

Introduction to Phased Array Weld Quality

For

82nd General Meeting of The National Board
of Boiler and Pressure Vessel Inspectors

Miami, Florida

Present by:
Ron Kent, ASNT Level III



KB Mission Statement

To provide quality and affordable nondestructive testing, training and consulting services, including but not limited to the methods: visual, penetrant, magnetic particle, ultrasonic, eddy current, and limited radiography testing methods for the aerospace, power, industrial, manufacturing, marine and other various industries.

....and to that end....

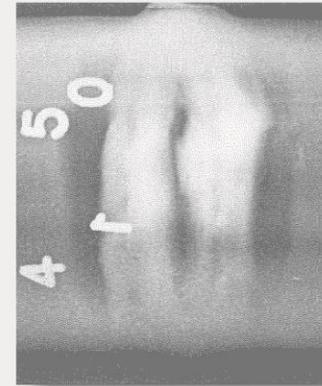
- Weld quality is an important part of our industrial, chemical, and power plant customers' tube, piping, tank & vessel related projects
- KB has implemented PAUT weld testing equipment for 5+ years
- Field proven procedures and techniques that locate and size common weld defects in a consistent and repeatable manner
- Implementation of PAUT save our customers time / \$ -- without sacrificing quality



Phased Array

vs.

X-Ray



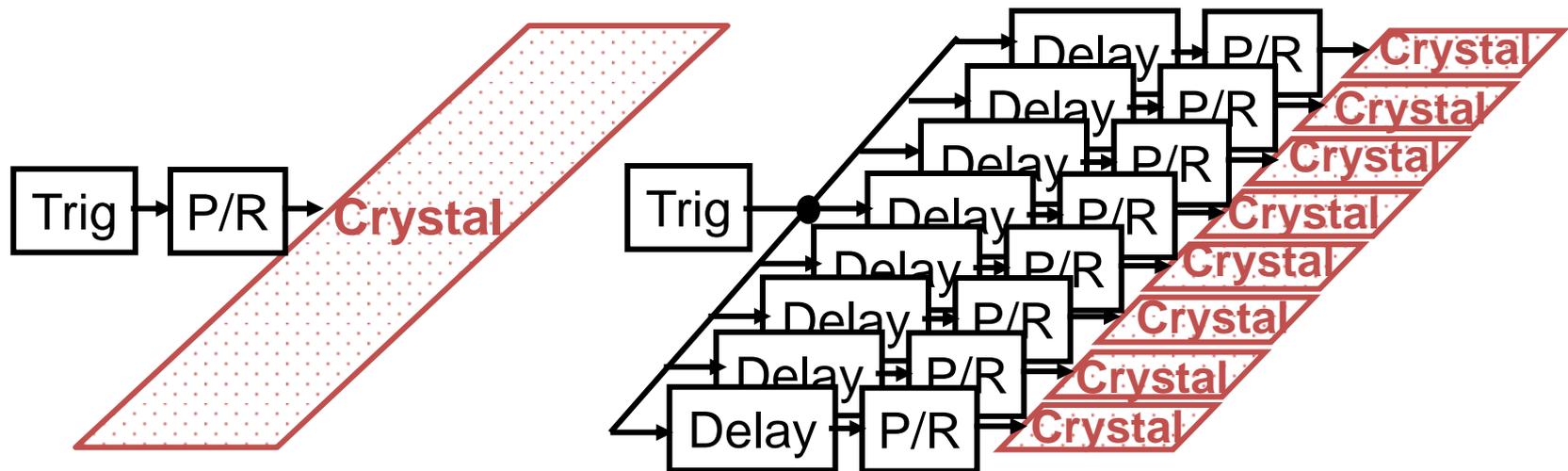
Same Results, Less Downtime, NO X-Ray

Meet Phased Array!

KB

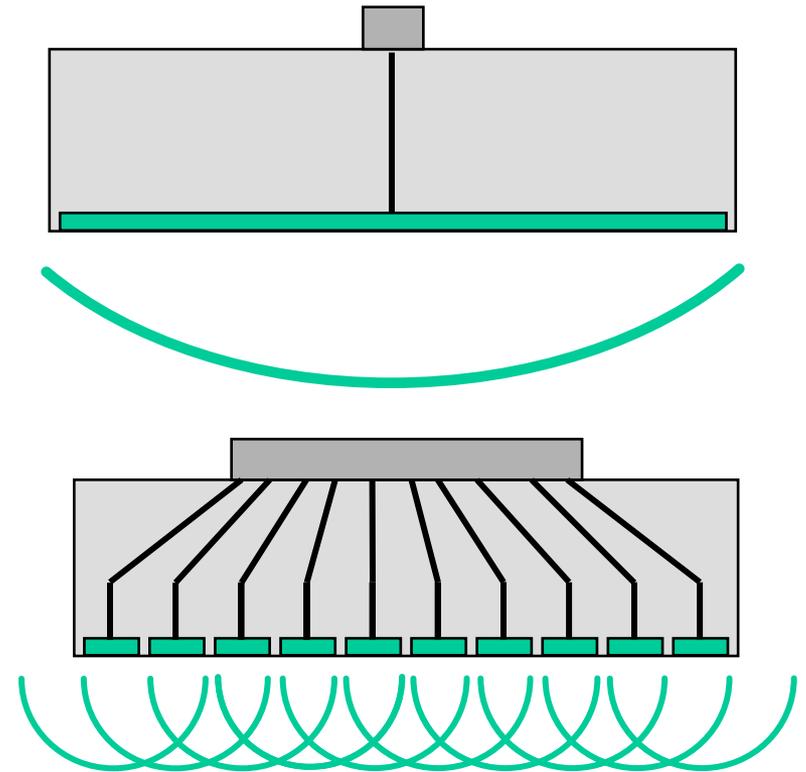
Concepts of the Phased Array Technology

- Conventional transducers are composed of a single crystal.
- For Phased Array transducers, the crystal is cut in many part elements. Elements are individually driven with time-shifts called “Focal law”.
- The aperture is controlled following the number of excited elements and the local law shape.



What is a Phased Array Transducer?

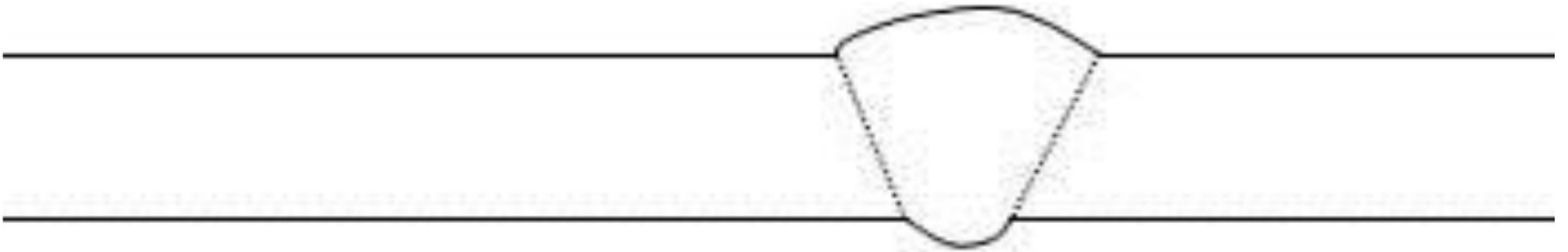
- A phased array transducer can be compared to a large single-element transducer whose active area has been subdivided into small segments or elements. When connected to a phased array instrument, the direction and focus of the sound beam can be changed on each pulse repetition by pulsing individual elements at slightly different times or in different order.



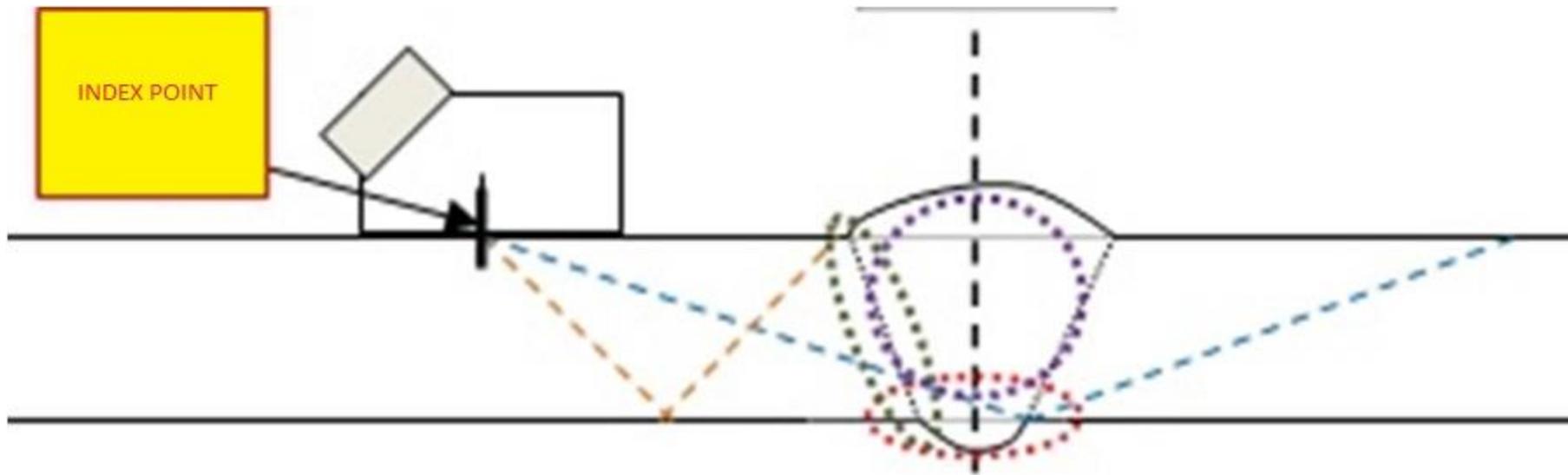
The Basic Approach



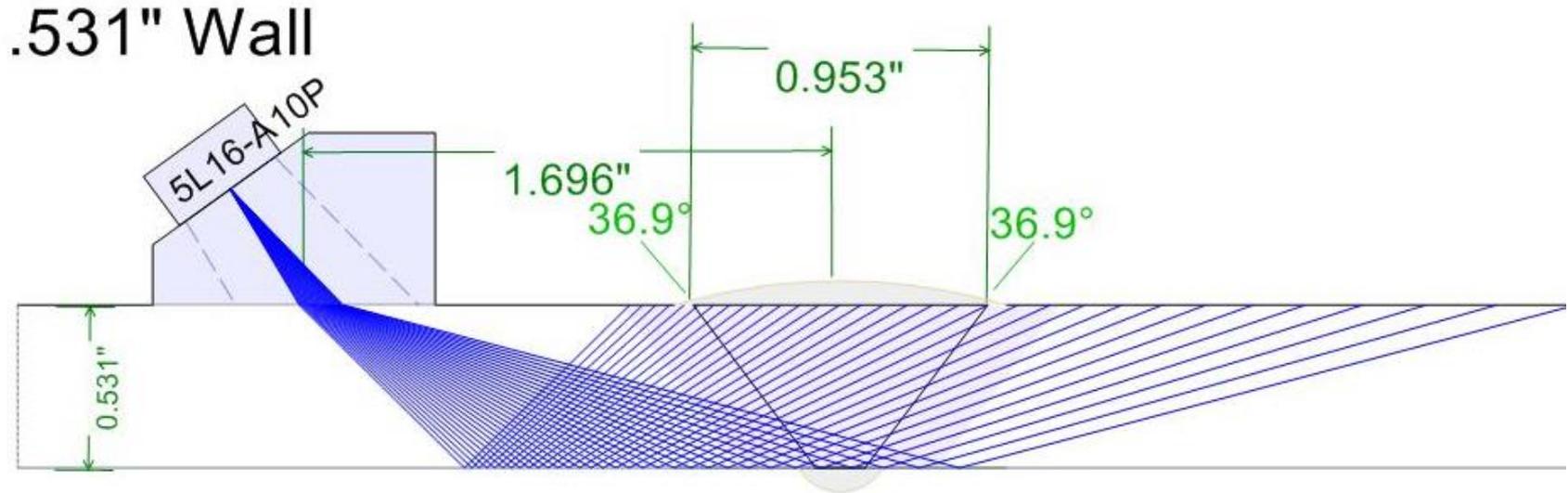
Scan Plan Design



Scan Plan Design

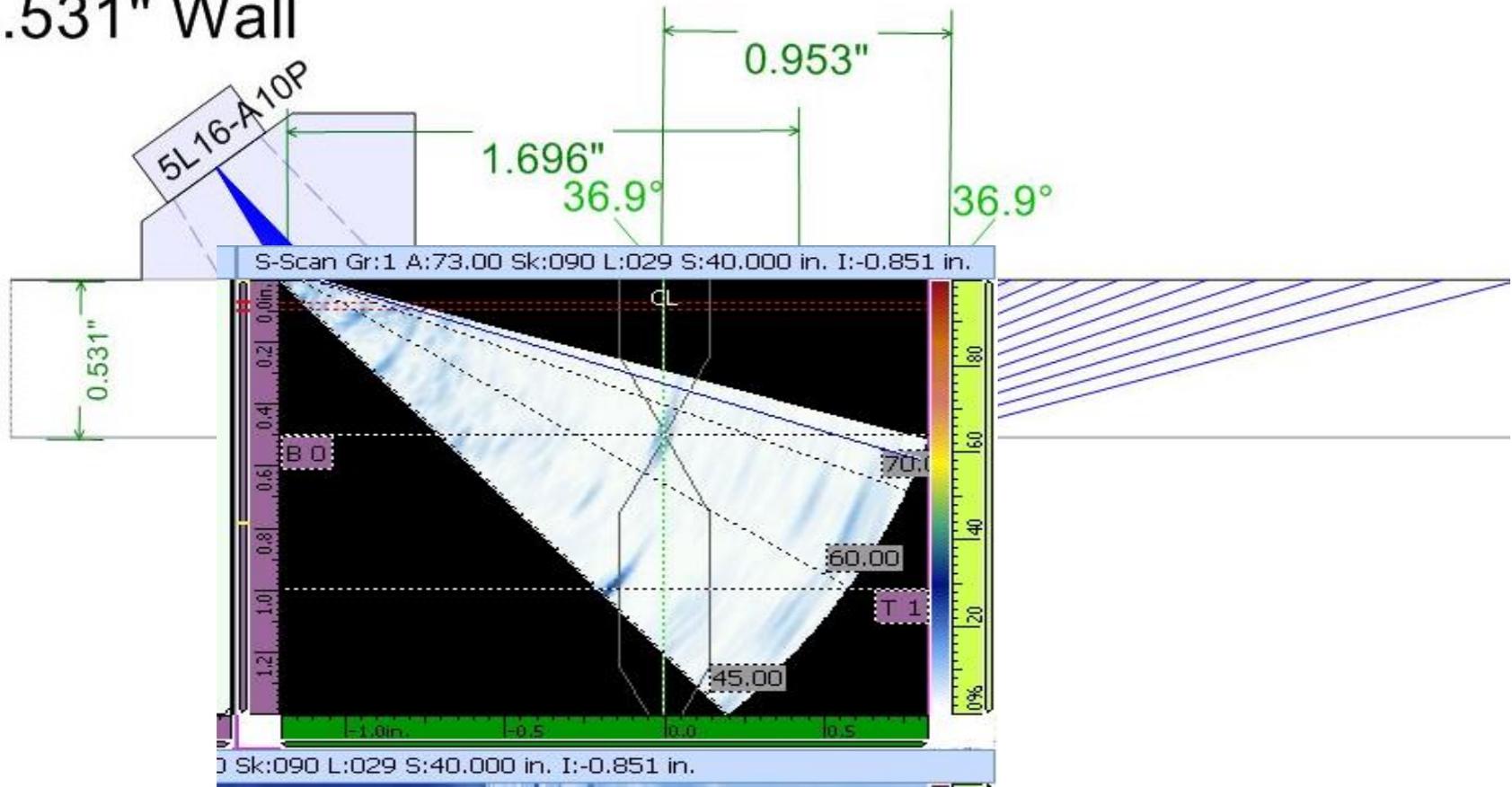


Scan Plan Details

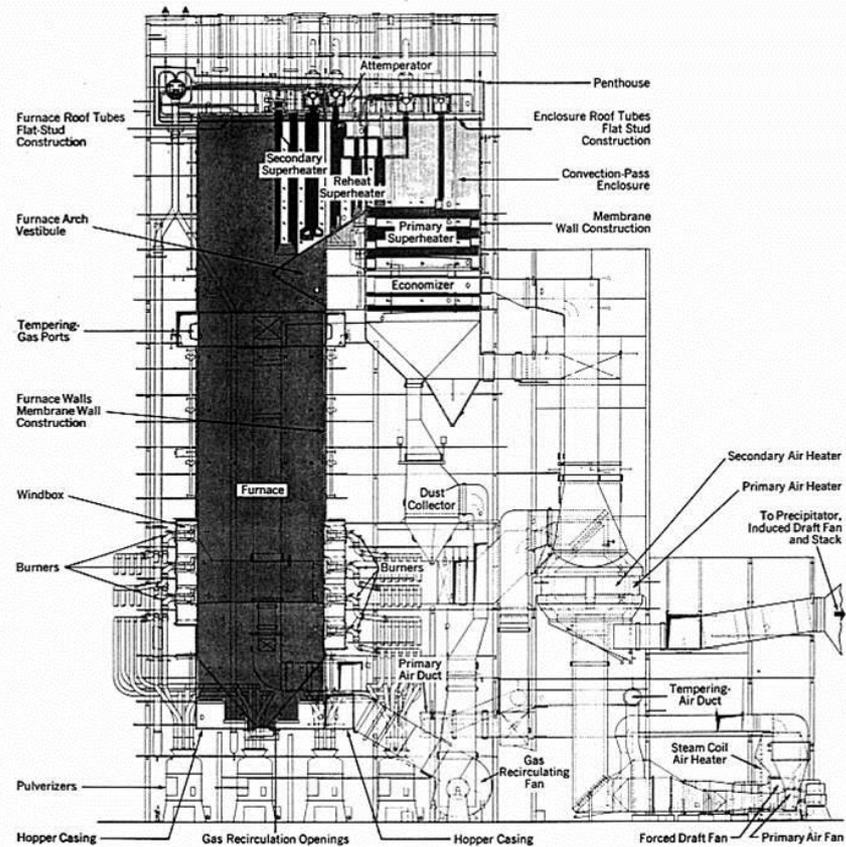


Scan Plan – to – Instrument Display

.531" Wall



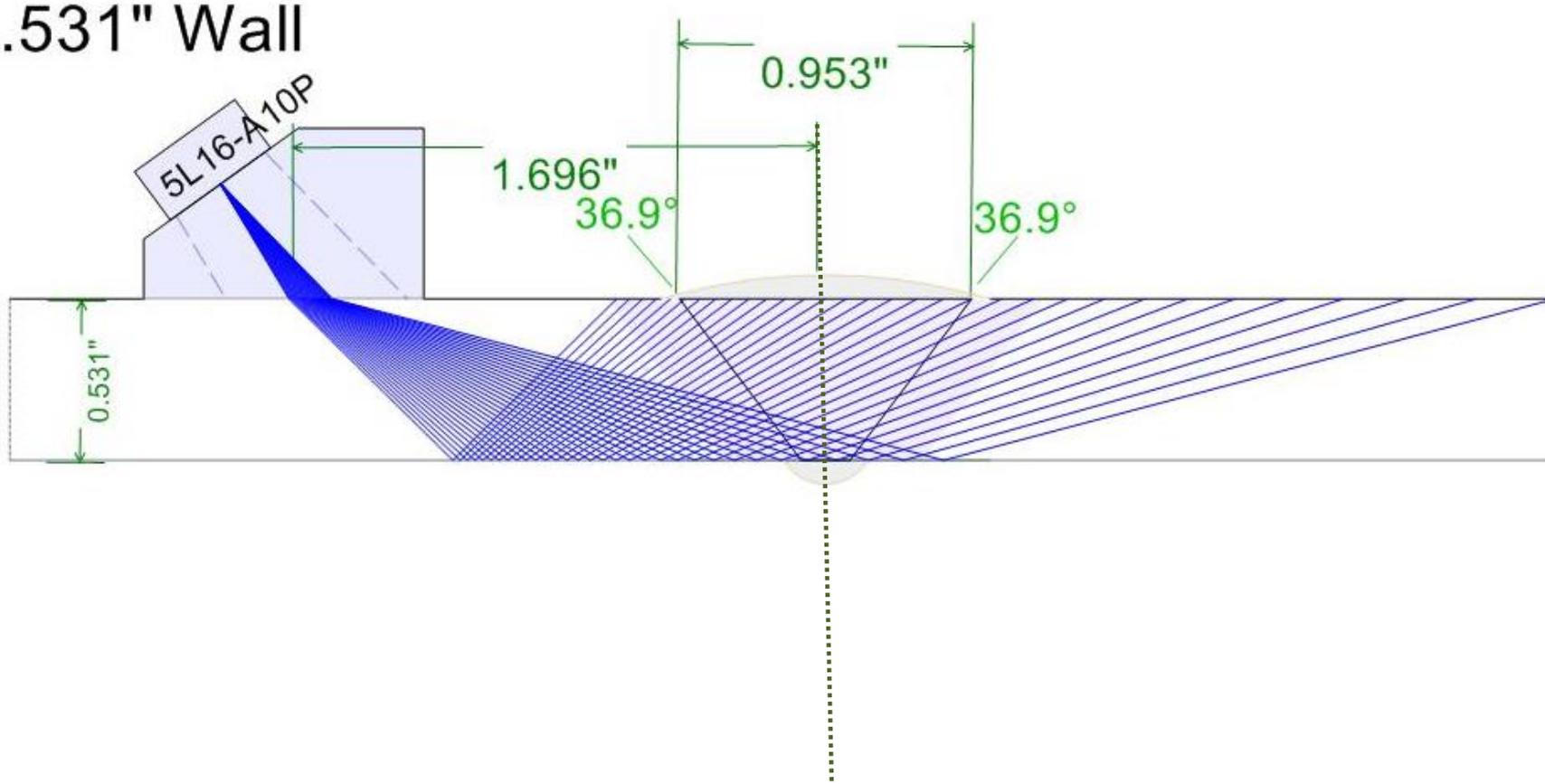
Where is PAUT Applied?



PAUT Applied

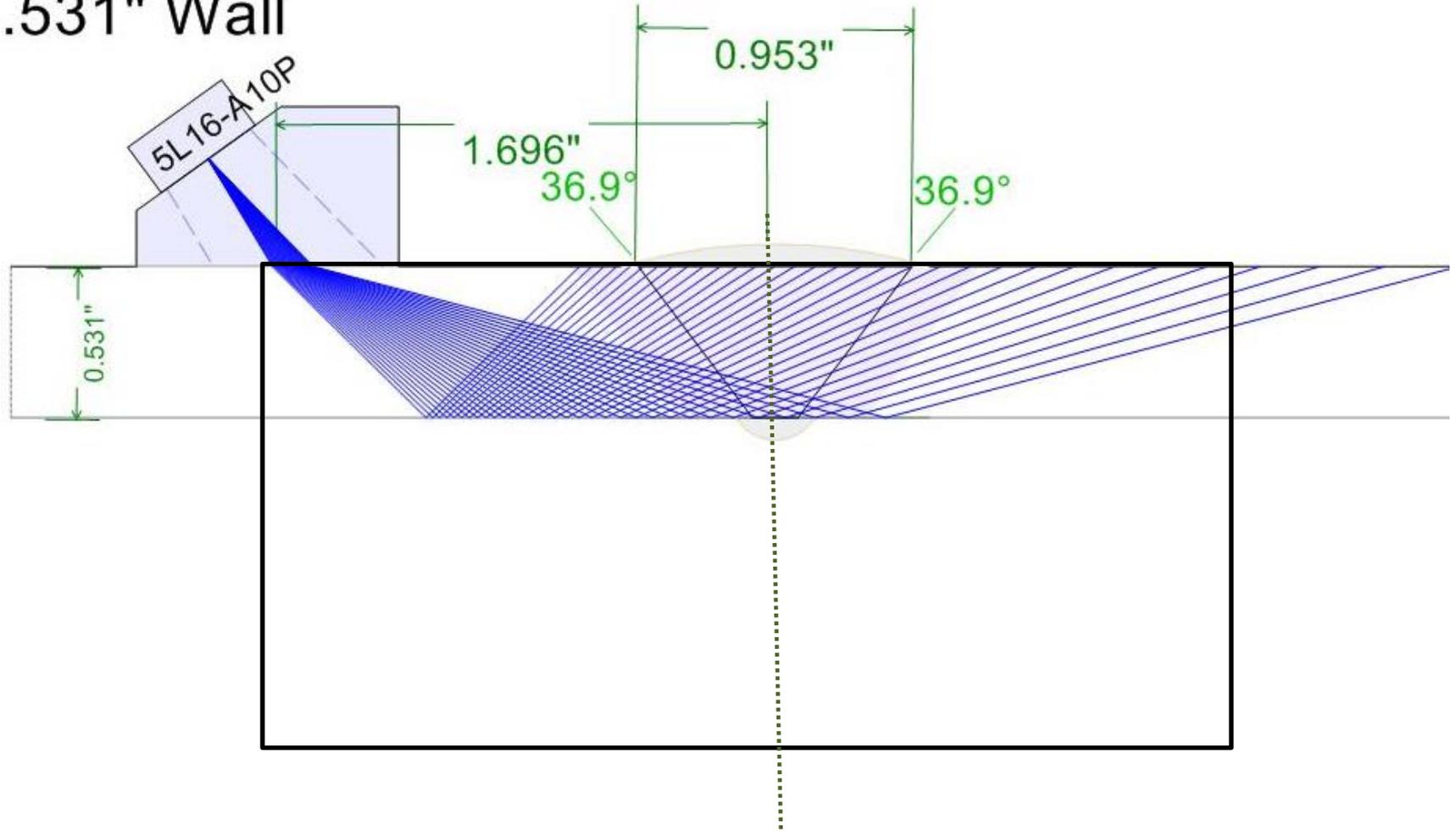


PAUT Interpretation



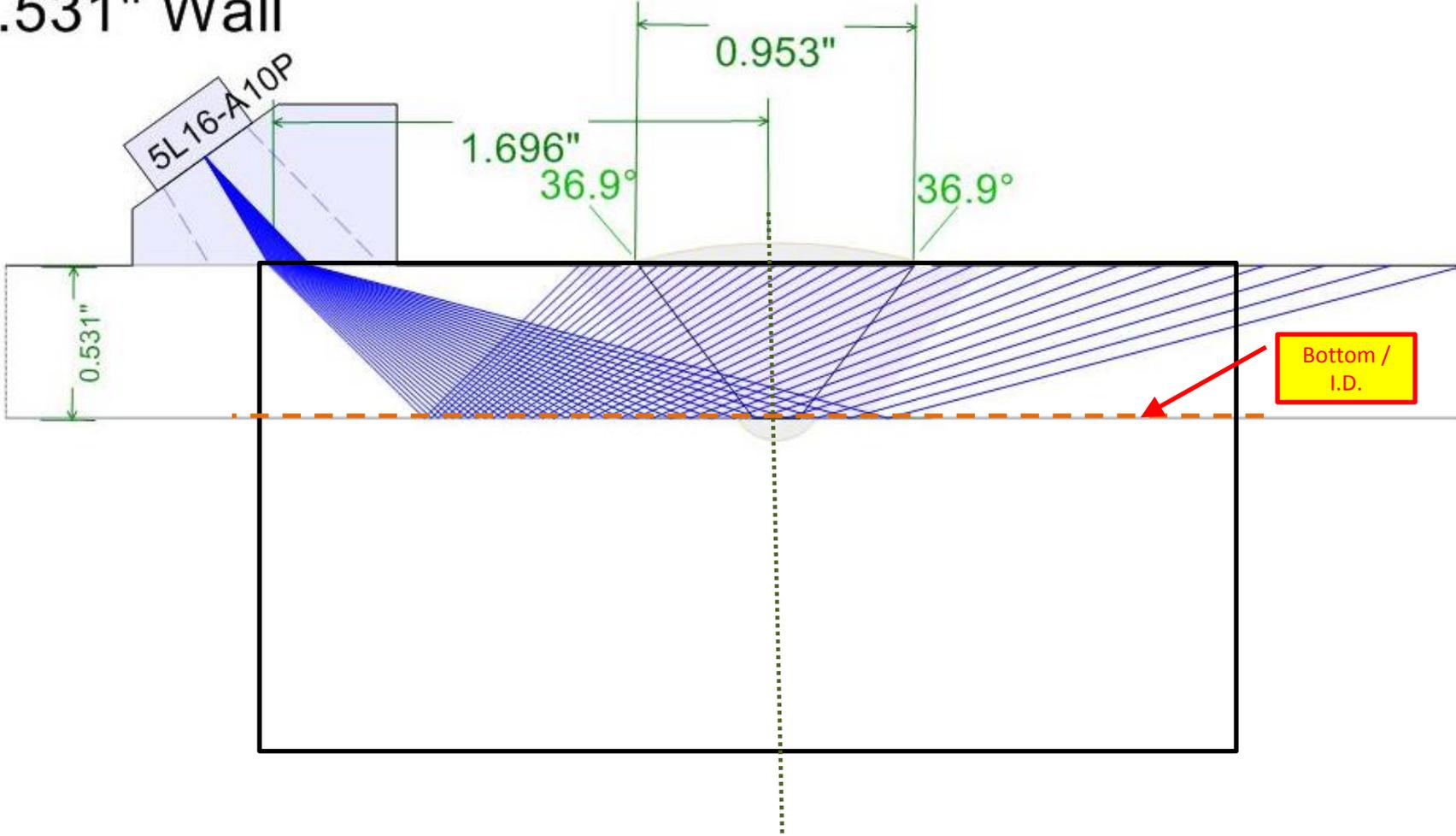
PAUT Interpretation

.531" Wall

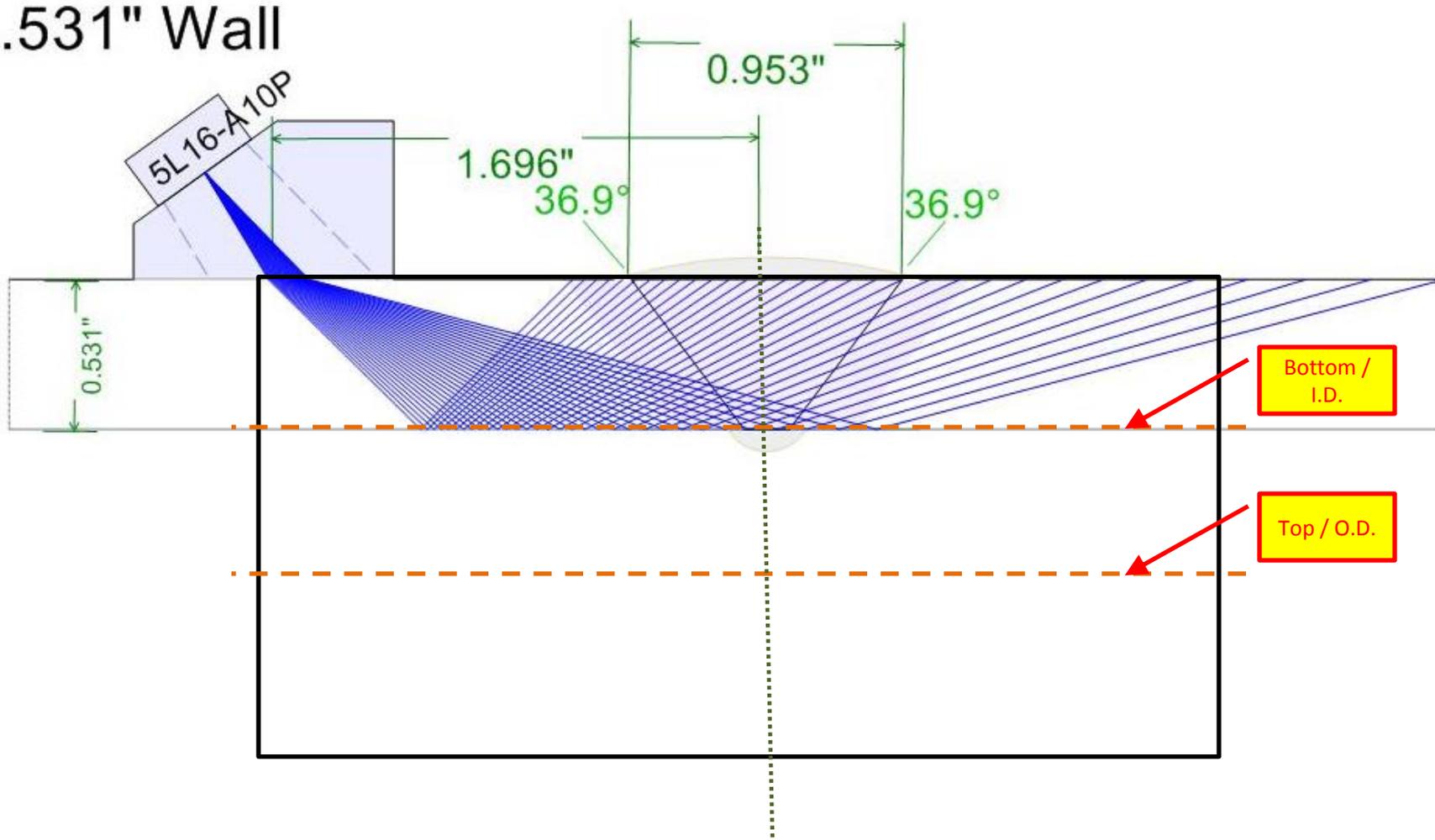


PAUT Interpretation

.531" Wall

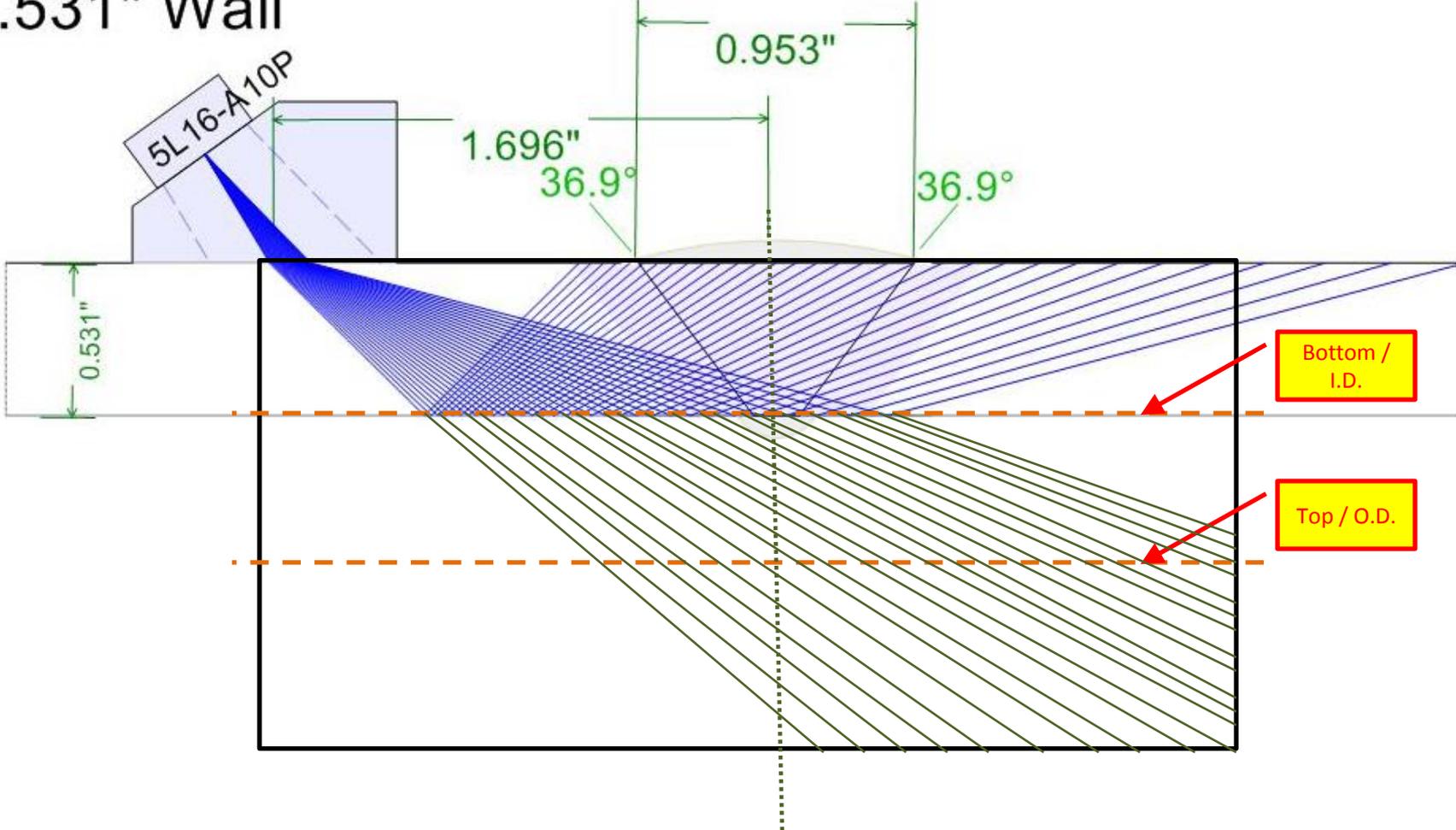


PAUT Interpretation

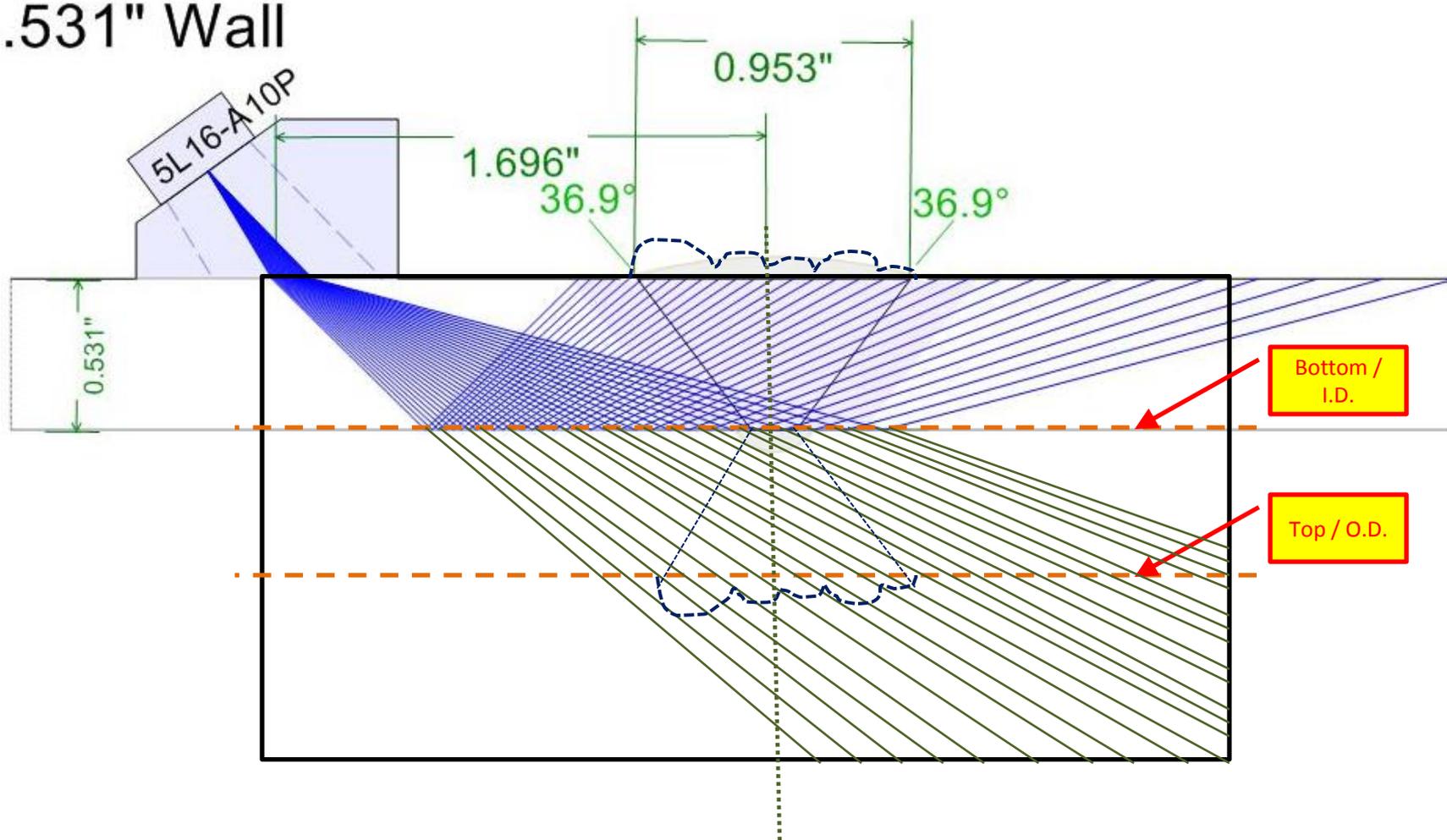


PAUT Interpretation

.531" Wall



PAUT Interpretation



Advantages of Implementing PAUT

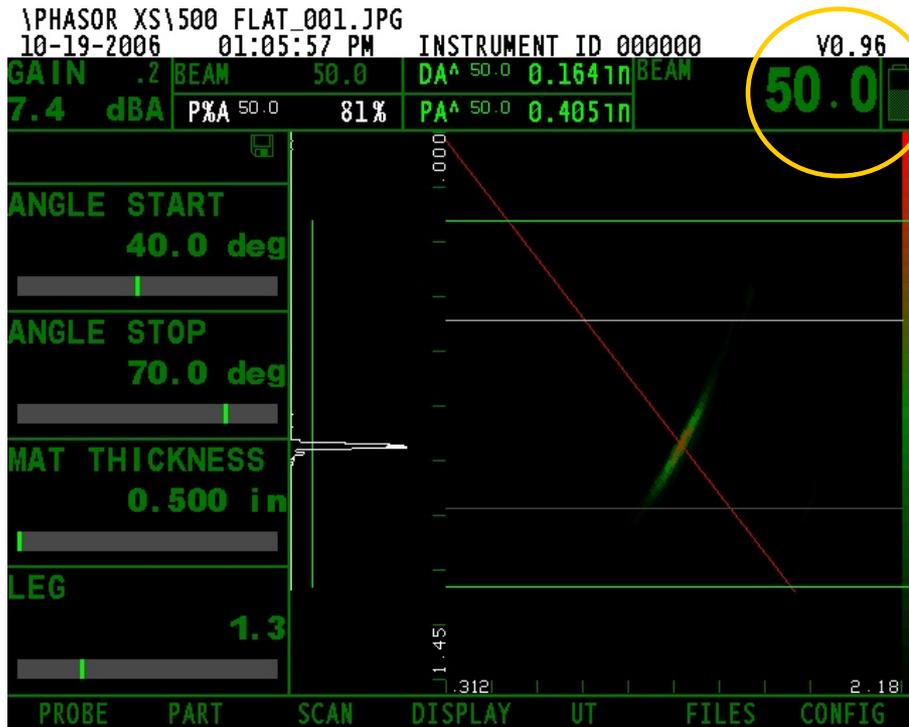
1. Elimination of Radiation Hazards & X-ray Work Stop Windows (delays)
2. Similar Quality – Improved Probability of Detection (POD) – Precision
3. Flaw Characterization / Depth Determination
4. Real-time Results – QA Review
5. Recordable Results – If Desired

Value 1: SCHEDULE



“As soon as it cools – Near Real time Results”

Value 2: Good Quality - Improved POD

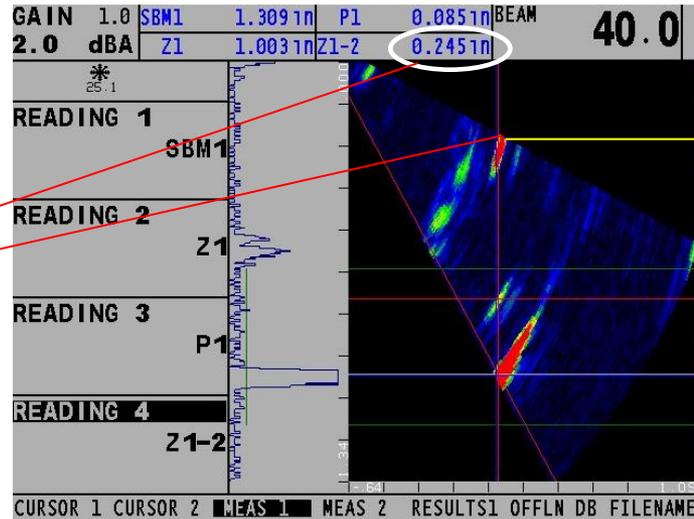
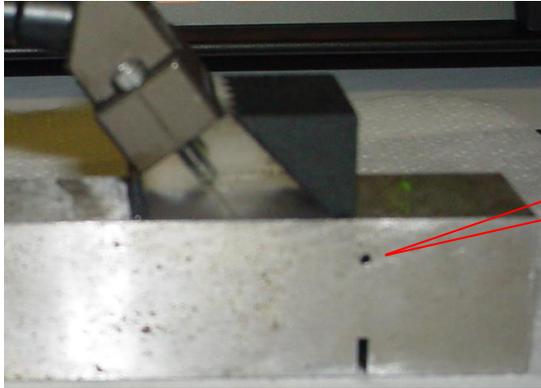


Flaws are often optimized at angles different than the ones operators typically search at.

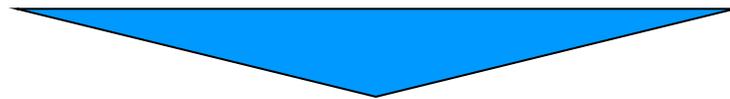
Phased Array also lowers the probability of missing flaws due to operator error.

*“What is the value of 30% improvement in POD to your business?”
GE Inspection Technologies*

Value 2: Improved Precision



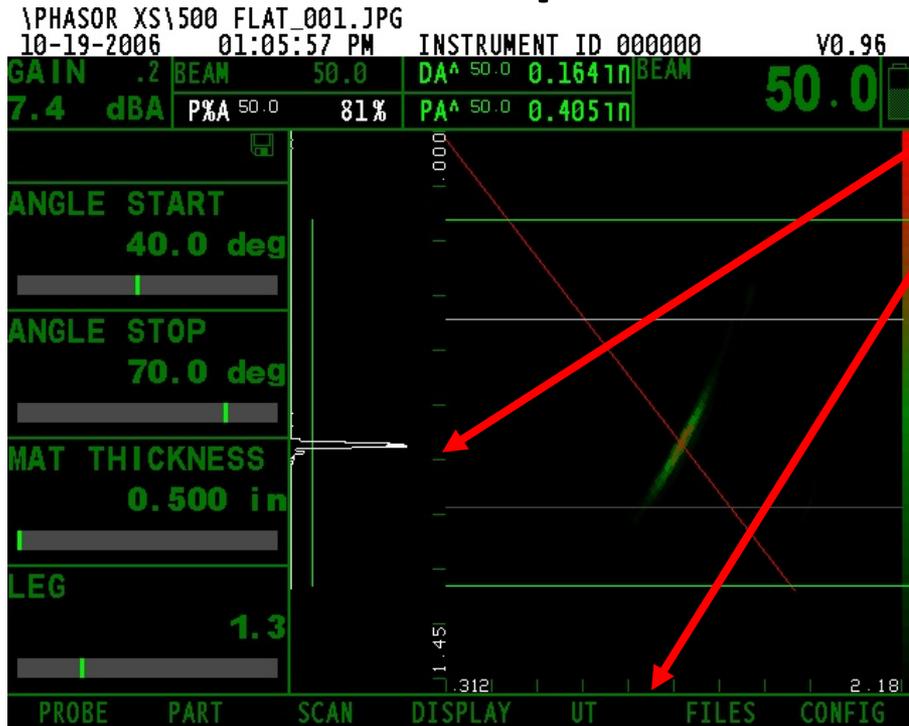
True depth
of side
drilled hole



- Improve precision by 40% (based on initial trials)
- Obtain reproducible and reportable proof of sizing calculation



Value 3: Flaw Characterization Depth Determination

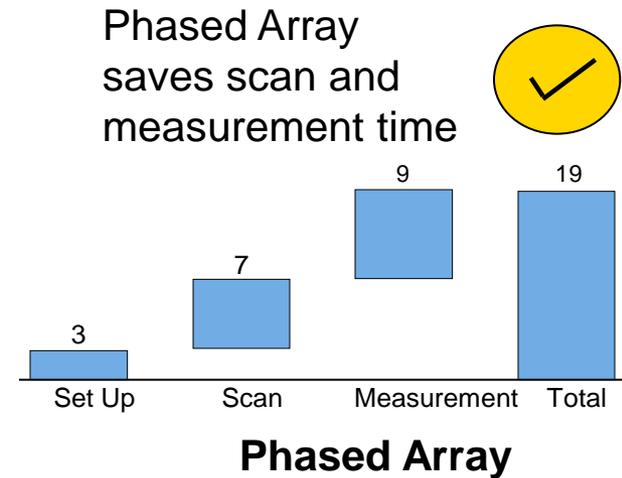
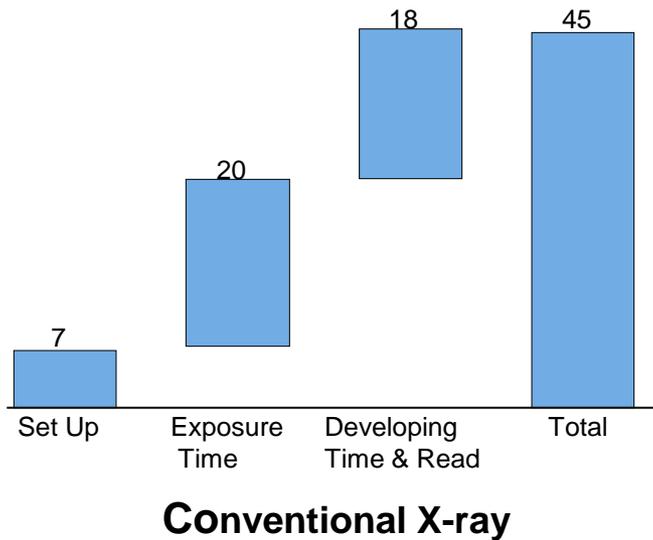


Easy to Read Rulers for depth and forward position

“Reduces repair size/depth”

Value 4: Faster Inspections

Illustrative Weld Inspection Example (minutes)



Cut your inspection times by 50%

Value 4: No Schedule Delays

Do more
with less
delays!



- No Shut-Downs or Re-staging of Welding Equipment
- Faster Weld Process Correction – Reducing Reject Rate

A Picture (image) Is Worth A Thousand Words

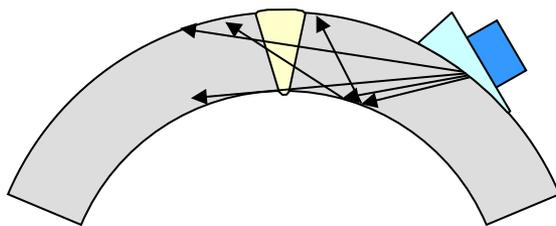


- We are all comfortable viewing X-ray Images
- With effort – owners and their representative will be comfortable with UT Phased Array Imaging

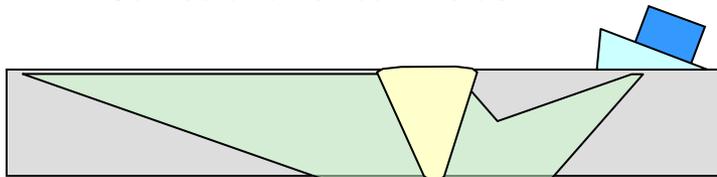
New Applications

Aerospace

- Boeing scribe line inspection (qualified)
- Landing gear inspection
- Advanced composite inspection



Curved and flat butt welds



Chemical / PetroChem

- Weld inspection on heavy-wall reactors
- Pitting & Corrosion detection
- PA in lieu of RT for pipe & tube inspection

Power

- Inspection of core shroud for SCC
- Turbine disk inspection
- Pressure vessel nozzle inspection



Rail and Other

- Wheel inspection
- Inspection of Bridge members
- Locomotive engine

Quick & Effective Training Capability

- “Ability to effectively train on Phased Array is the single biggest impediment to growth of Phased Array” – Service Company President
- “So simple,...anyone can do it” – NDT Service Company Advanced UT Manager
- Target audience is UT Level 2 and Level 3’s.
- “Simplicity is the key driving force in designing the future instruments. The needs of the everyday operator are of primary concern.” – Jeff Anderson, VP Product Management, GEIT.

New instruments are designed for large scale training and adoption

Incredible Value Story

Plant Inspection Example

Trait

Value To
Asset Owner

Value To
Service
Provider

30% Improvement in POD



20% Faster Inspections



40% Sizing Improvement



More Capable Systems



Real-time Reporting



Advanced Applications



Faster & Effective Training



Questions / Discussion

LEARNING / SUPPORT VENDOR LINKS:

<http://www.olympus-ims.com/en/knowledge/>

<http://www.ge-mcs.com/index.php/learning-center.html>

