refraction seismics

processing and interpretation

single shot data import and geometry setting

⇓ ■ Reflexw 2D-dataanalysis

⇓

filtering the seismic data

■ Reflexw 2D-dataanalysis

⇓

picking the first arrivals

■ Reflexw 2D-dataanalysis
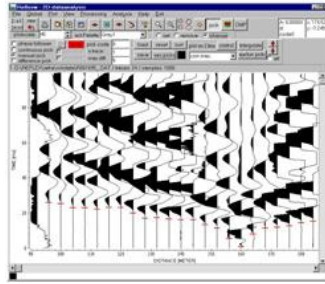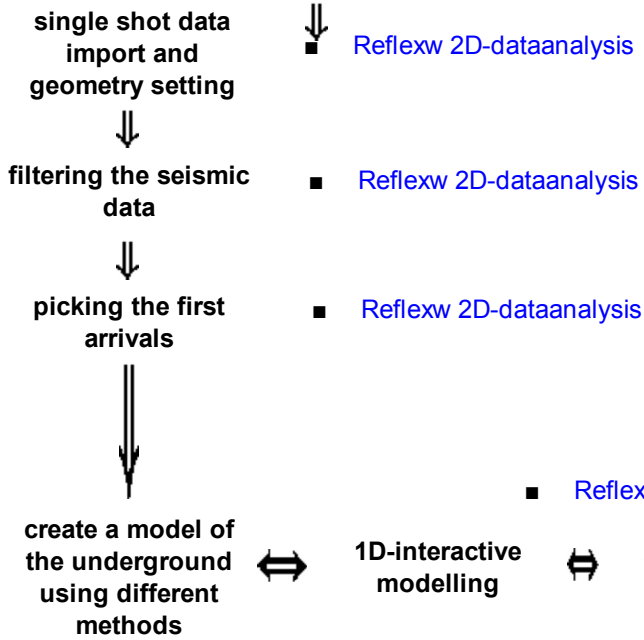
The 2D seismic shot data are processed within the 2D data-analysis module which includes various possibilities of setting the **geometries** and also all necessary **filter** and **edit** functions. Any kind of line based geoemetry for the shots and the receivers is possible. Some interactive interpretation tools like the **intercepttime method** are included for a very quick interpretation even within the field.

Different kinds of **picking** the first arrivals are included. You have the choice between manual picking, continuous picking and a semi-automatic picking using a phase follower (manual editing is always possible).

■ Reflexw modelling

create a model of the underground using different methods

⇔ **1D-interactive modelling** ⇔ **2D-wavefront inversion** ⇔ **refraction tomography** ⇔ **forward raytracing**

Short overview of the 2D-interpretation tools

wavefront-inversion *modelling*	**refraction tomography** *modelling*	**forward raytracing** *modelling*

wavefront-inversion

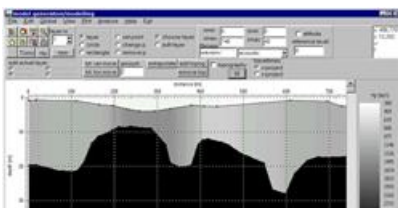**combine and assign picked first arrivals**

The first part (traveltime processing) contains the possibility to put together the picked traveltimes from several shots and to assign the picks to special layers. There exists nearly no practical limitation for the number of shots and receivers.
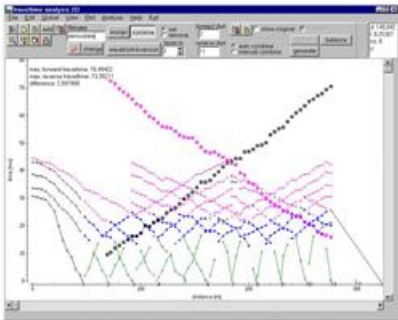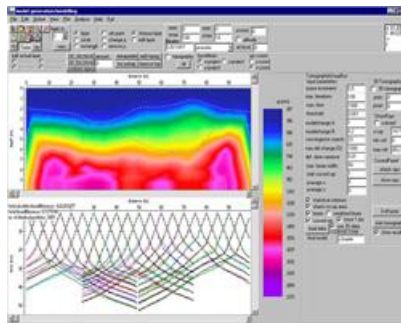

perform wavefront inversion

The combined traveltimes are directly inverted into a underground model using the **wavefront inversion method** which allows:
interactive back propagation of the wavefronts using finite differences approximation of the eikonal equation; the backpropagation is exact, even for very complicated overburdens.
inversion of **layer interfaces** and **layer velocities**
the **topography** can directly be included in the inversion process

refraction tomography

The **refraction tomography** allows an automatic inversion of the combined traveltimes. The data coverage must be high enough but no assignment to layers is necessary. The inversion is based on a two-dimensional tomographic approach based on **SIRT** (simultaneous iterative reconstruction technique). The **curved rays** are calculated using a finite difference approximation of the eikonal equation (see forward raytracing). A start model must be defined. The start model may be a simple constant velocity velocity without any pre-informations but may also consists of a complex layered model, e.g. resulting from a previous wavefront inversion. The resulting velocity model is a rasterfile stored in REFLEX-format whereby all possibilities of Reflexw are available for a further interpretation.

forward raytracing

The **forward raytracing** method can be used either for a validation of the models derived from the wavefront inversion or from the refraction tomography or it can be used as a trial and error method in order to improve the model or even to construct a model of the underground. The main goal is to calculate the traveltimes of the first arrivals but also reflections from layer boundaries can be built.
The method is based on a **finite difference** approximation of the **eikonal equation** for calculating first arrivals. It takes into the account the existence of different propagation waves like transmitted, diffracted or head waves. Therefore no practical limitation concerning the 2D complexity of the medium is given. The method is very suitable for near surface investigations, because there is no need for approximations concerning the complexity of the models. The wavefronts and therefore the raypaths can be stored and displayed.
The information about the geometry (shot and receiver positions) can automatically be adopted from the shot records or from the traveltime files. Editing, if necessary, is easily possible. The number of shots (e.g. a complete refraction seismic line) is not limited.