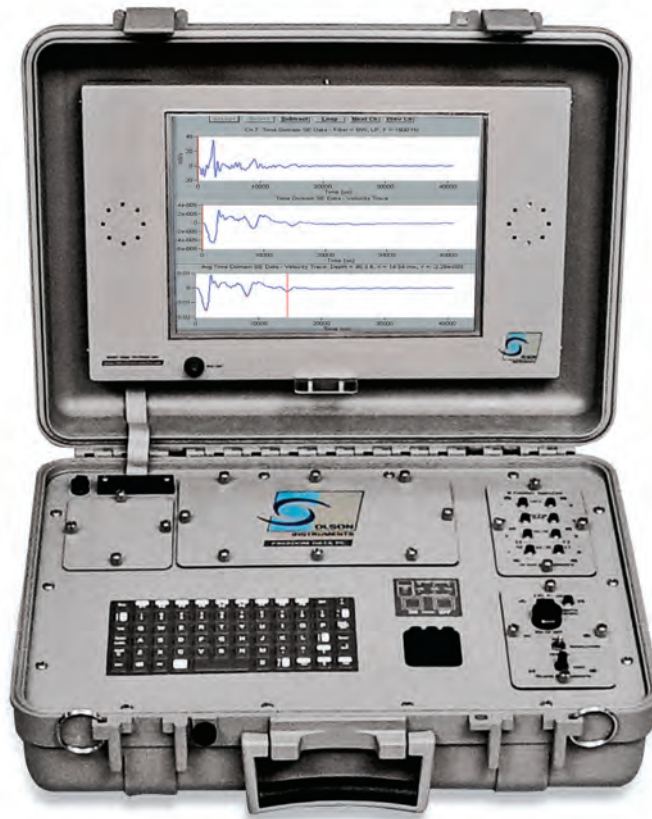


WIN-TFS Version 2.0

Step By Step Software Guide SONIC ECHO/IMPULSE RESPONSE





2.0 SOFTWARE SETUP

2.0 SE/IR SOFTWARE SETUP

2.1 SET-UP NEW PROJECT

First create a file directory on the computer where you want your measurements to be stored.

Open WINTFS 3.4 by double clicking either the "WINTFS.exe" or the shortcut you created on the desktop. The following dialog box should appear on the screen:

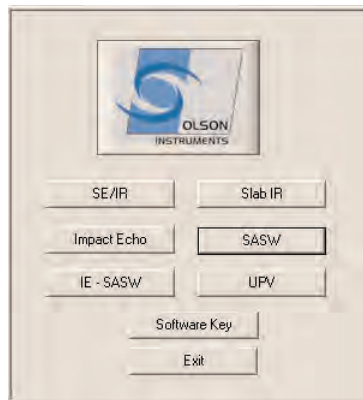


Figure 1: SE/IR project setup screen.

1. Left click on the SE/IR option to load the SE/IR acquisition software.

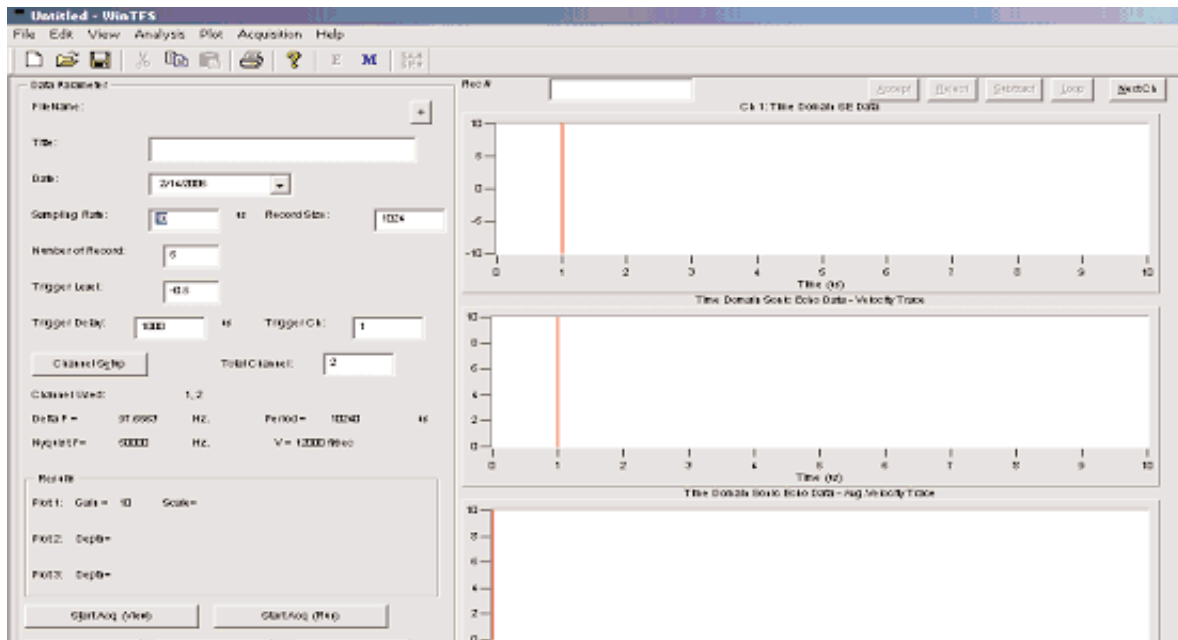


Figure 2: SE/IR Acquisition Screen



2.0 SOFTWARE SETUP

2. Enter desired project name in the "Title" entry.
3. Enter the correct date in the "Test Date" text entry.
4. The following are the default control settings and can be adjusted if need be.
 - a. Sampling Rate: 10 ms
 - b. Record Size: 1024 (can also be 512, 2048, and 4096)
 - c. Number of Record: 5 (3 can be used if transducer mount is stable)
 - d. Trigger Level: -0.5
 - e. Trigger Delay: 1000 ms
 - f. Trigger Channel: 1 (Can also be set to any channel if using an impulse hammer or if system is triggering off of geophone or transducer)
 - g. Total Channel: Input the number of channels that are active for the survey
5. Click the CHANNEL SETUP button. The following screen should appear:

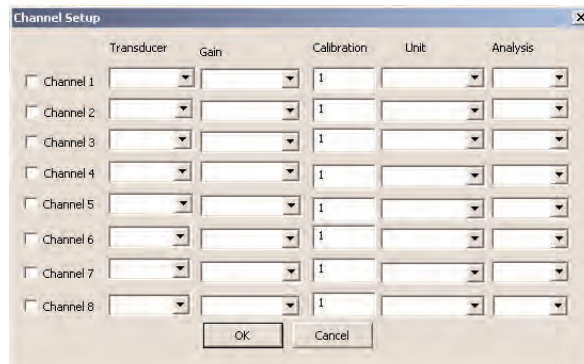


Figure 3: Channel Setup Screen

- Make sure to check the channel box for channels that are active. Next, set the following options:
- a. Transducer: Accelerometer, Displacement, Force, Geophone, Volt
 - b. Gain: enter gain amount
 - c. Calibration: enter the equipment calibration
 - d. Unit: insert units if desired
 - e. Analysis: SREF is reserved for the Force component (hammer), SA is reserved for the receivers (accelerometer and/or geophone)
 - f. Click OK
6. Click on "Acquisition/Save Parameters" (F10) to save acquisition parameters. Click OK.



2.0 SOFTWARE SETUP

7. Click the START ACQ (VIEW) button Start Acq (View) to activate the acquisition software.

The following screen will appear. Make sure that prior to opening WINTFS that a file directory was created. Go to that file directory now and enter the name of the file as shown below.

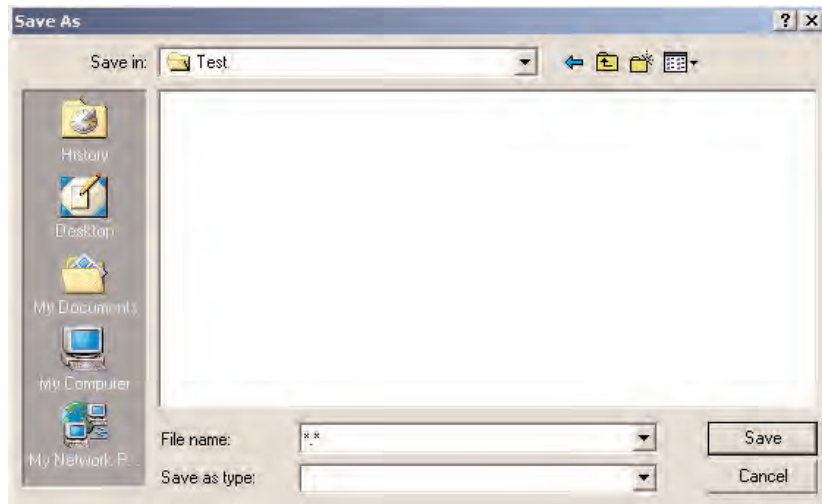


Figure 4: File Save Screen

8. Click SAVE.
9. The software allows users to setup a filename system with a prefix and an increment for repetitive tests with auto-naming of files for. This feature allows high speed testing of repetitive tests. To activate this option, go to "File/Setup FileName". The dialog box in Fig. 5 should appear in your screen. Once the prefix, first start suffix and increment are set, the automatic naming system will be assigned to the data when the user clicks on "Start Acquisition" either in VIEW or RUN mode. The filename system can be cancelled by checking the "No Increment System for Filename" box.

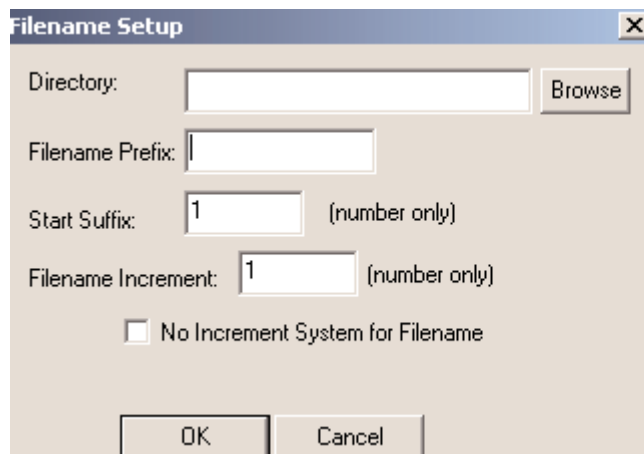


Figure 5: Filename Setup for Repetitive Tests



3.0 ACQUIRING DATA

3.0 ACQUIRING DATA

1. Strike the impulse hammer against the surface of the shaft. A screen similar to figure 6 below should appear:

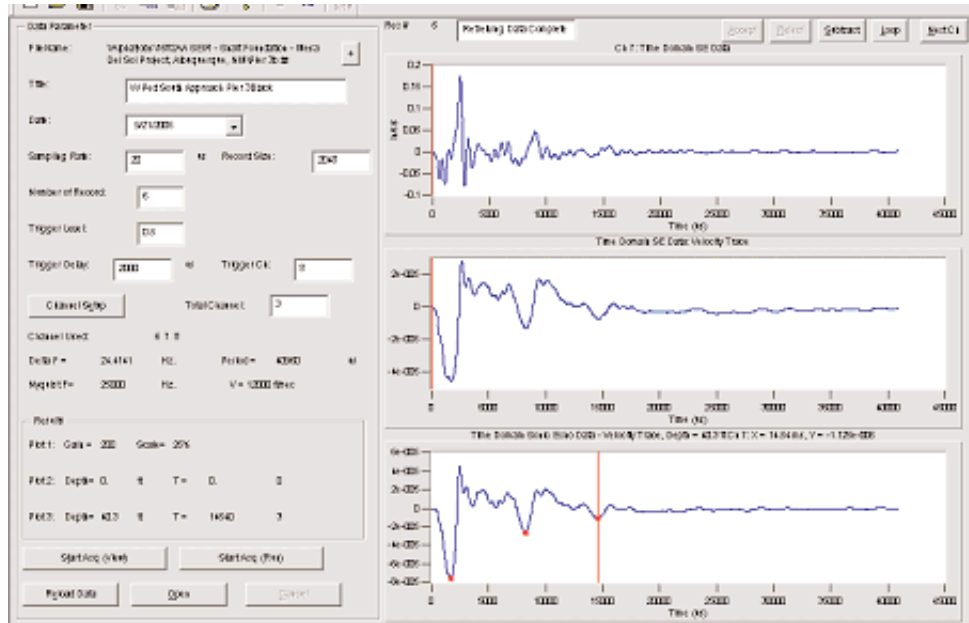






Figure 6: Acquisition software after one acquisition

2. To view each channel select NEXT CHANNEL  in the top right corner of the screen. To see which channel is currently being displayed looked directly above the top plot as indicated in Figure 6.
3. Next, check data quality and if data is good (meaning reflections are visible as in Figure 6) click the  button.
4. If the data quality is poor (usually caused by bad hammer hit) click the  button
If data has very small amplitudes and shows little variation in signal check the geophone/accelerometer mount. If the mount is sufficient, skip the next steps and go to the Data Gain in **Section 5.0**.
5. Repeat steps 1-3 until record number has been met. Then click the SAVE icon in the menu bar. The survey is now complete.
6. To start the next survey, click START ACQ (VIEW) button  and create a file name for the new survey. Then repeat steps 1-5.



4.0 TESTING OVERALL SYSTEM OPERATION

4.0 TESTING OVERALL SYSTEM OPERATION

The SE/IR system can be easily tested for proper operation before going in the field. Connect the geophone, accelerometer, and hammer as outlined in the **Section 1.0 HARDWARE** and follow **Section 2.0 SE/IR SOFTWARE SETUP**. Use a generic filename, i.e. Test, for testing the system. Follow the steps outlined in this section to verify the INPUT Module and all channels are working correctly before going into the field.

If a wave does not appear, verify that the computer is taking data and is triggering, and verify that all connections are made properly, switches are as described, and the unit has power. Once the unit displays the signal properly, check to see that the auto gain function sets the gain less than 400. If the gain is above 400, then it is likely that either the geophone or accelerometer is bad.



5.0 DATA GAIN

5.0 DATA GAIN

If the auto-gain function appears to be incorrectly gaining the data or is over gaining and thus clipping the data, the manual gain can be used. To activate this feature press **F2**. The following screen will appear.

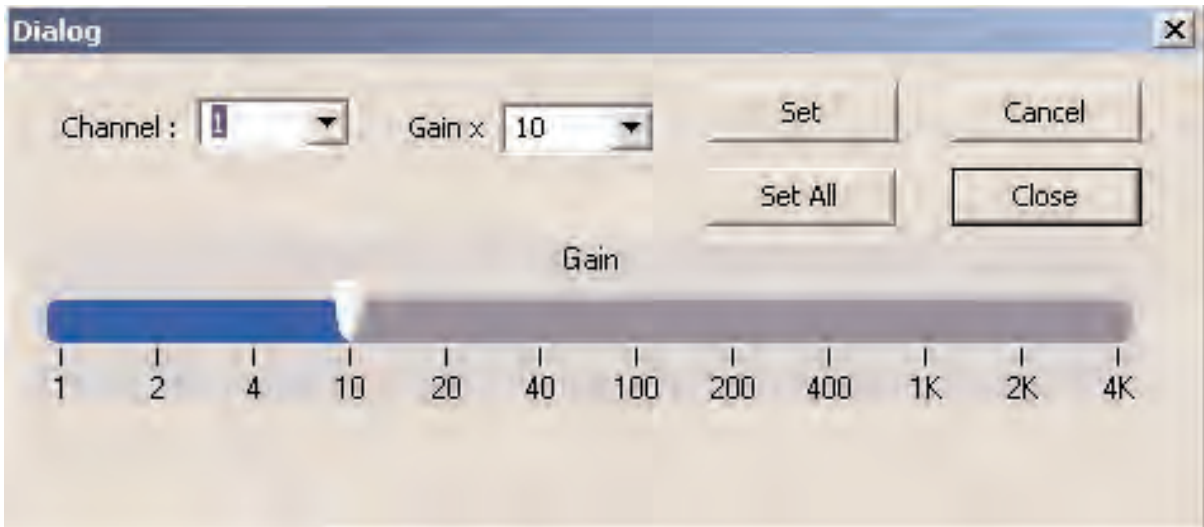


Figure 7: Manual gain screen

To set the manual gain, select the correct channel. Next select the gain amount and then click SET. After the gain has been adjusted, click CLOSE. To test the new settings, follow steps 1-3 in **Section 2.0**. If the data for each channel falls within the Gain Scale range of 10% - 80%, the data quality is good. This quantity can be found in the lower left corner of the acquisition screen. If this value is too high or too low the gain should be readjusted.



Remember to check each channel by using the NEXT CHANNEL button. Make sure that the force of the hammer swing is consistent as changes in the impact amplitude will affect the response of the geophone and accelerometer amplitudes.



6.0 PROCESSING

6.0 PROCESSING

1. If the user decided to use the “Run Mode” instead of the “View Mode”, it may be necessary to ACCEPT or REJECT certain records within the data. Records should be accepted or rejected based on the trigger and the data quality. Please refer to the Data Examples section for further information. Records are accepted or rejected by clicking on either the ACCEPT button or the REJECT button.
2. Once the user has either accepted or rejected the first record, then the next record will appear. The number of records corresponds with the Number of Records set in the data acquisition. Please refer to the Data Acquisition section for more information. The user must perform step 1 for all records before processing begins.
3. Now that all of the records have been analyzed for their data quality, the processing can begin. The most common processing tool is the Digital Filter. This processing tool can be accessed by clicking on “Analysis/Digital Filter”, see Figure 1.

| inTFS | |
|---|-----------------------|
| Analysis | Plot Acquisition Help |
| Depth/Frequency Scale | F1 |
| Window | F3 |
| Digital Filter | F4 |
| Velocity Plot | F5 |
| Change SASW Properties | F6 |
| Change Velocity | F7 |
| IE Calibration | F8 |
| Mobility/Flexibility | F9 |
| Padding Data | F11 |
| Depth/Time Scale | Alt+d |
| Amplification | Alt+m |
| IR Analysis | Alt+i |
| (Slab) IR Mobility/Flexibility Properties | Alt+p |
| UPV Property | Alt+u |
| UPV Calibration | Alt+l |
| Calculate P-Wave Velocity | Alt+v |

Figure 1: Digital Filter Application

4. Once the Digital Filter is selected, a screen indicating the filter type will appear (See Figure 2).



6.0 PROCESSING

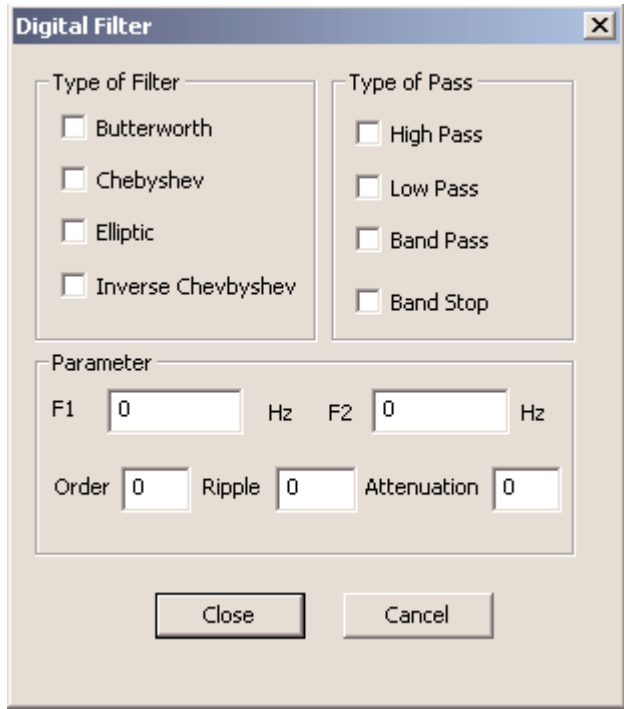


Figure 2: Digital Filter Selection

There are four options for digital filtering:

1. Butterworth
2. Chebyshev
3. Elliptic
4. Inverse Chebyshev.

Digital filter will be applied to all the data. To disable filtering, simply leave all the filter options unclicked. For more information concerning these types of filters, please refer to the Wave Theory and Processing Guide.

5. The next important aspect in SE/IR analysis is the velocity setting. To access the velocity being used to calculate the length of the shaft, simply click on ANALYSIS/CHANGE VELOCITY, see Figure 3.



6.0 PROCESSING

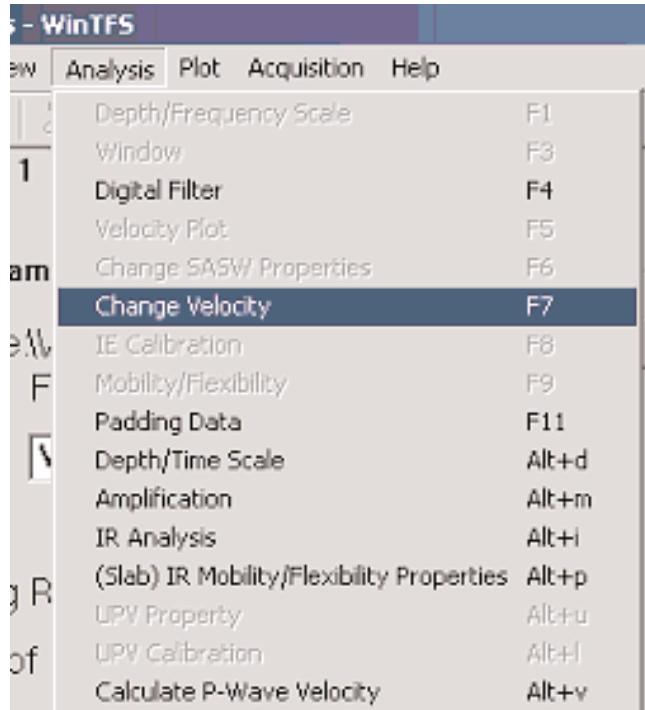


Figure 3: Change Velocity for Calculation

- Once "Change Velocity" has been selected, an input screen should appear prompting the user for the velocity and the units, see Figure 4. If a direct velocity measurement was taken using a hydrophone, then that number should be used. If a direct velocity measurement was not taken, then 12,500 ft/sec or 3,750 m/s should be used.

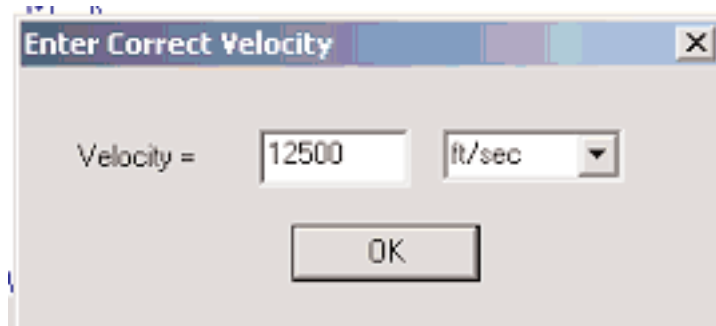


Figure 4: Velocity Input



6.0 PROCESSING

- At this point, the data can be analyzed. SE data is analyzed by picking the troughs in the wave form. This is done by placing the mouse cursor on the lowest point of the trough and left clicking the mouse. This should be repeated on each trough, moving from the left to the right. If the troughs are picked out of order, the depth calculation will be incorrect, see Figure 5.

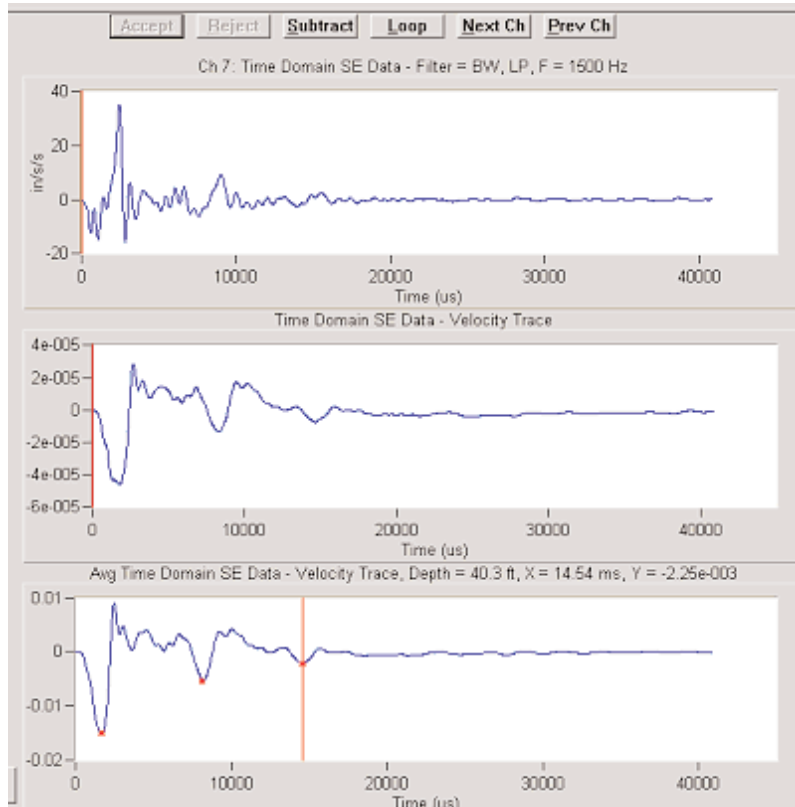


Figure 5: Picked SE data, note a shaft depth of 40.3 ft.

If the user mis-picks the trough, clicking the right mouse button will reset all picks. If the user has a difficult time discerning the lowest point in the trough, the user can double-click the right mouse button and enlarge the plot. To exit the enlarged plot, the user should double-click any mouse button. It should be noted that the picks from the enlarged plot will not be saved.

- If SE/IR data is collected with an impulse hammer, then IR analysis can be performed. This is done by selecting Analysis/IR Analysis, see Figure 6. next page.



6.0 PROCESSING

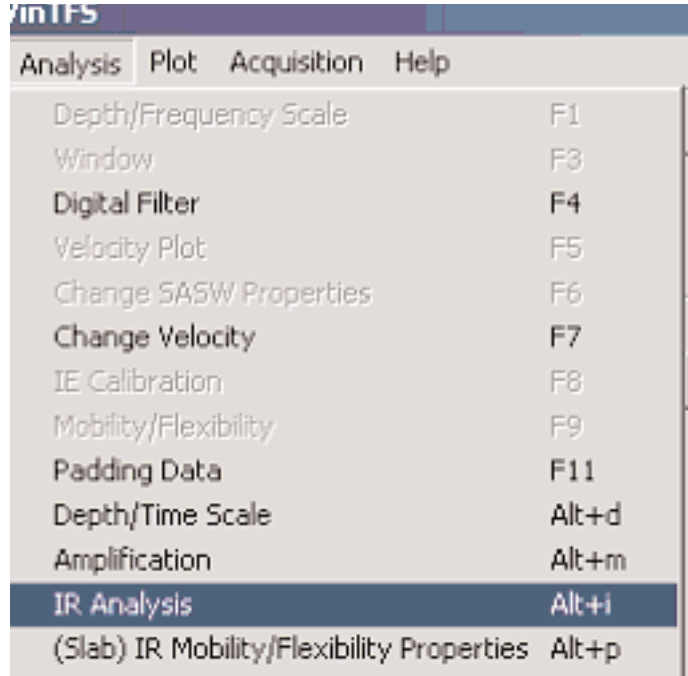


Figure 6: IR Analysis

- 9. Now that the IR Analysis has been selected, a prompt will appear asking the user if they would like the data to be padded and decimated. In general, both of these options should be selected, see Figure 7. Click OK.

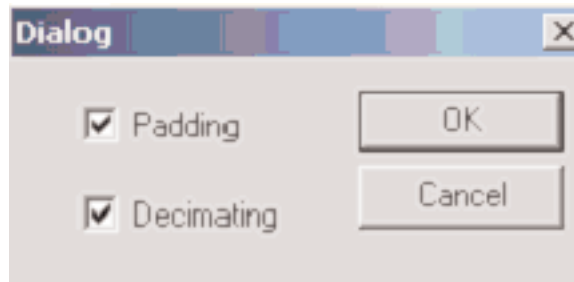


Figure 7: Padding and Decimating Option

- 10. The user will now be required to repeat step 1 for the Impulse Response (IR) analysis. Usually the same records are rejected in IR analysis as in the SE analysis.



6.0 PROCESSING

11. Once the records are either accepted or rejected, the IR Analysis can begin. This is done by picking the peaks seen the bottom plot, see Figure 8. The peaks are picked that same way as the troughs are picked in SE analysis, meaning that the mouse buttons and their corresponding functions are the same.

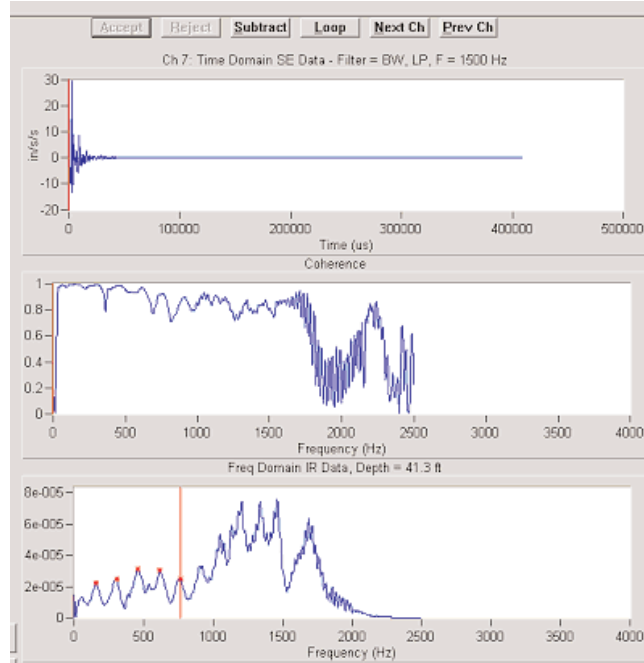


Figure 8: IR Analysis, note the depth of 41.3 ft.

12. The Sonic Echo/Impulse Response (SE/IR) Analysis is now complete.

For any questions concerning individual data sets, please contact Olson Engineering.

Colorado Corporate Office Phone Number: 303.423.1212

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Using Sound Technology*

