Main Vision Manual

User guide
2021

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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 Volts[1]. 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.

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.

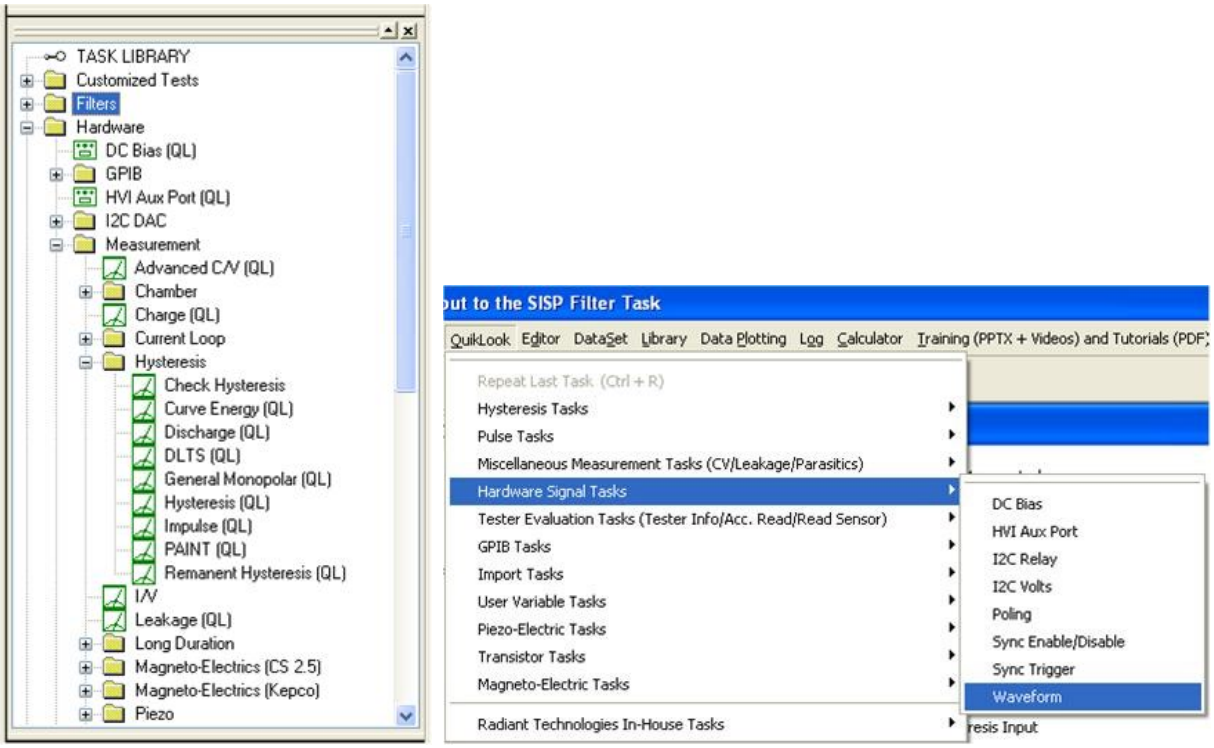

Figure 1 - Tasks in the Task Library and Figure 2 - Task in the QuikLook Menu.

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

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.

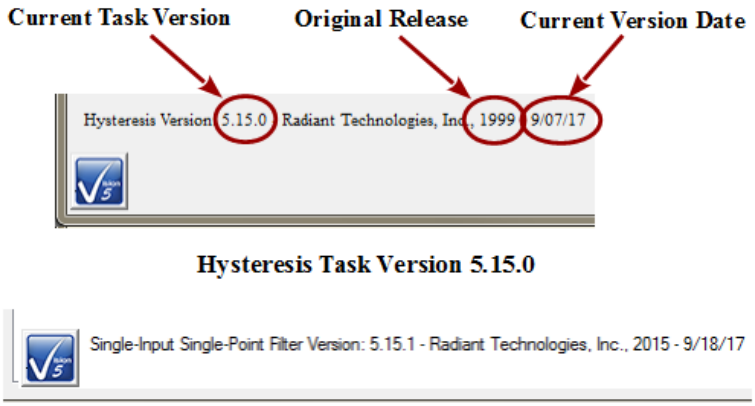

Figure 4 - Task Versions.

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 instaled 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

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 ($\mu C/cm^2$) 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 ($\mu C/cm^2$) 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 us 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 ($\mu C/cm^2$) 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.

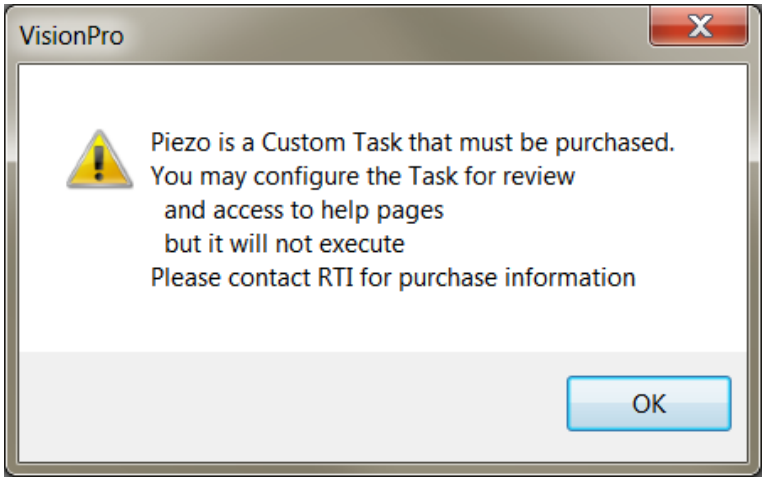

Figure 5 - Notice Appears when Unlicensed Piezo is Accessed. The Configuration Dialog will Open when the Notice is Closed.

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.

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.

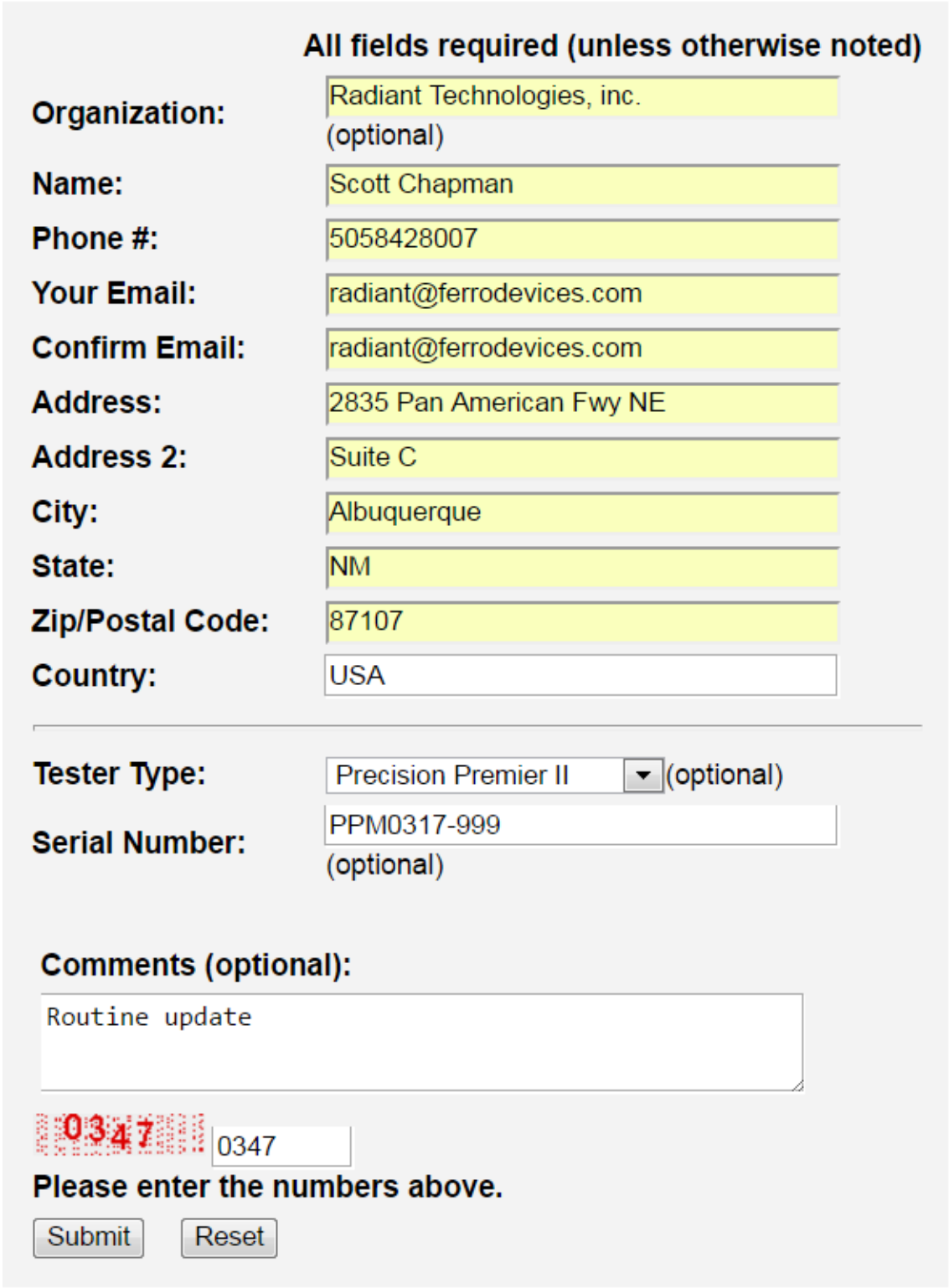

Figure 6 -Vision Install/Update Form.

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\xplorerdb.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\xplorerdb.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 xplorerdb.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.

DOWNLOAD Vision 5

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.

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.ferroelectrictesters.com	Precision Testers

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Hot Keys

Key	Action
<F1>	Execute the Current Test Definition (CTD)
<F10>	Close the Vision program
<Ctrl-N>	Create a new DataSet
<Ctrl-O>	Open the DataSet that is selected in the DataSet Explorer
<Shift-T>	Show/hide the Vision toolbar
<Shift-S>	Show/hide the Vision status bar
<Shift-X>	Show/hide the DataSet Explorer window.
<Shift-L>	Show/hide the Vision EDITOR window
<Ctrl-W>	Clear the Vision User Area of all data plot windows.
<Ctrl-G>	Clear the Vision User Area of all Test Definition Graph windows. The user is not prompted to save the Test Definition Graph to a file.
<Alt-W>	Hardware Refresh
<Ctrl-L>	Remove the last-entered Task from the bottom of the Test Definition in the Vision EDITOR. This renders the Test Definition Task list one Task shorter.
<Ctrl-A>	Remove all Tasks from the Vision EDITOR.
<Alt-A>	Open the Editor Aide tool.
<Shift-E>	Move the Tasks in the Current Test Definition (CTD) of the open DataSet back to the EDITOR window, appending them to any Tasks already in the EDITOR Test Definition.
<Shift-U>	Move the Tasks in the Current Test Definition (CTD) of the open DataSet to the Customized Tests folder of the TASK LIBRARY. Open a dialog to generate a name for the Customized Test.
<Alt-E>	Program Vision to close the EDITOR window when a DataSet Current Test Definition (CTD) is executed.
<Alt-X>	Program Vision to close the DataSet Explorer window when a DataSet Current Test Definition (CTD) is executed.
<Ctrl-F>	Search for specified text in the DataSet Log window. A dialog opens to specify the text.
<Alt-F>	Find the next instance of the specified text in the DataSet Log window.
<Alt-H>	Open the Vision "About" dialog to determine the Vision version, etc.
<Ctrl-H>	Open the Main Vision Manual.

Hot Keys

Most of Vision's primary functions can be accessed in a number of ways. As Vision is being learned most actions are taken by the user by selecting the option from the main menu. Many of these options are also duplicated by right-clicking the mouse with the cursor in the window that is specific to the action. Primary functions also have hot keys assigned to them that enable the operation from the keyboard without using the mouse. As the user becomes more comfortable with the program and is spending more time operating the Precision tester and less time learning Vision, the hot keys provide quicker access to the functionality than does the mouse. They become a very convenient tool once they are learned. The table below lists the hot keys and the operations that they control.

Key	Function
	File Functions
<Ctrl-O>	Open a DataSet. Select the DataSet in the DataSet Explorer and press the hot-key.
<Ctrl-N>	New DataSet. Initiate the DataSet creation operation
<F10>	Quit Vision
	View Functions
<Shft-T>	Toggle the toolbar between shown and hidden.
<Shft-S>	Toggle the status bar between shown and hidden.
<Shft-X>	Toggle the DataSet Explorer window between shown and hidden.
<Shft-L>	Toggle the Library and Editor windows between shown and hidden.
<Ctrl-W>	Close all plot windows. All windows generated by Filter Tasks and visible in the User Area will be closed. They may be reopened by recalling the Filters that created them from the DataSet Archive.
	QuikLook Functions
<Ctrl-R>	Repeat the last QuikLook Measurement. This option will open the configuration dialog for the most recently executed QuikLook Task. The Task will be preconfigured as it was for the execution.
	Editor Functions
<Ctrl-A>	Remove all Tasks. Completely empties the Editor of all Tasks in the Test Definition
<Ctrl-L>	Remove last Task. Eliminates the most recently added Task in the Test Definition in the Editor. The Test Definition length is shortened by one Task.
	DataSet Functions
<F1>	Execute the DataSet Current Test Definition.
<Shft-E>	Return the Current Test Definition to the Editor. The Test Definition in the DataSet is appended to any Test Definition already in the Editor.
<Shft-U>	Send the Current Test Definition to the Customized Test Folder. A Dialog will open to allow the Test Definition to be named as a Task in the Library Customized Test Folder.
<Alt-E>	Toggle the switch that forces the Editor window to close on DataSet execution. Status of the switch can be viewed in the " D ataSet" menu option.
<Alt-L>	Toggle the switch that forces the Library window to close on DataSet execution. Status of the switch can be viewed in the " D ataSet" menu option.
<Alt-X>	Toggle the switch that forces the DataSet Explorer window to close on DataSet execution. Status of the switch can be viewed in the " D ataSet" menu option.
	Log Window Functions
<Ctrl-F>	Find text. Opens a dialog in which text to be located in the uppermost DataSet log window is specified. Text search may be restricted to case-sensitive or this may be disabled. Window will scroll to the text location and the entry number will be indicated in a dialog. Text will not be highlighted.
<Alt-F>	Repeat search for the most recently specified text in the DataSet Log window.

	Help Functions
<Ctrl-H>	Access Help topics.
<Alt-H>	Vision "About" box

Error Reporting

When Measurement Tasks return from the Precision hardware with measured data for display, they data includes an integer error value. Normally this value will be zero, indicating no error. However, a very large and detailed set of error conditions may produce any of the values from the table below. Vision can use the error value to obtain both a textual description and a recommended course of action. Both of these text values are reported in the table. The text description is also reported on the response dialog and in exported text, Word and Excel files. When reported on a response dialog, the error can be reviewed by selecting the Error Report button. This will open a subdialog in which recommended actions may also be reviewed as in **Figure 1**.

Many errors refer to hardware and/or hardware driver details that will have no meaning to the user. However, if errors persist despite corrective action, the user may identify the error and report it to Radiant Technologies to help better understand the nature of the problem and correct it more quickly.

Error Code	Description	Action/Remedy
-4	TIA Output Overvoltage in the Positive Directions	The sample Hysteresis loop is too square for the Amplification settings used by the test system on the last measurement, with Auto-Amplification disabled. The tester can adjust itself, but must be in Auto-Amplification mode to do so. Please put the system into Auto-Amplification mode and re-run the measurement. After remeasuring, you may re-enable Auto-Amplification.
-3	TIA Output Overvoltage in the Negative Directions	The sample Hysteresis loop is too square for the Amplification settings used by the test system on the last measurement, with Auto-Amplification disabled. The tester can adjust itself, but must be in Auto-Amplification mode to do so. Please put the system into Auto-Amplification mode and re-run the measurement. After remeasuring, you may re-enable Auto-Amplification.
-2	TIA Output Overvoltage in both Directions	The sample Hysteresis loop is too square for the Amplification settings used by the test system on the last measurement, with Auto-Amplification disabled. The tester can adjust itself, but must be in Auto-Amplification mode to do so. Please put the system into Auto-Amplification mode and re-run the measurement. After remeasuring, you may re-enable Auto-Amplification.
-1	Amplification too High	The test system has determined that it is at too high an amplification level for the size of the sample and cannot lower its amplification level to match the sample. One possible reason is that the test system is already at its lowest amplification level and cannot go any lower. Another possibility is that the test system tried to make the measurement so many times that it reached its "number of tries" limit and was forced to stop. In the second case, it may be possible to achieve a proper measurement simply by starting the sample test again. If this does not work then the sample

		cannot be measured.
0	Valid Data	No error has occurred. The presented data represent the actual sample response to the applied signal.
1	Amplification too Low	The test system has determined that it is at too low an Amplification Level for the size of the sample and cannot raise its amplification level to match the sample. One possible reason is that the test system is already at its highest amplification level and cannot go any higher. Another possibility is that the test system tried to make the measurement so many times that it reached its "number of tries" limit and was forced to stop. In the second case, it may be possible to achieve a proper measurement simply by starting the sample test again. If this does not work then the sample cannot be measured.
2	Generic Error	This is a generic error not used in Version 3.1.0 or later. It is included to maintain compatibility with older versions. If this error is seen, please advice RTI.
3	Acquisition Exceeded MAX_NUMBER_OF_AMPX_LOOP_COUNTS	The Precision test system has attempted to make the measurement a number of times while adjusting the Amplification Level. Each attempt failed for one reason or another. The best approach is to try the measurement again one more time. If the second attempt is also unsuccessful, then the sample cannot be measured.
4	Acquisition Exceeded MAX_NUMBER_OF_ZERO_LOOPS during zeroing	The Precision test system has attempted to characterize its drift and internal noise prior to a measurement. It cannot successfully do so. The most likely cause of this failure is that the sample is shorted. Another possibility is that the sample is very large and the initial Amplification Level is too high for the sample size. In this case, a successful measurement can be accomplished by taking the tester off Auto-Amplification, manually setting the Amplification Level to a very low value like 0.001, re-enabling Auto-Amplification and then repeating the test. A third possible cause of this problem is an external signal being injected into the measurement cables. The final possible cause is that the sample is discharging into the tester while the tester is attempting its calibration.
5	RAMP_RATE_VS_MEASURE_PERIOD_ERROR_CODE - Ramp Rate Too Fast for the Measurement	The Precision test system evaluated the rise time that it used for the test just executed and found that the requested period for the pulse width or Hysteresis loop was too fast to allow the output voltage to reach its assigned value. The test must be slowed down or a higher Amplification Level must be used. The output rates are selected by the tester based on the Amplification setting. The higher the amplification setting, the faster the allowed ramp rate. Setting a higher Amplification Level increases the allowed tester speeds, but if the sample is too large to increase Amplification Lever, the only option is to slow down the test. To select a higher Amplification Level in Auto-Amplification,

		1. Disable Auto-Amplification. 2. Set the New Amplification Level. 3. Re-enable Auto-Amplification 4. Repeat the measurement.
6	A Math Error has Occurred While Converting the Assigned Voltage to a Binary Value.	An internal error has occurred. Please contact Radiant Technologies with the Error Code and a description of the problem.
7	AWFG Communication Error	An internal error has occurred. Please contact Radiant Technologies with the Error Code and a description of the problem.
8	An Error Loading Clocks has Occurred	An internal error has occurred. Please contact Radiant Technologies with the Error Code and a description of the problem.
9	AWFG Trigger Failure	An internal timing signal was corrupted. Resulting data are suspect. No corrective action is required. The test may be repeated.
10	A Communication Error with the Oscilloscope has Occurred.	An internal error has occurred. Please contact Radiant Technologies with the Error Code and a description of the problem.
11	A Request to Windows NT 4.0 has Generated an Error.	No corrective action required. Please repeat the measurement.
12	The System Cannot Compensate for Sample-Induced Measurement Drift.	The sample has either shorted or is generating current while the test system is attempting to calibrate prior to a measurement. If the sample is not shorted, the issue may be resolved by removing the sample and attaching it again. Otherwise the sample must be replaced.
13	Unspecified Error	This error value is not assigned. The user should not encounter this error. If this error appears please contact Radiant Technologies immediately.
14	Test System Would Not Self-Calibrate Prior to a Measurement.	The sample has most likely shorted or is too large for the tester. Try using the lowest Amplification Level allowed by the system while in Auto-Amplification to select the lowest Amplification Level in Auto-Amplification, 1. Disable Auto-Amplification. 2. Set the Amplification Level. 3. Re-enable Auto-Amplification. 4. Repeat the measurement.
15	Sample Current Too High with Amplification Level a Minimum.	The sample has most likely shorted or is too large for the tester. Try using the lowest Amplification Level allowed

		by the system while in Auto-Amplification. to select the lowest Amplification Level in Auto-Amplification, 1. Disable Auto-Amplification. 2. Set the Amplification Level. 3. Re-enable Auto-Amplification. 4. Repeat the measurement.
16	Amplification Level must be Manually Reduced to Successfully Measure.	The sample is too large for the initial Amplification Level in Auto-Amplification. The sample appears as a short to the system. Manually lower the Amplification Level to lower the Amplification Level in Auto-Amplification, 1. Disable Auto-Amplification. 2. Select the lower Amplification Level. 3. Re-enable Auto-Amplification. 4. Repeat the measurement.
17	The Oscilloscope Timed Out Clearing the Pipeline.	An internal error has occurred. Please contact Radiant Technologies with the Error Code and a description of the problem.
18	The Oscilloscope Reports an Incorrect Measurement.	No corrective action required. Please repeat the measurement.
19	A Communications Error to Output 3 is Reported.	An internal error has occurred. Please contact Radiant Technologies with the Error Code and a description of the problem.
20	Delay Period too Short	The specified delay period is not long enough to allow the system to reach the assigned voltage prior to the start of the measurement. The delay period must be lengthened. This error applies to delay periods assigned to Leakage, I(V), C(V) and Pulse Tasks.
21	Requested Pulse Width is too Short	The requested pulse width is shorter than the system specification. Increase the pulse width.
22	Requested Leakage Soak Time is too Short	The requested soak time for the Leakage test is shorter than the system specification. Increase the Leakage soak time.
23	Requested Leakage Measurement Time is too Short	The requested measurement time for the Leakage test is shorter than the system specification. Increase the Leakage measurement time.
24	Unspecified Error	This error value is not assigned. The user should not encounter this error. If this error appears please contact Radiant Technologies immediately.
25	Requested Tickle Voltage is too Low	The requested C/V or Advanced C/V Task tickle voltage is too small for the test system to generate.

26	Unspecified Error	This error value is not assigned. The user should not encounter this error. If this error appears please contact Radiant Technologies immediately.
27	Unspecified Error	This error value is not assigned. The user should not encounter this error. If this error appears please contact Radiant Technologies immediately.
28	Unspecified Error	This error value is not assigned. The user should not encounter this error. If this error appears please contact Radiant Technologies immediately.
29	Unspecified Error	This error value is not assigned. The user should not encounter this error. If this error appears please contact Radiant Technologies immediately.
30	Access to an Accessory Instrument Failed During Acquisition.	An error has occurred while accessing accessory equipment. Please contact Radiant Technologies with the Error Code.
31	Accessory Instrument of the Wrong Type.	The Precision tester found an accessory on the assigned port that is different from the specified instrument. Please check the cabling between the tester and the accessory and make sure that it is plugged into the COMM port. Recheck the menu settings. If the error persists, contact Radiant Technologies.
32	The HVI Detected a Sample Fault During a Test.	The sample shorted during a High Voltage test while using the High Voltage Interface (HVI) along with a High Voltage Amplifier (HVA). The short did not heal immediately, but continued for at least 17 ms. The HVI opened the high voltage test path and intentionally grounded both sides. of the sample. The sample is most likely permanently damaged.
33	Requested HVA Voltage Incorrect.	The requested amplifier voltage specification for the test does not match the tester's own voltage specification. DO NOT CONTINUE TESTING. There is a possible high voltage safety issue. Please contact Radiant Technologies.
34	Wrong HVI Rating on the Requested Port.	The High Voltage Amplifier (HVA) on the specified port does not match the amplifier specified in software. (For example: 4,000-Volt HVA specified, but 10,000-Volt HVA present.)
35	HVA Responded with Incorrect Address.	This error should never appear. If you see this error, contact Radiant Technologies immediately.
36	Mux not Present on Specified COMM Port.	No accessory Precision Multiplexer appears on the software-specified COMM port.
37	Mux not Present on Specified COMM Port.	No accessory Precision Multiplexer appears on the software-specified COMM port.
38	Unspecified Error	This error value is not assigned. The user should not encounter this error. If this error appears please contact Radiant Technologies immediately.
39	Unspecified Error	This error value is not assigned. The user should not encounter this error. If this error appears please contact Radiant Technologies immediately.
40	The Requested Period for the Hysteresis Loop is Too Short by a Factor of at Least 5.	The requested Hysteresis loop is so short that Vision cannot execute enough measurement points to display a loop. Please make the test period longer.

Table 1 - Table of Hardware Errors

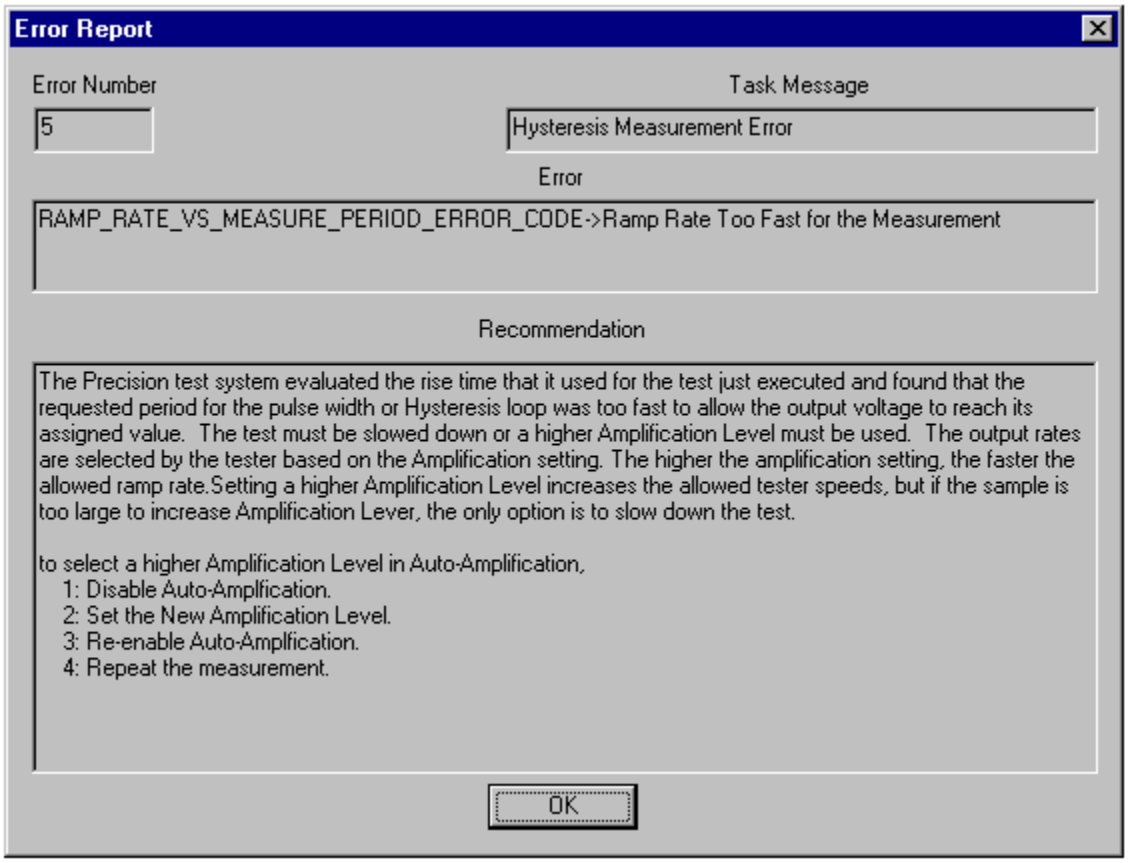
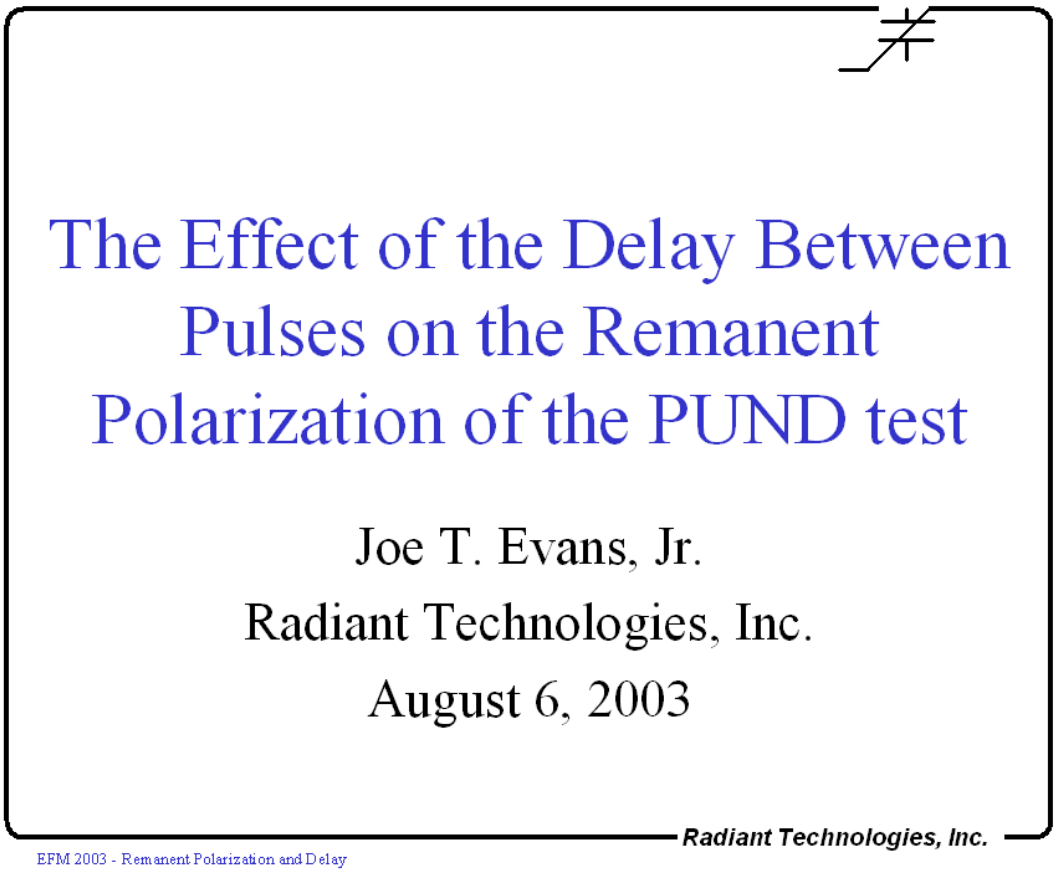


Figure 1 - Detailed Error Reporting Dialog

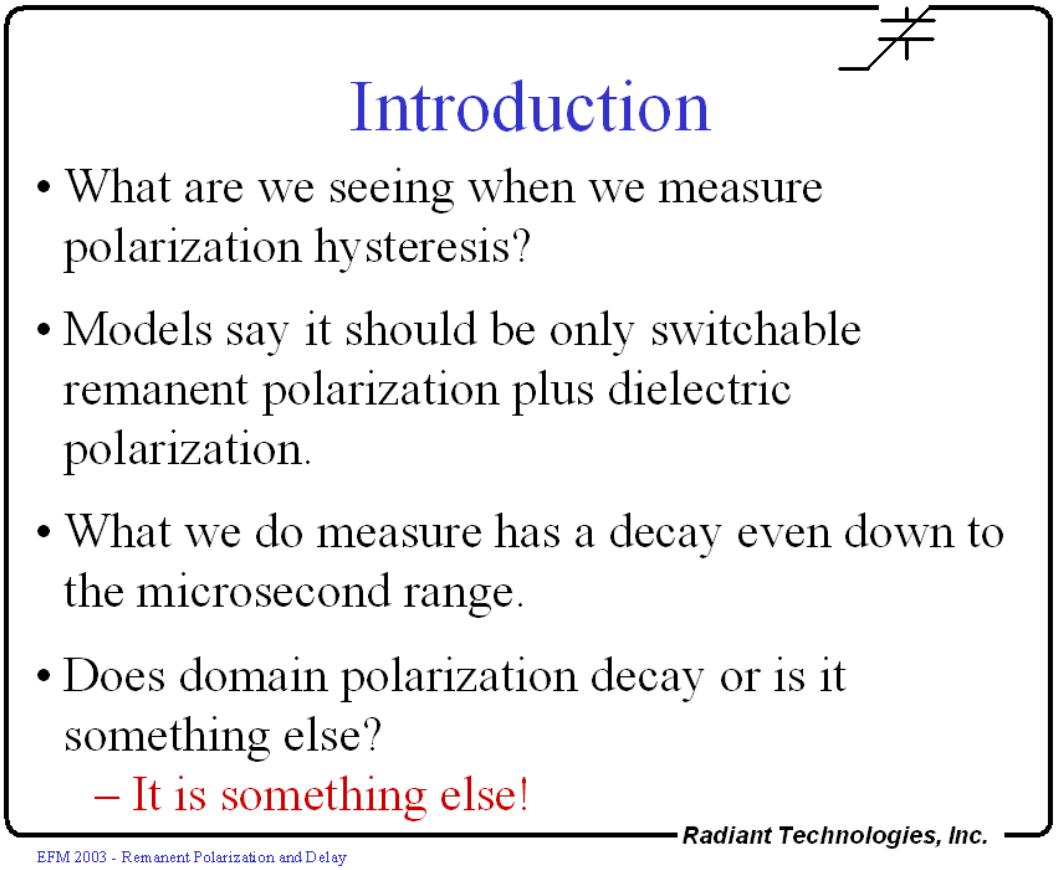
Application Notes

The application notes below, and many other resources, can also be found at the Radiant Technologies Support Page.

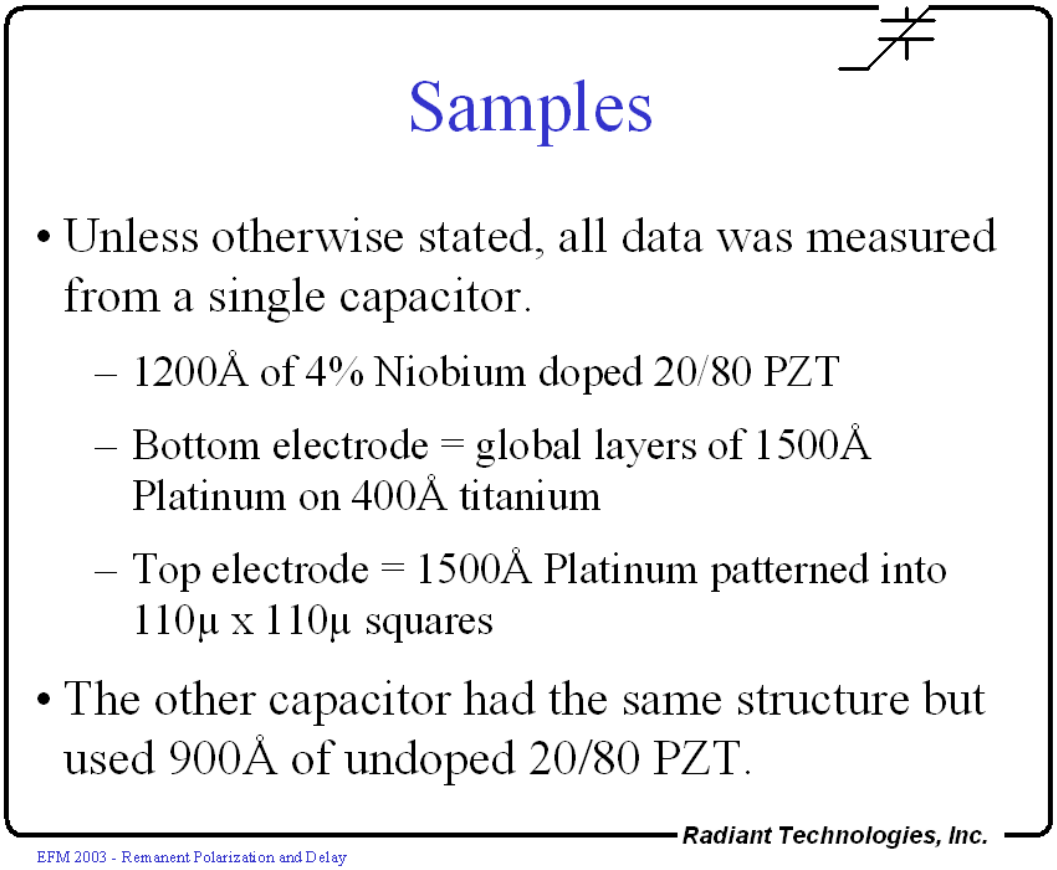
Remanent Polarization Study and the "Gap" - EMF 2003



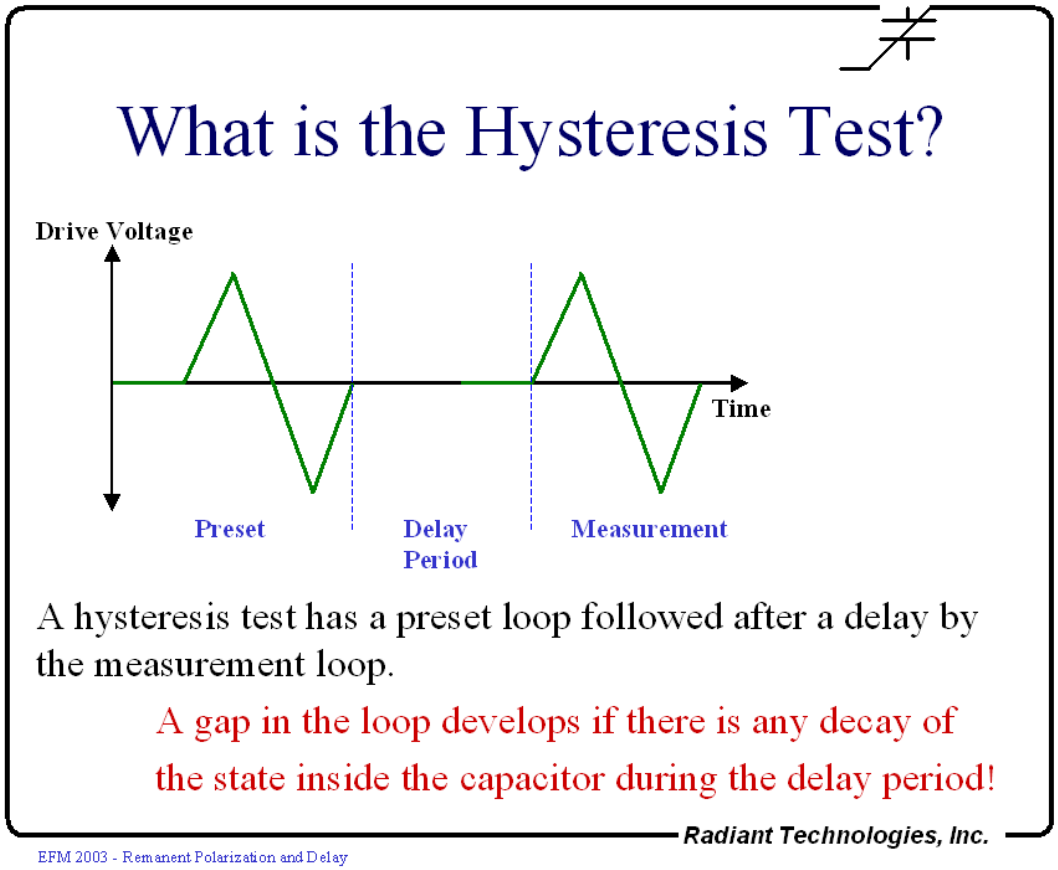
Slide 1 - Title Page



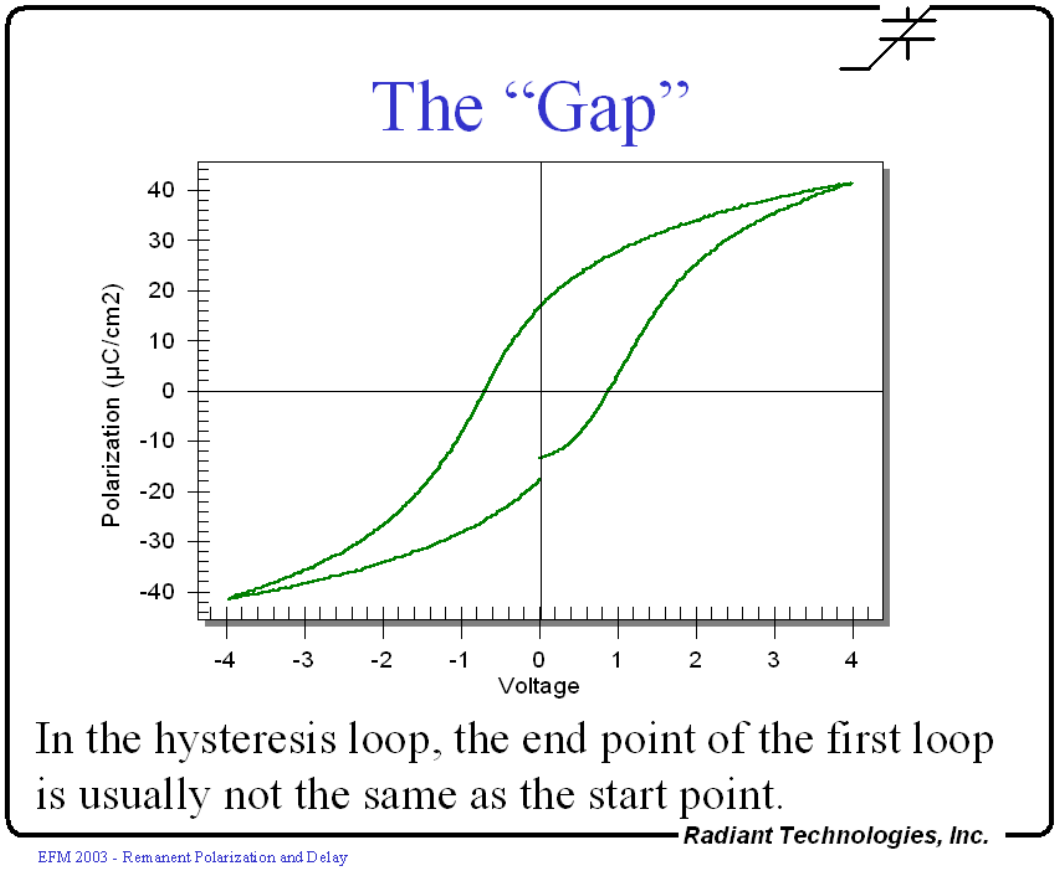
Slide 2 - Introduction.



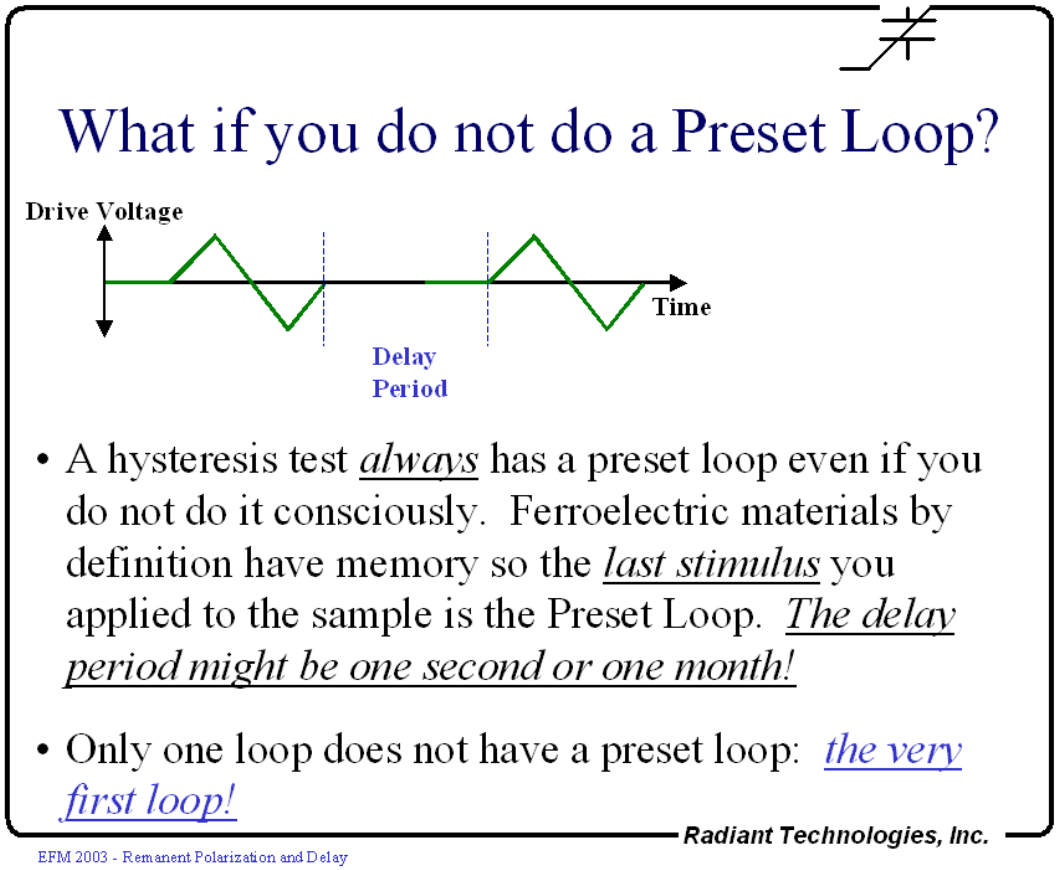
Slide 3 - Samples.



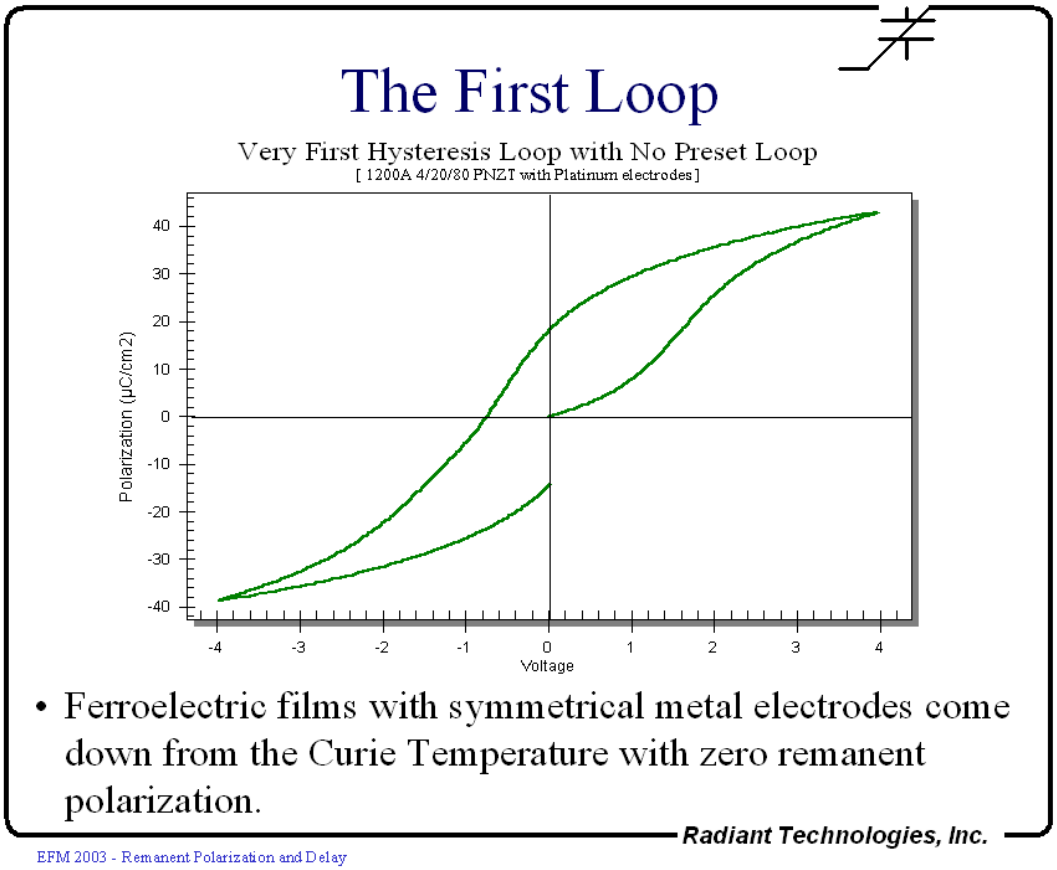
Slide 4 - Defining the Hysteresis Measurement.



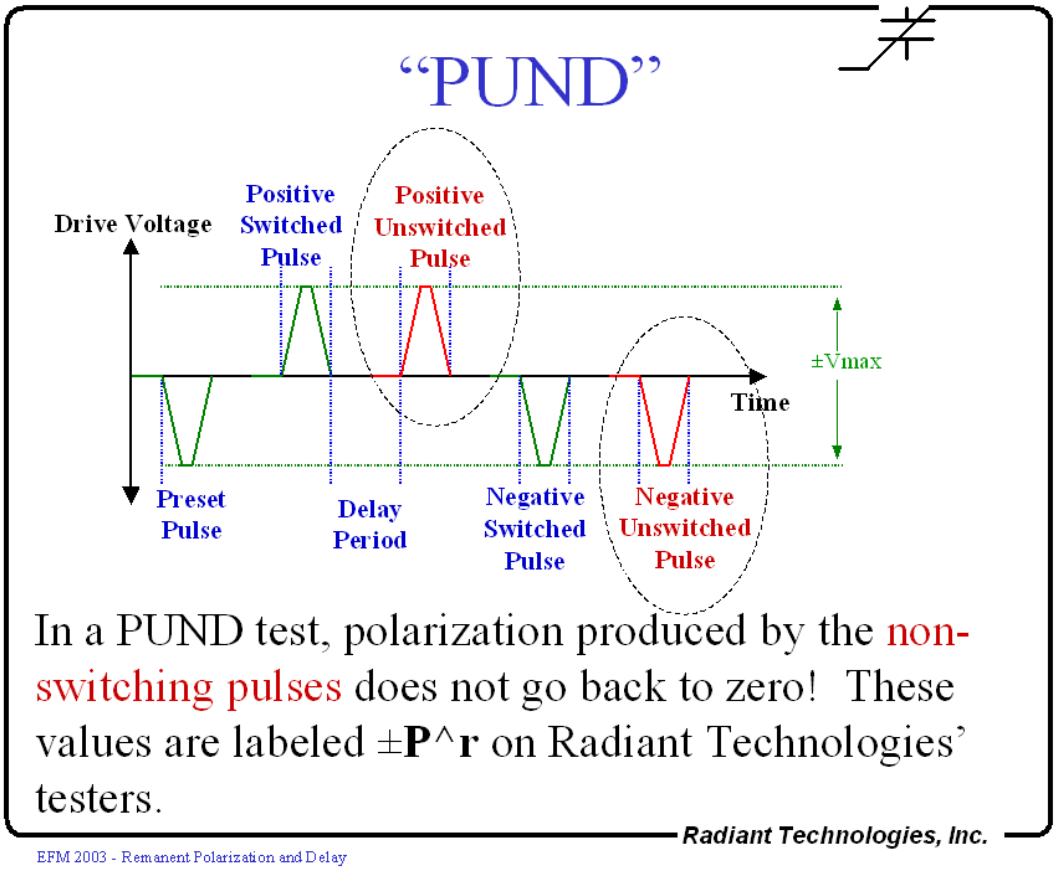
Slide 5 - Defining the "Gap".



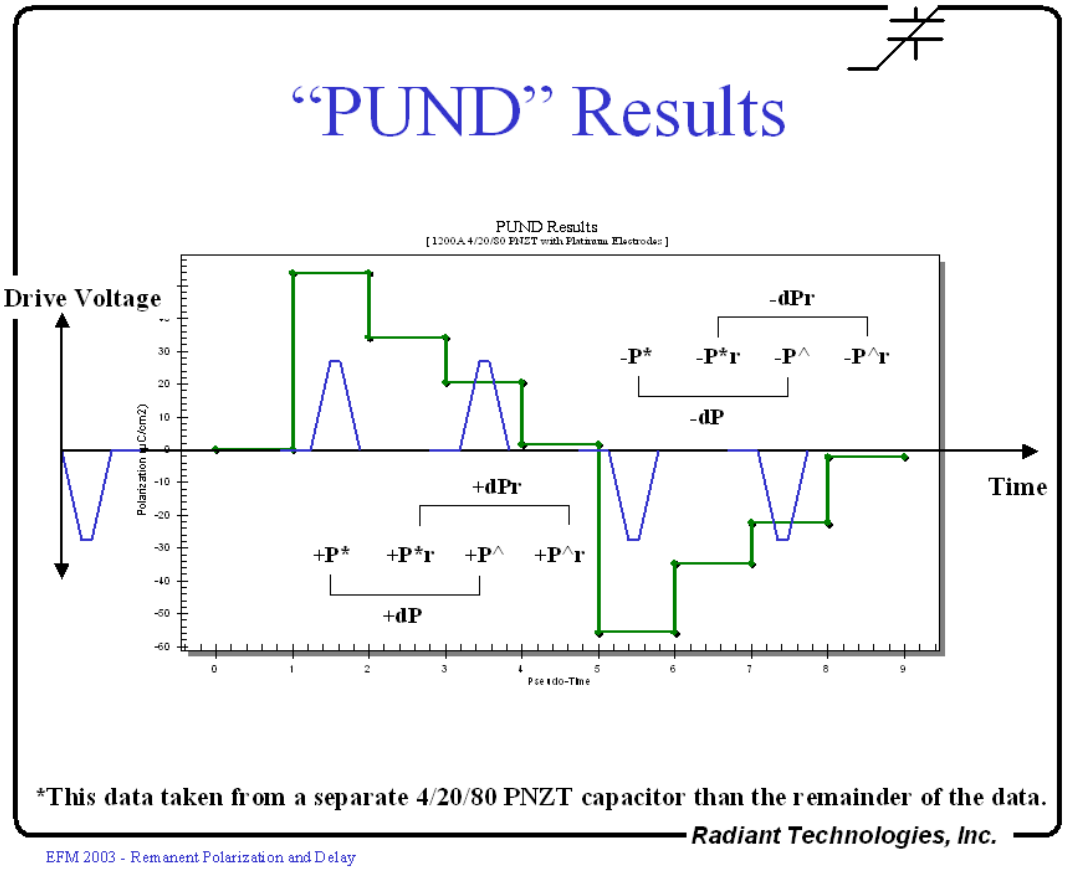
Slide 6 - Effects of Sample Preset.



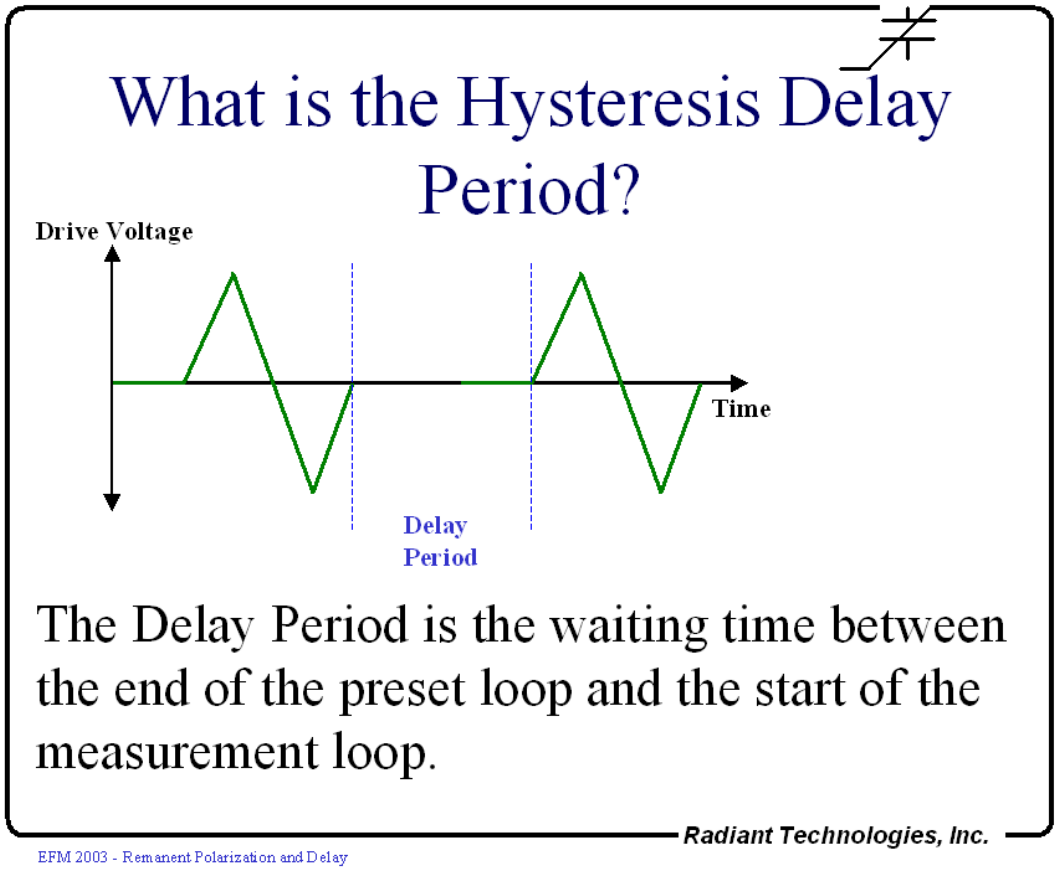
Slide 7 - A Virgin Hysteresis Loop.



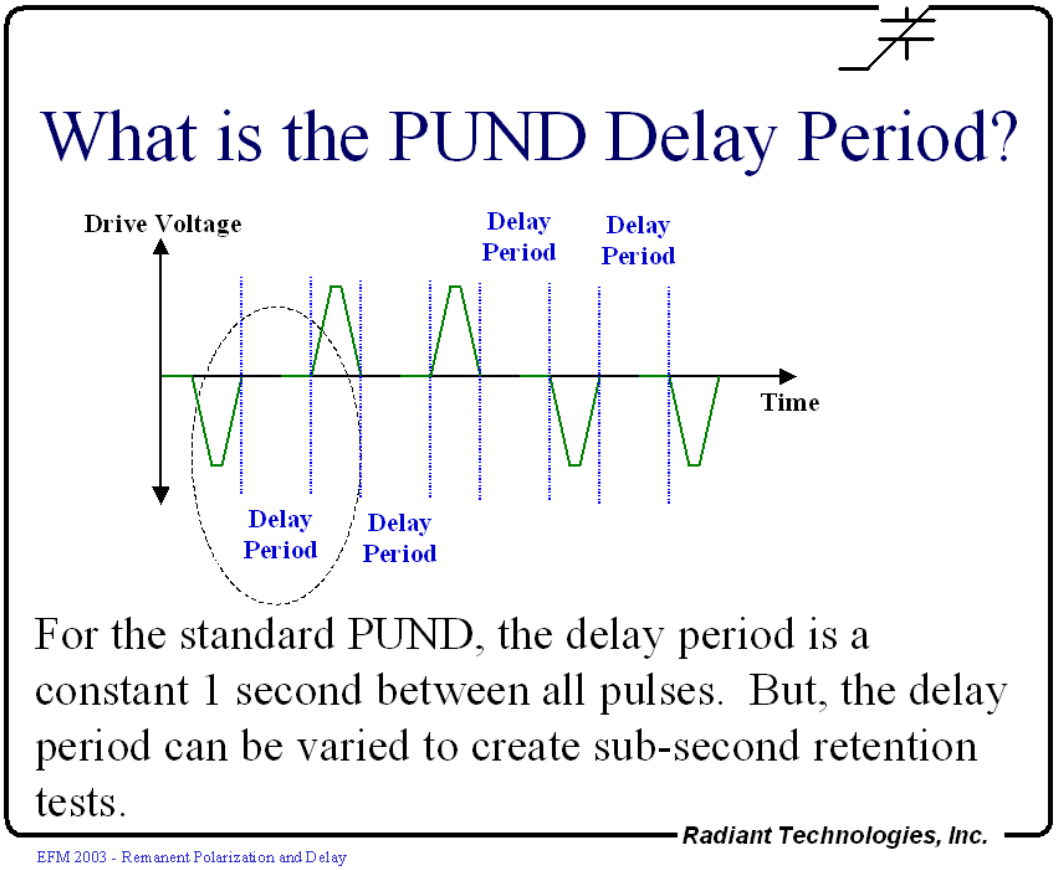
Slide 8 - Defining the PUND Test.



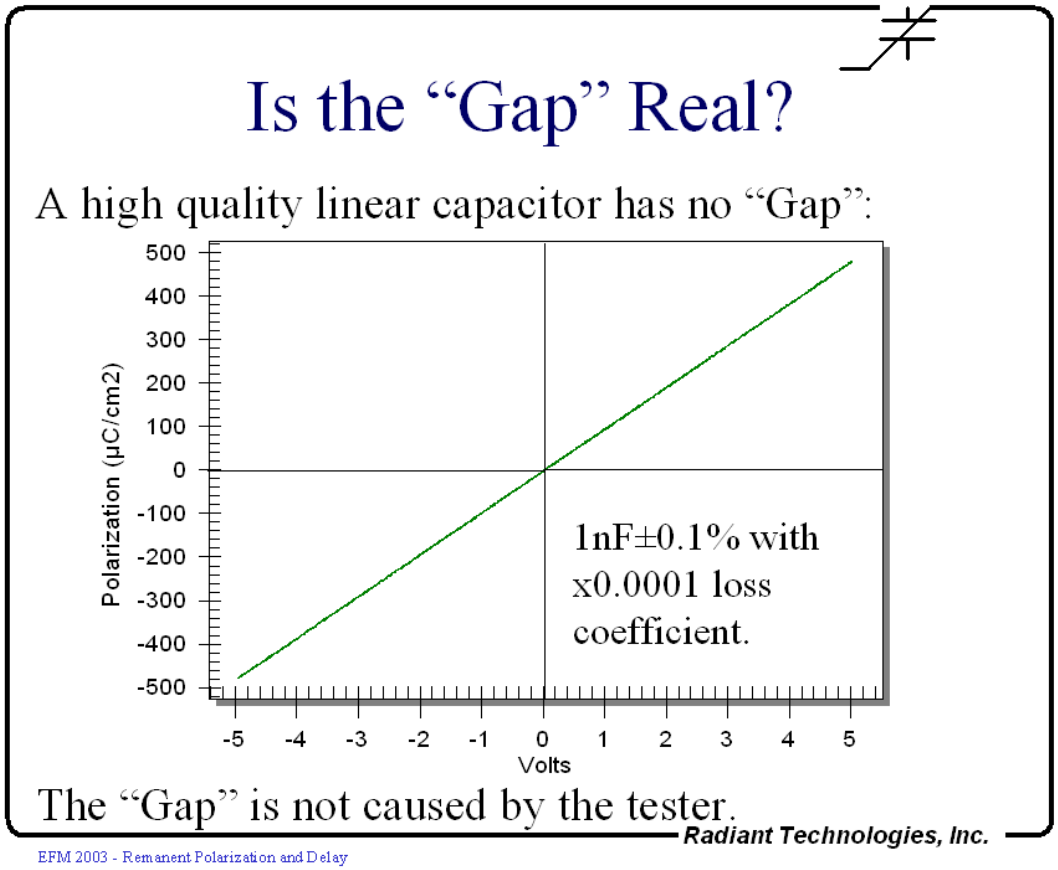
Slide 9 - PUND Results.



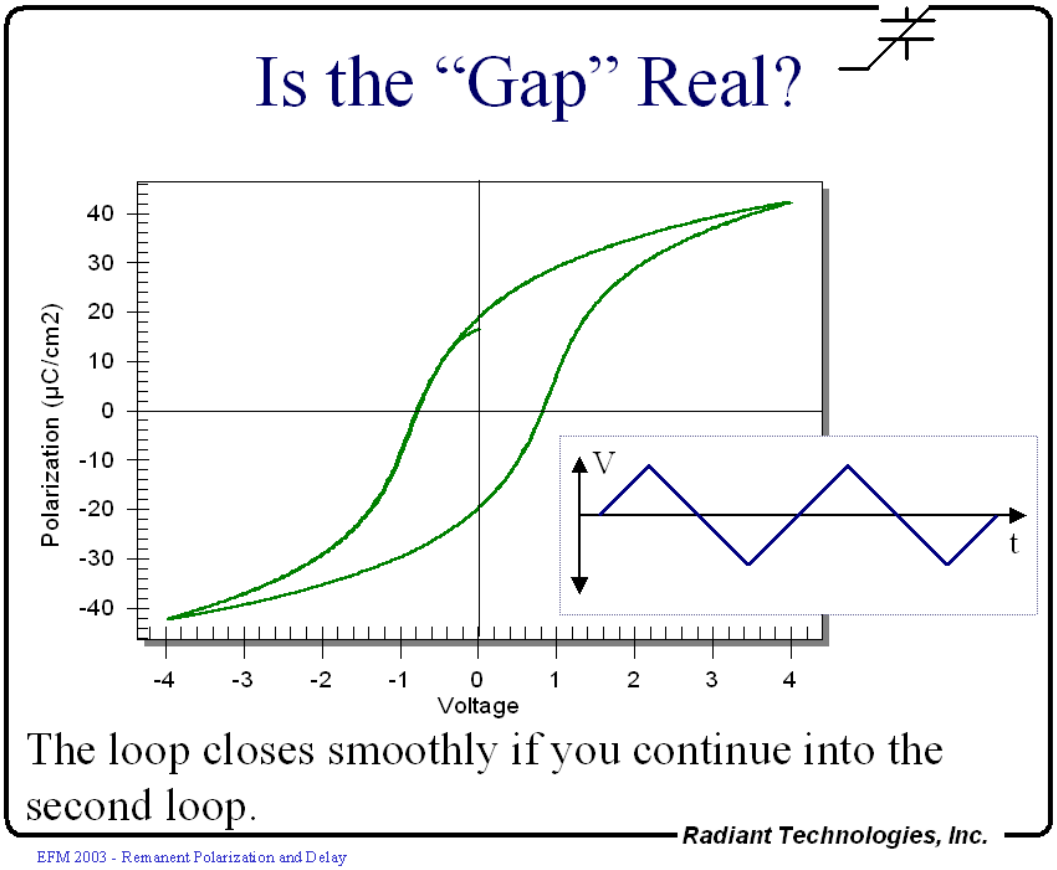
Slide 10 - Defining the Hysteresis Delay.



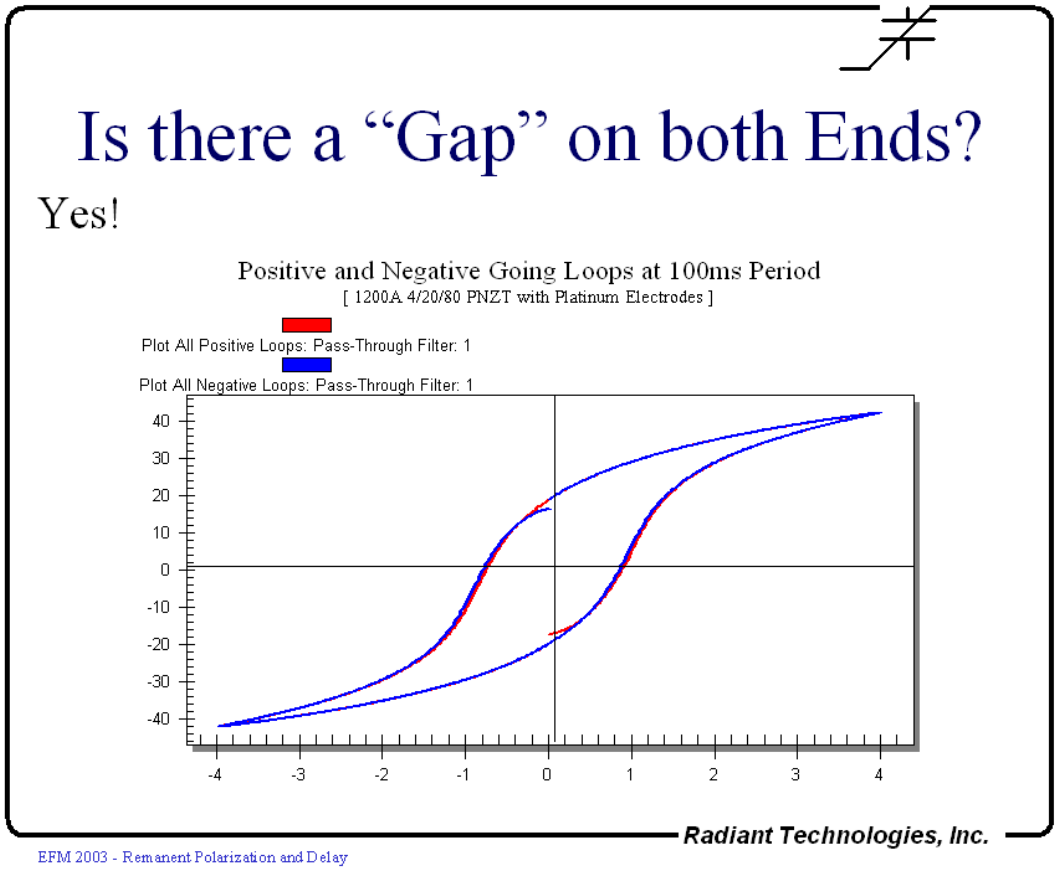
Slide 11 - Defining the PUND Delay.



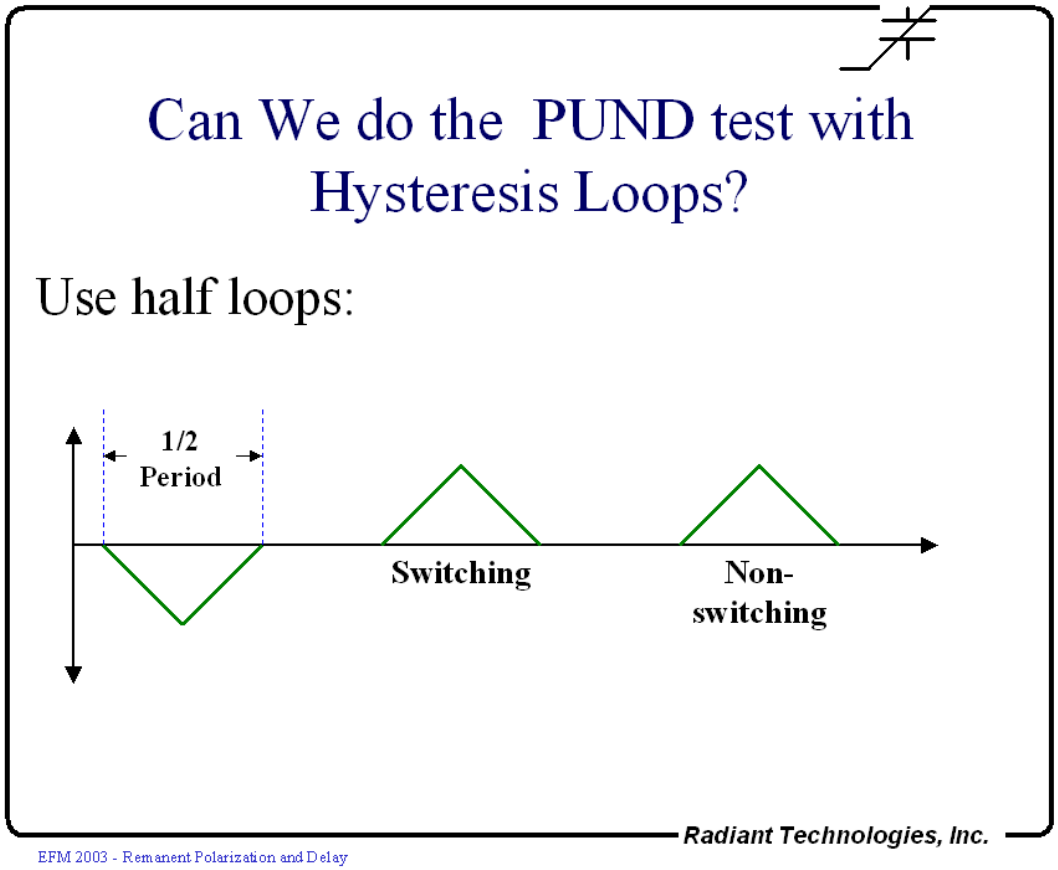
Slide 12 - Is the Gap Real?



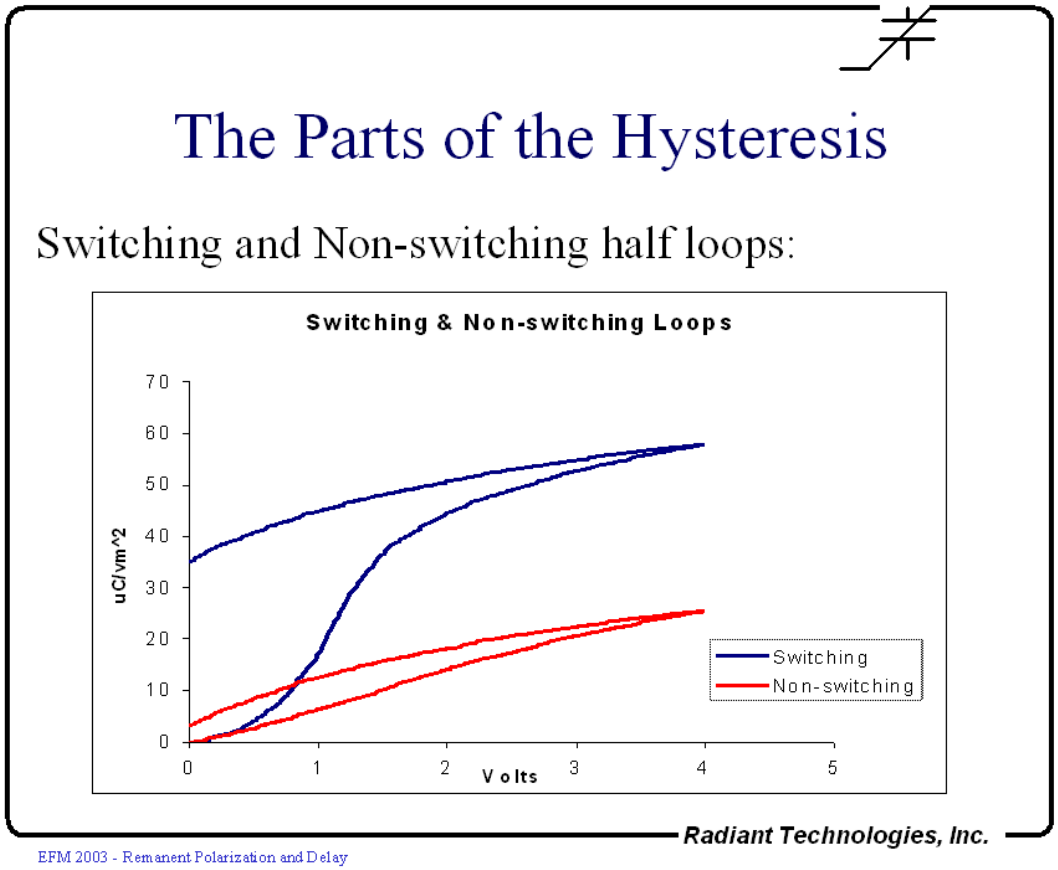
Slide 13 - Is the Gap Real? Slide 2.



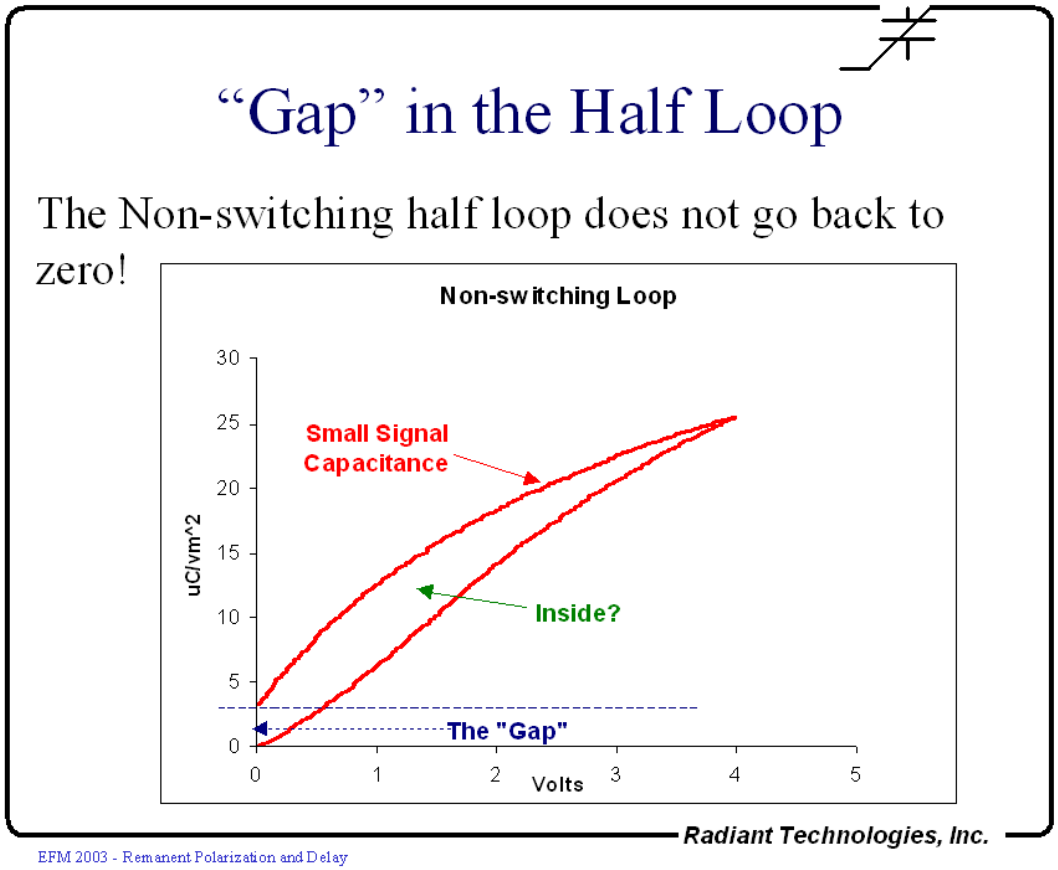
Slide 14 - Is There a Gap on Both Ends?



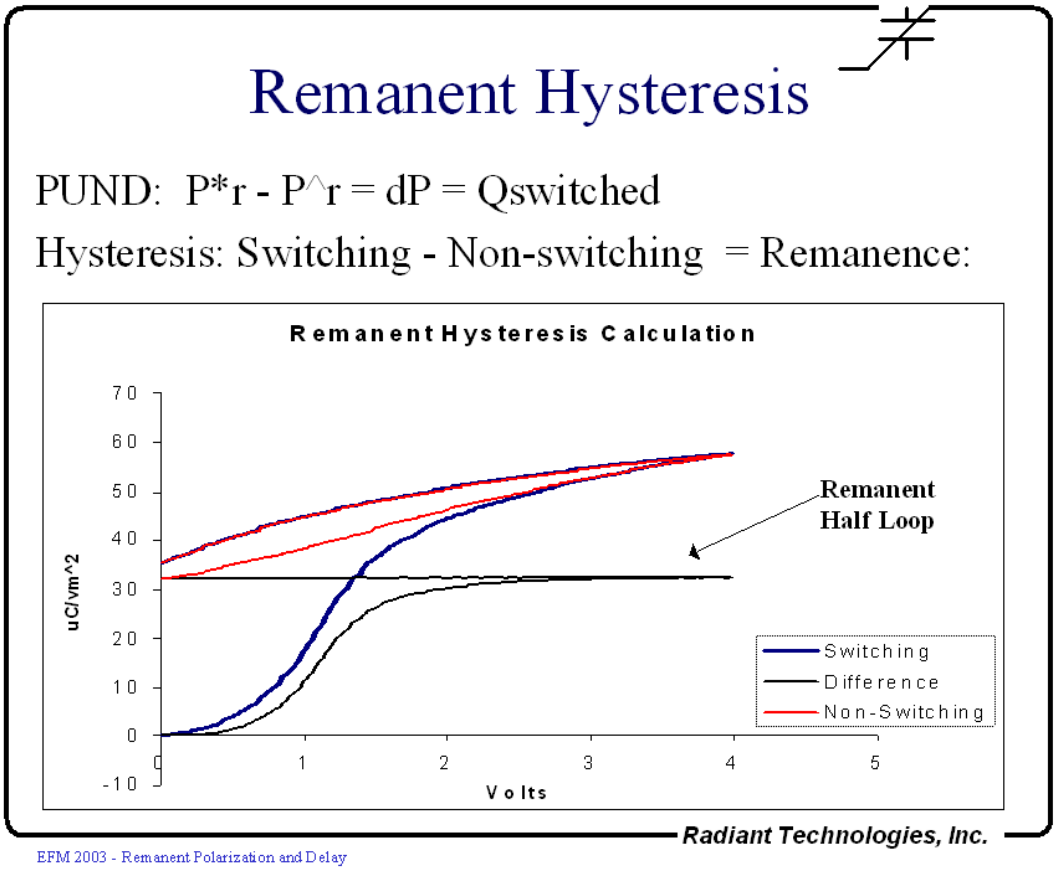
Slide 15 - PUND Using Hysteresis Loops.



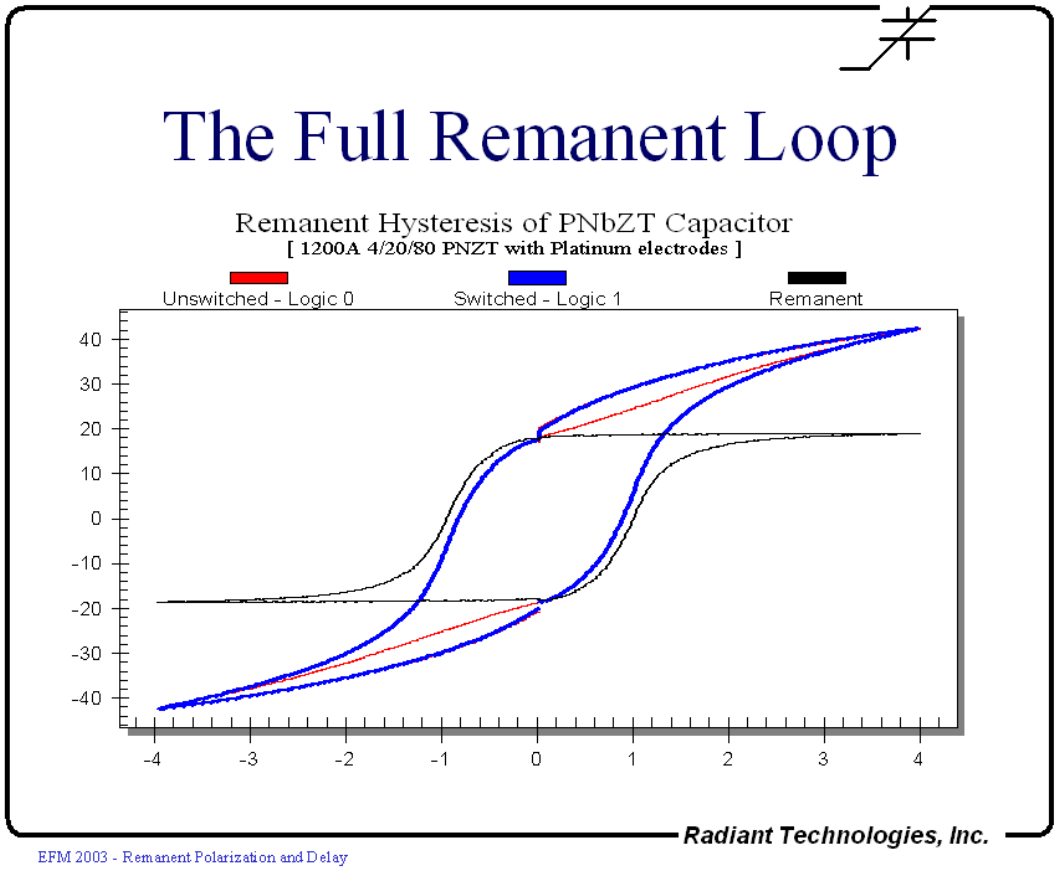
Slide 16 - Switching and Non-Switching Hysteresis Components.



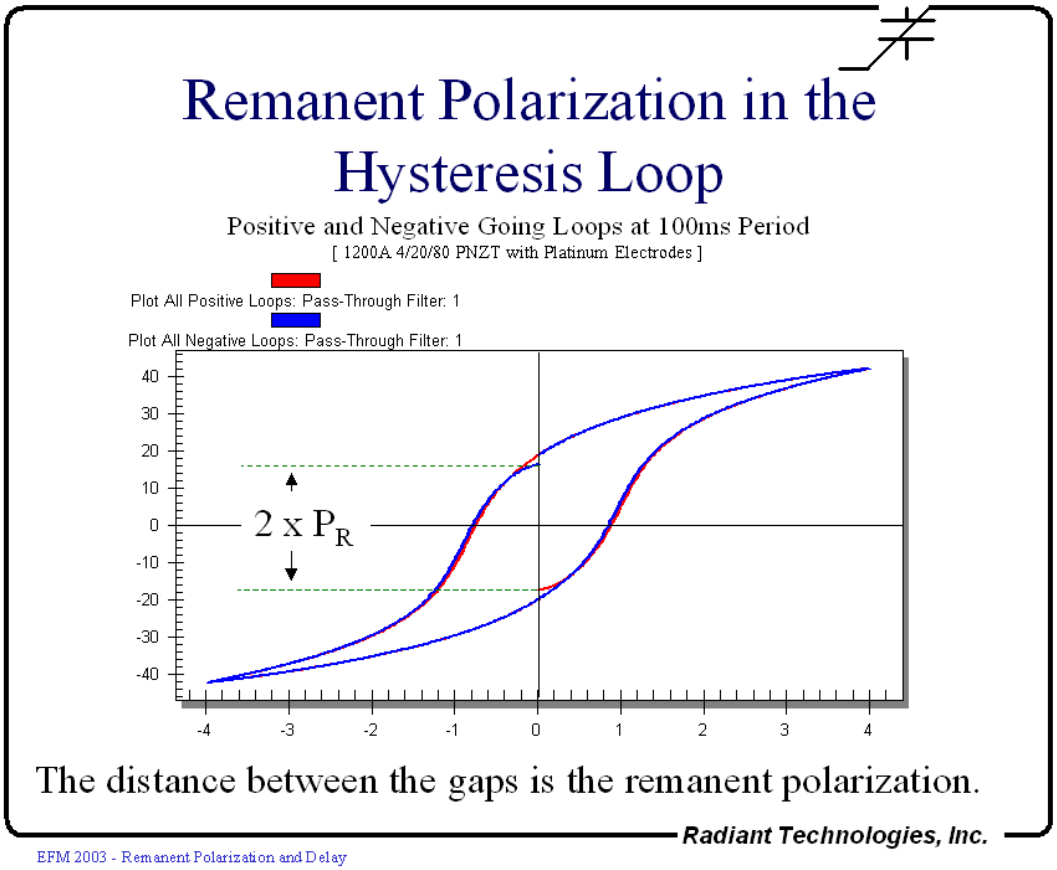
Slide 17 - "Gap" in the Half-Loop.



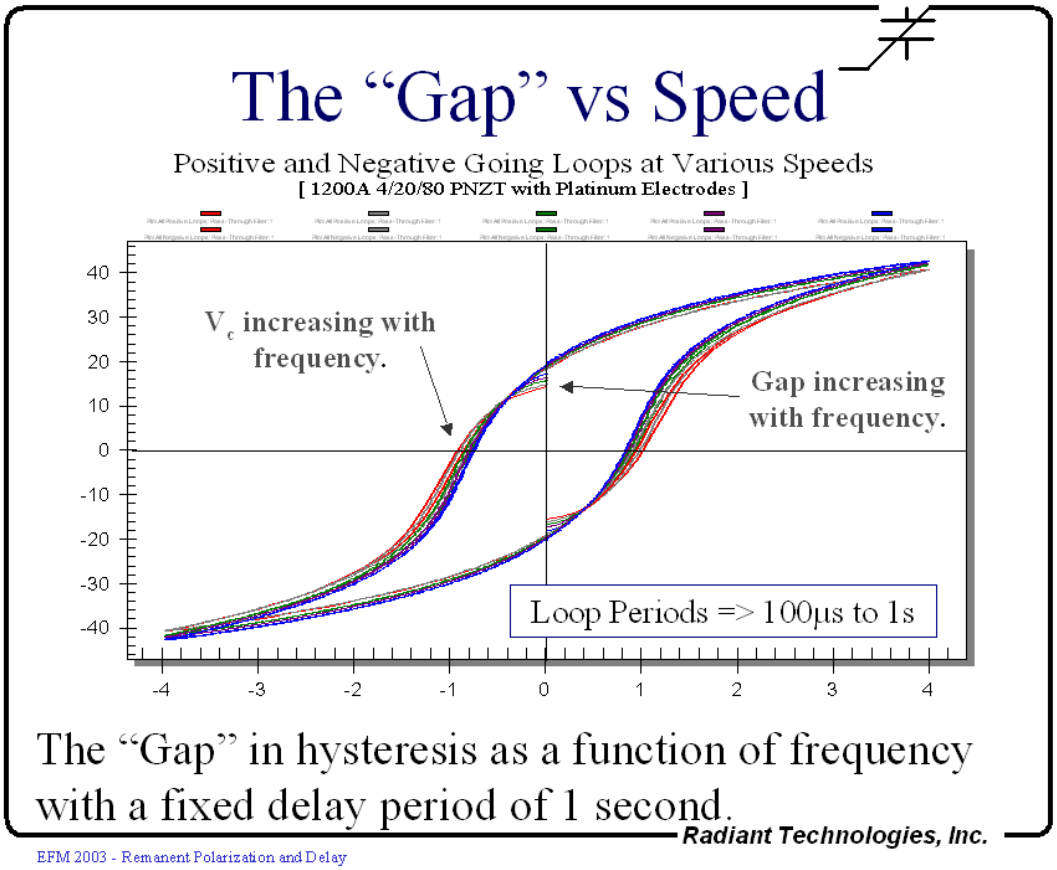
Slide 18 - Remanent Hysteresis.



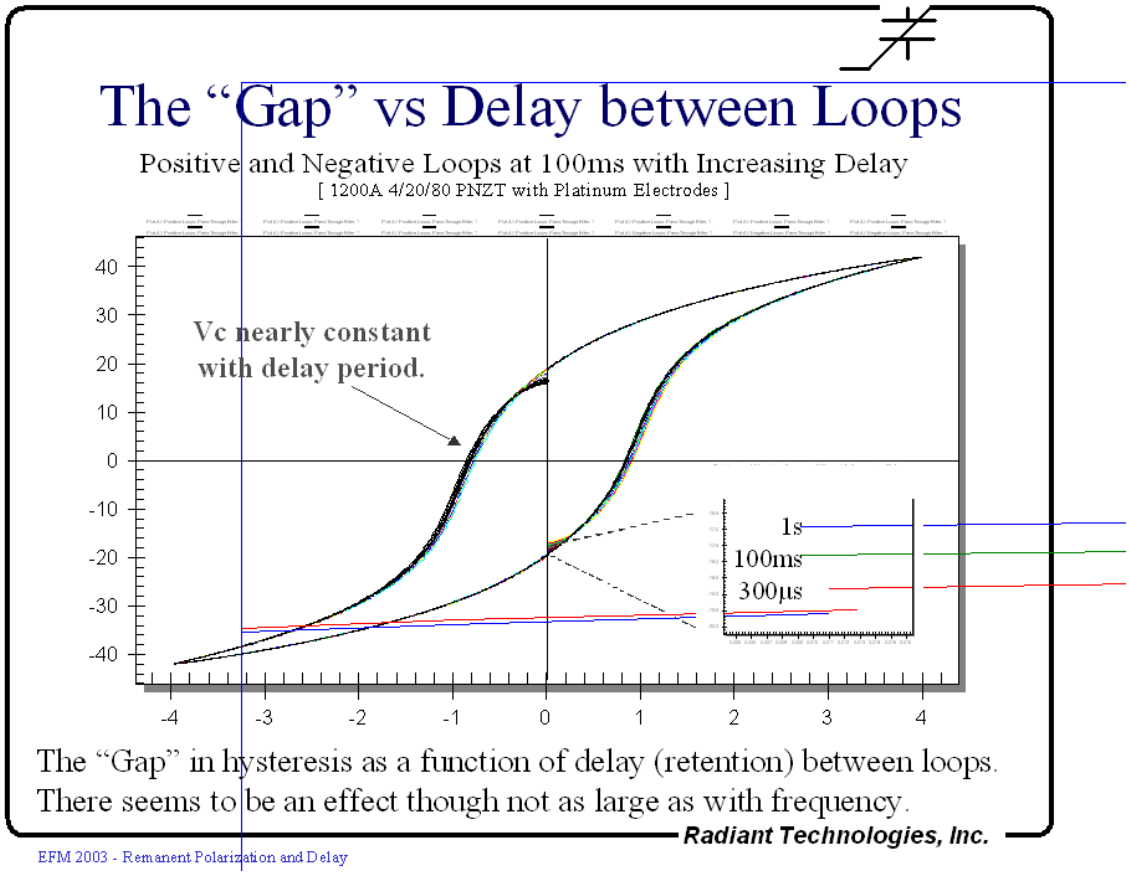
Slide 19 - The Full Remanent Loop.



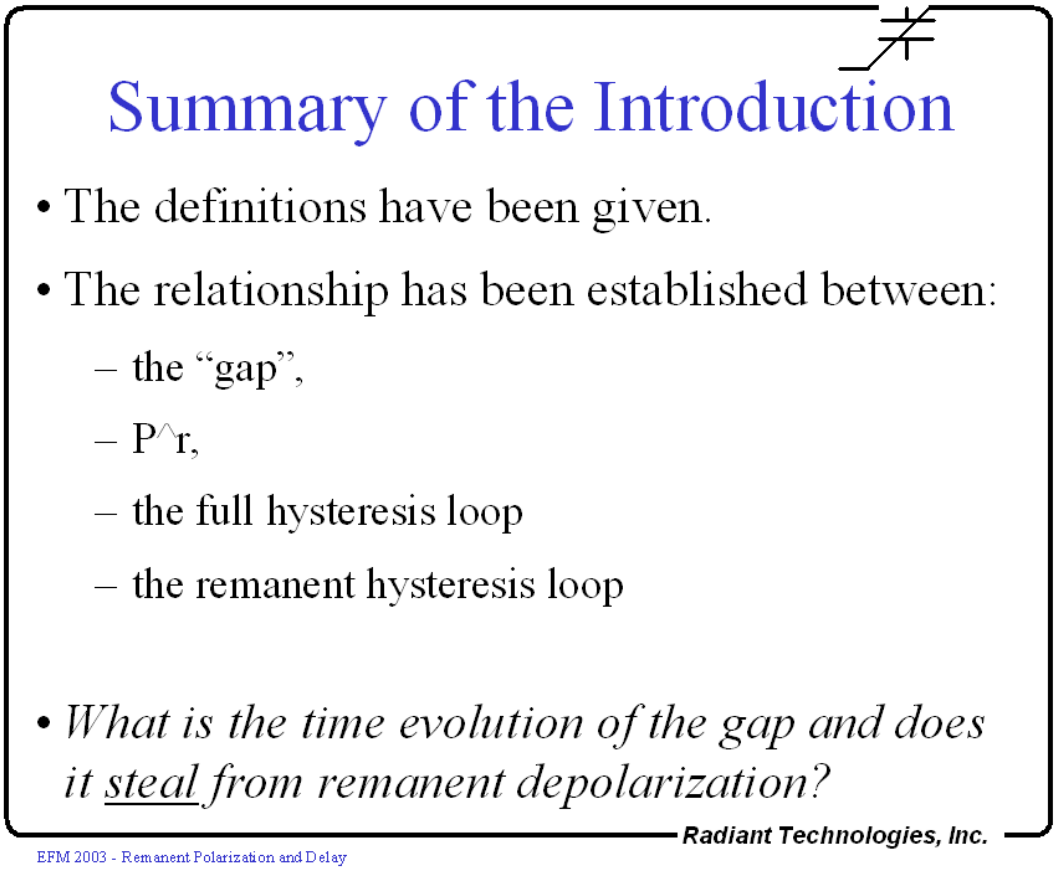
Slide 20 - Remanent Polarization in Hysteresis.



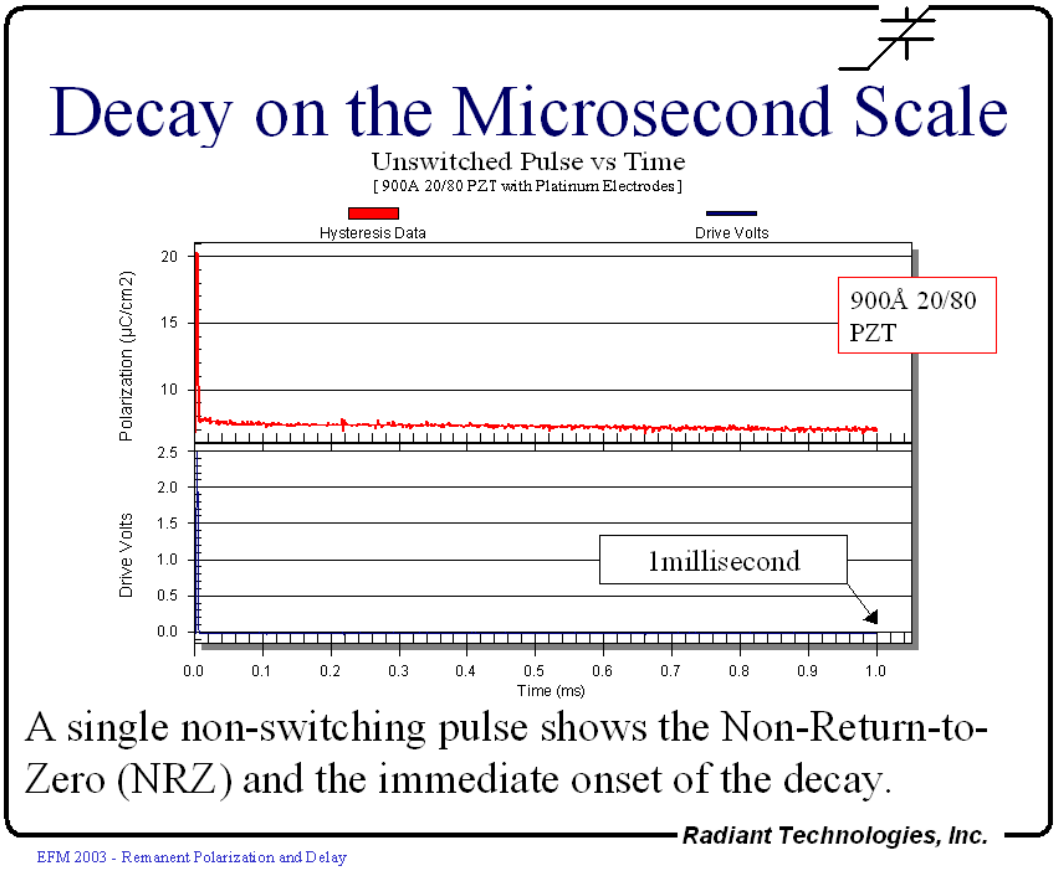
Slide 21 - The "Gap" Vs Speed.



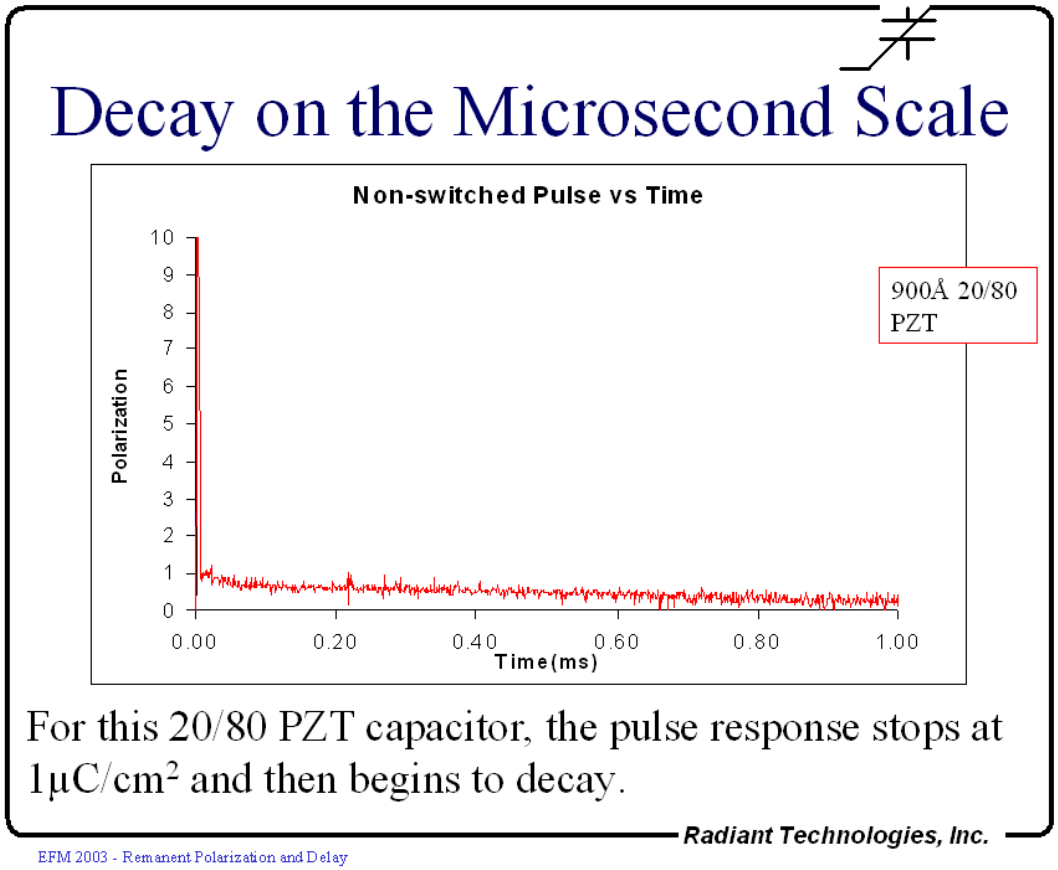
Slide 22 - The "Gap" Vs Delay.



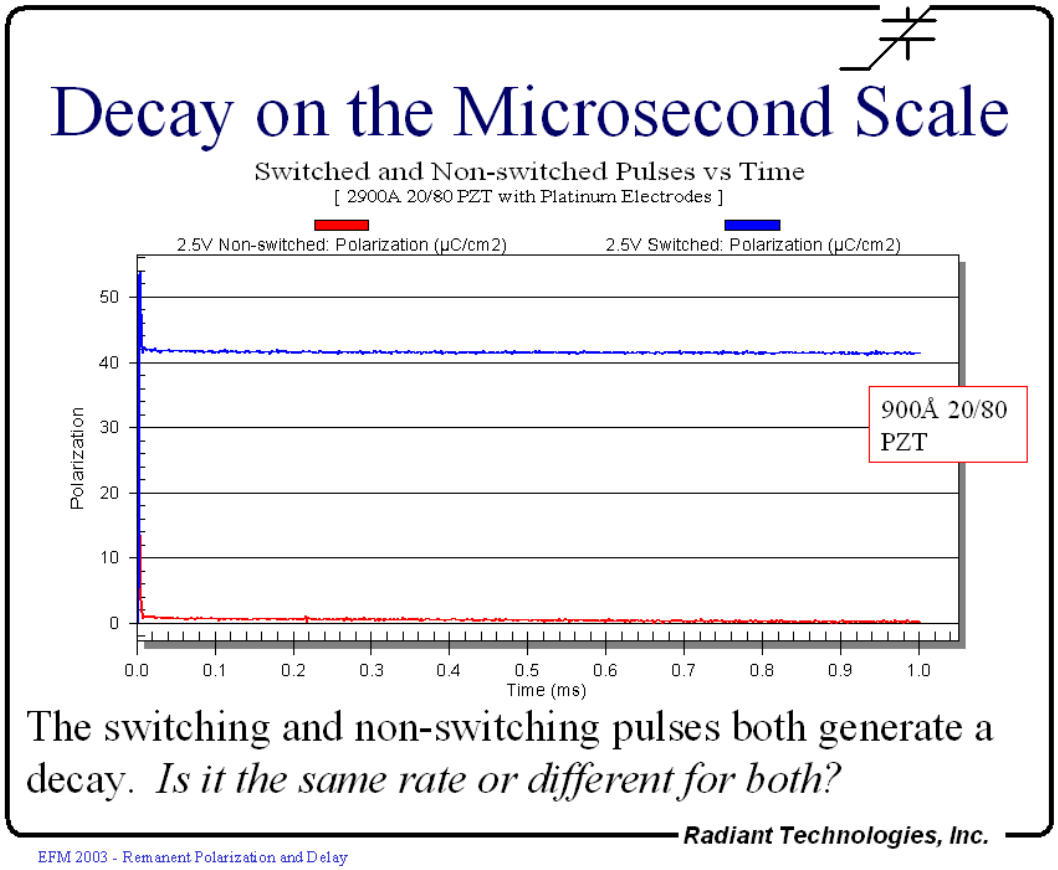
Slide 23 - Summary of the Introduction.



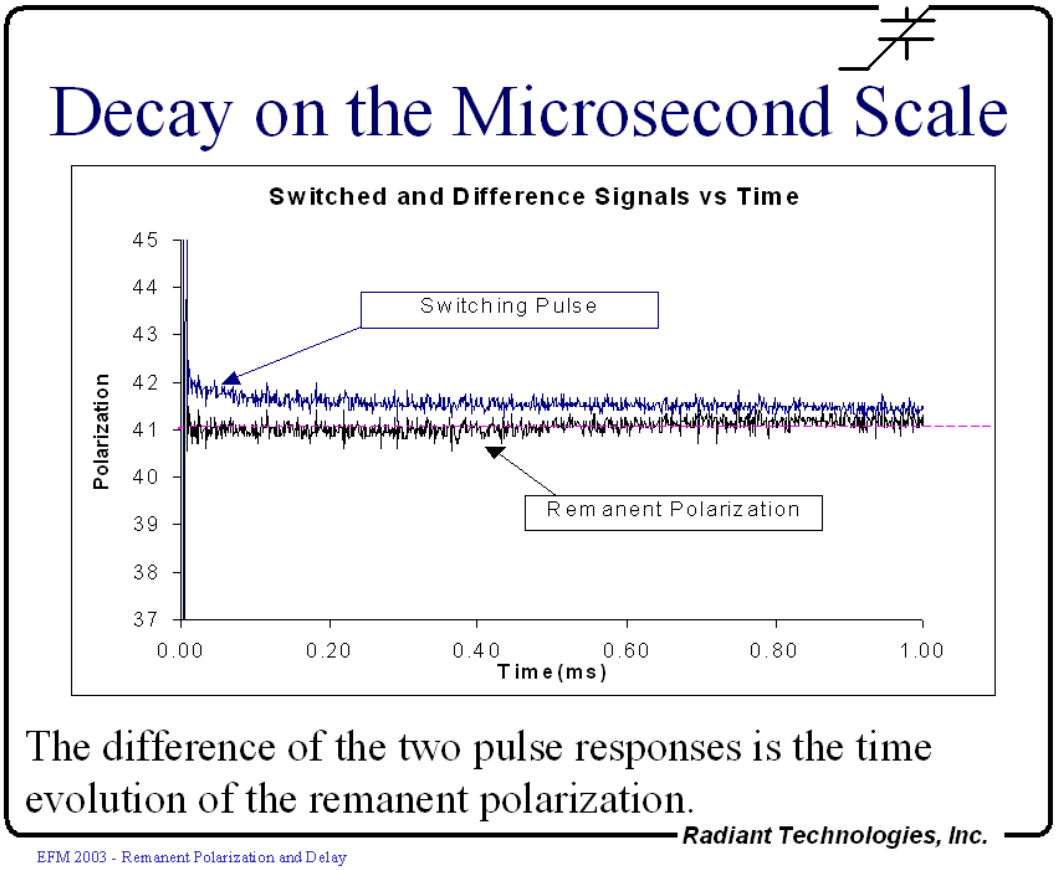
Slide 24 - Microsecond Delay.



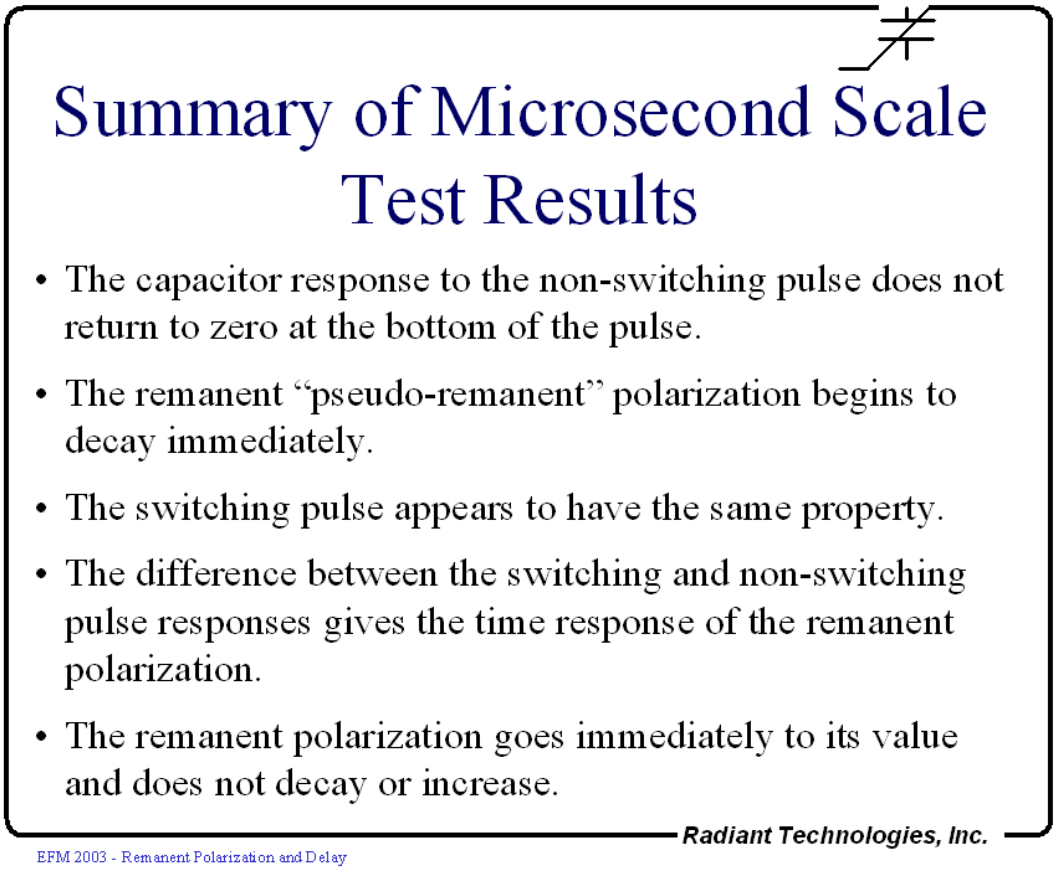
Slide 25 - Microsecond Delay. Slide 2.



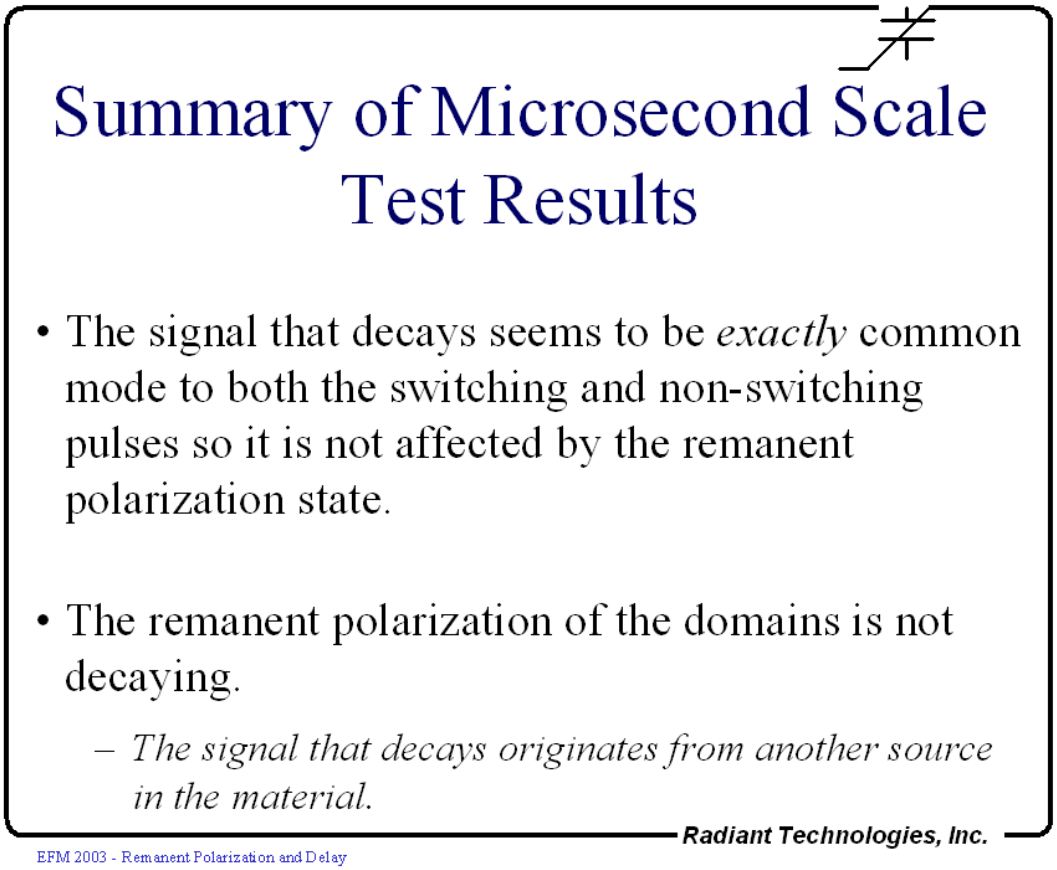
Slide 26 - Microsecond Delay. Slide 3.



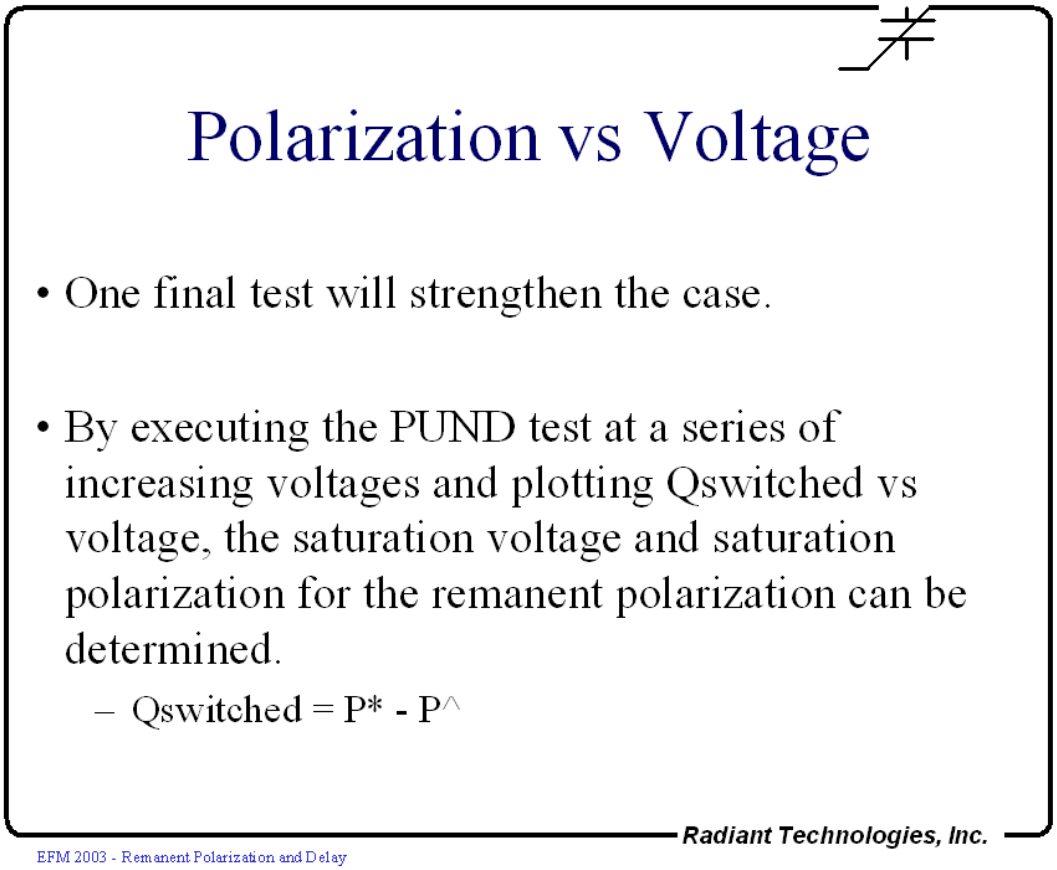
Slide 27 - Microsecond Delay. Slide 4.



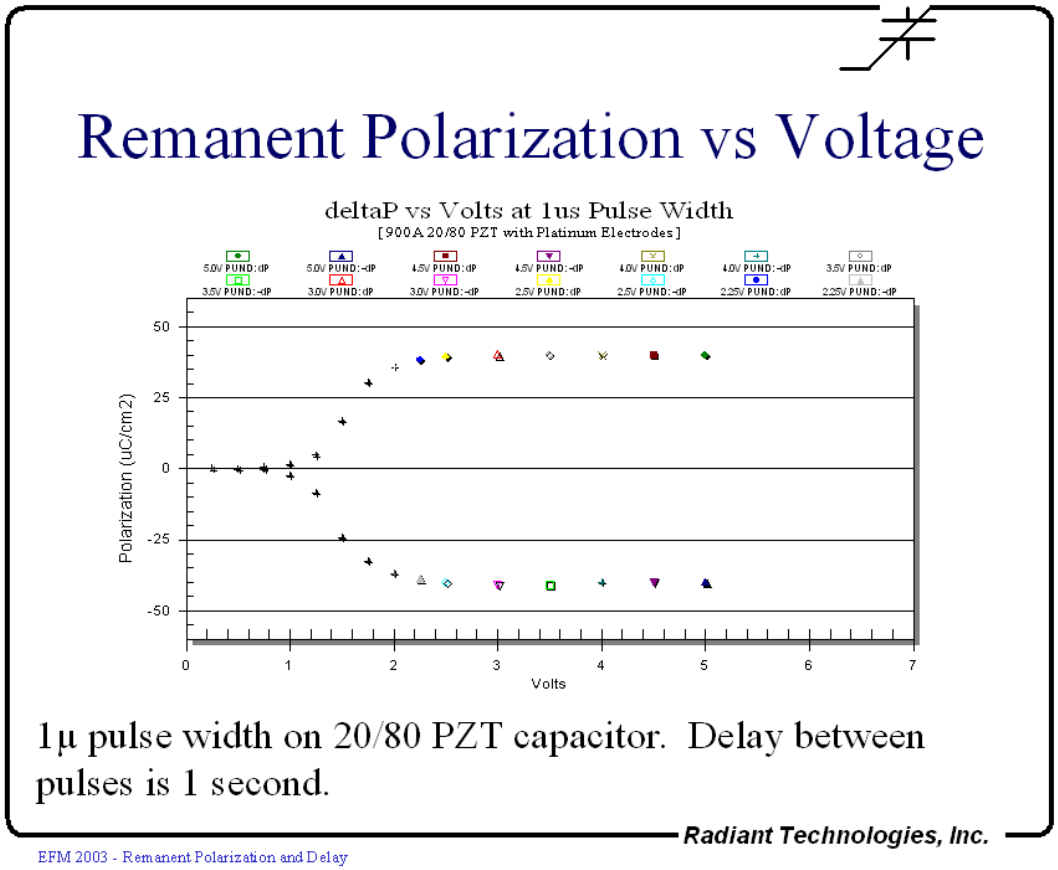
Slide 28 - Test Results Summary.



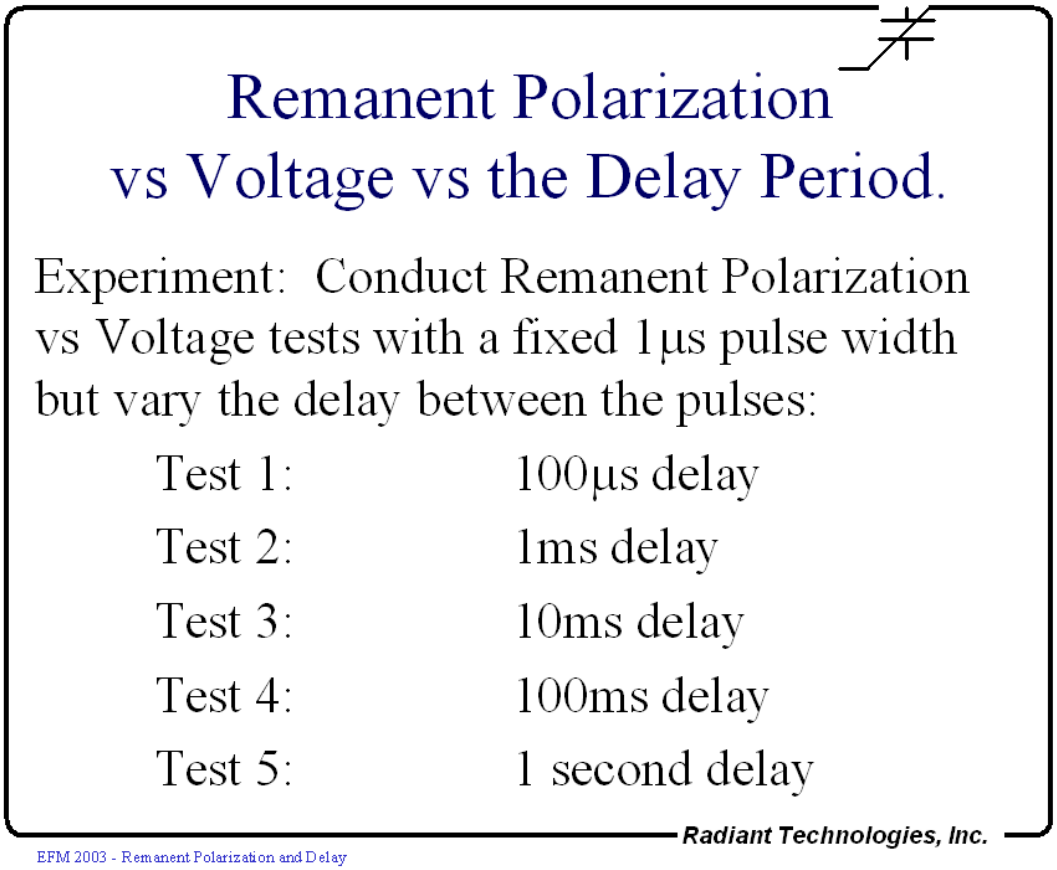
Slide 29 - Test Results Summary Page 2.



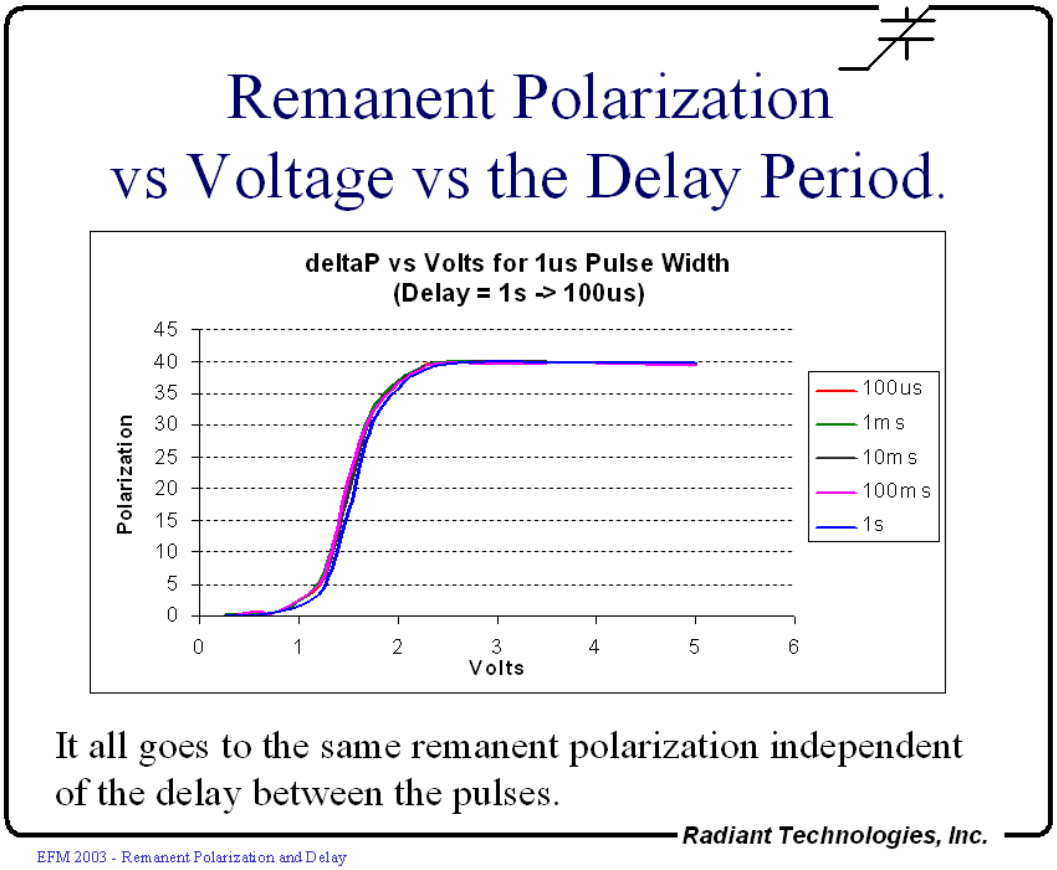
Slide 30 - Polarization Vs Voltage.



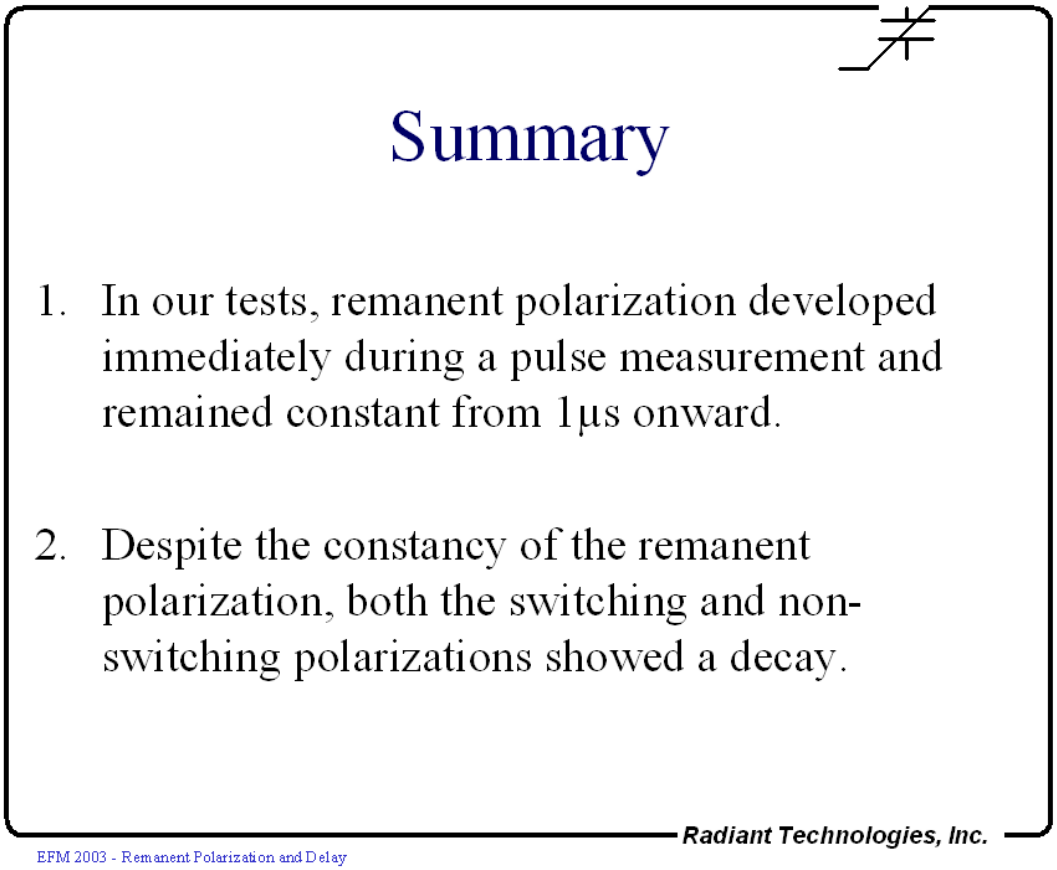
Slide 31 - Remanent Polarization Vs Voltage.



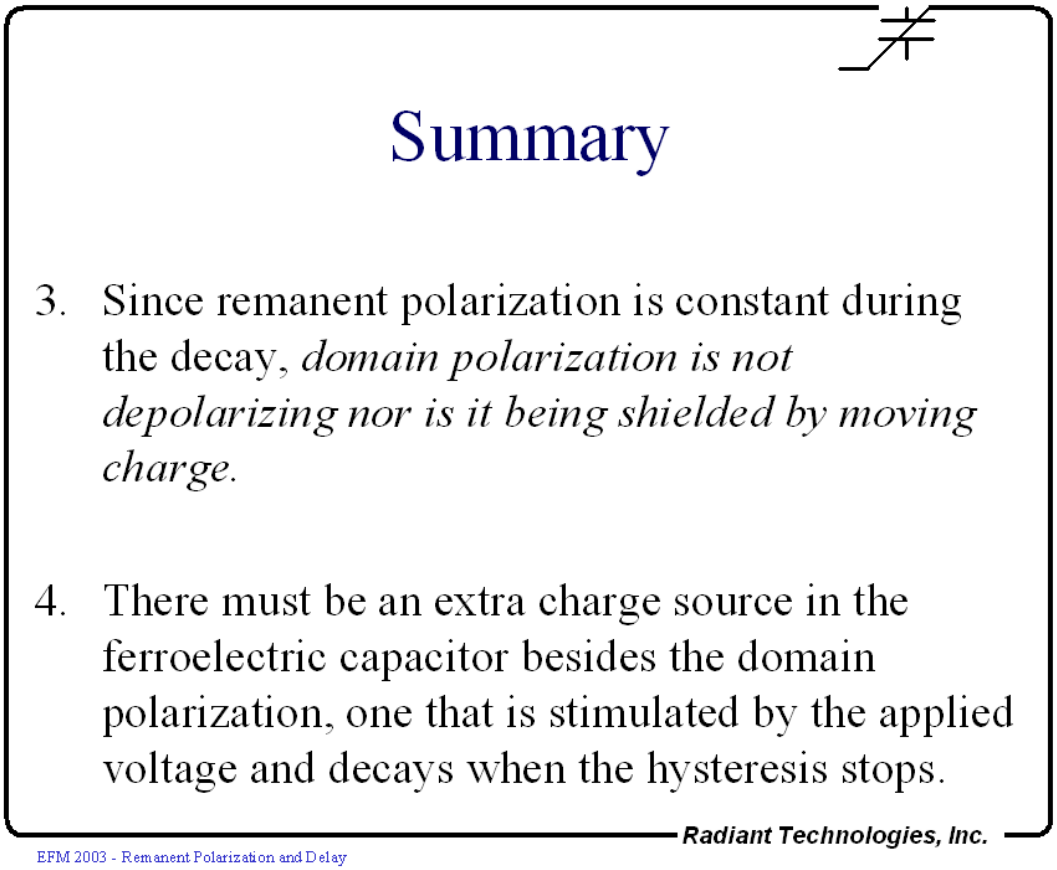
Slide 32 - Remanent Polarization Vs Voltage & Delay.



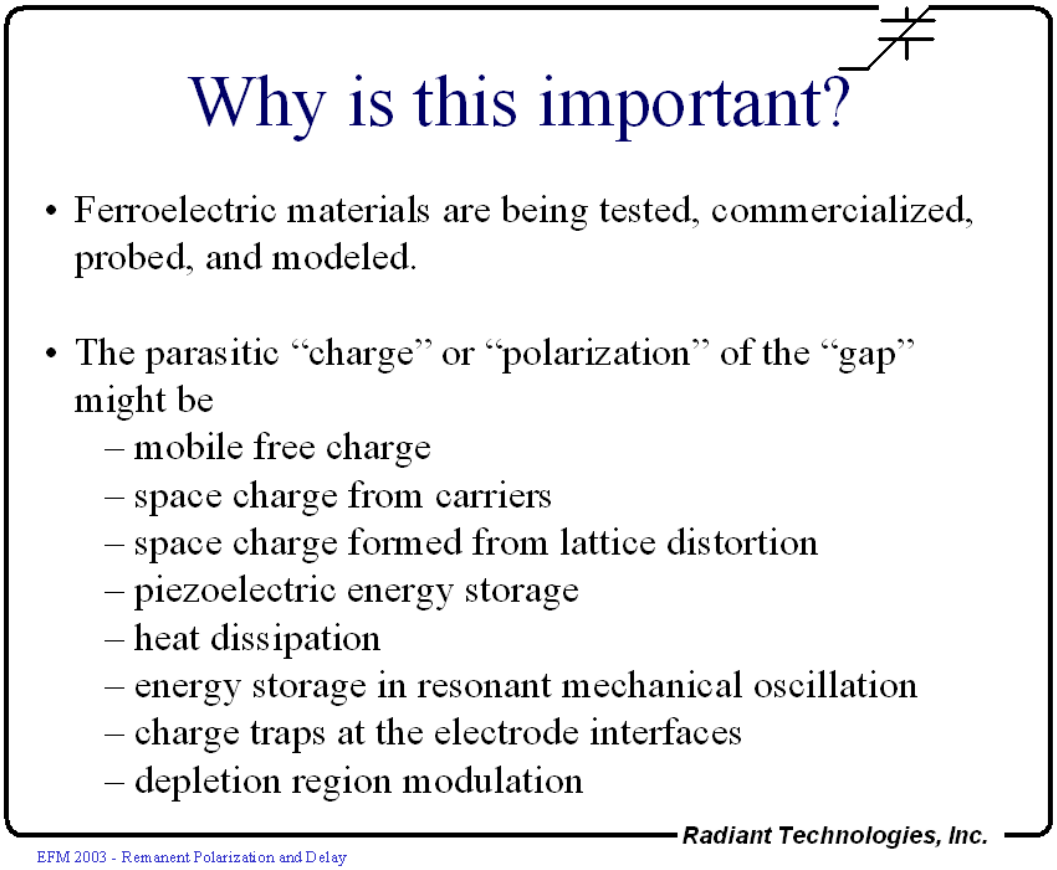
Slide 33 - Remanent Polarization Vs Voltage & Delay. Slide 2.



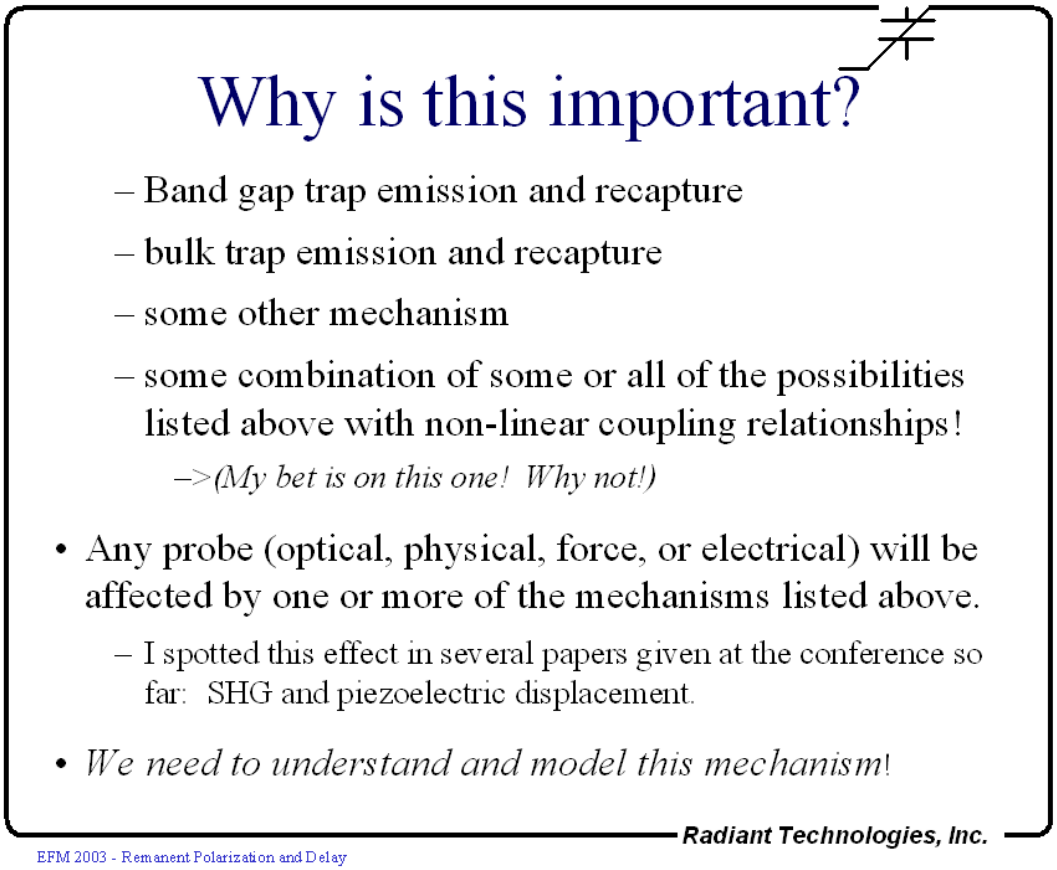
Slide 34 - Summary.



Slide 35 - Summay. Slide 2.



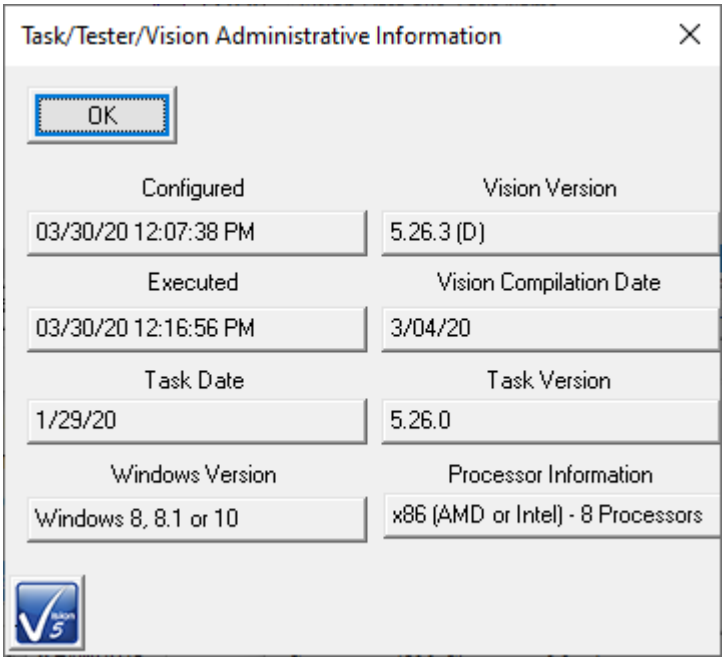
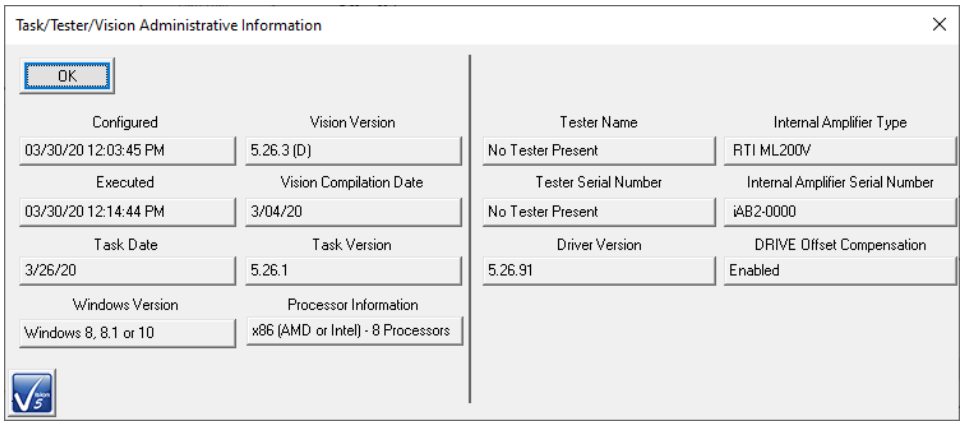
Slide 36 - Why is this Important?.



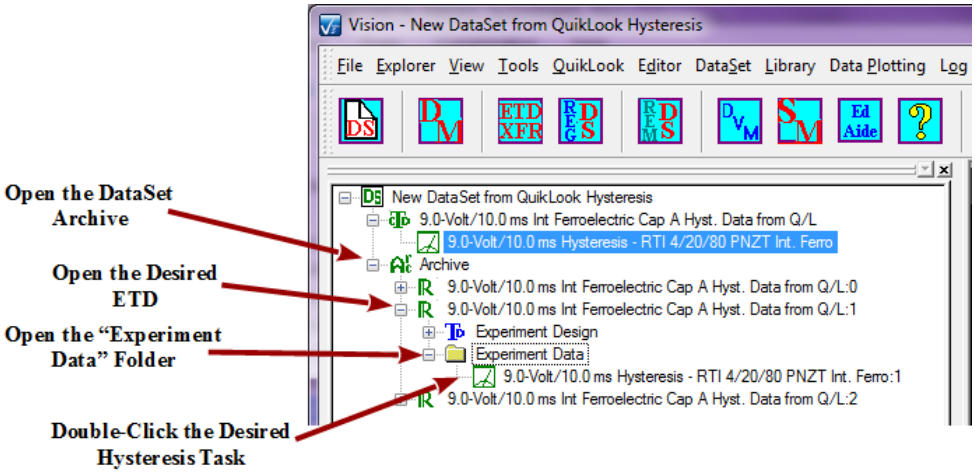
Slide 37 - Why is this Important?. Slide 2.

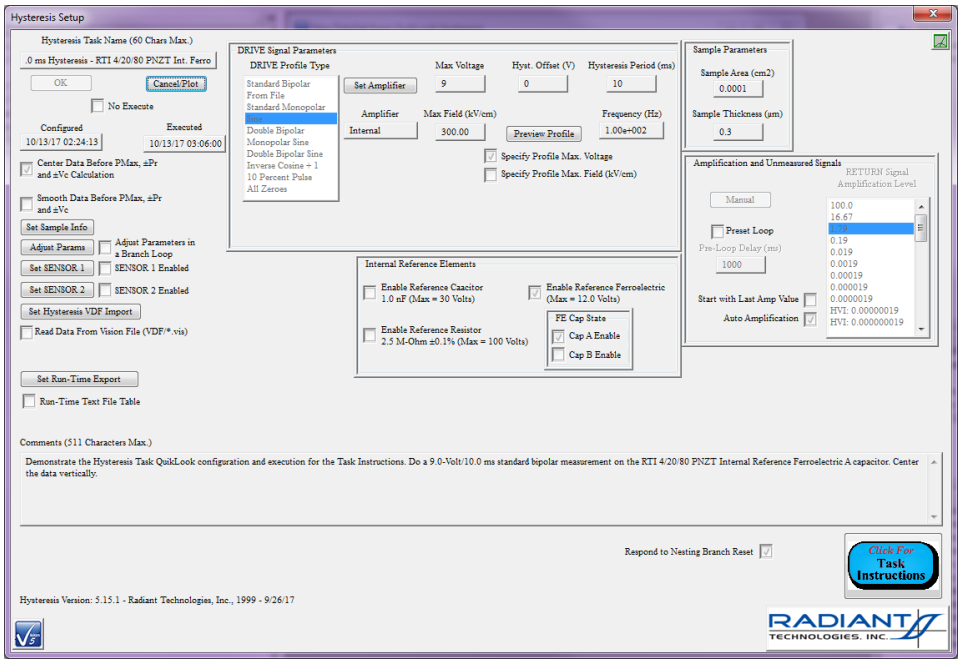
Glossary

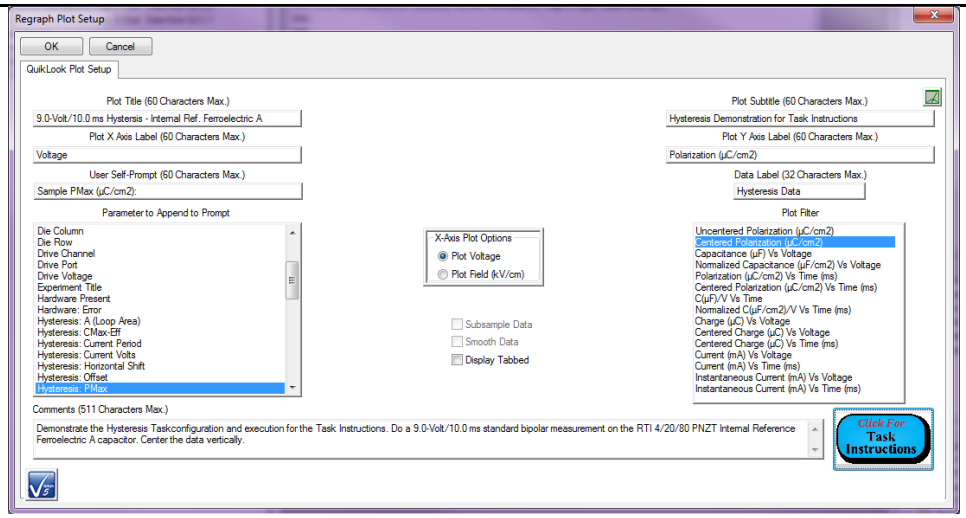
Glossary

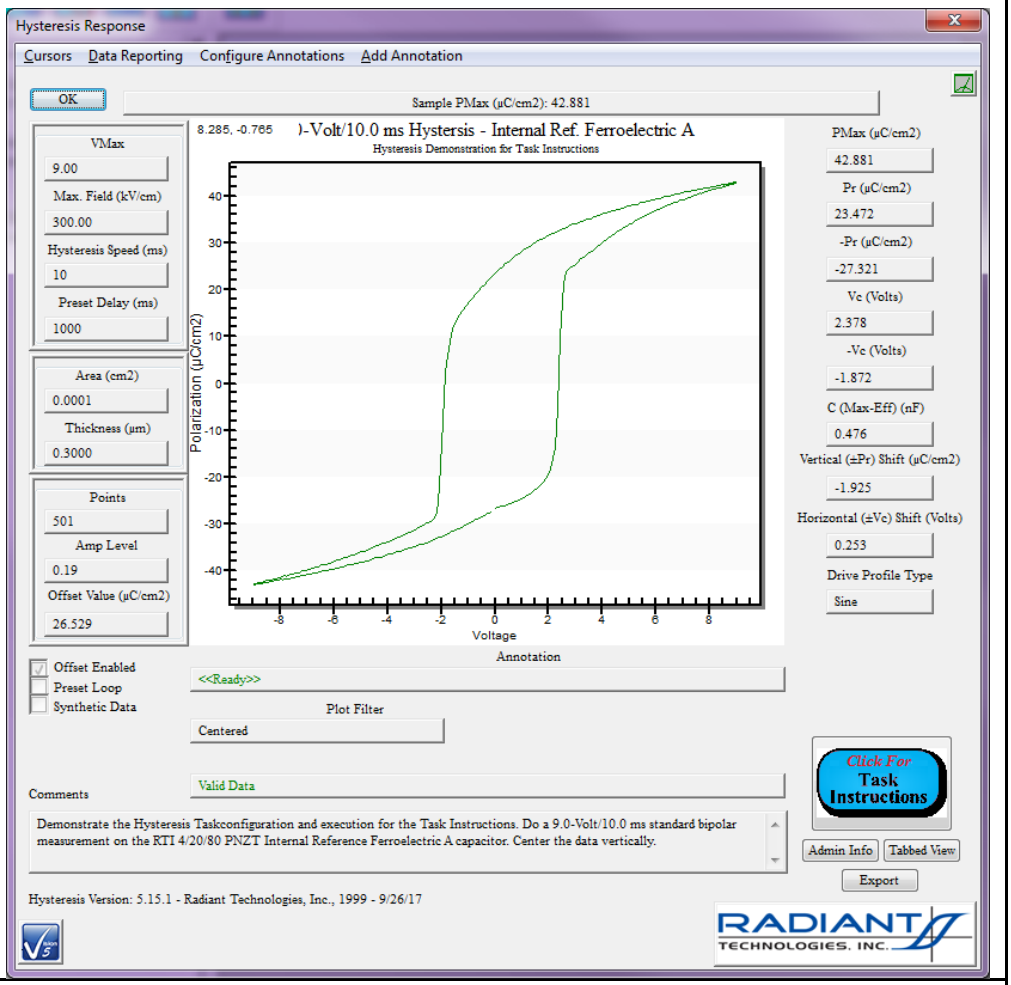
Term	Definition and Discussion
Administrative Information	The *Admin Info* button appears on a Task's configuration dialog or Data Presentation dialog when the Task is recalled from a DataSet Archive or executed under QuikLook. Clicking the button opens a subdialog that gives pertinent information regarding Vision, the Vision driver, the Precision Tester, the User's host computer and a variety of other parameters. The nature of the dialog will depend on the type of Task that is presenting the information. A simple Program Control Task will show a reduced dialog with only basic information. A Hardware or Measurement Task will show a larger dialog with more Precision tester detail.  **Branch Task Admin Info Dialog.**  **Hysteresis Task Admin Info Dialog.**
Archive Regraph	Archive Regraph refers to the action of recalling a Task from a DataSet Archive for configuration and, possibly, data review.

The figures show the procedure for an archived Hysteresis Task.

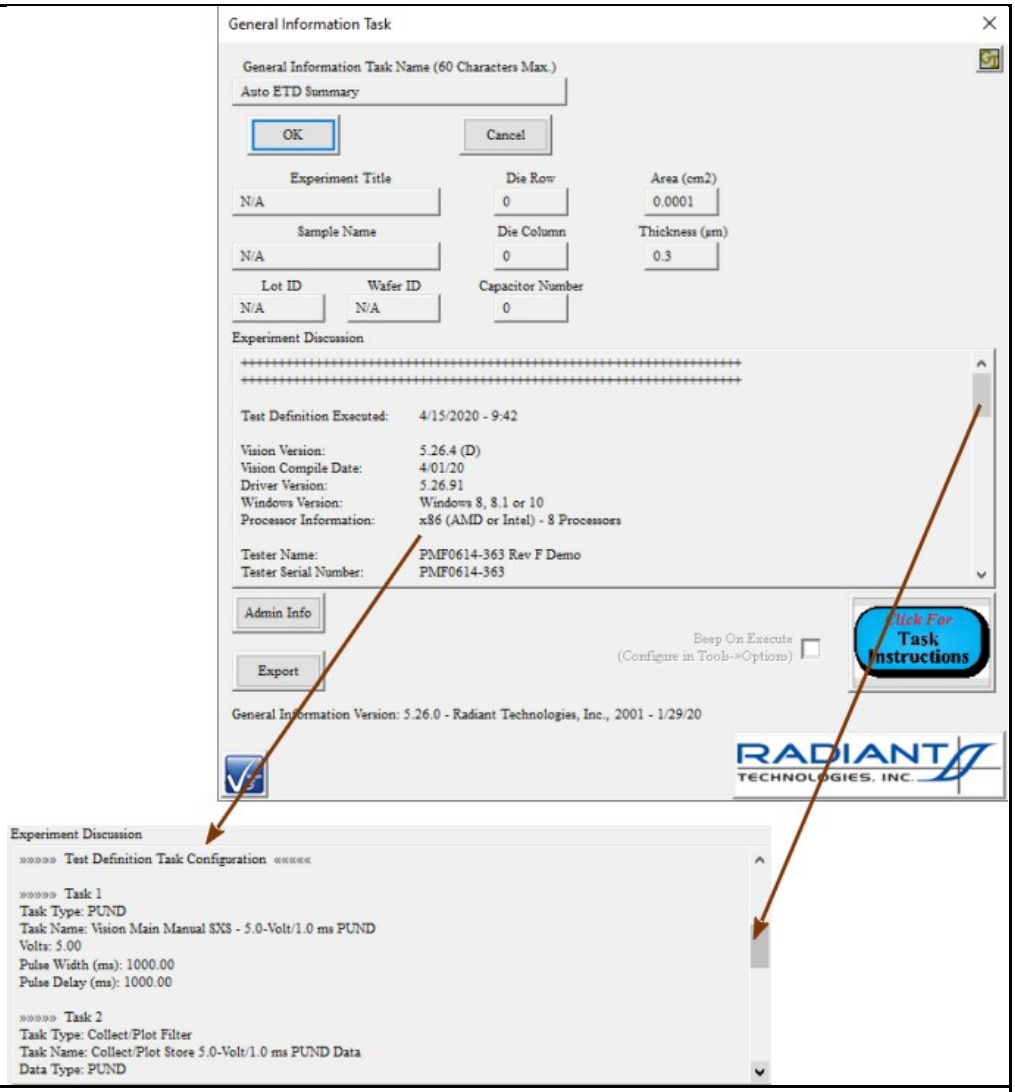


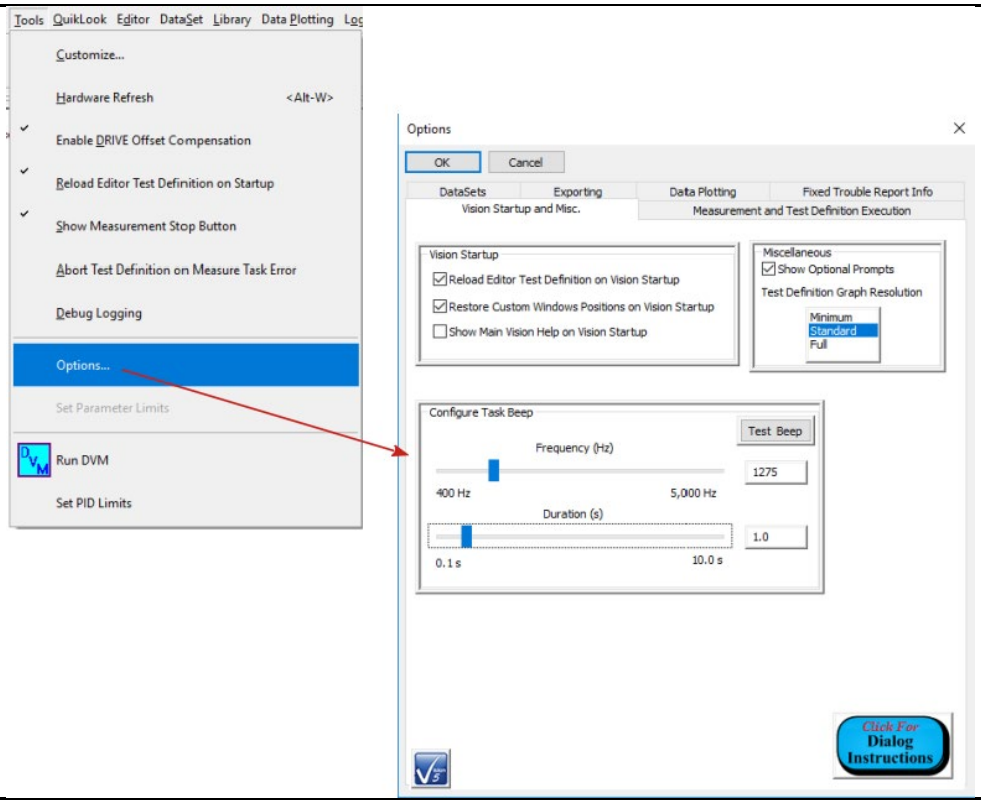


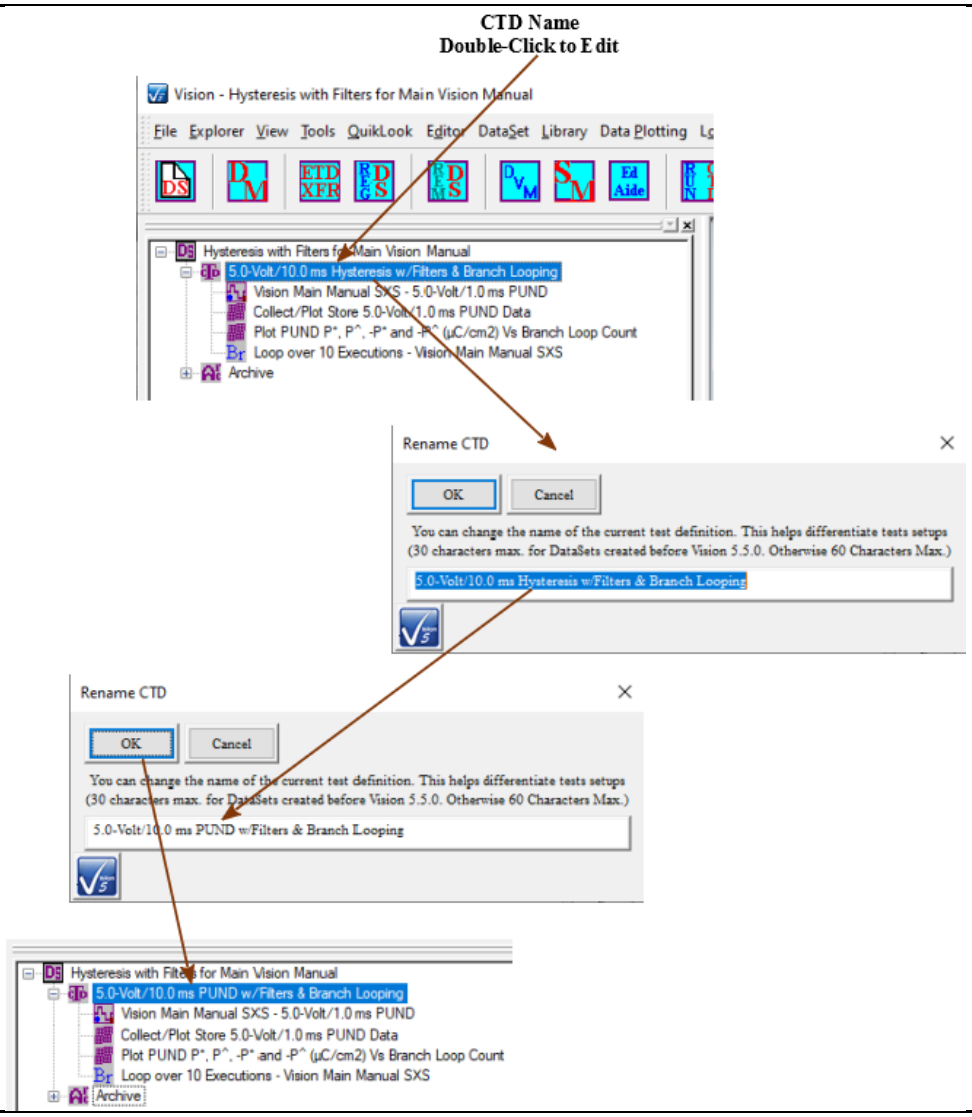


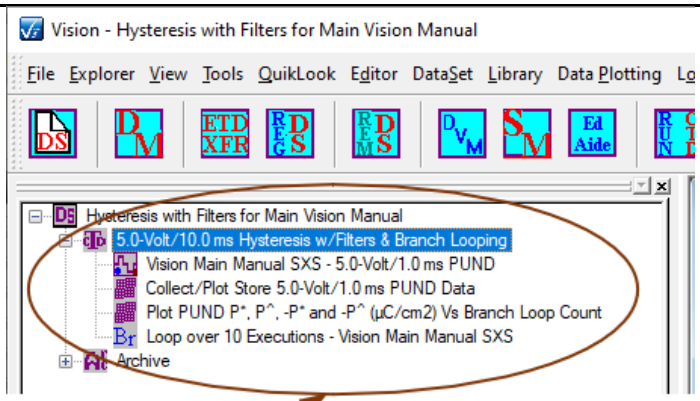
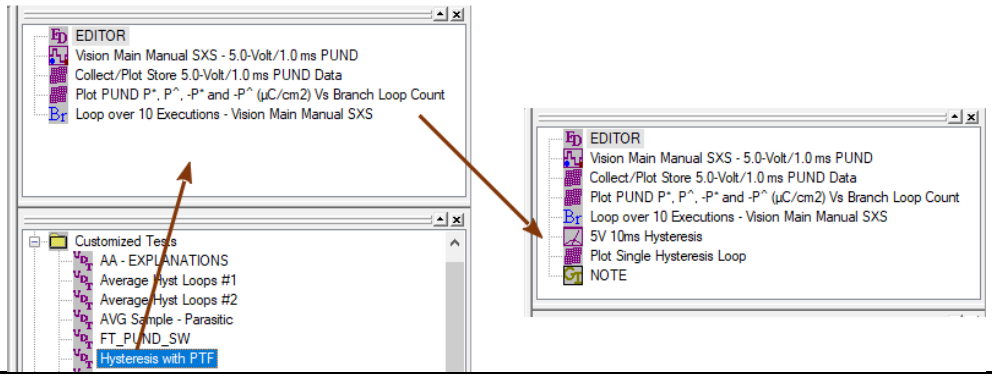


Auto ETD Summary	This is a General Information Task that is automatically added by Vision to an Executed Test Definition (ETD) as the first-executed Task. It contains a summary of the configuration of every Task in the Test Definition.

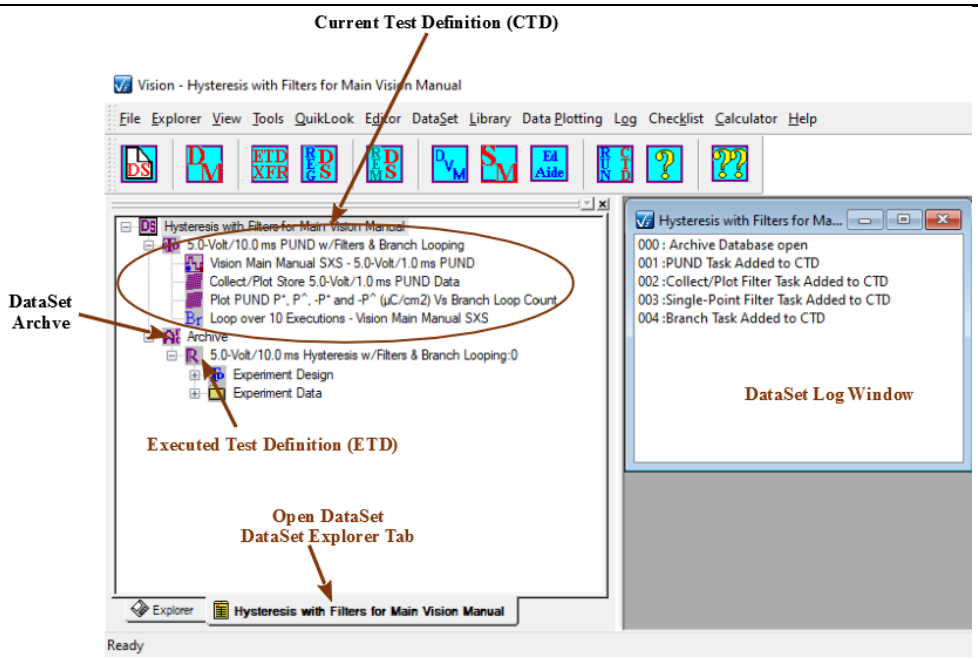
	
Beep On Execute	All Tasks now have a Beep On Execute check box added to their configuration dialogs. This control is absent on QuikLook configuration dialogs. This control will normally be unchecked. When checked, the Task will emit an audible beep when it executes in a Test Definition. This serves as an announcement to the human operator that that Task is executing. The duration and pitch of the beep is configured globally in "Tools->Options...->Vision Startup and Misc.".

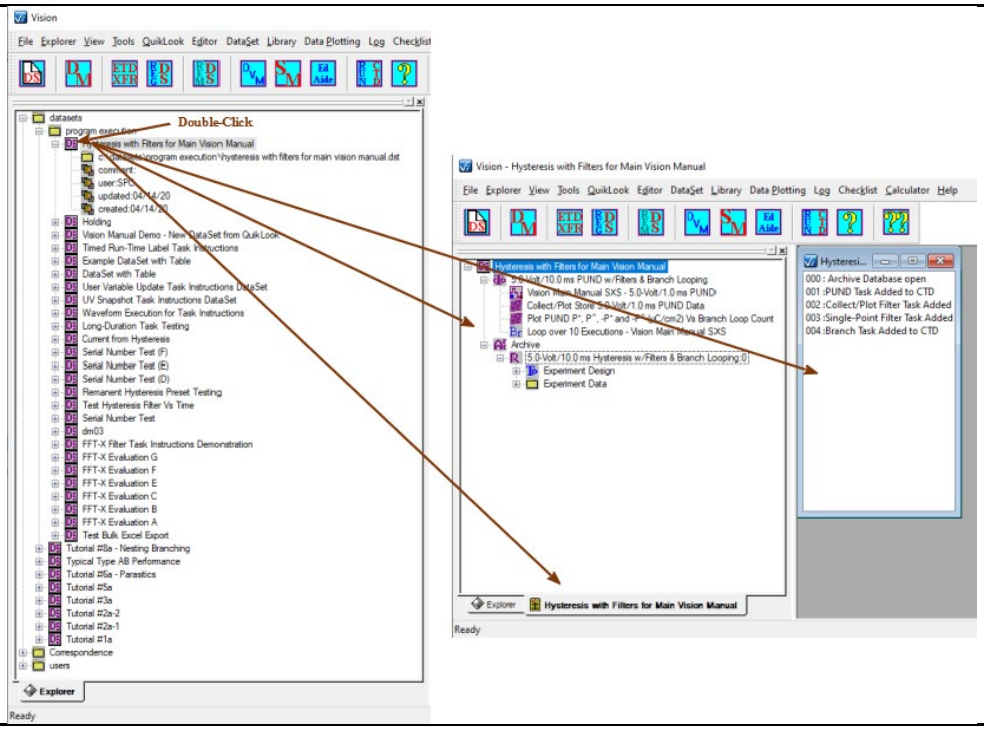
	
Branching/Branch Looping	This term refers to the act of returning Test Definition execution to a previous Branch Target Task, by a Branch Task, based on the current status of a Branch Logic Condition. This tool allows a Test Definition, or a subsequence of Tasks in a Test Definition, to be repeatedly executed in a single Test Definition Execution.
Branch Logic Condition	This is a comparison between the current state of a selected User Variable and a fixed value of the User Variable type (integer, real, text or Boolean), using a fixed comparator (less than, less than or equal to, equal to, greater than, etc.) The results of this comparison will be used by a Branch Task or a Nesting Branch Task to determine if Test Definition execution is to be returned to the associated Branch Target/Nesting Branch Target Task or to be passed to the Task following the Branch/Nesting Branch in the Test Definition.
Branch Target	This is any single Task with which a subsequent Branch Task has been associated and to which the Branch Task will return Test Definition execution if the Branch Logic Condition is met.
CTD Name	60 characters maximum. This is the descriptive name associated with a DataSet's Current Test Definition (CTD). This name should be descriptive of the CTD and should be unique. As the CTD is executed in the DataSet, the execution will be archived as an Executed Test Definition (ETD) using this name as a basis. The ETD name recorded in the DataSet Archive will be this text augmented with a serialized index to render the ETD name unique. This name is offered for editing when a Test Definition is moved from the EDITOR into the DataSet's CTD. It may also be immediately edited by double-clicking.

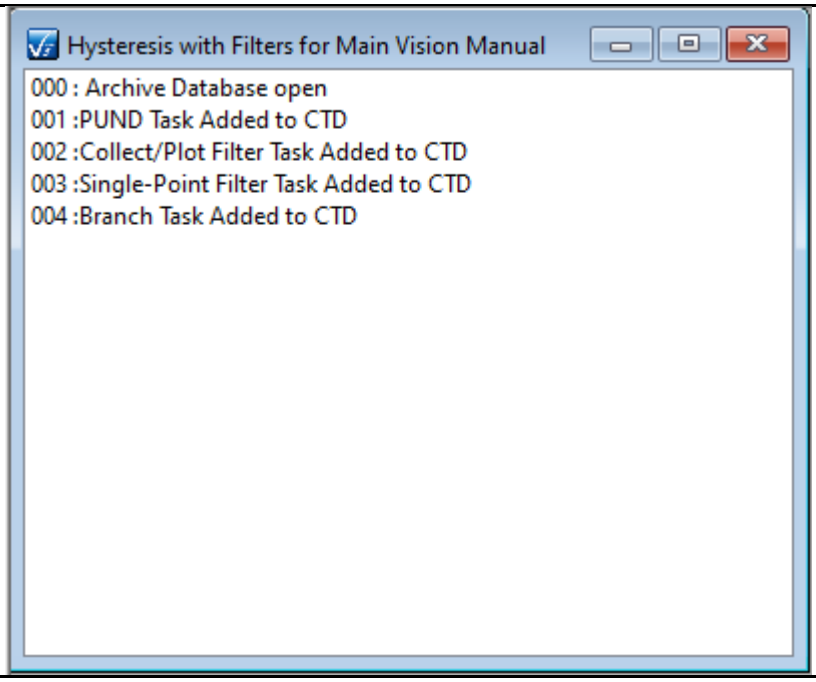
	
Current Test Definition (CTD)	This is the top-most structure in a DataSet. It is a single Test Definition that is ready for immediate execution. The CTD consists of a CTD Name and the list of Tasks that make up the Test Definition. Running the Test Definition by clicking <F1> or selecting "DataSet->Execute Current Test Definition (CTD)" will cause the Tasks in the CTD to execute. After complete execution the Tasks are written as Executed Test Definitions to the DataSet Archive using the CTD Name as basis and appending a serialized index to form the ETD Name.

	
Custom Task Suite	Although Vision and its associated Tasks are distributed free to anyone, a number of Tasks are grouped together into Custom Task Suites that must be purchased and licensed with a Security.Sec file. These Tasks are also freely distributed with Vision. Anyone can open a Custom Task to review the configuration dialog and access the Tasks Instructions. Anyone can review data that are captured by a Task in a Custom Task Suite. However, in order to include a Custom Task in a Test Definition or to operate the Task it must be licensed. Custom Task Suites include: • Chamber • Magneto-Electrics • Piezo • PiezoTest • Transistor
Customized Test	A Customized Test is an entry in the TASK LIBRARY under the "Customized Tests" folder. It appears to be a Task in the folder, but actually represents a complete Test Definition that has been configured in the EDITOR and moved into the TASK LIBRARY as a single entity. The Customized Test contains all Tasks in the Test Definition with configured values as they were established in the EDITOR. Moving the Customized Test back into the EDITOR does not open any configuration dialogs. However, the Tasks in the Customized Test are appended, as configured, to any Tasks already in the EDITOR Test Definition. 
Data Mining	Data Mining is a tool that allows any subset of data-collecting Tasks of a specific type to be collected from any number of source DataSets and written together to a single ETD in a single DataSet Archive in a new or existing DataSet. In addition a single Filter, of any type that

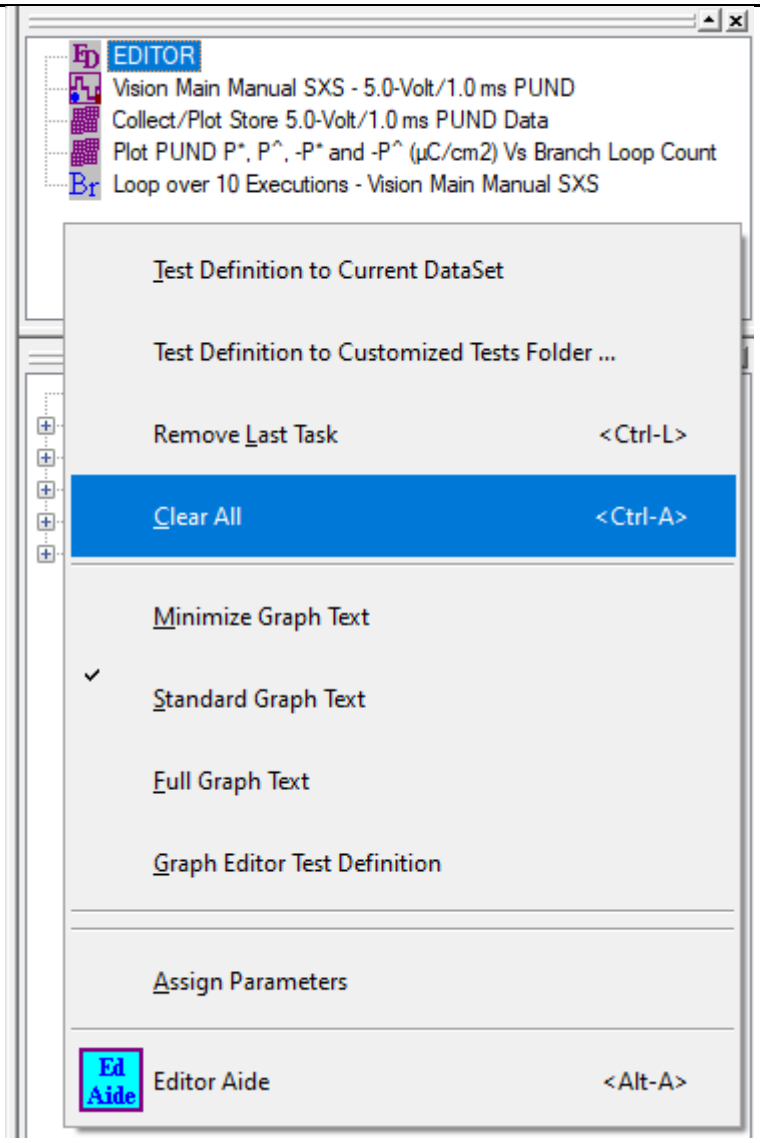
	is appropriate to the type of the Tasks being mined, can be configured to collect, operate on, plot and store the data of the Tasks being mined.
DataSet	A DataSet is a fundamental data management tool in Vision. It might be considered Vision's laboratory notebook. A DataSet consists of a Test Definition (or experiment) that is ready to executed, known as the Current Test Definition (CTD). It also contains the DataSet Archive that holds the complete record of Test Definitions executed within the DataSet. These are known as Executed Test Definitions (ETDs). DataSets may be registered to Vision or unregistered to keep Vision as clean as possible. Registered DataSet are listed, by file location, in the DataSet Explorer tree. Double-clicking a DataSet in the tree opens the DataSet in its own tab in the DataSet Explorer window. Any number of DataSets may be opened in Vision/the DataSet Explorer. When open, a DataSet has the following components: • Current Test Definition (CTD): The Test Definition that is ready for immediate execution. • DataSet Archive: The complete record of all previous experimental activity in the DataSet. • Executed Test Definitions (ETDs): The group if ETDs form the DataSet Archive. Each complete execution of a Test Definition is stored as an ETD in the DataSet Archive. • DataSet Log Window: This is a searchable text record of all activities performed in a DataSet. This window also serves as a DataSet manipulation tool. The window must be the top-most window in the user area to operate on the DataSet. Closing the Log Window closes the DataSet. • DataSet Explorer Tab: This is the tab window in the DataSet Explorer that holds the open DataSet. In addition a DataSet has the following properties: • DataSet Name: Each DataSet Name must be unique. 60 characters maximum. • DataSet File Path and Name: Each DataSet is stored in a Microsoft DAO (Data Access Object) database. DataSet file names have a *.dst file extension. DataSet files may be located anywhere in the Vision host file system. The DataSet will be recorded by file position in the DataSet Explorer tree. • Experiment Initials: This is the identity of the person who created the DataSet. • DataSet Creation Date: The date and time that the DataSet was created. • DataSet Update Date: The date and time of the last update to the DataSet. • Comments: An available text description edited by the user on creation. This text is of limited value and is not recommended.

	 Note that, despite the opportunity to configure and execute Tasks from the QuikLook menu, Vision is designed to have experiments performed by executing them as Test Definitions in DataSets.
DataSet Archive	This is the DataSet component that appears immediately below the Current Test Definition (CTD) in an open DataSet tree. This is the repository for all previous activity performed within the DataSet. It forms a collection of one or more Executed Test Definitions (ETDs)
DataSet Explorer	This is a primary Vision program window. By default it occupies the entire vertical expanse of the left side of the main Vision program User Interface (UI). The DataSet Explorer contains a tree that represents the file folder tree containing every registered DataSet. Each DataSet is represented by an icon in the tree at the position at which the DataSet file is located in the Vision host file system. Each DataSet is represented by an icon and the DataSet name in the tree. The DataSet representation can be opened to display DataSet File Path and Name, Comments (if any), Experimenter Initials, update date and creation date. Double-clicking the DataSet name/icon will open the DataSet in a new tab in the DataSet Explorer.

	
DataSet Log Window	This is a text window that appears in the Vision User Area when a DataSet is opened in the DataSet Explorer. The log window maintains a chronological record of activities in the DataSet as they occur. The text is searchable and can be saved to file and/or printed. This text record has proven to be of limited value. By default, the text is cleared each time the DataSet is closed. This default setting can be adjusted under the Vision "Log" menu. The Log window also offer some control over the DataSet. This window must be the topmost window in the User Area to execute the DataSet CTD or perform other actions. Closing the log window is the preferred method of closing the DataSet.

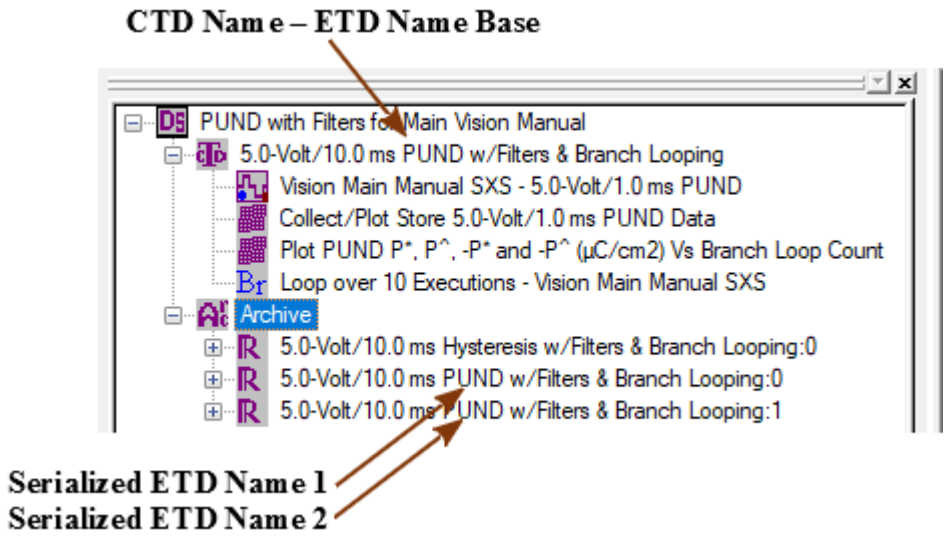
	
DRIVE Port	This is a BNC port at the front and rear panel of all Precision testers. The DRIVE port is normally connected to one electrode of the Device-Under-Test (DUT). The RETURN port is connected to the opposite electrode. The DRIVE port applies a DRIVE stimulus voltage to the sample electrode to stimulate a sample Charge (µC) response at the opposite electrodes. The DRIVE stimulus voltage is specified by the execution of a Task in the Vision program based on the experimenter's configuration of the Task. Note that the front-panel and rear-panel DRIVE BNC ports are electrically identical and either port may be used to contact the DUT. With the DRIVE connected directly to the DUT electrode, a maximum of ±500.0 Volts may be applied depending on the specifications and limits of the tester's internal amplifier. For high-voltage measurements greater than ±500.0 Volts, DRIVE is not connected directly to sample. Instead it is connected to a High-Voltage Amplifier (HVA) through a Radiant Technologies High-Voltage Interface (HVI). It serves as a low-voltage signal into the HVA that is amplified to produce the high-voltage output that is then connected to the sample electrode through the HVI. With an HVI/HVA present, Vision allows voltages of up to ±10,000.0 Volts.
EDITOR	This is a primary Vision program window. It is located, by default, at the top of the right-hand column of windows, just above the TASK LIBRARY. Test Definitions are designed and constructed in this window for execution in DataSets. Tasks are moved from the TASK LIBRARY into the Editor to append them to any Tasks already in the Editor and add them to the Test Definition. When a Task is moved into the Editor, its configuration dialog is opened to allow the Task to be programmed for use in the Test Definition. A Task may be reopened for configuration review and/or adjustment by double-clicking it in the Editor. The EDITOR window has a limited set of operations that may be performed on the Test Definition being constructed, normally by right-clicking in the EDITOR Window or by using Vision hot keys:

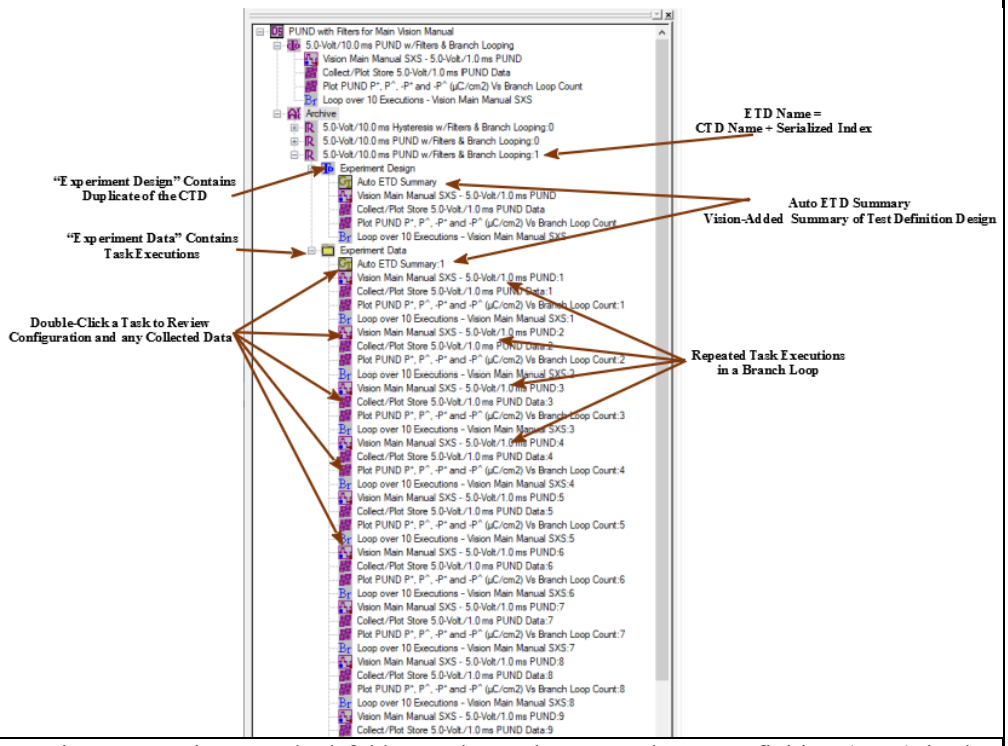
	• Append a Task to the Test Definition by moving it to the Editor from the TASK LIBRARY. • Remove the last-appended Task. • Clear the Editor of all Tasks. • Reopen a Task for configuration review and/or adjustment. • Move the Test Definition into an open DataSet as the CTD. • Move the Test Definition into the TASK LIBRARY as a Customized Test. • Access bulk parameter updating. • Create a Test Definition Graph. • Access the Editor Aide Tool. The EDITOR is not a completely general tool. Because of dependencies between some Tasks in the EDITOR, the following operations cannot be directly performed in the EDITOR: • Remove a Task from the interior or top of the Test Definition. • Change a Tasks position within the Test Definition. • Insert a Task into the interior or at the top of the Test Definition. The Editor Aide tool is provided to help completely generalize EDITOR operations.

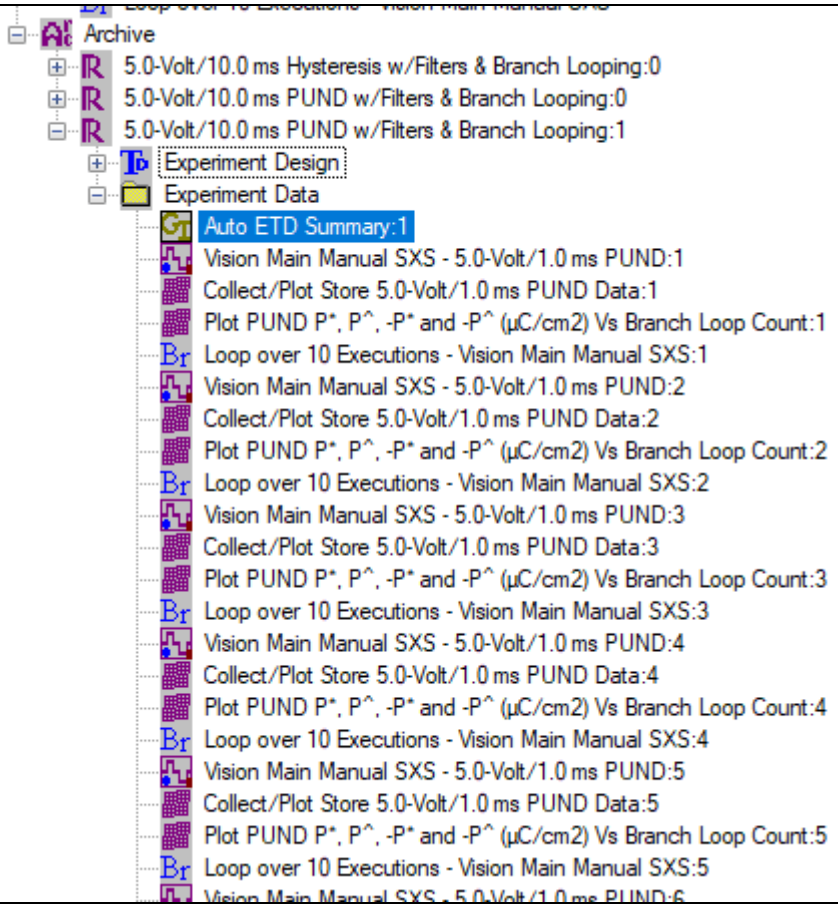
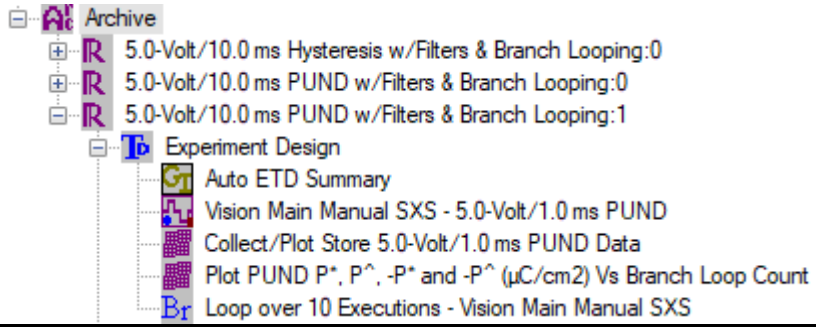


EDITOR Window and Right-Click Menu Options.

ETD Transfer	This tool allows any number of Executed Test Definitions (ETDs) to be copied sequentially from any number of source DataSets to a single new or existing DataSet Archive.
Editor Aide	The Editor Aide provides a set of tools that allow Test Definition editing to become completely general. In addition to standard EDITOR tools, the Editor Aide allows: • Tasks to be inserted anywhere into the Test Definition. (This is actually a two step process of appending a Task to the bottom of a Test Definition, then moving it up into position.) • Tasks to be removed from anywhere in the Test Definition. • Task position to be adjusted up or down in the Test Definition. In addition, the Editor Aide allows a Test Definition to be stored out to or recovered from a permanent file.

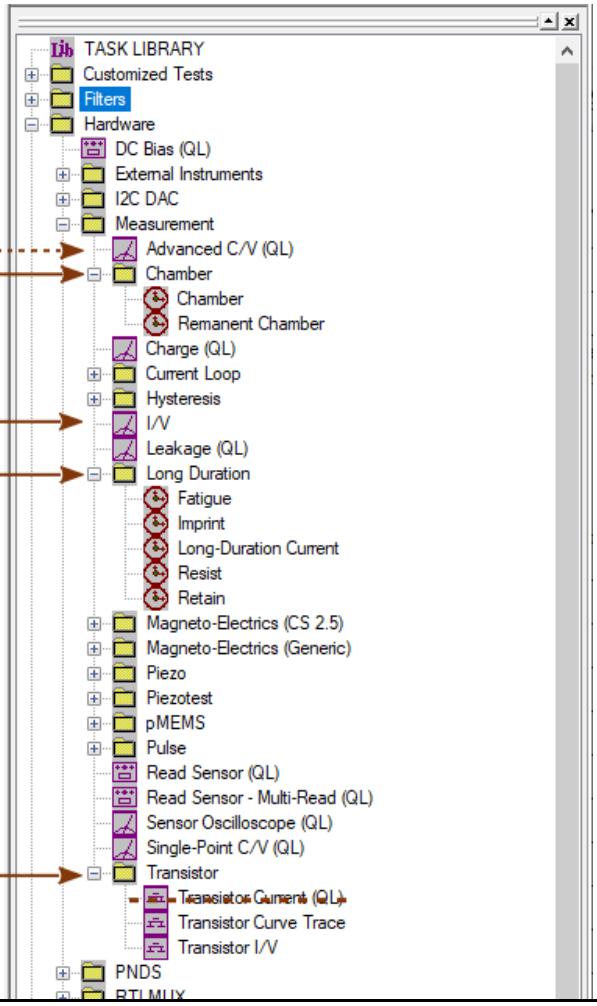
	Under normal operations, a Test Definition is moved into the Editor Aide from the EDITOR. Then it is adjusted appropriately and moved back to the EDITOR, with an option to clear the EDITOR of existing Tasks before returning the Test Definition. Tasks in the Editor Aide may have some basic parameters assigned. These include *Task Name*, *Comments* and, where appropriate, *Sample Area (cm2)*, *Sample Thickness (µm)* and *Max. Voltage*. As the Tasks in the Editor Aide are moved back to the EDITOR, their configuration dialogs are opened for review, update or initial configuraiton. See the Editor Aide entries in the Tutorials or Step-by-Step sections for complete details.
ETD Name	Each Executed Test Definition (ETD) is stored to a DataSet Archive under a unique identifier known as the ETD Name. The ETD Name has the CTD Name as its base. It is made unique by appending a serialized index. The ETD Name is an important element. If an ETD Note, or alternative icon is associated with a specific ETD, the association is made through the ETD Name. 
Executed Test Definition (ETD)	An Executed Test Definition (ETD) is the record under the DataSet Archive of a single full execution of a DataSet Current Test Definition (CTD). The ETD is recorded in the Archive by ETD Name. The ETD Name takes the CTD Name of the Test Definition that was executed to create the ETD as a base. It serializes the name to make it unique. The ETD contains two subfolders: • "Experiment Design": This is an exact duplicate of the Current Test Definition (CTD) that was executed to produce the ETD. It contains a fully-configured copy of each Task in the Test Definition. This allows the Test Definition to be copied from the ETD back into the CTD, or to the EDITOR, or into the TASK LIBRARY as a Customized Test. • "Experiment Data": This folder contains a copy of the execution results of every Task in the Test Definition. Task configuration of any Task can be recalled by double-clicking the Task entry in this Folder. Once the configuration dialog is close, data from any Task that collects data (Measurement Tasks, Filters) can be configured for display and then displayed. From the display, the data can be exported to targets outside of Vision for further review and manipulation. **NOTE: The Task list in the "Experiment Data" folder can differ significantly from the**

	list in the "Experiment Design" folder. Two main factors can contribute to this difference: repeated Task execution in a Branch Loop or early Test Definition termination using an Exit Task. An If/Then Task and Endif Task structure can also cause segments of Task in the Test Definition design to be omitted from execution. **NOTE: Both the Experiment Design and Experiment Data folders will show an initial Task called "Auto ETD Summary" that was automatically inserted by Vision. See the link for details.** 
Experiment Data	Experiment Data is a standard folder, under each Executed Test Definition (ETD) in the DataSet Archive, that contains the results of each Task executed when the Current Test Definition (CTD) was run. Note that the number, and possibly sequence, of Task entries in this folder will frequently differ from the Task sequence in the CTD. This can be the result of repeated execution of Tasks in a Branch Loop, early Test Definition termination using an Exit Task or skipping sequences of Tasks using an If/Then and Endif Task structure. Tasks in the Experiment Data folder can be opened to recall Task configuration and collected data, for Tasks that collect data (Measurement Tasks, Filters)

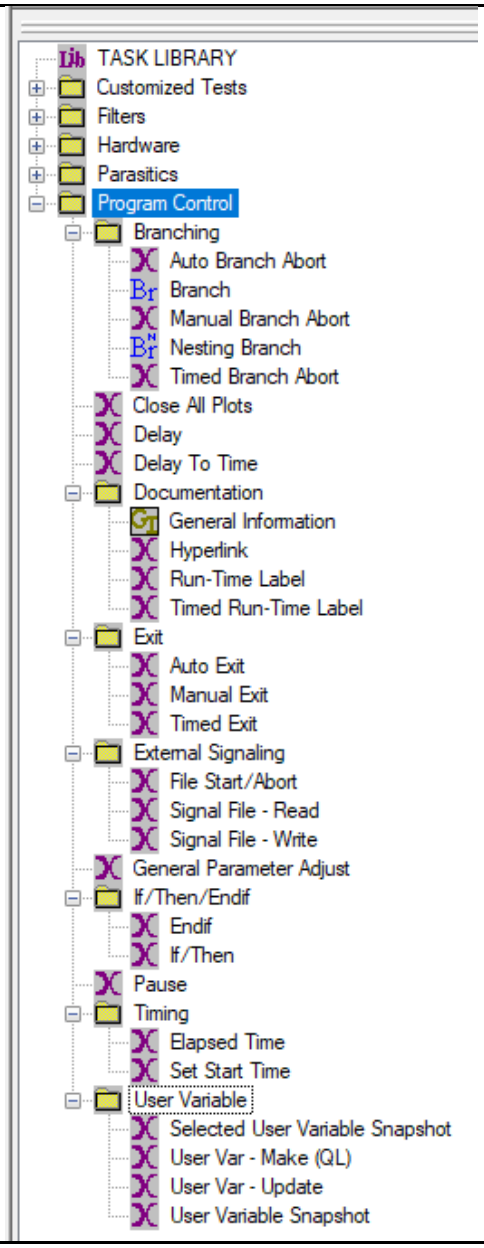
	
Experiment Design	Experiment Design is a standard folder under under each Executed Test Definition (ETD) in the DataSet Archive. The folder contains an exact duplicate of the Current Test Definition (CTD) that was executed to generate the ETD. The folder also includes and initial Auto ETD Summary, added by Vision. The Experiment Design folder is used by Vision when the ETD is copied back into the CTD, the EDITOR or a Customized Test. 
Exporting	All Tasks have the capability to have their configuration parameters and, for data-collecting Tasks, collected data exported to an external target. Targets include: • Printer: The user configures text size and vertical and horizontal text spacing. • Text file: The user must provide an output file name. • Excel Worksheet: Excel will open and the Task will write to the Worksheet. A file name may, but need not, be assigned when exporting is configured.

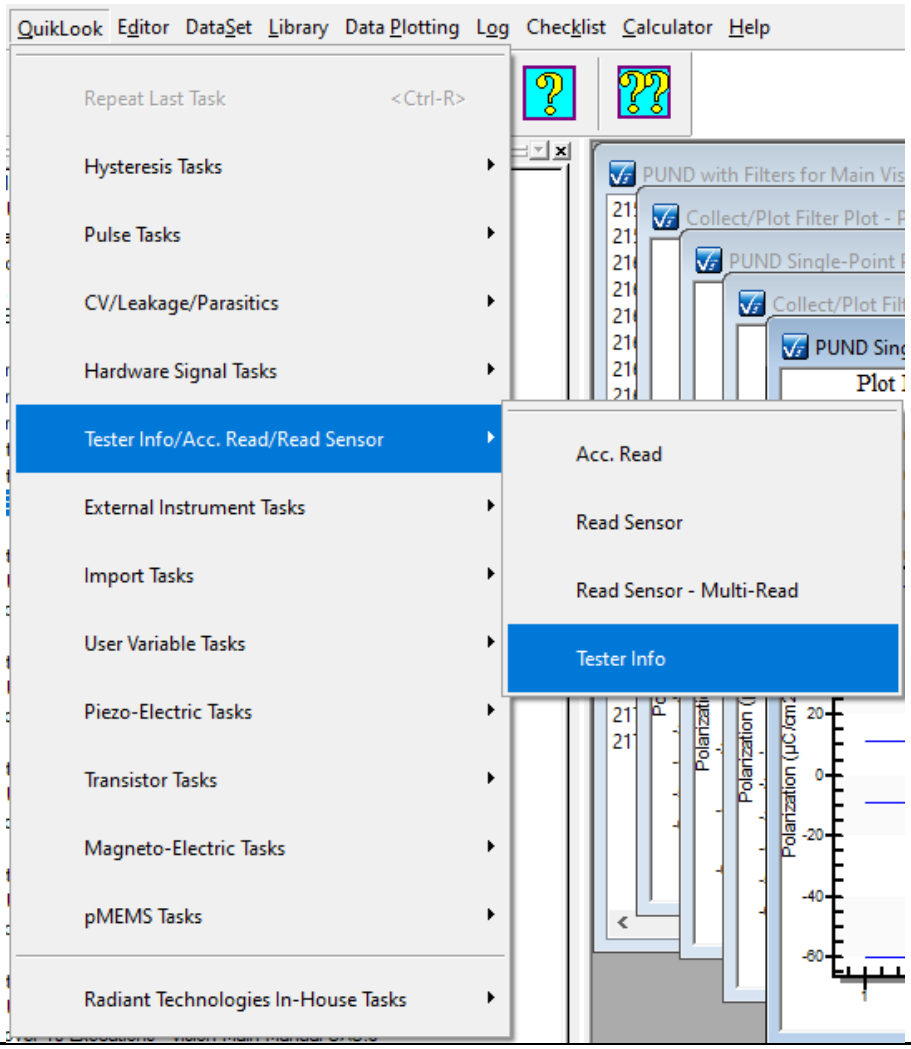
	• Word document: Word will open and the Task will write to the document. A file name may, but need not, be assigned when exporting is configured. Data-collecting Tasks can also export to a Vision Data File (VDF/*.vis). In addition, data-collecting Tasks can have their plotted data image exported to a Windows Meta File, JPEG File or Bitmap File. Exporting is available on a Tasks main configuration dialog when the Task is recalled from a DataSet Archive. For Measurement Tasks, exporting is accessed through the Data Presentation dialog. Measurement Tasks can also export data from a Data Presentation dialog that appears a the result of a QuikLook execution. Note that most exporting is deferred until all Task dialogs have been closed. Measurement Tasks that are configured to export the plotted data to an image file will have the image exported immediately after the export is configured.
Filter Task	In general, Filter Tasks are a class of Tasks that perform four functions: • Collect data from one or more Measurement Tasks or other Filter Tasks. • Operate on the data in some way. • Plot the data. • Store the data These represent a very generalized list of functionality. Many varieties of Filters exist. Not all match this list. Please see the Task Instructions for individual Filter Tasks under TASK LIBRARY->Filters.
GPIB	The General Purpose Interface Bus is an 8-bit parallel instrument communication bus developed by Hewlett-Packard. It has been an industry standard equipment communication bus. Recently it has become supplanted by the Universal Serial Bus (USB), but is still widely supported. Originally Vision communicated with external instruments - normally thermal controllers - only through the GPIB bus. GPIB<->Serial converters were required for serial devices. Later Vision began accommodating RS232/RS485 instruments directly. And now Vision will communicate with an instrument through any bus required provided the instrument manufacturer supports third-party control. However, Vision's original support for GPIB remains in place.
Hardware Refresh	Any time the hardware status changes while Vision is being run, Vision must be informed of the change by doing a Hardware Refresh. For example, if a High-Voltage Interface (HVI) or CS 2.5 Current Source is turned off or on, the Vision must be refreshed to detect the status change. A Hardware Refresh is performed by selecting "Tools->Hardware Refresh" or (more commonly) pressing <Alt-W>.
Hardware Task	In general, Hardware Tasks are Tasks that communicate with the Precision tester and cause the tester to operate on a Device-Under-Test connected between the tester DRIVE and RETURN ports. The Hardware Task will specify the DRIVE voltage signal that is to be applied to the sample by the tester on Task execution. Hardware Tasks may also refer to Tasks that operate devices other than the Precision tester. Such devices may be manufactured by Radiant Technologies, Inc. or other manufacturers. These include, but are not limited to: • Thermal controllers for pyroelectric testing. Except for the HVDM II, RTI D2850C and RTI pMUX 2108, these are devices are produces by other manufacturers.

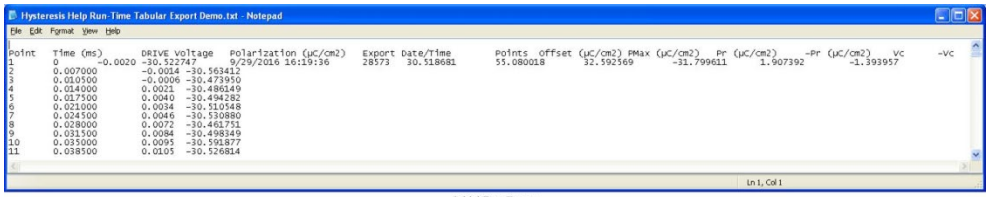
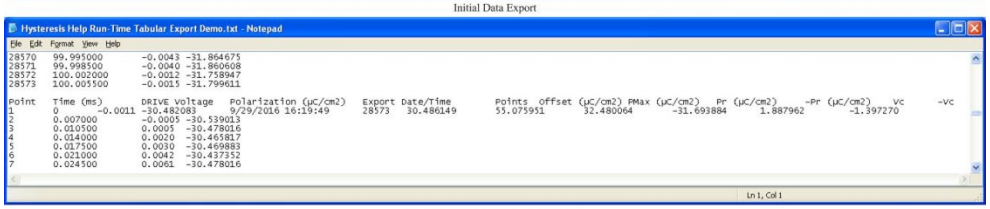
	• Radiant HVDM II high-voltage test fixture with sample displacement detection and, possibly, automatic motor-controlled calibration of the displacement detector. • RTI D2850C 8-Channel Multiplexer. This unit is normally mounted to a thermal chamber door. • RTI pMUX 2108 8-Channel Multiplexer. This unit is rack mounted and designed to be ganged with other pMUX 2108 instruments. • I^2C Voltage Controller. This is a simple I^2C device that can serve as a second voltage source or a voltage detector. • CS 2.5 Current Source. This is a voltage-to-current amplifier specifically intended to apply a magnetic field to a Device-Under-Test through a Helmholtz Coil. • Any GPIB device from any manufacturer. Most Hardware Tasks are found both in the TASK LIBRARY and in QuikLook. A few Hardware Tasks, including Tester Information and Accessory EEPROM, are found only in QuikLook.
High-Voltage Amplifier (HVA)	A High-Voltage Amplifier (HVA) is an instrument that takes a low-voltage (DRIVE) input signal and amplifies it to produce a high-voltage output. HVAs are built by manufacturers other than Radiant Technologies. (Most HVAs associated with the RTI Precision tester family are manufactured by Trek.) HVAs are connected to Precision testers through a High-Voltage Interface (HVI) manufactured by Radiant Technologies, Inc. With an HVI/HVA pair connected to the Precision tester, the maximum DRIVE voltage is boosted from ±500.0 Volts to ±10,000.0 Volts.
High-Voltage Interface (HVI)	A High-Voltage Interface (HVI) is a safety device places into the DRIVE signal path between a Precision tester and a High-Voltage Amplifier (HVA). In case of sample breakdown under the application of high voltages, the HVI detects a high-voltage signal short between the DRIVE and RETURN and opens the circuit to protect both equipment and human life. An HVI must be present for DRIVE voltages to exceed ±500.0 Volts. With an HVI/HVA pair present, the maximum allowed DRIVE signal is increased to ±10,000.0 Volts.
Long-Duration Tasks	Long-Duration Tasks are Measurement Tasks that continue execution over extended periods - perhaps days. As such, they are unique in two ways: 1. They do not fit the philosophy of QuikLook execution, which is not intended to collect data for archiving. Since Long-Duration Tasks operate over very extended periods the experimenter will intend to capture and store the data. As a consequence, Long-Duration Tasks do not appear in the QuikLook menu. 2. Most Measurement Tasks do not immediately plot their data when executing in a Test Definition in a DataSet. These Tasks normally rely on associated Filter Tasks for runtime data plotting. However, when a Long-Duration Task is executing over an extended period, the experimenter will want to observe the progress of the measurement. For this reason the measured data in a Long-Duration Tasks are plotted - normally as a function of some increasing stress factor such as time or fatigue cycles - as the data are measured at runtime. There are relatively few Long-Duration Tasks. Most, but not all, are found in TASK LIBRARY->Hardware->Measurement->Long Duration. These include: • Fatigue • Resist • Retain • Imprint • Long-Duration Current The Chamber Custom Task Suite consists of the Chamber and Remanent Chamber Tasks

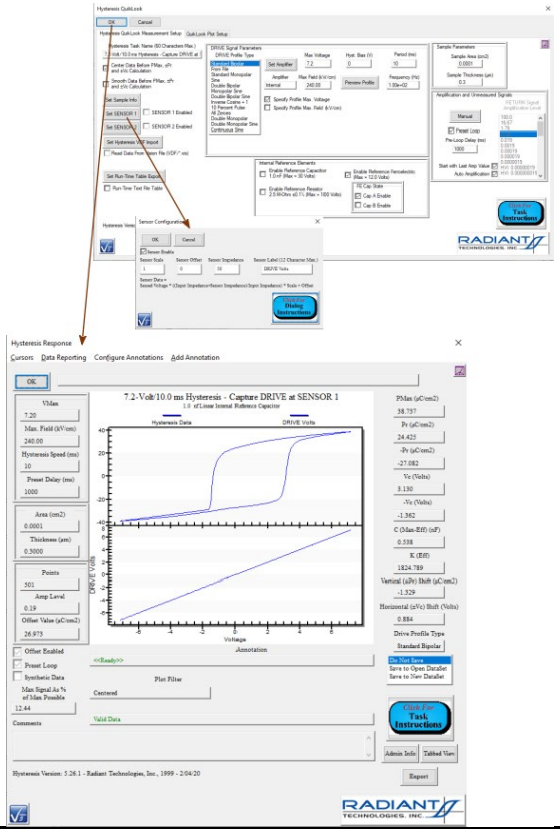
	found in TASK LIBRARY->Hardware->Measurement->Chamber. Advanced C/V meets the definition of a Long-Duration Task and does provide runtime data plotting. However, that Task is found under the QuikLook menu. However, its analog, the I/V Task, is not included in QuikLook. Both of these are found in TASK LIBRARY->Hardware->Measurement, without subsubfoklder. Transistor Current is a simple Tasks that returns a single measured value. It is found in QuikLook. However, the other two Tasks in the Transistor Custom Task Suite use the Transistor Current Tasks to make extended Long-Duration measurements. These are Transistor I/V and Transistor Curve Trace and are found in TASK LIBRARY->Hardware->Measurement->Transistor. **Long-Duration Tasks** 
Measurement Task	Measurement Tasks are Hardware Tasks that receive measured signal data back from the Precision tester RETURN port. They operate on the data as appropriate and store the data. They may pass data to Filter Tasks for further operation and display. Most Measurement Tasks are found in both the TASK LIBRARY and in the QuikLook menu. Long-Duration Measurement Tasks do not fit the philosophy of QuikLook and are not found in that menu.

No Execute	*No Execute* is a check box that has been added to the configuration dialog of every Task. (It is absent in QuikLook configuration dialogs.) When checked, the Task will take no action whatsoever when it is executed in a Test Definition. It will simple write itself to the DataSet Archive and then pass execution to the next Task in the Test Definition. For Tasks that collected data, data vectors and/or parameters will be assigned NULL DATA values that are written to the Archive. The purpose of the *No Execute* check box is to allow the Task to be removed from Test Definition execution without physically removing it from the Test Definition. When a Task is executed with *No Execute* checked, its standard icon will be replaced in the DataSet Archive with  .
NULL DATA	NULL DATA is a specific real numeric value that is recognized by Filters and data-plotting Tasks as data that do not exist and are not to be plotted.
Program Control Task	Program Control Tasks do not communicate with the Precision tester or any external device. These are Tasks that control and/or monitor Test Definition sequencing and provide experimental documentation. The Tasks can also be used to control and monitor program timing and to do basic and generic communications with external programs. The Tasks are found under TASK LIBRARY->Program Control. None of these Tasks is found in the QuikLook menu.

	
QuikLook	QuikLook is a Vision menu that holds a subset of the Hardware Tasks in Vision. These Tasks are available for immediate configuration and execution without the need to include them in a Test Definition or operate them in a DataSet. QuikLook is intended for a quick "Let's-See-What-We've-Got" measurement on a sample or to validate Vision and tester operation. It is not intended to be the primary experimental tool in Vision. It is not intended to store data. (For this reason, Long-Duration Tasks are not included under QuikLook.) Strict QuikLook operation limits Vision to about 3% of its capability. Nevertheless, tools to store data from a QuikLook measurement are available. These include QuikLook-to-DataSet and Exporting. Tasks do not appear directly under the QuikLook menu. Instead they are distributed among categories under the menu. See the Figure.

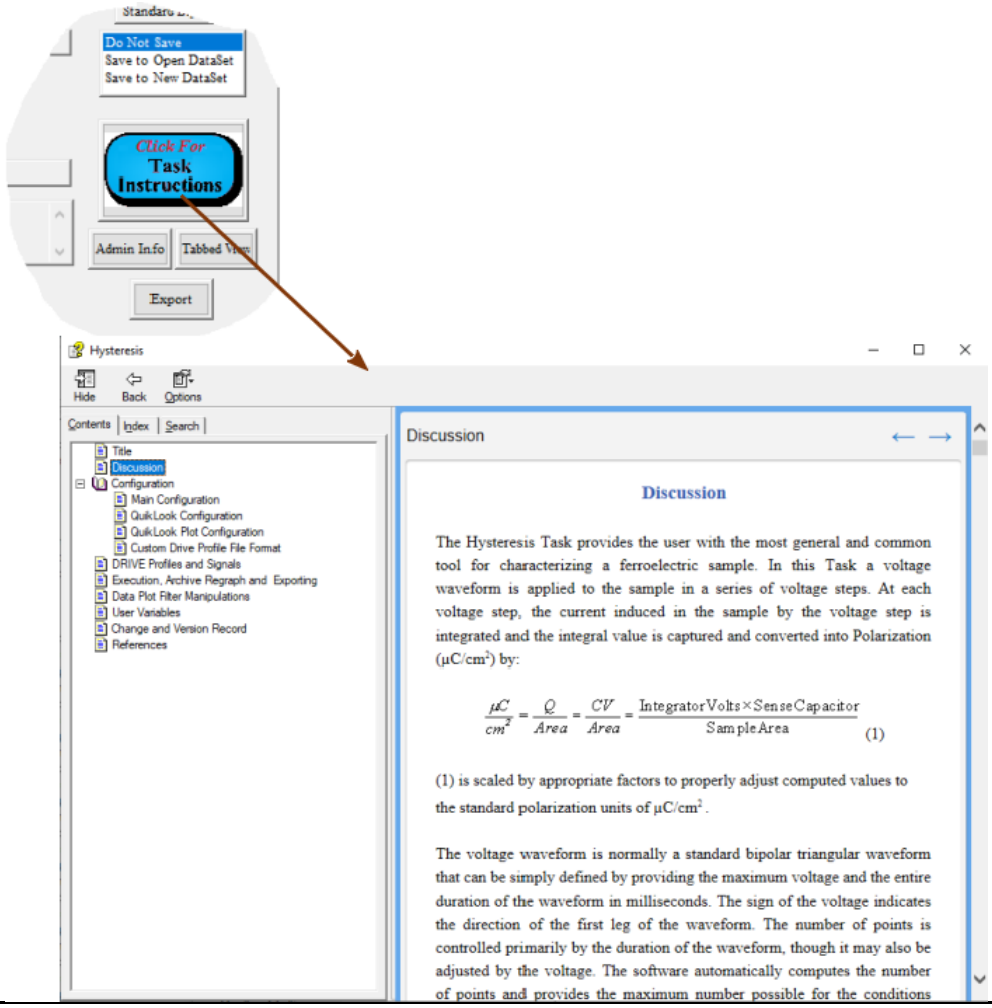
	When the Vision program is started, C:\Program Files (x86)\Radiant Technologies\Vision\System is searched for all *.vlr file. Each *.vlr file represents a Task. Each of these files is loaded into TASK LIBRARY as the program starts. Each Task is also queried to determine if it is to be placed under the QuikLook menu. If so, it is further queried to determine the category and then written to the menu. The Tester Information Task and Accessory EEPROM Task appear only under the QuikLook menu. These are not available in TASK LIBRARY. 
RETURN Port	This is a BNC port at the front and rear panel of all Precision testers. The RETURN port is normally connected to one electrode of the Device-Under-Test (DUT). The DRIVE port is connected to the opposite electrode. The RETURN port receives the DUT Charge response (µC) to a voltage stimulus applied by the DRIVE port to the opposite electrode. The DRIVE stimulus voltage is specified by the execution of a Task in the Vision program based on the experimenter's configuration of the Task. Note that the front-panel and rear-panel RETURN BNC ports are electrically identical and either port may be used to contact the DUT.

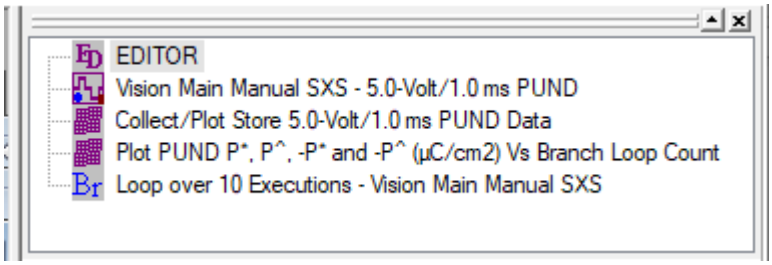
	With the RETURN connected directly to the DUT electrode, a maximum of ±500.0 Volts may be applied to the DRIVE electrode depending on the specifications and limits of the tester's internal amplifier. For high-voltage measurements greater than ±500.0 Volts, RETURN is not connected directly to sample. Instead it is connected to the DUT through a Radiant Technologies High-Voltage Interface (HVI).
Runtime Tabular Text Exporting	All Tasks are able to export their configuration to a text file. Data-collection Tasks, including Measurement Tasks and Filters, also export their collected data. Such exporting is performed after the Task has completed execution on QuikLook measurement or when the Task is recalled from a DataSet Archive. More recently data-collection Tasks have had the added capability of Runtime Tabular Text Exporting. In this case the Task exports data to a specified text file as the data are collected. Only capture data are exported, under columns with headings. The first data row will also include Single-Point data, if any, and a date/time stamp. Configuration parameters are not exported. As data are captured they are appended to any data already in the Runtime Tabular text file. In this way the Task may be repeatedly execute - by Branch Looping and/or repeated CTD execution - without having to reconfigure the Task. All data are collected into a single file. Data are exported in single tab-delimited format. Data may visibly shift left or right relative to column headers or as execution proceeds, when viewed in a text editor. But the data will import correctly into Excel, Origin or other common math or data manipulation program. The figure shows the output of subsequent executions of the Hysteresis Task.  Initial Data Export  Second Execution – Data are Appended
Security.Sec	Security.sec is a license file that enables configuration and execution of the Tasks in one or more Custom Task Suites that must be purchased and licensed. The file is keyed to one or more Custom Task Suites. It is also keyed to a unique code in the EEPROM of the Precision tester for which it was purchased. The file is copied into C:\Program Files (x86)\Radiant Technologies\Vision\System. The file may be copied into any number of Vision host computers. However, it is not transferable between users of multiple Precision testers.
SENSOR 1/SENSOR 2 Port	The SENSOR 1 and SENSOR 2 ports are BNC ports at the rear panel of the Precision tester. These are voltage input ports in the range ±10.0 Volts. These ports may be independently enabled for synchronous voltage capture simultaneously with the capture of a samples Charge (µC) output in any Measurement Task. Any externally-measured property that is linearly related to an output voltage from the capture device can be measured at these ports, provided the signal is within the ±10.0 Volt limit. Properties such as temperature (°C/F/K), light intensity, pressure, etc. might be measured. Most commonly these ports are used by the Tasks in the Piezoelectric Custom Task Suite to capture displacement.

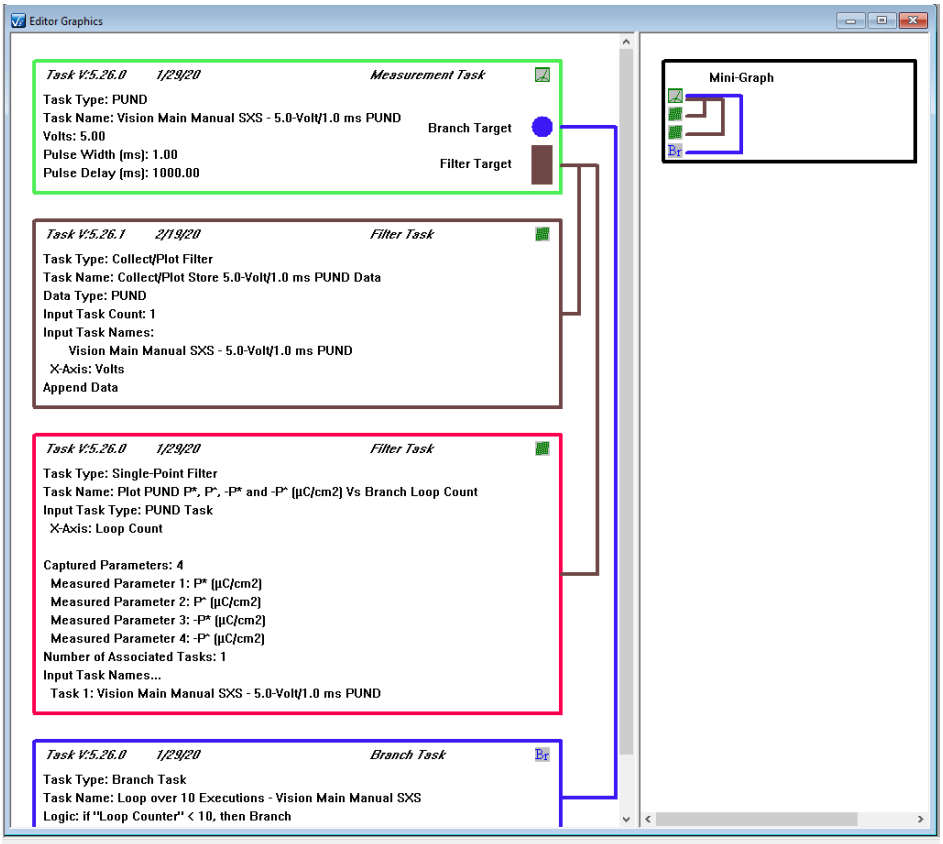
	The configuration offers a subdialog in which scale and offset terms, along with a label, may be specified. The label is provided to allow the captured data to be distinguished on a data plot. Scale and offset terms are provided to allow the captured voltage to be converted back into the measured property: Property = Scale (Property Units/Volt) X Voltage + Offset (Property Units) (1) [Displacement (µm) = -5.0 (µm/V) X SENSOR 1 Voltage + 0.0 µm] Note that the SENSOR configuration also allows the output impedance (Ω) of the measurement device to be specified. However, the input impedance (Ω) of modern Precision testers is infinite and the impedance (Ω) of the external device is irrelevant/insignificant. This control should be left at the default value of 50.0 Ω. The figure shows a 7.2-Volt/10.0 QuikLook Hysteresis measurement on the 1.0 nF Linear Internal Reference Capacitor. The DRIVE output voltage has been routed to the SENSOR 1 input port and capture is enabled. *Sensor Scale* is left a the default value of 1.0 X and the *Sensor Offset* remains at 0.0. The plotted data represent the actual DRIVE voltage. 
Single-Point Data	Single-Point Data refer to sample response that can be expressed as a single integer or real numeric value. The Single-Point data may represent the directly-measured Task response such as a PUND Task P^* (µC/cm^2) or $-P^\wedge$ (µC/cm^2) response. Single-Point data can also refer to single-number data derived from more-complex measured data such as P_{Max} (µC/cm^2) or ±Coercive Voltage (V_c) taken by analyzing a complete Hysteresis Polarization (µC/cm^2) Vs Voltage (PV or PE) loop.

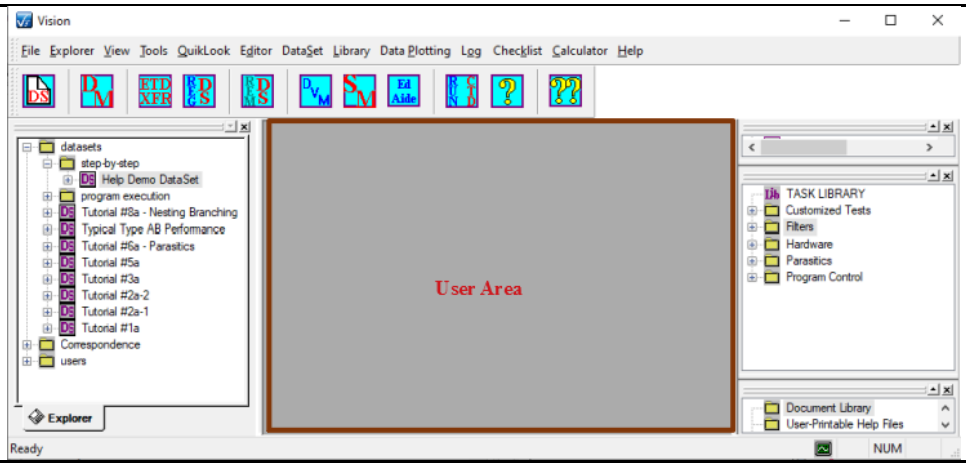
Task	A Task is a semi-independent agent that does the work within the Vision program. Tasks are user-configurable and executable program elements. Each Task performs one complete operation. Tasks may be very simple: Delay Test Definition Execution for a programmed number of seconds. Or Tasks may be very complex: perform a complete Fatigue characterization of the Device-Under-Test (DUT). Tasks are "semi-independent" because certain Tasks rely on a programmed association with one or more Tasks that precede them in the Test Definition. For example, a Branch Task must be associated with any single preceding Task to which it may return Test Definition execution depending on the Branch Logic Condition. This is known as a Branch Target Task. Likewise, most Filter Tasks require association with one or more preceding Measurement Tasks and/or other Filter Tasks to provide data as input. Each Task is a Windows Dynamic Link Library with a *.vlr extension and stored in C:\Program Files (x86)\Radiant Technologies\Vision\System. On startup the Vision program searches that file path for every instance of a *.vlr file. (Nearly) all *.vlr files found are opened and inserted into the Vision TASK LIBRARY window tree. If the Task indicates that it is also to be inserted into the QuikLook menu, it is queried for its QuikLook category and inserted into the menu under that category. Note that the Tester Information Task and Accessory EEPROM Task are inserted only into the QuikLook menu.

Task Instructions	Every Task has an associated *.chm help file known as the Task's Task Instructions. The file is located in C:\Program Files (x86)\Radiant Technologies\Vision\Help. Each *.chm file is specific to the Tasks being documented. The general format of the file is consistent and includes:
	
	• Discussion: General details regarding the Tasks purpose, theory, sequencing, features, etc.
	• Configuration: Details regarding the appearance, controls and interaction with the Task's configuration dialog(s). The format includes:
	
	  • A table that shows specific Task details.
	  • A series of images showing access to the configuration dialog and the dialog in a variety of states.
	  • A detailed discussion of the use of the configuration dialog
	  • A table with an entry for each control that includes the control name, type, default value and a discussion. The discussion provides a detailed description of the purpose of the control. It also presents specific dependencies between the control and other controls. For example if the control is a check box, the discussion will detail which other controls will be enabled or disabled, hidden or shown when the control is checked or unchecked.
	
	• Execution, Archive Regraph and Exporting: Details of actions taken when the program is executed including images if any appear. Details about recalling the Task from a DataSet Archive. A discussion of Admin Information, Test Definition Graphing and Runtime Tabular Text Exporting (if a data-collecting Task). Details about export procedures and output to the various external export targets.
	• User Variables: A table showing the name, type and details of every User Variable added to the User Variable List by the Task. For Hardware Tasks, the table will also present User Variable common to all Hardware Tasks. For Measurement Tasks the table will also be augmented.
	• Change and Version Record: A date-by-date record of changes made to the Task.
	
	The Task Instructions are accessed by clicking the *Click For Task Instructions* button from

	any Task dialog. The figure shows the Hysteresis Task Instructions. 
TASK LIBRARY	The TASK LIBRARY is a primary Vision window. By default it is the middle window, just below the EDITOR window and just above the Document Library, along the right border of the main Vision window. The TASK LIBRARY consists of a tree structure that contains (nearly) every Task available to Vision. Tasks are distributed by category, in the tree, to folders, subfolders and subsubfolders. They will never appear more than three levels deep in the tree. The TASK LIBRARY is filled, on Vision startup, by searching the file path C:\Program Files (x86)\Radiant Technologies\Vision\System for every instance of a file with a *.vlr extension. Each such file is a Windows Dynamic Link Library (DLL) representing a single Task. Each Task provides Vision the TASK LIBRARY tree location in the form of text defining the folder, subfolder and subsubfolder. The TASK LIBRARY primarily serves as the access location for Tasks to be moved into the EDITOR to be configured and then appended to the Test Definition that is being constructed in the EDITOR. Tasks that also appear in the QuikLook menu are indicated with " (QL)" appended to their name in the TASK LIBRARY tree. As a secondary function, QuikLook configuration and execution of a QuikLook Tasks can be done from the TASK LIBRARY

	by double-clicking the Task or by right-clicking and selecting "QuikLook Execute" from the popup menu.
Task Name	A text identifier for every Task in a Test Definition. Tasks are permanently stored in a DataSet Archive under the Task Name. For this reason the Task Name should be unique and meaningful for every Task in the Test definition. A carefully-specified Task Name will allow simpler future identification of archived data. Each Task type has a unique default Task Name that includes an abbreviated label for the type followed by a serialized index to keep the name unique. Although the default Task Name, along with the Task type icon, does allow future identification of the Task by type it does not convey enough information to distinguish the Task's configuration or purpose. This Task element has a 60-character limit.
Test Definition	A Test Definition is a linear sequence of Tasks that form an experiment. A Test Definition is constructed and modified in the EDITOR window. It is then moved into a new or existing DataSet Current Test Definition (CTD) for execution and archiving. A Test Definition executes serially by operating each Task in sequence from first (top-most) to last (bottom-most). The serial sequencing of the the Test Definition execution can be modified in one of three ways: • Return of execution to a previous Branch Target Task by a Branch Task depending on the Branch Logic Condition. This allows a subsequence of Tasks in the Test Definition to be repeatedly executed until some logical condition fails. • Premature termination of the sequencing using an Exit Task. • Bypassing a segment of Tasks in the Test Definition using an If/Then and Endif Task pair and depending on the results of a logical condition check. Of these, Branch Looping is very common. The other two are uncommon. A Test Definition renders Vision a very powerful tool. Properly constructed, the execution of a Test Definition can produce abundant and complex data automatically and very quickly. The cost of this convenience is careful attention to Test Definition construction and design. The Tasks in a Test Definition should be checked and double-checked for both proper parameter setting and for proper documentation (*Task Name*, *Comments*, Plot Labels).  **A Test Definition in the EDITOR Window.**
Test Definition Graph	A Test Definition Graph is a split window that shows a graphical representation of a Test Definition in a Windows meta document. In the document, each Task is represented as box. The box has a border represented by the Task type and also shows a Task type icon with Task type text. The text shown in the box is provided by the Task and represents the current Task configuration. The color of the border and the contents of the text can be edited for any text box. Associations between Tasks are shown as connecting lines and graphical elements in the Task. A blue line connects a Branch Task with its preceding Branch Target. The Branch Target has a blue dot centered along its right-most border. Filters are connected to their input Task(s) using brown lines and the Filter source Task(s) has (have) a brown rectangle at the

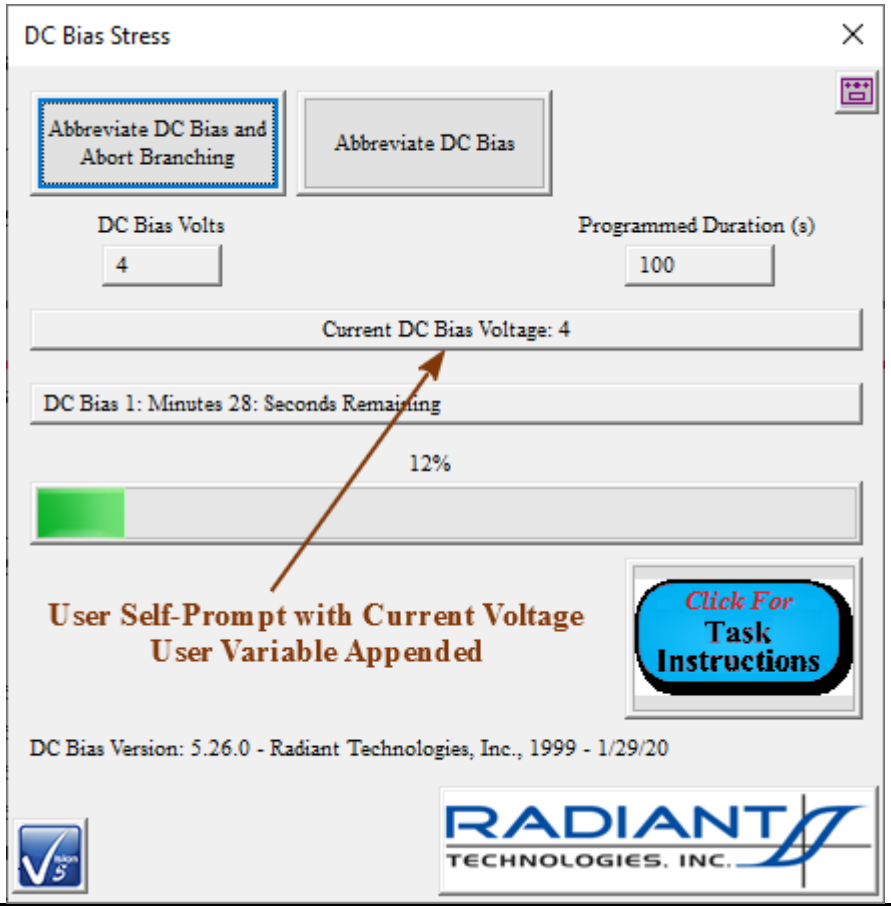
	bottom right of the Task box. The right half of the Test Definition Graph shows a mini structure with no text. It shows the Task type icons and the linking lines between dependent Tasks. The entire document can be copied to the clipboard for inclusion in a Word document or other document that recognizes Windows meta document objects. In the figure the Single-Point Filter Task is highlighted in pink. This indicates that the Task is selected for possible border color and/or text content editing. 
User Area	The User Area is the portion of the main Vision window that is not occupied by the menu, the toolbar or any of the standard Vision windows. By default this will be the center of the Vision window. This area is used to place DataSet Log Windows, Filter and Long-Duration Tasks' data plots and Vision and Task dialogs.

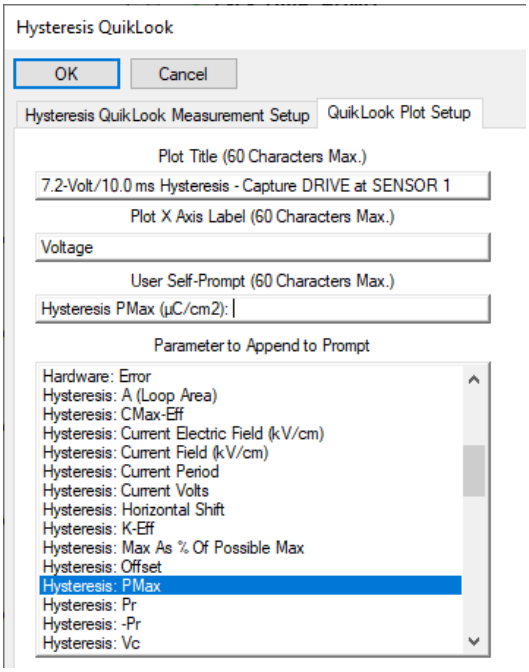


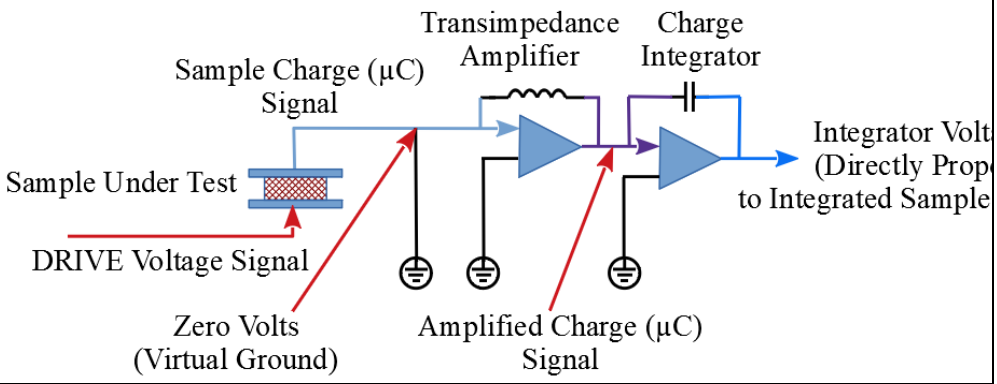
User Self-Prompt

Most Tasks that present a dialog on execution include a field that can by preprogrammed by the experimenter to display a text message. The text message can often have a single User Variable appended to it so that the user can review the current state of the Task or other program element.

The figure shows the execution of a DC Bias Task with the current DC Bias voltage appended to the User Self-Prompt



User Variable	A User Variable is an element on a variable-length list that is maintained by Vision. Each element on the list has a name, a type and a value. The list is primarily augmented by Tasks as they are accessed, each adding its own collection of User Variables. Custom User Variables may also be added to the list by the user using the Make User Variable Task. The user can adjust the value of an User Variable using the Update User Variable Task. However most User Variables are maintained by the Tasks that created them and only Custom User Variables should be adjusted by the experimenter. User Variables serve a variety of purposes including: • Maintaining the persistence of configuration parameters between the configurations of two Tasks of the same type or base type. (Example, set *Sample Area (cm2)* to 1.0 in the configuration of one Hardware Task. Subsequent Hardware Tasks will have a *Sample Area (cm2)* value of 1.0.) • Maintaining the current status of the program at each stage of program configuration or Test Definition execution. • Allowing the user to review the state of the program by appending the value of a User Variable to a User Self-Prompt on an execution dialog or by executing a User Variable Snapshot or Selected User Variable Snapshot Task. • Providing the current state of a program parameter to a Logic Condition in a Program Control Task such as a Branch Task, an Automatic Exit Task or an If/Then Task, among others. In this case, the current state of a User Variable is compared with a fixed value of the User Variable type using a selected comparator (<, <=, =, >, >= etc.). See Branching for much more detail. In the figure, the current value of Hysteresis P_{Max} ($\mu C/cm^2$) is to be appended to the User Self-Prompt on a Hysteresis Task Data Presentation dialog. 
Virtual Ground	This is the name of the circuit that is used to capture and measure the charge from the Device-Under-Test (DUT) that enters the tester at the RETURN port. The circuit is referred to

	as "Virtual Ground" because the charge integrator that performs the measurement keeps the input electrically at, or very near, the tester's earth ground potential. This averts a host of noise and other issues as described in detail in the Tester Theory section. 
Vision	Broadly, Vision is the Radiant Technologies, Inc. program that controls the Precision tester and other Radiant Technologies, Inc. instruments. More specifically, Vision is a framework that provides services to a variable list of semi-independent agents, known as Tasks, that do the work of Vision. Available Tasks are found, on Vision startup, and loaded into the TASK LIBRARY. A subset of the Tasks, as determined by each Tasks, is also loaded into the QuikLook menu. Services provided by Vision to the Tasks include, but are not limited to: • Direct communication with Precision testers and other Radiant instruments through the Vision driver. • EDITOR Test Definition construction and editing. • DataSet creation • Test Definition movement within Vision. • Test Definition execution and sequencing. • Database maintenance and I/O. • Data plotting tools. • QuikLook Task access - configuration and execution.
Vision Data File (VD)	A Vision Data File (VDF) is a binary file exported by a data-collection Tasks - Measurement or Filter. The file is specific to the Task and is headed by the Task Name. Both configuration parameters and measured data are exported to the file. The Task can both write (export) and read the file. And data-collecting Task can be configured to import (read) the file on execution instead of performing a normal data-collecting execution. Vision Data Files have a file extension of *.vis. The purpose of this option was to allow data to be moved from anywhere in Vision into a new execution of the Task. In this way data from any number of disparate locations could be collected together with Filter applied to the collection. However, this is a tedious process. With the introduction of Data Mining and ETD Transfer, this option has been rendered obsolete. However, although the file formats have not been updated as Tasks are updated, the export/import option is still available and is extended to new Tasks as they are introduces. The figure attempt to show the utility of the Vision Data File tool.