

WellCAD™

The Universal Borehole Data Toolbox



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About

Since its first release in 1993, WellCAD™ has become a valuable tool for thousands of geoscientists dealing with borehole data.

WellCAD™ handles the entire data loading, log editing, analysis and presentation workflow for drilling, wellsite, core and logging data - independent of the industry sector.

The modular architecture of WellCAD™ allows users to easily activate advanced modules to build a package tailored to their requirements and make it an attractive solution for small scale companies as well as large multinational corporations.



**DRILLING
WELLSITE GEOLOGY**

**GEOPHYSICAL &
IMAGE LOGGING**

CASING INTEGRITY

CORE DESCRIPTION

Product Overview

Rich graphical display

- Fully graphical driven standard Windows* software
- Real-time data display generated from the depth / time based information held in the data repository
- Display of curves, patterns, symbols, text, formation markers, image data, photographs,...
- Comprehensive sets of formatting styles (point, bar, curve style, color, thickness, fonts, shading,...)
- Editor for custom symbols, patterns, header & trailer design
- 3D borehole display

Comprehensive interpretation tools

- Common data processing tools: resampling, filtering, single-, block- or multi-curve statistics, equation editor,...
- Dedicated workspaces for Image & Structure Interpretation, FWS, NMR, Casing Integrity, Core Description, Multi Well Correlation,...
- Cross plotting workspace and chart log
- Application programming interface for batch processing scripts or advanced algorithm development

Intuitive data management

- Choose from 28 different data container types to host single point, interval or array data
- Intuitive user interface to manage data and properties
- Powerful templates for automatic plot formatting
- Alias tables for mnemonic management and standardization
- Automatic audit trail of changes made to each data container

Mobility

- WellCAD™ works on PCs, laptops and tablets with Windows OS *
- Completely portable through hardlock protection or server license borrowing
- Does not require a connection to a database system

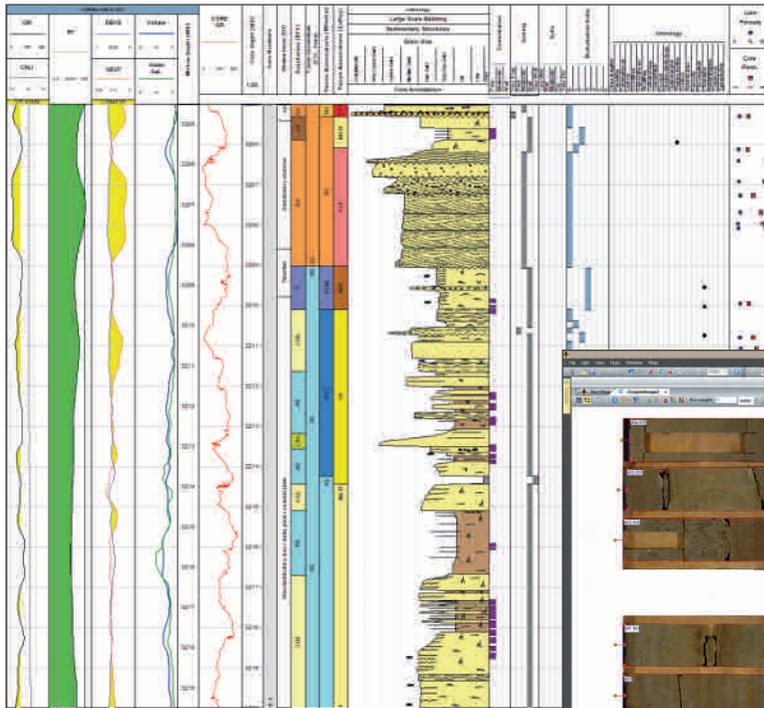
Global support team

- A Support & Maintenance plan guarantees free support from the WellCAD team globally and an up-to-date software version.

Name	Type	Description
WellCAD™ Basic	Main Application	The Basic version provides the foundation for data management, analysis and presentation. It allows creation of comprehensive log displays and is the base to activate Expert Modules
CoreCAD™	Add-on	Interactive digital core description workspace for WellCAD™ including Core Image Cropper and Core Shifter workspaces.
ISI (Image & Structure Interpretation) Workspace	Add-on	Single, built for purpose workspace combining manual and automated structure picking, classification, correction and interpretation into a single workflow
FWS	Add-on	A collection of built for purpose processes and a velocity Analysis workspace for the processing of Full Waveform Sonic data
NMR	Add-on	Collection of processes and a workspace for interactive T2 cutoff fitting to determine total porosity, fluid volumes, permeability and dry matrix density
Casing Integrity	Add-on	This module opens the door to professional cased hole data interpretation and adds a workspace and processing options for multi-finger caliper and ultrasonic televiewer
Deviation	Add-on	A collection of 2D and 3D display options for survey data
Automation	Add-on	An application programming interface allowing you to use objects, methods and properties exposed by WellCAD™ in VBS, VBA, VB, VC++, C# and Python program code
MultiWell	Add-on	2D multi-well correlation add-on seamlessly integrated into WellCAD™
Browser	Add-on	Connects WellCAD™ to your LoggerSuite data acquisition software to receive the currently logged data in real time
Reader	Viewer	Free data viewer for WellCAD™ files with ability to change depth scale and to print continuous or page-by-page

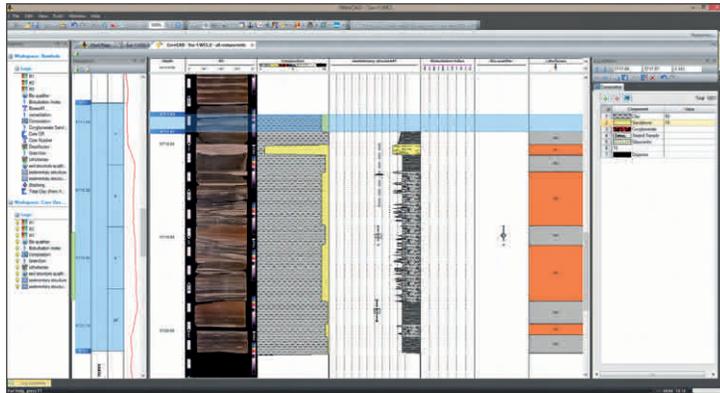
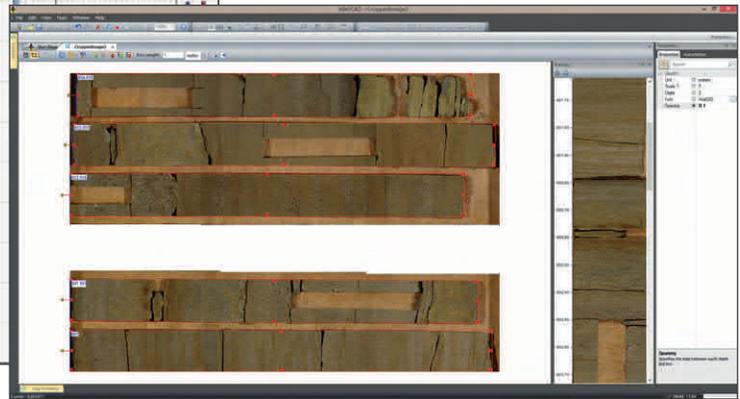
Core Description

Clastic Core Log



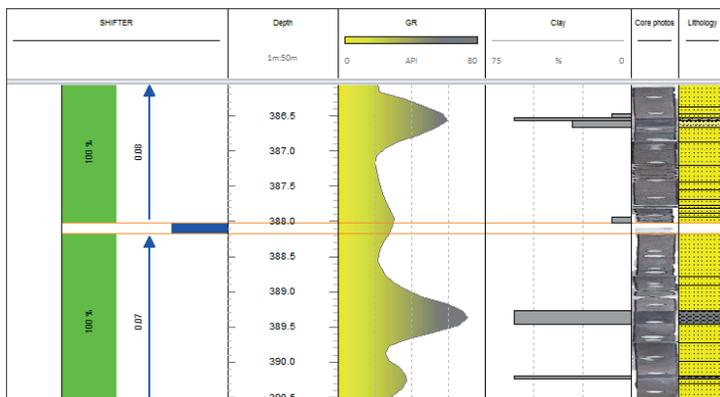
Core Logs for the Oil & Gas and Mining industry

Core Image Cropper

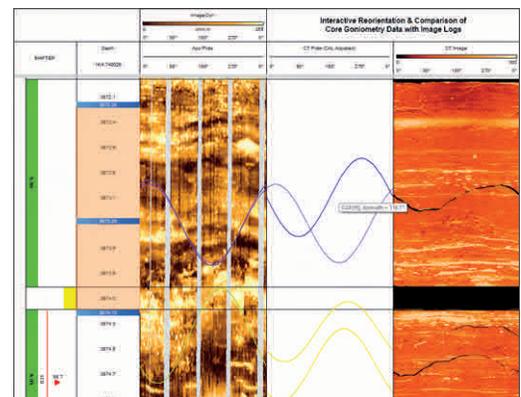


Core Description Workspace

- Lithology, structures and descriptions
- Grain size, porosity, texture
- Core photographs
- Core analysis data
- Digitization of paper core logs
- Core / Log depth matching
- ... and more



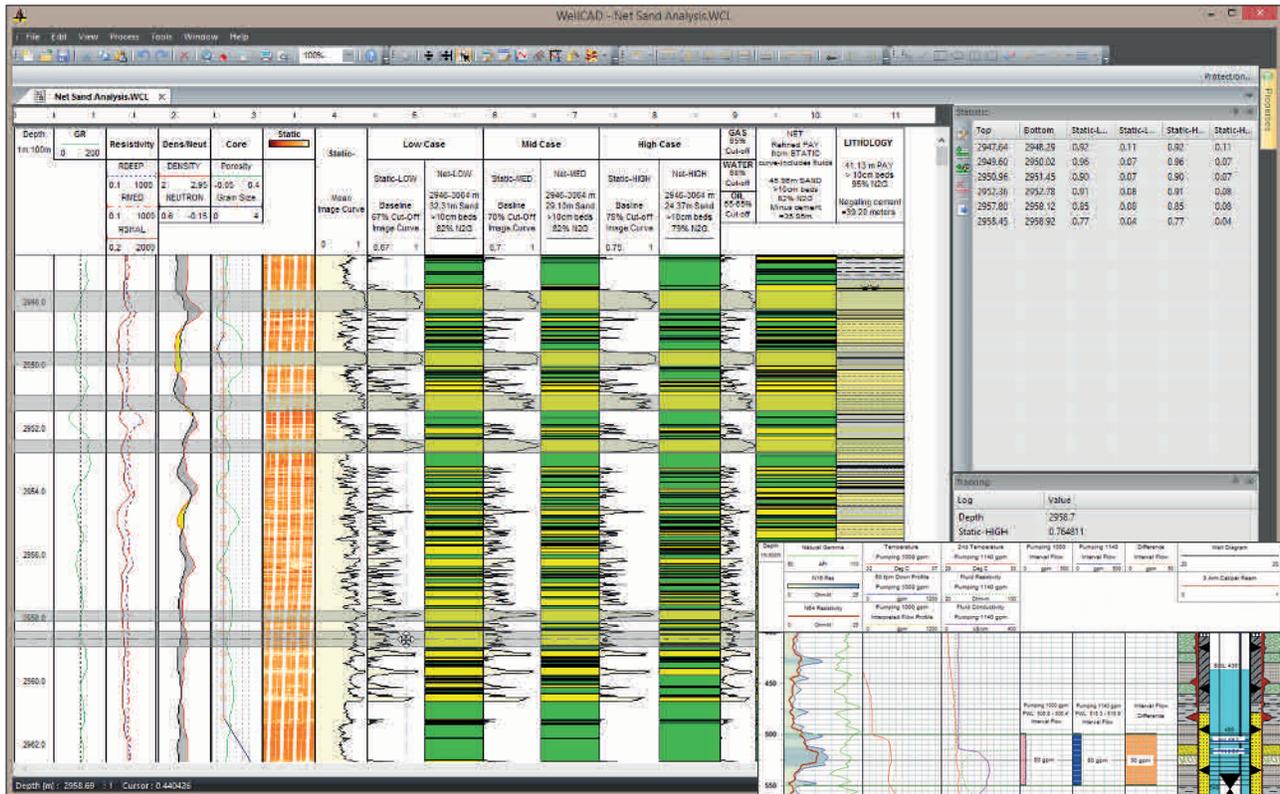
Core Shifter Workspace



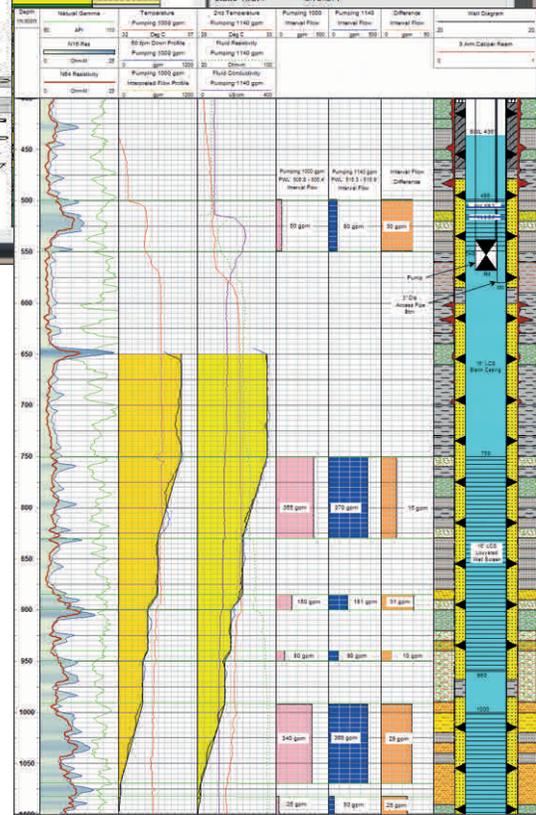
Core depth matching and re-orientation

Log Analysis

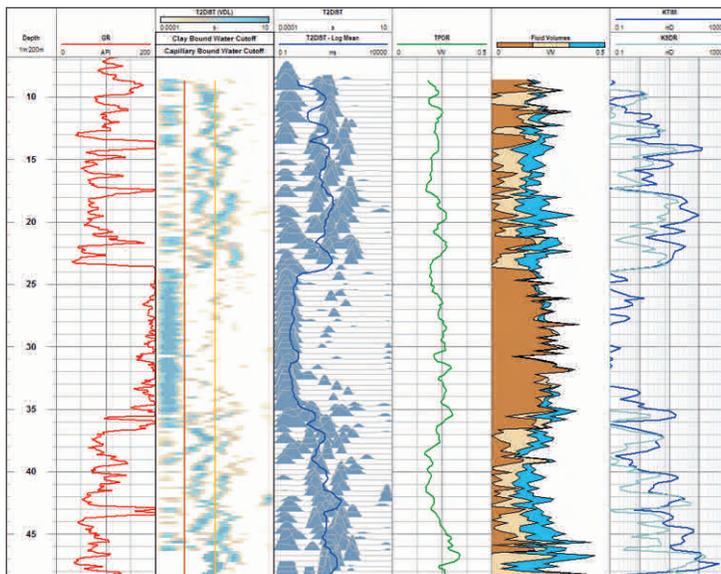
Net-sand Analysis from FMI



- Scalar and array data editing
- Cross plotting
- Single- and multi-curve statistics
- Interval statistics
- Custom equations editor
- Application programming interface for advanced algorithms
- ... and more



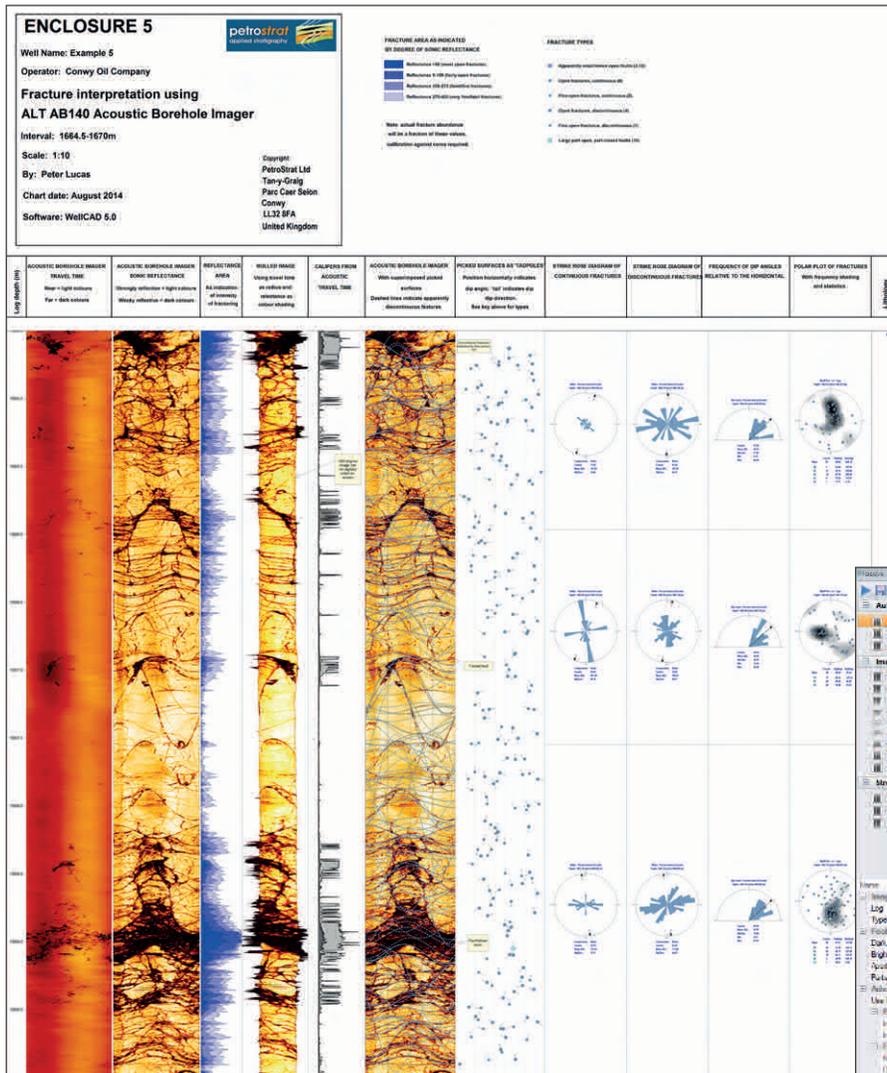
Flowmeter Analysis



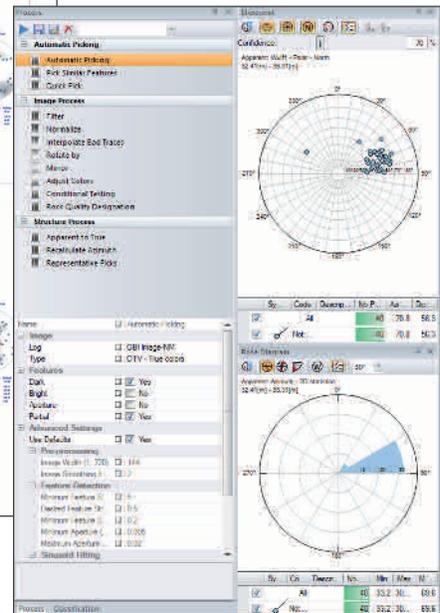
NMR Data Analysis

Image & Structure Interpretation

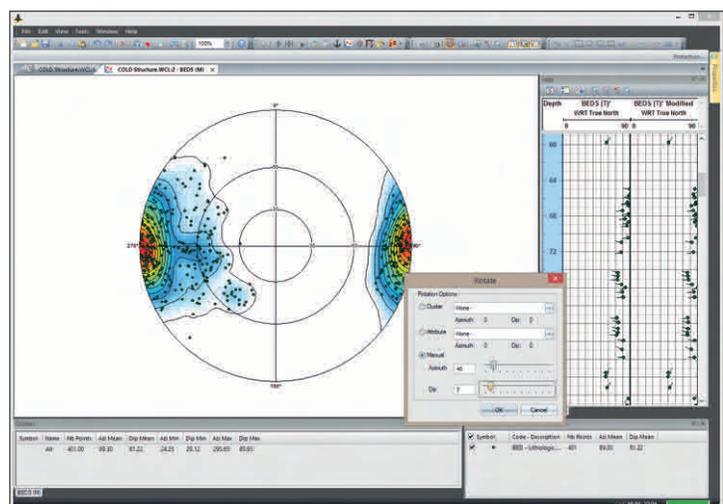
ATV Structure Analysis Plot



Acoustic and Optical
 Televiwer data
 FMI type data
 MWD Image data
 3D coescans



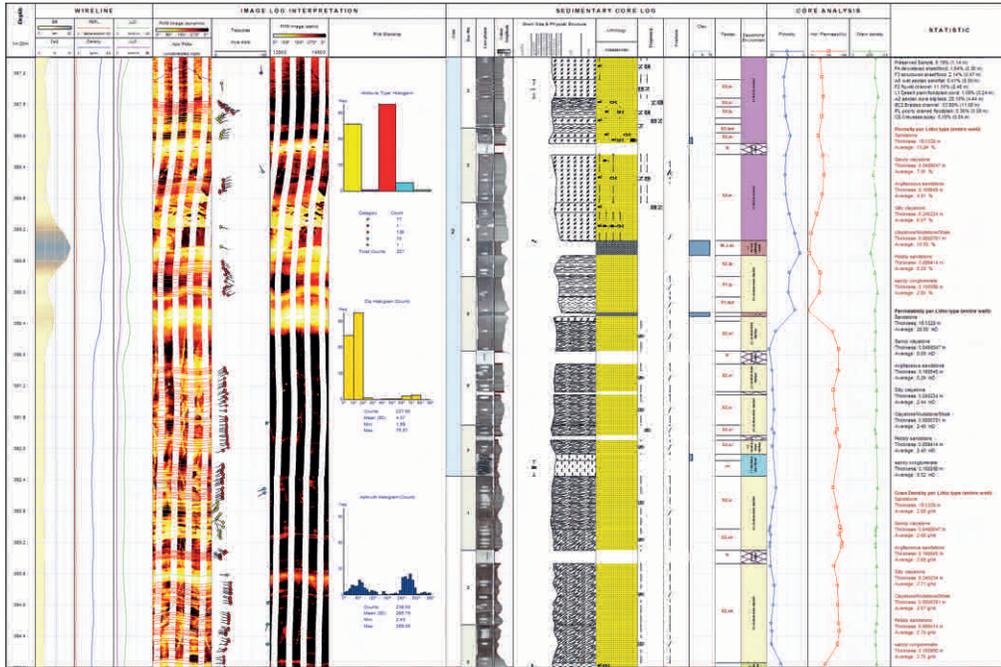
- Planar, linear and free hand structure picking
- Computer assisted and manual picking
- Apparent and corrected picks
- Custom pick classification
- Polar projection diagrams
- Rose and vector plots
- Structure interval statistics
- ... and more



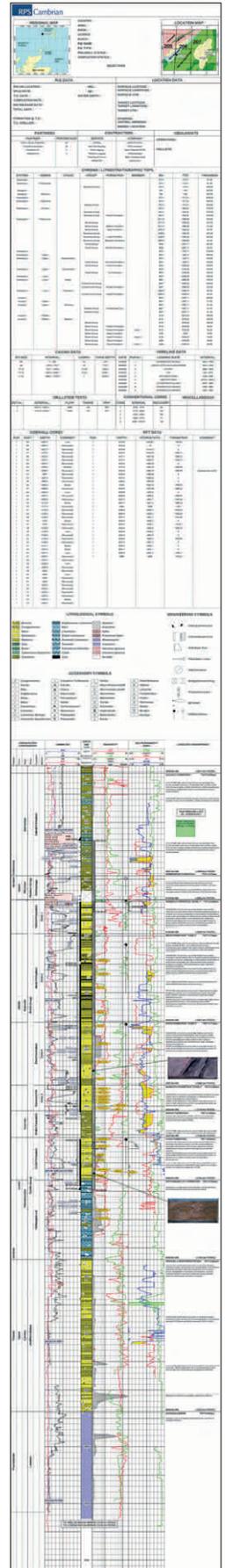
Dips Workspace

Composite Plots

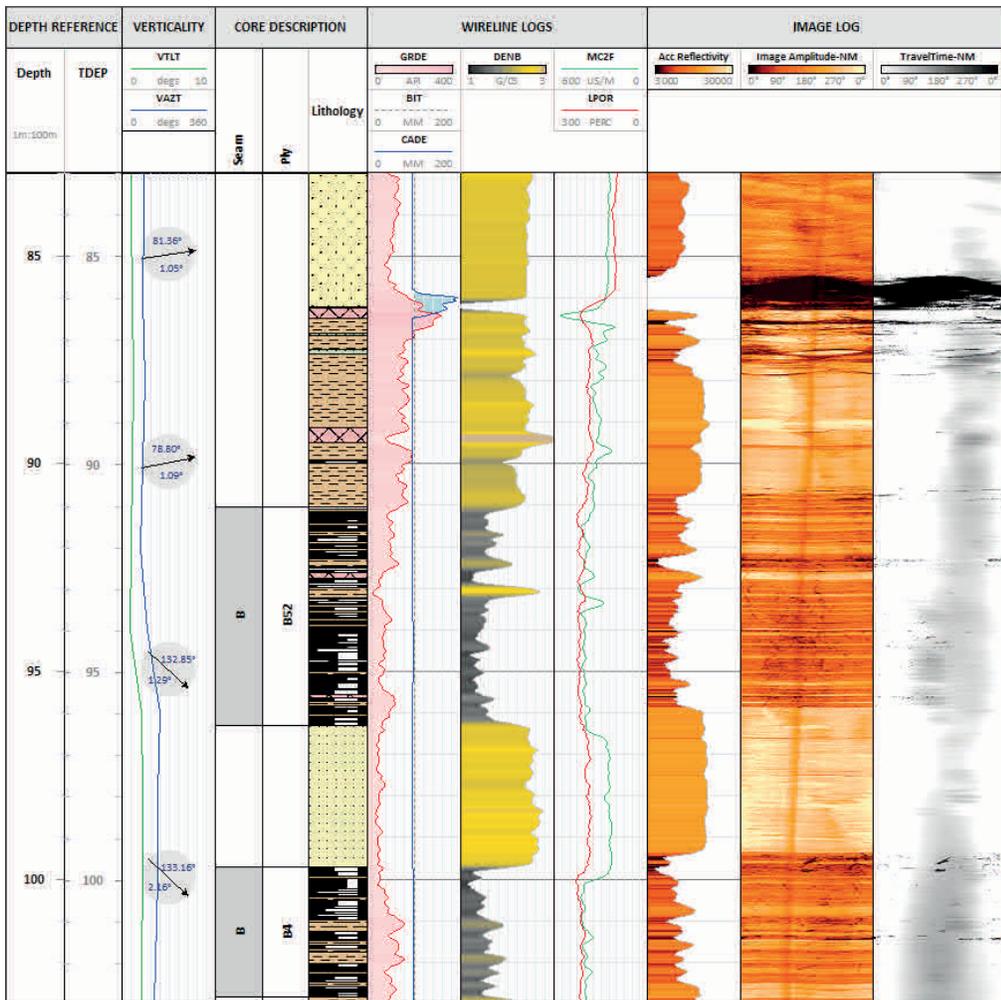
Composite Plot: Oil & Gas



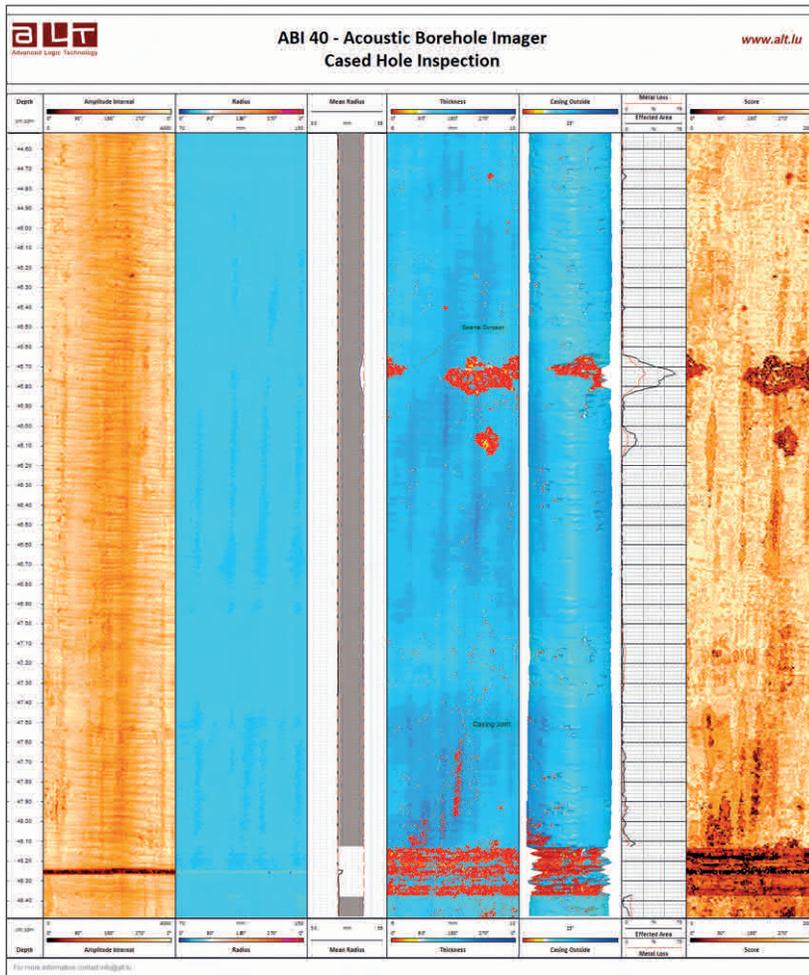
Composite Plot: Wellsite



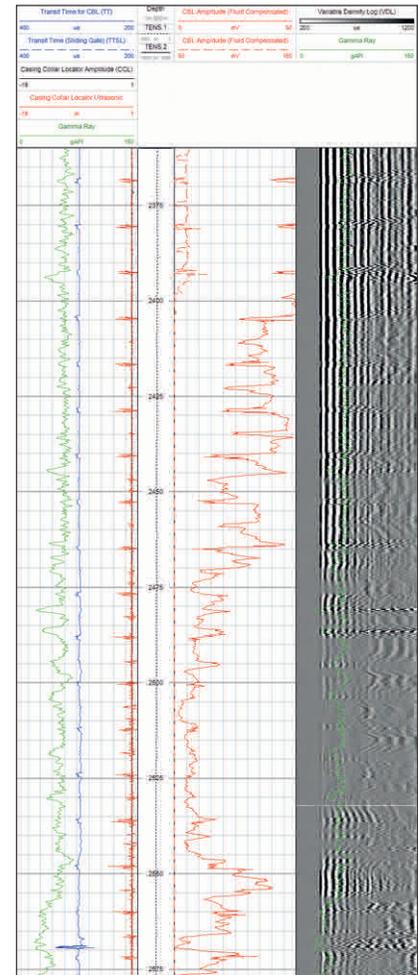
Composite Plot: Coal Mining



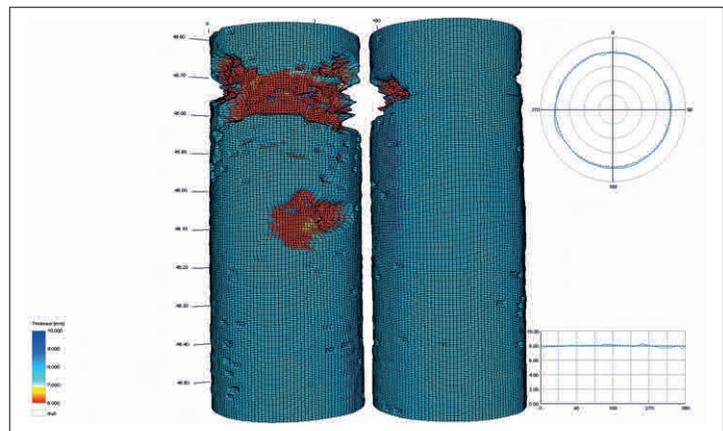
Acoustic Televiewer Well Integrity Plot



CBL Plot



- MFC, CBL and ultrasonic imager data handling
- Array data editing, filtering, centralization, recalibration
- 2D and 3D representation of data
- Fluid velocity estimation, acoustic caliper and casing thickness determination
- Cement bond evaluation
- ... and more

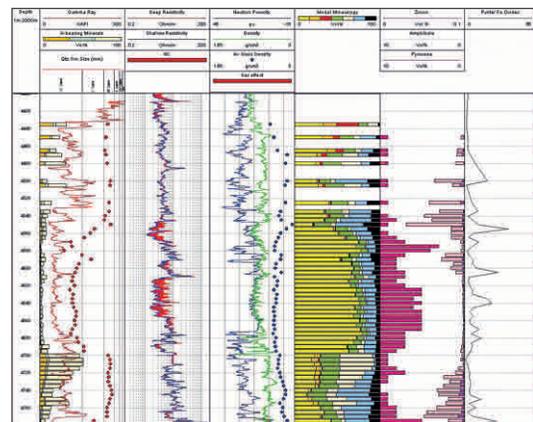
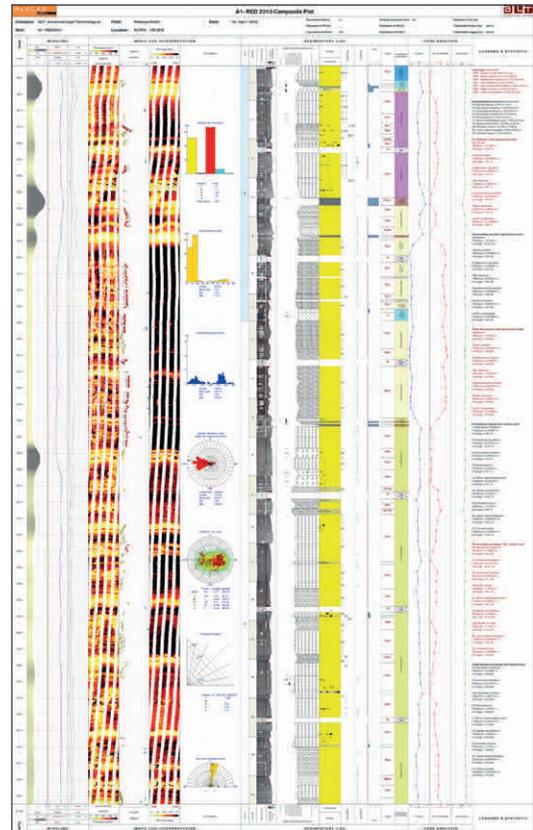


Well Integrity 3D View

WellCAD™ | Basic

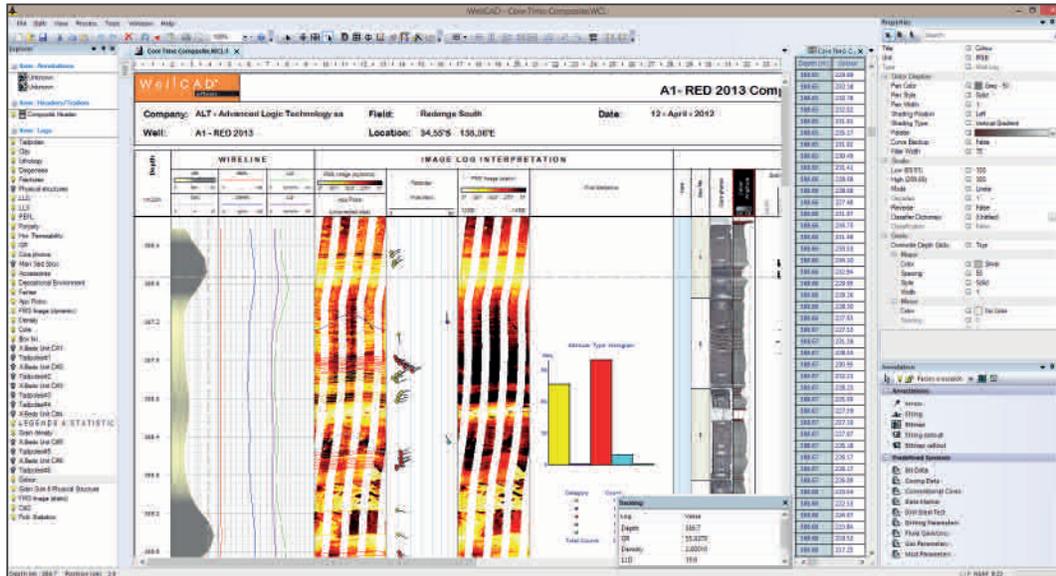
Data presentation

- Display of curves, patterns (e.g. lithology), symbols (e.g. fossils), text, formation marker, hierarchical stratigraphic columns, image data (e.g. FMI, ATV, OTV), photographs, operational symbols (e.g. DSTs, RFTs, Mud Data, Survey Data, etc.), ...
- An unlimited number of data containers, of which 28 different types exist to host single point (continuous and discontinuous), interval or array data, can be freely positioned on the workspace and combined for complex WYSIWYG plot formatting
- Audit trail for each data container and processing step (i.e. Log History)
- No restriction to number of tracks or number of curves to be plotted or superimposed
- Comprehensive sets of formatting styles are available for each data container type – pen type, pen thickness, pen colour, fonts, shading, curve style (e.g. point-to-point, step or bar) and many more
- Scale and appearance of vertical grids can be customized using individual classification schemes (e.g. Wentworth scale, Phi scale)
- Depth may be referenced to MD, TVD, TVDSS or any other depth (or date & time) system due to capabilities of non linear depth matching. Support of depth and elevation display
- Libraries of customisable and scaleable patterns and symbols (e.g. lithology, physical structures, fossils, pore types, ...) are provided. The freely distributed LithCAD application allows design and import of new patterns and symbols



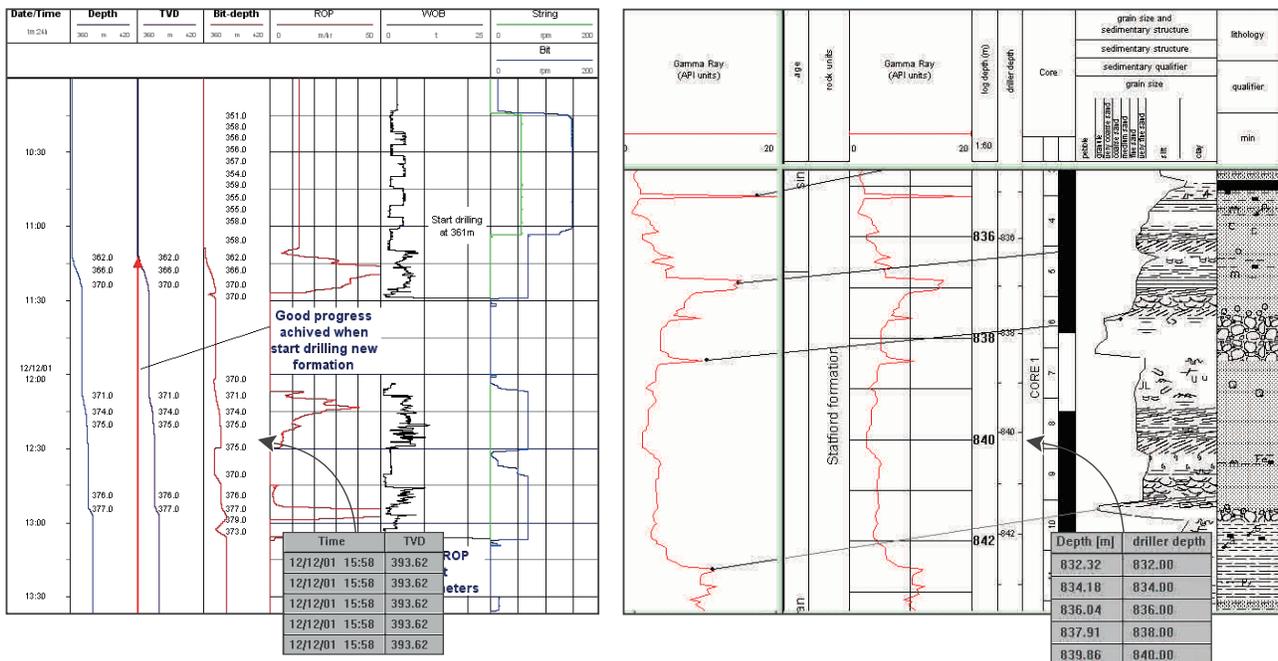
Data management

- Data Formats – Import (LIS, DLIS, LAS, ASCII, EXCEL, WITSML, JPEG, AGS,...)
- Data Formats – Export (LIS, DLIS, LAS, ASCII, CGM, JPEG, EXCEL, Petrel compatible ASCII,...)

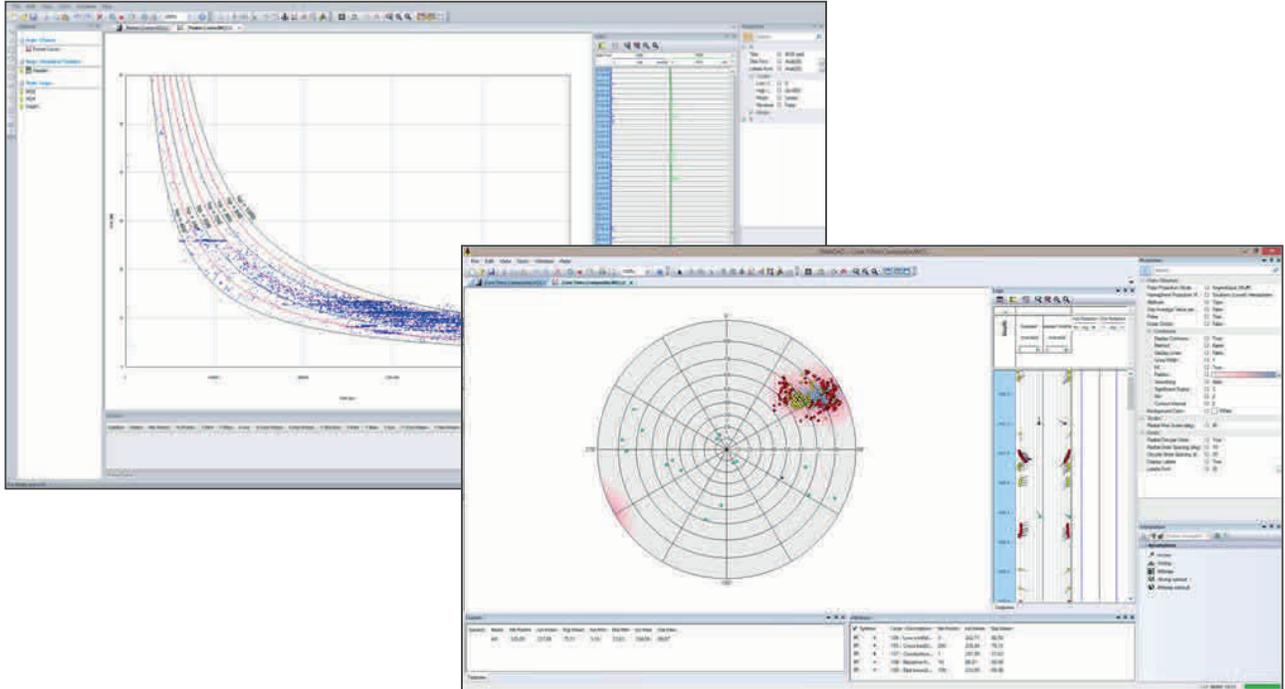


Multiple depth management

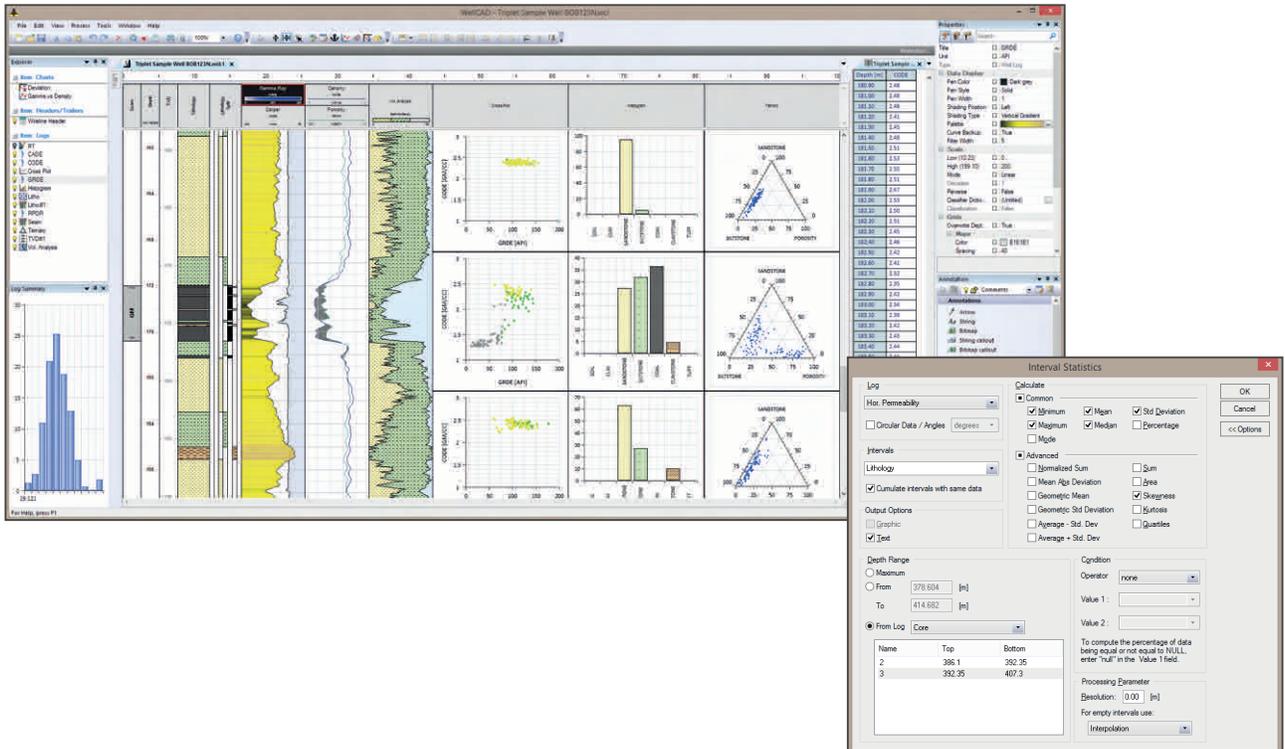
WellCAD™ provides a multiple depth management system (date/time, depth, TVD,...). The depth matching tool allows you to fine tune your data (e.g calibrate core description data to the wireline logs). All correlations will be saved in a new depth log helping you to assess the match.



Data interpretation



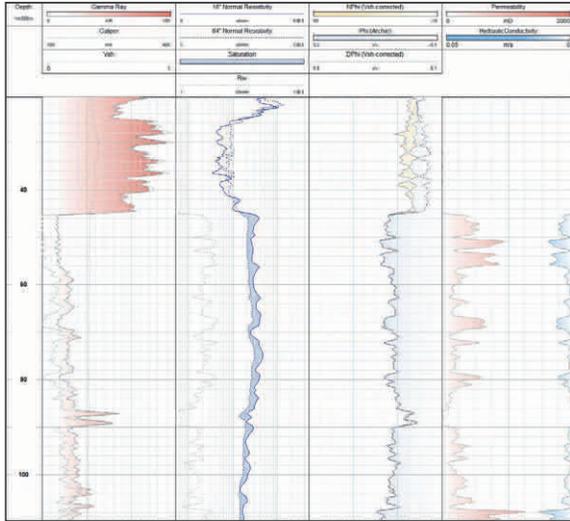
- Cross plotting workspace (up to 4 components, clustering, overlay and regression options)
- Chart log for cross plots, ternary diagrams and histograms as part of the report
- Workspace for dip data (rose, polar projection, walkout and woodcock diagrams)
- Tracking and statistic bars for interactive determination of statistical information
- Interval and multi-log statistics
- Interactive input and editing of data (in spreadsheet editor and graphic layout)
- Sophisticated annotation options including operational symbols for wellsite geologists



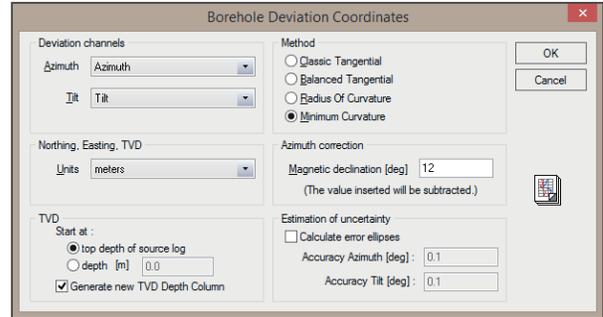
Data processing

Common processes

- Filter, resampling and data interpolation options
- Custom equation editor
- Zonation



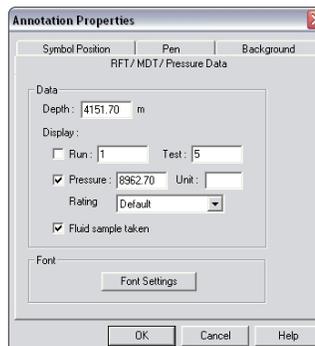
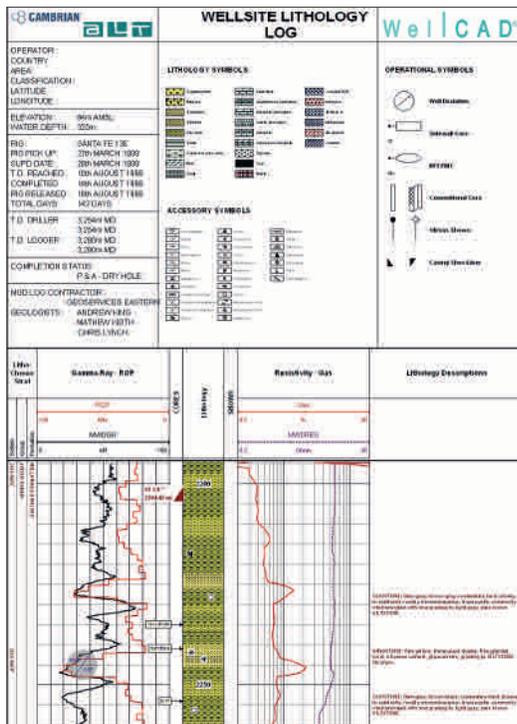
Groundwater Analysis Plot



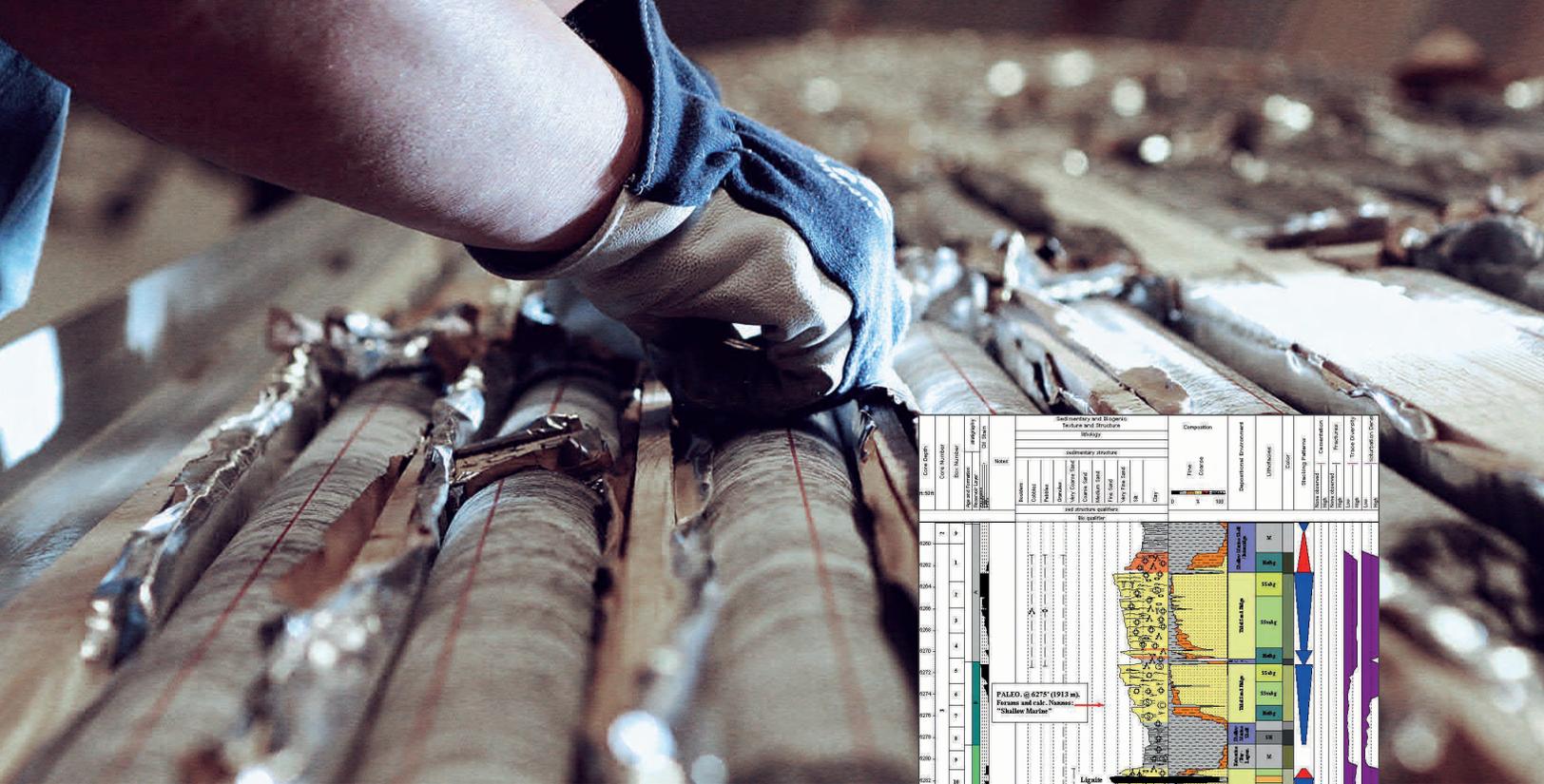
- Computation of borehole deviation data (azimuth, tilt, northing, easting, TVD and more)
- Borehole condition corrections
- Total & spectral gamma processing (window stripping and full spectrum analysis)
- Borehole volume calculations
- Multi log statistics

Annotations and operational symbols

Annotations (arrows, text or bitmap callouts,...) and a large number of specific operational symbols (oil & gas shows, sidewall cores, RFT/MDT/pressure test, casing data,...) can be added to the graphical report by drag & drop or using the annotation editor. All annotations and operational symbols have real data assigned to it and can be imported or exported.



Depth (m)	Run	Test	Pressure	Press Unit	Rating
1: 4113.27	1	1	8930.50		Default
2: 4119.40	1	31	8930.50		Default
3: 4125.50	1	2	8935.30		Default
4: 4134.10	1	3	8945.00		Default
5: 4141.10	1	4	8951.30		Default
6: 4151.70	1	5	8962.70		Default
7: 4160.30	1	6	0.00		Default
8: 4171.50	1	7	8982.40		Default
9: 4183.40	1	8	9002.20		Default
10: 4195.30	1	9	9007.80		Default
11: 4217.30	1	10	9030.40		Default
12: 4229.20	1	11	9043.00		Default
13: 4245.00	1	12	9056.20		Default
14: 4260.90	1	13	9075.00		Default
15: 4275.80	1	14	9091.40		Default
16: 4284.50	1	15	9098.80		Default
17: 4287.70	1	16	9102.50		Default
18: 4291.90	1	17	9106.50		Default
19: 4296.80	1	18	9111.70		Default
20: 4299.30	1	19	9118.20		Default

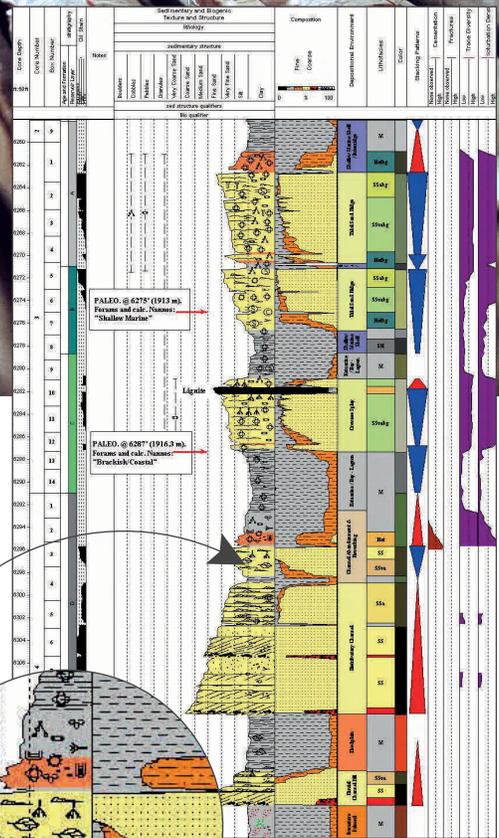


WellCAD™ | CoreCAD

CoreCAD™ is an interactive digital core description add on module for WellCAD™. Developed by and for geologists, the software offers a dedicated workspace with zoom & snap options, workflow templates, and fast data entry. These tools will allow the geologist to input core descriptions faster and convert them directly into digital format.

As soon as data is inserted into the CoreCAD™ workspace the underlying WellCAD™ composite log chart and its final layout is updated in real time.

CoreCAD™ allows the setting up of customised workflow schemes and layout templates in order to handle clastic, carbonate and outcrop descriptions.



Final log chart in WellCAD™ (courtesy of Sarian Resources Inc.)

- Allows easy and efficient digital and graphical description of cores
- All parameters described graphically are stored as real digital data – ready to export
- Multiple depth system management
- Use the integrated core image cropper or import core photographs.
- Import hand drafted core descriptions, digitise the data or integrate them into composite log charts
- Fully customisable system for easy and quick creation of all core description data types from biostratigraphy, to diagenetic minerals & depositional subenvironment
- Close the gap between core and log data by using the Core Shifter allowing an iterative interval based depth matching.

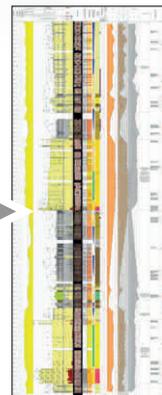
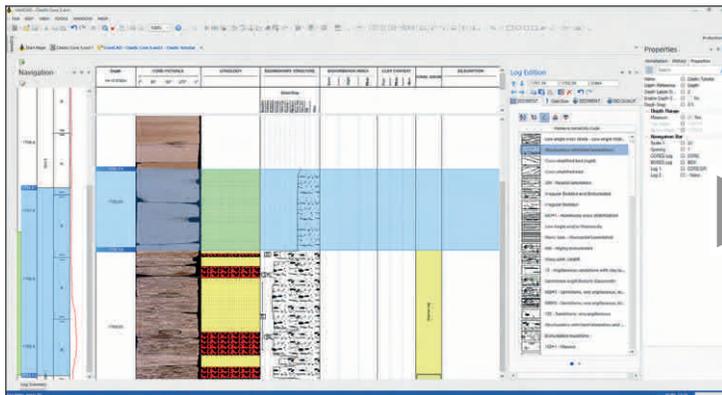
Core Description Workspace - CoreCAD

The revised Digital Core Description add-on comes with a new innovative workspace allowing the generation of visually attractive core descriptions (with the look of hand-drawn core sheets) and the acquisition of detailed digital data valuable for petrophysical analysis and reservoir modeling.

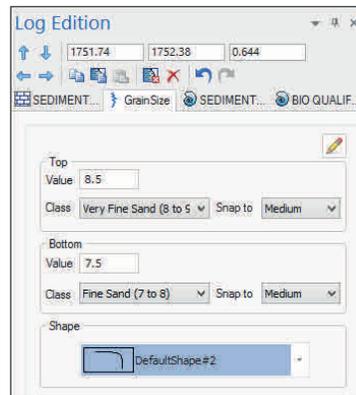
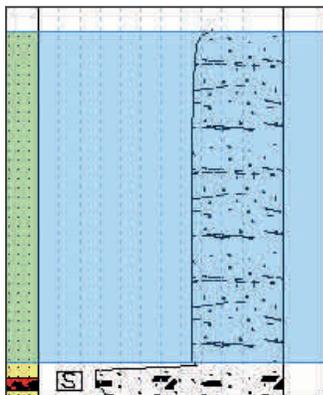
The new CoreCAD provides an intuitive and easy to use graphical user interface (GUI) to navigate between core runs and data columns, acquire data by free-hand drawing or interval based data capture and offers the unrivalled flexibility to import, add and export additional data.

Being fully integrated into the WellCAD platform the user has access to all functionalities like Core Image Cropper, Cross Plotting, Color Classification and many more analysis features.

- Innovative and intuitive workspace for core, outcrop and sample logging
- Graphical logging and simultaneous data digitization
- Detailed digital core data is available in each individual data column
- Visually attractive graphical reports.
- Flexible in layout, data organization and logging preference (e.g. free hand or interval based)
- Easy import of additional data columns or generation from Log Templates



CoreCAD Workspace with Navigation bar (left), Data Acquisition view (center) and Log Edition bar (right); simultaneous creation of visually attractive graphical report (far right)



Depth [m]	GrainSize
1746	1752.43 2.74
1747	1752.43 2.74
1748	1752.44 3.27
1749	1752.44 3.27
1750	1752.44 3.27
1751	1752.44 3.27
1752	1752.45 3.27
1753	1752.45 3.27
1754	1752.45 6.99
1755	1752.46 6.97
1756	1752.46 7.79
1757	1752.46 7.79
1758	1752.47 7.79
1759	1752.47 7.79
1760	1752.47 7.79
1761	1752.47 2.74

- Support of multiple depth reference systems (MD, Core Depth, TVD, ...)
- Full integration in WellCAD allowing seamless combination with wireline, image and laboratory data
- Generation of PDF and standard graphical file formats
- Comprehensive data export options for integration of the data into other software

Log column-by-column or drag a reference interval, enter the desired data or paste for example an entire sedimentary facies, Visually attractive, easy to log, readily available digital data

WellCAD™ | Image & Structure Interpretation Workspace

The Image & Structure Interpretation (ISI) module combines manual & computer assisted structure picking tools, classification, correction, sophisticated data visualization and a logical workflow into a powerful, built for purpose processing an interpretation platform.

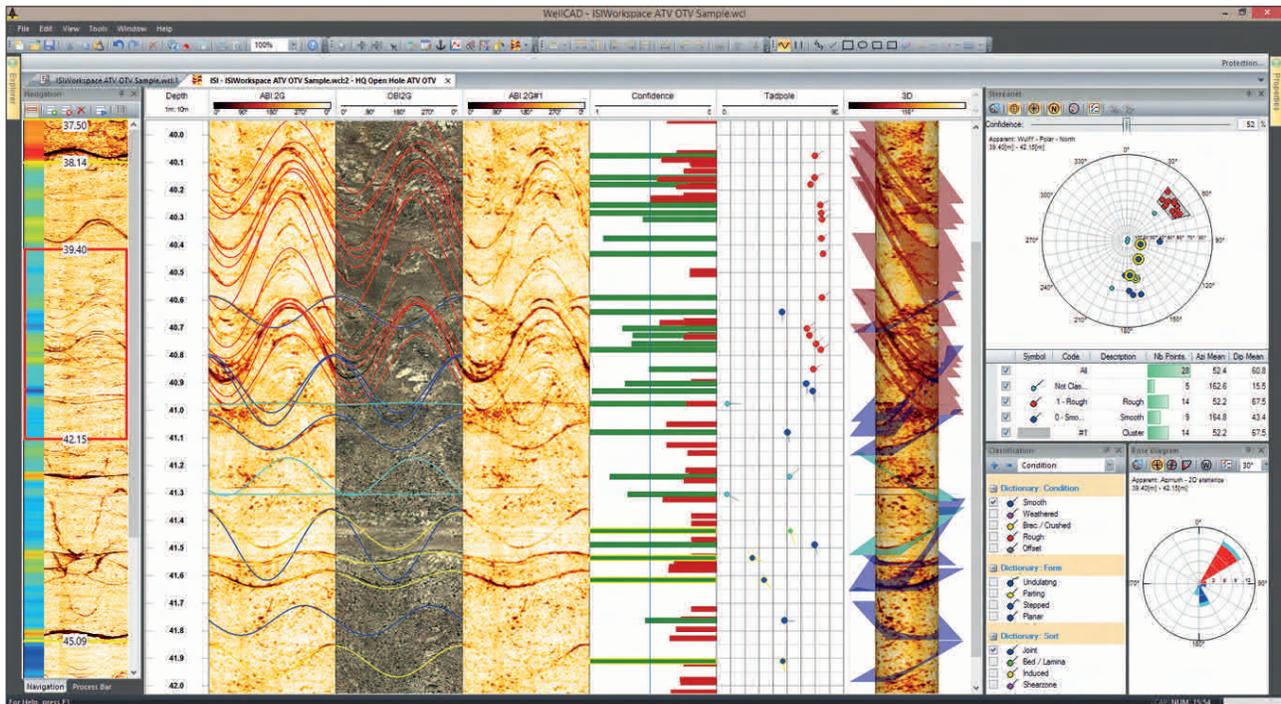
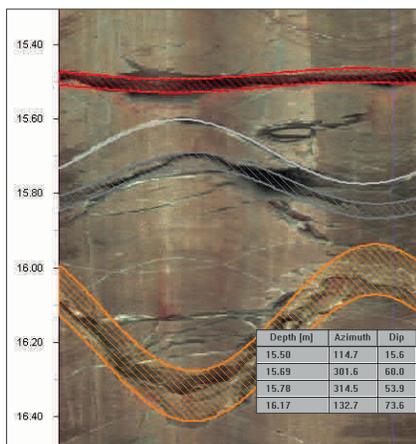


Image & Structure Interpretation Workspace (ISI)

A sophisticated computer assisted picking algorithm developed by The Centre for Exploration Targeting at The University of Western Australia* assists in picking structures.



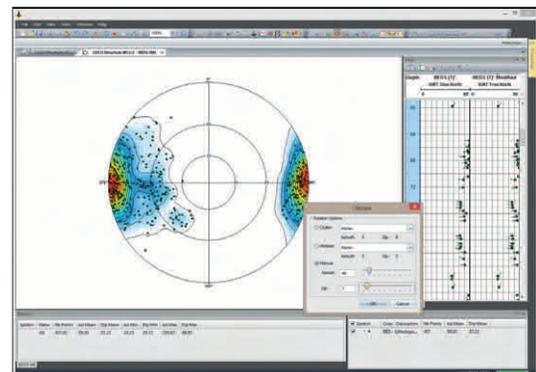
THE UNIVERSITY OF WESTERN AUSTRALIA



Any number of planar features can be interactively or automatically picked recording azimuth, dip and aperture.

Each pick can be described and categorized using customizable attribute classes (ToadCAD). Picks can be displayed as sinusoid, tadpole or stick plot.

Picking of linear features (e.g. breakouts, tensile fractures) or tracing features with a free hand tool is also possible.



A fully interactive dips workspace with polar, rose and vector plots and the Polar & Rose log for the graphical report complete the data interpretation workflow.

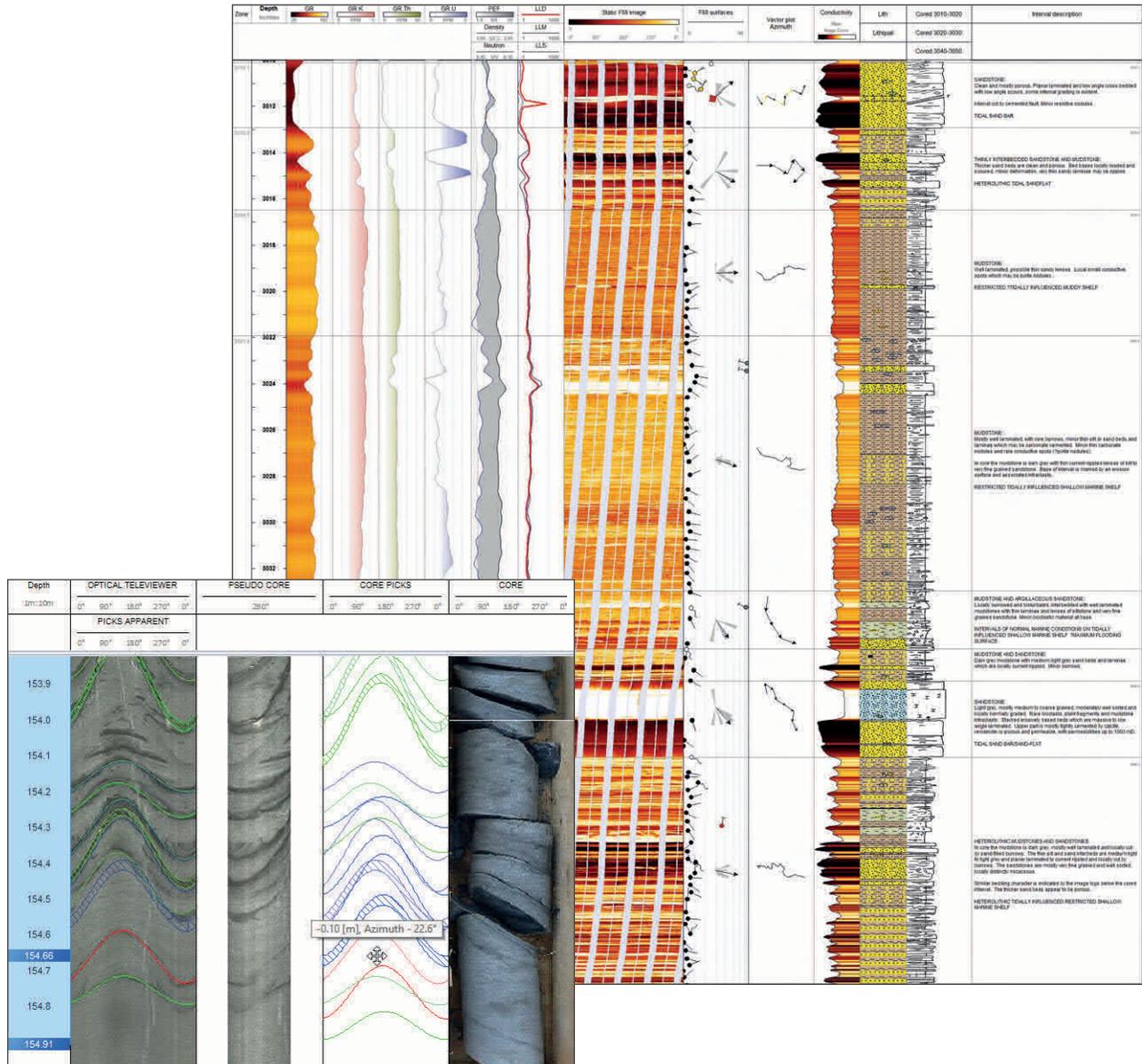
Supported Image Data

Borehole image data from a variety of sources including ATV, OTV, Electrical Imagers (e.g. FMI, STAR, QGEO, ...), Core Scans (CT, optical) and LWD are supported.

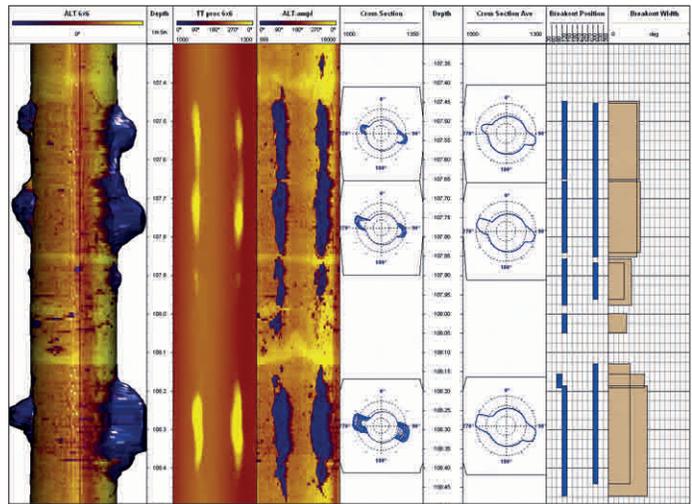
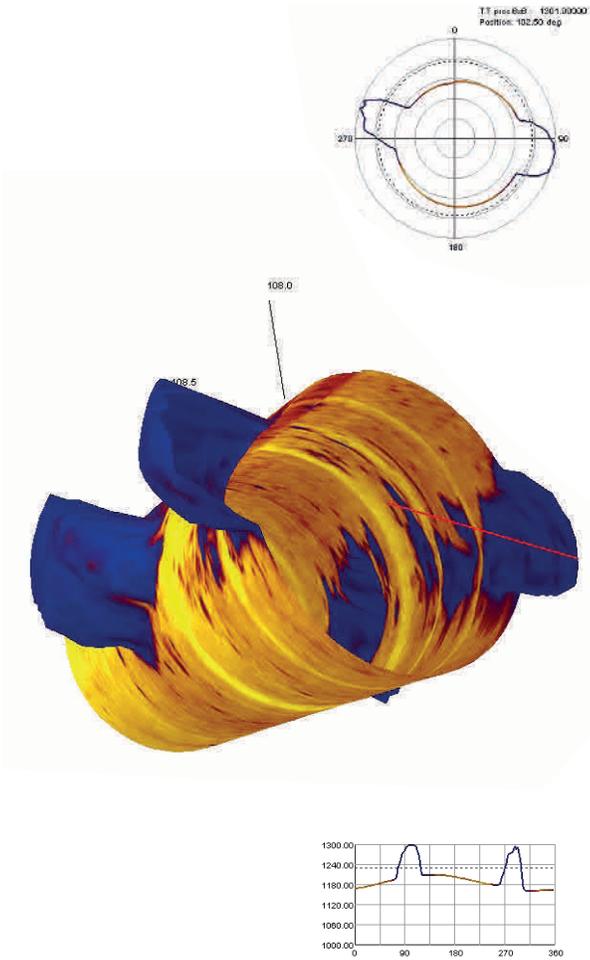
Data processing

A large number of pre- and post-processing options are available for image data and structural picks :

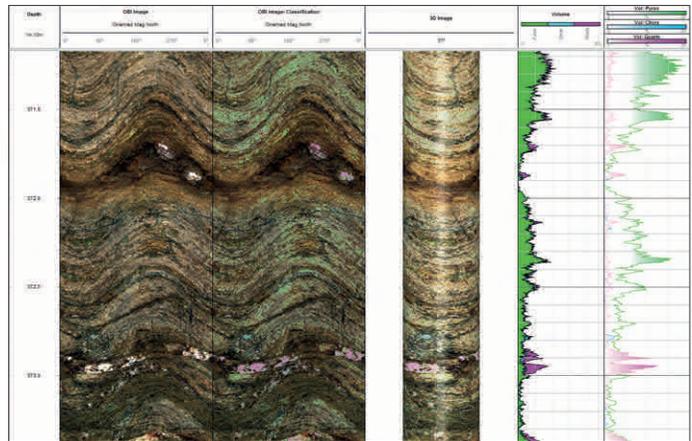
- Bad trace interpolation
- Dead sensor correction
- Image normalization
- Despiking filter
- Image centralization
- Brightness and contrast adjustment
- and more ...
- Apparent to true azimuth and dip correction
- Residual dip analysis
- RQD estimation
- Determination of fracture height
- Color classification
- Extraction of color components (RGB, HSV, ...)
- Structure reorientation (e.g core picks)



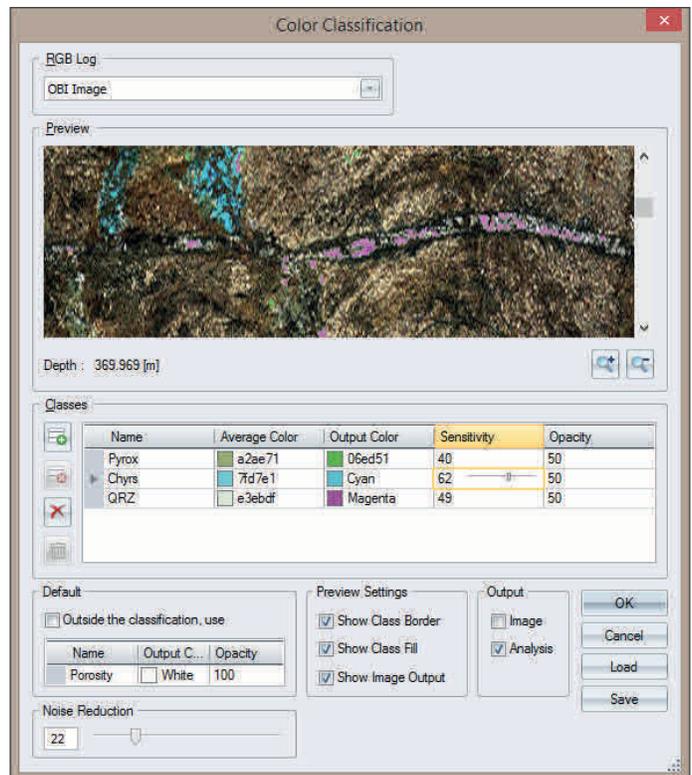
Data presentation



Acoustic televiewer breakout measurement



Color classification of core and televiewer images.

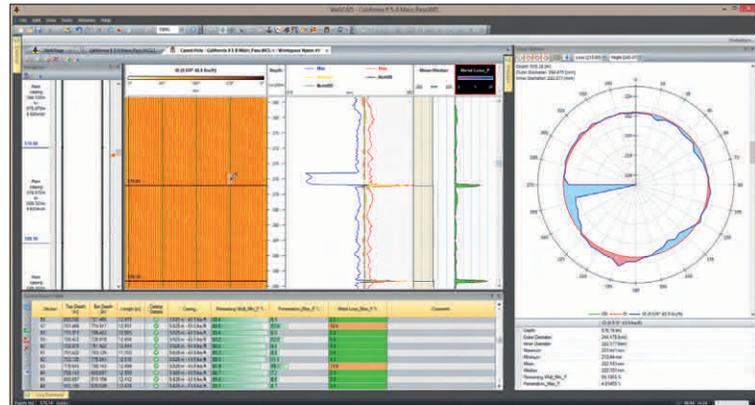
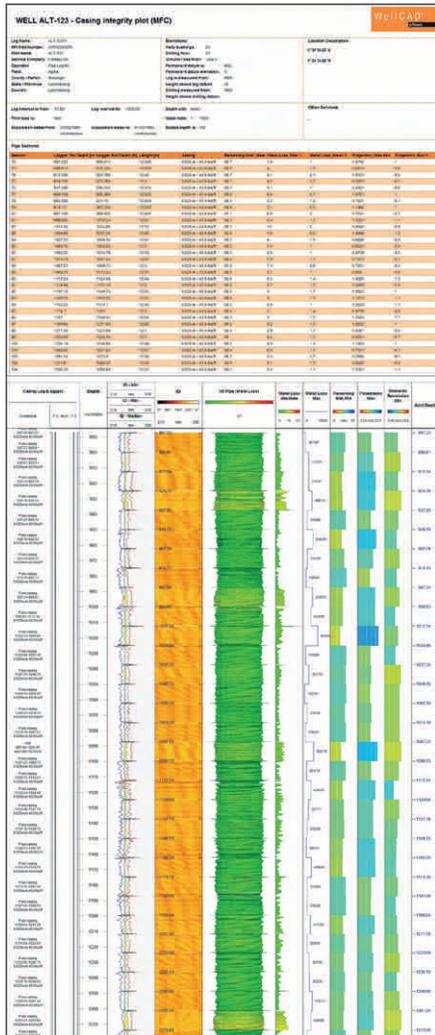


Data can be displayed in the graphical report as an image (user definable color palette), as curves (shifted or stacked) or as 3D cylinder display (virtual core). Data can be analyzed in 3D using the integrated 3D borehole view (ideal to visualise breakouts, well deformation, pipe corrosion). Data can be oriented to North or Highside, or rotated by a user defined input (magnetic North to true North correction).

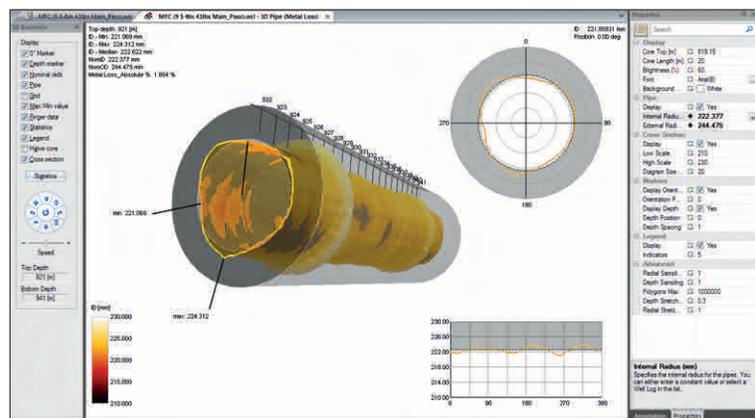
WellCAD™ | Casing Integrity Module

The Casing Integrity Module combines processing algorithms dedicated to cased hole data and a workspace to analyze pipe sections with comprehensive data visualization tools.

- Log editing, depth matching, splicing and merging
- Corrections for drift, dead sensor, decentralization, conditional corrections and more
- Workflows for ultrasonic travel time to radius/diameter conversion
- Automatic pipe detection, interactive joint editing, graphical data presentation and joint analysis table
- Computation of more than 35 different statistical parameters derived per pipe section or at each sample point
- Seamless integration with other downhole data
- Binary, ASCII and graphic export (WCL, LIS, DLIS, LAS, CSV, XLS(X), JPG, PNG, TIF, PDF, ...)
- Free data viewer “WellCAD Reader”



Casing Integrity Workspace (here with MFC data).



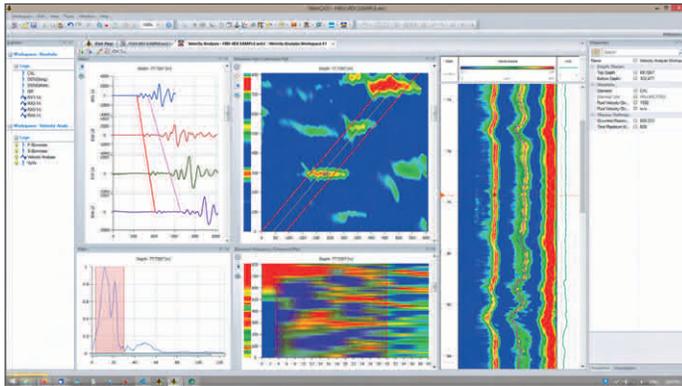
3D Pipe Viewer

WellCAD™ | Full Waveform Sonic

Data Processing

The user can choose from a number of processes to be applied to Full Waveform data traces coming from a single or multiple receivers.

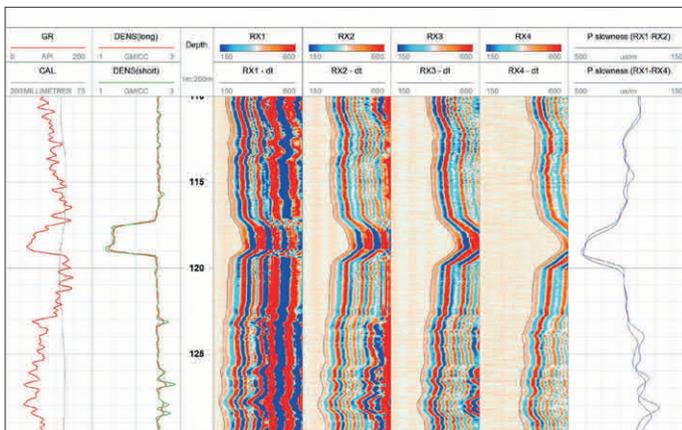
- Trace filtering and stacking options
- First Arrival Picking
- Frequency Spectrum
- Integrated Traveltime
- Extract Window Amplitude
- Reflected Tube Wave Analysis
- and more ...



Velocity Analysis Workspace

Velocity Analysis Workspace

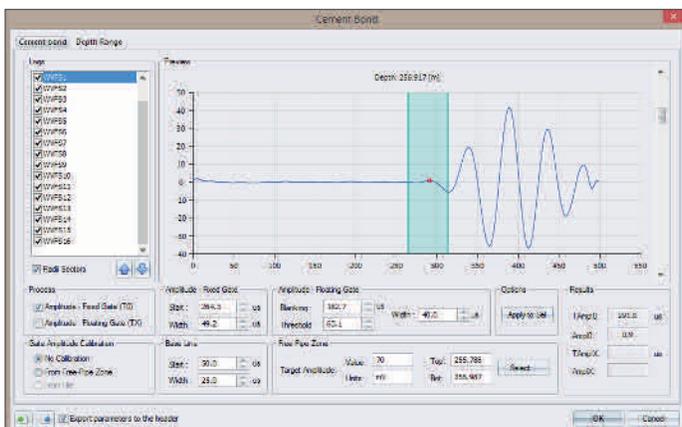
This new workspace keeps the user in control of the Velocity Analysis process through dynamically linked diagrams and immediate result feedback. The waveform slowness can be picked correctly and in a time efficient and user friendly manner.



FWS Interpretation Composite Plot

Rock Mechanical Parameters

Sonic logs are widely used to provide formation porosity/permeability and mechanical properties. If P-wave slowness, S-wave slowness and Density are known, the add-on module allows computation of a series of Rock Mechanical Properties (Poisson ratio, Vp/Vs Ratio, Shear modulus, Young's modulus, Bulk modulus and Bulk compressibility).



Cement Bond Processing for CBL and RBT tools

Cement Bond Logging

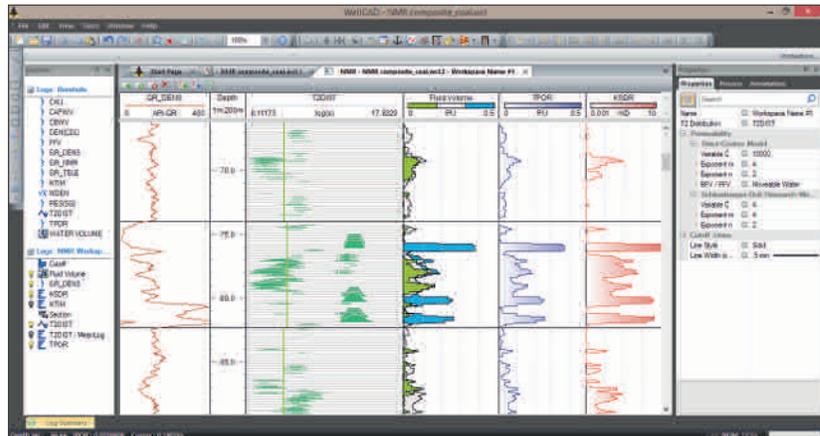
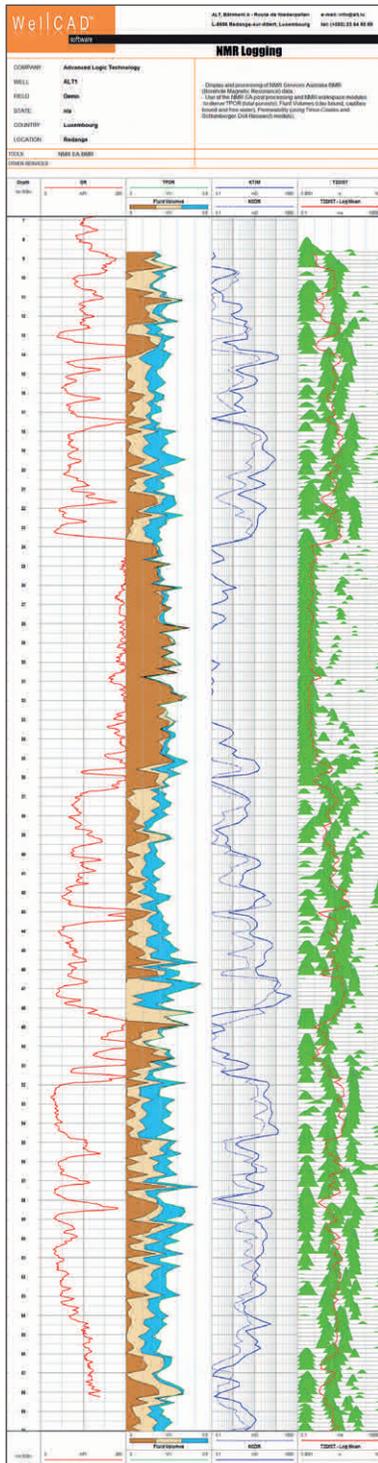
The FWS add-on module provides different algorithms to derive waveform amplitudes from fixed and floating gates. Calibrations can be applied to generate a Cement Bond Log. RBT tool data processing is supported.

WellCAD™ | NMR Data Processing Module

The NMR module provides industry standard presentation tools for T2 distribution data and delivers a set of processes to derive

- total porosity
- permeability (Timur Coates and SDR)
- fluid volumes
- dry matrix density

It also provides a dedicated workspace where the user has the possibility to examine T2 data in details and add T2 cutoffs. These can be adjusted for each imported or interactively defined zone.

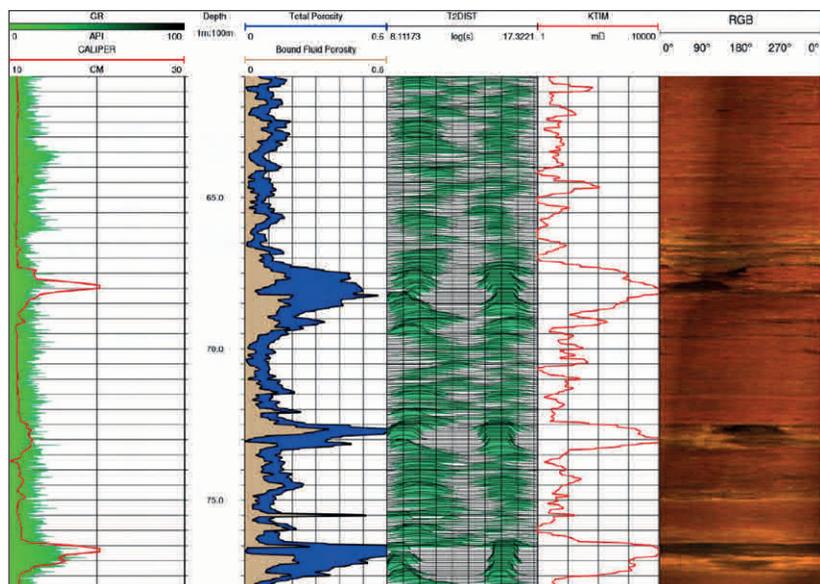


NMR workspace

BMR tool post processing



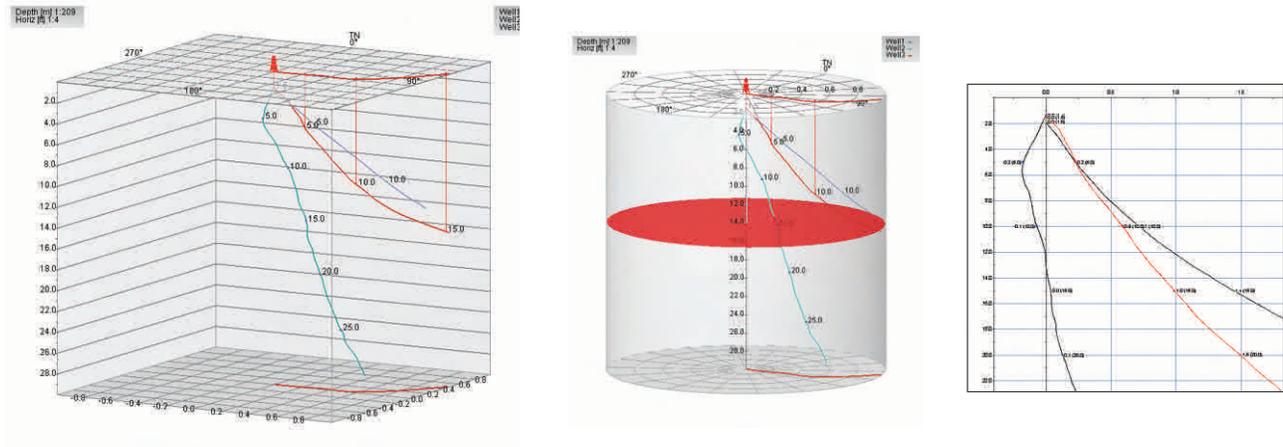
A special upgrade for the NMR Data Processing module is available to post-process data from the latest Borehole Magnetic Resonance (BMR) tool released by NMR Services Australia.



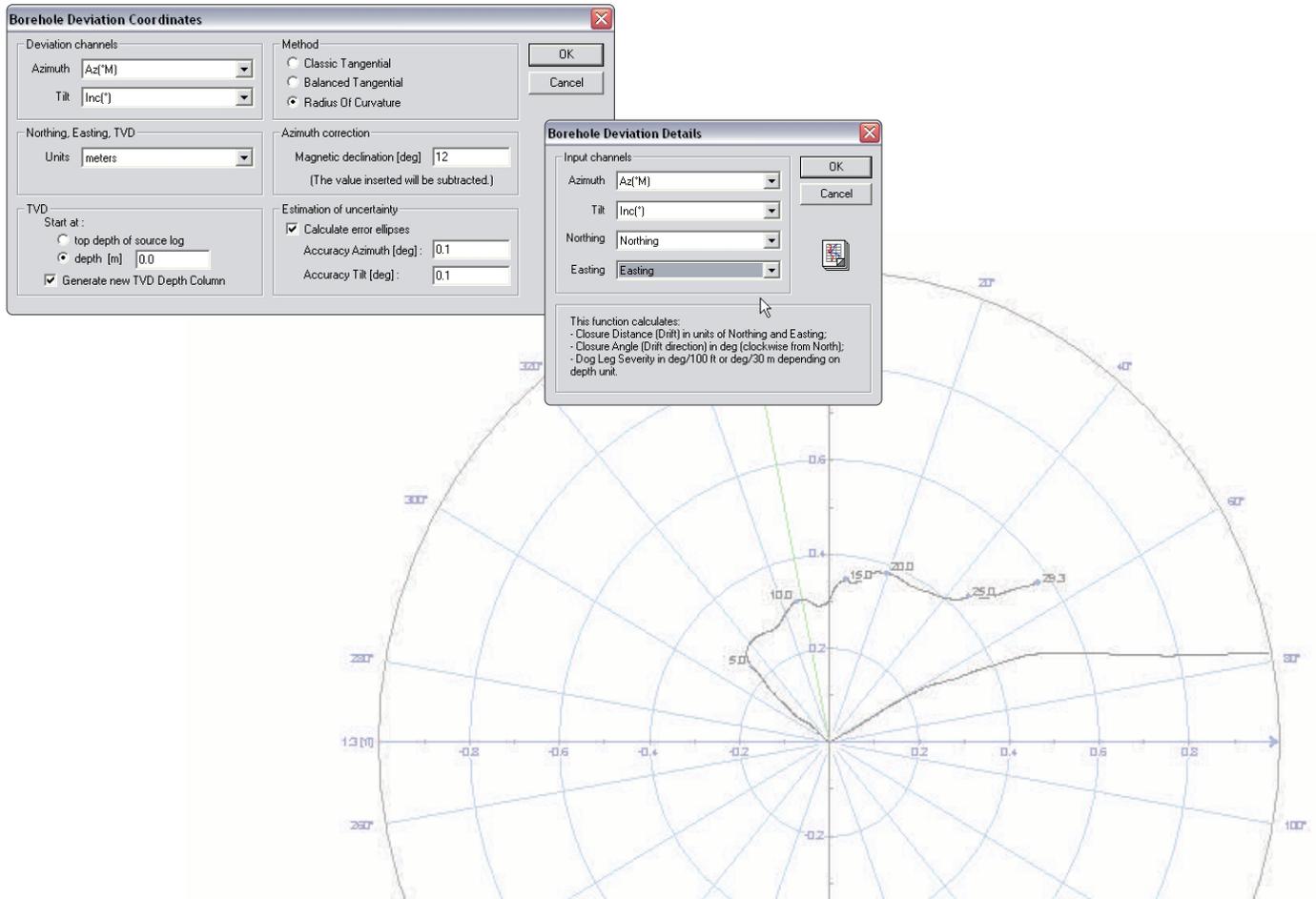
Hydraulic conductivity driven by vugs and fractures

WellCAD™ | Deviation Data Display

The module includes various 2D and 3D display options for deviation data from classical bull's eye, projection and closure 2D views to 3D cubic and cylindrical displays. Each view comes with its own settings and options. Multiple well paths and target layers can be displayed.



The methods for computing x,y,z coordinates from borehole azimuth and tilt are provided in the WellCAD™ basic process (classic tangential, balance tangential, radius of curvature, minimum curvature).

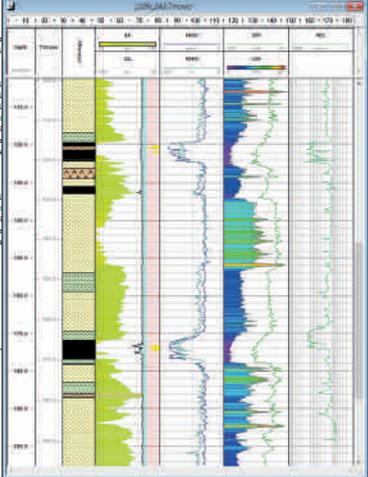


WellCAD™ | Automation

- Automate data loading and data processing tasks by writing simple Visual Basic Scripts (VBS) using a text editor or develop new processing algorithms in VC++ and use WellCAD™ as your data visualization and reporting platform
- WellCAD™ exposes objects, methods and properties to industry standard programming languages such as VBS, VBA, VB, VC++, C# and Python.
- Objects such as the WellCAD™ application, a borehole document, logs or headers allow access to methods and properties
- Exposed methods include file import and export, printing, common processes (filter interpolate, resample,...) or processes from add-on modules
- Properties allow access to log data and display settings

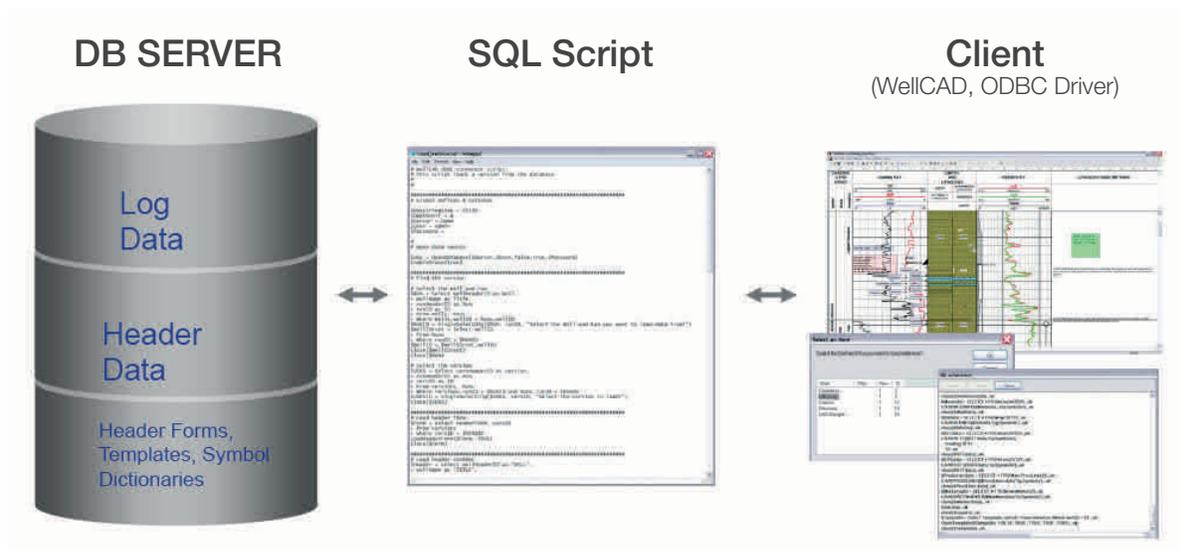
```

20 WellCAD startup
21 Set objCAD = CreateObject("WellCAD.Application")
22 objCAD.ShowWindow
23
24 *Create document through import of LAS file
25 Set objBHDoc = objCAD.FileImport(PATH & "Well 123.LAS", FALSE)
26
27 *Check whether the document could be created before proceeding
28 If objBHDoc Is NOTHING Then
29     *Script.Echo "Something went wrong and WellCAD could not load your file!"
30 Else
31     *Loop on header items and check if they are empty
32     Set objHeader = objBHDoc.Header
33     For i = 0 To objHeader.NoOfItems-1
34         strItemID = objHeader.ItemName(i)
35         strItemText = objHeader.ItemText(strItemID)
36         If Len(strItemText) < 1 Then
37             *Ask user to input missing details
38             strInput = InputBox("Enter " & strItemID & " :")
39             objHeader.ItemText(strItemID) = strInput
40         End If
41     Next
42
43 *Apply layout template
44 objBHDoc.ApplyTemplate PATH &
45
46 *Loop on all logs, find Well
47 For i = 0 To objBHDoc.NoOfLogs
48     Set objLog = objBHDoc.Log(i)
49     If objLog.Type = 1 Then
50         *Remove Null Data
51         Data = objLog.DataTabl
52         NullValue = objLog.Null
53         For j = LBound(Data,1)
54             *Check if we have
55             If Data(j,1) <> Null
56                 objBHDoc.Slice
57                 j = UBound(Da
58             End If
59         Next
60
61         For j = UBound(Data,1)
62             *Check if we have
63             If Data(j,1) <> Null
64                 objBHDoc.Slice
65                 j = Lbound(Da
66             End If
67         Next
68     End If
69 Next
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Name	Date modified
Well123.las	7/10/2007 5:28 PM
Well234.las	7/11/2007 10:57 AM
Well345.las	7/11/2007 10:57 AM

WellCAD™ | ODBC Connection Module

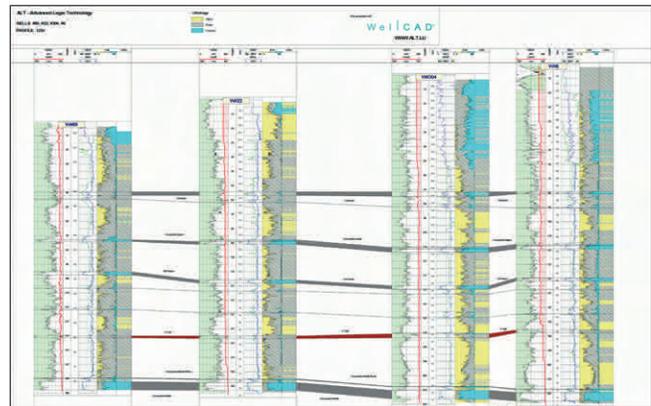


The ODBC connection module allows WellCAD to pull data from and push data to an ODBC compatible database. Database administrators or skilled users have to write their own SQL scripts to control the data transfer between WellCAD and the data base. A collection of WellCAD specific properties and methods is supported by the module. These can be used in the SQL scripts to fill logs and borehole document headers with data while adapting to the users own database model.

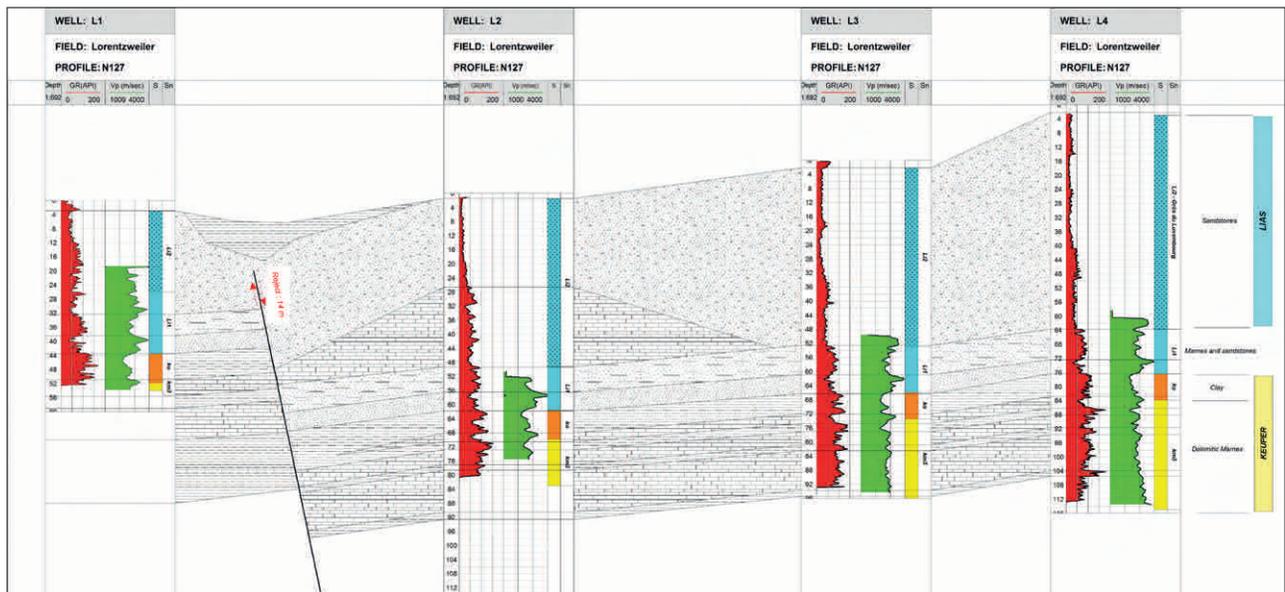
WellCAD™ | Multiwell

The MultiWell add-on module for WellCAD™ has been developed as an easy to use and simple to maintain tool to correlate multiple wells in 2D without the need for a powerful workstation or connection to a database server. The field document architecture does not require a database and therefore provides more flexibility when combining field and office work.

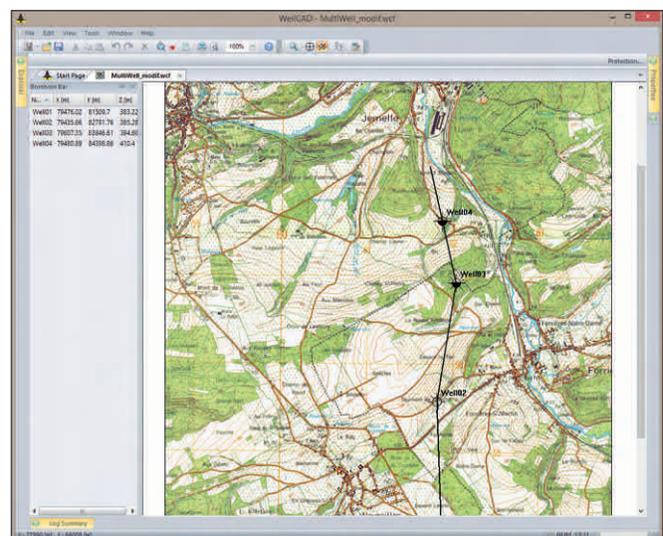
Each well in a field document corresponds to a single WCL file (WellCAD™ borehole document). In this way each individual data channel contained in the repository is easily accessible.



Ortho View



Cross section with surfaces and volume fill.



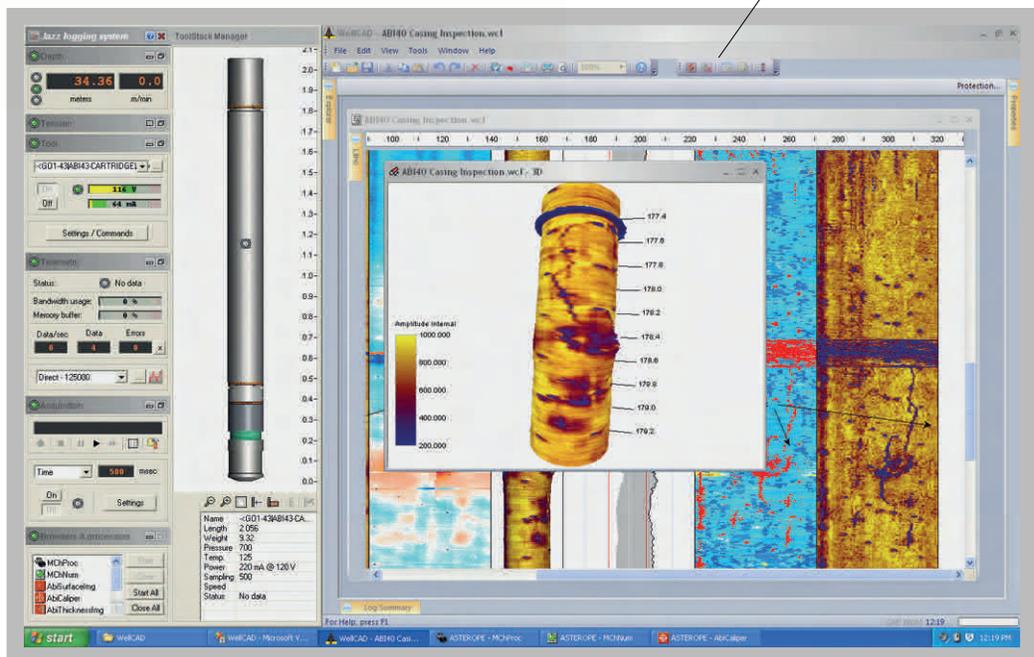
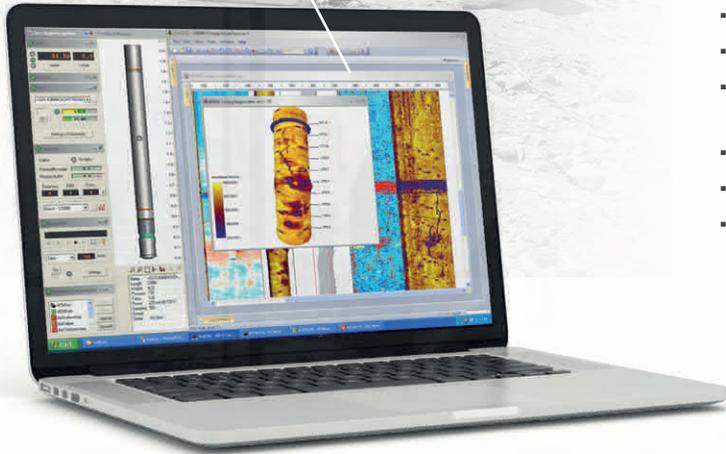
Map View to define projection profile.

WellCAD™ | Browser

From LoggerSuite* into WellCAD™ in real-time

WellCAD browser add-on module allows a real-time connection between the WellCAD data processing platform and the logger.

- collect data directly in WellCAD
- apply templates
- allow real time editing (annotation)
- compare currently logged data with reference / repeat data
- QA / QC tasks
- 3D display
- data preprocessing and field interpretation



In this example, the operator is able to monitor the realtime scrolling log, view any or all other logs while monitoring all the log outputs, including depth. Optionally raw sensor data may be displayed. Comparison with main & repeat section, scrolling and adding annotations while data acquisition continues. Log curve scale and other presentation parameters may be adjusted while logging.

* LoggerSuite comes with ALT/Mount Sopris Instruments data acquisition systems ALTLogger, MATRIX, BBox, Scout, OPAL and provides a sophisticated GUI to control your logging tools and the logging operation.