The Latest Advancements in Delayed Coke Drum Inspection & Reliability Techniques

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CIA INSPECTION INC.

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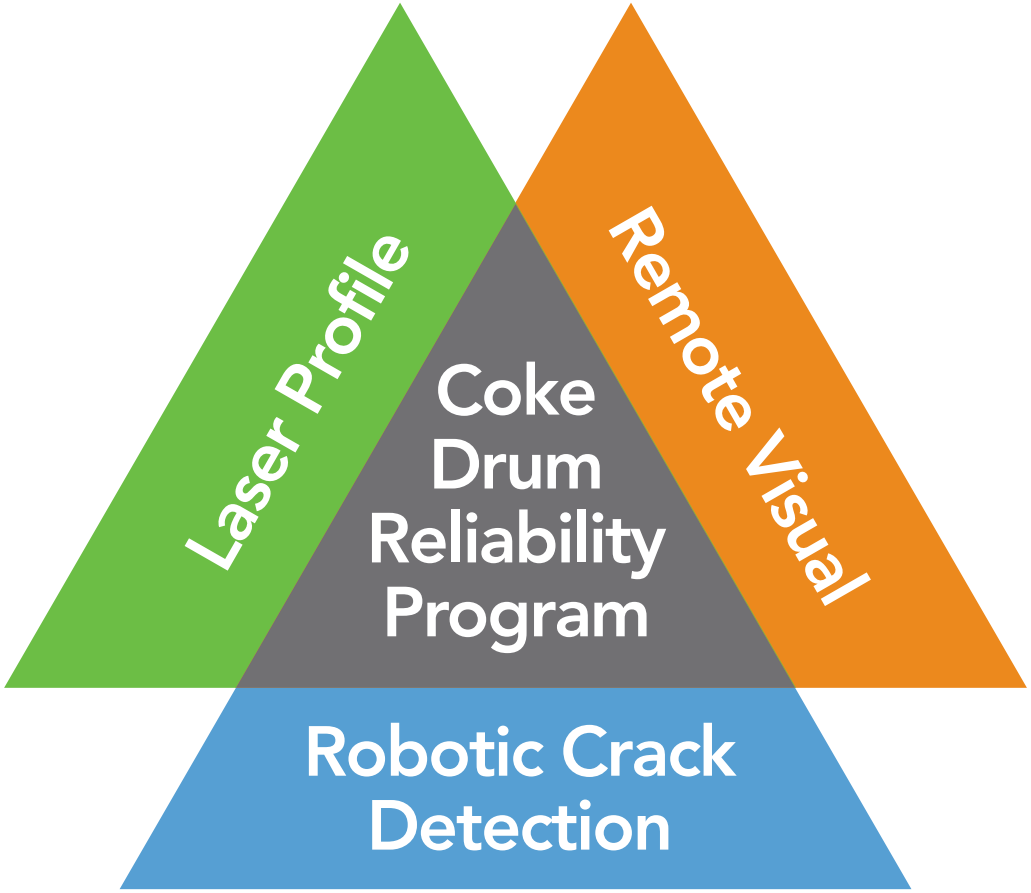
- ✓ Widely recognized as the world's leading coke drum inspection company with 1300+ site inspections realized for industry's leading refiners.
- ✓ Forefront of innovation in non-destructive examination (NDE) techniques for the delayed coking industry and proud to play a continued lead role in improving operator safety, asset life and unit output.
- ✓ First invented the technique and continues 100% dedicated and focused to the inspection of delayed coke drums with a 25+ year history and more than 150 years of collective expertise.
- ✓ Specific to India, 15+ years experience with over 160 inspections completed making India one of CIA's most important markets, **and CIA India's leading DCU inspection company**.
- ✓ Driven by continuous improvement and value add services, CIA has evolved into a full service partner in coke drum inspection and reliability services.
- ✓ The following slides demonstrate CIA's comprehensive coke drum inspection package that form part of the standard offering:

FULL SERVICE PARTNER IN DRUM RELIABILITY



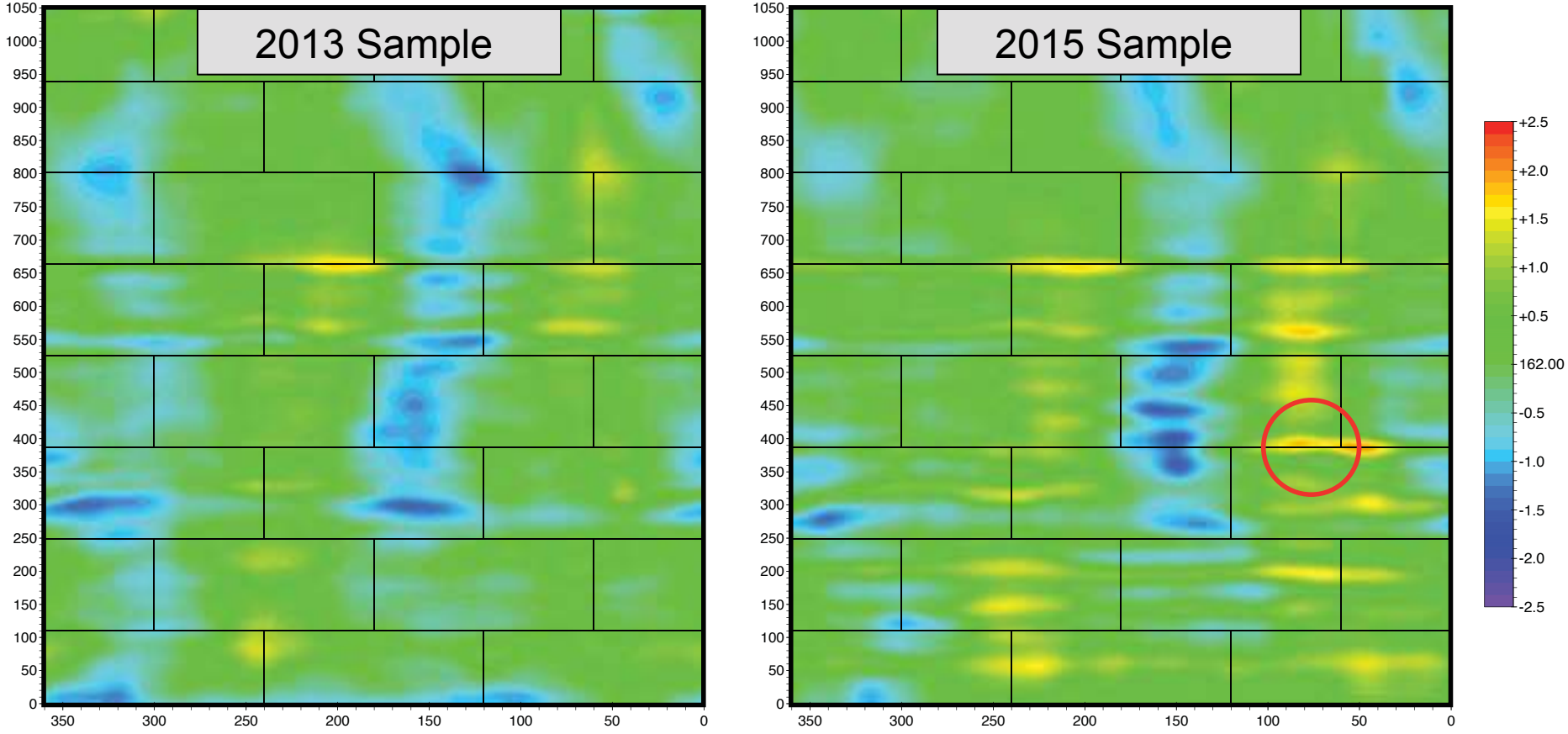
Laser Profile – a remotely deployed, laser-based range imaging tool designed to profile the internal surface of “online” coke drums in order to locate and measure vessel distortions in an accurate and consistent manner.

Remote Visual – best in class, state of the art, high-definition (HD) digital video camera with zoom capabilities to visually inspect the internal surface condition, including the dome, cone and nozzles.

Robotic Crack Detection – a telescopically deployed robotic crawler equipped with an NDE sensor (ACFM) used to characterize and size surface breaking cracks.

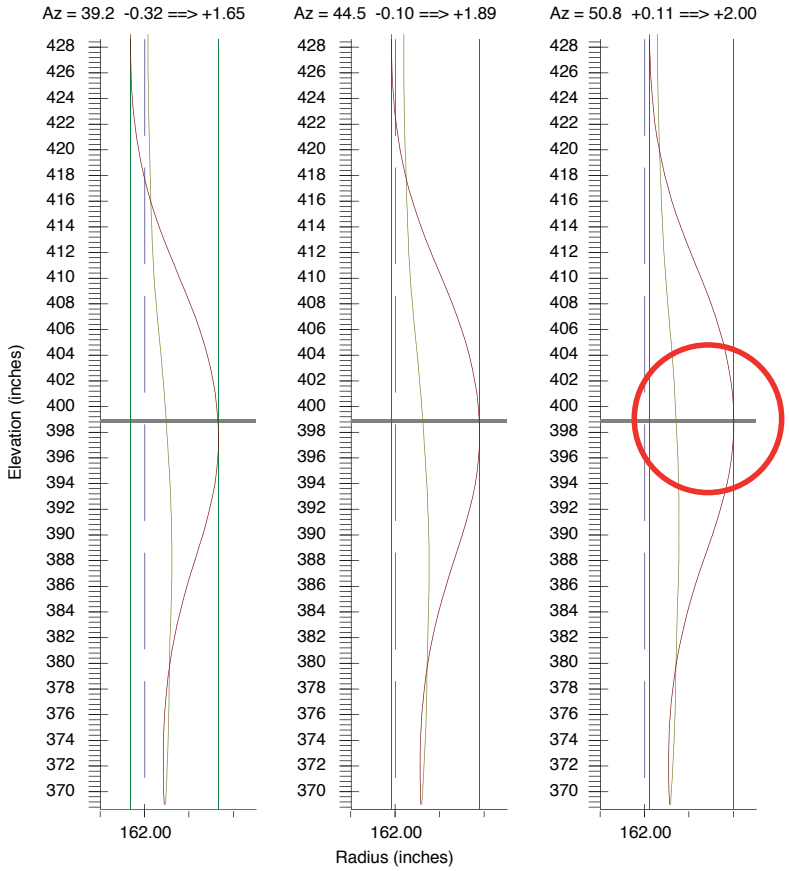
LASER PROFILING - TRACKING & TRENDING

DRUM IMAGE OR BULGE MAPS

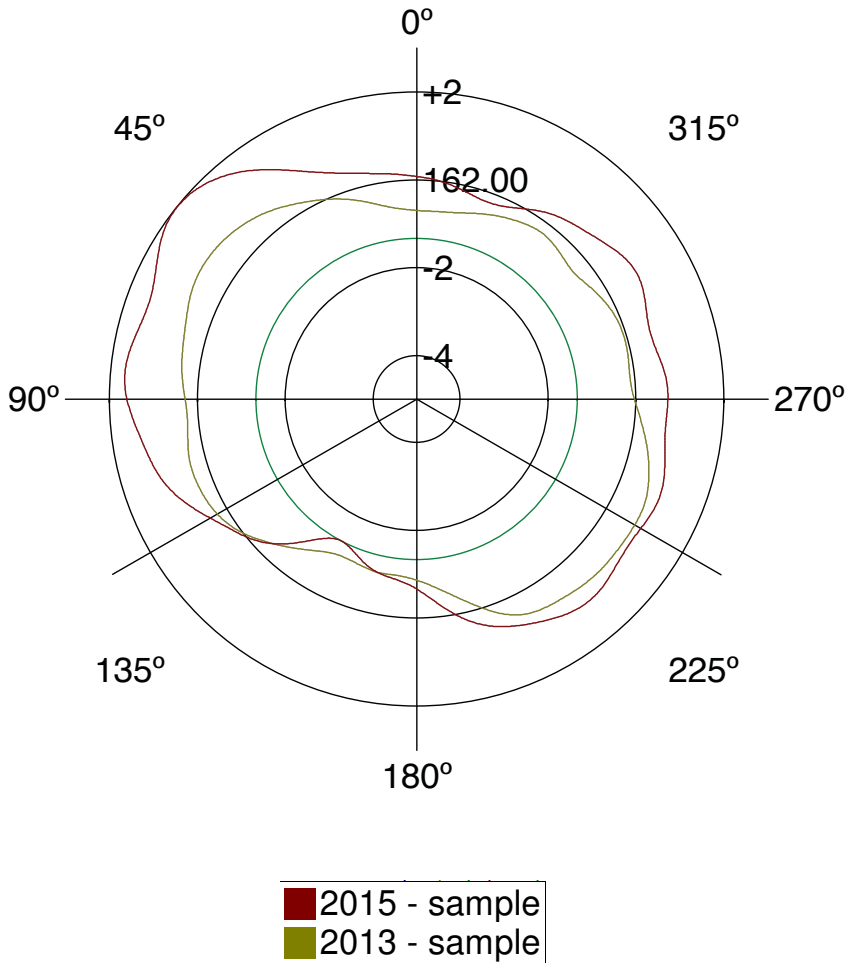


LASER PROFILING - TRACKING & TRENDING

VERTICAL SECTION COMPARISON



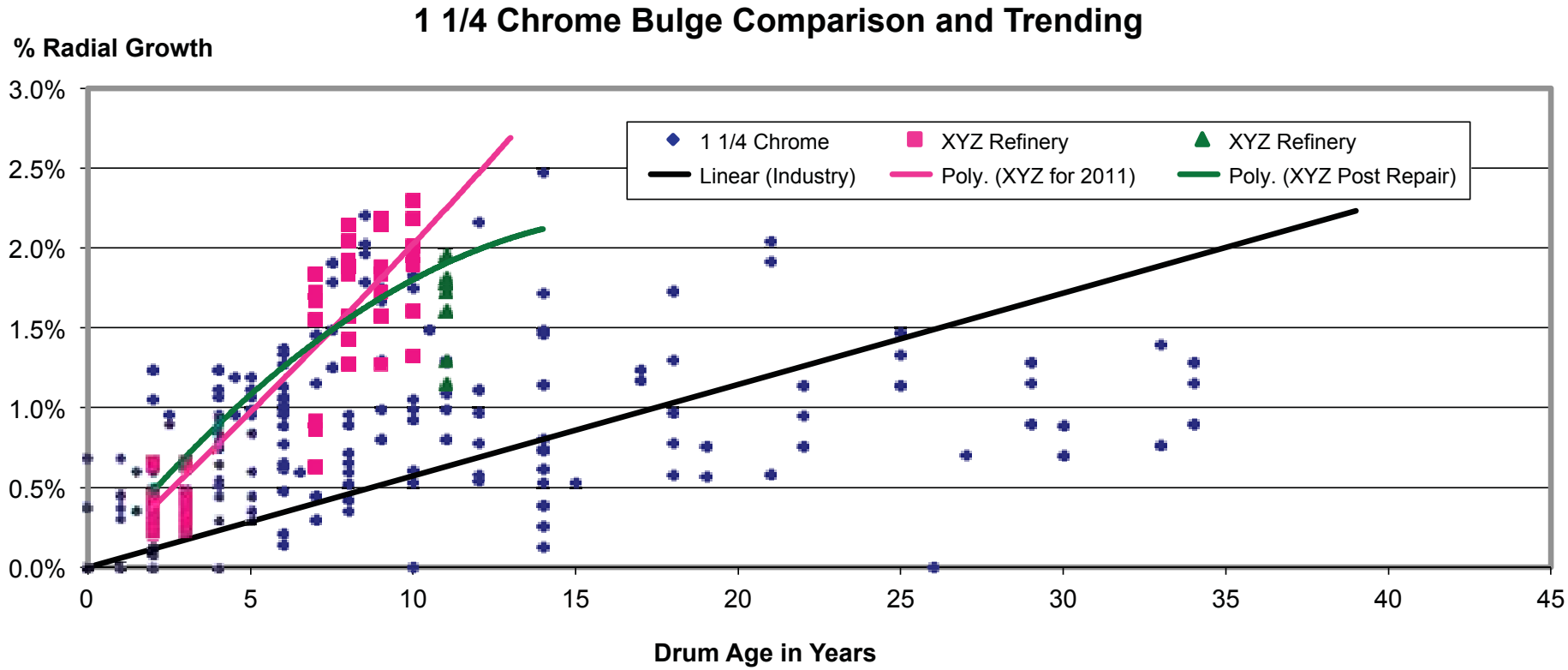
POLAR PLOT COMPARISON ACROSS 4th CIRC WELD



“DRUMVIEW”

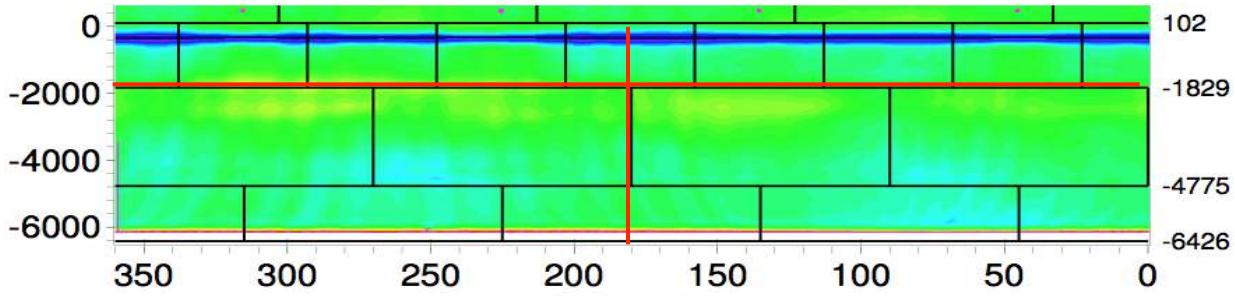
CIA presenter to run live demonstration of “DrumView”, CIA’s trademark drum imaging software program

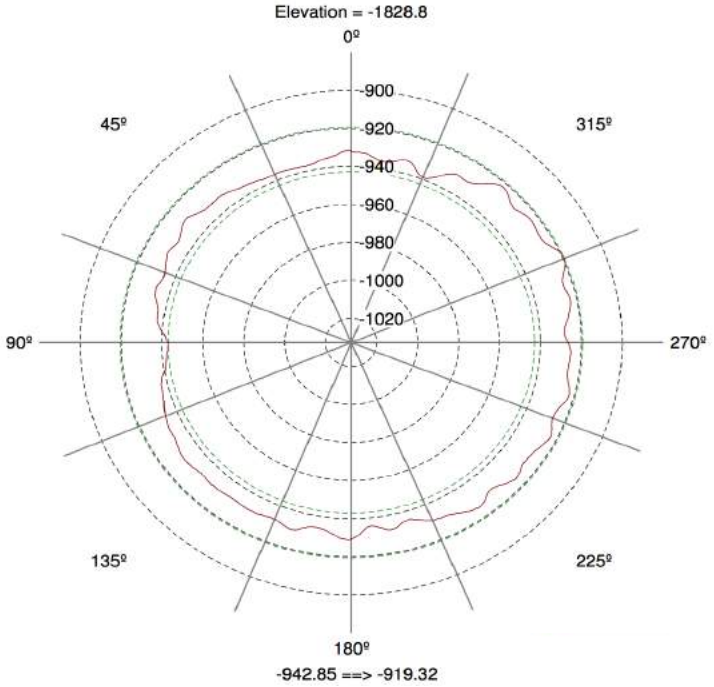
LASER PROFILING - INDUSTRY COMPARISON

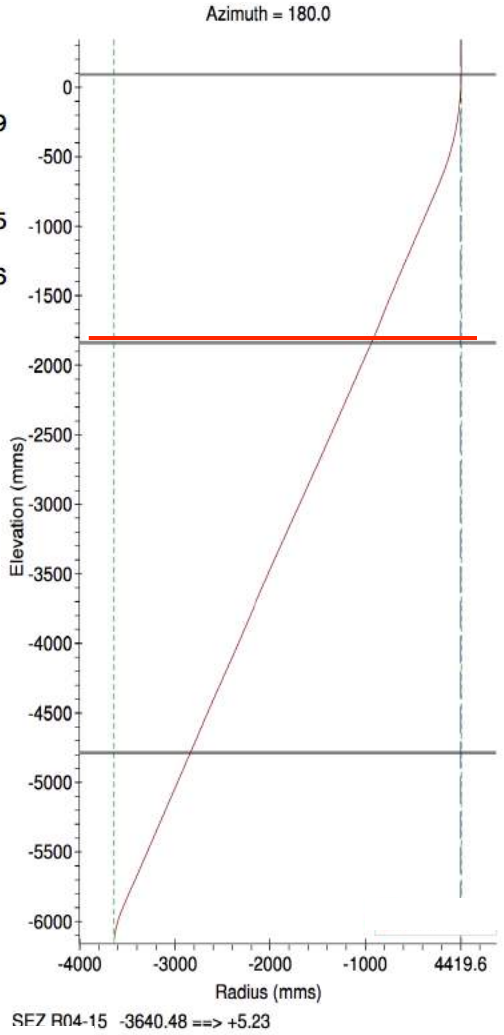


* Similar charts are available and or under development to track various features including drum design (i.e. vertical plate), unheading devices, bulge sharpness, weld overlay repairs, cycle time, etc.

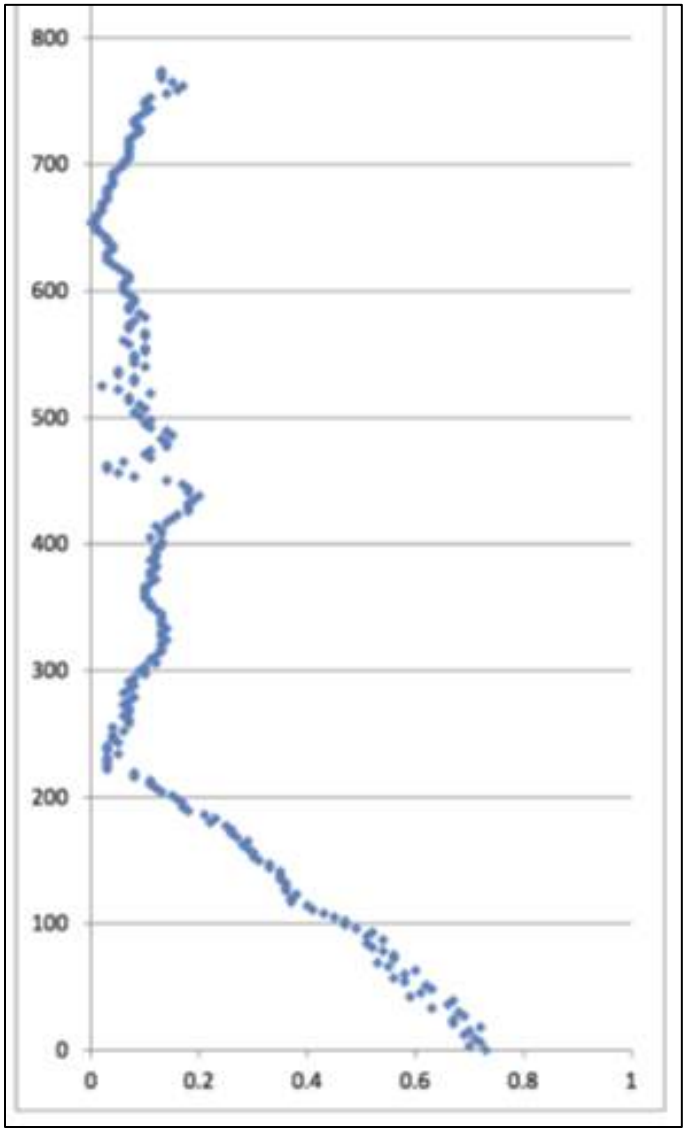
LASER PROFILING – CONE MAPPING

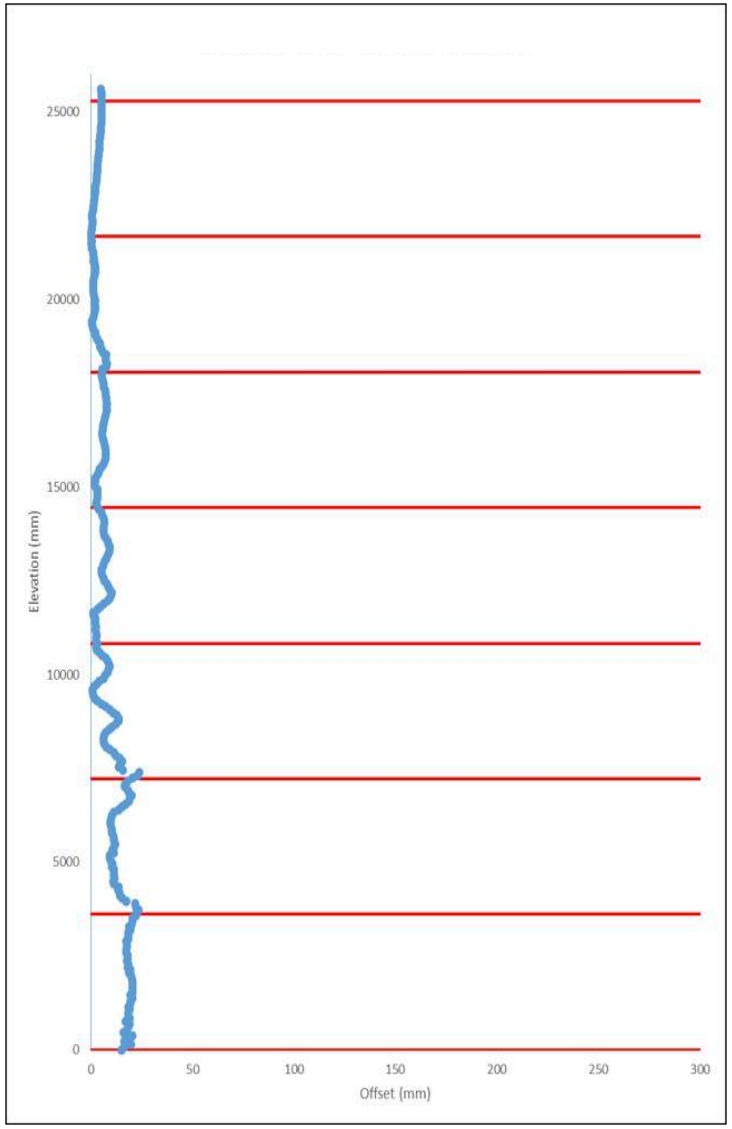




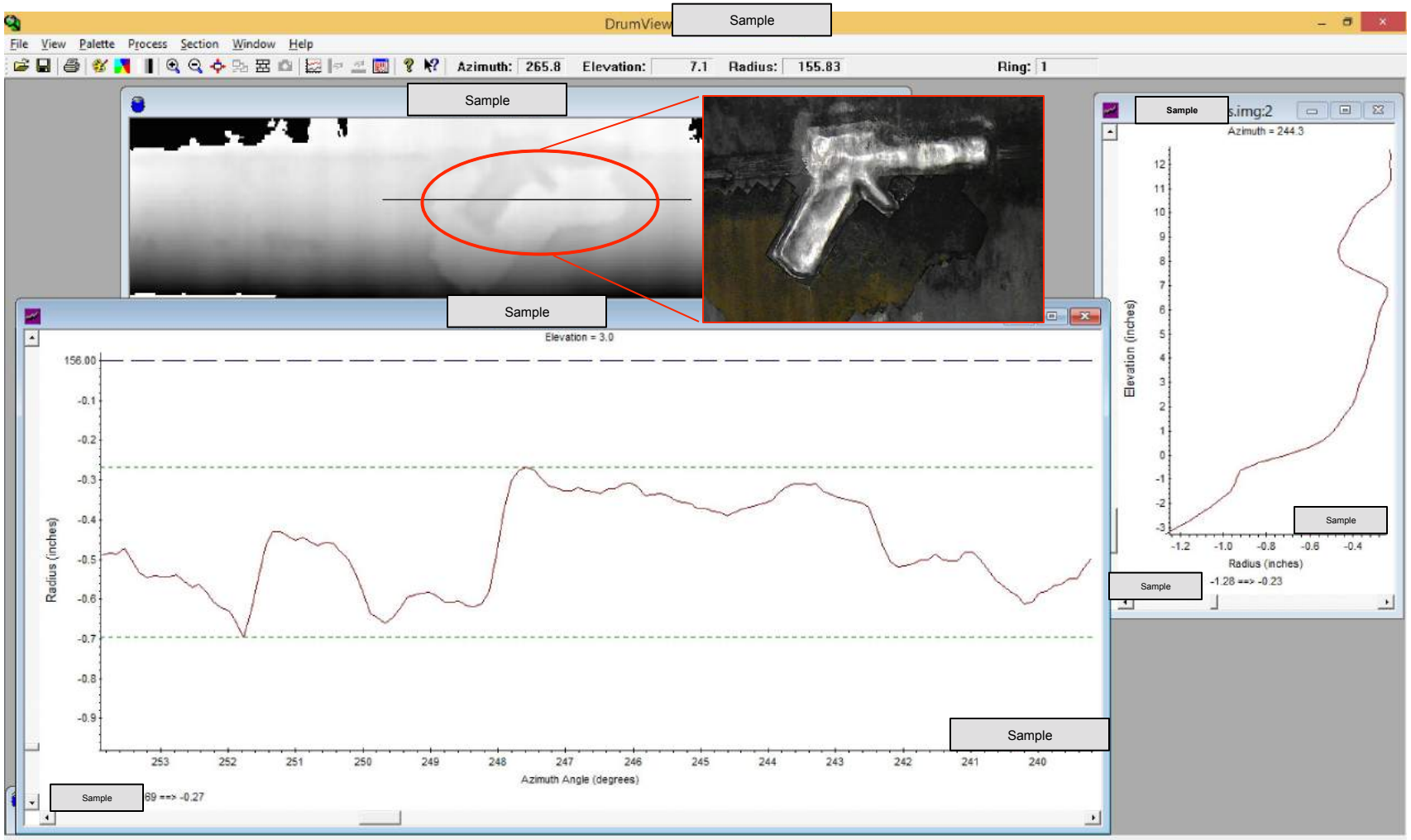


LASER PROFILING – DRUM BOW ESTIMATIONS

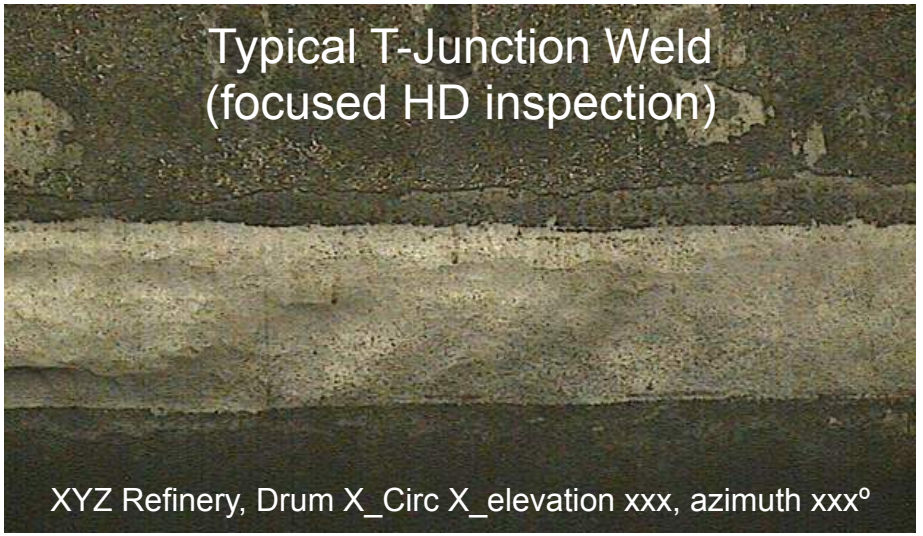


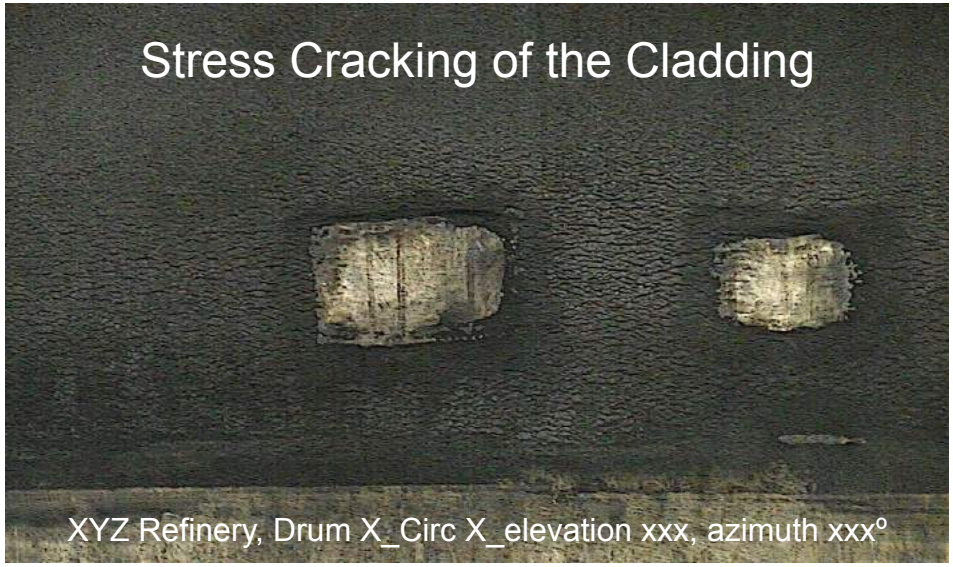


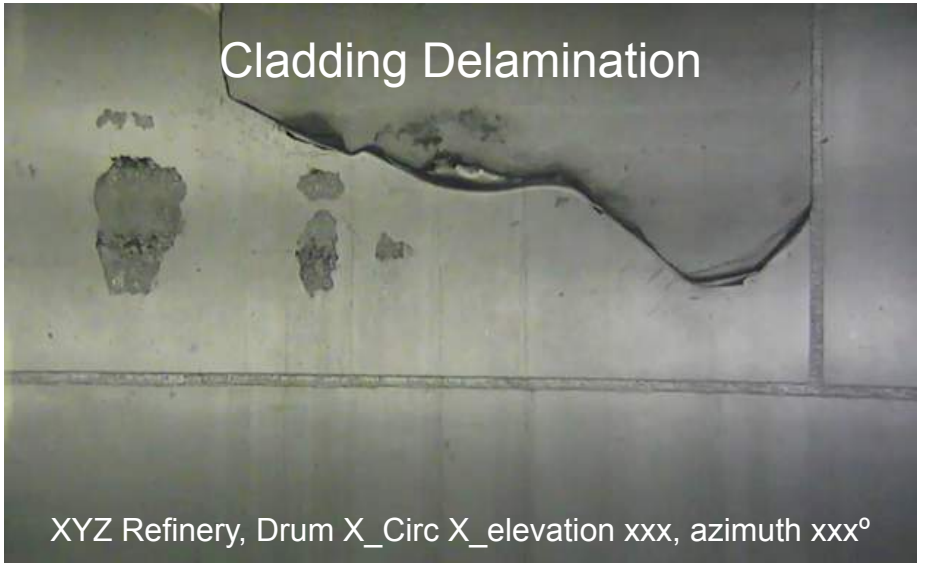
LASER PROFILING – HIGH DENSITY SCANNING



HI-DEFINITION (HD) DIGITAL VISUAL INSPECTION







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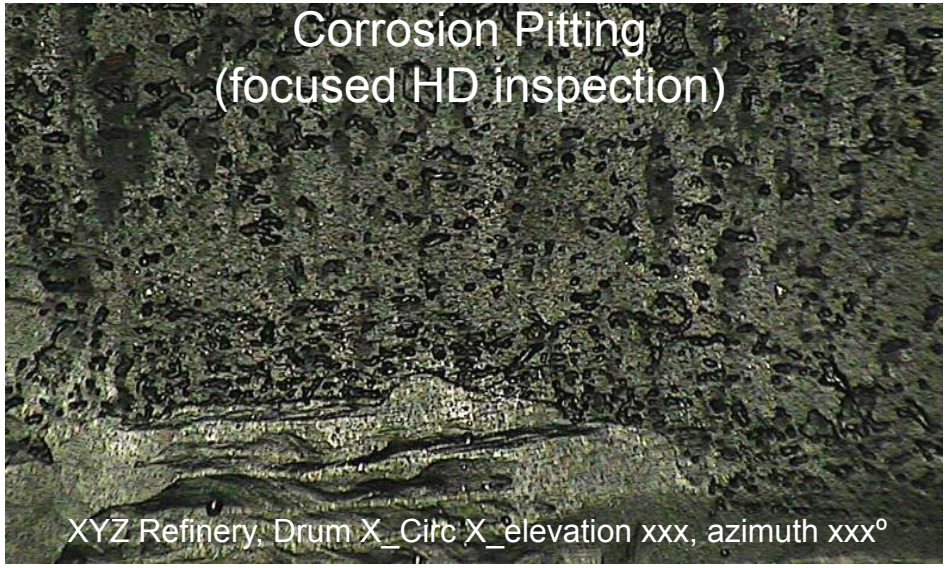
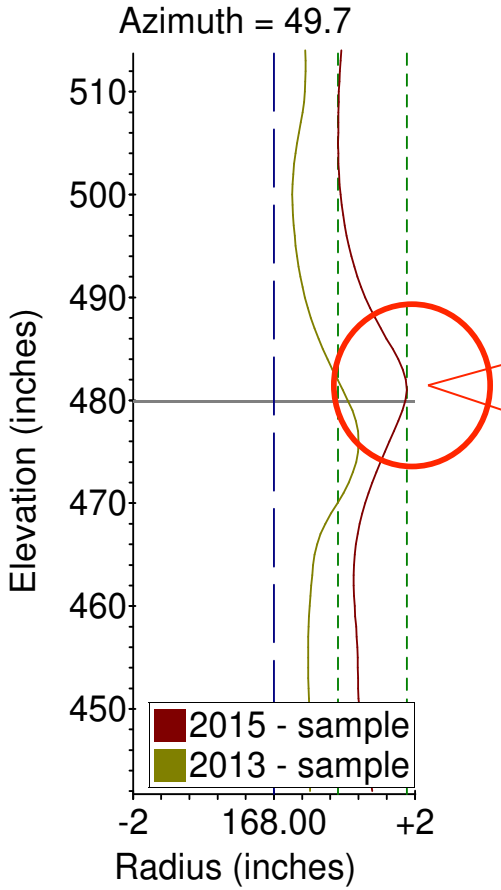


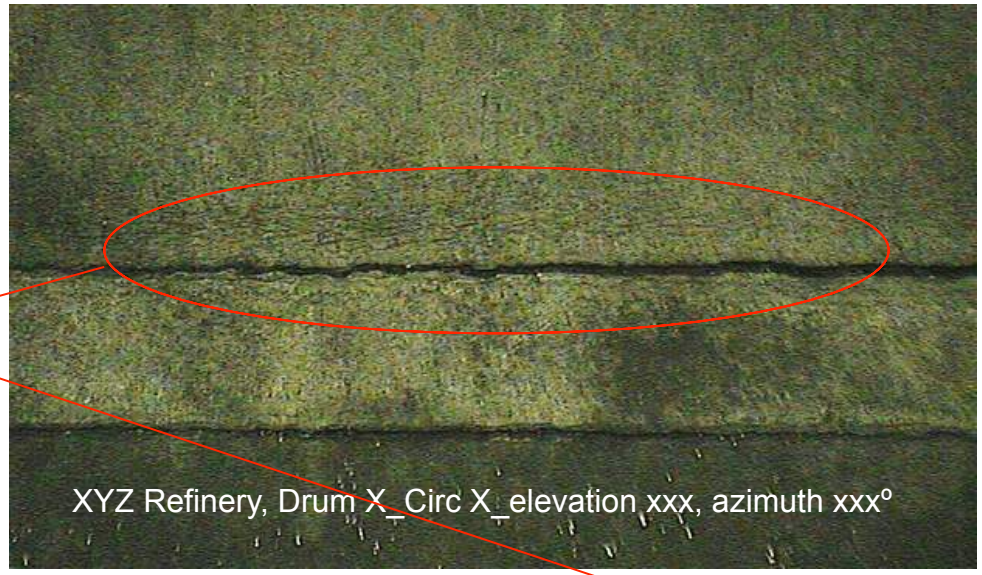
HD VIDEO INTEGRATED INTO “DRUMVIEW”

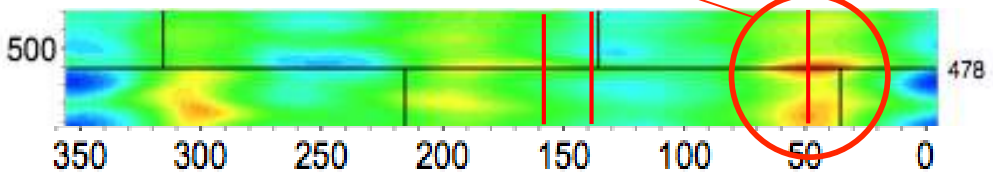
CIA presenter to run live demonstration
Integration of Hi-Definition Digital to
Laser Mapping findings

CORRELATION TECHNIQUES



2015 - sample +0.91 ==> +1.88
2013 - sample +0.26 ==> +1.20





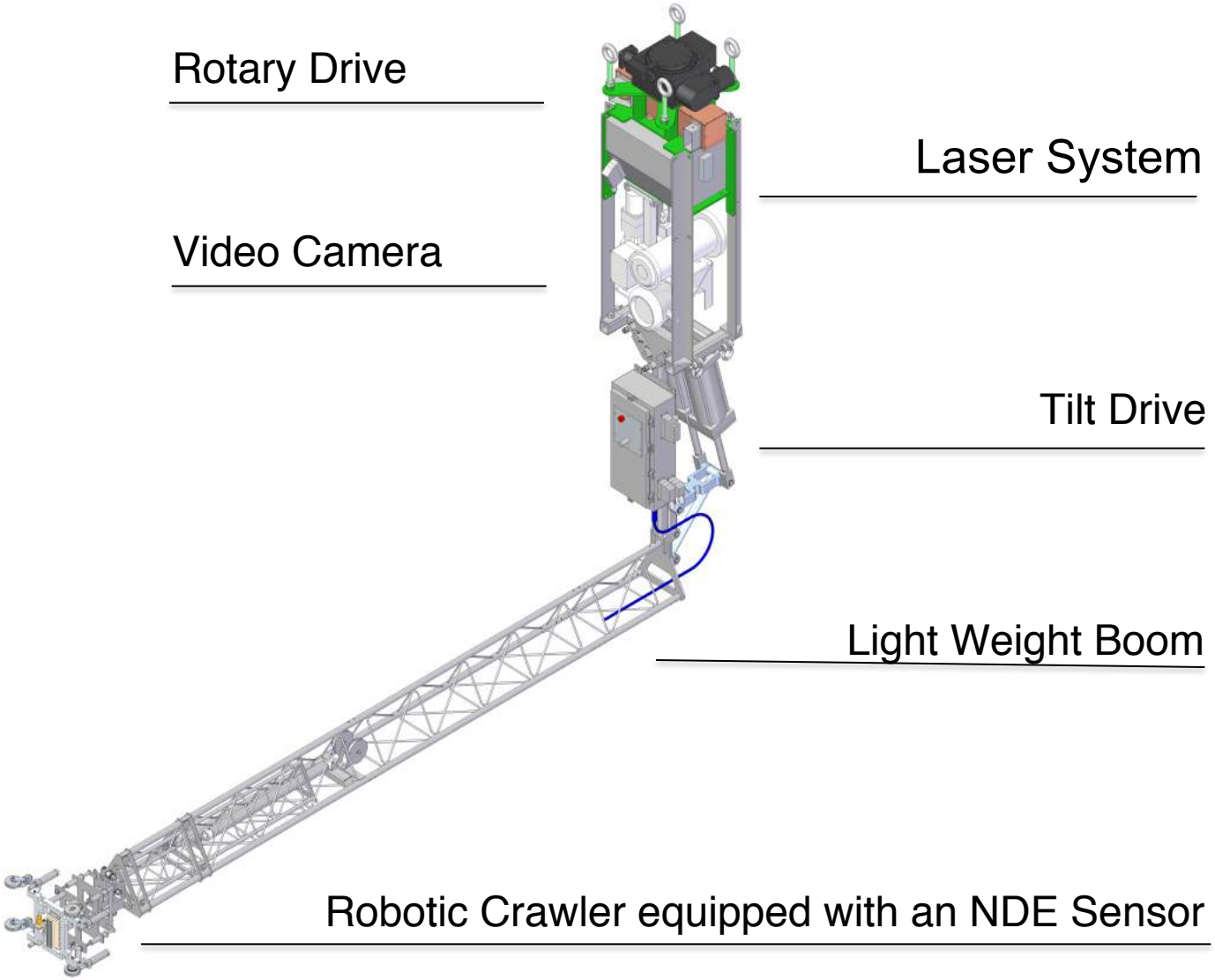
THE INNOVATIVE BREAKTHROUGH

INTERNAL ROBOTIC CRACK DETECTION

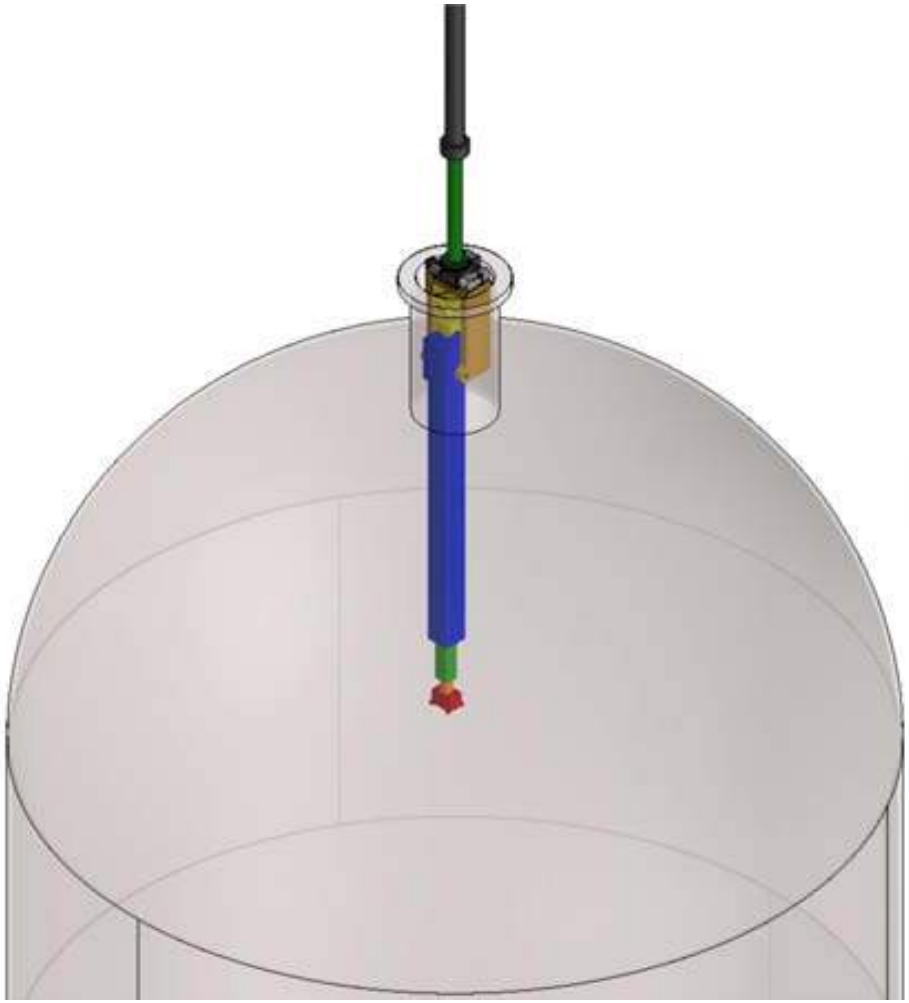
An independant research project into Robotic Crack Detection, undertaken by CIA Inspection.

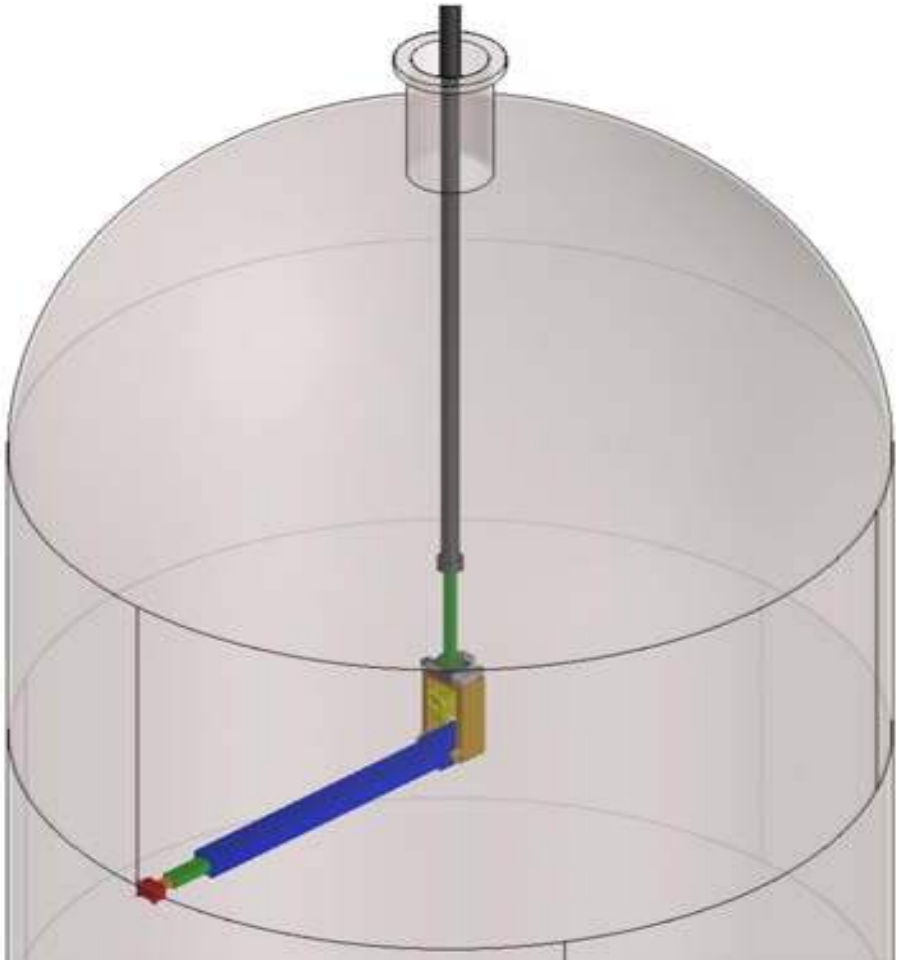
US Patent No. 7,940,298
B2 Issued May 10, 2011

ROBOTIC CRACK DETECTION USING ACFM



APPLYING ACFM TO A COKE DRUM



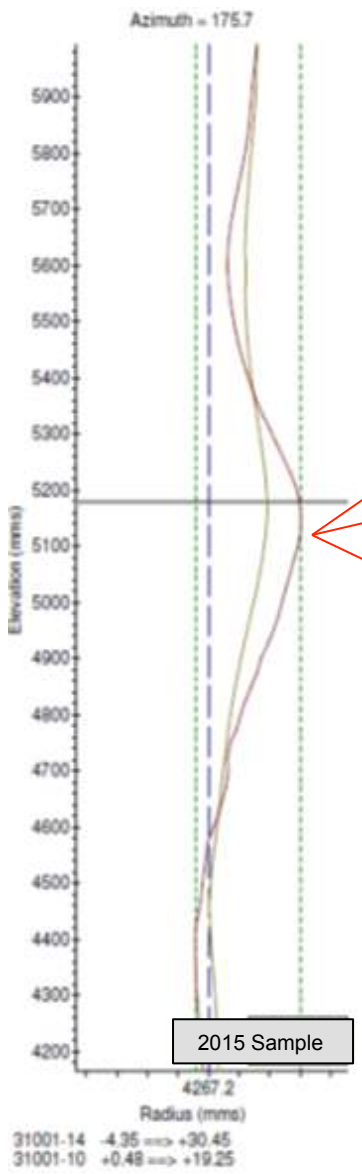


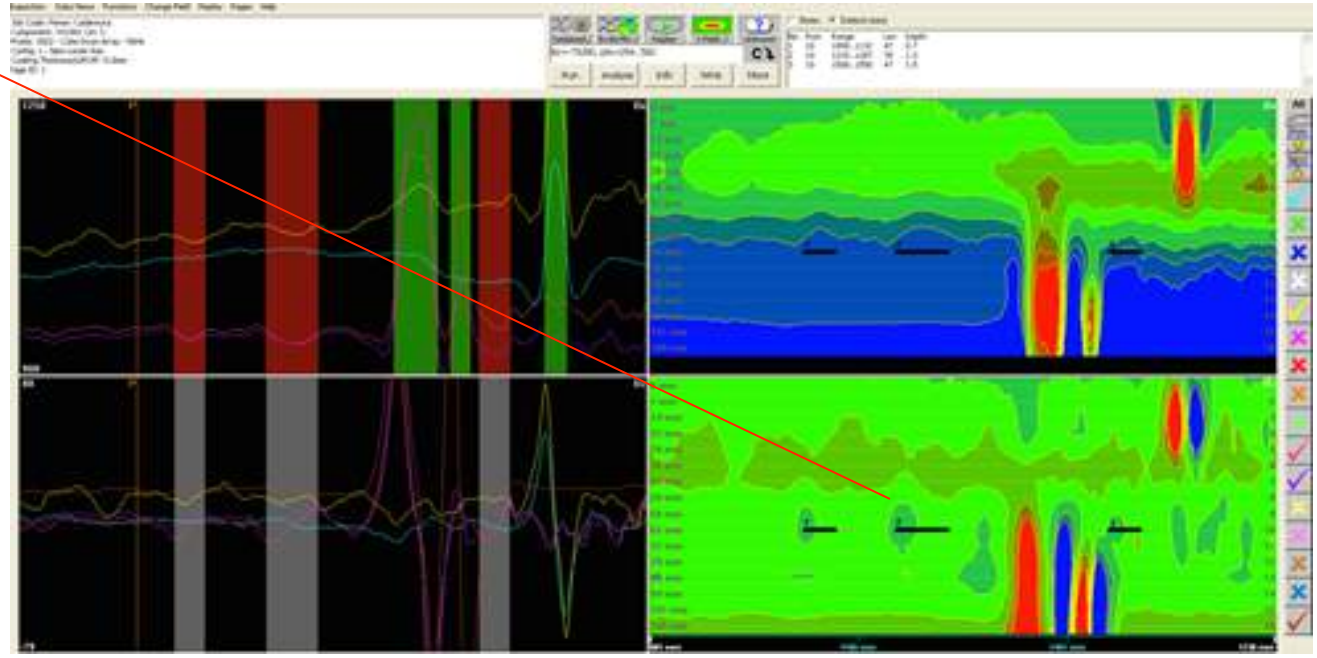
APPLYING ACFM TO A COKE DRUM

Key Factors:

- ✓ Remotely deployed service used to quickly verify the nature of surface breaking cracks
- ✓ Designed for online use, no need for scaffolding, removal of insulation or surface preparation
- ✓ Optimized for detecting indications extending beyond the clad
- ✓ Ideally suited for mid-life drums, works over coke cover, possible transition zones of metal overlay
- ✓ Used in combination with CIA's laser/video inspection service to pre-identify high-risk regions
- ✓ Results typically provided within two weeks of inspection date

TYPICAL FINDINGS OF AN ACFM INSPECTION





COKE DRUM MANAGEMENT THROUGH KNOWLEDGE

Laser Profiling:

- Tracking & Trending
- Cone Mapping
- Thermal Bowing or “Banana Effect”
- Enhanced Bulge Analysis Calculation
- Real-time analysis and processing
- Data Mining & Predictive Tools

Hi-Definition Digital Visual

- Optimized examination of most problematic and high-risk regions

Robotic Crack Detection:

- ID crack confirmation and measurement (length and depth)

Other Services:

- Pre-Turnaround Vessel Assessment
- External Structure Scanning
- Baseline Examinations of New to Service Vessels
- High-density scanning
- Operational Assessment

Important Partner in any long-term reliability program:

- Engineering Analysis
- Fitness for Service, Remaining Life
- Health Monitoring Systems
- Strain Gauge Instrumentation
- Weld Repair Strategies

CASE STUDIES

CIA presenter to discuss various case studies in which CIA's service and approach has benefited major Indian / global refiners

IN REVIEW - YOUR FULL SERVICE PARTNER

- ✓ Technically superior service, best in class remote visual inspection, highest quality data, analysis & reporting available, and post-inspection support.
- ✓ The first step in the process towards a coke drum reliability program for improved performance, operator safety, asset life.
- ✓ Continues to innovate and introduce value add services & solutions to provide refinery operators the information they need.
- ✓ Strong commitment to continuous improvement to provide the most comprehensive and cost effective service possible.
- ✓ Partnerships with other world leading service providers to the Delayed Coking Industry to deliver additional value and benefit.
- ✓ The goal is to be ***Proactive*** on issues affecting drum integrity rather than being ***Reactive*** to the resulting problems that are inevitable.
- ✓ As the industry strives to better understand drum condition and repair strategies, CIA is extremely well positioned to assist each step of the way.

THANK YOU!

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