HmFBA is Hydrometronics First Break Analysis OBC / OBN / OBS Picking and Positioning Software

Positioning Philosophy

There are many ways to position OBS receivers. Dedicated, high-frequency, positioning acoustics (e.g. USBL) are common ... and the most expensive in time and equipment.

Direct, seismic-airgun, water-arrival first break positioning lines are also possible. Extra time is required, but no extra equipment. Unfortunately, the first-break observable is much cruder than the acoustic observable, and there are first-break picking delays and instrumental delays that are difficult to calibrate. Therefore, direct water-arrival first breaks are not the same as dedicated acoustics.

A third technique is to use wide-azimuth, far-offset production seismic data, lots of them. This is the cheapest technique since no dedicated positioning lines are required. Vastly more data are available than in water-arrival first break positioning, especially in shallow water, so the statistics of large numbers make up for the coarse quality of the first-break observations. Because data are observed at all azimuths and offsets, picking and instrumental delays are easily calibrated.

On the other hand, far-offset seismic data may arrive horizontally through one or more refractors. These refracted data are subject to geological velocity gradients that must be calibrated. They are in HmFBA in 2-D mode with a Chebyshev regression equation for a single node or an entire swath and with or without anisotropy & angularity compensation. It's all a matter of statistics. With a crude observable like a first break, the statistics are in your favor with all the data in a wide-azimuth, far-offset receiver gather. And the outliers are easy to clean up with all those data, too.

HmFBA loads, picks and adjusts direct water-arrival and/or refractor-arrival OBC/OBN/OBS receiver gathers in SEG-Y or Seismic Unix (SU) formats receiver-by-receiver or *en masse* for best position. HmFBA picks first breaks using three different methods with user-selectable parameters, saves and loads first breaks as CSV files, and optionally conditions seismic traces with a high-pass filter. Seismic traces and their first-break picks can be viewed. Areal pick plots can be created. HmFBA solves for receiver or swath vertical velocity gradient, optionally balances geometry, rejects outliers with the Tau Method, compensates for node oscillator drift and provides copious diagnostic QC statistics and graphics.

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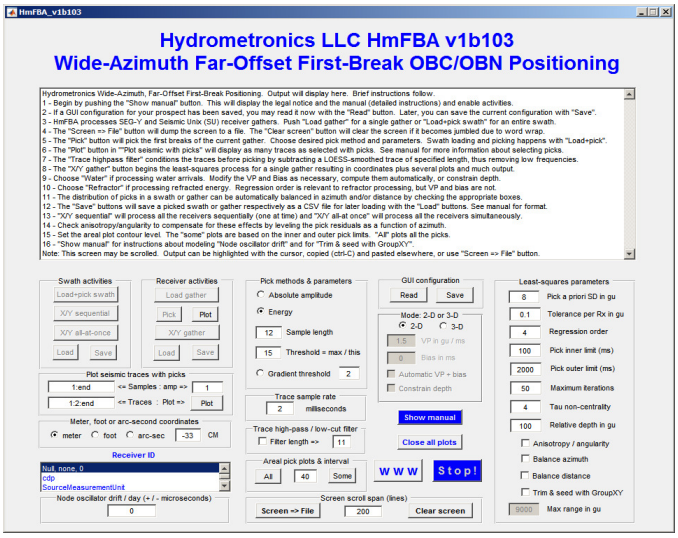
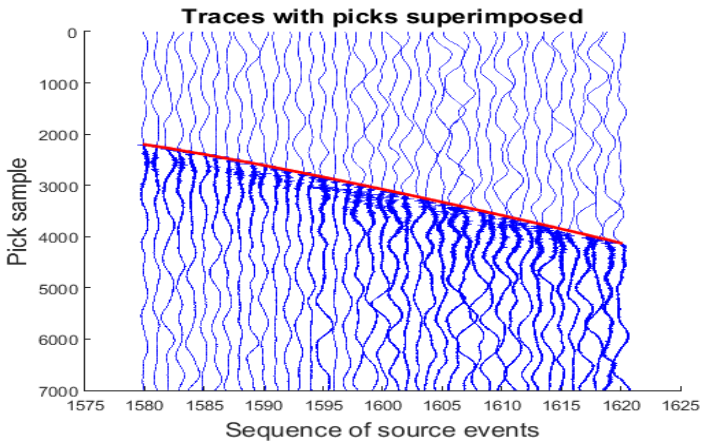
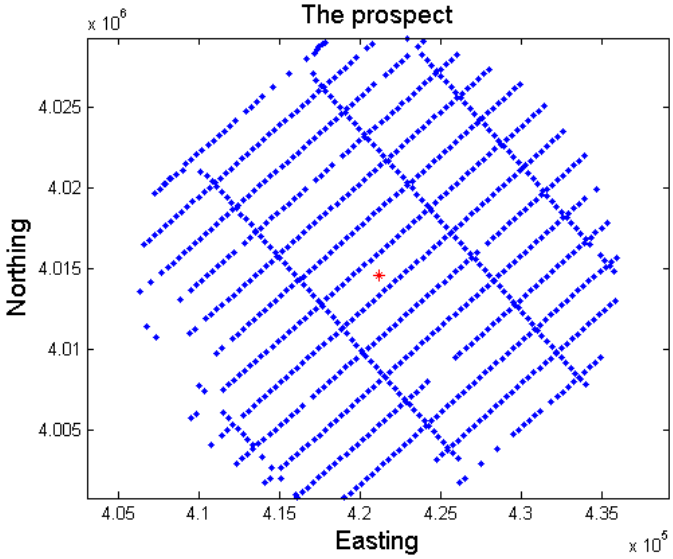






More on HmFBA

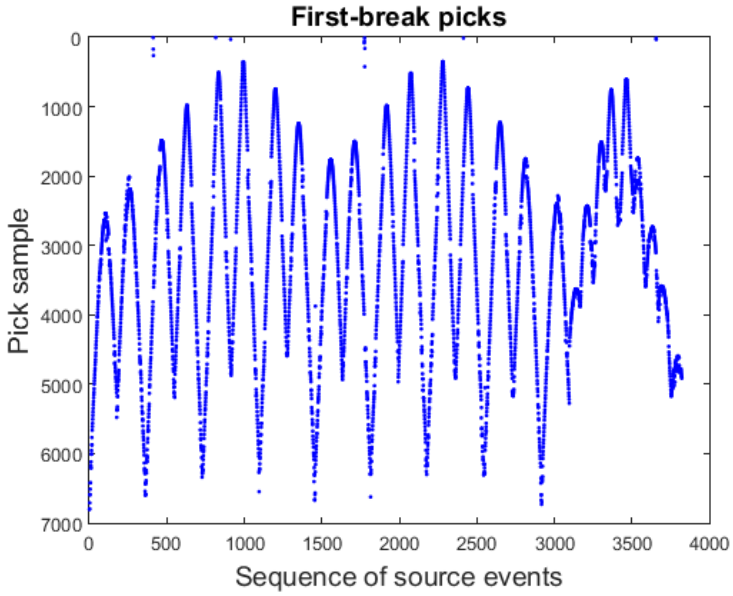
Three HmFBA First-Break Pick Options

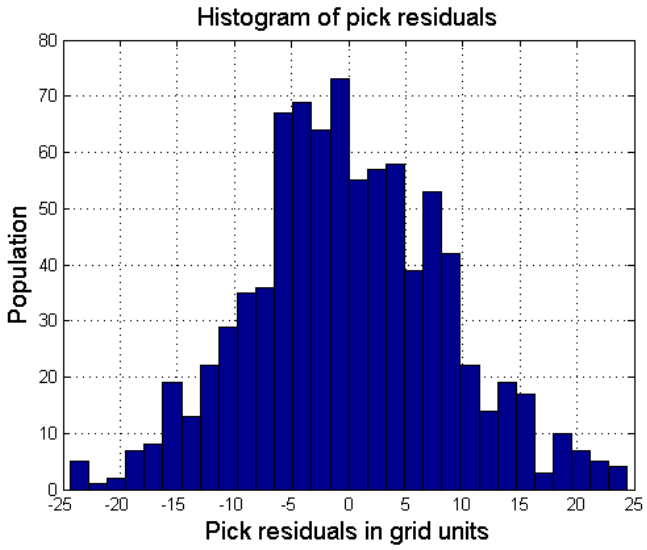
Absolute amplitude requires "sample length" and a threshold. The mean absolute value of the 10 largest trace amplitudes is determined. The mean absolute amplitudes of a rolling sample length are determined. When the threshold is exceeded the pick is the mean of the current rolling sample length.

Energy is the same as above except that energy (amplitude squared) is used instead of absolute amplitude.

Gradient threshold method computes the normalized mathematical gradient along the trace and picks the first above a specified threshold.

Trace High-Pass Low-Cut Filter cuts out low frequencies in the trace if necessary.





HmFBA output includes coordinates, the unit variance (UV), the uncertainties (SD) of the coordinates scaled by the UV, geometry metrics in azimuth and distance, total picks, selected picks and used picks. Also, if the 2-D mode regression order is set to 1, or if in 3-D mode, HmFBA provides velocity of propagation and the sum of picking and instrumental delays.

Of course, all the configuration parameters are echoed to the output screen.

Least-Squares Parameters

Pick *a priori* SD is an assessment of the standard deviation in grid units of a first-break pick.

Iteration stops when the shift in coordinates from the last iteration is less than the **Tolerance per Rx.**

Regression order is the order (degree) of the Chebyshev 2-D mode regression equation that converts picks in milliseconds into observations in grid units.

Pick inner and outer limit (ms) define the selection of picks in milliseconds.

Tau non-centrality is the number of tau statistics used for outlier detection and elimination.

Anisotropy / angularity compensates for anisotropy or source-array angularity effect in the prospect.

Balance azimuth balances geometry on azimuth.

Balance distance balances geometry on distance.

Trim & seed with GroupXY trims erroneous picks and seeds the adjustment using the GroupX and GroupY coordinates from the SEG-Y or SU and a range setting in grid units.

In 3-D mode, **VP** (velocity of propagation) and **bias** (static picking and instrumental delays) are available as well as the options to **automatically compute VP and bias** and to **constrain depth**.

The complete HmFBA user's manual is available here:
www.hydrometronics.com/downloads/HmFBA%20User%20Manual.pdf

More on Hydrometronics LLC is available here:
www.hydrometronics.com