





#### Index

- General intro Intero
- General capabilities
- High resolution
- Pitting corrosion
- Pitting analysis





### Company profile

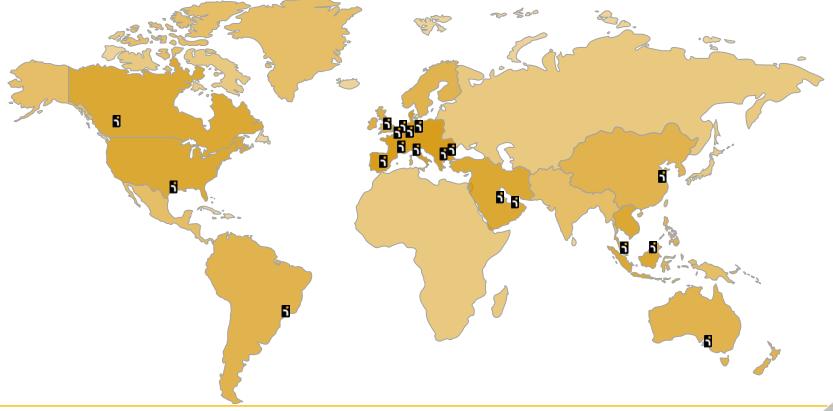
- Since 1985
- 380 People worldwide
- 250–300 Inspections per year
- > 15,0000 Miles of pipelines
- > 500 Furnaces
- > 1,000 tanks







#### Intero Integrity Services global locations







## **Training Facilities**

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















#### Furnace Inspection Tools

- Robust 2 unit, bi-directional
- Multiplex tools 3"-10" (12" available upon request)
- 1D 180° short radius return bends
- Onboard data storage of A-scan
- 3-5 feet per second inspection speed







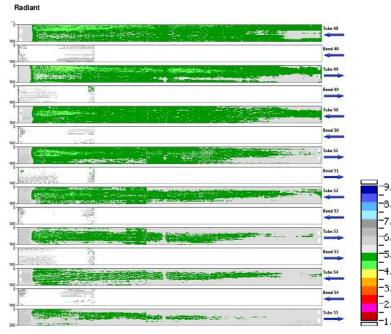
#### Furnace Tube Inspection Reporting

- On-site data check (field report)
- 48-hour final reporting
- General corrosion (minimum remaining wall thickness per tube)

Fretting, bulging, creep





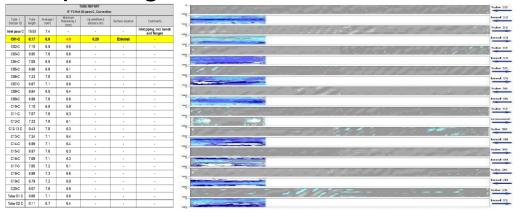






**Furnace Tube Inspection Reporting** 

- Reporting
  - Tabular overview
  - C-scan per pass/tube/bend

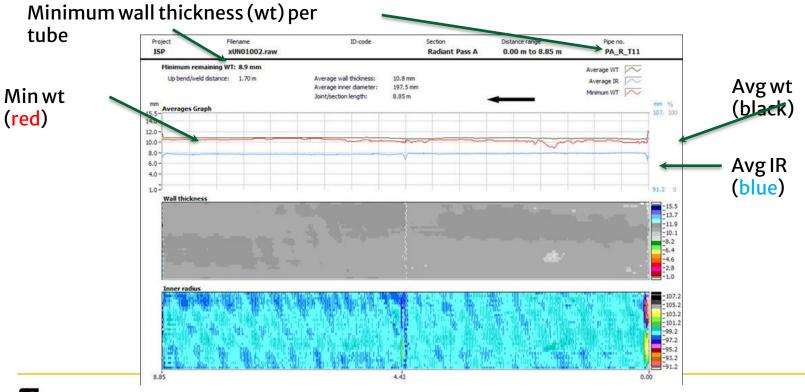


- Remaining life assessment
  - API 530
  - API 579 / ASME FSS 1

		TA	BULAR (	OVERVI 031, Pass 1	EW									
Tube Nr.	Bend Nr.	Length	Average t	Minimum Remaining t (mm)	Up weld/bend distance	Comments	Average percentage of successful measurement s (%)	New-built wallthickness	Years in service	Corr, Rate (mm per year)	Rejection limit t_rej (mm)		Rejection Date (mm/dd/yyyy)	
		(m)			(m)						Pressure	Creep	Pressure	Creep
	Transfer	34,45	7,2	4,5	0;01	-	99							
PI_C_TI		8,37	6,7	3,6	8,19	-	94	7,11	4,8	0,73	0,77		15-6-2018	
	P1_C_B1	0,48	7.2	5,2	0,47	-	37	7,11	4,8	0,40	1,71		8-5-2023	
P1_C_T2		7,66	6,9	4,6	7,57	-	98	7,11	4,8	0,52	0,77		28-11-2021	
	P1_C_B2	0,48	8,1	6,7	0,48	-	46	7,11	4,8	0,09	1,71		21-12-2072	
P1_C_T3		7,66	7	5,4	0,04	-	96	7,11	4,8	0,36	0,77		1-8-2027	
	P1_C_B3	0,49	7,6	5,7	0,46	-	51	7,11	4,8	0,29	1,71		27-2-2028	
P1_C_T4		7,65	6,9	5,1	2,31	-	94	7,11	4,8	0,42	0,77		3-12-2024	
	P1_C_B4	0,78	7,2	6,3	0,61	-	52	7,11	4,8	0,17	1,71		8-10-2041	
P1_C_T5		7,66	7	5,7	0,1	-	94	7,11	4,8	0,29	0,77		15-5-2031	
	P1_C_B5	0,48	8,1	6,9	0,48	-	41	7,11	4,8	0,04	1,71		25-2-2133	
P1_C_T6		7,66	6,8	4,8	7,49	-	100	7,11	4,8	0,48	0,77		16-12-2022	
	P1_C_B6	0,48	8	6,1	0,47	-	54	7,11	4,8	0,21	1,71		8-6-2035	
P1_C_T7		7,66	6,9	5,5	0,17	-	100	7,11	4,8	0,34	0,77		7-9-2028	
	P1_C_B7	0,48	8	6	0,01	-	53	7,11	4,8	0,23	1,71		14-2-2033	
P1 C T8		8.37	69	5.1	0.21	-	100	7.11	4.8	0.4188	0.77		3-12-2024	



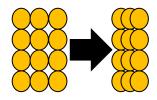
## Furnace Tube Inspection Reporting





#### Furnace Tube Inspection 2.0

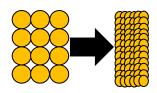
- Improved sampling rate
  - More measurements per foot

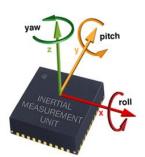


- IMU On-board
  - Tube mapping capabilities



- Selectable resolution
- Up to 360 measurements/rev

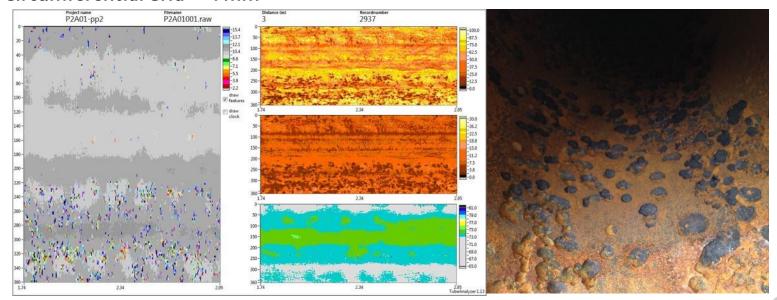






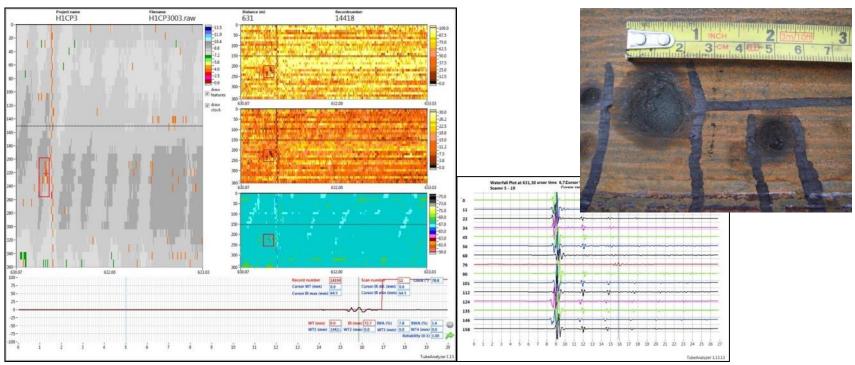
## Pitting Detection

- 6" Sch 40 tube
- Circumferential Grid < 4 mm</li>





## Pitting Detection







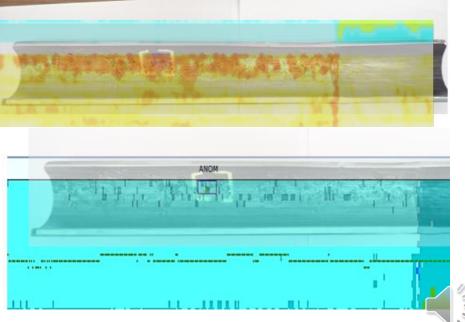
## Pitting Detection

3" Sch 80



Pitting depth of 6.4 mm



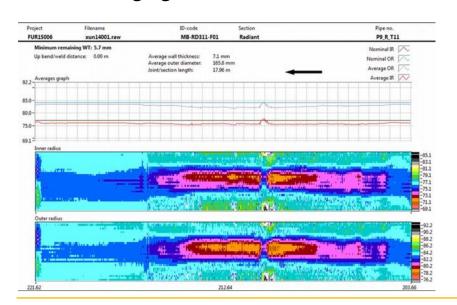




Location of lowest manual UT

## Capabilities (Bulging)

- Tube size 6"
- Bulging detected >= 1% of ID

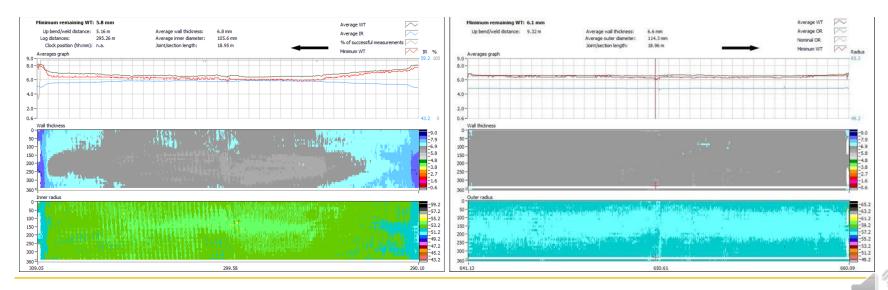






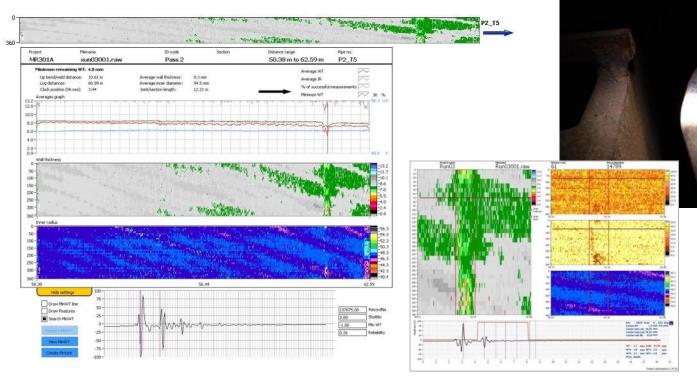
## Capabilities (Creep)

- Need comparison ID/OD
- Difficult to detect





## Capabilities (Fretting)







#### Cokescan (Execution)

- During final stage of the tube cleanout
- Run time between 1-5 minutes per pass depending on furnace size (3-5 feet per second)
- Data available roughly 15-30 minutes after each inspection
- Easy to read reporting





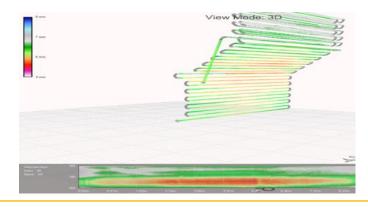


### Cokescan (Results)

- Tabular overview
  - Coverage
  - Thickness indication
- Color C scan per pass / tube / bend



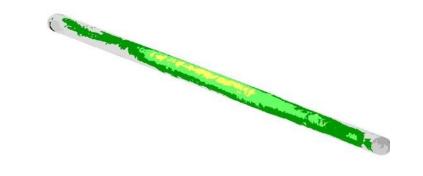
	TABULAR OVERVIEW											
Tube Nr.	Estimated cokes thickness (mm)	Estimated cokes surface (% of tube/bend)	Comments									
P1_R_T90	0-1	25-50	Traces over the complete length of the tube									
P1_R_T89	0-1	25-50	Traces over the complete length of the tube									
P1_R_T88	0-1	25-50	Traces over the complete length of the tube									
P1_R_T87	0-1	25-50	Traces over the complete length of the tube									
P1_R_T86	0-1	25-50	Traces over the complete length of the tube									
P1 R T85	0-1	25-50	Traces over the complete length of the tube									
P1_R_T84	0-1	25-50	Traces over the complete length of the tube									
P1_R_T83	0-2.5	25-50	Traces over the complete length of the tube									
P1_R_T82	0-1	25-50	Traces over the complete length of the tube									
P1_R_T81	0-1	10-25	Traces over the complete length of the tube									
P1_R_T80	0-2.5	10-25	Traces over the complete length of the tube									
P1_R_T79	0-1	25-50	Traces over the complete length of the tube									
P1 R T78	0-2.5	10-25	Traces over the complete length of the tube									
P1 R T77	0-2.5	10-25	Traces over the complete length of the tube									
			- d to to d follow									





#### Cokescan (Benefits)

- Reduces down time by focused de-coking
- Extends times between outages
  - Proven extension by 50%
- Reduces erosion of tubes by from cleaning pigs
- Eliminates distorted heat transfer at startup
- Reduced fuel required to heat the furnace







#### Fitness For Purpose & Corrosion Growth

- API 579 / ASME FFS1 (creep)
- API 579 / ASME FFS1 (internal pressure)
- API 530 Remaining life assessment (wall thickness)

														Years i	ce (mm per		imit t_rej nm)	Rejection Date	e (mm/dd/yyyy)
															year)	Pressure	Creep	Pressure	Creep
									_					4,8	0,51666667	1,00	1,23	5-9-2023	1-2-2021
														4,8	0,2666667	2,16	1,65	4-5-2032	1-6-2025
Tube Nr.	Bend Nr.	Length	Average t	Minimum Remaining t	Up weld bend distance		New-built wallthicknes	Years in	Corr, Rate (mm per	Rejection lin		Rejection Dan	e (mm/dd/yyyy)	4,8	0,24583333	1,00	1,33	26-12-2038	1-8-2027
		(m)	(mm)	(mm)	(m)		5	service	year)	Pressure	Creep	Pressure	Creep	4,8	0,1	2,16	2,77	6-12-2069	1-1-2032
P2_R_T1	P2_R_B1	18,83 0,65	7,8 8,8	5,7 6,9	18,67 0,65	-	8,18 8,18	4,8 4,8	0,51666667	1,00 2,16	1,23 1,65	5-9-2023 4-5-2032	1-2-2021	4,8	0,18333333	1,00	1,39	8-12-2048	1-8-2031
P2_R_T2	P2_R_B2	17,92 0,65	7,9 9,4	7,7	12,57	-	8,18 8,18	4,8 4.8	0,24583333	1,00 2,16	1,33 2,77	26-12-2038 6-12-2069	1-8-2027 1-1-2032	4,8	0,26666667	1,56	1,31	6-8-2034	1-9-2026
P2_R_T3		17,92	8	7,7	0,02	-	8,18	4,8	0,18333333	1,00	1,39	8-12-2048	1-8-2031	4,8	0.20416667	1,00	1,38	10-12-2044	1-12-2029
	P2_R_B3	0,97	8,3	6,9	0,49		8,18	4,8	0,26666667	1,56	1,31	6-8-2034	1-9-2026	1,0	0,20110007	2,00	1,50	10 12 20 11	1 12 2023





#### **Corrosion Monitoring**

9,85

0,44

9,15 0,44

Bend 1

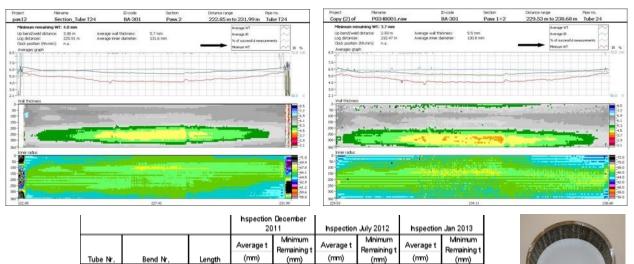
Bend 2

Year 3 Year 2 Year 1

3,9

5.5

4,2



5,3

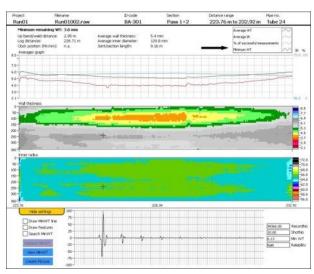
7,1

5,3

5.5

6.9

MA	





Tube 1

Tube 2



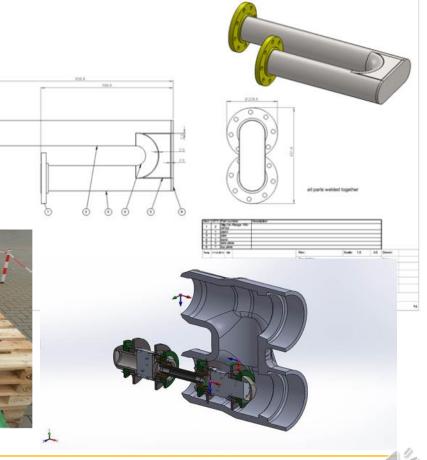
## Plug Headers (Mule Ears)

 Inspect furnaces without removing and/or cutting out plug headers (mule ears)

Tool configured per the specific plug











#### Serving clients all over the world







































## Thank you for your attention

For more information contact:

Cornel Coetzee cornel.coetzee@intero-integrity.com





# We know your space

