Accelerated Testing through Superior Software Flexibility

Cascade Microtech Nucleus Software enhances your test investment by providing quick results in a flexible and integrated environment. Each wafer test step from loading and aligning, creating wafer maps, collecting test data, and analyzing results has been carefully crafted to optimize your time spent taking measurements.

M**i**crotron ®

Flexible electronic solutions

Increased Productivity through Quick Setup and Flexibility

The heart of a semiautomatic wafer probe station is the control software. The software must make it easy to control the prober and all its functions. Nucleus does that and more. This next generation prober control software is powerful, yet extremely flexible, easy-to-learn and use, and allows you to customize the control of your S300 or Summit semiautomatic probe station.
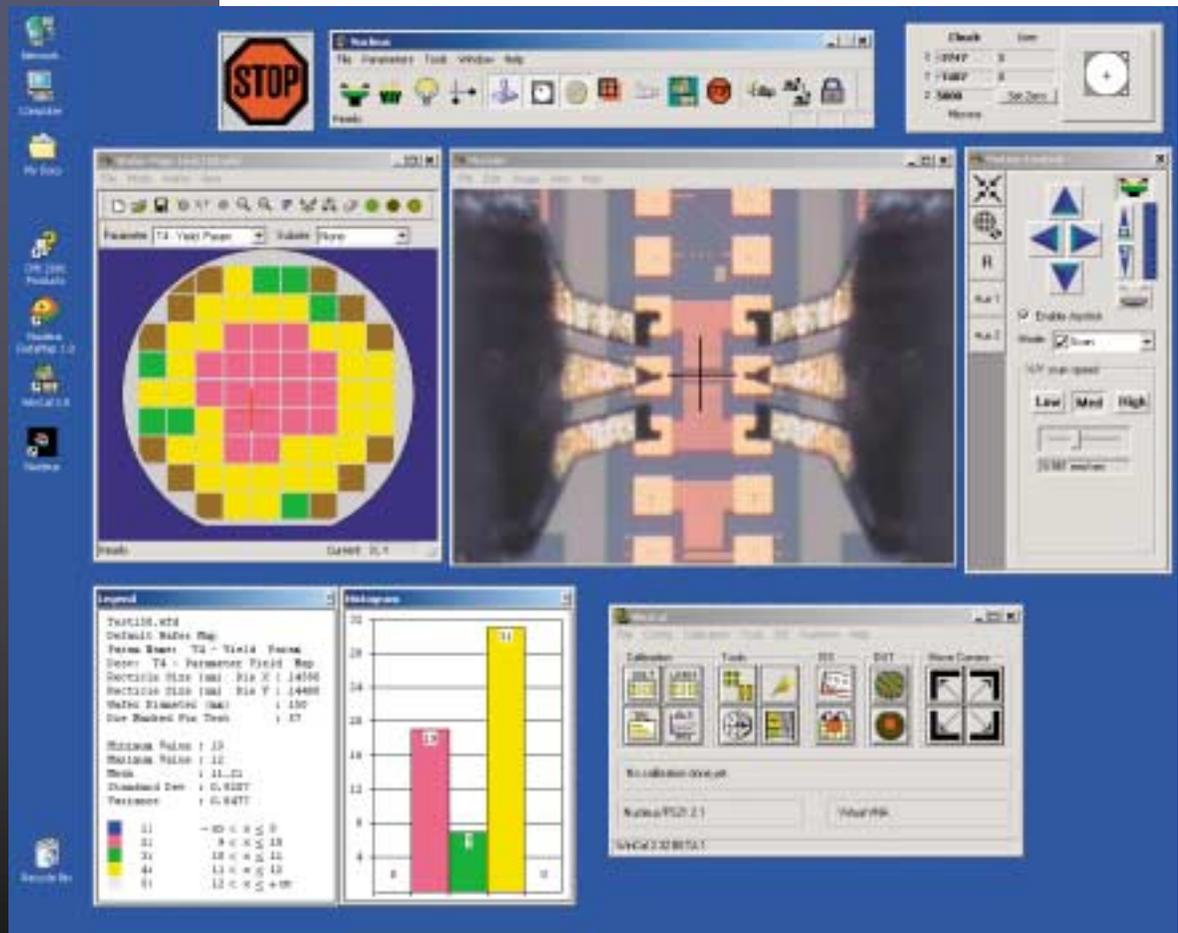
Nucleus Software:
Getting Your Job Done

Control and Performance

Getting your tests done quickly is key in today's fast-paced semiconductor manufacturing world. Nucleus makes your job easier with intelligent features that are tailored for the modern test lab.

Nucleus design is based on Cascade's long established knowledge of wafer test needs. Whether you're testing a single die or a batch of wafers, you can rely on the productivity enhancements of Nucleus Software.

Stable and Reliable Software

Nucleus uses an ultra-stable 32-bit software core, Nucleus System Manager, designed to run on Windows NT/2000. Together these provide a stable and robust environment for precision wafer testing. The Nucleus System Manager directs all prober hardware including the precision motorized stage with full closed-loop encoder feedback, while the Nucleus Interface provides the GUI windows. This client server design enables rock-solid stability and gives trouble-free operation.

Free Virtual Mode Available

Try out the Nucleus features described with a free virtual mode version that runs on your Windows NT or 2000 computer.

The CD comes with all the documentation, tutorials, example wafer maps and script files that the full Nucleus version contains.

Productivity Wizards

Your test setup tasks are automated with the easy-to-use wizards. Each step is clearly shown to the user in a concise manner for quick understanding.
• Wafer map setup – die size, wafer size
• Two-point align for wafers on S300 systems
• Distance tool for measuring die sizes

Ease of Use Features

• Live video window that supports point & shoot movement
• Integrated motion control window
• Wafer map with integrated Subsite support
• Automated 2-point wafer alignment for S300 systems
• Audio and voice feedback let you concentrate on your test

The main tool bar gives instant access to functions that you use every day.
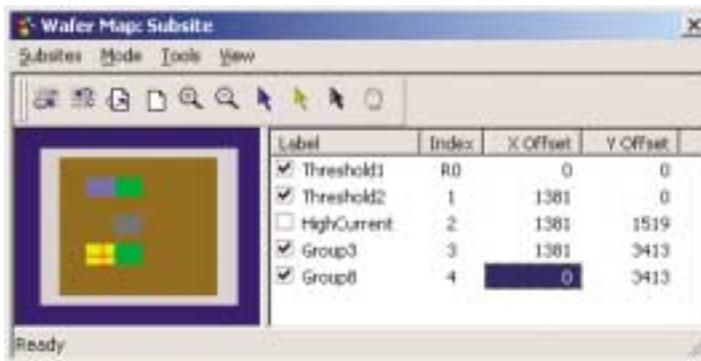
The easy-to-use graphical subsite window enhances productivity by letting you quickly setup multiple probe locations on each die. Use the move commands that are enhanced for subsite moves or use the Die Mode on the motion control window to move to subsites.
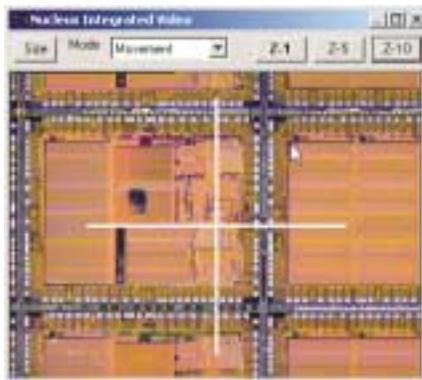
Point & Shoot in the live video window makes it possible to move with ease to features on your wafer.

Sophisticated Tools that Speed Your Work for Precision Prober Control

Instant Access to Motion Control

The motion control window makes your test setup faster by giving you precise control of machine movement. Each feature of the window has been carefully detailed for flexibility and clarity so your time is maximized when configuring a test.

The mode field of the window shows what type of move will occur. Change the mode by clicking on the listbox or by pressing the mode button on the joystick. The audio feedback tells you mode selected so you don't have to look at the screen.

The programmable position buttons on the left of the window let you move to frequently used positions. Right-click to change the position. The button labels and tool-tip text are editable as well.

Intelligent Window Configuring

The Motion Window displays only those fields which apply to the current mode.

In Scan mode, set the move speed with the slider or quick set speed buttons. In index mode (not shown) there are fields for setting the move size – it is automatically filled in with the die size from the wafer map.

Move to center of travel.

Move to load position.

Move to the reference die.

Move to the auxiliary chuck. Right-click to set the location.

The tool tip text shows you the values you have set in each of the programmable buttons.

Inner Pad
X Pos: 3476 µm
Y Pos: 2388 µm

Move to contact. Right-click to set the contact height.

Move to separate. Right-click to set the separation distance.

Select the move mode or press the mode button on the joystick.

Select speed for scan moves by clicking here or dragging the slider.

Nucleus Motion Control is easy to use and learn. Its intuitive grouping of functions lets you focus on your testing task.

Check boxes show which items will be selected by the joystick.

The Mode List is used to select how the stage will move.

Click the mouse, or press the Mode Button on the joystick.

The joystick and motion control window are connected through the software. The mode applies to the buttons on the GUI as well as on the joystick.

Push this button to change modes. The Voice feedback will tell you the new mode selected.

Integrated Video Point & Shoot

The integrated video with its point & shoot function can be used to quickly move targets on the video window to the crosshair. Move the mouse over the video window and double-click to make the stage move that feature to the crosshair.

Point & shoot can be used at any time in the setup process whether you are aligning the wafer, moving to subsite locations, measuring die sizes or looking at your probe alignment.

The integrated video window keeps track of the microscope zoom settings for you. When you switch objective lenses or zoom settings, click on one of the zoom factor buttons and point & shoot automatically uses the correct movement ratios.
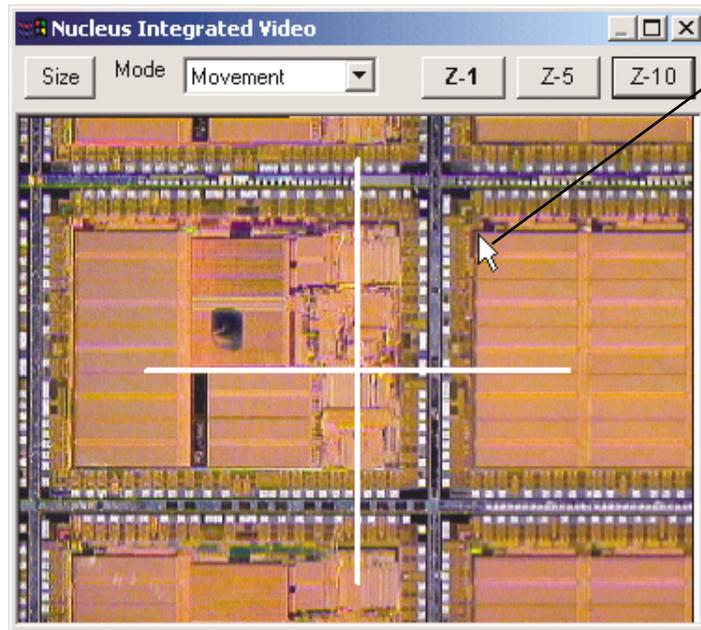
Double click here to move to the crosshair

The integrated video window speeds test setup with point & shoot. Double-click anywhere in the video window to move that point to the crosshair.

Alignment Tool Wizard

The alignment tool aligns the wafer streets with the stage. On the S300 station, which has motorized theta, this is a simple two-point alignment. Stations with manual theta control can use the hard align feature.

The alignment wizard walks you through two quick steps: 1. Move to one side of the wafer on a street, click Next. 2. Move to the other side of the wafer, click Next. The system does the rest.
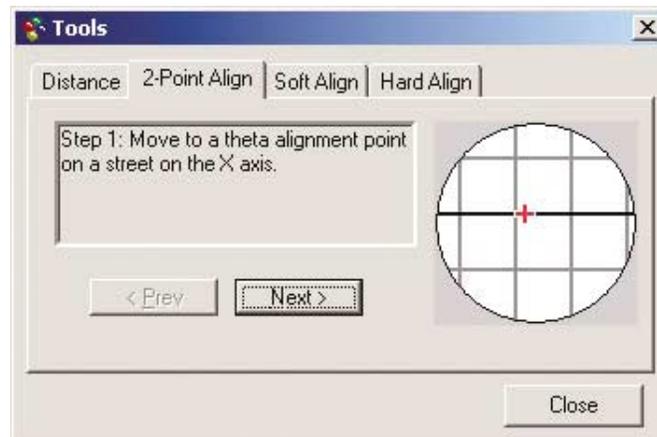
Two-Point Align uses two quick steps for aligning the wafer in theta on S300 stations.

Nucleus Makes it Happen

The goal is to walk up to a Nucleus probing station and rapidly set it up for taking measurements on your wafer. Nucleus achieves that goal through the many nuances of the GUI that speed your stride through the setup to your first measurement.

Nucleus has clear functions and easy-to-use features that minimize learning time. You'll be performing tests in a matter of minutes.

Customizable Main Tool Bar

The main tool bar gives you quick access to the windows and functions used most often.

Each user can add or delete buttons on the tool bar to meet their own requirements.

Click here to send the chuck up or down.

Turn vacuum on/off.

Open motion control window.

Start two point auto align.
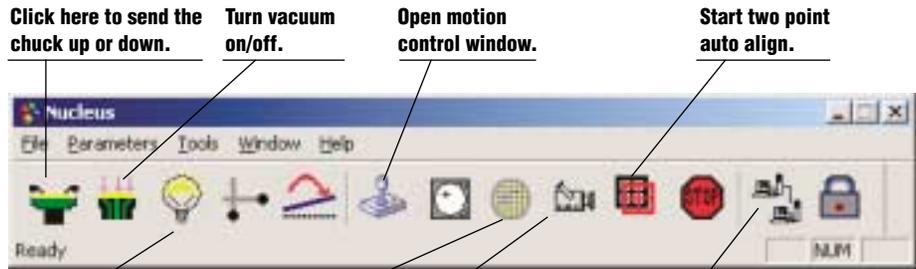
Lamp on/off.

Open wafer map and subsite windows.

Open live video window and point & shoot.

Open remote debug window.

Choose which buttons you want on the tool bar.
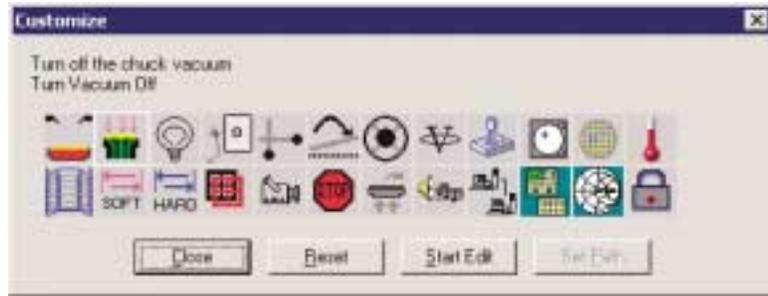
Multi-User Support

To get the best productivity from your prober system, multiple engineers and test operators can each have their own login names and preferences. Nucleus provides:
- Password login security
- Personalized ID and setup preferences
- Logs when each user logs into the system

Window locations, joystick mode settings and user stage positions are examples of items that each user can set for their own needs.
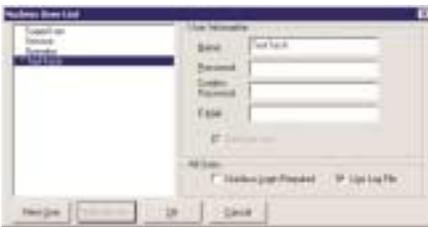
The user list window lets you create personalized user logins and assign administrative privileges.

Measuring Tape

The measuring tape lets you take a quick measurement of features on your wafer. Simply drag the mouse across the window.

Use it to measure die sizes or distances between test structures.

Get a quick measurement of features using the measuring tape.

$Y = 5960$

$x = 7290$ um
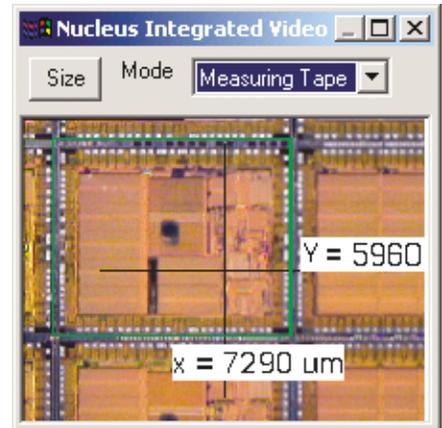
Distance Tool for Measuring On-Wafer

The distance tool uses two steps to rapidly measure the die size on your wafer. The die size estimate is automatically filled in from the wafer map. Use the point & shoot functions on the video and wafer map windows to quickly move the crosshair to features. When you are finished, click "copy to wafer map" to set the die size in the wafer map.

You can quickly measure die sizes using the distance tool.

Management of subsites is simplified by the graphical subsite window.

Graphical Subsite Window

The sophisticated subsite window lets you graphically add locations to probe on each die. Use the Point & Shoot function to move to subsite pads and then click the Add Subsite button. The subsite list can be changed by dragging items in the list, sorting and renumbering.

A complete set of remote commands enables moving to subsites, adding subsites and changing field values such as the label and X/Y offsets.

Use subsites in conjunction with the Data Value Parameters function of the Wafer Map to show real time test results of subsites for each die.

Remote Wafer Setup

Your test program can take charge of creating wafer maps automatically. Nucleus has a full set of remote commands for creating and modifying wafer maps and subsites. This total test integration means productivity gains by removing the operator steps for setup.

Nucleus comes with example script files that show how to create wafer maps using the remote commands.

Click here to move to a subsite.

Wafer Map Wizard

The wafer map wizard helps you rapidly create a new wafer map. Enter the dimensions, select the reference die and mark which die to test.
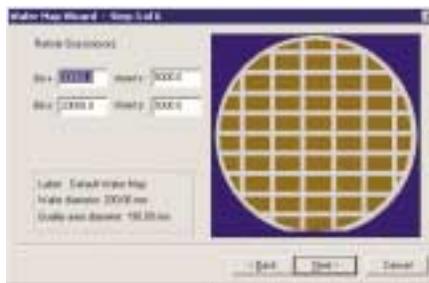
Wizard functions such as the wafer map wizard are one of the ways Nucleus speeds your test setup.

Productivity Tools

- Extensive online help and user guides eliminate paper manuals from your clean room.
- Tutorial sections are written for new users to help them quickly learn about the time-saving features in Nucleus.
- Remote programming tools for developing and debugging custom test software.
- Operator alerts via email for "last die tested" or "vacuum lost," etc.

Edge Sense

The intelligent edge sensing function in Nucleus lets you specify the search band and search speed for detecting the Z height switch.
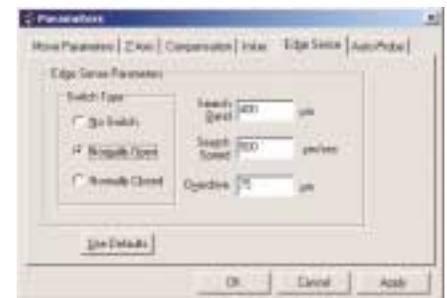
Z-height sensing is straightforward with the edge sense setup window.

Flexibility for All Measurement Applications

RF Application Support

Your RF testing is optimized by Nucleus with essential features that simplify your tasks.

Moving to an ISS on the auxiliary chucks is simplified with the aux buttons on the motion control window.

Added safety for your probes has been added with the aux chuck zones. The stage automatically senses when moving from the wafer to the aux chucks and moves down in z before moving between zones.

DC/CV Support

Nucleus also seamlessly integrates with popular DC/CV test software such as Metrics Technology's I/CV 2.0. I/CV performs I-V and C-V characterization tests and can generate histograms, statistical reports and tables of measured characteristic curves or extracted parameters. It also allows for different tests per device.

FA Support

Failure analysis tasks are simplified with the enhanced features in Nucleus.

Integrated live video with point & shoot gives you precision movement to ultra-fine features on-wafer.

Motorized positioners have resolution of 0.1 micron with the optional AutoProbe module.
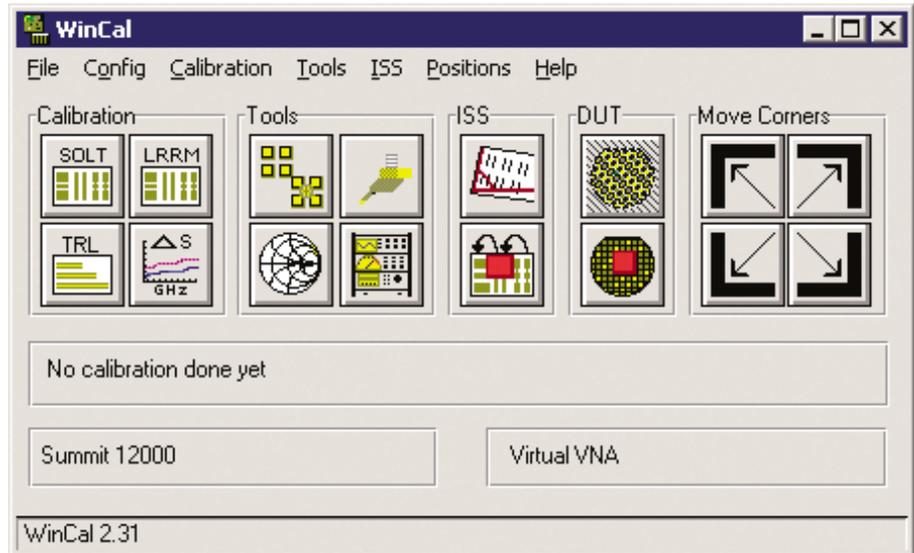
WinCal is Cascade's VNA calibration utility that is seamlessly integrated with Nucleus. It provides easy and accurate calibration of network analyzers for precision on-wafer measurements.
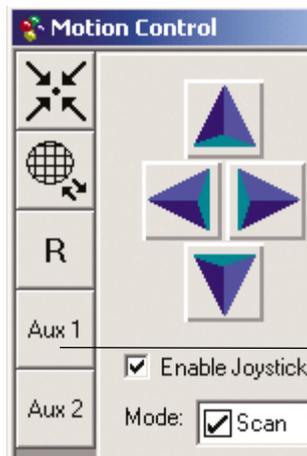
Click here to move to an ISS on the auxiliary chuck.
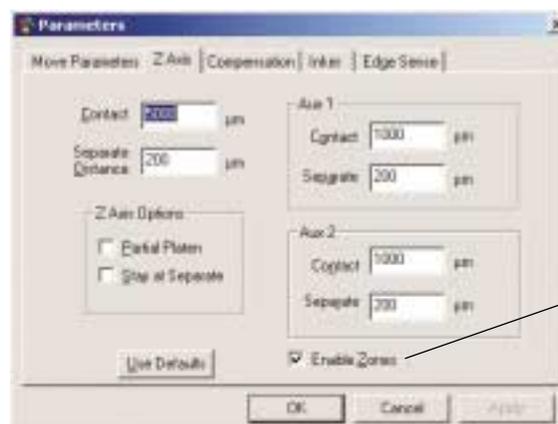
The chuck zones function protects your probe tips when the ISS is a different thickness than your wafer.

Test Monitoring At-A-Glance

Real Time Result Monitoring

A quick glance at the wafer map and histogram will assure you of the validity of the test. The Wafer Map display shows binning and histogram information as your test is proceeding.

The content of the histogram and statistics windows is customizable so you only see the information you need for your current application.

Real-time statistics of your test for min./max. values, standard deviation and the number of die in each bin are updated with each test result.

Data Parameter Values from Remote Commands

Your test program sends test result values to Nucleus to create bin assignments and colors for each die. Simply add one additional remote command to send the result. Nucleus will store values for each subsite on each die. Using an advanced partial map data access method, the storage is fast and uses minimum memory.
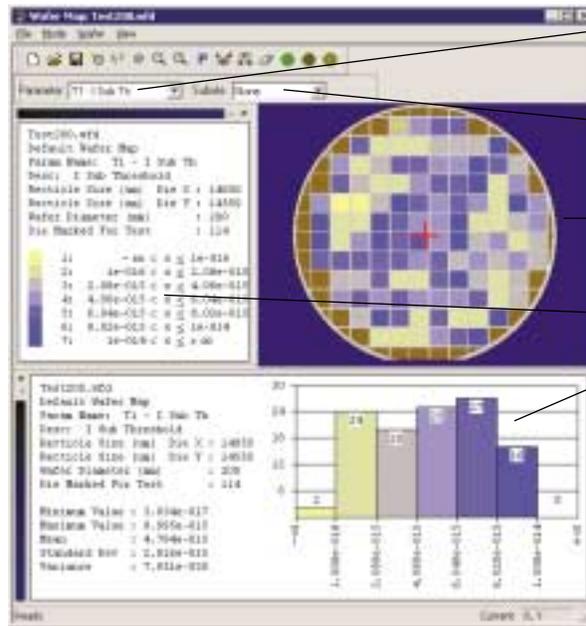
Select which parameter to display.

Select which subsite to display.

Real-time monitoring of results.

Legend shows the meaning of die colors.

Histogram of results.

Wafer map parameters give instant visibility to your test results with customizable histogram and legend information. A quick glance at the wafer map shows the status of tests.
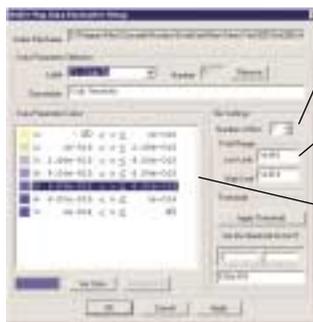
Number of bins for results.

Range for valid results.

Assign colors to bins.

Easy setup of the parameter display lets you take advantage of the real time data analysis with just a few quick steps.

Data Parameter Setup

Simple yet powerful, the test data parameter setup window lets you quickly set up a binning strategy for your test results so you can monitor them in real time:
- Data label name for selecting on the wafer map display
- Range of good measurement values
- Number of bins for good values
- Threshold values between bins
- Assign colors to each bin

Select which parameters to combine for pass/fail.

Specify range of passing values.

Pick color to display for pass/fail.
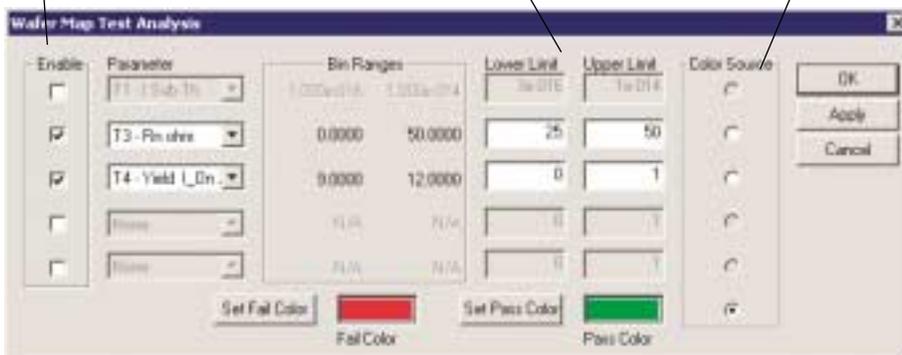
Test analysis is a powerful tool that lets you combine multiple test values into a single pass/fail result for display on the wafer map.

Test Analysis for Advanced Pass/Fail Monitoring

Combine test results in a concise manner to get instant yield analysis of your wafer.
- Select two or more measurement parameters
- Assign a range of good values for each
- Pick a color source• On the wafer map display, select the test analysis for display
- The wafer map will be updated in real-time to validate your tests

Accelerate Your Test Integration with Enhanced Remote Programming and Debug

Remote Window

Quick integration of remote programs is the intent of the Nucleus remote window. If you are creating your own test software, this window will speed you through the debug process.

All remote commands and responses are shown on the log window. They can also be sent to a log file for evaluation.

A direct command entry window is available to try single commands. The command and result will be shown on the log window. Creating a file of commands and then executing these are simplified with the script buttons.

Remote Interfaces

Nucleus uses industry standard interfaces to receive remote commands:
• RS-232 Serial
• IEEE-488 (GPIB)
• DDE (Windows Dynamic Data Exchange). Accessible from all Windows programming languages including LabVIEW, Visual Basic and C/C++.

Summit SCPI Remote Commands

The SCPI remote command set in Nucleus was designed to speed your software development and integration. The command set is complete and rich with functions that are robust and clearly organized.

If you have software currently controlling PCS, Nucleus can be used immediately to execute the same command stream. Improved productivity has been added with new command groups including parameter test data, wafer setup and thermal control.

Customize the layout of this window. Every portion of this window can be edited.

Log all remote commands and responses to a file.

Enter single line commands for a quick interactive trial.

Status of GPIB communication.

Click here to run a sample script file. Right-click to edit the file.

The Nucleus remote debug window will speed your test integration. The functions and layout are carefully crafted for quick and easy understanding of the remote communication stream.

Sample Scripts

To help you quickly learn to use the remote commands for controlling Nucleus, more than 25 sample script files of remote commands are included. These script files illustrate how a remote program can create wafer maps and subsites, setup parameters for real time monitoring, and send real time test results for displaying on the Nucleus wafer map.
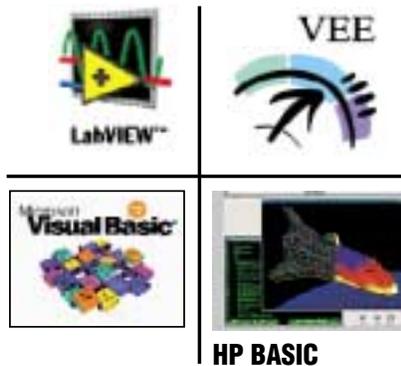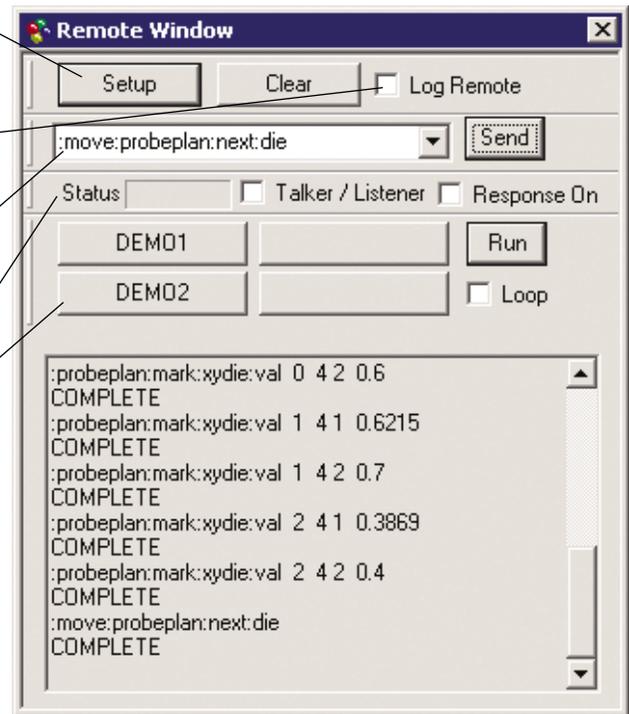
Standard Test Software Package Integration

Nucleus software continues the CMI legacy of Summit integration with industry standard test software packages. We partner with key companies in the industry to provide complete solutions for every wafer test application need. Examples of supported test packages include: Metrics I/CV, Agilent IC-CAP, BTA Technology (Celestry) BSIMPro, Silvaco UTMOST, and many others.

Drivers and sample programs are available for Agilent VEE Pro 6, LabVIEW, MS Visual Basic, and Agilent/TransEra Basic for Windows.

System Customization
with Add-On Capabilities

Nucleus Software Modules add productivity value. The optional Software Modules can be added to your system to meet your test requirements.

Vision – Alignment of Die using the Video image. Resolution down to 0.25 microns.

AutoProbe – Software Control of Microscope and Micro-positioners with GUI or remote commands.

Thermal – Automatic die size compensation for thermal expansion.

Nucleus Vision Software Module

Pattern recognition for die stepping can be added with the Nucleus Vision Module. This turnkey solution has quick and easy setup for X/Y alignment to adjust die spacing.

For example, in applications that use blue tape, the Vision Module can be used to shift the stage at each die move. No changes are required in your remote program to take advantage of this feature.

Simple Setup

Pattern recognition setup using the Vision Module is simplified to let you concentrate on your test.

Setup Steps
- Move to a target on your die.
- Click "train target." The system stores the image of the target and the location of the stage.

You're done. When you command a move to a die, the pattern recognition software will automatically be used to adjust the X/Y position.

Real-Time Monitoring

When the pattern recognition is enabled, the system shows you the search scores and locations for each search. You are assured of the accuracy of the die placements.

Dependable Accuracy

Nucleus Vision uses advanced spatial pattern matching and the MMX instruction set to accurately and quickly find your targets. Results are sub-pixel so the search accuracy can be as fine as 0.25 microns.
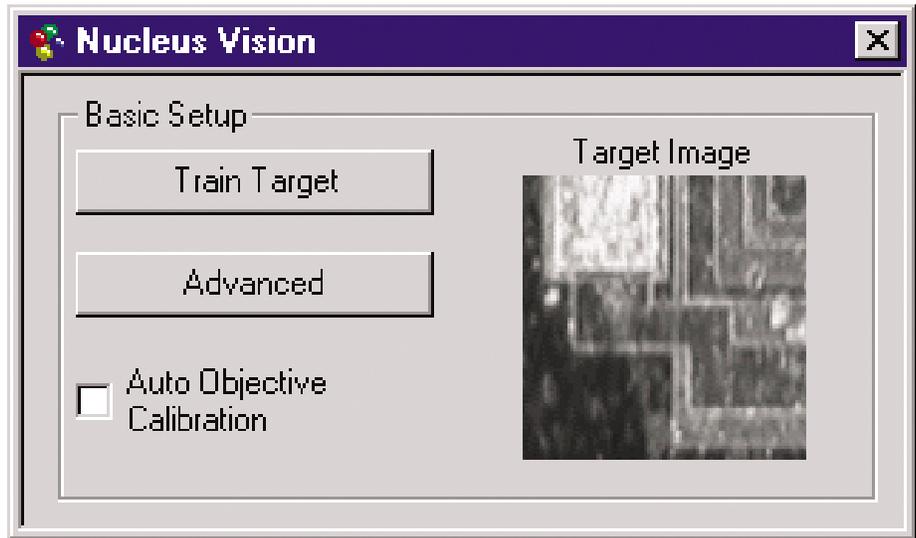
Vision setup is easy with one button training.
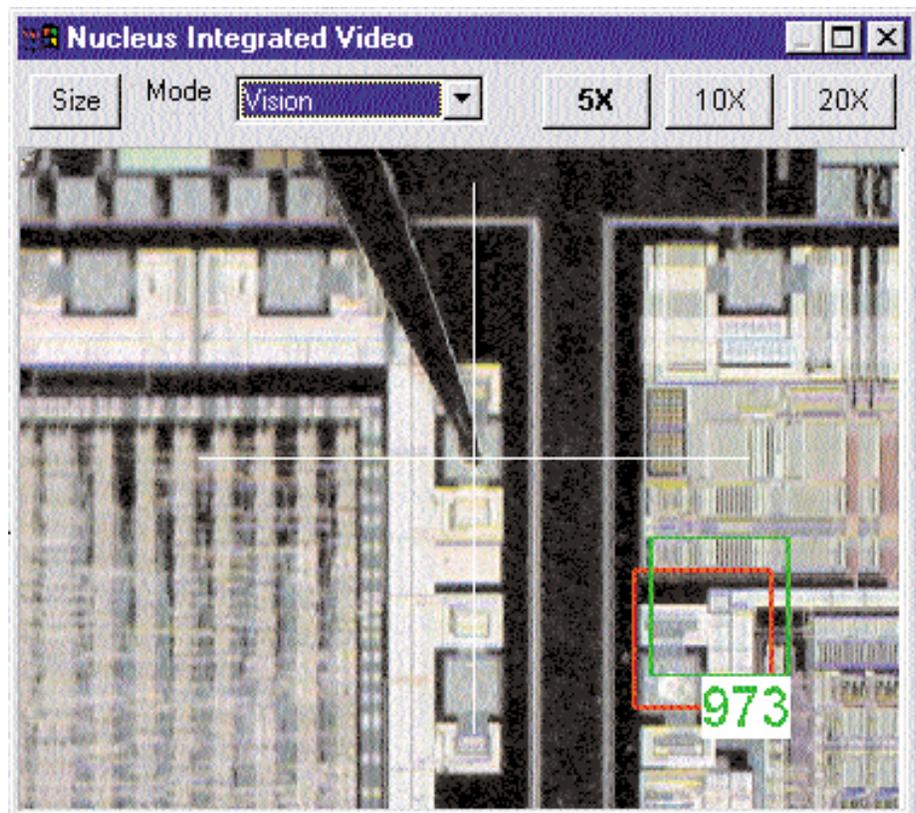
As the station steps from die to die, the Vision module shows you the status of the pattern recognition searches.

Powerful Vision Features:

Auto Illumination Control

When enabled, this function ensures that the microscope illumination is turned off after the search is completed so your circuit will not be affected by the illuminator light.

Auto Objective Calibration

Automatically calibrate the pixel-to-micron ratio of the live video image. The ratio is set once for each objective lens (magnification) and then used for the point & shoot function on the video window as well as for the pattern recognition alignment for die to die moves.

Quick Enable/Disable

Use the tool bar button to enable or disable the Vision function at any time. When it is enabled, die steps will automatically be corrected for misplacements.
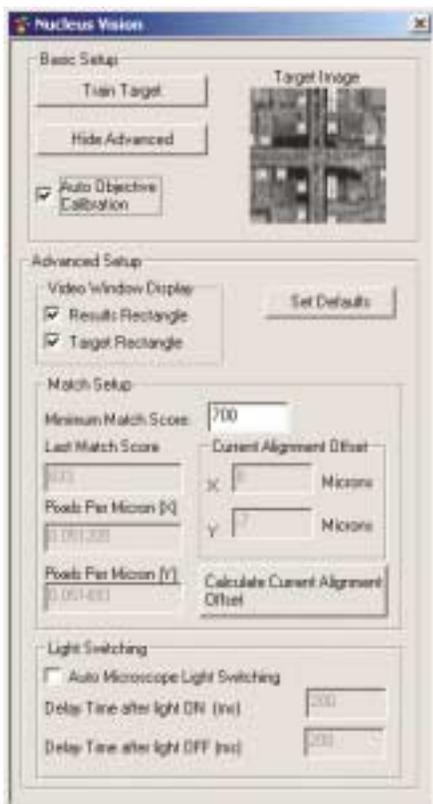
Remote Programming – No Changes

There is no need to change your remote program to take advantage of Nucleus Vision for die moves. When you enable the function by clicking on the tool bar button, subsequent die moves are automatically adjusted for small position errors.

Basic or Advanced Setup

Most users of Nucleus Vision will use the basic setup dialog – simply click the "train target button" and your process is ready to run. For situations that require more control, the advanced button shows additional fields for controlling illumination, monitoring the X/Y offsets and changing the minimum match score.

The advanced Vision setup can be used in situations that require more control of the search process.

Uses

Blue tape wafers. When die have been sawn apart and are not equally spaced, Nucleus Vision will correct for die placement errors.

Thermal Expansion. When the wafer is being tested at hot or cold temperature, Nucleus Vision will correct for the X/Y expansion of the wafer.

Quicker alignments. When Vision is enabled, it is not necessary to get the wafer exactly aligned. Nucleus Vision will adjust for alignment errors in the wafer so that die to die stepping is accurate.

Nucleus AutoProbe Software Module

Precision Control to 0.1 Micron

The Nucleus AutoProbe Software Module provides software control of up to 6 micropositioners and a microscope. These channels can be independently controlled through the integrated motion control window in the GUI or through the remote command set.

Nucleus AutoProbe builds on the proven motion control of the ECX-56-D that provides 0.1 micron resolution for the microscope and positioner channels.

Integrated Control Window

The easy-to-use motion control window gives instant access to all of the channels installed on the system. The channel select buttons tell you which positioner, microscope, or chuck is selected for movement. Click on the buttons or press the channel button on the joystick to change the channel. The voice audio feedback will tell you which channel is selected.

Remote Programming

The positioners and microscopes can be controlled by your remote test program using the industry standard SCPI format commands. The command set builds on the same command set used for the stage, so your programming task is simplified.

Drag and Drop Movement

The live video window gives you instant control of the positioner probe tip. Click and hold on the tip, and drag the mouse to the destination. When you release the mouse button, the probe will move to the new location.

User Convenience Positions

Each channel can have up to 5 user positions assigned to store "favorite" locations so you can move quickly between test structures.

The status window can be configured to show the locations of any channel.
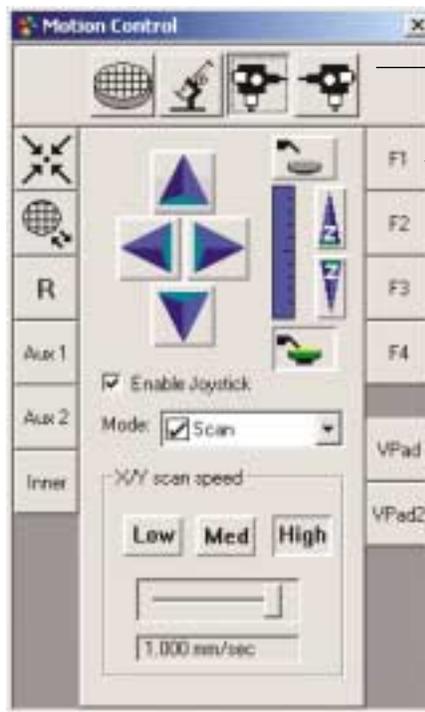
Click here to select which channel to move.

Click here to move to focus.

Convenience Positions: Click to move. Right-click to set location.
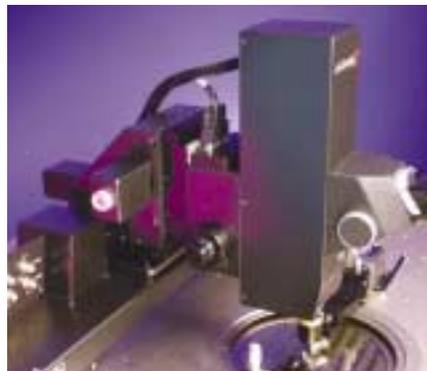
The motorized microscope mount lets you program moves to view your probe contacts on pads.

MS1-8 programmable micropositioners enable precision submicron hands-off probing as well as automated step and repeat sub-die testing.

Smart Configuration

The positioners can be right-hand or left-hand operation. The firmware will automatically detect which direction is selected and switch axis direction and icons.

Nucleus Thermal Software Module

Automatic Thermal Compensation

The Nucleus Thermal module gives you automatic compensation for expansion or contraction due to temperature. Your productivity is improved because it is not necessary to reset the die size when the chuck temperature changes. The die sizes are automatically adjusted in real time as the chuck temperature increases.

Easy Access to the Thermal Chuck

The Nucleus Thermal module gives you easy access to controlling the thermal chuck temperature. Enter a temperature value and click with the mouse. You can monitor the chuck temperature as it changes value. The thermal status window shows when the chuck is changing temperature and when it reaches the commanded value.

Remote Thermal Control

Your test program can control the parameters of the thermal chuck system and monitor the current chuck temperature using remote commands. A complete set of SCPI format commands for setting the temperature is included in the thermal module.

Essential Thermal Control for Parametric Measurements

The Nucleus Thermal module gives you the control you need for parametric tests at temperature. The Summit 12000-Series and S300-Series probing stations are configured with industry standard thermal controllers and the patented guarding and shielding technology to give you the low-noise, low-leakage and low-capacitance measurements that only Cascade Microtech can deliver.

Automatic compensation for thermal expansion. As the chuck temperature changes, the die step sizes are adjusted for expansion or contraction.

The thermal module gives you quick and easy access to the thermal chuck.

Supported Controllers

These thermal controllers are supported by the Nucleus Thermal Module:

TPO3000A
TPO3200A
TPO3010B
TPO3210B
TPO315A
TPO315B
TPO3215A
TPO3215B
Titan

Ordering Information

New Stations

Semiautomatic:
- Nucleus Software is included with Cascade Microtech's 12000-Series and S300-Series Semiautomatic probe stations.
- Computer controllers supplied by Cascade Microtech include Windows NT/2000. For further computer and OS specifications please consult the factory.

Manual:
- To use software-controlled microscope or motorized positioners with a manual probe station, Nucleus P/N 123-568 should be ordered as well as the AutoProbe Module

Upgrades

Upgrades from PCS, order P/N 123-568. Bring the superior productivity of Nucleus software to your Summit 12000 Series probing system.

For information on system upgrades, see the Nucleus Upgrade document NUCLEUS-UPG-0901.

Software Modules

Nucleus Vision
P/N 123-572
Requires high performance digitizer P/N 125-200

Nucleus AutoProbe
P/N 123-569
Hardware supported:
- High-resolution motion controller box
- Motorized microscope bridge-mounts
- Motorized microscope focus
- Programmable DC positioners
- Programmable RF positioners

Nucleus Thermal
P/N 123-570

OS Compatibility

Nucleus Software runs on these Operating Systems:

Windows NT 4.0
Order Service Pack 6 or higher.

Windows 2000
Order Service Pack 1 or higher.

Supported Stations

- Summit 12000-Series
- S300-Series

Innovating Test Technologies for better measurements faster

CASCADE®
MICROTECH

Microtron®
Flexible electronic solutions