

**DISPLAY VC Upgoing Wavefield at two-way time before enhancement**

This display describes the primary and multiple reflection responses of the subsurface at the borehole location, within and below the depth range of the VSP.

This data is filtered using the 'maximum bandwidth' filter designed after F-K analysis to determine the usable bandwidth of the upgoing wavefield.

In marine data, if source signature deconvolution has been applied, then the input wavelet is zero phase and the wavelet contained in the data is zero phase modified by earth absorption and transmission loss effects (ie mixed phase).

Events that reach the time-depth curve are primary and their lithologic significance can be established unequivocally by reference to the calibrated velocity log. Multiples having their last bounce from a primary within the range of the VSP may be identified by observing their termination in the data at the same depth point at which the primary cuts the time-depth curve.

From this display, any dip across the well location can be recognised by moveout of the primary event to shorter time, as the geophone moves up the well and away from the lithology creating the reflection. No azimuth of dip can be computed from this display but true dip can be computed from a measurement of the  $\Delta T$  against vertical depth increment.

Unconformities may be recognised by an abrupt change of moveout of adjacent primary events. Topographical features up-dip away from the well may be recognised by an increase in the  $\Delta T$  or in the termination of an event away from the time-depth curve. Dip increasing up-dip away from the well can be observed in the data; however, if dip is decreasing up-dip (ie crest of an anticline) then the event in question will disappear from the data. Dip can be calculated using the method described in the Appendix contained in this report.

**DISPLAY VC(FK) F-K Display of Upgoing Wavefield at two-way time before enhancement**

This display is used in the design of the 'maximum bandwidth' filter in conjunction with the F-K display of the deconvolved upgoing wavefield and filter trials. It shows the data from the upgoing wavefield at two-way time transformed into F-K space. Any filter applied to the data before transformation is noted on the display.

Since the upgoing wavefield is aligned horizontally, or near horizontally, in T-X space (unless there is steep dip across the well location) it is aligned vertically, through zero wavenumber, in F-K space.

The 'maximum bandwidth' filter is the least restrictive filter that can be applied to the upgoing wavefield to remove noise whilst retaining resolution of the data in the zone of interest. The F-K analysis is therefore performed on data within a window around the zone of interest. Additionally, the data is windowed in time so that data analysed is close to the time-depth curve, where we would expect better resolution.

If the zone of interest is not known, it is assumed to be just above T.D. of the well.