

✓ Vision 5

This program is protected by U.S. and international copyright laws as described in the about box.

Main Vision Manual

User guide
2021

Table of Contents

Introduction	4
Introduction	4
Contact Radiant Technologies, Inc.	14
Contact Radiant Technologies, Inc.	14
Main Vision Manual	15
I - Introduction	15
II - Overview.....	15
III - Startup	16
IV - Making Measurements	26
V - Main Menu.....	46
A. File Menu	46
B. Explorer Menu.....	51
C. View Menu	58
D. Tools Menu	60
E. QuikLook Menu	77
F. EDITOR Menu	92
G. DataSet Menu.....	103
H. Library Menu	109
I. Data Plotting Menu	111
J. Log Menu	120
K. Calculator Menu	127
L. Help Menu	129
VI - Library and Tasks	143
VII - Global User Variables	175
VIII - QuikLook and Exporting	176
IX - EDITOR and Test Definitions.....	187
X - DataSets and the DataSet Explorer	194
XI - Data Plotting.....	213
XII - Variable Task Icons	230
XIII - Nested Branch Looping	233

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

XIV - Test Definition Graphing.....	235
XV - Document Library.....	259
XV - Editor Aide	261
XVI - Data Mining.....	278
XVII - ETD Transfer	306
XVIII - Simple Measurement	319
Discussion.....	320
Operation.....	323
Dialogs	339
Select Target DataSet.....	339
Main Dialog Control.....	346
Configuration Dialog	349
Measurement Dialog.....	353
XVIII - Newly-Added Tools	362
Runtime Tabular Text Export.....	363
Runtime Data Image Export	366
Custom Text-File Branch Loop Parameter Adjustment.....	368

Introduction

Vision Program for Precision Testers

The Precision Family of Ferroelectric Testers

The Precision Materials Analyzer family of ferroelectric testers provides a full range of high-speed, high-precision ferroelectric material characterization instruments to meet every budget and research need. A comparison of model cost, speed and voltage capability is given at [Vision Testers](#). All systems are capable of internally-generated sample stimulus voltages of 10.0 Volts¹. Most systems include internal amplifiers that allow 100.0-Volt measurements. 200.0-Volt and 500.0-Volt options are also available. Voltages of up to 10,000 Volts can be used by adding an accessory High Voltage Amplifier (HVA) and High Voltage Interface (HVI). The researcher may connect any existing amplifier, provided a logic unit (known as an ID Module) is obtained from RTI. The latest HVI model, released in 2017, has the ID module built into the instrument. It is programmed for delivery at Radiant Technologies, Inc., but may be reprogrammed at any time by the user.

The Vision Program

A single, unifying program, called Vision, provides a consistent compatible interface across all hardware architectures. It is designed with the understanding that what is important in ferroelectric testing is maintaining a complete and accurate history of the signals applied to, and the responses of, a sample. The researcher has the capability to create custom experiments that are as simple or elaborate as required. Experiments can be run, rerun, reconfigured and repeated. As an experiment is executed, it is saved along with the measured data to be recalled for reuse. Data can easily be recalled for examination. On-board tools are available to provide data analysis and comparison of multiple data vectors. Data may be exported directly to Excel, Word, text files or a printer for analysis and publication. Data are organized into archives that hold both the data and the experiments that produced them. These archives are uniquely named and are written to individual files that may be sorted and stored in any way that is most logical to the researcher. These files can be emailed or written to an external data storage (USB drive, CD, etc.) for use by other researchers that are running the Vision program. Vision can be installed on non-tester computers for the purpose of recalling and reviewing data or creating experimental Test Definitions.

This manual provides a complete description and set of instructions for the use of Vision Version 5.x.x. (As of this writing, Vision 5.26.4 is being shipped.) The system is large and complex, but is designed so that the new user can begin to get immediate results without exhaustive training. Much of the detail of the program is segmented into Tasks that perform specific functions. Tasks may be very simple or very complex, but the user need only learn to use the Tasks that are important to the research at hand. The manual gives a complete overview of the program, a number of tutorial sessions, step-by-step operating procedures for the most common operations in Vision and a detailed description of each Task including a discussion of every control that appears on every dialog. The Task descriptions are also available using the *Click For [Task Instructions](#)* button on any dialog associated with the Task.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

The Vision program, its Tasks and its drivers, as well as these help pages, are under constant development. In order to use the most up-to-date and efficient release of the Vision program please visit the [Vision download form](#) regularly. The current Vision version and release date are noted near the top of the form. If an update is in order, fill in the form and click *Submit*. You will be linked to the Vision installer download page. Review the information on the page. Then click the installer download button and install or update per the instructions on the page.

A Note on Vision Structure and Versioning

The Vision program is a framework program that provides services to Vision Tasks. Tasks are semi-independent agents that perform the work within the program. Tasks loaded by Vision at runtime into the Task Library. Some Tasks are also loaded into the Vision QuikLook Menu.

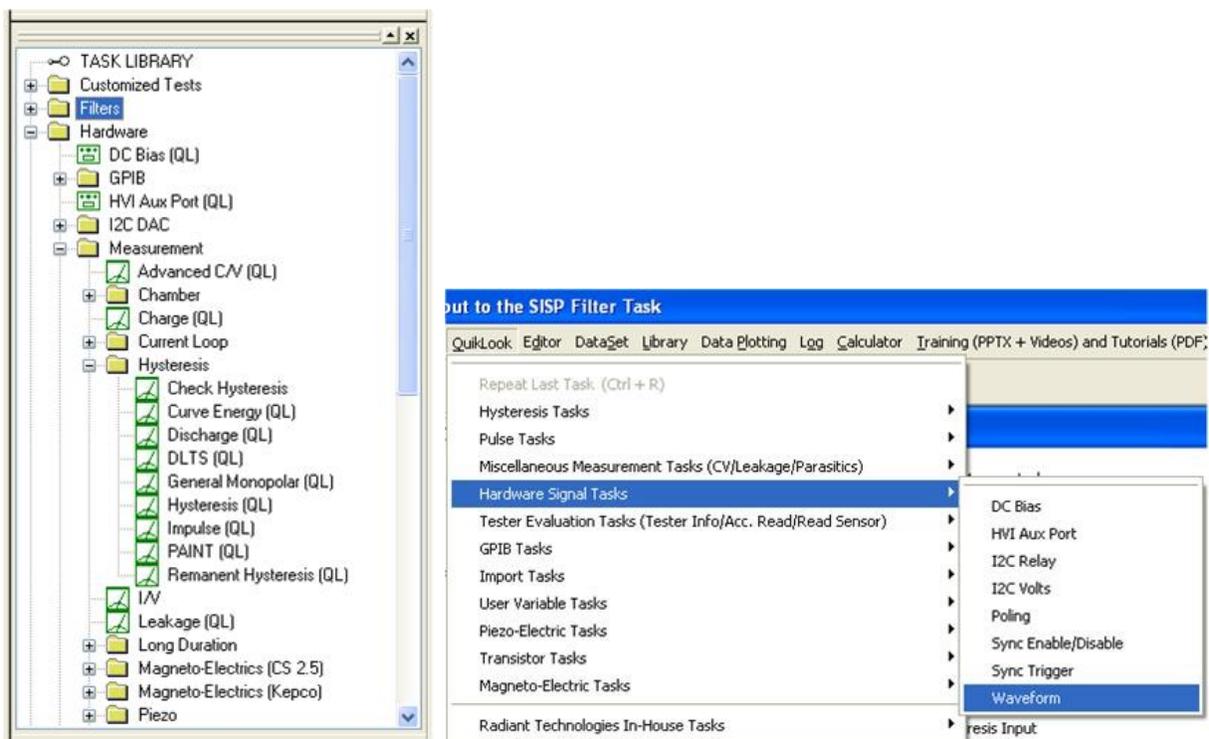


Figure 1 - Tasks in the Task Library and Figure 2 - Task in the QuikLook Menu.

The Vision program version is divided into three sections. The first is the main version. It represents major changes or additions to the program that occur infrequently. The current version is "5". The second digit represents changes to the main framework program that happen frequently but are of significant influence on the program. At this writing the second digit in the Vision version is "12". In some cases these changes will not be apparent to the customer. The final digit (currently "10") represents minor changes. In all cases, changes to the Vision version number refer only to changes to the framework program, not to changes to individual Tasks or groups of

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

Tasks. The Vision version can be seen by going to Help->About Vision. Note that the "(R)" in the version number indicates that this is a release compilation of the program for customers.



Figure 3 - The "About Vision" Dialog.

As a semi-independent agent, each Task has its own version. The first two numbers of the Task version will always agree with the first two digits of the Vision program version. When the Vision version was updated to "5.12.0" all Tasks were also updated to "5.12.0". After that point, the Vision program version - representing changes to the framework - and the Task version will diverge as changes are made to individual Tasks. Task versions will also differ from each other. The configuration dialog for each Task will show the Task version, the date of the version and the initial release year. Measurement Tasks that present data in a dialog will show the same information on that dialog.

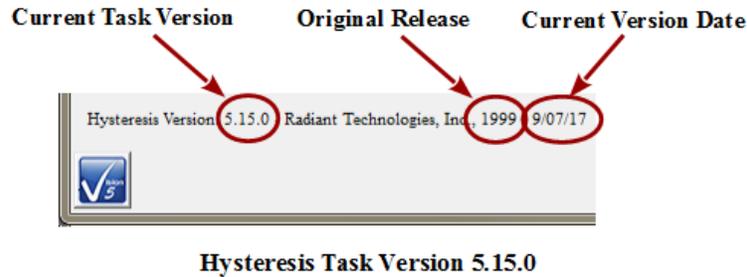


Figure 4 - Task Versions.

The "About Vision" dialog of **Figure 3** also shows a "Driver Version". The Driver is a Windows DLL program that takes input from Vision and formats it so that it can be understood by the tester. It communicates the information to the tester and receives tester response. The response is reformatted for, and passed back to, the Vision program. The driver program version will generally resemble the Vision version but is completely independent.

If you are having trouble with your tester, your Vision program or with Windows interface to either we will often ask you for the Vision and/or Driver version. Vision provides tools that make it easy for you to obtain that information in a suitable format and send it to us. If we need such information we will guide you to those tools.

Licensing

Vision is freely distributed to any and all parties who have an interest without further license. The program may be downloaded any number of times and may be installed on any number of host computers. The practical uses of the program are limited without a Precision tester, but the program is fully operational with or without a tester. With no tester present, data-collecting Tasks will generate meaningless synthetic data. Any party can register a DataSet taken by any other party to review archived data and investigate the construction of the experiment (Test Definition).

Licensing Custom Task Suites

A number of groups of Vision Tasks, known as Custom Task Suites must be purchased and licensed before they will operate. The Tasks are freely distributed with Vision. Any user can open the Task configuration dialog for review and to access the Task Instructions. Any user can review Custom Task data collected by a licensed installation of the Custom Task. However, to operate the Task it must be licensed. The license is in the form of a file named Security.sec that is placed in C:\Program Files (x86)\Radiant Technologies\Vision\System. The Task is coded to the Task Suite or Task Suites being purchased. It is also coded to an embedded ID in the tester for which it is purchased. In order for a Custom Task to operate, the security.sec file must be in

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

place and the specified tester must be connected to the Vision host and powered.

The security.sec file may be copied to any number of host computers. However, it cannot be transferred to any other Precision Tester.

Task Suites include:

- Chamber (Pyroelectric): Set Temperature/Measure at a series of temperatures. This offers automatic control of a variety of thermal controllers.
 - Chamber: Measure using PUND.
 - Remanent Chamber: Measure using Remanent Hysteresis.
- Piezo: Measure the sample polarization ($\mu\text{C}/\text{cm}^2$) and displacement response. The displacement response is measured by an external displacement detector and captured as a voltage at the SENSOR port.
 - Piezo: Basic measurement. Normally used for bulk samples. There are minimal onboard noise reduction tools.
 - Advanced Piezo: Normally used for thin film samples with data taken from an AFM. There are advanced noise reduction tools and extensive data processing.
 - Piezo Filter: Gather, operate on, store and plot Piezoelectric data from one or more Piezo and/or Advanced Piezo Task.
- Transistor: Capture transistor drain current as a function of V_{Source} and V_{Gate} .
 - Transistor Current: Transistor response at a single V_{gs} and V_{ds} .
 - Transistor IV: Transistor response at a single V_{ds} over a range of V_{gs} .
 - Transistor Curve Trace: Series of Transistor responses at a single V_{ds} over a range of V_{gs} . V_{ds} changes at each sweep.
- Magneto-Electric: Capture sample polarization ($\mu\text{C}/\text{cm}^2$) as a function of a variable magnetic field provided by a Helmholtz coil. Older installations used a KEPCO BOP 36 current amplifier to provide stimulus to the Helmholtz coil. These also used a Lakeshore 425 Gaussmeter to calibrate the field at the sample. Later measurements use the RTI CS 2.5 current source to drive the Helmholtz coil. Hall Effect sensors are built into a shield box to directly detect the magnetic field at measurement time. M.E. Tasks are divided into Kepco and CS 2.5 groups.
 - Magneto-Electric Response: Hysteresis style polarization ($\mu\text{C}/\text{cm}^2$) over a periodic magnetic field (G).
 - DC Field: Set and hold a fixed DC magnetic field (G) for a user-specified period of time (s).
 - Single-Point C/V (MR): measure sample small-signal capacitance (nF) using a magnetic field (G) stimulus.

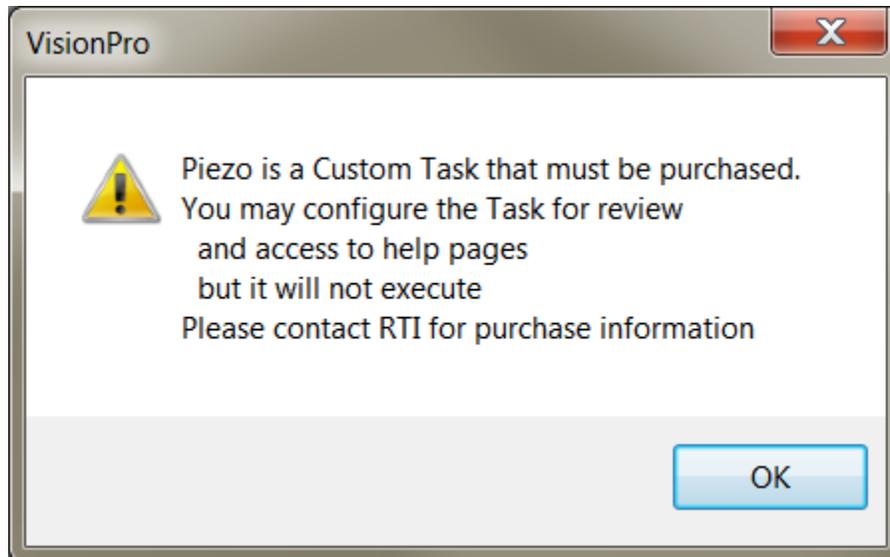


Figure 5 - Notice Appears when Unlicensed Piezo is Accessed. The Configuration Dialog will Open when the Notice is Closed.

A small note on text format in these Help pages.

There is not a large list of various textual representations in the Vision help pages. However, these few rules do apply:

1. Vision key words are always capitalized, as in Task, DataSet or Test Definition.
2. Names of controls on dialogs are italicized as in *Task Name* , *VMax* or *Comments* .
3. Text within controls is specified in quotations. For example '...' and set *Task Name* to "5.0-Volt Hysteresis".'
4. References to figures and tables with in text are set in bold type as in '... **Figure 7** represents...!'

A small note on Vision documentation

This collection of documents forms the main Vision manual. It, along with Task-specific and dialog-specific help, accessed by clicking *Click For Task Instructions/Click For Dialog Instructions* on any Vision dialog, form the complete set of program documentation. The Vision program changes frequently. Documentation will normally lag behind program updating, sometimes by significant periods of time. One consequence is often that an image of a dialog or set of controls in the documents to not exactly resemble the program windows being discussed. Nevertheless, Vision is designed to grow naturally so that older documentation will still be correct and helpful, even where it may be incomplete.

Note that Task Instructions will provide more detailed Task-specific information that is also likely to be more up-to-date than these general Vision help pages. The Task Instructions should form the major reference for the Vision program.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

System Requirements

All modern Windows-based host computers have sufficient resources to install and operate the Vision program. Vision should install and operate correctly under 32-bit and 64-bit Windows operating system from Windows XP through Windows 10. However Radiant Technologies, Inc. can no longer provide customer support for installations on Windows versions older than Windows 7.

Maintaining Vision

The Vision program does not have tools installed on the host computer to search for version updates. However, the Vision program is upgraded very frequently. Two or three version updates in a week are not unheard of. Often these updates include significant improvements or important fixes. Furthermore, the first request when you are asking Radiant Technologies, Inc. for assistance will be to ensure that you are running the latest Vision.

To update Vision, go to http://www.ferrodevices.com/1/297/download_vision_software.asp, fill in the form and click *Submit*. You will be linked to the Vision Installer Download page. Review the information on the page and click the download button. Acknowledge all warning. Allow the file to download and then run it. The installer will quickly update most installations. Older Vision installations must be uninstalled before the installer will write the newer version. Uninstalling using the standard Windows program uninstall tool will leave custom files such as security.sec and custom DataSets in place.

All fields required (unless otherwise noted)

Organization:	<input type="text" value="Radiant Technologies, inc."/> (optional)
Name:	<input type="text" value="Scott Chapman"/>
Phone #:	<input type="text" value="5058428007"/>
Your Email:	<input type="text" value="radiant@ferrodevices.com"/>
Confirm Email:	<input type="text" value="radiant@ferrodevices.com"/>
Address:	<input type="text" value="2835 Pan American Fwy NE"/>
Address 2:	<input type="text" value="Suite C"/>
City:	<input type="text" value="Albuquerque"/>
State:	<input type="text" value="NM"/>
Zip/Postal Code:	<input type="text" value="87107"/>
Country:	<input type="text" value="USA"/>

Tester Type:	<input type="text" value="Precision Premier II"/> <input type="button" value="v"/> (optional)
Serial Number:	<input type="text" value="PPM0317-999"/> (optional)

Comments (optional):



Please enter the numbers above.

Figure 6 -Vision Install/Update Form.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)



Vision 5 Presentation and Installer



Announcing the Release of Vision 5.0

The instructions in this document have been updated as of 21 March 2017

This page is used to install the latest version of the Vision program - Vision 5.12. Use the installer on this page to install Vision to host computers that have never had Vision installed or to update computers that have older versions of the program already installed.

Requirements

Vision may be installed on any Windows host computer running Windows 7. These include Windows 7, Windows 8, Windows 8.1 and Windows 10. Windows XP and Windows Vista are no longer supported. The same installer can be used for 32-Bit and 64-Bit host computers. For documentation purposes, 64-Bit host computers are assumed.

The Vision program installed from this page will operate all Precision Testers, regardless of model or age, that connect to a separate host computer through a USB cable. It does not operate the Precision Workstation or original Precision Pro/Premier with internal CPUs.

The Vision 5.6.x release offered a more up-to-date installer than previous versions. Changes include:

- New look.
- No random "Disk Space Errors"
- C++ Manifest installation is embedded instead of executing after the installation. The installation may require a reboot, but will only execute on initial installation. Updates will not require a re-installation of the manifest.
- Vision 5.6.x included a data plotting library update. The data plotting appearance is slightly different. The right-click Export bug has been repaired.
- **Installer updates to Version 5.6.8 and later do not need to have the previous Vision installation uninstalled. Just download the installer and run it. Older files will be updated by date and new files will be written.**

To Update Existing Vision Installations:

- Copy C:\DataSets\explorerdb.cpu and C:\DataSets\Editor List.EL to temporary locations. You may not find all three of these files, depending on your use of Vision. C:\DataSets\explorerdb.cpu is the important file. **NOTE: If the existing Vision Version is 4.9.2 or later this step does not need to be taken.**
- Go to Start->Settings->Control Panel and select "Add or Remove Programs..." **NOTE: If you are updating from Vision 5.6.8 or later, this step and the next step do not need to be taken. The latest installer will update the existing installation**
- When the program list is populated, scroll down to and double-click "Vision". Allow the program to completely uninstall.
- Download the installer under the Vision 5 download button below.
- Run the downloaded installer. Acknowledge all warnings and allow the installation to proceed. At the end of the installation a separate Microsoft Visual C++ program will run that will update Windows files to run with the Vision program. Allow this program to run to completion.
- Return the backed up explorerdb.cpu, and Editor List.EL to C:\DataSets\, overwriting the files from the installer. Note that you will not need to repeat the backup or restore steps in the future. **NOTE: If the Vision Version being updated is 4.9.2 or later this step does not need to be taken.**

To Install Vision to a Fresh Host Computer:

Note that you must install Vision before connecting your Precision tester for the first time. Simply download the installer under the Vision 5 download button below, and run the installer. Acknowledge all warnings and allow the installation to proceed.



Latest Vision Installer - Vision 5.12.10 - 21 March 2017

Support for Windows XP and Vista has ended.

NOTE: This installer is not for use with the Precision Workstation or original Precision Premier/Pro with on-board

Figure 7 - Vision Installer Download Page

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)



Contact Radiant Technologies, Inc.

Mr. Joe Evans	President
Ms. Michelle Bell	Marketing and Sales
Mr. Bob Howard	Hardware Design and Construction
Mr. Spencer Smith	Hardware Design and Vision/Hardware Interface (Driver)
Mr. Scott Chapman	Software Design and Programming, Training, Customer Support
2835 Pan American Fwy NE Suite B and C	
Albuquerque, NM 87107	
1-800-289-7176	
505-842-8007	Voice
505-842-0366	FAX
radiant@ferrodevices.com	
www.ferrodevices.com	Process and Clean Room
www.ferroelectric testers.com	Precision Testers

Main Vision Manual

I - Introduction

These help pages provide a complete and detailed description of the Vision program that is used to control the Precision test hardware, capture the Precision measurements and organize, store, analyze, display and export the captured data. The main manual provides a complete overview of the Vision system. Vision is actually a collection of programs of varying number. Vision itself provides a framework for the construction and execution of experiments (or Test Definitions) and the organization of data. Semi-independent programs, known as Tasks, are loaded by Vision at startup and used to perform the various experimental functions. Features of the Vision framework program are provided in detail here, and supplemented with tutorials and step-by-step procedures in preceding and subsequent topics.

II - Overview

The Vision software is an integral part of the Precision Precision Materials Analyzer Family. It comes fully configured and ready to operate on the Precision Family. Vision software originally ran over the Windows NT 4.0 operating system and would actually operate on any host that boots under Windows NT 4.0. Vision now runs under Windows 7, 8, 8.1 and 10. Windows 2000, XP and Vista are no longer supported. The Vision software may be downloaded onto any system by connecting to the Radiant Technologies, Inc. web site at http://www.ferrodevices.com/1/297/download_vision_software.asp. For users that received the Vision program with their test system, upgrades to both the Vision program and new and upgraded [Tasks](#) (see [below](#)) will be placed on the web site frequently. Running the program on a host with no Precision Family Tester attached will cause a synthetic data generator to be engaged that will produce meaningless data if measurements are attempted. The value of placing the program on a non-tester host is to be able to remotely design experiments that can then be moved to the Precision Family or to analyze data that have been acquired remotely on a tester.

The Vision program is located in the directory called C:\Program Files (x86)\Radiant Technologies\Vision. This folder contains two subfolders and a total of more than 100 files in the main folder and subfolders. The C:\Windows\SysWOW64 folder contains a driver that is started automatically when Vision is started and the tester(s) is (are) detected. This is called NGS_USB_DRIVER.DLL. This driver also depends on a file called Stop.dll in the same directory. C:\DataSets is the default repository for the [DataSets](#) files. (DataSets are described in detail, [below](#).) C:\DataSets folder also contains a number of files that may be both read from and written to by Vision. These files have been moved from the C:\ or C:\Program Files\... path to allow Vision to write them regardless of the user's permissions. The registry contains various paths and system values. None of these files, folders or registry entries should be moved, deleted or renamed or the system will not operate.

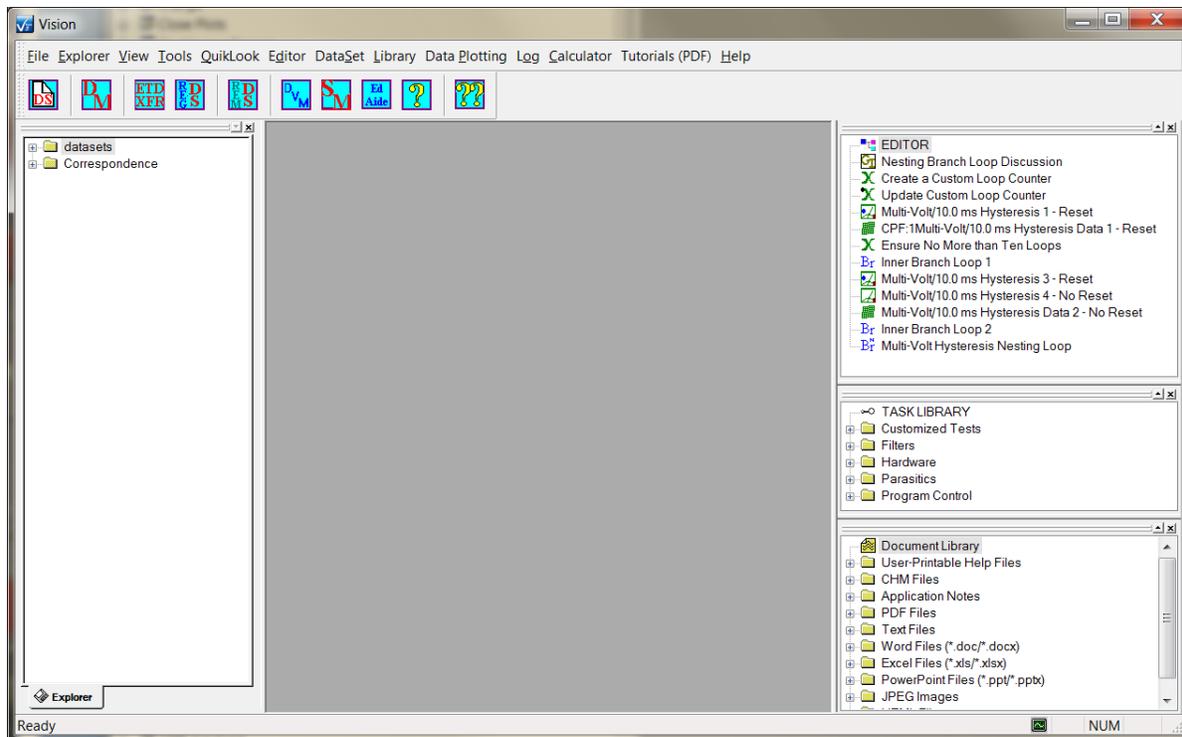


Figure 1 – Vision Program Screen

III - Startup

This topic discusses the various actions taken by Vision and the user on program startup.

III.1: Before Main Vision Window Display

Between the time the user initiates the Vision program and the time the program displays the main Vision window, several actions take place.

1. Vision searches C:\Program Files (x86)\Radiant Technologies\Vision\System for all files with a *.vlr extension. Each *.vlr file represents a Task that is available to Vision. Each Task found in the specified path is loaded into the Vision Library, with the exception of a very small number of Tasks that appear only in the QuikLook menu.
2. As Vision loads Tasks into the Library, the Task is examined to determine if it should be placed into the QuikLook menu. If it is to appear in the QuikLook menu, it is examined for the category under which it is to be placed in the menu (Hysteresis Task, Pulse Task, External Instrument Task, etc.) and sorted into that category in the menu. The Task also has its Library name modified with " (QL)" appended to the name. This is an indication in the Library that the Task is a QuikLook Task and may be accessed (configured and executed) from the Library by double-clicking.
3. Vision reviews the file C:\DataSets\explorerdb.cpu and uses the file to load registered

DataSets into the DataSet Explorer window.

4. If Vision does not find C:\DataSets\explorerdb.cpu it creates the file and notifies the user as in **Figure 1**. On first installation, the Vision installer writes a default C:\DataSets\explorerdb.cpu and this message will not normally appear on first startup after installation.



Figure 1 - Initial DataSet Explorer Data Base Creation.

5. Vision reviews the file C:\DataSets\explorerdb.cpu and registers the DataSets specified in the file to the DataSet Explorer.
6. Vision reviews the registry HKEY_CURRENT_USER/Software/Radiant Technologies/VisionPro/Settings path for various user-selected Vision configuration options. These keep the Vision operation persistent from one execution to the next.
7. If the "RELOADEDITOR" registry key is set to "True", Vision reviews the file C:\DataSets\EditorList.el and uses the file to reload the Test Definition that was present in the EDITOR when the program was shut down. If the registry key is "False", the EDITOR is not reloaded. The option is set in the Tools->Reload Editor Test Definition on Startup option in the main Vision menu (**Figure 2**). Note that a corrupt C:\DataSets\EditorList.el file may cause Vision to fail on startup. If Vision is not starting, but producing a Windows failure dialog, remove the C:\DataSets\EditorList.el file, or edit the RELOADEDITOR registry entry and set it to "False", then try the startup again. If Vision continues to fail, it is for another reason. Note that if Vision is configured to reload the EDITOR, but does not find C:\DataSets\EditorList.el, it will produce the message of **Figure 3**, but will start normally.

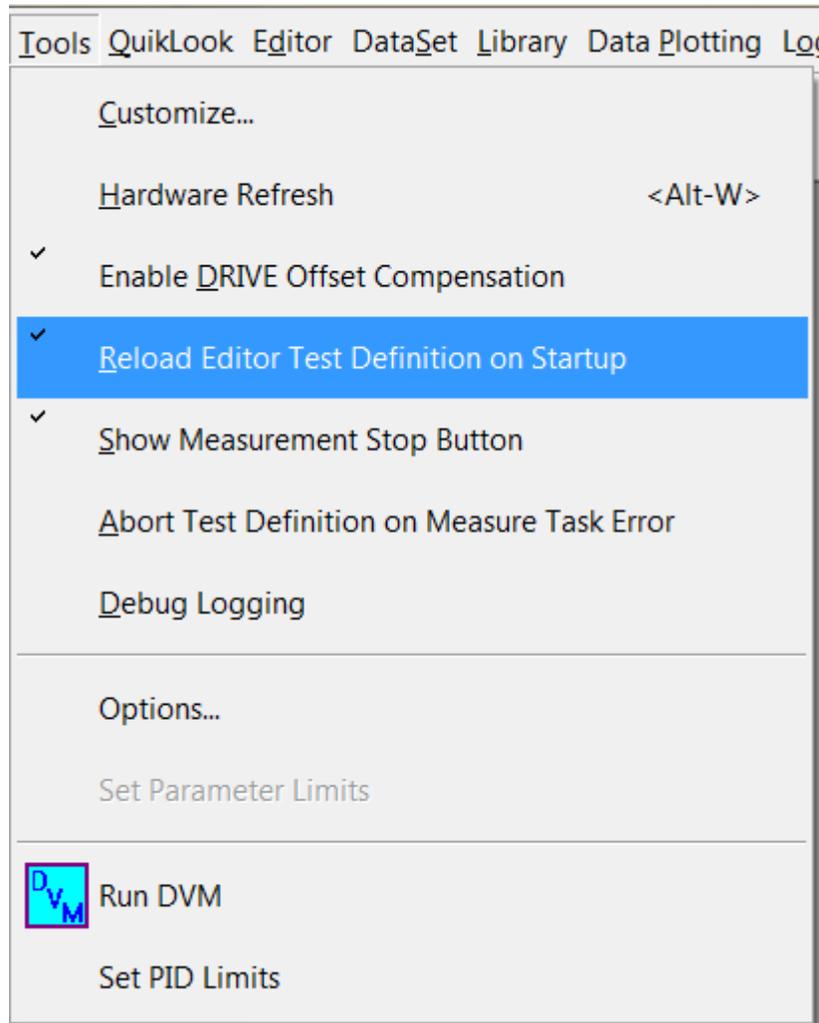


Figure 2 - Adjust the EDITOR Reload Option.



Figure 3 - C:\DataSets\EditorList.EL Not Found.

8. Vision detects and starts drivers for all attached Precision testers.
9. Vision opens the Main Vision Window. If the registry entry "RESTOREWINPOS" is set to "True", the program windows will be returned to the state they were in when the previous instance of Vision was shut down. Windows size and docking position (or undocked location) will be maintained. If the registry entry is set to "False", the windows

will always open in the default size and position. This option is set in using the View->Restore Window Position on Startup Vision menu option (**Figure 4**).

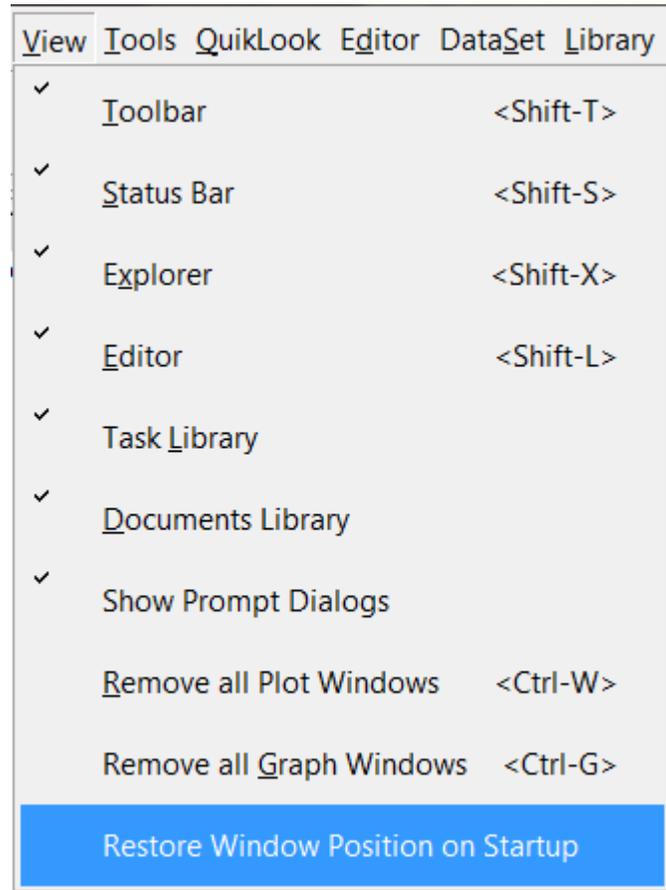


Figure 4 - Adjust the Window Position on Startup Option.

III.2: Initial Windows Display

As noted above, when Vision first starts it detects any Precision tester connected to the host computer through USB connections and starts the drivers for the connected testers. When the Vision program display is opened, an initial dialog is presented that lists the tester. If no tester was detected, the dialog indicates "No Tester Attached" (**Figure 5**). In this case, the dialog is of little value. It must be closed by clicking *Cancel*. At that point, Vision can be operated normally, though no actual measurement data can be collected.

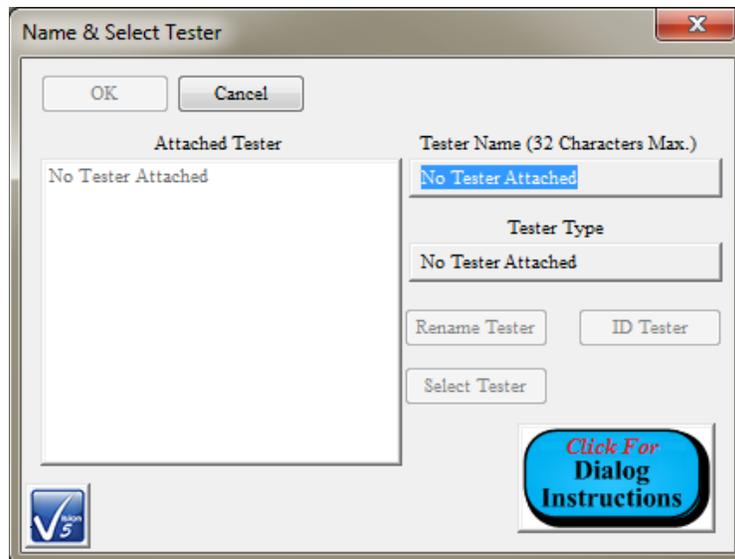


Figure 5 - Vision Startup Tester Selector Dialog. No Powered Testers are Connected.

If a tester is identified on startup, the dialog will list the tester in the *Attached Tester* control of the dialog. With a tester present, the dialog becomes a useful tool. With multiple testers attached, the tool becomes even more useful. Earlier documentation indicated that multiple testers could be connected of which one would be selected. Multiple testers are no longer supported. The Tester Selection dialog remains unchanged with legacy controls that operate on multiple testers.

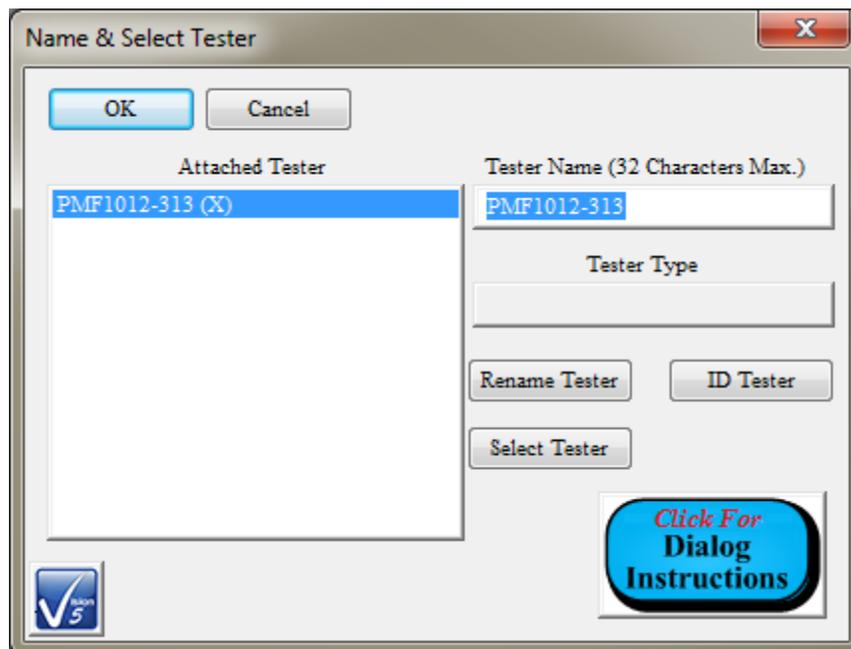


Figure 6 - Vision Startup Tester Selector Dialog. Two Powered Testers are Connected.

If a tester is connected and powered it is listed in the dialog by name. The name is written to and read from the tester's EEPROM. The name may be assigned or changed by the user, and written "permanently" to the tester EEPROM in the dialog. When the tester is selected in *Attached Tester*, its name appears in the *Tester Name* control. That control may be edited. Once it is edited, clicking *Rename Tester* will cause the tester's name in its EEPROM to be updated. Naming a tester is particularly useful in cases where multiple testers of the same type are connected to the host. Unique names will help distinguish the testers.

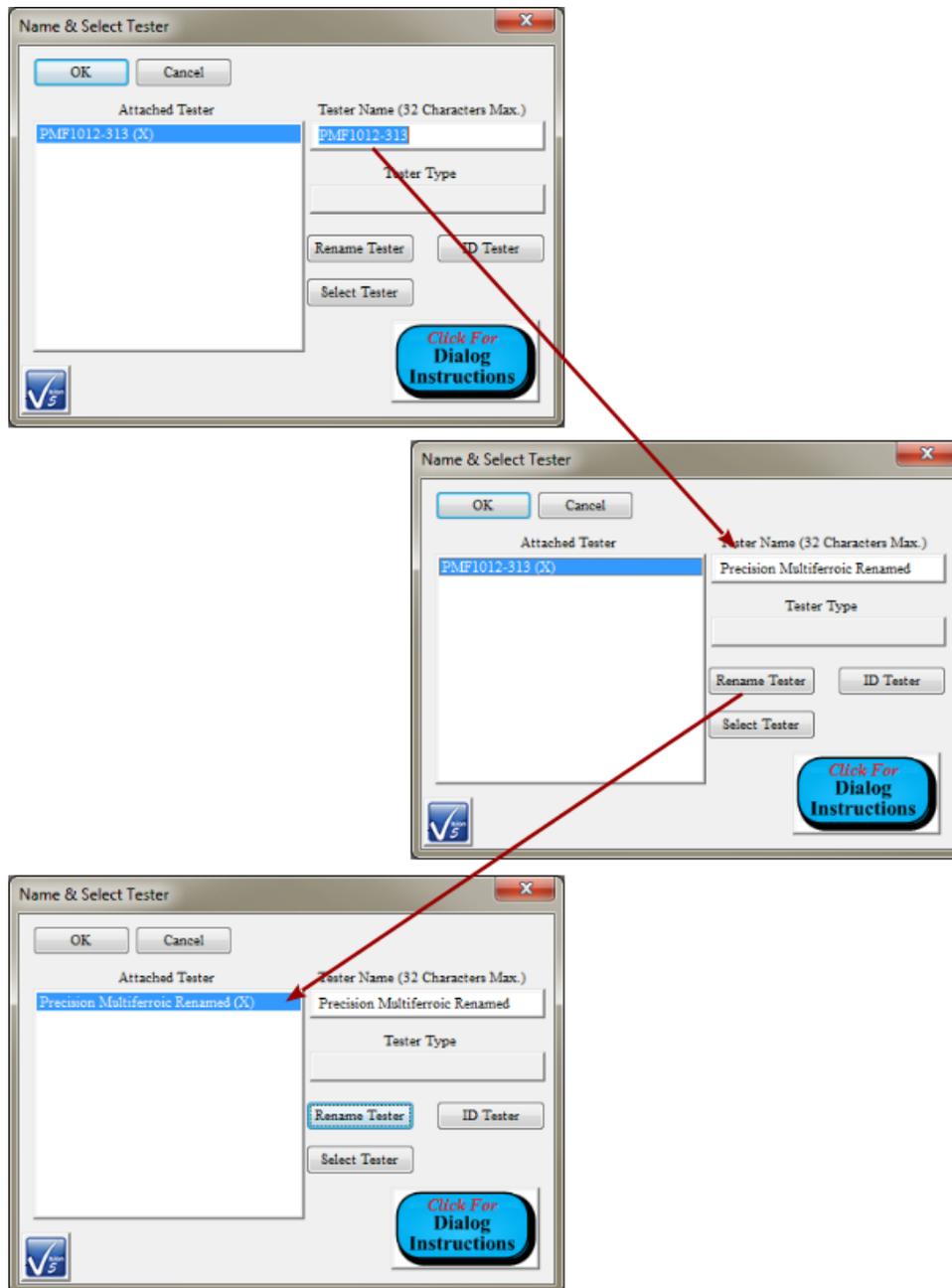


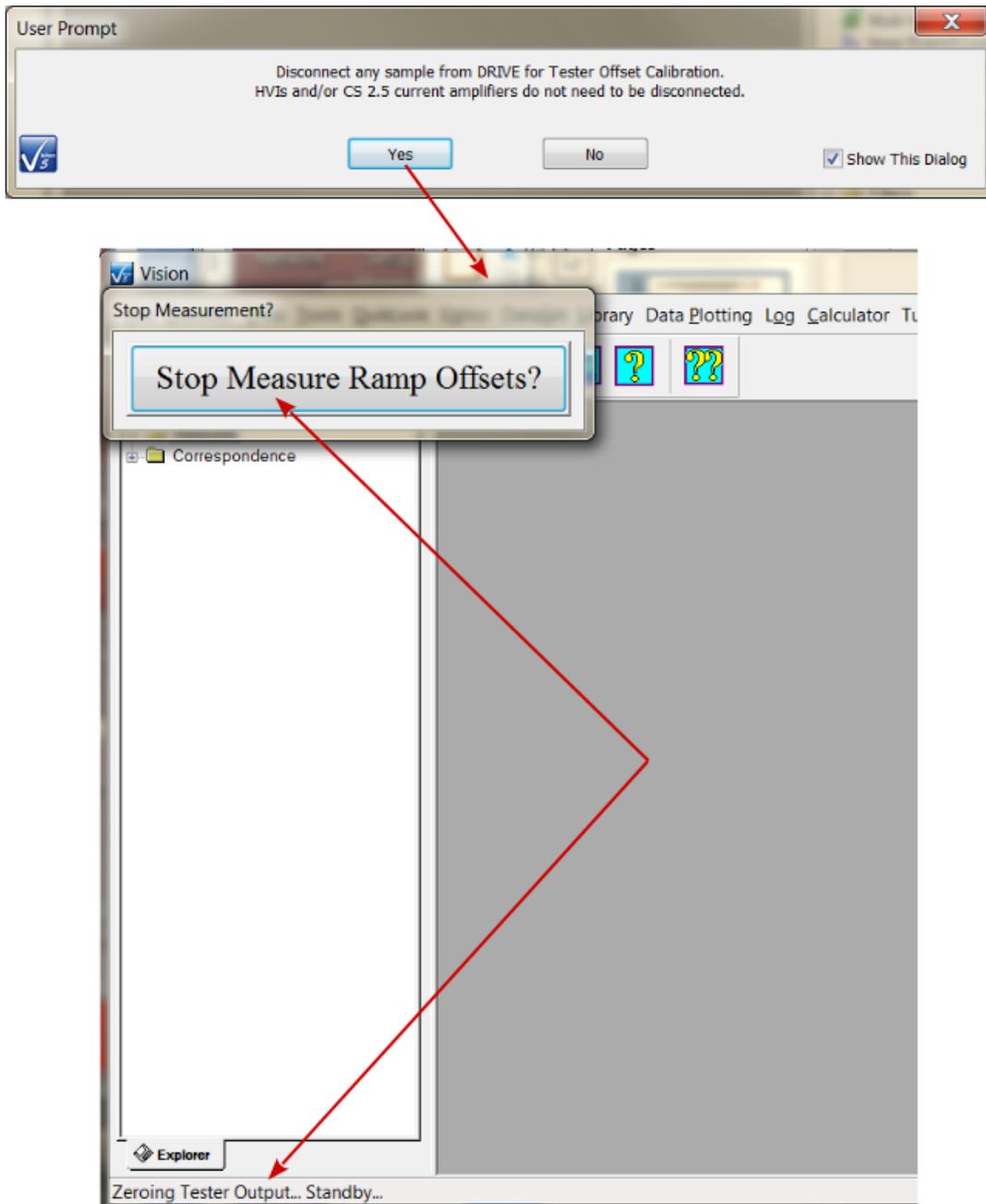
Figure 7 - Renaming a Tester.

The dialog offers a legacy ID tool. Selecting the tester name in *Attached Tester* and clicking *ID Tester* will cause the tester's green light to blink rapidly for about five seconds, signaling which tester is selected.

The *Select Tester* button is a legacy control that allowed a single tester to be selected for operation from a list of several testers. Only a single tester may now be operated and this

control offers no current function.

Once the tester configuration has been properly adjusted, close the dialog by clicking *OK* . A prompt dialog will appear that indicates that the program will enter a tester calibration procedure. Click *Yes* to allow the calibration to proceed. The Vision status bar will indicate that the program is calibrating the tester with "Zeroing Tester Output... Standby...". A *Stop Measure Ramp Offsets?* button will also appear. Calibration is complete when the button disappears and the status bar indicates "Ready".



Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

Figure 8 - Calibrate the Tester.

Vision is then ready for normal operation. The hardware configuration may be changed - testers may be added and/or removed, or tester selection changed - without closing and re-starting Vision. Make the appropriate hardware configuration changes, then press <Alt-W> or select "Tools-> Hardware Refresh". Vision will redetect and reinitialize any connected, powered testers and the Tester Selection dialog will reappear. When the dialog is closed the calibration procedure of **Figure 8** will proceed. The Hardware Refresh option must be exercised any time that there is a hardware change such as turning a tester on or off or adding a High-Voltage Interface (HVI).

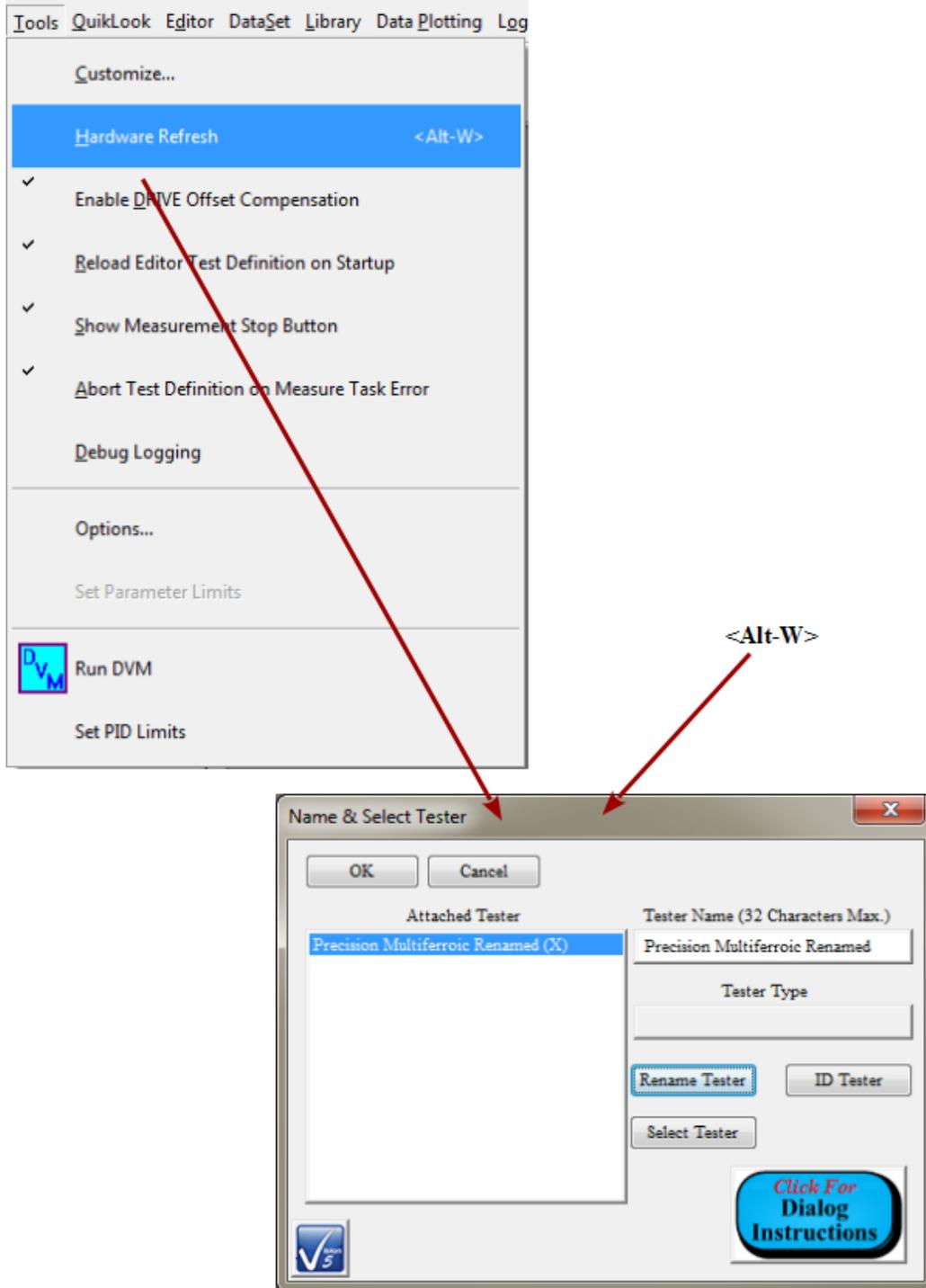


Figure 9 - Hardware Refresh after Hardware Reconfiguration.

IV - Making Measurements

IV.1 - Discussion

Once the Vision and the tester are installed, Vision has started and the tester has been calibrated, the next order of business is to start to make these tools work by making measurements. To this end, it is important to distinguish two different methods of accessing measurements from within Vision: QuikLook and DataSet Test Definition. This discussion presents a quick introduction to these two methods. The rest of this manual provides in-depth discussion of the methods and Vision tools that support them. It is highly recommended that you work through the [Tutorials](#). These will provide a quick and in-depth education into the use of the Vision program.

IV.2 - QuikLook

The Vision program serves as a framework that provides services to a variable list of semi-independent agents known as Tasks. Tasks are configurable and executable entities that do the work in Vision. On Vision startup, Tasks are identified and loaded into the Vision Task Library. A subset of Tasks - primarily those that interact directly with the tester - are also loaded into the QuikLook menu.

(Note that, for these discussions, the Hysteresis Task is used extensively to provide the example measurements. The Hysteresis Task is the most fundamental measurement performed by Vision and the Precision tester. At the tester RETURN port it captures the charge Q (μC) from a sample electrode induced by a voltage applied to the opposite electrode by the tester DRIVE port. The charge is normalized by the sample area (cm^2) to produce polarization ($\mu\text{C}/\text{cm}^2$)).

QuikLook measurements provide fast access to measured data by presenting Tasks that can be immediately configured and executed, with Measurement Tasks displaying data on execution. Go to QuikLook->Hysteresis-Hysteresis.

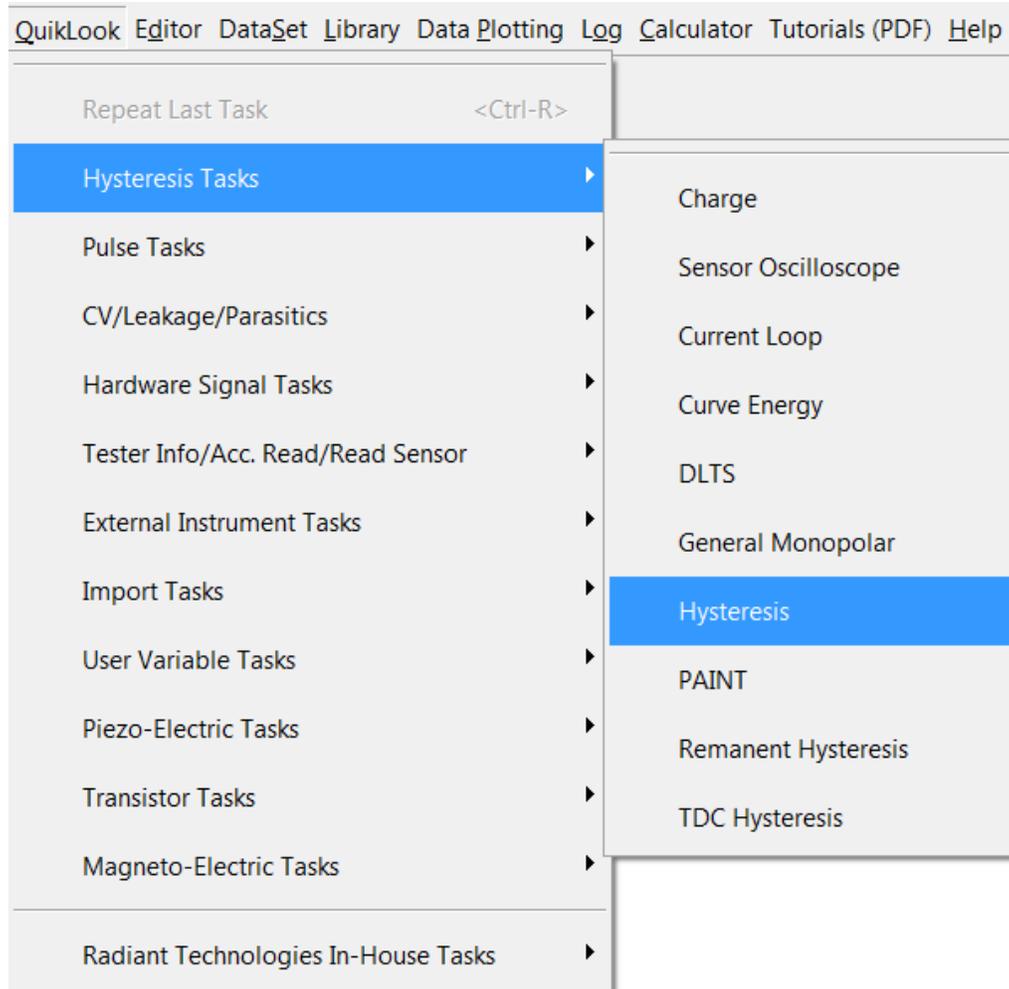


Figure 1 - Initiate the Hysteresis Task from the QuikLook Menu.

The Hysteresis Task QuikLook configuration dialog immediately appears. The dialog presents a complex set of controls. Just a few controls will be adjusted for this measurement. But a complete discussion of the Task - its theory, configuration and execution - can be accessed by clicking Click For Task Instructions. This opens a help project that provides complete detail of the meaning of, use of and interaction between every control.

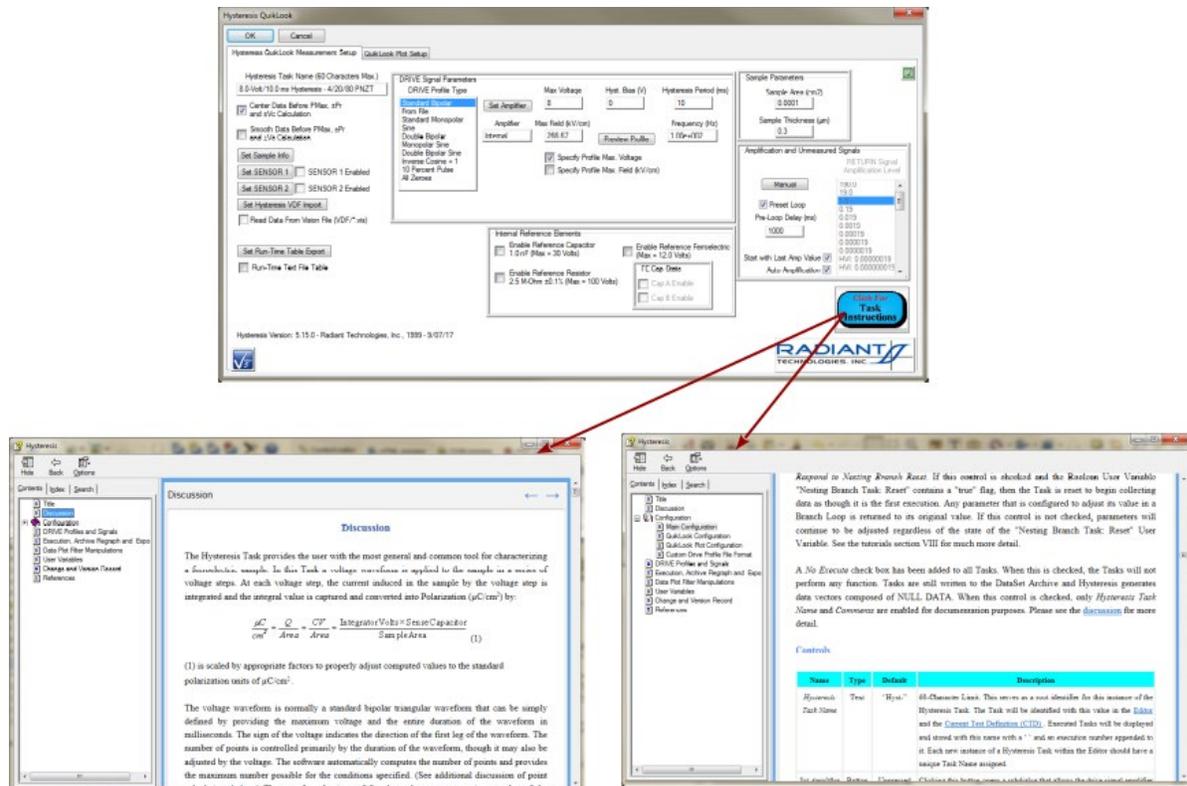


Figure 2 - Hysteresis QuikLook Configuration and Task Instructions.

In the configuration dialog these few controls were adjusted:

- *Hysteresis Task Name* - All Tasks include a *Task Name*. Tasks are identified throughout Vision by their *Task Name*. It is important to assign a unique and meaningful name to the Tasks, although this is less important in QuikLook.
- *Max Voltage* - This is the maximum DRIVE port signal strength to be applied to the sample electrode. In this standard default state, a bipolar triangular voltage profile will be applied, peaking at this voltage.
- *Hysteresis Period (ms)* - This is the duration of the application of the DRIVE voltage profile. It is equivalent to 1000/Frequency (Hz).
- *Sample Area (cm²)* - This is the surface area of the smaller of the two sample electrodes. This value is provided as documentation. It also affects the magnitude of the polarization response since polarization ($\mu\text{C}/\text{cm}^2$) is charge (μC) normalized by sample area (cm^2).
- *Sample Thickness (μm)* - This is the depth of the sample ferroelectric material between the two sample electrodes. This is primarily intended for documentation, but may be used if data are to be plotted, and/or signal is to be specified, in units of electric field (kV/cm). Here, electric field (kV/cm) is given by:

$$\text{Field (kV/cm)} = \text{Voltage} / (1000 \text{ V/kV} \times \text{Sample Thickness } (\mu\text{m}) \times 10^{-4} \text{ cm}/\mu\text{m}) \quad (1)$$

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

Many of the other controls will also influence the measurement, but are left in their default state. These are discussed in detail in the Task Instructions.

Since the QuikLook execution of the Hysteresis Task will present its data on a data plot as soon as the data are captured, a QuikLook Plot Setup tab is available as part of the QuikLook configuration. The dialog is primarily used to specify plot labels. The user can also opt to plot as a function of Voltage or Field (kV/cm). *Plot Filter* offers a variety of mathematical manipulations that can be applied to the data before plotting. (See the Task Instructions for complete details.) A *Comments* field is common to all Tasks. It can be used to provide extensive detailed documentation of the Task configuration, the sample, the purpose of the measurement, etc. Detail, here in QuikLook, is less important than in DataSet Test Definition measurements.

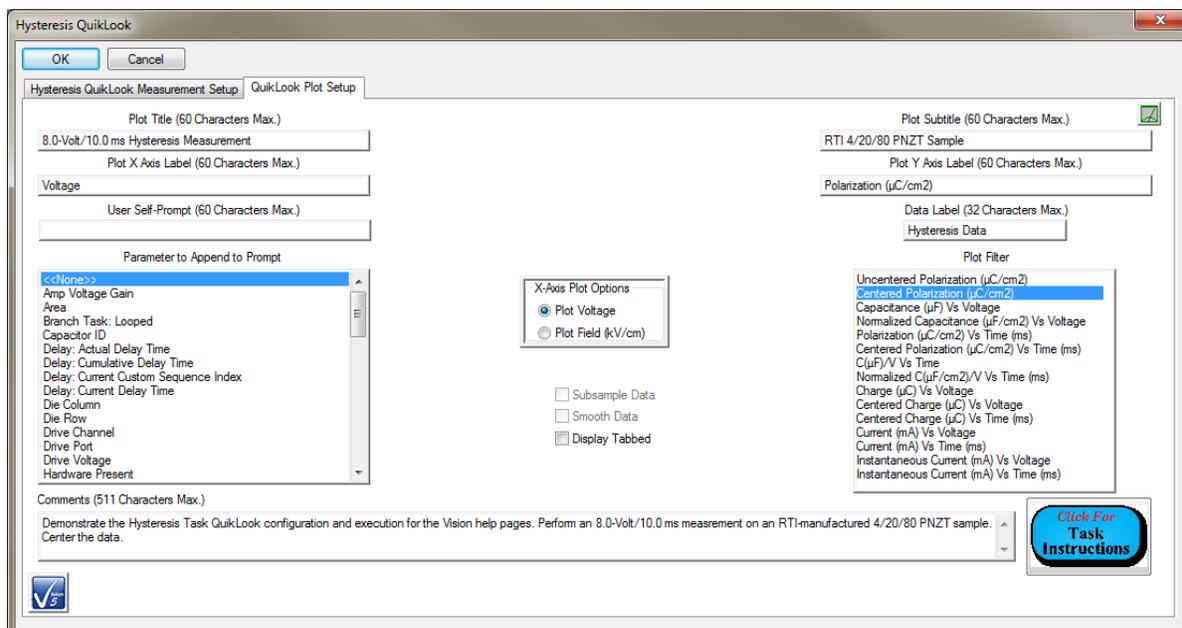


Figure 3 - Hysteresis QuikLook Plot Configuration.

Click *OK* to make the measurement. The data are displayed in a Data Presentation dialog. The dialog also offers several options. These are discussed in detail in the Task Instructions and throughout this manual.

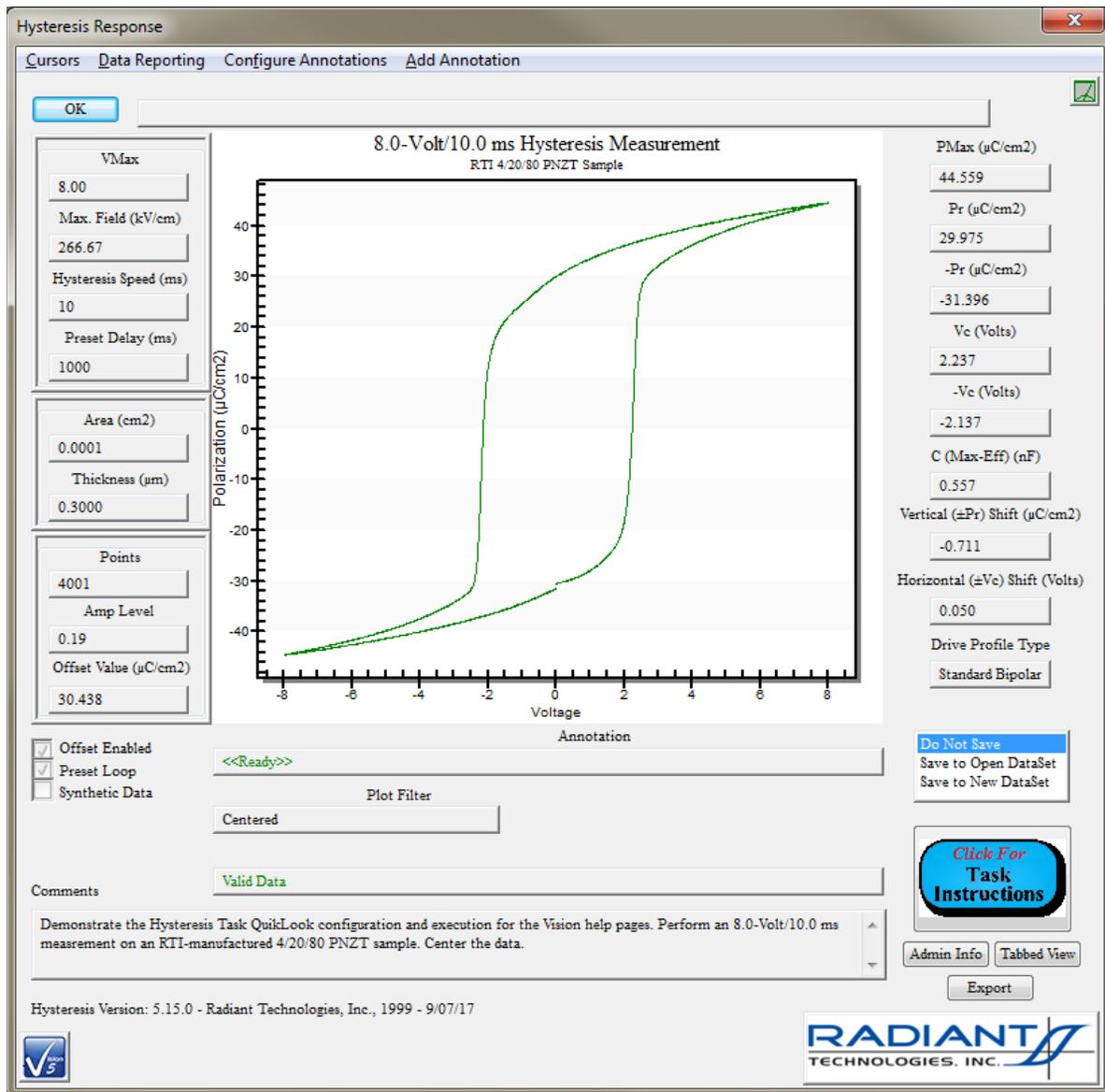


Figure 4 - Hysteresis QuikLook Data Presentation Dialog.

Although QuikLook configuration and execution is quick and relatively simple, it is a very limited option. As soon as the dialog of **Figure 4** is closed the data are lost forever. The only way to recover the data is to repeat the measurement. There are remedies for this, but QuikLook execution makes use of only about 3% the total capability of the Vision program. Vision is intended to make it measurements within a DataSet.

IV.3 - DataSet Test Definition

Let's start with some terminology:

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

- Test Definition - A Test Definition is a sequence of Tasks that make up an experiment. The Tasks are executed in their sequential order. (Advanced topics will provide exceptions to this.)

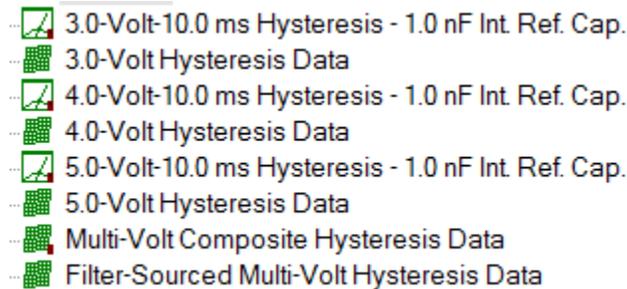


Figure 5 - A Hysteresis Test Definition with Filter Tasks.

- DataSet - A DataSet is a record, with associated database file, that contains Test Definitions. A single Current Test Definition (CTD) is an experiment that is ready to execute. The DataSet Archive contains any number of Executed Test Definitions (ETDs). These are complete records of the previous execution of Test Definitions within a DataSet. An open DataSet also includes a log window that contains a record of activity within the DataSet.

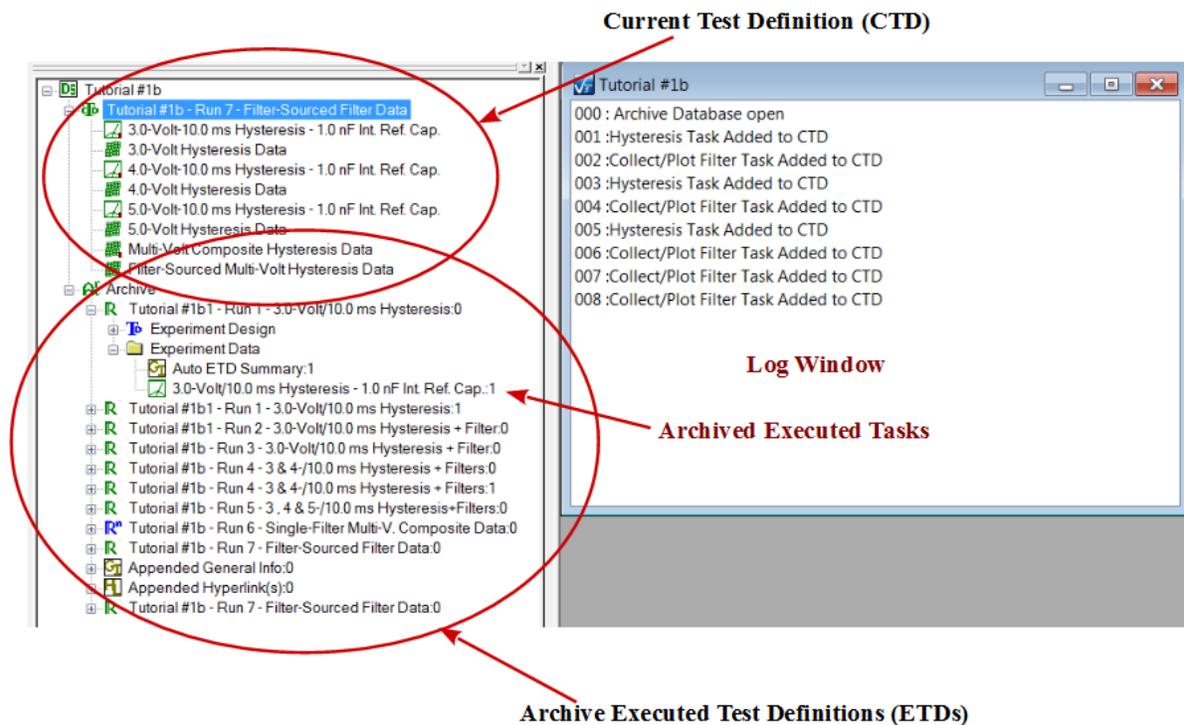


Figure 6 - A DataSet.

- DataSet Explorer - This is a window, normally located along the left border of Vision, that contains a list of all DataSets registered to Vision. The DataSets are displayed in a tree structure that represents the physical location of the DataSets on the Vision host computer (or network) disk drive. Any number of DataSets may be opened. Each open DataSet is represented by a tab in the DataSet Explorer window.

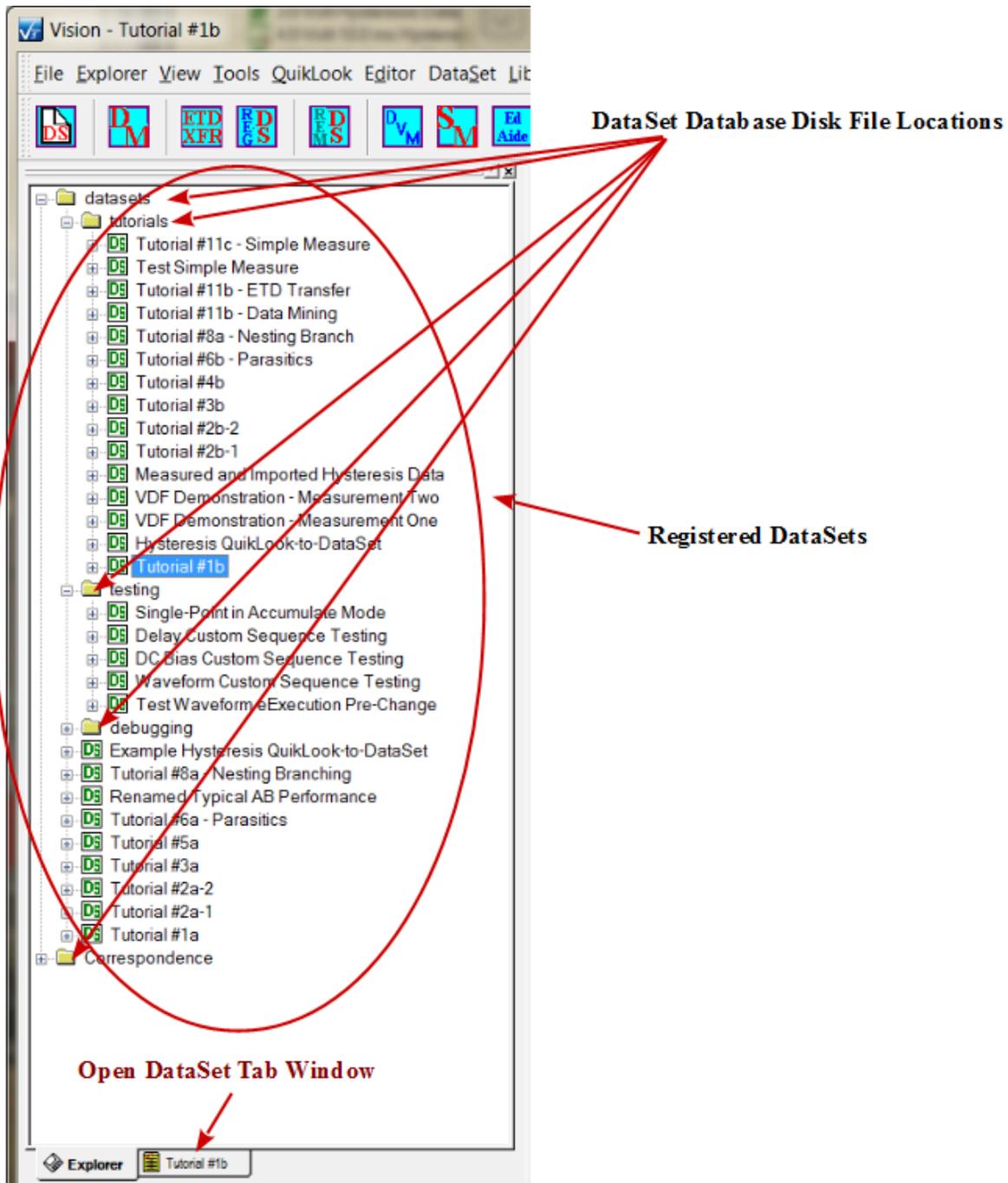


Figure 6 - DataSet Explorer Window.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

- **TASK LIBRARY** - This is a window that holds all Tasks available in Vision. Tasks are identified by Vision on startup and loaded into this window in a tree structure based on Task type. (A Task will never be more than three folders deep in the tree.) By default the **TASK LIBRARY** is the center window along the right Vision border.



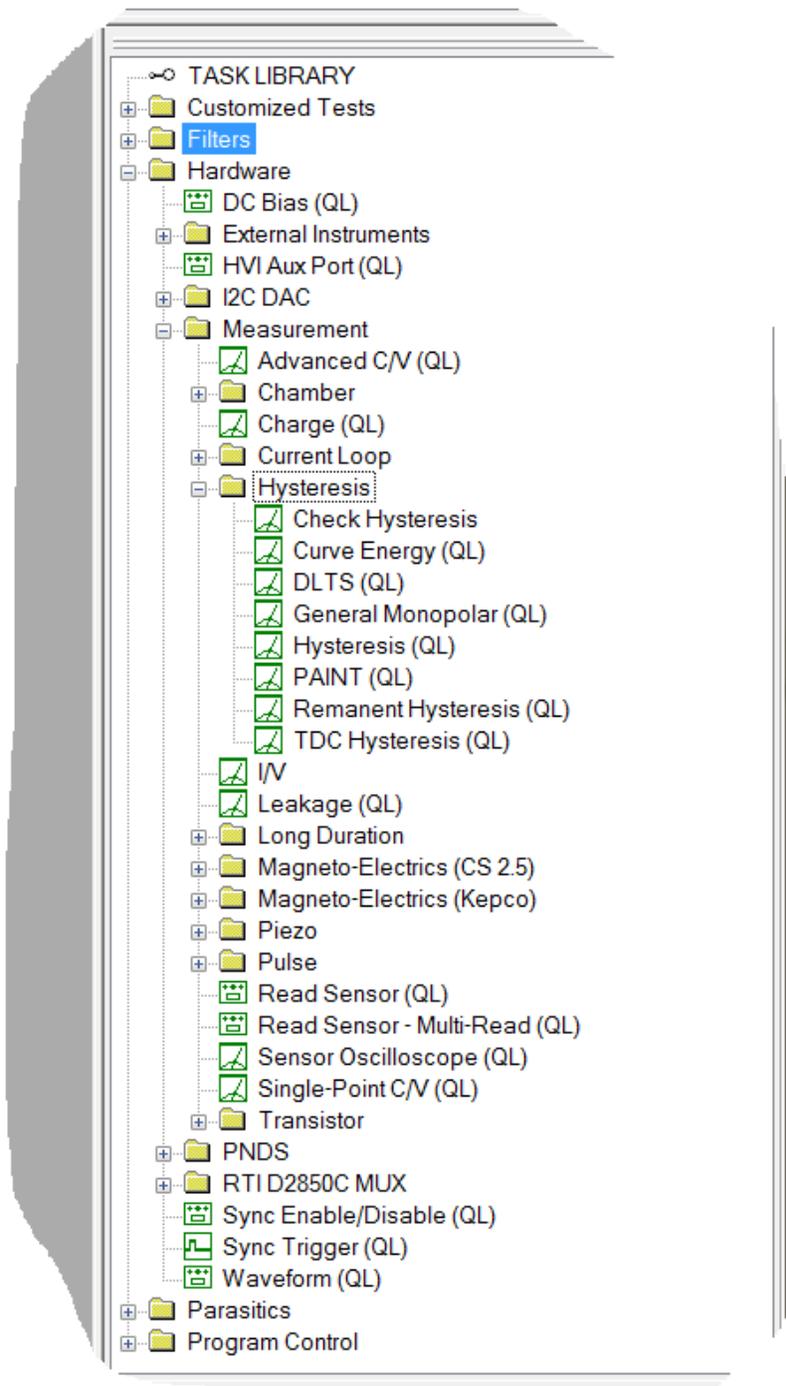


Figure 7 - TASK LIBRARY Window.

- EDITOR - This is a window in which Test Definitions are constructed. Tasks are moved from the TASK LIBRARY into the Editor, configured and appended to existing Tasks in the Test Definition that is under construction in the EDITOR. By default this is the upper

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

window along the right Vision border.

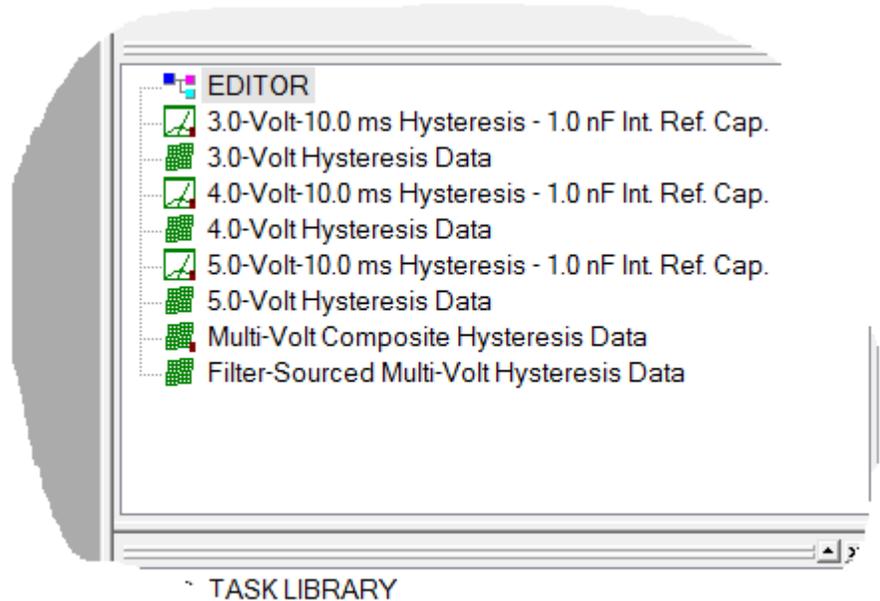


Figure 8 - EDITOR Window.

The process begins by moving a Task from the TASK LIBRARY into the EDITOR. (In somewhat more advanced discussion, complete Test Definitions can be moved to the EDITOR from DataSets and the "Customized Tests" folder in the TASK LIBRARY.) Tasks are moved by drag-and-drop or by right-clicking and selecting "To Editor".

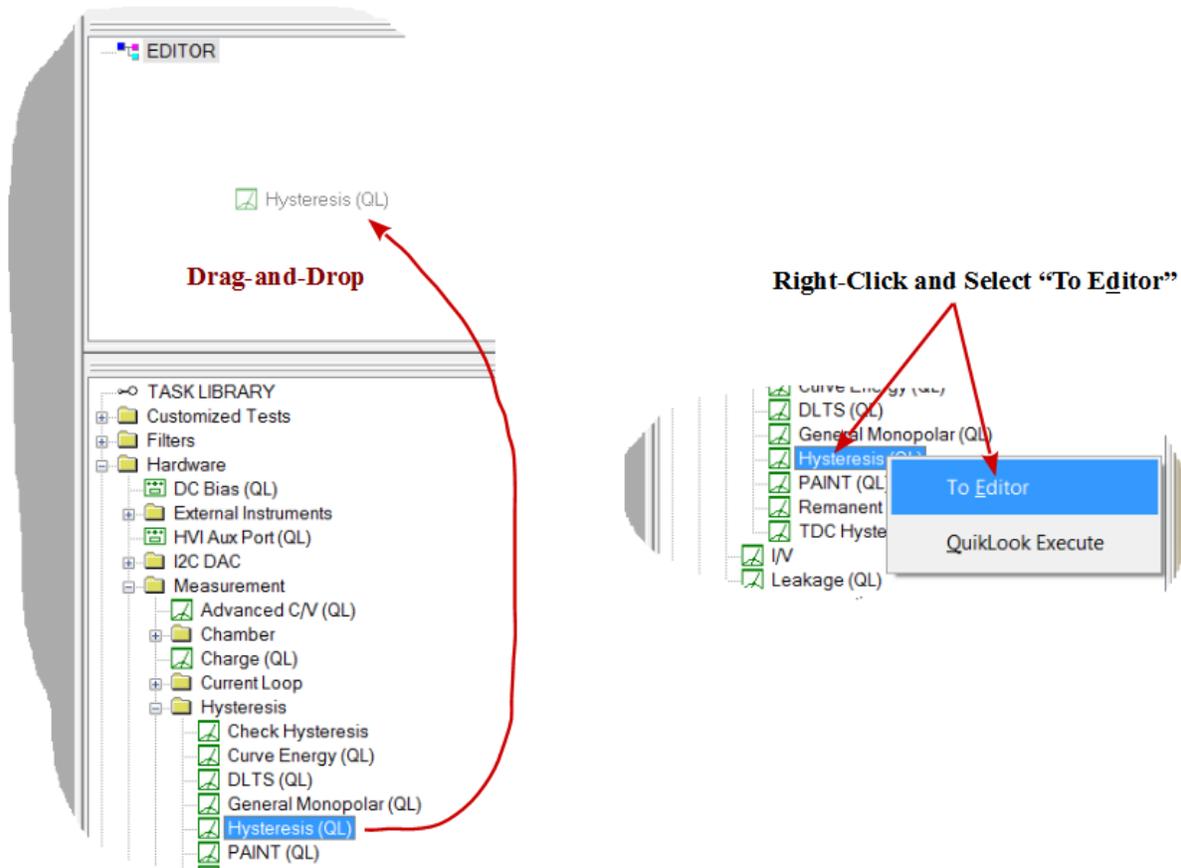


Figure 9 - Hysteresis Task to EDITOR.

The configuration dialog opens. Configure the Task and click *OK* to add it to the EDITOR Test Definition.

(Note: The Task is permanently stored in Vision under *Task Name*. *Task Name* should be unique and descriptive. *Comments* also represent permanent documentation.)

(Note: The Hysteresis Task in this demonstration does not plot data on execution. There is no plot configuration tab.)

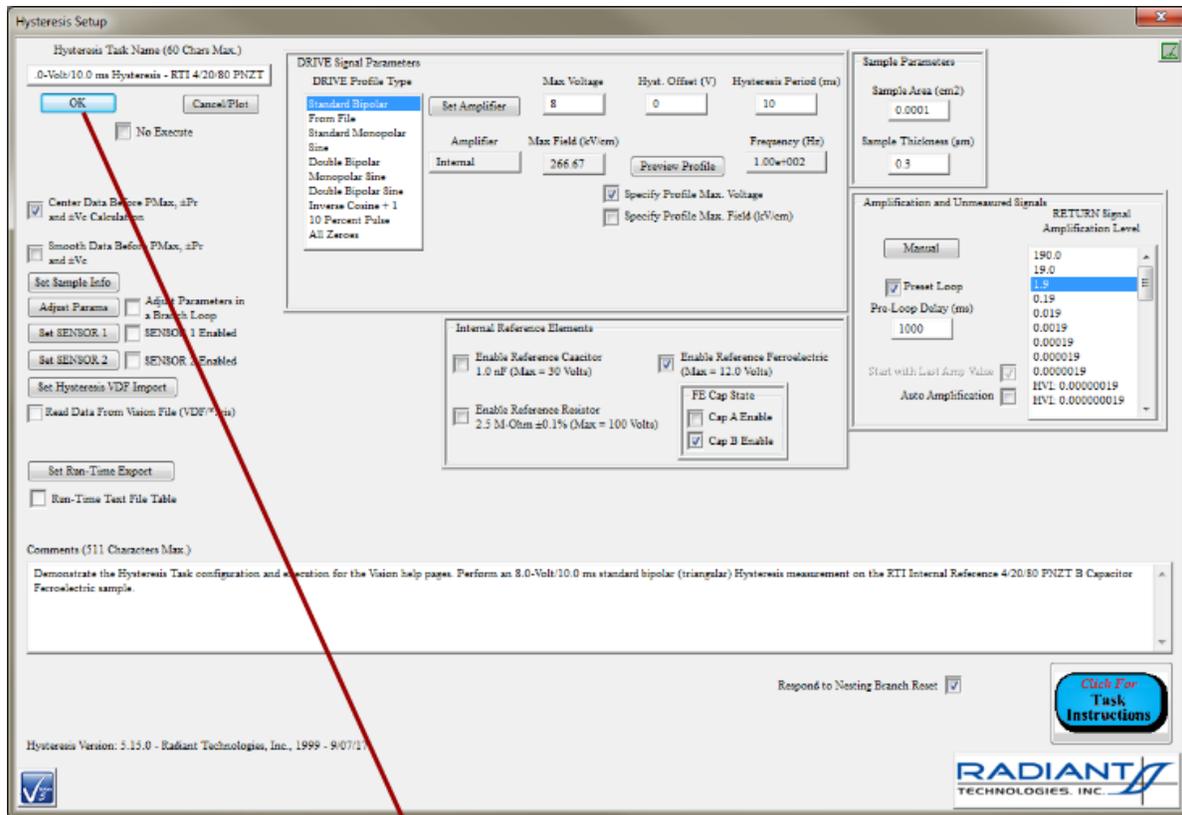


Figure 9 - Hysteresis Configuration and Append to EDITOR Test Definition.

In this demonstration a Collect/Plot Filter Task is added to collect the Hysteresis Task data and display it at runtime. Since the Collect/Plot Filter displays data at runtime it includes a configuration tab and a plot configuration tab.

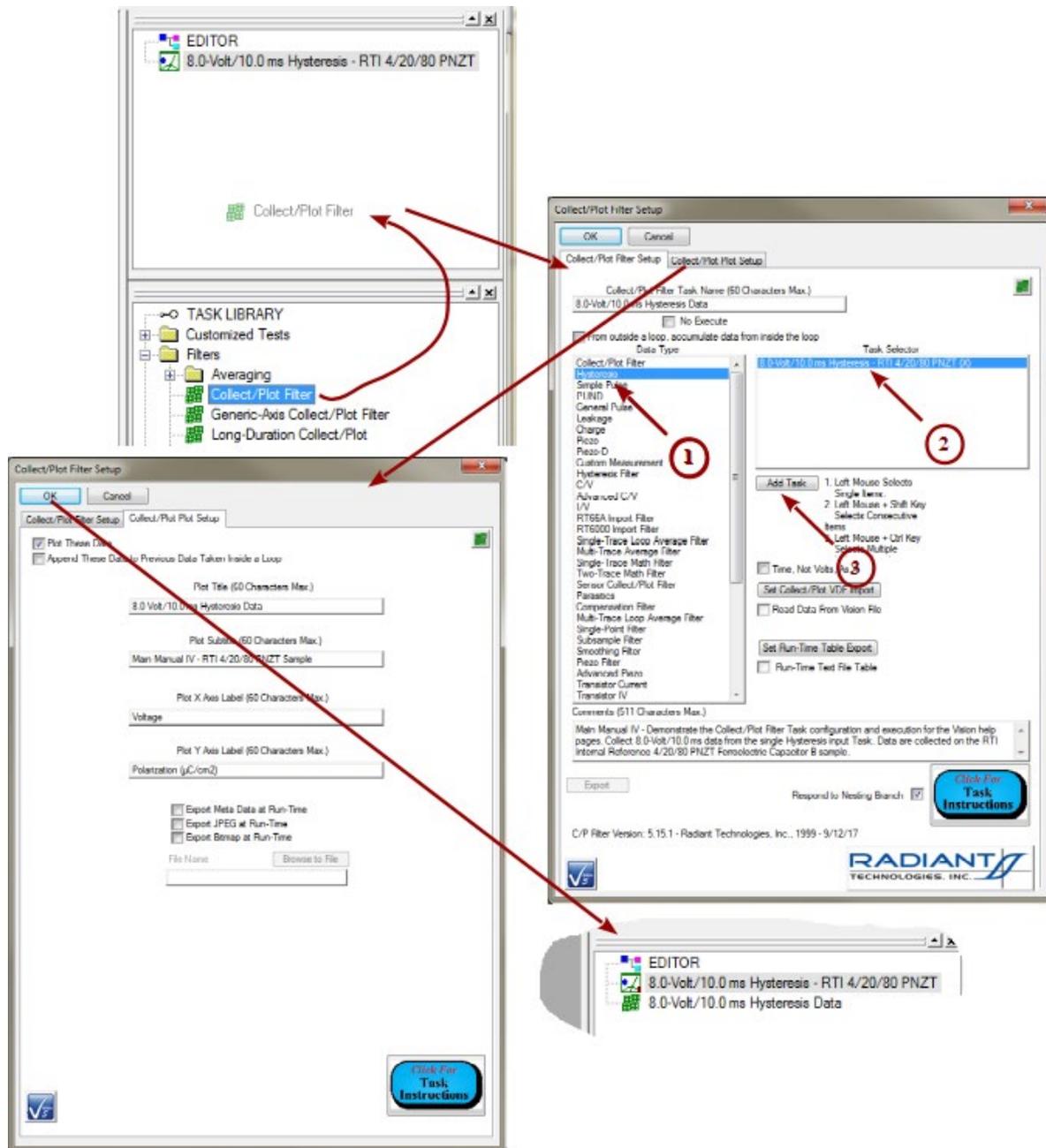
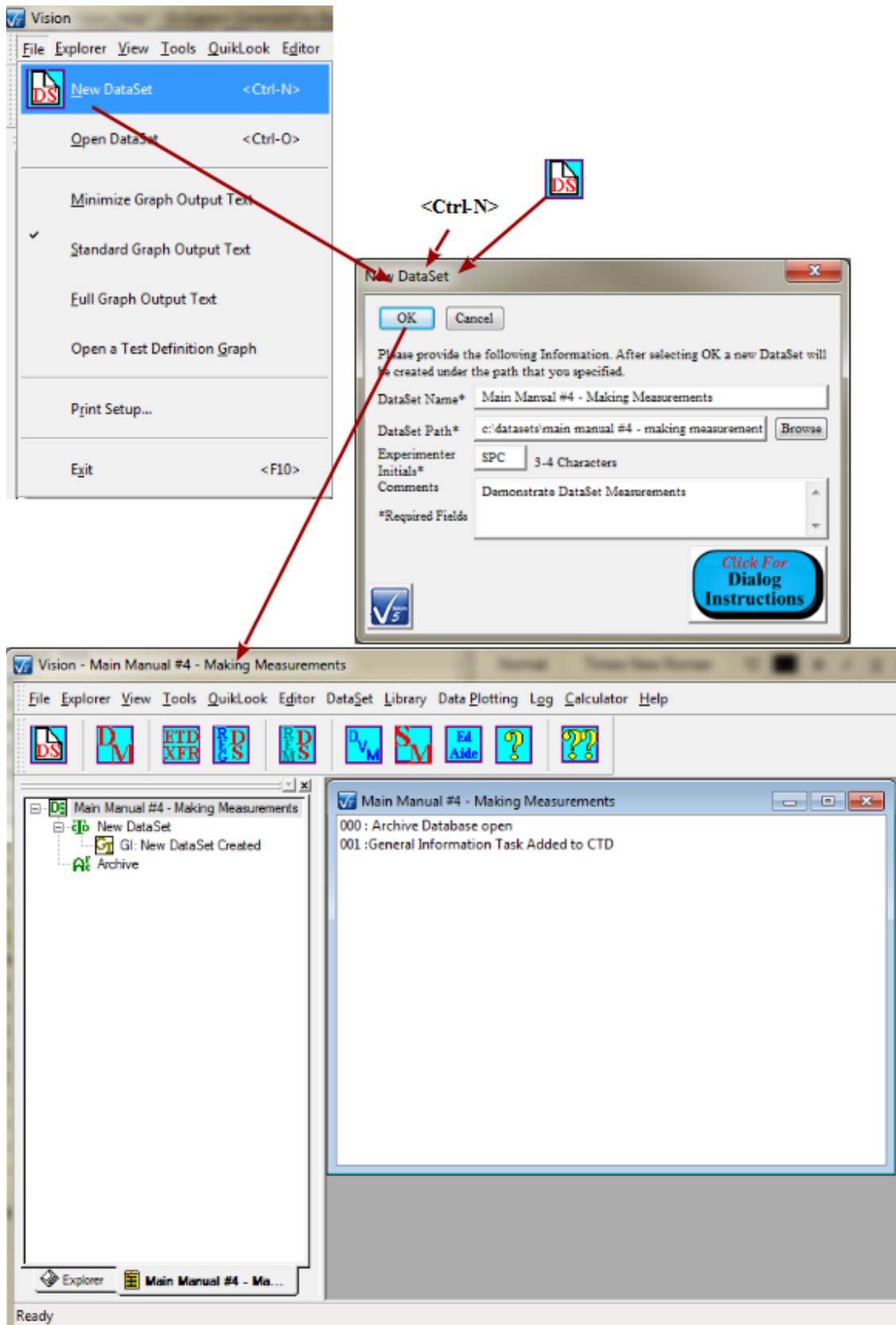


Figure 10 - Add a Collect/Plot Filter Task.

With a Test Definition in the EDITOR, the next thing that is needed is a DataSet. The options for creating the DataSet are shown in **Figure 11**. The DataSet is opened when created. Another option would be to operate the Test Definition in an existing open DataSet.



Copyright Radiant Technologies, Inc. 2021. This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)



Figure 11 - Create a New DataSet.

Now the Test Definition must be copied from the EDITOR into the DataSet Current Test Definition (CTD). This action also involves assigning a name to the CTD. The data will be permanently stored in an ETD based on this name. Therefore the name needs to be unique and meaningful. The process is shown in **Figure 12**.

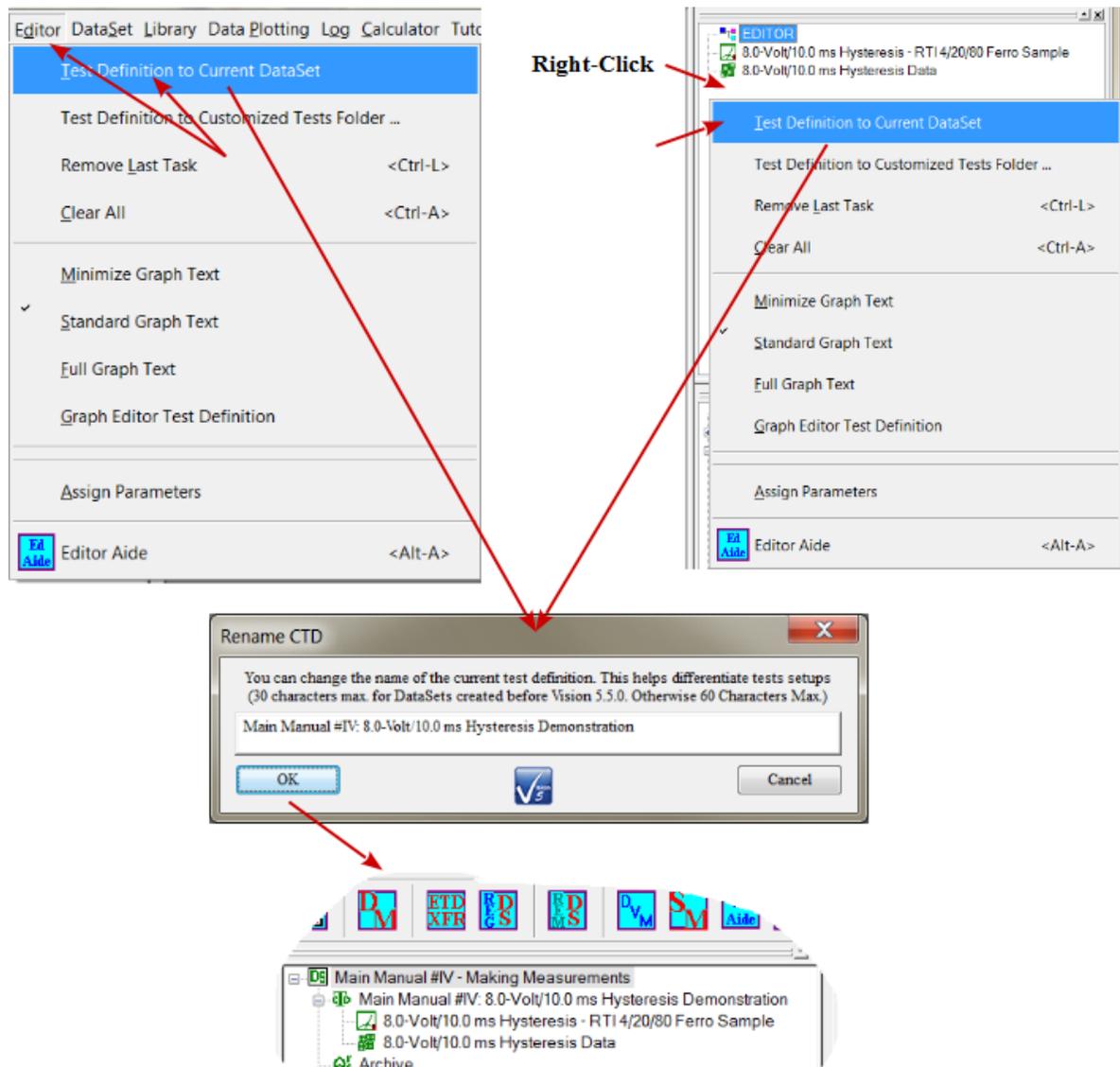


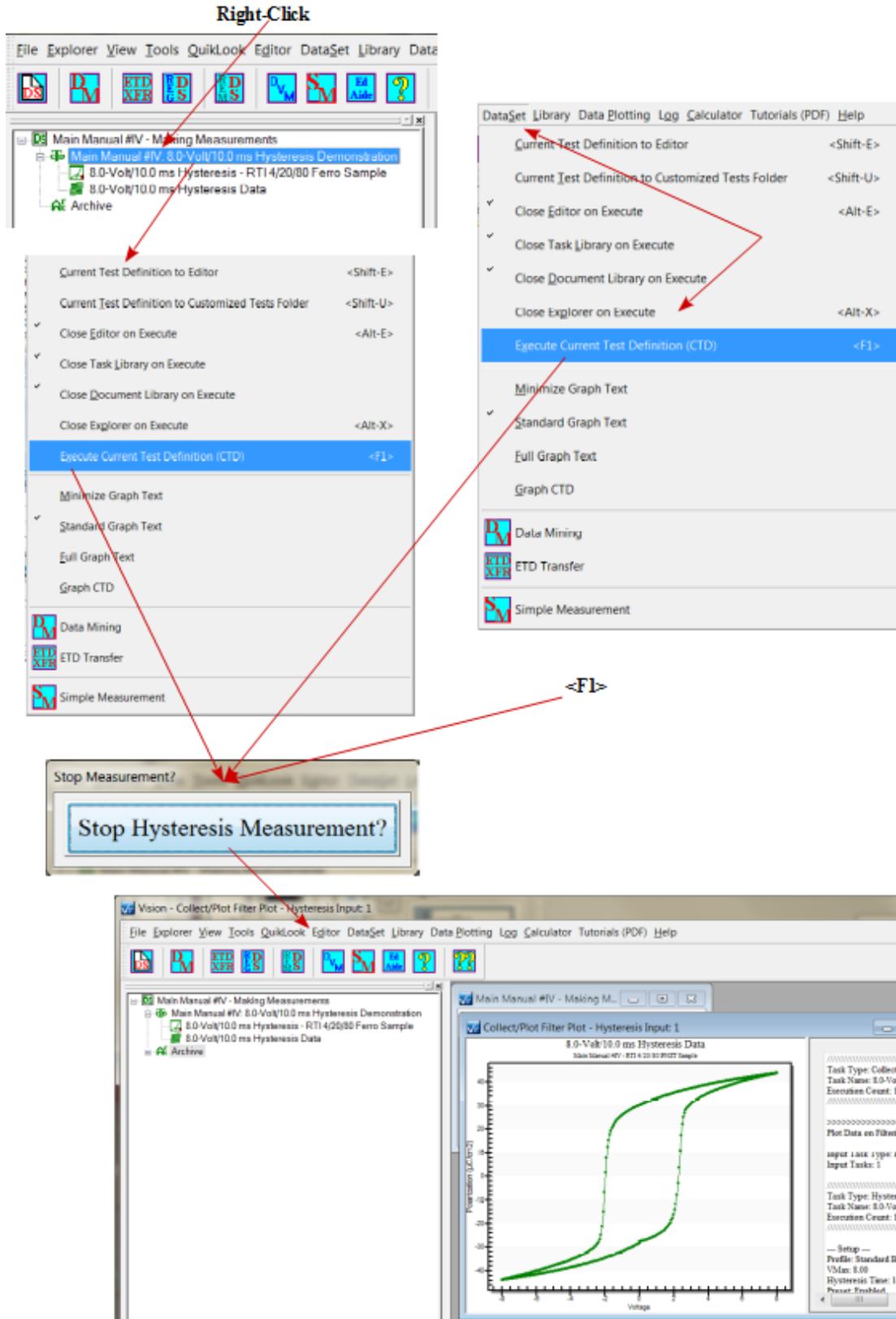
Figure 12 - EDITOR Test Definition to DataSet Current Test Definition (CTD).

The experiment is ready to run, as in **Figure 13**.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)





Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. <http://creativecommons.org/licenses/by-nc-sa/2.5/>



Figure 13 - Run the CTD.

The execution can be repeated any number of times by repeating the procedures of **Figure 13**. The data from any execution can be reviewed as shown in **Figures 14** and **15**.

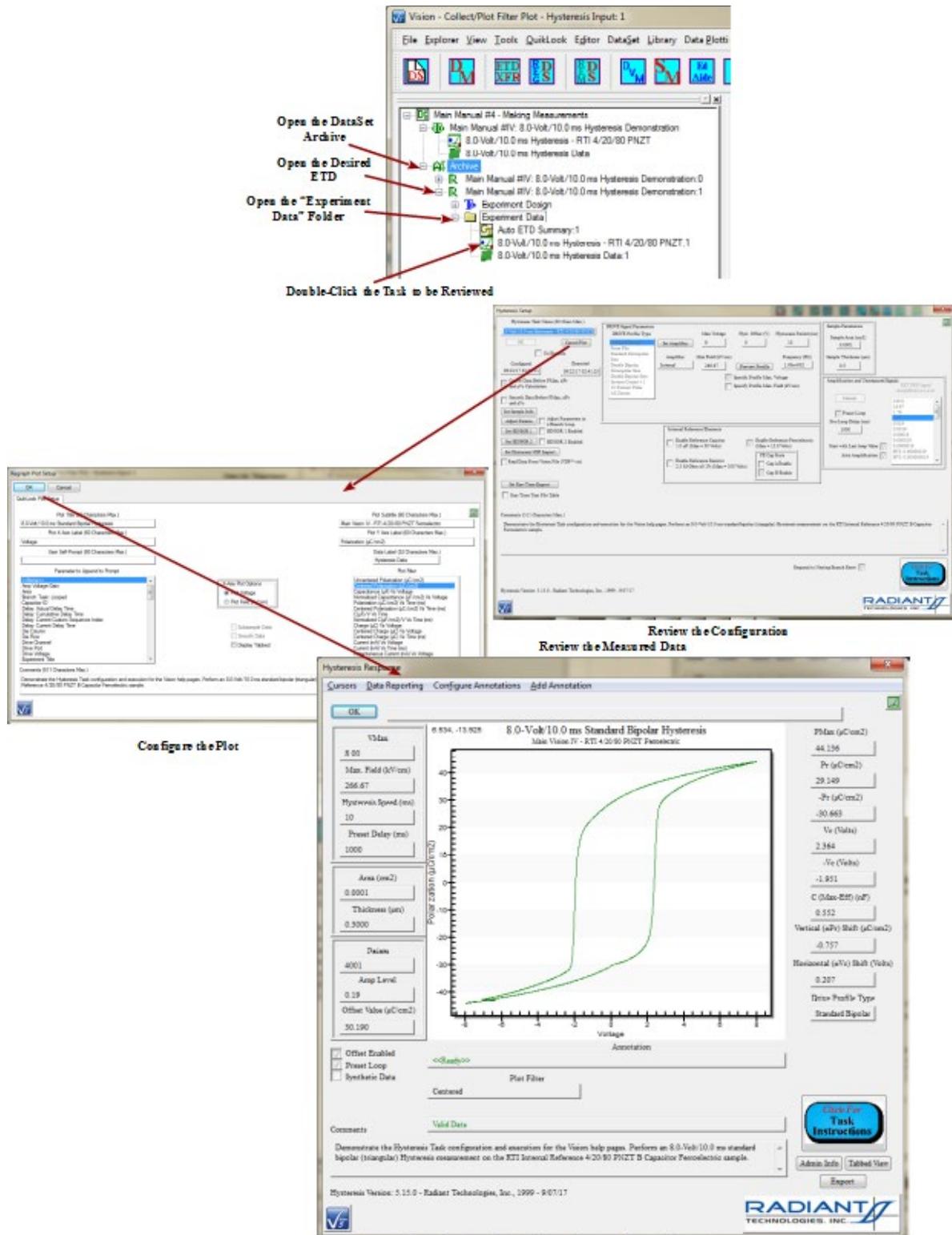


Figure 14 - Review the Hysteresis Task Configuration and Data.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. <http://creativecommons.org/licenses/by-nc-sa/2.5/>



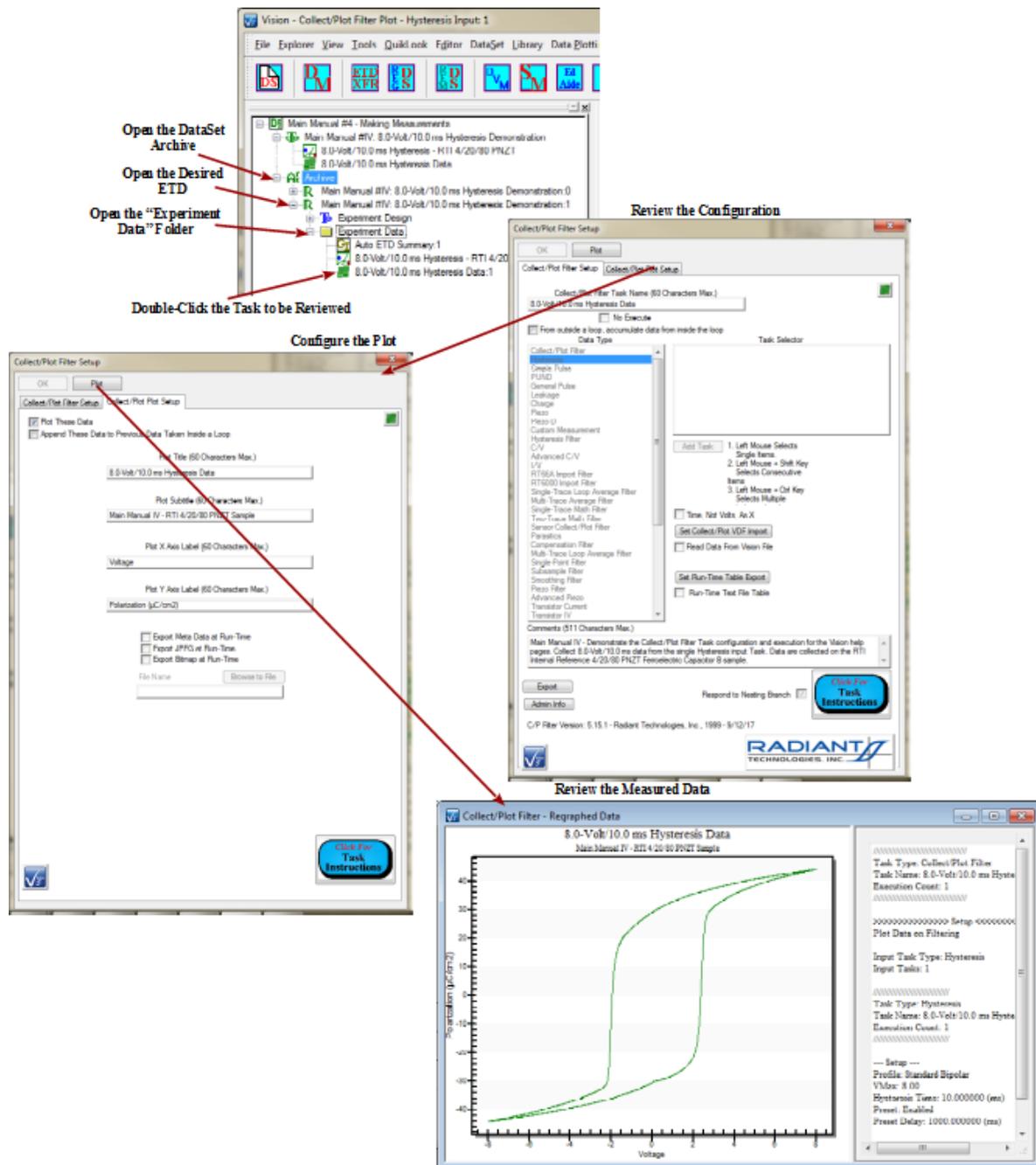


Figure 15 - Review the Collect/Plot Filter Task Configuration and Data.

V - Main Menu

A. File Menu

V: Main Menu Operations

When the Vision program starts up four dockable windows - [TASK LIBRARY](#), [EDITOR](#), Document Library and [DataSet Explorer](#) – appear at the edges of a larger empty user space (**Figure 1**). At the top of the program view is a menu with the following options. These are discussed in subsequent sections. Links are made to the sections.

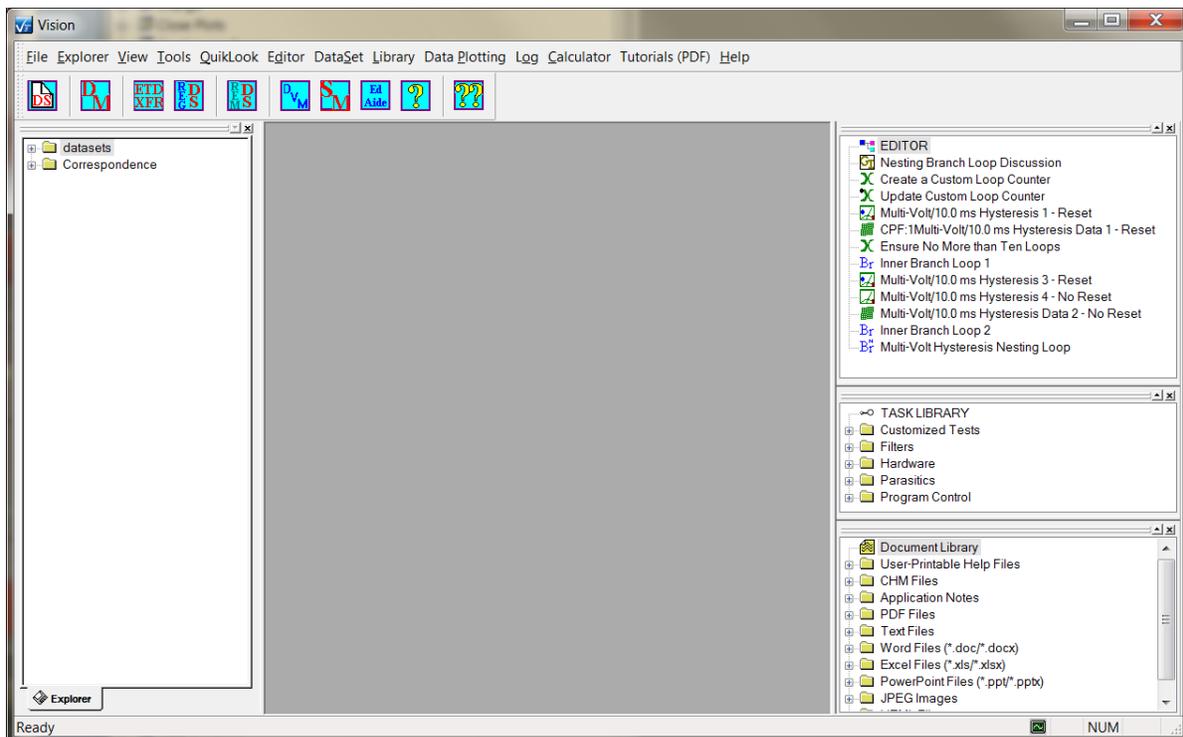


Figure 1 – Vision Program Screen

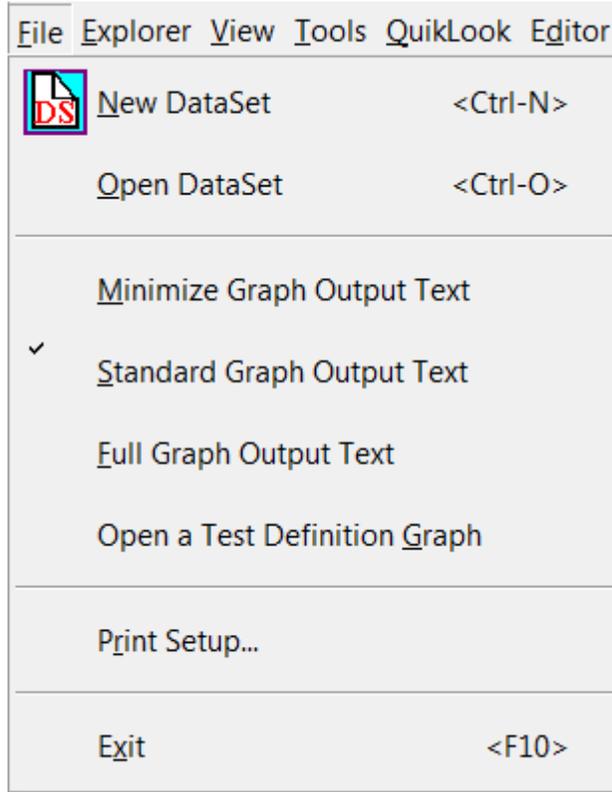
V.A - File Menu (Figure 2)

Figure 2 – The File Menu.

1. New **DataSet** – (Toolbar Icon: ) Create a new DataSet. A DataSet is a fundamental Vision object and is discussed in detail [below](#). This operation is mirrored by clicking the white “page” icon on the toolbar. <Ctrl-N> is a hot key shortcut to this operation. The New DataSet dialog will open.

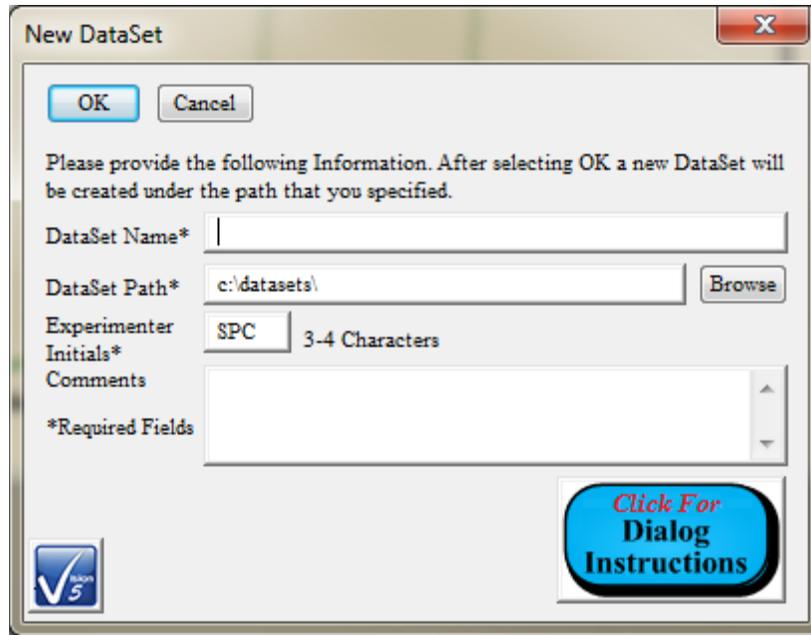


Figure 3 – New DataSet Dialog.

2. Minimize Graph Text Output - Cause future instances of a [Test Definition Graph](#) to display minimized Task Text.
3. Standard Graph Text Output - Cause future instances of a [Test Definition Graph](#) to display the normal Task Text.
4. Full Graph Text Output - Cause future instances of a [Test Definition Graph](#) to display maximized Task Text.
5. Open a Test Definition Graph - This selection opens a standard Windows Browser Dialog that can be used to navigate to a Test Definition Graph saved as a file. (*.grph file extension, by default.) Selecting the file and clicking Save will open the file in a new Test Definition Graph window.

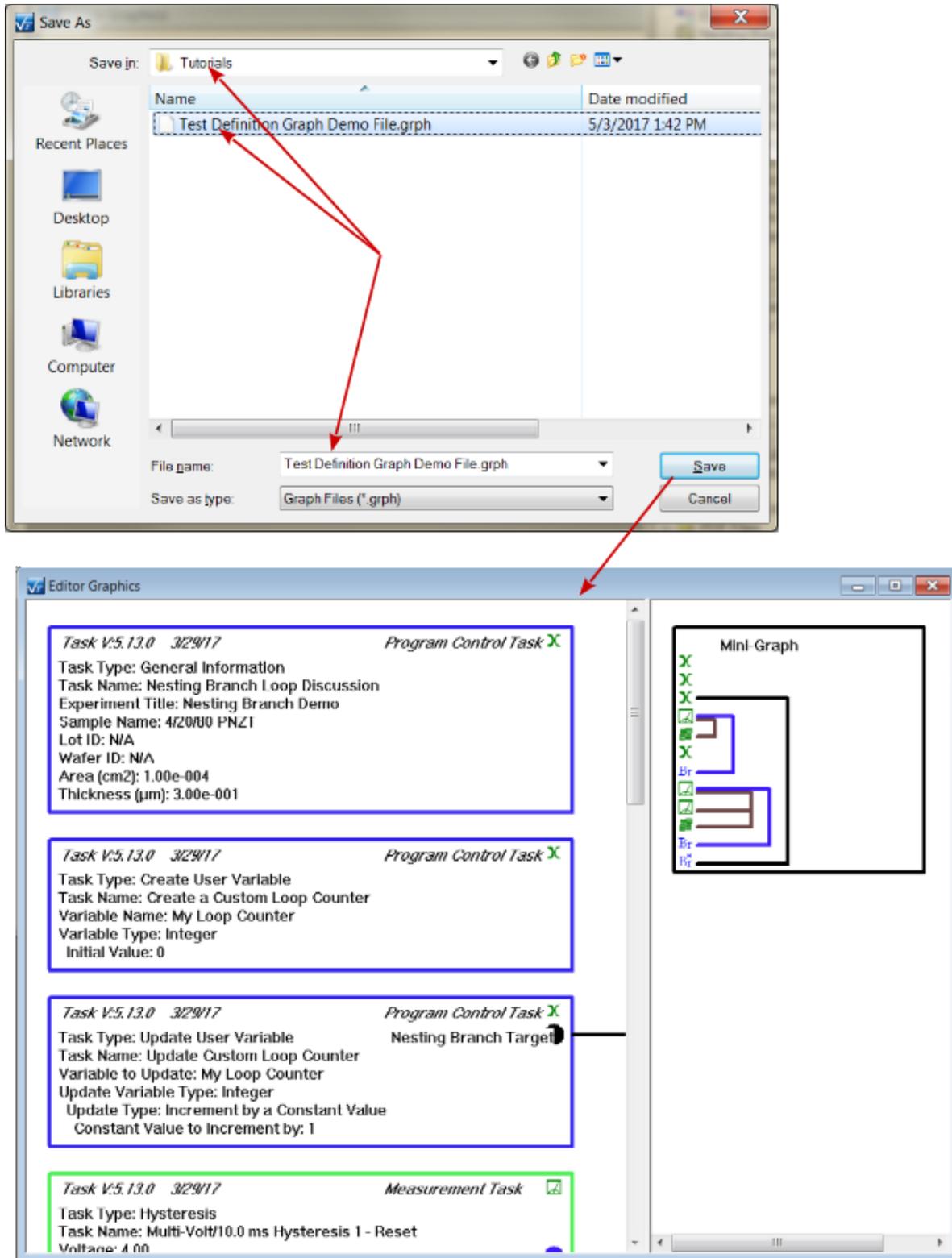


Figure 4 - Open a Test Definition Graph.

6. Open DataSet – This operation is performed with a DataSet selected in the Explorer. Double-clicking a DataSet in the DataSet Explorer also opens it. The DataSet and DataSet Explorer objects are described [below](#). <Ctrl-O> also accesses this operation.
7. Print Setup... – This option opens a dialog in which the default printer configuration is set (**Figure 5**). Vision offers Printing as an export option in each Task. Print configuration applies to the print export function of all Tasks.

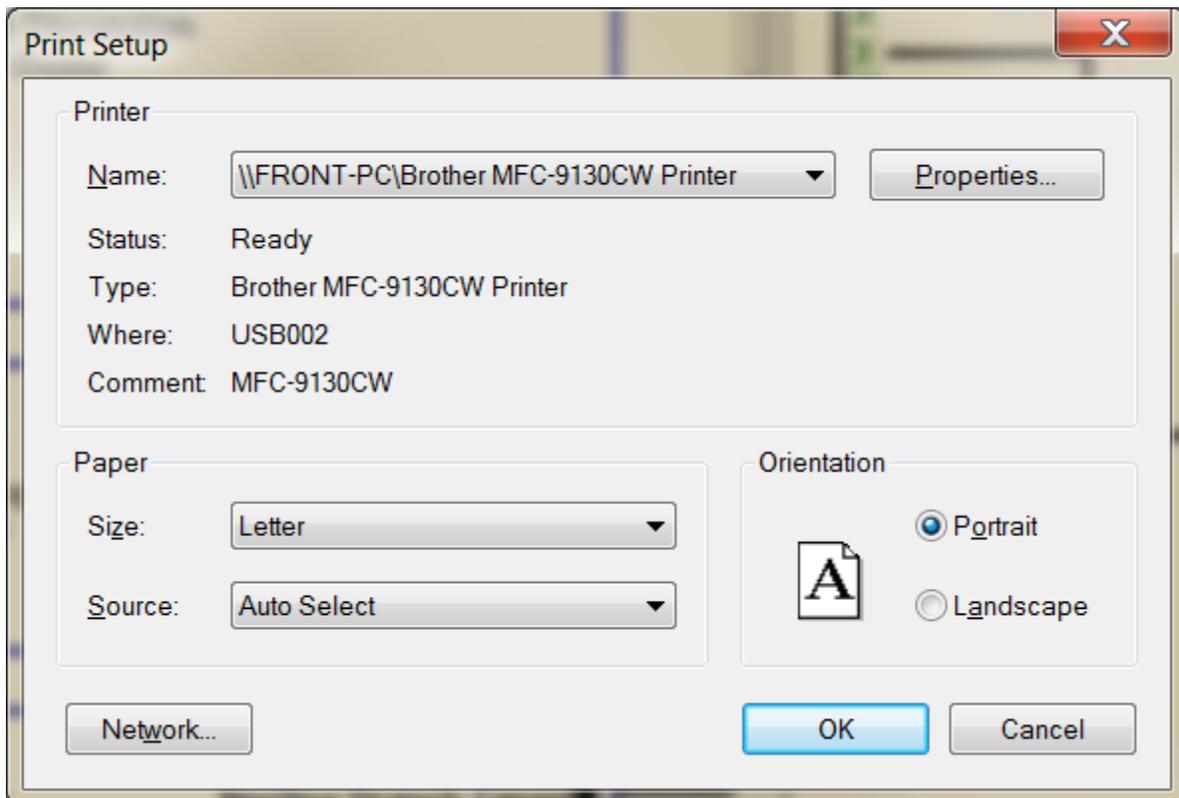


Figure 5 - Default Printer Configuration Setup Dialog.

8. Exit <F10>

B. Explorer Menu

V: Main Menu Operations

When the Vision program starts up four dockable windows - [TASK LIBRARY](#) , [EDITOR](#) , Document Library and [DataSet Explorer](#) – appear at the edges of a larger empty user space (**Figure 1**). At the top of the program view is a menu with the following options. These are discussed in subsequent sections. Links are made to the sections.

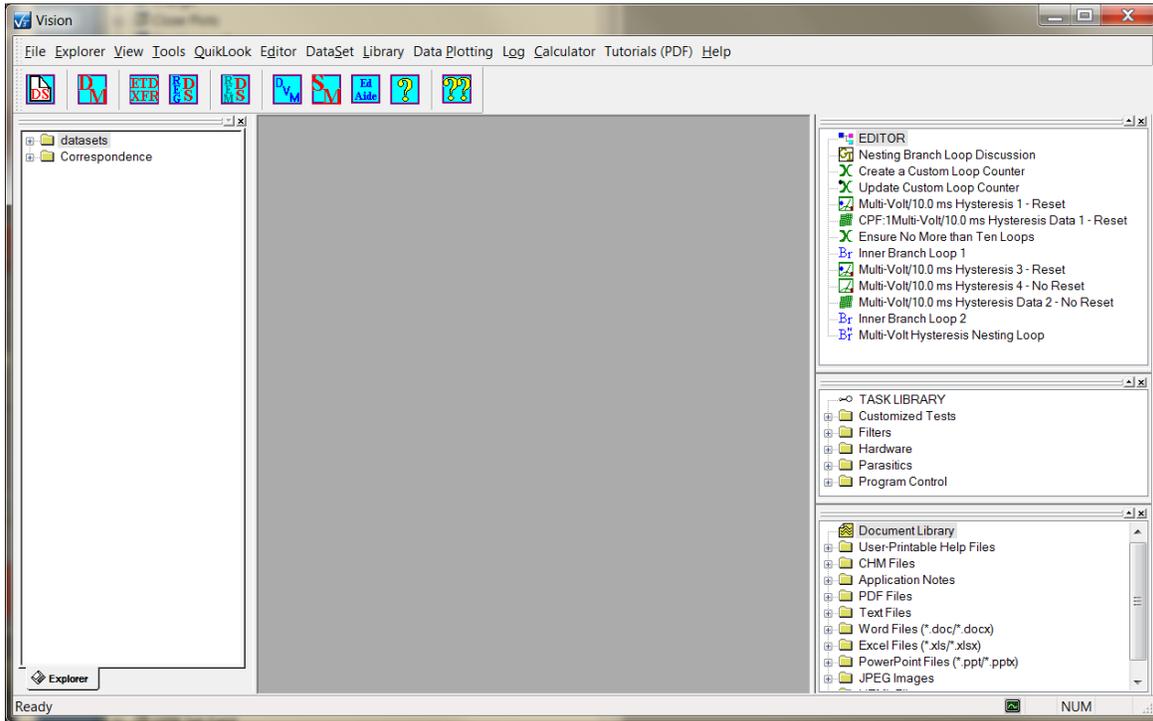


Figure 1 – Vision Program Screen.

V.B - Explorer (Figure 2)

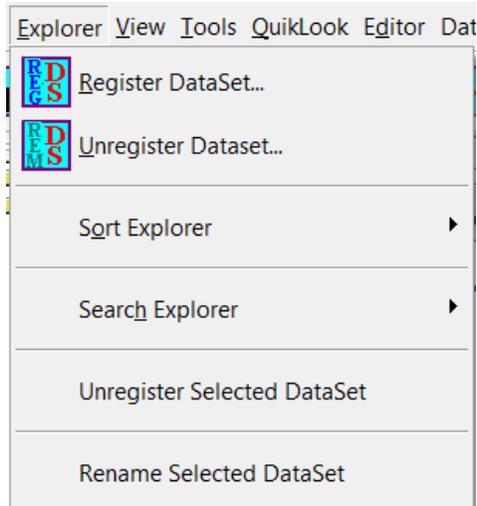


Figure 2 – Explorer Menu

1. Register DataSet – (Toolbar Icon: ). Add an existing DataSet file (*.dst) to the DataSet Explorer. A standard Windows file browser dialog will open. See [Below](#).

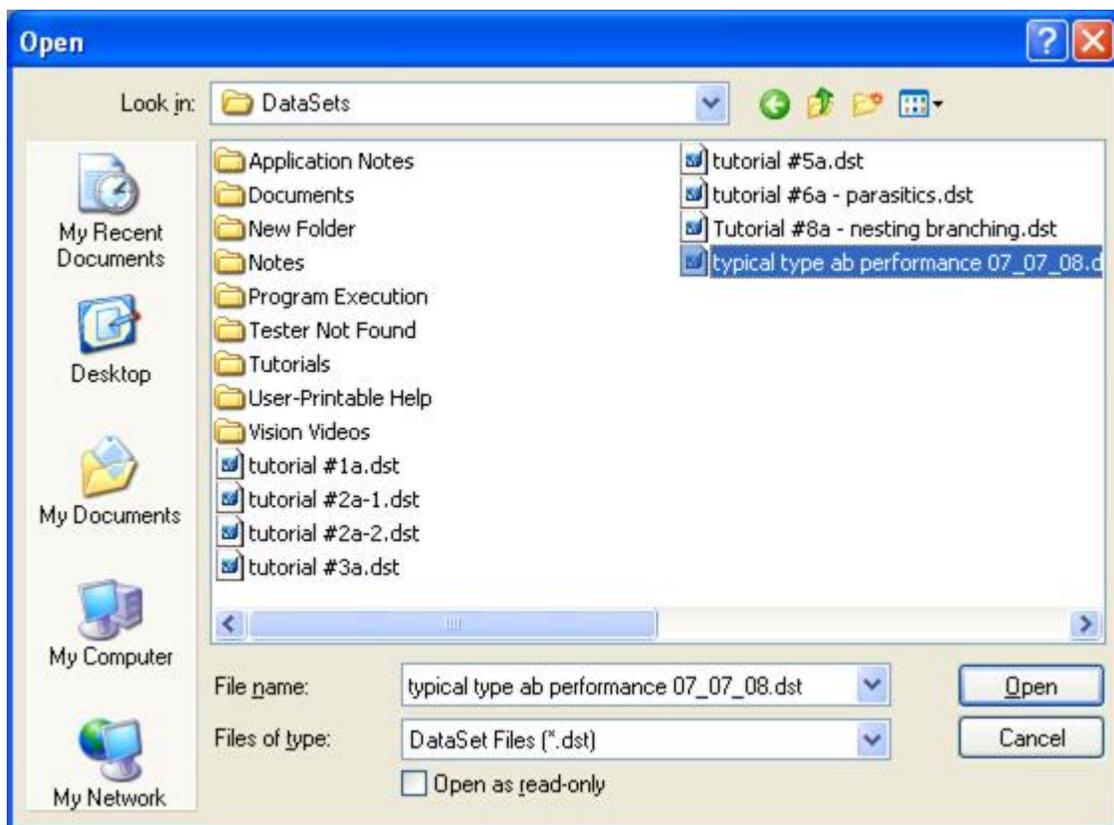


Figure 3 – Register DataSet Dialog.

2. Unregister DataSet – (Toolbar Icon: ). Remove a DataSet from the DataSet Explorer. Used as a housekeeping tool to reduce clutter. The DataSet file (*.dst) is not removed and may be reregistered at any time. A dialog appears in which one or more DataSets can be selected for Unregistering. Vision must be stopped and restarted for the changes to take effect. See [Below](#).

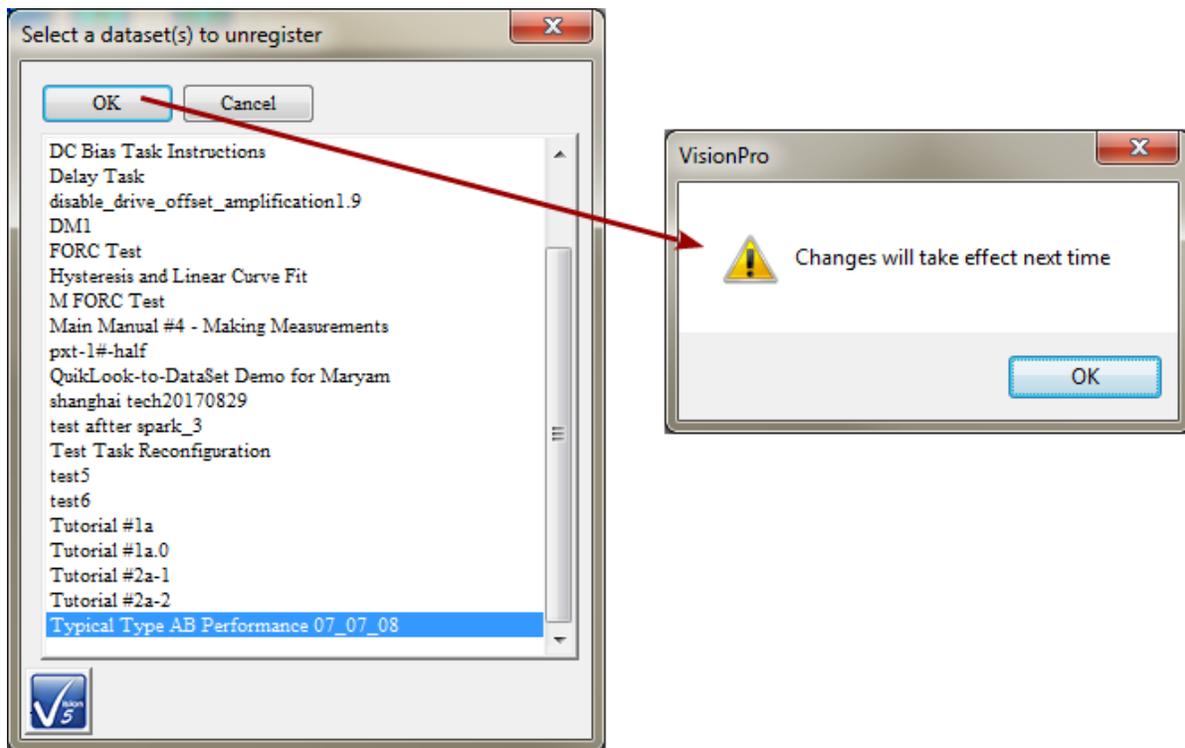


Figure 4 – Unregister DataSets.

3. Sort Explorer.

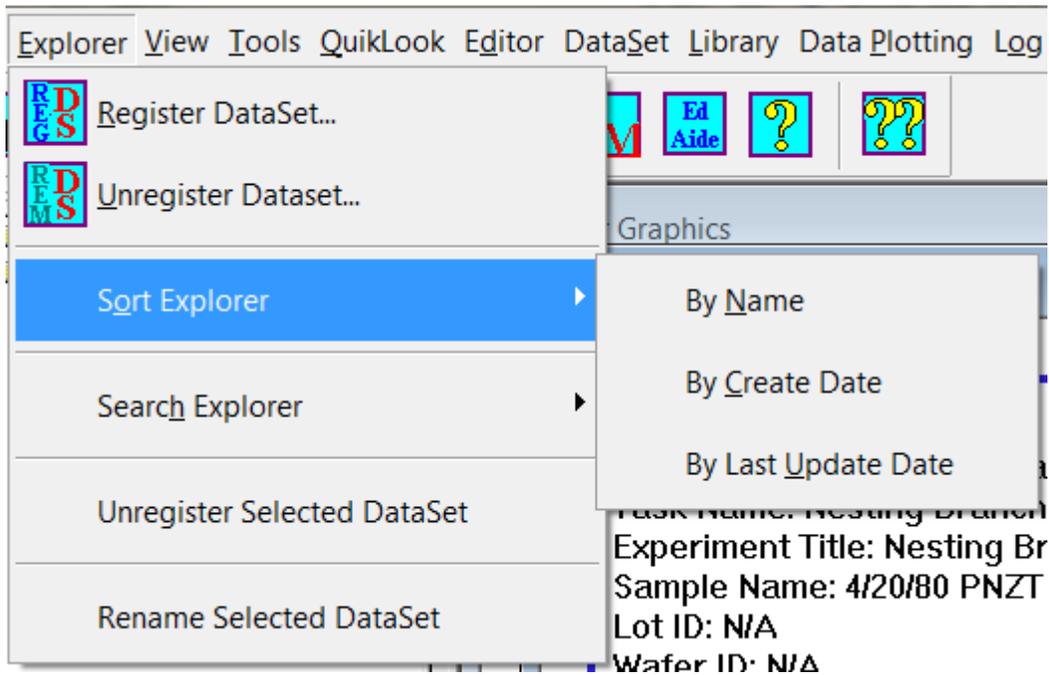


Figure 5 – Sort Explorer Submenu.

1. By Name - DataSets will be organized alphabetically in the Explorer menus and submenus. Repeated executions will toggle between low-to-high and high-to-low sorting.
2. By Create Date - DataSets will be organized by the original DataSet creation date in the Explorer menus and submenus. Repeated executions will toggle between low-to-high and high-to-low sorting. **Note: This operation has errors that can result in the loss of DataSet registration.**
3. By Last Update Date - DataSets will be organized by the date of most-recent access in the Explorer menus and submenus. Repeated executions will toggle between low-to-high and high-to-low sorting. **Note: This operation has errors that can result in the loss of DataSet registration.**
4. Search h Explorer.

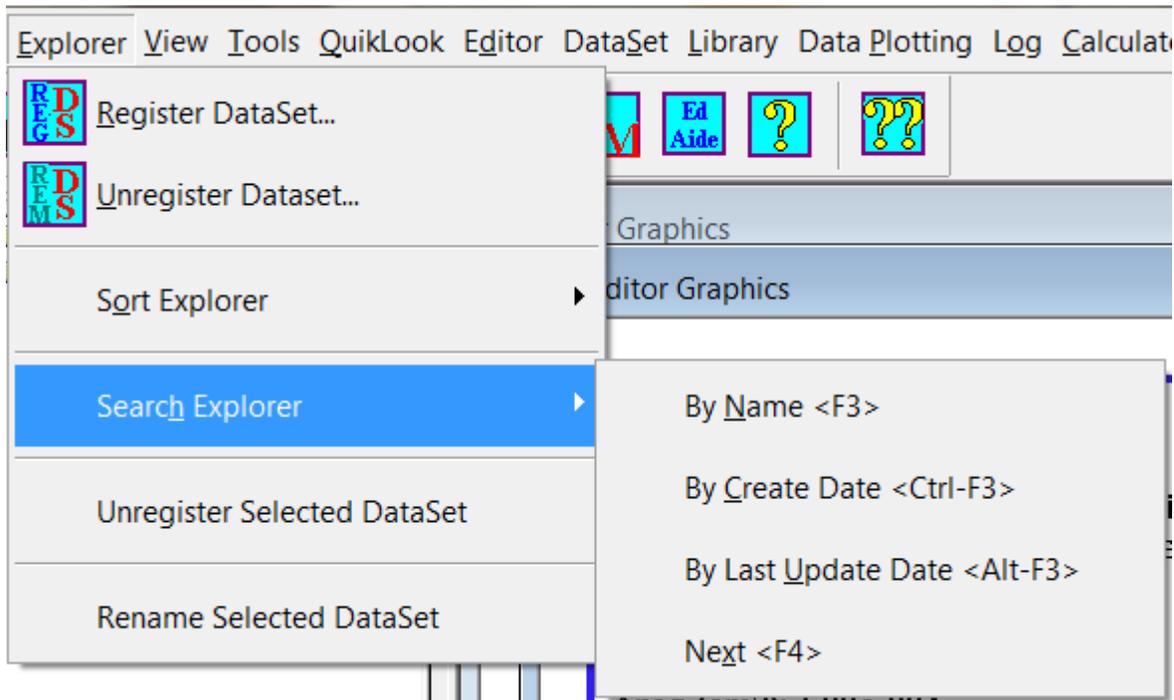


Figure 6 – Search Explorer Submenu.

1. By Name <F3> - Locate the first instance of a registered DataSet, whose name contains the specified text, in the DataSet Explorer. A search dialog opens.

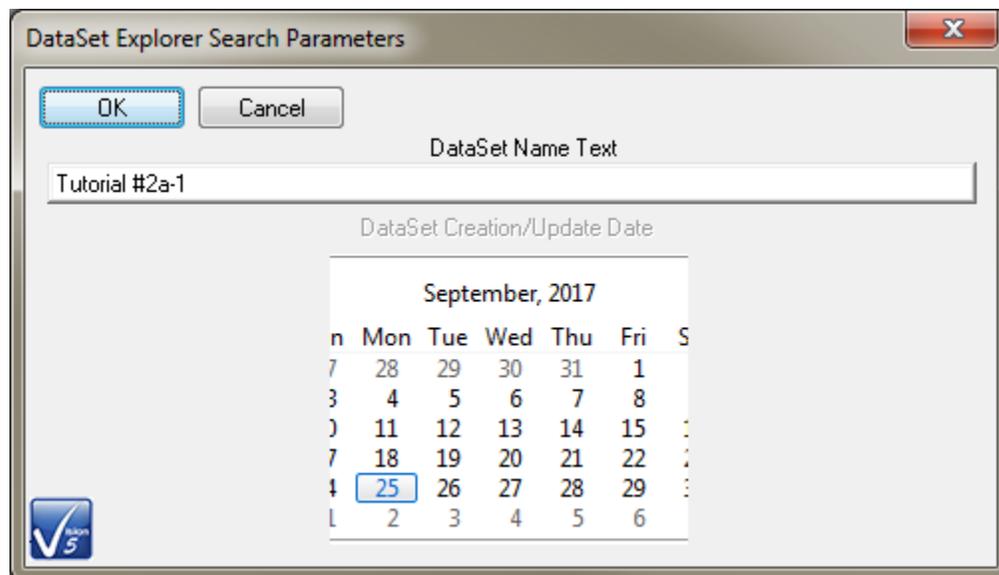


Figure 7 – Search Explorer By Name Dialog.

2. By Create Date <Ctrl-F3> - Locate the first instance of a registered DataSet, created on the specified date, in the DataSet Explorer. A search dialog opens as in **Figure 8**.

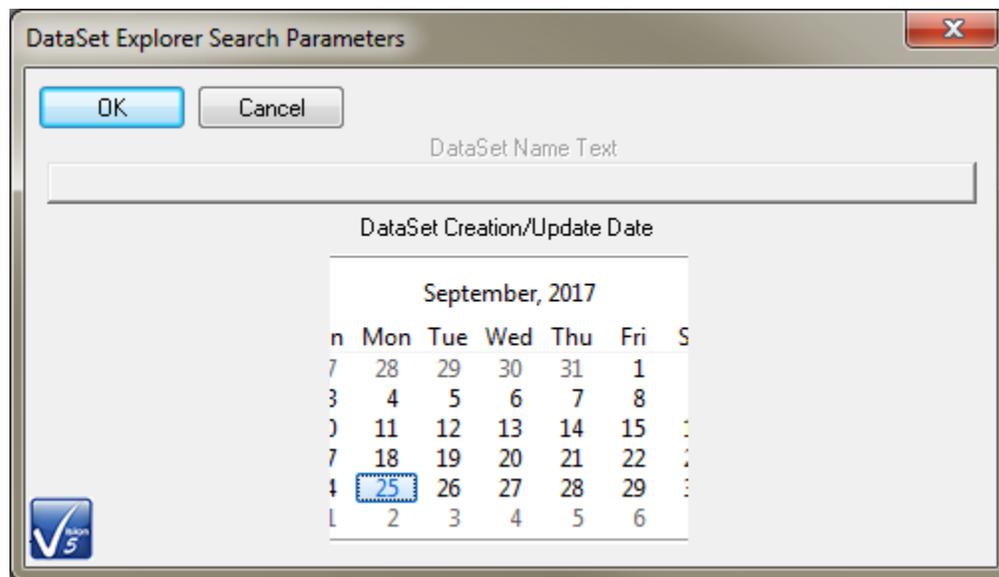


Figure 8 – Search Explorer By Create Date/Last Update Dialog.

3. By Last Update Data <Alt-F3> - Locate the first instance of a registered DataSet, created on the specified date, in the DataSet Explorer. A search dialog opens as in **Figure 8**.
4. Next <F4> - Repeat the previous search, locating the second, third, fourth or subsequent instance of a DataSet that meets the search specification.
5. Unregister Selected DataSet. Cause a DataSet that is highlighted in the DataSet Explorer to be removed from the DataSet Explorer at the next instance of Vision.
6. Rename Selected DataSet. Permanently adjust the name of the DataSet that is highlighted in the DataSet Explorer.. This is particularly useful if two registered DataSets have the same name. DataSets of the same name are permitted by are bad practice and may result in confusion or errors within Vision. A dialog will open.

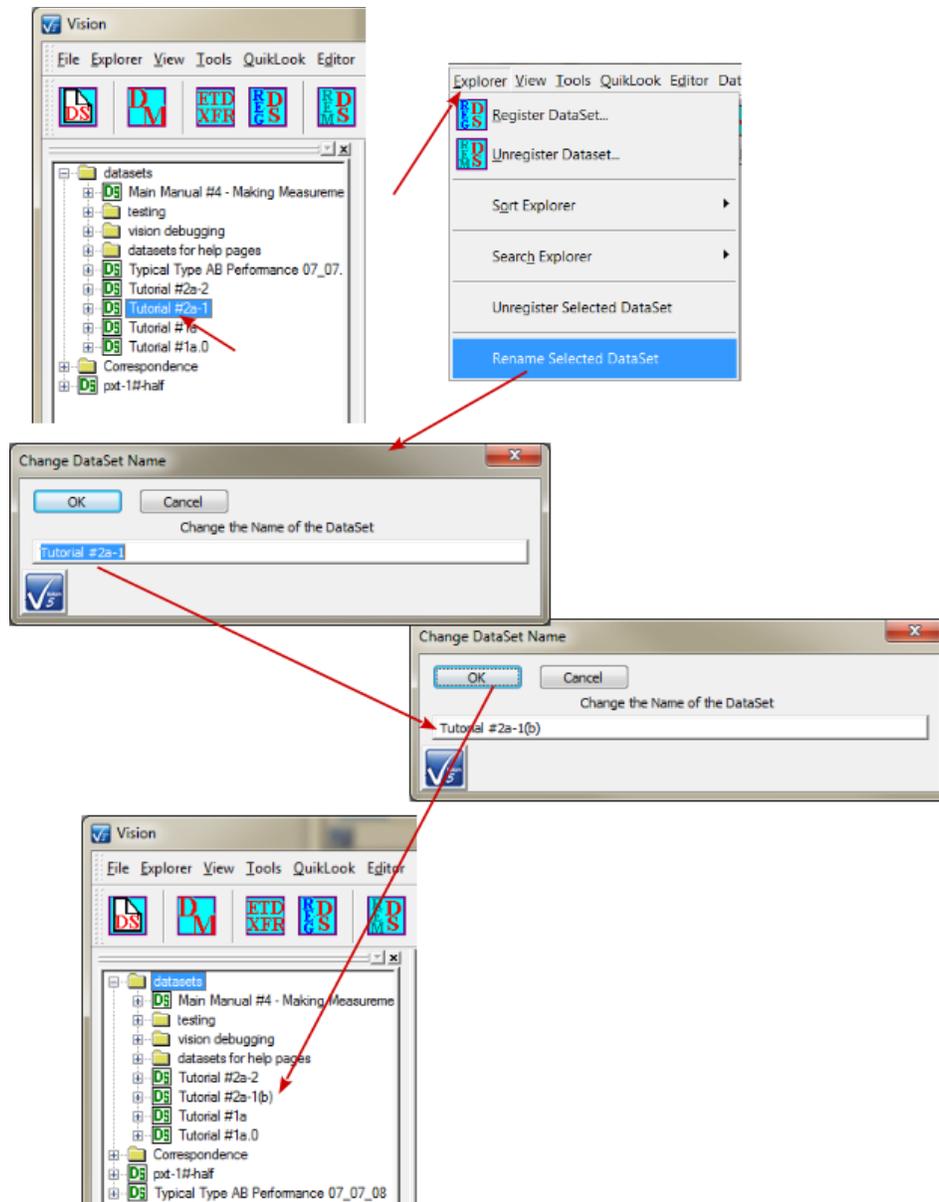


Figure 9– Rename a DataSet.

C. View Menu

V: Main Menu Operations

When the Vision program starts up four dockable windows - [TASK LIBRARY](#), [EDITOR](#), Document Library and [DataSet Explorer](#) – appear at the edges of a larger empty user space (**Figure 1**). At the top of the program view is a menu with the following options. These are discussed in subsequent sections. Links are made to the sections.

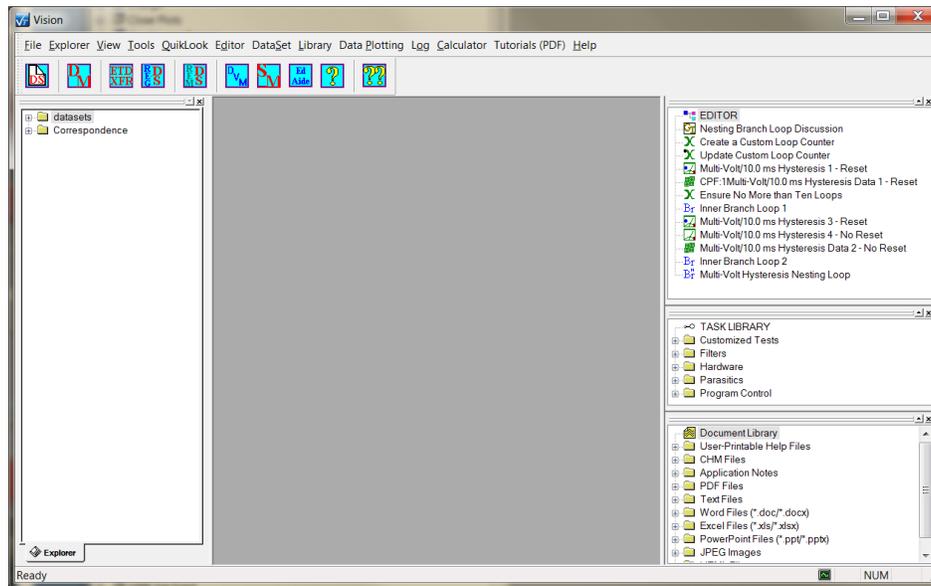


Figure 1 – Vision Program Screen

V.C - View (Figure 2)

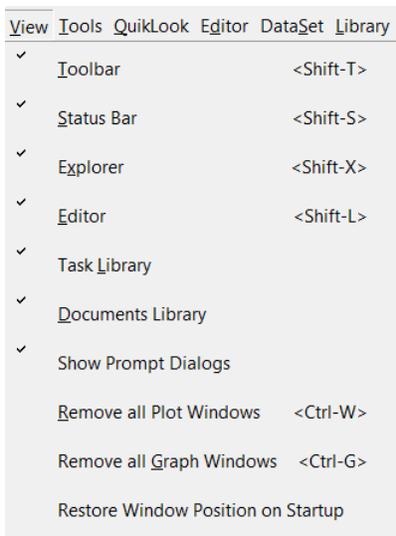


Figure 2 – View Menu.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

1. Toolbar <Shift-T> - Show or hide the Toolbar.
2. Status Bar <Shift-S> - Show or hide the Status Bar. Note that the status bar is used to show the progress of Task execution for many Tasks. In some cases this will be the only indication that there is activity.
3. Explorer <Shift-X> - Show or hide the DataSet Explorer Window – The DataSet Explorer is described below. Note that the Explorer window may be automatically hidden during Test Definition execution and redisplayed when the experiment completes. This is described below.
4. Editor <Shift-L>, Task Library and Documents - Show or hide the EDITOR, Library and Document Library Windows – These windows are described below. Note that the three windows may be automatically hidden during Test Definition execution and redisplayed when the experiment completes. This is described below. These three windows are always either shown or hidden together as a unit.
5. Show Prompt Dialogs - Disabled by default. When enabled, various dialogs throughout Vision will appear when certain actions are taken. For example, when an open DataSet is closed, a prompt dialog will appear only if this option is enabled. The option may also be enabled or disabled from the dialog.

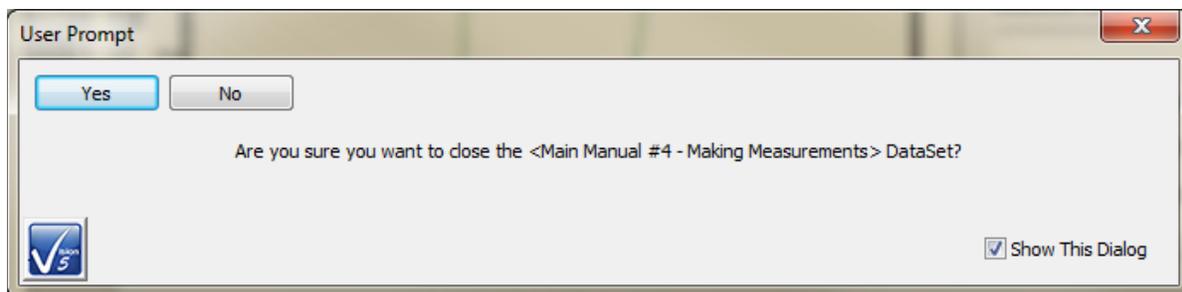


Figure 3 – Example User Prompt Dialog.

6. Remove all Plot Windows <Ctrl-W> - Clear any and all data plot windows that may appear in the Vision User Area <Ctrl-W>. The User Area of the Vision program can become very cluttered with displayed data. This device quickly cleans up the window.
7. Remove all Graph Windows <Ctrl-G> - Clear the User Area of any Test Definition Graphs. This operation will close the windows without prompting to save the Graphs to file.
8. Restore Window Position on Startup - Disabled by default. If disabled, Vision will always open with the EDITOR window above the Library Window to the right of the program window and the DataSet Explorer window extending vertically to the left of the Vision program window. If this option is enabled, Vision will attempt to restore the dockable windows to the position they held when the program was closed. Although this option is available, window restoration has not yet been perfected.

D. Tools Menu

V: Main Menu Operations

When the Vision program starts up four dockable windows - [TASK LIBRARY](#), [EDITOR](#), Document Library and [DataSet Explorer](#) – appear at the edges of a larger empty user space (**Figure 1**). At the top of the program view is a menu with the following options. These are discussed in subsequent sections. Links are made to the sections.

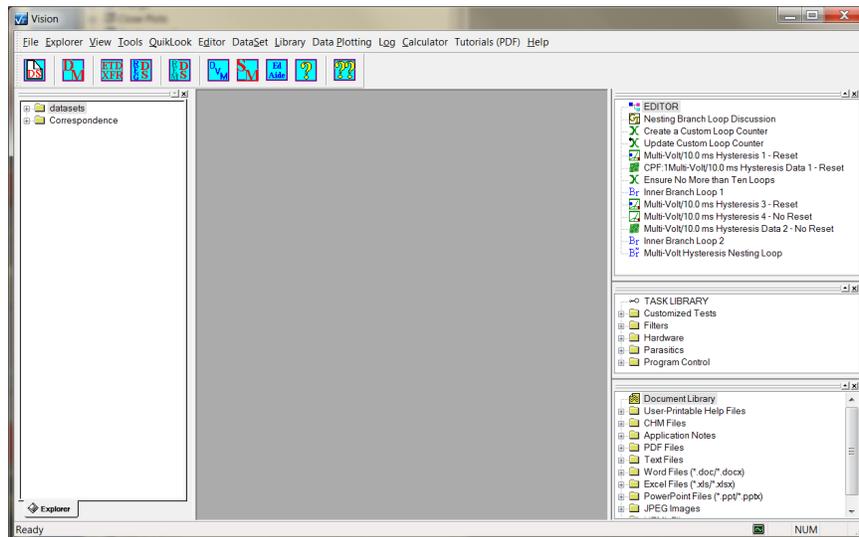
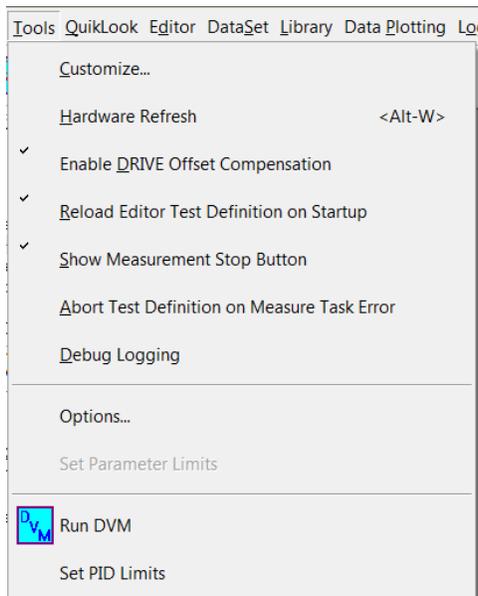


Figure 1 – Vision Program Screen.

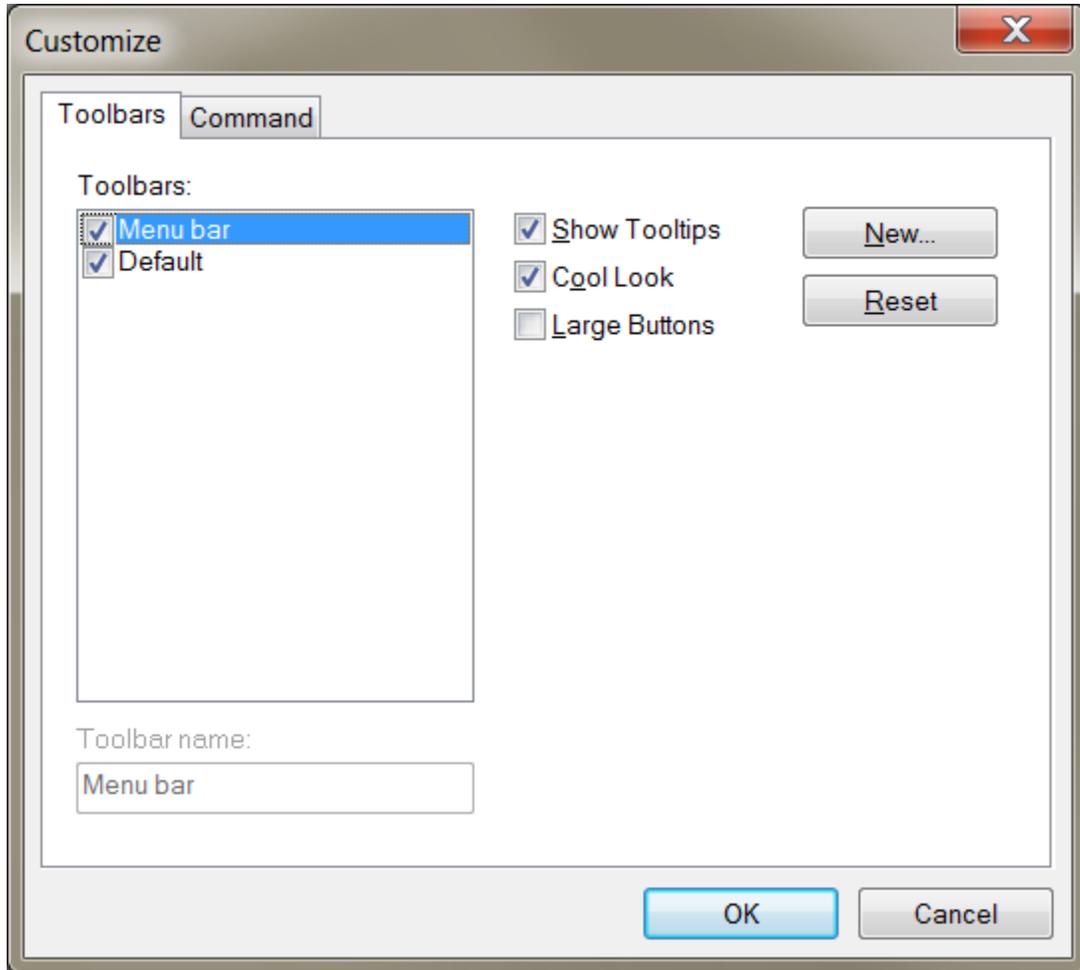
V.D - Tools (Figure 2)



Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

Figure 2 – Tools Menu.

1. Customize... – Allows some customization of the toolbar. This is a standard feature for Windows programs and is of very limited value in Vision.



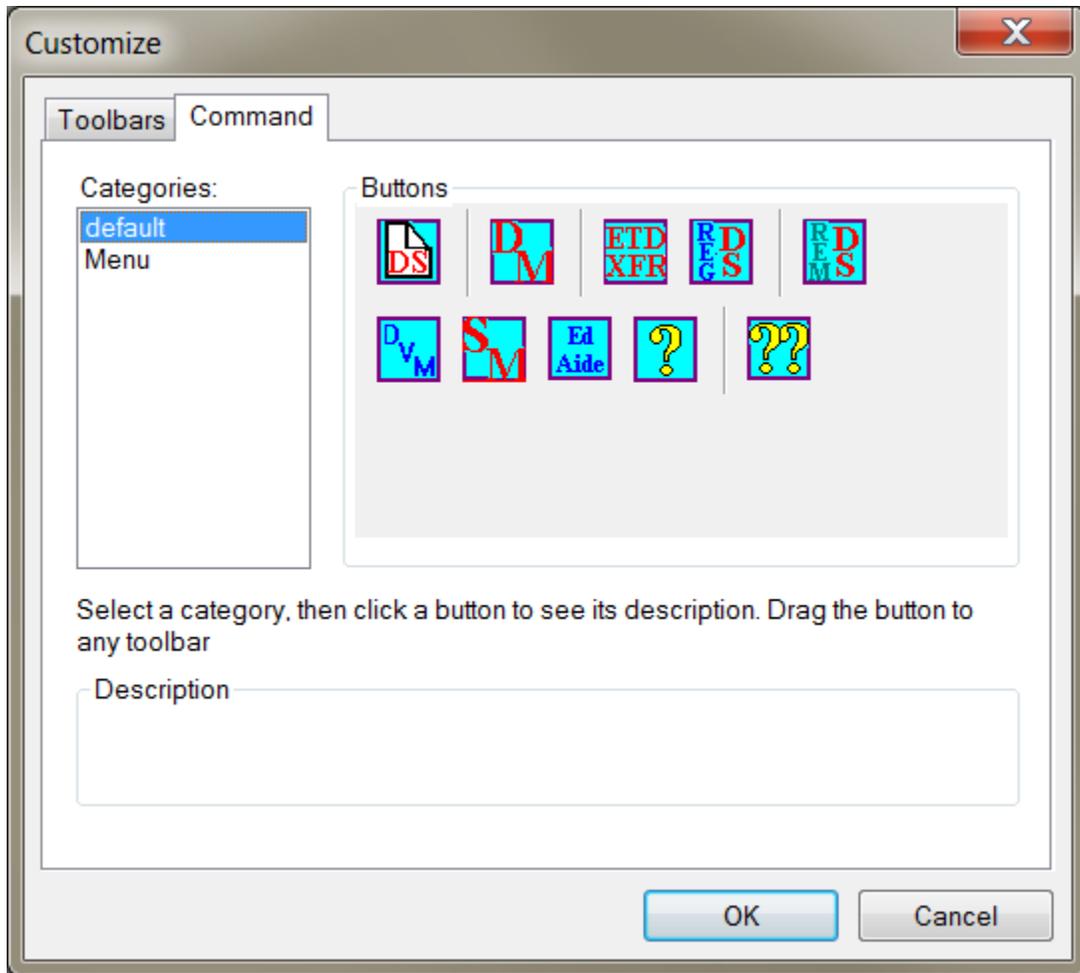


Figure 3 – Toolbar Customization Dialog.

2. Hardware Refresh <Alt-W> - This option causes the hardware driver to reexamine the number and type of Precision testers attached to the host computer. The program reopens the Tester Selection dialog that appeared at Vision startup. The dialog shows the updated suite of testers connected and allows the user to select a new tester for use or provide names to the testers. This option should be exercised when the configuration of powered testers attached to the host computer has been altered. This menu option should also be used when the user needs to change the tester that will make the measurements, even when no actual hardware configuration change has been made. Set topic III - Startup for more detailed description of this dialog.

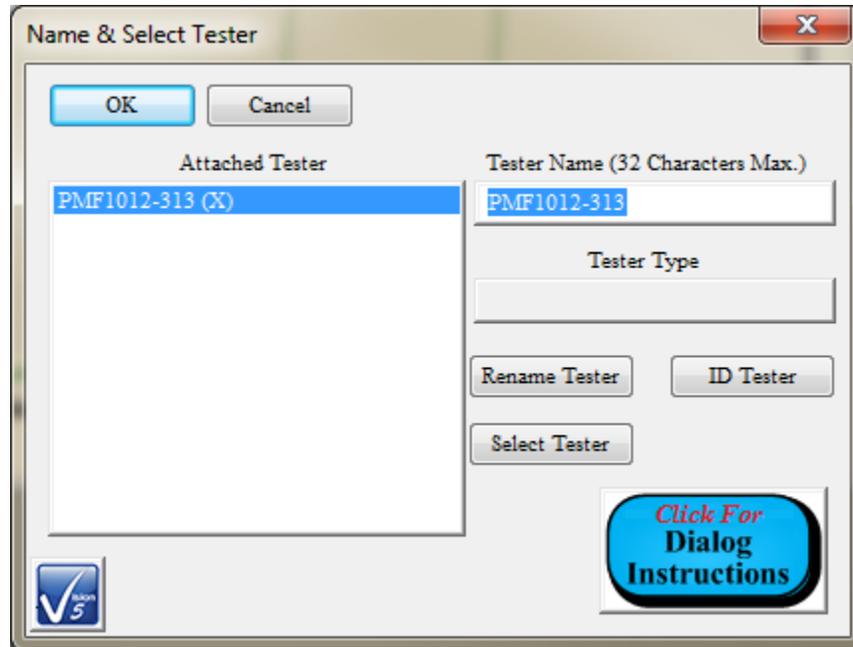


Figure 4 – Tester Selection Dialog.

3. Enable Drive Offset Compensation - Depending on measurement configuration, the test voltage is applied to the sample at the DRIVE port at various ramp rates. Changing ramp rates involves changes in hardware configuration. Each new configuration may apply a constant offset error, so that if zero Volts are requested, the non-zero offset will be applied. An automatic offset detection for each ramp rate has been added to the Hardware Driver. If this option is selected (normal, default and recommended condition), the Driver will be told to correct the drive voltage by the offset. If this option is unchecked, the Driver will not perform this correction. This application is especially important for the Precision Premier II, Multiferroic and LC II testers.
4. Reload Editor Test Definition on Startup - Enabled by Default. If this option is selected, any Test Definition (defined below) that was loaded into the EDITOR window when Vision was shut down will be reloaded into the EDITOR at startup. If this option is not enabled, the EDITOR will always be empty on startup and any previous Test Definition in the EDITOR will be lost.
5. Show Measurement Stop Button - Enabled by Default. Measurements can be stopped as they are being made by the tester. During the measurement a *Stop Measurement?* button will appear. If this menu selection is unchecked, the *Stop Measurement?* button will not appear.

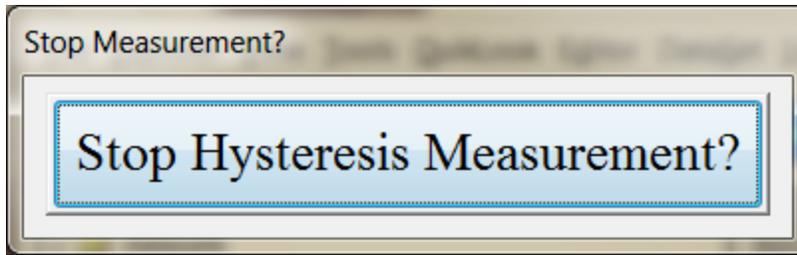


Figure 5 – Measurement Stop Button.

6. Debug Logging - Disabled by default. If enabled, various actions in Vision will cause text entries to be written to a file created at C:\Program Files\Radiant Technologies\Vision. The file will have the date-unique file name "Vision Debug m(m).dd.yyyy.text". The purpose of this option is to help RTI troubleshoot problem behavior that the user is reporting. This option should be disabled unless RTI requests that it be enabled. Once enabled, the problem behavior should be recreated and the "Vision Debug m(m).dd.yyyy.text" file should be sent to Radiant Technologies, along with one or more DataSets that provide examples of the behavior, if possible.
7. Options... - Open a dialog that allows most of the Vision menu options to be configured in a single location.

1. Vision Startup and Misc.

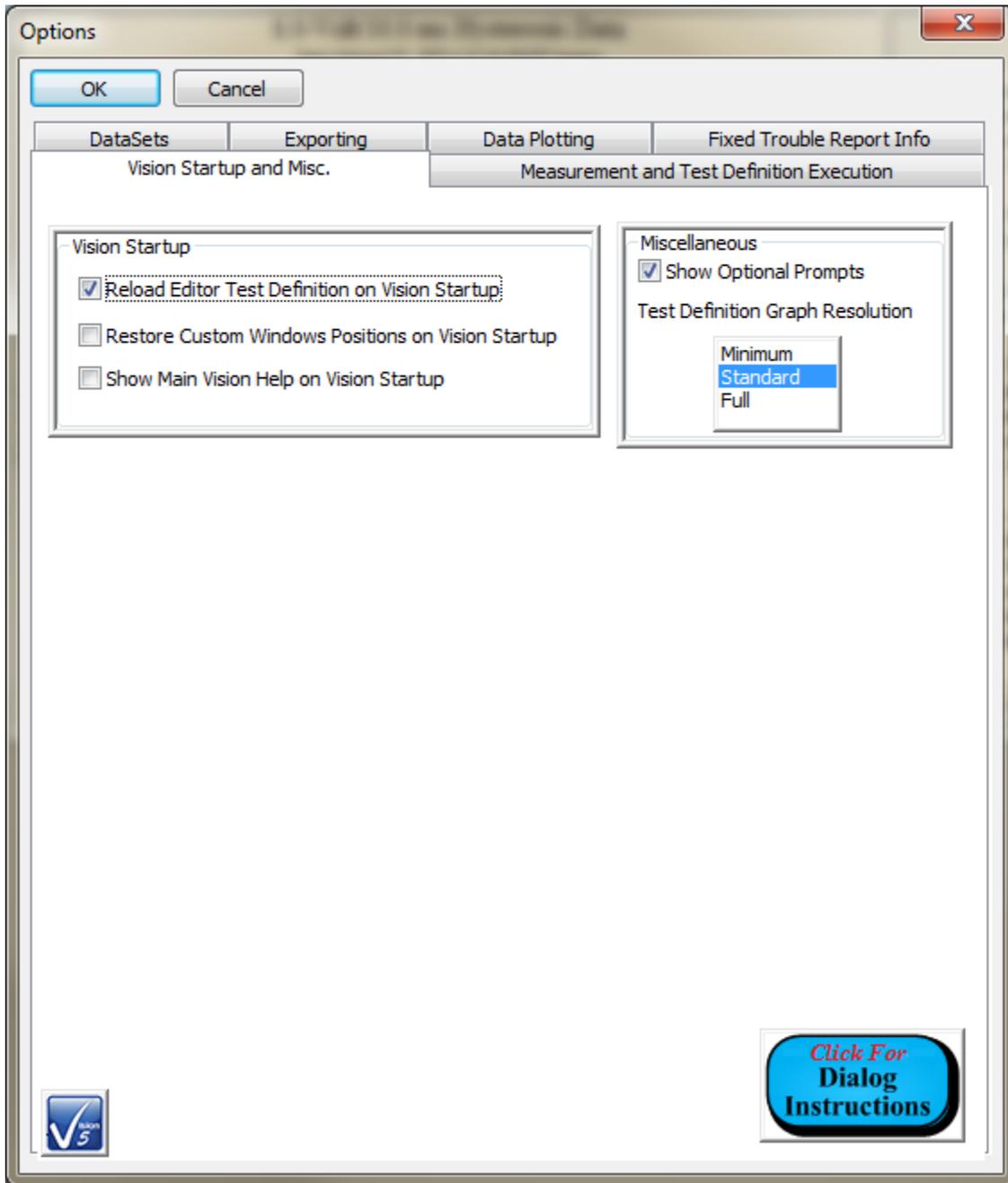


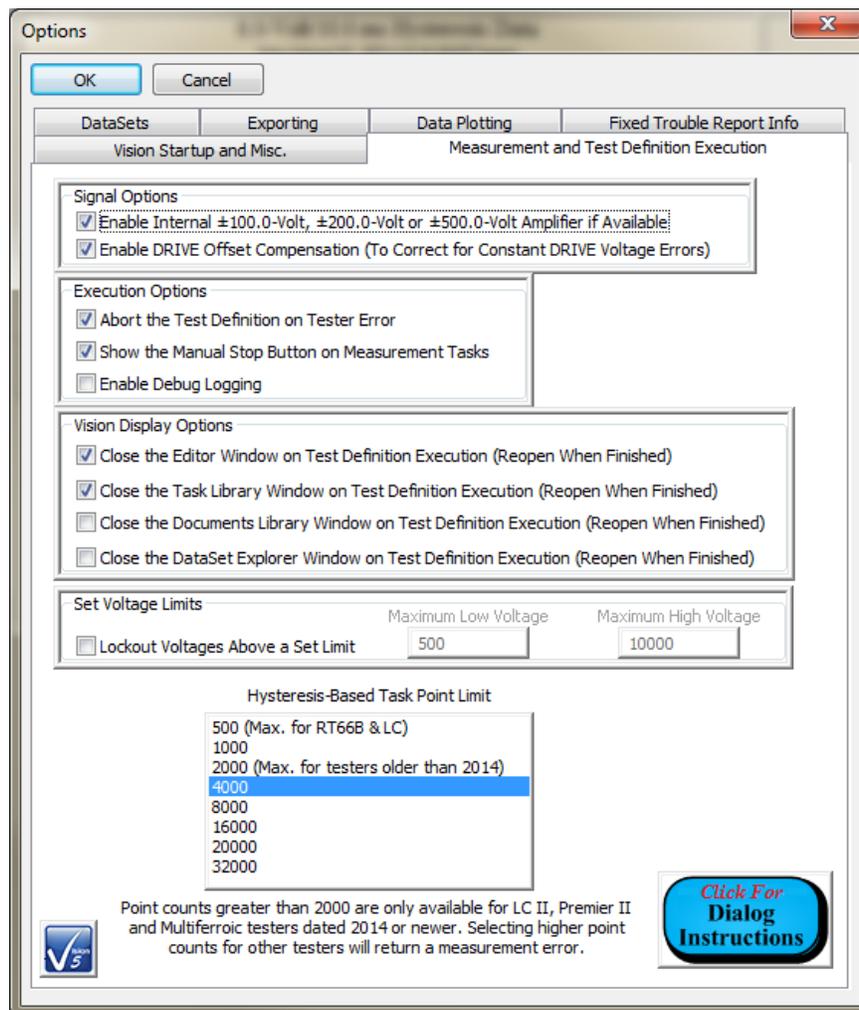
Figure 6 - Options Dialog: Vision Startup and Miscellaneous Tab.

- *Reload Editor Test Definition on Startup* - If checked (default) the Test Definition that was in the EDITOR when Vision was closed will be reloaded into the EDITOR on Vision startup. The EDITOR is reloaded from C:\DataSets\Editor List.EL. If this option is not checked, the EDITOR will be empty on Vision

startup.

- *Restore Custom Windows Positions on Vision Startup* - Unchecked by default. If checked and Vision windows have been moved, undocked, etc. the user-adjusted positions will be restored on the next Vision execution. If unchecked, the default distribution of Vision windows will appear on startup.
- *Show Vision 5 "What's New" Wizard on Vision Startup* - Unchecked by default. Vision will no longer display the Vision 5 "What's New" wizard on startup regardless of this setting.
- *Show Optional Prompts* - Checked by default. Some Vision prompt dialogs may be disabled by the user so that they no longer appear. This control toggles between showing and hiding these prompts.
- *Test Definition Graph Resolution* - "Standard" by default. This control determined the amount of text to be written by each Task to a Test Definition Graph. In practice, adjustments to this control will have little or no effect.

2. Measurement and Test Definition Execution



Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

Figure 7 - Options Dialog: Measurement and Execution Tab

- *Signal Options: Enable Internal ± 100.0 -Volt, ± 200.0 -Volt or ± 500.0 -Volt Amplifier if Available* - Checked by default. This option has been withdrawn. Previously the user could opt to turn off the internal amplifier for measurements of magnitude less than 10.0 Volts. This has been supplanted by driver control of the state of the internal amplifier based on test conditions.
- *Signal Options: Enable DRIVE Offset Compensation (To Correct for Constant DRIVE Voltage Errors)* - Checked by default. On Vision startup or hardware refresh the tester is calibrated for voltage output deviations from zero-Volt output at each of the various DRIVE signal stages. With this control checked, the offset of the DRIVE signal stage used is subtracted from the ordered signal to correct for the error to produce the requested signal. This option should normally be selected. However, in some cases where problems are encountered, the engineers at Radiant Technologies, Inc. may ask the user to disable this option.
- *Execution Options: Abort the Test Definition on Tester Error* - Checked by default. When this option is checked, any error returned to a Hardware Task (including Measurement Tasks) by the driver will cause the Test Definition execution to terminate at that Task. If the control is not checked, the Test Definition will continue to execute despite the error. Note that Error 9 will terminate the execution regardless of the state of this control. Error 9 is returned when the user clicks the *Stop <Measurement>?* button.
- *Execution Options: Show the Manual Stop Button on Measurement Tasks* - Checked by default. When checked the execution of a Measurement Task will show the *Stop <Measurement>?* button. This button allows the user to attempt to stop the Task execution before the measurement is completed. If this control is not checked the button will not appear.
- *Execution Options: Enable Debug Logging* - Unchecked by default. When checked Tasks may output text to a file named C:\DataSets\Debugging\ Vision Debug MM.DD.YYYY.txt. When troubleshooting problems remotely at the customer's location, Vision engineers may ask the user to enable this option, run the Task(s) to duplicate the problem and forward the resulting text file back to the engineer. Otherwise, this control should remain unchecked.
- *Vision Display Options: Close the Editor Window on Test Definition Execution* - Checked by default. When checked, the EDITOR window will be closed when Vision is executing a Test Definition in a DataSet. The window will be reopened when the execution completes.
- *Vision Display Options: Close the Library Window on Test Definition Execution* - Checked by default. When checked, the Library window will be closed when Vision is executing a Test Definition in a DataSet. The window will be reopened when the execution completes.
- *Vision Display Options: Close the Documents Library Window on Test Definition Execution* - Checked by default. When checked, the Documents Library window

will be closed when Vision is executing a Test Definition in a DataSet. The window will be reopened when the execution completes.

- *Vision Display Options: Close the DataSet Explorer Window on Test Definition Execution* - Unchecked by default. When checked, the DataSet Explorer window will be closed when Vision is executing a Test Definition in a DataSet. The window will be reopened when the execution completes.
- *Hysteresis-Based Task Point Limit* - Set the maximum number of points available to Hysteresis-based measurements (Hysteresis, Piezo, Remanent Hysteresis, etc.) This number may be adjusted downward based on the configured parameters of the measurement. Up to 32,000 points may be selected. Actual maximum may be reduced based on the tester model as noted in the selection box.

3. DataSets

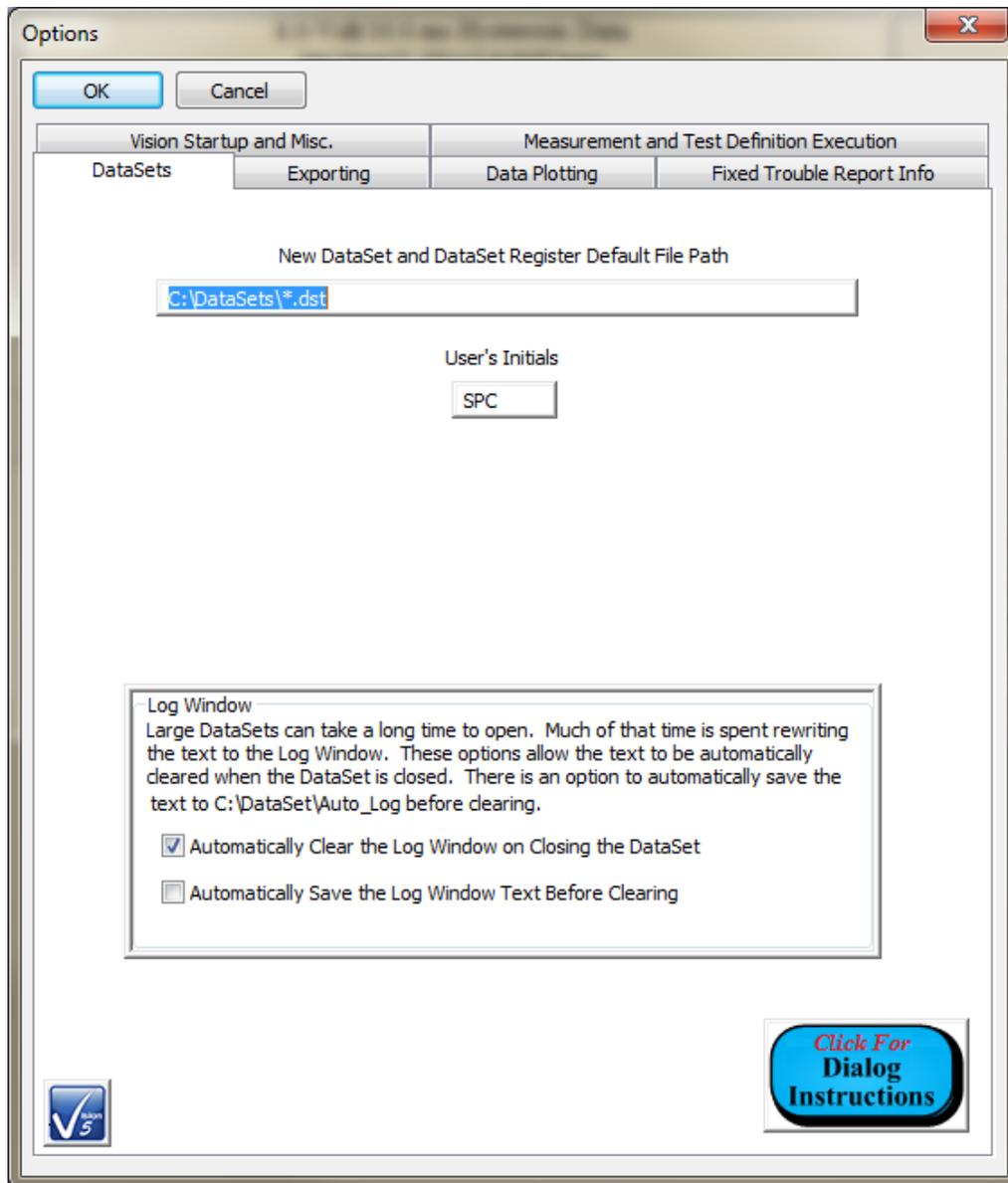


Figure 8 - Options Dialog: DataSets Tab.

- *New DataSet: New DataSet and DataSet Register Default File Path* - "C:\DataSets*.dst" by default. This is the file path to which DataSet files (*.dst) will be located when new DataSets are created. This value will change as a new file path is assigned when the DataSet is created.
- *New DataSet: User's Initials* - "" by default. These are the default user's initials that are specified when a new DataSet is created. A two, three or four-character string is required to be associated with a DataSet. This default value will change as initials are changed during the creating of a DataSet.
- *New DataSet: Folder*- "" by default. This value is no longer used and the control

is not shown.

- *New DataSet: Subfolder-* "" by default. This value is no longer used and the control is not shown.
- *Log Window: Automatically Clear the Log Window on Closing the DataSet* - Checked by default. When checked, all DataSets' log windows will be cleared of all text when the DataSet is closed. The log window is often of little documenting value and clearing it allows the DataSet to reopen more efficiently. Unchecking this control disables *Log Window: Automatically Save the Log Window Text Before Closing*.
- *Log Window: Automatically Save the Log Window Text Before Closing* - Unchecked by default. This control is disabled if *Log Window: Automatically Clear the Log Window on Closing the DataSet* is unchecked. If checked, all of the text in the a DataSet's log window will be written to C:\DataSets\Auto_Log\

4. Exporting

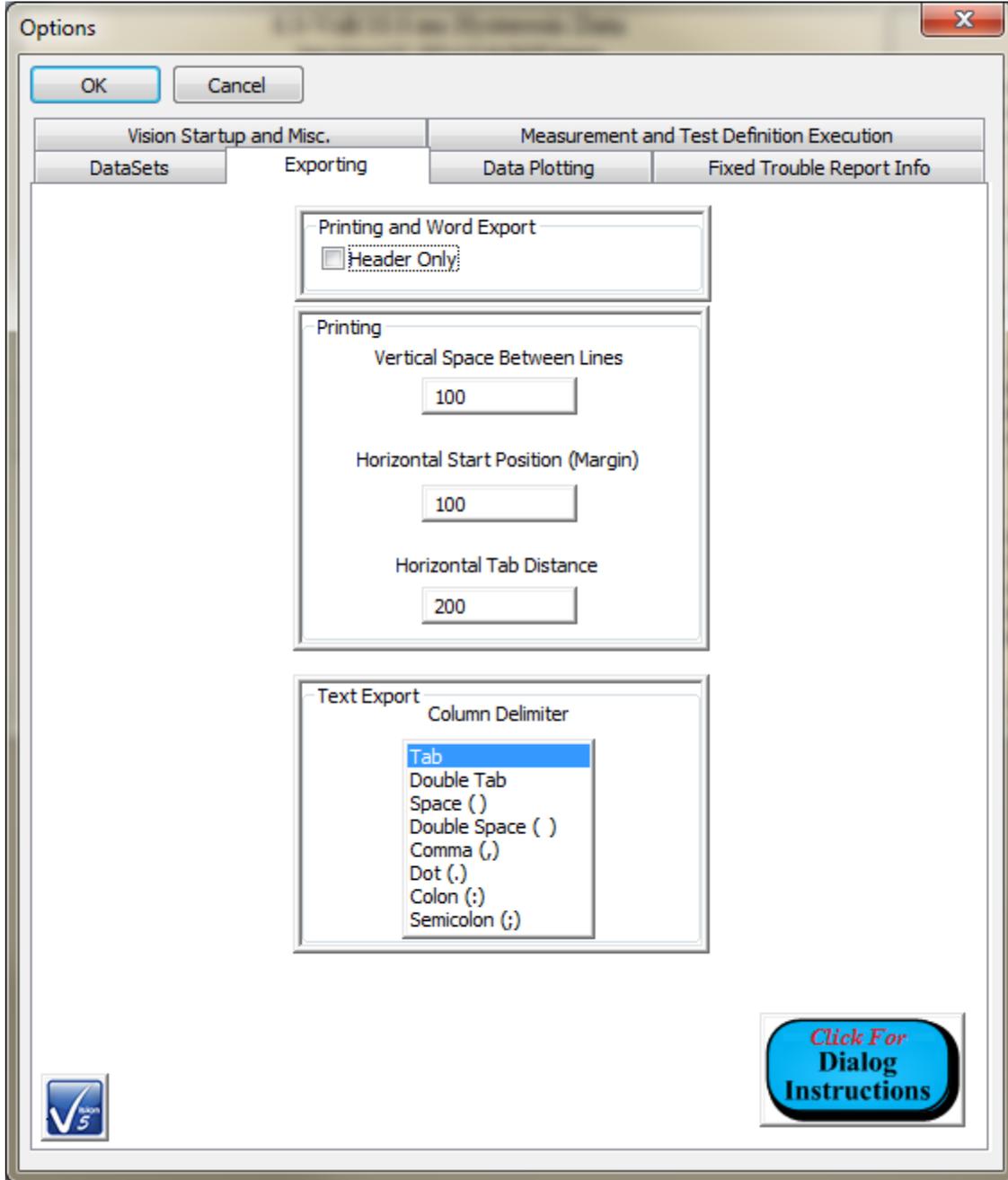


Figure 9 - Options Dialog: Exporting Tab.

- *Printing and Word Export: Header Only* - Unchecked by default. When checked, Word document exporting and printer exporting will not output columns of measured data vectors in Tasks that take data in vectors. This reduces the size of the output in formats where columnar output is of little value. Unchecking this con-

trol allows the output of columnar data.

- *Printing: Vertical Space Between Lines* - "100" by default. Adjust this value to adjust line spacing the printer output. Proper spacing is a function of the printer driver on the Vision host computer. The proper value to enter here is established by trial-and-error.
- *Printing: Horizontal Start Position*- "100" by default. Adjust this value to adjust left location of the first character on a line in the printer output. Proper location specification is a function of the printer driver on the Vision host computer. The proper value to enter here is established by trial-and-error.
- *Printing: Horizontal Tab Distance* - "200" by default. Adjust this value to adjust spacing of columns in the printer output. Proper spacing is a function of the printer driver on the Vision host computer. The proper value to enter here is established by trial-and-error.
- *Text Export: Column Delimiter* - "Tab" by default. Select the delimiter used to separate columns of data in text exporting. The selection may determine the distribution of exported data if the text export is imported into a data analysis program such as Excel or Origin.

5. Data Plotting

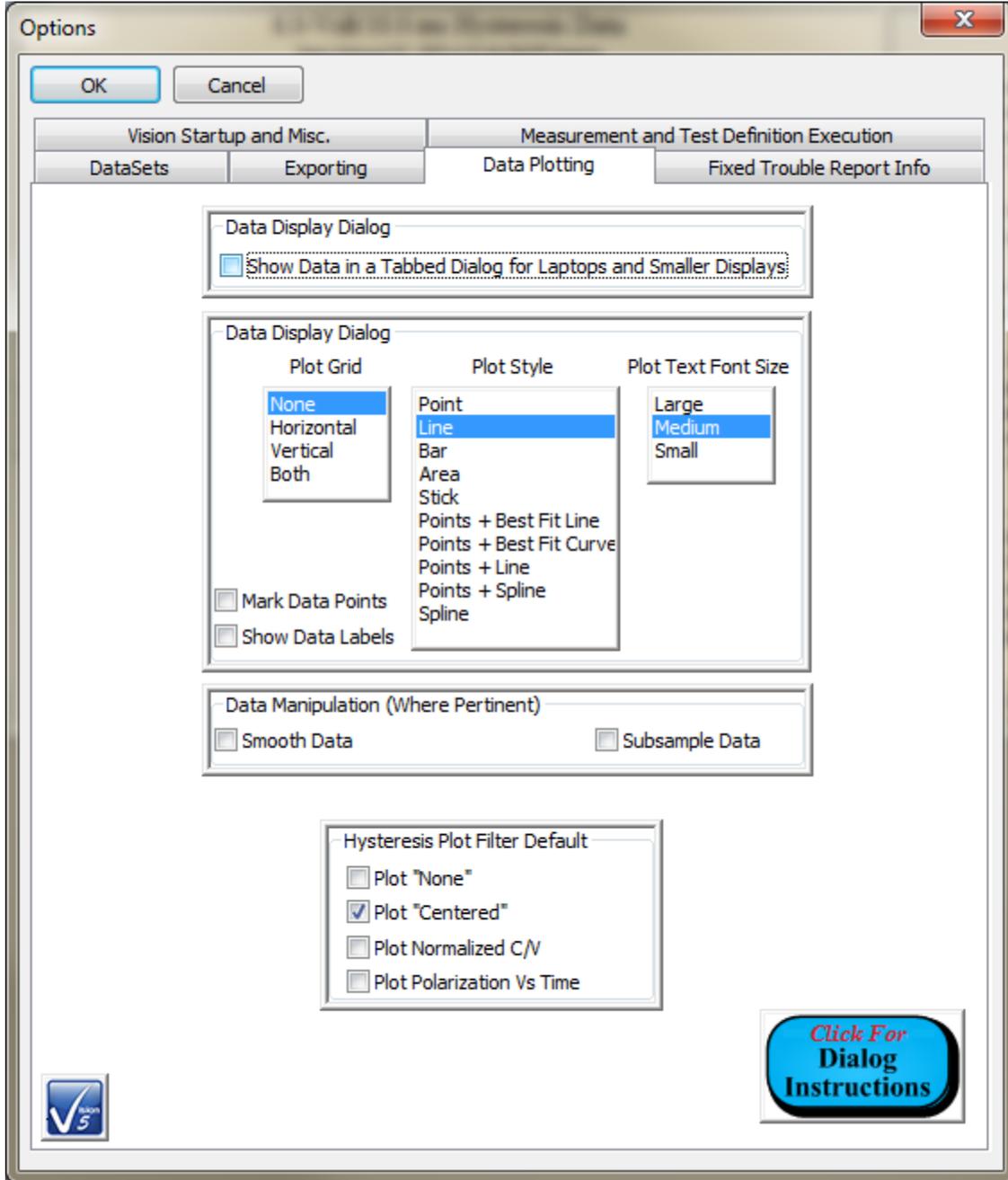


Figure 10 - Options Dialog: Data Plotting Tab.

- *Data Display Dialog: Show Data in a Tabbed Dialog for Laptops and Smaller Displays* - Unchecked by default. When unchecked, Measurement Tasks that display data in a Data Presentation dialog will show plotted and text data on a single dialog page. This page may be too large for laptop displays and other small moni-

tors. Checking this control separates the display of plotted data and text data into two tabs in a tabbed dialog, allowing the size of the dialog to be reduced for smaller displays. However, operating Vision with a display smaller than 19" (49.25 cm) is not recommended.

- *Data Display Dialog: Plot Grid* - "None" by default. Select the grid that is to appear over the data display when data are first plotted. (The display can always be adjusted by right-clicking.)
 - *Data Display Dialog: Plot Style* - "Line" by default. Select the visual representation that the data are to take on when first displayed. (The display can always be adjusted by right-clicking.)
 - *Data Display Dialog: Plot Text Font Size* - "Medium" by default. Select the size of the text of the labels that appear on the data display when data are first plotted. (The display can always be adjusted by right-clicking.)
 - *Data Display Dialog: Mark Data Points* - Unchecked by default. When checked, each data point in a line display will be marked with a circular point. This can dramatically clutter the display. (The display can always be adjusted by right-clicking.)
 - *Data Display Dialog: Show Data Labels* - Unchecked by default. When checked, each data point the display will be accompanied by numeric text showing the point's X and Y axis values. This can dramatically clutter the display. (The display can always be adjusted by right-clicking.)
 - *Data Manipulation: Smooth Data* - Unchecked by default. When checked, for Hysteresis data representations that allow weighted moving average smoothing before plotting (primarily derivative representations) the smoothing will occur.. This control has no relevance to most data presentation.
 - *Data Manipulation: Subsample Data* - Unchecked by default. When checked, for Hysteresis data representations that data to be subsampled by selected every fourth point before plotting (primarily derivative representations) the subsampling will occur.. This control has no relevance to most data presentation.
 - *Hysteresis Plot Filter Default* : - *Plot "Centered"* checked by default. This set of check boxes allows the user to select which Hysteresis plot filter will be set, by default, before data plotting. The selection may be changed by adjusting the Filter control in the plot configuration dialog that appears immediately before plotting. *Plot "Centered"* is the default and is the most-common representation of Hysteresis data. *Plot Polarization Vs Time* is the option most commonly selected by Radiant Technologies, Inc. engineers.
6. Fixed Trouble Report Info - Establish customer details required when submitting an automatic trouble report. Automatic Trouble Reports are initiated under the Help menu.

Options

OK Cancel

Vision Startup and Misc. Measurement and Test Definition Execution

DataSets Exporting Data Plotting Fixed Trouble Report Info

Name Telephone 1
 Scott Chapma 505-842-8007

Organization Telephone 2
 Radiant Technologies, Inc. 1-800-289-7176

Address (Line 1) Mobile Phone
 2835 Pan American Fwy NE

Address (Line 2) Fax
 Suite D 505-842-0366

City Email
 Albuquerque radiant@ferrodevices.com

State
 NM

Country
 USA

Postal Code
 87107

Under the Help->Trouble Report Vision menu option, the user can initiate a semi-automatic problem report that asks some basic questions, makes a measurement and emails the responses and results to Radiant for evaluation. Customer identifying information is fixed and can be set here.

Click For Dialog Instructions

Figure 11 - Options Dialog: Fixed Trouble Report Information Tab.

- Set Parameter Limits - This functionality is not yet available.
- Run DVM - This option is available in the  icon on the toolbar. This option runs tool that collects RTI I²C Voltage Controller input voltage as a Digital Voltmeter (DVM). At this writing no I²C Voltage Controller is available to allow a demonstration.
- Set PID Limits - This option opens a dialog that allows the user to set the proportional (K_p), integral (K_i) and differential (K_d) parameters to control the thermal rate of the RTI HVDM II high-voltage thermal displacement meter. Use of this

control is not recommended for anyone who is not familiar with the operation of PID controllers.

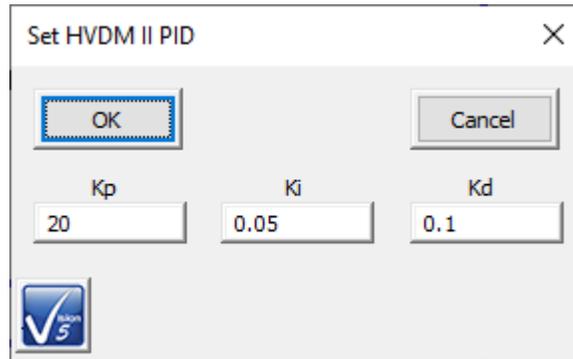


Figure 12 - PID Limits Dialog.

E. QuikLook Menu

V: Main Menu Operations

When the Vision program starts up four dockable windows - [TASK LIBRARY](#) , [EDITOR](#) , Document Library and [DataSet Explorer](#) – appear at the edges of a larger empty user space (**Figure 1**). At the top of the program view is a menu with the following options. These are discussed in subsequent sections. Links are made to the sections.

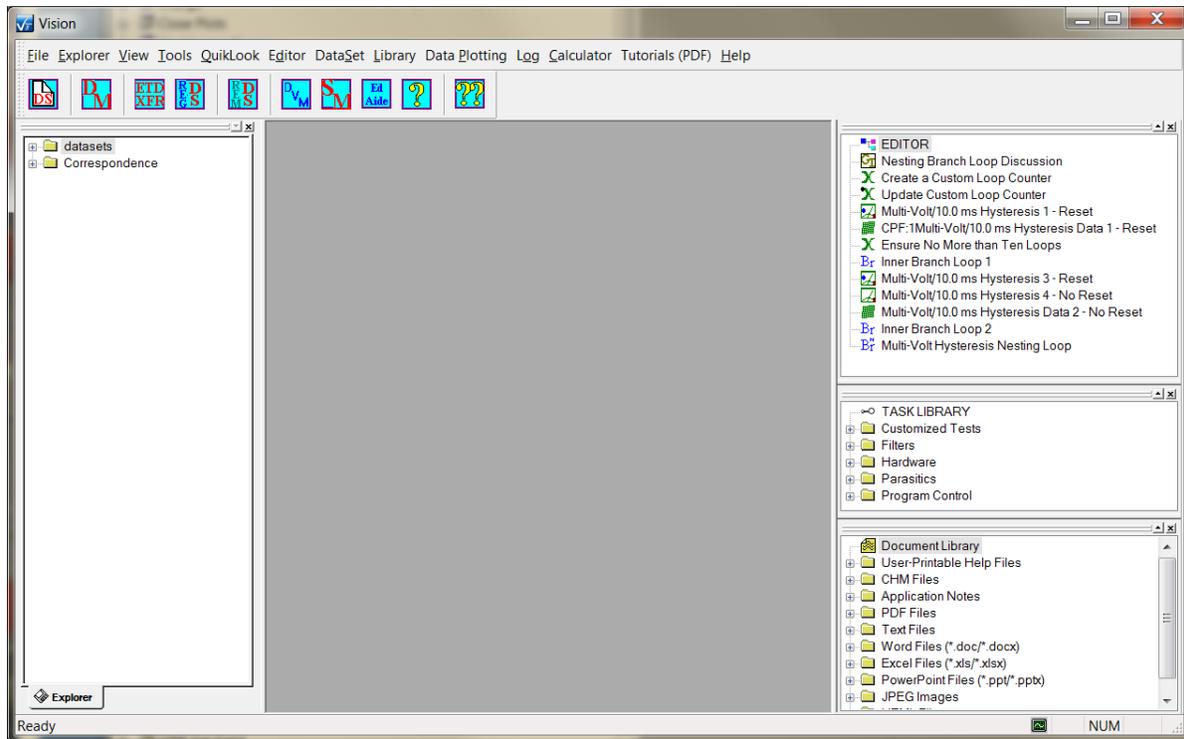


Figure 1 – Vision Program Screen.

V.F - QuikLook (Figure 2)– Perform the following Tasks independently of a DataSet for a quick sampling. ([See Below](#)) The QuikLook menu has been divided into categories to make organization easier. (Note that the "Repeat Last Task" option is disabled. This is a bug that needs correction. However, the action can be taken by pressing <Ctrl-R> as indicated in the menu label.)

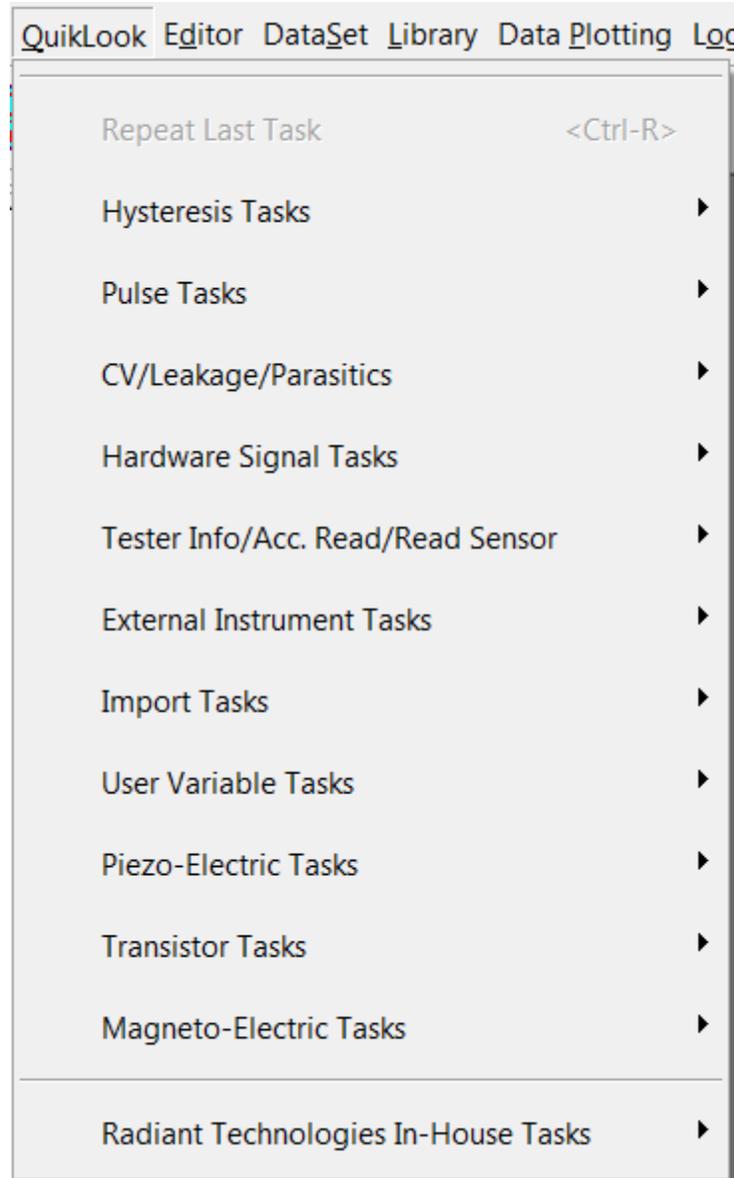


Figure 2 - Root QuikLook Menu.

1. Repeat Last Task (Ctrl + R) - There is an option to repeat the last configured QuikLook Task using <Ctrl-R>. Since the menu has been subdivided into categories, this option has been disabled in the menu. However, the <Ctrl-R> key combination still operates as intended.
2. Hysteresis-Based Tasks. These are Tasks derived from the basic Hysteresis measurement.

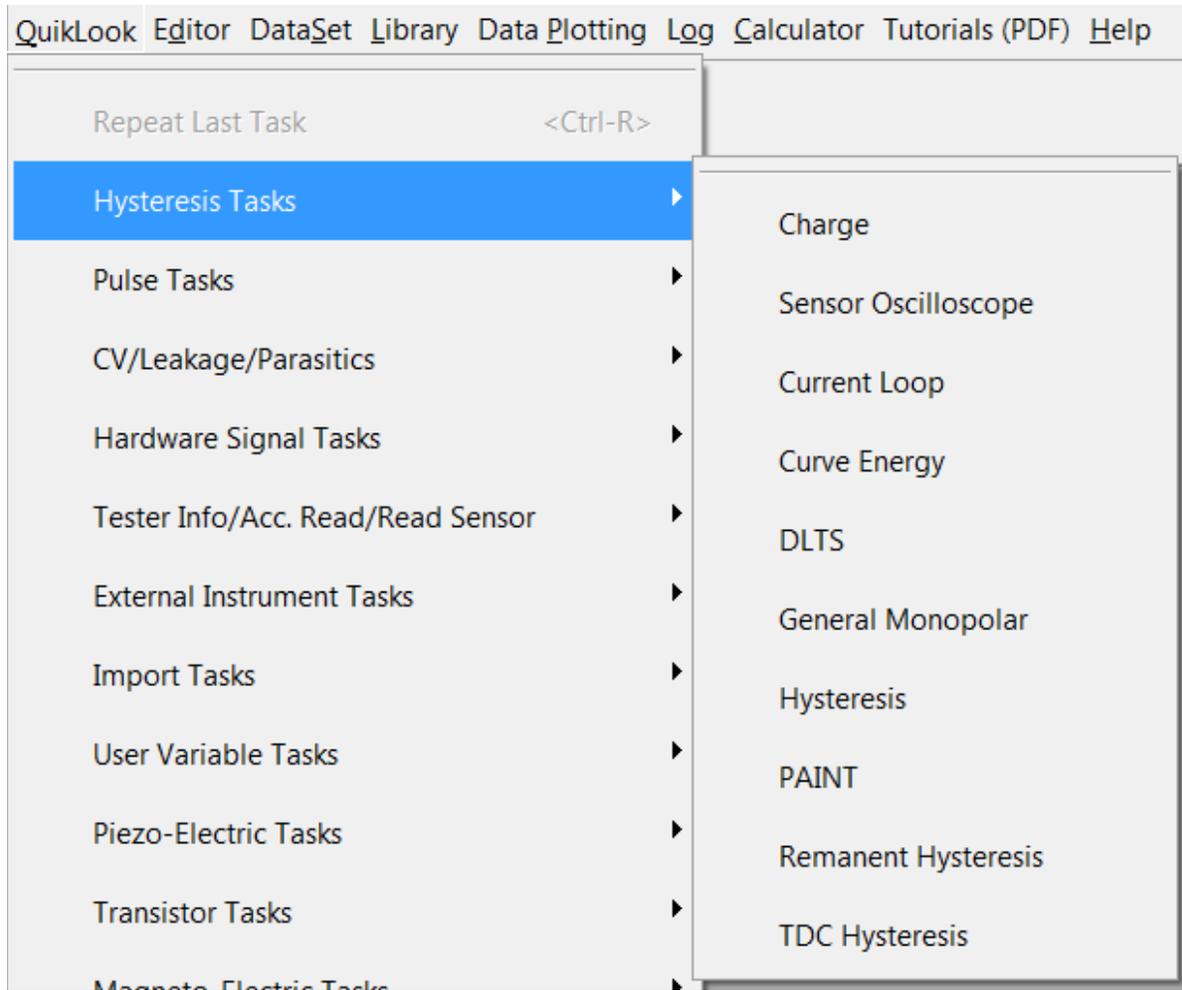


Figure 3 - Hysteresis-Based Tasks.

3. Pulse Tasks - These are Tasks that measure and/or preset the sample using stepped voltages.

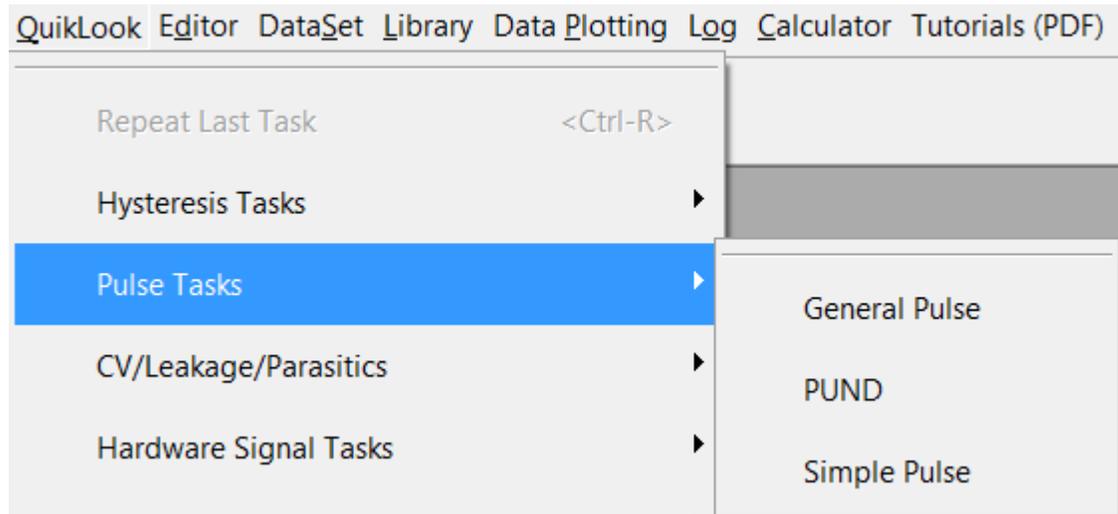


Figure 4 - Pulsed Tasks.

4. CV/Leakage/Parasitics - This submenu contains miscellaneous Measurement Task.

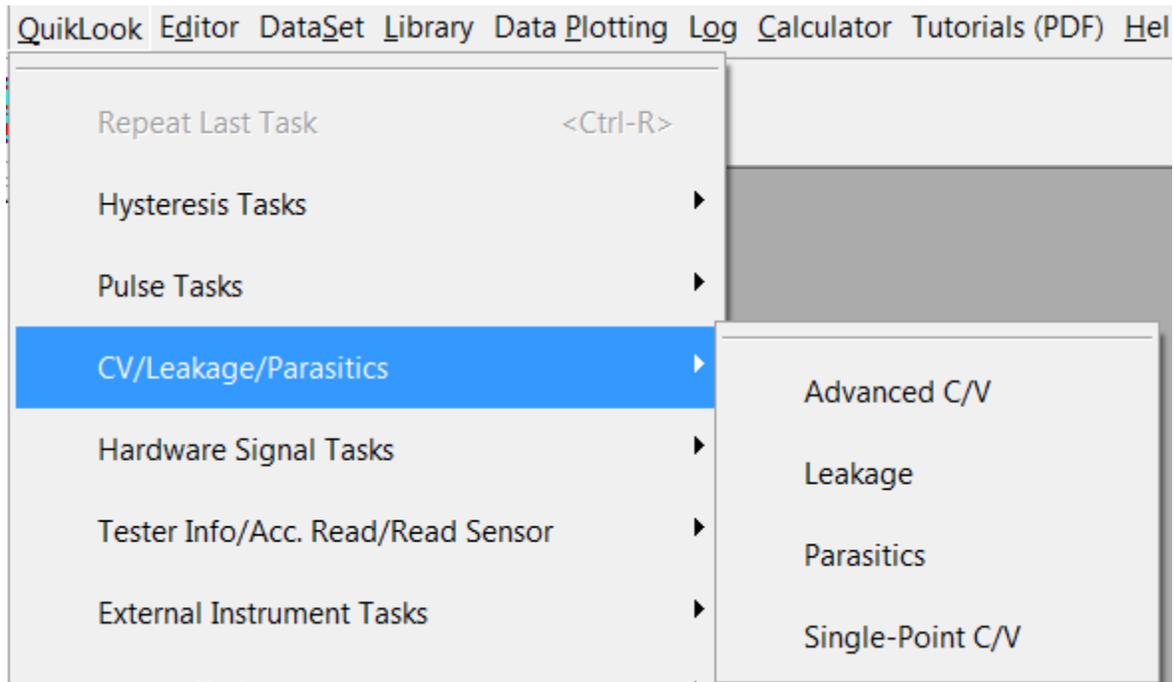


Figure 5 - Miscellaneous Tasks.

5. Hardware Signal Tasks. These are Tasks that do not take measured data.

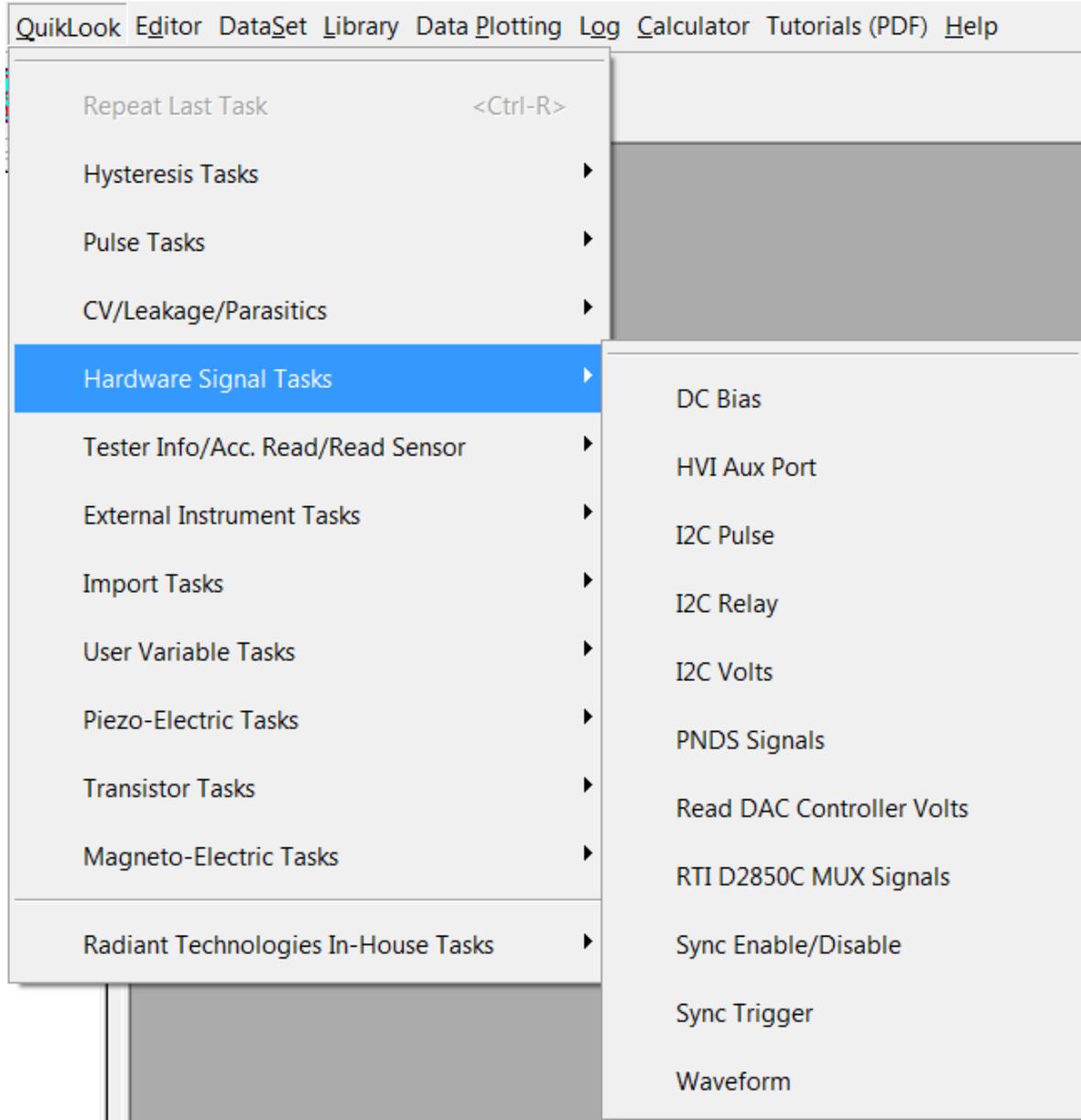


Figure 6 - Hardware Signal Tasks.

- 6. Tester Info/Acc. Read/Read Sensor. These are Tasks that report the current status of the tester, including the voltage(s) at the SENSOR port(s).

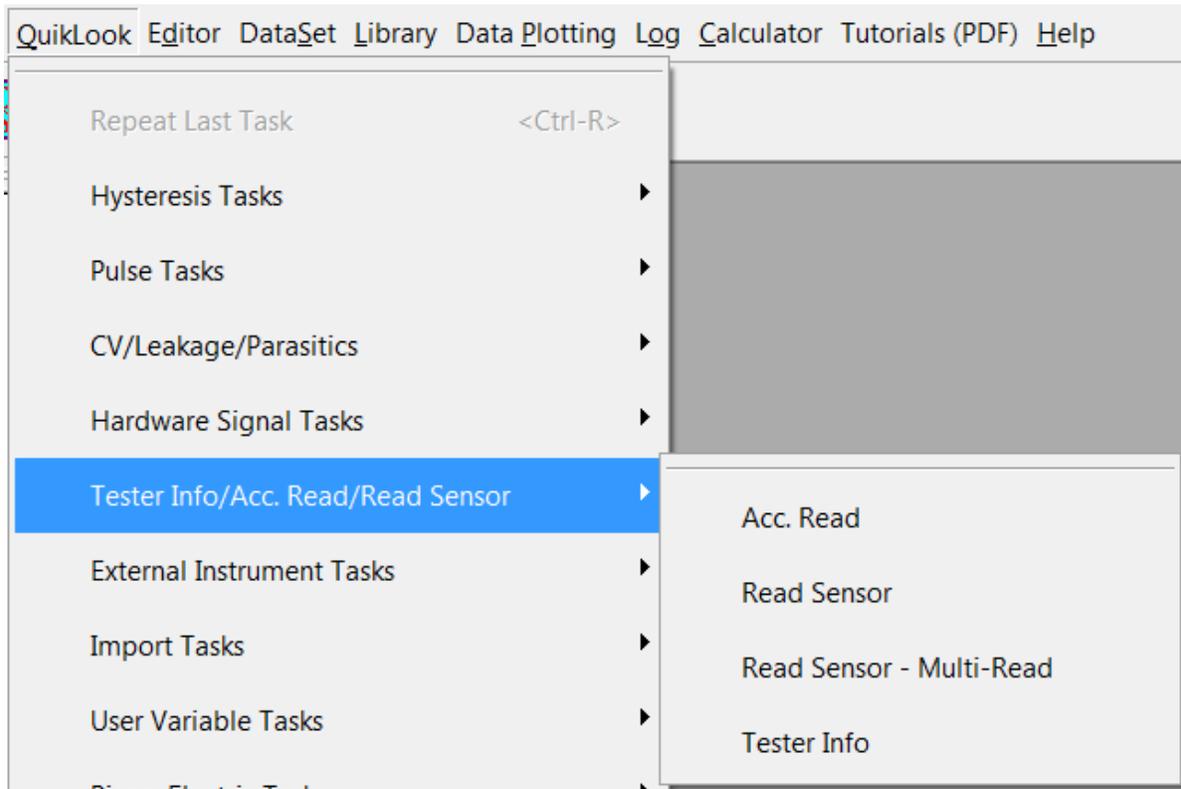


Figure 7 - Tester Status Tasks.

7. External Instrument Tasks. Until recently this category was called GPIB Tasks. This menu contains Tasks that talk to external instruments not manufactured by Radiant Technologies, Inc. Most communication is still through a National Instruments GPIB interface. However, some Tasks include instruments that are connected through RS232, RS485 or USB buses. Therefore the name of this menu has been changed.

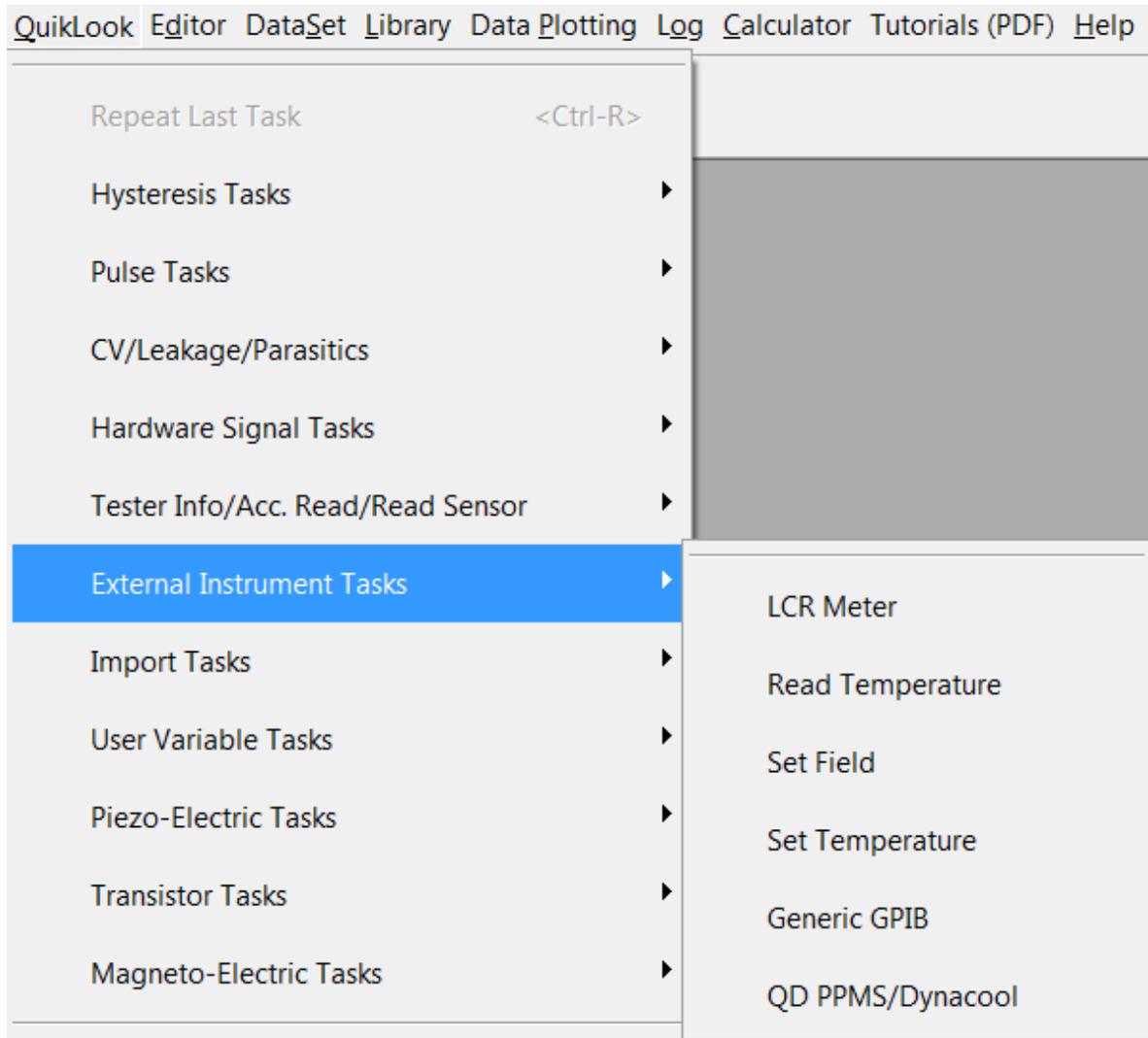


Figure 8 - External Instrument Tasks.

- 8. Import Tasks - These two "Filter" Tasks import data from text files exported by RT66A and RT6000 tester programs.

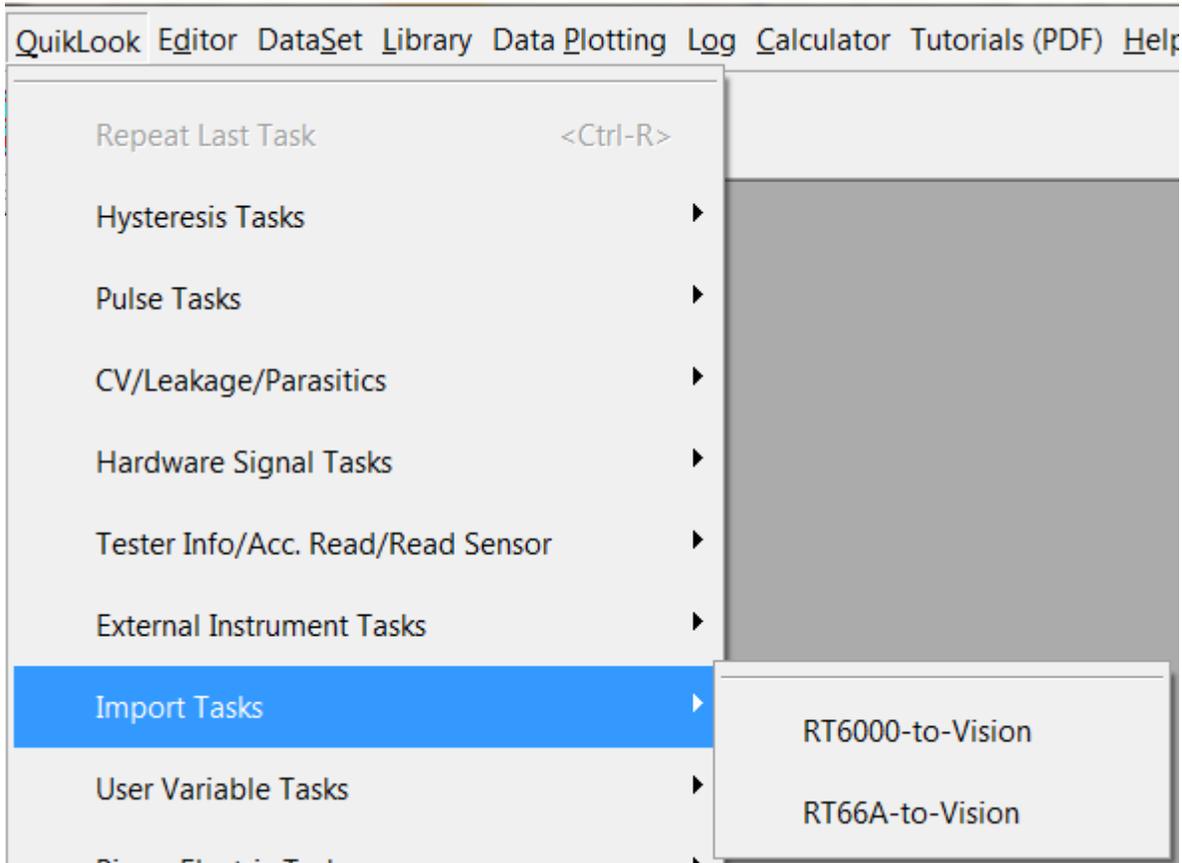


Figure 9 - RT66A and RT6000 Data Import Filter Tasks.

9. User Variable Tasks. Only the "Create User Variable" Task is available in QuikLook.

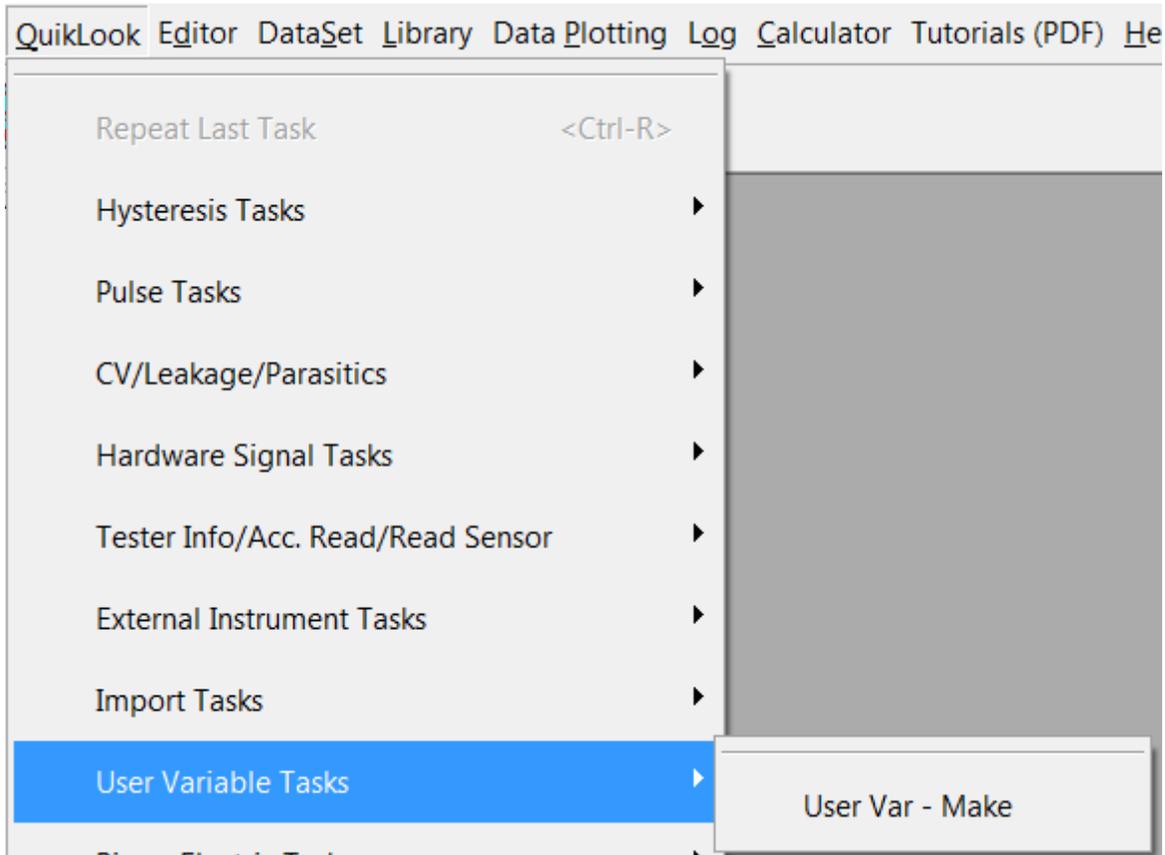


Figure 10 - Create User Variable Task.

10. Piezo-Electric Tasks. These are Tasks designed to capture sample displacement and/or other piezo-electric properties

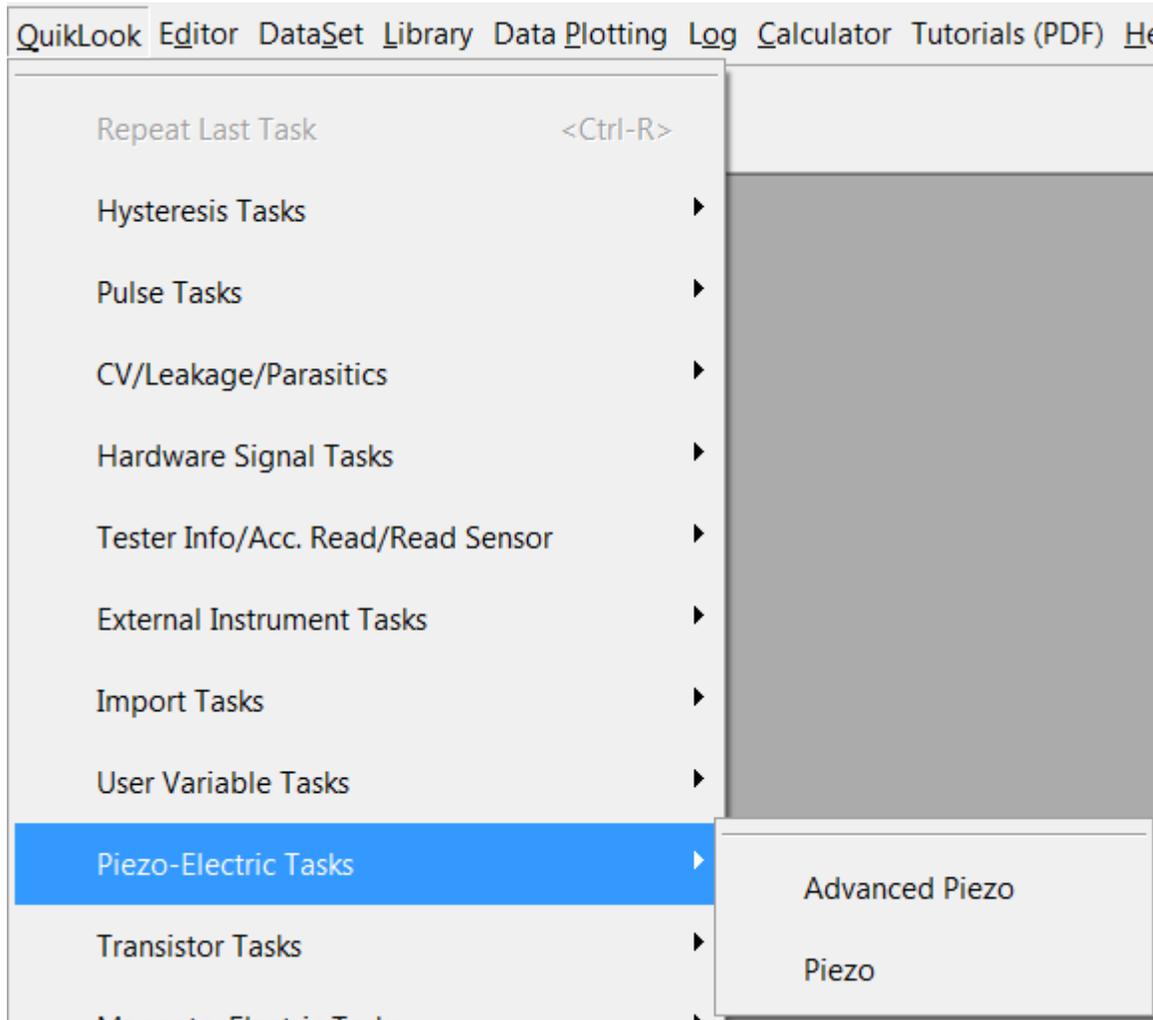


Figure 11 - Piezo-Electric Tasks.

11. Transistor Tasks - Only the Transistor Current Task is available under the QuikLook menu.

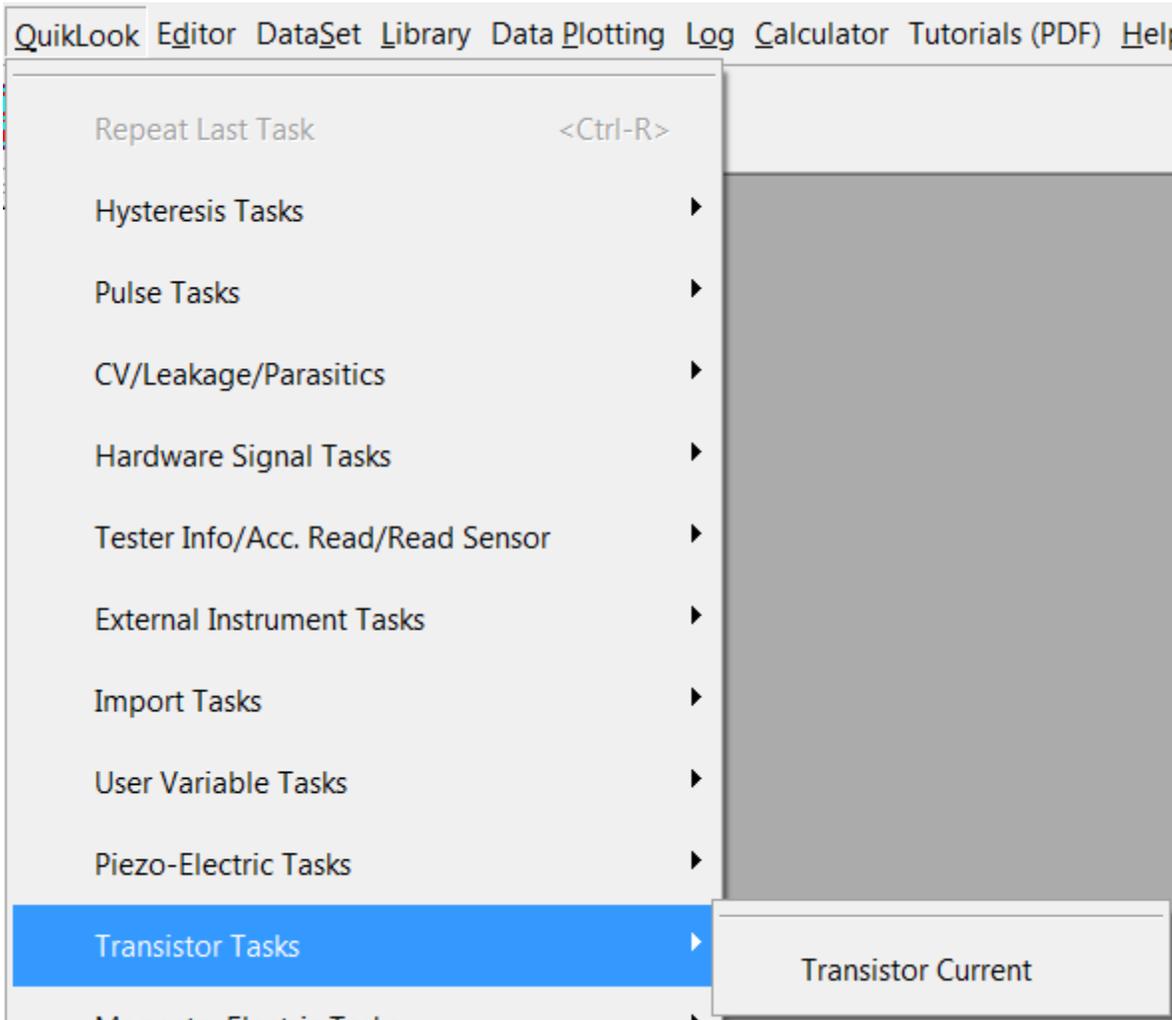


Figure 12 - Transistor Task.

12. Magneto-Electric Tasks - These Tasks are grouped into submenus under two upper submenus. The Magneto-Electric bundle has been shipped in two different formats. The earlier bundles were shipped with a Kepco BOP 36 current amplifier. More recent bundles are being shipped with the Radiant Technologies, Inc. CS 2.5 current source. These two bundles have distinct, though very similar, sets of Tasks. Each set is assigned its own submenu.

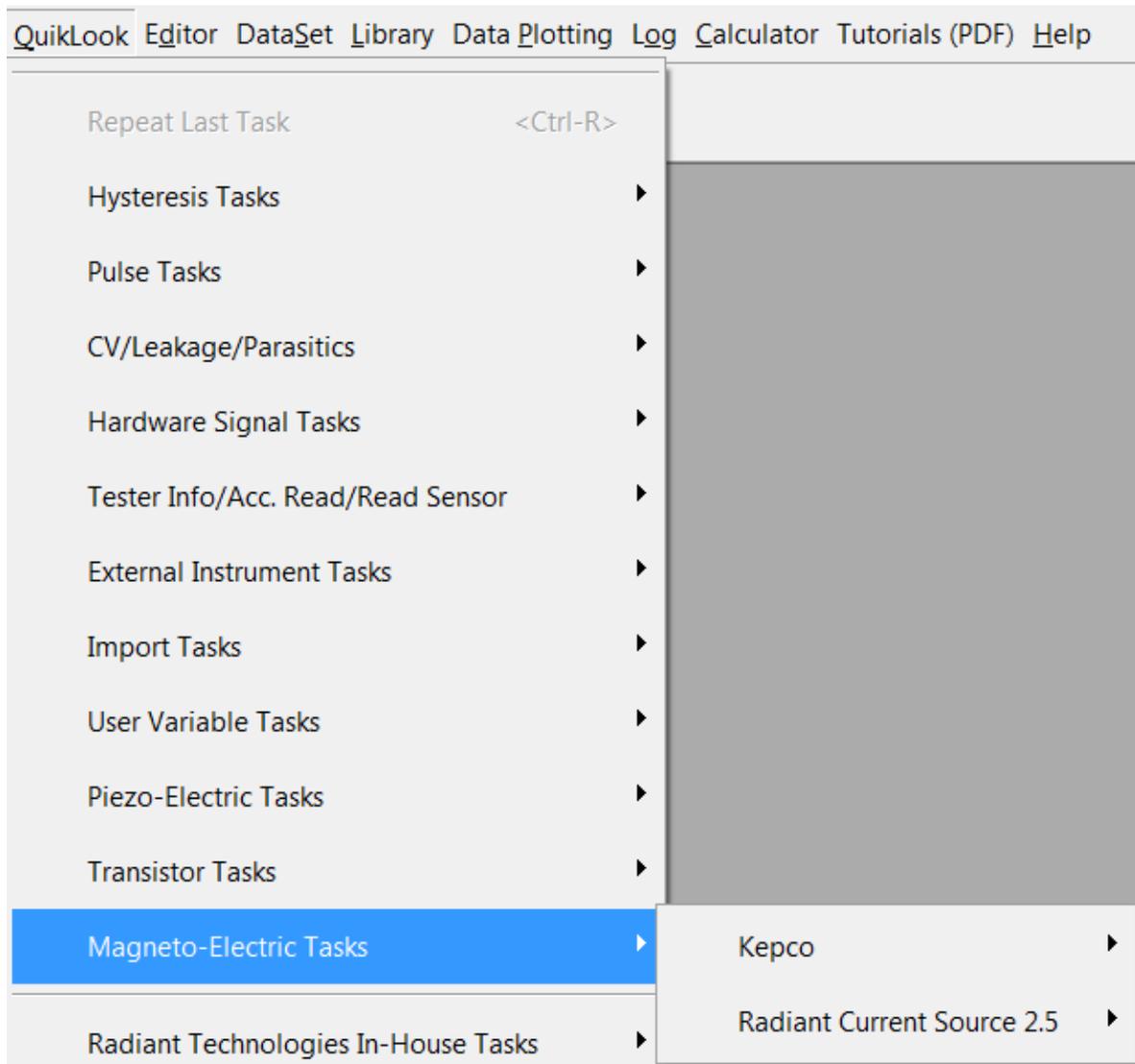


Figure 13 - Magneto-Electric Groups.

13. Magneto-Electric Tasks->Kepco.

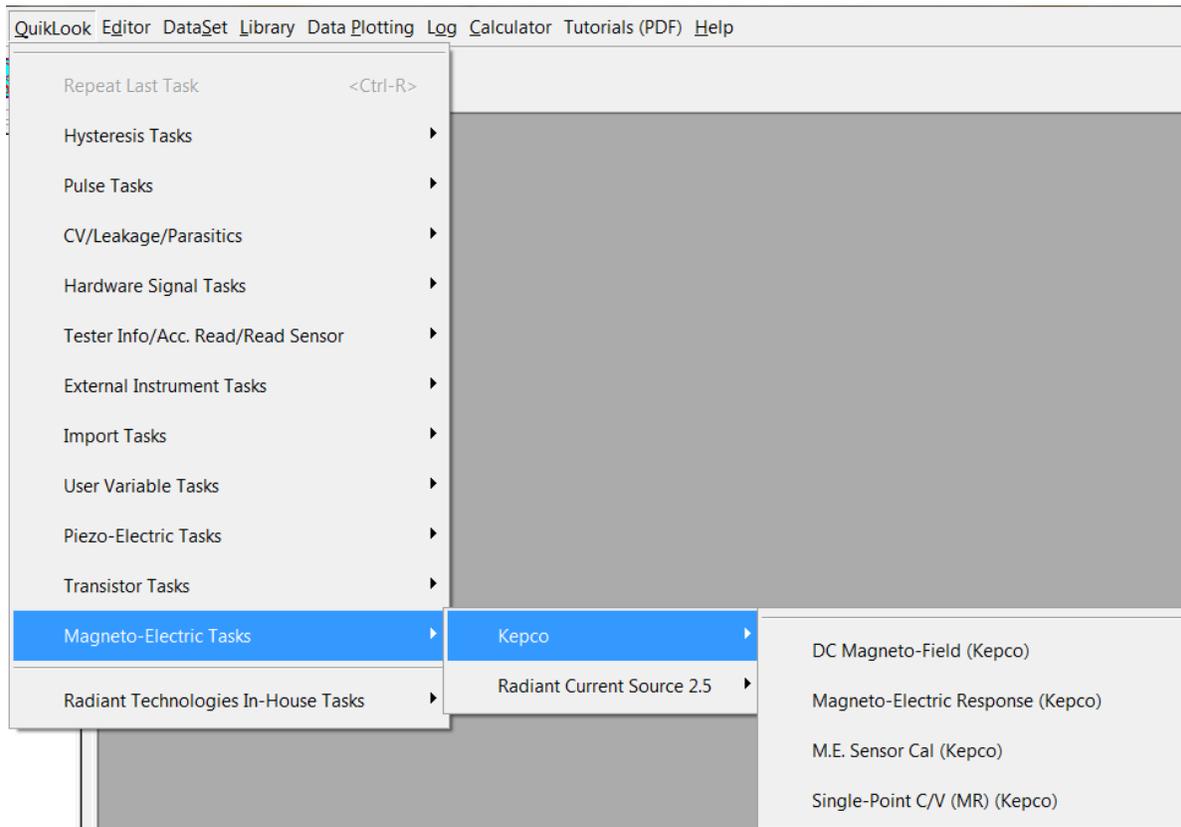


Figure 14 - Magneto-Electric->Kepco Tasks.

14. Magneto-Electric Tasks->Radiant Current Source 2.5

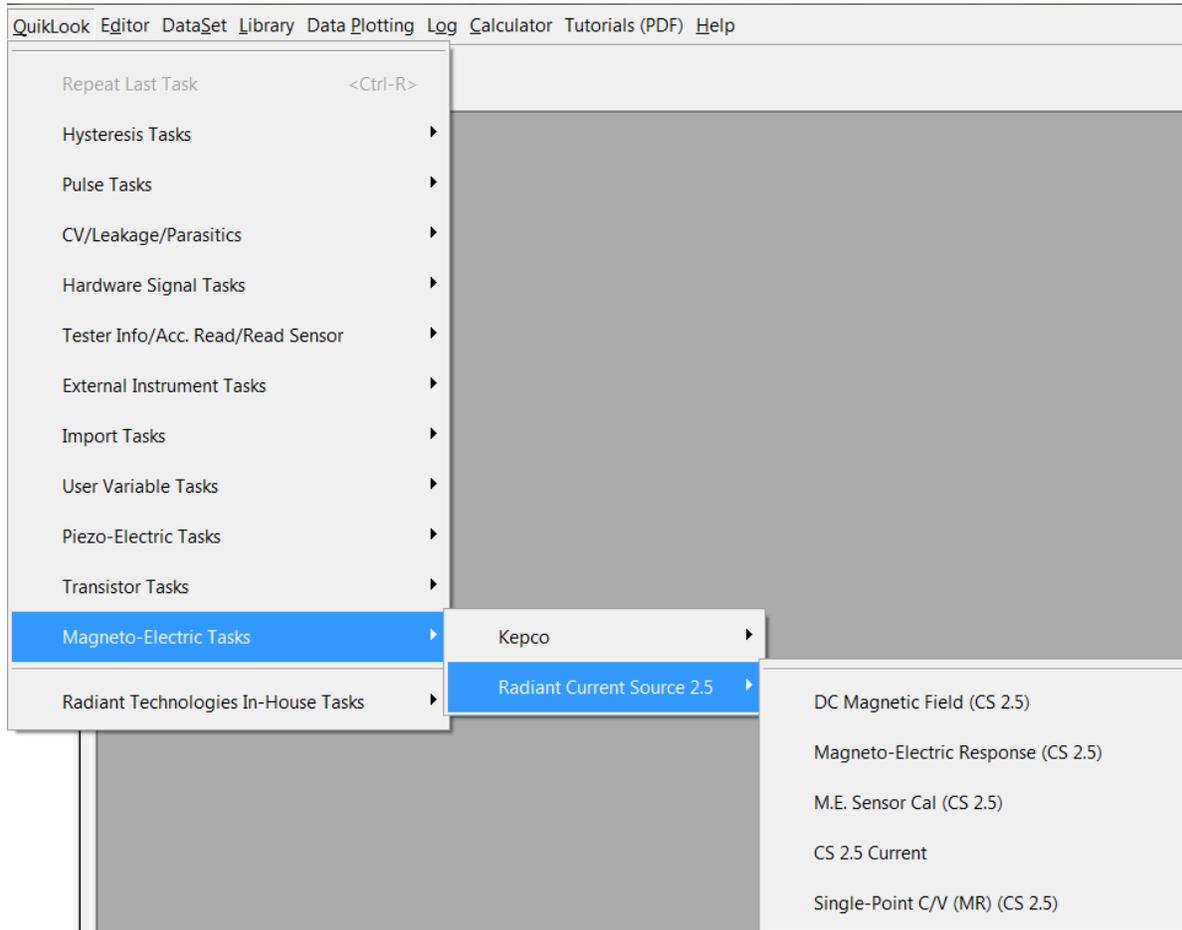


Figure 15 - Magneto-Electric->CS 2.5 Tasks.

15. Radiant Technologies In-House Tasks. This is a menu category reserved for Tasks that are used by Radiant Technologies, Inc. engineers. These Tasks are not distributed to customers and this menu will be empty.

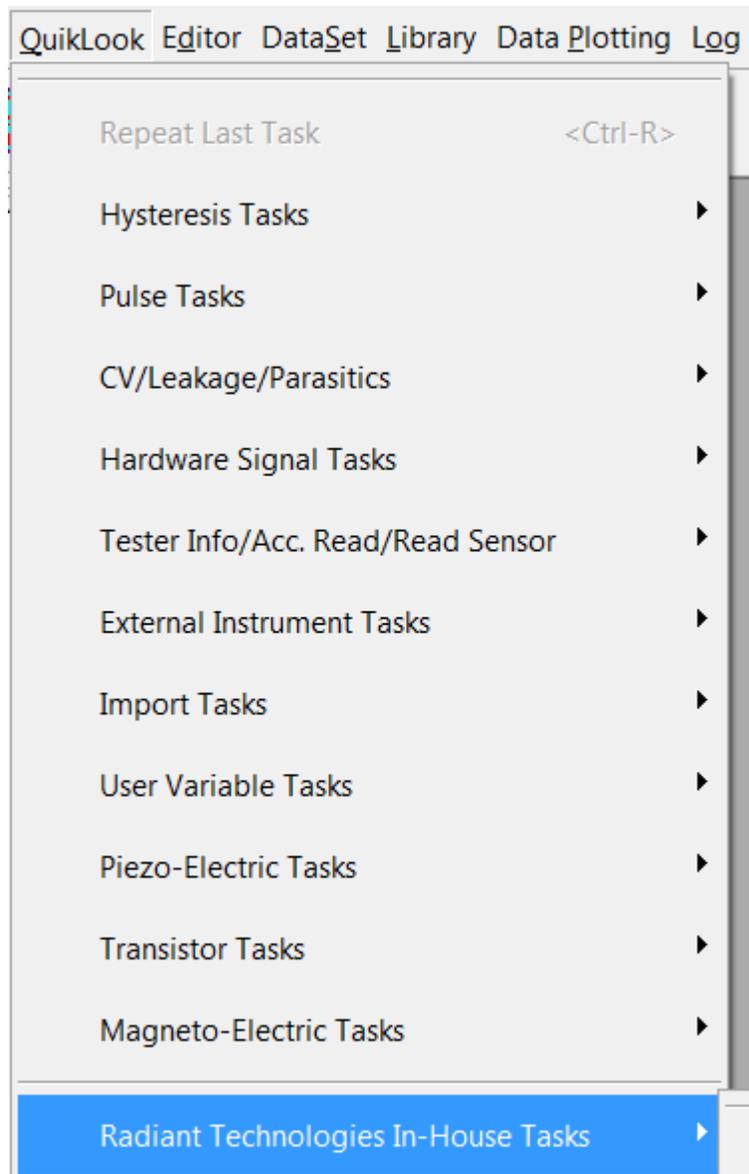


Figure 16 – Radiant Technologies In-House Menu.

F. EDITOR Menu

V: Main Menu Operations

When the Vision program starts up four dockable windows - [TASK LIBRARY](#) , [EDITOR](#) , Document Library and [DataSet Explorer](#) – appear at the edges of a larger empty user space (**Figure 1**). At the top of the program view is a menu with the following options. These are discussed in subsequent sections. Links are made to the sections.

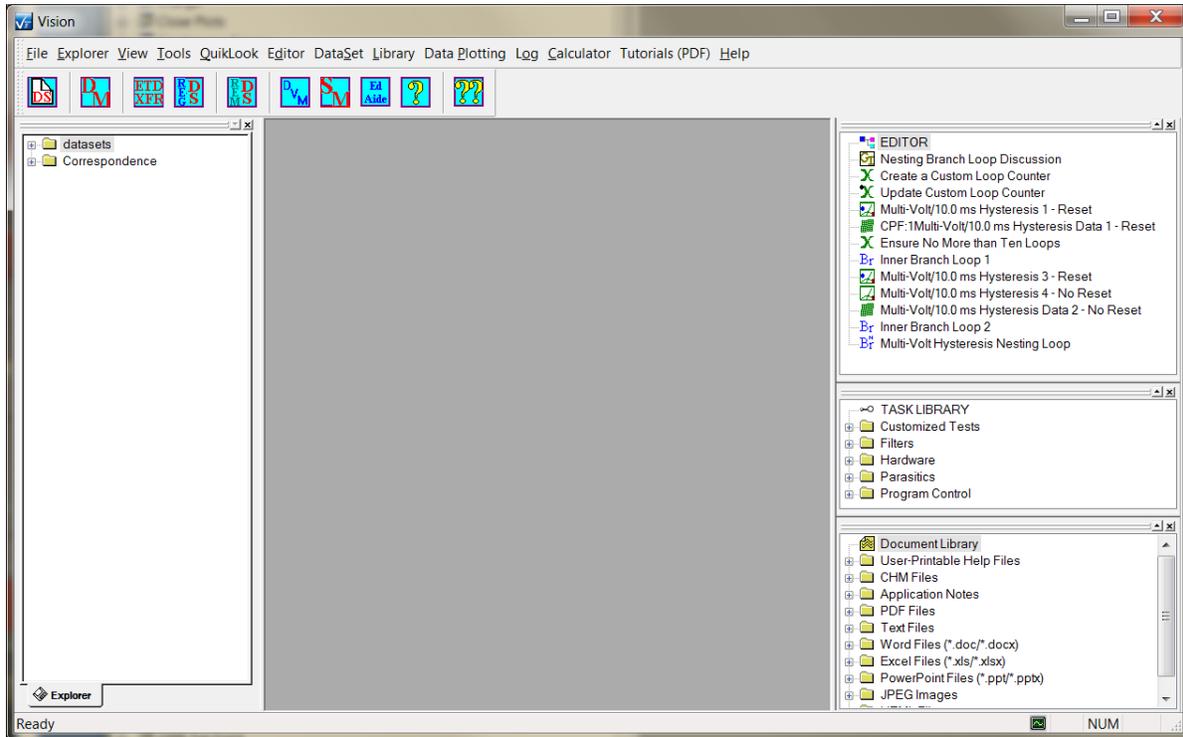
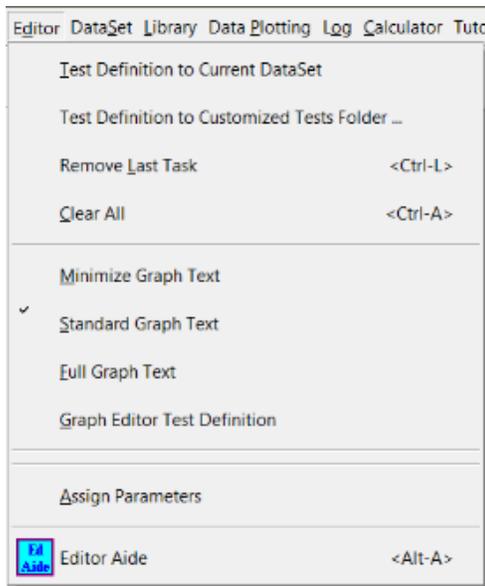
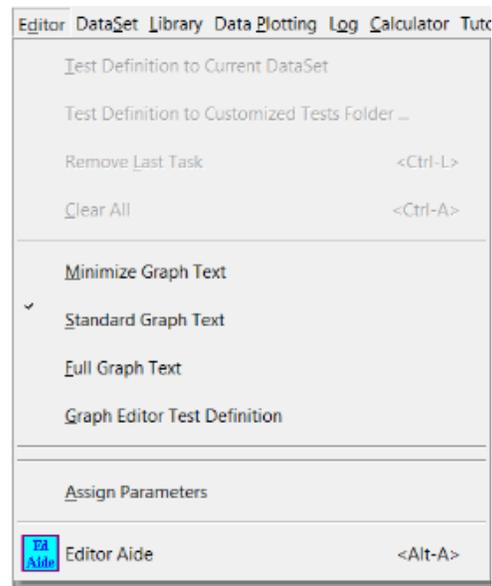


Figure 1 – Vision Program Screen

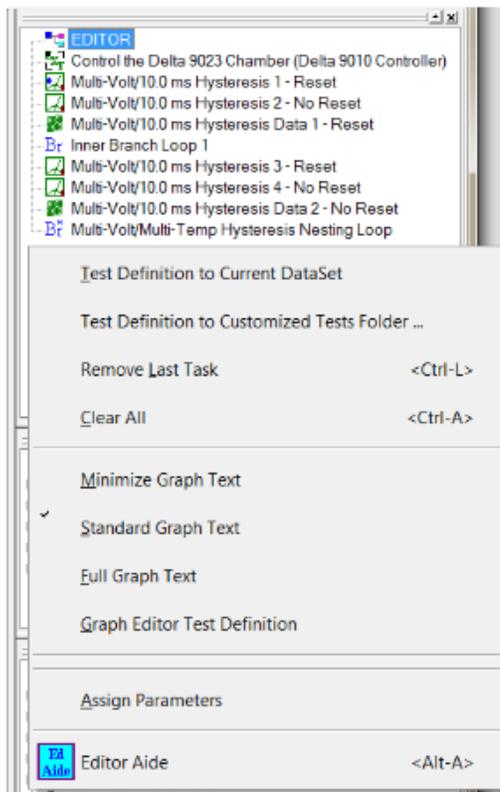
V.F - Editor (Figure 2) – Perform operations on the **EDITOR** window. This menu is also available by right-clicking in the EDITOR window. Some options are disabled if the EDITOR window is empty.



E ditor Menu



E ditor Wind ow is Empty



R ight-Click in E ditor Wind ow

Figure 2 – Editor Menu.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

Go to EDITOR Topic

1. **Test Definition to Current DataSet** - Move the Test Definition that is in the EDITOR to open DataSet replacing the Current Test Definition (CTD). The option is disabled if the EDITOR is empty of Tasks. A warning appears if there are no open DataSets to receive the Test Definition. If there are two or more open DataSets, a dialog appears to allow the target DataSet to be selected. Once the Test Definition has been transferred, a dialog will appear to allow the CTD to be named or renamed.

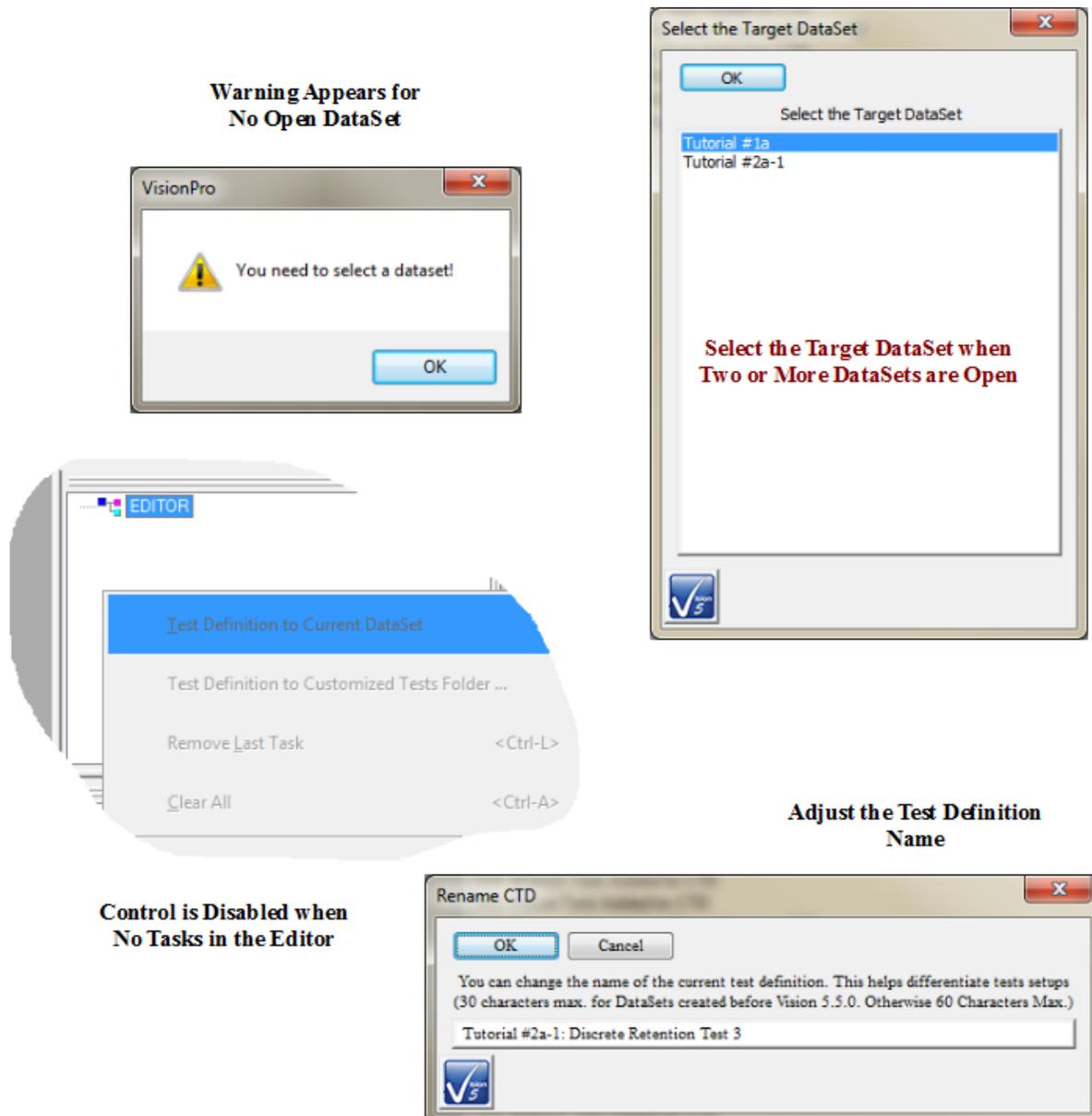
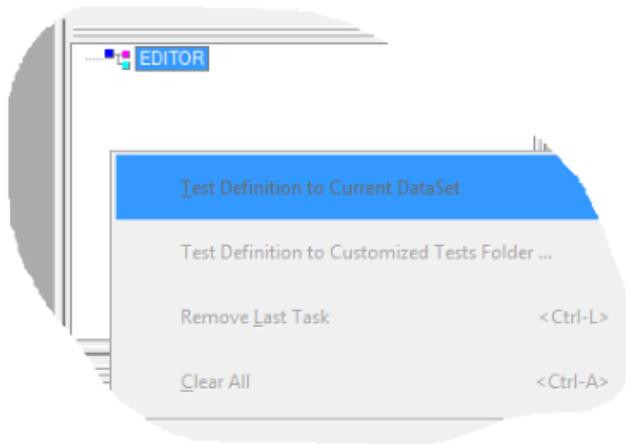


Figure 3 – Various CTD Transfer Conditions.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

2. Test Definition to Customized Test Folder - This option moves the existing Test Definition into a single named entry in the Task Library under the Customized Tests folder. The entire Test Definition can then be recalled from the Library as though it were a single Task. This option is disabled if there are no Tasks in the EDITOR. A dialog appears that allows the Customized Test to be given a unique and meaningful name of up to 25 characters.



**Control is Disabled when
No Tasks in the Editor**

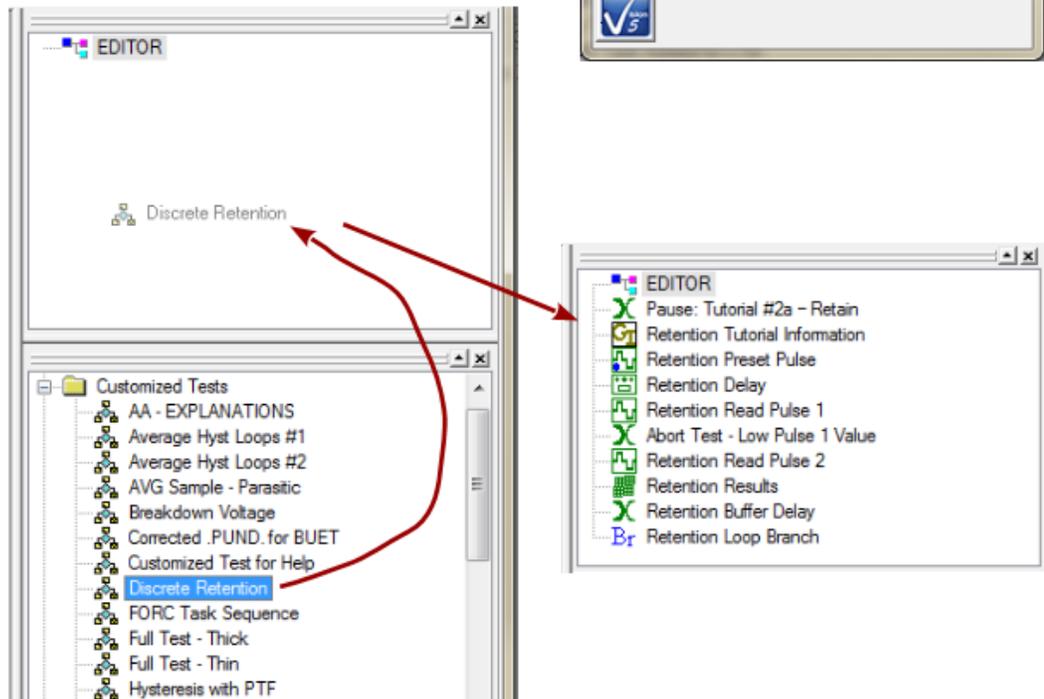
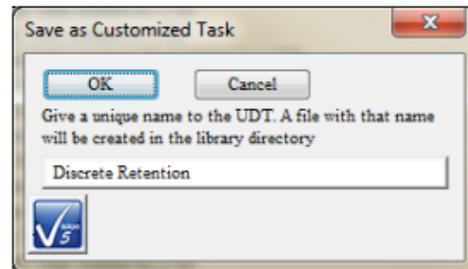


Figure 4 – Test Definition to Customized Test.

3. Remove Last Task (Ctrl-L) - Clear the last Task appended to the Test Definition in the EDITOR. This option is disabled if there are no Tasks in the EDITOR.

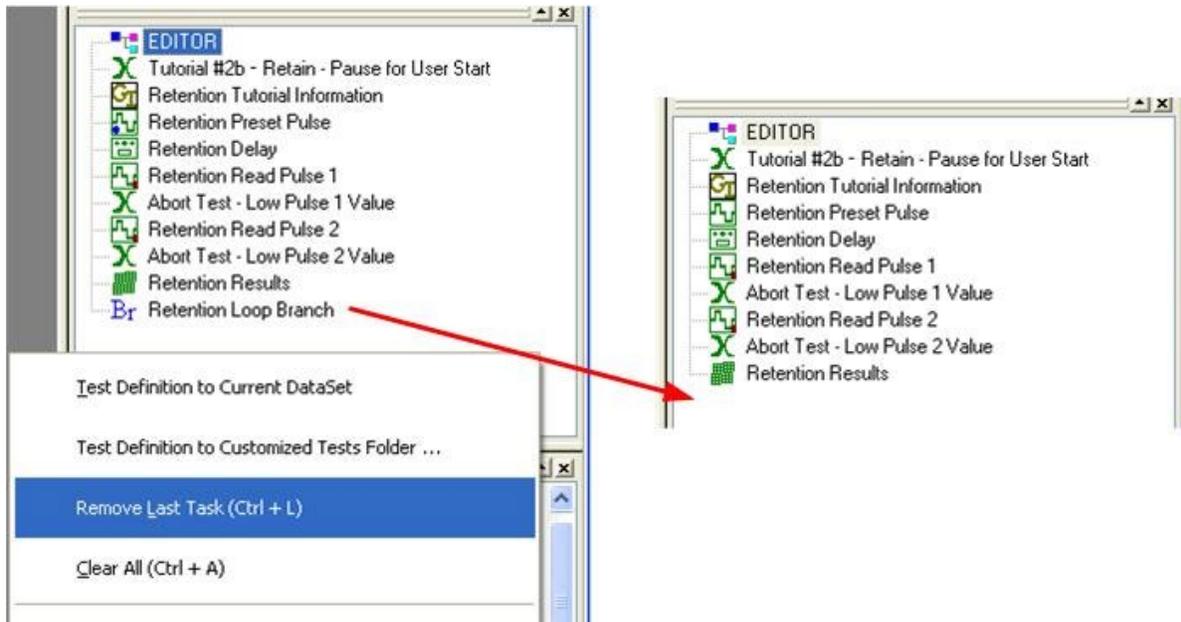


Figure 5 – Remove the Last Task in the EDITOR Test Definition.

4. Clear All – Remove all Tasks from the Test Definition under construction in the EDITOR window. This option is disabled if there are no Tasks in the EDITOR.

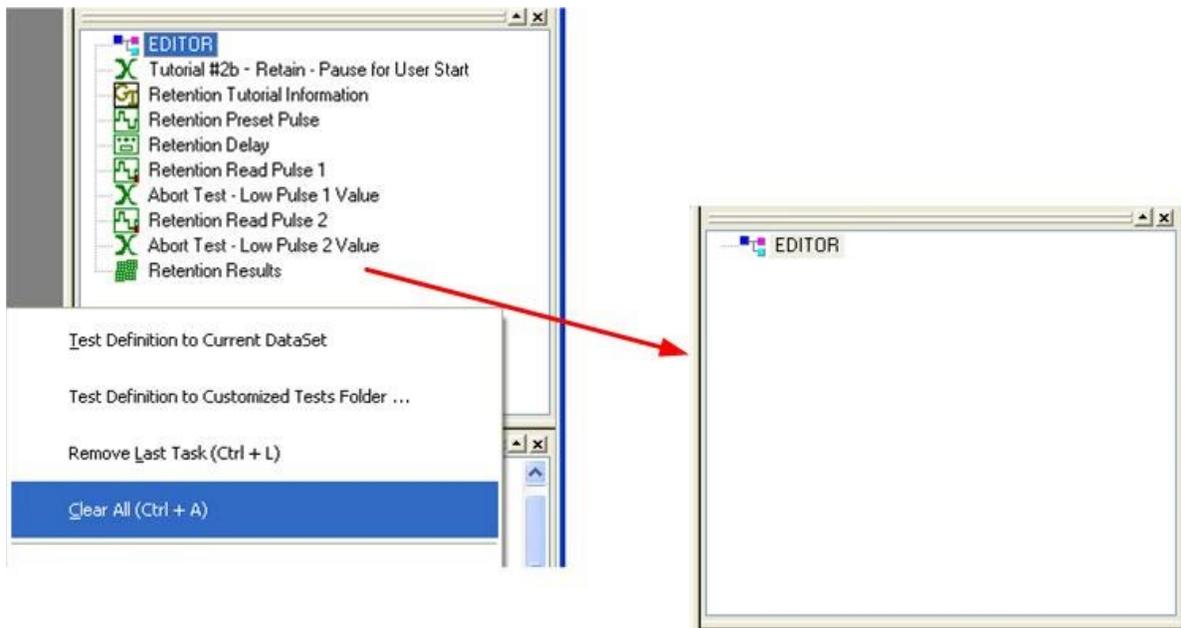


Figure 6 – Remove All Tasks in the EDITOR Test Definition.

5. Minimize Graph Text - Cause future instances of a [Test Definition Graph](#) to display minimal Task Text. These three options have little or no practical effect on Task Text output.

6. Standard Graph Text - Cause future instances of a [Test Definition Graph](#) to display the normal Task Text. These three options have little or no practical effect on Task Text output.
7. Full Graph Text - Cause future instances of a [Test Definition Graph](#) to display maximal Task Text. These three options have little or no practical effect on Task Text output.
8. Graph Editor Test Definition - Causes the Test Definition currently in the EDITOR to display in a Graph window. The Test Definition Graph can be copied for pasting into Microsoft word or Excel. It can be edited, printed and saved for recall into Vision,

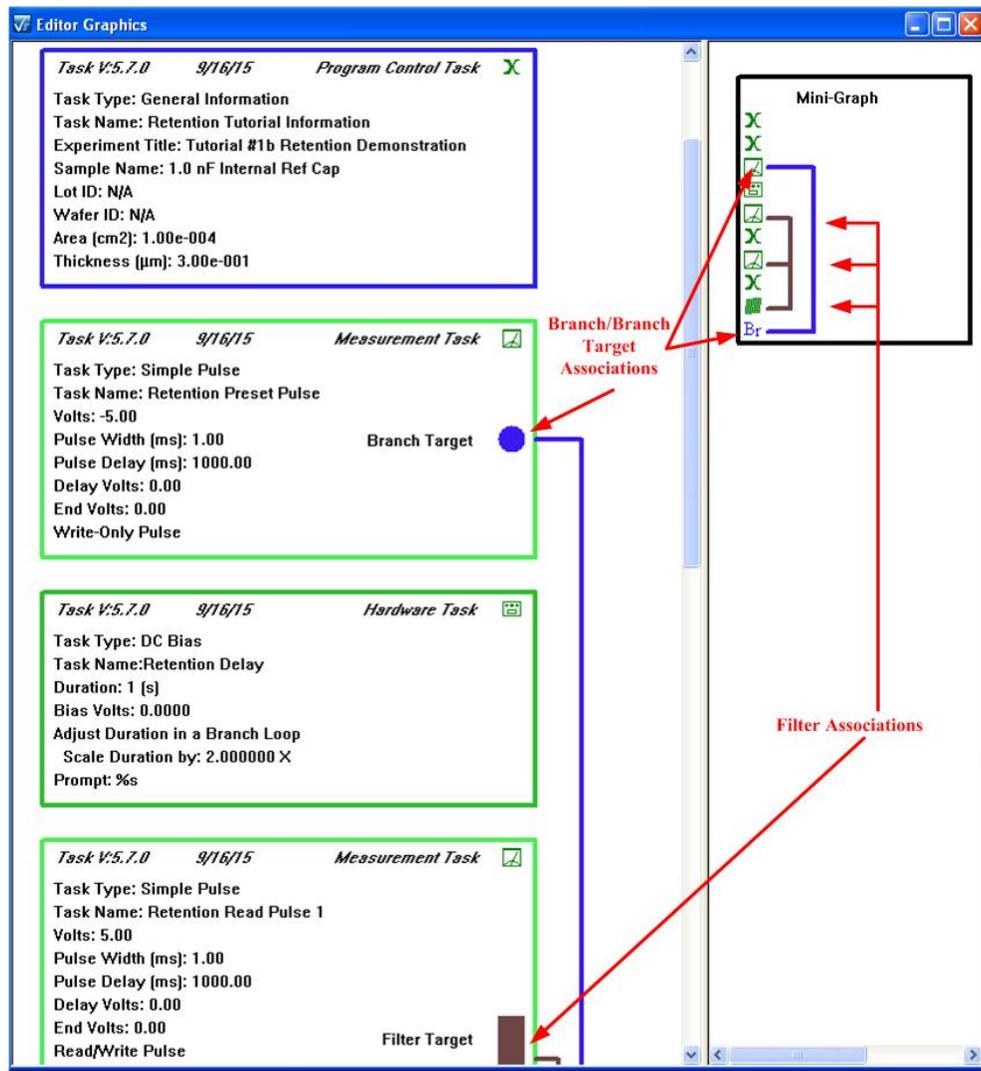


Figure 7 - Editor Test Definition Graphic.

9. Assign Parameters - This option opens a dialog that allows a number of common, global parameters to be immediately updated among all Tasks in the Test Definition. This is a convenient tool when, for example, changing a sample requires sample *Area (cm2)* and *Thickness (µm)* to be changed in all Measurement Tasks in the Test Definition. Parame-

ters are selected for adjustment and their new values are specified. On closing the dialog, the change takes effect.

1. Sample Parameters: Entries are clear and need no further discussion.

Global Editor Parameter Set

OK Cancel

Sample Parameters Measurement Parameters Plot Titles

On "OK" parameters assigned here will be updated in all relevant Tasks in the Editor. They will also be set in the User Variable list as defaults for subsequent Tasks.

After assigning here, individual Tasks in the Editor Test Definition may be reconfigured to adjust individual Task settings.

Area (cm ²)	<input checked="" type="checkbox"/> Set Area (cm ²)	Sample Name	<input type="checkbox"/> Set Sample Name	Die Row	<input type="checkbox"/> Set Die Row
<input type="text" value="0.0025"/>		<input type="text" value="Internal Refer"/>		<input type="text" value="0"/>	
Thickness (µm)	<input checked="" type="checkbox"/> Set Thickness (µm)	Wafer ID	<input type="checkbox"/> Set Wafer ID	Die Column	<input type="checkbox"/> Set Die Column
<input type="text" value="1.3"/>		<input type="text" value="N/A"/>		<input type="text" value="0"/>	
		Lot ID	<input type="checkbox"/> Set Lot ID	Capacitor ID	<input type="checkbox"/> Set Capacitor ID
		<input type="text" value="N/A"/>		<input type="text" value="0"/>	

Figure 8 - Global EDITOR Sample Parameter Adjustment.

2. Measurement Parameters: Entries are clear and need no further discussion.

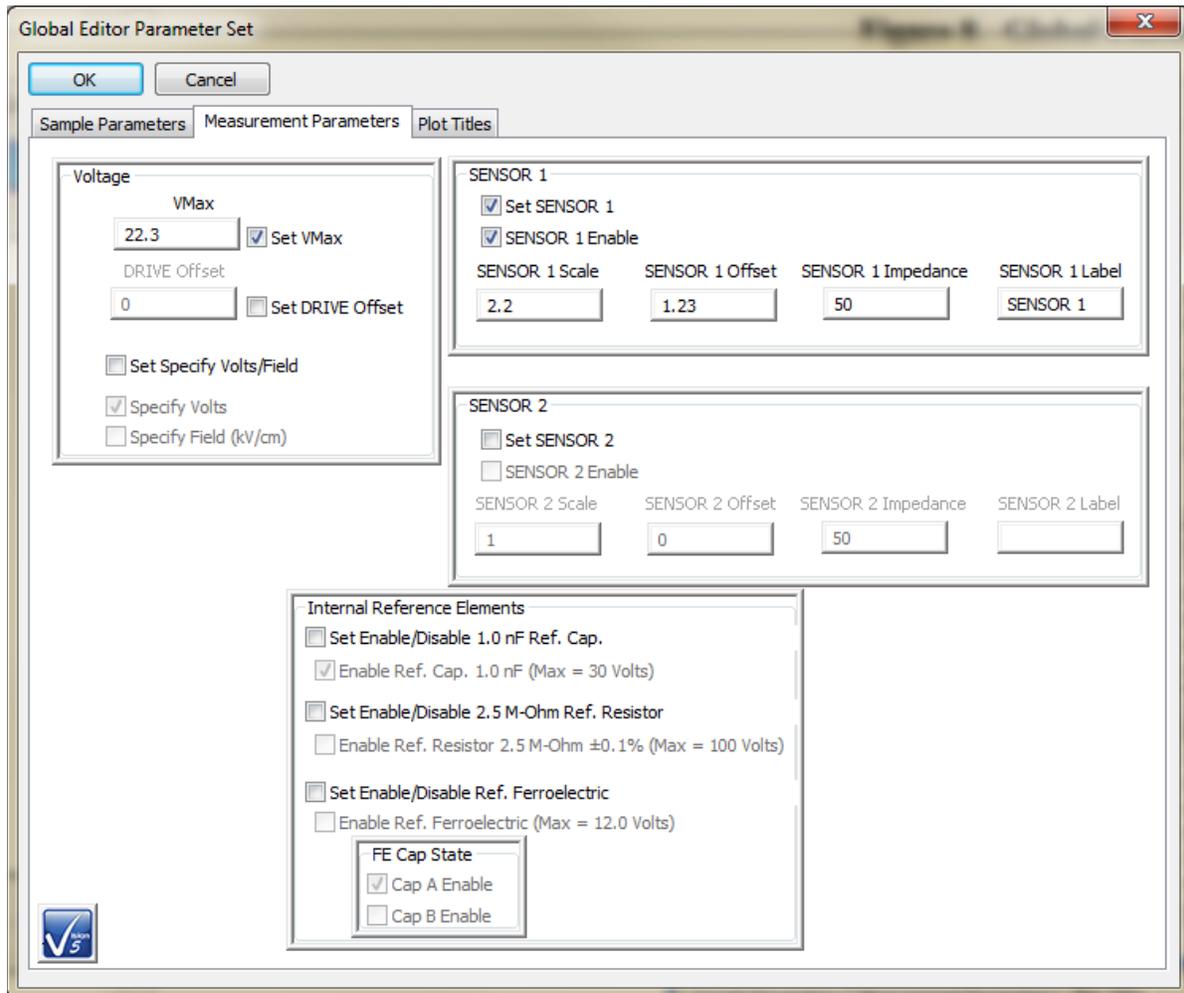


Figure 9 - Global EDITOR Measurement Parameter Adjustment.

3. Plot Titles

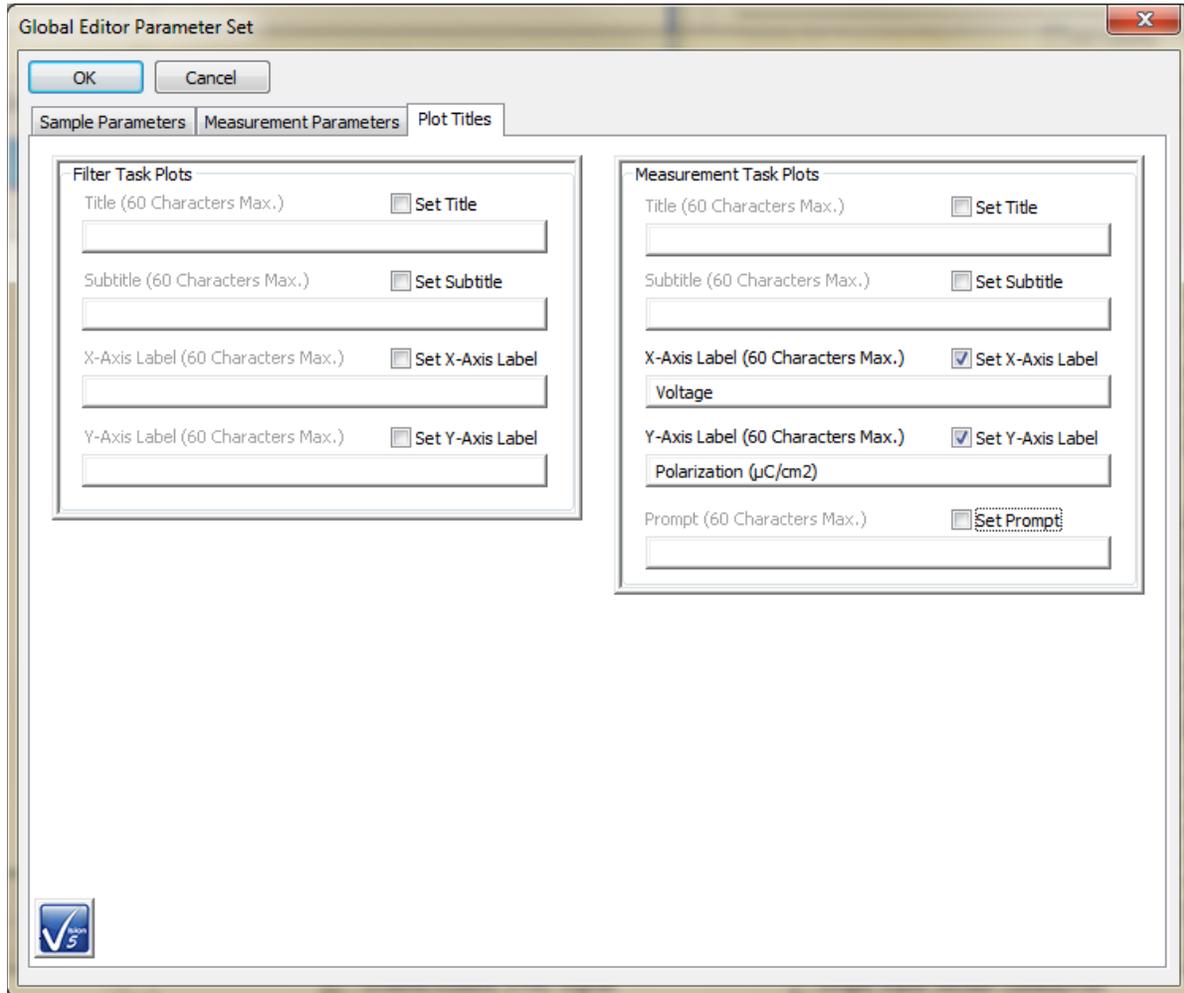


Figure 10 - Global EDITOR Plot Titles Adjustment.

10. Editor Aide - Also accessible using the  icon on the toolbar. Open the Editor Aide dialog. Use this dialog to build Test Definitions and modify sequencing of Tasks in the existing EDITOR Test Definition. This is a sophisticated tool presented in [Tutorial XII](#) or [Main Manual Topic XV](#).

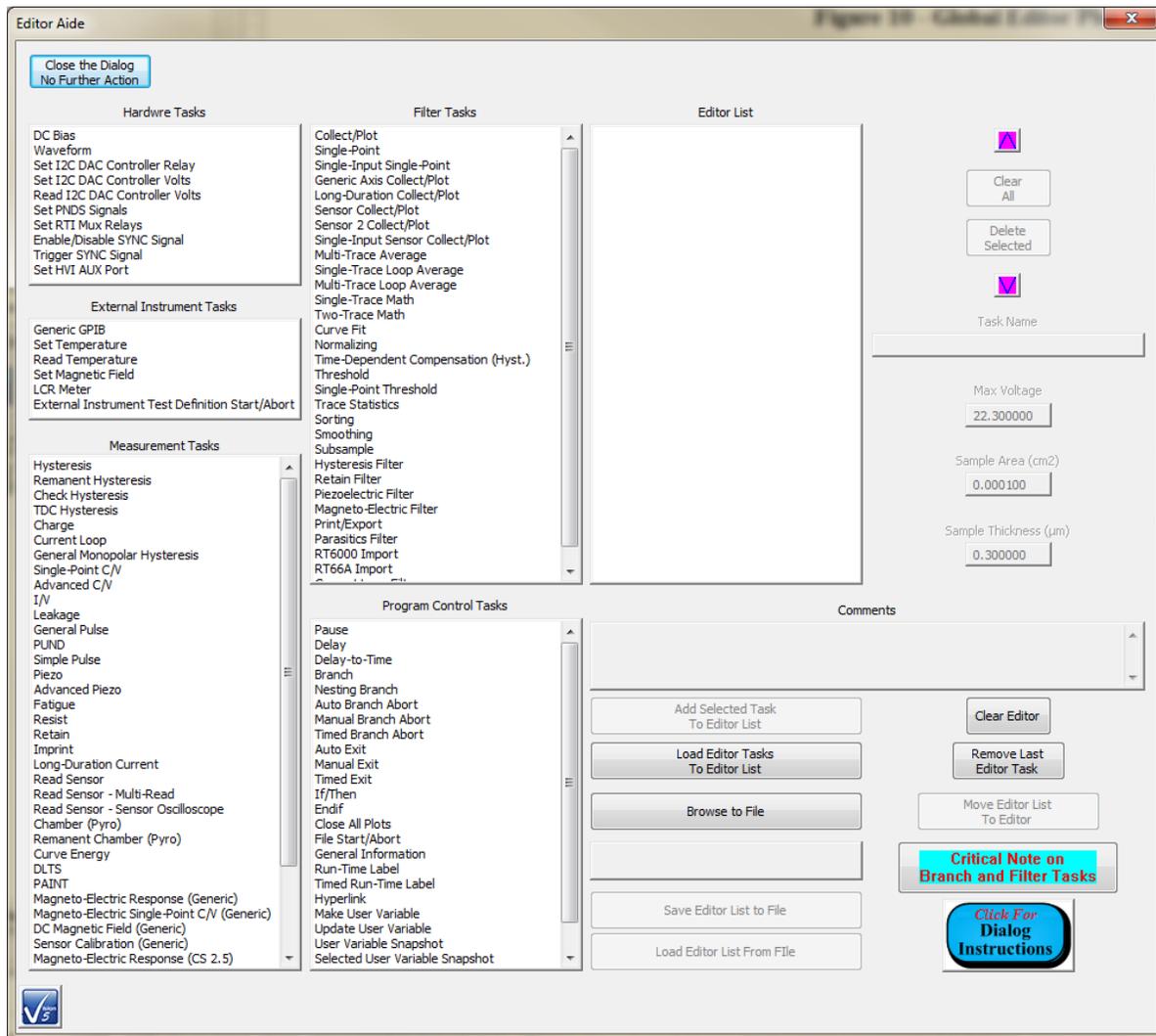


Figure 11 - Initial Editor Aide Dialog.

G. DataSet Menu

V: Main Menu Operations

When the Vision program starts up four dockable windows - [TASK LIBRARY](#) , [EDITOR](#) , Document Library and [DataSet Explorer](#) – appear at the edges of a larger empty user space (**Figure 1**). At the top of the program view is a menu with the following options. These are discussed in subsequent sections. Links are made to the sections.

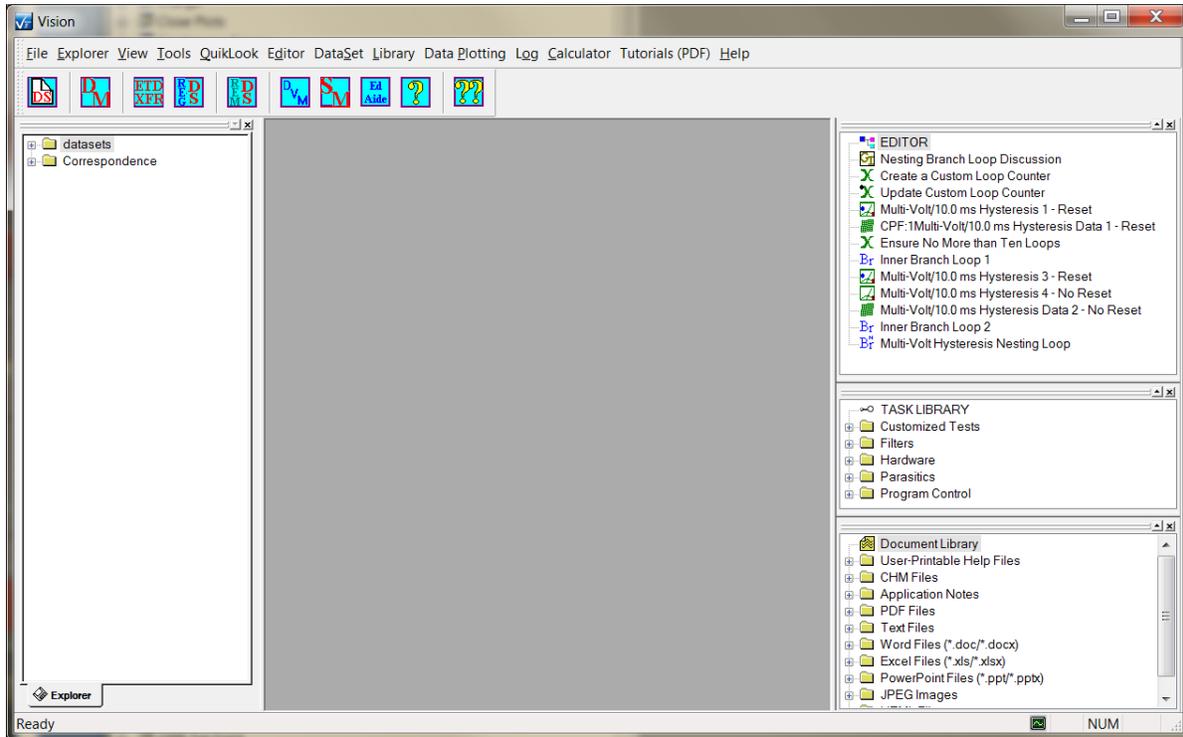


Figure 1 – Vision Program Screen.

V.G - DataSet (Figure 2) - Perform operations on and/or configure the selected DataSet. This menu is also available by selecting the Current Test Definition (CTD) name and right-clicking. If no DataSet is open, most of the menu options are disabled. "Data Mining", "ETD Transfer" and "Simple Measurement" are processes that can be initiated without an open DataSet.

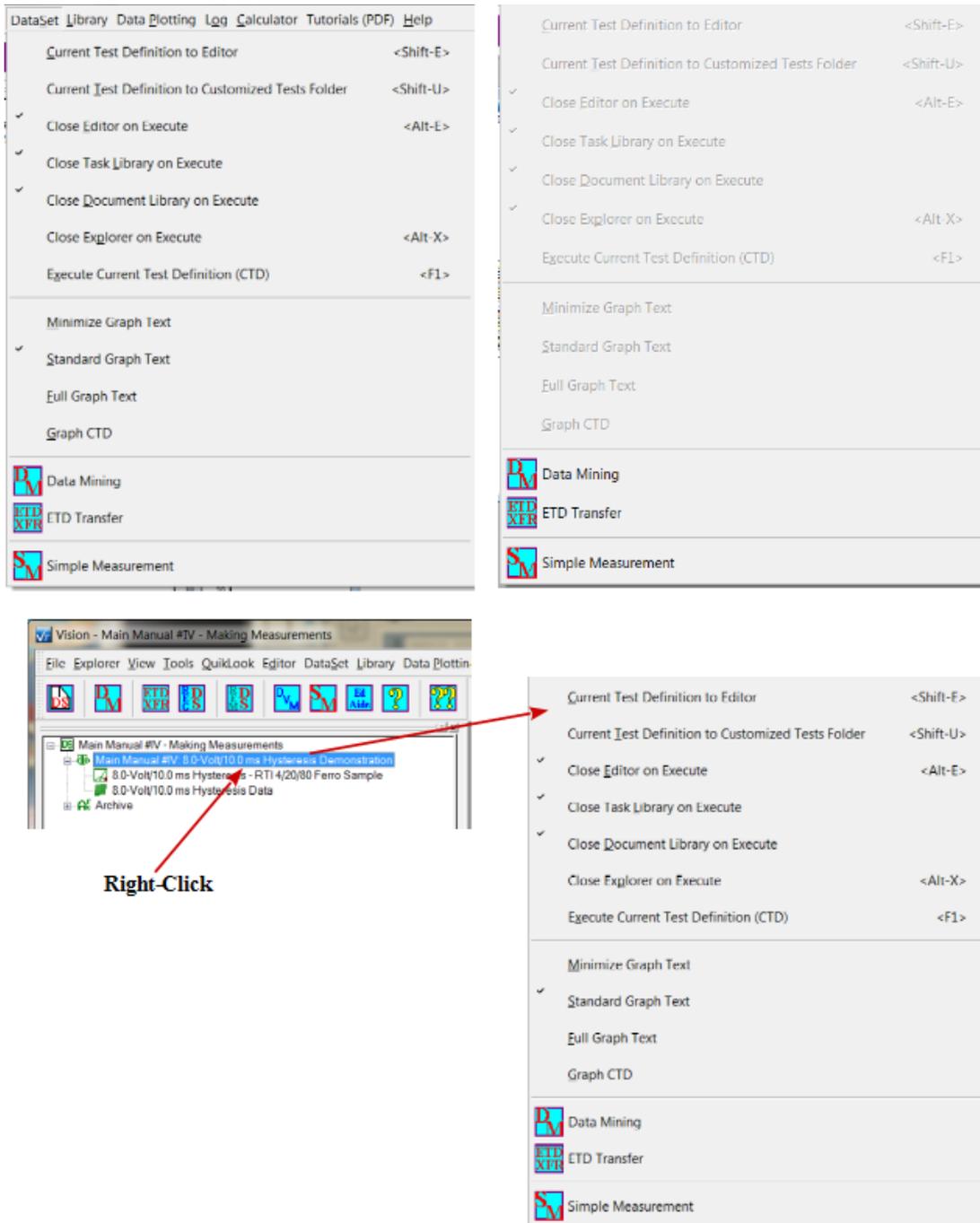


Figure 2 - DataSet Operation Menu.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

1. CTD to Editor (<Shift-E> Hotkey) - Return the CTD in the currently active DataSet to the EDITOR. The Test Definition will be appended to any Tasks already in the EDITOR.

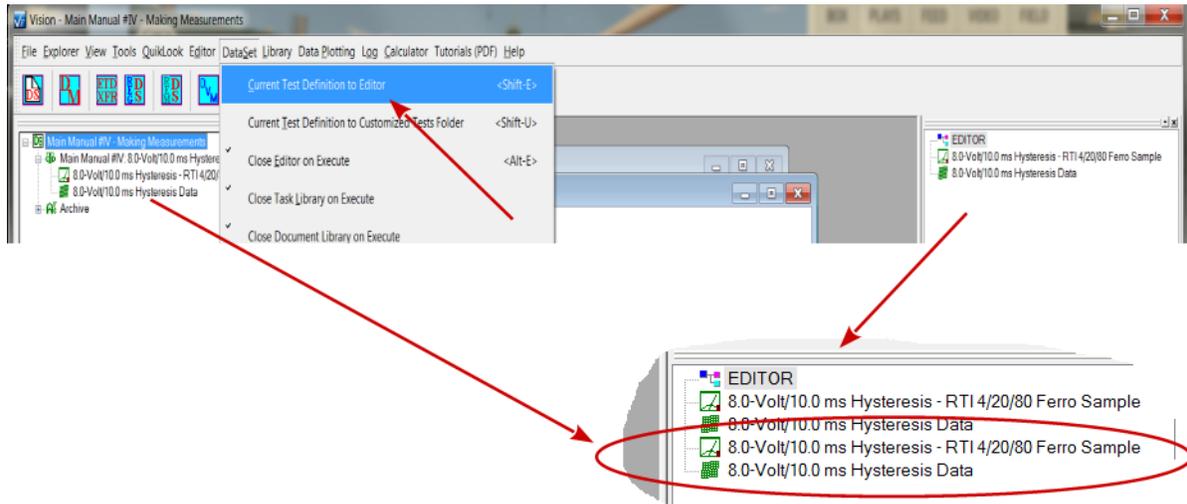


Figure 3 - CTD to EDITOR.

2. CTD to UDT (<Shift-U> Hotkey) - Create a Customized Test in the Library using the CTD in the currently active DataSet.

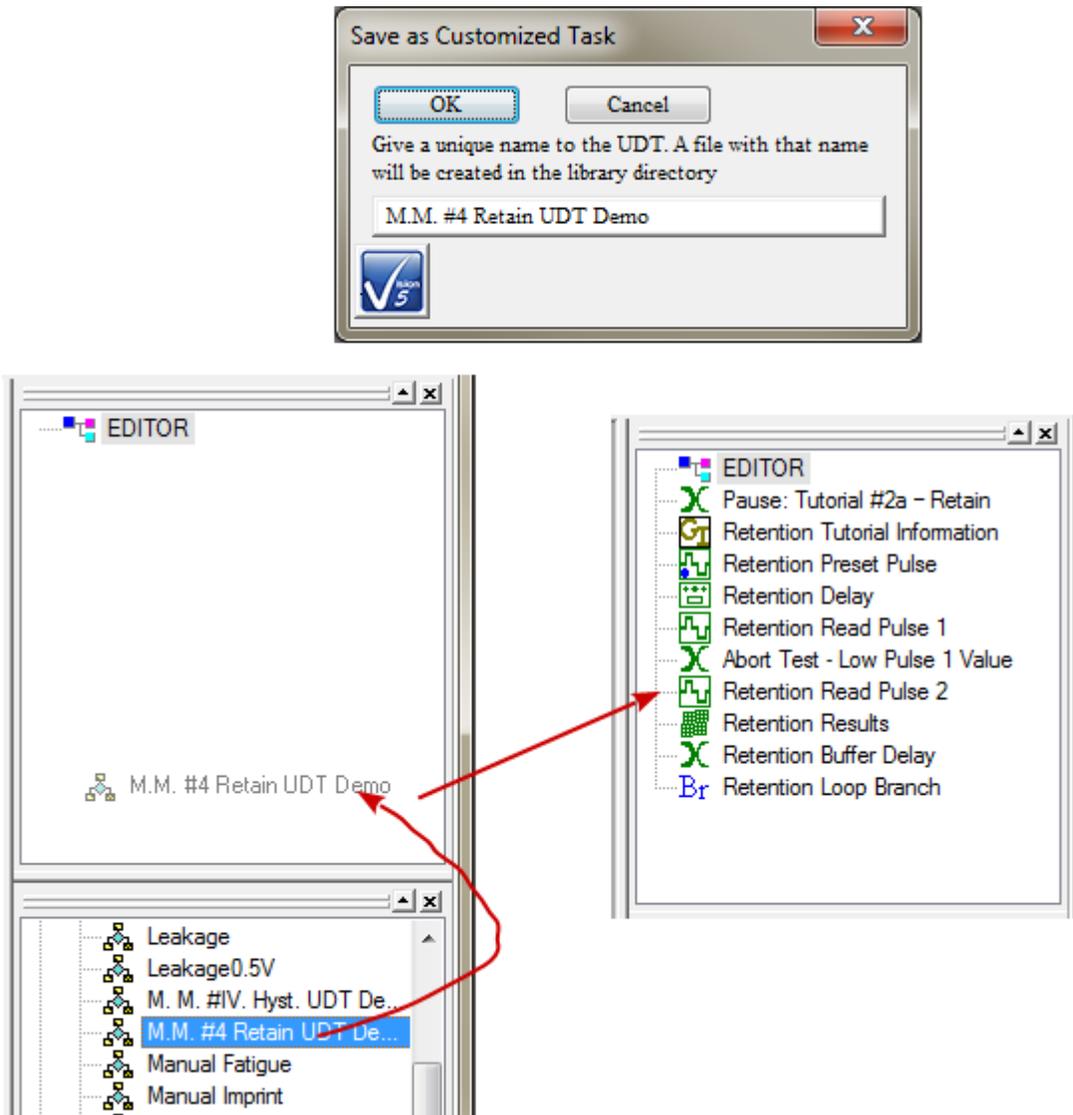


Figure 4 - CTD to Customized Test.

3. Close Editor on Execute (Alt-E) - Checked by Default. Enable or disable the hiding of the EDITOR window when a Test Definition is executed. This feature allows more room on the User Area of the Vision window for the display of data. The window will reappear when the execution is complete.
4. Close Task Library on Execute - Checked by Default - Enable or disable the hiding of the Task Library window when a Test Definition is executed. This feature allows more room on the User Area of the Vision window for the display of data. The window will reappear

when the execution is complete.

5. Close Document Library on Execute - Checked by Default - Enable or disable the hiding of the Document Library window when a Test Definition is executed. This feature allows more room on the User Area of the Vision window for the display of data. The window will reappear when the execution is complete.
6. Close Explorer on Execute (Alt-X) - Unchecked by Default - Enable or disable the hiding of the Explorer window when a Test Definition is executed. This feature allows more room on the User Area of the Vision window for the display of data. The window will reappear when the execution is complete.
7. Execute Current Test Definition (CTD) (F1) – Run the Current Test Definition (CTD) in the open DataSet , storing the execution and results in the DataSet [Archive](#) . <F1> is a shortcut.
8. Minimize Graph Text - Cause future instances of a [Test Definition Graph](#) to display minimized Task Text. These three options have little or no practical effect on Task Text output.
9. Standard Graph Text - Cause future instances of a [Test Definition Graph](#) to display the normal Task Text. These three options have little or no practical effect on Task Text output.
10. Full Graph Text - Cause future instances of a [Test Definition Graph](#) to display maximized Task Text. These three options have little or no practical effect on Task Text output.
11. Graph CTD - Causes the Current Test Definition of the upper-most open DataSet to be displayed in a Graph window.

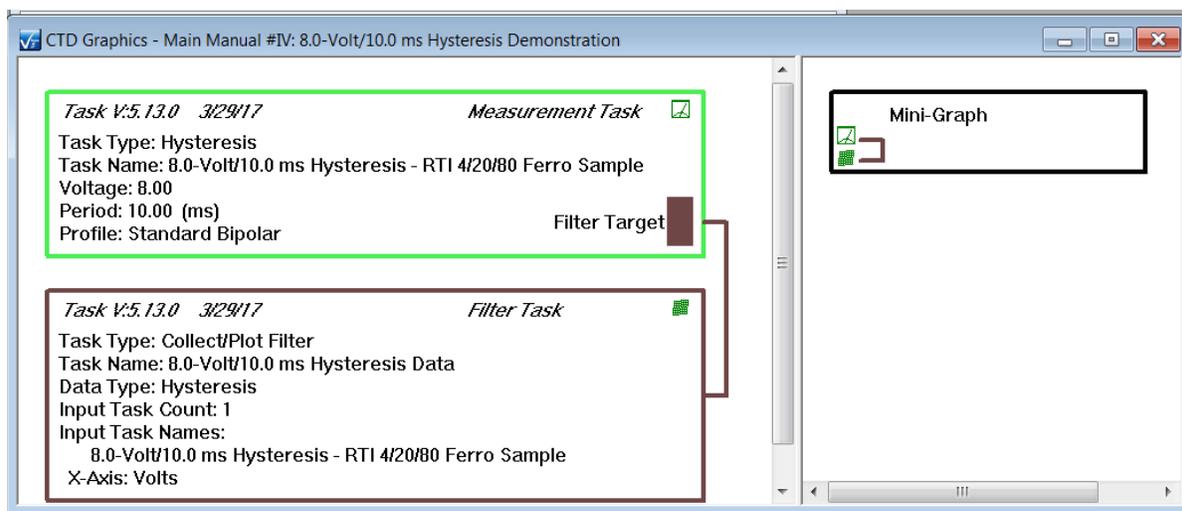


Figure 5 - Graph of the Current Test Definition.

12. Data Mining – (Toolbar Icon: ) - Initiate Data Mining. See [Tutorial XI.A](#) or [Main Manual XVI](#) for complete details.
13. ETD Transfer – (Toolbar Icon: ) - Initiate ETD Transfer. See [Tutorial XI.B](#) or [Main Manual XVII](#) for complete details.
14. Simple Measurement – (Toolbar Icon: ) - Initiate ETD Transfer. See [Tutorial XI.C](#) or [Main Manual XVIII](#) for complete details.

H. Library Menu

V: Main Menu Operations

When the Vision program starts up four dockable windows - [TASK LIBRARY](#) , [EDITOR](#) , Document Library and [DataSet Explorer](#) – appear at the edges of a larger empty user space (**Figure 1**). At the top of the program view is a menu with the following options. These are discussed in subsequent sections. Links are made to the sections.

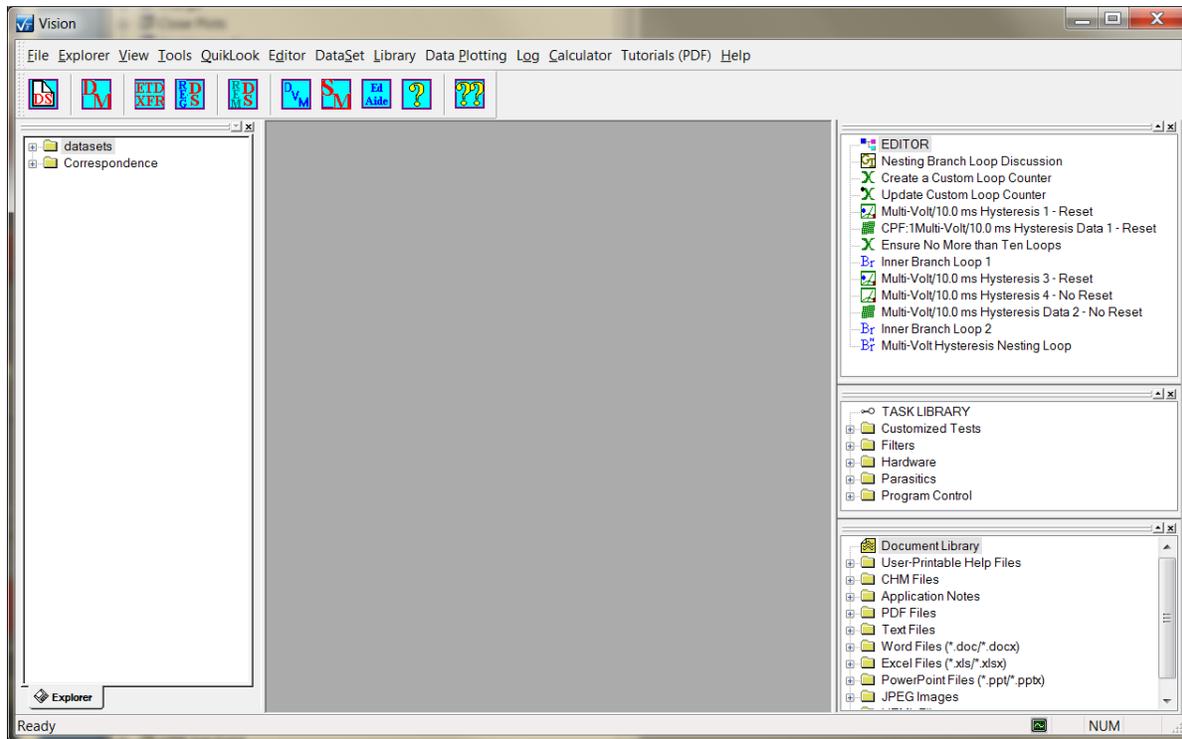


Figure 1 – Vision Program Screen.

V.H - Library (Figure 2)

1. **Delete Customized Test** – Select one or more Customized Tests from a list of all Customized Tests in the Library and delete them completely. The dialog of **Figure 20** appears. Customized Tests are Test Definitions that have been saved for reuse as a single Task in the Library under the "Customized Tests" folder. **Note that Customized Tests were originally called User-Defined Tests. The acronym UDT will still appear in some places within Vision.**

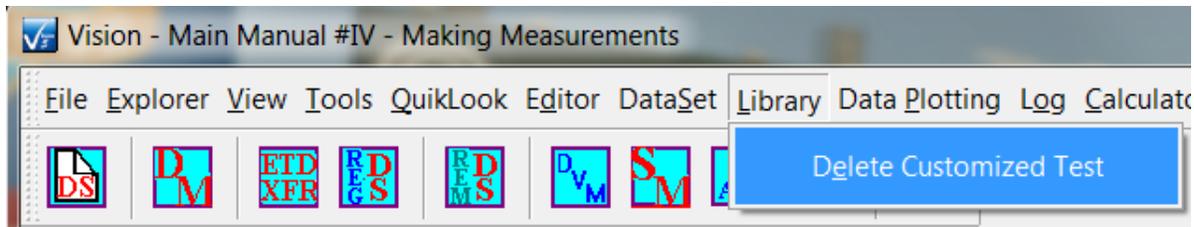


Figure 2 – Library Menu.

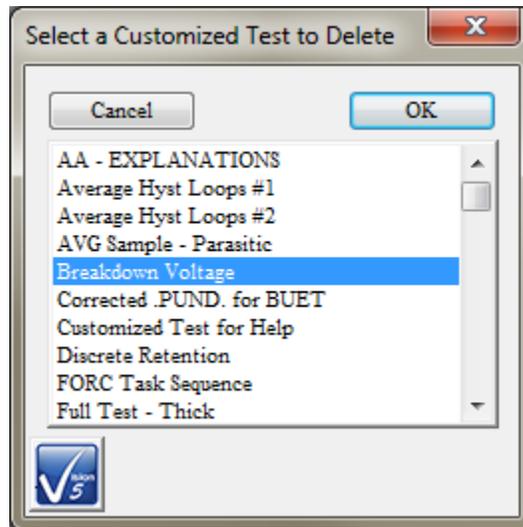


Figure 3 – Customized Test Selection Dialog.

I. Data Plotting Menu

V: Main Menu Operations

When the Vision program starts up four dockable windows - [TASK LIBRARY](#) , [EDITOR](#) , Document Library and [DataSet Explorer](#) – appear at the edges of a larger empty user space (**Figure 1**). At the top of the program view is a menu with the following options. These are discussed in subsequent sections. Links are made to the sections.

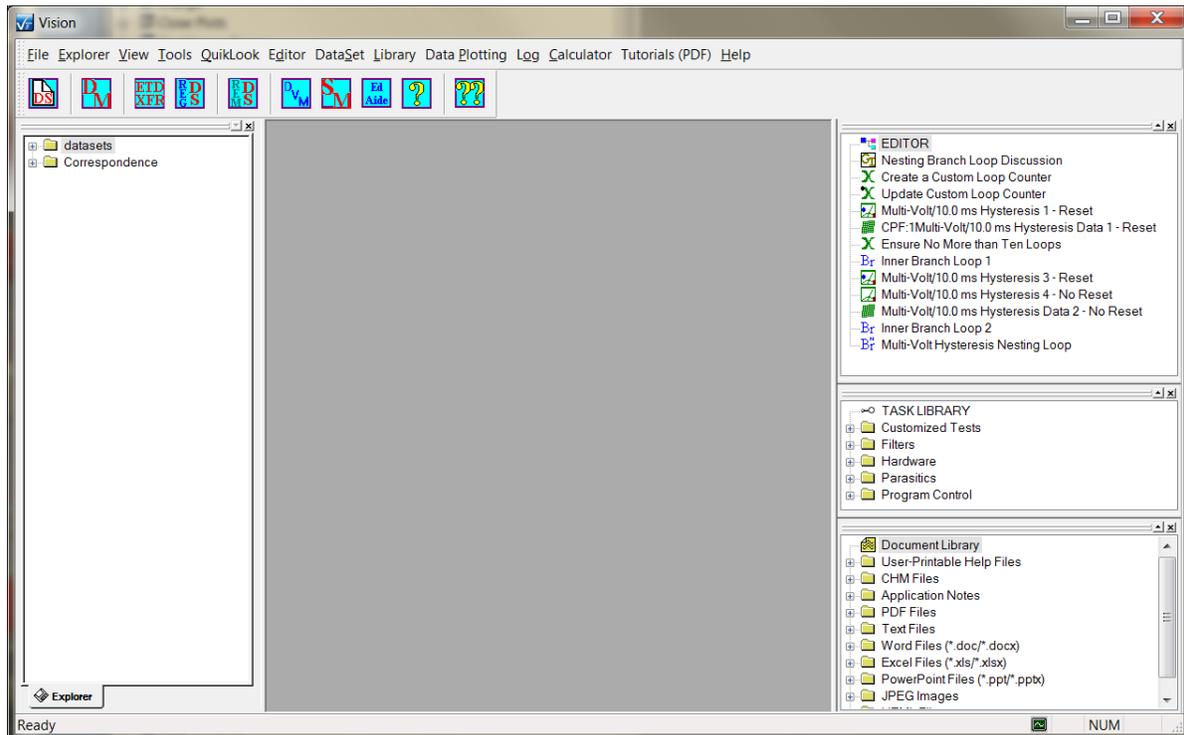


Figure 1 – Vision Program Screen.

V.I - Data Plotting (Figure 2, etc.).

This menu provides the user an opportunity to preconfigure the format plotted data will appear in. Entries that are particularly useful are the Plotting Method and the Grid Line selections.

1. Plotting Method - Select the format under which the data points will be displayed. "Line" is default.

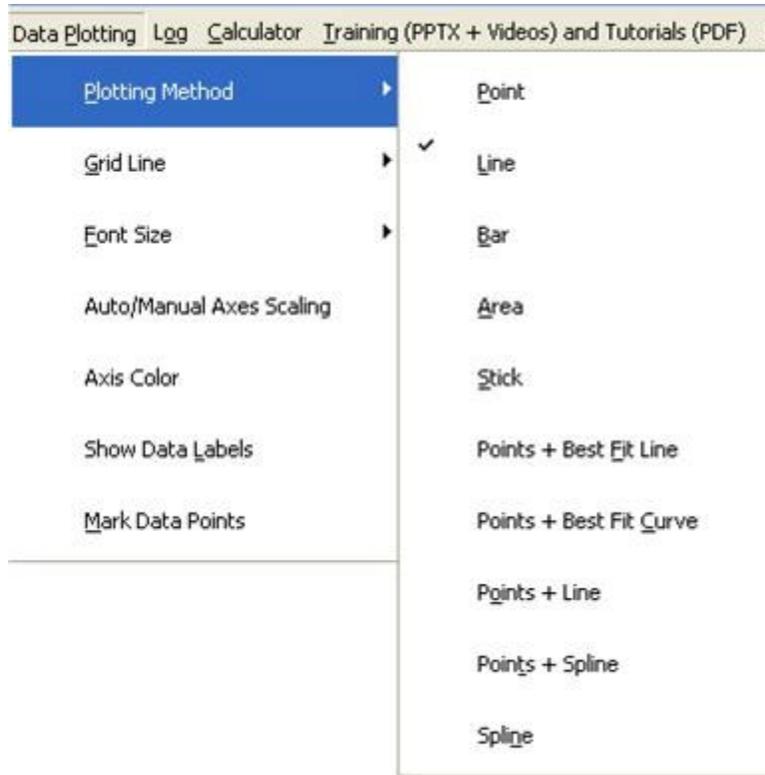


Figure 2 – Data Plotting: Plotting Method Menu.

- 2. Grid Line - Select which Grid presentation, if any, will appear. Select the Grid line style. "None" and "Thick Solid" are default".

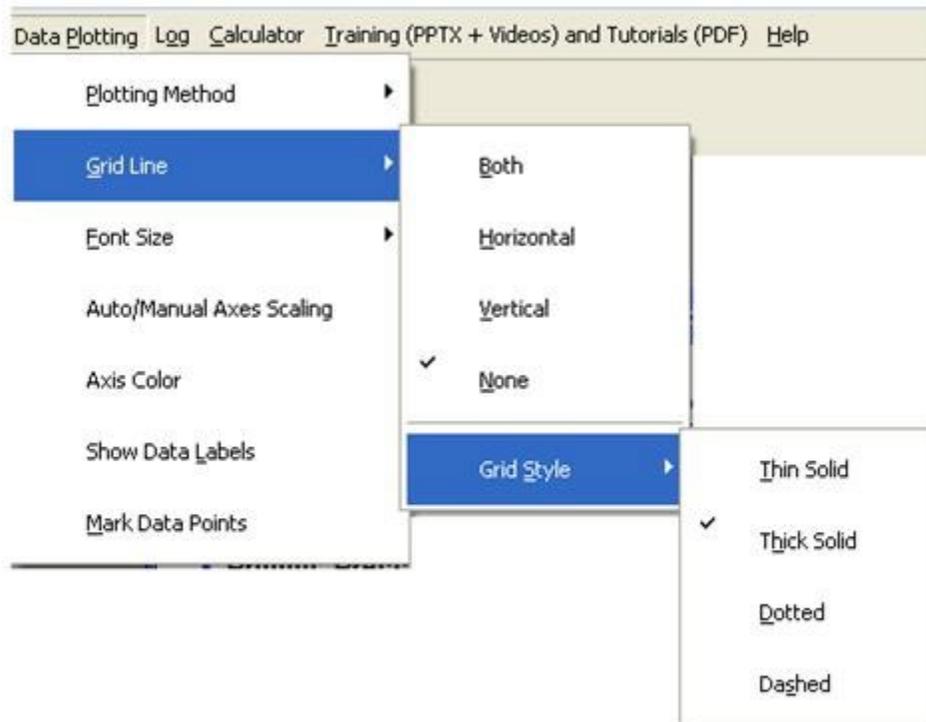
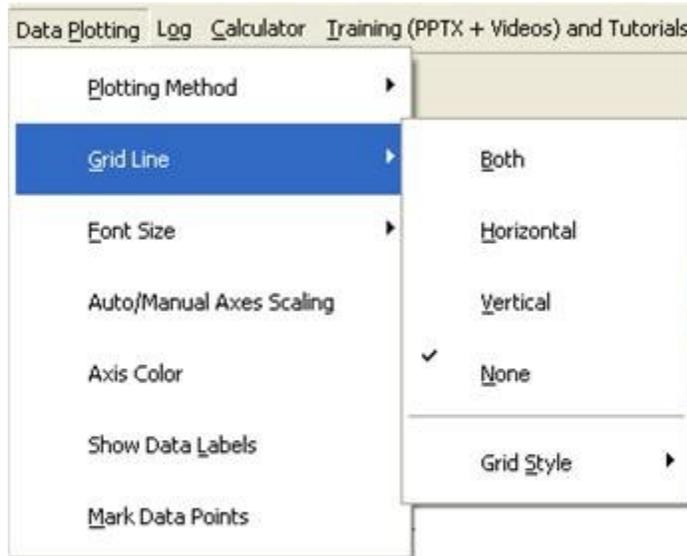


Figure 3 - Data Plotting: Grid Line Menu.

3. Font Size - Select the size of the text that appears on the plot. "Medium" is default.



Figure 4 - Data Plotting: Font Size Menu.

4. Auto/Manual Axes Scaling. Selecting this option opens a dialog that allows the X- and Y-Axis scaling to be independently configured to automatically scale to the data or to take on a user-specified set of limits. Default for both Axes is automatic scaling.

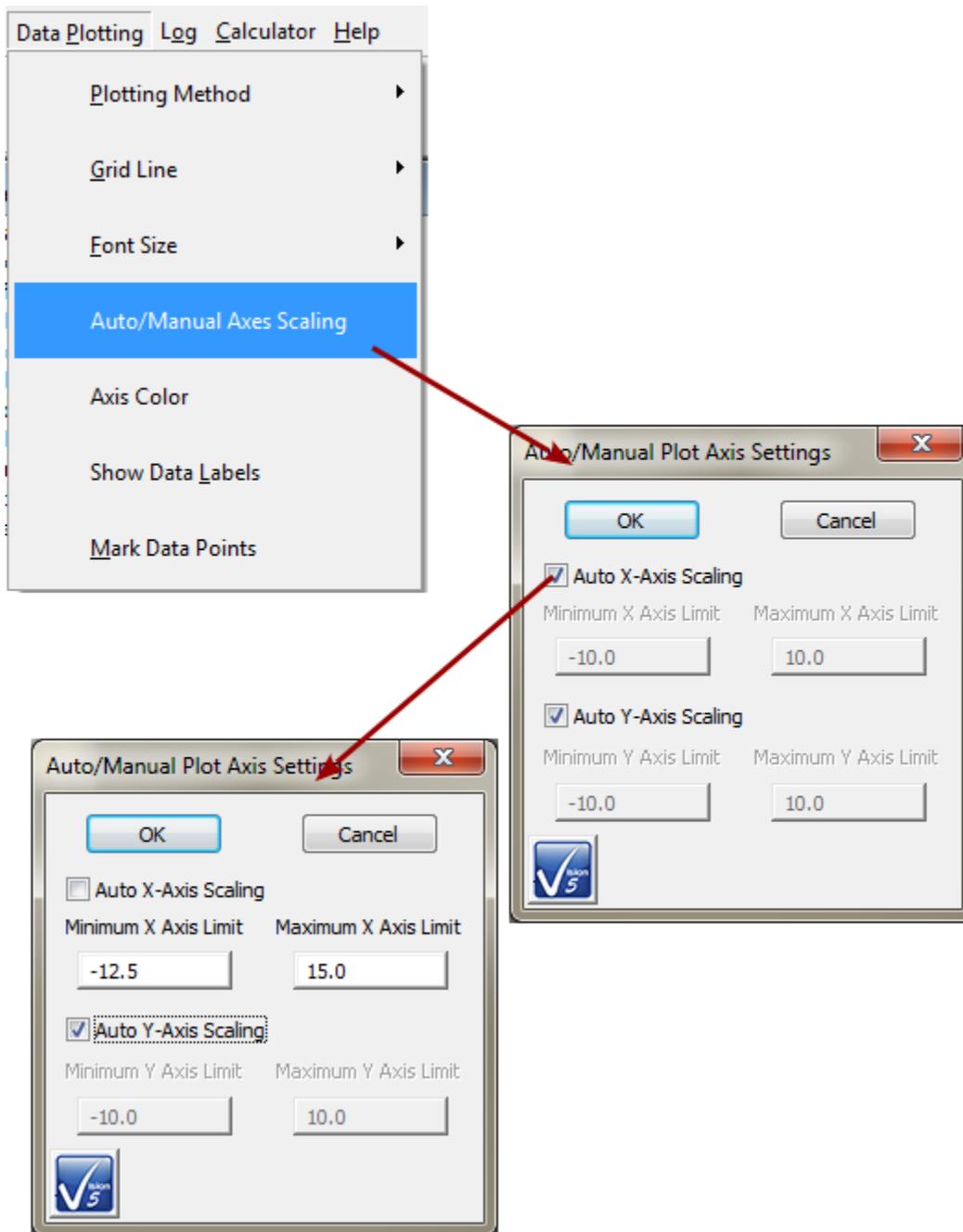


Figure 5 - Data Plotting: Axis Scaling.

5. Axis Color - Clicking this option opens a dialog that allows colors to be assigned to the various plot data traces by index. The operation of this dialog is not yet well defined.

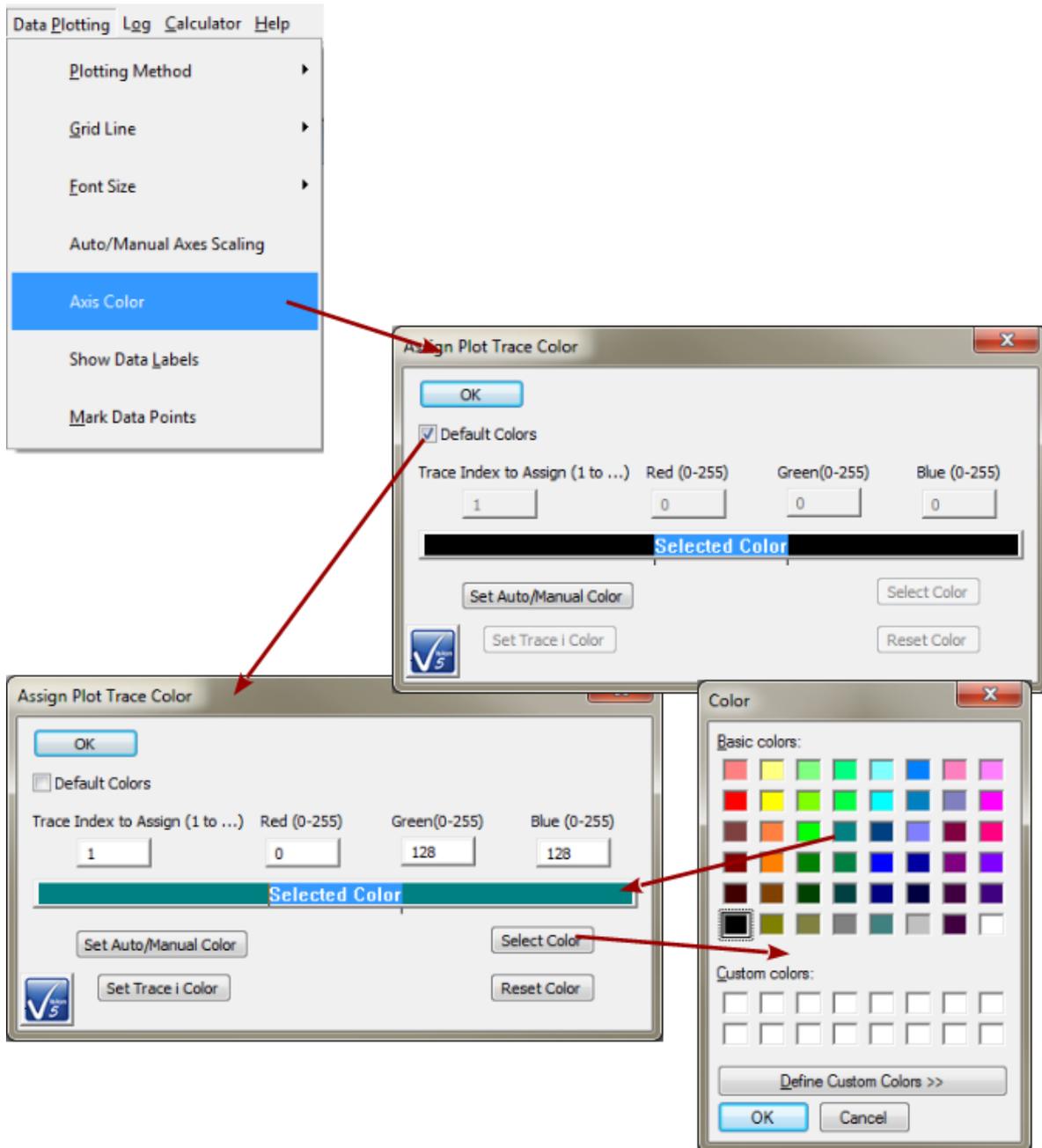


Figure 6 - Data Plotting: Data Trace Color.

- Show Data Labels - Unchecked by default. When checked plotted data will be accompanied by the numeric X- and Y-Axis values, to three decimals, for each data point. This option is really only effective for zoomed data.

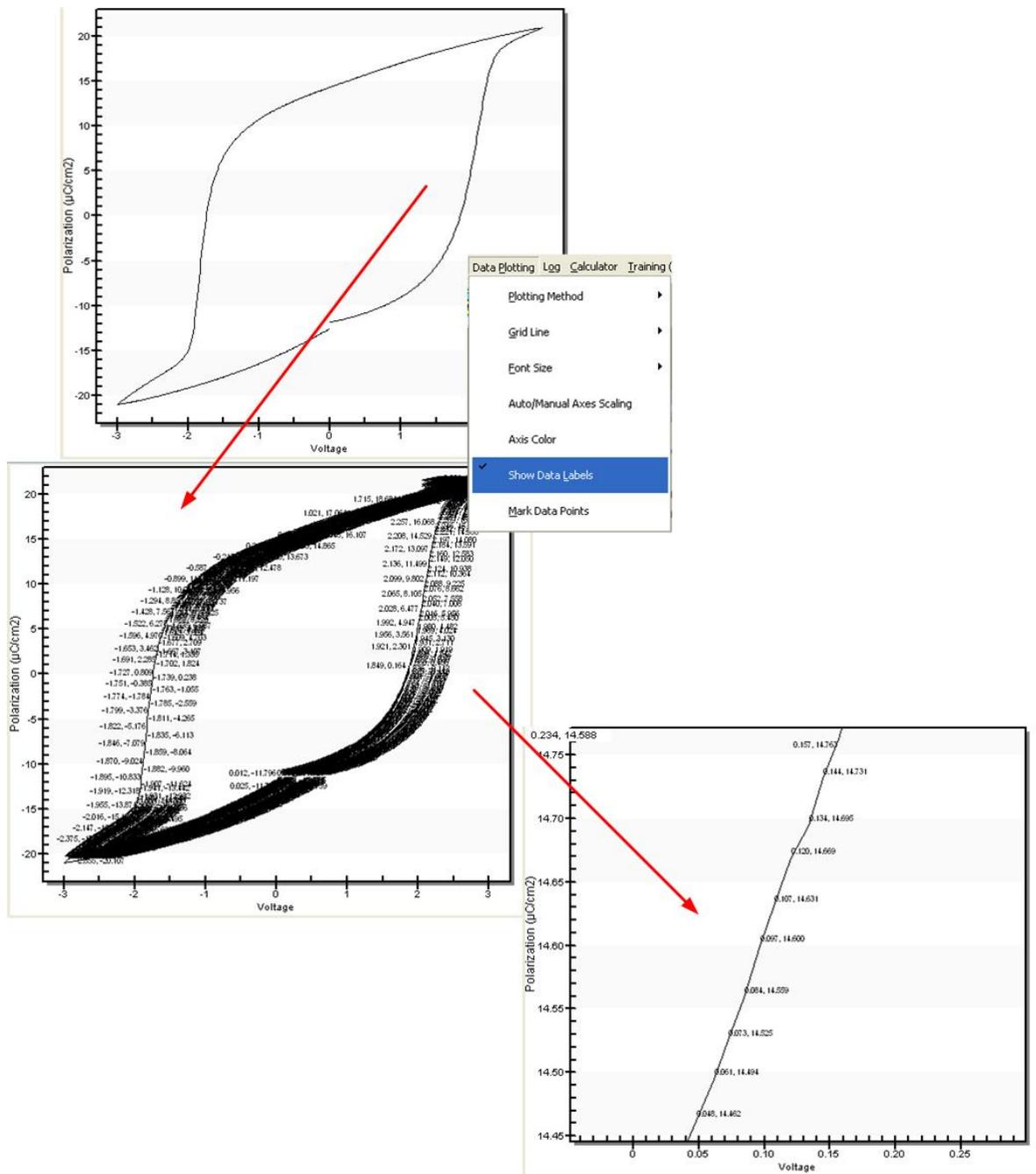


Figure 7 - Data Plotting: Show Data Labels.

7. Mark Data Points - Unchecked by default. When checked plotted data will be marked by a small dot on the plot.

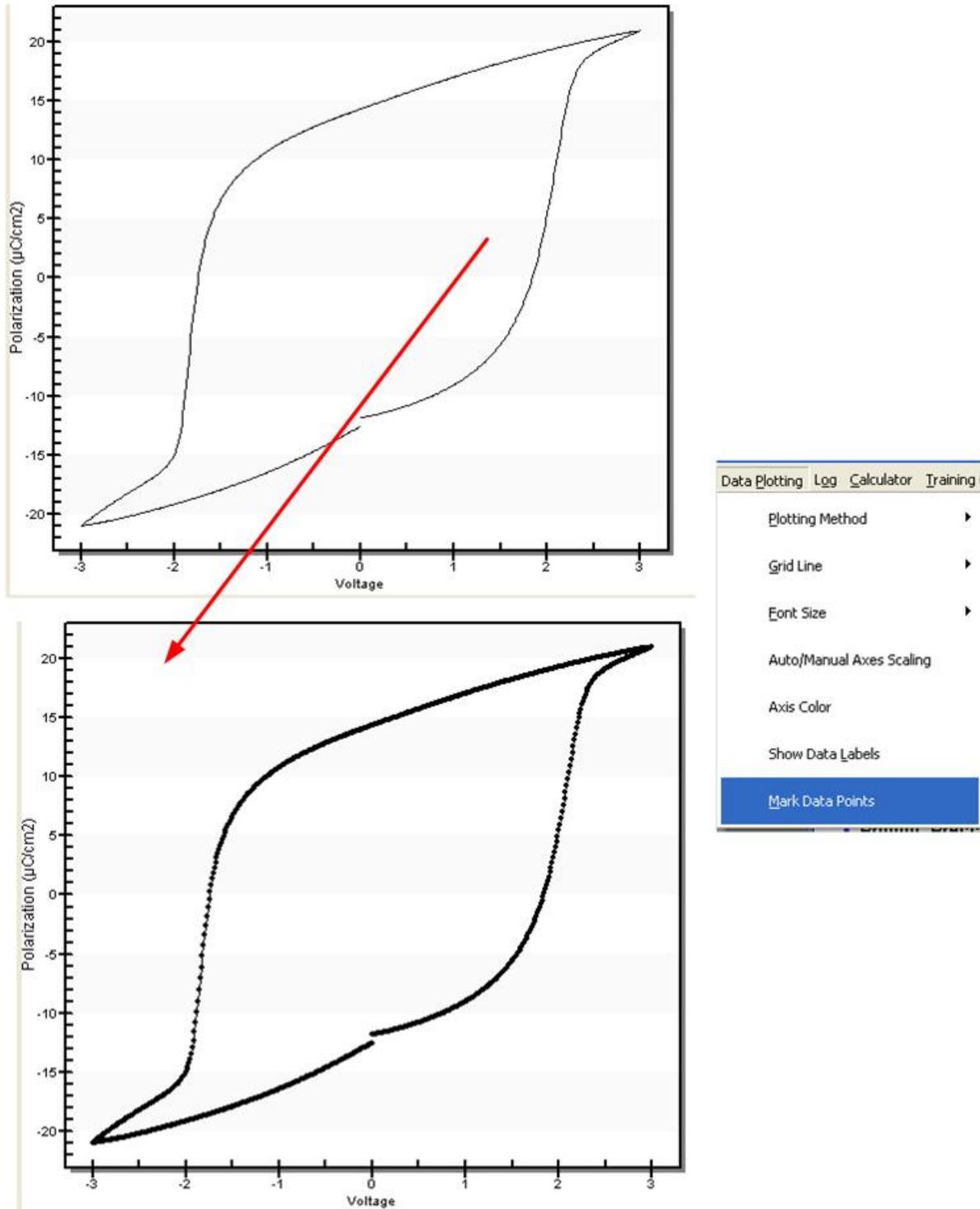


Figure 8 - Data Plotting: Mark Data Points.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

[sa/2.5/](http://creativecommons.org/licenses/by-nc-sa/2.5/)



Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)



J. Log Menu

V: Main Menu Operations

When the Vision program starts up four dockable windows - [TASK LIBRARY](#) , [EDITOR](#) , Document Library and [DataSet Explorer](#) – appear at the edges of a larger empty user space (**Figure 1**). At the top of the program view is a menu with the following options. These are discussed in subsequent sections. Links are made to the sections.

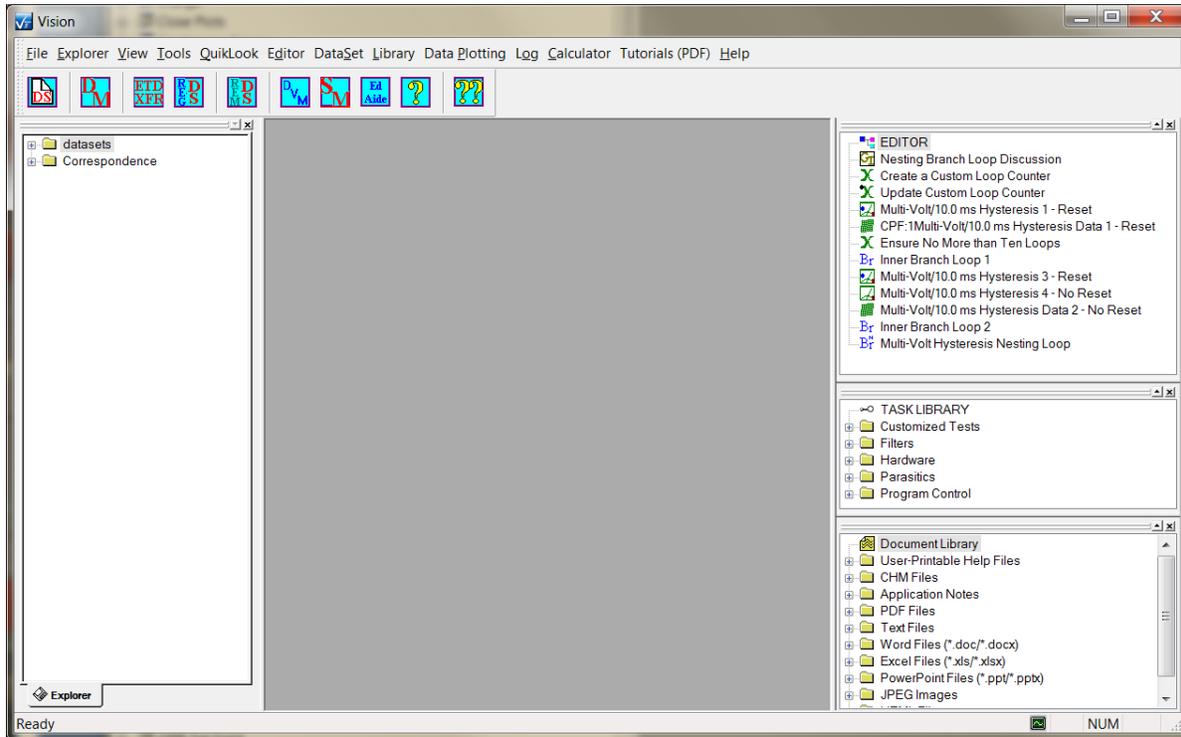


Figure 1 – Vision Program Screen.

V.J - Log (Figure 2)

Perform actions and configure automatic actions for the DataSet Log Window.

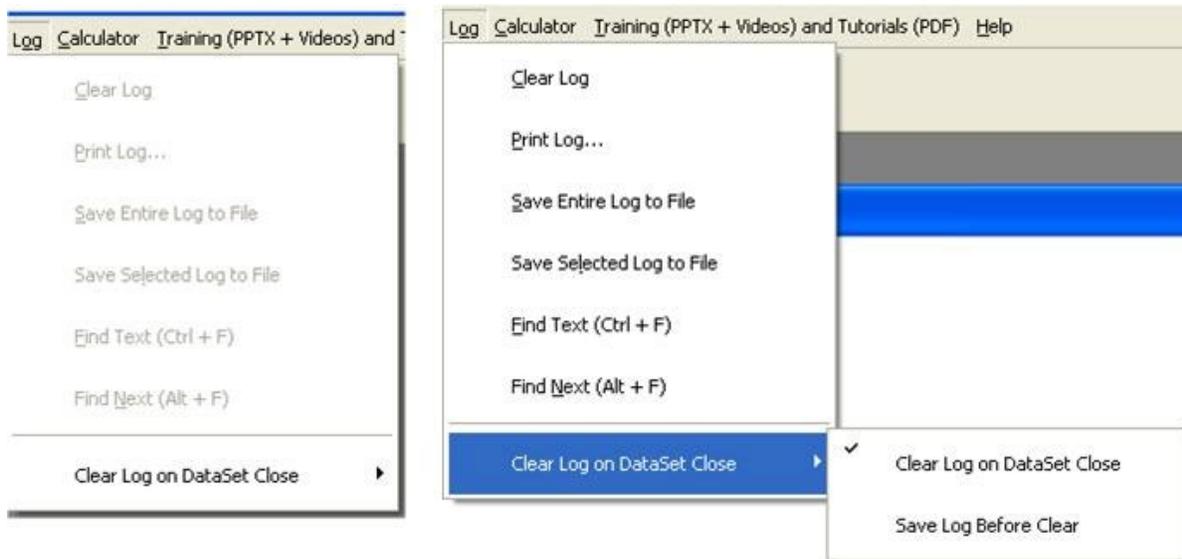


Figure 2 - Log Operations Menu

1. **Clear Log** - Permanently remove all text from the log window. It may be a good idea to save the Log to a file before clearing if the information in the window is useful. New text will be generated as operations are performed on the DataSet. This option is disabled if there is no open DataSet.

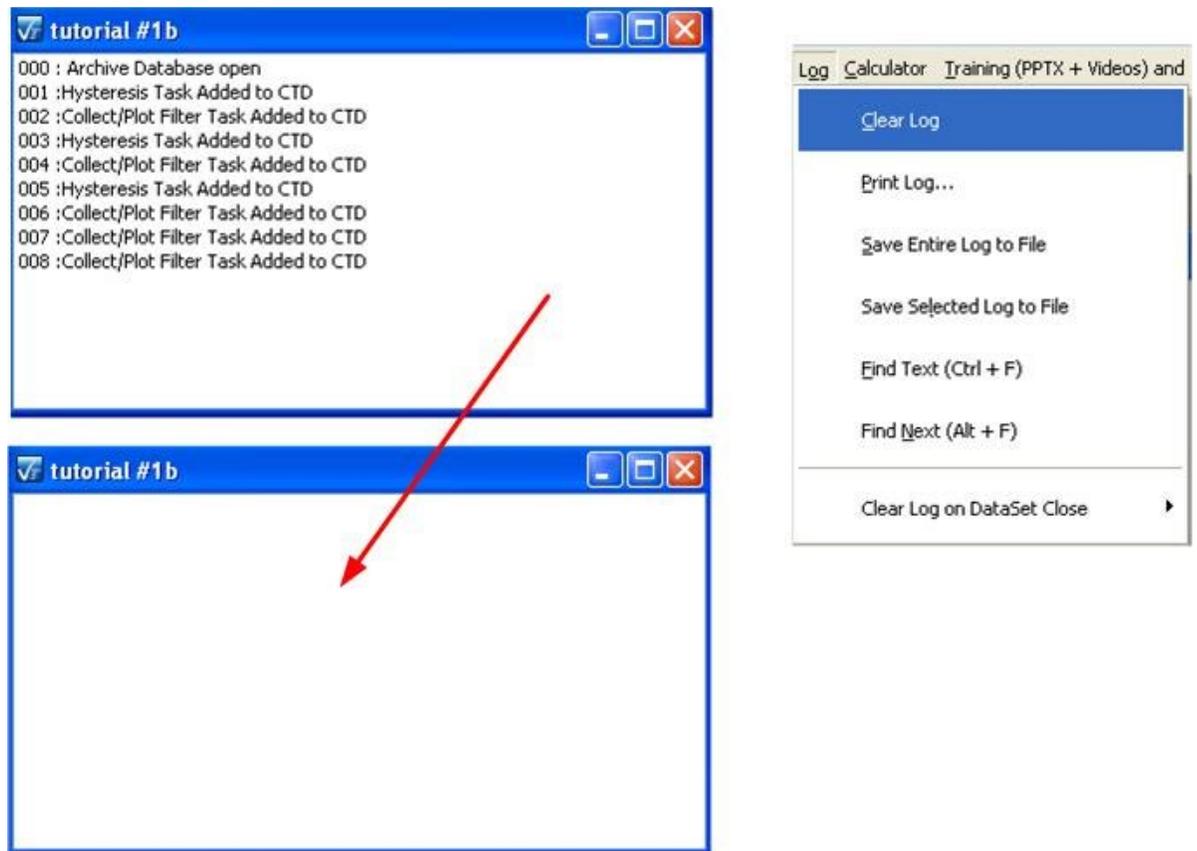


Figure 3 - Clear the Log Window.

2. Print Log - Send the content of the Log Window to the printer. This operation opens the printer setup dialog. This option is disabled if there is no open DataSet.
3. Save Entire Log to File - Store the entire contents of the Log Window into a text file. This option is disabled if there is no open DataSet.

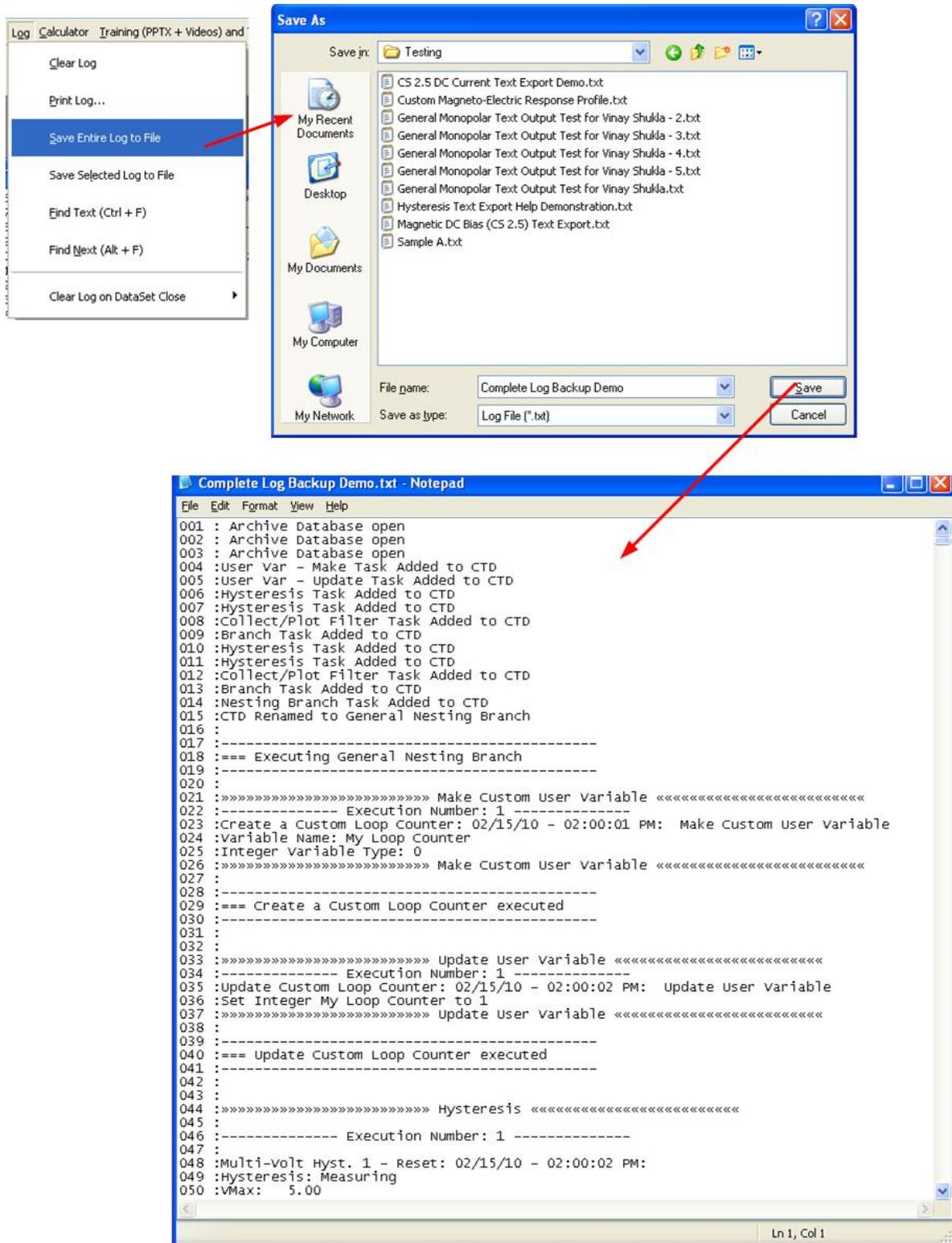


Figure 4 - Complete Log Backup.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)



- 4. Save Selected Log to File - Store highlighted text only to a text file. This option is disabled if there is no open DataSet. **Note: As shown in the figure, this function is not operating properly. A subset of text other than the selected subset has been exported. This is a bug.**

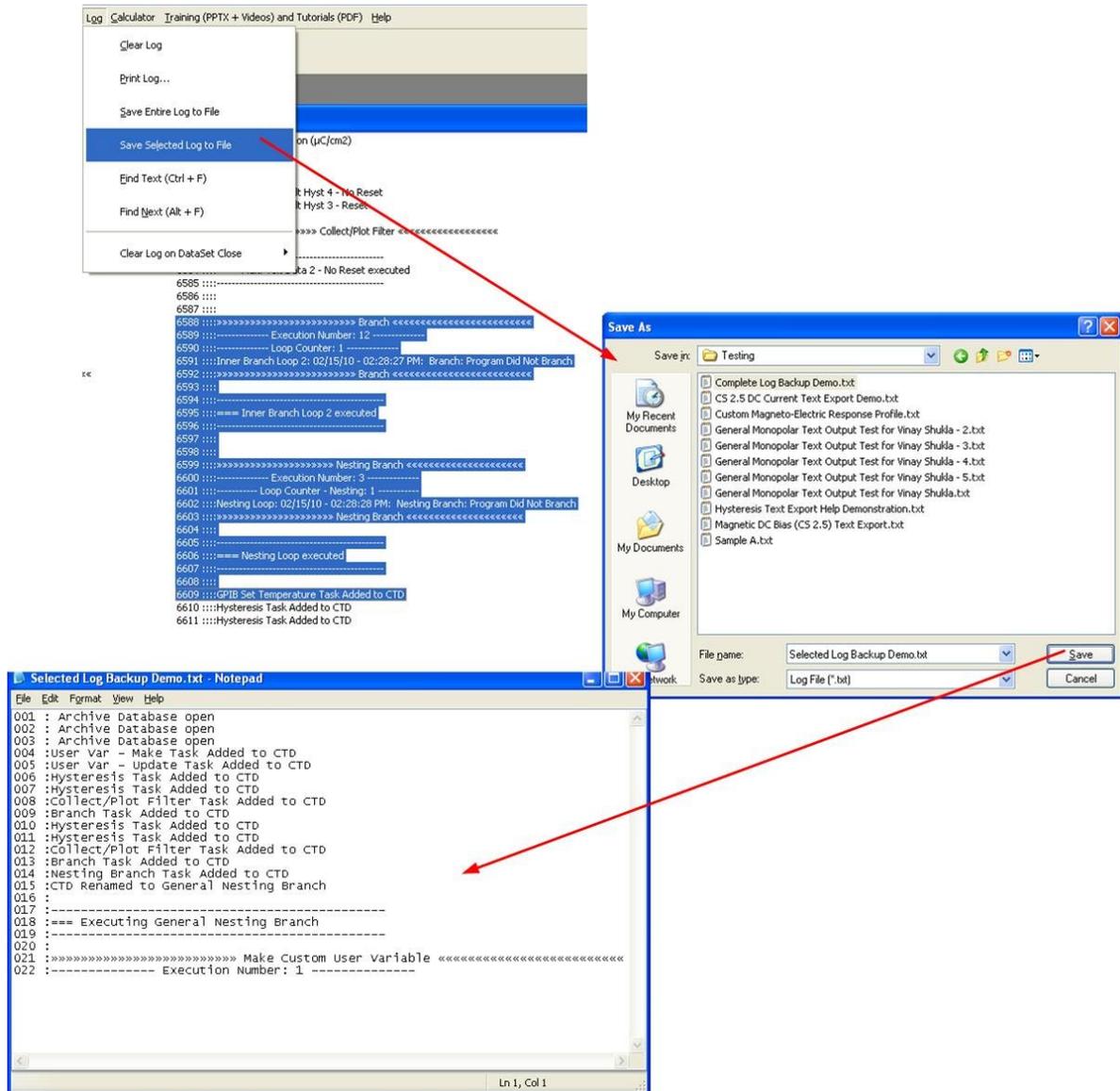


Figure 5 - Selected Log Backup.

5. Find Text (Ctrl-F) - This feature opens a dialog (**Figure 6**) in which the user enters text to be searched for in the Log window. The search may either be case sensitive, or ignore case. When the text is found, the Log window is scrolled to the page and a dialog appears indicating the text line number (**Figure 7**). This option is disabled if there is no open DataSet.

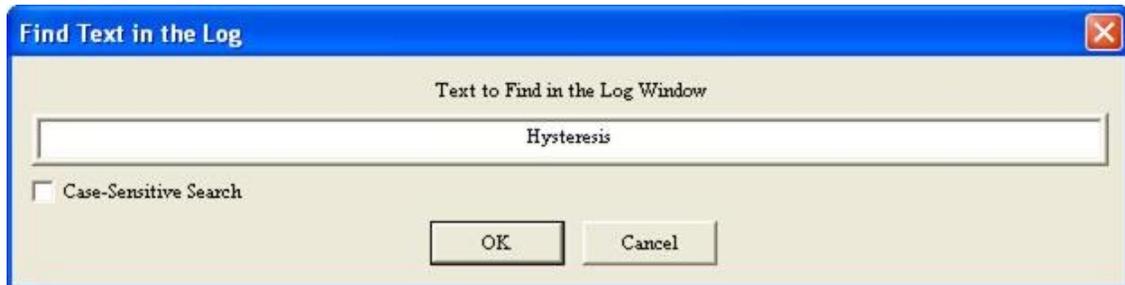


Figure 6 - Search For Text in the Log Window.

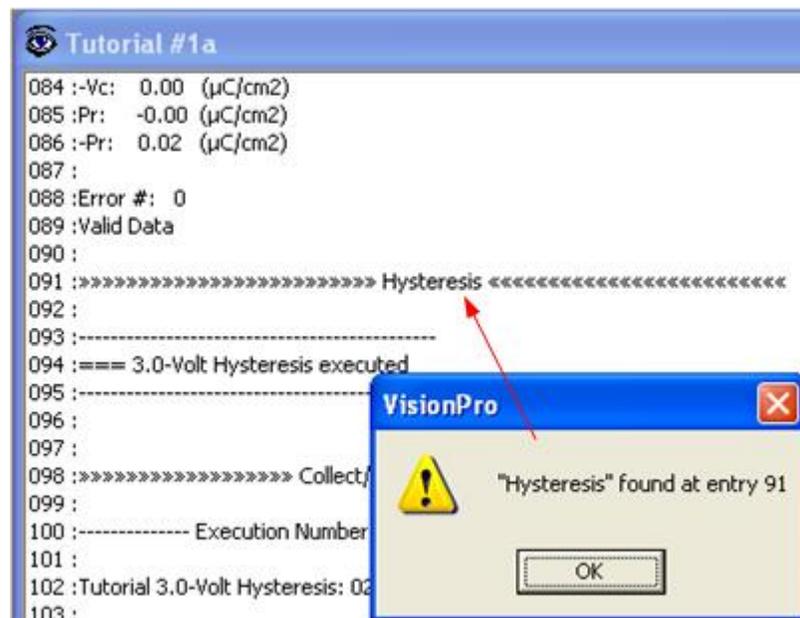


Figure 7 - Text Located in the Log Window.

6. Find Next (Alt-F) - Find the next occurrence of the previously specified text in the Log window. This option is disabled if there is no open DataSet.
7. Clear Log on DataSet Close->Clear Log on DataSet Close - Checked by default. When checked, the log window is cleared of all text each time a DataSet is closed. The text in a DataSet log window may be found to be of limited documentary benefit. Clearing the log can speed DataSet opening since the text does not need to be rewritten to the window. When this control is checked, Clear Log on DataSet Close->Save Log Before Clear will be enabled. Otherwise that option is disabled.

8. Clear Log on DataSet Close->Save Log Before Clear - Unchecked by default. When checked, the contents of the DataSet log window will be entirely written to a file named C:\DataSets\Auto_Log\

K. Calculator Menu

V: Main Menu Operations

When the Vision program starts up four dockable windows - [TASK LIBRARY](#) , [EDITOR](#) , Document Library and [DataSet Explorer](#) – appear at the edges of a larger empty user space (**Figure 1**). At the top of the program view is a menu with the following options. These are discussed in subsequent sections. Links are made to the sections.

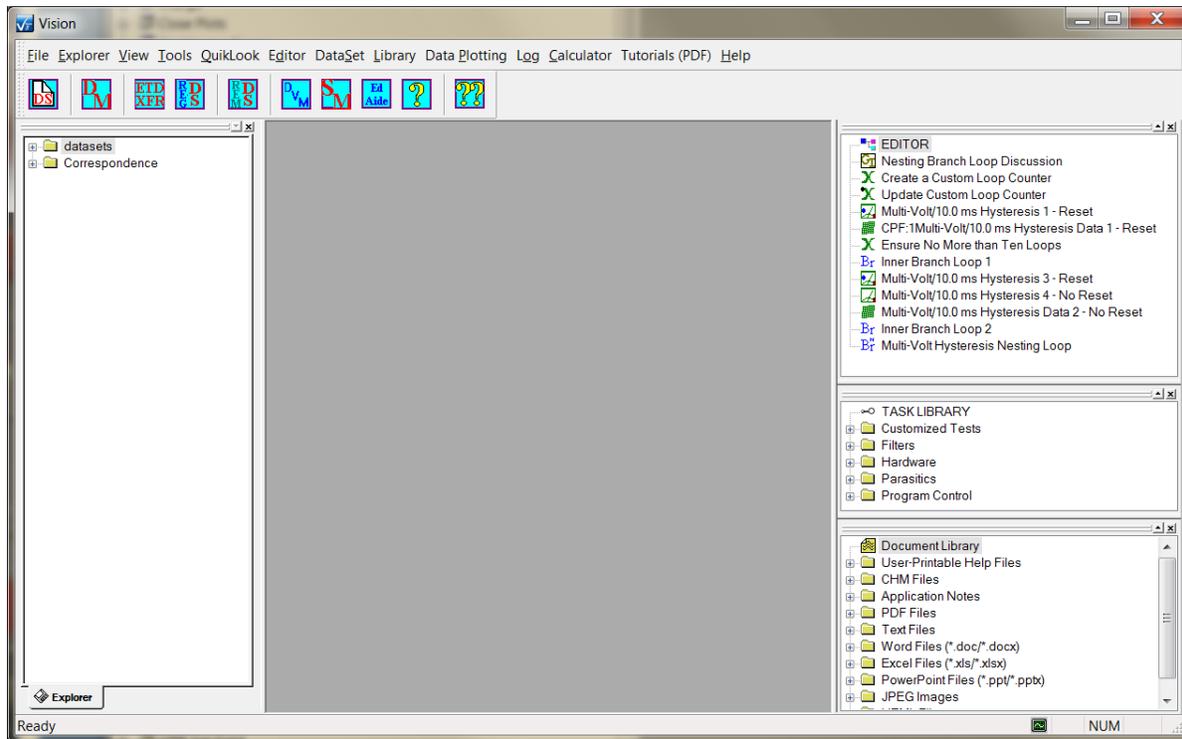


Figure 1 – Vision Program Screen.

V.K - Calculator (Figure 2)

This option opens a dialog (**Figure 3**) that allows one of five ferroelectric parameters to be derived from user-specified values entered in the other four. See [Step-by-Step](#) for details.

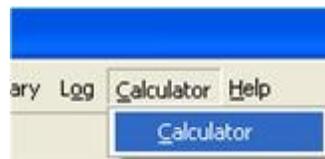


Figure 2 - Calculator Menu.

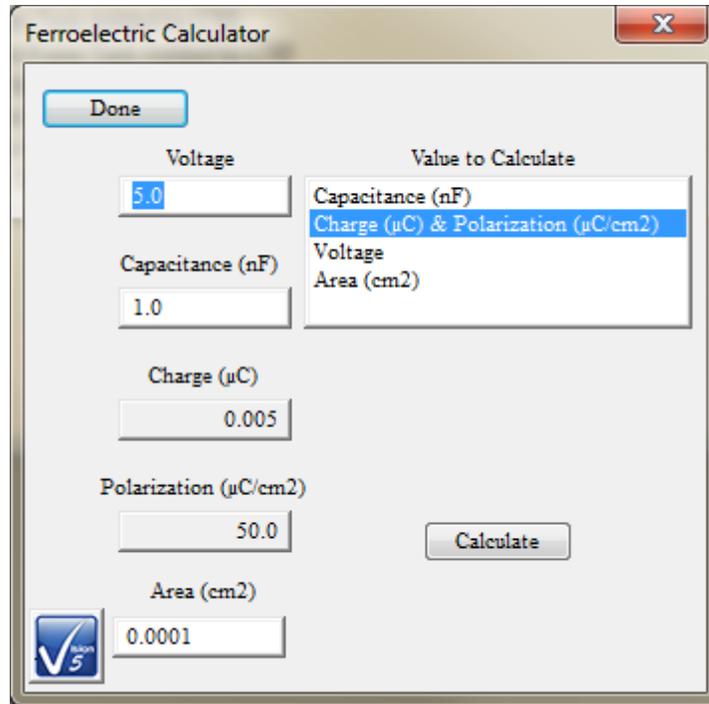


Figure 3 - Calculator Default Dialog.

L. Help Menu

V: Main Menu Operations

When the Vision program starts up four dockable windows - [TASK LIBRARY](#) , [EDITOR](#) , Document Library and [DataSet Explorer](#) – appear at the edges of a larger empty user space (**Figure 1**). At the top of the program view is a menu with the following options. These are discussed in subsequent sections. Links are made to the sections.

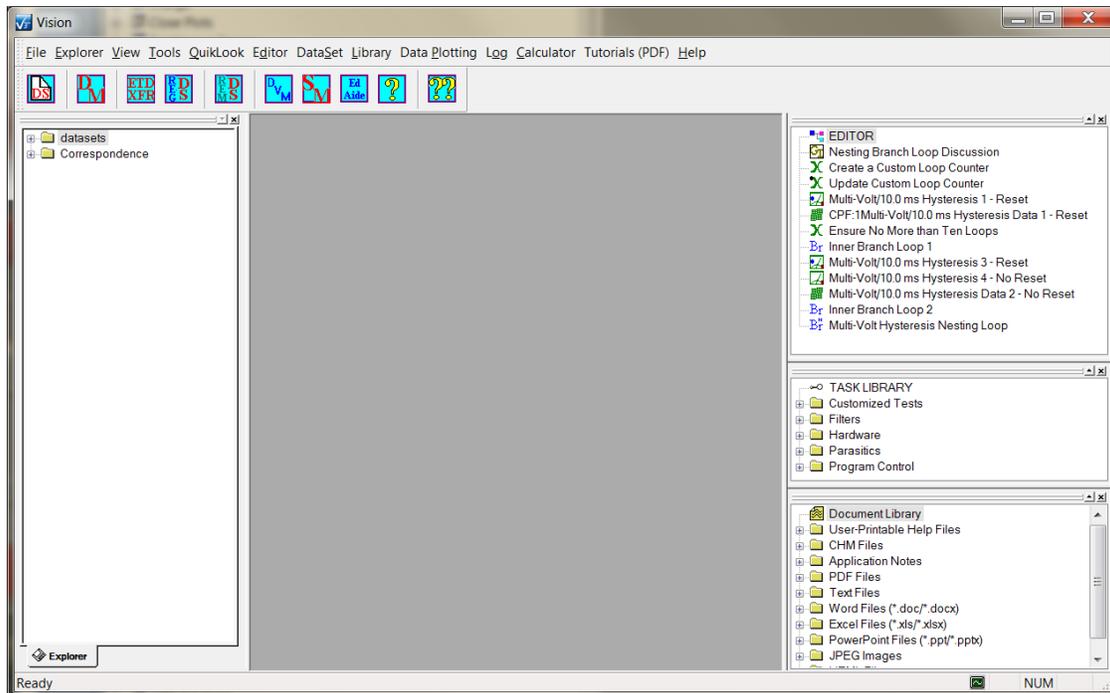
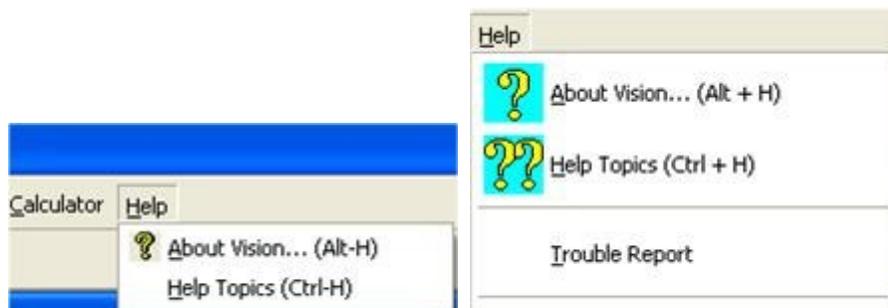


Figure 1 – Vision Program Screen.

V.L - Help (Figure 2)

Show this Help program or the “About” dialog or initiate an automatic help report. Please visit the Radiant Technologies, Inc. web site at www.ferrodevices.com frequently to download updated Vision software and updated and new tasks.



Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

Figure 2 – Help Menu

1. About Vision... – (Toolbar Icon: ) - Get up-to-date information about your Vision installation.



Figure 3 – About Vision.

2. Help Topics – (Toolbar Icon: ) - Launch this help document.

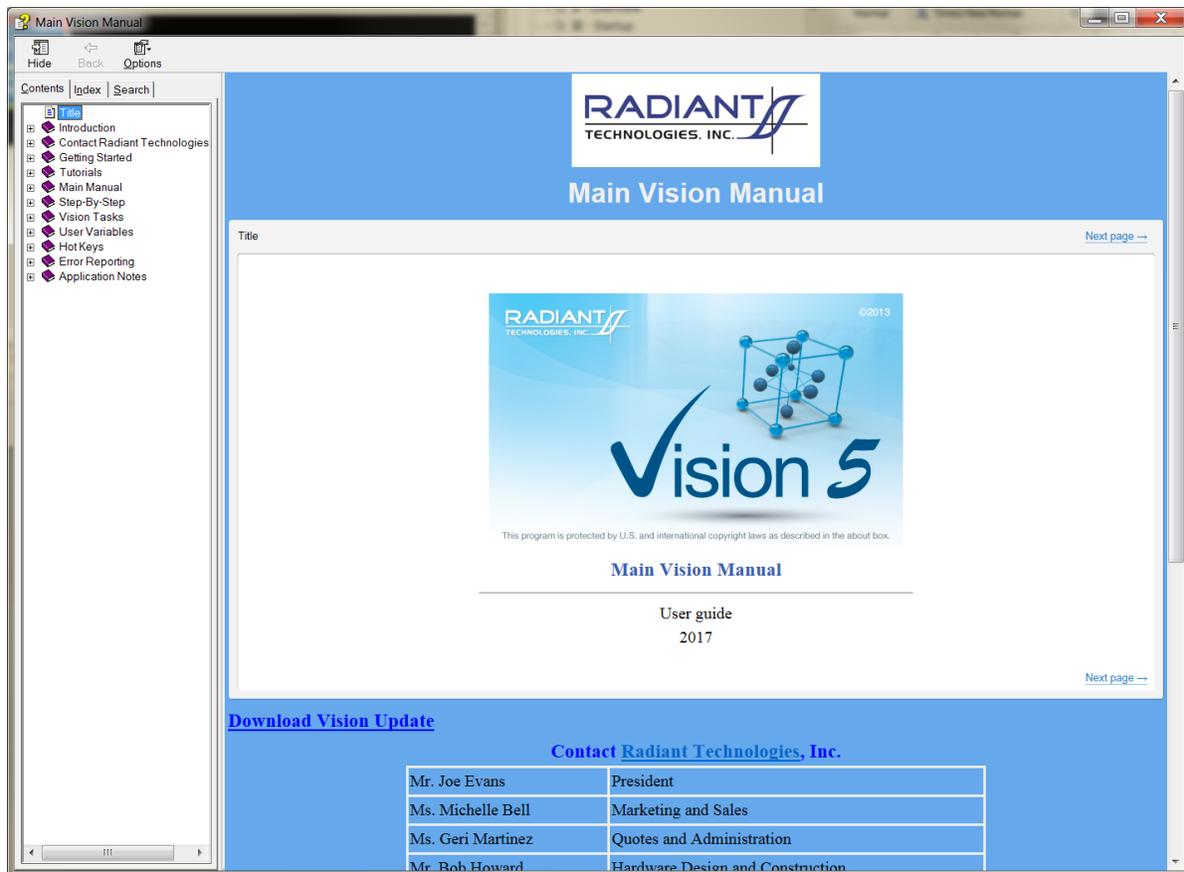


Figure 4 – Main Help Browser.

3. Trouble Report - This menu option opens a trouble report wizard that allows you to provide Radiant Technologies, Inc. engineers detailed information about problems that you are having. During the course of the wizard an analysis DataSet will be automatically created and executed and the trouble report, along with the DataSet, will be automatically emailed to Radiant Technologies, Inc. Note that a Precision tester must be attached and powered to run the Trouble Report Wizard. If no tester is attached, a message appears:



Figure 5 - No Tester Attached - Wizard Will Not Run.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

1. General Information - This wizard page is used to provide automatic, required and optional information about you, your tester, your Vision version and your operating system to the Radiant Technologies, Inc. engineers. Note that the Windows operating system version selection is limited to Windows 7, 8, 8.1 and 10. Windows 2000, XP and Vista is are longer supported. If you are operating Windows 8, 8.1 or 10, please select Windows 7 until this control is updated. Note that, once entered, the information in this dialog is written to the registry and need not be re-entered. This information can also be provided in the Tools->Options...->Fixed Trouble Report menu location.

Property Page

9/25/2017 Report Date

PMF1012-313 (PMF) Tester Serial Number

5.15.94 Driver Version

5.15.3 (D) Vision Version

9/22/17 Vision Date

Required

Name
Scott Chapman

Organization
Radiant Technologies, Inc.

Email
radiant@ferodevices.com

Country
USA

Operating System
Windows 10
Windows 7
Windows 8
Windows 8.1
Windows Vista
Windows XP

Optional

Street Address 1
2835 Pan American Fwy NE

Street Address 2
Suite D

City
Albuquerque

State
NM

Postal Code
87107

Phone
505-842-8007

Phone 2
1-800-289-7176

Mobile

FAX
505-842-0366

< Back Next > Cancel

Figure 5 – Trouble Report Tab 1 - General Information.

3. Problem Description - The user is guided to describe the problem as he/she best understands it. These are the questions that the Radiant engineer will ask when the problem is presented.

Problem Description

The Problem Appears Related to Hardware
 The Problem Appears Related to Software
 I Don't Know

The Tester/Program Have Operated Properly in the Past
 The Tester/Program Have Never Operated Properly

Vision is the Original Distribution
 Vision has been Updated
Estimated Update
10/22/15
 Problem Appeared Immediately After Update

The Driver is the Original Distribution
 The Driver has been Updated
Estimated Update
10/22/15
 Problem Appeared Immediately After Update

The Problem is Intermittent

The Problem Relates to High-Voltage Operations:
Amplifier Model:
Amplifier Serial Number:
HVI Serial Number:
ID Module Serial:



< Back Next > Cancel

Figure 6 – Trouble Report Tab 2 - Formatted Error Information.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

3. Problem Description (Detailed) - Provide as detailed a description of the problem as possible. Include, as appropriate, sample description, method of connection to the sample, test configuration conditions, observed behaviour, etc. Attach any single file that may help illustrate the problem. In particular, images that show experimental configuration, errors, error data or data that are not understood, etc. are of value to the RTI engineers.

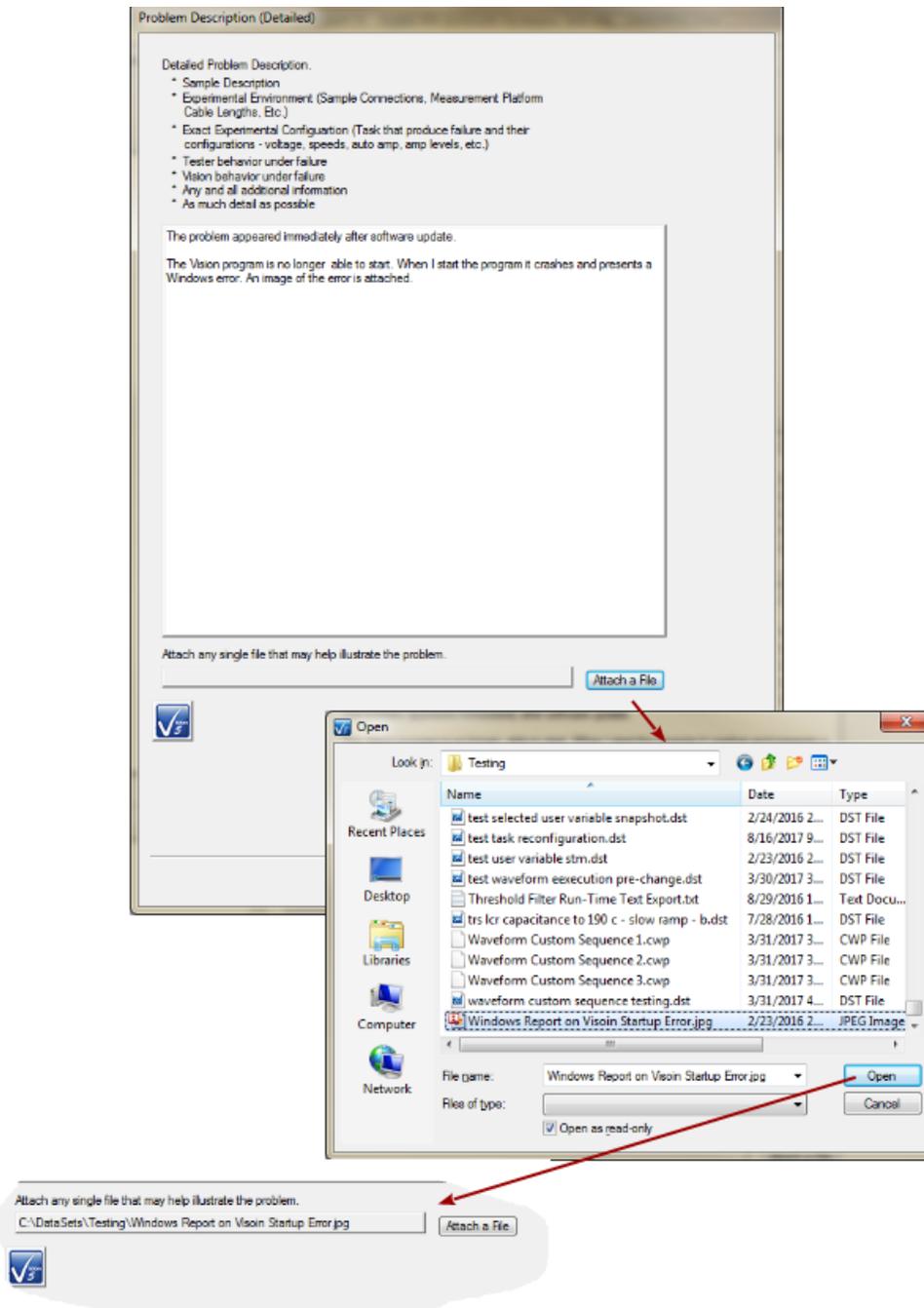


Figure 7 – Trouble Report Tab 3 - Detailed Error Information.

4. Create a DataSet - The automated Vision Trouble Report can be configured to make a standard 5.0-Volt/10.0 ms Hysteresis measurement on the 1.0 nF internal reference capacitor, store the measurement in a DataSet and attach the DataSet file to the email to Radiant Technologies, Inc. This is a basic analysis Radiant engineer will often request in troubleshooting. As part of this process, the user will be afforded the oppor-

tunity to append a single measurement to this DataSet that shows an example of the error. This is the most valuable tool that RTI engineers have to evaluate the configuration and results of the error measurement and to validate that basic measurements are operating correctly.

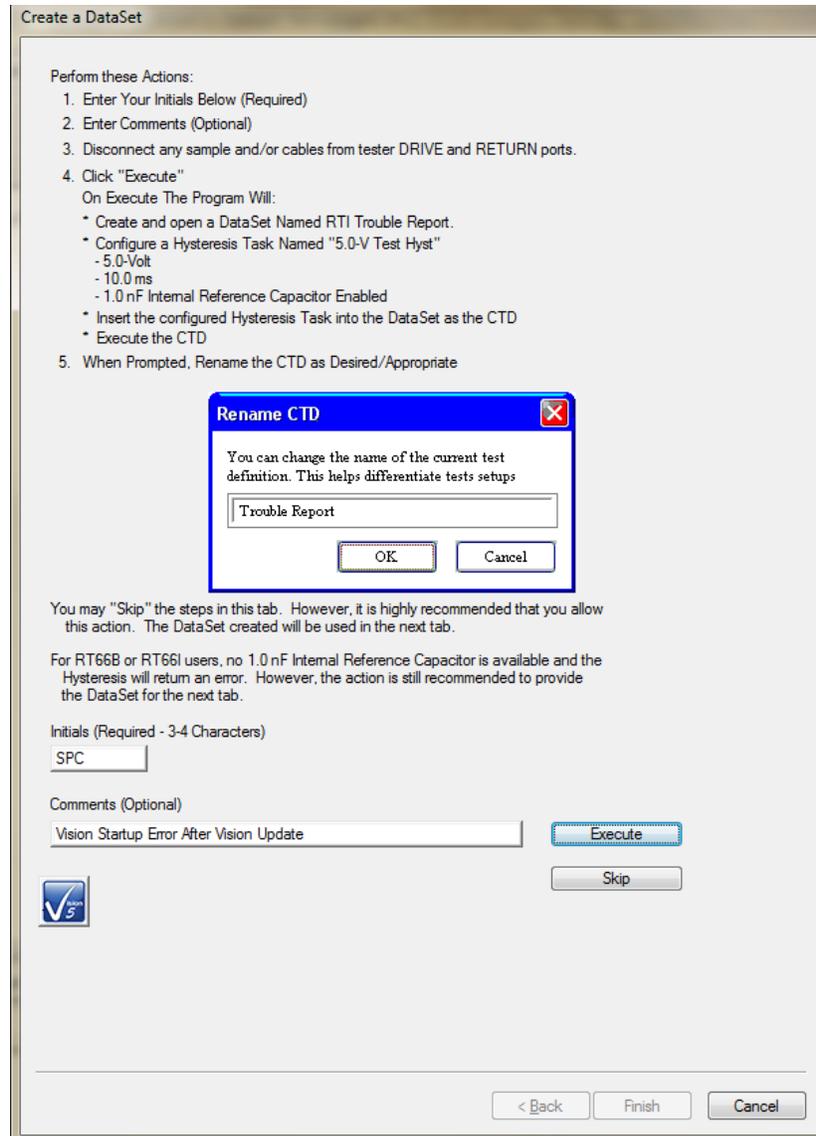


Figure 8 – Trouble Report Tab 4 - Automated Tester Evaluation DataSet.

Set *Initials* and add *Comments* (if desired). Click *Execute* . A DataSet named "RTI Trouble Report:x" will be created and opened. A 5.0-Volt/10.0 ms Hysteresis Task will be configured and executed, measuring the 1.0 nF Internal Reference Capacitor. A dialog will appear to name the CTD and the ETD in the DataSet Archive. Assign

an appropriate name to the CTD and click *OK* . The DataSet Archive will be updated.

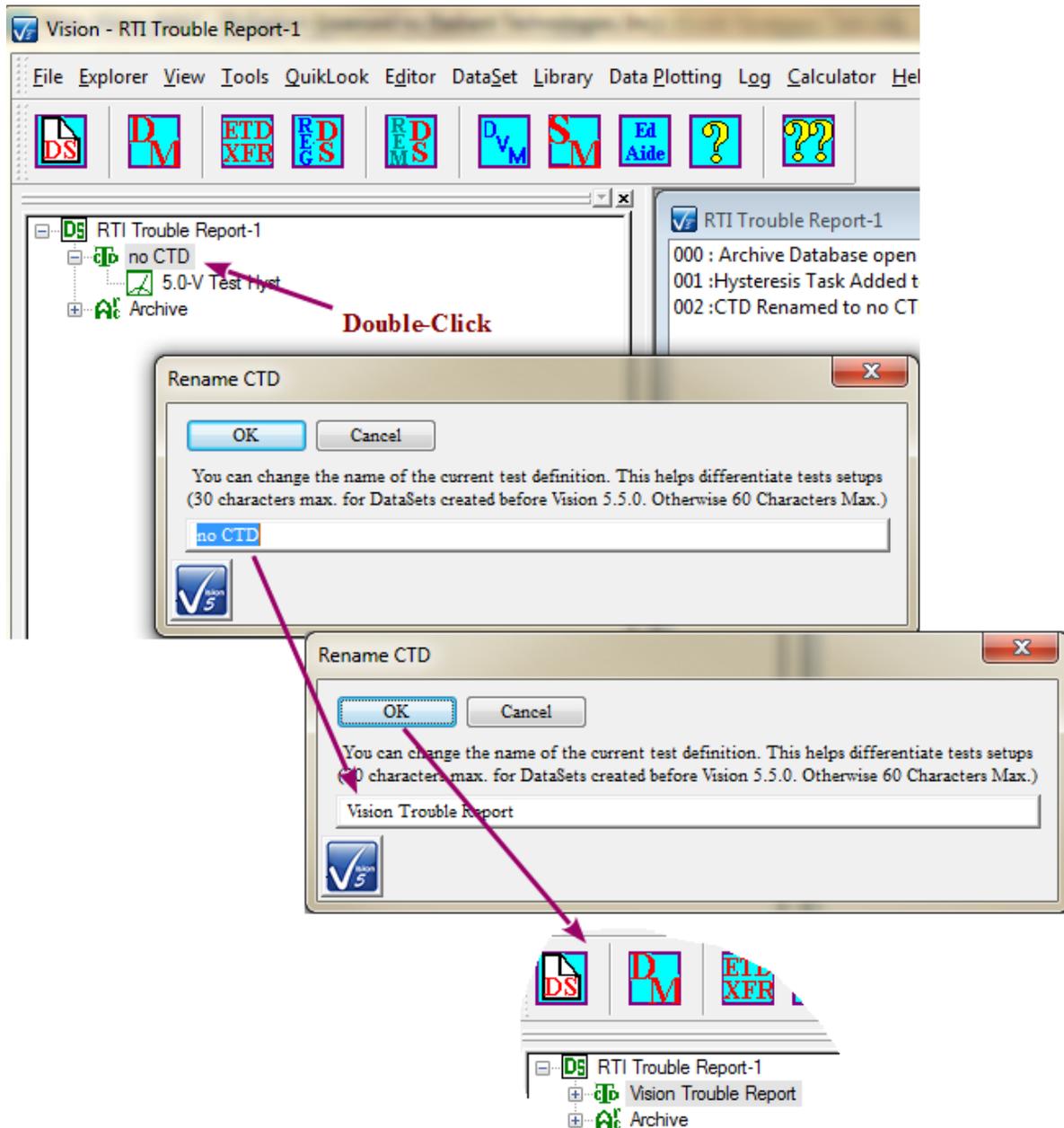


Figure 9 – Operate the Automated Tester Evaluation DataSet.

NOTE: You may *Skip* this step. This is not recommended if an example of the error can be generated in a Task, or Test Definition, in a DataSet. If this step is skipped, the next wizard tab will not appear.

5. Custom Test - If the DataSet of the previous tab was created and executed, this tab al-

allows you to configure a Test Definition that demonstrates the error, so that error results will be recorded to the DataSet. Create the Test Definition, move into the DataSet and execute as though the Trouble Report wizard were not open.

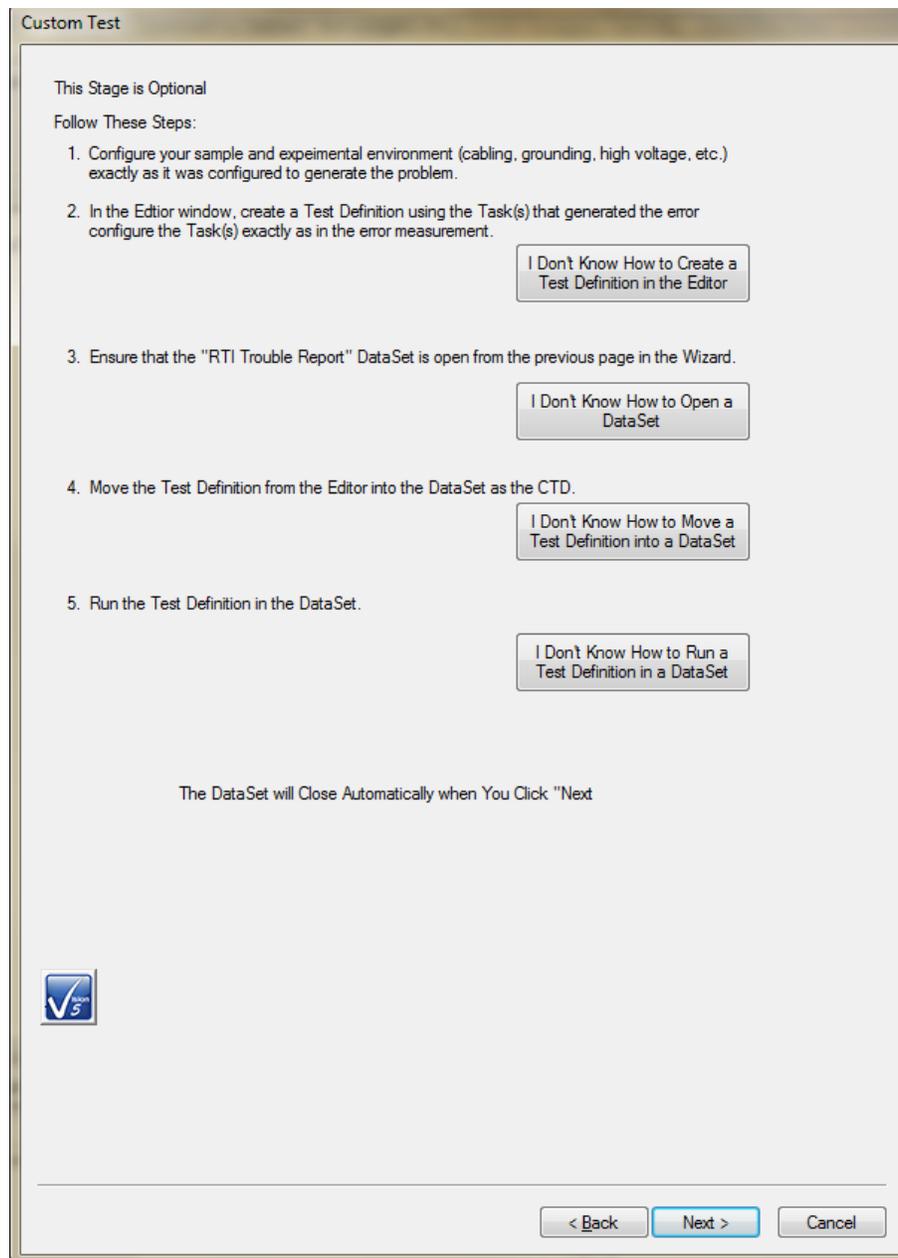
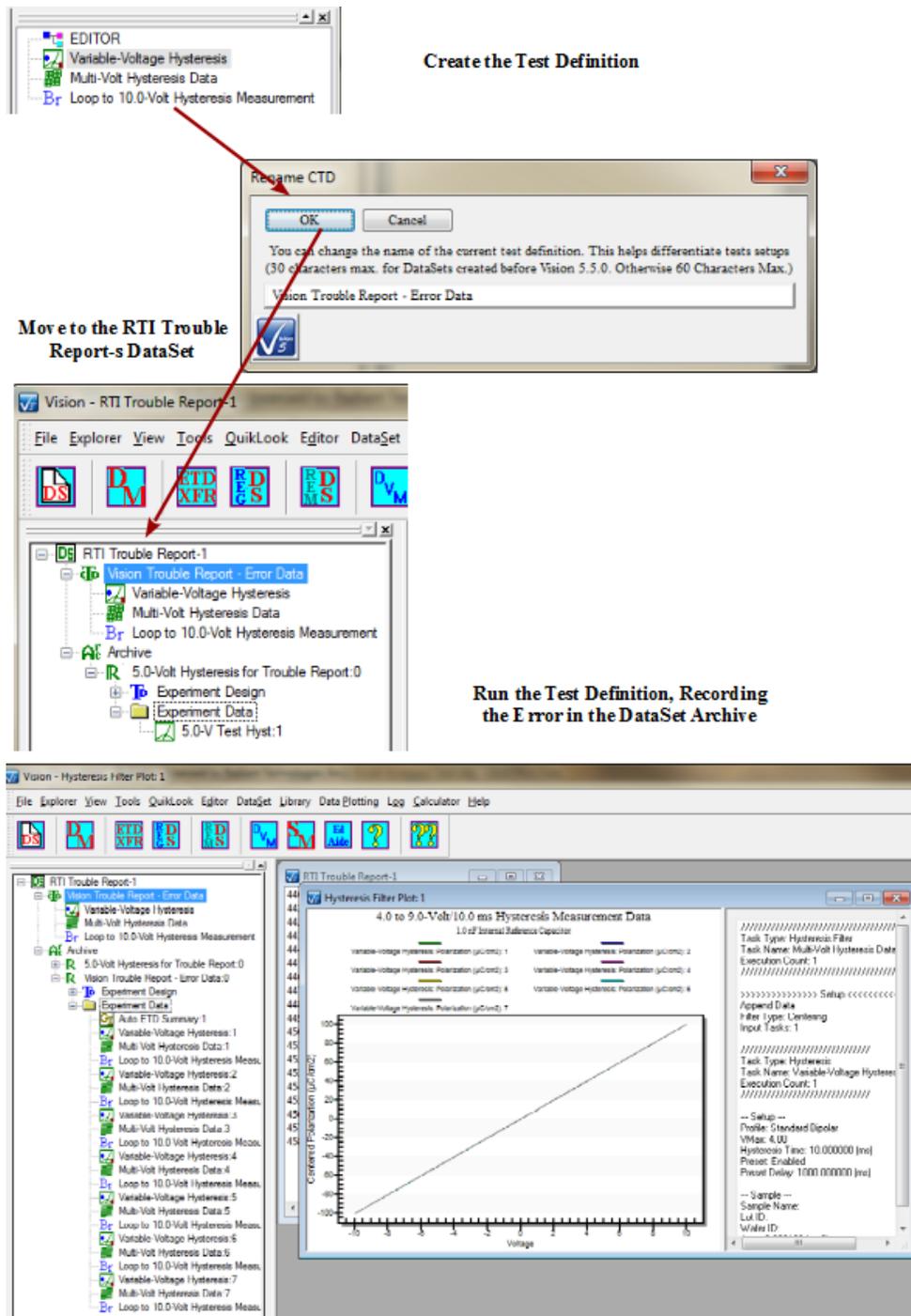


Figure 10 – Trouble Report Tab 5 - Guidelines for Custom Error-Generating Test Definition Execution in the DataSet.



Create the Test Definition

Move to the RTI Trouble Report-s DataSet

Run the Test Definition, Recording the Error in the DataSet Archive

Figure 11 – Results of Custom Error-Generating Test Definition Execution in the DataSet.

If the user is not familiar with DataSet operations, each of the steps in this process has a button on the wizard dialog that will open a help page to guide the user in that

step.

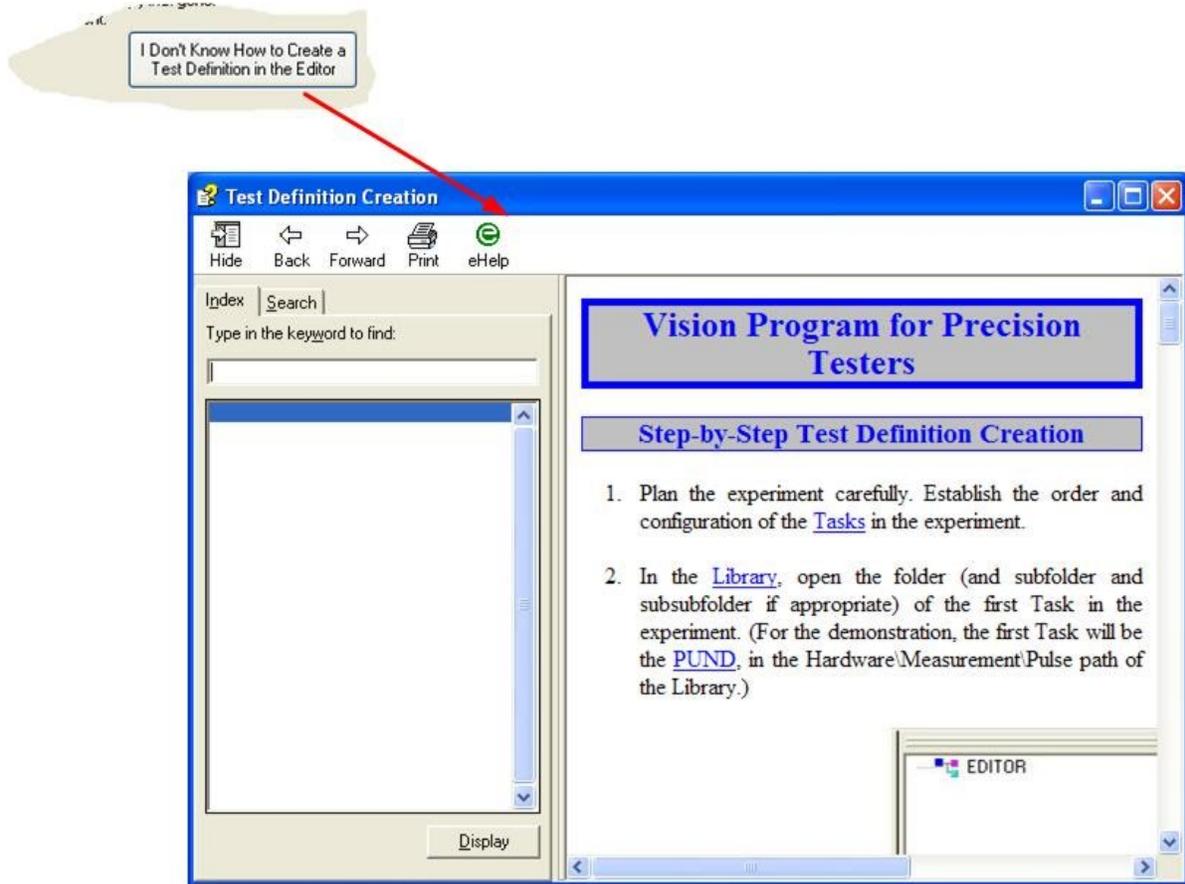


Figure 12 – Access to Help Operating the Custom Test Definition.

Click Next > to close the DataSet and move to the final wizard page. This step can be skipped completely by immediately clicking Next > .

6. Transmit Report - This final wizard page can be used to automatically email the report and the DataSet and attached file to Radiant Technologies, Inc. for review by the engineers. If the host computer is not an email client, is not connected to the Internet or if the attempt to email produces errors, the report can be saved, along with the attachments and emailed manually by the user. The *Save* button can be used to save the error report text even if the mail is successfully transmitted.

Transmit Report

If You Have an Internet Connection with an EMail Program Installed, Select the Outgoing Host type, Set the Outgoing EMail Host Address and Channel, Set the "cc" if desired and then Click "Send".

Outgoing Mail Host Type Outgoing Mail Host Address
 POP3 mail.xxx.com
 SMTP

This information can be obtained by selecting Tools->Accounts in Outlook Express or by contacting your system administrator

Add optional cc address(es). Separate addresses with ";". (ex. "joe@gmail.com;sue@aol.com")
joe@joesplace, markdark@arkpark.com

Send

If You Do Not Have an Internet Connection with Outlook Express Installed, Click "Save".
Then Go to C:\DataSets\Trouble Report\Trouble Report and Attach
c:\datasets\trouble report\trouble report\vti trouble report.2.dst and
RTI Trouble Report.txt to an email to radiant@ferrodevices.com.
Use Subject "RTI Trouble Report".

Also Attach: C:\DataSets\Testing\Windows Report on Visoin Startup Error.jpg

Save

< Back Finish Cancel

Figure 13 – Trouble Report Tab 6 - Transmit the Trouble Report.

VI - Library and Tasks

VI: The Library Window and Tasks

To the center right (in its default position) of the program space is the Library window (**Figure 1**). It currently holds five folders named “Filters”, “Hardware”, "Parasitics" and “Program Control”. A fifth folder named “Customized Tests” will appear as the user adds custom Tasks, known as Customized Tests, to the Library. (Vision ships with example Customized Tests installed, so this window will normally also appear.) Some folders contain subfolders and even subsubfolders. All folders contain Tasks. Each Task is represented by an icon and a descriptive name. No Task will ever appear more than three folders deep in the Library hierarchy.

Tasks that are loaded into the QuikLook menu are also labeled " (QL)" appended to their names in the Library. QuikLook configuration and execution of these Tasks may be done by double-clicking the Task in the Library.

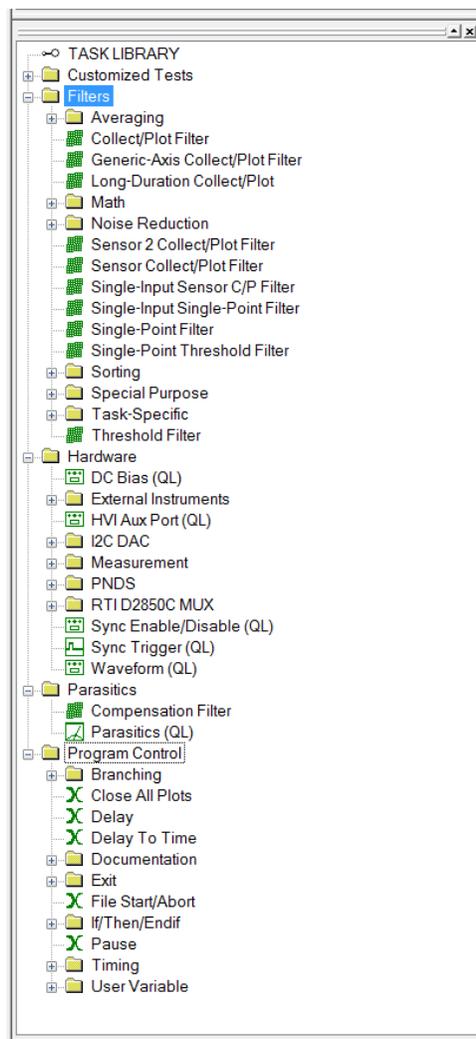


Figure 1 – Library Window with Expanded Task Menu.

Tasks are individual experimental programs provided by Radiant Technologies, Inc. Each Task performs a specific operation. These Tasks may be arranged sequentially in nearly any order and number to create an experiment, known as a Test Definition. Currently more than 120 Tasks are provided with the Vision software. (All users are provided with Custom Tasks that can be configured and reviewed. These Tasks must be purchased to be executed and include the Chamber, Piezoelectric, Magnetolectric and Transistor Task Suites, among others.) One or more additional Tasks may be provided by Radiant Technologies to detect and correct certain hardware errors when reported. More are planned and will be available on our web site. Tasks are installed or updated simply by writing the Task file (a file with a *.vtr extension) into the "C:\Program Files (x86)\Radiant Technologies\Vision\System" directory. The Task help file is written to "C:\Program Files (x86)\Radiant Technologies\Vision\Help". Tasks currently fall into four main categories represented by the folders in the Library. Many also fall into subcategories or subsubcategories. Tasks will not be installed more than three levels deep in the Library. More detail specific to each Task described below can be found by clicking on the *Click For Task Instructions* button of the Task's configuration page(s).

It is important to regard the Vision software as a collection of programs including the main Vision program and all of the Tasks. Tasks, in other words, should be regarded as individual programs. The main Vision program provides the framework in which the Tasks operate. It provides the TASK LIBRARY, EDITOR and DataSet Explorer windows. It manages Test Definition creation and execution and maintains the database. As individual programs Tasks can be added, deleted or updated independently of each other and of the Vision program. Vision changes relatively slowly. Tasks, on the other hand may be added and updated on nearly a daily basis. Tasks are independently versioned. With the release of an updated Vision version (5.13.0, for example), all Tasks are also set to the Version (5.13.0). However, once released, the Task Version numbers will begin to change as changes are made and new Task Versions released. Vision will update its minor version (5.13.1, 5.13.2, etc.) independently of any Task and at each new release of the program.

Task types are associated with type-dependent icons in the Task Library (and in all Test Definitions). In some cases the icons are Task-specific. The icons are shown with the Tasks in the lists below. Also shown, at the end of the Task discussion, is a link to the Task-specific Help project. That project will provide much more detail about Task theory, configuration and execution.

Tasks marked with "(QL)" are also loaded into the QuikLook menu. These can be configured and executed in QuikLook mode, from the TASK LIBRARY, by double-clicking or right-clicking and selecting "QuikLook Execute". Note that, in general, Hardware and Measurement Tasks are found in the QuikLook menu. However, Long-Duration Measurement Tasks do not meet the philosophy of a quick "Let's see what we've got" execution under QuikLook. These also take a lot of data over an extended time. They are, therefore, not included in the QuikLook menu. The exception is the Advanced C/V Task. There is no particular reason that it is found in QuikLook, but it has been included in that menu option from the beginning of Vision and has not

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

been removed. A few diagnostic Tasks are found only in QuikLook.

The following section summarizes all Tasks that are, distributed with Vision.

VI.1: Hardware Tasks

Hardware Tasks are those Tasks that communicate with the Precision Family stimulus and measurement hardware. These provide direct stimulus to the sample under test. Three Tasks fall directly into this category.

1. **DC Bias (QL)** () - This Task applies a continuous DC voltage stress to the sample for a pre-determined period of time. A progress dialog appears during the stress period to indicate the stress duration. The DC Bias may be abbreviated by clicking the *Cancel* button of the progress dialog. If not cancelled, the stressing voltage will be returned to zero volts at the end of the delay period. The delay period may be altered in a [Branch Loop](#) (discussed [below](#)) by incrementing it or scaling it. DC Bias voltage may also be adjusted in a Branch Loop. In a Branch Loop, an *Abort Loop* button may be used to cancel the DC Bias and prevent the subsequent [Branch Task](#) from returning execution to its [Branch Target](#) regardless of the [Branch Logic Condition](#).
2. **Sync Enable/Disable (QL)** () - Under normal circumstances, when a Measurement Task is making a measurement, the tester SYNC port is set to 3.3 Volts. This Task will enable, disable or toggle that output. Disabling the SYNC port output allows the user to incorporate a Sync Trigger Task that will pulse the SYNC port output to 3.3 Volts for a user-specified pulse width. That allows the SYNC port to be used to trigger external devices.
3. **Sync Trigger (QL)** () - This Task will pulse the SYNC port to 3.3 Volts for a user-specified period to allow Vision to trigger external instruments. The Sync Enable/Disable Task will normally be used before this Task to disable the SYNC port. That keeps other Measurement Tasks from applying the SYNC trigger during the measurement.
4. **Waveform (QL)** () - This Task applies a periodic stress signal to the sample for a pre-determined period of time. The signal may be a Sine, a Square Wave, a Triangle or a Pulse Train, with two pulses per cycle of independent voltage. An external stimulus or a custom profile read directly as voltages from a file may be used to create the stress waveform. A progress dialog appears during the stress to indicate the stress duration. The Waveform may be abbreviated by clicking the *Cancel* button of the progress dialog. The delay period may be altered in a Branch Loop (discussed below) by incrementing it or scaling it. Waveform voltage and frequency may also be altered in a Branch Loop. In a Branch Loop, an *Abort Loop* button may be used to cancel the Waveform and prevent the subsequent Branch Task from returning execution to its Branch Target regardless of the Branch Logic Condition.

Some Hardware Tasks are unique in that they appear only in the QuikLook menu and do not interact with a sample. QuikLook entries do not associate icons with the Tasks.

5. **Tester Information** - A Task that appears only in the QuikLook menu. The Task reads tester-identifying information from the tester hardware and displays it on a dialog. Comments may then be added and the information exported. The utility is to provide Radiant Technologies information that will assist in troubleshooting the Tester when there is a problem report.
6. **Accessory Read** - This Task reads the contents of the EEPROMs of all accessory instruments - High Voltage Interfaces (HVIs), High Voltage Amplifiers (HVAs) and/or 48-Channel Multiplexers currently attached to the Precision tester. This information is reported in detail and may be exported. This allows the user and/or Radiant Technologies, Inc. to verify that logic communications between instruments is occurring as expected and that the EEPROMs are properly programmed.

VI.1.1: External Instruments

External Instruments Tasks are Hardware Tasks that communicate with external accessory instrumentation that may or may not be provided by Radiant Technologies, Inc. Most instruments are controlled using a National Instruments General Purpose Interface Bus and the IEEE-488 software standard. However some instruments are controlled over RS232, RS485 or USB buses. Tasks will include interaction with specific instruments such as probe stations and thermal devices (hot chucks and chambers) as well as more generic communications that can be associated with any instrument. Users who wish to control GPIB devices must insert and configure a National Instruments GPIB board in their tester host computer. Some Measurement Tasks, listed below, also communicate to instruments using the IEEE-488 GPIB or other standard.

NOTE that National Instruments continues to provide installed GPIB interface boards that will provide outstanding service to these Tasks. However, given the portability of the Vision program, Radiant Technologies, Inc. recommends the National Instruments GPIB-USB-HS interface. This is a GPIB connector on a cable with a USB connector at the other end. It can be easily moved between computer hosts. (Each host must have the NI-488.2 software installed.)

NOTE that the GPIB interface hardware used must be 100% compatible with the National Instruments NI-488.2 drivers. In particular, Radiant Technologies is aware of GPIB interfaces produced by Keithley. These interfaces are not compatible with Vision.

1. **Generic GPIB (QL) (L²T)** - This Task can be used to communicate to any external device that supports the IEEE-488 GPIB parallel communications standard. It can be accessed from the QuikLook menu or may be programmed into a Test Definition . The Task allows the user to send commands, receive responses or combine the two

operations into a query. As a generic interface, it cannot react to responses from the instruments under control. However, instrument response is written to the "GPIB Response String" User Variable where it could be used to control Branching, etc.

2. **GPIB Start (L^QT)** - This Task renders the Vision host computer a slave on a GPIB bus controlled by a separate host. (Note that the Vision host must have its GPIB System Controller capabilities disabled.) The Task will normally appear as the first Task in the Test Definition. On execution a dialog will appear and the Task will wait for either a "Start" or "Abort" signal from the GPIB system controller. The Test Definition will proceed or stop based on this signal. The Test Definition may also be started or stopped by clicking buttons on the dialog box. Please see the Task description for more details.
3. **LCR Meter (QL) (L^QT)** - This Task configures an Agilent or Wayne-Kerr LCR meter to measure at the user's specifications. A selection of two LCR properties: Inductance, Capacitance, Q-Factor, Dissipation Factor, Resistance, Reactance, Impedance, admittance, Susceptance, Conductance, Theta can be returned as the measured value. In the Wayne-Kerr instrument, the data may also be returned as a vector function of a frequency sweep.
4. **Quantum Design PPMS/Dyancool (QL) (L^QT)** - This Task is specific to the Quantum Design PPMS and Dynacool models of cryochambers. The Task runs simultaneously with a Task-specific script run by the Quantum Design MultiVu program. This Task is in beta release and requires feedback from the Quantum Design users for final approval. The Task offers control over temperature, temperature ramp rate, magnetic field and magnetic field ramp rate. Quantum Design thermal controllers originally communicated over the GPIB bus and older models are still incorporated into the Set Temperature, Read Temperature and Set Field Tasks. Later models are USB controlled and offer the MultiVu scripting that is used by this Tasks. Communication may be entirely performed on the Vision host computer or may be performed using a script that is written and read over a LAN.
5. **Read Temperature (QL) (L^QT)** - This Task can be used to communicate to a thermal controller such as a hot chuck or chamber. It repeatedly reads, stores and displays the current temperature (°C). Normally the temperature is read automatically, with a possible user-programmed delay between updates until a) a user-programmed number of reads is reached, b) the user aborts the process or c) a user-specified time interval has been reached. A fourth option exists in which the sampling is performed manually each time the user clicks a sample button, until the user clicks an abort button. This Task only controls specific thermal instruments that have had drivers programmed into Vision. Other instruments may be added - at additional expense - as they are required by customers.

6. **Set Field (QL)**() - This Task is specific to older model Quantum Design thermal controllers that communicate over a GPIB bus. This Task is used to set the magnetic field and magnetic field ramp rate on a Quantum Design Cryochamber.
7. **Set Temperature (QL)** () - This Task can be used to communicate to a thermal controller such as a hot chuck or chamber. It will command the controller to a specific set temperature, and then sample the current temperature until it is within a user-specified tolerance of the set temperature. At that time the Task may exit. The Task may also enter a "stability" phase as described in the next paragraph. If the Task is programmed to exit immediately, it is recommended that the Task be followed by an extended Delay Task to allow time for the thermal device to settle. This Task may also be used to set the ramp rate (°C/min.) of some of the thermal device. Ramp Rate is currently available only for a subset of the programmed thermal controllers. This Task only controls specific thermal instruments that have had drivers programmed into Vision. Other instruments may be added - at additional expense - as they are required by customers.

The Set Temperature Task offer a "stability" option. If the user enables this option, the Task attempts to determine temperature stability. Each time the detected temperature moves to within the tolerance of the set temperature, the Task sets a timer. After that, each time the Task detects a temperature that is outside the tolerance, the timer is reset. The timer is set and reset until a sequence of detected temperatures remains within the tolerance for a period of time programmed by the user. At that point, the Task assumes temperature stability and terminates. The temperature progress dialog includes red and green indicators that indicate whether or not the most-recently read temperature is within the tolerance of the set temperature. This option is also available to the QD PPMS/Dynacool and Set Field Tasks.

VI.1.2: I²C DAC

This series of Tasks is intended for use with the Radiant Technologies, Inc. I²C Voltage Controller. This controller is a small package that connects, at one end, to the Precision tester through an I²C (telephone) cable. The opposite end has a male BNC connector. The I²C Voltage Controller can be used as a software-controlled voltage source in the ±10.0-Volt range. It can also be used to capture and digitize input voltages in the ±10.0-Volt range.



Figure 2 - I²C Voltage Controller

1. **I²C Pulse (QL)** () - This Task outputs a user-specified voltage for a user-specified period.
2. **I²C Relay (QL)** () - This Task is used to set the I²C Voltage Controller output relay: Enabled, Disabled or Toggle. There is some control of the relay state in the other I²C Controller Tasks. In the other Tasks, the relay may be closed before Task execution if it had been opened.
3. **I²C Volts (QL)** () - The Task outputs a user-specified voltage and exits. The voltage the DC signal is constant after the Task exits.
4. **Read DAC Controller Volts (QL)** () - Here the voltage at the I2C Voltage Controller is sampled in one of four ways: for a programmed number of samples with use-specified delay between samples, continuously with a user-specified delay between samples until user abort, continuously with a user-specified delay between samples over a programmed period of time and intermittently on user demand until user abort.

VI.1.3: PNDS

The Precision Nano-Displacement System is a table-top Atomic Force Microscope, offered by Radiant Technologies, Inc., to measure the Angstrom-to-nanometer level piezoelectric response of thin film samples.

1. **PNDS Signals (QL)** () - The PNDS system includes two signal switch boards

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

that are under the software control of this Task. The first switches the charge measurement signal into the tester RETURN port between Capacitor A, Capacitor B (for the RTI sample board), the PNDS Cantilever (for conductive cantilevers) and No Connection. The second board enables or disables signals to the tester SENSOR 1 and SENSOR 2 ports and switches the signals to each port between Z Drive, Z Error, Z Strain or Left-Right.

VI.1.3: RTI D2850C MUX

The Radiant Technologies, Inc. D2850C Multiplexer is a 16-to-2 MUX with each of the two output channels (High and Low) associated with one 8-relay bank of sample connections. The mux controller is designed to bolt to the outside of a thermal chamber door with penetrations that allow the sample connections to be made inside the chamber. A thermocouple is also associated with the RTI D2850C and may be selected for sampling in the Read Temperature Task.

1. **RTI D2850C MUX Signals (QL)** () - This Task assigns the user's selection of High Signal relays to the High Sense/High mux BNC and the Low Signal relays to the Low Sense/Low mux BNC.

VI.2: Measurement Tasks

Measurement Tasks are Hardware Tasks that record the sample response to the applied tester stimulus. These Tasks include:

1. **Advanced C/V (QL)** () - The Advanced C/V Task measures sample capacitance at each of a series of voltage steps over a specified voltage profile. The measurement is made by stepping to the current voltage, waiting a user-specified "soak" period to allow step-induced signal to settle and then applying a small "tickle" voltage to induce the detected charge. Since the charge of the tickle voltage is small, the tickle measurement is repeated a user-specified number of times and averaged to remove random noise. The stepped voltage provide may be either linear (zero to max Volts and then zero to negative max Volts) or triangular (zero to max Volts to zero and zero to negative max Volts to zero). Before each leg of the measurement (positive, then negative) an unmeasured preset signal - pulse or monopolar triangle - may be applied to preset the polarization state. The user may also establish a custom drive profile with arbitrary voltages at each step.
2. **Charge (QL)** () - This Task mimics the standard Charge program of the RT66A and RT6000 families of testers. It provides an easily configured measurement that includes both a Hysteresis loop and a PUND measurement.
3. **I/V** () - The Task is similar to Advanced C/V. It measures the current through the sample at each of a series of voltage steps over a specified voltage profile. The stepped voltage provide may be either linear (zero to max Volts and then zero to negative max

Volts) or triangular (zero to max Volts to zero and zero to negative max Volts to zero). Before each leg of the measurement (positive, then negative) an unmeasured preset signal - pulse or monopolar triangle - may be applied to preset the polarization state. The user may also establish a custom drive profile with arbitrary voltages at each step.

4. **Leakage (QL)** () – A DC Bias is applied to the sample continuously over two periods. First a non-measurement “soak” period allows noise and switching introduced by the application of the voltage to settle and the sample to reach steady state. Then the measurement period begins and the sample response is repeatedly measured. The response value is converted into Current (mA), Resistance (Ω) and Resistivity ($\Omega \cdot \text{cm}$).
5. **Read Sensor (QL)** () - The Task produces one or two single scaled, offset and labeled value(s) derived from voltages captured at the SENSOR 1 and/or SENSOR 2 ports. The values at the ports are sampled a user-specified number of times and averaged to produce the single value(s).
6. **Read Sensor - Multi-Read (QL)** () - This Task captures Sensor voltages from SENSOR 1 and/or SENSOR 2 ports. It scales, offsets and labels the data. Unless operating in "silent" mode, the captured data are changed in list boxes during execution. The ports are sampled repeatedly in one of three ways: Automatically, with a user-specified delay between samples, for a programmed sample count, automatically, with a user-specified delay between samples, until the user stops the execution, manually, on user demand, until the user stops execution.
7. **Sensor Oscilloscope (QL)** () - This Task captures, scales, offset and labels SENSOR 1 and/or SENSOR 2 continuously for a user-programmed period of up to 30,000 ms (30 seconds), depending on tester model. This is equivalent to making a Hysteresis measurement without capturing polarization ($\mu\text{C}/\text{cm}^2$) data.
8. **Single-Point C/V (QL)** () - This Task is equivalent to the Advanced C/V Task except that it measures sample capacitance at a single voltage. No data are displayed on execution unless the Task is associated with a Single-Point Filter and operating in a Branch Loop.

VI.2.1: Chamber Tasks

This suite of two custom Tasks measures sample Displacement as a function of temperature. These Tasks perform GPIB, RS232, RS485 or USB control of a thermal instrument - chamber, furnace or hot chuck. These are custom Tasks that must be purchased and licensed to operate. The Tasks are distributed to everyone who installs Vision. Anyone can open the Task configuration dialog for review and to access the Task instructions. Anyone can review Chamber Task Suite data taken by a licensed copy of these Tasks. However, in order to operate the Tasks a license file, named security.sec, must be placed in C:\Program

Files (x86)\Radiant Technologies\Vision\System. Security.sec is coded to the Chamber Task suite and to any other custom Tasks that may have been purchase. It is also coded to a unique ID embedded into the tester for which it was purchased. The tester must be connected to the Vision host computer and powered for the Tasks to operate. The license may be copied to as many computers as required, but cannot be transferred to other Precision testers.

NOTE that, for GPIB thermal controllers, National Instruments continues to provide installed GPIB interface boards that will provide outstanding service to these Tasks. However, given the portability of the Vision program, Radiant Technologies, Inc. recommends the National Instruments GPIB-USB-HS interface. This is a GPIB connector on a cable with a USB connector at the other end. It can be easily moved between computer hosts. (Each host must have the NI-488.2 software installed.)

NOTE that, for GPIB thermal controllers, the GPIB interface hardware used must be 100% compatible with the National Instruments NI-488.2 drivers. In particular, Radiant Technologies is aware of GPIB interfaces produced by Keithley. These interfaces are not compatible with Vision.

1. **Chamber** () - This program characterizes the Dielectric Constant of a sample as a function of applied temperature using a PUND and/or Small-Signal AC (C/V) measurement. From these measurements the Pyroelectric Constant can be derived for the sample. The program controls an external thermal device through the GPIB or other bus on the Vision host computer. It alternately sets a new experimental temperature, then measures the sample properties. This procedure is repeated for a programmable number of times at various temperatures. Temperatures for each stress/measure sequence may be independently specified. Or an initial temperature is programmed and subsequent temperatures are determined by incrementing the previous temperature by a fixed step size.
2. **Remanent Chamber** () - This program is identical to Chamber except that it replaces the PUND measurement with a Remanent Hysteresis measurement to arrive at the spontaneous polarization value. This alters the values captured by the Task and measurement configuration. The reason for the change is that there is concern that high voltage pulse measurements at high temperatures will be so conductive that sample will be damaged. Remanent Hysteresis measurements have more gradual rise times than PUND measurements and are safer in this regard.

VI.2.2: Current Loop

1. **Current Loop (QL)** () - This Task is identical to the Hysteresis Task except that the integrating capacitor is not switched into the Precision Tester virtual ground circuitry. Instead a resistor is switched in. The voltage output of the circuitry, then, relates to current through the sample by $V = ir \Rightarrow i = V/r$. As a result, this Task

provides a direct measurement of sample current as a function of the DRIVE voltage profile.

VI.2.3: Hysteresis

This collection of Tasks is based around the basic Hysteresis measurement that forms the fundamental tool for ferroelectric research.

1. **Check Hysteresis** () - This is identical to the Hysteresis Task except: it runs only in a Test Definition in a DataSet and is not found in QuikLook, It shows a Data Presentation dialog on execution, it offers the user an opportunity to accept the data, reject the data and remeasure or abort the measurement. This allows modification and checking of the physical experiment - such as resetting a probe tip - before a measurement is recorded to the DataSet Archive.
2. **Curve Energy (QL)** () - The Curve Energy Task integrates various sections of standard bipolar and/or standard monopolar Hysteresis measurements to theoretical ferroelectric material properties including:
 - \pm Instantaneous Dielectric Constant
 - High-Field Imaginary Dielectric Constant
 - High-Field Real Dielectric Constant
 - Dielectric Loss
3. **DLTS (QL)** () - The DLTS (Deep-Level Transient Spectroscopy) Task is a highly-customized Hysteresis measurement for researchers who want to study sample response after being pulsed to a voltage. Here, after a zero-Volt delay period, a signal pulse is applied of user-specified voltage and pulse width. To allow the RETURN signal amplification level to be increased, the user may specify a slower ramp to voltage. The DLTS is unique in that the user can tell the Task to open the virtual ground integrator (start the measurement) at any time during the measurement period. Normally the measurement will begin immediately after the pulse returns to 0.0 Volts. The difference in measured polarization ($\mu\text{C}/\text{cm}^2$) between any two measured points may be captured for any number of point pairs.
4. **General Monopolar (QL)** () - In the General Monopolar Task between one and five triangular or sinusoidal monopolar hysteresis measurements can be made. Each measurement is of independent voltage and period (ms). Each measurement may independently have a DC Bias or pulse preset of measurement-specific voltage and duration. In its default configuration, the Task mimics a continuous PUND measurement.
5. **Hysteresis (QL)** () - This is the fundament ferroelectric measurement. By de-

fault a triangular bipolar voltage stimulus waveform, of user-defined voltage and period (ms) is applied to the sample inducing a charge (μC) response that is captured by the tester and Vision and converted to polarization ($\mu\text{C}/\text{cm}^2$). The Task offers many, many variations on this basic measurement.

6. **PAINT (QL)** () - PAINT (Piezo-Acoustic sensing of Ink channels in the Time domain) is very similar to the DLTS Task. It is intended to capture acoustic-induced polarization generated in a fluid and resulting in a pulse and echo response. In particular, the response within an inkjet printer ink well is to be analyzed. What is of interest, here, is the reflections after the pulse. The integrator (measurement) can be delayed until after the pulse, measuring only the acoustic response and echo.
7. **Remanent Hysteresis (QL)** () - This is a piecemeal composite Hysteresis constructed by making Logic 1 and Logic 0 measurements, in both positive and negative voltage directions and subtracting the Logic 0 measurement from the Logic 1 measurement.

Logic 1 is a measurement that presets the polarization state so that the measurement switches sample polarization state. It contains polarization components:

Remanent Polarization + Non-Remanent Polarization + Linear Capacitance + Resistive Leakage
+ Other.

Logic 0 is a measurement that presets the polarization state so that the measurement does not sample polarization state. It contains polarization components:

Non-Remanent Polarization + Linear Capacitance + Resistive Leakage + Other.

Where:

- Non-remanent polarization is polarization that switches with the application of voltage, but rerandomizes at zero Volts.
- Remanent polarization is polarization that switches with the application of voltage and remains switched at zero Volts. This is the desirable polarization component in ferroelectric capacitors.

8. **TDC Hysteresis (QL)** () - Some components of a polarization measurement will vary with measurement period (ms). These are known as Time-Dependent Components. They are equivalent to Frequency-Dependent Components, where Frequency (Hz) = 1000/Period (ms). (By extension, Period (ms) = 1000/Frequency (Hz).) These components are normally, though not always, undesirable. Resistive Leakage is a primary Time-Dependent Component of a polarization measurement. This Task takes two Hysteresis measurements at the same voltage, but differing pe-

riods (ms) and derives the Time-Dependent Component from the measurements. It then compensates one of the two measurements, as selected by the user, to eliminate the Time-Dependent Component.



VI.2.4: Long-Duration Tasks

This is a suite of Tasks whose execution is extended in time, usually over several stress/measure sequences. The stress portion of the sequence is often extended over time and is variable in time from sequence to sequence. These Tasks are notable in several ways relating to the fact that execution is extended. First, they do not appear in the QuikLook menu. This is because, by their nature, they would not be executed if data were not to be stored. Second, the user may follow the Task progress because these plot their data as they are executed, unlike most Measurement Task that require a Filter. Finally, these Tasks are able to export their data on execution and do not require a Print/Export Filter to do so.

1. **Fatigue** () – It performs a standard [PUND](#) measurement, then repeatedly cycles through a waveform stress period and PUND measurement pair. The stress period can be modified at each sequence, normally resulting in longer and longer periods between measurements. Fatigue differs from other Tasks in that it does not require a Filter ([described below](#)) in order to plot during execution. Since Fatigue is a long duration Task, it provides its own updated plot without using a Filter. It also exports data without the need for the Print/Export Filter.
2. **Imprint** () - The Imprint Task measures the growth of the Imprint damage mechanism by applying a sequence in which the sample is poled, raised to an elevated temperature for a time, reduced in temperature and measured. The sequence can be repeated for a programmed number of times and the duration of the imprinting temperature can be automatically adjusted at each iteration. The measurement establishes a Figure of Merit that is based on the shift in coercive voltage as the Hysteresis loop shifts horizontally away from center in a direction opposite the imprinted state as imprint grows. This program normally requires automatic adjustment of a thermal controller as in the Set Temperature Task. However, the Task may operate with the temperature adjusted manually.
3. **Long-Duration Current** () - This Task measures the current through the sample at regular, user-defined intervals, as the sample is stressed by a series of DC Bias voltages, each of independent voltage and duration (s).
4. **Resist** () - The Task measures the current through the sample at a fixed voltage. It then performs a stress/measure sequence in which a DC Bias is applied to the sample for a period of time and then removed so that the sample's current can again be measured. The measurement sequence is repeated for a programmed number of times. At each iteration the duration of the stress Bias is adjusted in a programmed way. This Task measures the Time-Dependent Dielectric Breakdown (TDDB).
5. **Retain** () - In this Task the sample is preset to a polarization state and then held in that state for a period of time. At the end of the period the two pulse measurements are applied to the sample to characterize the amount of Remanent polarization that remains

in the sample after the delay. The delay/measure sequence is repeated for a programmable number of times with the delay adjusted at each iteration in a programmable way. A bias voltage can be applied to the sample during the delay period.

VI.2.5: Magneto-Electrics (CS 2.5) Tasks

This suite of custom Tasks must be purchased and licensed. The license normally accompanies the purchase of the Radiant Technologies Magneto-Electric bundle that includes the Radiant Technologies, Inc. CS 2.5 Current Source. These Tasks are specifically intended to operate with the CS 2.5. The CS 2.5 is an I2C-controlled instrument connected to a Precision tester. It is primarily a constant current source that outputs a current (Amps) that is linearly related to an input voltage by $A = 0.25 V$. The current output can also be controlled programmatically with no input voltage. The output current is limited to a range of $\pm 2.0 A$. The CS 2.5 also has two ± 10.0 -Volt outputs. These are controlled programmatically from within Vision. For magneto-electric purposes, the output current is normally routed as input to a Helmholtz Coil. The ± 10.0 -Volt output(s) can be used to operate fixed magnets.

1. **CS 2.5 Current (QL)** () - The Task programmatically sets a specific DC output current at the CS 2.5. The current is not related to an input voltage at the CS 2.5. Once the current is set, the Task exits. The current must be halted by 0.0 A execution of the Task or by other means.
2. **DC Magnetic Field (CS 2.5) (QL)** () - The Task sets a specific DC magnetic field (G) by applying a constant input voltage to the fixed magnet amplifier. To achieve the specified field, the user must enter a *Field-to-Volts Ratio (G/A)* that comprise the G/A ratio of the fixed X the A/V ratio of the magnet amplifier. The fixed voltage is applied programmatically through the CS 2.5 Field Bias 1 or Field Bias 2 voltage source.
3. **Magneto-Electric Response (CS 2.5) (QL)** () - This Task measures a sample's polarization response to the application of a periodic magnetic field. It is equivalent to a Hysteresis measurement that replaces the voltage stimulus with the magnetic field stimulus.
4. **Single-Point C/V (MR) (CS 2.5) (QL)** () - This Task performs a standard Single-Point C/V measurement in the presence of a fixed magnetic field. (No Help Project Available as of this Writing.)

VI.2.5: Magneto-Electrics (Generic) Tasks

This suite of custom Tasks must be purchased and licensed. The license normally accompanies the purchase of the Radiant Technologies Magneto-Electric bundle that is to be associated with another manufacturer's current amplifier. The original magneto bundle included the Kepco BOP 36 amplifier. But any amplifier associated with an electromagnet or Helmholtz Coil may be used.. Experiments are often configured using two sets of magnetic

field generators: A Helmholtz Coil that can be driven with a periodic signal and a fixed electromagnet providing a DC field. The control of the fixed magnet amplifier is provided by an RTI I²C Voltage Controller.

1. **DC Magnetic Field (Generic) (QL)** () - The Task sets a DC magnetic field on a fixed electromagnet by providing a fixed voltage into the magnet amplifier through the I²C Voltage Controller (**Figure 2**, above). The user must know the ratio of the fixed magnet field output to the amplifier input voltage, given as *Field-to-Volts Ratio (G/V)*.
2. **ME Sensor Cal (Generic) (QL)** () - The actual magnetic field applied to the sample during a measurement can be inferred or measured in a number of ways. The voltage applied to the current amplifier is known. Scaling this voltage by the appropriate ratios - Voltage x Amplifier Amps/Volt x Helmholtz Coil Field (G)/Amp - gives an accurate estimate of the field, provided the ratios are accurate. Inserting an RTI Current Sensor into the signal path eliminates one of the ratios by measuring the current into the Helmholtz Coil directly. Then Field = Current Amps x Helmholtz Coil Field (G)/Amp. Or the field can be measured directly using a Gaussmeter. In some cases the Gaussmeter detector cannot be physically present during the actual measurement. In this case its contribution must be measured off-line. More recently, Radiant Technologies, Inc. Magnetic Shield Boxes incorporate two Hall-Effect Sensors - one perpendicular to the sample that measures field parallel to the sample and the other parallel to the sample, measuring field perpendicular to the sample. This Task allows any or all of these measurement techniques to be characterized and linearly related over a series of stepped fields, with each step providing a DC field for an extended period so that values can be captured.
1. **Magneto-Electric Response (Generic) (QL)** () - This Task measures a sample's polarization response to the application of a periodic magnetic field. It is equivalent to a Hysteresis measurement that replaces the voltage stimulus with the magnetic field stimulus.
1. **Single-Point C/V (MR) (Generic) (QL)** () - This Task performs a standard Single-Point C/V measurement in the presence of a fixed magnetic field.

VI.2.6: Piezo Tasks

This suite of custom Tasks must be purchased and licensed. The Piezo Tasks are Tasks that capture the SENSOR port voltage simultaneously with the measurement. The voltage at the SENSOR port is assumed to be linearly related to the sample's displacement, captured by some form of displacement sensor. That instrument must output a voltage in the ±10.0-Volt range and the voltage is linear with respect to the measured voltage. Piezo Tasks perform displacement analysis on the SENSOR port signal.

1. **Piezo (QL)** () - Piezo adds the measurement of a piezo-electric sample displacement to the [Hysteresis](#) Task. Normally the displacement signal is provided by an MTI-2000 displacement meter, provided by Radiant Technologies, Inc., that linearly relates sample displacement to a voltage that is detected by the Precision hardware and the Piezo Task. Any displacement meter that provides a voltage that relates linearly to displacement may be used. Thin film samples may be measured by attaching an AFM.

2. **Advanced Piezo** () - Although the Advanced Piezo Task serves the piezoelectric measurement needs of any experimental situation, the Task is primarily intended for users whose displacement measurements are small relative to displacement signal noise and/or users who have a constant linear drift in their displacement signal. In particular, the Task serves well for, and is targeted at, thin film measurements made on an Atomic Force Microscope (AFM). The Task performs repeated measurements, over a user-programmed number of iterations (1-10) and averages these to produce a noise-reduced measurement. The averaged (processed) data and all of the raw measurements are stored and available for data recall and display. The user may optionally zero the processed data by subtracting the initial displacement value from all sample points in the data. An optional weighted smoothing average may be passed over the processed data to further reduce noise. Finally, linear drift throughout the measurement may be removed either manually, by providing a constant known drift term, or automatically, by incrementally removing the difference between the first and last displacement value.

VI.2.7: Pulse Tasks

Pulse Tasks are Measurement Tasks that take data from the sample by performing one or more voltage pulses on the sample. Data are measured both at the peak voltage and after the voltage has returned from the pulse.

1. **Simple Pulse (QL)** () – A single pulse is applied to the sample. The pulse may be read/write or write-only. A write-only pulse would be used to preset the sample to a known state. No measurement is returned from a write-only pulse. Pre-pulse voltage may be set to a non-zero value for a controllable period of time. After the pulse a non-zero end voltage may be specified to which the drive voltage is set. This end voltage will be maintained until the post-pulse measurement is made, then voltage will return to zero.

2. **General Pulse** () – A series of between 1 and 5 completely independent pulses. Start voltage, pulse voltage, pulse width end voltage and read or write-only characteristics of the pulses can be independently varied. Any pulses may be completely disabled to create a pulse train that has fewer than the maximum 5 pulses.

3. **PUND** () – A standard ferroelectric pulse test consisting of a sequence of five

pulses. The first pulse is write-only and presets the sample to a known state. The four following pulses are read pulses that alternatively switch, then maintain the sample polarization state during the pulses. Eight values are taken. P^* values represent measurements of the switching pulses. P^\wedge values are taken from the non-switching pulses. The first two-pulse sequence measures positive response and the second sequence the negative response. An “r” subscript indicates that the measurement was taken after the pulse voltage returned to zero volts. Its absence indicates that the measurement was taken at the maximum voltage application. The resulting parameters are $\pm P^*$, $\pm P^*_r$, $\pm P^\wedge$ and $\pm P^\wedge_r$.

VI.2.8: Transistor Task

This suite of custom Tasks must be purchased and licensed. These three Tasks characterize the current through a sample by providing a Gate-Source Voltage (V_{GS}) through the tester DRIVE port and a Drain-Source Voltage (V_{DS}) using an I²C Voltage Controller (**Figure 2**, above).

1. **Transistor Current (QL)** () - This Task is analogous to the standard Leakage Task. Here, the current through the transistor sample is measured at fixed V_{GS} and V_{DS} for a user-specified period. A user-controlled *Soak Time (ms)* is applied after the step to the voltages to allow step-induced charge movement to settle and ensure that the sample is at steady state.
2. **Transistor I/V** () - This Task extends Transistor Current in the same way that the I/V Task extends Leakage. The Task makes repeated Transistor Current measurements, over a profile that varies V_{GS} to \pm DRIVE Volts (V_{gs}) using a linear or triangular profile. The sample may be preset by applying a voltage opposite the maximum voltage for the measurement leg (switched) or in the same direction of the voltage of the measurement leg (unswitched).
3. **Transistor Curve Trace** () - Here, the Transistor Current measurement is extended into a third dimension by repeating the Transistor V_{DS} curves while stepping V_{GS} in fixed increments over a user-defined number of measurements.

VI.3: Parasitics Tasks

The purpose of these two Tasks is to measure and store the influence of tester electronics on captured data (parasitics). The measured noise is then removed from standard data measurements to render them more accurate. This process consists of a single Measurement Task and a single Filter Task. The two Tasks have been grouped together into their own category.

1. **Parasitics (QL)** () - The Parasitics Task works in tandem with the Compensation Filter Task. This Task performs a measurement, selected by the user, on an unloaded tester. The purpose is to characterize the parasitic contribution of the tester's internal elec-

tronics to the measurement in question. The results can then be saved to a file as a permanent record of system parasitics for the particular measurement under the particular configuration specified by the user. The Parasitics (Compensation) Filter Task can then take input from a loaded measurement and subtract the parasitic contribution by recalling it from the file. This device is particularly useful in the measurement of very small samples whose response may have a significant contribution from internal system parasitic values. Along with the Parasitics Filter Task, Parasitics is placed in its own folder, named "Parasitics", in the Library.

2. **Compensation Filter** () - This Task has been added in conjunction and works together with the Parasitics measurement Task. Together with the Parasitics Task, it is listed separately in its own Folder named "Parasitics". This Task takes as its input a Measurement Task of type Hysteresis, Piezo, PUND, Simple Pulse or General Pulse. It also takes as input a file that was generated by the Parasitics Task when making a measurement of the chosen type with no sample attached (unloaded). That file represents response generated by the tester electronics that is very low. The file is checked for agreement with the input Task in measurement type and general configuration, then the file data are subtracted from the measured data to remove system parasitics. This is very useful for measurements on extremely small samples that have low signal of which a significant portion may be system parasitics.

VI.4: Program Control Tasks

Program Control Tasks are Tasks that can be combined with Hardware and Filter Tasks in the design of a program or Test Definition. These Tasks are used to regulate experimental flow and sequencing. Some are used to document the Test Definition.

1. **Close All Plots** () - When this Task executes all plots generated by Filter Tasks and/or Long-Duration Measurement Tasks will be removed from the User Area. This Task must be used carefully. If it is included in a Branch Loop with a Filter Task that is operating in Append Mode, the Filter Task will crash after the first Branch Loop iteration since there is no plot to append data to.
2. **Delay** () - This Task pauses Test Definition execution for a user-specified period of time (s). During that period, a progress dialog is displayed. The progress dialog can be configured to display a message, known as a prompt. The prompt may have a single User Variable appended to it to monitor some property of the Test Definition. The delay period may be manually abbreviated by clicking *Cancel*. Loop Abort also abbreviates the delay and will force any subsequent Branch Task to stop Branch Looping regardless of the state of the Branch Logic Condition.
3. **Delay To Time** () - This Task pauses Test Definition execution until the Vision host computer clock reaches a programmed date and time. The Task displays a count-down dialog while waiting for the programmed time. At that programmed time the dialog closes.

es and the Task passes execution to the next Task in the Test Definition. The count-down dialog can be used to abbreviate the delay, with an option to abort any Branch Looping. A drawback of this Task is that it cannot be repeatedly executed in a Test Definition without reprogramming before each execution. For the same reason, the Task will only be effective during the first iteration of a Branch Loop.

4. **File Start/Abort (X)** - This Task pauses Test Definition execution until Vision detects C:\DataSets\StartTest\Start.txt or C:\DataSets\StartTest\Abort.txt. The Task also presents a dialog on execution at which the Test Definition may be manually started or aborted. On detecting a file or a dialog button click the Task will close the dialog and either pass execution to the next Task in the Test Definition or abort Test Definition execution.
5. **Pause (X)** - On execution this Task displays a dialog and waits for a user to close it. The dialog can display a prompt string and the prompt string can have a single User Variable appended to it to display the state of some property of the Test Definition. The user may cause any Branch Task that follows the Pause Task to stop Branch Looping regardless of the state of the Branch Logic Condition. This Task is particularly useful in Test Definitions that require physical reconfiguration, such as moving a probe tip from one sample to another.

VI.4.1: Branch Tasks

Branch Task and Branch Looping – The Branch Task is a very special Task. Using this Task a loop can be created within an experiment allowing any series of Tasks to be repeatedly executed in sequence. Thus a simple series of a few Tasks can be used to create a large and complex experiment. A loop is created by inserting the Branch Task immediately after the series of Tasks that is to be repeated. In the Branch configuration, a preceding Task is selected as the Branch Target. When execution reaches the Branch Task it may return to the Branch Target. The decision to return execution to the Branch Target or continue execution with the following Task is made by the Branch Task based on a logical comparison (Branch Logic Condition), programmed by the user, between a Global User Variable and a user-defined constant value. Note that Branch Tasks will not Branch to Branch Target Tasks that follow the Branch in the experimental Task sequence. (No forward Branching.) Branch Loops may not include other Branch Loops within them (no nested Branching). This is enforced by the software by showing only a list of eligible Tasks as Branch Target Tasks. Delay, DC Bias and Waveform Tasks may alter the length of their duration in a Branch Loop by repeatedly applying an increment or a scale factor to the previous duration. Most Measurement Tasks are able to adjust Task configuration parameters such as voltage or delays. These include voltage, frequency and pulse width adjustments as appropriate. Controls on the progress dialog of the Delay, DC Bias and Waveform Tasks, as well as the Pause, Manual Exit and Manual Branch Abort Tasks also allow the user to terminate the Branch Looping before the Branch Loop Condition fails.

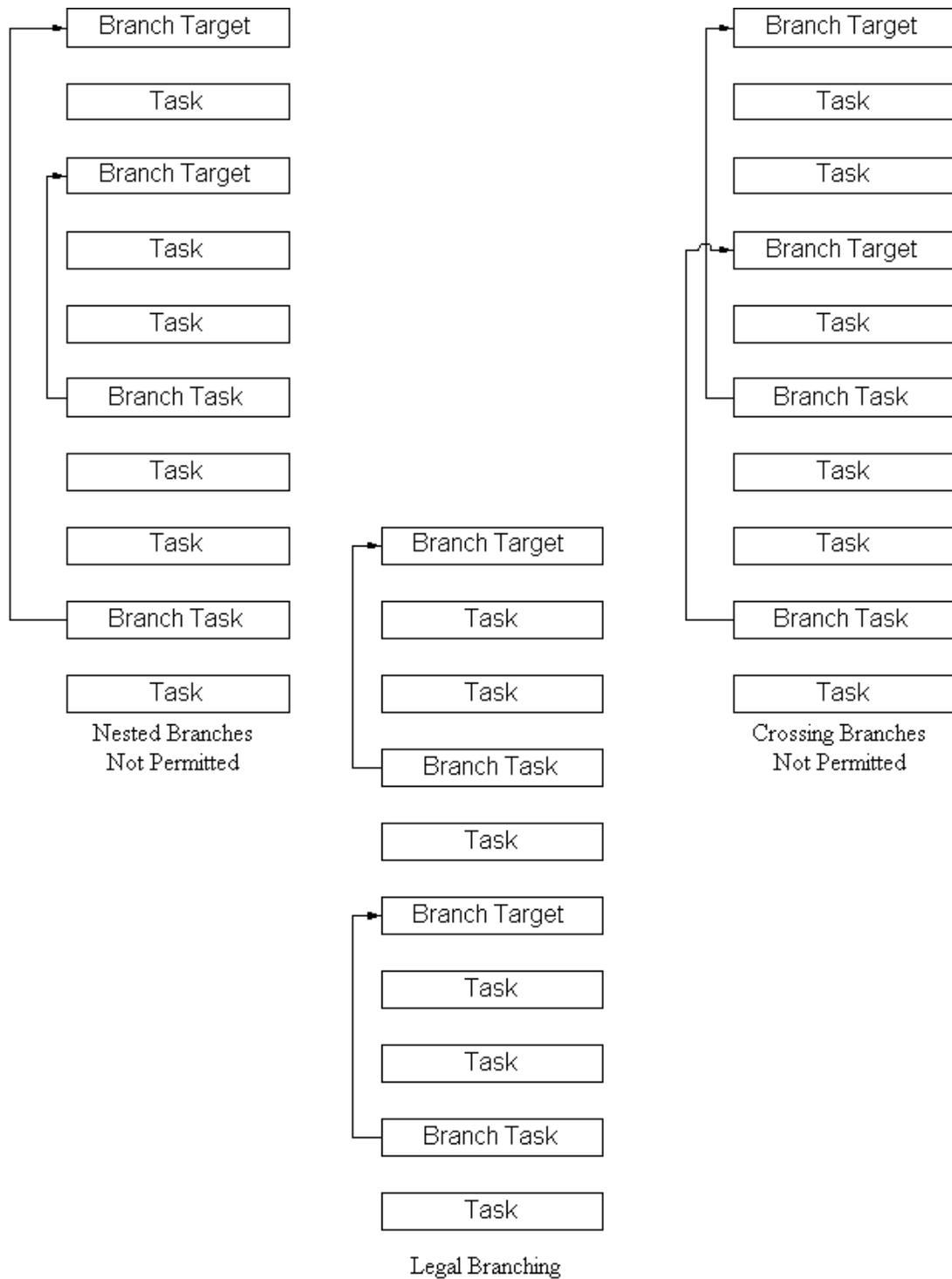


Figure 3 - Legal and Illegal Branching.

1. **Branch Task** (B_r) - This is the primary Task in a Branch structure. It compares the

current state of a User Variable to a fixed condition using a selected comparison. If the comparison is true ("Hysteresis: Current Volts < 20.0", for example) the Branch passes execution control back to the Branch Target Task. (Presumably, in this example, there is a Hysteresis Task that is adjusting its voltage in the Branch Loop.) If the comparison is not true ("Hysteresis: Current Volts >= 20.0") the Branch passes execution to the Task that follows it in the Test Definition. If no Task follows it, the Test Definition terminates.

2. **Auto Branch Abort (X)** - This is a convenient Task that is designed to be programmed into a Branch Loop. It performs a logic comparison between a User Variable and a fixed constant programmed value. Based on that comparison it either forces the subsequent Branch Task to abort branching or allows it to continue. This is identical to the way the Branch Task itself operates and is an option that allows the Branch to operate by depending on multiple User Variables or a User Variable with multiple limits. In other words, Branching can depend on more than one Branch Logic Condition.
3. **Manual Branch Abort (X)** - The Task is programmed into a Branch Loop and is used to force the subsequent Branch Task to stop Branching regardless of the state of its Branch Logic Condition.
4. **Timed Branch Abort (X)** - This is a combination of the Manual Branch Abort and Delay Tasks. Like the Manual Branch Abort Task, execution of the Timed Branch Abort Task presents a dialog that allows the user to abort a Branch Loop into which the Task is programmed or to allow the Branch to continue. However, the Manual Branch Abort has the disadvantage of freezing the execution of the Test Definition until the user responds. The Timed Branch Abort includes a programmable expiration time, presented to the user as a progress dialog during execution. If the user does not respond within the delay period, the Task will exit and not adjust the Branch Loop option. This allows the Manual Branch Abort option to be included in a Test Definition that can, nevertheless, run unsupervised.
5. **Nesting Branch Task (Br^N)** - This Task is identical to the Branch Task except that it allows one or more inner Branch Loops, defined by Branch Tasks and their Branch Targets to be programmed within an outer Branch Loop, defined by the Nesting Branch Task and its Branch Target. The Nesting Branch Task adds its own "Loop Counter - Nesting" User Variable. It also resets the standard "Loop Counter" User Variable to '1' to allow the nested Branch Loop to be controlled based on that User Variable. See [Tutorial VIII](#) for examples of the use of this Task.

VI.4.2: Documentation Tasks

1. **General Information (GI)** - This Task is normally the first, or nearly the first, Task

- in a Test Definition. It is not normally programmed into a Branch Loop. The Task is used to set experimental information such as the Sample Name, Area, Thickness, etc. a single time. Once the Task is configured, these values are persistent and automatically preset in each new Task added to the Test Definition. The main feature of this Task is a *Comments* box that is not limited to 511 characters. This allows for a lengthy and detailed description of the Test Definition. No known limit is placed on the number of characters, though there may be some practical limit such as 32,768.
2. **Hyperlink (X)** - On execution, the Task allows the user to insert any number of links to documents on the Vision host computer hard drive and/or to web browser html documents. The links can then be exercised at a later time when the Task is recalled from the DataSet Archive. The drawback of this Task is that the user must predict that documentation will need to be established at runtime.
 3. **Runtime Label (X)** - This Task presents a dialog on execution. The dialog allows both the *Task Name* to be changed and a *Comments* box to be written when the Task is run. The utility is that the user can make notes regarding the Test Definition as it is executing. The user must predict where and when such comments will be appropriate and must be present to acknowledge the Task as it executes.
 4. **Timed Runtime Label (X)** - This Task duplicates the Runtime Label Task. However, on execution it presents a progress dialog with a user-programmed expiration time. The dialog allows both the Task name to be changed and a comment box to be written when the Task is run. The utility is that the user can make notes regarding the Test Definition as it is executing. The user must predict where and when such comments will be appropriate and must be present to acknowledge the Task as it executes. The expiration time allows the Task to be programmed into a Test Definition that can be run unsupervised. The user may still interact with the Task and provide documentation, but if no interaction occurs, the Test Definition will continue to execute.

VI.4.3: Exit Tasks

Exit Tasks are Tasks that terminate the execution of a Test Definition prematurely.

1. **Automatic (Conditional) Exit (X)** – This Task also allows the experiment execution to terminate prematurely. However, the decision to terminate or continue is made by the Task itself, based on criteria programmed during its configuration. A comparison is made between a Global User Variable and a user-defined constant value. (See the discussion of [Global User Variables](#)). Depending on the results of that comparison, the experiment will either continue or will terminate.
2. **Manual Exit (X)** – This is a Task that allows the experiment execution to terminate prematurely. It will normally be inserted between Tasks in an experiment sequence.

The Task is identical to the Pause Task in its presentation. However, the user has a choice to either continue execution with the following Task (press *Continue*) or to terminate execution (press *Exit*). The Task also has a Prompt and appended Global User Variable available. This Task requires human intervention. If the Task allows the Test Definition to continue, a check box can be selected that will force a Branch Loop to terminate, assuming the Task is programmed into a Branch Loop, regardless of the state of the Branch Logic Condition. [See the discussion of the Branch Task](#) .

3. **Timed Exit (X)** - This Task is identical to the Manual Exit Task except that it will wait for user input only for a programmed period of time. If no input is received within that time, the Task will terminate and the Test Definition will continue normally. This allows an unsupervised Manual Exit Task to be inserted that will not prevent Test Definition execution if no human intervention occurs.

VI.4.4: If/Then/Endif Tasks

The If/Then and Endif Tasks work in a pair that allows the user to skip execution of the Tasks that form sections of a Test Definition.

1. **If/Then Task (X)** - As with the Branch, Nesting Branch, Auto Branch Abort and Auto Exit Tasks, the If/Then Task is configured by construction a logic condition out of the comparison of the current state of a User Variable with a fixed parameter. If the logic condition is false, the If/Then Task passes execution to the next Task in the Test Definition. However, if the logic condition is true, the If/Then Task will search the subsequent Tasks in the Test Definition, sequentially, until it locates the Endif Task and will pass execution to it, bypassing the intermediate Tasks. If there is no Endif Task, the execution will terminate, making the If/Then Task equivalent to an Auto Exit Task.
2. **Endif Task (X)** - The Endif Task performs no function. It simply serves as a place marker at the end of a sequence of Tasks in the Test Definition that may be skipped, based on a Logic Condition, by a preceding If/Then Task. If the Task sequence is skipped, execution will resume at the Endif Task.

VI.4.5: Timing Tasks

The Set Start Time and Elapsed Time Tasks work as a pair to mark the elapsed real clock time in a Test Definition.

1. **Set Start Time (X)** - The Set Start Time Task captures and records the Vision host computer clock date and time at the time of Task execution. The Task records the various Date/Time parameters (Month, Day, Hour, Minute, etc.) as well as the full date/time as both text and integer value User Variables. ("Set Start Time: Day (Text)", "Set Start Time: Day (Value)", etc.) This establishes the reference time for the Elapsed Time Task.

2. **Elapsed Time (X)** - On execution the Set Start Time Task captures and records the Vision host computer clock date and time and computes the difference from the time recorded by the Set Start Time Task. The Task records both the currently detected and elapsed Dat/Time parameters (Month, Day, Hour, Minute, etc.) as well as the full date/time as both text and integer value User Variables. ("Elapsed Time: Current Day (Text)", "Elapsed Time: Current Day (Value)", ("Elapsed Time: Elapsed Days (Text)", "Elapsed Time: Elapsed Days (Value)", etc.).

VI.4.6: User Variable Tasks

User Variables are elements on a list maintained by Vision that are accessible to the user to monitor the current state of the Vision program. Each User Variable has a unique name by which it is identified in all applications. It also has a type (Real, Integer, Text or Boolean) and a value of that type. As seen in early Task discussion, User Variables can be used to report the status of the program. They also play a very key role in programmatic control, forming the Logic Conditions of the Branch, Nesting Branch, Auto Branch Abort, Auto Exit and If/Then Tasks. Normally User Variables are added by the individual Tasks as they are accessed in Vision. However, the user may employ these Tasks to create and manipulate custom User Variables as well.

1. **Make User Variable (X)** - The Task allows the user to create a custom User Variable of user-programmed name, type and initial value. The User Variable may be referred to, as with any other User Variable, to provide information or program control. The Task is most useful when combined with the Update User Variable Task to modify the custom variable during program execution.
2. **Update User Variable (X)** - The Task allows the user to change the value stored in a User Variable based on the variable type and programmed update methods. It is included to allow the addition of custom variables using Make User Variable a useful tool in programming experiment sequencing and reviewing and analyzing data. However, there is no distinction between User Variables created by Tasks and those created by users, so this Task can alter any existing User Variable.
3. **User Variable Snapshot (X)** - The Task collects and stores the state of all listed User Variables at the time the Task executes.
4. **Selected User Variable Snapshot (X)** - The Task collects and stores the state of all listed User Variables at the time the Task executes.

VI.5: Filter Tasks

A very important category of Tasks is the Filter. In general, a Filter Task serves four functions.

1. Gather data from one or more preceding Measurement Tasks of like type or from a pre-

ceding Filter.

2. Manipulate the gathered data in accordance with the Filter function.
3. Store manipulated data.
4. Optionally display the data in a plot window.

The Filter is particularly important for three reasons. First, it is the only way to alter the original measured data. Altered data are then stored by the Filter for immediate recall, while the original data are stored unadulterated by the Task(s) that measured them. Secondly, data are not displayed to the user, during execution, by the Tasks that measured them. (The Fatigue and Retain Tasks, among others, are exceptions to this rule.) Instead, the data are simply stored. These data may then be regathered, during the execution of a Filter Task and displayed to the user. Third, data may be gathered from multiple Tasks (of identical type) so that a single plot window may display several measurements. Most Filters can collect input data vectors from either Measurement Tasks or from other Filters so that data may be repeatedly filtered.

Since Filters can take their data from preceding Filters as well as from Measurement Tasks, the data can be manipulated in stages. Plotting can be enabled or disabled for any of the Filters, so that the progression of data manipulation can be observed as it occurs.

1. **Collect/Plot Filter** () - This Filter does not perform any data manipulation, but simply gathers data from any measurement and optionally displays them. (Data simply pass through the Filter, thus the original name of Pass-Through Filter.) Data gathering and plotting options are sophisticated and varied. If plotting data and operating in a Branch Loop the Filter can be configured to Append collected data to a single plot or generate a new plot at each Task execution This is a common option to most Filter Tasks.
2. **Generic Axis Collect/Plot Filter** () - This Task is identical to the Collect/Plot Filter except that the independent X-Axis value is taken from the Y-Axis parameter of a single input Tasks of the same or different type as the collected input data. Since only a single Y-Axis vector can be input as the X-axis of this Filter, the Filter X-Axis input types are limited to Filters that output only a single data vector. These include Single-Input Single-Point Filter, Single-Input Collect/Plot Filter, Single-Trace Loop Average Filter, Two-Trace Math Filter and the RT6000 and RT66A Data Import Filters.
3. **Long-Duration Collect/Plot Filter** () - This Filter gathers X- and Y-Axis data from one or more Long-Duration Tasks of a single type. Tasks include Advanced C/V, I/V, Transistor I/V, Chamber, Remanent Chamber, Fatigue, Imprint, Resist and Retain.
4. **Sensor Collect/Plot Filter** () - All measurement Tasks may collect , scale and offset SENSOR port voltage data simultaneously with their measurement. In order for the

SEDNSOR Port data to be distinguished from the measured data (normally polarization ($\mu\text{C}/\text{cm}^2$) data) when collected by Filters, a distinct Sensor Collect/Plot Filter is provided. This Filter, then collects the scaled and offset SENSOR port data as a function of the input Task(s) X-Axis parameter (normally Volts). The Task was created before the SENSOR 2 port was exposed for data collection. As a result, only SENSOR 1 data are collected by this Task.

5. **Sensor 2 Collect/Plot Filter** () - This Task is identical to the Sensor Collect/Plot Filter, except that it gathers only SENSOR 2 port data.
6. **Single-Input Sensor Collect/Plot Filter** () - This Task is identical to the Sensor Collect/Plot Filter, except that it gathers data only from a single input Task. It can capture SENSOR 1 or SENSOR 2 data, but not both. The intention is to allow the Task to output only a single X/Y data vector. This allows the Task to be used as input to other Filters, such as the Generic Axis Collect/Plot Filter and the Two-Trace Math Filter, that limit the number of input Tasks to a specific count.
7. **Single-Point Filter** () - This Filter is specifically intended to operate in a Branch Loop. It takes single-point parameters from its input Tasks and plots them as a function of a parameter that is changing in a Branch Loop. Single-point parameters are specific values measured by input Tasks or derived from the measured data. For example P_{Max} ($\mu\text{C}/\text{cm}^2$), $\pm P_R$ ($\mu\text{C}/\text{cm}^2$) and $\pm V_c$ for Hysteresis or $\pm P^*$ ($\mu\text{C}/\text{cm}^2$) and $\pm P^\wedge$ ($\mu\text{C}/\text{cm}^2$) for PUND.
8. **Single-Input Single-Point Filter** () - This Task is identical to the Single-Point Filter except that it limits the number of input Tasks to one and allows only one single-point parameter to be captured and plotted. The intention is to allow the Task to output only a single X/Y data vector. This allows the Task to be used as input to other Filters, such as the Generic Axis Collect/Plot Filter and the Two-Trace Math Filter, that limit the number of input Tasks to a specific count.
9. **Threshold Filter** () - The Threshold Filter Task is a very specific Task that reports the sample time at which one or both of the SENSOR ports passes a user-defined threshold voltage in a user-defined direction. The Threshold Filter takes its input from one or more Sensor Collect/Plot and/or Sensor 2 Collect/Plot Filter Tasks. Those Filters must be associated with Hysteresis-based Tasks that are configured to capture SENSOR 1 and/or SENSOR 2 data. The Sensor (2) Collect/Plot Filter must be configured to collect the SENSOR voltage data as a function of Hysteresis Sample time. The Filter may report any number of threshold crossings for a given input data vector.
10. **Single-Point Threshold Filter** () - This Task operates in a Branch Loop that contains a Delay Task. In general, the Delay Task is configured to adjust the delay time in the

Branch Loop. The Tasks takes, as input, measured data and time vectors from one or more Hysteresis Tasks that are configured to capture SENSOR 1 and/or SENSOR 2 port data. The Filter collects, plots and stores the first time vector point at which the measured data cross a user-defined threshold, in either the positive or negative direction, as a function of the current delay period.

VI.5.1: Averaging Filters

There are three Filter Tasks that present data that represent an average of data vectors.

1. **Multi-Trace Averaging (MTA) Filter** () - This Task takes two or more input vectors from two or more Measurement Tasks or Filters. It produces a single vector that is the average of all input vectors.
2. **Multi-Trace Loop Averaging (MTLA) Filter** () - The Filter is intended to operate in a Branch Loop. It takes as input any number of vectors and output twice the number of vectors. One set of vectors is the summation of the input data over the current number of Branch Loop iterations. The second series is the summation divided by the number of Branch Loop iterations, producing the input vector averaged with itself over the Branch Looping. This reduces random noise in the input data.
3. **Single-Trace Loop Averaging (STLA) Filter** () - This Filter is identical to the Multi-Trace Loop Average Filter except that it limits its input to a single vector. This, in turn, limits the Filter input Task types to those that generate only a single output vector. The intention is to allow the Task to output only the accumulate and averaged X/Y data vectors. This allows the Task to be used as input to other Filters, such as the Generic Axis Collect/Plot Filter and the Two-Trace Math Filter, that limit the number of input Tasks to a specific count. These take only the averaged data from the STLA Filter.

VI.5.2: Math Filters

A variety of Filters perform mathematical operations on the input data.

1. **Curve Fit Filter** () - The Filter fits the input data to a polynomial from a first degree (linear) fit up to a fourth degree fit. Exponential fits are also planned.
2. **Normalizing Filter** () - The Filter allows the input data to be normalized by a constant value that is user-defined or derived from a trace maximum or minimum positive or negative values. The maximum or minimum positive or negative value may vary as it is derived from the trace being operated on. Or it may be a constant value derived from one of the input traces, as selected by the user, and applied to all traces.

3. **Single-Trace Math Filter** () - This Task takes input from one or more Measurement Tasks or other Filters and produces one or more output vectors that are related to the input data through one of four operations: The name Single-Trace refers to the fact that the transform is applied independently to each input vector. Input vectors are not mathematically combined. Multiple inputs and outputs are allowed.
- Scale, then offset - $Y = m X + b$
 - Offset, then scale - $Y = m (X + b)$
 - Differentiation - This operation will produce an output vector that may have fewer points than the input vector. This is a noise reduction technique that is discussed in detail in the Task help pages.
 - Integration
4. **Two-Trace Math Filter** - This Task takes input of exactly two data vectors from two Tasks. It produces a single output vector that is the combination of the input vectors. The input data are combined in one of four ways.
- Addition
 - Subtraction
 - Multiplication
 - Division

The independent (X-axis) vector that is output can be programmed to be the independent vector from data input Task A, from Task B, an average of the two or the math may be applied to the independent data vectors as well. Because the Filter must Take exactly two input data vectors, it can only take data from input Filters if they are Filters that produce only a single output data vector, such as Multi-Trace Averaging.

5. **Time-Dependent Compensation (TDC) Filter** () - This Task derives frequency-dependent changes in polarization response from two Hysteresis input measurements and corrects one of the measurement for the frequency dependent component. The two Hysteresis input measurements are of the same voltage and point count and differ in frequency by a small factor of, at most, 2X or 3X. Note that "Time-Dependent" and "Frequency-Dependent" are equivalent. $\text{Frequency (Hz)} = 1000/\text{Period (ms)} \Rightarrow \text{Period (ms)} = 1000/\text{Frequency (Hz)}$.
6. **Trace Statistics Filter** () - In this Filter, one or more input traces is operated on to produce four real-valued numbers per trace that represent the Maximum, Minimum, Mean and Standard Deviation of the input trace over the number of points in the trace.

VI.5.3: Noise Reduction Filters

These two Filters work to reduce noise in measured Tasks and in Filtered Data.

1. **Smoothing Filter** () - The Task replaces the input dependent value at every point, i , with a weighed average of the values at point i and the n adjacent points before and after point i . (Points $i, i \pm 1, i \pm 2, \dots, i \pm n$.) This produces values that do not change the overall nature of the data vectors, but reduces high-frequency local noise.
2. **Subsample Filter** () - This Filter extracts approximately every n th point from the input data to produce a reduced data vector. n is specified by the user. The Task modifies n so that the first point and last point are always extracted while keeping the step size as close to n as possible. The reduced data can help reduce noise when the data are used in mathematical operations such as the denominator in a division or in a differentiation.

VI.5.4 - Sorting Filter

1. **Sorting Filter** () - Apply a name and evaluation to a sample measurement. (No Task Instructions are available for this Task at the time of writing.)

VI.5.5: Special Purpose Filters - These Filters do not take measured data from other Tasks. They perform special operations that defy categorization as anything but a Filter Task.

1. **Print/Export Filter** () - This is an unusual Filter in that it performs none of the four standard Filter functions. Instead, it calls upon assigned Tasks that precede it in the Test Definition to export themselves during execution. Data may be exported to a text file, to an Excel file, to a Word file or to the default printer. File export requires the specification of a file path and file name during configuration. In the case of a text file, data will be appended to a file if it already exists. In the case of Excel or Word files, an existing file will be overwritten. For this reason, indices are appended to file names to indicate a) which of the possibly multiple assigned Tasks is being recorded and b) the loop iteration in the eventuality that the Tasks are programmed into a Branch Loop. Re-execution of the same Test Definition will result in overwriting previous executions files. Before re-executing, either the existing files should be re-named or moved to a different file path or the Filter should be reconfigured. Any Task can be associated with the Print/Export Filter.
2. **RT66A-to-Vision and RT6000-to-Vision** () - These two Filters are presented to allow the users of the older generation Radiant Technology testers - the RT66A and the RT6000 series - to import their data into Vision where it can be stored, reviewed and compared directly with other Vision-acquired data. The Filters read data that have been stored in the original RT66A/RT6000 programs to the standard program text data file. Files of the type generated by Charge, Fatigue, Resist and Retain can be imported. The Filter automatically recognizes the file type and applies the correct im-

port filter. These Filters may be associated as data input with other Filters, so that the data can be linked with Vision-measured data for direct comparison. This option is only available if the Filter is importing from a Charge file. These Filters are especially unusual as Filters in that they are present in the QuikLook menu.

VI.5.6: Task-Specific Filters

These are Filters that perform specific operations on ferroelectric data taken from specific Tasks. These operations are those that are common in ferroelectric literature.

1. **Current Loop Filter** () - This Task takes Hysteresis input data and backs out the charge (μC) from the polarization ($\mu\text{C}/\text{cm}^2$). It then calculated dQ/dt for each measurement point. This gives the current (A) through the sample at each point.
2. **Hysteresis Filter** () - This Filter takes data only from the Hysteresis Task, Check Hysteresis Task or Remanent Hysteresis Task. It cannot accept data from other Filters. It applies one of the following operations to the data...
 - Centering
 - Capacitance Vs. Voltage
 - Normalized Capacitance Vs. Voltage
 - Normalized Capacitance Vs. Polarization
 - dP/dT Vs. Voltage
 - Several Integrated Polarization Scalings.
3. **Magneto-Electric Filter** () - The Filter collects polarization ($\mu\text{C}/\text{cm}^2$) data from one or more Magneto-Electric Response (CS 2.5) and/or Magneto-Electric Response (Generic) input Tasks. It applies one of a variety of mathematical manipulations on the data before plotting and storing. (No Task Instructions are available for this Task at the time of writing.)
4. **Piezo Filter** () - The Piezo Filter Task is identical to the Hysteresis Filter Task except that it takes as it input data from a Piezo Task. In addition to polarization data input and manipulation, the Piezo Filter Task accepts displacement data, captured at the tester SENSOR port and applies these filters:
 - No Filter
 - dL/dV
 - dL/dP
 - L/V
 - L/P

The Filter also allows both the polarization and displacement data to be (independently) normalized by the first or last measure point or the absolute of the maximum or

minimum (maximum negative) data value. The displacement data may also be zeroed by subtracting the value at the first data point from all data points. Finally, the displacement data may be compensated for linear drift that occurs over the course of the measurement. This final option may be allowed or suppressed depending on future Filter policy. This Filter is distributed in company with the Piezo Task. The Piezo Task must be purchased for this Filter to operate.

5. **Retain Filter** () - This Filter takes data only from Retain Tasks. It cannot accept data from other Filters. Input is taken from exactly two Retain Tasks (or a single Retain Task twice, though this is not of practical value). Any combination of the Top and Bottom measurements from Pulse one and/or Pulse two may be plotted for both input Tasks. The purpose of the Filter is to allow direct comparison of the two measurements. This is the most practical use of the Retain Tasks.

V.6: A Note on Tasks and Program Versioning

It is important to regard Vision as a collection of programs in which Vision is distinguished from the Tasks that perform within it. Vision provides the framework for Test Definition execution. It manages the EDITOR, the Library and the DataSet Explorer. It provides menus and responds to the selection of their options. It manages the Database and the Archiving of data into a DataSet.

Each Task constitutes a unique program, independent of Vision. Tasks can be added, modified or updated with no change to the Vision program. New and altered Tasks are updated simply by dropping their *.vlr file into the proper directory. Tasks may be added and/or altered on a daily basis. Though they will maintain the root version number of Vision, their versions may be incremented repeatedly and differ considerably one from the other and all from Vision. Tasks released with Version 5.13 will maintain version numbers of 5.13.0 until changed. As they change, they will adopt version numbers 5.13.x, with x increasing serially as the Task changes. The Vision version will remain fixed at 5.13.y. y will change only as the Vision framework itself changes.

VII - Global User Variables

VII: Global User Variables

Global User Variables are a very important entity in Vision. They are probably better understood by using them than by this brief description. After reading this description, please refer to Tutorial II, the discussion of the Branch Task, etc. to better understand this topic.

The Vision software maintains a long list of experimental parameters that may be referred to by the user for a variety of purposes. Parameters are specified by name and have a type (Real, Integer, Text or Boolean) and a value. The length and composition of the list depends on the Tasks that have been accessed either in programming the experiment, in running QuikLook measurements or by creating or opening experiments in earlier DataSets (See the discussions below for a description of [QuikLook](#) and [DataSet](#) objects.) A Task may add any number of named and typed values to the Global User Variable list. Measurement Tasks may add both configuration and measurement result variables to the list. For example a Hysteresis Task will add Hysteresis Delay and P_{Max} to the list (along with many other parameters.) A complete list of parameters is given in the [User Variables](#) help topic. Global User Variables can be displayed along with prompt strings in a variety of Tasks to allow the user to track the progress of some important parameter. The values are also used as control parameters in the Automatic Exit, Branch and Automatic Branch Abort Tasks. For example a Branch Task may include a Waveform Task in its Branch Loop. The Waveform Task may have its duration altered by scaling by a factor greater than 1.0. The Branch Task, in turn, may examine the Current Waveform Duration Global User Variable and continue to branch to the Branch Target until the Current Waveform Duration exceeds some duration. The Branch Task itself adds a Loop Counter as a Global User Variable. This might also be used to control the Branching.

In general, values of three types are maintained as User Variables...

1. Parameters that change during program execution. These might include, for example, voltages that are adjusted in a Branch Loop. Waveform, DC Bias and Delay Task duration is maintained as a value that can be altered from execution-to-execution.
2. Parameters that are of informative use, such as Sample Name or Area.
3. Value such as P^* in PUND or P_{Max} in Hysteresis that are returned as the result of a measurement.

Users may add their own custom User Variables for their own purposes. They may also update the value of any User Variable during the execution sequence of a Test Definition. This tool is intended for use with custom User Variables only, but there is no method for preventing automatic User Variables from being controlled by the User.

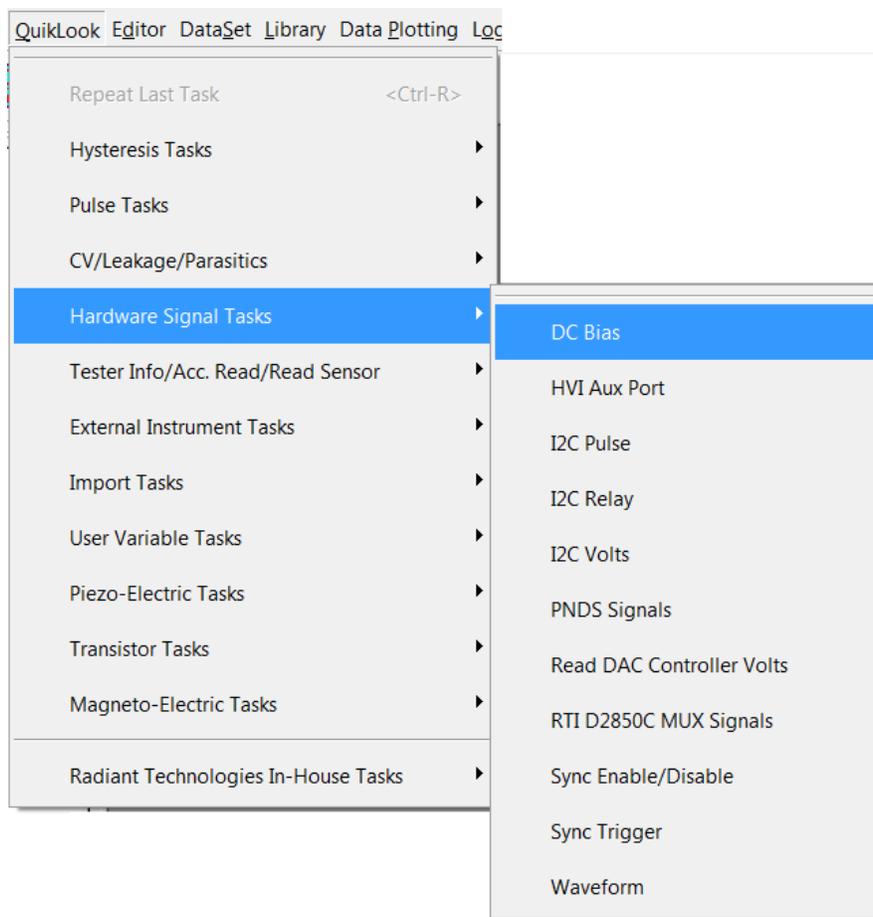
VIII - QuikLook and Exporting

VIII: QuikLook

VIII.1: Discussion

Most Hardware Tasks appear not only in the Library, but on the main menu bar under the QuikLook label. Selecting a Task in the QuikLook menu allows it to be configured and executed immediately without the need to design an experiment or create or open a DataSet. (See the discussion below on [DataSets](#).) The purpose of the QuikLook option is to allow a quick review of the response of a sample without concern regarding the maintenance of the resulting data. This might be used, for example, to locate a wafer that is acceptable for further, more formal testing. *QuikLook is not normally intended to save the measured data.*

When a Task is selected in the QuikLook menu (**Figure 1**), a configuration dialog will appear (**Figure 2**). For the DC Bias and Waveform Tasks, this is a single page. For most other Tasks this dialog is two-paged, with the second page allowing the plot to be configured. (Hysteresis Task **Figures 4 and 5**.)



Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

Figure 1 – QuikLook Menu with DC Bias Task Selected.

Figure 2 – QuikLook configuration dialog for DC Bias – User Variables are shown in the list box labeled *Parameter to Append to Prompt*.

Once the Task is configured, it will be executed on the current sample and its execution displayed. In the case of DC Bias and Waveform, execution appears as a progress dialog (Figure 3). For the measurement Tasks and the RT66A and RT6000 Import Filters the results are displayed on a dialog that includes a plot and fields that indicate configuration and measurement result parameters.

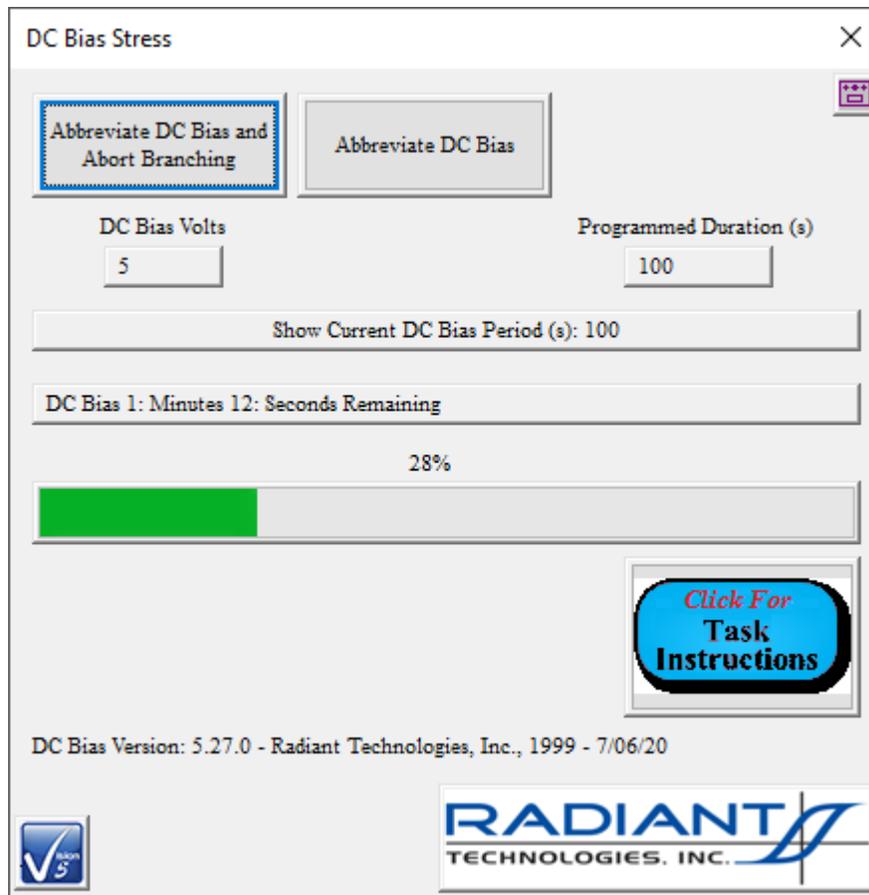


Figure 3 – QuikLook progress dialog for DC Bias stress. The prompt text "Current DC Bias Time (s):" has the User Variable "Current Bias Time" value of 100 appended to it.

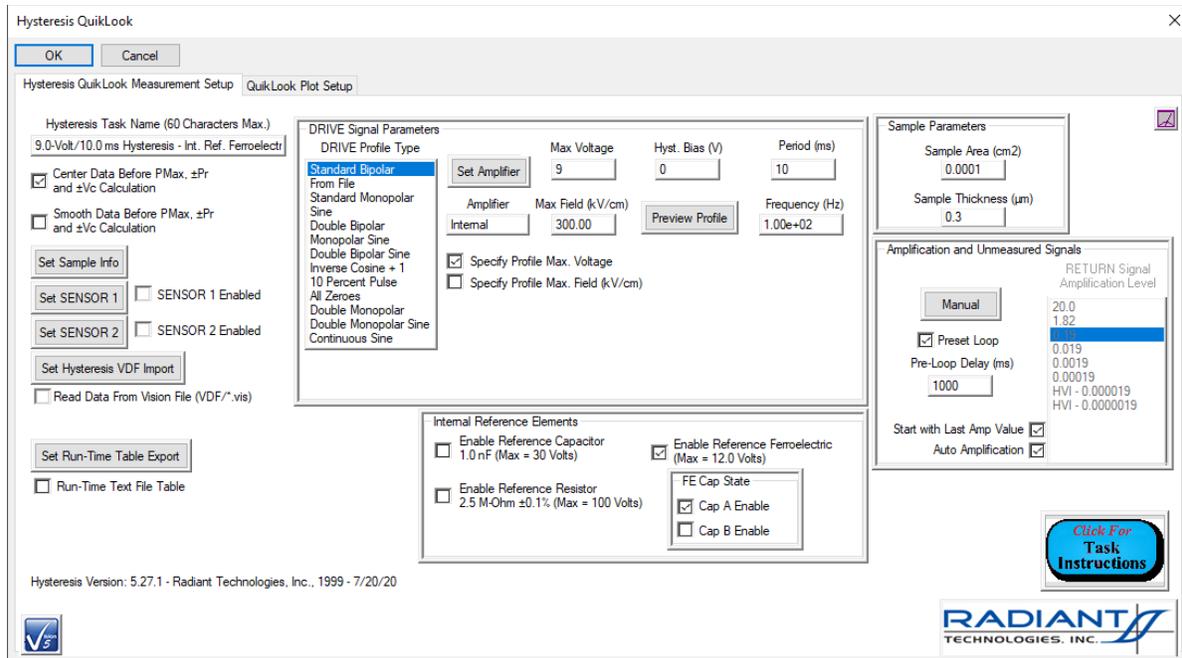


Figure 4 – Hysteresis Task QuikLook Configuration Dialog with Main and Plot Setup Tabs.

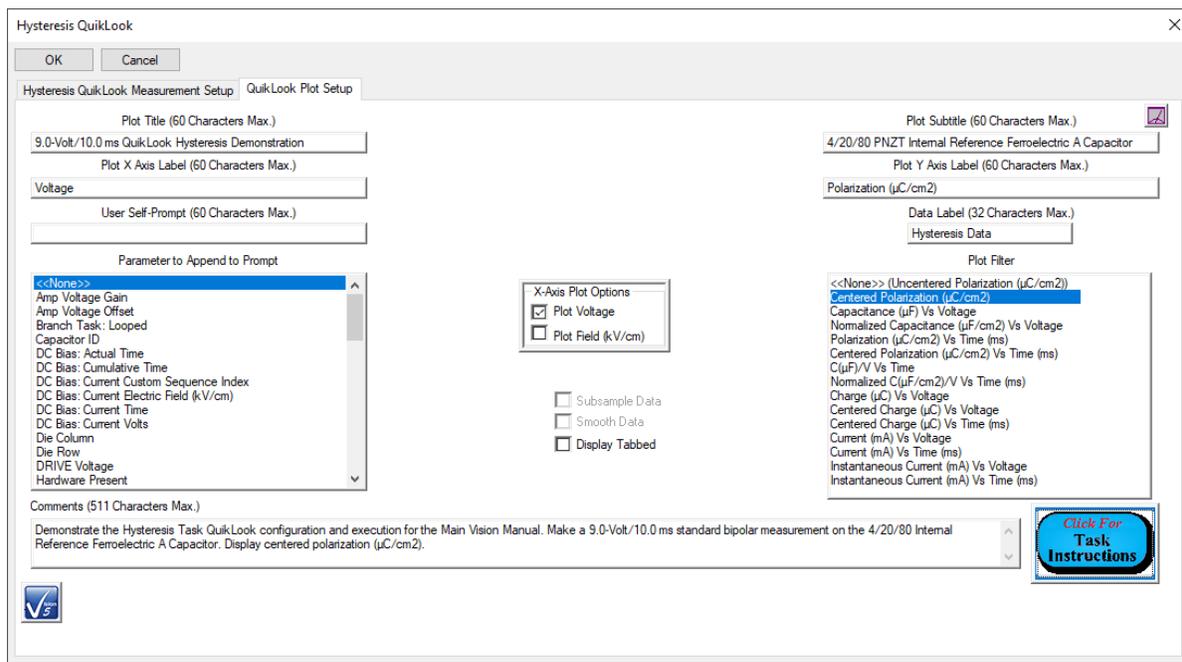


Figure 5 – Hysteresis Task QuikLook Plot Configuration Dialog.

VIII.2: Saving QuikLook Data

Although QuikLook measurements are not normally intended to be used to save data, there will

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

certainly be occasions in which it is important or even imperative that the measured data be saved. Several options are available to maintain a record of the data. One feature of Measurement QuikLook Tasks is to allow the user to create a DataSet from the results of the QuikLook measurement. For complete understanding, see the discussion of DataSets below. The results dialogs contain an labeled list box just above the *Task Instructions* button. The list box offers "Do Not Save" (default), "Save to Open DataSet" and "Save to New DataSet" options. If "Save to New DataSet" is selected before closing the dialog, the process of creating a new DataSet will be initiated. This option will be of value if a sample is found on which further experimentation is desired. The single measurement Task becomes the Current Test Definition (CTD) in the new DataSet, and the measured results will be added to the Executed Test Definition (ETD) in the Archive. More detail regarding this option is reserved until after DataSets have been fully introduced. "Save to Open DataSet" requires that a DataSet be opened in the DataSet Explorer.

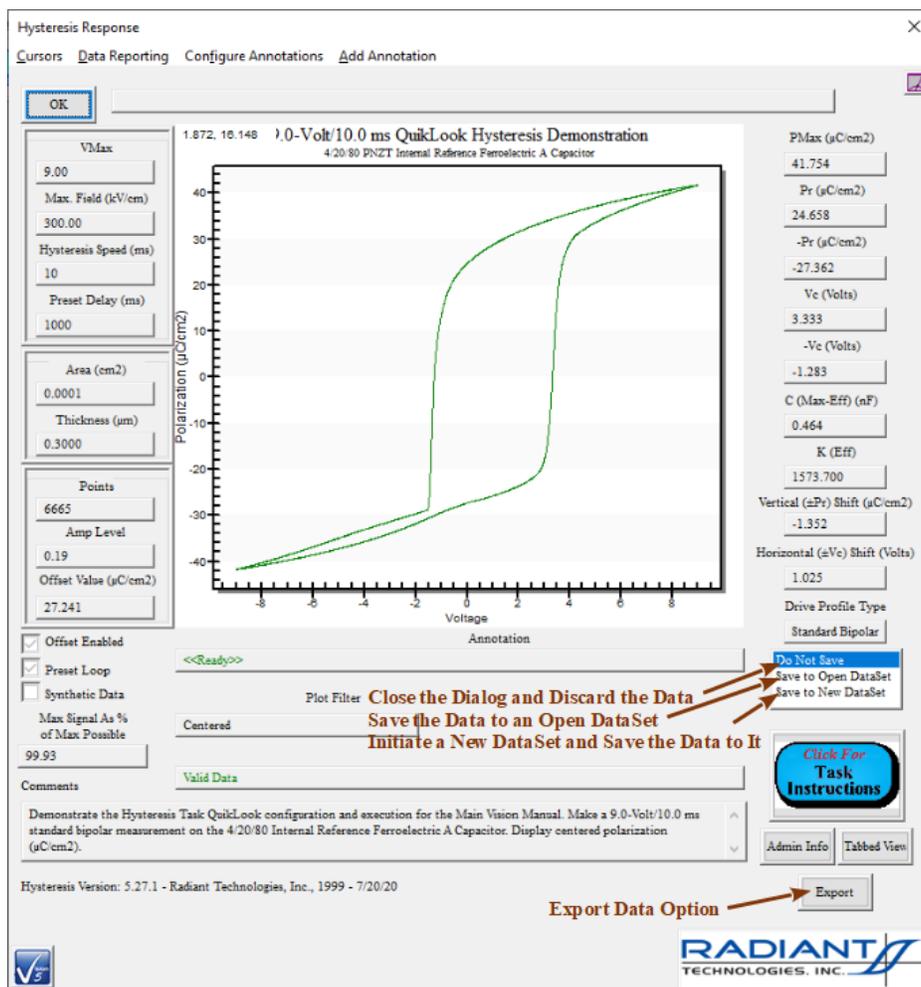


Figure 6a – Hysteresis QuikLook Results Dialog with Export Button and DataSet Saving Option.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

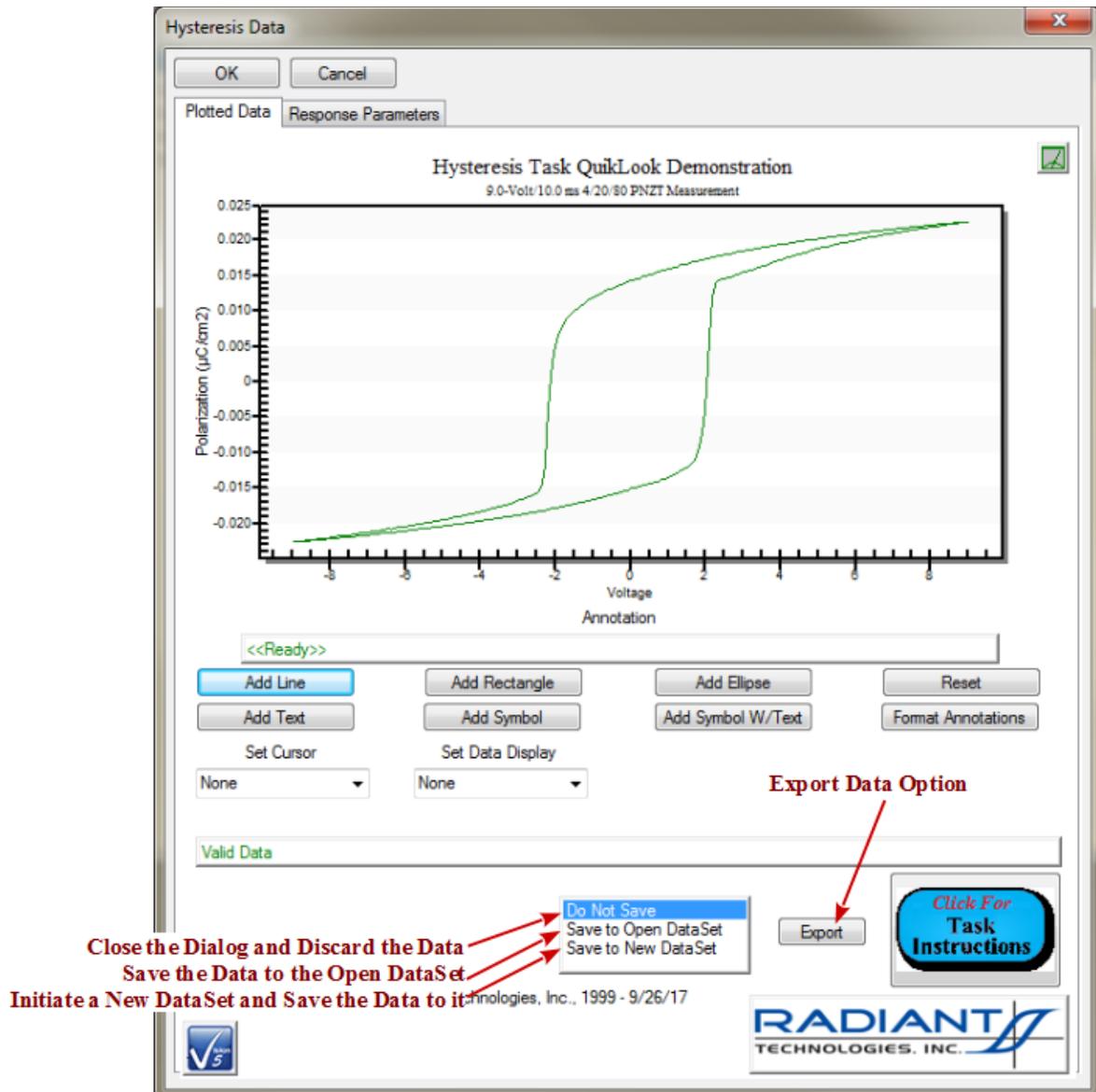


Figure 6b – Hysteresis QuikLook Results Tabbed (Reduced) View Dialog.

VIII.3: Exporting QuikLook Data

Another method of saving data from Tasks executed in QuikLook is to export their data using plotting tools discussed elsewhere. A more efficacious method for exporting is provided directly within Vision. An *Export* button has been added to the QuikLook results dialog as in **Figure 6**.

When this button is clicked an Export dialog appears (**Figure 7**).

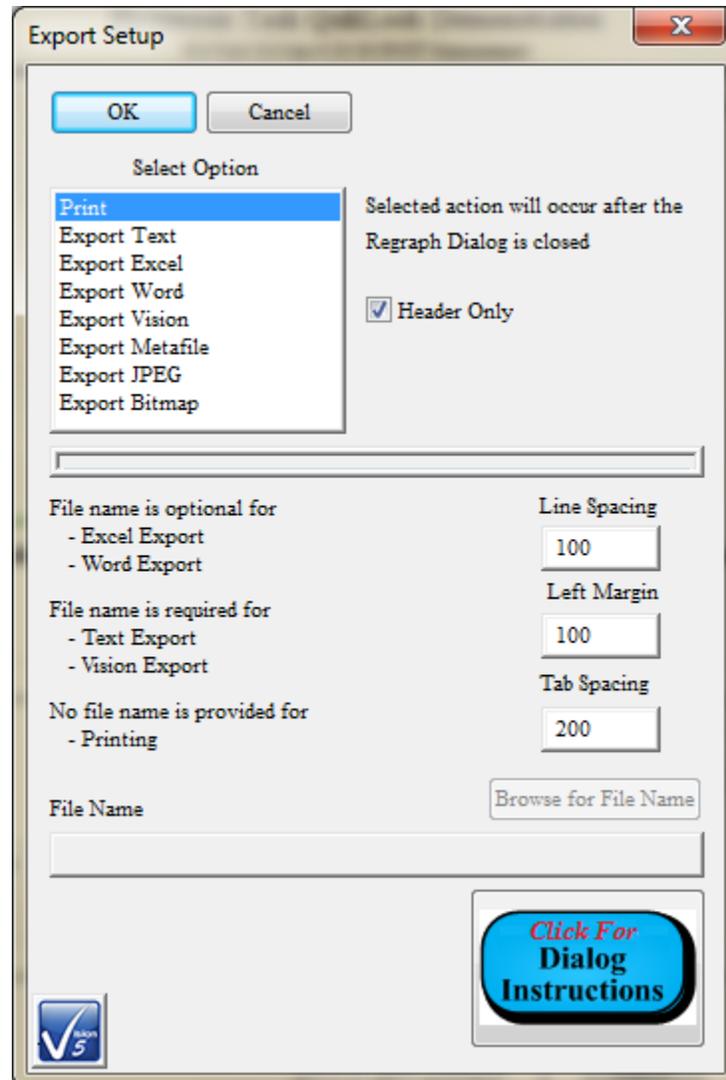


Figure 7 – The Export Dialog - Print Export Features.

Here the user may choose one of eight options:

1. **Print** - The Task data, including configuration and measured data, are sent to the default printer. A printer setup dialog will appear when the results dialog is closed (**Figure 8**). The printer option allows the user to adjust output line spacing, tab size and left margin. These values should be adjusted to create a proper output to the printer attached to the Precision tester or tester host computer. For most measurement Tasks, the dialog includes a *Header Only* control. When checked, line-by-line output of measured data is disabled to eliminate many output pages that include only columns of number. The printer dialog of **Figure 8** appears only when the Data Presentation dialog is closed. Printing may be cancelled from this dialog.

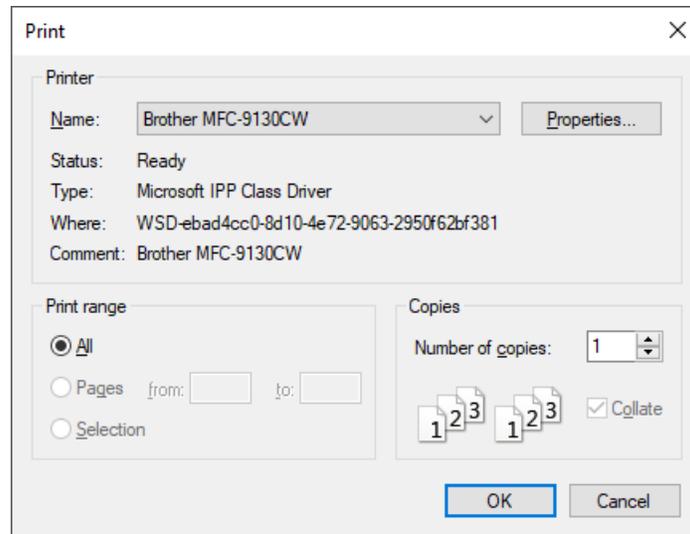


Figure 8 – Standard Windows Printer Configuration Dialog.

- Export Text** - The Task data, including configuration and measured data, are written to a text file in preformatted fashion.

Text output may not always align vertically. However, the user specifies a delimiter to segment the data into columns. When the data are imported into Excel, Origin or other data manipulation program they will align properly based on the selected delimiter.

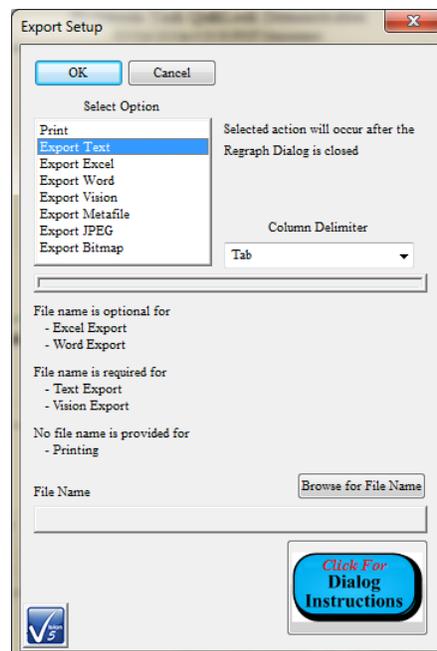


Figure 9 – Text File Output Configuration with *Column Delimiter* Selection.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

The *Browse for File Name* button is enabled for this selection and must be used to identify an output file path and file name. The output file may, but need not, exist. If it exists, text output will be appended to the existing text file.

The text file will not be created until the Data Presentation dialog is closed.

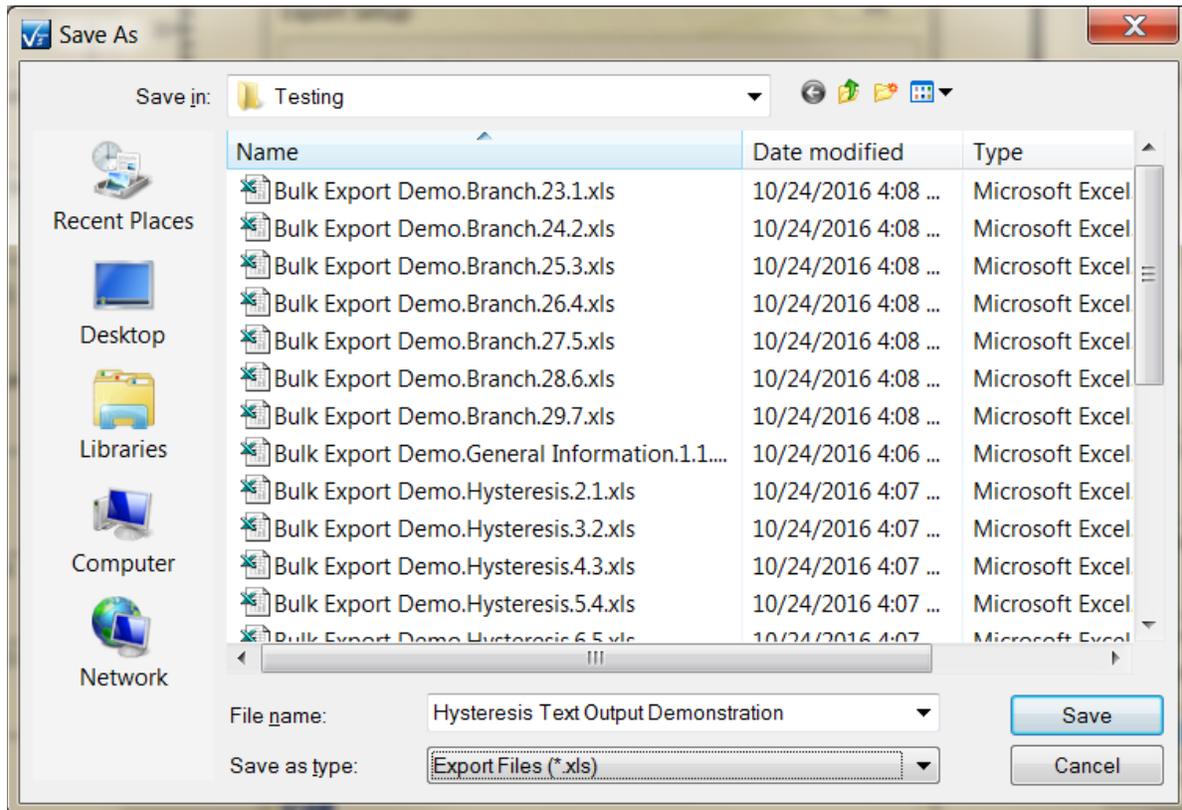


Figure 10 – Browse to Establish a File Path and File Name.

- Export Excel** - The Excel program is opened and Task data, including configuration and measured data, are written into the spreadsheet. A file name may be provided but is not required. If no file name is provided, the user will be prompted to provide one when the Excel spreadsheet is closed. If the specified file name already exists, the user will be prompted to overwrite. Microsoft Office 2000 or later must be installed on the Precision tester or host computer for this function to operate. Excel output and file saving will not occur until the Data Presentation dialog is closed.

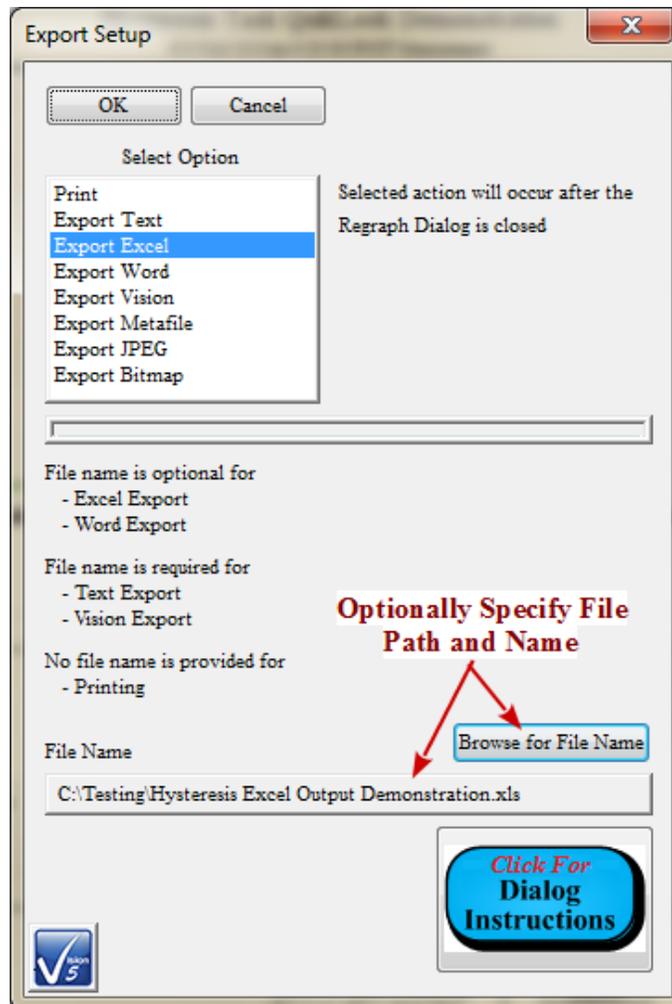


Figure 11 – Exporting to Microsoft Excel. The File Name is Optional.

4. **Export Word** - The Word program is opened and Task data, including configuration and measured data, are written into the document. A file name may be provided but is not required. If no file name is provided, the user will be prompted to provide one when the Word document is closed. If the specified file name already exists, the user will be prompted to overwrite. Microsoft Office 2000 or later must be installed on the Precision tester or host computer for this function to operate. As with Printer output, the Word option allows the user to select Header Only, eliminating lengthy columns of numbers. Word output and file saving will not occur until the Data Presentation dialog is closed.
5. **Vision Data File Exporting** - The option is available to Measurement Tasks and most Filter Tasks. Here a Task-specific file is created that contains complete Task configuration information and measured data. Subsequent executions of the same Task type can be configured to read their data in from an exported file, rather than performing a measure-

ment. They will also take on the configuration of the original Task that wrote the file. This simple mechanism provides a powerful advantage in that a single execution of a Task can now have its data passed into any DataSet and data can be shared among DataSets. This option requires that a file path and file name be specified. The utility of this feature is demonstrated in **Figure 12**. Vision Data File output will not occur until the Data Presentation dialog is closed.

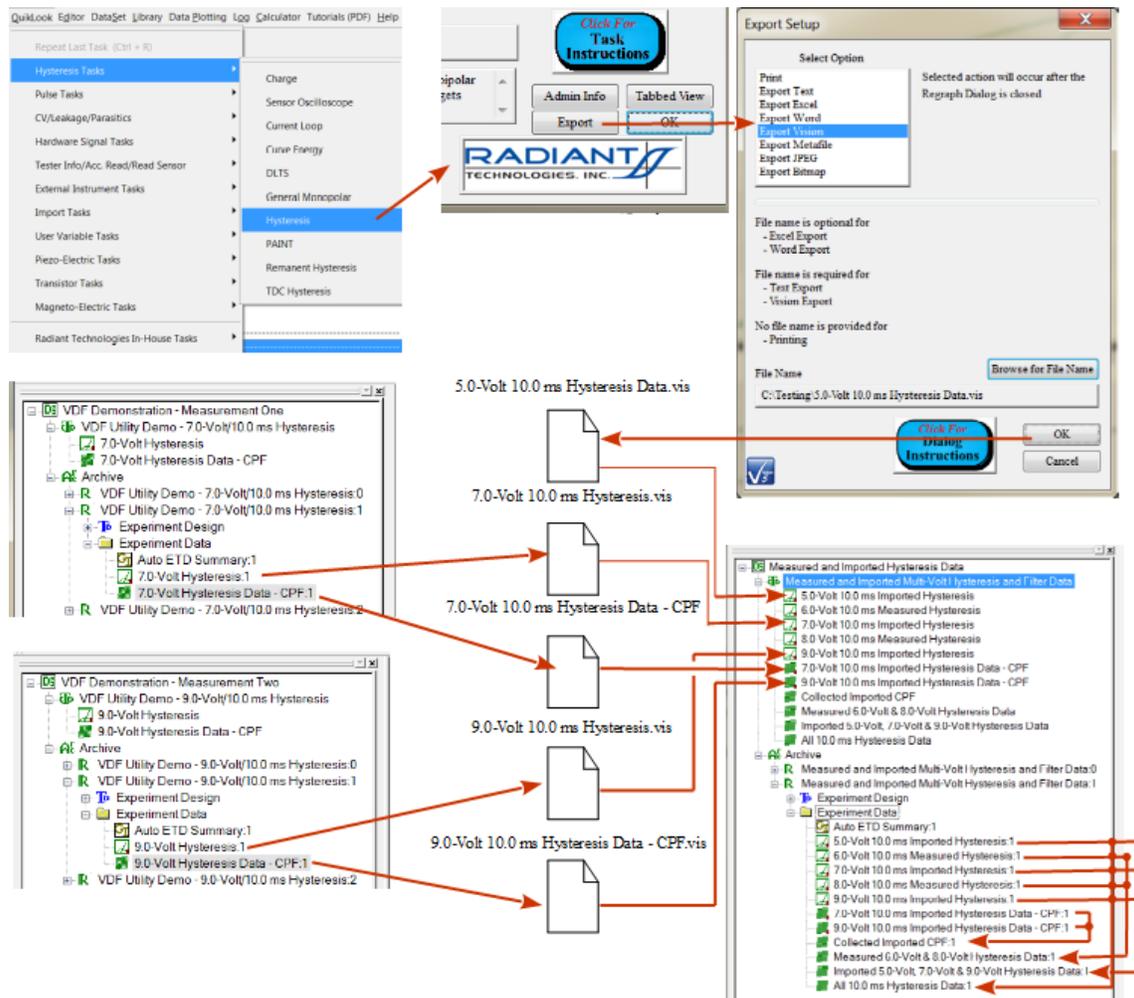


Figure 12 – Example Utility of Vision Data File Exporting.

6 - 8. Export Metafile, Export JPEG, Export Bitmap - These export options write the image of the plotted data to the selected image file type. The actual plotted image is used to create the output file. Unlike all other Export options, therefore, the output file is created as soon as the Export subdialog is closed and before the Data Presentation dialog is closed. An output file path and file name is required. File extensions are *.wmf, *.jpg and *.bmp, respectively.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

IX - EDITOR and Test Definitions

IX: The EDITOR Window and Experiment (Test Definition) Design.

For Tasks other than those initiated under the QuikLook menu, an experiment, or Test Definition must be constructed and moved into a DataSet for execution. The experiment consists of a sequence of Tasks of nearly arbitrary order and number. The construction and configuration of the Test Definition is performed entirely within the EDITOR window where Tasks are arranged sequentially, from-top-to-bottom, in the order that they are to execute. As new Tasks are added to the Test Definition they are appended to the bottom of the list.

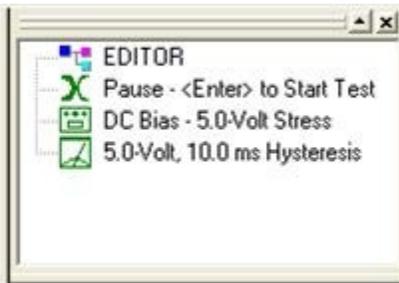


Figure 1 – EDITOR Window with a Partially Constructed Experiment or Test Definition Consisting of a Pause Task, a DC Bias Task and a Hysteresis Task.

By default, the EDITOR window (**Figure 1**) is located at the upper right of the Vision program screen. When the program starts, this window will be empty if the " Tools->Reload Editor Test Definition on Startup" menu option is unchecked. Otherwise, any Test Definition in the EDITOR when the program was last closed will be reloaded. The EDITOR is closely linked with the Library window. A Test Definition is constructed by moving Tasks from the Library into the EDITOR Window in the order that they are to appear in the experiment. A Task is inserted by selecting it in the Library with the left mouse button. It is dragged to the EDITOR by moving the mouse into the EDITOR window with the left button continuously held down. (This is known as Drag-and-Drop and is familiar to users of the Windows Explorer (**Figure 2**)). When the cursor is in the EDITOR window and the mouse button is released, the configuration dialog for the Task will appear (**Figure 3**). Note that the Task has not yet been added to the Test Definition and if the configuration dialog is *Canceled*, the Task will not be added to the EDITOR window. The Task may also be moved into the EDITOR by right-clicking it in the TASK LIBRARY and selecting "To Editor" from the popup menu. (Note that QuikLook Tasks are indicated by " (QL)" in the Task Library. QuikLook configuration and execution may be initiated by double-clicking the Task in the Library, or by right-clicking and selecting "QuikLook Execute".)

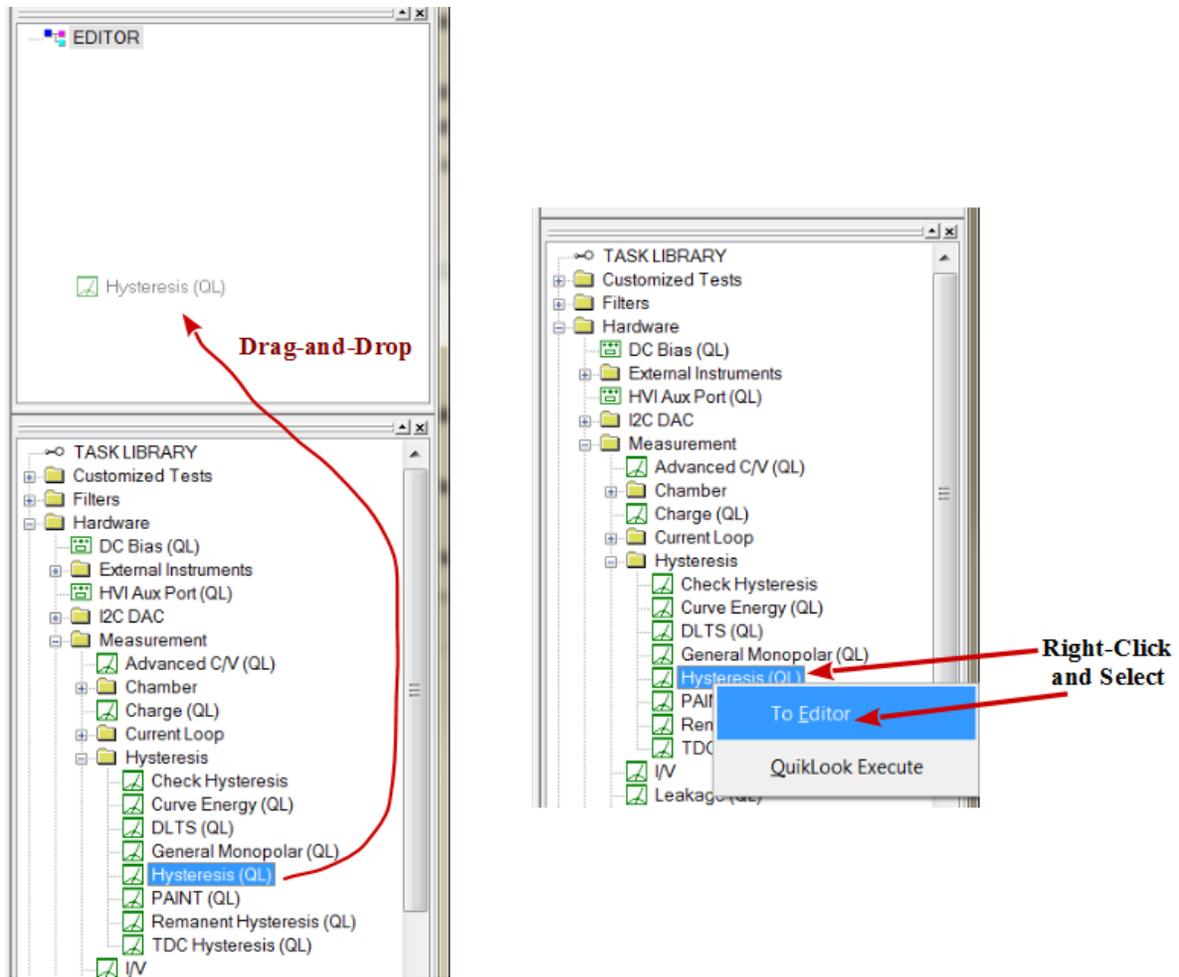


Figure 2 – Task from Library to EDITOR.

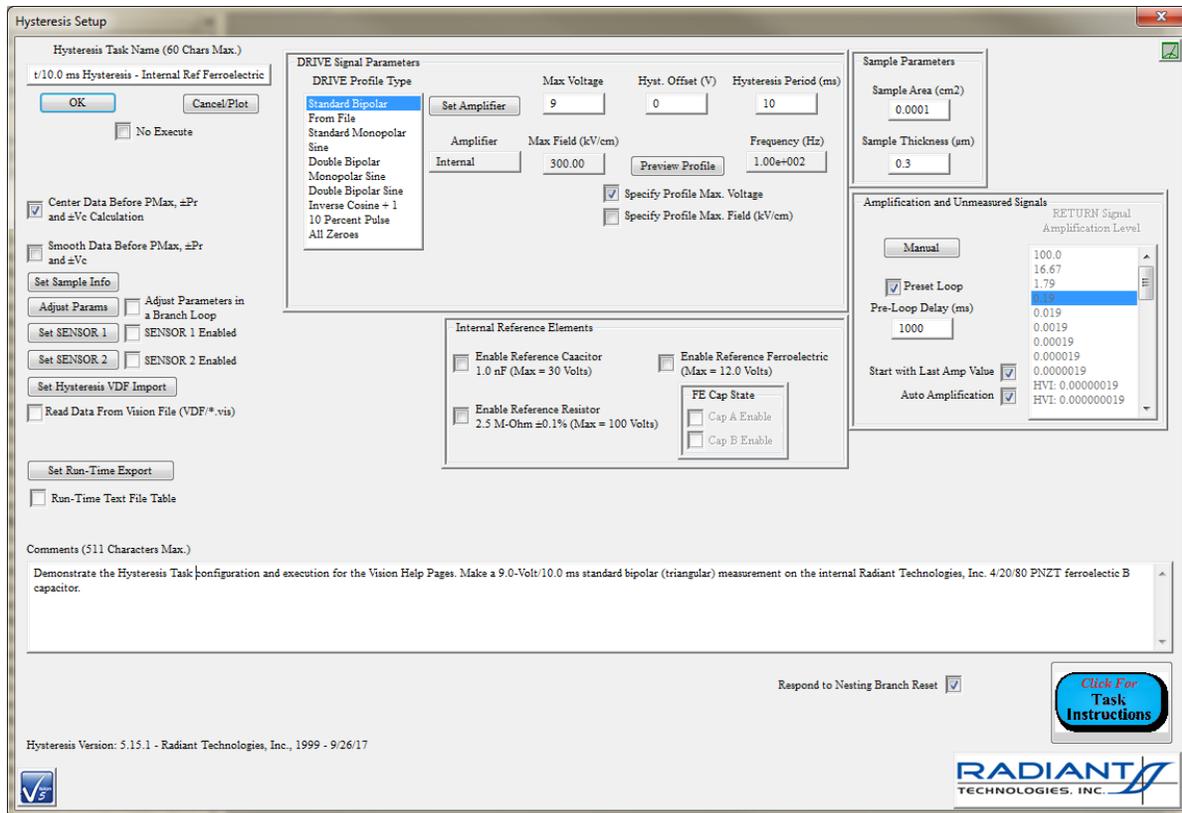


Figure 3 – Second Hysteresis to be added to the Test Definition in the EDITOR. The Dialog opened as a result of dragging and dropping the Hysteresis task from the Library to the EDITOR. Once configured, it will be added to the Test Definition. If Cancel d, it will not be added to the EDITOR Task list.

Once a Task is completely configured, clicking *OK* in its configuration dialog will insert it into the EDITOR. A Task may be reconfigured any number of times by double-clicking it with the left mouse button in the EDITOR. This action will reopen the configuration dialog. The EDITOR menu option on the main menu panel includes an option to clear the EDITOR. This will delete all Tasks in the Test Definition. The most-recently-added Task may also be deleted from the end of the list of Tasks. A completely general EDITOR, that allows Tasks to be inserted and deleted anywhere in the list and allows Tasks to be moved up and down within the list is not available due to complex interdependencies between certain types of Tasks, such as Filters or the Branch Task, and the Tasks that they associate with.

Once a Test Definition is constructed and properly configured it may be moved into the DataSet (see discussion below). But another option in the EDITOR menu is to send “TD to Customized Test”. If this option is exercised, a dialog first appears that allows the user to name the Test Definition (**Figure 4a**). The Test Definition is then copied, maintaining both the Task sequencing

and the specific configuration of each Task, into the Library under the folder “Customized Test” where it appears as a single icon associated with the name entered into the dialog (**Figure 4b**). If no previous Customized Tests are available, the folder will be created. The Customized Test is now available, with a single drag-and-drop, for all future Test Definition construction as if it were a single Task. When it is moved back into the EDITOR it will expand and appear as the sequence of Tasks. The Customized Test may be appended to a Test Definition that already contains Tasks and may have Tasks appended to it in the EDITOR. Once the Customized Test is expanded into the Task list in the EDITOR, the member Tasks may be reconfigured by double-clicking. The Library menu option includes an option to “Delete Customized Test”. Selecting this option will present a dialog that shows a complete list of the available Customized Tests. Any number of tests may be selected and deleted at each instance of the delete dialog. Note that deleting a Customized Test, unlike unregistering a DataSet, occurs immediately and is a permanent action.

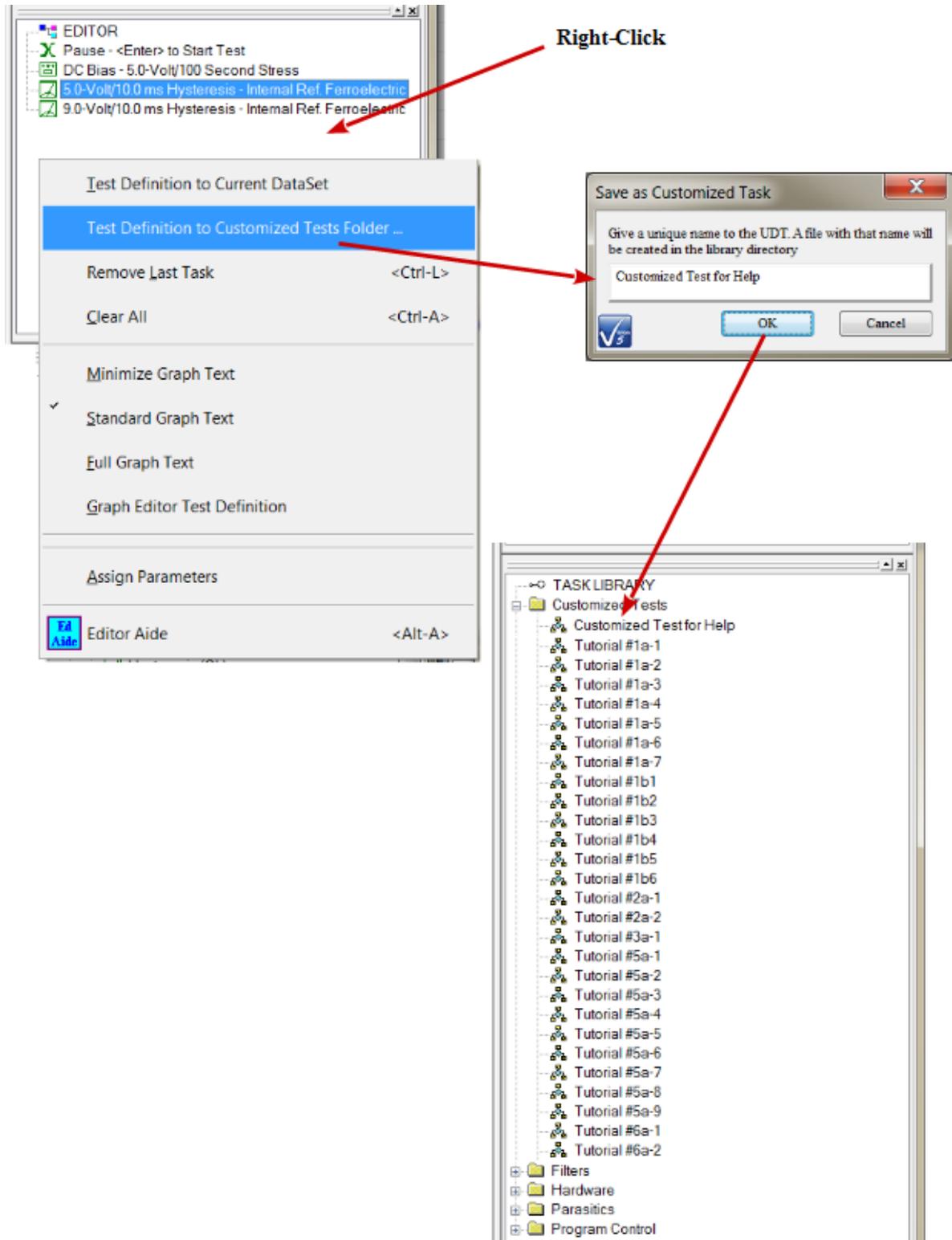


Figure 4 – Library with User-Defined Customized Test Added to it.

In addition to adding Tasks to the Test Definition in the EDITOR as described, the Test Definition can be modified in several ways...

1. All Tasks can be cleared so that there is no Test Definition in the EDITOR. This option can be exercised from the main Vision E_ditor menu, from the popup menu that appears when the right mouse button is clicked with the cursor in the EDITOR window or by pressing <Ctrl-A>.

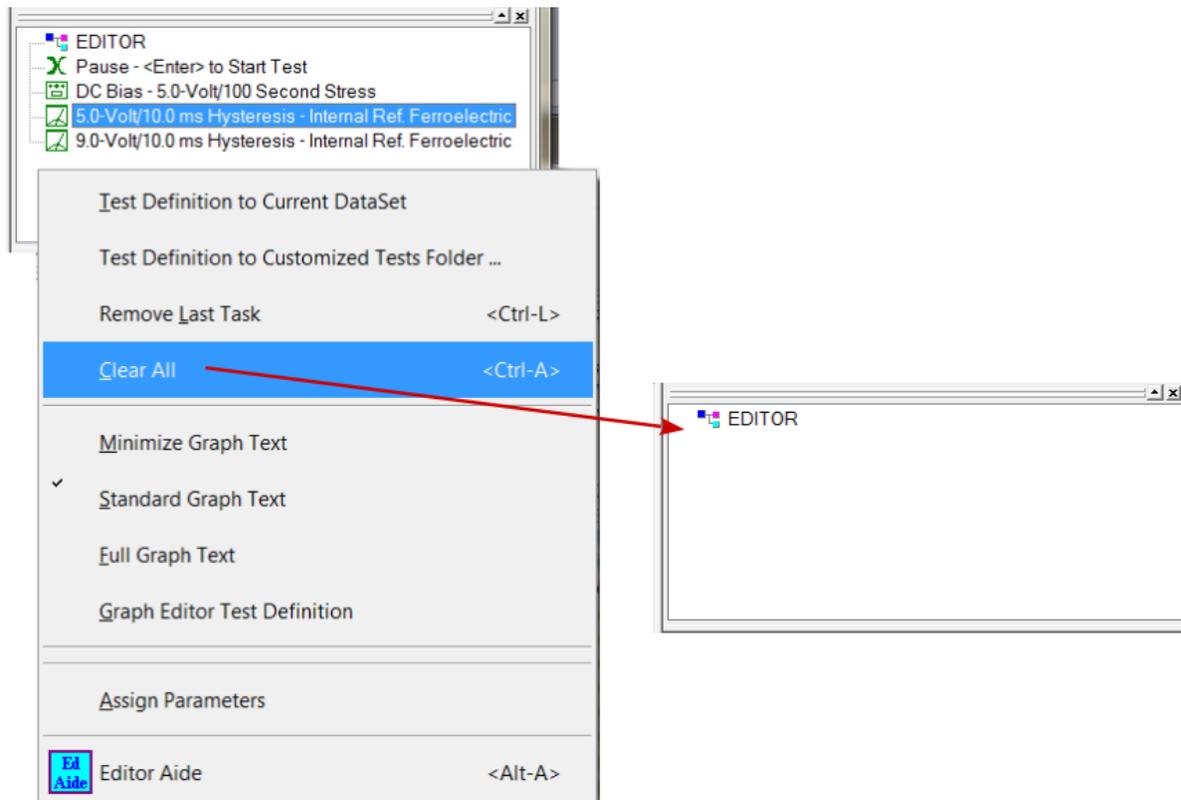


Figure 5 – EDITOR "Clear All" Operation.

2. The single most recently added Task can be removed from the end of the Test Definition list. This operation can be repeated until some interior unwanted Task has been removed, and then the remaining Tasks reinstalled. This option can be exercised from the main Vision E_ditor menu, from the popup menu that appears when the right mouse button is clicked with the cursor in the EDITOR window or by pressing <Ctrl-L>.

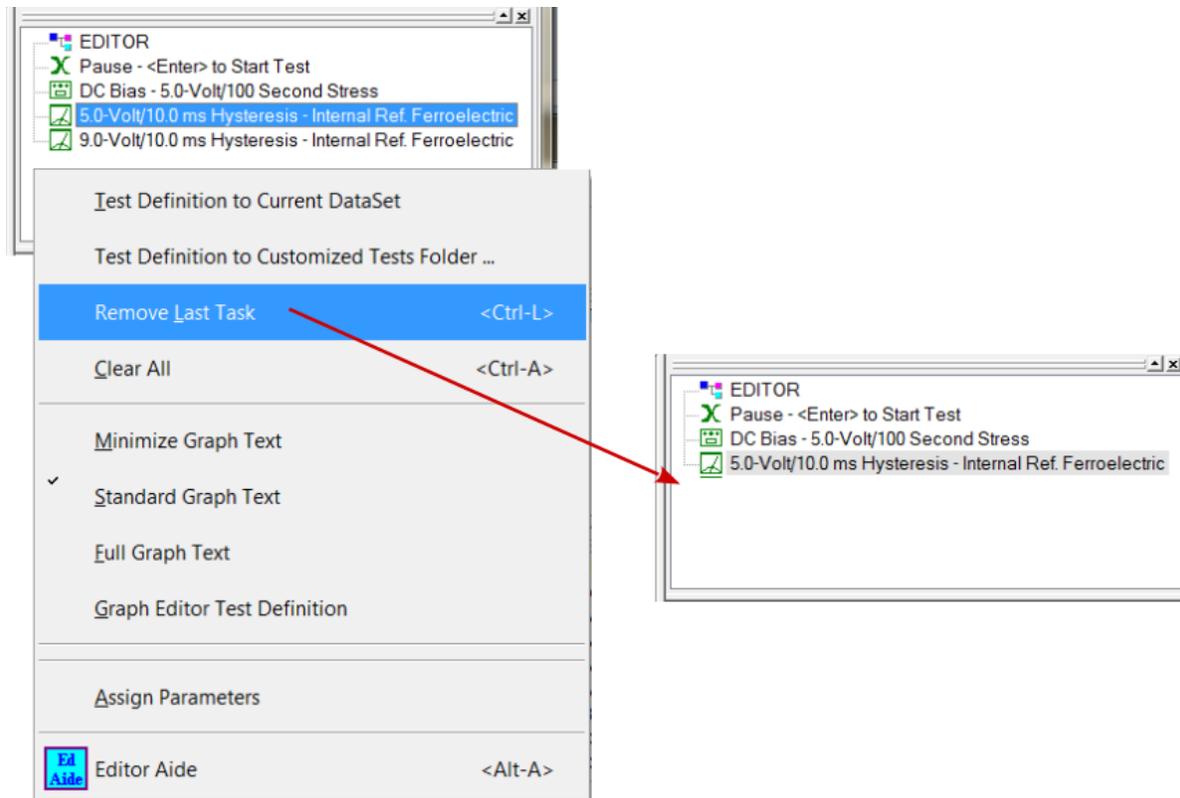


Figure 6 – EDITOR "Remove Last Task" Operation.

3. The Current Test Definition (CTD) in a DataSet can be moved back to the EDITOR for reconfiguration. If there is a Test Definition in the EDITOR, the CTD Tasks will be appended. This is discussed in more detail in the DataSets discussion below.
4. An Executed Test Definition (ETD) in a DataSet Archive can be moved back to the EDITOR for reconfiguration. If there is a Test Definition in the EDITOR, the ETD Tasks will be appended. This is discussed in more detail in the DataSets discussion.
5. The remaining right-click popup menu options are detailed in more-advanced discussions, below.

X - DataSets and the DataSet Explorer

X.1: Discussion.

To the left of the Vision program screen (by default) is a window labeled “Explorer” (**Figure 1**). Initially empty, as new DataSets are registered into the program, this window will list the registered DataSets. (Current installations should show the sample tutorial DataSets registered in this window.) DataSets may be placed anywhere on the Vision host hard disk. Their hard disk folder location will be represented by their location in the DataSet Explorer tree. Registered DataSets may be opened in any number in the Explorer. Each open DataSet will be accompanied by an additional tabbed window of the same name as the DataSet. Each open DataSet will also show a [Log Window](#) in the main user space (**Figure 1**). The Log Windows may be maximized or minimized. If the log window is closed, the DataSet will also be closed. A DataSet may be opened by selecting it in the Explorer and choosing the **File-> Open DataSet** menu option. When a new DataSet is created, it is automatically opened and registered. DataSets may be unregistered from the

Explorer by selecting **Explorer-> Unregister DataSet...** (or by clicking the  Vision toolbar icon). In this case a dialog appears listing all registered DataSets. Any number of DataSets may be selected. These will not be unregistered until the next time the Vision program is run. A DataSet may not be unregistered if it is open. An unregistered DataSet remains on the hard disk and may be reregistered by selecting **Explorer-> Register DataSet...** from the menu. (Or by clicking the  Vision toolbar icon.) A browser dialog appears from which the DataSet file is selected. **Figure 2** shows both the "Register DataSet" and "Unregister DataSet" dialogs.

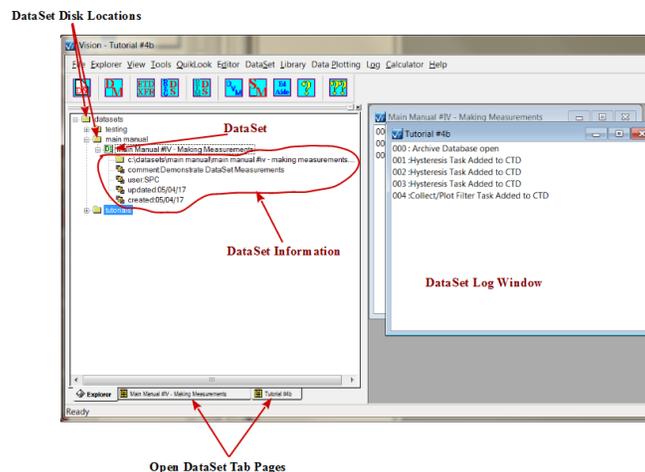


Figure 1 – DataSet Explorer with registered demonstration DataSets. DataSets are shown as entries in the Explorer and as tabbed pages at the bottom of the Explorer. Only open DataSets will appear as tabbed pages. The Log Window is open next to the Explorer. It reflects the creation of Help Pages Demo One.

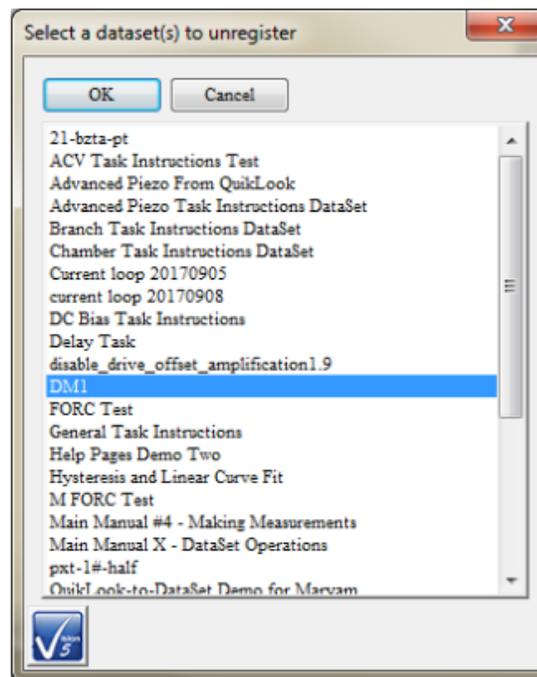
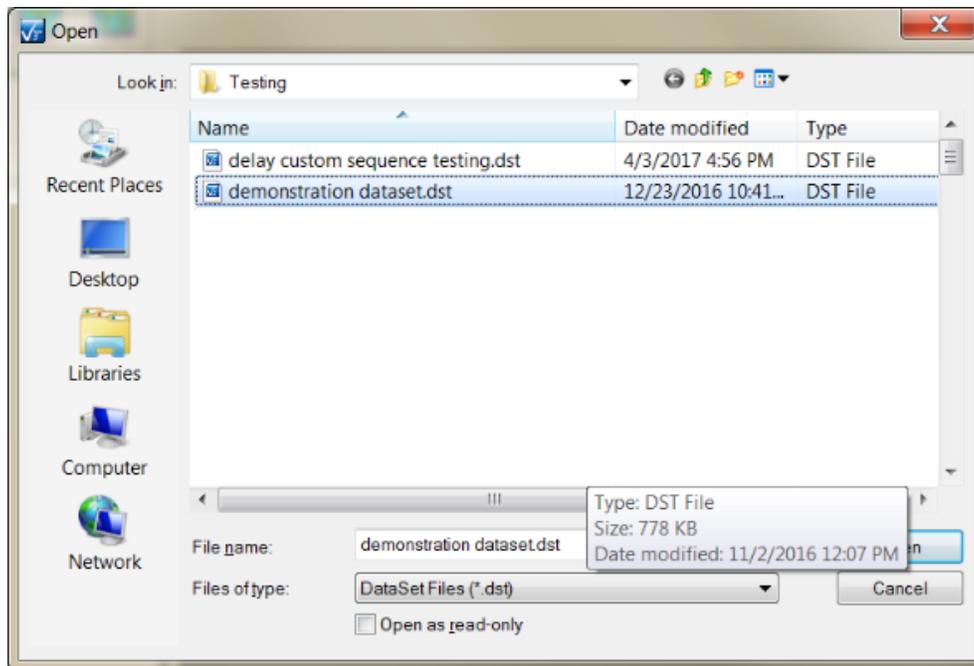


Figure 2 - DataSet Register and Unregister Dialogs.

So what is a DataSet? The Vision software is designed with the philosophy that what is important in researching a memory technology is the maintenance and analysis of the history of stimuli applied to a sample. A DataSet is a repository for a history of experimentation. Although it may be used in any way the user deems fit, the DataSet might normally be associated with a

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

single Lot, Wafer, Die or Module. Used in this way, the DataSet will provide a complete record of experimentation performed on its associated process stage. Or it may be used to store a particular type of experiment. A DataSet consists of the following elements:

1. **DataSet Name.** This is provided by the user at the time the new DataSet is created. It should be uniquely descriptive of the purpose of the DataSet.
2. **DataSet Info.** This is a set of information provided at DataSet creation or during the update of the DataSet. It includes a comment field to allow detailed description of the DataSet and its intended purpose, a required field to contain the user's initials and date of creation and date of last update. (**Figure 1**)
3. **Current Test Definition (CTD).** This is an experiment or Test Definition that is ready for execution (**Figure 3**) . Selecting DataSet-> Execute Current Test Definition (CTD) from the menu, or pressing <F1>, will initiate the operation of the programmed Test Definition contained in the CTD on the sample connected to the Precision Tester. The CTD is written by clicking on the Test Definition in the EDITOR with the left mouse button. With the button held down, the mouse is dragged into the open DataSet window. With the cursor in the DataSet window, the button is released. (The Test Definition in the EDITOR can also be moved to the CTD by selecting Editor-> Test Definition to Current DataSet from the menu or by right-clicking in the EDITOR window.) When the Test Definition is moved a dialog will open to allow the user to assign a name to the CTD (**Figure 4**). The name should uniquely identify the Current Test Definition. If a Current Test Definition exists in the DataSet, it will be overwritten by the new Test Definition. The configuration of each Task in the Current Test Definition can be reviewed by double-clicking on the Task in the CTD, opening its configuration dialog. This will be only a review as the dialog controls are disabled and cannot be adjusted. (**Figure 5**) The CTD can be repeatedly re-executed any number of times. When the DataSet is closed and reopened, even between executions of the Vision program, the CTD will be maintained. CTDs can be returned to the EDITOR or sent to the Customized Tests folder in the Library by selecting the appropriate option from the DataSet menu. A popup menu can also be used by selecting the Current Test Definition name in the DataSet Explorer, then right-clicking.

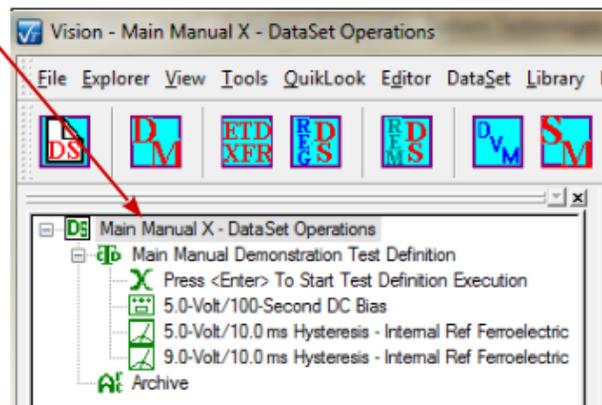
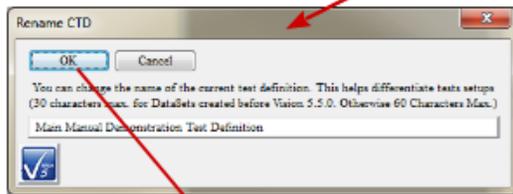
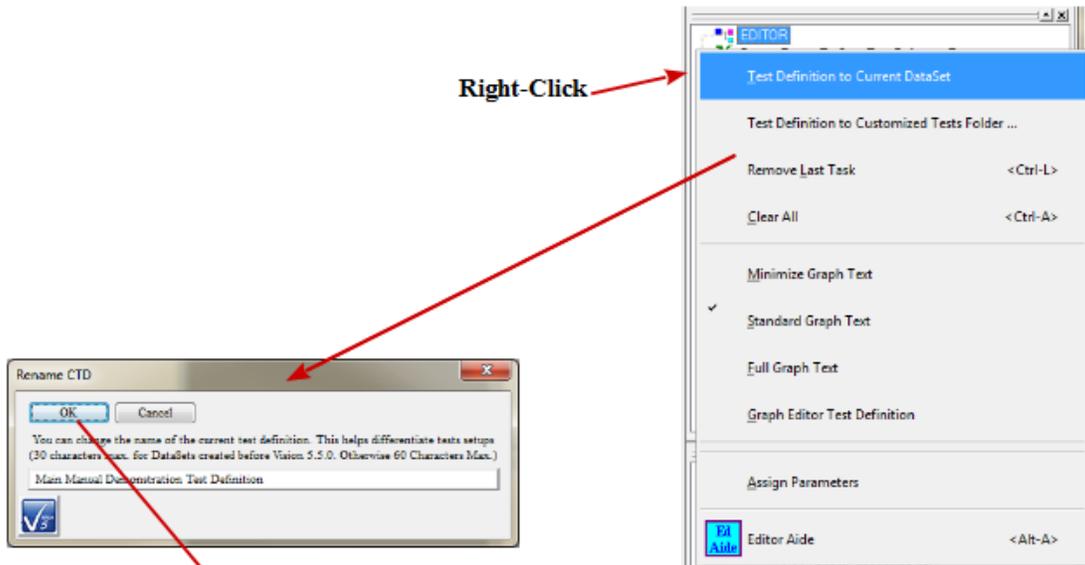
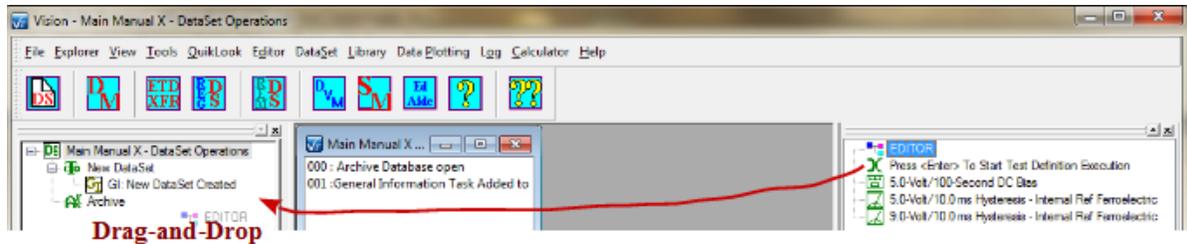


Figure 3 – DataSet Tab in Explorer with CTD.

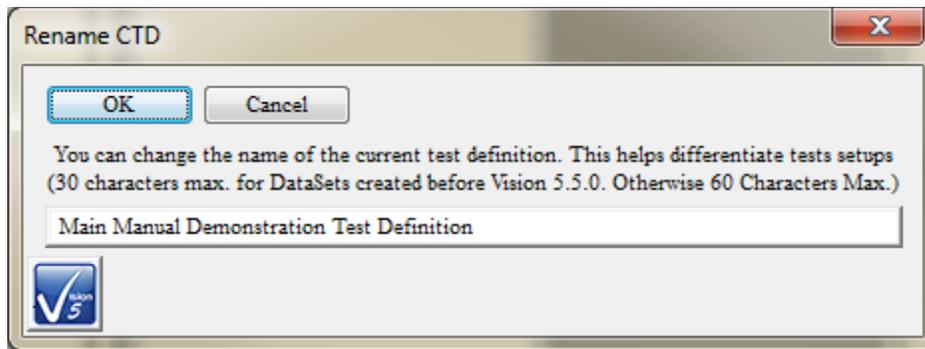


Figure 4 – CTD Naming/Renaming Dialog.

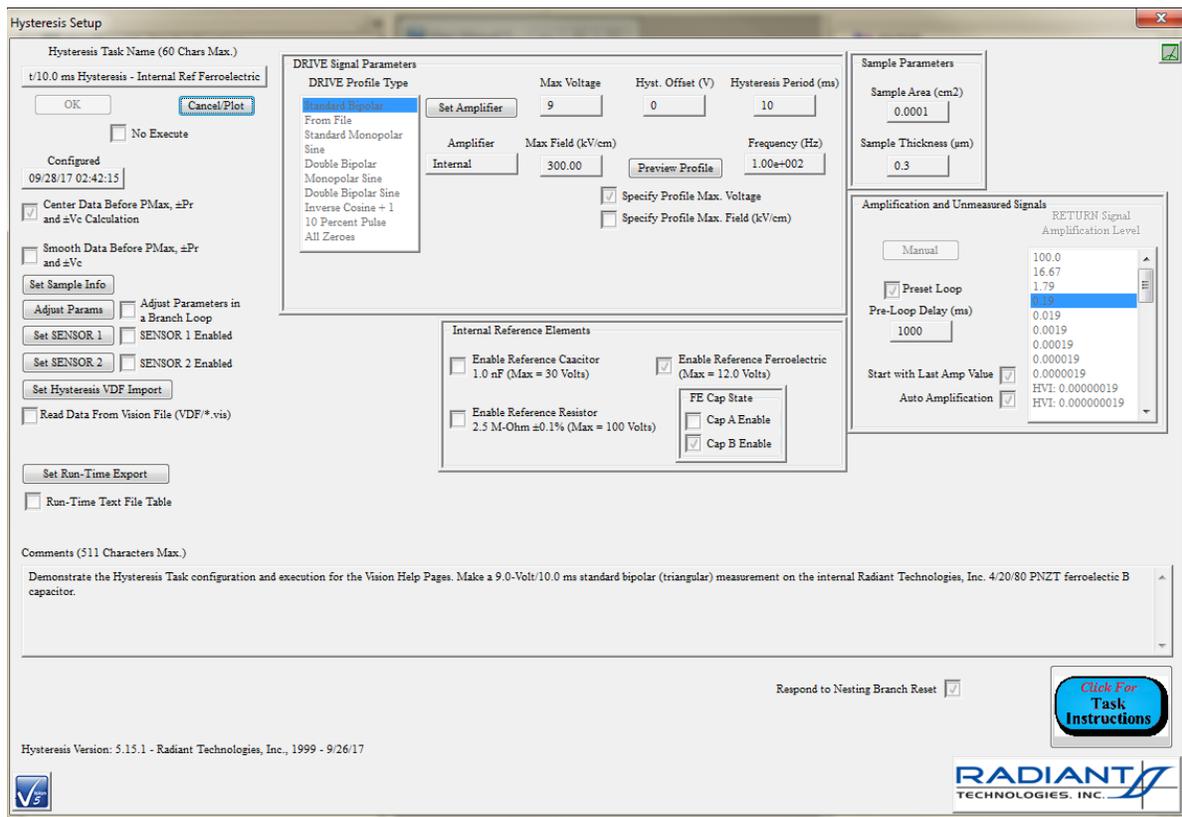


Figure 5 – Task Configuration Elements Dialog in Review Mode.

4. **Archive.** This is a repository for all previous executions of the CTD or earlier manifestations of the CTD (**Figure 6**). It consists of a number of Executed Test Definitions (ETDs). Each ETD takes the name of the CTD that was active when the ETD was created. To resolve duplicate name issues, a serial value is appended to the ETD name and separated from it by a “.”. The serial value begins at 0 and is incremented indefinitely until the CTD is renamed, at which time it is reset to 0. Each ETD contains two subfolders labeled “Experiment Design” and “Experiment Data”. The Experiment Design folder contains a duplicate of the CTD that was active when the ETD was created. The “Exper-

iment Data” folder contains a copy of each executed Task. The folders may differ in size as Branch Looping will allow a Task to execute many times and be represented by many copies in the Experiment Data folder. This is the reason for the existence of the “Experiment Design” folder. The experiment cannot necessarily be reconstructed from the Data. Double-clicking any Task in the Experiment Data folder will open its configuration dialog for review. No alterations may be made. If the Task is a Measurement Task, when the dialog is closed a second dialog will open that shows the data plot and configuration and measurement results. This is the same dialog shown by the QuikLook option, but the "Save to Open DataSet"/"Save to New DataSet" control is does not appear. (Figure 7). If the Task is a Branch or one of the two Exit Tasks, a dialog will appear after the configuration dialog that will indicate if the Branch or Exit occurred.

As with the QuikLook results dialog, the Export functionality is available for measurement Tasks recalled from the ETD.

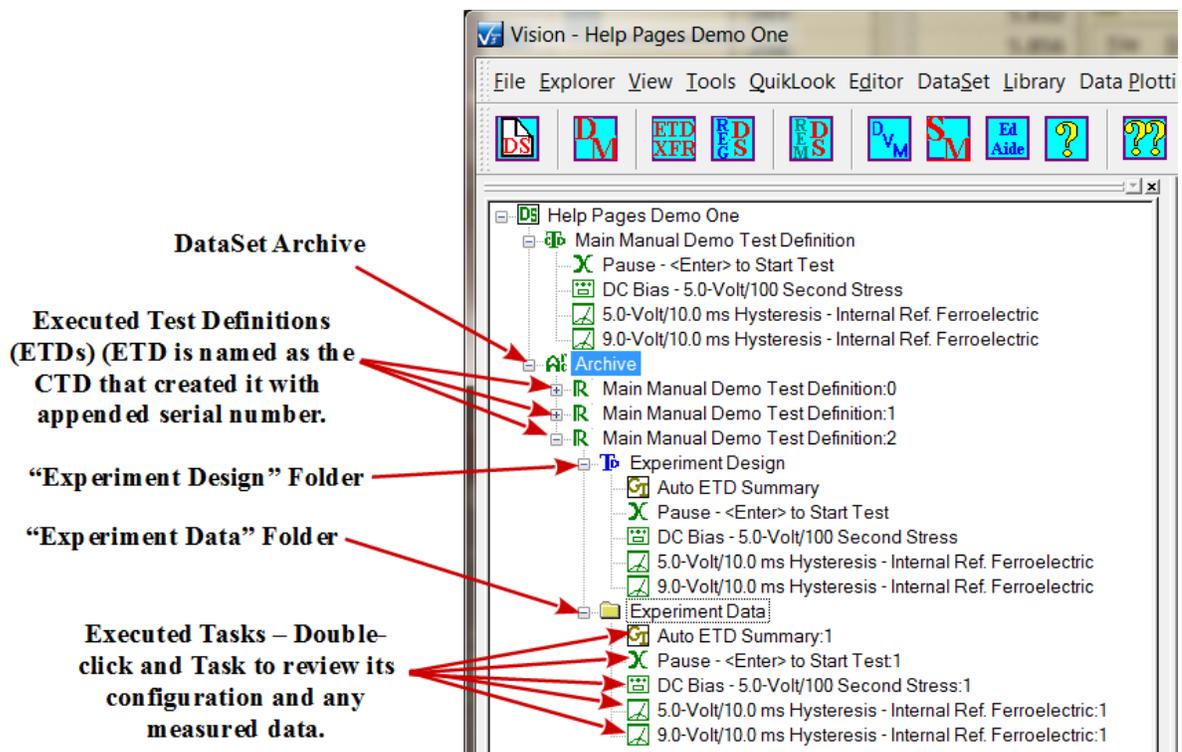


Figure 6 – DataSet Explorer with the Demonstration DataSet tab page open. The Current Test Definition named "Main Manual Demo TD" holds a Pause Task, a DC Bias Task and a Hysteresis Task. The Archive is open to show three Executed Test Definitions: Main Manual Demo TD:0, :1 and :2. Main Manual Demo TD:2 is open to show the "Experiment Design" folder. This is a copy of the

CTD. "Experiment Data" contains copies of the executed Tasks.

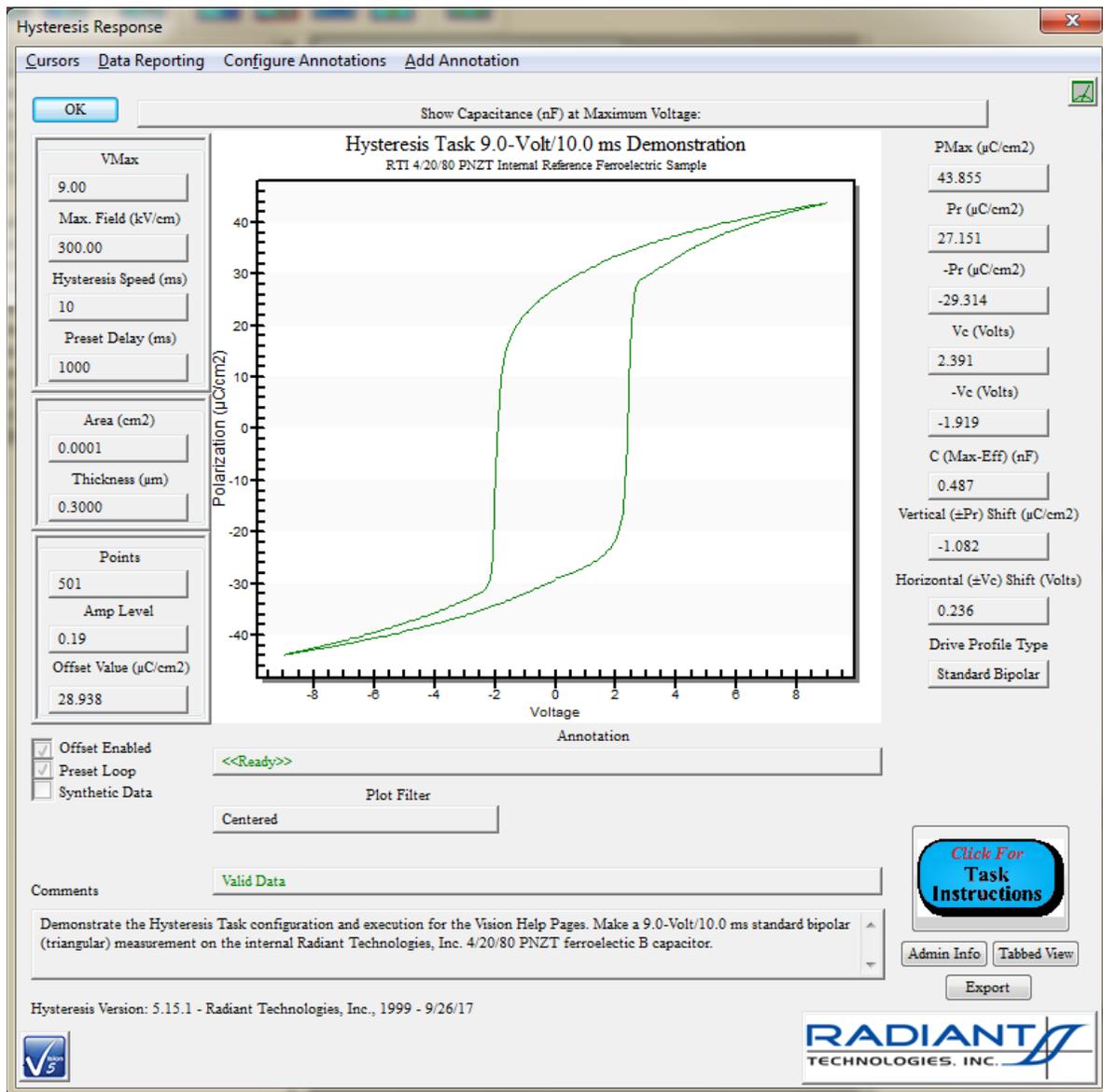


Figure 7a - Hysteresis Plot Showing Data Recalled from the DataSet Archive.

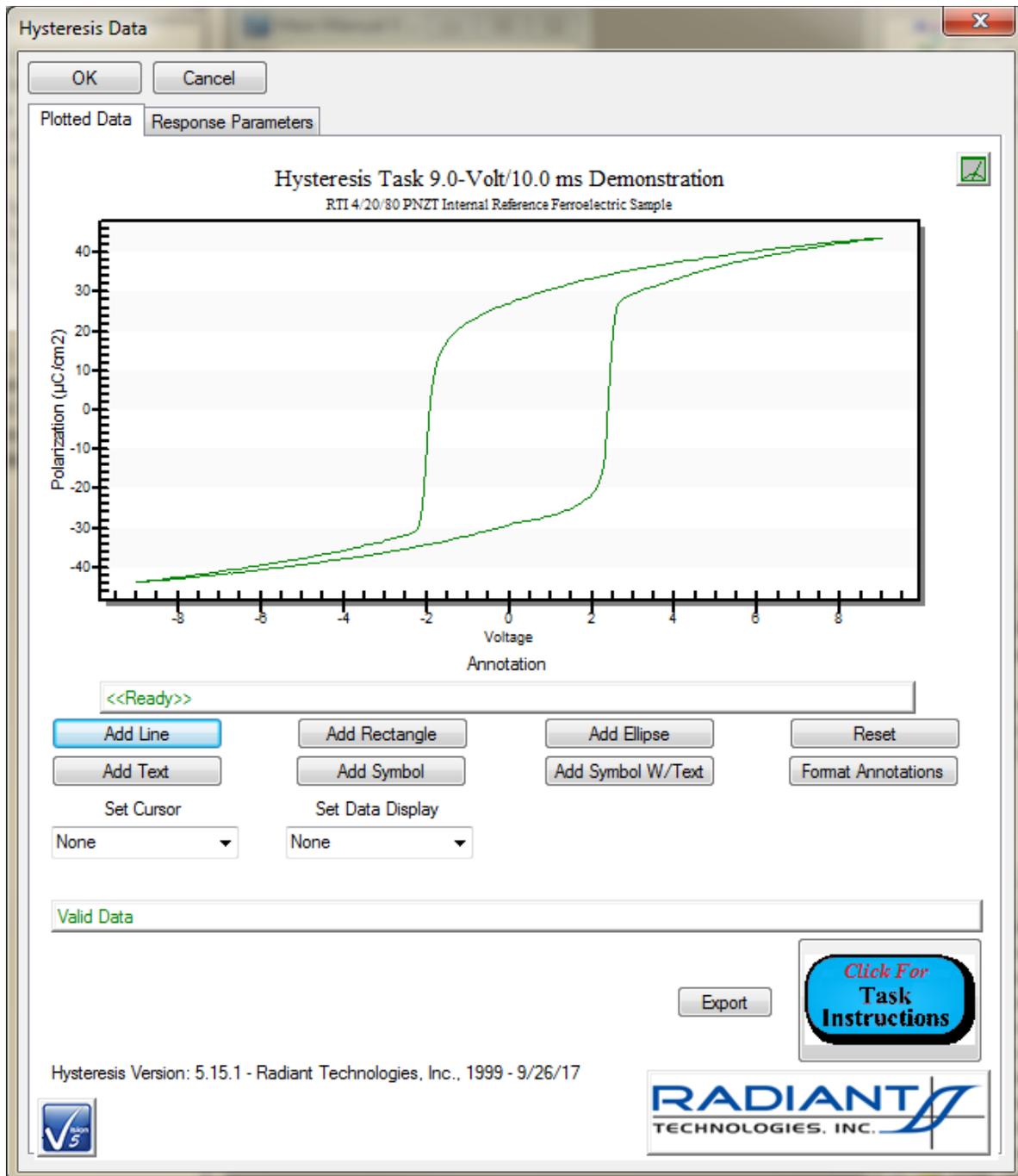


Figure 7b - Tabbed (Reduced) Hysteresis Plot Showing Data Recalled from the DataSet Archive.

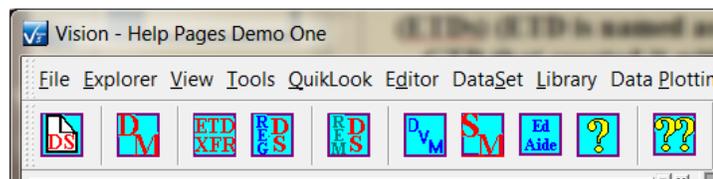
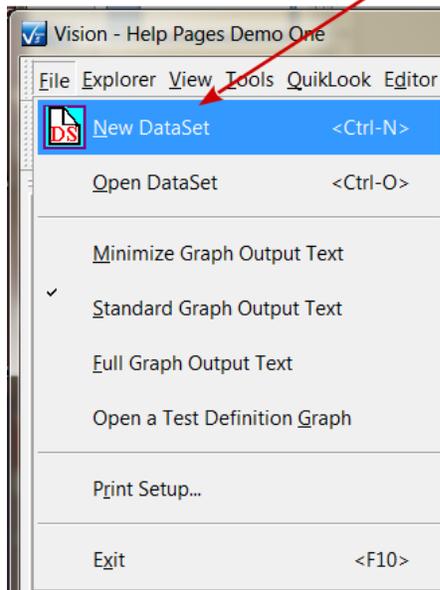
X.2: Creating a DataSet.

Under normal circumstances, a DataSet is created for association with a particular sample, type of sample or type of experiment. The DataSet is opened, then a Test Definition is created in the

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

EDITOR, moved into the DataSet as the CTD and executed on a sample. The creation process is initiated by selecting **File-> New DataSet**, by clicking the Page icon on the Vision toolbar or by pressing <Ctrl-N> (**Figure 8**). When initiated a dialog will appear in which the *DataSet Name*, *File Name* and *Experimenter Initials* are established. An optional field also allows descriptive comments to be entered (**Figure 9**). The process can be terminated at this point by clicking *Cancel*. If *OK* is clicked the DataSet will be created, added to the DataSet Explorer and a tab window will be added to the DataSet Explorer in which the empty DataSet is opened (**Figure 10**). Note that the DataSet file will be placed in "C:\DataSets" by default. This path can be changed to suit the user's needs.

Select "**File->New DataSet <Ctrl-N>**", or...



...Click the Page Toolbar Icon or Press <Ctrl-N>

Figure 8 - Initiating DataSet Creation.

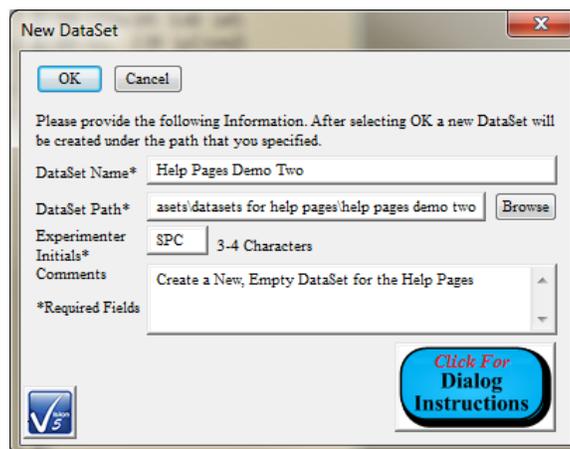


Figure 9 - DataSet Creation Dialog.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

NOTE: The *DataSet Path* control is automatically updated to assign the *DataSet Name* value as the DataSet File Name, with a *.dst extension. If the *DataSet Name* control is edited, the *DataSet Path* is automatically updated to be "C:\File Path\DataSet Name". This automatic updating may be defeated by using the *Browse* button to assign the file path and file name or by editing directly in the *DataSet Path* control. "C:\DataSets" is the default root folder. It will be replaced in further updates to the *DataSet Path* control if it is changed using the *Browse* button or by editing directly into the *DataSet Path* control. Folders in the *DataSet Path* control need not exist when the DataSet is created. The folders will be created if they are not found. This feature was added at the request of Tohoku University and Michio Ohata-san of Kojundo Ltd. Note that, when a new DataSet is created, a placeholder General Information Task, named "GI New DataSet Created" forms the Current Test Definition (CTD). This is done so that the CTD is never empty.

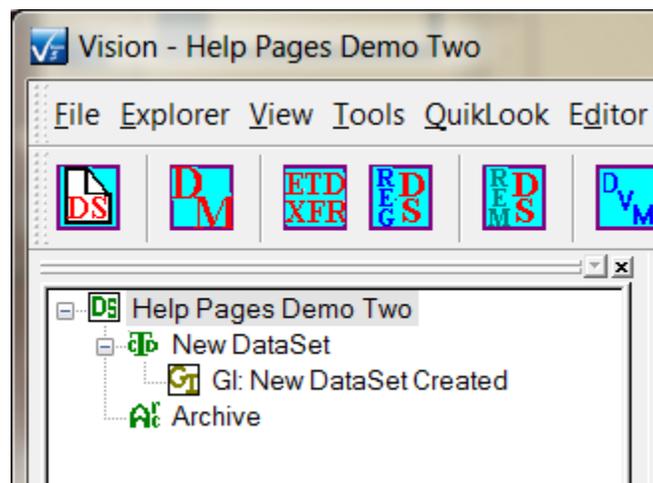


Figure 10 - DataSet Explorer Tab Window for the Newly Created DataSet.

A DataSet may also be created and/or written to by a Task that has been executed in QuikLook. If "Save to a New DataSet" is checked before the QuikLook results dialog is closed, then the DataSet creation process will begin when the dialog is closed. A new DataSet may be created. Or the Task may be added to the current open DataSet by selecting "Save to Open DataSet". In this case one or more DataSets must be open and a DataSet tab window must be opened in the DataSet Explorer. The Task will be written to the DataSet whose tab window is open and visible.

If the QuikLook Task is written to a new DataSet, the DataSet will have that Measurement Task as its only Task in the CTD. The Task will be configured as it was in the QuikLook measurement. The DataSet Archive will contain a single ETD that consists of the executed QuikLook Task. If the Task is recalled from the Archive, it will be configured as in the QuikLook measurement. The recalled data that are displayed will be those of the QuikLook Measurement. See **Figure 11**.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

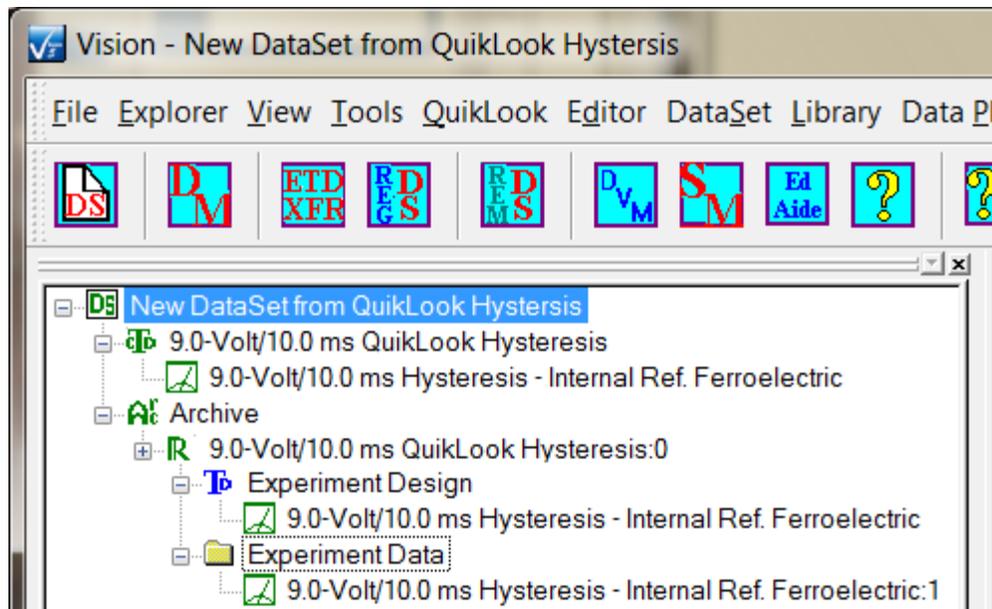


Figure 11 - New DataSet Created from a QuikLook Hysteresis Task Measurement.

If the QuikLook Task is written to an existing DataSet, the CTD of the open DataSet will be overwritten by a Test Definition consisting of the single QuikLook Task configured as it was in QuikLook. If there are more than one DataSet open, a DataSet selection dialog appears (**Figure 12**). A single ETD will be appended to the DataSet Archive. It will contain the single QuikLook Task, configure as in, and with data measured in, the QuikLook execution. **Figure 13** shows a QuikLook PUND Task appended to the DataSet of **Figure 11**.

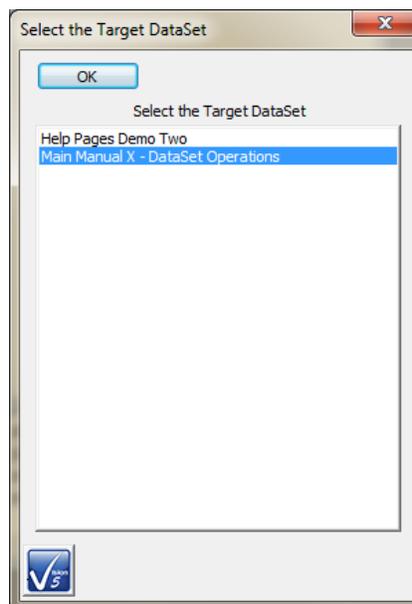
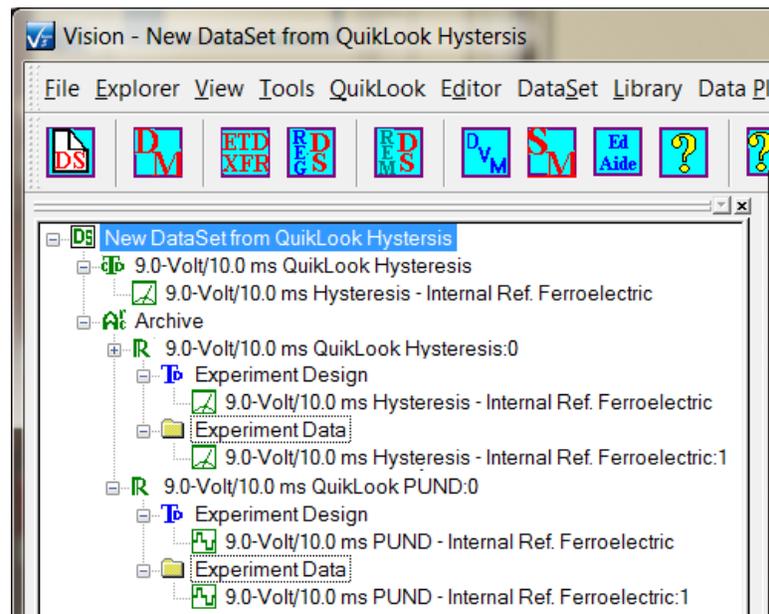


Figure 12 - DataSet Selection Dialog.**Figure 13 - QuikLook PUND Measurement Appended to an Existing DataSet.**

X.3 - Rename ETD

As a DataSet is exercised by running the Current Test Definition (CTD), the history of the execution is stored in a single Executed Test Definition (ETD) in the DataSet Archive. Each ETD contains a record of each Task as it executed, including the Task configuration and any measured data. Each Task can be individually recalled for configuration and measured data review. Once a DataSet Archive is written, it cannot be modified except by appending new executions of the CTD as ETDs. ETDs that contain unwanted or incomplete data or were executed in error remain part of the record and cannot be removed.

One solution is to assign a new name to the ETD. Although described as a method for marking a DataSet that cannot be removed, this is a generic tool that can serve any purpose. An ETD is renamed by right-clicking its name in the DataSet Archive and selecting "Rename ETD" in the popup menu. The existing name appears in a "Rename DataSet" dialog (see below). Type a new ETD Name, the DataSet Archive is refreshed and the ETD permanently takes on a new name.

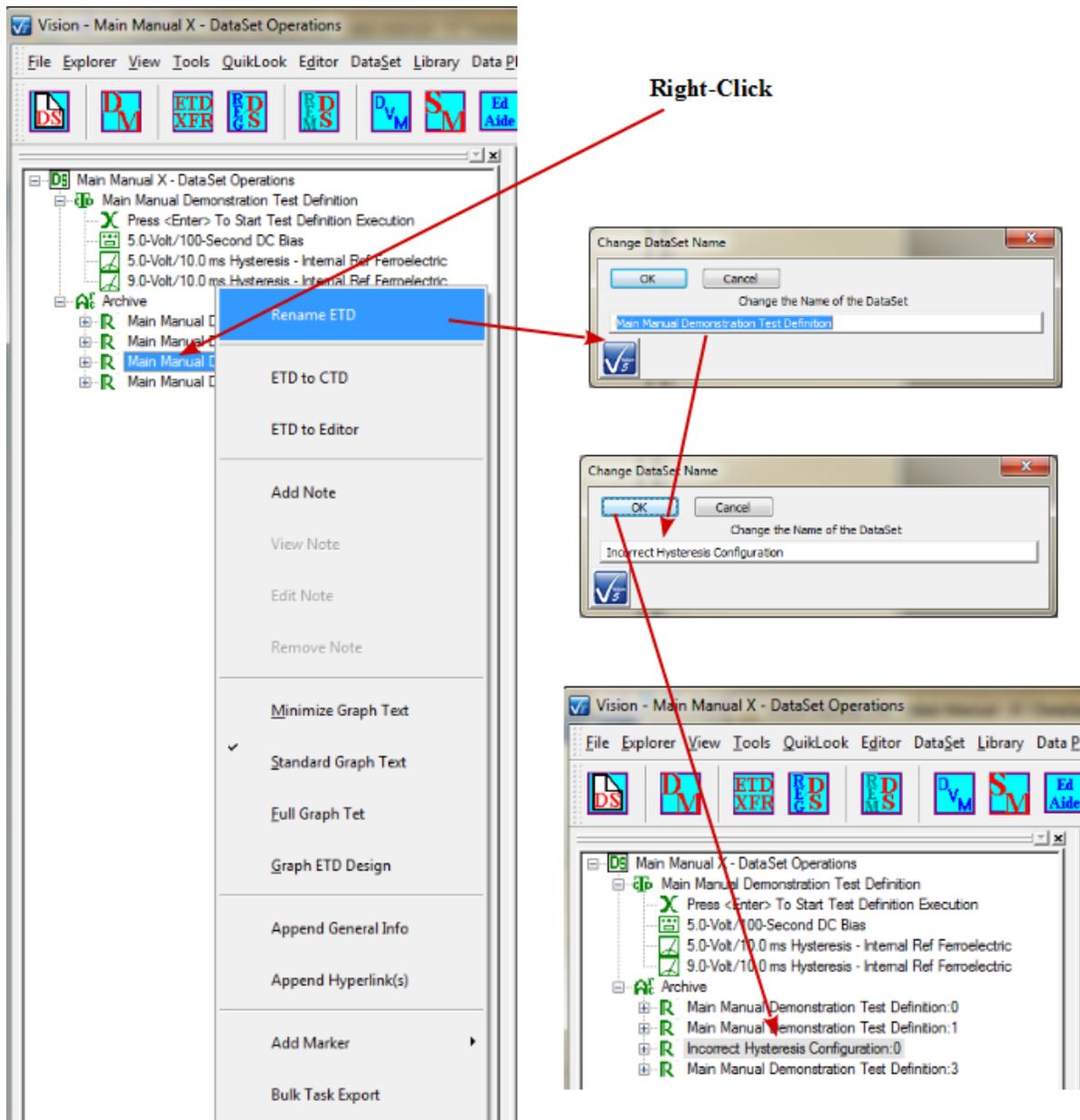


Figure 14 - Rename an ETD.

X.4 - ETD Markers

Another solution, and one that can be used in conjunction with ETD renaming, is to give the ETD a special icon. ETDs are stored in the DataSet Archive with a standard  icon. However, one of three special icons can be assigned to any ETD. The icons are:

1. : Error
2. : Important

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

3. : Special Attention

Although the icons have been given the labels "Error", "Important" and "Special Attention" when selecting them, they can take on any meaning intended by the user.

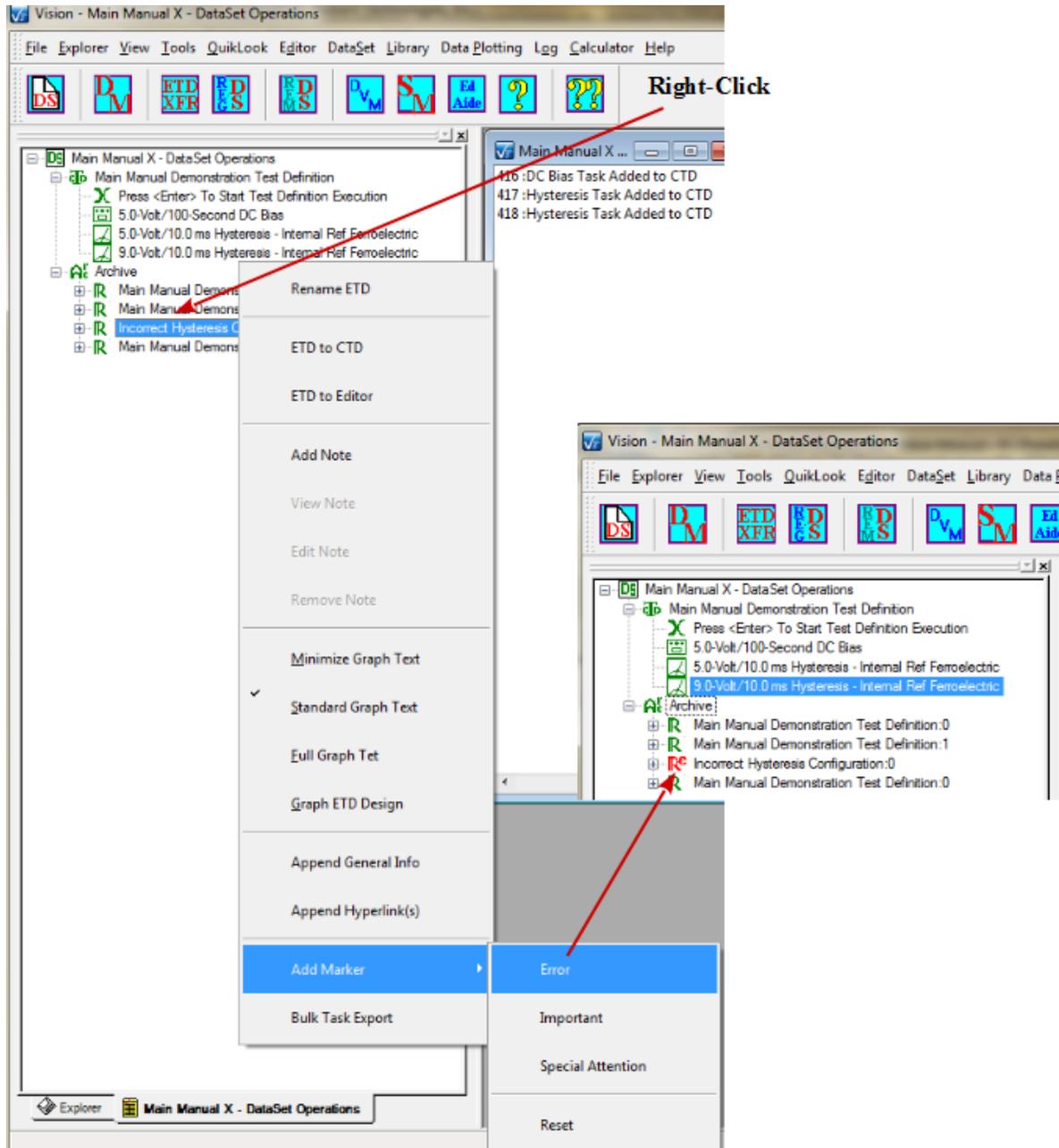


Figure 15 - Adjust the ETD Marker.

Note that the record of the marker for the ETD cannot be stored in the DataSet. Instead, a file

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

based on DataSet Name and ETD name is stored in C:\DataSets\Notes. Since the file is based on the ETD name, make any changes to the ETD name (X.4) before setting the marker. Also, make any changes to the DataSet Name (below) before taking this action. Note, too, that removing this file would restore the maker to its original.

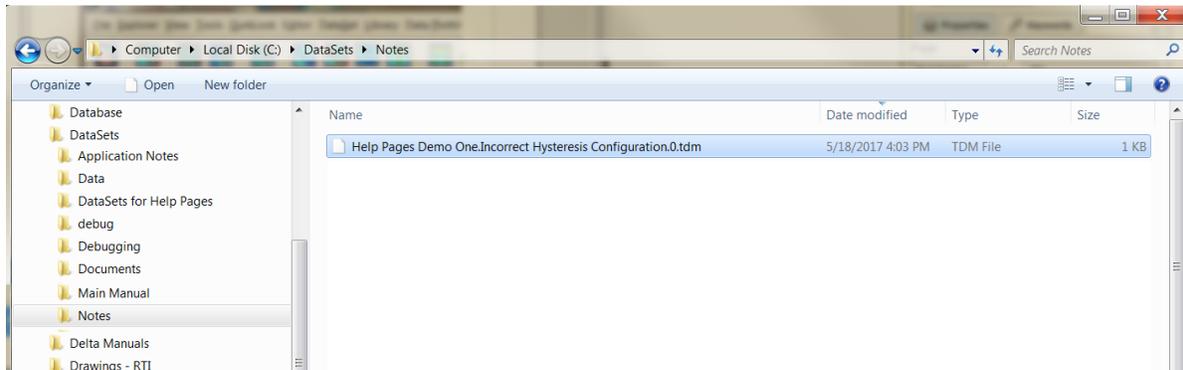


Figure 16 - ETD Marker File in C:\DataSet\Notes.

X.5 - ETD Notes

Another tool is available that allows an individual ETD to have a Rich Text-formatted document of up to 2000 characters associated with it. As a Rich Text document, the text can be formatted for color, and type style (bold, italic, etc.). Once created, the document can be recalled for review, editing or deleting. The document is stored in C:\DataSets\Notes and is associated with an ETD by DataSet Name, ETD name and execution count. (Note that it is possible to associate the note with multiple ETDs through manipulations that cause duplicate ETD names and execution counts in the DataSet. This would be an error condition.)

To add an ETD note, open the DataSet and its Archive, select the appropriate ETD, right-click and select "Add Note" from the popup menu.

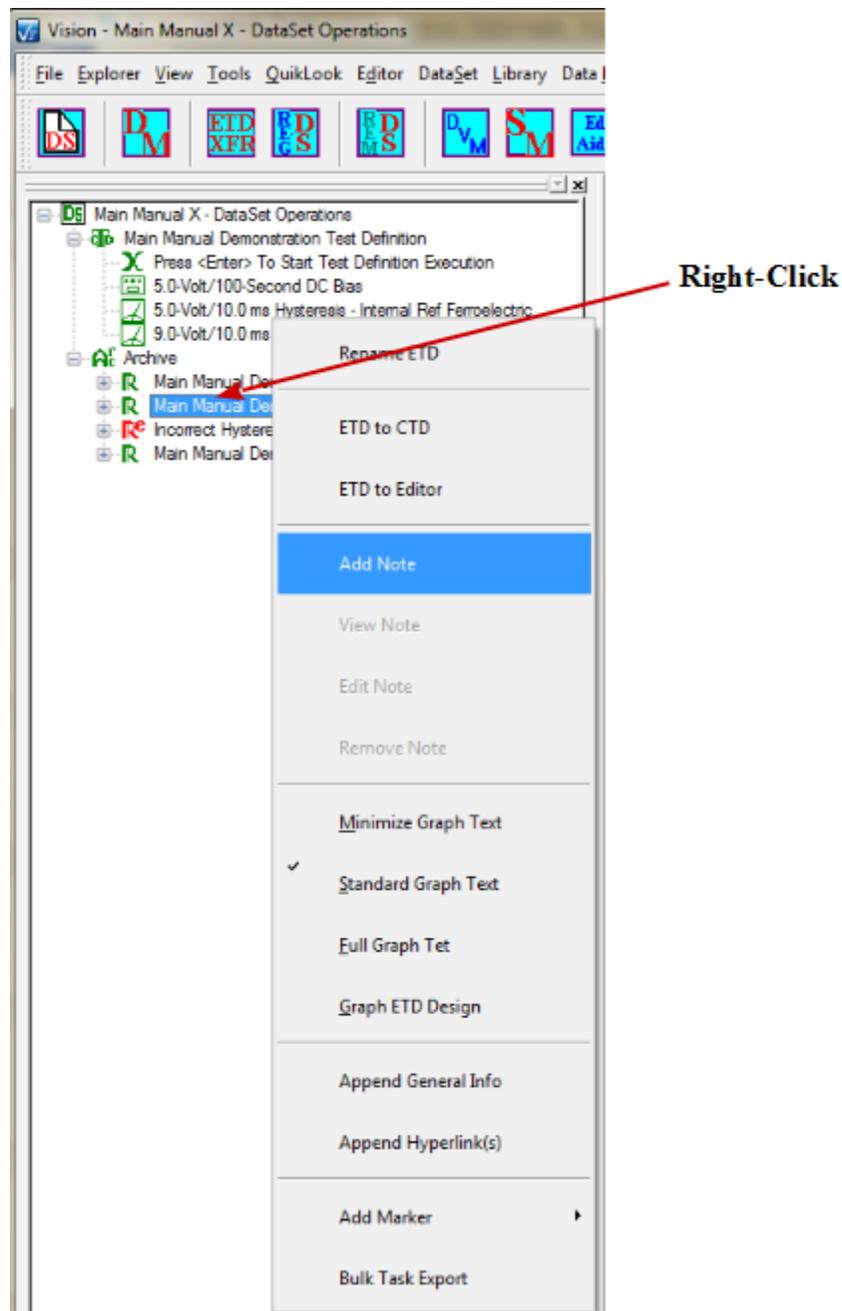


Figure 17 - Initiate an ETD Note.

A dialog will appear that allows the note to be edited. The dialog will automatically add the date of the note. A brief summary can be added, then up to 2000 characters of text to document the ETD. The text can be formatted using the dialog menu options. It may be formatted for color and style. The document may also be printed and/or exported to a text file from the menu.

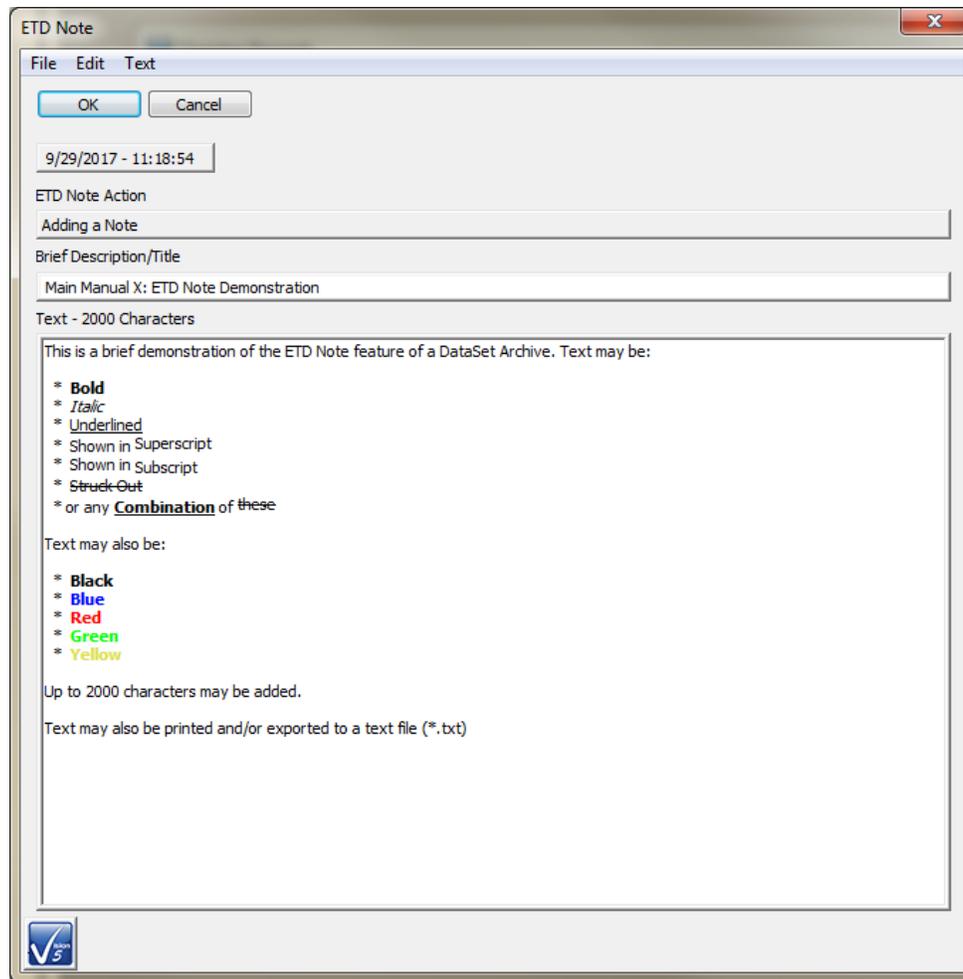


Figure 18 - Construct an ETD Note.

Once the note is edited, it is added to the ETD by clicking *OK*. The DataSet Archive will refresh its display and close. If reopened, the ETD with the associated note will be indicated by a change in icon to a blue "R", with a superscripted appended "n", as in **Figure 19**.

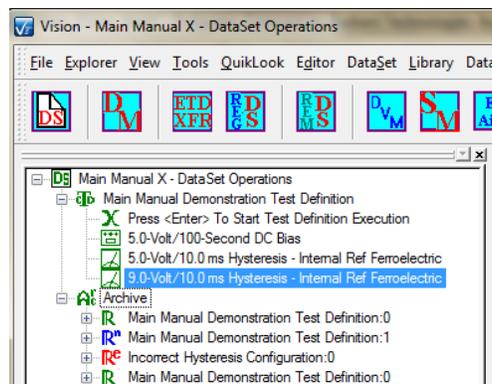


Figure 19 - ETD with Associated Note Icon.

Once the note is associated with the ETD, right-clicking on the ETD will produce a popup menu with "View Note", "Edit Note" and "Remove Note" enabled. These actions are mostly intuitive. Editing an existing ETD note has some nuances that are best addressed by referring to the Editing an ETD Note topic.

As with the ETD Marker of X.4, the ETD note is associated with an ETD through two files in C:\DataSet\Notes. Once again, the ETD and/or DataSet should have their final name set before adding the note, since the file depends on both the DataSet and ETD names. The **Rⁿ** icon will supersede and special markers added in X.4.

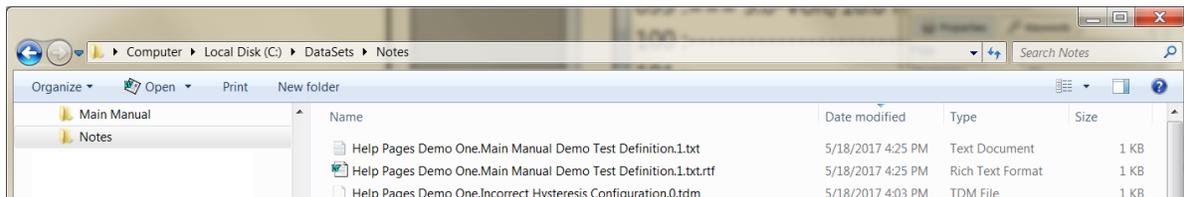


Figure 20 - ETD Note Files in C:\DataSets\Notes.

X.6 - Rename the DataSet

At this point it should be evident that the naming of things in Vision - Tasks, DataSets, Test Definitions - is critical both for documentation purposes and for program execution. Duplicate names, though legal in the case of Tasks, can cause particular problems. There may be occasions in which it is efficacious or even necessary to permanently change a DataSet name. The process is simple. With a DataSet closed, select it, by name, in the DataSet Explorer. Then go to "Explorer->Rename Selected DataSet". The current DataSet Name will appear in the "Change DataSet Name" dialog. Adjust the name as desired and click *OK*. The DataSet name will be permanently updated in the DataSet Explorer.

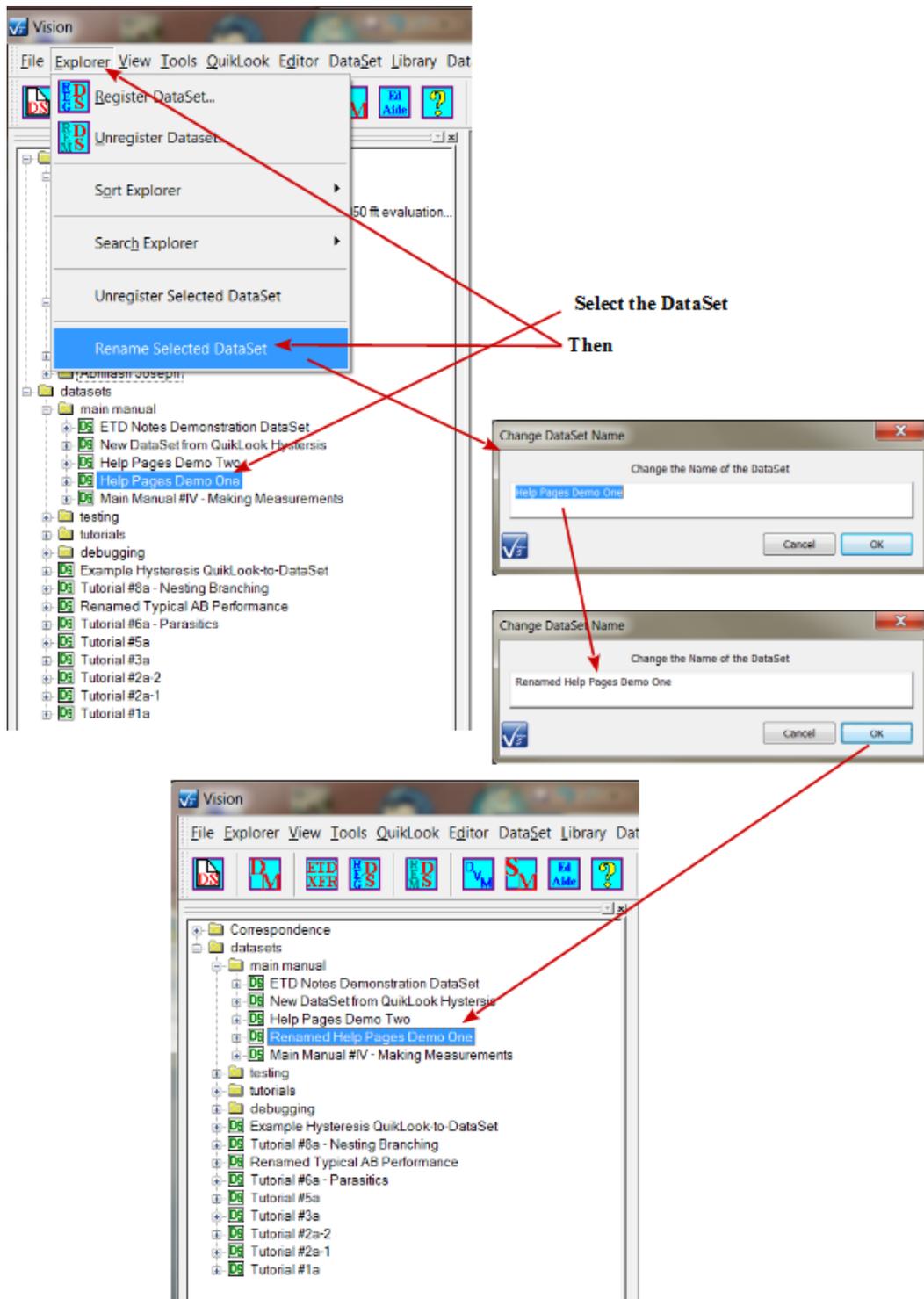
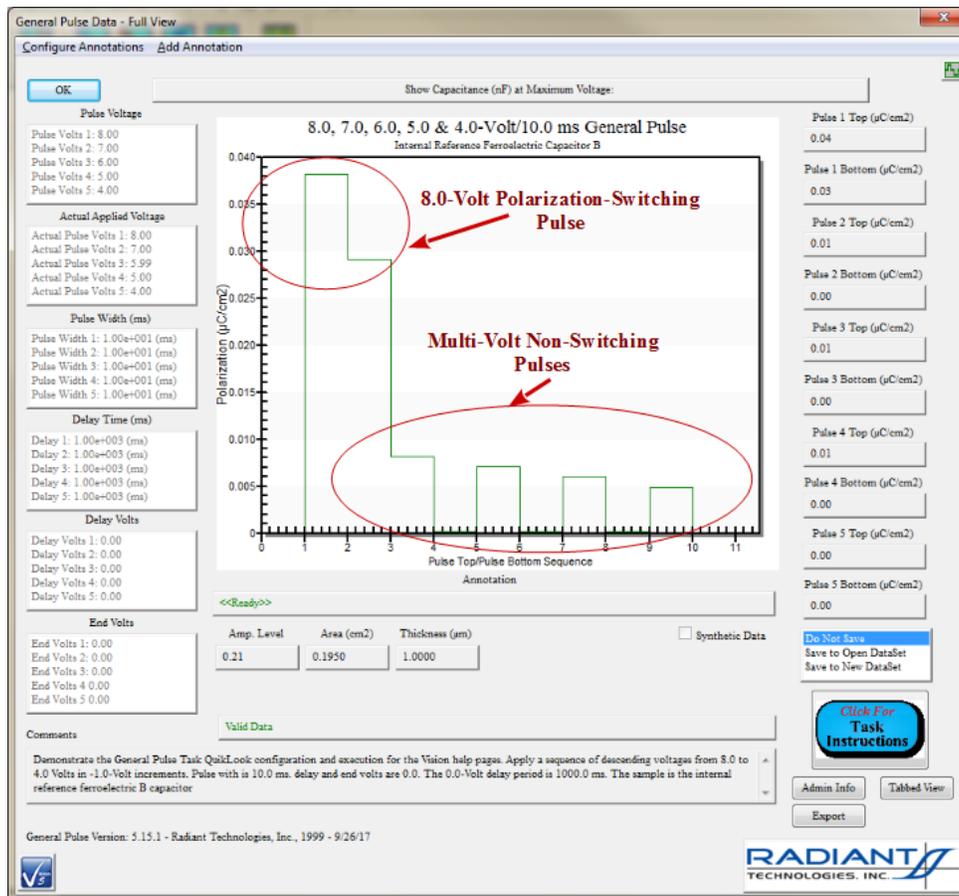


Figure 21 - Rename a DataSet.

XI - Data Plotting

X.1 : Data Plotting

Measured data can be displayed to the user in three ways. Data taken using the QuikLook option will be automatically displayed in a dialog after they are acquired. Data acquired in a DataSet can be similarly viewed by double-clicking on the recorded Measurement Task in the Experiment Data folder of the Executed Test Definition (ETD) after the Current Test Definition (CTD) has complete execution. This will present the configuration dialog for review, then show the plot dialog. During actual experiment execution data can be viewed by associating one or more Filter Tasks with the measurements of interest and enabling the Filter's plot option. The plot window will appear and be updated during the execution of the CTD. There are many options for plotting data in this way. See the *Help* option under the Filter configuration dialog. **Figure 1** shows a QuikLook General Pulse Task response dialog including the plotted data. A typical Filter Task data presentation, taken during Task execution (or recalled from the DataSet Archive), is shown in **Figure 2**.



Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)



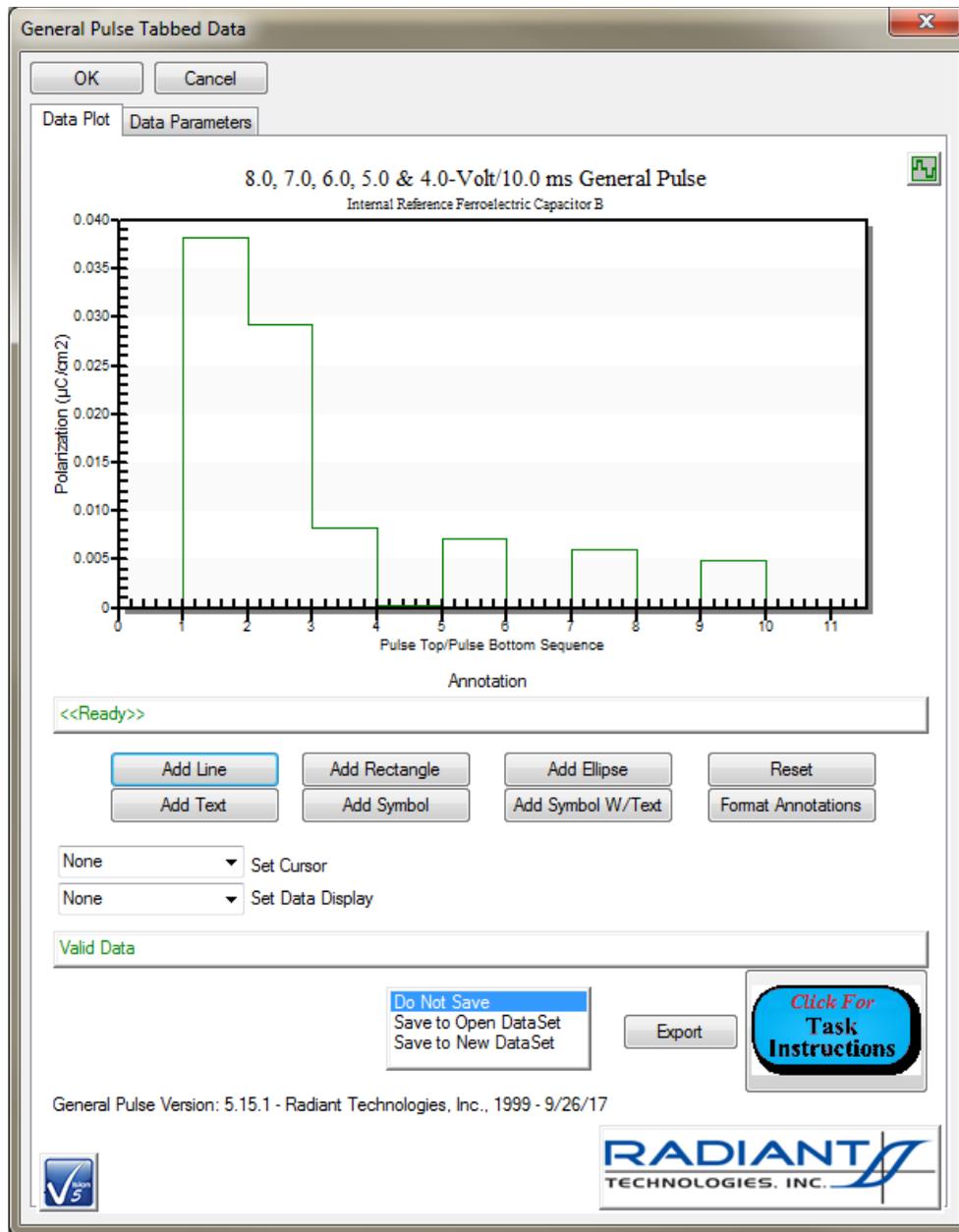


Figure 1a and b - Dialog that results from a QuikLook General Pulse measurement. The top and bottom of each pulse is plotted against an X-axis that has no real meaning. Data are plotted from left to right in the sequence taken. On the full dialog derived measurement results are shown to the right. Derived measurement results are shown to the right. Data validity indicators are at the lower right.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

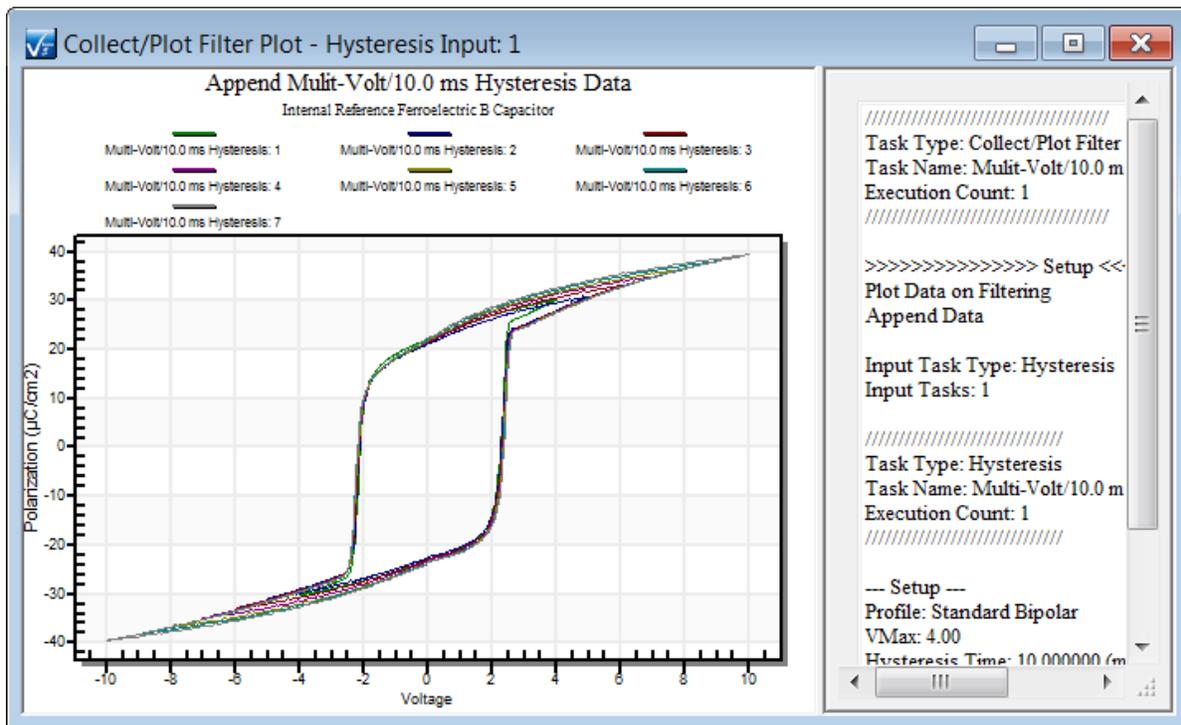


Figure 2 – Filter plot created during the program execution. This plot is created as the data are measured. Multiple plots may be created in a single execution. Plots may contain more than one data source. In a Branch Loop, a new plot may be created for each loop, or the data may be appended to a single plot. This shows data from three 10.0 ms Hysteresis sources of drive voltages varying from 4.0 to 10.0 Volts. To the right is a full textual experiment description created by the Hysteresis Tasks that sourced the data.

X.2 - Right-Click Options

Once data are plotted a large number of plotting options are available to the user. These are accessed by placing the cursor into the plot window and clicking the right button. A popup menu will appear (**Figure 3**) that directs the user to one of several options. The window may be maximized, being reduced again by pressing the 'Esc' key. Selecting the *Customization Dialog...* option will open a multi-paged dialog (**Figure 4**) that will allow, among other things, rewriting titles, enabling or disabling the grids, adjusting the axis scales, adjusting the data color, line type and/or symbols, changing font, etc.

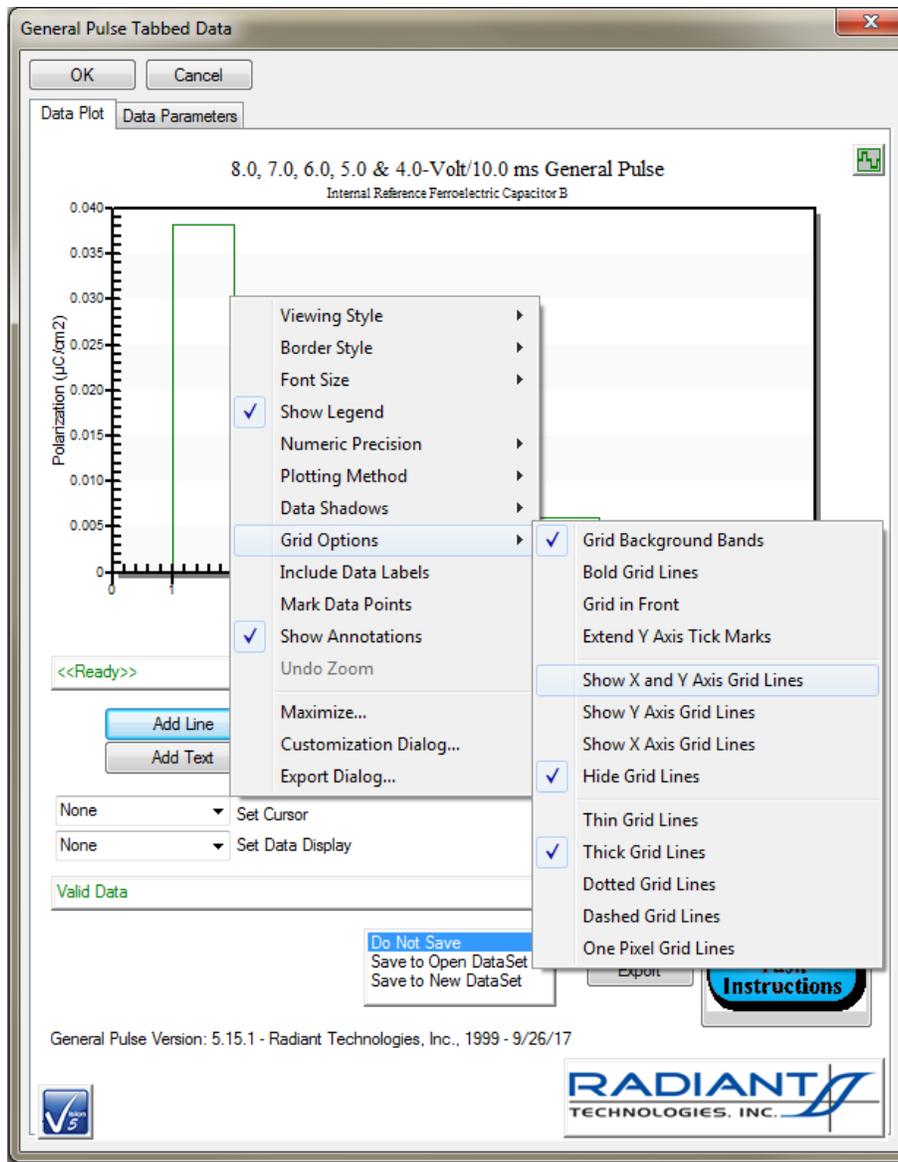


Figure 3 – QuikLook Results for General Pulse Showing Right-Click Popup Menu.

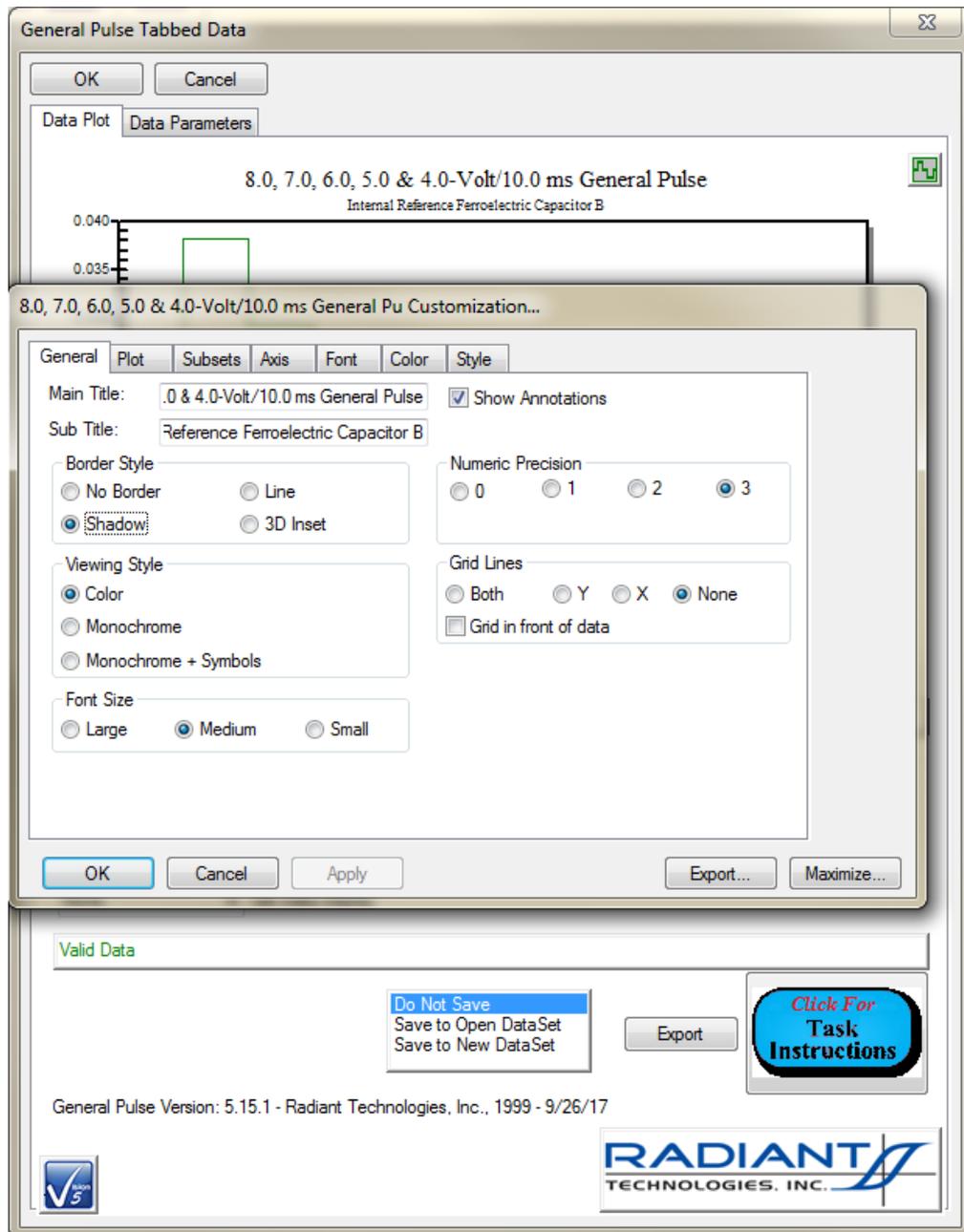


Figure 4 – Same as Figure 3, with the Customization Dialog Presented.

In order to send the plot to the printer, right-click in the plotting surface and select "Export Dialog..." When the dialog appears, select the output type (Enhanced Metafile [EMF], Metafile [WMF], bitmap [BMP], JPEG [JPG] or PNG), and Printer. Click Print... and acknowledge the desired printer. Landscape or Portrait modes can be selected by clicking Setup... in the Printing dialog. Page size, etc may also be adjusted using Setup... The sequence is shown in **Figure 5**.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

The export dialog can also be used to save the plot to a file of the selected type or to save it on the clipboard for pasting into another document. It can be imported into a spreadsheet, drawing program or word processor from the clipboard or the Meta File. Note that when printing or saving the plot, only the plot portion of the dialog applies. Portions of the dialog containing other controls will not be printed or saved to the file or clipboard. Note that the export feature of Vision, accessed through the *Export* button on the results dialog, provides a simpler, more complete and better-formatted method of sending data to a printer, an Excel file or a text file. However, data sent to a printer using Vision export will not include the data plot.

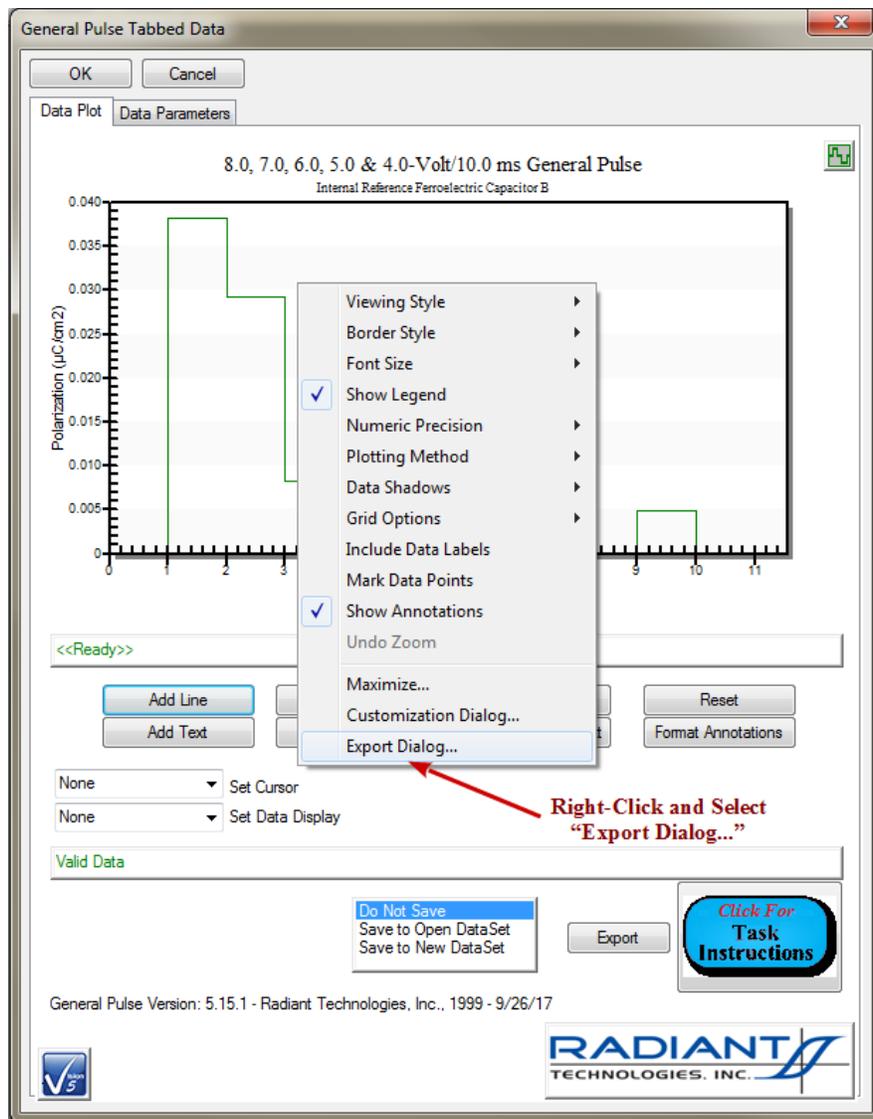


Figure 5a – Plot Printing Sequence 1. Right-Click and Select "Export Dialog ...".

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

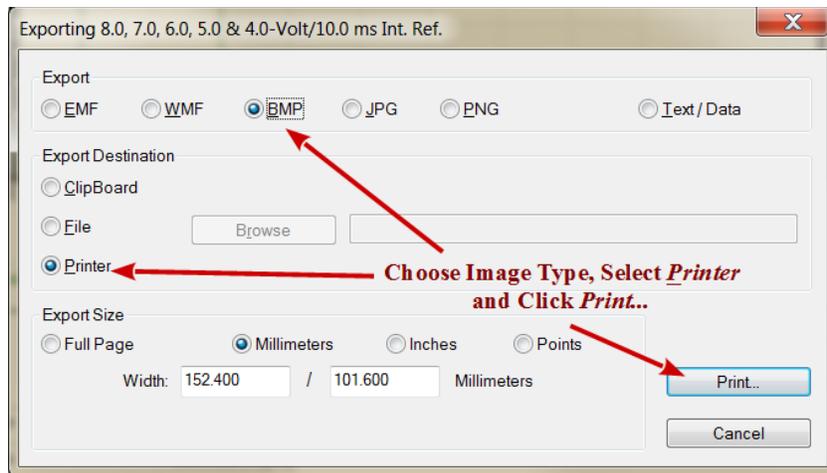


Figure 5b – Plot Printing Sequence 2. Export Dialog Configured for Printing.

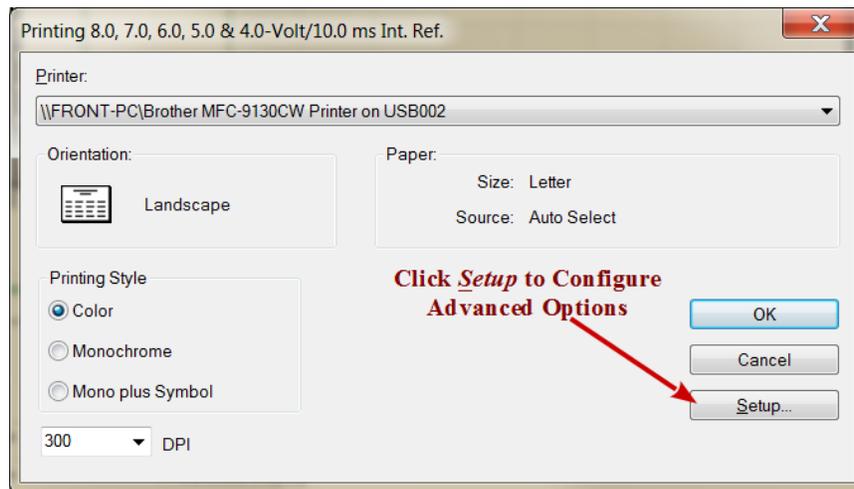


Figure 5c – Plot Printing Sequence 3. Typical Windows Printing Dialog. Click Setup... for Additional Configuration.

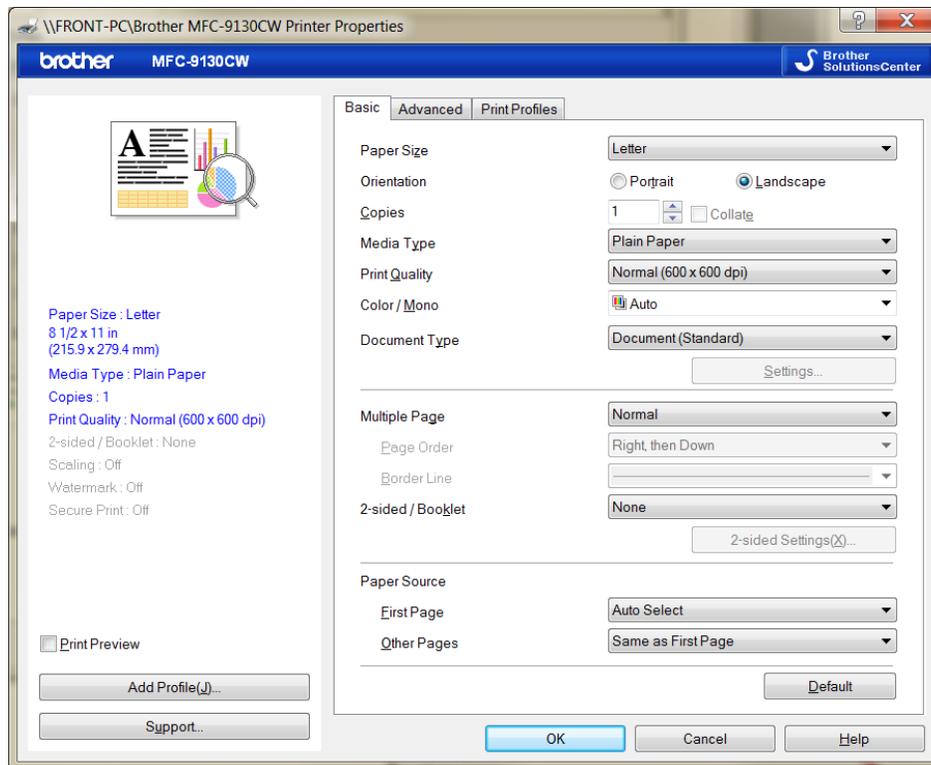


Figure 5d – Plot Printing Sequence 4. Typical Printer Configuration Subdialog.

Zooming in on data of interest can be performed automatically without manually adjusting the axis limits. To do this, place the cursor adjacent to the data of interest. Click and hold the left button and drag the cursor over the data forming a rectangular window, originating at the spot that the button was clicked and completely containing the data of interest. When the button is released, the view will expand so that it contains only the window that was created by the click-and-drag (rubber band) method. Return to normal zoom by right-clicking in the window and selecting *Undo Zoom* in the popup window. A zooming sequence is shown in **Figures 6** and **7**.

Figure 7 - Zoomed Data.

X.3 - Annotations

A limited set of annotation tools is available to data plots that appear in dialogs in which menus may appear. Long duration Measurement Tasks and Filter Tasks present data in a plot window such as in **Figures 6** and **7**, that do not allow menuing and do not include annotations. All other Measurement Tasks allow annotations to be added. **Figure 8** shows two samples of ellipses, lines and text annotations. The following annotations and their styles may be added:

1. Lines - Line type and color.
2. Rectangles - Line type and color
3. Ellipses - Line type and color
4. Text - Text size and color
5. Symbol - With or without text, symbol type and color

The current line type and color apply to Lines, Rectangles and Ellipses. These do not maintain discrete configurations. All color selections include Black, Blue, Red, Green, Yellow and Custom. Line types include:

1. Thin Solid
2. Medium Solid
3. Thick Solid
4. Dotted
5. Dashed

Text sizes are:

1. Tiny
2. Small
3. Medium
4. Large
5. Very Large

Changes to text size apply to all existing text on the plot as well as the future addition of text. This is the only property that can be changed for annotations that have already been placed on the plot.

Symbol types are:

1. Dot - Open or Solid
2. Square- Open or Solid
3. Diamond - Open or Solid
4. Triangle - Up or Down, Open or Solid
5. Plus (+)

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

6. Cross (X)

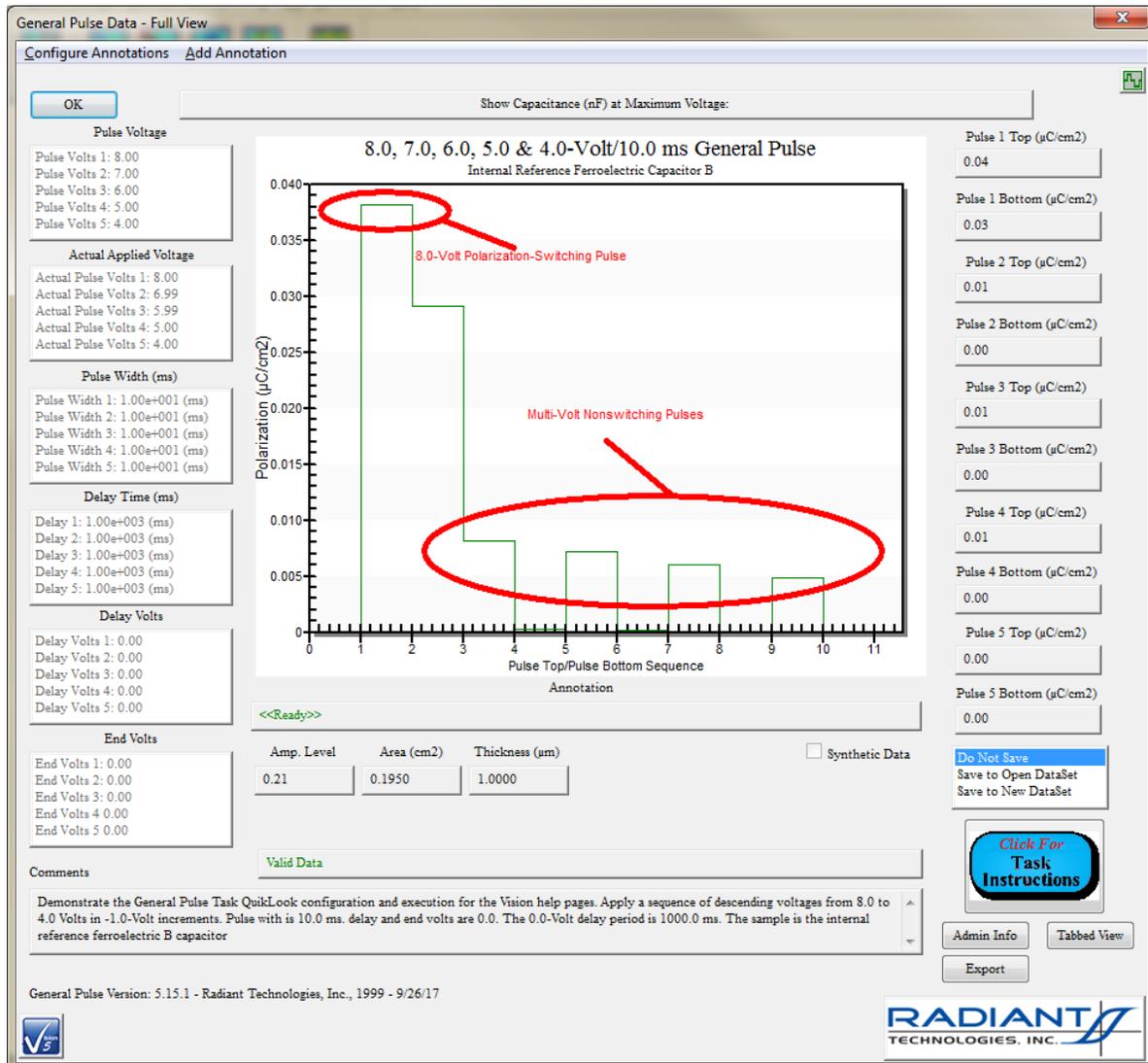


Figure 8 - Plot with Annotations.

Annotations are configured and initiated by selection adjacent to the cursors option in Tasks that offer cursors. In pulse Tasks, such as the General Pulse of **Figure 8**, the annotation menu has been added to the plot dialog that does not include cursors.

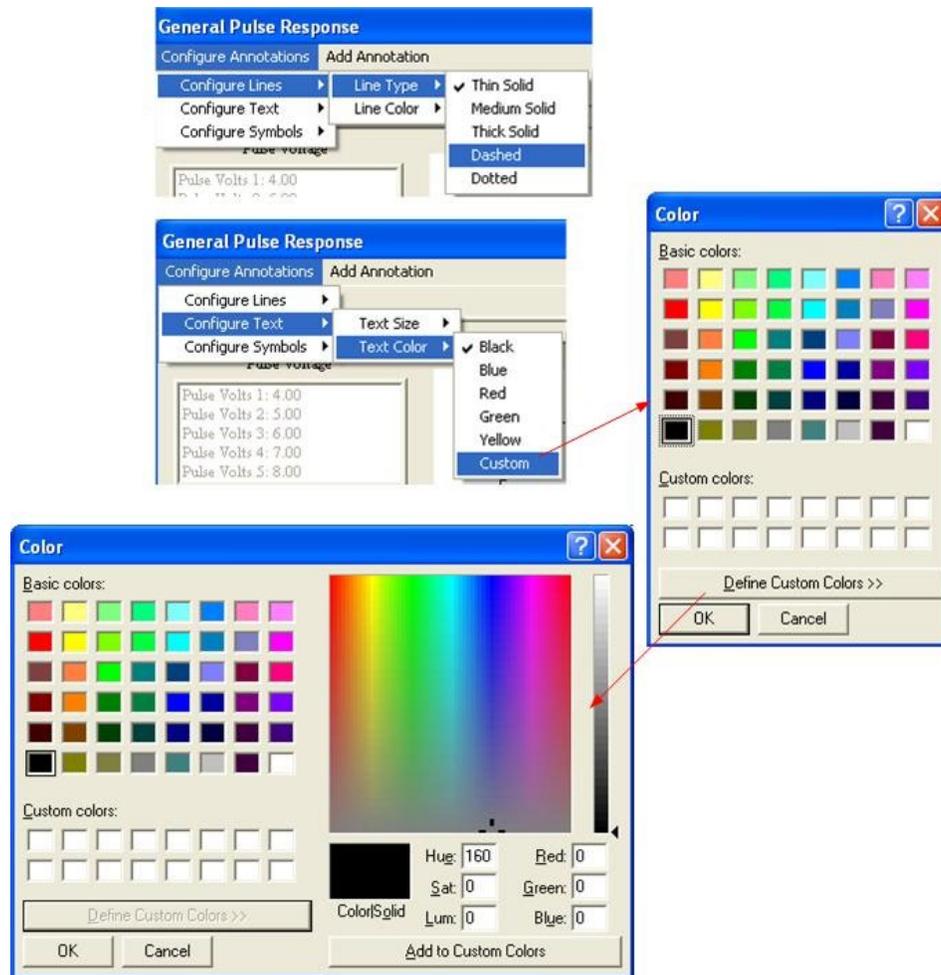


Figure 9 - Various Annotation Configuration Actions.

The configuration action will be reflected in the plot dialog's *Annotation* indicator. The indicator will either reflect the most-recent annotation configuration action or provide instruction when annotations are being added. If annotation operations are idle, the control will show <<Ready>>.

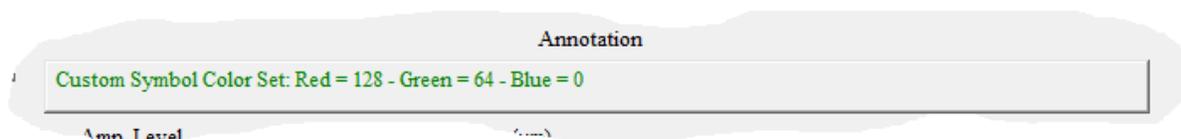


Figure 10 - Annotation Indicator.

Once the annotations are configured as desired, click the "Add Annotation" menu option and select the annotation type. If this is the first annotation to be inserted, the left mouse button must be clicked anywhere in the plot surface to change the focus. The left button is then used to define

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

the annotation limits. For lines, the mouse is clicked twice, once at each end point. For rectangles and ellipses the mouse is clicked twice. The first click selects one corner of a rectangle that defines the limits of the annotation. The second click defines the opposite corner - both horizontally and vertically of the defining rectangle. Symbols and text annotations require only a single click. For text annotations and symbols with text, the click defines the position of the left-most part of the annotation. If text is to be inserted, the mouse click is followed by a dialog in which the text is entered. There is a 48-character limit to the text length.

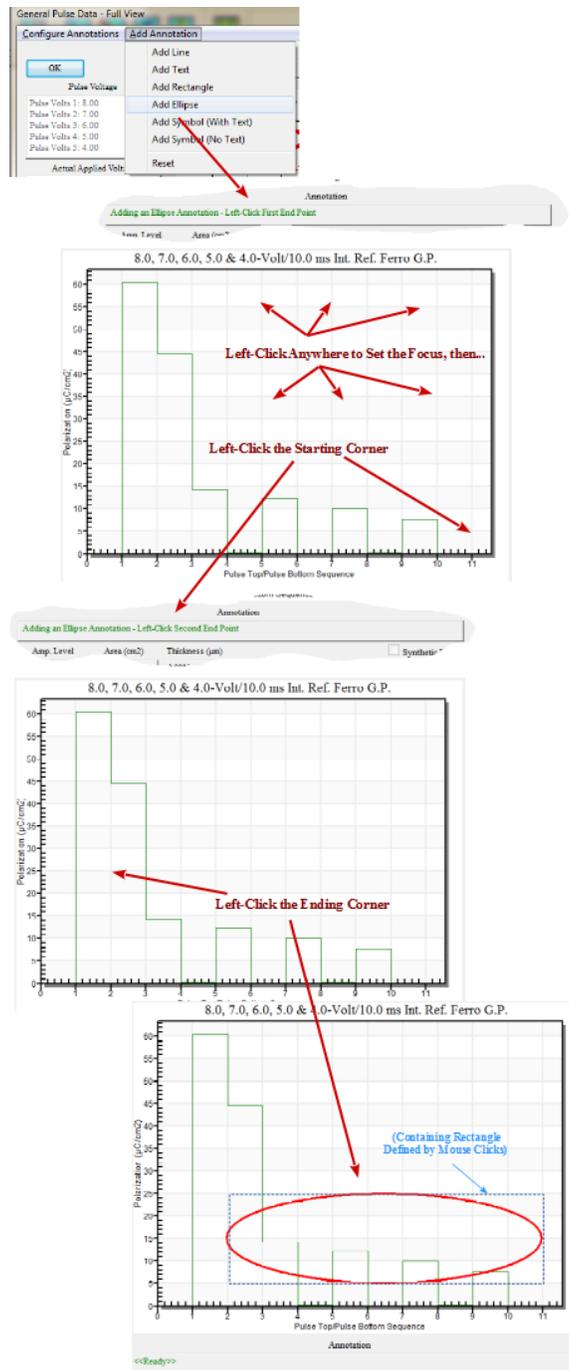


Figure 11 - Adding an Ellipse.

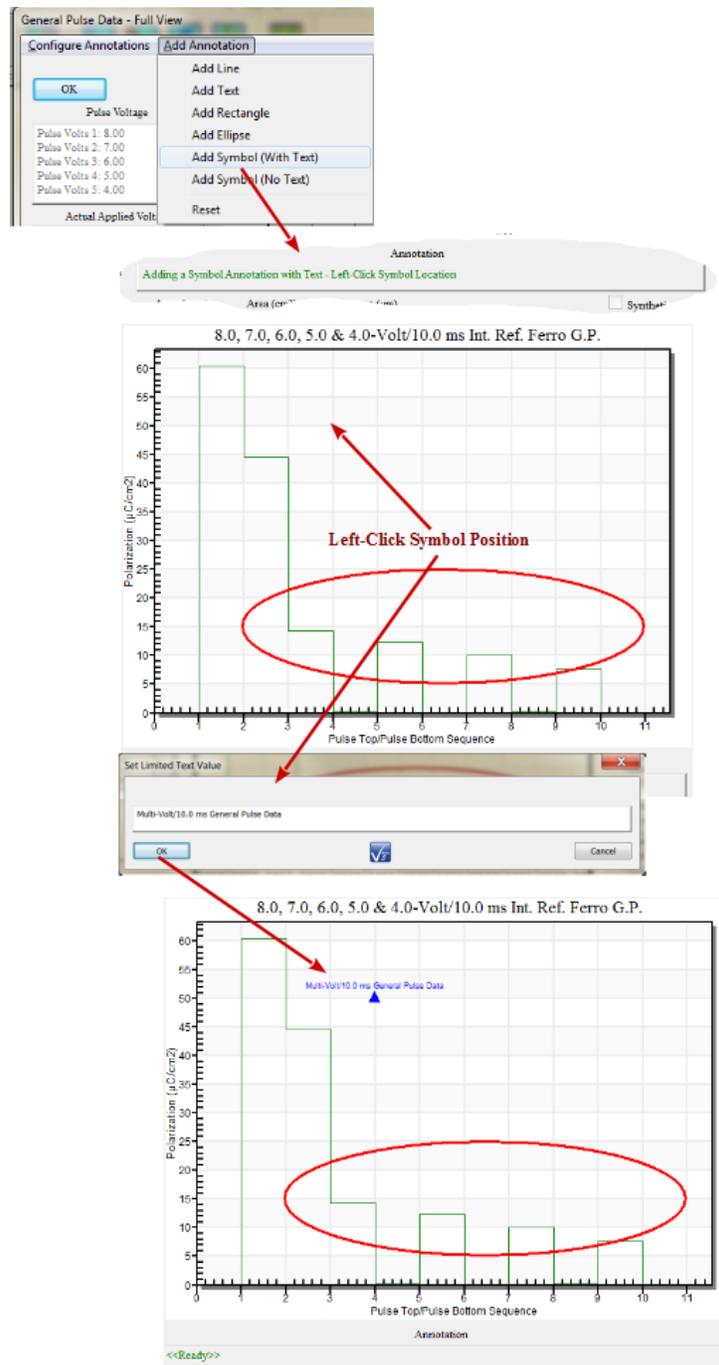


Figure 12 - Adding a Symbol with Text.

Tabbed Data Presentation dialogs do not include menus. For tabbed dialogs, annotation control (and cursor controls when available) is performed using dialog button controls.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

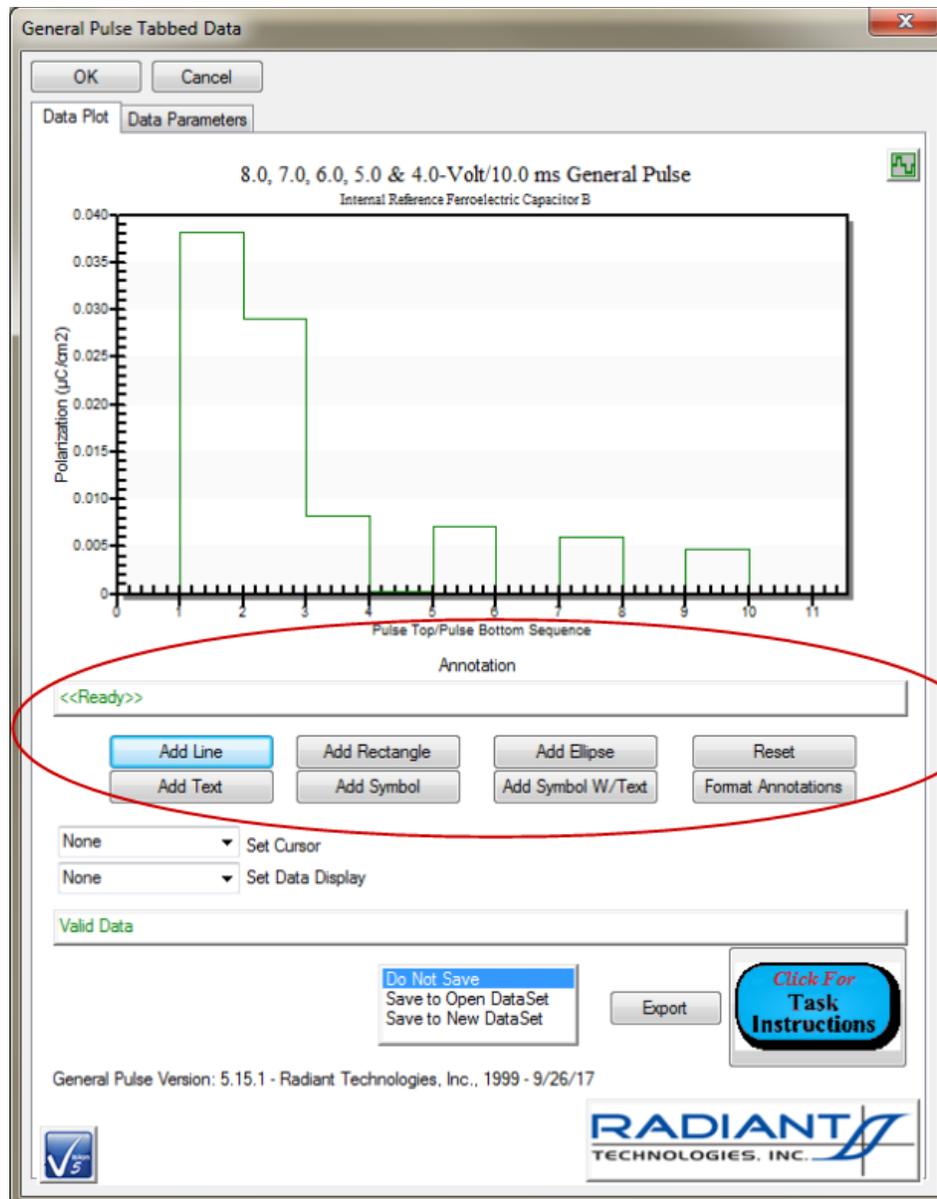


Figure 13 - Tabbed Data Presentation Annotation Controls.

The figures in this section show annotations added to a QuikLook plot. Once the QuikLook response dialog is closed, the annotations are lost. However, if a plot dialog, recalled from a DataSet Archive, has annotations applied, the list of annotations is saved to a file in C:\DataSets\Annotations. The file has the name <DataSet Name>.<Task Name>.<Execution Count>.mm.dd.yy hh.mm.ss AM/PM. The annotation file is, therefore, very specific to the Task. When the Task is recalled from the DataSet Archive again, the previously-added annotations will appear.

Note that once the annotations are placed on a plot, the only modifications possible are to add

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

new annotations or to remove all annotations as a group. The only other change that can be generally applied is to change text size for all text and symbols with text annotations. Annotations cannot be individually removed. They cannot have their properties changed or be moved. These actions will be the subject of future Vision releases.

X.4 - Global Plotting Options

The global default settings for data plotting can be adjusted in the main Vision "Data Plotting" menu. Options include plot type (line, points, etc.), grid control, font size, etc. See the [Data Plotting](#) Vision menu help page for more detail.

XII - Variable Task Icons

Version Tasks are grouped into general types that are identified by Task location in the TASK LIBRARY and QuikLook (if applicable) and by Task icon. The general icons are listed in **Table 1**.

Icon	Task Type
	Program Control Task (Pause, Delay, General Information, Etc.)
	Hardware Task that makes no measurement (Waveform, DC Bias)
	Sync Trigger Task
	Measurement Task (Hysteresis, Fatigue, etc.)
	Transistor Measurement Task (to be introduced in future releases)
	Long-Duration Measurement Tasks (Fatigue, Imprint, Resist, Retain, etc.)
	Magneto-Electric Sensor Calibration
	Pulse Tasks (PUND, General Pulse, Simple Pulse)
	External Instrument Task (Generic GPIB, Set Temperature, LCR Meter etc.)
	Filter Task (averaging, math, etc.)
	Branch Task
	Nesting Branch Task
	General Information Task
	Customized Test

Table 1 - General Task Type Identifying Icons.

One of multiple icons can appear for any given Task in a Test Definition. Each Task is assigned the appropriate icon from **Table 1** when it appears in the Library. This same icon is used for most representations of a Task in the EDITOR, a DataSet Current Test Definition (CTD) or a DataSet Executed Test Definition (ETD) in the DataSet Archive. However, the Task appearance may change in the EDITOR or a DataSet CTD if it is associated with a Branch Task or one or more Filter Tasks or both. In that case the icon is augmented by a blue dot on the icon's left border when it is a Branch Target and by a brown rectangle in the lower-right corner when it is associated with one or more Filters. Both icons may appear if the Task is associated with both a Branch Task and Filters. In addition, a Task may appear with a red icon in a DataSet ETD if there was an error during execution. In all cases, the basic icon from **Table 1** is retained as a ba-

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

sis for the variable icon. **Note that Tasks in DataSets created prior to the Version 4.1.x update will not display variable icons, nor will they be displayed if a Test Definition is moved from the older DataSet back to the EDITOR unless the Branch or Filter Task is reconfigured and the association reassigned.**

The figures below show the various situations.

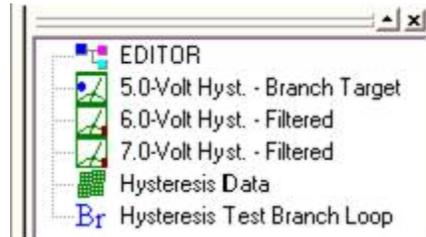


Figure 1 - Hysteresis Icons - Branch Target and Filter Association.

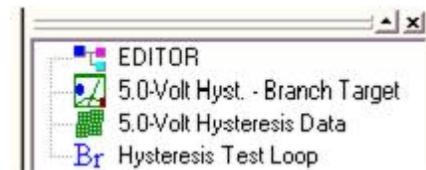


Figure 2 - Hysteresis Icons - Single Task as Branch Target and Filter Associate.

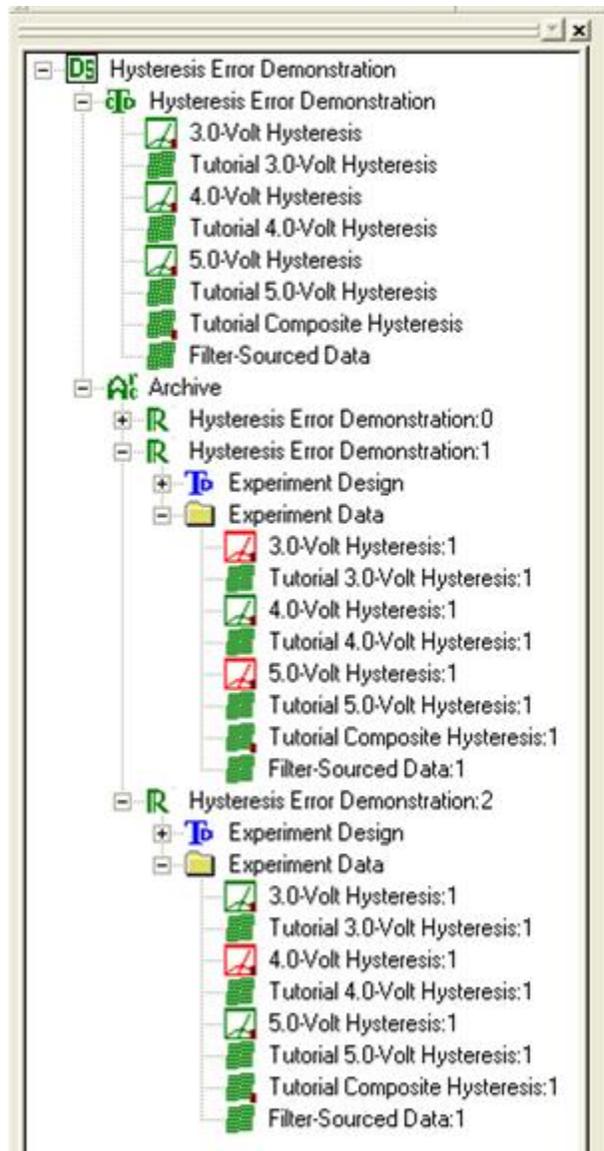


Figure 3 - Hysteresis Error Icons - The ETDs Hold Hysteresis Tasks with Forced Errors.

XIII - Nested Branch Looping

The Nested Branch allows Nested Branch Looping by allowing Branch Tasks (and their target Tasks) to be included in the Nested Branch Loop. The Branch Task defines an inner loop and the Nested Branch Task an outer loop. As originally conceived the use of the Nested Branch Task was confusing and its purpose difficult to grasp. This was primarily because the user was strongly cautioned against including Measurement and Filter Tasks within the inner Branch Loop. In this situation the inner loop could only be used for GPIB or program control. A simple mechanism has been added to Vision to make Nested Branch Looping simpler and more useful. The Nested Branch Loop has added a Boolean User Variable, called "Reset", added by the Nested Branch Loop Task, that can be used by Hardware Tasks, Measurement Tasks and Filters to return there configuration to the original state in a Branch Loop. Consider the Test Definition of Figure 1...

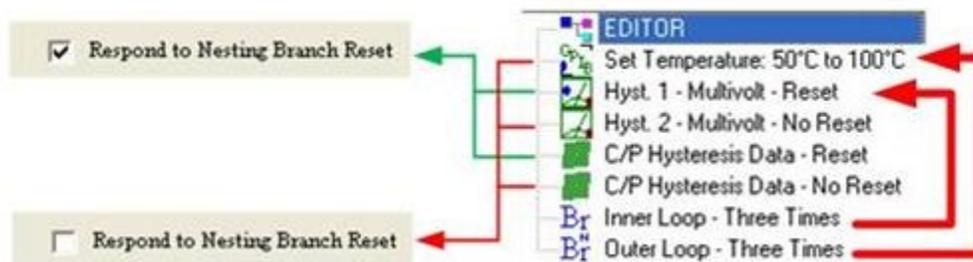


Figure 1 - Nested Branch Loop Test Definition.

The Tasks are defined as follows:

1. *Set Temperature 50°C to 100°C - Set Temperature* - This Task sets a thermal controller. Its initial temperature is 50° C. It is programmed to increment its temperature by 25° C in a Branch Loop. It has Nested Branch Loop Reset disabled.
2. *Hyst.1 - Multivolt - Reset - Hysteresis* - A Hysteresis Task programmed to perform a 5.0-Volt initial measurement and to increment its voltage by 1.0 Volts in a Branch Loop. Nested Branch Loop Reset is enabled.
3. *Hyst.2 - Multivolt - Reset - Hysteresis* - A Hysteresis Task programmed to perform a 5.0-Volt initial measurement and to increment its voltage by 1.0 Volts in a Branch Loop. Nested Branch Loop Reset is disabled.
4. *C/P Hysteresis Data - Reset - Collect/Plot Filter* - The Filter Task collects data from both preceding Hysteresis Tasks. It is programmed to append data in a Branch Loop. It is programmed with Nested Branch Loop Reset enabled.
5. *C/P Hysteresis Data - No Reset - Collect/Plot Filter* - The Filter Task collects data from both preceding Hysteresis Tasks. It is programmed to append data in a Branch Loop. It is programmed with Nested Branch Loop Reset disabled.
6. *Inner Loop - Three Times - Standard Branch* - This Task is programmed to Branch twice, causing a total of three executions of its nested Tasks. (The Branch Logic Condition is "Loop Counter <= 2".) Its Branch Target is *Hyst.1 - Multivolt - Reset*. This Task

automatically sets the "Reset" User Variable to "false".

7. *Outer Loop - Three Times - Nested Branch* - This Task is programmed to return execution to its *Set Temperature 50° C to 100° C* Branch Target three times. (The Branch Logic Condition is "Loop Counter - Nested <= 2".) This Task is programmed by the user to set the "Reset" flag to "true". This is a new option in the Nested Branch Task.

The *Respond to Nesting Branch Reset* checkbox of **Figure 1** has been added to all appropriate Hardware, Measurement and Filter Tasks to allow "Reset" to be either acknowledged or ignored. Tasks that have Reset enabled will execute their initial conditions on first execution and after each Nested Branch Task execution. Tasks that have Reset disabled will execute their initial conditions only on first execution. Note that, for Filter Tasks that have Reset conditions, the condition only applies if the Task is programmed in Append mode. **Table 1** tracks the progress of the execution of the Test Definition and highlights the difference between Reset enabled (green) and Reset disabled (red) Tasks.

Outer Loop Iteration	Inner Loop Iteration	Temperature (°C)	Hysteresis 1 Voltage	Hysteresis 2 Voltage	Filter 1 Plots	Filter 1 Traces/Plot	Filter 2 Plots	Filter 2 Traces/Plot
1	1	50	5.0	5.0	1	2	1	2
1	2	50	6.0	6.0	1	4	1	4
1	3	50	7.0	7.0	1	6	1	6
2	1	60	5.0	8.0	2	6/2	1	8
2	2	60	6.0	9.0	2	6/4	1	10
2	3	60	7.0	10.0	2	6/6	1	12
3	1	70	5.0	11.0	3	6/6/2	1	14
3	2	70	6.0	12.0	3	6/6/4	1	16
3	3	70	7.0	13.0	3	6/6/6	1	18

Table 1 - Task Condition at Each Test Definition Branch Iteration.

As is evident from the Table, the Reset option allows the Hysteresis Task to repeat a series of voltages over a range of temperatures. With Reset disabled, a different range of voltages is covered at each temperature. For the Filter plot, a new plot is generated at each new temperature if Reset is enabled. If Reset is disabled, all data are shown on a single plot.

XIV - Test Definition Graphing

Introduction

A graphical representation of any Test Definition in Vision can be made and then edited, printed and exported. This is called a Test Definition Graph. Recall that a Test Definition refers to a linear sequence of Vision Tasks that, taken together, form an experiment. There is usually a Test Definition under construction in the EDITOR window. All DataSets contain a single Test Definition, called the Current Test Definition (CTD), which is the experiment that is ready for execution within the DataSet. The DataSet may also contain any number of archived Executed Test Definitions (ETDs) that represent previous experiment executions in the DataSet.

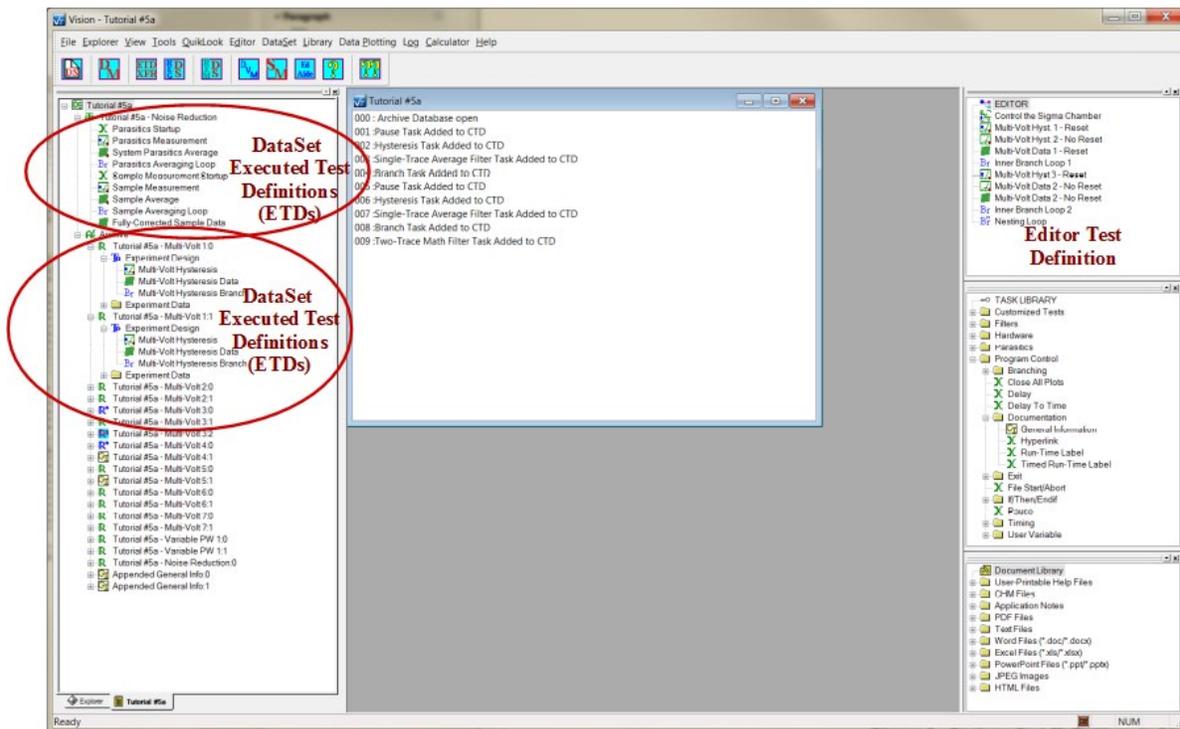


Figure 1 - Various Test Definitions in Vision.

A Test Definition Graph is opened by right-clicking the appropriate Test Definition and selecting "Graph Editor Test Definition", "Graph CTD" or "Graph ETD Design" as appropriate.

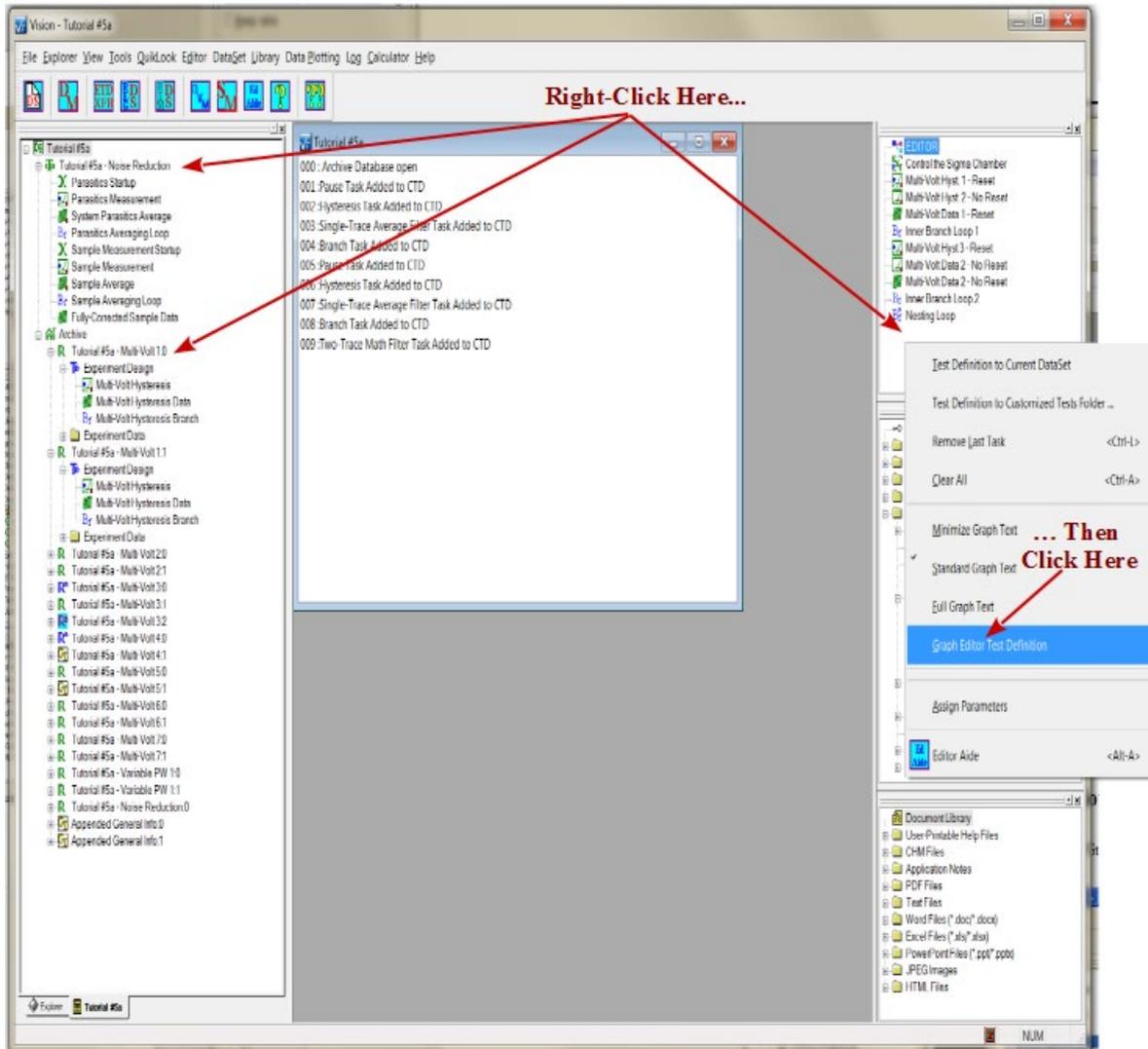


Figure 2 - Initiate Test Definition Graphing.

A two-paned, scrollable window will open that details the Test Definition graphically. For the moment, the right pane contains a simple box labeled "Mini-Graph". The box contains the sequence of Tasks in the Test Definition represented only by the Task icons. In addition, links between Filters and their Target Tasks are presented as brown lines. Branch Task links are presented as blue lines.

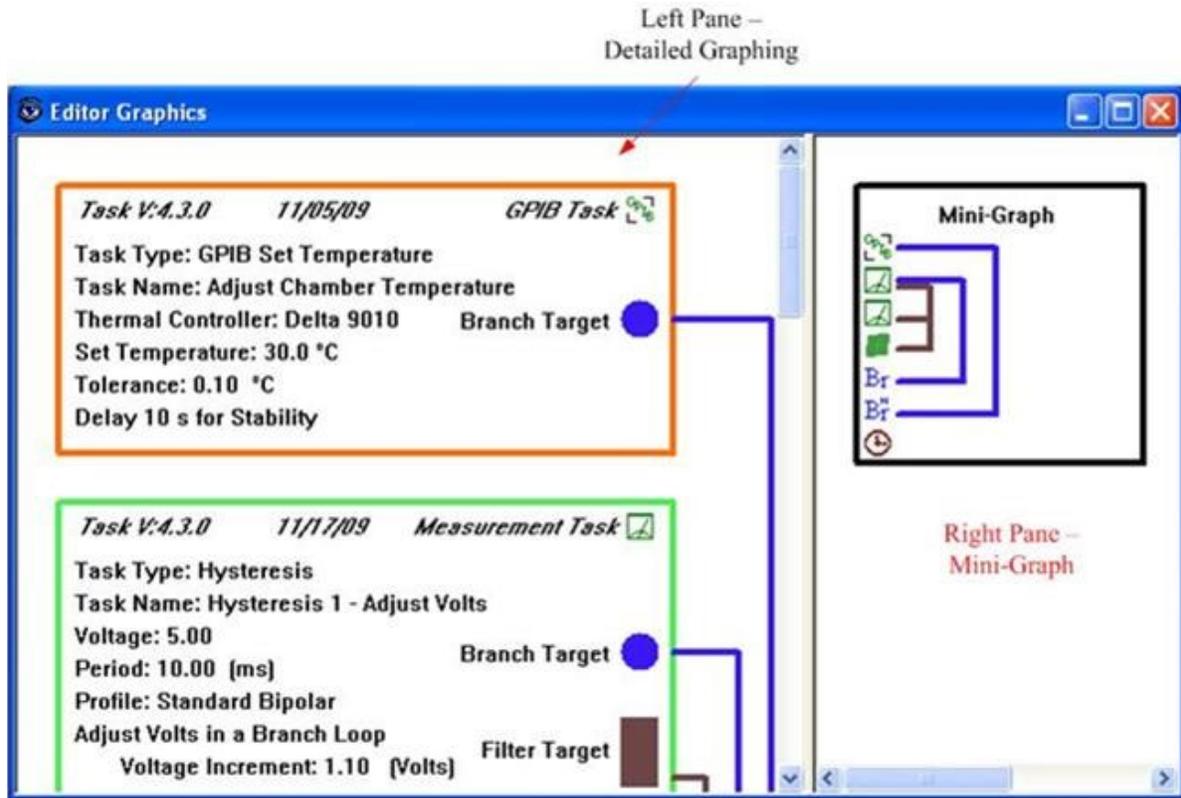


Figure 3 - Initial Graph.

The left pane includes more detail. Each Task is assigned a box. The initial box color depends on Task type. In the upper right corner, the Task icon appears. It is also Task dependent. Default values are shown in **Table 1**.

Task Family Type	Box Color	Icon
Program Control	Blue	
Hardware	Dark Green	
Measurement	Light Green	
External Instruments	Orange	
Filter	Dark Brown	
Long-Duration	Light Brown	
Branch	Blue	Br
Nesting Branch	Blue	Br

Table 1 - Icons and Box Colors by Task Family Type.

Each Task in the main window indicates Task version, compilation date and Task family/Library location in italics along the top of the Task box. The remainder of the text in the box is provided by the Task and details Task configuration. All Tasks first present "Task Type:" and "Task Name:" information. Tasks that are Target Task for Filters add a brown rectangle in the lower

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

right corner. The rectangle is labeled "Filter Target". Likewise, Tasks that are Branch Targets have a blue circle, labeled "Branch Target" to the middle right. Cascading link lines outside the box show the association between Filter and Branch Tasks and their Targets.

Levels of Task Description

Tasks can be asked to provide three levels of detail to the Test Definition graph. Once a graph is created, the level is not changed. But the level may be selected before graphing and the selected level remains persistent - even between executions of Vision - until it is changed. The information level is selected by right clicking, as in **Figure 2**, then selecting "Minimize Graph Text", "Standard Graph Text" or "Full Graph Text". The level may also be changed by selecting "File-> Minimize Graph Output Text", "Standard Graph Output Text" or "Full Graph Output Text" in the main Vision menu.

Minimize Text.

In the minimized text representation, all Tasks provide the same information. This includes the italicized Task Version, compilation date and family and the Task Type and Task name entries. Since the size of the boxes is minimized, links and symbols indication associations between Filter and Branch Tasks and their Targets are eliminated. This information is still provided in the Mini-Graph of the right pane.

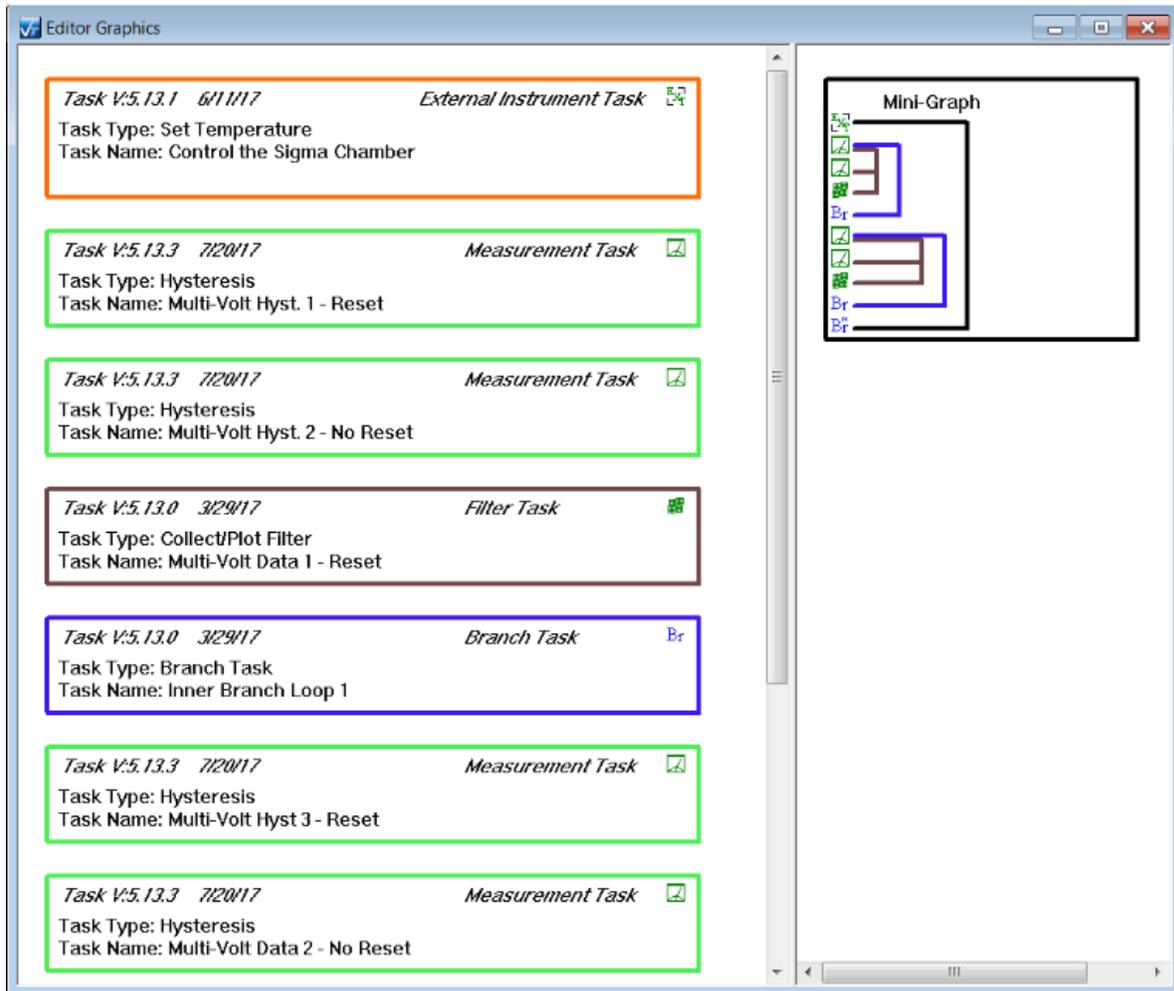


Figure 4 - Minimized Text.

Standard Text

This is the normal Task presentation. Tasks provide complete configuration information. Full links are provided between Branch and Filter Tasks and their Targets.

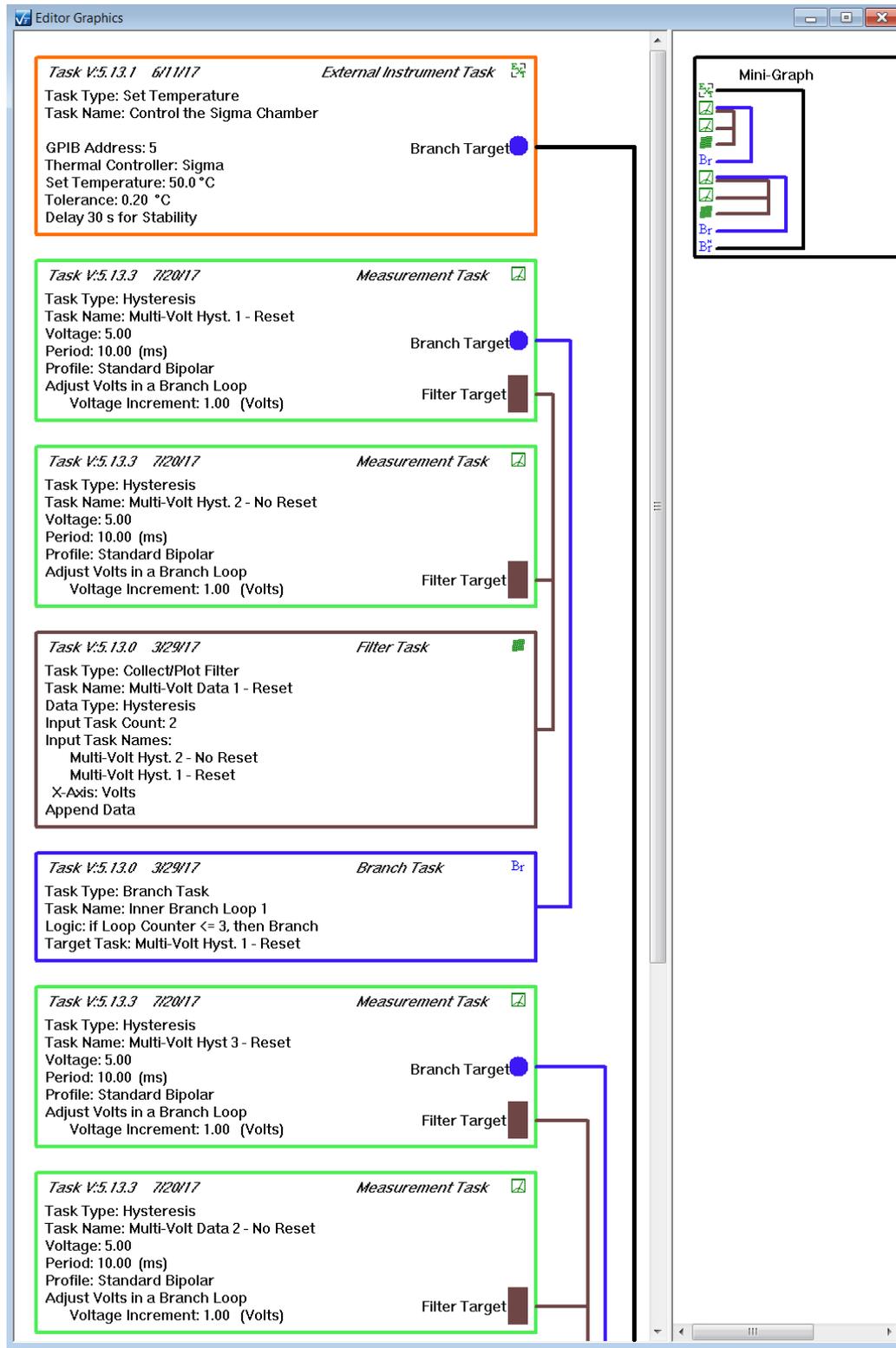


Figure 5 - Standard Text.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)



Full Text.

In the Full Text presentation Tasks add just a little bit more information. All Tasks add the Task configuration date to the bottom of the displayed Text. Hardware Tasks also add the sample Area (cm²) and Thickness (μm) information. Finally, Measurement Tasks present the configuration of the return signal amplification level.

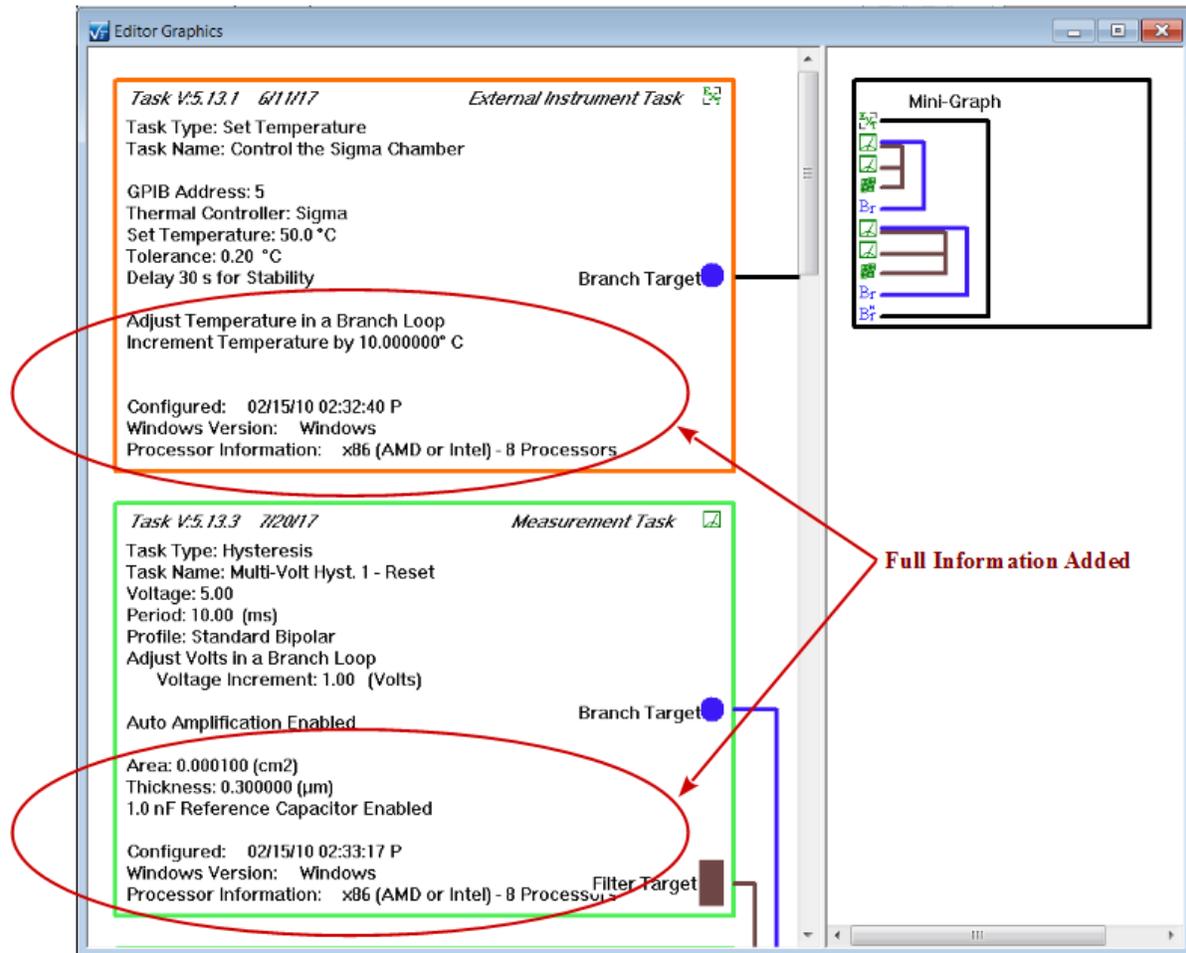


Figure 6 - Full Text.

Editing Task Graphics

Any Task entry may be selected for editing within the left pane. To select a Task, simply left-click within the Task box boundary. The Task is "Highlighted" by turning its box to a pink color, indicating that it has been selected.

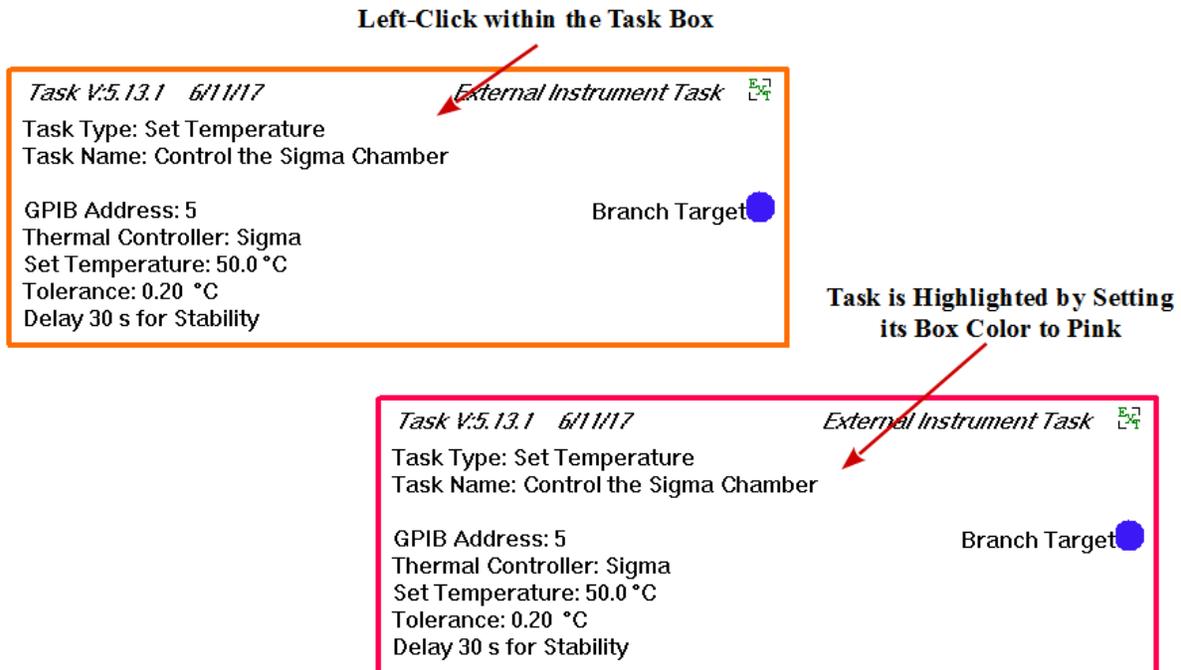


Figure 7 - Selecting (Highlighting) a Task for Editing.

Once a Task is selected, it may be edited in two ways. First the color of the Task box may be changed to any desired value. Right-click anywhere within the Graph window and select "Change Task Box Color" from the popup menu. A standard Windows Color-Picker dialog will appear. The dialog may be expanded to allow any custom color to be selected or defined. Once the appropriate color is established in the dialog, click OK to close the Color-Picker and set the new Task box color.

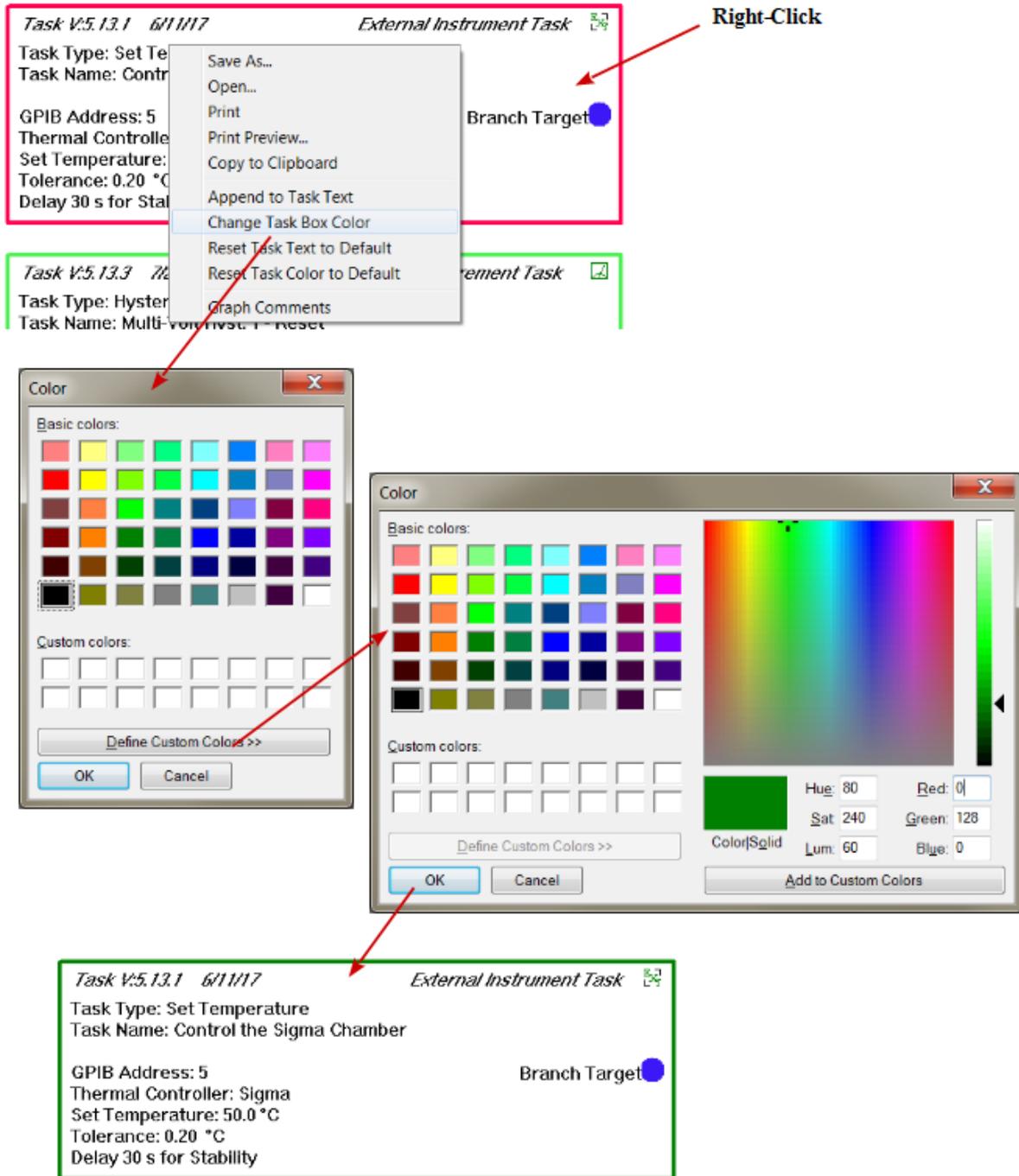


Figure 8 - Changing a Task's Box Color.

The second change that can be made is that the descriptive Task text can be edited to append any additional information the user may choose to add. With the Task highlighted, right-click anywhere in the Graph window and select "Append to Task Text" from the popup menu. A simple dialog will open that allows text to be entered. Text may be of any length and may include car-

riage returns. Once the text is edited, click OK to append it to the existing text provided by the Task. Once text is added it becomes "permanent". Subsequent repetitions of the process will continue to append to the previously-appended text.

Any Task can be returned to its original color and/or text state by highlighting the Task, right-clicking and selecting "Reset Task Text to Default" and/or "Reset Task Color to Default".

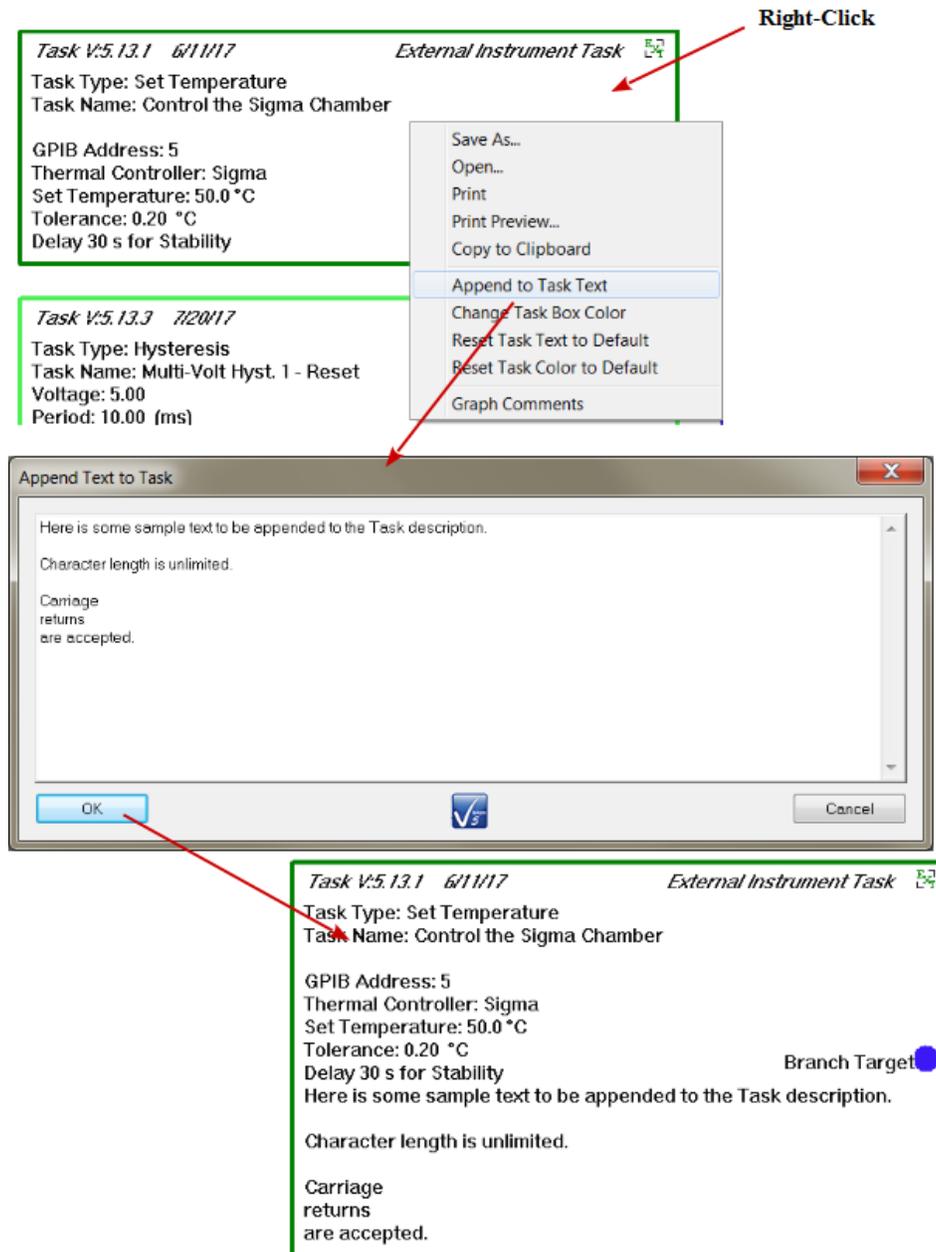


Figure 9 - Appending Text to a Task's Graph Entry.

Adding Comments

An unlimited amount of text, including carriage returns, may be added to the Graph to further document the represented Test Definition as the user sees fit. Right-click anywhere in the Graph window and select "Graph Comments" in the popup menu. A simple text editor dialog will appear. Add any descriptive text desired, then click OK. A box containing the text will appear in the right window pane.

Text may be reedited to an unlimited degree by reopening the "Graph Comments" dialog. The current text will appear. It may be deleted and/or corrected and/or appended to. Once the dialog is closed, the update text will appear in the right pane. If all text is deleted, the Comments box will disappear.

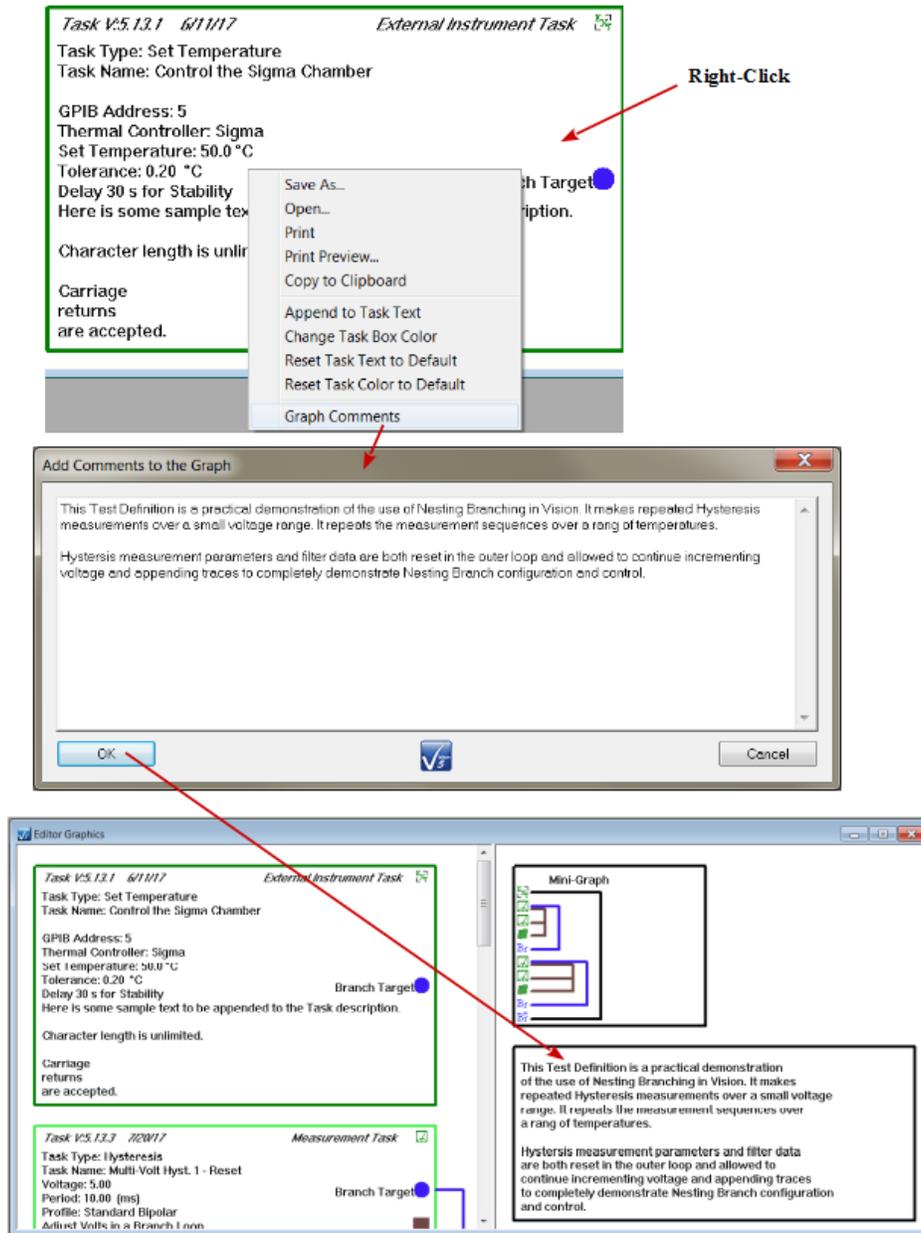


Figure 10 - Adding Comments to a Graph.

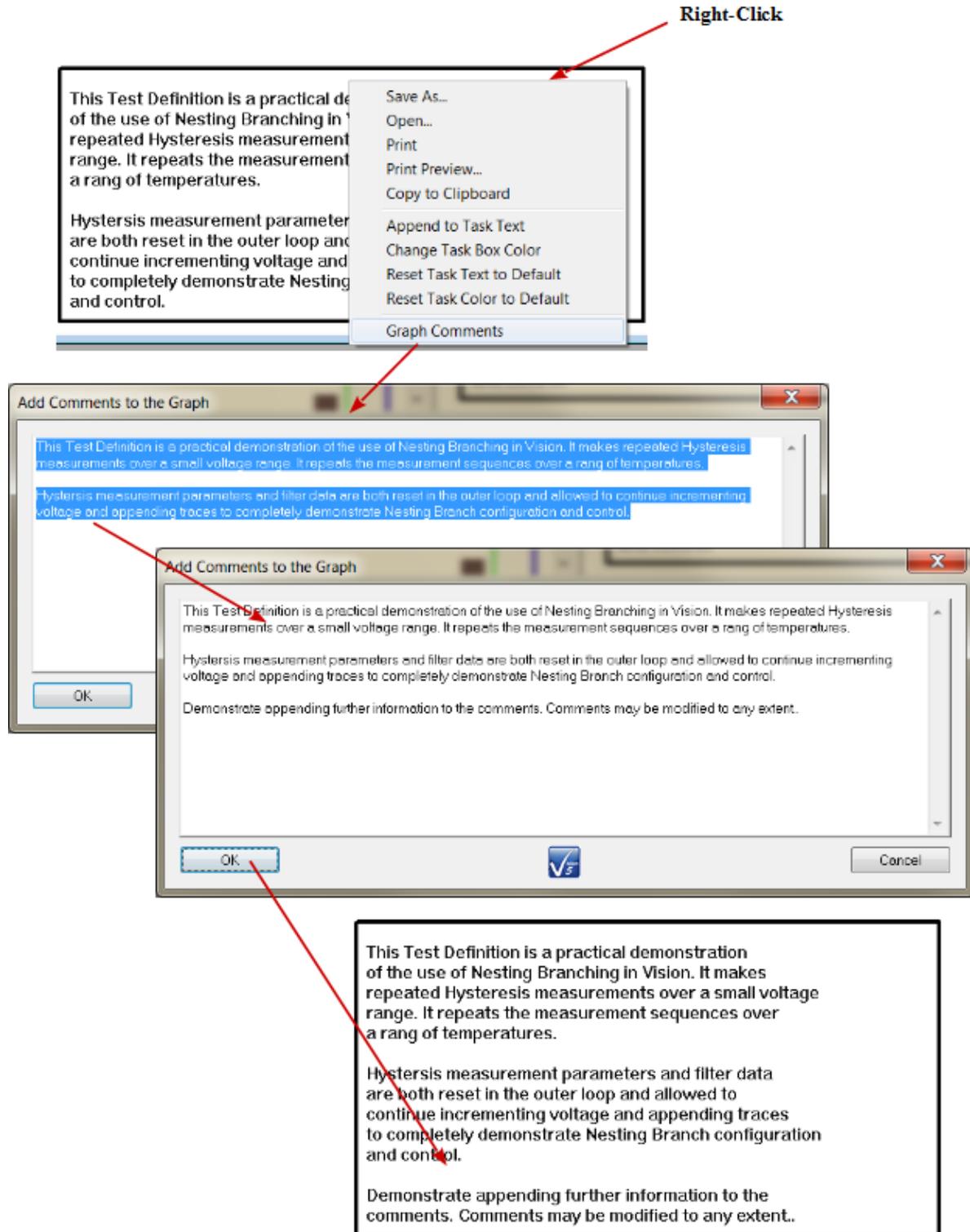


Figure 11 - Editing Graph Comments.

Saving and Recalling Graphs

Once the user is satisfied with the state of a Test Definition Graph, the graph may be permanently stored to a file and then recalled into a graph window at any future time. Right-click anywhere in the Graph and select "Save As...". The standard Windows browser dialog will appear. Navigate to the desired file path and set a file name. Note that the "*.grph" extension is filtered for, but the file may take on any name and file extension. Click *Save* to write the file.

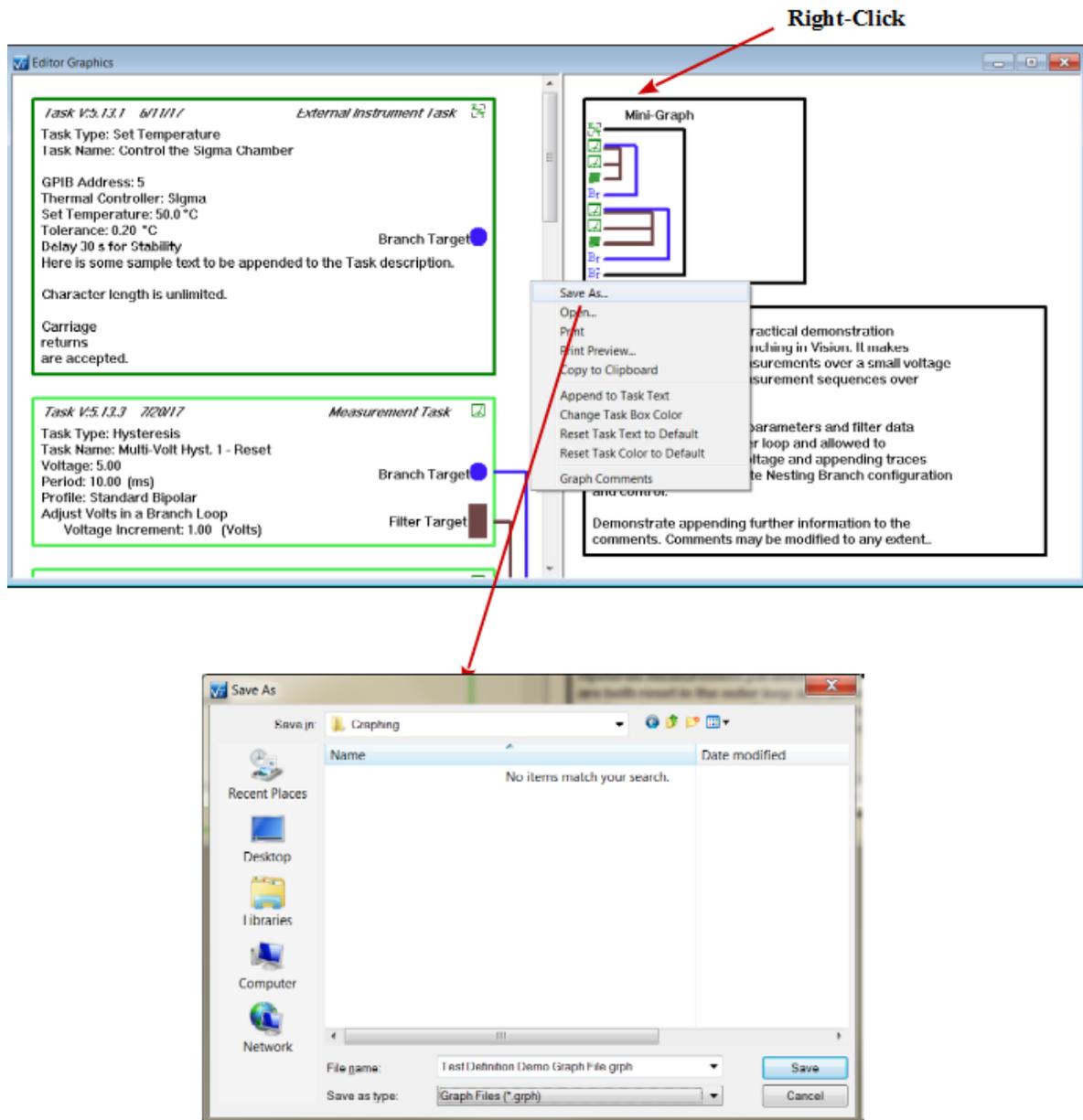


Figure 12 - Saving a Graph to File.

A file may be reopened into any existing graph (overwriting the previous graph) by right-

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

clicking anywhere in the Graph window and selecting "Open..." from the popup menu. A more common approach may be to select "File->Open a Test Definition Graph" from the main Vision menu. In this case a new graph window will be created and the file data will be written to it. Either of these actions will open a standard Windows browser dialog that should be used to navigate to and identify the file. The dialog will have the *.grph filter, but any file name may be used.

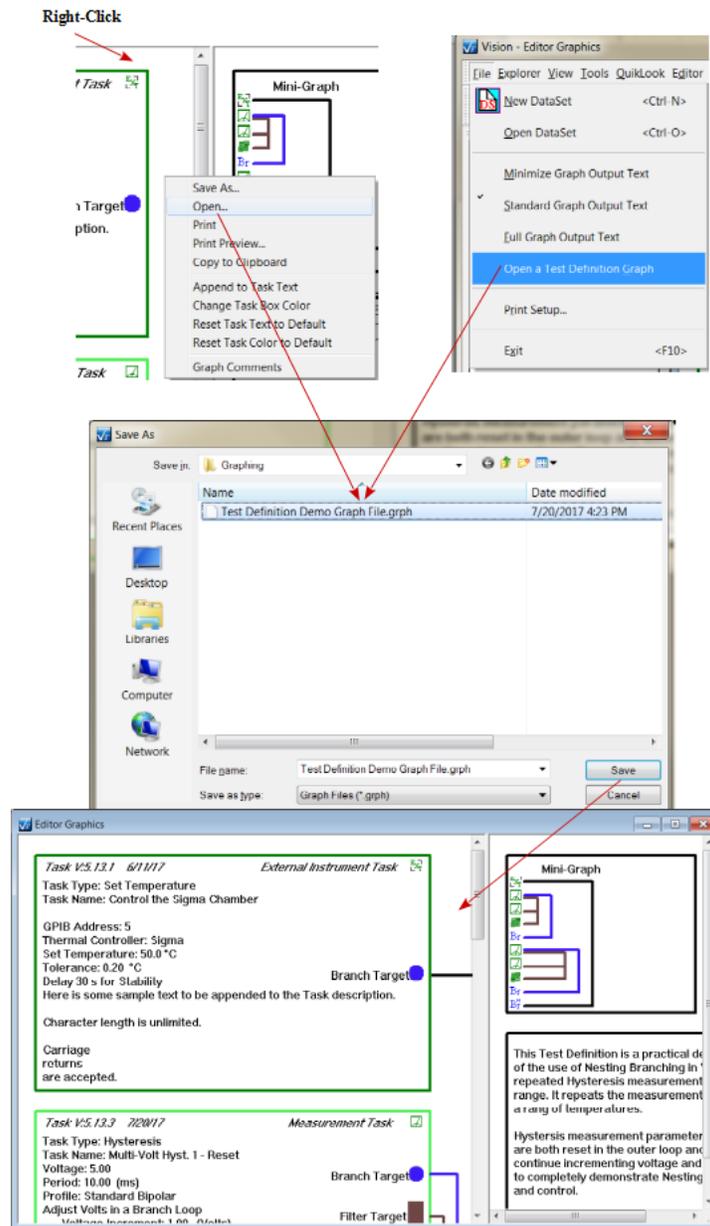


Figure 13 - Recalling a Graph from a File.

Closing Graphs

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

Each time a Graph is closed by clicking *X* in its upper-right corner, the user is prompted to save the graph.

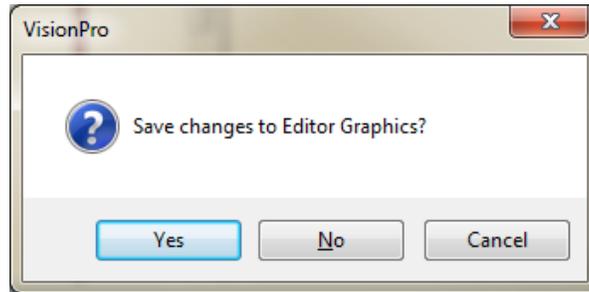


Figure 14 - Graph Save Prompt on Graph Closing.

If *Yes* is clicked, the save process of **Figure 12** will be initiated. If *No* is clicked the Graph will simply close. *Cancel* causes the Graph to remain open. If Graph windows are open when Vision is closed, the user will be prompted by the dialog of **Figure 14** once for each open Graph. However, <Ctrl-G> will close all open Graph windows without prompting.

Printing

Any graph may be sent to any printer accessible to the Vision host simply by right-clicking in the Graph window and selecting "Print". A standard Windows printer configuration dialog will open that allows the number of copies and/or pages to print to be selected. Each printout will include at least to printed pages. The first page represents the right window pane with the Mini-Graph and any Comments. The remaining pages show the left pane.

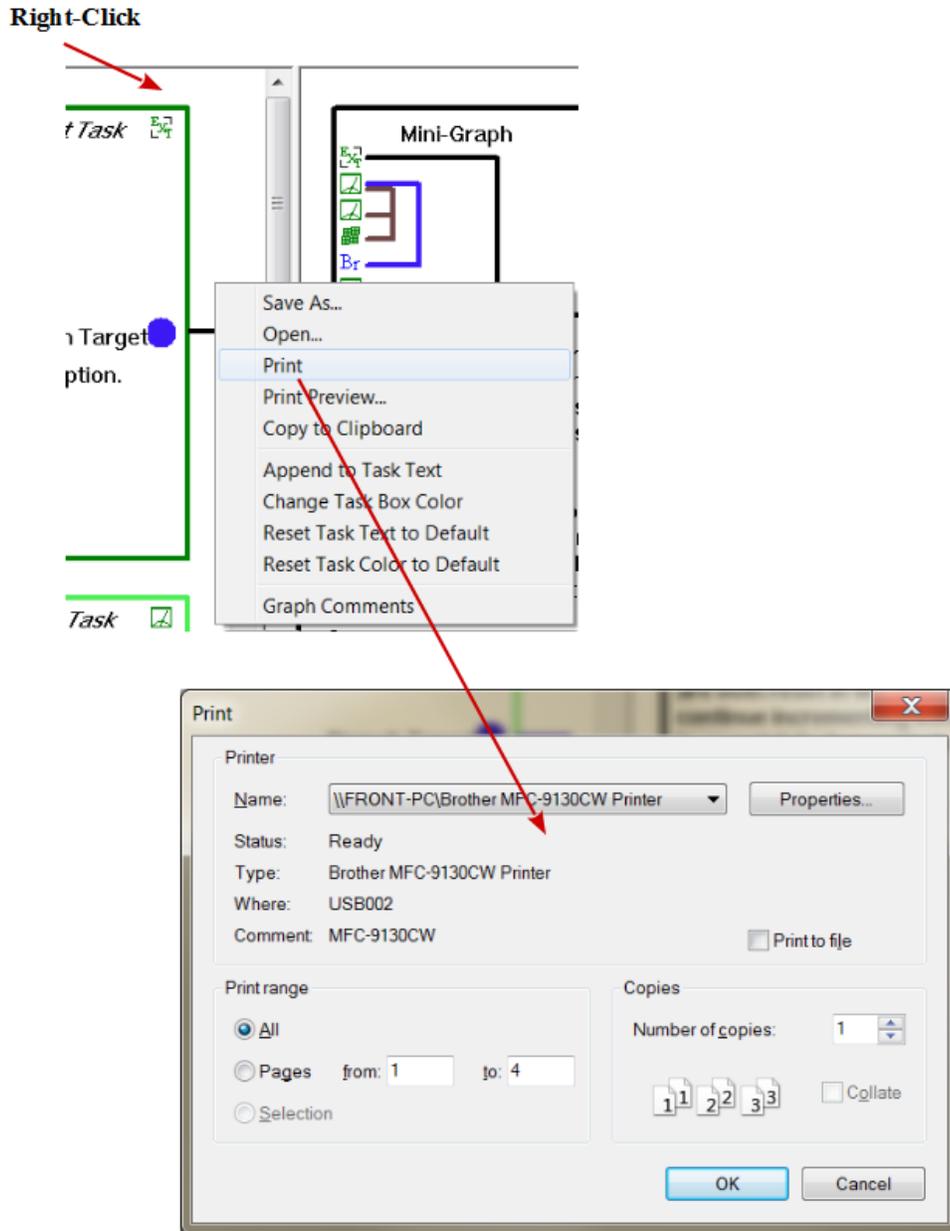


Figure 15 - Initiating a Graph Printout.

The printout can be previewed by right-clicking and selecting "Print Preview...". Note that Print Preview has difficulty positioning the Task icons as is evident in the figures below. This problem does not extend to the actual printout, which should display correctly.

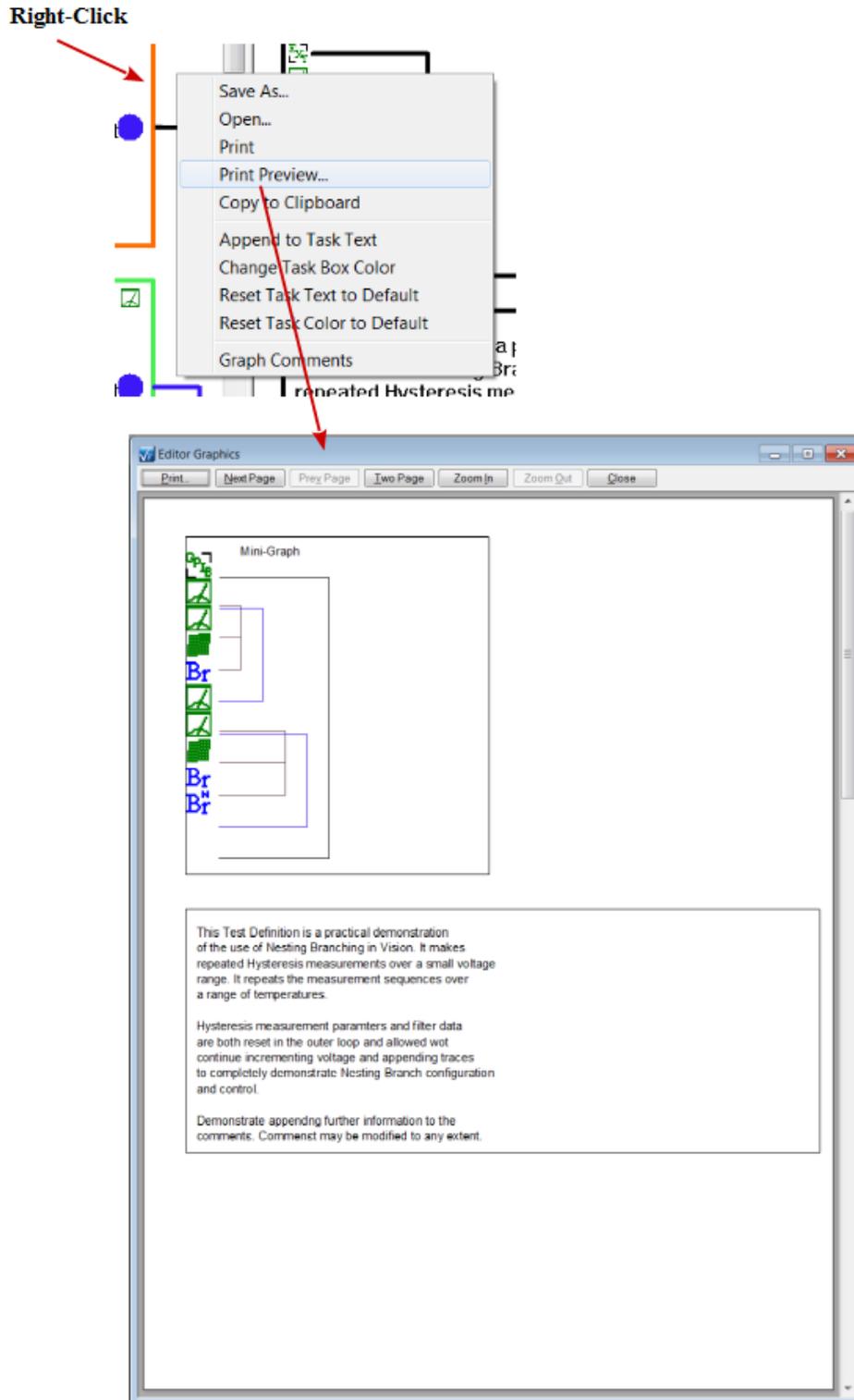


Figure 16 - Print Preview 1.

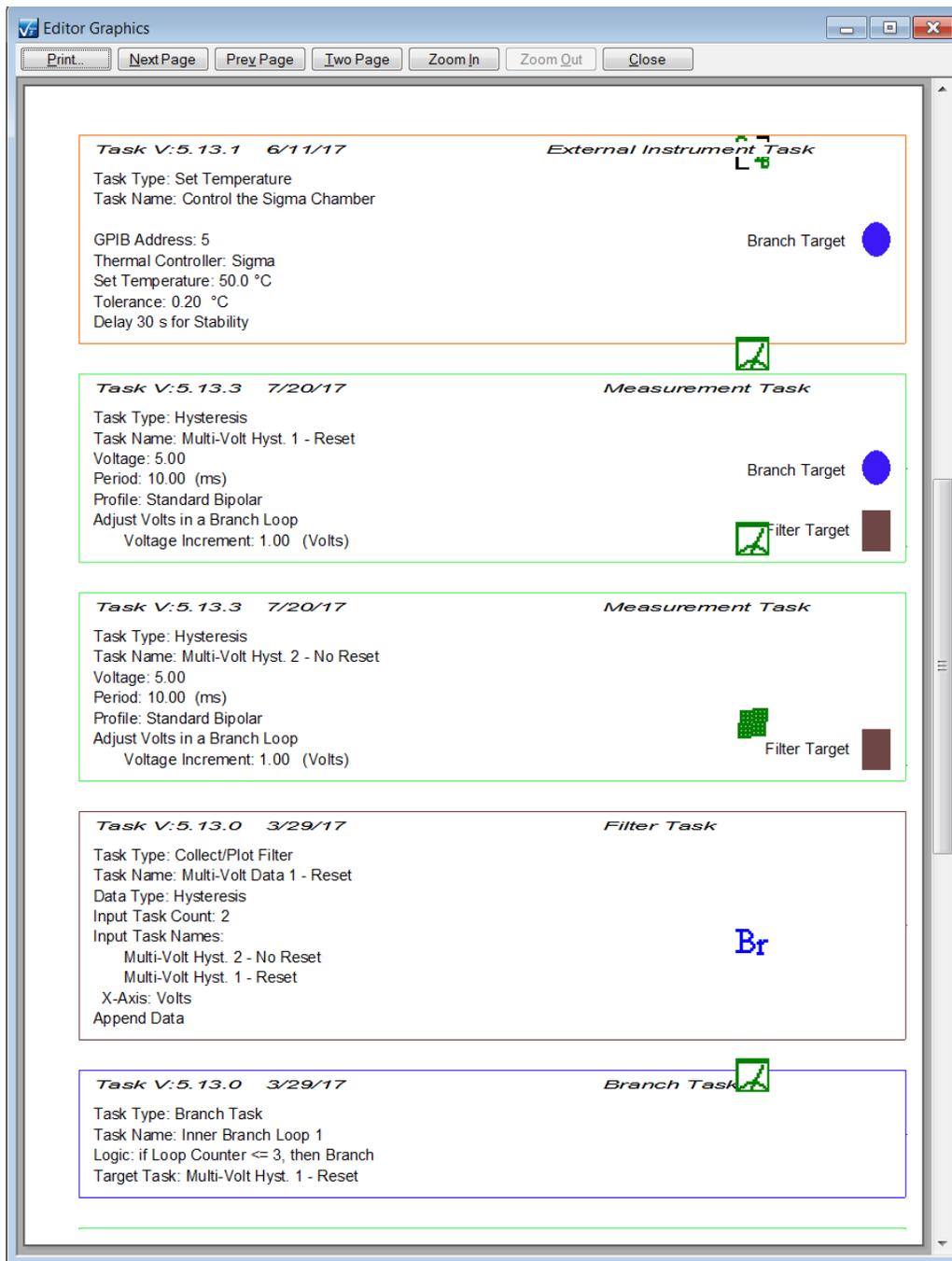


Figure 17 - Print Preview 2.

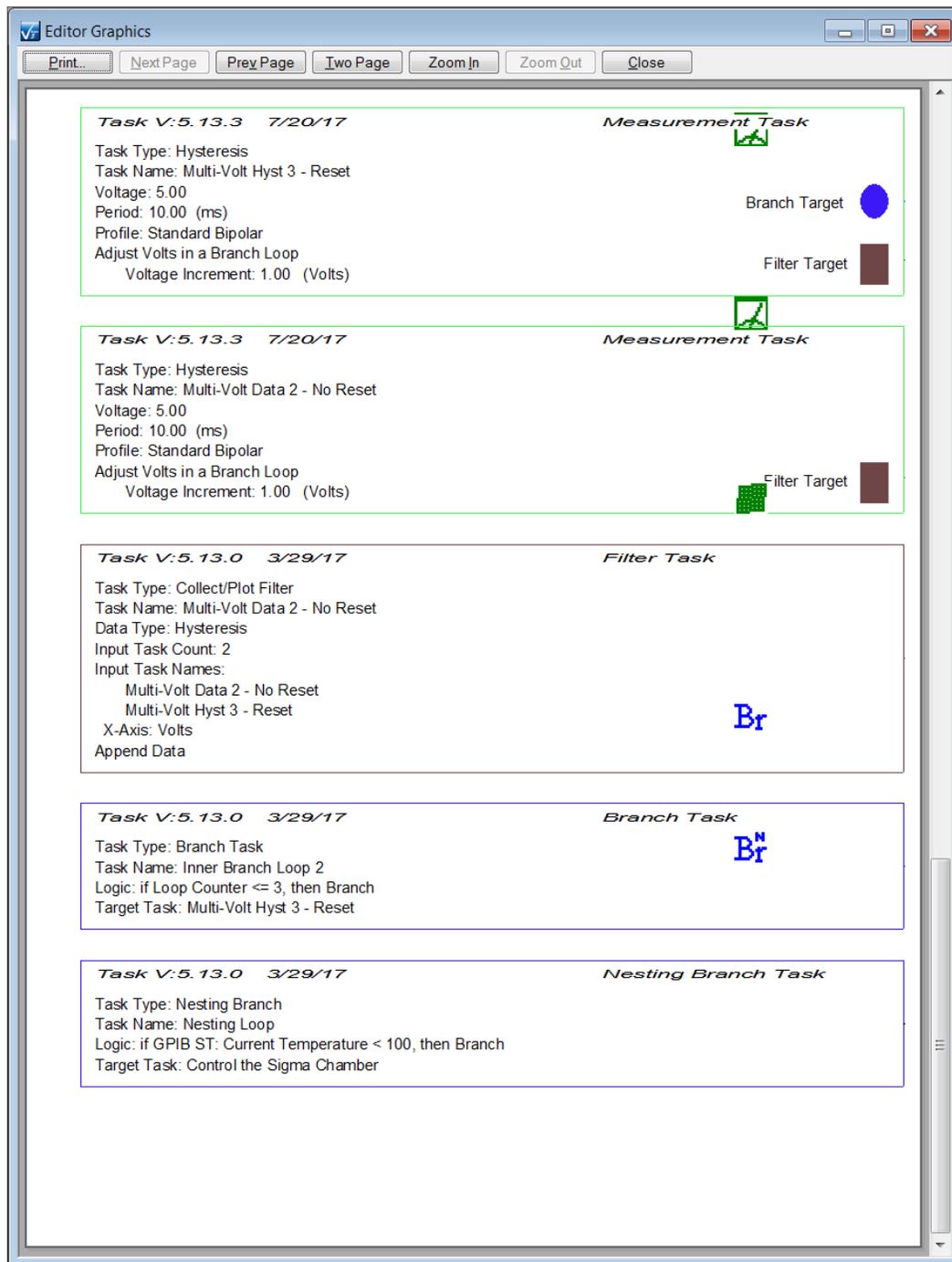


Figure 18 - Print Preview 3.

Buffering Test Definition Graphs

Perhaps the most useful feature of Test Definition Graphing is the ability to copy the Graph to the Windows Clipboard, from which it may be pasted into any standard program such as Microsoft Word, Excel, PowerPoint or Visio. Each of the Graph panes is independently buffered. To

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

capture the right pane, right-click in the right pane and select "Copy to Clipboard". The open any suitable target program and click <Ctrl-V> or select Edit->Paste. The Mini-Graph and any Comments will appear just as in the Graph window.

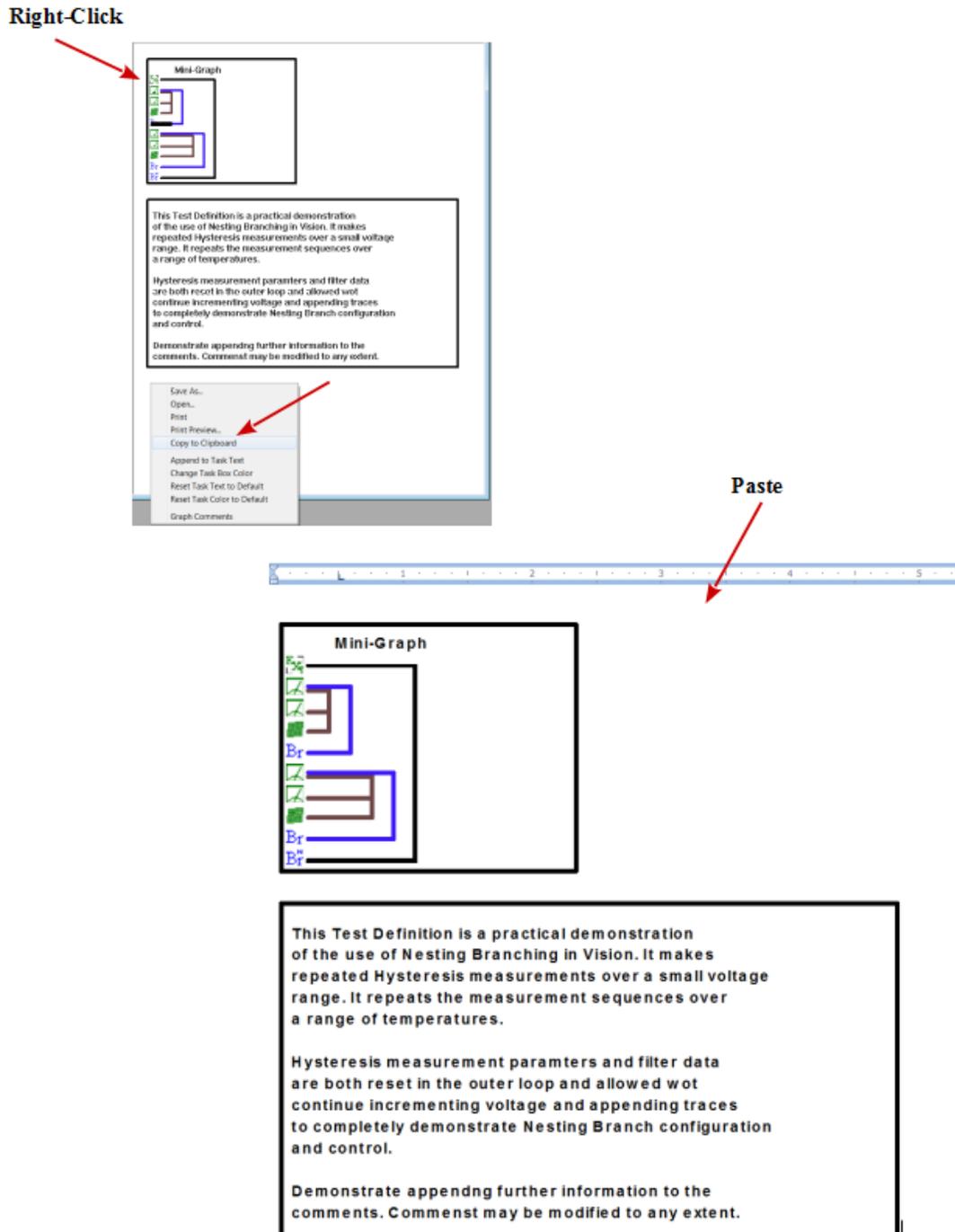
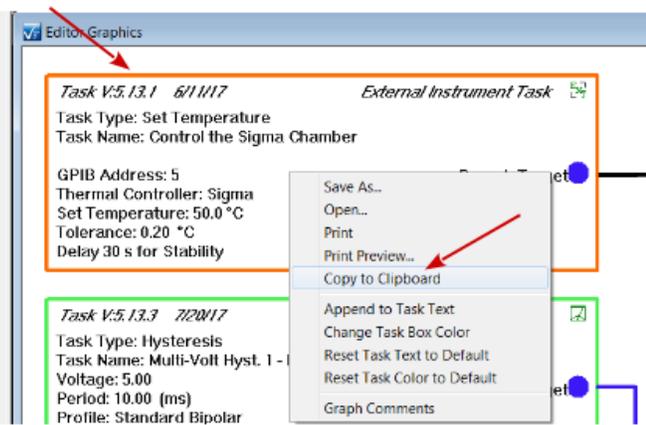


Figure 19 - Copy and Paste the Right Graph Window Pane into

Word.

The process is the same for the left window pane. This time right-click in the left pane and select "Copy to Clipboard". Then paste into the desired program. Note the entire Test Definition Graph is buffered on the Clipboard as a single item. For paged programs such as Word, pasting a large Test Definition Graph may result in an object that is either clipped at the bottom or whose output is scaled too small for proper viewing. This is the case in the partial view of Word output in **Figure 20**. In this case a minimized Text representation may be a better option. Such scaling will not be an issue in an unpagged program such as the partial Excel output example of **Figure 21**.

Right-Click



Paste

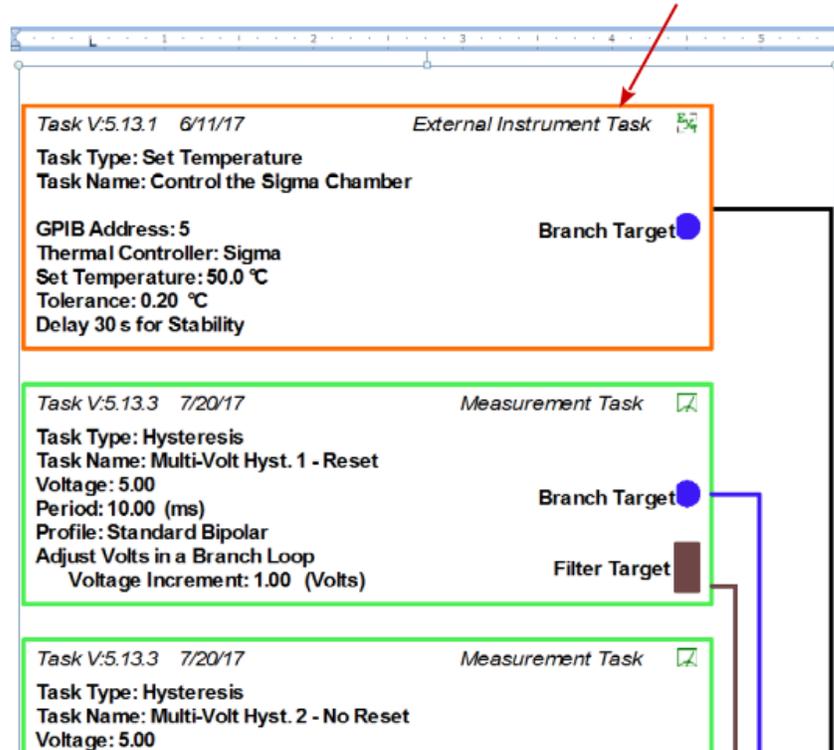


Figure 20 - Copy and Paste the Left Graph Window Pane into Word.

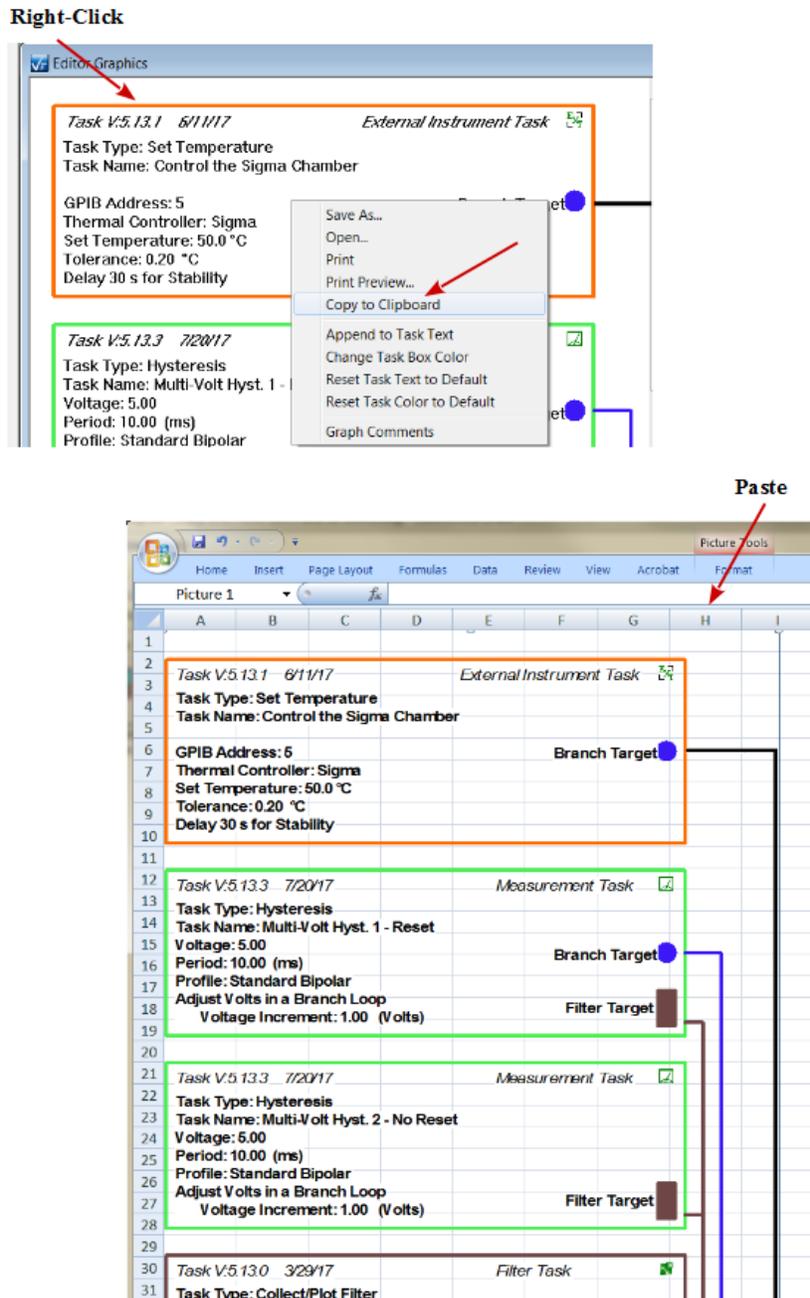


Figure 21 - Copy and Paste the Left Graph Window Pane into Excel.

Conclusion

Test Definition Graphing provides the user an important documentation tool. It allows the experimenter to quickly and easily present his experiment design in any correspondence tool such as Word or PowerPoint. The experiment may be presented at three levels of detail and may be customized with additional text documentation. Along with the distribution of actual DataSets, this tool allows the user greater flexibility in sharing experimental processes.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

XV - Document Library

By default, the lower-right Vision window is a feature known as the Document Library.

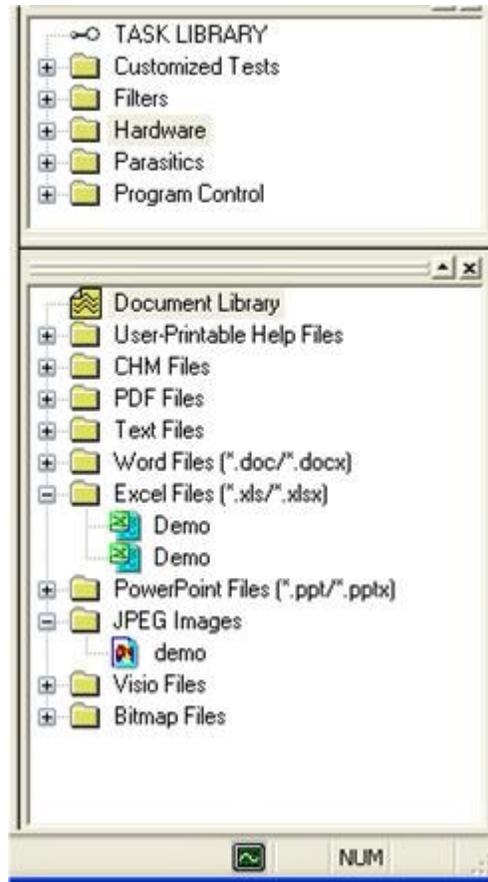


Figure 1 - The Document Library.

On Vision startup, certain folders on the C:\ drive are scanned for files of certain types. If the files of the appropriate extensions are found, folders for them are created in the Document Library and the files are placed there. Vision first looks for *.PDF (Adobe Reader) files in C:\DataSets\User-Printable Help and places them in a folder named "User Printable Help Files". These files are written by the installer and represent the *.PDF format versions of these help pages. Next files of extension *.CHM are searched in C:\Program Files\Radiant Technologies\Vision\Help and placed in the "CHM Files" folder. These are also written by the installer and represent the compiled help pages including this main manual and the Task-specific help pages. Finally, the path C:\DataSets\Documents is searched for a variety of document types and these are loaded into folders per **Table 1** . Many dummy examples of these files are written by the installer to this location. The user should place any files at that location that are to be accessible through Vision.

File Type	Extension	Folder Name
Adobe Reader	*.PDF	PDF Files
Text	*.TXT	Text Files
Microsoft Word	*.DOC/*.DOCX	Word Files (* .DOC/* .DOCX)
Microsoft Excel	*.XLS/*.XLSX	Excel Files (* .XLS/* .XLSX)
Microsoft PowerPoint	*.PPT/*.PPTX	PowerPoint Files (* .PPT/* .PPTX)
JPEG (Images)	*.JPG	JPEG Images
Microsoft VISIO (Drawings)	*.VSD	Visio Files
Bitmap Files (Images)	*.BMP	Bitmap Files
Web Files	*.HTML	HTML Files

Table 1 - Document Library File Types, Extensions and Folders.

To access any file, simply open its folder and double-click the file name/icon in the Document Library. The file will be opened in the appropriate program provided that program is installed on the Vision host computer.

XVI - Editor Aide

Discussion

The single largest drawback in Vision is that the EDITOR is not a completely general tool for inserting and removing Tasks. This is because of the complex dependencies between Branch and Filter Tasks and their targets. Here are the things that can be done in the EDITOR:

- Clear the EDITOR of all Tasks.
- Append a Task or series of Tasks to existing Tasks in the EDITOR.
- Remove the last Task from the EDITOR.
- Prepend a Task or series of Tasks to the top of the Test Definition Task list in the EDITOR. This is done by copying the existing Test Definition to a temporary location (DataSet CTD or Customized Test), writing the Task(s) to be prepended to the EDITOR and then restoring the original list of Tasks from the temporary location.

Here are examples of things that cannot be done in the EDITOR:

- Remove any Tasks from the interior of the Test Definition in the EDITOR. Only the last Task may be removed. This may be done repeatedly to remove a series of Tasks, but a Task cannot be removed that is not the last (bottom-most) Task. Tasks may be disabled by checking No Execute. This is functionally equivalent to removing them from the Test Definition.
- Insert any Task into the interior of the Test Definition. Tasks may only be appended or prepended. Tasks are prepended by copying the existing Test Definition to a temporary location (DataSet CTD or Customized Test), writing the Task(s) to be prepended to the EDITOR and then restoring the original list of Tasks from the temporary location.
- Move a Task's position in the Test Definition up or down.

The Editor Aide tool has been added to make the construction of a Test Definition completely general, eliminating the restrictions found in the Editor. In the Editor Aide an *Editor List* is constructed that forms the organization of a Test Definition to be moved into the Editor. Tasks may be moved into the *Editor List*, in any order, from any of five categorical lists of Tasks: *Hardware Tasks*, *External Instrument Tasks*, *Measurement Tasks*, *Filter Tasks* and *Program Control Tasks*. The complete list of Tasks already in the Editor can also be moved into the Editor List as a single group. Any Task in the *Editor List* can have a *Task Name* and/or *Comments* independently assigned. Any Hardware/Program Task can have its programmed *Max. Voltage* (Field (kV/cm) specification is not available) and/or *Sample Area (cm²)* and/or *Sample Thickness (μm)* independently assigned within the Editor Aide. Furthermore, Tasks that are imported as a group from the Editor window now retain all configured values

Once in the *Editor List* Tasks may be moved up or down in position or removed from the list. In this way the limitations on the Editor are overcome. Once the Task sequence is established in the *Editor List* Tasks may be moved back into the Editor from the Editor Aide. Tasks will be appended to any existing Tasks in the Editor Window. Tasks may be removed from the Editor

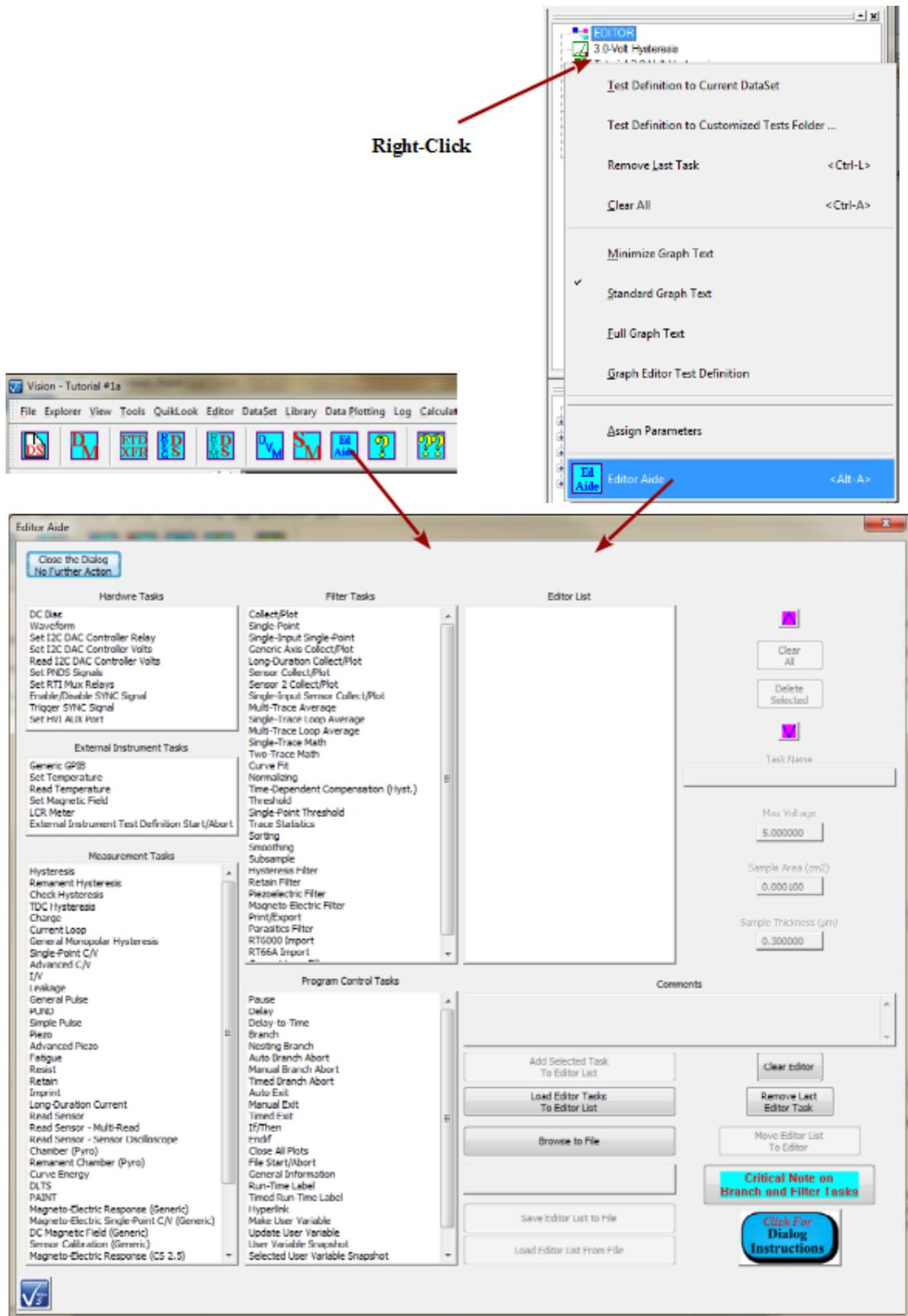
Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

Window from within the Editor Aide, either singly, by removing the last Task in the Editor Test Definition or as a group, but clearing all Tasks from the Editor Test Definition. As Tasks are sequentially moved from the *Editor List* to the Editor, their configuration dialog is opened for review and adjustment. For Tasks that were added to the *Editor List* from within the Editor Aide, only Task Name, Comments, Max. Voltage, Sample Area (cm²) and Sample Thickness (μm) may be preset. All other Task parameters must be configured at this time. For Tasks that were loaded into the *Editor List* from existing Tasks in the Editor, all configured parameters will be retained from their original Editor configuration. However, note this caution: **Filter and Branch Tasks are associated with their Target Task(s) by the relative distance between the Filter/Branch and its Target Task(s). If Tasks are inserted or removed between the Filter/Branch and the Target Task(s) or if the Target Task(s) is (are) moved in position or removed, the association(s) between the the Filter/Branch and its Target Task(s) must be reestablished.** This caution will be noted repeatedly here and below.

The current state of the *Editor List* may be saved to a file for future recall at any time. Note that for all Tasks, including those whose configuration is maintained on importing from the Editor, only *Task Name*, *Comments*, *Max. Voltage*, *Sample Area (cm²)* and *Sample Thickness (μm)* are saved to file.

Accessing the Editor Aide Tool.

To access the Editor Aide, right-click in Editor Window and select "Editor Aide" from the popup menu, or click the  icon on the Vision toolbar or press <Alt-A>. The Editor Aide window will appear as in **Figure 1**.



Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)



Figure 1 - Accessing the Editor Aide Tool.

Inserting a Task into the *Editor List*

To insert a Task into the Editor List, locate and select the Task in the appropriate Task list and then click *Add Selected Task to Editor List*. The Task will be appended, by Task type, to any Tasks already in the list. Once in the List a Task may be selected in the Editor List and *Task Name* and *Comments* may be assigned. If the Task is a Hardware/Measurement Task, *Max. Voltage*, *Sample Area (cm²)* and *Sample Thickness (μm)* may also be assigned.

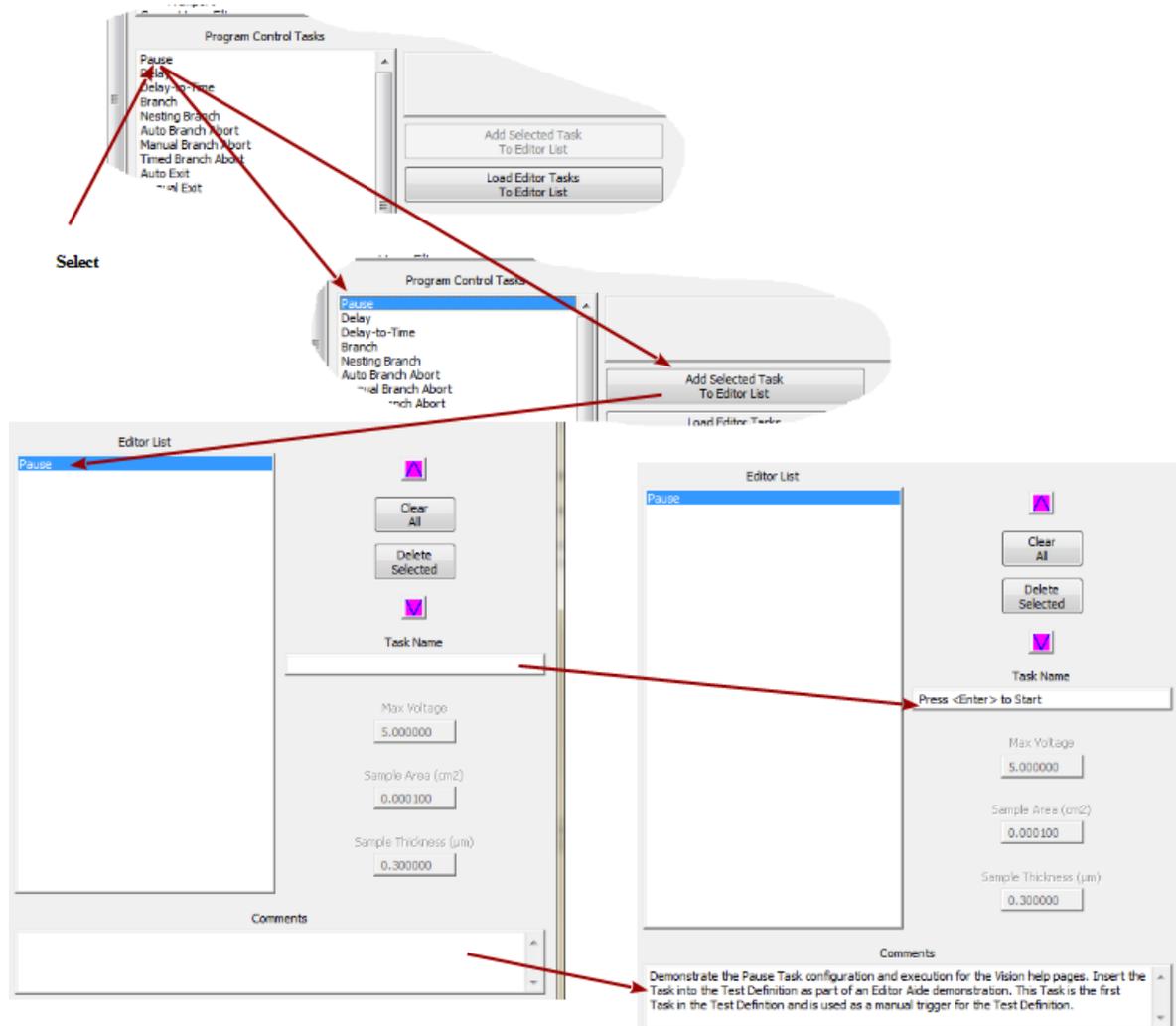


Figure 2 - Inserting a Task into the *Editor List*.

Moving the Editor Test Definition into the *Editor List*

If the Editor has one or more Tasks in its Test Definition, these may be moved as a group into the *Editor List*. Unlike Tasks added from within the Editor Aide tool, these Tasks will retain all configured parameters when moved into the Editor Aide. To move the Editor Tasks into the Edi-

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

tor List, simply click *Load Editor Tasks to Editor List*. All Tasks in the Editor Test Definition will be appended, in order, to any Tasks already in the *Editor List*.

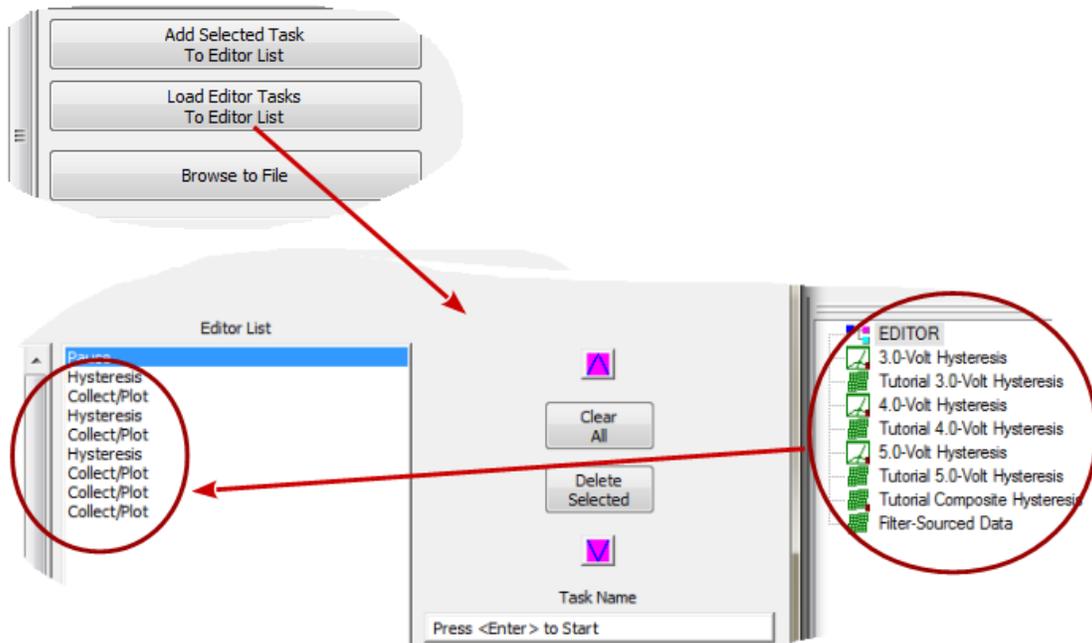


Figure 3 - Moving the Editor Test Definition into the *Editor List*.

Moving a Task Up or Down in the *Editor List*

To move a Task up or down in the Editor List, simply select the Task and click the up (▲) or down (▼) button to swap positions with the previous or next Task. For the demonstration of **Figure 4** a Delay Task is appended to the Tasks in the Editor List and then repeatedly moved up until it is just below the second Hysteresis Task. The Hysteresis Task is then moved down to position the Delay Task just above it.

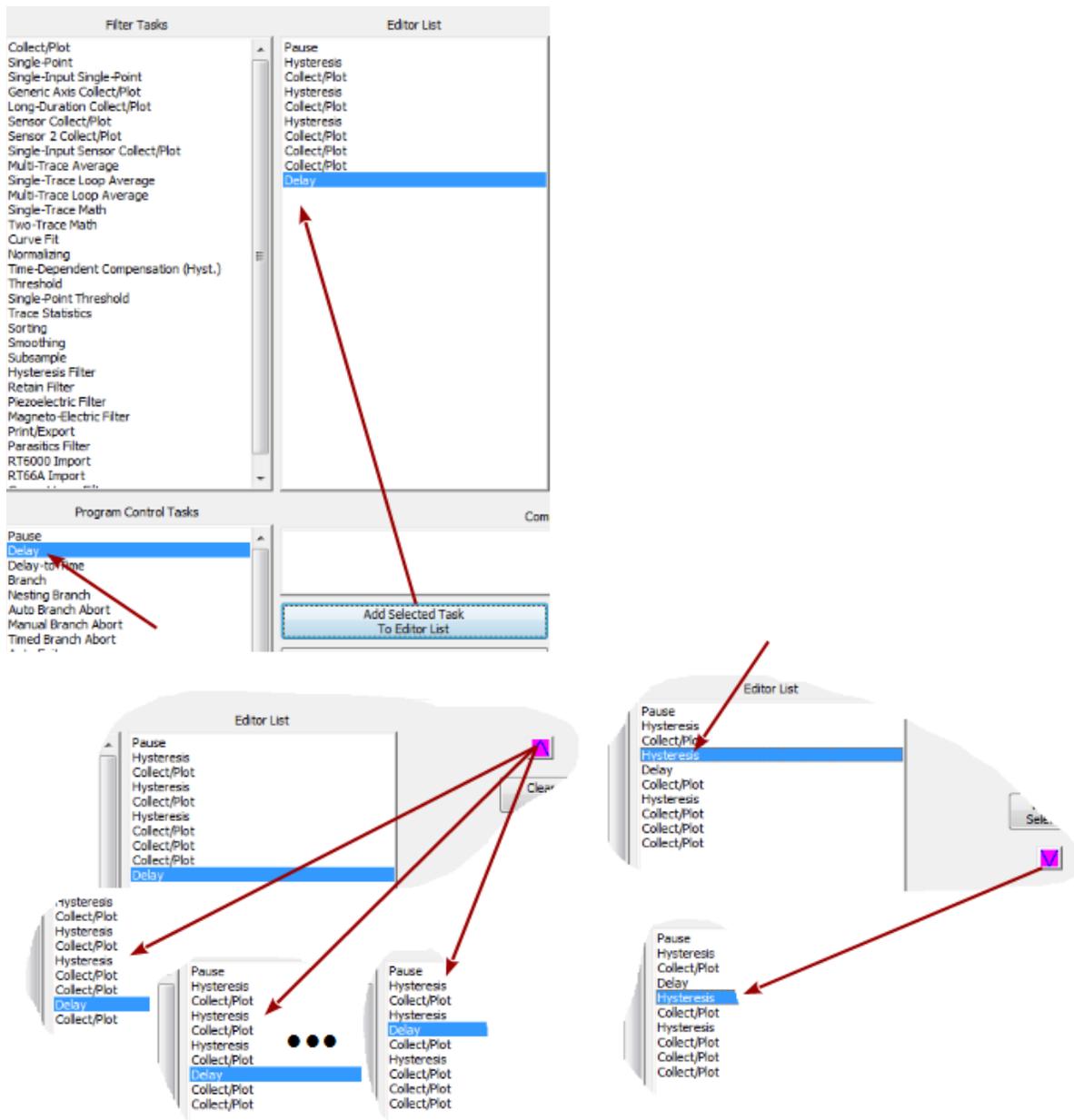


Figure 4 - Move Tasks Up and Down in the List.

Remove a Task from the Editor List

To remove a Task from the Editor List, select it in the Editor list and click *Delete Selected*. For **Figure 5**, a second Delay Task has been added to the Editor List just after the second Hysteresis Task. In the figure that second Delay Task is removed from the Editor List.

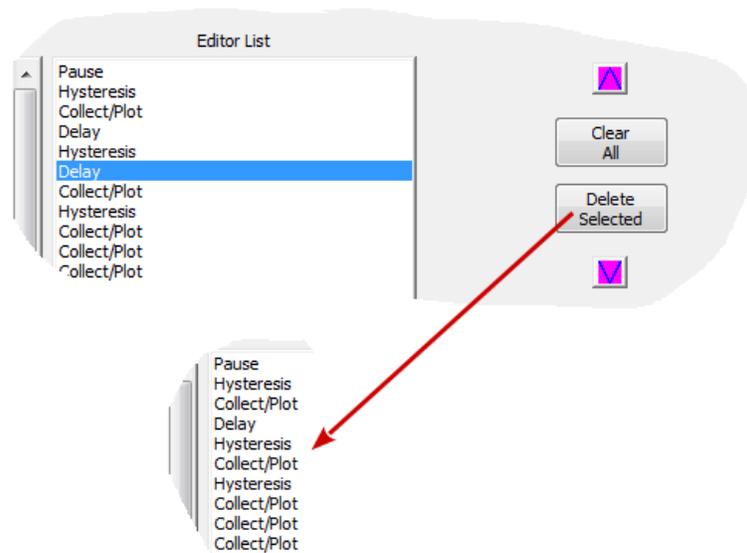


Figure 5 - Delete the Selected Task.

The entire list of Tasks in *Editor List* can be deleted by clicking *Clear All*.

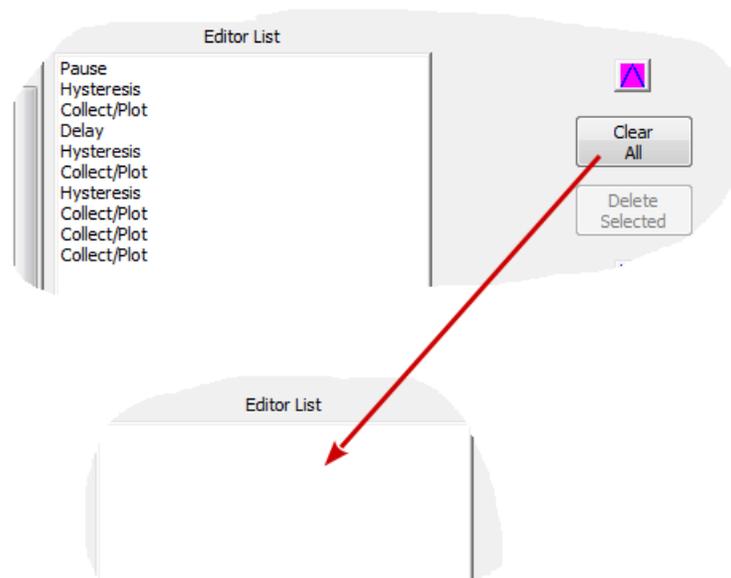


Figure 6 - Clear All Tasks from the Editor List.

Move the *Editor List* into the Editor

The Tasks in the *Editor List* can be moved, one-by-one, into the Editor by clicking *Move Editor List to Editor*. The *Editor List* Tasks will be appended to any Tasks already in the Editor. The Editor Task list can be adjusted, from within the *Editor Aide*, by *Remove Last Editor Task* or

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

Clear Editor.

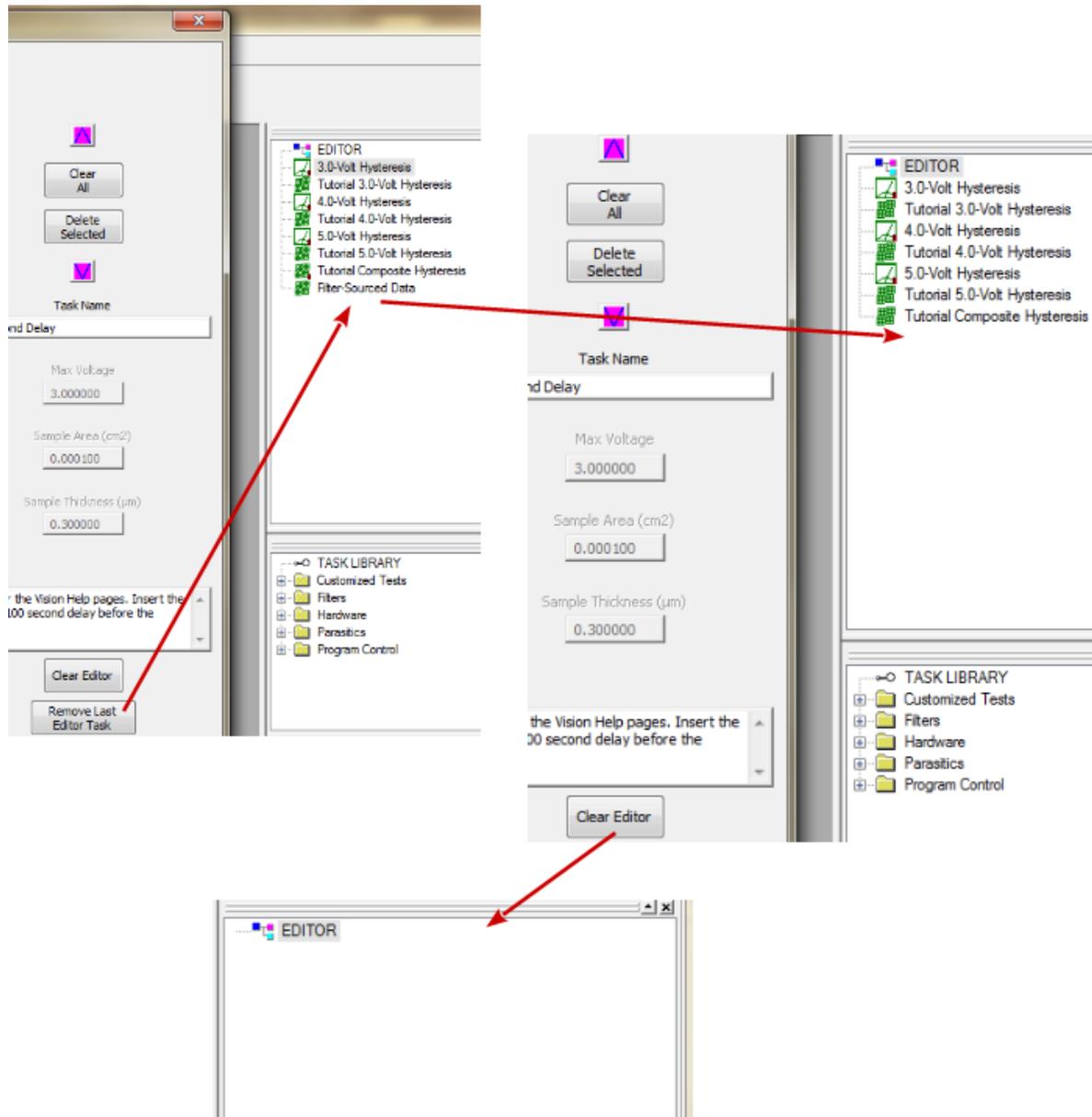


Figure 7 - Remove Tasks from the Editor Test Definition.

When *Move Editor List to Editor* is clicked, the configuration dialog for each Task in the *Editor List* is opened for review and configuration. Except for *Task Name*, *Comments*, *Max Voltage*, *Sample Area (cm²)* and *Sample Thickness (μm)*, which may have been established in the Editor Aide, Task parameters for Tasks that have been inserted in the Editor Aide must be configured before the Task dialog is closed and the Task is appended to the Test Definition in the Editor. Tasks that were imported from the Editor into the Editor List maintain all originally-configured values. However, Branch Tasks and Filter Tasks may have lost their connections to their respec-

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

tive target Tasks. This is because the association is made by relative position between the Branch/Target Tasks and their target(s). In these cases it is critical to reestablish the associations when the Task configuration appears. In the example of the figures above, the Hysteresis-Filter pairs associations have not been disrupted. However, inserting the Delay Task in **Figure 4** has affect the association between the Hysteresis-Filter pairs and the last two Filter Tasks as shown in the figures below. The *Critical Note on Branch and Filter Tasks* button presents a message to this effect.

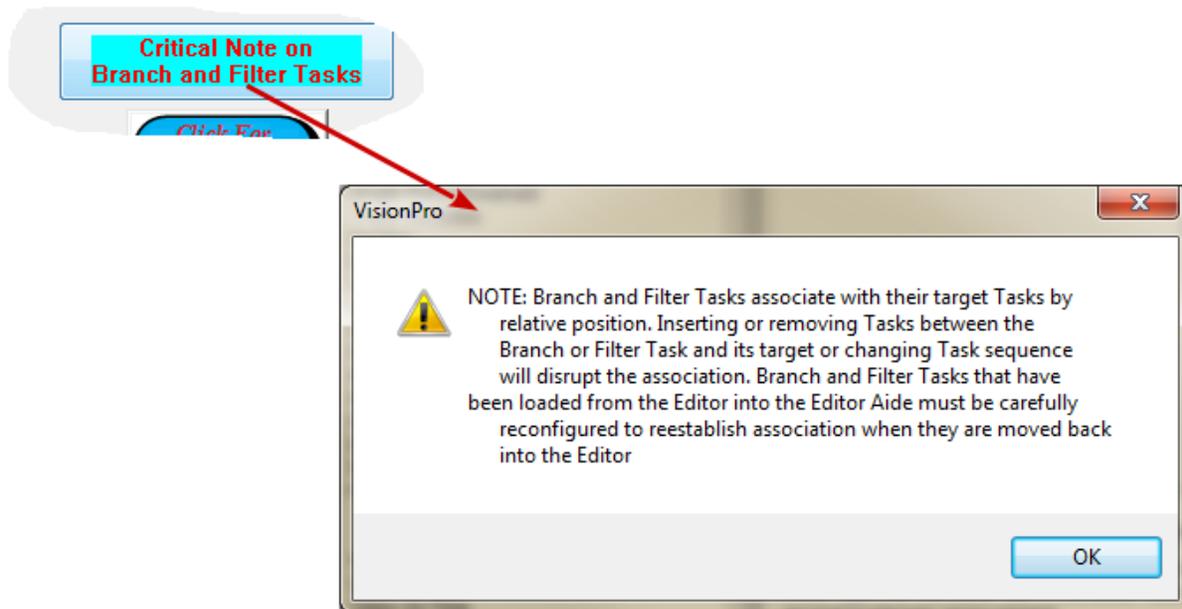


Figure 8 - A Note on Branch and Filter Task Reconfiguration.

Note that this reconfiguration is especially critical if a Target Task is removed or displaced. In the example above, if the first Hysteresis Task is removed, the first Filter Task must also be removed since there is no preceding Task with which to associate it.

In **Figure 9** the transfer to the Editor has been initiated by clicking *Move Editor List to Editor*. The Pause Task configuration dialog appears. *Pause Task Name* and *Comments* have been previously configured in the Editor Aide. *User Self-Prompt* retains some persistent value from a previous configuration. It must be adjusted to match the current purposes.

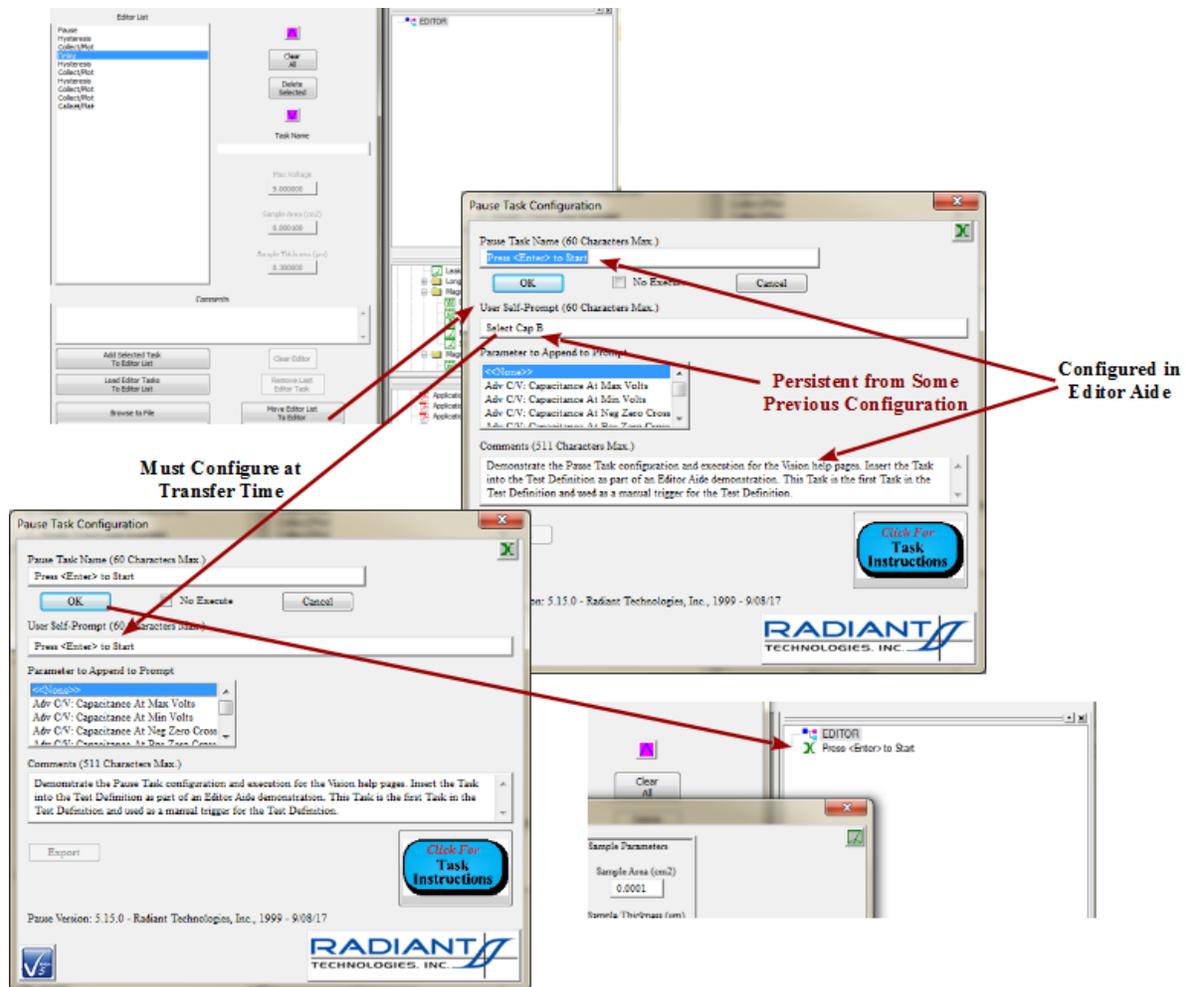


Figure 9 - Initiate Transfer to Editor - Configure the Pause Task.

The first Hysteresis Task configuration dialog appears next. The Task retains all configured values that it held when moved from the Editor into the Editor List. Parameters may be, but need not be, adjusted at this time.

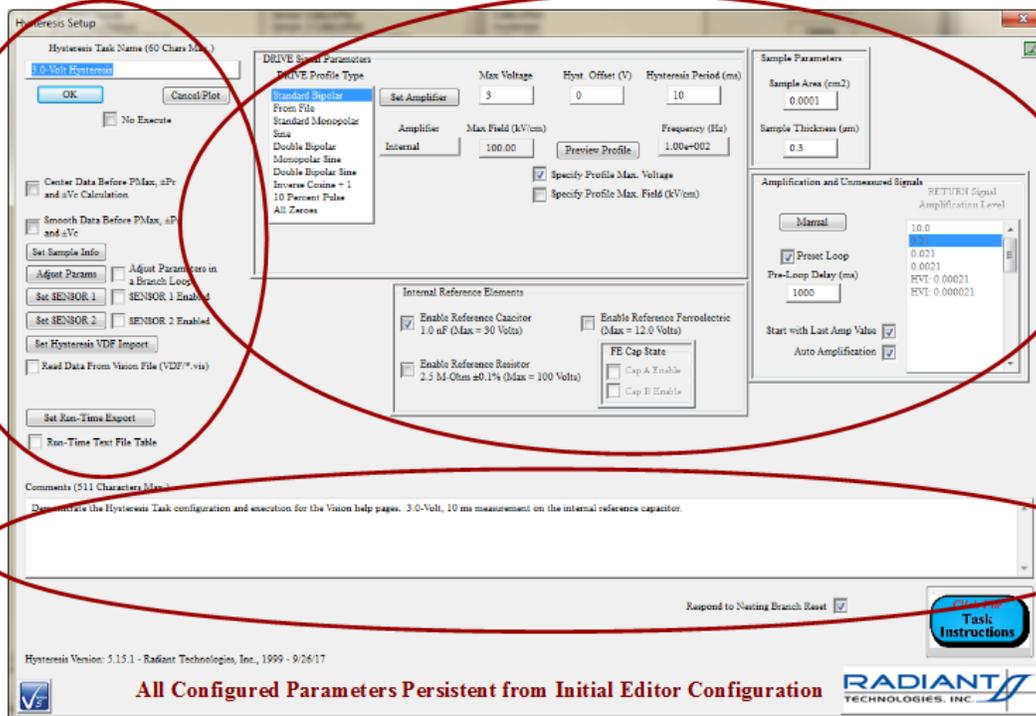


Figure 10 - Hysteresis Task Retains all Original Parameter Values.

The first Filter Task also retains its configuration. Its association with the first Hysteresis Task is maintained because nothing has been inserted, or deleted from, between the Tasks. The same will be true for all three Hysteresis-Filter pairs.

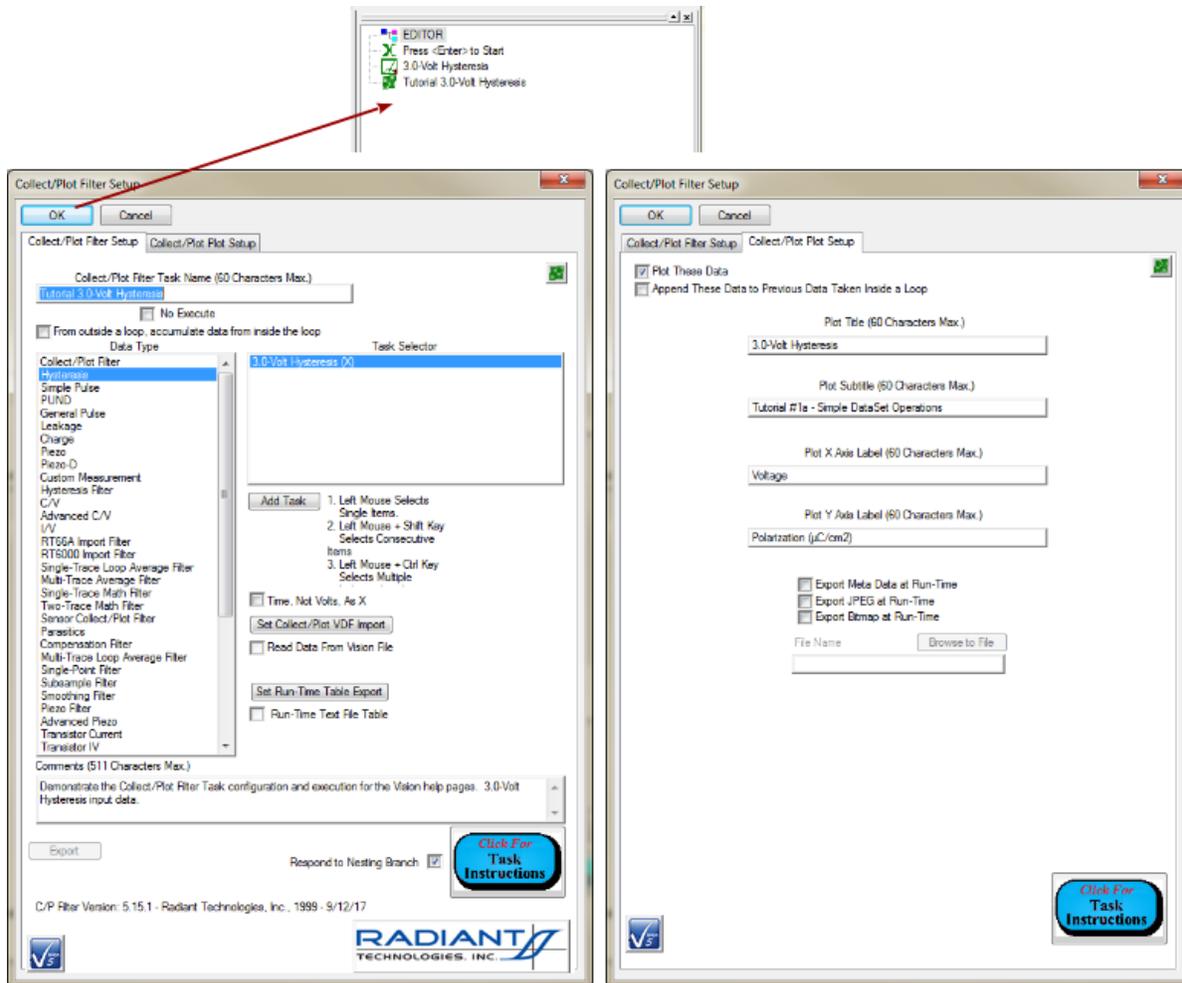


Figure 11 - First Collect/Plot Filter. Task Retains Proper Configuration from the Editor.

The Delay Task Name and Comments were not configured in the Editor Aide. Delay Task Name and Duration (s) are both set to default values. The Task must be completely configured to meet the needs of the Test Definition under construction. (Note that the Delay Task is not added, here, for practical purposes - only for demonstration.)

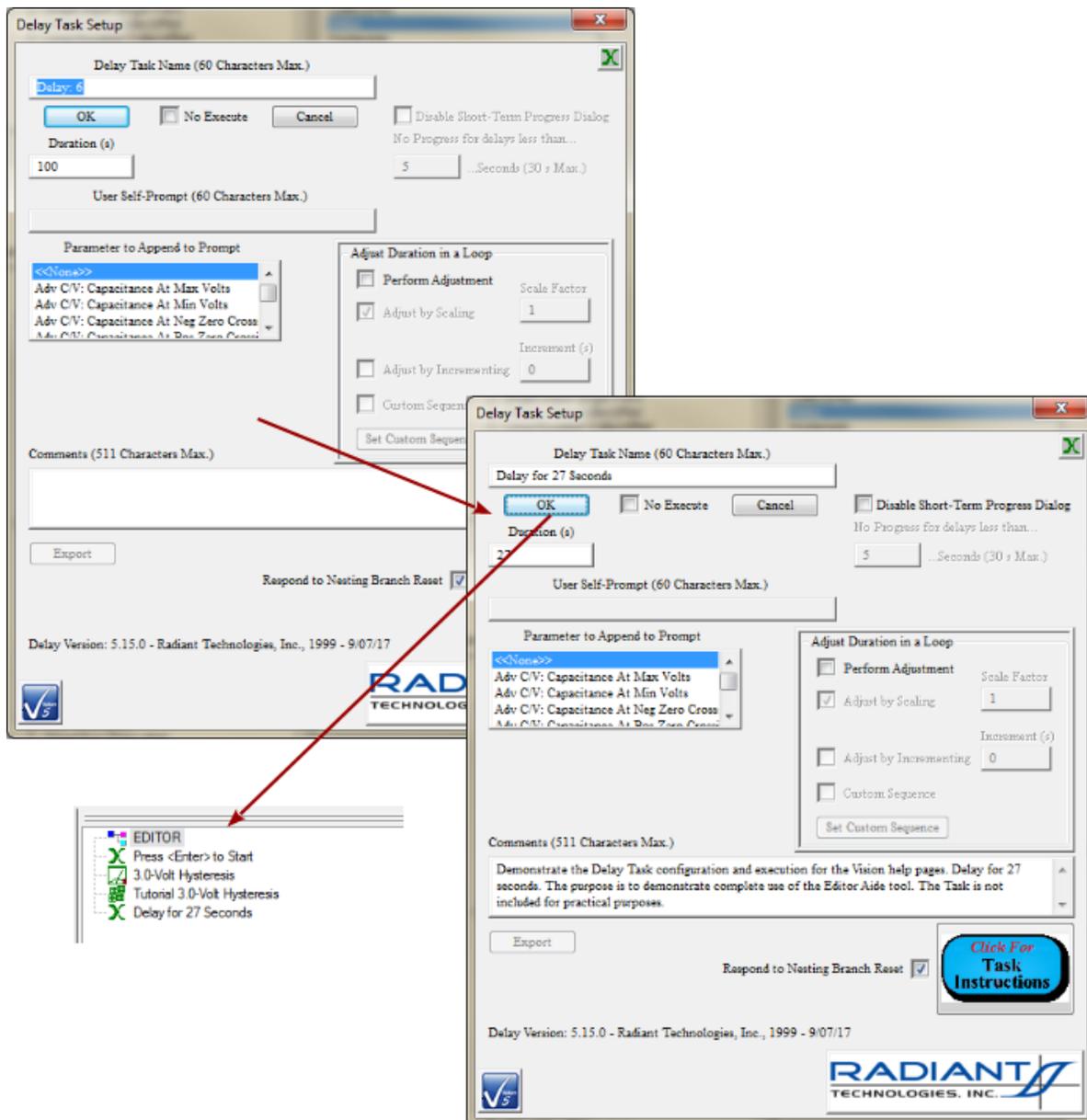


Figure 12 - Delay Task Configuration.

The remaining Tasks were all imported from the Editor and insertion back into the Editor proceeds as discussed above until the fourth Filter Task is to be configured. That Filter associates with all three Hysteresis Tasks. Because the Delay Task was inserted between the first Hysteresis Task and the Filter Task, the Filter loses its association with the first Hysteresis Task. This must be reestablished at this configuration time. This reconfiguration is also critical for Branch Tasks.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

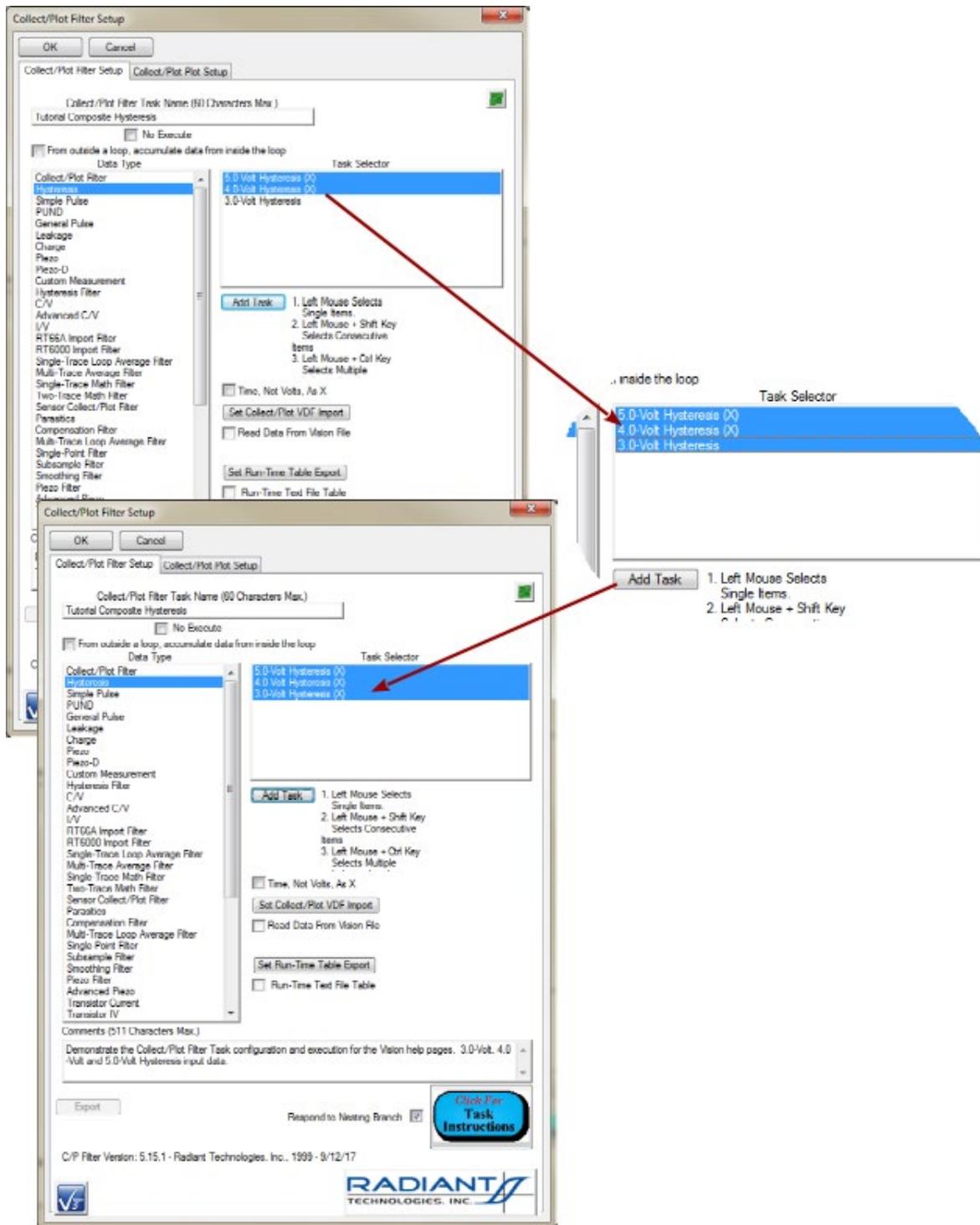


Figure 13 - Original Filter Reconfiguration.

Editor List File Storing and Recovering

The Task sequence in *Editor List*, along with *Task Name*, *Comments*, *Max Voltage*, *Sample Area*

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)



(*cm2*) and *Sample Thickness* (μm), may be stored to a file, at any time, for future recovery. Note that only the five standard parameters noted will be stored. Tasks in *Editor List* that were imported from the Editor and retain parameters as configured in the Editor will not necessarily maintain those parameters when stored to and recalled from the *Editor List* file.

The procedure consists of three buttons. *Browse to File* opens a standard Windows browser that is used to identify the file path and file name of the *Editor List* file. The file will have a *.elx extension. The file may or may not exist. When the browser is closed, the file path and file name will be displayed in the unlabeled text control immediately below *Browse to File*. If the file does not exist, *Save Editor List to File* will be enabled. If the file does exist, *Load Editor List From File* will be enabled. Clicking *Save Editor List to File* will cause the file to be created and all Tasks in *Editor List*, along with their associated parameters, will be copied, in sequence, to the file. Since the file now exists, *Save Editor List to File* will be disabled and *Load Editor List From File* will be enabled. Clicking *Load Editor List From File* will append all Tasks in the file, in sequence, to any Tasks already in the *Editor List*.

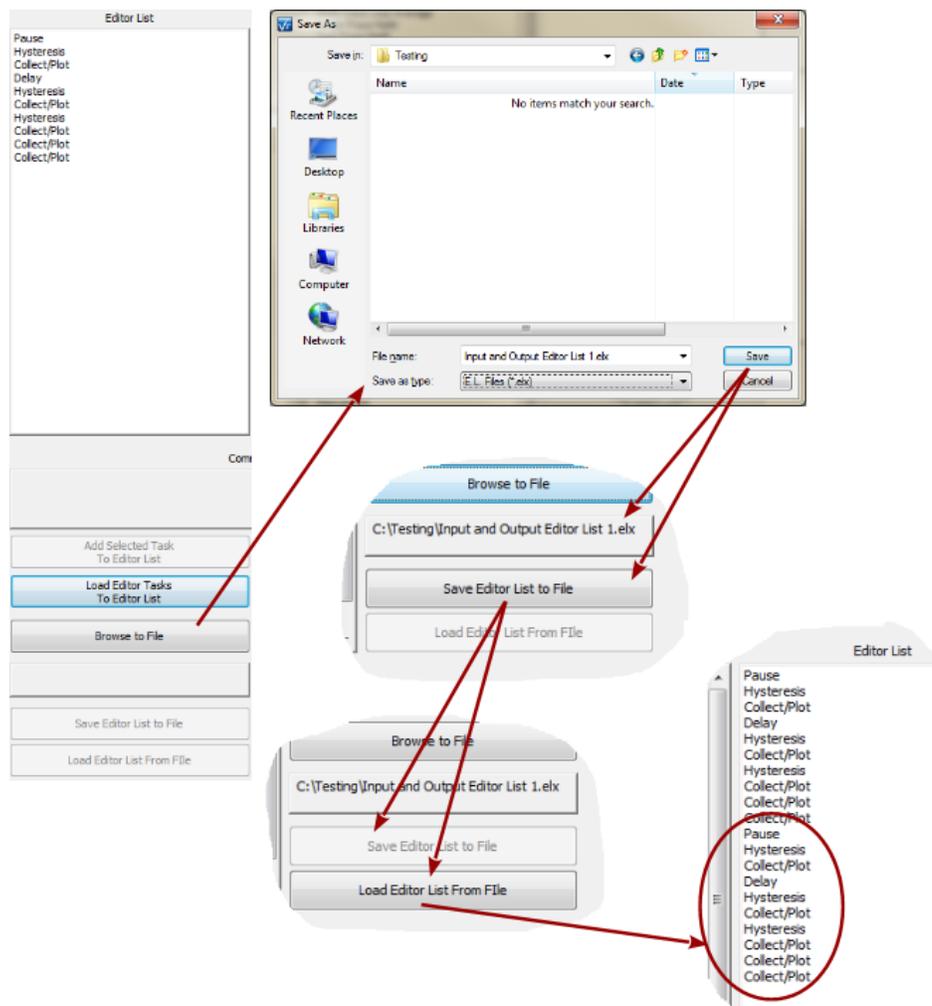


Figure 14 - Storing *Editor List* to a File and Recovering Task from the File.

Figure 15 shows two instances of the Collect/Plot Filter configuration from the first Hysteresis/Filter Pair as the Task is being moved into the Editor. In the first instance, the Task was loaded into *Editor List* from the Editor and it retains all configured values. The configuration can be reviewed and changed if desired, but the Task is immediately ready for direct insertion into the Editor. In the second case, the Task had been recalled from an *Editor List* file. retains only its proper *Collect/Plot Filter Task Name* and *Comments*. The critical parameter of *Data Type* and the Task(s) selected in *Task Selector* are lost and must be reestablished. Less critical, but still incorrect, is the *Plot Title*. The text in this control is persistent from the most-recent configuration of a Collect/Plot Filter Task and does not apply to the current configuration. *Plot Subtitle*, *Plot X Axis Label* and *Plot Y Axis Label* are also persistent from the earlier configuration. It is coincidental that these labels are correct for this configuration as well.

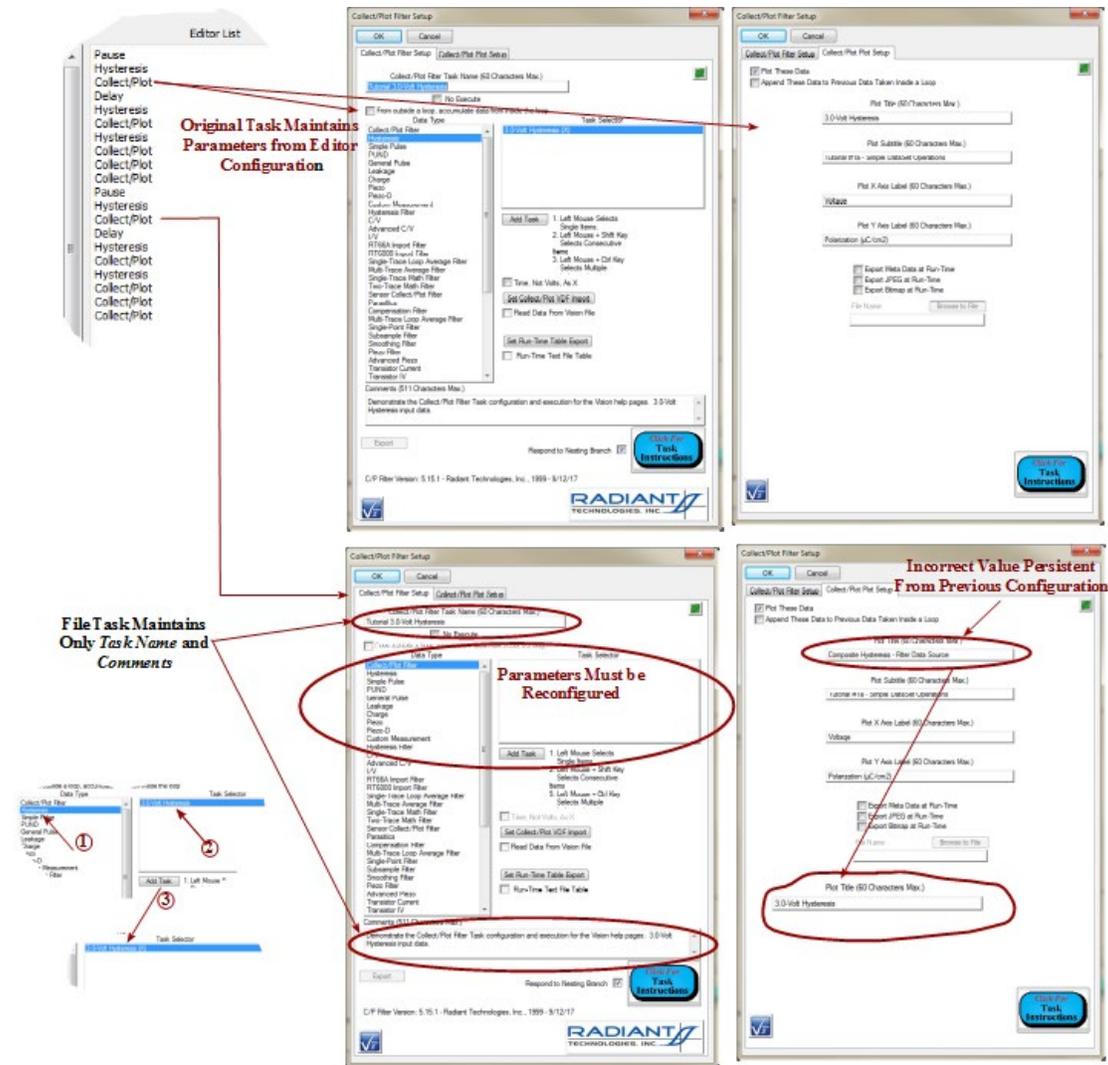


Figure 15 - Restoring the Editor from the *Editor List*. Tasks Recovered from a File Lose Configured Parameters.

XVII - Data Mining

XVII.1 - Discussion

The Vision Data Mining tool is provided to simplify collection of data from diverse locations in Vision to a single location for comparison. Before the introduction of Data Mining, this process involved laboriously exporting Task data of interest either to a target outside Vision ([text](#), [Excel](#), [etc.](#)) or to a [Vision Data File](#) (VDF/*.vis) from which the data could be imported back into Vision. These tools remain available, but the process has been greatly simplified by the Data Mining process.

The process of Data Mining refers to the copying of any number of archived data-collecting Tasks ([Measurement Tasks](#) or [Filter Tasks](#)) of one particular type from any number of registered source DataSets into one Executed Test Definition (ETD) in the [DataSet Archive](#) of a single Target DataSet. A single Filter Task, of a type appropriate to the collected Task type, may be applied to the collected data and recorded to the ETD.

Although Data Mining greatly simplifies the data collection and comparison process, the tool still requires careful attention and pre-planning. The pre-planning involves careful identification of the Tasks to be targeted for Data Mining including their names and the ETD and DataSet names of their archived locations. Because of the nature of Vision execution, and as shown in the example below, Tasks to be mined may have duplicate Task Names. The Data Mining tool will offer an opportunity to rename the Tasks to better distinguish them. The assignment of Task Names should be part of the preplanning process.

XVII.2 - Data Mining Wizard

The Data Mining tool is a "wizard", or serial sequence of dialogs, that configures and executes the operation. The wizard is accessed through the Vision Toolbar  icon or the DataSet->Data Mining menu option.

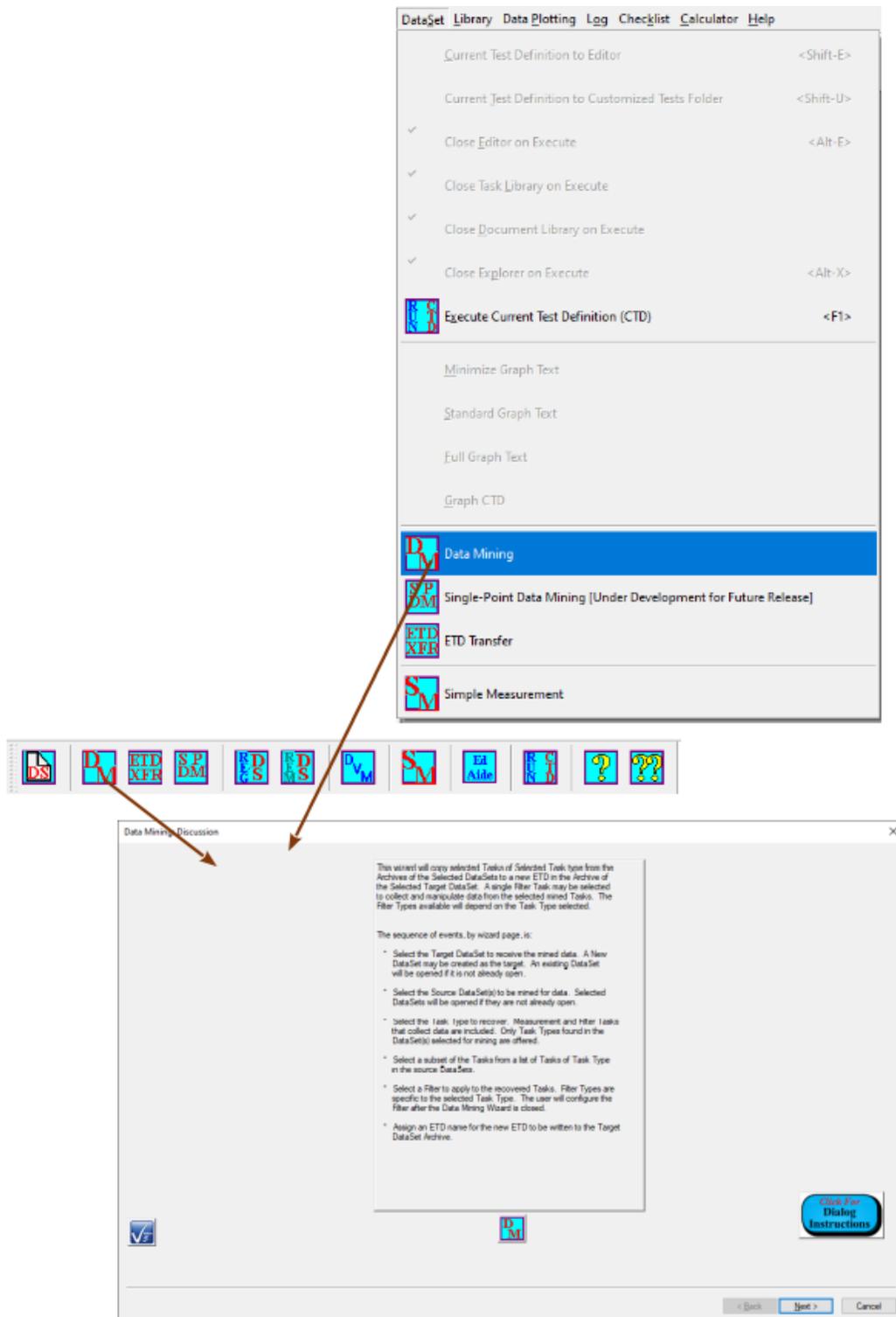


Figure 1 - Initiate Data Mining.

XVII.2.a - First Tab: Discussion

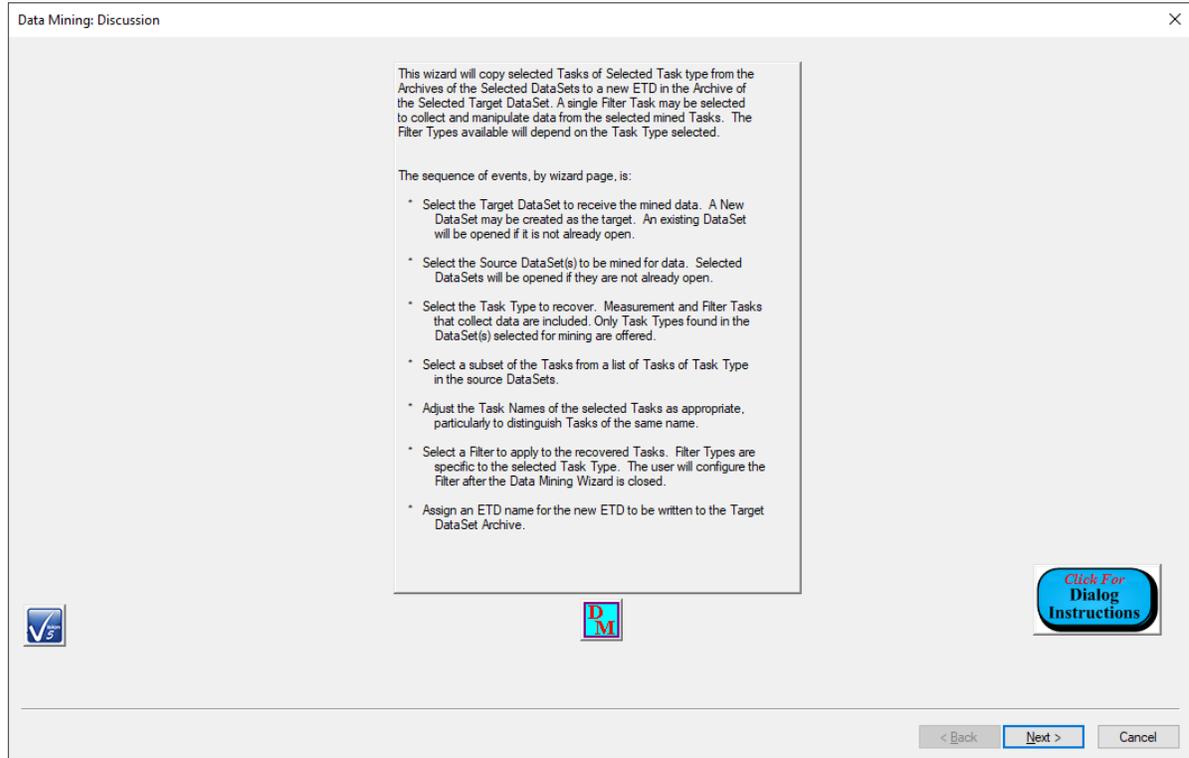


Figure 2 - Discussion Tab

The first dialog tab to appear is simply a discussion of the procedures and tabs that will follow.

Control	Type	Default	Discussion
<i>Click For Dialog Instructions</i>	Button	Unpressed	This button opens a Dialog Instructions project that provides complete details regarding the entire Data Mining process
<i><Back</i>	Button	Unpressed	This button is disabled since there is no previous dialog tab in the Data Mining wizard.
<i>Next ></i>	Button	Unpressed	This button advances the wizard to the next dialog tab.
<i>Cancel</i>	Button	Unpressed	This button closes the Data Mining wizard with no action taken by the Data Mining tool.

XVII.2.b - Second Tab: Select Target DataSet

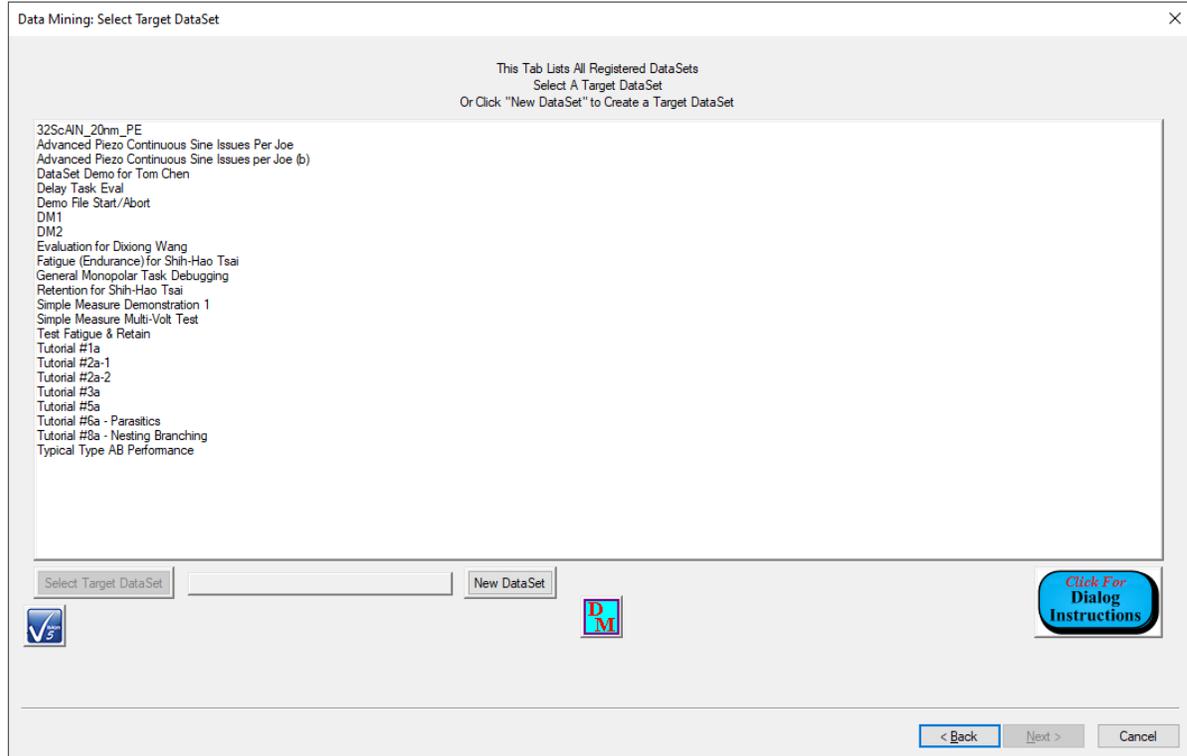


Figure 3 - Select Target DataSet Data Mining Tab.

This second tab is used to identify the single DataSet that is to receive the mined data. All registered DataSets are listed in the unlabeled *Registered DataSets* list. A single DataSet is selected (highlighted) in the list. This enables the *Select Target DataSet* button. The *Select Target DataSet* button is clicked. Three actions are then taken:

- The selected DataSet Name is copied into the unlabeled *Selected DataSet* text box.
- The selected DataSet is opened in the DataSet Explorer if it was not previously opened.
- The Next > button is enabled.

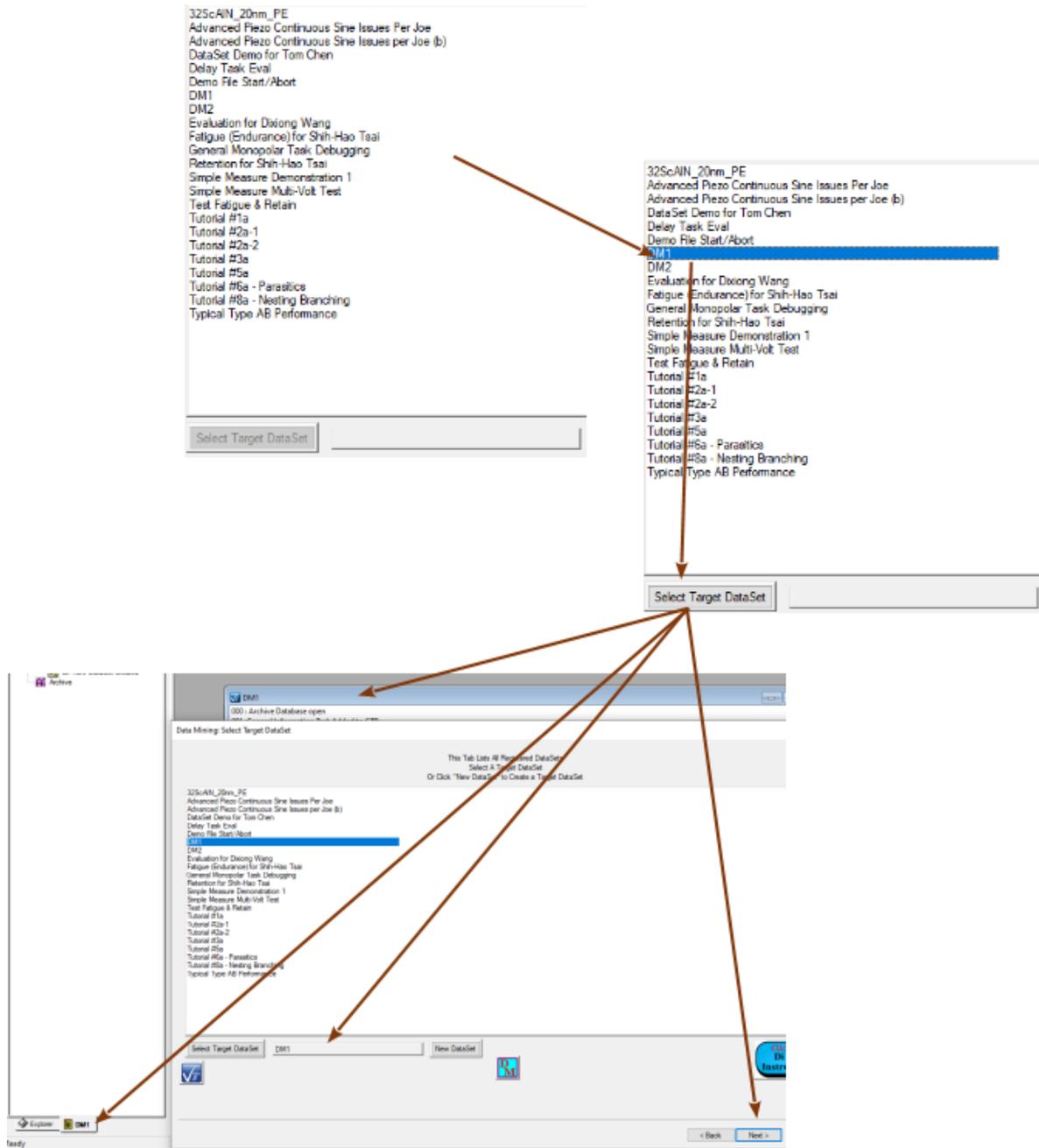


Figure 4 - Select Existing Target DataSet.

Before clicking *Next* > a new DataSet may be selected and registered as the target using the *Select Target DataSet* button. This repeats the three actions above. In addition, the first selected DataSet will be closed if it was previously opened. The process may be repeated until the correct target DataSet is selected.

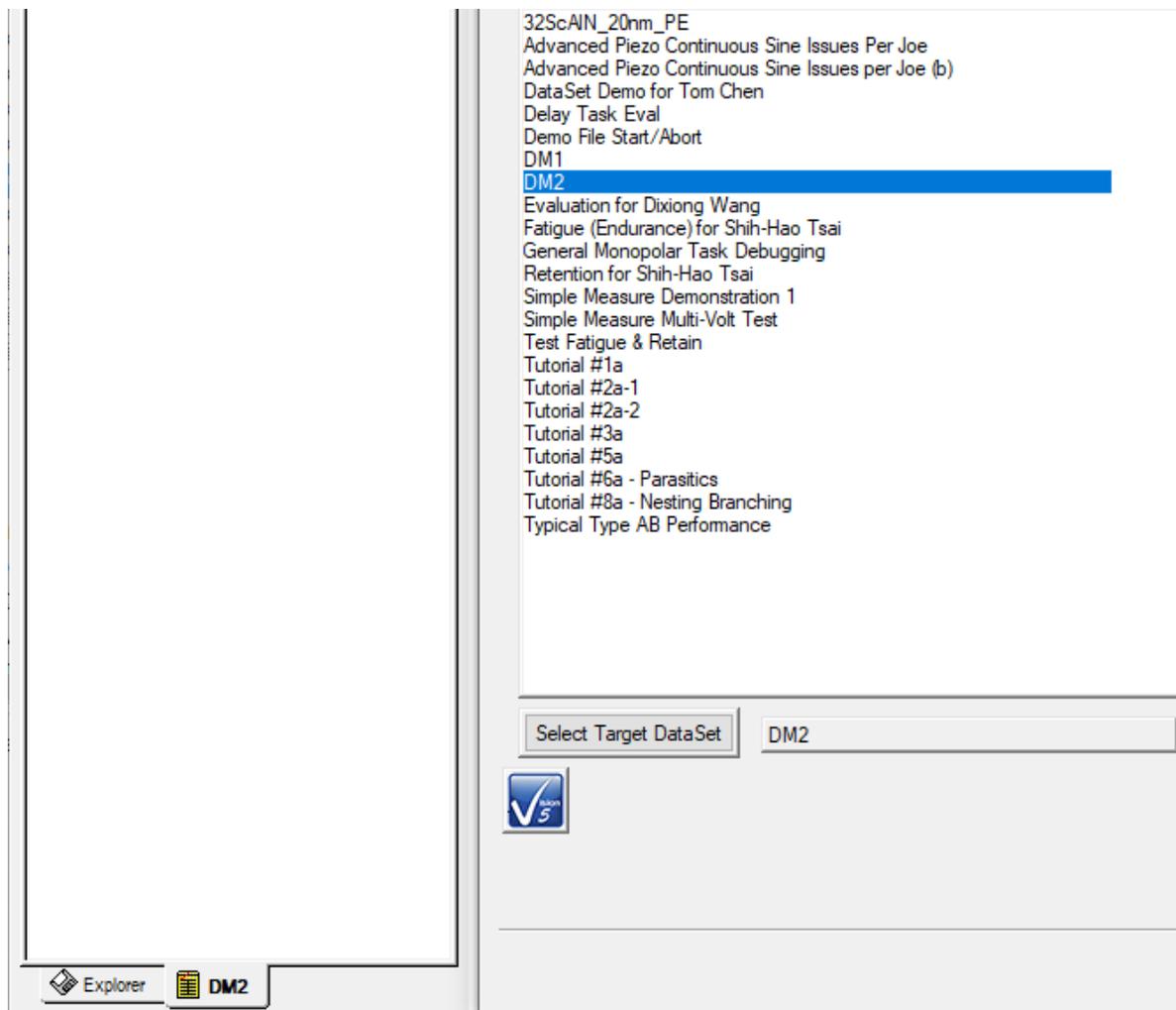


Figure 5 - Reselect an Existing Target DataSet.

A new DataSet may also be created from within the Target DataSet Selection tab and assigned as the target. Clicking the *New DataSet* button initiates the [New DataSet](#) process. When the New DataSet dialog is closed the DataSet is created and opened, the DataSet name is added to the unlabeled *Selected DataSet* control, the DataSet is added to the unlabeled *Registered DataSet* list control and the *Next >* button is enabled. The process automatically selects the new DataSet as the target DataSet. However, once the new DataSet is created, the selection may be changed to any registered DataSet .

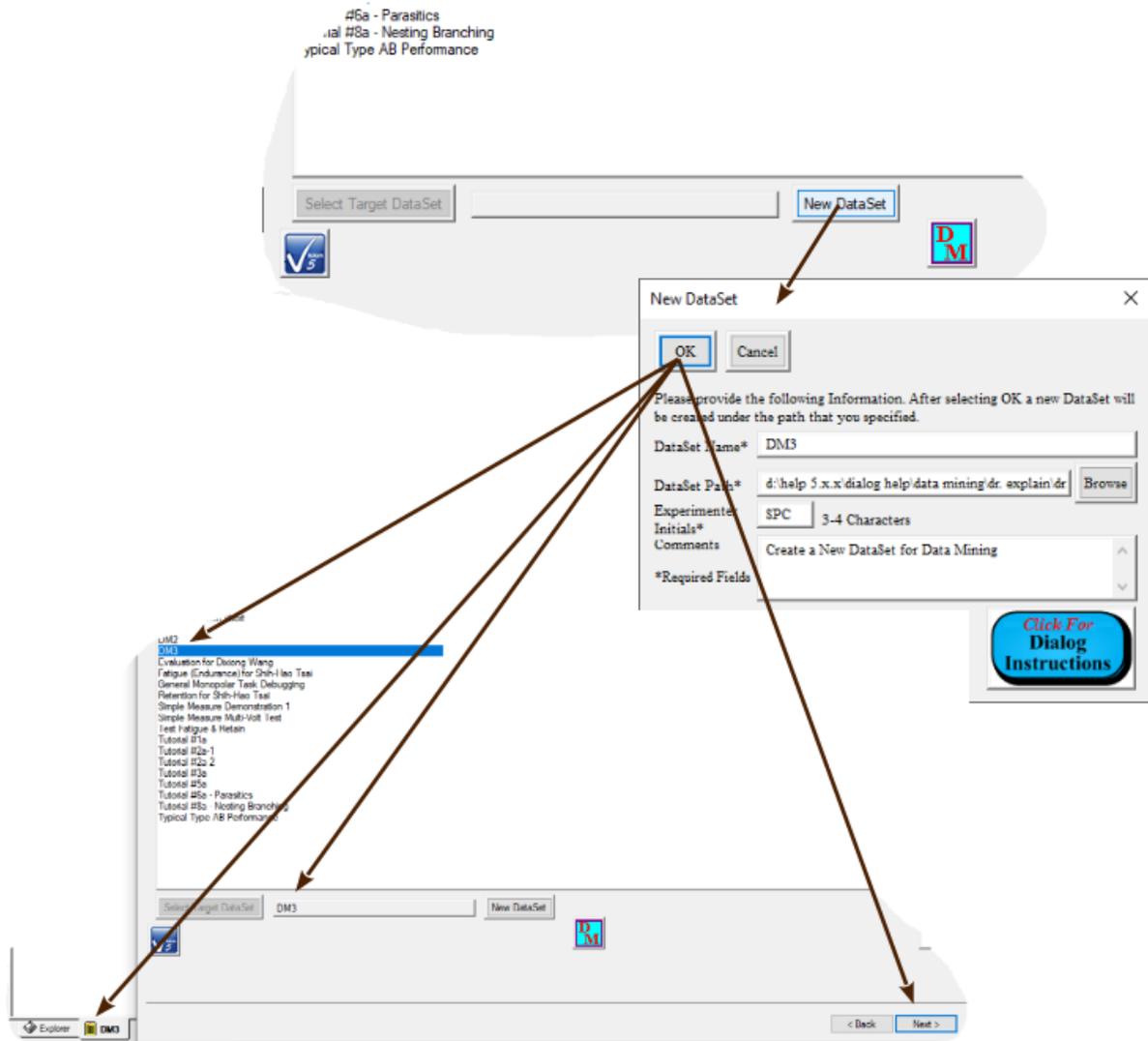


Figure 6 - Create a New Target DataSet.

Control	Type	Default	Discussion
<i>Registered DataSets (Unlabeled)</i>	List Box	No Selection	This control lists all DataSets currently registered to Vision. A single DataSet is selected (highlighted) in this list to identify it as the Target DataSet selection. This control initially has no DataSet selected. Selecting a DataSet enables <i>Select Target DataSet</i> . This list may be augmented by inserting a new DataSet, alphabetically, using the <i>New DataSet</i> button. After the list is augmented, the new DataSet will be selected (highlighted).
<i>Select Target DataSet</i>	Button	Unpressed	This control is disabled until a single DataSet is selected in <i>Registered DataSets</i> . Clicking this button registers the DataSet selected in <i>Registered DataSets</i> as the target DataSet and: <ul style="list-style-type: none"> Copies the DataSet name into the unlabeled <i>Selected DataSet</i> text control.

			<ul style="list-style-type: none"> • Opens the selected DataSet in the DataSet Explorer if it was not previously opened. • Closes any DataSet that was opened by the button, but was previously closed. • Enables the <u>N</u>ext > button. <p>This button may remain disabled if the DataSet selected in <i>Registered DataSets</i> was created using the <i>New DataSet</i> button.</p>
<i>Selected DataSet (Unlabeled)</i>	Text	""	This control is initially empty of text. It is updated to show the target DataSet name by either the <i>Select Target DataSet</i> or <i>New DataSet</i> button.
<i>New DataSet</i>	Button	Unpressed	Initiate the creation of a new target DataSet as shown in Figure 6 and the discussion above the figure.
<i>Click For Dialog Instructions</i>	Button	Unpressed	This button opens a Dialog Instructions project that provides complete details regarding the entire Data Mining process
< <u>B</u> ack	Button	Unpressed	This button is will move the wizard backward to the previous (Discussion) tab.
<u>N</u> ext >	Button	Unpressed	This button advances the wizard to the next dialog tab. This control is disabled until <i>Select Target DataSet</i> is clicked or a new DataSet is created.
<i>Cancel</i>	Button	Unpressed	This button closes the Data Mining wizard with no action taken by the Data Mining tool.

XVII.2.c - Third Tab: Select Source DataSet(s)

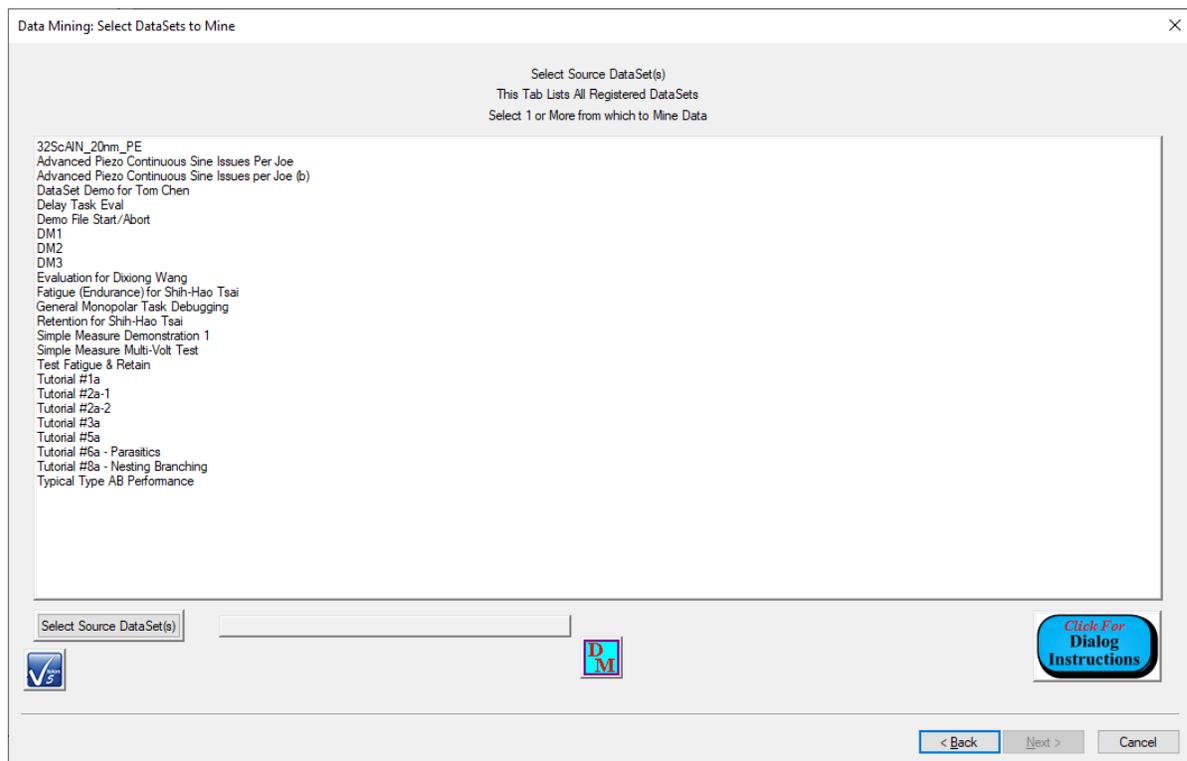
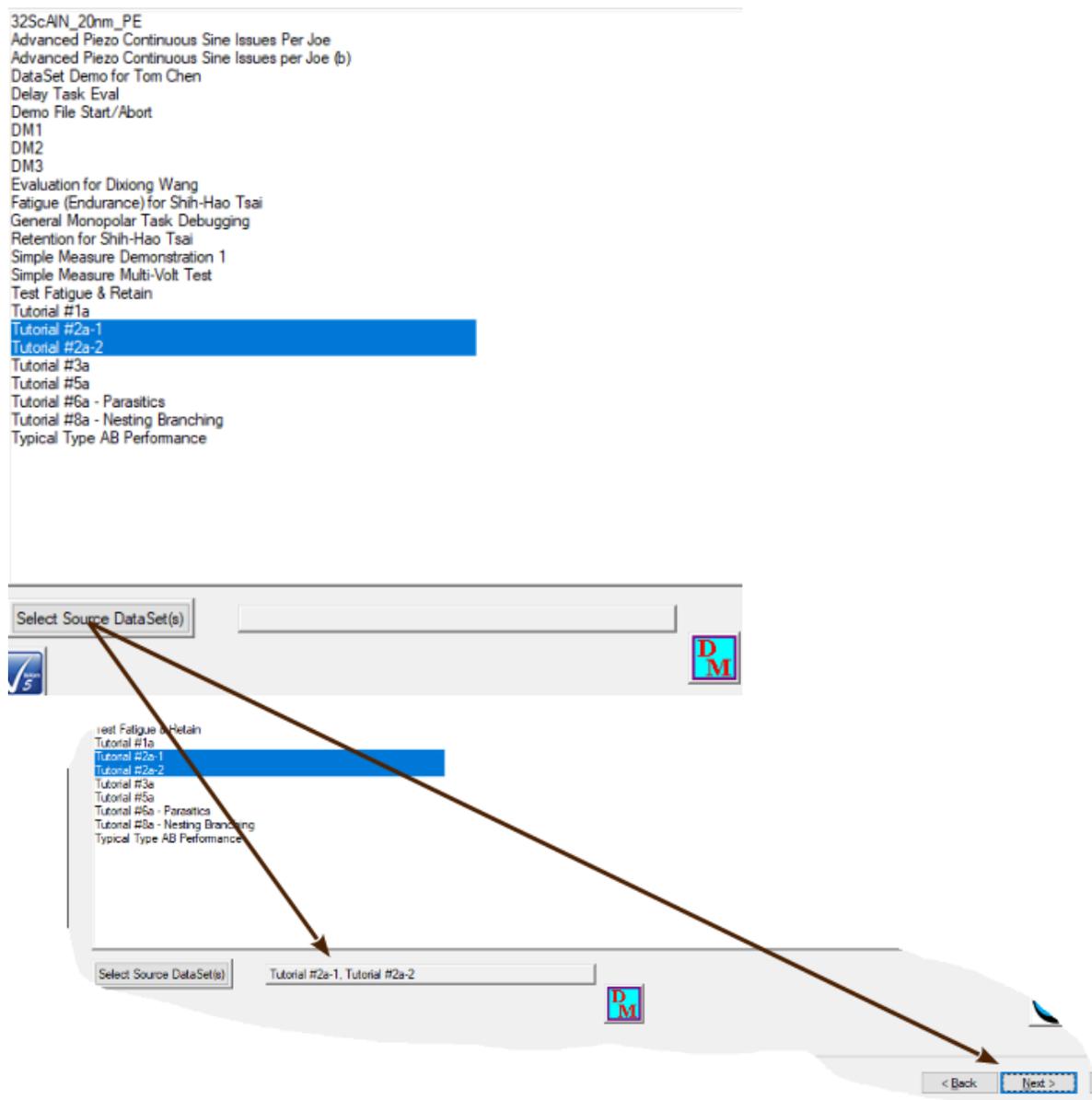


Figure 7 - Select Source DataSets Tab.

The third Data Mining wizard tab also lists all DataSets currently registered to Vision. Here, one or more DataSets are selected to provide the archived Tasks whose data are to be mined. Note that the user should carefully identify all DataSets of interest before executing the Data Mining wizard. Note that there is no restriction to the number or identity of the DataSets to be selected. This extends to the target DataSet that may also serve as a data source. Select the intended source DataSets and then click *Select Source DataSets*. Two things will occur:

- The unlabeled Source DataSet(s) text control will show a list of the selected source DataSets.
- The Next > button will be enabled.



Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

Figure 8 - Select Source DataSets.

The selection may be adjusted at any time by deselecting unintended DataSets, selecting the intended one and clicking *Select Source DataSets* again.

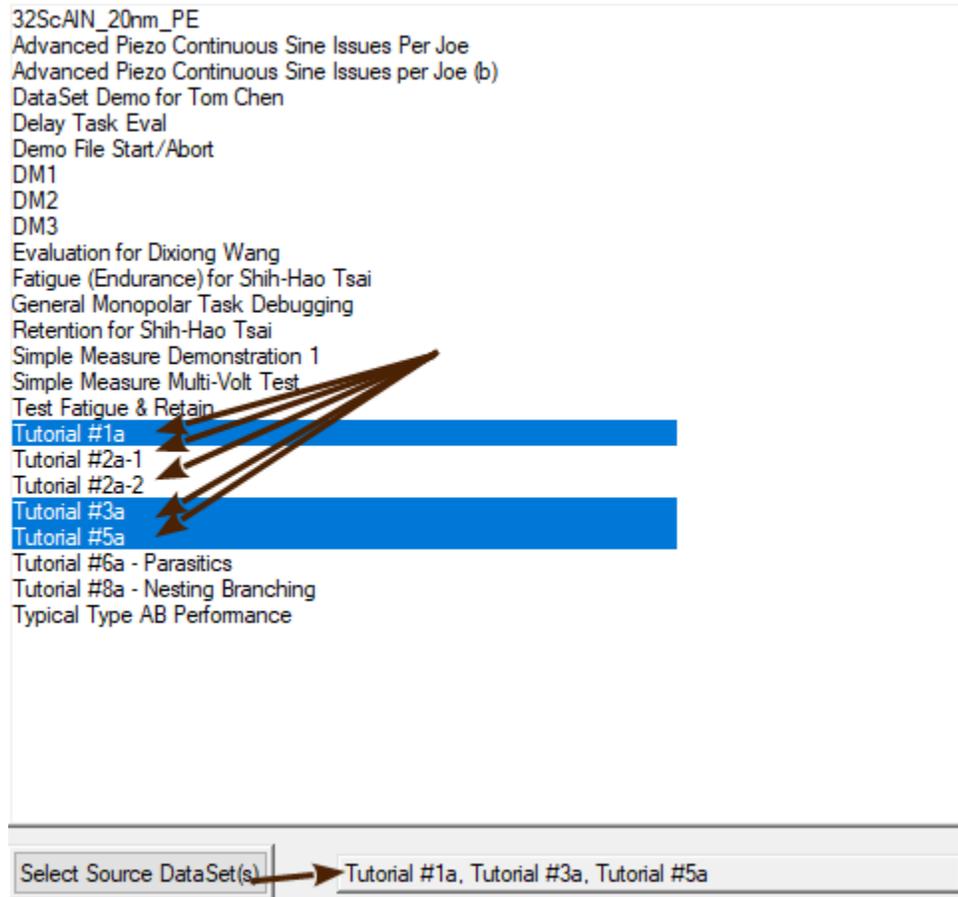


Figure 9 - Adjust Source DataSet Selection.

Control	Type	Default	Discussion
<i>Registered DataSets (Unlabeled)</i>	List Box	No Selection	This control lists all DataSets currently registered to Vision. One or more DataSet(s) is/are selected (highlighted) in this list to identify the data source DataSet selection. This control initially has no DataSet selected. Selecting any DataSet(s) enables <i>Select Source DataSet(s)</i> .
<i>Select Source DataSet(s)</i>	Button	Unpressed	This control is disabled until a single DataSet is selected in <i>Registered DataSets</i> . Clicking this button registers the DataSet(s) selected in <i>Registered DataSets</i> as the source DataSet(s) and: <ul style="list-style-type: none"> Copies the DataSet name, or list of names, into the unlabeled <i>Selected DataSet</i> text control. Enables the <i>Next ></i> button.
<i>Selected DataSet</i>	Text	""	This control is initially empty of text. It is updated to show the target DataSet name by either the <i>Select Target DataSet</i> or <i>New DataSet</i> button.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

<i>(Unlabeled)</i>			
<i>Click For Dialog Instructions</i>	Button	Unpressed	This button opens a Dialog Instructions project that provides complete details regarding the entire Data Mining process
<i><Back</i>	Button	Unpressed	This button is will move the wizard backward to the previous (Select Target DataSet) tab. Note that this action is not well-supported in Data Mining. The results may or may not be as expected.
<i>Next ></i>	Button	Unpressed	This button advances the wizard to the next dialog tab. This control is disabled until <i>Select Source DataSet(s)</i> is clicked.
<i>Cancel</i>	Button	Unpressed	This button closes the Data Mining wizard with no action taken by the Data Mining tool.

XVII.2.d - Fourth Tab: Select Task Type

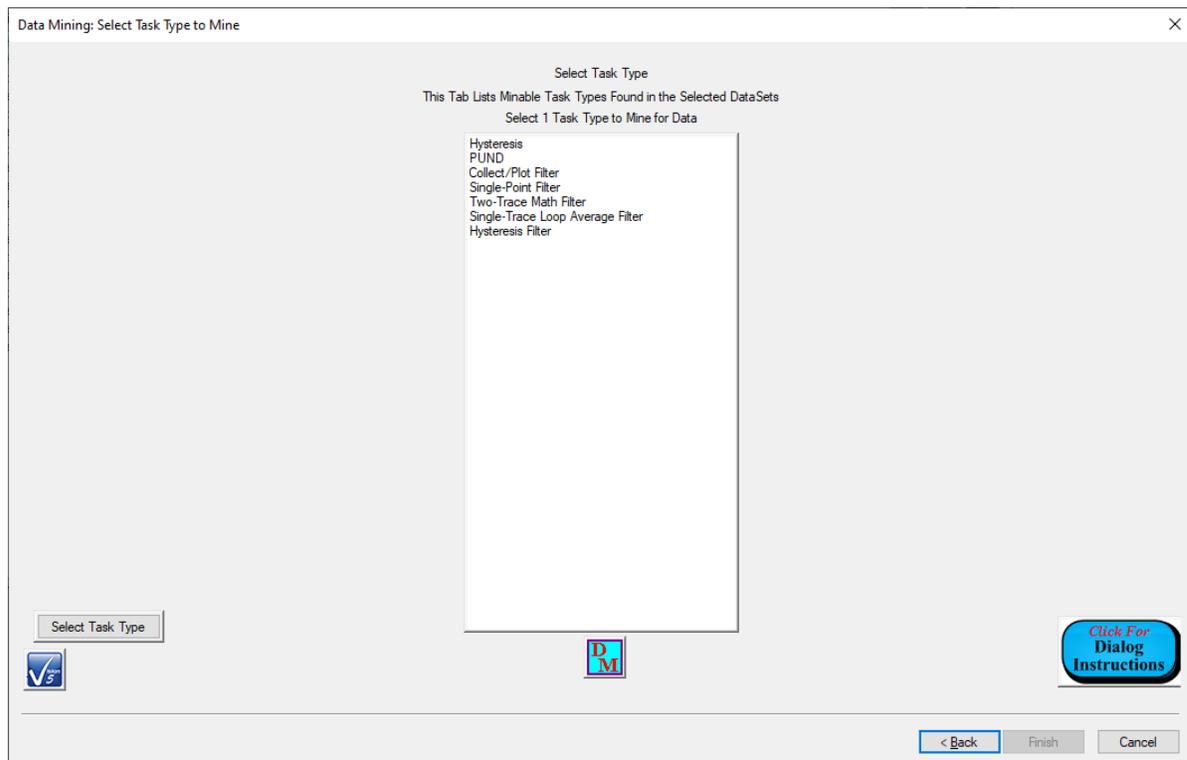


Figure 10 - Task Type Selection Dialog.

When *Next >* is clicked on the Select Source DataSet(s) tab, two things happen:

- Selected DataSets are opened if they were not previously opened.
- The selected DataSet are searched for instances of Task types that contain data that can be mined. This will include [Measurement Tasks](#) and [Filter Tasks](#).

Note that this process may take considerable time depending on the number and size of the source DataSets. The fourth Data Mining wizard tab then displays a list of those data-producing Task types that were found in the source DataSets. The user must select a single

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

Task type. Clicking Select Task Type then enables the *Next >* button. The selection may be changed, perhaps repeatedly, before proceeding to the next wizard tab.

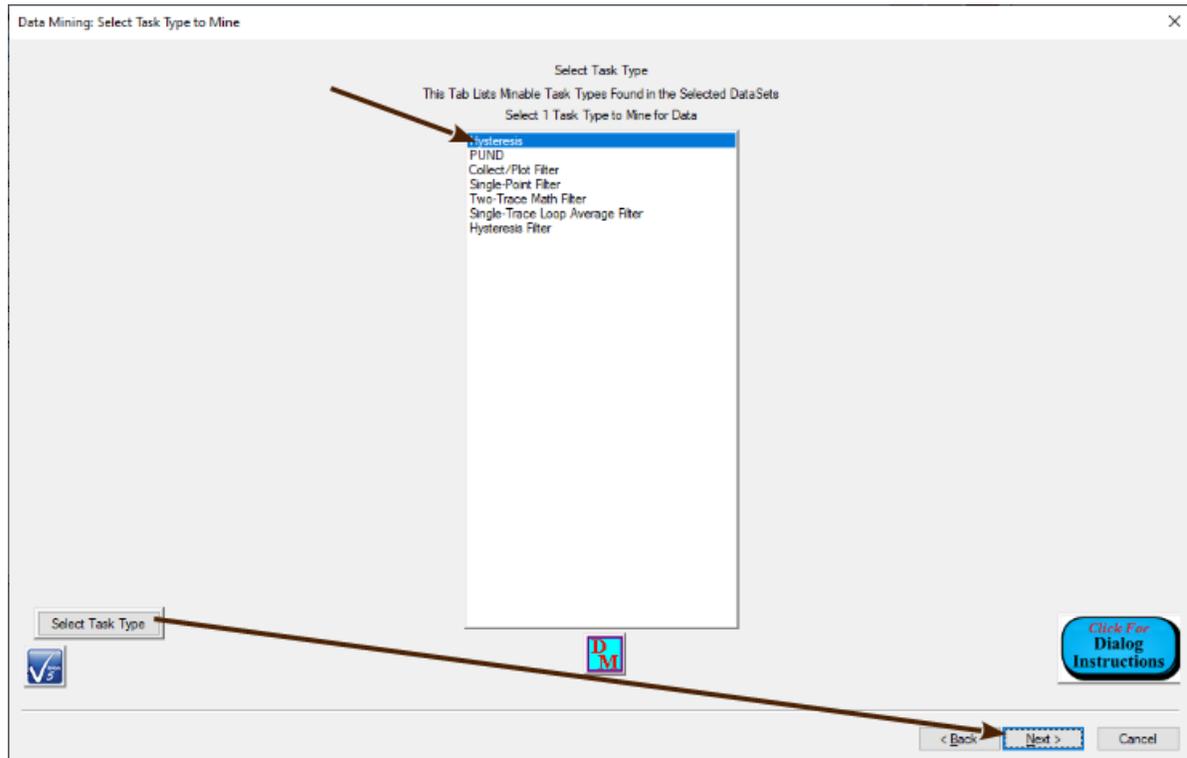


Figure 11 - Select the Hysteresis Task Type.

Control	Type	Default	Discussion
<i>Available Task Types (Unlabeled)</i>	List Box	No Selection	This control lists all Tasks types in the source DataSet(s) that may be mined for data. A single Task Type is to be selected for mining. This control initially has no Task type selected.
<i>Select Task Type</i>	Button	Unpressed	Clicking this button registers the Task Type selected in <i>Available Task Types</i> as the type to mine. It enables the <i>Next ></i> button.
<i>Click For Dialog Instructions</i>	Button	Unpressed	This button opens a Dialog Instructions project that provides complete details regarding the entire Data Mining process
<i><Back</i>	Button	Unpressed	This button is will move the wizard backward to the previous (Select Source DataSet(s)) tab. Note that this action is not well-supported in Data Mining. The results may or may not be as expected.
<i>Next ></i>	Button	Unpressed	This button advances the wizard to the next dialog tab. This control is disabled until <i>Select Task Type</i> is clicked.
<i>Cancel</i>	Button	Unpressed	This button closes the Data Mining wizard with no action taken by the Data Mining tool.

XVII.2.e - Fifth Tab: Select Tasks

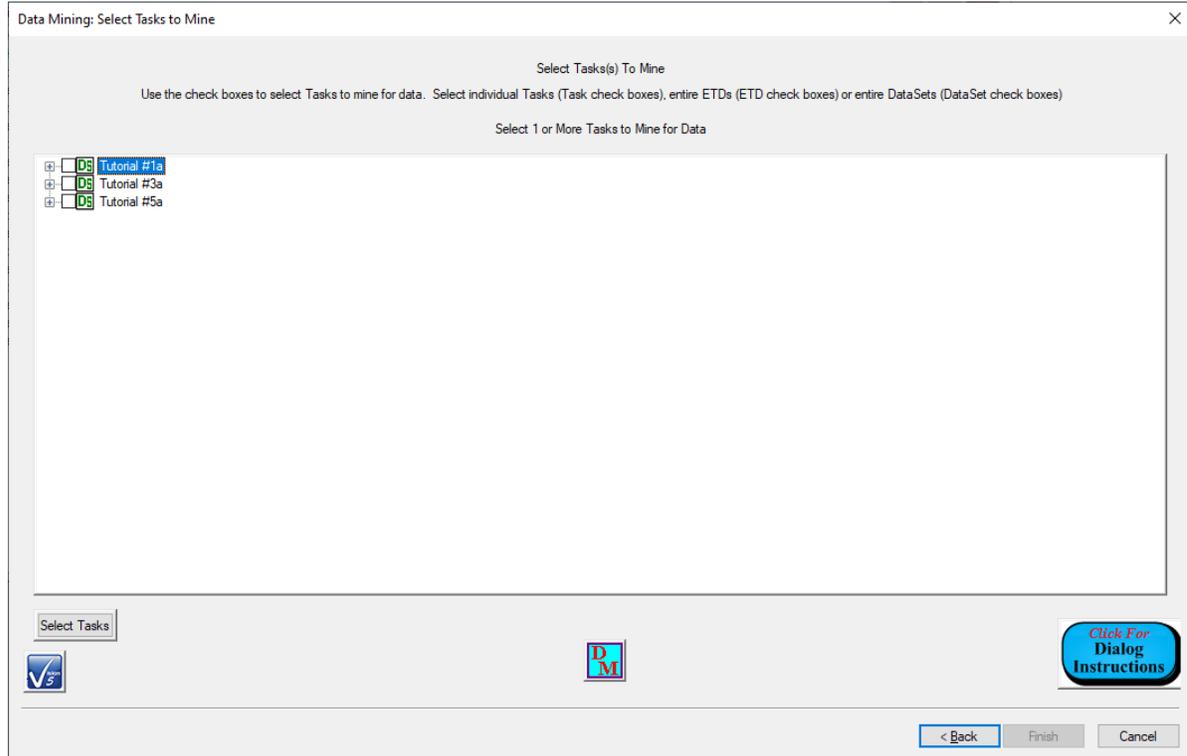


Figure 12 - Select Tasks Tab.

When *Next* > is clicked in the Select Task Type tab the source DataSet(s) is/are searched again. This time every instance of the selected Task type is identified in the DataSet(s). Once again this may take considerable time, depending on the number and size of source DataSet(s). The identified Tasks are then listed in the unlabeled *Select Task(s)* list box. The Tasks are organized into a three-level tree. The outer-most level shows the source DataSet(s), by DataSet Name. Under each DataSet is a list, by ETD (Executed Test Definition) Name, of all ETDs that contain instances of the selected Task type. Under each ETD are the individual Tasks of the selected Task type. From this list the user selects any subset of the available Tasks. Tasks may be individually selected or all Tasks in an ETD may be selected by checking the ETD. All Tasks in a DataSet may also be selected by checking the DataSet. Once the subset of Tasks is properly selected, clicking *Select Tasks* registers the Task for mining and enables *Next* >.

Note that the procedures in this wizard tab require careful preplanning to identify the intended Tasks and their locations.

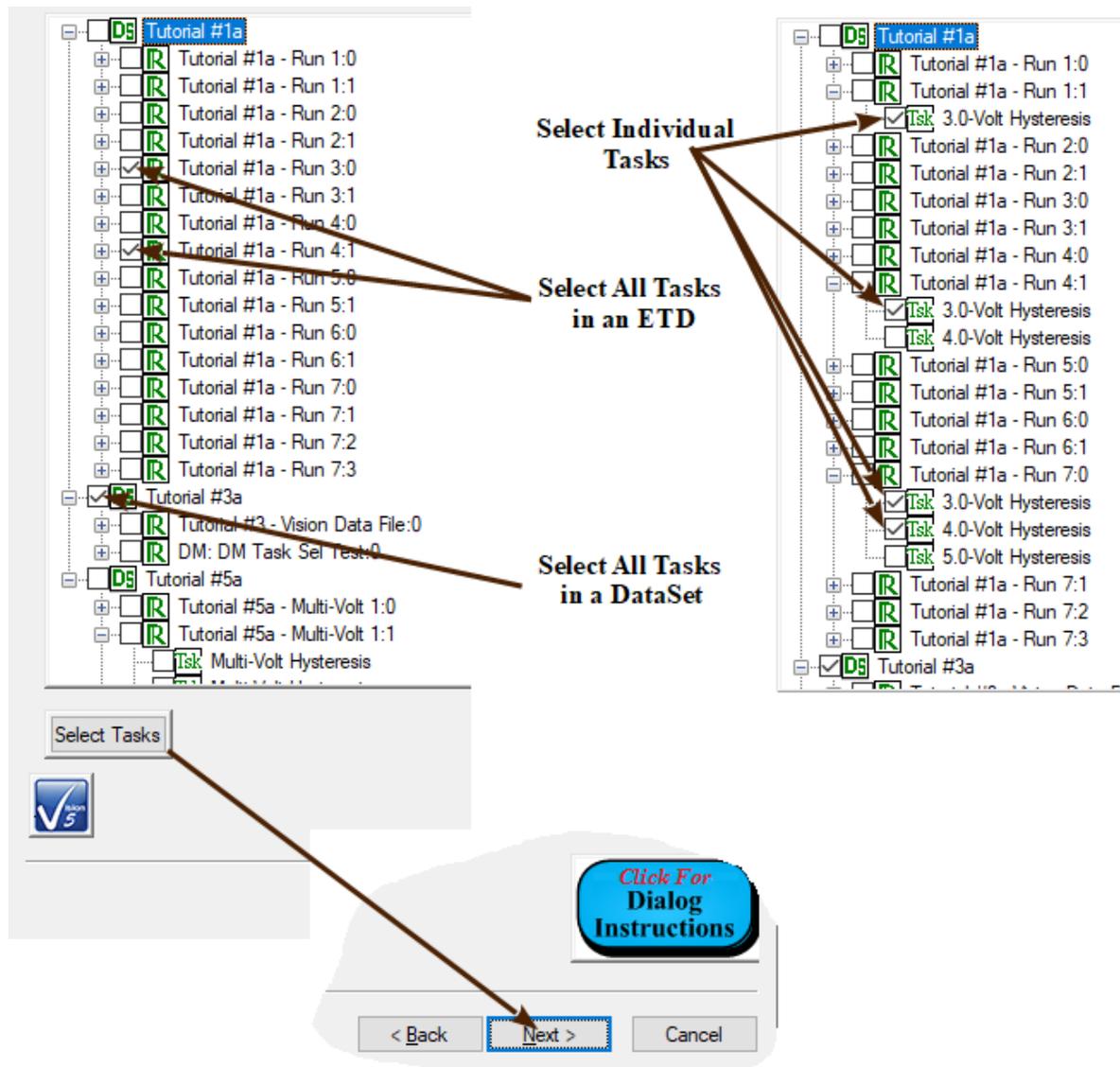


Figure 13 - Select Tasks by Task and/or ETD and/or DataSet.

Control	Type	Default	Discussion
Select Task(s) (Unlabeled)	List Box	No Selection	This control lists all Tasks of the selected type in the source DataSets. Tasks are listed in the DataSet by DataSet Name->ETD Name->Task Name. Any subset of the available Tasks is to be selected for mining. Tasks may be selected individually, by all Tasks in an ETD or all Tasks in a DataSet.
Select Tasks	Button	Unpressed	Clicking this button registers the Tasks selected in Available Task Types as the type to mine. It enables the Next > button.
Click For Dialog Instructions	Button	Unpressed	This button opens a Dialog Instructions project that provides complete details regarding the entire Data Mining process
<Back	Button	Unpressed	This button will move the wizard backward to the previous (Select Task Type) tab. Note that this action is not well-supported in Data Mining. The

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)



			results may or may not be as expected.
<i>Next ></i>	Button	Unpressed	This button advances the wizard to the next dialog tab. This control is disabled until <i>Select Tasks</i> is clicked.
<i>Cancel</i>	Button	Unpressed	This button closes the Data Mining wizard with no action taken by the Data Mining tool.

XVII.2.f - Sixth Tab: Rename Tasks

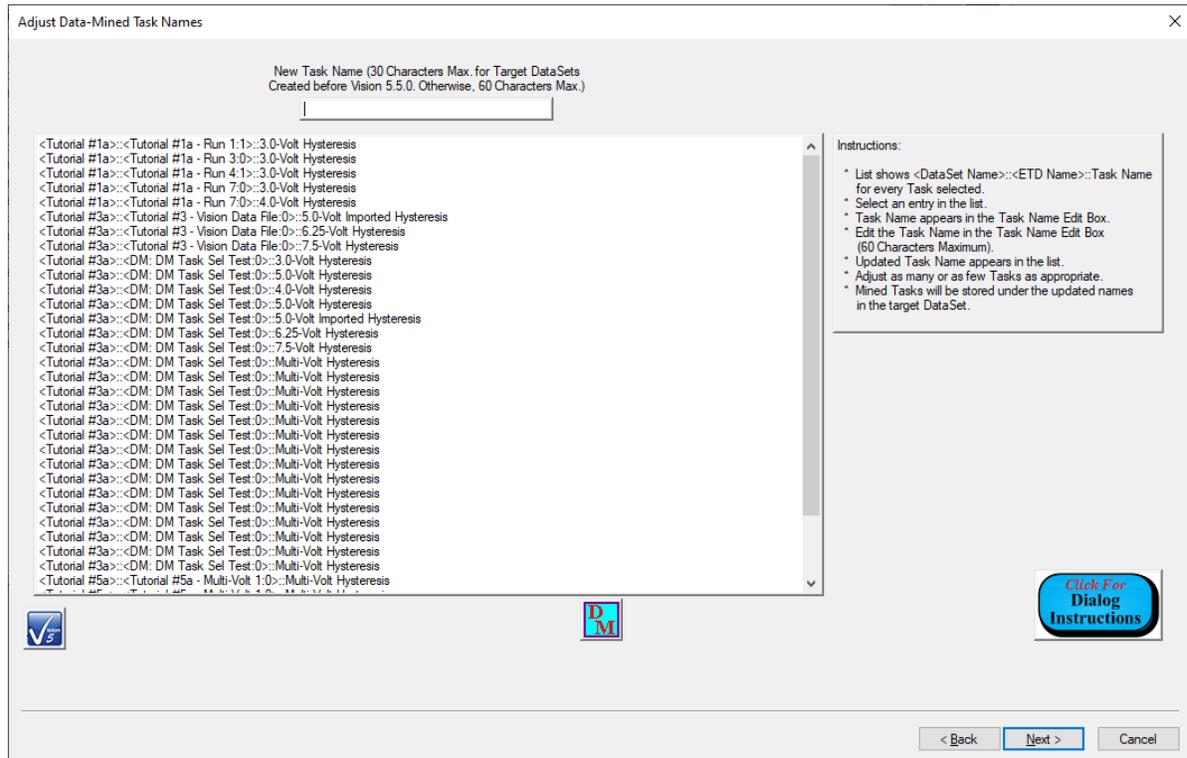


Figure 14 - Rename Tasks Tab.

As shown in **Figure 13**, by the nature of Vision, Tasks of the same name may be repeatedly executed and stored to the DataSet. This is particularly true if the Task is operating in a [Branch Loop](#). This next wizard tab allows the user to adjust the names of Tasks before Data Mining to render them more descriptive and, especially, unique. Each of the selected Tasks is listed, by DataSet Name->ETD Name->Task Name in the unlabeled *Selected Task* list box. Select each Task in the list whose name is to be updated. The Task Name will be copied to the *New Task Name* control. Edit the name in the control. As the name is edited, the Task Name in the list is updated. As noted on the *New Task Name* control, the Task Name length is limited to 30 characters for older target DataSets. Otherwise the limit is 60 characters. It is up to the user to enforce the 30-character limit.

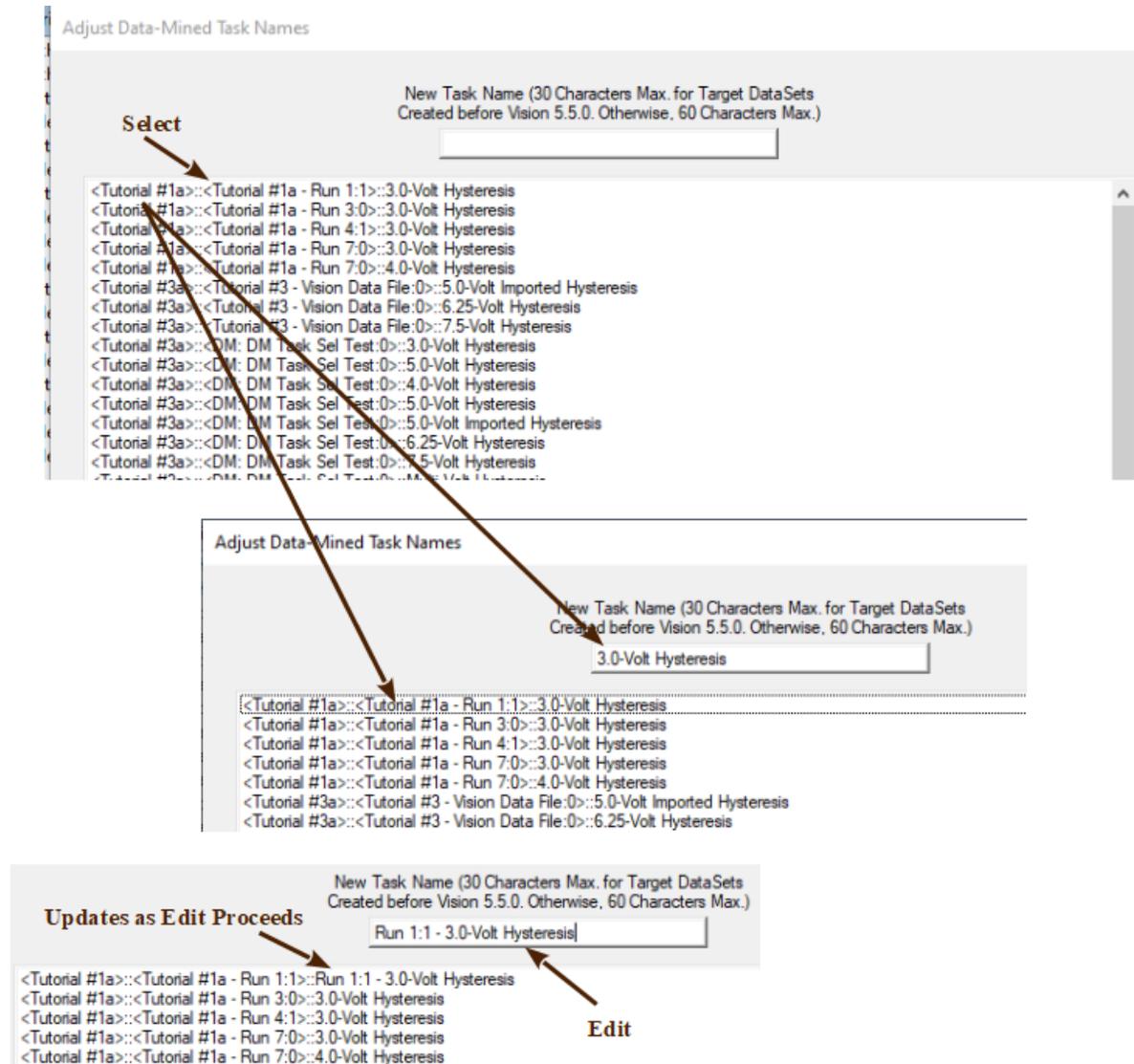


Figure 15 - Rename the First Selected Task.

Control	Type	Default	Discussion
<i>New Task Name</i>	Text	""	30 characters maximum for target DataSets created in Vision versions older than 5.5.0. 60 characters maximum for newer target DataSets. When a Task is selected in the unlabeled <i>Selected Tasks</i> list, the <i>Task Name</i> is duplicated in this control. The name can then be edited to make it more meaningful and, especially, unique. As the name is adjusted in <i>New Task Name</i> it is also adjusted in <i>Selected Tasks</i> .
<i>Selected Tasks (Un-labeled)</i>	List Box	No Selection	This control lists all Tasks that are selected for Data Mining. Tasks are listed by DataSet Name->ETD Name->Task Name. Selecting a Task duplicates it Task Name in the <i>New Task Name</i> control. Editing the name in <i>New Task Name</i> adjusts the Task Name in this list as it is edited.
<i>Click For Dialog</i>	Button	Unpressed	This button opens a Dialog Instructions project that provides complete details regarding the entire Data Mining process

<i>Instructions</i>			
<Back	Button	Unpressed	This button will move the wizard backward to the previous (Select Tasks) tab. Note that this action is not well-supported in Data Mining. The results may or may not be as expected.
Next >	Button	Unpressed	This button advances the wizard to the next dialog tab.
Cancel	Button	Unpressed	This button closes the Data Mining wizard with no action taken by the Data Mining tool.

XVII.2.g - Seventh Tab: Select a Filter to Apply

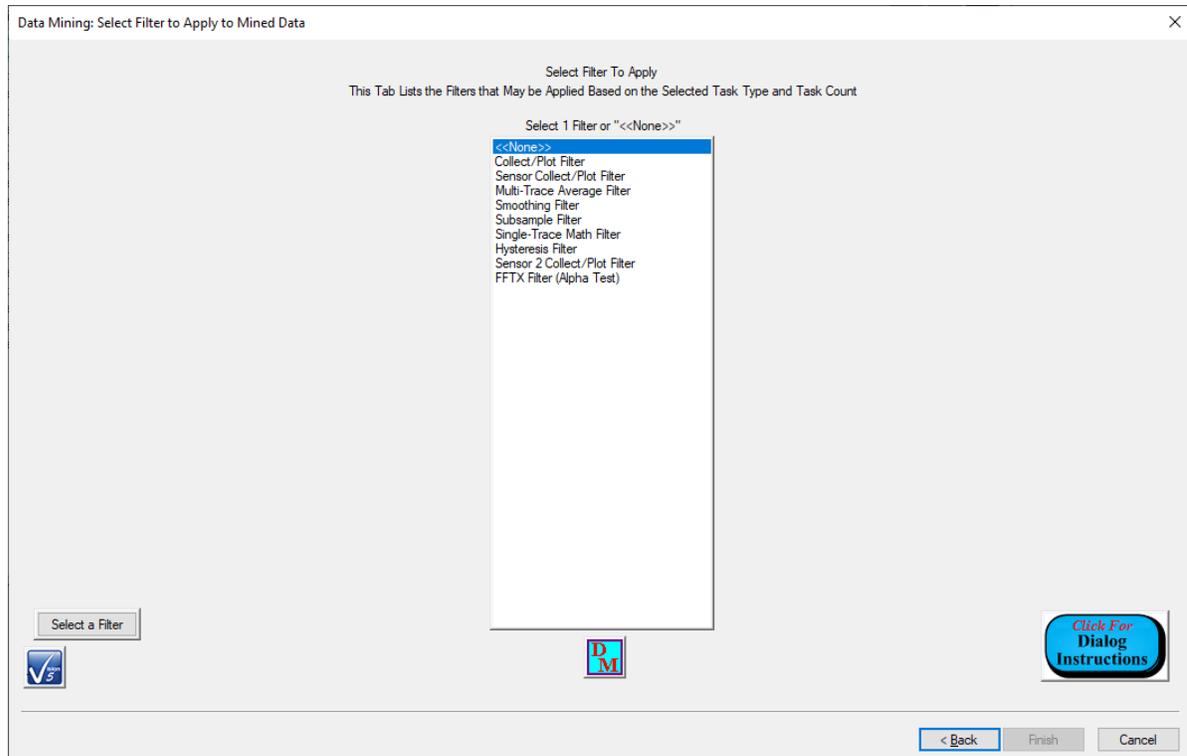


Figure 16 - Filter Tasks that Can Task Hysteresis Data as Input.

The next tab lists all Filter Tasks that can take the selected Task Type as input. At the top of the list is "<<None>>". That is selected by default. With "<<None>>" selected no Filter will be applied to the mined data. Otherwise the Filter of the selected type will be applied. To select a Filter choose the Filter option (or "<<None>>") in *Select 1 Filter or "<<None>>"* and then click *Select a Filter*. This registers the selected Filter type for use and enables the *Next >* button.

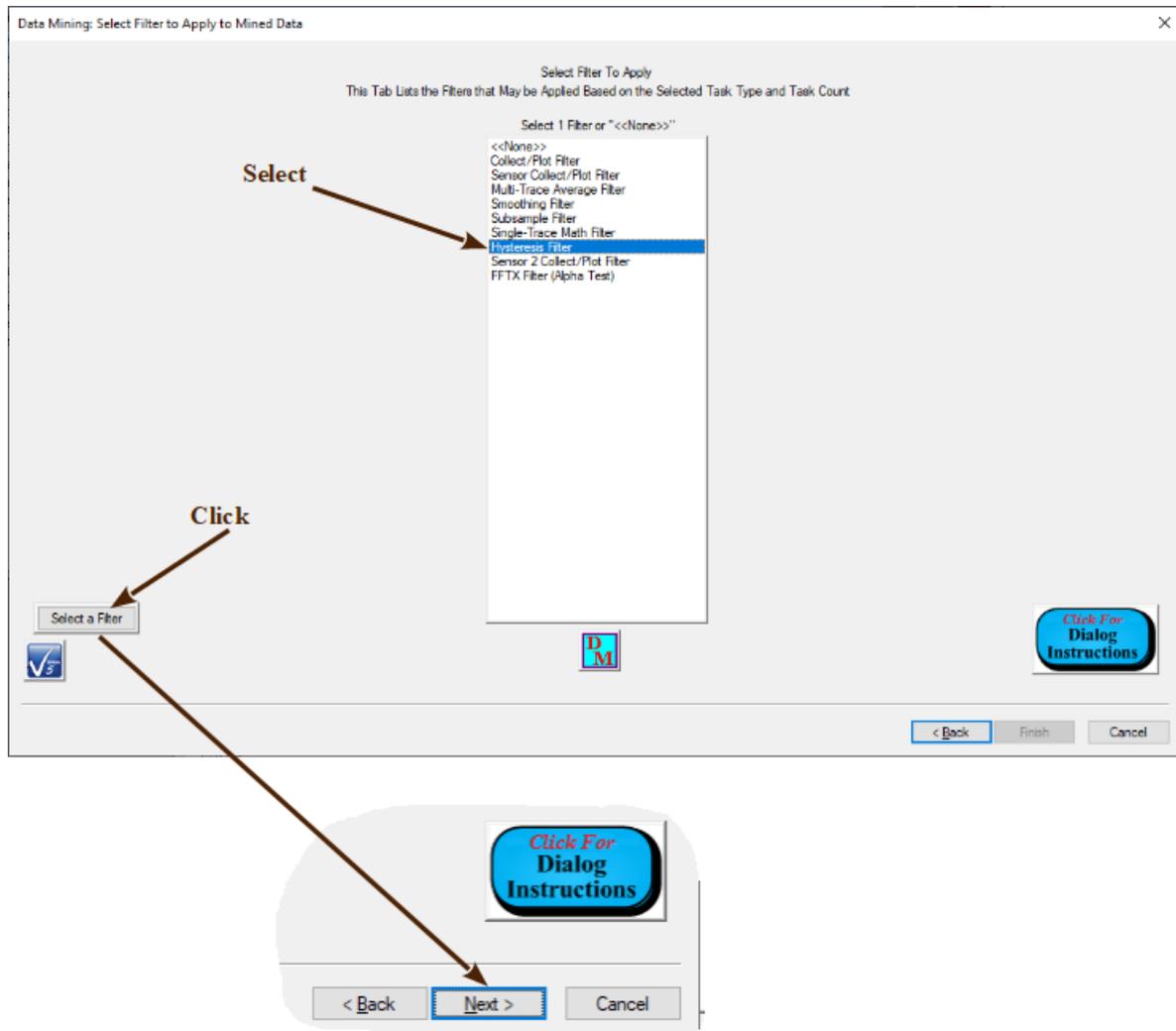


Figure 17 - Select the Hysteresis Filter Task.

Control	Type	Default	Discussion
<i>Select 1 Filter or "<<None>>"</i>	Text	"<<None>>"	This list box shows a Filter Tasks that can be associated with the selected Task Type. The top of the list is "<<None>>". One entry from the list may be selected. Selecting "<<None>>" disables the appending of a Filter Task. Otherwise the Filter selected is registered by clicking <i>Select a Filter</i> .
<i>Select a Filter</i>	Button	Unpressed	This button registers the selection in <i>Select 1 Filter or "<<None>>"</i> and enables <i>Next ></i> .
<i>Click For Dialog Instructions</i>	Button	Unpressed	This button opens a Dialog Instructions project that provides complete details regarding the entire Data Mining process
<i><Back</i>	Button	Unpressed	This button is will move the wizard backward to the previous (Rename Tasks) tab. Note that this action is not well-supported in Data Mining. The results may or may not be as expected.
<i>Next ></i>	Button	Unpressed	This button advances the wizard to the next dialog tab. This control is

			disabled until <i>Select a Filter</i> is clicked.
<i>Cancel</i>	Button	Unpressed	This button closes the Data Mining wizard with no action taken by the Data Mining tool.

XVII.2.h - Eighth Tab: Assign a CTD/ETD Name

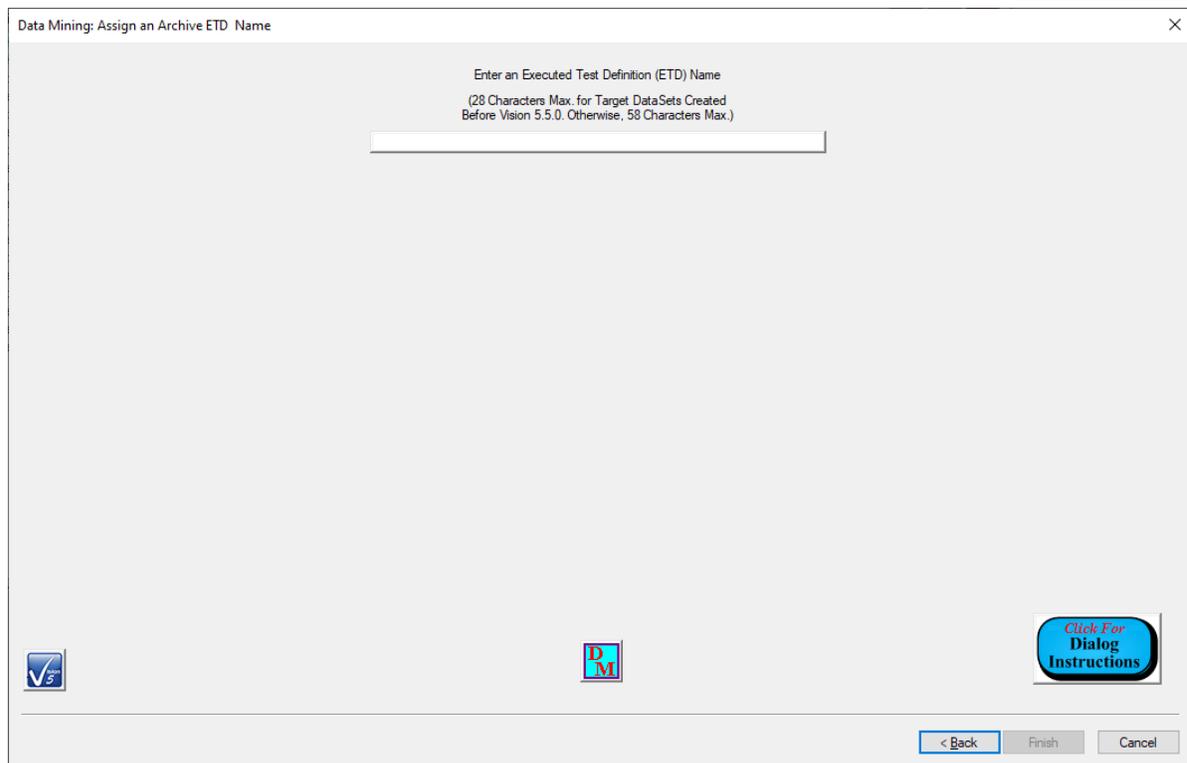


Figure 18 - CTD/ETD Naming Tab.

The mined Tasks will be appended to the target DataSet Archive in a new Executed Test Definition (ETD). Test Definitions are recorded in the DataSet Archive by name. The final tab allows the user to specify the name under which the data will be archived. It is important to assign a unique and meaningful name so that future data reviews can identify the data. Once characters are entered into Enter and Executed Test Definition Name, *Finish* will be enabled.

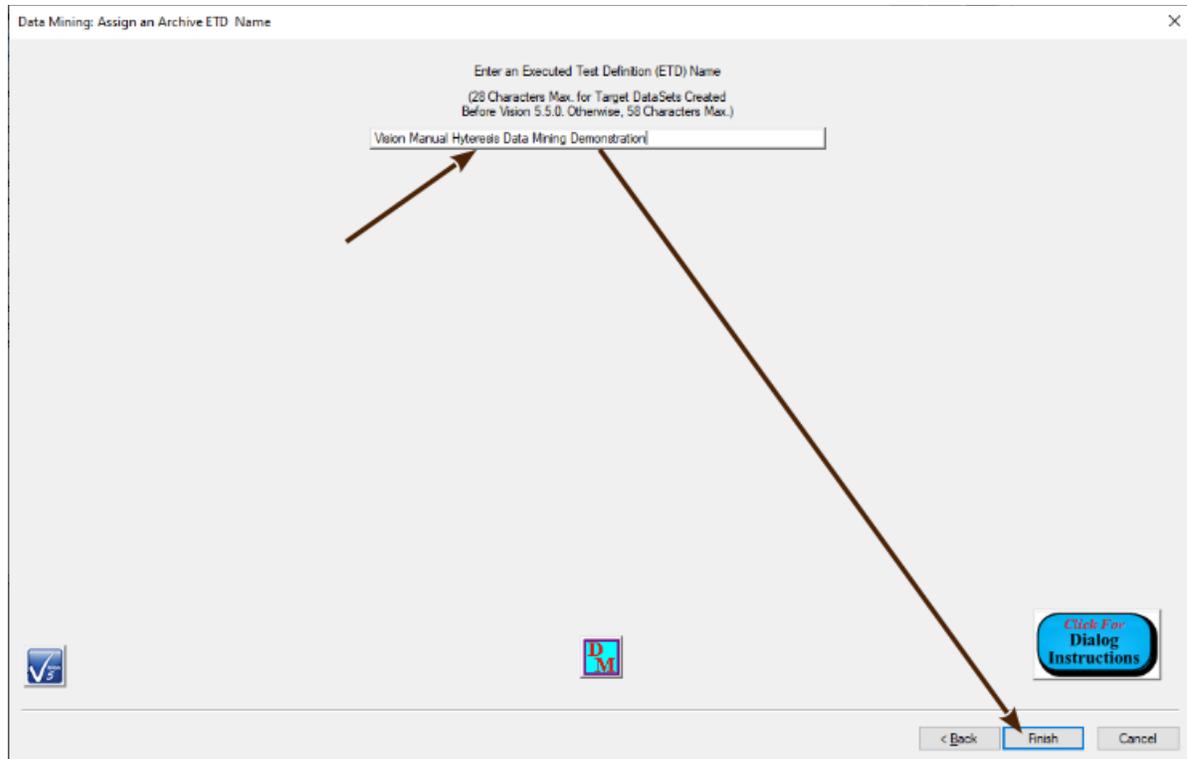


Figure 19 - Assign the CTD/ETD Name.

Control	Type	Default	Discussion
<i>Enter an Executed Test Definition (ETD) Name</i>	Text	""	Enter the name underwhich all Data-Mined data will be archived. This value has a 30-character limit if the target DataSet was created under a Vision version older than 5.5.0. Otherwise the limit is 60 characters. Entering text in this control enables <i>Finish</i> .
<i>Click For Dialog Instructions</i>	Button	Unpressed	This button opens a Dialog Instructions project that provides complete details regarding the entire Data Mining process
<i><Back</i>	Button	Unpressed	This button is will move the wizard backward to the previous (Select a Filter) tab. Note that this action is not well-supported in Data Mining. The results may or may not be as expected.
<i>Finish</i>	Button	Unpressed	This button closes the Data Mining wizard and initiates the Data Mining process. This control is disabled until text is entered into <i>Enter an Executed Test Definition (ETD) Name</i> .
<i>Cancel</i>	Button	Unpressed	This button closes the Data Mining wizard with no action taken by the Data Mining tool.

XVI.3 - Configure the Filter Task

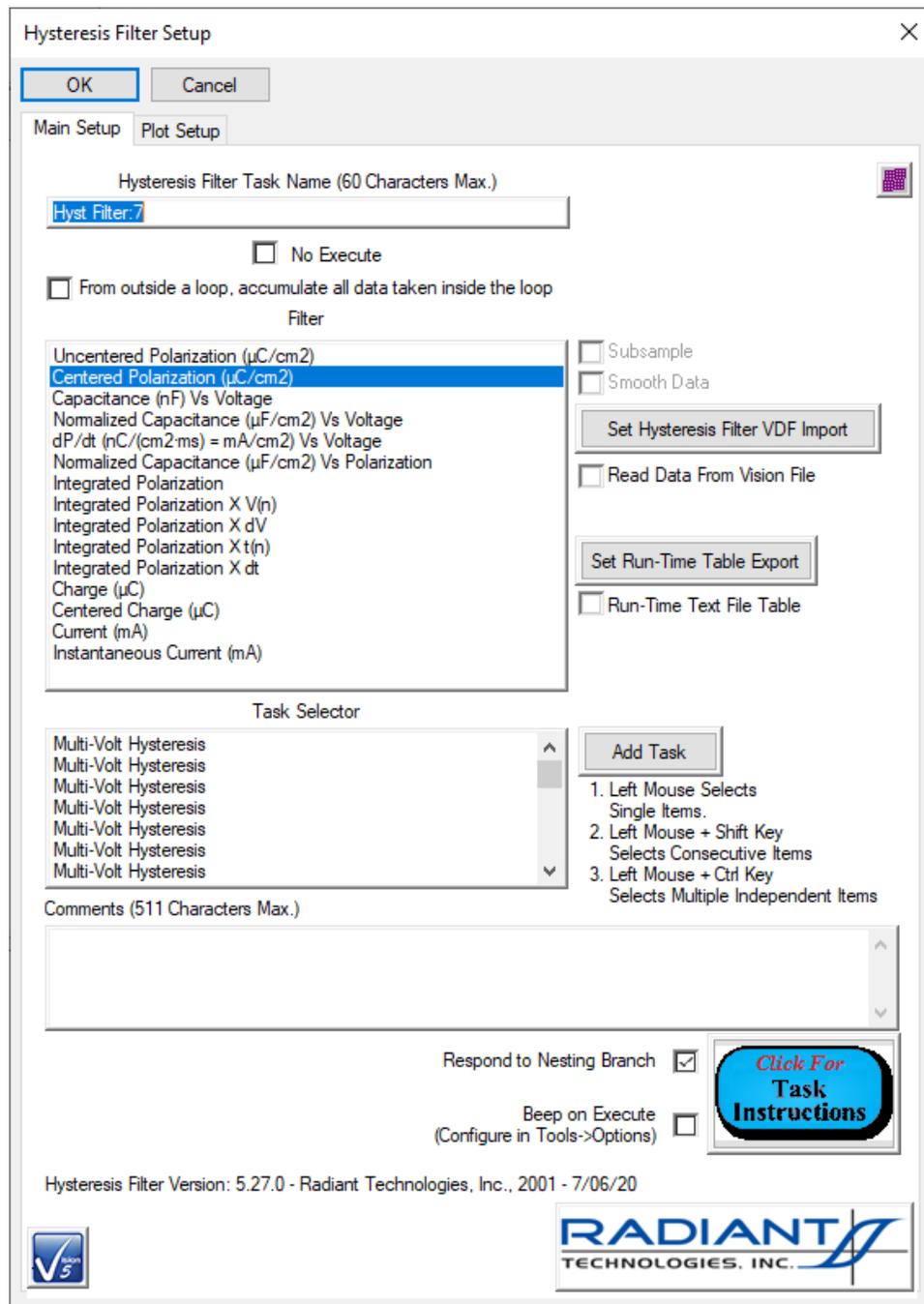


Figure 20 - Hysteresis Filter Task Configuration Dialog.

If the mined data are to have a Filter appended to collect the data, the Filter Task is not being mined from the source DataSets. Instead this is a new Filter that must be configured and executed. The configuration opens when the Data Mining wizard is closed. (If no Filter Task was se-

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

lected, then no configuration dialog will appear and the process moves to **XVI.4) THE USER MUST ENSURE THAT THE FILTER TASK IS CORRECTLY AND COMPLETELY CONFIGURED OR THE DATA MINING PROCEDURE WILL FAIL.** Once the Filter Task is correctly configured, click *OK* to close the Filter configuration dialog and finish the Data Mining process.

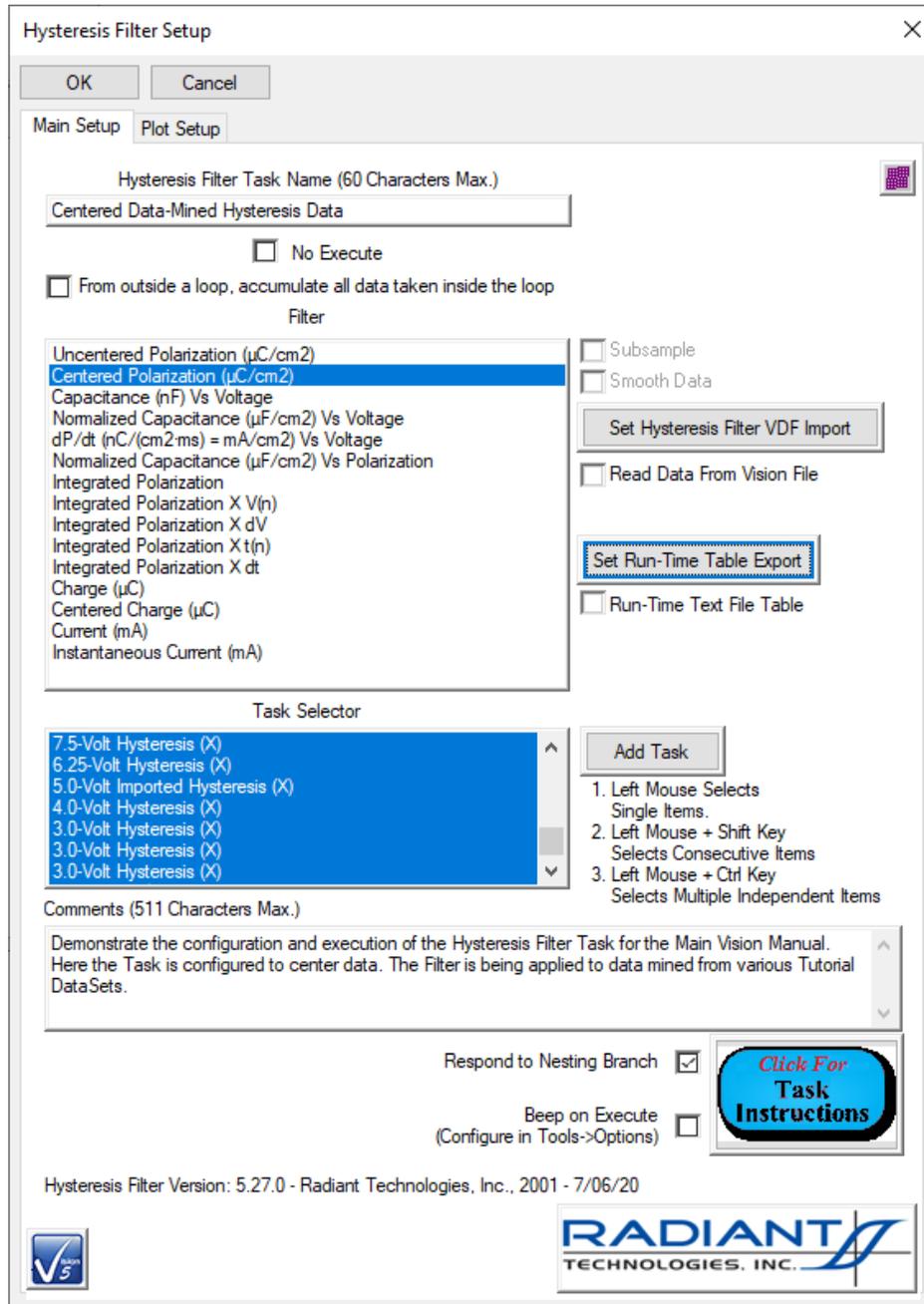


Figure 21 - Configure the Main Hysteresis Filter Tab.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

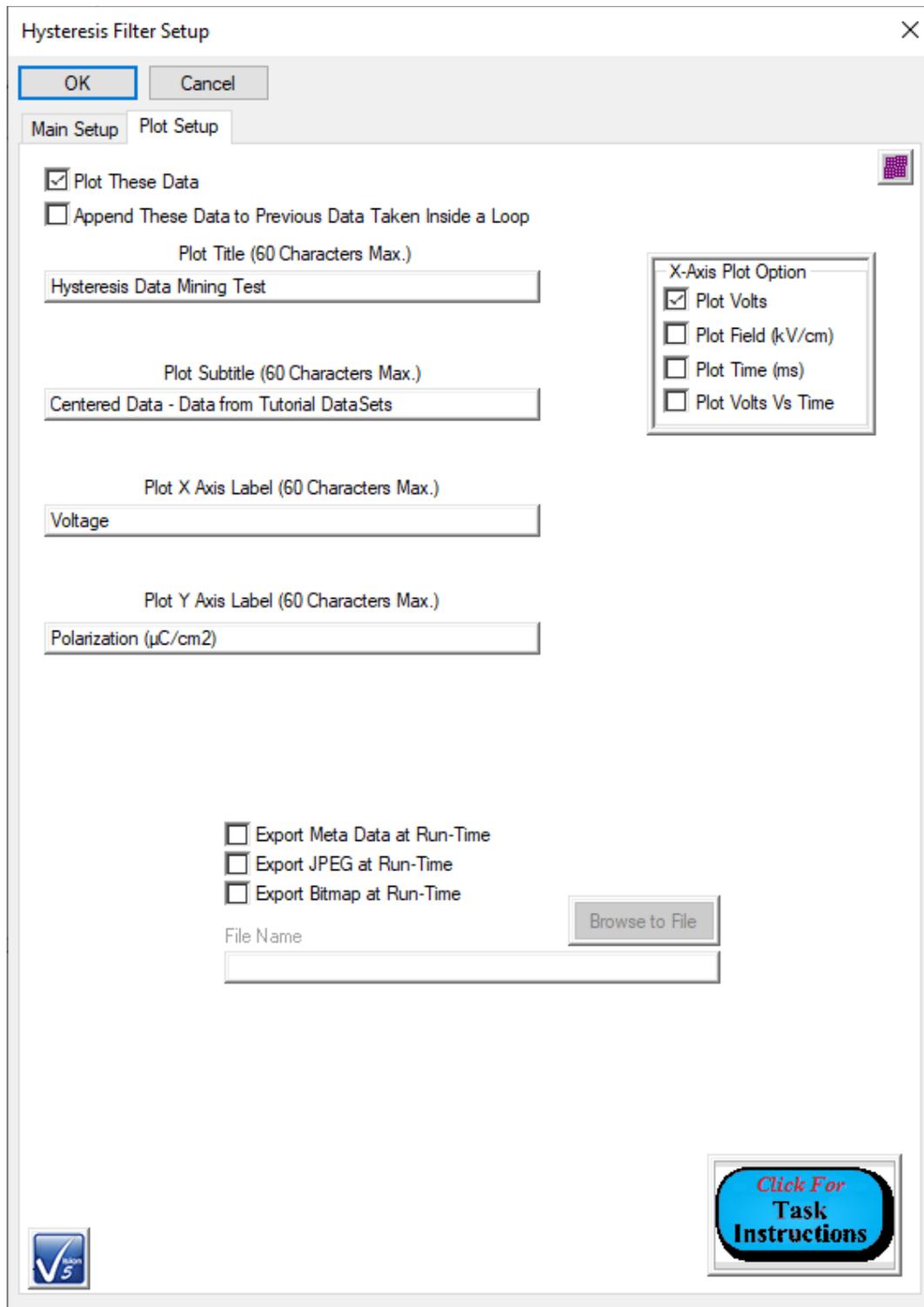


Figure 22 - Configure the Hysteresis Plot Tab.

XVI.4 - Data-Mined Data

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

[sa/2.5/](http://creativecommons.org/licenses/by-nc-sa/2.5/)



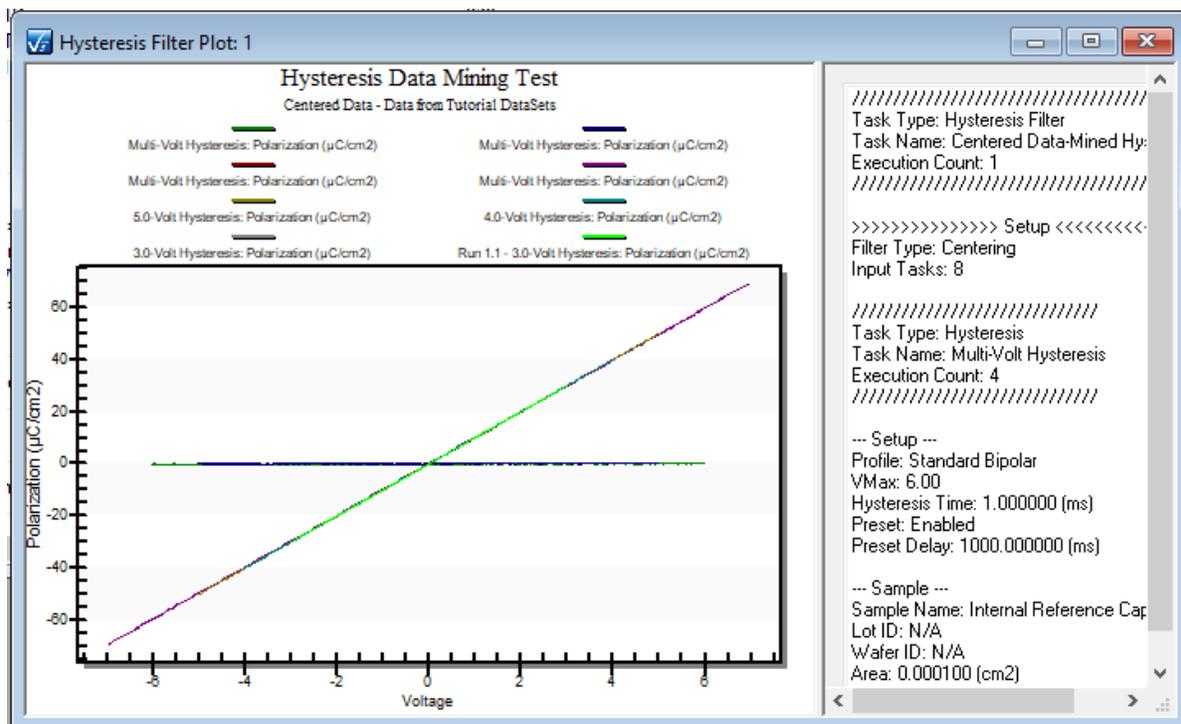


Figure 23 - Hysteresis Filter Applied to Data-Mined Data. These are Measurements Taken on the 1.0 nF Linear Internal Reference Capacitor.

If a Filter Task is applied to the data and if the Filter is configured to plot data on execution, the Filter plot will appear with the collected (and, perhaps, manipulated) data. In the example of **Figure 23**, fewer Tasks were mined for data than shown in **Figures 13** and **14**. These represent actual Hysteresis measurements taken on the Precision tester's 1.0 nF linear Internal Reference Capacitor.

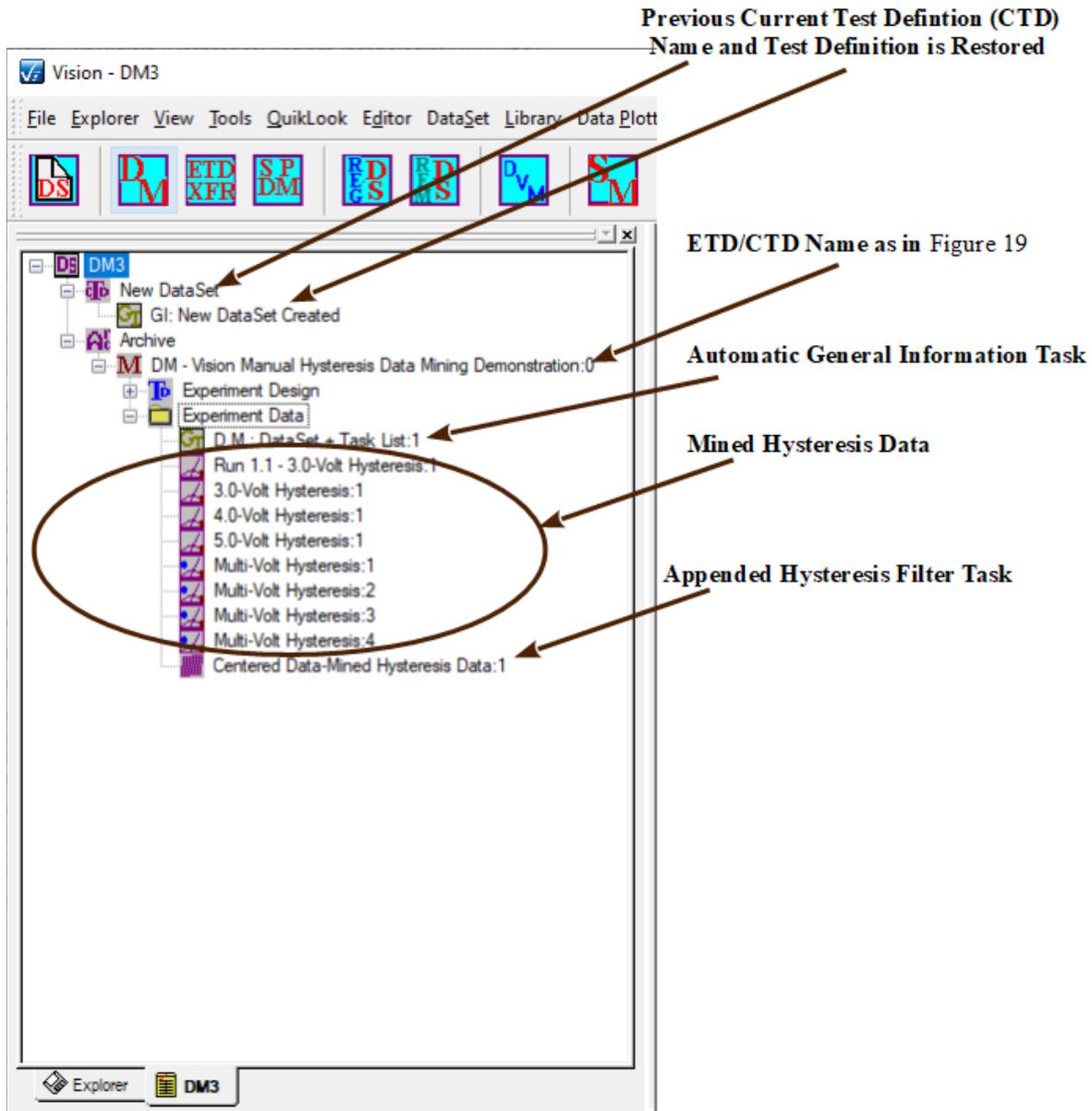


Figure 24 - Target DataSet with Mined Data Plus Appended Hysteresis Filter Task.

The target DataSet is updated with a new Executed Test Definition (ETD) appended. The EDT takes on the name as assigned in **Figure 19**. The first entry under the "Experiment Data" folder is a General Information Task that is added to any Test Definition execution automatically by Vision. It contains details of the configuration of each Task in the Test Definition. In the case of Data-Mined Tasks it gives only the Task Name, represented by Source DataSet Name->ETD Name->Task Name.

General Information Task

General Information Task Name (60 Characters Max.)
D.M.: DataSet + Task List

OK Cancel

Experiment Title: Data Mining Die Row: 0 Area (cm²): 0.0001

Sample Name: N/A Die Column: 0 Thickness (um): 0.3

Lot ID: N/A Wafer ID: N/A Capacitor Number: 0

Experiment Discussion

DATA MINING: Mined Tasks by DataSet
* "DataSet Name" <=> "Task Name"

- * Tutorial #1a <=> Tutorial #1a - Run 1:1 <=> 3.0-Volt Hysteresis (Original)/Run 1.1 - 3.0-Volt Hysteresis (Adjusted)
- * Tutorial #1a <=> Tutorial #1a - Run 4:0 <=> 3.0-Volt Hysteresis (Original)/3.0-Volt Hysteresis (Adjusted)
- * Tutorial #1a <=> Tutorial #1a - Run 6:0 <=> 4.0-Volt Hysteresis (Original)/4.0-Volt Hysteresis (Adjusted)
- * Tutorial #1a <=> Tutorial #1a - Run 6:0 <=> 5.0-Volt Hysteresis (Original)/5.0-Volt Hysteresis (Adjusted)
- * Tutorial #3a <=> DM: DM Task Sel Test:0 <=> Multi-Volt Hysteresis (Original)/Multi-Volt Hysteresis (Adjusted)
- * Tutorial #3a <=> DM: DM Task Sel Test:0 <=> Multi-Volt Hysteresis (Original)/Multi-Volt Hysteresis (Adjusted)
- * Tutorial #5a <=> Tutorial #5a - Multi-Volt 6:0 <=> Multi-Volt Hysteresis (Original)/Multi-Volt Hysteresis (Adjusted)
- * Tutorial #5a <=> Tutorial #5a - Multi-Volt 6:0 <=> Multi-Volt Hysteresis (Original)/Multi-Volt Hysteresis (Adjusted)

Admin Info Export

Beep On Execute (Configure in Tools->Options)

Click For Task Instructions

General Information Version: 5.27.0 - Radiant Technologies, Inc., 2001 - 7/06/20



Figure 25 - Automatic General Information Task.

The Automatic General Information Task is followed by a cloned copy of each of the mined Tasks. Task configuration and measured data are accessible, as in and DataSet Archive, by double-clicking.

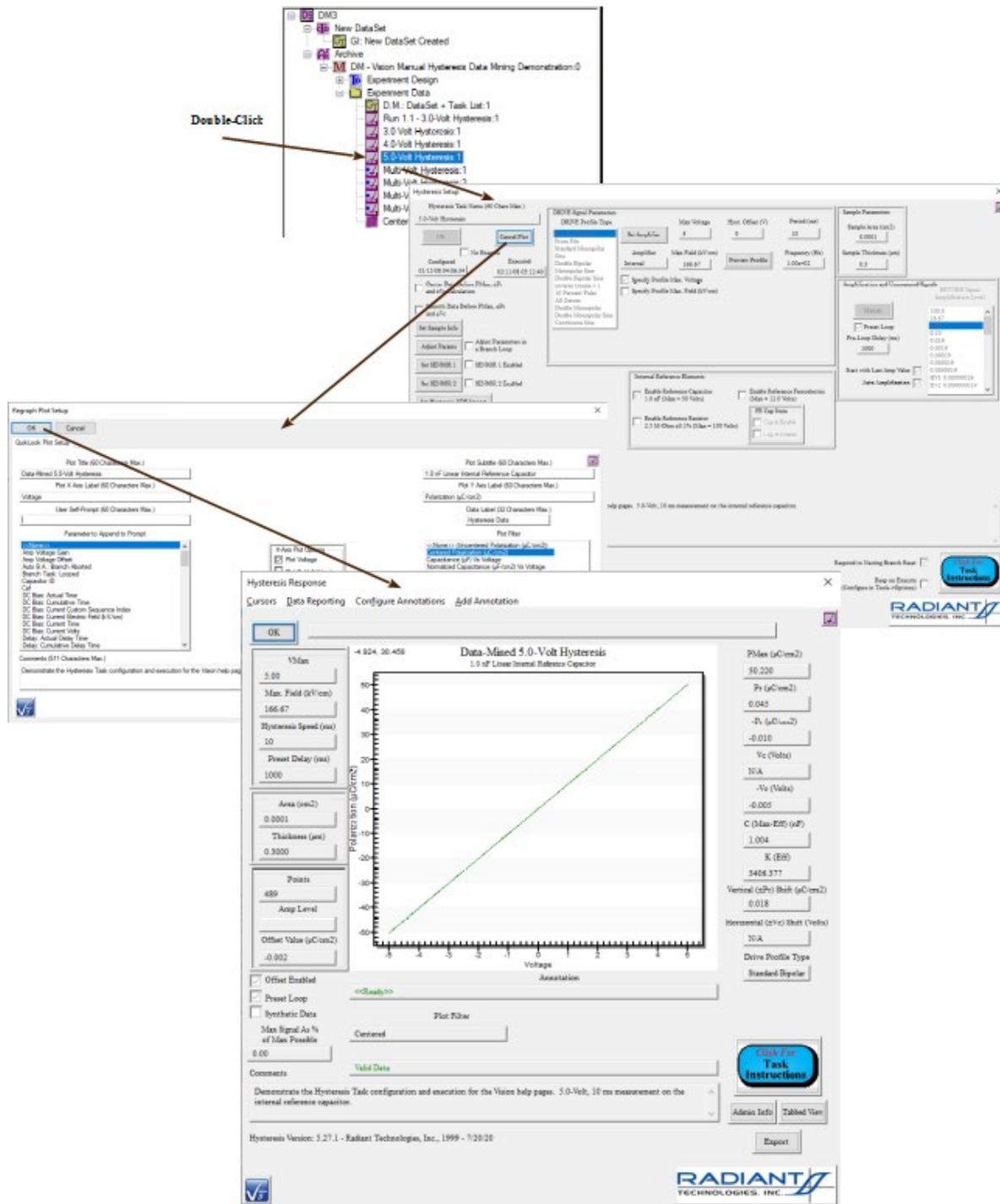


Figure 26 - Review Mined Data.

Finally, the appended Hysteresis Task appears as the last Task in the ETD. It can also be recalled for review.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)



sa/2.5/

SOME RIGHTS RESERVED

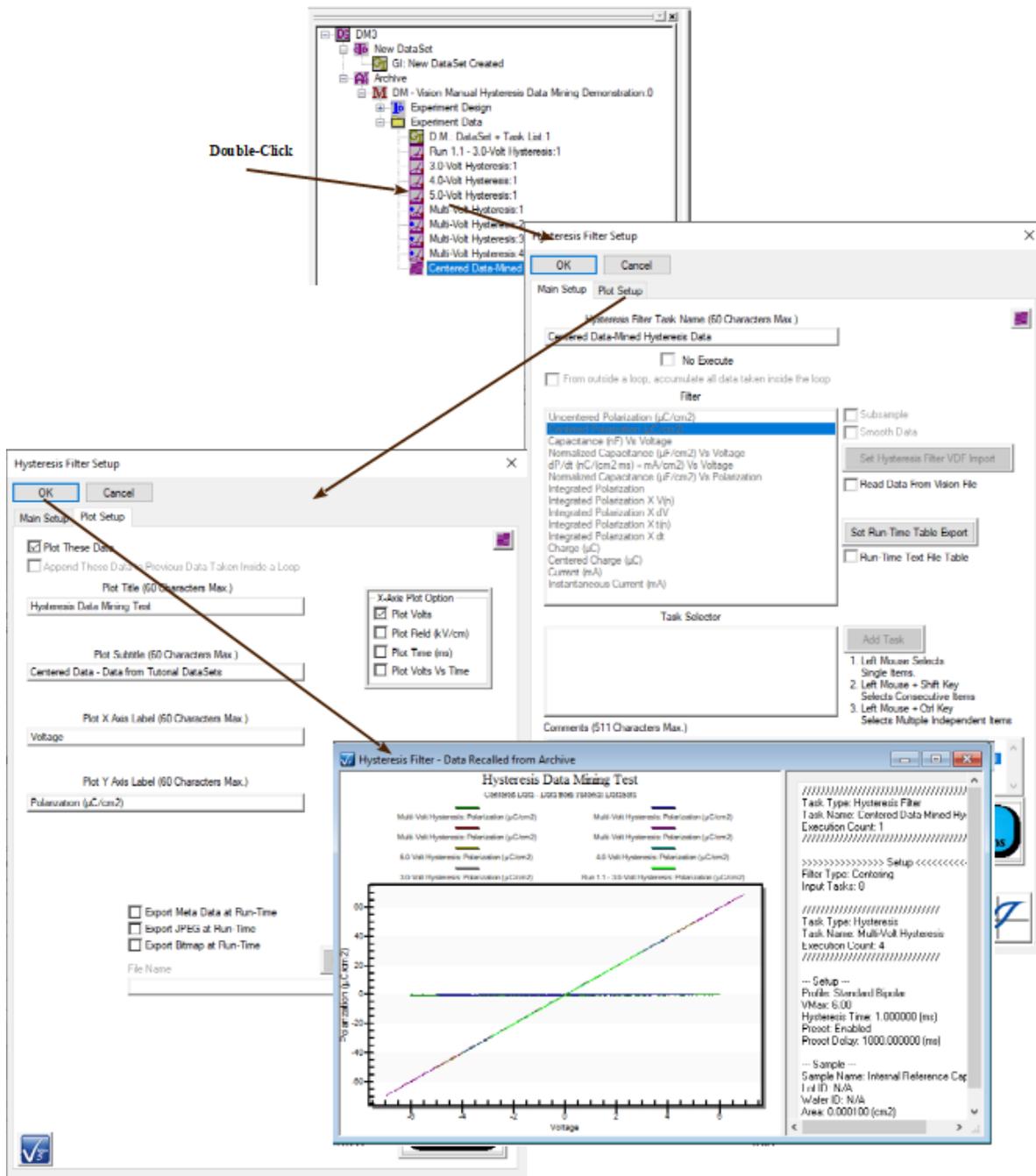


Figure 27 - Review the Appended Filter Data.

XVIII - ETD Transfer

XVIII.1 - Discussion

The ETD Transfer tool is similar in configuration and intent to the [Data Mining](#) tool. In the Data Mining tool any number of Tasks of a specific type is cloned from the archives of any number of DataSets to a single [Executed Test Definition](#) (ETD) in the DataSet Archive of a single target DataSet. In addition a single [Filter Task](#) may be applied to collect and, perhaps, operate on the data from the mined Tasks. The ETD Transfer tool, on the other hand, copies all Tasks, of any type, from any number of ETDs in any number of DataSet Archives to an equivalent number of ETDs in the DataSet Archive of a single target DataSet.

As with the Data Mining tool, the ETD Transfer tool is configured using a wizard.

XVII.2 - ETD Transfer Wizard

The ETD Transfer tool is a "wizard", or serial sequence of dialogs, that configures and executes the operation. The wizard is accessed through the Vision Toolbar  icon or the DataSet->ETD Transfer menu option.

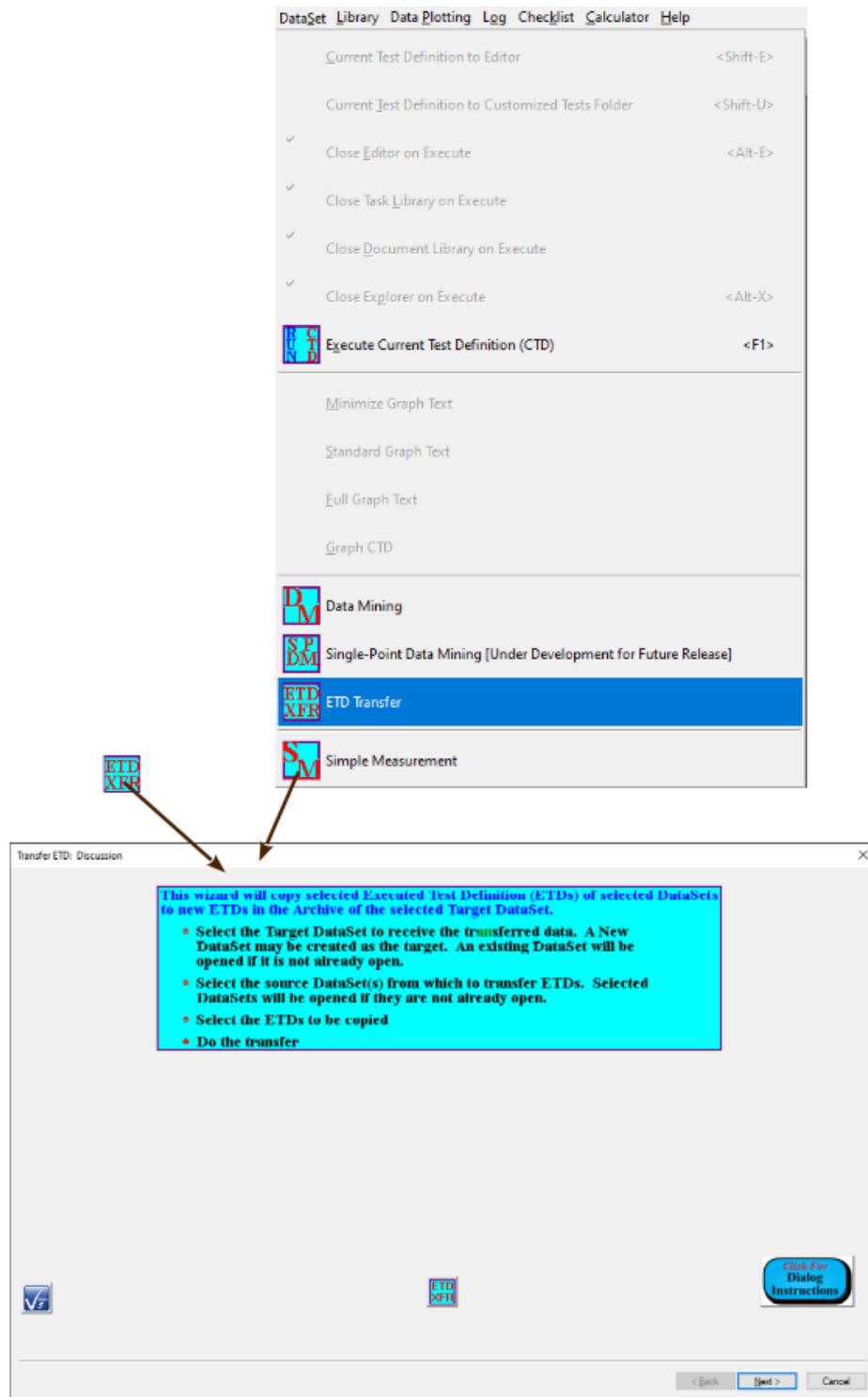
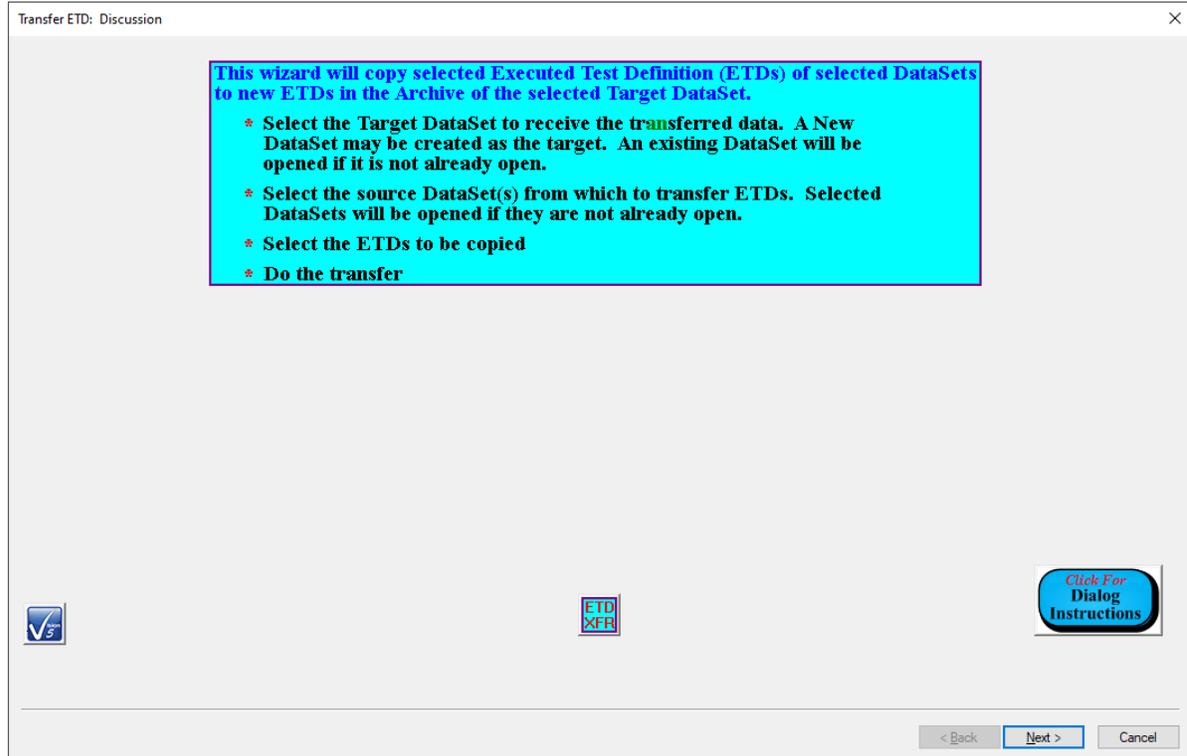


Figure 1 - Access the ETD Transfer Tool.

XVIII.2.a - First Tab: Discussion**Figure 2 - Discussion Tab**

The first dialog tab to appear is simply a discussion of the procedures and tabs that will follow.

Control	Type	Default	Discussion
<i>Click For Dialog Instructions</i>	Button	Unpressed	This button opens a Dialog Instructions project that provides complete details regarding the entire ETD Transfer process
<i><Back</i>	Button	Unpressed	This button is disabled since there is no previous dialog tab in the ETD Transfer wizard.
<i>Next ></i>	Button	Unpressed	This button advances the wizard to the next dialog tab.
<i>Cancel</i>	Button	Unpressed	This button closes the ETD Transfer wizard with no action taken by the ETD Transfer tool.

XVIII.2.b - Second Tab: Select Target DataSet

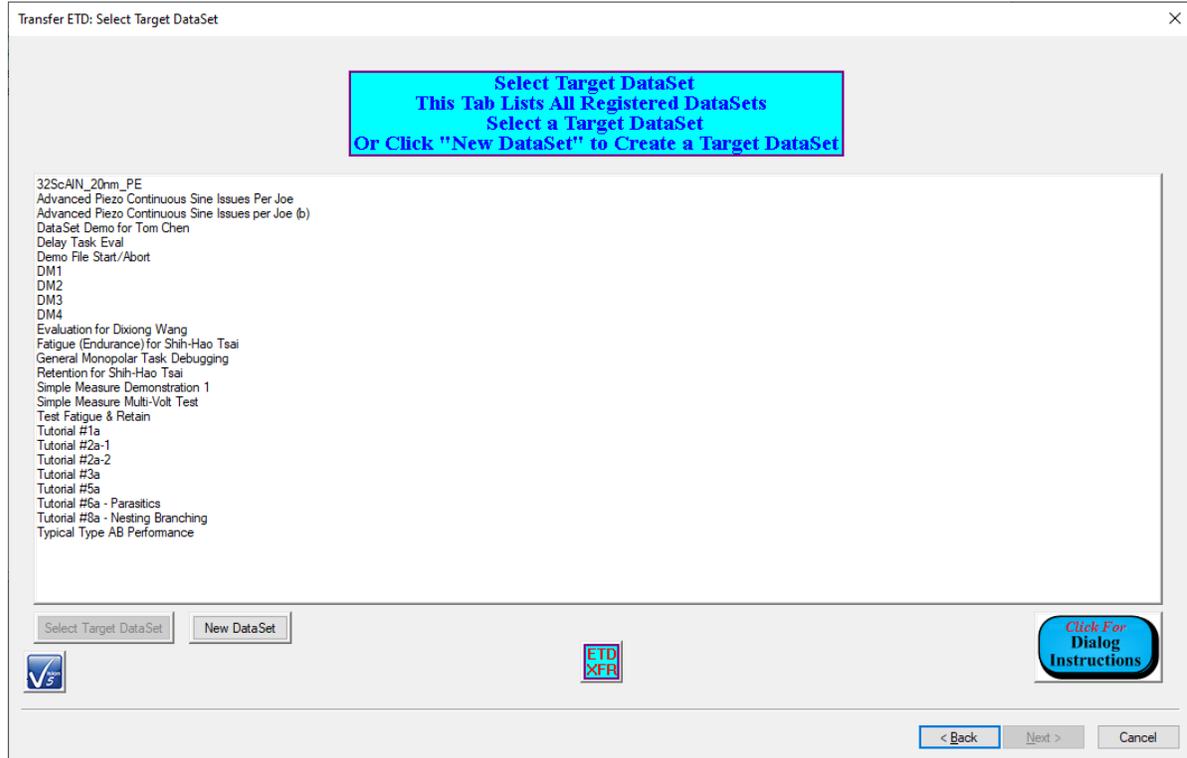


Figure 3 - Select Target DataSet ETD Transfer Tab.

This second tab is used to identify the single DataSet that is to receive the mined data. All registered DataSets are listed in the unlabeled *Registered DataSets* list. A single DataSet is selected (highlighted) in the list. This enables the *Select Target DataSet* button. The *Select Target DataSet* button is clicked. Two actions are then taken:

- The selected DataSet is opened in the DataSet Explorer if it was not previously opened.
- The *Next >* button is enabled.

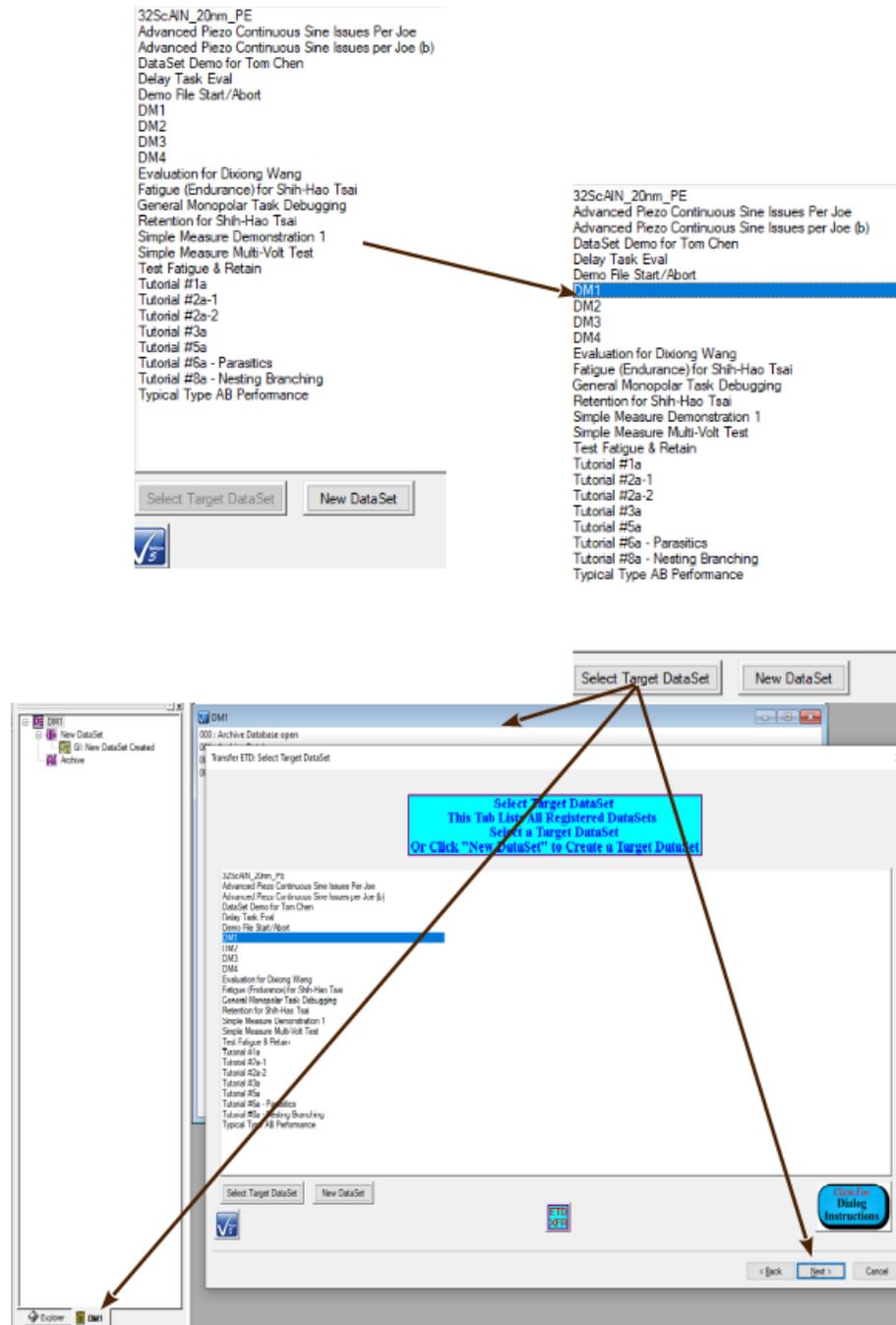


Figure 4 - Select Existing Target DataSet.

Before clicking *Next >* a new DataSet may be selected and registered as the target using the *Select Target DataSet* button. This repeats the two actions above. In addition, the first selected DataSet will be closed if it was previously opened. The process may be repeated until the correct target DataSet is selected.

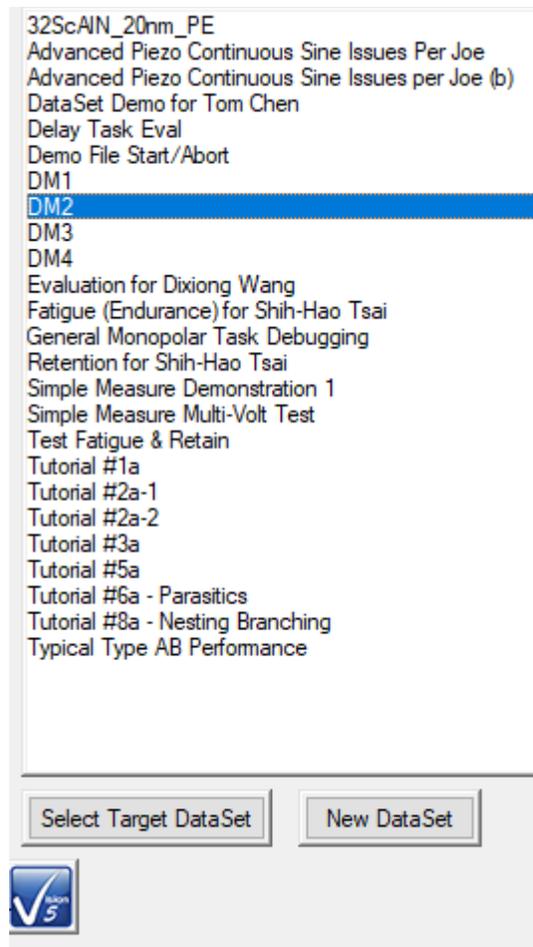


Figure 5 - Reselect an Existing Target DataSet.

A new DataSet may also be created from within the Target DataSet Selection tab and assigned as the target. Clicking the *New DataSet* button initiates the [New DataSet](#) process. When the New DataSet dialog is closed the DataSet is created and opened, the DataSet name is added to the unlabeled *Selected DataSet* control, the DataSet is added to the unlabeled *Registered DataSet* list control and the *Next* > button is enabled. The process automatically selects the new DataSet as the target DataSet. However, once the new DataSet is created, the selection may be changed to any registered DataSet .

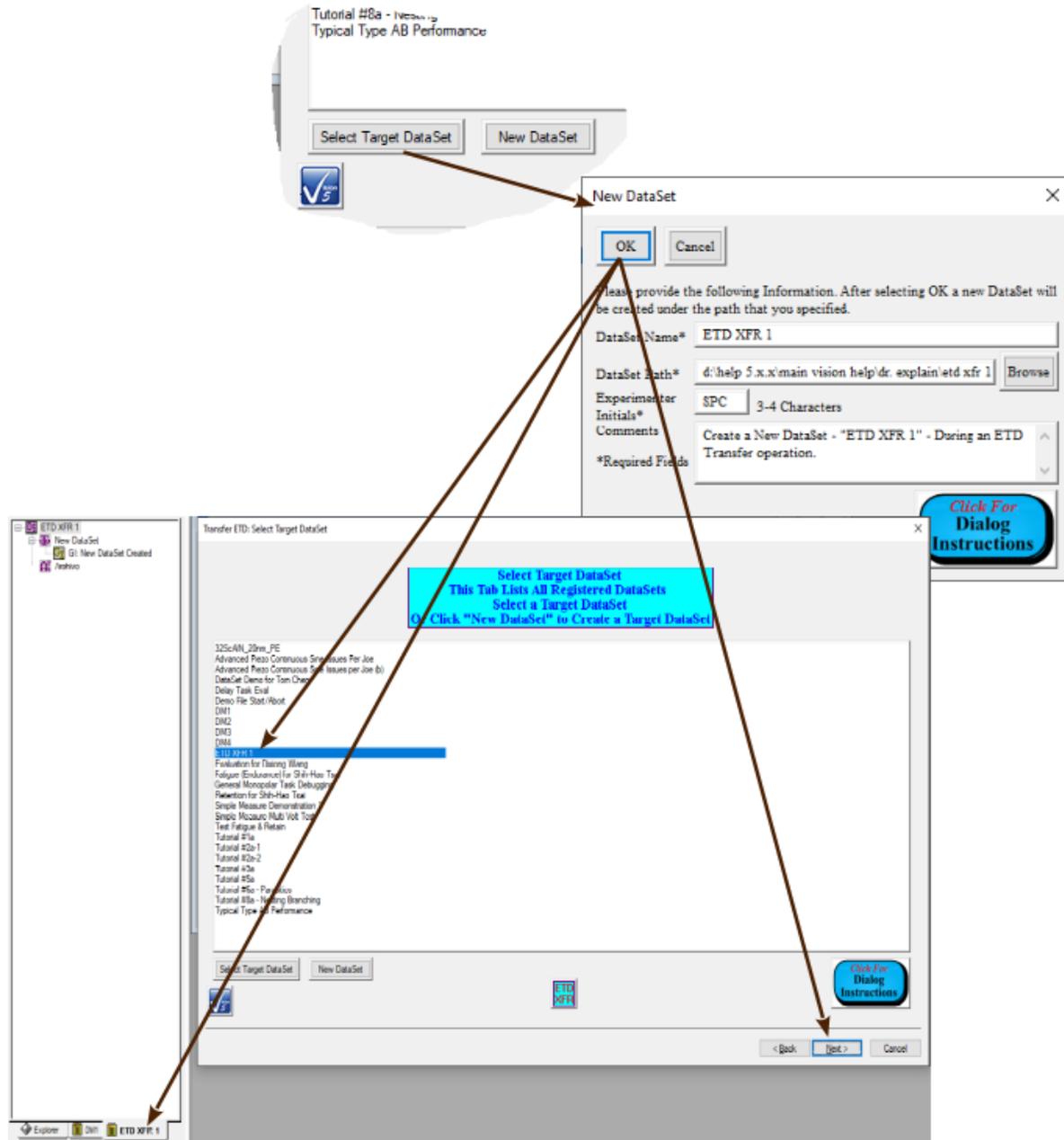


Figure 6 - Create a New Target DataSet.

Control	Type	Default	Discussion
<i>Registered DataSets (Unlabeled)</i>	List Box	No Selection	This control lists all DataSets currently registered to Vision. A single DataSet is selected (highlighted) in this list to identify it as the Target DataSet selection. This control initially has no DataSet selected. Selecting a DataSet enables <i>Select Target DataSet</i> . This list may be augmented by inserting a new DataSet, alphabetically, using the <i>New DataSet</i> button. After the list is augmented, the new DataSet will be selected (highlighted).
<i>Select Tar-</i>	Button	Unpressed	This control is disabled until a single DataSet is selected in <i>Registered Da-</i>

<i>get DataSet</i>			<p><i>taSets</i>. Clicking this button registers the DataSet selected in <i>Registered DataSets</i> as the target DataSet and:</p> <ul style="list-style-type: none"> • Opens the selected DataSet in the DataSet Explorer if it was not previously opened. • Closes any DataSet that was opened by the button, but was previously closed. • Enables the <i>Next ></i> button. <p>This button may remain disabled if the DataSet selected in <i>Registered DataSets</i> was created using the <i>New DataSet</i> button.</p>
<i>New DataSet</i>	Button	Unpressed	Initiate the creation of a new target DataSet as shown in Figure 6 and the discussion above the figure.
<i>Click For Dialog Instructions</i>	Button	Unpressed	This button opens a Dialog Instructions project that provides complete details regarding the entire ETD Transfer process
<i><Back</i>	Button	Unpressed	This button is will move the wizard backward to the previous (Discussion) tab.
<i>Next ></i>	Button	Unpressed	This button advances the wizard to the next dialog tab. This control is disabled until <i>Select Target DataSet</i> is clicked or a new DataSet is created.
<i>Cancel</i>	Button	Unpressed	This button closes the ETD Transfer wizard with no action taken by the ETD Transfer tool.

XVIII.2.c - Third Tab: Select Source DataSet(s)

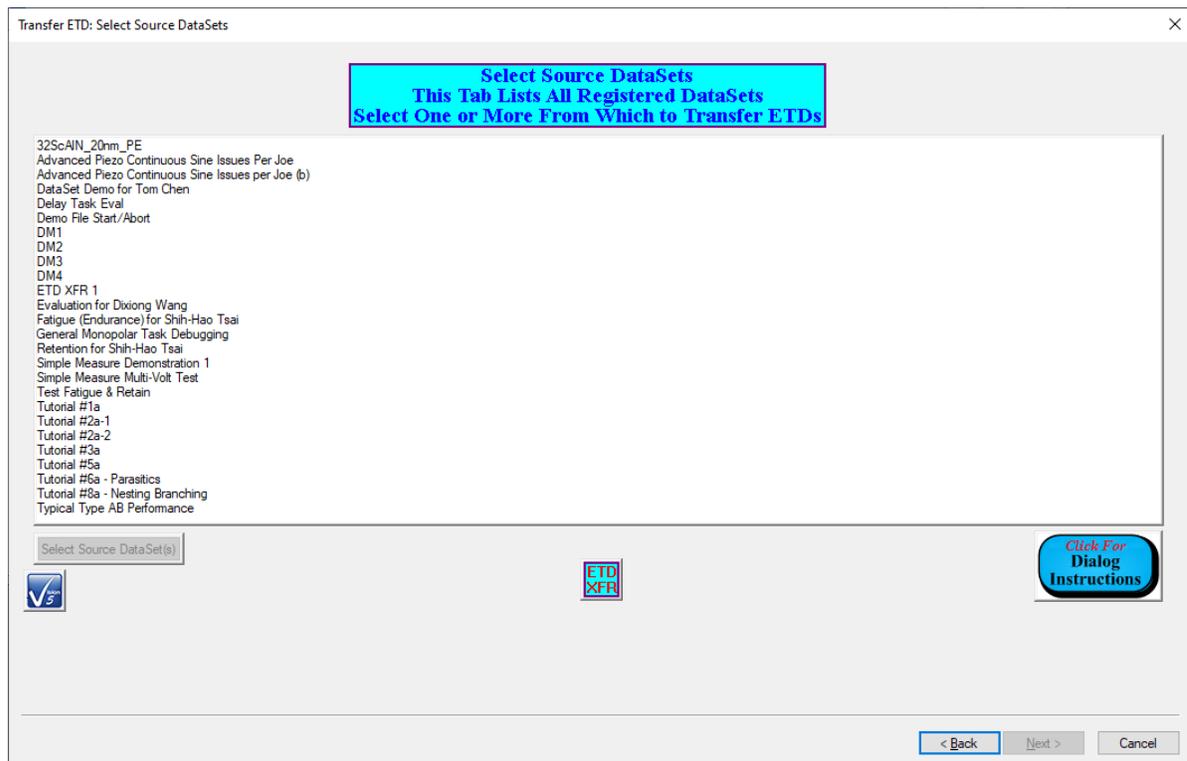


Figure 7 - Select Source DataSets Tab.

The third ETD Transfer wizard tab also lists all DataSets currently registered to Vision. Here, one or more DataSets are selected to provide the archived Tasks whose data are to be mined. Note that the user should carefully identify all DataSets of interest before executing the ETD Transfer wizard. Note that there is no restriction to the number or identity of the DataSets to be selected. This extends to the target DataSet that may also serve as a data source. Select the intended source DataSets and then click *Select Source DataSets*. The Next > button will be enabled.

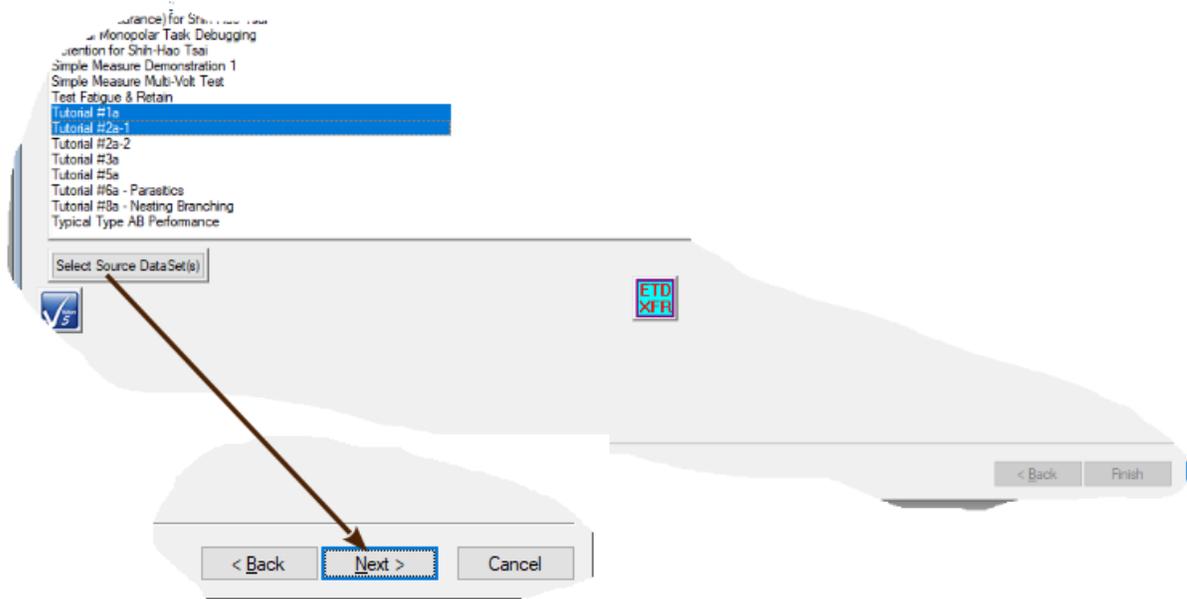


Figure 8 - Select Source DataSets.

The selection may be adjusted at any time by deselecting unintended DataSets, selecting the intended one and clicking *Select Source DataSets* again.

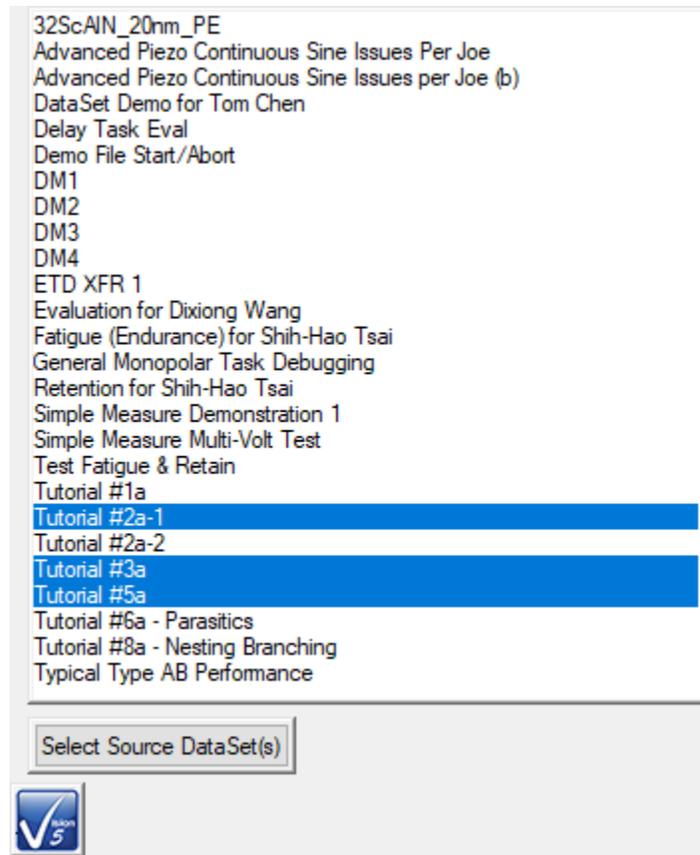


Figure 9 - Adjust Source DataSet Selection.

Control	Type	Default	Discussion
<i>Registered DataSets (Unlabeled)</i>	List Box	No Selection	This control lists all DataSets currently registered to Vision. One or more DataSet(s) is/are selected (highlighted) in this list to identify the data source DataSet selection. This control initially has no DataSet selected. Selecting any DataSet(s) enables <i>Select Source DataSet(s)</i> .
<i>Select Source DataSet(s)</i>	Button	Unpressed	This control is disabled until a single DataSet is selected in <i>Registered DataSets</i> . Clicking this button registers the DataSet(s) selected in <i>Registered DataSets</i> as the source DataSet(s) and Enables the <i>Next ></i> button.
<i>Click For Dialog Instructions</i>	Button	Unpressed	This button opens a Dialog Instructions project that provides complete details regarding the entire ETD Transfer process
<i><Back</i>	Button	Unpressed	This button is will move the wizard backward to the previous (Select Target DataSet) tab. Note that this action is not well-supported in Data Mining. The results may or may not be as expected.
<i>Next ></i>	Button	Unpressed	This button advances the wizard to the next dialog tab. This control is disabled until <i>Select Source DataSet(s)</i> .
<i>Cancel</i>	Button	Unpressed	This button closes the ETD Transfer wizard with no action taken by the ETD Transfer tool.

XVIII.2.d - Fourth Tab: Select ETDs to Transfer**Figure 10 - Select ETDs to Transfer Tab.**

When the *Next* > button is clicked on the Source DataSet Selection tab, the selected DataSets are opened and searched for all archived Executed Test Definitions (ETDs). The fourth ETD Transfer wizard tab lists the selected DataSets in a tree structure in a list box. Under each DataSet entry each ETD archived in the DataSet is listed by name. Individual ETDs can be selected for transfer by checking them under the DataSets. All ETDs in a DataSet can also be selected for transfer by checking the DataSet in the tree. With the collection of ETDs to be transferred selected, clicking *Select ETD(S)* will register the selected ETDs for transfer and enable the *Finish* button.

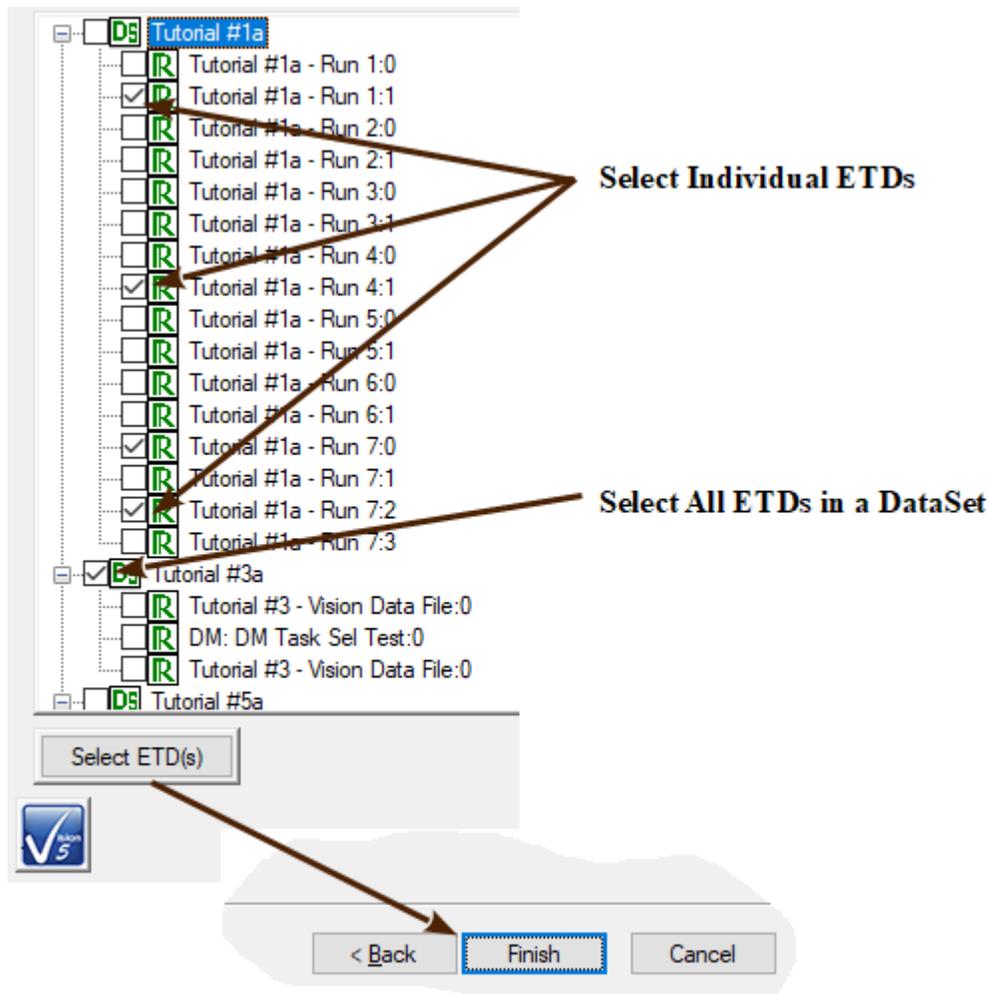


Figure 11 - Select ETDs to Transfer.

Control	Type	Default	Discussion
<i>ETDs (Unlabeled)</i>	List Box	No Selection	This control lists all selected source DataSets in a tree control. Expanding the DataSets entries shows all Executed Test Definitions (ETDs) archived in the DataSets. Individual ETDs can be selected for transfer by checking them in the tree. All ETDs under any DataSet can be selected by checking the DataSet.
<i>Select ETD(s)</i>	Button	Unpressed	This control is disabled until at least one ETD is selected for transfer. Click this button registers all ETDs selected in the tree for transfer. It enables the <i>Finish</i> button.
<i>Click For Dialog Instructions</i>	Button	Unpressed	This button opens a Dialog Instructions project that provides complete details regarding the entire ETD Transfer process
<i><Back</i>	Button	Unpressed	This button is will move the wizard backward to the previous (Select Source DataSet) tab. Note that this action is not well-supported in Data Mining. The results may or may not be as expected.
<i>Finish</i>	Button	Unpressed	This button closes the wizard and initiates the ETD Transfer. This control is disabled until <i>Select ETD(s)</i> is clicked.

Cancel	Button	Unpressed	This button closes the ETD Transfer wizard with no action taken by the ETD Transfer tool.
--------	--------	-----------	---

XVIII.3- ETD Transfer

When the ETD Transfer Wizard is closed with the Finish button, the transfer is initiated. Vision will show rapid activity until all ETDs are transferred. When finished, the Target DataSet will have each of the selected ETDs appended to its DataSet Archive.

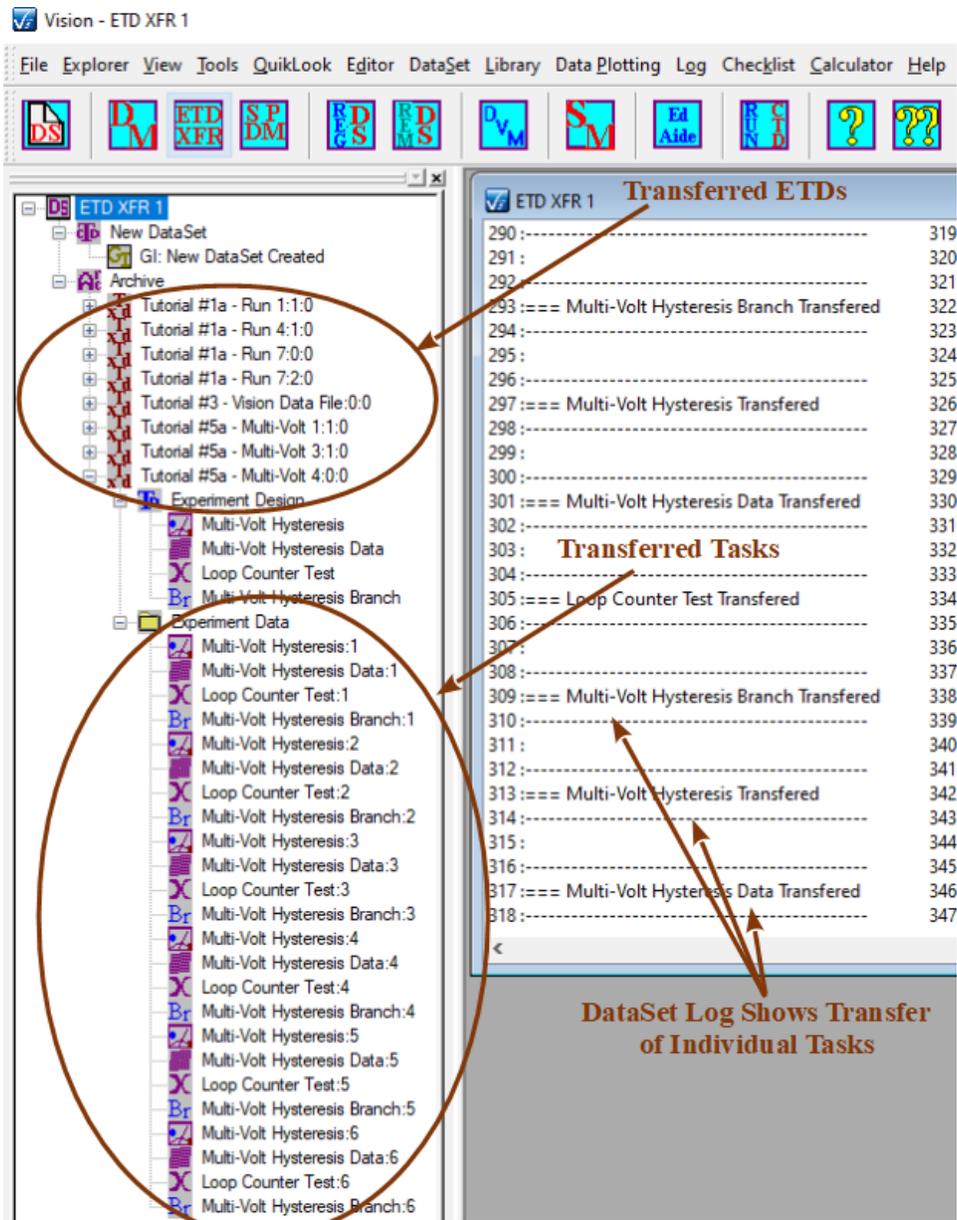


Figure 12 - Results of the ETD Transfer.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)



XIX - Simple Measurement



Simple Measure Tool

User guide
2020

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

[sa/2.5/](http://creativecommons.org/licenses/by-nc-sa/2.5/)



Discussion

The Simple Measure option is introduced to Vision in version 5.12.0. This option allows basic low-voltage Hysteresis measurements to be quickly configured, executed and stored, as a Task, to an Executed Test Definition (ETD) in a DataSet. The configuration and execution are independent of any other Tasks in Vision, so the process can be initiated immediately without accessing a Task in QuikLook or configuring a Test Definition in the Editor.

Any number of Hysteresis measurements may be made and stored to the DataSet. Configuration parameters may be changed and new measurements may be appended to existing data. Or data may be cleared between measurements. The user has a limited number of parameters to configure, including:

1. *Task Name*: (60 characters maximum). Since the Simple Measure data are stored to the DataSet a standard Task Name must be provided under which the data will be stored.
2. *Volts*: (± 500.0) The voltage to be applied to the sample during the Hysteresis measurement. This is limited to the capability of the tester's internal amplifier and depends on the model purchase. Limits of ± 10.0 Volts, ± 30.0 Volts, ± 100.0 Volts, ± 200.0 Volts or ± 500.0 Volts may apply.
3. *Period (ms)*: (0.0002 to 30,000.0 ms) The duration, in milliseconds, of the Hysteresis measurement. This is equivalent to $1000.0 / \text{Frequency (Hz)}$. The actual limits will depend on the tester model being used.
4. *Area (cm²)*: (Strictly greater than 0.0) This is the area (cm²) of the smallest sample electrode connected to the Precision tester DRIVE or RETURN port. (Note that, if the electrodes are not the same area, DRIVE is normally connected to the larger electrode. For example, if an array of capacitors on a wafer have a common bottom electrode, DRIVE should be connected to the bottom electrode. Theoretical discussion of the reasons for the are beyond the scope of this document.) The tester captures charge that is moving onto or off of the sample RETURN electrode as the result of the application of the DRIVE voltage. However, Vision reports the data in units of Polarization. Polarization is given as Charge (μC)/Area (cm²). *Area (cm²)* must be correctly entered to produce accurate data.
5. *Thickness (μm)*: (Strictly greater than 0.0) This is the third dimension in the sample geometry. It is the distance through the ferroelectric material, between sample electrodes. This value is recorded simply for complete documentation of the measurement.
6. *Preset*: As in a standard Hysteresis Task, with this option checked and unmeasured DRIVE profile voltage will be applied to the sample. This is to preset the sample into a polarization state opposite the state that will be switched by the application of *Volts*. This ensures that the polarization is switching throughout the bipolar measurement. With this option unchecked, the polarisation behavior of the first half of the measurement will de-

pend on the state of the sample before the Simple Measure process is initiated. When this control is checked, *Preset Delay (ms)* will be enabled.

7. *Preset Delay (ms)*: when *Preset* is checked, this control is used to specify the delay between the application of the unmeasured Preset DRIVE voltage waveform and the measurement waveform. Sufficient delay should be applied to allow any charge movement in the sample that results from the preset waveform to settle so that the measurement begins in a quiescent state.

To maintain simplicity, a large number of options available to the standard Hysteresis measurement are predetermined for the Simple Measure process and are not under user control. Some of the more important options that are fixed include:

1. DRIVE profile is standard bipolar triangular.
2. High-voltage measurements are not available.
3. Auto Amp and User Last Amp Value are enabled.
4. Internal reference elements are not available.

The process is initiated by clicking the  button on the Vision toolbar or by selecting the DataSet->Simple Measurement Vision menu option.

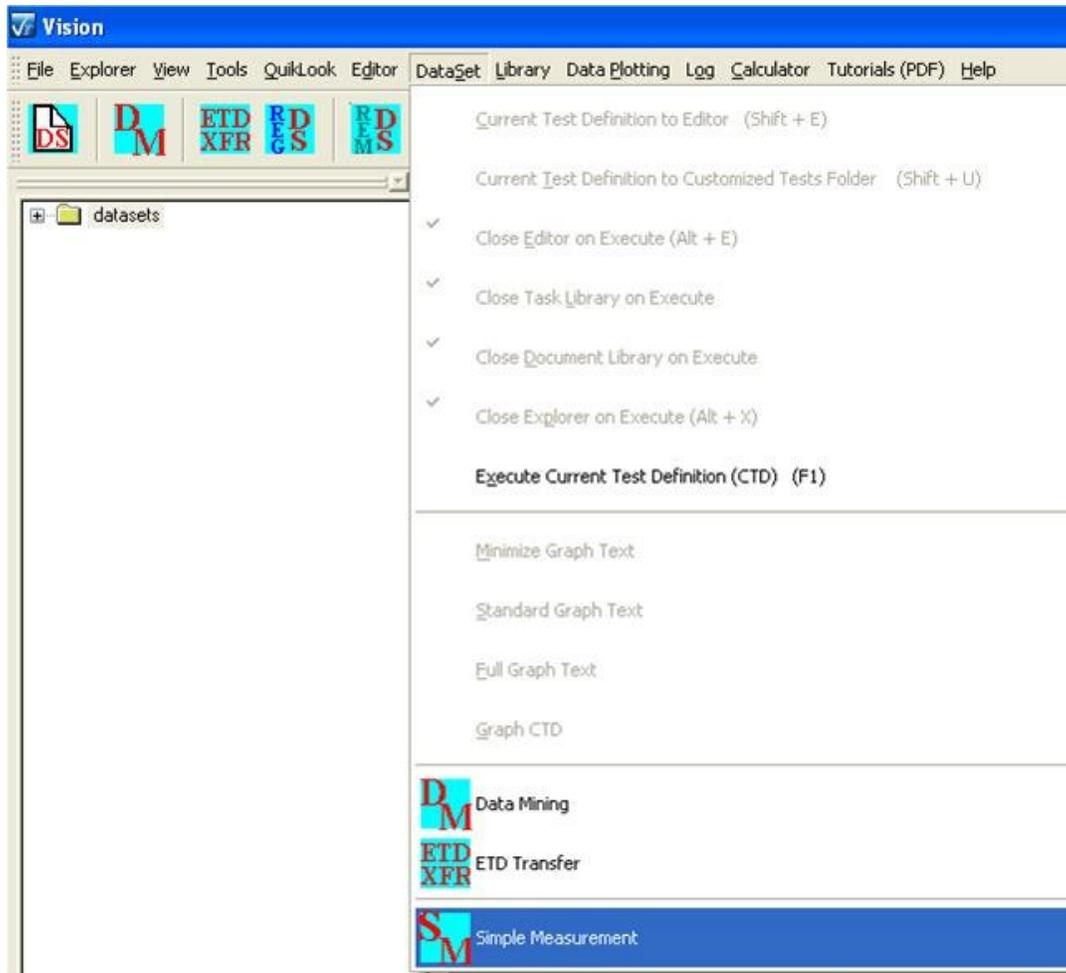


Figure 1 - Access the Simple Measure Process.

A new target DataSet may be created during the DataSet selection process.

For a complete discussion of the Simple Measure process, see the [Simple Measure Operation](#) page.

Operation

Initiate the Simple Measure Process

To initiate the Simple Measure Process, click the  button on the Vision toolbar or select the DataSet->Simple Measurement Vision menu option.

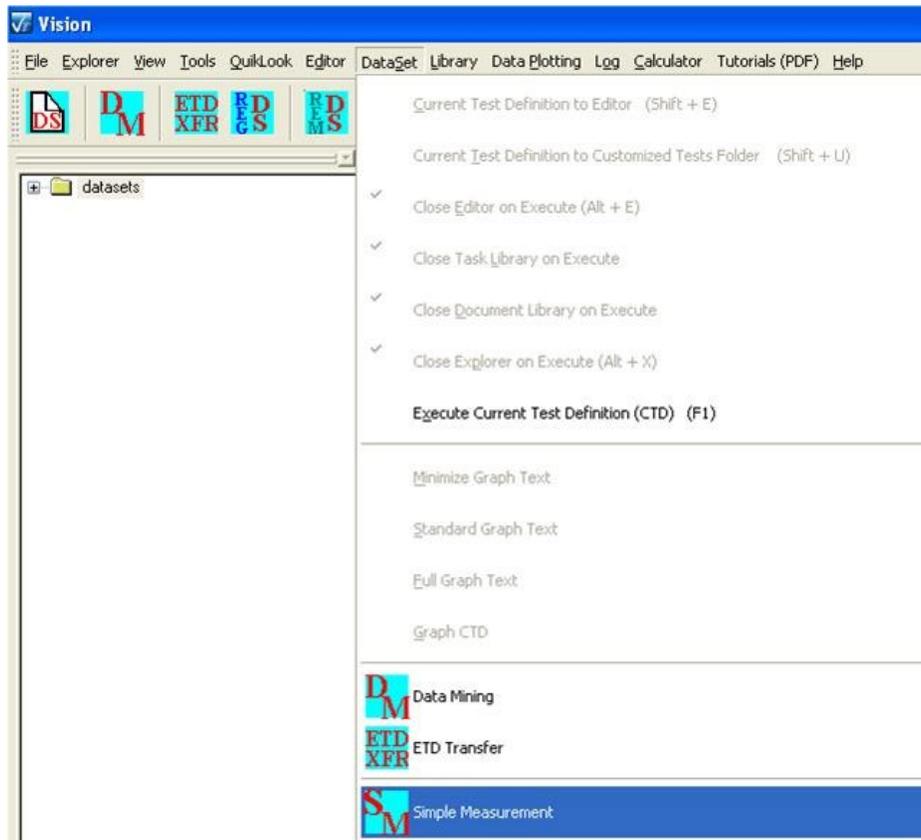


Figure 1 - Access the Simple Measure process.

Select a Target DataSet

The first step is to select the target DataSet. A DataSet selection dialog appears, similar to the dialog in Data Mining. Because this process uses a "Pseudo" Task called Simple Measure, internal complexities require that an existing DataSet, with a Current Test Definition (CTD) that is not empty, be selected as the target. As a result, when a new DataSet is created, either from within the DataSet Selection dialog or before the Simple Measure process, a General Information Task is now configured and inserted into the DataSet as the CTD.

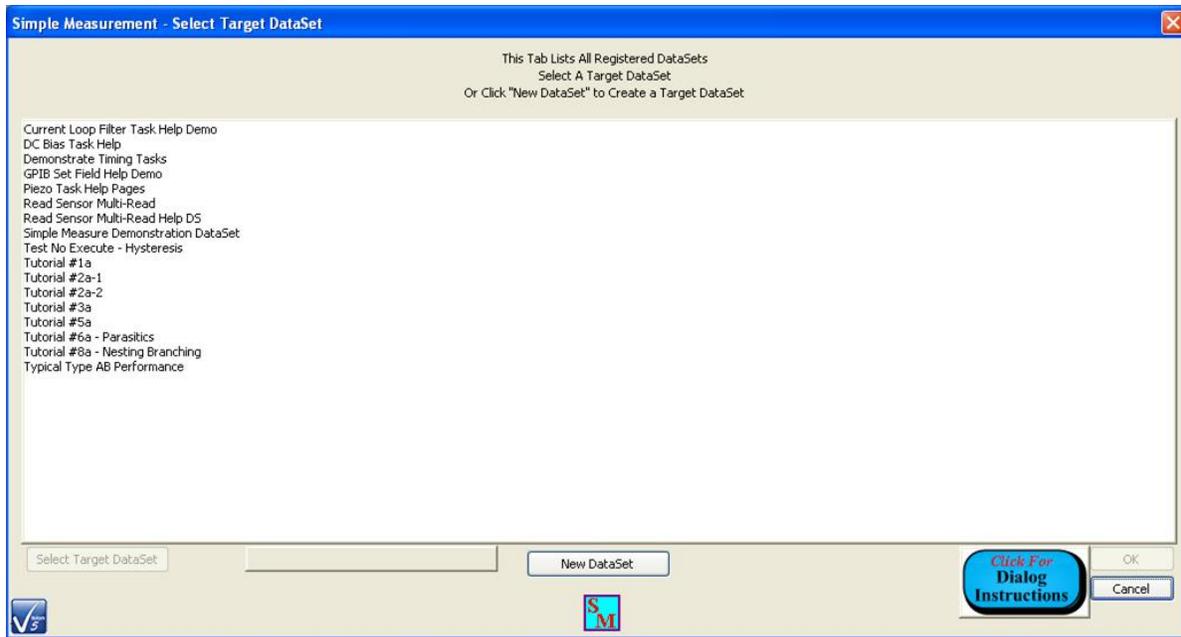


Figure 2 - DataSet Selection Dialog - No DataSet Selected.

The dialog will appear as in **Figure 2** . All registered DataSets are listed. *Select Target DataSet* and *OK* are disabled. *Select Target DataSet* is enabled once a DataSet is selected. A new DataSet may be created from this dialog. The DataSet will be selected once it is created and *Set Target DataSet* will be enabled.

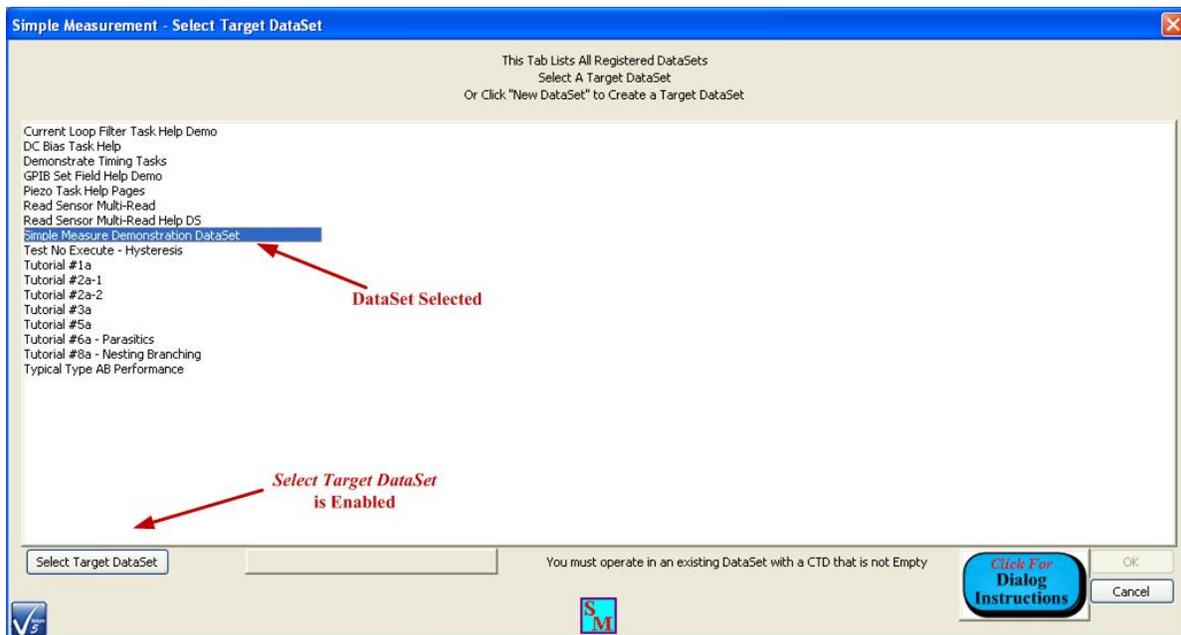


Figure 3 - DataSet Selection Dialog - A DataSet is Selected.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

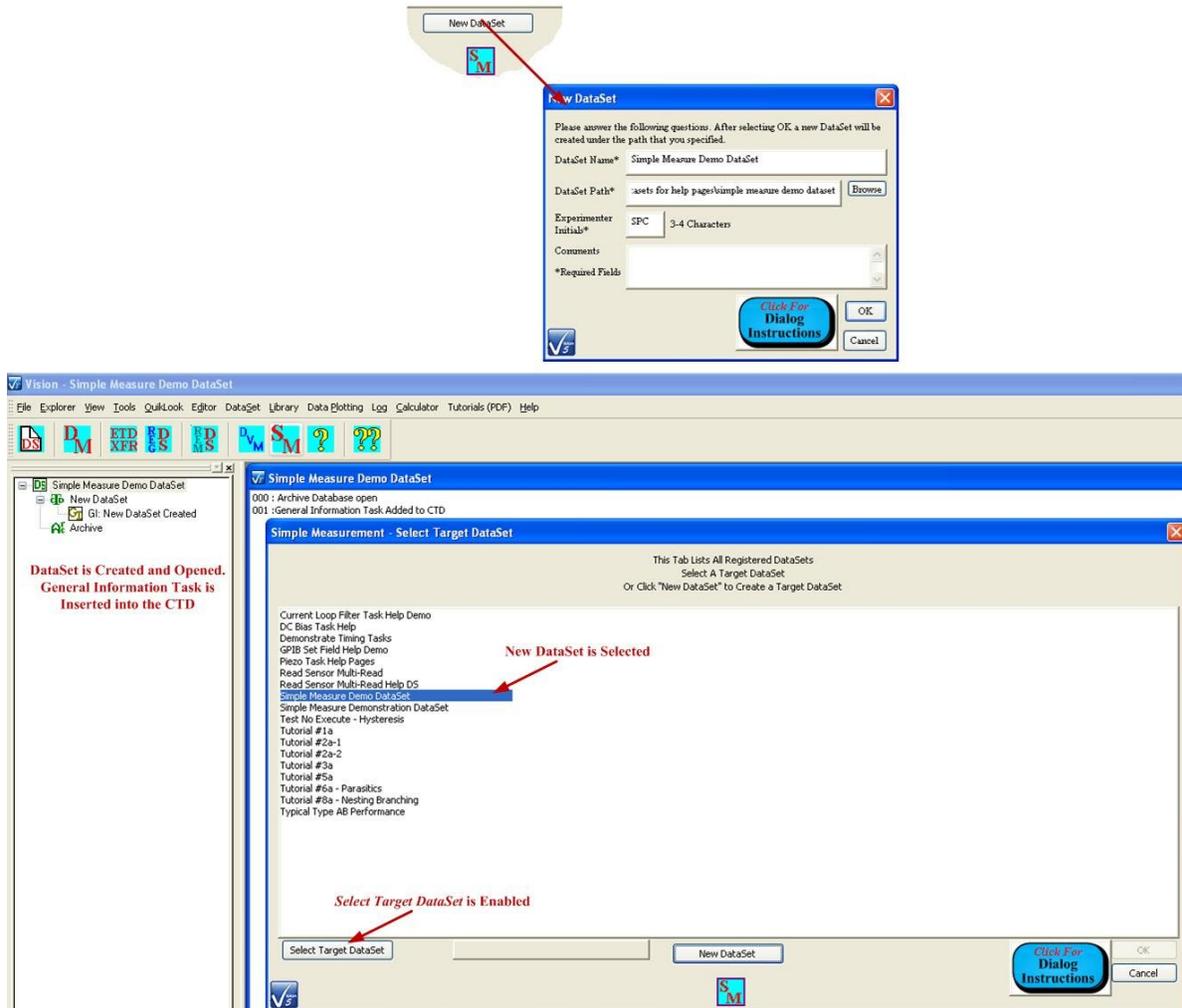


Figure 4 - DataSet Selection Dialog - New DataSet Process.

Clicking *Select Target DataSet* will open the selected DataSet if it is closed. It also enables the *OK* button.

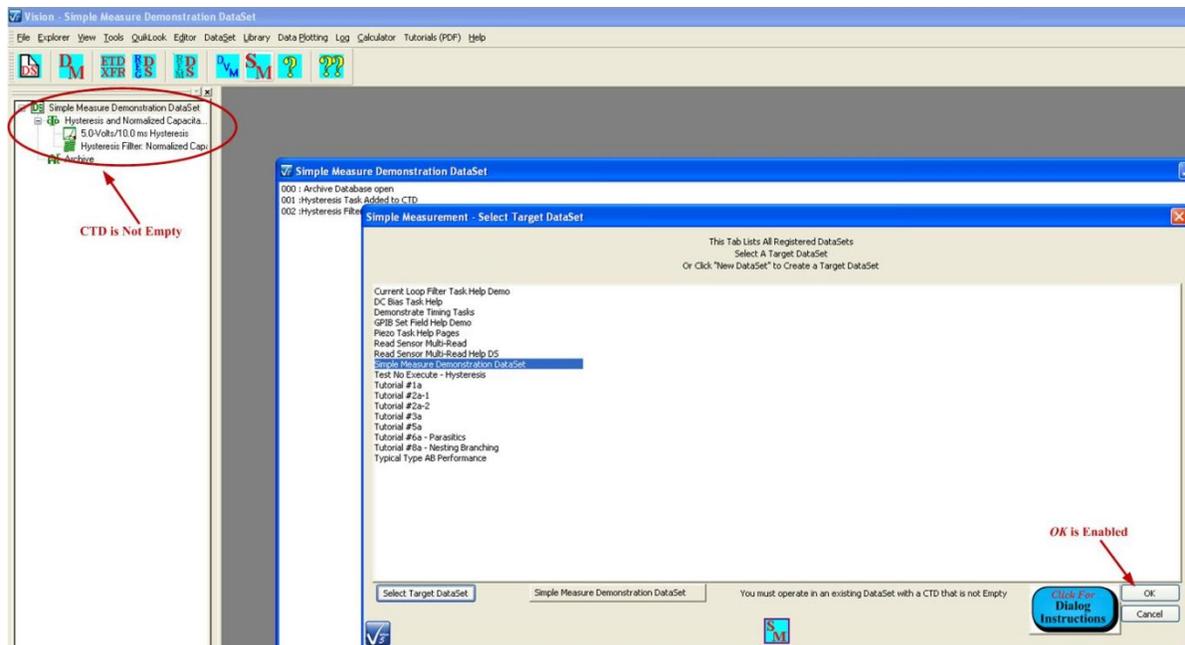


Figure 5 - DataSet Selection Dialog - *Select Target DataSet* is Clicked.

Configure the Measurement

If *Cancel* is clicked in the DataSet Selection Dialog, the Simple Measure process is terminated, but the target DataSet remains open. Clicking *OK* closes the DataSet selection dialog and opens the Simple Measure Control dialog.



Figure 6 - Simple Measure Control Dialog - Measurement is not

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

Configured.

Initially, only *Configure*, *Click For Dialog Instructions* and *Done* are enabled in the simple dialog. *Click for Dialog Instructions* opens this help project. *Done* terminates the project. *Configure* opens the basic Configuration dialog.

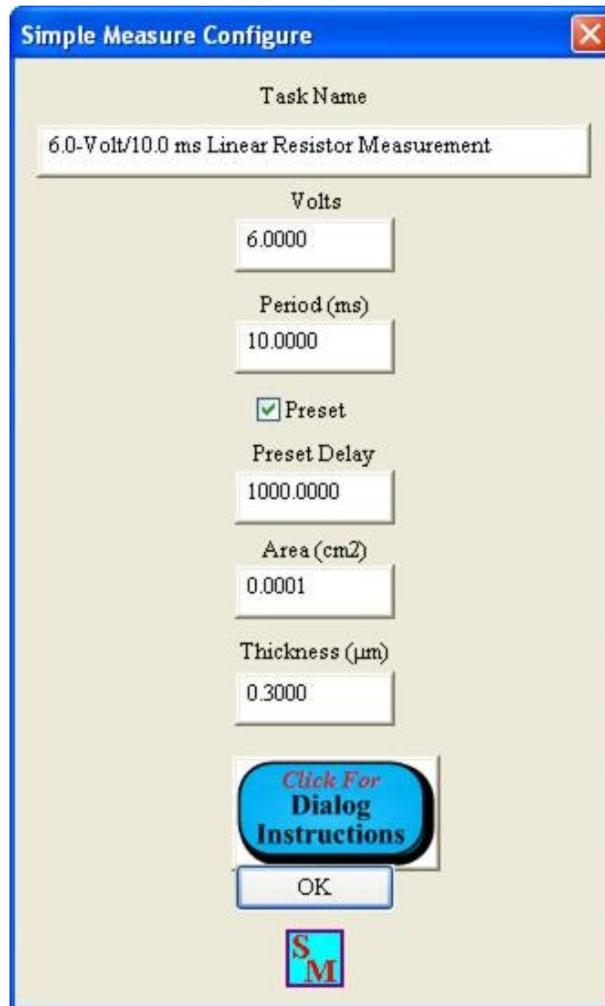


Figure 7 - Simple Measure Control Dialog - Measurement is not Configured.

The dialog is used to set:

1. *Task Name*: (60 characters maximum). Since the Simple Measure data are stored to the DataSet a standard Task Name must be provided under which the data will be stored.
2. *Volts*: (± 500.0) The voltage to be applied to the sample during the Hysteresis measurement. This is limited to the capability of the tester's internal amplifier and depends on the

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

model purchase. Limits of ± 10.0 Volts, ± 30.0 Volts, ± 100.0 Volts, ± 200.0 Volts or ± 500.0 Volts may apply.

3. *Period (ms)*: (0.0002 to 30,000.0 ms) The duration, in milliseconds, of the Hysteresis measurement. This is equivalent to $1000.0 / \text{Frequency (Hz)}$. The actual limits will depend on the tester model being used.
4. *Area (cm²)*: (Strictly greater than 0.0) This is the area (cm²) of the smallest sample electrode connected to the Precision tester DRIVE or RETURN port. (Note that, if the electrodes are not the same area, DRIVE is normally connected to the larger electrode. For example, if an array of capacitors on a wafer have a common bottom electrode, DRIVE should be connected to the bottom electrode. Theoretical discussion of the reasons for the are beyond the scope of this document.) The tester captures charge that is moving onto or off of the sample RETURN electrode as the result of the application of the DRIVE voltage. However, Vision reports the data in units of Polarization. Polarization is given as Charge (μC)/Area (cm²). *Area (cm²)* must be correctly entered to produce accurate data.
5. *Thickness (μm)*: (Strictly greater than 0.0) This is the third dimension in the sample geometry. It is the distance through the ferroelectric material, between sample electrodes. This value is recorded simply for complete documentation of the measurement.
6. *Preset*: As in a standard Hysteresis Task, with this option checked and unmeasured DRIVE profile voltage will be applied to the sample. This is to preset the sample into a polarization state opposite the state that will be switched by the application of *Volts* . This ensures that the polarization is switching throughout the bipolar measurement. With this option unchecked, the polarization behavior of the first half of the measurement will depend on the state of the sample before the Simple Measure process is initiated. When this control is checked, *Preset Delay (ms)* will be enabled.
7. *Preset Delay (ms)*: When *Preset* is checked, this control is used to specify the delay between the application of the unmeasured Preset DRIVE voltage waveform and the measurement waveform. Sufficient delay should be applied to allow any charge movement in the sample that results from the preset waveform to settle so that the measurement begins in a quiescent state.

Note that *Task Name* must not be empty or the dialog will not exit.

Once the Simple Measure is configured and the Configuration Dialog is closed, the Main Control Dialog will have *Measure* enabled.

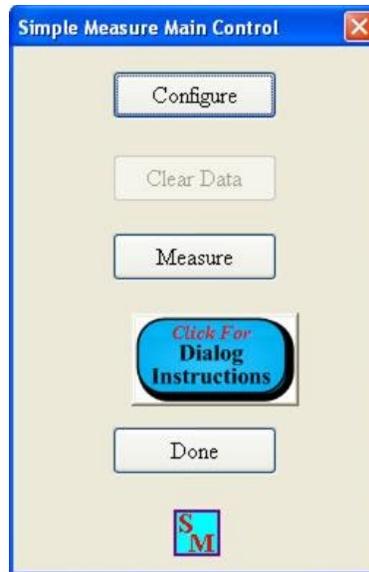


Figure 8 - Simple Measure Control Dialog - Measurement is Configured and Measure is Enabled.

Measurement

Clicking Measure opens the Measurement Dialog.

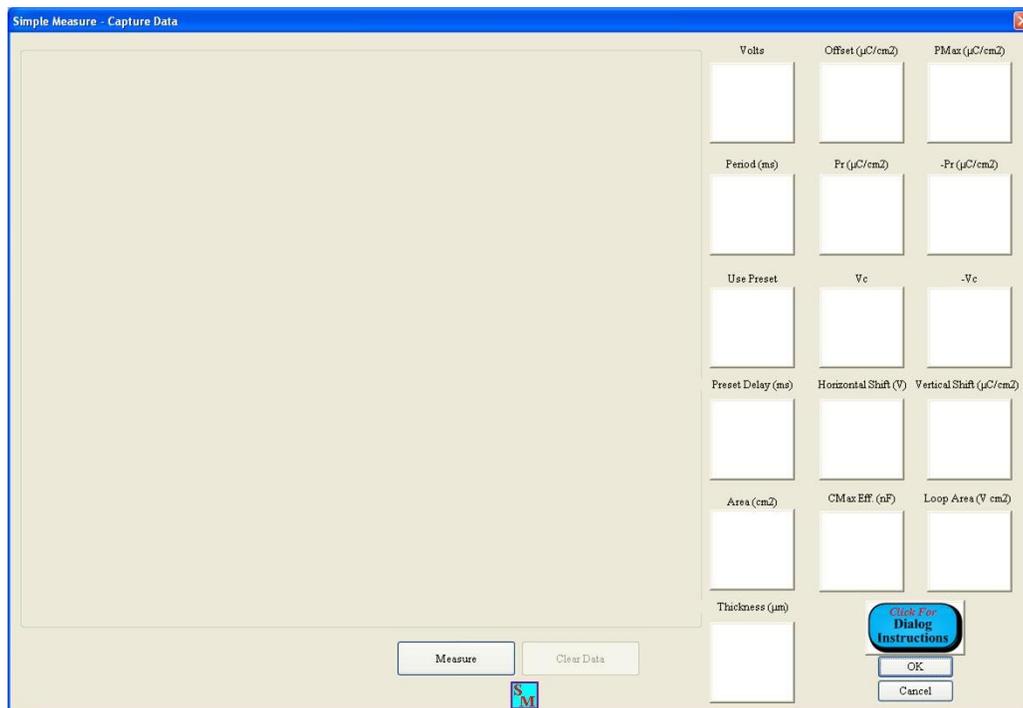


Figure 9 - Measurement Dialog - No Data Have Been Taken.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

The dialog consists of a central plotting area, a series of list boxes that show configuration parameters and extracted measured values for each of the plotted measurements, a *Measure* button that will initiate a new measurement and a *Clear Data* button that deletes all measured data. In **Figure 9**, no data have yet been collected. There is no plot, the list boxes are empty and *Clear Data* is disabled. Clicking *Measure* causes the the Hysteresis measurement to begin. Once it has completed, the data are plotted, the various list boxes have an appended entry and *Clear Data* is enabled.

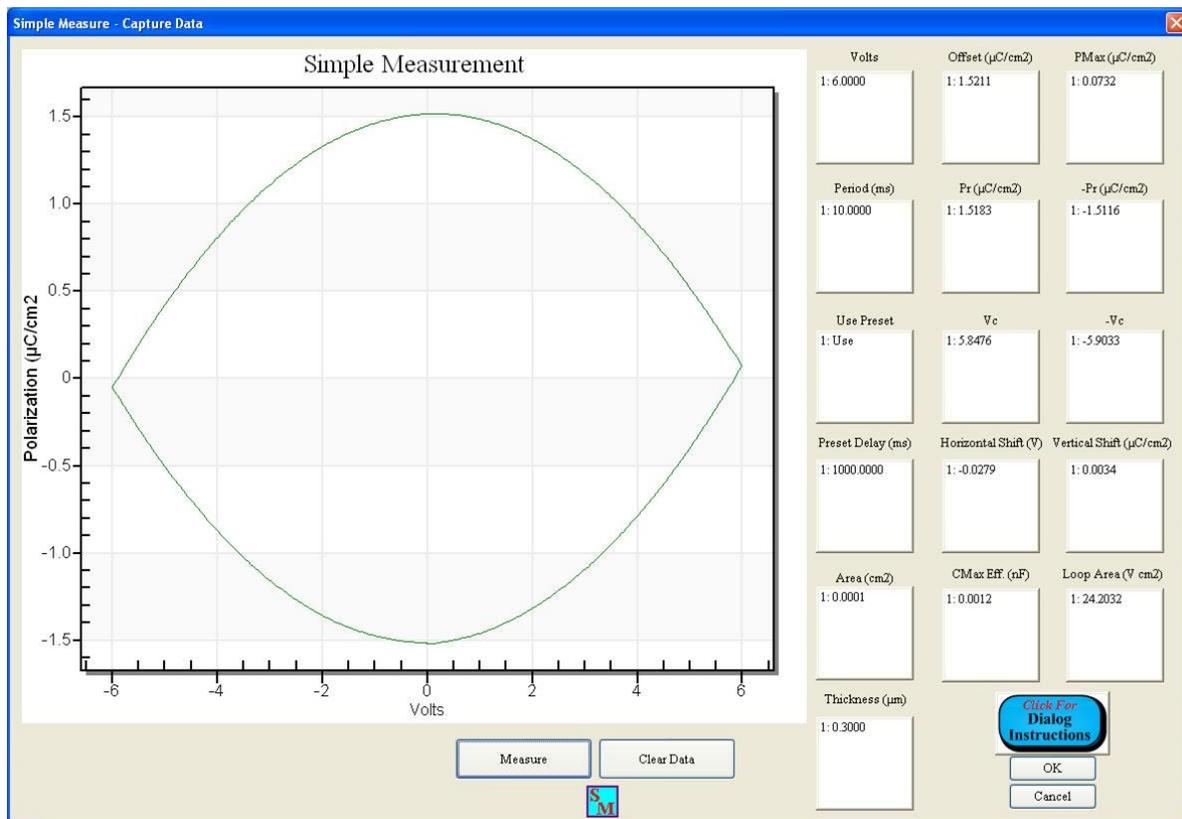


Figure 10 - Measurement Dialog - Single Data Plot.

The measurement may be repeated any number of times.

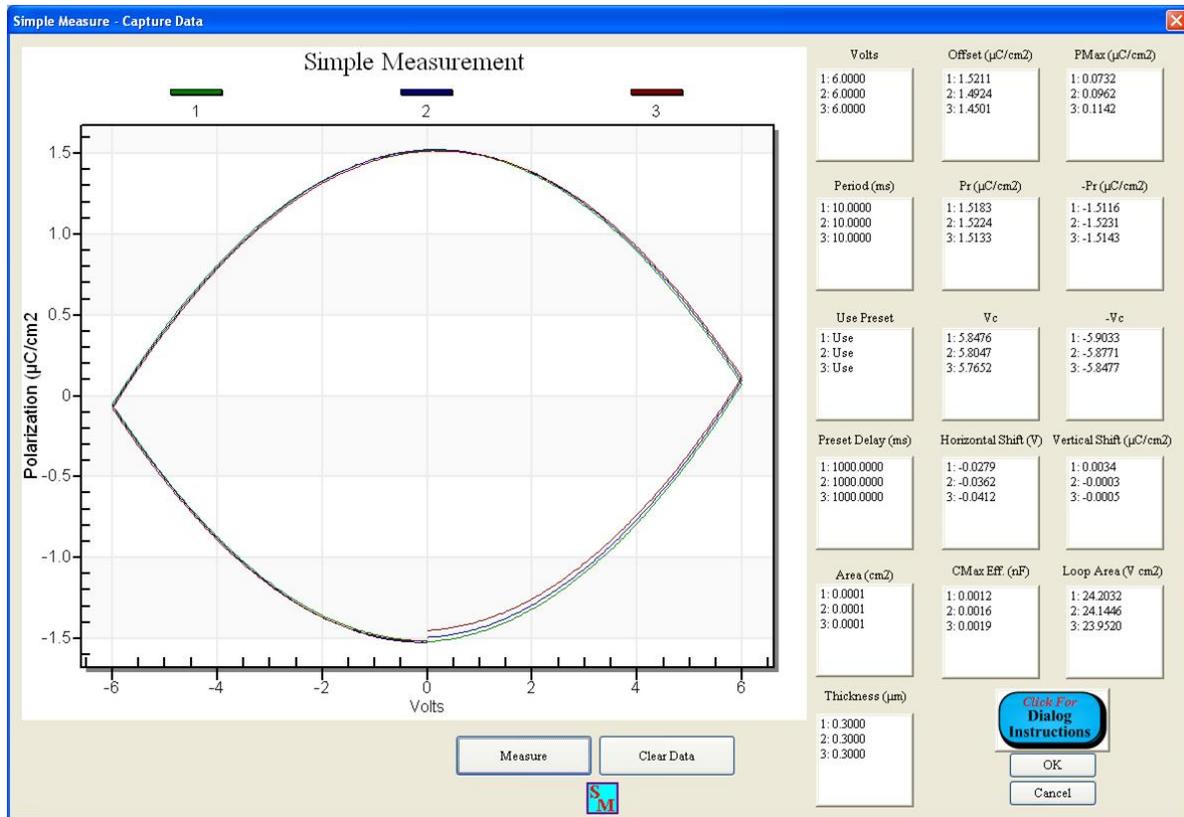


Figure 11 - Measurement Dialog - Multiple Data Plot.

Measured data may be cleared and retaken. Note that Clear Data will not remove the displayed data or clear the list boxes. However, the new measurement will overwrite the displayed data and parameters in the lists.

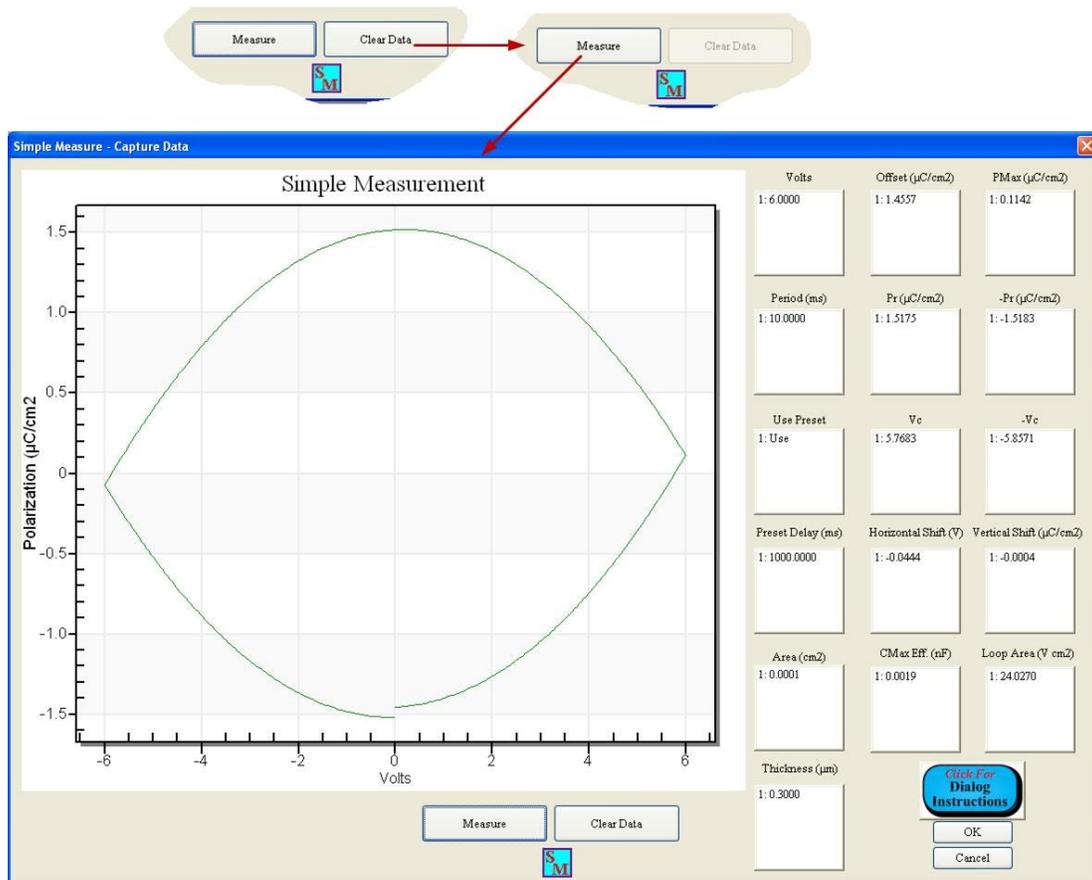


Figure 12 - Measurement Dialog - Cleared and Remeasured Data.

Cancel will close the dialog and return the the Main Control Dialog with no further action. Any captured data and parameter vectors are permanently lost. However, if the dialog is closed with *OK*, the measured data an parameter lists are retained when the control is returned to the Main Control Dialog. In this case, before returning to the Main Control Dialog, the user is prompted to adjust the CTD/ETD name with the standard text control. It is important to enter a unique and meaningful name.

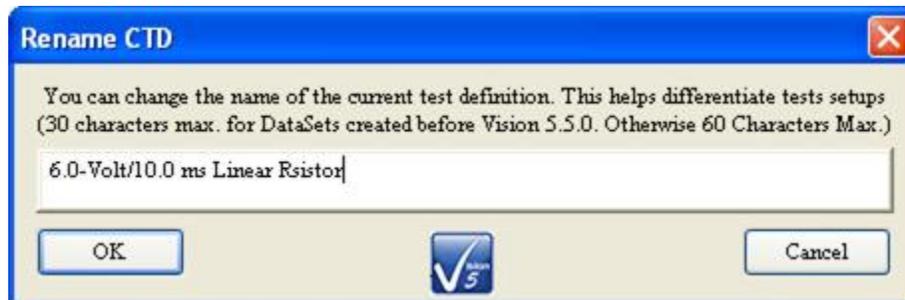


Figure 13 - Provide a Unique and Meaningful CTD Name.

When the CTD/ETD Name Dialog is closed, the DataSet will be updated with the measured data and data lists written to the DataSet Archive. *Clear Data* is enabled in the Main Dialog Control. Data can be removed from the Simple Measure project using *Clear Data*. The data are permanently saved to the DataSet Archive. If *Clear Data* is clicked, *Clear Data* is disabled.

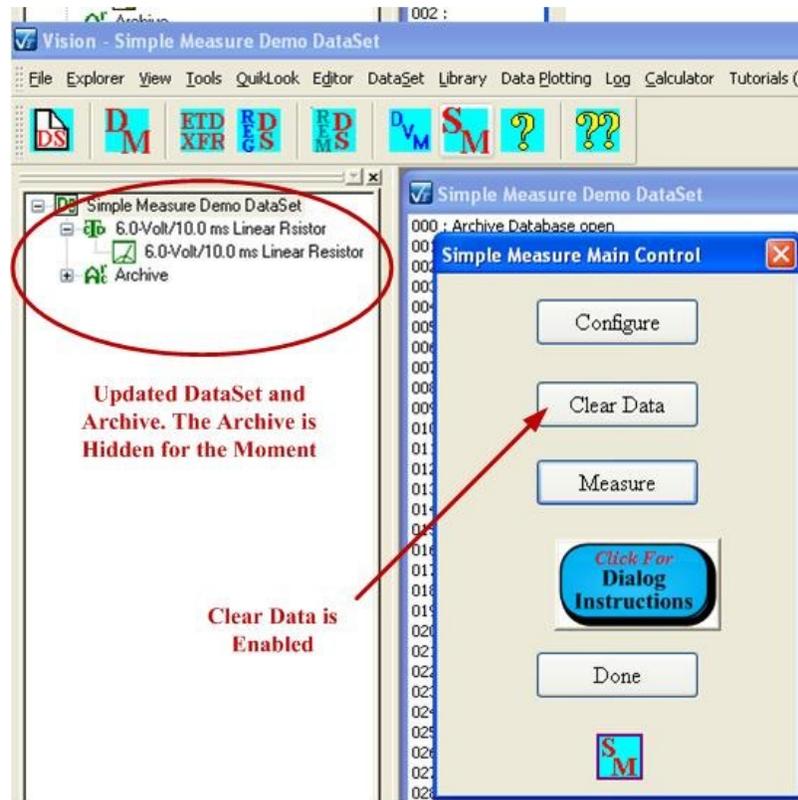


Figure 14 - Main Control with Data in Memory. Updated DataSet.

If *Clear Data* is not clicked, the measured data and parameter lists remain in memory. A new measurement may be configured and appended to existing data.

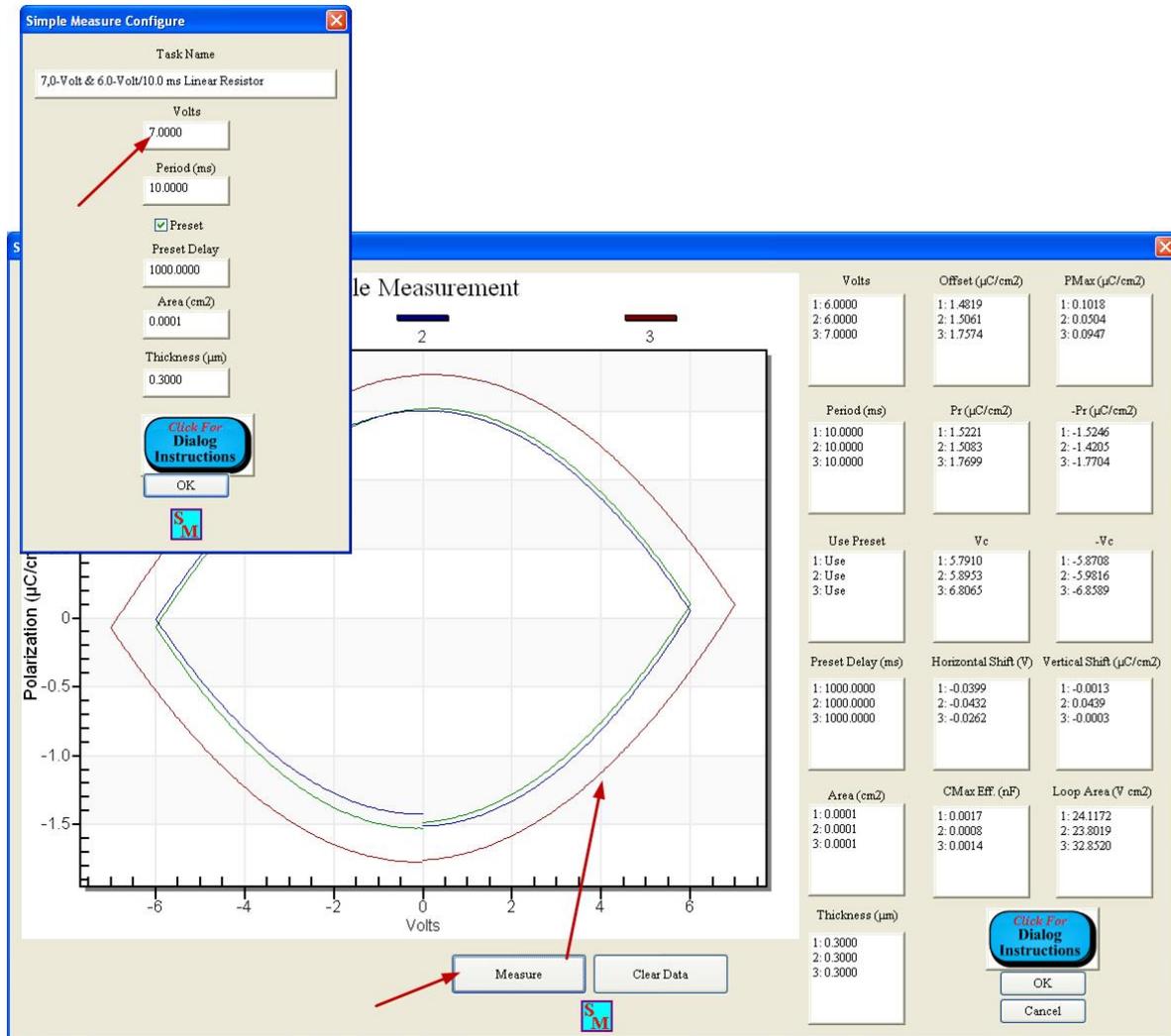


Figure 15 - Measure Under a New Configuration.

When the Measurement Dialog is closed, the data will again be saved to the DataSet Archive with a new CTD/ETD Name, if desired.

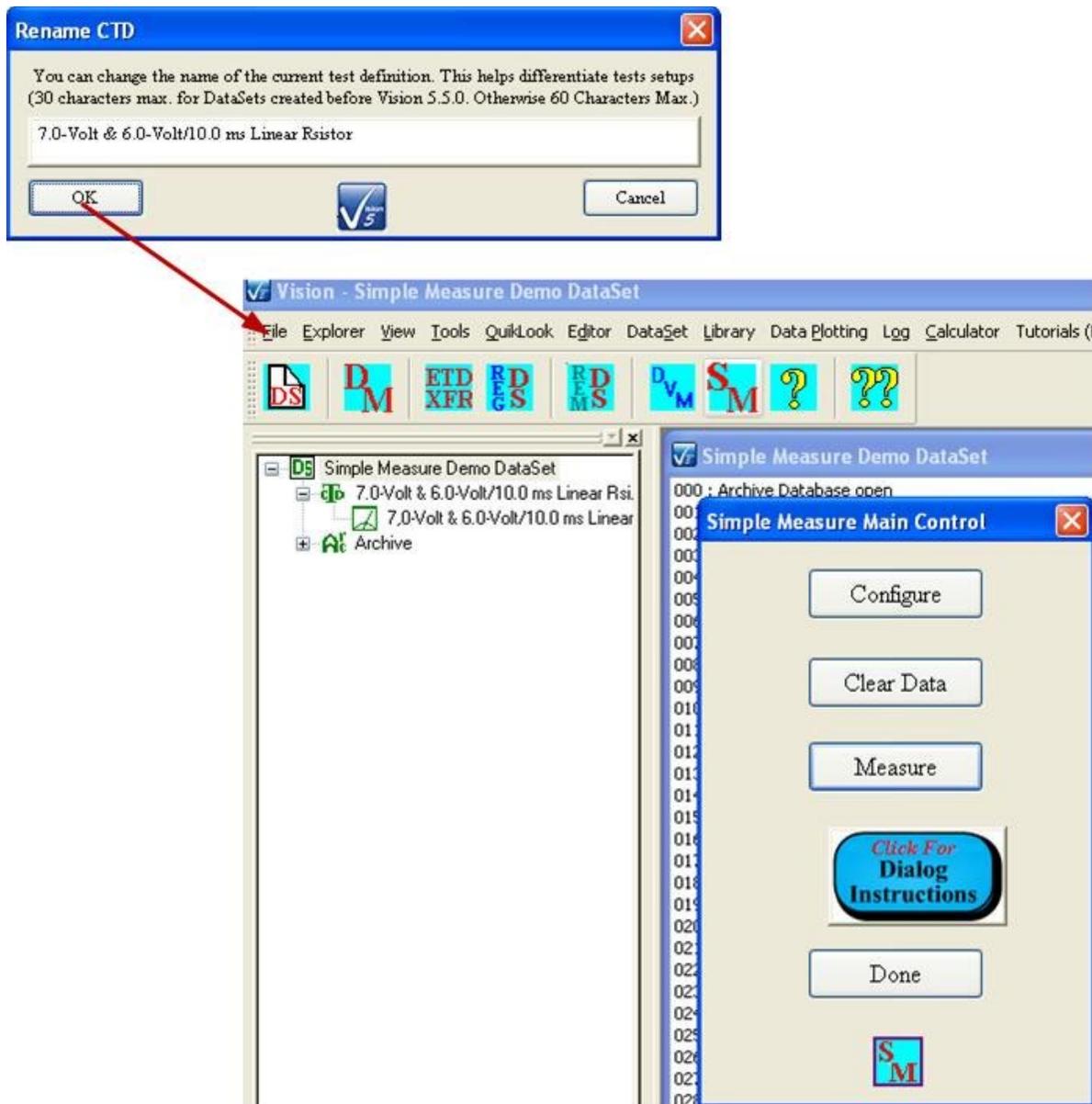


Figure 16 - Second Archive Update.

Recover Archived Data

When the dialog is closed, the DataSet is also closed. To review data, reopen the DataSet, open the DataSet Archive, open the Desired ETD and double-click the Simple Measure "Task", just as you would any Task in a DataSet. Note that the original General Information Task (or any previous Test Definition) has been restored to the CTD under the original CTD name.

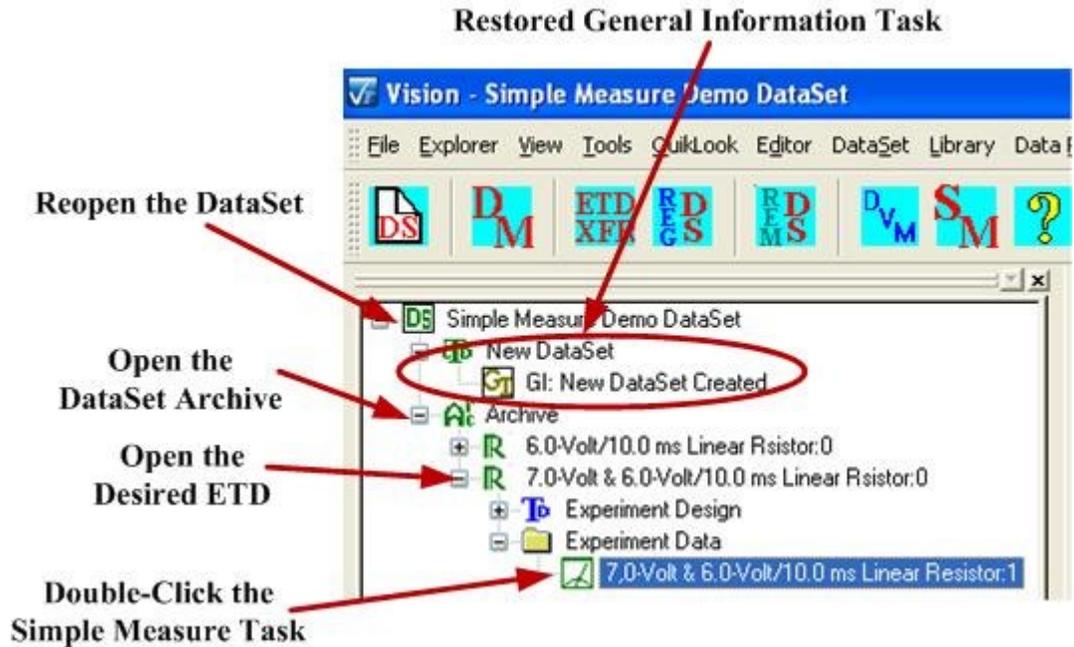


Figure 17 - Data Recovery Process.

The archived data will reappear in the Measurement Dialog. *Clear Data* and *Measure* are disabled.

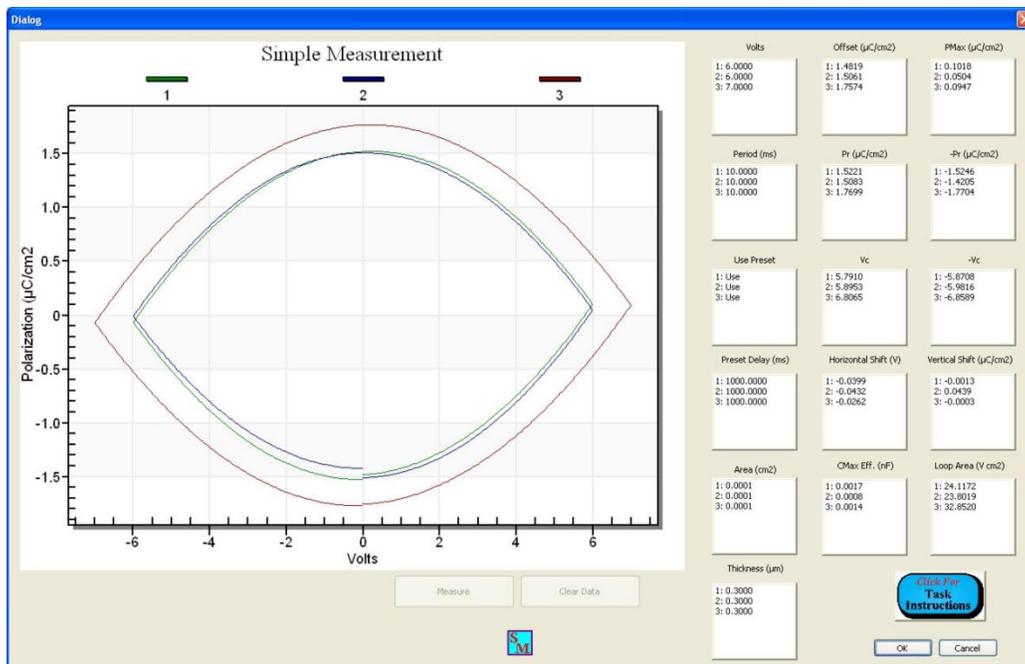


Figure 18 - Recovered Archived Data.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

Export Data

Since the intention of this process is to provide a direct measurement tool that is kept as simple as possible, the discussion above provides the complete extent of the tool. There are no further features available. For example, the Exporting tool that is common to all Tasks is absent. However, since the data are plotted, the plotting library does provide a number of automatic actions, including an export tool. Although for most Measurement Tasks and Filters the use of this tool is discouraged in favor of the Vision export option, in this case the plotted data can be exported even without such a tool.

To export data, right-click in the plot surface. A popup menu will appear. Investigate the various options available from the menu. Then select *Export Dialog...* Several of the options allow you export directly to image files. You may also export - point-by-point - the data vectors that form the image. These may be exported to a text file or to the clipboard.

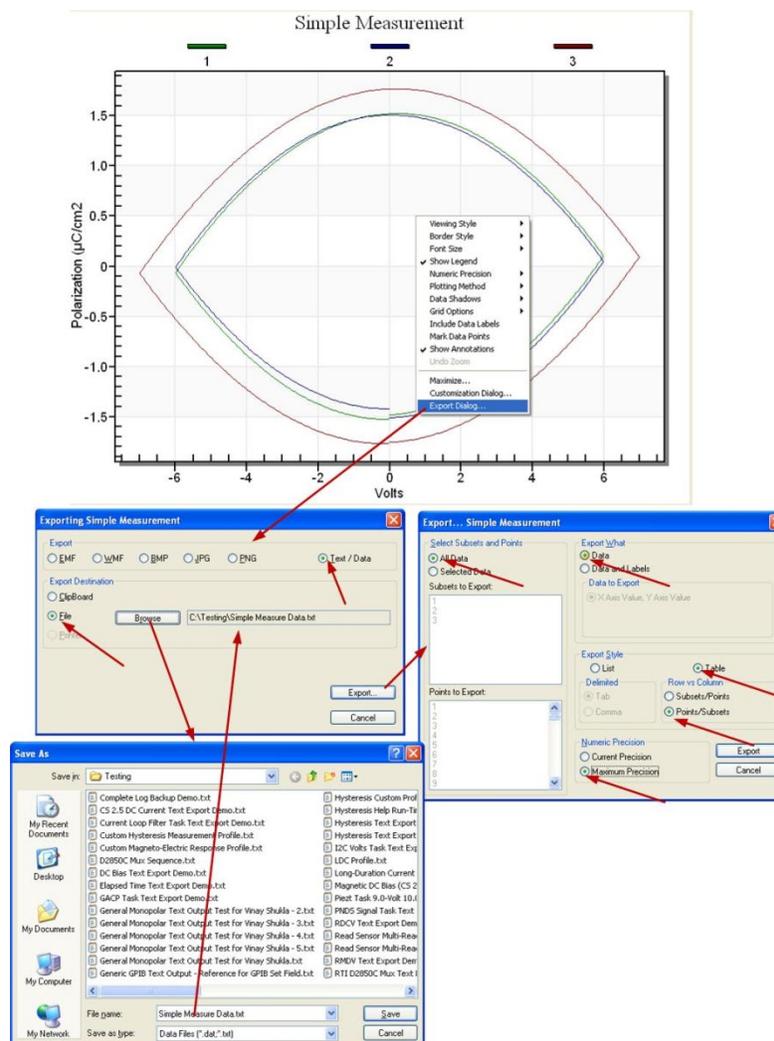


Figure 19 - Configure Data Exporting.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

Best results are achieved when the export is to a text file that can be imported into Microsoft Excel. Once the file is identified, click Export to configure the output. For best results select:

1. *All Data*
2. *Data*
3. *Table*
4. *Points/Subsets*
5. *Maximum Precision*

The resulting output file is shown in **Figure 20**.

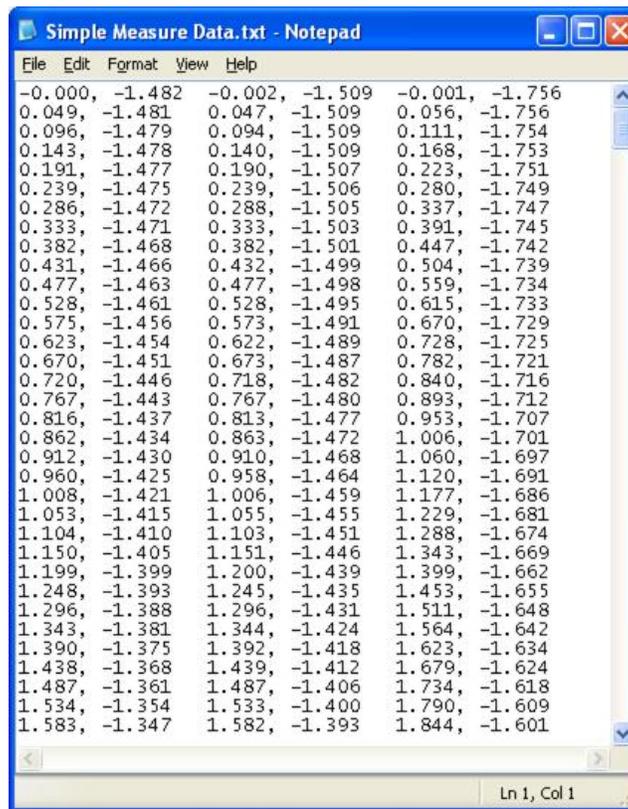


Figure 20 - Exported Text File.

Select Target DataSet

Task Name:	Simple Measure
Version:	5.12.0
Last Task Update:	5 December 2016
In QuikLook Menu:	No
Folder:	None
Subfolder:	None
Subsubfolder:	None
Window Name:	Simple Measurement - Select Target DataSet
Known Bugs:	None
User Variables Added:	None

Dialog

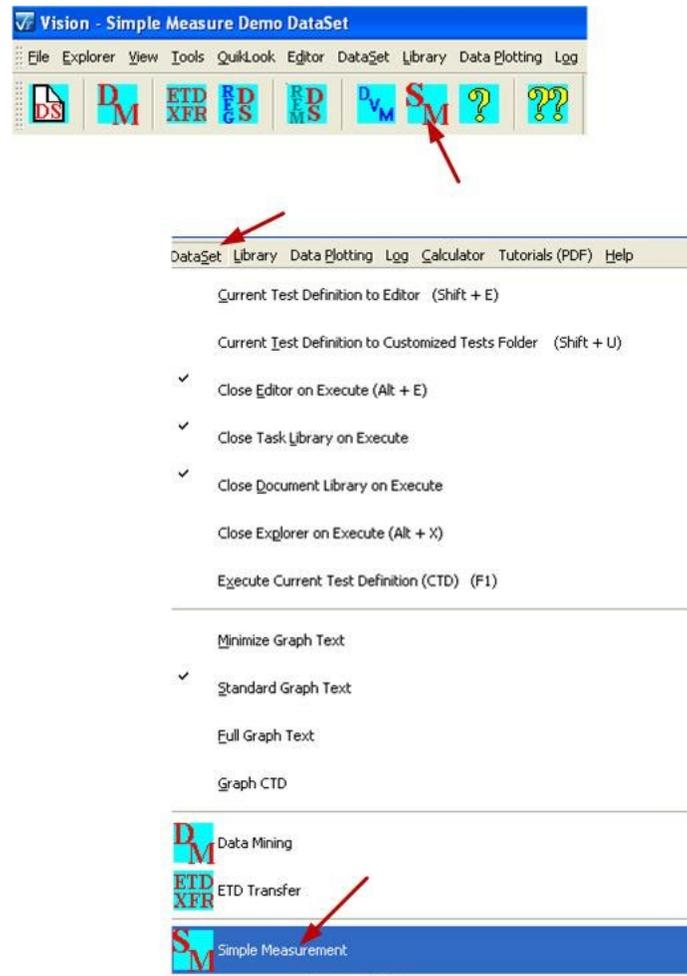


Figure 1 - Access the Simple Measure Project.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

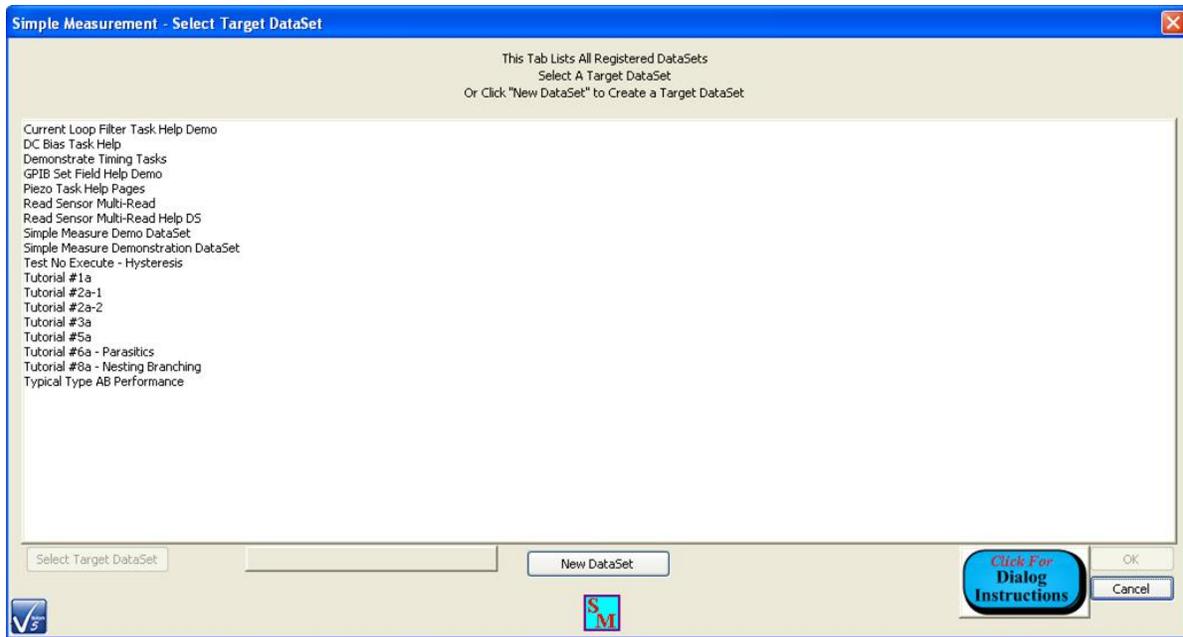


Figure 2 - Initial Target DataSet Selection Dialog.

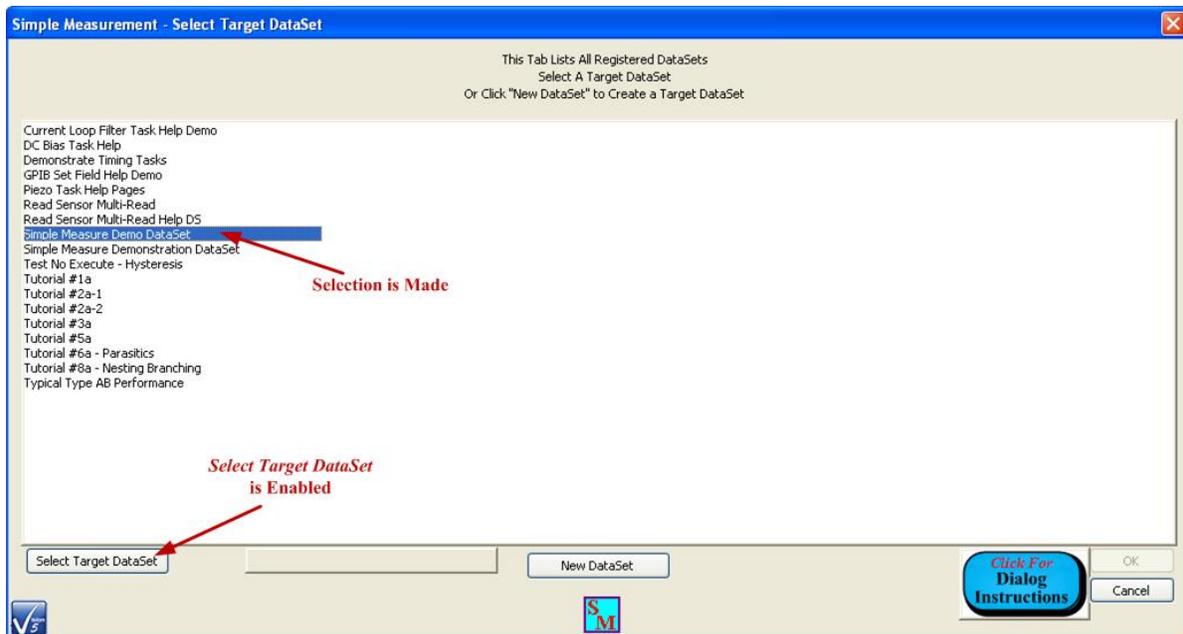


Figure 3 - DataSet List Selection is Made.

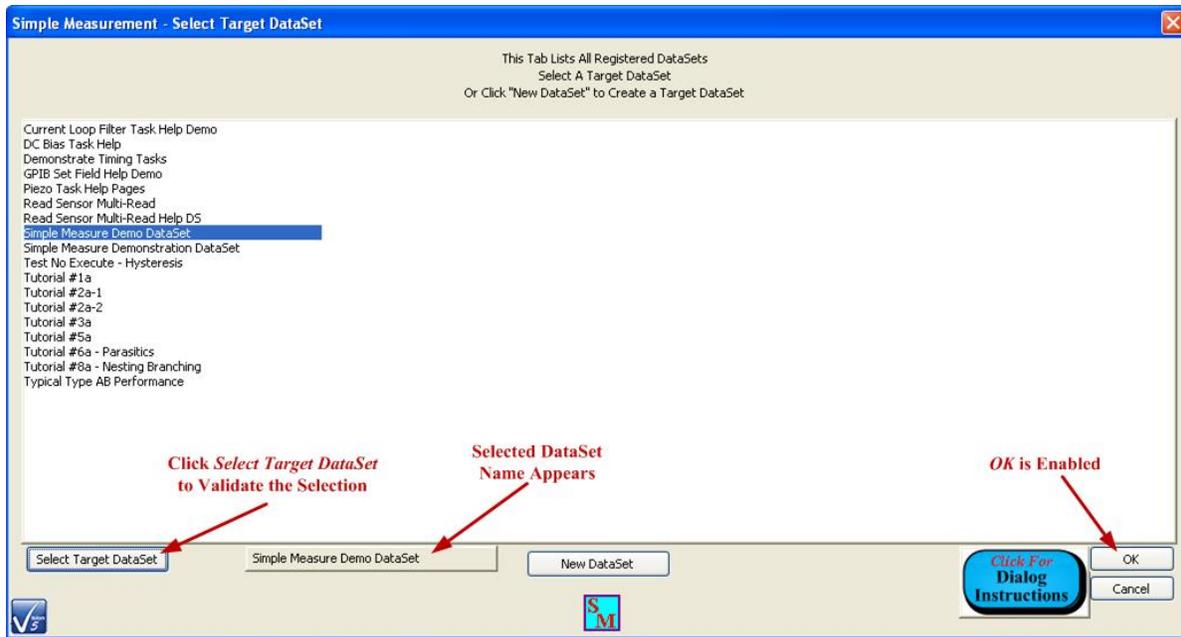


Figure 4 - Target DataSet Selection is Validated.

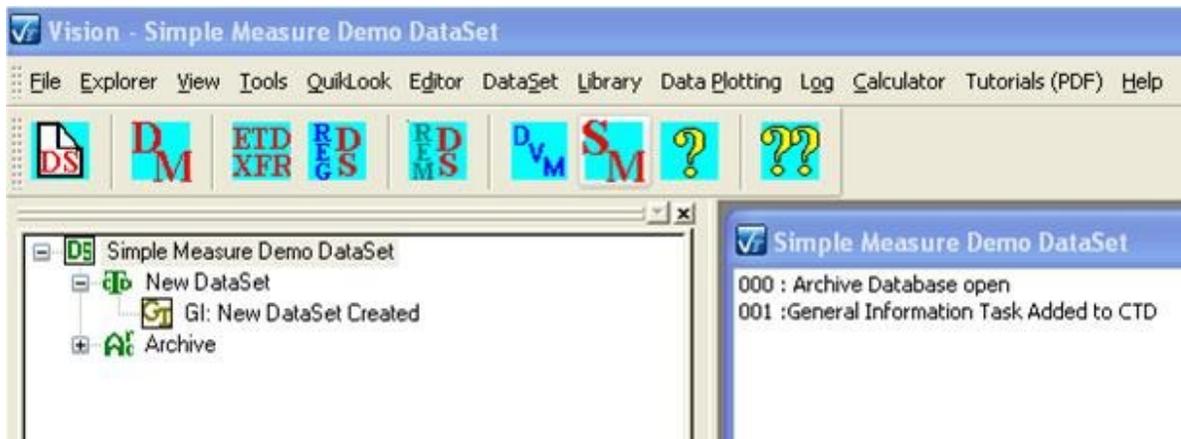


Figure 5 - Target DataSet is Opened.

New DataSet

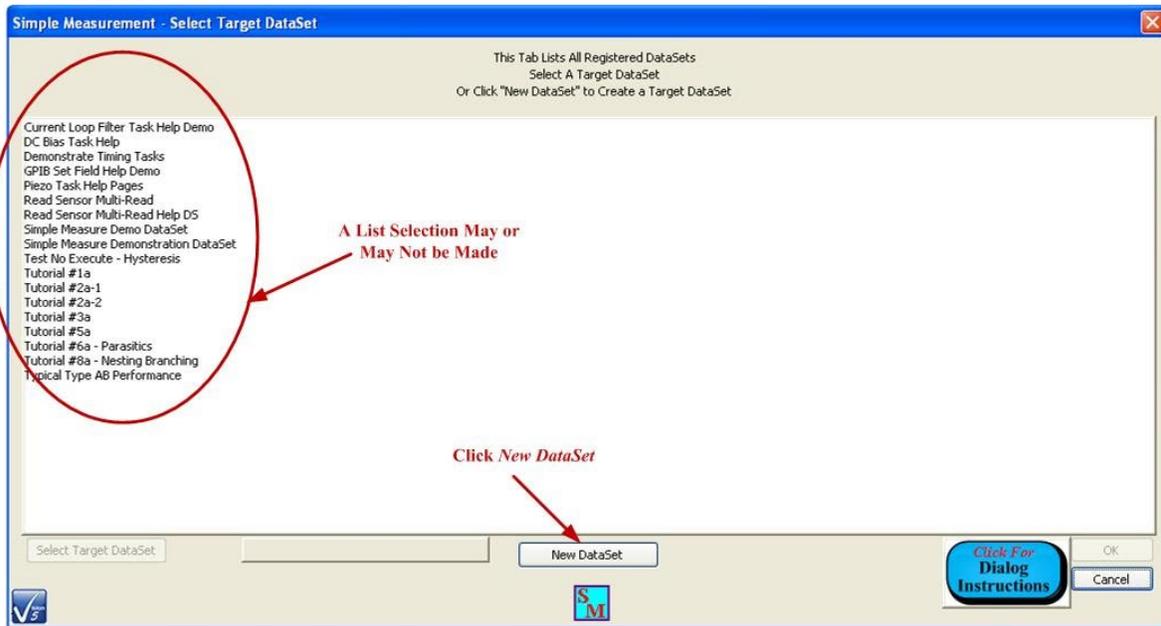


Figure 6 - Initiate a New DataSet.

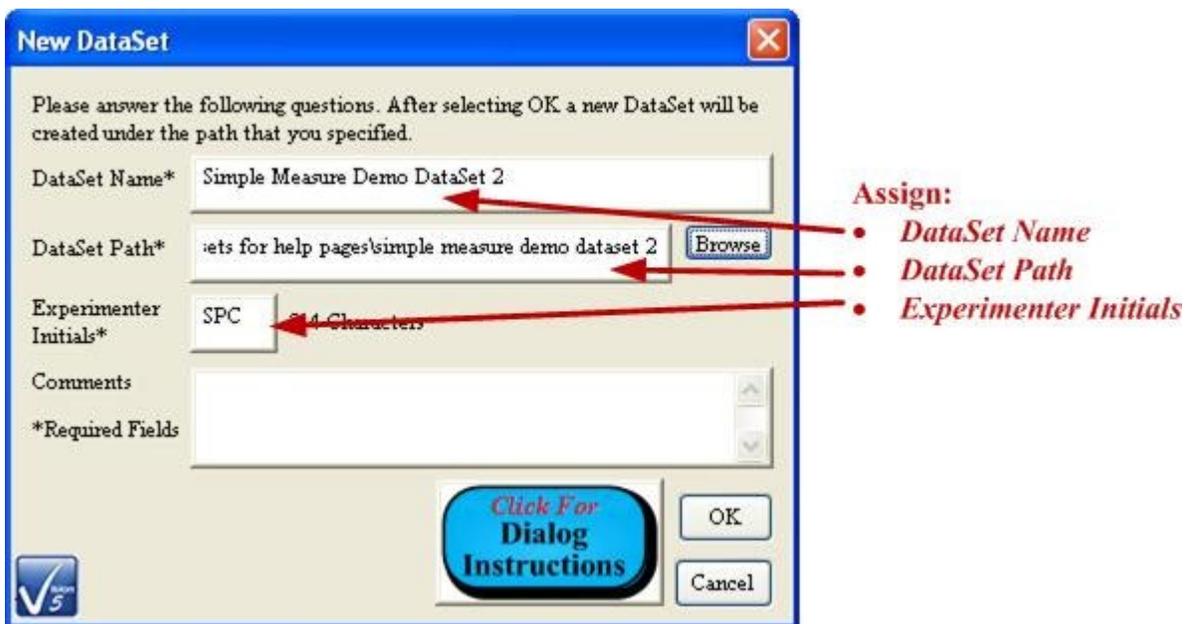


Figure 7 - Standard New DataSet Dialog.

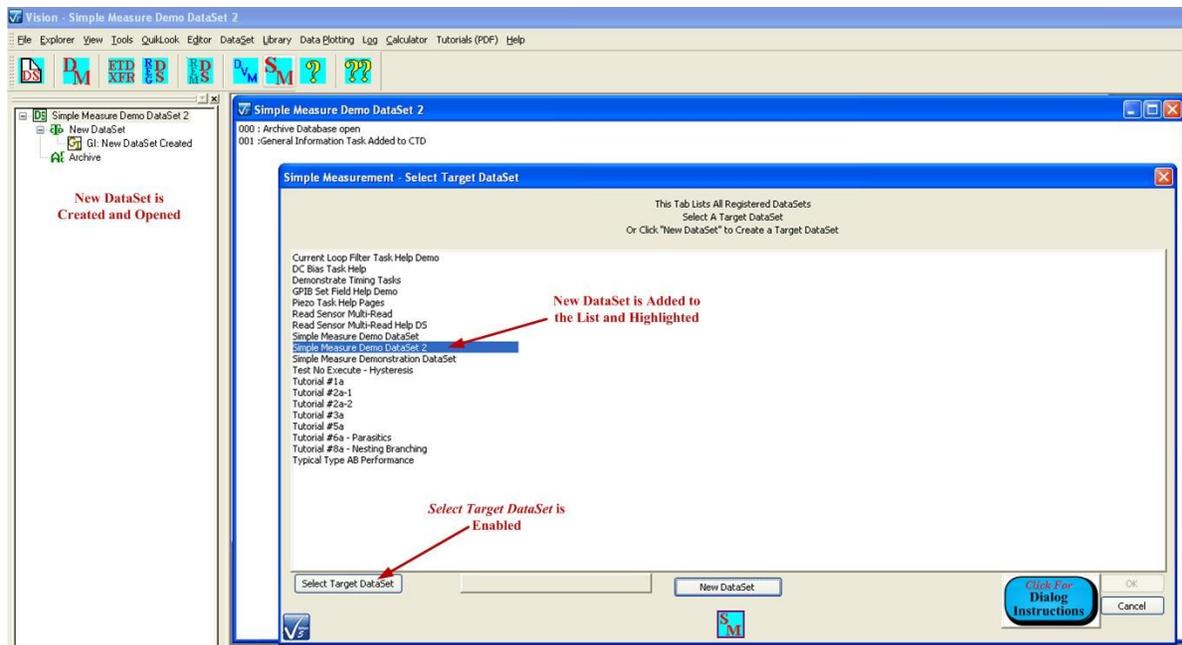


Figure 8 - Process is Updated with the New DataSet.

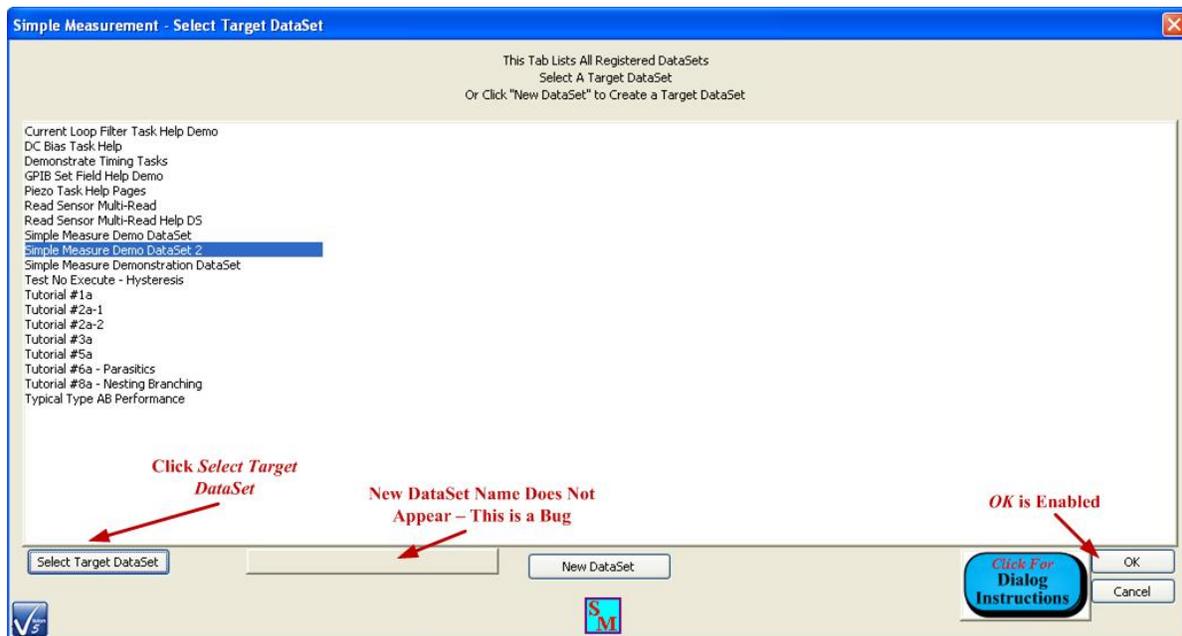


Figure 9 - The New DataSet is Selected.

Discussion

The Simple Measurement - Select Target DataSet dialog opens, as the first dialog in the Simple Measure process, when  is clicked on the Vision toolbar. The dialog's primary control is an

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

unlabeled *DataSets* list box. The box lists, by DataSet name, all DataSets that are currently registered to Vision. Initially no selection is made in the control. (No DataSet is highlighted.) The controls *Select Target DataSet* and *OK* are disabled. A single DataSet should be selected in the list. Highlighting a DataSet name in the list enables *Select Target DataSet*. Clicking *Select Target DataSet* validates the target selection by opening the DataSet (if it is initially closed), writing the DataSet name to the unlabeled *Selected DataSet Name* control and enabling *OK*. The DataSet selection can be changed any number of times. However, each time a new selection is made, the DataSet will be opened (if it is not already) without closing the previously-selected DataSet.

A new DataSet may be created from within the Target DataSet Selection Dialog. Clicking *New DataSet* opens a standard New DataSet dialog. The dialog is used to create and open the DataSet. In this process the new DataSet is added to the *DataSet* list box and highlighted. However, the DataSet selection is not yet validated. *Select Target DataSet* is enabled if it was not previously enabled. Clicking *Select Target DataSet* validates the selection. *OK* is enabled if it was not previously enabled.

Clicking *OK*, closes the dialog and opens the Main Control Dialog. Clicking *Cancel* closes the dialog and returns Vision to the idle state. Any DataSets opened during the process will remain open.

Controls

Name	Type	Default	Discussion
<i>DataSets</i> (Unlabeled)	List Box	No Selection	This list box lists every DataSet that is currently registered to Vision. Initially no selection is made in the list. (No entry is highlighted.) With no selection made <i>Select Target DataSet</i> is disabled. A single selection must be made by left-clicking on the intended DataSet. This highlights the selection and enables <i>Select Target DataSet</i> . If a new DataSet is created by using the <i>New DataSet</i> control, the DataSet name will be added to the list and highlighted. <i>Select Target DataSet</i> will be enabled.
<i>Select Target DataSet</i>	Button	Unpressed	This control is initially disabled. It is enabled when a single selection is made in the unlabeled DataSets list box. The selection is made either by left-clicking an existing entry in the list box or by creating a new DataSet using the <i>New DataSet</i> button. Clicking this button registers the DataSet selected in <i>DataSets</i> as the target DataSet. It opens the selected DataSet if it was initially closed. It writes the DataSet name to the unlabeled <i>Target DataSet Name</i> control and enables <i>OK</i> . Selections can be changed any number of times. Each time a selection is made the DataSet will be opened if it was initially closed. All opened DataSets will remain open once the dialog is closed.
<i>Target DataSet Name</i> (Unlabeled)	Text	""	This control is read-only. It contains the name of the target DataSet and is updated by clicking <i>Select Target DataSet</i> .
<i>New DataSet</i>	Button	Unpressed	Clicking this button opens a standard New DataSet Dialog. The dialog is used to create a new DataSet that is opened and whose name is added to the <i>DataSets</i> list. The DataSet is also selected (highlighted) in the <i>DataSets</i> List and <i>Select Target DataSet</i> is enabled.
<i>Click for Dialog In-</i>	Button	Unpressed	Clicking this button opens this help project.

<i>structions</i>			
<i>OK</i>	Button	Unpressed	This control is initially disabled. It is enabled when a DataSet is selected in the DataSets list and <i>Select Target DataSet</i> is clicked. Clicking this button closes the dialog and opens the Main Control Dialog. Any DataSets opened during the operation of this dialog will remain opened.
<i>Cancel</i>	Button	Unpressed	Clicking this button closes the dialog and terminates the Simple Measure process. Any DataSets opened during the operation of this dialog will remain opened.

Main Dialog Control

Task Name:	Simple Measure
Version:	5.12.1
Last Task Update:	5 December 2016
In QuikLook Menu:	No
Folder:	None
Subfolder:	None
Subsubfolder:	None
Window Name:	Simple Measure Main Control
Known Bugs:	None

Dialog

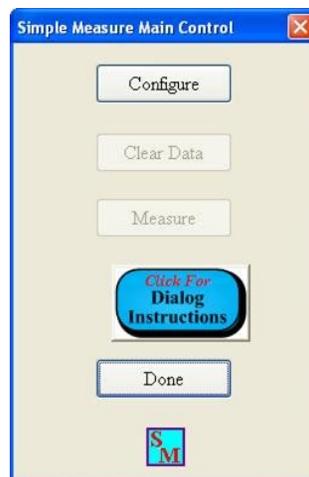


Figure 1 - Main Control Dialog - Initial - Not Configured/No Data.

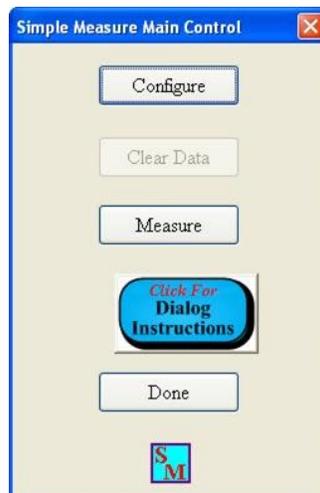


Figure 2 - Main Control Dialog - After Configuration.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

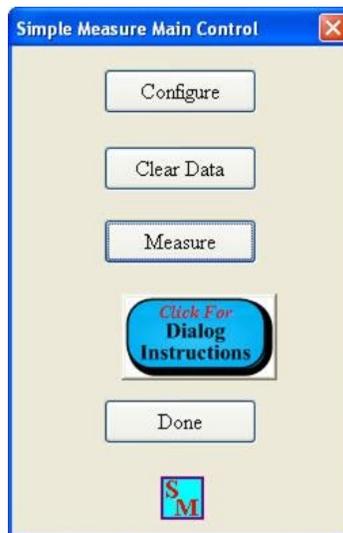


Figure 3 - Main Control Dialog - Measurement is Made and Data are Available.

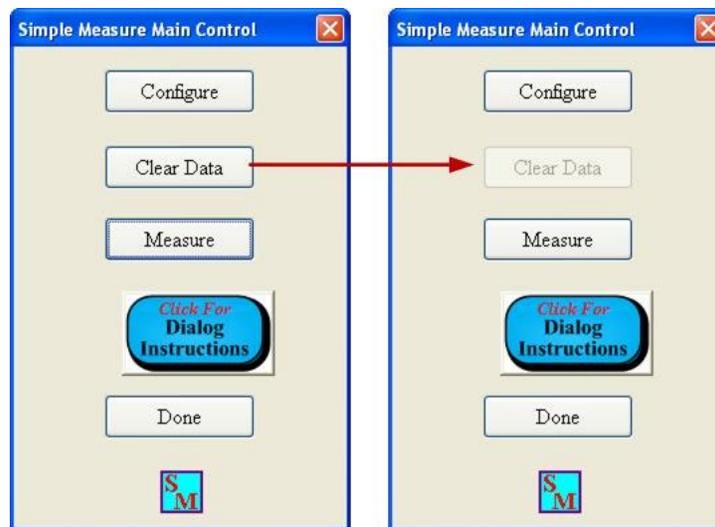


Figure 4 - Main Control Dialog - Clear Data from Memory.

Discussion

This very simple dialog is the main operation dialog in the Simple Measure process. It is opened after a target DataSet has been selected. The dialog either passes program operation to subdialogs or performs basic functions. On initial startup, dialog actions are limited to configuring a measurement, reading these Dialog Instructions or exiting the process. To those ends, *Configure*, *Click for Dialog Instructions* and *Done* are enabled. *Clear Data* and *Measure* are disabled (**Figure 1**). The configuration of a measurement is done by opening Configuration Dialog using the *Configure* button. When the configuration is done and the Configuration Dialog is closed, pro-

gram operation returns to the Main Dialog. With the measurement configured, *Measure* is enabled (**Figure 2**). Clicking *Measure* opens the Measure Dialog. In that dialog one or more measurements may be made using the current measurement configuration. When the Measure Dialog is closed, the data are written to the selected DataSet Archive and program execution returns to the Main Control dialog. Since data are recorded in memory, *Clear Data* is enabled (**Figure 3**). Clicking *Clear Data* removes the data from memory and disables *Clear Data*.

Controls

Name	Type	Default	Discussion
<i>Configure</i>	Button	Unpressed	This button is always enabled. Clicking this button opens the Configuration Dialog. In that dialog Task Name must be assigned and measurements parameters may be adjusted. This dialog may be accessed at any time from the Main Dialog. The configuration may be changed whether or not there are data in program memory. Closing the Configuration Dialog returns execution to the Main Dialog, where <i>Measure</i> will be enabled.
<i>Clear Data</i>	Button	Unpressed	This button is disabled until a measurement has been configured using the <i>Configure</i> button and made using the <i>Measure</i> button. If there are data in program memory, clicking this button removes the data from program memory. Clicking this button disables <i>Clear Data</i> .
<i>Measure</i>	Button	Unpressed	This button is disabled until a measurement has been configured using the <i>Configure</i> button. Clicking this button opens a subdialog in which one or more measurements may be made using the current measurement configuration values. The dialog will also display the measured data and list configuration and extracted measurement parameters. When the Measurement Dialog is closed measured data remain in memory. These are written to the Archive of the selected DataSet. Since there are data in memory, <i>Clear Data</i> will be enabled.
<i>Click for Dialog Instructions</i>	Button	Unpressed	This button is always enabled. Clicking this button opens this help project for Simple Measurement.
<i>Done</i>	Button	Unpressed	This button is always enabled. Clicking this button closes the Main Control Dialog, terminates the Simple Measure process and returns Vision to the idle state.

Configuration Dialog

Task Name:	Simple Measure
Version:	5.12.1
Last Task Update:	5 December 2016
In QuikLook Menu:	No
Folder:	None
Subfolder:	None
Subsubfolder:	None
Window Name:	Simple Measure Main Control
Known Bugs:	None

Setup Dialog

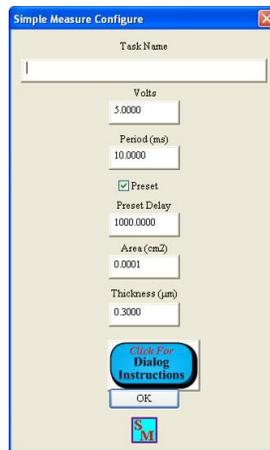


Figure 1 - Initial Configuration - No *Task Name* Assigned.

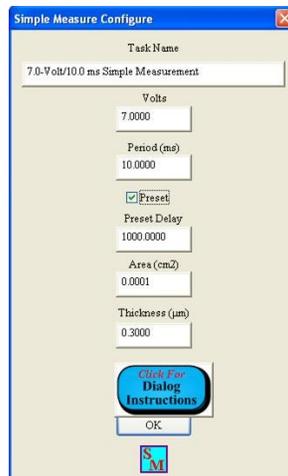


Figure 2 - *Task Name* is Assigned.

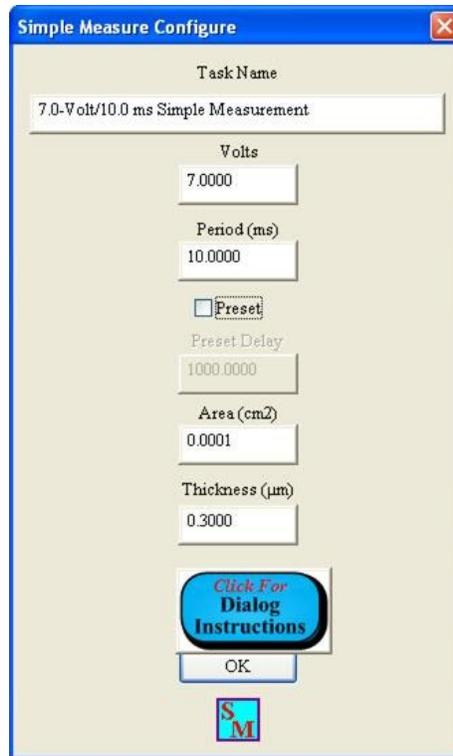


Figure 3 - No Preset.

Discussion

The Simple Measure configuration dialog is opened when *Configure* is clicked in the Main Control Dialog. The dialog appears with no *Task Name* assigned and default values and selections presented. At a minimum *Task Name* must have a non-empty text string for the dialog to close on *OK*. The data will be stored under the Task Name in the selected DataSet Archive. A unique and meaningful *Task Name* should be provided for clear archiving.

The user may provide a limited number of measurement specifications. The magnitude of *Volts* specifies the maximum positive and negative voltage to be applied in the bipolar triangular DRIVE waveform. The sign of *Volts* indicates the voltage direction (positive, then negative or negative, then positive) the waveform will take. *Period (ms)* is the duration of the DRIVE profile waveform. It is equivalent to 1000/Frequency (Hz).

When checked, *Preset* causes an unmeasured DRIVE profile to precede the measurement waveform. This forces the sample polarization ($\mu\text{C}/\text{cm}^2$) to be switched into a state (negative or positive) opposite the voltage direction (positive or negative) of the first half of the voltage waveform. This ensures that the polarization will switch states during the application of the first half of the waveform. Otherwise the behavior of sample polarization will depend on the polarization condition the sample was left in - either within or outside Simple Measure - prior to the measurement. If *Preset* is checked, the user defines a *Preset Delay (ms)* period over which zero Volts are applied to the sample between the application of the present and measurement waveforms.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

Preset Delay (ms) is disabled if *Preset* is unchecked. For preset measurement, the preset delay should be sufficient to allow sample charge motion, induced by the preset waveform, to settle before the measurement is made.

As a simple measurement, there are many parameters that are not under users control. A partial list includes:

1. High Voltage: Not available.
2. Profile: Fixed at bipolar triangular.
3. Bias Offset: Fixed at 0.0 V.
4. Auto Amp: Enabled.
5. Use Last Amp. Level: Enabled.
6. Maximum Waveform Signal Assigned as Field (kV/cm): Not Available.
7. Data Plotted Vs Field: Not Available.
8. Plot Titles: Automatically assigned.
9. Internal Reference Elements (1.0 nF Linear Capacitor, 2.5 MW Linear Resistor, RTI 4/20/80 PNZT): Not available.

Although a Profile Preview is not available, the image of **Figure 4** shows the profile that will be applied for the configuration of **Figure 2**.

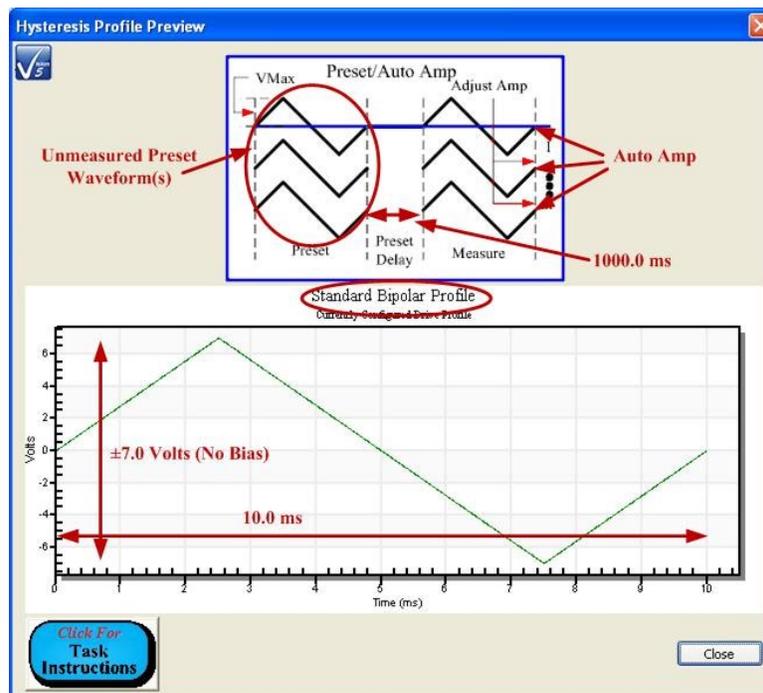


Figure 4 - Simple Measure Profile.

The sample dimensions *Area (cm²)* and *Thickness (μm)* are specified in this dialog. *Thickness (μm)* is the depth, in microns/micrometers, of the ferroelectric or dielectric material between the

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

sample electrodes. It is maintained merely as sample documentation. *Area (cm²)* is the surface area, in square centimeters, of the smaller of the two sample electrodes (if they differ in size). This also provides sample documentation. But this value is also used to normalize the measured charge data to produce the polarization ($\mu\text{C}/\text{cm}^2$) data that is reported by the Task.

Controls

Name	Type	Default	Discussion
<i>Task Name</i>	Text	""	60-Character Limit. This is the identifier for this execution, or series of executions, of the Simple Measure Task. The Task will be stored under this name in the DataSet archive. The identifier should be unique and meaningful for archival purposes. This control must have a non-empty value assigned for <i>OK</i> to close the dialog.
<i>Volts</i>	Real	4.0	This is the sign and magnitude of the voltage waveform to be applied during the sample preset, if enabled, and measurement. The magnitude entered here is the magnitude of the maximum positive and negative voltages applied during the preset and measurement waveforms. The sign of this value is the direction (positive or negative) of the first half of the DRIVE voltage waveform.
<i>Period (ms)</i>	Real	10.0	This is the duration, in milliseconds, of the preset (if enabled) and measurement DRIVE waveforms. It is equivalent to $1000/\text{Frequency (Hz)}$
Preset	Check Box	Checked	When checked, an unmeasured DRIVE profile will precede the application of the measurement profile. The purpose is to preset the sample's polarization state into a state (negative or positive) opposite the direction (positive or negative) of the voltage over the first half of the measurement. This ensures that the first half of the measurement loop switches the sample's polarization state. Otherwise the behavior of the sample polarization will depend on previous (unknown) signals applied to the sample - either within or outside of Simple Measure - immediately before the measurement. If enabled, a zero-Volt delay of <i>Preset Delay (ms)</i> length will separate the application of the preset and measurement waveforms. If checked, <i>Preset Delay (ms)</i> is enabled. Otherwise it is disabled.
Preset Delay (ms)	Real	1000.0	This control is enabled if Preset is checked. Otherwise it is disabled. This control specifies, in milliseconds, the zero-Volt delay between the application of the preset and measurement waveforms. This delay should be sufficient to allow any charge movement induced by the preset waveform to settle.
<i>Area (cm²)</i>	Real	0.0001	This is the surface area of the sample's smaller electrode. This documents the sample. However, the value is also used to normalize the sample's measured charge, induced by the measurement DRIVE waveform, to generate the polarization ($\mu\text{C}/\text{cm}^2$) data displayed and stored by the Simple Measure process.
<i>Thickness (μm)</i>	Real	0.1	This is the depth, in microns/micrometers, of the ferroelectric or dielectric material between the sample electrodes. This value is stored to document the sample being measured.
<i>Click For Dialog Instructions</i>	Button	Un-pressed	Read this Help page.
<i>OK</i>	Button	Un-pressed	Accept the configured values, close the dialog and return to the Main Control Dialog. <i>Measure</i> will be enabled on the Main Control Dialog. This button will not close the dialog unless a non-empty text string is present in <i>Task Name</i> .

Measurement Dialog

Task Name:	Simple Measure
Version:	5.12.1
Last Task Update:	5 December 2016
In QuikLook Menu:	No
Folder:	None
Subfolder:	None
Subsubfolder:	None
Window Name:	Simple Measure Main Control
Known Bugs:	None

Dialog

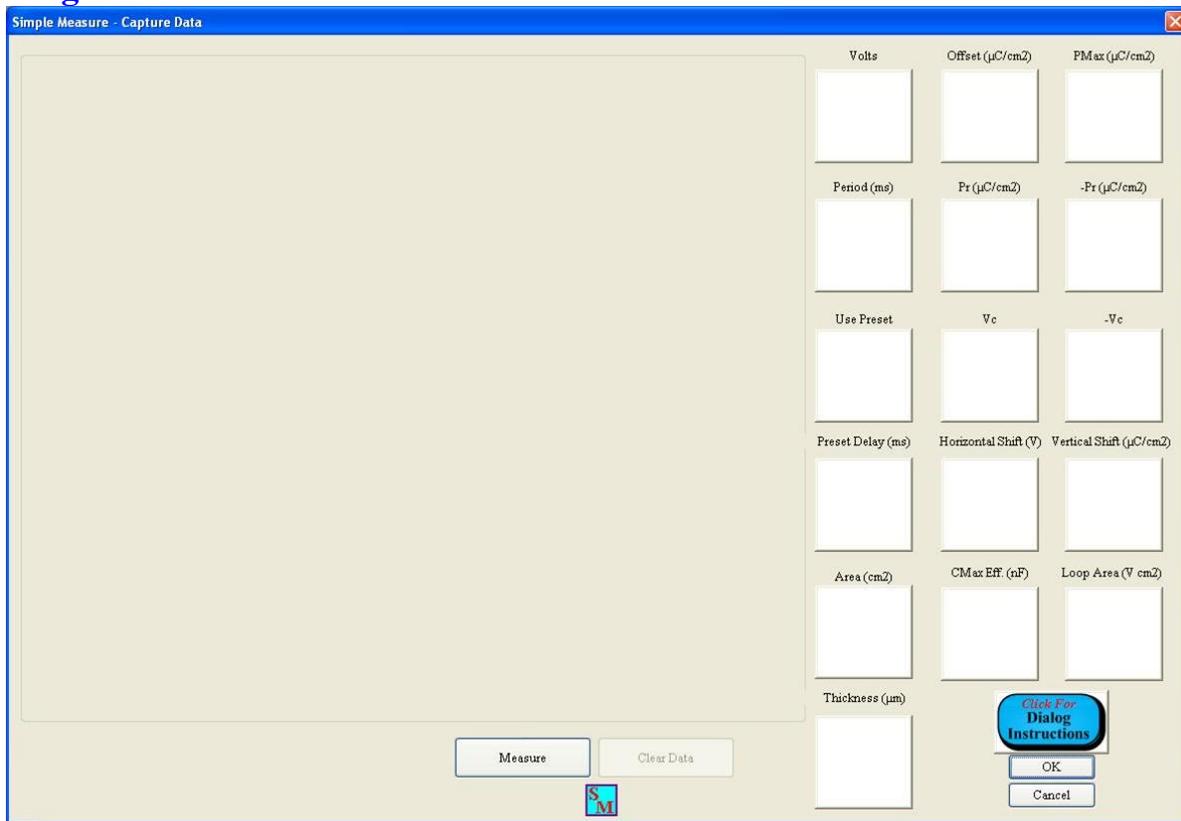


Figure 1 - Initial Dialog - No Measured Data.

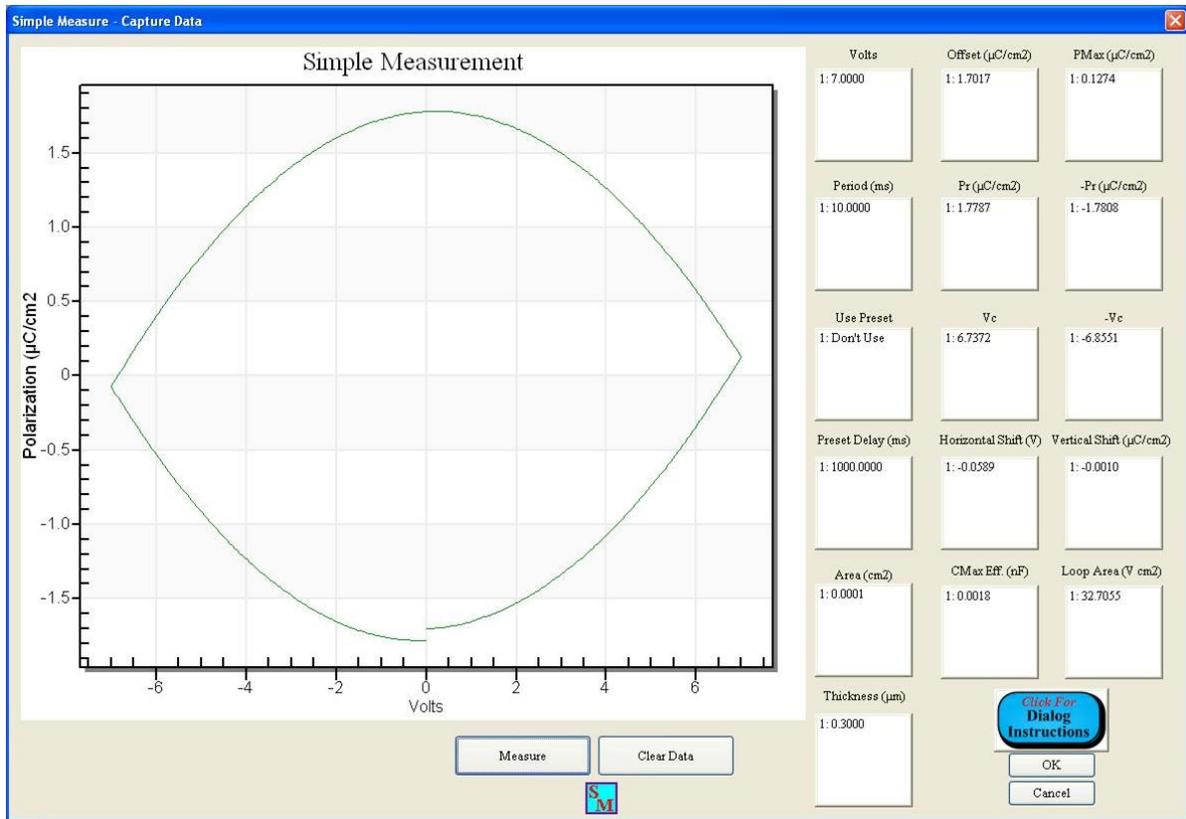


Figure 2 - First Measurement.

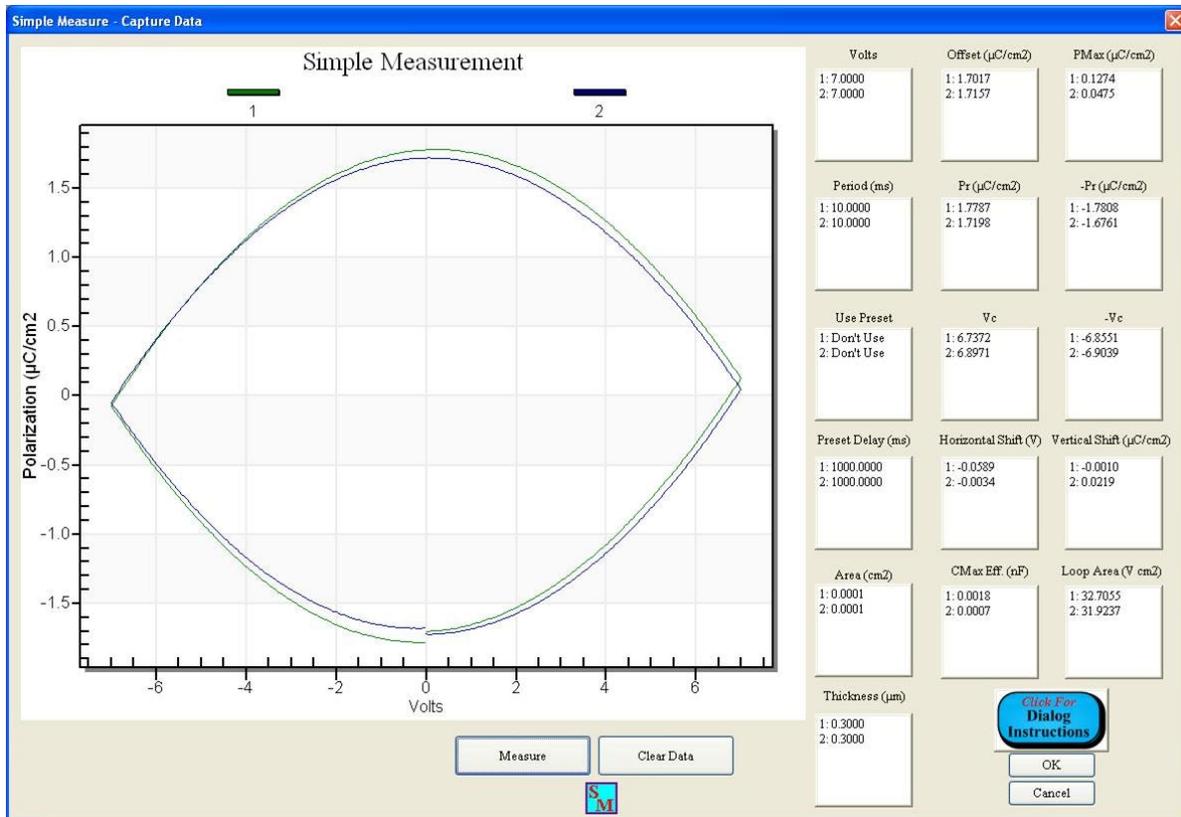


Figure 3 - Second Measurement.

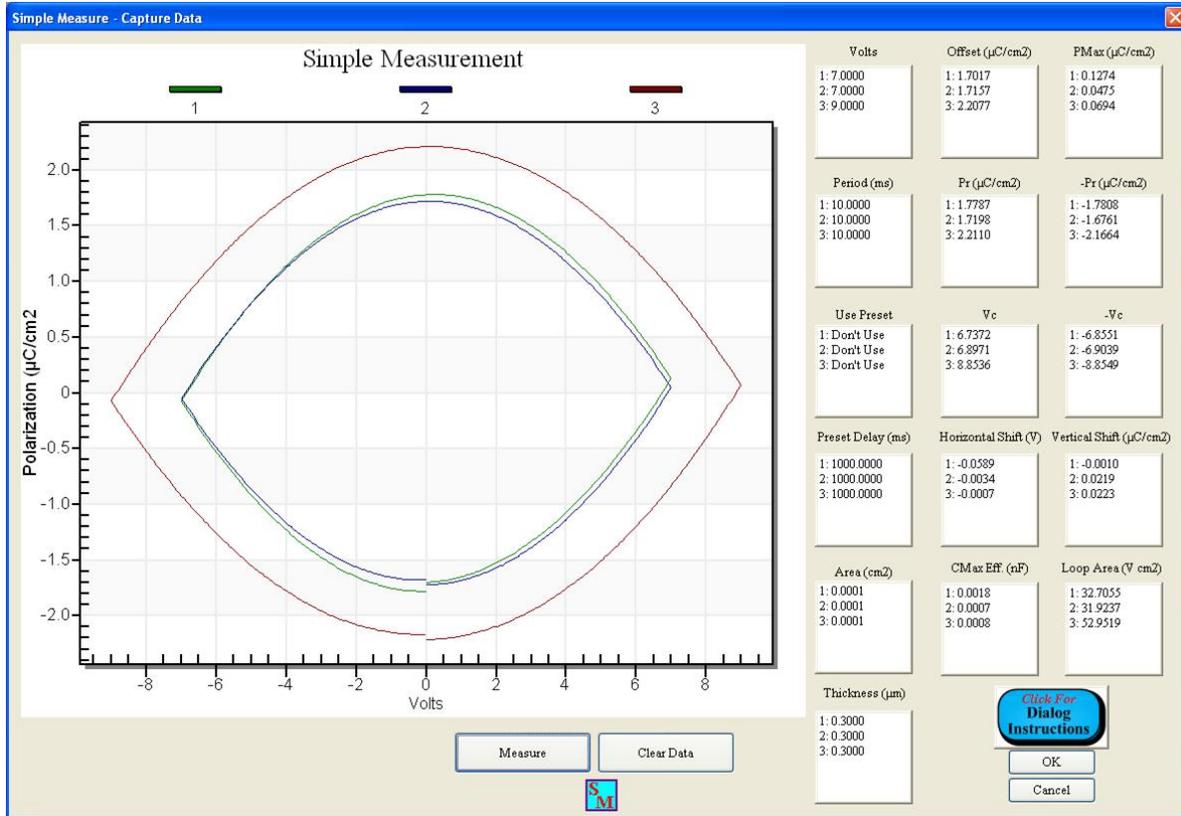


Figure 4 - Third Measurement - Reconfigured.

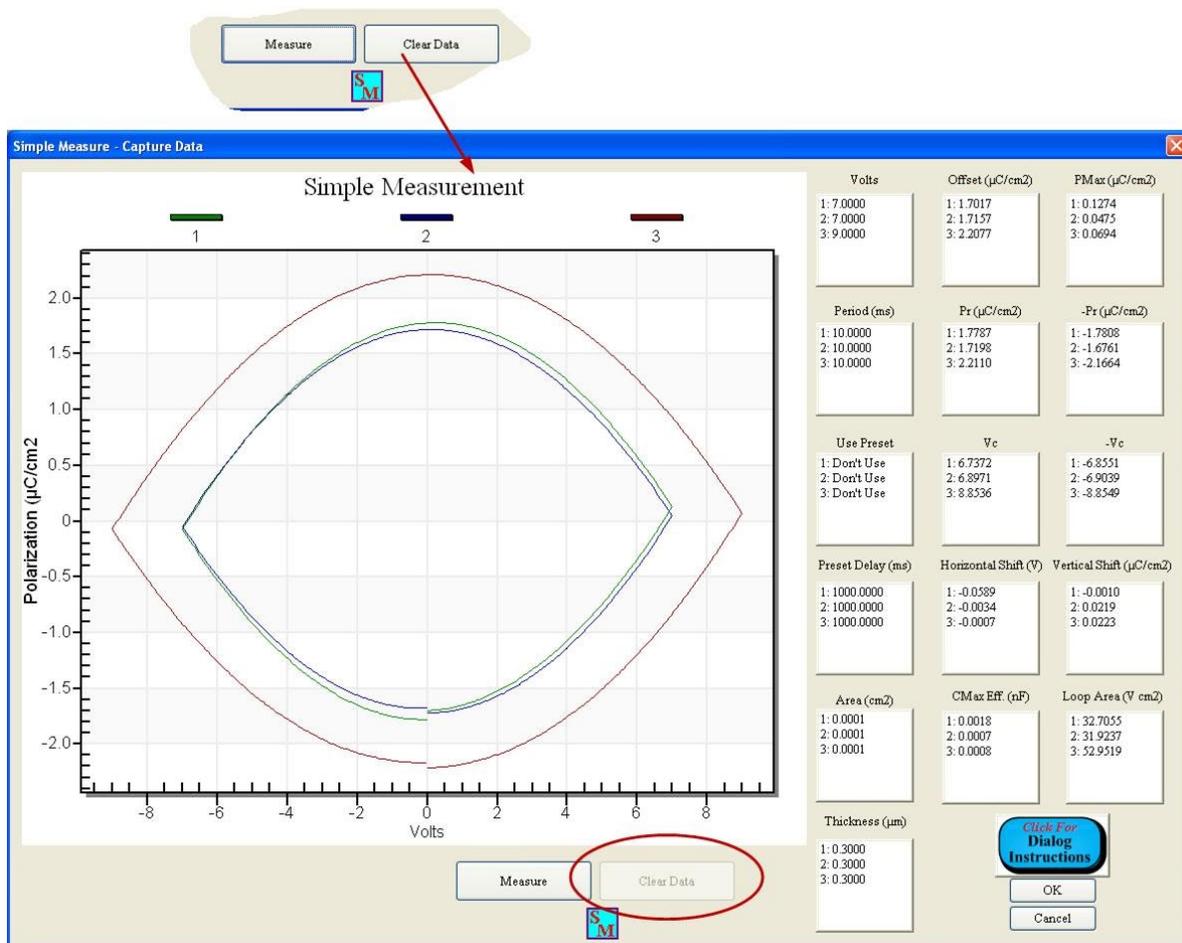


Figure 5 - Clear Measured Data.

Discussion

The Measurement Dialog will open when *Measure* is clicked on the Main Control Dialog. This can only happen after the measurement has been configured. On initial access, there will be no data displayed, the various list boxes will be empty and *Clear Data* will be disabled (Figure 1). Clicking *Measure* will cause a single triangular bipolar Hysteresis measurement of the configured voltage and period (ms) to be made on the sample that is connected to the tester DRIVE and RETURN ports. Once made, the data are displayed in a plot on the dialog and the various configuration and measurement parameters are appended to the list boxes. These parameters are discussed in detail in the table, below. *Clear Data* is enabled (Figure 2). The measurement may be repeated any number of times (Figure 3). Clicking *OK* closes the dialog, writing the measured data, if any, to the selected DataSet Archive and reopening the Main Control Dialog. In the main dialog, the data may be cleared, so that the Measurement Dialog would again appear as the initial dialog in Figure 1. Or the configuration may be adjusted and the measurement repeated with a new set of voltage and period (ms) parameters (Figure 3). If the data are cleared within the Measurement Dialog by clicking *Clear Data* (Figure 4) the measurement data are cleared from the main process memory and no data will be written to the DataSet Archive on *OK*, if the dialog

is closed. However, the plot maintains the data and continues to display and the list boxes are not cleared.

Controls

Name	Type	Default	Discussion
<i>Simple Measurement</i>	Data Plot	No Plot	This is the plot display of the data. It is not shown if there are not data in memory, except that it will continue to display data if <i>Clear Data</i> is clicked. A new data plot is appended to this display each time <i>Measure</i> is clicked
<i>Measure</i>	Button	Unpressed	Clicking this button causes a bipolar triangular Hysteresis measurement to be made at the currently-specified voltage and period (ms). If no data were previously displayed, the newly measured data will be shown on a new data plot. If there are data displayed, the new data are appended to the data in the data plot. Clear Data is enabled if previously disabled. The configuration and measured parameters are appended to the various list boxes as discussed below in this table.
<i>Clear Data</i>	Button	Unpressed	This button is disabled until data are written into process memory using the <i>Measure</i> button. Clicking this button removes all data from process memory. Any data displayed in the plot and list boxes will remain displayed until the dialog is closed and reopened or a new measurement is made.
<i>Volts</i>	Real List Box	Empty	This box is empty until a measurement is made using the <i>Measure</i> button. This list box will not be visibly emptied using the Clear Data button until the dialog is closed and reopened or a new measurement is made. This box lists, in sequence, the voltages at which all of the measurements have been made.
<i>Offset (μC/cm²)</i>	Real List Box	Empty	<p>This box is empty until a measurement is made using the <i>Measure</i> button. This list box will not be visibly emptied using the Clear Data button until the dialog is closed and reopened or a new measurement is made. This box lists, in sequence, the value used to center the polarization (μC/cm²) data vertically about the voltage axis. Polarization (μC/cm²) is a relative value that needs a reference. In a Hysteresis measurement, no such reference exists. Instead, the first measure point is arbitrarily set to 0.0 μC/cm². All subsequent points are referenced to that 0.0 value. This shifts the loop, vertically, in the direction of the sign of the first half loop maximum voltage. In order to produce the standard vertically-centered data, the Offset (μC/cm²) value is subtracted from every point in the loop. The offset is given as the maximum of the polarization values at the positive and negative maximum voltage magnitudes:</p> $\text{Offset Offset } (\mu\text{C}/\text{cm}^2) = \text{Polarization}_{(V_{\text{Max}})} \text{ Offset } (\mu\text{C}/\text{cm}^2) + \text{Polarization}_{(-V_{\text{Max}})} (\mu\text{C}/\text{cm}^2)/2 \quad (1)$ <p>Note that the Offset (μC/cm²) is subtracted from the uncentered Hysteresis data before the calculation of P_{Max} (μC/cm²), ±P_r (μC/cm²), ±V_c, Horizontal Shift (V) and Vertical Shift (μC/cm²). This gives accurate derivation of these parameters.</p>
<i>PMax (μC/cm²)</i>	Real List Box	Empty	This box is empty until a measurement is made using the <i>Measure</i> button. This list box will not be visibly emptied using the Clear Data button until the dialog is closed and reopened or a new measurement is made. This box lists, in sequence, the Polarization (μC/cm ²) at the maximum magni-

			tude voltage of the first half of the loop. This value is calculated after the Offset ($\mu\text{C}/\text{cm}^2$) is removed from the data.
<i>Period (ms)</i>	Real List Box	Empty	This box is empty until a measurement is made using the <i>Measure</i> button. This list box will not be visibly emptied using the Clear Data button until the dialog is closed and reopened or a new measurement is made. This box lists, in sequence, the period (ms) at which each of the measurements is made. Period is equivalent to $1000/\text{Frequency (Hz)}$.
<i>Pr ($\mu\text{C}/\text{cm}^2$)</i>	Real List Box	Empty	This box is empty until a measurement is made using the <i>Measure</i> button. This list box will not be visibly emptied using the Clear Data button until the dialog is closed and reopened or a new measurement is made. This box lists, in sequence, the Polarization ($\mu\text{C}/\text{cm}^2$) at which the voltage is zero Volts when switching from positive to negative voltage. If the currently configured voltage is negative, this value is the last measured point. This value is calculated after the Offset ($\mu\text{C}/\text{cm}^2$) is removed from the data.
<i>-Pr ($\mu\text{C}/\text{cm}^2$)</i>	Real List Box	Empty	This box is empty until a measurement is made using the <i>Measure</i> button. This list box will not be visibly emptied using the Clear Data button until the dialog is closed and reopened or a new measurement is made. This box lists, in sequence, the Polarization ($\mu\text{C}/\text{cm}^2$) at which the voltage is zero Volts when switching from negative to positive voltage. If the currently configured voltage is positive, this value is the last measured point. This value is calculated after the Offset ($\mu\text{C}/\text{cm}^2$) is removed from the data.
<i>Use Preset</i>	Boolean List Box	Empty	This box is empty until a measurement is made using the <i>Measure</i> button. This list box will not be visibly emptied using the Clear Data button until the dialog is closed and reopened or a new measurement is made. This box lists, in sequence, the enabling or disabling of the preset waveform for each recorded measurement.
<i>Vc</i>	Real List Box	Empty	This box is empty until a measurement is made using the <i>Measure</i> button. This list box will not be visibly emptied using the Clear Data button until the dialog is closed and reopened or a new measurement is made. This box lists, in sequence, voltage at which polarization ($\mu\text{C}/\text{cm}^2$) is zero when switching from negative to positive polarization ($\mu\text{C}/\text{cm}^2$). This is the positive Coercive Voltage. This value is calculated after the Offset ($\mu\text{C}/\text{cm}^2$) is removed from the data.
<i>-Vc</i>	Real List Box	Empty	This box is empty until a measurement is made using the <i>Measure</i> button. This list box will not be visibly emptied using the Clear Data button until the dialog is closed and reopened or a new measurement is made. This box lists, in sequence, voltage at which polarization ($\mu\text{C}/\text{cm}^2$) is zero when switching from positive to negative polarization ($\mu\text{C}/\text{cm}^2$). This is the negative Coercive Voltage. This value is calculated after the Offset ($\mu\text{C}/\text{cm}^2$) is removed from the data.
<i>Preset Delay (ms)</i>	Real List Box	Empty	This box is empty until a measurement is made using the <i>Measure</i> button. This list box will not be visibly emptied using the Clear Data button until the dialog is closed and reopened or a new measurement is made. This box lists, in sequence, the delay period between the application of the preset and measurement waveforms if the preset is enabled. Entries in this box have no meaning if present is not enabled for the particular entry.
<i>Horizontal Shift (V)</i>	Real List Box	Empty	This box is empty until a measurement is made using the <i>Measure</i> button. This list box will not be visibly emptied using the Clear Data button until the dialog is closed and reopened or a new measurement is made. This box lists, in sequence, the average of positive and negative Coercive

			<p>Voltages:</p> $\text{Horizontal Shift (V)} = (V_c + -V_c) / 2 \quad (2)$ <p>This value is calculated after the Offset ($\mu\text{C}/\text{cm}^2$) is removed from the data.</p>
<i>Vertical Shift</i> ($\mu\text{C}/\text{cm}^2$)	Real List Box	Empty	<p>This box is empty until a measurement is made using the <i>Measure</i> button. This list box will not be visibly emptied using the Clear Data button until the dialog is closed and reopened or a new measurement is made. This box lists, in sequence, the average of positive and negative Pr ($:\mu\text{C}/\text{cm}^2$).</p> $\text{Vertical Shift (V)} = (Pr + -Pr) / 2 \quad (3)$ <p>This value is calculated after the Offset ($\mu\text{C}/\text{cm}^2$) is removed from the data.</p>
<i>Area</i> (cm^2)	Real List Box	Empty	<p>This box is empty until a measurement is made using the <i>Measure</i> button. This list box will not be visibly emptied using the Clear Data button until the dialog is closed and reopened or a new measurement is made. This box lists, in sequence, The surface area of the top electrode of the sample(s) that have been measured. This value is used to normalize the captured charge to produce the polarization ($\mu\text{C}/\text{cm}^2$).data. It scaled the data presented in <i>Sample Measurement</i> , <i>PMax</i> ($\mu\text{C}/\text{cm}^2$) , <i>Pr</i> ($\mu\text{C}/\text{cm}^2$) , <i>-Pr</i> ($\mu\text{C}/\text{cm}^2$) , <i>Vertical Shift</i> ($\mu\text{C}/\text{cm}^2$) and <i>Loop Area</i> ($V \cdot \mu\text{C}/\text{cm}^2$) .</p>
<i>CMax Eff</i> ($n\text{F}$)	Real List Box	Empty	<p>This box is empty until a measurement is made using the <i>Measure</i> button. This list box will not be visibly emptied using the Clear Data button until the dialog is closed and reopened or a new measurement is made. This box lists, in sequence, the effective capacitance of the measured sample at the maximum programmed voltage. (Note that, for non-linear - ferroelectric - devices, capacitance is not a constant.) The capacitance is derived from the relationship</p> $\text{Charge (Q in Coulombs)} = \text{Capacitance (F)} \times \text{Volts} \Rightarrow C (\text{F}) = Q (\text{C}) / V \quad (4)$ <p>For the measurement at maximum voltage:</p> $C_{\text{Max Eff}} (n\text{F}) = P_{\text{Max}} (\mu\text{C}/\text{cm}^2) \times 1000 (n\text{C}/\mu\text{C}) \times \text{Area} (\text{cm}^2) / \text{Current Maximum Voltage} \quad (5)$ <p>This value is calculated after the Offset ($\mu\text{C}/\text{cm}^2$) is removed from the data.</p>
<i>Loop Area</i> ($V \cdot \mu\text{C}/\text{cm}^2$)	Real List Box	Empty	<p>This box is empty until a measurement is made using the <i>Measure</i> button. This list box will not be visibly emptied using the Clear Data button until the dialog is closed and reopened or a new measurement is made. This box lists, in sequence, the integral of the interior of the Hysteresis Polarization ($\mu\text{C}/\text{cm}^2$) Vs Voltage data. This value is calculated after the Offset ($\mu\text{C}/\text{cm}^2$) is removed from the data.</p>
<i>Thickness</i> (μm)	Real List Box	Empty	<p>This box is empty until a measurement is made using the <i>Measure</i> button. This list box will not be visibly emptied using the Clear Data button until the dialog is closed and reopened or a new measurement is made. This box lists, in sequence, the linear depth of the ferroelectric or dielectric material between the sample electrodes.</p>

<i>Click For Dialog Instructions</i>	Button	Unpressed	Read this Help page.
<i>OK</i>	Button	Unpressed	Close the dialog. Cause the data currently in memory, if any to be written to the selected DataSet Archive. Reopen the Main Control Dialog with <i>Clear Data</i> enabled if there are data in process memory.
<i>Cancel</i>	Button	Unpressed	Close the dialog. Do not write data to the selected DataSet Archive. Reopen the Main Control Dialog. If no data were in process memory when <i>Measure</i> was clicked, do not enable <i>Clear Data</i> .

XVIII - Newly-Added Tools

1. Runtime Tabular Text Export.
2. Runtime Data Image Export.
3. Custom Text-File Branch Loop Parameter Adjustment.
4. Runtime Input-File Task Configuration.

Runtime Tabular Text Export

After QuikLook execution or when recalled from a DataSet Archive, all Tasks may have configuration parameters and, for data-collecting Tasks, measured data exported to targets outside Vision including:

- Direct to Printer.
- Text File.
- Excel Table.
- Word Document.

Data-collecting Tasks may also export to a [Vision Data File](#) (VDF/*.vis) and/or have their data plot images exported to a Windows Meta File, JPEG file or Bitmap file. (Vision Data Files allow data to be exported by one Task of a particular type and then imported by another, allowing data to be moved from one Vision location to another as described [below](#).)

Such exporting is performed after the Task has completed execution and, for Tasks recorded into a [DataSet Archive](#), only on [Archive Regraph](#). Runtime export can be accomplished by including a [Print/Export Filter Task](#) in the Test Definition, but this is a rather clumsy procedure that slows Test Definition execution.

Recently, data-collecting Tasks, including Measurement and Filter Tasks, have been fitted with a Runtime Tabular Text Export option. In this option the Task will export all data collected at a single execution to a single text file at execution time. Only measured data are exported in tabular format, with column headings. Header information, common to standard Task exporting, is not available. Hysteresis-based Tasks, and Filters, that generate or collect columns of data output data from each measured point, line-by-line in the data columns. Other Tasks that collect only single-point data, such as pulse-based Tasks, will output data in a single line under the column headings. In either case, the first line of data will include any derived single-point data and a date/time stamp.

Each line that is appended to a runtime text file will be appended to any previous line exported. That means that a single file may be assigned to multiple Task executions - as in a Branch Loop and/or in repeated Test Definition executions. Multiple Tasks may even be configured with the same file name so that data from multiple sources may be gathered into one common file.

As a final note, the columns output to the text file are single-tab-delimited. That means that the data may appear offset from the column headers when viewed in Notepad or other text editor. However, the data will import correctly into Excel, Origin or other data manipulation program.

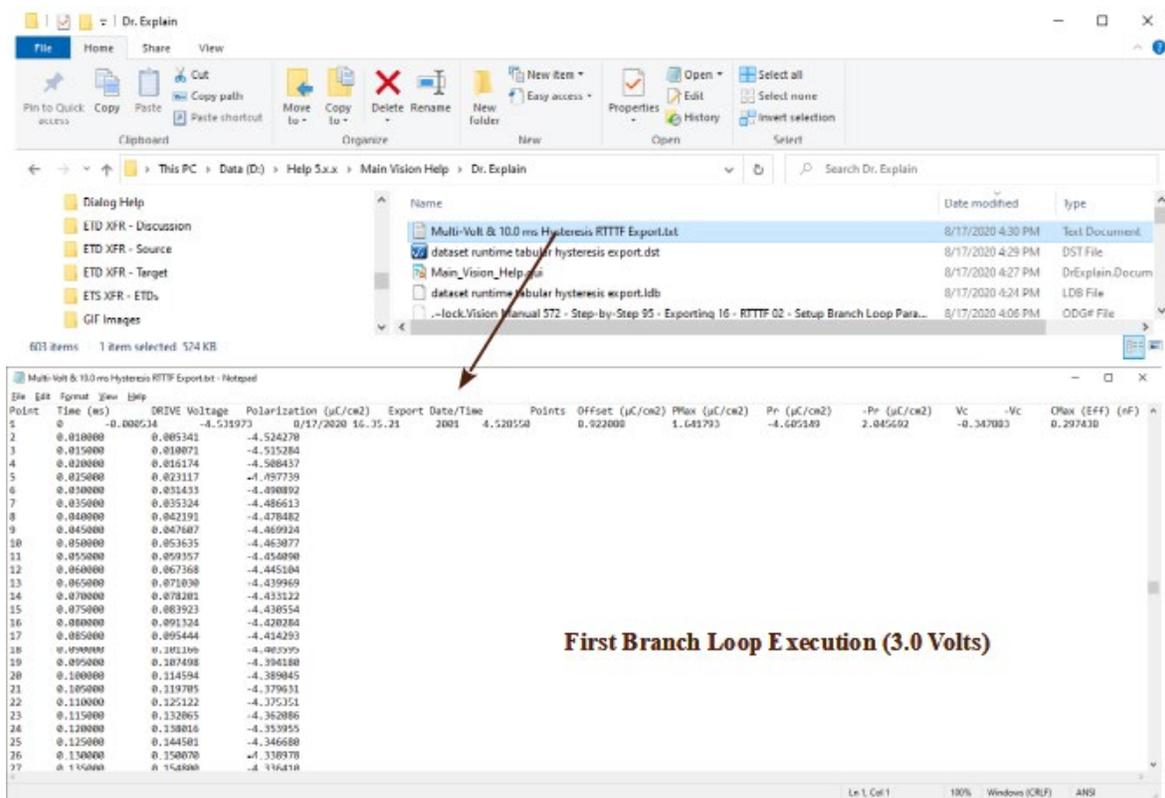


Figure 1 - Hysteresis Task Runtime Tabular Text File Output Over Two Task Executions.

Note that Runtime Tabular Text Exporting is configured in the Task that is to be doing the execution. Configuration is similar for all data-collecting Tasks. Figure 2 shows the configuration procedures for the Hysteresis Task.



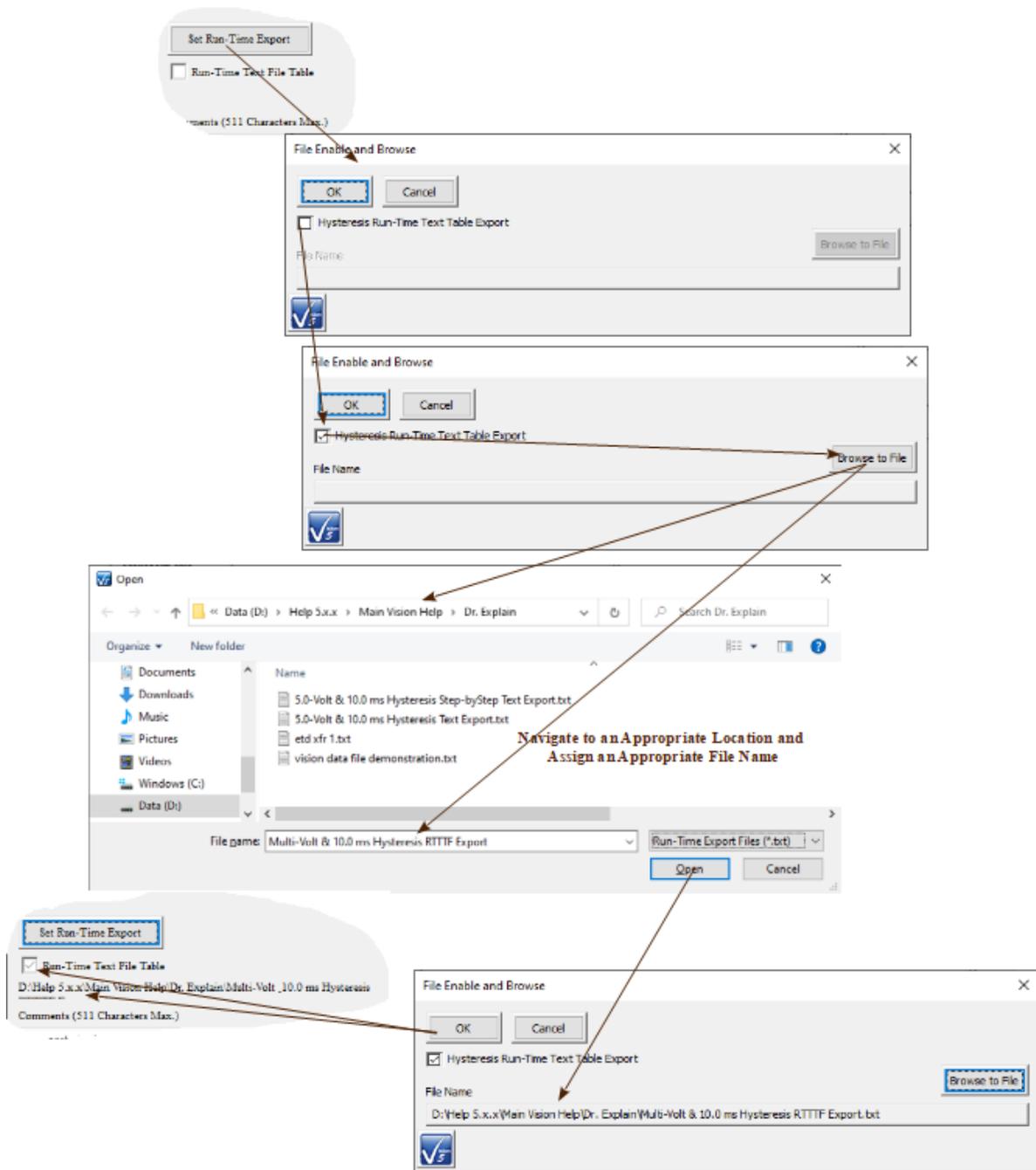


Figure 2 - Setup Runtime Tabular Text File Exporting.

Runtime Data Image Export

Data-collecting Tasks that generate data plots on execution - primarily Filter Tasks - can be configured to allow the data images to be exported to Windows Meta File, JPEG or Bitmap files at execution time as the plots are generated. To exercise this option the Task plot configuration dialog has the desired image format output enabled. Then a *Browse to File* button is used to open a standard Windows file browser dialog that allows the file path and a baseline file name to be specified.

The specified file name serves as a root identifier to which an index and date/time stamp are appended. This renders the file name unique over repeated Task executions. It allows the Task to operate in a Branch Loop and/or over repeated Test Definition executions without the need to overwrite the file. **Figure 1** shows the Hysteresis Filter Task configured to output a Bitmap image file of the plot to a file with baseline path and name "D:\Help 5.x.x\Task Help (b)\Hysteresis Filter\Dr. Explain\Hysteresis Filter Normalized Capacitance Data.bmp".

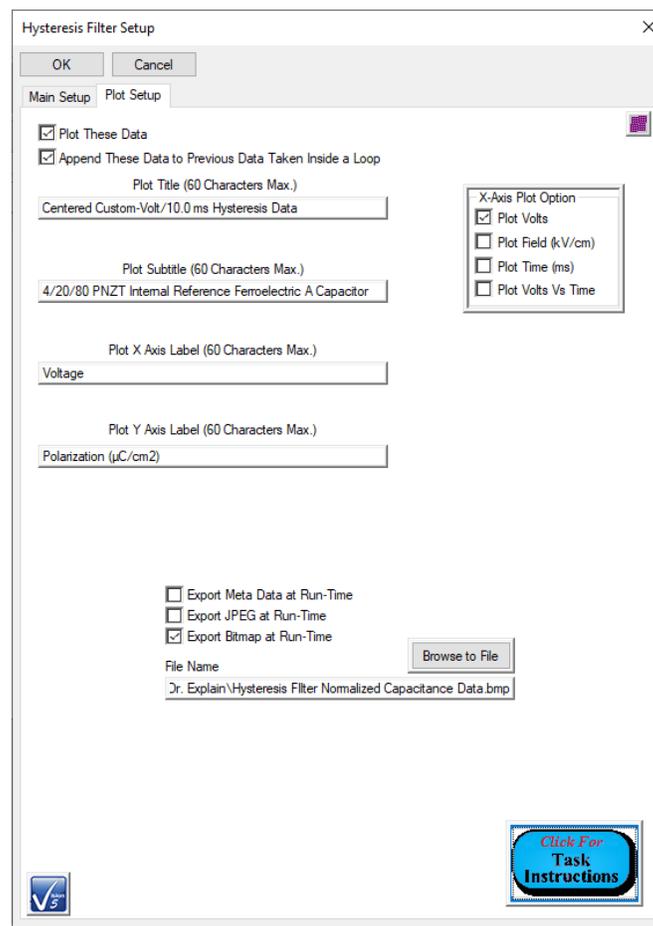


Figure 1 - Configure the Hysteresis Filter Task to Write a Bitmap Image File of the Data Plot at Runtime.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

Figure 2 shows the Task's bitmap image output over five Branch Loop iterations.

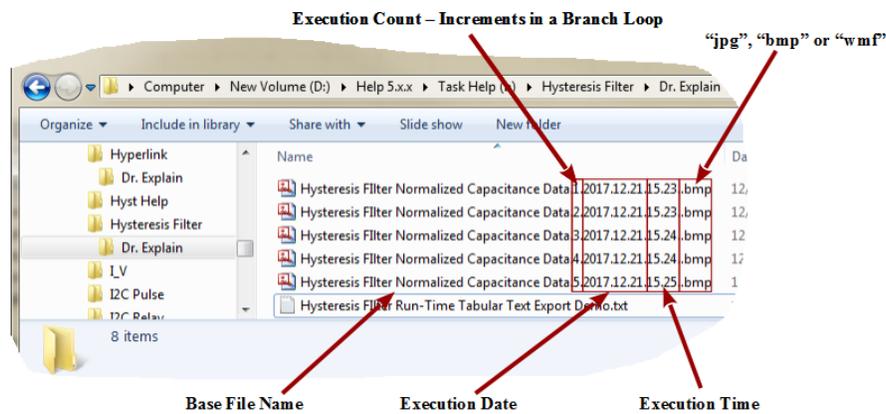


Figure 2 - Bitmap Files Output by the Hysteresis Filter Task over Five Branch Loop Iterations.

Figure 3 shows the contents of Hysteresis Filter Normalized Capacitance Data.3.2017.12.21.15.24.bmp.

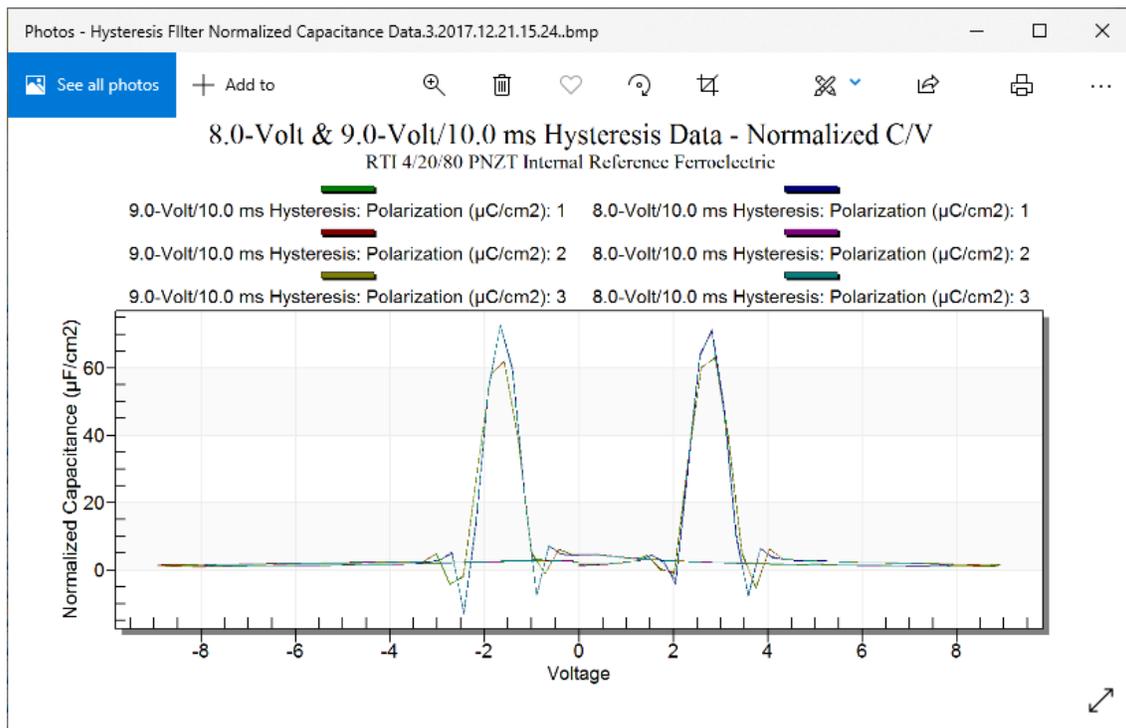


Figure 3 - Hysteresis Filter Normalized Capacitance Data Bitmap Image.

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)



Custom Text-File Branch Loop Parameter Adjustment

Copyright Radiant Technologies, Inc. 2021 - This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.5 License. [http://creativecommons.org/licenses/by-nc-](http://creativecommons.org/licenses/by-nc-sa/2.5/)

[sa/2.5/](http://creativecommons.org/licenses/by-nc-sa/2.5/)

