Data Base
Frequency-time analysis program

Reference Manual

Surface waves processing & seismic source inversion Web site is located at:

http://www.mitp.ru/soft/index.html

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Fmt4Db

The program **Fmt4Db** written on the base of **Data Base** package is designed for database creation. **Data Base** is a package of programs designed by **Daniel Quinlan (IRIS corporation)**.

Menu and Toolbar

File:	**Edit:**	**Tools:**	**Help:**
New.....	Edit...Project.....	Record List …	
Help……..			
Open.....		Data Base..…	
Save			
Save..as.			
Exit.....			

New Project File - Create new Project File .

Open Project File.

Save Project File.

Edit Project File

Create & Edit Record List

Create Data Base

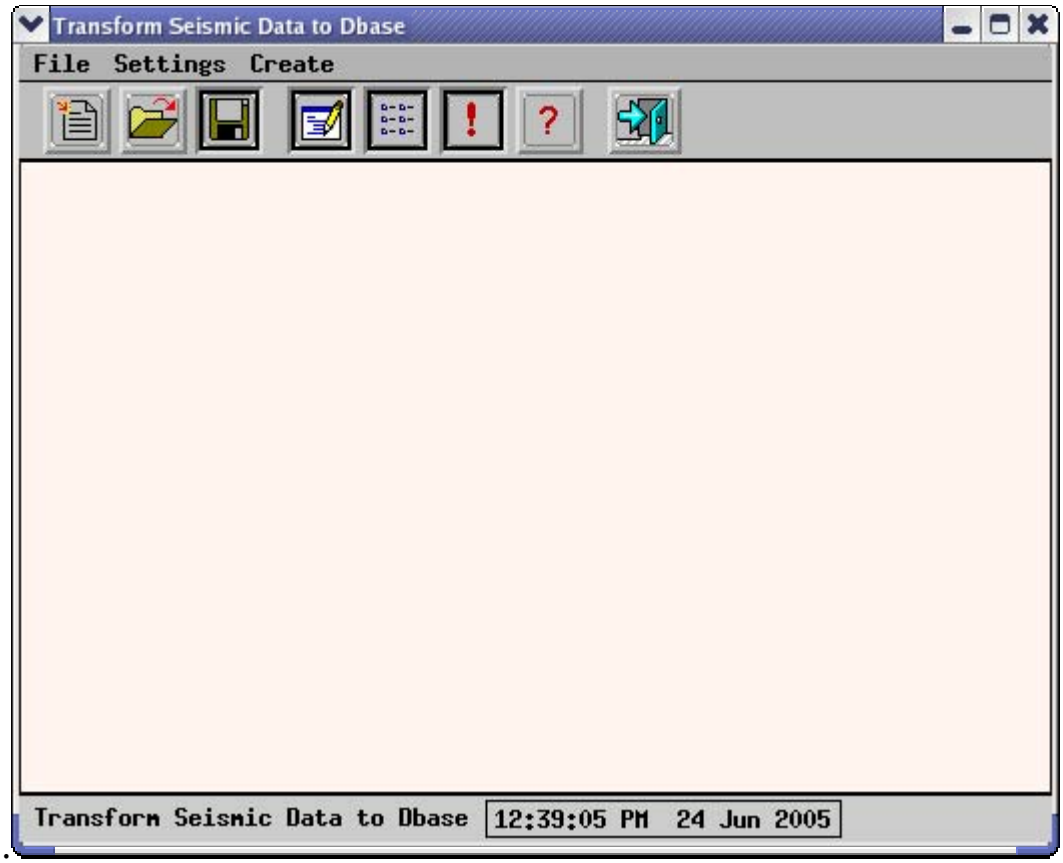
Help

We illustrate application of the program by the example provided for downloading.
We assume that the directory /opt/fmt/example/Seed2Db contains SeedVols - the directory for the input seed volumes. The names of the seed volumes must have last extension name “seed”.
In our example this directory contains seed volumes: colima.seed
Dbase/ - the directory for the output resulting dbase
work/ - the directory for the working materials.
All of these directories must be created in advance!
Colima.ah4db - the project file name.
Colima.err_log - the error log file name.

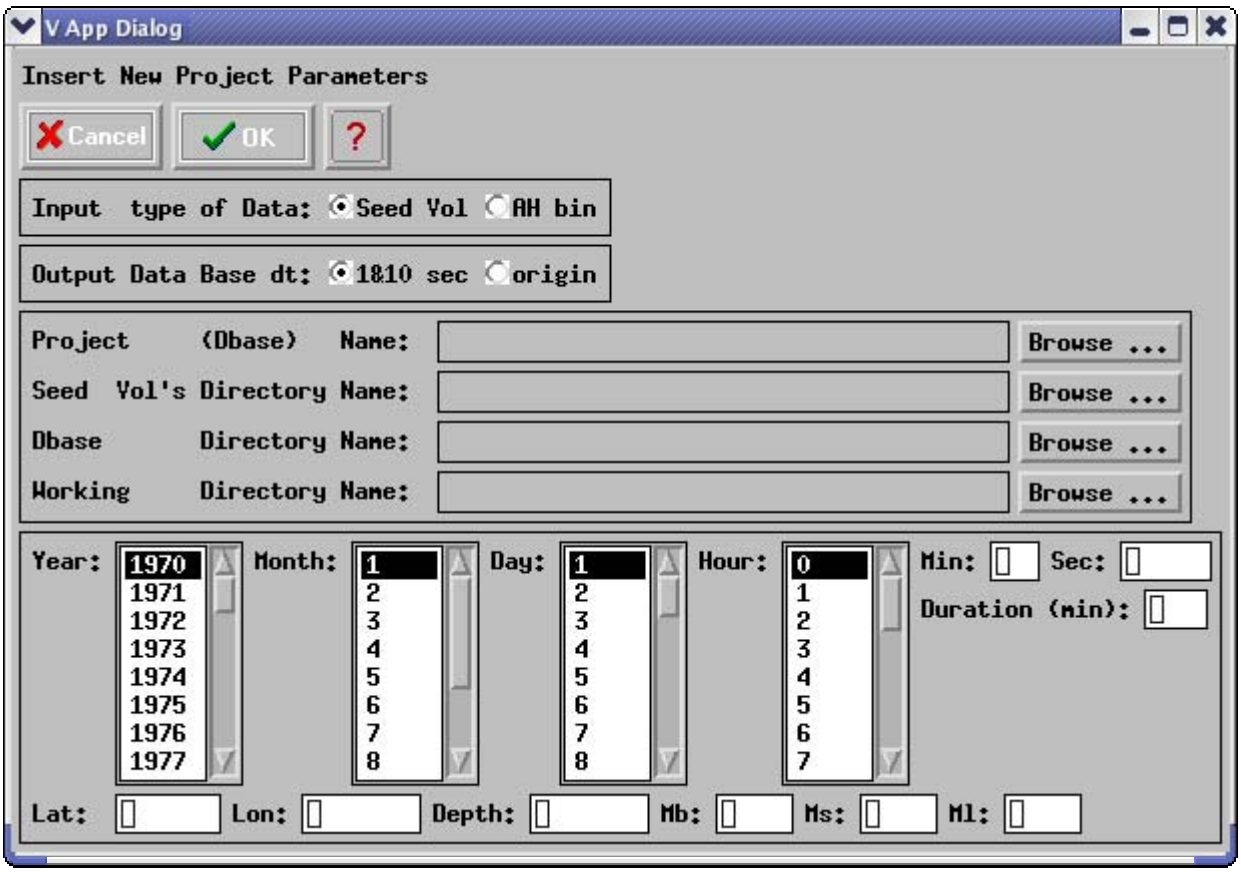
Note: You can put all these files and directories in any accessible disk space.

1. Input data.

When you execute program Fmt4Db initial window will appear:



1a. Use the icon if you just start to work with earthquake for the first time. The following window will appear:



The user have to browse or type to fill the empty boxes, lists, radio buttons related to the different items shown in the window.

Input type of Data radio button:

Seed Vol - Dbase will be created from seed volumes.

AH bin - Dbase will be created from Ah bin files. Last extension name of these files must be “AH” (See Technical Notes 2).

Output Data Base dt radio button:

1&10 sec - Input time series will be decimated to 1&10 seconds

origin - Dbase will contain time series with original sampling

(See Technical Notes 3).

Duration (min): Fill this box, if you are ordering the decimation. The duration of each resulting Dbase record will not exceed the value indicated in this box.

Project (Dbase) Name:

Push “browse” button to choose directory and type project name. This name will become a root name of resulting dbase (later on “**Db Root Name**”). The program will add to the project name (name of the Project File, see **item 3**) a fixed extension “ah4db”.

Seed Vol's Directory Name:

Browse directory "**Seed2Db"** and click on "**SeedVols**" directory which contains seed volume(volumes). The name of this directory will appear in browser’s “Selection” box . Click "OK" buttton and "**SeedVols**" will appear in the box *Seed Vol's Directory Name.*

Dbase Directory Name:

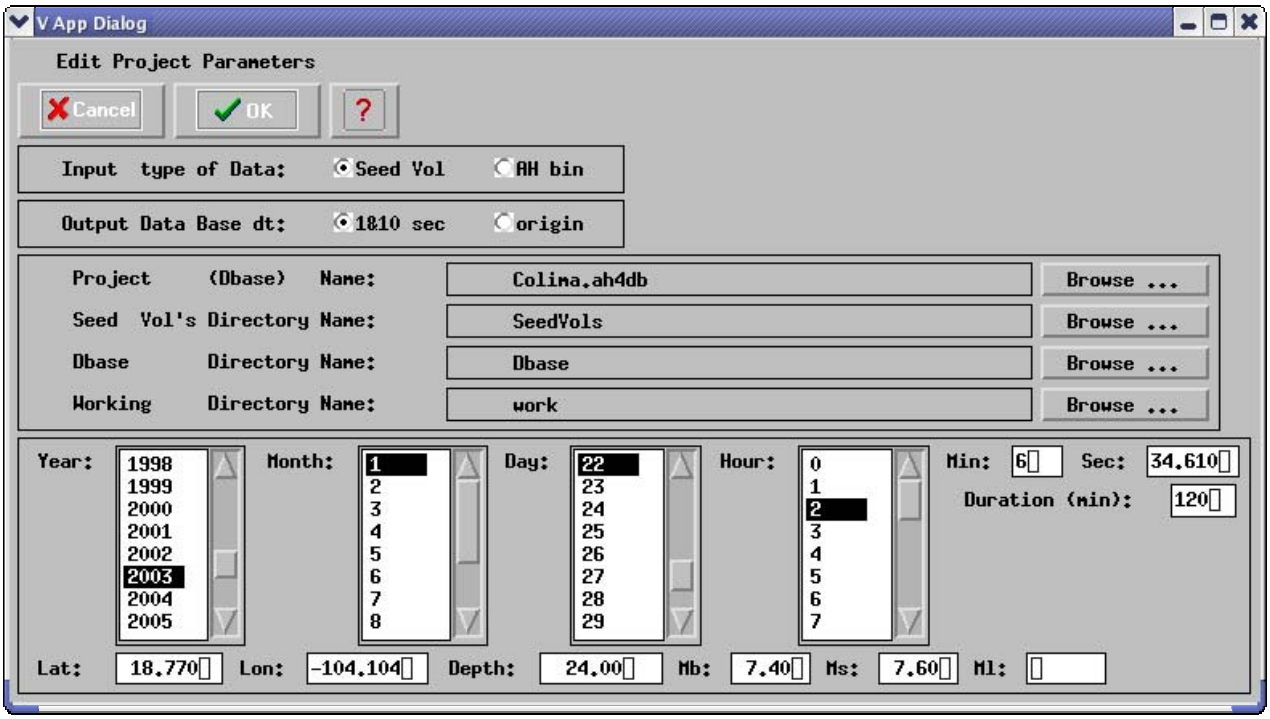
Browse directory "**Seed2Db"** and click on "**Dbase**" directory which will contain the output dbase.

Working Directory Name:

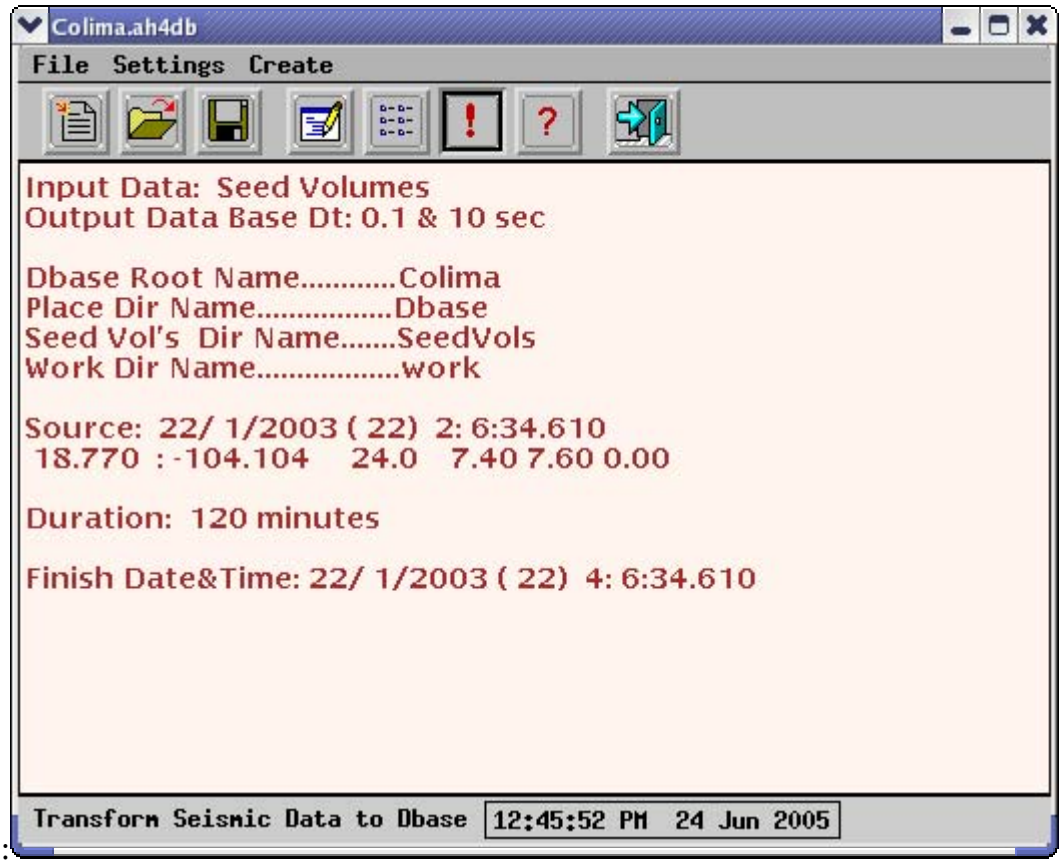
Browse directory "**Seed2Db"** and click on "**work**" directory which will be used for working materials.
Example for infill of the rest of boxes and lists is given in the item **1b**.

1b. Use the icon to modify an existing Dbase. Using the directory-file navigator find the Project File you would like to modify, edit it, and save with the same or new name.

Use icon to modify the contents of the session input parameters during the current session. Push this icon and the following window will appear:



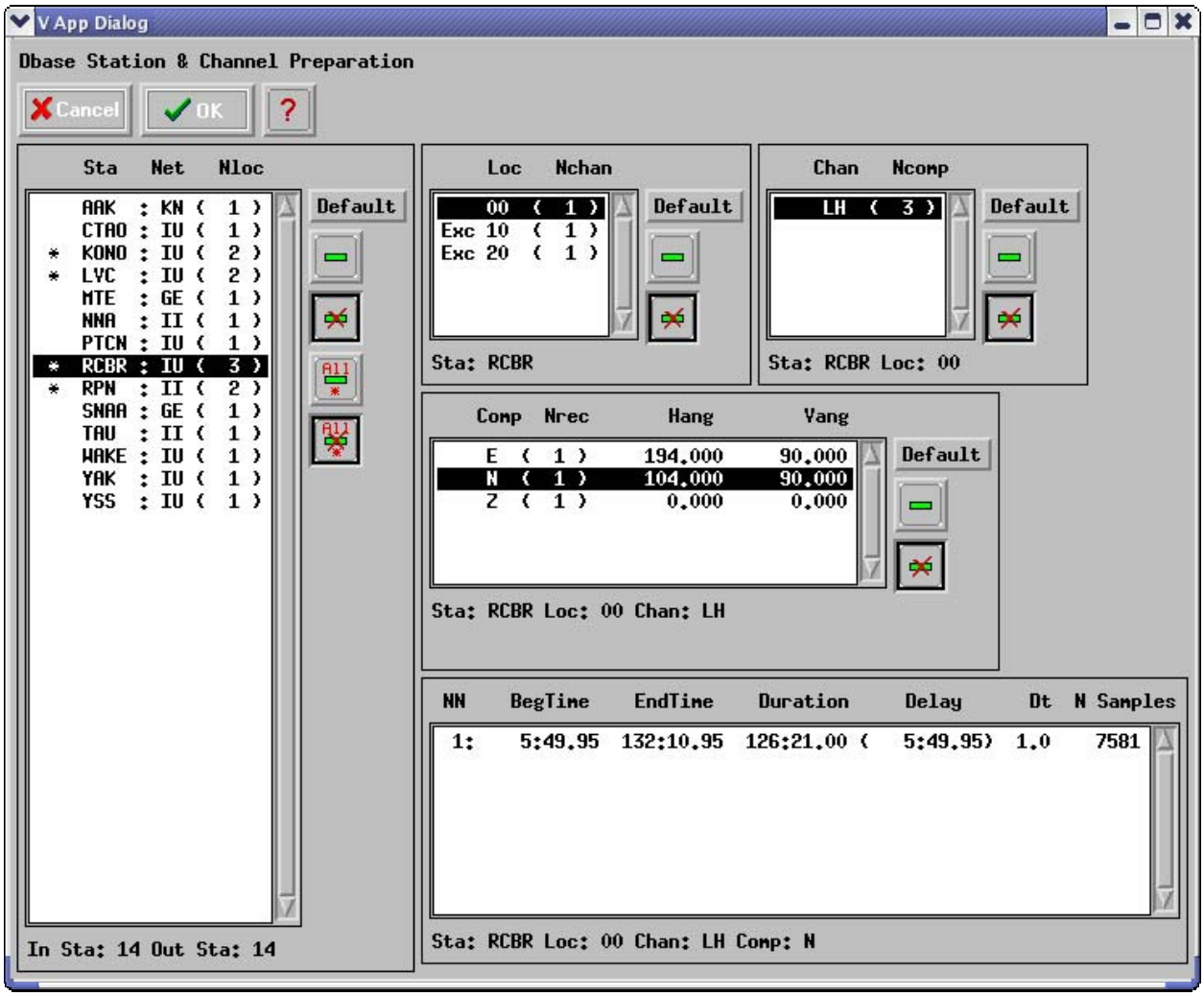
To confirm the changes close this window using button “OK”. Next window will appear


Colima.ah4db
File Settings Create
Input Data: Seed Volumes
Output Data Base Dt: 0.1 & 10 sec
Dbase Root Name.....Colima
Place Dir Name.....Dbase
Seed Vol's Dir Name.....SeedVols
Work Dir Name.....work
Source: 22/ 1/2003 (22) 2: 6:34.610
18.770 : -104.104 24.0 7.40 7.60 0.00
Duration: 120 minutes
Finish Date&Time: 22/ 1/2003 (22) 4: 6:34.610
Transform Seismic Data to Dbase
12:45:52 PM 24 Jun 2005

2. Action (Tools).

<u>2a.</u> Selection of stations for creating the Dbase.

Push the button . The following window will appear:



These lists allow user to choose suitable station for transmission to Dbase using buttons:

- Mark selected row from left list for excluding corresponding station from resulting Dbase.

- Unmark selected row from left list for excluding corresponding station from resulting Dbase.

- Mark all of selected rows from left list for excluding corresponding stations from resulting Dbase.

- Unmark all of selected rows from left list for excluding corresponding stations from resulting Dbase.

List's mark: ' * ' – records of few sensors are available, 'Exc' – excluded, 'Err' – error.

Station List:
Sta - station name.
Net - network codes. (See Technical Notes 4)
NLoc - number of locations. (See Technical Notes 5)

Location List:
Loc - location identifier,
Nchan – number of channels.

Channel List:
Cha - channel name,
Ncomp – number of components.

Component List:
Comp - component name,
Nrec - number of fragments,
Hang - azimuth of component direction,
Vang - angle between component direction and the outward-pointing vertical direction.

Record List:
NN - fragment sequence number,
BegTime - fragment start time counting from the event time,
EndTime - fragment end time counting from the event time,
Duration - duration of fragment,
Delay - time delay of the fragment with respect to the end time of preceding fragment, for the first fragment – with respect to the event time.
Dt - time step,
Nsamples - number of samples.

2b. Creating resulting Dbase

Push the button and wait.

3. Output

Using icon button or the item “Save”, or “Save as..." of the File menu you write the Project File to the disc.
In the example it is file **Colima.ah4db**
If different Seed Volumes contain the same station name, all of them but one must be excluded.
In the example file **Colima.err_log** contains complete list of stations and records attributes.
Dbase directory (in the example “**Dbase**”) contains following information:
response/ - instrument response directory
wf_l/ - binary time series files directory (1 count per second)
wf_v/ - binary time series files directory (1 count per 10 second)

Frequency-time analysis and source inversion programs use following Dbase tables:

"**Colima_l.wfdisc**"- Waveform file header and descriptive information. This table provides a pointer (or index) to waveforms stored on **wf_l**/ directory.

"**Colima_v.wfdisc**"- This table provides a pointer to waveforms stored on **wf_v**/ directory.

"**Colima.instrument**" - Generic (default) calibration information about a station. This table serves three purposes. It holds nominal one-frequency calibration factors for each instrument. It holds pointers to the nominal frequency-dependent calibration for an instrument. Finally, it holds pointers to the exact calibrations obtained by direct measurement on a particular instrument. See **sensor**.

"**Colima.site**"- Station location information. Site names and describes a point on the earth where seismic measurements are made (e.g. the location of a seismic instrument or array). It contains information that normally changes infrequently, such as location. In addition, site contains fields to describe the offset of a station relative to an array reference location. Global data integrity implies that the sta/ondate in site be consistent with the sta/chan/ondate in **sitechan**.

"**Colima.sensor**"- Specific calibration information for physical channels. This table provides a record of updates in the calibration factor or clock error of each instrument, and links a sta/chan/time to a complete instrument response in the relation **instrument**.

"**Colima.sitechan**"- Station-channel information.This relation describes the orientation of a recording channel at the site referenced by sta. This relation provides information about the various channels (e.g. sz, lz, iz) that are available at a station and maintains a record of the physical channel configuration at a **site**.

"**Colima.origin**" - Data on event time, location and magnitude.

Technical Notes:

1. Seismograms in SEED format can be retrieved from multiple data centers: http://www.iris.washington.edu/manuals/netdc/netdc_user.htm , via "view processing queue WILBER II": http://www.iris.washington.edu/cgi-bin/wilberII_page1.pl or http://www.iris.edu/data/WebRequest.htm. then transform them from SEED to DB DATASCOPE format, and store them.

2. Program Fmt4Db uses 'rdseed' program to create AH binary files from all of seed volumes (directory SeedVols , files *.seed) and puts these AH binary files into working directory "work". Program rdseed is placed in /opt/fmt/bin directory. The text file </opt/fmt/bin/fmtRdseed.initial> contains information for Fmt4Db program. Using this file Fmt4Db creates temporary file for rdseed program providing AH binary files extraction from rdseed volume. Such program design allows working with AH binary files directly. Make sure that last extension name of each file is "AH" (for example "1997.288.00.16.45.8310.IU.WVT.01.LHN.AH" or "WVT.LHZ.AH", or "1.AH").
If you work with the files those not created with the program 'rdseed', do not use file names containing more than 5 dots. It is recommended to use 'rdseed' standard name format:
yyyy.ddd.hhh.mm.ss.ffff.NNN.SSSSS.LLL.CCC.Q.AH
(See http://www.iris.edu/manuals/rdseed.htm). Here yyyy is the year, ddd is the Julian day, hh.mm.ss.ffff is the time of day of the start of the first record, SSSSS is the station name, and CCC is the component name for the particular seismogram being recovered, NNN is Network codes, LLL is Location identifiers, Q is specify data type (E - Everything, D - Data of undeteminated state, R - Raw waveform data, Q - Quality controlled data, some processes have been aplyed to the data).
Attention! In accordance with the standard of program 'rdseed' it is assumed that responses in AH binary files are given for displacements.

3. Program allows decimating of time series to 1 sample per second and to 1 sample per 10 seconds. The decimate rate must be a multiple of the product of 2,4,5.
The program allows to keep the original sampling.

4. Network codes are assigned by the FDSN archive (IRIS DMC) to provide uniqueness to seismological data streams.
Look at http://www.iris.washington.edu/FDSN/networks.txt (permanent)
and http://www.iris.washington.edu/FDSN/networks.portable.txt (temporary).

5. In 1998, the DMC started to use location identifiers to identify uniquely a data stream among many data streams for the same channel id and station id.

EXAMPLES: `1997.288.00.16.45.8310.IU.WVT.`**`00`**`.LHN.AH` and `1997.288.00.16.45.8310.IU.WVT.`**`10`**`.LHN.AH` means there are two different instruments at the ANMO sight that use the BHZ channel designation.

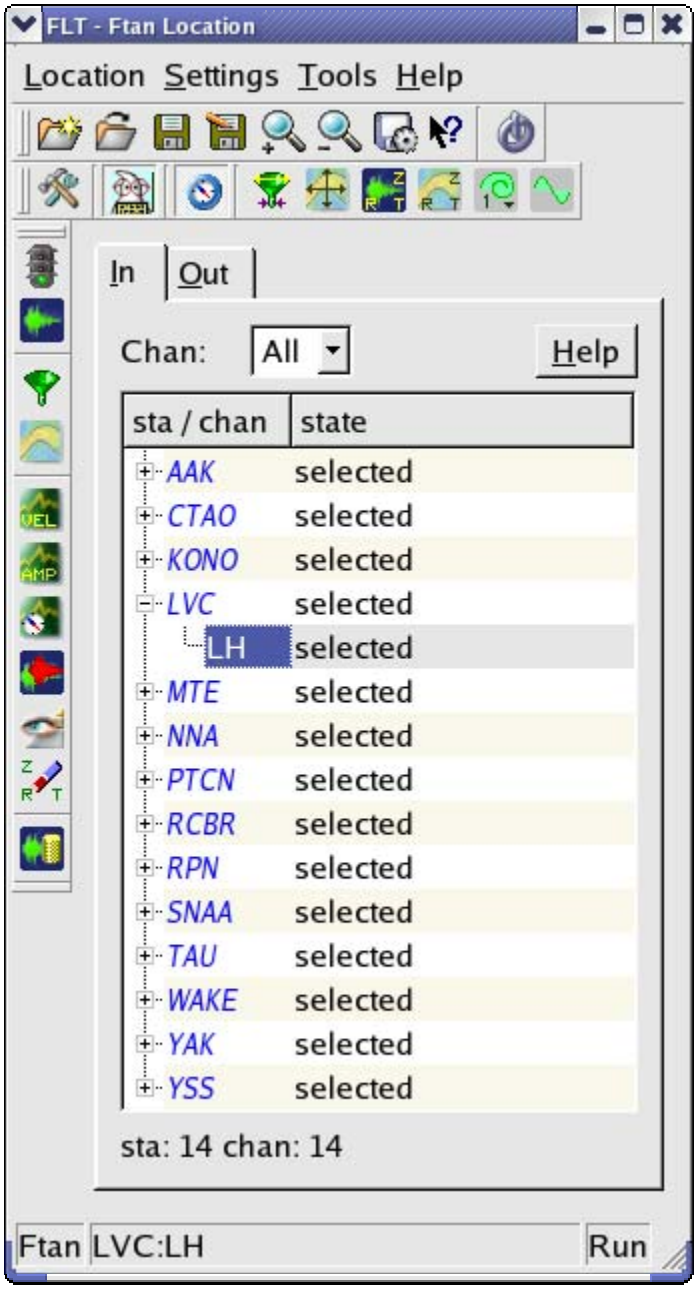
(For more information about how location identifiers are applied, please read this DMC Electronic Newsletter article. http://www.iris.washington.edu/newsletter/vol1no1/page1.htm)

If a station does not use location identifiers, the file name will look something like this: 1997.288.00.16.45.8310.IU.WVT**..**LHN.AH. For instance if you have an STS-1 and STS-2 BHZ channel the location id could be:

00 for the STS-1 (primary stream)
10 for the STS-2 (the secondary stream)
20 for other sensors, etc

6. More details concerning **IRIS (**Data Sources, Request Methods, Manuals, Software, Services etc.) can be found in ***http://www.iris.washington.edu/HTM/manuals.htm.***

Program FTAN



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1. Introduction.

The program **FTAN** was designed for processing of seismic surface waves records by methods of spectral and frequency-time analysis. It is a Colorado University product designed by Profs. A. L. Levshin and M. Ritzwoller with their assistants and students. The program uses input data in **CSS Datascope** format. The output of program is also **CSS** formatted database containing cleaned waveforms. It's possible to export measured group velocities in ASCII format and cleaned waveforms in AH or ASCII formats. Program **FTAN** works under control of "Ftan control panel" program named **ftan**. Using **ftan** program you define input data, processing parameters, start **FTAN** as external program, and communicate with it.

FTAN code is a fortran code. Program **ftan** is a C++ code using Qt C++ toolkit for multiplatform Graphic User Interface and application development.

2. Main Window.

2.1 The ToolBars.

2.1.1 Location Toolbar.

We define as location a directory containing FTAN output materials:

a) subdirectory with cleaned waveforms;
b) subdirectory with dispersion files;
c) output tables (**table.wfdisc** related to cleaned records and tables related to dispersion files);
d) postscript files.
e) subdirectory **wfah** contains cleaned wave forms in ah format;
f) subdirectory **wfascii** contains cleaned wave forms in ah ascii format;
g) subdirectory **dispascii** contains dispersion files in ascii format

- Create a new location. Correspondent menu option is **Location->New** and keyboard shortcut is Ctrl+N.

- Open an existing location. Menu option is **Location->Open** and keyboard shortcut is Ctrl+O.

- Save currently open location. Menu option is **Location->Save** and keyboard shortcut is Ctrl+S.

- Save the current location under a new name. Menu option is **Location ->Save as....**

- Zoom in - increases the font size. Keyboard shortcut is Ctrl++.

- Zoom out - decreases the font size. Keyboard shortcut is Ctrl +-.

- **Export** of cleaned waveforms (in AH and/or AH ASCII format) and measured group velocities (ASCII file) into the selected directory. The menu option is **Location->Export**.

- Close **ftan**. Menu option is **Location->Exit** and keyboard shortcut is Ctrl+Q.

2.1.2 Settings Toolbar.

Settings toolbar is intended for assignment of **FTAN** specifications.

- Main settings. Menu option is **Settings->Main**; keyboard shortcut is (Ctrl+M).

- Toggle button. If the button is pressed then postscript files will be created. The menu option is **Settings->Ps On/Off** and the keyboard shortcut is (Ctrl+P).

- Toggle button. If the button is pressed then polarization measurement will be performed. The menu option is **Settings->Polar On/Off** and the keyboard shortcut is (Ctrl+R).

- Assignment of parameters for bandpass filtering. The menu option is **Settings->Filter Spec** and the keyboard shortcut is (Ctrl+F).

- Assignment of parameters defining FTAN window.
The menu option is **Settings->Fta Window** and the keyboard shortcut is (Ctrl+W).

- Selection of waveform components to be plotted. The menu option is **Settings->Plot Comp** and the keyboard shortcut is (Ctrl+L) .

- Selection of waveform components for FTAN processing. The menu option is **Settings->Fta Comp** and the keyboard shortcut is (Ctrl+T) .

- Assignment of orbit number. The menu option is **Settings->Orbit**.

- Assignment of mode number. The menu option is **Settings->Mode** and the keyboard shortcut is (Ctrl+D) .

2.1.3 Tools Toolbar.

Tools toolbar is intended for performance of **FTAN** processing and view of results.

- Start FTAN processing. The menu option is **Tools->Start** and the keyboard shortcut is (Alt+R) .

- Plot selected waveforms. The menu option is **Tools->Wave** and the keyboard shortcut is (Alt+W) .

- Apply bandpass filtering to waveforms raw data. The menu option is **Tools->Filter** and the keyboard shortcut is (Alt+I) .

- Start the performance of floating filtering. The menu option is **Tools->Fta** and the keyboard shortcut is (Alt+F) .

- View calculated group velocity curves. The menu option is **Tools->Velocity** and the keyboard shortcut is (Alt+V) .

- View cleaned and raw amplitude spectra. The menu option is **Tools->Amplitude** and the keyboard shortcut is (Alt+A) .

- View estimated polarization anomalies. The menu option is **Tools->Polarity** and the keyboard shortcut is (Alt+P) .

- View cleaned and raw seismograms. The menu option is **Tools->Overlay** and the keyboard shortcut is (Alt+O) .

- View a FTAN diagrams for cleaned and raw records. The menu option is **Tools->Image** and the keyboard shortcut is (Alt+M) .

- Clean results of processing for chosen components. The menu option is **Tools->Clean** and the keyboard shortcut is (Alt+N) .

- Save results of processing. The menu option is Tools->Save and the keyboard shortcut is (Alt+E).

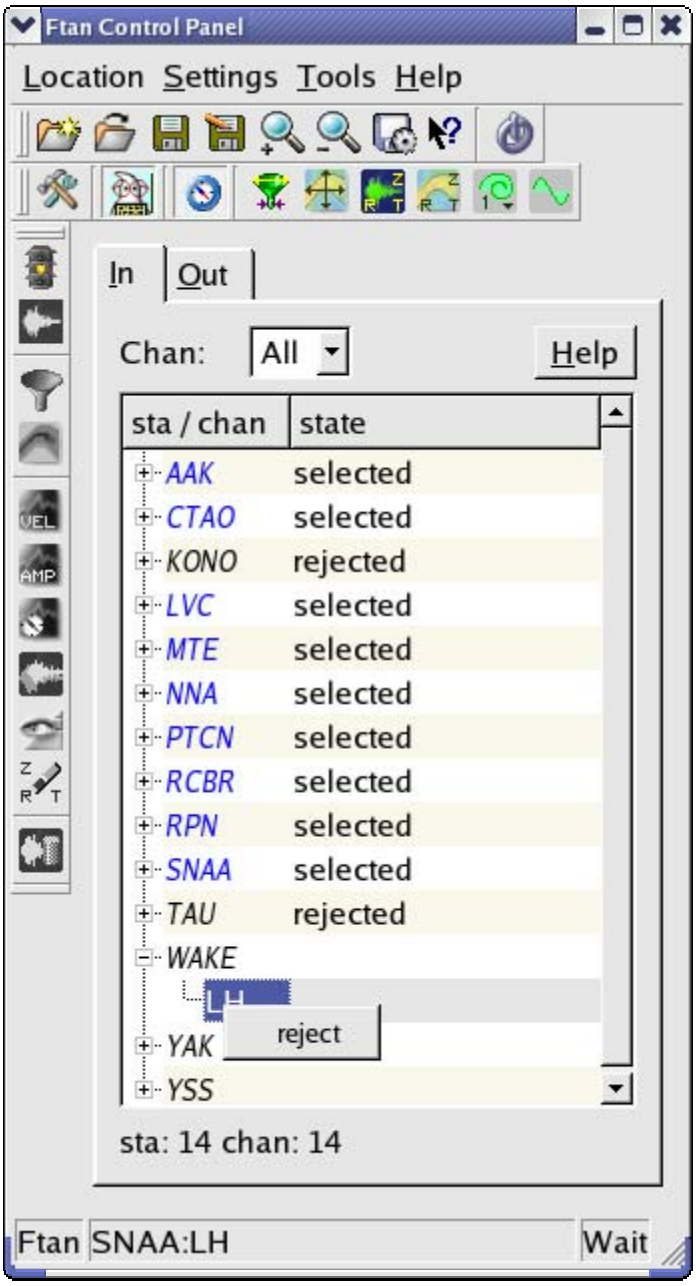
2.2 Central Area.

2.2.1 In Tab.

The **In Tab** first column "sta/chan" in Central Area contains the names of seismic stations and available channels. The second column "state" contains indicator showing the status of station or channel.

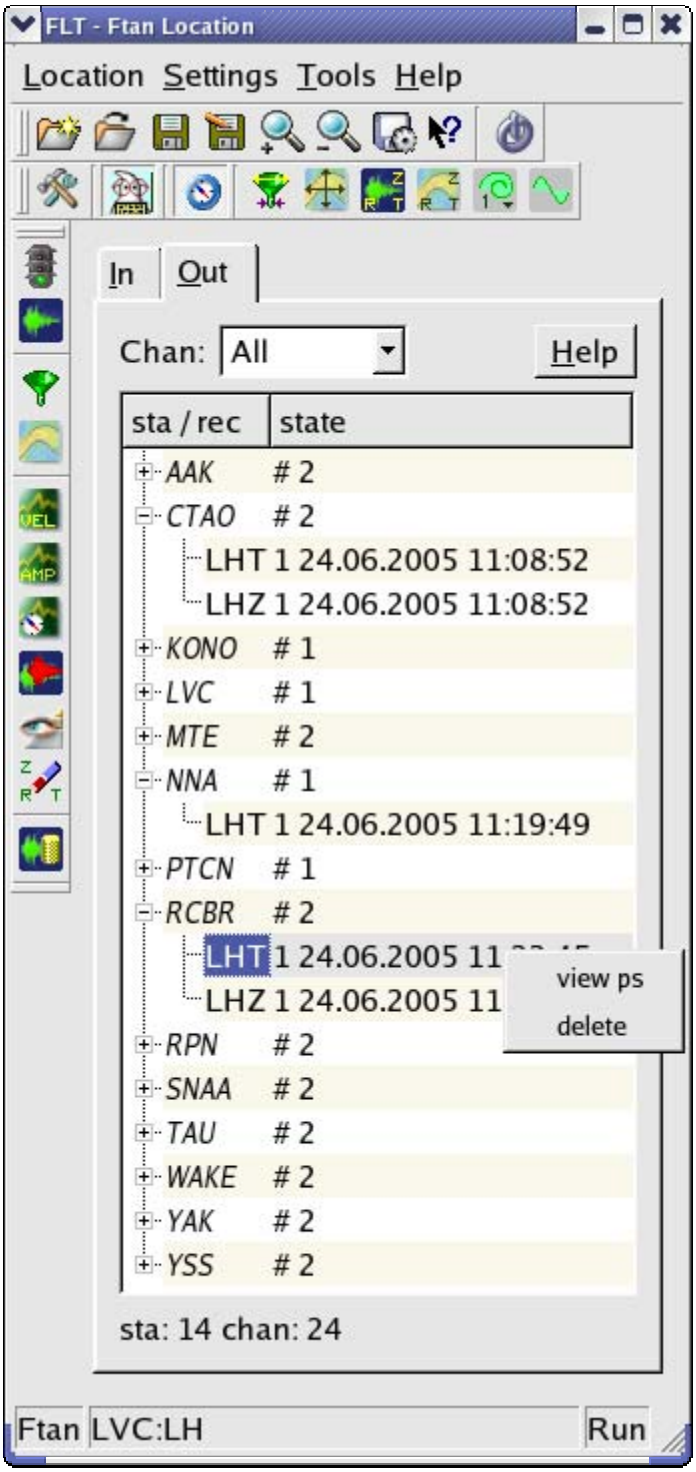
The channel indicator **selected** appears after the cleaned channel records were saved (selected for output). The channel indicator **rejected** appears after the channel (which is not selected) was rejected manually. To perform the rejection click by right mouse button on the channel, pop up menu "reject" will appear, click it by mouse button.

The station indicator **selected** appears after at least one cleaned channel record is saved. The station indicator **rejected** appears after all channels are rejected. A station which is not selected can be rejected manually in the same way as channel (in this case all channels will be marked as rejected).



2.2.2 Out Tab.

The **Out Tab** first column " sta/rec " in the Central Area contains names of seismic stations and components of cleaned records. The second column "state" contains (a) the number of cleaned records for correspondent station, and (b) orbit number and the time of record creation. The creation time is given in format: dd/MM/yyyy hh:mm:ss.
The **Out Tab** provides the tools for selected (saved) records deleting and for viewing of postscripts produced by **FTAN** during the record processing. To perform the deleting of any record click on it by right mouse button, pop up menu will appear. Click on the item "delete". To view the postscripts click on the item "view ps", the window "View Postscript Dialog" will appear. This dialog window handling is described below in paragraph 4.15.



2.3 Status bar.

The status bar contains the information about current operations.

3. The Menu Entries.

3.1 Location.

The keyboard shortcut is (Alt+L).The following functions are available from the Location menu:

Location->New... (Ctrl+N) - Create a new location.

Location->Open... (Ctrl+O) - Open an existing location.

Location->Save (Ctrl+S) - Save the currently open location.

Location->Save as... - Save the currently location under a new name.

Location->Export - **Export** of cleaned waveforms (in AH and/or AH ASCII format) and measured group velocities (ASCII file) into the selected directory.

Location->Open Recent - Displays a list of recently opened location to choose from.

Location->Exit (Ctrl+Q) - Close **ftan**.

3.1 Settings.

The keyboard shortcut is (Alt+S).The following functions are available from the Settings menu:

Settings->Total Settings... - Full configuration of all parameters.

Settings->Main Settings (Ctrl+M) - Configuration of main parameters.

Settings->Ps On/Off (Ctrl+P) - Toggle button. If the button is pressed then postscript files will be created.

Settings->Polar On/Off (Ctrl+R) - Toggle button. If the button is pressed then polarization measurement will be performed.

Settings->Filter Spec (Ctrl+F) - Assignment of parameters for bandpass filtering.

Settings->Fta Window (Ctrl+W) - Assignment of parameters defining FTAN window.

Settings->Plot Comp (Ctrl+L) - Selection of waveform components to be plotted.

Settings->Fta Comp (Ctrl+T) - Selection of waveform components for FTAN processing.

Settings->Orbit - Assignment of orbit number.

Settings->Mode (Ctrl+D) - Assignment of mode number.

3.3 Tools .
The keyboard shortcut is (Alt+T). The following functions are available from the Tools menu:

Tools->Start (Alt+R) - Start FTAN processing.

Tools->Wave (Alt+W) - Plot selected waveforms.

Tools->Filter (Alt+I) - Apply bandpass filtering to waveforms raw data.

Tools->Fta (Alt+F) - Start the performance of floating filtering.

Tools->Velocity (Alt+V) - View calculated group velocity curves.

Tools->Amplitude (Alt+A) - View cleaned and raw amplitude spectra.

Tools->Polarity (Alt+P) - View estimated polarization anomalies.

Tools-> Overlay (Alt+O) - View cleaned and raw seismograms.

Tools-> Image (Alt+M) - View a FTAN diagrams for cleaned and raw records.

Tools->Clean (Alt+N) - Clean results of processing for chosen components.

Tools->Save (Alt+E) - Save results of processing.

3.4 Help.
The keyboard shortcut is (Alt+H). The following functions are available from the Help menu:
Help->Content (F1)
Help->About - Displays a simple message box about **ftan** program.
Help->About Qt - Displays a simple message box about **Qt C++ toolkit**.
Help->What´s This (Shift + F1)

Ftan program provides online-help, with three levels of detail:

1.**Tool Tips** and **Status Tips**.
Tool Tips is extremely brief help, that appears when cursor is hanging over a toolbar button for a certain period of time. Tool Tips are presented with black text on a yelow background. **Status Tips** are also a short piece of descriptive text, a little longer then a tooltip. When the mouse hangs over a toolbar buton, a status tip appears in the **Status bar**.

2.**What's This?** provides a single window with an explanatory text that pops up when the user asks "What's this?" When you push button or push keyboard buttons (Shift + F1) the cursor changed to and you can click on any toolbar button to obtain its help text.

3.**Online Help** is provided by a help browser. Ftan program have a "Content" entry in the Mane Window Help menu and help buttons in Central Area of Main Window (In Tab and Out Tab .) Click "Content" entry of Windows Help menu (keboard button - F1) to open ftan HTML-based

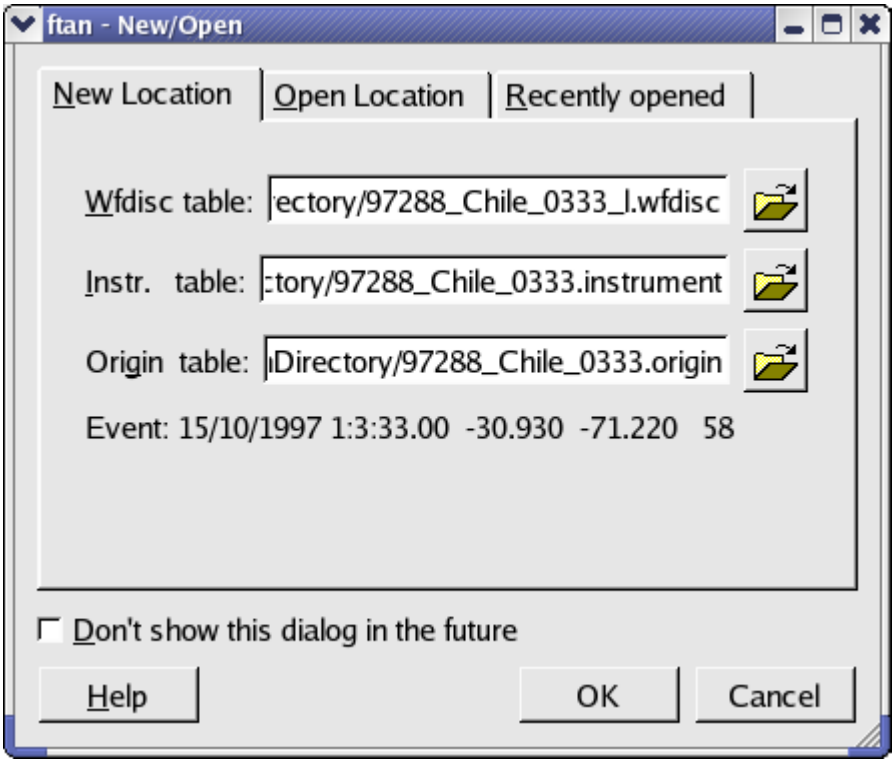
program manual.

4. The Dialogs.

4.1 The New/Open Start.

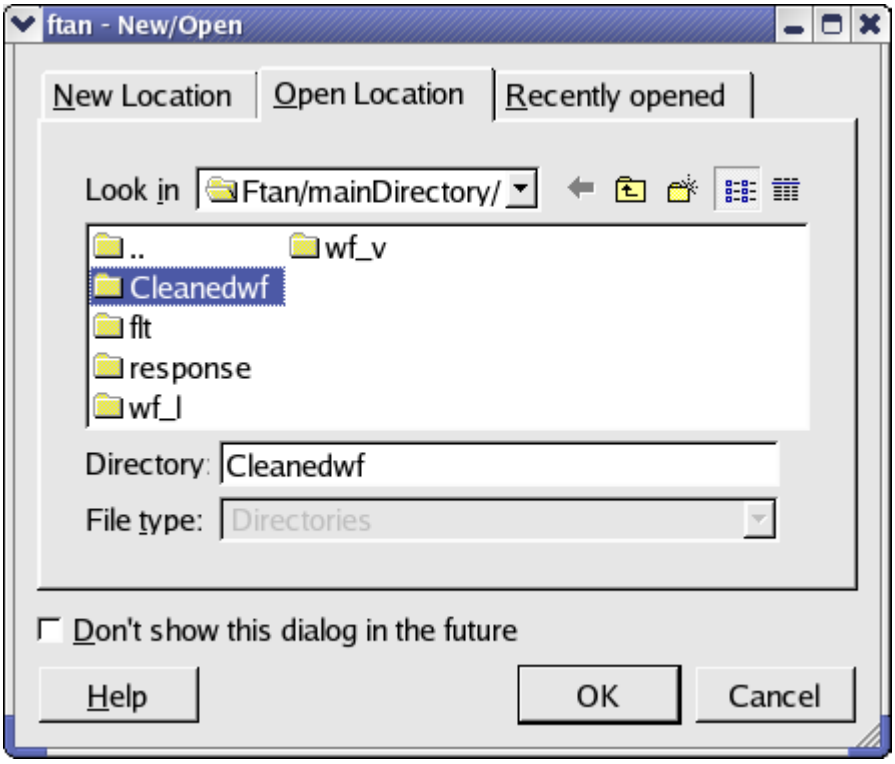
Start up **ftan** to invoke the New/Open Start dialog. This dialog contains three tabs to use depending on what you want to do once you start up **ftan**.

The New Location Tab



This tab is the default when you start up **ftan**. Browse wfdisc, instrument, origin tables to start a new location. For more information about new location, see the **The New Location Dialog** section 4.2.

The Open Location Tab



Click this tab to open an already existing directory. The tab shows the current directory and it's subdirectories. Click once on directory to select it. Click OK to open the selected directory. Click Cancel to leave the dialog without opening a new directory.

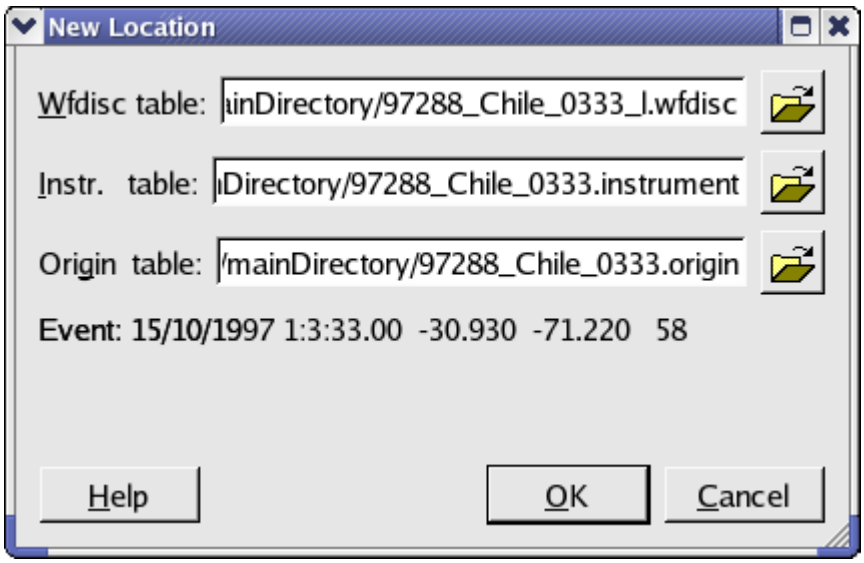
The Recently Opened Tab

This tab displays all recently opened locations. Select a location and then click OK to open it.

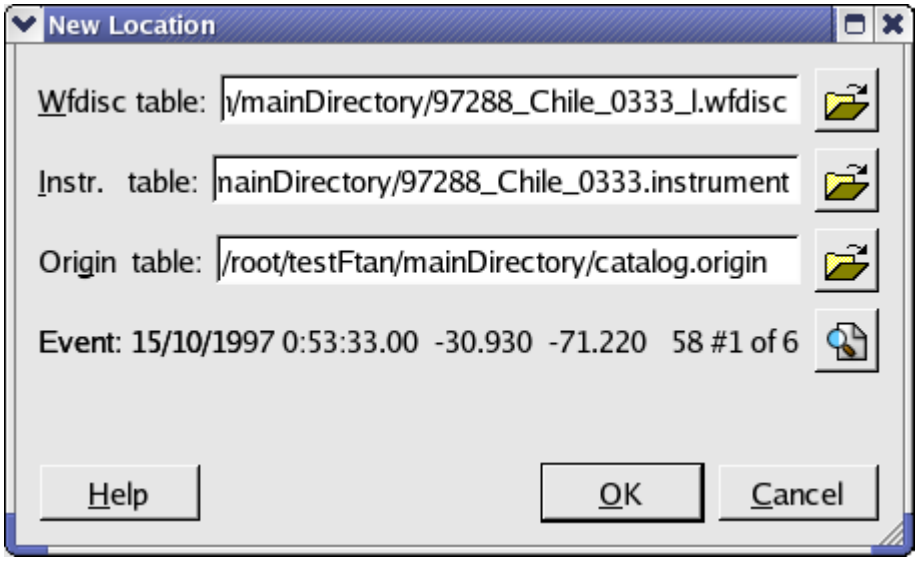
4.2 The New Location.

Location->New... (Ctrl+N)

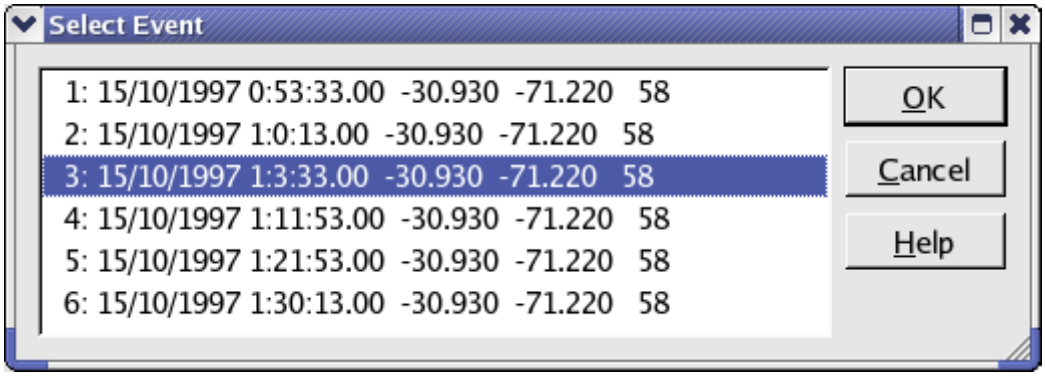
The **New Location Dialog** may be used instead of the **New Start Dialog** (see 4.1) for creation a new location at any time not closing current session.



Browse ‘wfdisc’, ‘instrument’, ‘origin’ tables. If the origin table contains one row, gray label ‘Event’ appears. It's the event information: day/month/year hour:min:sec, latitude longitude, depth. If origin table contains information about more then one event, the following window appeares:



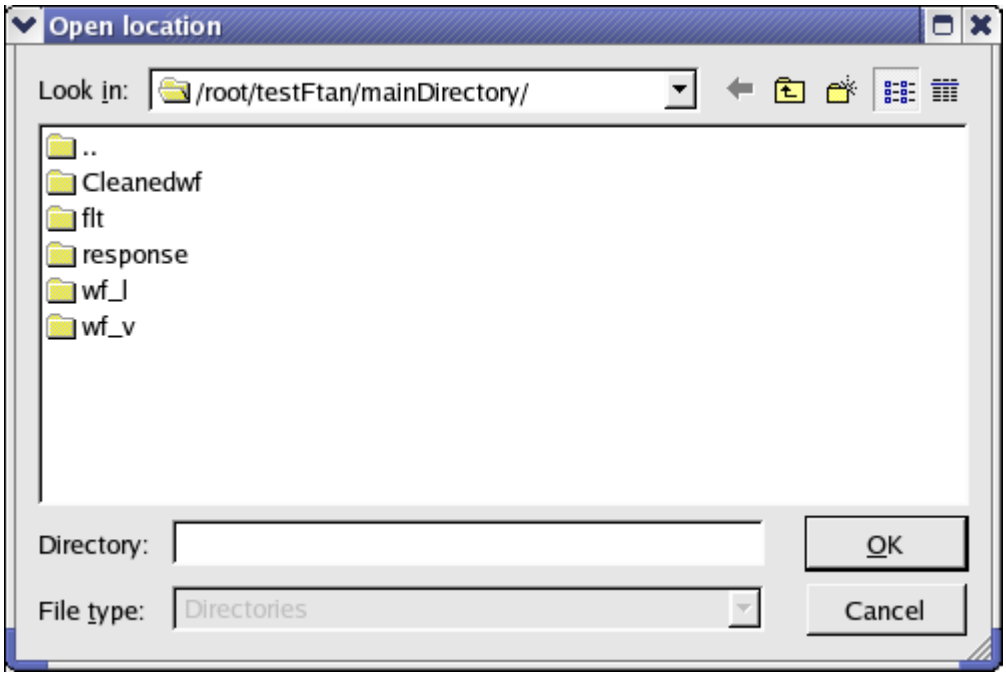
This window shows the first origin table row and number of such rows. Click the button at the right end of the row, a window containing complete origin table will appear:



Select a row and click OK. Selected Event information will appear in **New Location Dialog.**
Click button Ok to work with new location.
Click Cancel to leave the dialog without opening a new location.

4.3 The Open Location.

Location->Open... (Ctrl+O)
The **Open Location Dialog** may be used instead of the **Open Start Dialog** (see 4.1) for opening an already existing directory at any time not closing current session.



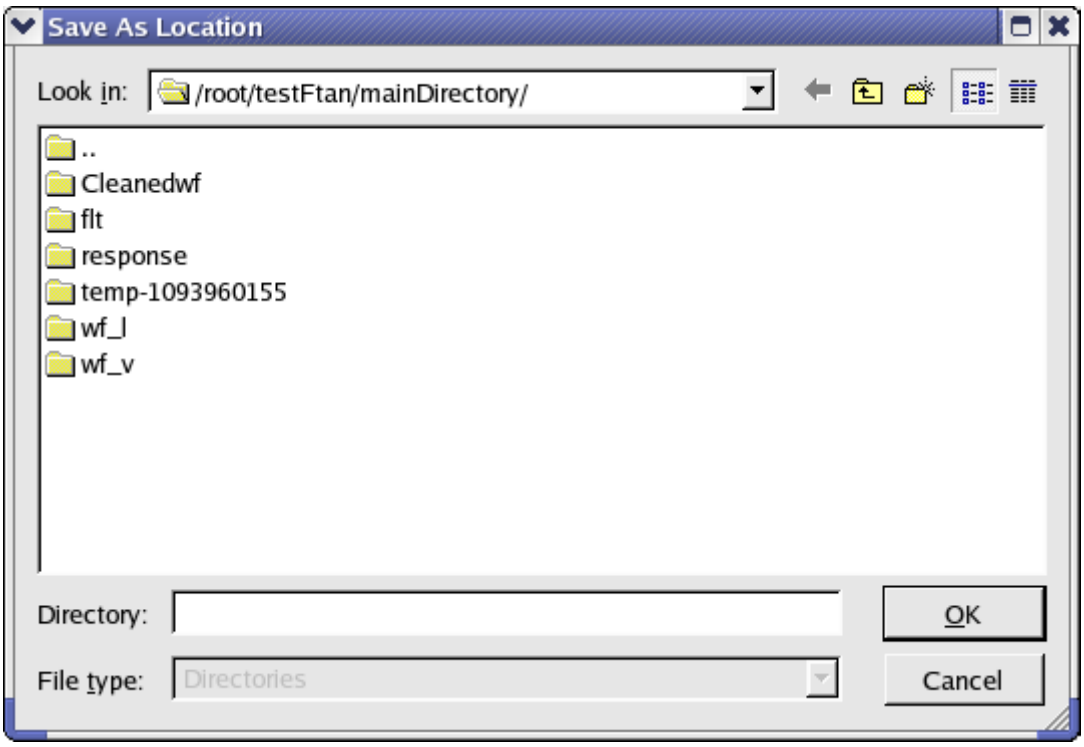
This dialog is assigned to open an already existing directory. The window shows the current directory and it's subdirectories. Click once on directory to select it. Click OK to open the selected directory. Click Cancel to leave the dialog without opening a new directory.

4.4 Save as… and Save Location

Location->Save (Ctrl+S)
This button and menu option are assigned for saving the location. In the case of new Locaton

the **Save Location As Dialog** will be invoked for selection of directory name.

Location ->Save as...

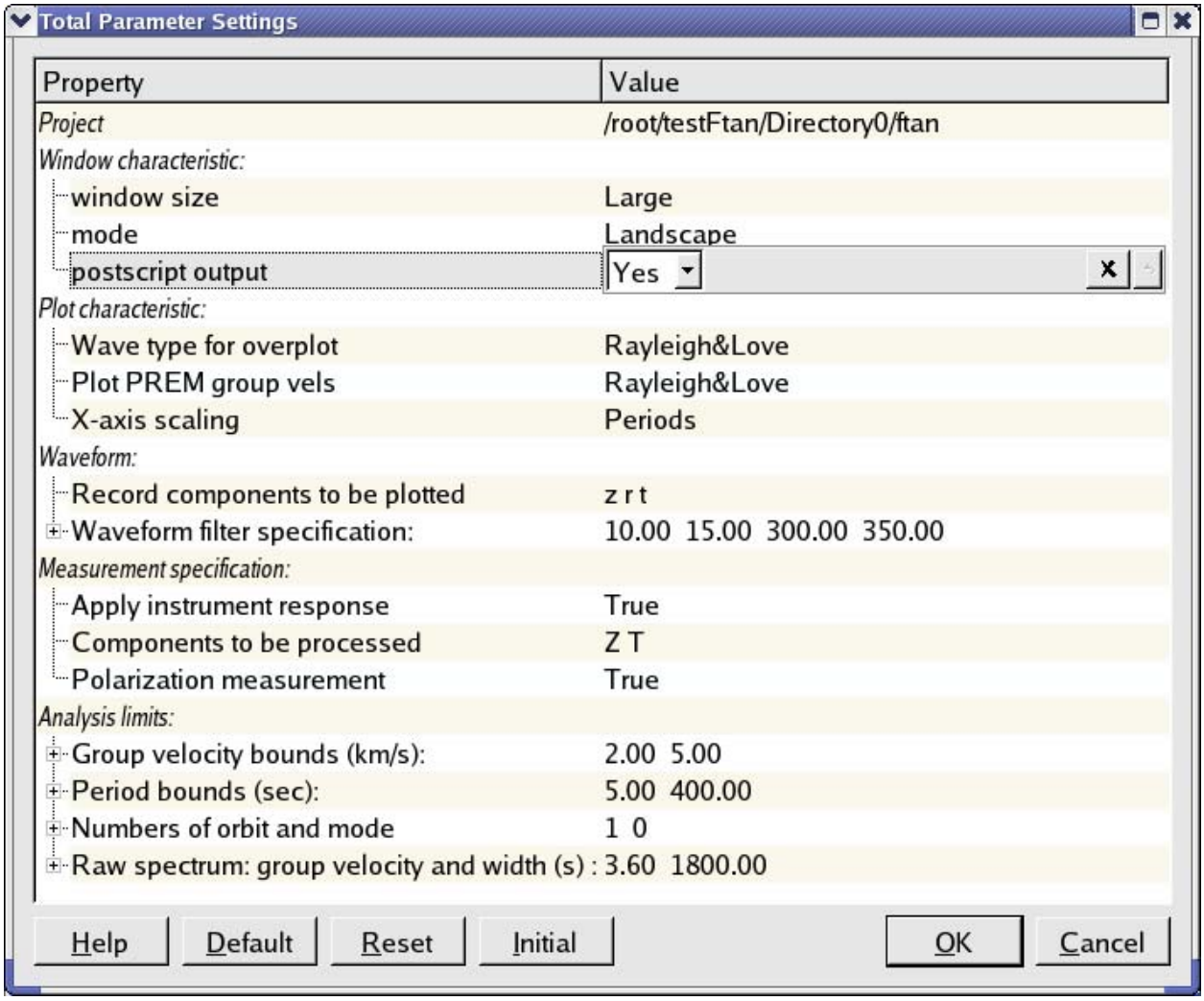


This window shows the current directory and it's subdirectories.
1. Using an existing directory as saved location you have two possibilities:
(a) Click once on selected directory and directory name will appear in 'Directory' box. Click OK to save the location.
(b) Double click on selected directory will open this directory. Name of selected directory will appear in 'Look in' combobox. 'Directory' box will be empty. Click OK to save the location.
2. To save the location as a new directory click the 'Create New Folder' toolbar button to create the new directory. Then rename it using popupmenu which appeared pushing right mouse button. Then use one of possibilities described above.

Location->Exit (Ctrl+Q)
This button and menu option are designed for program exit. If you will push this button without preliminary save of location (**FTAN** parameters and results of processing) the program will remind you to save the location.

4.5 Total Settings.

Settings->Total Settings...
Total Parameter Settings window provides the tool for editing of the values of **FTAN** parameters.



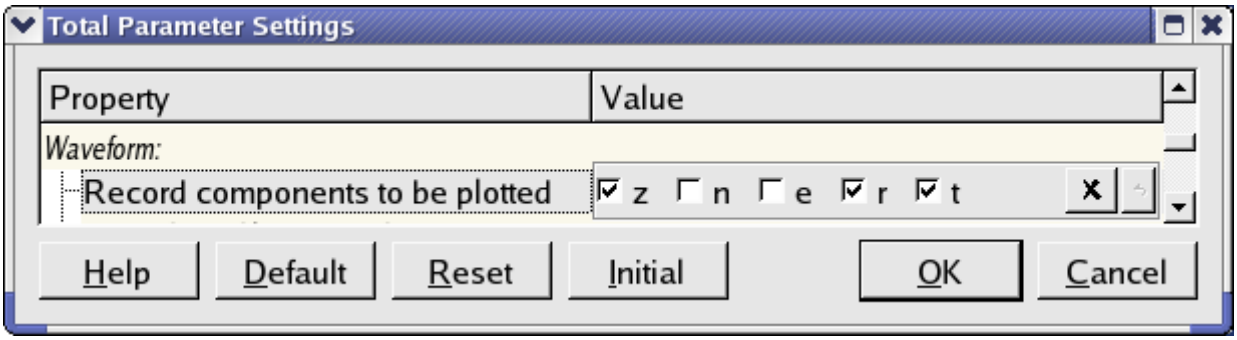
The first column contains the titles (italic font) of groups of parameters, the collective names for a set of related parameters (accompanied by '+'), and single parameter names.
The second column contains the parameter values. To change the value of any parameter click the correspondent row in any place. A row dialog window will appear. There are five different types of row dialog (the descriptions and examples are shown below).
To close row dialog click second time on first column in any place or **OK** button or <Enter>.
To close row dialog without changes push button . To set default values for all row dialog parameters push button . If any parameter was changed it's name will be rewritten by bold font.
Bottom row of buttons of Total Parameter Settings window:
Default button - to set default values for all parameters;
Reset button - to remove last changes for all parameters;
Initial button - to set initial parameter values (at the moment of start of location session) for all parameters ;
OK button or **Enter** button - to exit Total Parameter Settings with changed parameters (all row dialogs must be closed);

Cancel - to exit without changes.

Five Types of Row Dialog

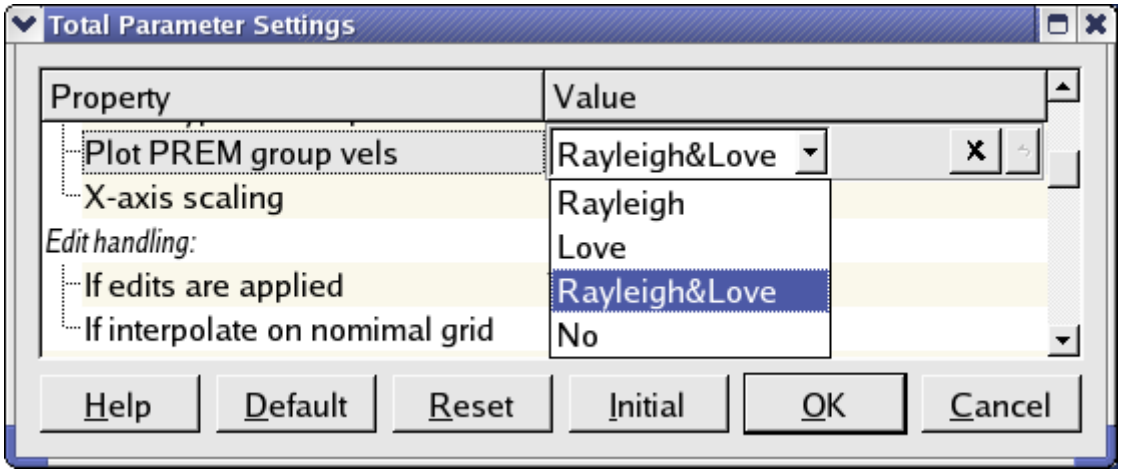
1. Row of check box widgets.

Input dialog values are given as a list of characters. Output dialog values form a list of selected characters. To select any character click on the nearest to it from the left checkbox. You can close this dialog if at least one of characters is selected.



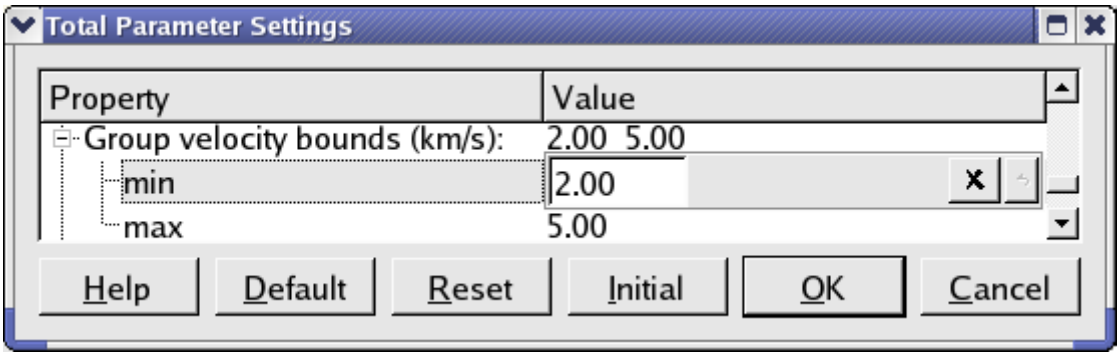
2. Combo box widget.

Input dialog value is a string of text parameters. Output dialog value is a text item selected in the combo box widget. To select an item click on it.



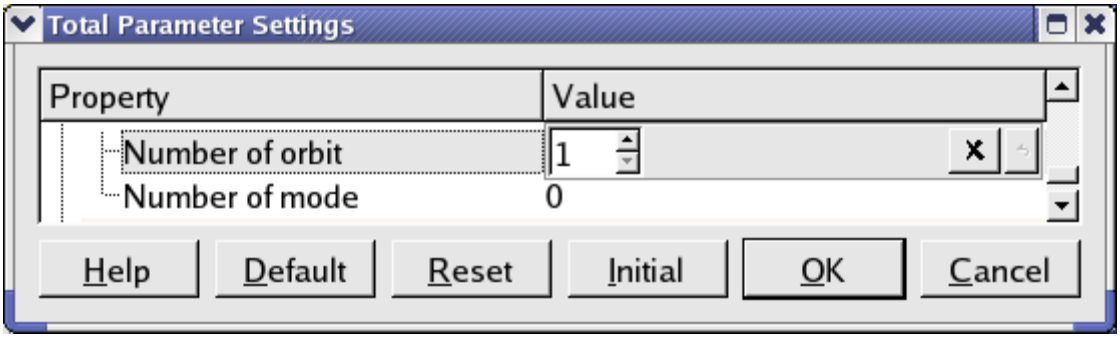
3. LineEdit box widget.

Input dialog value is a floating-point number. Output dialog value is an edited number. The program checks if the number meets the conditions defining maximum and minimum values and number of digits after the decimal point (minimum, maximum, decimals).



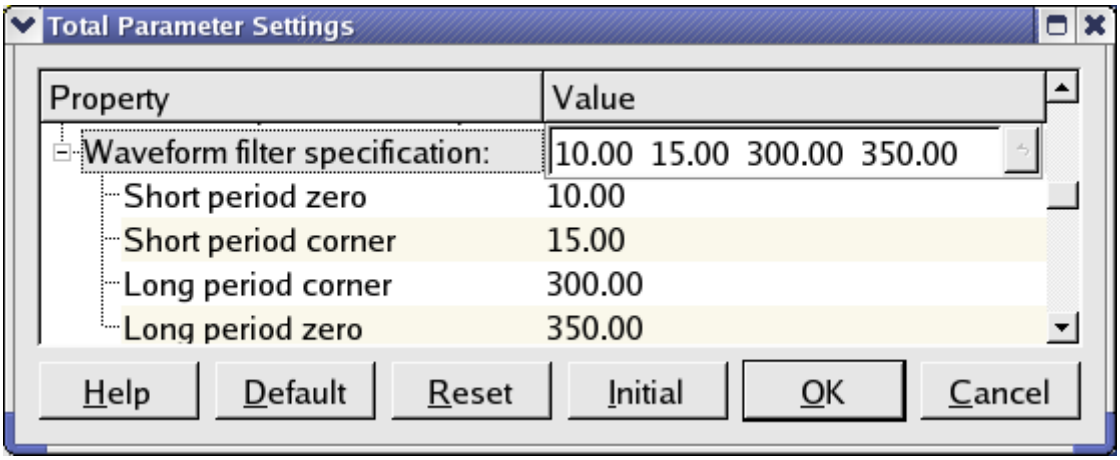
4. Spin box widget.

Input dialog value is an integer number. Output dialog value is the edited number. Spin box ensures that a string contains a valid integer within a specified range.



5. ReadOnly LineEdit box widget.

Input dialog value is a set of related float or integer numbers. LineEdit box widget provides viewing of values of related parameters and setting of their default values. The program checks if the values of related parameters are ordered in required way if it is necessary.



Detailed description of the Total Parameter Settings window.

1. Project – complete pass of location.

2. Window characteristic.

Property - "window size"
Type of row dialog - combo box widget
Value list - "Small", "Large"
Default - "Large"
Description - Size of plotting window.

Property - "mode"
Type row dialog - combo box widget
Value list - "Portrait", "Landscape"
Default - "Landscape"
Description - Output pictures orientation.

Property - "postscript output"
Type row dialog - combo box widget
Value list - "No Yes"
Default - "Yes"
Description - If value "Yes" is chosen, then postscript files will be created.

3. Plot characteristic

Property - "wave type for overplot"
Type row dialog - combo box widget
Value list - "Rayleigh, Love, Rayleigh&Love"
Default - " Rayleigh&Love"
Description - Type of waves for over plotting of raw and cleaned records.

Property - "Plot PREM group vels"
Type row dialog - combo box widget
Value list - "Rayleigh, Love, Rayleigh&Love, No"
Default - " Rayleigh&Love"
Description - To plot PREM group velocity curves on resulting picture for estimated group velocities.

Property - "X-axis scaling"
Type row dialog - combo box widget
Value list - "Periods, Frequencies"
Default - "Periods"
Description - FTAN map X axis scaling.

4.Waveform:

Property - "Record components to be plotted"
Type row dialog - row of check box widgets
Value list - "z, n, e, r, t"
Default - "z, r, t"
Description - Waveform components to be plotted at the start of processing.

Property - "Waveform filter specification"
Type row dialog – ReadOnly LineEdit box widget
Value list - List of float numbers

Sort order – ascending
Description - Band pass filter parameters. Two left and two right bounds for cosine window (in seconds).

Property - "Short period zero"
Type row dialog - LineEdit box widget
Value - float number
Default - "10.00"
minimum - 0, maximum - FLT_MAX; decimals - 2
Description - short zero period.

Property - "Short period corner"
Type row dialog - LineEdit box widget
Value - float number
Default - "15.00"
minimum - 0, maximum - FLT_MAX; decimals - 2
Description - short corner period.

Property - "Long period corner"
Type row dialog - LineEdit box widget
Value - float number
Default - "300.00"
minimum - 0, maximum - FLT_MAX; decimals - 2
Description - long corner period.

Property - "Long period zero"
Type row dialog - LineEdit box widget
Value - float number
Default - "350.00"
minimum - 0, maximum - FLT_MAX; decimals - 2
Description - long zero period.

5.Measurement specification:

Property - "Apply instrument response"
Type row dialog - combo box widget
Value list - "False True"
Default - "True"
Description - Apply correction for instrument response.

Property - "Components to be processed"
Type row dialog - row of check box widgets
Value list - "Z, R, T,"
Default - "Z, T"
Description - Components to be proceeded by FTAN.

Property - "Polarization measurement"
Type row dialog - combo box widget
Value list - "False, True"
Default - "True"
Description - If selected "True" then polarization measurements will be performed.

6. Analysis limits:

Property - "Group velocity bounds (km/s)",
Type row dialog - ReadOnly LineEdit box widget
Value list - List of float numbers
Sort order - ascending
Description - Minimum and maximum values of group velocity for FTAN diagram (km/sec).

Property - "min"
Type row dialog - LineEdit box widget
Value - float number
Default - "2.00"
minimum - 0, maximum - FLT_MAX; decimals - 2
Description - Minimum value of group velocity.

Property - "max"
Type row dialog - LineEdit box widget
Value - float number
Default - "6.00"
minimum - 0, maximum - FLT_MAX; decimals - 2
Description - Maximum value of group velocity.

Property - "Period bounds (sec)",
Type row dialog - ReadOnly LineEdit box widget
Value list - List of float numbers
Sort order - ascending
Description - Minimum and maximum values of period for FTAN diagram (sec).

Property - "min"
Type row dialog - LineEdit box widget
Value - float number
Default - "10.00"
minimum – 0, maximum - FLT_MAX; decimals - 2
Description - Minimum period value.

Property - "max";
Type row dialog - LineEdit box widget
Value - float number
Default - "350.00"
minimum - 0, maximum - FLT_MAX; decimals - 2
Description - Maximum period value.

Property -"Numbers of orbit and mode"
Type row dialog - ReadOnly LineEdit box widget
Value list - List of integer numbers
Sort order - no
Description - Numbers of orbit and mode.

Property - "Number of orbit"
Type row dialog - Spin box widget
Value - integer number
Default - "1"

minimum - 1, maximum - 16; unsigned value
Description - Orbit number.

Property - "Number of mode"
Type row dialog - Spin box widget
Value - float number
Default - "0"
minimum - 0, maximum - 4; unsigned value
Description - Mode number.

Property - "Raw spectrum: group velocity (km/s) and width (s)"
Type row dialog - ReadOnly LineEdit box widget
Value list - List of float numbers
Sort order - ascending
Description - Raw spectrum for comparison with cleaned one is calculated in time segment of given width centered at time correspondent to given group velocity value.

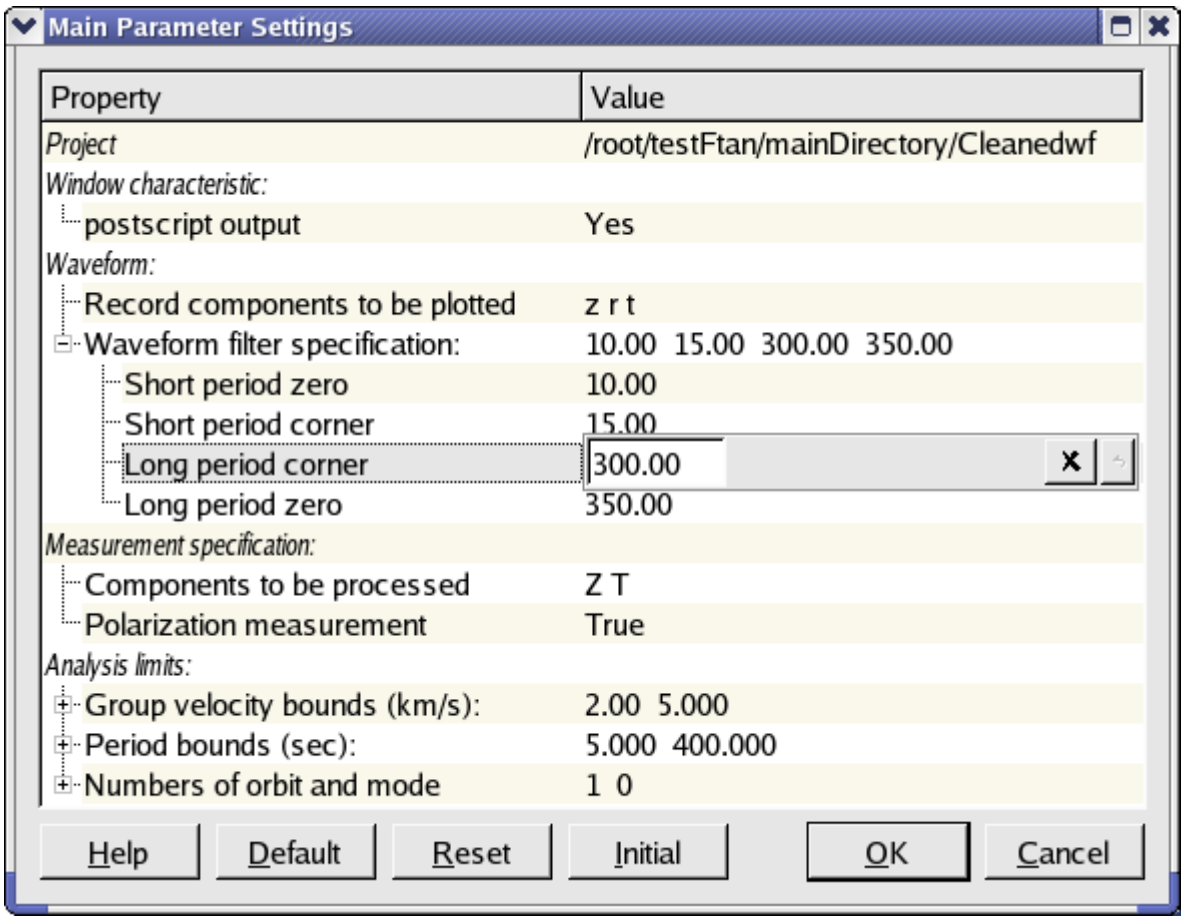
Property - " group velocity"
Type row dialog - LineEdit box widget
Value - float number
Default - "3.60"
minimum - 0, maximum - FLT_MAX; decimals - 2
Description - group velocity value correspondent to the center of time segment for raw spectrum calculation.

Property - " width"
Type row dialog - LineEdit box widget
Value - float number
Default - "1800.00"
minimum - 0, maximum - FLT_MAX; decimals - 2
Description - Width of time segment for raw spectrum calculation.

4.6 Main Settings.

Settings->Main Settings (Ctrl+M).

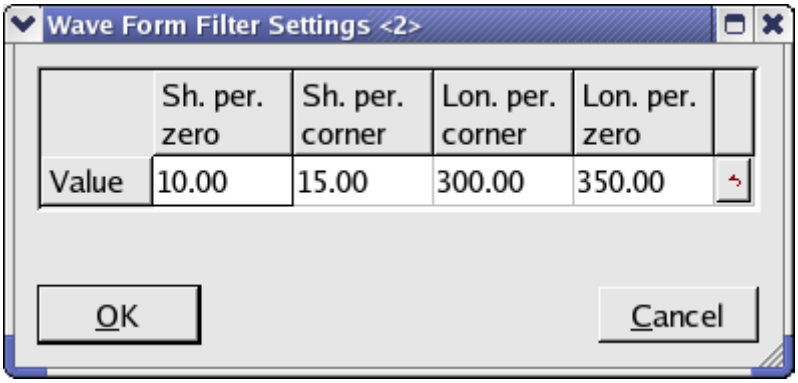
Program provides the tool for editing of main parameters only. It can be done with help of Main Parameter Settings window.



The detailed description of parameters and dialogs is given in paragraph 4.5.

4.7 Filter specification.

Settings->Filter Spec (Ctrl+F)
Type parameters for bandpass filtering: short period zero, short period corner, long period zero, long period corner. The program checks if this numbers are given in ascending order.
You can use default button to set default values for all of dialog items.

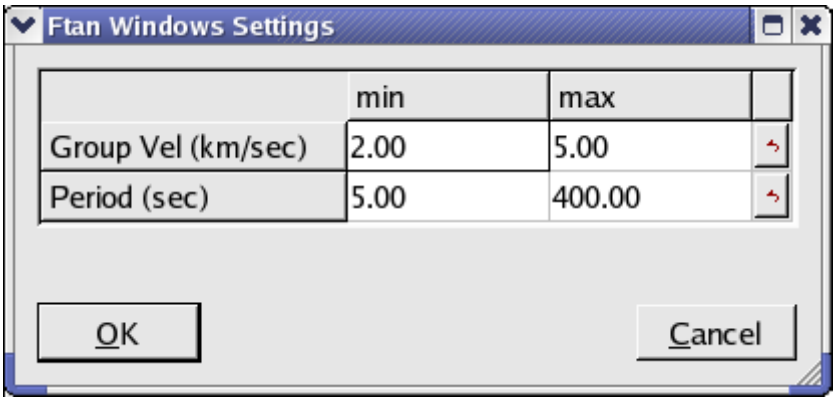


Click OK button to close the window with new parameter values, or Cancel - to close the window without changes.

4.8 Ftan Window.

Settings->Fta Window (Ctrl+W)

Type parameters for group velocity and period bounds of FTAN diagram. You can use default button to set default values separately for group velocity bounds and period bounds.

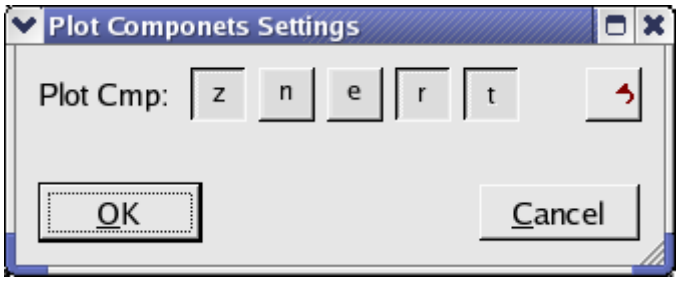


Click OK button to close the window with new parameter values, or Cancel - to close the window without changes.

4.9 Plot Components.

Settings->Plot Comp (Ctrl+L)

Click component toggle buttons required for plotting to switch them on or off. You can use default button to set default values for all of dialog items.

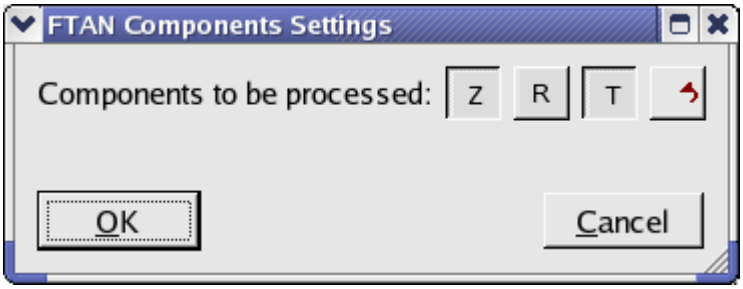


Click OK button to close the window with new parameter values, or Cancel - to close the window without changes.

4.10 Ftan Components.

Settings->Fta Comp (Ctrl+T)

Click component toggle buttons required for FTAN processing to switch them on or off. You can use default button to set default values for all of dialog items.

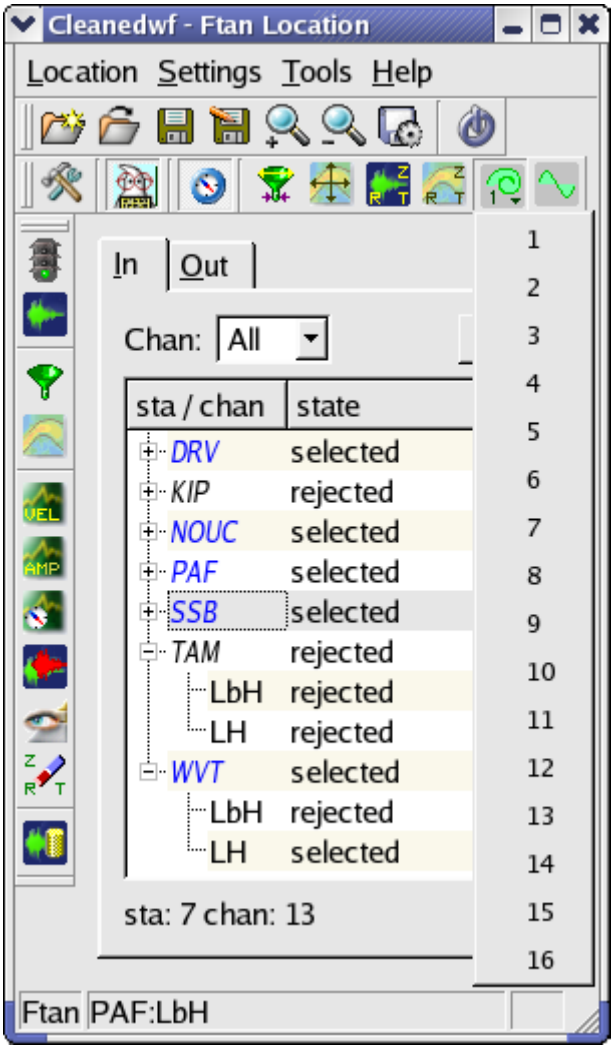


Click OK button to close the window with new parameter values, or Cancel - to close the window without changes.

4.11 Orbit Settings.

Settings->Orbit

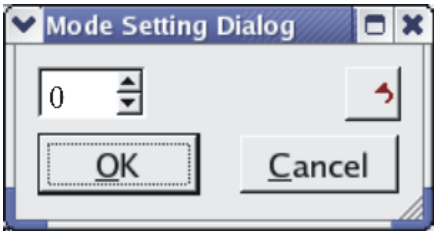
Click required orbit number in pop up menu shown below.



4.12 Mode Settings.

Settings->Mode (Ctrl+D)

Choose the required mode number either by clicking the up/down buttons or by typing the value directly into the spin box. If the value is entered into the spin box directly, <Enter> or <Return> must be pressed to apply the new value. You can use default button to set default values for mode number.

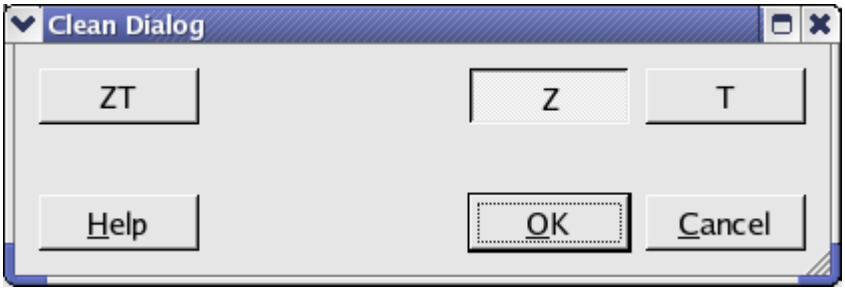


Click OK button to close the window with new parameter value, or Cancel to close the window without changes.

4.13 Clean Records.

Tools->Clean (Alt+N)

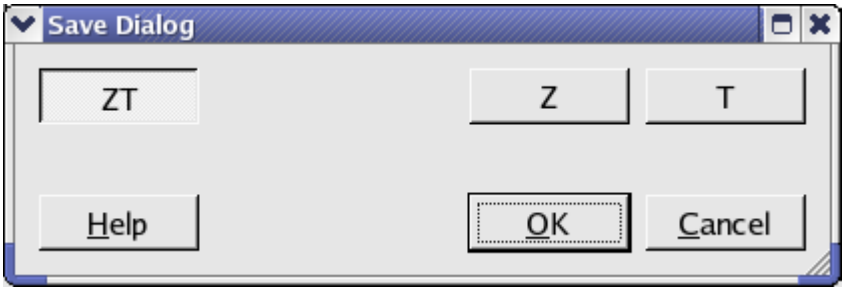
Click component toggle buttons required to be cleaned to switch them on or off.



Click OK button to perform the cleaning, or Cancel - to close the window without cleaning.

4.14 Save Records.

Tools->Save (Alt+E)
Click component toggle buttons required to be saved to switch them on or off.

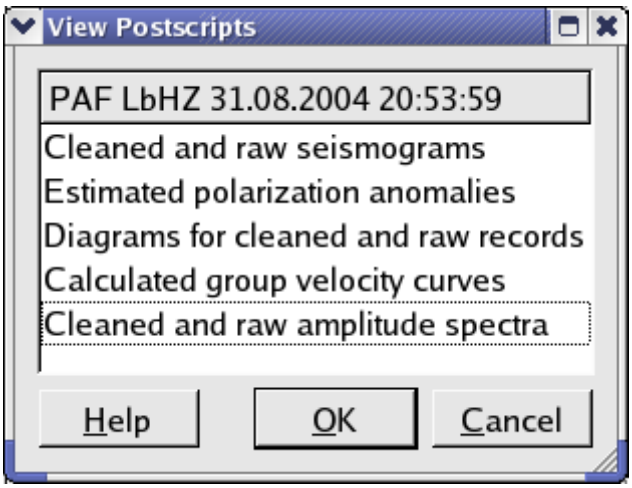


Click OK button to save records, or Cancel - to close the window without saving.

4.15 View Postscript.

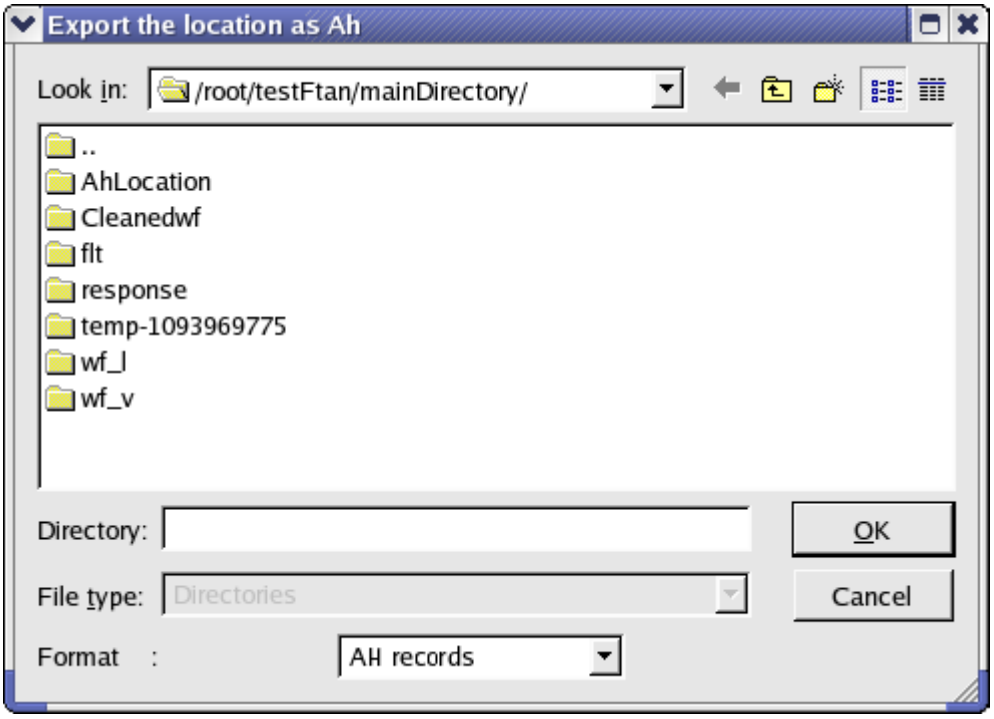
Click Out tab in Central Area of MainWindow.
Click right mouse button on channel required, pop up menu will appear:

Click "view ps". **View Postscript** window will appear. Select a line and click OK button to view correspondent postscript file. To close the window click Cancel.



4.16 Export of cleaned waveforms and measured group velocities

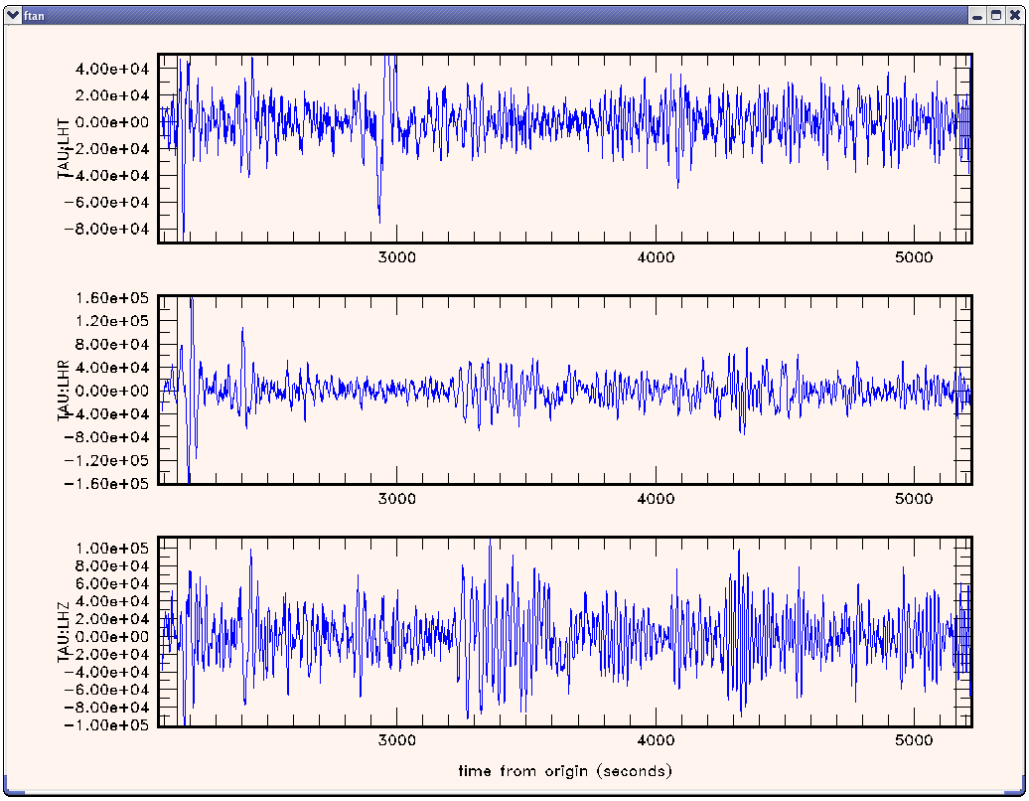
Location->Export
Select location as was described in paragraph 4.4. Select format and click OK button.



You can export following output results (formats):
(1) AH records - cleaned waveforms in AH (binary) format;
(2) ASCII records - cleaned waveforms in ASCII format;
(3) ASCII disp. curves – measured group velocities in ASCII files (number, central filter period, apparent period, group velocity).
Every exported file name contains the correspondent station name and the time of record processing.

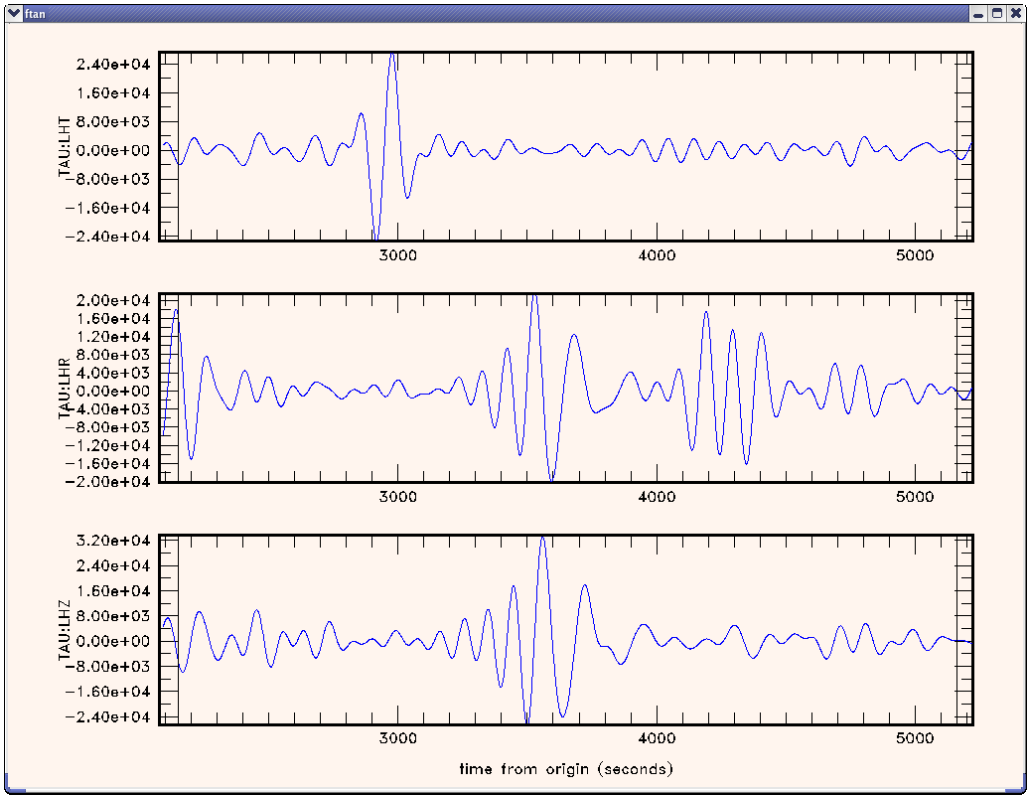
5. Processing performance

Until you didn't select a station and a channel to be processed the light of semaphore button is red . Click on '+' near selected station, available channels will appear. Click on one of them. The semaphore light will change to yellow . The program is ready for processing of selected seismograms. Click on semaphore button. The semaphore light will change to green , and selected waveforms will be plotted

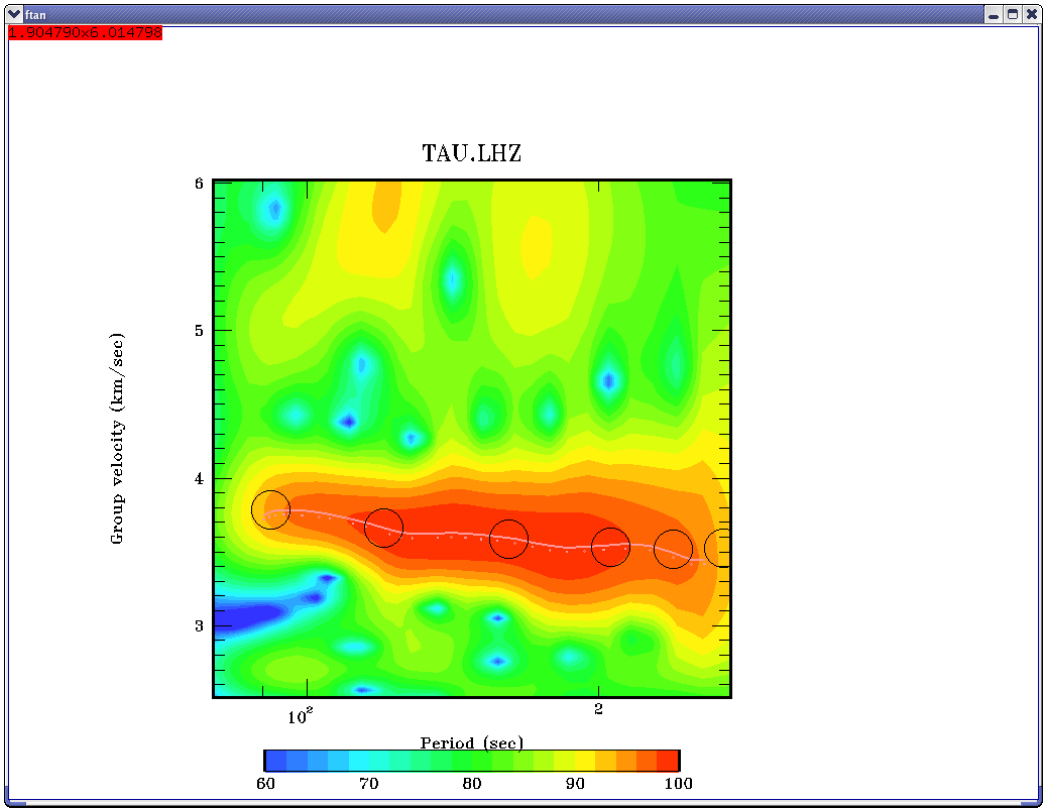


Note, that the raw waveforms can be plotted at any moment by clicking on the button .

To apply bandpass filtering click the button . Filtered records will be plotted

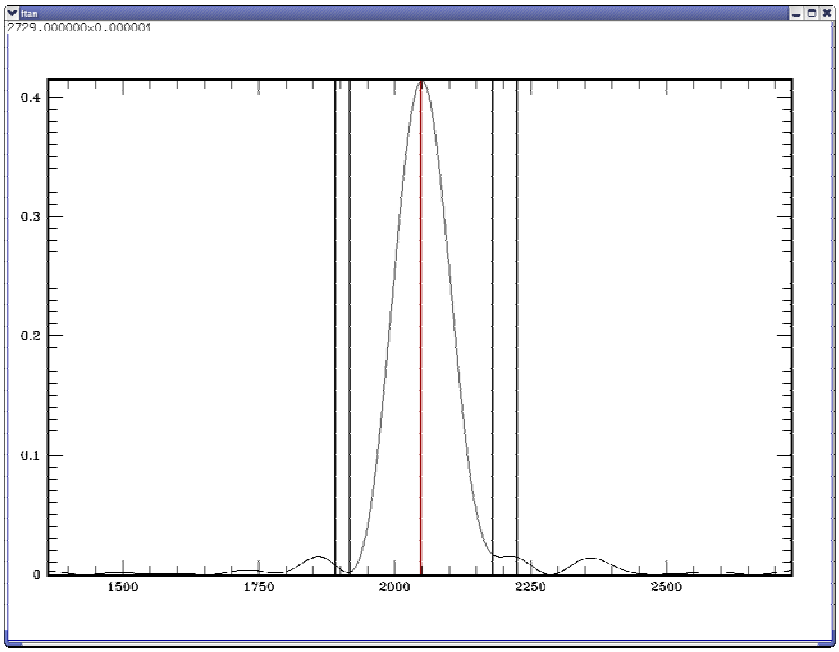


To view FTAN maps for selected components and to make floating filtering push the button .



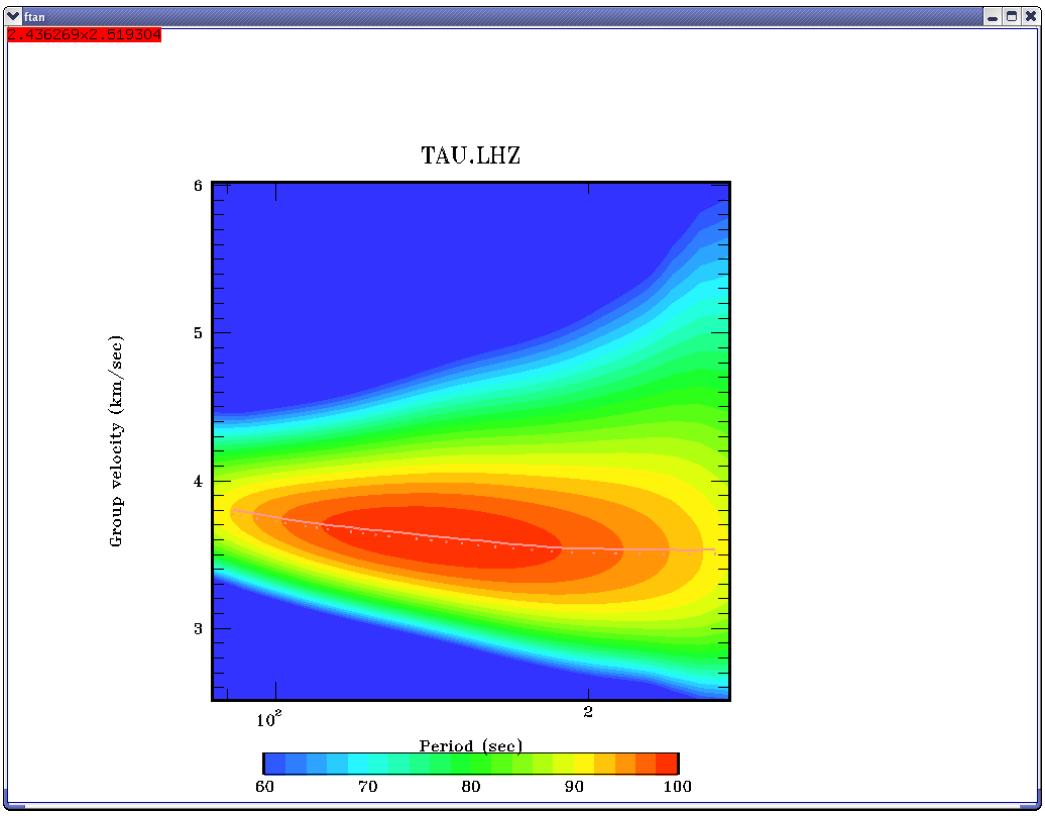
To make a floating filtering it is necessary to plot dispersion curve to make phase equalization (black circles). Use mouse to do this. Click left mouse button to put a point and the right one to delete the point nearest to cursor location. Type "e" to finish the plotting.

The picture of envelope of signal will appear:



It is necessary to cut a signal which you've selected. This signal is concentrated near the center of picture (red vertical line). To do this you must set four points to define the filtering window with cosine edges. Use the same commands as above.

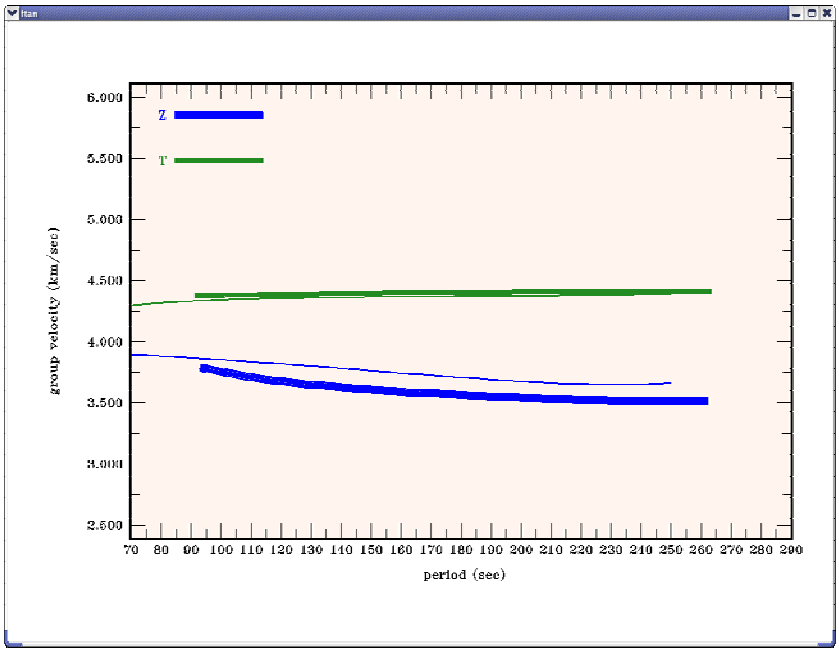
The picture of FTAN map for a cleaned signal will appear:



You can continue with filtering of this component. If you're satisfied with the result of filtering type "y". FTAN diagram of next component will appear.

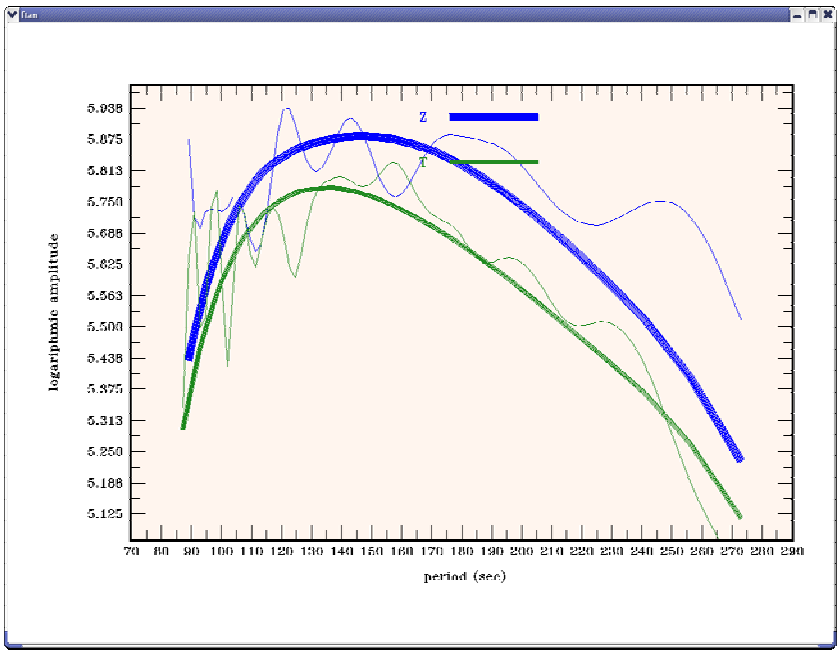
View of results

To view results of FTAN calculation of group velocities click button . Here is an example of group velocities plotting.



The black lines are theoretical curves for PREM model.

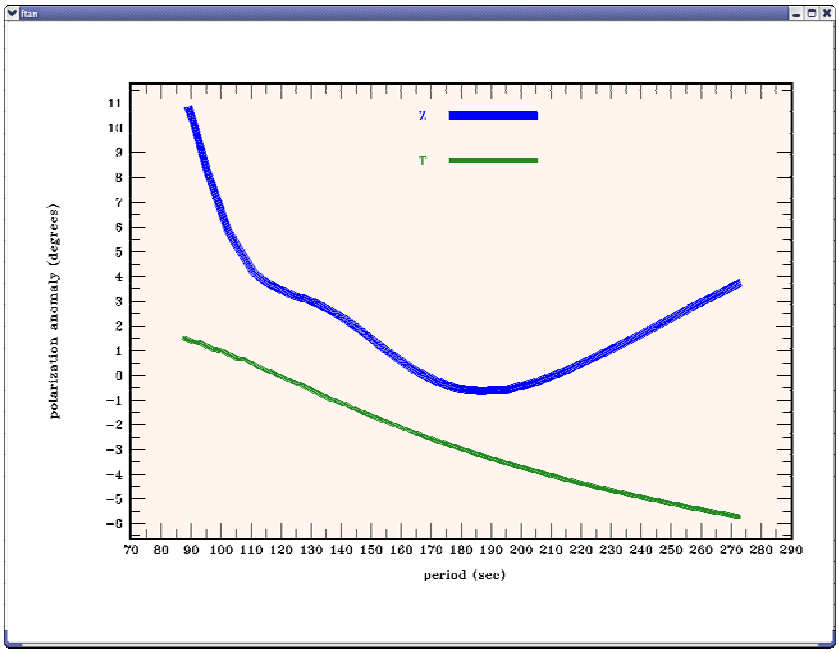
To view amplitude spectra push the button .
Here is an example of picture of amplitude spectra:



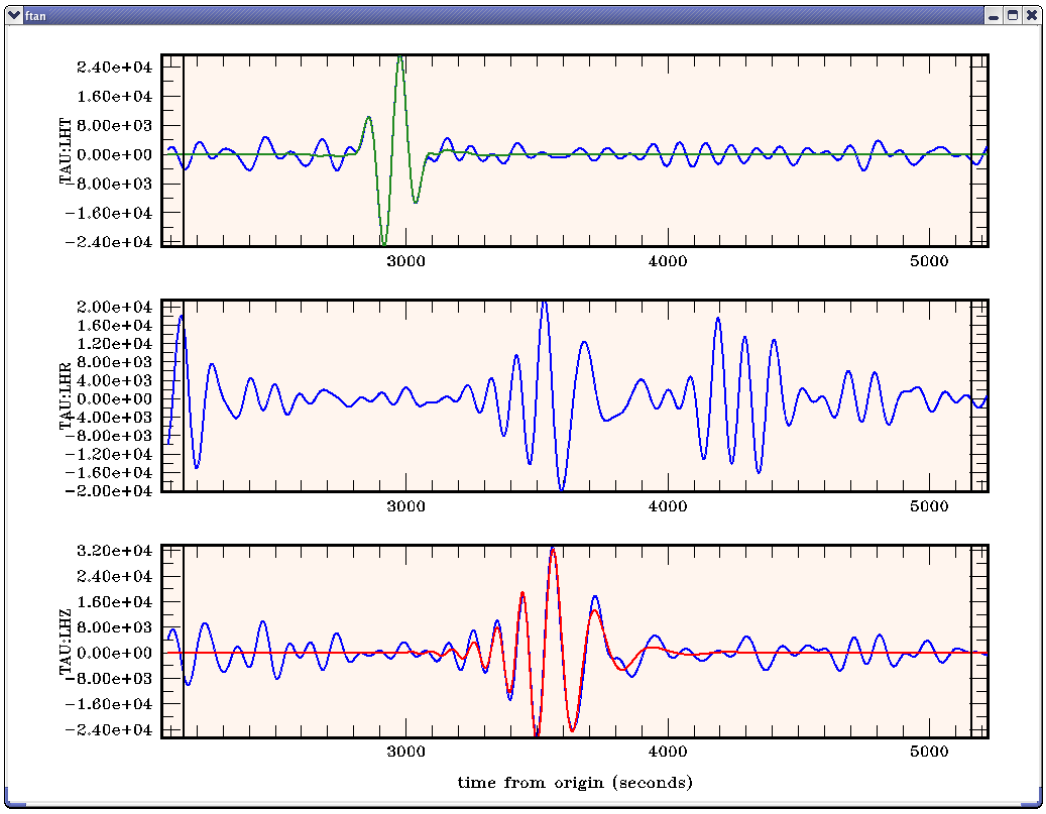
Thin lines present the amplitude spectra of raw signals; thick lines present the amplitude spectra of cleaned signals.

To view the FTAN estimates of polarization anomalies push the button .

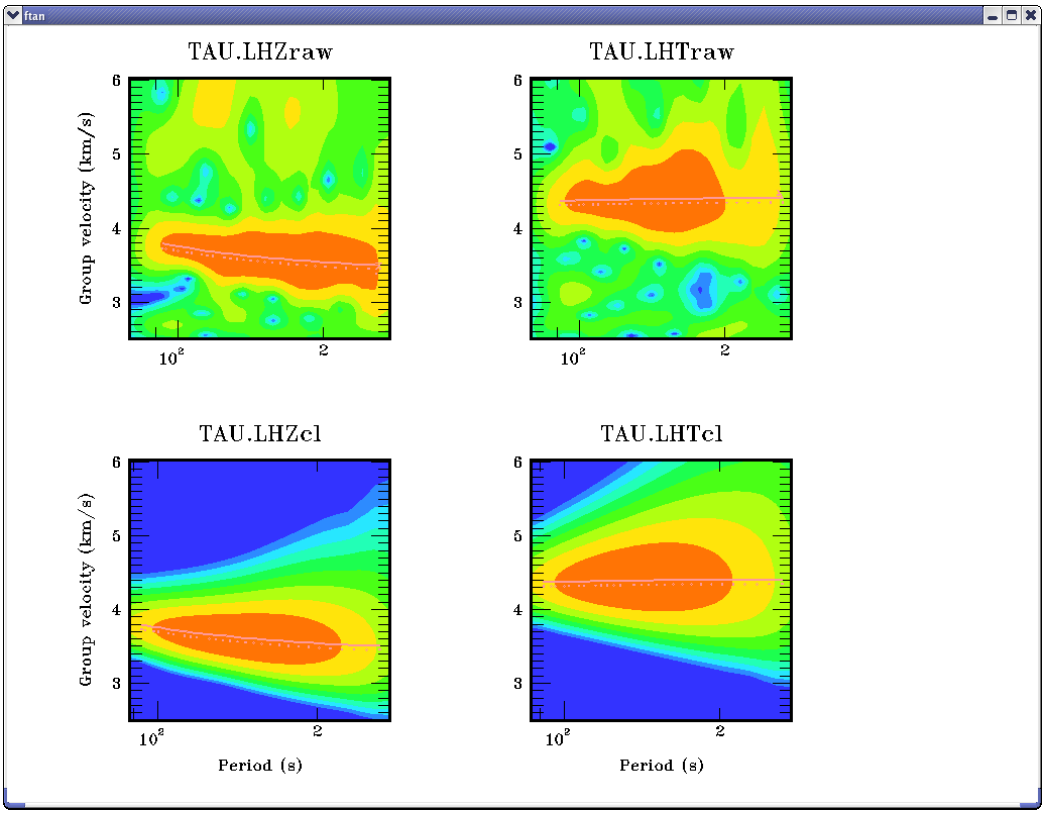
Here is an example of picture of polarization anomalies:



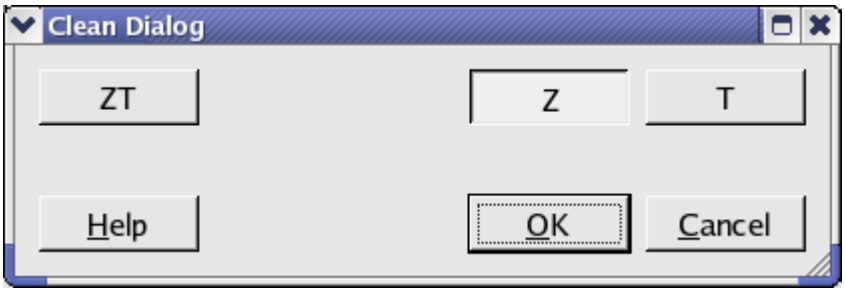
To view the picture of cleaned and raw seismograms push the button .
Here is an example of picture of filtered and raw signals:



To view a picture of FTAN diagrams for cleaned and raw records push the button .
Here is an example of picture of FTAN maps for filtered and raw seismograms:

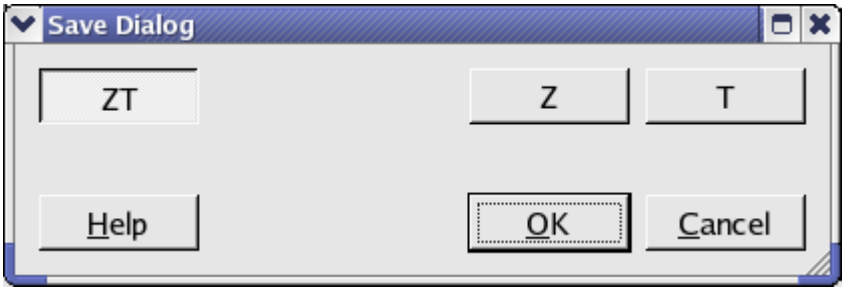


To clean any of processed components push the button . The **Clean Records Dialog** window will appear.



Click component toggle buttons required to be cleaned. Click OK button to perform the cleaning, or Cancel - to close the window without cleaning.

To save results click the button . The **Save Records Dialog** will appear.



Click component toggle buttons required to be saved. Click OK button to save records, or Cancel - to close the window without saving.

Select next station-channel. Button changes green color to yellow and you can work with new selection.