

## WIRELINE AND PERFORATING SERVICES

# MRIL® Enhanced Vertical Resolution Processing

## Improve the Vertical Resolution of Your MRIL Data

Halliburton's Enhanced Vertical Resolution (EVR™) processing for MRIL can improve vertical resolution by up to three-fold, depending on well conditions. Based on a novel approach that distinguishes it from standard MRI interpretation techniques, EVR processing can improve the evaluation of porosity and lithology in thin beds or in rapidly changing environments.

### MRIL EVR Benefits

EVR applies a mathematical analysis based on new insights that can increase vertical resolution on many MRIL logs, allowing you to make the most of your data. Benefits include:

- The ability to use existing MRIL data.
- Resolution comparable to conventional log data.
- Better estimation of fluid volumes.

### Boost Resolution on Existing Data

Typically, MRIL data is processed using combinations of phase-alternate-pairs (PAPs) of Carr-Purcell-Meiboom-Gill (CPMG) echo trains. This technique limits vertical resolution, which is controlled by logging speed and the number of phase-alternate pairs that must be stacked to bring about an acceptable signal-to-noise ratio (SNR) required to achieve a desired porosity accuracy.

Standard NMR processing uses a fixed SNR, regardless of the application. For many purposes, however, the target SNR may be higher than needed to collect meaningful results. EVR exploits this fact by allowing you to pre-select a SNR suited to your application.

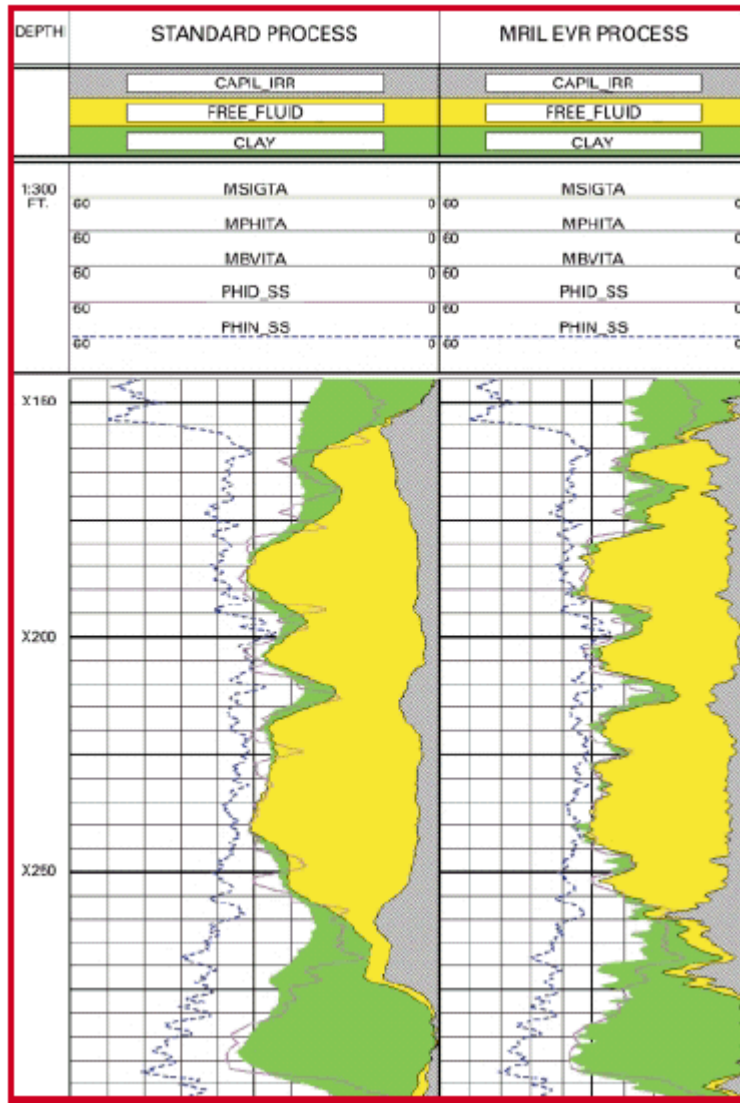
### Compare MRIL EVR Results to Conventional Log Data

You can use EVR to bring the vertical resolution of your MRIL logs in line with that of conventional logging data. This allows you to compare magnetic resonance data with resistivity logs, neutron, density, gamma ray, and other measured logging parameters more effectively.

EVR processing can give you better agreement between MRIL and conventional log data when determining formation boundary and fluid contact locations. This, in turn, increases the accuracy of net pay volume estimates and permeability.

### Increase Confidence in Interpretation

**Figure 1** shows how EVR processing matches the vertical resolution of MRIL data to the other wireline density log. The log on the left side is plotted from the original data. The much more sharply defined log on the right is derived from the same data, after EVR processing.

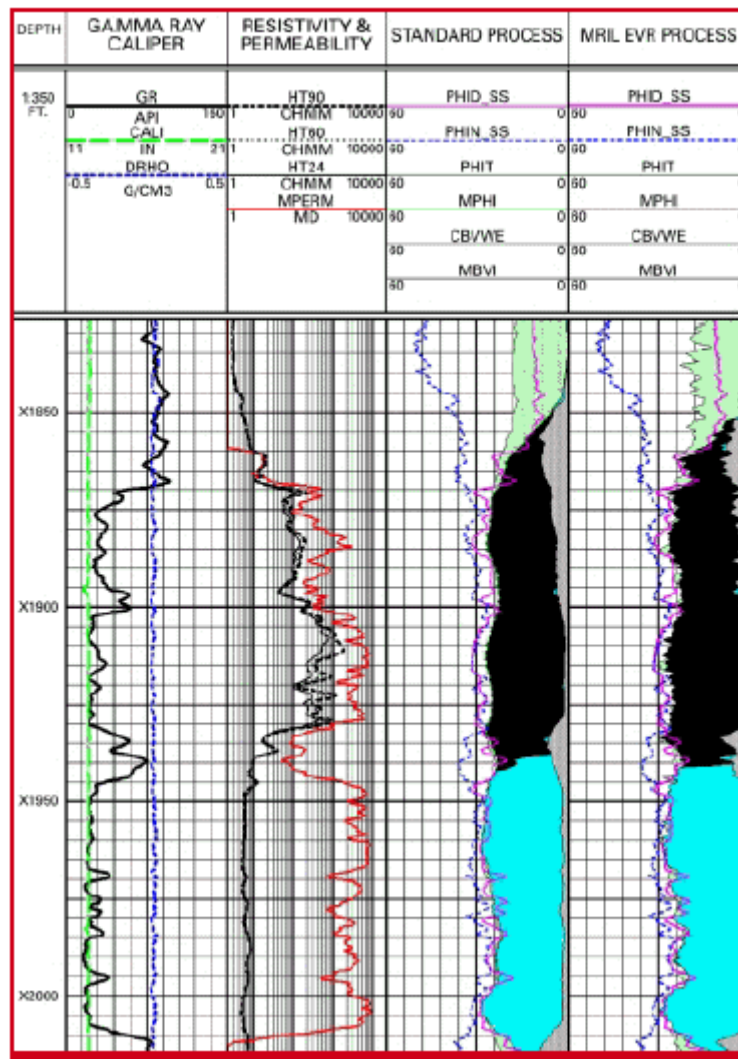


**Figure 1** - MRIL data modified by EVR shows good correlation with density porosity data.

This increased definition gives you better estimates of the volumes of free fluids, total porosity,

and bulk volume irreducible water (BVI). The result is a much better estimate of the reserves. EVR processing can bring the resolution of MRIL porosity data in line with that of density porosity data. The enhanced resolution in Figure 1 shows us that the two curves correlate well at bed boundaries, emphasizing a pinching at X212 feet. This pinching indicates a significant reduction in movable fluid, which suggests the upper and lower sands may produce as separate hydraulic flow units.

**Figure 2** shows how the enhanced resolution of the MRIL permeability curve (red) has a similar resolution with the resistivity (black) data curves within the X1860 ft. to X1940 ft. range.



**Figure 2** - MEVR gives a better estimate of oil reserves (shown in black).

Observe in track 4 how EVR processing makes the MRIL porosity better match the density curve,

giving a better comparison of porosity. Also note how EVR makes MRIL data more closely match the gamma ray (track 1) characteristics as well as the density (track 4) within the X1940 ft. to X2015 ft. range.

## **Pre-Plan Logging Jobs to Cut Rig Time and Costs**

By using the MRIL Pre-Job Design Planner, you can tailor a logging job to your specific application. This allows you to optimize the job based on the resolution you need.

If you know the logging tool's predicted gain as a function of borehole size, temperature, salinity, etc. you can select a SNR that will let you improve the vertical resolution of your MRIL logs in many cases before logging.

For instance, if the SNR and tool speed selected for a job implies a vertical resolution of 8 feet, you can use EVR processing to improve the vertical resolution to 4 feet or as little 3 feet, depending on the well conditions, thus determining the resolution before running the job.

Alternatively, if you know that the tool speed and SNR selected for a job will give you an adequate vertical resolution to begin with, you can increase your tool speed and use EVR processing to bring the vertical resolution of your data back to acceptable levels after logging, thus saving rig time.

EVR processing optimizes your MRIL data and helps you make the most productive use of it.

*Reference: "A Method for Enhancing the Vertical Resolution of NMR Logs," R.F. Sigal, D.L. Miller, J.E. Galford, R. Cherry, P.I. Day, Halliburton Energy Services, SPE 63215. Presented at the 2000 SPE Annual Technical Conference and Exhibition in Dallas, TX, 1-4 October 2000.*

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