

# NanoManipulator™

## Interactive Visualization and Control System for Scanning Probe Microscopes

### Enhance Your SPM

The NanoManipulator™ Interactive Visualization and Control System enhances the power of Scanning Probe Microscopes (SPMs) with a *virtual presence* interface — force feedback and advanced 3D visualization — to provide the most intuitive and informative user interface available. Designed for real-time manipulation and visualization, the NanoManipulator system changes the way you can display your data and interact with your samples — for new insights, more efficient investigations, and completely new ‘steered’ experiments never before possible.

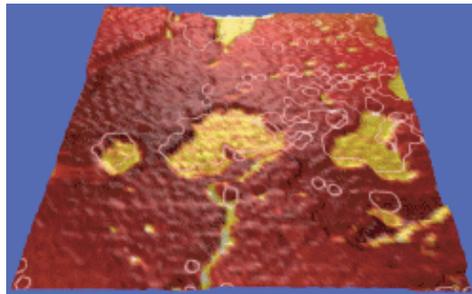
### Unparalleled Manipulation

The NanoManipulator system uses the industry’s most advanced haptic display device — a SensAble Technologies PHANTOM™ Desktop — to provide continual force feedback for investigating and manipulating your sample. Unlike the visual display from an SPM, which cannot update during sample manipulation, the haptic display of the NanoManipulator provides continual feedback on the sample’s topography. Scientists can manually change the lateral position of the probe, while the microscope maintains quantitative force control, and have precise knowledge of the location of the sample and the probe throughout. This compensates for the effects of drift and hysteresis, enabling rapid, accurate manipulations that are almost unthinkable otherwise — like manually putting a ‘dimple’ in the center of an adenovirus.

### Analysis Through Visualization

The NanoManipulator system uses 3D shaded interactive graphics to provide more intuitive displays of 3D structures in your data.

Once available only on high-end graphics supercomputers, the NanoManipulator’s integrated graphics workstation provides real-time rendering of complex and subtle structures — highlighting

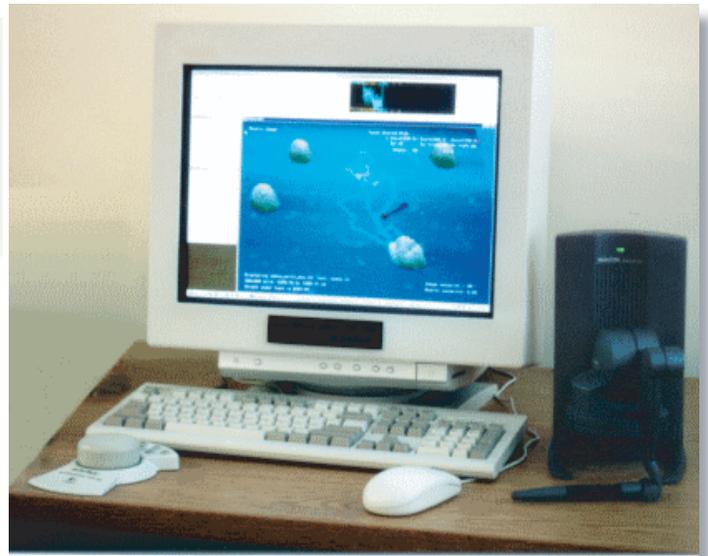


features for new insights and as a guide for data analysis. You can adjust surface colors and lighting to more accurately determine the surface shape—and color maps and contour lines can be applied to show additional parameters like friction or compliance — all in real time. Analysis through visualization becomes part of the investigation — not a post-process.

### Comprehensive Session Archive

The NanoManipulator system also adds network connectivity and complete session data archiving to your SPM. While working with the NanoManipulator, a comprehensive log of all scanning and manipulation data and parameter values are recorded in the automatic lab notebook on the NanoManipulator workstation. These archives are available not only for playback and review — but for new analyses on the archived experimental data.

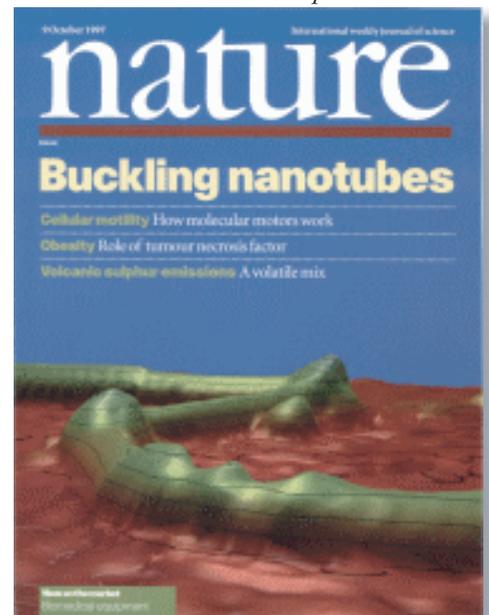
With the NanoManipulator system, you can review entire experiments, create new 3D visualizations of the data, and explore the surface topography with the PHANTOM haptic display — all without requiring the use of the SPM. In addition, the NanoManipulator’s PC Viewer enables viewing and presentation of archived data,



with a variety of visualizations, on any PC.

### Proven Results

Originally co-developed by the departments of Computer Science and Physics at the University of North Carolina at Chapel Hill, the NanoManipulator has been in development and has been used extensively by scientists in active research since 1992. Scientists have used the system to examine the mechanical and electrical properties of carbon nanotubes, the spreading of melting polymers, the rupture strength of DNA and of the adeno virus capsid, the behavior of nanochain aggregates, the differences between normal and hemophiliac blood clot fibers, the structure and strength of pili fibers, the behavior of optically-responsive materials under manipulation, the strength of microtubules, conductivity of metal particles, and voltage pulses on metals. References to this work, and additional information about the NanoManipulator System, are available at [www.3rdtech.com/NanoManipulator.htm](http://www.3rdtech.com/NanoManipulator.htm).



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## NanoManipulator's SPMs

The NanoManipulator™ is currently integrated with the Veeco Explorer™ AFM, the SPM from Nanotec Electronica, and the Asylum Research MFP™-3D AFM. The NanoManipulator is also being ported to additional platforms.

## Variety of Manipulation Tools

The NanoManipulator offers a host of tools to make manipulating samples easier. There's automatic switch-over from imaging to modification - this enables imaging a delicate sample in non-contact mode, and moving it easily in contact mode. The tip can also make automatic motions to change the type of modification—from following hand motions directly to using a VirtualTip™ probe to sweep an area. Motion can be constrained to a line or can proceed automatically along a series of lines. These tools enable open-ended exploratory manipulations or precisely controlled planned operations with repeatable force measurements.

## Real Users, Real Successes

Researchers at the University of North Carolina at Chapel Hill and the Katholieke Universiteit Leuven have been successfully employing the original development version of the NanoManipulator system for years — with new kinds of experiments, repeated insights and published results. Now 3rdTech has taken this revolutionary research tool and created a product that is enhancing the performance of SPMs around the world. Contact 3rdTech to discuss how the NanoManipulator can be used in your research.

## NanoManipulator Visualization and Control System

### Features

- Tactile probe feedback Force Feedback for surface relief information; available during otherwise 'blind' activities, e.g. surface manipulation
- Accurate position information Haptic feedback enables correction to hysteresis and drift for precise identification of a location before and during modification
- Multiple 3D Visualizations Multiple representations of 3D surface topography; change color maps and lighting or add contour lines of other data for new insights and relationships
- Multiple Manipulation Tools Explore samples with varying force, motion and control
- VirtualTip Manipulate samples with varied virtual probe shapes
- Multi-mode operation Automatically switch between oscillating-tip for imaging and contact-mode for modifications and lateral force measurements without disengaging the tip
- Automatic Lab Notebook Re-explore data scans and parameters from an entire NanoManipulator session with both visual and tactile interfaces; perform new analyses. Playback in 'fast-forward' mode at up to 100X real time.
- Intuitive control of the SPM Perform operations more rapidly and efficiently
- Seamless integration w/ SPM No disruption of ongoing work; straightforward addition to new or installed instruments

## NanoManipulator Visualization and Control System

Includes:

- SensAble Technologies PHANTOM Desktop (haptic) device - 3 Degrees-of-Freedom Force Feedback with 6 Degrees-of-Freedom input
- Force-feedback SPM interaction and control software
- For Veeco's Explorer SPM - Augmented SPMLab™ application software for communication with the NanoManipulator
- For Nanotec Electronica's SPM - Integrated with WSxM software
- For Asylum Research's MFP-3D AFM - Integrated with IGOR software
- Integrated 3D Visualization software
- Automatic Lab Notebook for recording, replaying, reanalyzing complete NanoManipulator sessions. (Includes playback/review capability on additional NT workstations.)
- Dial/push button peripheral input device
- Dual-processor NT workstation
- High-performance 3D graphics accelerator
- High-resolution flat panel color display
- Network interface
- Installation and Training (1 day each)
- 1-year warranty
- 1-year software upgrade and maintenance



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