



# Microvue

## Wavevue Measurement Studio

### Classroom Training Day 2 IV Measurements



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Revision 2  
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# **Wavevue Measurement Studio Training Tutorial**

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**Wavevue Training Course Day 2: DC-IV**  
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# Introduction

This Wavevue Training document consists of hands-on application tutorials. By following these tutorials, each student will learn everything necessary to immediately begin making measurements using the Wavevue Measurement Studio Software. The modules start with the fundamentals and grow in sophistication with each lesson. After the student has completed the last module, he/she will have created an entire measurement project that can be used as a model for future requirements.

# Requirements

- PC running Windows 98 or 2000 (SP1) with Wavevue installed
- Wavevue Instrument Edition software key
- Some sections require Nucleus 2.1 (or later) installed. These sections involve wafer stepping. However, the majority of this tutorial does not require Nucleus.

# Application Modules

The tutorials in this training document consist of the following Application Modules:

### Application Module 1: Create a New Project / Save Your Project

- Provides instruction on how to create a new Wavevue project.

### Application Module 2: Set Up Your Instrumentation

- Provides instruction on how to select the proper instrumentation drivers, how to configure the drivers, and how to view the configured instrumentation and accessories.

### Application Module 3: Set Up Your Devices

- Provides instruction on how to create Wavevue virtual devices to model your physical devices.
- Provides instruction on how to save the Wavevue project, understand the different components of a Wavevue project, how to organize the project components.

### Application Module 4: Set Up Your Connections

- Provides instruction on how to configure Connections to bind parameter analyzer channels to device ports, and how to control switch matrices and other miscellaneous test instruments.

### Application Module 5: DC-IV Measurement Set Up

- Provides instruction on how to configure DC-IV Measurement settings.

### Application Module 6: Use the Script Editor

- Provides instruction on how to create measurement scripts using the Script Editor. Begins with a simple DC-IV Measurement, and then increases the functionality by sequencing several IV measurements on the same device. Runs the measurement scripts and provides a general overview of the Script Editor's other capabilities.

# Application Modules (continued)

### Application Module 7: Wafer, Reticle and Subsite Set Up

- Provides instruction on how to define your wafer setup, how to define your reticle setup, and how to define your subsite setup. Also describes how to create a wafer walk script using the Script Editor. Finishes by running the created wafer walk script.

### Application Module 8: Viewing Your Data

- Provides instruction on how to view an existing report, how to define a new layout, how to set up a new report, and how to create a Wafer Map report.

### Application Module 9: Data Management

- Provides instruction on how to use the Data Manager, how to filter data from one data file, and how to combine and filter data from two data files.

# Where to Get More Information

**Wavevue Manual:** Software manuals are shipped with the software and are available separately from Cascade Microtech, Inc.

**Wavevue Training:** Cascade Microtech offers Wavevue training approximately once a month at the factory. These classes provide comprehensive hands-on training for the use of the Wavevue Measurement Studio software solution.

**Customer Support:** If you purchased your Cascade Microtech product from a third-party vendor, you can contact that vendor for service and support. Otherwise, you may contact Cascade directly at 1-800-550-3279. Requests for sales, service, and technical support information will receive a prompt response.

**Note:** When sending an email for technical support, please include information about the hardware and software involved, plus a technical description of the problem, including how it can be reproduced.

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# Module 1

## Create New Project

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What you will learn in this Module:

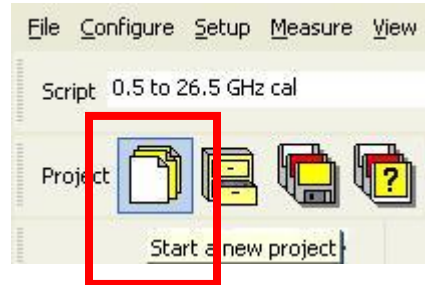
1. How to create a new Wavevue project

# Wavevue Measurement Studio Training Tutorial

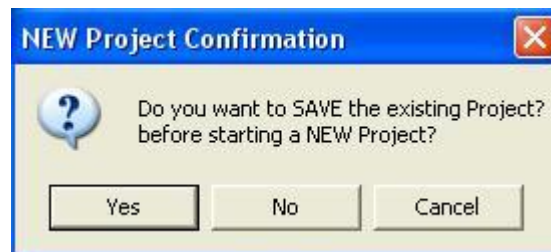
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## A. Create a New Project

1. On the Main Toolbar, click on the Start A New Project icon shown below.



2. If you have a project currently open that you would like to save, then click Yes in the New Project Confirmation box. Otherwise, click No.



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3. In the Open Project Files window, choose New Project and click Next. This will open a new project.



This dialog has three tabs.

- New – Select from the predefined standard projects.
- Existing – use the explorer functions to browse for an existing project.
- Recent – Show a list of most recently used projects for this user.

4. Notification>New Project created successfully, hit Ok.



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# Module 2

## Set Up Your Instrumentation

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What you will learn in this Module:

1. How to select your measurement instrumentation drivers
2. How to configure the instrument drivers for your specific setup
3. How to view your configured instruments and accessories
4. How to save your Wavevue project file
5. How to understand the different component files of your Wavevue project

# Wavevue Measurement Studio Training Tutorial

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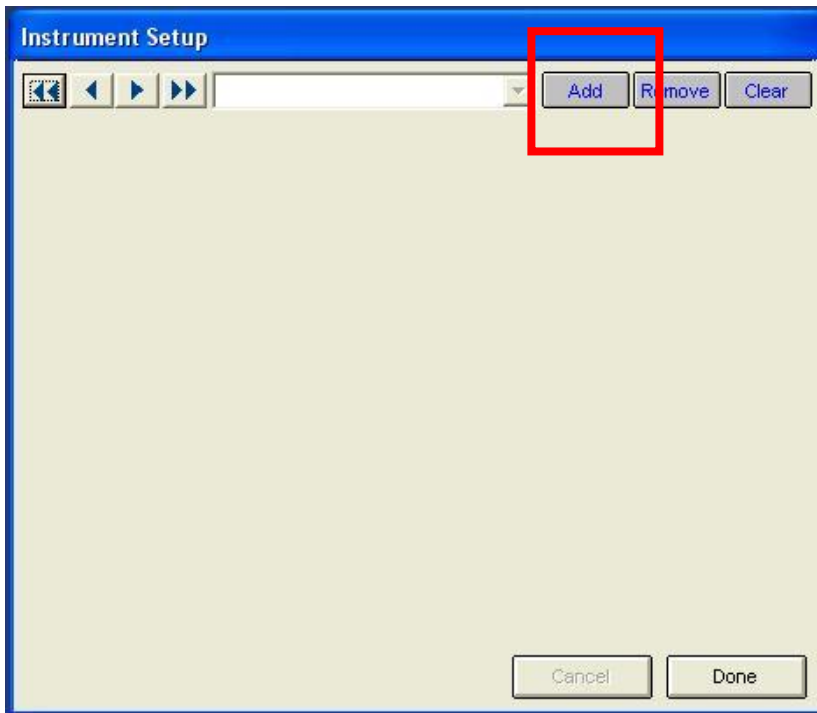
## A. Set Up Your Instrumentation

In this example we will be making DC-IV measurements on a HEMT device. We will use an Agilent E5270A Parameter Analyzer mainframe with four E5280A SMU plug-ins and a Cascade 12000 wafer prober.

1. On the Main Toolbar, click on the Configure the instruments icon shown below.



2. On the Instrument Setup window Click on the Add button to add a new Parameter Analyzer.

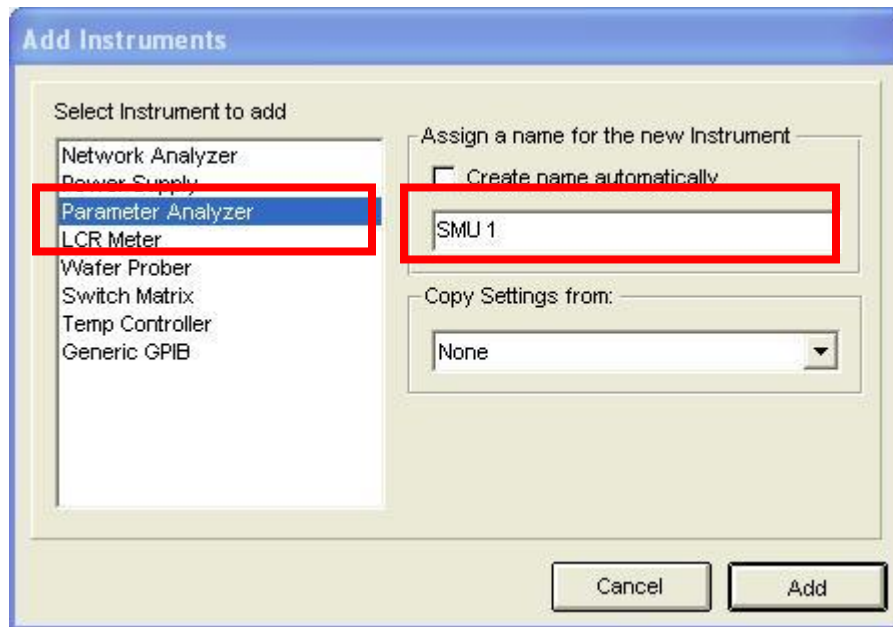


- All setup dialogs in Wavevue use the same format for managing entries.
- Click the Add button to add a new entry on the list.
- Click the Remove button to remove an entry from the list.
- When the list is empty, the dialog is gray (as shown).

## Wavevue Measurement Studio Training Tutorial

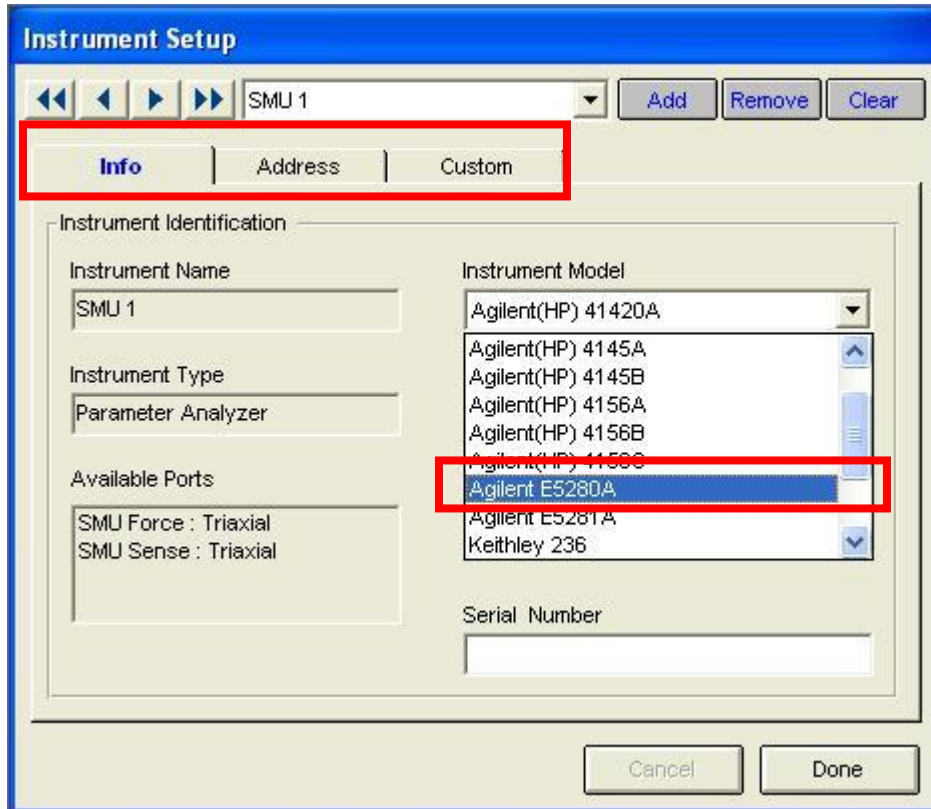
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3. The Add Instrument window shown below will appear. Select Parameter Analyzer from the list on the left, then un-check the Create Name Automatically box and change the name to something more meaningful like "SMU 1". Click the Add button to continue.



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4. The Instrument Setup window below will show the Parameter Analyzer's object information.



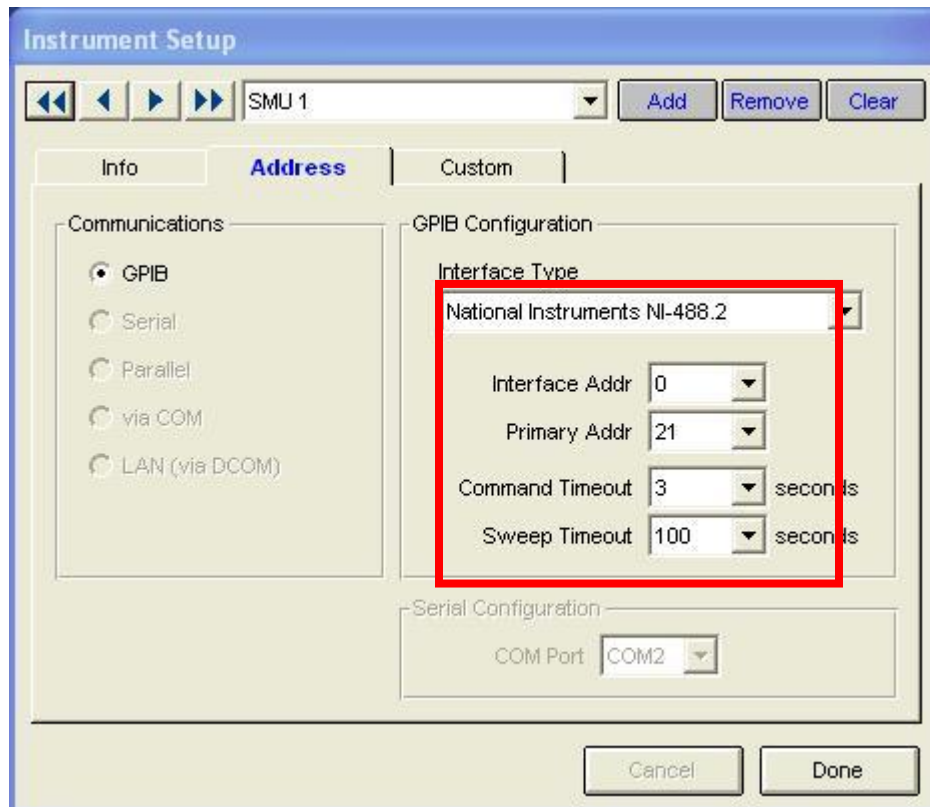
- The instrument setup dialog has three tabs:
- Info (shown). Use this tab to select the type of instrument.
- Address (shown below). Select the GPIB address of the instrument.
- Custom. Only applies to some instruments.

5. Select the correct model number, E5280A, from the Instrument Model pull-down list. A Reminder dialog will appear informing you that all of the other settings have changed to the correct defaults for the selected model. Click OK to continue.



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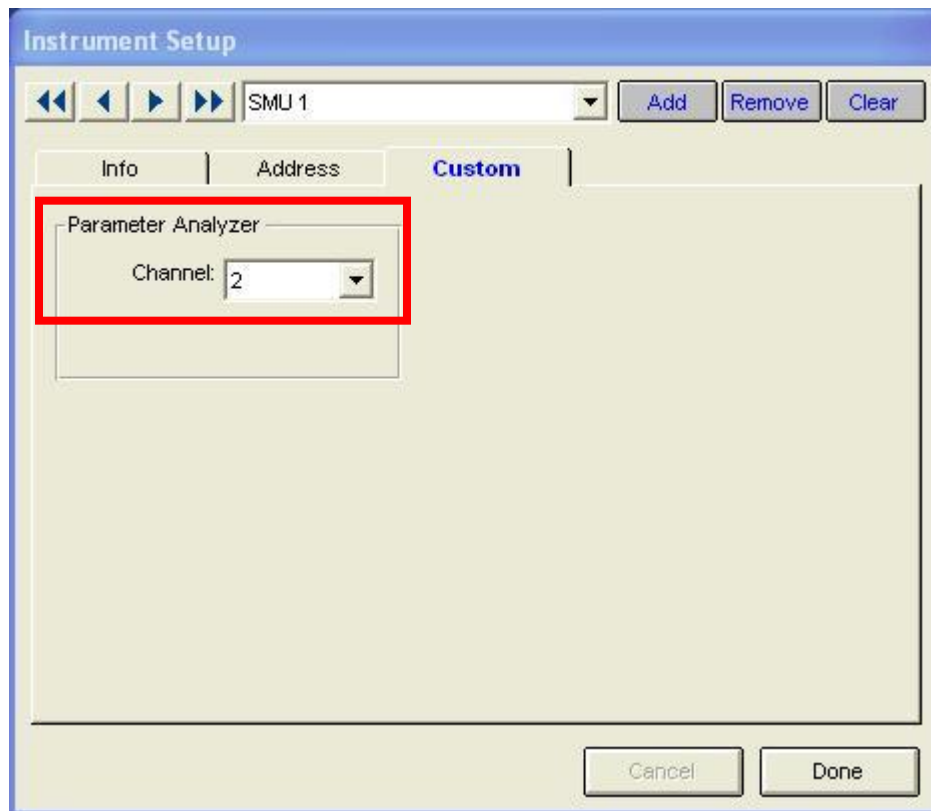
- Click on the Address tab and specify the correct GPIB address of the Parameter Analyzer. In most cases Wavevue will auto-detect your GPIB card and will default to the proper Interface Address. Wavevue also pre-selects the factory-preset address. Confirm the Primary Address for your analyzer. The Command and Sweep Timeouts are defaulted to reasonable values for the instrument model. Verify that all settings are correct for your configuration.



## Wavevue Measurement Studio Training Tutorial

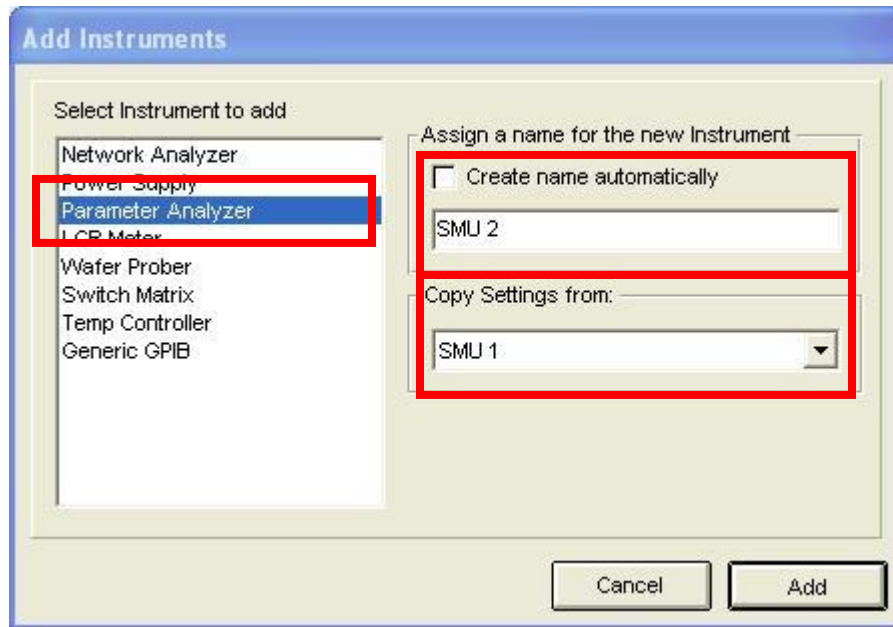
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- Click on the Custom to specify the channel number for the SMU plug-in. Select the slot number for the SMU from the Channel pull-down. Note that for 2-channel SMU's in the E5270A mainframe, you always specify the higher of the two slots that the plug-in occupies.



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8. We will now add the remaining Parameter Analyzer channels. Note that Wavevue treats each channel of a Parameter Analyzer as a separate instrument for maximum configuration flexibility. Click the Add button again. The Add Instrument window shown below will appear. Select Parameter Analyzer from the list on the left, then un-check the Create Name Automatically box and change the name to something more meaningful like "SMU 2". Select "SMU 1" from the Copy Settings from pull-down to save yourself some work.

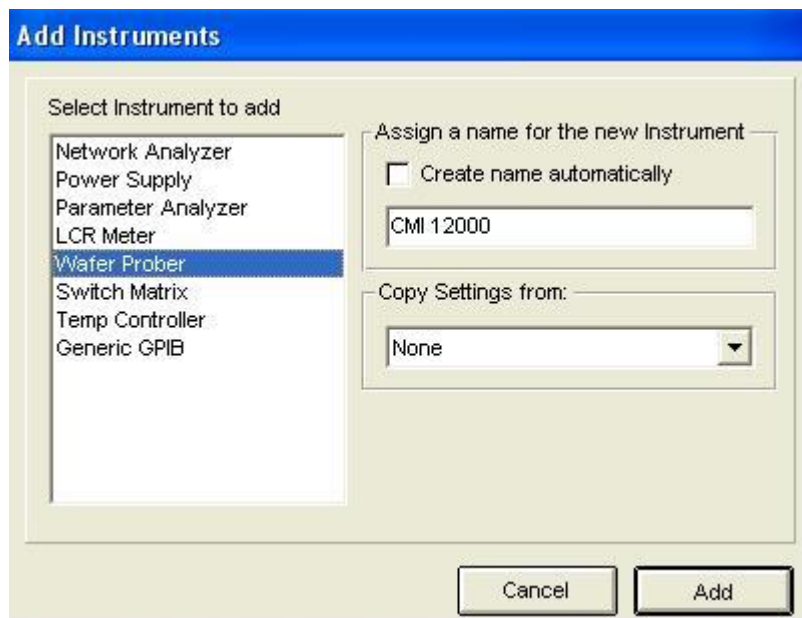


9. By copying the existing SMU channel, all of the settings will be inherited. The only setting we need to change for the new instrument is the Channel on the Custom tab. Change that to 4 for the second SMU.
10. Repeat the process to add "SMU 3" and "SMU 4". In each case, copy the settings from one of the existing SMUs. Set the Channels to 6 and 8 respectively.

## Wavevue Measurement Studio Training Tutorial

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11. The last instrument we need to set up is the wafer prober. Click the Add button again. The Add Instrument window shown below will appear. Select Wafer Prober from the list on the left, then un-check the Create Name Automatically box and change the name to something more meaningful like "CMI 12000". Click the Add button to continue.



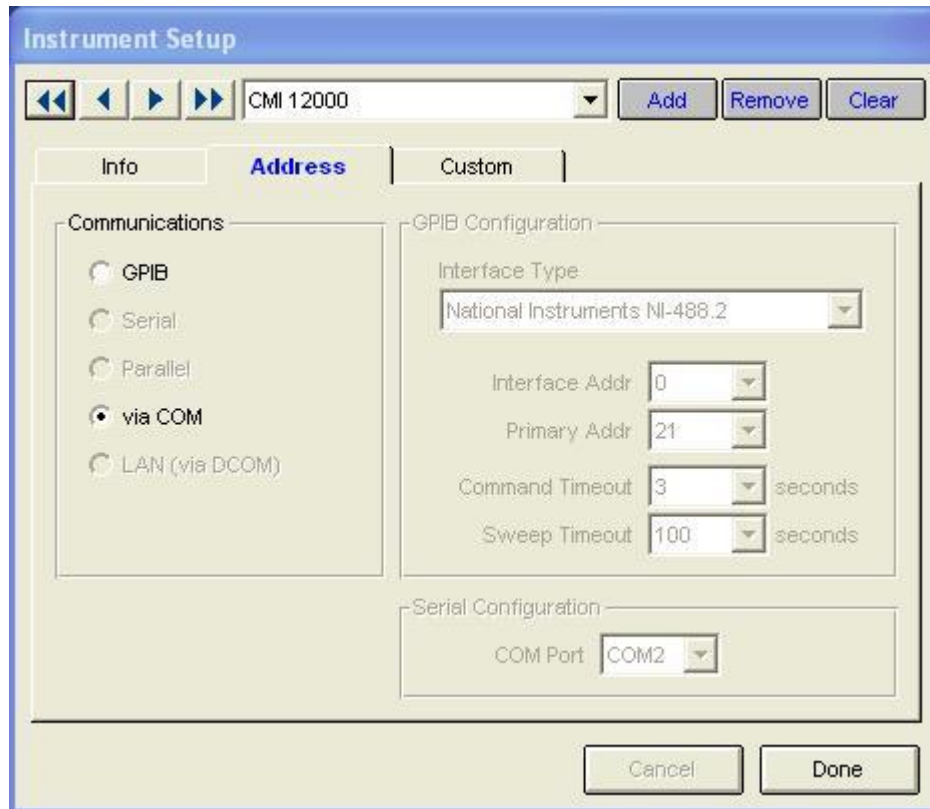
## Wavevue Measurement Studio Training Tutorial

12. The Instrument Setup window below will show the Wafer Prober's object information. Select CMI 12000 from the Instrument Model list. The program will warn you that the configuration parameters have been reset due to the model change.

The image shows the 'Instrument Setup' dialog box. At the top, there is a blue title bar with the text 'Instrument Setup'. Below the title bar, there is a navigation bar with four arrows (left, left, right, right) and a dropdown menu showing 'CMI 12000'. To the right of the dropdown are three buttons: 'Add', 'Remove', and 'Clear'. Below the navigation bar, there are three tabs: 'Info' (selected), 'Address', and 'Custom'. The 'Info' tab contains the 'Instrument Identification' section. This section has two columns. The left column contains 'Instrument Name' (text box with 'CMI 12000'), 'Instrument Type' (text box with 'Wafer Prober'), and 'Available Ports' (empty text box). The right column contains 'Instrument Model' (dropdown menu with 'CMI 12000'), 'Instrument Options' (empty text box), and 'Serial Number' (empty text box). At the bottom right of the dialog box are two buttons: 'Cancel' and 'Done'.

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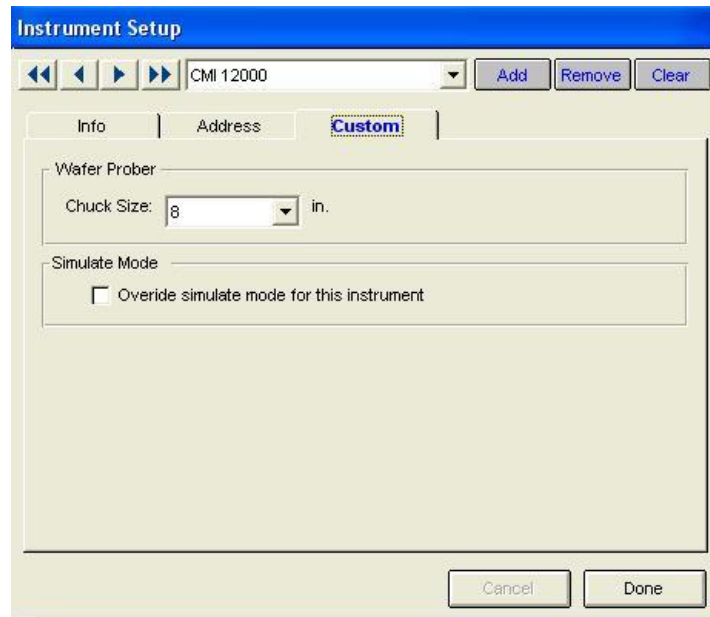
- Click on the Address tab and specify the communications settings. The default value of "via COM" is correct for Wavevue and Nucleus running on the same computer. No other settings are required for this communication mode.



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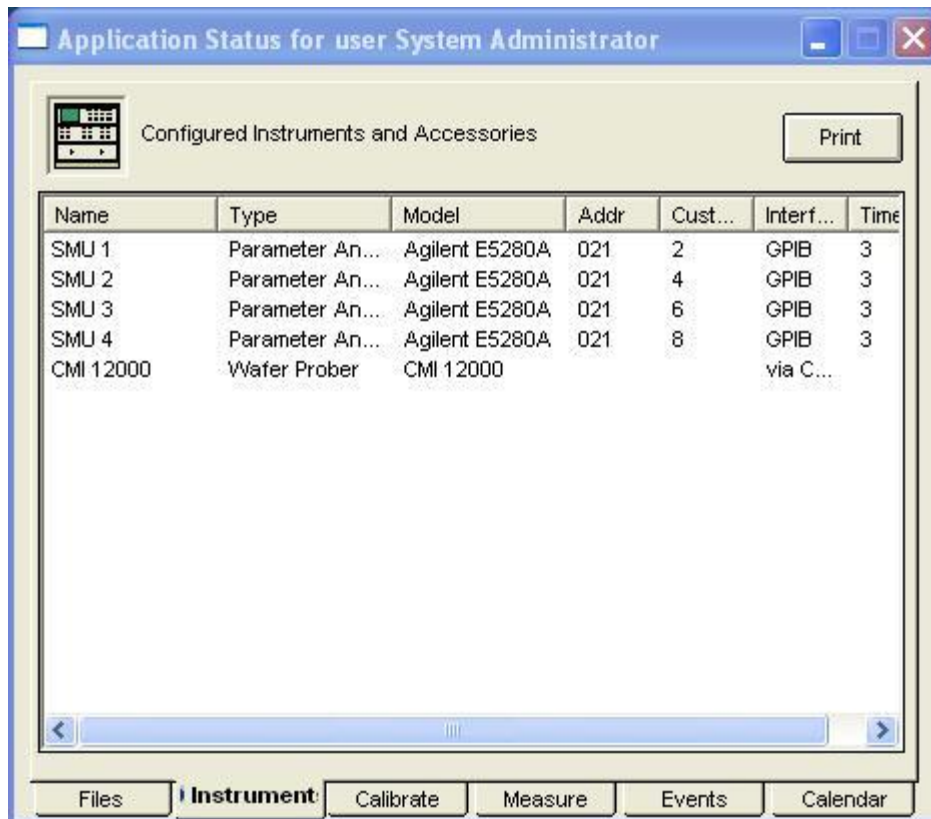
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- Click on the Custom tab to finish setting up the wafer prober instrument. We will keep the default 8-inch chuck size.



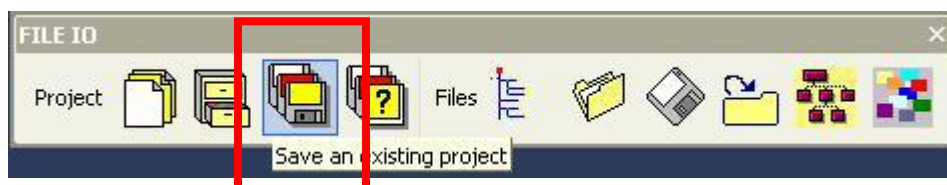
## Wavevue Measurement Studio Training Tutorial

15. The instruments are now all specified for this example. Click Done on the Instrument Setup window. Check the Application Status window to make sure that all of the instruments are set up correctly. It should look like the picture below. Make sure that the four parameter analyzers are set to the same address, but that they all have different channels specified.



### B. How to save your Wavevue project file

1. Now that we have setup our instrumentation, we should save our work by saving our Wavevue project.
2. On the Main Toolbar, click on the Save Project icon shown below:





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3. Since no project is currently defined, the Save Project As window will appear as shown below. Note that the directory paths for the project component files are automatically set to track the directory profile. You will need to specify the names of the component files. In this case, we are going to give them all the same base name – “IV Wafer Example.”

**Save Project As...**

**Directory Structure**

- ☒ Use Directory Profile paths: Default
- ☐ Use existing paths for all component files
- ☐ Use Project Path for all component files
- ☐ Specify individual paths for each component file

**Component Naming Options**

**b**

**Project**

Path: C:\Wavevue Data ... Name: IV Wafer Example.prj **a**

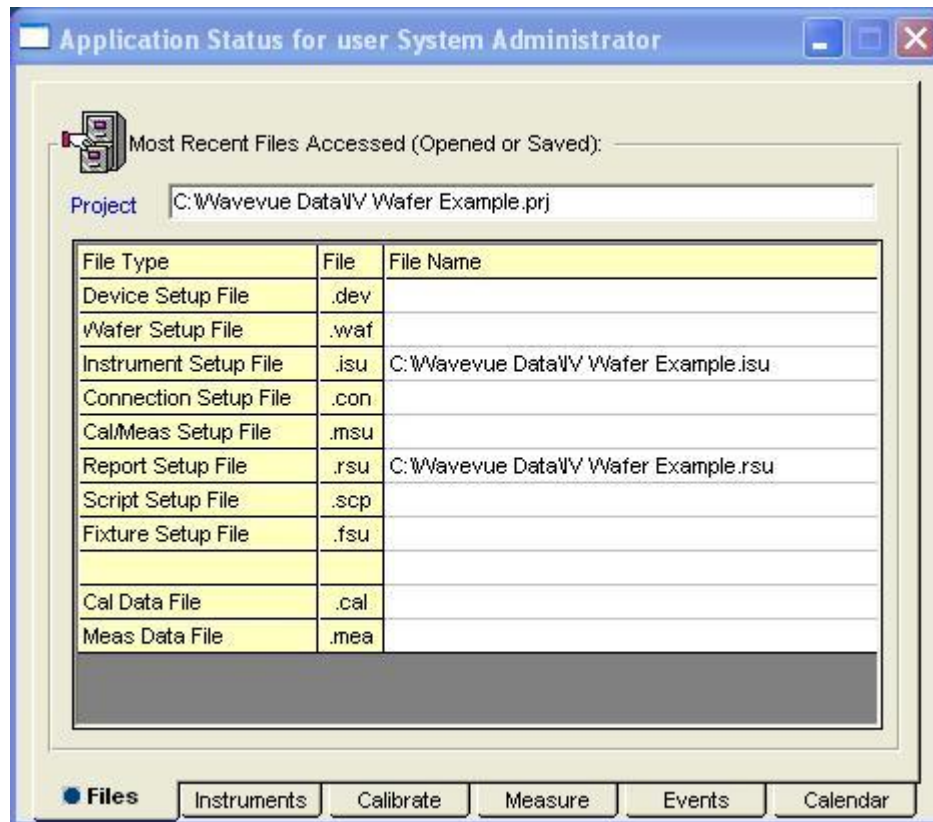
**Project Components**

Component	Ext	Path	Filename	Data?	Omit?
Device Setup File	.dev	C:\Wavevue Data	<No Data>	No	<input type="checkbox"/>
Wafer Setup File	.waf	C:\Wavevue Data	<No Data>	No	<input type="checkbox"/>
Instrument Setup File	.isu	C:\Wavevue Data	IV Wafer Example	Yes	<input type="checkbox"/>
Connection Setup File	.con	C:\Wavevue Data	<No Data>	No	<input type="checkbox"/>
Cal/Meas Setup File	.msu	C:\Wavevue Data	<No Data>	No	<input type="checkbox"/>
Report Setup File	.rsu	C:\Wavevue Data	IV Wafer Example	Yes	<input type="checkbox"/>
Script Setup File	.scp	C:\Wavevue Data	<No Data>	No	<input type="checkbox"/>
Fixture Setup File	.fsu	C:\Wavevue Data	<No Data>	No	<input type="checkbox"/>
Cal Data File	.cal	C:\Wavevue Data	<No Data>	No	<input type="checkbox"/>
▶ Meas Data File	.mea	C:\Wavevue Data	<No Data>	No	<input type="checkbox"/>

- a) Highlight the "<Untitled>" value in the Project Name field and type "IV Wafer Example."
- b) Click the Set All Filenames to Project Name button in the Component Naming Options.
4. Click Done. Wavevue will create all of the specified component files and also create a high level project file to map them.

## Wavevue Measurement Studio Training Tutorial

5. Note that the Files tab on the Application Status window has updated to reflect the new project you have created. Specifically, Wavevue has created an Instrument Setup File and a Report Setup File for your project.



Note: As you proceed through this tutorial, you will be creating the other components of your Wavevue project. At the end of each module, you will save your project, and Wavevue will automatically create the new component file for that section.

# Module 3

## Set Up Your Devices

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What you will learn in this Module:

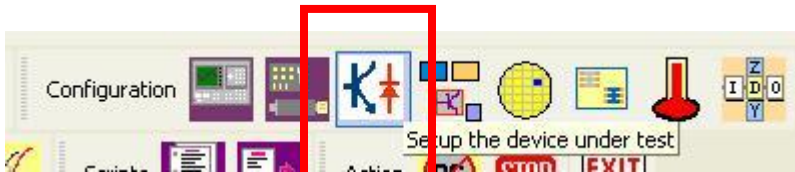
1. How to create a virtual Wavevue device to model your actual device
2. How to save your Wavevue project file

# Wavevue Measurement Studio Training Tutorial

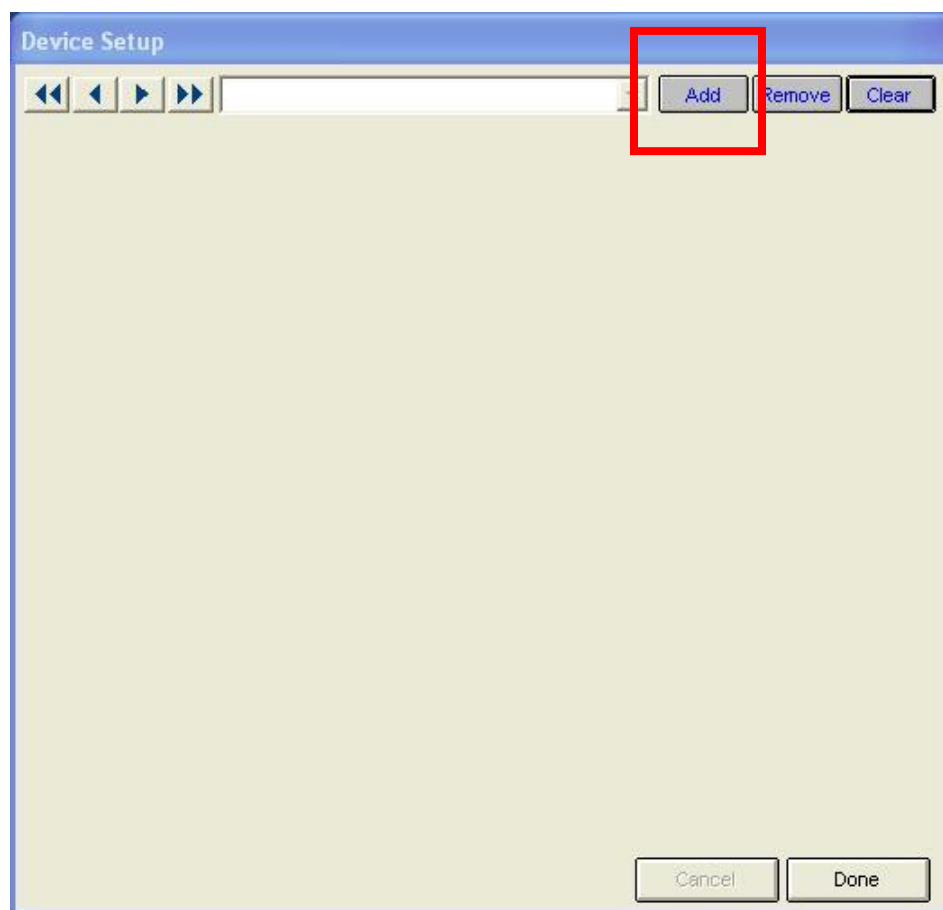
## A. Set Up Your Device

In this example we will be making a device to test our HEMT on wafer. The standard Wavevue devices don't include HEMTs, so we will use a normal FET instead, since the terminal names are the same.

1. On the Main Toolbar, click on the Setup the device under test icon shown below.



2. On the Device Setup window Click on the Add button to add a new Device.

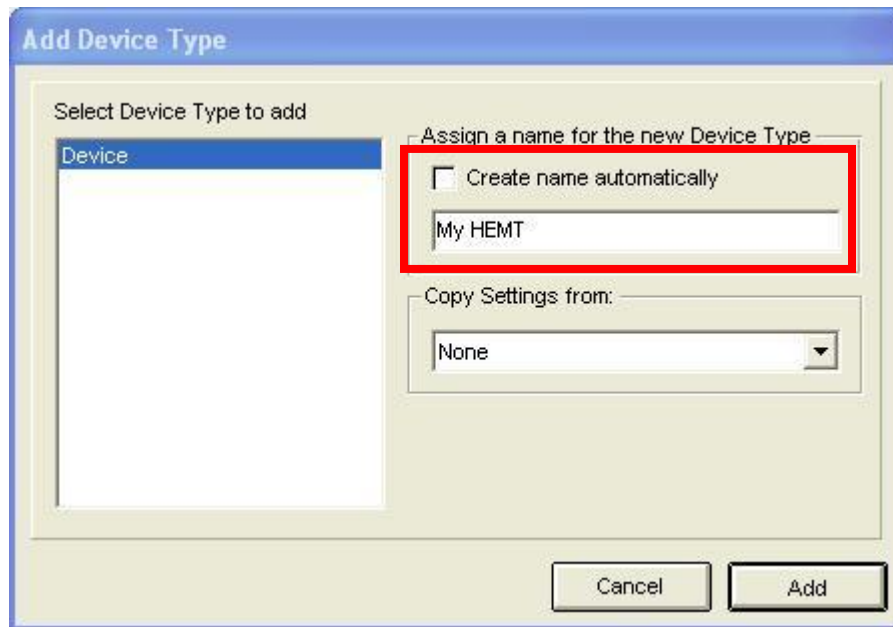


- All setup dialogs in Wavevue use the same format for managing entries.
- Click the Add button to add a new entry on the list.
- Click the Remove button to remove an entry from the list.
- When the list is empty, the dialog is gray (as shown).

## Wavevue Measurement Studio Training Tutorial

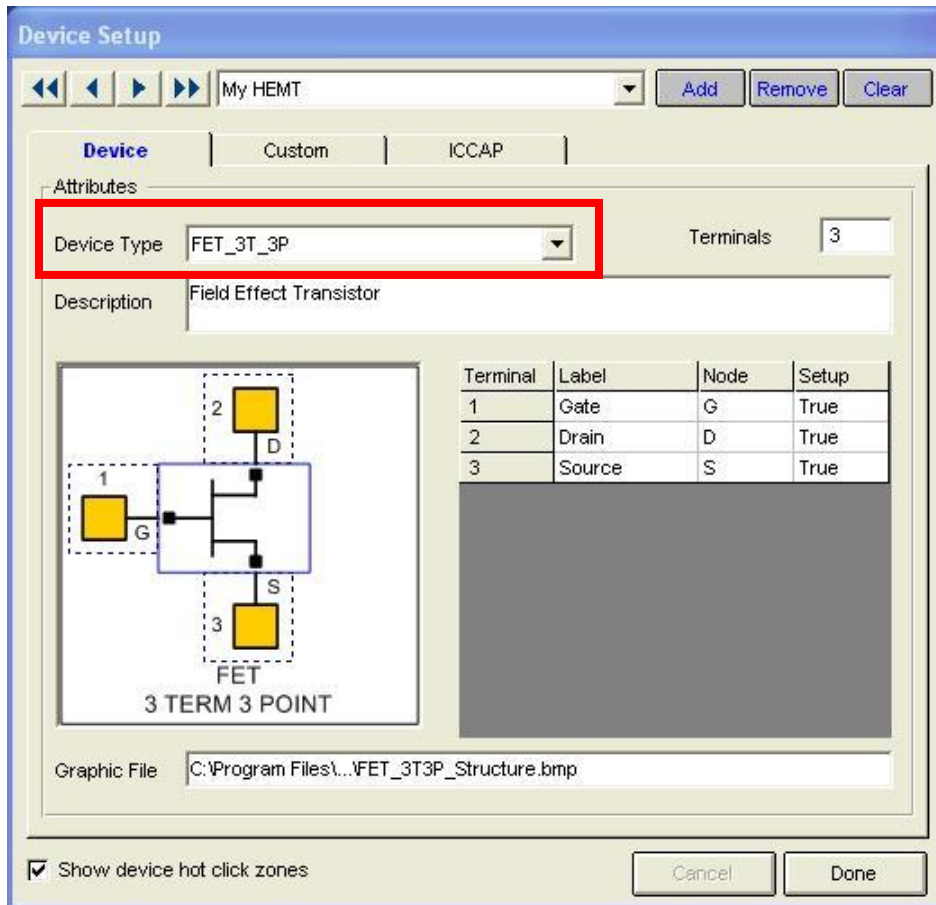
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3. The Add Device Type window shown below will appear. Un-check the Create Name Automatically box and change the name to something more meaningful like "My HEMT". Click the Add button to continue.



# Wavevue Measurement Studio Training Tutorial

4. The Device Setup window below will show the Device's object information.



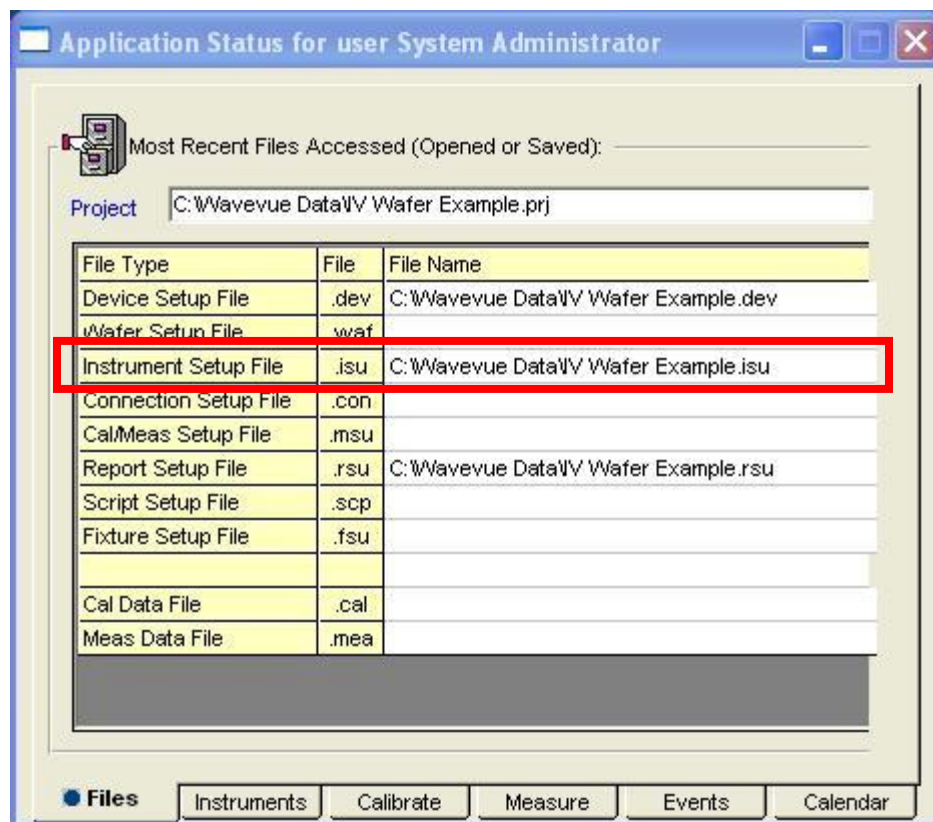
- The device setup dialog has three tabs:
- Device (shown). Use this tab to select the type of device.
- Custom. View the custom properties of the device.
- ICCAP. View the ICCAP settings for the device.

5. Select the correct device type, FET\_3T\_3P, from the Device Type pull-down list. Note that the naming convention of the Wavevue devices indicates the number of available device terminals and the pads available on each terminal. Thus, the FET\_3T\_3P is a FET with all 3 terminals available and a single pad per terminal. A FETCS\_2T\_4P would indicate a FET with the source hard-connected to ground and dual Kelvin pads on each of the other terminals. All of the other settings on the tab will change to reflect the selected device. FETs have no custom properties, so the Custom tab will be blank and the ICCAP settings are for reference only and can't be edited. Examine those tabs if you wish, then click Done to continue.

# Wavevue Measurement Studio Training Tutorial

## B. How to save your Wavevue project file

1. Now that we have setup our device, we should save our work by saving our Wavevue project.
2. On the Main Toolbar, click on the Save Project icon.
3. Since no filename is currently defined for the device setup file, the Save Project As window will appear. Click the Set All Filenames to Project Name button and Wavevue will automatically name the device setup file to match the rest of the project. Click Done and Wavevue will display a dialog for you to confirm that you wish to overwrite the existing project files.
4. Note that the Files tab on the Application Status window has updated to reflect the new device setup file you have added to the project.



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# Module 4

## Set Up Your Connections

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What you will learn in this Module:

1. How to set up a Connection to define your Parameter Analyzer channel to Device mapping
2. How to add switch matrix and other instrument control to your Connection
3. How to save your Wavevue project file

# Wavevue Measurement Studio Training Tutorial

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## A. Set Up Your Connection

In this example we will first be making a default connection setup for our HEMT device on wafer. It will assume that we have hard-wired connections from our SMU outputs directly to individual probe needles or a probe card. Then we will examine how we could add switch matrix control to the connection.

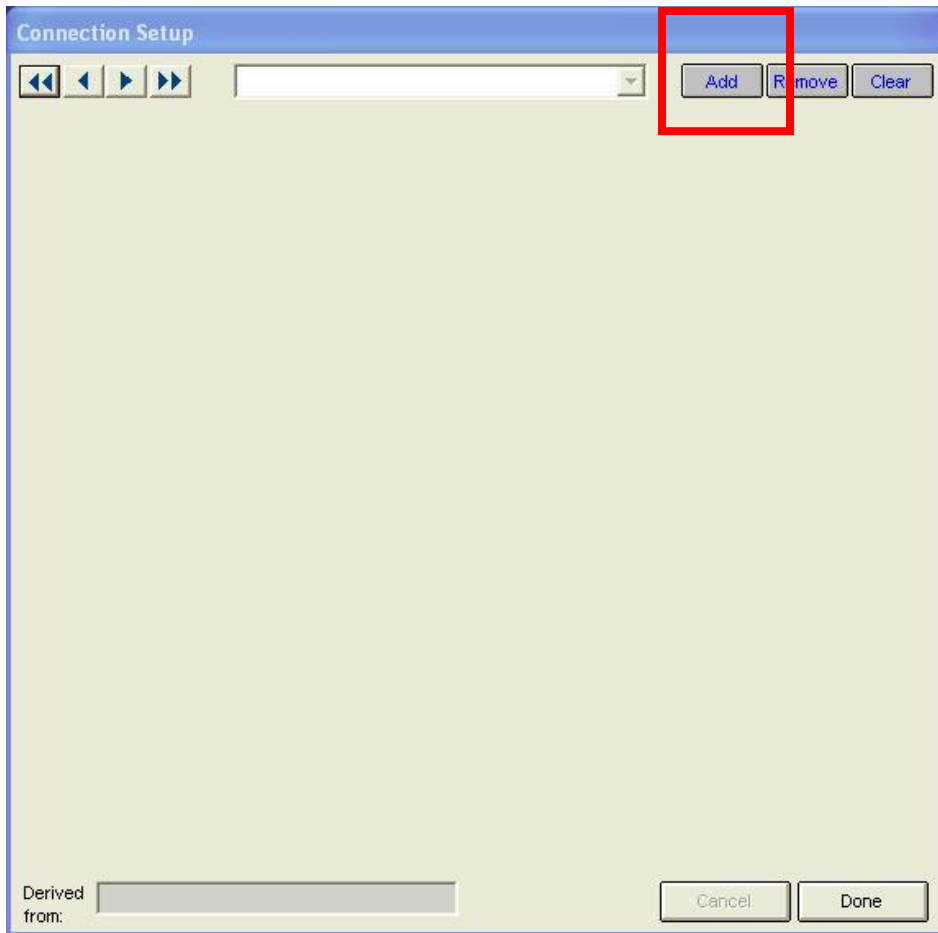
1. On the Main Toolbar, click on the Setup the connections between the device and the instruments icon shown below.



## Wavevue Measurement Studio Training Tutorial

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2. On the Connection Setup window Click on the Add button to add a new Connection.

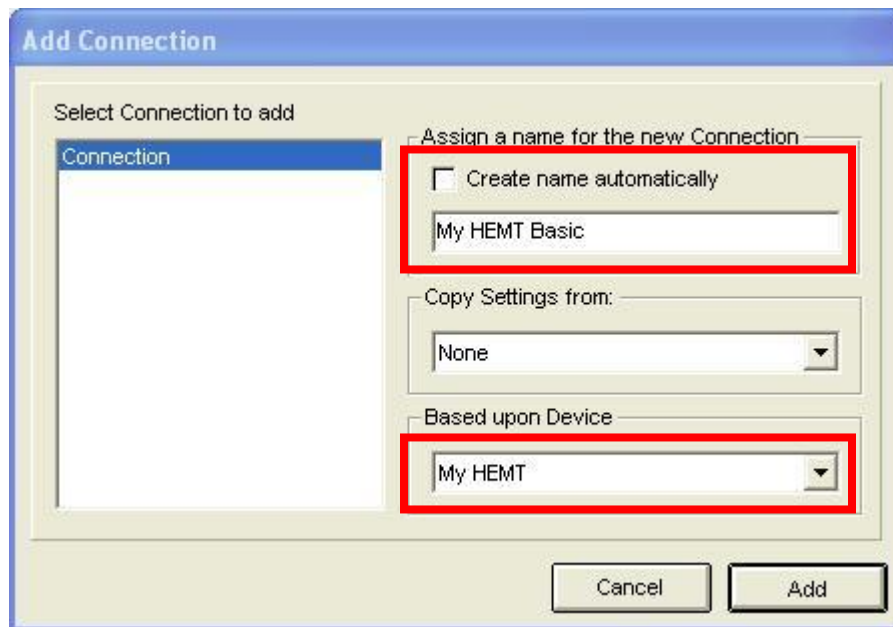


- All setup dialogs in Wavevue use the same format for managing entries.
- Click the Add button to add a new entry on the list.
- Click the Remove button to remove an entry from the list.
- When the list is empty, the dialog is gray (as shown).

## Wavevue Measurement Studio Training Tutorial

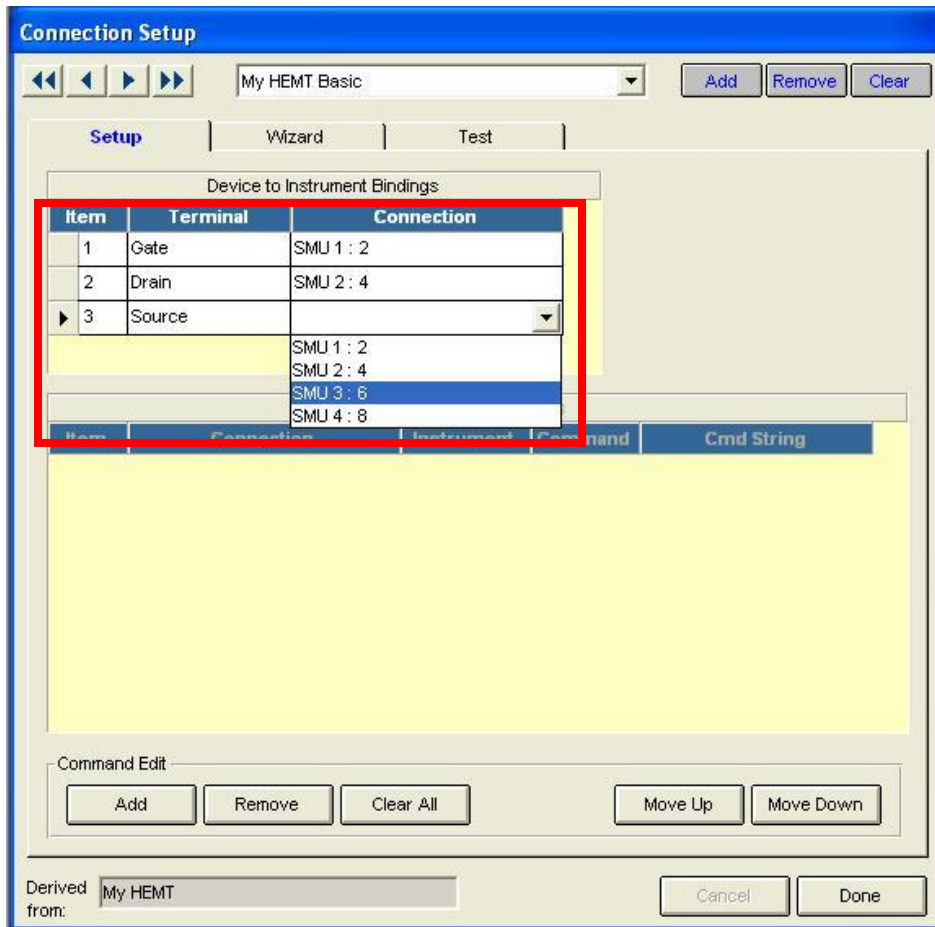
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3. The Add Connection window shown below will appear. Un-check the Create Name Automatically box and change the name to something more meaningful like "My HEMT Basic". Note that if you have more than one Device Type defined, you must make sure you have the correct one selected in the Based upon Device pull-down. Click the Add button to continue.



# Wavevue Measurement Studio Training Tutorial

4. The Connection Setup window below will show the Connection's object information.



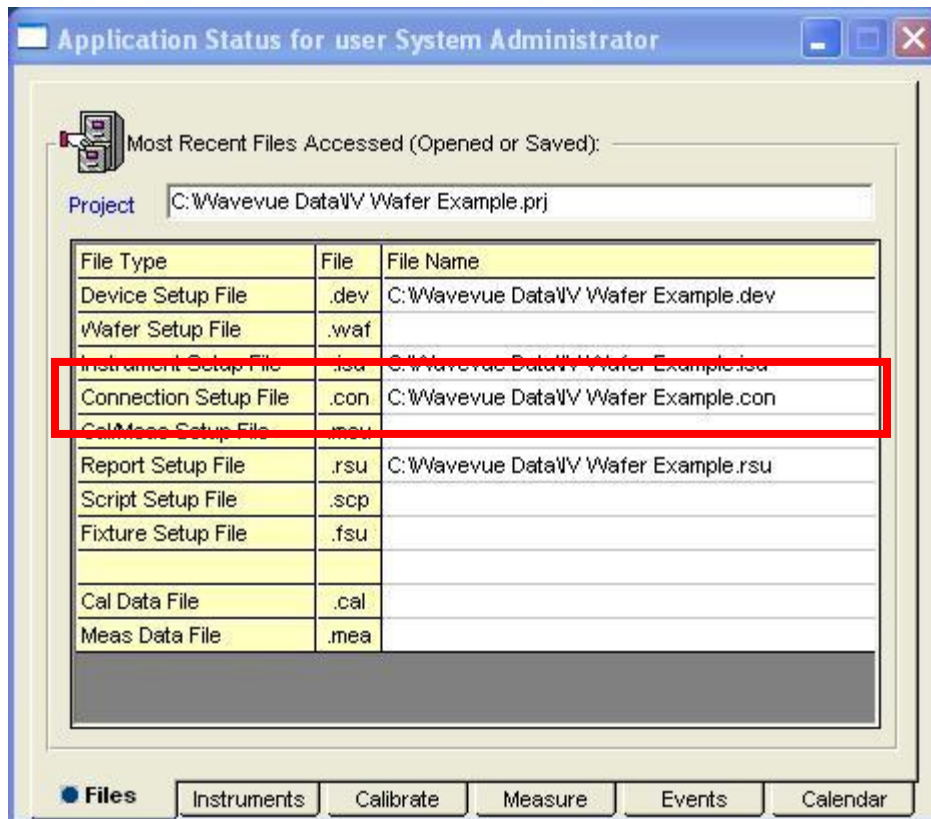
- The connection setup dialog has three tabs:
- Setup (shown). Use this tab to make the instrument to device terminal bindings and to implement connection commands.
- Wizard. Graphical tool to assist in setting up switch matrix control.
- Test. View the ICCAP settings for the device.

5. Select the appropriate SMU to tie to each of the device terminals in the Device to Instrument Bindings pull-downs. For this simple example, we won't use the Connection Commands grid in the lower half of the tab. You can examine the Wizard and Test tabs as well, but we won't be using either of those at this time. Click Done once you have verified the SMU assignments.

# Wavevue Measurement Studio Training Tutorial

## B. How to save your Wavevue project file

1. Now that we have setup our connection, we should save our work by saving our Wavevue project.
2. On the Main Toolbar, click on the Save Project icon.
3. Since no filename is currently defined for the connection setup file, the Save Project As window will appear. Click the Set All Filenames to Project Name button and Wavevue will automatically name the device setup file to match the rest of the project. Click Done and Wavevue will display a dialog for you to confirm that you wish to overwrite the existing project files.
4. Note that the Files tab on the Application Status window has updated to reflect the new connection setup file you have added to the project.



# Module 5

## DC-IV Measurement Set Up

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What you will learn in this module:

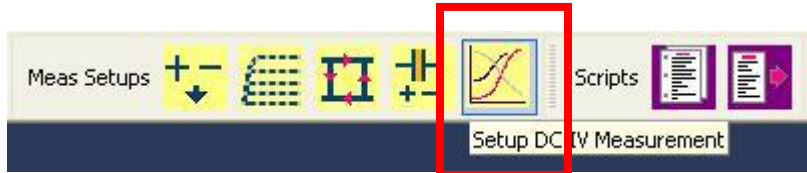
1. How to set up a basic FET curves measurement

# Wavevue Measurement Studio Training Tutorial

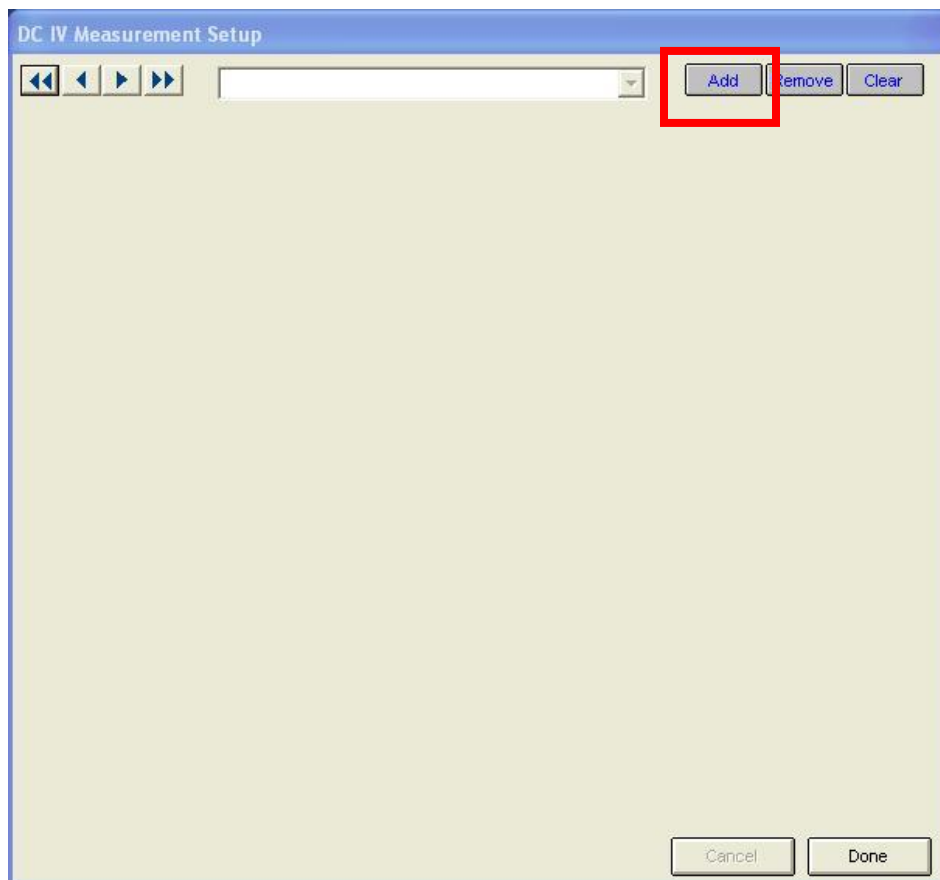
## A. DC-IV Measurement Set Up

In this section, we will be setting up a basic FET curves measurement to characterize our HEMT.

1. On the Main Toolbar, click on the Setup DC IV Measurement icon shown below:



2. On the DC IV Measurement Setup window Click on the Add button to add a new measurement setup.



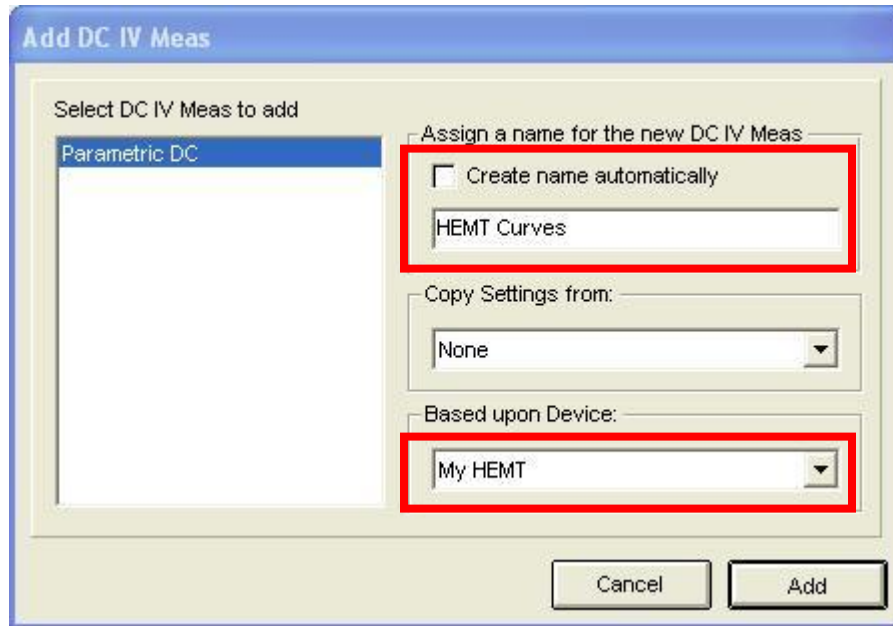
- All setup dialogs in Wavevue use the same format for managing entries.
- Click the Add button to add a new entry on the list.
- Click the Remove button to remove an entry from the list.
- When the list is empty, the dialog is gray (as shown).



## Wavevue Measurement Studio Training Tutorial

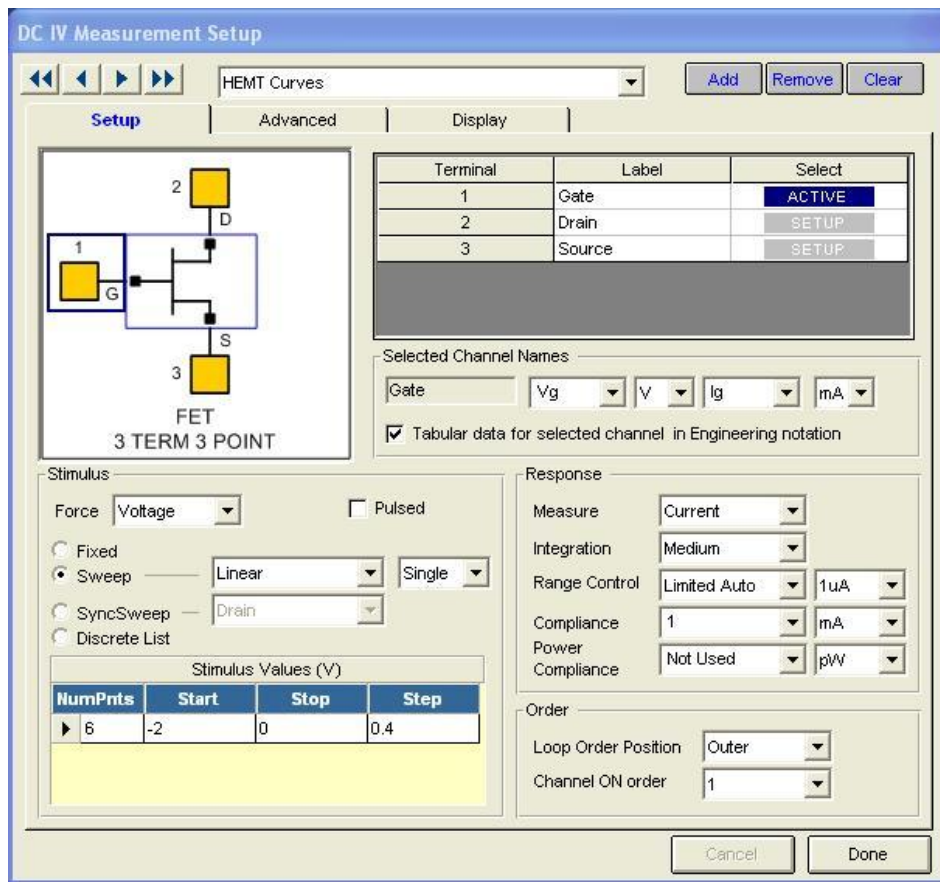
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3. The Add DC IV Meas window shown below will next appear. Un-check the Create Name Automatically box and type "HEMT Curves" in the field. Note that if you have more than one Device type defined, you need to select the correct one from the Based upon Device pull-down. Click Add to create the DC IV Measurement setup object.



## Wavevue Measurement Studio Training Tutorial

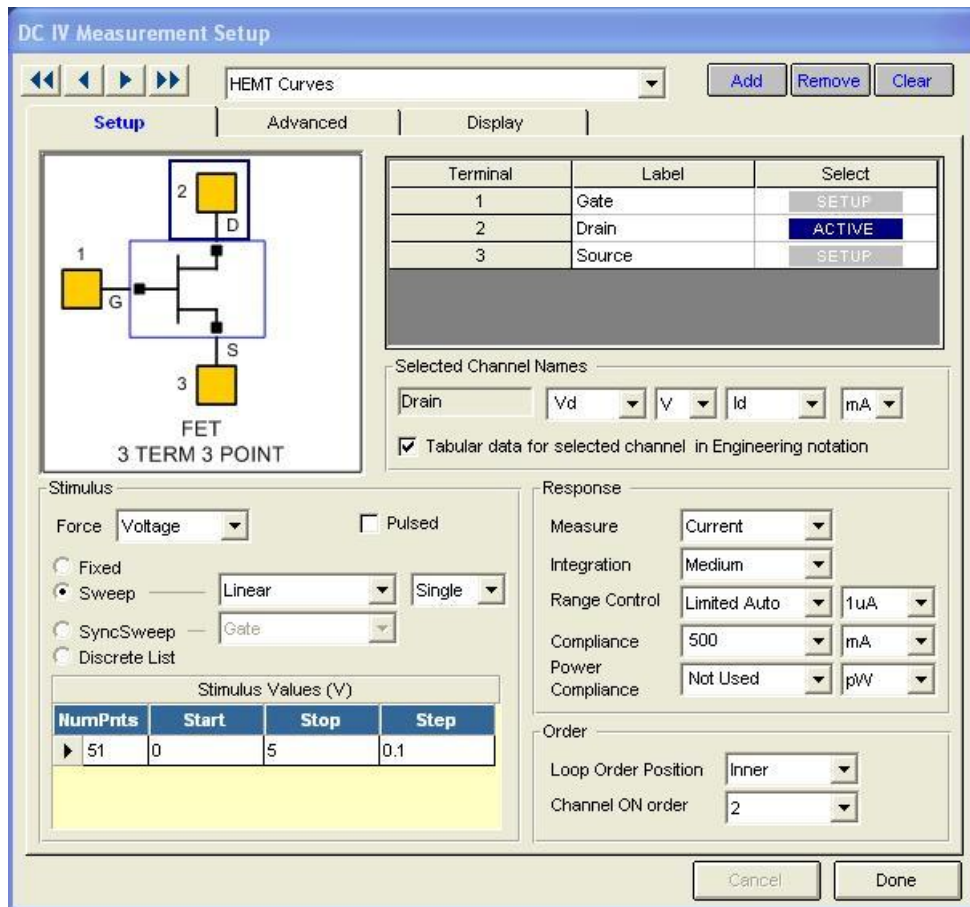
4. The DC IV Measurement Setup window will re-appear with the default settings for the new setup. Note that you can only view the settings for one device terminal at a time. Either click the terminal in the picture on the right, or click the corresponding row in the Select column on the upper right to select the active terminal.



- The DC IV measurement setup dialog has three tabs:
- Setup (shown). Use this tab to set up the parameters for each device terminal
- Advanced. Settings for advanced sweep timing and pulsed measurement
- Display. Settings for the parameter analyzer and virtual Wavevue display modes and a summary of the ICCAP settings for the measurement.

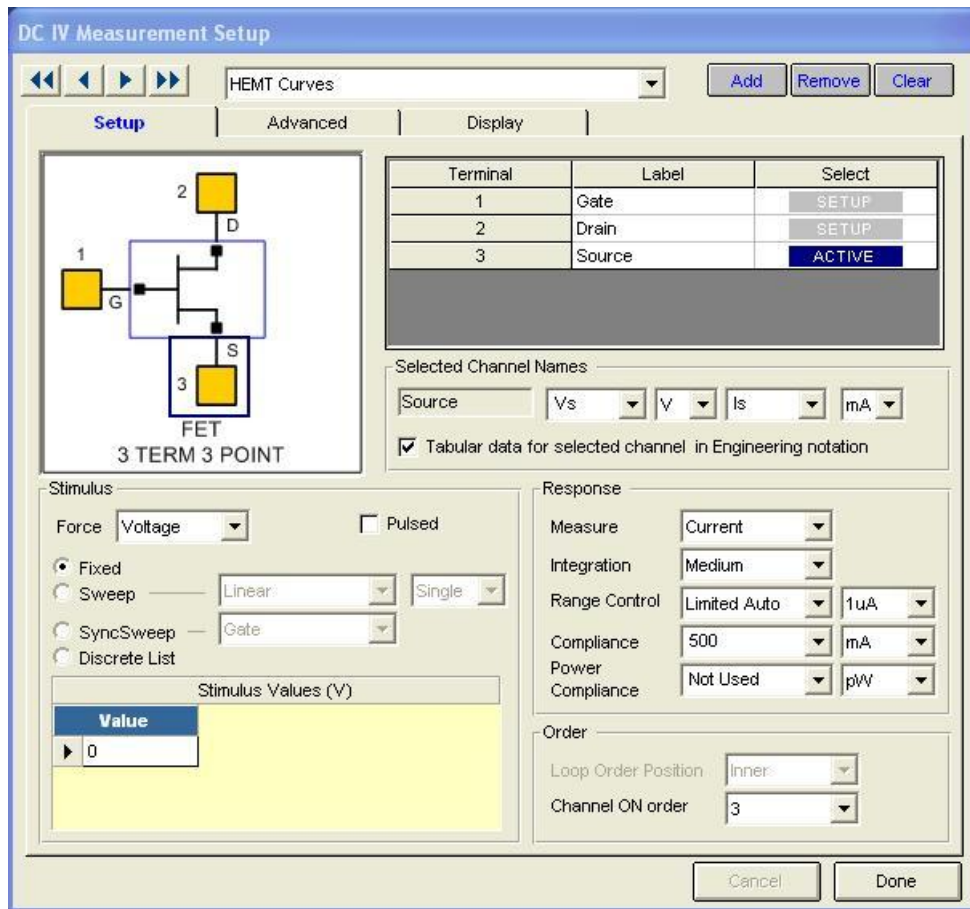
5. Set up the Gate terminal as follows:
- a. Select "Voltage" from the Force pull-down in the Stimulus box
  - b. Click the "Sweep" button in the Stimulus box to select a voltage sweep
  - c. Select "Linear" and "Single" from the pull-downs to the right of the "Sweep" button to select a single-ended sweep with linear point spacing.
  - d. In the Stimulus Values grid, enter "-2" in the Start column, "0" in the Stop column, and "0.4" in the Step column. Wavevue will automatically calculate the number of points for you.
  - e. The Measure pull-down in the Response box should automatically default to "Current" when you selected to Force "Voltage".
  - f. Select "Limited Auto" and "1uA" for the Range Control in the Response box
  - g. Select "1" and "mA" for the Compliance in the Response box
  - h. Select "Outer" for the Loop Order Position in the Order box
  - i. Select "1" for the Channel ON order in the Order box

# Wavevue Measurement Studio Training Tutorial



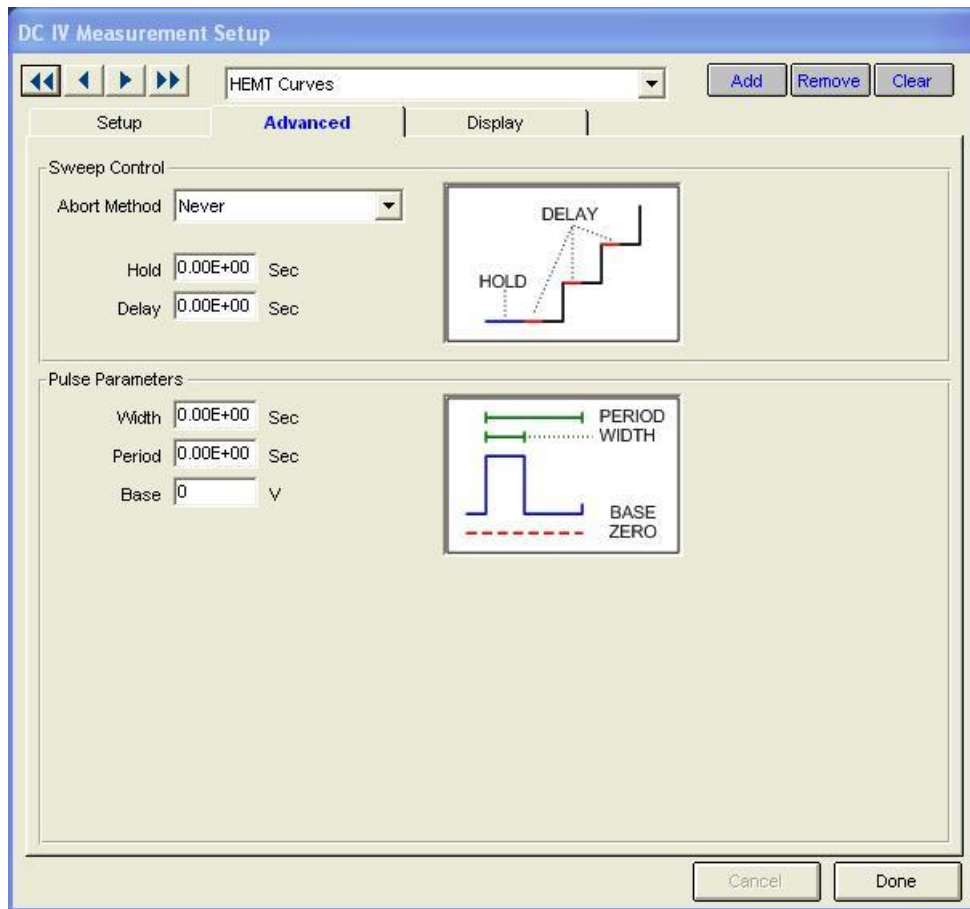
6. Set up the Drain terminal as follows:
  - a. Select "Voltage" from the Force pull-down in the Stimulus box
  - b. Click the "Sweep" button in the Stimulus box to select a voltage sweep
  - c. Select "Linear" and "Single" from the pull-downs to the right of the "Sweep" button to select a single-ended sweep with linear point spacing.
  - d. In the Stimulus Values grid, enter "0" in the Start column, "5" in the Stop column, and "0.1" in the Step column. Wavevue will automatically calculate the number of points for you.
  - e. The Measure pull-down in the Response box should automatically default to "Current" when you selected to Force "Voltage".
  - f. Select "Limited Auto" and "1uA" for the Range Control in the Response box
  - g. Select "500" and "mA" for the Compliance in the Response box
  - h. Select "Inner" for the Loop Order Position in the Order box
  - i. Select "2" for the Channel ON order in the Order box

# Wavevue Measurement Studio Training Tutorial



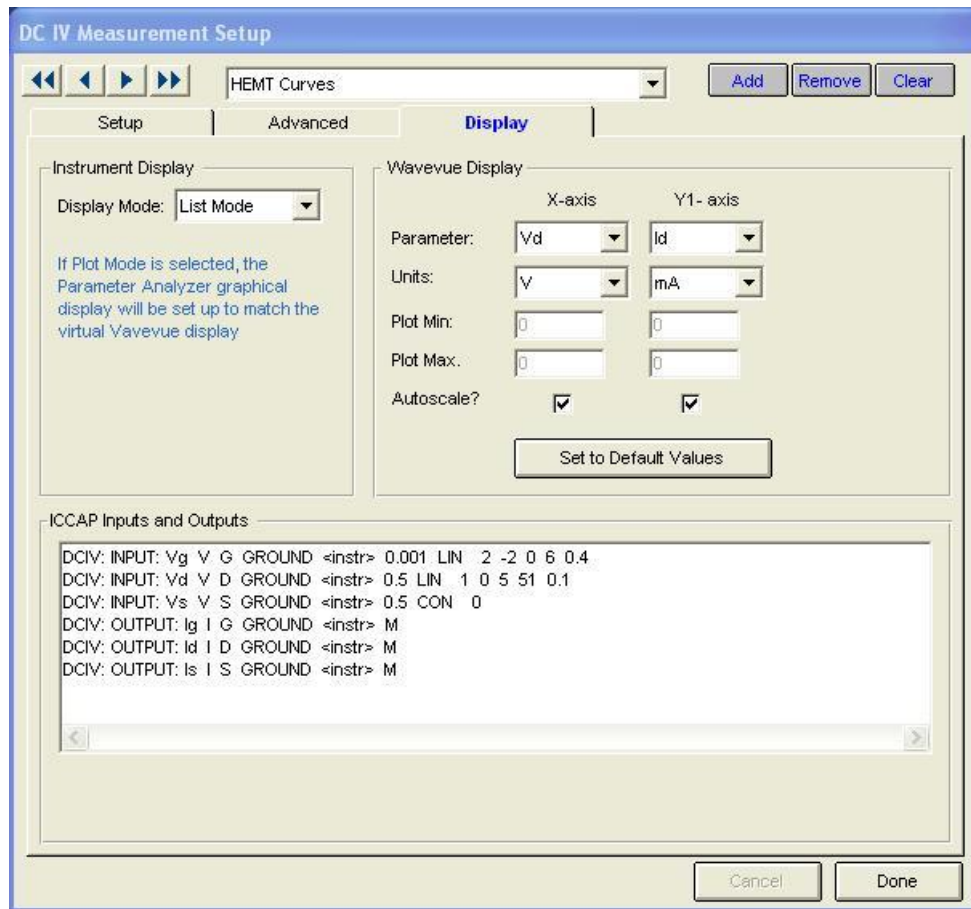
7. Set up the Source terminal as follows:
  - a. Select "Voltage" from the Force pull-down in the Stimulus box
  - b. Click the "Fixed" button in the Stimulus box to select a fixed voltage
  - c. In the Stimulus Values grid, enter "0" in the Value column (this effectively sets the SMU to ground).
  - d. The Measure pull-down in the Response box should automatically default to "Current" when you selected to Force "Voltage".
  - e. Select "Limited Auto" and "1uA" for the Range Control in the Response box
  - f. Select "500" and "mA" for the Compliance in the Response box
  - g. Select "3" for the Channel ON order in the Order box

# Wavevue Measurement Studio Training Tutorial



8. All of the default settings on the Advanced tab are fine in this case. Leaving the Hold and Delay values at the default values of 0 results in the fastest possible measurements.

# Wavevue Measurement Studio Training Tutorial



9. The Display Mode setting in the Instrument Display is irrelevant for our E5270A mainframe, since it doesn't have a display. But set up the Wavevue Display as follows:
  - a. Select "Vd" from the X-axis Parameter pull-down
  - b. Select "Id" from the Y1-axis Parameter pull-down
  - c. The rest of the settings are fine with their default values.
10. Once you have completed setting up the DC IV measurement, click Done to continue.
11. Save your project in the same manner as all of the previous sections.

# Module 6

## Use the Script Editor

---

What you will learn in this Module:

1. How to easily create measurement scripts using the Script Editor
2. How to run the measurement script

# Wavevue Measurement Studio Training Tutorial

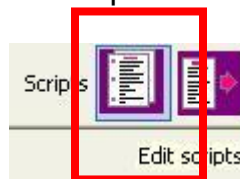
---

## A. Creating a DC IV Measurement Script

We will build our test script in stages and will test each stage before adding additional levels of complexity. In general, this is a good strategy, as problems with a script become more challenging to solve as the script becomes more complex.

Note that while Wavevue automatically generates calibration and measurement scripts for many types of measurement, this is not the case for DC IV measurements. Because the same DC IV measurement can be performed with different connection setups, Wavevue has no way to guess the correct one.

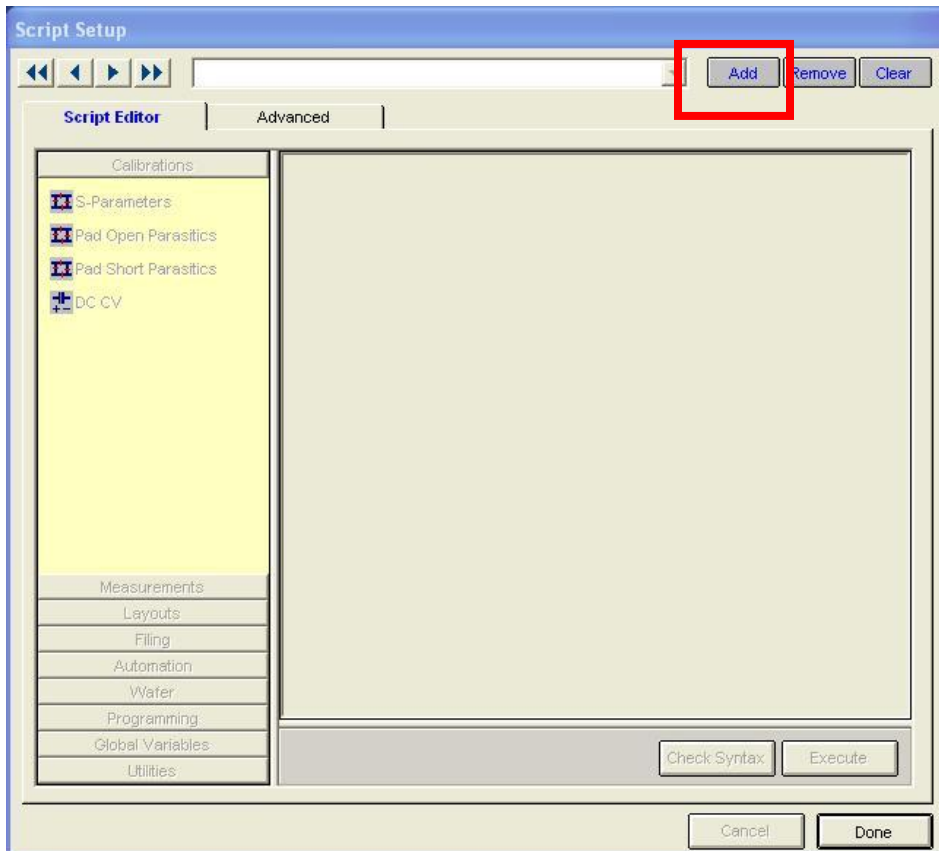
1. On the Main Toolbar, click on the Edit Scripts icon shown below:





## Wavevue Measurement Studio Training Tutorial

2. On the DC IV Measurement Setup window Click on the Add button to add a new measurement setup.

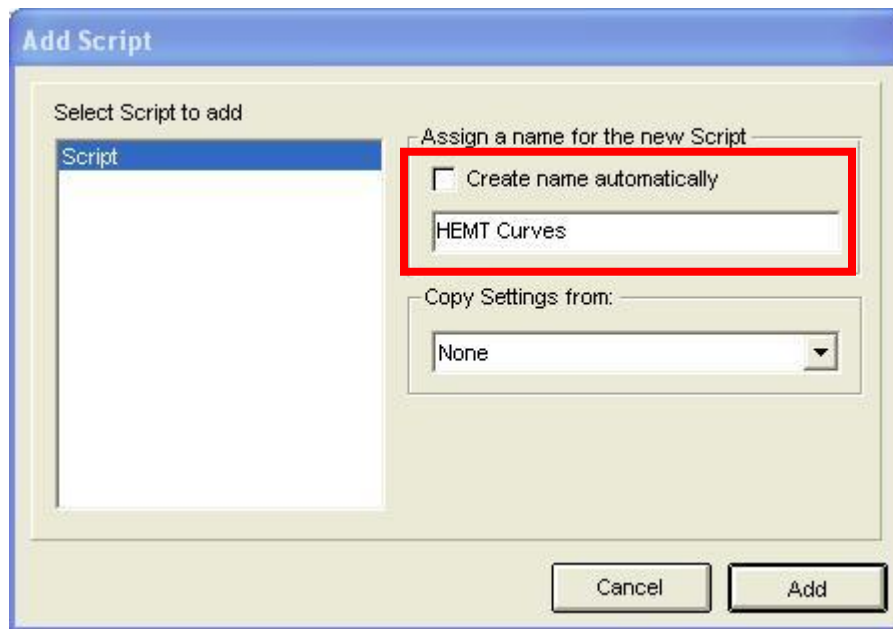


- All setup dialogs in Wavevue use the same format for managing entries.
- Click the Add button to add a new entry on the list.
- Click the Remove button to remove an entry from the list.
- When the list is empty, the dialog is gray (as shown).

## Wavevue Measurement Studio Training Tutorial

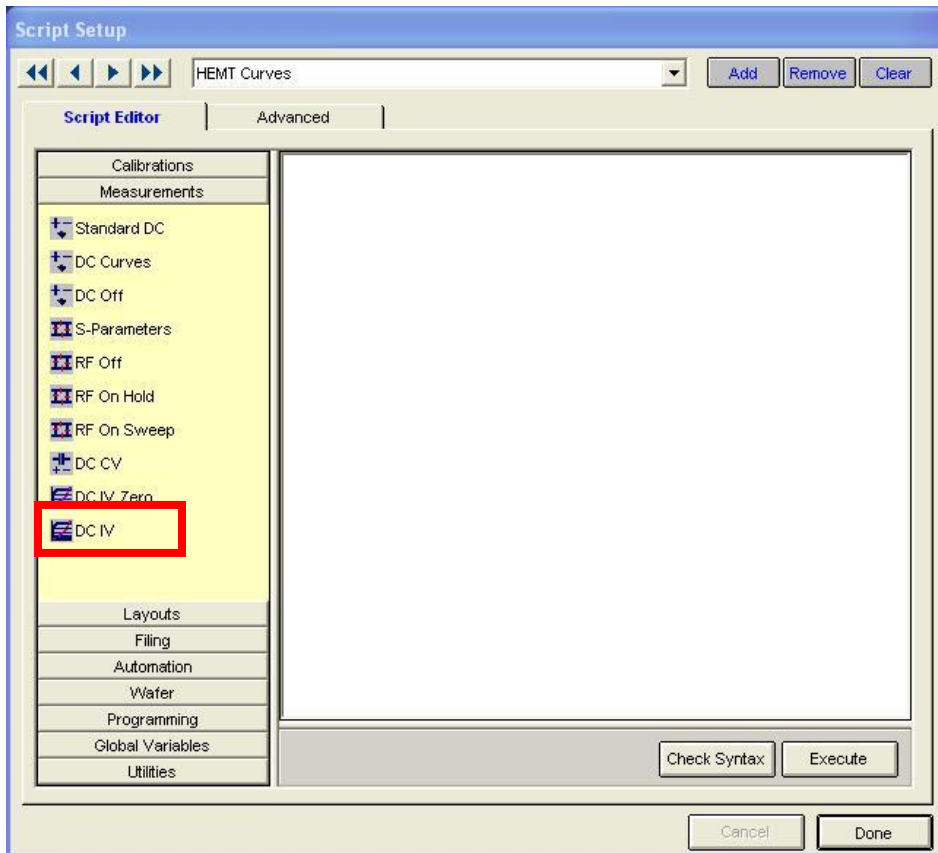
---

3. The Add Script window shown below will next appear. Un-check the Create Name Automatically box and type "HEMT Curves" in the field. Click Add to create the script.



## Wavevue Measurement Studio Training Tutorial

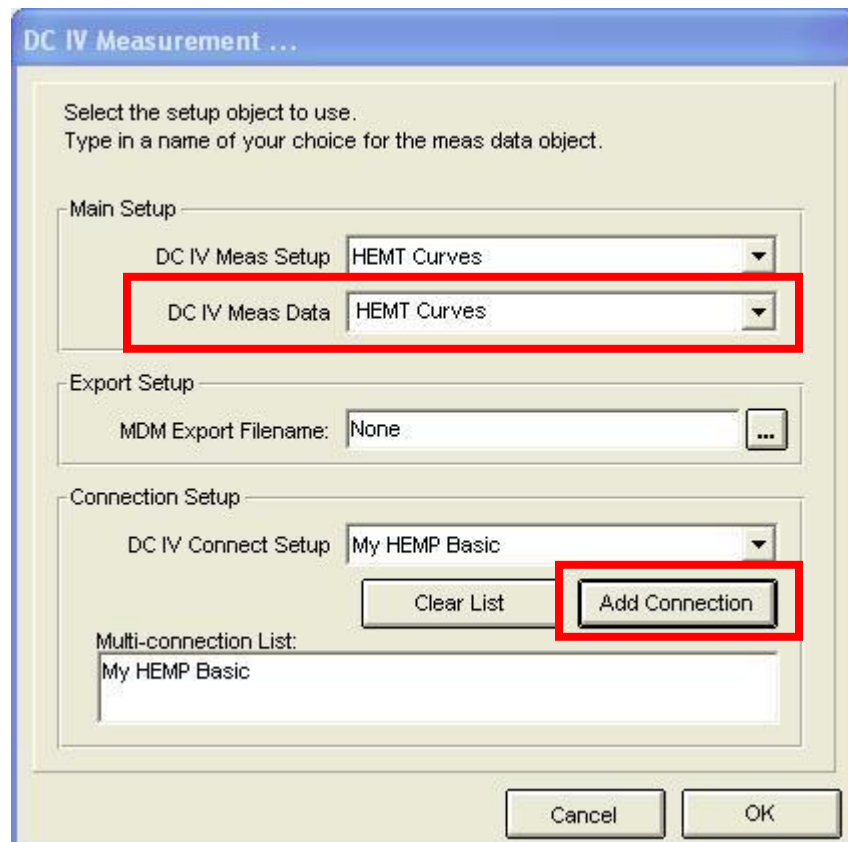
4. The DC IV Measurement Setup window will re-appear with an empty script.



- The Script setup dialog has two tabs:
- Script Editor (shown). Use this tab to write the script
- Advanced. Additional data control and instrument setup parameters

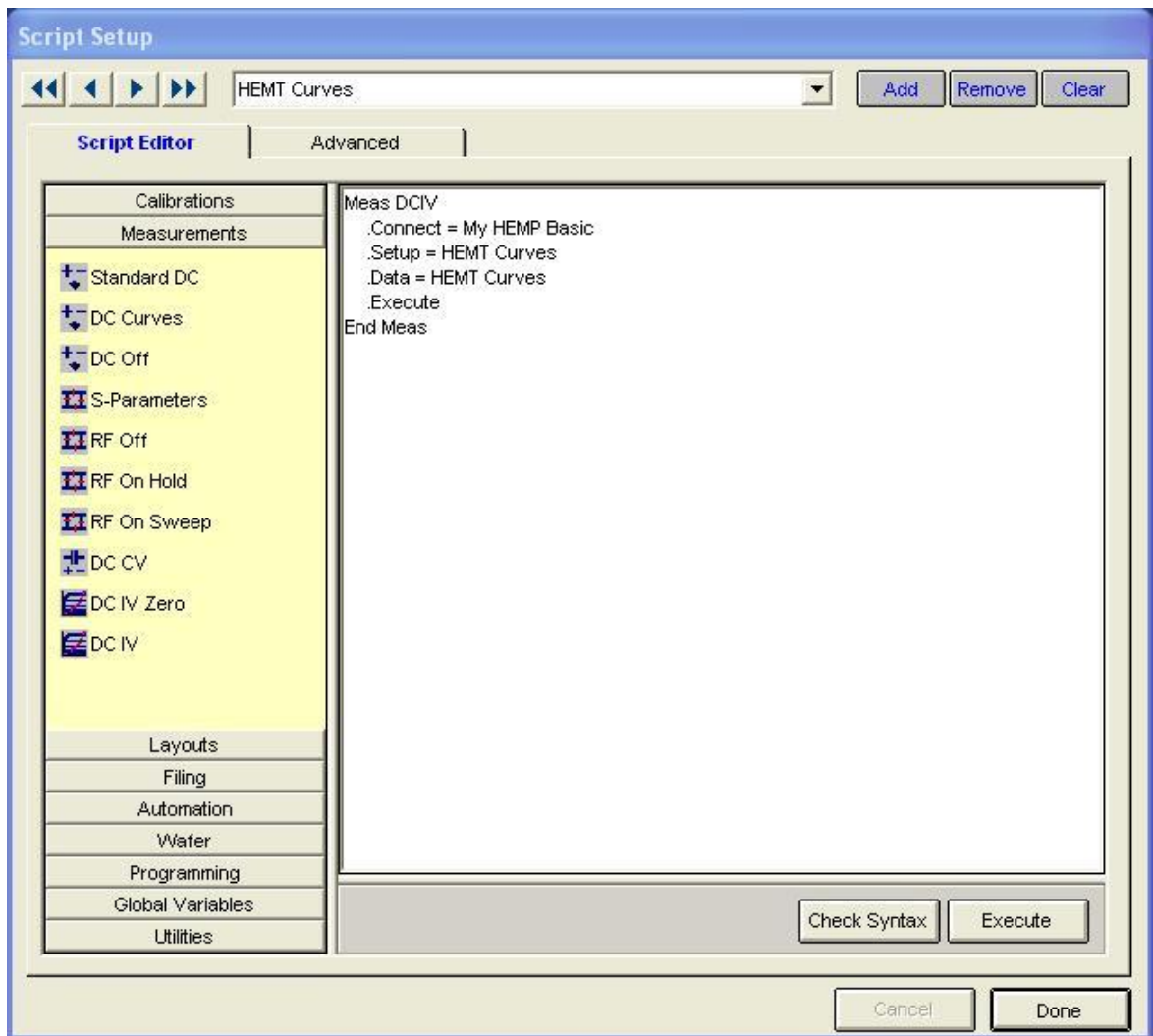
## Wavevue Measurement Studio Training Tutorial

- Click the Measurements group button, then click the DC IV icon to activate the IV Measurement setup wizard. The DC IV Measurement wizard shown below will appear. Change the default DC IV Meas Data object name to something more meaningful like "HEMT Curves". Click the Add Connection button to add the default connection to the measurement. Click OK to exit the wizard and add the new measurement to the script.



## Wavevue Measurement Studio Training Tutorial

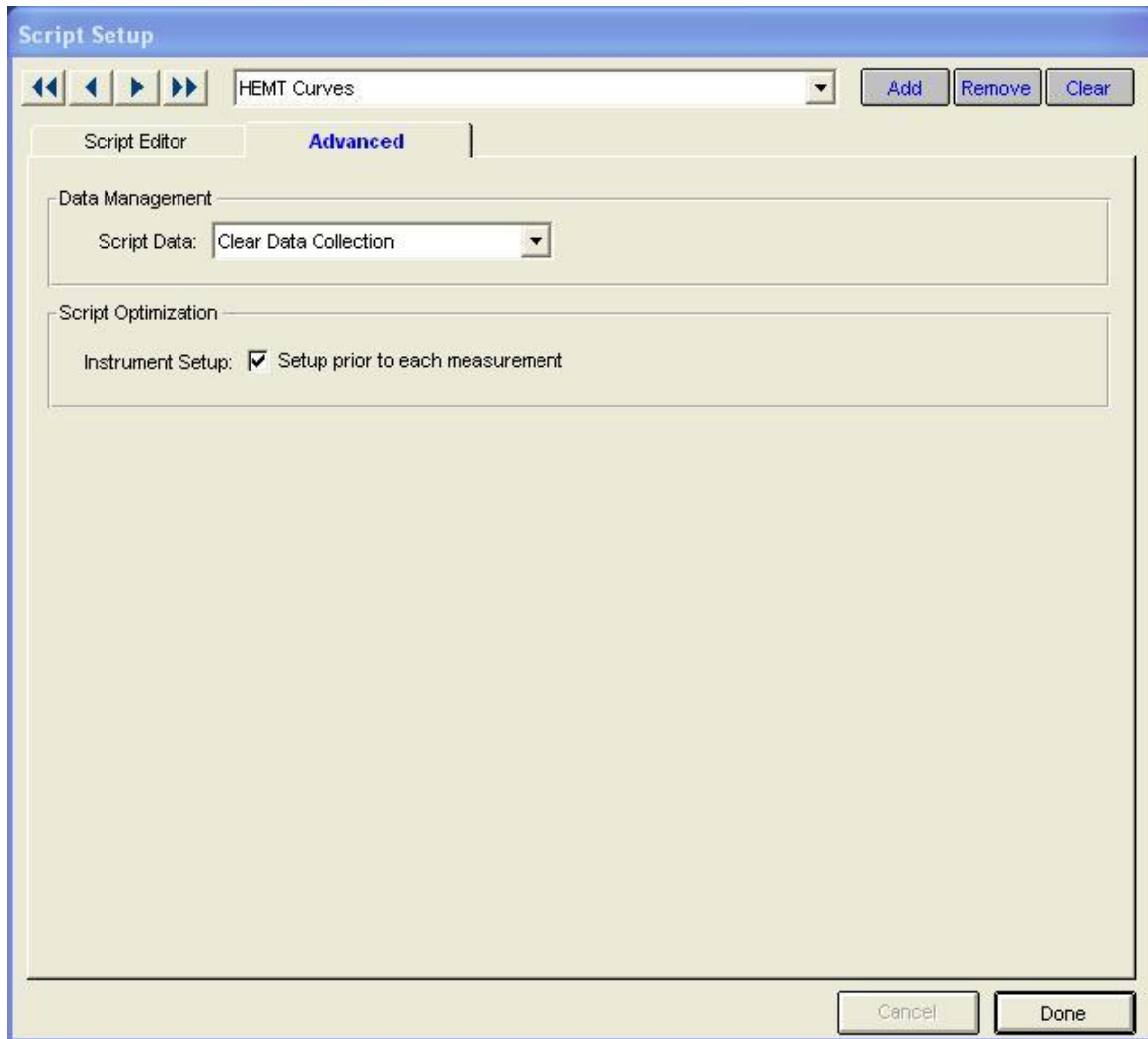
6. The script setup window will now appear as below where the wizard has added a DC IV measurement to the script.



## Wavevue Measurement Studio Training Tutorial

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- Click the Advanced tab and examine the settings there. The default values are fine for this script so we won't change any of them.



- This completes our basic measurement script. Click Done. Note that the Script will now appear in the Script pull-down list on the Main Toolbar.
- Save your project in the same way as the previous examples.

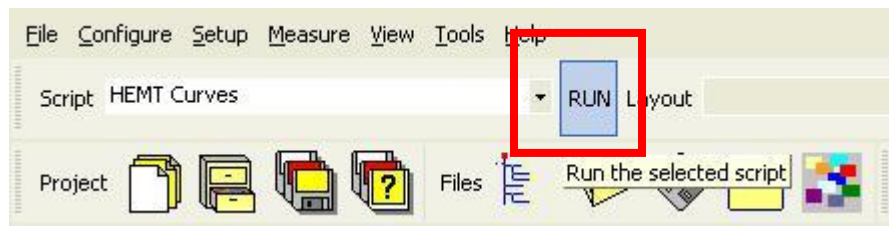
# Wavevue Measurement Studio Training Tutorial

---

## B. Running a DC IV Measurement Script

We will now run our basic script to make sure the HBT Curves measurement works. Note that Wavevue will simulate the data in the screen shots for this example.

1. Align the probes over your test device and bring them down to contact the device. Since the script doesn't contain any prober control commands yet, this step must be performed manually.
2. Select the "HEMT Curves" script in the Script pull-down menu on the Main Toolbar and click Run.



## Wavevue Measurement Studio Training Tutorial

- The Measurement Information screen shown below will appear next. This screen is used to enter descriptive information that will identify individual test data in your data archive. Note that required fields are shown in white while optional fields are gray. Any fields that contain a tag value in angled brackets (such as <UserName>) will be automatically filled in by the system at the time of measurement. Also note that some fields are free for typing while others are pull-down lists of fixed values.

**Measurement Information Entry**

**Titles and Tags**

Device Tag File: C:\Program Files\Microvue\Wavevue\Device Tags\DeviceTags.tx

Generic Title Lines:

TITLE1: Wavevue Wafer Example

TITLE2:

TITLE3:

Device Tags

Tag Name	Tag Value
OPERATOR	<UserName>
TIME	<TestStartTime>
DATE	<TestStartDate>
PART NUMBER	PN001
SERIAL NUMBER	SN101
SYSTEM NAME	System 1
CALIBRATION	SOLT
DEVICETECH	
WAFER NUMBER	001
WAFER DIA	<WaferDiameter>
FLAT LOCATION	<WaferFlat>
▶ LOT NUMBER	LOT 10
TEST NAME	

☐ Display required tags only

☐ Entry required  
☐ Entry not required

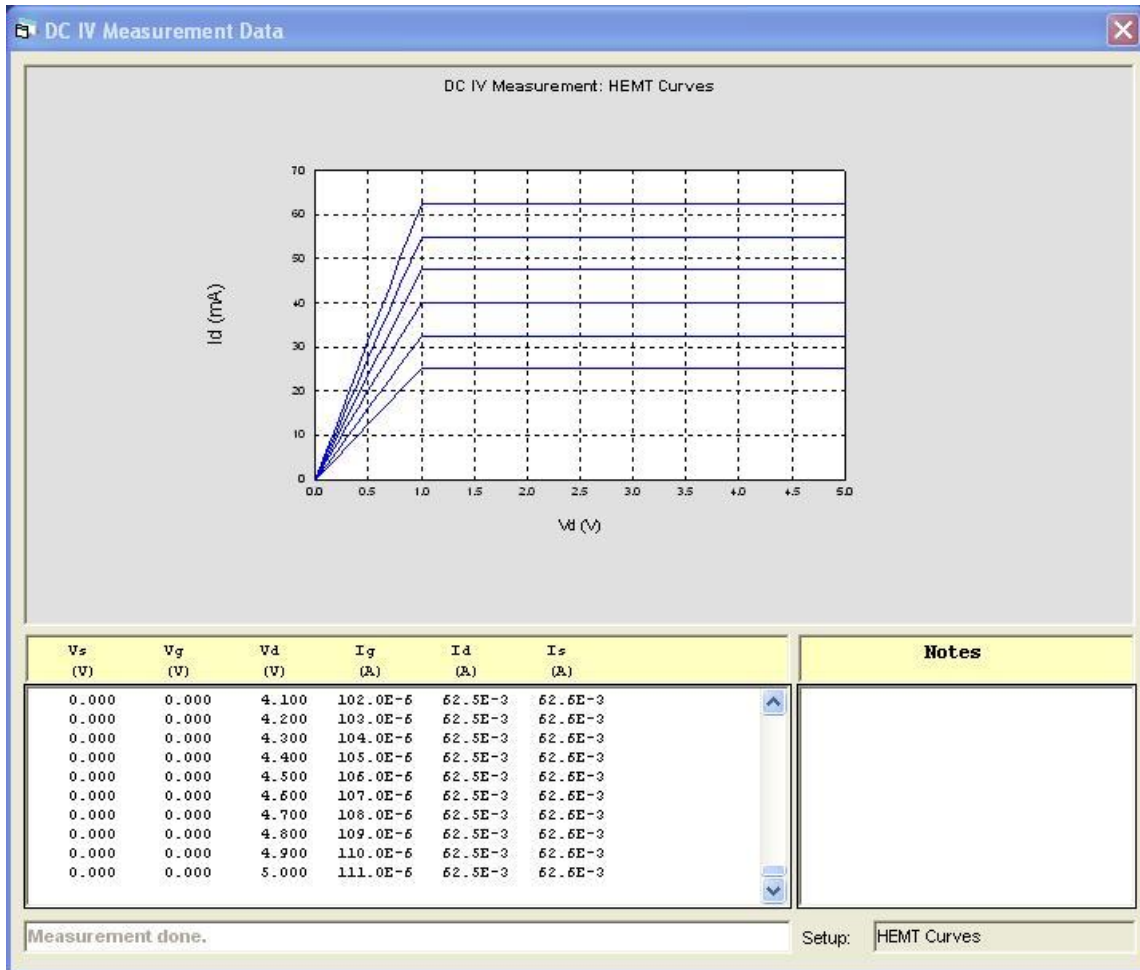
Cancel Done

- Enter or select values for all required fields and any optional ones you wish to specify. Click Done. Note that clicking Cancel will abort the entire script.



## Wavevue Measurement Studio Training Tutorial

- The DC IV Measurement Data window will appear next with the measurement results. Note that this data was simulated by Wavevue simply to give you an idea of what the display would look like.



- A file browser window will next appear where you can save your measurement file. If you wish to save your data, type the filename here and click Save. Since this was only a test run, you can also click Cancel to leave this menu.
- This verifies our HBT Curves measurement script. You can click the "X" button in the upper right corner of the measurement display window to close it.

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# Module 7:

## Wafer Reticle and Subsite Setup

---

What you will learn in this Module:

1. How to define your wafer setup
2. How to define your reticle setup
3. How to define your subsite setup
4. How to create a wafer walk script using the Script Editor
5. Test the wafer walk script by running it

# Wavevue Measurement Studio Training Tutorial

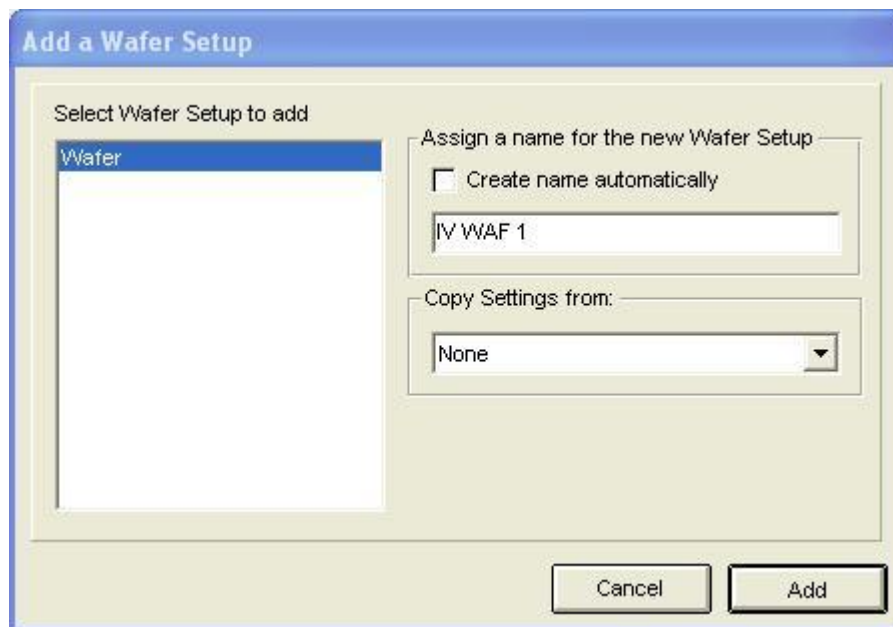
## A. Wafer Set Up

We will now leave the Script Editor for a moment in order to define our wafer setup. It is necessary to know the physical attributes of the wafer to translate reticle coordinates into actual physical coordinates for the wafer prober.

1. From the Main Toolbar, click on the Setup Wafer Map icon as shown below.



2. Click the Add button in the Wafer Setup window to add a wafer setup. Un-check the Create Name Automatically box in the Add a Wafer Setup window and type "IV WAF 1" into the name field. Click Add.



## Wavevue Measurement Studio Training Tutorial

3. The Wafer Setup window shown below will display the default settings for the new wafer setup. Make the following changes to the settings in the Wafer tab:

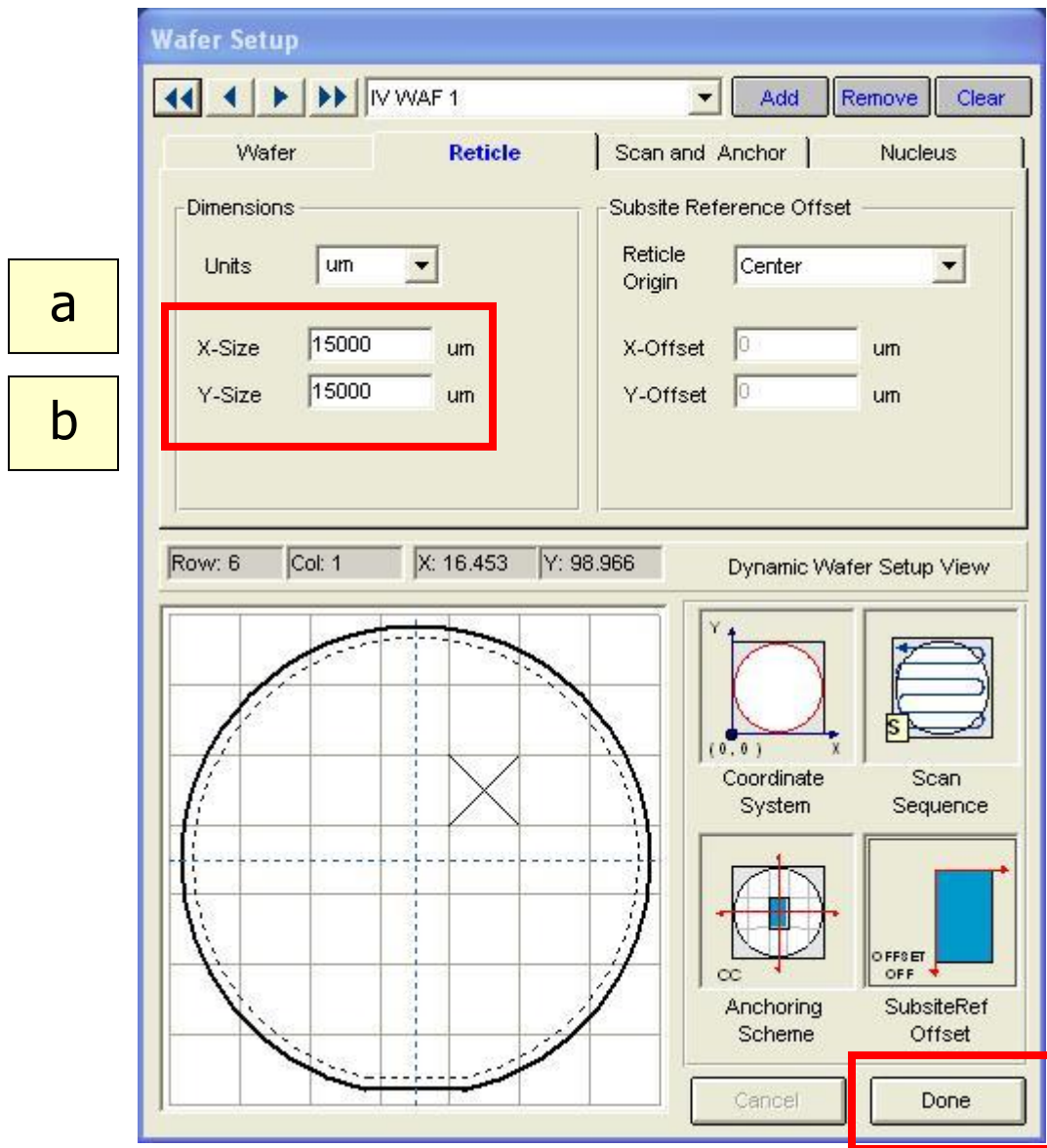
The screenshot shows the 'Wafer Setup' dialog box. The 'Wafer' tab is selected. The 'Diameter' section has 'Units' set to 'mm', 'Physical' set to '100 mm', and 'Test Limit' set to '95 mm'. The 'Locator' section has 'Type' set to 'Flat', 'Position' set to 'South', and 'Length' set to '21 mm'. The 'Reference Position' section has 'Row' set to '4' and 'Col' set to '4'. A red box labeled 'a' highlights the 'Physical' field, a red box labeled 'b' highlights the 'Test Limit' field, and a red box labeled 'c' highlights the 'Reference Position' fields. The bottom of the window shows a wafer map and a 'Dynamic Wafer Setup View' with various options like 'Coordinate System', 'Scan Sequence', 'Anchoring Scheme', and 'SubsiteRef Offset'.

- Change the Physical diameter to 100mm (4 inches). Note that the wafer map shown at the bottom of the form will update to reflect changes as we make them.
- Change the Test Limit diameter to 95mm to indicate the area near the edges of the wafer that we wish to avoid.
- Change the Reference Position Row and Column both from "3" to "4".

# Wavevue Measurement Studio Training Tutorial

## B. Reticle Set Up

1. Select the Reticle tab to make the following changes:

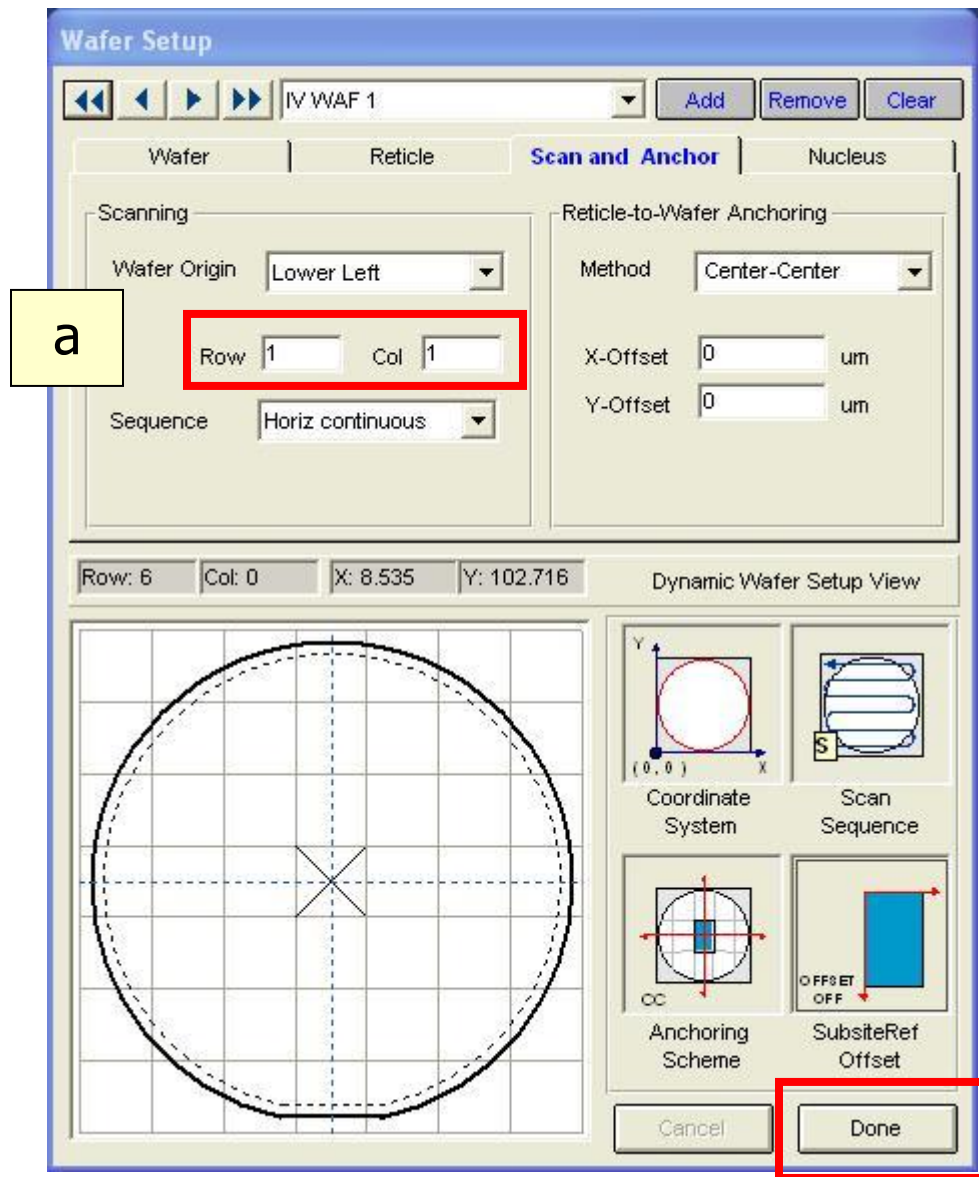


- a) Change the Reticle X-size to 15000 um. Note that these changes also update the wafer map as we make them.
- b) Change the Reticle Y-size to 15000 um.

# Wavevue Measurement Studio Training Tutorial

## C. Scan and Anchor Set Up

1. Select the Scan and Anchor tab to make the following changes:



- a) Change the Wafer Origin Row and Col both to 1. Note that these changes also update the wafer map as we make them.
2. This completes the wafer and reticle setup. The default settings for the remainder of the options are suitable for this example. Click Done.

# Wavevue Measurement Studio Training Tutorial

## C. Subsite Setup

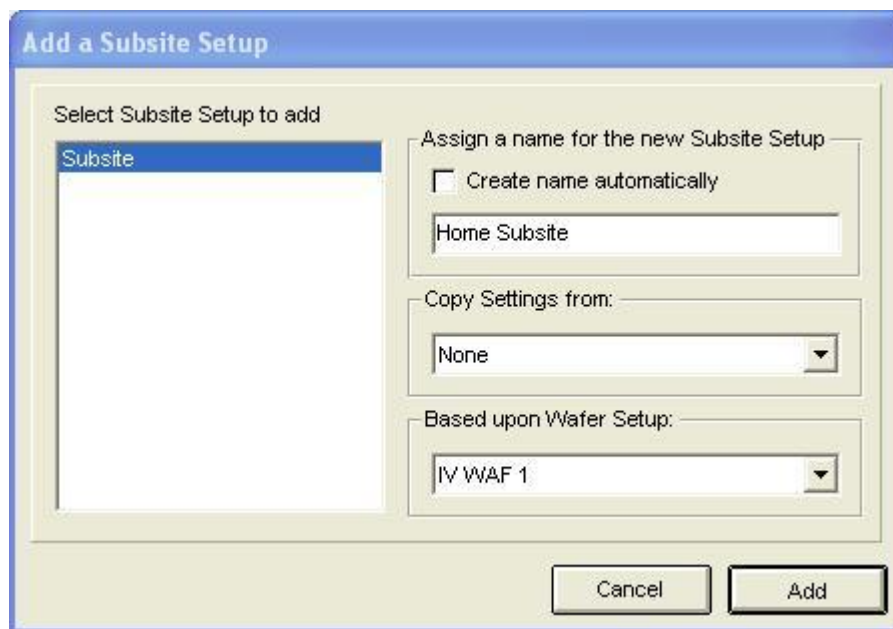
Once the wafer setup is defined, subsite setups can be added. Each subsite corresponds to the physical realization of a device on the wafer. Properties include the physical position within the reticle and the test map.

First, we will add the "Home" subsite.

1. On the Main Toolbar, click on the Setup Wafer Subsites icon next to the Wafer Setup icon as shown below.



2. Click the Add button on the Wafer Subsite Setup window to open the Add a Subsite Setup window. Un-check the Create Name Automatically box and type "Home Subsite" into the name field. Click Add to add the new subsite setup object.





## Wavevue Measurement Studio Training Tutorial

3. The Subsite Setup window shown below will display the default settings for the new subsite setup. Note that this subsite doesn't actually contain a device and is simply an extra set of pads. Since all wafer test scripts start and end on the "home" subsite, creating a dummy subsite can lengthen the life of the real device pads. This subsite will also be used for wafer alignment.

The image shows the 'Wafer Subsite Setup' dialog box. It has a title bar and a list of subsites at the top, currently showing 'Home Subsite'. Below this are three tabs: 'Subsite', 'Test Plan', and 'Display'. The 'Subsite' tab is active. The 'Subsite Definition' section contains fields for X-Location (-5000 um), Y-Location (-5000 um), Designator (R), Reference Pad Size (1000 um), and Reference Pad Color (Cyan). There are two checkboxes: 'This is the "Reference" subsite in its reticle' and 'Enable testing of this subsite', both of which are checked and highlighted with a red box and labeled 'c'. The 'Reticle Display' section has a Grid Size field (1000 um) and two checkboxes: 'Show reticle grid' and 'View all other subsites in collection', both checked and highlighted with a red box and labeled 'd'. At the bottom, there is a 'Device' dropdown (set to 'None') and a 'Wafer' field (set to 'IV WAF 1'). There are also 'Cancel' and 'Done' buttons. Annotations 'a' and 'b' point to the 'Reference Pad Size' and 'Reference Pad Color' fields respectively. Annotation 'c' points to the two checkboxes in the 'Subsite Definition' section. Annotation 'd' points to the two checkboxes in the 'Reticle Display' section.

**Wafer Subsite Setup**

Home Subsite [Add] [Remove] [Clear]

**Subsite** | Test Plan | Display

Subsite Definition

X-Location: -5000 um

Y-Location: -5000 um

Designator (One Character): R

Reference Pad Size: 1000 um

Reference Pad Color: Cyan

☒ This is the "Reference" subsite in its reticle

☒ Enable testing of this subsite

Reticle Display

Grid Size: 1000 um

☒ Show reticle grid

☒ View all other subsites in collection

X: -2413 Y: -7137

Reticle Coordinates

SubsiteRef Offset

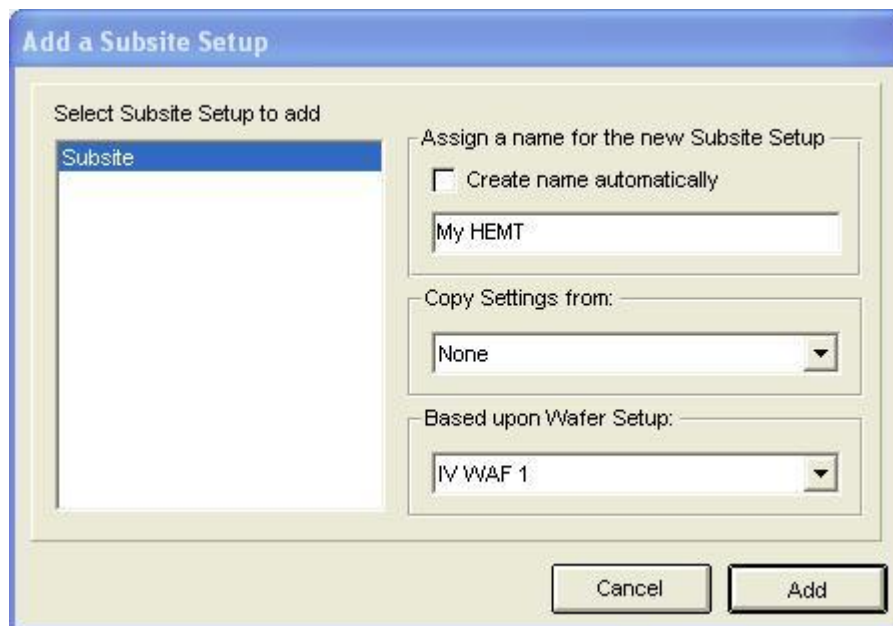
Device: None

Wafer: IV WAF 1

[Cancel] [Done]

## Wavevue Measurement Studio Training Tutorial

4. Make the following settings within the Subsite Setup window:
  - a) Change the default Reference Pad Size value from 500 to 1000 to make the devices easier to view. This value only affects the picture at the bottom of the window, and does not represent actual device pad sizes.
  - b) Change the subsite X-Location from 0 to -5000. Also change the Y-Location from 0 to -5000. Note that the reticle coordinate system origin is located in the center of the reticle.
  - c) Note that the "This is the Reference subsite in its reticle" checkbox is always checked by default on the first subsite created for a wafer setup.
  - d) Check the View all other subsites check box for later use.
5. This completes the Home Subsite set up.
6. We will now create a subsite setup for the actual HEMT device. On the Wafer Subsite Setup window, click the Add button to add a new subsite setup. The Add Subsite Setup window shown below will appear. Un-check the Create Name Automatically checkbox and type "My HEMT" into the name field. Click Done to add the new subsite setup object.



## Wavevue Measurement Studio Training Tutorial

7. The default settings for the new subsite setup will be displayed in the Subsite Setup window. Make the following changes to the subsite setup settings:

The image shows the 'Wafer Subsite Setup' dialog box with the following settings and annotations:

- Subsite Definition:**
  - X-Location: -5000 um (Annotation d)
  - Y-Location: 0 um (Annotation e)
  - Designator (One Character): 1 (Annotation b)
  - Reference Pad Size: 1000 um (Annotation a)
  - Reference Pad Color: Green (Annotation c)
  - ☐ This is the "Reference" subsite in its reticle
  - ☒ Enable testing of this subsite
- Reticle Display:**
  - Grid Size: 1000 um
  - ☒ Show reticle grid (Annotation f)
  - ☒ View all other subsites in collection
- Visuals:**
  - A grid view showing a green square at the center, labeled 'R'.
  - Coordinates: X: -6520, Y: 6931
  - Reticle Coordinates: A diagram showing a green square with a black dot at (0,0).
  - SubsiteRef Offset: A diagram showing a blue rectangle with an offset arrow.
- Device:** None
- Wafer:** IV WAF 1
- Buttons:** Cancel, Done

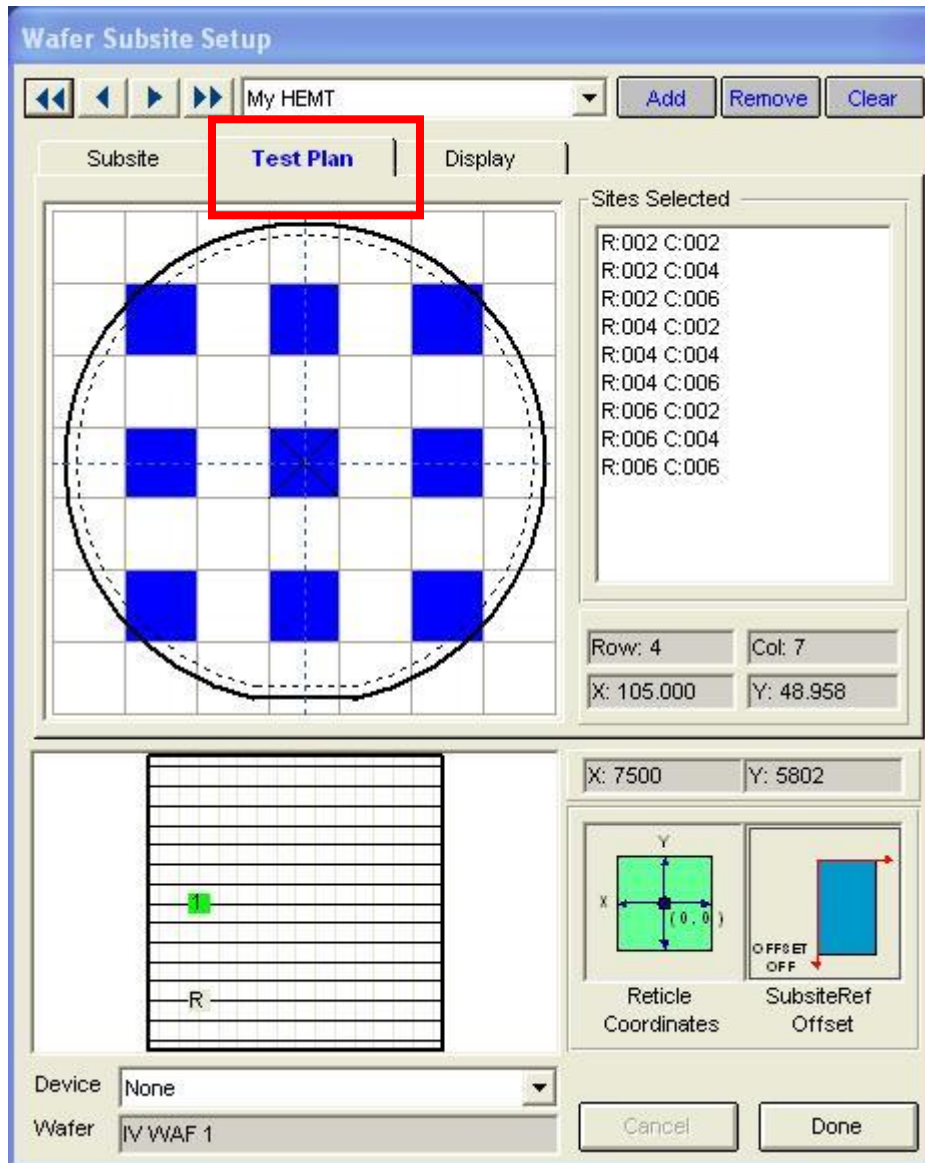
## Wavevue Measurement Studio Training Tutorial

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- a) Change the Reference Pad Size value from 500 to 1000 to make the devices easier to view. This value only affects the picture at the bottom of the window, and does not represent actual device pad sizes.
- b) Change the Designator from R to 1.
- c) Change the Reference Pad Color from Cyan to Green.
- d) Change the subsite X-Location from 0 to -5000. Leave the Y-Location set to 0. Note that the reticle coordinate system origin is in the center of the reticle.
- e) Note that the "This is the Reference subsite in its reticle" checkbox is not checked since this is the second subsite defined for the wafer setup.
- f) Check the View all other subsites check box. Note the grayed-out reference pad for our Reference Subsite and the green pad for our current subsite.

## Wavevue Measurement Studio Training Tutorial

- Click on the Test Plan tab to finish setting up this subsite.



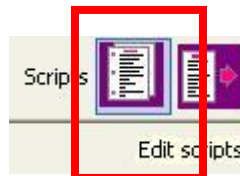
- Click to select 9 reticles to create a sample test plan as shown. Right clicking anywhere on the test plan picture will display a pop-up menu offering additional options for reticle selection. These multi-selection options are useful on wafers with a large reticle count. A list of the selected reticles appears on the right and is updated in real-time. Clicking a reticle toggles its state; clicking once will select the reticle, clicking again will deselect it.
- This completes the test subsite setup. Click Done to return to the main screen.
- Save the project as in the previous sections.

# Wavevue Measurement Studio Training Tutorial

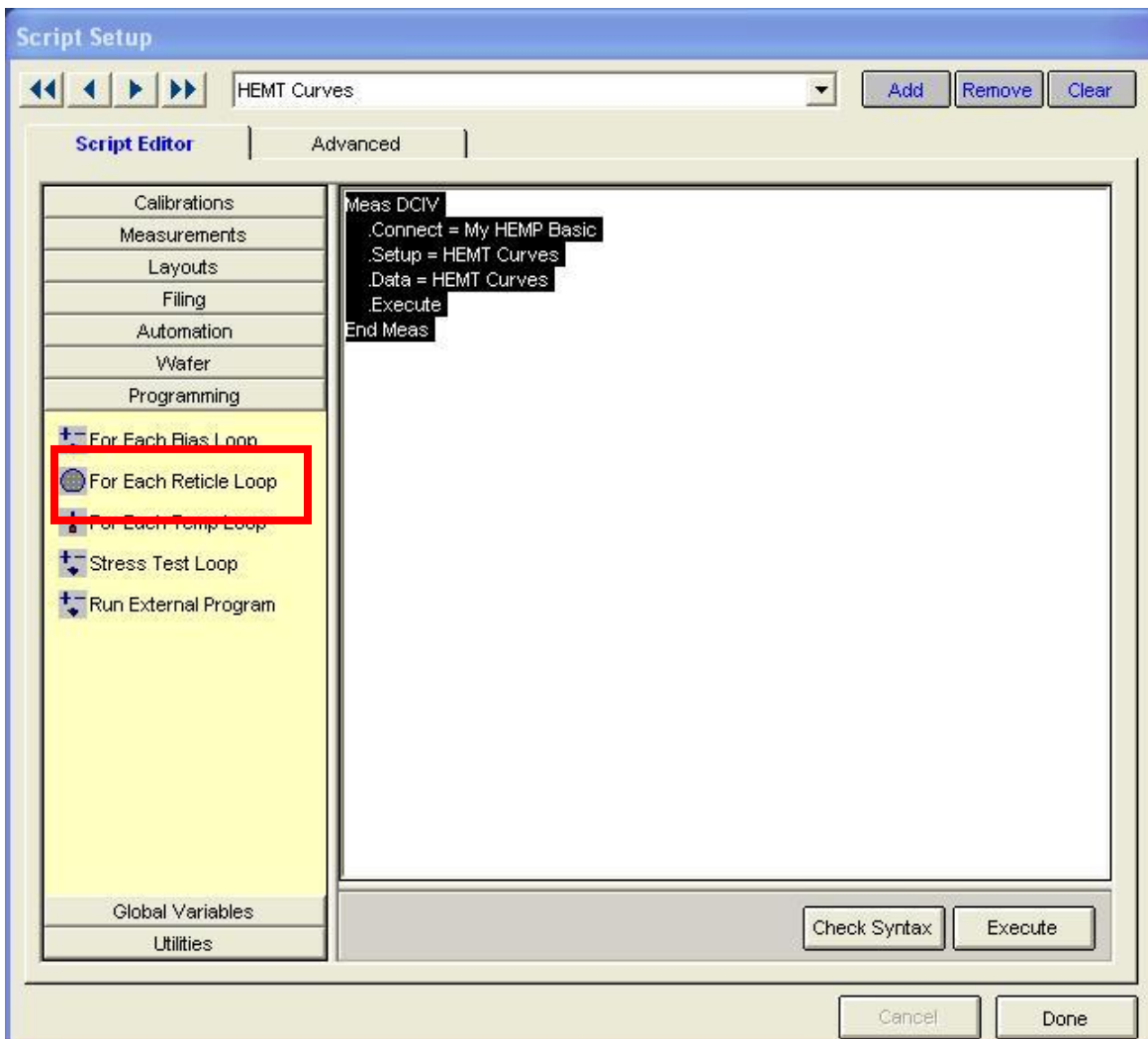
## D. Create a Wafer Walk Script

Now that we have finished the wafer, reticle and subsite setup, we can add the wafer walk functionality to our existing measurement script.

1. On the Main Toolbar, click the Edit Script icon as shown below.

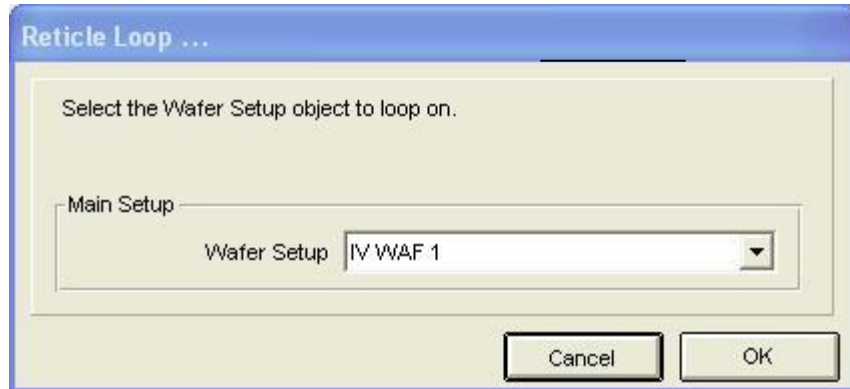


2. The Script Editor window will re-appear as shown below with our measurement script. Using the mouse, highlight the entire script and click the Programming button on the left toolbar menu. Next, click the For Each Reticle Loop icon.

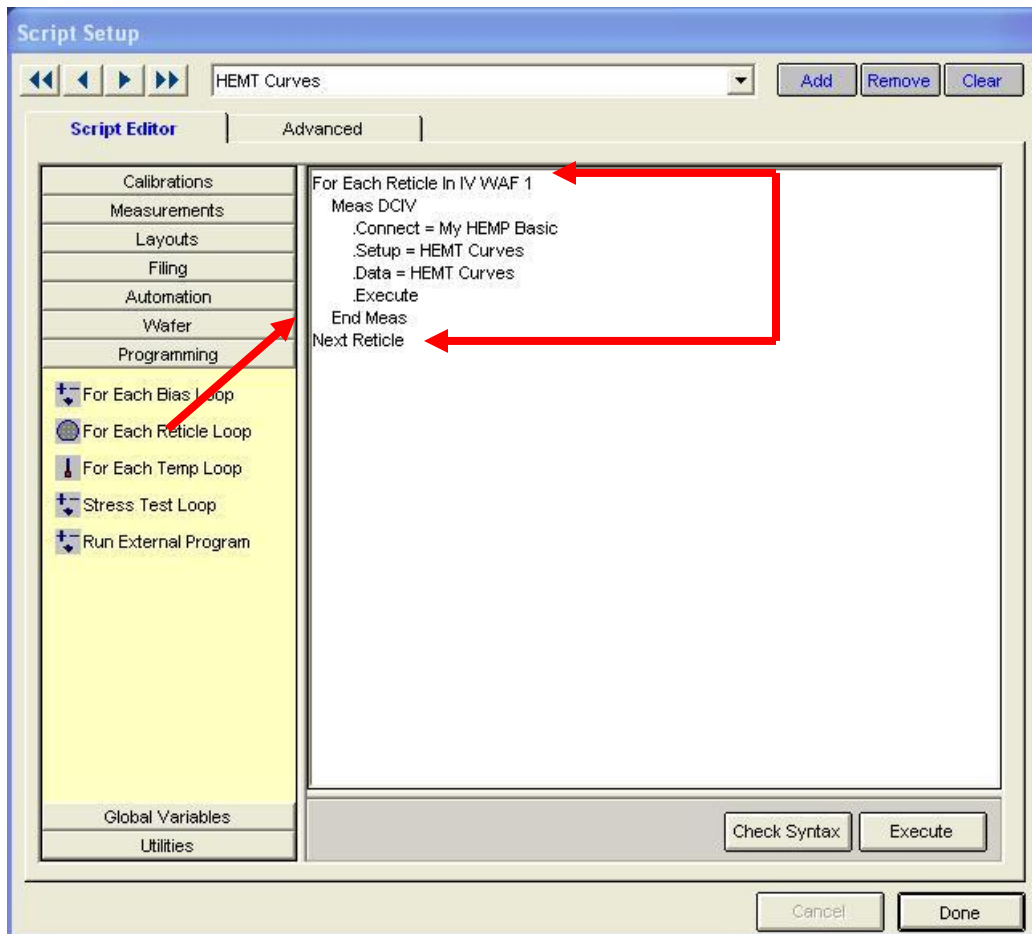


## Wavevue Measurement Studio Training Tutorial

3. The Reticle Loop window will appear as shown below. Since only one wafer setup ("IV WAF 1") is defined, the drop-down will default to the correct value. Click OK to add the loop to the script.

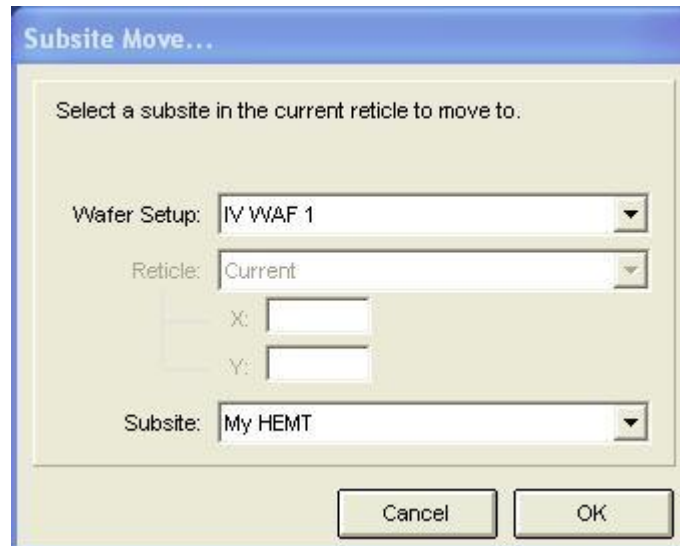


4. The Script Editor will re-appear with the modified script. Note that Wavevue automatically indents the script to make the loop structure easier to see.



## Wavevue Measurement Studio Training Tutorial

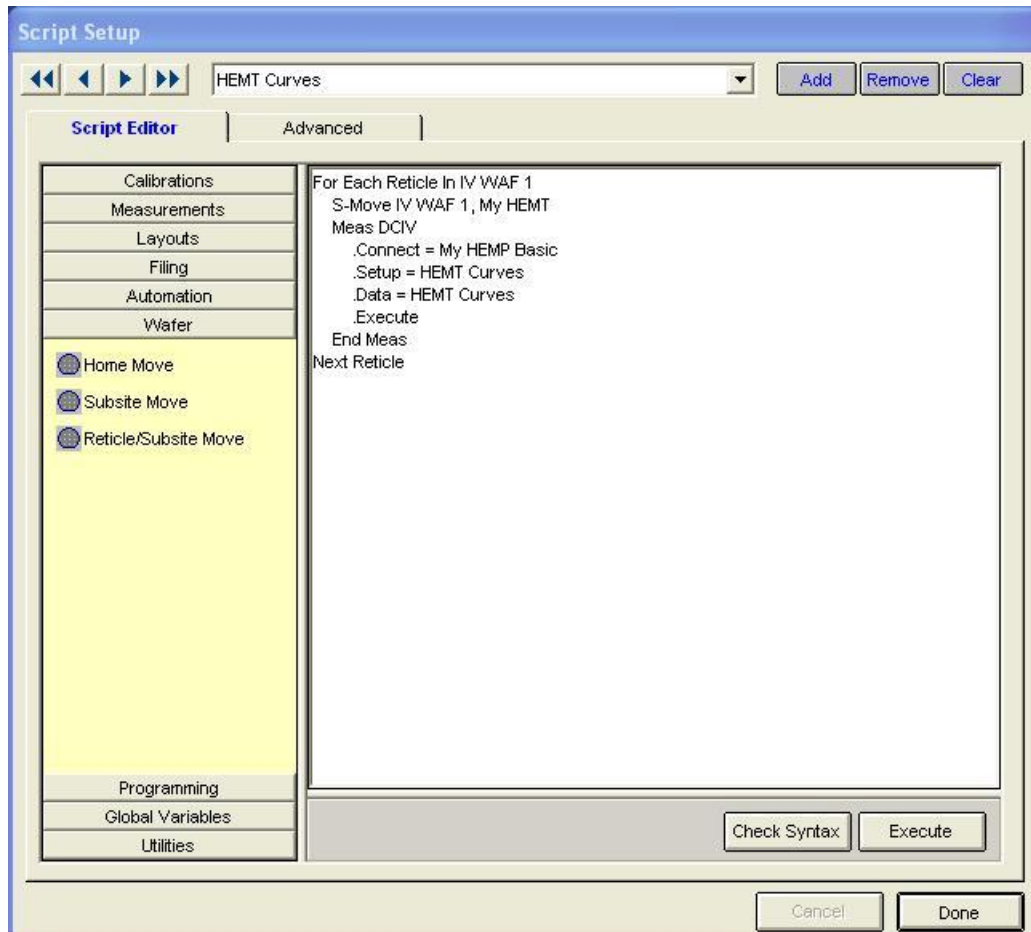
- Wavevue will automatically align the wafer and move to the home reticle and subsite when it processes the "For Each Reticle in IV WAF 1" statement. Each time it encounters the "Next Reticle" statement, it will move to the next reticle in the test map and repeat the script. To direct Wavevue to test our "My HEMT" rather than our dummy "Home Subsite," one more command must be added to the script.
- Click as far to the left on the "Meas DCIV" line as possible. If you have trouble getting the cursor at the correct position, click at the end of the previous line ("For Each Reticle in IV WAF 1") and press the right cursor arrow once. Click on the Wafer button and then click the Subsite Move icon.
- The Subsite Move window will appear as shown below. Since only one wafer setup ("IV WAF 1") is defined, the drop-down is already defaulted to the correct value. Select "My HEMT" from the Subsite drop-down and click OK to add the script command.





## Wavevue Measurement Studio Training Tutorial

8. The Script Editor window will re-appear with the completed wafer-walking script. Click Done to return to the main screen.



9. Save the project as in all the previous examples.

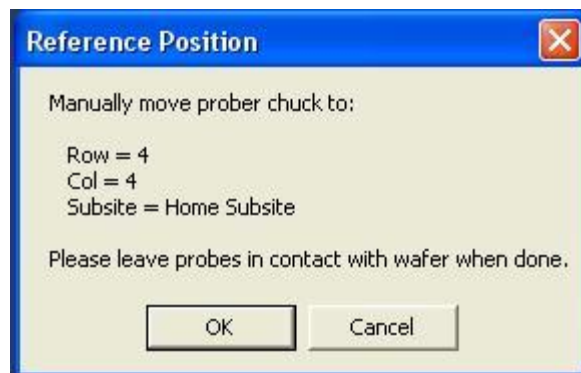
# Wavevue Measurement Studio Training Tutorial

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## E. Test the Wafer Walk Script

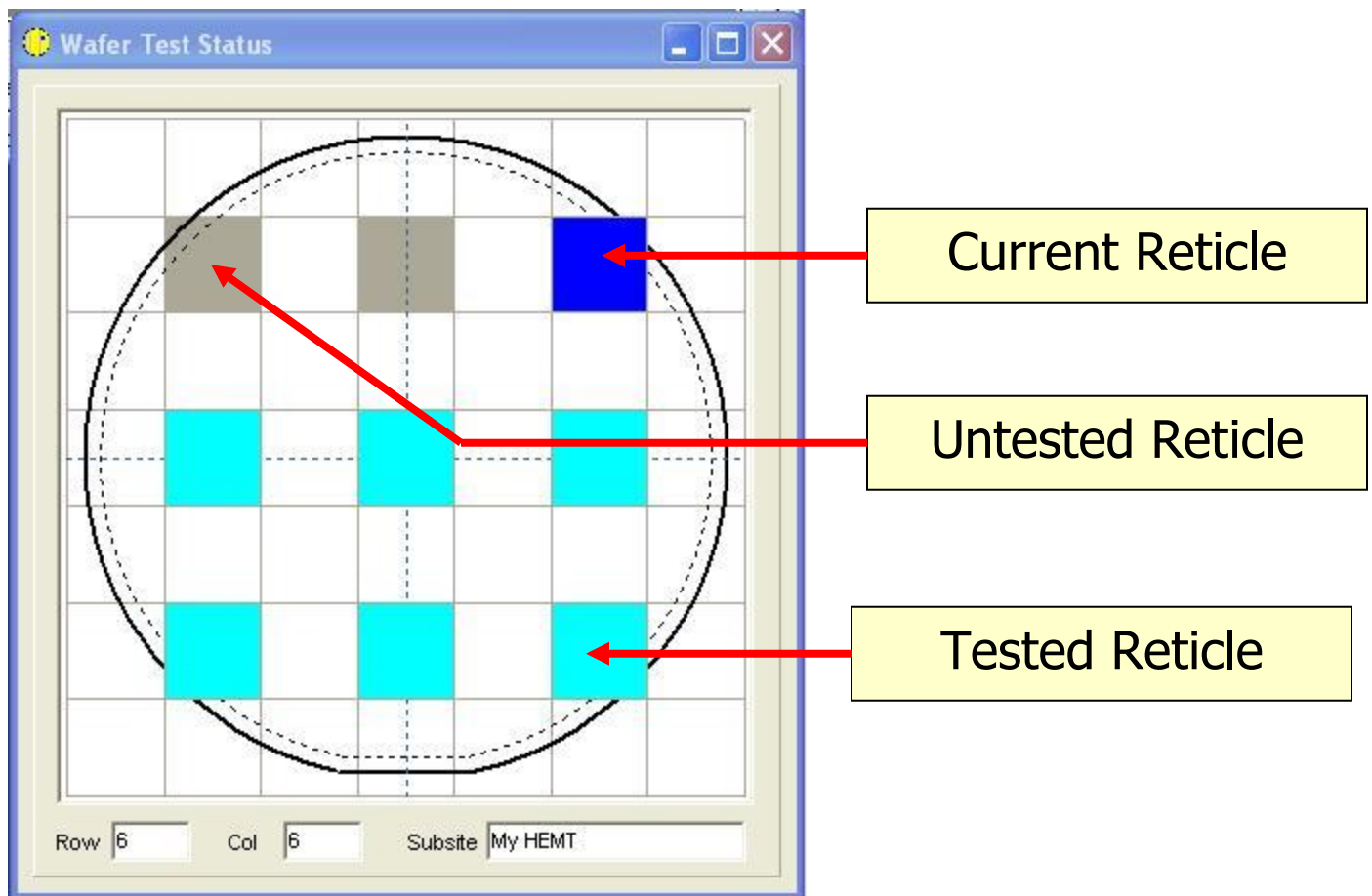
We are now ready for the final test of our script. This time, we will keep the data for reporting. Note again that Wavevue simulated the data in the screen shots for this example.

1. Make sure that "HEMT Curves" is selected in the Script pull-down on the Main Toolbar and click Run.
2. The Measurement Information screen will recall the selections from the previous measurement. The data we are about to take will be kept for reporting, so make sure that all of the values are correct. Click Done.
3. When the Home Position message appears, check that the wafer is aligned and the prober is at the home position, and click OK. Note that once you click Ok, Wavevue assumes that the probes are down on the home reticle and subsite. It will read that reference position and calculate all future moves from those coordinates.



## Wavevue Measurement Studio Training Tutorial

- The DC IV Measurement window will appear next to display the results and also the Wafer window, which is shown below. Wavevue will automatically measure the HEMT Curves at each reticle in the subsite test plan. Note that our simulated data has no random difference, so all of the traces will be identical. Real measured data will vary with reticle.



- Once the measurement has completed, save the measurement data with the Save Project window. To be consistent, name the data file "IV Wafer Example.mea". This data will be used in the next module while creating data reports.

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# Module 8

## Viewing Your Data

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What you will learn in this Module:

1. How to set up a new report
2. How to create a Wafer Map report
3. How to view an existing report (layout)

This section will show you how to display the data you have taken. Data is displayed in Reports and Layouts.

Reports set up your data in graphical or tabular form. A report can support up to 6 different graphical data items with legends or 12 different tabular data items.

Layouts are pages designed to contain 1 to 4 reports.

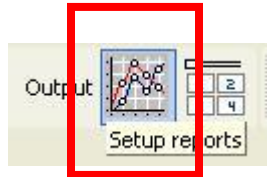
You can define as many reports and layouts as you choose. The standard projects come with a Standard RSU file that contains a variety of reports for active and passive devices.

# Wavevue Measurement Studio Training Tutorial

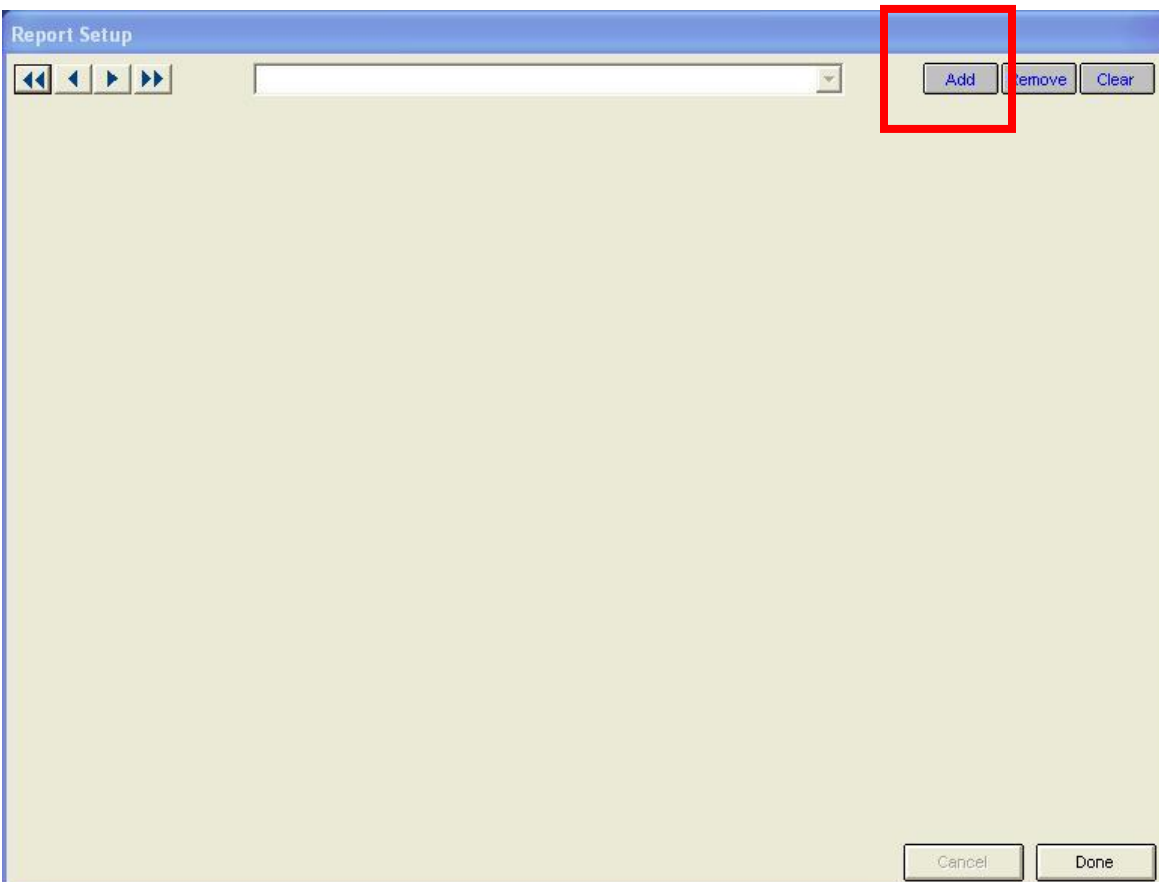
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## A. Setting Up a New Report

1. Wavevue's standard projects come with a variety of standard reports for active and passive devices that should fit most of your needs. However, you may also define your own reports.
2. On the Main Toolbar, click the Reports icon as shown.



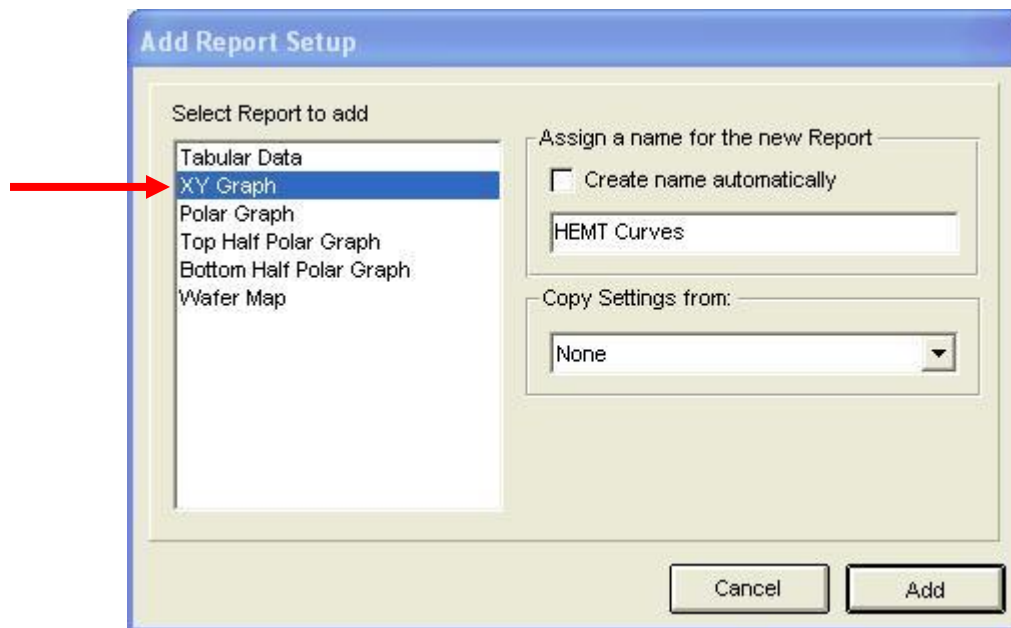
3. The following window will appear. Press the Add button to add a new report setup.



4. In this example we will build a report duplicating the HEMT curves we saw during the measurement. So, select XY Graph, un-check the "Create name automatically" checkbox, and type "S11 Smoothed Smith" in the text box provided.

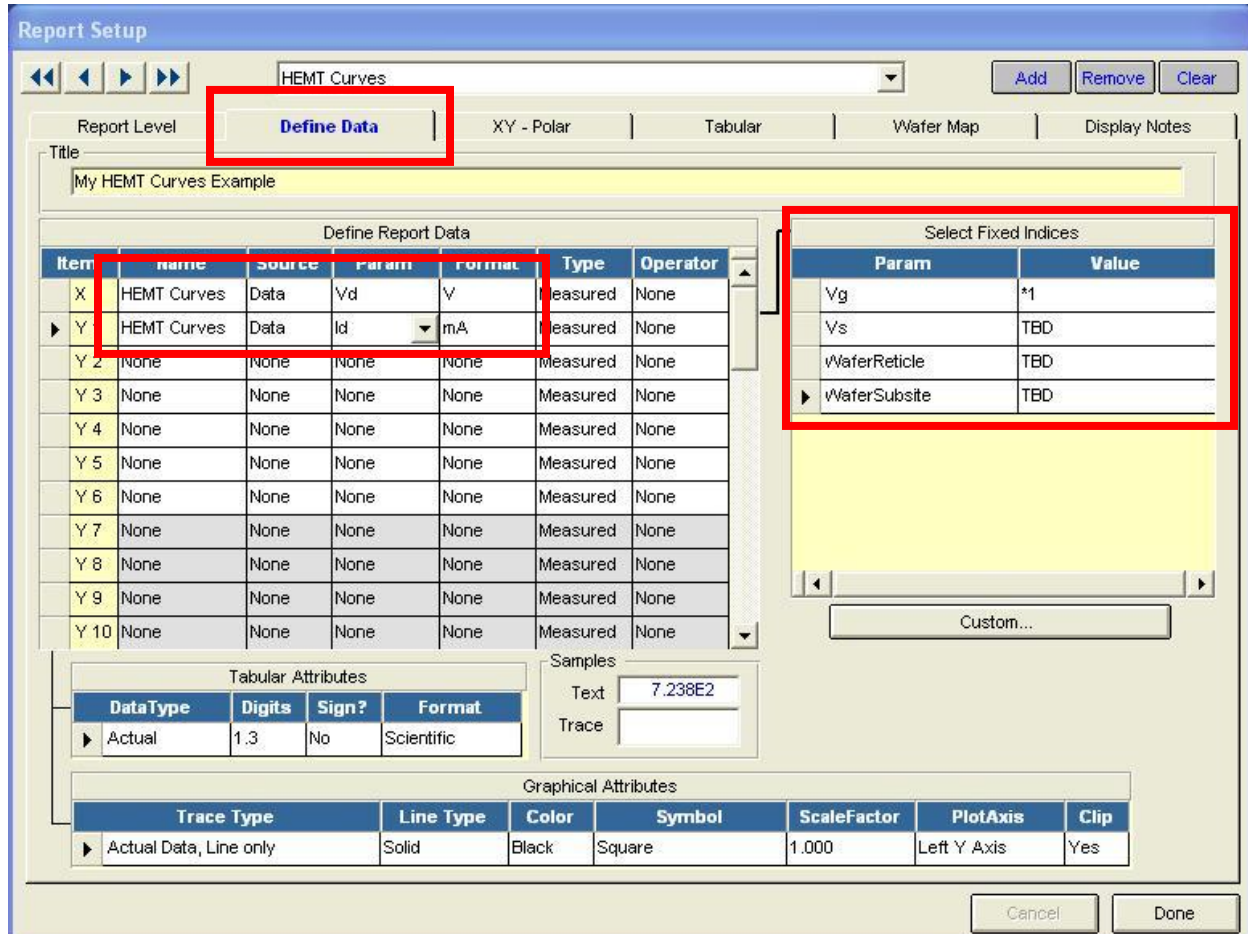
## Wavevue Measurement Studio Training Tutorial

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# Wavevue Measurement Studio Training Tutorial

- Click Add and you will return to the Report Setup window defaulted to your new report. Under the Report Level Tab, type "My HEMT Curves Example" in the top Title line. This title will appear on your data report.

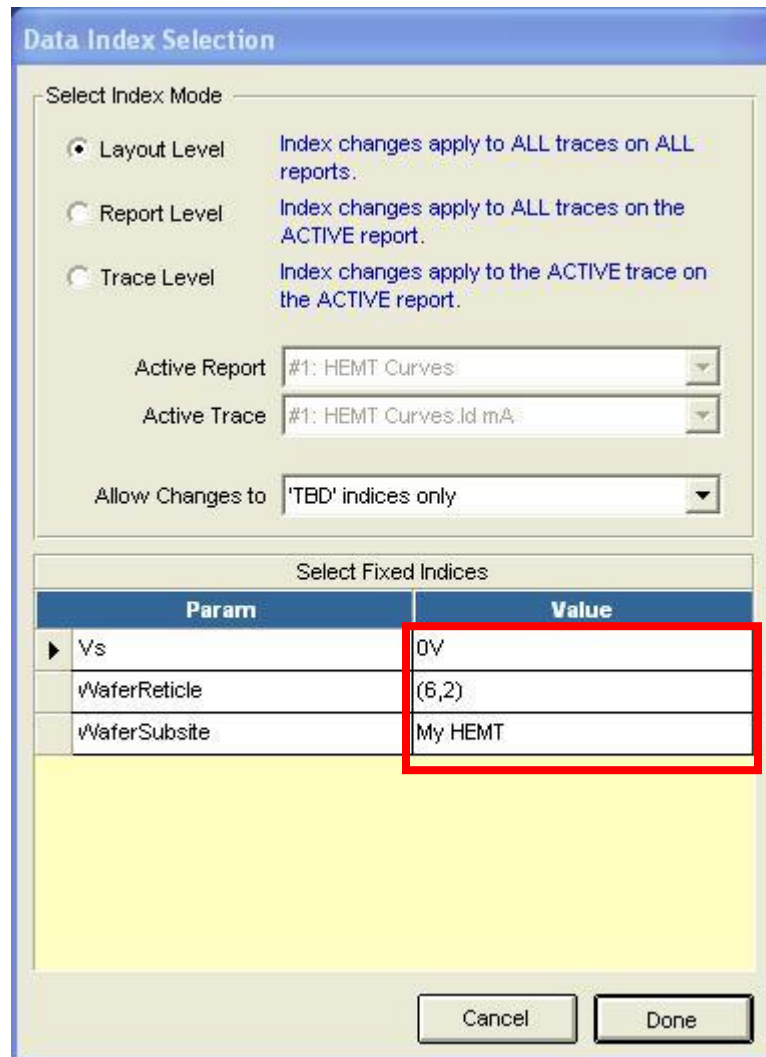


- Select the Define Data Tab. Click on the X data row. Select "HEMT Curves" from the Name cell. Select "Vd" from the Param Cell and note that the Format will default to "V"
- Now Click the Y1 data row. Select "HEMT Curves" from the Name cell again. Select "Id" from the Param call and note that the Format will default to "mA".
- Move to the Select Fixed Indices box and select "\*1" for Vg. This will cause the report to be a family of curves rather than a single curve. You can leave the rest of the fixed indices set to their default value of "TBD".
- The rest of the settings can be left at their default values to view the plot. Click Done.



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10. A single layout with the same name as this new report will be now appear in the Layout drop-down menu on the Main Toolbar.
11. Select the layout in the menu and click View.
12. The Data Index Selection window will appear next. You now need to choose the Wafer Reticle you want to plot. A drop-down menu will appear when you place your mouse in the fields shown below. Select the desired reticle from the list and press Done.

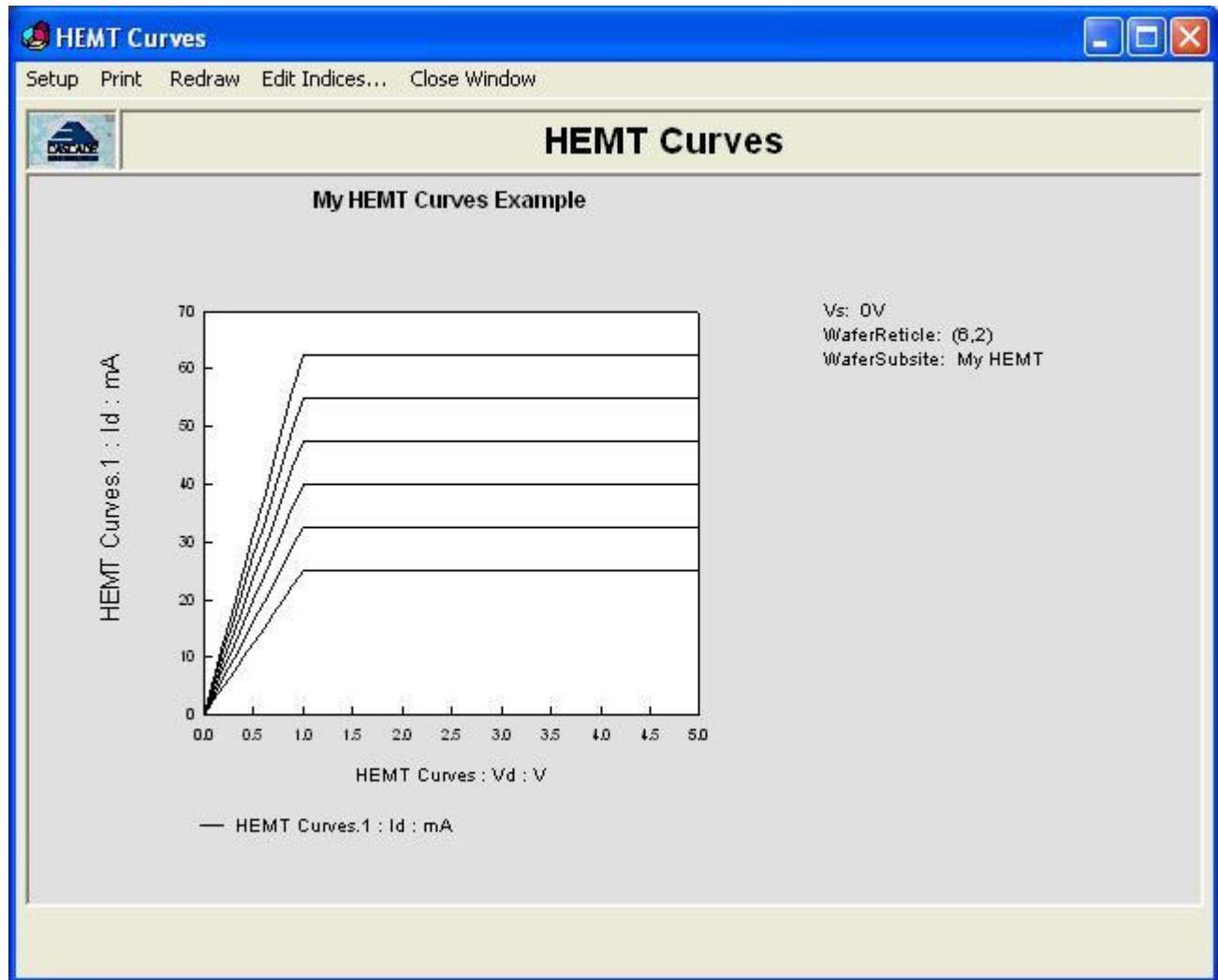


The Data Index Selection dialog box is shown. It has a title bar 'Data Index Selection'. Inside, there is a section 'Select Index Mode' with three radio buttons: 'Layout Level' (selected), 'Report Level', and 'Trace Level'. Each radio button has a description: 'Layout Level' (Index changes apply to ALL traces on ALL reports.), 'Report Level' (Index changes apply to ALL traces on the ACTIVE report.), and 'Trace Level' (Index changes apply to the ACTIVE trace on the ACTIVE report.). Below this are two dropdown menus: 'Active Report' (showing '#1: HEMT Curves') and 'Active Trace' (showing '#1: HEMT Curves.Id mA'). There is also a dropdown menu 'Allow Changes to' (showing 'TBD' indices only'). Below these is a section 'Select Fixed Indices' containing a table with two columns: 'Param' and 'Value'. The table has three rows: 'Vs' with value '0V', 'WaferReticle' with value '(6,2)', and 'WaferSubsite' with value 'My HEMT'. The 'Value' column is highlighted with a red box. At the bottom are 'Cancel' and 'Done' buttons.

Param	Value
Vs	0V
WaferReticle	(6,2)
WaferSubsite	My HEMT

## Wavevue Measurement Studio Training Tutorial

13. The following plot will appear showing the HEMT Curves.



17. Close the plot window.

## B. Setting Up a Wafer Map Report

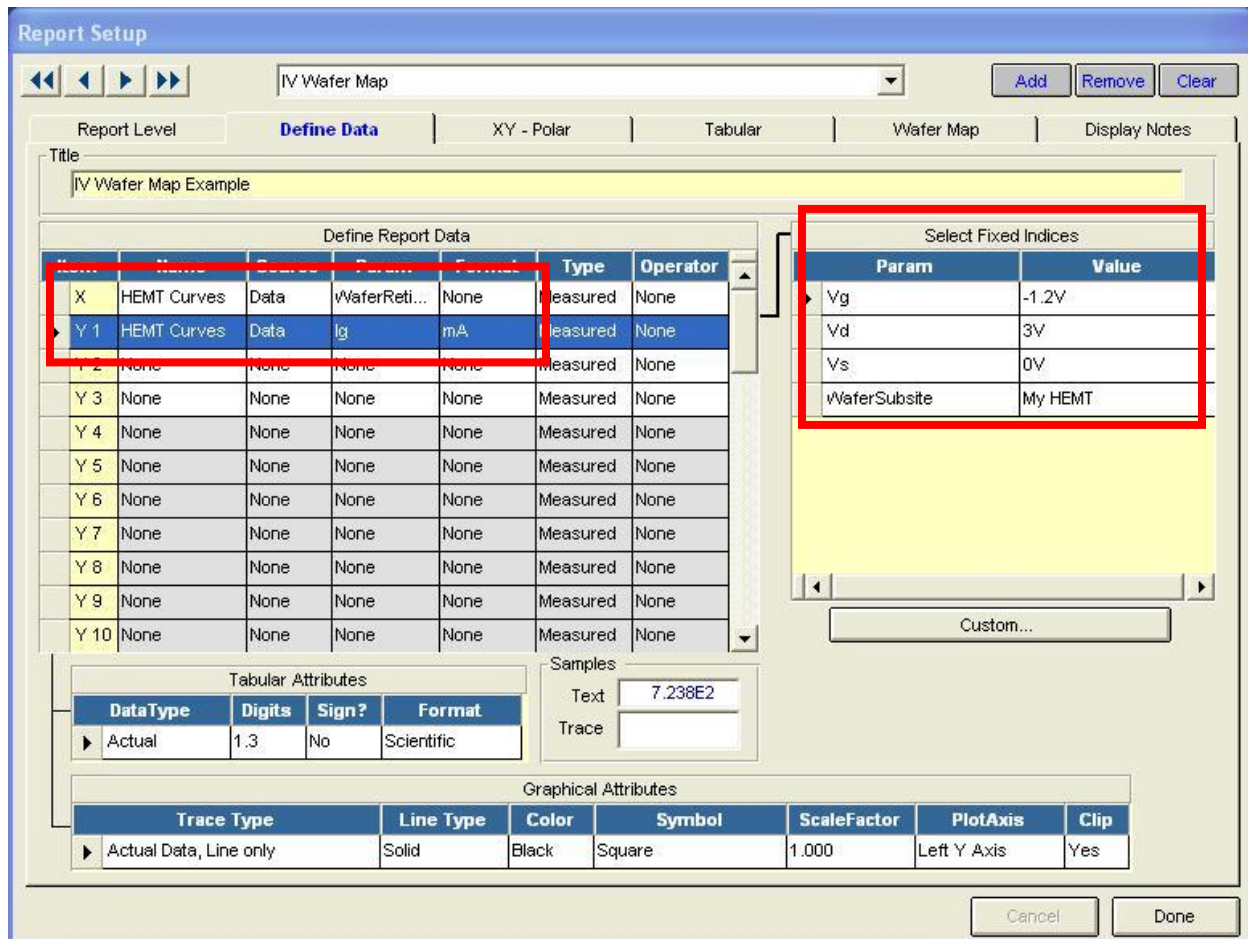
This section will discuss a new report type called the Wafer Map. Setting up a wafer map is relatively easy once the measured data is available to reference. Wavevue will examine your data objects and lead you through the set up process.

1. On the Main Toolbar, click the Report Setup icon.
2. Click the Add button on the Add Report Setup window. Select "Wafer Map" from the list on the left, un-check the Create Name Automatically box and type "IV Wafer Map" in the field. Click Add to create the report setup object.



3. The Report Setup window will display the default values for the new report setup.
4. Type "IV Wafer Map Example" into the first title line.

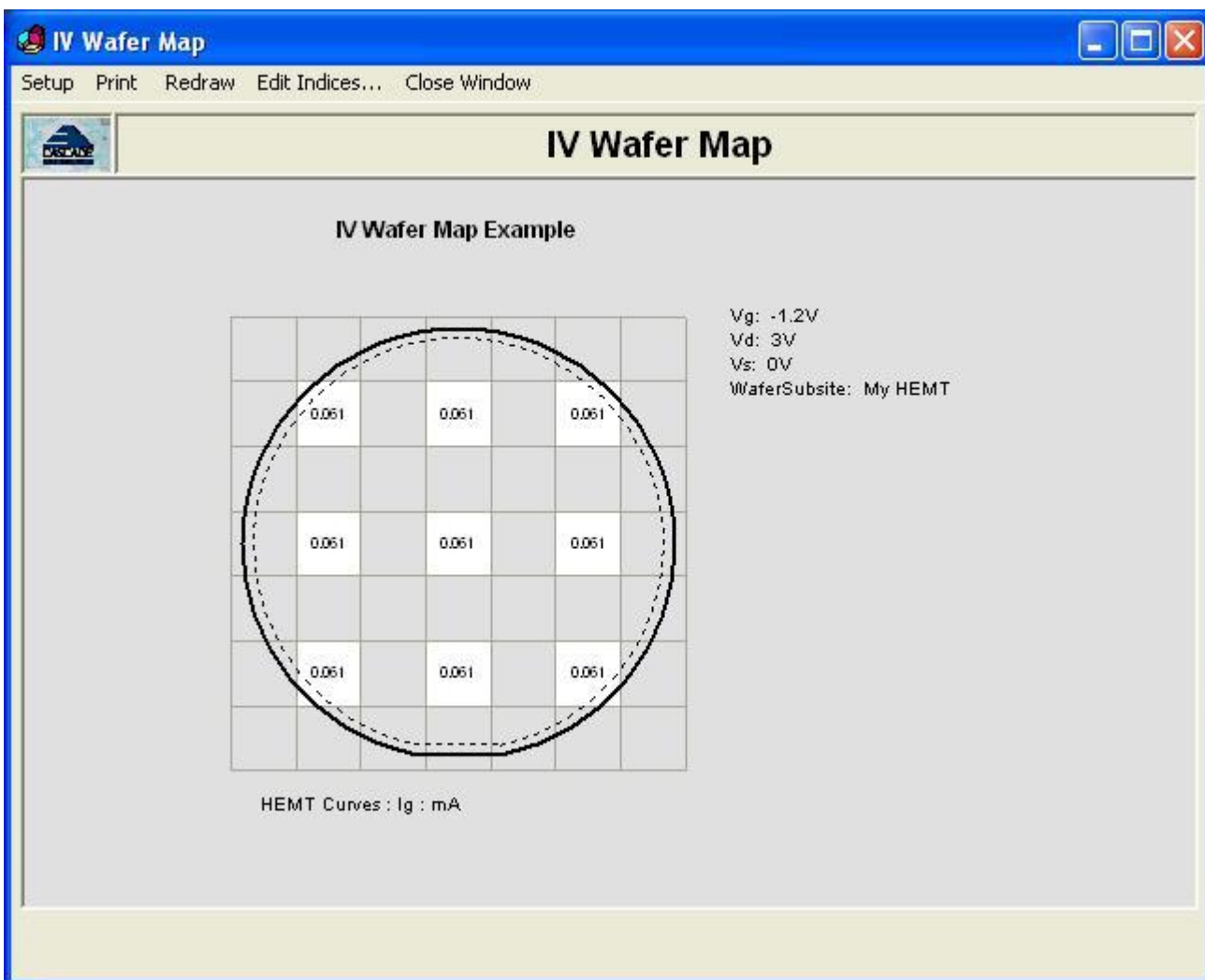
# Wavevue Measurement Studio Training Tutorial



5. Select the Define Data Tab. Click on the X data row. Select "HEMT Curves" from the Name cell. The Param cell will default to WaferReticle since that is the only legal X data item for Wafer Map reports.
6. Now Click the Y1 data row. Select "HEMT Curves" from the Name cell again. Select "Id" from the Param call and note that the Format will default to "mA".
7. Move to the Select Fixed Indices box and select "-1.2V" for Vg, "3V" for Vd, "0V" for Vs, and "My HEMT" for WaferSubsite. This will avoid having to pass through the Data Index window to view the plot
8. There are many additional capabilities in Wafer maps, such as coloring the reticles by data range. But those are best left to a more advanced tutorial. The rest of the settings can be left at their default values to view the plot. Click Done.
9. A single layout with the same name as this new report will be now appear in the Layout drop-down menu on the Main Toolbar. Select it from the pull-down and click View.

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10. The following plot will appear showing the wafer map data.



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Once the plot is displayed, a number of options exist to export the plot. From the menu bar, the following options are available. Note that several of the options require Microsoft Word and the Windows Metafile file filter to be installed on your computer. (Windows Metafile file filter is an optional feature in most versions of Word).

- a) *Print, Print Layout Directly* sends a representation of the report directly to a printer. Wavevue will use Windows native drawing commands to duplicate the report on the printer. Quality of the printed image varies depending on the type and brand of printer.
- b) *Print, Print Layout using Word* starts Microsoft Word in the background, exports the report as a Windows metafile (\*.wmf) to Word, and then uses Word's Print feature to print the report. This tends to give a more consistent quality printed image on different types and brands of printers.
- c) *Print, Save Layout as Word Document* starts Microsoft Word in the background, exports the report as a Windows metafile (\*.wmf) to Word, and then uses Word's Save feature to save the report as a \*.doc file.
- d) *Print, Open Word and Show Layout* starts Microsoft Word in the foreground, exports the report as a Windows metafile (\*.wmf) to Word, and leaves it displayed on the screen. This allows you to manipulate the layout and then either Print or Save the resulting document.
- e) *Print, Export Graphic Reports to File* exports the report as a Windows Metafile (\*.wmf) and then displays the Windows Save File dialog to allow you to specify the file name and location.
- f) *Print, Export Tabular Reports to File* does not apply in this case, but for tabular reports, it will allow the report to be saved as a text file (\*.txt).

## END OF TRAINING SESSION 2