

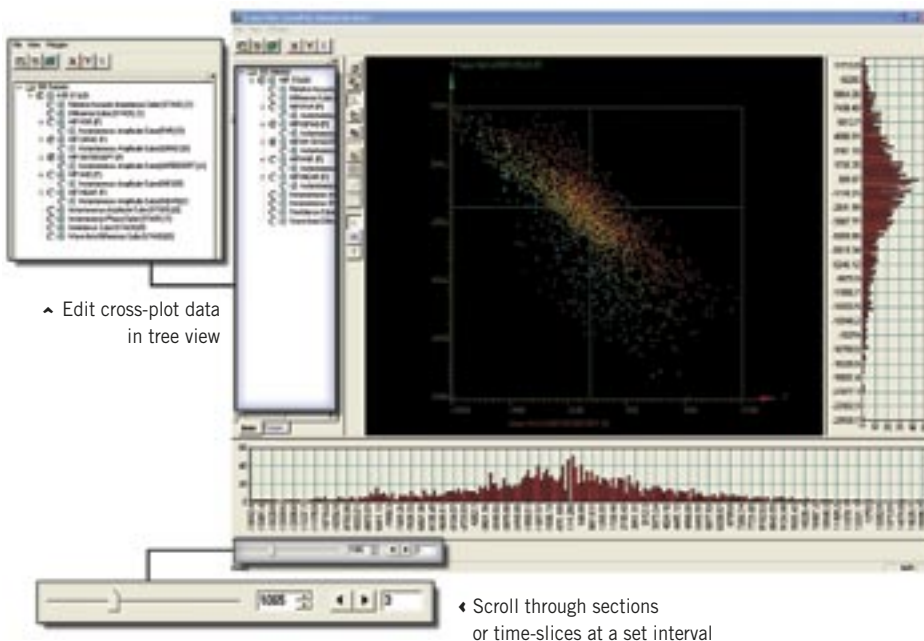
## INTERACTIVE CROSS-PLOTTING

### OVERVIEW

The key to accurate seismic interpretation is understanding what data relationships are important for reservoir characterization. One attribute alone may not reveal anomalies related to oil- and gas-bearing units. By cross-plotting multiple seismic attributes, interpreters can easily visualize the hidden relationships between the attributes and identify hydrocarbon indicators in the reservoir.

VisualVoxAt's interactive cross-plot tools enable fast attribute correlations and efficient interpretation of AVO data. The resulting correlations help to predict reservoir properties and define the best drilling opportunities in areas without well data.

▼ Figure 1: VisualVoxAt cross-plot interface.



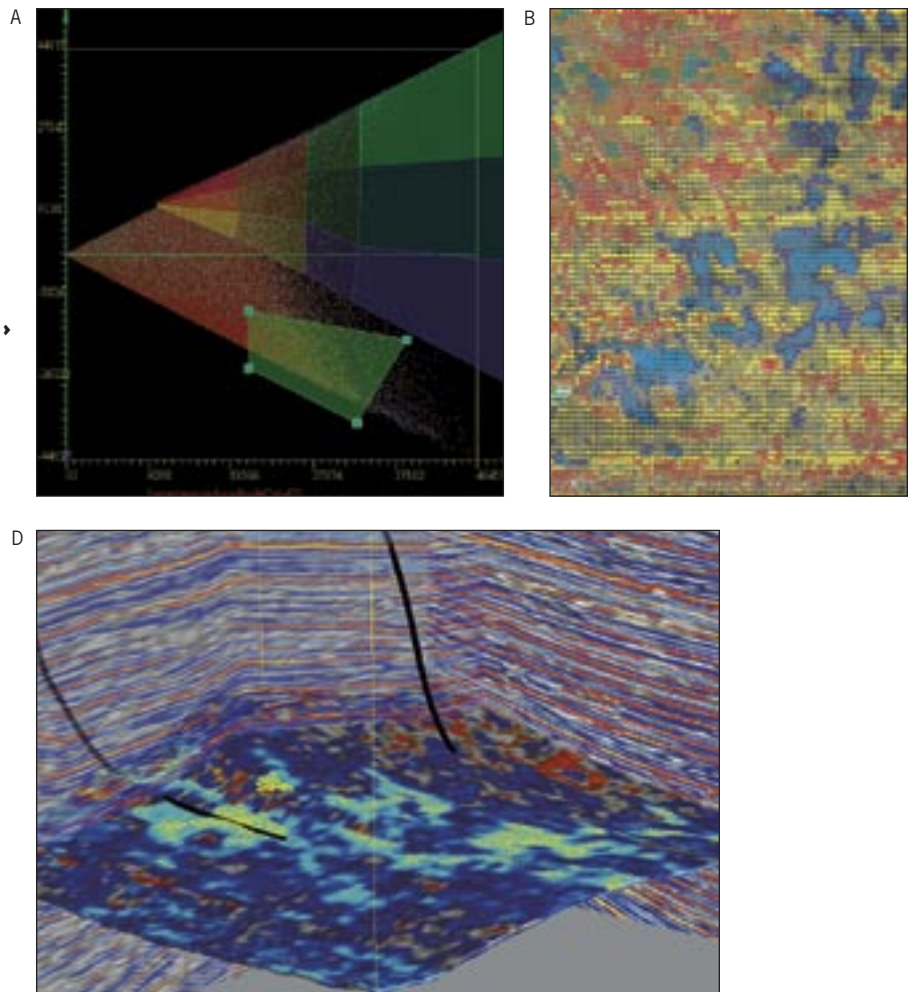
### EASY-TO-USE WINDOWS INTERFACE

- Cross-plot the following data types:
  - 2D Seismic • 3D Volume • Horizon
  - Interval • Strata-grid • Well data
- View data clusters as color-coded points in cross-plot space.
- Easily edit, search and organize cross-plot variables in tree view.
- Drag-and-drop between cross-plot variables to change x, y and color axis.
- Scroll through in-line, cross-line and time slice displays and set scrolling interval between displays.
- View data distribution in histograms along x and y axis.
- Access menu items quickly with right mouse-click functionality.
- Output colored cross-plot to new attribute volume.

## IMPROVED PERFORMANCE WITH OpenGL ENGINE

- Correlate attribute trends efficiently with fast and seamless graphic displays.
- Reduce cycle times with increasing GPU speeds and interactive, real-time cross-plotting.

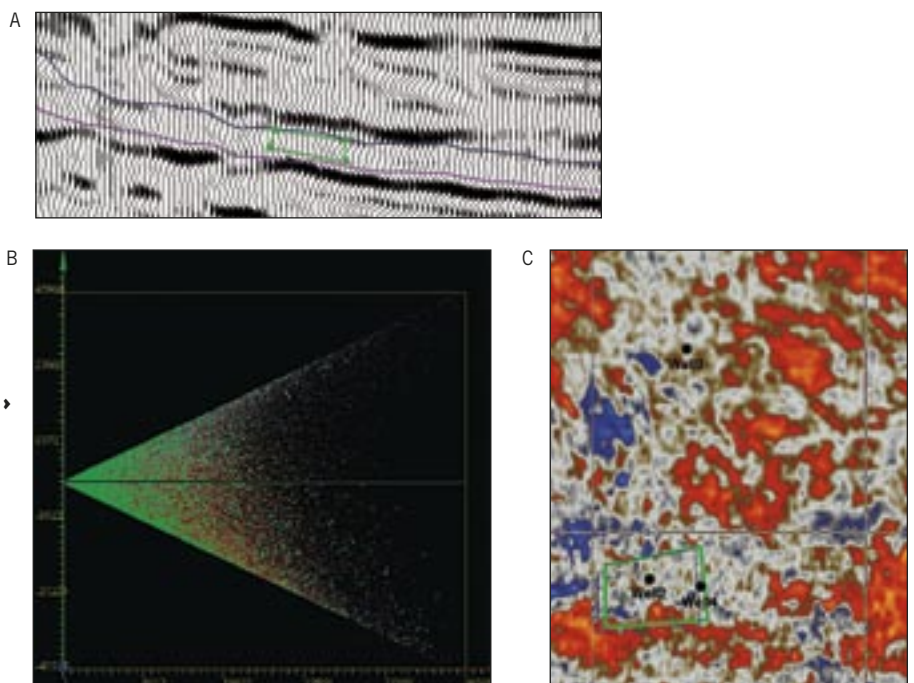
Figure 2: Interactive polygons in cross-plot enable fast correlations with seismic data. Color-coded polygons highlighting different data clusters in cross-plot (A) correspond to colored data in basemap (B). Digitized green polygon in cross-plot (shown with nodes in Figure 2A) correspond to green highlighted areas in basemap (C) and 3D view (D).



## INTERACTIVE POLYGON SELECTION

- Digitize polygons in well, map or section, and view corresponding data clusters in cross-plot.
- Digitize polygons on cross-plots and identify corresponding points in well, map, section, or 3D views.
- Opacity controls on polygons enable various viewing preferences.

Figure 3: Seismic data highlighted by digitized polygons in 2D section and basemap views appear as highlighted points in cross-plot.

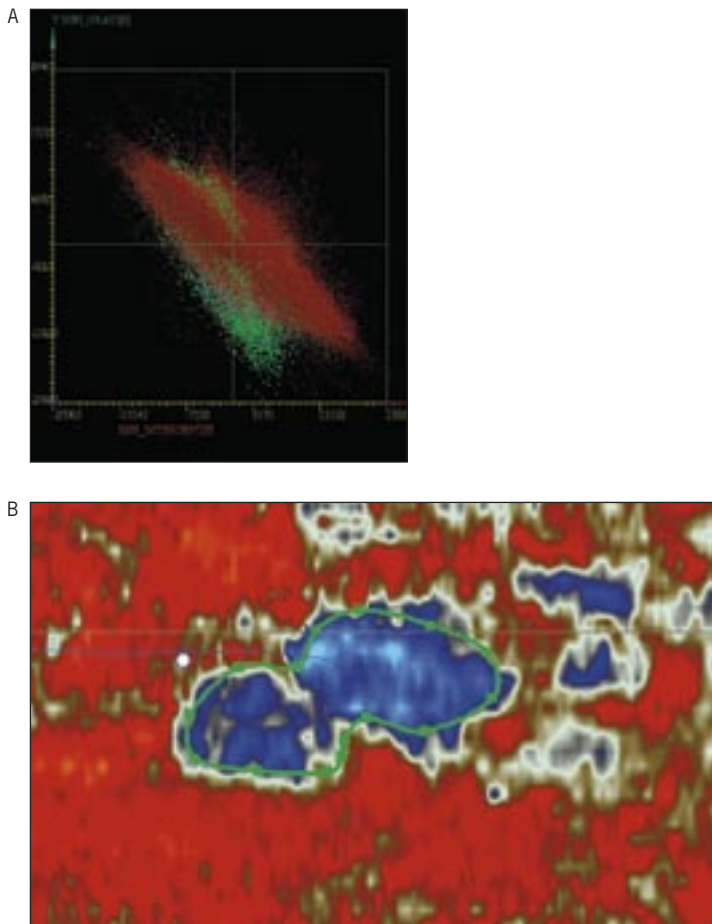


## CLEAN UP INTERPRETATION WITH CROSS-PLOT

- Delete bad or noisy picks by highlighting anomalous edge or structural horizon attributes in cross-plot with a polygon.
- Interactively quality control the results on basemap.

## AVO INTERPRETATION

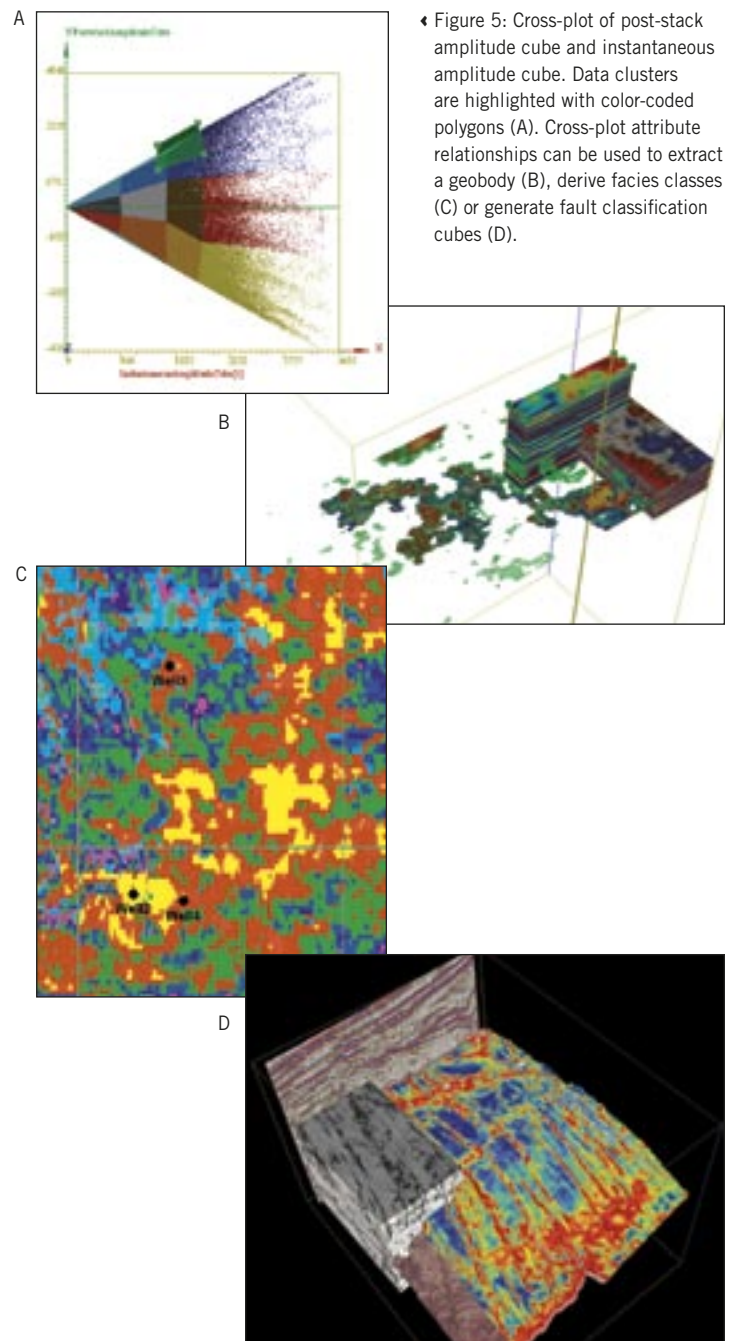
- Cross-plot far offset and near offset to view AVO anomalies.
- Correlate different AVO clusters to variations in lithology or fluid type, and discriminate gas and water zones.
- Identify anomalous data that may bias correlations or may indicate potential hydrocarbons.



▲ Figure 4: AVO cross-plot of far offset (y axis) vs. near offset (x axis). Green data points in cross-plot correlate with highlighted anomaly in basemap.

## CLASSIFY ATTRIBUTES, TRACK GEOBODIES, AND DETECT SUBTLE FAULTS BASED ON CROSS-PLOT RESULTS

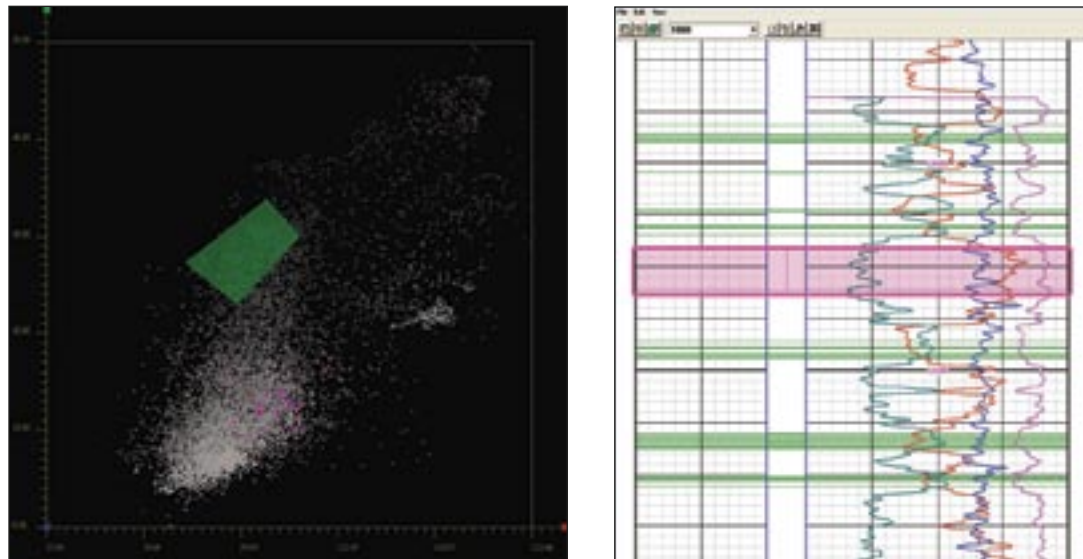
- Cross-plot attributes of interest and define attribute clusters.
- Apply color-coded polygon grid to data clusters.
- Display cross-plot results as:
  - Extracted geobody
  - Facies classification map or volume
  - Fault classification



◆ Figure 5: Cross-plot of post-stack amplitude cube and instantaneous amplitude cube. Data clusters are highlighted with color-coded polygons (A). Cross-plot attribute relationships can be used to extract a geobody (B), derive facies classes (C) or generate fault classification cubes (D).

## ATTRIBUTE CALIBRATION WITH WELL DATA

- Generate cross-plots of well curves.
- Identify seismic data anomalies that are related to producing wells and zones.
- Examine relationships between rock properties and geological trends at the well bore.
- Apply relationships to areas lacking well control to predict lithologies and fluid types.



^ Figure 6: Interactivity between cross-plot and well displays simplifies well calibration. Green polygon selection in well data cross-plot corresponds to green intervals in well log. Pink interval in well view represents pink data points in cross-plot.



VisualVoxAt is an integrated, Windows-based toolkit for seismic attribute generation, visualization, calibration, classification and interpretation. The software combines fast rendering technology with easy-to-use analysis tools to reduce cycle times for faster decisions. As a plug-in to reservoir interpretation workflows, VisualVoxAt is a cost-effective solution for optimizing reservoir assets and increasing well accuracy.