

WellCAD™

The Universal Borehole Data Toolbox

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,...
- Specialized Workspaces for Image & Structure Interpretation, FWS data, core description, multi-well correlation,...
- Cased Hole Interpretation Workspace (available in 2016)
- 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
- New 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

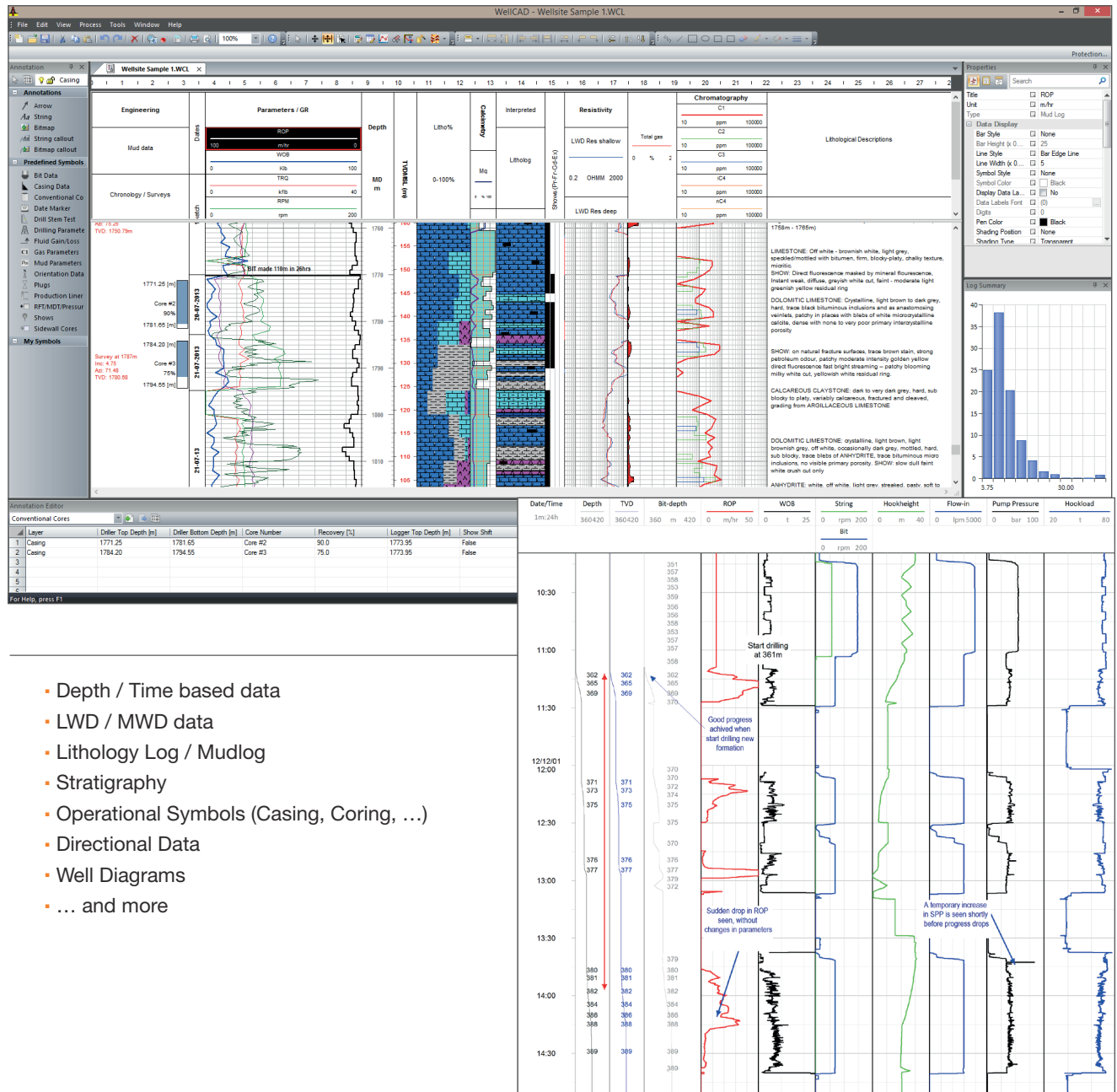
Name	Type	Description
WellCAD™ Basic	Main Application	The Basic version provides the foundation for data management, analysis and presentation. It allows creation of comprehensive log displays and is the base to activate any Expert Modules.
CoreCAD™	Add-on	Interactive digital core description workspace for WellCAD™.
ISI (Image & Structure Interpretation) Workspace	Add-on	Single, build for purpose workspace combining manual and automated structure picking, classification, correction and interpretation into a single workflow.
FWS	Add-on	A collection of pre build processes for the processing of Full Waveform Sonic data.
Deviation	Add-on	A collection of 2D and 3D display options for survey data.
Automation	Add-on	An application programming interface allowing 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

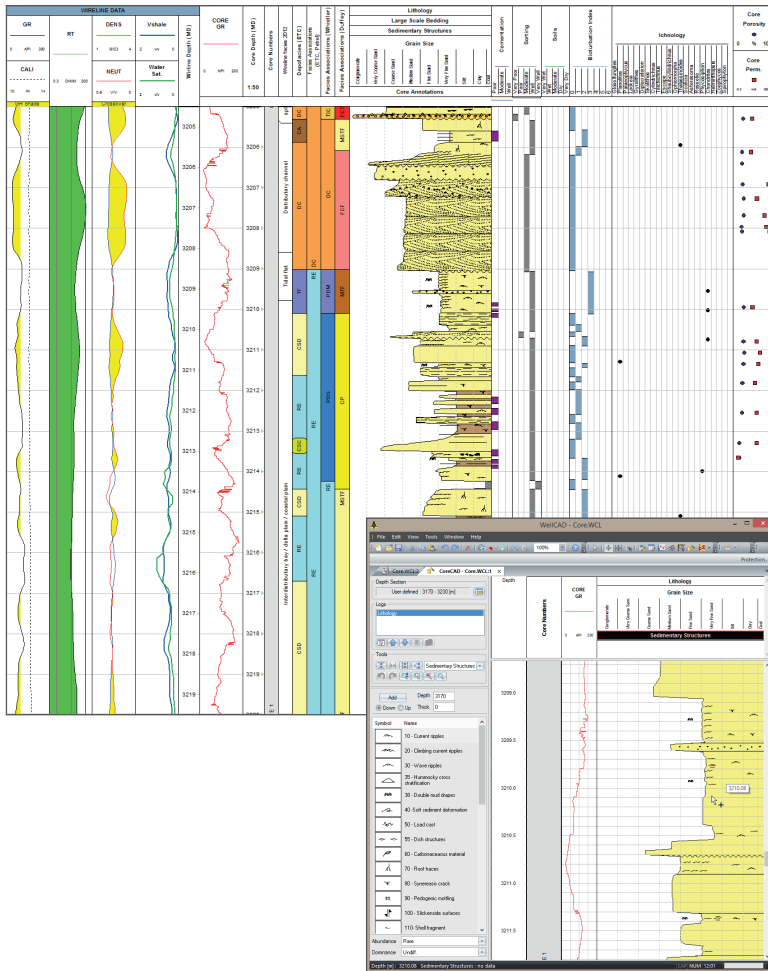


- Depth / Time based data
- LWD / MWD data
- Lithology Log / Mudlog
- Stratigraphy
- Operational Symbols (Casing, Coring, ...)
- Directional Data
- Well Diagrams
- ... and more

Time Based Log

Core Description

Clastic Core Log

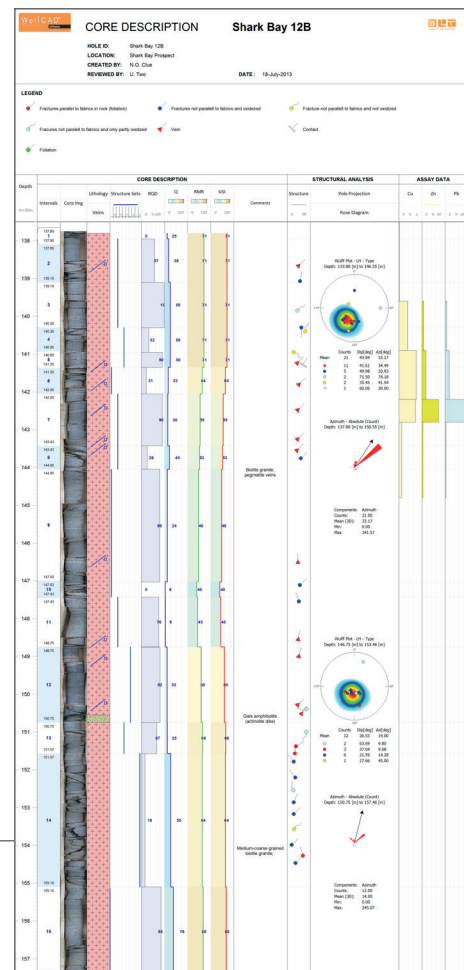


Core Description Workspace

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

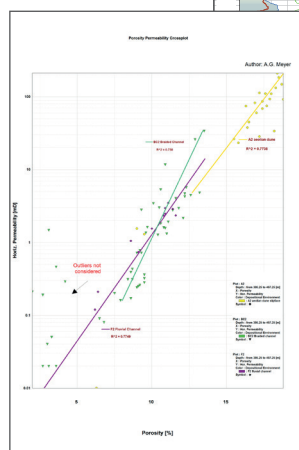
Log Analysis

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

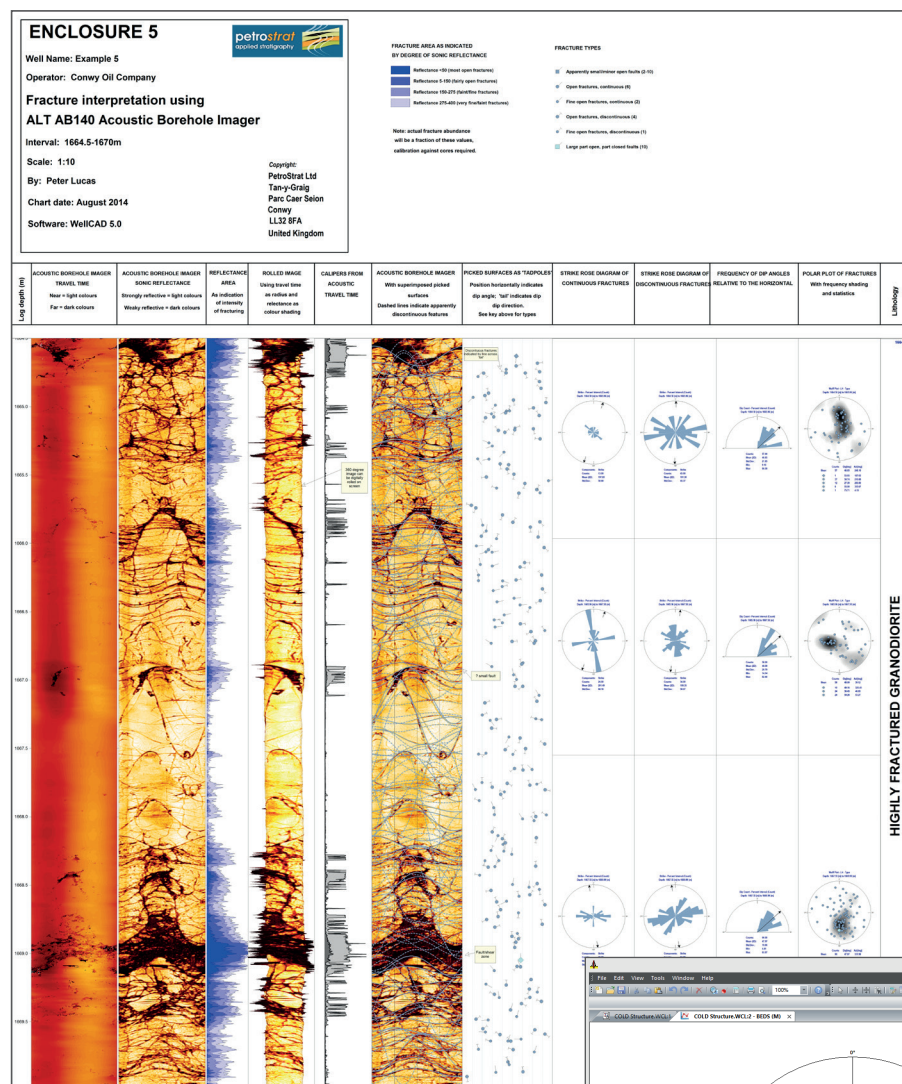
Flowmeter Analysis



Poro-Perm Crossplot

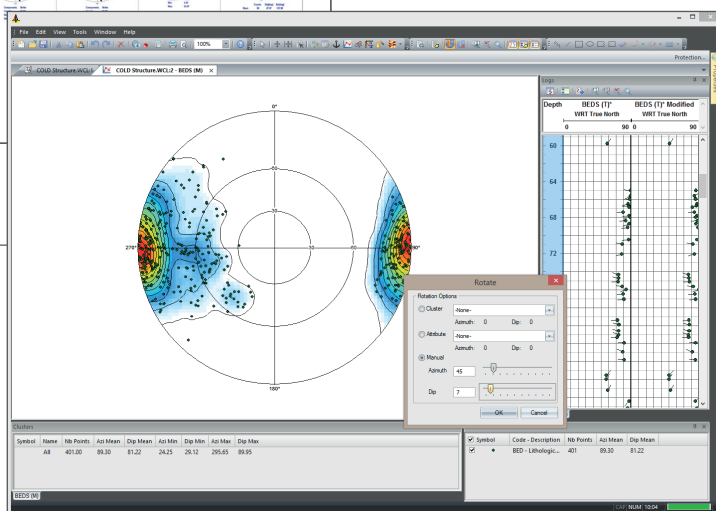
Image & Structure Interpretation

ATV Structure Analysis Plot



Acoustic and Optical
Televiewer data
FMI type data
MWD Image data
3D Core Scans

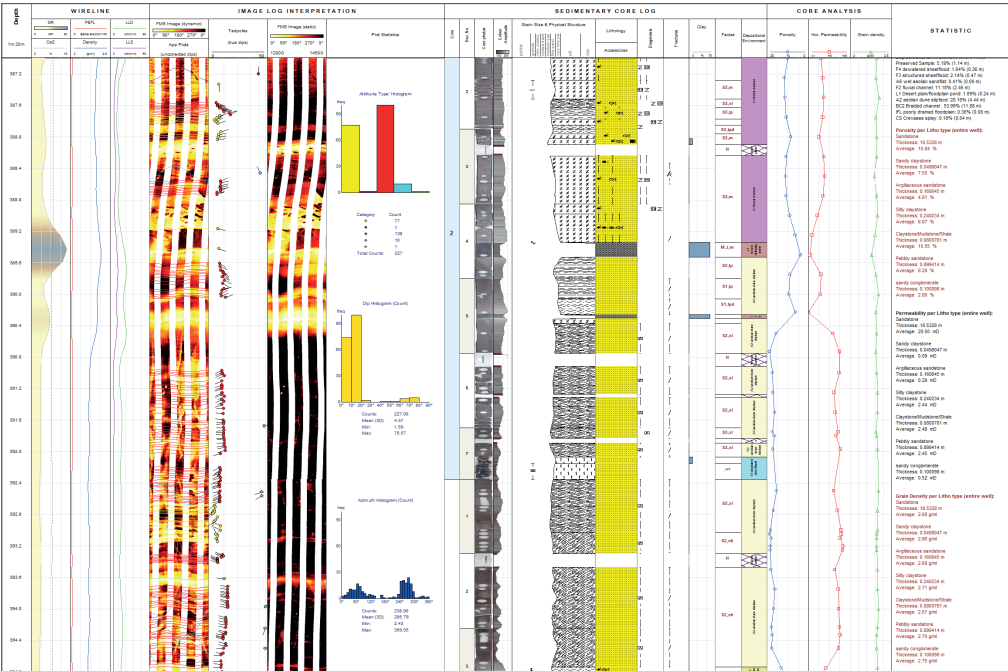
- Planar, linear and free hand structure picking
- Computer assisted and manual picking
- Apparent and corrected picks
- Custom pick classification
- Polar Projection diagrams
- Rose and Vector plots
- Structure interval statistics
- ... and more



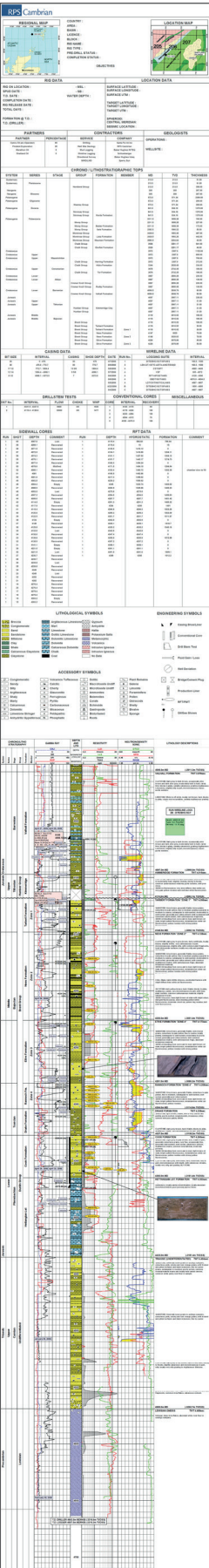
Dips Workspace

Composite Plots

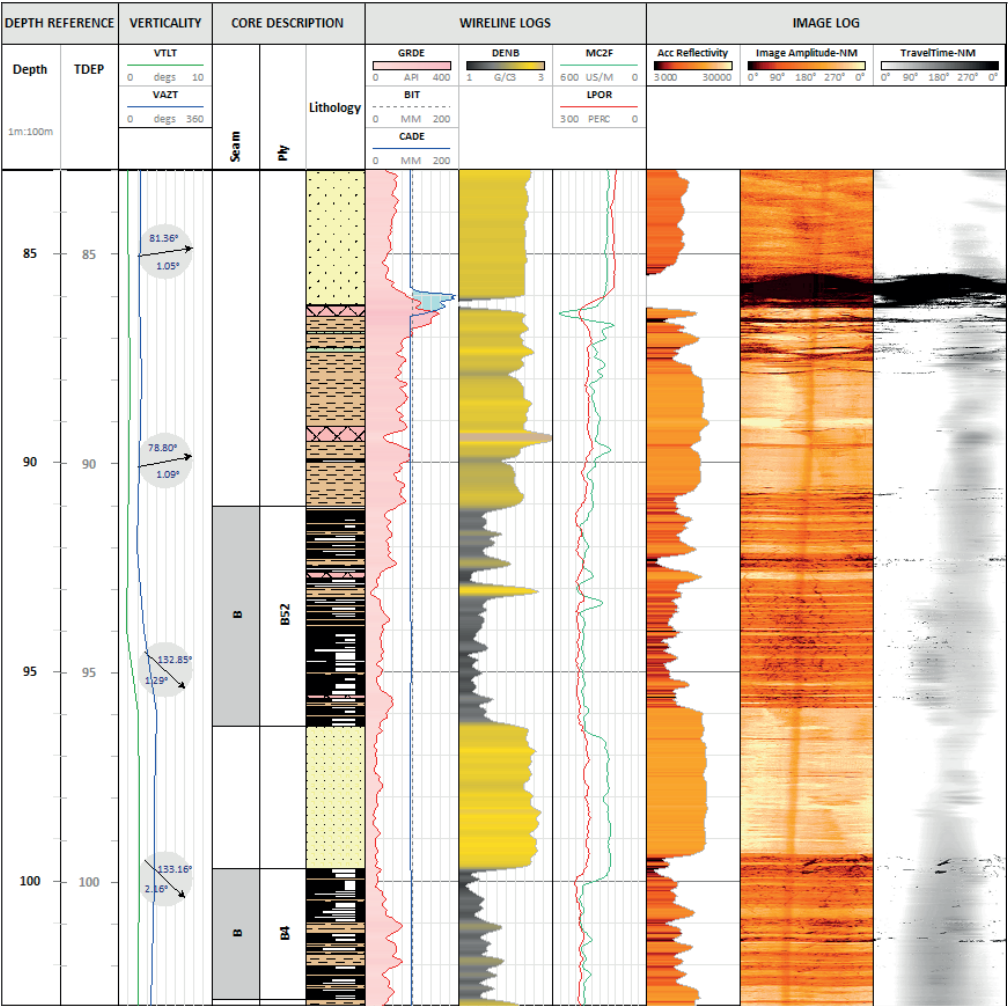
Composite Plot: Oil & Gas



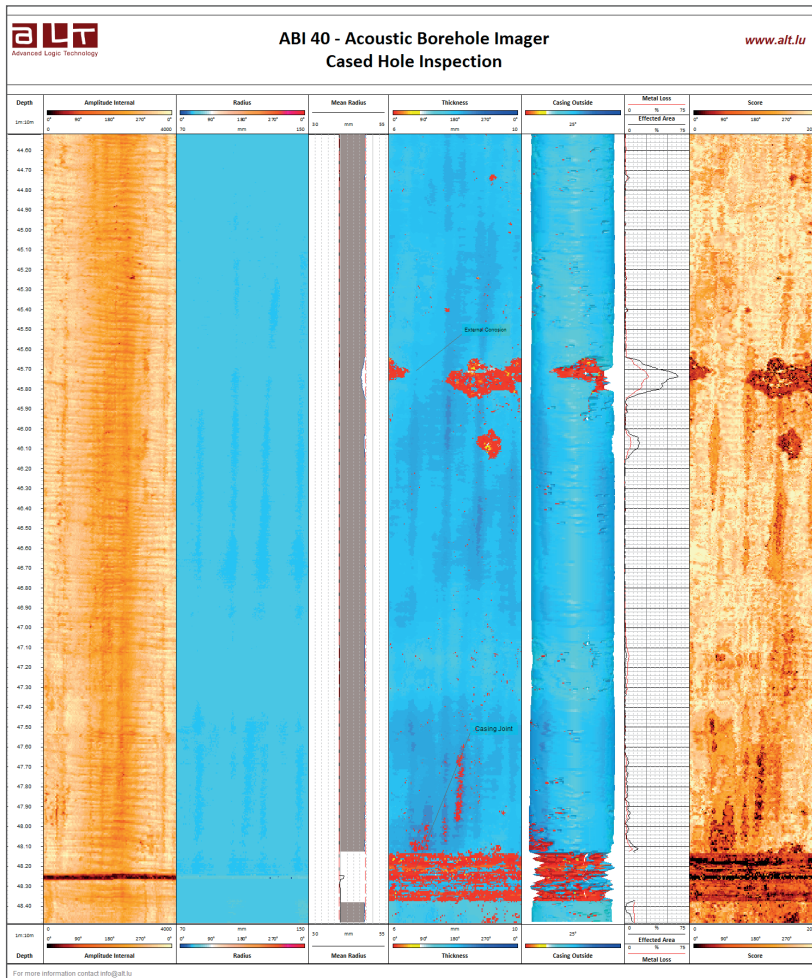
Composite Plot: Wellsite



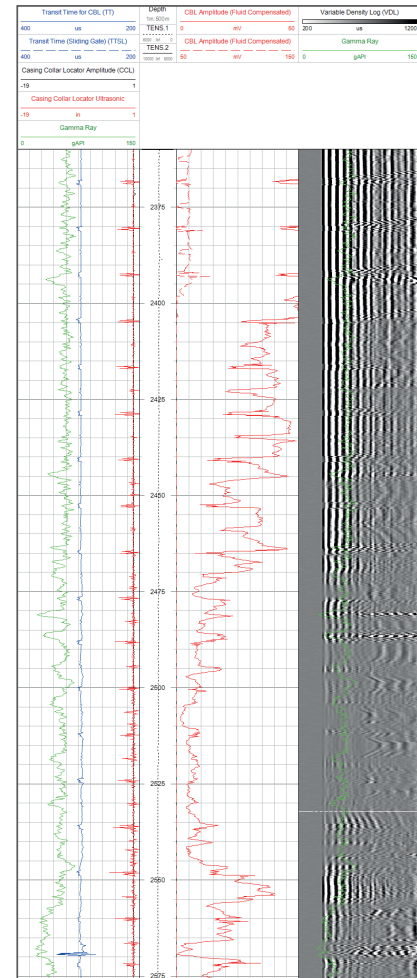
Composite Plot: Coal Mining



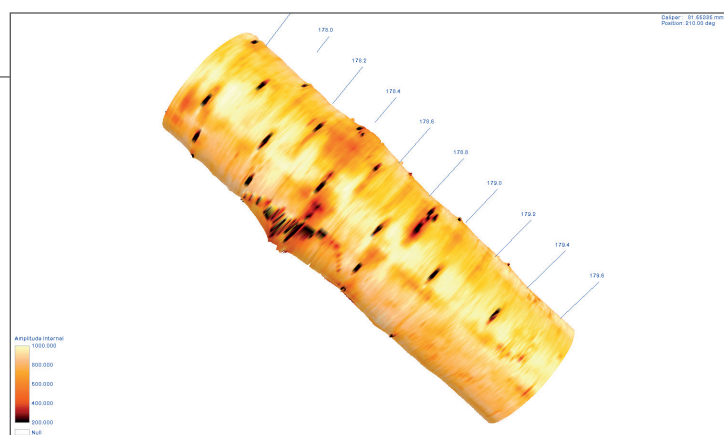
Acoustic Televiewer Well Integrity Plot



CBL Plot



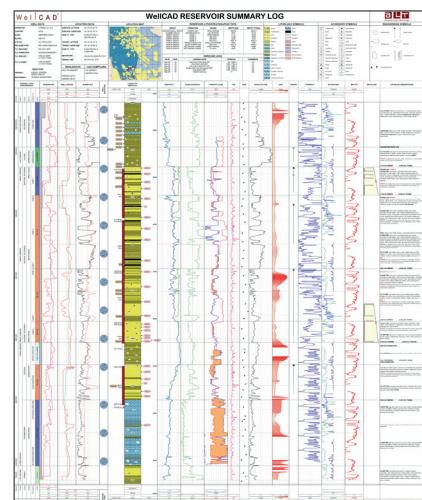
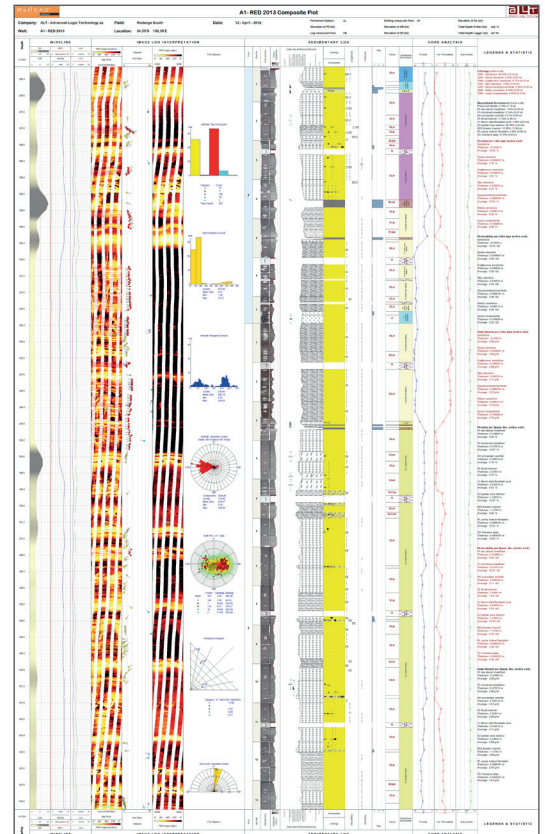
- MFC, CBL and Ultrasonic Imager data handling
- Array data editing, filtering, centralization, recalibration
- 2D and 3D representation of data
- Fluid velocity estimation, acoustic caliper and casing thickness determination
- Cement bond evaluation
- ... and more



Well Integrity 3D View

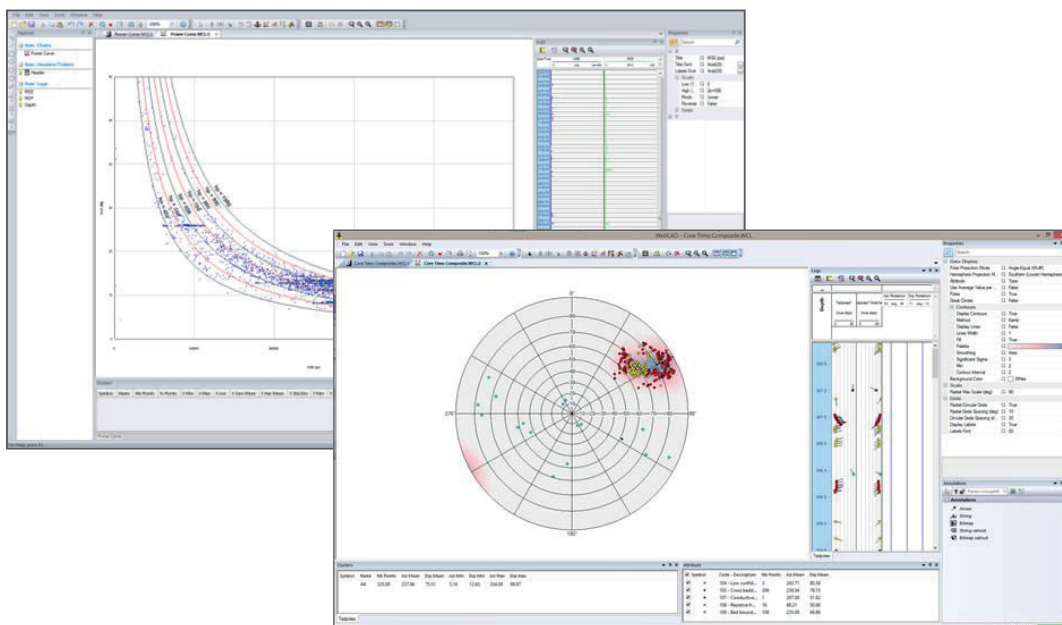
Data presentation

- 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 structure, fossils, pore types, ...) are provided. The freely distributed LithCAD application allows design and import of new patterns and symbols.

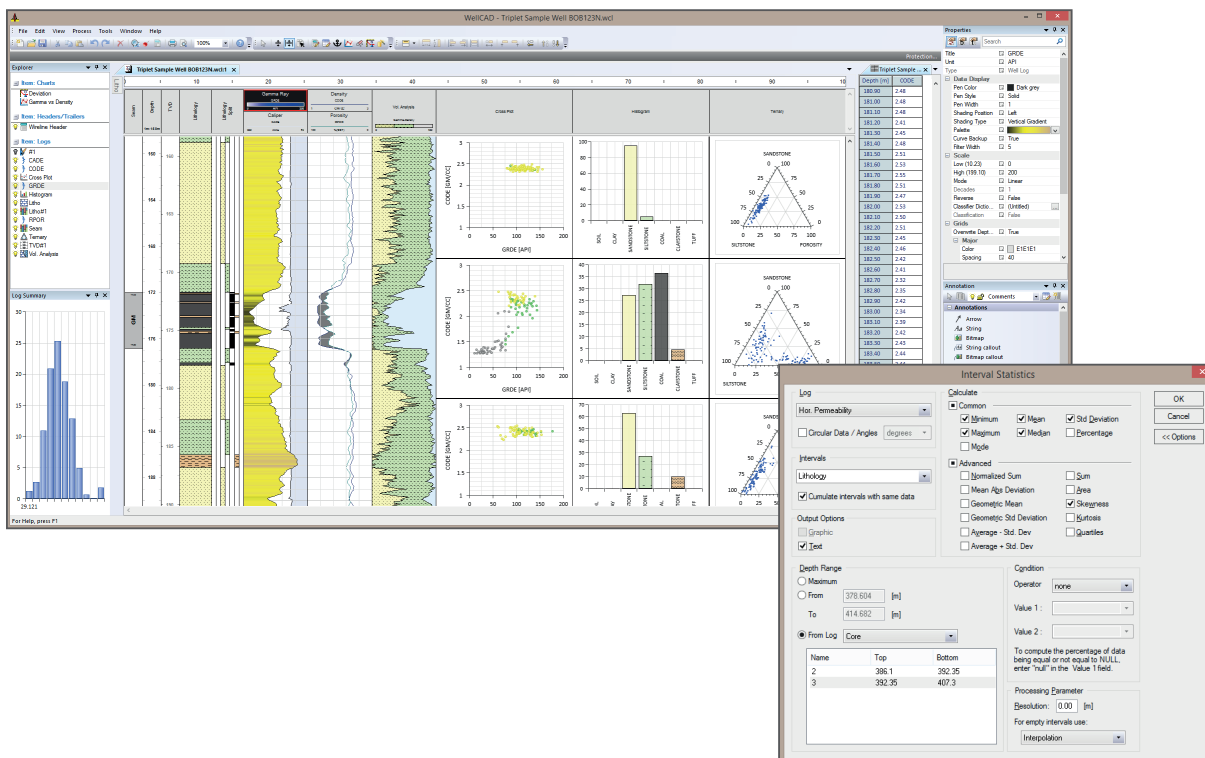




Data interpretation



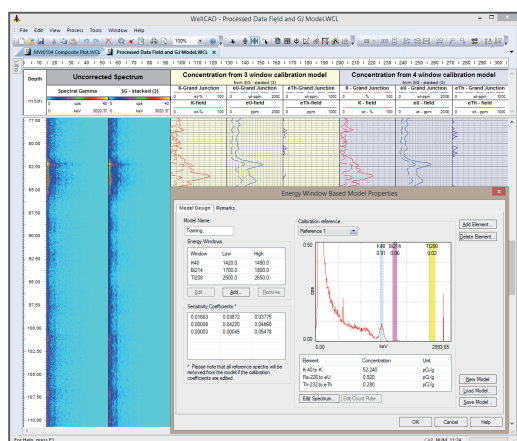
- Cross plotting workspace (up to 4 components, clustering, overlay and regression options).
- Chart Log for cross plots, ternary diagrams and histograms as part of the report.
- Workspace for dip data (rose, polar projection, walkout and woodcock diagrams).
- Tracking and statistic bars for interactive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

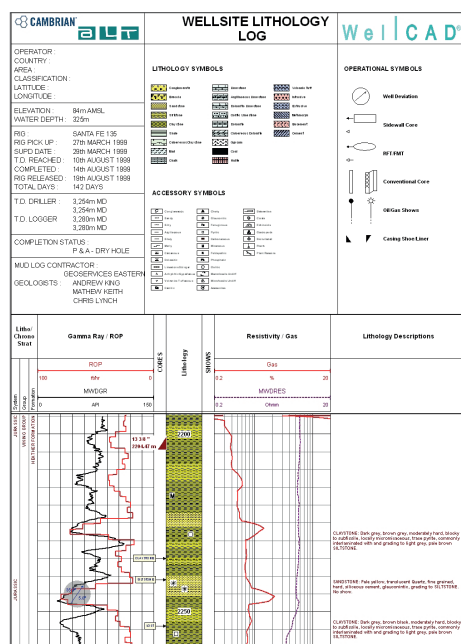


The 'Borehole Deviation Coordinates' dialog box is shown. It has tabs for 'Deviation channels', 'Method', and 'Background'. The 'Deviation channels' tab is active, showing 'Azimuth' and 'Tilt' channels. The 'Method' tab shows options for 'Classic Tangential', 'Balanced Tangential', 'Radius Of Curvature', and 'Minimum Curvature'. The 'Background' tab shows 'Azimuth correction' and 'TVD' settings.

- 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.



The 'Annotation Properties' dialog box is shown. It has tabs for 'Symbol Position', 'Pen', and 'Background'. The 'Symbol Position' tab is active, showing 'Data' and 'RFT / MDT / Pressure Data' settings. The 'Data' section shows 'Depth: 4151.70 m' and 'Display: Run: 1, Test: 5'. The 'RFT / MDT / Pressure Data' section shows 'Pressure: 0962.70' and 'Rating: Default'.

The 'Engineering Data Editor' dialog box is shown. It has a table with columns: 'Depth [m]', 'Run', 'Test', 'Pressure', 'Press Unit', and 'Rating'. The table contains 20 rows of data.

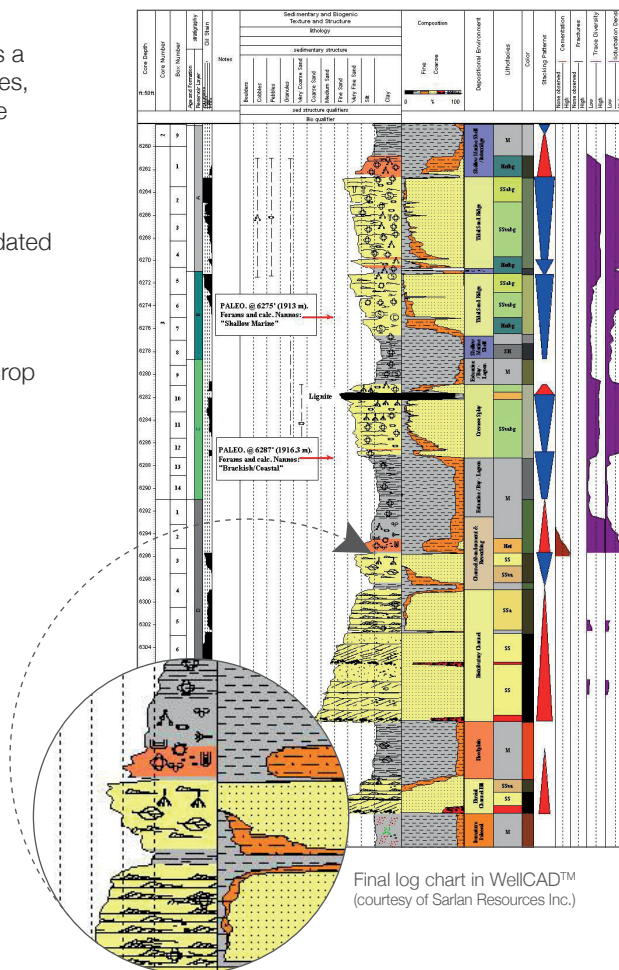
Depth [m]	Run	Test	Pressure	Press Unit	Rating
1	4113.27	1	8930.50	Default	
2	4115.40	1	8935.50	Default	
3	4125.50	1	8935.30	Default	
4	4134.10	1	8945.00	Default	
5	4141.10	1	8951.90	Default	
6	4151.70	1	8962.70	Default	
7	4163.30	1	9002.20	Default	
8	4171.50	1	9062.40	Default	
9	4183.40	1	9002.20	Default	
10	4185.30	1	9007.60	Default	
11	4217.30	1	9030.40	Default	
12	4229.20	1	9041.00	Default	
13	4245.00	1	9056.20	Default	
14	4263.90	1	9075.00	Default	
15	4275.60	1	9091.40	Default	
16	4284.60	1	9098.60	Default	
17	4287.70	1	9102.50	Default	
18	4291.30	1	9106.50	Default	
19	4296.80	1	9111.70	Default	
20	4299.30	1	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.

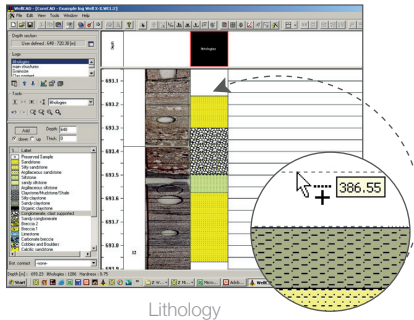


- Allows easy and efficient digital and graphical description of cores
- All parameters described graphically are stored as real digital data – ready to export
- Multiple depth system management
- Import core photographs
- Import hand drafted core descriptions, digitise the data or integrate them into composite log charts
- Fully customisable system for easy and quick creation of all core description data types from biostratigraphy, to diagenetic minerals & depositional subenvironment

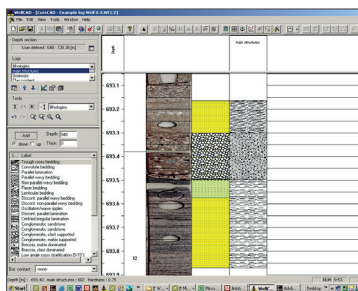
CoreCAD workspace

Typical clastic core description workflow

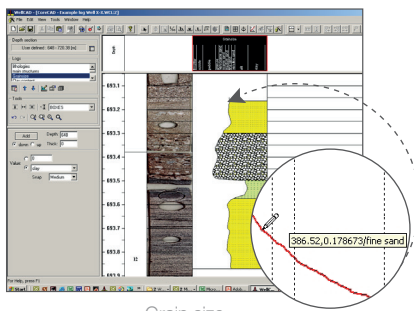
The CoreCAD workspace provides an interactive environment to describe user defined depth intervals (e.g. boxes or outcrops) in detail. The final core description chart is updated in real time with data acquired in CoreCAD.



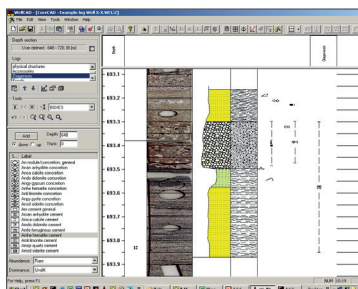
Lithology



Sedimentary structures



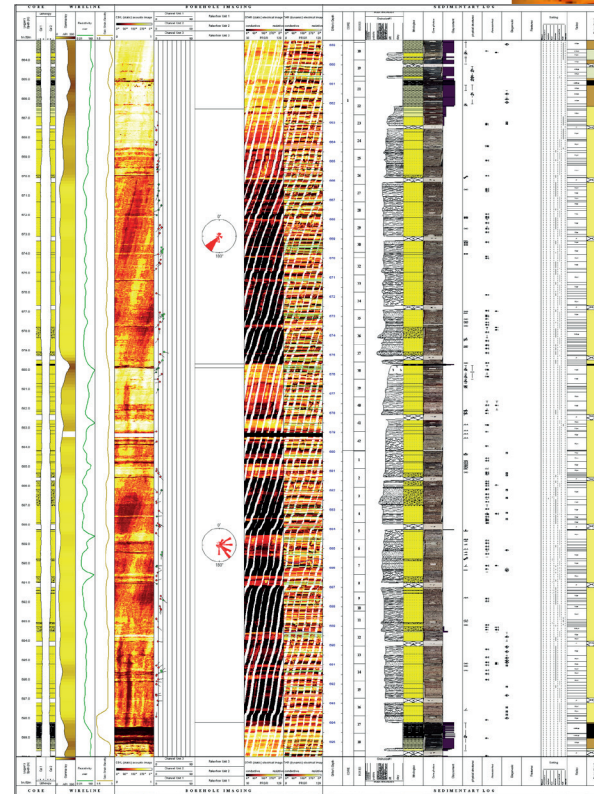
Grain size



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.



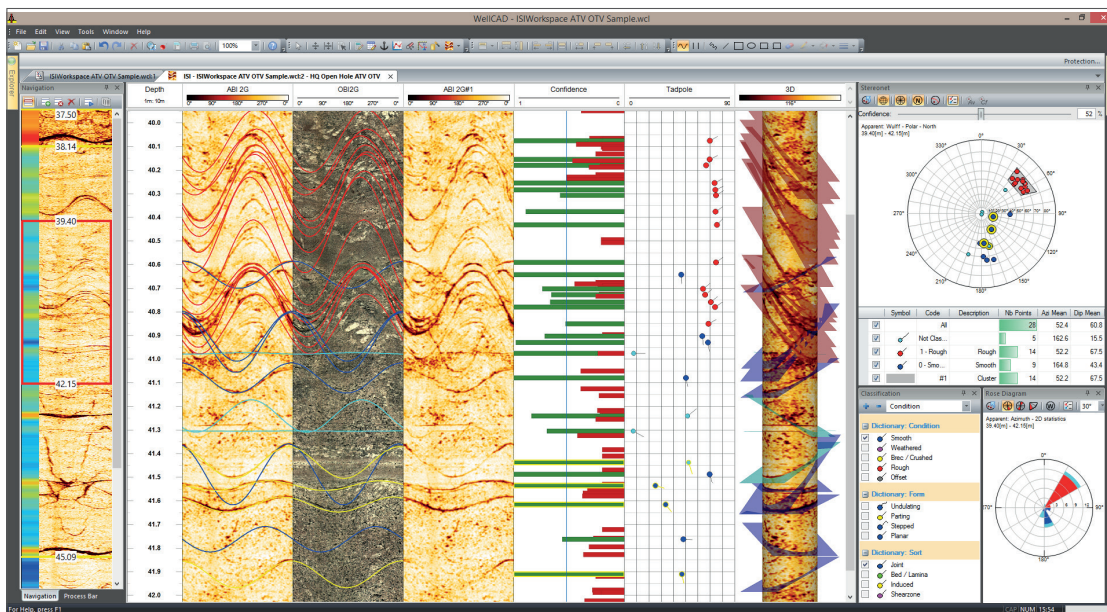
Final log chart in WellCAD™ (courtesy of PanTerra Geoconsultant)

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) Workspace is a new add-on module for WellCAD™ incorporating and extending the functionality of the old Image module. ISI is a single, build-for purpose workspace combining structure picking, classification, correction and interpretation into a single workflow.

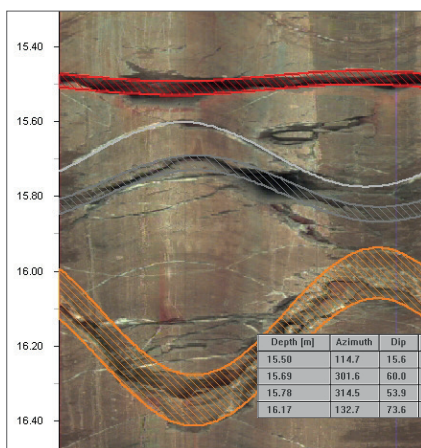


The Image & Structure Interpretation (ISI) Workspace combines manual and automated structure picking tools, sophisticated data visualization and a logical workflow into a powerful, build for purpose processing and interpretation platform.

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



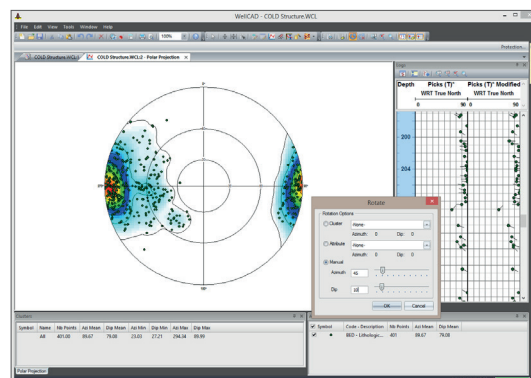
THE UNIVERSITY OF
WESTERN AUSTRALIA



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, STAR and Sondex MIT are supported.

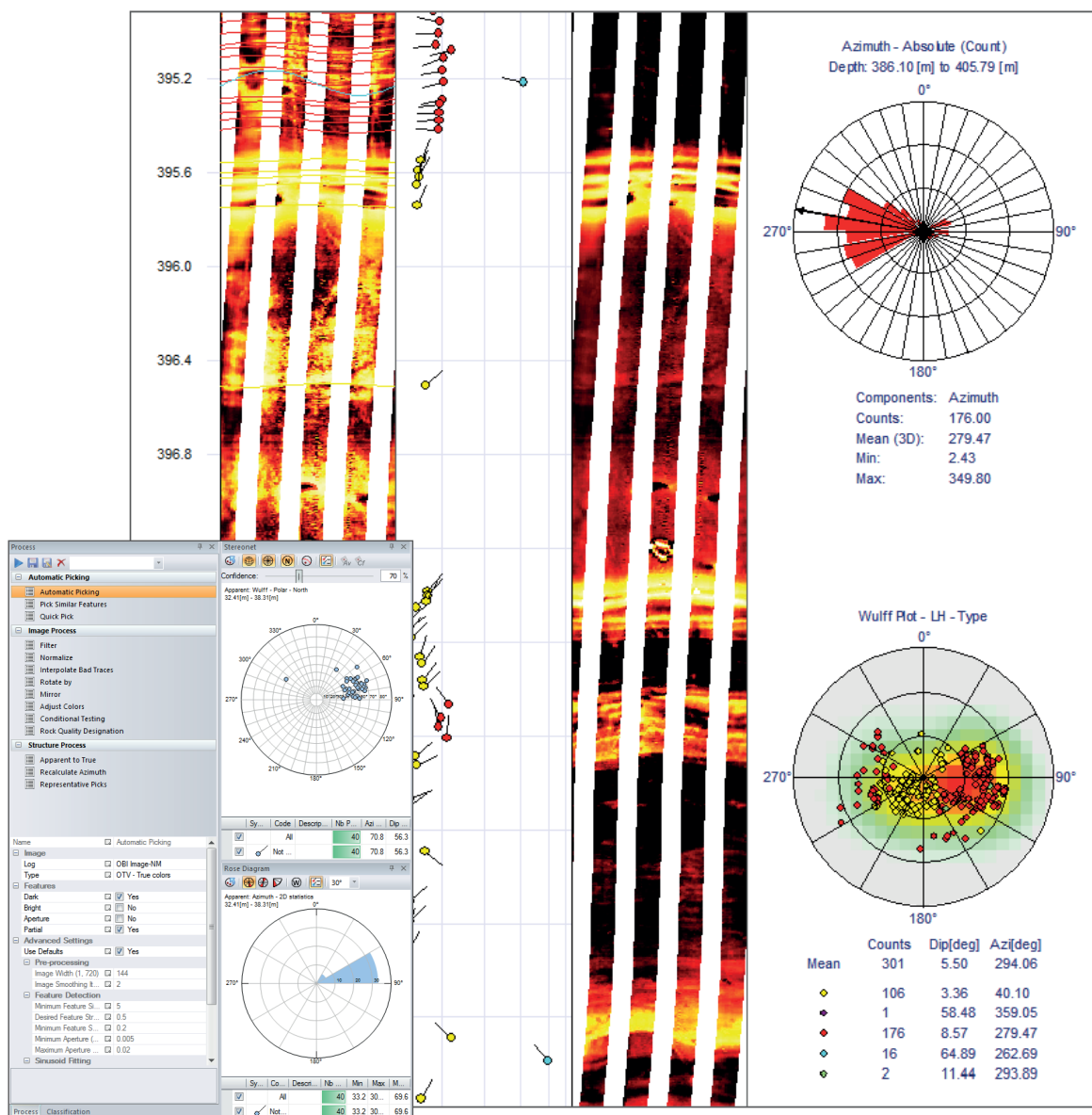
Data processing

Before any form of analysis is performed, the data needs to be processed. This involves the creation of a reliable high quality image from raw tool measurements.

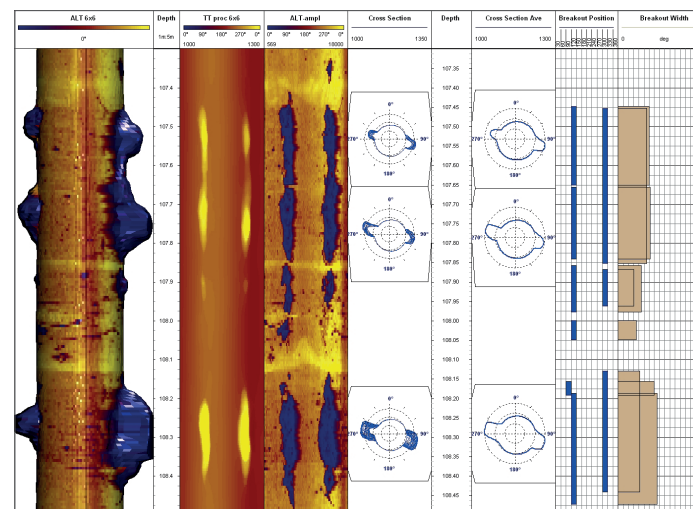
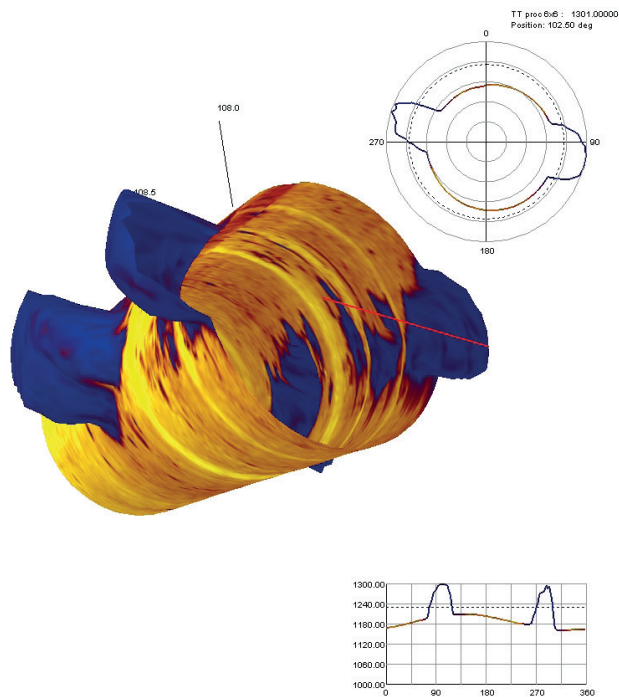
A number of processing options are available for enhancing the quality of the data.

These include :

- Bad trace interpolation
- Image normalisation
- Despiking filters
- Centralise image
- Adjust brightness and contrast (for RGB logs)

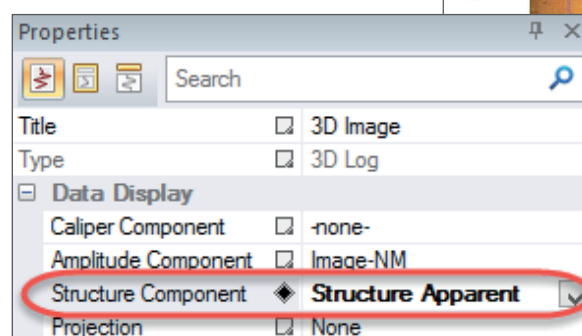
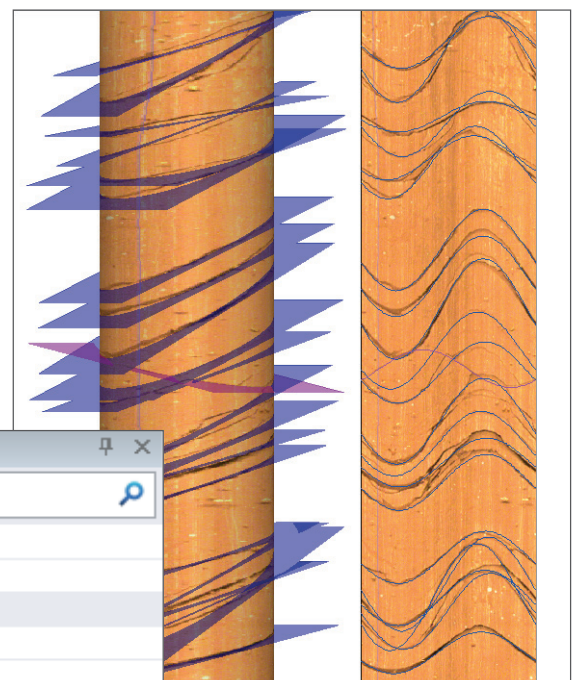


Data presentation



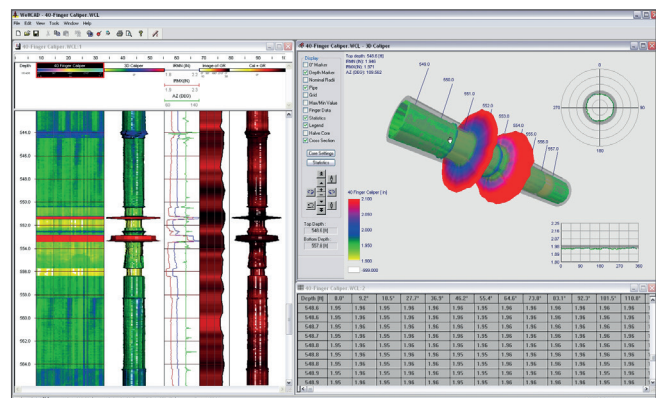
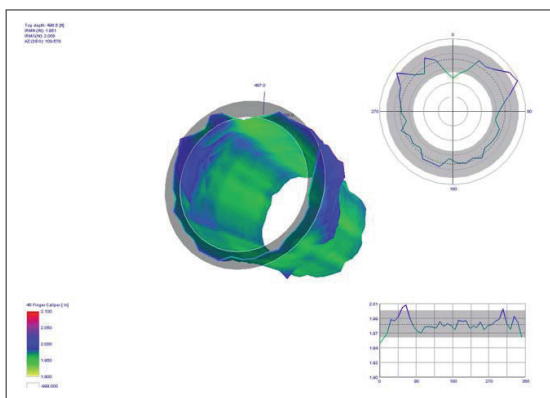
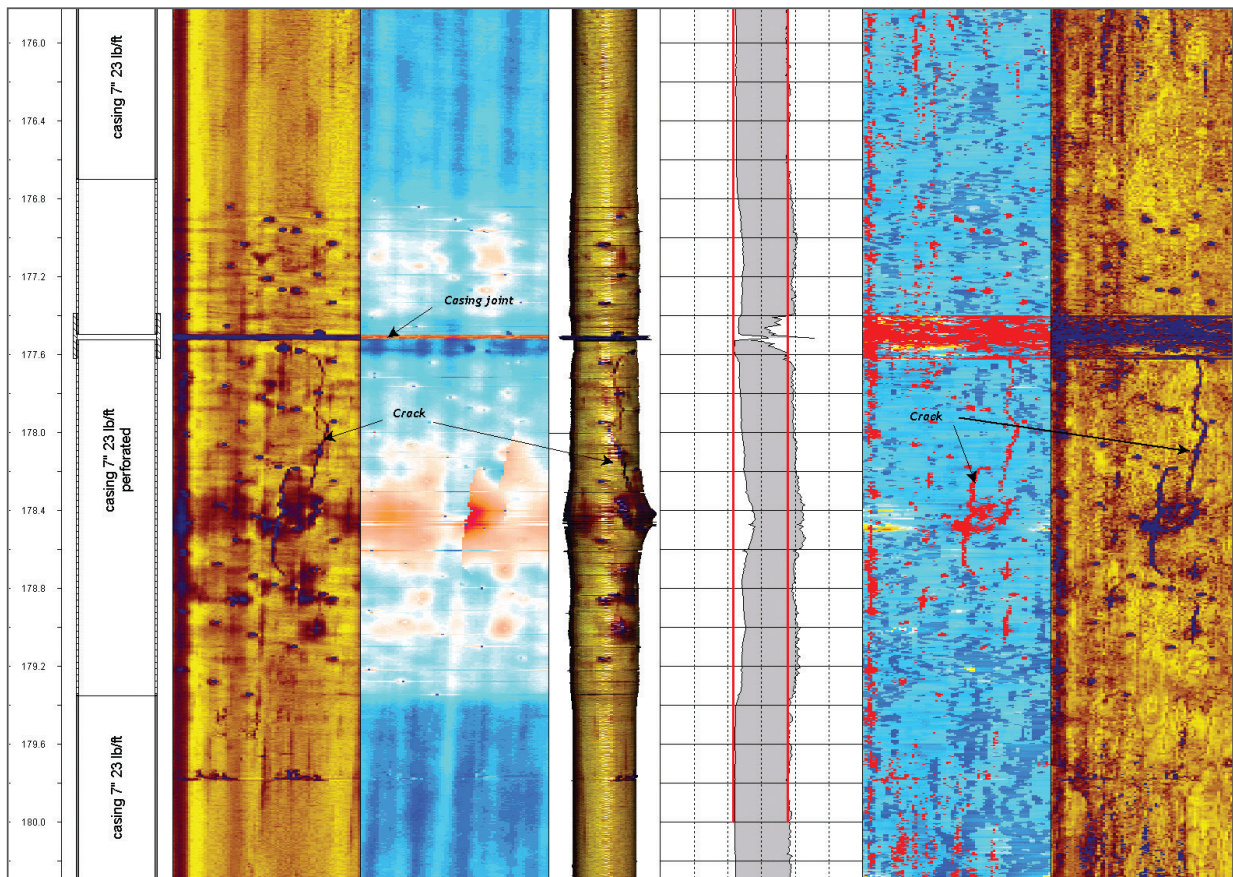
Acoustic televiewer breakout measurement

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).



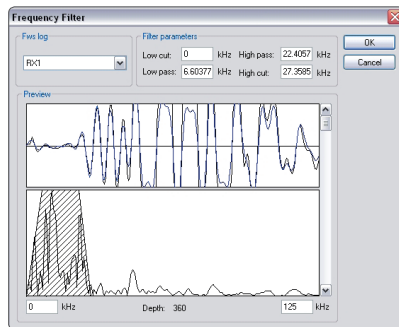
Corrosion evaluation

Mapping distribution, configuration, orientation and severity of corrosion through the entire borehole. WellCAD™ 3D data virtual borehole reality can help to identify internal deposits, localize pipe deformity or pipe buckling. The software includes specific processes such as metal loss calculation for multi-arm calliper.



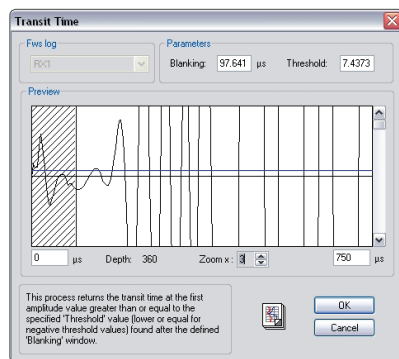
WellCAD™ Full waveform sonic

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.



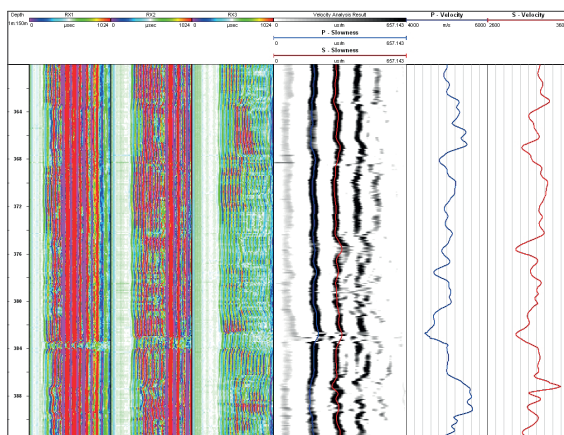
Preprocessing

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.

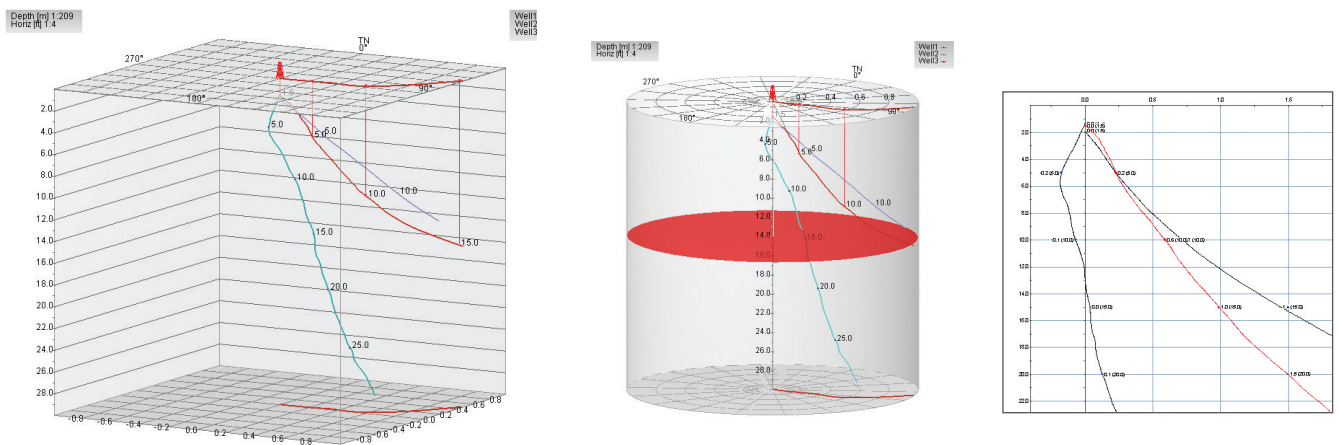


Velocity analysis

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

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).

Borehole Deviation Coordinates

Deviation channels
Azimuth:
Tilt:

Northing, Easting, TVD
Units:

TVD
Start at:
☐ top depth of source log
☒ depth [m]
☒ Generate new TVD Depth Column

Method
☐ Classic Tangential
☐ Balanced Tangential
☒ Radius Of Curvature

Azimuth correction
Magnetic declination [deg]:
(The value inserted will be subtracted.)

Estimation of uncertainty
☒ Calculate error ellipses
Accuracy Azimuth [deg]:
Accuracy Tilt [deg]:

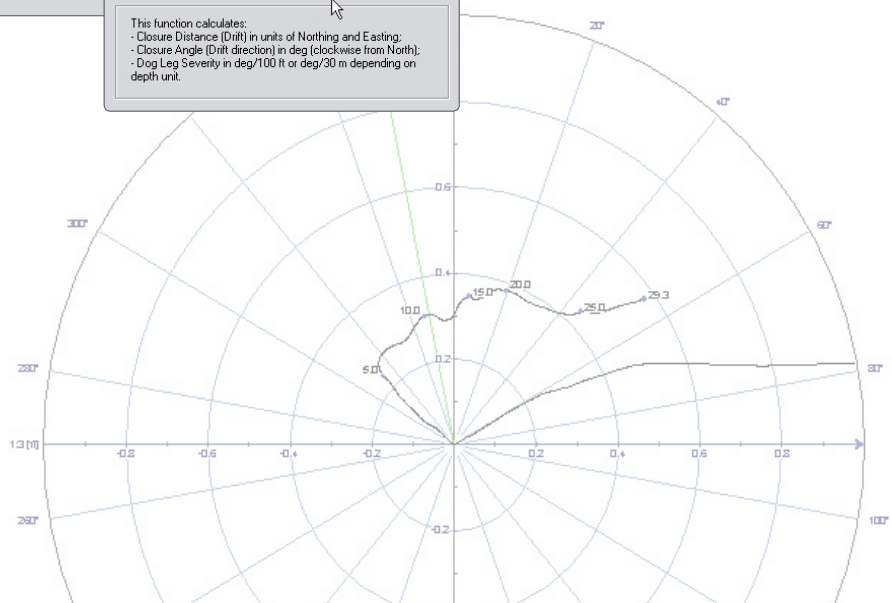
OK
Cancel

Borehole Deviation Details

Input channels
Azimuth:
Tilt:
Northing:
Easting:

OK
Cancel

This function calculates:
- Closure Distance (Drift) in units of Northing and Easting;
- Closure Angle (Drift direction) in deg (clockwise from North);
- Dog Leg Severity in deg/100 ft or deg/30 m depending on depth unit.



WellCAD™ Automation

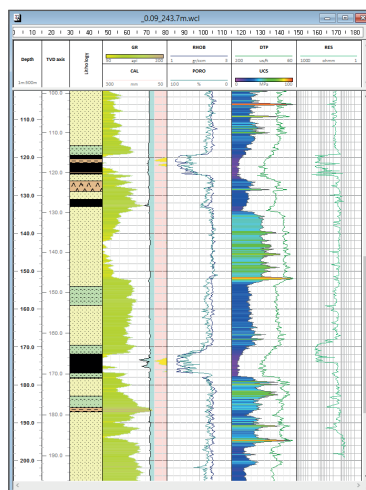
- Automate data loading and data processing tasks by writing simple Visual Basic Scripts (VBS) using a text editor or develop new processing algorithms in VC++ and use WellCAD™ as your data visualization and reporting platform.
- WellCAD™ exposes Objects, Methods and Properties to industry standard programming 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.

```

10 'WellCAD startup
11 Set objWellCAD = CreateObject("WellCAD.Application")
12 objWellCAD.ShowWindow
13
14 'Create document through import of LAS file
15 Set objBHDoc = objWellCAD.FileImport(PATH & "Well 123.LAS", FALSE)
16
17 'Check whether the document could be created before proceeding
18 If objBHDoc Is NOTHING Then
19     WScript.Echo "Something went wrong and WellCAD could not load your file!"
20 Else
21     'Loop on header items and check if they are empty
22     Set objHeader = objBHDoc.Header
23     For i = 0 To objHeader.NbOfItems-1
24         strItemID = objHeader.ItemName(i)
25         strItemText = objHeader.ItemText(strItemID)
26         If Len(strItemText) < 1 Then
27             'Ask user to input missing details
28             strInput = InputBox("Enter " & strItemID & " : ")
29             objHeader.ItemText(strItemID) = strInput
30         End If
31     Next
32
33     'Apply layout template
34     objBHDoc.ApplyTemplate PATH & "Well 123.wdt", FALSE, TRUE
35
36     'Loop on all logs, find Well Logs and remove NULL DATA from top and bottom
37     For i = 0 To objBHDoc.NbOfLogs-1
38         Set objLog = objBHDoc.Log(i)
39         If objLog.Type = 1 Then
40             'Remove Null Data
41             Data = objLog.DataTable
42             NullValue = objLog.NullValue
43             For j = LBound(Data,1)+1 To UBound(Data,1)
44                 'Check if we have a Null value
45                 If Data(j,1) <> NullValue Then
46                     objBHDoc.SliceLog objLog.Name, Data(j,0)+0.001, FALSE, TRUE, FALSE
47                 j = UBound(Data,1)
48             End If
49         End If
50     Next
51
52     For j = UBound(Data,1) To LBound(Data,1)+1 Step -1
53         'Check if we have a Null value
54         If Data(j,1) <> NullValue Then
55             objBHDoc.SliceLog objLog.Name, Data(j,0)+0.001, TRUE, FALSE, FALSE
56         j = LBound(Data,1)+1
57     Next

```

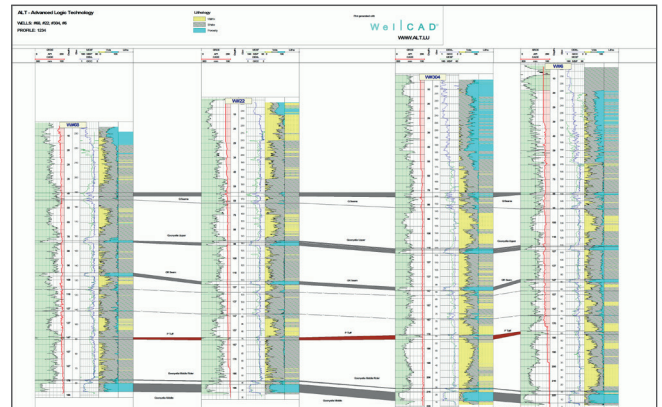
Name	Date modified
Well123.las	7/10/2007 5:28 PM
Well234.las	7/11/2007 10:57 AM
Well345.las	7/11/2007 10:57 AM



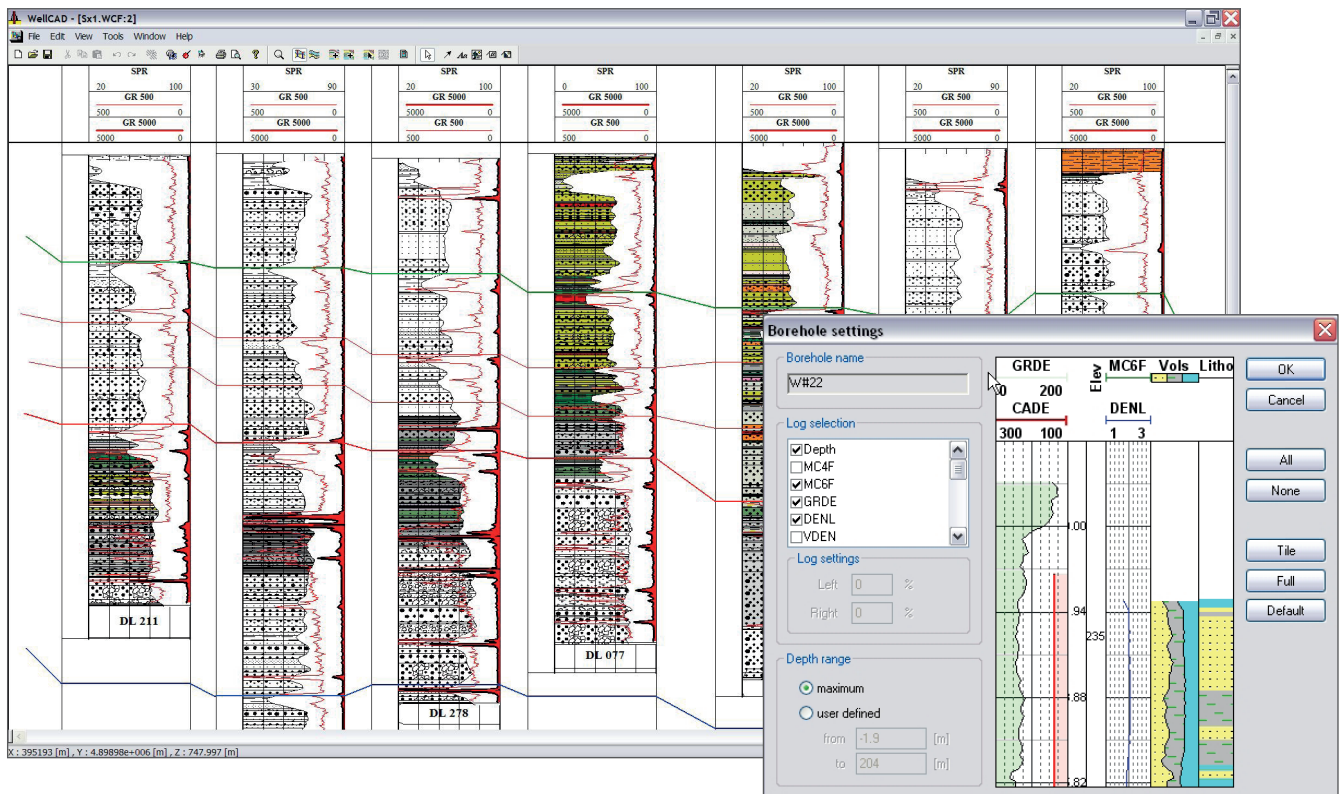
WellCAD™ Multiwell

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.



Connect WellCAD™ with the Browser add-on module to your LoggerSuite data acquisition software and receive the currently logged data in real time in WellCAD™.

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



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