

# CNRL-Endiang Plant

## PAUT-TOFD ULTRASONIC REPORT

<b>Client</b>	CNRL	<b>Work Location</b>	ENDIANG, ALBERTA
<b>Client Representative</b>	Darren Welch	<b>Date of Inspection</b>	October 27 <sup>th</sup> 2016
<b>WO# PO #</b>	TA161383S721	<b>Report Number Client Number</b>	KN-001PAUT-TOFD-A#218190 Rev.1 AB101-10292016-03
<b>Reference Specifications</b>	ASME SECTION V ART 4 UT	<b>Acceptance Criteria</b>	ASME SECTION VIII Div.1
<b>Item Inspected</b>	LPG Storage Bullets( 5 Circs and 4 Long Seam)	<b>Material Type/Thickness Material Grade</b>	Carbon Steel-19.76mm 516 70N
<b>Equipment A #</b>	A#218190	<b>Location #</b>	Endiang, Alberta 06-28-34-15 W4M
<b>Inspection Method</b>	Phased Array/TOFD/MUT Ultrasonic Testing	<b>Procedure Technique</b>	FOCUS UT-04B/C-09 Rev.2 /UT-04-09 Rev.2 TS#01 Butane Storage Bullet
<b>Technician 1 Technician 2</b>	Kalidas Natarajan Thomas Dearden	<b>Qualifications</b>	ASNT/SNT-UT3 /PCN-PAUT-TOFD 2 SNT-UT1 MT2 PT2/CGSB-MT2

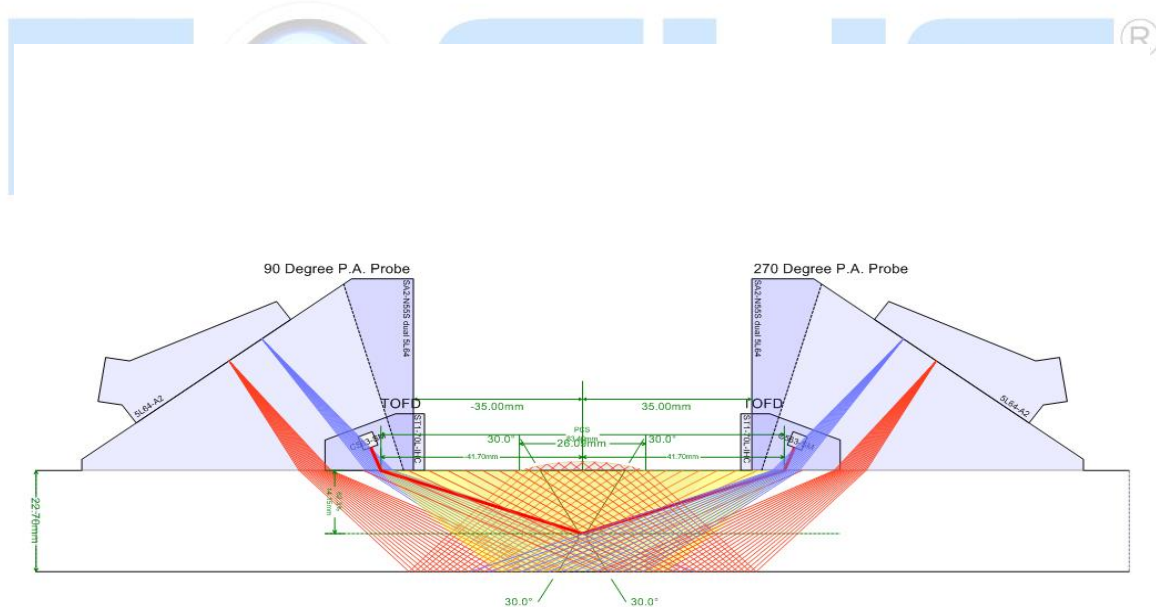
Examination Settings													
<b>Method:</b>		<input checked="" type="checkbox"/> Contact <input type="checkbox"/> Immersion <input type="checkbox"/> Other:				<b>Surface Temp (C):</b> <input checked="" type="checkbox"/> < 5° <input type="checkbox"/> > 45° / < 45° <input type="checkbox"/> > 60°							
<b>Type:</b>		<input checked="" type="checkbox"/> PE <input type="checkbox"/> T/T <input type="checkbox"/> Dual <input checked="" type="checkbox"/> Automated <input checked="" type="checkbox"/> PAUT/TOFD				<b>Scanning Surface:</b> <input checked="" type="checkbox"/> OD <input type="checkbox"/> ID <input type="checkbox"/> Other:							
<b>Application:</b>		<input type="checkbox"/> Laminar <input checked="" type="checkbox"/> Shear Wave <input checked="" type="checkbox"/> Volumetric <input checked="" type="checkbox"/> Thickness				<b>Surface Condition:</b> Painted-Acceptable							
<b>Instrumentation:</b>		Manufacturer:		OlympusNDT		Type:		Omni-Scan Mx		Instrument Ser. #:		OMNI-1566	
<b>Calibration:</b>		Date:		10/27/2016		Reference Flaw Size:		2.38mm SDH		Module Ser. #:		OMNI-600208	
<b>Calibration Block(s):</b>		Type:		IIW Block Type 1		FOCUS #:		20107		Type:		PAUT 0.750"	
		Type:		ASME Block 0.750"		FOCUS #:		001-UT		<b>Software Version:</b>		2.0R28	
<b>Couplant:</b>		Brand:		H2O		Type:		Water		Cable:		Type:	
				Sonotech		Type:		Ultragel II				Type:	
										Coaxial		Length:	
										Umbilical		Length:	
												72"	
												15 meter	
Probe						Settings – Db			Range - <input type="checkbox"/> inches <input checked="" type="checkbox"/> mm				
Manufacturer	Type	Serial #	Angle	Freq.	Size	Wedges	Ref. Level	Scan Level	Screen Size	Skip Value	Beam Travel		
Panametrics	A109S	697957	0°	5.0MHz	12.70	N/A	80%	+6	75.00	N/A	N/A		
OlympusNDT	5L64	H2698	40° - 70°	5.0MHz	64 Elmts	SA2-N55S	80%	+6	125.00	Variable	Variable		
OlympusNDT	5L64	H2696	40° - 70°	5.0MHz	64 Elmts	SA2-N55S	80%	+6	125.00	Variable	Variable		
Panametrics	C563	697859	70°	10.0MHz	3.00	ST1-70LW	80%	+0	125.00	Variable	Variable		
Panametrics	C563	677040	70°	10.0MHz	3.00	ST1-70LW	80%	+0	125.00	Variable	Variable		
Panametrics	C540	687930	45°	5.0MHz	12.70	ABSA 5T	80%	+6	125.00	Variable	Variable		

### SCOPE:

Carry out Phased Array Ultrasonic (PAUT) examination on the LPG Storage Bullet-South A#218190 Circseam and Longseam welds, in areas designated by the client (refer Figure 2 Page 3 of this report). The examination shall consist of Phased Array Sectorial and Time of Flight Diffraction scan, a 0° UT thickness verification and Manual shear wave (Transverse) scan. The examination shall cover the weld and its associated heat affected zones. Report all relevant indications and analyze in accordance with ASME V.

### RESULTS:

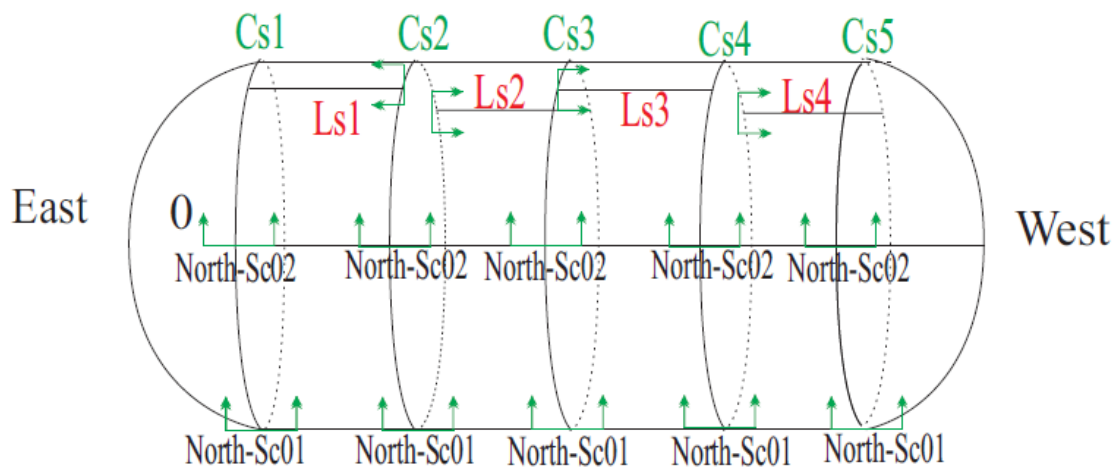
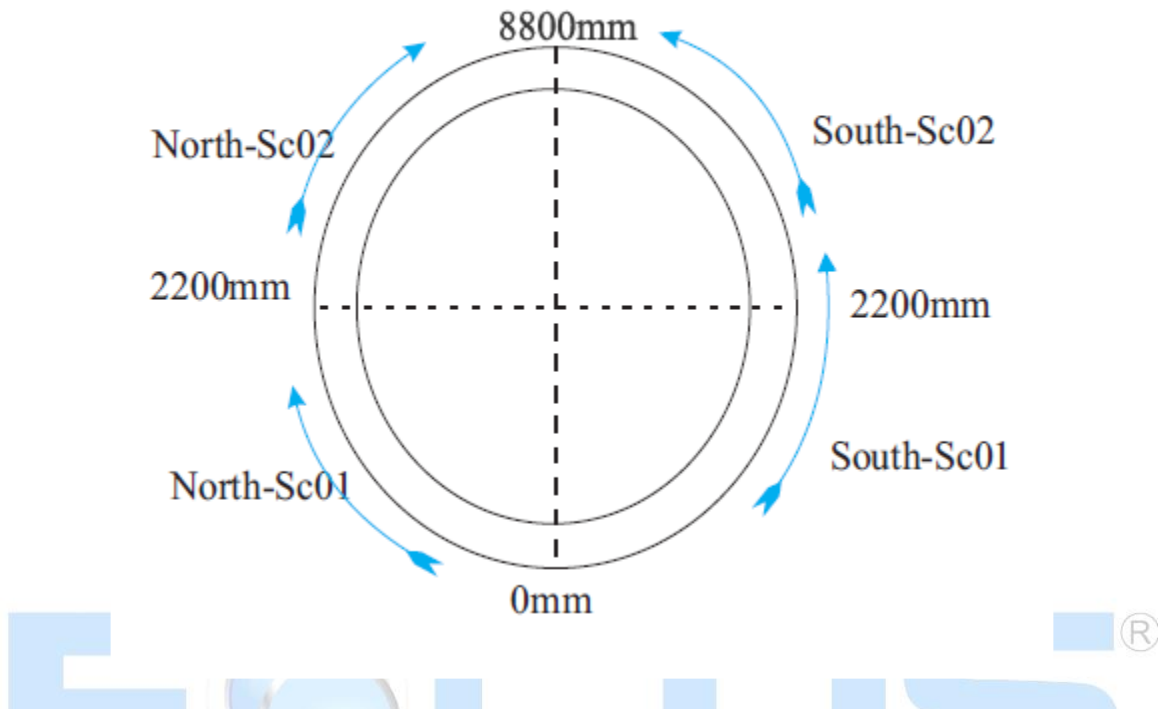
PAUT/MUT examination was performed on 100% of all accessible welds of LPG Storage Bullet-South A#218190, 5 Circseam welds and 4 Longseam welds; see Figure 2 Page 3 of this report. The summary of the examination carried out on the bullet can be found on page 5. Refer to Table 1 thru 3 for comments Page 7.



**Figure 1: Scan Plan for Sectorial scan 40° thru 70°**

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**Figure 2: A#218190 Endiang storage Bullet-south Scan Directions and layout**

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**Figure 3: A#218190 Endiang storage Bullet**



**Figure 4: A#218190 Endiang storage Bullet Restricted Area**

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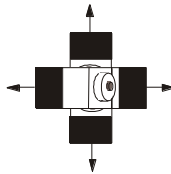
## PAUT-TOFD ULTRASONIC REPORT

1. SUMMARY OF 0° UT THICKNESS INSPECTION:

A UT thickness measurement reading was performed during this evaluation. The majority of readings were found to be in the range of 20.30mm to 22.75m.

2. SUMMARY OF SHEAR WAVE INSPECTION:

Manual Shear wave was carried out on all welds utilizing a 45° and 60° probe to detect, locate and characterized all defects. A transverse scan was also carried out utilizing 45° manual shear wave technique on all accessible welds. See Figure 2 below.



**Figure 5: Manual Shear Wave (45°) scan pattern**

3. SUMMARY OF PHASED ARRAY-TOFD INSPECTION:

**Primary Inspection Area:**

A Phased Array and TOFD scan was carried out on all 5 circs and 4 Long seam welds utilizing the PAUT-TOFD combination, with 2 sets of phased array probes 5L64-A2 and 1 set of TOFD probes, refer to the scan plan-Figure 1 of this report. The Circseam welds were divided into 4 scans of 2200mm per scan with an overlap of 100mm, and the long seam welds were scanned by the full length of 3100mm with overlaps. Circseam and Long seam welds that were scan are shown in Figure 2 Page 3 in green color. This examination was performed to detect and locate any cracking within the welds.

**Final Analysis:**

After the final analysis it appears that there was no evidence of cracks or cracking in any of the welds inspected. Refer to indication Tables 1 and 2 on pages 6 and 7 of this report. Summary of scan images can be found on pages 9 thru 21 of this report.

Respectfully submitted by,

Kalidas Natarajan

Report Accepted by: \_\_\_\_\_ Client Representative: **Darren Welch**

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## PAUT-TOFD ULTRASONIC REPORT

CIRCSEAM #	SCAN#	SCAN LENGTH	EVALUATION	ACCEPT	REJECT	COMMENTS
CS1	North- Sc01	0.0-2300.0		✓		No Cracks Found
	North- Sc02			✓		No Cracks Found
CS1	South-Sc01	0.0-2300.0		✓		No Cracks Found
	South-Sc02	2300.0-4600.0	Intermittent Slag found	✓		No Cracks Found
	South-Sc03	4500.0-4600.0		✓		No Cracks Found
CS2	North- Sc01	0.0-2300.0		✓		No Cracks Found
	North- Sc02	2300.0-4600.0		✓		No Cracks Found
CS2	South-Sc01	0.0-2300.0		✓		No Cracks Found
	South-Sc02	2300.0-4600.0		✓		No Cracks Found
CS3	North- Sc01	0.0-2300.0		✓		No Cracks Found
	North- Sc02	2300.0-4600.0		✓		No Cracks Found
CS3	South-Sc01	0.0-2300.0		✓		No Cracks Found
	South-Sc02	2300.0-4600.0		✓		No Cracks Found
CS4	North- Sc01	0.0-2300.0		✓		No Cracks Found
	North- Sc02	2300.0-4600.0		✓		No Cracks Found
CS4	South-Sc01	0.0-2300.0		✓		No Cracks Found
	South-Sc02	2300.0-4600.0	Incomplete Penetration (Start:2871.0,Length:283mm, Depth:19.8mm,Height:2.3)	✓		No Cracks Found
CS5	North- Sc01	0.0-2300.0	Internal attachment's close to the weld on the Head side	✓		No Cracks Found
	North- Sc02	2300.0-4600.0	Internal attachment's close to the weld on the Head side	✓		No Cracks Found
CS5	South-Sc01	0.0-2300.0	Internal attachment's close to the weld on the Head side	✓		No Cracks Found
	South-Sc02	2300.0-4600.0	Internal attachment's close to the weld on the Head side	✓		No Cracks Found

**Table 1: Results**

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## PAUT-TOFD ULTRASONIC REPORT

LONGSEAM #	SCAN LENGTH	SCAN #	EVALUATION	ACCEPT	REJECT	COMMENTS
LS1	0 – 3100mm	S1		✓		No Cracks Found
LS2	0 – 1600mm	S1		✓		No Cracks Found
	1500-3150	S2		✓		No Cracks Found
LS3	0 – 1600mm	S1		✓		No Cracks Found
	1500-3150	S2		✓		No Cracks Found
LS4	0 – 1520mm	S1		✓		No Cracks Found

**Table 2: Results**



## **ANNEX A**

### **Phased Array Scan Images for Circseam and Longseam Welds**





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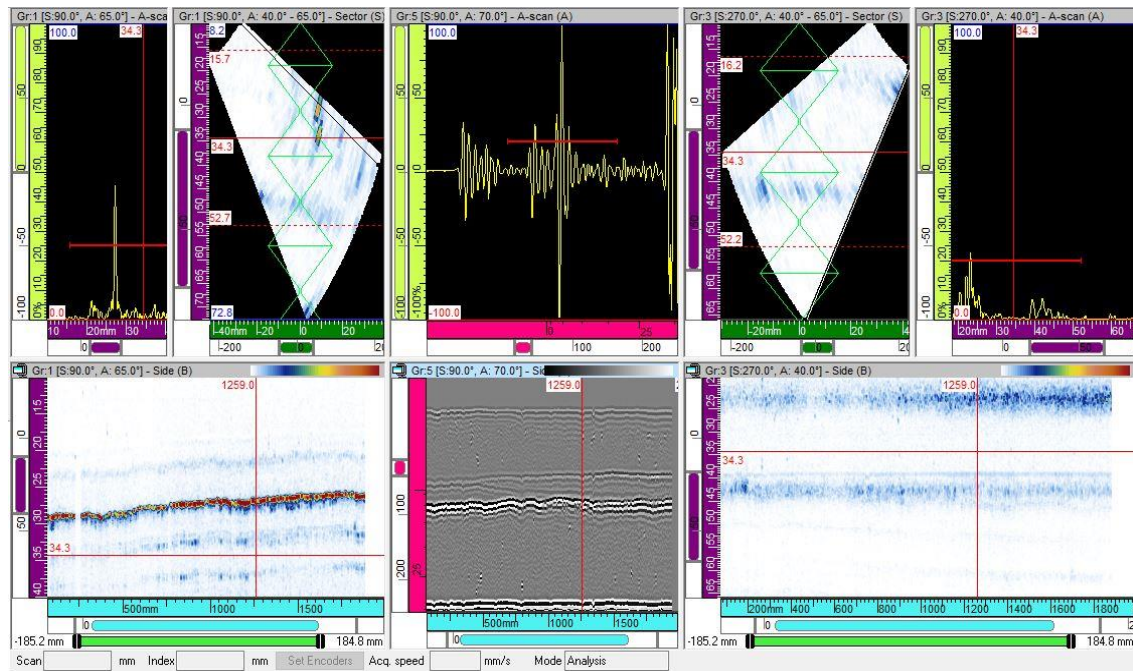


Figure 4: CS#1-S1 North (0mm to 2300mm)

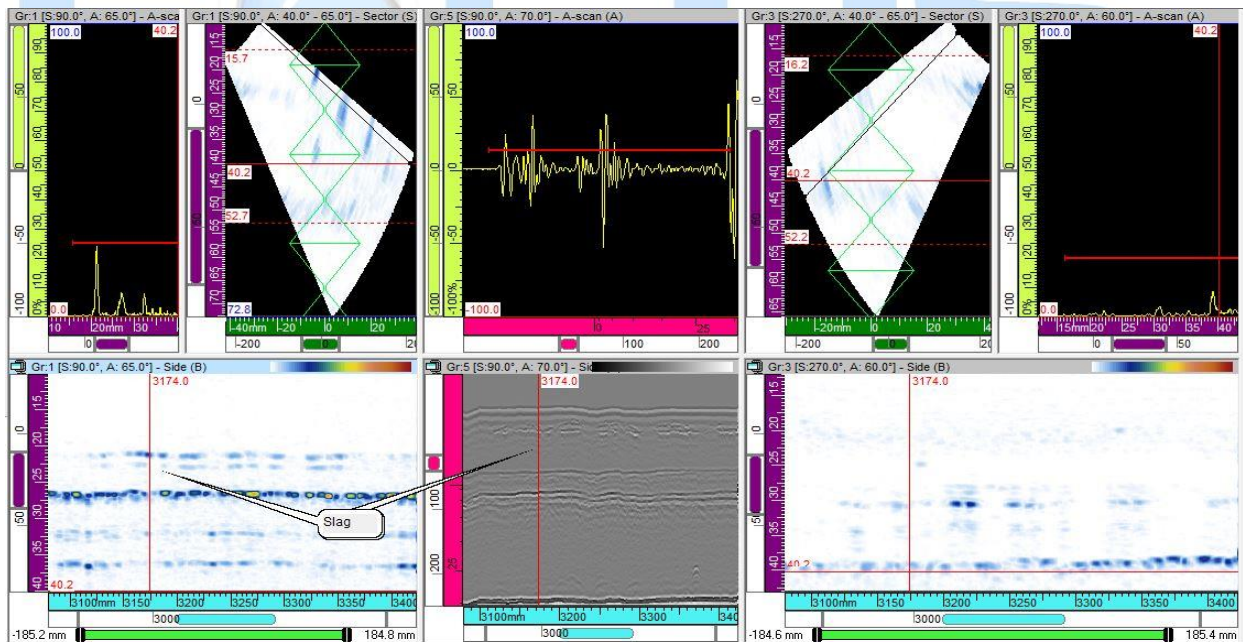


Figure 5: CS#1-S2 North (2200mm to 4600mm)

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## PAUT-TOFD ULTRASONIC REPORT

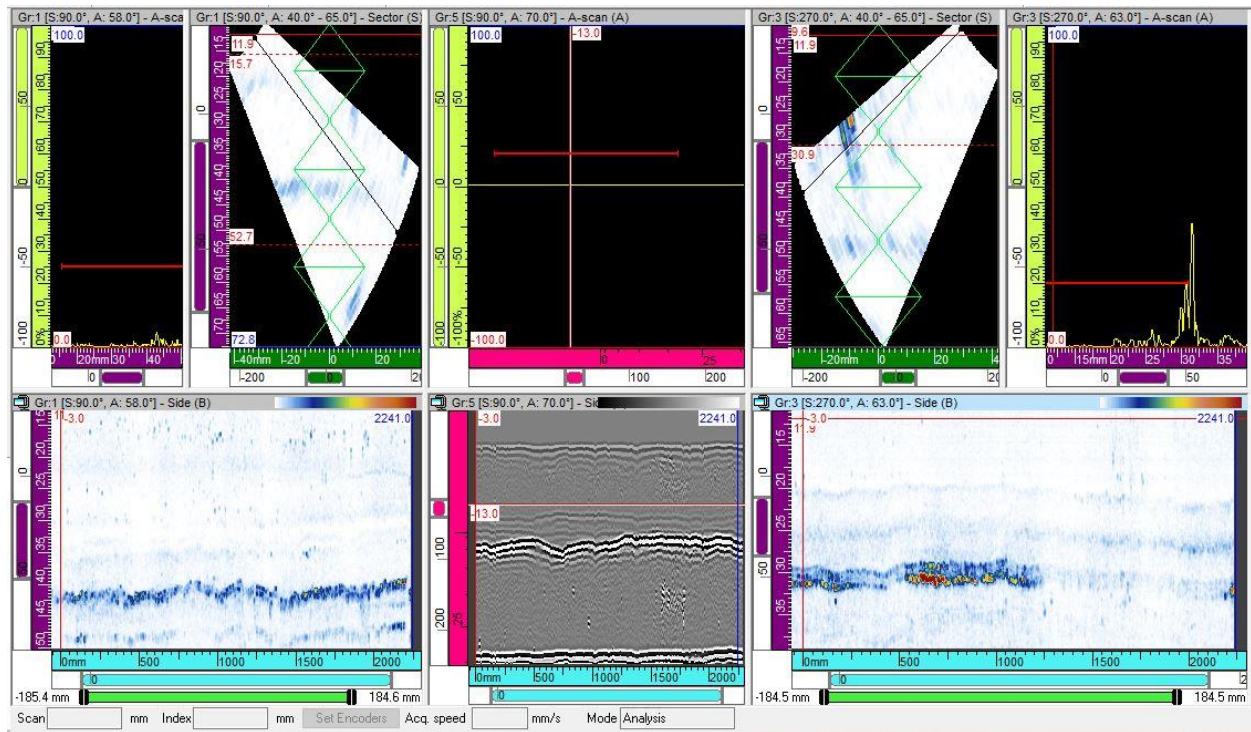


Figure 6: CS#1-S1 South (0mm to 2300mm)

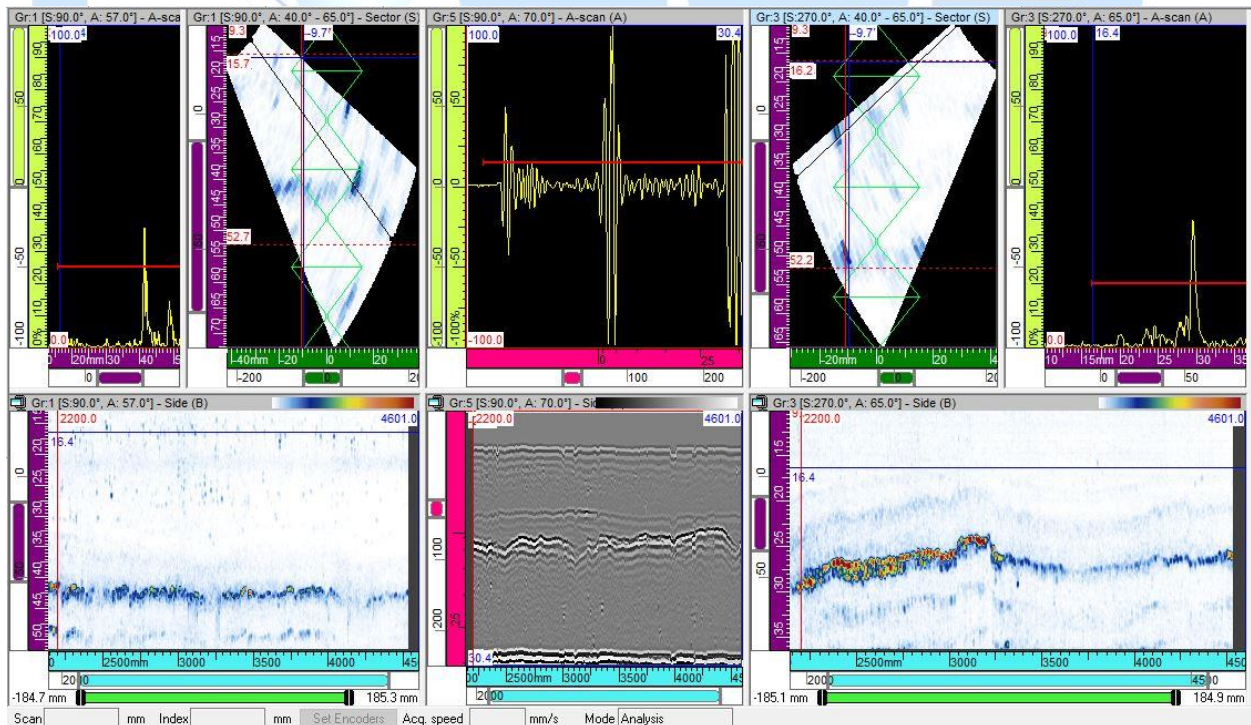


Figure 7: CS#1-S2 South (2200mm to 4600mm)



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## PAUT-TOFD ULTRASONIC REPORT

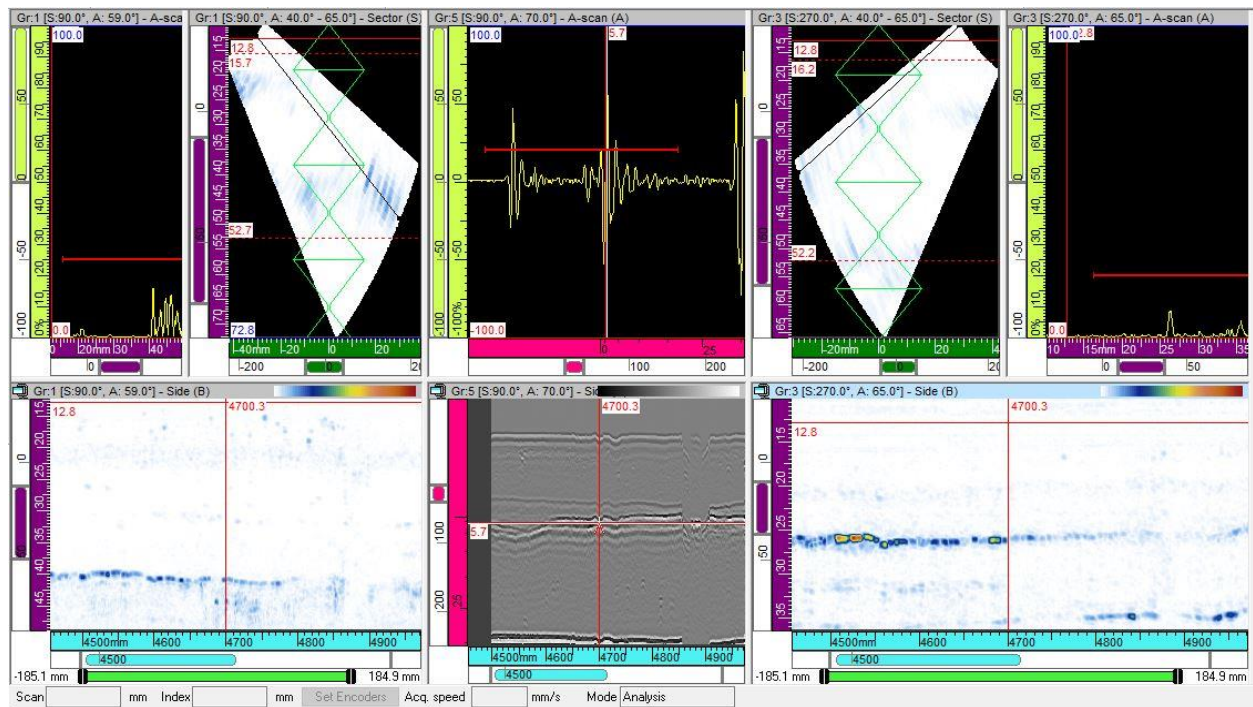


Figure 8: CS#1-S2 South (2200mm to 4600mm)

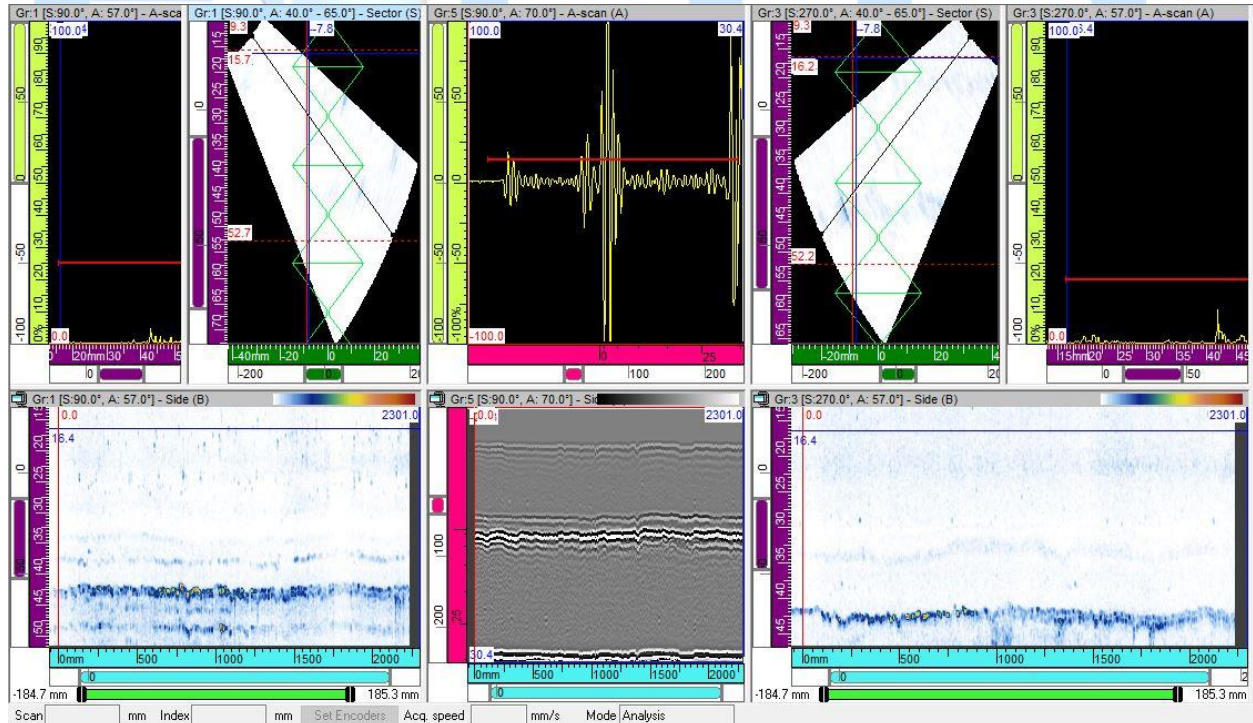


Figure 9: CS#2-S1 North (0mm to 2300mm)

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## PAUT-TOFD ULTRASONIC REPORT

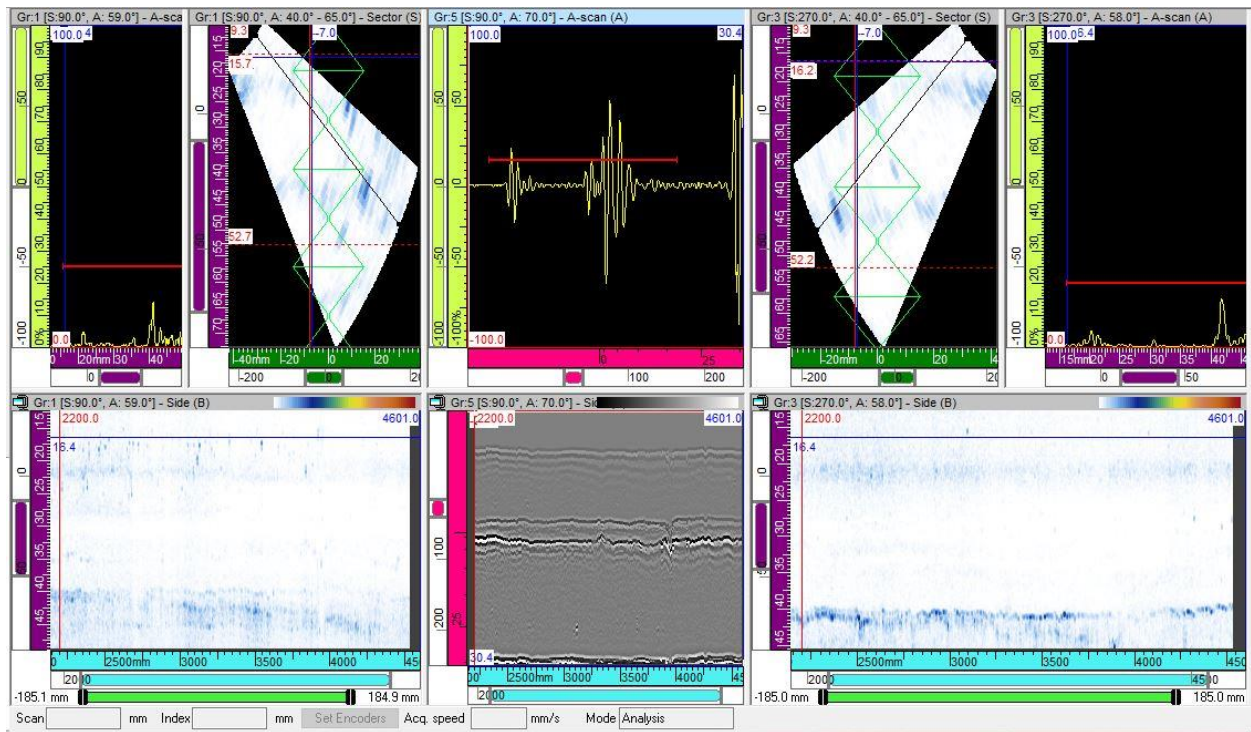


Figure 10: CS#2-S2 North (2200mm to 4600mm)

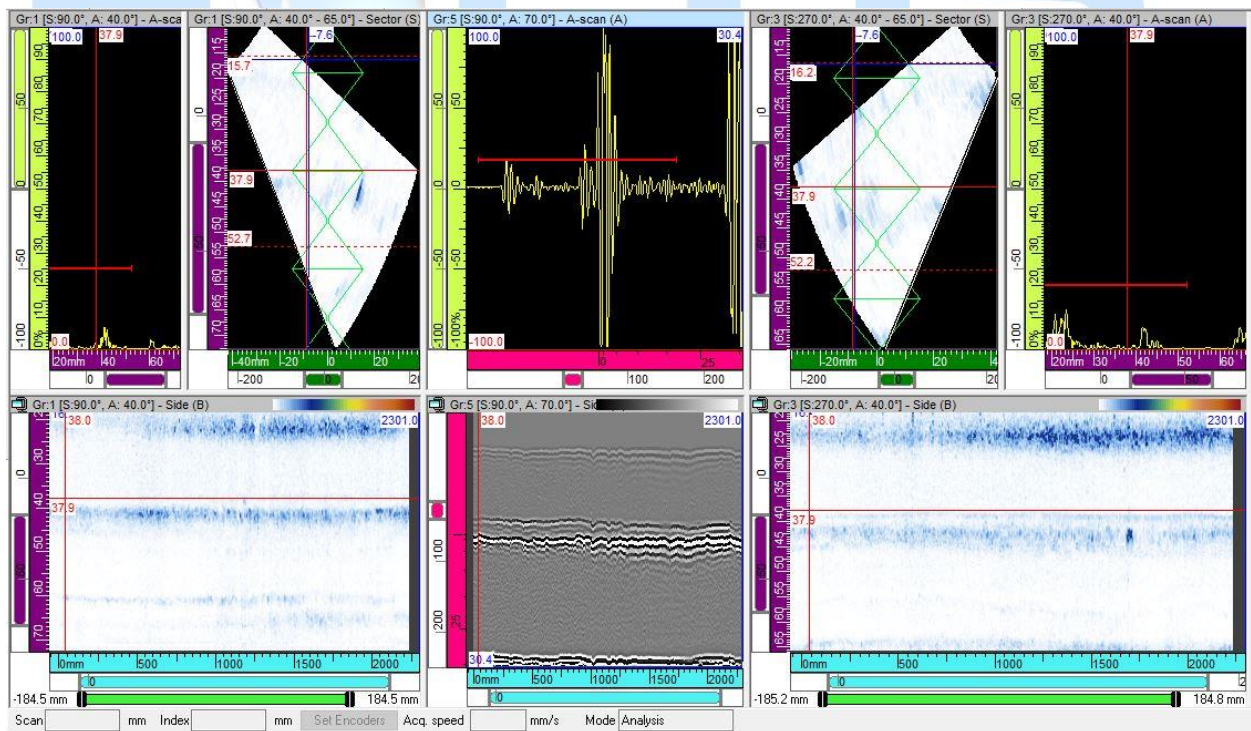


Figure 11: CS#2-S1 South (0mm to 2300mm)



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## PAUT-TOFD ULTRASONIC REPORT

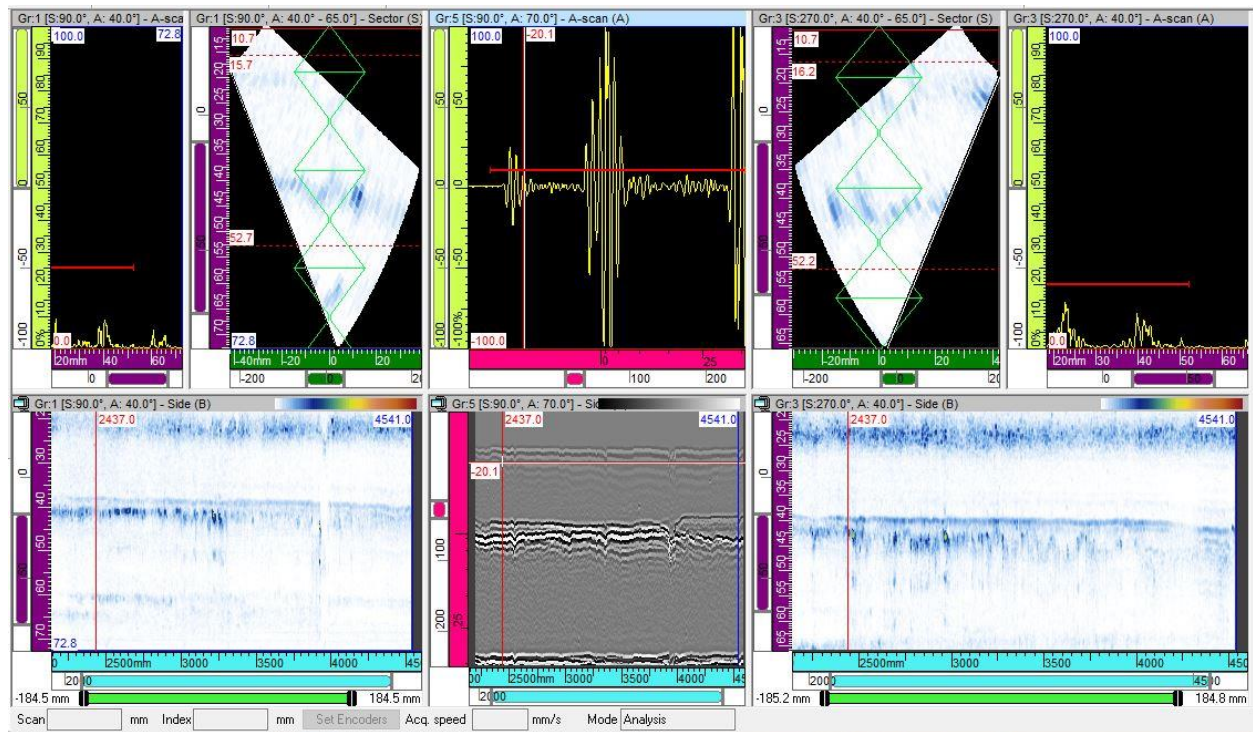


Figure 12: CS#2-S2 South (2200mm to 4600mm)

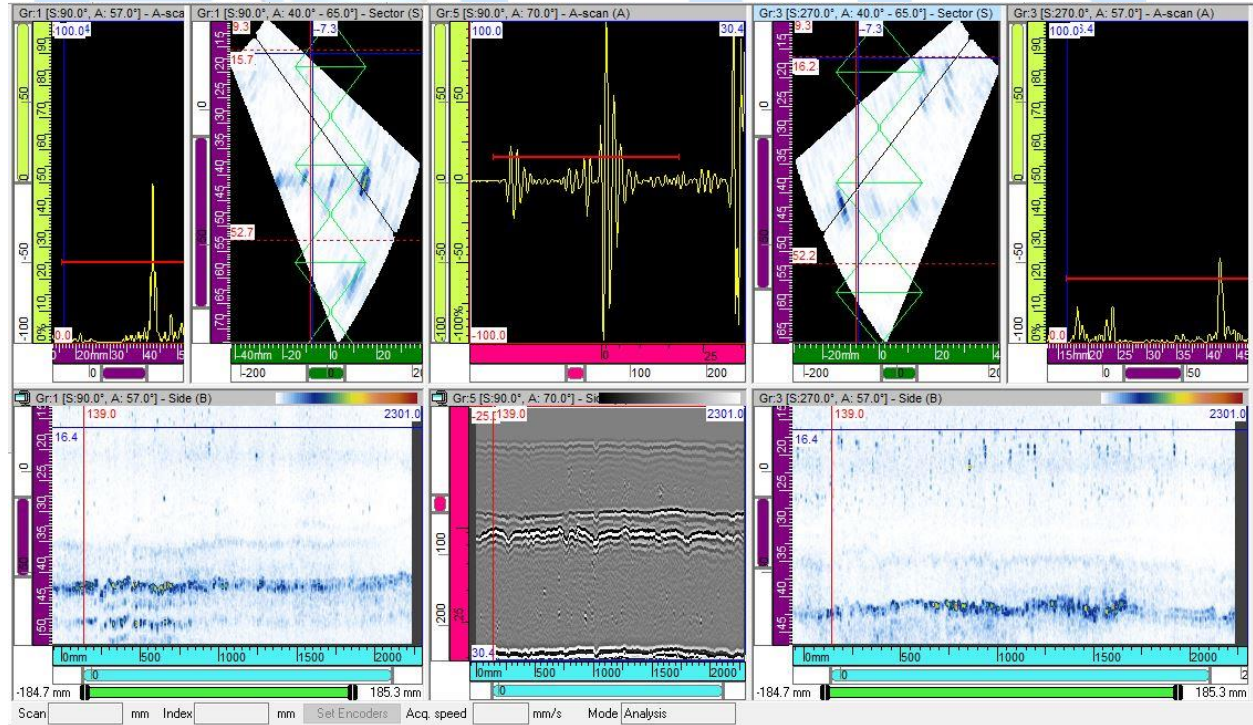


Figure 13: CS#3-S1 NORTH (0mm to 2300mm)



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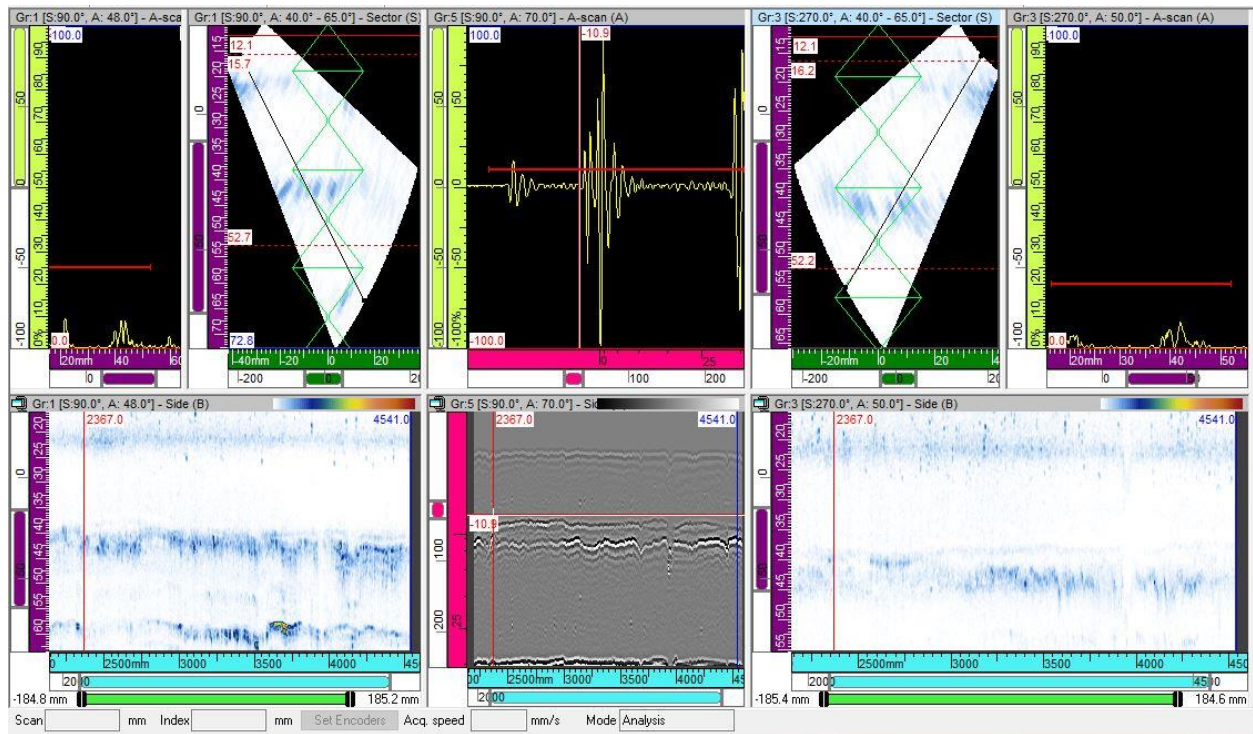


Figure 14: CS#3-S2 NORTH (2200mm to 4600mm)

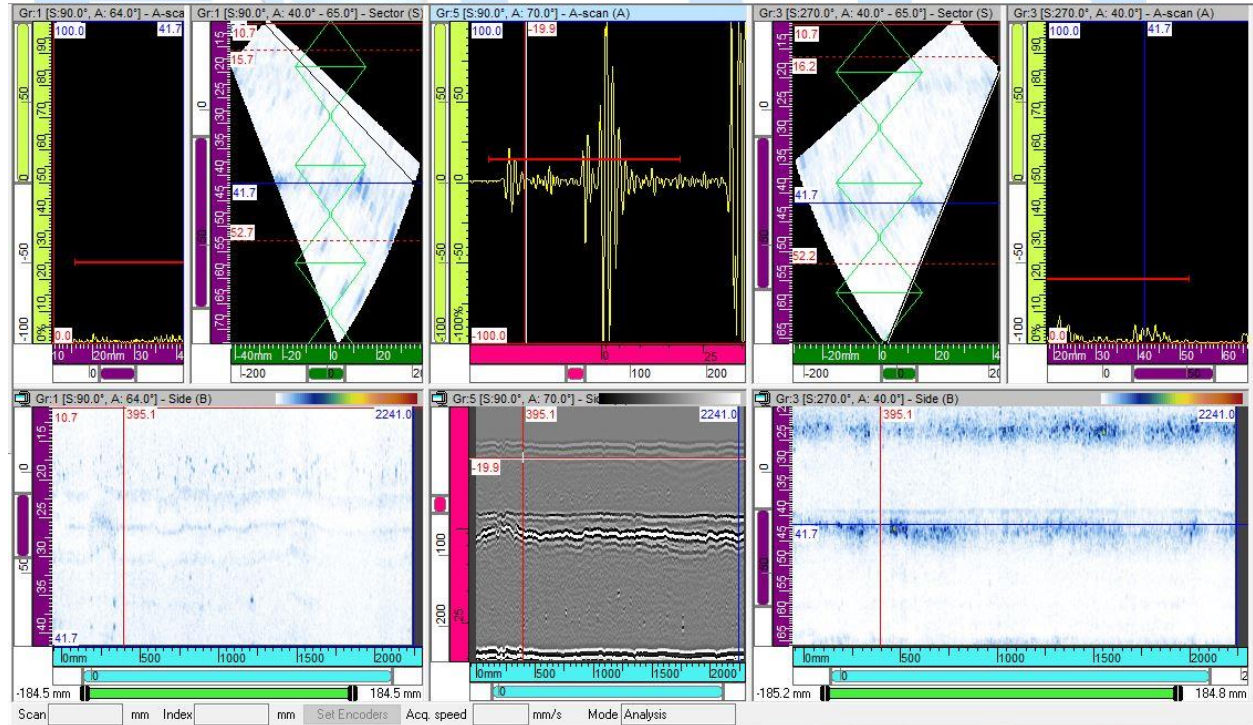


Figure 15: CS#3-S1 SOUTH (0mm to 2300mm)



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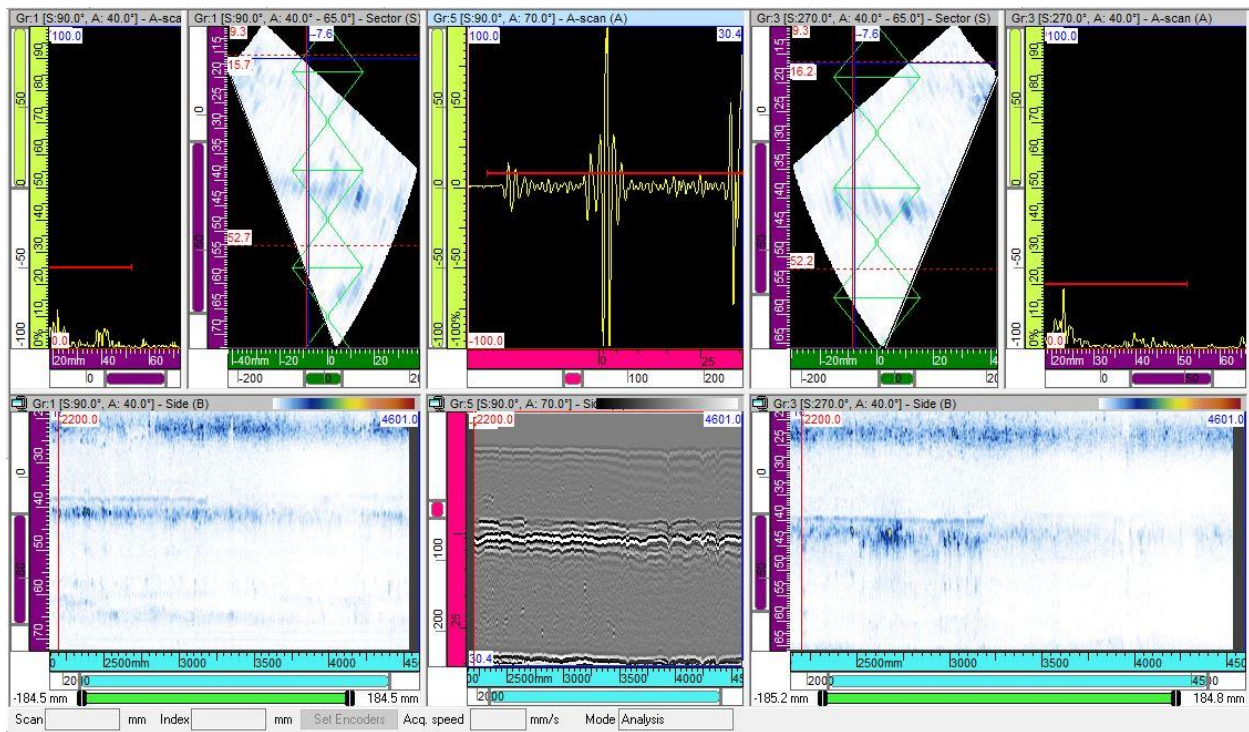


Figure 16: CS#3-S2 SOUTH (2200mm to 4600mm)

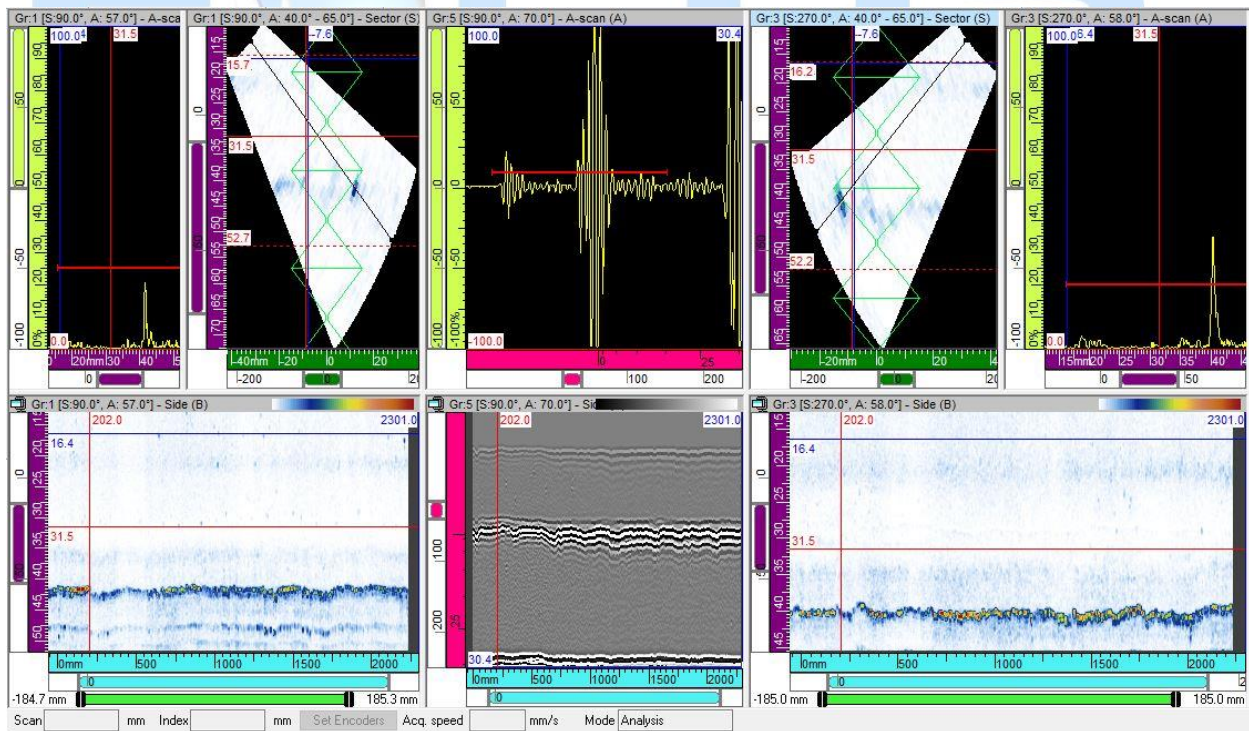


Figure 17: CS#4-S1 NORTH (0mm to 2300mm)



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## PAUT-TOFD ULTRASONIC REPORT

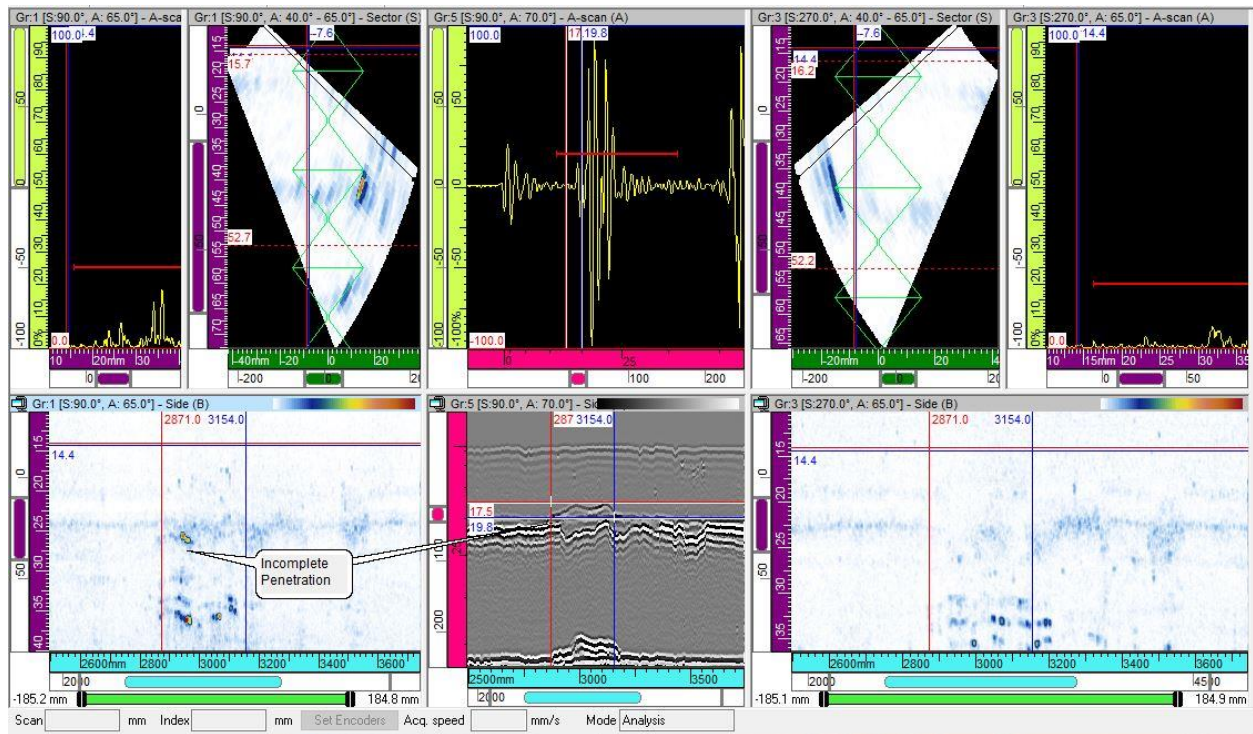


Figure 18: CS#4-S2 NORTH (2200mm to 4600mm)

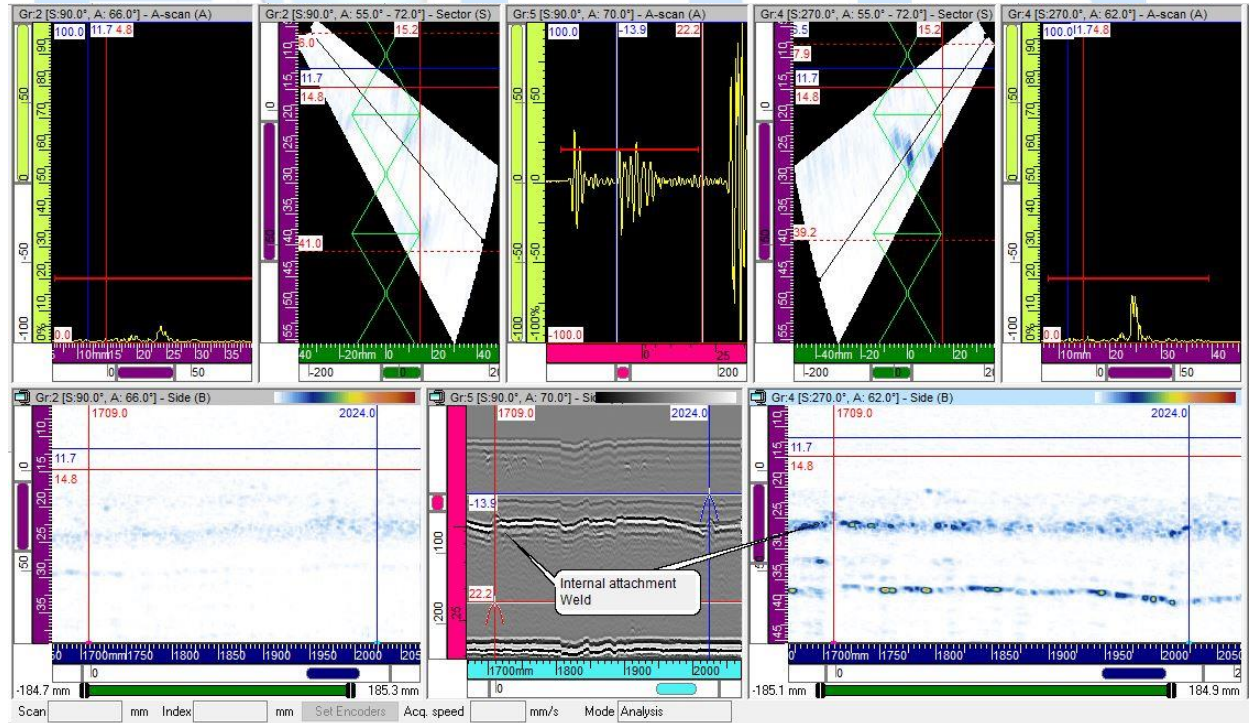


Figure 18: CS#5-S1NORTH (0mm to 2300mm)



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## PAUT-TOFD ULTRASONIC REPORT

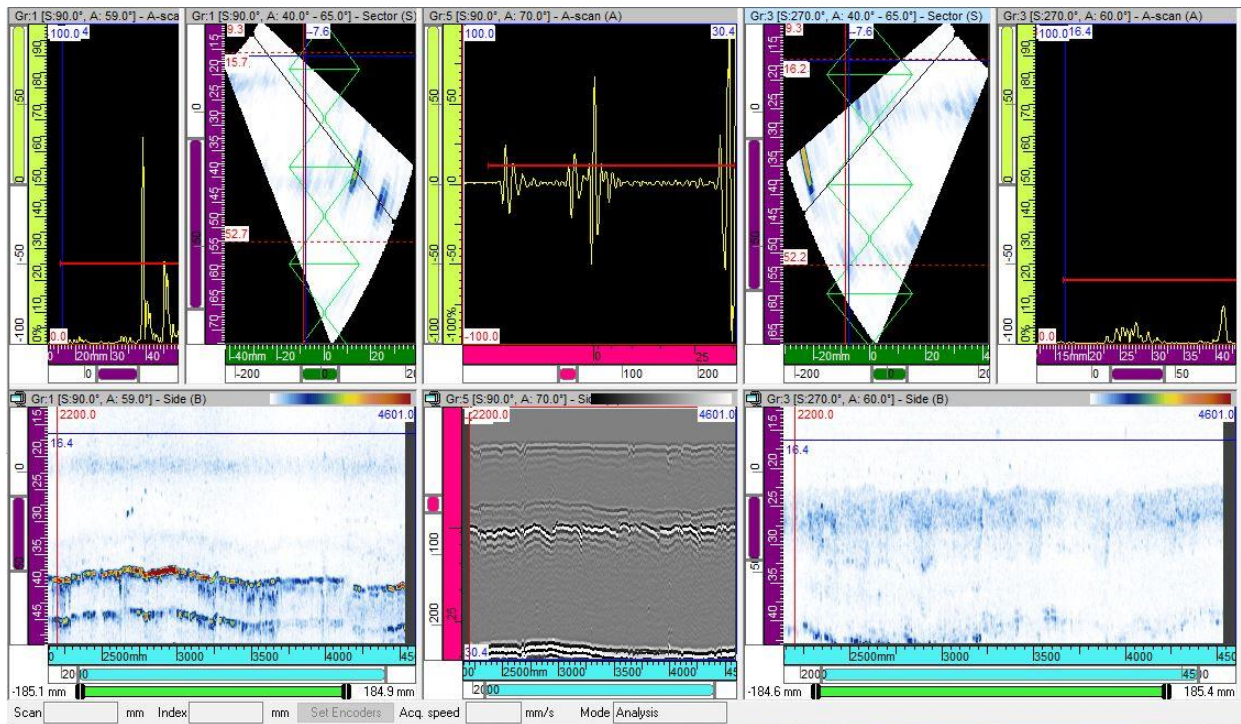


Figure 19: CS#5-S2 NORTH (2200mm to 4600mm)

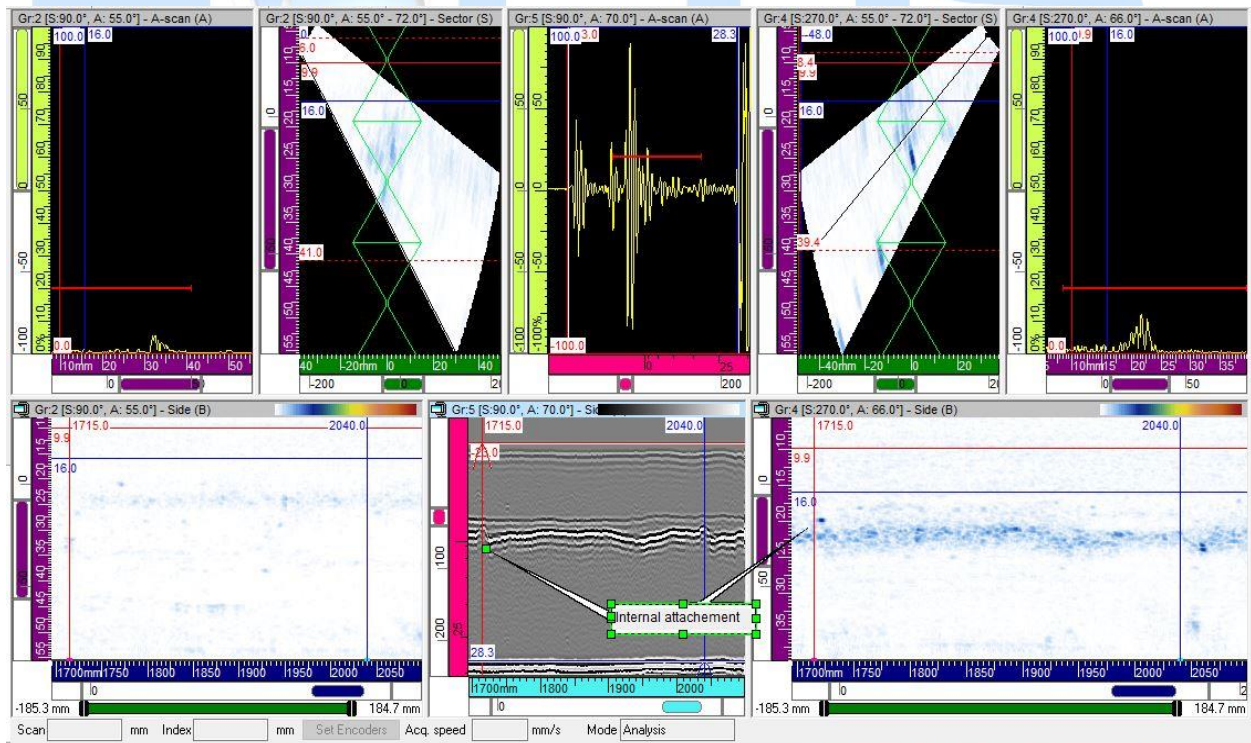


Figure 20: CS#5-S1 SOUTH (0mm to 2300mm)

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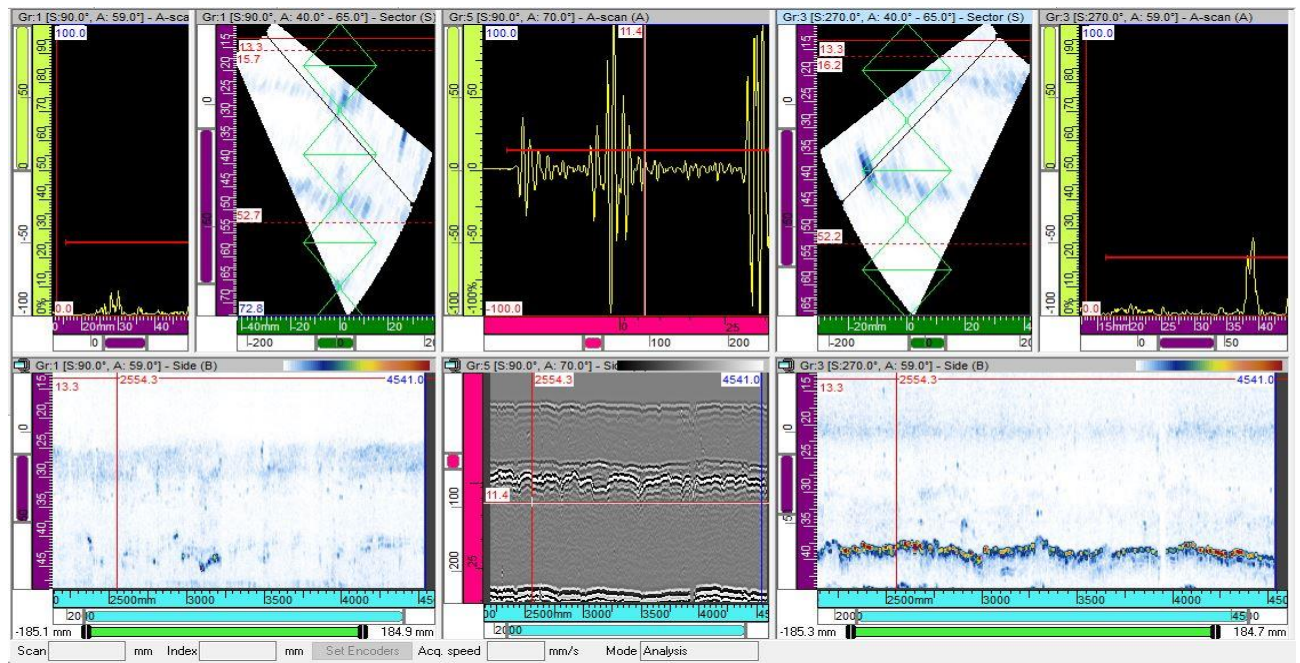


Figure 21: CS#5-S2 SOUTH (2200mm to 4600mm)

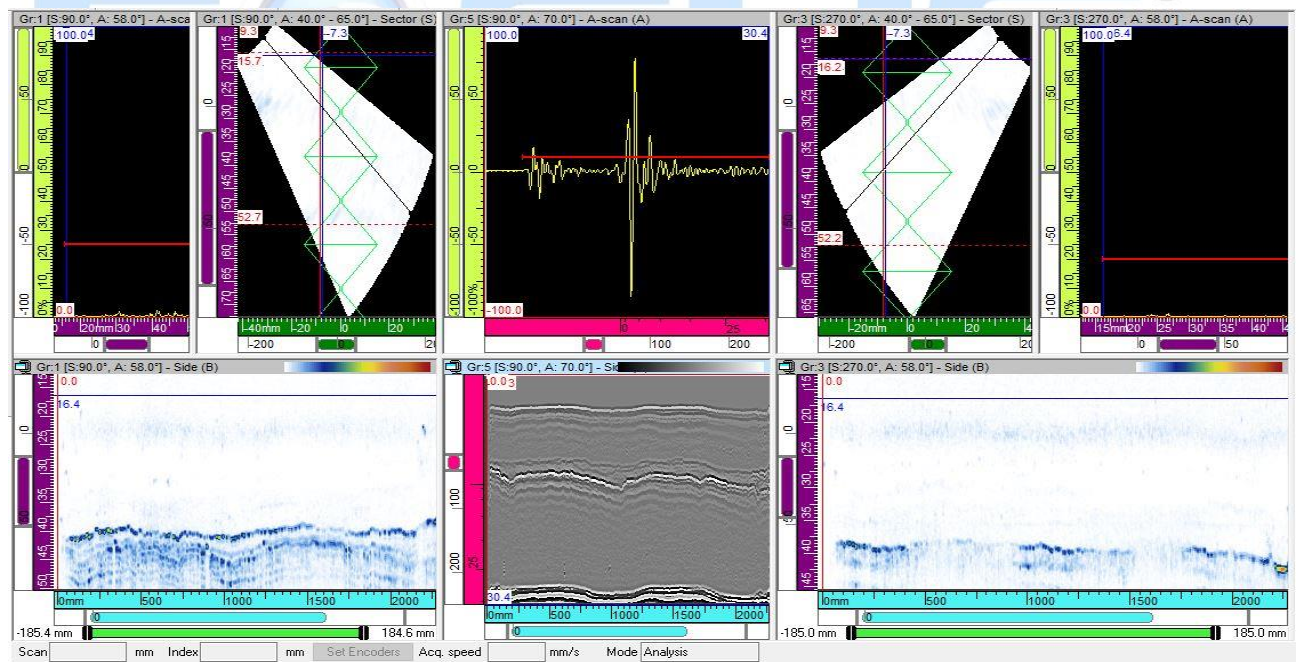


Figure 22: LS#1-Scan1 (0mm to 1600mm)



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## PAUT-TOFD ULTRASONIC REPORT

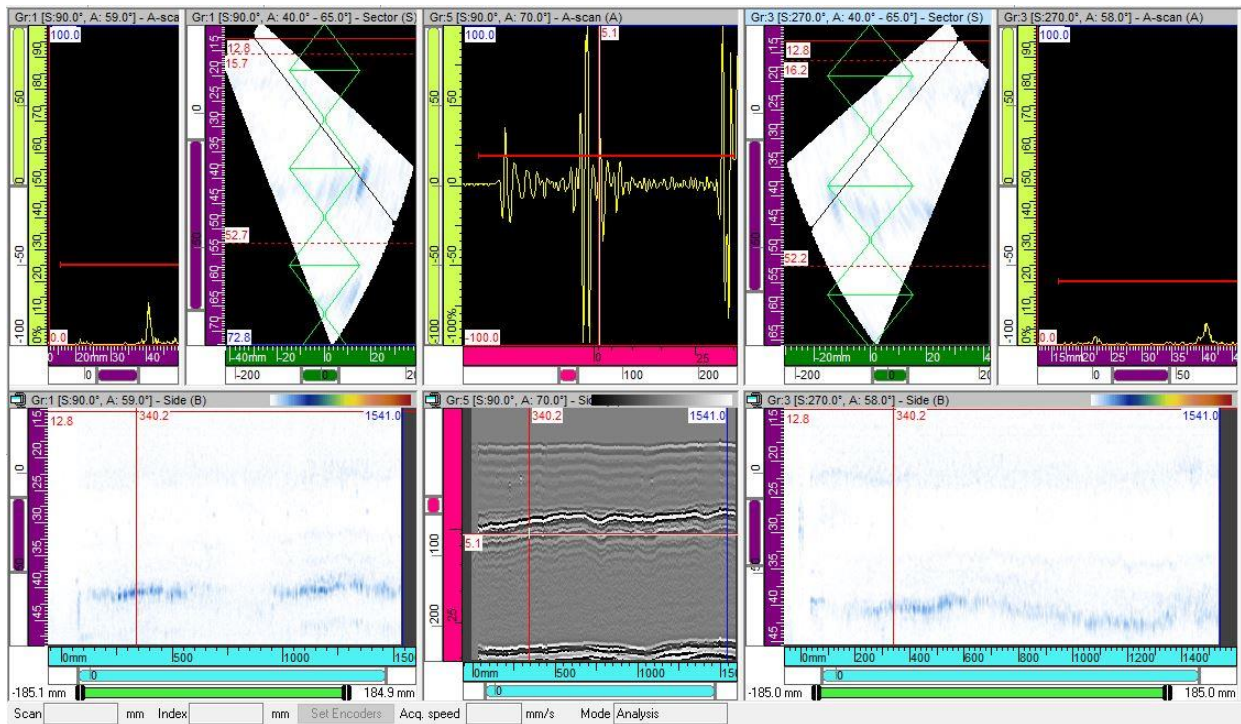


Figure 23: LS#2-Scan1 (0mm to 1600mm)

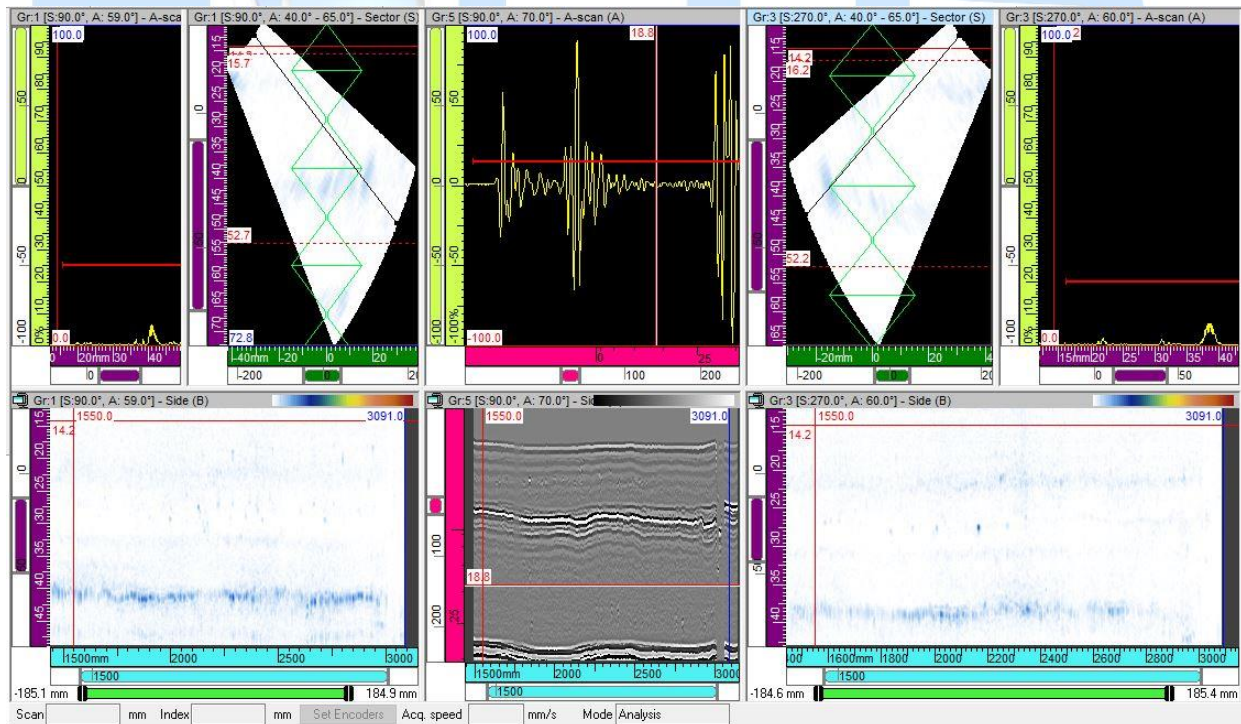


Figure 24: LS#2-Scan2 (1500mm to 3100mm)

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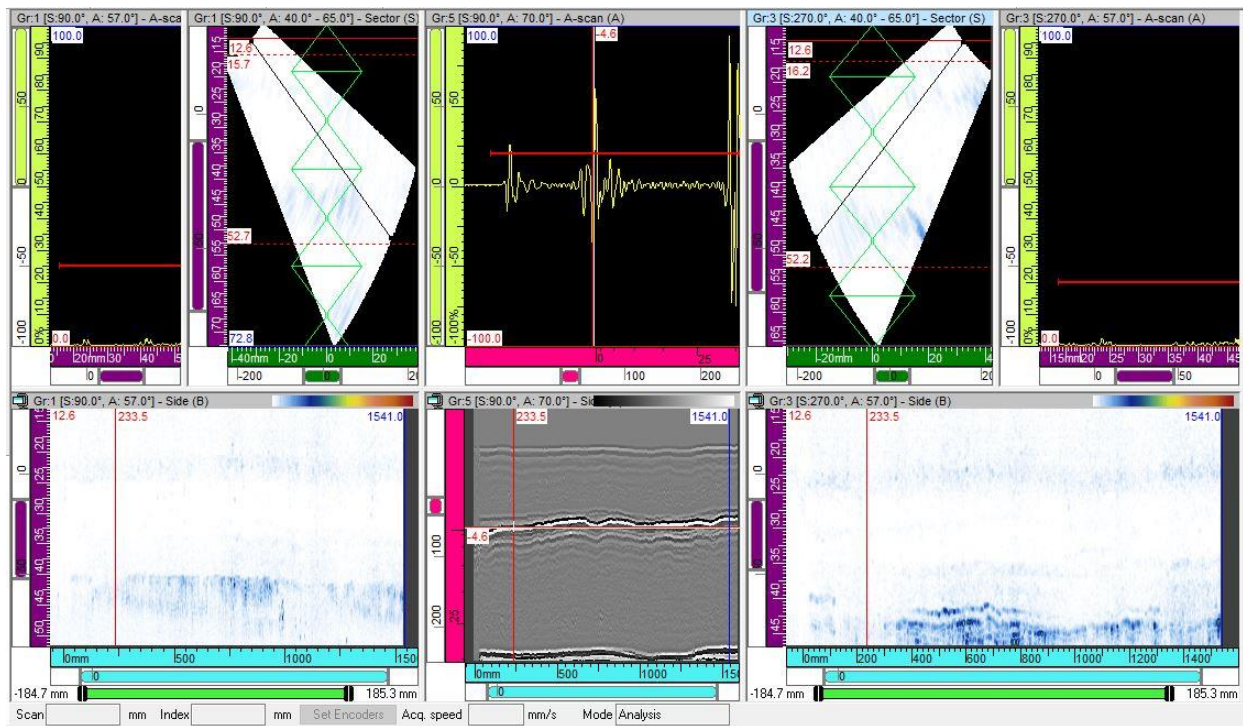


Figure 25: LS#3-Scan1 (0mm to 1600mm)

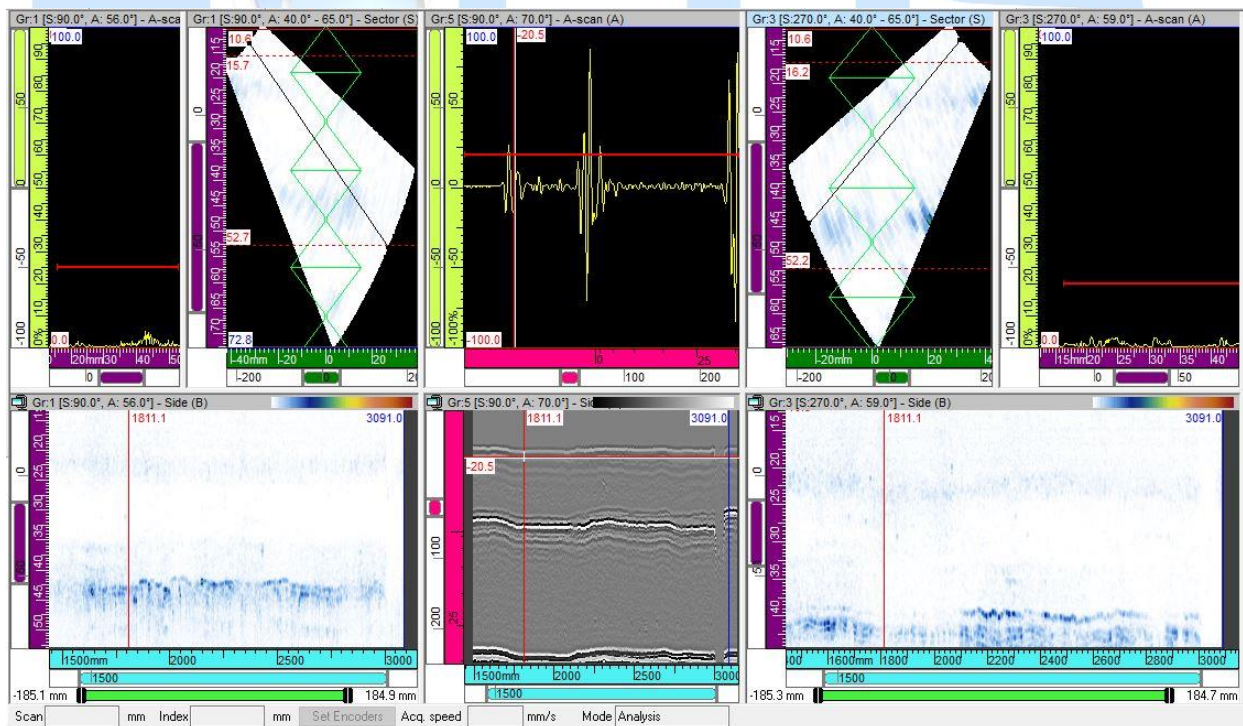


Figure 26: LS#3-Scan2 (1500mm to 3100mm)



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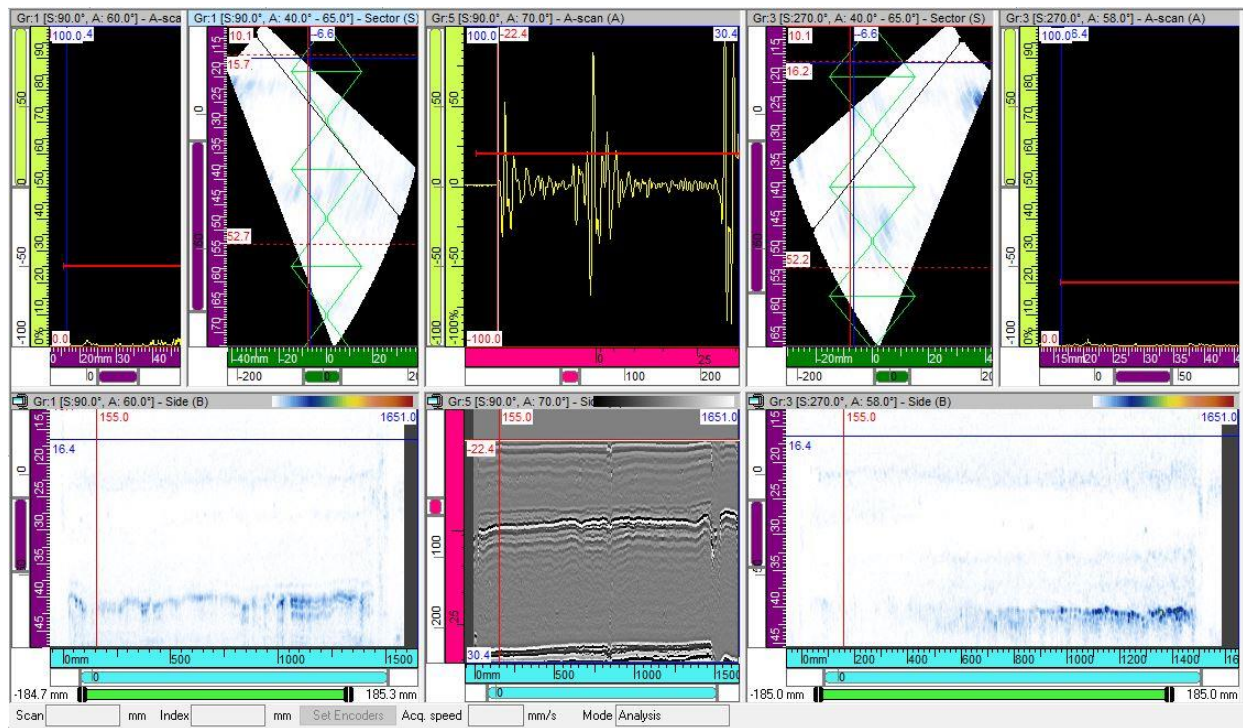


Figure 39: LS#4-Scan1 (0mm to 1600mm)