Heat Exchanger Tubing: Extending the Reach of IRIS Inspections

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Over 15 years of experience in the NDT industry (R/D Tech, Zetec and Eddyfi)

Now, in charge of tubing probes and instruments for the: Oil & Gas, Nuclear, BoP, HVAC/Chiller markets

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IRIS for Heat Exchanger Inspection

+ Work for both ferrous and non-ferrous material
+ Versatile
+ Reliable and precise technology
+ Validation technique
- Obstacles (such as small tubes, low inspection speed, etc.)

Manifold

Typical heat exchanger tube unit

.500’’–.750’’ Current IRIS Solution

Common plastic tulip centering device

- Very good, but they burn fast !

Isolation tape modified centering device

- Good – less expensive solution
- Often limited with internal scaling, old bended tube and at tubesheet

.500’’–.750’’ New IRIS Solution

Spring-loaded arms

- More durable
- Better data results with optimal centering
- Drastically less affected by scaling, old bended tube and at tubesheet
- Compatible with both turbines .335 in (8.5 mm) and 0.472 in (12 mm)

Extra-small centering device from 0.370–0.730 in (9.4–18.5 mm)

.500’’–.750’’ New IRIS Solution

Selection table

Tube OD	Tube wall thickness (BWG, mm, in)								
	4 6.05 0.238	6 5.16 0.206	8 4.19 0.165	10 3.4 0.135	12 2.77 0.109	14 2.11 0.083	16 1.65 0.065	18 1.24 0.049	20 0.89 0.035
12.7 mm (.500 in)	-	-	-	-	-	-	CDXS-SLA TB-085 MTD-20M-191	CDXS-SLA TB-085 MTD-20M-191	-
15.87 mm (.625 in)	-	-	-	-	CDXS-SLA TB-085 MTD-20M-191	CDXS-SLA TB-085 MTD-20M-191	CDXS-SLA TB-120 TD-20M-254	CDXS-SLA TB-120 TD-20M-254	CDXS-SLA TB-120 TD-20M-254
19.05 mm (.750 in)	-	-	-	-	CDXS-SLA TB-120 TD-15M-254	CDXS-SLA TB-120 TD-15M-254	CDXS-SLA TB-120 TD-20M-254	CDXS-SLA TB-120 TD-20M-254	CDXS-SLA TB-120 TD-20M-254
22.22 mm (.875 in)	-	-	CDXS-SLA TB-120 TD-10M-254	CDXS-SLA TB-120 TD-15M-254	CDXS-SLA TB-120 TD-15M-254	CDXS-SLA TB-120 TD-15M-254	CDXS-SLA TB-120 TD-20M-254	CDXS-SLA TB-120 TD-20M-254	-
25.4 mm (1.0 in)	CDXS-SLA TB-120 TD-10M-254	CDXS-SLA TB-120 TD-10M-254	CDXS-SLA TB-120 TD-10M-254	CDXS-SLA TB-120 TD-15M-254	CDSM-SLA TB-170 TD-15M-318	CDSM-SLA TB-170 TD-15M-318	CDSM-SLA TB-170 TD-20M-318	CDSM-SLA TB-170 TD-20M-318	-

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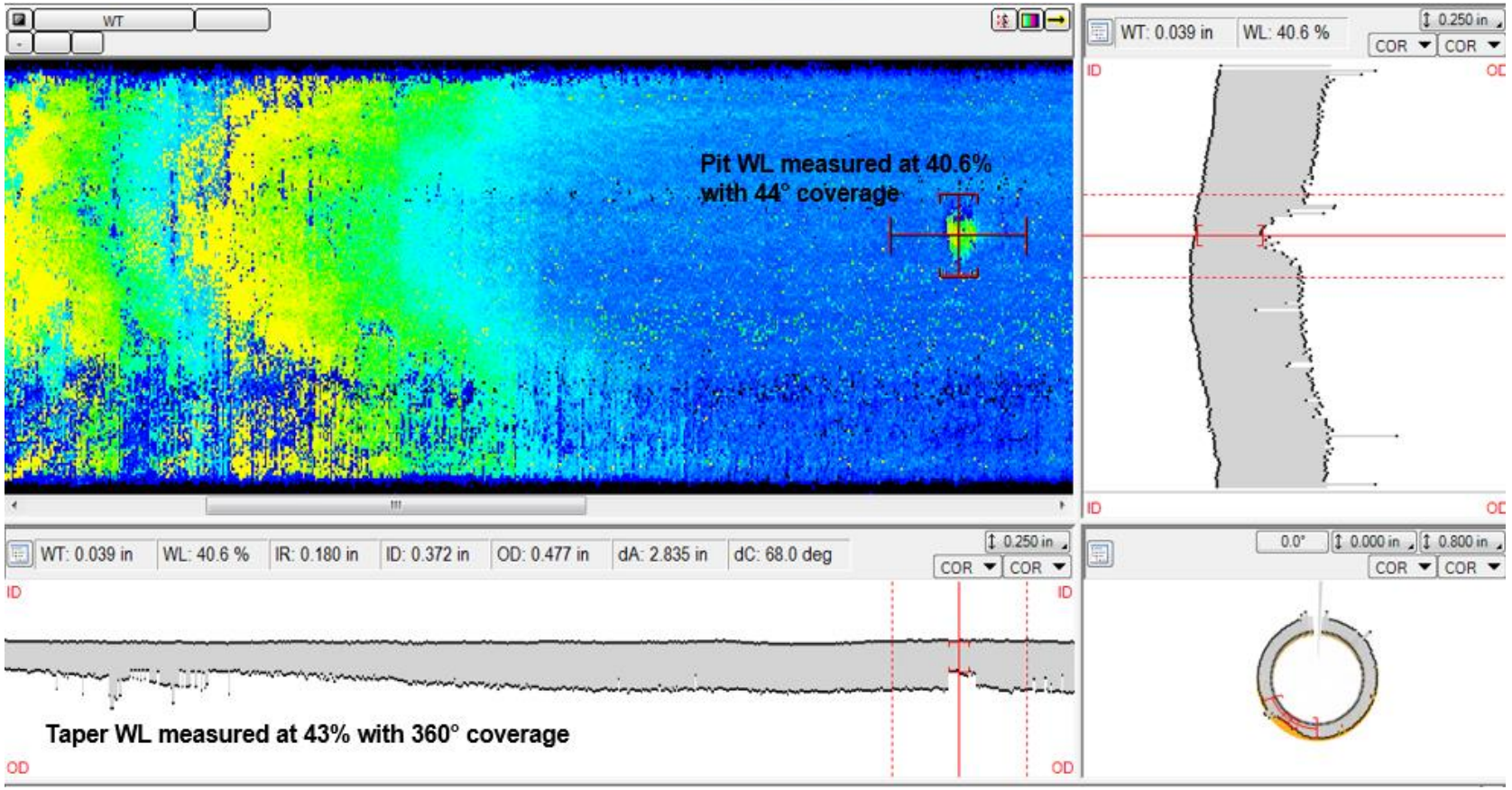
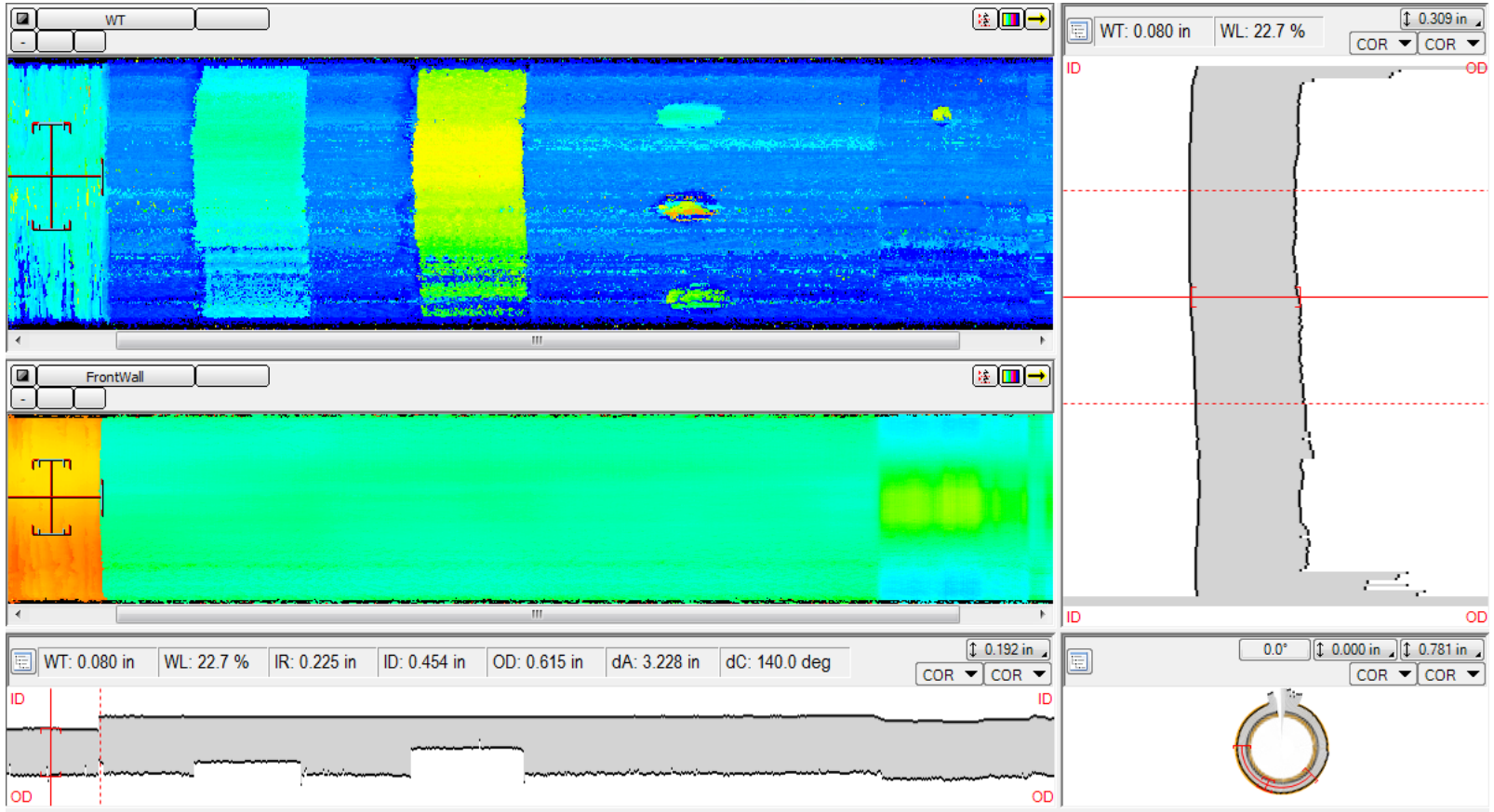
Field-Testing Results

316 Stainless Steel 0.500 × 0.065 in



Field-Testing Results

304 Stainless Steel 0.625 × 0.103 in



3.0’’– 6.5’’ IRIS solution

Extra-Large Spring-loaded arms centering device

- Cover a large diameter range from 2.8 – 6.6 in
- Robust and easily adjustable mechanical design
- Smooth inspection, **even with internal scaling / welds / deposits**
- High quality data

Collapses down to 72 mm (2.8 in)

Extends up to 169 mm (6.6 in)

3.0’’– 6.5’’ IRIS solution

Extended IRIS selection table

DIMENSIONS					UT TRANSDUCER						RECOMMENDED SPEED			TYPICAL MINIMUM FLAW DETECTION *	
					10 MHz			15 MHz							
OUTSIDE DIAMETER		WALL THICKNESS			63.50 mm (2.500 in)	76.20 mm (3.000 in)	88.90 mm (3.500 in)	63.50 mm (2.500 in)	76.20 mm (3.000 in)	88.90 mm (3.500 in)	ROTATION RPS	PULLING mm/s	PULLING in/s	mm	in
88.90 mm	3.5 in (ND 3.0 in)	SCH 10	3.05 mm	(0.120 in)				X			83	50.8	2	4.3	0.169
		SCH 40	5.49 mm	(0.216 in)	X						55	50.8	2	4.0	0.157
		SCH 80	7.62 mm	(0.300 in)	X						57	53.34	2.1	3.8	0.150
101.60 mm	4.0 in (ND 3.5 in)	SCH 10	3.05 mm	(0.120 in)				X			48	45.72	1.8	5.0	0.197
		SCH 40	5.74 mm	(0.226 in)	X						50	45.72	1.8	4.7	0.185
		SCH 80	8.08 mm	(0.318 in)	X						51	48.26	1.9	4.4	0.173
114.30 mm	4.5 in (ND 4.0 in)	SCH 10	3.05 mm	(0.120 in)					X		44	40.64	1.6	5.6	0.220
		SCH 40	6.02 mm	(0.237 in)		X					45	43.18	1.7	5.3	0.209
		SCH 80	8.56 mm	(0.337 in)		X					47	43.18	1.7	5.0	0.197
140.61 mm	5.563 in (ND 5.0 in)	SCH 10	3.40 mm	(0.134 in)						X	37	33.02	1.3	7.0	0.276
		SCH 40	6.55 mm	(0.258 in)			X				38	35.56	1.4	6.6	0.260
		SCH 80	9.53 mm	(0.375 in)			X				39	35.56	1.4	6.3	0.248
168.28 mm	6.625 in (ND 6.0 in)	SCH 40	7.11 mm	(0.280 in)			X				33	30.48	1.2	8.0	0.315
		SCH 80	10.97 mm	(0.432 in)			X				34	30.48	1.2	7.6	0.299

ND means: pipe Nominal Diameter

* Based on a circumferential detection of three points with a 180° resolution.

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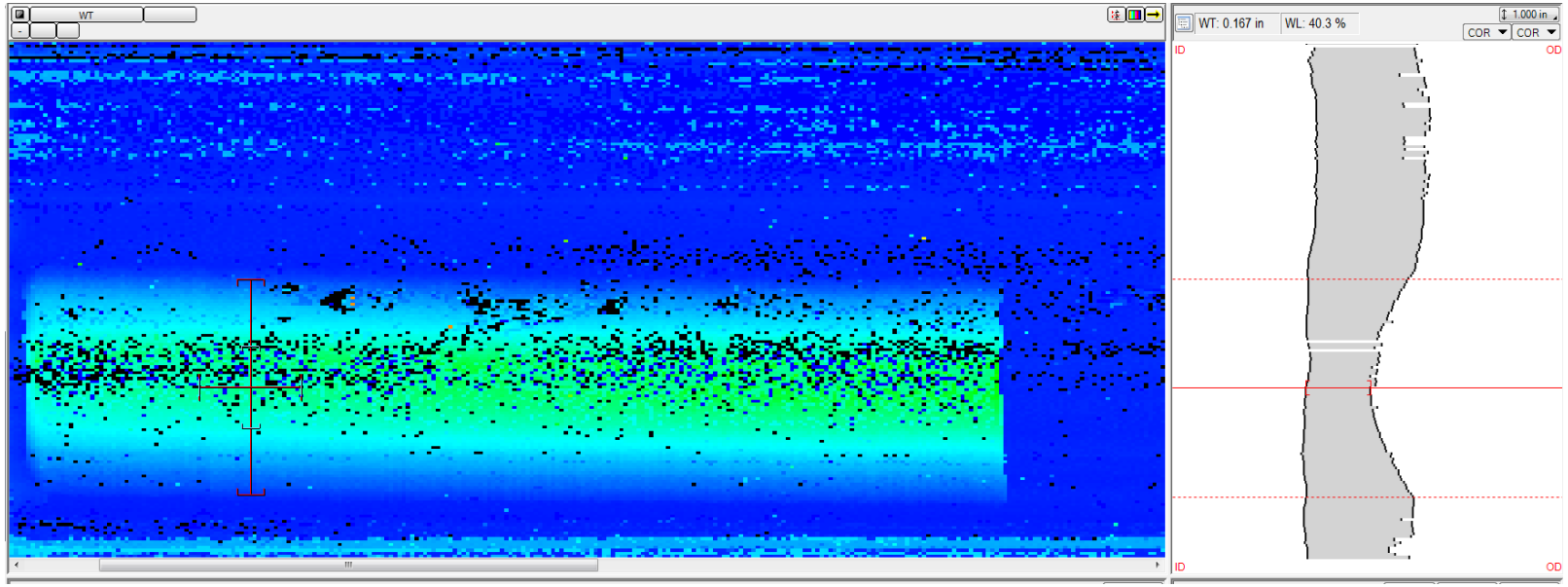
Field-Testing Results

Carbon steel 6.0 in pipe sch. 80 (0.432 in – 10.97 mm)

IRIS measured wear scar
40.3% wall loss / 148° coverage



Custom bended tube application

Custom flexible IRIS

Custom flexible probe head

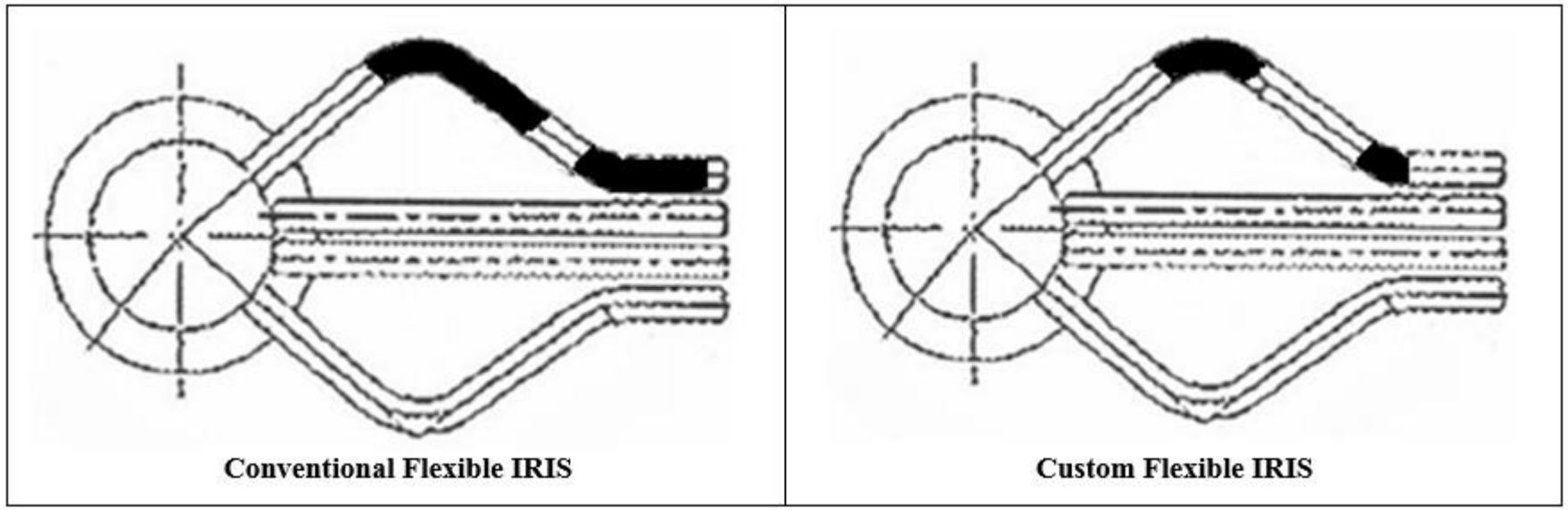
- Can manage aggressive bends and elbows
- Better coverage at bend areas with higher quality data
- Interchangeable centering devices offer large variety of possibility
- Foam-loaded balls help for centering and remain water at the probe head

Probe assembly

Foam-loaded balls

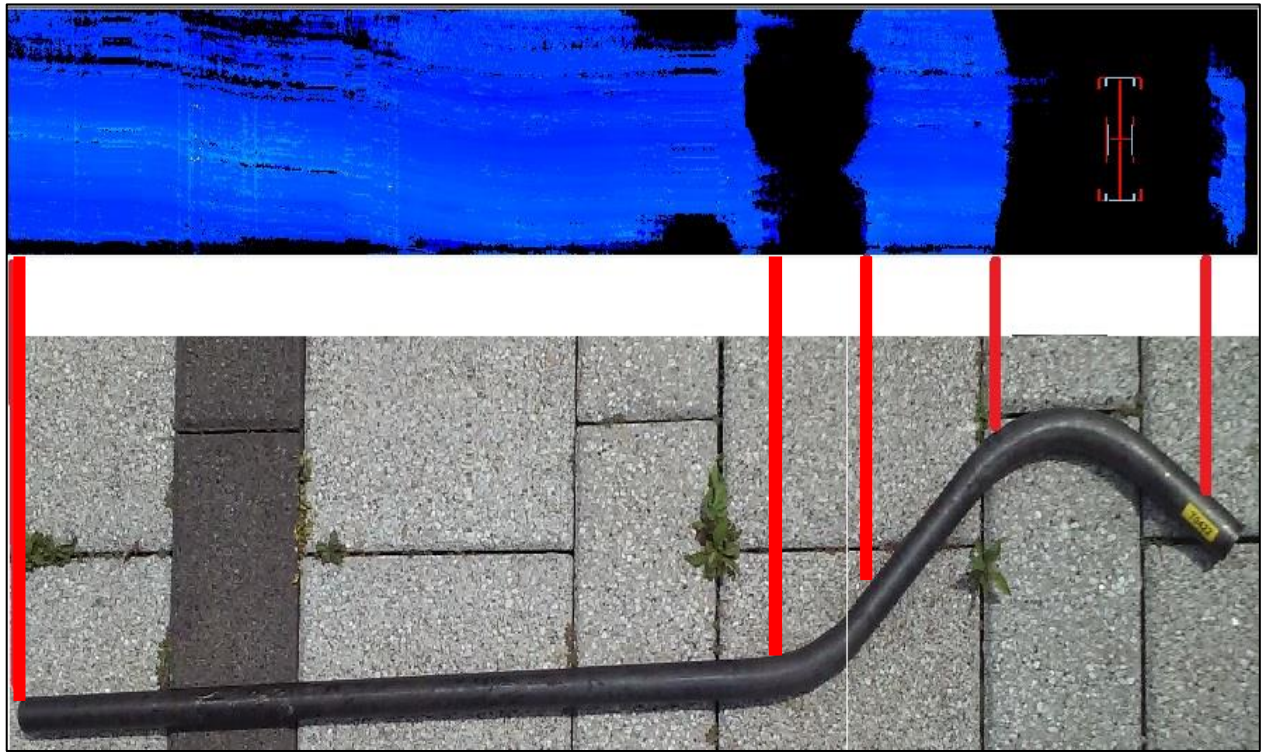
Custom bend tube application

Manifold bends example:



Field-Testing Results

Carbon steel 1.25 × 0.332 in (31.8 × 8.4 mm)



Pull speed comparison

Centering device	Reference	X-small	Flexible	X-large	
Tube OD	1.0 in (25 mm)	0.500 in (13 mm)	1.25 in (32 mm)	3.5 in (89 mm)	6.5 in (165 mm)
Pull speed	2.0 in/s (51 mm/s)	5.0 in/s (127 mm/s)	3.4 in/s (86 mm/s)	2.3 in/s (58 mm/s)	1.5 in/s (38 mm/s)

The reference pull speed is extrapolated from industry baselines.

Conclusion

- Small tubes and large pipes can now be fully inspected, including internal obstacles, thanks to a "***collapsible design***"
- Probes can go through aggressive bends and elbows with a better coverage, allowing ***complete asset integrity assessment***
- Higher pull speed, reduce time, yielding ***better ROI*** and with improved IRIS technology offers ***higher quality data!***

Questions?

Visit us at our booth for further discussion

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