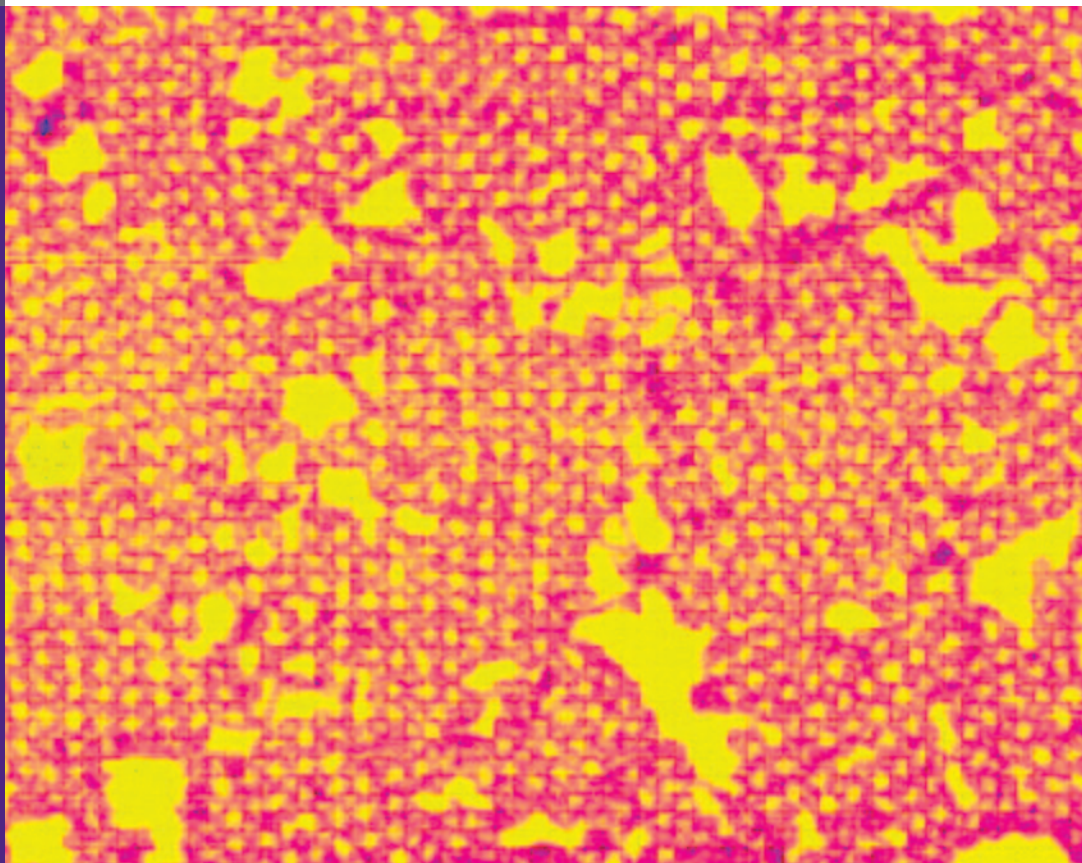


diMultiMode V

The World's Highest-Resolution SPM



- **New High Speed Controller**
- **Superior Scanning Performance**
- **Complete Range of AFM Techniques**

diMultiMode V

Proven Performance and Unmatched Flexibility



The Digital Instruments MultiMode® V represents the next generation of the world's highest-resolution, most application-proven commercial scanning probe microscope (SPM). Its compact hardware design, new NanoScope® V controller, and user-friendly, powerful software allow the MultiMode V to easily acquire data from micro- to atomic-scale images. Proven productivity, flexibility, and reliability have made MultiMode V SPMs the gold standard in materials, life sciences, and polymers research.

- ▶ New NanoScope V controller
Offers high-speed data capture (50MHz)
Captures up to eight images simultaneously
High-pixel-density images (5000 x 5000)
- ▶ Variety of available scanners
Offers flexibility of scan sizes
Delivers application-specific accuracy
- ▶ More than 18 operating modes
Provides flexibility of applications
Performs wide range of SPM techniques
- ▶ Top-view optical head
Allows easy setup
Permits sample viewing during imaging
- ▶ Compact, rigid design
Delivers convenience and ease of use
Produces low-noise images

The World's Highest Resolution

Every facet of the MultiMode V system's electronic and mechanical design has been optimized for the highest resolution, including a short mechanical path, rigid low-vibration construction, and ultra-low-noise electronics. The high resolution of the MultiMode V has helped lead to more scientific publications than all competitive SPMs combined. And the addition of the state-of-the-art NanoScope V controller now means MultiMode V users can be even more productive.

Superior Scanning

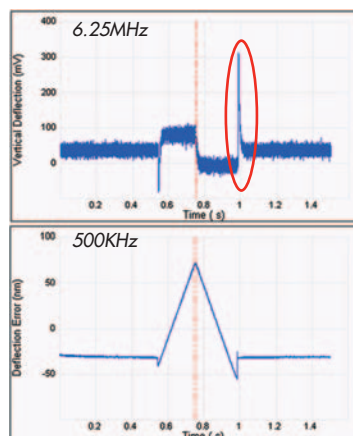
The MultiMode V features multiple scanners that permit each user to tailor the system for individual research. Scanners with large scan ranges up to 120 microns on the X-Y axes and a Z range up to 6 microns, as well

as high-resolution scanners with 0.5 microns on the X-Y axes and submicron Z range, are available.

The vertical-engage "JV" and "EV" scanners let users position the tip at any point on the surface without adjusting for lateral movement of the tip during approach. Additionally, the MultiMode PicoForce has a closed-loop Z axis for advanced force-curve measurements.

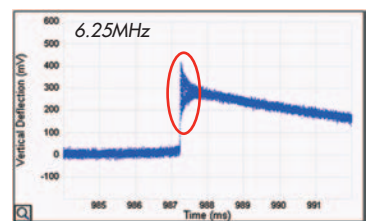
Incorporating a host of proprietary design features, these scanners are constructed of a combination of piezoelectric materials that minimizes X,Y, and Z cross-coupling and the effects of nonlinearity and hysteresis, while maintaining calibration throughout the full vertical range.

Scanner calibration and linearization are maintained (regardless of the scan size, offset, or direction) by software control, providing the user with easy, direct access to all aspects of scanner operation.

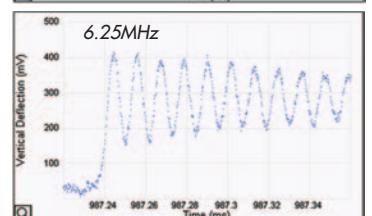


a.

d.

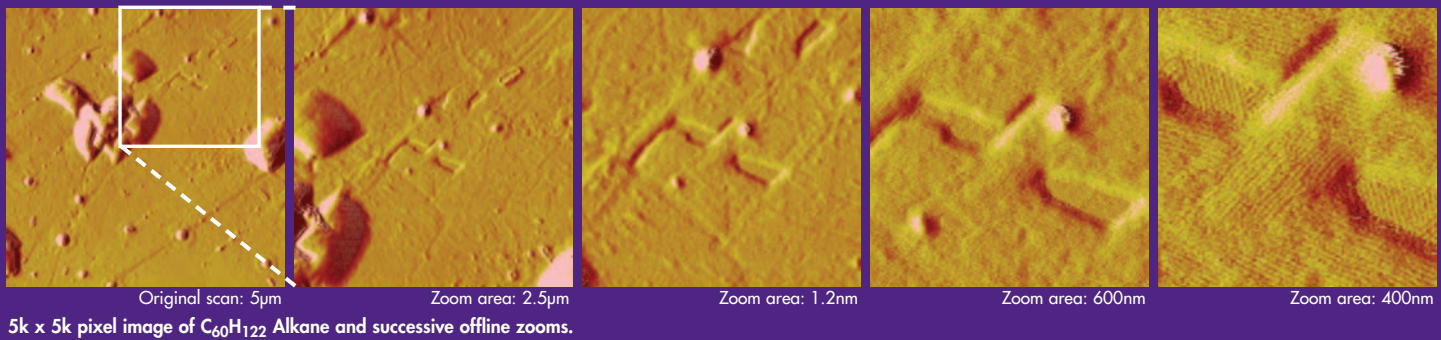


b.



c.

The new high-speed data capture allows the user to monitor tip-sample interactions during a force pulling experiment in a time scale that was not possible before. Figure b is a detail of the area circled in graph a. Figure c is further detail of the circled area in graph b.



Original scan: 5µm
Zoom area: 2.5µm
Zoom area: 1.2nm
Zoom area: 600nm
Zoom area: 400nm
5k x 5k pixel image of C₆₀H₁₂₂ Alkane and successive offline zooms.

New NanoScope V — World's Best Controller Technology

The MultiMode V SPM system includes the NanoScope V controller, which utilizes advanced high-speed electronics, along with A/D and D/A converters operating at 50MHz, to deliver reliable, high-speed data capture. This new controller allows researchers to record and analyze tip-sample interactions (e.g., at pull-off in force spectroscopy) that probe nanoscale events at timescales previously inaccessible to SPM.

The NanoScope V enables up to eight images to be simultaneously displayed in real-time (and captured for analysis) with outstanding signal-to-noise ratio. The controller incorporates three independent lock-in amplifiers (two at up to 25MHz, one at up to 250kHz) and provides thermal tune measurements of cantilever resonances (e.g., for spring constant calibration) up to 2MHz.

High-pixel-density images, up to 5000 x 5000, improve "time to results" by reducing the need to capture several images at lower pixel densities as well as eliminating the requirement for offset adjustments to correlate information from multiple images. The high pixel density also allows observation of large structures and small features in the same image.

The controller affords easy access to most input and output signals through front-panel BNCs. Input

data into the controller from an external source (e.g., photomultiplier tube) is supported, as is user access to lock-in amplifiers and to signals to/from a microscope (e.g., XYZ sensors, amplitude, phase).

Unsurpassed Flexibility and Functionality

The NanoScript™ open-architecture option provides a growing list of functions to control the SPM for custom experiments and nanoscale research (e.g., nanomanipulation in X, Y, and Z; automated scanning; nanolithography with different tip-sample interactions). These functions can also be called from any programming language that can act as a client of Microsoft's Component Object Model (COM), including LabView, MATLAB™, Visual Basic, Ruby, Python, C++/MFC, Excel®, and Word®.

Easy-AFM, Remarkable Simplicity

For streamlined simplicity, Easy-AFM™ ease-of-use feature offers an intuitive, easy-to-follow graphic user interface for new or infrequent SPM users. Easy-AFM reduces the time for initial setup (including probe, laser, and detector alignments), engaging the sample with the probe (in air), adjusting the scanning parameters, and obtaining high-quality, useful TappingMode™ images in air on most samples with minimal user intervention.

Unlimited Application Expandability

The MultiMode V performs a full range of SPM techniques for surface characterization of properties like topography, elasticity, friction, adhesion, and electrical and magnetic fields:

- TappingMode AFM
 - Contact Mode AFM
 - Phasemaging™
 - Lateral Force Microscopy (LFM)
 - Magnetic Force Microscopy (MFM)
 - Scanning Tunneling Microscopy (STM)
 - Force Modulation
 - Electric Force Microscopy (EFM)
 - Scanning Capacitance Microscopy (SCM)
 - Surface Potential Microscopy
 - Force-Distance and Force-Volume Measurements
 - Electrochemical Microscopy (ECSTM and ECAFM)
 - PicoForce Force Spectroscopy
 - Tunneling AFM (TUNA)
 - Conductive AFM (CAFM)
 - Scanning Spreading Resistance Microscopy (SSRM)
 - Torsional Resonance Mode (TRmode)
- ...and many more

Cover image: Height image of 2D network of 10nm wide RNA tectosquares. Scan size 600nm. Courtesy of Alexey Koyfman (UCSB) and Sergei Magonov (Veeco Instruments). Sample, courtesy of Arkadius Chworos (Prof. L. Jaeger's Lab, UCSB).

MultiMode V Specifications

PERFORMANCE

- **Microscope:** – MultiMode V SPM head; choice of scanners (see Table 1)
- **Noise:** – 0.3\AA RMS in vertical (Z) dimension w/ vibration isolation
- **Sample size:** – 1.5mm diameter; 5mm thick
- **Tip/cantilever holders:**
 - Tapping mode/contact mode in air (std);
 - Tapping mode/force modulation in fluid (optional);
 - Force modulation in air (optional); electrical field (optional);
 - Scanning thermal (optional—requires large sample head or additional application modules);
 - STM converter (optional);
 - Low-current STM converter (optional); contact mode fluid cell (optional);
 - Electrochemistry AFM or STM fluid cell (optional);
 - Electrochemistry tapping mode fluid cell (optional)
 - TRmode (optional)
- **Vibration and Acoustic Isolation:**
 - Silicone vibration pad provided and acoustic cover (std);
 - Vibration isolation tripod (optional); vibration isolation table (optional);
 - Integrated vibration isolation table and acoustic enclosure (optional)

HARDWARE/SOFTWARE OPTIONS

- **Optical viewing system:** – Provides vertical view of tip and sample surface w/ optical microscope, color CCD camera, and color monitor;
- **Signal Access Module™:** – Provides access to every input and output signal between controller and microscope
- **Quadrex electronics module:** – Provides phase and frequency detection hardware for Phase Imaging, MFM, EFM
- **Heater and cooler:** – Provides sample heating and cooling for biological applications, polymers and other materials
- **Environmental Chamber:** – Allows purging of environment at atmospheric pressure when scanning with gases
- **Nanoindenting/scratching option:** – Provides software, cantilever holder, and diamond-tipped cantilever for nanoindenting/scratching experiments
- **Electrochemistry package:** – Required for electrochemical STM/AFM
- **Nonmagnetic option:** – Consists of magnet removal from microscope scanner for MFM measurements of low-coercivity samples and applied fields
- **Application modules:** – SCM, TUNA, SSRM and CAFM

Note: Performance specifications are typical and subject to change without notice.

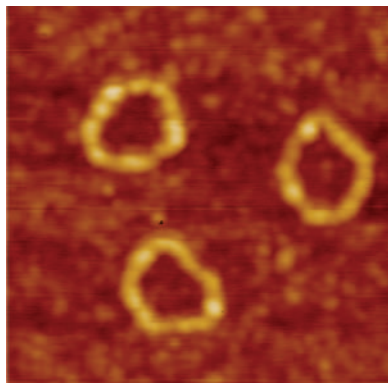
Scanner	Lateral (X-Y) Range	Vertical (Z) Range
AS-0.5, AS-0.5MF ("A")	0.4 μ m x 0.4 μ m	0.4 μ m
AS-12, AS-12MF, AS-12NM ("E") • AS-12V, AS-12VMF ("EV")	10 μ m x 10 μ m	2.5 μ m
AS-130, AS-130MF, AS-130NM ("J") • AS-130V, AS-130VMF ("JV")	125 μ m x 125 μ m	5.0 μ m
PF50	40 μ m x 40 μ m	20 μ m

Table 1 MF= Magnet Free, NM= Non-Magnetic, V= Vertical engage

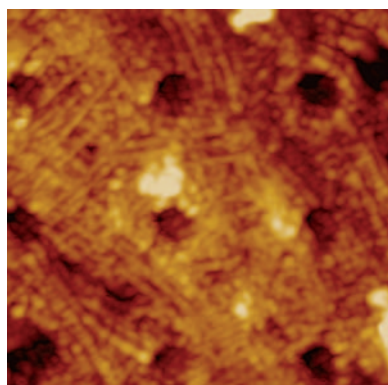
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B36, Rev A4, 3/24/06

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