WellCAD™

The Universal Borehole Data Toolbox
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

* 32 and 64bit compatible, supported by Windows XP, Vista, 7, 8, 8.1 and 10
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<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
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<tbody>
<tr>
<td>WellCAD™ Basic</td>
<td>Main Application</td>
<td>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.</td>
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<tr>
<td>CoreCAD™</td>
<td>Add-on</td>
<td>Interactive digital core description workspace for WellCAD™.</td>
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<tr>
<td>ISI (Image &amp; Structure Interpretation) Workspace</td>
<td>Add-on</td>
<td>Single, build for purpose workspace combining manual and automated structure picking, classification, correction and interpretation into a single workflow.</td>
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<tr>
<td>FWS</td>
<td>Add-on</td>
<td>A collection of pre build processes for the processing of Full Waveform Sonic data.</td>
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<td>Deviation</td>
<td>Add-on</td>
<td>A collection of 2D and 3D display options for survey data.</td>
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<td>Automation</td>
<td>Add-on</td>
<td>An application programming interface allowing to use objects, methods and properties exposed by WellCAD™ in VBS, VBA, VB, VC++, C# program code.</td>
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<tr>
<td>MultiWell</td>
<td>Add-on</td>
<td>2D multi-well correlation add on seamlessly integrated into WellCAD™</td>
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<tr>
<td>Browser</td>
<td>Add-on</td>
<td>Connects WellCAD™ to your LoggerSuite data acquisition software to receive the currently logged data in real time.</td>
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<tr>
<td>Reader</td>
<td>Viewer</td>
<td>Free data viewer for WellCAD™ files with ability to change depth scale and to print continuous or page by page.</td>
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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 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
Image & Structure Interpretation

ATV Structure Analysis Plot

- 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

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

Composite Plot: Oil & Gas

Composite Plot: Coal Mining

Composite Plot: Wellsite
Well Integrity

Acoustic Televiewer Well Integrity 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

CBL Plot

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. 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 structure, 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,...)

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

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.

- 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.
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.
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.

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 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).
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.

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 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 caliper.
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 density, compressional, 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.

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**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).

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**Cement bond logging (CBL)**

Standard algorithms for cement bond quality evaluation are available (e.g., fixed and floating gate method).
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).
• 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.
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.
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 Sopri's Instruments data acquisition systems ALTLogger, MATRIX, BBox and provides a sophisticated GUI to control your logging tools and the logging operation.