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State-Of-The-Art

Paradigm's FastVel -- Automatic Anisotropic Velocity Analysis for Multi-Azimuth and Full Azimuth Gathers

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Velocity picking and analysis is a central component in seismic data processing, and probably the most complex and human intensive part of the workflow. A robust and reliable automatic velocity picking is the holy-grail of seismic data processing, as it can replace this long and tedious procedure with an automated one. The Paradigm™ FastVel® algorithm involves the usage of amplitude versus angle (AVA) techniques and measurements in order to automatically perform a detailed residual moveout/velocity analysis in a robust and effective way, and indeed it was quickly adopted by many of our users.

Today, seismic data is being acquired with richer and wider azimuths. Wide-Azimuth seismic datasets are used for fractured reservoir analysis. The fractures produce anisotropy (mainly HTI) which causes velocity variations as a function of offset/reflection angle, as well as moveout variations as a function of azimuth, which are a reflection of the anisotropic velocity field. Wide azimuth data captures these anisotropic effects and provides the means for fracture characterization. Anisotropic velocity analysis is therefore a critical step when processing wide azimuth data. At the same time, anisotropic velocities are the basic elements in fractured reservoir characterization. These velocities are also required for amplitude versus angle versus azimuth (AVAZ) analysis which requires "flattened" data.

There are two ways to deal with the rich and wide azimuthal data that is being acquired today in both offshore and onshore environments. The conventional approach is to separate the seismic data into a number of azimuth sectors and process each data independently. This means that the velocity for each dataset is picked independently from the other sectors. Consequently, velocity picking must be performed multiple times, and there is no consistency in the picking procedures between the different datasets.

Although anisotropic Fastvel can facilitate the analysis of these sectored gathers, a preferred approach, following the application of EarthStudy 360™ full azimuth decomposition and imaging, is to analyze full azimuth 3D gathers. Here velocity picking is done once, but the resulting velocity varies with azimuth. FastVel can automatically convert multiple sector datasets into 3D gathers and perform anisotropic velocity analysis in a single consistent step. Anisotropic FastVel provides a two (and four) component high resolution velocity field in both time and depth. Note that the fractures impose high frequency variations on the velocity field, and therefore a high resolution procedure is a basic requirement for fractured reservoir analysis. FastVel is thus the ideal tool.

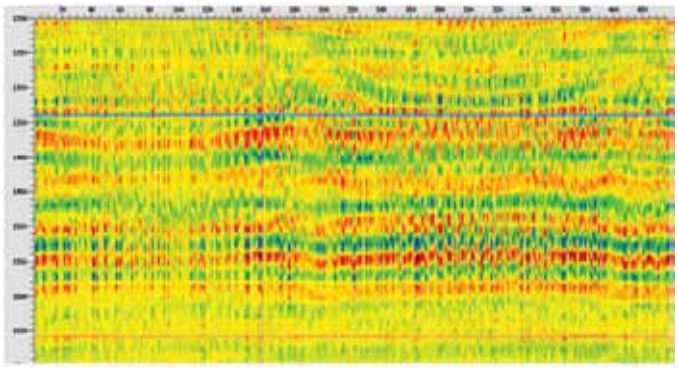

Fig. 2a: *Real Data example – Unfolded 3-D gather - reflection angle varies laterally. Note the moveout variations with azimuth which are repeating in this gather.*

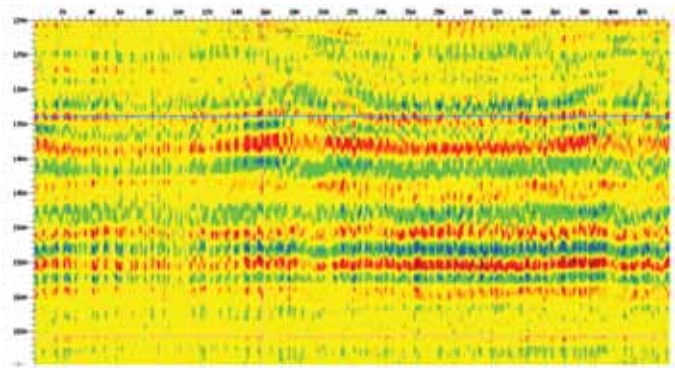

Fig. 2b: *Same gather – flattened by anisotropic FastVel*