

## HVSR Processing in Geopsy

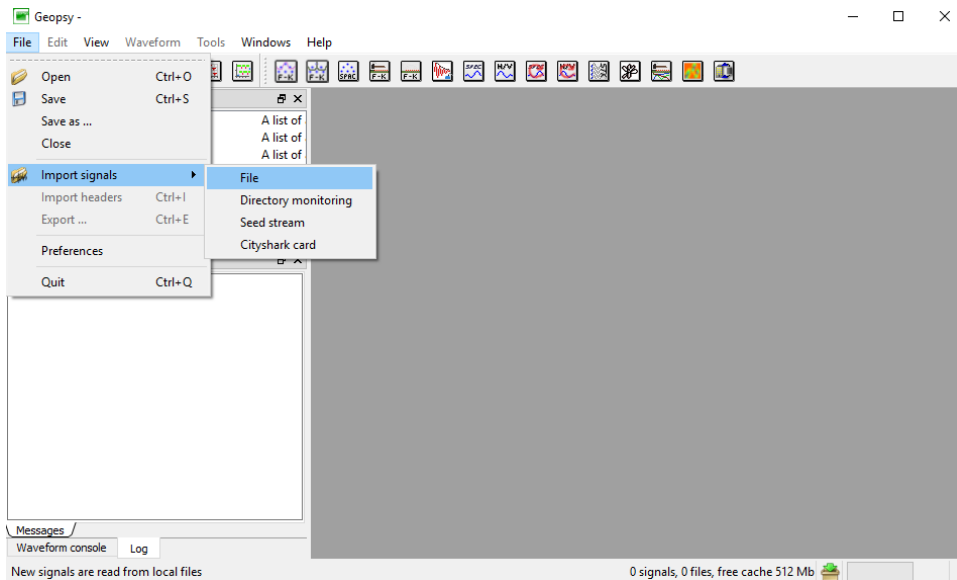
### Run Program

### File

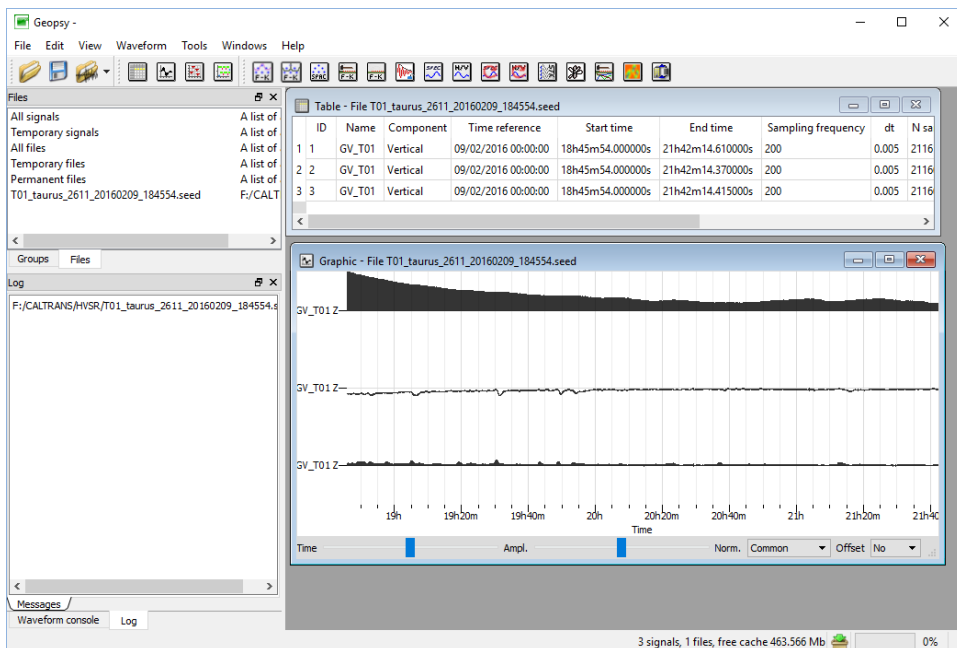
#### Import Signals

#### File

Load file (Geopsy will automatically recognize file format)



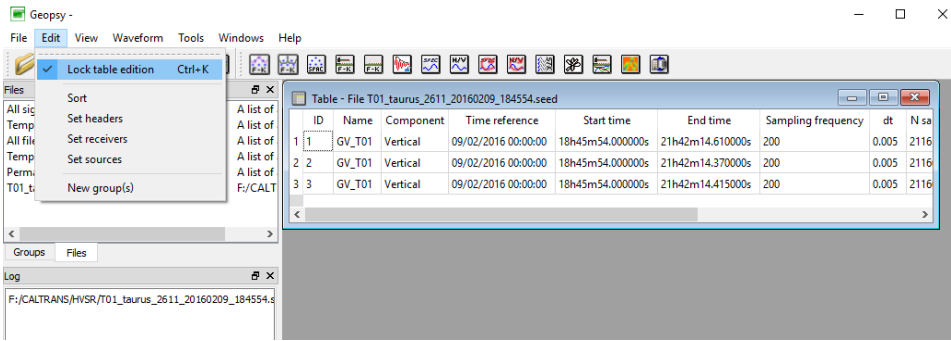
Once the file is loaded the Table and Graphic windows should display on screen.  
If not drag the file name from File window on upper left to the spreadsheet icon.



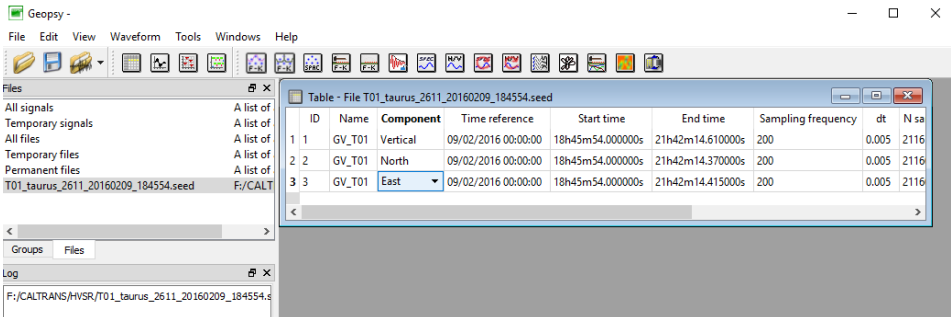
Note that graphic window and table show all vertical(Z) components which needs to be corrected.  
Close the graphic window

### Edit

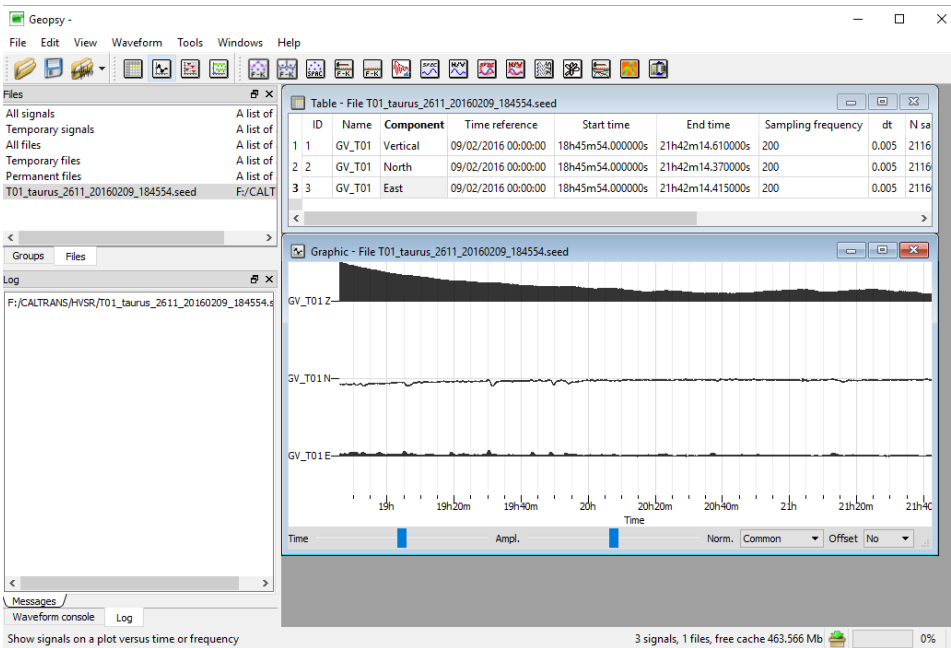
click on lock table edition so no check mark (this will allow editing of table)



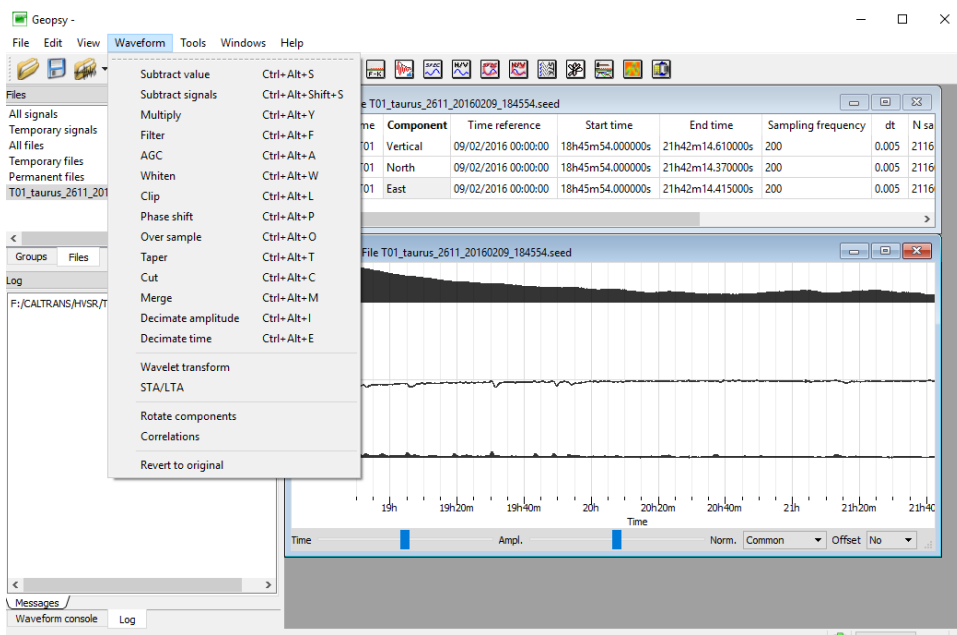
Change components to vertical, north, east (order may depend on digitizer and seismometer)  
Time, sample frequency should all be correct (if not can be changed)



Once components are correct, drag file name from file window (upper left) to graphic tab

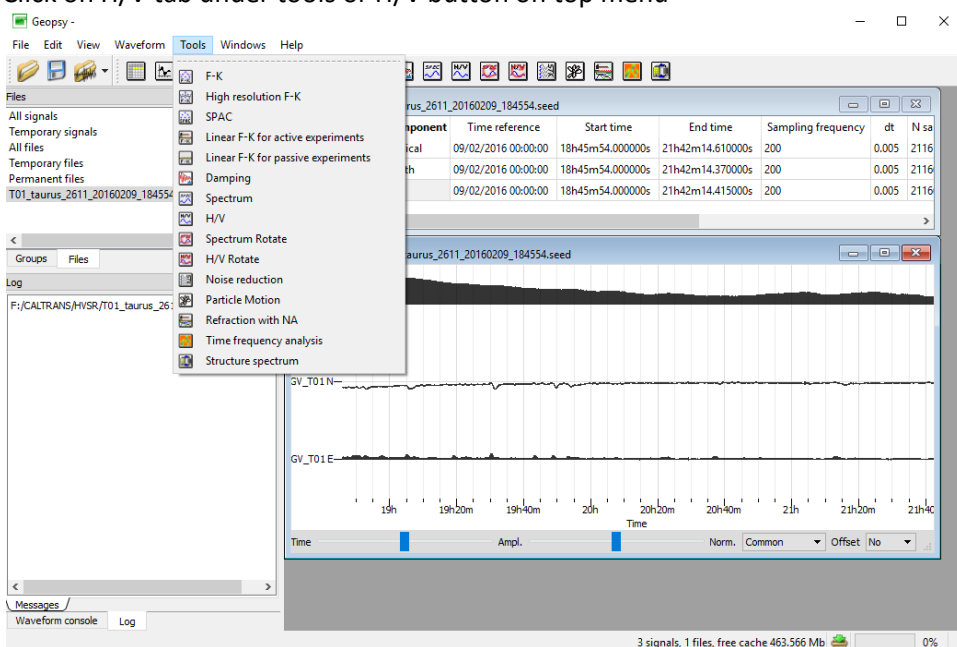


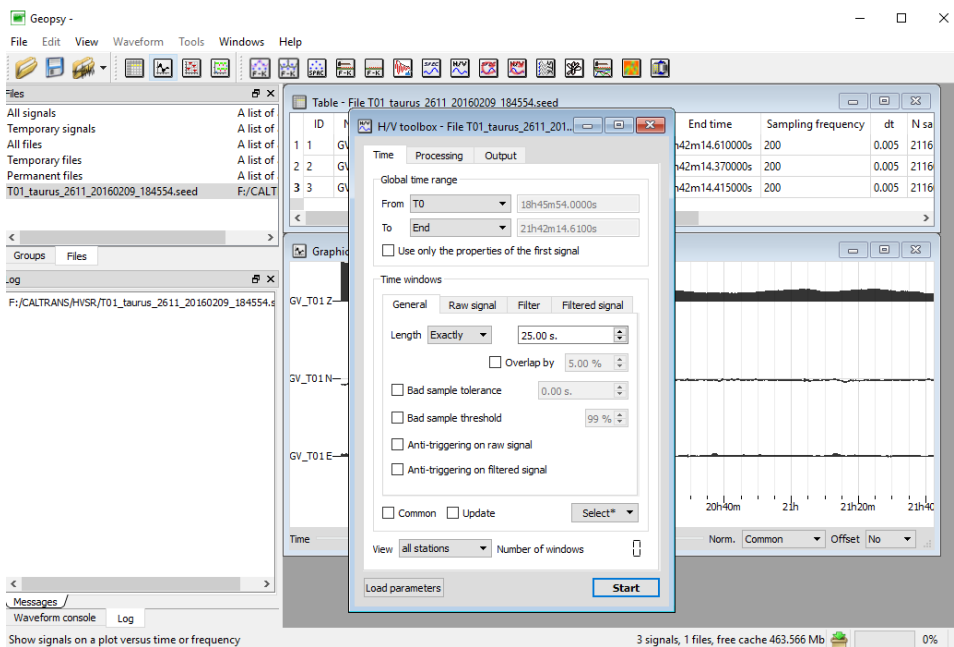
The graphic should now show Z, N, E components rather than all Z



In waveform window you can demean (under subtract value), apply filters, etc. Usually not necessary. Demean and detrend are common for HVSR analysis - not sure if there is a detrend in Geopsy. I don't usually worry about it.

Click on H/V tab under tools or H/V button on top menu

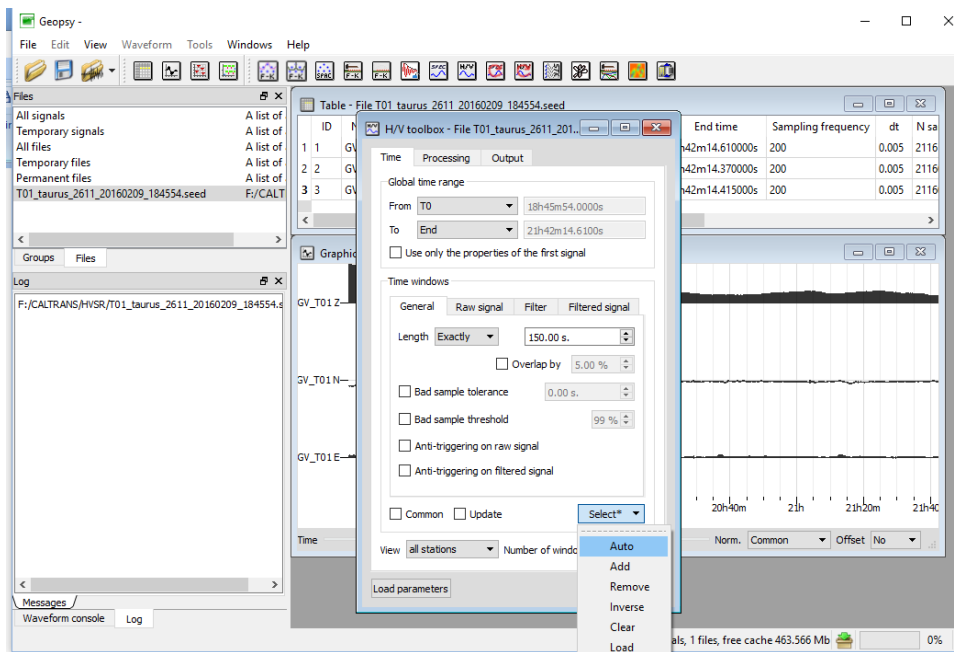




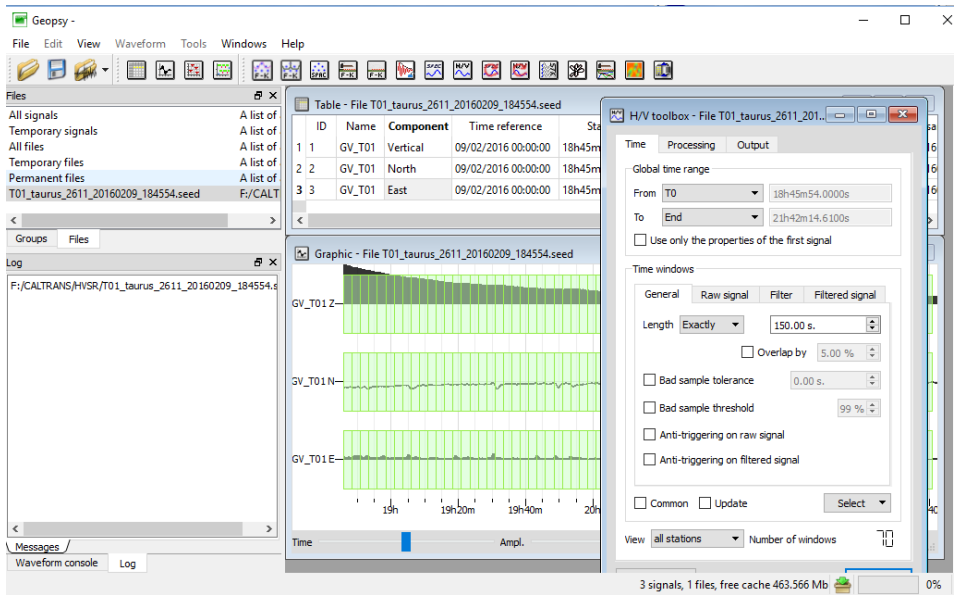
## Start with parameters in Time menu option General submenu

Important parameters are window length (exact length, at least, or frequency dependent). Overlapping signal is an option if short record length and need more windows (e.g. if 5% cosine taper used during processing then use 5 or 10 % overlap to use all of the signal for analysis). Window length needs to be at least 10 times the maximum period of interest (not the peak period) as may be in the HVSR guidelines. I prefer longer windows, especially if you have over an hour of data. 50 s for high frequency peak, 100 s for peak around 0.5 Hz and 200 s for low frequency peak. If there are many transients then you might want to experiment with anti-triggering, etc. I don't bother and delete bad windows later. If you want to use anti triggering then parameters are set up in the raw signal submenu. You can also apply filters in the filter menu. Probably will not be necessary but you should experiment.

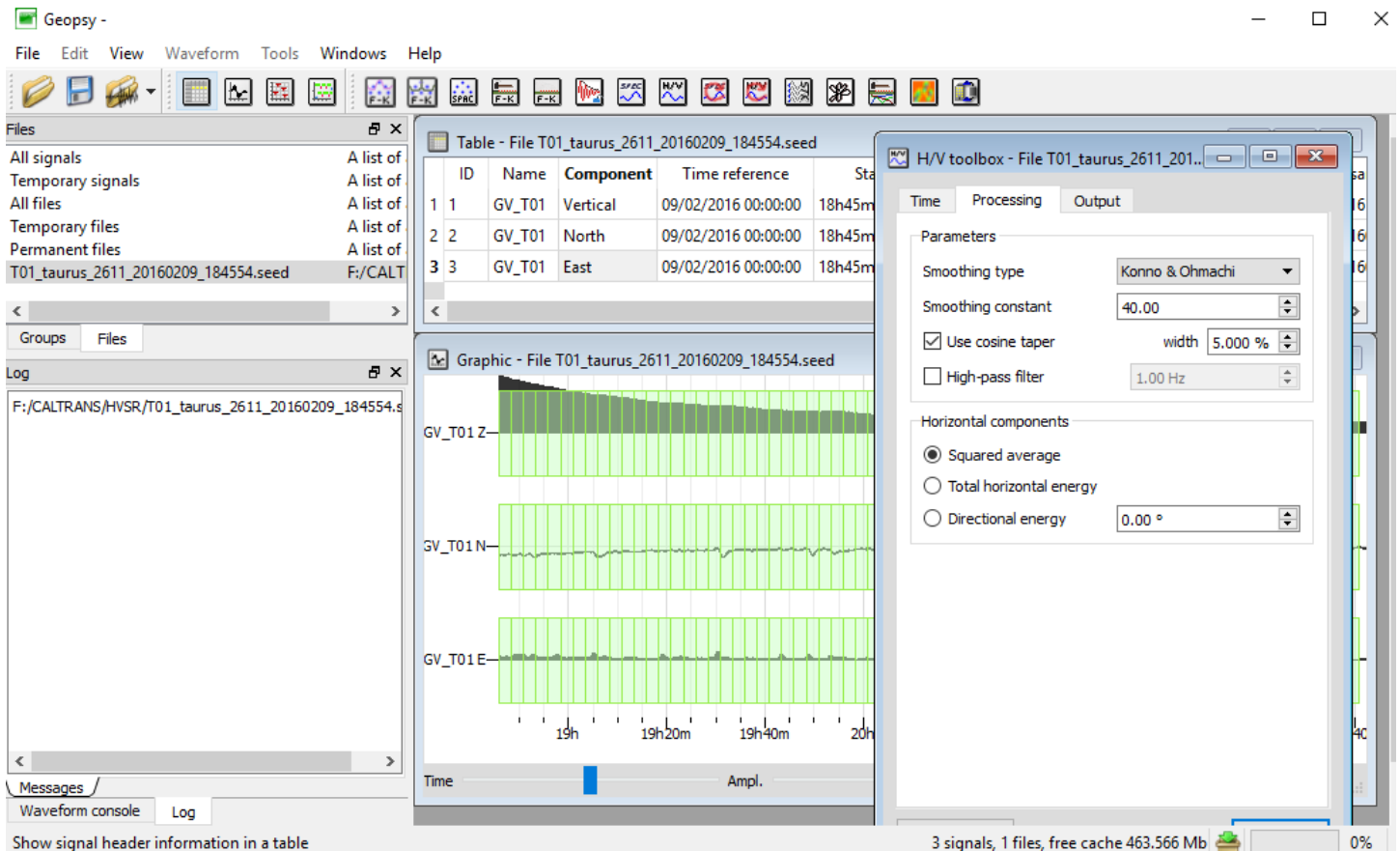
Once you have entered parameters, click on select menu then auto to pick the windows



If using the Trillium you may then go to select, remove and remove first several minutes of data or just wait until later.



## Processing Tab



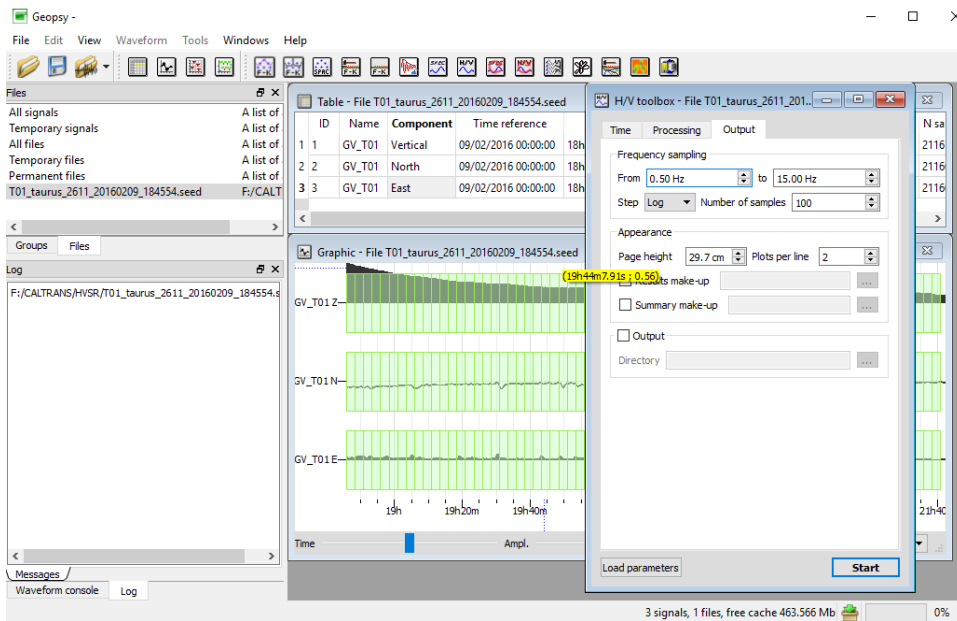
Use Konno&Ohmachi smoothing.

Smoothing constant of 40 is fine (smaller number increases smoothing) - experiment.

A 5% cosine taper is suitable, but experiment.

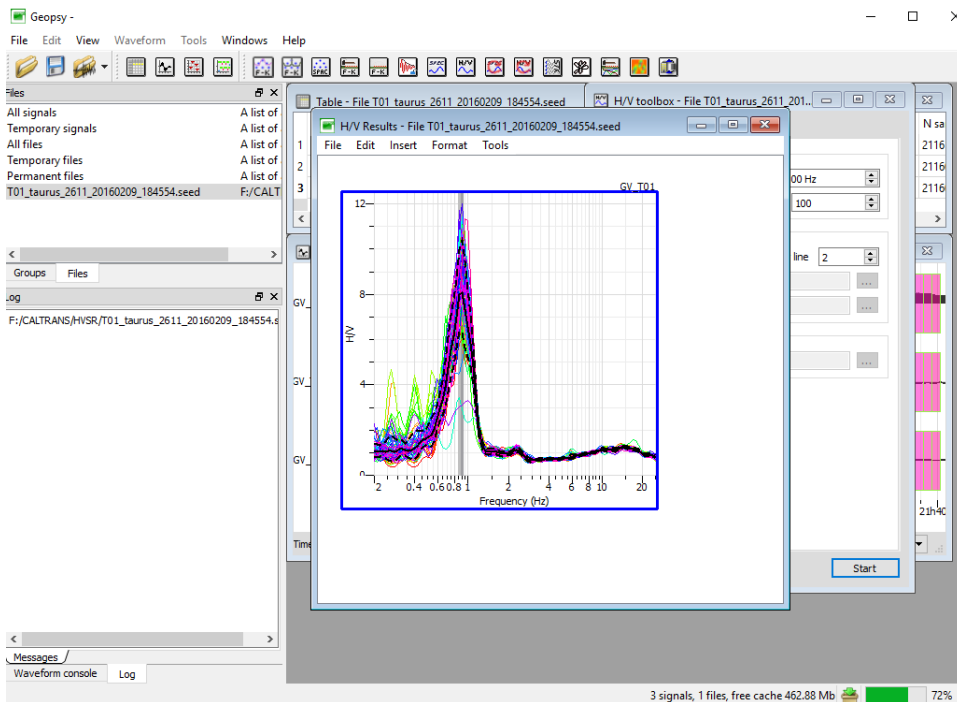
I believe that squared average of horizontal components is the norm. Using total horizontal energy will change the peak amplitude, which will have ramifications for modeling.

## Output Tab



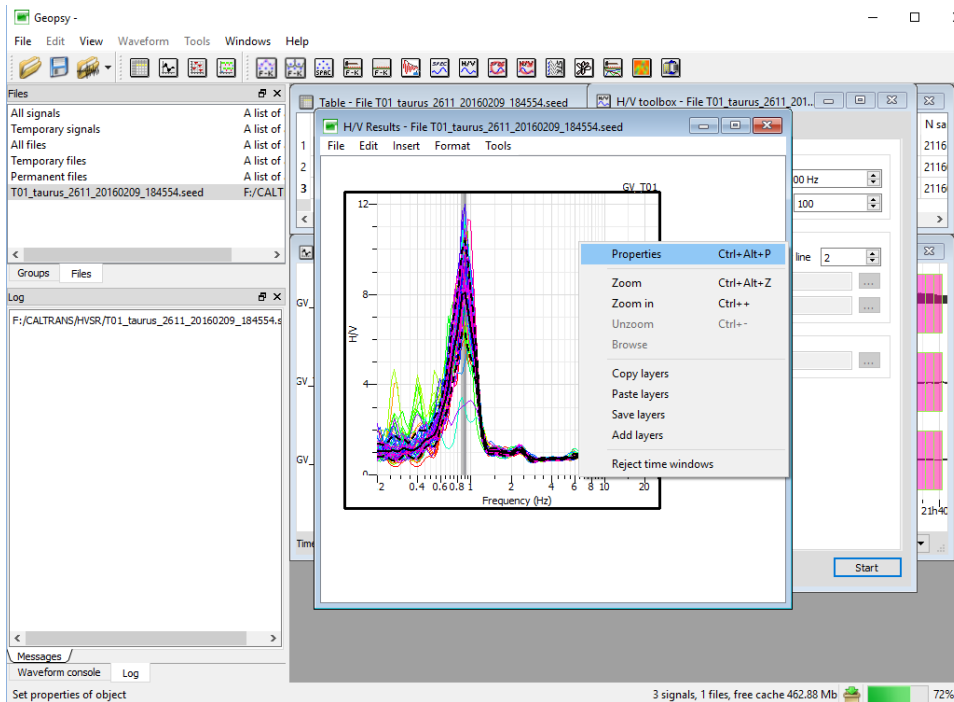
Enter frequency range - data dependent. Unless I am chasing a very low frequency peak, I often start with 0.2 to 25 Hz. I typically use a Log step and 100 samples - experiment.

Once parameters are entered hit START button

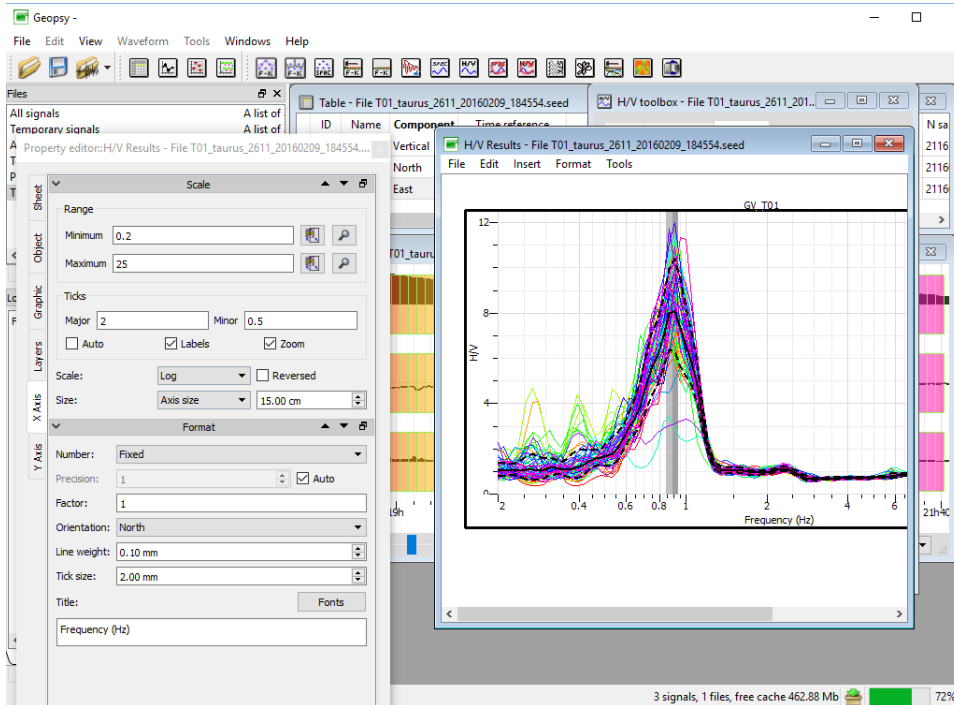


Now it is time to remove bad windows, change plot scale, etc.

Right click on image and click properties to change plot parameters

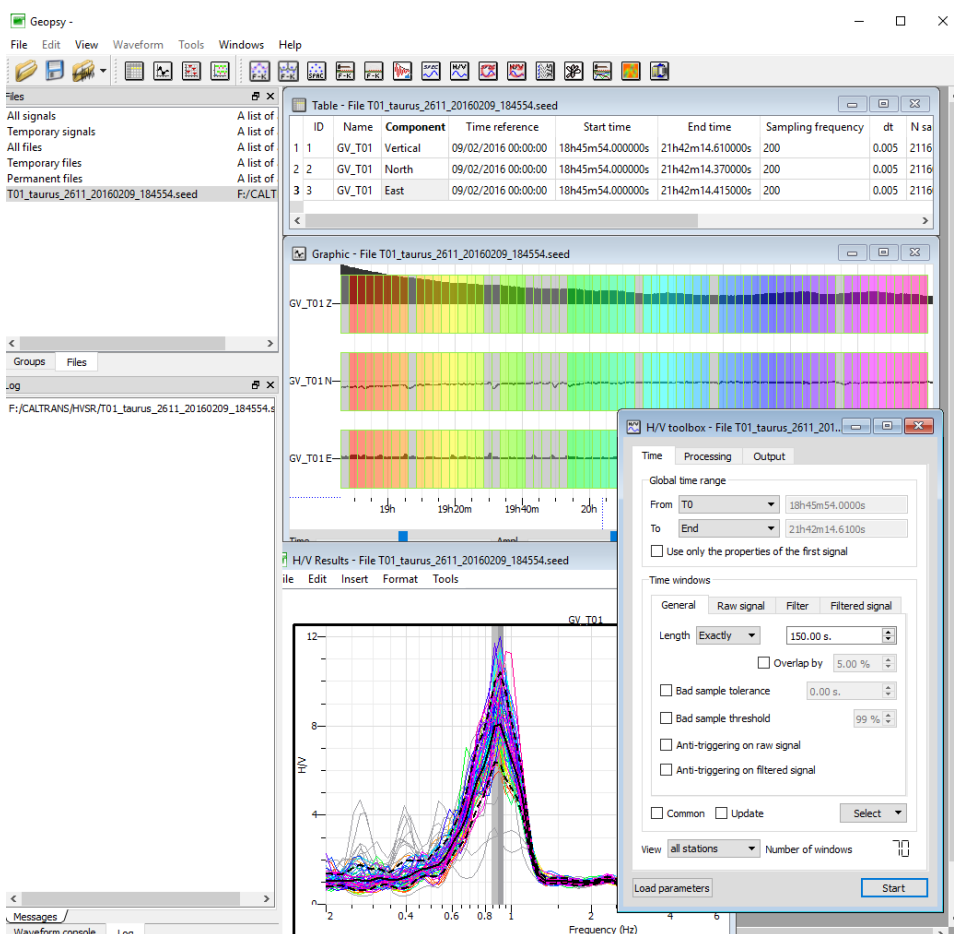
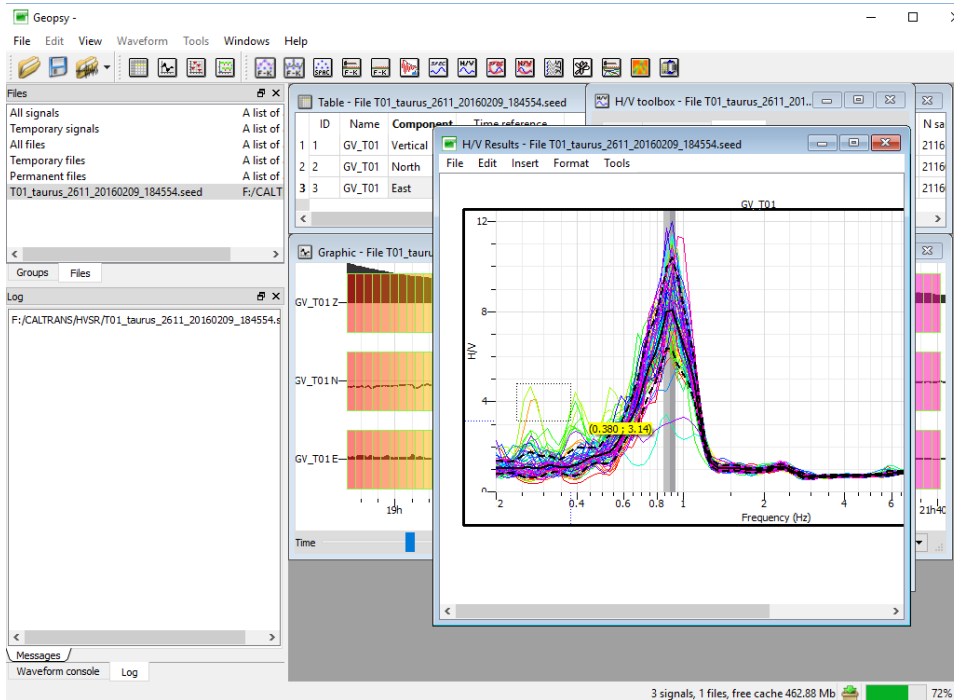


At a minimum you often need to make the x-axis a little longer. This is where you change font size, etc. for later display.



Once you are happy with display parameters, then right click again and go to reject time windows.

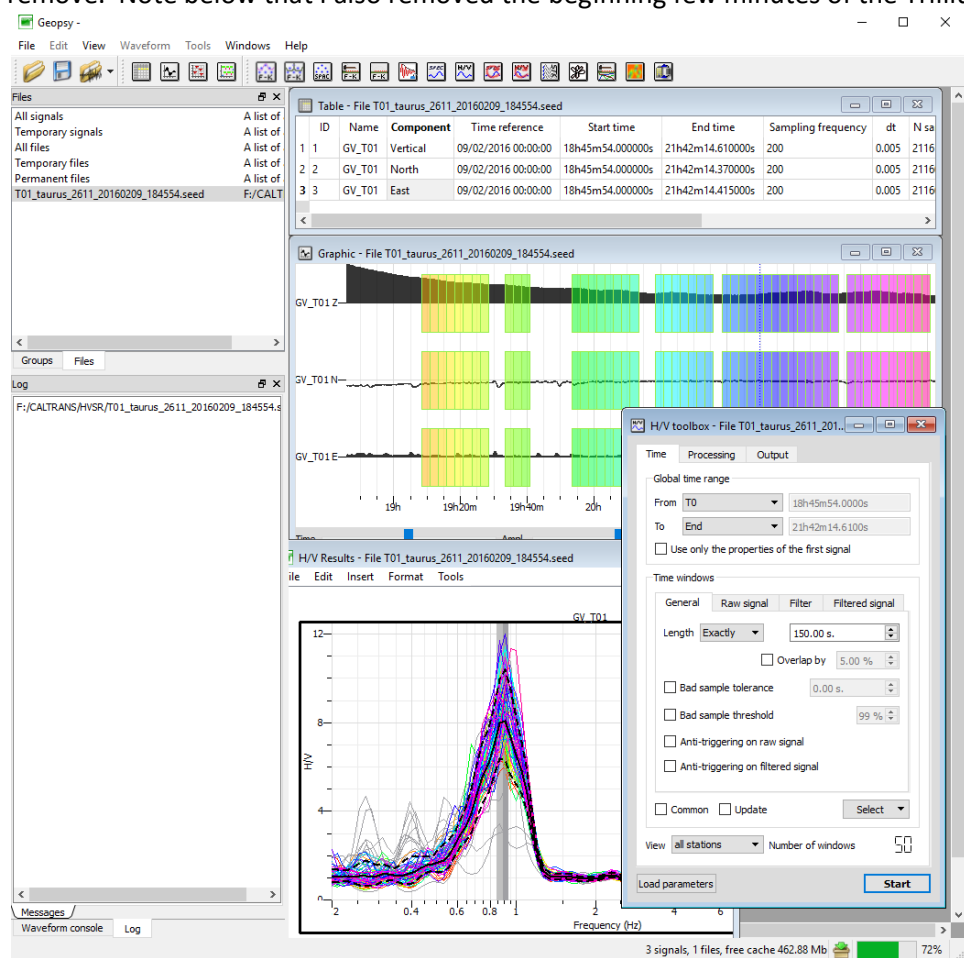
Draw boxes around small segments of the HVSR data you want to delete and they will be greyed out on the waveform graphic display.



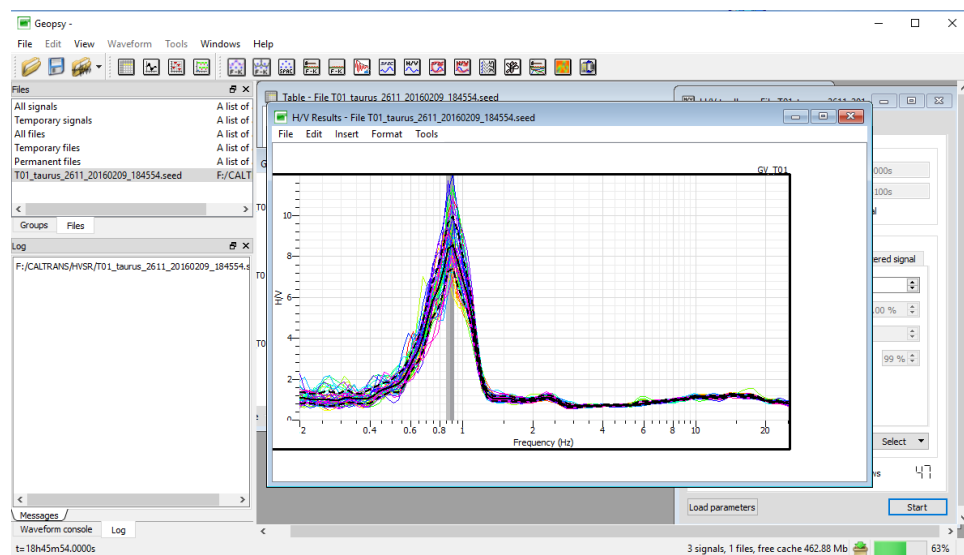
This is often an iterative process. Be careful not to delete good data. Note color coding on HVSR plot and windows.



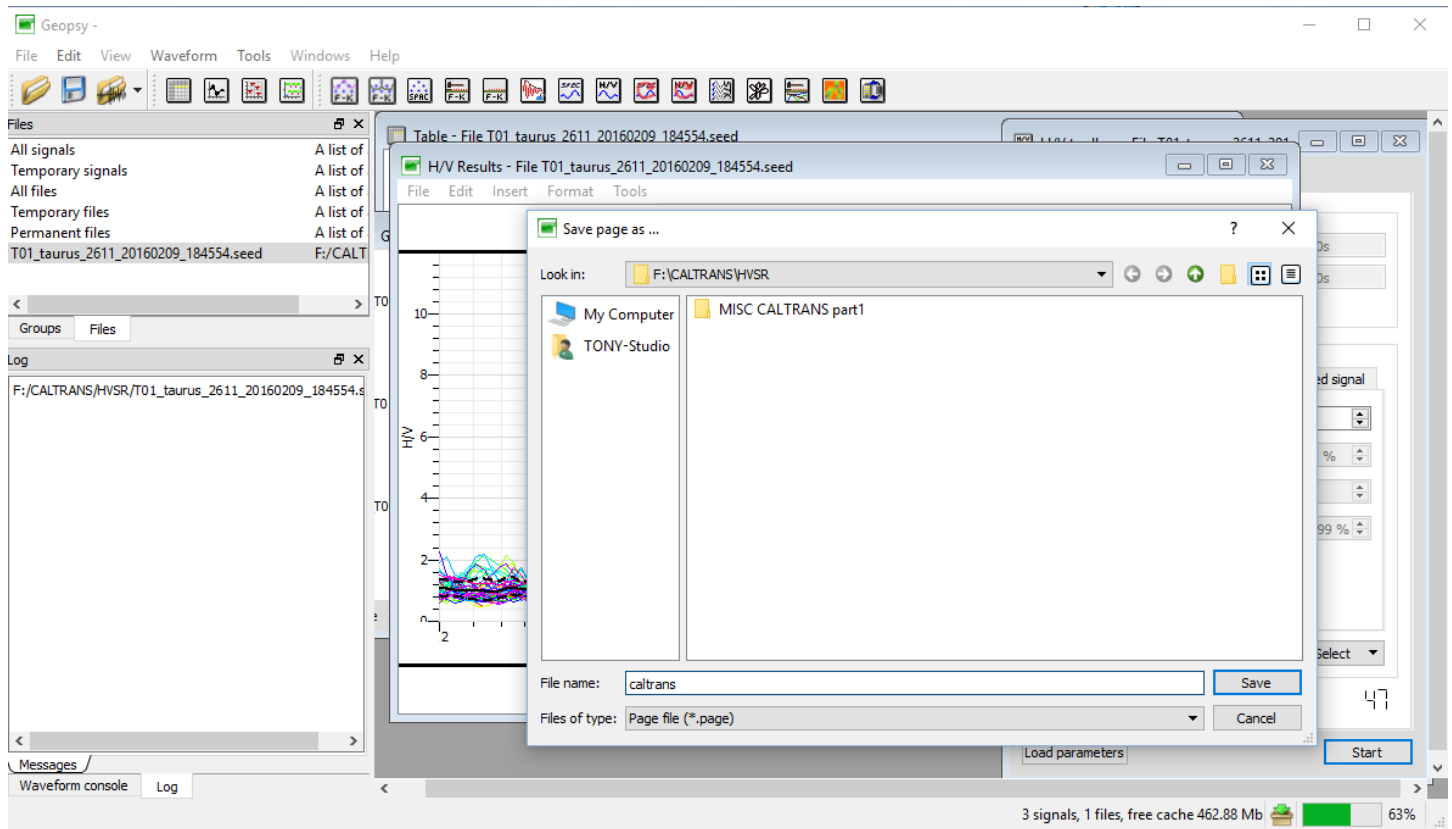
Click on select (Time submenu), remove windows, left click and move cursor on grey windows in waveform graphic to remove. Note below that I also removed the beginning few minutes of the Trillium data.



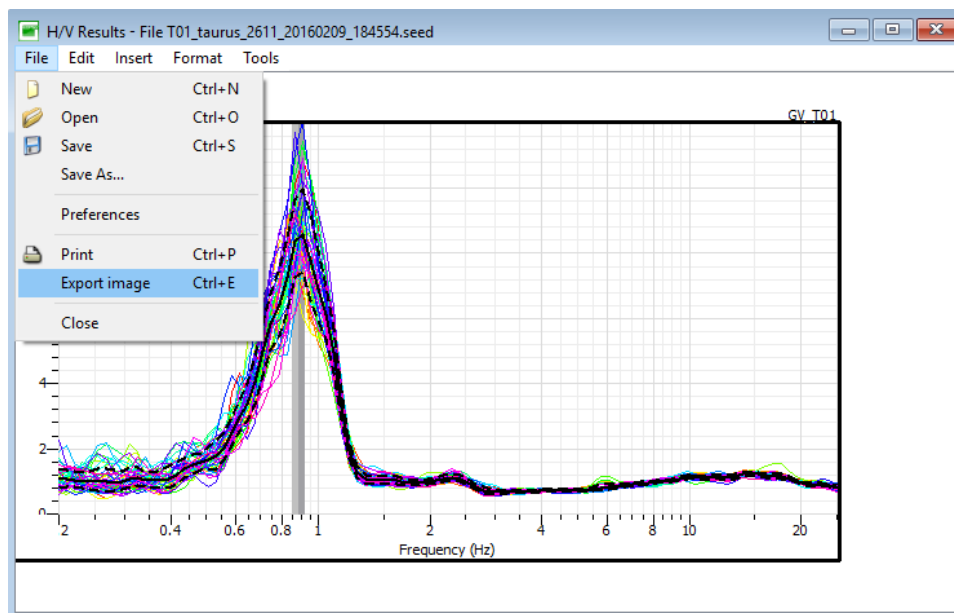
Click on Start again - might take a couple iterations until you are happy with result. Note that if you do not want to show the shaded delimiter of maxima can turn off under properties.



If you want to save the file go to file in the HV plot window and save as a page file



you can also export the image to various formats.



I am sure there is quite a bit I am not covering but this is a good start.