Appendix B: Quick Start Guide

B.1 Starting the Program

After the CHAMP has been powered up, the unit will boot up to the desktop where the user may start the program by double clicking the CHA-S icon. This brings up the Main Menu(Figure B.1)

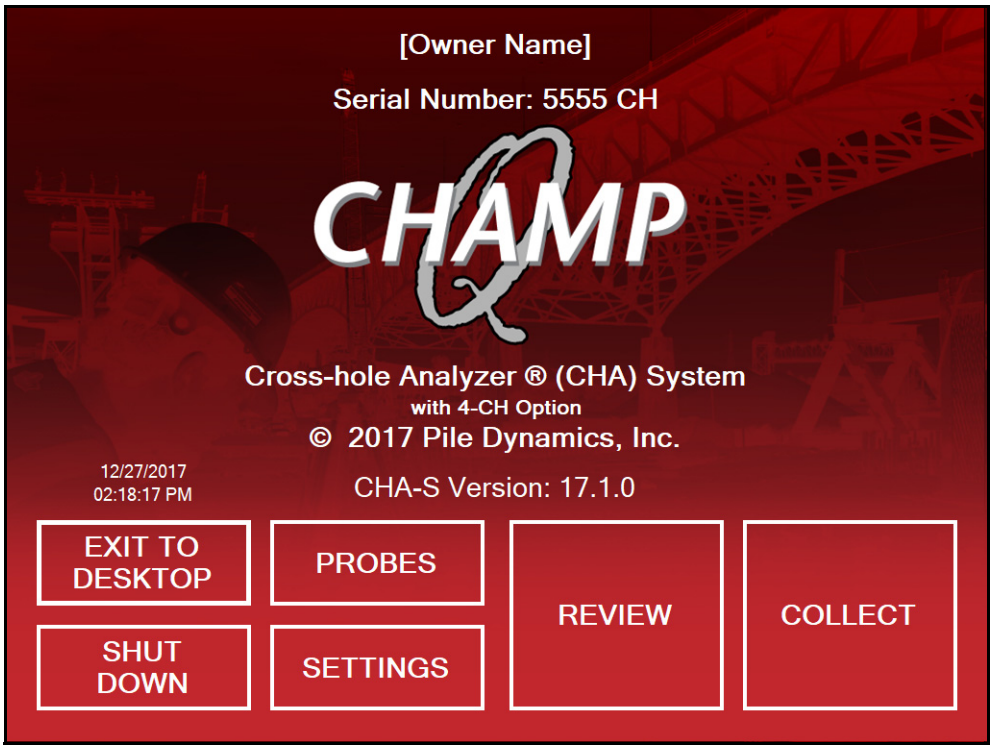

Figure B.1: Main Menu

The SETTINGS button will take the user to the Settings menu where units can be changed. The REVIEW button will allow a user to review previously collected data. The EXIT button terminates the program. To turn off the CHAMP, follow normal Windows shut-down procedures.

B.2 Probes Screen

Before starting a test, it is important to make sure that the correct probes information has been entered. From the MAIN MENU (Section), pressing **PROBES** brings up the probe screen (Figure B.2).

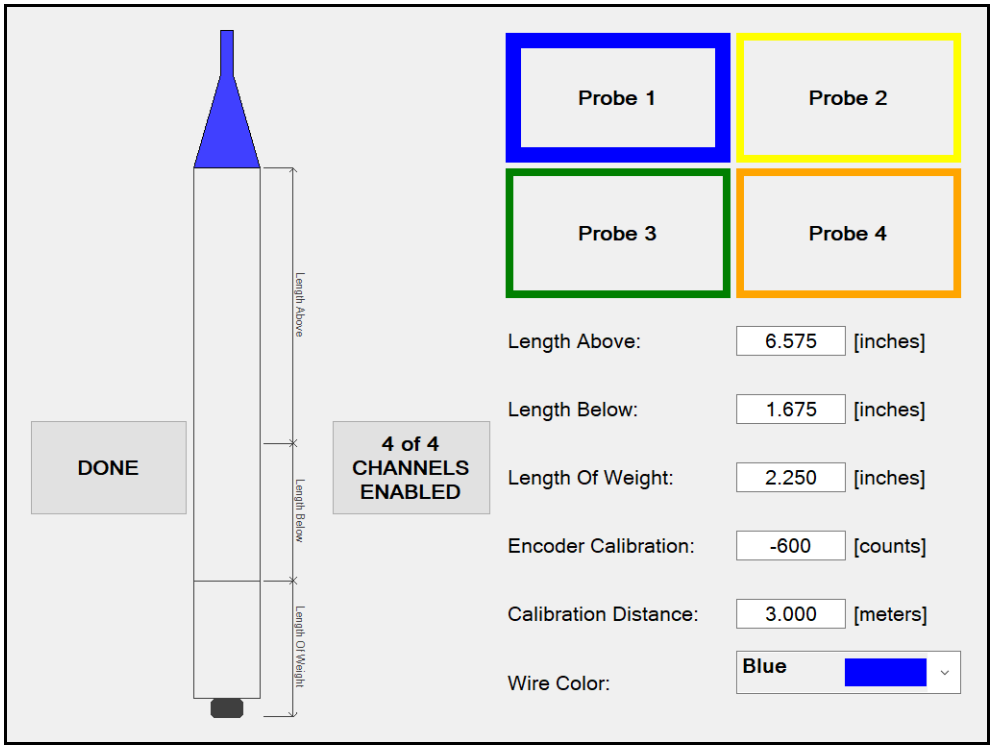

Figure B.2: Probes Screen

B.2.1 Assigning Probes to Channels

It is imperative to accurately assign the probe wire color to the input channel. The system come pre-configured with the following assignments

- Channel 1 - Blue Cable
- Channel 2 - Yellow Cable
- Channel 3 - Green Cable
- Channel 4 - Orange Cable

While it is possible to reassign cable colors to different channels, Pile Dynamics strongly recommends that the user maintain these channel assignment to reduce the potential for errors occurring during data collection. It is equally important that the probe cable, encoder wheel and encoder cable colors all match.

B.2.2 Encoder Calibration

The current recommended value for the encoder calibration is 595 for the currently used encoders and a calibration distance value of 3 (meaning 3 meters equals 595 counts).

Note: In the CHA-W software for reporting final results, the REPORT feature allows direct determination of the calibration if and only if the probes are pulled the entire distance of the tubes and the probe dimensions and tube lengths are properly entered.

When using encoders on the PDI tripod, two of the four encoder calibrations will have opposite sign values (two positive and two negative). If the encoders are directly on the shaft tubes, all encoder calibrations will be negative (e.g. -595).

B.2.3 Probe Geometric Values

The total length of the probe should be measured and the sensor location considered and both **LENGTH ABOVE** and **LENGTH BELOW** the sensing element should be entered. The actual transmitting and sensing elements are about 25 mm above the bottom of the main probe (e.g. **LENGTH BELOW**). The currently offered entire probe length is about 210 mm, leaving 185 mm for the length above the sensing element. However, if the nylon tube top inserts are employed, then the length of the nylon insert should also be included in the **LENGTH ABOVE** distance for the "calibration" described in the above "Note" to be accurate.

The length of any optional add-on weight below the probe (if any) must be entered for the appropriate probe as the **LENGTH OF WEIGHT**. These weights are useful to help allow the probes to descend in the water and overcome friction effects. Larger or longer weights are generally helpful for longer tube lengths. Enter a value of zero if no weight is used.

B.2.3.1 Switching Between 4 Probes and 2 Probes

The system can be used in a traditional manner by selecting the button on the right hand side of the probe image so that is displays '2 of 4 channels enabled' (Figure B.3). When two channels are enabled, Probes 3 and 4 will be displayed with a red X through each box to indicate they are unused.

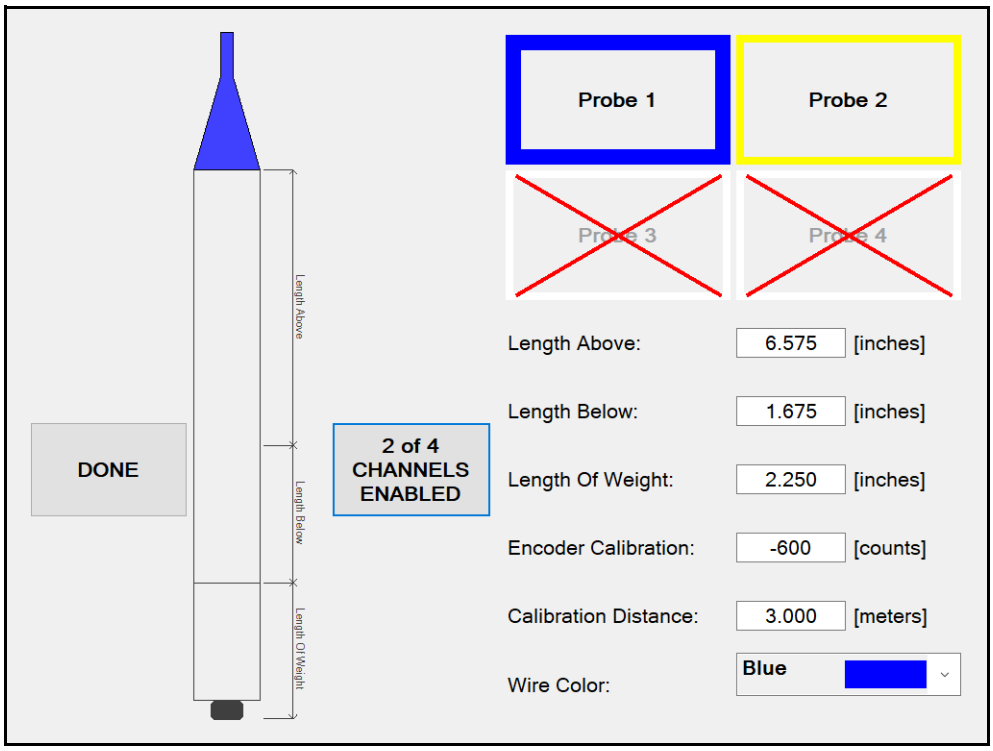

Figure B.3: The system can toggle between four probes and two.

B.3 Collecting Data

Data collection begins by selecting the 'Collect' button from the main menu (Figure B.1)

B.3.1 Create New Project

To create a new project or select an existing project, click **PROJECT** drop down menu (Figure B.4). The user may select an existing project or select the '**Create New**' which will open the keyboard screen where the user can define the new project.

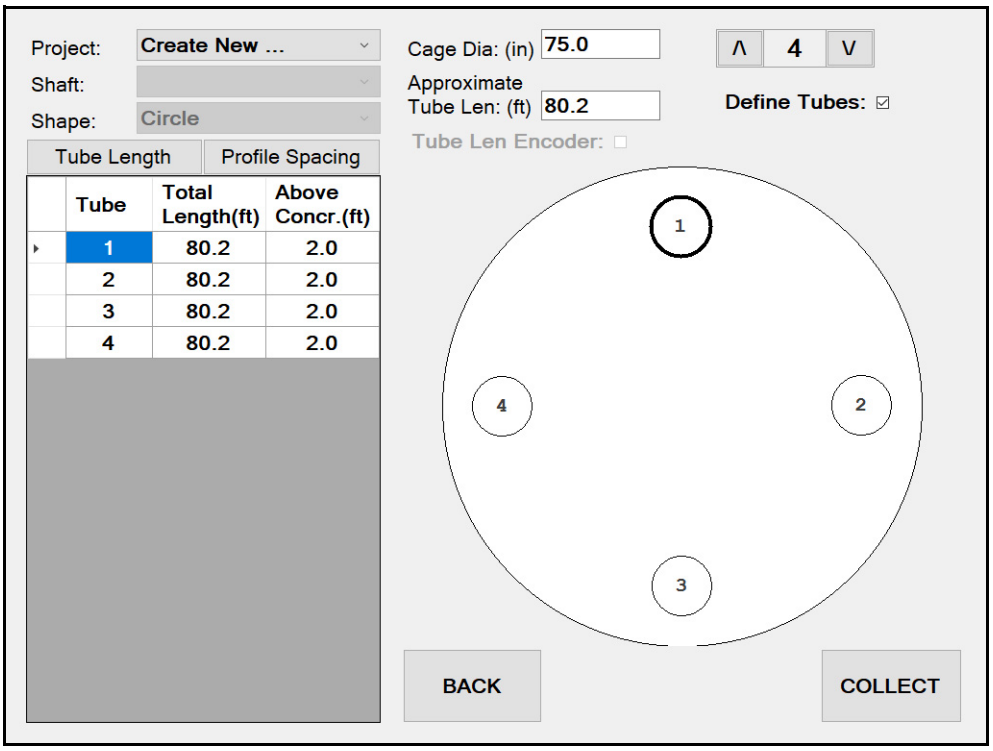

Figure B.4: Creating a New Project or Selecting an Existing Project

NOTE: Once a project is selected or created, all new data files (.chx files) will be placed into that project folder. **All projects and (.chx files) will be saved automatically in the CHAMP-Q Projects Folder on the CHAMP-Q; no data is unintentionally erased or lost.** It should be mentioned that eventually, this project folder and the files it contains should be downloaded to the office computer (or network server) for permanent storage and this temporary CHAMP folder then deleted to provide room for new data to be acquired.

B.3.2 Create New Shaft

After selecting an existing project or creating a new project the user can create a new shaft by selecting the 'Create New' from the Shaft drop down menu. The keyboard screen will appear where the user can define the new shaft name (Figure B.5).

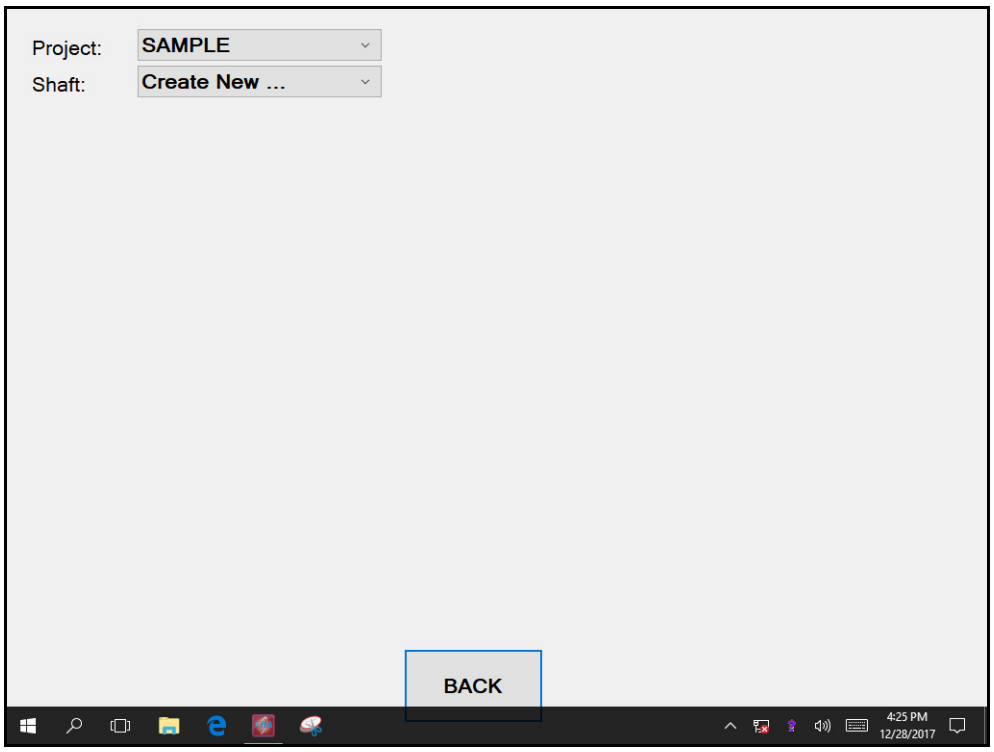

Figure B.5: The Pile/Profile Menu.

B.3.3 Shape

Currently the CHAMP-Q allows for circular shapes only.

B.3.4 Tube Configuration

The tube configuration window will allow the user to nominally define the pile tube geometry. The user has the ability to either provide basic geometric measurements or provide further details before proceeding to data collection.

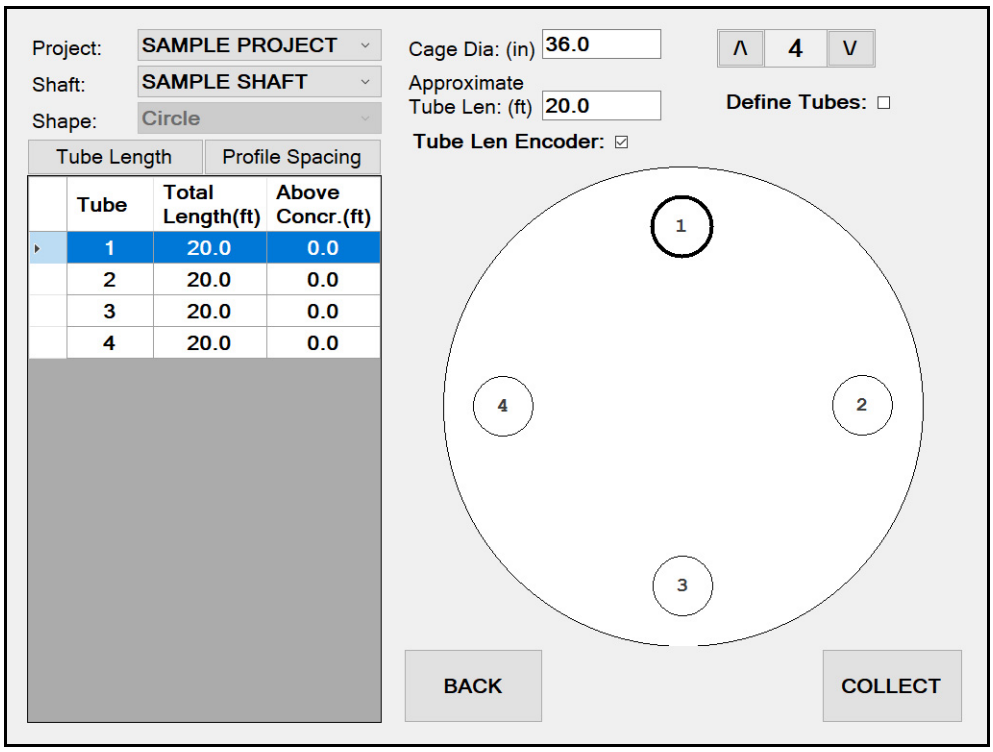

Figure B.6: Tube Configuration

B.3.4.1 Adjusting Number of Tubes

Adjust the number to the appropriate number of access tubes for the shaft by pressing the up or down arrow in the upper right hand side of the screen until it reflects the number of tubes in the shaft. The graphic display of the shaft will reflect the number of tubes displayed.

B.3.4.2 Basic Shaft Definitions

The following entries are the “nominal” values:

- **Cage Diameter:** is the diameter of the reinforcement cage.
- **Approximate Tube Length:** is the nominal tube length (can change individually later if needed. Figure 3.7)

The **Cage Diameter** is used to calculate the nominal distance between all access tubes and assumes the tubes are spaced uniformly around the perimeter. This Spacing is the average distance between adjacent pairs of perimeter tube centers (affects calculated wavespeed). Usually the spacings are not uniform, and the correct individual spacings should be adjusted either before data collection (by ensuring the "Define Tubes" check box is checked) or in post processing.

Once the user has entered all appropriate values they may either proceed to data collection by selecting COLLECT or provide more accurate measurement details by clicking the DEFINE TUBES checkbox.

B.3.5 Tube Length Edits

For most shafts, tube lengths and tube pair spacings are all non-uniform, so the user must edit the parameters for each individual tube length and tube spacing.

The next request contains a listing for editing of the individual tubes (Figure B.7). Generally the tubes are not identical, so the user selects a tube (by click,) and then enters the correct value for each tube of the **TOTAL LENGTH**, **LENGTH ABOVE**, and **DIAMETER**. In the Figure B.7 example, tube 2 is now altered.

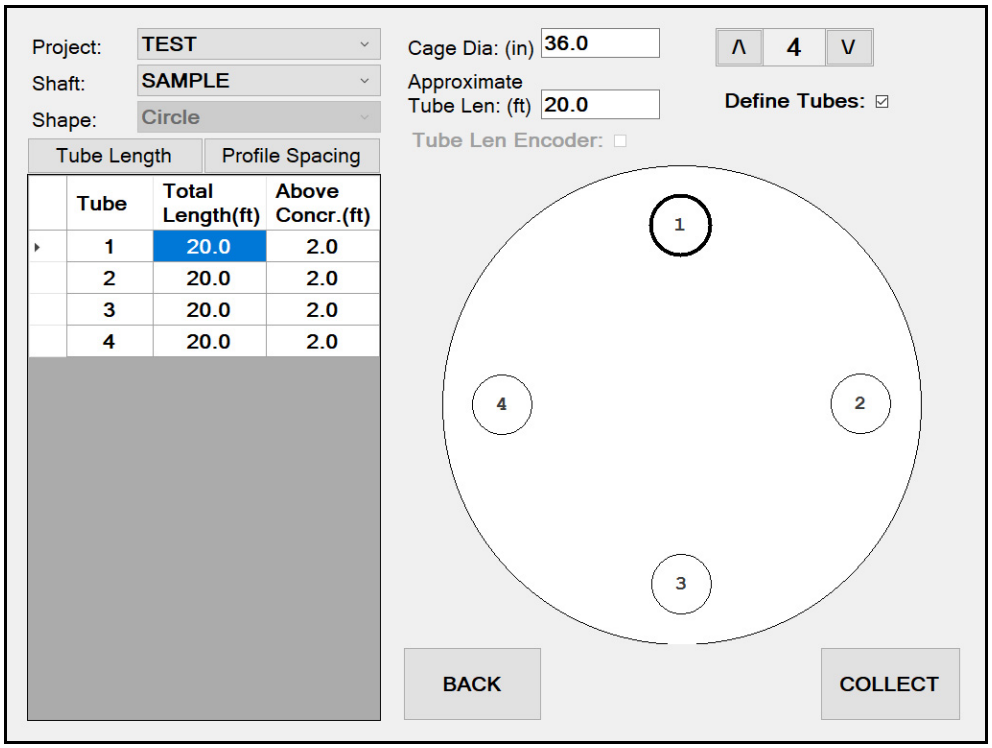

Figure B.7: Tube lengths can be entered by selecting the Tube Length tab and changing the total length and length above concrete for each profile.

B.3.6 Tube Spacing Edits

Since the spacings between tube (center to center) are almost always different than the "average", enter each new measured spacing by clicking the **Profile SPACING** tab.

Enter each new measured spacing. The **Status** column notes the **Reference Tube** which is the major diagonal indicating two particular tubes (user selected) from which all other measurements are referenced. This minimizes the measurements required to define the tube geometry.

The next request allows changes to the spacings between tubes. Only combinations of tubes that have one or the other reference tube included are contained in this list. For

example, with the reference being 1-3, only spacings containing either tubes 1 or 3 will be required, as shown in Figure B.8. Click to select the tube pair, and then click **SPACING** to access entry of a new value. The geometry will be redrawn to reflect the data entry. Only these measurements need to be made and entered, and all other tube spacings will be computed.

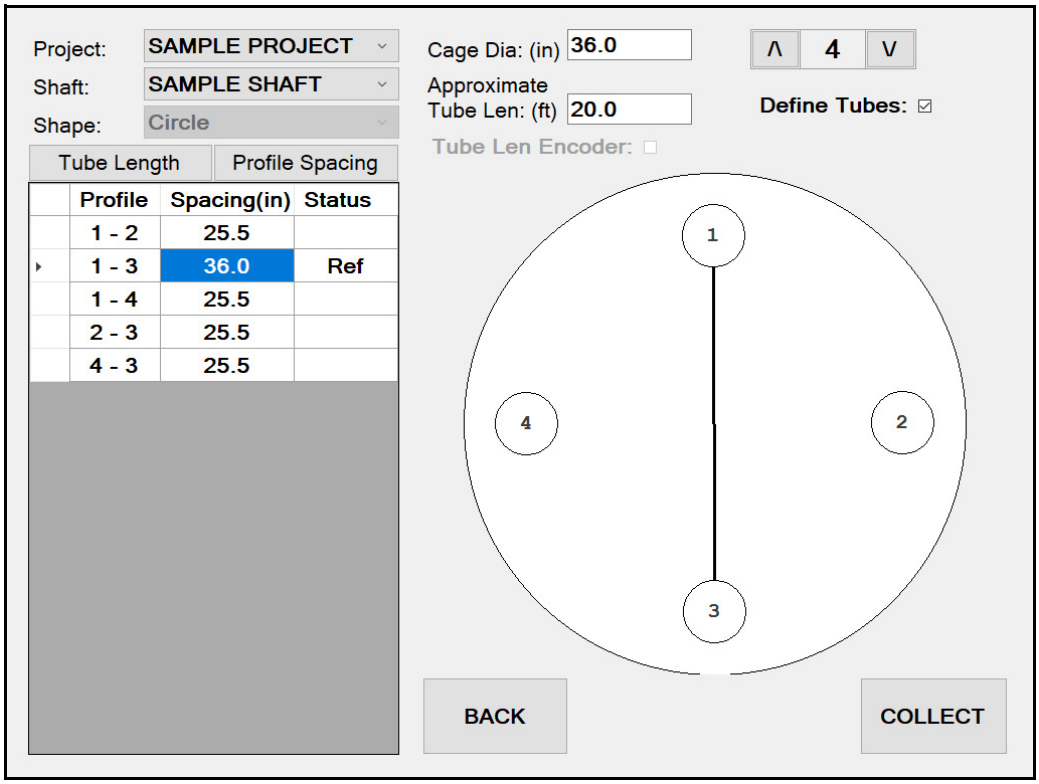

Figure B.8: Profile spacing can be entered by selecting the profile spacing tab and changing the distance for each profile.

When all changes have been entered, click **OK** to continue. If a physically impossible spacing is entered (relative to other entries) then the user will be notified and will require correction prior to continuing.

B.4 Profile Selection

Once the user completes inputting all the pile information (Total Tube Length, Length Above, spacings, etc.) click the **COLLECT** button to proceed to the profile selection screen

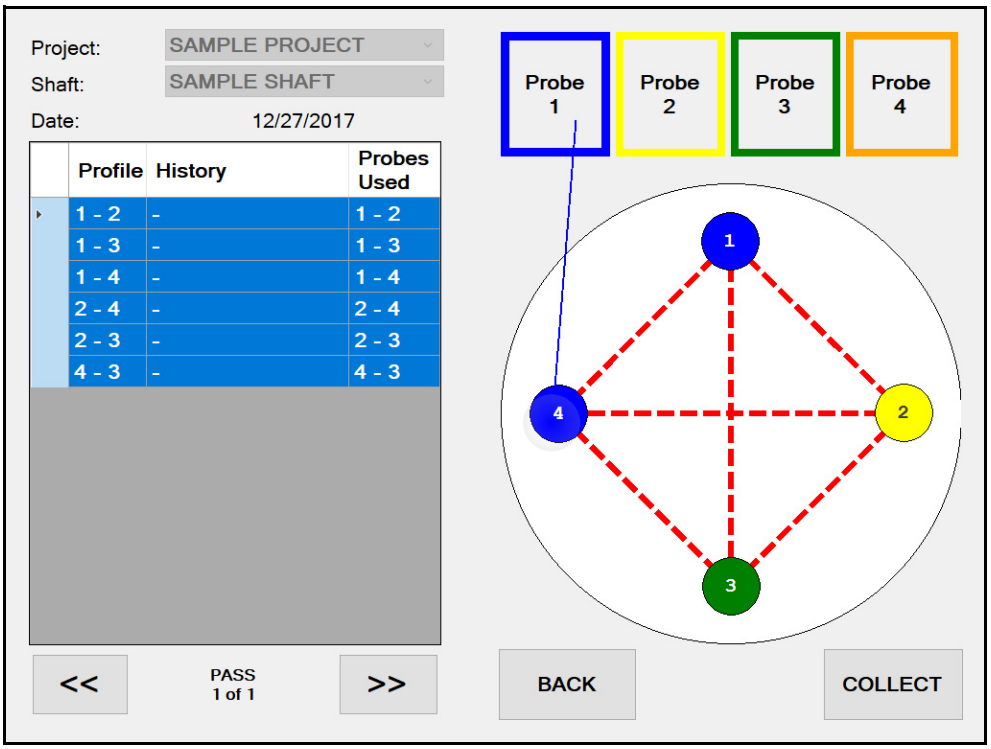

Figure B.9: The Profile Selection Screen allows the user to choose which profiles will be tested by assigning probes to access tubes.

The program will automatically assign probes to each tube when entering the profile selection screen. In general it makes sense to follow the assigned configuration but the user is able to adjust which probe is assigned to which tube. **It is critically important that the displayed configuration match the actual placement of the probes**. Failure to follow these assigned tubes may result in strange results, particularly when the tube lengths differ or when offset testing is performed.

If adjustments to the tube assignments are required the user may simply select the probe and drag it to the tube it is placed in. Once done, the access tube color should reflect the color of the probe in that tube. For a four tube shaft this will on require one pull to complete all six profiles.

B.4.1 Probe Assignment for Multiple Passes

In situations where more that four tubes are installed in a shaft, data collection will require more than one pass to complete all profiles. In this situation the CHAMP-Q is pre-programmed to assign the probe placement for the minimum number of passes (Figure B.10)

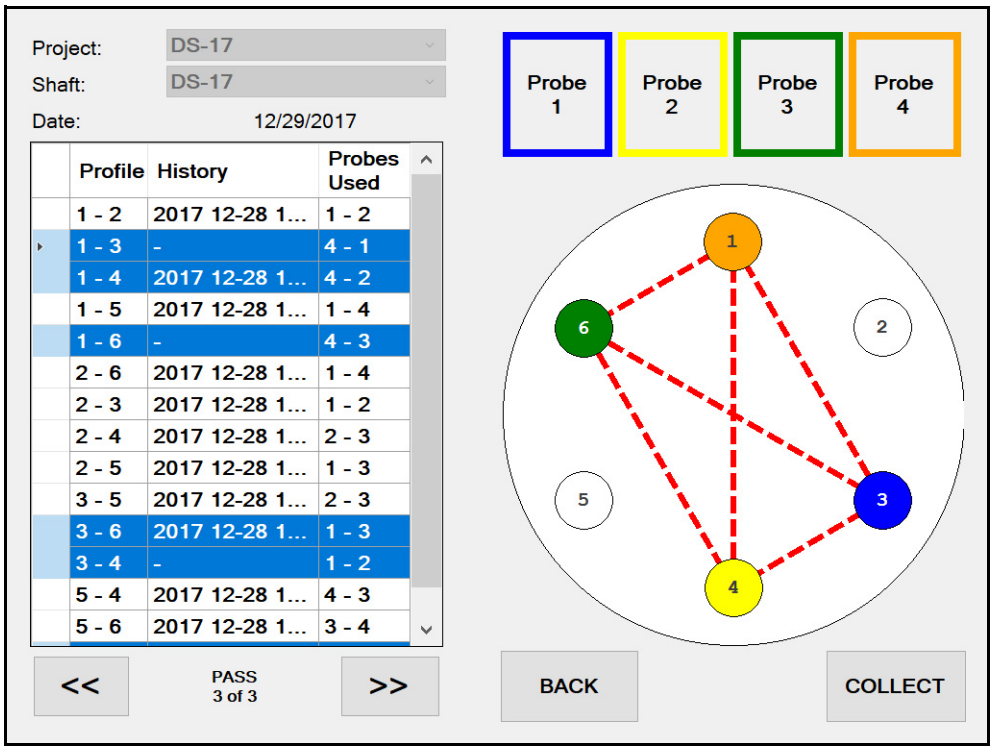

Figure B.10: **Probe assignment are pre-programed to minimize the number of passes required to complete a test.**

Once a pass is completed the user can move to the next set of probe assignments by selecting the [>>] button. Please note that while the program minimizes the number of passes required for a test, often multiple measurements for a given profile are collected. The CHAMP-Q will not save over a file but creates multiple files for the same profile, from which the user can choose for final reporting..

B.4.2 File History

If a profile has already been collected for a given profile it will be noted in the History column of the Profile Page. Profiles with a dash in the history column have yet to be collected.

B.5 Proceeding to Data Collection

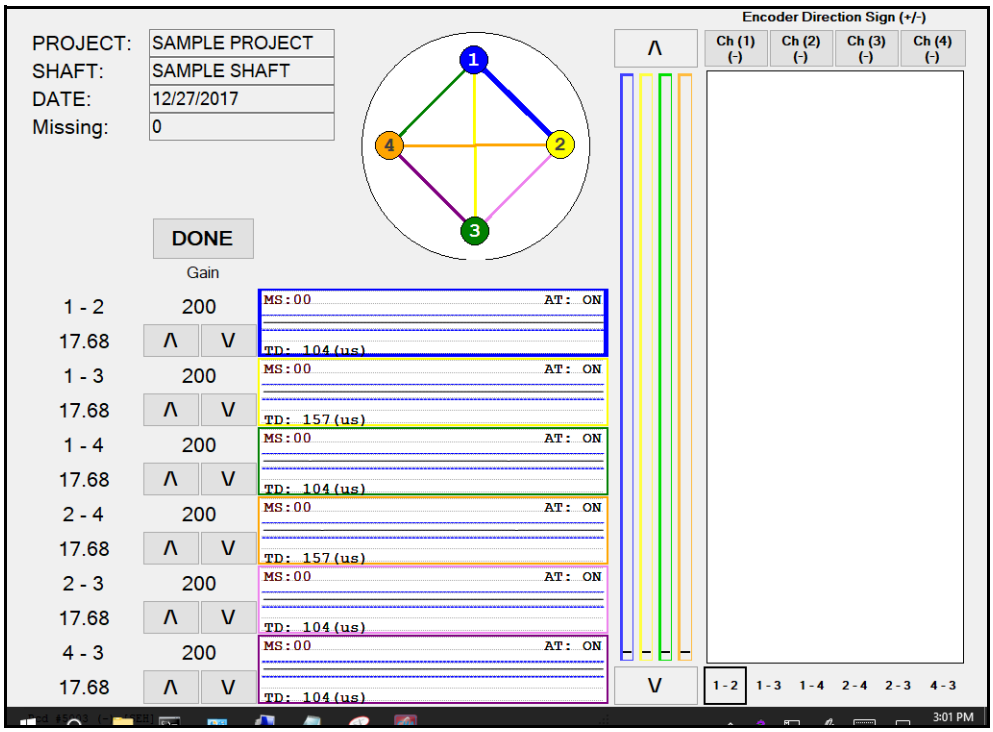

Figure B.11: Data Collection Screen

B.5.1 Profile Monitor Windows (Raw Data Windows)

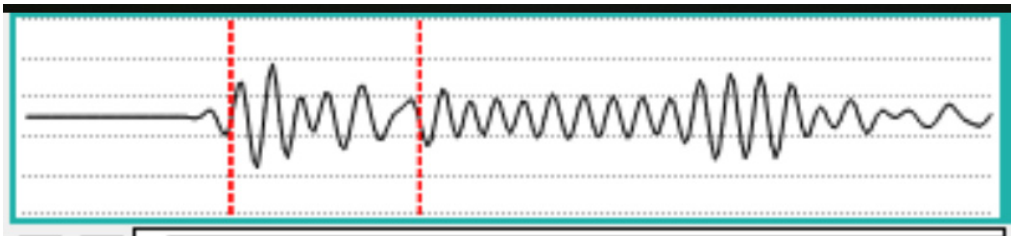

Figure B.12: The Data Acquisition Signal

This left side of the data collection screen display all six of the actual data acquisition signal graphs simultaneously (250 data points, or 500 data points, or 1000 data points, either sampled at 500 kHz or 1 MHz or 2 MHz) at the current probe depths, and is offset by the trigger delay (TD). The graph represents a range of –10 to +10 volts (center is zero). This trace is nested with others versus depth to comprise the "waterfall diagram" shown on the right half of the screen.

B.5.2 Zeroing The Depth Encoders

The CHAMP will allow data collection by either pulling the probes from the bottom of the access tubes (generally preferred) or lowering the probes from the top of the access tubes. Both of these methods effectively reference "zero" depth to nominally the top of

the concrete, and show the current probe location referenced to the top of concrete (defined as zero depth). Accurate measurement of depths requires that carefully measured dimensions of each tube (such as: total tube length and length of tube above concrete) have been entered properly in the tube wizard, and that the probes are in the correct tubes indicated by the Tube Wizard.

Initially, the right half of the data acquisition screen is blank, because no data has yet been collected. For each profile the user must first define the current probe location to set the depth reference (or **ZERO**). There are basically two methods of referencing the probe depths: either to the top of the tubes, or to the bottom of the tubes.

B.5.2.1 From the Tube Bottom

The first (preferred) method of referencing is when both probes are physically located at the bottom of their respective tubes. Once all slack has been removed from the probe cables, select the down arrow button (Figure B.13) to set the current probe depth to the bottom of the access tubes. You should see one line of "waterfall" data (right half of screen) at the pile bottom (Figure B.13). If the **MISSING** window shows any value but zero, press the down arrow button a second time.

If a profile contains access tubes with varying bottom tube elevations, (for example a tube was obstructed a partial distance from the bottom of the shaft), after zeroing the probes, the probe at the higher elevation should not be pulled until all probes are at the same elevation then pulling all probes in parallel.

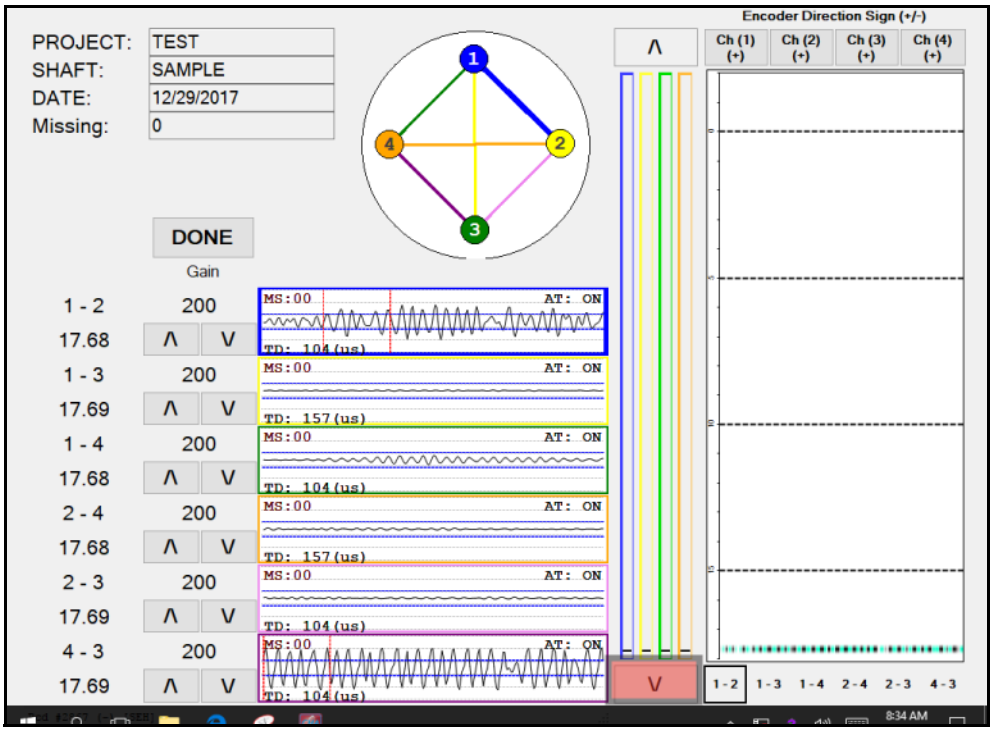

Figure B.13: Zeroing the Depth Encoders at the bottom by selecting the down arrow (highlighted in red).

An additional minor adjustment for the probe depths occurs because the active transmitter and receiver probe elements are located near the bottom of the main probes.

Note: these values are set in the PROBES button of the MAIN MENU (Section), and remain unchanged unless new different probes are used, or if the lengths of bottom weights are changed.

B.5.2.2 From the Tube Top

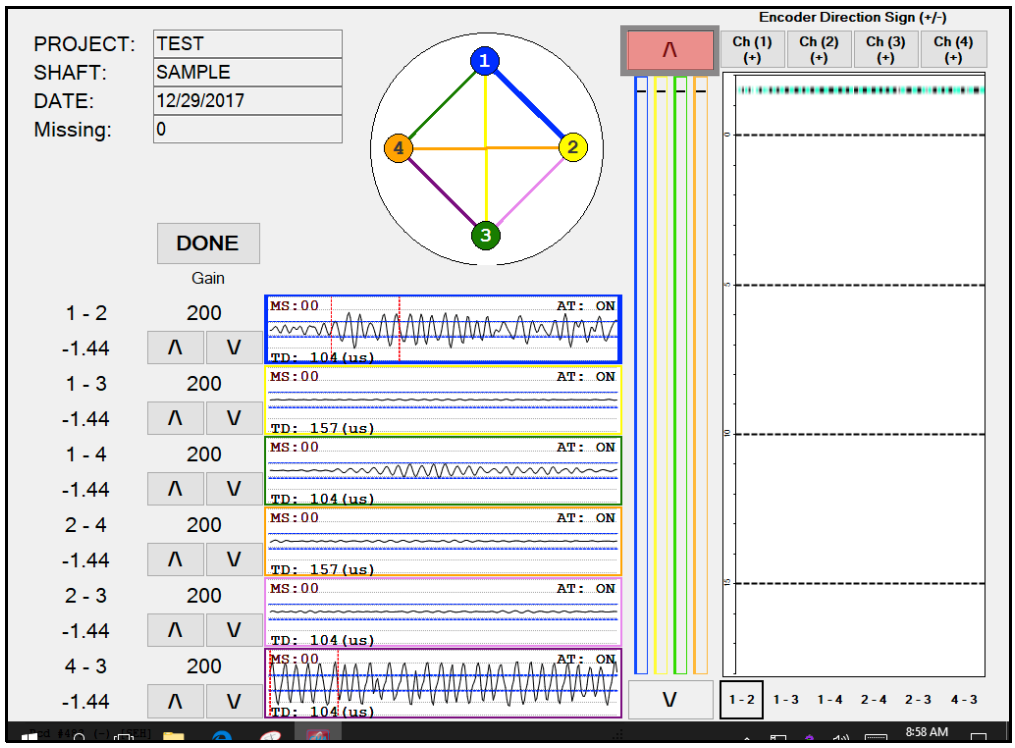

Figure B.14: Zeroing the Depth Encoders at the top by selecting the up arrow (highlighted in red).

The other optional method (but only infrequently used) is when all probes are physically located at the TOP of their respective tubes. Pressing the up arrow button (Figure B.14) sets the probe location to the top of the access tube. Again a small adjustment is made for probe length above the sensing element, which should also include the length of the nylon tube top inserts, if used.

B.5.3 Trigger Delay

The **trigger delay** (TD) is the wait time between generating a sonic pulse and the start of data acquisition for detecting and capturing the received signal (needed because of the finite time window of data collection and variable distances between tubes). Ideally, trigger delay TD should be set so that the leading edge of the sonic pulse is about 20-30 percent from the left edge of the graph. This allows for variation of "First Arrival Time" ("FAT" – left edge of the waterfall diagram) when tubes are not parallel (adequate margin to the left of, or prior to, the real first arrival), or allows for slower wavespeeds due to a defect. The CHAMP-Q automatically calculates a suggested value for TD (based on tube spacing and wave speed).

(TD [in "microseconds"] = 10^6 * (tube spacing / wave speed) – 100)

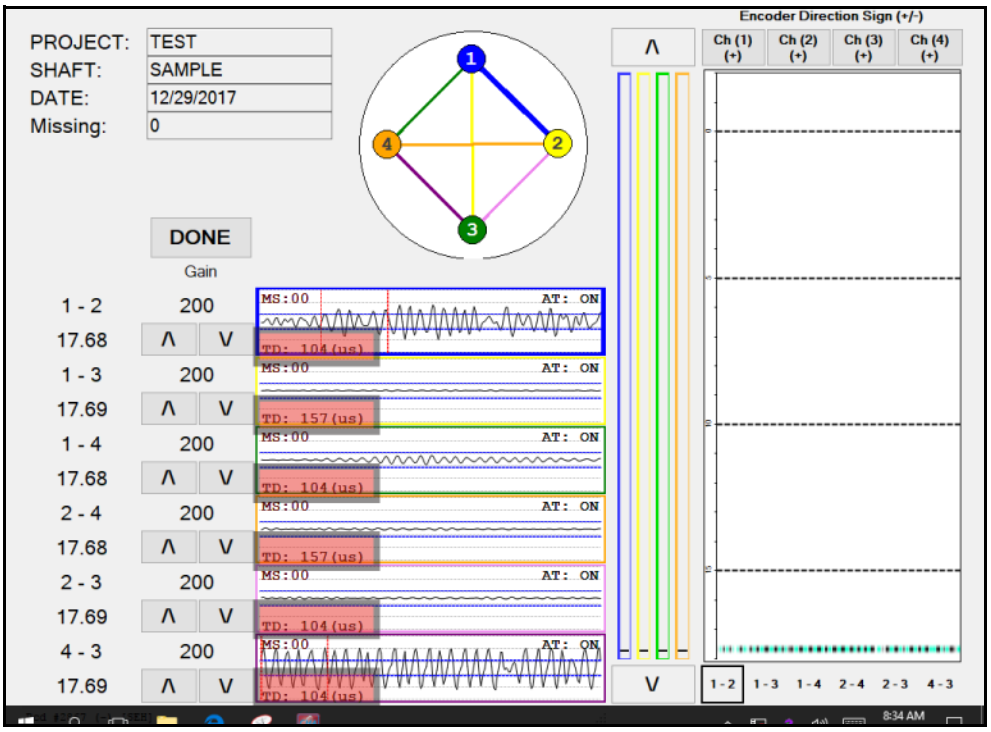

Figure B.15: **The Trigger Delay is noted in the red shaded area for each profile.**

Tube spacing divided by wave speed is the theoretical travel time for a pulse between tubes. Subtracting 100 (micro-seconds) offsets the arrival time by 40% (of 250 points which is 0.5 milliseconds at a sampling frequency of 500,000 Hz), or 20% (of 500 data points which is 1 millisecond). Note that the TD value can not be adjusted **so it is crucial that a reasonable distance be entered in set-up to allow TD to be set properly during data acquisition to display the left edge of the waterfall.** The signals must contain the desired ("left edge" of waterfall) First Arrival Time data during data collection. If you do not see the left edge of the data, the assumed wavespeed or tube spacing at deeper depth is different and the TD should be adjusted manually).

B.5.4 Signal Gain

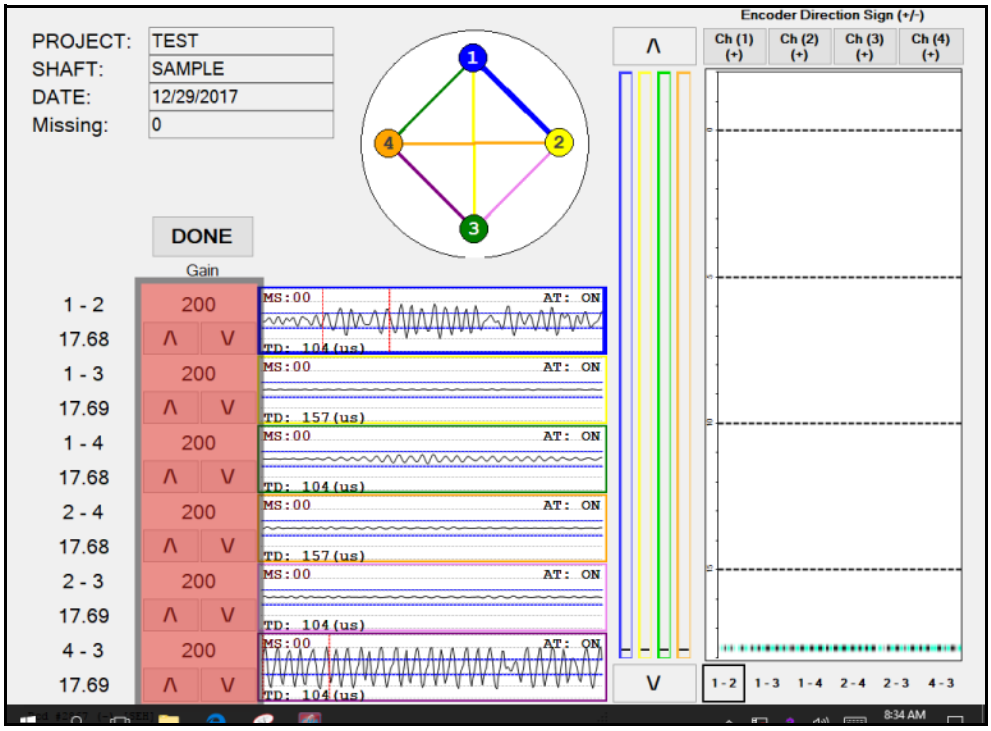

Figure B.16: The Gain setting for each profile can be adjusted at the beginning of data collection by selecting the up or down arrow below each gain value (highlighted in red).

The **GAIN** of the signal processing circuitry can be adjusted up or down using the up or down arrows below each gain setting (Figure B.15). This adjusts the strength of the signal data display graph (immediately to the right) for each respective profile. Ideally, the gain should be set high enough so that the signal is nominally at least 60% of full scale, yet low enough so that (most) larger peaks are less than full scale. Usually the same GAIN is used for all perimeter profiles. Larger tube spacings (such as the main diagonals) require higher gain.

The entire profile (for one tube pair) must use the same gain. If the gain needs adjustment, the entire profile must be repeated (probes returned to tube bottoms, the "zero" reset, and probes re-pulled). It is often best to make all adjustments for **GAIN** when the probes are raised about one or 1.5 meters (3 or 5 ft) above the shaft toe where the shaft is likely to be more uniform, so that a potential "soft bottom" does not influence the input selection.The CHAMP-Q will prevent adjustments to the gain after the probes have been pulled 5 ft (1.5 m).

B.5.5 Tracking Depth

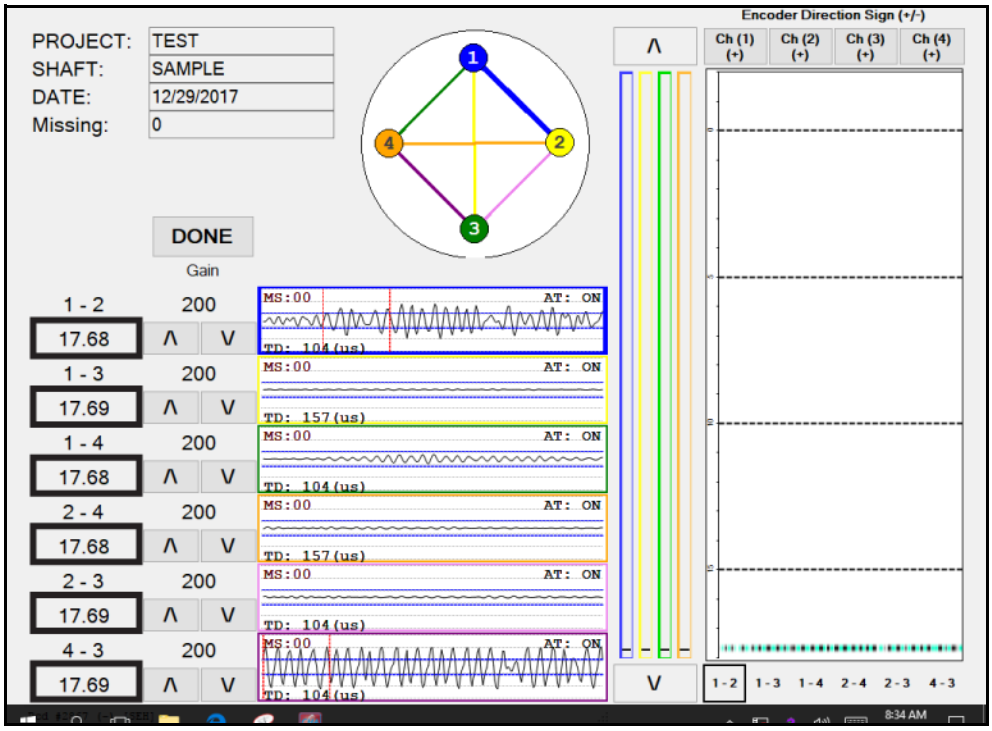

Figure B.17: Depth for each profile is displayed below each profile name (noted by black square).

Depth locations are displayed below each profile. Additionally the graphs to the left of the waterfall diagram display the location of each probe.

If a probe indicates a depth difference of greater that 6 inches (150 mm) from the other probe, the probe will be highlighted in red on the depth display and all associated profiles will be highlighted in red.

B.5.6 Missing Data Sets

The Missing box in the upper left hand side of the data collection screen reports the total number of missing data sets for all profiles. This occurs if the cable is pulled too fast for the scan/second rate and the signal is therefore skipped. If a data set is missing, the user may lower the probes until the data set is recovered ("Missing" value returns to zero), and then resume pulling the probes. Any missing profiles will also be noted by a red X on the probe graph noting the depth of the missing data set.

B.5.7 Switching Waterfall View

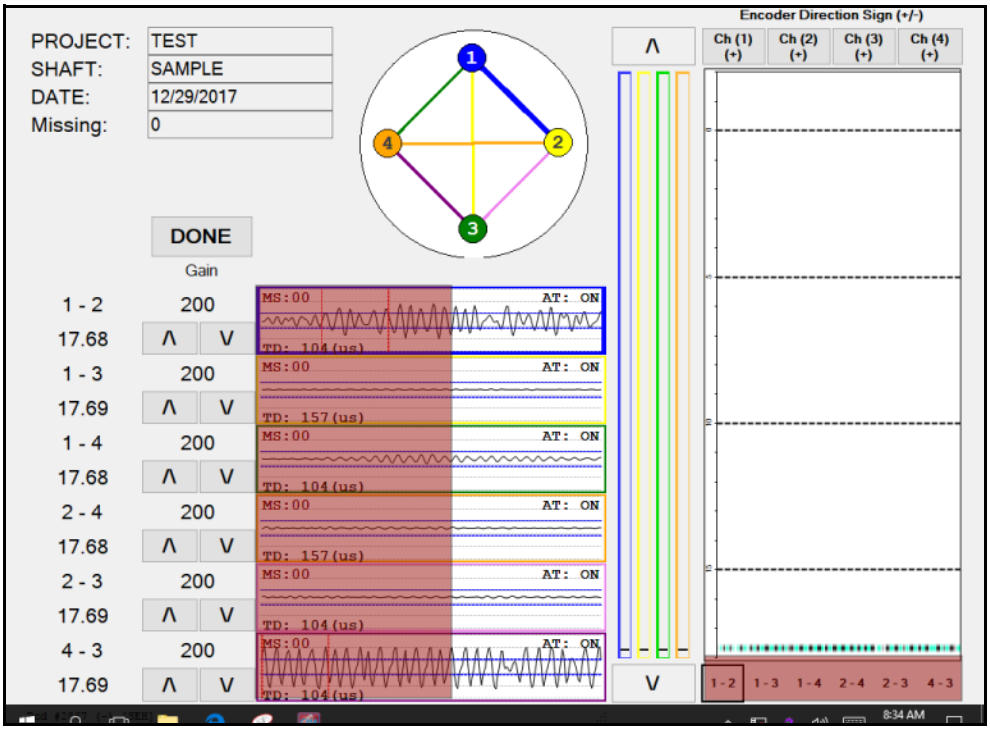

Figure B.18: The displayed waterfall diagram may be changed during data collection.

The displayed waterfall diagram may be changed during data collection by either selecting the appropriate tab under the waterfall diagram or touching the left hand side of the data acquisition signal for the desired profile.

B.5.8 Turning On/Off AT Lines

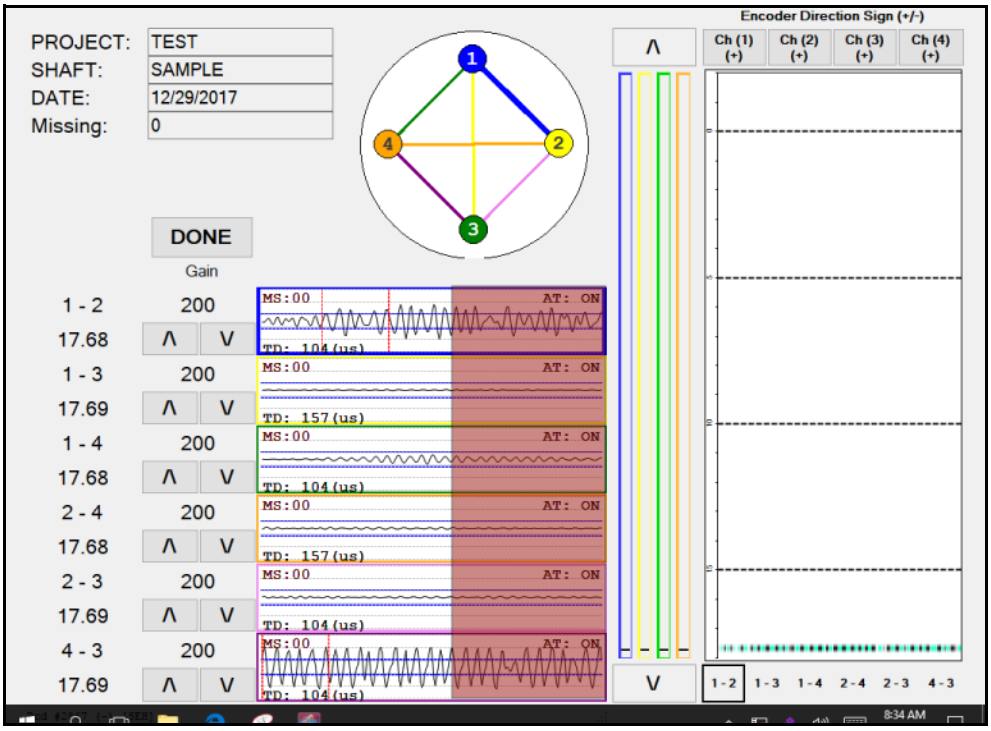

Figure B.19: The AT lines for each profile may be toggles on or off.

The arrival time lines for each profile in the waterfall diagrams may be toggled on or off by clicking on the right hand side of each data acquisition signal.

B.5.9 Completing Data Collection

Press **DONE** to finish the data collection (the active tube pair is shown on this button). CHAMP-Q then proceeds to the data review screen where the waterfall for all six profiles may be view simultaneously.

B.6 Data Review

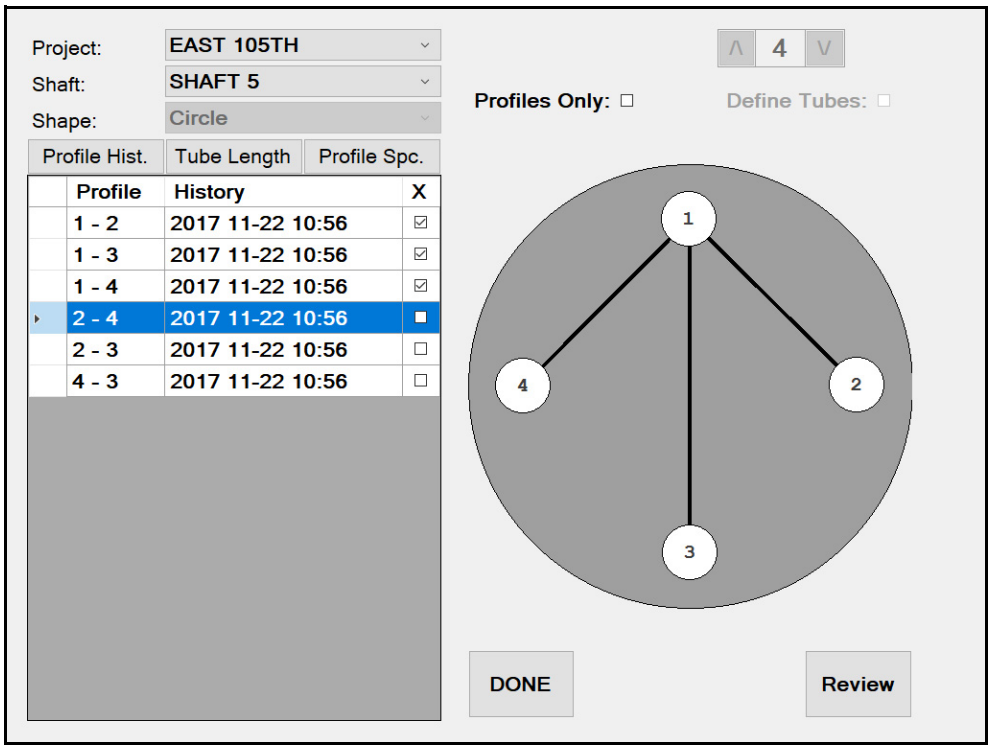

Figure B.20: The user may choose up to 6 profiles to review simultaneously.

Selecting Review from the main menu will allow a user to review up to six profiles from one shaft.

B.6.1 Data Review Screen

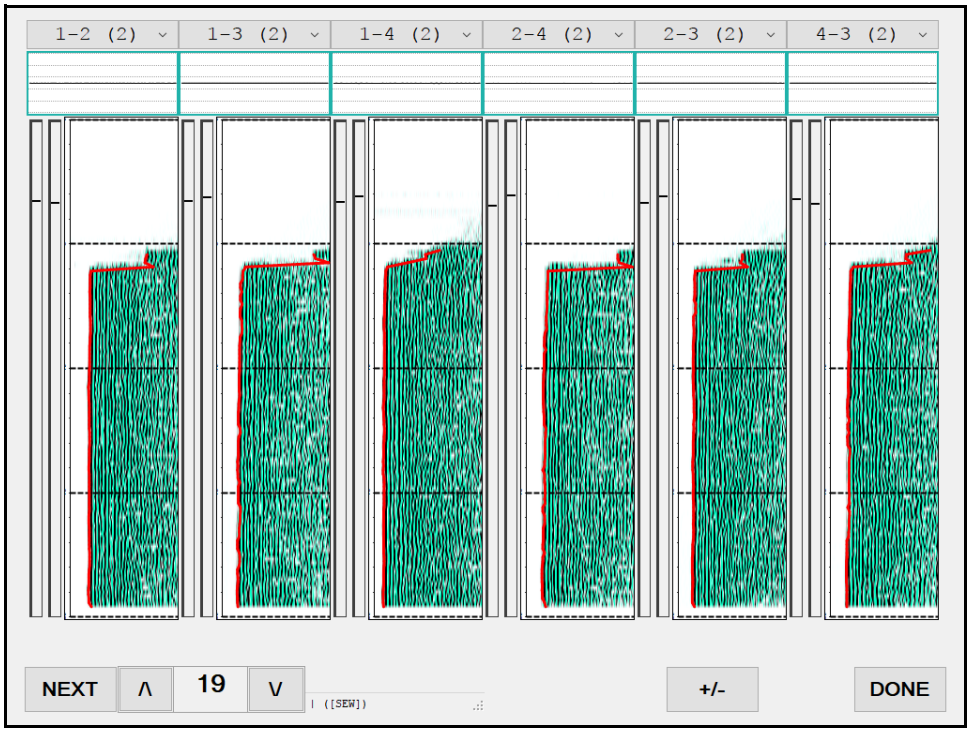

Figure B.21: Data Review Screen

The review screen (Figure B.21) allows the user to review data, adjust AT thresholds, and modify the **COLORS** and **SCALES** of the waterfall color pallet and intensity as described in Section B.7.11 and Section B.7.12

If the tube pair has more than one test, the user may select a different data set for that profile from the top drop down menu for each profile. Multiple data sets for the same profile will display a name appended with additional characters (e.g. 1-2-1 indicates the second test of the tube pair 1-2, while 1-2-3 would indicate the fourth test of tube pair 1-2). When a new profile is selected the review screen will be redrawn with the new profile.

B.6.2 Scrolling Through Data Sets

The up and down arrow buttons in the lower left hand corner of the review screen allow the data to scroll the depth cursors up and down through the data. Continuously pressing the UP or DOWN arrow will cause continued movement until the desired shaft detail is in view..

B.7 Data Transfer and Analysis

When data collection is complete, return to the MAIN MENU and press EXIT. The collected data is stored in the CHA projects folder, which can be accessed from the Windows desktop.

Insert a USB drive into one of the USB ports of the CHAMP and copy the desired data files/project folder using one of the following operations:

1. Drag the desired data file/folder from the CHA Projects Folder to the drive corresponding to the USB port/memory stick.
2. Press and hold on the desired data file/folder to be copied and select **COPY**. Then press and hold on the drive corresponding to the USB port/memory stick and click **PASTE**. This operation is analogous with the right click feature available while using a mouse.

The data can be then transferred to a personal computer and accessed by the CHA-W software program for final data processing. That would include final selection of **FAT** by the **EDGE FINDER**, analysis for defects by the **DEFECT ANALYSIS** feature, and final report preparation. A separate Manual for the software program CHA-W, also provided by PDI, describes that program's operation.

B.7.1 Editing Geometry

Because the CHAMP-Q allows data collection without detailed entry of tube distances and lengths it will be necessary to perform this task in not entered in the field. Please note that any wavespeed calculation and subsequent analysis with the tomography program is dependent onthe accuracy of the distance measurements between the access tubes as well as the vertical difference in elevation of the probes during data collection. Failure to enter accurate distance values based off of actual field measurements will likely result in incorrect data analysis and interpretation.

To perform the necessary edits to the pile geometry the user must do so by creating a report in the CHA-W program and then selecting the 'Profile I...' from the 'Edit menu (Figure B.22)

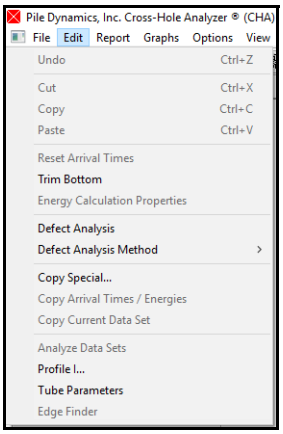

Figure B.22: The Profile Editor can be accessed from the 'Edit' menu.

The profile editor scree will appear where the user may adjust many parameters. Within the scope of this manual we will limit the discussion to altering the tube length and spacing values.

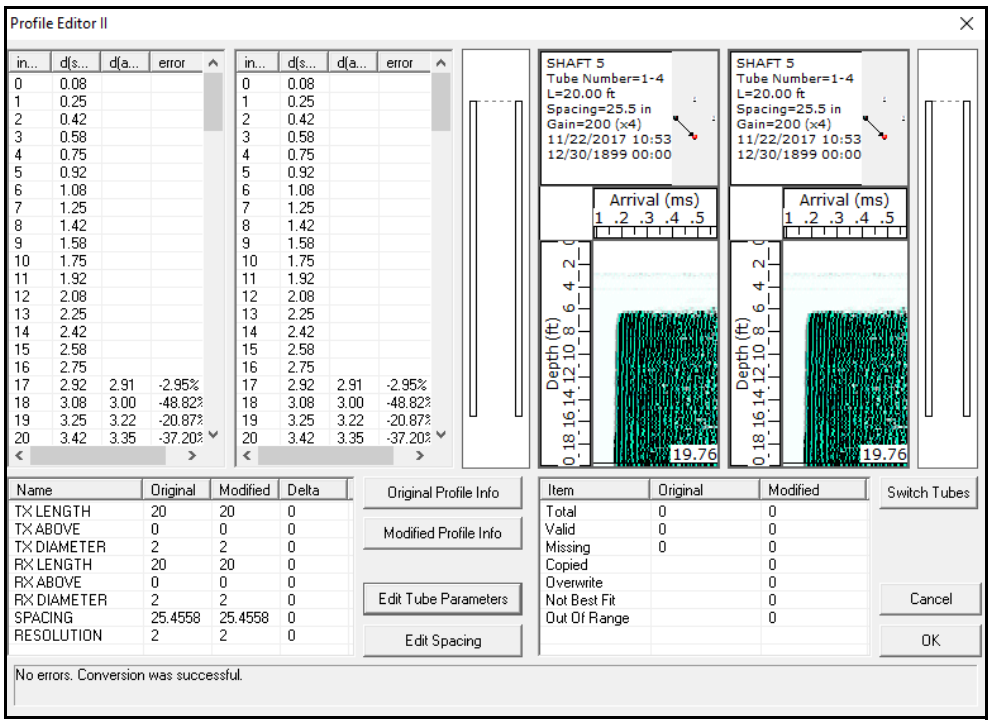

Figure B.23: The profile editor in CHA-W allow the user to change spacing and tube lengths.

B.7.1.1 Changing Tube Lengths

Tube Lengths and length above concrete can be entered by selecting the 'Edit Tube Parameter' from the profile editor window. The user can redefine the total tube length and change the zero reference by altering the tube length above concrete. Once all modifications have been made click OK to accept changes.

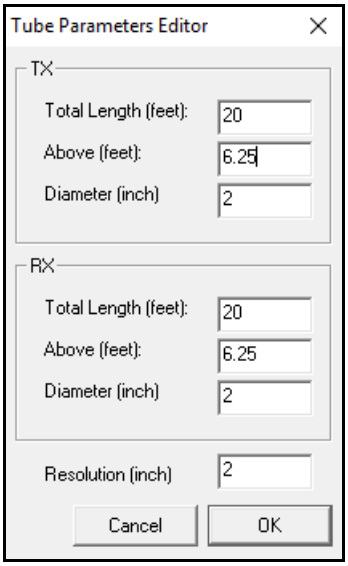

Figure B.24:

B.7.1.2 Edit Tube Spacing

Tube spacing may be altered by selecting the ‘Edit Spacing’ button in the Profile Editor, changing the values and clicking OK to apply changes.