

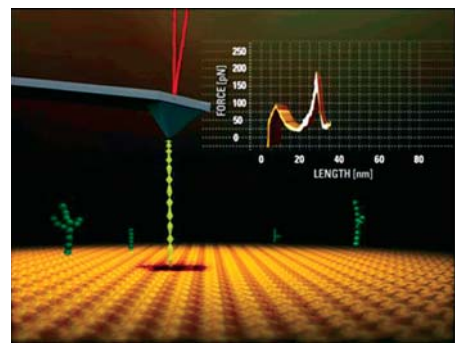
# diDimension Hybrid XYZ

## Scanning Probe Microscope Head

- Precisely-Localized, Controlled Force Pulling & Nanoindention
- Accurate, Repeatable Step Height Measurement
- High Resolution Imaging & Reliable Metrology
- High Fidelity Zoom and Offset at Any Scan Angle
- Precision Nanolithography & Nanomanipulation

**Veeco**

Solutions for a nanoscale world.™



Dimension Hybrid XYZ enables precisely-localized force pulling with piconewton force resolution.

## diDimension Hybrid XYZ Head

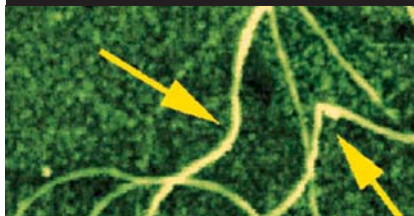
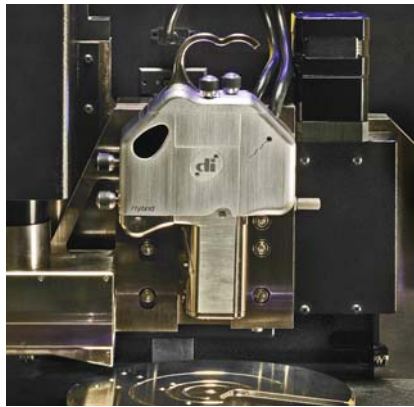


Image carbon nanotubes with TappingMode. Manipulate tubes with AFM tip. Image again. All in just a few minutes. Scan size 900nm

The diDimension™ Hybrid XYZ head<sup>1</sup> for the Dimension V, Dimension 5000, BioScope™ SZ, and NanoMan™ V offers up to six times lower Z-sensor noise than any other closed-loop system available. This patented hybrid head combines the benefits of the industry-leading Dimension tube scanner technology with a uniquely designed sensed Z actuator to deliver revolutionary accuracy in a three-axis closed-loop scanner. These advanced capabilities significantly expand the benefits of the Dimension Series and BioScope SZ by making it possible to perform highly accurate force spectroscopy, nanoindenting, and "force pulling" techniques in a single head, while still delivering high-resolution images. This is an excellent scanner for nanolithography and advanced nanomanipulation applications with its ability to define and control tip movement with superior precision.

### Outstanding Performance

- Lowest Z-sensor noise
- Uncompromised closed-loop XYZ scanning
- Faster scanning than with flexure-based closed-loop designs

### Advanced Capabilities

- Nanomanipulation in-plane and out-of-plane (Z)
- Nanolithography
- Highly repeatable step height measurement
- Accurate in-plane measurements independent of scan size, angle, zoom and offset



Line traces of a 200nm deep pit imaged at 12 $\mu$ m per second tip velocity. The lack of ringing or overshoot in the line traces demonstrate the high rate of response of the Z piezo. The data trace shows piezo creep, but the Z-sensor data has no related artifact.

### 3-AXIS CLOSED-LOOP CONTROL

With closed-loop control, sensors monitor the scanner position in three axes and provide feedback to control the scanner movement. A patented design combines the low mass and high speed of a tube scanner with an integral flexure, ensuring that the Z-axis remains orthogonal to the XY plane. Closed-loop feedback provides precise XY control for nanomanipulation, with linear scans that are accurate, independent of XY offset and scan size/angle. Low-noise, rigorous control of probe movement enables high-definition nanolithography. The scanner's unique engineering, the enhanced Z height accuracy and repeatability require less frequent and extensive calibration than other scanners.

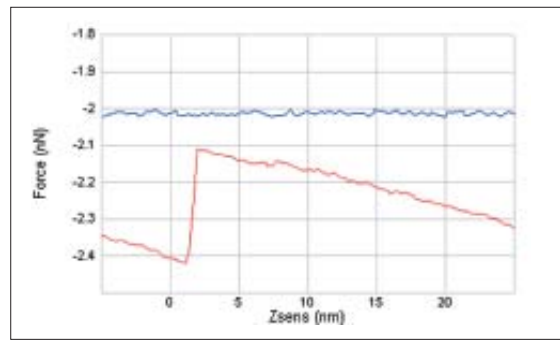
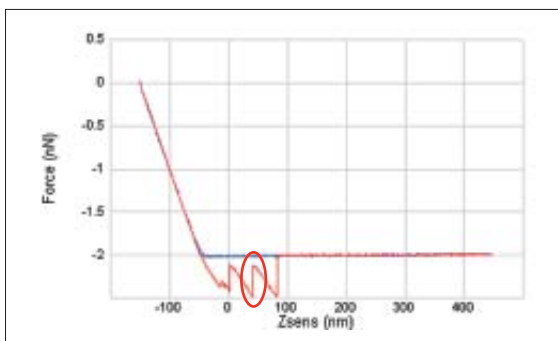
### FLEXIBILITY FOR A BROAD RANGE OF APPLICATIONS

The Dimension Hybrid XYZ is fully integrated with the state-of-the-art, low-noise electronics of the NanoScope<sup>®</sup> V Controller. The combination of the advanced electronics and closed-loop control enables high fidelity, high-resolution imaging down to the nanoscale, with Z-sensor noise less than 0.06 nm RMS and linearity better than 1 percent. The low mass structure ensures a high intrinsic resonant frequency that is immune to the low frequency noise of real-world lab environments.

With the Hybrid XYZ head, researchers can locate a specific feature, zoom in, then pull or indent with pico-Newton resolution. Using the natural resonance frequency of the cantilever driven by Brownian motion, the spring constant of the cantilever is easy to determine using a thermal tuning feature. Combining the unique hardware of the Hybrid XYZ head that monitors the Z position and cantilever deflection with enhanced software, this head enables precise control of speed, distance, or force throughout "pulling" experiments.

### COMPATIBLE WITH NUMEROUS SPM MODES

- TRmode™
- CAFM
- SCM
- SSRM
- STM
- Imaging in liquid
- and more...



Force vs. Z-sensor plot of a titin pull in PBS solution. A titin molecule connected to the tip unfolds as the tip is retracted. The zoomed plot shows a single unfolding event demonstrating the low Z-sensor noise.

**Veeco Probes** offers the world's largest selection of AFM probes and accessories. Below is a partial list available for the Hybrid XYZ. For a full list of probes and accessories, please visit [www.veecoprobes.com](http://www.veecoprobes.com) or call 1-800-715-8440.

Application or Mode	Probe	Specifications
Tapping	RTESP	42N/m, 320kHz, 4 Sided Tip, No Coatings
Electrical	SCM-PIC	0.2N/m, 13kHz, 4 Sided Tip, Pt/Ir Coating
Magnetic	MESP	2.8N/m, 75kHz, ~400 Oe, ~1e-13 EMU
Conductive	DDESP-FM	2.8N/m, 75kHz, 4 Sided Tip, Doped Diamond Coating
MEMS	TESP-HAR	42N/m, 320kHz, High Aspect Ratio Tip (5:1), No Coatings
Thin Film	Multi 75	3N/m, 75kHz, Symmetric Tip, No Coatings
TUNA	SCM-PIT	2.8N/m, 75kHz, 4 Sided Tip, Pt/Ir Coating
SSRM	DDESP	42N/m, 320kHz, 4 Sided Tip, Doped Diamond Coating

### Dimension Hybrid XYZ Head Specifications

XY Scan Range	90 $\mu$ m x 90 $\mu$ m
Z Range	
Imaging Mode	Nominal 8 $\mu$ m $\pm$ 6% or better
Force Curve Mode	Nominal 7 $\mu$ m $\pm$ 6% or better
Integral XY Nonlinearity	<1% typical
Integral Z Nonlinearity	<1% typical
XY Noise Level	
Closed-Loop Feedback Activated	<1.8nm RMS
XY Sensor Noise Level	
Open-loop	<1.2nm Adev ( $R_a$ )
Z-sensor Noise Level	
Force Curve Bandwidths	0.1 nm RMS (0.1 Hz to 5 KHz)
Typical Imaging Bandwidths	0.06 nm RMS
Vertical Noise Floor	<0.05nm RMS open-loop

<sup>1</sup>The Dimension Hybrid XYZ Head is patented.

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

Cover image, top right: Epithelial cells from the cheek imaged using tapping mode in air. The Z-sensor is highly linear and provides 10% greater accuracy than a traditional scanner calibrated with a 200nm step.

Cover image, bottom right: Epitaxial wafer substrate imaged in TappingMode -7 V bias applied to cantilever/tip to "write" Lithography mode: Point-and-click. Scan size 700nm



For more information visit [www.veeco.com](http://www.veeco.com)  
or call 800-873-9750

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