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
The diDimension™ Hybrid XYZ head 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 sensored 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
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® 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 response 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...

Line traces of a 200nm deep pit imaged at 12µm 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.

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 or call 1-800-715-8440.

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**DIMENSION HYBRID XYZ HEAD SPECIFICATIONS**

**XY Scan Range**
90µm x 90µm

**Z Range**
- Imaging Mode: Nominal 8µm ±6% or better
- Force Curve Mode: Nominal 7µm ±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 (Rₙ)

**Z-sensor Noise Level**
- Force Curve Bandwidths: 0.1nm RMS (0.1Hz to 5 KHz)
- Typical Imaging Bandwidths: 0.06nm RMS

**Vertical Noise Floor**
<0.05nm RMS open-loop

1The 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 15% greater accuracy than a traditional scanner calibrated with a 200nm step.

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

Worldwide Customer Support from the Industry Leader

Veeco Instruments Inc. provides solutions for nanoscale applications in the worldwide semiconductor, data storage, HB-LED/wireless and scientific research markets. Our Metrology products are used to measure at the nanoscale and our Process Equipment tools help create nanoscale devices. Veeco’s manufacturing and engineering facilities are located in New York, New Jersey, California, Colorado, Arizona and Minnesota. Global sales and service offices are located throughout the United States, Europe, Japan and Asia Pacific.