INSPECTION INTELLIGENCE NDT GLOBAL

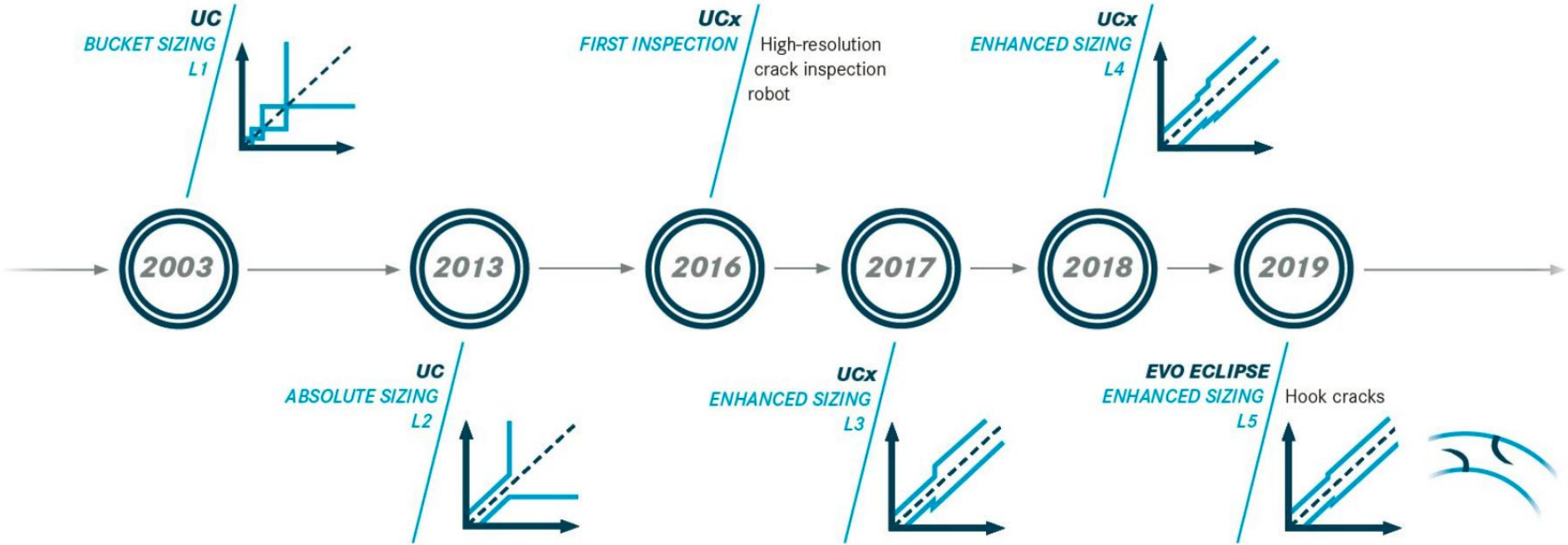
HIGH-RESOLUTION INSPECTIONS FOR CRACK DETECTION

THE NEXT LEVEL OF ACCURACY

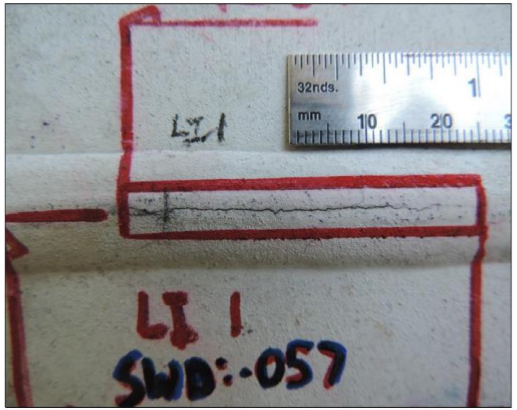
Speaker: *Ben Bergius*

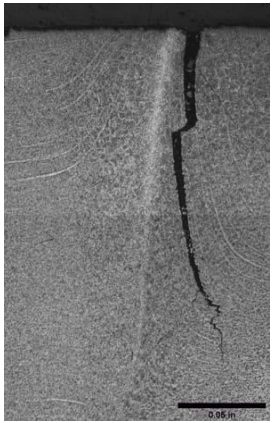
Date: *20th November 2019*

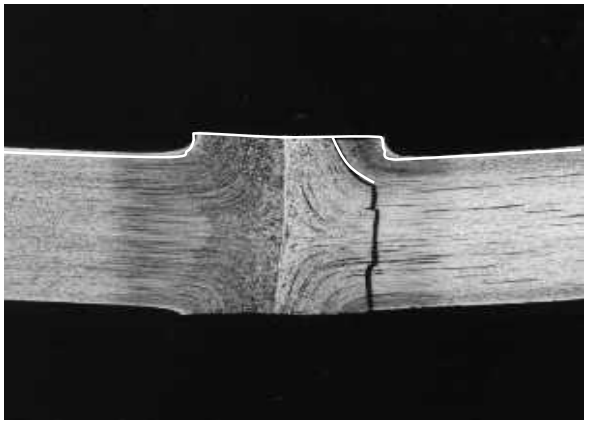
CRACKING – EVOLUTION

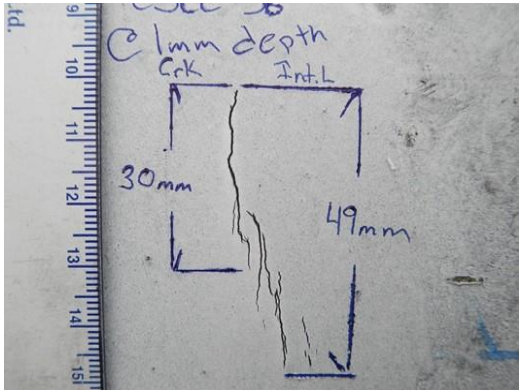


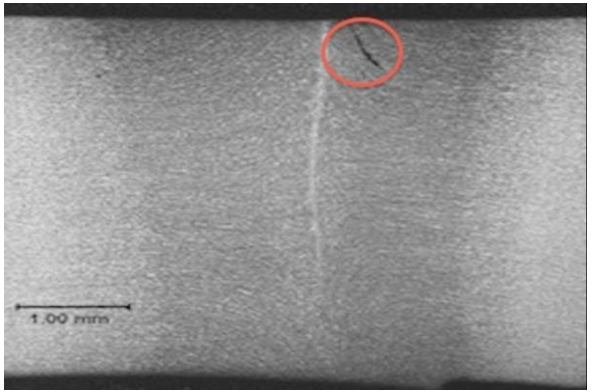
CRACKING



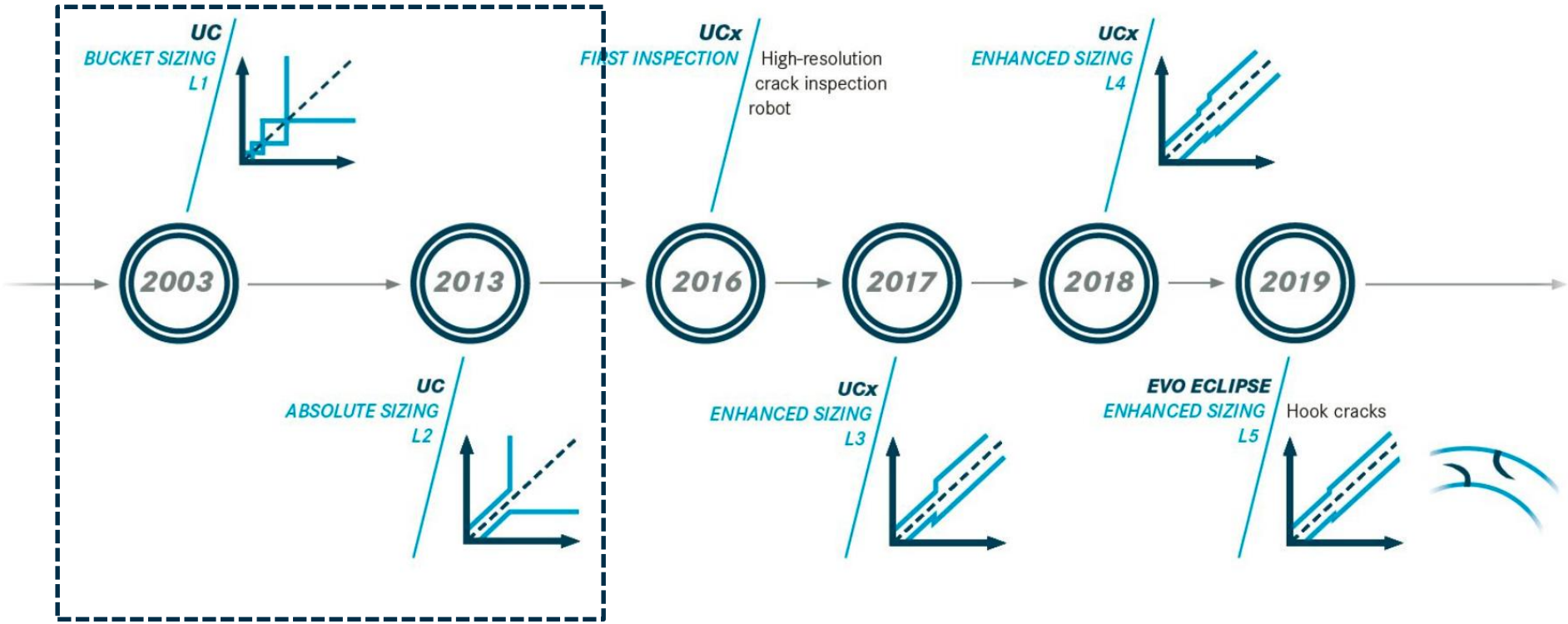




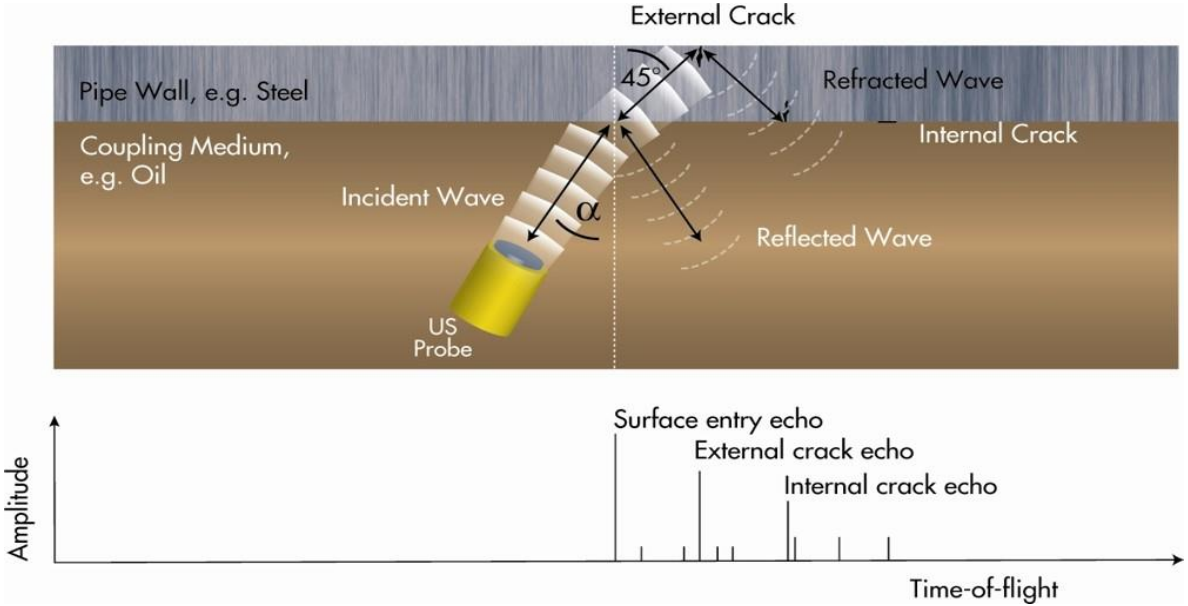




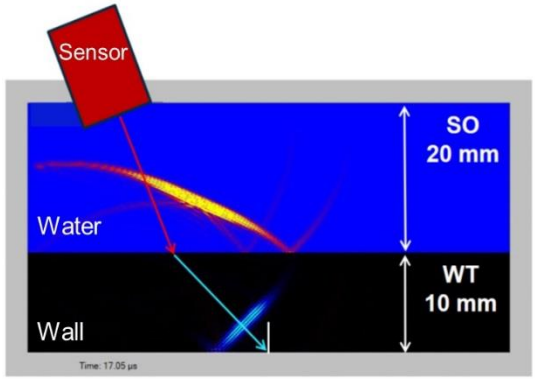
CRACKING – EVOLUTION

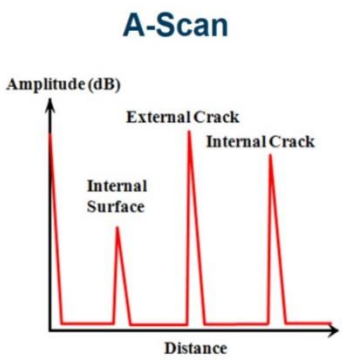


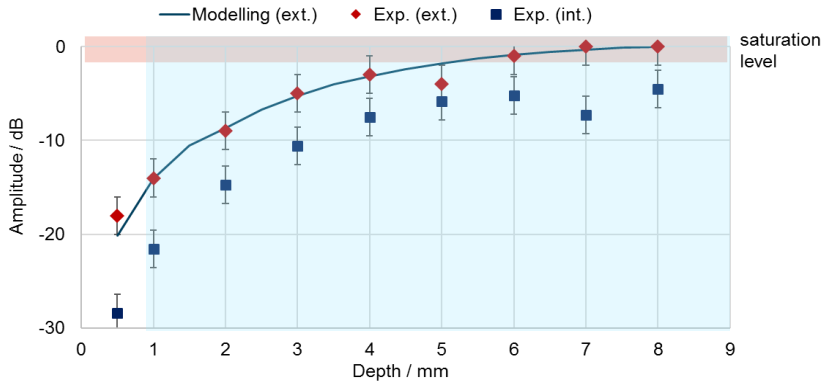
UC - PRINCIPLE



UC – PRINCIPLE – PULSE ECHO



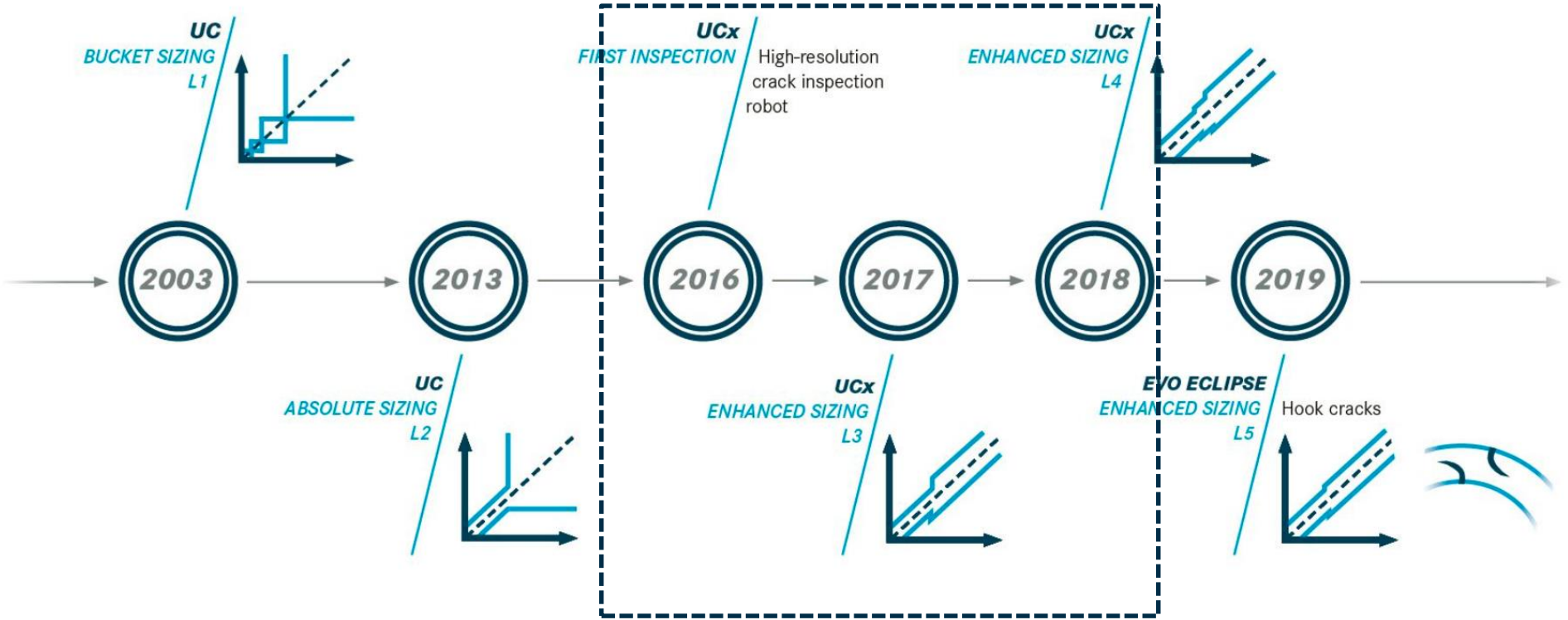




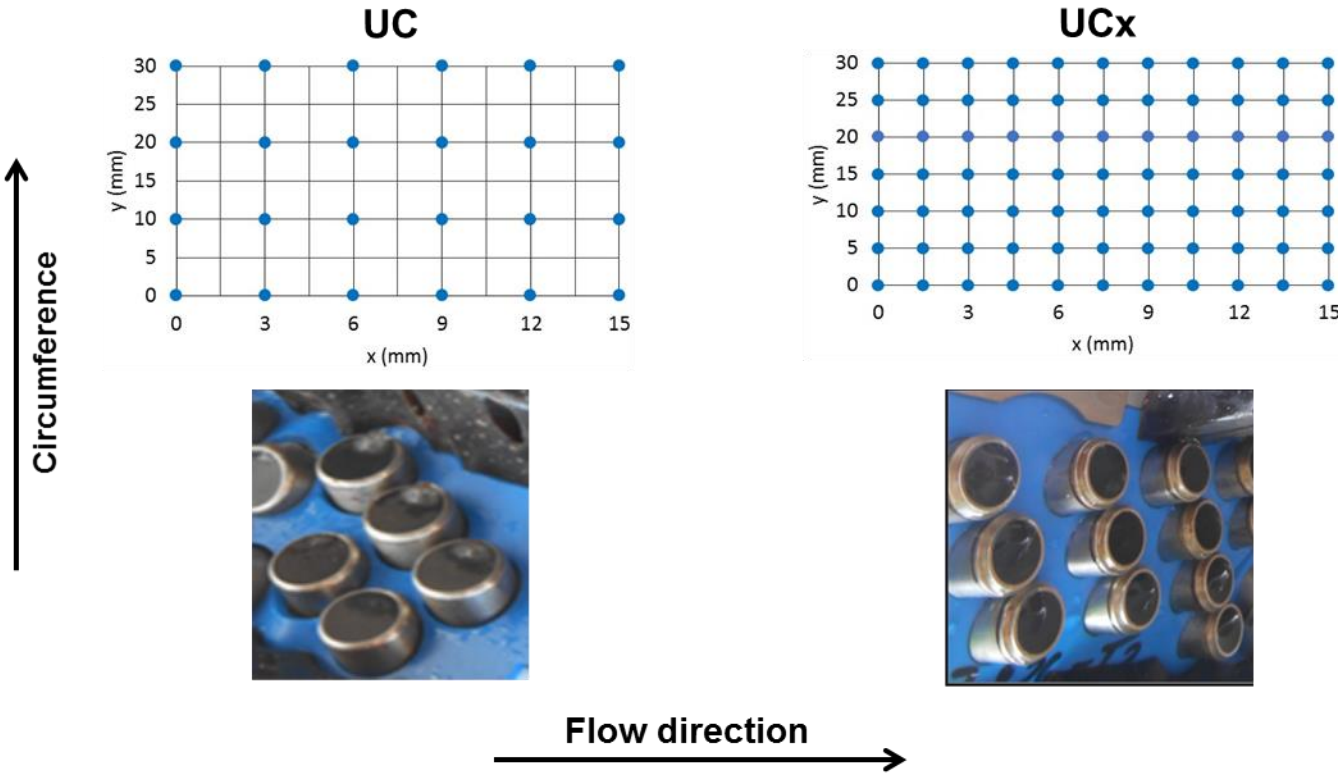
Detection and sizing capabilities

- Internal / external cracks
- Seam cracks: ERW, DSAW, SAW
- Base material cracks: Single cracks, Crack fields
- Crack in and at dents and deformations

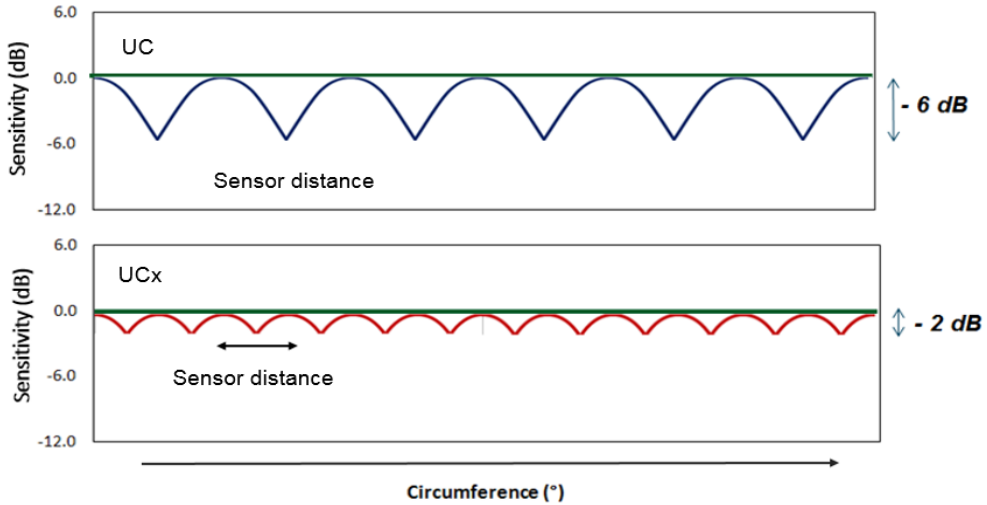
EVOLUTION OF UC



UC - RESOLUTION

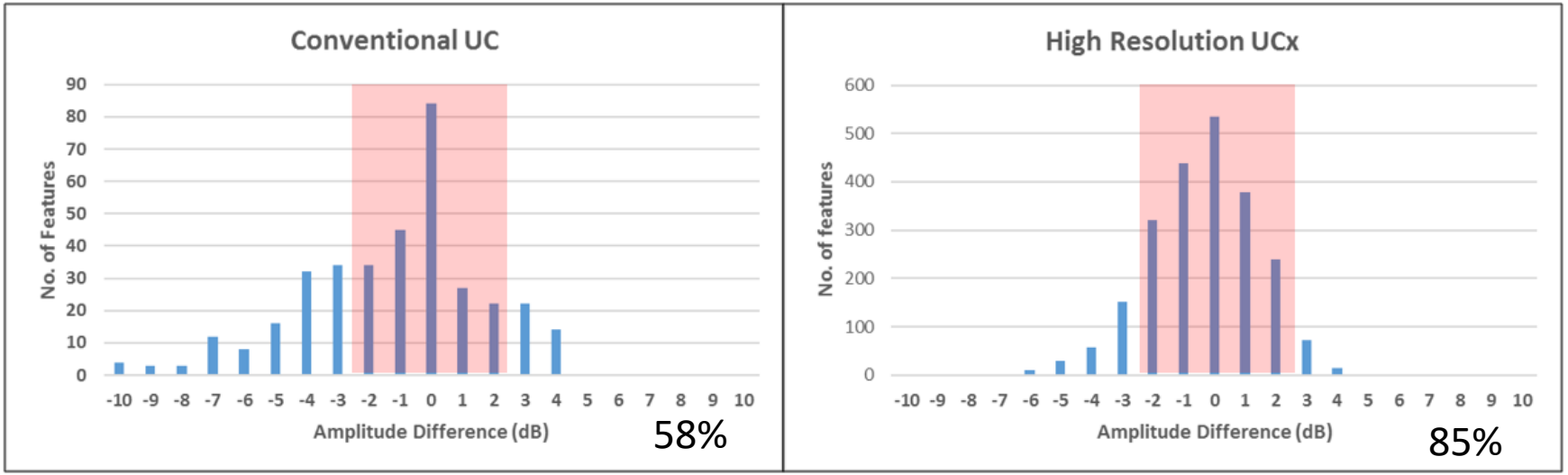


UC - RESOLUTION



- Amplitude collection
- Detect size deepest point
- High density crack profile
- Better representation of feature
- >200% coverage compared to conventional robots
- Robustness
- Made possible by introduction of Evo 1.0 in 2015

UC VS UCX RESOLUTION



Population

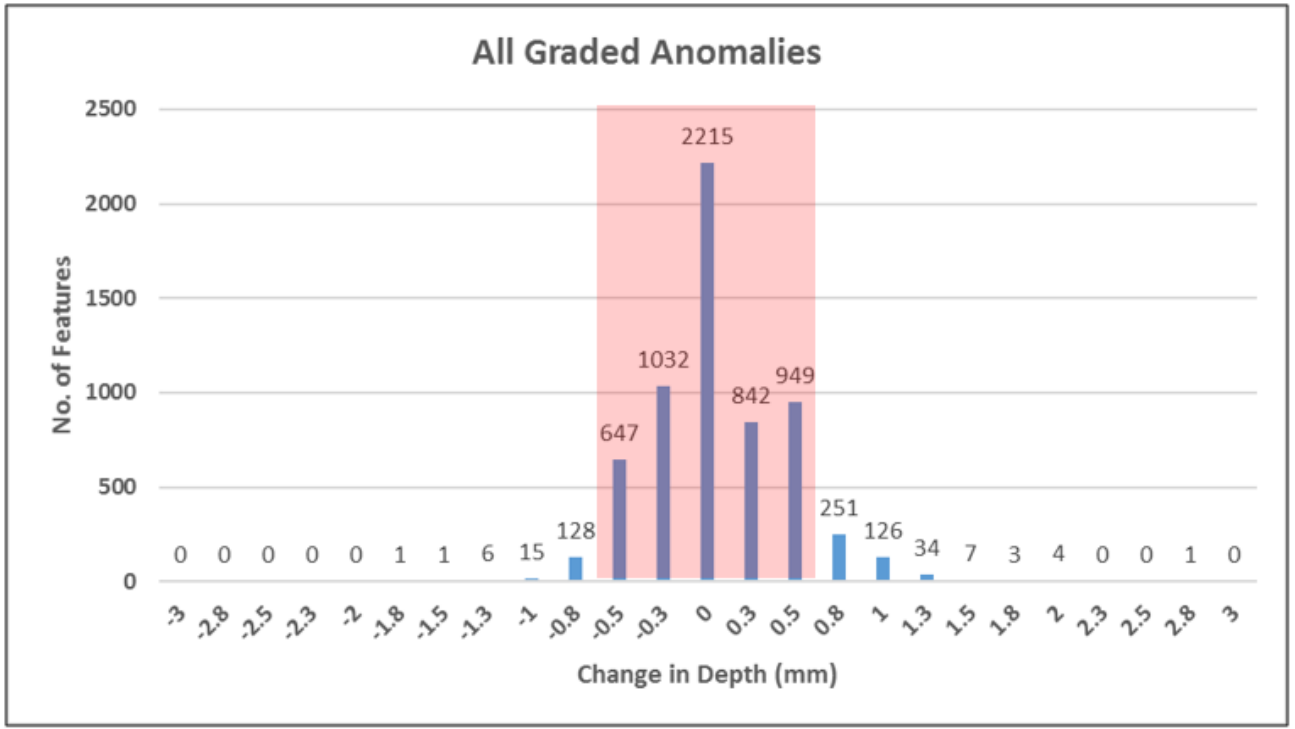
- 30 features
- Depths 1.0mm to 4.0mm

±2 dB threshold

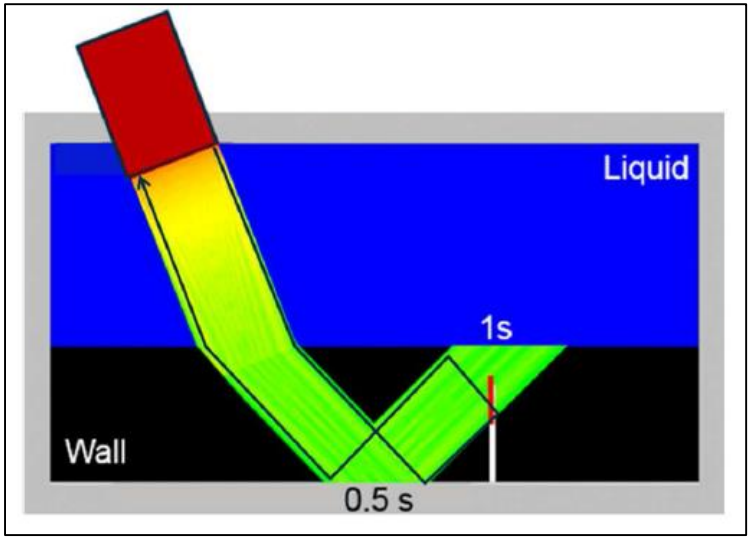
UCX COMMERCIAL INSPECTIONS

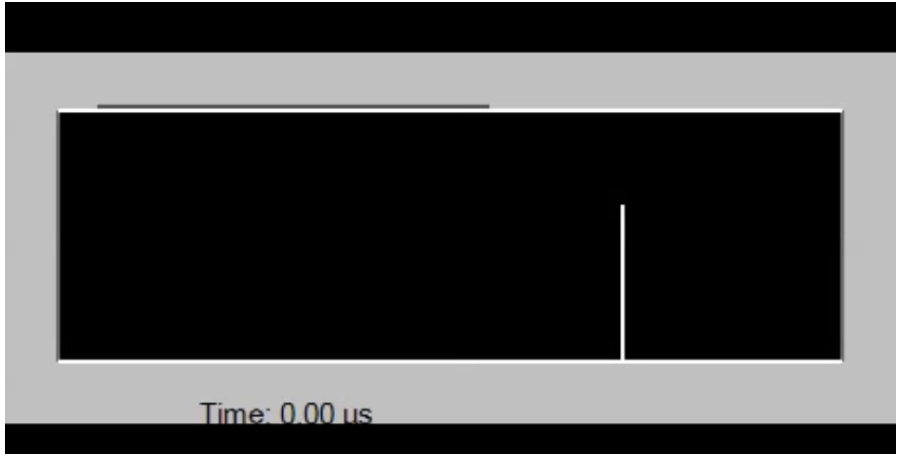
Consecutive 12" Inspections

- >6,000 features
- 90% of the results are within ±0.5 mm



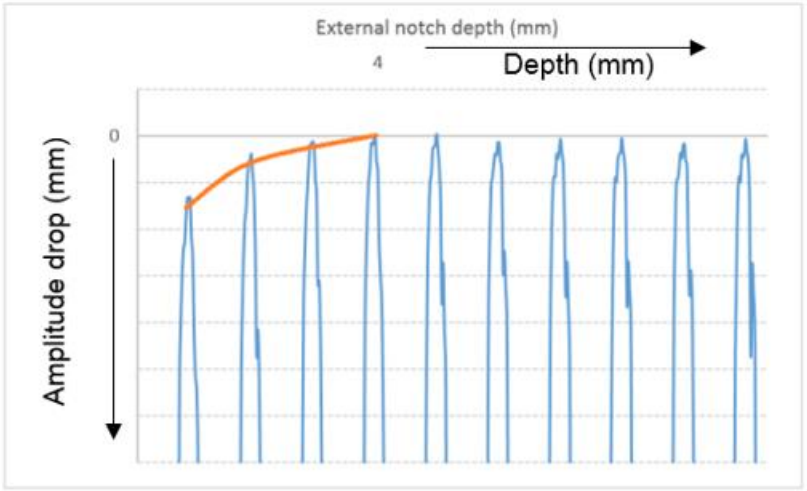
UC – ENHANCED SIZING



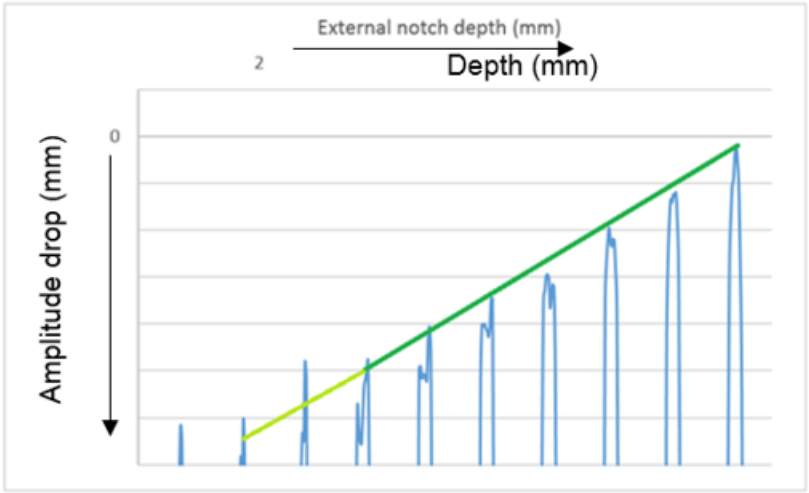


Sound beam propagation – Finite Difference modeling package

UCX - ENHANCED SIZING

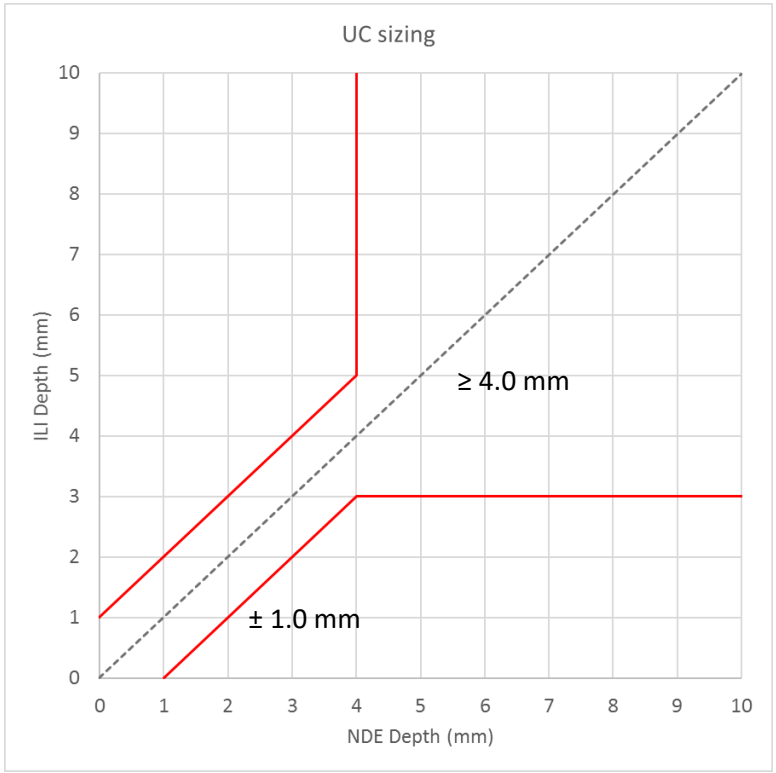


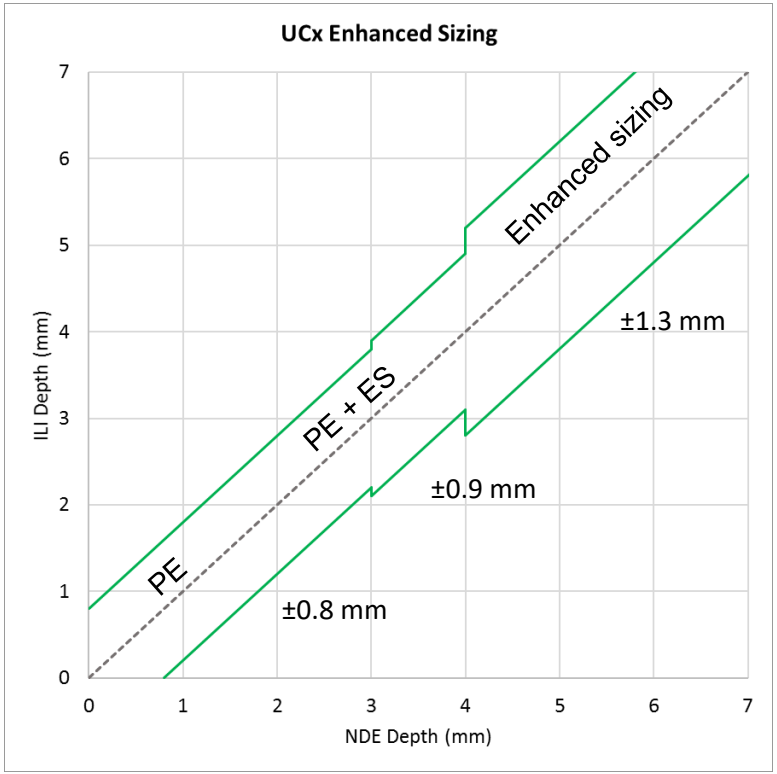
Signal is saturated at 4.0mm
No sizing capabilities beyond 4.0mm



Amplitude increases with depth
Sizing capabilities - full range

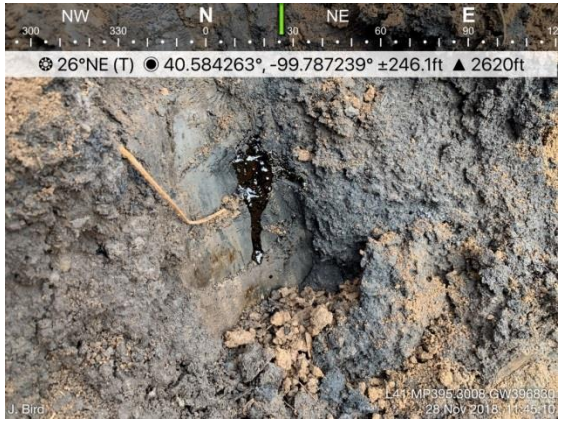
UCX – ENHANCED SIZING





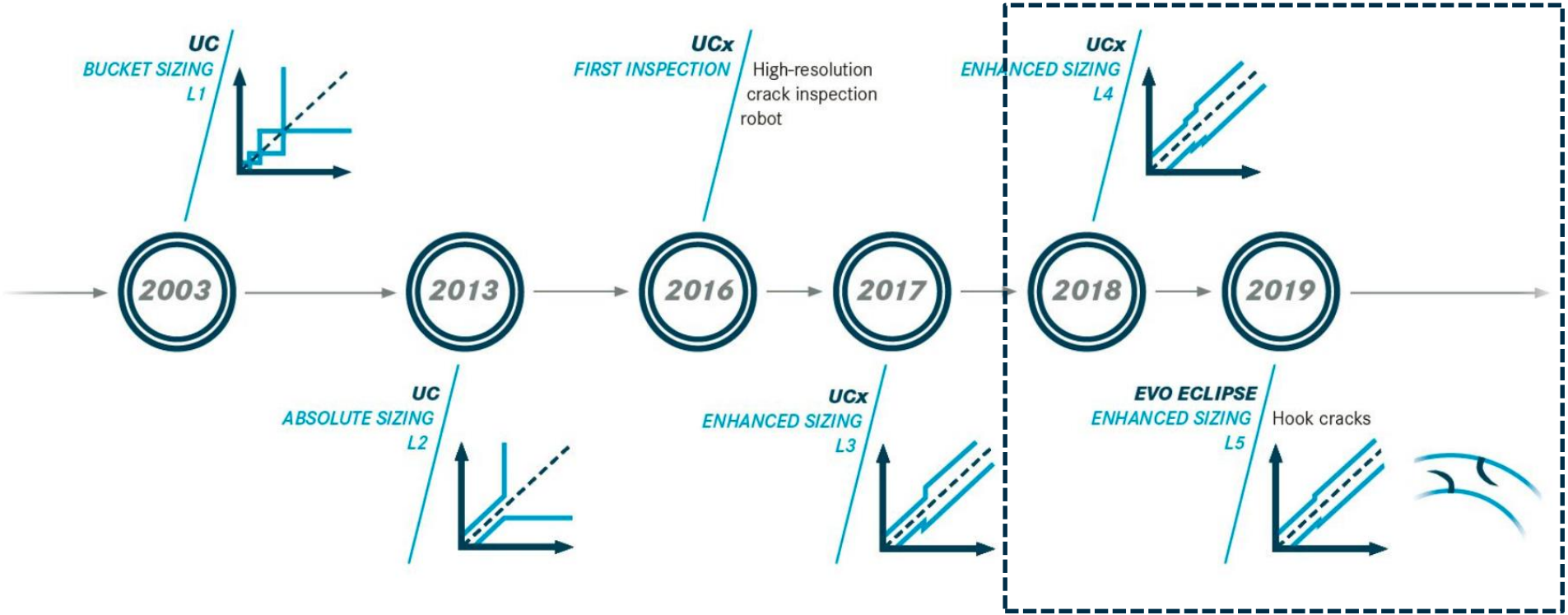
UCX – ENHANCED SIZING

- Canadian pipeline operator
- 20’’ diameter pipeline
- 7.8 mm nominal WT
- UCx ILI by NDT Global
- Submitted Priority Notification
- ILI sizing: 6.9 mm
- NDE: Through wall crack

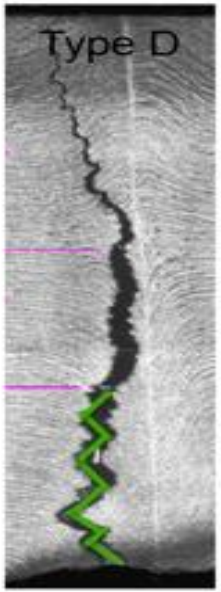


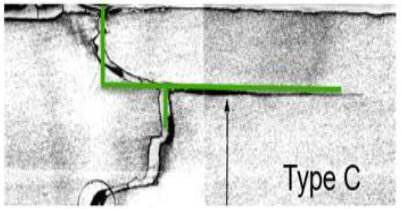
"We were lucky, we found another leak based on your accurate ILI crack results. Conventional technology would have not allowed us to find and address this threat".

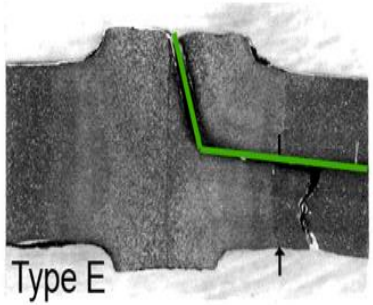
EVOLUTION OF UC

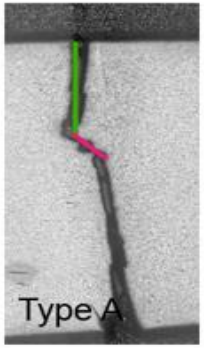


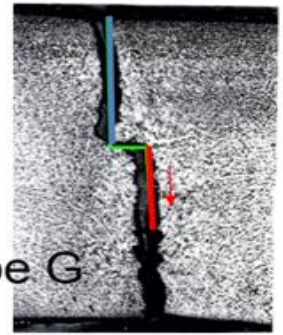
CRACK DETECTION - LIMITATIONS

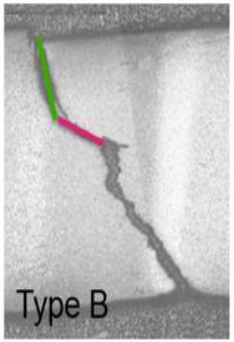


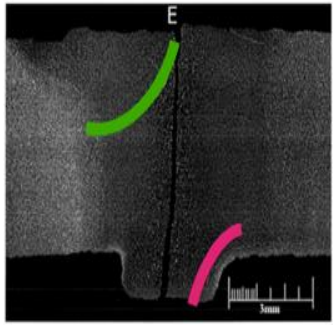




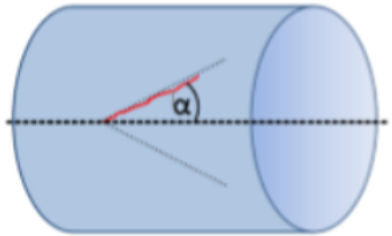
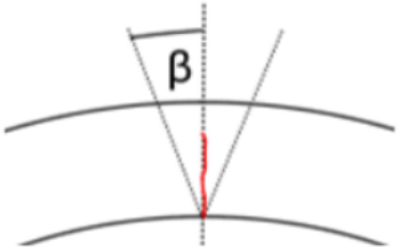








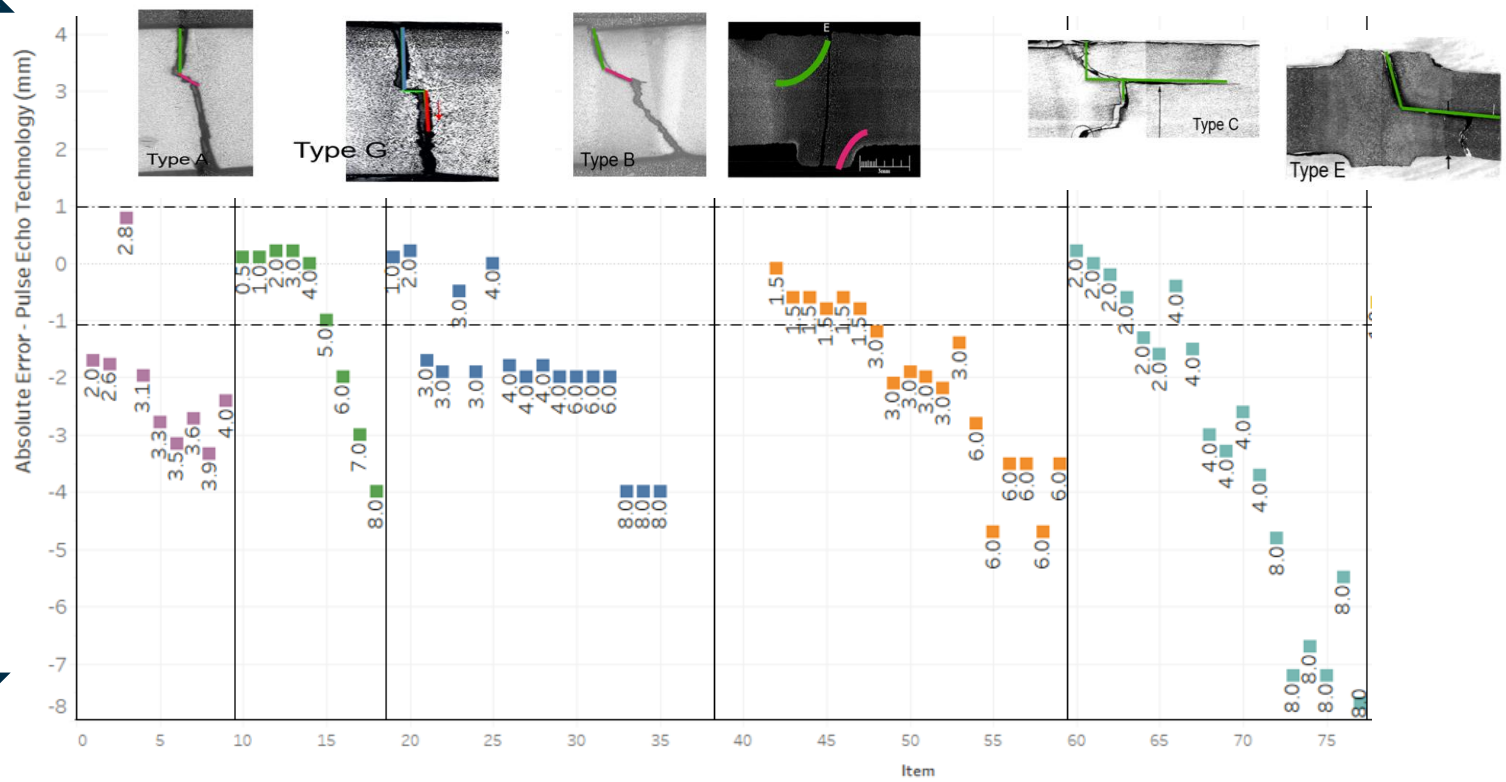
TILT & SKEW

Skew	Tilt
	
α ±10°	β ±45°

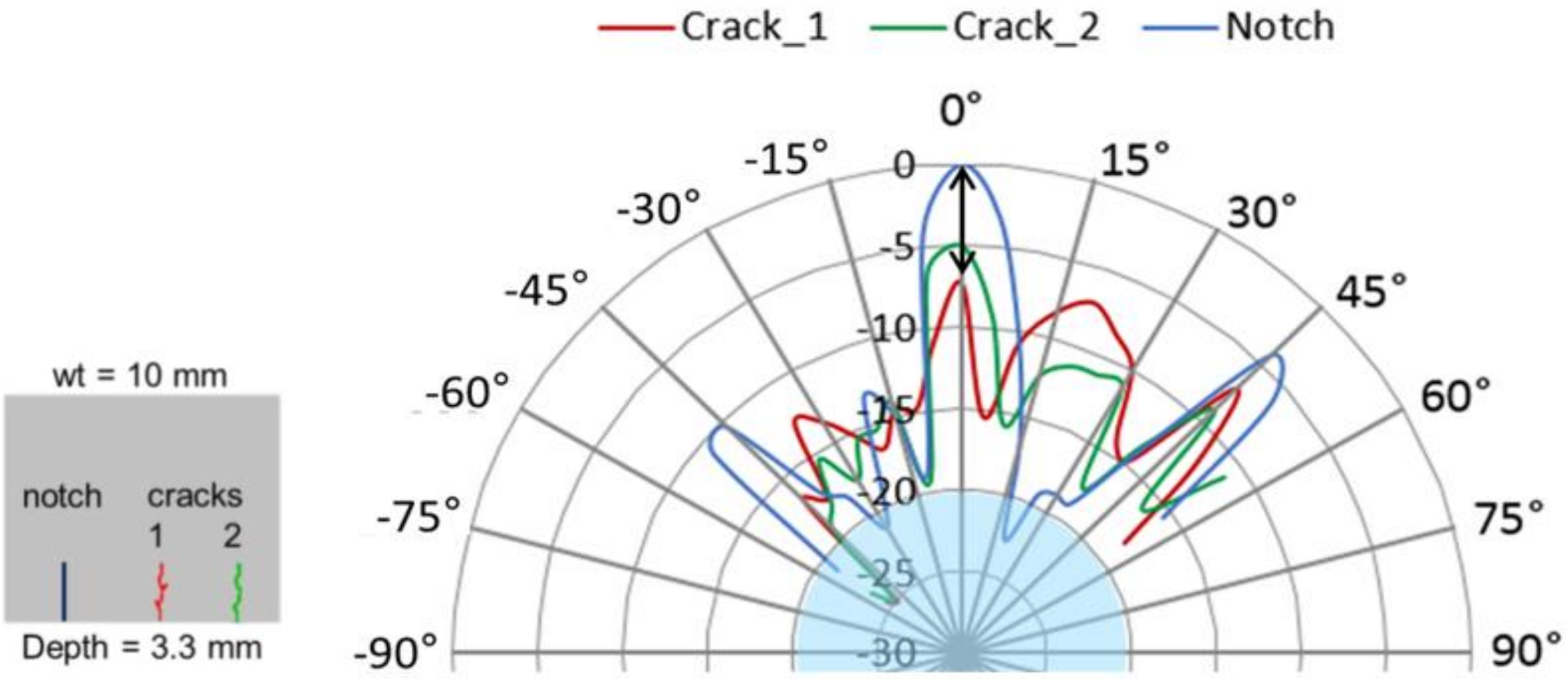
SIMULATIONS

over sizing

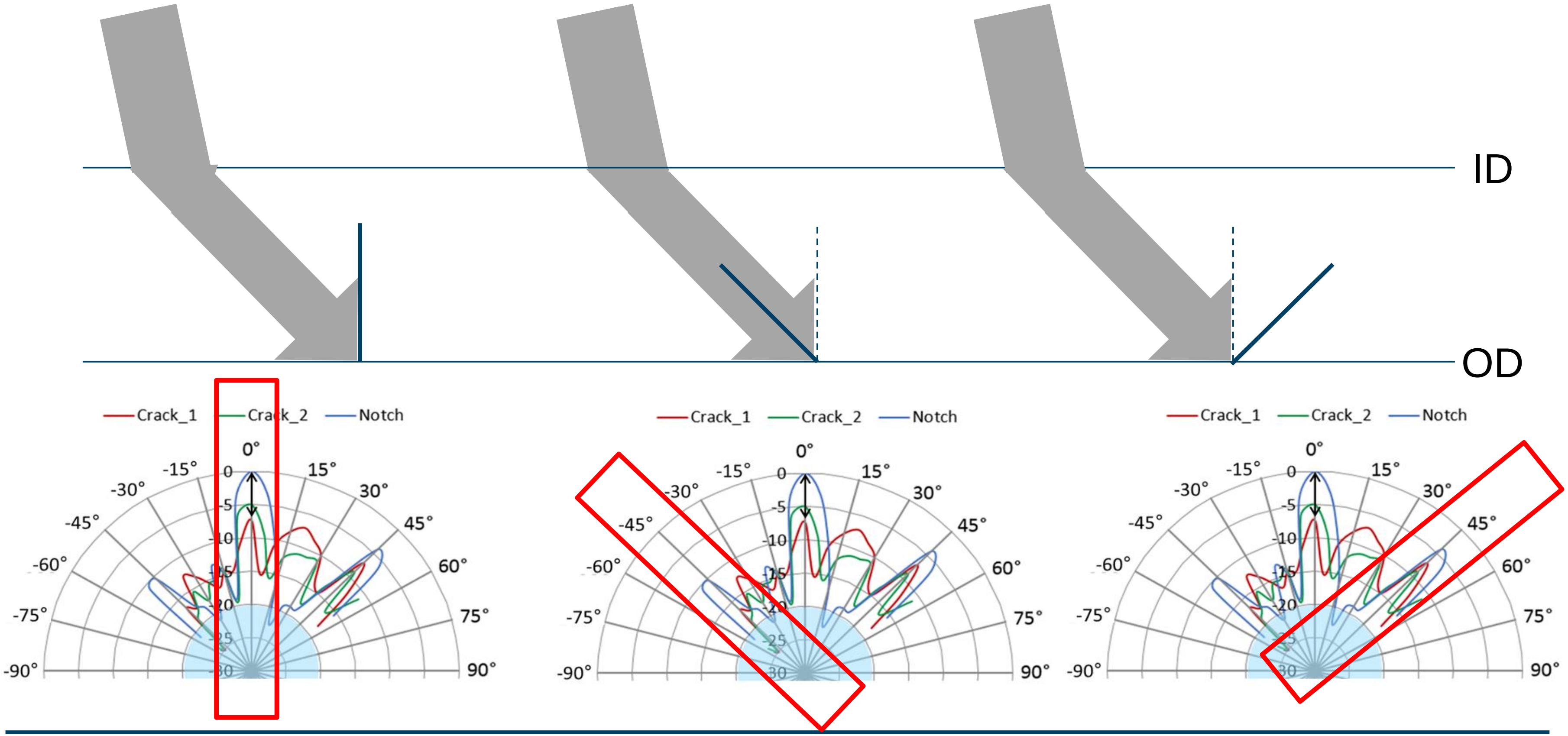
under sizing



SIMULATIONS - LIMITATIONS

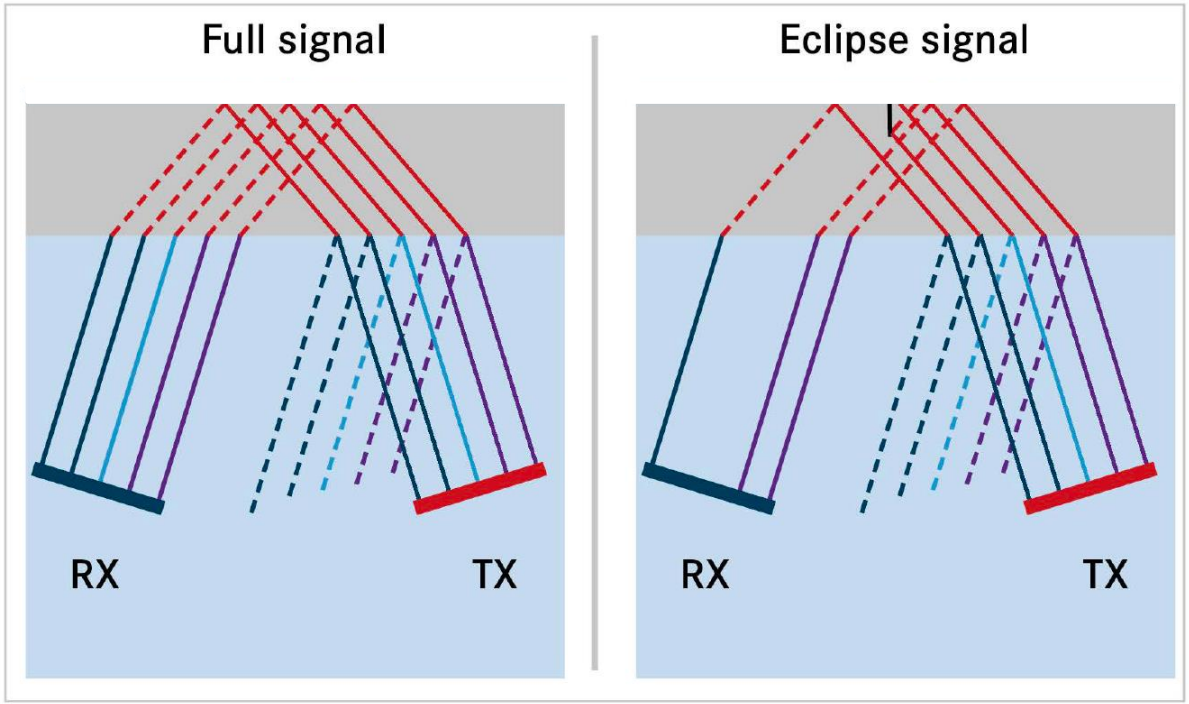


SIMULATIONS - LIMITATIONS



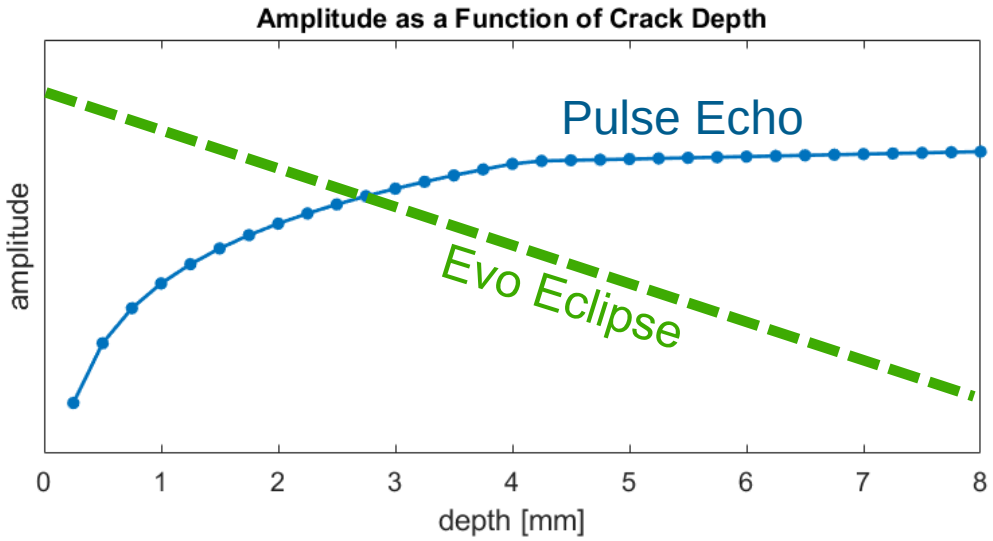
CRACK DETECTION - ECLIPSE

- Enhancement of PE
- High resolution
- New sensor carrier design
- Record the shaded or "eclipsed" signal

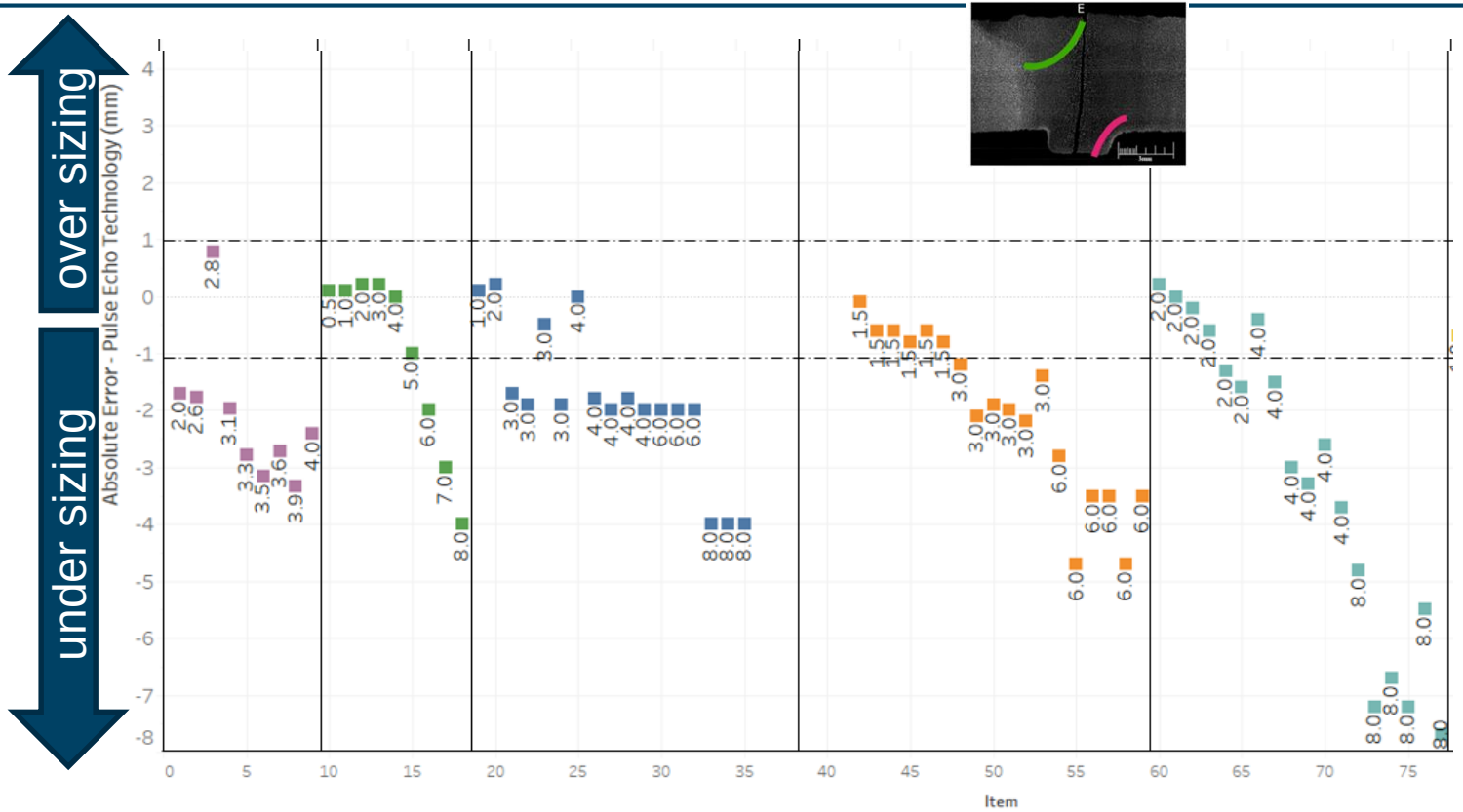


CRACK DETECTION - ECLIPSE

- 'Inverted' Signal
- Complementary analysis
- High amplitude – no flaw
- Low amplitude – deep flaw



CRACK DETECTION - ECLIPSE

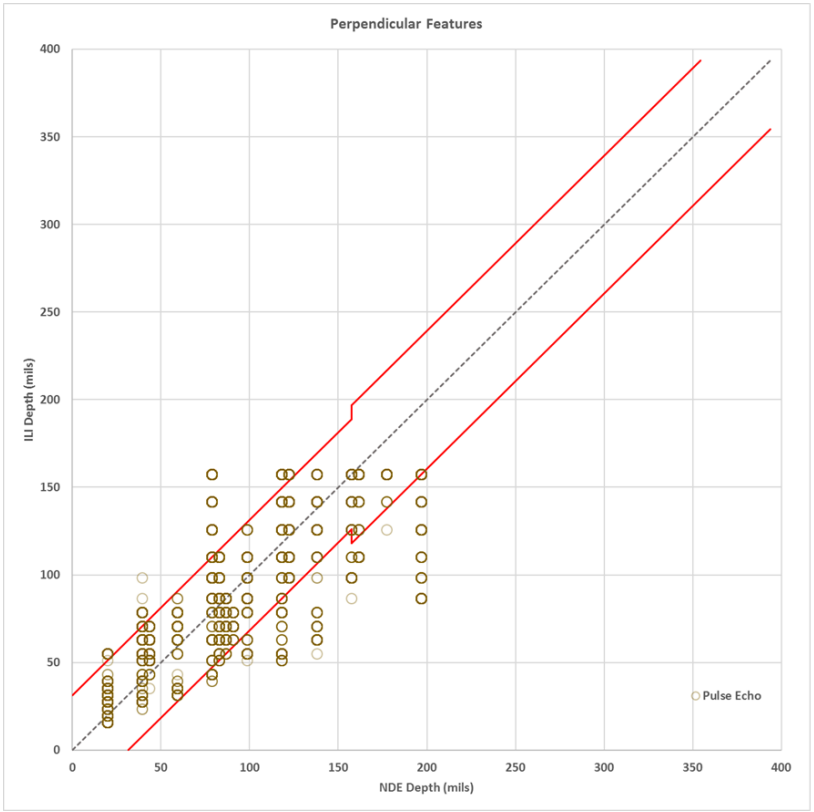


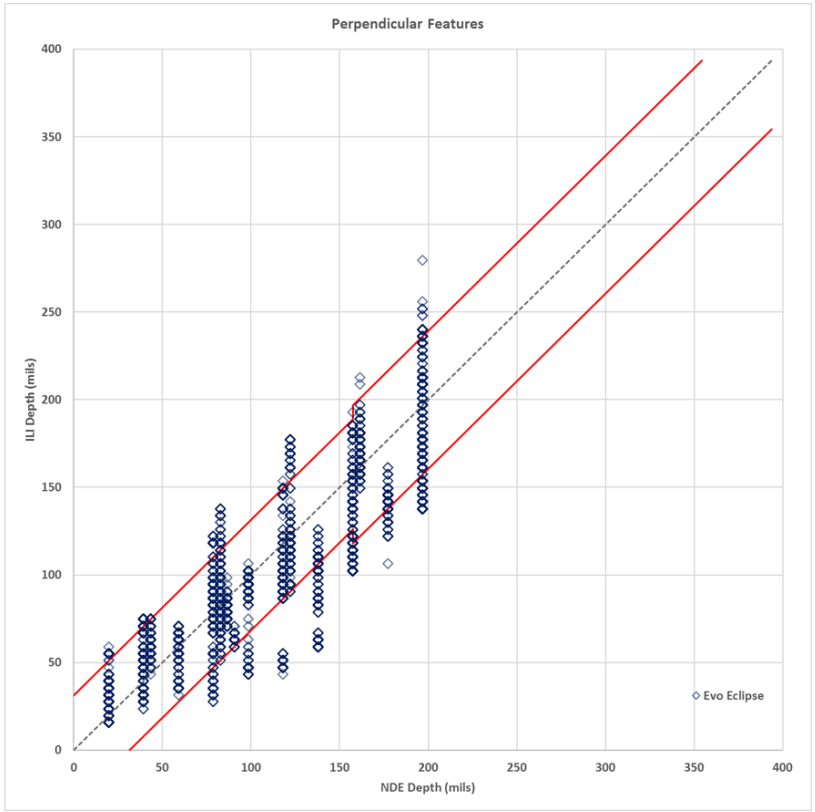
ECLIPSE - TESTING

12" Loop test

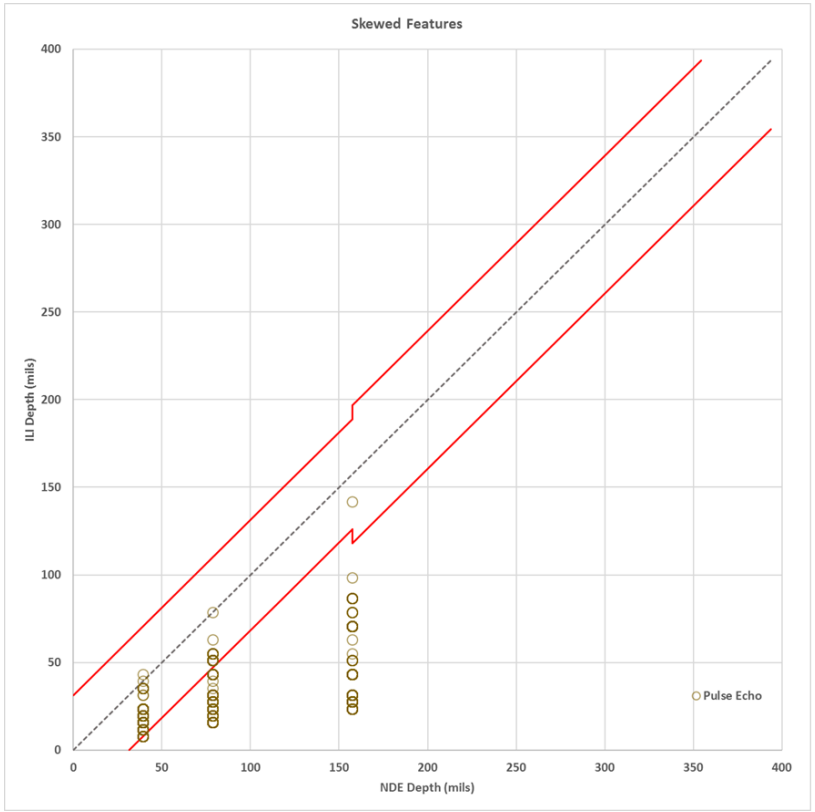
- Perpendicular
- Tilted 5°10°15°30°45°
- Skewed 2° 5°7°10°
- Depths: 1.0 – 5.0 mm
- Location in wall:
  - internal & external

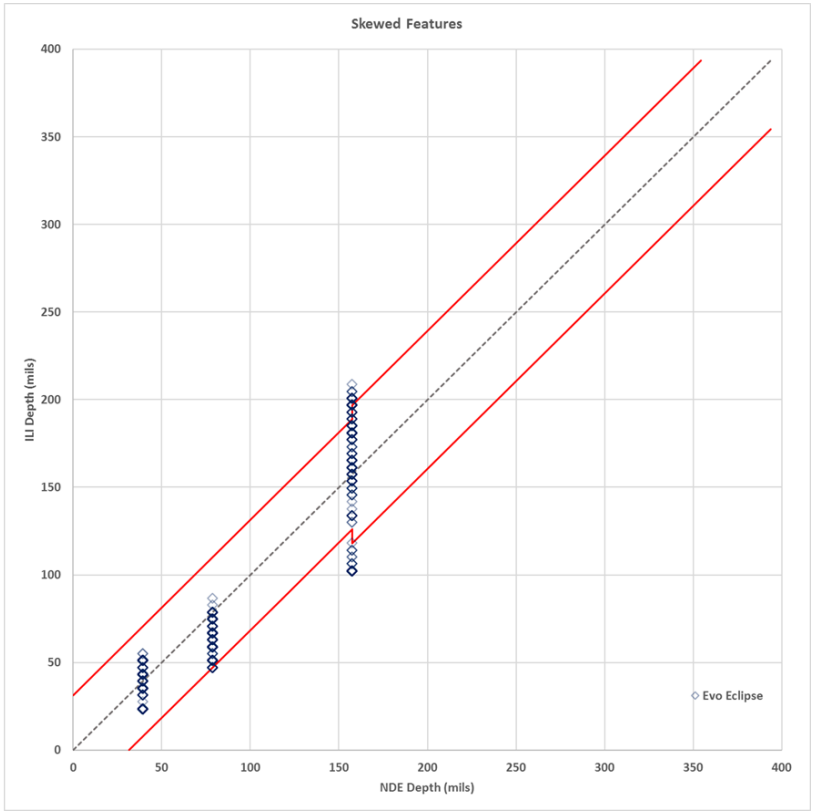
CRACK DETECTION – RADIAL FLAWS



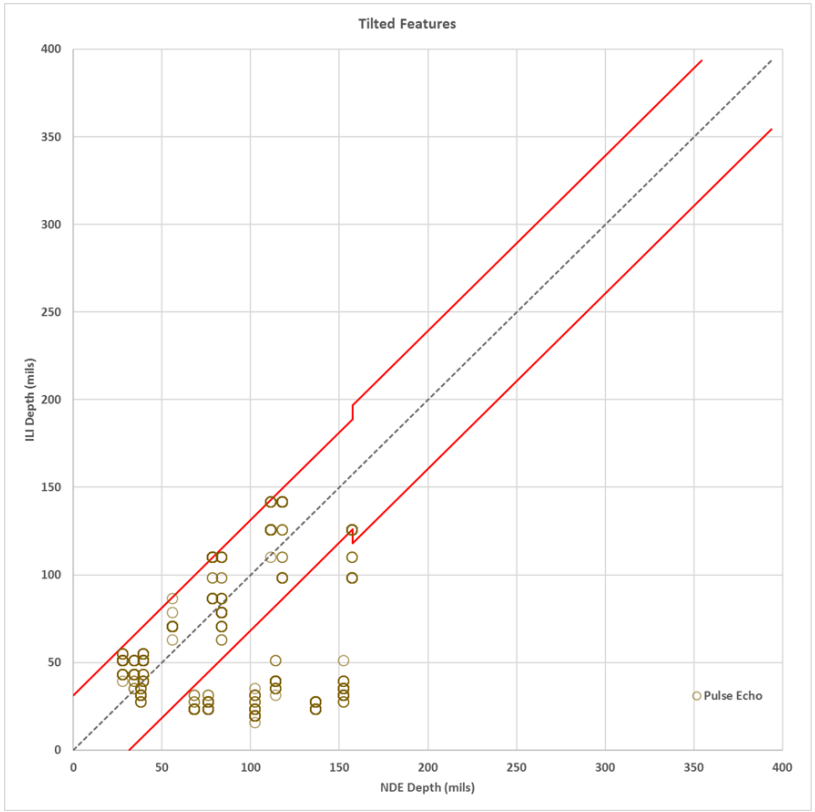


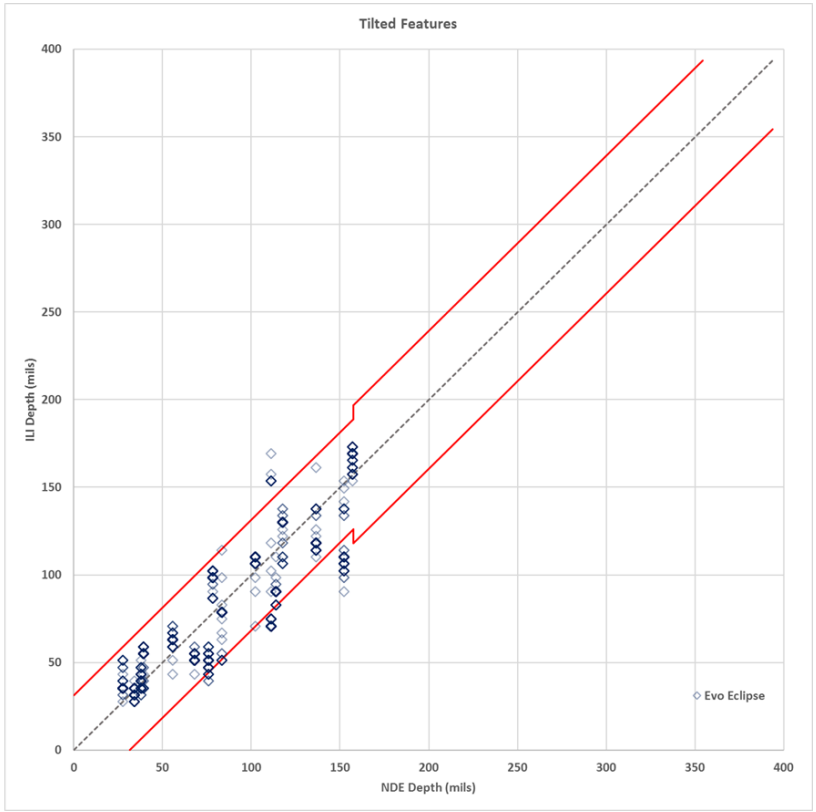
CRACK DETECTION - SKEWED FLAWS





CRACK DETECTION – TILTED FLAWS



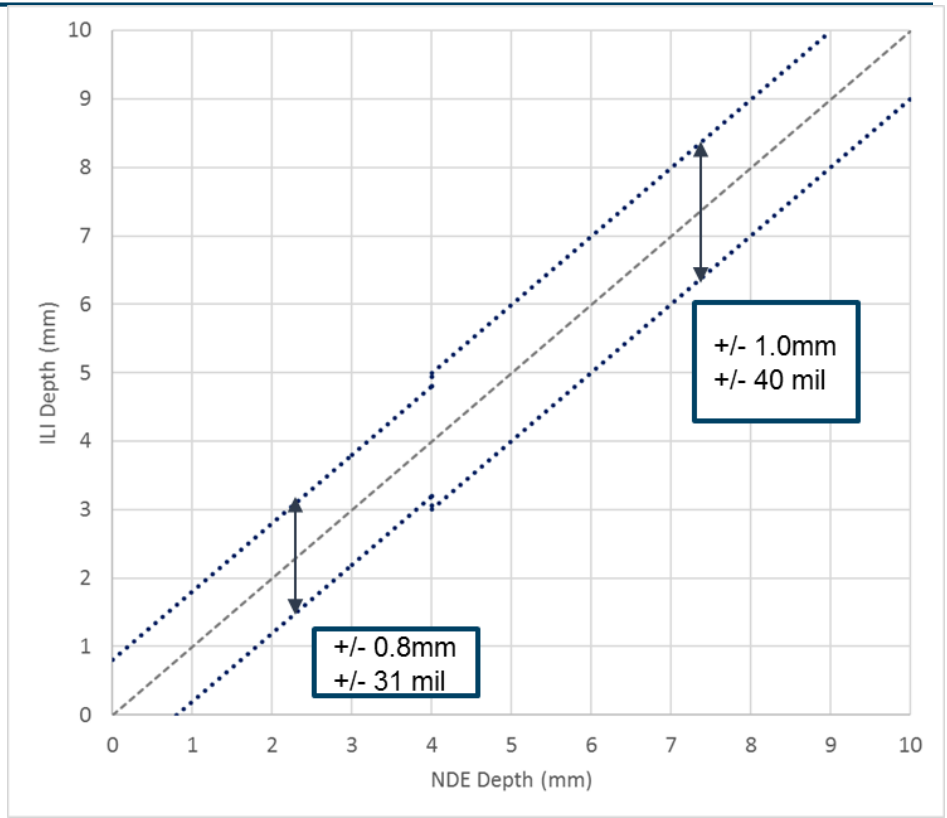


ECLIPSE – SPECIFICATION

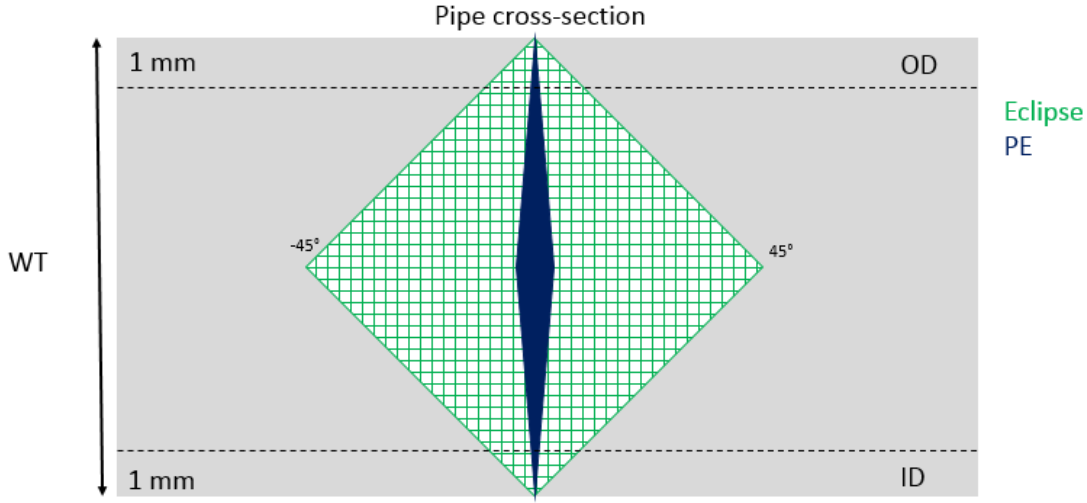
5 Depth Sizing Accuracy Evo Eclipse

Depth sizing accuracy and reporting of axial cracks, crack-like anomalies and linear indications		
Circumferential resolution	5.0 mm (UCx)	0.2 in (UCx)
Depth range	**1.0 mm … < 4.0 mm**	**0.040 in … < 0.120 in**
Depth sizing accuracy		
at 80% certainty	± 0.8 mm	± 0.031 in
at 90% certainty	± 1.0 mm	± 0.039 in
Depth range	**≥ 4.0 mm**	**≥ 0.160 in**
Depth sizing accuracy		
at 80% certainty[7]	± 1.0 mm	± 0.040 in
at 90% certainty	± 1.3 mm	± 0.051 in
Maximum wall thickness[8]	13.0 mm	0.510 in
Reporting of depth	Absolute value	Absolute value
Flaw orientation for sizing		
Maximum skew angle	10°	10°
Maximum tilt angle	45°	45°

Table 4 – Depth sizing accuracy and reporting for axial cracks, crack-like anomalies and linear indications with Evo Eclipse.

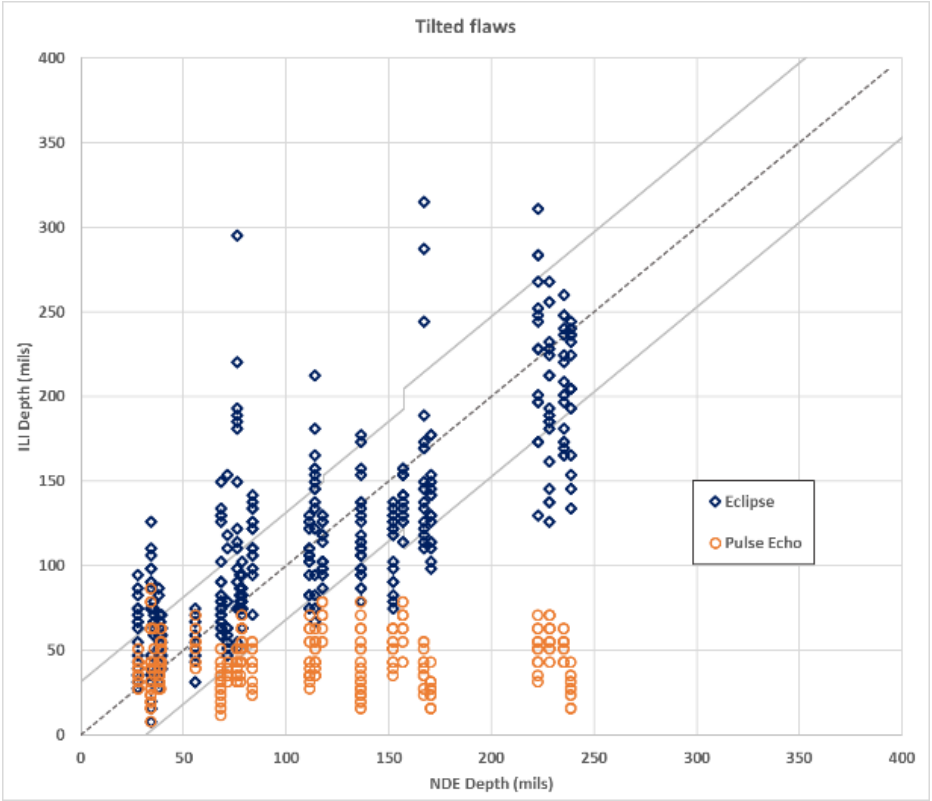


ECLIPSE - SPECIFICATION



SUMMARY

- Pulse Echo technology is suited for radial flaws under 4mm in depth.
- UCx & Evo 1.0 has further improved depth sizing accuracy to up to ±0.8mm.
- Enhanced sizing leads to correct sizing of features >4mm in depth
- Eclipse technology (with Pulse Echo, UCx, Evo 1.0 & Enhanced Sizing) leads to **correct sizing** of **tilted and skewed** flaws.



THANK YOU!

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