



# Well Integrity

Solutions



Advanced Logic Technology

# System overview



**QL43 ABI**  
Ultrasonic cased hole imager



**OPAL - Logger suite**  
Acquisition system



**WellCAD™**  
Processing software

Since the company's foundation in 1993, Advanced Logic Technology has grown to become a globally recognized leader in developing solutions for the borehole logging industry.

With more than 20 years experience and holding patents in technology, the company has built a solid reputation for the design and production of state of the art imaging tools (acoustic and optical televiwers) and high-end data acquisition systems & software.

Since its first release in 1993, WellCAD® has provided support to the daily work of thousands of people dealing with borehole data. WellCAD® handles the entire data loading, log editing, analysis and presentation workflow. The modular architecture of WellCAD® allows users to easily activate expert modules to build a package tailored to their exact requirements and make it an attractive solution for small scale companies as well as large multinational corporations

# OPAL acquisition system



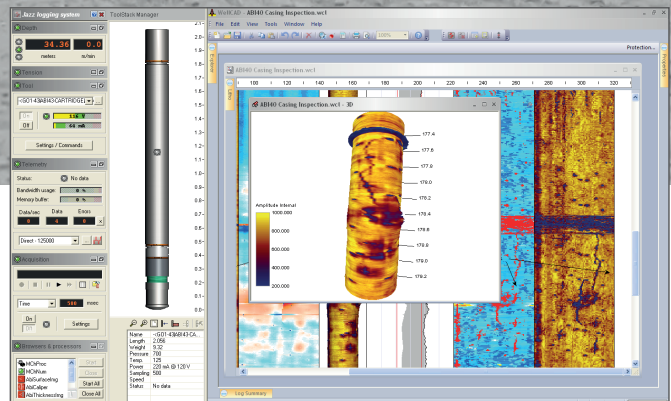
The OPAL is a modular and flexible acquisition system. Its standard configuration is optimized for the ALT tool telemetry protocol and provides high telemetry performance when running borehole

logging tools on multi and single conductor cables. Its architecture allows easy integration of additional telemetry modems to support equipment from other vendors.

Whether mounted into a 19" rack or used in a light weight portable configuration the OPAL offers the unique combination of versatility, ruggedness and ease of use.

OPAL systems are operated worldwide in a diverse range of applications supporting also the Oil & Gas requirements.

Our systems are delivered with the LoggerSuite/WellCAD® software package for acquiring and presenting your data sets in the most efficient manner.





# QL43 ABI

## Ultrasonic cased hole imager

### Our technology

The QL43-ABI is the most compact high-resolution ultrasonic imaging tool available in the wireline logging industry. Based on more than 20 years of experience and market leadership with ultrasound technology, the QL43-ABI consists of a state-of-the-art electronics and sensors designed to meet the oil & gas industry standards. The electronic architecture uses a super fast digital signal processor performing complex data processing operations in real time on each individual ultrasonic wave train. Its wide dynamic range of signal detection and its easy field operation offer a large variety of logging applications.

### Fields of application

- Mining & mineral exploration
- Geothermal energy
- Geotechnical projects
- Water industry
- Oil & gas

### Applications in details

#### OPEN HOLE

- Geological structure identification and orientation
- Lithology and mineralogy characterization
- Stratigraphic analysis
- Core orientation
- Stress field analysis (breakout and borehole deformation analysis)
- Caliper information
- Rock strength

#### CASED HOLE

- Casing integrity: internal and external inspection of casing/tubing (corrosion, wear, perforations, scale deposits, deformation analysis)
- Inside and outside casing/tubing diameter
- Direct measurement of casing and tubing thickness
- Metal loss

### Key benefits

- Slimest tool of its kind currently available
- Real-time high-resolution images and thickness measurement
- Wide measurement range from 2"7/8 to 15" tubulars
- Records 36 ultrasonic waveforms per revolution for data post-processing
- Operates on mono, multi or coax electric lines
- Auto-adaptive telemetry system with equalizer option

### Principle of measurement

The acoustic borehole imager records a 360° unwrapped and 3D images of the borehole wall. The tool emits an ultrasonic beam towards the borehole wall and records amplitude and travel time of the reflected signal. Amplitude records are representative of the impedance contrast between the borehole wall and fluid. Travel time is used to determine accurate borehole diameter data, which makes the tool ideal for borehole deformation - stress field analysis and casing inspection.

Sophisticated algorithms and real time processes are also implemented to extend tool applications for casing thickness measurement, corrosion evaluation and measurement behind a PVC casing.

The QL43-ABI uses a built-in high precision 3-axis fluxgate magnetometer and 3 accelerometers to orient the recorded images to a global reference - Magnetic North or High Side<sup>1</sup>.

### Measurements features

#### Cased hole mode

- 360° Unwrapped image of the steel casing based on travel time and amplitude records : caliper, amplitude, thickness and CADI<sup>2</sup> image logs
- 36 ultrasonic waveforms per revolution for data post processing (WellCAD cased hole ultrasonic workspace)

#### Open hole mode

- 360° Unwrapped and oriented image of the borehole wall based on travel time and amplitude records : caliper and amplitude image logs
- Deviation parameters : azimuth, tilt, tool relative bearing, magnetic field, gravity
- 3 Accelerometer calibrated components, 3 Magnetometer calibrated components

<sup>1</sup> Only applicable in open hole

<sup>2</sup> Cement Attenuation Decay Index



# Technical specifications

## Cartridge

**Diameter** : 43 mm - 1\*11/16  
**Length** : 1.45 m - 4.8 ft  
**Weight** : 6.2 kg - 13.7 lbs  
**Max. Temp** : 170 °C - 338°F  
**Max. Pressure** : 700 bar - 10,000 psi

## Orientation sensor

**Sensor** : 3-axis fluxgate magnetometer  
 3 accelerometers  
**Location** : Mid point @ 1.66 m from tool bottom  
**Inclination accuracy** : +/- 0.5 deg  
**Azimuth accuracy** : +/- 2.5 deg

## Operating conditions

**Centralisation** : Always required  
**Borehole fluid** : Water  
 Water based mud  
 Brine  
 Pure oil (not applicable in oil based mud)  
**Cable type** : Mono conductor  
 Multi-conductor  
 Coaxial  
**Acquisition system** : OPAL  
 SCOUT-PRO



## Acoustic heads

**Acoustic sensor** : Fixed transducer and rotating focusing mirror  
**Focusing** : Collimated acoustic beam  
**Frequency** : 1.2 MHz  
**Acoustic beam width** : 3 mm @ focal distance  
**Mirror rotation speed** : Up to 20 rev/sec - automatic  
**Azimuthal resolution** : 72 - 144 or 288 (user defined)  
**Caliper resolution** : 0.08 mm



OPEN HOLE & CORROSION  
**QL43 ABI HEAD OHCO-L**

**Application** :  
**Open Hole** : up to 21" depending on borehole conditions  
**Cased Hole** : 5\*1/2 to 15" with a minimum of 5mm casing thickness

Max. Temp. Open Hole: 170°C - 338°F  
 Max. Temp. Cased Hole: 150°C - 302°F  
 Max. Pressure: 700 bar - 10,000 psi  
 Weight: 2.8 Kg - 6.2 lbs  
 Length: 0.48 m - 1.57 ft



CORROSION SMALL FOCUS  
**QL43 ABI HEAD CO-S**

**Application** :  
**Cased Hole** : 3" to 5\*1/2 with a minimum of 3mm casing thickness

Max. Temp. Cased Hole: 150°C - 302°F  
 Max. Pressure: 700 bar - 10,000 psi  
 Weight: 2.8 Kg - 6.2 lbs  
 Length: 0.51 m - 1.57 ft



CORROSION - EXTRA SMALL FOCUS  
**QL43 ABI HEAD CO-XXS**

**Application** :  
**Cased Hole** : 2\*7/8 with a minimum of 3mm casing thickness

Max. Temp. Cased Hole: 150°C - 302°F  
 Max. Pressure: 700 bar - 10,000 psi  
 Weight: 2.8 Kg - 6.2 lbs  
 Length: 0.51 m - 1.57 ft

# Centralizers for 1" 11/16 43mm tools

## Non-magnetic Slip Over Centralizer

**Centralizer rings :** Two pairs required – Part number : ALT18460

**Centralizer ring diameter :** 58mm

**Blade sizes available :**

- 76 mm - 3" (NQ) - 8 required - Part ref. : 208-003
- 102 mm - 4" (HQ) - 8 required - Part ref. : 208-004
- 127 mm - 5" (PQ) - 8 required - Part ref. : 208-005
- 152 mm - 6" (SQ) - 8 required - Part ref. : 208-006
- 203 mm - 8" - 8 required - Part ref. : 208-008
- 254 mm - 10" - 8 required - Part ref. : 208-010
- 305 mm - 12" - 8 required - Part ref. : 208-012
- 356 mm - 14" - 8 required - Part ref. : 208-014
- 406 mm - 16" - 8 required - Part ref. : 208-016



## Bow Spring Loaded Slip Over Centralizer

**Models :**

- BSL-CENT43-MXC (Cased Hole application)
- BSL-CENT43-NMIB (Open Hole application - non-magnetic)

**Blades :**

- 6 required per centralizer
- Blades-BSL-MXC (Cased hole)
- Blades-BSL-NMIB (Open hole - non-magnetic)

**Weight :** 4 kg (8.8 lbs)

**Max length :** 67 cm (26.4")

**Applicable Casing/Hole Size :** 140 mm to 346 mm (5"1/2 to 13"5/8)



## QL43 Inline Centralizer

**Models :**

- QL43 Inline (Non-magnetic)
- Open and Cased Hole applications

**Diameter :** 43 mm (1"11/16)

**Length :** 1060 mm (41.7")

**Shaft length :** 629 mm (24.8")

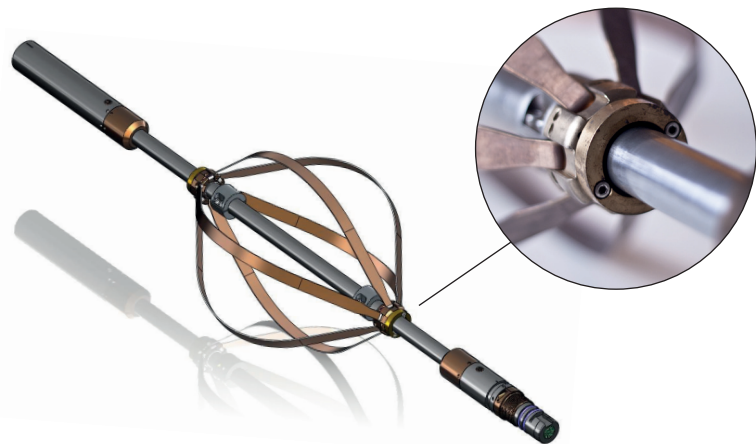
**Weight :** 4.8 kg (10.6 lbs)

**Temperature Max. :** 170°C (338 °F)

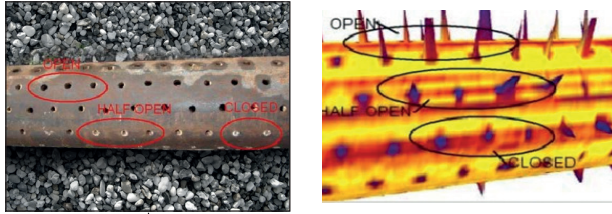
**Pressure Max. :** 700 bars (10000 psi)

**Applicable Casing/Hole Size :**

- Blades ALT25128 : 76 mm to 230 mm (3" to 9") - 6 required
- Blades ALT25129 : 230 mm to 406 mm (9" to 16") - 6 required



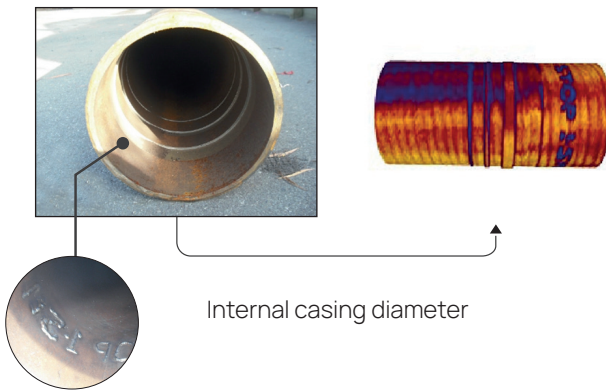
# Applications



Perforation position & aperture



Internal/external casing surface imager



Internal casing diameter



External casing diameter

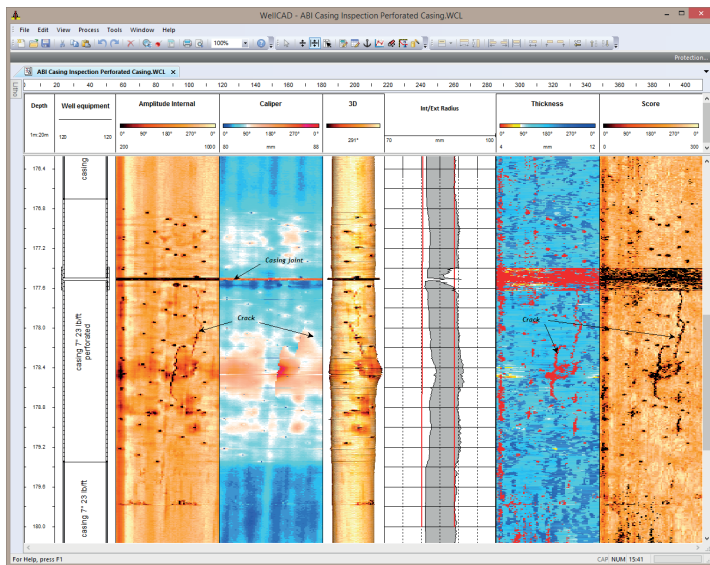
## Applications

### Casing inspection

- Inside & outside diameter
- Casing thickness & corrosion rate
- Scale & hole detection
- Casing defects
- Casing wear & deformation
- Metal loss indicators



# FIELD DATA CASING INSPECTION



Inspection of a 7" casing (23lbs/ft) with the QL43-ABI and OHCO-L acoustic head

**Image log azimuthal resolution:**  
72 pts over the circumference (6.9 mm - 0.27")

**Image log vertical resolution:**  
3mm (0.12")

**Features demonstrated:**

- Image log of the inside of the 7" casing
- Casing inner diameter measurement – casing geometry and 3D visualization
- Steel thickness measurement
- Perforations and cracks induced by the blasting operations

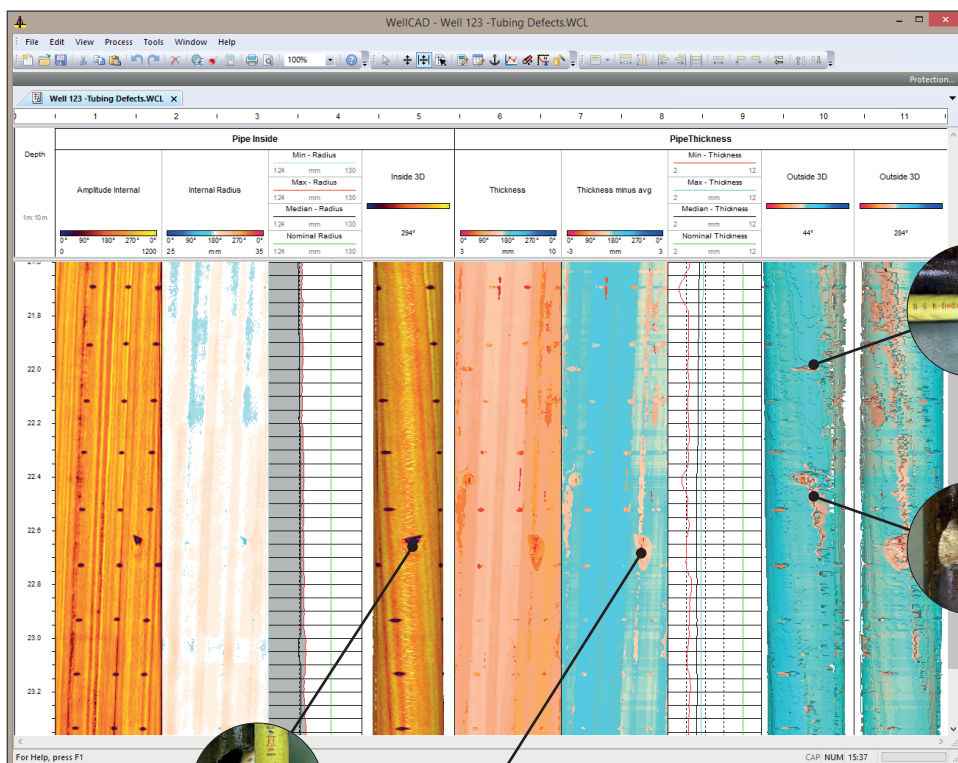
Ultrasonic logs recorded in a perforated 2 7/8" tubing with the CO-S acoustic head model.

**Image log azimuthal resolution:** 144 pts over the circumference (1.31 mm – 0.05")

**Image log vertical resolution:** 3mm (0.12")

**Features demonstrated:**

- Image log of the inside of the 2 7/8" tubing
- Tubing inner diameter measurement – tubing geometry and 3D visualization
- Steel thickness measurement
- Perforations



Defect #3

Defect #1

Defect #2

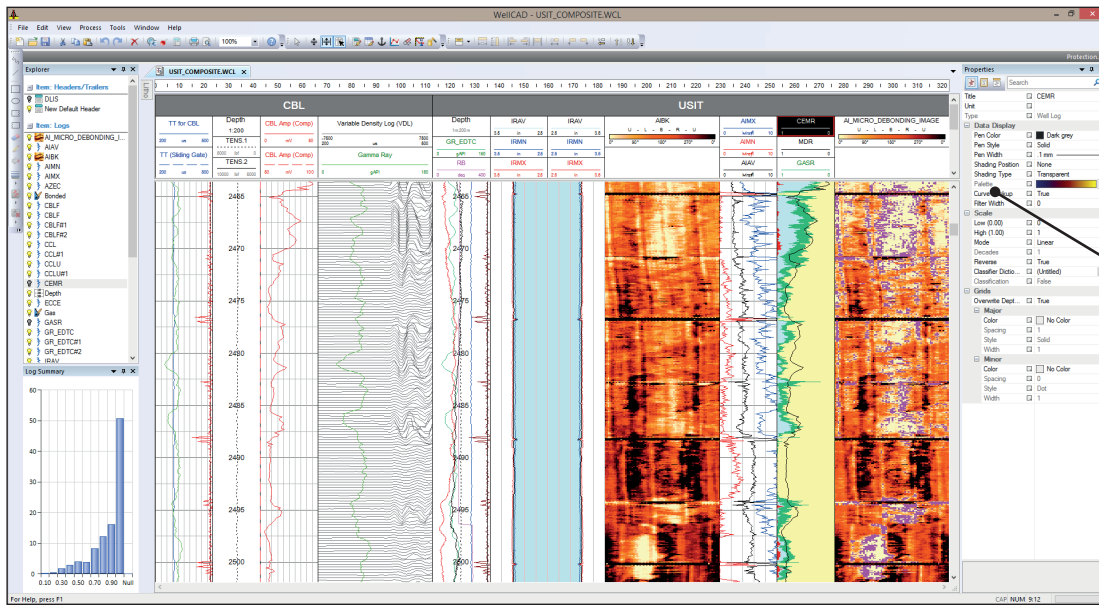
**Defect #1:** 1.0cm (0.39") planar cut on casing external surface

**Defect #2:** 3.0cm (1.2") planar cut on casing external surface

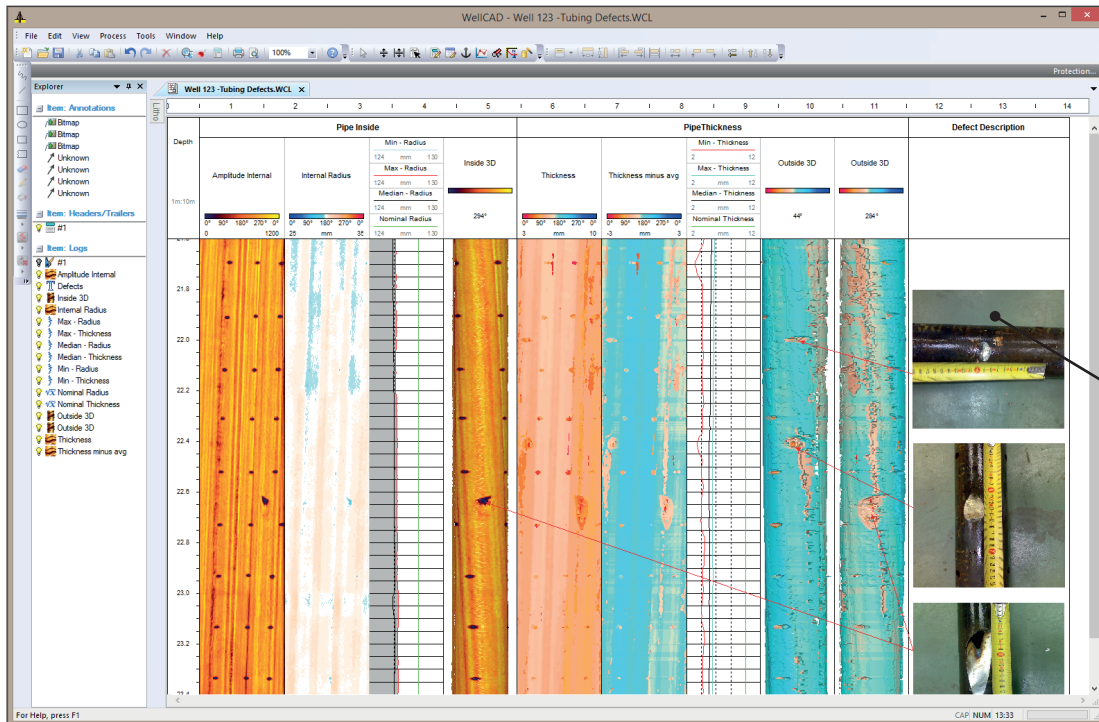
**Defect #3:** 10.0cm (3.9") oblique cut intersecting the inner casing surface – hole size: 2.5cm (1")

# WellCAD™ for Well Integrity Data

Tool manufacturer independent toolbox  
for casing and evaluation data



WellCAD main view showing a cement bond composite plot. Data imported from DLIS files.

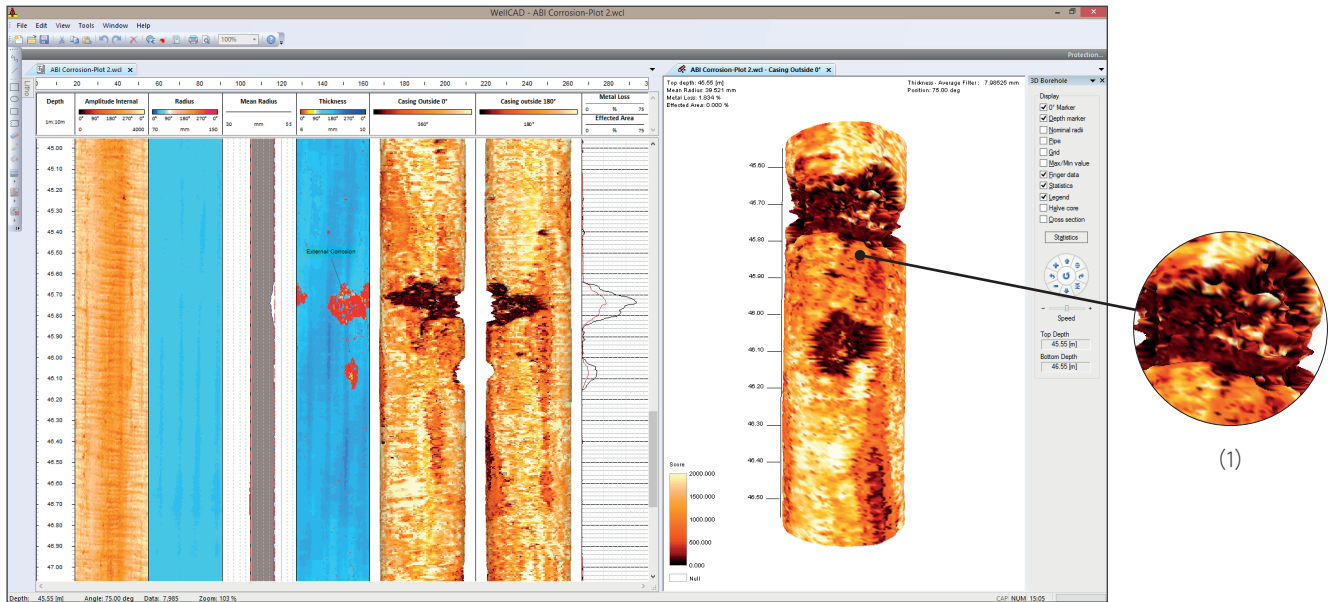


Report with description of tubing defects in WellCAD® using 2D, 3D data representation and annotations.

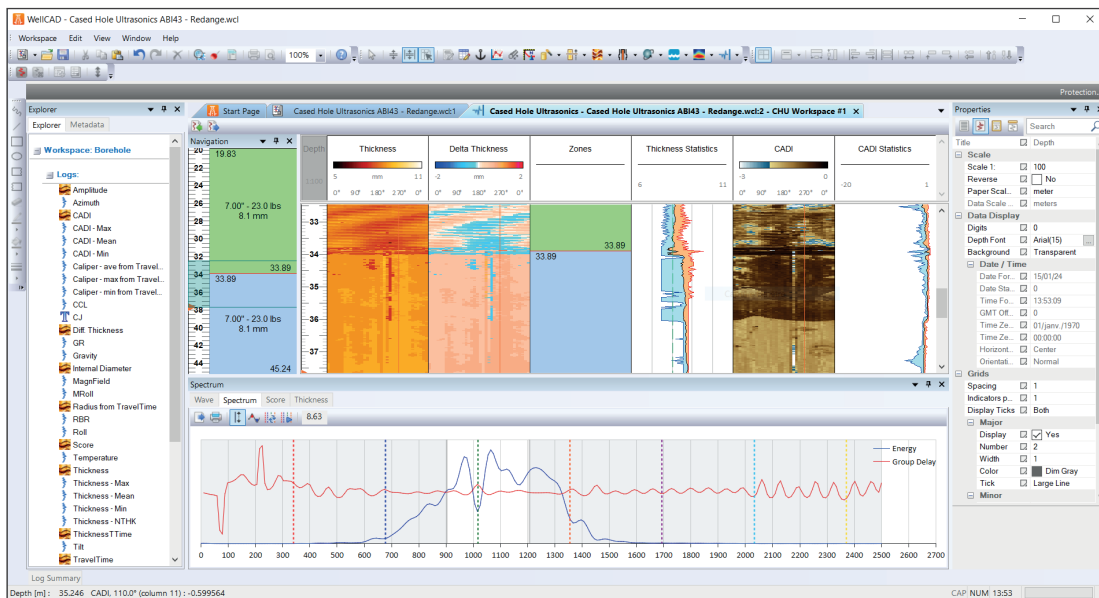
(1) Comprehensive data presentation settings including custom value to color maps.

(2) Floating text and bitmap annotations referenced by depth. A dedicated Annotation Editor allows control of data i/o.

# Ultrasonic casing and corrosion evaluation



Track 2 + 3 show the surface quality and traveltime derived radius image of pipe inside. In track 5 the pipe wall thickness image is presented. The data presentation is completed with 3D views of the defect on the pipe outside. The WellCAD workspace provides an integrated interactive 3D viewer (on the right).



Casing thickness processing in WellCAD Cased Hole Ultrasonic (CHU) workspace

(1) Fully interactive 3D viewer integrated into the WellCAD workspace and directly linked to the 2D data display.





# WellCAD™ Specs\*

## Data Import

- Industry standard LIS and DLIS files
- LAS 2.0 and custom ASCII files
- WITSML
- Custom and vendor specific formats

## Data & Graphic Export

- Industry standard LIS and DLIS files
- LAS 2.0, LAS 3.0 and ASCII files
- Custom Formats
- PDF, CGM, JPEG, TIF, PGN, ...

## Interactive 2D & 3D Data Presentation

- Configurable display of curves, patterns, symbols, text, zone markers, hierarchical columns, color coded array data, wiggle traces, vdl, photographs, well schematic, cross sections, ...
- Overlay of annotations (text, pictures, callouts, operational symbols) organized in multiple layers
- Unlimited number of data containers to store and manage single point, interval and array data
- Customizable layout templates
- Tabbed or floating multi window graphical and tabulated data display
- Selection of application appearance schemes
- Integrated interactive 3D viewer
- Audit trail for each data set recording each processing step
- Customized headers and trailers

## Data Processing

- Log editing: filter, resampling, bad trace or data interpolation, depth shifting (block, stretch & squeeze), merge or slice, math editor for curves, volume calculation, deviation data processing
- MFC: conditional testing, centralization, statistics, data re-orientation, metal loss, volume calculation, 2D & 3D cross sections
- CBL: filter algorithms, first arrival picking algorithms, amplitude extraction (fixed and sliding gate), data calibration
- Ultrasonic: centralization, conditional testing, filter algorithms, fluid velocity computation, traveltime to caliper, thickness calculation, metal loss, data re-orientation, statistics, 2D & 3D cross sections synthetic pipe overlay
- Copy and paste between WellCAD and EXCEL (and vice versa)
- Automation module for batch processing, custom processing algorithms or report creation

## System Requirements

- Supports Win 2000, Win XP, Win 7, Win 8 and Win 8.1,
- Min. Intel Pentium III or equivalent, min. 512 MB RAM, min. 250 MB disk space

## Support & Training

- WellCAD is fully documented and installs with a context sensitive help system. Support is provided via email, phone and in online meetings. Public workshops as well as customized training sessions are provided worldwide.

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\* This is an extract of the WellCAD specs suitable for Well Integrity data. For a full description of WellCAD and its various add-on modules for wellsite geology, core description, image & structure analysis, automation, multi well correlation,... please contact sales@alt.lu.



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