Automatic Velocity Model Building Technology

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The automatic velocity model building technology is a new velocity model building method researched all by ourselves, it had been supported by China Ministry of Geology and Mineral Resources and SinoPec petroleum corporation from 1992 to 2004. We have got Chinese Patent in 2004 after over ten years study. After that, we applied this technology successfully in several workareas of China with different geology conditions, such as foothill complex surface and subsurface structure in the southern part of Tianshan Mountain、carbonate platform edge in Tahe area and marine carbonate rock in southern China etc.

This technology includes two main procedures: High Density CDR Velocity Analysis and Constrained Interval Velocity Inversion.

High density CDR velocity analysis uses ray parameters at shot and receiver, and the corresponding traveltime to calculate the seismic velocity trace-by-trace at peak times. Its basic procedures include 1) Perform time-variant stacking on CMP gather, and automatically pick the traveltimes、amplitudes、frequencies、wavefield coherences, and ray parameters at shots and receivers for the regular waves. 2) Calculate the reflection velocities at peak times of trace for each offset using ray parameters at shots and receivers、traveltimes、as well as the coordinates of the shots and receivers. 3) Improve velocity accuracy via space-variant、time-variant velocity filtering、frequency filtering or dip filtering. Then we obtain a high dense rms-velocity model in each CMP Gathers.

Constrained interval velocity inversion is a stable inversion method to create a geologically constrained instantaneous velocities from rms-velocity model. The inversion includes five steps: 1) Building a global initial instantaneous velocity trend function; 2) Calculating the rms-velocity by Dix-equation; 3) Performing a constrained least-squares inversion; 4) Modifying the initial velocity and repeat 2 and 3 steps; 5) Interval velocity model establishing. Finally we obtain a smooth interval velocity model for time migration and initial macromodels for depth migration or tomography.