



*KehlCo Inc.*

## VoxelCalc Features and Functions Map

Houston Texas USA [www.kehlco.com](http://www.kehlco.com) 281.748.8092

### Tools Menu (Frequently Used Features)

*Exit VoxelCalc*

*Shop for features*

*3D Rendering – Mind-Over-Matter Objects  
producing high performance interactive  
viewing and publishing of Virtual Reality  
volumes to the web*

*Publication tool to produce snapshots of  
current image array in tif, jpeg, bmp formats*

*Display stacked array of slice histograms and  
tabulate statistics*

*Measure 3D distances interactively with mouse*

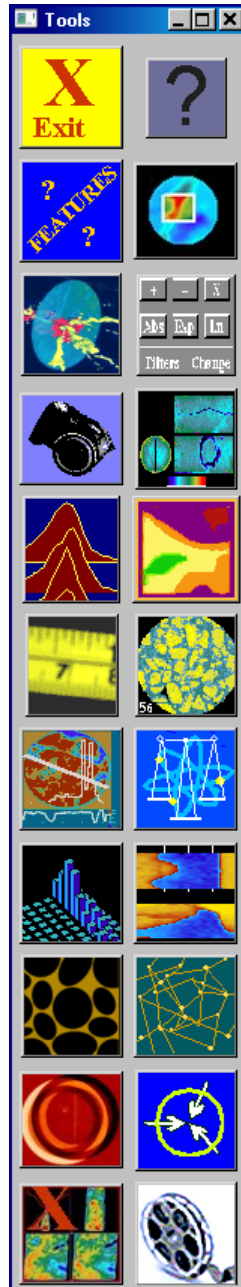
*Slice profile analysis tool*

*3D bar cross plot of two properties, such as  
atomic number and density*

*Calculate estimate of porosity using empirical  
technique*

*Align skewed slices interactively*

*3D slice editor – delete slices from display stack*



*Show VoxelCalc User Guide (right click on either  
icons shows user guide for that function)*

*Region of Interest (ROI) tool with beam  
hardening filter function*

*Calculator for 3D arrays. Embedded basic filters  
and logical operators for rescaling, editing*

*Orthogonal display of 3D volumes in vertical or  
horizontal formats.*

*Classification tool for export to spreadsheets*

*Segmentation-morphology image processing  
tool (optional extensions for aggregate/grain  
analysis of 3D volumes.)*

*Density-Atomic Number tool for Petrophysical  
analysis (dual energy scans)*

*Saturation calculation tool*

*Connectivity tool to identify fractures,  
inclusions, air entrapment*

*Centering tool to automatically align slices in an  
array*

*Movie tool to publish slice animations in AVI or  
mpeg format.*



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*VoxelCalc includes many features designed to provide the researcher, scientist and engineer with numerical, computational and (interactive) visual answers from 3D data in a form for publication of reports and sharing of results. It has its genesis in the scientific materials science and petrophysical community which uses high resolution industrial CT. VoxelCalc runs on Windows operating system.*

**Cyan** highlighting indicates significant features, **yellow** highlighting indicates special computations.

### MAIN PANEL MENUBAR Function Map

ICON Button VoxelCalc

**Calculator** – Performs math operations on slice arrays, filtering and data type conversions.

MENU Control

**Exit** – Quit VoxelCalc, discard all data

**Reset All** -Resets the main interface to default conditions.

**Clear** - Clears all memory contents and the main display memory

**Retain Range** - Holds the display range for fetching new images. (a toggle)

**Pixelate** - Shows pixels at the scanned resolution rather than interpolating the images for display (a toggle)

**Grid** - Turns on/off main display grid. (a toggle)

**Enumerate** - Turns on/off enumeration of displayed slices (a toggle)

**Retain Write Directory** - File outputs are defaulted to the last chosen path (a toggle)

**View Log** – Show/Hide a display of the VoxelCalc log of selected user actions (a toggle)

**Measure Settings** - Parameters for converting pixel/voxel sizes to engineering unit measurement of 3d distances

**Measure** – Enable/Disable measurement of 3d distances with mouse (toggle)

MENU Image File

**Write "hdf"** – Save displayed data in a standard binary format, readable by PetroPresents and VoxelCalc (Browser)

**Write "fld"** - Save displayed data in a binary format compatible with PetroPresents and AVS.

**Write "dat"** Binary Slices 0...n - Save displayed data in a binary format for future VoxelCalc reading. Slices are numbered.

**Write "dat"** Binary Volume - Save displayed data in a binary format for future VoxelCalc reading.

**Write Binary Image(s)-Stripped** – Save displayed data in binary form (stripped or “raw”) for use in other applications. Images are named with dimensions. Readable by Import tool.

**Write Binary Slices 0...n** - Exports displayed data in a binary format for export (to ParaView, for example). Slice files are numbered.

**Export ASCII Table** – Saves displayed data in row-major text format. Useful for import to spreadsheets.

**Export ASCII xyz (raw)** – Saves displayed data in four columns text: X, Y, Z and Value

**Import Image(s) Tool** – Reads foreign binary data with user guidance.

**Publish Each Image** – Saves each display image in a publication file format – jpeg, tiff, gif, etc.

MENU Render

**MindOverMatter3D** - provides interactive visualization of 3-D data in VoxelCalc display memory. This is a high performance rendering tool which utilizes transparency, and visualization of slabs, isosurfaces, glyphs, and much more.

**Cross Plot** – Plots display data against Memory #1 data.

**Ortho Slab** – Displays three views of volume, xy, xz, and yz in vertical or horizontal format with plot of mean values.

**Surface** - Makes mesh and shaded surfaces from currently focused slice values.

**Isosurface** – Renders an Isosurface of displayed 3D data under user control.

MENU Plug-ins (this varies with extra options purchased or customized features owned exclusively by our customers)

**Option:** High Speed DICOM slice reader

**Option:** Dual Energy Package (including Facies-Lithology mapping)



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### MENU Statistics

**Histogram Spreadsheet** – Calculates slice and volume histograms and classifies data

**Histogram Tool** – Graphs histograms of displayed images several ways.

**Statistics (Profiles+)** – Provides several modes of displaying current slice statistics, profiles, table, etc.

### MENU Color

**Load Image Colors** – Provides selection of several color maps and skewing of them.

**Load Plot Colors** – Loads 16 colors for annotation and plotting and overlays them atop color table.

**Edit Colors** – Provides color manipulation one at a time and building of custom color tables.

**Equalize** – Equalizes the distribution of colors across the values in display memory.

**Unequalize** – Restores map after equalize

**Load Default Map** – Loads map that user has set as default.

**Set Default Map** – Sets the default color map used at startup

**Load KehlCo Map** – Reloads the default KehlCo color map.

**Std Colors** => List of maps from PV-Wave

**Custom Colors** => List of maps from KehlCo or user.

**Color=>Legends**

CT Number Horizontal – Color legend for displayed memory values

Dual Horizontal - Color legend for displayed memory values and Calibrated quantities

CT Number Vertical - Color legend for displayed memory values

Dual Vertical - Color legend for displayed memory values and Calibrated quantities

### MENU Special

**Resize 3-D** – Resamples displayed memory with interpolation.

**Volume Movie** - Provides a "fly through" of slices in display

**Porosity Distribution** - Calculates and displays porosity distributions

**GeoRadiograph** - Extracts objects using Range limits, stacks them vertically and adds a plot of relative density as a depth log.

**Density-Atom # Calibrate** - Provides calculation of true density and effective atomic number images from dual energy scans - usually at 120keV and 80 or 90 keV. This is done in two steps - Calibrate and Calculate.

**Density-Atom # Calculate** – See above.

**Align** – Translates displayed images under user control to align first and last slices of array.

### MENU Plug-Ins

Menu items that are customized features for the licensee company...

### MENU ROI (Region Of Interest)

**Define ROI** - To extract the area (polygon, circle, rectangle) within slices that include meaningful objects and exclude the remainder or background values. Also can produce statistical tabulation files. A Save ROI function allows the ROI information to be retrieved later using the File Browser. Once defined, the ROI can be used as a mask to read slices and volumes.

**Rectangular Crop & Adjust** - Adjusts CT images in which the object scanned is rectangular. This is an arbitrary adjustment and should be used with care; however, it can be used to adjust these images to more nearly agree with the CT values found in circular cross sections of the same object.

**Crop Below Range** – Crops displayed data based on Range settings by finding the minimum size slices that can contain all pixels within the Range min/max.

**Beam Hardening Adjustment** – Adjusts CT images to remove beam hardening artifacts.

MENU Help => Introductory help for new users



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### **BROWSER DRIVEN TOOLS MENUBAR**

*The browser provides the means of building 3D volumes from CT and MRI data formats including DICOM or DICONDE in any slice order from multiple directories. KehlCo provides licensees with plug-in readers for special data formats as a standard feature of our annual support. **The following tools operate on lists chosen in the browser, as a means of optimizing memory and gaining significant processing speed.***

**Info** - Provides a display of image DICOM header information for selected files with extensions "250" and "idf".

**Fly Through Slices** – Displays slices at a rate of no more than one per 1.5 seconds.

**Publish Picture Groups** – Produce image groupings from selected slice files as a sequence of image files.

**Slabs** - Slabs images selected in file browser using Measure Settings and Range. Produces X and Y slabs in display memory with proper aspect ratio.

**ROI/Beam Hardening** - Performs beam hardening adjustment using currently defined ROI and a list of images selected in the File Browser. Adjusted images are saved to the subdirectory "Processed" These saved images will have the extension of "dat" and are in PV-Wave variable save/restore form

**A op B Calculator** – Slice pairs are scaled and then combined using basic binary arithmetic operations - +, -, X, /.

**Density & Atomic # (Dual Energy CT)** - Density and/or Atomic number calculation to be used after the main menubar function Speical=>Density Atomic # Calib(rate) function has been performed. It writes slices of density and optionally atomic number maps to subdirectories of the source image data.

**Cross Plot Tool** – Produces a cross plot color map of two properties whose volumes are comprised of an equal number of slices.

**Saturations, (Two Phase)** - Provides the means of calculation of saturations from 3 slice arrays - Oil, Water, Total. This tool uses the File Browser to establish lists of each of the slice arrays.

**Histogram Spreadsheet** – Tabulations are provided for Basic Statistics, Histogram and Classes.

**Histogram Volume Graph** - Produce a cumulative histogram graph for the selected files

**Import** - Binary files which the system has not been programmed for may be read. Selection of such a file causes a panel to appear and the user may then define some rules for reading all files which have the same extension. (See Import)