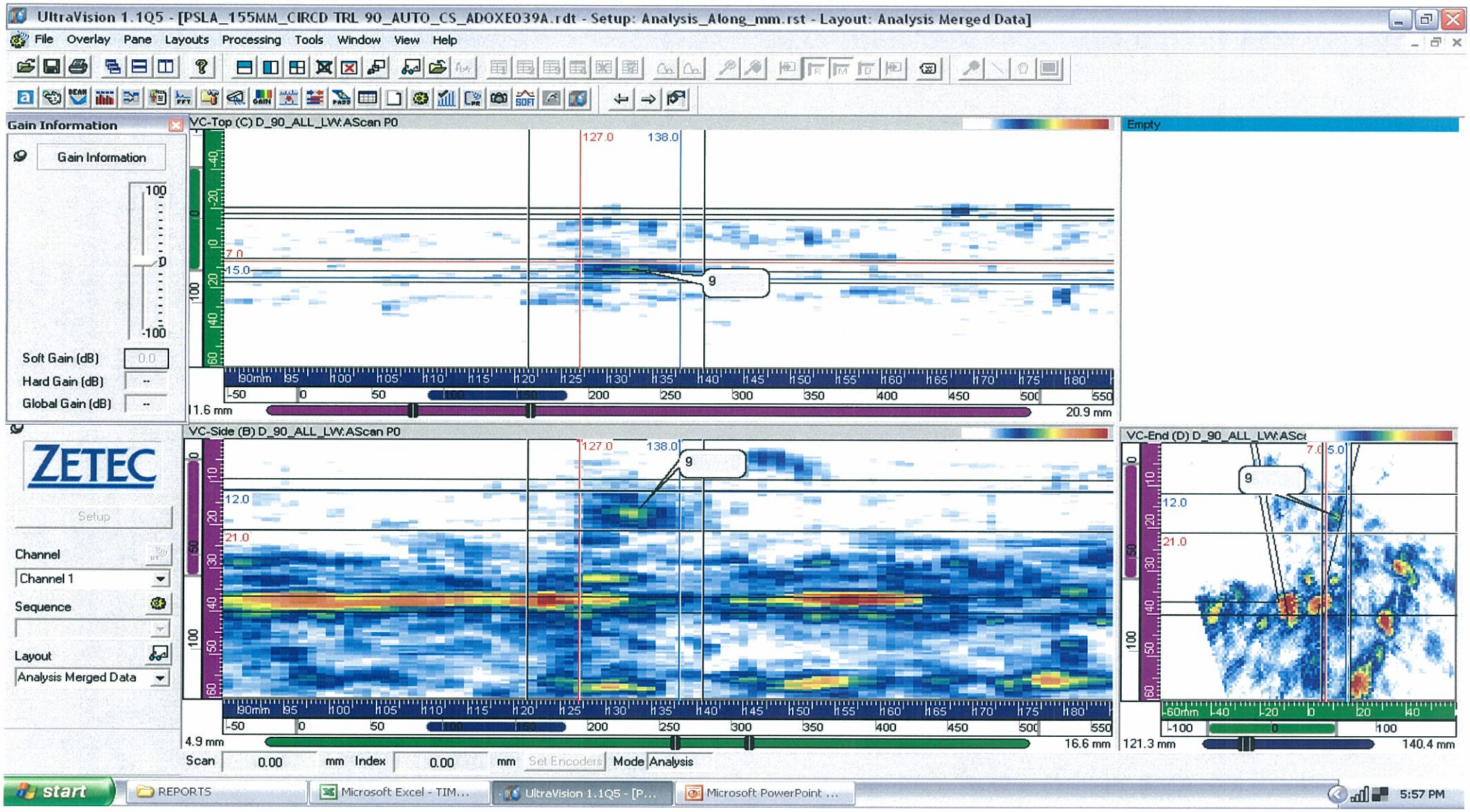
EPRI Review _____

LMT Review _____ **Level** III

T.P. Blechinger

ANII Review N/A

Report# EPRI-PA-01



Data Analyst _____ **Level** III

J. L. Devers

EPRI Review _____

LMT Review _____ **Level** III

T.P. Blechinger

ANII Review N/A

Report# EPRI-PA-01

LINEARITY CHECK DATA SHEET

Equipment / module : OMNI-MX/OMNI-M-PA32128PR
Serial number : OMNI-Z-1012/OMNI-Z-6012
Calibration Due 11/21/08
Procedure : TechDocE_OmniScanPA_SiteLinearityCheck_revA.doc

Phased array probe: MODEL-AS SN-5135 G106
Reference block: MEUXE005A
Verification: PRE EXAMINATION

Gain Setting	Gain Value (dB)	EA (%FSH)	EB (%FSH)	EA/2 (%FSH)
Nominal Gain	7.7	40	20	20
Nominal Gain + 6 dB	13.3	76	37.6	18.8
Nominal Gain - 6 dB	1.7	20	10	10

Test	OK / NOK
Vertical Amplification Linearity	OK
Amplitude Control Linearity	OK

Data Analyst : Jeff Devers
Date/Time : 3/8/2008-1720

EPRI Review Date : 3/17/08

ANII Review Date : N/A

LMT Review Todd Blechinger
Date : 3/14/08

Report # EPRI-PA-02

LINEARITY CHECK DATA SHEET

Equipment / module : OMNI-MX/OMNI-M-PA32128PR
Serial number : OMNI-Z-1012/OMNI-Z-6012
Calibration Due 21-Nov-08
Procedure : TechDocE_OmniScanPA_SiteLinearityCheck_revA.doc

Phased array probe: MODEL-AS SN-5135 G106
Reference block: MEUXE005A
Verification: POST EXAMINATION

Gain Setting	Gain Value (dB)	EA (%FSH)	EB (%FSH)	EA/2 (%FSH)
Nominal Gain	7.7	40	20	20
Nominal Gain + 6 dB	13.3	76	37.6	18.8
Nominal Gain - 6 dB	1.7	20	10	10

Test	OK / NOK
Vertical Amplification Linearity	OK
Amplitude Control Linearity	OK

Data Analyst : Jeff Devers JD
Date/Time : 3/13/2008-1700

EPRI Review Date : 3/17/08

ANII Review Date : N/A

LMT Review Todd Blechinger
Date : 3/14/08

Report # EPRI-PA-02

PHASED ARRAY CALIBRATION DATA SHEET

Procedure : ZETEC_Omniscan PA_03_revD **Plant / Unit :** PSL/1

UT equipment : OMNI-M-PA32128PR **Ser. Number:** OMNI-Z-1012/OMNI-Z-6012

Probe Configuration	Serial No.	Active Channels	Wedge assembly	Calibration block	Reflector	Sens. (dB)	UT path (mm)	Date (dd/mm/yy)	Time (hh:mm)	Status	Operator (initials)
CS/ CIRCU TRL 270	5155A103 5155B105	ALL	ADUXE 039A	MEUXE015A	1.0"	32.5	35.6	3/10/08	0900	INITIAL	JPB
CS/ CIRCU TRL 270	5155A103 5155B105	ALL	ADUXE 039A	MEUXE015A	1.0"	32.5	35.6	3/10/08	1900	FINAL	JPB
CS/ CIRCD TRL 90	5155A103 5155B106	ALL	ADUXE 039A	MEUXE015A	1.0"	32.5	35.6	3/10/08	0905	INITIAL	JPB
CS/ CIRCD TRL 90	5155A103 5155B106	ALL	ADUXE 039A	MEUXE015A	1.0"	32.5	35.6	3/10/08	1905	FINAL	JPB

"Sens. (dB)" = gain setting (in dB) required to obtain echo amplitude of 80% SH on reference reflector

Data Analyst Jeff Devers JD
Date : 3/10/08

EPRI Review 3/17/08
Date :

ANII Review N/A
Date :

LMT Review Todd Blechinger
Date : 3/14/08

Report # EPRI-PA-02

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'B'

Menu item	Setting	Essential / Non-Essential / Not applicable
File		
File		
Destination	Storage Card	Non-Essential
Save Mode	A-Scan	Essential
File Name	***PSLB_155MM_CIRCD TRL 90_AUTO_CS_ADUXE039A***	Essential
Report		
Template	Complete	Non-Essential
File Name	***PSLB_155MM_CIRCD TRL 90_AUTO_CS_ADUXE039A***	Essential
Paper Size	Letter	Non-Essential
Format		
User field	Off	Non-Essential
Probe	Off	Non-Essential
Setup	On	Essential
Note	Off	Non-Essential
View	Current Layout	Non-Essential
User field		Not applicable
Notes		Not applicable
Reading		
Result		
Selector	List 1	Essential
Field 1	A% (Peak Amplitude in Gate)	Essential
Field 2	A^ (Half Path position in Gate)	Essential
Field 3	B%	Not applicable
Field 4	B^	Not applicable
Cursors		Not applicable
Table		Not applicable
Export		Not applicable
Utilities		
Pref.		
Units	Millimeters	Essential
Bright (%)	25	Non-Essential
Scheme	Indoor	Non-Essential
System		
Clock Set	*Set to correct time*	Essential
Date Set	*Set to correct date*	Essential
Time Zone	*Set to correct time zone*	Non-Essential
Daylight saving	On	Non-Essential
Select Key	F2	Non-Essential
Assign Key	Gain	Non-Essential
Service		Not applicable

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'B'

Options			Not applicable
Network	*Only for network saving*		Non-Essential
UT			
General			
Gain	33.7		Essential
Start	0		Essential
Range	113.09mm		Essential
Wedge delay	2.30		Essential
Velocity	5890 m/s		Essential
Pulser			
Pulser	1		Not applicable
Tx/Rx mode	PE		Essential
Freq	1.5		Essential
Voltage	High		Essential
PW	*Imported from LAW file (333 ns)*		Essential
PRF	25		Essential
Receiver			
Receiver	1		Not applicable
Filter	None		Essential
Rectifier	FW		Essential
Video Filter	Off		Essential
Receiver			
Averaging	1		Essential
Reject	0		Essential
Beam			
Gain Offset	*Imported from LAW file*		Essential
Scan Offset	*Imported from LAW file*		Essential
Index Offset	*Imported from LAW file*		Essential
Angle	*Imported from LAW file*		Essential
Skew	*Imported from LAW file*		Essential
Beam Delay	*Imported from LAW file*		Essential
Advanced			
dB Ref	Off		Essential
Points Qty	640		Essential
Scale Factor	6		Essential
Sum Gain	*Imported from LAW file*		Essential
Scan			
Encoder			
Encoder	1 (Scan)	2 (Index)	Essential
Polarity	Normal	Inverse	Essential
Type	Quad		Essential
Resolution	35.38	58.00	Essential
Origin	0		Essential
Synchro			

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'B'

Source	Both Axes	Essential
Scan	Encoder 1	Essential
Index	Encoder 2	Not applicable
Scan Speed	25 for scan resolution of 1 mm	Not applicable
Area		
Scan Start	0 mm	Essential
Scan End	512	
Scan Resolution	1.0 mm	Essential
Index start	-34.0 mm	Essential
Index end	40.3 mm	Essential
Index resolution	14.9 mm	Essential
Start		
Start Mode	Reset All	Essential
Pause	Off	Non-Essential
Data		
Storage	Last	Essential
Display		
Selection		
Display	A-S-C	Essential
C-Scan 1	A%	Non-Essential
Group	Current	Non-Essential
Projection	On	Not applicable
Rulers		
UT Unit	Sound Path	Essential
% Ruler	Linear(%)	Essential
Grid	Off	Non-Essential
DAC / TCG	Off	Essential
Gate	On	Essential
Cursor	On	Essential
Zoom		Not applicable
Color		
Select	Amplitude	Essential
Start (%)	0.0	Essential
End (%)	100.0	Essential
Properties		Not applicable
Probe/Part		
Select		
Group	1	Not applicable
Group Link	Off	Not applicable
Select	Select Tx/Rx	Essential
Select Probe	Unknown	Not applicable
Select Wedge	Contact / Contact	Not applicable
Auto Detect	Off	Essential
Scan Offset	0	Essential

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'B'

Index Offset	0			Essential
Skew	0			Essential
Characterize				Not applicable
Parts				Not applicable
Wizard				Not applicable
PGM Probe				
Configuration				
Group	1			Not applicable
Enable	Off			Not applicable
Scan Type	Custom			Essential
Connection P	1			Not applicable
Connection R	1			Not applicable
Aperture				Not applicable
Beam				Not applicable
Laws				
Auto Program	Off			Essential
Wizard				Not applicable
Gate/Alarm				
Gate				
Gate Select	Gate A	B	I	Essential
Gate Start	10	0	0	Essential
Width	End of time base	0	0	Non-Essential
Threshold	25	0	0	Essential
Mode	Positive			Not applicable
Synchro	Pulse			Essential
Alarms				Not applicable
Output				Not applicable
Gate/Alarm (ctd.)				
DAC / TCG				Not applicable
Thickness				Not applicable
Calibration				
Phased Array				Not applicable
Axis				Not applicable
TCG				Not applicable
Code				Not applicable
User				
Gain				Not applicable
Start				Not applicable
Range				Not applicable
Display				Not applicable
Gate				Not applicable

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'B'

Focal Law Calculator Inputs

Menu item	Setting	Essential / Non-Essential / Not applicable
Probe (CS) 90°		
Name	1.5M16x2E32-7(EWUXE083A)	Essential
Probe Skew Angle	90°	Essential
Probe Frequency	1.5 MHz	Essential
Number of elements on primary axis	16	Essential
Primary axis pitch	2 mm	Essential
Secondary axis width	7 mm	Essential
Pitch and Catch	Checked	Essential
Probe separation		Not applicable
Squint angle	"0.0°"	Essential
Reverse primary axis	Unchecked	Essential
Specimen		
Name	Memphis CS LW	Non-Essential
Specimen Type	"Pipe OD"	Essential
Wave type	"Longitudinal" for TRL	Essential
Sound velocity	90°-5890 m/s	Essential
Thickness	40 mm	Essential
Radius	77 mm	Essential
Wedge		
Name	ADUXE039A	Essential
Footprint	"Curvature along secondary axis"	Essential
Wedge angle	22.3	Essential
Roof angle	6.0	Essential
Sound velocity	"2330 m/s"	Essential
Height at the middle of the first element	"8.17 mm" for ADUXE039A	Essential
Primary axis offset of the middle of the first element	"8.43 mm" for ADUXE039A	Essential
Secondary axis offset of the middle of the first element	"7.74 mm" for ADUXE039A	Essential
Primary axis position of wedge reference	"-50.00 mm"	Essential
Secondary axis position of wedge reference	"-15.00 mm"	Essential
Wedge length	"50.00 mm"	Essential

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'B'

Distance between contact points (wedge width)	"30.00 mm"	Essential
Scan		
Type	"Linear"	Essential
Beam angles selection		
Primary steering angle		Not applicable
Secondary steering angle		Not applicable
Refracted angle	90°-30°,45°,60°,70°	Essential
Beam skew angle		Not applicable
Focal points selection		
Focusing type	Auto	Essential
Focal plane position		Not applicable
Emission focus position		Not applicable
Reception focus position		Not applicable
Elements selection		
Improved resolution	Checked	Essential
Pulser Start	" 1 "	Essential
Pulser Stop	9	Essential
Pulser Resolution	" 1 "	Essential
Receiver Start	" 1 "	Essential
Primary axis aperture	8	Essential
Pulser connection	" 1 "	Essential
Receiver connection	" 65 "	Essential
Hardware selection		
Type	"OmniScan 32/128"	Essential

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'B'

Menu item	Setting	Essential / Non-Essential / Not applicable
File		
File		
Destination	Storage Card	Non-Essential
Save Mode	A-Scan	Essential
File Name	***PSLB_155MM_CIRCU TRL 270_AUTO_CS_ADUXE039A***	Essential
Report		
Template	Complete	Non-Essential
File Name	***PSLB_155MM_CIRCU TRL 270_AUTO_CS_ADUXE039A***	Essential
Paper Size	Letter	Non-Essential
Format		
User field	Off	Non-Essential
Probe	Off	Non-Essential
Setup	On	Essential
Note	Off	Non-Essential
View	Current Layout	Non-Essential
User field		Not applicable
Notes		Not applicable
Reading		
Result		
Selector	List 1	Essential
Field 1	A% (Peak Amplitude in Gate)	Essential
Field 2	A^ (Half Path position in Gate)	Essential
Field 3	B%	Not applicable
Field 4	B^	Not applicable
Cursors		Not applicable
Table		Not applicable
Export		Not applicable
Utilities		
Pref.		
Units	Millimeters	Essential
Bright (%)	25	Non-Essential
Scheme	Indoor	Non-Essential
System		
Clock Set	*Set to correct time*	Essential
Date Set	*Set to correct date*	Essential
Time Zone	*Set to correct time zone*	Non-Essential
Daylight saving	On	Non-Essential
Select Key	F2	Non-Essential
Assign Key	Gain	Non-Essential

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'B'

Service			Not applicable
Options			Not applicable
Network	*Only for network saving*		Non-Essential
UT			
General			
Gain	33.7		Essential
Start	0		Essential
Range	110.78		Essential
Wedge delay	2.30		Essential
Velocity	5770 m/s		Essential
Pulser			
Pulser	1		Not applicable
Tx/Rx mode	PE		Essential
Freq	1.5		Essential
Voltage	High		Essential
PW	*Imported from LAW file (333 ns)*		Essential
PRF	25		Essential
Receiver			
Receiver	1		Not applicable
Filter	None		Essential
Rectifier	FW		Essential
Video Filter	Off		Essential
Receiver			
Averaging	1		Essential
Reject	0		Essential
Beam			
Gain Offset	*Imported from LAW file*		Essential
Scan Offset	*Imported from LAW file*		Essential
Index Offset	*Imported from LAW file*		Essential
Angle	*Imported from LAW file*		Essential
Skew	*Imported from LAW file*		Essential
Beam Delay	*Imported from LAW file*		Essential
Advanced			
dB Ref	Off		Essential
Points Qty	640		Essential
Scale Factor	6		Essential
Sum Gain	*Imported from LAW file*		Essential
Scan			
Encoder			
Encoder	1 (Scan)	2 (Index)	Essential
Polarity	Normal	Inverse	Essential
Type	Quad		Essential
Resolution	35.36	58.00	Essential
Origin	0		Essential

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'B'

Synchro		
Source	Both Axes	Essential
Scan	Encoder 1	Essential
Index	Encoder 2	Not applicable
Scan Speed	25 for scan resolution of 1 mm	Not applicable
Area		
Scan Start	0 mm	Essential
Scan End	512	
Scan Resolution	1.0 mm	Essential
Index start	-43.8 mm	Essential
Index end	36.0 mm	Essential
Index resolution	16 mm	Essential
Start		
Start Mode	Reset All	Essential
Pause	Off	Non-Essential
Data		
Storage	Last	Essential
Display		
Selection		
Display	A-S-C	Essential
C-Scan 1	A%	Non-Essential
Group	Current	Non-Essential
Projection	On	Not applicable
Rulers		
UT Unit	Sound Path	Essential
% Ruler	Linear(%)	Essential
Grid	Off	Non-Essential
DAC / TCG	Off	Essential
Gate	On	Essential
Cursor	On	Essential
Zoom		Not applicable
Color		
Select	Amplitude	Essential
Start (%)	0.0	Essential
End (%)	100.0	Essential
Properties		Not applicable
Probe/Part		
Select		
Group	1	Not applicable
Group Link	Off	Not applicable
Select	Select Tx/Rx	Essential
Select Probe	Unknown	Not applicable
Select Wedge	Contact / Contact	Not applicable
Auto Detect	Off	Essential

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'B'

Position				
Scan Offset	0			Essential
Index Offset	0			Essential
Skew	0			Essential
Characterize				Not applicable
Parts				Not applicable
Wizard				Not applicable
PGM Probe				
Configuration				
Group	1			Not applicable
Enable	Off			Not applicable
Scan Type	Custom			Essential
Connection P	1			Not applicable
Connection R	1			Not applicable
Aperture				Not applicable
Beam				Not applicable
Laws				
Auto Program	Off			Essential
Wizard				Not applicable
Gate/Alarm				
Gate				
Gate Select	Gate A	B	I	Essential
Gate Start	10	0	0	Essential
Width	End of time base	0	0	Non-Essential
Threshold	25	0	0	Essential
Mode	Positive			Not applicable
Synchro	Pulse			Essential
Alarms				Not applicable
Output				Not applicable
Gate/Alarm (ctd.)				
DAC / TCG				Not applicable
Thickness				Not applicable
Calibration				
Phased Array				Not applicable
Axis				Not applicable
TCG				Not applicable
Code				Not applicable
User				
Gain				Not applicable
Start				Not applicable
Range				Not applicable
Display				Not applicable
Gate				Not applicable

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'B'

Focal Law Calculator Inputs

Menu item	Setting	Essential / Non-Essential / Not applicable
Probe (CS) 270°		
Name	1.5M16x2E32-7(EWUXE083A)	Essential
Probe Skew Angle	270°	Essential
Probe Frequency	1.5 MHz	Essential
Number of elements on primary axis	16	Essential
Primary axis pitch	2 mm	Essential
Secondary axis width	7 mm	Essential
Pitch and Catch	Checked	Essential
Probe separation		Not applicable
Squint angle	"0.0°"	Essential
Reverse primary axis	Unchecked	Essential
Specimen		
Name	Memphis SS LW	Non-Essential
Specimen Type	"Pipe OD"	Essential
Wave type	"Longitudinal" for TRL	Essential
Sound velocity	270°-5770 m/s	Essential
Thickness	40 mm	Essential
Radius	77 mm	Essential
Wedge		
Name	ADUXE039A	Essential
Footprint	"Curvature along secondary axis"	Essential
Wedge angle	22.3	Essential
Roof angle	6.0	Essential
Sound velocity	"2330 m/s"	Essential
Height at the middle of the first element	"8.17 mm" for ADUXE039A	Essential
Primary axis offset of the middle of the first element	"8.43 mm" for ADUXE039A	Essential
Secondary axis offset of the middle of the first element	"7.74 mm" for ADUXE039A	Essential
Primary axis position of wedge reference	"-50.00 mm"	Essential
Secondary axis position of wedge reference	"-15.00 mm"	Essential
Wedge length	"50.00 mm"	Essential

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'B'

Distance between contact points (wedge width)	"30.00 mm"	Essential
Scan		
Type	"Linear"	Essential
Beam angles selection		
Primary steering angle		Not applicable
Secondary steering angle		Not applicable
Refracted angle	270°-30°,45°,60°,70°	Essential
Beam skew angle		Not applicable
Focal points selection		
Focusing type	Auto	Essential
Focal plane position		Not applicable
Emission focus position		Not applicable
Reception focus position		Not applicable
Elements selection		
Improved resolution	Checked	Essential
Pulser Start	" 1 "	Essential
Pulser Stop	9	Essential
Pulser Resolution	" 1 "	Essential
Receiver Start	" 1 "	Essential
Primary axis aperture	8	Essential
Pulser connection	" 1 "	Essential
Receiver connection	" 65 "	Essential
Hardware selection		
Type	"OmniScan 32/128"	Essential

OmniScan Report

Report Date	Report Version	Setup File name	Date of Inspection	Inspection Version	Save Mode
2008 / 03 / 10	1.4R3	PSLB_155MM_CIRCD TRL 90_AUTO_CS_ADUXE039A2.opd	2008 / 03 / 10	1.4R3	A Scan
OmniScan Type	**OmniScan Serial #**	**Module Type**	**Module Serial #**	**Calibration Due**	**Data File name**
OmniScan MX	OMNI-Z-1012	OMNI-M-PA32128PR	OMNI-Z-6012	2008 / 11 / 21	PSLB_155MM_CIRCD TRL 90_AUTO_CS_ADUXE039A2

Group 1

Setup

A:30.0 Sk:090 L:001

Beam Delay	Start (Half Path)	Range (Half Path)	PRF	Type	Averaging Factor
12.10 us	-0.02 mm	113.09 mm	25	PA	1
Scale Type	**Scale Factor**	**Video Filter**	**Pretrig**	**Rectification**	**Band Pass Filter**
Compression	6	Off	0.00 µs	FW	None (0.52 - 19 MHz)
Voltage	**Gain**	**Mode**	**Wave Type**	**Sound Velocity**	**Pulse Width**
High	33.70 dB	PC (Pitch And Catch)	User Defined	5890.0 m/s	332.50 ns
Scan Offset	**Index Offset**	**Skew**			
0.00 mm	0.00 mm	N/A			

Gate	Start	Width	Threshold	Synchro
I	0.01 mm	1.00 mm	0.00 %	Pulse
A	10.20 mm	122.48 mm	25.00 %	Pulse
B	0.01 mm	1.00 mm	0.00 %	Pulse

Law

Law File name	Scan Type
DM_155_CIRCD TRL 90_AUTO_CS_ADUXE039A.law	Custom

Part

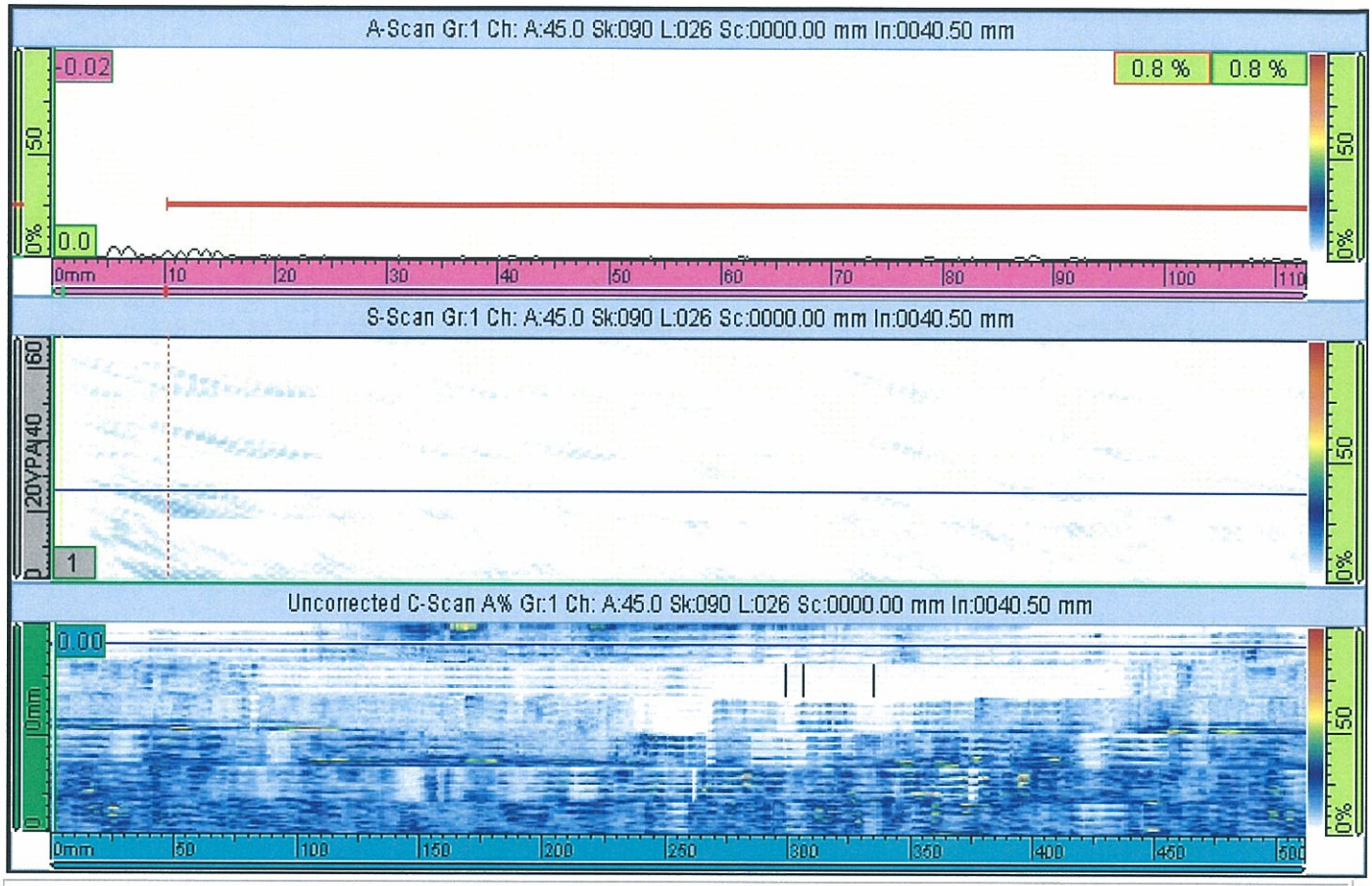
Material	Geometry	Thickness
STEEL MILD	Plate	50.00 mm

Scan Area

Scan Start	Scan Length	Scan Resolution	Index Start	Index Length	Index Resolution
0.00 mm	512.00 mm	1.00 mm	-34.00 mm	74.50 mm	14.90 mm
Synchro	**Max Scan Speed**				
Both Axis	25.00 mm/s				

Axis	Encoder	Encoder Type	Encoder Resolution	Polarity
Scan	1	Quadrature	35.36 step/mm	Normal
Index	2	Quadrature	58.00 step/mm	Inverse

A%	A^	B%	B^	None	None	None	None
5.5 %	--- mm	1.2 %	0.27 mm				



Technician Name Todd P. Blechinger

Technician Signature _____

Contractor LMT INC.

Date 3/10/08

OmniScan Report

Report Date	Report Version	Setup File name	Date of Inspection	Inspection Version	Save Mode
2008 / 03 / 10	1.4R3	PSLB_155MM_CIRCU TRL 270_AUTO_CS_ADUXE039A2.opd	2008 / 03 / 10	1.4R3	A Scan
OmniScan Type	**OmniScan Serial #**	**Module Type**	**Module Serial #**	**Calibration Due**	**Data File name**
OmniScan MX	OMNI-Z-1012	OMNI-M-PA32128PR	OMNI-Z-6012	2008 / 11 / 21	PSLB_155MM_CIRCU TRL 270_AUTO_CS_ADUXE039A2

Group 1

Setup

A:30.0 Sk:270 L:001

Beam Delay	Start (Half Path)	Range (Half Path)	PRF	Type	Averaging Factor
12.08 us	-0.02 mm	110.78 mm	25	PA	1
Scale Type	**Scale Factor**	**Video Filter**	**Pretrig**	**Rectification**	**Band Pass Filter**
Compression	6	Off	0.00 µs	FW	None (0.52 - 19 MHz)
Voltage	**Gain**	**Mode**	**Wave Type**	**Sound Velocity**	**Pulse Width**
High	33.70 dB	PC (Pitch And Catch)	User Defined	5770.0 m/s	332.50 ns
Scan Offset	**Index Offset**	**Skew**			
0.00 mm	0.00 mm	N/A			

Gate	Start	Width	Threshold	Synchro
I	0.02 mm	0.98 mm	0.00 %	Pulse
A	10.00 mm	119.99 mm	25.00 %	Pulse
B	0.02 mm	0.98 mm	0.00 %	Pulse

Law

Law File name	Scan Type
DM_155_CIRCU TRL 270_AUTO_CS_ADUXE039A.law	Custom

Part

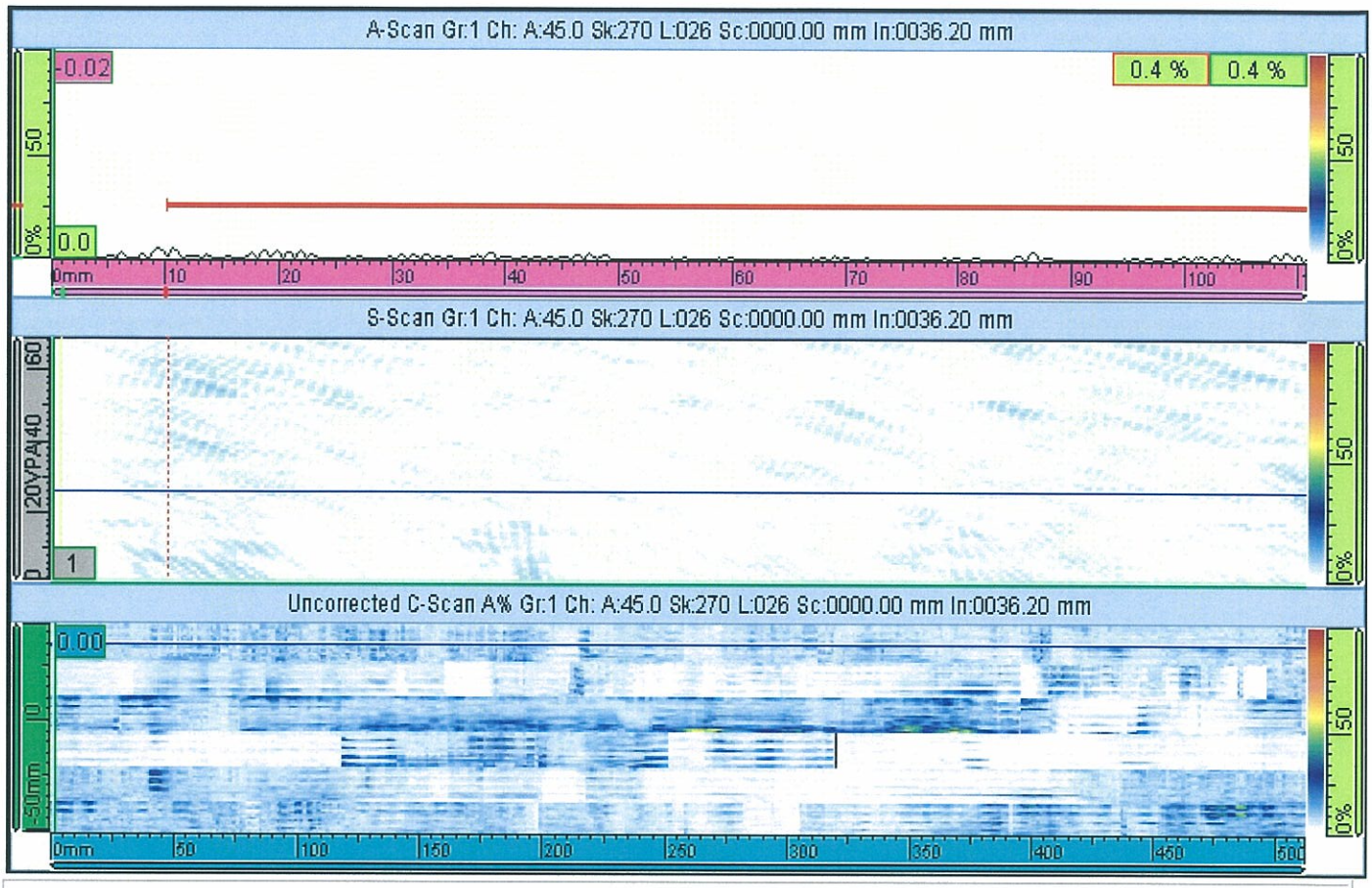
Material	Geometry	Thickness
STEEL MILD	Plate	50.00 mm

Scan Area

Scan Start	Scan Length	Scan Resolution	Index Start	Index Length	Index Resolution
0.00 mm	512.00 mm	1.00 mm	-43.80 mm	80.00 mm	16.00 mm
Synchro	**Max Scan Speed**				
Both Axis	25.00 mm/s				

Axis	Encoder	Encoder Type	Encoder Resolution	Polarity
Scan	1	Quadrature	35.36 step/mm	Normal
Index	2	Quadrature	58.00 step/mm	Inverse

A%	A^	B%	B^	None	None	None	None
8.2 %	--- mm	1.2 %	0.71 mm				



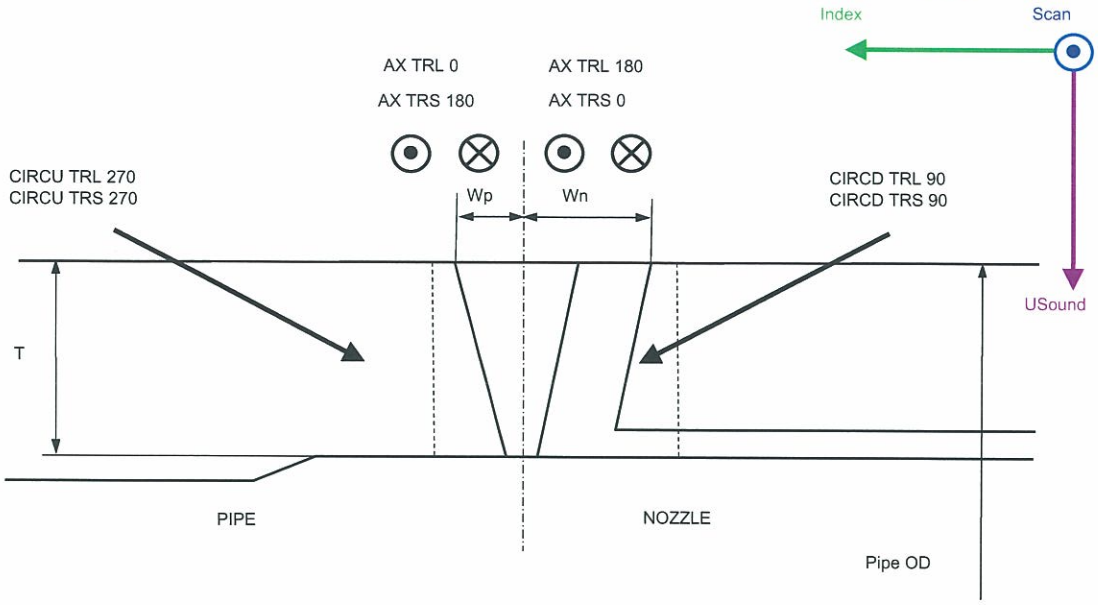
Technician Name Todd P. Blechinger

Technician Signature

Contractor LMT INC.

Date 3/10/08

SCAN PLAN



Procedure :	ZETEC_OmniScanPA_03_revD	**Pipe Thickness T :**	40.0 mm
Plant / Unit :	PSL/1	**Pipe OD :**	155.0 mm
Weld Id. :	PSL Safety Nozzle 'A', 'B', & 'C'	**Weld Extent Pipe Side Wp :**	20.0 mm
Dual Side Access :	yes	**Weld Extent Nozzle Side Wn :**	23.5 mm
Complete Pipe:	yes	**Access Limitation Pipe Side Lp :**	86.0 mm
		Access Limitation Nozzle Side Ln	84.0 mm
		Weld Length:	486.0 mm

SCANNING SEQUENCES CIRCUMFERENTIAL FLAWS

Focal law group	Probe Type	MinTB (mm)	MaxTB (mm)	# Data Points	Scan Start (mm)	Scan End (mm)	Scan Resol. (mm)	Index Start (mm)	Index End (mm)	Index Resol. (mm)	# Lines	Done ? (OK / NA)
CIRCD TRL 90	CS	100.0	125.0	640	0.0	511.9	1.0	-34.0	40.3	14.9	6	ok
CIRCU TRL 270	CS	100.0	125.0	640	0.0	511.9	1.0	-43.8	36.0	16.0	6	ok
CIRCD TRS 90	CS	100.0	125.0	800	0.0	511.9	1.0	-34.0	-16.3	18.5	1	N/A
CIRCU TRS 270	CS	100.0	125.0	800	0.0	511.9	1.0	12.8	36.0	11.6	3	N/A

SCANNING SEQUENCES AXIAL FLAWS

Focal law group	Probe Type	MinTB (mm)	MaxTB (mm)	# Data Points	Scan Start (mm)	Scan End (mm)	Scan Resol. (mm)	Index Start (mm)	Index End (mm)	Index Resol. (mm)	# Lines	
AX TRL 0	AS	75.2	94.0	640	0.0	511.9	1.0	-29.9	26.4	9.4	7	N/A
AX TRL 180	AS	75.2	94.0	640	0.0	511.9	1.0	-29.9	26.4	9.4	7	N/A
AX TRS 0	AS	75.2	94.0	1120	0.0	511.9	1.0	-29.9	26.4	9.4	7	N/A
AX TRS 180	AS	75.2	94.0	1120	0.0	511.9	1.0	-29.9	26.4	9.4	7	N/A
AX TRL 0												NA
AX TRL 180												NA

Data Analyst : Jeff Devers
Date : 3/10/08

LMT Review Todd Blechinger
Date : 3/14/08

EPRI Review
Date : 3/17/08

Report # EPRI-PA-02

ANII Review N/A
Date :

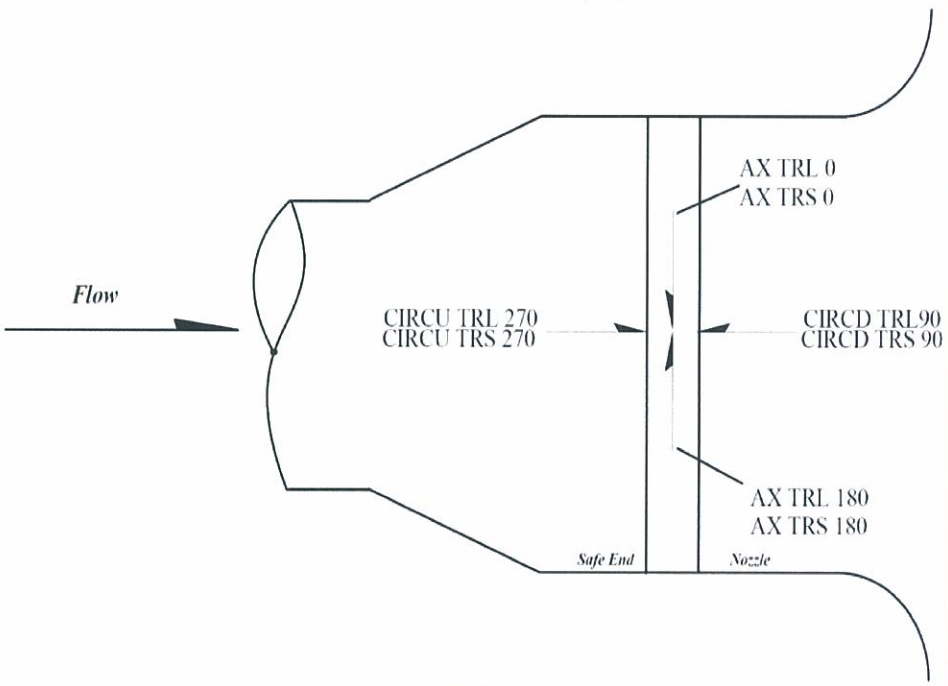
Report # EPRI-PA-02

Ultrasonic Phased Array Examination Report

Plant / Unit	PSL/1	OmniScan Software Version	1.4R3	Acquisition Tech. Todd Blechinger	Level III
Comp / System	Safety Nozzle 'B'	OmniScanConverter Software Version	1.7R5	Acquisition Tech. N/A	Level
Component Temp.	52°	UltraVision Software Revision	1.1Q5		
Procedure No.	Zetec_ OmniScanPA_03				
Revision#	rev.D				

Focal Law Group Used	Data File Identification	Results
CIRCD TRL 90	PSLB_155MM_CIRCD TRL 90_AUTO_CS_ADUXE039A	RI-See Attached
CIRCD TRL 270	PSLB_155MM_CIRCU TRL 270_AUTO_CS_ADUXE039A	NRI

Technique Referencing System



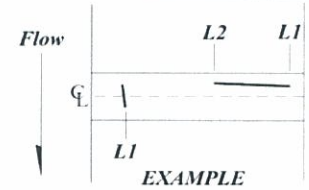
Comments:

See attached Phased Array Indication Data Tabulation Sheet for indication information.

Data Analyst Jeff Devers		Level III	Date 3/10/2008	LMT Review Todd Blechinger		Level III	Date 3/14/2008
EPRI REVIEW / DATE	3/17/08			ANII REVIEW / DATE			

Phased Array Indication Tabulation Sheet

Report # EPRI-PA-02



PLANT/ UNIT	PSL /1	REFERENCE LOCATION	0 Stamp / Weld Centerline
COMP / SYSTEM	Safety Nozzle 'B'	COMP THICKNESS	40mm
PROCEDURE NO.	Zetec_ OmniScanPA_03	WELD CROWN WIDTH	43.5mm
REV / CHANGE NO.	rev.D	WELD LENGTH	486mm

DATA ANALYST / LEVEL J.L. Devers / III

LMT REVIEW / LEVEL T.P. Blechinger / III

IND. #	Data File	Merged Data Group Used	Length Sizing Information			Thru Wall Sizing Information			Indication Position		Evaluation / Comments	Printout Page #
			Start (L1)	Stop (L2)	Length	T.W. Depth	Remain. Ligament	T.W. %	Upstream	Dnstream		
1	PSLB_155MM_CIRCD TRL 90_AUTO_CS_ ADUXE039A	CIRCD TRL 90	210mm	225mm	15mm	4.5mm- See Note 1	15.5mm	N/A		20mm	Embedded Fabrication Flaw	23of27
2	PSLB_155MM_CIRCD TRL 90_AUTO_CS_ ADUXE039A	CIRCD TRL 90	337mm	427mm	90mm	6.0mm- See Note 1	31mm	N/A	2mm		Embedded Fabrication Flaw	24of27
3	PSLB_155MM_CIRCD TRL 90_AUTO_CS_ ADUXE039A	CIRCD TRL 90	394mm	410mm	16.0mm	10.5mm- See Note 1	9.5mm	N/A	3mm		Embedded Fabrication Flaw	25of27
4	PSLB_155MM_CIRCD TRL 90_AUTO_CS_ ADUXE039A	CIRCD TRL 90	373mm	398mm	25mm	11.5mm- See Note 1	2.5mm	N/A		21mm	Embedded Fabrication Flaw	26of27
5	PSLB_155MM_CIRCD TRL 90_AUTO_CS_ ADUXE039A	CIRCD TRL 90	445mm	459mm	14mm	8.5mm- See Note 1	12mm	N/A		2mm	Embedded Fabrication Flaw	27of27

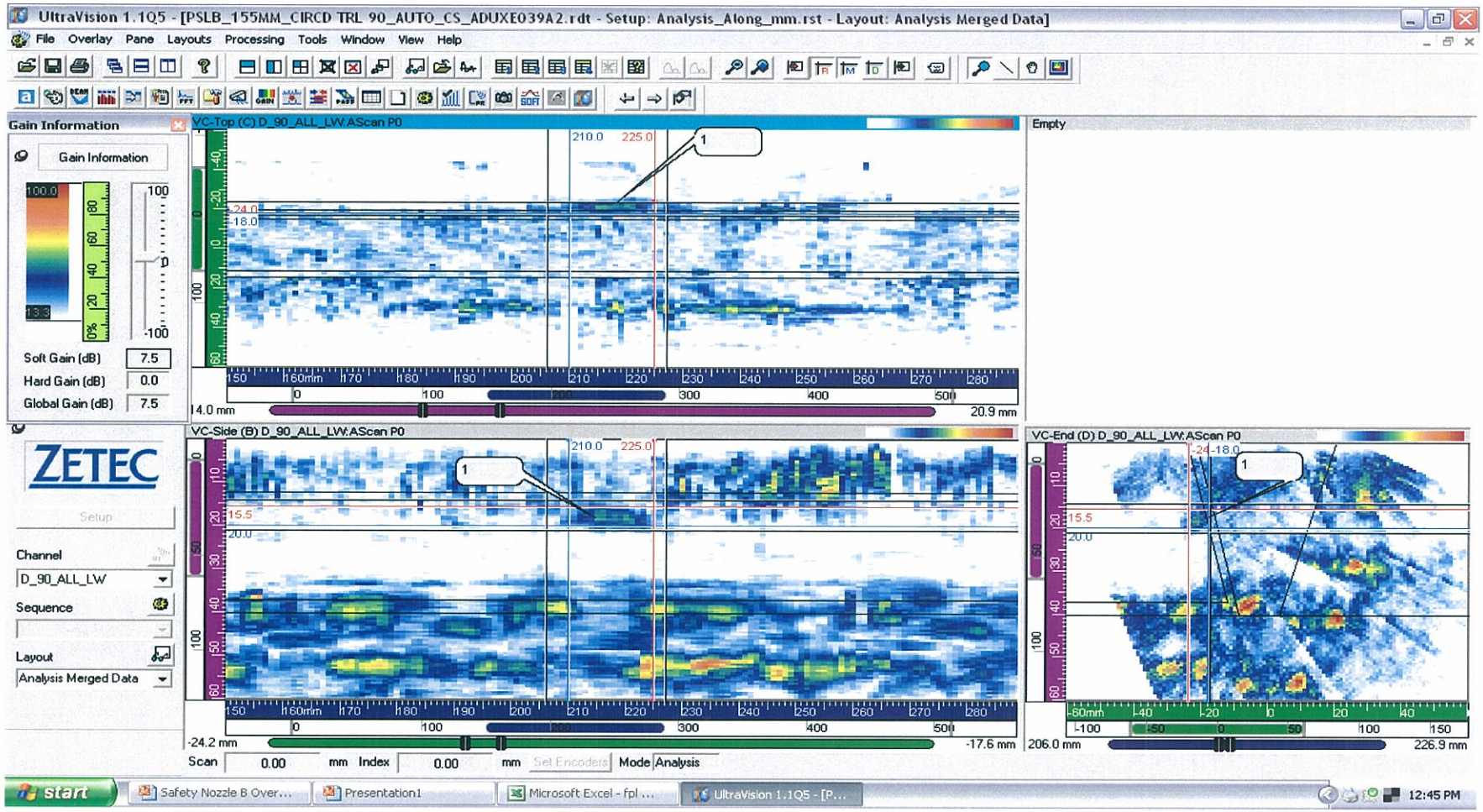
Comments: Note 1- Flaw sizing was conservatively measured using full dB drop method.

Data Analyst J.L. Devers Level III Date 3/10/2008

Further Evaluation Required? [ ] Yes [X] No

EPRI REVIEW / DATE 3/17/08

ANII REVIEW / DATE



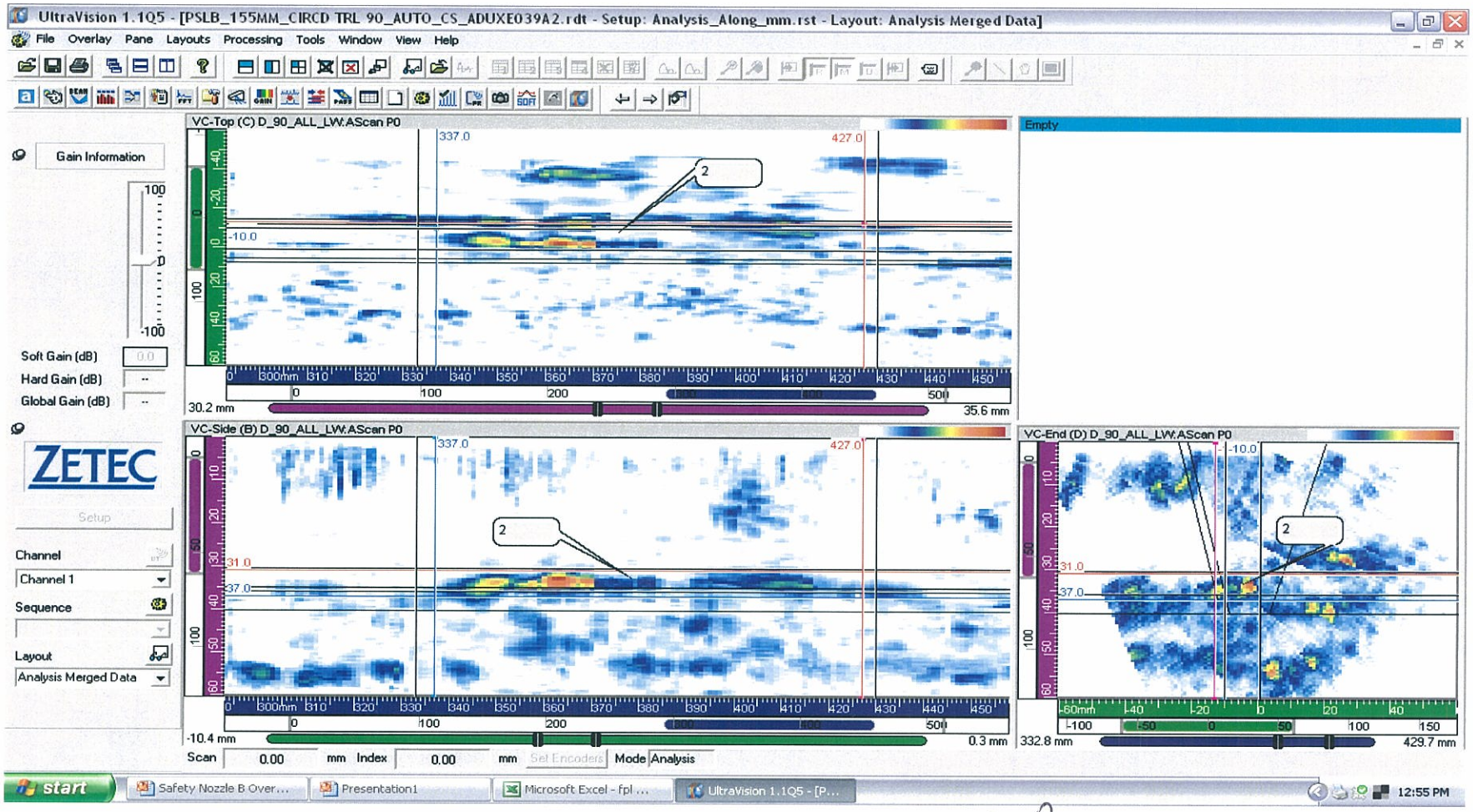
Data Analyst _____ **Level** III
J. L. Devers

EPRI Review _____

LMT Review _____ **Level** III
T.P. Blechinger

ANII Review N/A

Report# EPRI-PA-02



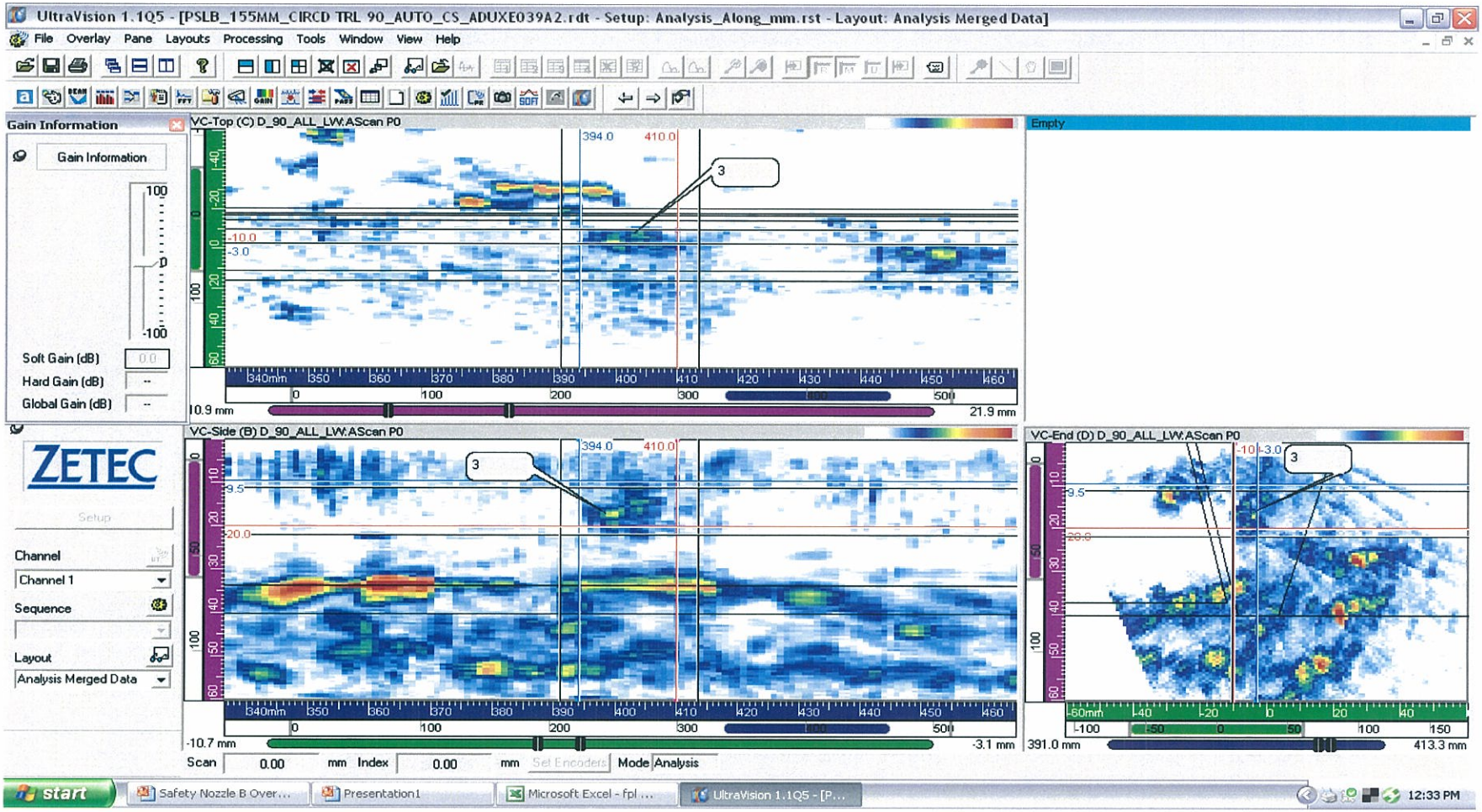
Data Analyst _____ **Level** III
J. L. Devers

EPRI Review _____

LMT Review _____ **Level** III
T.P. Blechinger

ANII Review N/A

Report# EPRI-PA-02

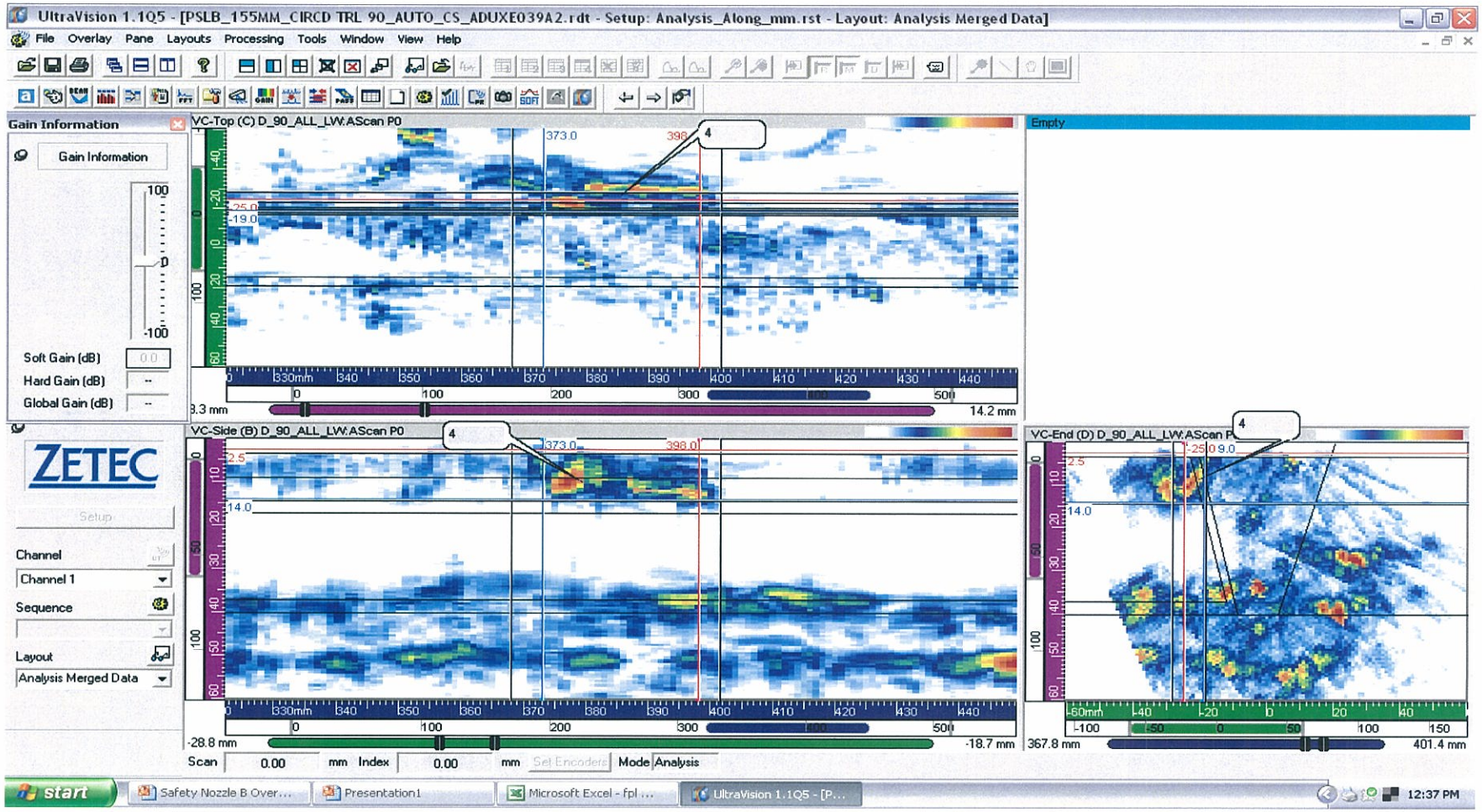


Data Analyst JLD **Level** III **EPRI Review**

J. L. Devers

LMT Review **Level** III **ANII Review** N/A **Report#** EPRI-PA-02

T.P. Blechinger



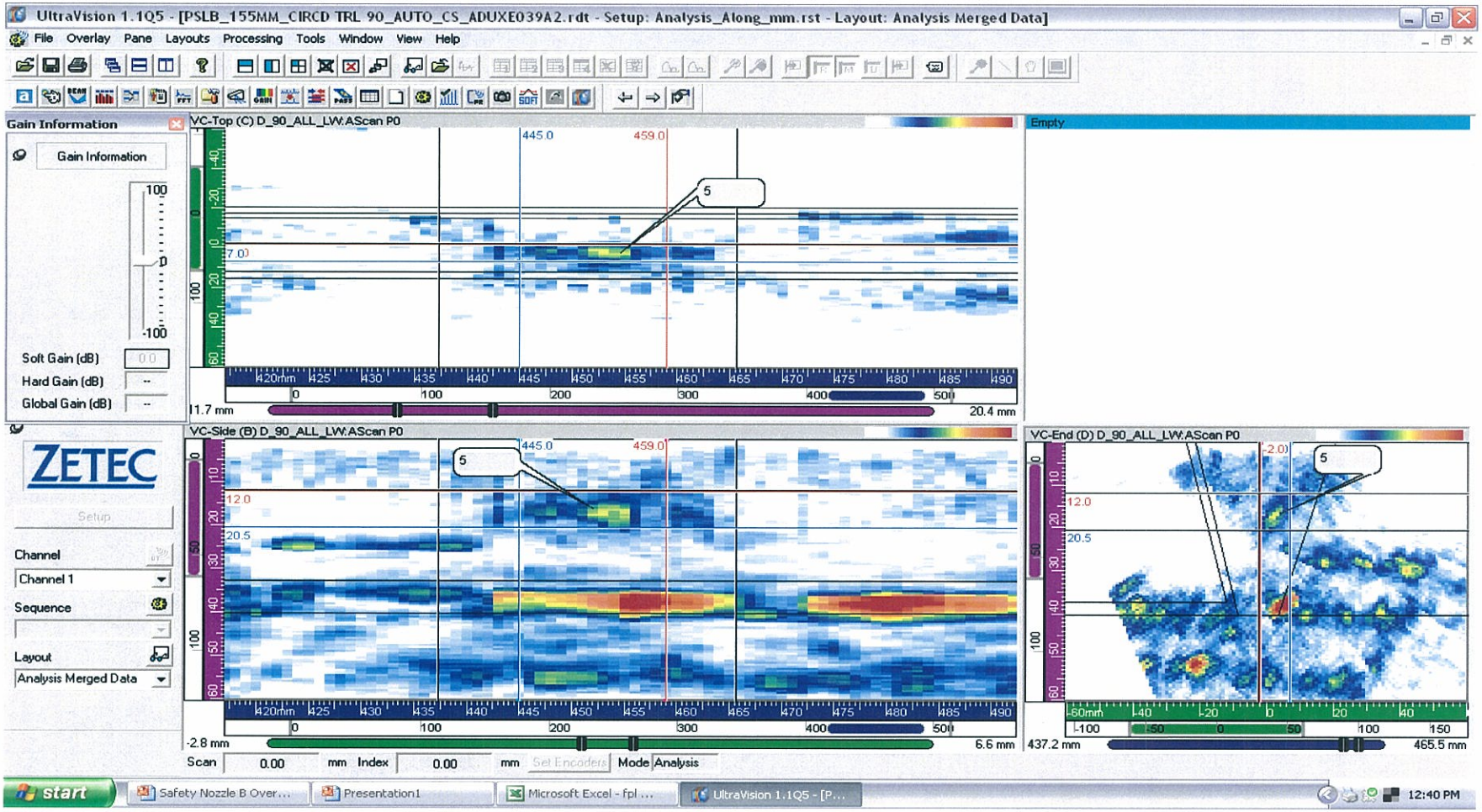
Data Analyst JL Devers **Level** III

EPRI Review

LMT Review T.P. Blechinger **Level** III

ANII Review N/A

Report# EPRI-PA-02



Data Analyst J. L. Devers **Level** III

EPRI Review

LMT Review T.P. Blechinger **Level** III

ANII Review N/A

Report# EPRI-PA-02

LINEARITY CHECK DATA SHEET

Equipment / module :	OMNI-MX/OMNI-M-PA32128PR
Serial number :	OMNI-Z-1012/OMNI-Z-6012
Calibration Due	11/21/08
Procedure :	TechDocE_OmniScanPA_SiteLinearityCheck_revA.doc

Phased array probe:	MODEL-AS SN-5135 G106
Reference block:	MEUXE005A
Verification:	PRE EXAMINATION

Gain Setting	*Gain Value* (dB)	*EA* (%FSH)	*EB* (%FSH)	*EA/2* (%FSH)
Nominal Gain	7.7	40	20	20
Nominal Gain + 6 dB	13.3	76	37.6	18.8
Nominal Gain - 6 dB	1.7	20	10	10

Test	*OK / NOK*
Vertical Amplification Linearity	OK
Amplitude Control Linearity	OK

Data Analyst : *Jeff Devers* JD

Date/Time : *3/8/2008-1720*

EPRI Review Date : 3/17/08

ANII Review Date : *N/A*

LMT Review *Todd Blechinger*

Date : *3/14/08*

Report # *EPRI-PA-03*

LINEARITY CHECK DATA SHEET

Equipment / module :	OMNI-MX/OMNI-M-PA32128PR
Serial number :	OMNI-Z-1012/OMNI-Z-6012
Calibration Due	21-Nov-08
Procedure :	TechDocE_OmniScanPA_SiteLinearityCheck_revA.doc

Phased array probe:	MODEL-AS SN-5135 G106
Reference block:	MEUXE005A
Verification:	POST EXAMINATION

Gain Setting	*Gain Value* (dB)	*EA* (%FSH)	*EB* (%FSH)	*EA/2* (%FSH)
Nominal Gain	7.7	40	20	20
Nominal Gain + 6 dB	13.3	76	37.6	18.8
Nominal Gain - 6 dB	1.7	20	10	10

Test	*OK / NOK*
Vertical Amplification Linearity	OK
Amplitude Control Linearity	OK

Data Analyst : *Jeff Devers* JD

Date/Time : *3/13/2008-1700*

EPRI Review Date : 3/17/08

ANII Review Date : *N/A*

LMT Review *Todd Blechinger*

Date : *3/14/08*

Report # *EPRI-PA-03*

PHASED ARRAY CALIBRATION DATA SHEET

Procedure : ZETEC_Omniscan PA_03_revD **Plant / Unit :** PSL/1

UT equipment : OMNI-M-PA32128PR **Ser. Number:** OMNI-Z-1012/OMNI-Z-6012

Probe Configuration	Serial No.	Active Channels	Wedge assembly	Calibration block	Reflector	Sens. (dB)	UT path (mm)	Date (dd/mm/yy)	Time (hh:mm)	Status	Operator (initials)
CS/ CIRCU TRL 270	5155A103 5155B105	ALL	ADUXE 039A	MEUXE015A	1.0"	32.5	35.6	3/10/08	0900	INITIAL	PB
CS/ CIRCU TRL 270	5155A103 5155B105	ALL	ADUXE 039A	MEUXE015A	1.0"	32.5	35.6	3/10/08	1900	FINAL	PB
CS/ CIRCD TRL 90	5155A103 5155B106	ALL	ADUXE 039A	MEUXE015A	1.0"	32.5	35.6	3/10/08	0905	INITIAL	PB
CS/ CIRCD TRL 90	5155A103 5155B106	ALL	ADUXE 039A	MEUXE015A	1.0"	32.5	35.6	3/10/08	1905	FINAL	PB

"Sens. (dB)" = gain setting (in dB) required to obtain echo amplitude of 80% SH on reference reflector

Data Analyst Jeff Devers
Date : 3/10/08

EPRI Review 3/17/08
Date :

ANII Review N/A
Date :

LMT Review Todd Blechinger
Date : 3/14/08

Report # EPRI-PA-03

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'C'

Menu item	Setting	Essential / Non-Essential / Not applicable
File		
File		
Destination	Storage Card	Non-Essential
Save Mode	A-Scan	Essential
File Name	***PSLC_155MM_CIRCD TRL 90_AUTO_CS_ADUXE039A***	Essential
Report		
Template	Complete	Non-Essential
File Name	***PSLC_155MM_CIRCD TRL 90_AUTO_CS_ADUXE039A***	Essential
Paper Size	Letter	Non-Essential
Format		
User field	Off	Non-Essential
Probe	Off	Non-Essential
Setup	On	Essential
Note	Off	Non-Essential
View	Current Layout	Non-Essential
User field		Not applicable
Notes		Not applicable
Reading		
Result		
Selector	List 1	Essential
Field 1	A% (Peak Amplitude in Gate)	Essential
Field 2	A^ (Half Path position in Gate)	Essential
Field 3	B%	Not applicable
Field 4	B^	Not applicable
Cursors		Not applicable
Table		Not applicable
Export		Not applicable
Utilities		
Pref.		
Units	Millimeters	Essential
Bright (%)	25	Non-Essential
Scheme	Indoor	Non-Essential
System		
Clock Set	*Set to correct time*	Essential
Date Set	*Set to correct date*	Essential
Time Zone	*Set to correct time zone*	Non-Essential
Daylight saving	On	Non-Essential
Select Key	F2	Non-Essential
Assign Key	Gain	Non-Essential
Service		Not applicable

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'C'

Options			Not applicable
Network	*Only for network saving*		Non-Essential
UT			
General			
Gain	33.7		Essential
Start	0		Essential
Range	113.09mm		Essential
Wedge delay	2.30		Essential
Velocity	5890 m/s		Essential
Pulser			
Pulser	1		Not applicable
Tx/Rx mode	PE		Essential
Freq	1.5		Essential
Voltage	High		Essential
PW	*Imported from LAW file (333 ns)*		Essential
PRF	25		Essential
Receiver			
Receiver	1		Not applicable
Filter	None		Essential
Rectifier	FW		Essential
Video Filter	Off		Essential
Receiver			
Averaging	1		Essential
Reject	0		Essential
Beam			
Gain Offset	*Imported from LAW file*		Essential
Scan Offset	*Imported from LAW file*		Essential
Index Offset	*Imported from LAW file*		Essential
Angle	*Imported from LAW file*		Essential
Skew	*Imported from LAW file*		Essential
Beam Delay	*Imported from LAW file*		Essential
Advanced			
dB Ref	Off		Essential
Points Qty	640		Essential
Scale Factor	6		Essential
Sum Gain	*Imported from LAW file*		Essential
Scan			
Encoder			
Encoder	1 (Scan)	2 (Index)	Essential
Polarity	Normal	Inverse	Essential
Type	Quad		Essential
Resolution	35.38	58.00	Essential
Origin	0		Essential
Synchro			

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'C'

Source	Both Axes	Essential
Scan	Encoder 1	Essential
Index	Encoder 2	Not applicable
Scan Speed	25 for scan resolution of 1 mm	Not applicable
Area		
Scan Start	0 mm	Essential
Scan End	512	
Scan Resolution	1.0 mm	Essential
Index start	-34.0 mm	Essential
Index end	40.3 mm	Essential
Index resolution	14.9 mm	Essential
Start		
Start Mode	Reset All	Essential
Pause	Off	Non-Essential
Data		
Storage	Last	Essential
Display		
Selection		
Display	A-S-C	Essential
C-Scan 1	A%	Non-Essential
Group	Current	Non-Essential
Projection	On	Not applicable
Rulers		
UT Unit	Sound Path	Essential
% Ruler	Linear(%)	Essential
Grid	Off	Non-Essential
DAC / TCG	Off	Essential
Gate	On	Essential
Cursor	On	Essential
Zoom		Not applicable
Color		
Select	Amplitude	Essential
Start (%)	0.0	Essential
End (%)	100.0	Essential
Properties		Not applicable
Probe/Part		
Select		
Group	1	Not applicable
Group Link	Off	Not applicable
Select	Select Tx/Rx	Essential
Select Probe	Unknown	Not applicable
Select Wedge	Contact / Contact	Not applicable
Auto Detect	Off	Essential
Scan Offset	0	Essential

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'C'

Index Offset	0			Essential
Skew	0			Essential
Characterize				Not applicable
Parts				Not applicable
Wizard				Not applicable
PGM Probe				
Configuration				
Group	1			Not applicable
Enable	Off			Not applicable
Scan Type	Custom			Essential
Connection P	1			Not applicable
Connection R	1			Not applicable
Aperture				Not applicable
Beam				Not applicable
Laws				
Auto Program	Off			Essential
Wizard				Not applicable
Gate/Alarm				
Gate				
Gate Select	Gate A	B	I	Essential
Gate Start	10	0	0	Essential
Width	End of time base	0	0	Non-Essential
Threshold	25	0	0	Essential
Mode	Positive			Not applicable
Synchro	Pulse			Essential
Alarms				Not applicable
Output				Not applicable
Gate/Alarm (ctd.)				
DAC / TCG				Not applicable
Thickness				Not applicable
Calibration				
Phased Array				Not applicable
Axis				Not applicable
TCG				Not applicable
Code				Not applicable
User				
Gain				Not applicable
Start				Not applicable
Range				Not applicable
Display				Not applicable
Gate				Not applicable

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'C'

Focal Law Calculator Inputs

Menu item	Setting	Essential / Non-Essential / Not applicable
Probe (CS) 90°		
Name	1.5M16x2E32-7(EWUXE083A)	Essential
Probe Skew Angle	90°	Essential
Probe Frequency	1.5 MHz	Essential
Number of elements on primary axis	16	Essential
Primary axis pitch	2 mm	Essential
Secondary axis width	7 mm	Essential
Pitch and Catch	Checked	Essential
Probe separation		Not applicable
Squint angle	"0.0°"	Essential
Reverse primary axis	Unchecked	Essential
Specimen		
Name	Memphis CS LW	Non-Essential
Specimen Type	"Pipe OD"	Essential
Wave type	"Longitudinal" for TRL	Essential
Sound velocity	90°-5890 m/s	Essential
Thickness	40 mm	Essential
Radius	77 mm	Essential
Wedge		
Name	ADUXE039A	Essential
Footprint	"Curvature along secondary axis"	Essential
Wedge angle	22.3	Essential
Roof angle	6.0	Essential
Sound velocity	"2330 m/s"	Essential
Height at the middle of the first element	"8.17 mm" for ADUXE039A	Essential
Primary axis offset of the middle of the first element	"8.43 mm" for ADUXE039A	Essential
Secondary axis offset of the middle of the first element	"7.74 mm" for ADUXE039A	Essential
Primary axis position of wedge reference	"-50.00 mm"	Essential
Secondary axis position of wedge reference	"-15.00 mm"	Essential
Wedge length	"50.00 mm"	Essential

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'C'

Distance between contact points (wedge width)	"30.00 mm"	Essential
Scan		
Type	"Linear"	Essential
Beam angles selection		
Primary steering angle		Not applicable
Secondary steering angle		Not applicable
Refracted angle	90°-30°,45°,60°,70°	Essential
Beam skew angle		Not applicable
Focal points selection		
Focusing type	Auto	Essential
Focal plane position		Not applicable
Emission focus position		Not applicable
Reception focus position		Not applicable
Elements selection		
Improved resolution	Checked	Essential
Pulser Start	" 1 "	Essential
Pulser Stop	9	Essential
Pulser Resolution	" 1 "	Essential
Receiver Start	" 1 "	Essential
Primary axis aperture	8	Essential
Pulser connection	" 1 "	Essential
Receiver connection	" 65 "	Essential
Hardware selection		
Type	"OmniScan 32/128"	Essential

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'C'

Menu item	Setting	Essential / Non-Essential / Not applicable
File		
File		
Destination	Storage Card	Non-Essential
Save Mode	A-Scan	Essential
File Name	***PSLC_155MM_CIRCU TRL 270_AUTO_CS_ADUXE039A***	Essential
Report		
Template	Complete	Non-Essential
File Name	***PSLC_155MM_CIRCU TRL 270_AUTO_CS_ADUXE039A***	Essential
Paper Size	Letter	Non-Essential
Format		
User field	Off	Non-Essential
Probe	Off	Non-Essential
Setup	On	Essential
Note	Off	Non-Essential
View	Current Layout	Non-Essential
User field		Not applicable
Notes		Not applicable
Reading		
Result		
Selector	List 1	Essential
Field 1	A% (Peak Amplitude in Gate)	Essential
Field 2	A^ (Half Path position in Gate)	Essential
Field 3	B%	Not applicable
Field 4	B^	Not applicable
Cursors		Not applicable
Table		Not applicable
Export		Not applicable
Utilities		
Pref.		
Units	Millimeters	Essential
Bright (%)	25	Non-Essential
Scheme	Indoor	Non-Essential
System		
Clock Set	*Set to correct time*	Essential
Date Set	*Set to correct date*	Essential
Time Zone	*Set to correct time zone*	Non-Essential
Daylight saving	On	Non-Essential
Select Key	F2	Non-Essential
Assign Key	Gain	Non-Essential

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'C'

Service			Not applicable
Options			Not applicable
Network	*Only for network saving*		Non-Essential
UT			
General			
Gain	33.7		Essential
Start	0		Essential
Range	110.78		Essential
Wedge delay	2.30		Essential
Velocity	5770 m/s		Essential
Pulser			
Pulser	1		Not applicable
Tx/Rx mode	PE		Essential
Freq	1.5		Essential
Voltage	High		Essential
PW	*Imported from LAW file (333 ns)*		Essential
PRF	25		Essential
Receiver			
Receiver	1		Not applicable
Filter	None		Essential
Rectifier	FW		Essential
Video Filter	Off		Essential
Receiver			
Averaging	1		Essential
Reject	0		Essential
Beam			
Gain Offset	*Imported from LAW file*		Essential
Scan Offset	*Imported from LAW file*		Essential
Index Offset	*Imported from LAW file*		Essential
Angle	*Imported from LAW file*		Essential
Skew	*Imported from LAW file*		Essential
Beam Delay	*Imported from LAW file*		Essential
Advanced			
dB Ref	Off		Essential
Points Qty	640		Essential
Scale Factor	6		Essential
Sum Gain	*Imported from LAW file*		Essential
Scan			
Encoder			
Encoder	1 (Scan)	2 (Index)	Essential
Polarity	Normal	Inverse	Essential
Type	Quad		Essential
Resolution	35.36	58.00	Essential
Origin	0		Essential

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'C'

Synchro		
Source	Both Axes	Essential
Scan	Encoder 1	Essential
Index	Encoder 2	Not applicable
Scan Speed	25 for scan resolution of 1 mm	Not applicable
Area		
Scan Start	0 mm	Essential
Scan End	512	
Scan Resolution	1.0 mm	Essential
Index start	-43.8 mm	Essential
Index end	36.0 mm	Essential
Index resolution	16 mm	Essential
Start		
Start Mode	Reset All	Essential
Pause	Off	Non-Essential
Data		
Storage	Last	Essential
Display		
Selection		
Display	A-S-C	Essential
C-Scan 1	A%	Non-Essential
Group	Current	Non-Essential
Projection	On	Not applicable
Rulers		
UT Unit	Sound Path	Essential
% Ruler	Linear(%)	Essential
Grid	Off	Non-Essential
DAC / TCG	Off	Essential
Gate	On	Essential
Cursor	On	Essential
Zoom		Not applicable
Color		
Select	Amplitude	Essential
Start (%)	0.0	Essential
End (%)	100.0	Essential
Properties		Not applicable
Probe/Part		
Select		
Group	1	Not applicable
Group Link	Off	Not applicable
Select	Select Tx/Rx	Essential
Select Probe	Unknown	Not applicable
Select Wedge	Contact / Contact	Not applicable
Auto Detect	Off	Essential

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'C'

Position				
Scan Offset	0			Essential
Index Offset	0			Essential
Skew	0			Essential
Characterize				Not applicable
Parts				Not applicable
Wizard				Not applicable
PGM Probe				
Configuration				
Group	1			Not applicable
Enable	Off			Not applicable
Scan Type	Custom			Essential
Connection P	1			Not applicable
Connection R	1			Not applicable
Aperture				Not applicable
Beam				Not applicable
Laws				
Auto Program	Off			Essential
Wizard				Not applicable
Gate/Alarm				
Gate				
Gate Select	Gate A	B	I	Essential
Gate Start	10	0	0	Essential
Width	End of time base	0	0	Non-Essential
Threshold	25	0	0	Essential
Mode	Positive			Not applicable
Synchro	Pulse			Essential
Alarms				Not applicable
Output				Not applicable
Gate/Alarm (ctd.)				
DAC / TCG				Not applicable
Thickness				Not applicable
Calibration				
Phased Array				Not applicable
Axis				Not applicable
TCG				Not applicable
Code				Not applicable
User				
Gain				Not applicable
Start				Not applicable
Range				Not applicable
Display				Not applicable
Gate				Not applicable

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'C'

Focal Law Calculator Inputs

Menu item	Setting	Essential / Non-Essential / Not applicable
Probe (CS) 270°		
Name	1.5M16x2E32-7(EWUXE083A)	Essential
Probe Skew Angle	270°	Essential
Probe Frequency	1.5 MHz	Essential
Number of elements on primary axis	16	Essential
Primary axis pitch	2 mm	Essential
Secondary axis width	7 mm	Essential
Pitch and Catch	Checked	Essential
Probe separation		Not applicable
Squint angle	"0.0°"	Essential
Reverse primary axis	Unchecked	Essential
Specimen		
Name	Memphis SS LW	Non-Essential
Specimen Type	"Pipe OD"	Essential
Wave type	"Longitudinal" for TRL	Essential
Sound velocity	270°-5770 m/s	Essential
Thickness	40 mm	Essential
Radius	77 mm	Essential
Wedge		
Name	ADUXE039A	Essential
Footprint	"Curvature along secondary axis"	Essential
Wedge angle	22.3	Essential
Roof angle	6.0	Essential
Sound velocity	"2330 m/s"	Essential
Height at the middle of the first element	"8.17 mm" for ADUXE039A	Essential
Primary axis offset of the middle of the first element	"8.43 mm" for ADUXE039A	Essential
Secondary axis offset of the middle of the first element	"7.74 mm" for ADUXE039A	Essential
Primary axis position of wedge reference	"-50.00 mm"	Essential
Secondary axis position of wedge reference	"-15.00 mm"	Essential
Wedge length	"50.00 mm"	Essential

OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
WELD # PSL SAFETY 'C'

Distance between contact points (wedge width)	"30.00 mm"	Essential
Scan		
Type	"Linear"	Essential
Beam angles selection		
Primary steering angle		Not applicable
Secondary steering angle		Not applicable
Refracted angle	270°-30°,45°,60°,70°	Essential
Beam skew angle		Not applicable
Focal points selection		
Focusing type	Auto	Essential
Focal plane position		Not applicable
Emission focus position		Not applicable
Reception focus position		Not applicable
Elements selection		
Improved resolution	Checked	Essential
Pulser Start	" 1 "	Essential
Pulser Stop	9	Essential
Pulser Resolution	" 1 "	Essential
Receiver Start	" 1 "	Essential
Primary axis aperture	8	Essential
Pulser connection	" 1 "	Essential
Receiver connection	" 65 "	Essential
Hardware selection		
Type	"OmniScan 32/128"	Essential

OmniScan Report

Report Date	Report Version	Setup File name	Date of Inspection	Inspection Version	Save Mode
2008 / 03 / 10	1.4R3	PSLC_155MM_CIRCD TRL 90_AUTO_CS_ADUXE039A2.opd	2008 / 03 / 10	1.4R3	A Scan
OmniScan Type	**OmniScan Serial #**	**Module Type**	**Module Serial #**	**Calibration Due**	**Data File name**
OmniScan MX	OMNI-Z-1012	OMNI-M-PA32128PR	OMNI-Z-6012	2008 / 11 / 21	PSLC_155MM_CIRCD TRL 90_AUTO_CS_ADUXE039A2

Group 1

Setup

A:30.0 Sk:090 L:001

Beam Delay	Start (Half Path)	Range (Half Path)	PRF	Type	Averaging Factor
12.10 us	-0.02 mm	113.09 mm	25	PA	1
Scale Type	**Scale Factor**	**Video Filter**	**Pretrig**	**Rectification**	**Band Pass Filter**
Compression	6	Off	0.00 µs	FW	None (0.52 - 19 MHz)
Voltage	**Gain**	**Mode**	**Wave Type**	**Sound Velocity**	**Pulse Width**
High	33.70 dB	PC (Pitch And Catch)	User Defined	5890.0 m/s	332.50 ns
Scan Offset	**Index Offset**	**Skew**			
0.00 mm	0.00 mm	N/A			

Gate	Start	Width	Threshold	Synchro
I	0.01 mm	1.00 mm	0.00 %	Pulse
A	10.20 mm	122.48 mm	25.00 %	Pulse
B	0.01 mm	1.00 mm	0.00 %	Pulse

Law

Law File name	Scan Type
DM_155_CIRCD TRL 90_AUTO_CS_ADUXE039A.law	Custom

Part

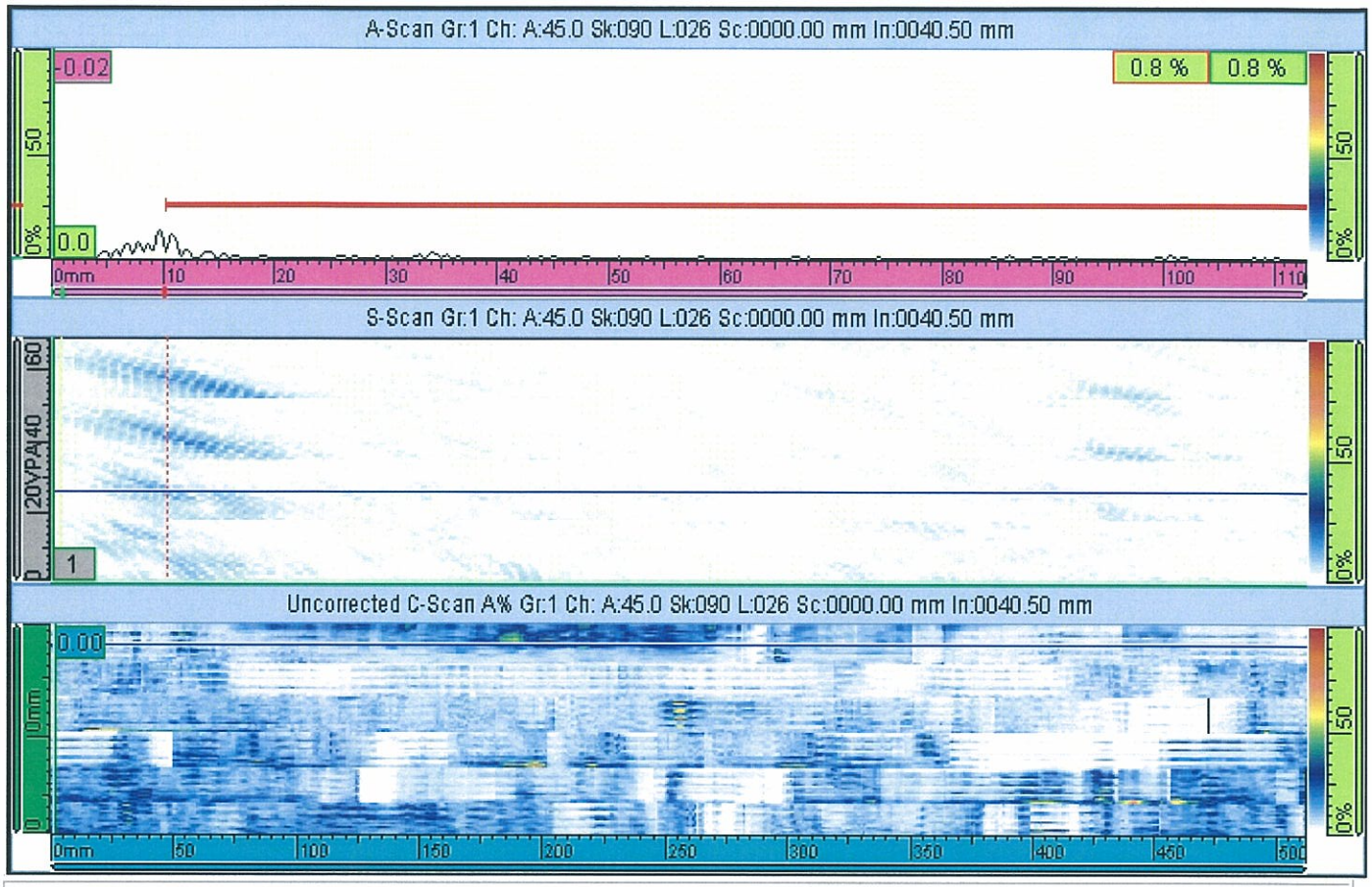
Material	Geometry	Thickness
STEEL MILD	Plate	50.00 mm

Scan Area

Scan Start	Scan Length	Scan Resolution	Index Start	Index Length	Index Resolution
0.00 mm	512.00 mm	1.00 mm	-34.00 mm	74.50 mm	14.90 mm
Synchro	**Max Scan Speed**				
Both Axis	25.00 mm/s				

Axis	Encoder	Encoder Type	Encoder Resolution	Polarity
Scan	1	Quadrature	35.36 step/mm	Normal
Index	2	Quadrature	58.00 step/mm	Inverse

A%	A^	B%	B^	None	None	None	None
12.1 %	--- mm	0.8 %	0.04 mm				



Technician Name	Todd P. Blechinger
Technician Signature	
Contractor	LMT INC.
Date	3/10/08

OmniScan Report

Report Date	Report Version	Setup File name	Date of Inspection	Inspection Version	Save Mode
2008 / 03 / 10	1.4R3	PSLC_155MM_CIRCU TRL 270_AUTO_CS_ADUXE039A2.opd	2008 / 03 / 10	1.4R3	A Scan
OmniScan Type	**OmniScan Serial #**	**Module Type**	**Module Serial #**	**Calibration Due**	**Data File name**
OmniScan MX	OMNI-Z-1012	OMNI-M-PA32128PR	OMNI-Z-6012	2008 / 11 / 21	PSLC_155MM_CIRCU TRL 270_AUTO_CS_ADUXE039A2

Group 1

Setup

A:30.0 Sk:270 L:001

Beam Delay	Start (Half Path)	Range (Half Path)	PRF	Type	Averaging Factor
12.08 us	-0.02 mm	110.78 mm	25	PA	1
Scale Type	**Scale Factor**	**Video Filter**	**Pretrig**	**Rectification**	**Band Pass Filter**
Compression	6	Off	0.00 µs	FW	None (0.52 - 19 MHz)
Voltage	**Gain**	**Mode**	**Wave Type**	**Sound Velocity**	**Pulse Width**
High	33.70 dB	PC (Pitch And Catch)	User Defined	5770.0 m/s	332.50 ns
Scan Offset	**Index Offset**	**Skew**			
0.00 mm	0.00 mm	N/A			

Gate	Start	Width	Threshold	Synchro
I	0.02 mm	0.98 mm	0.00 %	Pulse
A	10.00 mm	119.99 mm	25.00 %	Pulse
B	0.02 mm	0.98 mm	0.00 %	Pulse

Law

Law File name	Scan Type
DM_155_CIRCU TRL 270_AUTO_CS_ADUXE039A.law	Custom

Part

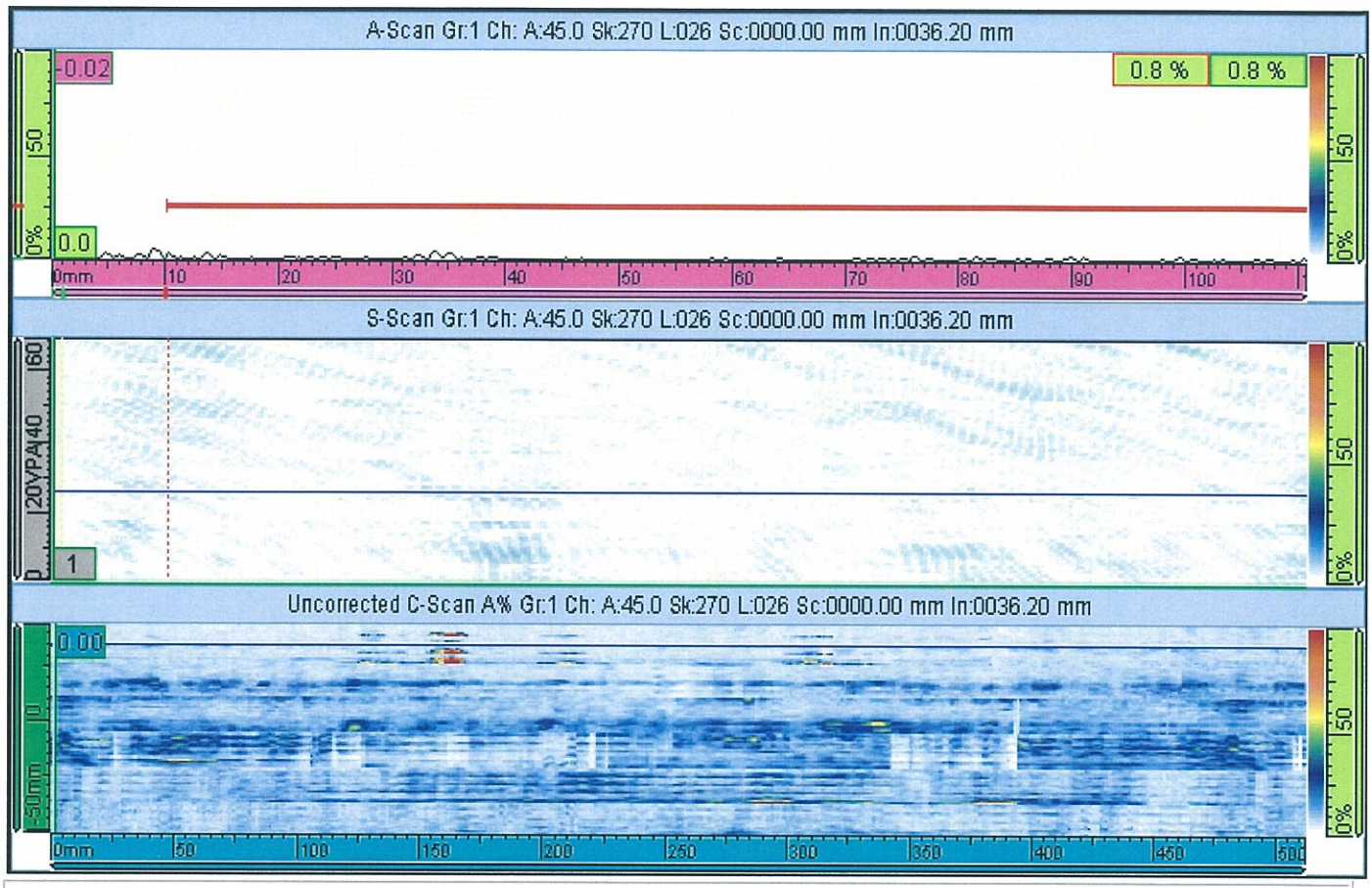
Material	Geometry	Thickness
STEEL MILD	Plate	50.00 mm

Scan Area

Scan Start	Scan Length	Scan Resolution	Index Start	Index Length	Index Resolution
0.00 mm	512.00 mm	1.00 mm	-43.80 mm	80.00 mm	16.00 mm
Synchro	**Max Scan Speed**				
Both Axis	25.00 mm/s				

Axis	Encoder	Encoder Type	Encoder Resolution	Polarity
Scan	1	Quadrature	35.36 step/mm	Normal
Index	2	Quadrature	58.00 step/mm	Inverse

A%	A^	B%	B^	None	None	None	None
6.7 %	--- mm	1.2 %	0.65 mm				



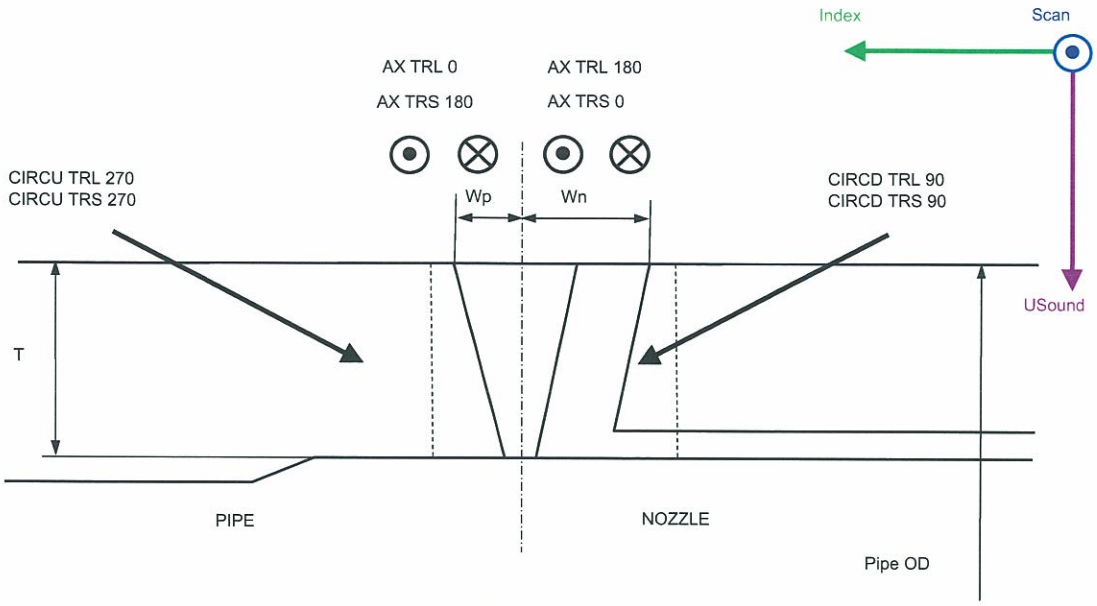
Technician Name Todd P. Blechinger

Technician Signature

Contractor LMT INC.

Date 3/10/08

SCAN PLAN



Procedure :	ZETEC_OmniScanPA_03_revD	**Pipe Thickness T :**	40.0 mm
Plant / Unit :	PSL/1	**Pipe OD :**	155.0 mm
Weld Id. :	PSL Safety Nozzle 'A', 'B', & 'C'	**Weld Extent Pipe Side Wp :**	20.0 mm
Dual Side Access :	yes	**Weld Extent Nozzle Side Wn :**	23.5 mm
Complete Pipe:	yes	**Access Limitation Pipe Side Lp :**	86.0 mm
		Access Limitation Nozzle Side Ln	84.0 mm
		Weld Length:	486.0 mm

SCANNING SEQUENCES CIRCUMFERENTIAL FLAWS

Focal law group	Probe Type	MinTB (mm)	MaxTB (mm)	# Data Points	Scan Start (mm)	Scan End (mm)	Scan Resol. (mm)	Index Start (mm)	Index End (mm)	Index Resol. (mm)	# Lines	Done ? (OK / NA)
CIRCD TRL 90	CS	100.0	125.0	640	0.0	511.9	1.0	-34.0	40.3	14.9	6	ok
CIRCU TRL 270	CS	100.0	125.0	640	0.0	511.9	1.0	-43.8	36.0	16.0	6	ok
CIRCD TRS 90	CS	100.0	125.0	800	0.0	511.9	1.0	-34.0	-16.3	18.5	1	N/A
CIRCU TRS 270	CS	100.0	125.0	800	0.0	511.9	1.0	12.8	36.0	11.6	3	N/A

SCANNING SEQUENCES AXIAL FLAWS

Focal law group	Probe Type	MinTB (mm)	MaxTB (mm)	# Data Points	Scan Start (mm)	Scan End (mm)	Scan Resol. (mm)	Index Start (mm)	Index End (mm)	Index Resol. (mm)	# Lines	
AX TRL 0	AS	75.2	94.0	640	0.0	511.9	1.0	-29.9	26.4	9.4	7	N/A
AX TRL 180	AS	75.2	94.0	640	0.0	511.9	1.0	-29.9	26.4	9.4	7	N/A
AX TRS 0	AS	75.2	94.0	1120	0.0	511.9	1.0	-29.9	26.4	9.4	7	N/A
AX TRS 180	AS	75.2	94.0	1120	0.0	511.9	1.0	-29.9	26.4	9.4	7	N/A
AX TRL 0												NA
AX TRL 180												NA

Data Analyst : Jeff Devers
Date : 3/10/08

LMT Review Todd Blechinger
Date : 3/14/08

EPRI Review
Date : 3/17/08

Report # EPRI-PA-03

ANII Review N/A
Date :

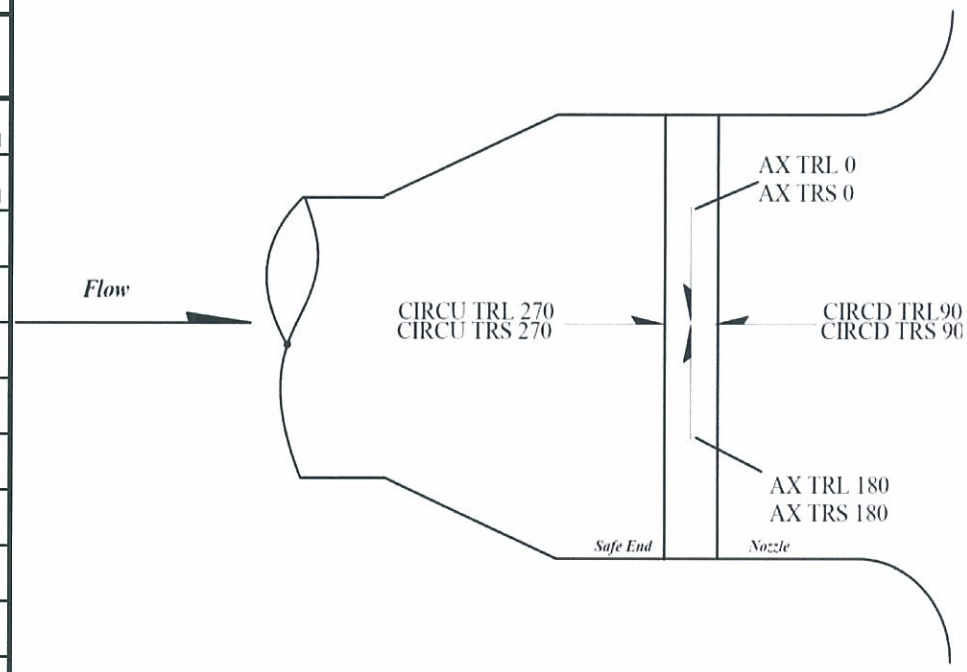
Report # EPRI-PA-03

Ultrasonic Phased Array Examination Report

Plant / Unit	PSL/1	OmniScan Software Version	1.4R3	Acquisition Tech. Todd Blechinger	Level III
Comp / System	Safety Nozzle 'C'	OmniScanConverter Software Version	1.7R5	Acquisition Tech. N/A	Level
Component Temp.	58°	UltraVision Software Revision	1.1Q5		
Procedure No.	Zetec_ OmniScanPA_03				
Revision#	rev.D				

Focal Law Group Used	Data File Identification	Results
CIRCD TRL 90	PSLC_155MM_CIRCD TRL 90_AUTO_CS_ADUXE039A	RI-See Attached
CIRCU TRL 270	PSLC_155MM_CIRCU TRL 270_AUTO_CS_ADUXE039A	RI-See Attached

Technique Referencing System



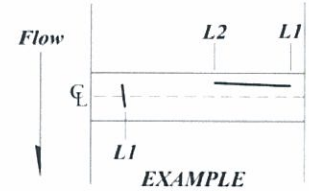
Comments:

See attached Phased Array Indication Data Tabulation Sheet for indication information.

Data Analyst	Jeff Devers	Level III	Date 3/10/2008	LMT Review	Todd Blechinger	Level III	Date 3/14/2008
EPRI REVIEW / DATE	3/17/08			ANII REVIEW / DATE			

Phased Array Indication Tabulation Sheet

Report # EPRI-PA-03



PLANT/ UNIT	PSL /1	REFERENCE LOCATION	0 Stamp / Weld Centerline
COMP / SYSTEM	Safety Nozzle 'C'	COMP THICKNESS	40mm
PROCEDURE NO.	Zetec_ OmniScanPA_03	WELD CROWN WIDTH	43.5mm
REV / CHANGE NO.	rev.D	WELD LENGTH	486mm

DATA ANALYST / LEVEI J.L. Devers / III JL

LMT REVIEW / LEVEL T.P. Blechinger / III

IND. #	Data File	Merged Data Group Used	Length Sizing Information			Thru Wall Sizing Information			Indication Position		Evaluation / Comments	Printout Page #
			Start (L1)	Stop (L2)	Length	T.W. Depth	Remain. Ligament	T.W. %	Upstream	Dnstream		
1	PSLC_155MM_CIRCU TRL 270_AUTO_CS_ ADUXE039A	CIRCU TRL 270	49mm	67mm	18mm	17mm- See Note 1	8mm	N/A		10mm	Embedded Fabrication Flaw	24of31
2	PSLC_155MM_CIRCU TRL 270_AUTO_CS_ ADUXE039A	CIRCU TRL 270	192mm	205mm	13mm	6.5mm- See Note 1	15.5mm	N/A		10mm	Embedded Fabrication Flaw	25of31
3	PSLC_155MM_CIRCU TRL 270_AUTO_CS_ ADUXE039A	CIRCU TRL 270	249mm	264mm	15mm	9.5mm- See Note 1	2.5mm	N/A		6mm	Embedded Fabrication Flaw	26of31
3	PSLC_155MM_CIRCD TRL 90_AUTO_CS_ ADUXE039A	CIRCD TRL 90	246mm	265mm	19mm	9.5mm- See Note 1	2mm	N/A		2mm	Embedded Fabrication Flaw	30of31
4	PSLC_155MM_CIRCU TRL 270_AUTO_CS_ ADUXE039A	CIRCU TRL 270	330mm	342mm	12mm	7.5mm- See Note 1	9mm	N/A		2mm	Embedded Fabrication Flaw	27of31

Comments: Note 1- Flaw sizing was conservatively measured using full dB drop method.

Data Analyst J.L. Devers JL Level III Date 3/10/2008

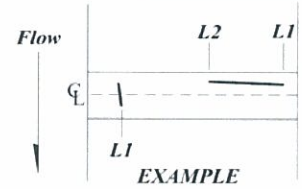
Further Evaluation Required? ☐ Yes ☒ No

EPRI REVIEW / DATE 3/17/08

ANII REVIEW / DATE

Phased Array Indication Tabulation Sheet

Report # EPRI-PA-03



PLANT/ UNIT	PSL /1	REFERENCE LOCATION	0 Stamp / Weld Centerline
COMP / SYSTEM	Safety Nozzle 'C'	COMP THICKNESS	40mm
PROCEDURE NO.	Zetec_ OmniScanPA_03	WELD CROWN WIDTH	43.5mm
REV / CHANGE NO.	rev.D	WELD LENGTH	486mm

DATA ANALYST / LEVEL J.L. Devers / III JL

LMT REVIEW / LEVEL T.P. Blechinger / III

IND. #	Data File	Merged Data Group Used	Length Sizing Information			Thru Wall Sizing Information			Indication Position		Evaluation / Comments	Printout Page #
			Start (L1)	Stop (L2)	Length	T.W. Depth	Remain. Ligament	T.W. %	Upstream	Dnstream		
5	PSLC_155MM_CIRCU TRL 270_AUTO_CS_ ADUXE039A	CIRCU TRL 270	375mm	391mm	16mm	8mm- See Note 1	12mm	N/A		11mm	Embedded Fabrication Flaw	28of31
6	PSLC_155MM_CIRCU TRL 270_AUTO_CS_ ADUXE039A	CIRCU TRL 270	414mm	455mm	41mm	11.5mm- See Note 1	5.5mm	N/A		6mm	Embedded Fabrication Flaw	29of31
7	PSLC_155MM_CIRCD TRL 90_AUTO_CS_ ADUXE039A	CIRCD TRL 90	354mm	360mm	6mm	9.5mm- See Note 1	2mm	N/A		12mm	Embedded Fabrication Flaw	31of31

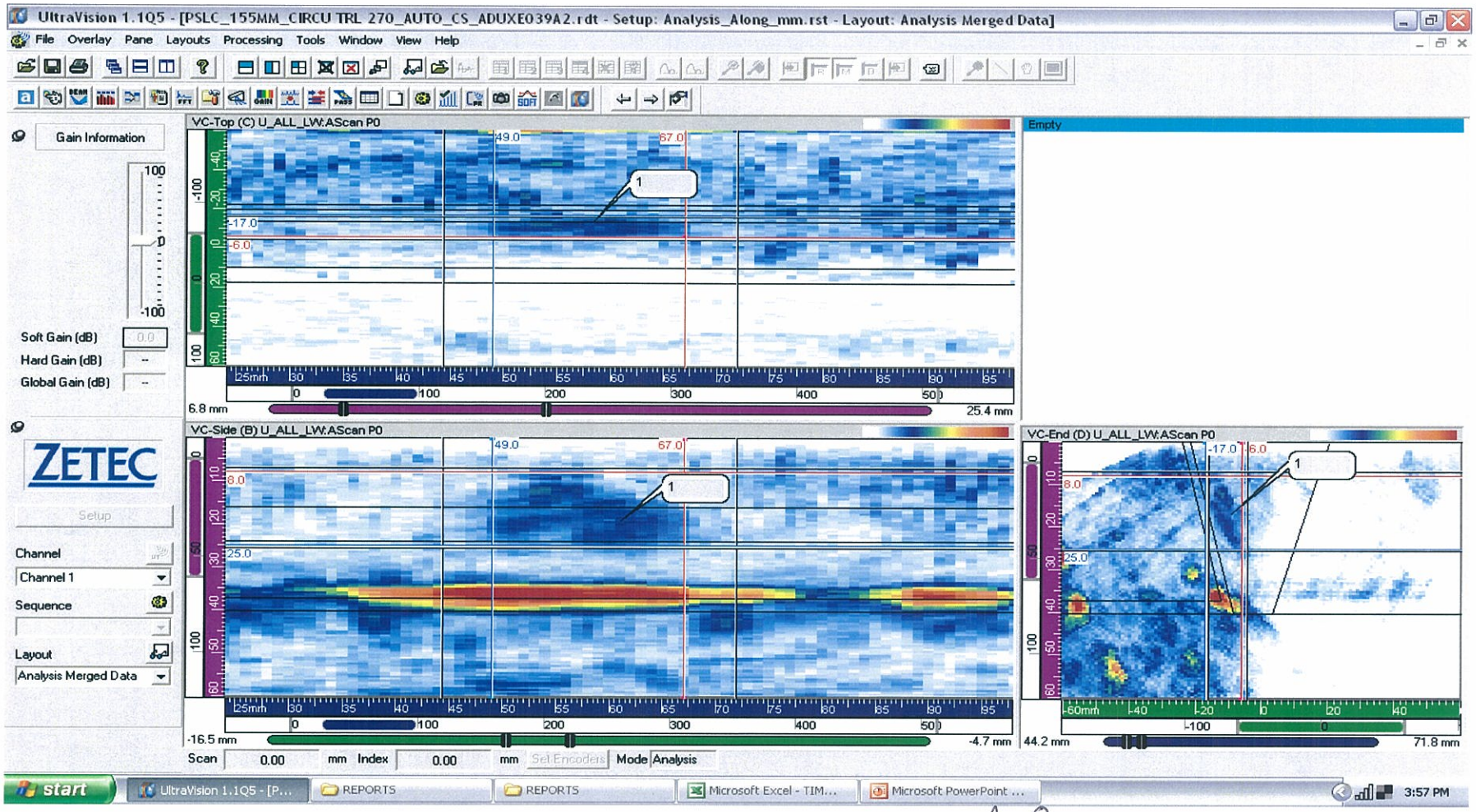
Comments: Note 1- Flaw sizing was conservatively measured using full dB drop method.

Data Analyst J.L. Devers Level III Date 3/10/2008

Further Evaluation Required? [ ] Yes [X] No

EPRI REVIEW / DATE 3/17/08

ANII REVIEW / DATE



Data Analyst _____ Level III

J. L. Devers

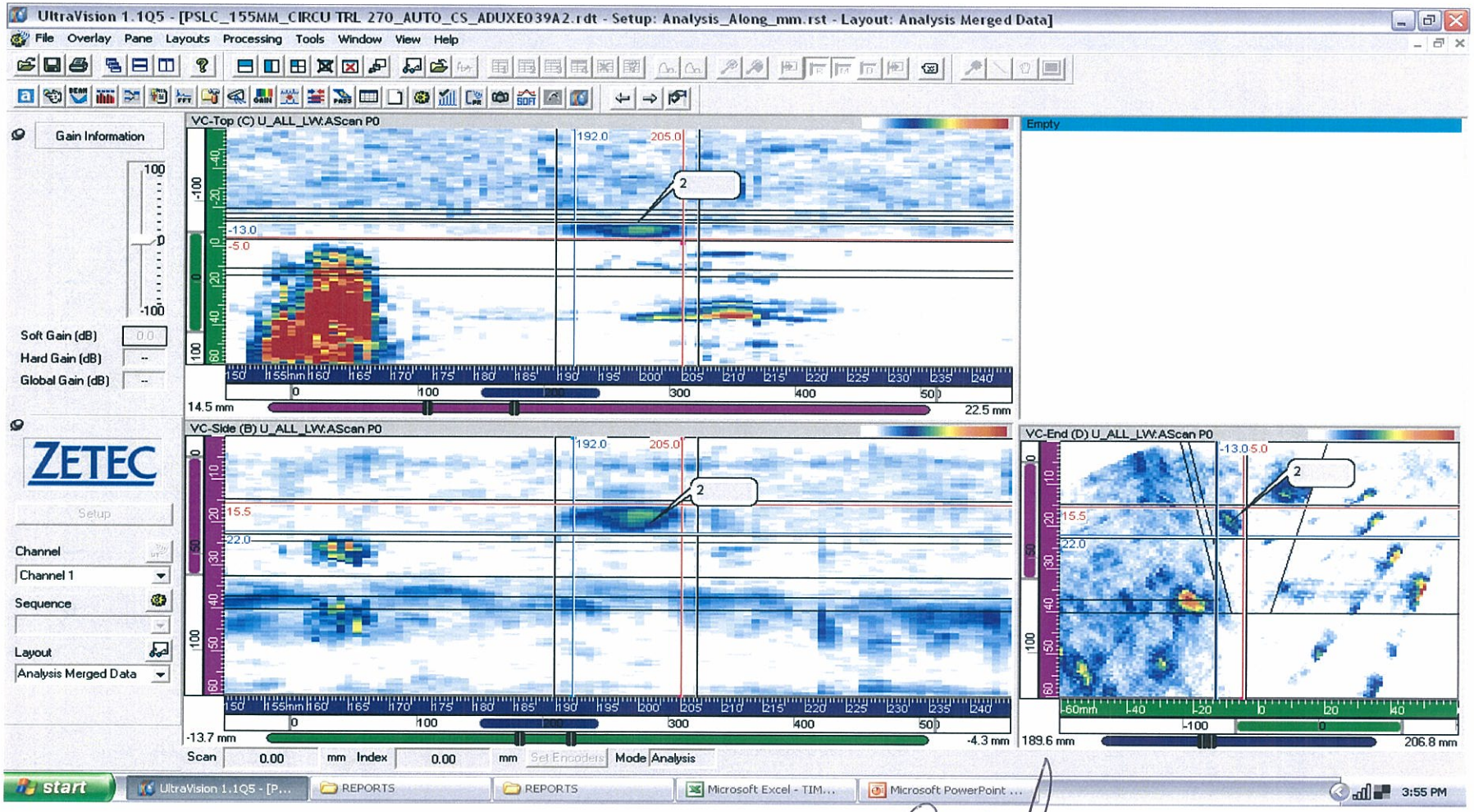
LMT Review _____ Level III

T.P. Blechinger

EPRI Review _____

ANII Review N/A

Report# EPRI-PA-03

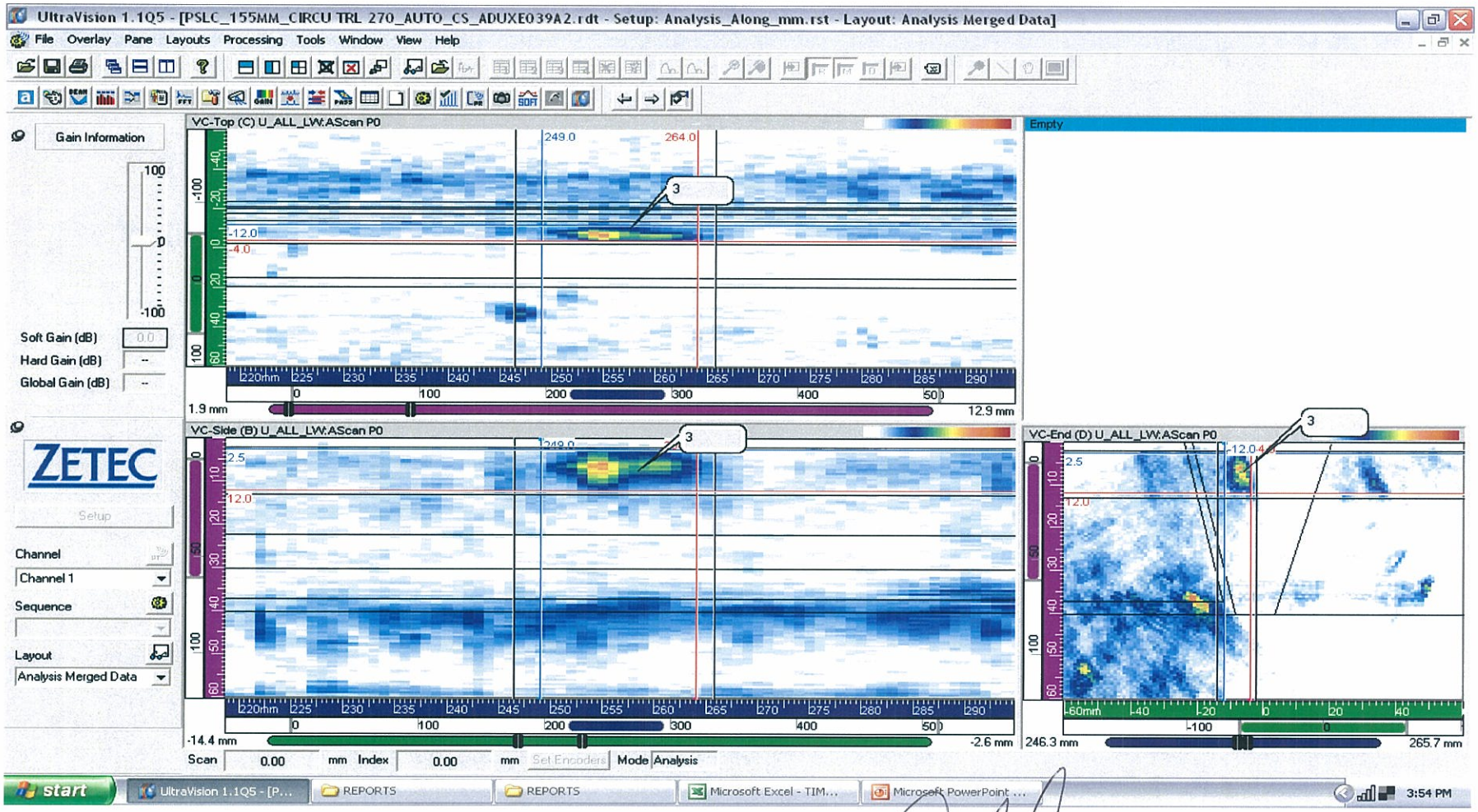


Data Analyst JL Level III **EPRI Review**

J. L. Devers

LMT Review Level III **ANII Review** N/A **Report#** EPRI-PA-03

T.P. Blechinger



Data Analyst _____ **Level** III

J. L. Devers

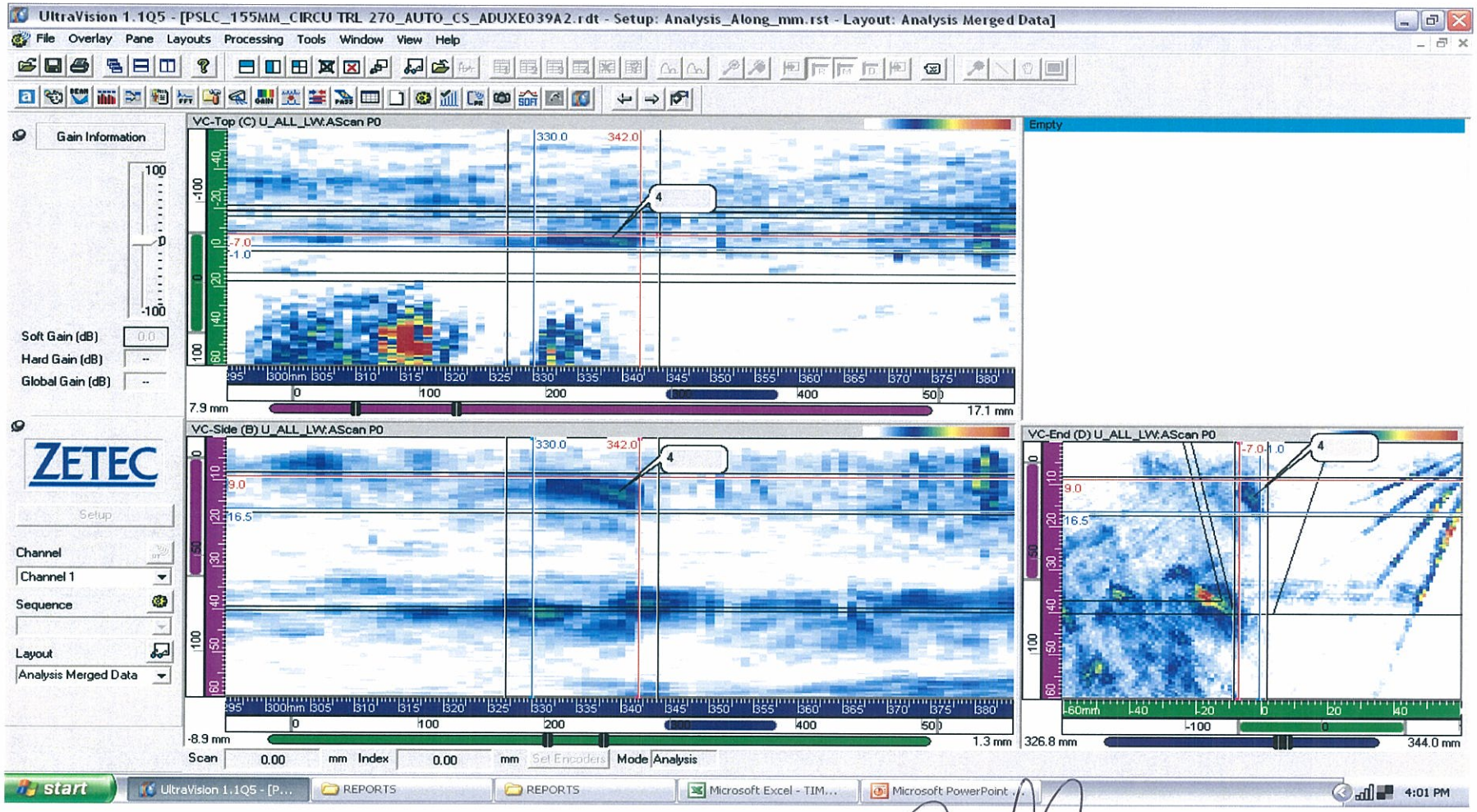
LMT Review _____ **Level** III

T.P. Blechinger

EPRI Review _____

ANII Review N/A

Report# EPRI-PA-03

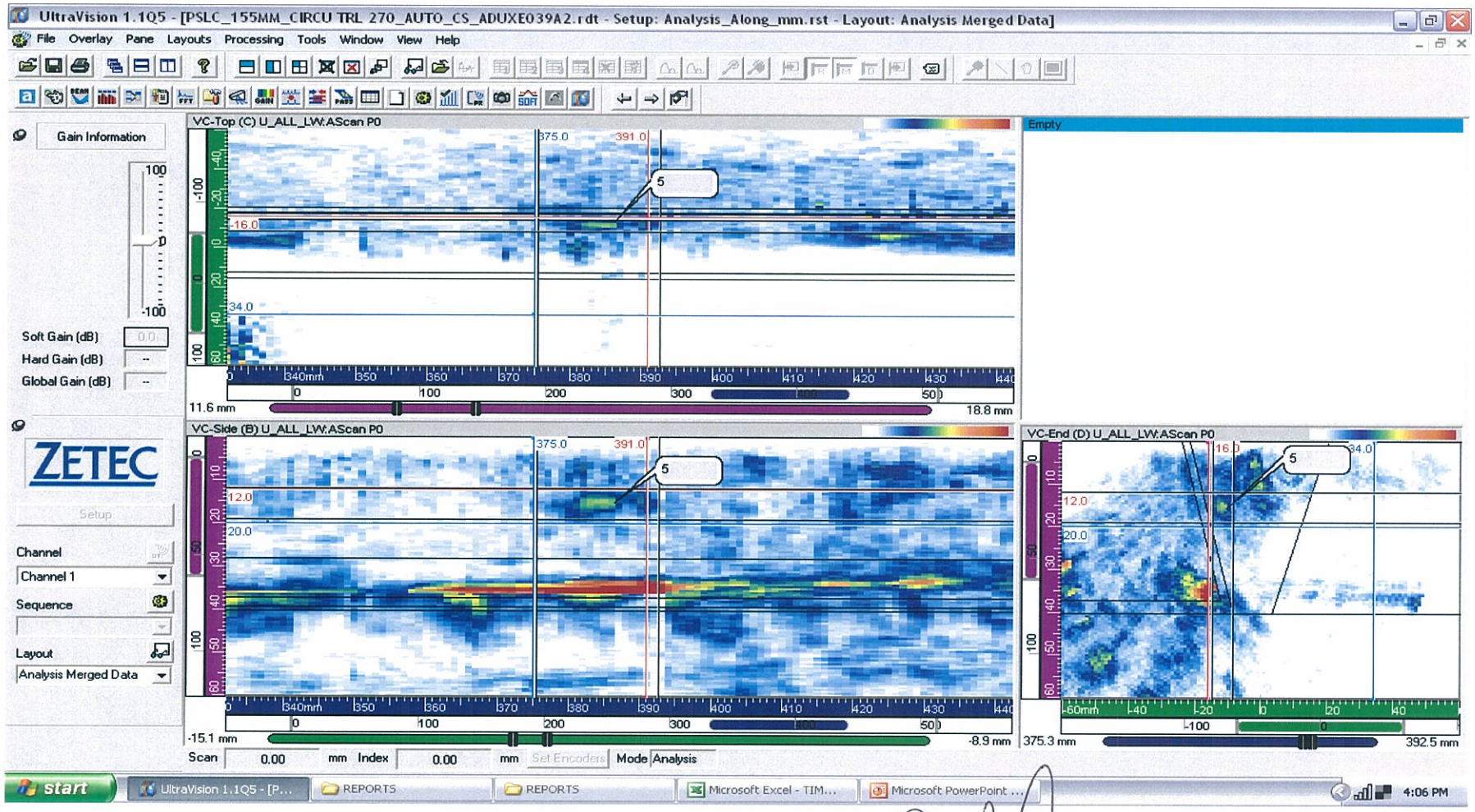


Data Analyst JD **Level** III **EPRI Review**

J. L. Devers

LMT Review **Level** III **ANII Review** N/A **Report#** EPRI-PA-03

T.P. Blechinger



Data Analyst _____ **Level** III

J. L. Devers

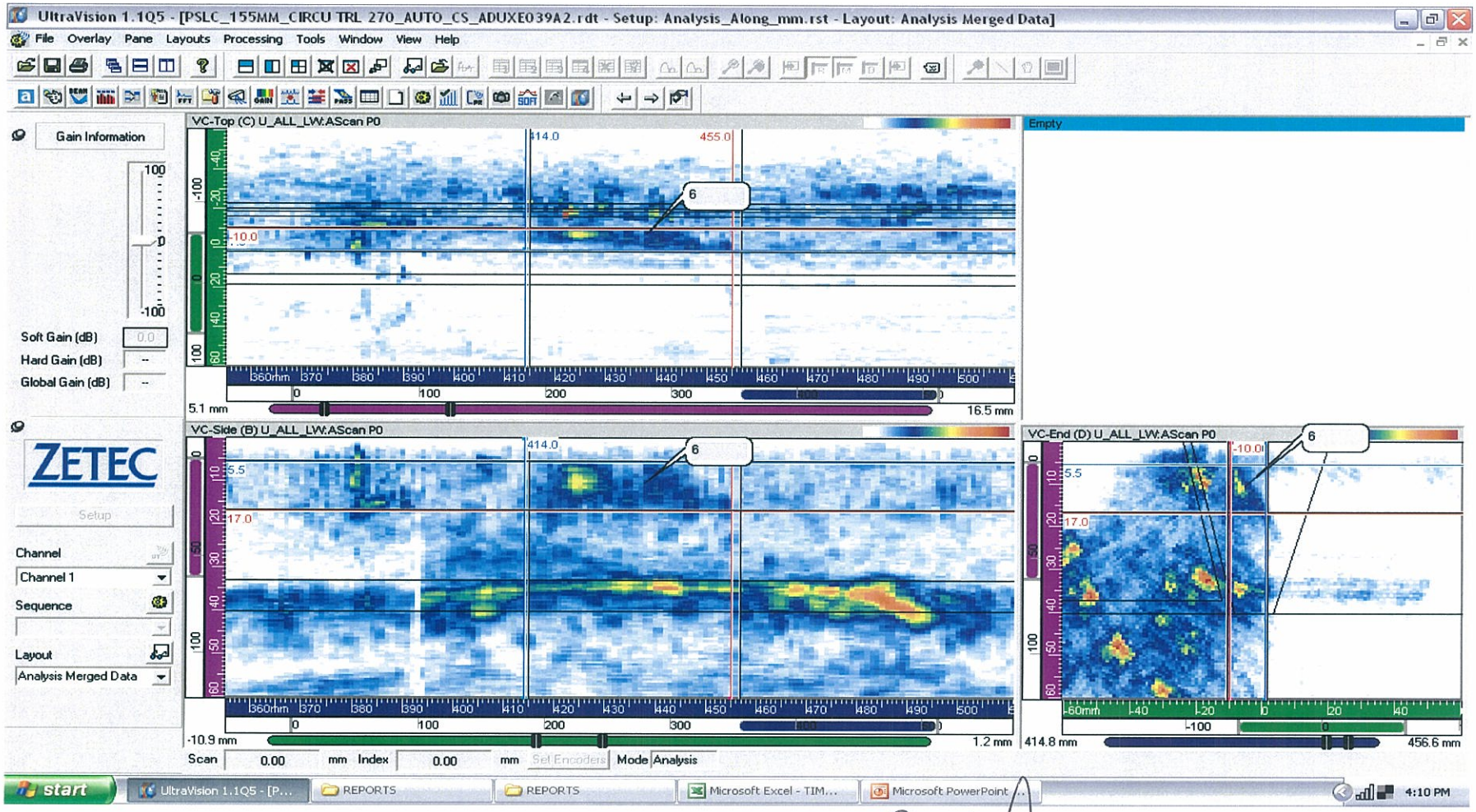
EPRI Review _____

LMT Review _____ **Level** III

T.P. Blechinger

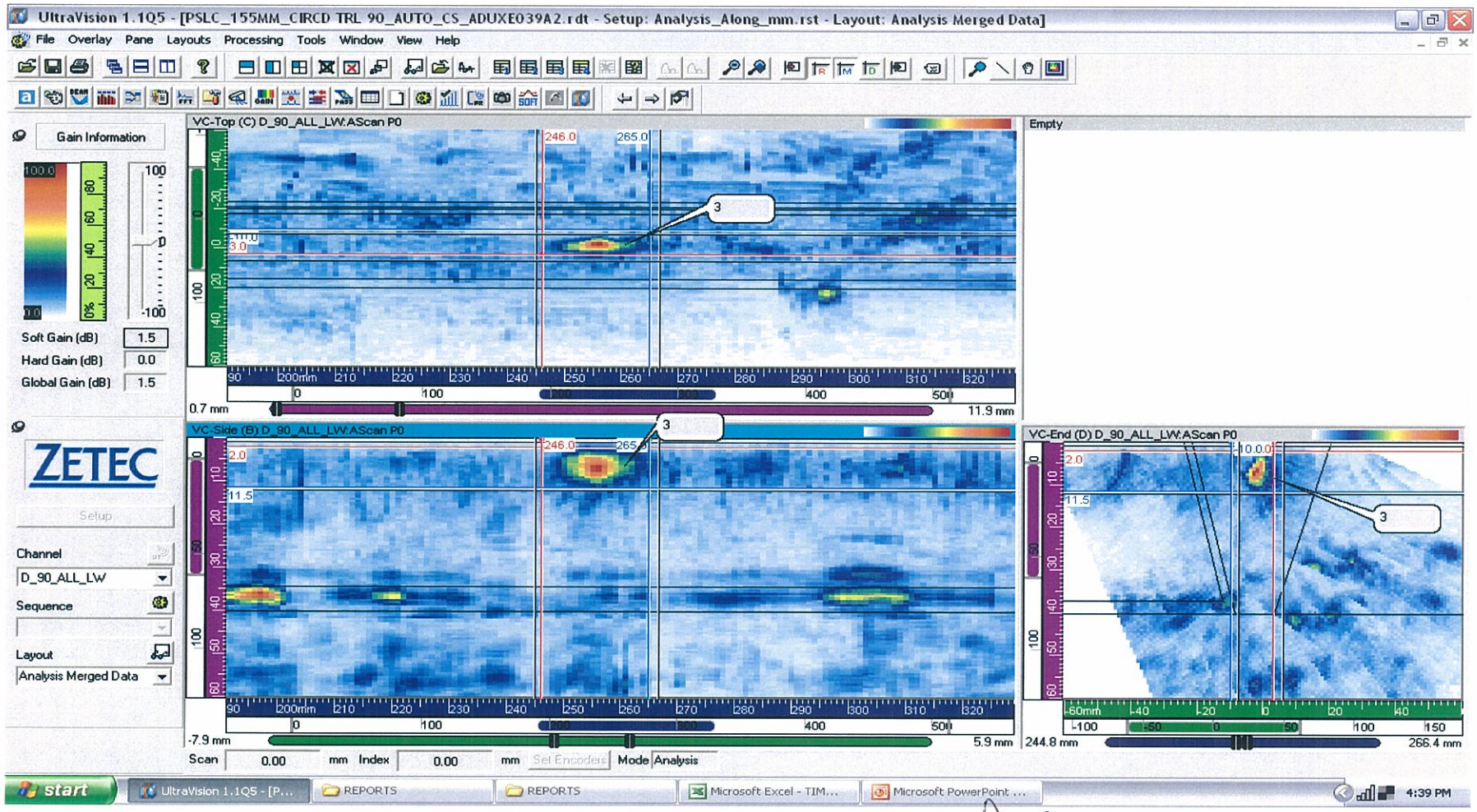
ANII Review N/A

Report# EPRI-PA-03



Data Analyst JD J. L. Devers **Level** III **EPRI Review**

LMT Review T.P. Blechinger **Level** III **ANII Review** N/A **Report#** EPRI-PA-03



Data Analyst _____ Level III

J. L. Devers

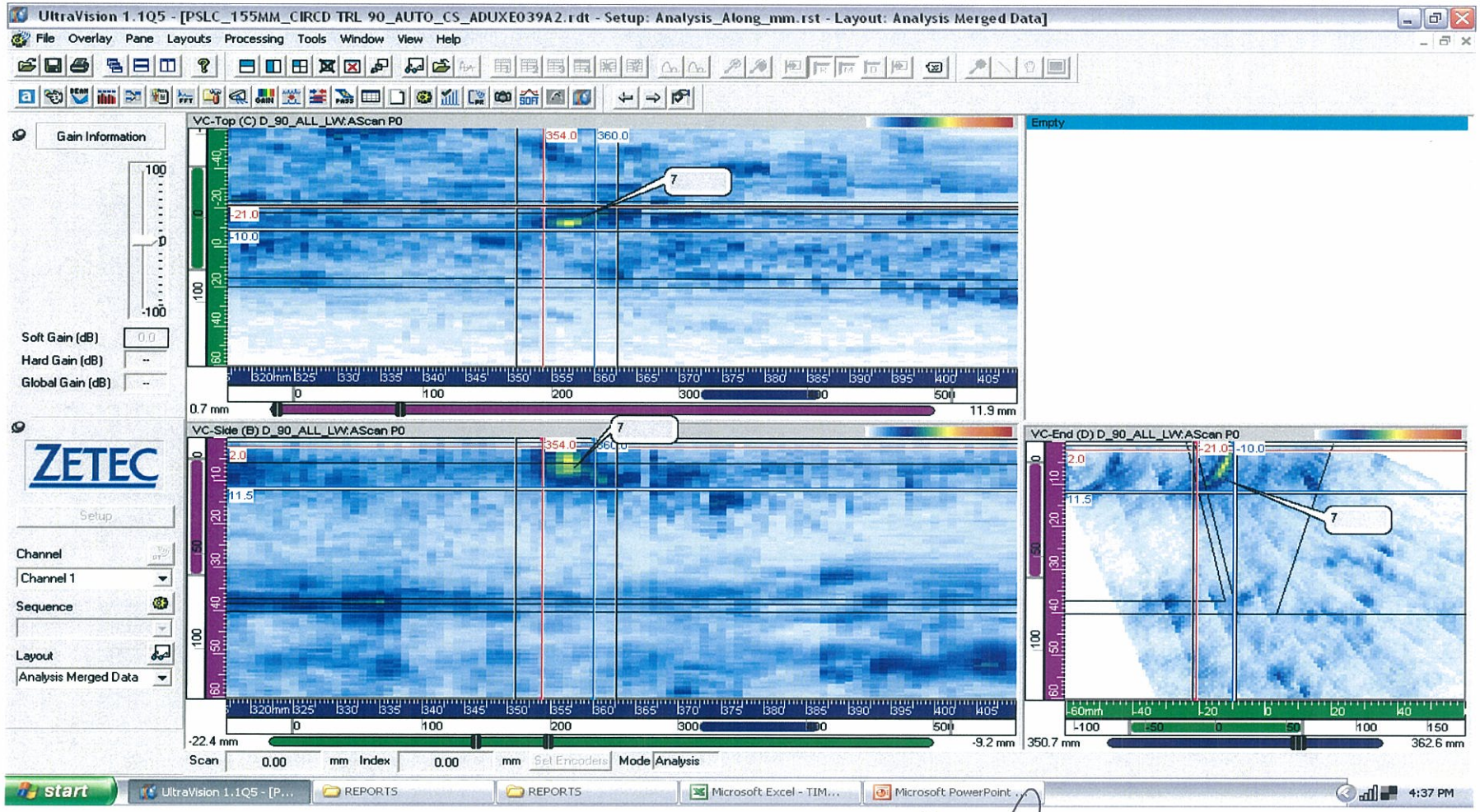
LMT Review _____ Level III

T.P. Blechinger

EPRI Review _____

ANII Review N/A

Report# EPRI-PA-03



Data Analyst _____ Level III

J. L. Devers

EPRI Review _____

LMT Review _____ Level III

T.P. Blechinger

ANII Review N/A

Report# EPRI-PA-03

Attachment 4

Technical Justification for the Acceptance of Ultrasonic Examination Demonstration Results on Port St. Lucie Pressurizer Safety Nozzle Dissimilar Metal Weld Mockup

ELECTRIC POWER
RESEARCH INSTITUTE

3/13/2008

Timothy O'Hara
Region I
475 Allendale Road
King of Prussia, PA 19406

Subject: PDI Qualification Changes to PDI Qualified Procedure ZETEC-OMNISCAN-PA03 Revision D

Dear Mr. O'Hara:

The purpose of this letter is to document the qualification activities performed at the Studsvik facility in Memphis, Tennessee on March 12, 2008. This demonstration was performed to qualify an additional search unit wedge that was used to examine safety nozzles A, B and C on the pressurizer that had been removed from service in Port St. Lucie (PSL), Unit 1.

The PSL nozzles were examined using a search unit/wedge combination that was contoured for a larger component diameter, because the standard kit of wedges for this procedure does not include a wedge that is contoured ideally for the PSL safety nozzle diameter. This application of a larger-diameter wedge contour had not implemented during the original qualification of the procedure. The performance of this larger-diameter wedge was evaluated by comparing the examination data from the PSL safety nozzle welds against data collected during the original qualification of the procedure. This evaluation concluded that the overall quality of the data was comparable.

In addition, the procedure was demonstrated using the larger-diameter wedge on a mockup that is fully compliant with the quality and design standards of the Performance Demonstration Initiative (PDI), matches the exact configuration of the PSL safety nozzles, and contains cracks. The demonstration was performed in accordance with PDI's implementation of ASME Boiler and Pressure Vessel Code, Section XI, Appendix VIII, Supplement 10. The data was of high quality, the reported results satisfied the acceptance criteria defined in Appendix VIII for detection, length and depth sizing, and no limitations were noted. Due to PDI data security requirements, the mockup flaw truth information cannot be included in this letter. EPRI will develop a formal technical justification in the next several days to formally document this demonstration, but until this is completed and reviewed internally this letter should be used as an attestation that the equipment and techniques were qualified in full compliance with the PDI program.

Sincerely,

Carl Latiolais
EPRI Program Manager
Appendix VIII Performance Demonstration

c: G. Selby
T. MaCalister (SCANA)

CHARLOTTE OFFICE
1300 West W.T. Harris Boulevard, Charlotte, NC 28262-8550 USA • 704.595.2000 • Fax 704.595.2860
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ABSTRACT

Neither ASME Section XI [1], nor the Performance Demonstration Initiative (PDI) Program, requires that an Appendix VIII Supplement 10 (Dissimilar Metal Piping Weld) qualification test set include all possible configurations. The intent of the PDI Program is to perform a thorough and complete examination on all dissimilar metal piping weld configurations. However, due to the numerous different configurations present in the industry, it is not feasible for the PDI Program to include all of them in a single qualification test. Therefore, qualified procedures for the examination of dissimilar metal piping welds may require the use of an additional mockup or mockups when the component configuration contains variations that were not included in the procedure qualification. Mockups are used to optimize the essential inspection variables and to demonstrate the effectiveness of the examination for that specific geometry. Essential inspection variables which may be revised include:

- Alternate search unit angles
- Size, focal depths and contours of the search units
- Selection of compound angles to accommodate tapered inspection surfaces
- Adjustment to scan patterns
- Other essential inspection variables as required

These additional mockups also serve to aid examination personnel in familiarizing themselves with the ultrasonic responses from unique geometric configurations.

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1
INTRODUCTION

Neither ASME Section XI [1], nor the Performance Demonstration Initiative (PDI) Program, requires that an Appendix VIII Supplement 10 (Dissimilar Metal Piping Weld) qualification test set include all possible configurations. The intent of the PDI Program is to perform a thorough and complete examination on all dissimilar metal piping weld configurations. However, due to the numerous different configurations present in the industry, it is not feasible for the PDI Program to include all of them in a single qualification test. Therefore, qualified procedures for the examination of dissimilar metal piping welds may require the use of an additional mockup or mockups when the component configuration contains variations that were not included in the procedure qualification. Additional PDI mockups are used to optimize the essential inspection variables and to demonstrate the effectiveness of the examination for that specific geometry. Essential inspection variables which may be revised include:

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These additional mockups also serve to aid examination personnel in familiarizing themselves with the ultrasonic responses from unique geometric configurations.

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2
BACKGROUND / HISTORY / APPROACH

When the pressurizer at Port St. Lucie (PSL) Unit 1 was replaced several of the nozzles were removed and saved for evaluation at a later date. Among the nozzles saved were three safety nozzle to flange dissimilar metal welds (DMW). The PSL pressurizer nozzles had never been examined using Performance Demonstration Initiative (PDI)-qualified UT techniques while they were in service. Therefore, the Nuclear Regulatory Commission Office of Nuclear Regulatory Research (NRC RES) and the Materials Reliability Program (MRP) engaged a nondestructive evaluation (NDE) vendor to examine the nozzles and learn which DMWs would be of greatest interest for the research program. This examination took place February 5-7, 2008 at the Studsvik Memphis facility where the nozzles were being stored. The examination vendor used a PDI-qualified manual phased array ultrasonic examination (UT) procedure to perform the examinations. The examiner's preliminary conclusions were that all three safety nozzle DMW's contained indications of circumferential cracking around the entire circumference. The reported cracking was most severe in nozzle A. The examiner noted that the indications also could be consistent with stacked fabrication defects instead of cracking, and recommended that encoded ultrasonic examination should be performed in order to make a more precise interpretation. A dye penetrant examination (PT) of the inside surface of the nozzles resulted in a few, short linear indications, but nothing approaching the extent of the UT indications.

An additional NDE vendor company, Lambert MacGill and Thomas (LMT), was engaged to perform an encoded UT examination. LMT used the PDI-qualified procedure "Procedure for Encoded, Manually Driven, Phased Array Ultrasonic Examination of Dissimilar Metal Piping Welds"; Zetec_OmniScanPA_03; Revision D; Addenda: 0 [3]. This procedure uses a standard set of wedges contoured for various nozzle diameters. The PSL safety nozzles are of an unusual configuration and none of the available wedge contours were within the qualified range of the procedure. Therefore, the nozzles were scanned using the most appropriate of the available wedges, and the procedure's qualification was expanded by demonstrating the effectiveness of the wedge in a blind test using a PDI-approved mockup of the same configuration. In addition, two additional angles were added to examination technique to help obtain additional coverage and aid in depth sizing of the deeper flaws reported during the previous examination.

The procedure employs a phased array probe with dual 2x16-element arrays mounted on a wedge with a 6° roof angle. The probe uses an 8-element virtual aperture to generate longitudinal-wave beam angles of 30°, 45°, 60°, and 70°. At each probe position the virtual aperture is scanned electronically through the 16-element actual aperture. The probe is manipulated manually as its position is tracked and recorded by an encoder system. The acquired data was analyzed off-line using Zetec's UltraVision software, version 1.1Q5. This software allows the analyst to view three-dimensional reconstructions of the ultrasonic data and to view slices and projections in three orthogonal planes.

This demonstration included only axial scans in an effort to address the safety significant circumferential flaws reported using manual phased array techniques. In order to address this and similar configurations not contained within the program, PDI has developed a set of guidelines and created the "PDI Dissimilar Metal Weld Mockup Criteria, Revision A" [2]. This document focuses on the key points that need to be addressed when modifying a qualified procedure for examinations performed on configurations not present in the procedure qualification. It requires the fabrication of a mockup to replicate the effects of the geometries not contained within the scope of qualified procedures.

This report describes the process and basis for the modification of Zetec_Omniscan-PA03. Ultrasonic beam plots of various discrete angles were used to address Port St. Lucie's unique DMW configuration. The beam plots were used to select the optimum focal law angles and estimate the resulting coverage percentages. The approaches used in this project for array and wedge selection have proven to provide effective examinations of this and similarly configured components. The modifications to the procedure, necessary to address this component, will be included in a later revision to the procedure's Performance Demonstration Qualification Summary (PDQS).

The objective of this project was to evaluate the detection, length sizing, and depth sizing capabilities of the technique and the modifications necessary to compensate for the unique geometries associated with the PSL safety nozzles.

A mockup owned by FPL Energy was used for this demonstration activity. The mockup accurately represents the PSL pressurizer safety nozzle with respect to material and form. Section 6 of this report addresses in detail how this mockup conforms to the requirements of the "PDI Dissimilar Metal Weld Mockup Criteria, Revision A." While these criteria do not require the testing to be performed in a blind fashion, the data analysis portion of this demonstration was performed by an analyst that had no prior knowledge of the number, size and location of the flaws in the mock-up.

3
COMPONENT REQUIRING PROCEDURE MODIFICATION

This technical justification (TJ) is applicable to the first welds off of the safety nozzles located on top of the pressurizer. The materials and DMW configuration for the manufactured mockup is as indicated in Figure 3-1. Review of the Westinghouse supplied fabrication drawing for the PSL Unit 1 safety nozzles confirmed that mock-up matched the actual field removed components. The direction of flow indicated in Figure 3-1 may differ than that of the actual field installed component. All scan direction references in this report are based on the mockup and not the actual component.

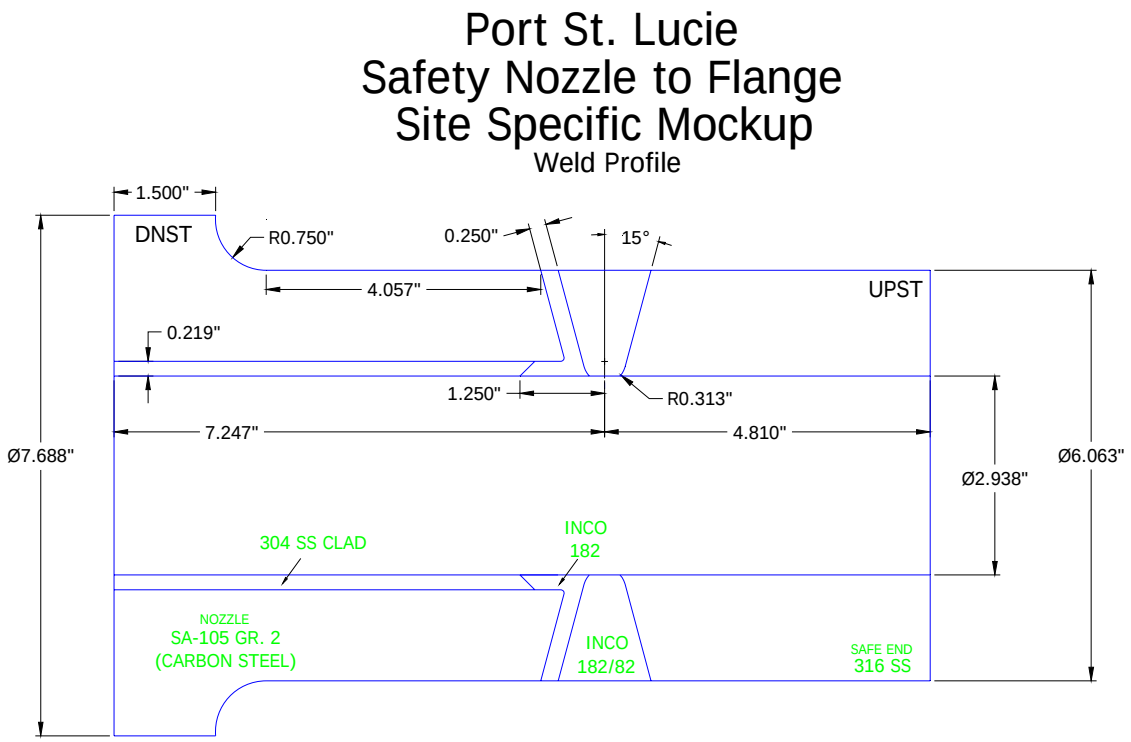


Figure 3-1
Weld Profile of the Port St. Lucie Safety Mockup

4
BASIS OF EXPANSION

The PDI DMW qualification program does not contain samples in the thickness range that address the specific weld configuration associated with the PSL safety nozzles. Because the procedure did not include a wedge/array combination to inspect components between six and eight inches, it was necessary to demonstrate the procedure modifications on a PDI designed mockup. Using beam simulation software for phased array search units, it was established that by adding a 30° focal law to the scan plan it would add coverage by an additional angle as well as increase the flaw resolution. In addition, because of the number of and type of flaws previously reported in the prior examination a 70° focal law was added to the examination plan in order to provide better depth sizing capability for the deeper flaws reported.

5
REQUIRED DEVIATIONS TO THE QUALIFIED TECHNIQUES DEFINED IN ZETEC_OMNISCAN_PA03

Table 5-1 below details the procedure deviations required to adjust for the unique configuration of Port St. Lucie Safety Nozzle-to-Flange components. Only areas within the procedure that require modification are listed in Table 5-1. The primary reason for the deviation from the procedure is that there were no appropriate wedge/array combinations qualified for use on components between six and eight inches. Furthermore, adding the 30° focal law to the scan plan allowed the search unit to be focused closer to the inside surface while providing additional coverage with a supplementary angle. A 70° focal law was added in order to assist with depth sizing of the deeper flaws reported by the previous examination.

Table 5-1 Table of Deviations

Procedure Paragraph	Deviations	Alternative Techniques/Comments
5.4.3	The procedure does not specify a wedge/array combination for longitudinal wave or transverse wave inspections on components between 6 and 8 inches.	The wedge/array combination specified for use on components between 8 and 12 inches will be used to address the Port St. Lucie safety nozzle to flange DM welds.
5.5.1	The procedure only requires the use of a 30 degree longitudinal wve focal law when scan limitations are present on the nozzle side.	For the exam of the Port St. Lucie safety nozzles the 30 degree longitudinal wave focal law was used in both of the looking-up and looking-down exams.
5.5.1	The procedure does not require the use of a 70 degree longitudinal wave focal law when scanning on the nozzle side of the weld.	In order to accurately size indications, from the nozzle side, that extends into the upper portion of the volume it would be necessary to add the 70 degree focal law for both scan directions.
9.3.2	The merges specified within the procedure do not include the 30 and 70 degree angles added to address this component.	When the additional focal laws are used they will be merged separately as well as included in the all angle merge.

6
CONFORMANCE TO "DISSIMILAR METAL WELD MOCKUP CRITERIA, REVISION A"

The purpose of Table 6-1 is to identify how the site-specific mockup complies with the requirements of Section 4 of the "Dissimilar Metal Weld Site Specific Mockup Criteria, Revision A."[2]

Table 6-1
Dissimilar Metal Weld Mockup Criteria

Criteria Paragraph Requirement	Complied w/Criteria	Means of Compliance
4.1	Yes	The original procedure qualification did not contain PDI samples representative of Port St. Lucie safety nozzle components. The site-specific mockup was built to represent the actual in-service components. The mockups address the limited scan access due to the nozzle and flange location.
4.2.1	Yes	Material types and product forms are presumed to be identical to the removed component.
4.2.2	Yes	The mockup was manufactured using similar welding techniques to those used when manufacturing the Port St. Lucie safety nozzle to flange components.
4.2.3	Yes	The Port St. Lucie safety nozzle to flange component does not contain a taper.
4.2.4	Yes	All physical limitations are present or simulated.
4.2.5	Yes	All inside surface geometric conditions warranting duplication were represented in the mockup.
4.2.6 a) thru j)	Yes	The flaws contained within the mockup were manufactured in accordance with the PDI fabrication quality program.
4.2.7 a) thru d)	N/A	This mockup was not commercially dedicated.
4.3	Yes	A sufficient number of flaws were placed in the mockups taking into consideration the component geometry and scan limitations.
4.4	Yes	All flaws are in conformance with the "PDI Dissimilar Metal Weld Mockup Criteria, Revision A."[2] No flaws exceeded 20% of the nominal wall thickness.
4.5	Yes	All flaws in this mockup were produced via the thermal fatigue or alternative flaw processes and compressed using the hot isostatic pressure (HIP) process to ensure a final flaw tip width of less than or equal to 0.002 inch (0.05mm). The alternate flaws were fabricated to have crack-like characteristics.
4.6	Yes	The mockup contains flaws oriented in both the axial and circumferential directions in areas known to be susceptible to cracking. All flaws in the mockup were placed in the weld material or heat-affected zones with

		emphasis placed on the weld and butter materials.

7
ASSESSMENT OF COVERAGE

Figures below depict the expected examination volume coverage obtained using the techniques in this document. The extent of scanning is limited by the search unit size and the proximity of the nozzle blend and the flange. Axial scans looking in both directions were performed from the base material and extended across the weld and onto the nozzle as well as the flange. No physical limitations were noted that would interfere with obtaining the procedurally defined coverage. Obtainable coverage will vary based on each of the field removed components' unique contour. See Examination Limitations in Section 9 of this report for ASME code exam volume coverage details for the Port St. Lucie safety nozzle mockup.

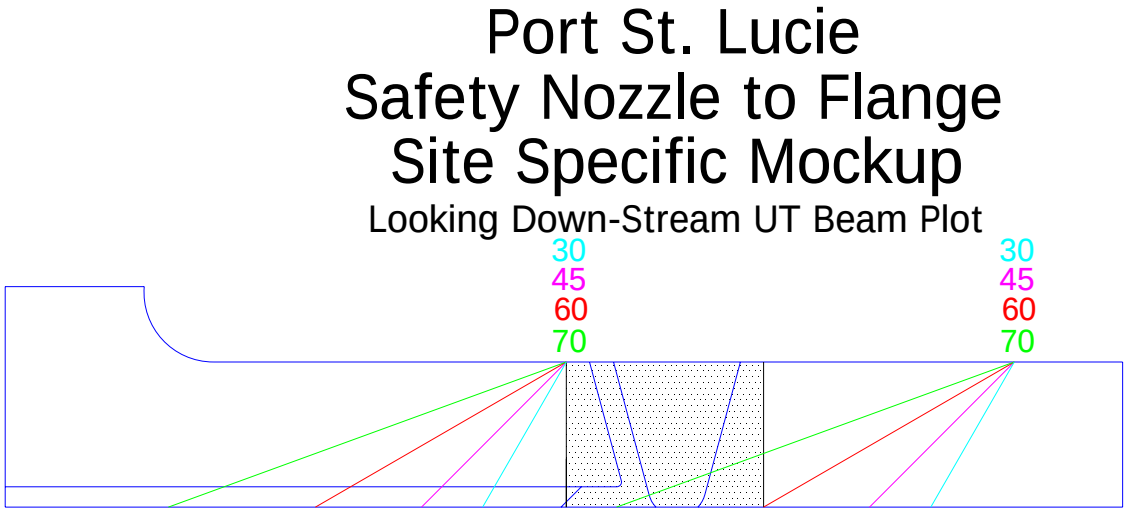


Figure 7-1
Port St. Lucie Safety Nozzle Mockup – Looking Down-Stream Ultrasonic Beam Plot

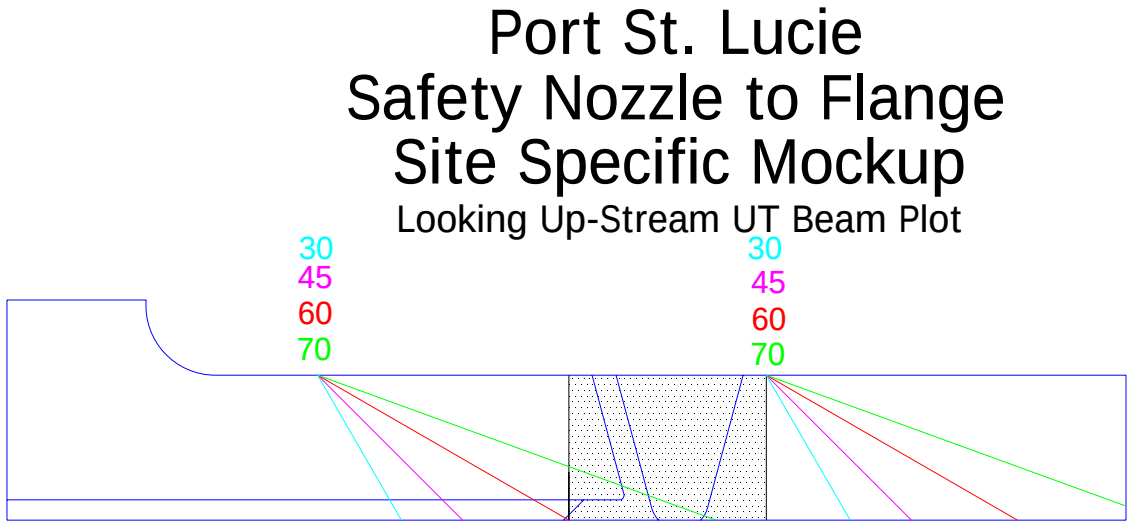


Figure 7-2
Port St. Lucie Safety Nozzle Mockup – Looking Up-Stream Ultrasonic Beam Plot

In Figure 7-3, the heavy red (bold) line indicates where coverage could be claimed using the techniques and examination volume defined within the procedure.

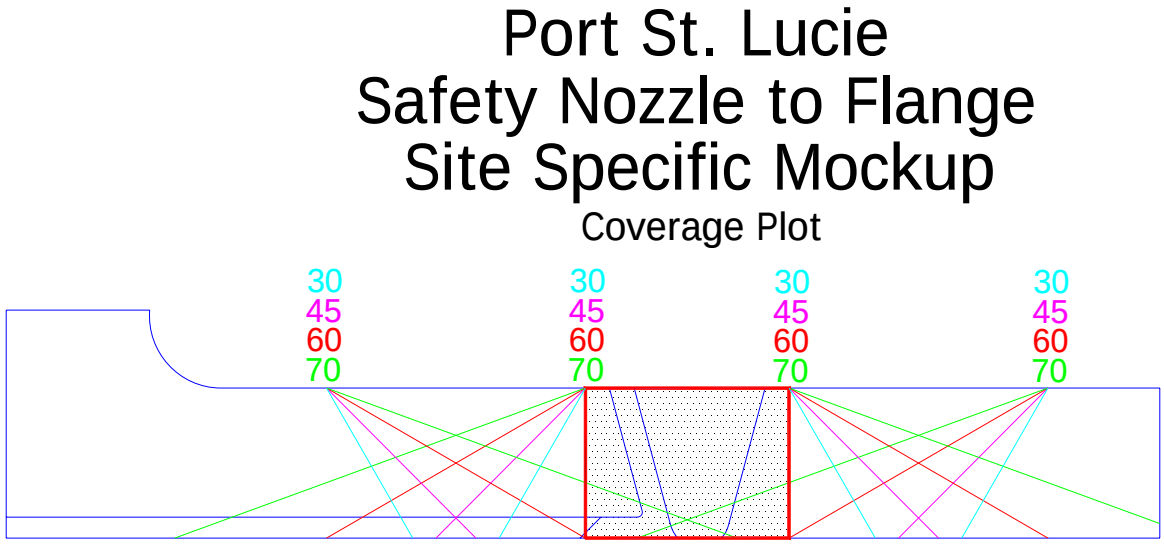


Figure 7-3
Port St. Lucie Safety Nozzle Mockup - Ultrasonic Coverage

8
EQUIPMENT CHANGES FROM ZETEC_OMNISCAN_PA03

The PDI “Dissimilar Metal Weld Site Specific Mockup Criteria, Revision A”[2] allows for technique adjustments to a qualified procedure to compensate for component geometries that were not included in the procedure qualification. These technique adjustments are limited to search unit parameters such as angle, focusing, and contouring. In addition to search unit parameters, adjustments to the scan pattern may be made as well.

No procedural equipment deviations were required to perform the axial scans on the Port St. Lucie safety nozzle mockup.

9
EMPIRICAL DOCUMENTATION OF CHANGES

See Attachment B for the on-site demonstration ultrasonic examination documentation. The flaws contained within the mockups were readily detectable and had a signal to noise ratio that was 2:1 or greater during the on-site performance demonstration. All flaws were sized within the acceptance criteria of ASME Section XI, Appendix VIII, Supplement 10 [1].

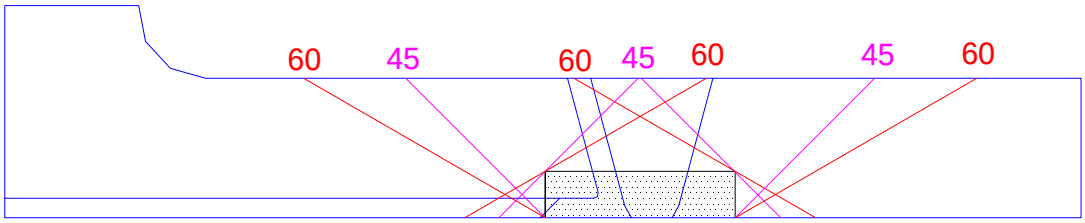
Examination Limitations

See "Coverage Plots", Section 7, for a pictorial representation of the estimated coverage obtainable. Examination volume coverage percentages in this report are based on the configuration and surface condition of the provided mockup and the actual mock-up. The calculated examination coverage presented in this report is based on simple geometric renditions of the ultrasonic beams using straight lines for the discrete angles generated by the phased array search unit. It should be noted that there is not yet a consensus in the industry on how to determine examination coverage or how to introduce the relative effectiveness of individual scans in a composite coverage figure. The examination volume coverage calculations here are based on AutoCAD models and may differ from those calculated by physical measurements.

Port St. Lucie Safety Nozzle Mockup ASME Code Coverage Analysis

The axial scan coverage for the Safety Relief, nozzle to flange dissimilar metal weld mockup, where two angles passed through the examination volume, is 100%.

Port St. Lucie
Safety Nozzle to Flange
Site Specific Mockup
ASME Code Exam Volume Coverage Plot



Search Unit Information

The parameters for the actual array wedge combination used for this demonstration and for the actual examination are shown in Table 9-1 below. For additional information pertaining to the array/wedge combinations, see Attachment A.

Table 9-1
Wedge/Array Information

Flaw Type	Config., Wave mode	Probe Type	Probe Position, Skew	Contour	Assembly model	Manuf.	Wedge angle	Roof angle
CIRC	T/R Long., Shear	CS	Nozzle, 90º Pipe, 270º	12”	**ADUXE039A**	Zetec	22.3º	6.0º

10
SUMMARY OF RESULTS

The PSL safety nozzle DMW configuration was not represented within the PDI Program sample inventory at the time procedure “Zetec_OmniScanPA_03; Revision D; Addenda: 0” was qualified. Due to the unique configuration of these welds, the qualified array/wedge combination defined within the procedure required modifications. The primary reason for the deviation from the procedure is that there were no appropriate wedge/array combinations qualified for use on components between six and eight inches. Furthermore, by adding the 30° focal law to the scan plan will allow the search unit to be focused closer to the inside surface while providing additional coverage with a supplementary angle. A 70° focal law was added in order to assist with depth sizing of the deeper flaws reported by the previous examination.

All modifications to the previously qualified procedure can be found in Table 5.1 of this document.

The PDI “Dissimilar Metal Weld Mockup Criteria, Revision A” was followed for the flaw design, flaw fabrication, and examination demonstration for PSL safety nozzle mockup. The mockup was designed and built to accurately represent the in-service components. The diameter and thickness combination provided challenges to proper search unit selection. These challenges were offset by evaluating the effective beam formation using an advanced beam simulator, selecting the most appropriate array/wedge combination and successfully demonstrating it on a representative mockup.

The search units and techniques outlined in this technical justification yield adequate mockup examination volume coverage and detection capabilities for circumferential flaws. Axial scan coverage with all angles, excluding the 70° beam which was used for sizing only, is 100%. No circumferential scanning was performed during this demonstration.

All flaws that were implanted into the mockups were successfully detected at signal-to-noise ratios of 2:1 or greater.

The depth and length sizing techniques defined in procedure Zetec_OmniScanPA_03; Revision D; Addenda: 0 were used during the demonstration and the reported values were well within the acceptance standards defined in ASME Section XI, Appendix VIII, Supplement 10 [1].

The documentation of the on-site demonstration showing the calibration and indication data sheets with amplitude measurements is attached to this document as Attachment B.

11
DEMONSTRATION DOCUMENTATION

See Attachment B.

The demonstration grading sheet is included as Attachment C.

12
REFERENCES

1. ASME Section XI, Appendix VIII.
2. "PDI, Dissimilar Metal Weld Mockup Criteria", Revision A.
3. "Procedure for Encoded, Manually Driven, Phased Array Ultrasonic Examination of Dissimilar Metal Piping Welds"; Zetec_OmniScanPA_03 Rev. D Addenda 0