



Welkom bij A.Hak Inspection Services



Tricht, 2 november 2016



Veiligheidsregels

A. Hak Industrial Services

Roken alleen op aangewezen plaatsen



Draag uw veiligheidsschoenen buiten de aangegeven gele paden



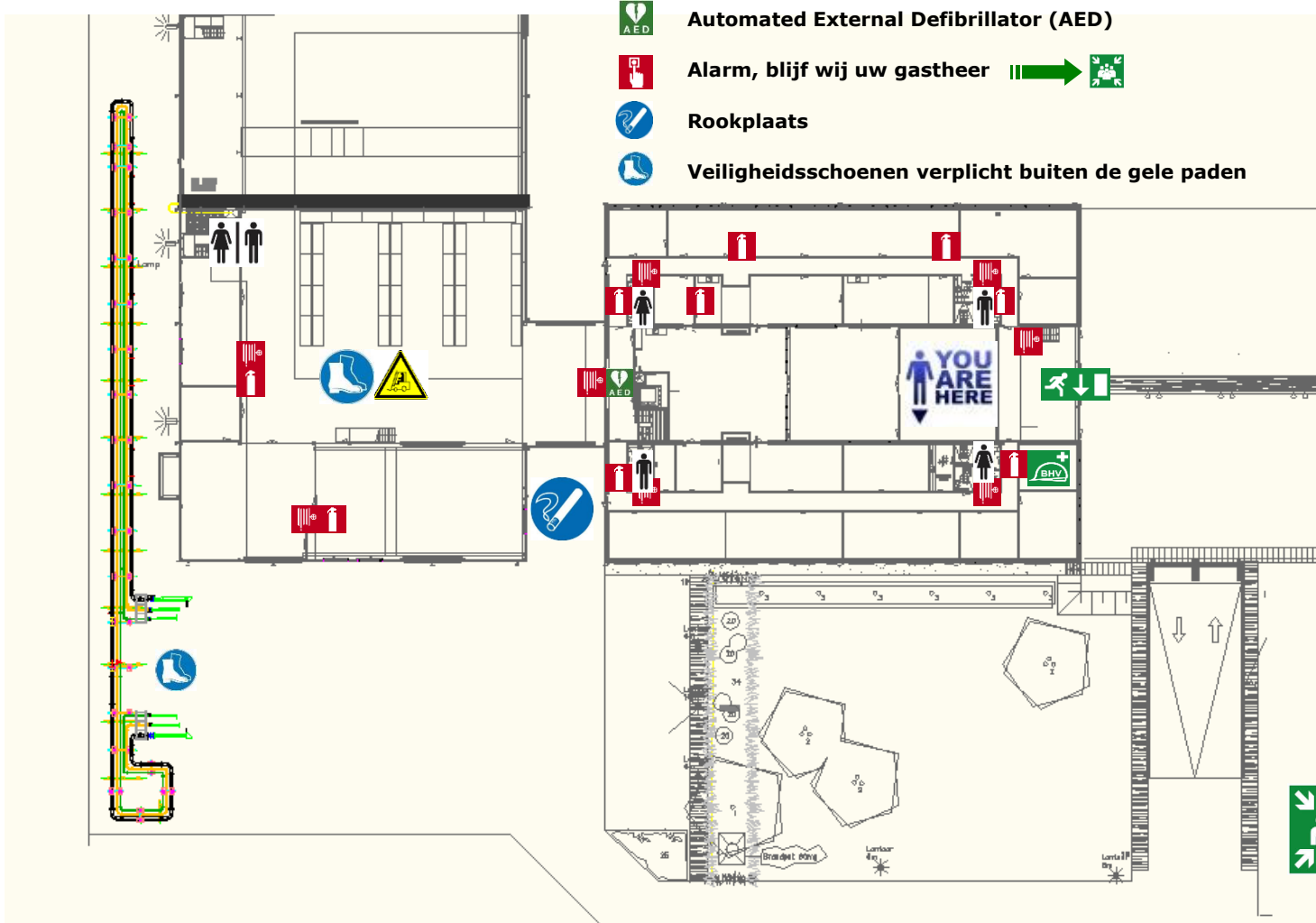
Let op de vorkheftruck



Verzamelplaats bij calamiteiten op grasveld naast hoofdkantoor



Veiligheids regels



Who are we?

A.Hak park was founded in 1963

- Conglomerate of companies providing solutions for transportation and distribution of oil, gas, water, electricity, heat and cold, data and telecom traffic, industrial services and products
 - From design to maintenance
 - From source to end user
- > € 500.000.000 turnover
- ~ 3500 employees
- Active worldwide
- Private company, family owned



Company Profile

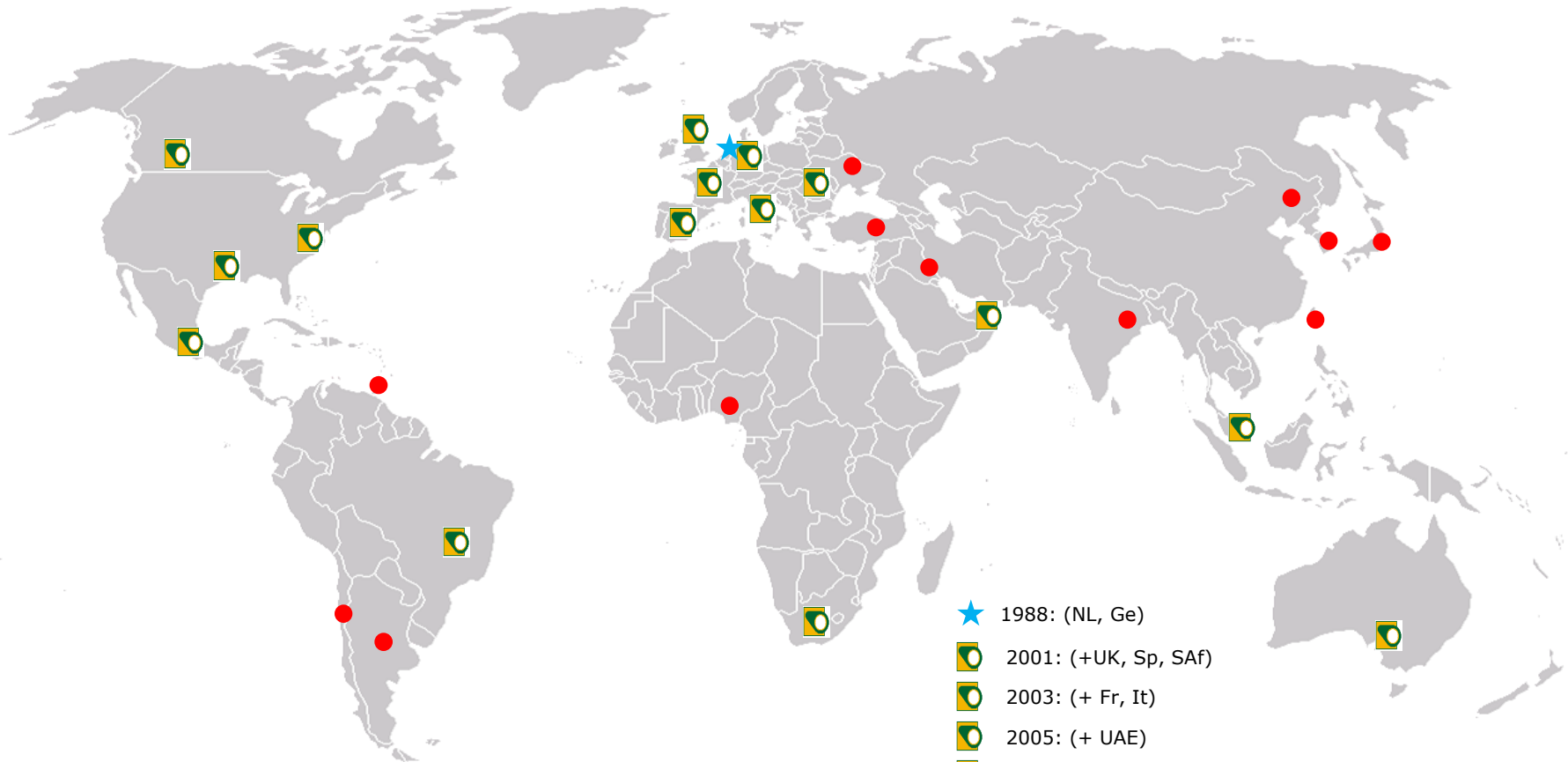
All about pipeline inspection

- Since 1988
- 10% of turnover A.Hakpark
- 300 people worldwide
- 200-250 inspections per year
- > 25.000 km of pipelines



...to maintain the integrity of your assets

Worldwide services



- ★ 1988: (NL, Ge)
- 📍 2001: (+UK, Sp, SAf)
- 📍 2003: (+ Fr, It)
- 📍 2005: (+ UAE)
- 📍 2007: (+ Br, USA)
- 📍 2009: (+ Ro)
- 📍 2011: (+ Mex, Intank)
- 📍 2013: (+ SAE, DMC1)
- 📍 2015: (+ Aus, Can)

Wat is piggen

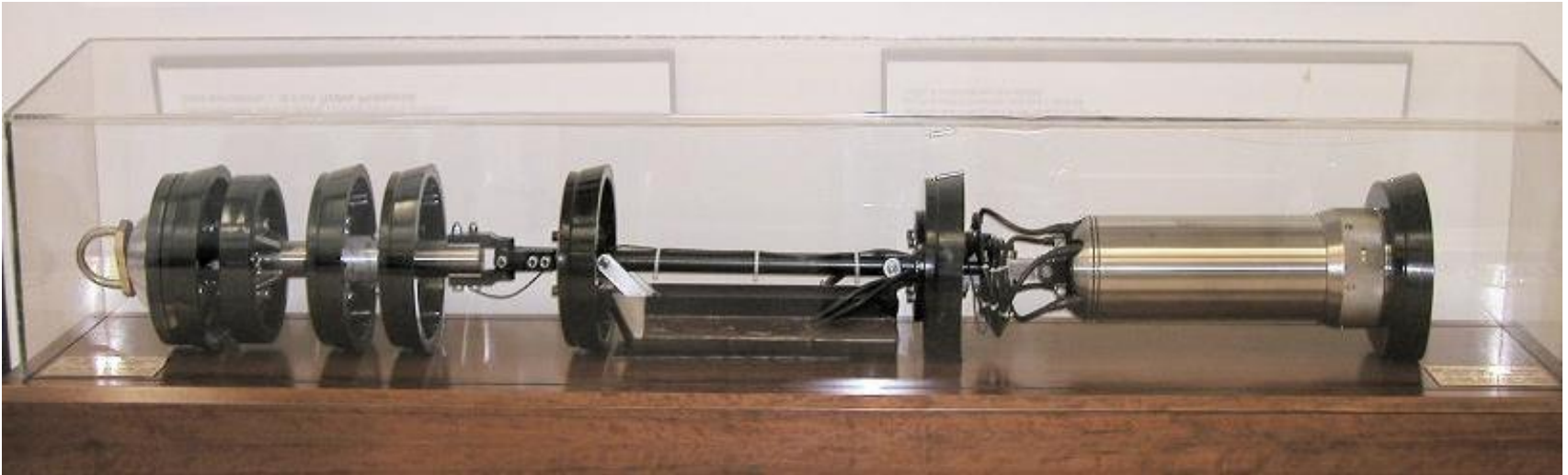
The practice of using "pigs" to perform various maintenance operations on a pipeline, among which batching, cleaning, gauging and inspection.



Geschiedenis van piggen

- 1870 Eerste pigging activiteiten bekend in Pennsylvania
 - Samengebonden voden om wax te verwijderen
 - Later verbeterde versie met leder
- 1904 Rubberen bal (sphere) gebruikt in Montana
 - Gebruikt om doorgang van de leiding te controleren op beschadigingen
- 1961 Shell Research: ILI test
 - Shell gepatenteerd concept in 1963
- 1964 MFL ILI tool in gebruik
 - Tuboscope ontwikkeling (Shell patent)

Geschiedenis van piggen



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Waarom piggen

- Constructie en (Pre-)Commissioning
 - Reinigen
 - Gauging
 - Vullen, legen en drogen



Waarom piggen

- Constructie en (Pre-)Commissioning
 - Reinigen
 - Gauging
 - Vullen, legen en drogen
- Productie
 - Reinigen
 - Batching



Waarom piggen

- Constructie en (Pre-)Commissioning

- Reinigen
- Gauging
- Vullen, legen en drogen

- Productie

- Reinigen
- Batching

- Onderhoud

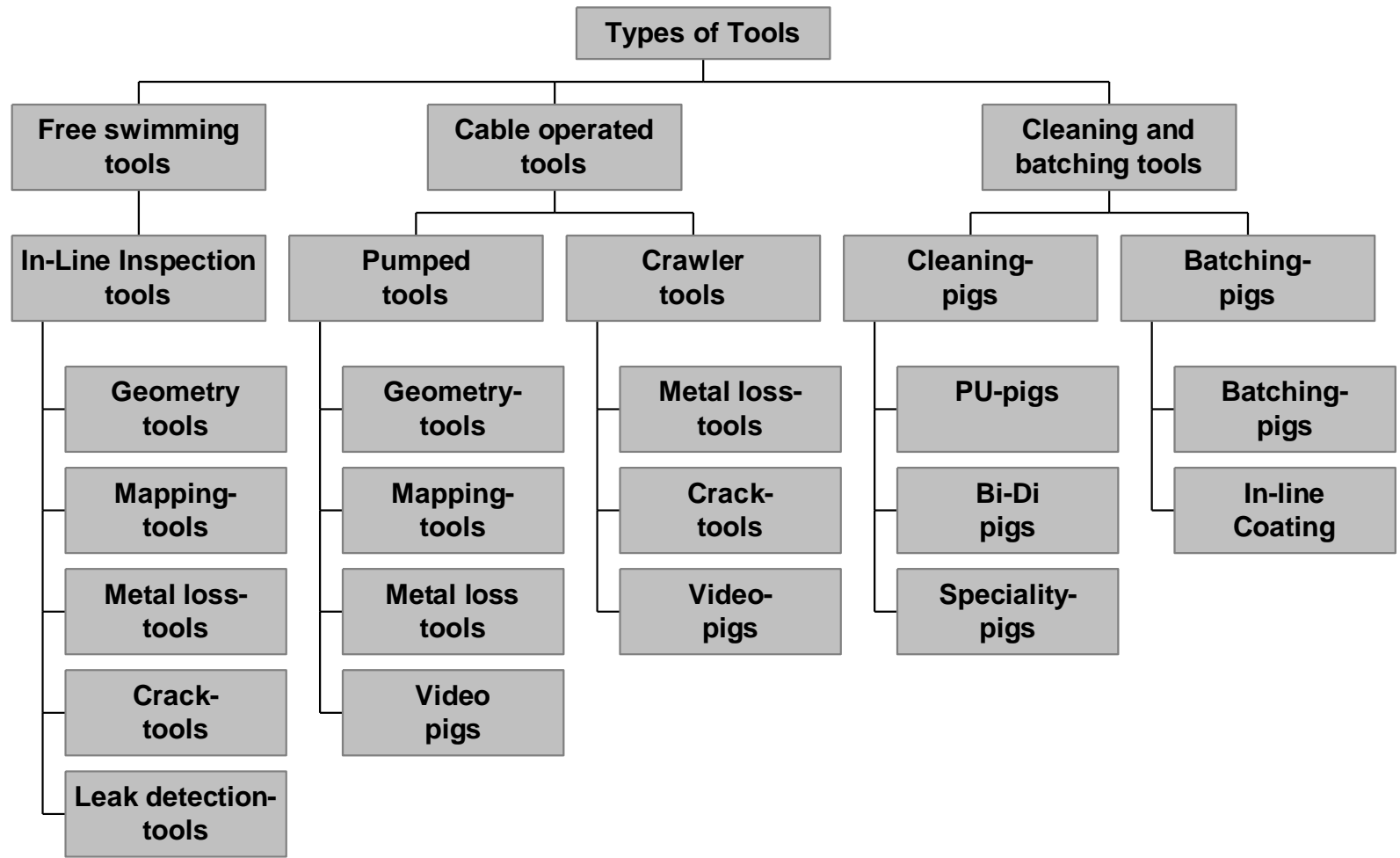
- Inspecteren
- Lekdetectie
- Renovatie



Pig indications

- Level 0
 - Batching pig
 - Cleaning pig
- Level 1
 - Gauging pig
 - Dummy pig
- Level 2
 - Caliper pig
 - Geometry pig
 - Mapping Pig
- Level 3
 - Magnetic Flux Leakage pig (MFL)
 - Ultrasonic pig (UT)
- Combtools
 - Obstructions
 - Piggability Pipeline
 - Large Dents
 - Large Deformations
 - Diameter change
 - Weld penetration
 - Bend radius
 - Ovality and large dents
 - Dents and Buckles
 - Corrosion
 - Erosion
 - Cracks

Types of pigs



Pipeline integrity

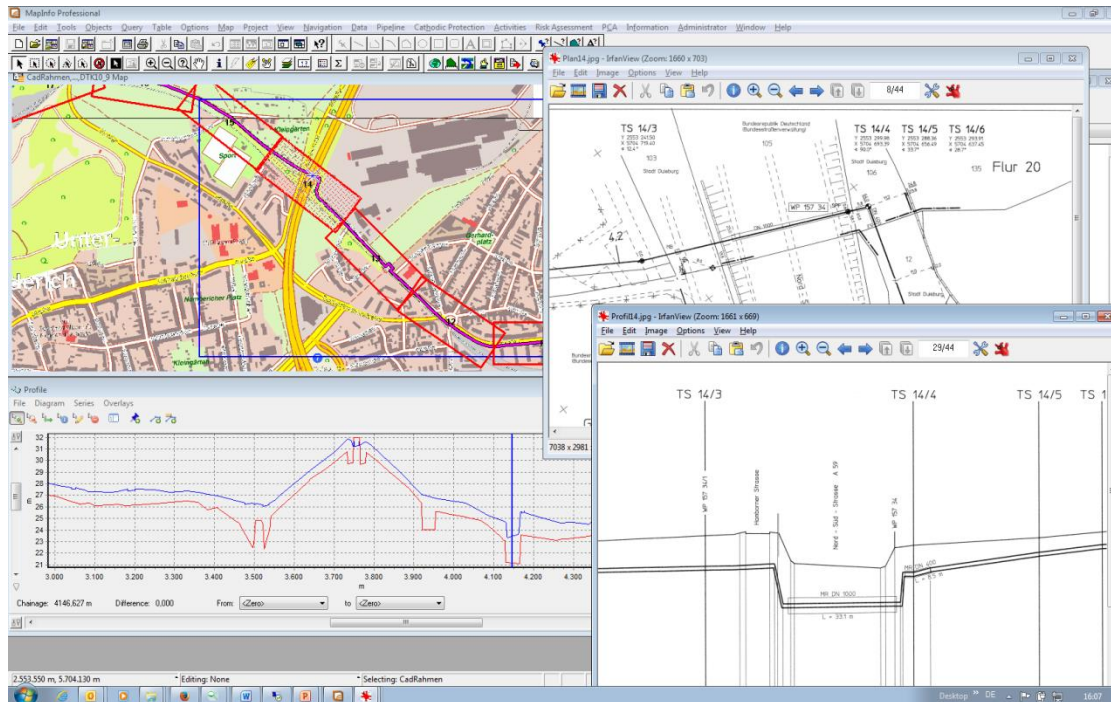


Pipeline integrity



Pipeline Management

- Geographical pipeline information system
- Exact routing and risk analysis
- Data based on existing plans or xyz mapping runs
- Can contain and combine different data sets (CIPS, DCVG, UT, etc.)
- Corrosion growth, defect origine analysis



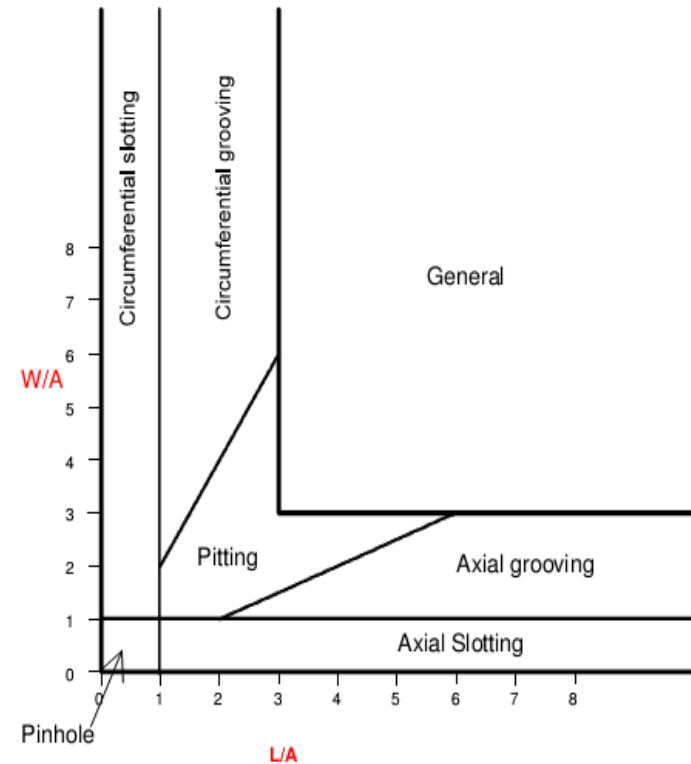
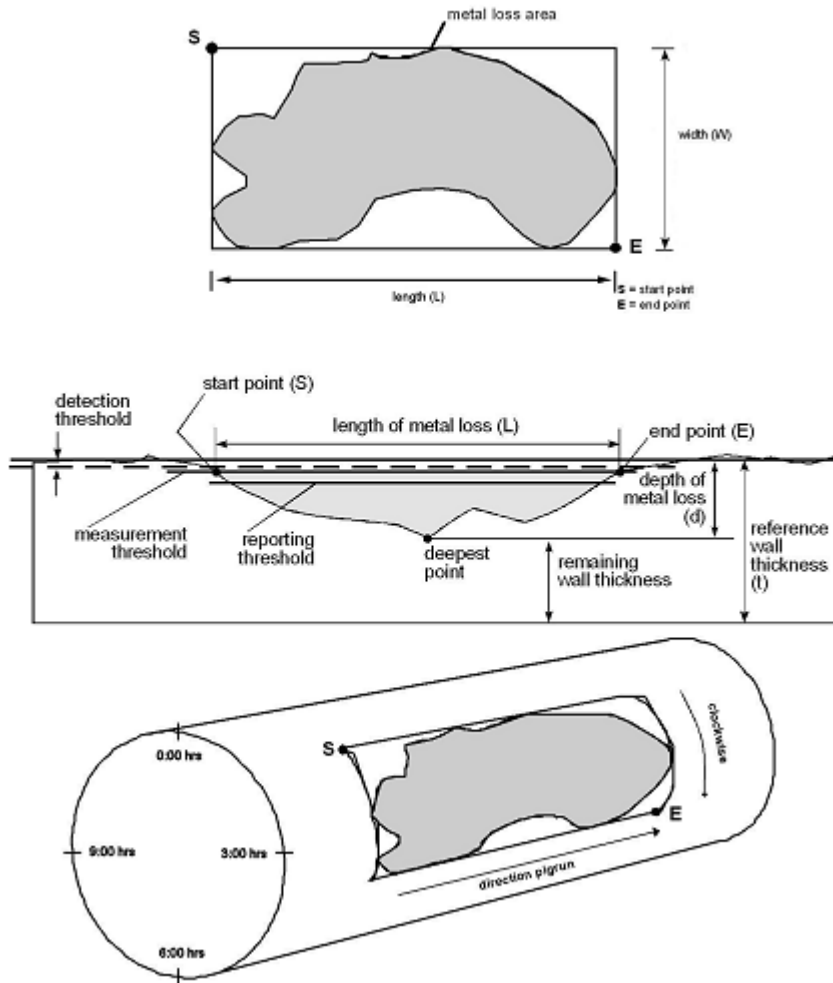
DMC One

Pipeline operator Forum

The Pipeline Operators Forum is a non profit, informal forum enabling pipeline integrity engineers to share and build best practice, thereby raising the standard of pipeline integrity management globally



Defect nomenclature



The geometrical parameter A is linked to the NDE methods in the following manner:

- If $t < 10$ mm then $A = 10$ mm
- If $t \geq 10$ mm then $A = t$

Figure 2: Graphical presentation of metal loss anomalies per dimension class.

Integrity Assessment

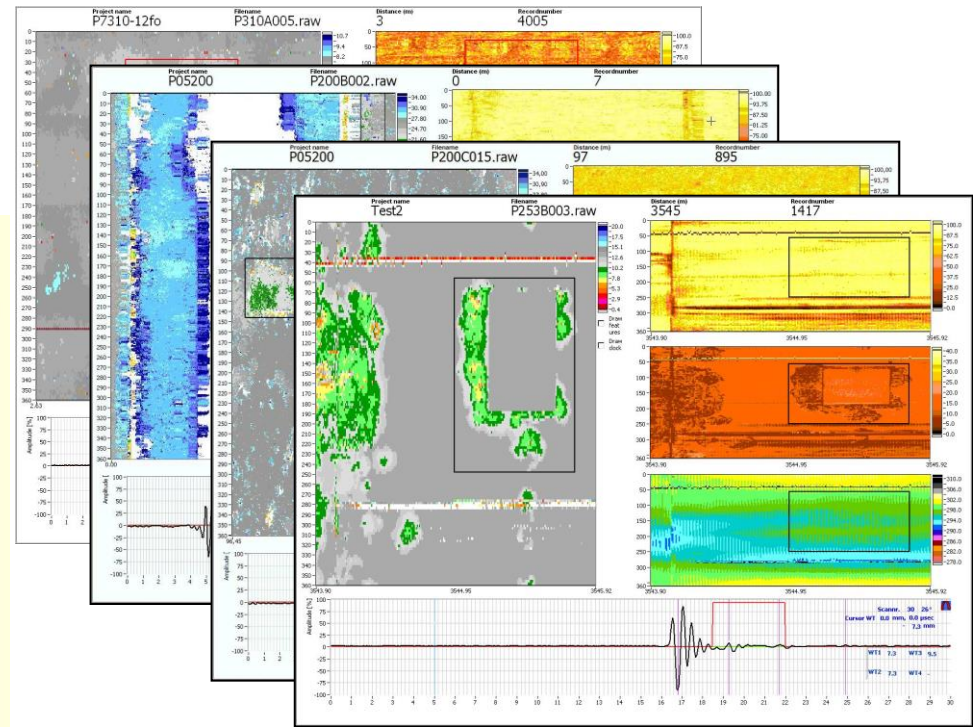
- Field report for dat quality check
- On-site reporting, first assessment
- Final reporting in accordance with POF2009
- Defect assessment ASME B31G
- Dig-up sheet
- Fit-for-Service report

Sort menu Log distance (m) Sort features Metric Imperial Plot menu Info / pipe plots Create plot Cobble features Edit features Returns to main

Select subset menu Above Ground Create subset Plot list in WCD format Create report Add feature

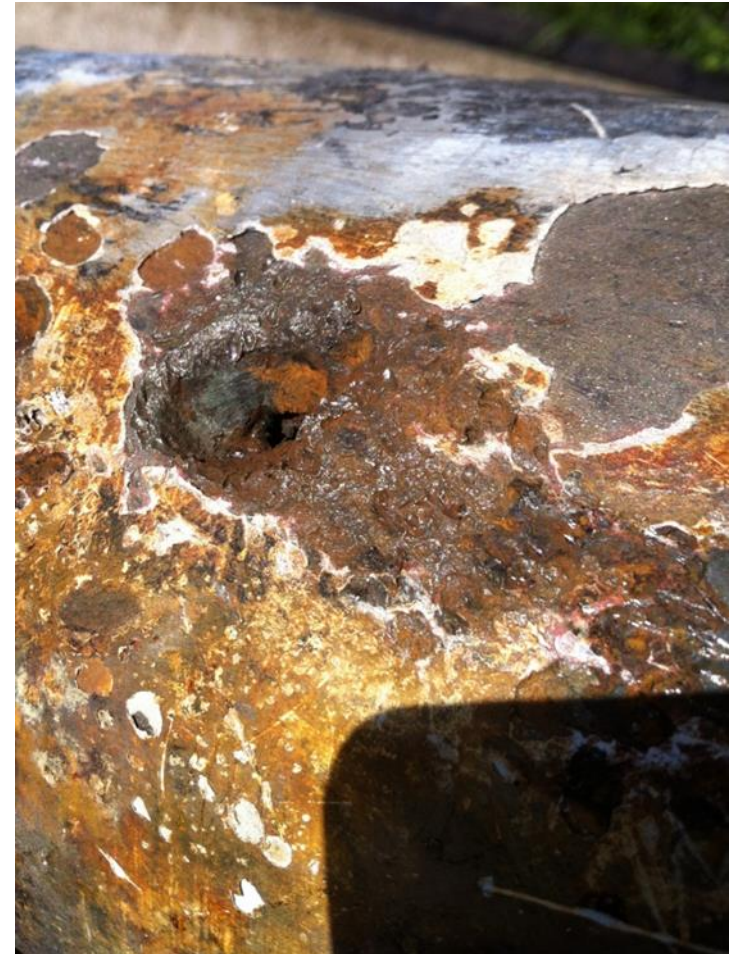
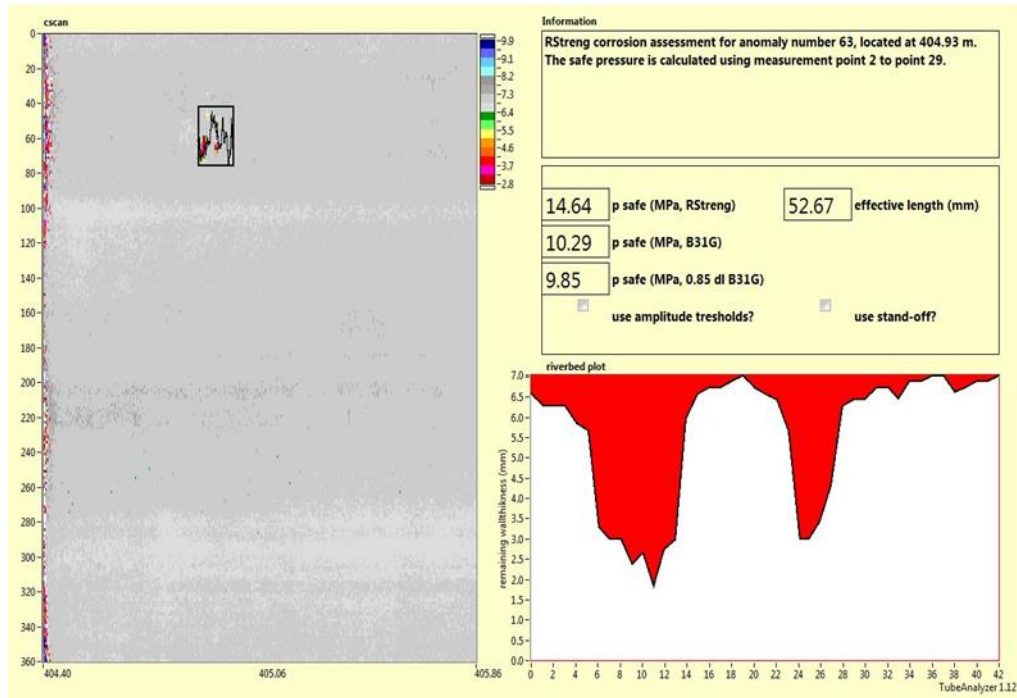
Log distance (m)	Up weld distance (m)	Start length (m)	Feature type	Feature identification	Anomaly dimension class	Click position (mm)	Normal t (mm)	Reference t (mm)	Length (mm)	Width (mm)	Remaining t (mm)	d peak (mm)	d mean (mm)	Surface location	DSF	Comments
0.00	-	0.00	Weld	Flange	-	-	6.350	-	-	-	-	-	-	-	-	start 1 piece- start inspection
0.37	0.37	0.60	Weld	-	-	-	6.350	-	-	-	-	-	-	-	-	1 piece
0.60	-	1.07	Weld	Flange	-	-	6.350	-	-	-	-	-	-	-	-	end 1 piece
1.75	-	10.23	Weld	-	-	-	6.350	-	-	-	-	-	-	-	-	-
11.07	10.12	10.23	Anomaly	Pipe mill anomaly	General	944	6.350	6.394	218.000	16.000	5.066	1.33	0.87	Not applicable	0.39	in HAZ
11.98	-	10.43	Weld	-	-	-	6.350	-	-	-	-	-	-	-	-	-
22.41	-	6.60	Weld	-	-	-	6.350	-	-	-	-	-	-	-	-	change of WT
29.93	-	0.95	Weld	-	-	-	6.350	-	-	-	-	-	-	-	-	-
29.96	-	0.31	Weld	-	-	-	6.350	-	-	-	-	-	-	-	-	-
29.97	-	0.35	Weld	Flange	-	-	6.350	-	-	-	-	-	-	-	-	change of WT
30.18	-	1.09	Weld	-	-	-	6.350	-	-	-	-	-	-	-	-	start bend, change of WT
31.27	-	0.18	Weld	-	-	-	6.350	-	-	-	-	-	-	-	-	end bend, change of WT
31.46	-	0.42	Weld	-	-	-	6.350	-	-	-	-	-	-	-	-	end bend, change of WT
34.52	-	0.41	Weld	-	-	-	6.350	-	-	-	-	-	-	-	-	start bend, change of WT
34.93	-	0.21	Weld	-	-	-	6.350	-	-	-	-	-	-	-	-	end / start bend
35.14	-	10.95	Weld	-	-	-	6.350	-	-	-	-	-	-	-	-	end bend, change of WT
46.09	-	11.28	Weld	-	-	-	6.350	-	-	-	-	-	-	-	-	-
55.41	9.32	11.28	Anomaly	Corrosion	General	10.04	6.350	6.466	150.000	33.000	4.768	1.70	1.29	Internal	0.37	
55.97	9.88	11.28	Anomaly	Corrosion	General	10.04	6.350	6.466	97.000	33.000	5.066	1.40	1.27	Internal	0.37	
56.62	10.53	11.28	Anomaly	Corrosion	General	10.04	6.350	6.466	175.000	33.000	4.768	1.70	1.27	Internal	0.37	
57.37	-	10.67	Weld	-	-	-	6.350	-	-	-	-	-	-	-	-	-
69.04	-	11.00	Weld	-	-	-	6.350	-	-	-	-	-	-	-	-	-
79.04	-	10.35	Weld	-	-	-	6.350	-	-	-	-	-	-	-	-	-
89.30	-	0.38	Weld	-	-	-	6.350	-	-	-	-	-	-	-	-	-
97.40	-	11.07	Weld	-	-	-	6.350	-	-	-	-	-	-	-	-	-
99.68	1.28	11.07	Anomaly	Pipe mill anomaly	General	5.00	6.350	6.105	238.000	132.000	5.066	1.04	0.85	Not applicable	0.39	
99.93	2.53	11.07	Anomaly	Corrosion	Fitting	10.50	6.350	6.105	41.000	22.000	5.066	1.04	0.90	Internal	0.37	
100.68	3.28	11.07	Anomaly	Corrosion	Acad. growing	10.50	6.350	6.105	150.000	22.000	5.066	1.04	0.90	Internal	0.37	
102.24	4.84	11.07	Anomaly	Corrosion	Acad. growing	10.56	6.350	6.105	167.000	33.000	5.066	1.04	0.92	Internal	0.37	
103.06	5.65	11.07	Anomaly	Corrosion	Acad. growing	11.00	6.350	6.105	105.000	22.000	5.066	1.04	0.83	Internal	0.37	
103.74	6.34	11.07	Anomaly	Corrosion	Acad. growing	11.00	6.350	6.105	258.000	22.000	4.917	1.19	0.99	Internal	0.40	
104.51	7.11	11.07	Anomaly	Corrosion	General	10.56	6.350	6.105	165.000	33.000	5.066	1.04	0.83	Internal	0.37	
105.29	7.89	11.07	Anomaly	Corrosion	General	11.00	6.350	6.105	95.000	22.000	5.066	1.04	0.90	Internal	0.37	
107.42	10.02	11.07	Anomaly	Corrosion	Acad. growing	11.04	6.350	6.105	94.000	11.000	5.066	1.04	0.92	Internal	0.37	
108.05	10.65	11.07	Anomaly	Corrosion	General	11.04	6.350	6.105	220.000	33.000	4.917	1.19	0.93	Internal	0.40	
108.46	-	11.31	Weld	-	-	-	6.350	-	-	-	-	-	-	-	-	-
108.63	0.17	11.31	Anomaly	Dent	-	3.90	0.000	6.496	53.000	88.000	6.258	0.24	6.50	Not	0.00	3 in deep

Pipe tally with welds, features and anomalies



Integrity Assessment

Dig-up verification of severe anomaly



Dig-up sheet according POF2009

Dig-up sheet for Anomaly no. 42 located at log distance 425.17 m

Table 1: Information on selected Anomaly

Anomaly no.	Feature type	Feature id.	Anomaly dimension class	Joint no.	Log distance (m)	Distance to upstream weld (m)	Distance to downstream weld (m)	Clock (h:min)	Length (mm)	Width (mm)	Remaining t (mm)	Surface location	Comment
42	Anomaly	Corrosion	Pitting	470	425.17	1.55	3.23	7:40	34	27	6.3	Internal	

Table 2: Information on known features

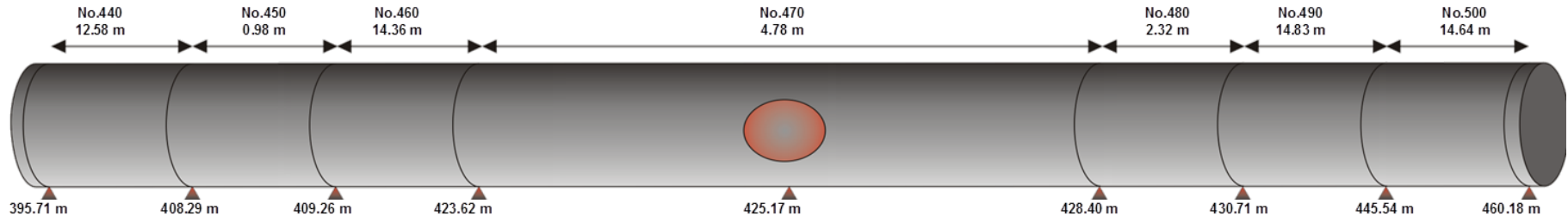
Feature type	Feature id.	Joint no.	Log distance (m)	Distance to upstream weld of feature (m)	Comment
Not available	Not available	Not available	Not available	Not available	

Table 3: Information on marker positions relative to the upstream girth weld of the selected Anomaly

Feature type	Joint no.	Log distance (m)	Distance of upstream weld to marker (m)	Comment
Not available	Not available	Not available	Not available	

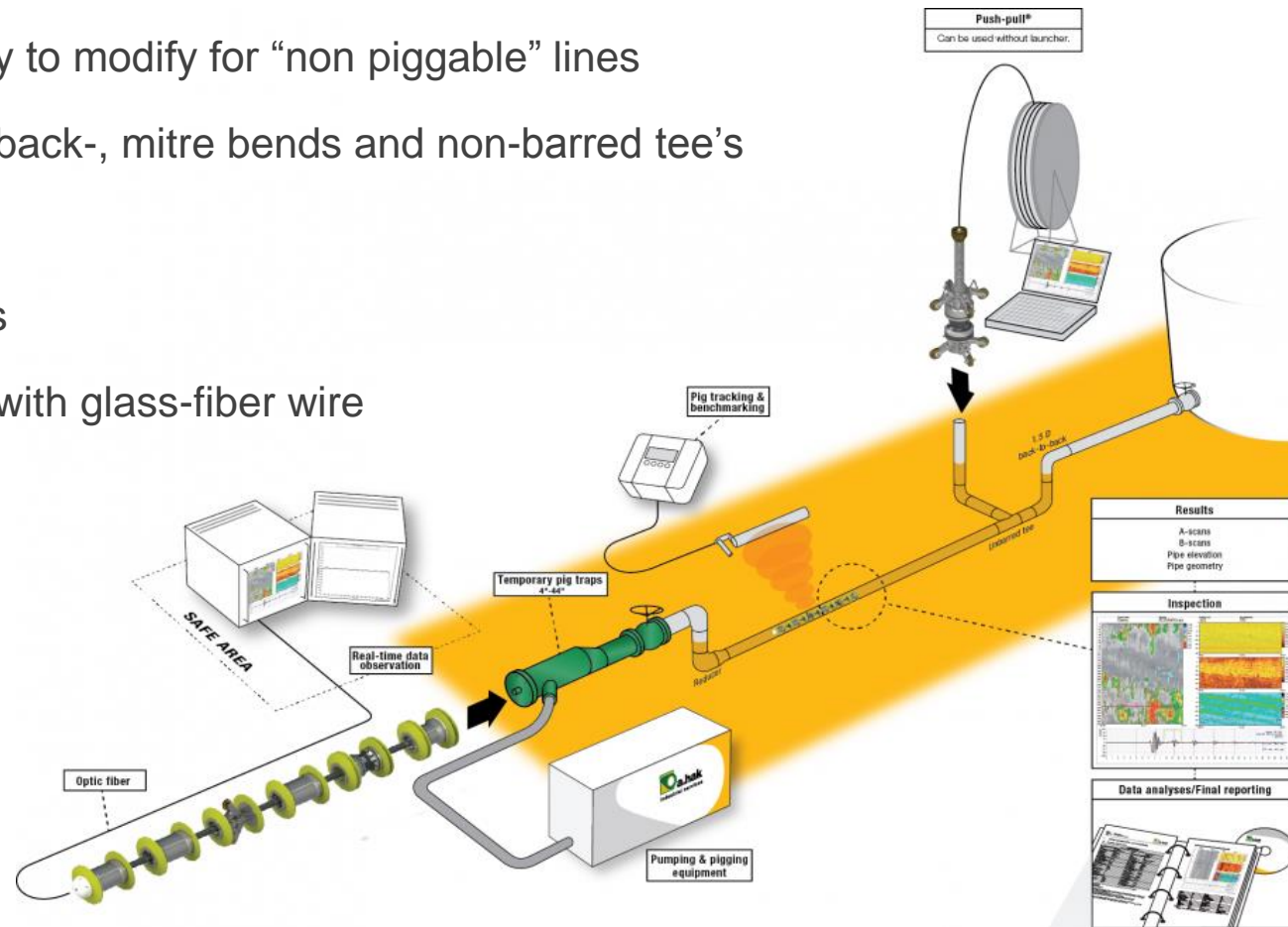
Table 4: Information on joints surrounding the selected Anomaly

	Joint no.	Start distance (m)	End distance (m)	Length of joint (m)	Nominal t of joint (mm)	Upstream longitudinal / spiral weld position (h:min)	Downstream longitudinal / spiral weld position (h:min)
third upstream joint	440	395.71	408.29	12.58	7.9	9:40	8:33
second upstream joint	450	408.29	409.26	0.98	8.3	10:20	8:47
first upstream joint	460	409.26	423.62	14.36	8.0	8:27	10:13
joint with feature	470	423.62	428.40	4.78	8.6	7:53	6:40
first downstream joint	480	428.40	430.71	2.32	8.0	8:27	6:47
second downstream joint	490	430.71	445.54	14.83	8.1	9:33	7:40
third downstream joint	500	445.54	460.18	14.64	8.2	10:07	7:53

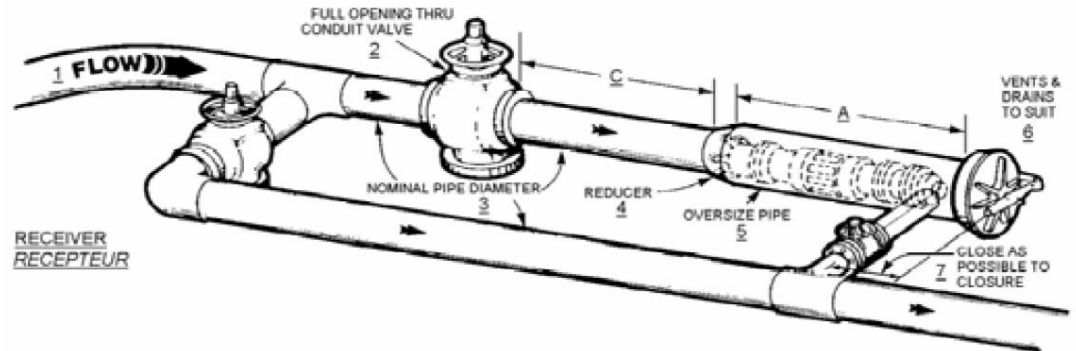
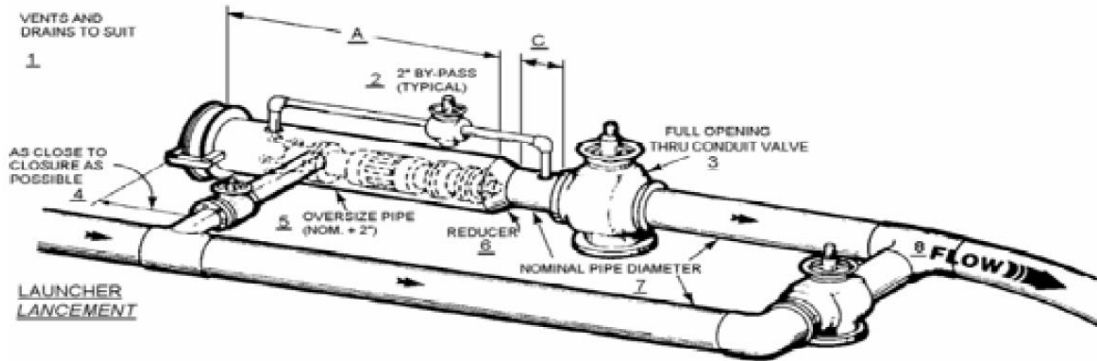


Our UT Inspection Program

- Diameter ranges from 3 till 46 inch
- Flexible tool and easy to modify for “non piggable” lines
- 1,5D bends, back to back-, mitre bends and non-barred tee’s
- Heavy wall thickness
- (Non) Ferro materials
- Realtime monitoring with glass-fiber wire



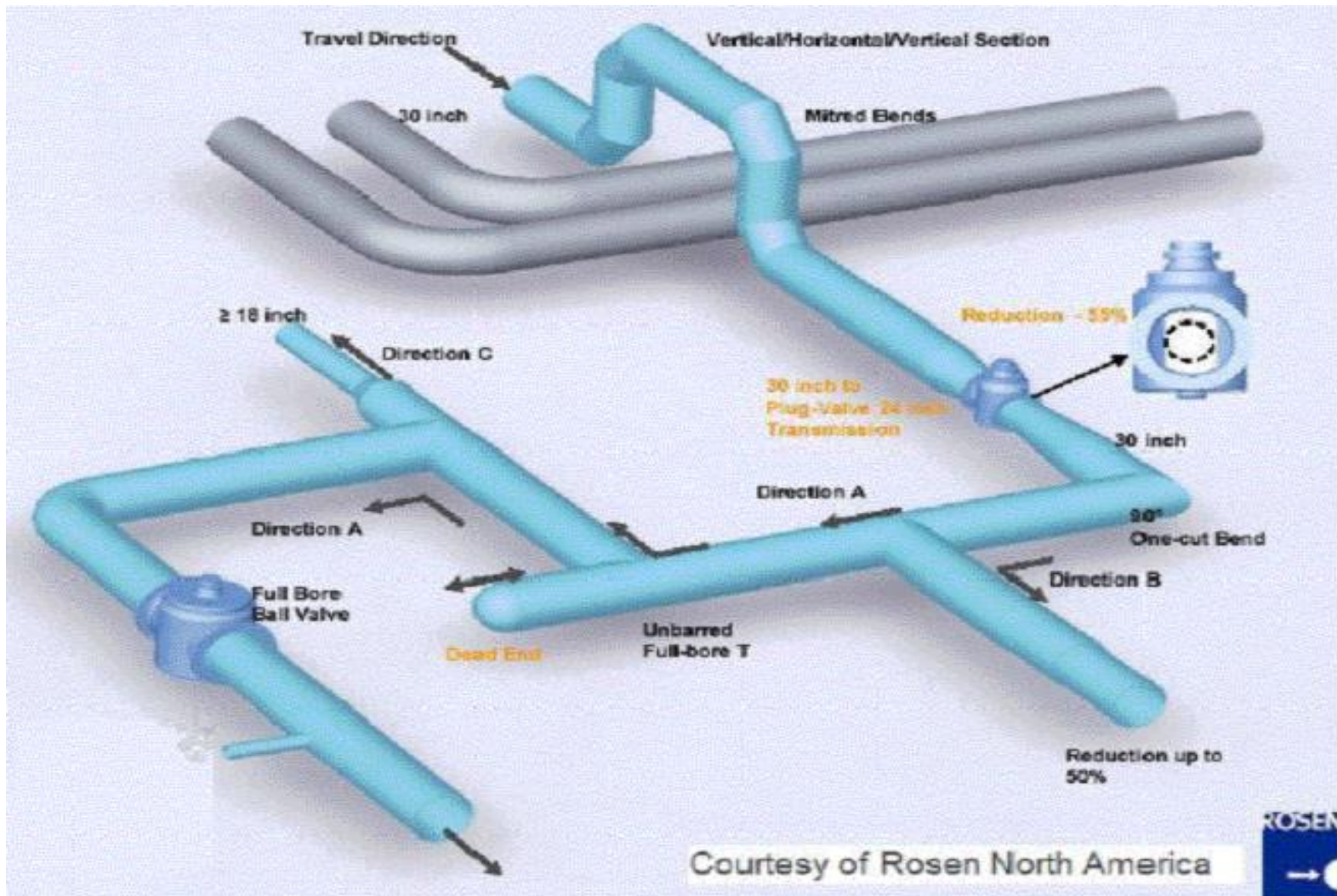
Piggable or non-piggable



Piggable or non-piggable



Piggable or non-piggable



Non-piggable pipelines

Why not piggable

Mechanical layout of the pipeline

- Pipeline dimensions (diameter changes, wall thickness)
- Bend restrictions (forged $< 3D$, miter's, back to back)
- Off takes (design of Tee's)
- Valves (block, check)
- Relative position of features (pig stalling)
- No entrance/retrieving point (launcher, receiver)

Operational conditions

- Product, pressure, temperature, fluid velocity

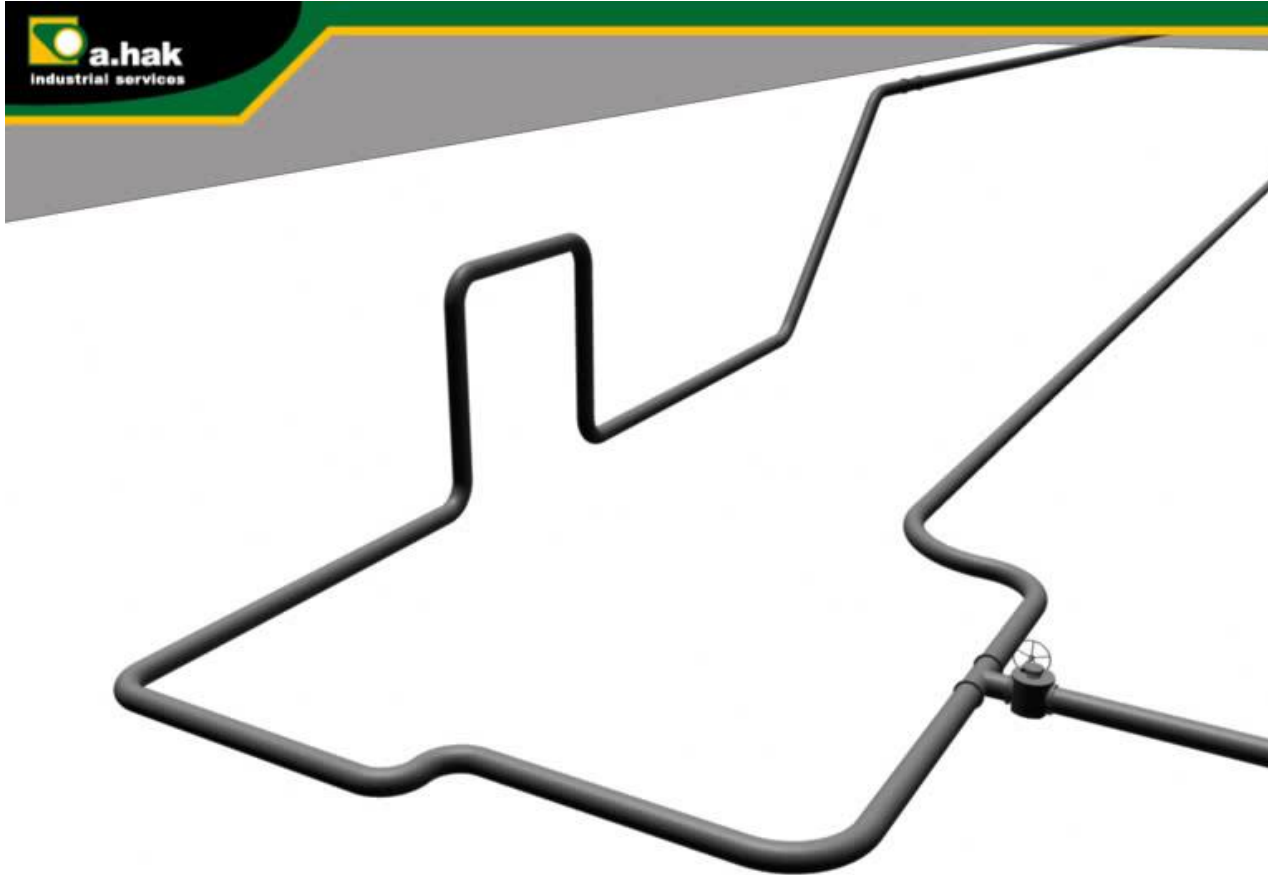
Applications

WTT Piglett® 432'''

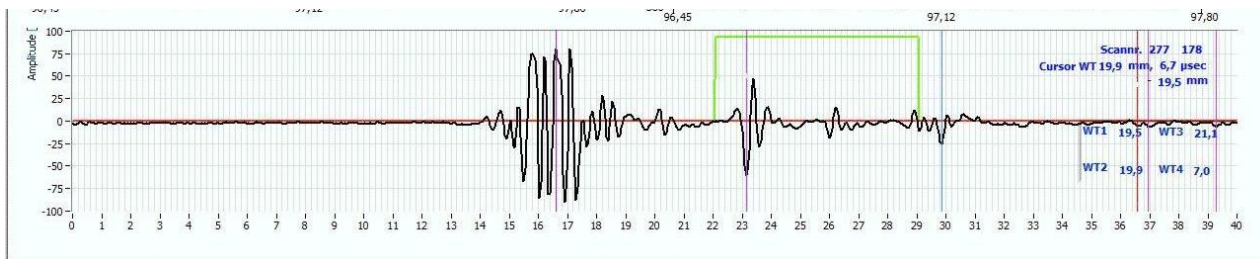
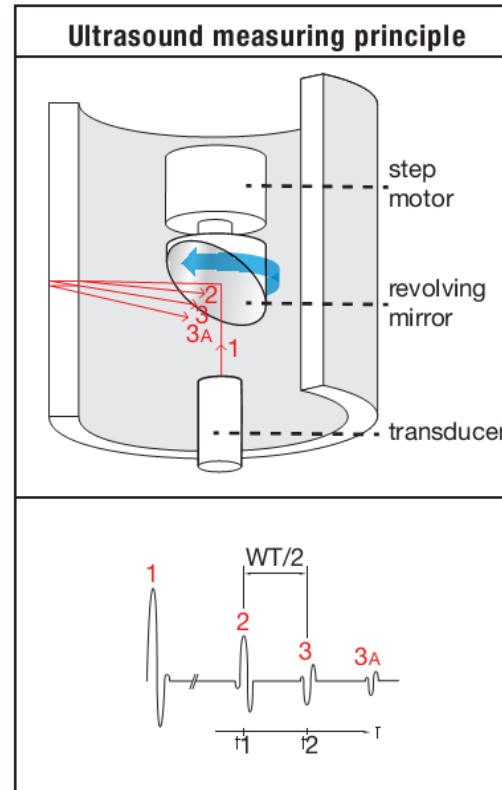
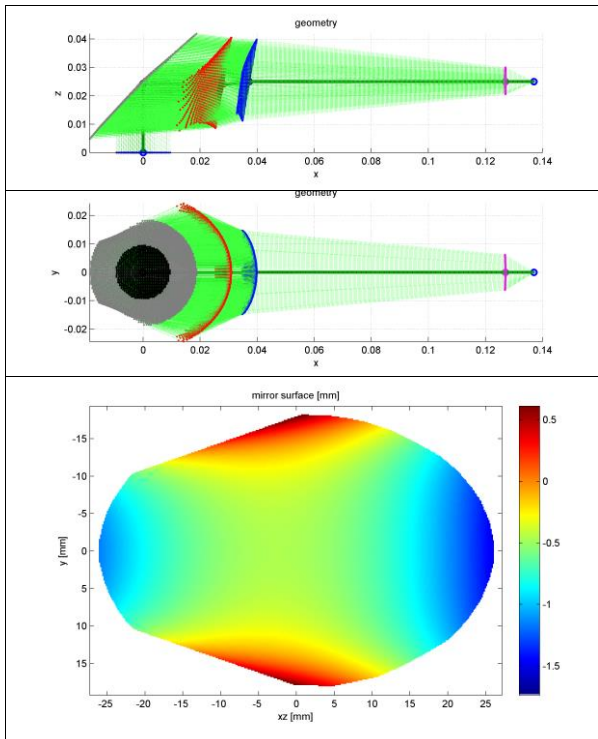
UT Piglet® 124'''



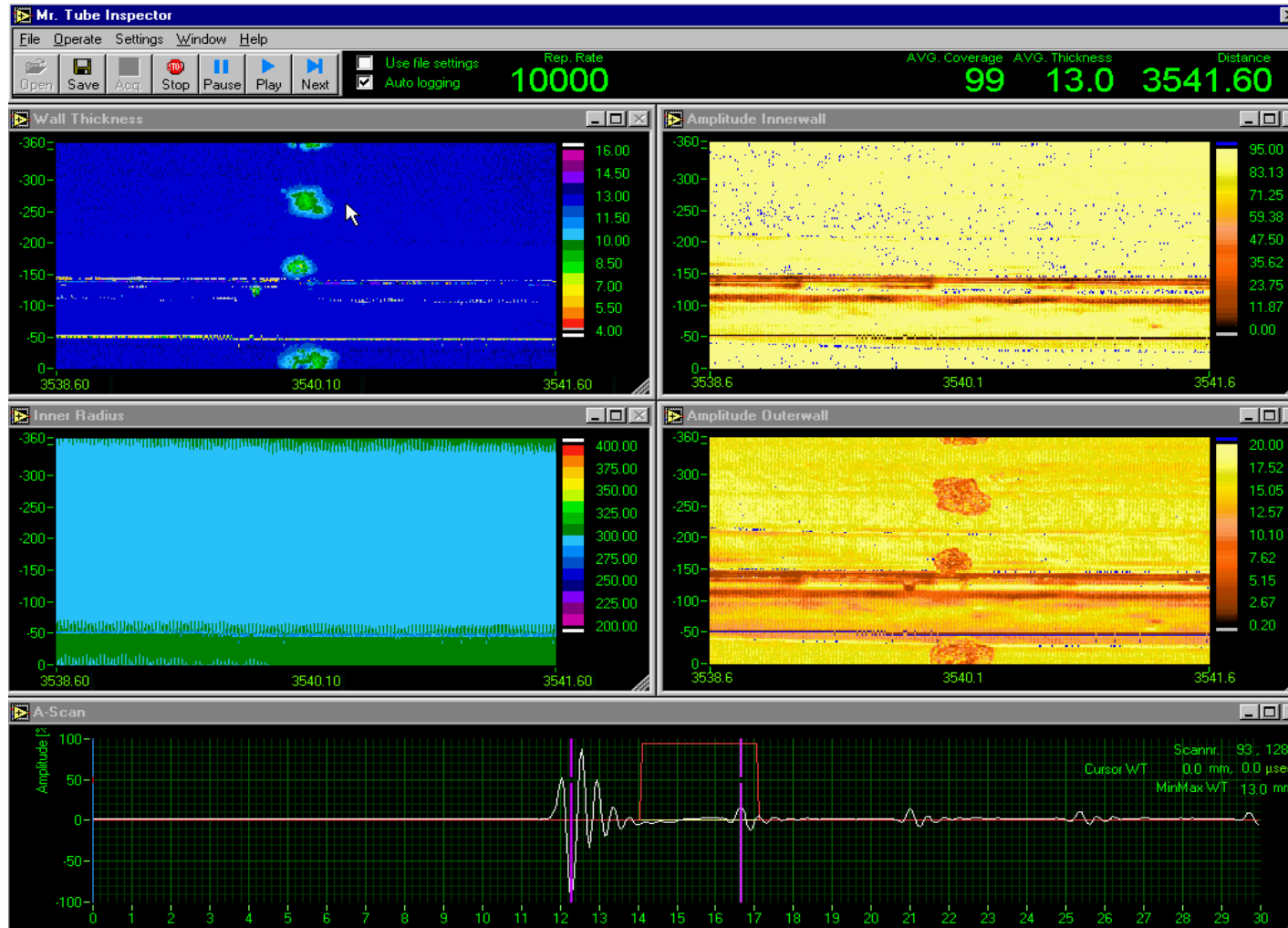
Pipeline Inspection (animation)



High resolution ILI Piglet[®]



Realtime data analysis



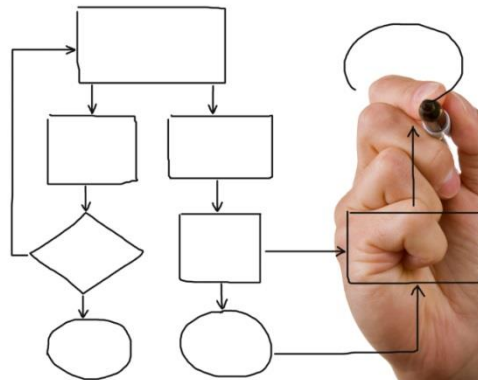
Inspection Services

- **Inline Pipeline Inspection**
Challenging pipelines on jetties, terminals,
process lines or transport lines up to 20 km
Multi-diameter
- **High resolution Piglet®**
(Ultra)-High resolution inspection
Exotic material inspection
- **Offshore inspections**
Flowlines and risers
Loading lines to PLEM or SBM
- **Furnace inspection**
Refinery pre-heaters
- **Hydrant and downhole inspection**
Airport fuel system inspection
Cavern riser inspection



Operational procedure

1. Project management
2. Is the pipeline piggable?
3. Cleaning of pipeline
4. Calibration/Gauging
5. In-line inspection
6. Data analysis
7. Defect assessment (Final report)



Temporary pig traps



Pig launcher and receiver

Cleaning of pipeline



Cleaning of pipeline



Debris, wax, scale, rust, sand, etc...

Dummy run before inspection



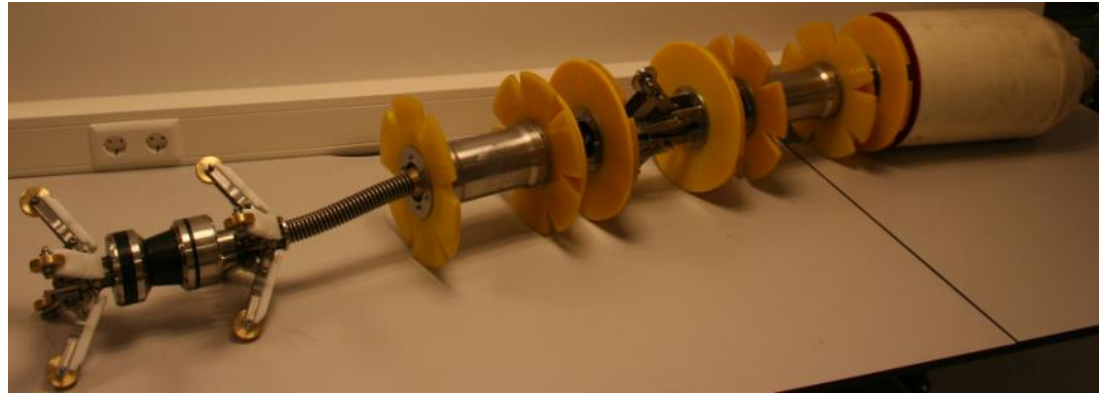
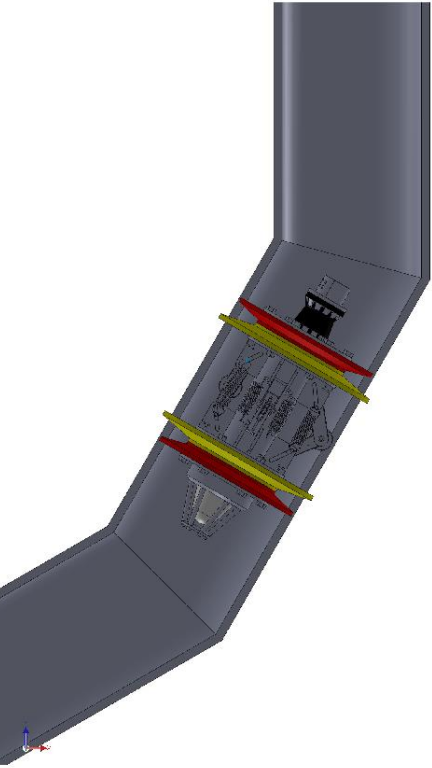
In-line Inspection



Purpose designed tools



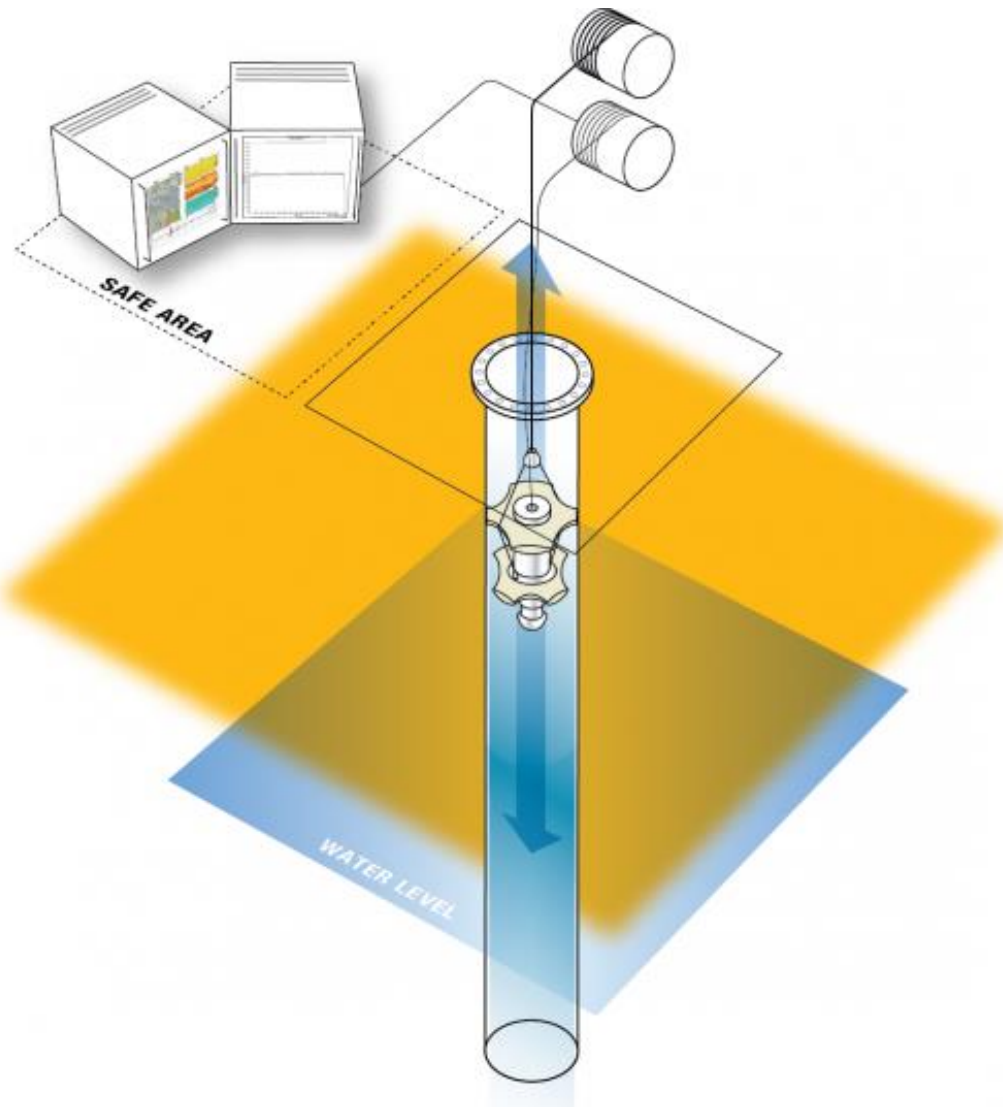
Purpose designed tools



Offshore riser inspection



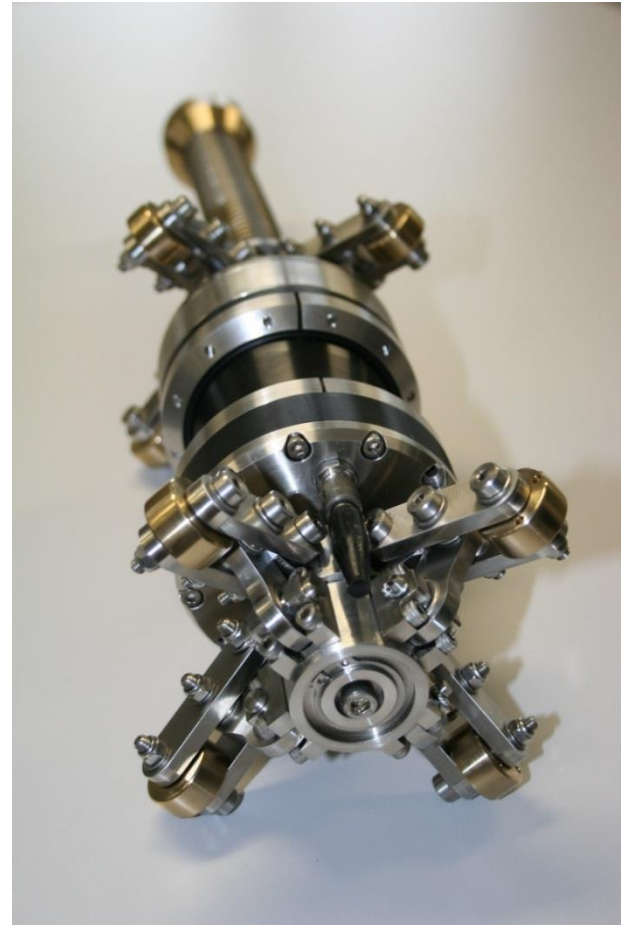
Push-pull configuration



Hydrant and downhole Inspection

Cable operated Piglet[®]

- Airport hydrant inspection
- Refinery pipe inspection
- Cavern inspection
- Offshore riser tube inspection



Hydrant and downhole Inspection

Cable operated Piglet®



Cable operated ILI pig

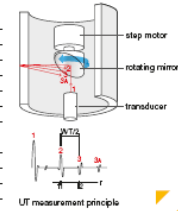
Developed for airport fuel systems

- Minimum impact on operations
 - No pumping
 - No launcher or receiver
 - Compact, easy manageable
- 270° 1.5D capability
- 60 meters length
- 6", 8" & 10" operational
- 4" version prototype



HIGH RESOLUTION PUSH-PULL PIGLET® 6", 8" AND 10" TOOL SPECIFICATIONS

Nominal pipe diameter	6"	8"	10"
Pipeline characteristics			
Minimum bend radius, No.	1.5D ¹⁾	1.5D ¹⁾	1.5D ¹⁾
Minimum inner diameter	124 mm	130 mm	165 mm
Wall thickness range	3 – 22 mm	3 – 44.5 mm	3 – 50.8 mm
Pipe material	carbon steel, alloy, stainless steel, duplex, HDPE, PVC, cast iron		
Max. length (real-time)	60 m	60 m	60 m
Operational specifications			
Bi-directional capability	yes	yes	yes
Inspection medium	liquid	liquid	liquid
Inspection speed (full resolution)	800 m/hr	800 m/hr	800 m/hr
Max. operating pressure	not applicable	not applicable	not applicable
Max. operating temp.	40°C	40°C	40°C
Physical characteristics			
Weight (std. configuration)	40 kg	45 kg	50 kg
Technical specifications			
Measurement grid ²⁾	5 x 5 mm	5 x 5 mm	5 x 5 mm
Sampling rate	20 – 40 MHz	20 – 40 MHz	20 – 40 MHz



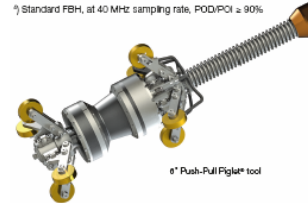
Performance specifications			
Data recording	full A-scan	full A-scan	full A-scan
Reporting threshold	selectable ³⁾	selectable ³⁾	selectable ³⁾
Ultrasonic transducer freq.	3 1/4 MHz (opt. 5 MHz)	3 1/4 MHz (opt. 5 MHz)	3 1/4 MHz (opt. 5 MHz)
D/OO flaw discrimination	yes	yes	yes
Wall thickness accuracy ⁴⁾	± 0.20 mm	± 0.20 mm	± 0.20 mm
Radius accuracy ⁴⁾	± 0.40 mm	± 0.40 mm	± 0.40 mm
Minimal defect size ⁴⁾	Ø 6 mm	Ø 6 mm	Ø 6 mm
String accuracy	± 5 mm	± 5 mm	± 5 mm
Distance accuracy	> 99%	> 99%	> 99%
Clock position grid	2.5"	2.5"	2.5"

¹⁾ Combined bend radii of all bends max 270 degree, 10" depending on the pipeline

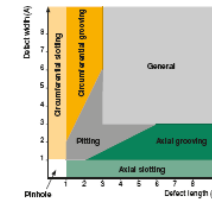
²⁾ High resolution spec, (200% coverage), ultra high resolution on request

³⁾ Standard 80% of wall thickness

⁴⁾ Standard FBH, at 40 MHz sampling rate, POD/PCI ± 90%



6" Push-Pull Piglet® tool



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 4190 CD Geldermalsen
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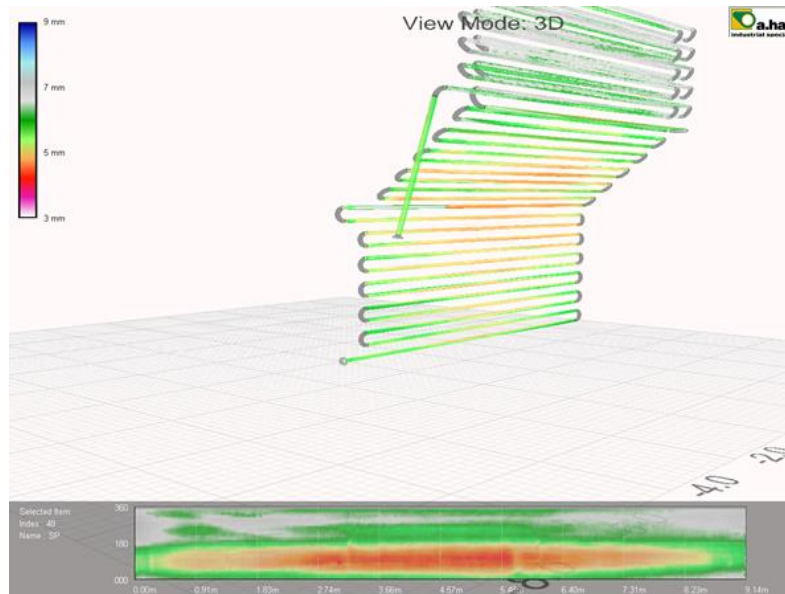
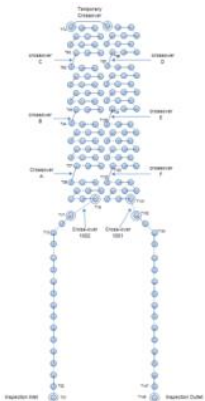
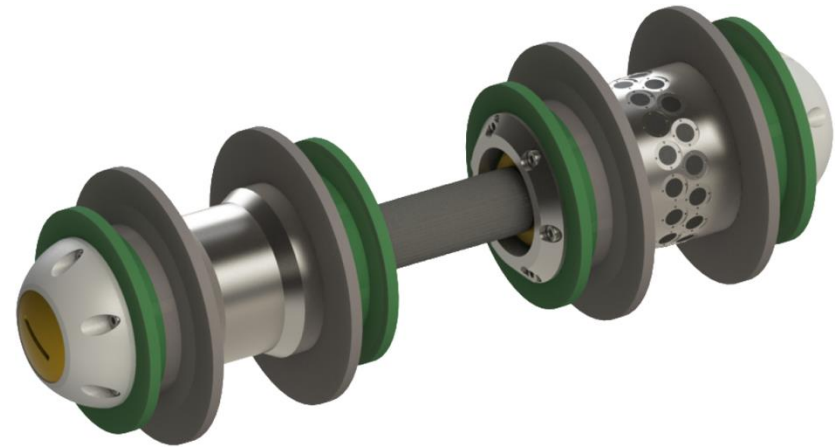
Furnace Decoking and Inspection



Furnace Inspection

Multiplex tools 3" - 8"

- Robust 2 unit, bi-directional
- 1D return & back to back
- 32 fixed transducers
- Onboard storage
- Onsite data verification



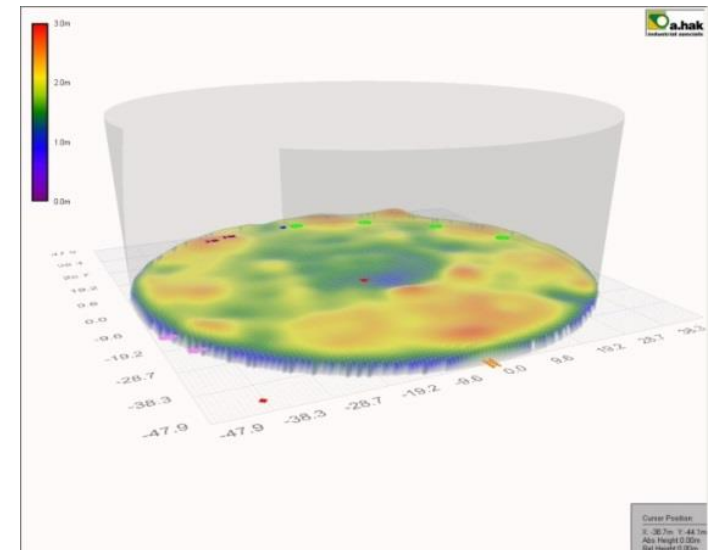
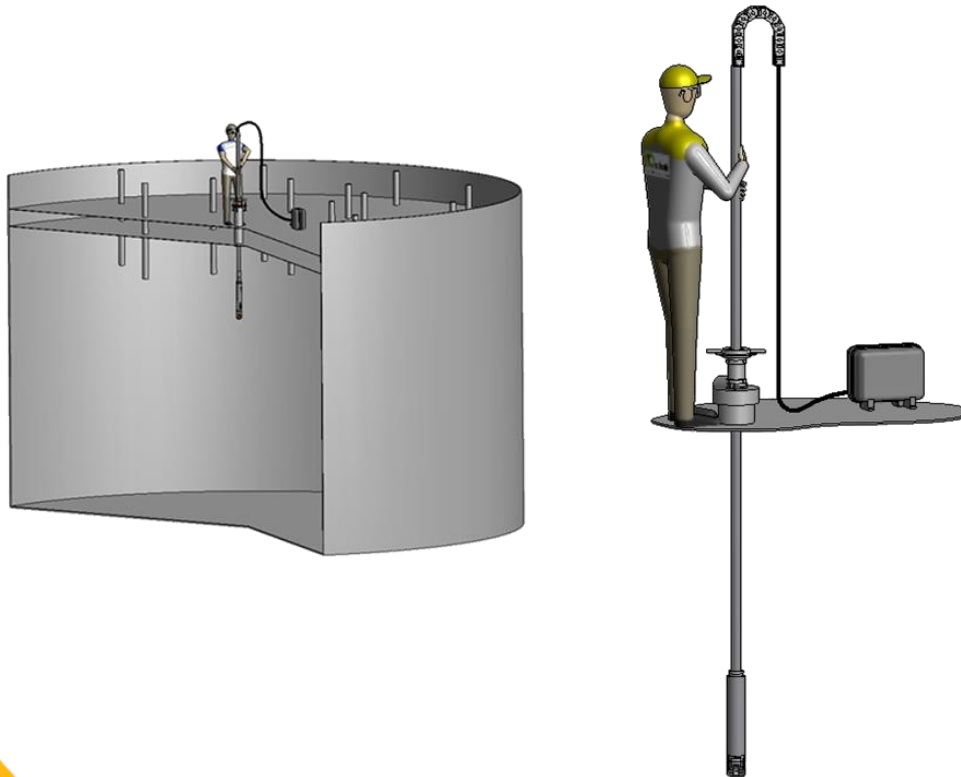
Integrated Tank Services



Integrated Tank Services

Sludge profiling

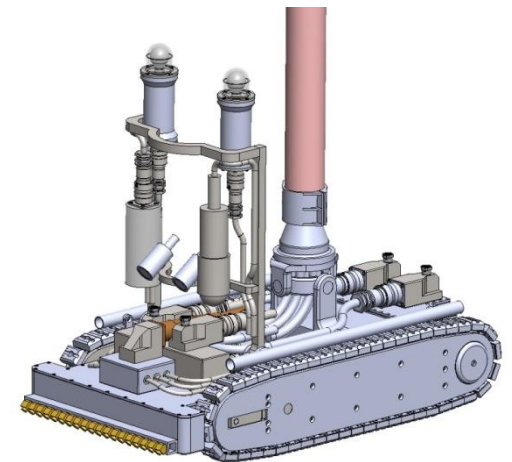
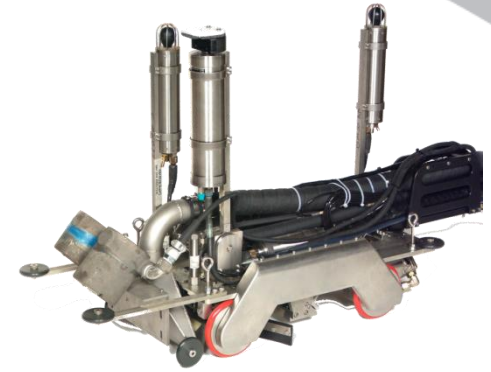
- Ultrasonic determination of sludge contents
- Atex certified zone-1



Integrated Tank Services

Tank floor UT inspection

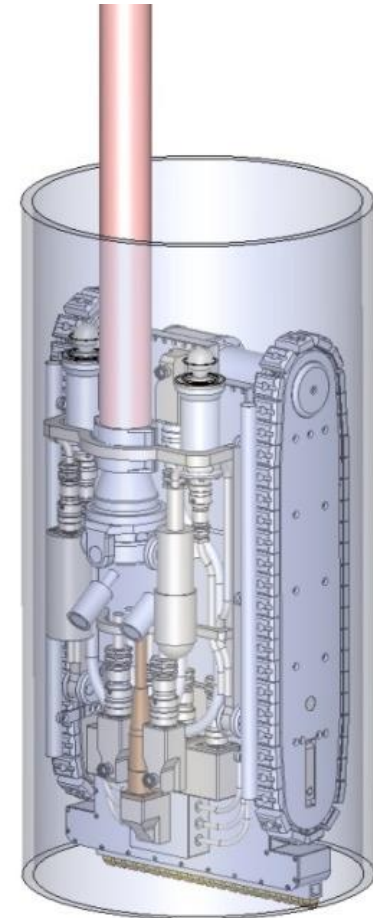
- Automatic floor scanning
- Atex certified zone-1



OTIS 500

Deployment from tank roof

- New system in development
 - Refined & Crude products
 - Tanks up to 80m, stand-alone navigation
 - Ultrasonic inspection system
 - API 563 std, reporting
 - Apr. 10 -30% floor coverage
 - ATEX Level-1 compliant



Training facilities

- Personnel training
- Client training
 - Operational
 - Defect assessment
 - Pipeline integrity
- Students
 - Master pipeline study



Audited and rated top 5 in the world by ExxonMobil (2013)



...to maintain the integrity of your assets

Meer informatie op onze website: www.a-hak-is.com

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