

8th PINC Meeting
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Proposed CRDM and BMI Mockups using NA 2 Nozzle 31 Results

by

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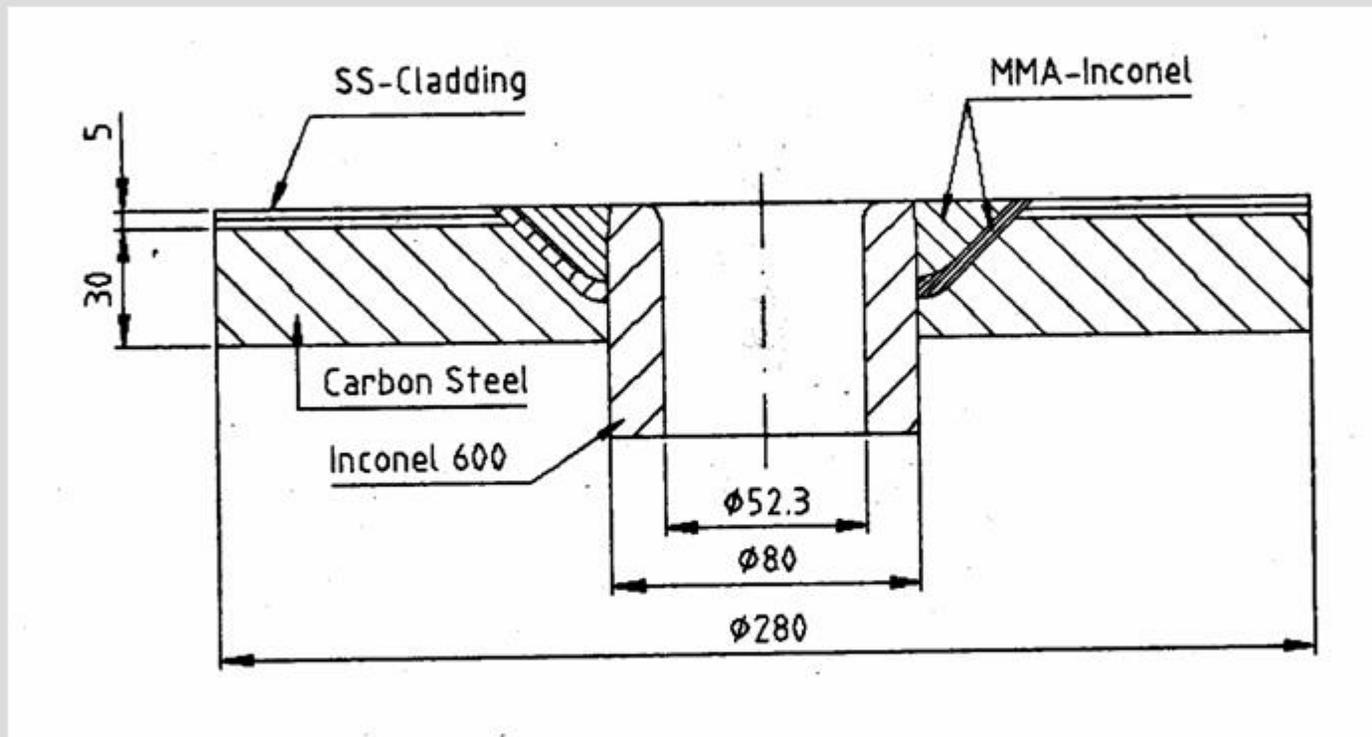
Proposed CRDM and BMI Mockups **Presentation Outline**

- ▶ Eddy Current Tests
 - Wetted surface of seal weld
- ▶ Existing Test Blocks
 - Design drawings
 - Crack distributions
- ▶ New Test Blocks
- ▶ Crack Types
 - Comparison to NA 2 Results
- ▶ Schedule

Proposed CRDM and BMI Mockups For Use in **Eddy Current Tests**

- ▶ All cracks in the surface of the Seal Weld or Buttering
- ▶ Manufactured cracks selected to cover realistic eddy current response range.
- ▶ Eddy current responses from cracks in NA 2 nozzle are now available
- ▶ Response from manufactured cracks are being discussed with vendors

Proposed CRDM and BMI Mockups Existing Test Blocks



- ▶ Design drawing shows how test block is made
- ▶ Cracks are distributed in the surface of the weld metal

Proposed CRDM and BMI Mockups Existing Test Blocks (cont.)

Table 3.2 All cracks in the PINC CRDM test blocks

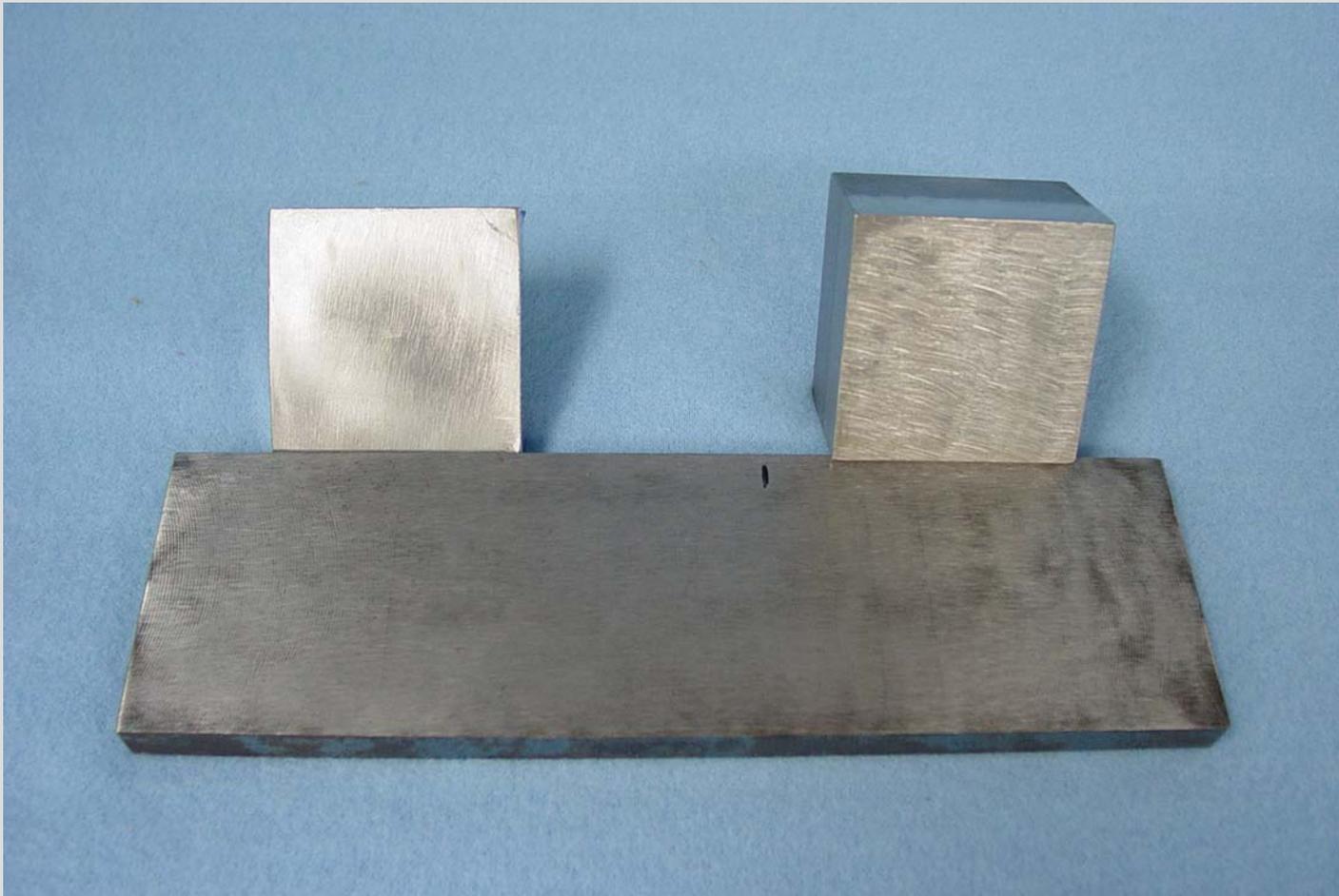
Crack Size Range	Number of Cracks Available
1-9% through-wall	9
10-30% through-wall	8
31-60% through-wall	10
61-100% through-wall	2

Table 3.3 All cracks in the PINC BMI Test Blocks

Crack Size Range	Number of Cracks Available
1-9% through-wall	10
10-30% through-wall	9
31-60% through-wall	6
61-100% through-wall	5

Proposed CRDM and BMI Mockups **New Test Blocks**

- ▶ Alloy 182 Coupons (TFC, WSC, SCC)



Proposed CRDM and BMI Mockups **New Test Blocks**

- ▶ Alloy 182 Coupons
- ▶ WNP-1 BMI Nozzle Penetrations
- ▶ WNP-1 CRDM Nozzle Penetrations

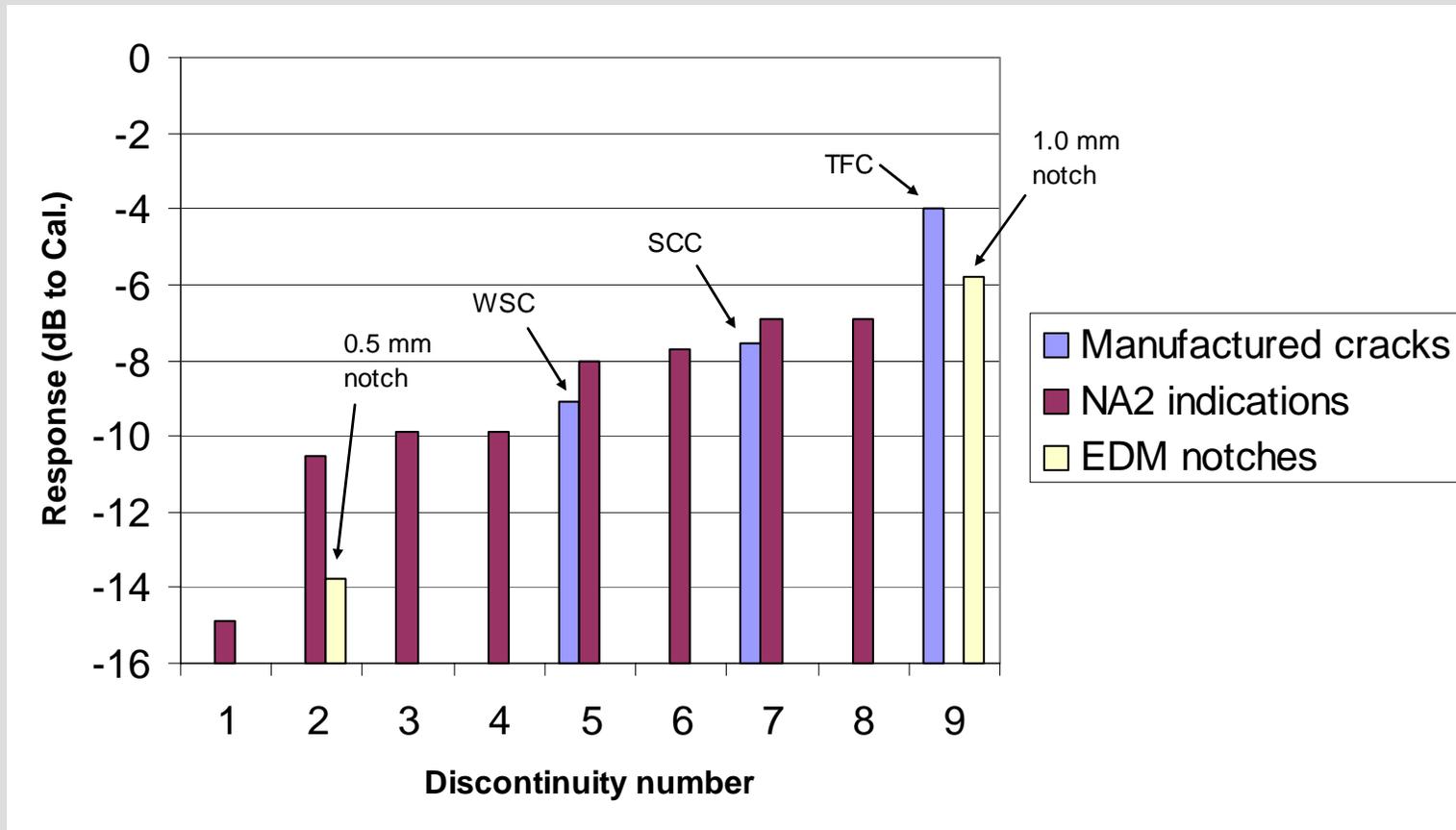


Proposed CRDM and BMI Mockups

Crack Types

- ▶ Laboratory grown SCC: available in Alloy 182 coupons only
- ▶ Weld solidification cracks: install in WNP-1 weldments. Realistic responses.
- ▶ Thermal fatigue cracks: install in WNP-1 weldments. Strong responses. Working with the vendor on this issue.
- ▶ Responses Distribution from NA2 nozzle 31 cracks documented for use in manufacturing cracks

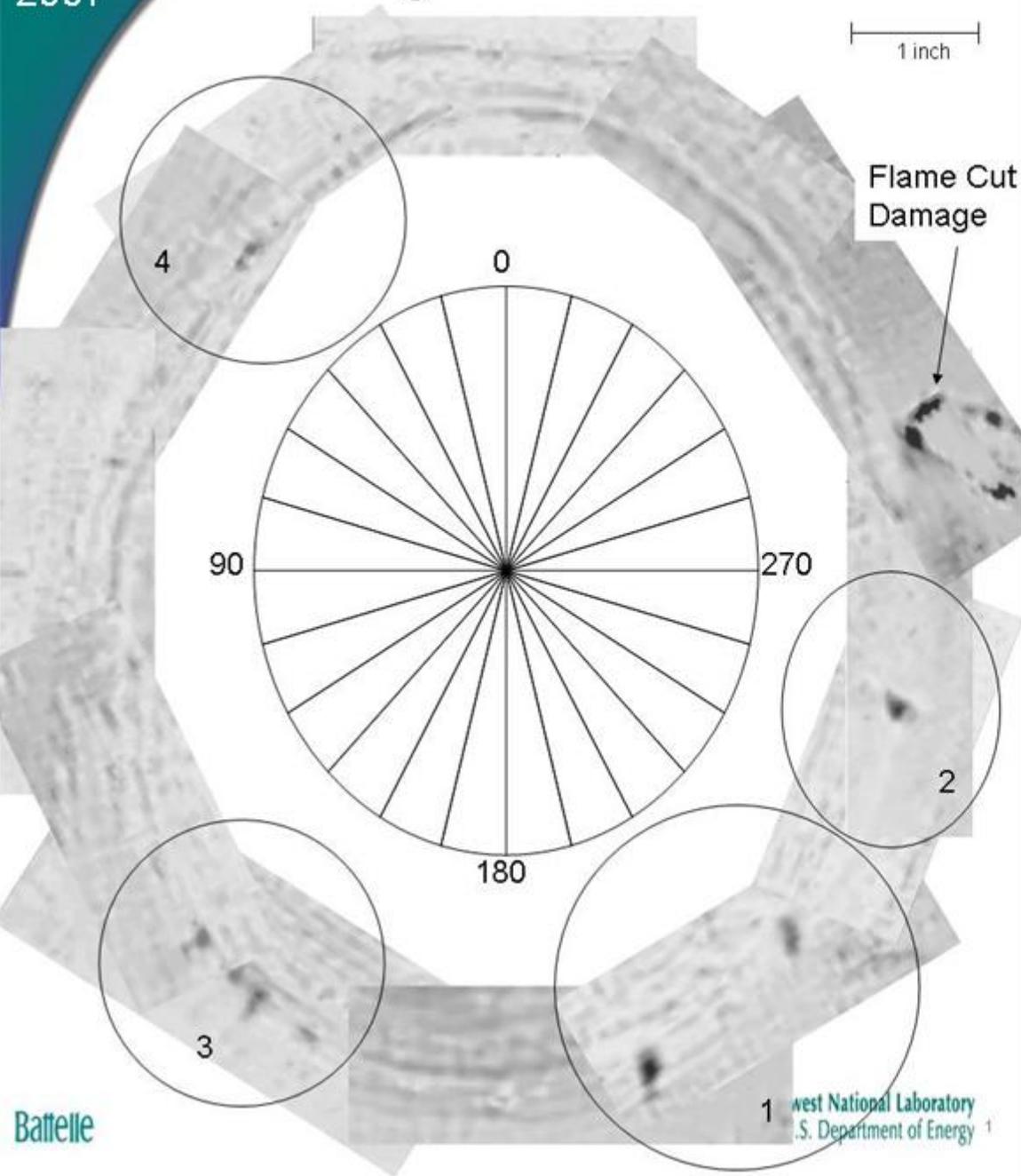
Proposed CRDM and BMI Mockups Crack Types (Cont.)



PWSCC in NA2 Nozzle NDE and DE Report

- ▶ Visual Testing Completed
- ▶ Penetrant Testing Completed
- ▶ Ultrasonic Testing Completed
- ▶ Eddy Current Completed
- ▶ Sectioning Started

Zero Degree Probe Rotation



NDE of PWSCC in NA2 Nozzle

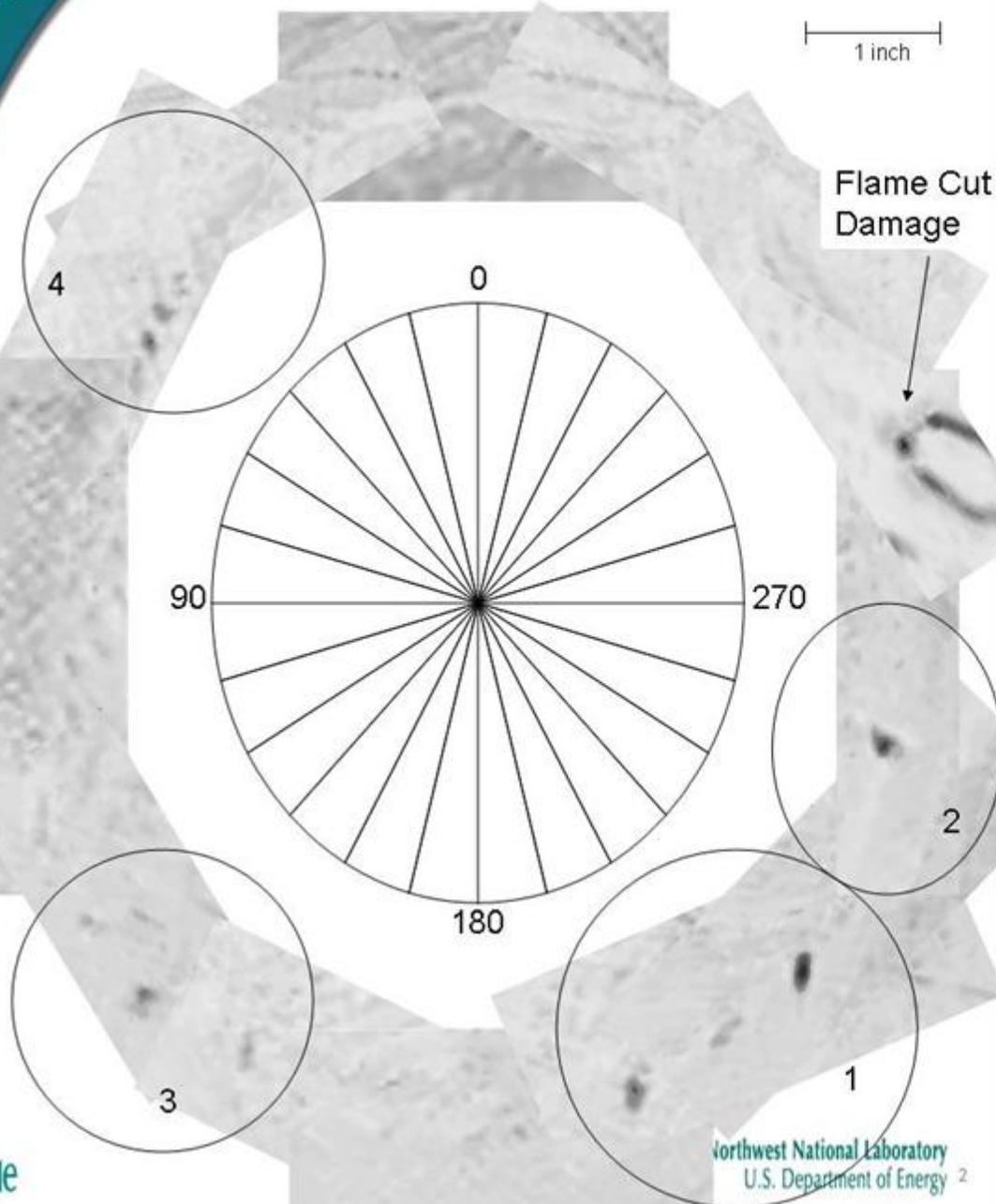
Eddy Current Responses

- ▶ Plus point probe
- ▶ 350 KHz
- ▶ Zero degree probe rotation

45 Degree Probe Rotation

1 inch

Flame Cut
Damage

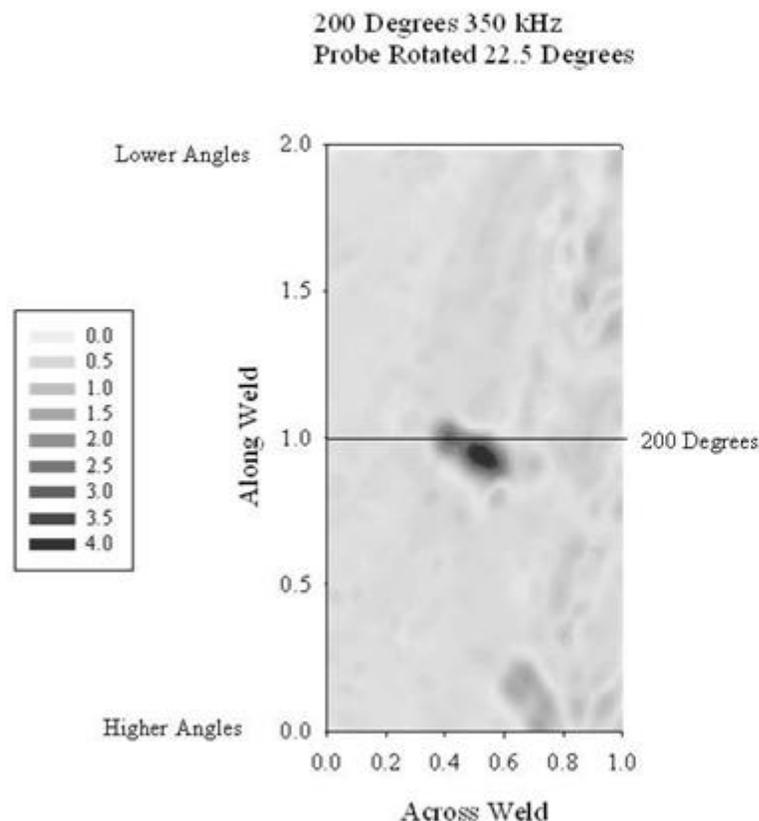


**NDE of PWSCC in NA2
Nozzle**

Eddy Current Responses

- ▶ Plus point probe
- ▶ 350 KHz
- ▶ 45 degree probe rotation

Indication at 200 degrees
Confirmed with PT
Highest voltage response is 4.6 V
Indication is 7 mm long



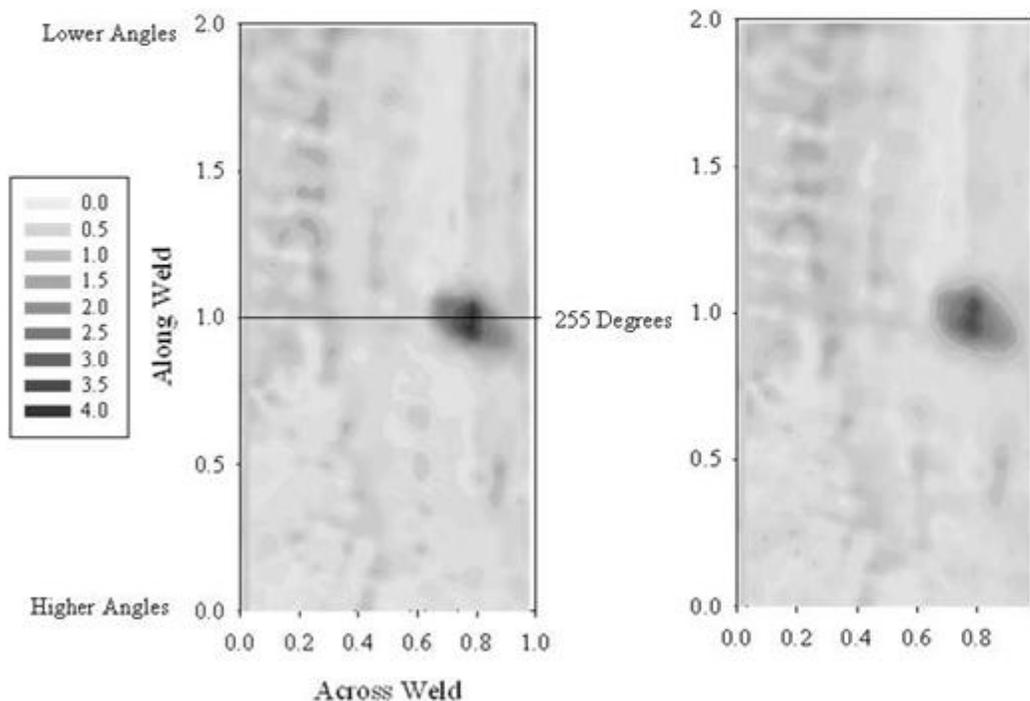
NDE of PWSCC in NA2 Nozzle Eddy Current Responses

- ▶ Plus point probe
- ▶ 350 KHz
- ▶ Indication at 200 degrees
- ▶ Confirmed with PT and VT

Indication at 255 degrees
No PT indication
Highest voltage response is 4.2 V
Indication is 8 mm long

255 Degrees 350 kHz
Zero Probe Rotation

150 kHz

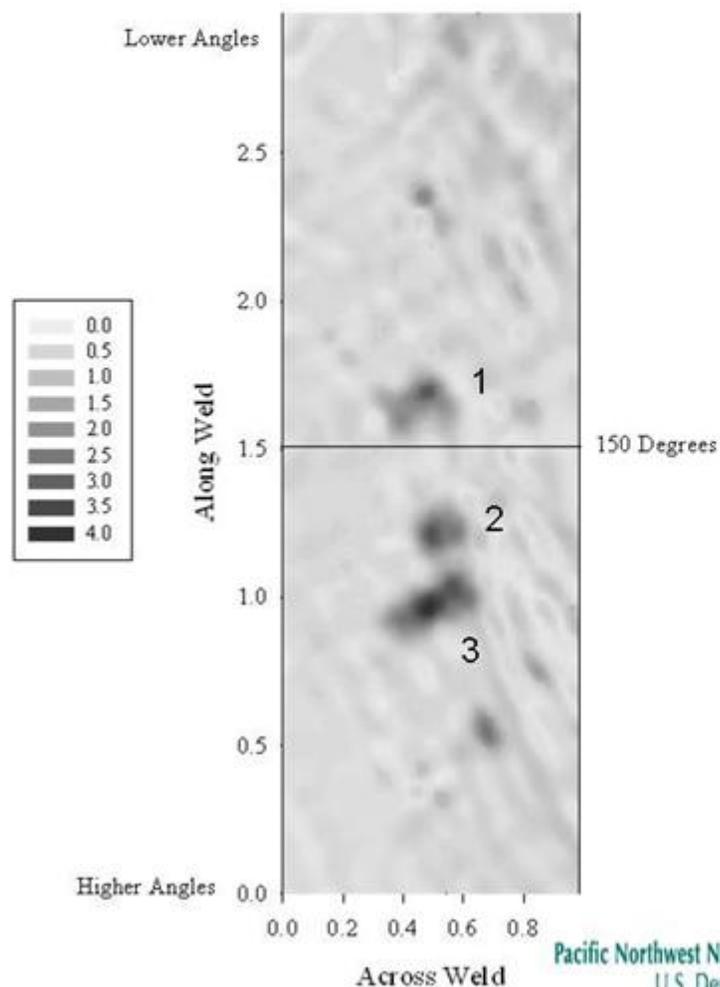


NDE of PWSCC in NA2 Nozzle Eddy Current Responses

- ▶ Plus point probe
- ▶ 350 and 150 KHz
- ▶ Indication at 255 degrees
- ▶ No PT indication

Indications near 150 degrees
No PT indications
Indication 1: Max 3.1 Volts, 5 mm long
Indication 2: Max 3.3 V, 4 mm long
Indication 3: Max 4.1 V, 8 mm long

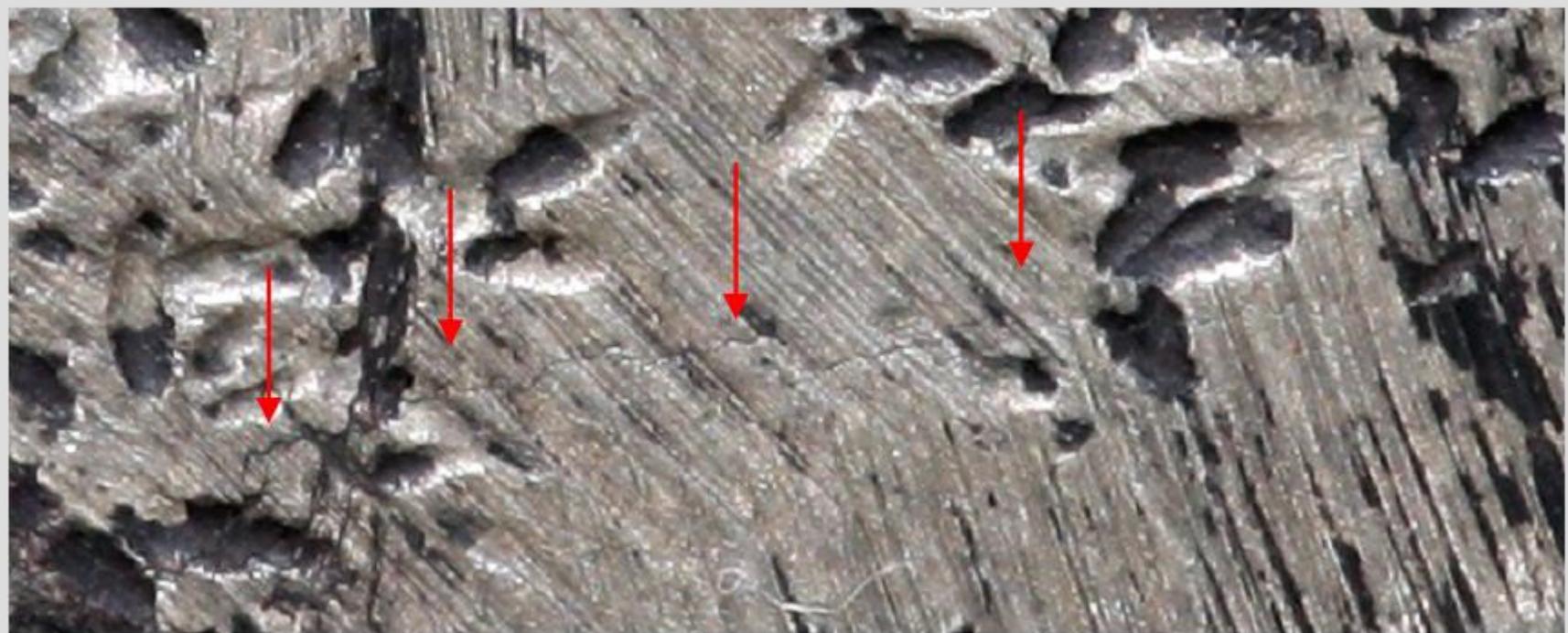
150 Degrees 350 kHz
Probe rotated 45 Degrees



NDE of PWSCC in NA2 Nozzle Eddy Current Responses

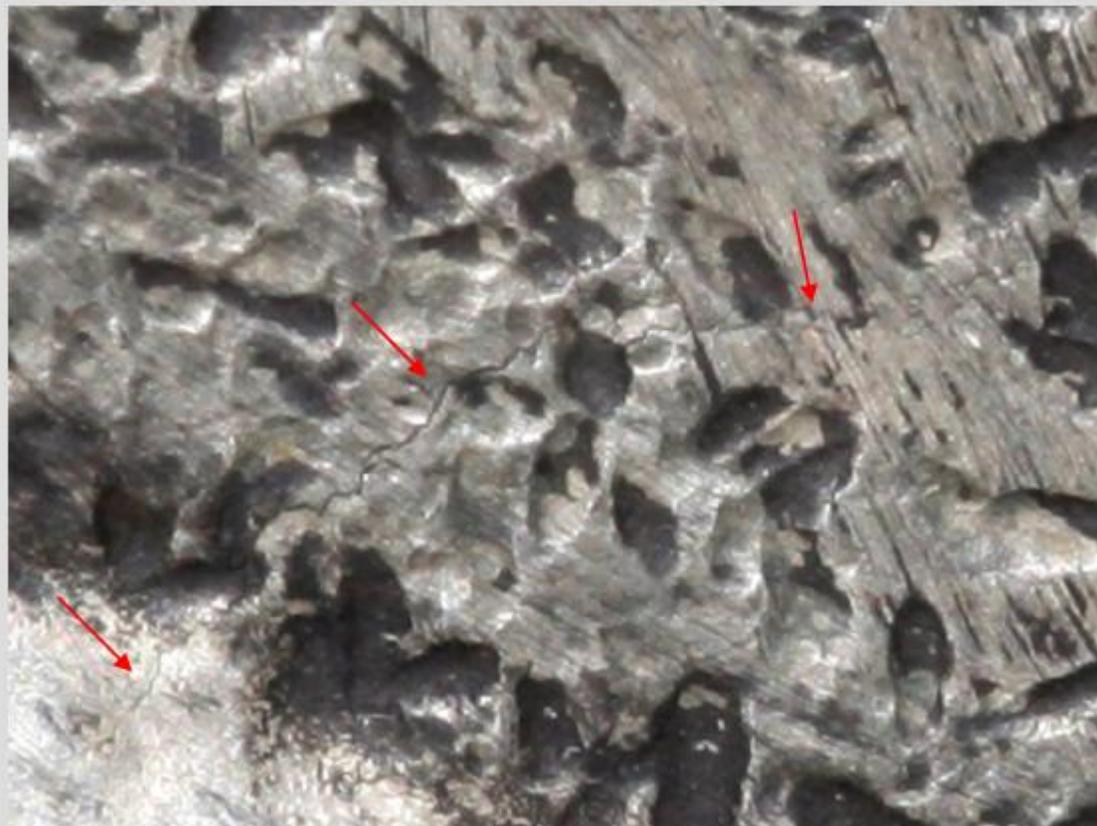
- ▶ Plus point probe
- ▶ 350 KHz
- ▶ No PT indication

NDE of PWSCC in NA2 Nozzle Visual Testing Images Flaw at 200 Degrees



► Flaw is approximately 4 mm long

NDE of PWSCC in NA2 Nozzle Visual Testing Images Flaw at 225 Degrees



- ▶ Flaw is approximately 4 mm long

NDE of PWSCC in NA2 Nozzle Preliminary Sectioning Results

Section #1



Section #2

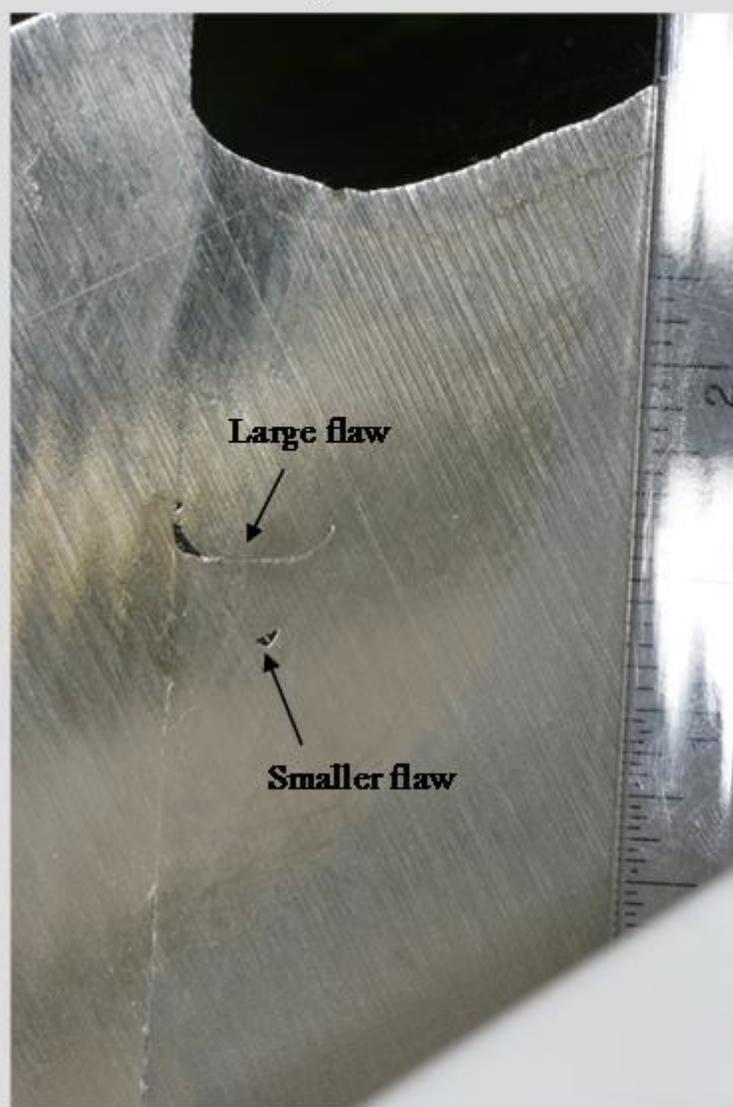


Section #3



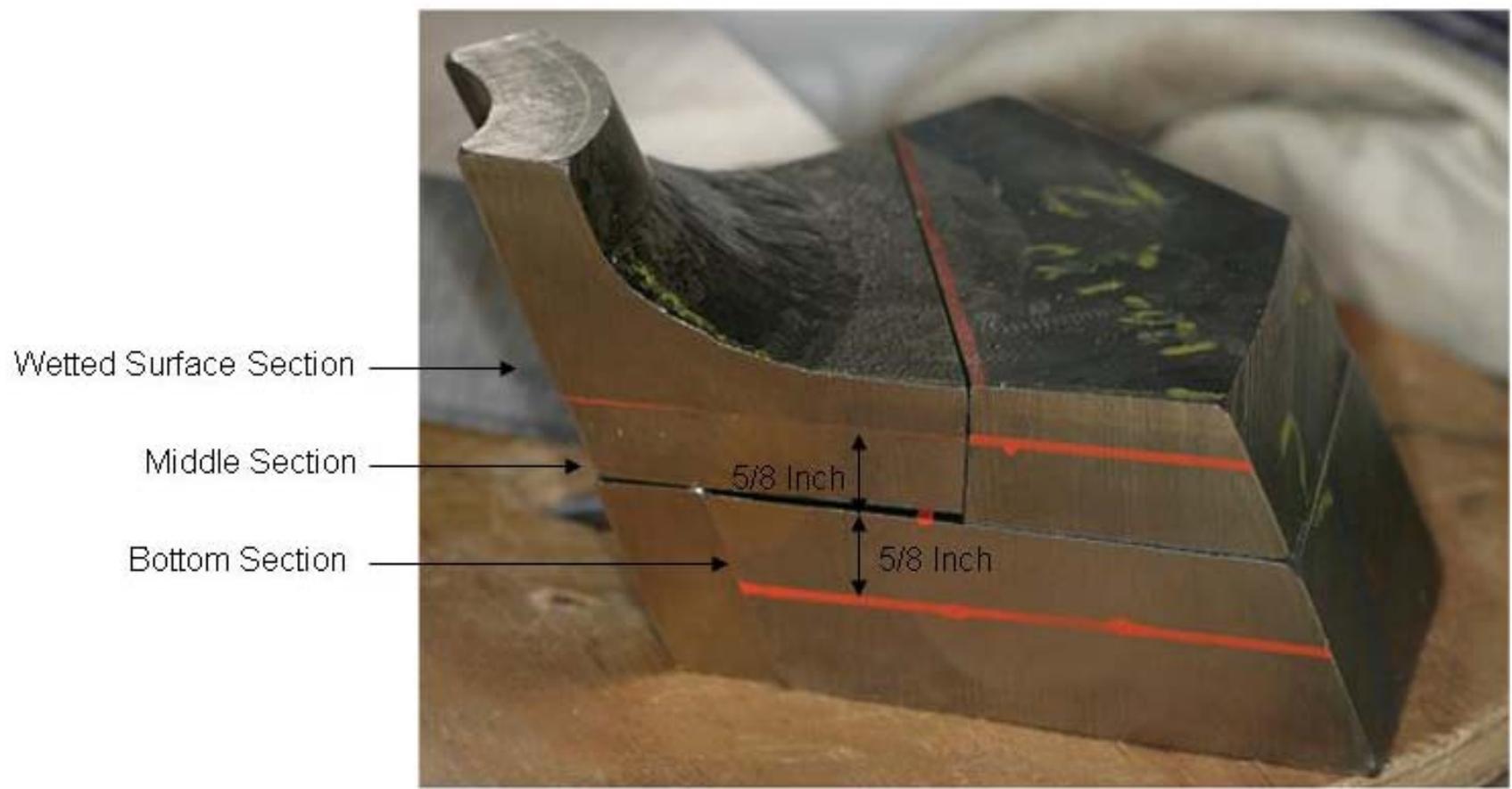
NDE of PWSCC in NA2 Nozzle Preliminary Sectioning Results (cont.)

15 Degree Face



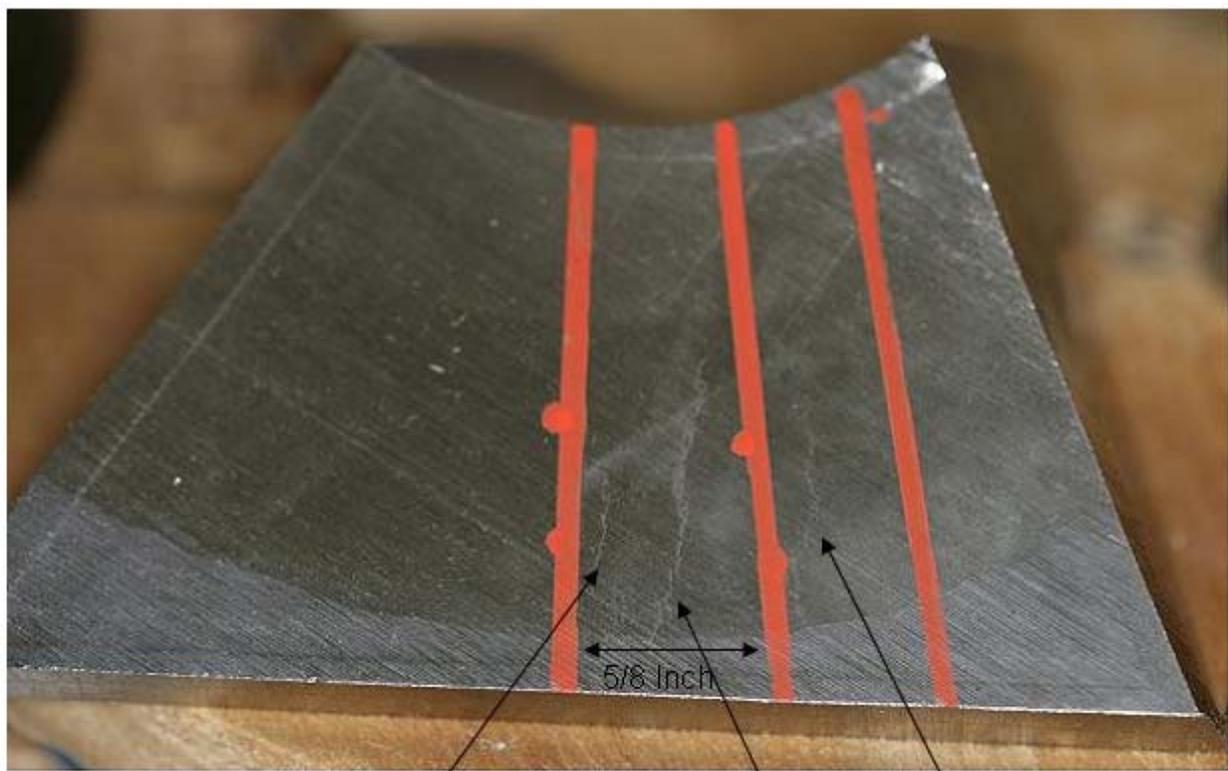
- ▶ Ultrasonic indication was recorded from inside tube
- ▶ Cut was made through ultrasonic indication
- ▶ Indication was in fusion zone of seal weld with tube

NDE of PWSCC in NA2 Nozzle Preliminary Sectioning Results (cont.)



NDE of PWSCC in NA2 Nozzle Preliminary Sectioning Results (cont.)

Wetted Surface Section Dry Side



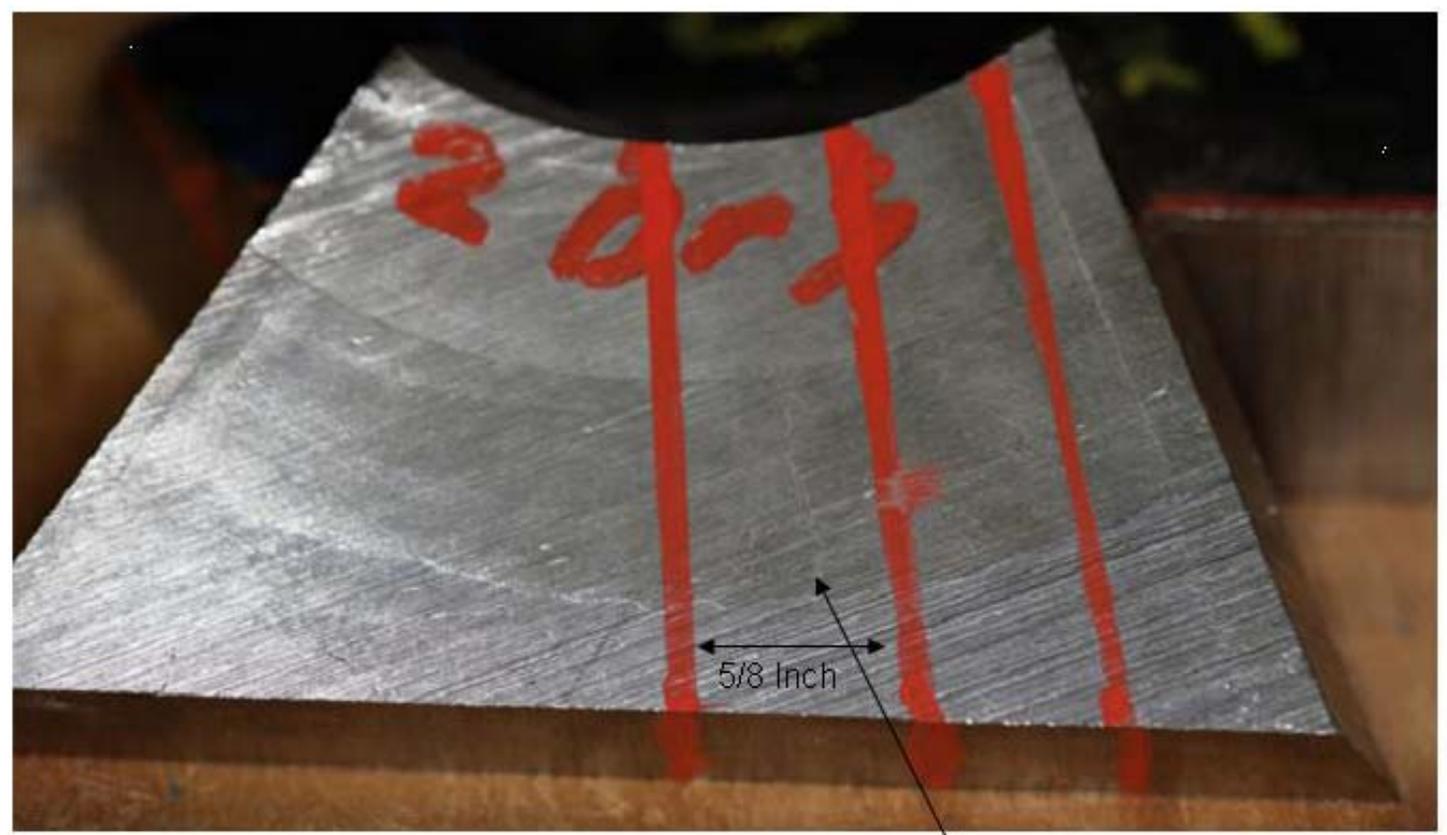
Secondary crack #1

Through-wall crack

Secondary crack #2

NDE of PWSCC in NA2 Nozzle Preliminary Sectioning Results (cont.)

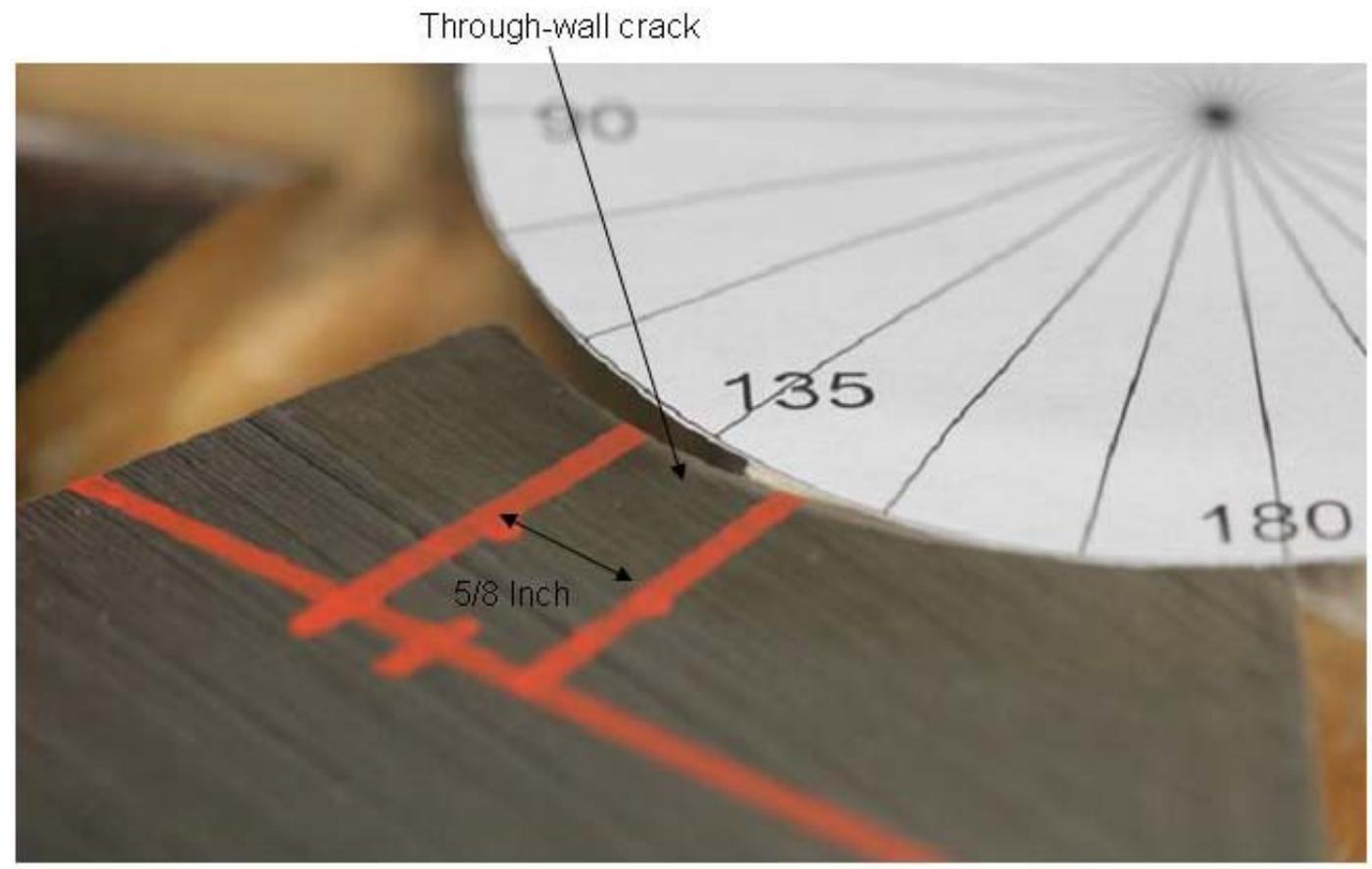
Middle Section Dry Side



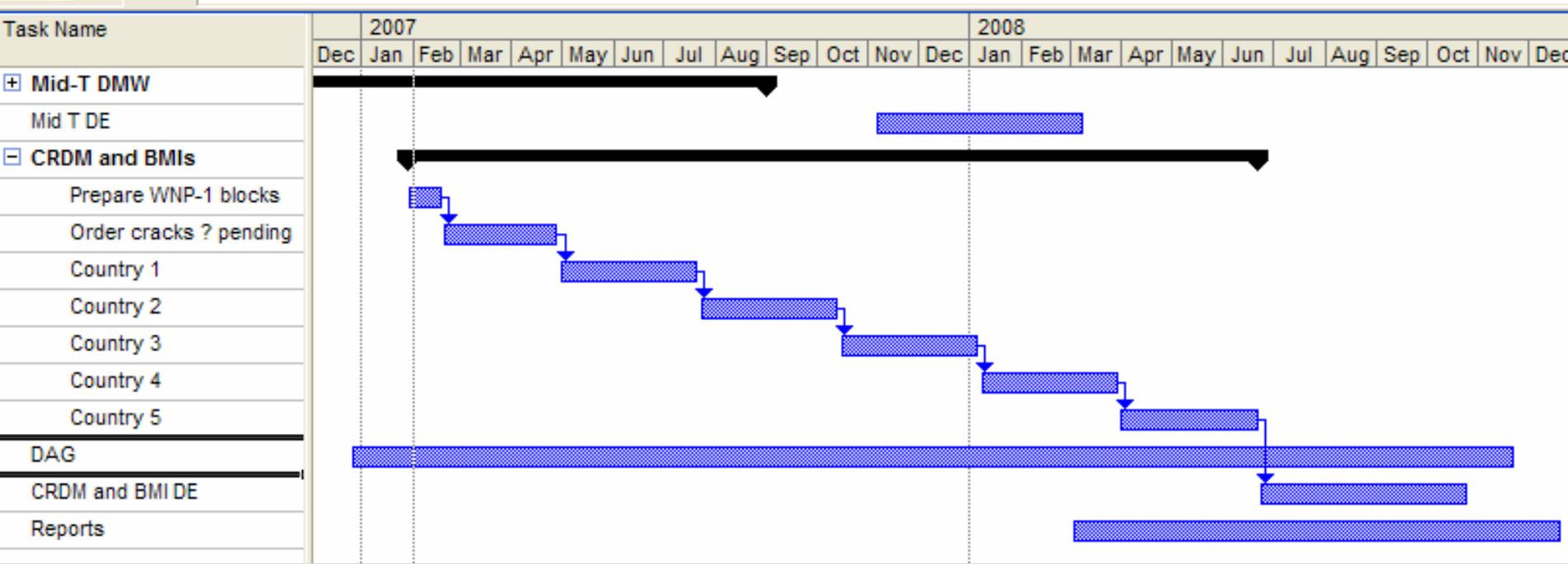
Through-wall crack

NDE of PWSCC in NA2 Nozzle Preliminary Sectioning Results (cont.)

Bottom Section Wet Side



Proposed Schedule for PINC RRT



- ▶ Team schedule for Mid-T RRT discussed later
- ▶ Crack manufacture time being negotiated