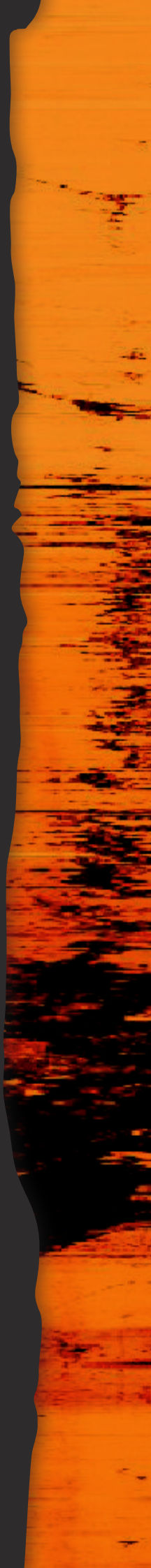
WellCAD™

The Universal Borehole Data Toolbox



Advanced Logic Technology

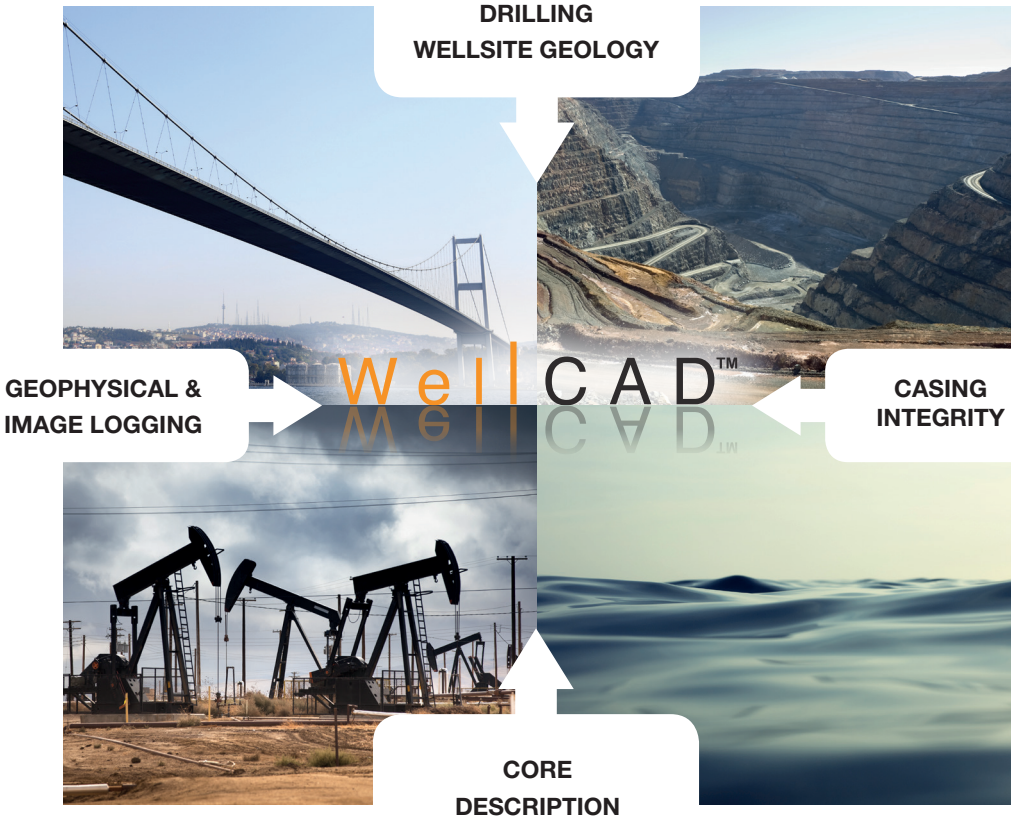
MOUNT SOPRIS INSTRUMENTS

About WellCAD™

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.



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

- Rely on effective support from the WellCAD™ team and partners in offices worldwide

* 32 and 64bit compatible, supported by Windows XP, Vista, 7, 8, 8.1 and 10

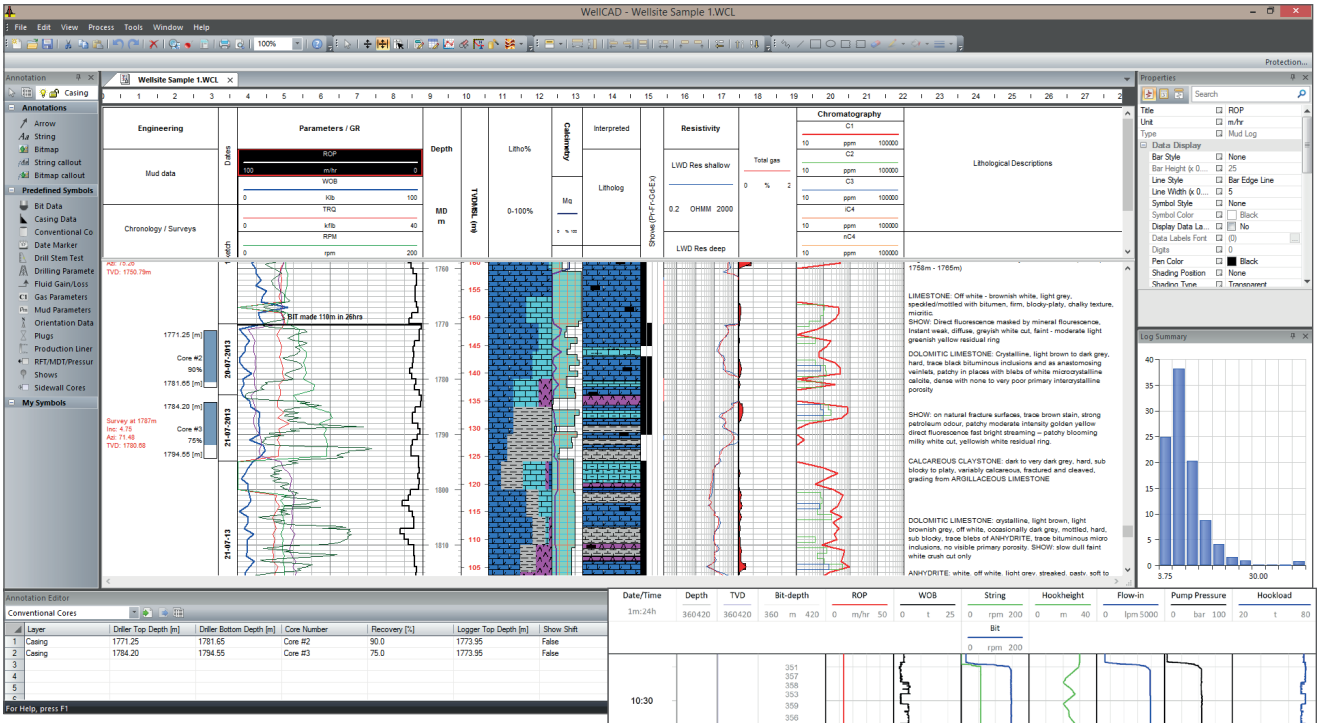
Name	Type	Description
WellCAD™ Basic	Main Application	The Basic version provides the foundation for data management, analysis and presentation. It allows creation of comprehensive log displays and is the base to activate Expert Modules
CoreCAD™	Add-on	Interactive digital core description workspace for WellCAD™
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 pre-built processes 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# 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

Applications

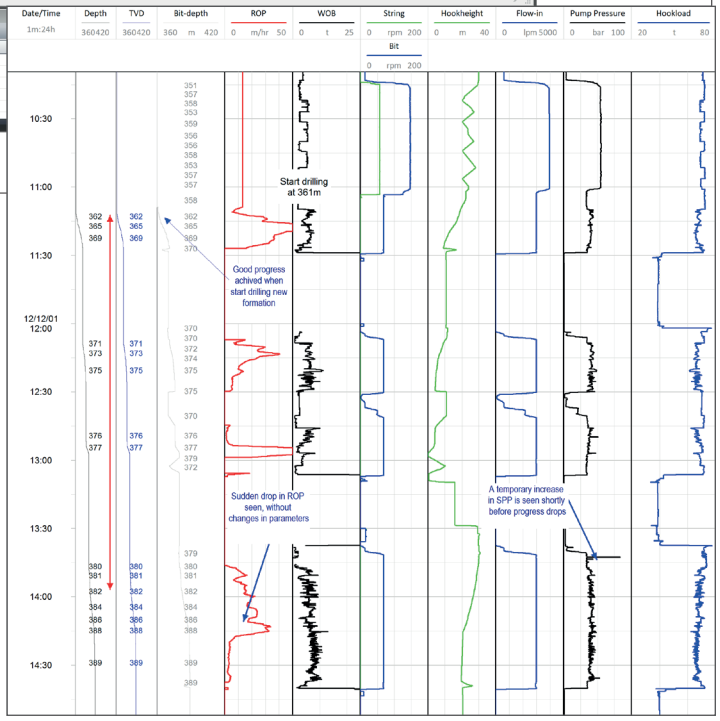
Wellsite Logs

Well Planning, Operations, Progress & Completion Logs

Well Operations Log



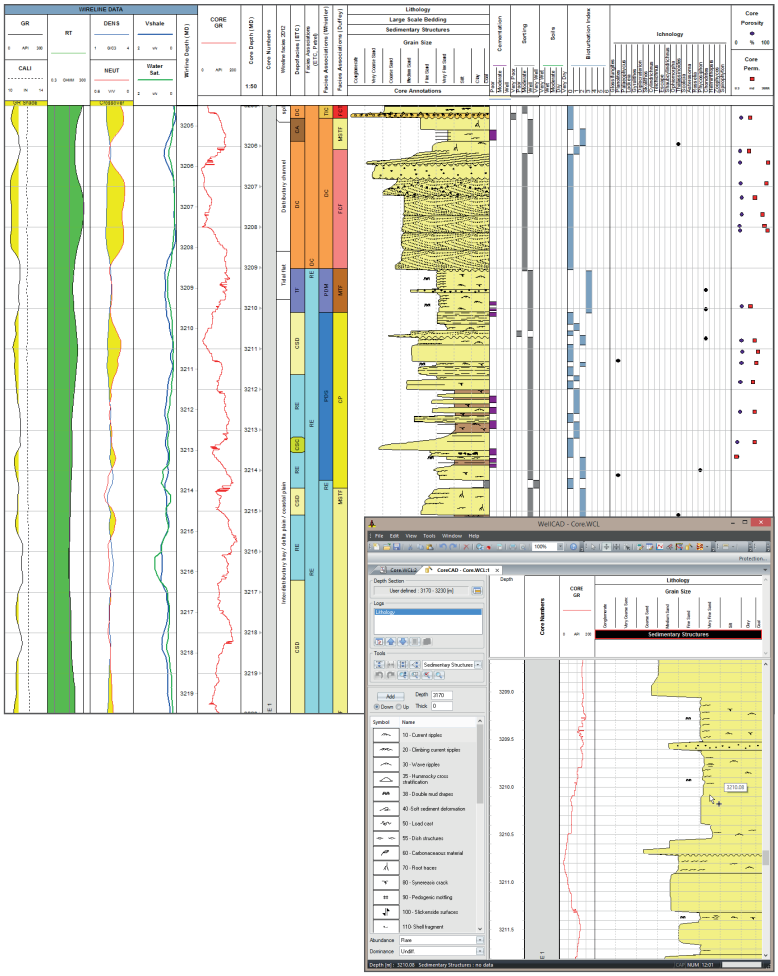
- Depth / Time based data
- LWD / MWD data
- Lithology log / Mudlog
- Stratigraphy
- Operational symbols (casing, coring, …)
- Directional data
- Well diagrams
- … and more



Time Based Log

Core Description

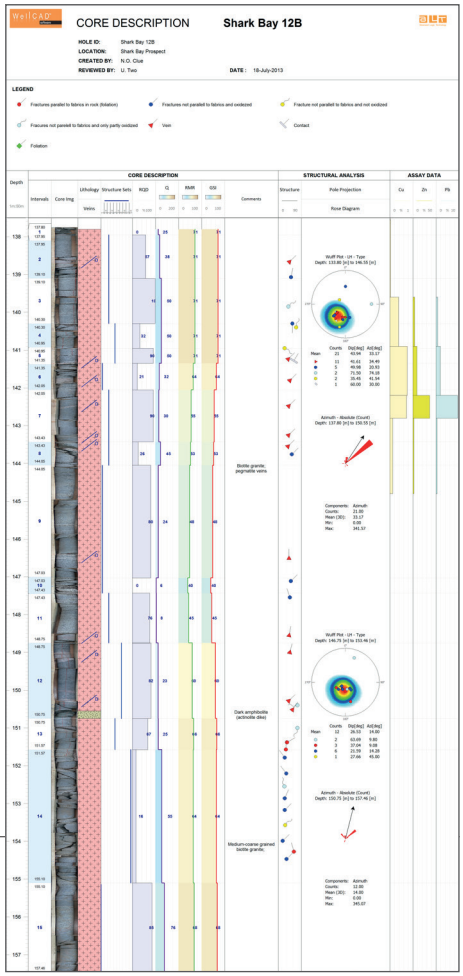
Clastic Core Log



Core Description Workspace

Core logs for Oil & Gas
(e.g. clastic, carbonate, unconventional),
Mining (e.g. geological, geotechnical)
or other fields of application.

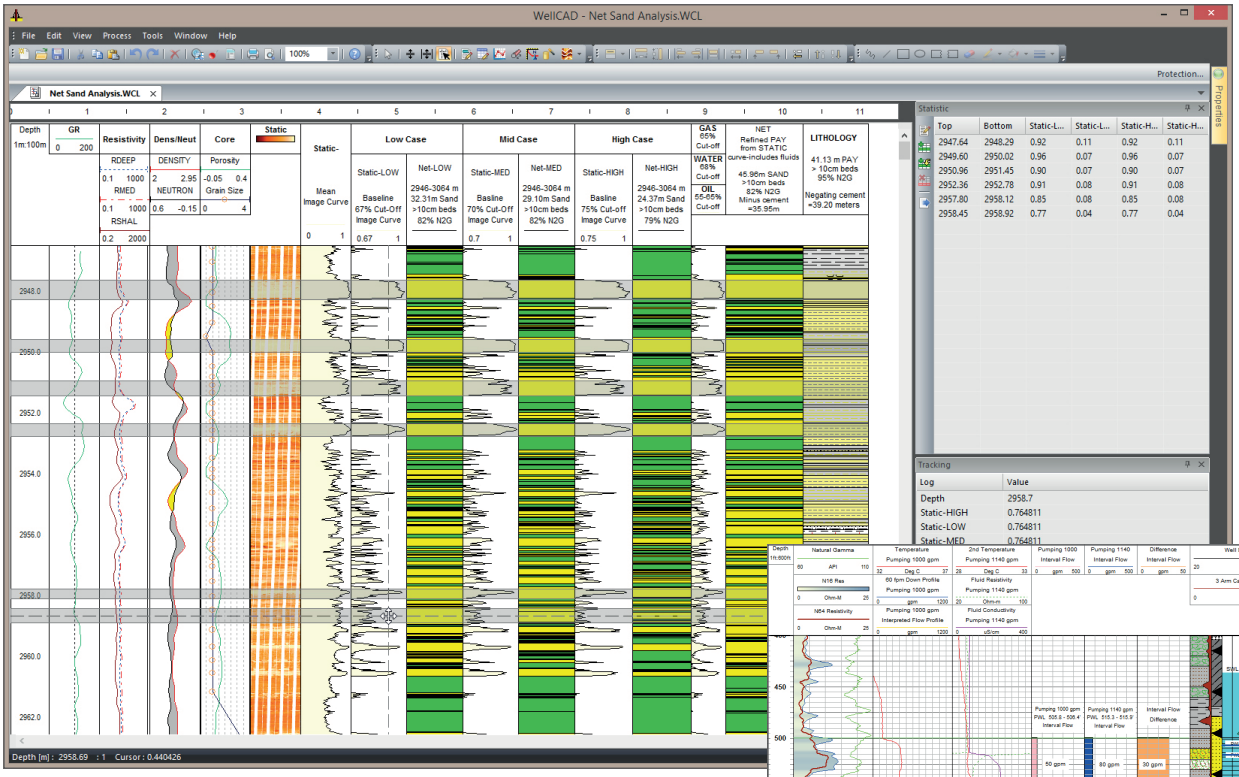
Geotechnical Core Log



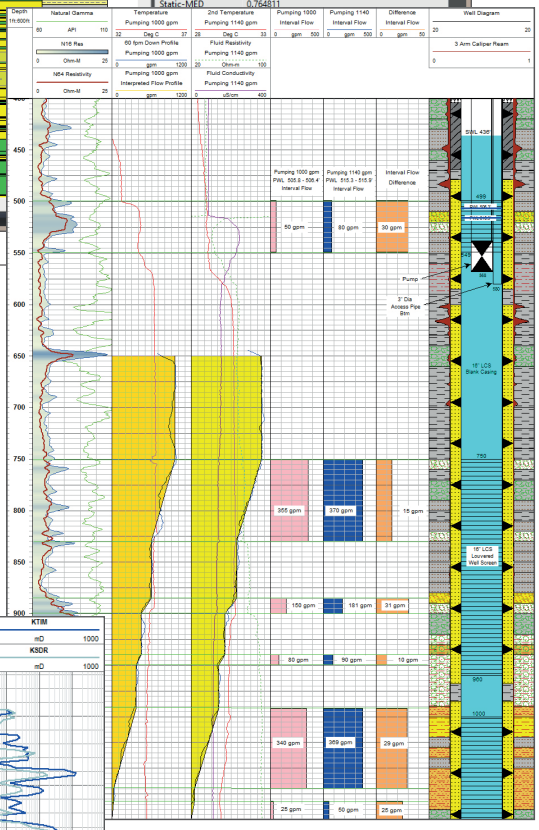
- Lithology, structures and descriptions
- Grain size, porosity, texture
- Core photographs
- Core analysis data
- Digitization of paper core logs
- Core / Log depth matching
- … and more

Log Analysis

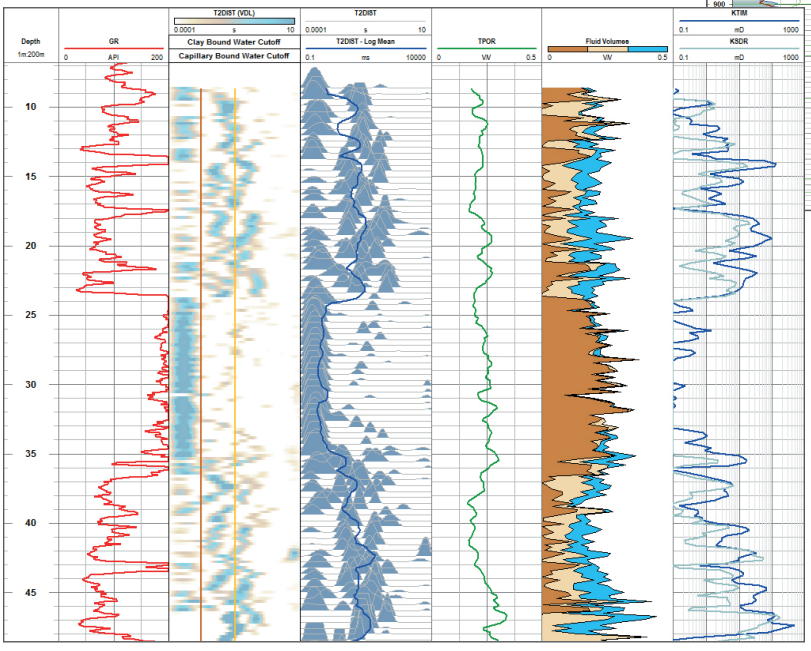
Net-sand Analysis from FMI



- 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



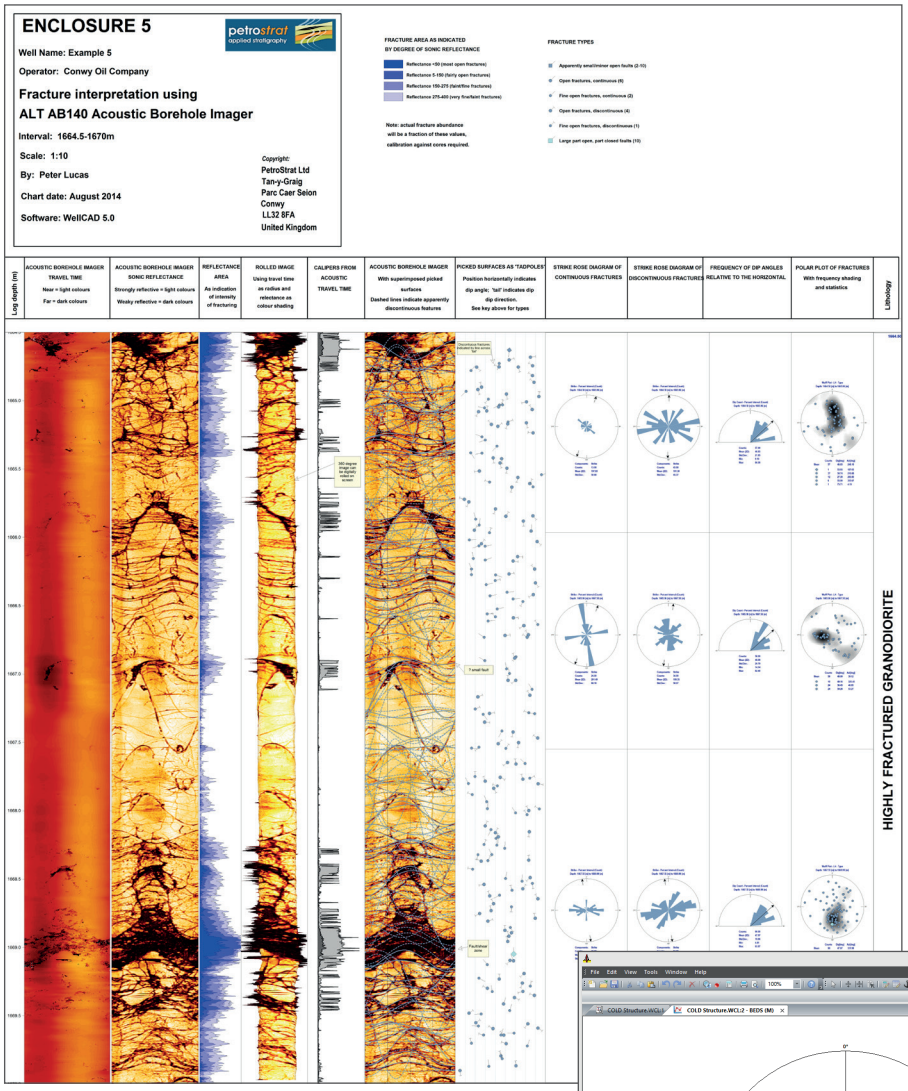
Flowmeter Analysis



NMR Data Analysis

Image & Structure Interpretation

ATV Structure Analysis Plot



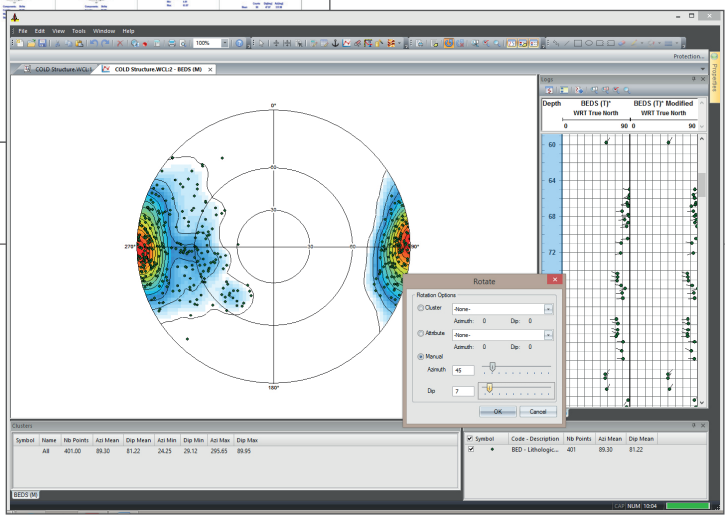
Acoustic and Optical Televiewer data

FMI type data

MWD Image data

3D corescans

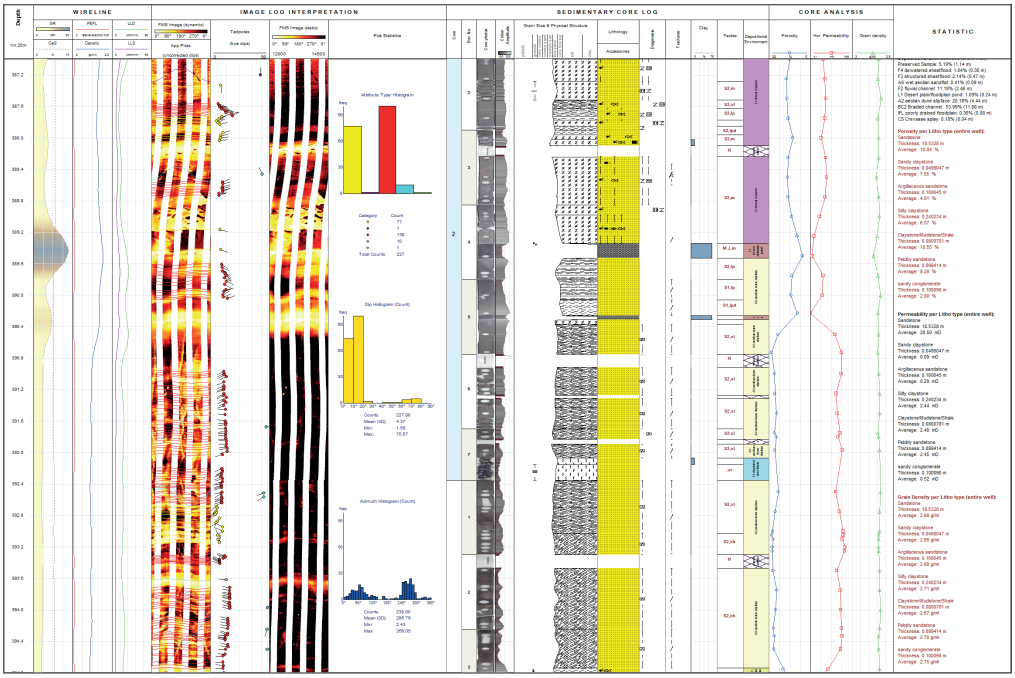
- Planar, linear and free hand structure picking
- Computer assisted and manual picking
- Apparent and corrected picks
- Custom pick classification
- Polar projection diagrams
- Rose and vector plots
- Structure interval statistics
- … and more



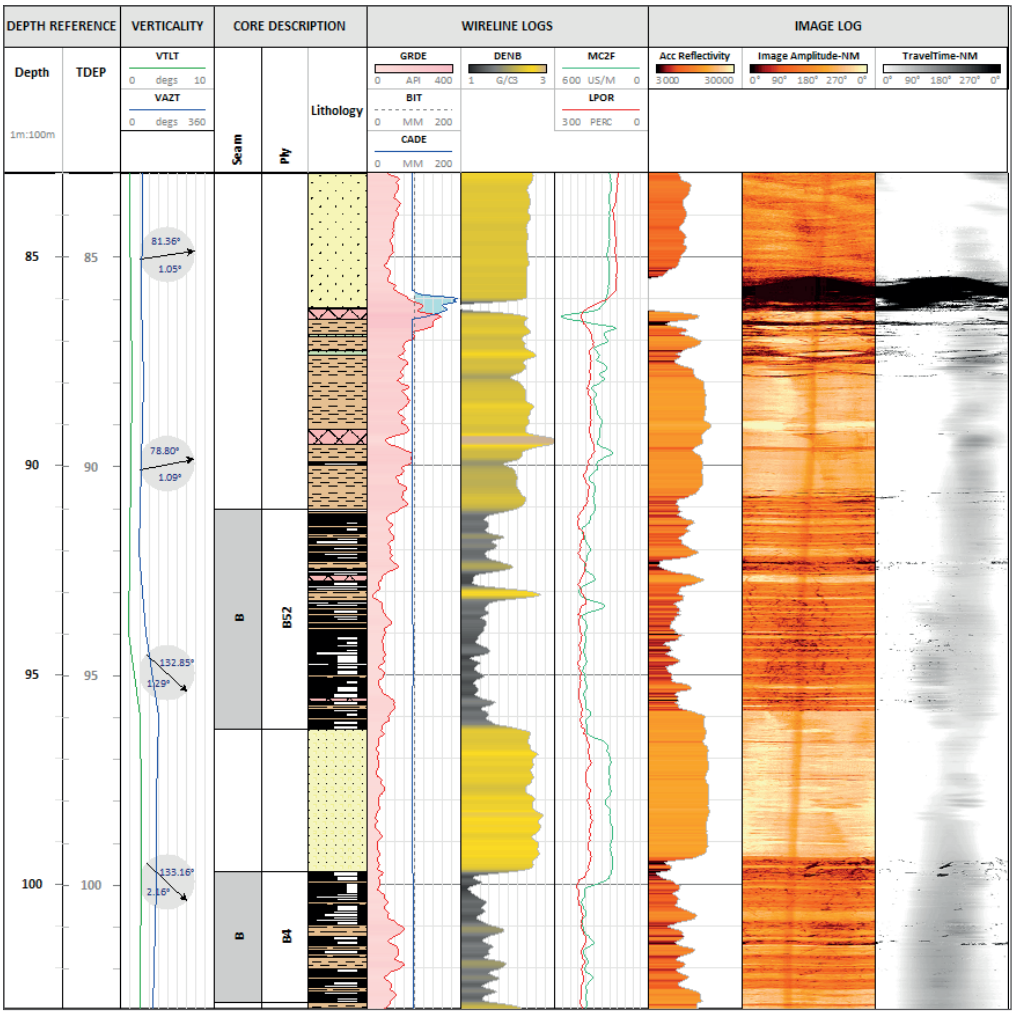
Dips Workspace

Composite Plots

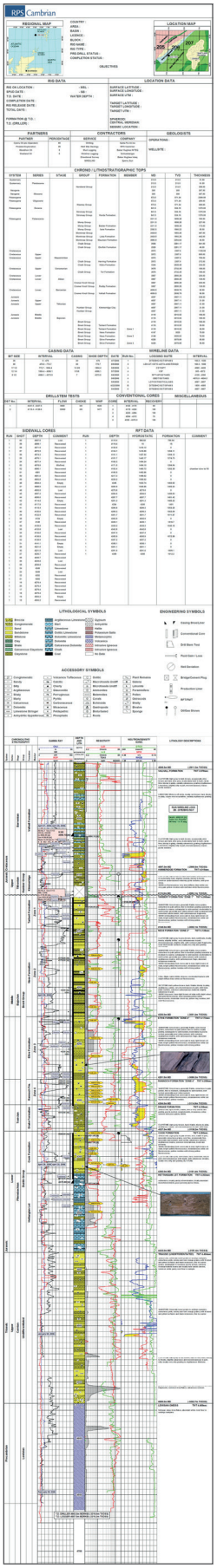
Composite Plot: Oil & Gas



Composite Plot: Coal Mining

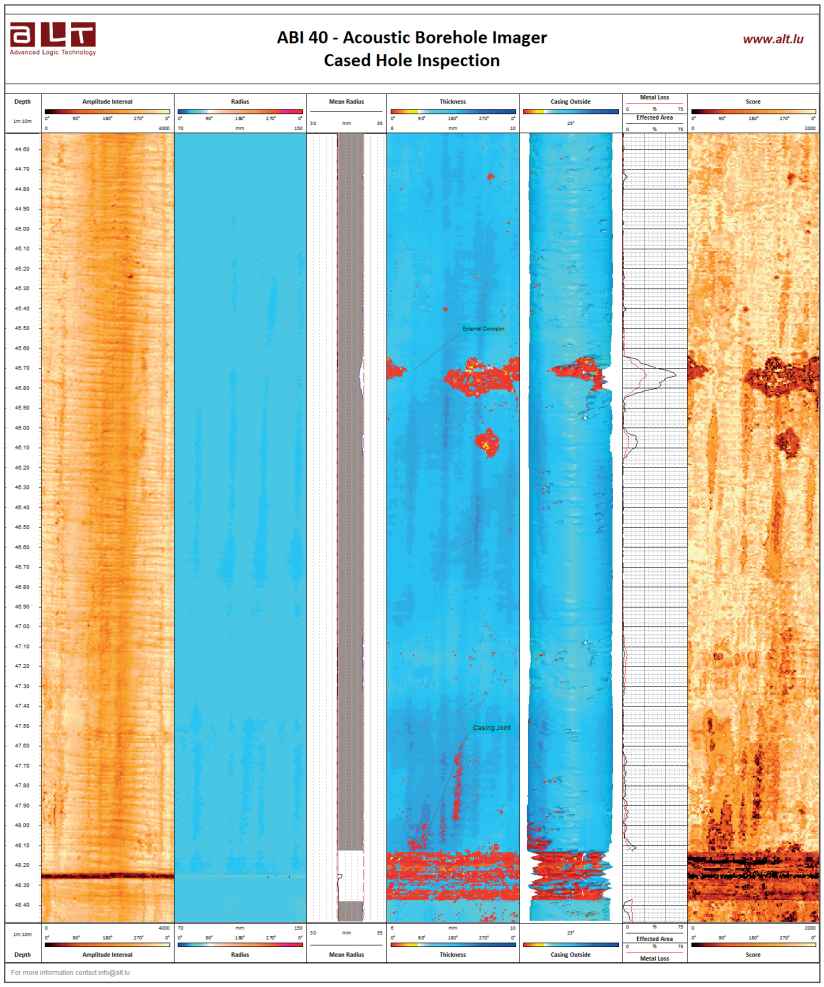


Composite Plot: Wellsite

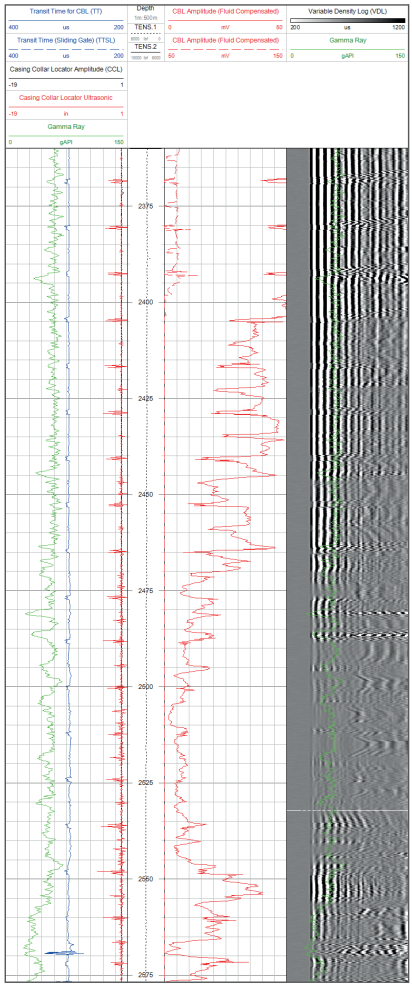


Well Integrity

Acoustic Televiewer Well Integrity Plot

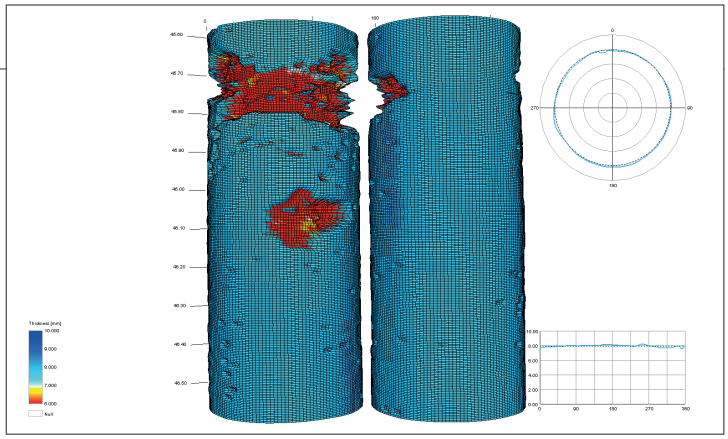


CBL Plot



- 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

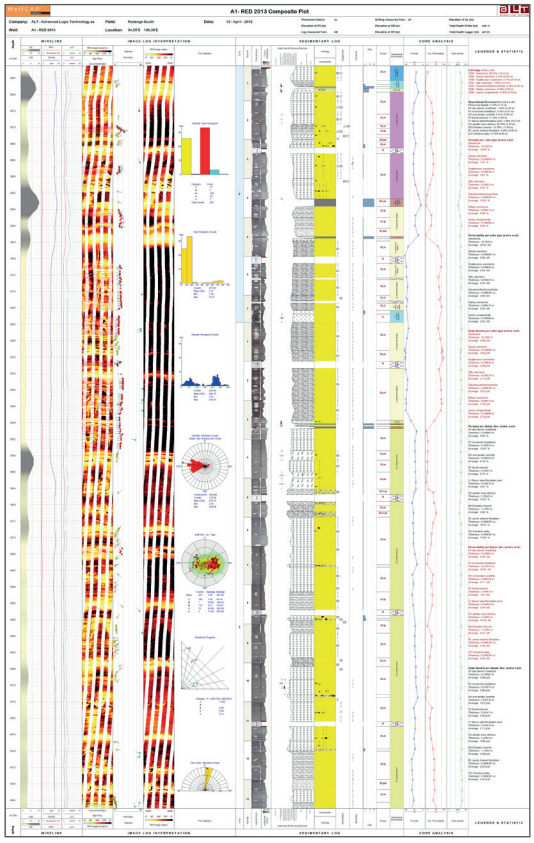


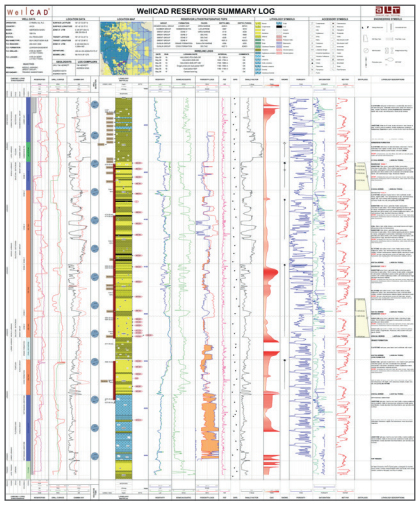
Well Integrity 3D View

WellCAD™ Basic

Data presentation

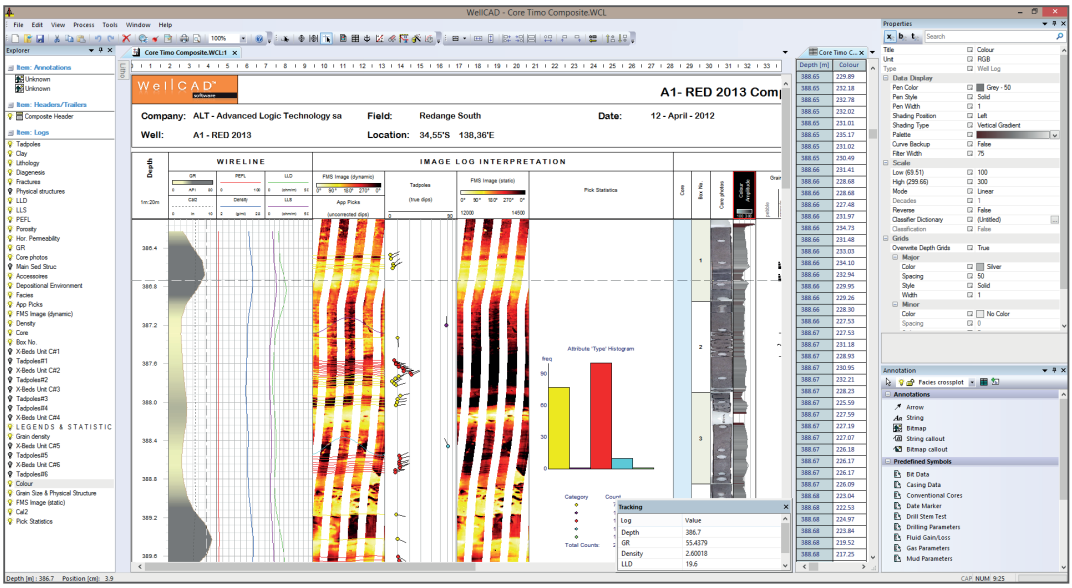
- Display of curves, patterns (e.g. lithology), symbols (e.g. fossils), text, formation marker, hierarchical stratigraphic columns, image data (e.g. FMI, ATV, OTV), photographs, operational symbols (e.g. DSTs, RFTs, Mud Data, Survey Data, etc.), …
- An unlimited number of data containers, of which 28 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. Wenthworth 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





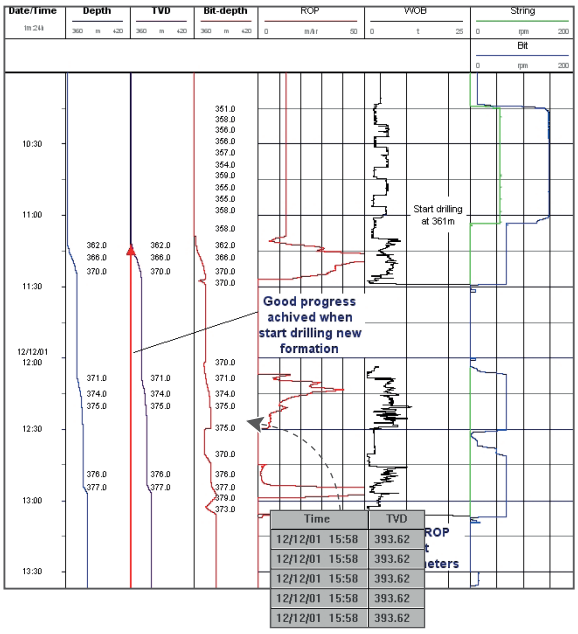
Data management

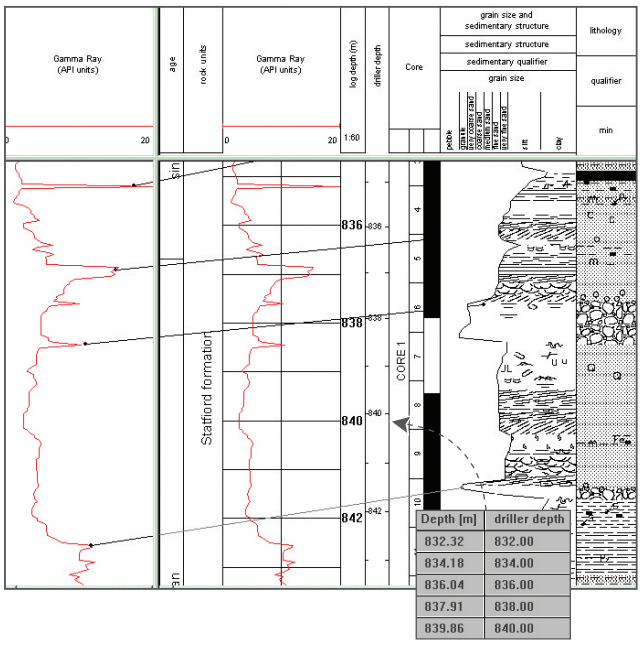
- Data Formats – Import (LIS, DLIS, LAS, ASCII, EXCEL, WITSML, JPEG, AGS,...)
- Data Formats – Export (LIS, DLIS, LAS, ASCII, CGM, JPEG, EXCEL, Petrel compatible ASCII,...)



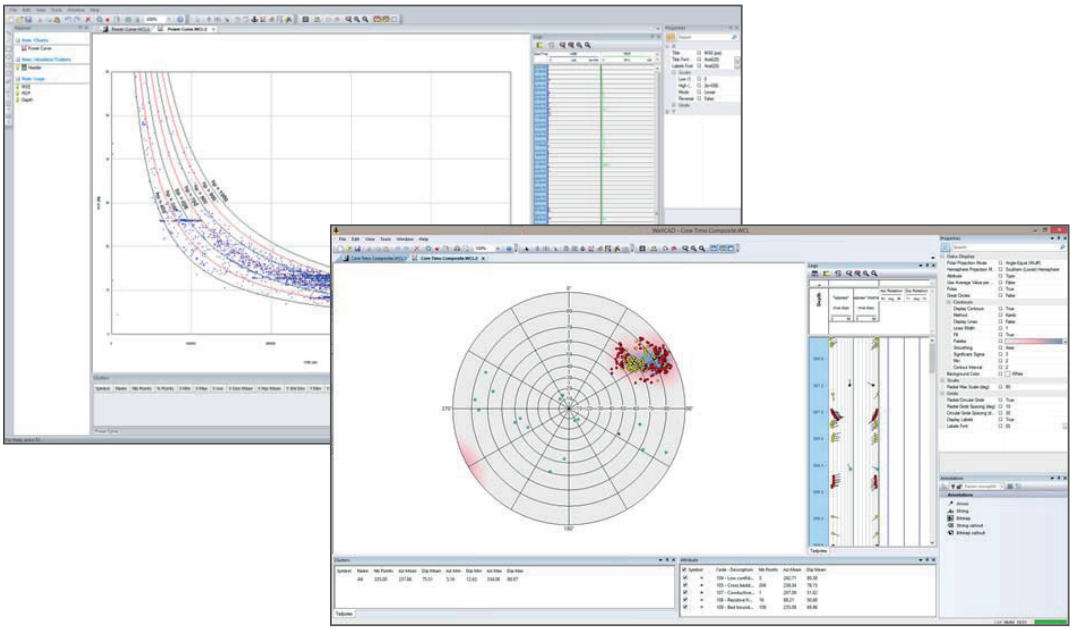
Multiple depth management

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.

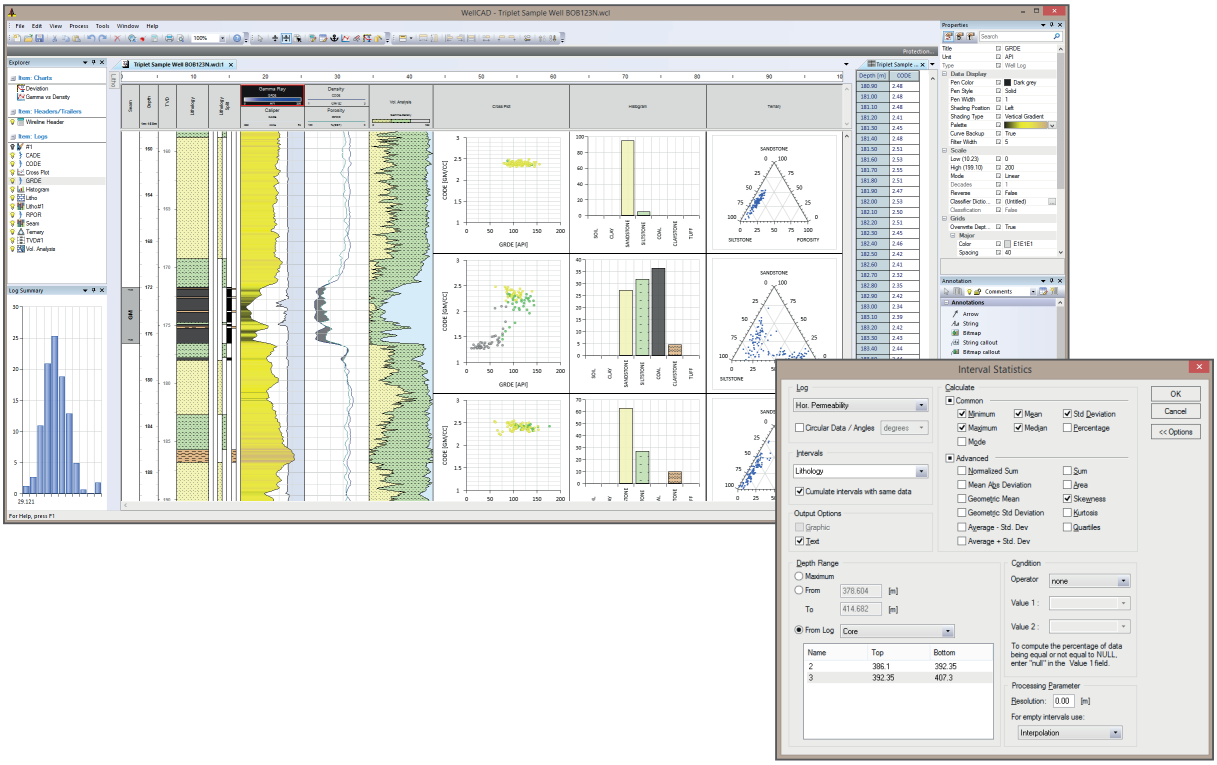




Data interpretation



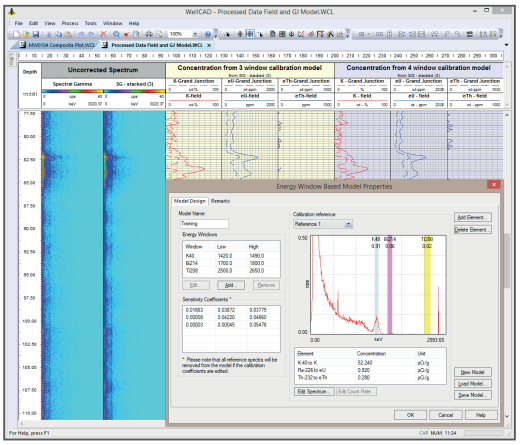
- Cross plotting workspace (up to 4 components, clustering, overlay and regression options)
- Chart log for cross plots, ternary diagrams and histograms as part of the report
- Workspace for dip data (rose, polar projection, walkout and woodcock diagrams)
- Tracking and statistic bars for interactive 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

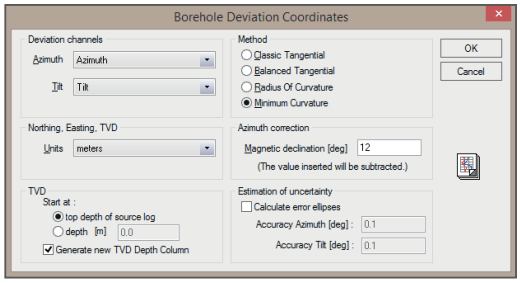


Data processing

Common processes

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

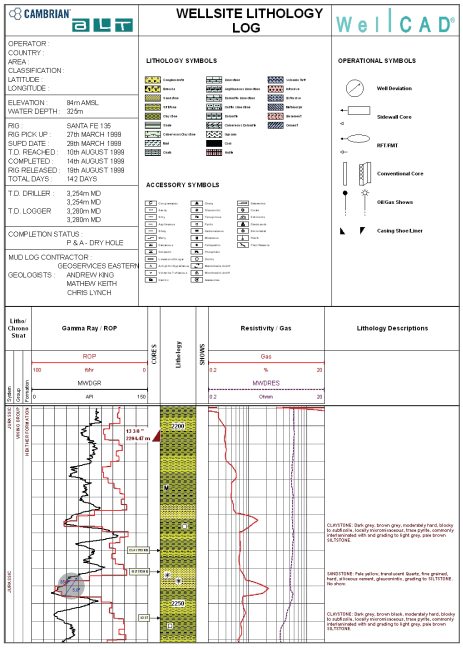


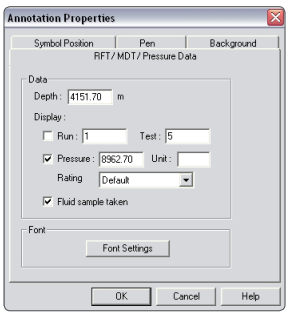


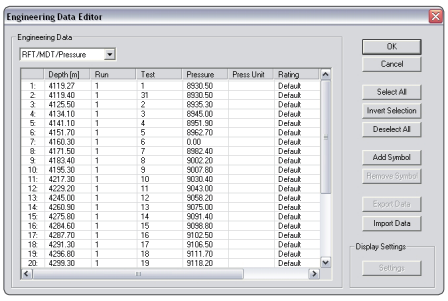
- Computation of borehole deviation data (azimuth, tilt, northing, easting, TVD and more)
- Borehole condition corrections
- Total & spectral gamma processing (window stripping and full spectrum analysis)
- Borehole volume calculations
- Multi log statistics

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.





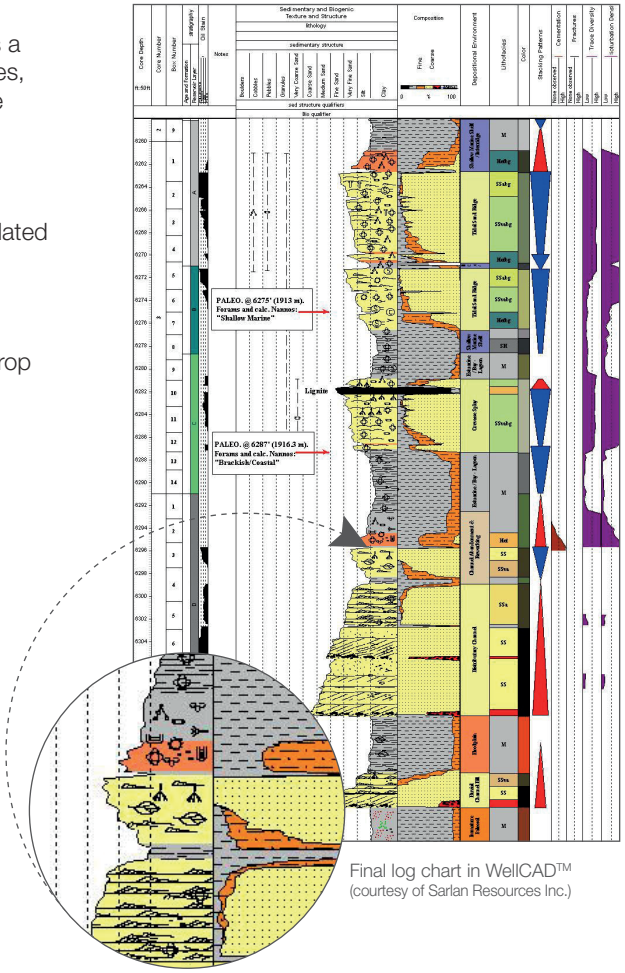


WellCAD™ CoreCAD™

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.



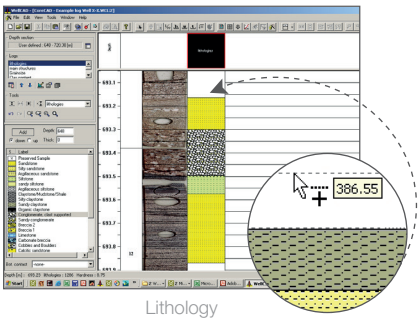
Final log chart in WellCAD™
(courtesy of Sarlan Resources Inc.)

- 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
- 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

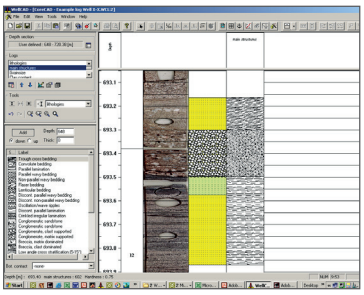
CoreCAD workspace

Typical clastic core description workflow

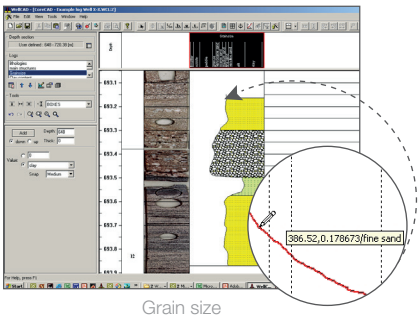
The CoreCAD workspace provides an interactive environment to describe user defined depth intervals (e.g. boxes or outcrops) in detail. The final core description chart is updated in real time with data acquired in CoreCAD.



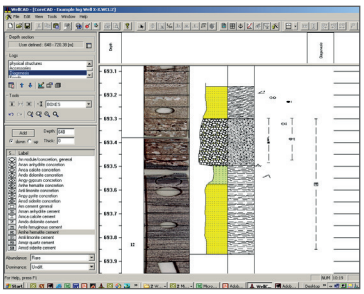
Lithology



Sedimentary structures



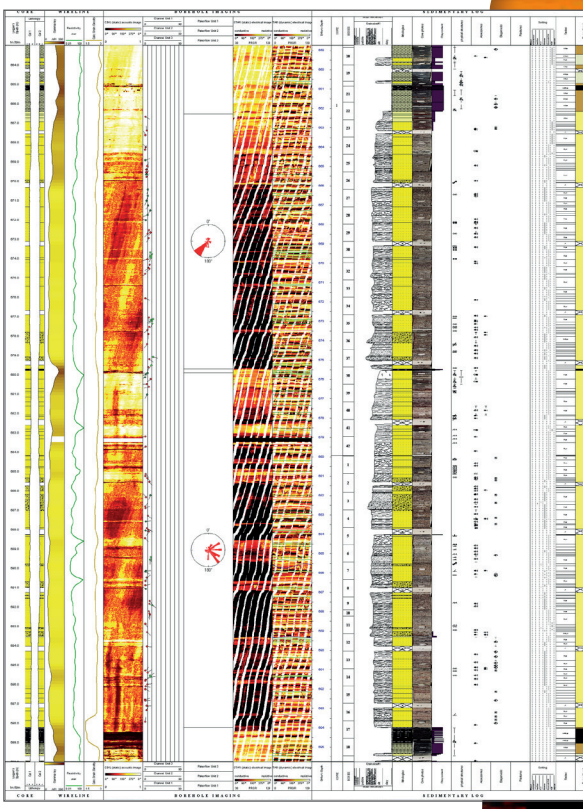
Grain size



Accessories-fossils-diagenesis-…

Core description workflow, symbol libraries can be customized to meet the reservoir specific requirements and the sedimentologist's ways of working.

Each parameter is described in its own workspace. All necessary data management and workspace layout control are combined in a toolbar. The toolbar content adapts automatically to the parameter being described.



Final log chart in WellCAD™ (courtesy of PanTerra Geoconsultant)

Final composite log document

Further data as borehole images, wire line data, sedimentological core information and conventional core analysis may be integrated to create a Well composite log. Data sets can be accurately calibrated and correlated at high-resolution scale (lithofacies interpretation and extrapolation).

WellCAD™ Image & Structure Interpretation Workspace

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

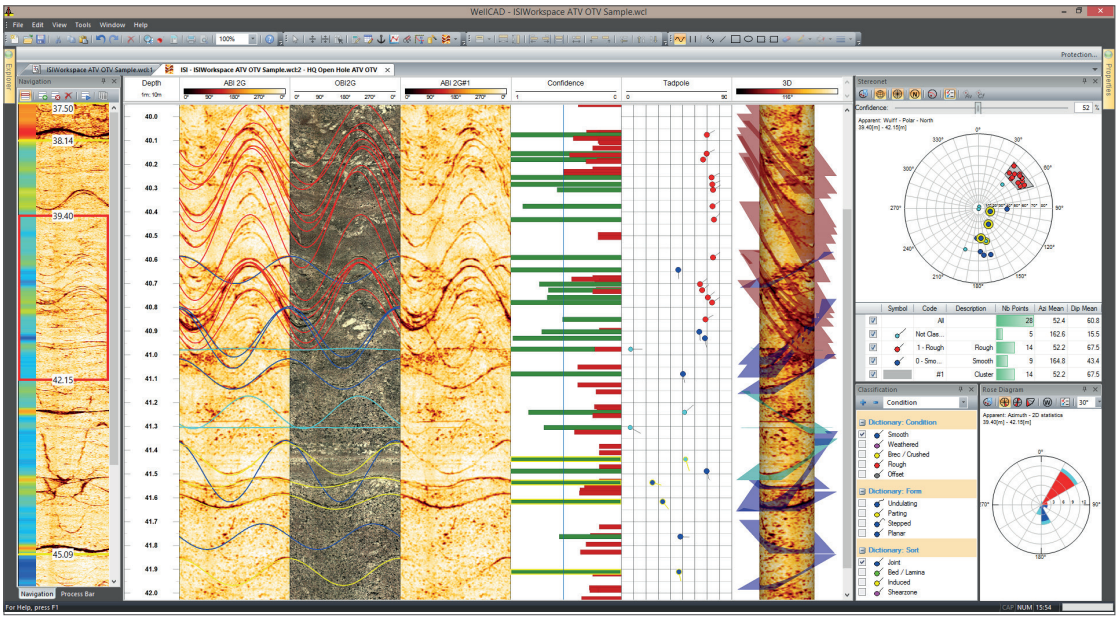
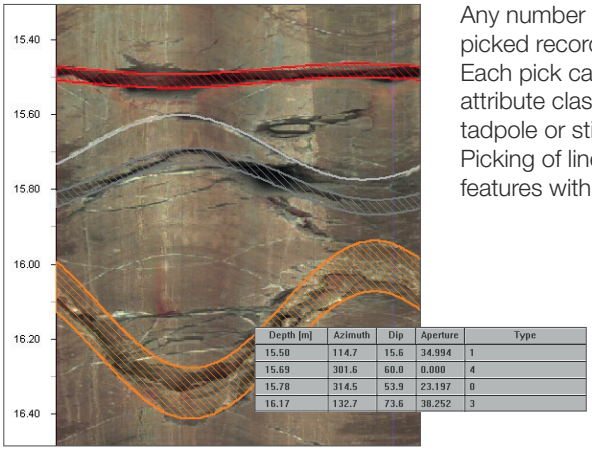


Image & Structure Interpretation Workspace (ISI)

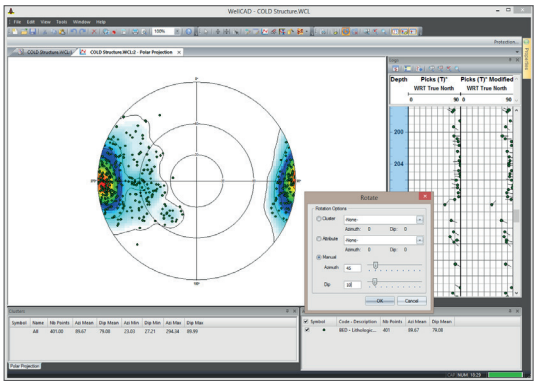
A sophisticated auto picking algorithm developed by The Centre for Exploration Targeting at The University of Western Australia* assists in picking structures.

THE UNIVERSITY OF WESTERN AUSTRALIA



Depth [m]	Azimuth	Dip	Aperture	Type
15.50	114.7	15.6	34.994	1
15.69	301.6	60.0	0.000	4
15.78	314.5	53.9	23.197	0
16.17	132.7	73.6	38.252	3

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.

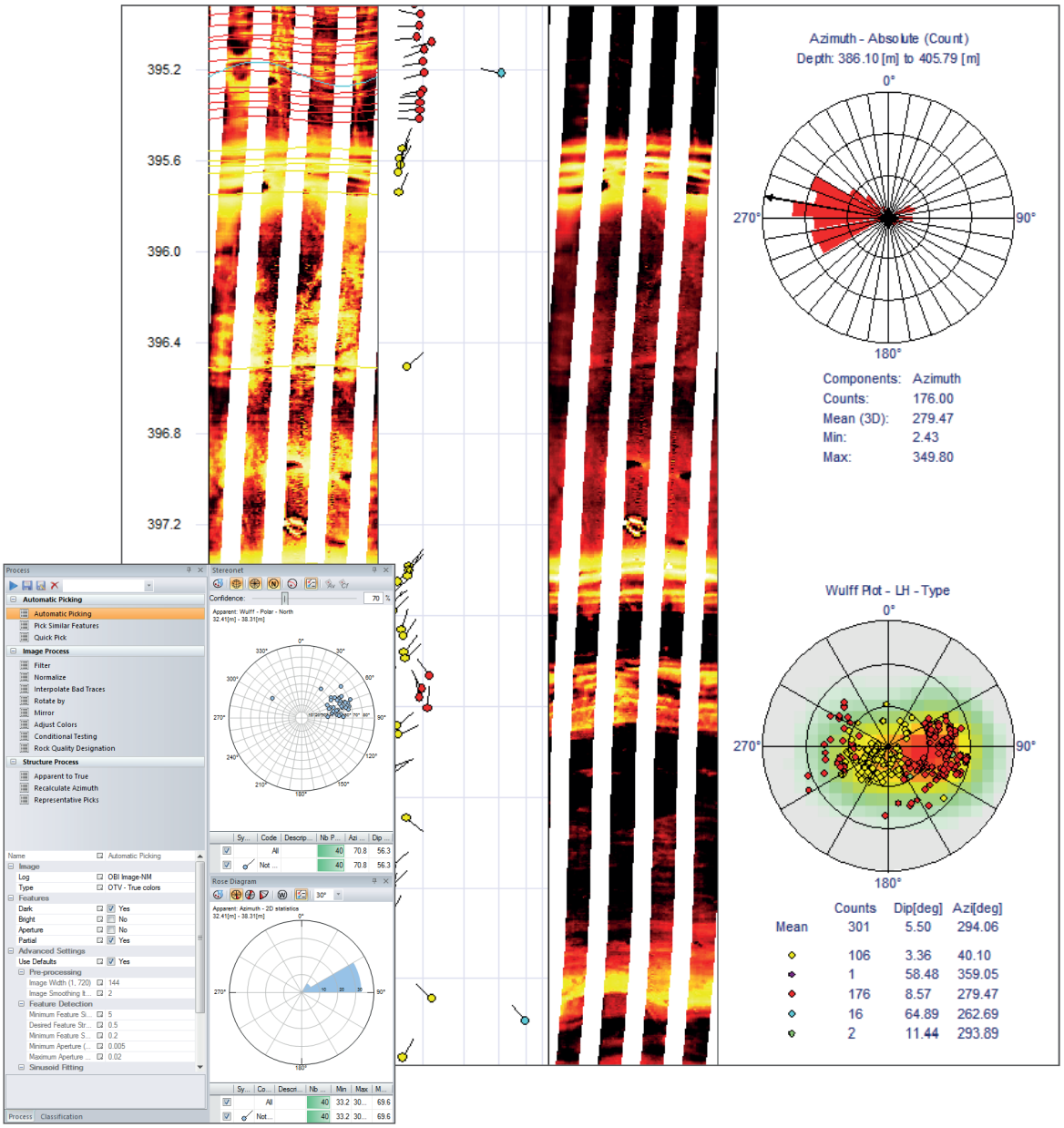
Data import

Borehole image data from a variety of tools including acoustic televiewer, optical televiewer, corescanned images, FMI, FMS, CAST, CBIL, UBI and STAR are supported.

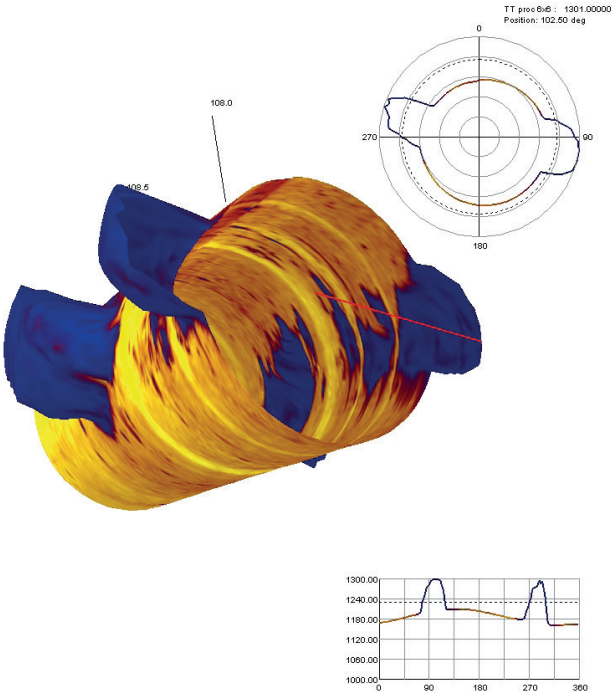
Data processing

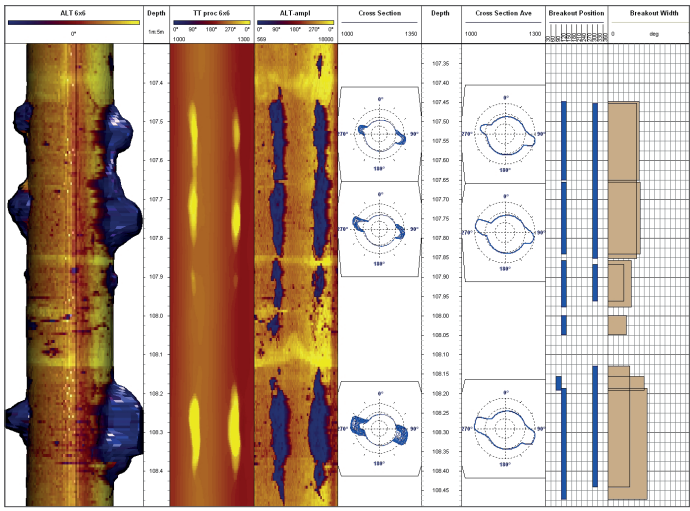
A large number of pre- and post-processing options are available for image data and structural picks :

- 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, …)



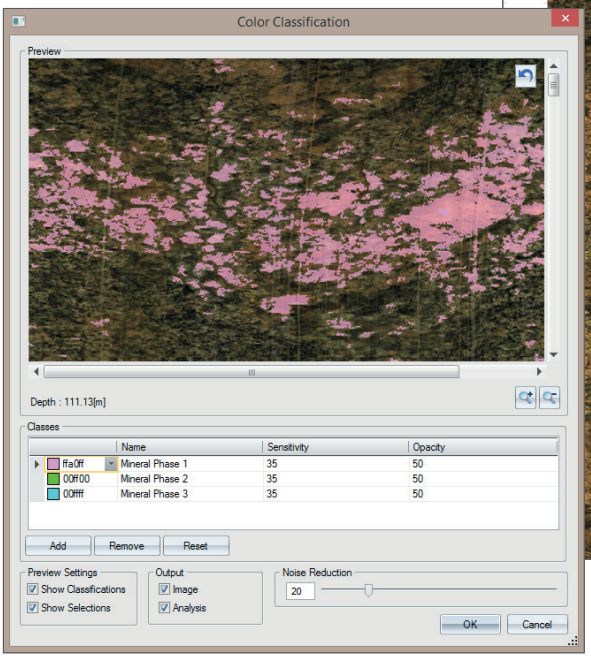
Data presentation

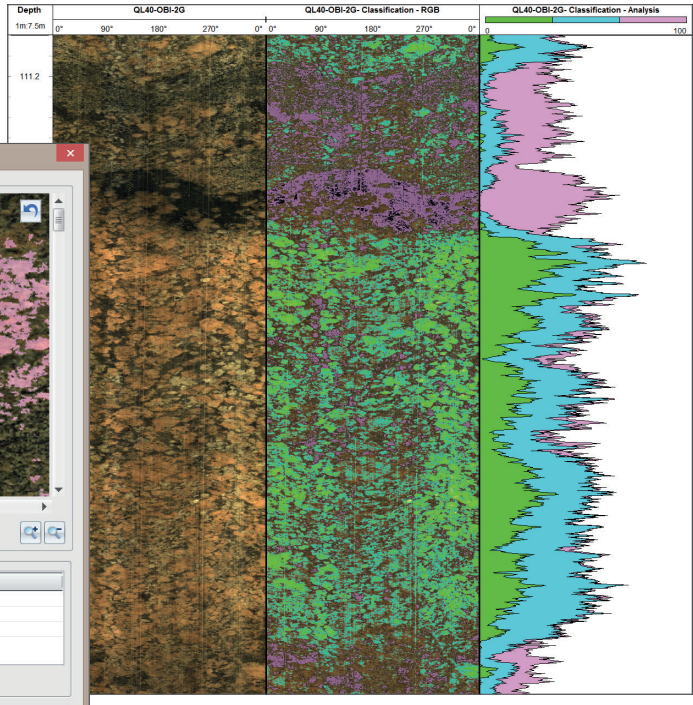




Acoustic televiewer breakout measurement

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).





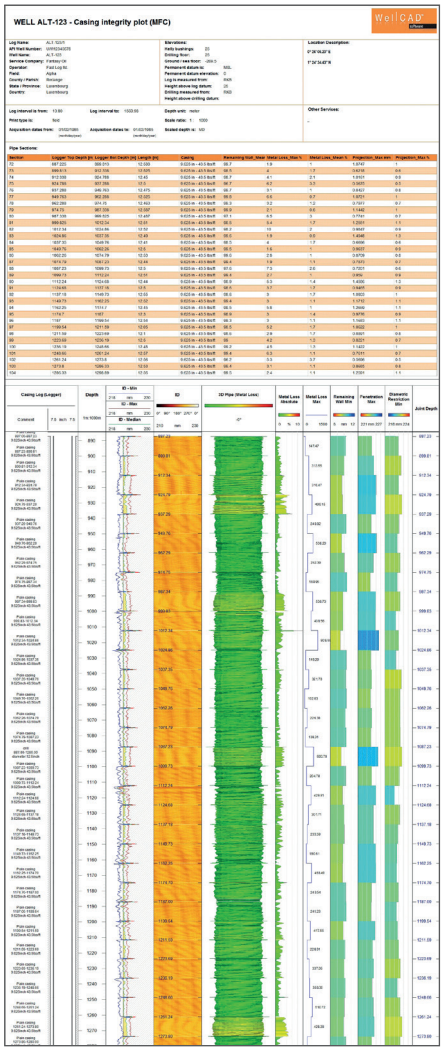
Color classification of core and televiewer images.

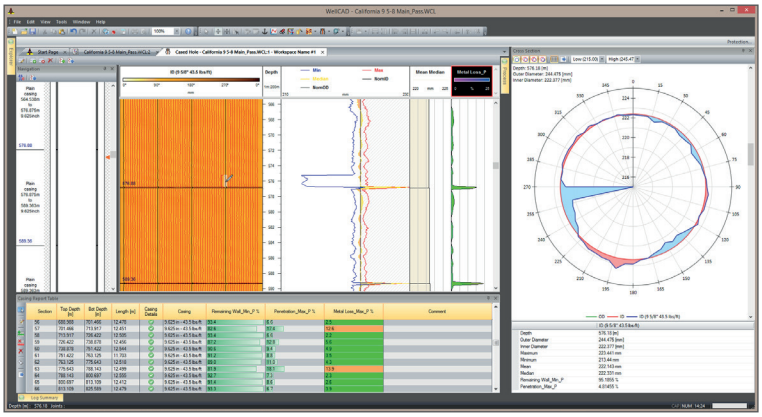
WellCAD™ Casing Integrity Module

NEW

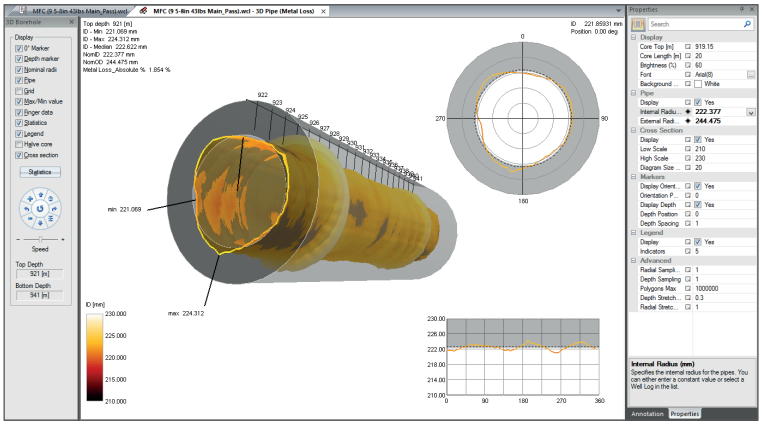
The Casing Integrity Module combines processing algorithms dedicated to cased hole data processing and a workspace to analyze pipe sections with comprehensive data visualization tools.

- 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”





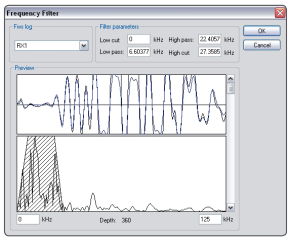
Casing Integrity Workspace (here with MFC data).



3D Pipe Viewer

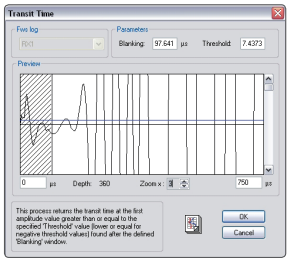
WellCAD™ Full Waveform Sonic

The FWS module includes a set of processing techniques to interpret sonic data. The software provides full control of the process by allowing the user to define the parameters.



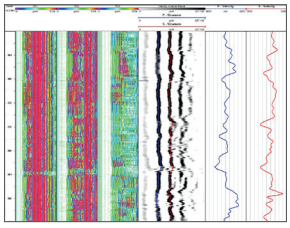
Preprocessing

A range of preprocessing techniques are provided to get optimized data prior to applying the relevant process. Filtering can be applied using moving average, weighted average or frequency. For improved results, these filters can be combined. In some cases, it might be useful to interpolate bad traces prior to filtering.



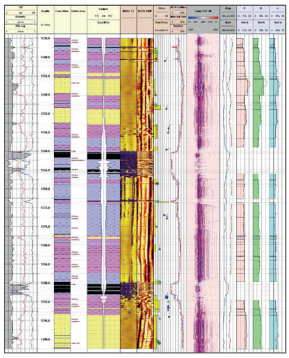
DT Picking

WellCAD™ allows different algorithms for dt pick up. The standard threshold algorithm returns the transit time at the first amplitude value greater or equal to the specified threshold value, found after the blanking window. The advanced threshold process computes the ratio of the average value of signal and noise windows. The user may define the values for blanking,small window width, large window width and ratio threshold.



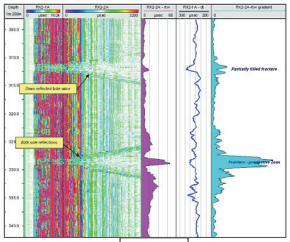
Velocity analysis

The velocity analysis based on semblance processing can be used to derive P-, S- and tube wave velocities.



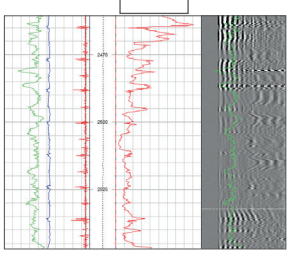
Mechanical properties computation

Sonic logs are widely used to provide formation porosity/permeability and mechanical properties. If dt compressional, dt shear and rhob are known, WellCAD™ computes for each depth mechanical properties of the rocks: Poisson ratio, shear modulus, Young's modulus, bulk modulus, bulk compressibility.



Reflected tube wave analysis

The tube wave may be seen as an indicator of fracture. Prior to computation, the offset, blanking, transmitter frequency and the fluid velocity have to be defined. The process returns a curve. The value of each depth is the cumulative energy computed over a V shaped area in the late time area of the FWS log. The higher amplitude could be seen as indicator of fracture (fluid velocity defining the slope and the transmitter frequency the width).



Cement bond logging (CBL)

Standard algorithms for cement bond quality evaluation are available (e.g. fixed and floating gate method).

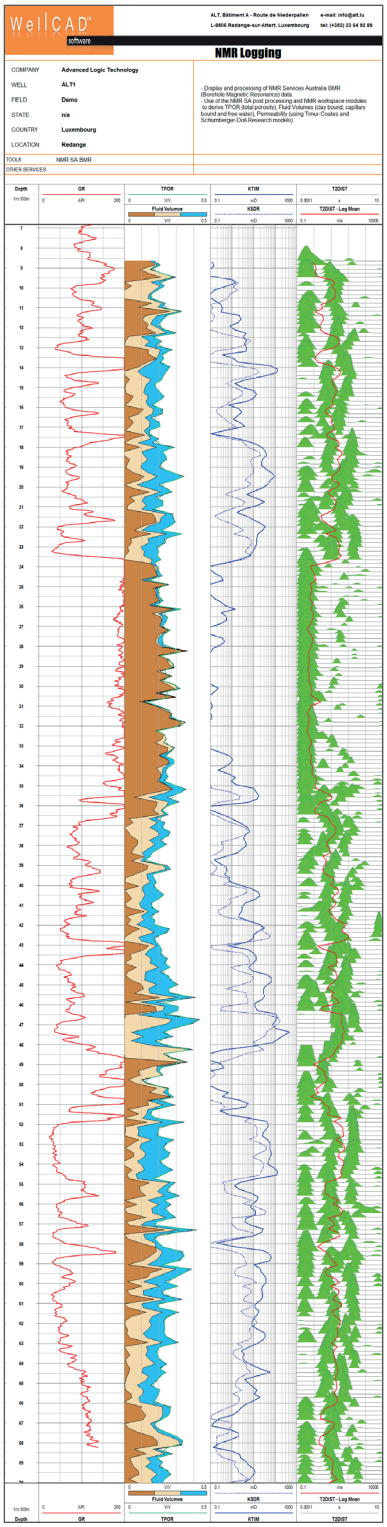
WellCAD™ NMR Data Processing Module

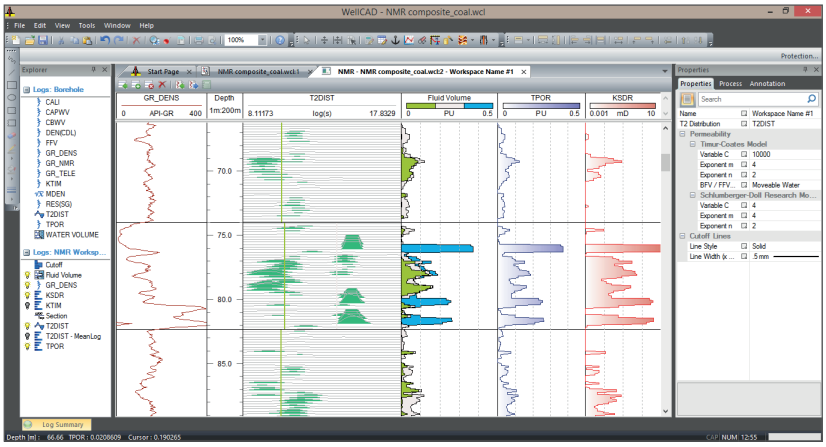
NEW

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

- total porosity
- fluid volumes
- permeability (Timur Coates and SDR)
- 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.



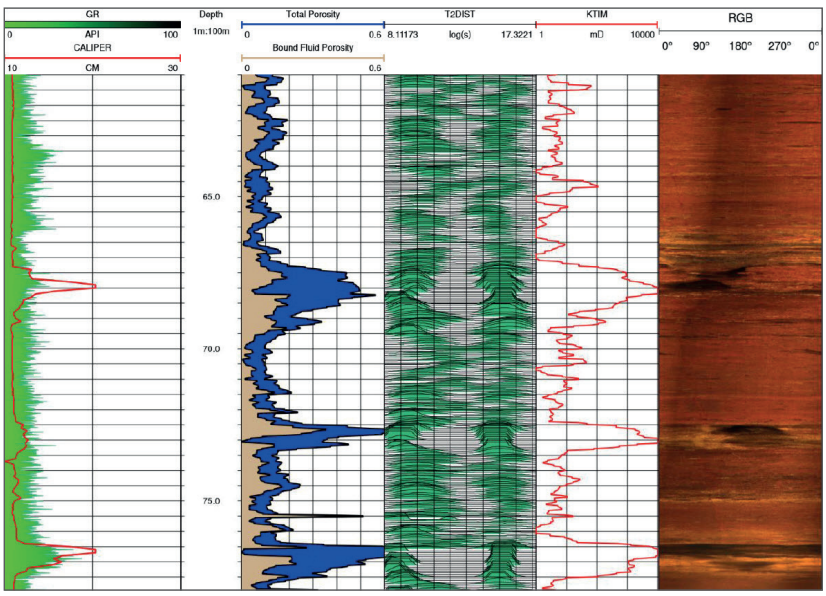


NMR workspace

BMR tool post processing

NMR SERVICES AUSTRALIA

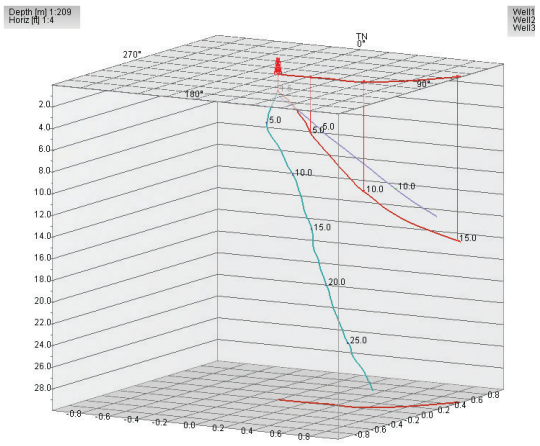
A special upgrade for the NMR Data Processing module is available to post-process data from the latest Borehole Magnetic Resonance (BMR) tool released by NMR Services Australia.

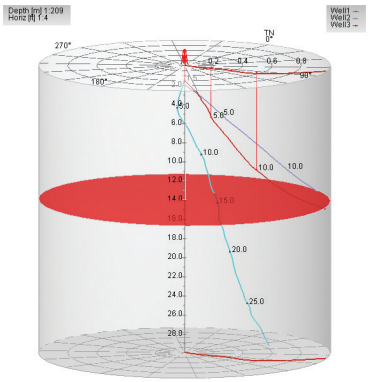


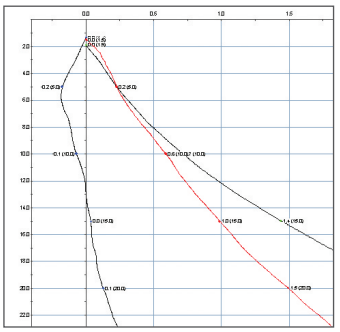
Hydraulic conductivity driven by vugs and fractures

WellCAD™ Deviation Data Display

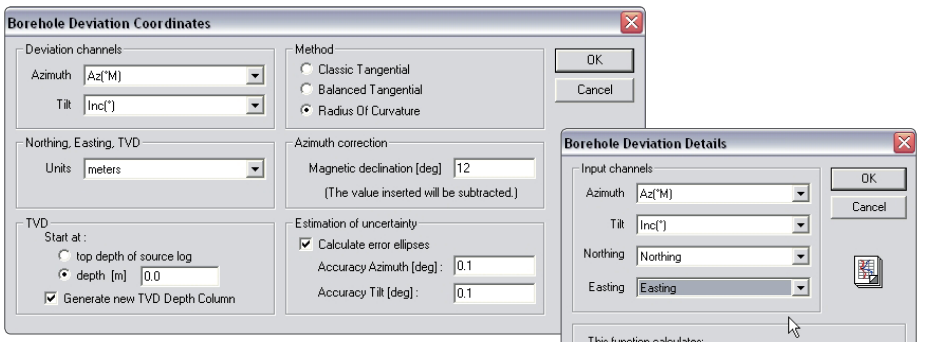
The module includes various 2D and 3D display options for deviation data from classical bull's eye, projection and closure 2D views to 3D cubic and cylindrical displays. Each view comes with its own settings and options. Multiple well paths and target layers can be displayed.

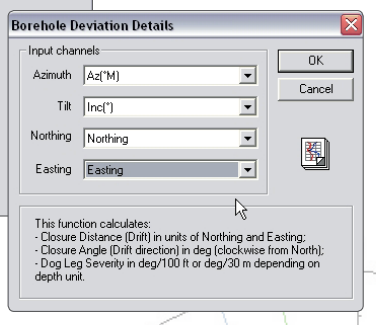


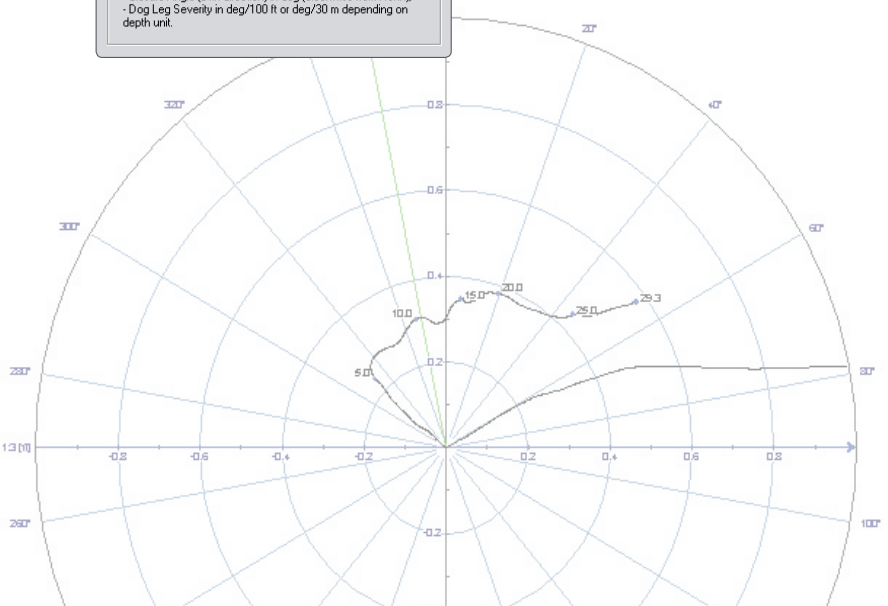




The methods for computing x,y,z coordinates from borehole azimuth and tilt are provided in the WellCAD™ basic process (classic tangential, balance tangential, radius of curvature, minimum curvature).

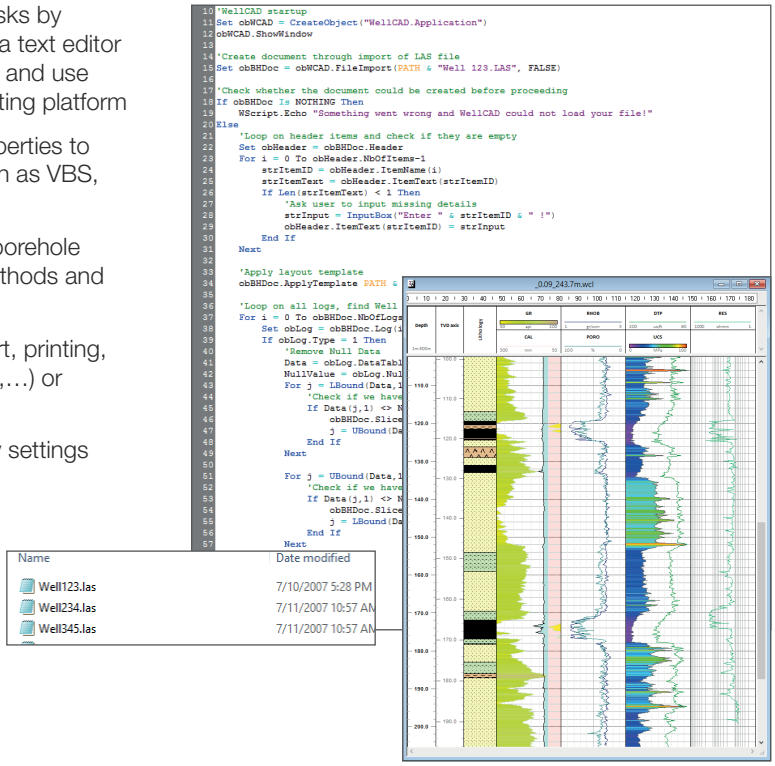




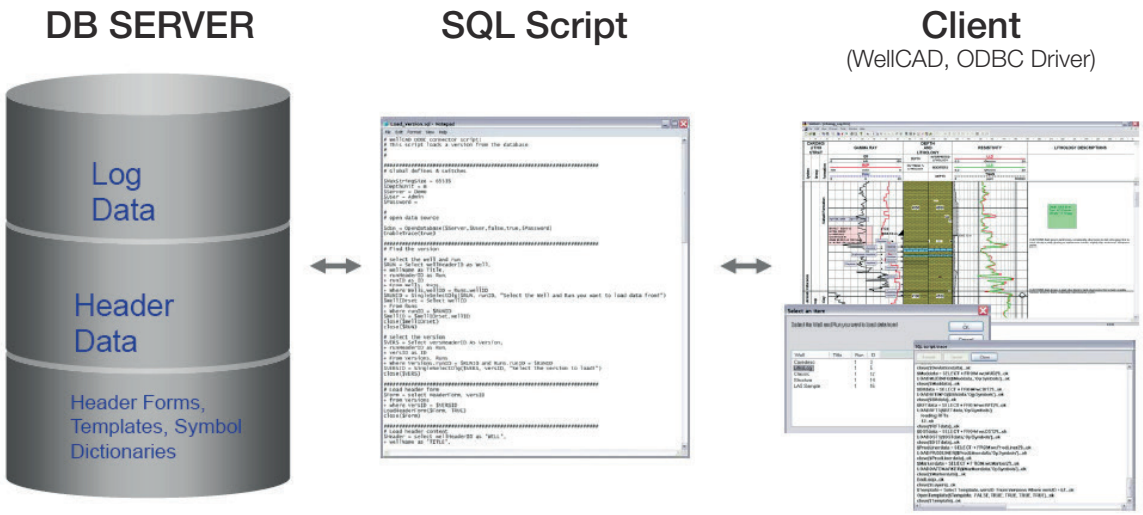


WellCAD™ Automation

- 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#
- 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



WellCAD™ ODBC Connection Module

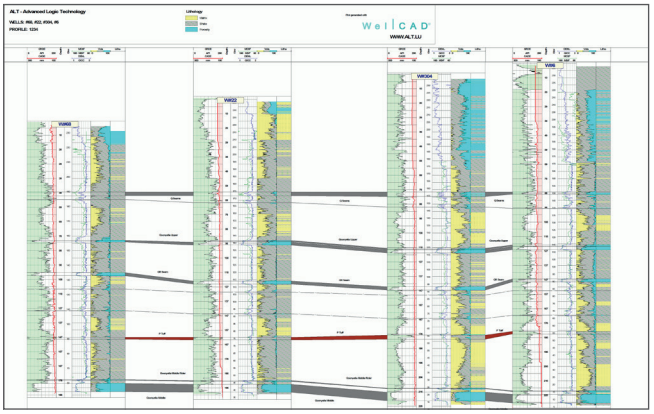


The ODBC connection module allows WellCAD to pull data from and push data to an ODBC compatible database. Database administrators or skilled users have to write their own SQL scripts to control the data transfer between WellCAD and the data base. A collection of WellCAD specific properties and methods 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.

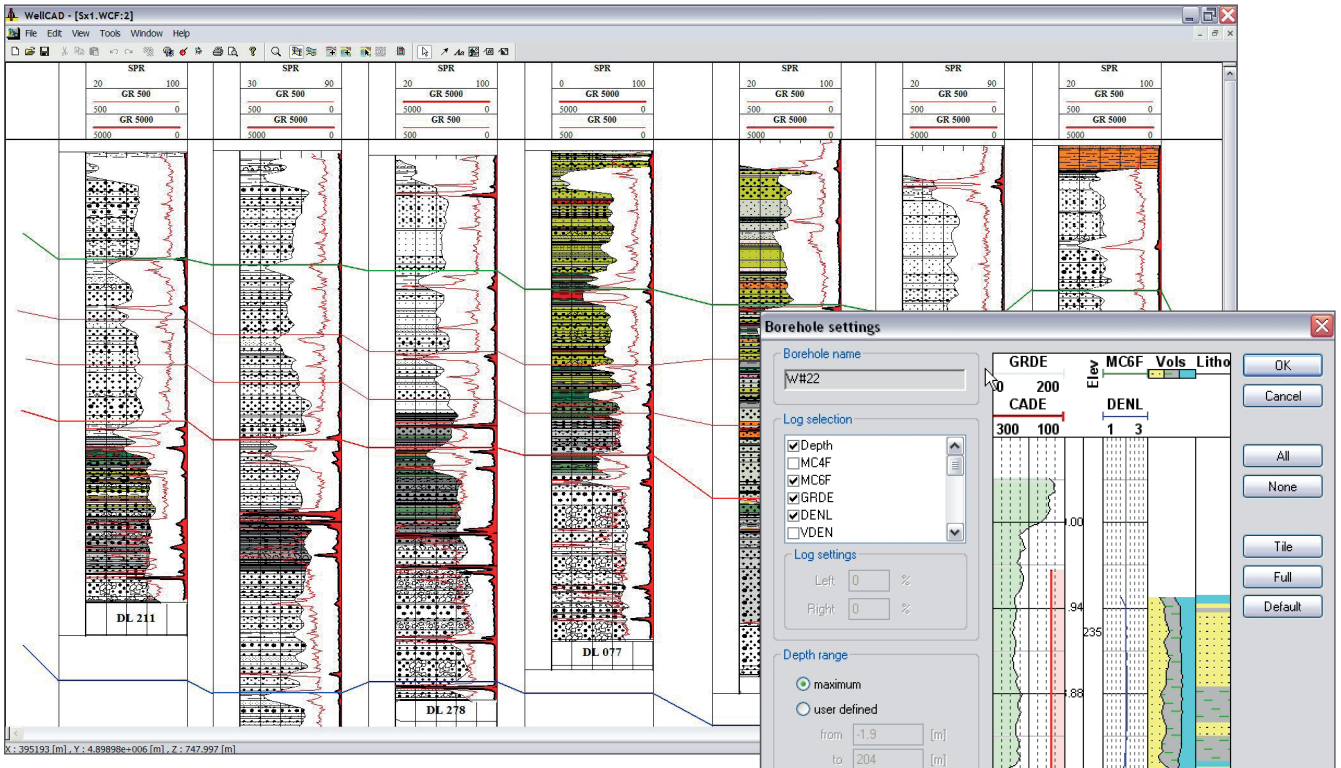
WellCAD™ Multiwell

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



OrthoView

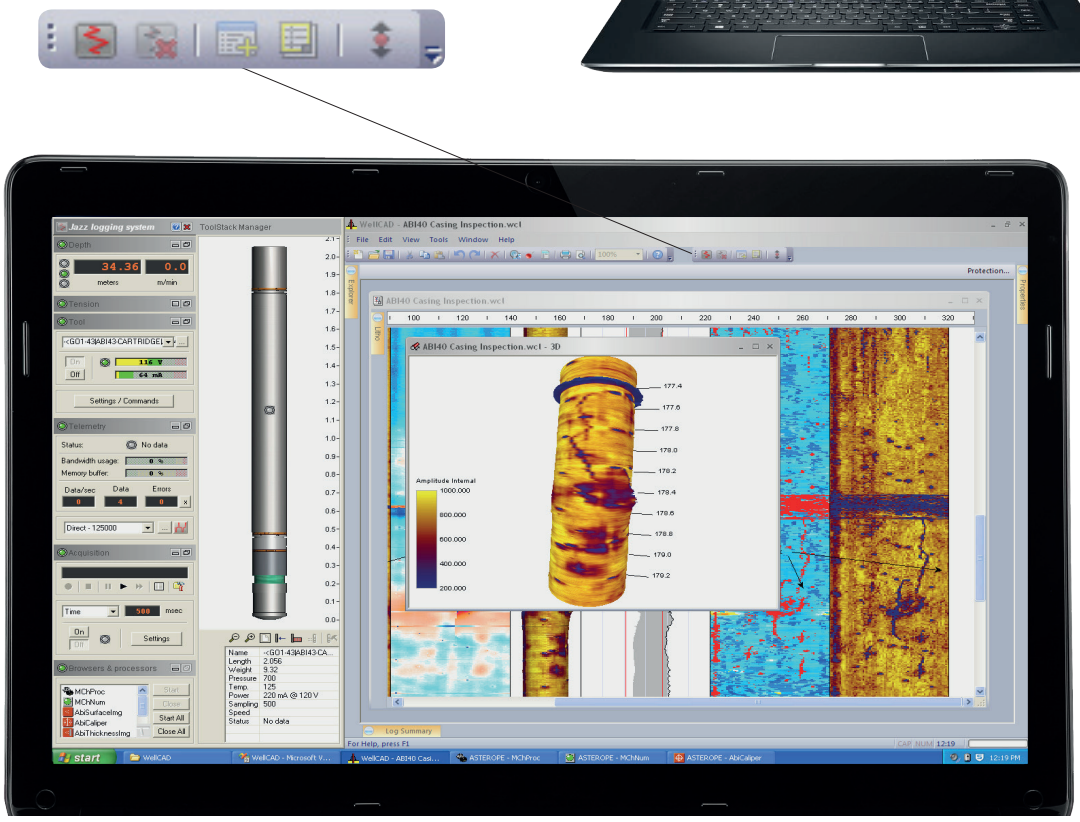
Individual well stick options

WellCAD™ browser

From LoggerSuite* into WellCAD™ in real-time.

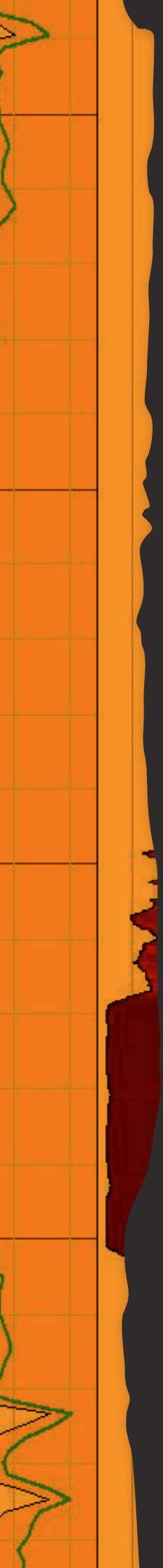
WellCAD browser add-on module allows a real-time connection between the WellCAD data processing platform and the logger.

- 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.



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