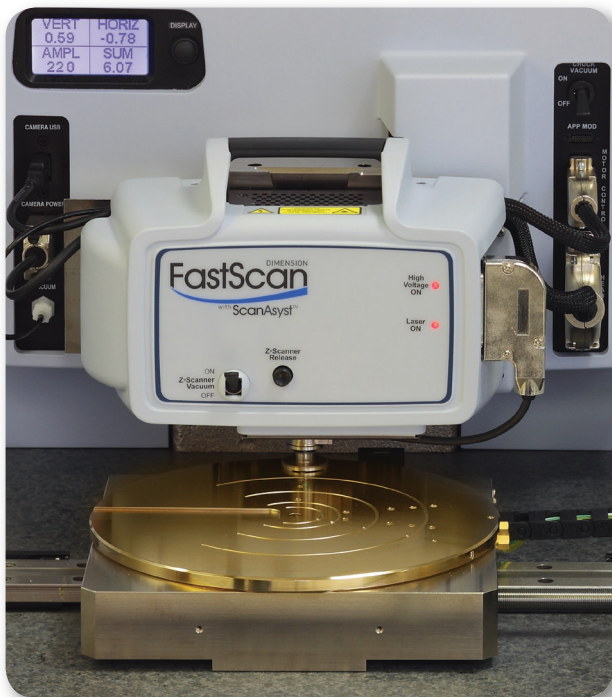


# Dimension FastScan

- The World's Fastest AFM

# The New Benchmark for Speed... with Highest Resolution and Performance



The Dimension FastScan™ Atomic Force Microscope (AFM) delivers, for the first time, extreme imaging speed without sacrificing legendary Dimension® Icon® resolution and performance. This breakthrough innovation enables radically faster time to publishable data for all levels of AFM expertise.

Stimulated by AFM users' need for greater AFM efficiency, Bruker set out to develop a system that could scan fast without loss of resolution, loss of force control, added complexity, or additional operating costs. Now, with the Dimension FastScan system you achieve immediate AFM images with the expected high resolution of a high-performance AFM, all in one system. Whether you scan at >125Hz when surveying a sample to find the region of interest, or at time rates of 1-second per image frame in air or fluid, FastScan redefines the AFM experience.

## High Productivity

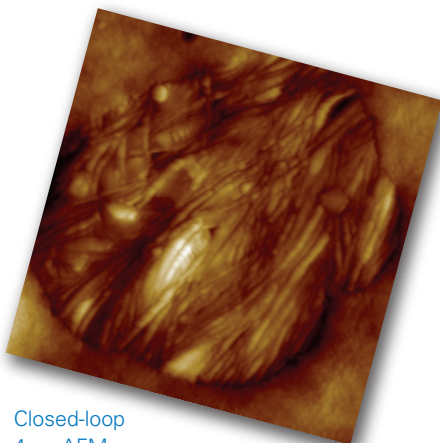
- Work 100s of times faster with fast scanning rates up to frames per second in air or fluid, automated laser and detector alignment, comprehensive work flow and smart engaging
- Built-in measurement automation software in conjunction with higher speed ScanAsyst™ provide exceptional measurement confidence and repeatability

## High Resolution

- FastScan delivers precise force control at the tip rendering high resolution and long tip-life
- High-quality TappingMode™ images can be achieved at 20Hz and superb-quality ScanAsyst images at 6Hz
- Low-noise, temperature compensated sensors in the scanners deliver sub-nanometer noise levels

## High Performance on Any AFM Sample

- Closed-loop Icon and FastScan scanners provide vertical noise below 30pm and 40pm, respectively, as well as high accuracy with ultra-low drift
- Fast scan samples from subnanometer to 100s of nanometers in height without loss of resolution



Closed-loop  
4µm AFM survey scan  
of SPP-PEO, 60Hz scan rate and  
256x256 pixel density.

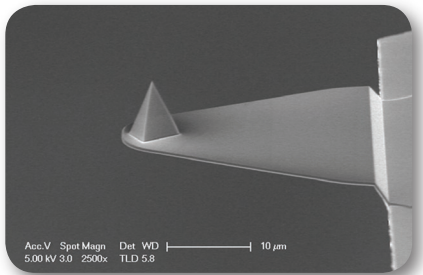
# Dimension FastScan

## The Benchmark for AFM Speed

Dimension FastScan is the first AFM to achieve the perfect balance of scan-speed, resolution, accuracy, drift, and noise, making fast scanning atomic force microscopy a commercial reality.

To deliver the new gold standard in AFM technology, Bruker engineers

- Used the lowest drift tip-scanning AFM platform technology and increased its fundamental resonant frequency,
- Implemented a new generation NanoScope® controller with proven high-bandwidth electronics,
- Developed a process for a consistent supply of small cantilevers, with 1.3MHz resonant frequency for air and 250kHz to 500kHz for fluid applications,
- Integrated the mechanical and electronic key elements with a low-noise, high-resonant frequency X-Y-Z scanner that features numerous technical breakthroughs.



Bruker Broadband™ Air and Fluid Cantilevers.



Most stable tip-scanning AFM.



Scanner Resonant Frequency X-Y: 2.70kHz, Z: >50kHz.

## FastScan Enables the Greatest Productivity Seen on Any AFM

- High bandwidth enables exceptional force control and high scan rates with closed-loop accuracy to surpass efficiency of any other commercial AFM system
- 20Hz TappingMode scan rates provide excellent quality images, matching that typically seen at 1Hz and maintaining good quality even at scan rates >100Hz
- Higher speed ScanAsyst delivers superb quality images at 6Hz and a surveying capability up to a 32Hz scan rate
- Z-axis tip velocity of 12mm/second in contact mode and velocities of 2.5mm/second in closed-loop while retaining <1% X-Y tracking error make the FastScan the world's most practical fast scanning AFM
- Automated laser and detector alignment enable quick and optimized setup
- The system provides the sample navigation tool MIRO with optical resolution to quickly identify and capture nanometer features in minutes
- Innovative optical design allows use of all Bruker broadband small cantilevers, as well as traditional sized cantilevers, by simply turning the adjustable spot lever to optimize laser signal, without disturbing system stability
- Tip-scanning design in conjunction with a 210mm sample stage eliminates sample constraints while retaining lowest noise and drift performance

## Dimension FastScan AFM System

Bruker's Dimension FastScan is a technological innovation built upon one of the world's most utilized AFM platforms. The FastScan system delivers high-bandwidth in conjunction with an ultra-stable, low-noise platform to provide the most productive AFM available. Whether using the Icon scanner with ultra-low noise and high accuracy, or employing the FastScan scanner for high scan rates, this system will expand your laboratory's capabilities beyond that of any other single instrument you can purchase.

### Dimension FastScan System Configuration



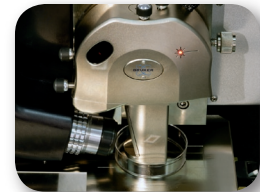
1. Acoustic and Vibration Isolation Enclosure
2. Scanners (includes 2, see right)
3. Ultra-Stable High-Resonance Microscope Base
4. 30" Monitor and FastScan NanoScope Software
5. Computer
6. NanoScope V, Stage Controller and HV Amplifiers



FastScan Scanner

#### FastScan Scanner AFM Modes

**Standard:** ScanAsyst, Nanomechanical Mapping, TappingMode (air), TappingMode (fluid), PhaseImaging, Contact Mode, Lateral Force Microscopy, Lift Mode, MFM, EFM, Force Spectroscopy, Force Volume  
**Optional:** Nanoindentation, Nanomanipulation, Nanolithography, Surface Potential, Piezoresponse Microscopy



Icon Scanner

#### Icon Scanner AFM Modes

**Standard:** ScanAsyst, TappingMode (air), Contact Mode, Lateral Force Microscopy, PhaseImaging, Lift Mode, MFM, Force Spectroscopy, Force Volume, EFM, Surface Potential, Piezoresponse Microscopy, Force Spectroscopy  
**Optional:** PeakForce QNM, PeakForce Tuna, HarmoniX, Nanoindentation, Nanomanipulation, Nanolithography, Force Modulation (air/fluid), TappingMode (fluid), Torsional Resonance Mode, Dark Lift, STM, SCM, C-AFM, SSRM, TUNA, TR-TUNA, VITA

## Ultimate Performance

The Dimension FastScan's superior scan speed, high-bandwidth electronics, and Broadband family of cantilevers provide the user a new experience in AFM by providing a choice of where to apply the bandwidth capacity. High scan rate or ultimate resolution while maintaining exceptional tip force control is a leap into a new generation of AFM use. The FastScan AFM system is the latest evolution of our industry-leading, tip-scanning AFM technology, incorporating temperature-compensating position sensors in its two scanners to render noise levels in the sub-angstrom range for the Z-axis, and angstroms in X-Y. This is extraordinary performance in a large-sample system, using 34- and 90-micron scanner ranges and surpassing the open-loop noise levels of high-resolution AFMs.

The Dimension FastScan AFM system allows operation of the industry-proven, ultra-low noise Icon scanner or the new FastScan head, both with low noise floor and higher accuracy than any other large-sample AFMs on the market today. The innovative design of the FastScan scanner is built to deliver higher scan speed without loss of image quality, to enable greater throughput for data collection. The Icon scanner delivers performance and flexibility to support nearly all practical AFM modes for research and manufacturing applications.

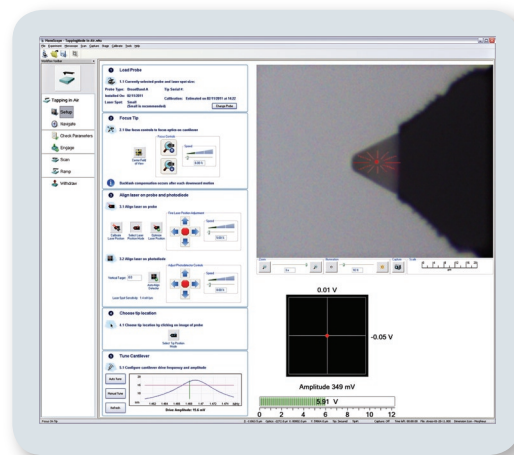
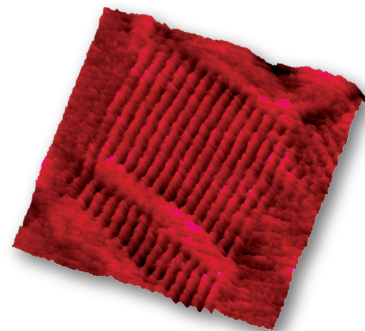
## Exceptional Productivity

The Dimension family of AFMs has gained an iconic reputation in both research and industry by leading to more published data than any other large-sample AFM platform. The FastScan AFM system raises the industry gold standard to a new level of excellence, providing the expected high performance with faster results. The expanded software and intuitive workflow delivers automated laser and detector alignment, a built-in user-accessible cantilever database for system auto-settings, fast and safe engage control, and many additional features that make even the most advanced AFM techniques much easier to perform than ever before. FastScan users can achieve immediate high-quality results without the usual hours of expert tweaking. Every facet of the Dimension FastScan — from wide-open tip and sample access to preconfigured software settings — has been specifically engineered for trouble-free operation and surprising AFM ease of use.

Fast sample navigation, fast engaging, fast scanning, low-noise, less than 200pm per minute of drift rate over hours, an expanded intuitive user interface, and the world-renowned Dimension platform combine to deliver an entirely new experience in AFM, while ensuring high-quality data with faster time to results and publication.

## World's Most Flexible Platform

The FastScan system delivers uncompromised scan speed, performance, robustness, and flexibility to perform nearly every measurement at scales previously obtained only by extensively customized systems. Utilizing an open-access platform, large- or multiple-sample holders, and numerous ease-of-use features, FastScan opens up the power of AFM to research and industry alike, setting a new standard for high-quality AFM imaging, mechanical, electrical and electro-chemical properties.



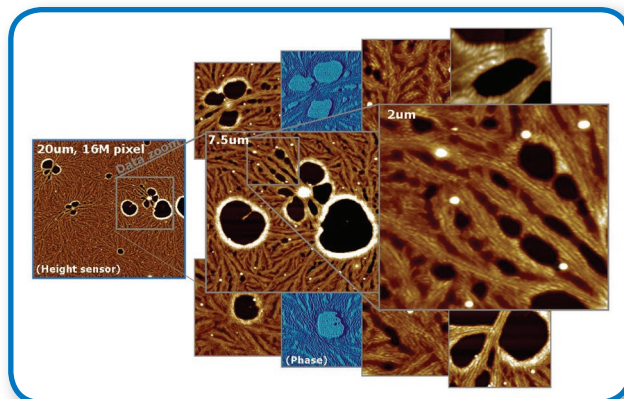
User interface with a sensible workflow and automatic setup.

## Optimization of Data Quality and Time to Publishable Results

Whether publishing data to communicate to colleagues or submitting to research journals, Dimension FastScan provides the ability to optimize your measurement session to obtain high-quality data ten to hundreds of times faster. A true, practical fast-scanning AFM enables a simplified assessment of complex applications by allowing you to investigate more information sooner.

### Sample Surveying Applications

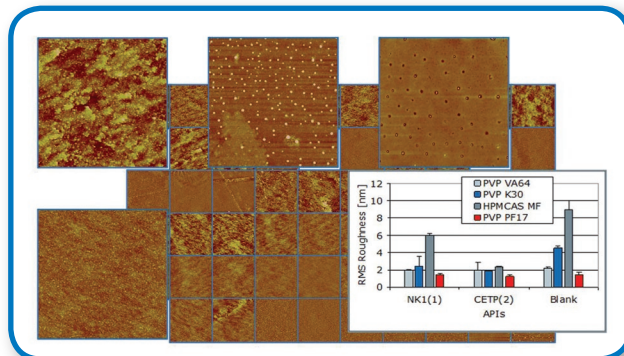
Sample Surveying is a common way to explore unknown samples to understand heterogeneity, unique feature characteristics, and mechanical properties. Here are the results of a FastScan sample survey, which produced a set of high-quality images ranging from high-resolution topography images of a 20 $\mu\text{m}$  area to subsections 10 times smaller than the original scan. The results from one 8 minute scan are 16 megapixels of data in multiple channels, where high-resolution data is observed with clarity.



8 minutes with Dimension FastScan AFM.

### Sample Screening Applications

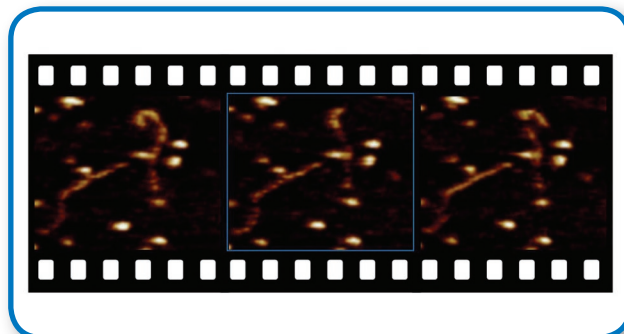
Screening of well-understood samples is routine with AFM systems. Whether performing failure analysis or nanoscale quality control for material manufacturing environment, immediate feedback is essential to a process for product quality control. Nanoscale characterization amplifies the challenge of speed when a high level of accuracy is required. An application monitoring amorphous formulations relies greatly on high amounts of statistical data for precise correction in drug formulation.



60 Minutes with Dimension FastScan AFM, 12 Samples, 60 Sites. Automated. Amorphous Drug Formulations. Samples courtesy of M.E. Lauer, O. Grassmann, F. Hoffmann-La Roche, Basel, Switzerland.

### Sample Dynamics Application

Another common application is to resolve the time propagation of a nanoscale object or structure, as a function of external conditions or stimuli, whether physical or chemical. Observation of dynamic events at the nanometer scale are invaluable capabilities for both air and fluid measurements. The Dimension FastScan provides capability for both environments using the same scanner and Bruker's air and fluid line of Broadband probes.



1 second with Dimension FastScan AFM. DNA on Mica in Fluid (Prep by APS Method). Sample courtesy of Y. Lyubchenko, Univ. of Nebraska Med. Ctr.

Look for our FastScan videos at  
[www.bruker-axs.com](http://www.bruker-axs.com)

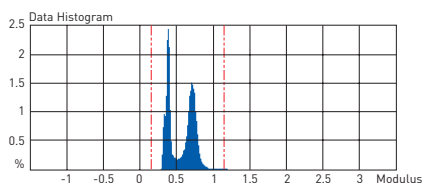
# Complete Suite of Standard and Advanced AFM Modes

## Superior Application Versatility

The Dimension FastScan captures multiple data channels at high speeds, producing more channels of high-quality data. Combined with our many proprietary AFM techniques, modes, and mode enhancements, the FastScan provides the unique capabilities that can take your nanoscale research to the next level.

### Material Mapping

FastScan supports Bruker's patent-pending PeakForce QNM™ Imaging Mode with the Icon Scanner, and nano-mechanical mapping with the FastScanner. With this technology, researchers can now map and distinguish quantitatively or relatively at high scan rates between nanomechanical properties while simultaneously imaging sample topography at high resolution.



### Electrical Characterization

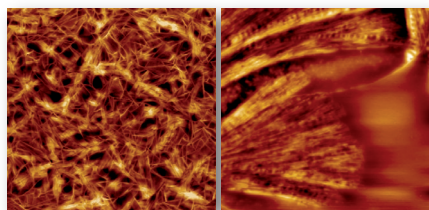
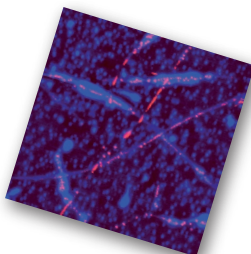
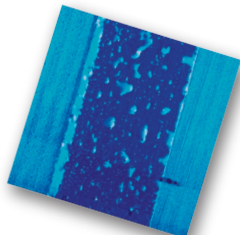
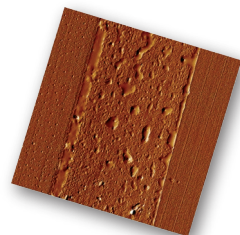
Carry out electrical characterization at the nanoscale with Bruker-proprietary AFM modes for greater sensitivity, resolution, and dynamic range. PeakForce TUNA™ and PeakForce SSRM provide unique electrical characterization capability while simultaneously providing correlated mechanical property information on the same sample location.

### Nanomanipulation

Perform manipulation and lithography at the nanometer and molecular scales. The XYZ closed-loop Icon scanner provides precise probe positioning with no piezo creep and extremely low-noise for the best positioning of any available nanomanipulation system.

### Heating and Cooling

Execute temperature control and thermal analysis on samples from -35°C to 250°C while scanning in various AFM modes. Alternately, perform sub-100nm-node heating with the scanning probe up to 500°C.



## More Modes = Higher Productivity

PeakForce Tapping™

ScanAsyst™

PeakForce QNM™

PeakForce TUNA

PeakForce SSRM

Contact Mode

TappingMode™

PhaseImaging™

HarmoniX™

LiftMode™

Dark Lift

Nano-Indentation

Nanolithography

Nanomanipulation

Force Volume

Piezo Response

Force Modulation

Lateral Force

Microscopy (LFM)

Magnetic Force

Microscopy (MFM)

Electric Force

Microscopy (EFM)

Surface Potential

Scanning Capacitance

Microscopy (SCM)

Scanning Spreading

Resistance Microscopy

(SSRM)

Tunneling Atomic Force

Microscopy (TUNA)

Conductive Atomic

Force Microscopy

(CAFM)

Scanning Tunneling

Microscopy (STM)

Torsional Resonance

Mode (TRmode)

TR-TUNA

Thermal Analysis (VITA)

# Dimension FastScan Specifications

Parameter	Icon AFM Scanner	FastScan AFM Scanner
X-Y scan range	90µm x 90µm typical, 85µm minimum	35µm x 35µm typical, 30µm minimum
Z range	10µm typical in imaging and force curve modes, 9.5µm minimum	≥3µm
Vertical noise floor	<30pm RMS, height in appropriate environment, typical imaging BW (up to 625Hz)	<40pm RMS, sensor in appropriate environment (up to 625Hz)
X-Y tip-velocity max. (1% tracking error)	—	>2mm/Sec
Z tip-velocity max.	—	12mm/Sec
X-Y position noise (closed-loop)	≤0.15nm RMS typical imaging BW (up to 625Hz)	≤0.20nm RMS typical imaging BW (up to 2.5kHz in Adaptive)
Z sensor noise level	35pm RMS typical imaging BW (up to 625Hz); 50pm RMS force curve BW (0.1Hz to 5kHz)	30pm RMS typical imaging BW (up to 625Hz)
X-Y flatness (30µm range)	—	≤3nm
Integral nonlinearity (X-Y-Z)	<0.50%	≤0.50%
Sample size/holder	210mm vacuum chuck for samples ≤210mm in diameter, ≤15mm thick	
Motorized position stage: X & Y axis	150mm x 180mm inspectable area with rotating chuck; 2µm repeatability, unidirectional; 3µm repeatability, bidirectional	
Microscope optics	5MP digital camera; 180µm to 1465µm viewing area; digital zoom and motorized focus	5MP digital camera; 130µm to 1040µm viewing area; digital zoom and motorized focus
Controller/Software	NanoScope V/ NanoScope v8.15 and later	
Workstation	Integrates NanoScope V, Stage Controller, HV Amplifiers, computer and provides an ergonomic design with immediate physical and visual access	
Vibration and Acoustic isolation	Integrated, refer to installation requirements for additional information	
AFM Modes	<p><b>Standard:</b> ScanAsyst, TappingMode (air), Contact Mode, Lateral Force Microscopy, PhaseImaging, Lift Mode, MFM, Force Spectroscopy, Force Volume, EFM, Surface Potential, Piezoresponse Microscopy, Force Spectroscopy</p> <p><b>Optional:</b> PeakForce QNM, PeakForce Tuna, HarmoniX, Nanoindentation, Nanomanipulation, Nanolithography, Force Modulation (air/fluid), TappingMode (fluid), Torsional Resonance Mode, Dark Lift, STM, SCM, C-AFM, SSRM, TUNA, TR-TUNA, VITA</p>	<p><b>Standard:</b> ScanAsyst, Nanomechanical Mapping, TappingMode (air), TappingMode (fluid), PhaseImaging, Contact Mode, Lateral Force Microscopy, Lift Mode, MFM, EFM, Force Spectroscopy, Force Volume</p> <p><b>Optional:</b> Nanoindentation, Nanomanipulation, Nanolithography, Surface Potential, Piezoresponse Microscopy</p>
EH&S compliance	CE certified	

© 2011 Bruker Corporation. B077 Rev. A2

## Cover images

Foreground: Dimension FastScan AFM.

Background: (left) Phase image and (right) Topography of Closed-loop 4µm AFM survey scan of SPP-PEO, 60Hz scan rate and 256x256 pixel density.

Bruker Nano Surfaces Division is continually improving its products and reserves the right to change specifications without notice. Broadband, Dimension, FastScan, Icon, PhaseImaging, TappingMode, LiftMode, HarmoniX, ScanAsyst, PeakForce QNM and NanoScope are trademarks of Bruker Corporation. All other trademarks are the property of their respective companies.

## ● Bruker Nano Surfaces Division

Santa Barbara, CA USA  
 Phone +1.805.967.1400/800.873.9750  
 productinfo@bruker-nano.com

[www.bruker.com](http://www.bruker.com)

