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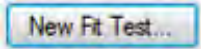
FitCheck Solo™

QUICK START GUIDE

After installing the program, the following steps should help you run attenuation tests without delay. **Only the operator should be able to view the PC screen**. The test subject will use the mouse to respond.

1. Double click on the FitCheck Solo headphone icon to start the program.

2. Either select an existing study or create a new one. The 'study' is simply the database file where the data is stored.

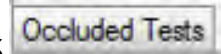3. Check left and right earphones on the Sound Check window. Click close.
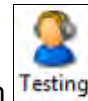
4. The testing window should be open. If not, click on the Testing icon .

5. Select the test subject from the drop down box or click New Subject and enter appropriate info.

6. Click New Fit Test , select HPD and enter appropriate data. Click OK.

7. Instruct subject as follows:

 "When the test begins, FitCheck Solo will present a pulsing test sound. Use the scroll wheel on the mouse to adjust the level of the pulsing test sound so that you can barely hear it. You can lower the sound until you don't hear it and then bring it back until you can barely hear it if that is easier. After you are satisfied with the adjustment, click the left mouse button. The sound will then get louder, and you are to repeat the process. Eventually the test sounds will change frequency, or pitch as the test proceeds through multiple frequencies. Keep performing the same operation with the mouse wheel and left button. I will monitor the test and tell you when it is complete."

8. With the subject's ears open, click , have subject don headphones, and click .

9. When test is complete, have the subject remove headphones, click and have the subject don hearing protectors and then refit headphones.

10. Click [Start Test].

11. When test is complete, the data may be viewed by looking at the PAR (Personal Attenuation Rating) Report.
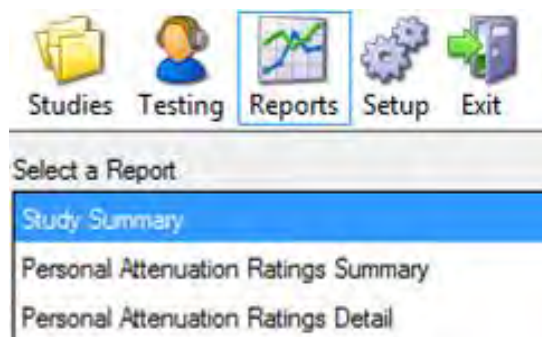
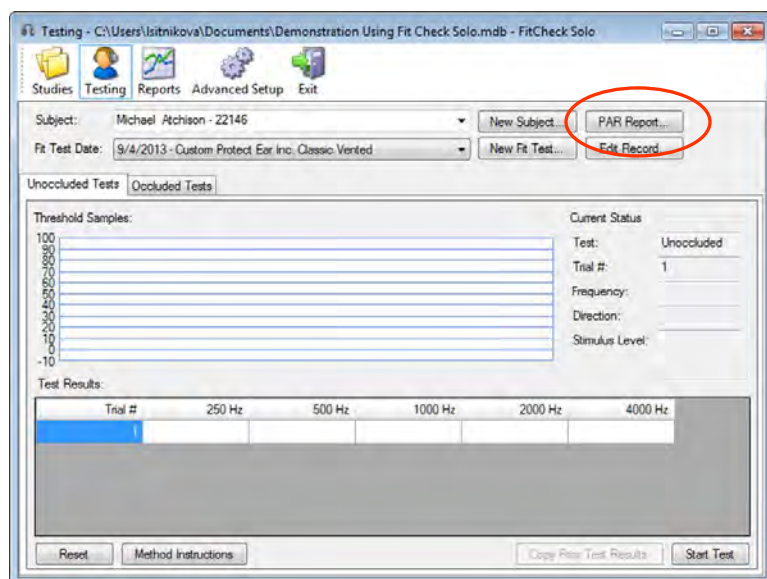Or you can arrive at the reports screen from the test screen by clicking the PAR report button.

Figure 1

FitCheck Solo™

INSTALLATION GUIDE

1   Installation of FitCheck Solo

1.1   System Requirements

FitCheck Solo runs in the Windows XP/7 environment. The PC must have a 24-bit audio card. Windows XP Service Pack 3 is not compatible due to some Microsoft idiosyncrasies. The program comes with a USB mouse with a scroll wheel and custom FitCheck Solo™ sound isolating FitCheck headphones.

FitCheck Solo must be used in a quiet office environment. If the room is too noisy, the open ear test results will be elevated and the measurements will be compromised.

1.2   New Installation

Insert the USB Flash drive marked program into the USB port of your computer. Using Windows Explorer, navigate to the folder Setup.exe file on the Flash Drive containing the FitCheck Solo™. FitCheck Solo™ has an installer called FitCheckSoloSetup.exe or Setup.exe.   Double clicking on the file will launch the installer. Alternatively, if your system requires administrator rights to install new software, right click on the installer program and 'Run as administrator'.

This is the first screen you will see during setup.
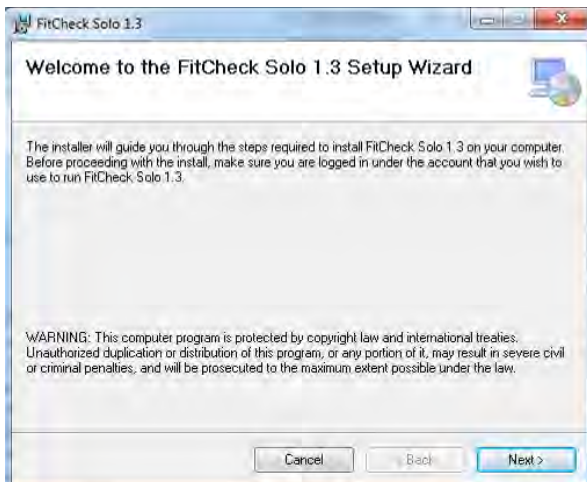

Figure 2

For a new installation, you will be prompted to select a directory to store files. This directory will contain the FitCheck Solo database and the support files used during testing. As a user, you should not need to

have administrator privileges to install FitCheck Solo.
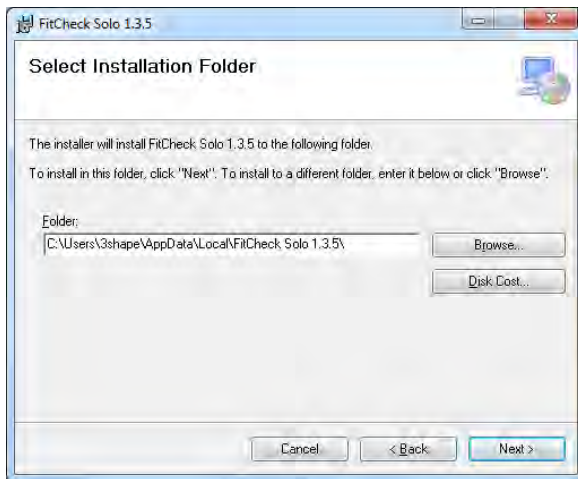
Figure 3

If you prefer to use another directory that is accessible to other users on the computer you can do so. You may have to consult with the computer administrator to access a suitable directory. The Browse button will allow the selection of another directory.

After selecting your directory, click on the [Next] button to continue with the installation. You will be prompted to confirm the installation. Select [Next] if you wish to continue.
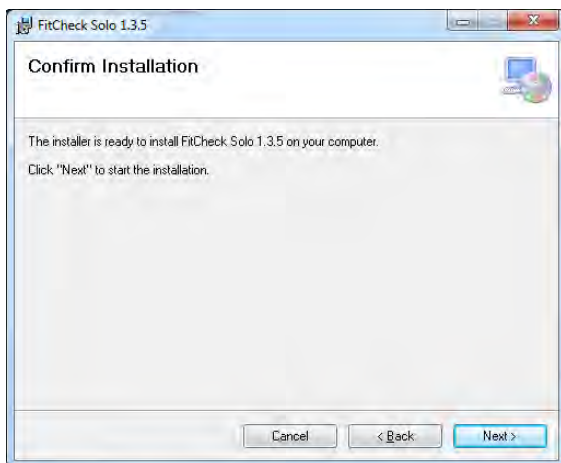
Figure 4

When the installation is successful, you will see the following screen.
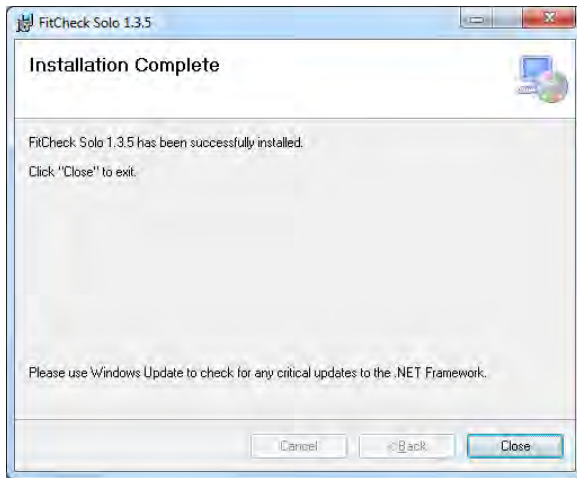
Figure 5

2 Confirming the Installation

To verify the software has been installed correctly and it's ready to run, we will open a new study. This will open the Sound check window (Figure 6) Successful selection of an existing study or creation of a new study will open the simple Sound Check window. This simply allows the user to determine if both earphones are working correctly.

Launch the FitCheck software by clicking the icon on the desktop. The window below will open.

Figure 6

Put the headphones on to perform a Sound Check. Place the cursor over the [Left Check] button and click the left mouse button. You should hear a tone coming from the left side of the headphones. Repeat the same procedure with the [Right Check] button.

The first time you use FitCheck Solo, you should perform the biologic calibration. This can be performed at any time, but it is not necessary to perform this calibration often. This process should be performed by a person with normal, or near-normal hearing. You can access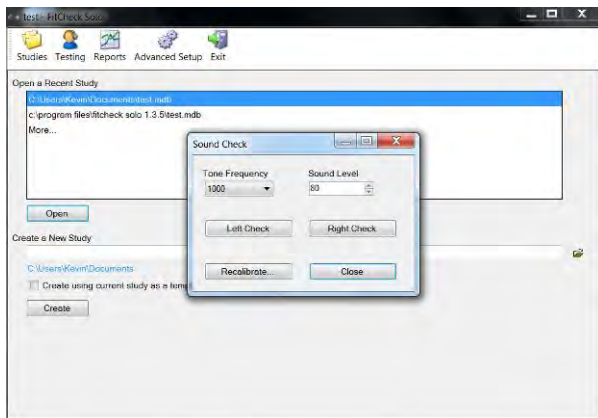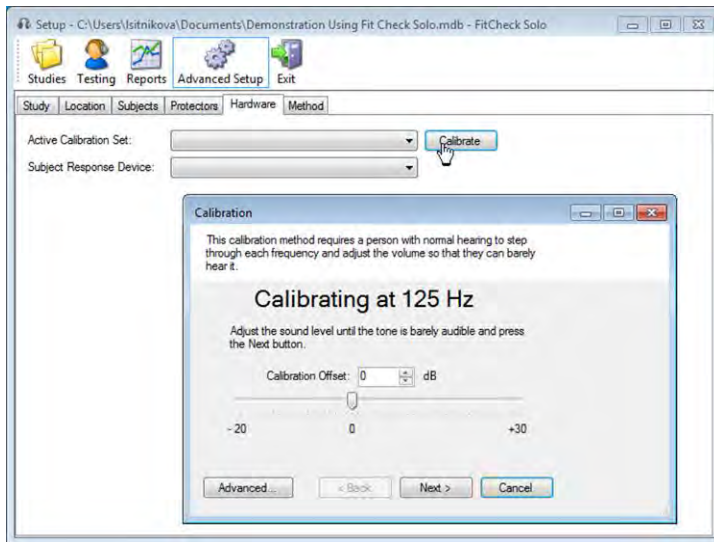 the biologic calibration by clicking on Recalibrate from the Sound Check window (figure 6), or by clicking on Advanced Setup, Hardware then Calibrate. After opening the window, move the slider to the right. You should start to hear the 125 Hz tone through the headphones. If you don't hear anything as the slider goes to the extreme right side, there is probably a problem with the sound card configuration. Adjust the slider until the test tone is barely audible. Then, advance the frequency (Next button), and repeat. **You must repeat for all test frequencies**. This simple procedure will calibrate the entire system.

3   Uninstall

FitCheck Solo may be uninstalled by running the installation a second time. The Installer will prompt you to either repair or remove FitCheck Solo.
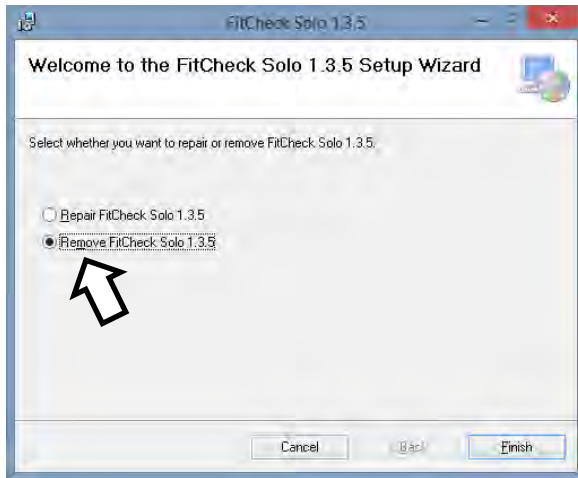
Figure 7

If you choose Remove FitCheck Solo, then the following screen will be visible while the installer determines what files need to be removed from the Windows Registry.
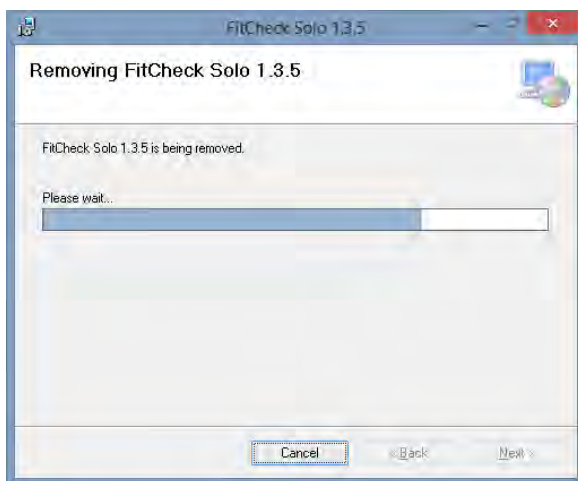

Figure 8

You can also uninstall the program from the Control Panel.

4   Training, Testing, and Assessment

FitCheck Solo measures hearing protector attenuation by testing a subject's hearing threshold with and without the hearing protector being worn. One-third octave-band noise stimuli are presented to the subject whose task is to identify hearing threshold at several different test frequencies. The laboratory method used to measure the NRR measures thresholds at 125 Hz, 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 3000 Hz, 4000 Hz, 6000 Hz, and 8000 Hz frequencies. The difference between occluded and unoccluded thresholds yields the attenuations for each noise band which are combined to yield the NRR rating.

FitCheck Solo™ estimates the Personal Attenuation Rating (PAR) from a subset of all the possible frequencies that can be measured. From research conducted by NIOSH[1], typically 500, 1000 and 2000 Hz are necessary to accurately estimate the attenuation of the protector. Testing at these frequencies provides an attenuation estimate within 3 dB with a 95% statistical confidence. Attenuation tends to level off after 1000 Hz.   FitCheck Solo™ recommends testing at 250, 500, 1000, 2000 and 4000 if there is enough time, and if a reduced set of frequencies is desired, we recommend testing at the NIOSH specified frequencies (500 Hz, 1,000 Hz, and 2,000 Hz) See section 8.5 for hearing impaired subjects. Note that the PAR can be less than or greater than the NRR. The NRR is based on best-fit measurements, so if the protector is not fitting the FitCheck Solo test subject, obviously the FitCheck data will be lower than the NRR. It can also exceed the NRR, since the NRR has built in safety factors that are not necessary when measuring attenuation on the actual end user.

4.1   Setting the Test Frequencies

FitCheck Solo allows the frequencies to be selected by the tester. To do that, click on the **Advanced Setup** button and click the **Method** tab. This will reveal a list of the frequencies that may be selected (Figure 9).

To select a frequency, position the cursor over the box beside the frequency you wish to select and click the left mouse button.

FitCheck Solo can test up to seven frequencies, 125, 250, 500, 1000, 2000, 4000 and 8000 Hz. Practically, it is not necessary to test all seven frequencies, and the test will take less time if a subset of frequencies is selected.

NIOSH[1] research has determined that testing at 500, 1000 and 2000 Hz will generally result in a PAR value that is within 1 dB of the PAR value that would be calculated from testing all seven frequencies. Lower frequency test frequencies will reveal air leaks or compromised fitting of the earplug. High frequency attenuation usually tends to level off after about 2000 Hz, so generally it isn't necessary to test all of the higher frequency bands.

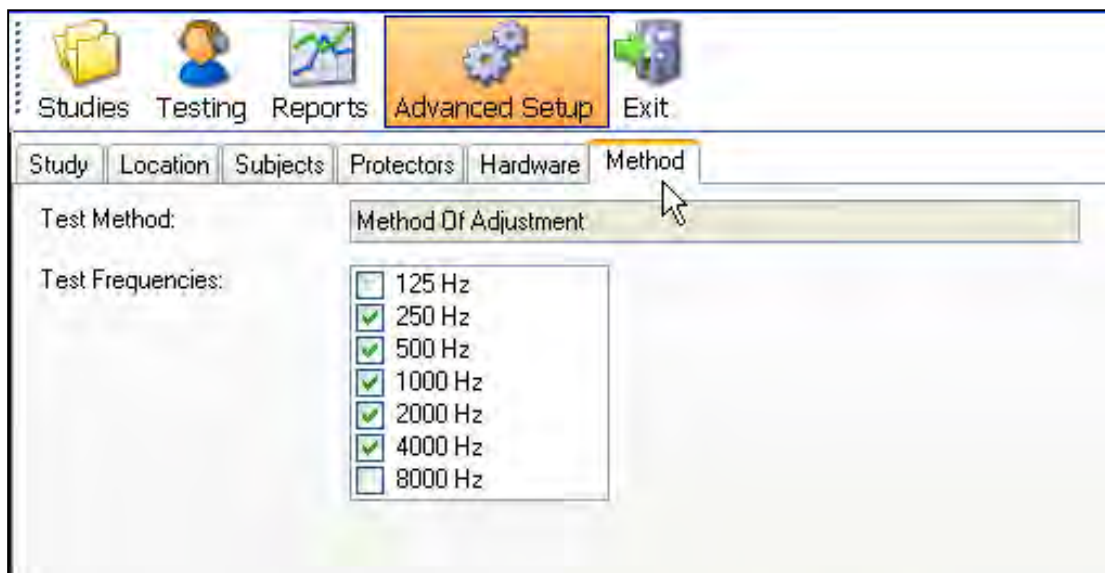[1] National Institute of Occupational Safety and Health.

Figure 9. Test frequency selection

Training

Training the earplug user to fit the device properly is usually required to achieve high attenuation. Research has shown that for many reasons, less than half of hearing protector users will approach the rated attenuation for earplugs. These reasons include lack of training, poor selection, poor dexterity and intentional misuse do to comfort issues or communication requirements

As part of this training, the user should observe the hearing conservation professional demonstrating the proper technique to fit the protector and practice under supervision of the hearing conservation professional.

4.2 Fitting Earplugs

To begin fitting a reusable or disposable earplug the pinna should be pulled up and back to straighten the ear canal.

a. **Formable Plugs:** A formable earplug must be rolled into a tight crease-free cylinder or golf-tee shape. While the formable protector is still compressed, it should be inserted fully into the ear canal.

b. **Premolded Plugs:** For premolded earplugs, the protector should fit snugly into the canal. The seal

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can be checked by gently tugging on the stem of the plug. If the seal is good, then the tugging should produce a change in the pressure of the middle ear.

c. **Custom Molded Protectors:** Insert the tip of the ear canal portion of the protector (earplug) into the ear canal and rotate the protector (earplug) towards the back of your head until the helix portion (top of the protector) slides into the pocket at the top of your outer ear.

Visual observation of the earplug provides the hearing conservation professional with some assurance that the plug is properly seated. However, it cannot detect a small acoustic leak[2].

In order to quantify the fit of an earplug, you can use FitCheck Solo™. FitCheck Solo quickly measures the attenuation provided to the end-user. If the attenuation is adequate, no further training is necessary. If the attenuation is marginal or insufficient, retraining can improve attenuation. The attenuation should be retested for confirmation.

Typically fit-testing requires about 5-10 minutes depending on the number of test frequencies. Retraining and retesting may need an additional 5-10 minutes. Training workers to fit the protectors and testing the attenuation with a quick method such as FitCheck Solo™ will help workers use their personal protection effectively and will document that the employee was fitted and trained properly.

4.3   Verification

From time to time the user's skill in fitting the earplug should be confirmed. FitCheck Solo™ is the only system capable of doing this.

a. **Selecting users.** Following a normal rotation, users should be selected from the work area while wearing their hearing protection to test their attenuation. In this way, changes to the user's manner for fitting their protector can be corrected. Simply select the user and test first their occluded (earplugs in) condition. Then test the open condition (Unoccluded).

5   Studies

The fit-testing data is stored in a database file, and these files are called Studies in FitCheck Solo. When you enter the program, you are immediately prompted to determine if you want to store your data in a current database file (called a Recent Study), or if you want to create a new database file (a new Study).

This allows the user to organize fit-testing data in several different files, or studies. For example, a large manufacturing company might be fit-testing employees once / year. They could have studies labeled "FitCheck Solo 2013", "FitCheck Solo 2014", etc. Or, an audiometric testing company might be performing fit-testing at several different clients. They could create a study called "Company A Location 1 year 2013", for example. This would allow them to organize their data efficiently.

The user can create a new study, maintaining any or all of the following from a previous study:

---

[2] Michael and Bloyer (1999) conducted a fit-test study with a population of workers and demonstrated that visual inspection was insufficient.

1) hearing protector information

2) employee information

3) Calibration data

4) Defaults, employer information and test frequency selections

Carry these data forward to a new study by clicking Create when another study is already open. You will be prompted asking which of the data you want to include in your new study. You can select any or all or none of the options. If you select none of the options, you will create a blank study. Actual test results are not included in the new study.
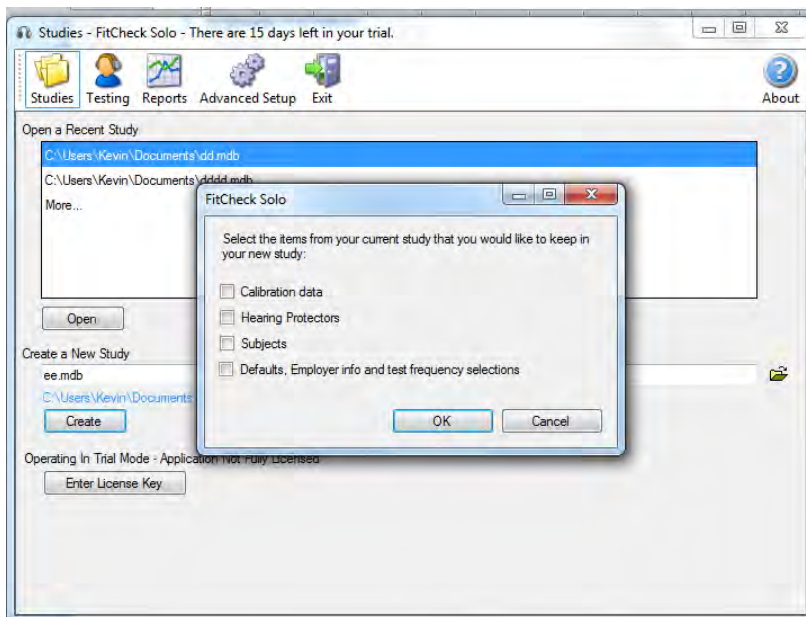

Figure 10

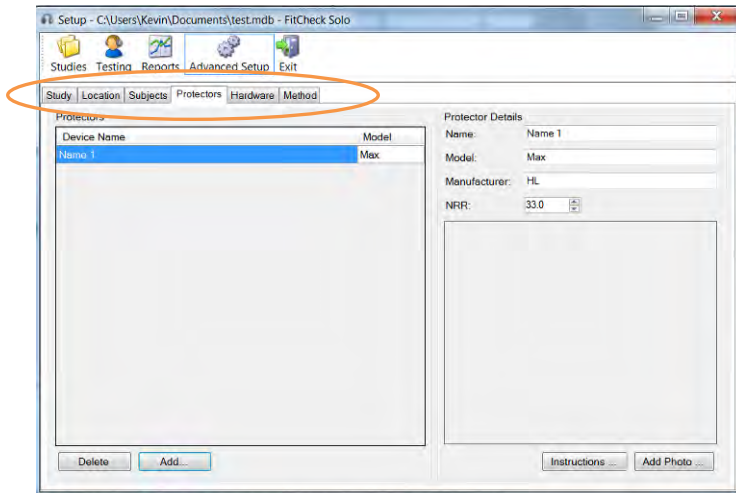## 5.1 Setup for Study, Location, Subjects and Protectors

Figure 11

The Advanced Setup icon allows the user to add descriptors to the current study and to manage the employee and hearing protector database. The Study tab allows the user to add descriptors, including the study name and test number. It also allows the user to enter default values for assumed exposure levels and target PAR values. These optional entries can, of course, be changed later. The location tab simply allows the user to describe the company where the fit-tests are being performed both by the proper name of the entity, and the various locations within that entity that are being tested. All of these entries are optional. The Subjects and Protectors tabs allow the user to add and delete records in these respective databases. The Method tab allows the user to specify which frequencies are tested.
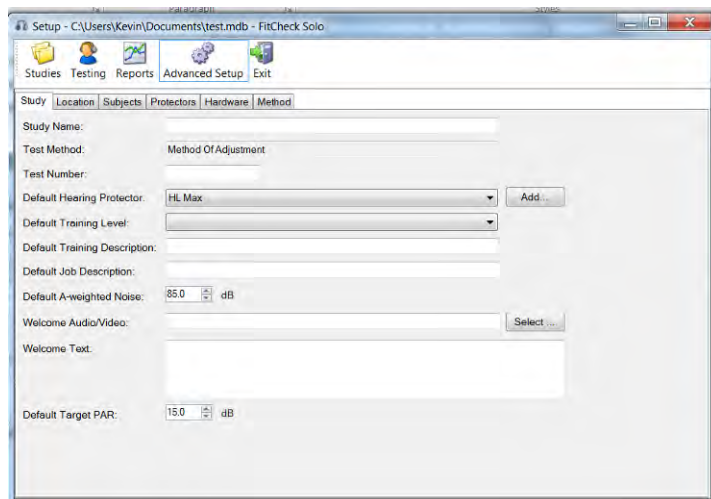

Figure 12

5.2   Sound Check and Calibration

Successful selection of an existing study or creation of a new study will open the simple Sound Check window. This simply allows the user to confirm that both earphones are working correctly.
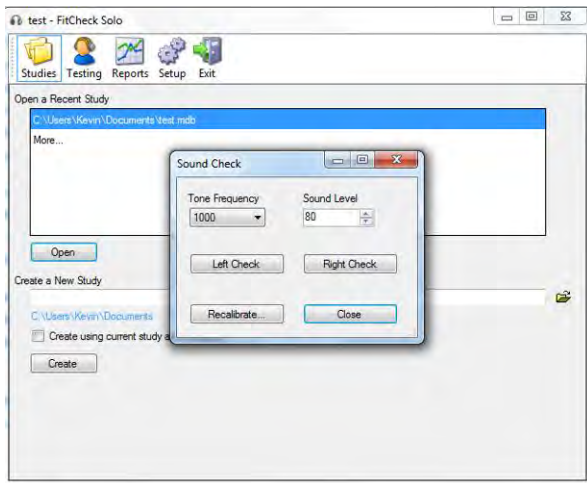

Figure 13

After the Sound Check, you may perform a hearing threshold level-based biologic calibration. To perform this calibration, click "Recalibrate". A person with normal or near-normal hearing should don the headphones and adjust the slider so that the stimulus at 125 Hz is barely audible. Then, step to 250 Hz, and 500 Hz, etc, performing the slider adjustments through all 7 frequencies. Note that this approximate calibration is sufficient since all attenuation measurements are *relative,* that is, all attenuation measurements performed by FitCheck Solo are open thresholds minus occluded thresholds. If the calibration is slightly off, there is no effect on the attenuation calculation.

The biologic calibration is usually all that is required for proper operation of FitCheck Solo. If a more detailed, instrumentation-based calibration is required, click on the Advanced button on the Calibration window.
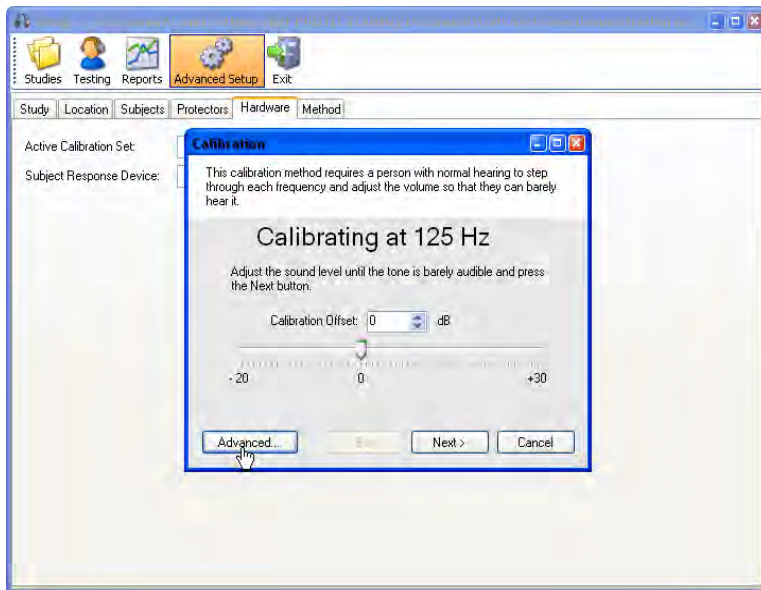
Figure 14

This will open the Fit-Test Sound Check and calibration screen. The headphones can be calibrated such that when the Left Check and Right Check buttons are clicked, an 80 dB tone will be played. A coupler and sound level meter are required for this operation. This option is activated with the "Advanced" button on the biologic calibration window. This operation generally is not required and is performed by advanced users only who may be using FitCheck Solo for purposes other than conventional HPD attenuation measurements.
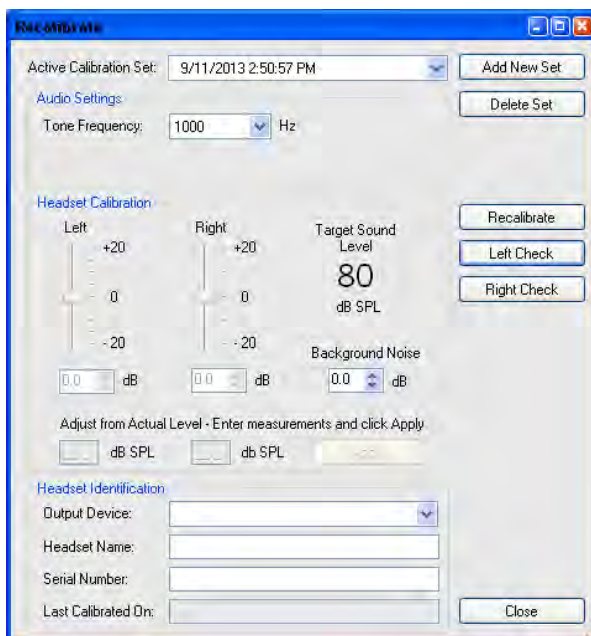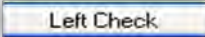

Figure 14

This advanced calibration function is performed as follows:

1. Attach the left headphone cup to the sound level meter coupler so you can read sound pressure level on the sound level meter.

2. Click on [Left Check]

 3. Enter the sound level reported by the sound level meter into the actual level box and click the apply button. This will adjust the attenuation of the signal to match the target sound level of 80 dB.

4. Recheck the sound level. It should now be 80 dB as long as it was within range - there is limited power that we can send through the sound card to the headphones.

5. Repeat at each frequency for both left and right earphones.

NOTE:

If both the right and left ear sound checks seem to come from both sides of the headphones, make sure that 'Audio Enhancement' is turned off in the Control Panel, Sound window. The option may appear in a special control panel window specifically for your sound card.

5.3 Hearing Protectors

Hearing protectors can be added or deleted to/from the study by using the Add/Delete buttons on the Protectors tab (Figure 15). All the protectors currently used on site or being contemplated for use on site should be added into the study so that they are available for attenuation tests. HPDs may be added to the database at any time.
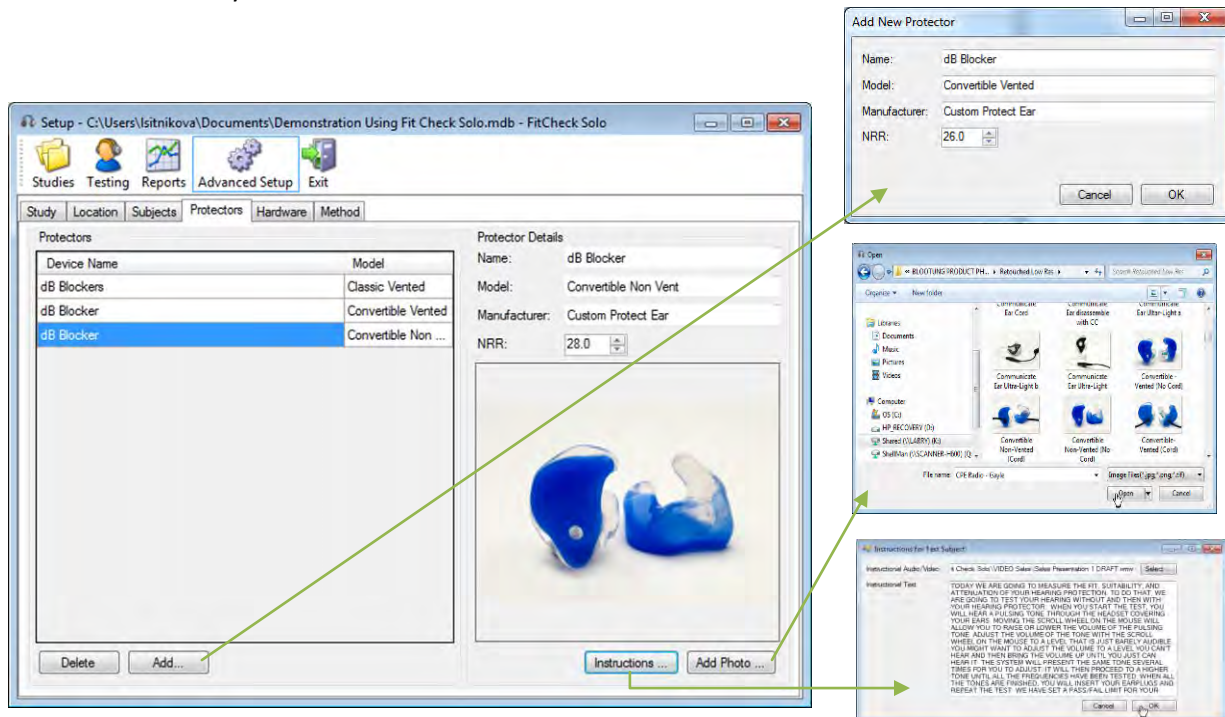

Figure 16

There are a number of additional data capture options that can be used to aid in the study of the hearing conservation program's effectiveness. Using these options will allow the measure of attenuation and HPD effectiveness to be correlated with other criteria like training and demographics like Job Description.

6.3 Training Level (Optional)

FitCheck Solo has several options for identifying the level of training that a person has received. If the hearing conservation professional conducts training using a brochure, one-on-one training, or video training, then this should be selected as the default training option. Using the training option might yield some information on the effectiveness of one training mode over another.

6.4 Training Description (Optional)

A simple description of the training should be entered in this location. (See Training Level above)

6.5 Job Description (Optional)

If most of the persons being tested by FitCheck Solo can be described a particular job type then it should

be entered here. Tracking attenuation by job description may yield understanding of where training efforts need to be placed

6.6   A-weighted Noise (Optional)

Typically, workers will have some level of *noise exposure* that can be described in this field. The A-weighted decibel value, if known, should be entered at this location.
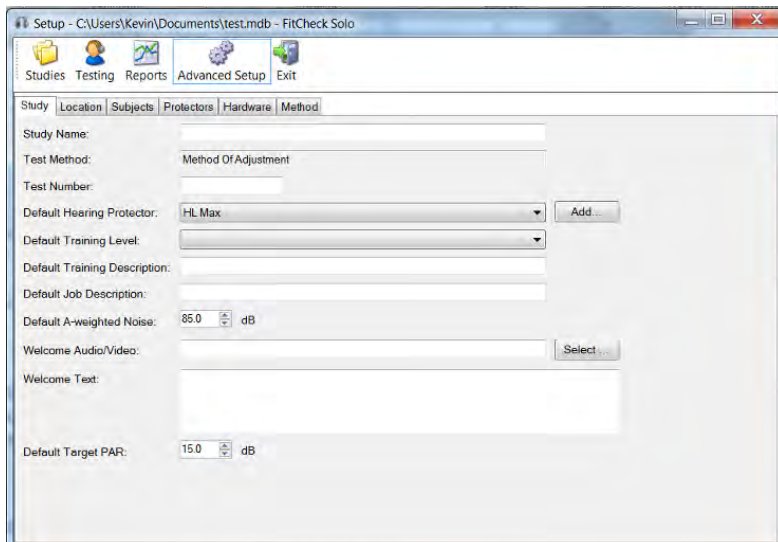

Figure 17

6.7   Setting a Target PAR (Recommended - Optional)

You may specify a target PAR so that each individual test is listed as 'PASS' or 'FAIL' on the report.
In this way users who's PAR is sufficient but slightly lower than another's will not think their protection is substandard.

6.8   Employer (Optional)

On the Location tab, the employer, or company name, can be entered into the study description. The NAICS (North American Industry Classification System) code can be assigned based upon the company's industry.

6.9   Location (Optional)

The location refers to the actual site where the subject is working. The name of the plant, factory or building can be entered along with an ID number to identify the location. Information about address, country, city state and zip code should be entered in the respective text boxes.

Figure 18

7 Enrolling Subjects

Click the Subjects Tab under Advanced Setup. The subject's name is the only mandatory entry. The Subject ID number and other fields may also be completed but they are optional. Test subjects can be added and deleted from the database file from this window. Gathering optional information about subjects may yield understanding of specific emphasis that needs to be placed on certain groups.

Figure 19

Setting the shift length in this window to greater than 8 hours will decrease the allowable exposure presented in the PAR Report according to NIOSH guidelines.

Editing information

If the information is incorrectly entered, corrections can be made easily. The person's name needs to be selected and the information can be edited. Changes can be made at any time.

8   Conducting a Fit-Test

FitCheck Solo™ is a simple system to operate. The hardware is simple in that there are no external electronic modules to connect. The user interface is easy to understand and use. But the biggest advantage of FitCheck Solo™ is that it allows you to verify the user's ability to fit their protection by removing them from noise, testing the occluded condition (earplugs in) first.

After successful installation and setting up the software, you should be ready to conduct a fit-test. The second icon from the left on the ribbon bar, labeled "testing", will open the Testing Screen (*Figure 20*). *Note: If you are testing subjects you suspect or that you know have some hearing impairment be sure to read section 8.5 before beginning their tests.*

8.1   Selecting the Subject
a.   Previously enrolled subjects:

From this screen, the subject may be selected from the "Subject:" dropdown menu. Previously enrolled subjects will be shown in this list. To select someone, click on the down arrow in the list box and the list of subjects will be displayed. Click on the name of the person who is to be tested and they will be shown in the list box. If no fit-tests have been conducted for this person, then no dates will be displayed in the Fit Test Date list box. The New Fit Test button should be selected.
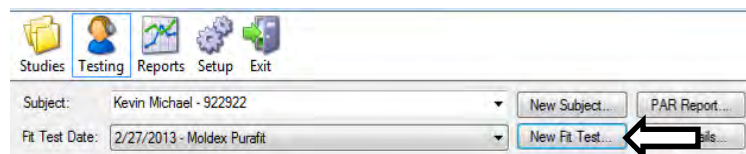

Figure 20

b.   New Subject:

When conducting a study, new subjects, not previously tested or entered into the database, may be added from the testing screen (see figure 21).
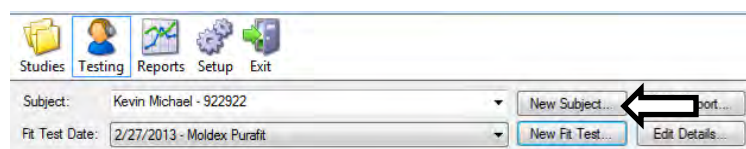

Figure 21

Selecting the [New Subject] button will open a window where the subject's information can be entered

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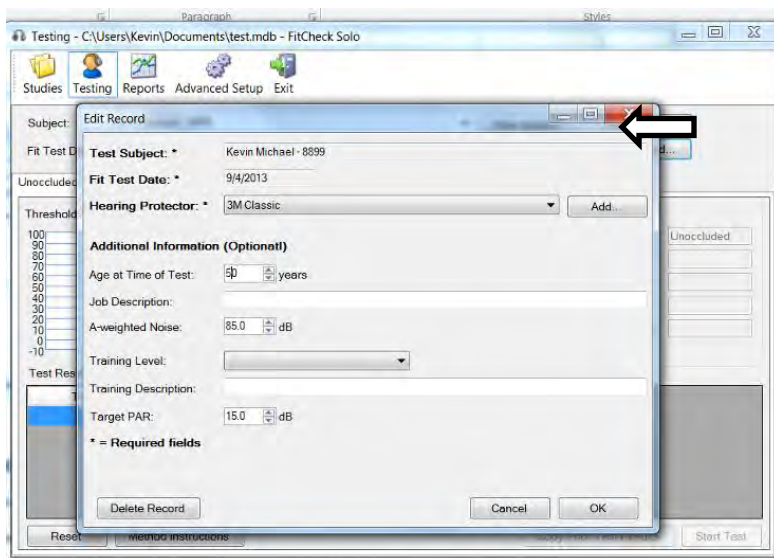
Figure 22

8.2   New Fit Test

   a.   **New Fit-Test:**

Figure 23

Select [New Fit Test] button. This will open a small dialog box where some additional information about the testing situation may be entered. The Hearing Protection, The Age, Job Description, A- weighted exposure level, Training Level, Target PAR, and a description of the training information can be collected. The specific hearing protector worn by the employee must be specified. Note that you may select Binaural testing, for testing both ears, or right or left ear only. Usually, binaural testing is recommended since the test will be testing the poorer fit of the right and left occluded ears. In special cases, such as a unilateral hearing loss, you may want to test each ear separately.

Edit Details:

Note: Although collecting this information may be very valuable in understanding the results of the fit test as they relate to the workers, only the type of hearing protector is necessary.

This button allows the operator to change particular information about a specific fit-test such as the age at the time of testing, exposure information, the level of training, etc. This is especially useful when the current study has been created using a previous study's Subject and Protector Information.

Figure 24

b. **Instructing the test subject and running the test**

Instruct the test subject as follows:

"When the test begins, FitCheck Solo will present a pulsing test sound. Use the scroll wheel on the mouse to adjust the volume of the pulsing test sound so that you can barely hear it. You can lower the sound until you don't hear it and then bring it up until you can barely hear it if that is easier. After you are satisfied with your adjustment, click the left mouse button. The sound will then get louder, and you are to repeat the process. Eventually the test sounds will change frequency, or pitch as the test proceeds through multiple frequencies. Keep performing the same operation with the mouse wheel and left button. I will monitor the test and tell you when it is complete."

This language may be changed to suit, but must be consistently used for each test subject.

The subject should not be able to view the screen during testing.

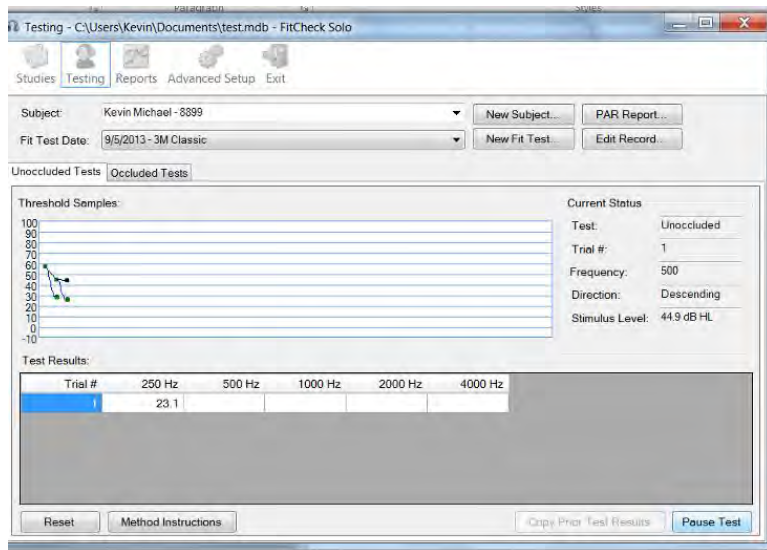The following screen is what you will see when the test is running.

Figure 25

When the test is complete, the "pause/start" button will be grayed out, indicating this step of the test is complete.

8.3   Unoccluded Test

After selecting the New Fit Test button and entering the subject's information, the above screen will open. Several elements are present. First notice the tabs for the Unoccluded and Occluded Tests. FitCheck Solo allows the operator to collect the data in either order. Typically one would start with the unoccluded test and then ask the subject to insert the earplugs for the occluded test[3].

Note: Before starting the Unoccluded test, make sure that the **tab is selected.**

a.   Threshold Samples:

In this part of the screen, the progress of the test can be observed. The narrow-band noise stimuli will be presented at a level that is above the subject's hearing threshold. As they adjust the level of the stimulus, the graph will display the presentation level. Whenever the subject identifies the threshold by clicking on the left mouse button, two marks will appear on the graph. The first mark indicates the level that the subject chose for threshold. The second mark will be immediately above the threshold, identifying the new stimulus level which was set randomly higher by about 10 to 20 dB. The subject will be required to identify threshold values at least three times depending on the consistency of responses.

b.   Test Results:

The average threshold for each frequency will be displayed, as the test progresses. Each time the subject selects a threshold, the result is stored in the database. When a valid set of thresholds for a given

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[3] If you are testing a user to verify their ability to fit their protection by removing them from noise, test the occluded condition (earplugs in) first.

frequency are completed, the average threshold is stored in the associated trial and frequency box.

c. Current Status:

As the testing progresses, the operator will see the Current Status updated throughout the testing period. The Frequency, Direction (Ascending/Descending) and Noise Level will be updated in real time.

d. Start Test:

After the operator has instructed the subject about how the fit-test will proceed, then the [*Start Test]* button in the lower right corner should be pressed. Control of the computer mouse with a scroll wheel should be given to the subject. After the test is started, the Start Test button changes its caption to Stop Test.

e. On the fly test manipulation:

Pressing the escape key during the test will make the cursor appear and pause the test. If you press escape again, you can choose to repeat the band or skip the band or to substitute another band for the current one.

You can also press the Reset button when the test is paused, which will allow you to restart the current test.

8.3.1 Interrupting the Test

a. Stop Test:

The operator can pause the fit test for several potential reasons (e.g. earplugs dislodged, subject is not responding consistently). To pause the test, the operator should click the pause test button. Toggle between Pause and Resume test by pressing the Escape (ESC) key or Space bar on the keyboard. To resume testing the Start/Stop/Resume Test button should be pressed. Pressing the Escape key or space bar allows the test administrator to regain control of the mouse pointer.

b. Reset Test:

In some cases, the entire test may need to be halted and restarted from the beginning. For instance, the subject may have misunderstood the test or the operator may have mistakenly started an unoccluded test when the subject was wearing protectors. Regardless of the cause for the problem, selecting the Reset Test button provides the operator with several choices: Retest the current frequency, retest the occluded/unoccluded condition from the beginning, retest the entire fit-test from the beginning, or throw away all results. The choices are self-explanatory (see figure 26).
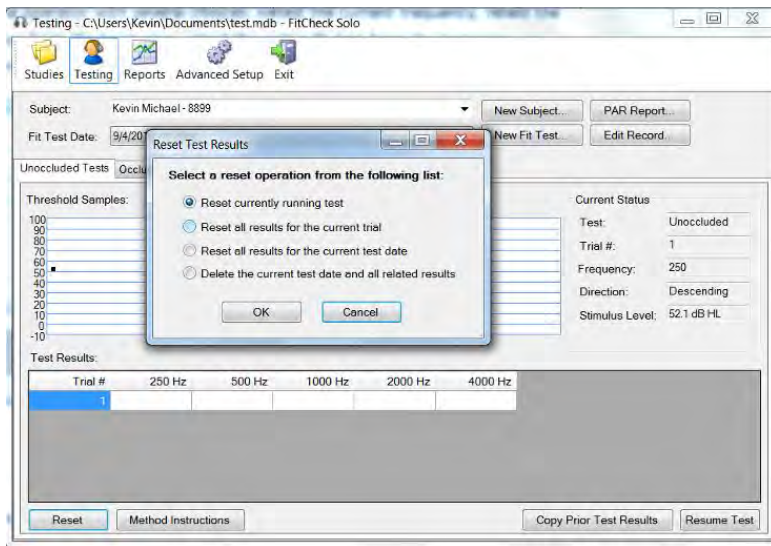
Figure 26

Typically one would choose to restart the current frequency or restart the occluded/unoccluded condition from the beginning.

8.4   Occluded Test

Prior to the occluded test run, have the test subject fit their hearing protector. The occluded test run is completed in the same manner as the unoccluded (open ear) test run.

Note: If you're testing a subject to determine how he/she wears his HPDs while on the job, you may want to ask them to leave their work station and come into the test room without touching the protectors. In this case, run the occluded condition first followed by the unoccluded condition.

Note: Before starting the Occluded test, make sure that the Occluded Tests **tab is selected.**

   a. **Start Test:**

One difference will be noticed when testing in the occluded condition. After the *Start Test* is selected, a dialog box with a 2 minute timer will appear. The purpose of the timer is to allow sufficient time for formable (foam) ear plugs to expand and properly seal the ear canal. The operator may choose to forego the 2-minute waiting period to demonstrate the test. For premolded or custom ear plugs, the waiting period is unnecessary because the materials do not require time to expand. The 2 minute timer is in accordance with the ANSI S12.6-2008 standard that requires two minutes between plug insertion and the commencement of an occluded test. If specific fitting instructions have been entered for this earplug (via the Protectors window under Advanced Setup), you may access them during this time.
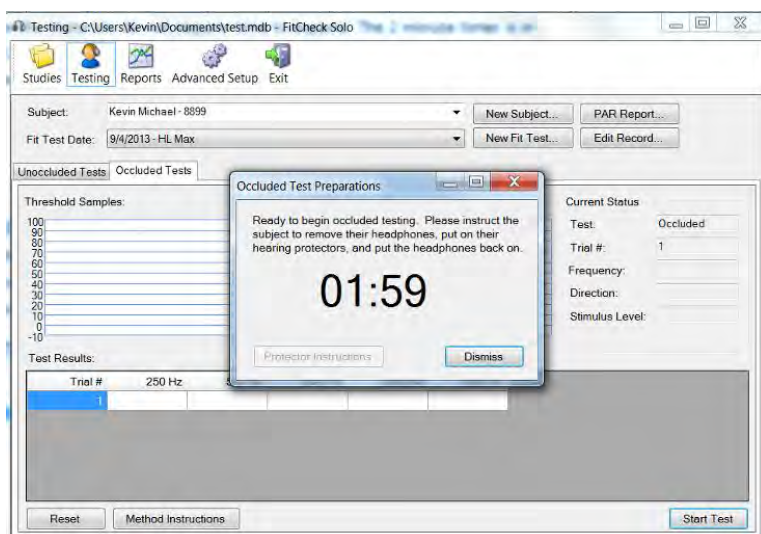
Figure 27

8.5 Testing Hearing-Impaired Test Subjects

If the test subject has a significant hearing loss, or you suspect the subject might have a hearing loss, he/she may not be able to hear the test sounds, especially in the occluded condition. It is recommended to begin testing these individuals in the occluded condition doing the unoccluded condition afterwards (Note: make certain before starting the test you have clicked the "Occluded" tab on the test screen - see figure 23). If you have a frequency the subject cannot hear the pop up window will eventually appear, and the administrator can select 'Skip frequency'. The test will then proceed to the next test frequency and the no-response frequency will be labeled as NR.

8.6 Viewing Individual subject responses

From the testing window, each subject response can be viewed by selecting either the unoccluded or occluded tabs, then clicking on an individual test frequency. In Figure 28, you can see the individual responses at 500 Hz during the Occluded test run.
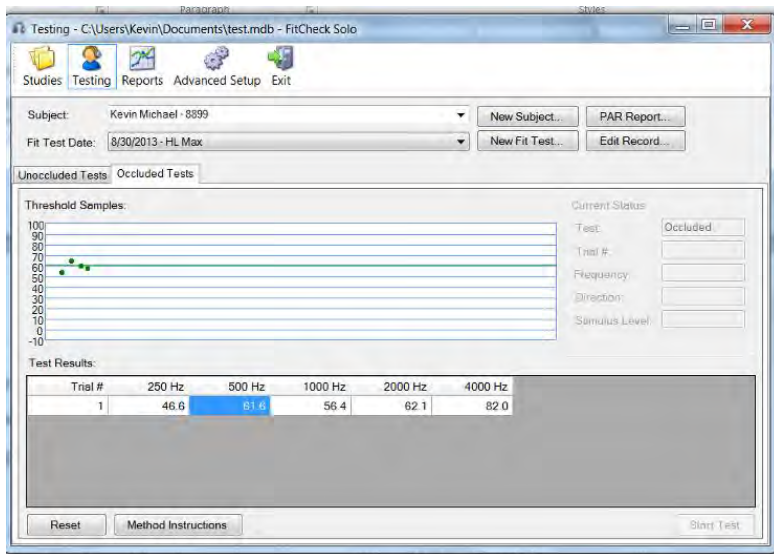
Figure 28

9   Reporting the Results

There are 4 ways reports can be generated in FitCheck Solo. Using the icons at the top of the any of the screen reports, these reports can be printed, exported as a PDF file, exported as an Excel spreadsheet or exported as a Word document (note the icons at the top center of figure 30). Once in Excel or Word, the files can be further manipulated.
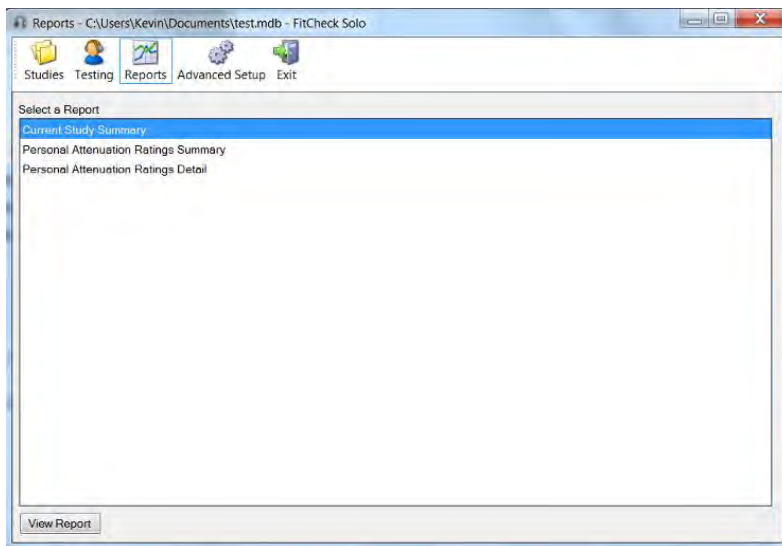

Figure 29

a. From the Reports Tab, Current Study Summary

The study summary presents a list of the tests that have been done within that study without individual data.
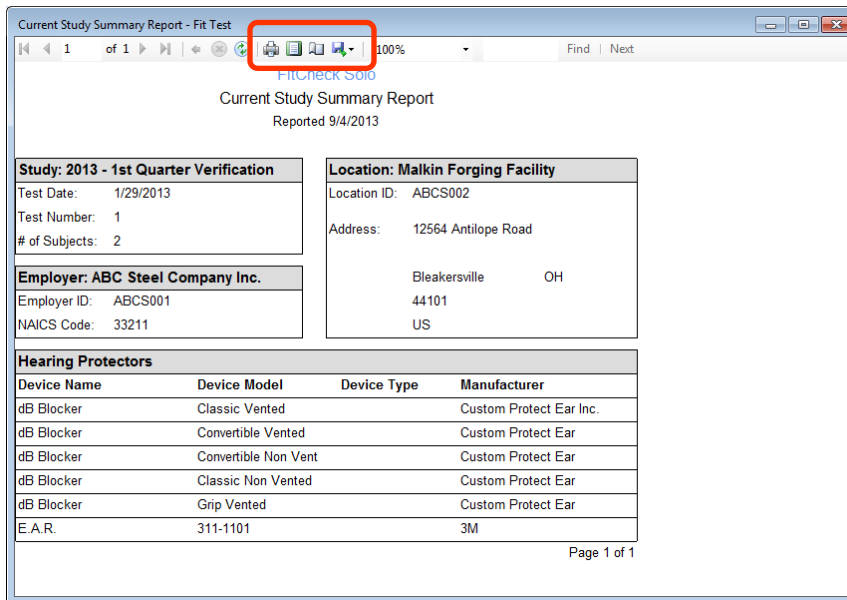

Figure 30

b. From the Reports Tab, PAR (Personal Attenuation Ratings) Summary

The PAR summary lists all of the attenuation tests performed in the current study and a summary of the results. All tests are listed for all test subjects. The columns in this report have ranking buttons so that the data can be presented in a variety of ways. Click on the up/down arrows next to the column title to switch the order of presentation of the data. The Filters on the left side can be used to limit the amount of data presented. Again, the report Table can be exported to Excel or Word using the icons at the top of the window.
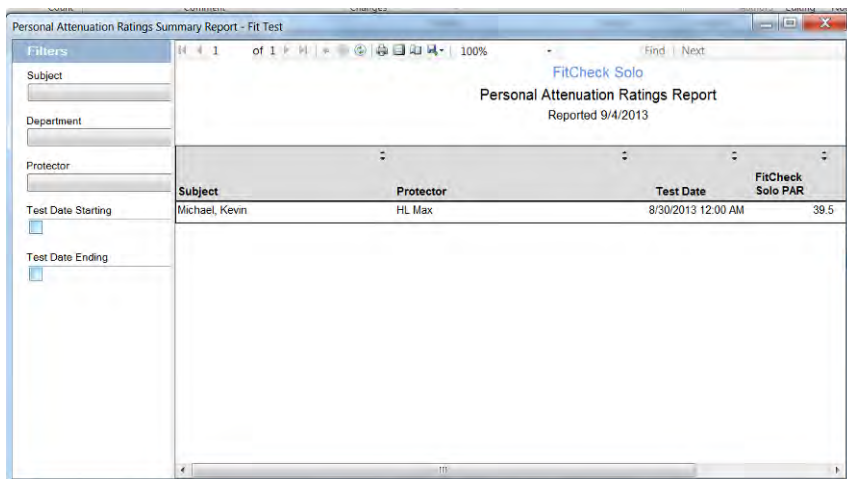

Figure 31

c. From the Reports Tab, PAR Detail

The PAR detail report displays a table with the results of the most recent attenuation test and then a history for all test subjects that have participated in this study. This will be the longest of the reports.

Figure 32

d. From the Testing Tab, PAR Report

This PAR detail report can also be accessed from the testing tab by clicking the PAR report button displays a table of the most recent attenuation test and then a history for *only the current test subject*, i.e. the subject that is listed in the subject box on the Testing window.

Figure 33

10. Testing employees with existing hearing loss

While testing employees with significant existing hearing loss, it is likely they will have difficulties performing the test, especially when they reach the higher frequency test stimulus. This can lead to abnormal PAR readings and a failed test. The problem is related to the limited output of the PC sound card. One possible solution is to use an external sound card, such as the Sound Blaster X-Fi series, that can generate higher output levels.

If these problems persist, the subject will not detect the high frequency signals at maximum volume and

therefore will not click the mouse. An error window will be displayed, and the test operator has the option of skipping the test frequency or ending the test.

To overcome this error condition, you can change the settings for these employees so that they are tested on only lower frequency test signals. It is likely that their hearing is better at the lower frequencies. To do this, go to the **Method** tab, under the **Advanced Settings** menu option, and uncheck the higher frequencies of 8000Hz, 4000Hz and 2000Hz. Then, check the lower frequencies of 125Hz, 250Hz, 500Hz and 1000Hz, or a subset of these test frequencies.

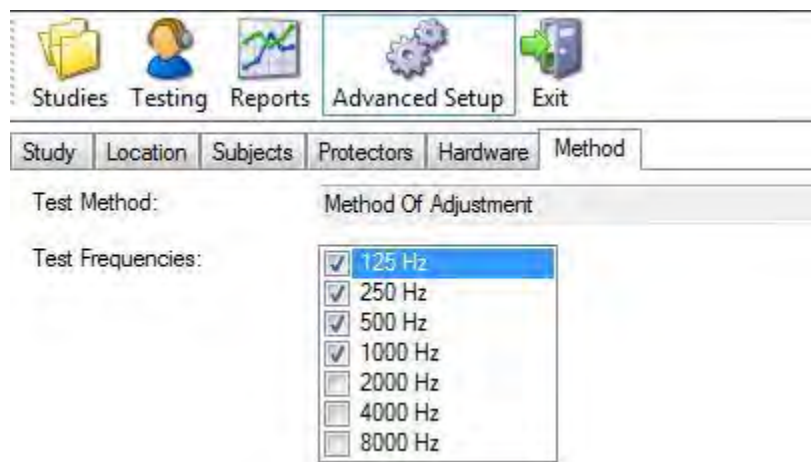By changing these settings, the subject will be more likely to respond correctly, resulting in a valid PAR.

Figure 34

11 Troubleshooting: When test subjects are having difficulties with the test methodology

In cases where the test subject seems to be having difficulty with the test, as evidenced by:

- Frequently repeating frequencies or frequently requiring more than the normal 3 repetitions per test frequency

- Subjects having difficulties establishing a consistent hearing threshold

Then the test administrator can switch to the following protocol

1. Introduce and explain the test using something like the following.

    "The results so far are somewhat inconsistent, so I'm going to change our method a little bit. I will control the Fit Check Solo mouse. Indicate to me with your thumb to raise or lower the volume: thumb up to raise the volume and thumb down to lower the volume. I'll start with a level where I believe you can easily hear the test signal. I'll raise or lower the volume of the test signal according to your

instructions. Then just raise your index finger when you're satisfied that you are at the level where you can barely hear the test signal. This is your hearing threshold. We will run the test both with and without earplugs, and we're going to test ___ frequencies (fill in the number). Do you have any questions?"

If you need to explain the goal of the test again, you can say something like:

"Remember we are trying to establish your hearing threshold, which is the level where you can barely hear the test signal. In other words, if it was any quieter, you would not hear it."

2. Proceed as usual with the FitCheck Solo test. You may begin in either the unoccluded or occluded position. Ensure the correct tab (Occluded or Open) is selected on the FCS test screen. Start the test by positioning the cursor over the "Start" button and clicking the mouse. The test administrator should then look away from the screen. To avoid any bias, once the test has started, the test subject should not look at the computer screen and the test administrator should look at the screen as little as possible.

3. Proceed through all the frequencies being tested. Then the test subject should remove the headphones and either insert or remove their earplugs as appropriate.

4. Refit the headphones and start the test again as was done previously in #3. Proceed through all the frequencies until the test concludes.

From this point, the individual test will be completed and the PAR report should be generated. The test administrator will have the option to print, export or save an individual copy of the Summary Report if required or proceed with the next subject within the same Study.

12   Exiting the Program

On the main ribbon bar is an icon with a door and a green arrow. When this is selected the program will save its information and exit.

Important: **Do not exit the program by closing the window** **as this will not save the information.**