

# ScanAsyst

Exclusive Self-Optimizing AFM Imaging Mode

- Faster, More Consistent Expert-Quality Results
- Direct Force Control Protects Samples and Probes
- Easier Imaging in Air or Fluid on Almost Any Sample



# ScanAsyst



## EXPERIENCE THE FUTURE OF AFM

ScanAsyst™ is the world's first imaging mode with automatic image optimization technology for atomic force microscopy (AFM). This patent-pending innovation frees researchers from the task of adjusting scan parameters, such as setpoint, feedback gains, and scan rate. Intelligent algorithms continuously monitor image quality to make appropriate parameter adjustments. This makes imaging as easy as simply selecting a scan area and scan size for almost any sample in either air or fluid.

ScanAsyst is based on Bruker's patent-pending, new general-purpose imaging mode, Peak Force Tapping™. This proprietary mode performs a very fast force curve at every pixel in the image. The peak force of each of these

curves is then used as the imaging feedback signal. Unlike TappingMode™, where imaging force is a complex function of the setpoint and other variables, Peak Force Tapping provides direct force control. This allows it to operate at even lower forces than TappingMode, which helps protect delicate samples and tips. Together, these capabilities make ScanAsyst the most powerful and productive way to use AFM.

ScanAsyst is standard on all new MultiMode® 8, Dimension® Icon®, and BioScope™ Catalyst™ Scanning Probe Microscope Systems, and is also available as an upgrade for some existing systems.

## AFM experts and novices alike will benefit from the revolutionary capabilities of ScanAsyst

- Automatic image optimization results in faster, more consistent results, regardless of user skill level
- Direct force control at ultra-low forces helps protect delicate samples and tips from damage
- Elimination of cantilever tuning, setpoint adjustment, and gain optimization makes even fluid imaging simple

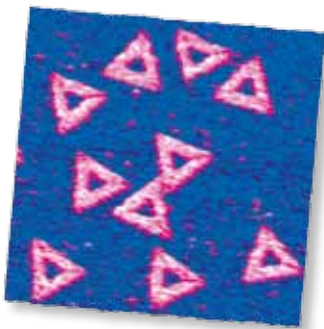
# Proven Results on a Wide Range of Samples in Air and Fluid

## Simple, Consistent High-Resolution Imaging

- Robust image optimization, even on challenging high-resolution samples
- Resolution as good or better than any other imaging mode



Polymer brush structures imaged on a MultiMode 8. Scan size 750 nm. (Sample courtesy of S. Sheiko, University of North Carolina, Chapel Hill)



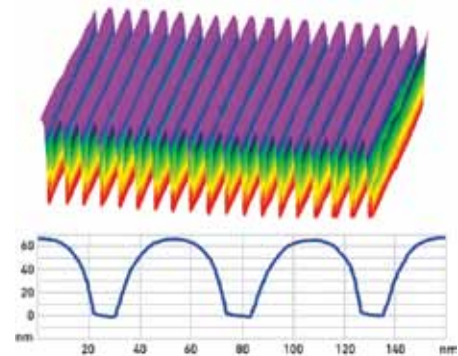
DNA origami structures imaged in fluid on a Dimension Icon. Scan size 600 nm. (Sample courtesy of P. Rothemund, California Institute of Technology)

## Easier, More Stable Imaging in Fluid

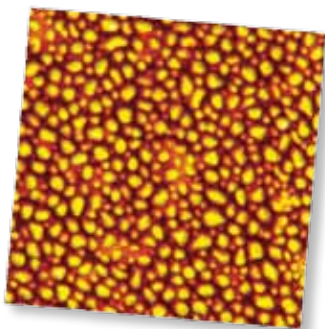
- Very low imaging force, here 50 pN, limits compression of soft samples
- Imaging remains stable for extended periods because setpoint does not drift

## Fewer Imaging Artifacts than TappingMode

- Narrow trenches and pits cause problems for TappingMode due to excessive damping of the probe oscillation
- Peak Force Tapping is immune to these effects, easily reaching the bottom of these types of difficult features



Deep (~65 nm), narrow (<50 nm) trenches are a very challenging sample for TappingMode. ScanAsyst, however, permits the probe to travel at the bottom of narrow trenches. Scan size 1  $\mu\text{m}$ .



Tip sharpness is maintained even after multiple scans on a polysilicon wafer. Scan size 1.5  $\mu\text{m}$ .

## Less Tip Wear Even after Many Scans

- Direct force control prevents tip damage, even on very hard, rough samples
- Reduces occurrence of artifacts due to dull or broken probe tips

## SCANASYST + PEAK FORCE TAPPING = MORE EFFICIENT AFM

ScanAsyst's core technology, Peak Force Tapping, oscillates the Z piezo at a rate well below the resonance of the probe. As the probe periodically taps the sample, the interaction force is measured by the deflection of the cantilever. The feedback uses the peak force of each tap as its control signal to maintain a constant imaging force. Unlike TappingMode, where the amplitude and phase represent the average interaction, Peak Force Tapping controls the instantaneous interaction force of each tap.

This is similar to Pulsed Force Mode, but Peak Force Tapping is different in several important ways. First, it uses a real-time force interaction pattern analysis algorithm that removes parasitic deflection. Thus, the signal-to-noise ratio of the interaction force control is dramatically better than is possible with Pulsed Force Mode. Peak Force Tapping is able to routinely operate at imaging forces <200 pN. This is at least 50 times lower than is typically used with Pulsed Force Mode (~10 nN), and nearly 5 times lower than typically used with TappingMode (~1 nN).

Peak Force Tapping also simplifies the dynamics of imaging feedback control. This allows the ScanAsyst control algorithms to automatically optimize the peak force setpoint, feedback gain, scan rate, and Z limit to achieve routinely expert-quality results on a wide range of sample types in both air and liquid environments.

A further benefit enabled by Peak Force Tapping is that additional information can be derived from the force interactions measured during each tap. This optional feature, called PeakForce QNM™, allows high-resolution mapping of quantitative nanomechanical properties, including modulus and adhesion. Though similar in function to HarmoniX® mode, PeakForce QNM measures the interactions directly instead of reconstructing them from higher torsional harmonics of a special probe. This allows more accurate quantitative results over a wider range of properties.

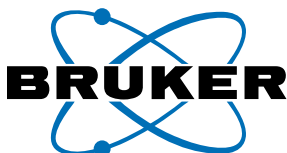
## SPECIFICATIONS

CAPABILITIES	
Main Data Types	Topography (Height), Peak Force Error, Peak Force Phase
ScanAsyst Self-Optimization	ScanAsyst automatically optimizes the Peak Force setpoint, imaging gains, scan rate, and Z limit to obtain the best image possible; Users can override ScanAsyst and control Peak Force Tapping manually, if desired
ScanAsyst Verified Samples	ScanAsyst has been tested against a wide range of samples that are representative of the challenges presented by common sample types; In air — samples with sharp steps, loosely bound particles, easily damaged features, ultra-high resolution, and very rough features; In fluid — DNA, lipid bilayers, and collagen have been tested (live cell imaging is not currently recommended with ScanAsyst)
PROBES (see veecoprobes.com)	
General Imaging in Air	ScanAsyst-Air (k ~ 0.4 N/m, tip radius <10 nm)
General Imaging in Fluid	ScanAsyst-Fluid+ (k ~ 0.7 N/m, tip radius <10 nm, max. 15 nm); ScanAsyst-Fluid (k ~ 0.7 N/m, tip radius ~20 nm, max. 60 nm)
AVAILABILITY	
New Systems	ScanAsyst and Peak Force Tapping are standard at no additional charge on all new Dimension Icon, MultiMode 8, and BioScope Catalyst SPM systems
Upgrades	Existing Dimension Icon and BioScope Catalyst systems require only an inexpensive upgrade; Existing MultiMode V systems require an upgrade package that includes a new computer, 30" widescreen monitor and software; Existing MultiMode systems with NanoScope IIIa, IIID, or IV controllers require an upgrade package that includes a NanoScope V controller, a new computer, 30" widescreen monitor and software

Note: Performance specifications are typical and subject to change without notice. Visit the Bruker website for most up-to-date specifications.

### Cover images

Left: Polymer brush structures imaged on a MultiMode 8. Scan size 2 µm. (Sample courtesy of S. Sheiko, University of North Carolina, Chapel Hill)  
Top-right: C<sub>36</sub>H<sub>74</sub> alkane layer on HOPG imaged using ScanAsyst on a Dimension Icon with Adaptive XY closed-loop scanning. Scan size 120 nm.  
Middle-right: DNA imaged using ScanAsyst on a MultiMode 8. Scan size 1 µm.  
Bottom-right: Latex microspheres imaged using ScanAsyst on a MultiMode 8. Scan size 3 µm.



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