COMPASS Time_Domain

Interactive Weak and Strong Motion Data Processing Software

Rev 2008.11.19 Document Rev C

2011.02.22

This COMPASS manual provides a detailed overview of processing operations using the Time-Domain menu.

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Revision History:

Revision	Date	Reason for change	Pages
C	**2008.12.13**	**Compass 2008Nov19 Update**	**All**
B	**2008.07.13**	**Updated for COMPASS**	**All**
A	**2007.05.05**	**Update for REF TEK SM**	**All**
0.1	**2007.02.23**	**Initial Draft**	**All**

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Notation Conventions

The following notation conventions are used throughout REF TEK documentation:

Notation	Description
ASCII	Indicates the entry conforms to the American Standard Code for Information Interchange definition of character (text) information.
Binary	Indicates the entry is a raw, numeric value.
Hex	Indicates hexadecimal notation. This is used with both ASCII characters (0 – 9, A – F) and numeric values.
BCD	Indicates the entry is a numeric value where each four bits represents a decimal digit.
FPn	Indicates the entry is the ASCII representation of a floating-point number with n places following the decimal point.
<n>	Indicates a single 8-bit byte. When the contents are numeric, it indicates a hexadecimal numeric value; i.e. <84> represents hexadecimal 84 (132 decimal). When the contents are capital letters, it represents a named ASCII control character; i.e. <SP> represents a space character, <CR> represents a carriage return character and <LF> represents a line feed character.
MSB	Most Significant Byte of a multi-byte value.
MSbit	Most Significant Bit of a binary number.
LSB	Least Significant Byte of a multi-byte value.
LSbit	Least Significant Bit (bit 0) of a binary number.
YYYY	Year as a 4-digit number
DDD	Day of year
HH	Hour of day in 24-hour format
MM	Minutes of hour
SS	Seconds of minute
TTT	Thousandths of a second (milliseconds)
IIII	Unit ID number

n, nS	nano, nanoSecond; 10-9 = 0.000000001
u, uS	micro, microSecond; 10-6 = 0.000001
m, mS	milli, milliSecond; 10-3 = 0.001
K, KHz	Kilo, KiloHertz; 103 = 1,000
M, MHz	Mega, MegaHertz; 106 = 1,000,000
G, GHz	Giga, GigaHertz; 109 = 1,000,000,000
Kb, KB	Kilobit, KiloByte; 210 = 1,024
Mb, MB	Megabit, MegaByte; 220 = 1,048,576
Gb, GB	Gigabit, GigaByte; 230 = 1,073,741,824

Related Manuals:

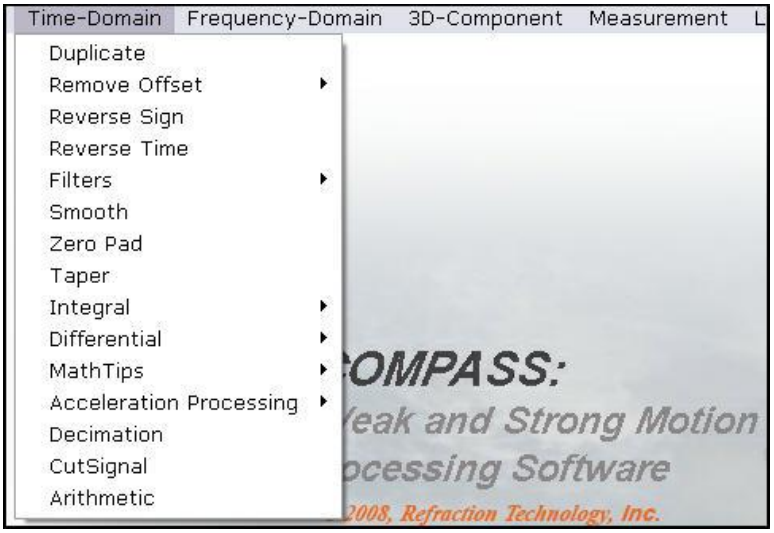
130-SMA System Documents	Number	PDF file
130-SMA Startup (Command Line)	Doc-SMA-Ops	130SMA_startup.pdf
Data Utilities Users Guide	Doc-Datautils	130_utilities.pdf
130-SMA Command Interface	**Number**	**PDF file**
130 Cmd Line - Theory of Operations	Doc-CmdL-Theory	130_CLtheory.pdf
130 Cmd Line - Release Notes	Doc-CmdL-Release	130_CLRN.pdf
130 Cmd Line - Reference	Doc-CmdL-Ref	130_CLcmd.pdf
130 Cmd Line - Recording Format	Doc-CmdL-Record	130_CLrecord.pdf
130-SM GUI Users Guide	Doc-130-SMGui	RT130SM.pdf
Optional Manuals	**Number**	**PDF file**
SNDP Installation and Users Guide	Doc-SNDP-Users	SNDPUser.pdf
SNDP Reference Guide	Doc-SNDP-Reference	SNDPRef.pdf
RTCC Command / Control Users Guide	Doc-RTCC	RTCC.pdf
RT_Display Users Guide	Doc-RT_Display	RTDisplay.pdf
RT_View Users Guide	Doc-RT_View	RTView.pdf
RTPMonitor Installation and Users Guide	Doc-RTP_Monitor	RTPM.pdf
RTPD Installation and Users Guide	Doc-RTPD	RTPD.pdf
RTP Protocol	Doc-RTProtocol	RTProtocol.pdf
Accelerometers		
131A-02/3 3G Triaxial Accelerometer	Doc-131A-03/2	131A023.pdf
131A-02/2 3G Triaxial Accelerometer	Doc-131A-02/2	131A022.pdf
131A-01/3 4G Triaxial Accelerometer	Doc-131B-01/3	131B013.pdf
131B-01/1 4G Unixial Accelerometer	Doc-131B-01/1	131B011.pdf

Software Version:

Current software and documentation is available on our web site. Some early units may require hardware modifications to use the latest software. Contact REF TEK if you have any queries on the compatibility of your unit(s) and the current software release.

About this manual:

This COMPASS Technical Reference manual provides a detailed overview of the operations and setup of the COMPASS software. It covers the following broad operational topics:



- Duplicate
- **Remove Offset** => Mean Removal – Polynomial - Removal BAP
- Reverse Sign
- Reverse Time
- **Filters** => IIR Butterworth – IIR Bessel – FIR – RC_LOWPASS – CR_HIPASS
- Smooth
- Zero Pad
- Taper
- **Integral** => Trapezoidal – Three Point – RC Method
- Differential => Three Point
- **Math Tips** => Envelope STA – Envelope STA (max) – Compute 20*Log – Cut - Skew
- **Acceleration Processing** => Arias Intensity – Cumulative Abs Vel. – Label G's – RSP Filter
- Decimation
- CutSignal
- Arithmetic

REF TEK Support and update notifications

As a valued user of REF TEK equipment we would like to provide the best support possible by keeping you up to date with our product updates.

If you would like to be notified of any REF TEK product updates please spend a couple of minutes to register with the REF TEK customer support team.

To register, enter your company information through the Register link on our website at http://support.reftek.com .

Our support team will send you a unique Username and Password allowing secured access to all product documentation and software sold to your company.

Once we register your contact we will only send necessary notifications via email. The same notifications will be shown on our website http://support.reftek.com notifications page .

Thanks,

Your REF TEK support team

Contents

List of Figures:

4 Time-Domain

4.1 Time Domain menu commands

The **Time Domain** menu is for signal processing in a time domain.

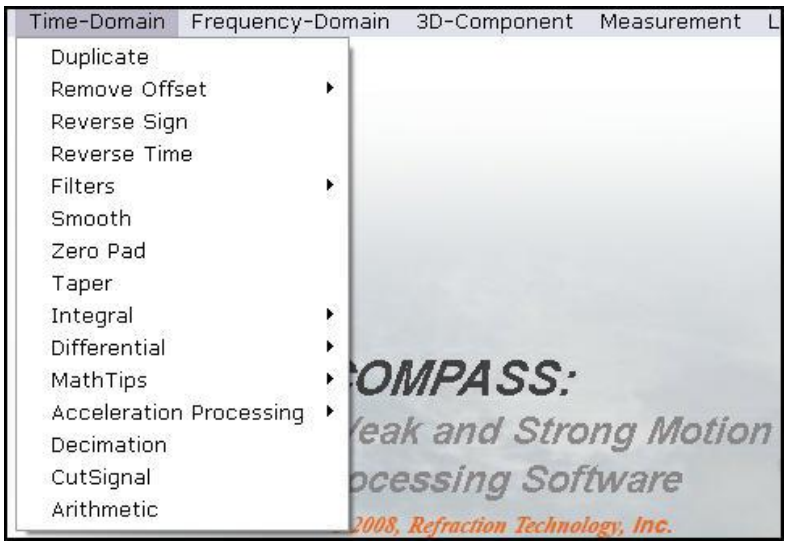


Figure 4-1 Time-Domain commands

4.2 Duplicate

Use the **Duplicate** command to create a copy of selected channels in program memory. Sometimes it is more useful to study the spectrum of the signal and the spectrum of noise at the same time.

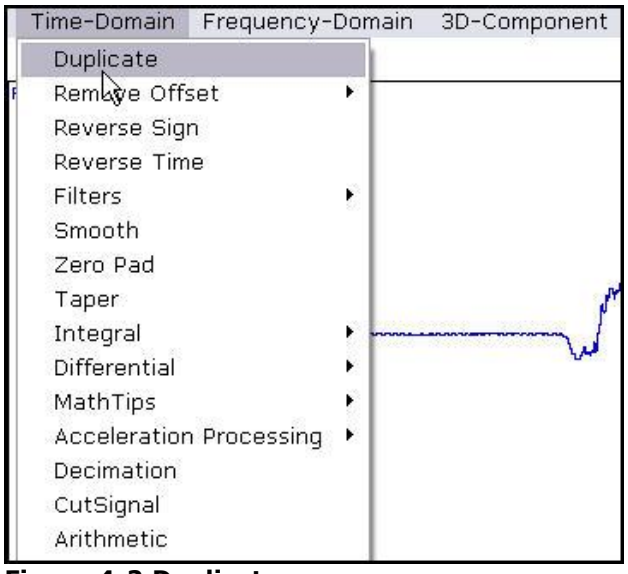


Figure 4-2 Duplicate

4.2.1 Duplicate Command Example

1. Duplicate the signal. Two same traces will be visible in display.

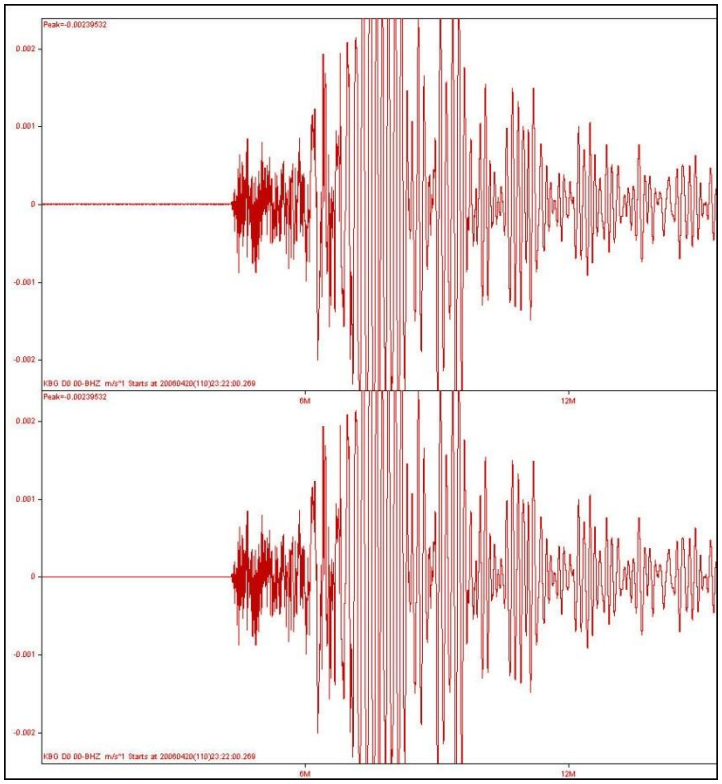


Figure 4-3 Duplicate

2. Pick the time at the beginning of useful signal on the first component (using the **Pick Time** command).

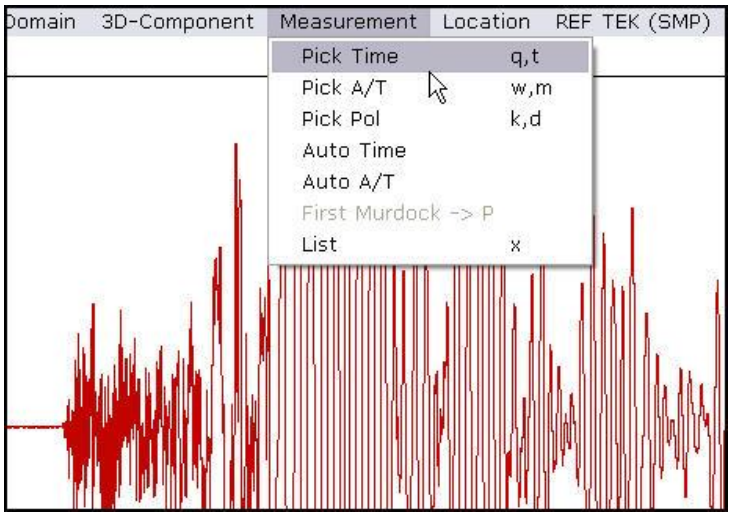
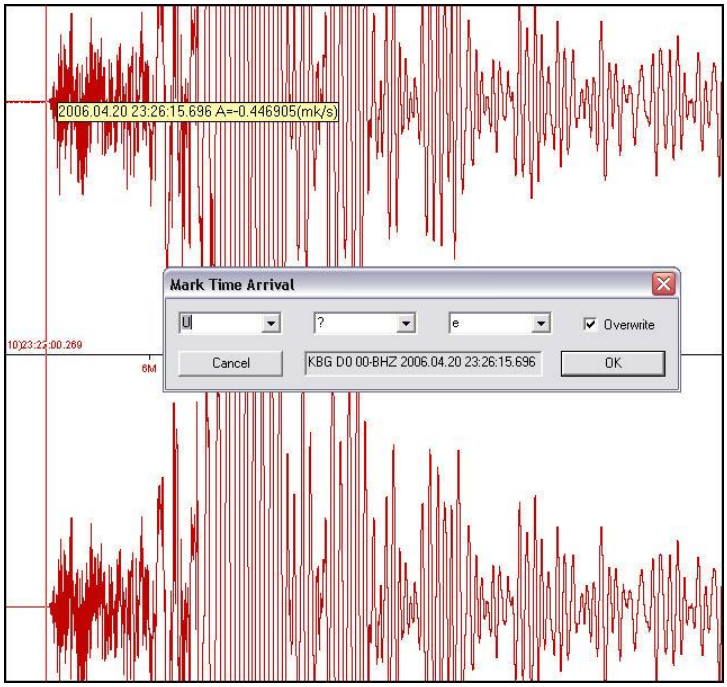


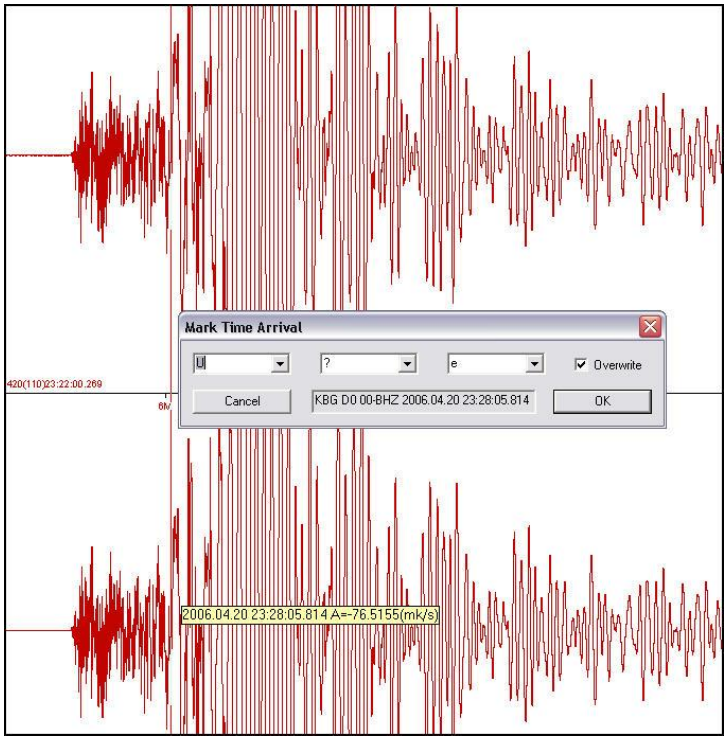
Figure 4-4 Time Pick

3. Type in the name of the timepick as **U** (for user).

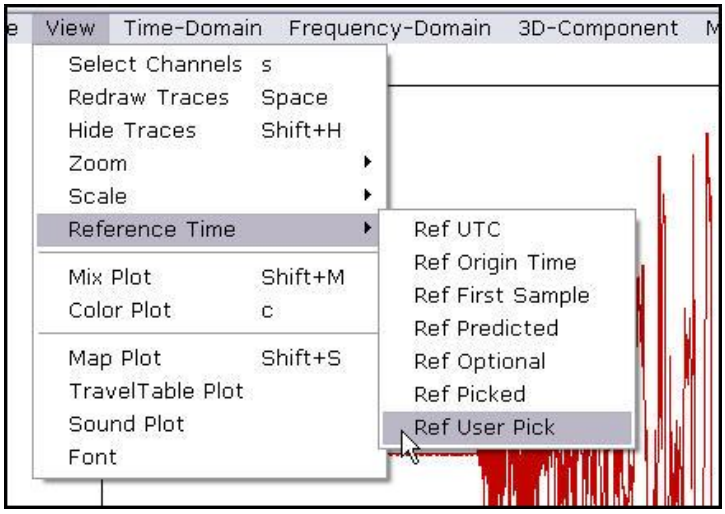


4. Pick the time of the beginning of the noise without useful signal on the second component.

5. Type in the name of timepick as **U** again.



6. Select the **Reference Time** to be User Pick.



7. The traces will be displayed according to User Pick U times.

8. **Zoom In** the time interval containing signal + noise on the first trace and noise on the second.

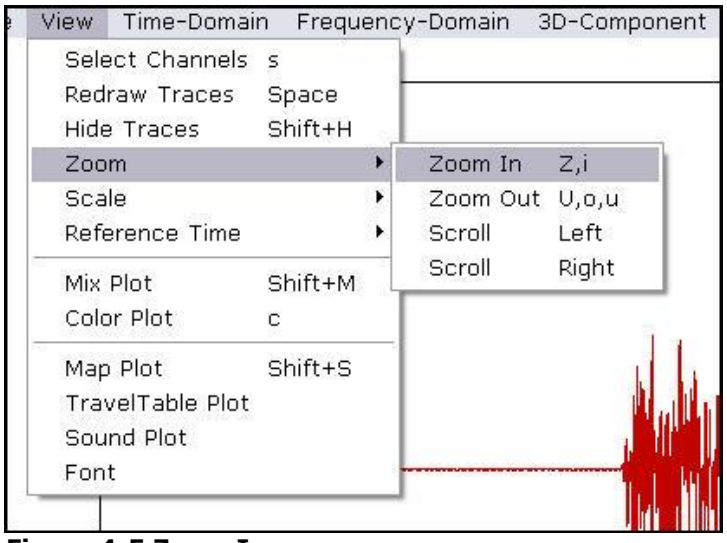
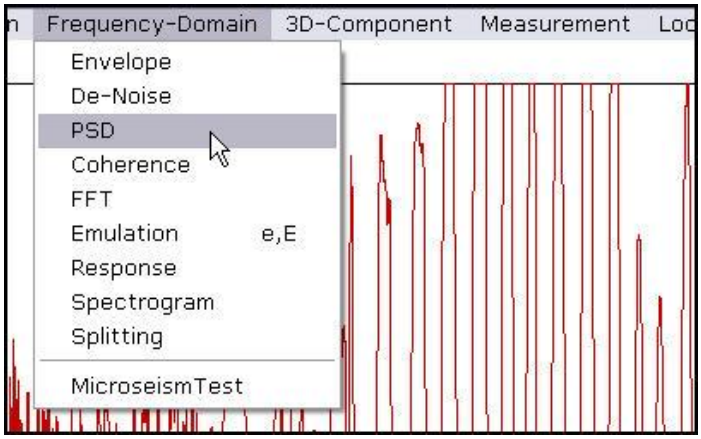
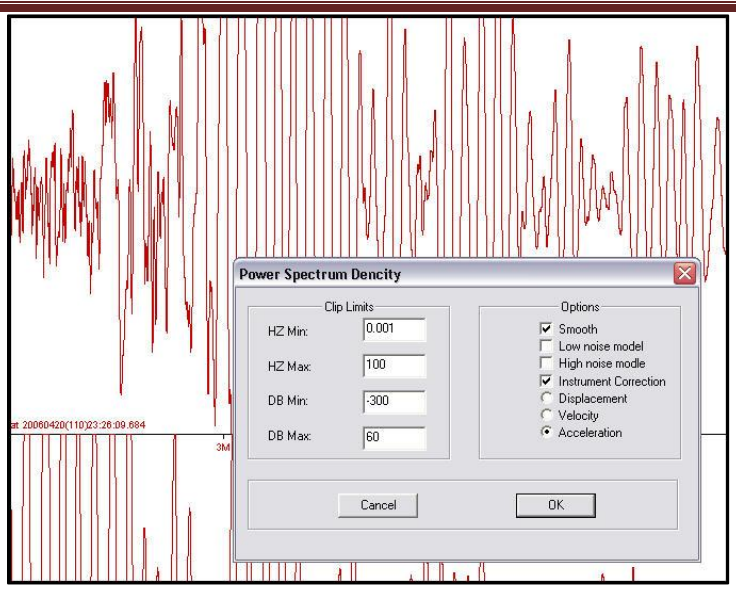


Figure 4-5 Zoom In

9. Compute **Power Spectral Density** of the signals.





The result after the **OK** button is selected.

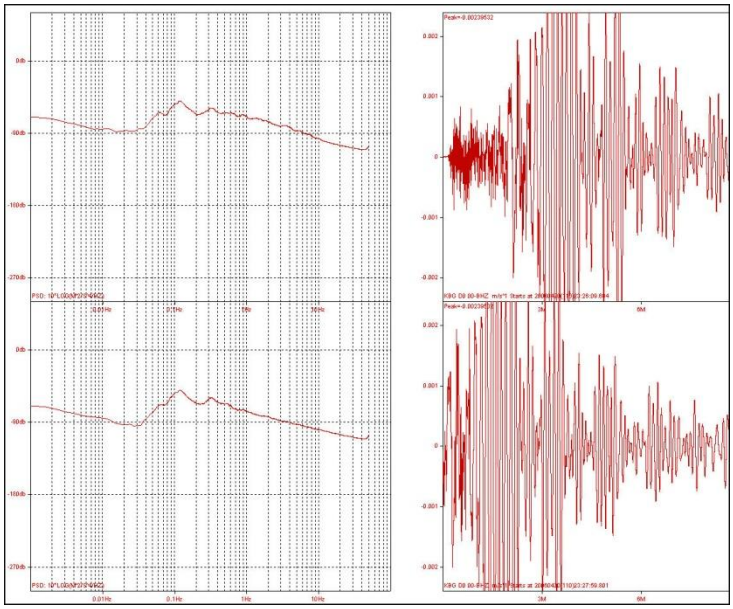


Figure 4-6 Power Spectral

10. Select the best signal to noise frequency band and apply to the initial signal.

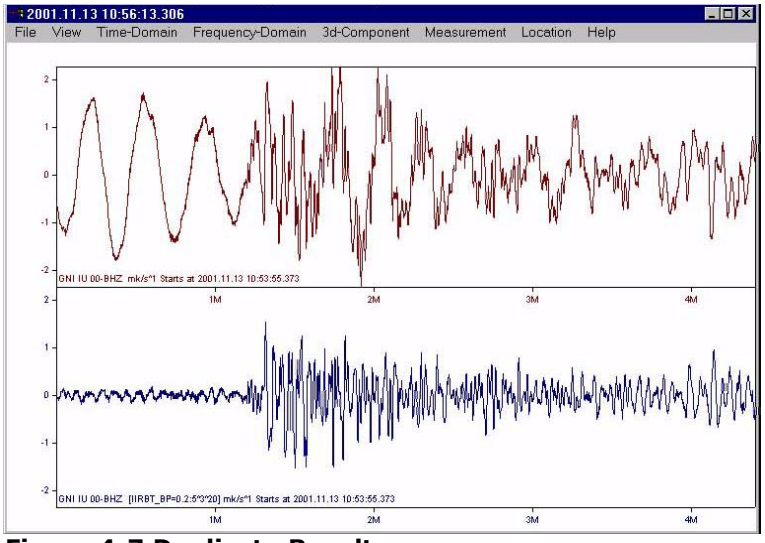


Figure 4-7 Duplicate Results

4.3 Remove Offset

The **Remove Offset** command will remove the DC offset from the signal. The Mean Removal option just removes the average value constant (computed for the zoomed in interval) from the whole signal.

To remove the offset by mean removal:

1. Select the **Time-Domain** menu and use the **Remove Offset** by **Mean Removal** option.

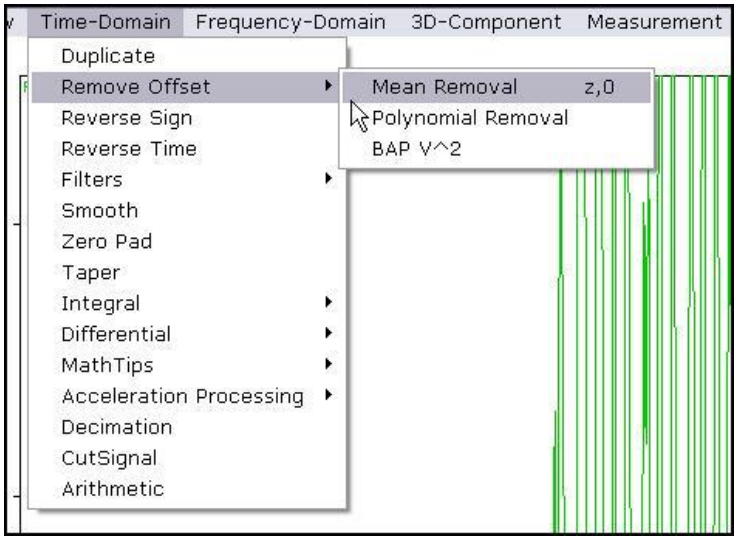
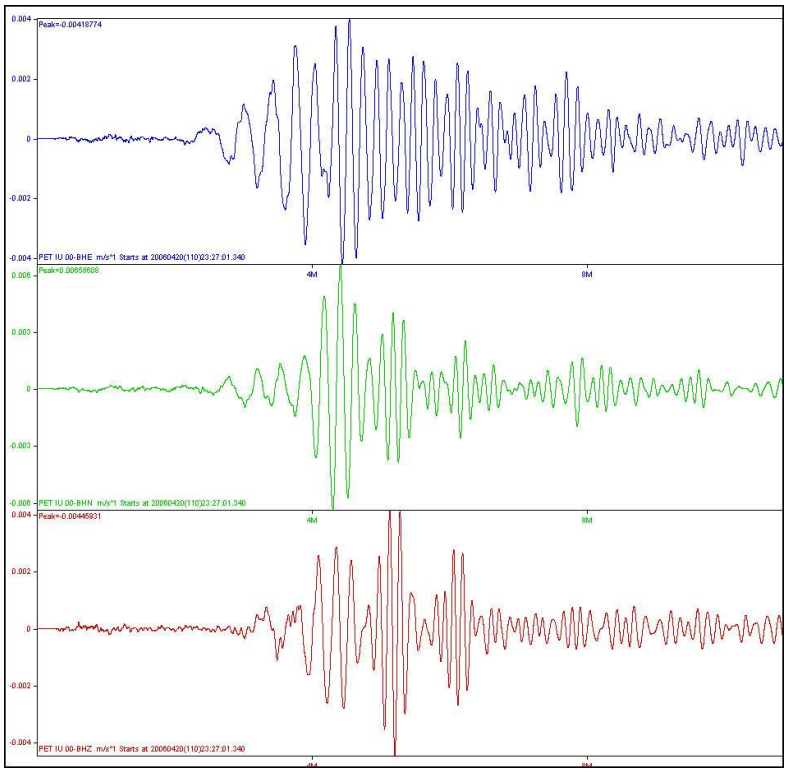


Figure 4-8 Remove Offset

2. After selecting **Mean Removal** the result displays.



4.3.1 Polynomial Removal

This **Remove Offset** menu option (Polynomial Removal) will remove the DC offset from the signal by computing the polynomial fit to the zoomed in data and removing it from the signal.

To remove the offset by polynomial removal:

1. Select **Polynomial Removal** from the **Remove Offset** options under the **Time-Domain** menu.

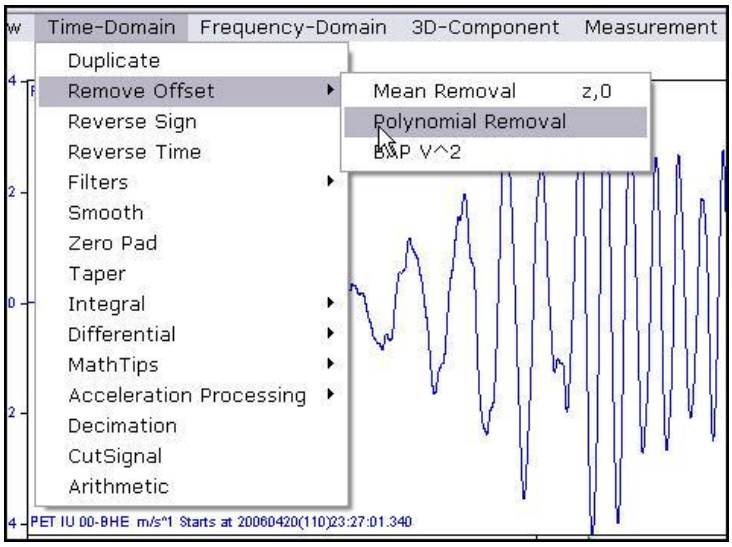
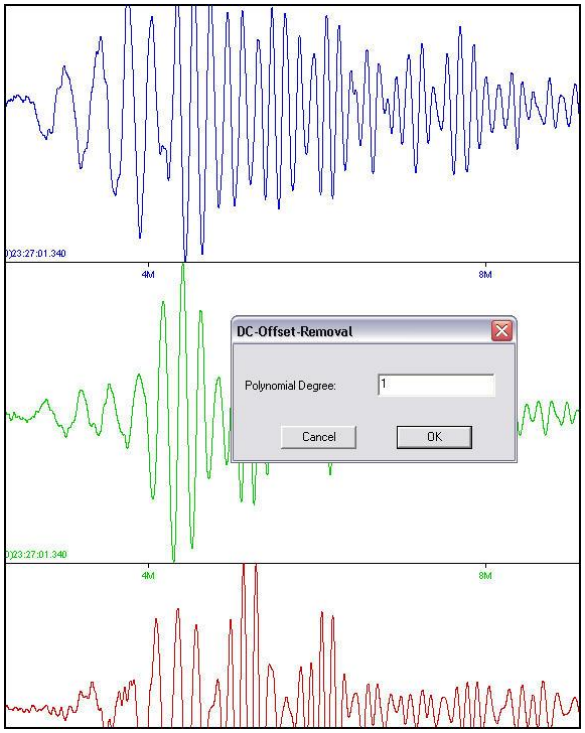


Figure 4-9 Polynomal

2. Enter the **Polynomial Degree** in the option.
3. Select the **OK** button to approve the removal.



4. The offset is removed and the display redraws.

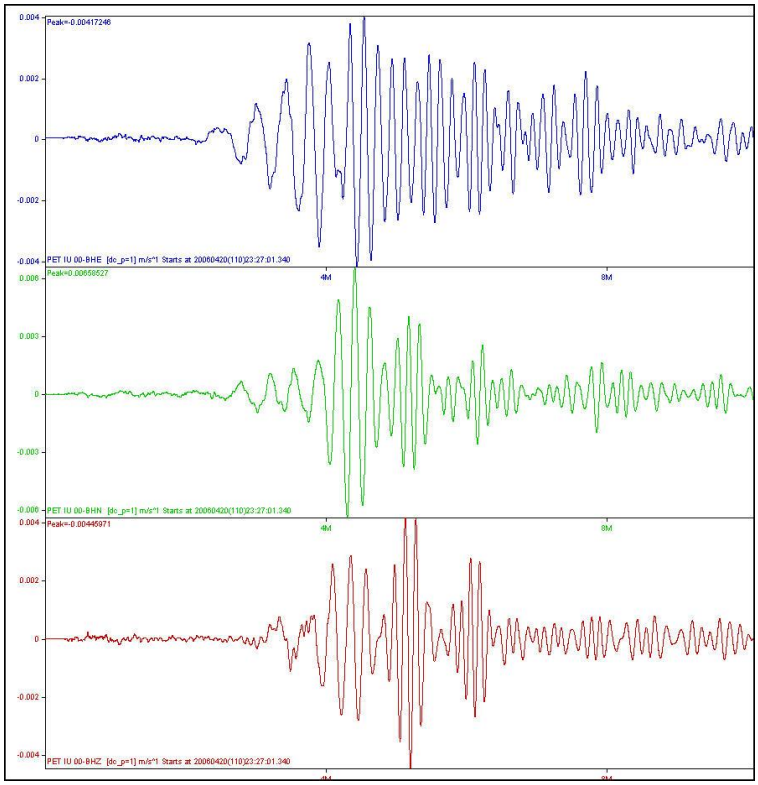


Figure 4-10 Polynomial Results

4.3.2 Bap V^2 Fit

This **Remove Offset** menu option (Bap V^2 Fit) will remove DC offset from the signal by using a math procedure for DC correction used in BP processing (quadratic fit to velocity).

Basic Strong-Motion Accelerogram Processing (Response-Spectra)

Most algorithms are similar to the one on this website: http://nsmp.wr.usgs.gov/bap/BAP_v10.pdf. This menu can be applied only to acceleration records (look up units=M/(SEC^2). However an acceleration record can be built from other "ground motion" by computing:

- Double differential of displacement records
- Single differential of displacement records
- Emulating real ACCELERATION records in a frequency domain

Brief Theory for steps to apply dc offset correction to acceleration records:

Used for events with pre-event signal, particularly those with very long pre-event signal of tens of seconds, but also applicable to events with no pre-event signal.

1. Remove a mean from the whole record, where the mean is determined from t = 0 to t = tp, the approximate onset time of the earthquake signal [if tp = 0.0, then the mean of the entire record is used; if t p < 0, no mean is removed.].
2. Integrate the mean-corrected acceleration to velocity
3. Fit a second-order polynomial to the velocity, v = c1*(t-tp) + c2*(t-tp)2, from t = tp to the end of the record.
4. The function is chosen so that the fitted curve = 0.0 for t = tp;
5. Remove the derivative of the fitted curve, c1 + 2*c2*(t-tp), from the mean-corrected acceleration in the time interval t = t p to the end of the record.
6. Low-cut filter the baseline-corrected acceleration with a causal, 4th-order low-cut Butterworth filter that has a corner frequency fc = 0.02 Hz (50 s).
7. Use BAP to integrate the baseline-corrected, filtered acceleration to obtain velocity and displacement, to compute Fourier amplitude spectra of corrected acceleration, and to compute response spectra.

To remove the offset by BAP:

1. Select **Bap V^2 Fit** from the **Remove Offset** options under the **Time-Domain** menu.

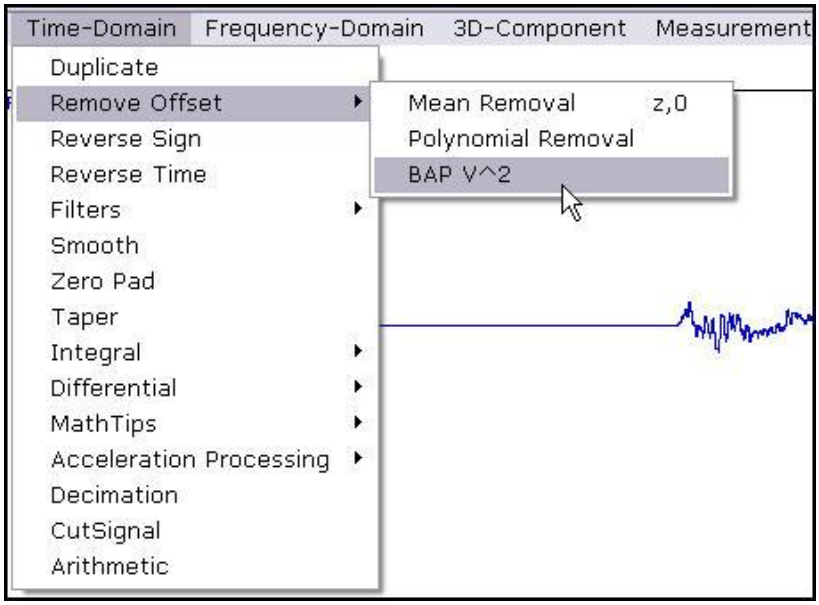
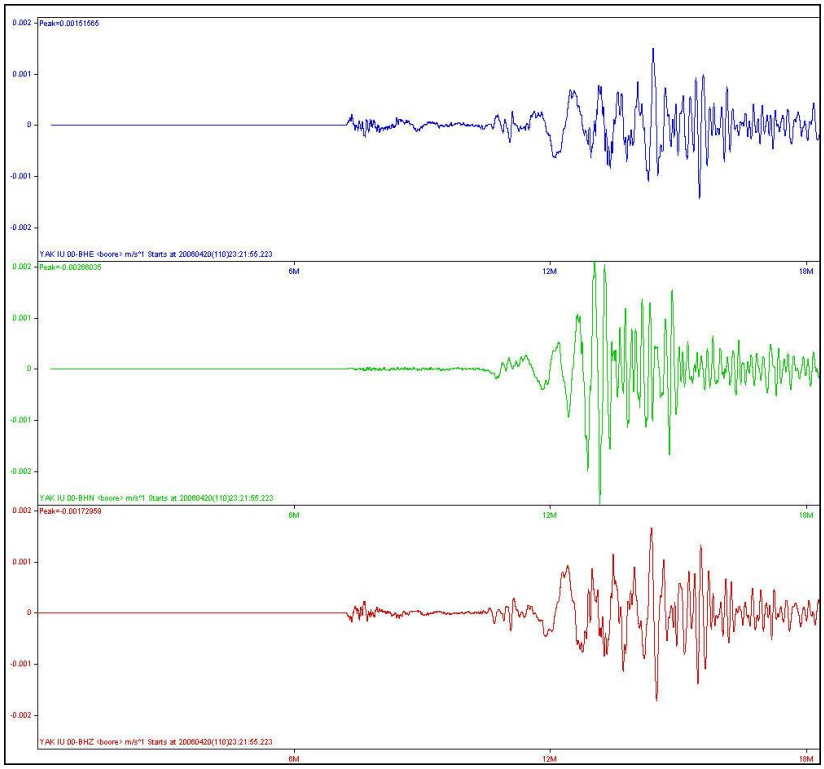


Figure 4-11 Bap V^2

2. The screen redraws to show the updated display after processing.



4.4 Reverse Sign

The **Reverse Sign** command uses very simple math to multiply each digital count on (-1). The purpose in some cases is to get the reverse polarity of the signal while connecting the wire from the seismometer to ADC in the field. To find out if its reversed or not tap the vertical sensor in the direction of the middle of the earth. Actually the raw digital counts recorded by ADC should have the negative spike. If not the Reverse Sign should be used.

For a proper polarization study and correct azimuth to source determination the following information is used:

For every component the orientation of a channel is defined by two angles.

- The azimuth of the instrument in degrees from north-clockwise.
- The dip of the instrument (down from horizontal).

The traditional orientation:

- Z ----------Dip=-90, Azimuth 0
- N ----------Dip= 0, Azimuth 0
- E ----------Dip= 90, Azimuth 0

The program reads these values from FULLSEED data files or DATALESS SEED response files (Blockette N=52). Sometimes the orientation of instrument in the field is reversed and the blockette contains default angles. So this Reverse Sign item is a simple component correction by reversing sign of the component without changing defined angles.

Note: Use this menu item only if sure that a reversion is needed.

Note: Reverse sign applies to all selected components on display. So if the reverse applies to only E and N but not Z channels, goto the Select Channels menu and highlight only E and N channels before selecting Reverse Sign.

To apply a Reverse Sign:

1. Select the Time-Domain menu and Reverse Sign command.

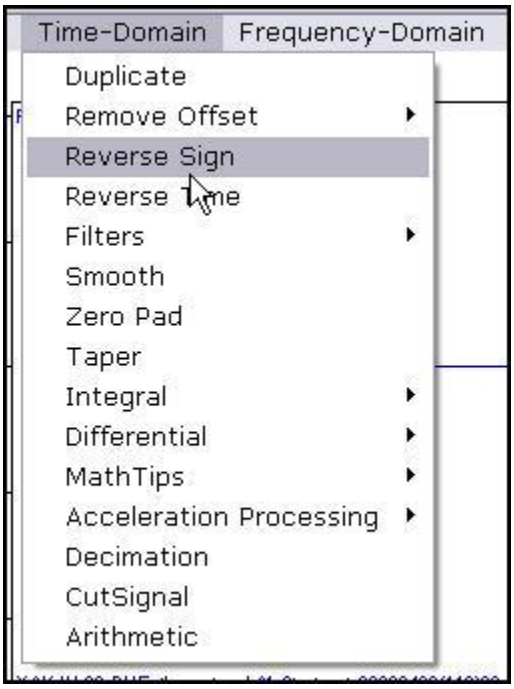
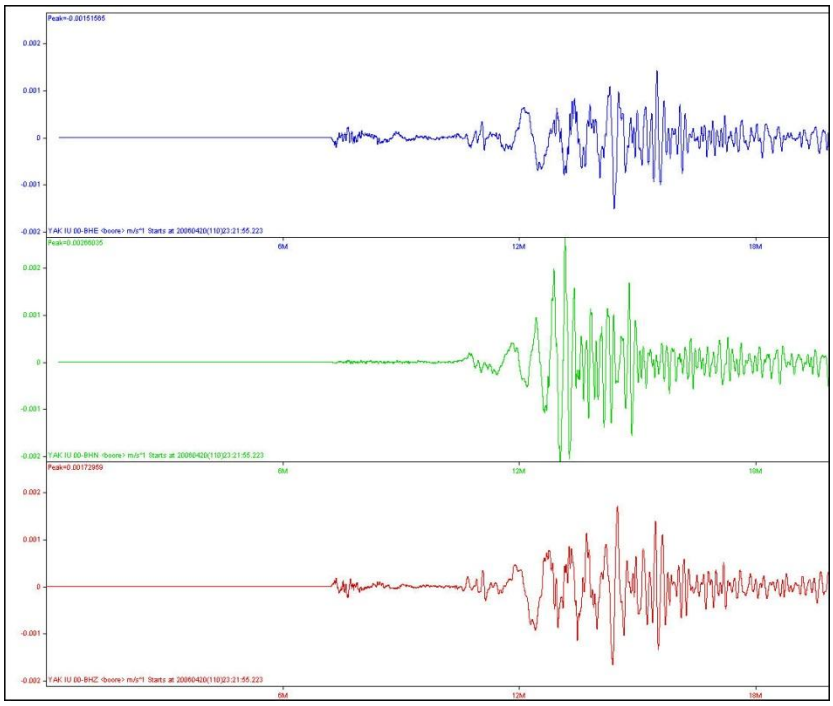


Figure 4-12 Reverse Sign

2. The window redraws to show the updated traces.



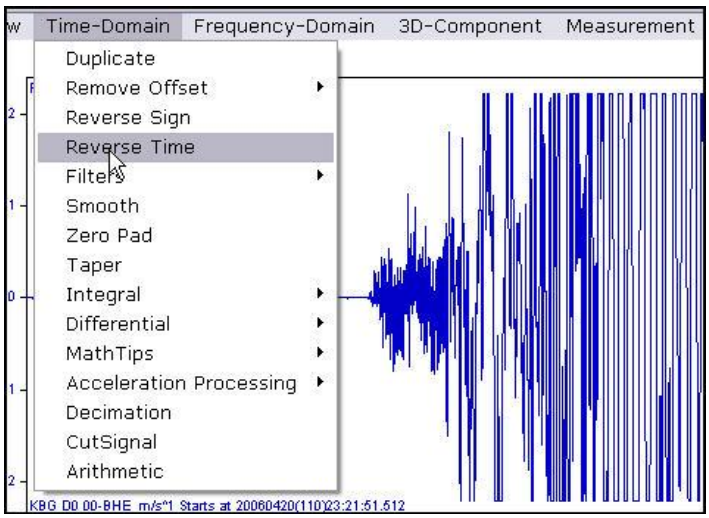
4.5 Reverse Time

Some math operations apply time shift and phase changes to the signal. To decrease that effect it is possible to reverse the waveform and apply the same math operation to the reversed waveform again. After this operation it is possible to reverse the time series using this option again.

Note: All time picks are invalid if measured on reversed components.

Use this command to flip the wave forms and change the time.

1. Select the **Time-Domain** menu and the **Reverse Time** command.



2. The window redraws to show the reverse time.

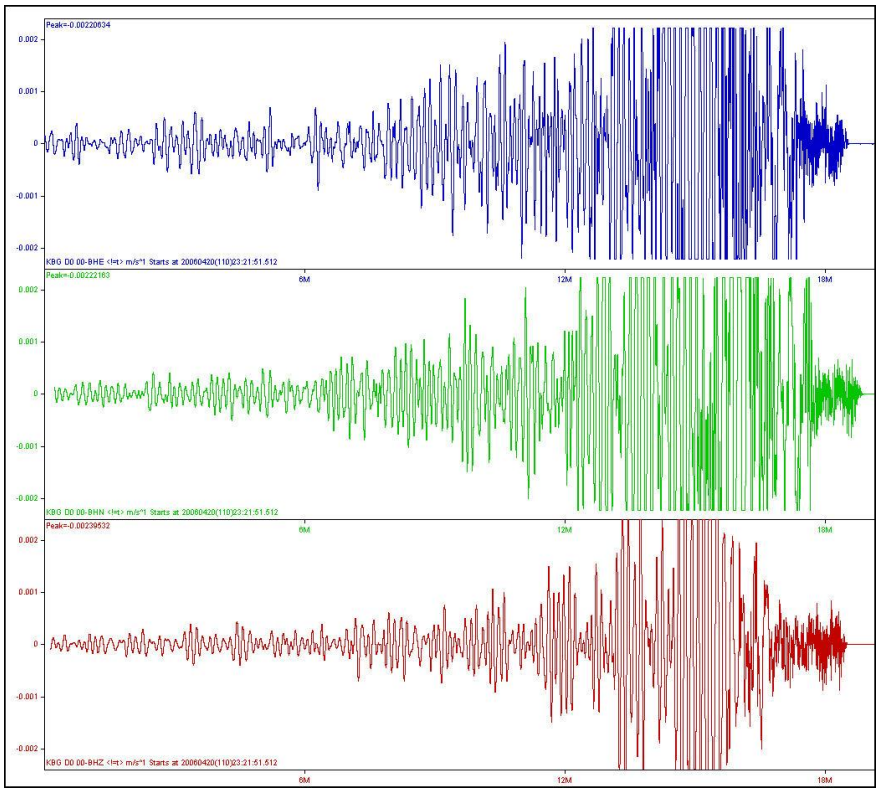


Figure 4-13 Reverse Time

4.6 Filters

Different types of filters are applied to the signal.

- FIR - Filters are always linear phase but will give some time offset to the signal which is 1/2 of the length*time interval.
- IIR - Usually give nonlinear phase effects but to make it casual there is a bidirectional option.

To apply a filter to the waveform data select the Filters menu.

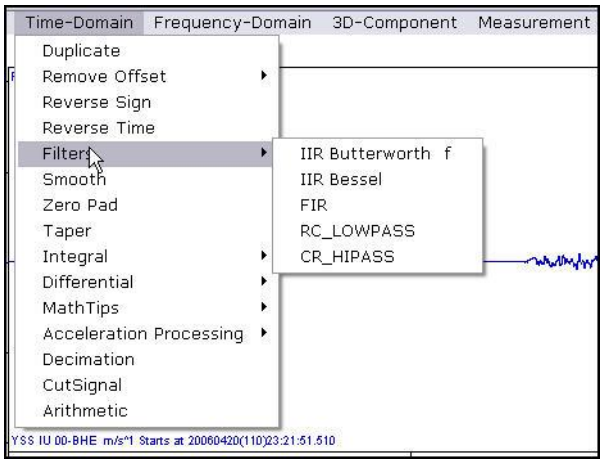
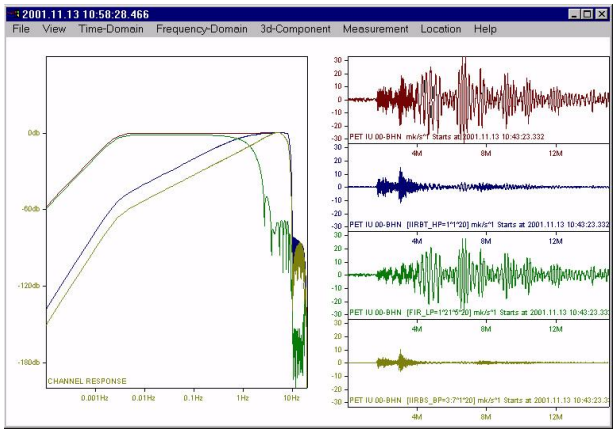


Figure 4-14 Filters

Filter operations are applied to the currently-displayed traces. Original traces may be retrieved for filtering by using the **Select Channels** menu.



4.6.1 FIR Butterworth Filter

Filtering with a Butterworth type filter design is accomplished with the following steps:

1. From the Filters menu select the IIR Butterworth option.

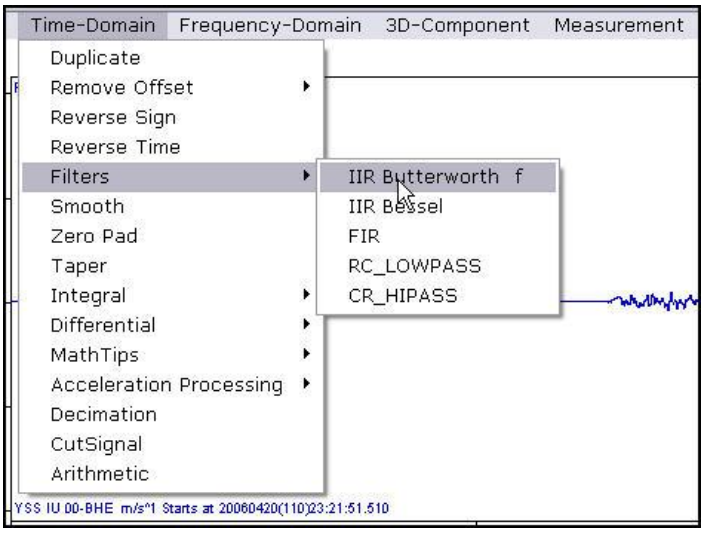
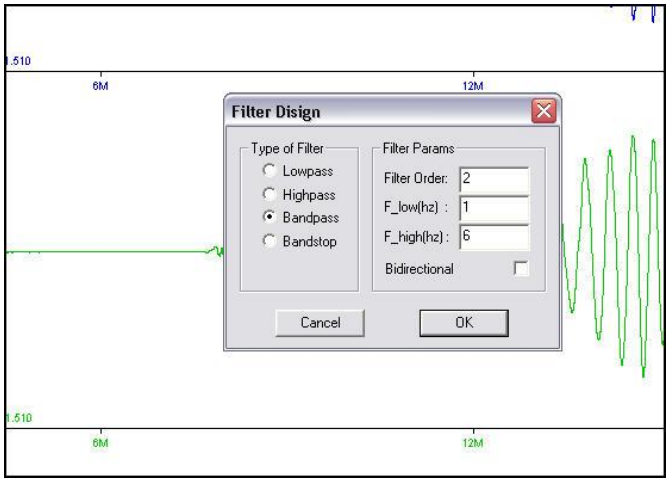


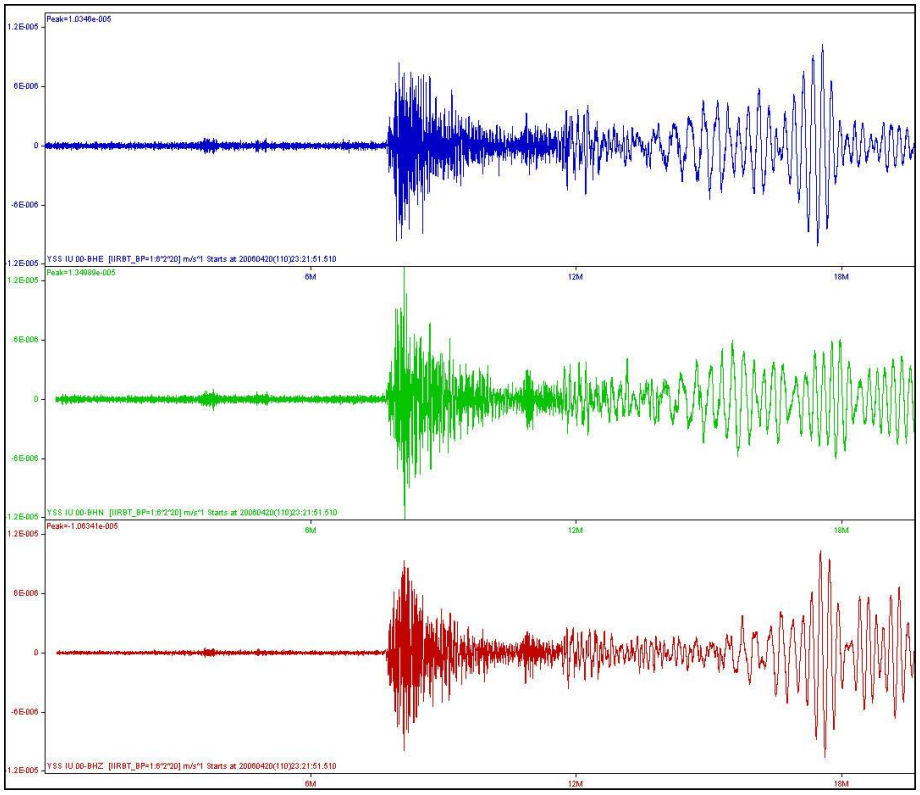
Figure 4-15 IIR Butterworth

2. A window opens with the activated program dialog.
3. Check the corresponding check box to select type of filter (Lowpass, Highpass, Bandpass, Bandstop).
4. Edit the filter order to control the range of frequencies between the passband and stopband.
5. Edit the corner frequencies of a user-defined filter.
6. Select the **OK** button to approve the settings.



Note: Corner frequencies should be between 0 hz and Nyquist frequency

7. Results are re-displayed on the screen.



4.6.2 IIR Bessel

Filtering with a Bessel type filter is accomplished with the following steps:

1. From Filters menu select the IIR Bessel option.

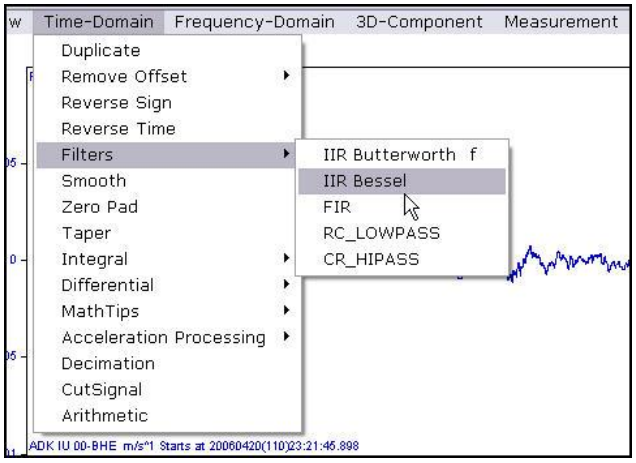


Figure 4-16 IIR Bessel

2. Fill the activated program dialog.
3. Check the corresponding check box to select the type of filter (Lowpass, Highpass, Bandpass, Bandstop).
4. Edit the filter order to control the range of frequencies between the passband and stopband.
5. Edit the corner frequencies of the user-defined filter.
6. Select the **OK** button to approve the setting.

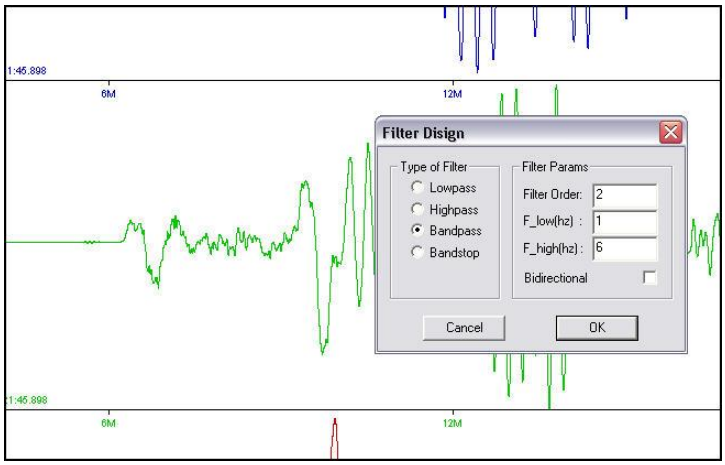


Figure 4-17 Filter Design Options

Note: Corner frequencies should be between 0hz and Nyquist frequency

7. Results are shown on the display.

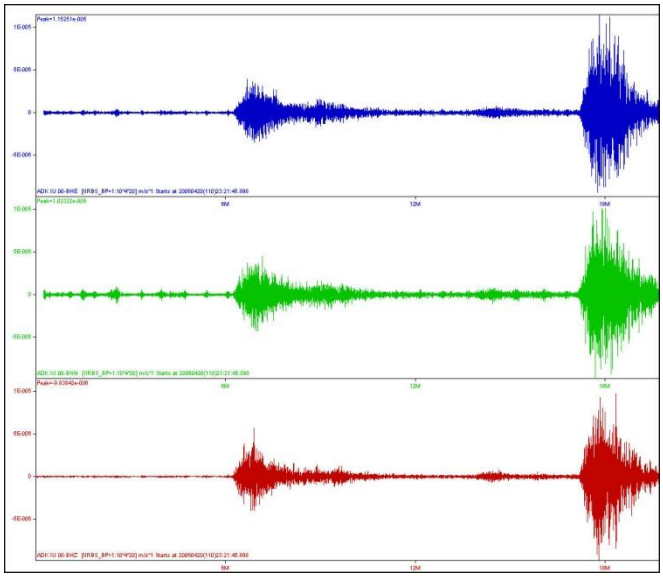


Figure 4-18 IIR Filter Results

4.6.3 FIR

Response of digital recorders is normally determined by digital (FIR - Finite Impulse Response) filters that decimate the oversampled data streams.

Filtering with FIR type filter is accomplished with the following steps:

1. From **Filters** menu select the **FIR** option.

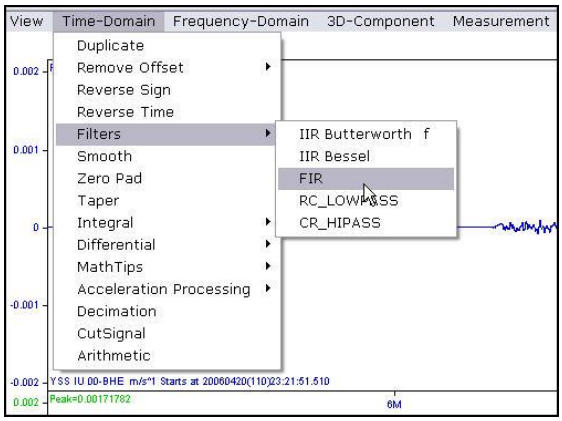


Figure 4-19 FIR Filter

2. From this menu item fill the activated program dialog.
3. Check the corresponding check box to select type of filter (**Lowpass**, **Highpass**, **Bandpass**, **Bandstop**).
4. Select the window type using the **Filter Design** option.
5. Edit the length of filter to control the number of filter coefficients.
6. Edit the corner frequencies of the user-defined filter.
7. Approve the settings with the **OK** button.

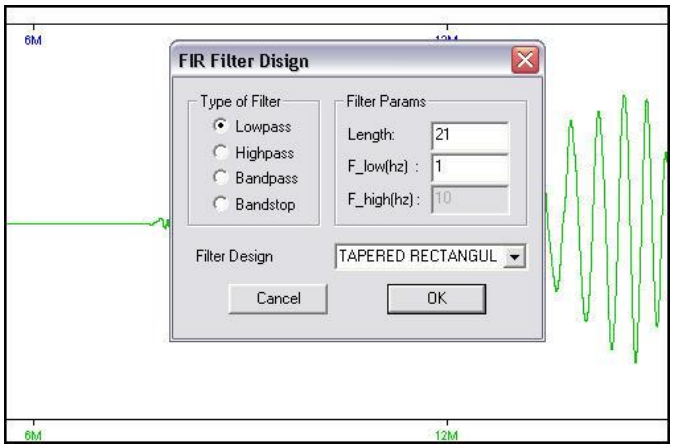


Figure 4-20 Filter Options

Note: Corner frequencies should be between 0hz and Nyquist frequency

8. The resulting filter creates the following display.

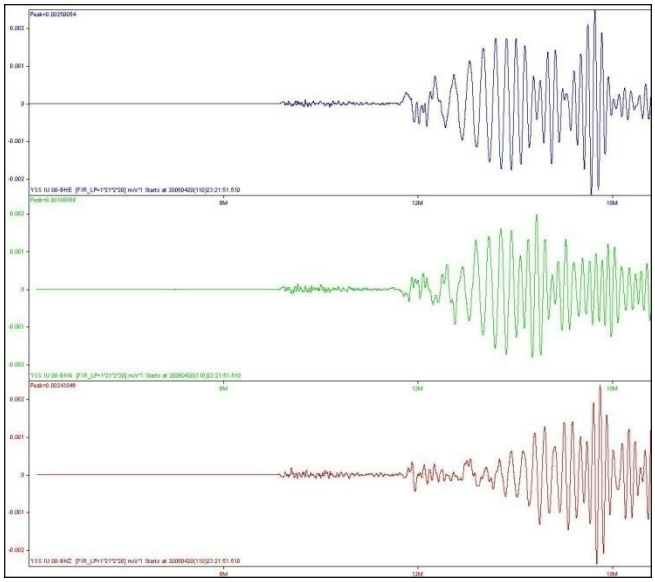
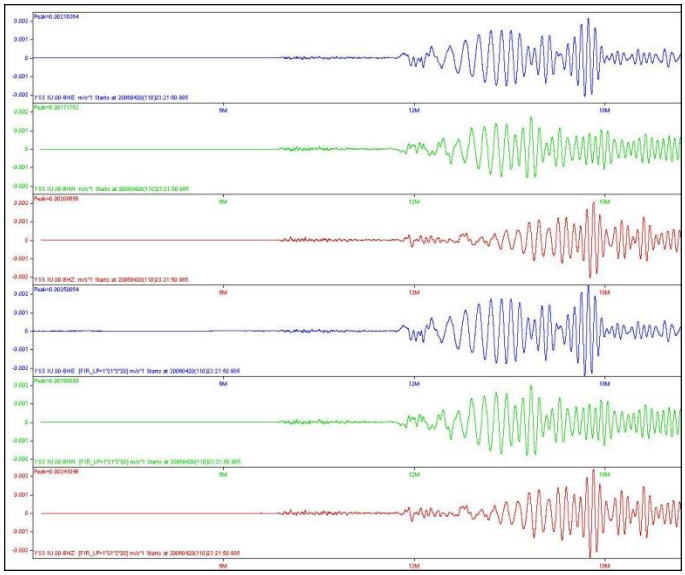


Figure 4-21 FIR Results

9. Use the Select Channels command to compare results.



4.7 RC_LOWPASS

This filter is used for filter a signal to remove frequencies above a given frequency. It passes only the low frequencies.

1. From the filters menu select the **RC_LOWPASS** filter option.

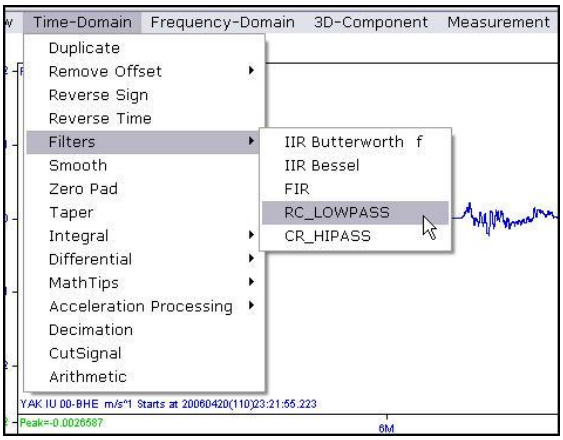


Figure 4-22 RC_LOWPASS

2. Select the desired STA time in seconds.
3. Approve with the **OK** button.

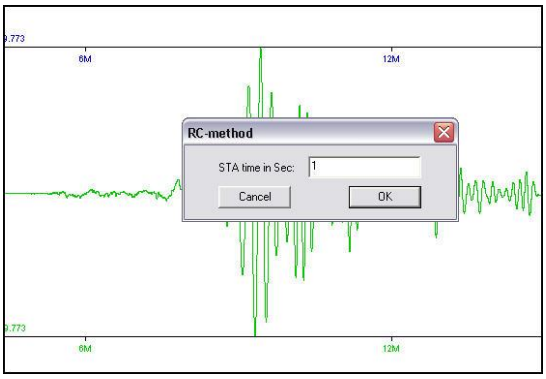
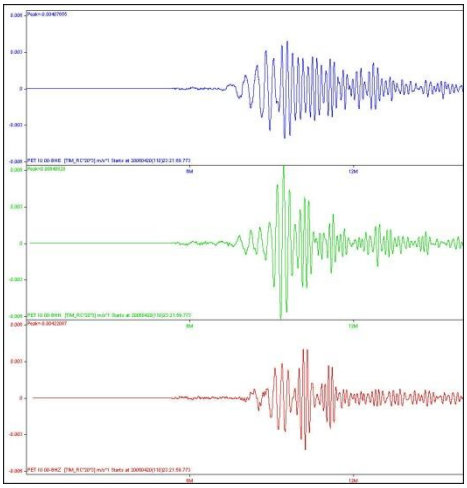


Figure 4-23 STA Time

4. The resulting filter creates the following display.



4.8 CR_HIPASS Filter

The CR_HIPASS filter command is used for filtering a signal to remove frequencies below a given frequency. It passes only the high frequency.

1. From the filter menu select the CR_HIPASS option.

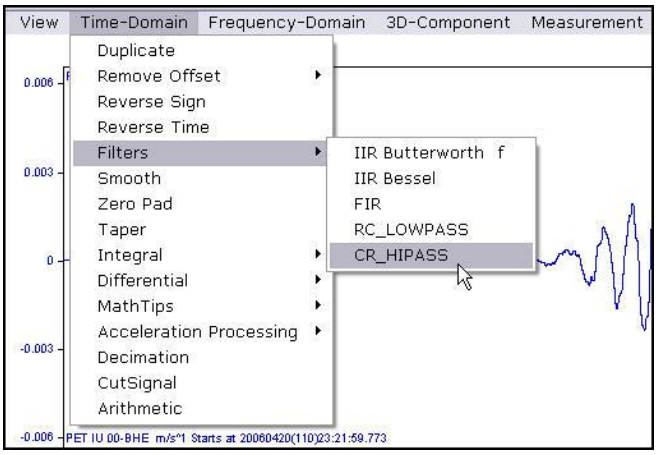


Figure 4-24 CR_HIPASS Filter option

2. From the activated dialog box fill in the options.
3. Select the **OK** button to approve the options.

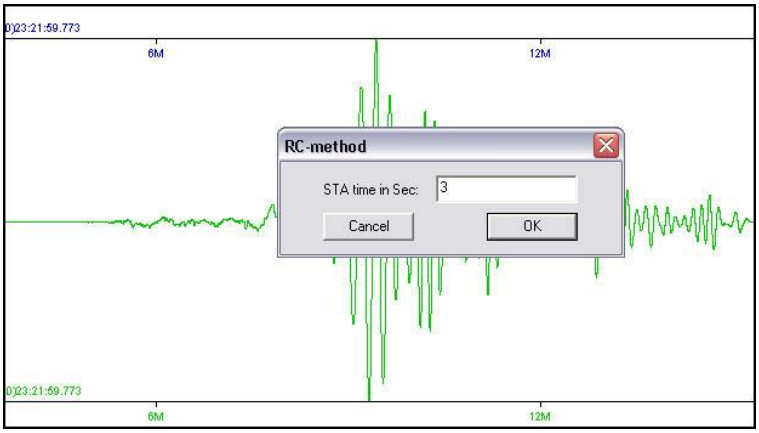
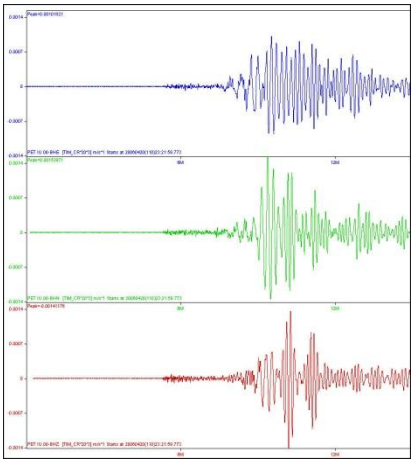


Figure 4-25 STA time

4. The resulting filter creates the following display.



4.9 Smooth

The Smooth command is a type of Lowpass filter that computes the running average of the signal within some type of window with a predefined length.

This Smooth command is used to smooth the signal with different types of time-windows.

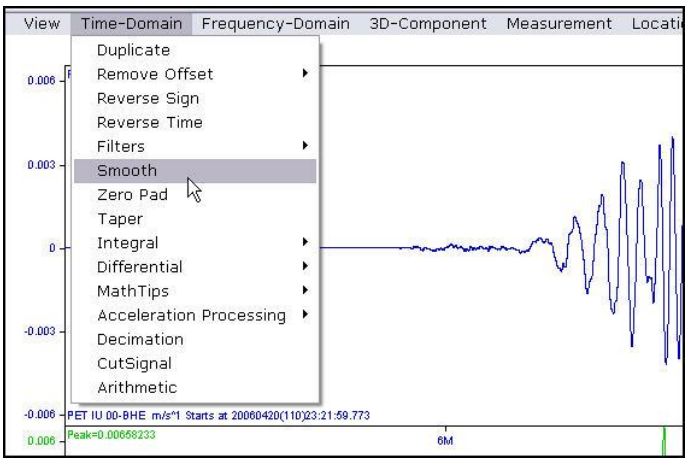


Figure 4-26 Smooth Filter

1. From the opening dialog select the desired smoothing window type.
2. Select the length of window in samples
3. Select the **OK** button to approve the selections.

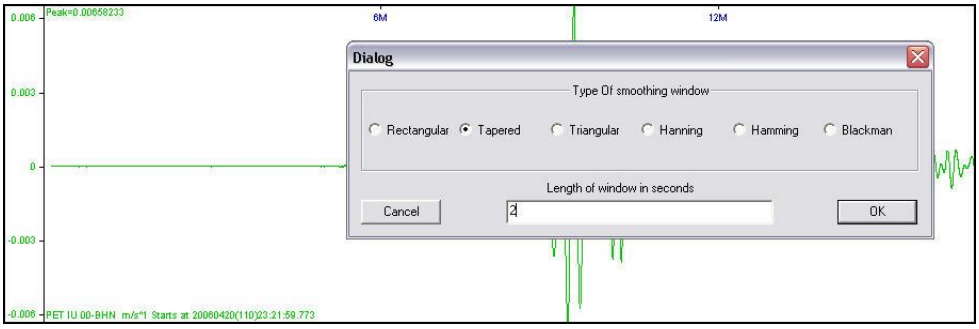


Figure 4-27 Smooth Options

4. The results of the selections will display.

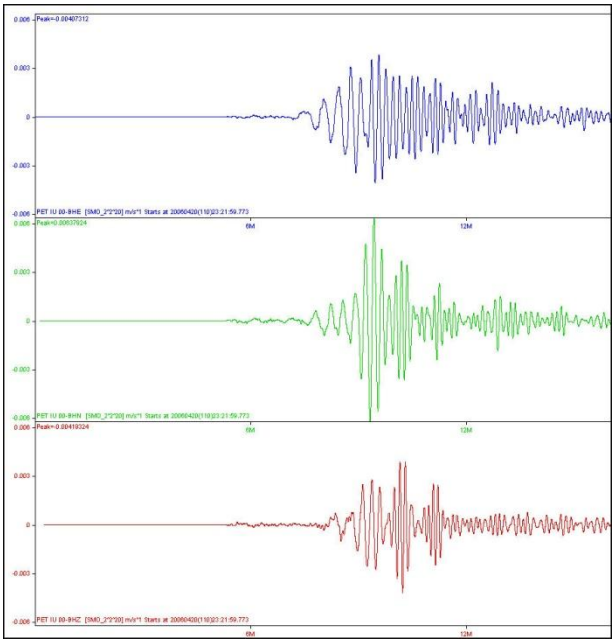


Figure 4-28 Smoothing Results

4.10 Zero Pad

The Zero Pad command came from the BAP processing algorithms. It just adds several zero counts before and after the waveform signal. It is often used to decrease the side effect during bidirectional IIR filtering and spectral analysis. With the option Zero Cross On it adds zeros up to the first count of the trace across the zero line.

The Zero Pad will compute the average value of the signal. This value is removed from all channels on the display. Zero line removed depends on zoomed in time interval and can be applied to the signal several times as needed by the user.

To use Zero Pad:

1. Select the **Zero Pad** command from the **Time-Domain** menu.

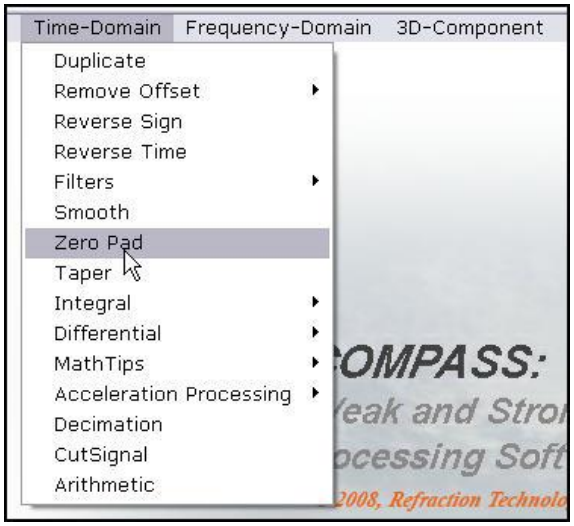


Figure 4-29 Zero Pad

2. Input the number of desired Seconds Before.
3. Input the desired number of Seconds After.
4. Approve the settings with the **OK** button.

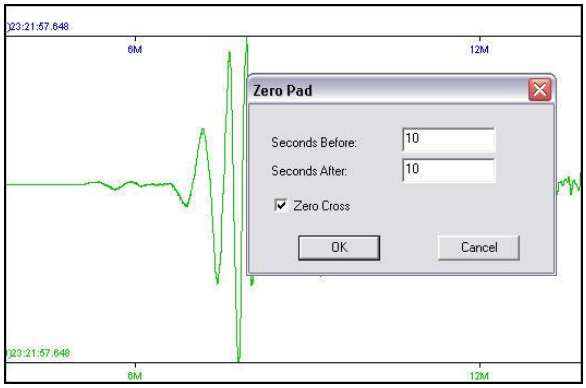
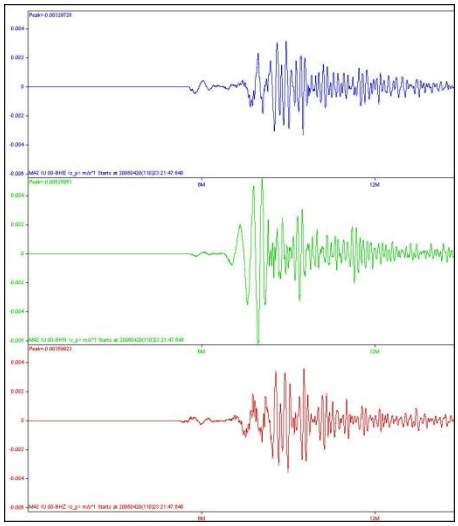


Figure 4-30 Zero Pad Options

5. The results will display after approving the options with the OK button.



4.11 Taper

The Taper command is also used to decrease side effects. It is used to smooth decreasing of a signal using the COS law on the sides.

This Taper command is used to taper the signal with different types of time-windows.

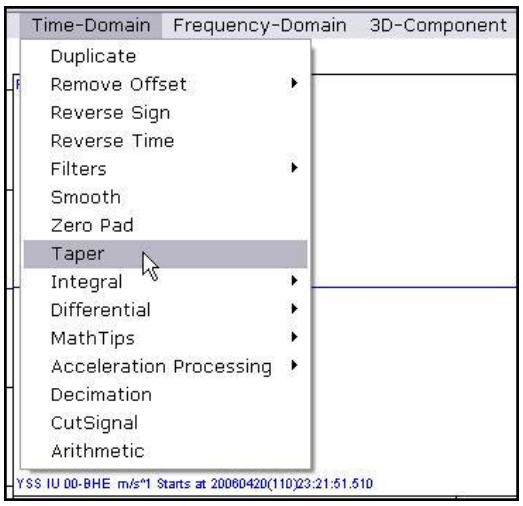


Figure 4-31 Taper

1. Select the desired area of the traces with the vertical cross-hairs.
2. The desired taper will show in the display.

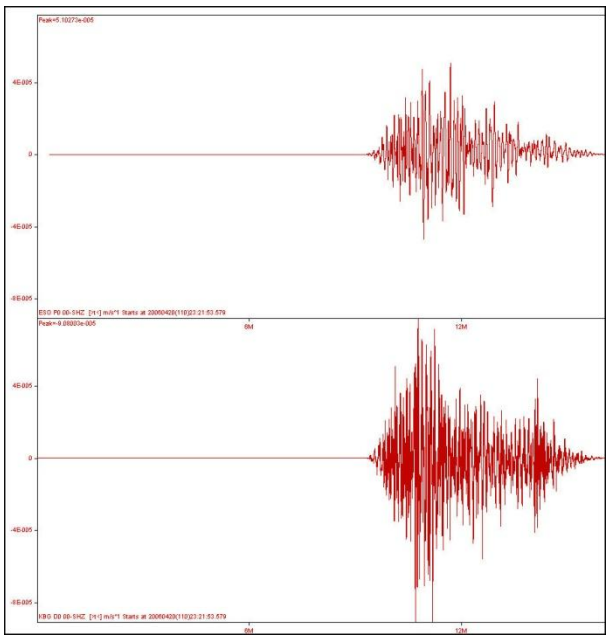


Figure 4-32 Taper Results

4.12 Integral

The Integral command is the computation of the integral of the signal in the time domain. It is often used to get the velocity record from acceleration.

There are three recursive formulas for calculation:

- Trapezoidal
- 3-Point
- RC - Digital analog of resistor-capacitor chain

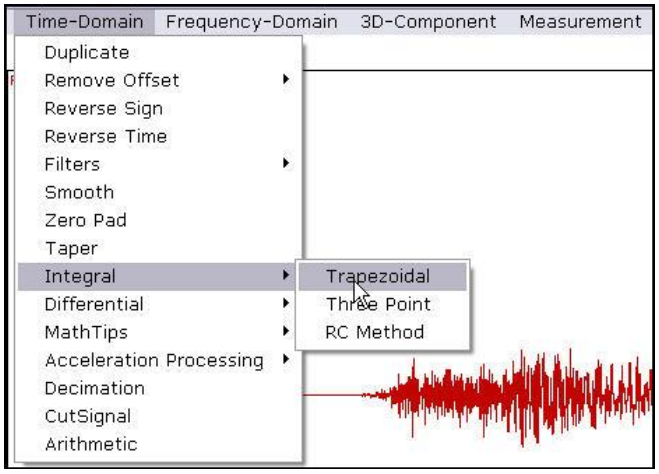


Figure 4-33 Integral

4.12.1 Integral - Trapezoidal

Formula for calculation:

```
y[i] = y[i-1] + (x[i] + x[i-1)/2*dt
```

where:

x = Original data points

dt = sampling interval

To use the Trapezoidal formula:

1. Select the **Integral** command with the **Trapezoidal** option to compute the integral.

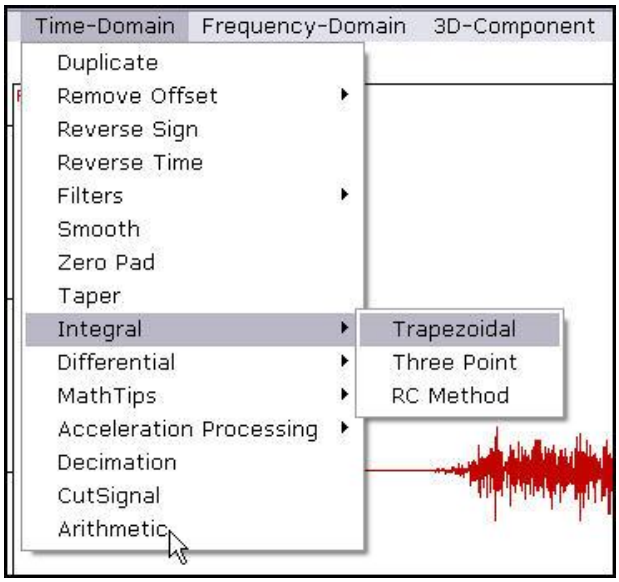


Figure 4-34 Integral

2. The display shows the **Integral** according to Trapezoidal.

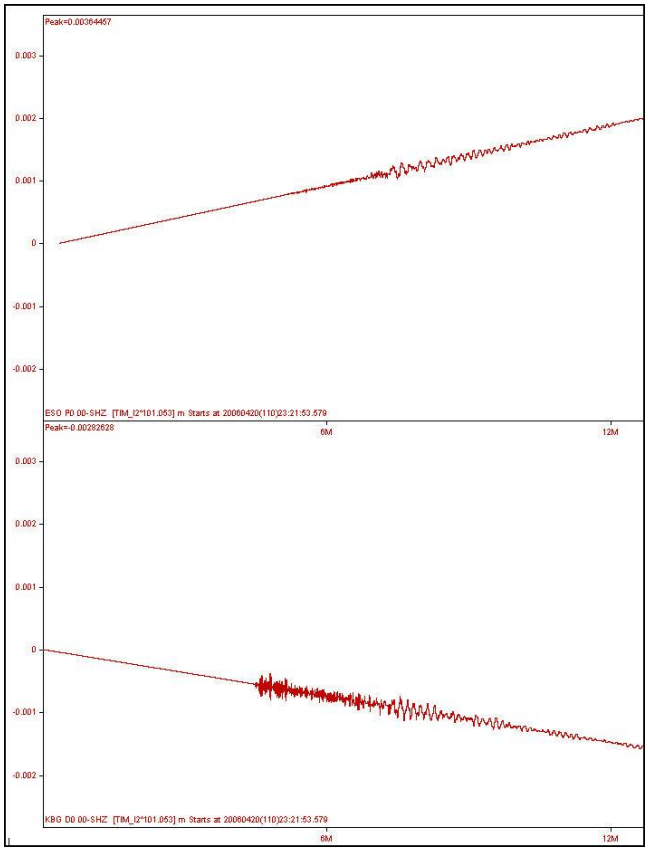


Figure 4-35 Integral Results

4.12.2 Three Point

Formula for calculation:

Digital analog of resistor-capacitor:

y[i] = y[i-1] + 0.5*(3x[i]-x[i-1])*dt

where:

x = Original data points

dt = sampling interval

To use three point integral:

1. Select the **Integral** command with the **Three Point** option.

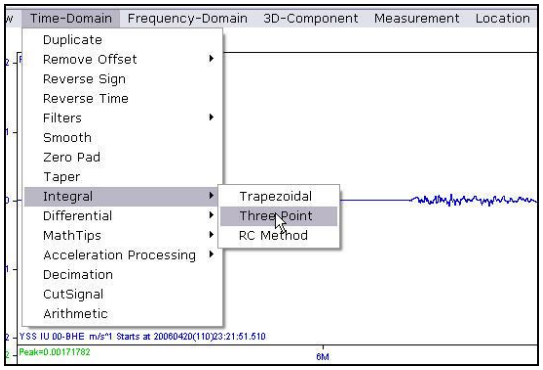
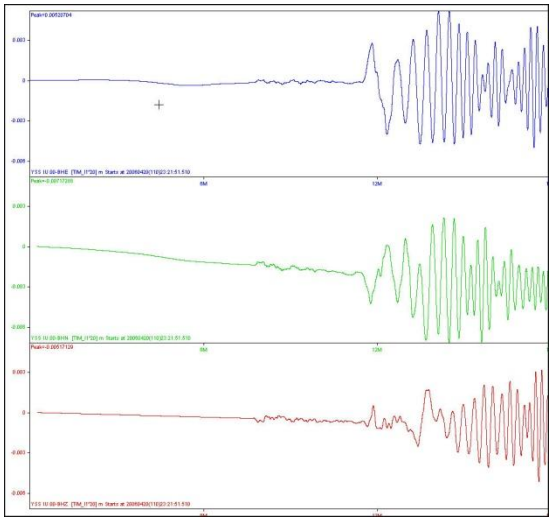


Figure 4-36 Three Point

2. The results will open in the display.



4.12.3 RC method

Formula for calculation:

```
y[i] = y[i-1] + (x[i]-y[i-1])/M
where:
x = Original data points
dt = sampling interval
M = RC/dt
```

To compute the integral with the RC method.

1. Select the **Integral** -> **RC Method** from the drop-down menu.

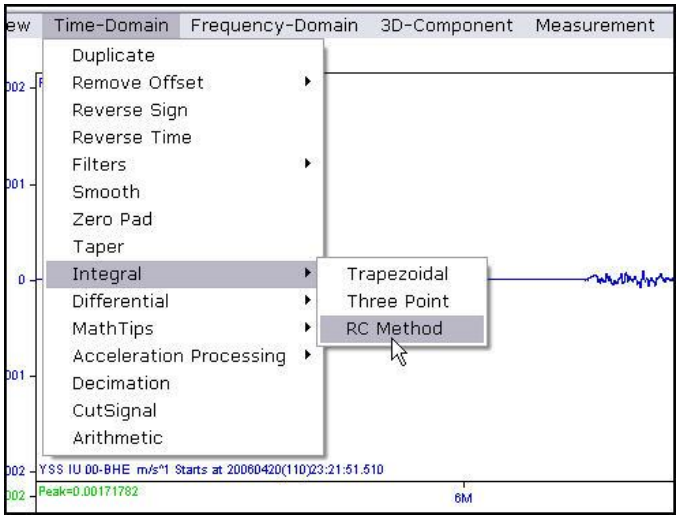
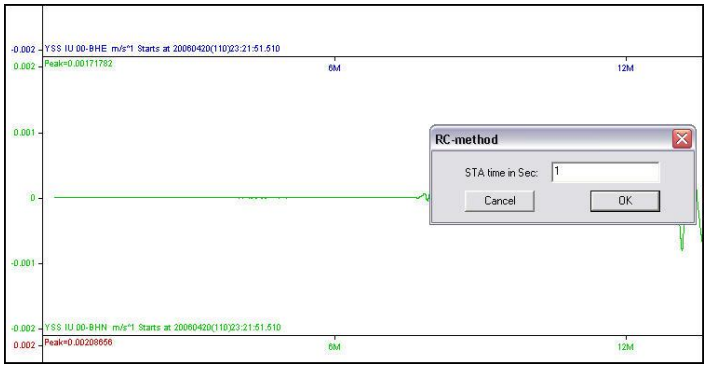


Figure 4-37 RC Method

2. Enter the STA time (in Seconds).
3. Select the **OK** button to view the results:



4. The results display as shown in the example below.

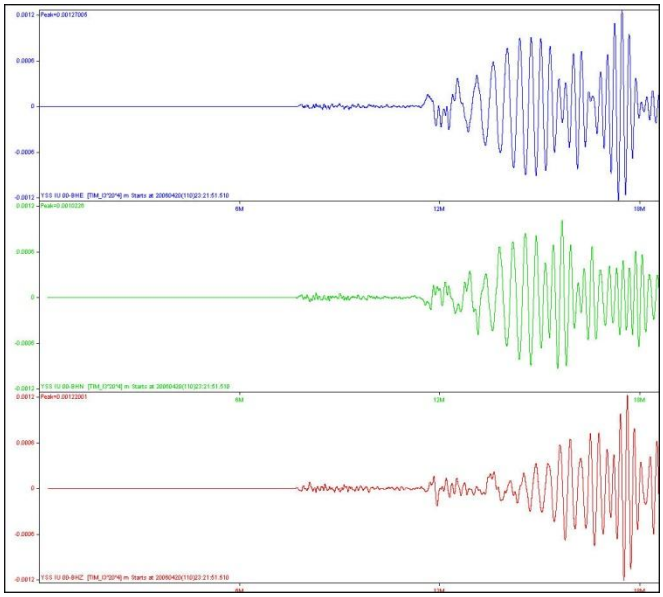


Figure 4-38 RC Results

4.13 Differential

The Differential command involves computation of the first derivative of the signal. This could be used to get the acceleration record from a sensor.

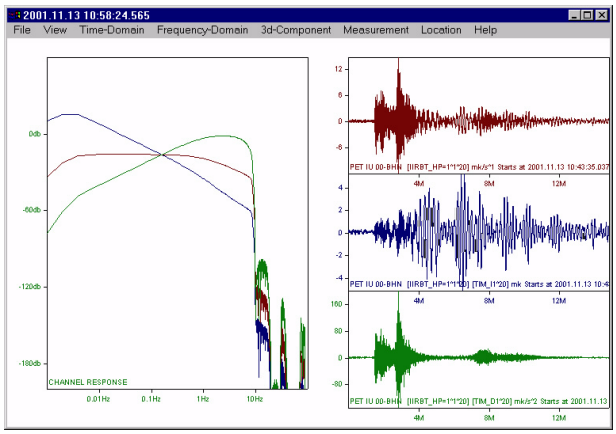
```
y[i] = (x[i + 1] - x [i - 1])/2dt
```

Compute the differential of the signal according the following formula:

$$y_{k+1} = \frac{1}{2\Delta t}(-f_{k-1} + f_{k+1})$$

The example of using the Differential command is shown on the picture:

- Top - original trace
- Middle - after applying Integral
- Bottom - after applying Differential.



1. Select the **Time-Domain Differential** option:

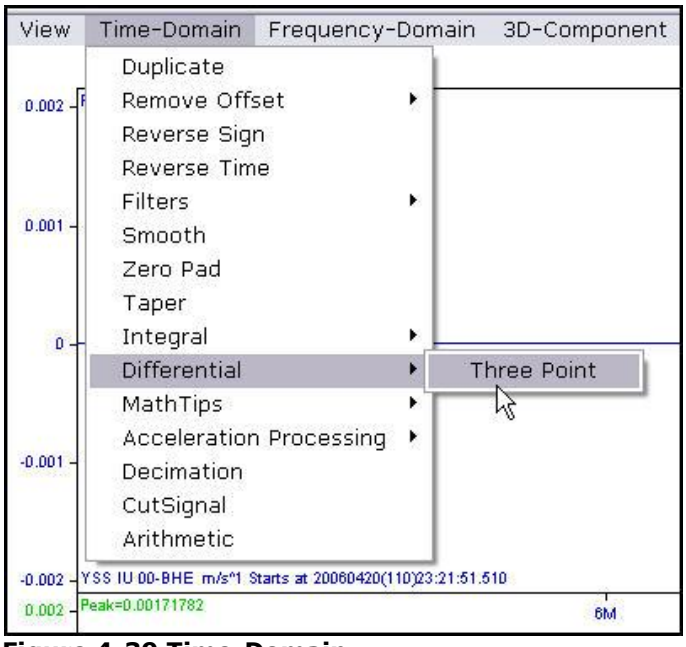


Figure 4-39 Time-Domain

2. The results display to show the **Differential** applied.

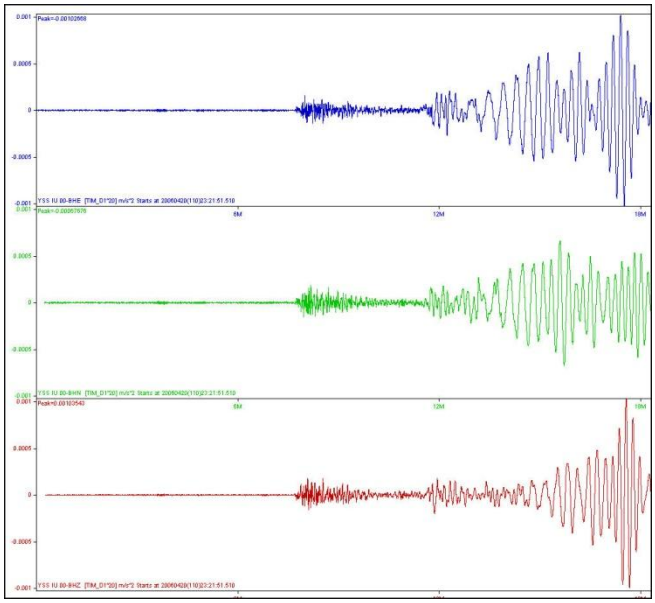


Figure 4-40 Differential

4.14 Math Tips

Math Tips are used for predefined math operations on the signal:

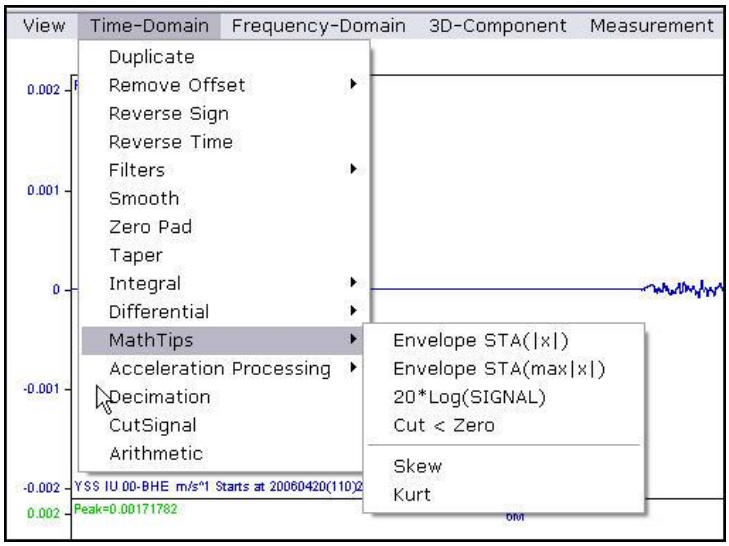


Figure 4-41 Math Tips

4.14.1 Envelope STA

The **Envelope STA** command is the average amplitude of the signal within a time window using an STA detector.

```
y[i] = y[i-1]+(|x[i]|-y[i-1])/N
```

where:

```
x[i] = Original data points
```

```
N = (length of the window in seconds)/(sampling interval)
```

To use the Envelope STA command:

1. Select the **MathTips** Envelope command.

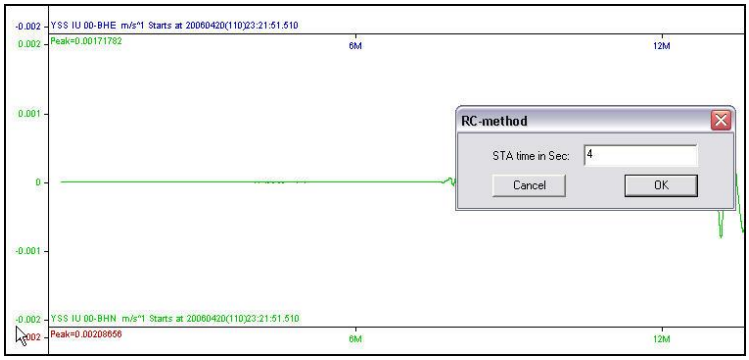
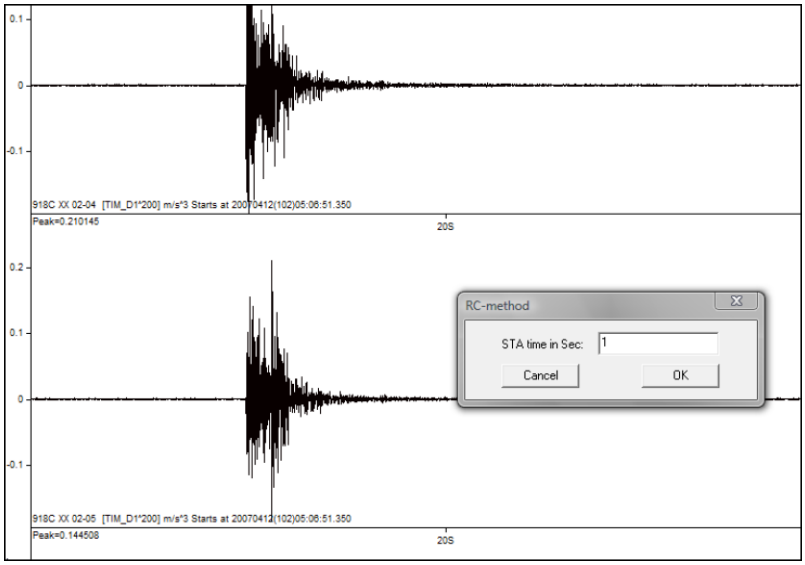


Figure 4-42 Envelope

2. Enter the **STA time** in seconds.
3. Approve the settings with the **OK** button.



4. The results display.

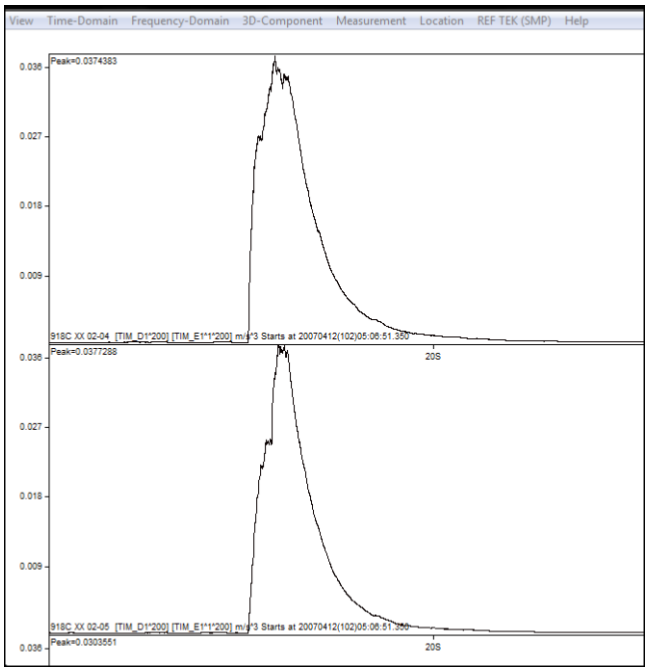


Figure 4-43 Envelope STA

4.14.2 Envelope STA max

The **Envelope STA max** command is the maximum amplitude of the signal within a time window using an STA detector.

1. Select the **Envelope STA (max|x|)** option from the **Math Tips** menu.

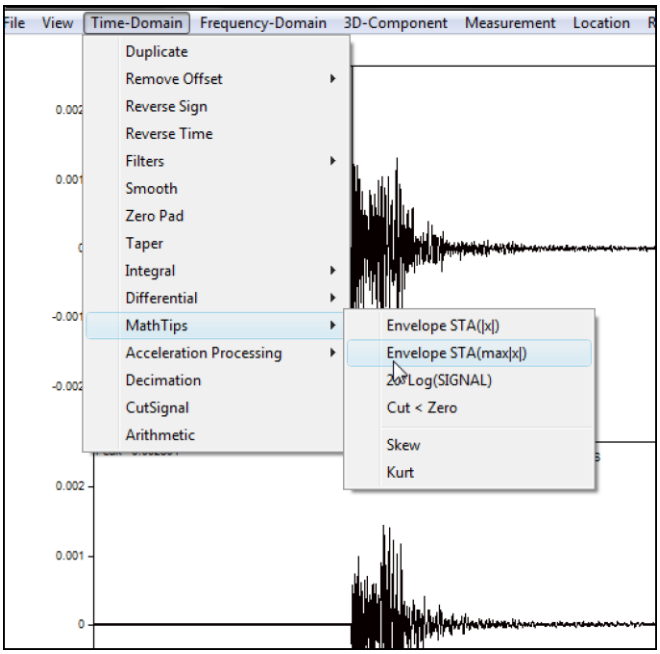
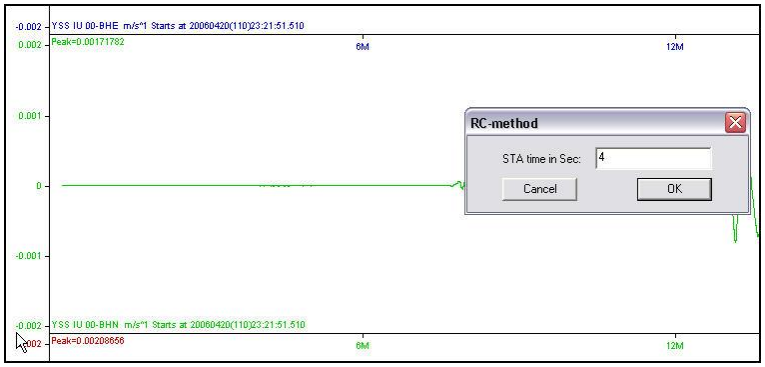


Figure 4-44 Envelope STA (max)

2. Enter the STA time in seconds.
3. Select the **OK** button to approve the settings.



4. The results will display.

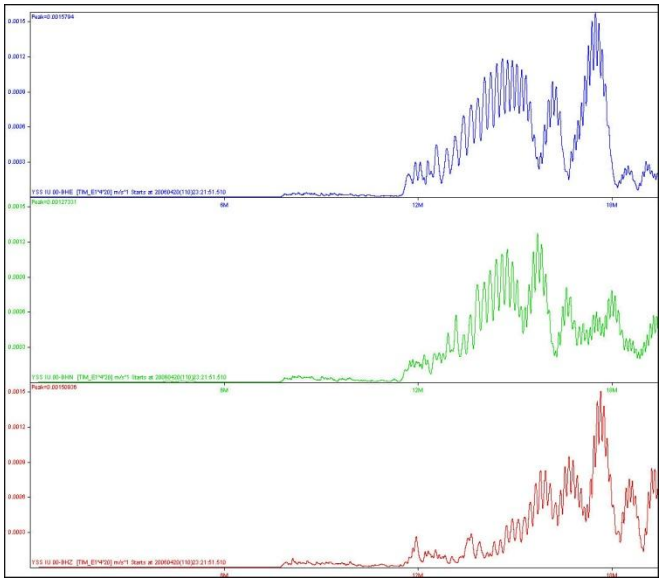


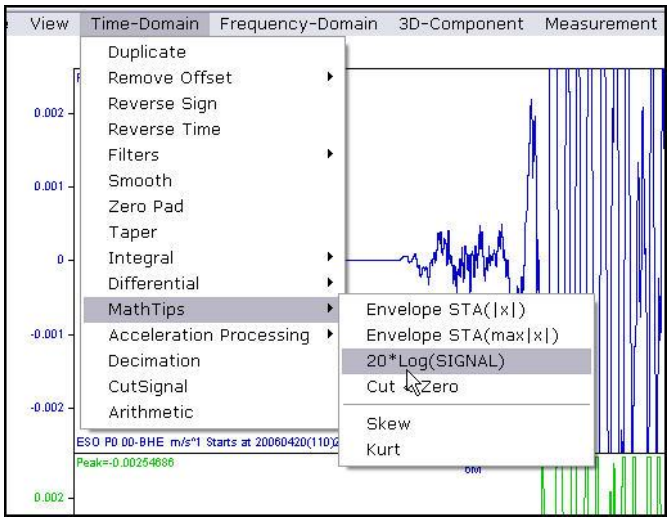
Figure 4-45 Envelope STA max

4.14.3 Compute 20*Log (Signal)

This command applies to the envelope of a signal in log scale. This is never applied to the original traces because the log of negative values does not exist.

To use Math Tips **Compute**:

1. Select the **Compute** command from the **Math Tips** menu.



2. The results will display.

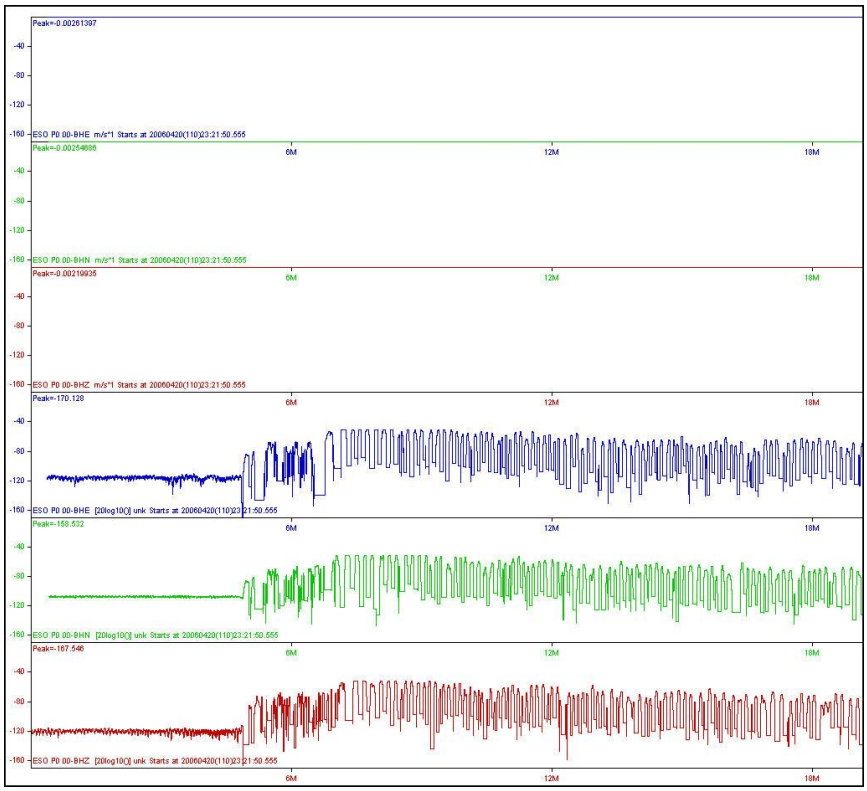


Figure 4-46 Compute 20*Log

4.14.4 Cut<Zero

The Cut<Zero command will set all negative values to zero.

To use the Math Tips Cut option.

1. Select **Cut** from the **MathTips** menu.

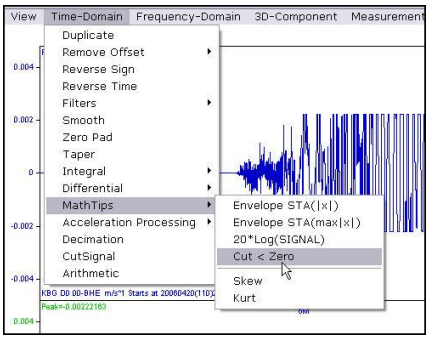
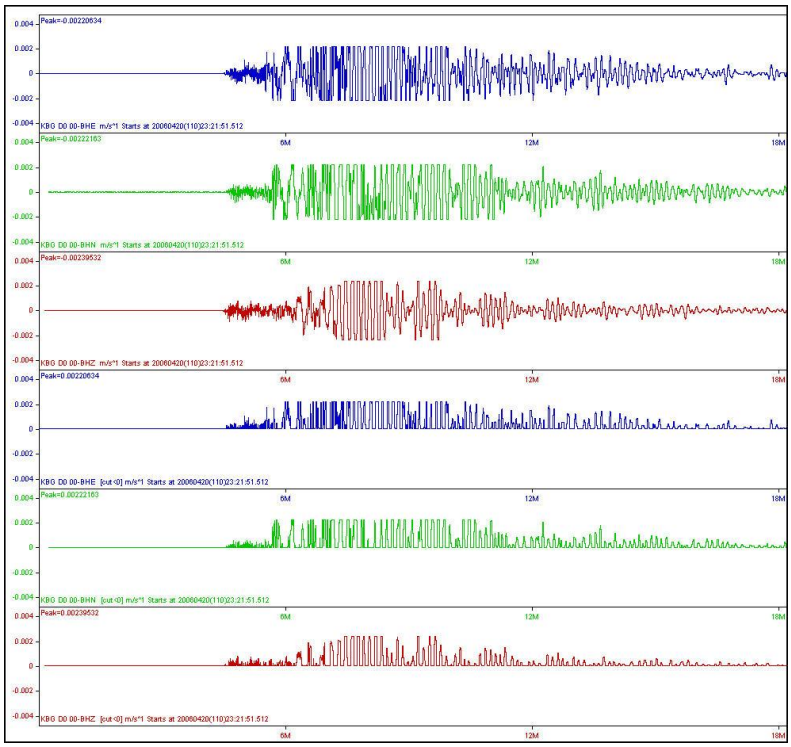


Figure 4-47 Cut<Zero

2. The results are displayed in the window.



4.14.5 Skew option

The Skew command is used to do a window running an average of Third order statistics. Skewness characterizes the degree of asymmetry of the distribution around its mean.

To use the MathTips Skew option:

1. Select the **MathTips** menu **Skew** command option.

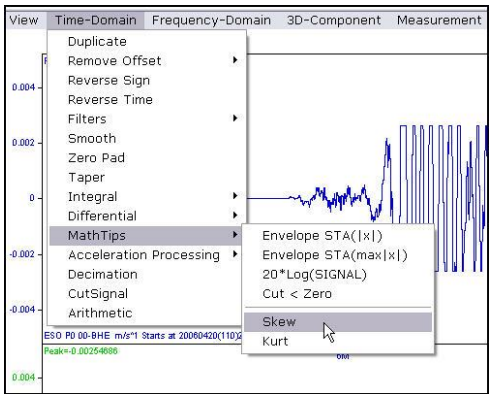
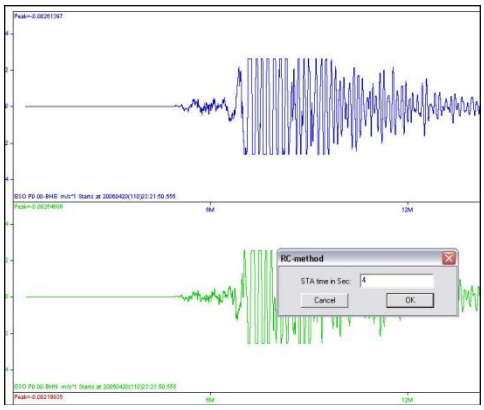


Figure 4-48 Skew

2. Enter the STA time (in seconds).
3. Select the **OK** button to approve the settings.



4. Skew option results display in the window.

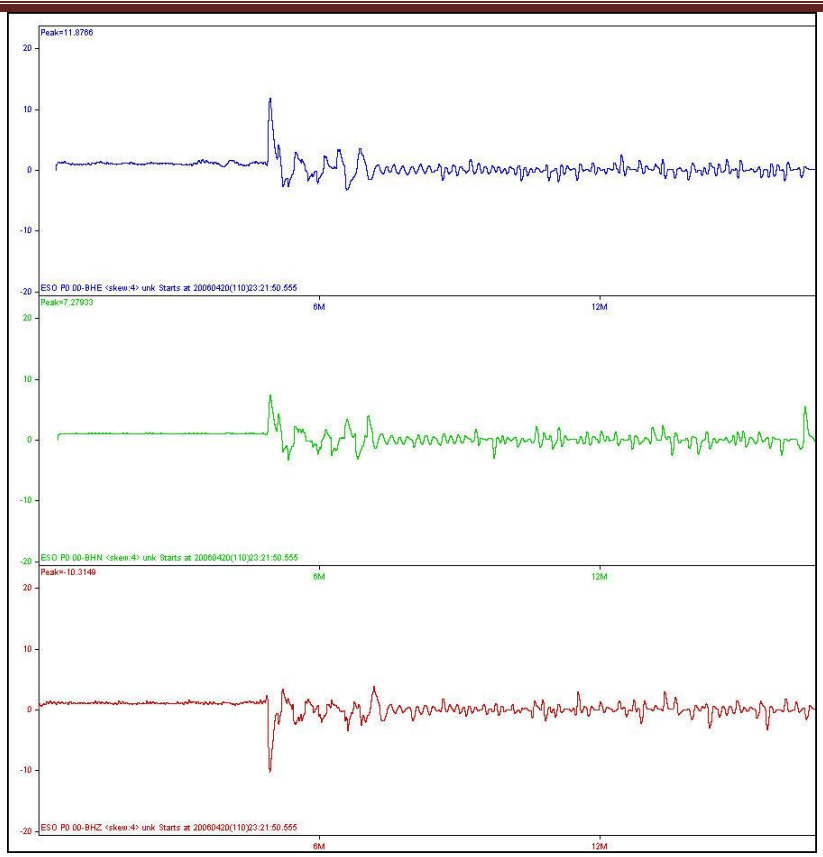


Figure 4-49 Skew Results

4.14.6 Kurt

The Kurt command is used to do a window running an average of Fourth order statistics. Kurtosis characterizes the relative peakedness or flatness of a distribution.

To use the Kurt option:

1. Select the **Kurt** command from the **Math Tips** menu.

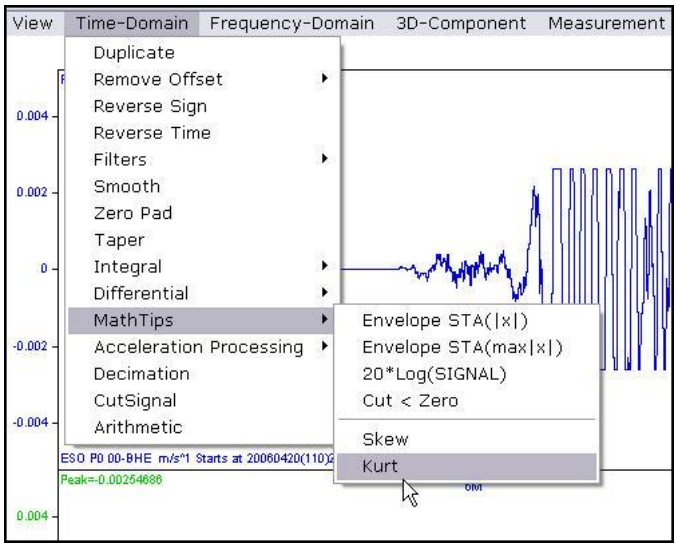
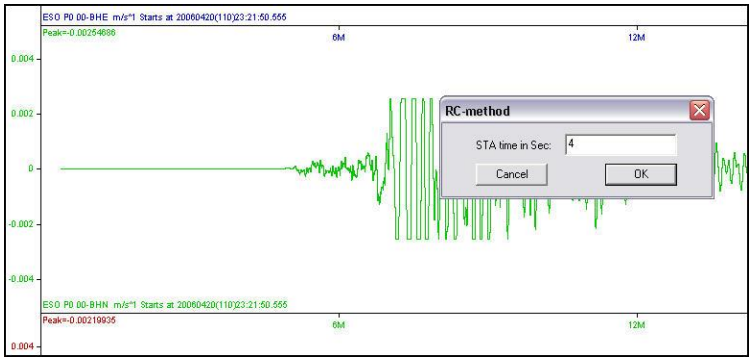


Figure 4-50 Kurt

2. Enter the STA time (in seconds)
3. Approve the settings with the **OK** button.



4. The result will display in the window.

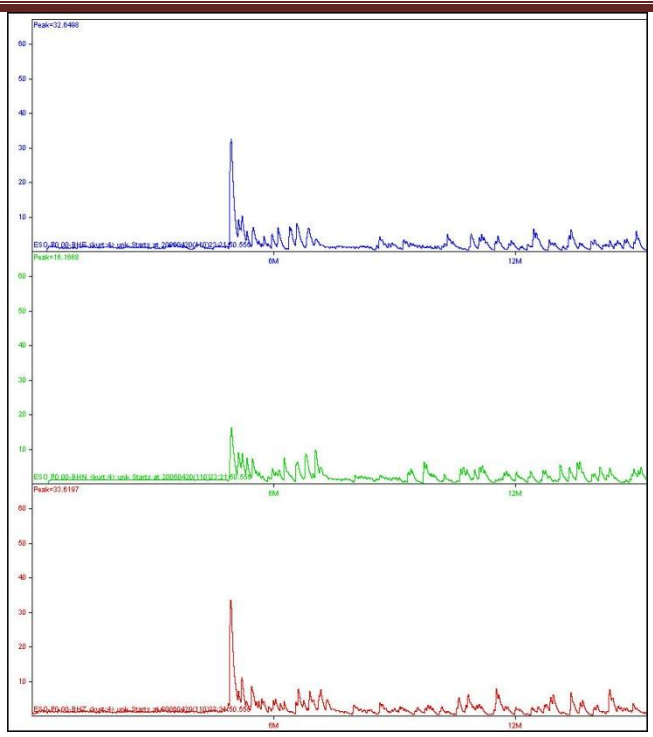


Figure 4-51 Kurt Results

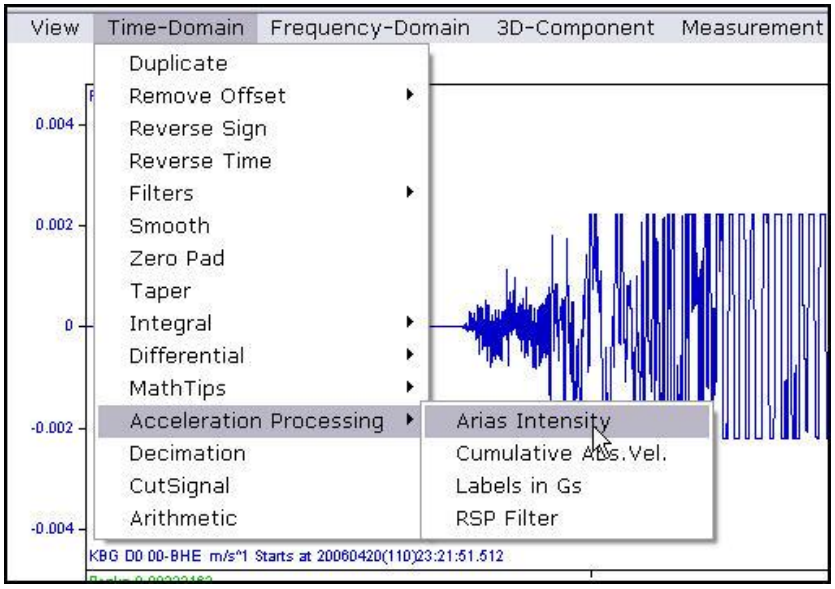
4.15 Acceleration Processing

The Acceleration Processing command does either an Arias Intensity plot or a Cumulative Absolute Acceleration study for acceleration record only. The signal is then m/(s^2).

It is also possible to label the data in Gs by selecting the Labels in Gs option.

To use the Acceleration Processing option:

1. Select the **Time-Domain** menu **Acceleration Processing** command option.



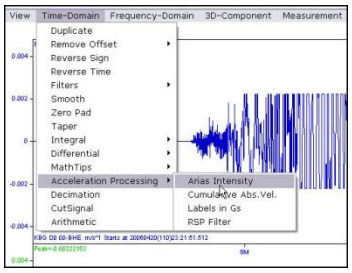
4.15.1 For the Arias Intensity option:

The Arias Intensity is defined as:

$$I_a = \frac{\pi}{2g}\int_0^{\infty}[a(t)]^2 dt$$

It has units of velocity and is usually expressed in meters per second.

1. Select the **Arias Intensity** option button.



2. The Arias Intensity option results display in the window.

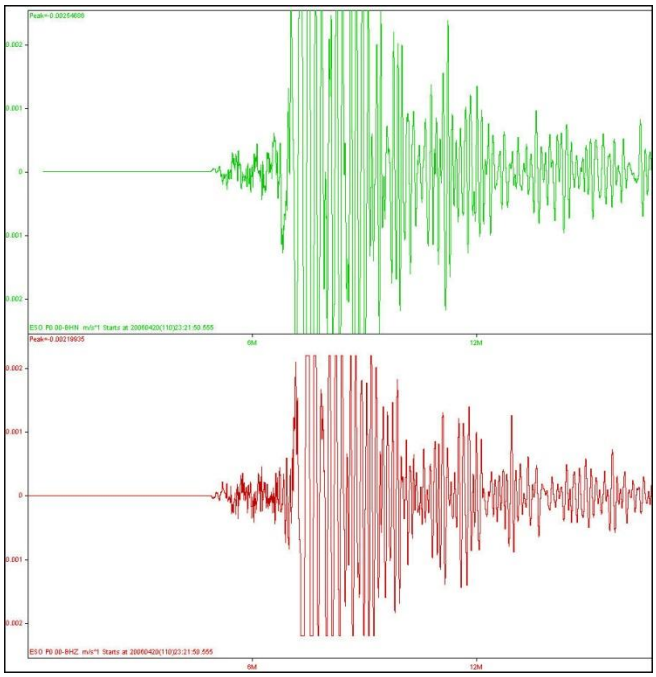


Figure 4-52 Arias Intensity

4.15.2 For a Cumulative Absolute Velocity:

CASV is simply the area under the absolute accelerogram:

$$CAV = \int_0^{T_d} |a(t)|(dt)$$

1. Select the **Cumulative Absolute Velocity** button.

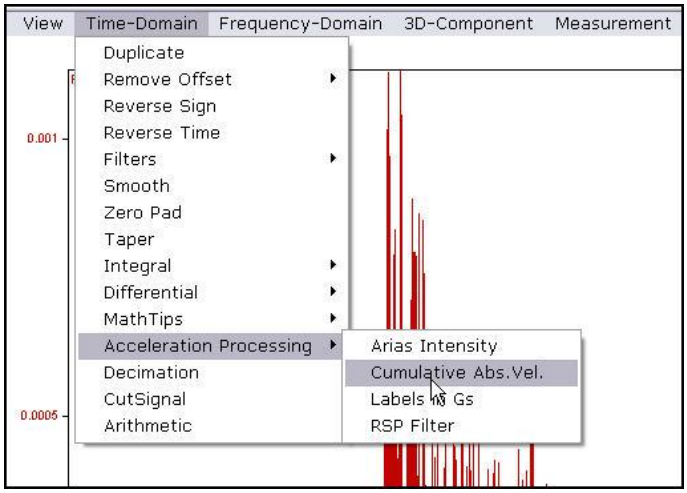
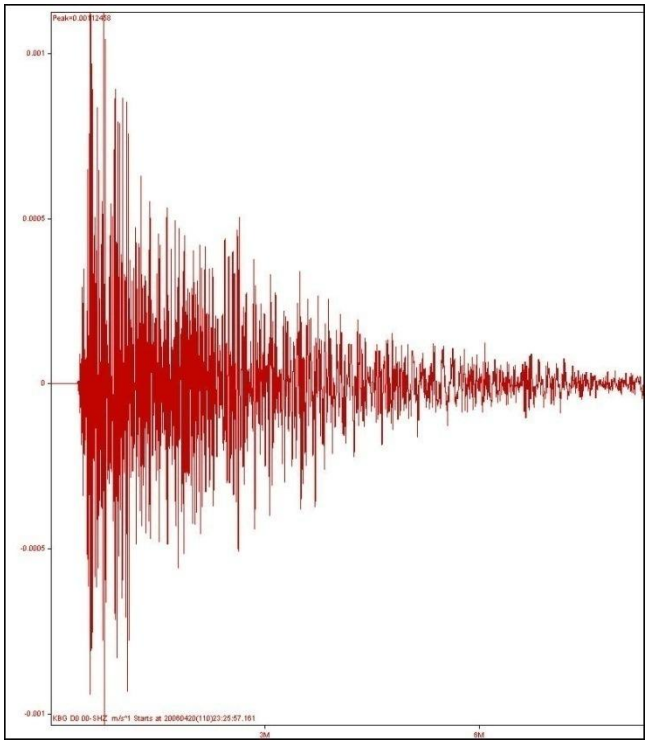


Figure 4-53 Cumulative

2. The **Cumulative Absolute** option results display in the window.



4.15.3 To change the labels to read Gs:

1. Select the **Acceleration Processing** > **Labels** in Gs option and the display will refresh with the data labels in Gs.

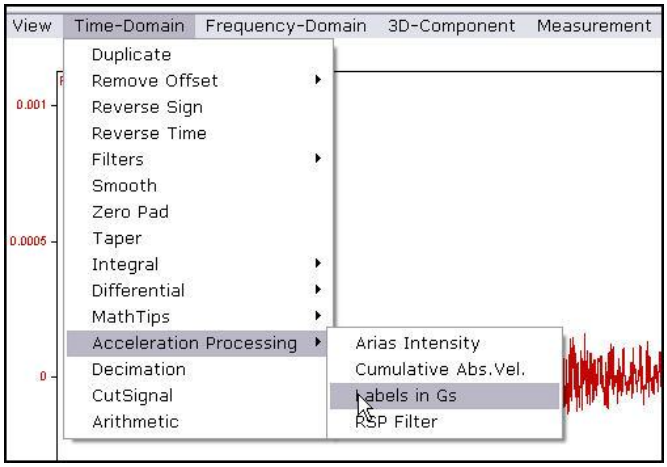
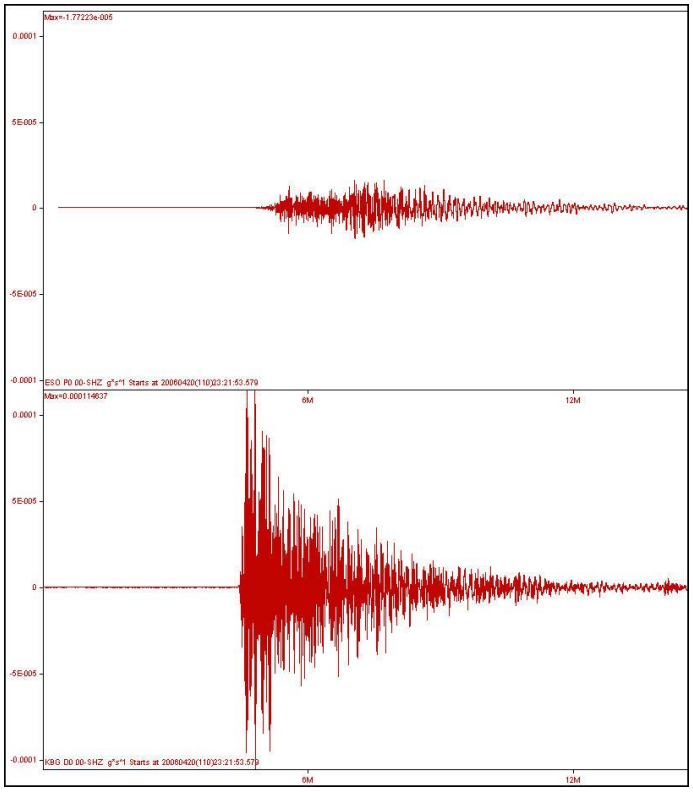


Figure 4-54 Labels in G's

2. The data will be re-displayed with labels in Gs.



4.15.4 RSP Filter

The **RSP Filter** command is used to select a Response Spectral type of filter and apply it as part of acceleration processing.

1. Select the RSP Filter command.

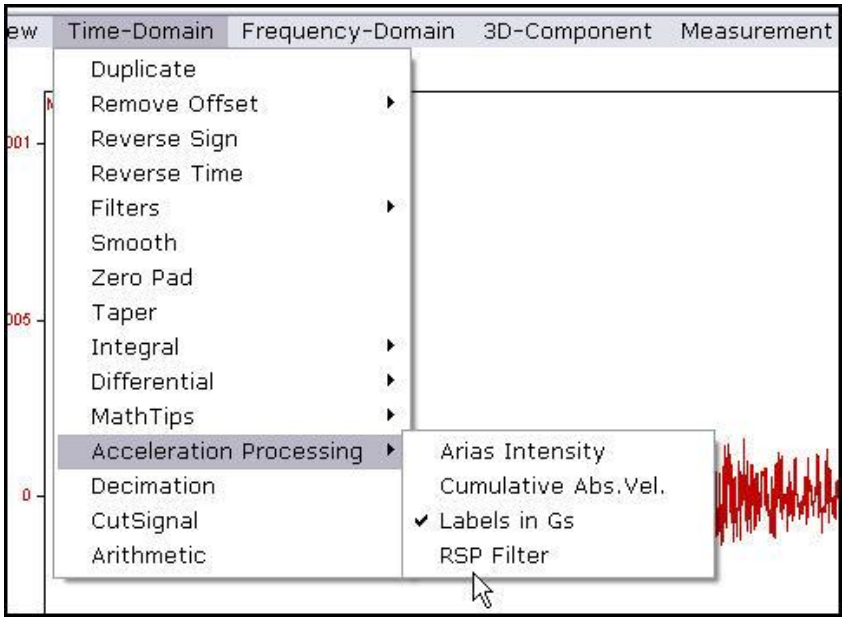
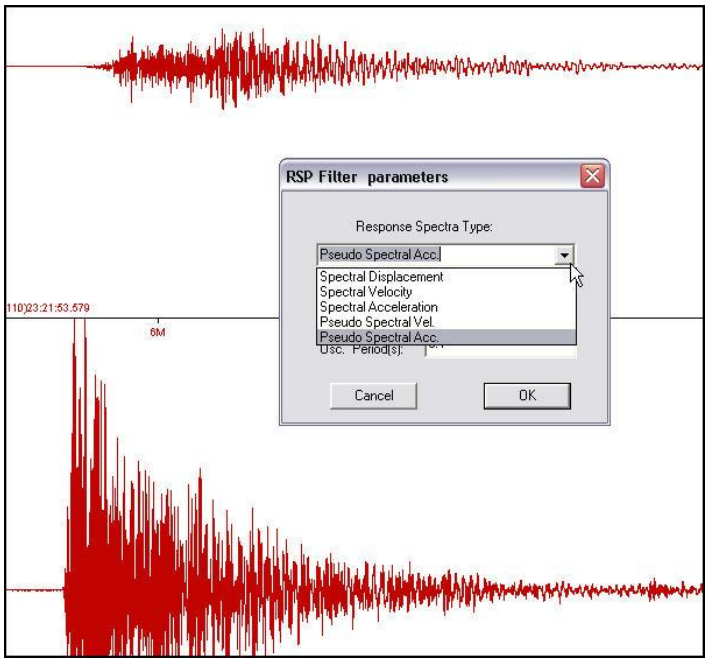
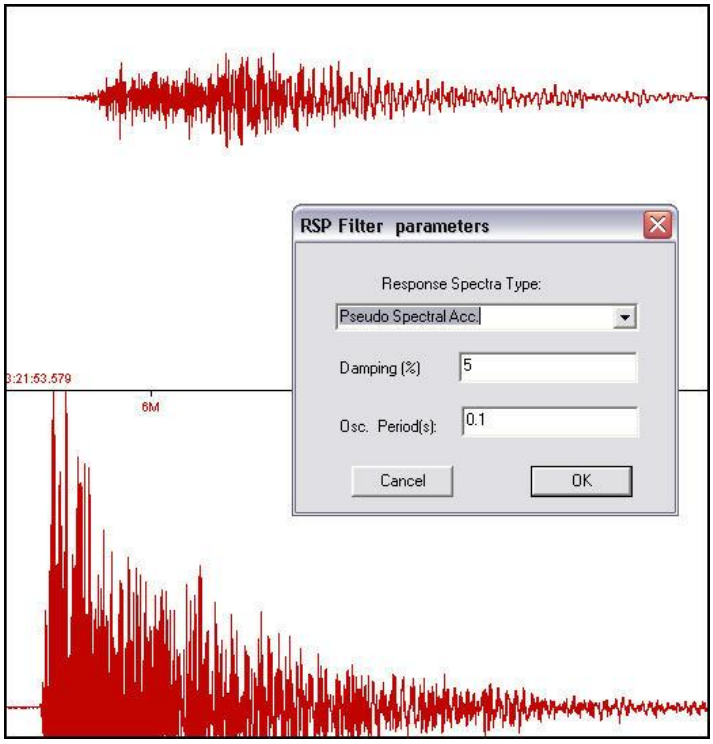


Figure 4-55 RSP Filter

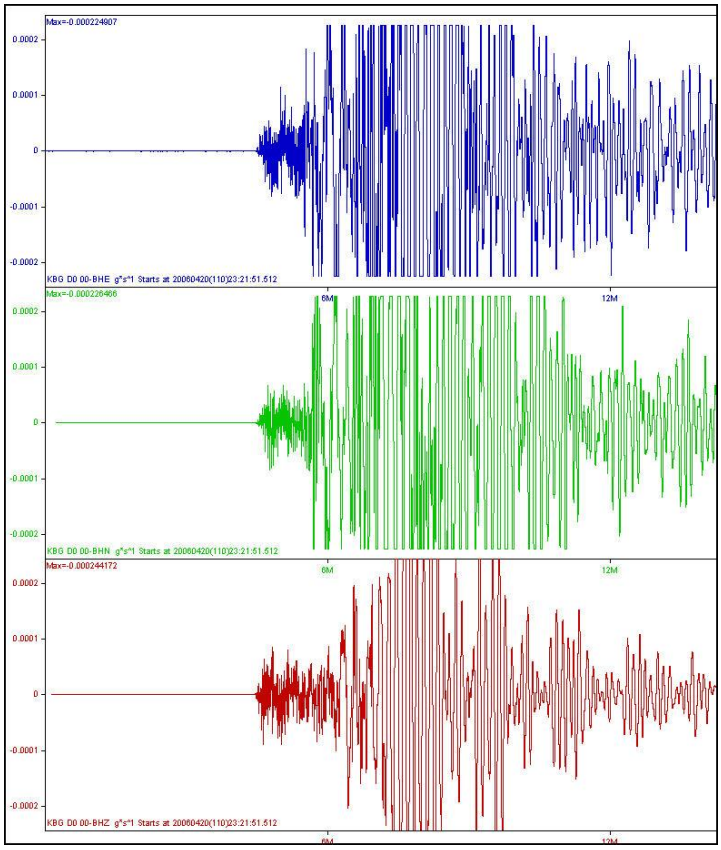
2. Input the desired **Response Spectra Type** option.
3. Select the **OK** option to approve.



4. Input the desired **Damping** and **Osc** Period options.
5. Select the **Ok** button to approve.



6. The results will display.



4.16 Decimation

The Decimation command is used to decrease the sample rate.

To decimate the signal:

1. Select the **Time-Domain Decimation** command.

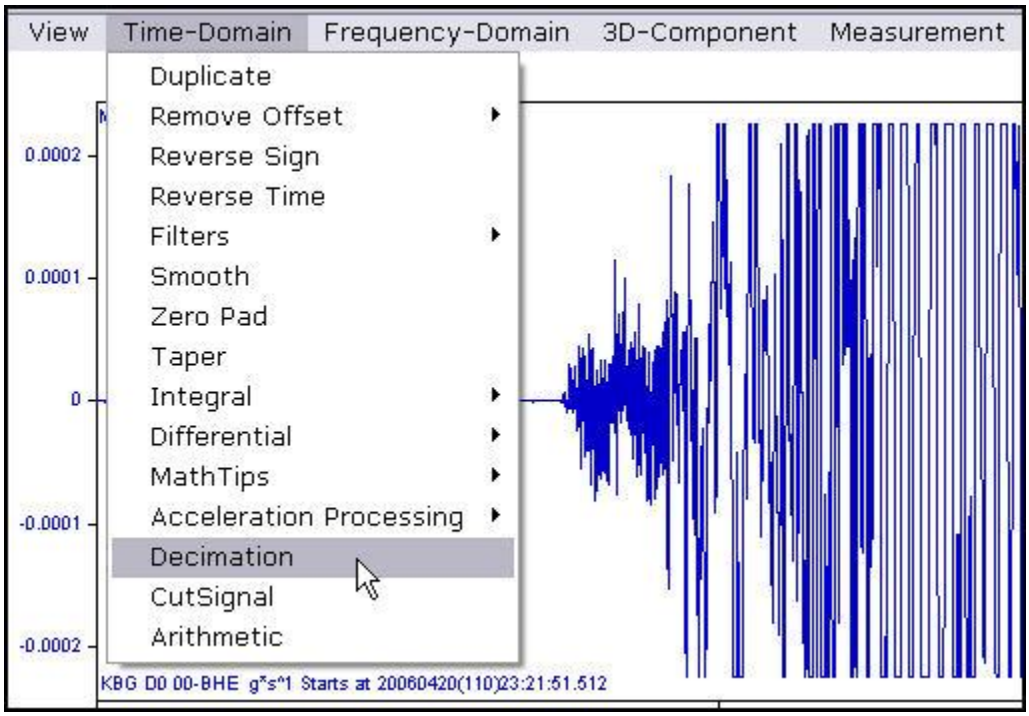
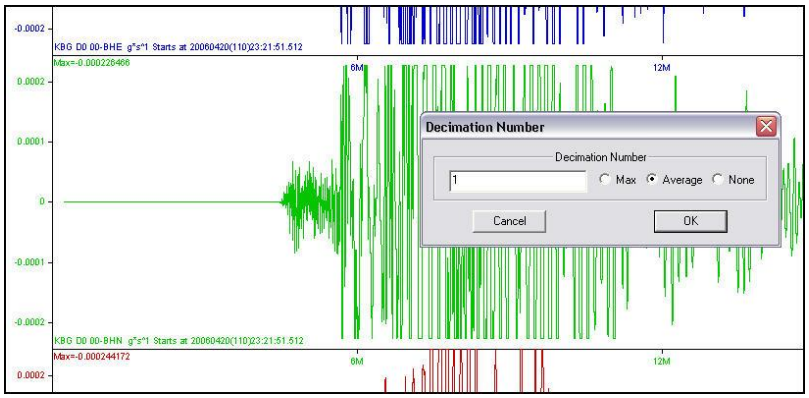


Figure 4-56 Decimatation

2. To decimate the signal fill in the decimation dialog.
3. Edit the Decimation Number (N) to decrease the original signal sample rate.

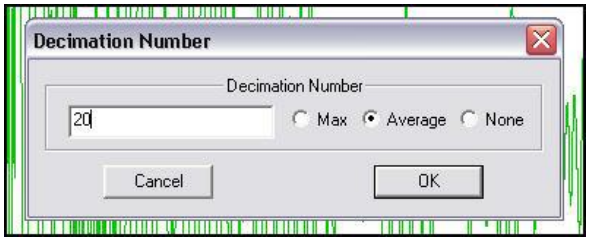


The decimation will take every N-th sample of original trace according to the current check box switch.

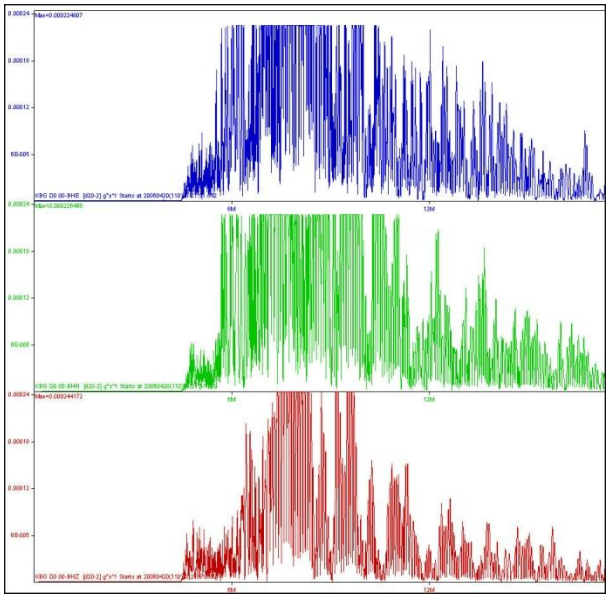
- Max On ----- The program will look for maximum absolute value of the signal during N-th sample section
- Average On ----- The program will look for average absolute value of the signal during N -th sample section
- None On ---- The program will simply take every N-th sample of original signal

4.16.1 An example Decimation with 20 and average:

1. Fill in an example with 20 and Average.
2. Approve the settings with the **OK** button.

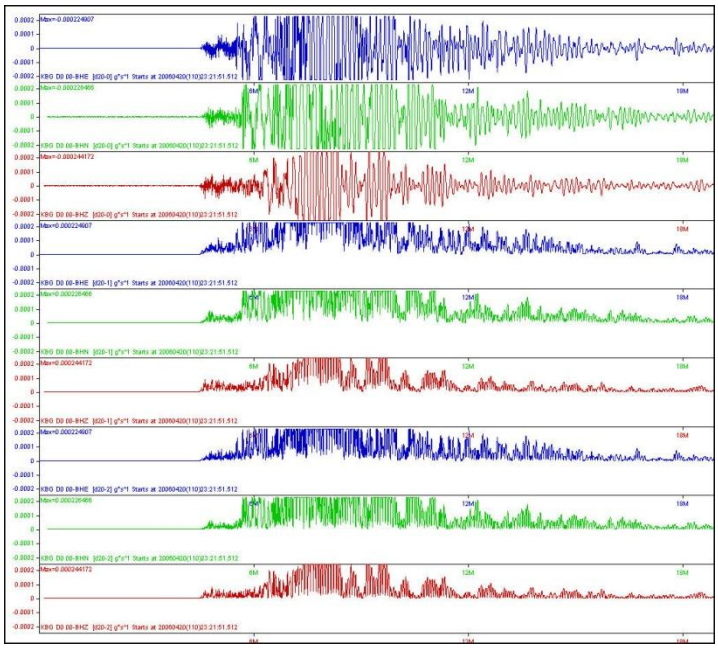


3. The settings will result in this display.



4.16.2 Example of decimation from top to bottom:

- Original trace 20 times decimated using Max-On
- 20 times decimated using Average-On
- 20 times decimated using None-On



4.17 Cut Signal

To decrease or clear the program memory and to make the program work faster, it is possible to cut the signal using two left mouse button clicks on the left and right sides of signal. This looks like a Zoom In menu operation.

1. Select the **CutSignal** command from the Time-Domain menu.

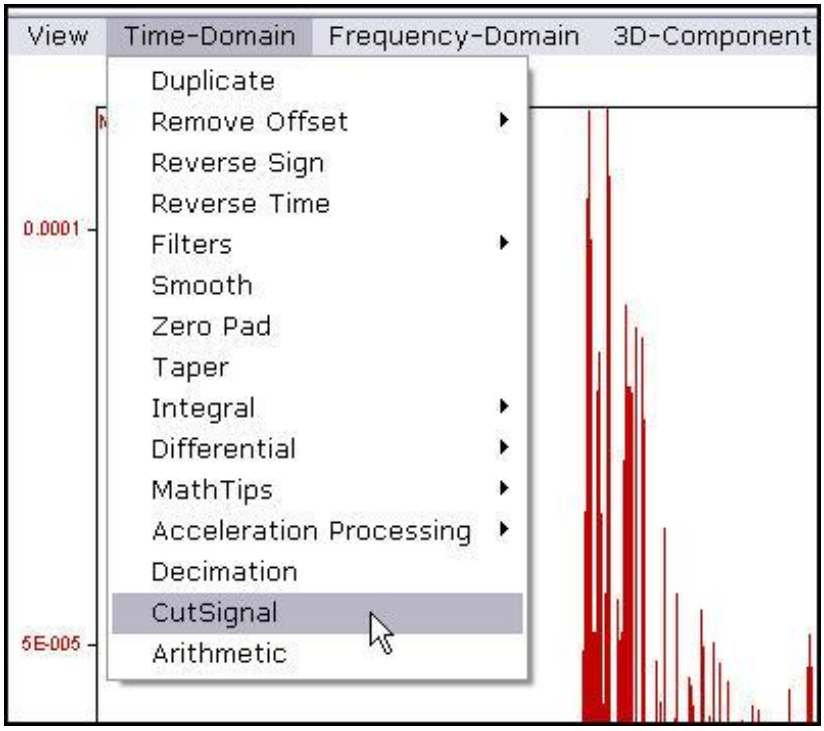


Figure 4-57 CutSignal

After that operation the original trace can be ONLY recovered from a data file on the disk. This option is useful if the user loads a very big segment of data to the program's memory, which is a much larger then useful signal. After this operation only the zoomed in interval is left in the display.

4.18 Arithmetic

The Arithmetic command does simple cross channel math. The selected traces should have the same sample rate.

To use the Arithmetic command:

1. From top to bottom the traces are assigned the letters A, B, C,etc.
2. Select the **Arithmetic** command.

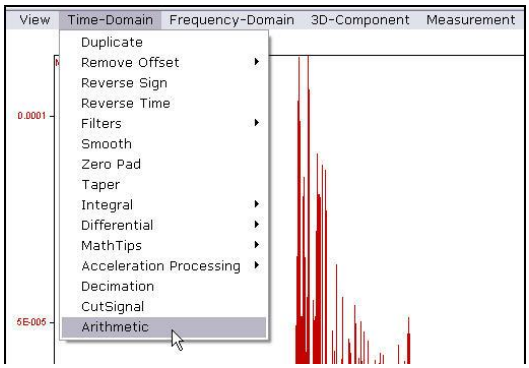


Figure 4-58 Arithmetic

3. Use this information in the formula window.
4. Select the **OK** button to approve the settings.

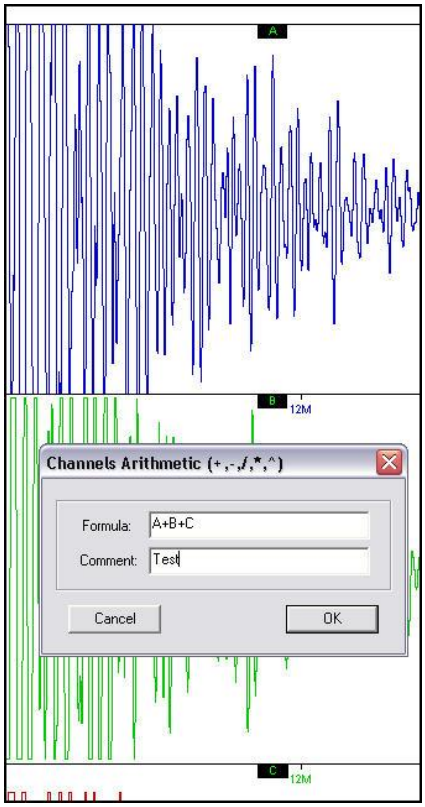
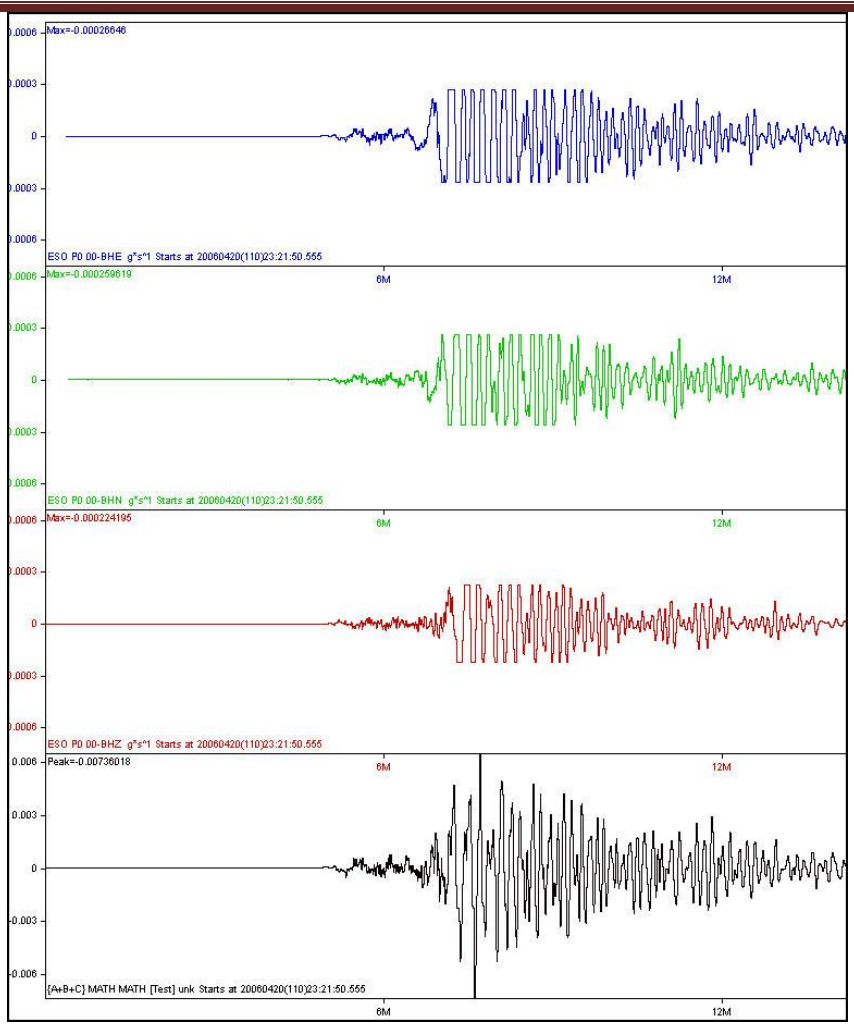


Figure 4-59 Arithmetic Dialog

5. The results are shown in the display.


Max=-0.00026646
ESO P0 00-BHE g*s^1 Starts at 20060420(110)23:21:50.555
6M
12M
Max=-0.000259619
ESO P0 00-BHN g*s^1 Starts at 20060420(110)23:21:50.555
Max=-0.000224195
ESO P0 00-BHZ g*s^1 Starts at 20060420(110)23:21:50.555
Peak=-0.00736018
{A+B+C} MATH MATH [Test] unk Starts at 20060420(110)23:21:50.555

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