GUWT for Integrity Management

Pipeline R &D Forum

Larry Weigel

Structural Integrity Associates, Inc.

Whittier, Ca

(562) 944-8210

lweigel@structint.com

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Our Experience with GWUT

- **Started utilizing technology 2000**

- **Utilized both Teletest and GUL systems**

- **Provided inspection services with Unitek until 2004**

- **Joined Structural Integrity Associates in 2004**

- **Over 40,000 shots on above and below ground piping, 950 miles of piping**

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When we joined SI

The Questions Came Quickly:

What can it detect? What will it not detect?

- **How can it be used in a integrity management process?**

- **How can we prioritize the indications?**

- **How well does it measure the depth and axial length of metal loss?**

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Over time the answers became apparent

- **Developed software models to estimate flaw size and predict detectable feature sizes**

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Example of expected detectable flaw sizes

16-inch x 0.281-inch Pipe GScan Flaw Detection Limits at Indicated % Sensitivity

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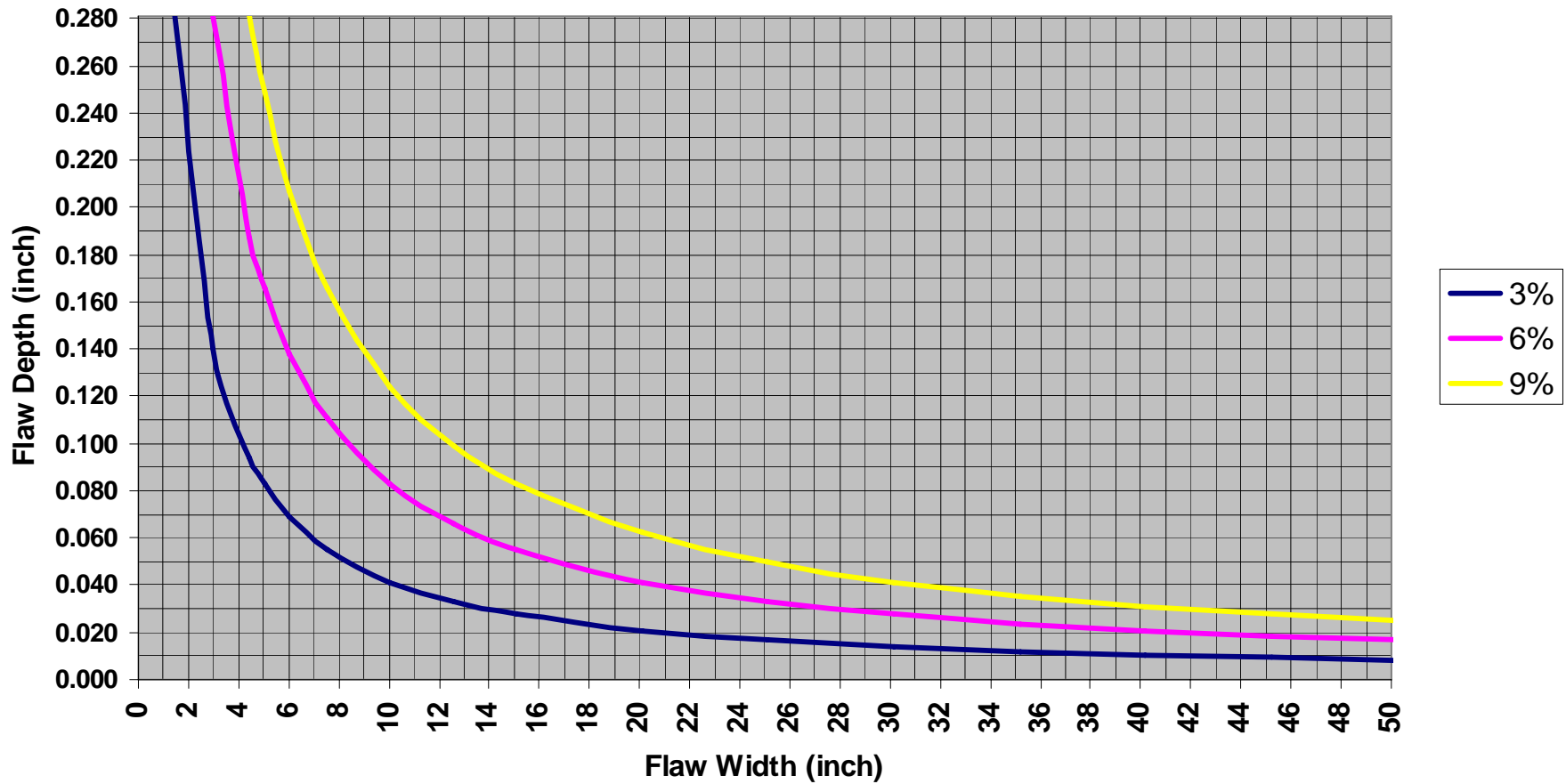
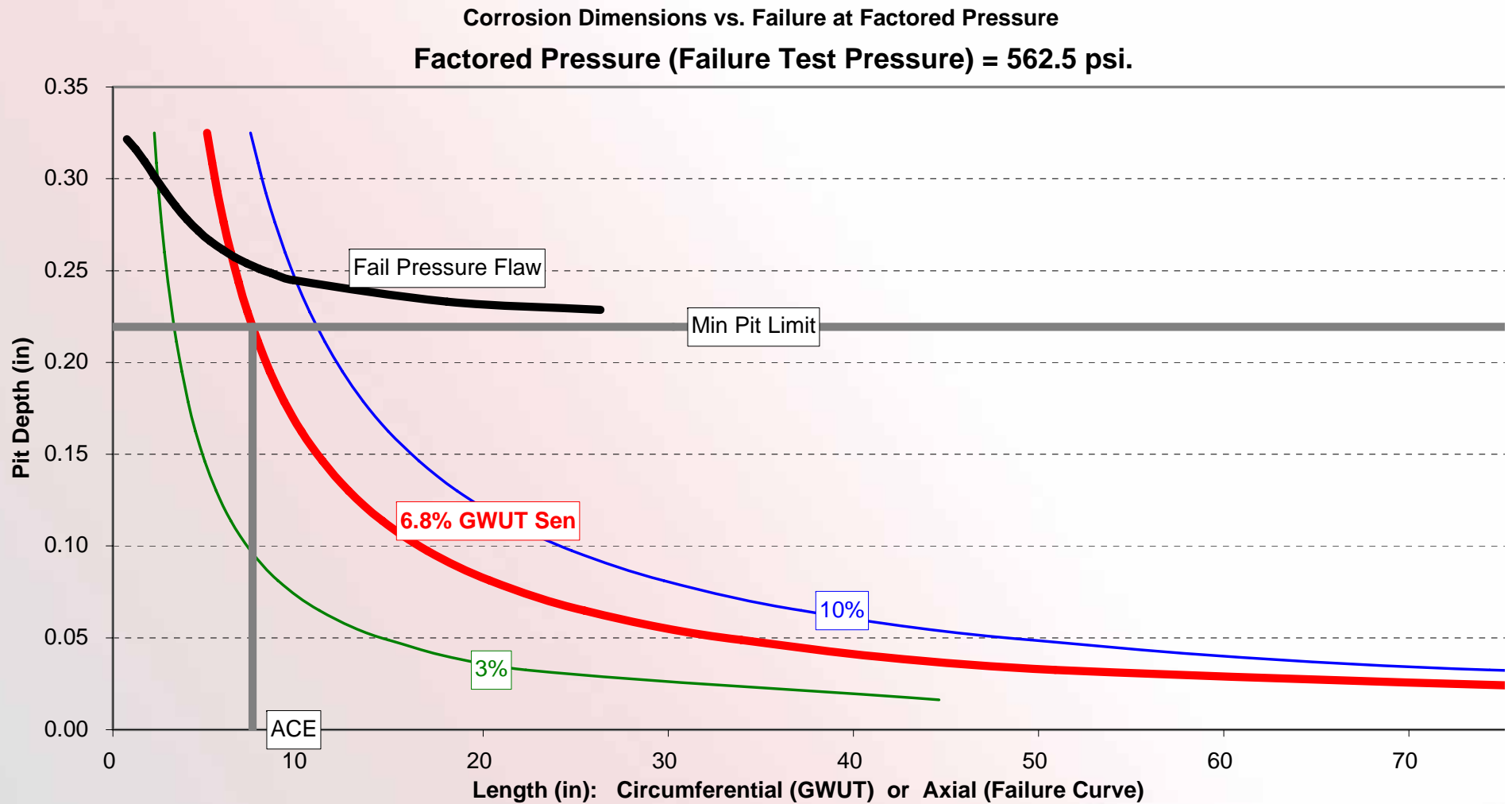| Feature	Location	Size (mV)	ECL	Extent	Class	Notes
+F1	2'5"	2.93	-	40	Flange	
-F1	-4'0"	6.94	60	70	Medium	100% Circ. Affected 1/2" length
-F2	-6'9"	2.22	24	30	Severe	30%Circ. Affected Estimated 80% Wall Loss, 1" length
-F3	-8'7"	1.33	19	60	Medium	50%Circ. Affected Estimated 38% Wall Loss, 2" length
-F4	-9'3"	0.883	-	50	Weld	
-F5	-15'5"	0.634	12	7	Medium	25%Circ. Affected Estimated 48% Wall Loss, 1" length
-F6	-16'5"	0.86	15	45	Medium	40%Circ. Affected Estimated 38% Wall Loss, 2" length
-F7	-20'6"	2.39	32	35	Severe	40%Circ. Affected Estimated 80% Wall Loss, 1 1/2" length
-F8	-21'5"	1.42	-	60	Weld	
-F9	-23'8"	0.857	19	9	Severe	25%Circ. Affected Estimated 76% Wall Loss, 1" length
-F10	-27'0"	11.8	160	80	Medium	100% Circ. Affected 1/2" length
-F11	-31'6"	40	-	90	Flange	
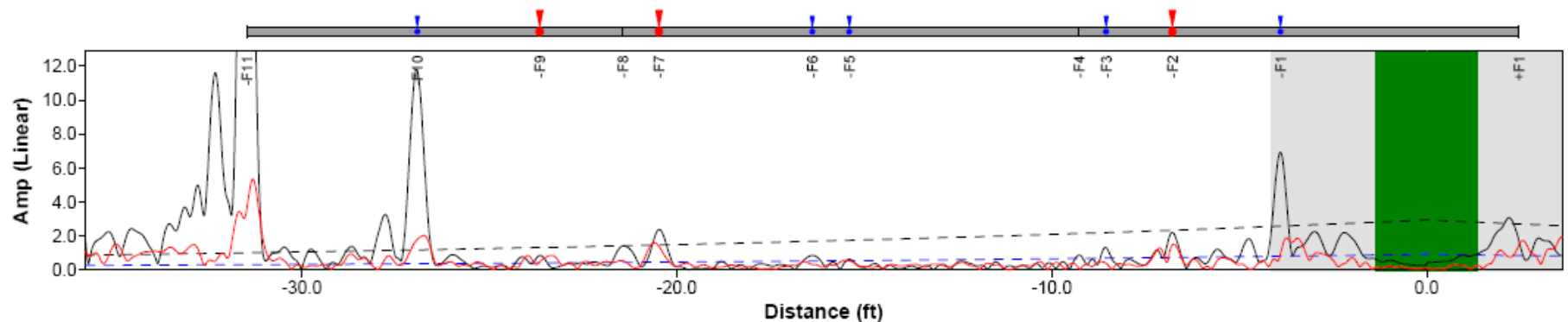
Over time the answers became apparent (cont.)

- **Developed the concept that GWUT is similar to a pressure test AND developed procedures that specify the sensitivity that is needed for pressure test equivalency**

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Example how SI Calculates required sensitivities

ailure Plot

Corrosion Dimensions vs. Failure at Factored Pressure
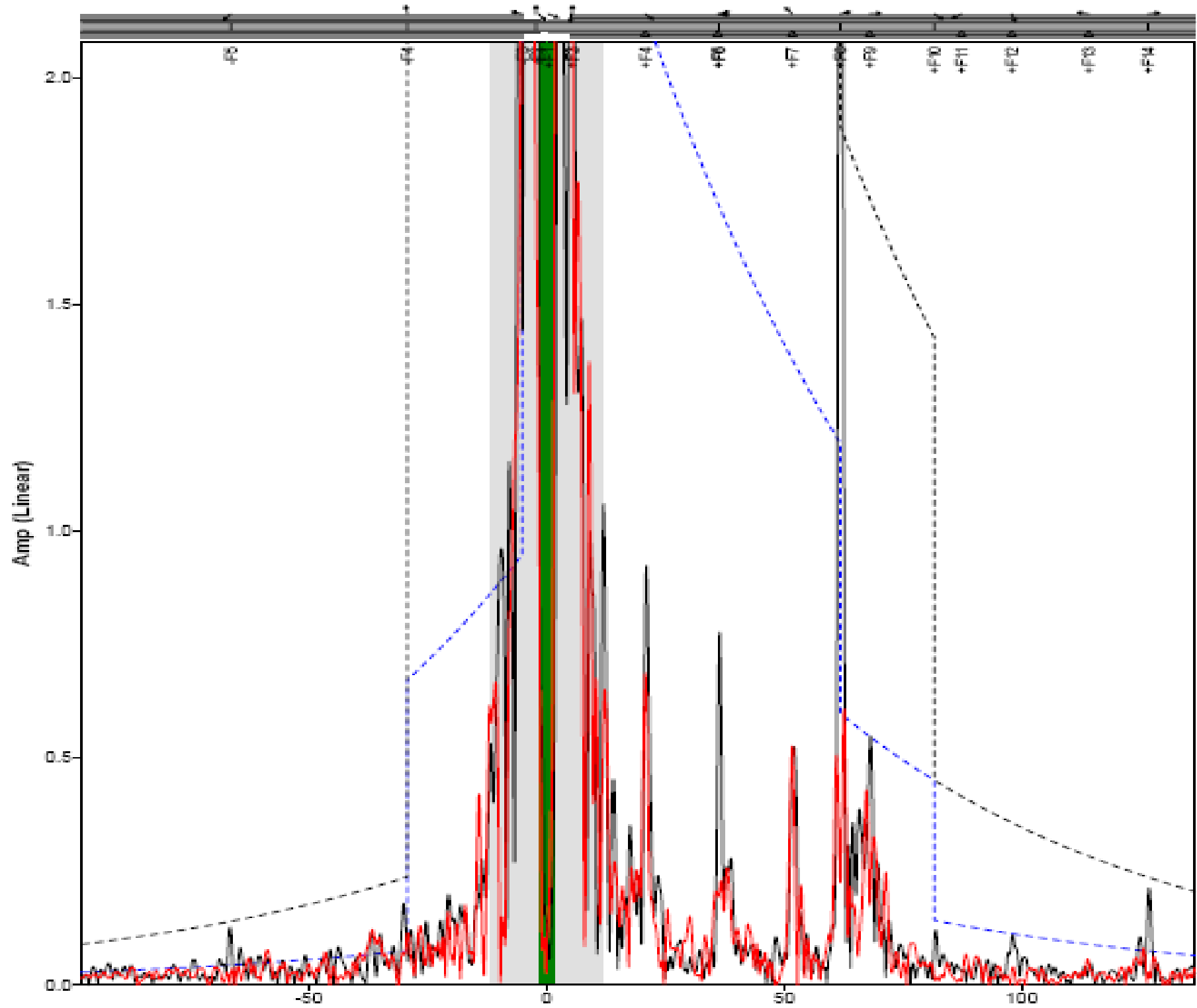
Factored Pressure (Failure Test Pressure) = 562.5 psi.

Over time the answers became apparent (cont.)

- **Developed procedures to measure the sensitivity of the actual shot**

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Over time the answers became apparent (cont.)

- **Have shot numerous test loops**
- **While the test loops are challenging they are not realistic**
  - ♦ **Machined flaws rather than natural**
  - ♦ **Density and physical orientation of flaws**
  - ♦ **Flaws are much smaller than pressure test would detect**
  - ♦ **Intact coating fills or covers external flaws**
  - ♦ **Limited feedback**
  - ♦ **Tend to compare operators instead of establishing GWUT as an equal to pressure testing**

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Going Forward

Challenges we continue to see:

- **Unpredictable Attenuation**

- **Industry understanding of the technology**

- **Qualification of operators**

- **indications**

- **Pattern recognition**

- **Inaccurate or misleading preassessment data**

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Attenuation

Conduct research on the measurement and reduction of attenuation

- **Attenuation measurements on coatings, soils and corrosion damage**

- **Research on new technology approaches i.e. Through Transmission**
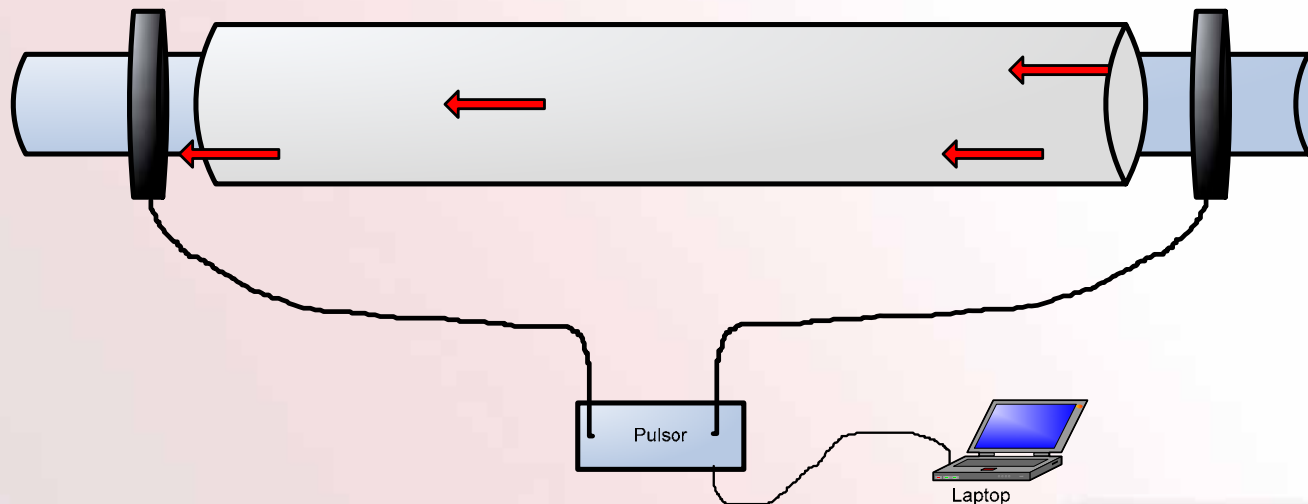
Qualifications

- ## A Learning Loop

  - ### A test loop with natural defects that inspectors can learn from

  - ### Inspectors can see the defect and compare to GWUT response

- ## A certification body that certifies GWUT technicians consisting of:

  - ### Education

  - ### Training

  - ### Experience

  - ### Demonstrated capabilities

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Indication Prioritization

- **Data analysis: SI has thousands of shots with prove-up BScan data. Compare prove-up with GWUT signature**

- **Develop industry accepted methodology on prioritizing indications**

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