



# Lamont 4-D Software for Enhanced Recovery

The industry's first 4-D software for increasing reservoir yields is now available from Western Geophysical as part of a service package or as a licensed software product. Developed by scientists at Columbia University's Lamont-Doherty Earth Observatory, the Lamont 4-D software allows you to evaluate the history of fluid movement in the reservoir, predict future movement, and calculate hydrocarbon volumes.

Two software products – Rapid Analysis and Inversion – provide the tools for interpreting multiple 3-D data sets, including legacy data, to describe time-lapse seismic differences and their relation to changes in the reservoir. The Lamont 4-D software has been proven in actual field studies and is currently being used to monitor fluid movement in almost half of the 4-D projects worldwide.

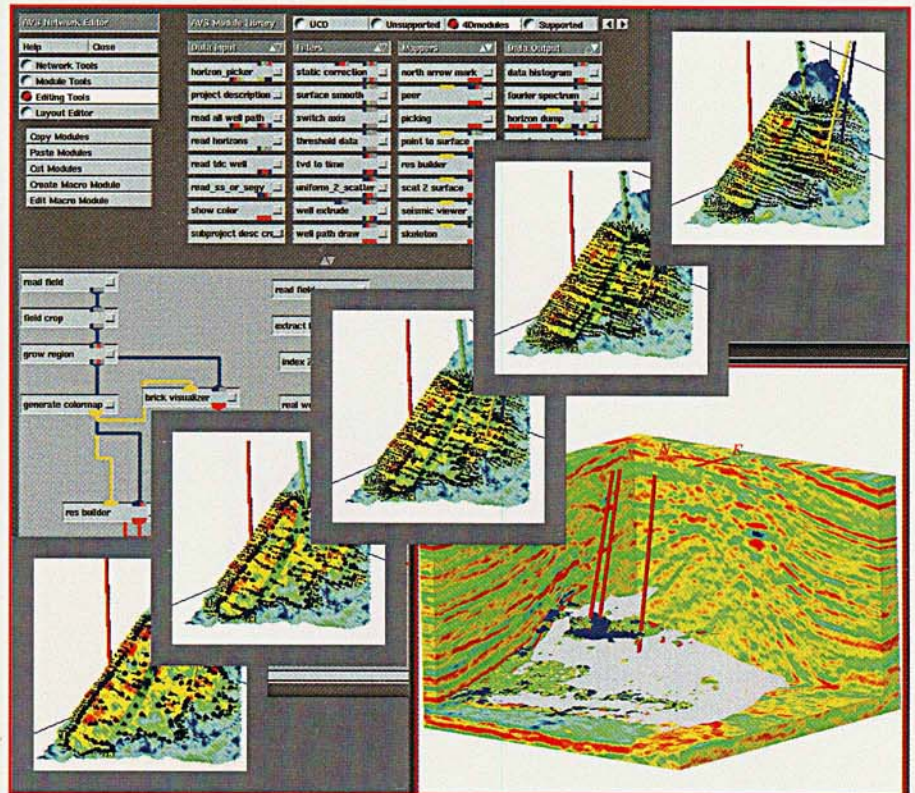
## 4-D Capabilities

The Lamont 4-D software allows you to:

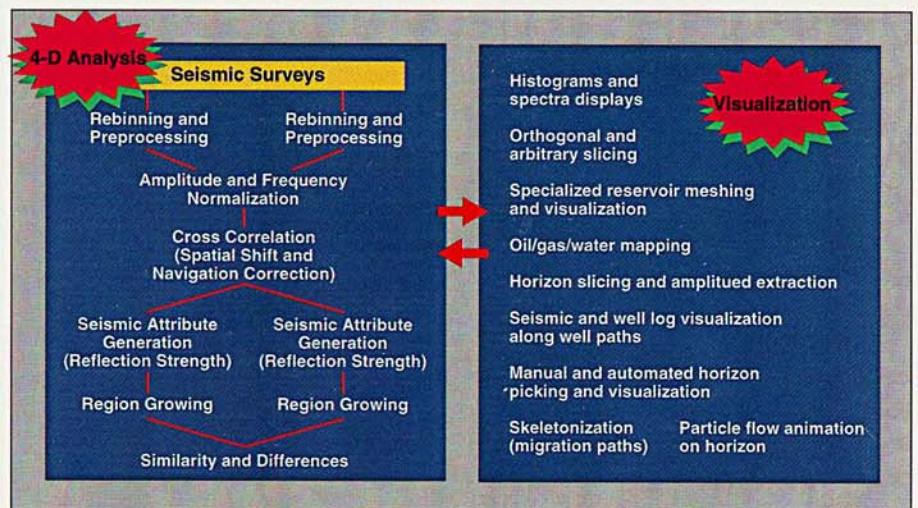
- Track fluid movement
- Calculate seismic response to fluid changes
- Enhance the determination of:
  - Porosity
  - Lithology
  - Structure
  - Fluid saturation

Identify:

- Bypassed oil and gas
- Drainage patterns by compartments (fault blocks, etc.)
- Hydrocarbon volumes in place
- Potential new well locations



The series of reservoir models depict oil drainage into a simulated horizontal well over time. The Lamont 4-D software significantly reduces analysis time—An average reservoir study can be completed in only three days, allowing for the timely use of 4-D seismic data in production management.



Processing flow of 4-D rapid analysis

## Key Features

### Rapid Analysis Product

| <i>Feature</i>       | <i>Benefit</i>  |
|----------------------|---|
| Survey rebinning     | Quickly merges multiple surveys into the same grid volume   |
| Spectral matching    | Normalizes surveys by extracting seismic signals for comparison   |
| Region growing       | Intelligently selects and isolates oil and gas reservoir changes with time in a statistically meaningful manner |
| AVS™ graphics system | Enhanced 4-D capability through the use of a state-of-the-art visualization language                            |

### Inversion Product

|  |   |
|--|---|
| Survey rebinning                                       | Quickly merges multiple surveys into the same grid volume   |
| Enhanced normalization                                 | Models the differences to further refine the seismic signal similarities in multiple surveys                                |
| Enhanced region growing                                | Adds quantitative measurement to reservoir properties   |
| Export of reservoir properties                         | Enhances predictive simulation capability to reservoir simulator  |
| Quantitative interpretation of fluid changes over time | Allows volume calculations and aids decision making   |
| Consistent inversion of multiple surveys               | Increased accuracy of calculations  |
| Integrated applications                                | Use as a stand-alone package or with the Rapid Analysis product. Can also be linked to proprietary products and techniques. |

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