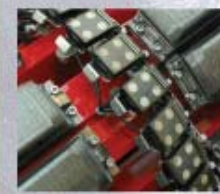




YOUR PARTNER IN INTEGRITY MANAGEMENT

- in-line inspection
- data services
- tethered inspection
- asset integrity management support
- pig tracking and locating equipment
- engineering services
- cleaning pigs and cleaning services
- rehabilitation services



Cased Pipeline Integrity Workshop - ROSEN Tethered Pigging



Brian Parker
Supervisor – Data Evaluation
ROSEN USA

1. Tethered Pigging Process and Equipment
2. Data Analysis and Reporting
3. Additional Options – ROSEN Robotics

Tethered Pigging

- An inline inspection survey performed with the tool attached to a wireline or tethered system
- The ILI tool is pulled through the pipeline segment by a wireline or tethered system.



Tethered Pigging – Applications

- Short line segments
- Cased crossings
- Systems with low flow or lack of product flow
- Valve areas – crossovers
- River Crossings
- HCA inspections only



Tethered Pigging – Advantages

- This type of survey will produce the same results as a typical in-line inspection. Geometric deformations, metal loss, cracking, and pipeline mapping
- Many companies are considering this option as it is typically more economical, environmentally friendly, and can provide a more complete assessment

Tethered Pigging Process and Equipment

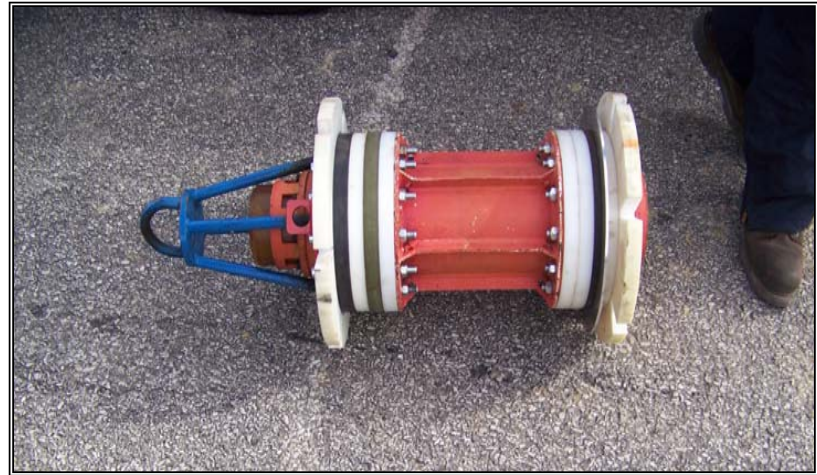


Typical set-up with
pipe cut on both ends

Installation of
Cleaning or Pull Pig



Tethered Pigging Process and Equipment



Cleaning tool for cable transport



Tethered Pigging Process and Equipment



Wireline setup and operation



Tethered Pigging Process and Equipment



MFL tool
launch/receive



Details

- On-site run confirmation and analysis can be provided
- The entire tool fleet can be pulled or tethered

Limitations

- Typical weight of the pull or pull strength – 10,000 lbs tension (varies depending on tool type, diam., and length of pipe segment)
- 270 degrees of total bends in segment to be inspected
- Complex systems may require more than one set-up or reverse survey from one entry/exit location

1. Tethered Pigging Process and Equipment
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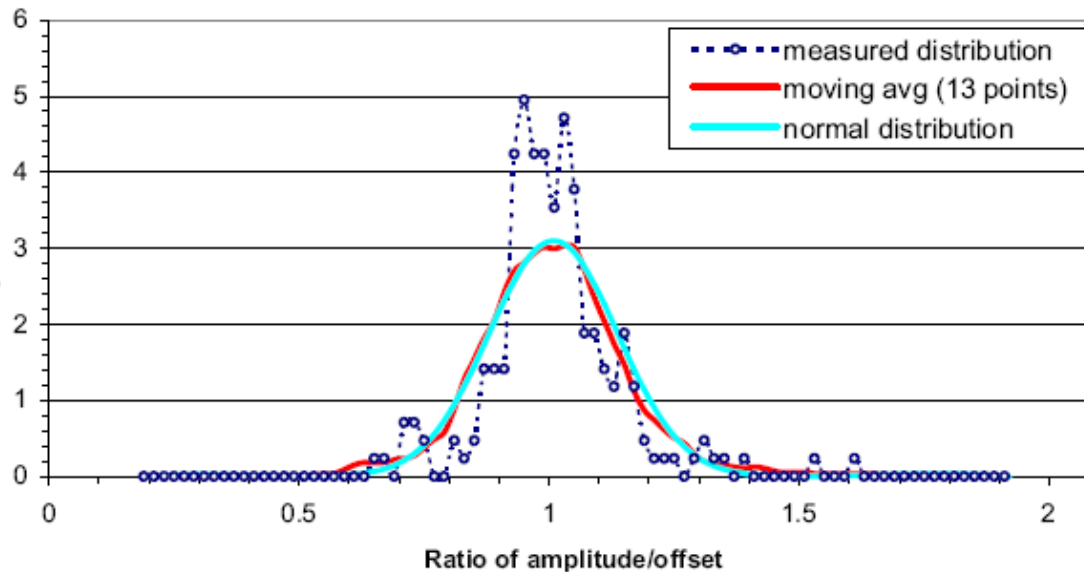
Data Analysis – Casing Considerations

- For MFL inspections, it has been well established that the sizing of metal loss anomalies is influenced by the presence of a casing around the parent pipe
- This influence is primarily caused by the difference in achieved magnetization levels, which consequently will have an affect on the calculated wall thickness of the carrier pipe and signal amplitudes recorded
- In August 2002, two pull tests were performed to simulate a 10” pipeline within a 14” casing with more than 200 anomalies present in the parent pipe

Data Analysis – Casing Considerations

- Upon completion of these pull tests, previous theories of an equal amplitude/mag. level offset ratio were confirmed and are illustrated in the graphic below

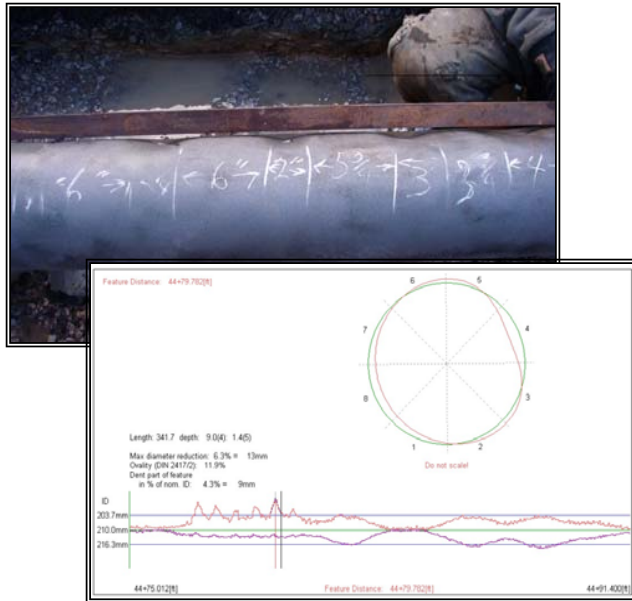
Distribution of the amplitude/offset-ratio between pure pipe and casing-covered pipe



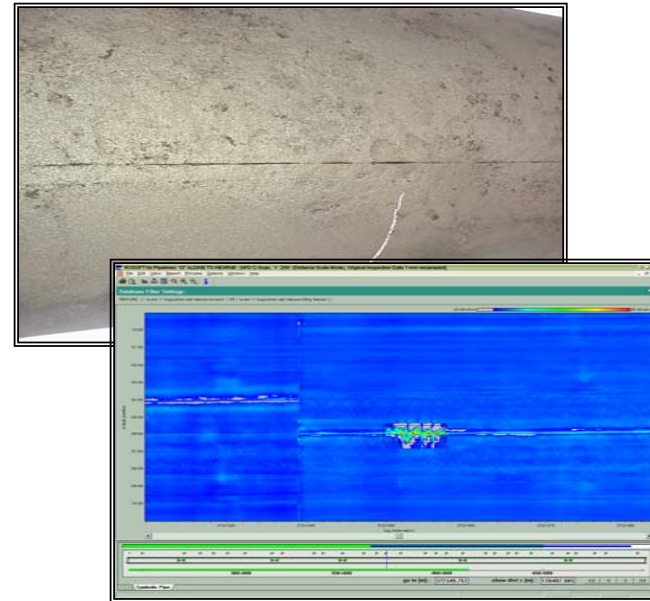
Average of all 212 calculated ratios:	1.0084
Standard deviation:	0.1287

Reporting Details

- All reporting aspects of a traditional ILI are achieved during a tethered application including the ability to size and characterize anomalies



Dents $\pm 0.5\%$ of ID

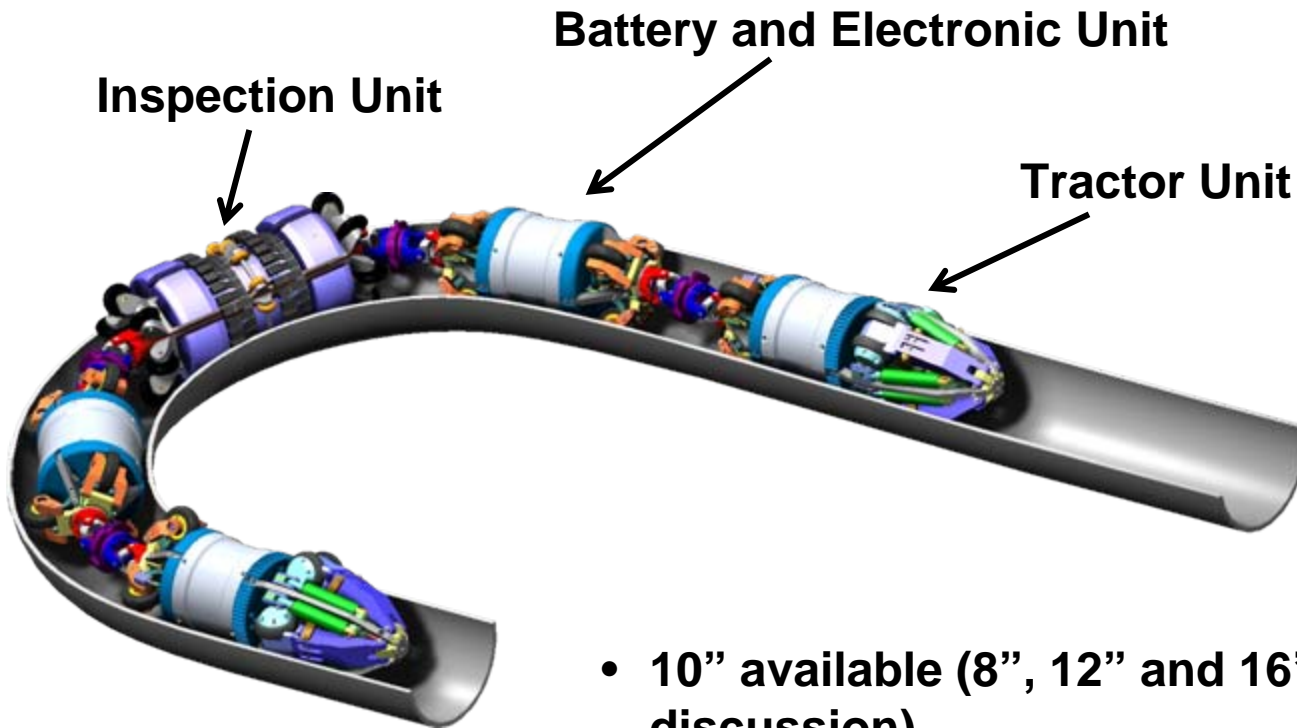


Metal Loss $\pm 10\%$ of WT

Reporting Details

- Confident to identify location and orientation of shorted casings
- With a second generation inspection, estimates of corrosion growth rates are possible
- Deliverables for inspections will include not only a hard copy report, but also client software which will include sortable listings, graphics, and metal loss pressure based assessment (RSTRENG, etc.)

1. Tethered Pigging Process and Equipment
2. Data Analysis and Reporting
3. **Additional Options – ROSEN Robotics**



- 10" available (8", 12" and 16" in discussion)
- autonomous, self-propelled
- heavy duty, bi-directional
- navigation system on-board
- MFL inspection unit for accurate feature detection & sizing
- single entry/exit point



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