

# Divine Microseismic Imaging Software

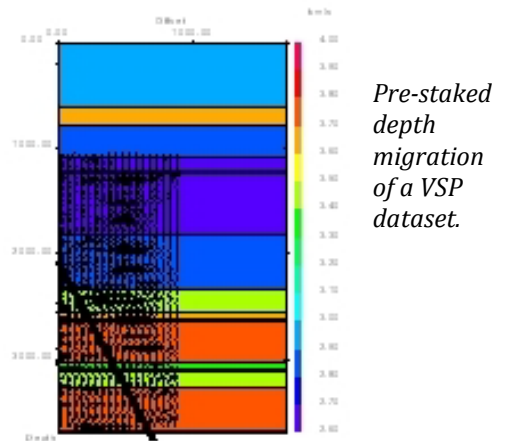
Divine is a modular, 2D and 3D active and passive seismic (microseismic) imaging package for crosshole, VSP, surface reflection, single well and critical refraction surveys along with real time microseismic monitoring. The principle functions of Divine are:

- Wavefield processing
- Trace interpretation
- Raytrace modelling
- Tomography
- Pre-stack migration
- Microseismic data acquisition
- Microseismic processing

## Processing

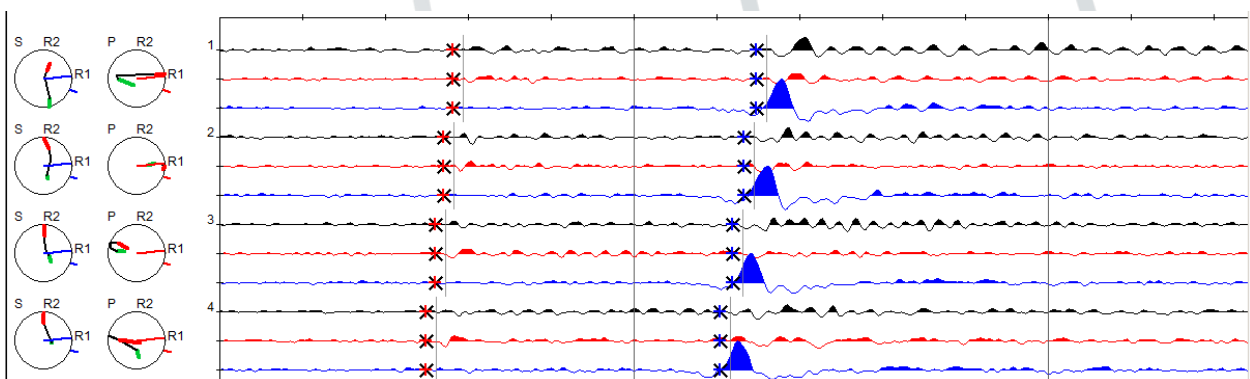
Sequential processing operations can be defined to obtain a new trace data set, which can be stored separately from the raw data set. Processing sequences can be built up from a number of different processing operators: LP, HP, source track as the average or median, sensor rotation, hodogram rotation and several others.

Pre-stack depth migration can be carried out using the diffraction stack, or diffraction times using the tomographic velocity image or the ray trace model velocity.



## Travel time Interpretation

Divine software suite includes interpretation features to assist in the interpretation process.



Hodograms of the P and S wave arrivals for each channel

Autopicked P, with secondary arrivals automatically tracked.

Traces can be aligned at existing interpretation or model time, making picking reflection events and shear events easier. Static corrections can also be applied to assist in the travel time interpretation by removing misalignment.

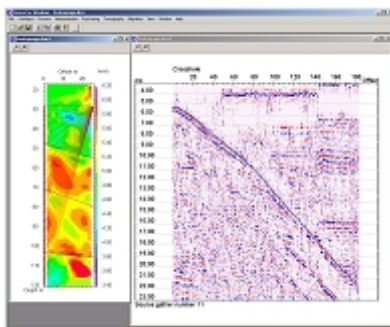
## Ray Trace Modeling

Divine is capable of modeling up to 100,000 source and 1500 receivers anywhere within the model. Any source/receiver format can be employed:

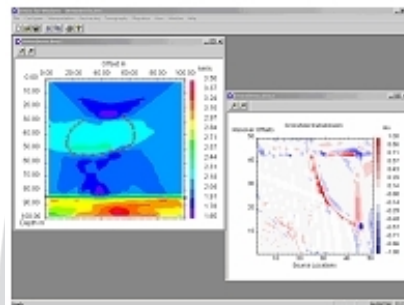
- 1) Surface reflection
- 2) VSP
- 3) Vertical incidence VSP and offset VSP
- 4) Crosshole
- 5) Critical refraction
- 6) Single well formats

## Crosshole Tomography

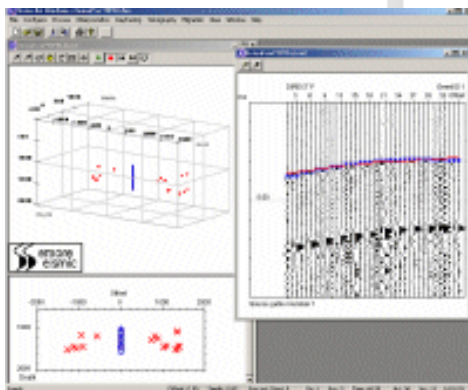
Tomographic velocity imaging can be applied to any form of transmission data, including crosshole, VSP, critical refraction and cross gallery. It is also applicable to reflection data for known reflector geometries or reflectors imaged by migration.



*Tomogram and interpretation of the body outline and deep interface.*



*Misfit in milli-seconds between the data and the travel time through the tomogram.*



*Geothermal microseismic results.*

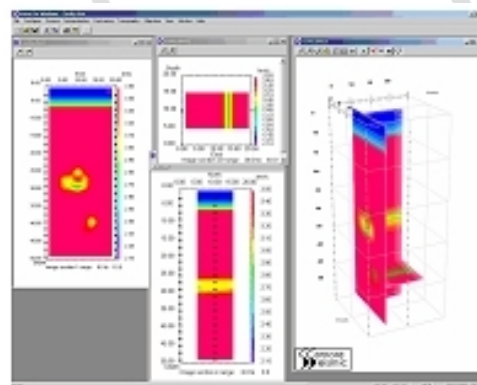
## Microseismic

Microseismic events are typically monitored using either a string of 3 component sensors with a single borehole or a widely spaced network of sensors at the surface. Divine is able to use the P and S wave travel time data, from the sensor network, to locate the event hypocenters.

Divine incorporated a range of trace display facilities that enable P and S times to be efficiently picked or checked interactively in a consistent manner, which is important in obtaining reliable event location. Divine also includes the Bootstrap processing method for geothermal application.

## 3D Module

Divine has the capability to produce 3D transmission ray tracing. This is an essential tool for forward modelling and imaging for transmission or critical refraction surveys, microseismic event location and generating diffraction stack times. This allows for a 3D velocity grid of P and S values to be produced, with anisotropy parameters incorporated into the model data sheet. The resolution of these models is determined by the number of nodes specified along the edge of the rectangular cells of the grid.



*Forward model of a cavity detection application.*