

Surface waves floating filtering

by

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Computer exercises 1

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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Data Base


Data Base is a package of programs designed by **Daniel Quinlan (IRIS corporation)**. Practically all the program components described here are using this package. FTAN and Moment Tensor & Source Depth Inversion programs read seismic records from Database. Use program **Fmt4Db** to create DBase for FTAN program starting.

From SEED Files to Database.

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/SD2DB.EX 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:

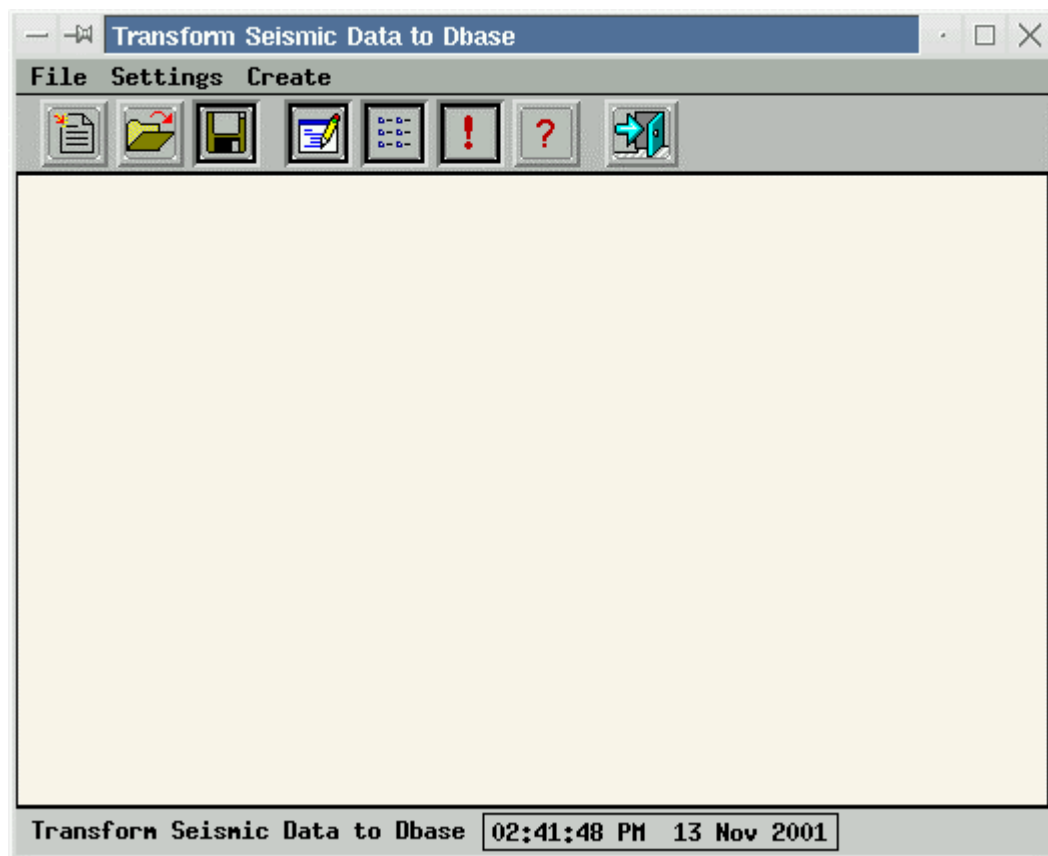
99118_Vrancea_0847_BH.seed


99118_Vrancea_0847_LH.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!
99118_Vrancea_0847.ah4db - the project file name.
99118_Vrancea_0847.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 1).

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 2).

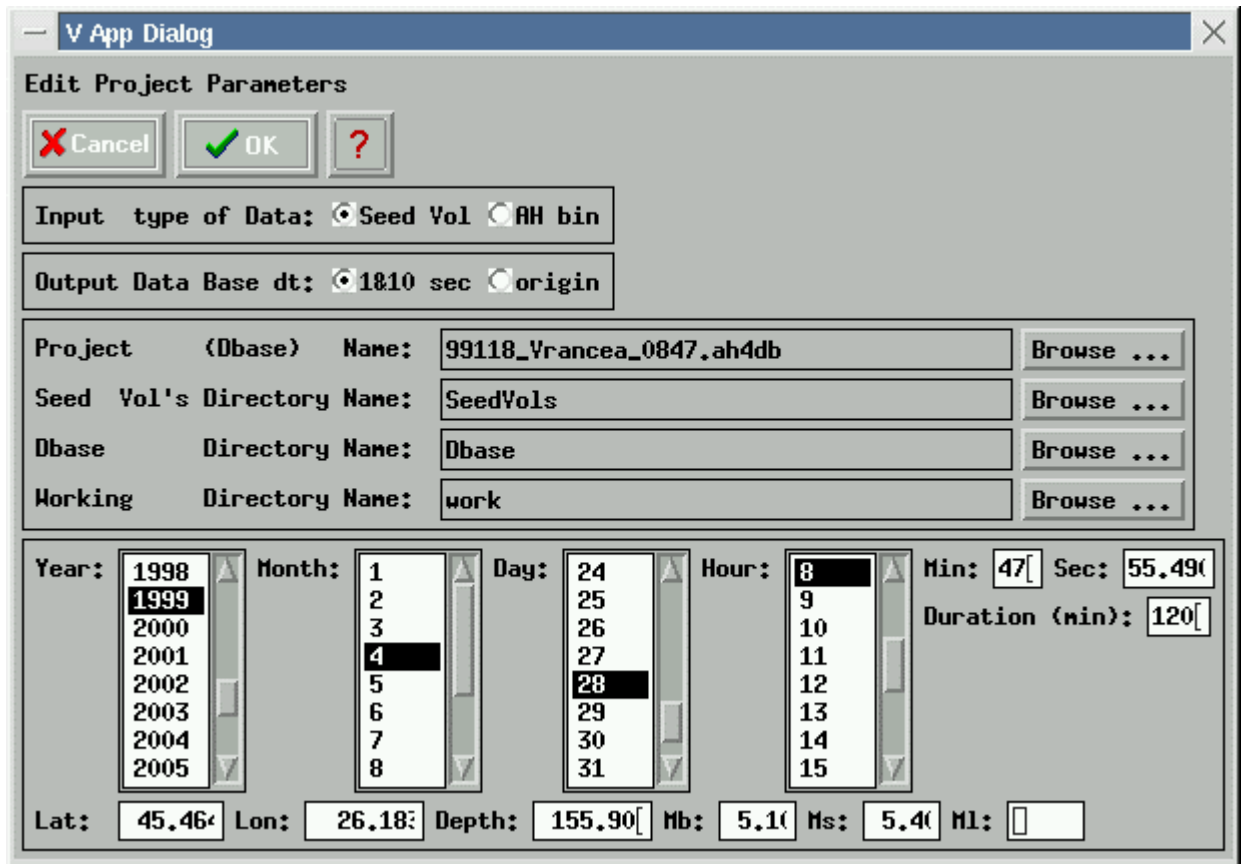
Duration (min): Fill this box, if you are ordering the decimation. The duration of each resulting Dbase record will not exceed the value indicated in this box.

Project (Dbase) name: Push "browse" button to choose directory and type project name. This name will become a root name of resulting dbase. The program will add to the project name (name of the Project File, see item 3) a fixed extension "ah4db".

Example for infill of the rest boxes and lists is given in the item 1b.

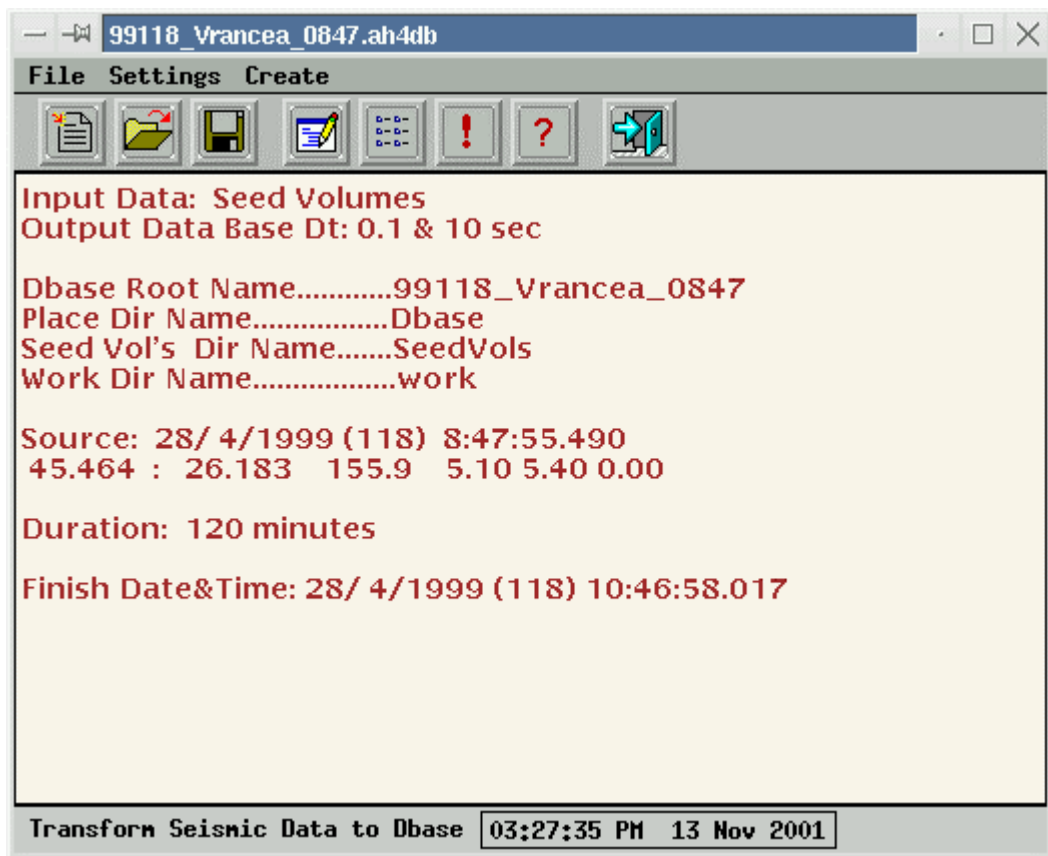
1b. Use the icon  to modify an existing Dbase. Using the directory-file navigator find the Project File you would like to modify, edit it, and save with the same or new name.

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



The image shows a software dialog box titled "V App Dialog" with a close button in the top right corner. The main title is "Edit Project Parameters". At the top left, there are three buttons: "Cancel" (with a red X), "OK" (with a green checkmark), and a help button (with a question mark). Below these are two rows of radio button options: "Input type of Data:" with "Seed Vol" selected and "AH bin" unselected; and "Output Data Base dt:" with "1&10 sec" selected and "origin" unselected. The next section contains four rows of text boxes, each with a "Browse ..." button to its right: "Project (Dbase) Name:" with the value "99118_Vrancea_0847_ah4db"; "Seed Vol's Directory Name:" with the value "SeedVols"; "Dbase Directory Name:" with the value "Dbase"; and "Working Directory Name:" with the value "work". Below this is a date and time selection area with five spinners: "Year:" (values 1998-2005, 1999 selected), "Month:" (values 1-8, 4 selected), "Day:" (values 24-31, 28 selected), "Hour:" (values 8-15, 8 selected), and "Min:" (value 47). To the right of the "Min:" spinner is a "Sec:" spinner with value 55.49 and a "Duration (min):" spinner with value 120. At the bottom, there are five text boxes for coordinates: "Lat:" (45.46), "Lon:" (26.18), "Depth:" (155.90), "Mb:" (5.1), and "Ms:" (5.4), followed by an empty "Ml:" text box.

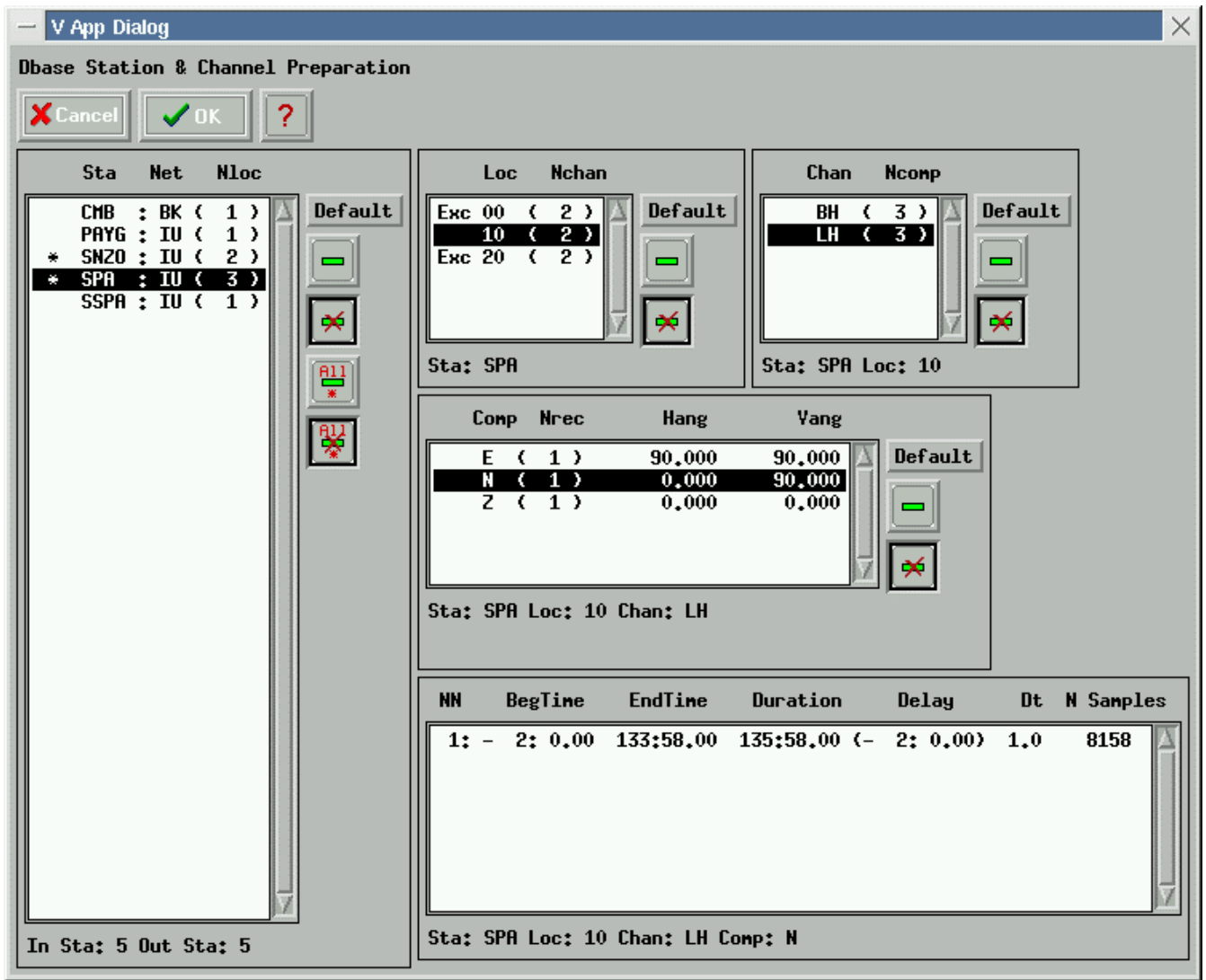
For the confirmation of changes close this windows using button "OK". Next window will appear:







2. Action (Tools).

2a. 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 3)

NLoc - number of locations. (See Technical Notes 4)

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 99118_Vrancea_0847.ah4db

Every station can be represented in Dbase by one seismogram only (only one location identifier is acceptable, other location identifiers must be excluded).

In the example file 99118_Vrancea_0847.err_log contains full 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)
99118_Vrancea_0847.* - Dbase tables
Gftan - cshell script for FTAN program starting .

Technical Notes:

1. Using AH bin files directly

Program Fmt4Db uses rdseed program to extract AH bin files from all of seed volumes (directory SeedVols , files *.seed) and puts these AH bin 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 bin files extraction from rdseed volume. Such program design allows working with AH bin 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")

2. Time series decimation.

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.

3. Network codes.

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).

4. Location identifiers

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

5. More details concerning IRIS:

Data Sources,

Request Methods,

Manuals,

Software,

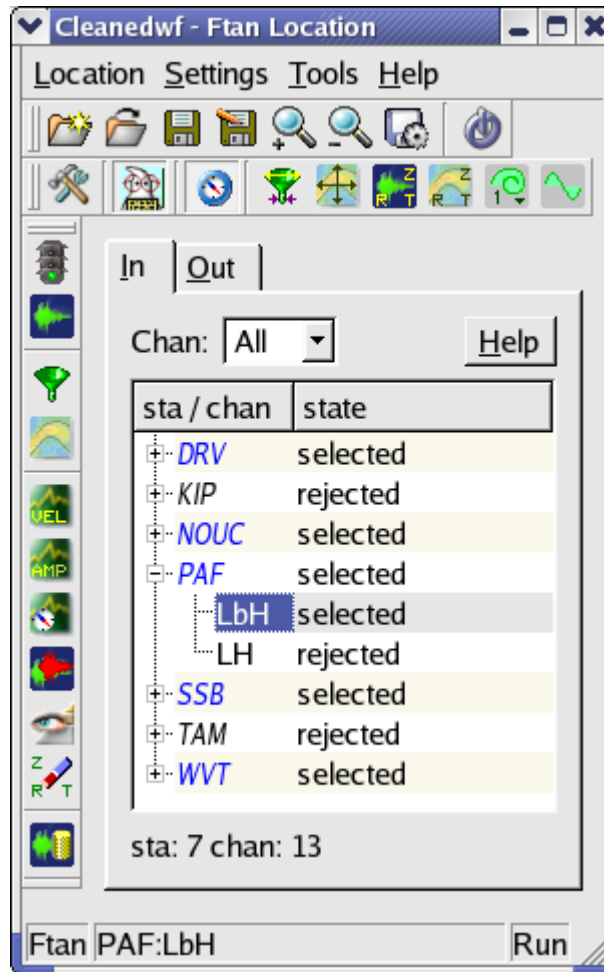
Services

etc.

are in

<http://www.iris.washington.edu/HTM/manuals.htm>

Program FTAN



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5. Processing performance

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 table files (wfdisc, ftdisc, disp);
- d) postscript files.



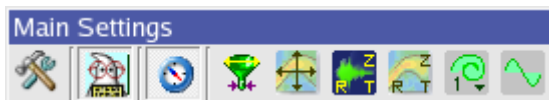
- Create a new location. Correspondent menu option is **Location->New** and keyboard shortcut is **Ctrl+N**.












- 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 measured group velocities in ASCII format and cleaned waveforms in AH or ASCII formats 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) .

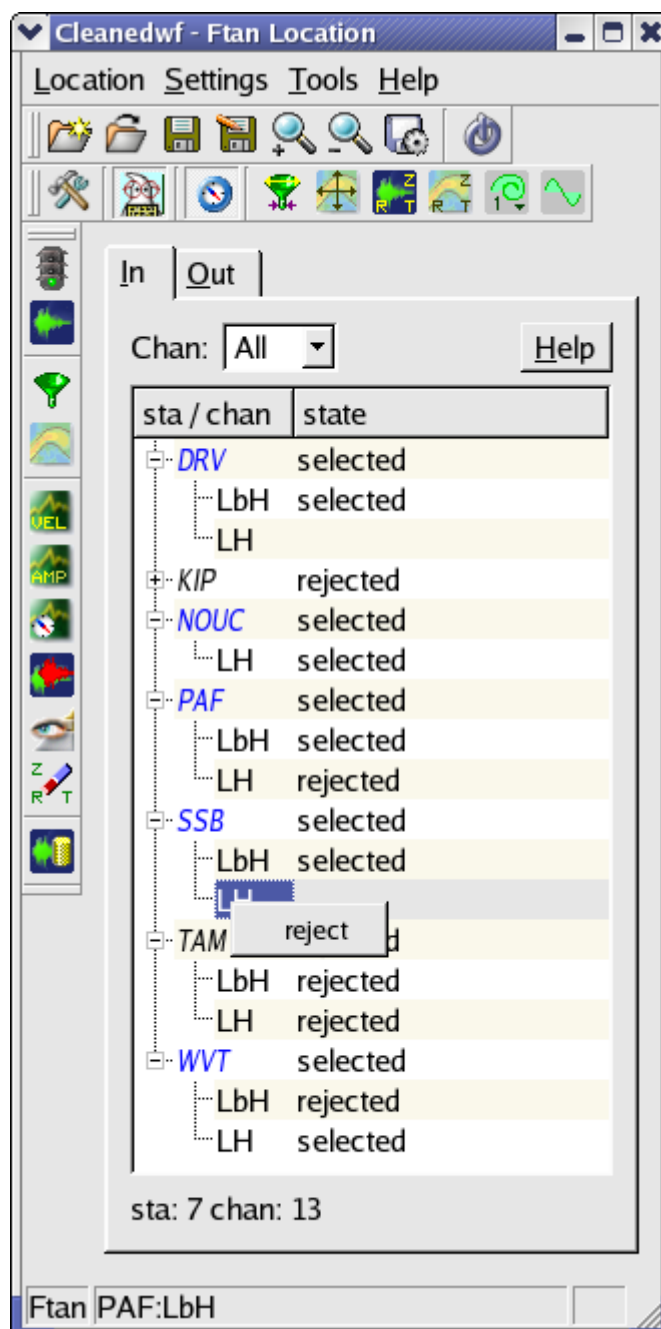
2.2 Central Area.

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.

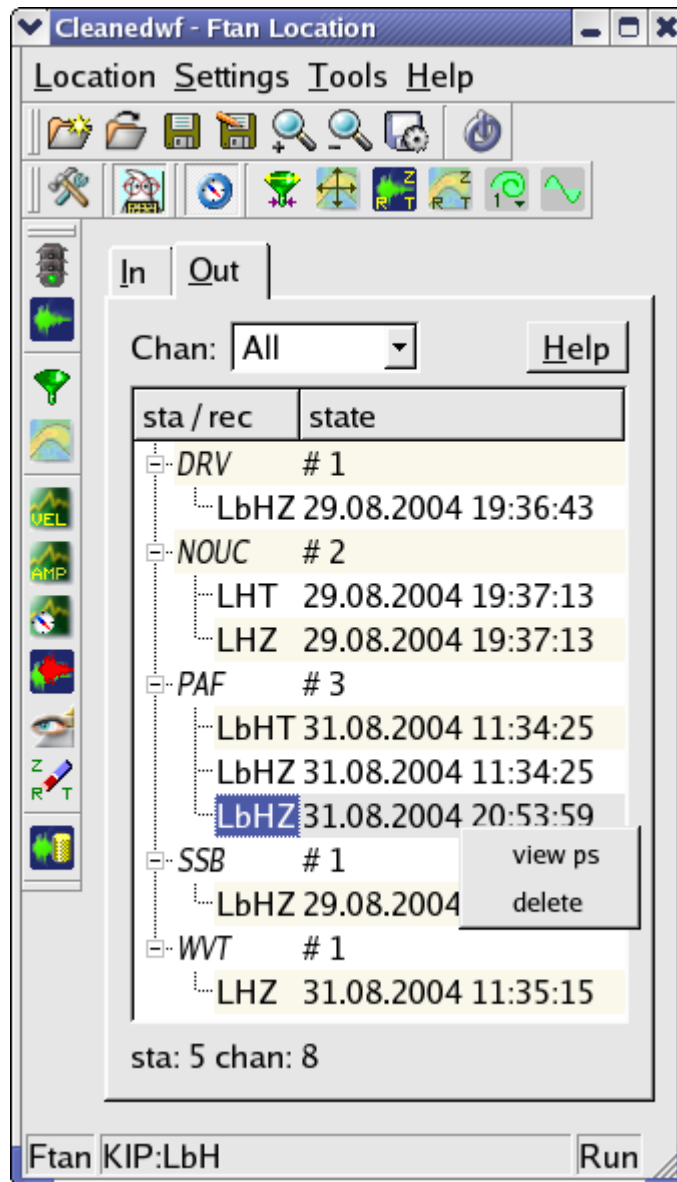
The station indicator **selected** appears after at least one cleaned channel record is saved. The station indicator **rejected** appears after all channels are rejected. A station which is not selected can be rejected manually in the same way as channel (in this case all channels will be marked as rejected).



2.2.2 Out Tab.

The **Out Tab** first column " sta/rec " in Central Area contains names of seismic stations and components of cleaned records. The second column "state" contains (a) the number of cleaned records for station name, and (b) the creating time of record for component name. The creating 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 measured group velocities in ASCII format and cleaned waveforms in AH or ASCII formats 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->Image (Alt+O) - View cleaned and raw seismograms.
-  Tools->Overlay (Alt+I) - 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:

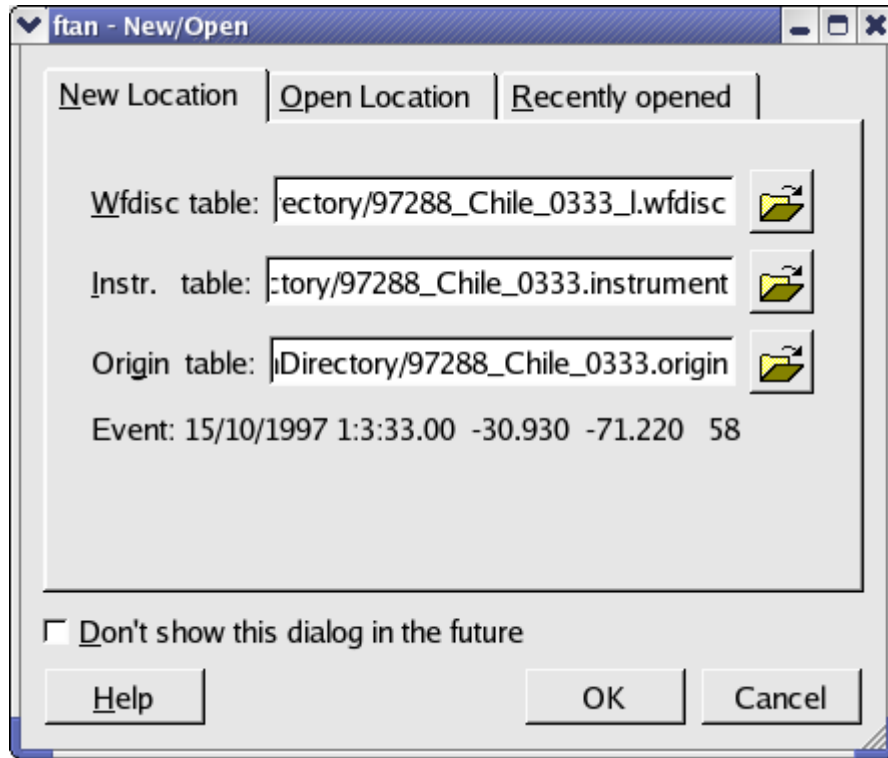
- Help->About - Displays a simple message box about **ftan** program.
- Help->About Qt - Displays a simple message box about **Qt C++ toolkit**.

4. The Dialogs.

4.1 The New/Open Start.

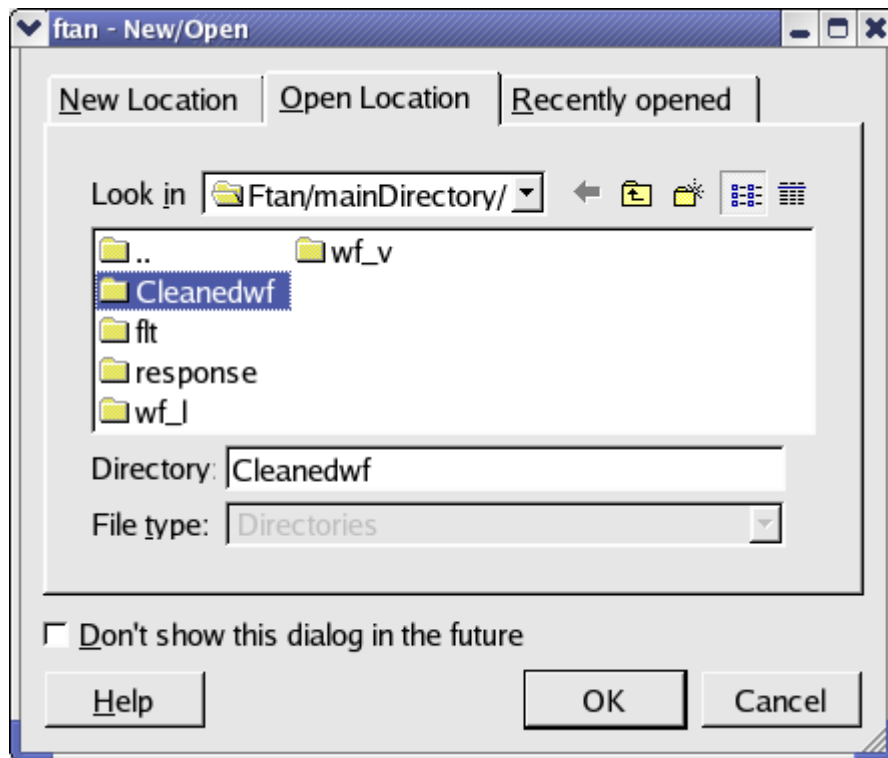
Start up **ftan** to invoke the New/Open Start dialog. This dialog contains three tabs to use depending on what you want to do once you start up **ftan**.

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 its 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.

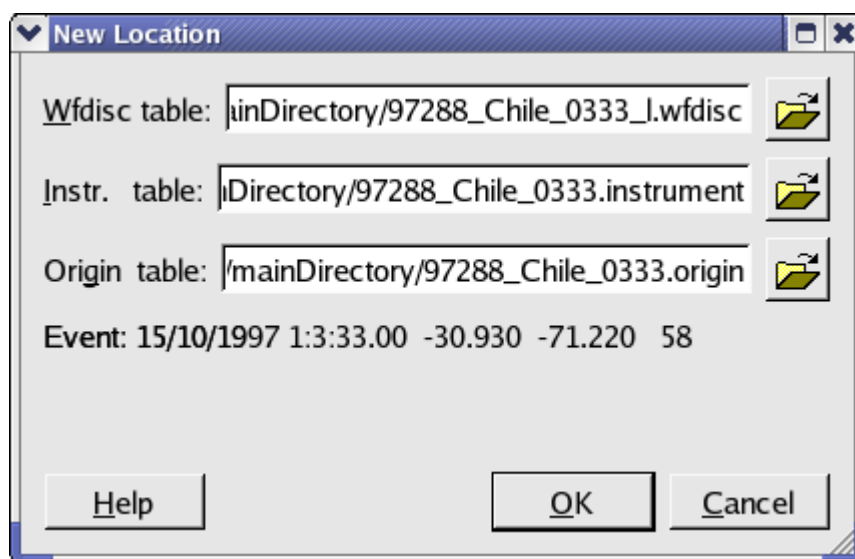
The Recently Opened Tab

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

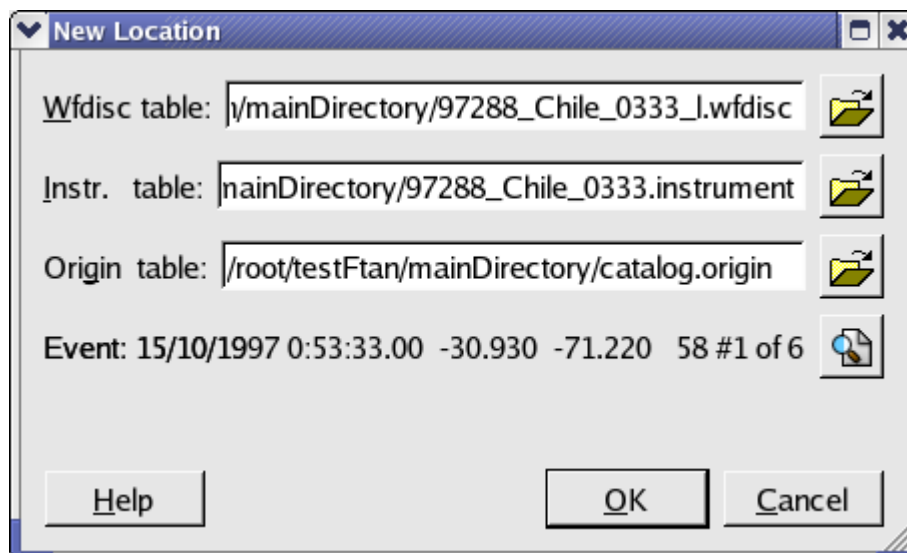
4.2 The New Location.

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

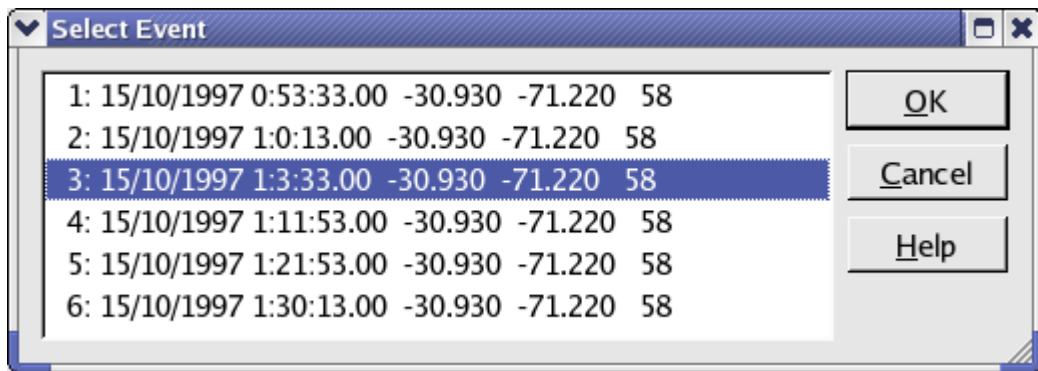
The **New Location Dialog** may be used instead of the **New Start Dialog** (see 4.1) for creation a new location at any time not closing current session.



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 appears:



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:



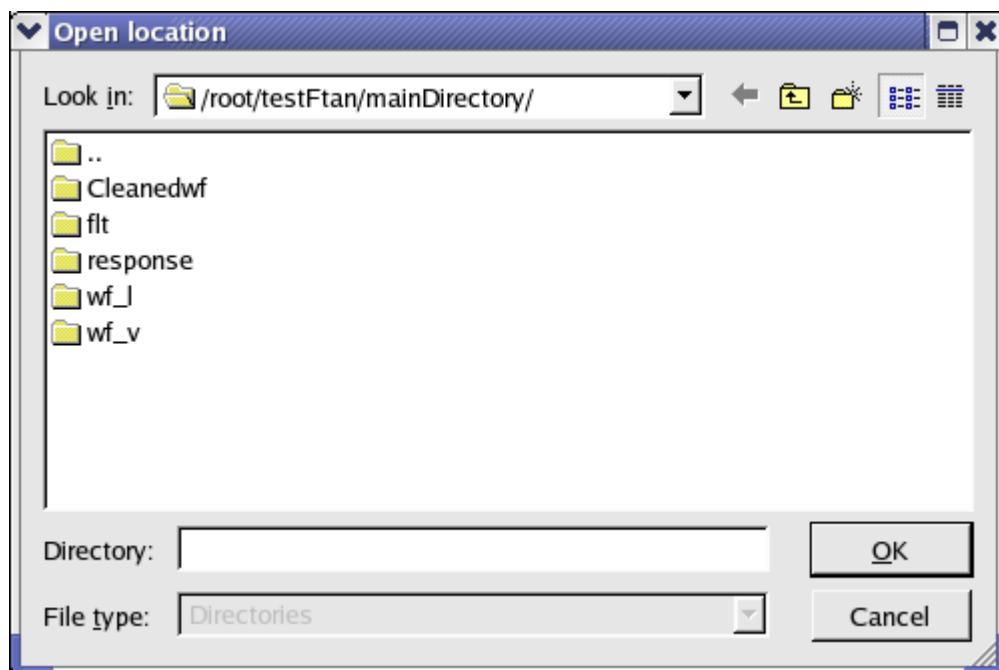
Select a row and click OK. Selected Event information will appear in **New Location Dialog**. Click button Ok to work with new location. Click Cancel to leave the dialog without opening a new location.

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 its 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

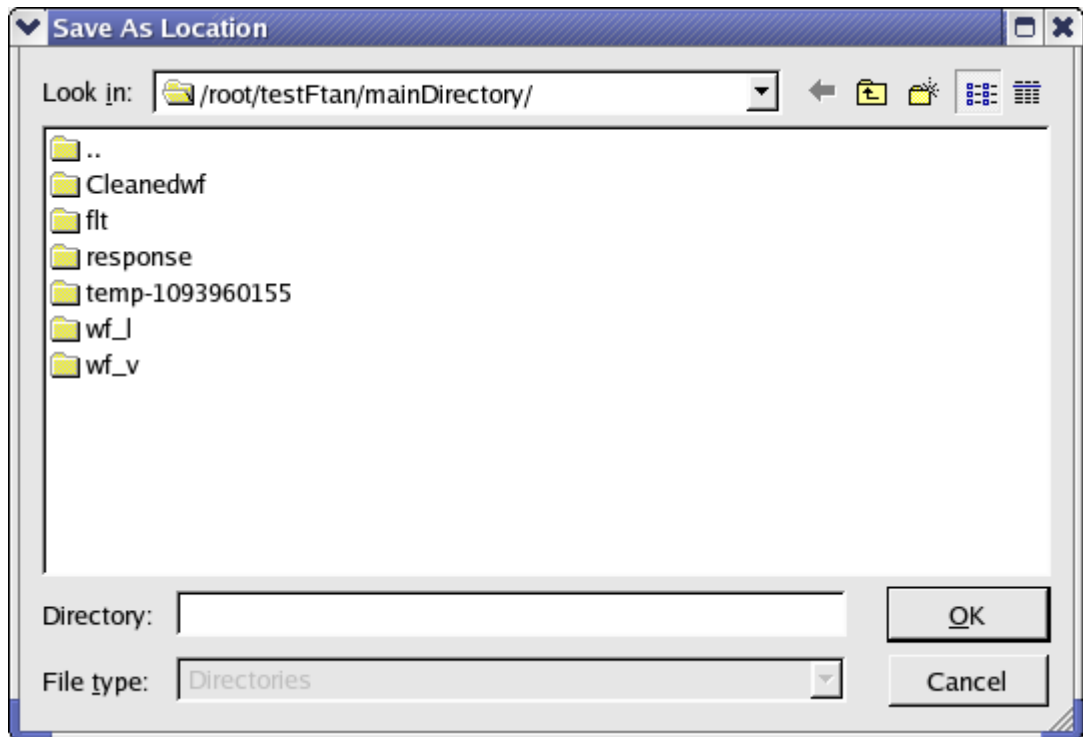


Location->Save (Ctrl+S)


This button and menu option are assigned for saving the location. In the case of new Location

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

 Location ->Save as...



This window shows the current directory and its subdirectories. Choose a directory or click the 'Create New Folder' toolbar button to create a new directory. Click once (double click will open directory) on selected directory and directory name will appear in Directory box. Click OK to save the location. Click Cancel to leave the dialog without saving the location.

 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.

Property	Value
<i>Project</i>	/root/testFtan/Directory0/ftan
<i>Window characteristic:</i>	
window size	Large
mode	Landscape
postscript output	Yes
<i>Plot characteristic:</i>	
Wave type for overplot	Rayleigh&Love
Plot PREM group vels	Rayleigh&Love
X-axis scaling	Periods
<i>Waveform:</i>	
Record components to be plotted	z r t
Waveform filter specification:	10.00 15.00 300.00 350.00
<i>Measurement specification:</i>	
Apply instrument response	True
Components to be processed	Z T
Polarization measurement	True
<i>Analysis limits:</i>	
Group velocity bounds (km/s):	2.00 5.00
Period bounds (sec):	5.00 400.00
Numbers of orbit and mode	1 0
Raw spectrum: group velocity and width (s) :	3.60 1800.00

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 ;

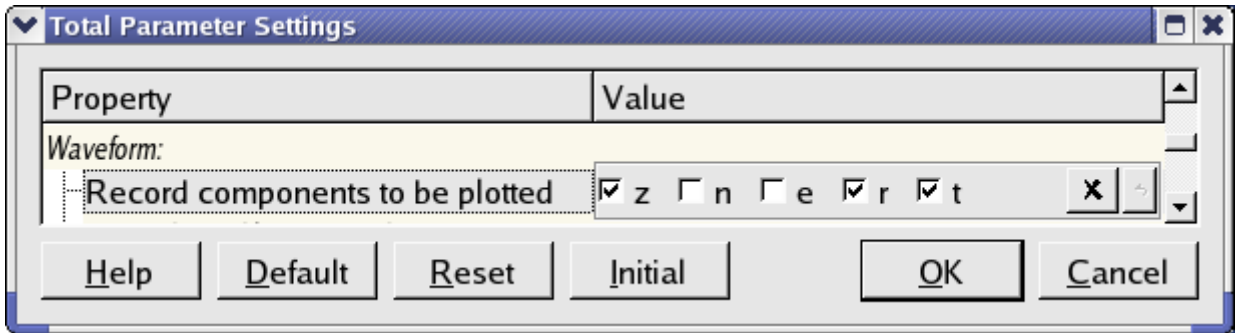
OK button or **Enter** button - to exit Total Parameter Settings with changed parameters (all row dialogs must be closed);

Cancel - to exit without changes.

Five Types of Row Dialog

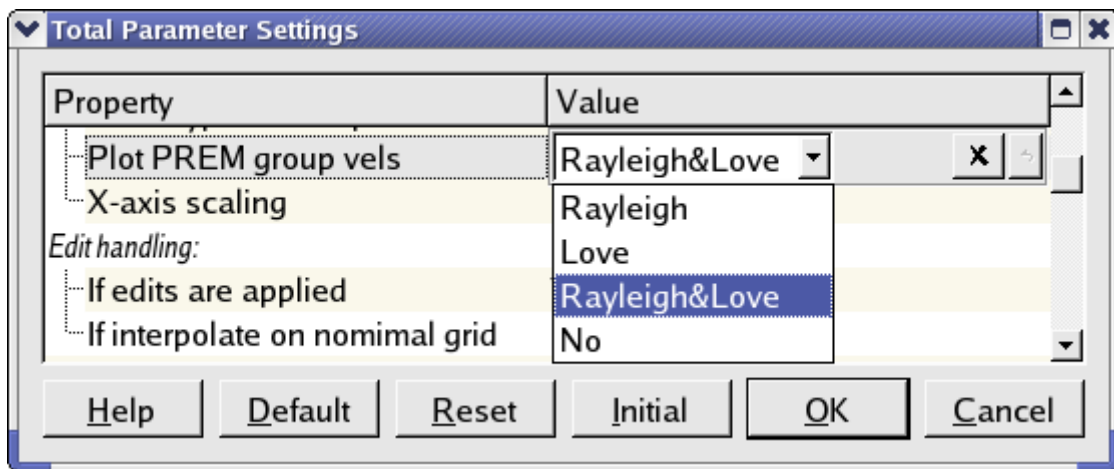
1. Row of check box widgets.

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.



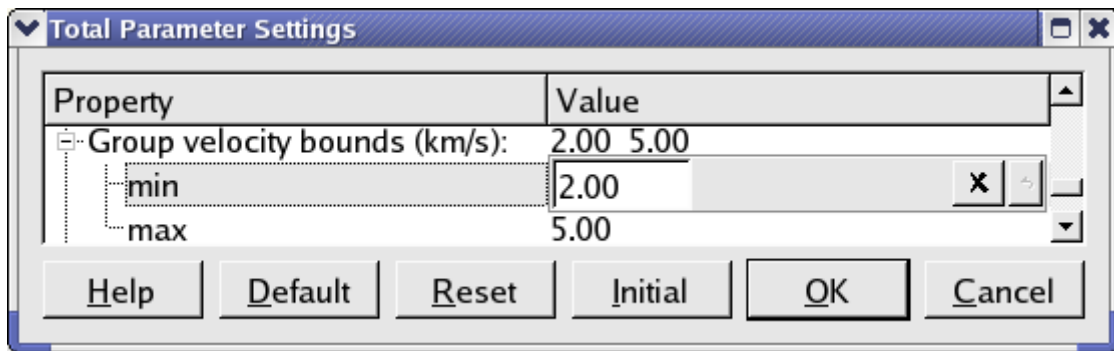
2. Combo box widget.

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.



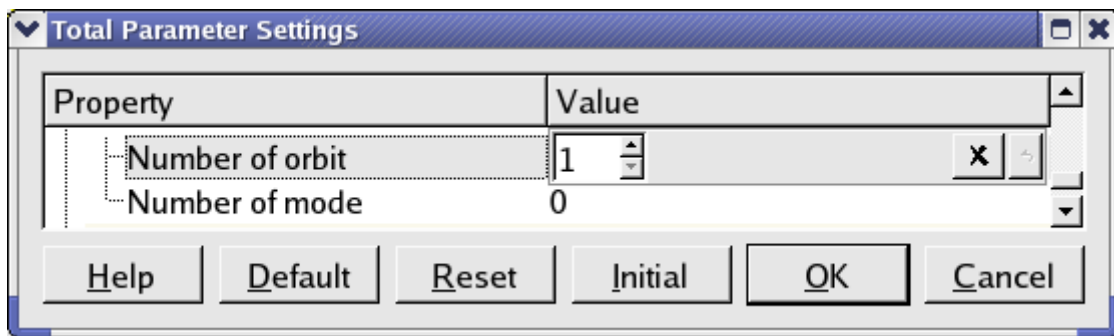
3. LineEdit box widget.

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).



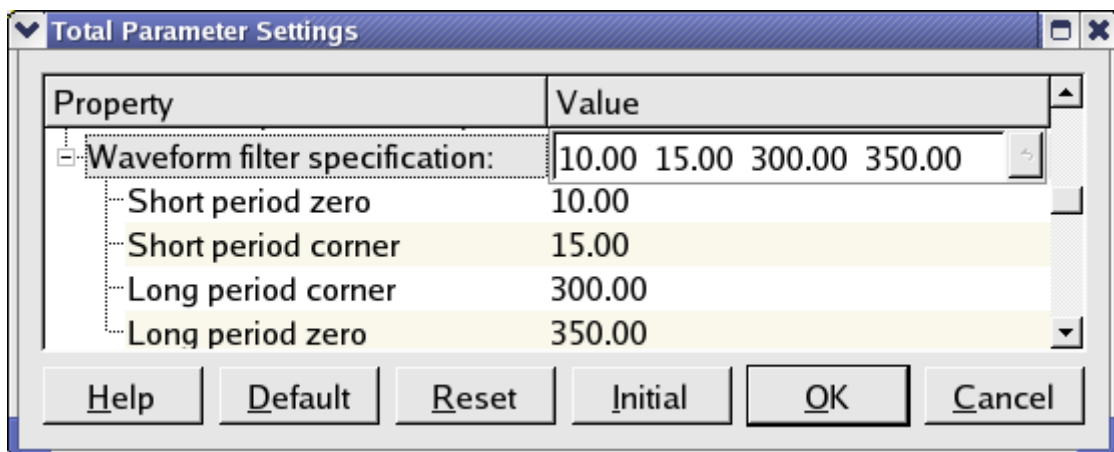
4. Spin box widget.

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 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.

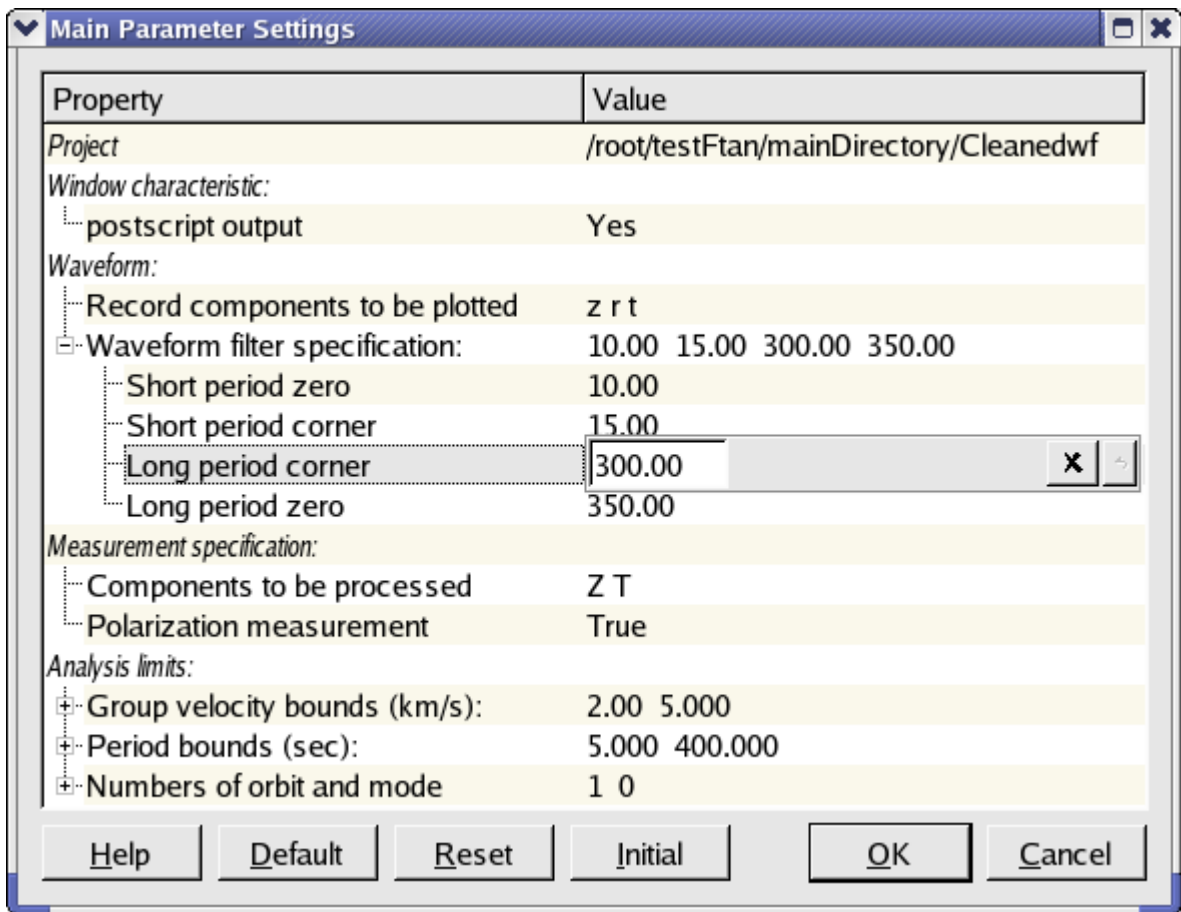
Property - " width"
Type row dialog - LineEdit box widget
Value - float number
Default - "1800.00"
minimum - 0, maximum - FLT_MAX; decimals - 2
Description - Width of time segment for raw spectrum calculation.

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.

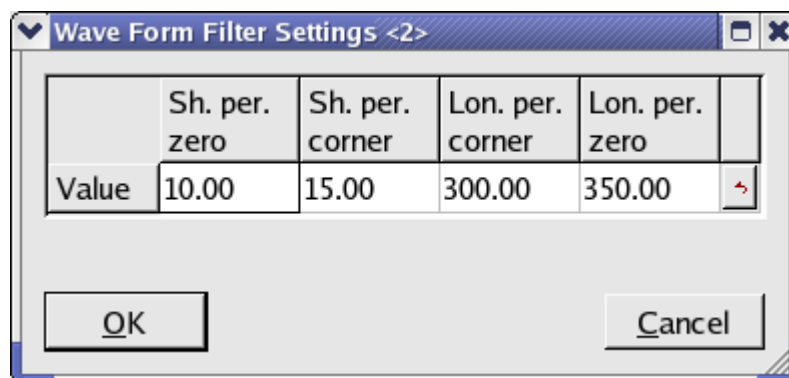
4.7 Filter specification.



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.



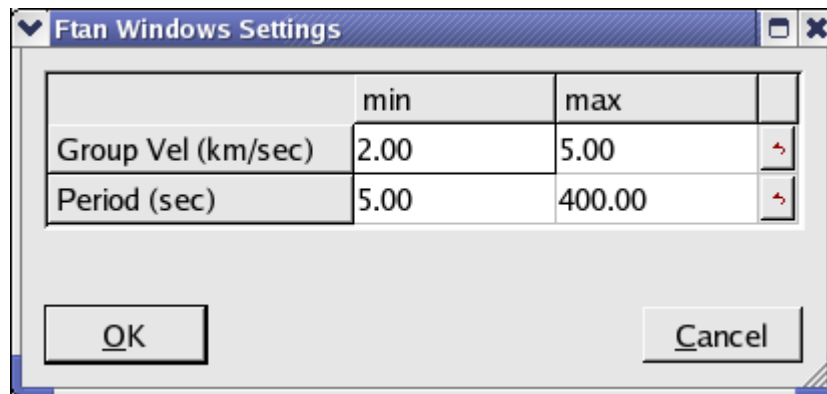
Click OK button to close the window with new parameter values, or Cancel - to close the window without changes.

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.



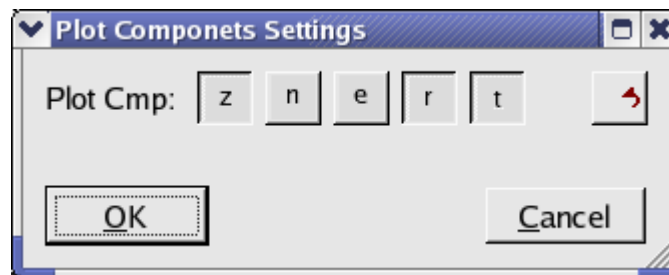
Click OK button to close the window with new parameter values, or Cancel - to close the window without changes.

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.



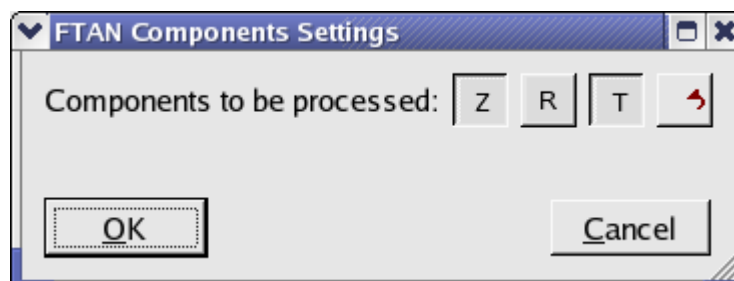
Click OK button to close the window with new parameter values, or Cancel - to close the window without changes.

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.

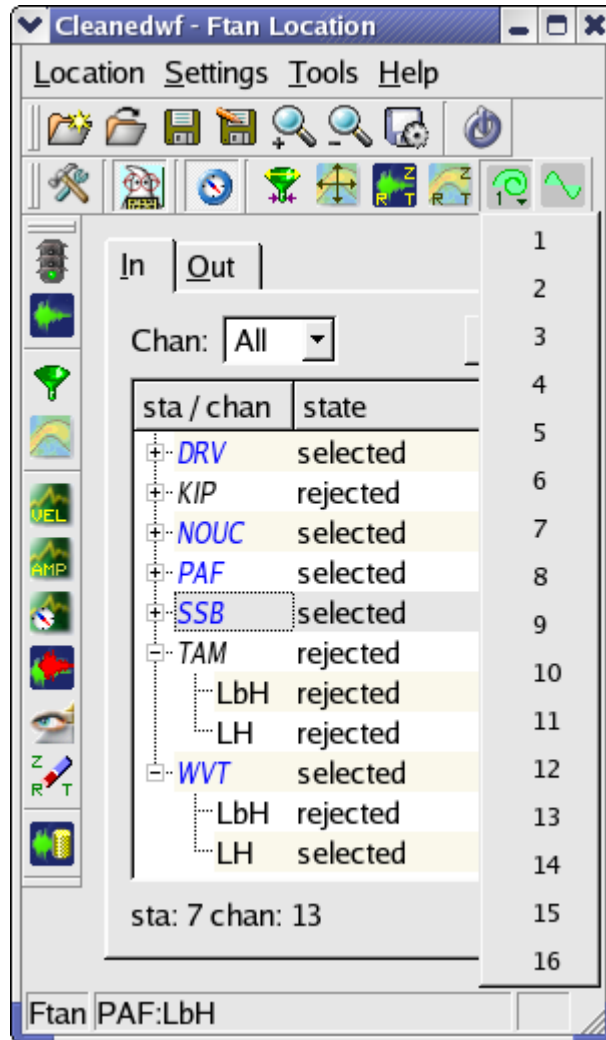


Click OK button to close the window with new parameter values, or Cancel - to close the window without changes.


4.11 Orbit Settings.

 Settings->Orbit

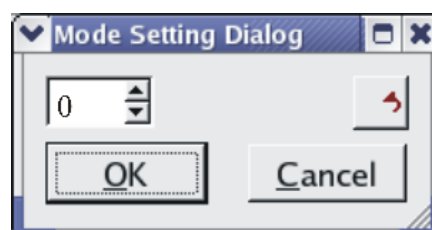
Click required orbit number in pop up menu shown below.



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.

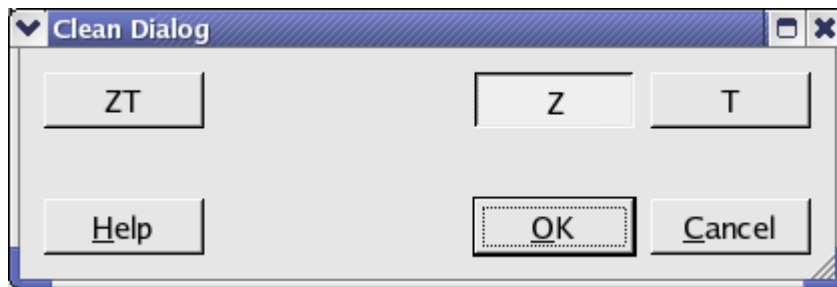


Click OK button to close the window with new parameter value, or Cancel to close the window without changes.

4.13 Clean Records.


 Tools->Clean (Alt+N)

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

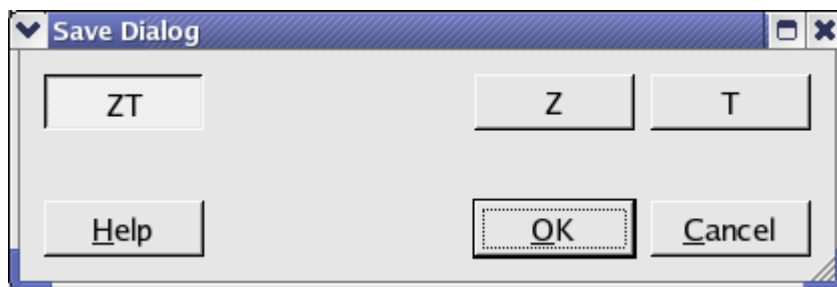


Click OK button to perform the cleaning, or Cancel - to close the window without cleaning.

4.14 Save Records.

 Tools->Save (Alt+E)

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

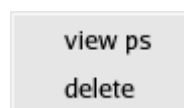


Click OK button to save records, or Cancel - to close the window without saving.

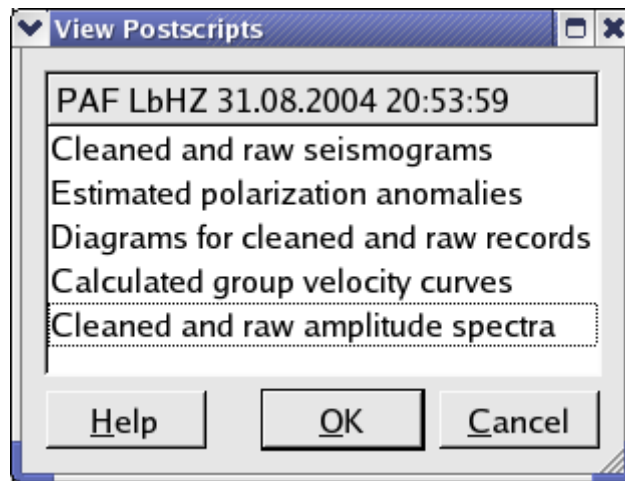
4.15 View Postscript.

Click Out tab in Central Area of MainWindow.


Click right mouse button on channel required, pop up menu will appear:



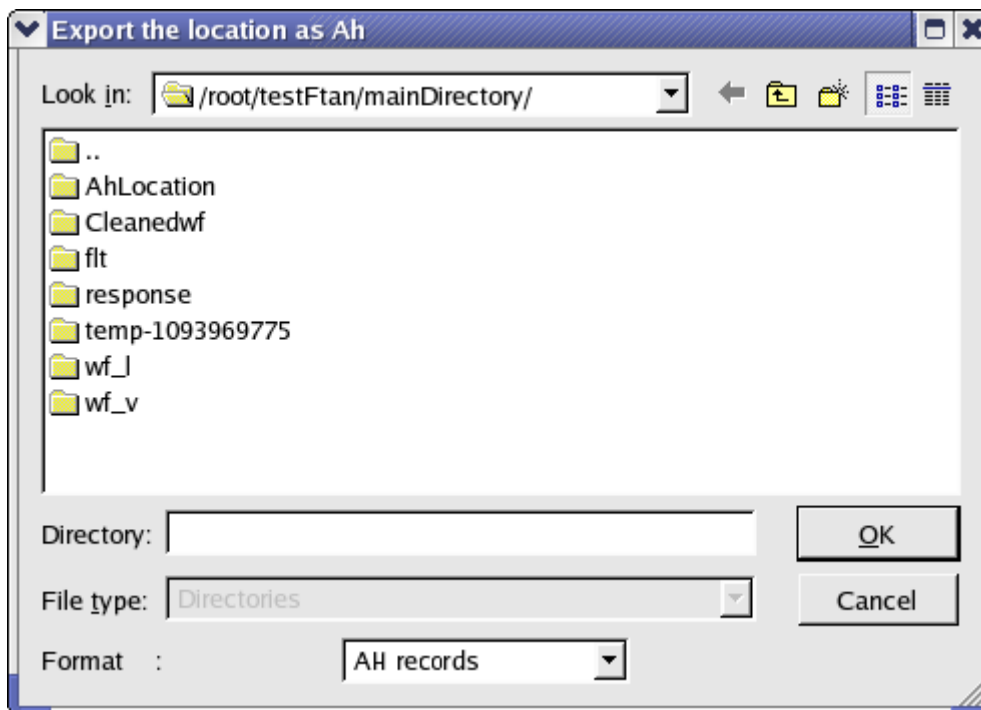
Click "view ps". **View Postscript** window will appear. Select a line and click OK button to view correspondent postscript file. To close the window click Cancel.



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.






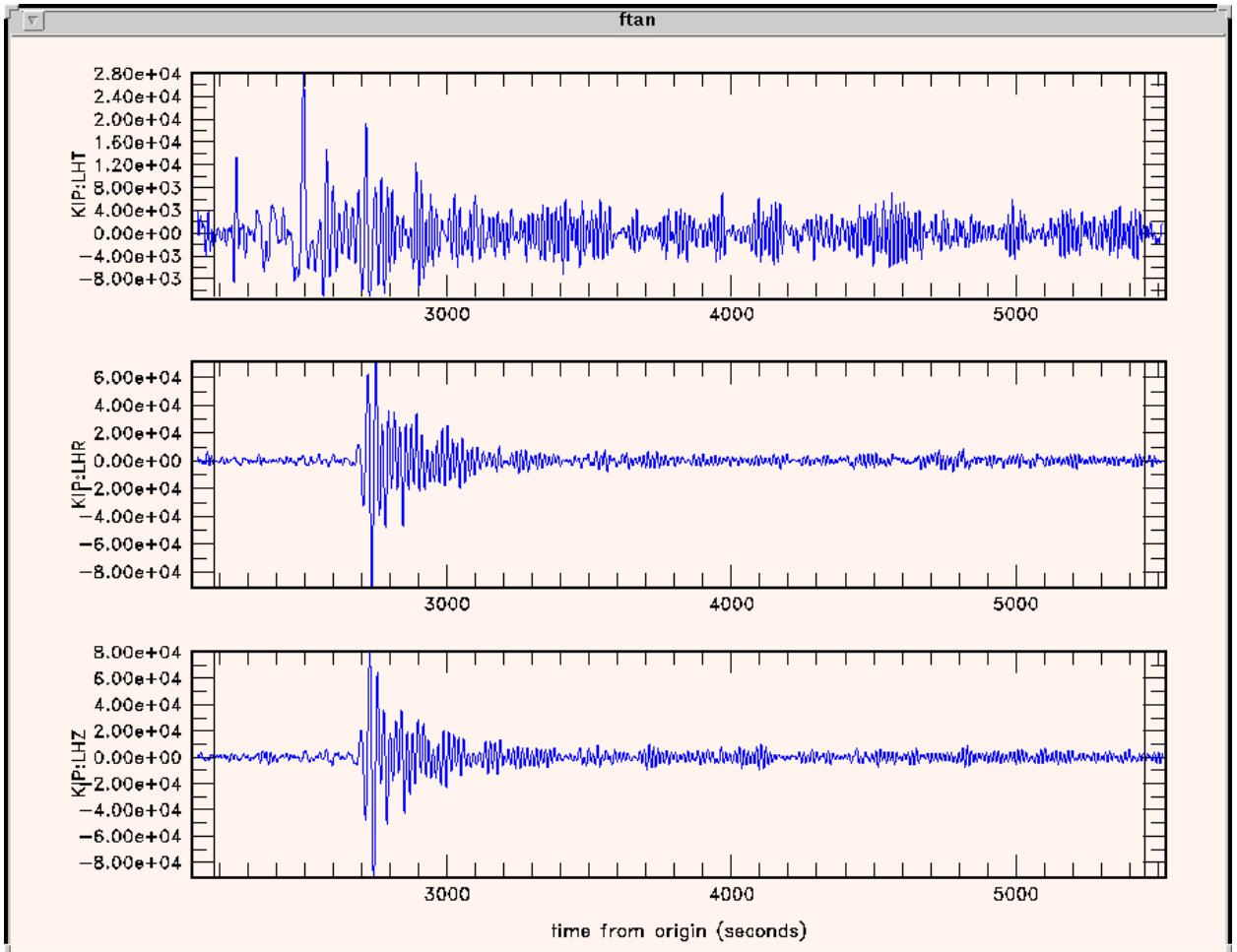
You can export following output results (formats):


- (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

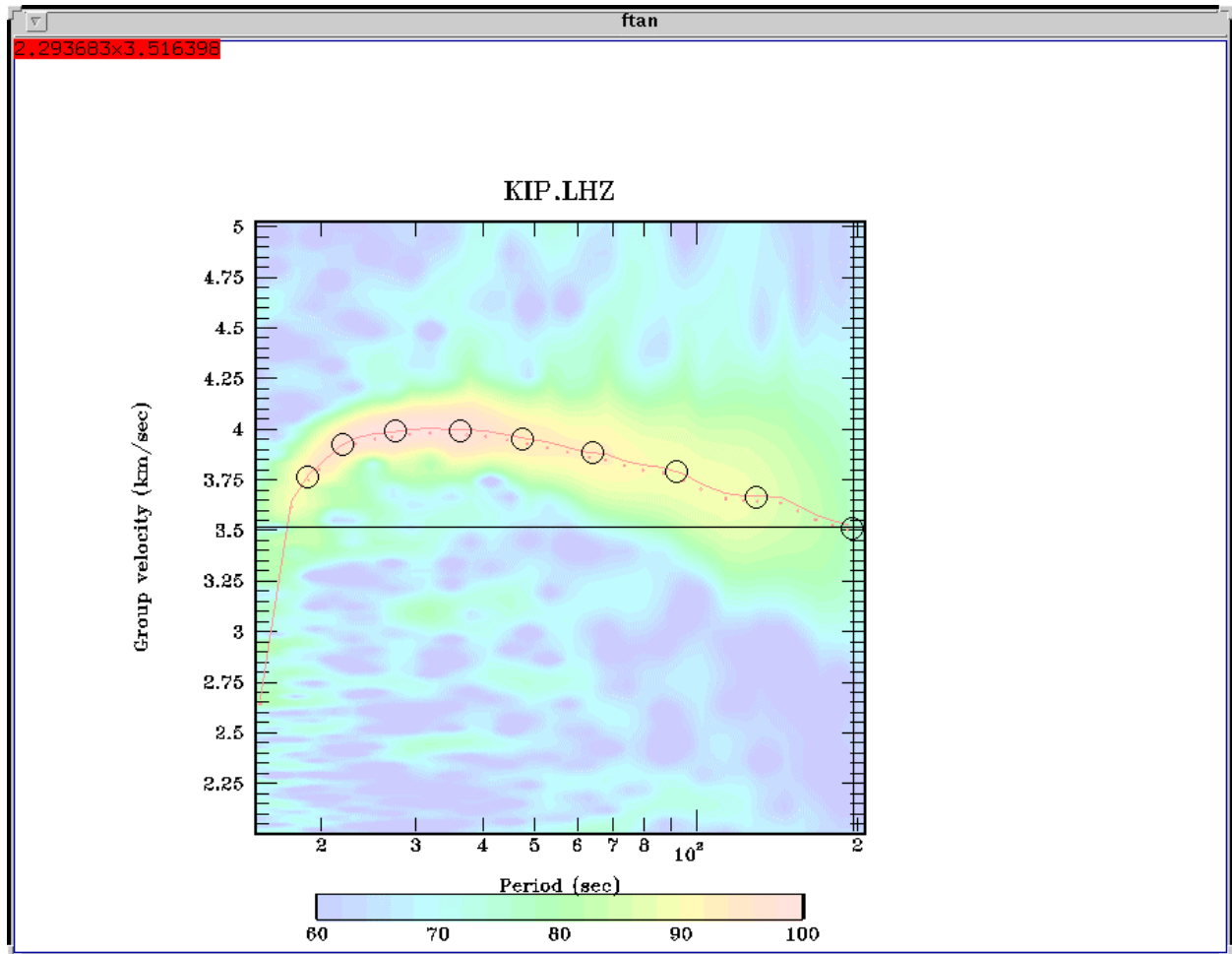


Note, that the raw waveforms can be plotted at any moment by clicking on the button .

To apply bandpass filtering click the button .

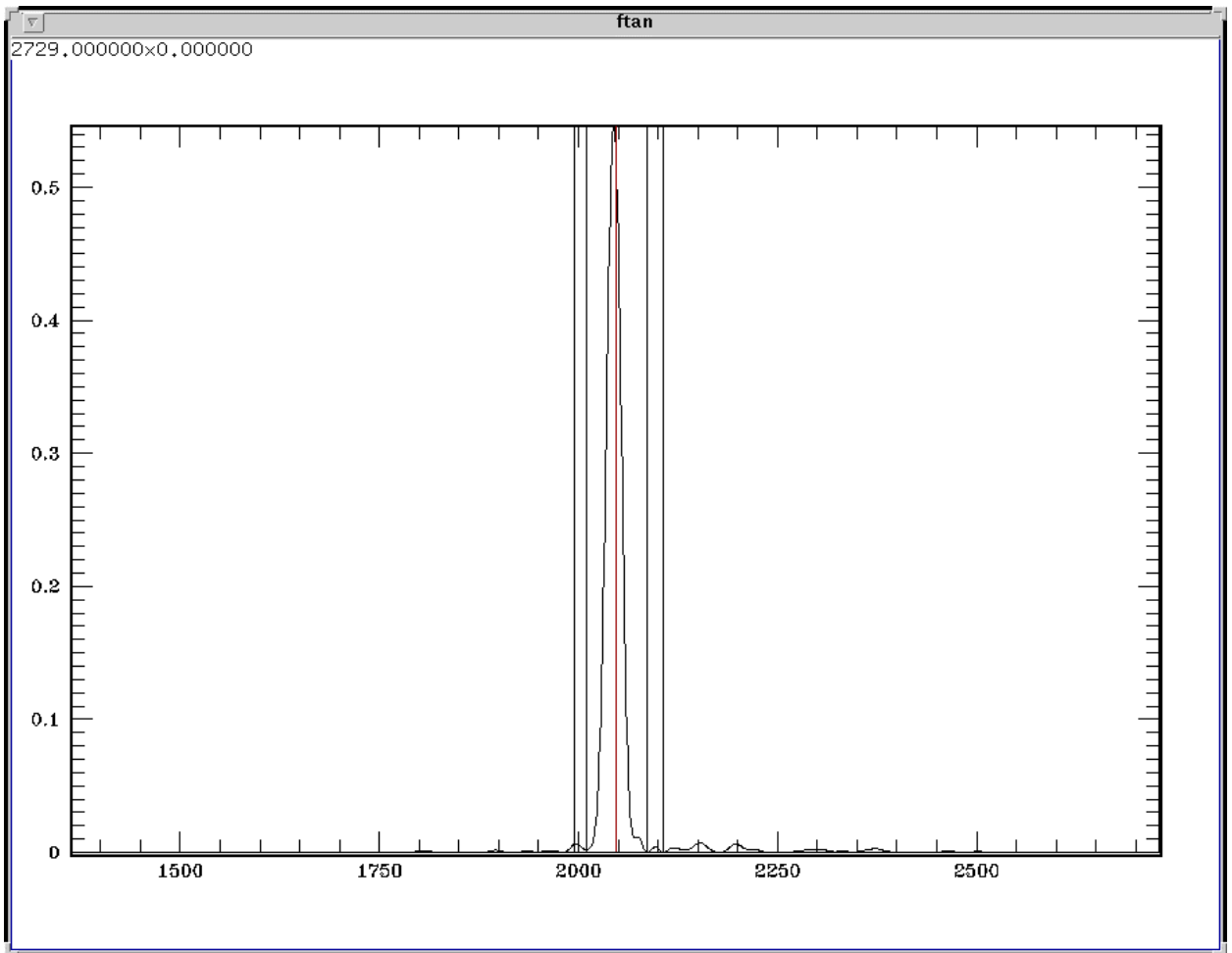
To view FTAN maps for selected components and to make floating filtering push the button .

Here is an example of FTAN map:



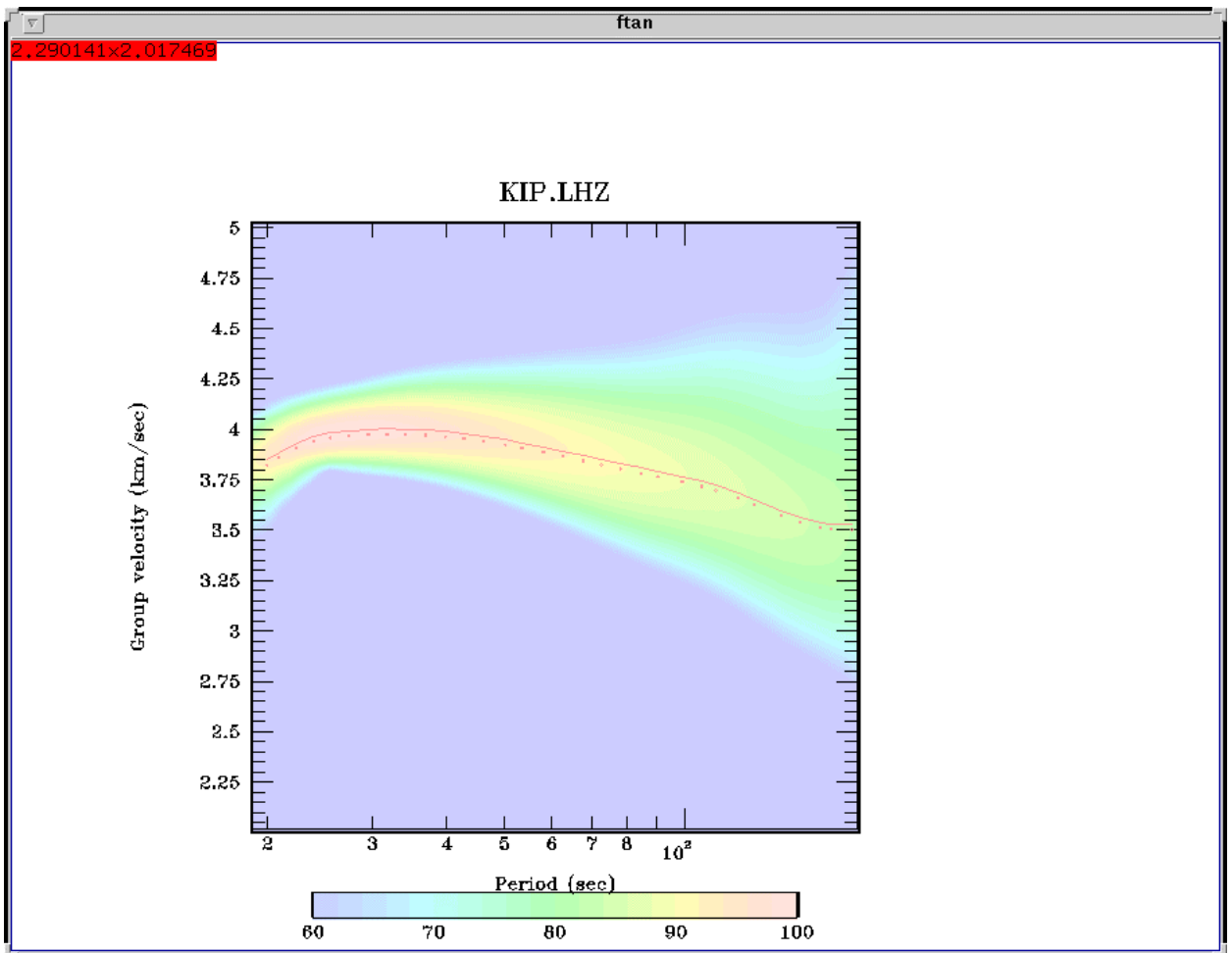
To make a floating filtering it is necessary to plot dispersion curve to make phase equalization (black circles). Use mouse to do this. Click left mouse button to put a point and the right one to delete the point nearest to cursor location. Type "e" to finish the plotting.

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.

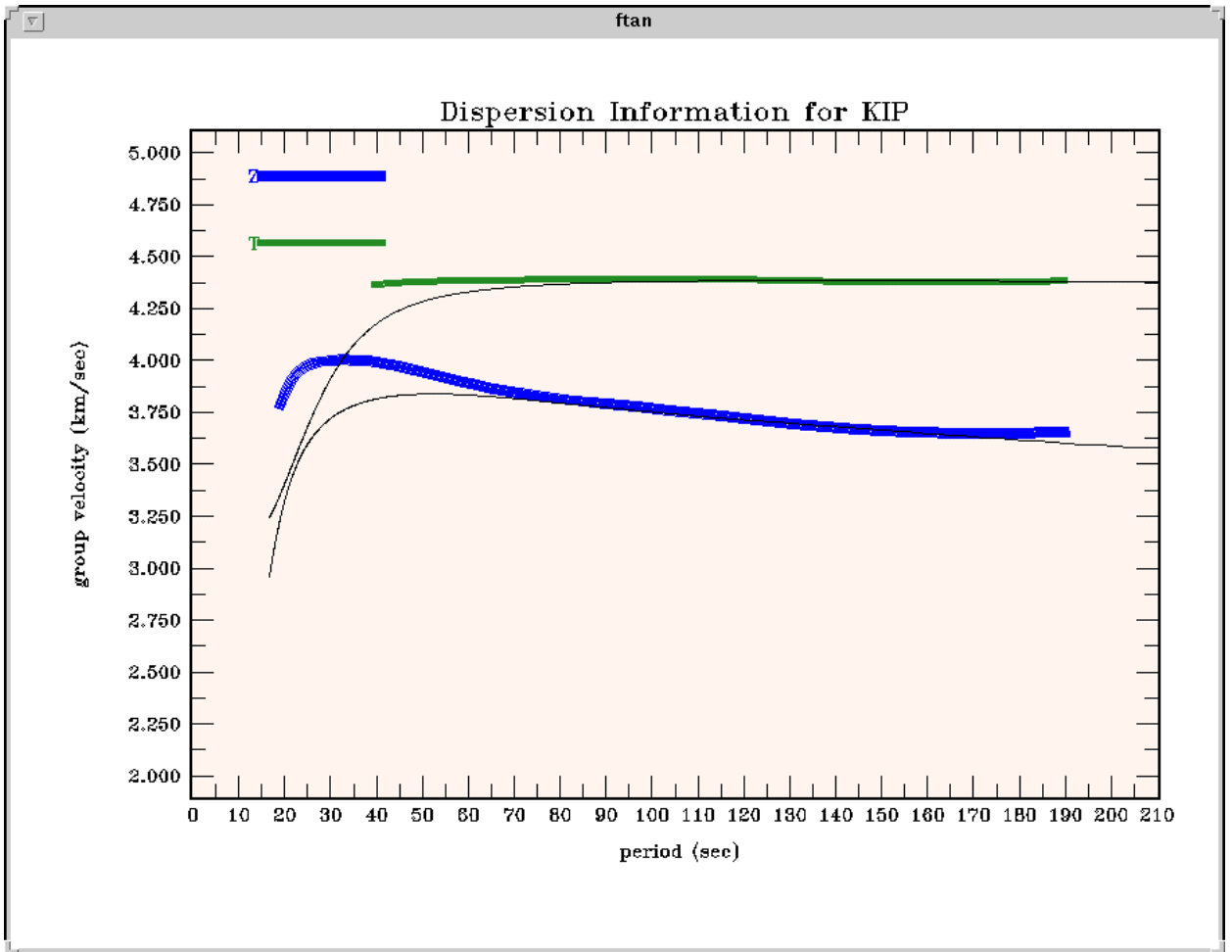
After this a picture of FTAN map for a cleaned signal will appear:



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

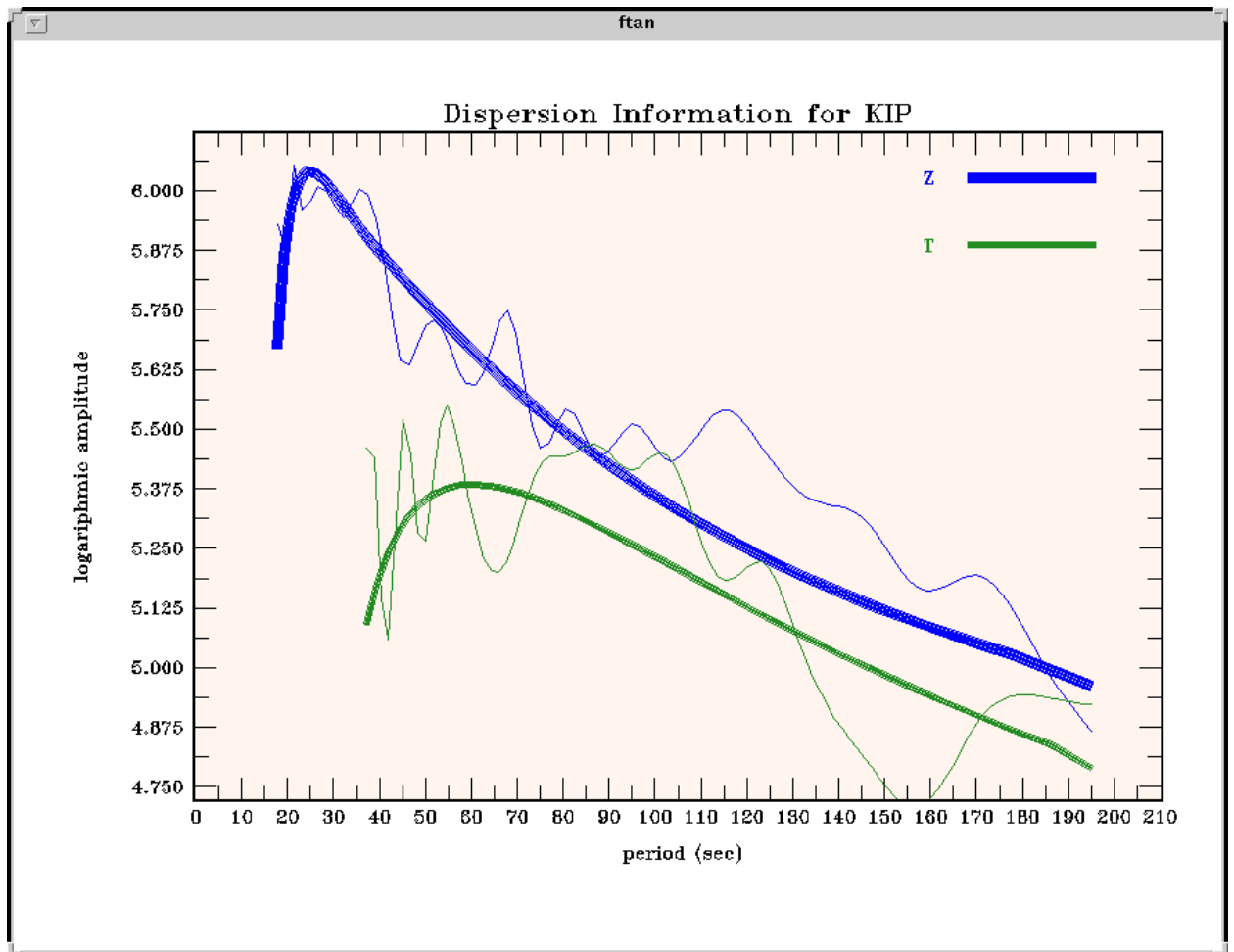
To view results of FTAN calculation of group velocities click button  . Here is an example of group velocities plotting.




The black lines are theoretical curves for PREM model.

To view amplitude spectra push the button  .

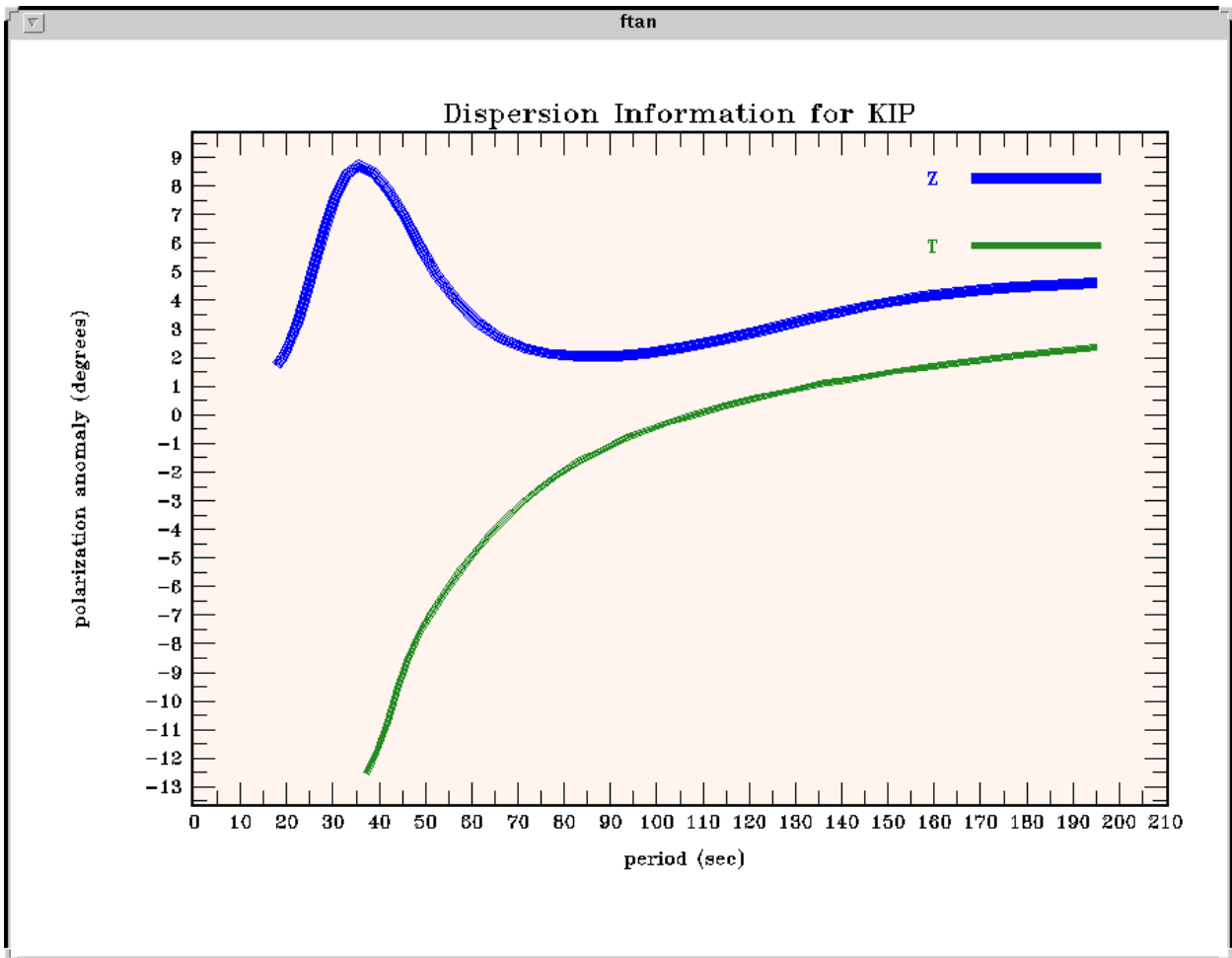
Here is an example of picture of amplitude spectra:




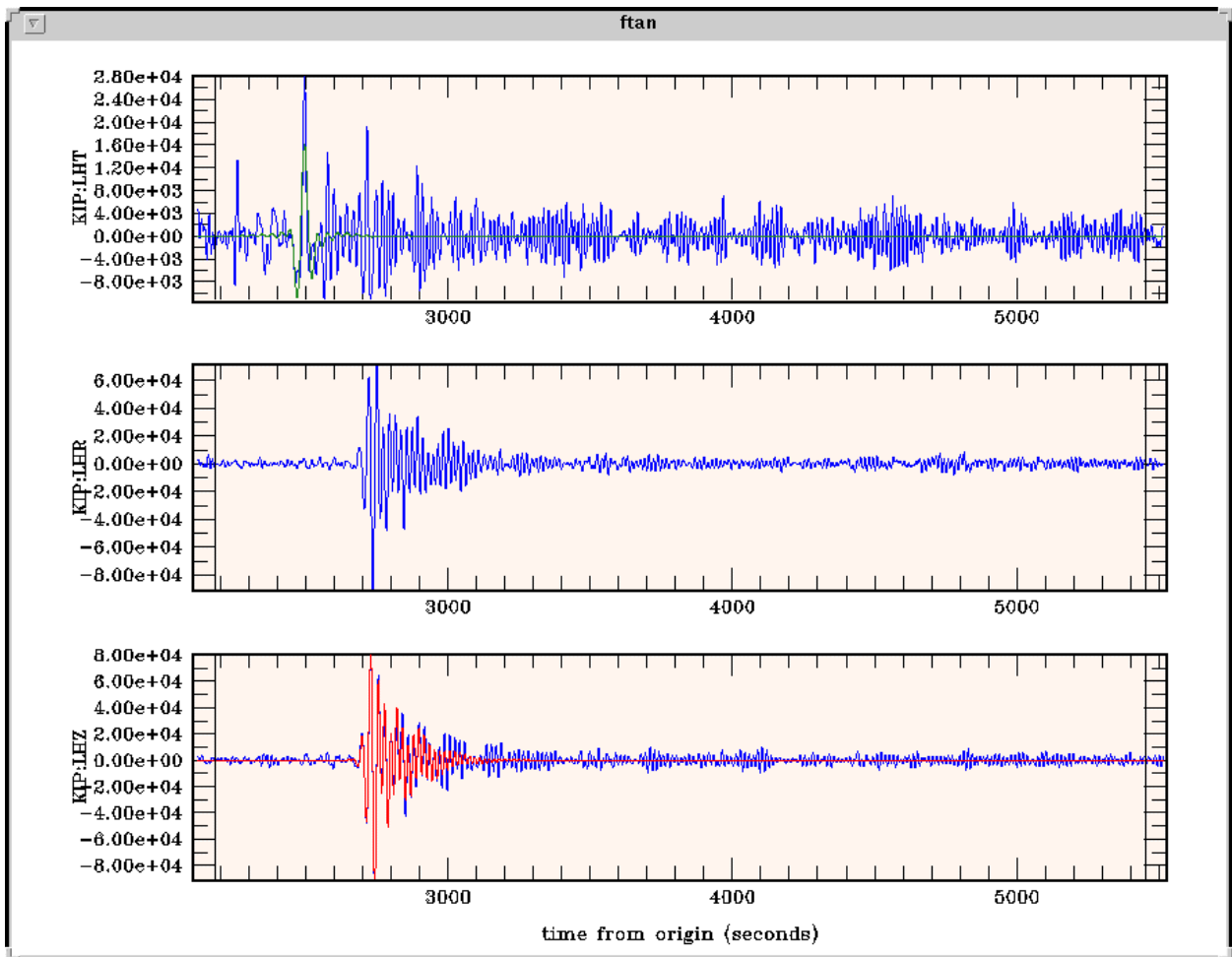
Thin lines present the amplitude spectra of raw signals; thick lines present the amplitude spectra of cleaned signals.


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

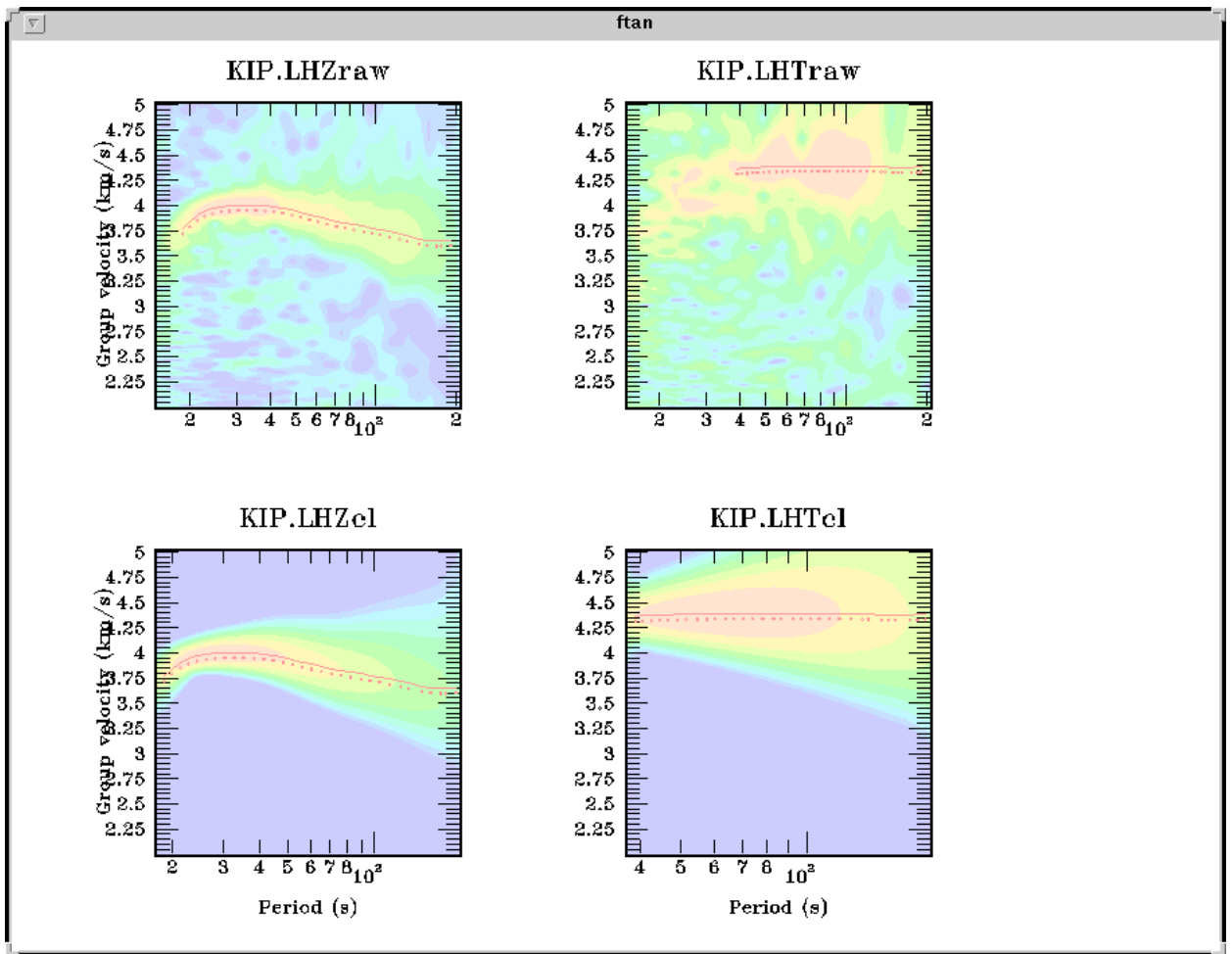
Here is an example of picture of polarization anomalies:




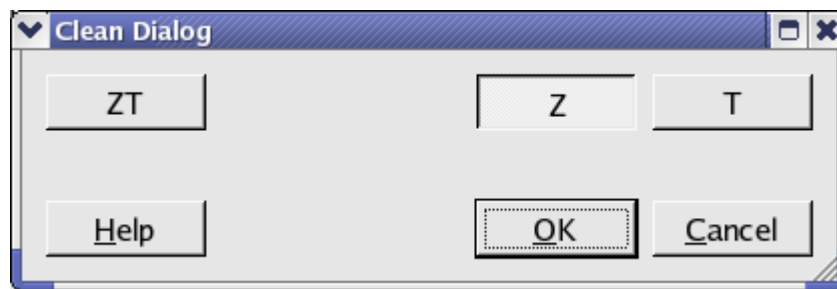
To view the picture of cleaned and raw seismograms push the button .
Here is an example of picture of filtered and raw signals:



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:

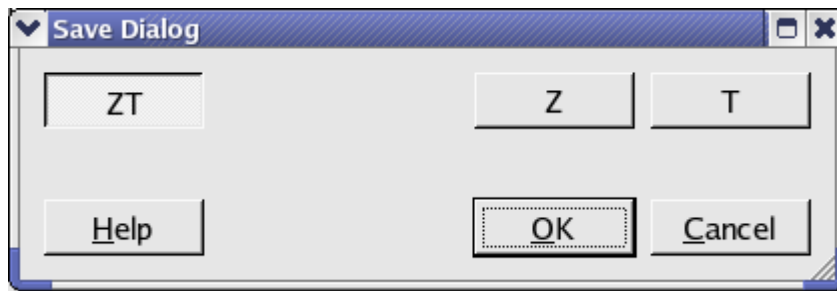


To clean any of processed components push the button . The **Clean Records Dialog** window will appear.





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.