



3D Viewer

ev_3dvw

The EarthVision 3D Viewer displays data, grids, and models in their proper spatial orientation in 3D space. The visualization techniques found in the 3D Viewer are important tools for data verification and for comprehending complex relationships between data of diverse types in 3D space. The 3D Viewer provides interactive capabilities that range from rotation, slicing, peeling, zoom, and pan to variable stratigraphic zone display and 3D editing. Nearly all types of EarthVision data can be visualized: scattered data, annotation, 2D surface grids, 3D seismic and property grids, fault files, well data, and models of property distribution and geologic sequences.

Specifications

- displays 3D property models, 3D structure (faulted and unfaulted) models, 2D and 3D grids including 3D seismic grids, scattered data files, vertical and non-vertical fault files, fence displays, well data, and raster images in 3D orthogonal or rotated space; many file types can be displayed with one another (e.g., a 3D seismic grid can be displayed against a 3D property model)
- well paths and logs from an OpenWorks® well database or EarthVision well data can be displayed; requires the Well Display option
- seismic data in the form of a 3D grid, imported from a SeisWorks® .3dv file or a SEG-Y file¹, can be displayed as an x-, y-, and/or z-slice, or as cubes, isosurfaces, or volumetric clouds
- raster images, such as aerial photos, and Landsat images can be draped on 2D surfaces or 3D models, and can be viewed as solid or transparent displays
- up to 256 zones and 64 property intervals can be displayed
- up to 1024 fault blocks can be displayed
- multiple windows can be created so that differing views of the same model can be viewed simultaneously
- a synchronized viewing capability allows users at different locations to view and manipulate the same model at the same time (TCP/IP connection required)
- stereo viewing is possible using StereoGraphics® CrystalEyes® 3D glasses (SGI™ and Sun™ only) or NVIDIA® Quadro4® line of graphics cards and Elsa® Revelator 3D glasses (Linux® and Windows® 2000 only)
- a series of different views of a model (or models) can be displayed in sequence using a script file
- the volume of the currently displayed portions of 3D models or 3D grids can be calculated dynamically
- portions of the display can be sliced away along x-, y-, and z-planes at any arbitrary location
- a rectangular block (chair cut) can be removed from any corner of the 3D display range
- surfaces can be displayed transparently
- the density of transparency display can be customized
- by default, the point in the model that is the center of the view is the center of the 3D range of the model; this lookpoint can be customized
- a scaled 3D cursor enables distances, the strike/dip of a plane, or the trend/plunge of a line to be measured; the 3D cursor can be snapped or dragged to any location
- fault block, zone, property, and surface information, in addition to the xyz location, is displayed for the 3D cursor location selected
- the 3D cursor can be used to specify the display lookpoint, to extend well paths, or to determine locations on surfaces
- the z-exaggeration of the display can be customized
- displays can be zoomed in or out, translated, inclined above and below the horizontal axes, and rotated through 360 degrees
- by default, objects appear in perspective; isometric display is available
- a lighting model with up to two customizable light sources gives objects the appearance of being three dimensional (the azimuth, inclination, scene ambience, material specularity, and shading algorithm are customizable)
- graphic color editors are available for customizing colors for different file types
- 3D axes can be displayed with tickmarks or a lattice; the axes width, tickmark reference value and interval, tick label sizes, axes captions, etc., can be customized
- a legend can be displayed with the model or data indicating the use of colors, exaggeration, slicing planes, azimuth and inclination, X, Y, Z, & P units, file name(s), and a dynamic axes schematic; the legend content can be customized and, if desired, automatically removed if the window size becomes too small
- viewing parameters for the current display can be saved in an EarthVision vue file; loading this file later immediately sets the current model with the saved viewing parameters
- annotation can be displayed either on a flat surface above a model or draped on a surface
- EarthVision screen annotation is available for annotating displays with simple text

¹. Due to variations in SEG-Y formats, some formats may not be currently supported. For a fee, Dynamic Graphics will make program modifications to import SEG-Y formats not currently supported.

and graphics; this annotation can be modified interactively

- the entire screen display, or a subarea selected by the user, can be output to a GIF, JPEG, RGB, or TIFF file, directly to a printer, or both; the JPEG quality can be user-specified
- image files can be created that are the maximum size allowed by the machine (i.e., it can exceed the screen size)
- keyboard characters (hot keys) can be used in addition to graphic menus to select functions
- inline command parameters and environment variables allow customized displays, as well as access to additional information

3D Property Models

- property layers (the volume occupied between two user-specified isosurfaces) can be peeled off inside or outside a user-specified property range (an isosurface is a surface of constant property value)
- layers that have been peeled off can be shown using transparent display (in either zone or property colors) with all remaining levels shown using solid display
- property outlines can be displayed on slicing planes; the property-outline color can be customized
- layers can be shown in property or zone colors
- a property color legend with property values or user-specified labels can be displayed
- a bracket on the color legend indicates which property layers are currently displayed (as solid layers)
- when displaying the model with a chair cut removed from one of the corners, a user-specified range of property layers can be displayed either within or outside the cut
- as portions of the model are sliced away along x, y, or z planes, the intersection of the property layers with the slicing plane is visible
- the x-, y-, z-, and p-values for the polygons that make up the isosurfaces within the current slicing planes can be saved

3D Geologic Layer Models

- geologic zones can be displayed using a different color for each zone, or can use the same color for zones grouped as a formation
- a zone color legend with user-specified zone names can be displayed
- the display of each zone can be controlled independently; zones can be displayed using property or zone transparency
- structure tops can be displayed with color-filled elevation/depth contours; the contour z-range, the contour interval, the starting color-level from a color file, and the interval within the color file can be user-specified
- a color legend for elevation color-filled contours can be displayed
- a chair cut can be independently controlled for each layer or formation
- each layer or formation can have an associated property model

3D Faulted Structure Models

- the display of each fault block can be controlled independently
- fault blocks can be viewed and colored on a block-by-block basis
- fault outlines can be displayed on slicing planes; the fault-outline color can be customized
- fault surfaces can be displayed in a single gray color or with the colors of the zones or properties that intersect it
- All fault planes can be displayed using transparency (Allan fault-plane displays show the intersection of the fault surface with the zones on both sides of the fault)

Scattered Data

- any number of data files, with similar or different properties, can be displayed together, with or without a 3D model and/or 3D grid
- multiple data sets can be colored based on different properties, color tables, or as a uniform color per file
- any z- or p-field in a scattered data file can be selected for posting; the data

points can be color coded according to the values in the selected field

- the x-, y-, and z-coordinate, property fields, and any other information contained in the input data file can be displayed by clicking on any data location
- ten three-dimensional symbols are available for posting data locations to visually distinguish points; symbol sizes can be customized; symbol types include earthquake foci (fault-plane solutions), ellipsoids, and elliptical, tilted disks (based on strike/dip information)
- additional dimensions can be represented by specifying the symbol type, and the symbol size or radius, in addition to color (representing the fourth dimension); the radius could be proportional to magnitude of another property, for example
- data points can be edited, deleted, and/or subsets selected using the mouse cursor and saved to a new file (see also Data Editing)
- data points sharing the same line identifier value can be connected with a line in the display and edited as a unit
- cylinders of fixed or varying radii can enclose data points sharing the same line identifier; colors displayed along the cylinders can be customized
- a 3D cursor can be used to select data locations that are saved in a capture file (see also Data Editing)
- a subset of a currently displayed data file that falls within the current slicing planes can be saved to a capture file
- data locations that share a common characteristic, for example, ones that fall in close proximity to a feature of interest, can be identified as a group and color coded
- data locations with an associated sequential time field can be dynamically or manually animated through the time sequence; a dynamically updated time scale can be displayed
- data animation can either display only those points in the current time interval (front points) or the current and all preceding time intervals (growing lines)
- the magnitude of the time step used from the data file, and the length of time each time step is displayed during data animation can be customized

- a time color legend can be displayed for data locations color-coded by time value
- data represented as vectors can be displayed

3D Grids

- 3D property or seismic grids can be viewed alone, with a scattered data file, or with a geologic model
- 3D grids are contoured in 3D on the fly with approximately 20 isosurfaces generated
- property isosurface values can be interactively user-specified; property colors can be customized
- 3D grids are displayed as series of solid zones within isosurfaces, as cubes (with each cube surrounding a node color coded based on the node's value), or as a transparent volumetric cloud
- regions within a 3D seismic or property grid can be displayed on a zone and/or fault-block basis
- 3D grids can be displayed using 256 continuous colors (where each color represents a value) or 64 distinct color levels (where each color represents a range of values)
- x, y, or z planar slices can be displayed on the fly from a 3D grid
- an animation can be run through the series of x, y, or z planar slices (from front to back or vice versa)
- 3D grid animation can be run once or repeated, cycling either in the same direction or in the opposite direction
- conformal 3D grids are sliced parallel to the conformal surface used in gridding
- a 3D color legend can be displayed

2D Grids

- 2D grids are displayed as solid or transparent 3D surfaces
- the colors used to display the grids can be solid or customizable color-filled z-contours
- the contour z-range, the contour interval, the starting color-level from a color file, and the interval within the color file can be user-specified

- a color legend for elevation color-filled contours can be displayed

Vertical Faults

- vertical faults can be displayed as vectors on a constant z-plane at the top of the 3D display range
- fault vectors can be projected through the z-range of the display as vertical, transparent curtains

Polygon Files

- non-vertical fault, operations, or volumetrics polygons can be displayed on a constant z-plane at the top of the 3D display range
- the polygon outline can be projected through the z-range of the display, as vertical, transparent curtains

Fence Displays

- a 3D fence display can be viewed in 3D space using solid color fill to distinguish layers, and can be dynamically rotated, sliced, inclined, etc.
- scattered data, annotation, and fault files can be displayed along with the fence display

Annotation

- an annotation file is displayed as vectors and color-filled polygons at the top and/or bottom of the display range; top displays can be set to post on the current z-slice
- an annotation file can be draped on top of any surface

Well Path Designer

(available at an additional cost)

- creates well paths and side tracks, or extends existing wells, in 3D space
- wells are interactively designed via a spreadsheet from a variety of section types, with automatic display in the 3D Viewer
- display shows the path's relationship to a geologic model (including calculated fault and horizon intersections), target data points, and offset well data

- MD, DLS, TVD, North and East coordinates, azimuth, and inclination can be calculated or specified by typing or via the 3D Viewer's 3D Cursor

- DLS can be constrained to remain less than a user-specified limit
- ellipsoids of uncertainty can be calculated for the designed well
- a traveling cylinder diagram indicating where the well path approaches offset wells can be displayed
- clicking on sections in the spread-sheet or traveling cylinder diagram highlights the corresponding section in 3D, aiding user understanding and evaluation of the design.

Well Positioning/Display

- well log, picks, tops, etc. can be displayed along well paths
- a well path can be extended to a specific location via a snap-to-surface feature or along a user-specified vector
- new well points can be interpolated along an existing well and continually updated as edits to the well path are made
- areas that fall below a user-specified minimum dog-leg severity can be highlighted
- information such as x, y, z, well ID, radius-of-curvature, measured depth, dog-leg angle and severity, and changes in x, y, z, azimuth, and inclination can be displayed
- the distance, dip, and azimuth between two or three interactively specified locations can be calculated
- models can be sliced on-the-fly along a well path

Well Positioning Toolbox

(available at an additional cost)

- run the WorkFlow Manager from within the 3D Viewer for the current model (ev_ps license required)
- introduce a new fault or horizon to the current model using the WorkFlow Manager from within the 3D Viewer (ev_ps license required)
- adjust a fault or horizon within the current model using the WorkFlow Manager from within the 3D Viewer (ev_ps license required)

EarthVision

- seismic data can be displayed on a tube along a well path
- a well can be extended to vertical given a well path and a user-specified angle and elevation
- well path can be updated based on user-specified bit-location
- a 3D disk symbol representing the strike and dip at every well-path/structure intersection can be calculated
- a specified horizon in a structural model can be shifted by a user-specified amount
- edit field values of a displayed data file using a text editor from within the 3D Viewer

Data Editing

- multiple data files may be interactively edited; the active-edit file specifies which is currently being edited
- scattered data, property data, and well path data can be created and/or edited
- several editing modes exist: build lines; digitize points or lines; insert, delete, or move points or lines; change attributes of field values; and pick points that have the same feature (e.g., points along a fault or a sand body)
- all edits can be undone or redone; these functions allow an unlimited number of edits to be undone or repeated
- digitizing allows quick creation of points or lines along a surface or, for example, a feature in a 3D seismic plane
- edits can be specified as applying to all the points in a line or to a single point in a line
- default values can be specified when editing field values to facilitate quick editing
- any numeric or non-numeric field can be edited
- displayed data file(s) can be "hidden" from view without having to remove the files
- data locations are saved in double precision
- new data files are saved in free format; existing files are saved in their original format

Input Data

- fixed- or free-format ASCII data
- EarthVision non-faulted 2D grids
- EarthVision faulted 2D grids (2D Faulting option required)
- EarthVision 3D grids
- EarthVision annotation files
- EarthVision vertical fault files
- EarthVision polygon files
- EarthVision faces files
- EarthVision well database
- EarthVision script files
- well data from an OpenWorks database
- 3D seismic grids from a SeisWorks database or a SEG-Y file
- EarthVision screen annotation files

Output Data

- ASCII scattered data
- EarthVision color files
- EarthVision vue files
- GIF, JPEG, TIFF, and SGI RGB pixel image files
- VRML 1.0 files

User Interface

- graphical user interface

Online Help/Documentation Features

- online help is available from the graphical user interface
- complete online user documentation

ev_3dvw Module Included in:

- 3D Property Modeling System
- 2D Surface and 3D Property Modeling System
- Geologic Modeling System
- Environmental Suite

- Petroleum Suite
- Well Design Suite

The ev_3dvw option requires 3D graphics hardware on supported workstations and PCs. For more information on these systems or for hardware and third party software requirements, please contact your Dynamic Graphics representative or visit www.dgi.com.

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