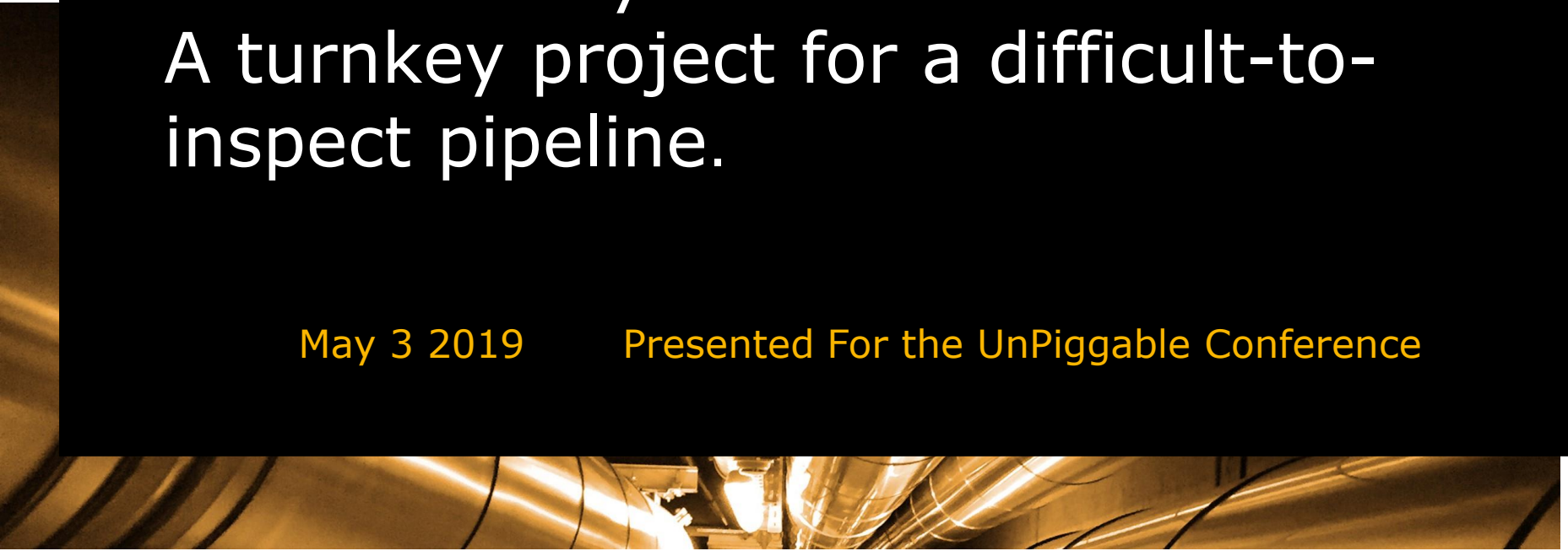
A Case Study:
A turnkey project for a difficult-to-inspect pipeline.

May 3 2019 Presented For the UnPiggable Conference



In-House R&D Capabilities

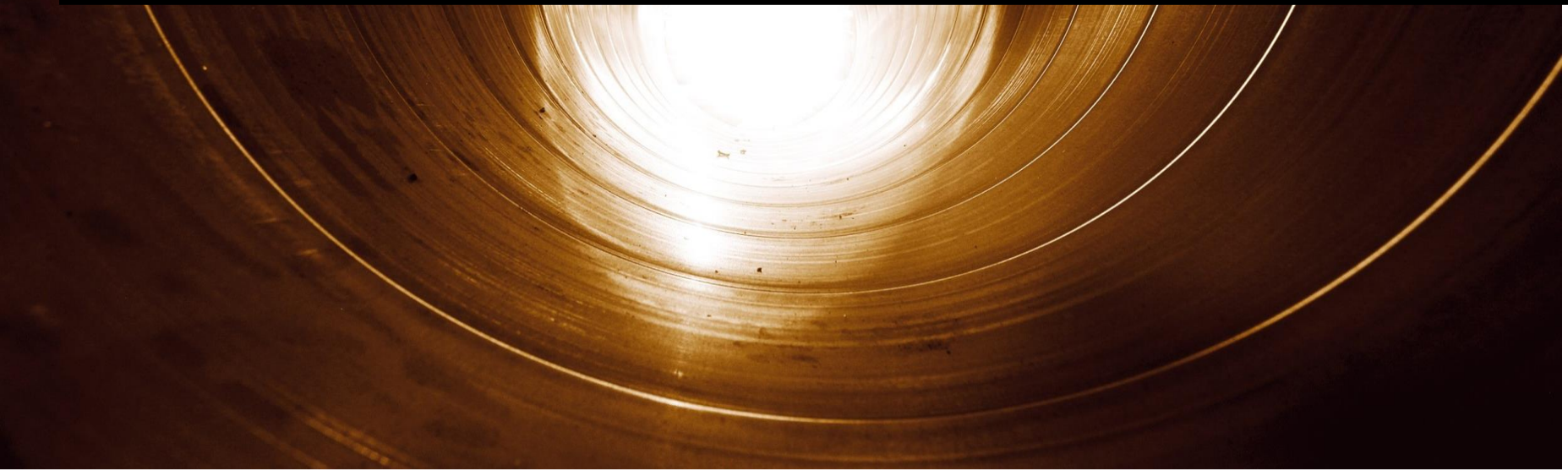
- Drive growth by developing innovative and differentiating inspection solutions

- Be a partner for clients to respond to non-standard inspection challenges and develop tailor-made inspection solutions

Testing facilities

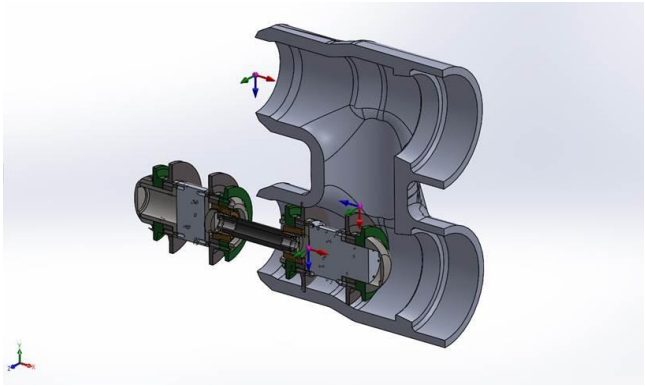
- Test loops +/- 200m: 3”, 4”, 6”, 12”, flanged
- Various mock-up arrays to suit client’s requirements
- Furnace 4”, 5”, 6”, and 8”, multiple 1D bends

Furnace Services



Furnace Inspection

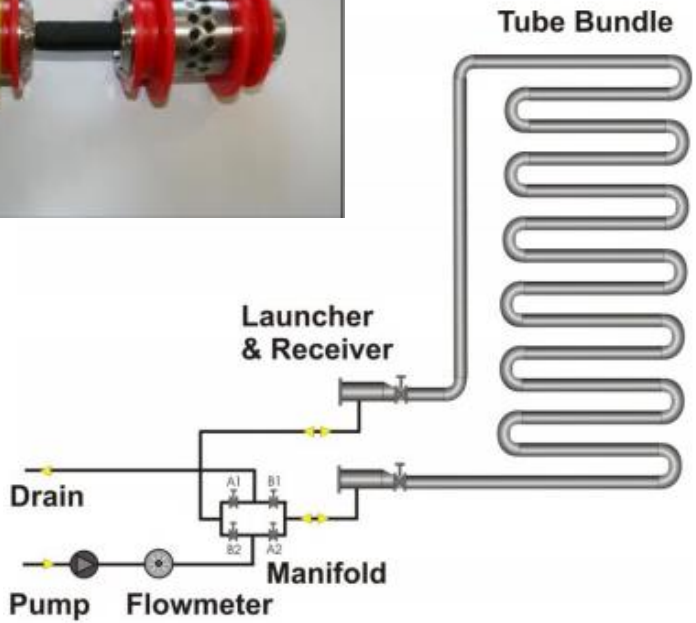
- Multiplex Piglet® tools from 3”-8”
- In-house developed, tested, and operated Furnace Piglet®
- Tool can be modified for specific situations



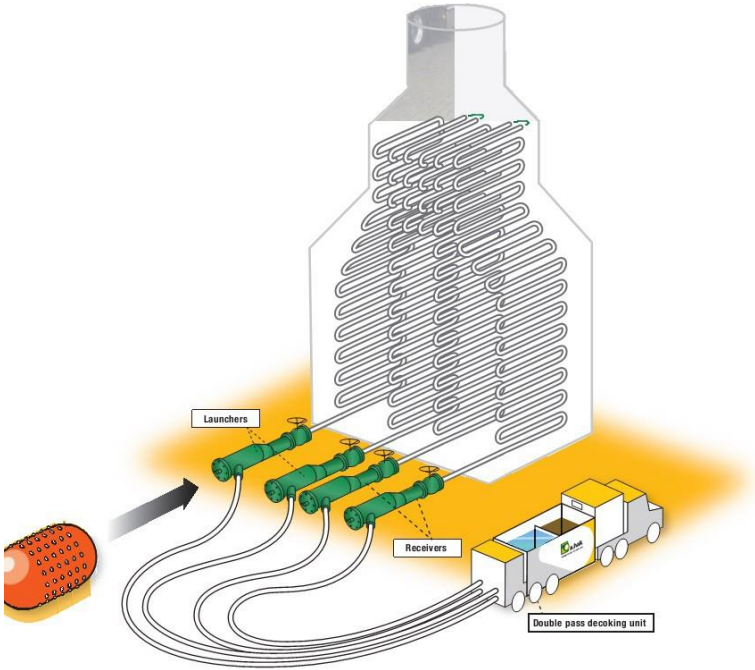
Photos of the test setup.

Furnace Inspection

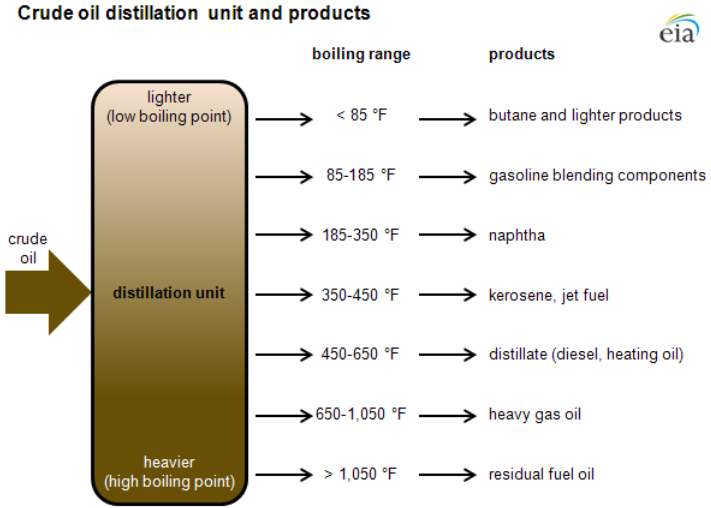
- Standard Set up
- Patented UT Flowmeter
- Focused cleaning for removal of fouling
  - Furnace Piglet inspection technology guarantees the cleanliness of the furnace tubes
  - Verification run validates the cleanliness of the tubes in order to optimize results
  - High quality cleaning and inspection = reliability and continuity with longer run times



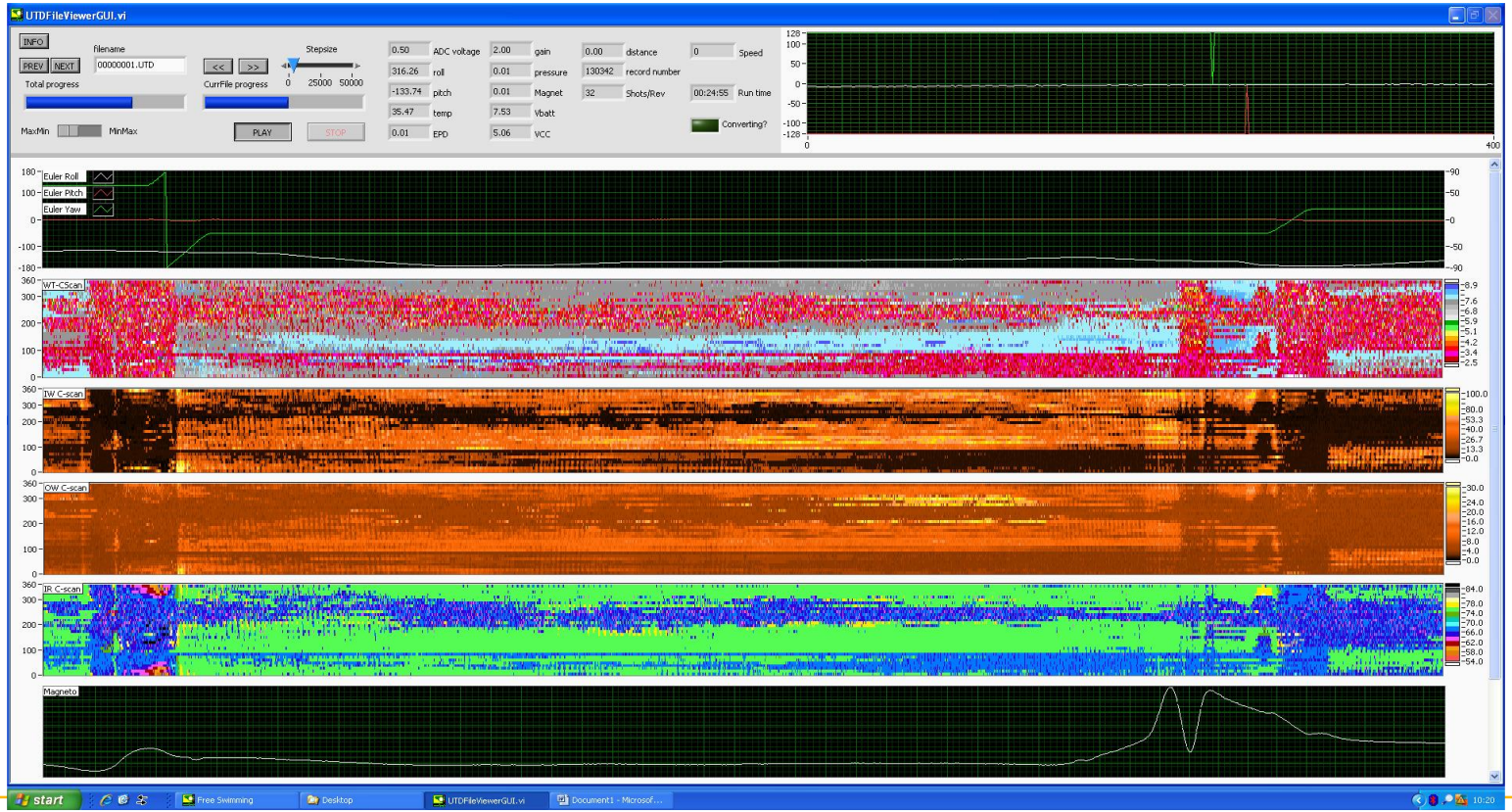
Decoking



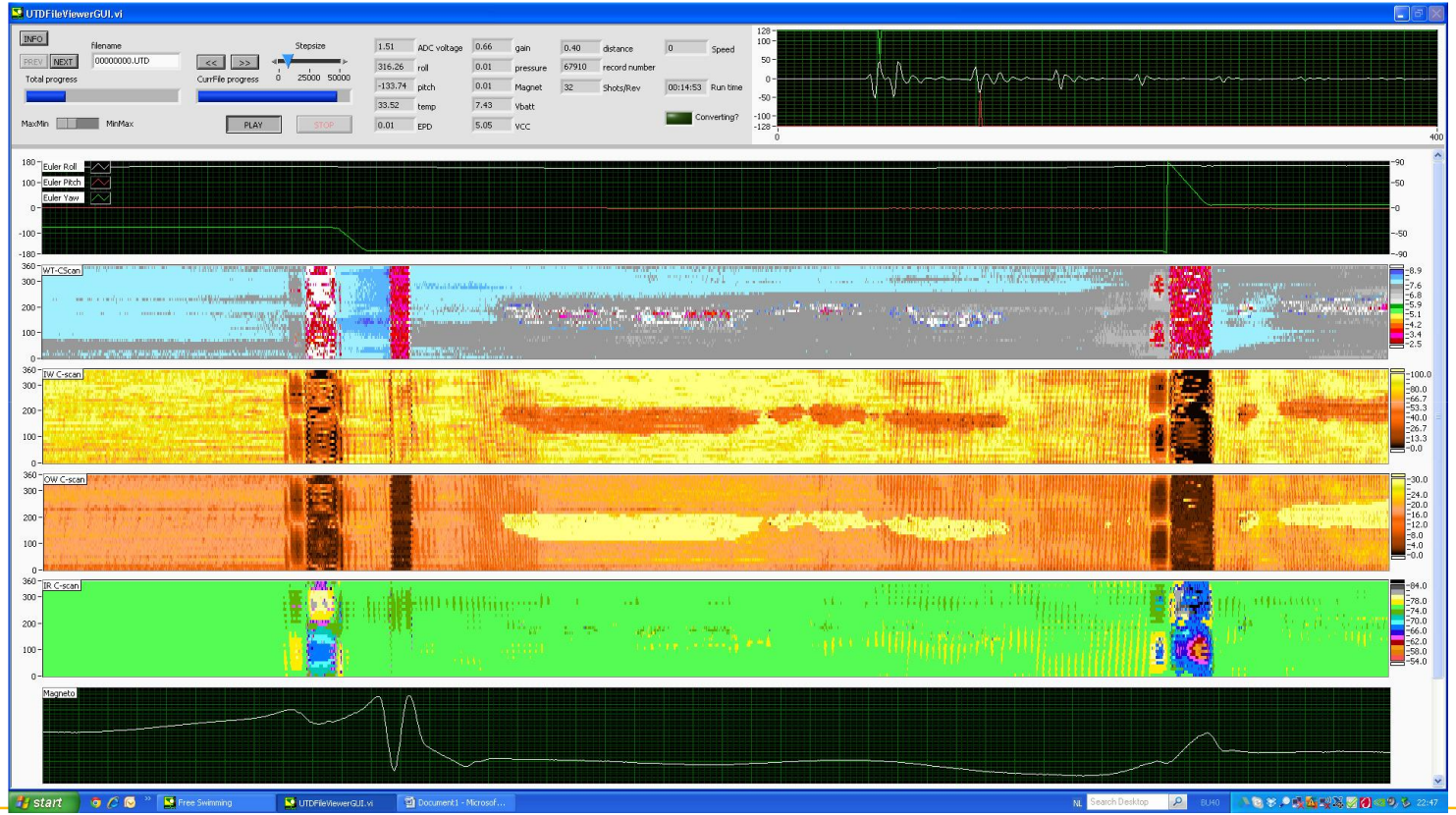
- Adequate decoking is critical to a successful heater tube inspection.
- The inspection tool can verify cleanliness when required.



Decoking Not Completed



Decoking Complete



Strengths of a good Heater Tube inspection company

- **Good relationship with decoking companies**
- **Ability to accurately read pipe drawings for planning the operation**
- **Inspection tool with an accurate technology and reliable design**
- **On-time report delivery**
- **On-time arrival on site**

Maintenance

- Maintenance is the practice of protecting or restoring equipment in order to maintain function and integrity.
- Maintenance engineers dedicate time towards developing and implementing maintenance strategies that optimize production
- Typical maintenance techniques include cleaning, inspection, replacing, and/or repairing components.
- Maintenance may be predictive or preventive.
- Predictive maintenance is a continuous process based on the current condition of equipment.
- Preventive maintenance is performed in scheduled intervals based on the age and remaining life of a piece of equipment.

Preventive Maintenance

- Preventive maintenance depends on the probability of failure and the consequences of a potential failure, which is also known as risk.
- The *frequency* of inspection and maintenance is based on the probability and consequences of failure.
- The purpose is to eliminate unnecessary inspection and repair tasks and reduce maintenance costs.
- Examples of preventive maintenance may include simple tasks such as cleaning, tightening bolts, changing oil, or lubricating equipment or added parts such as filters to separate dirt and other impurities from contaminating products.

Predictive Maintenance

- The purpose of predictive maintenance is to prevent unscheduled shutdowns by predicting damage and failures before they occur.

- Can be done through inspection methods or utilizing sensors to collect data and measure the current condition of equipment during operation.

- Although installing predictive maintenance measures can be costly, the result of such an investment can show an overall reduction in maintenance costs and facility downtime.

Corrective Maintenance

- Corrective maintenance is performed on equipment in order to restore a failing piece of equipment back to its acceptable operating conditions.

- If maintenance technicians need to replace a component, they follow specifications to replace components with original equipment manufacturers, when possible.

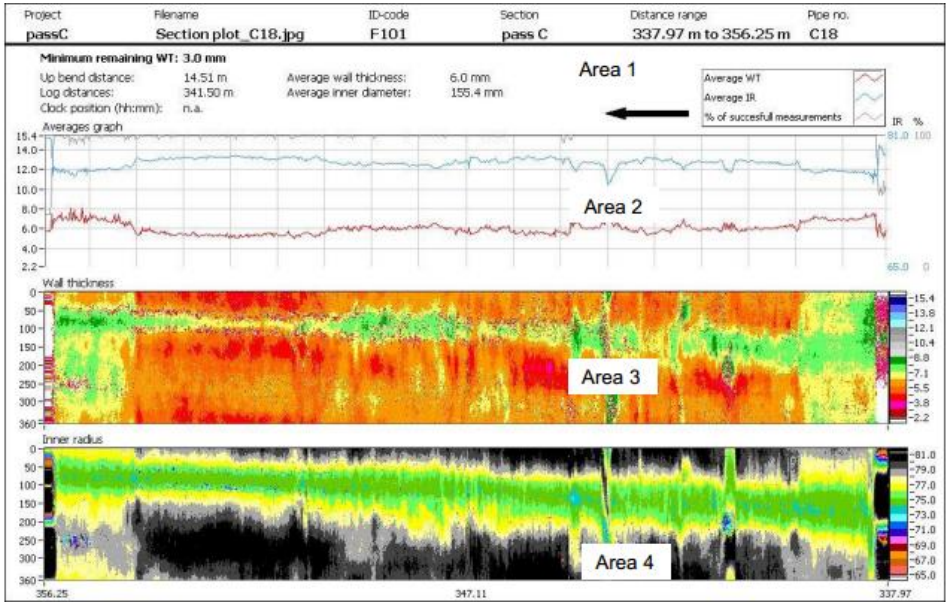
- Example of corrective maintenance repairs include welding, sealing, adjusting fixtures, etc.

Furnace Piglet® Tool Specs

- Multiplex tools from 3” – 8”
- 4” and greater tools have 32 - 48 transducers
- Inspection speed 1.0m/s
- Wall thickness accuracy ±0.2mm
- Radius accuracy ±0.5mm
- ≥5mm x 10mm for the resolution
- ≥138% pipe coverage

Furnace Inspection

- Onboard storage (A-Scan) and onsite data verification
- On request, furnace inspection reports can be available immediately after the run
- Final Deliverable – within 24 hours for furnace applications



A Case Study: Avoiding Modification Costs and Downtime when Inspecting Refinery Heater Coils with oversized Common Headers.

- Many Refinery heater coils are not designed for traditional decoking and ILI inspection.
- Often the heater coils are tied to a common header of a larger diameter pipe.
- For this paper the nominal heater coil diameter is 4” but they are tied to a 16” and a 6” common header.

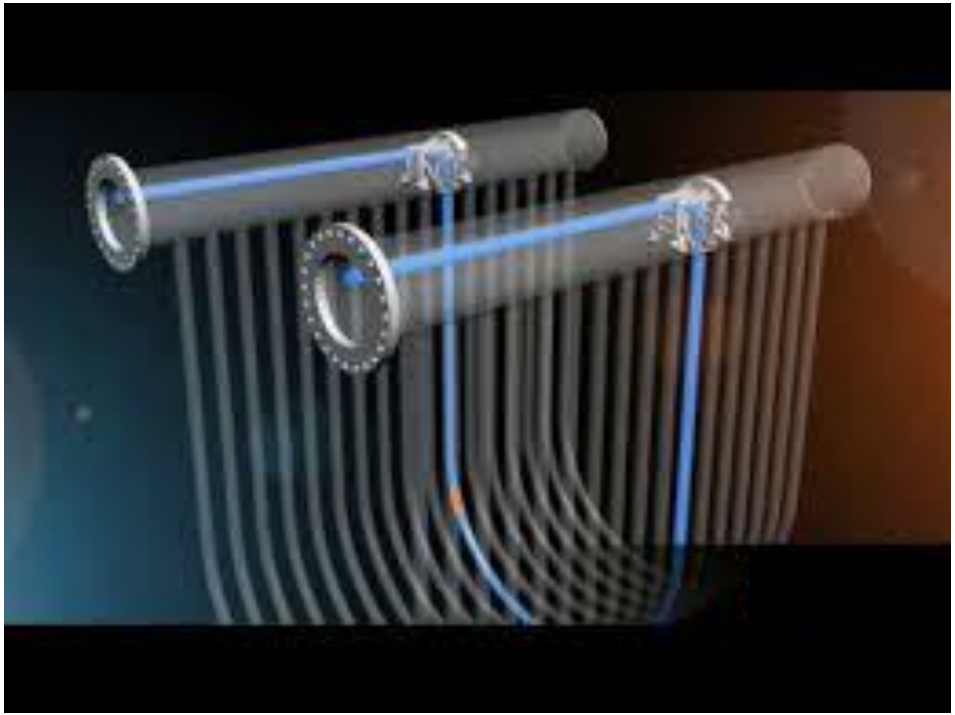
A Case Study: Continued…

- The common Header Delivery System (HDS), developed by Steady Flux, allows safe access of the decoking and inspection tools into heater coils previously inaccessible and "unpiggable".

- Each HDS is customized for the refinery's asset to ensure minimum downtime.

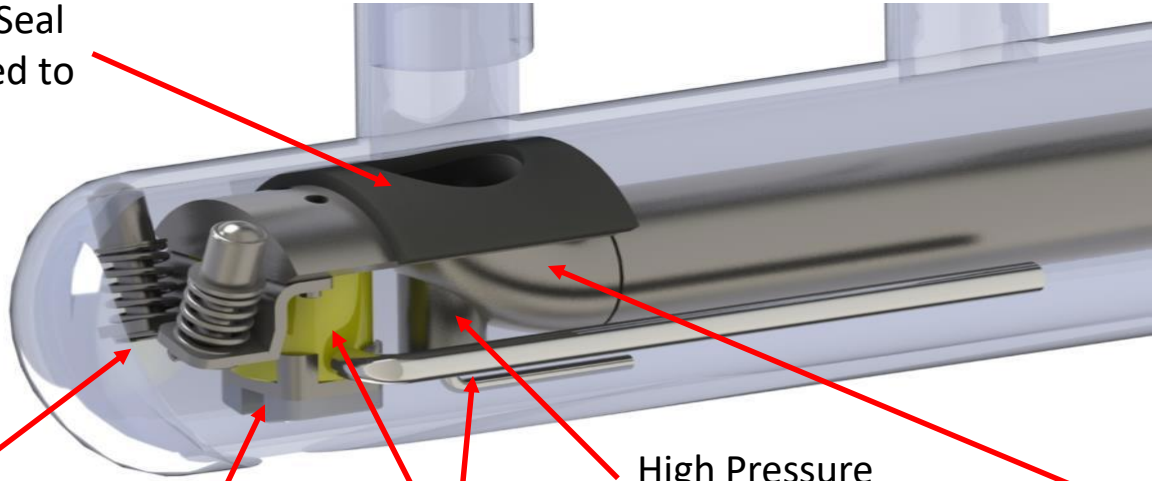
- Without the HDS, expensive modifications must be performed, creating increased expense and downtime.

Picture of Common Header



Header Delivery System

Header Delivery System



Polyurethane Seal Custom Molded to ID of Header

Centering Bracket w/ Ball Transfers

Jack Pad Used for Centering & Jacking Support

Hydraulic Jack & Hydraulic Line

High Pressure Camera

Snout Weldment Designed & Machined to Match Small Diameter Header (Typically 6”-12”)

Steady Flux Common Header Delivery System

Testing passage of Inspection Tool through HDS piping

- Small Access Tool Test
  - –Schedule
  - –Test Equipment List
  - –TestHeader
  - –Test Plan

Test Outline

– Use representative hardware to simulate the header and the HDS tool to validate that the tool path through the HDS system allows the Intero Integrity smart pig to enter the representative tube

– Verify HDS path alignment techniques to see if alignment in the representative header impacts the passage of the Intero Integrity tool into the test loop

– Conduct various test runs to establish the size of the Intero Integrity tool that should be used (3 Inch Vs. 4 Inch), default shall be the 3 inch tool

– Vary disks on the Intero Integrity tool if necessary to support passage through the HDS tool

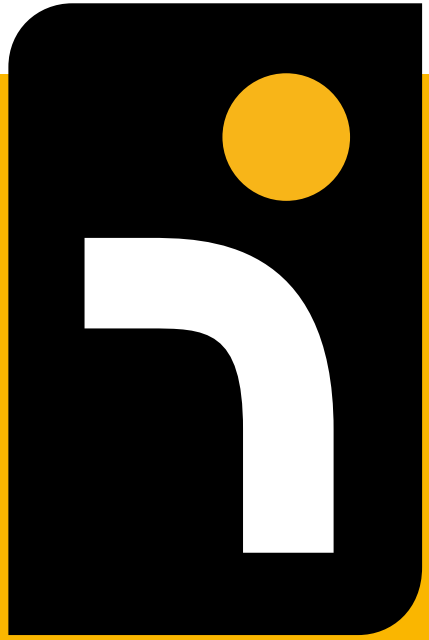
– Establish preferred water pump parameters, i.e. flow rates, operating pressure, back pressure, etc.

- Documentation of the variables that resulted in successful passage of the pig

TECHNICAL SPECIFICATIONS

- Access to tubes ranging from 2" to 10" with common headers ranging from 6" to 54" in diameter with 1D navigable bends
- Rated for pressure up to 850 psi that ensures that our system will work with all mechanical decoking companies.
- Reduces down time and allows access to tubes inside a common header without the need for cutting or welding tubes.
- Certified and tested per ASME, API, and ASTM standards as well as a professional engineer.
- Custom materials available to ensure no contamination within the fired heater (titanium, UHMW, stainless steel, etc.)
- Engineering oversight on all jobs to ensure the process is done expediently and safely.

https://www.steadyflux.com/hds



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Thank you.

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