Tribo iQ

- A complete data processing, analysis, graphing, and reporting solution for Hysitron nanomechanical test instruments

Innovation with Integrity

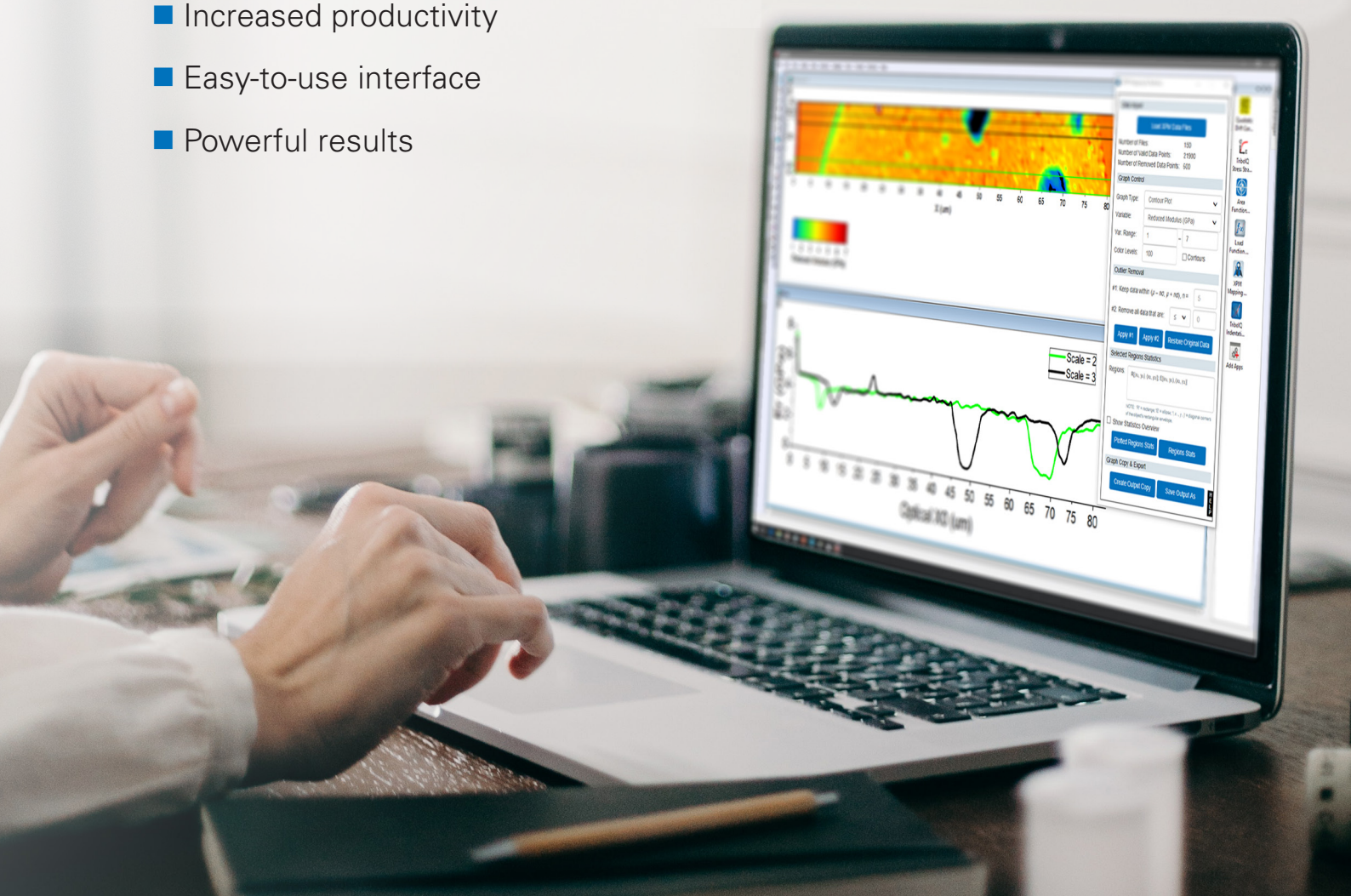
Nanomechanical Testing

A smarter way to handle your data

Tribo iQ™ is designed to be the brains behind Bruker's advanced nanoindentation and nanomechanical testing instruments, which cover the widest range of samples and techniques. Tribo iQ encompasses a suite of technique-specific software applications that handle everything post data acquisition, including advanced data processing, analysis, graphing, and reporting for the Hysitron family of nanomechanical instruments.

The streamlined individual technique-focused nature of Tribo iQ simplifies and accelerates the experiment-analysis loop. In addition to Tribo iQ's continuously expanding suite of pre-programmed applications, users can write their own customized application recipes that can be shared within the nanomechanical testing community. This user-driven experience results in:

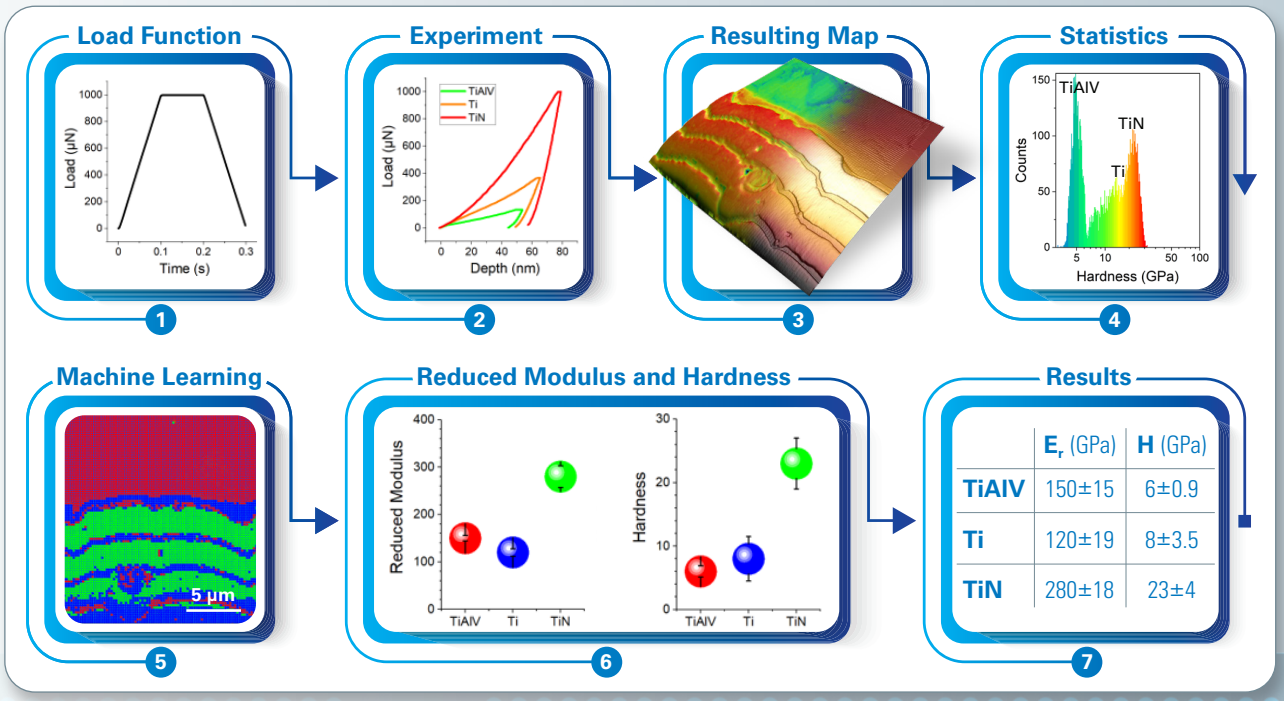
- Increased productivity
- Easy-to-use interface
- Powerful results



Tribo iQ—Visualize Your Results

Streamlined Data Analysis

Tribo iQ combines an easy-to-use user interface, built upon an industry-leading scientific software engine, to support hundreds of advanced graphing, fitting, and statistical functions. Each Tribo iQ application has been developed to deliver a comprehensive and streamlined data analysis experience for a diverse range of testing techniques, from indentation and scratch testing to particle compression and tensile testing. Additionally, all-in-one application functionality goes beyond data handling to useful functions like generating complex test-functions and advanced tip-area function calibrations.



	E_r (GPa)	H (GPa)
TiAlV	150±15	6±0.9
Ti	120±19	8±3.5
TiN	280±18	23±4

Compatible Instruments

Tribo iQ comes standard with Hysitron nanomechanical test instruments operating with the Performech II advanced control module or later:

Hysitron TI 980 TriboIndenter
The world's most powerful nanomechanical and nanotribological test system

Hysitron PI 89 SEM PicoIndenter
Robust, precise and modular in-situ SEM nanomechanical instrument

Hysitron PI 95 TEM PicoIndenter
Quantitative nanomechanical testing inside your transmission electron microscope

Hysitron BioSoft
In-situ indenter for soft biomaterials mechanical characterization

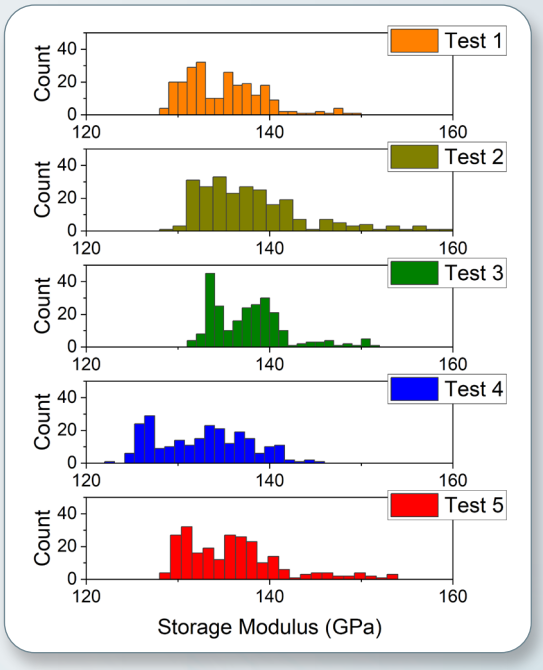
performech® II
Advanced Control Module

Delivers a Full Suite of Essential Apps

Indentation Explorer

Comprehensive analyzer and viewer of quasistatic, partial unload, XPM high-speed mapping, and nanoDMA III nanoindentation data.

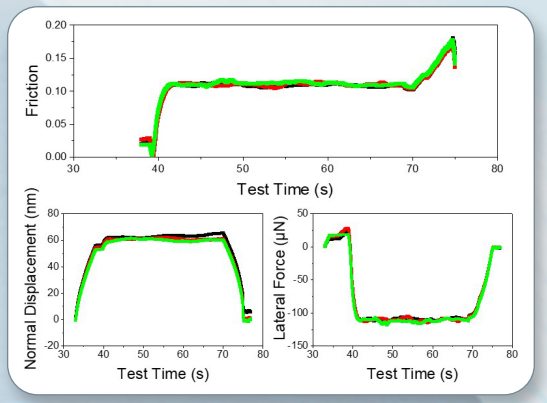
- Indentation analysis with extended list of results parameters; including total energy, energy dissipated, energy recovered, indentation creep, indentation relaxation, Martens hardness, Vickers hardness, Young's Modulus
- Graphing of user-defined combinations of recorded indentation parameters; all or selected segments only
- Interactive mode for indentation analysis
- Advanced drift correction and extended area function definition
- Averaging of diverse combinations of indentation parameters; statistical analysis of parameters



Scratch Explorer

Advanced data viewer and analysis package for nanoscale to microscale scratch/tribology measurements.

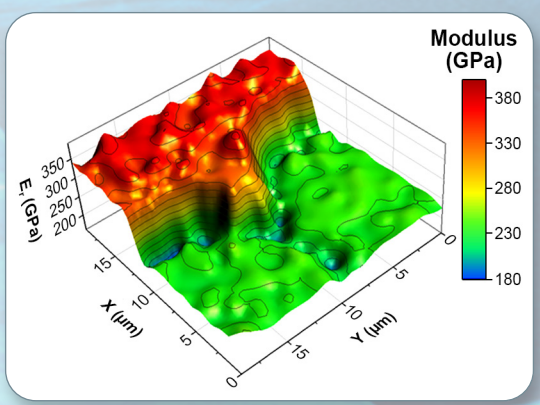
- Graphing of numerous combinations of recorded scratch parameters; all or selected segments
- Advanced drift correction and tilt correction of scratch data
- Averaging of multiple combinations of scratch parameters; statistical analysis of parameters in a given range of any other chosen scratch parameter



XPM Mapping and Statistics

Provides advanced statistical analysis and plot generation of XPM high-speed mechanical mapping data.

- High-resolution maps of hardness and modulus, histogram representing the distribution of mechanical property values
- Rapid outlier removal: range limited or clustering techniques (K-means, density based Gaussian mixture, spectral, etc.)
- Non-supervised machine learning techniques to identify clusters of similar mechanical behavior in the mapped material region

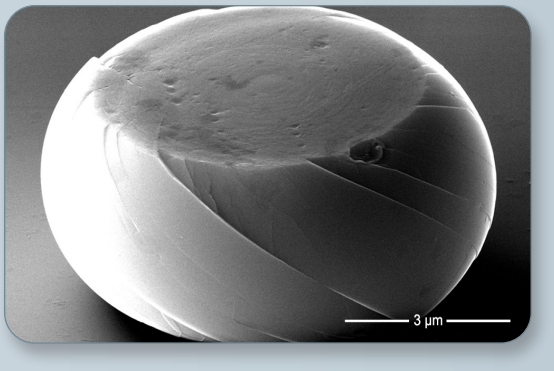


Powers Your PicoIndenter Apps

Particle Compression

Tribo iQ Particle Compression is an easy-to-use app for the viewing and analysis of particle compression data.

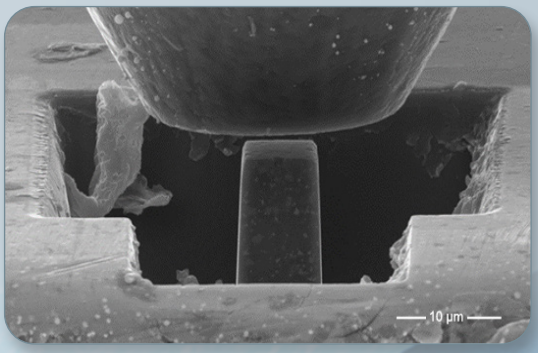
- Hertzian Fit to determine the particle's elastic modulus
- Brittle fracture; strength of the particle
- Stress-strain-curve plotted side-by-side with SEM video sequence



Pillar Compression

Tribo iQ Pillar Compression is a data analyzer and viewer.

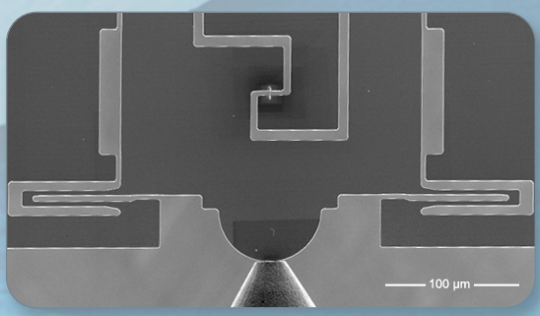
- Calculating stress strain considering the pillar geometry, pillar height, cross-section, tapered/untapered
- Sneddon's correction for elastic deformation of substrate or indenter.
- Stress-strain-curve plotted side-by-side with SEM video sequence



Push-to-Pull™

Tribo iQ Push-to-Pull app analyzes data utilizing Bruker's push-to-pull device to calculate the stress-strain curve for the measurement.

- Calculating stress strain considering the sample geometry: gauge length, cross-section
- Stress-strain-curve plotted side-by-side with SEM video sequence

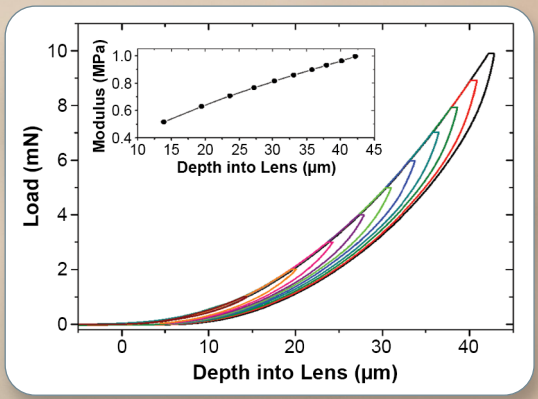


Add Ever More Functionality

BioSoft Analysis

Tribo iQ Biosoft Analysis provides reliable analysis of force-displacement curves taken on soft matter.

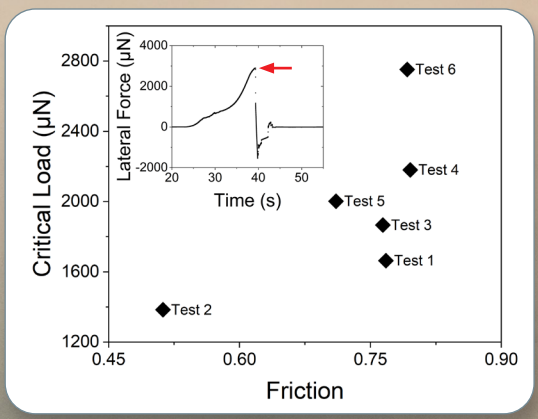
- Hertz model, linear model
- Winkler model for soft material on ridgid substrate
- Load relaxation model is for biphasic samples
- JKR and DMT models
- Load-displacement curve plotted side-by-side with optical video sequence



Scratch Critical Load

Tribo iQ Scratch Critical Point Detection enables automatic or manual determination of of critical points in scratch data.

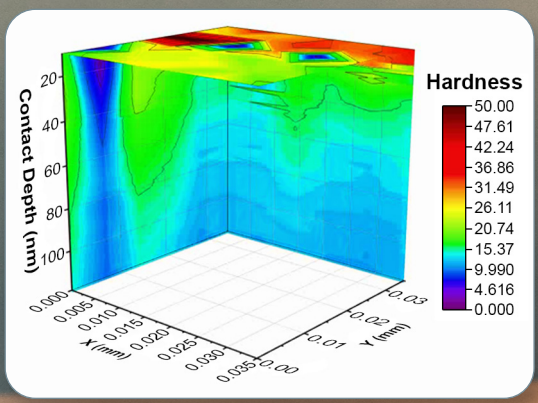
- Reliable detection of transient events in the normal and lateral force/displacement signals during a scratch test
- Trainable algorithms for critical point detection, with tunable parameters
- Rapid plotting of any combination of scratch parameters



Stacked 3D Maps

Tribo iQ 3D Stacked Maps delivers robust 3D statistical analysis and graph generation of XPM mechanical property mapping data.

- Fast generation of 2D and 3D mechanical property maps
- 3D contour mapping enables plotting multiple planes (XY, XZ, and YZ) together with graph rotation and automatic scaling



Providing Endless Possibilities

Area Function Calibration

For advanced characterization of nanoindentation probe tip area functions.

- 6 or 15 coefficient polynomial fitting with contact depth splitting, Bernie-Laguerre fitting to minimize uncertainty
- Supports all standard probe geometries: Berkovich, cube corner,spherical, ideal conical, flat conical, cono-spherical, rounded cono-spherical

Impact Test Analysis

For viewing and evaluating indentation impact data.

- Calculation of velocity, strain rate, momentum and kinetic energy during a nanoscale impact test
- Impact energy analysis (total, elastic, plastic)
- Fast plotting of impact parameters vs. measured mechanical properties

Scratch Depth

- Automated calculations of residual scratch depth from retrace segments of constant load scratches

Stress-Strain

- Conversion of indentation data to stress-strain to provide valuable insights into the plastic deformation characteristics of a material
- Rapid plotting of multiple experimental variables and measurement results

Strain Rate Jump

- Generator for nanoindentation test functions with changing strain rates

Time-Temperature Superposition

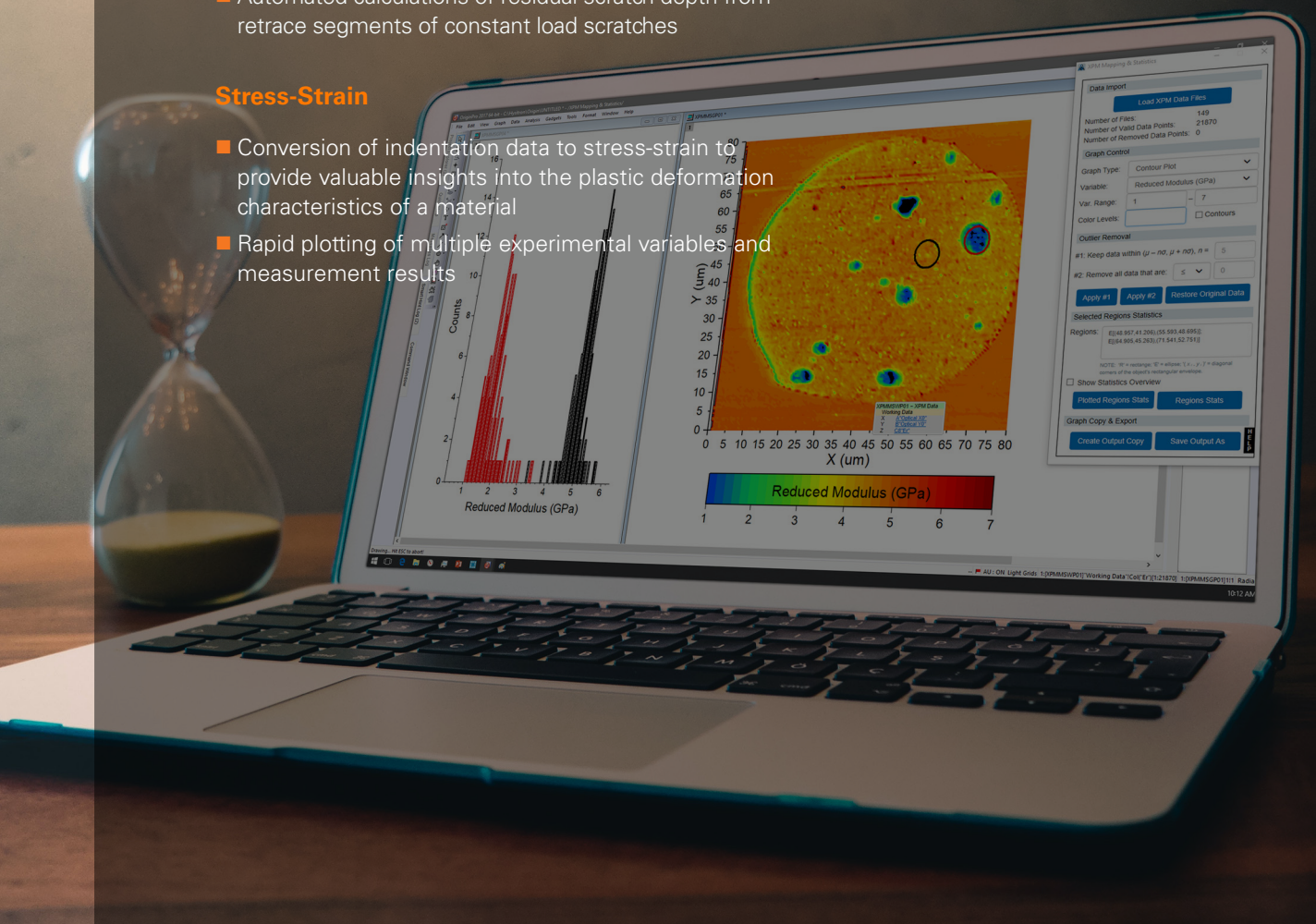
- Master curve plot for polymers from data sets with changing temperature and frequency
- Automatic detection of shifting parameter a_T

Time Frequency Series

- FFT to determine the frequency spectrum in the load-displacement data
- Filtering of load-displacement data to reduce noise

XPM Test Function Generator

- XPM mechanical property test function generator to program partial unloading or dynamic measurements at every test coordinate



Tribo iQ Brings Intelligence to Your Research

With 17 applications and growing, Tribo iQ provides industry-leading analysis for nanomechanical and nanotribological characterization. Developed with ease-of-use and versatility at the forefront, Tribo iQ delivers the fastest time to powerful results.

Application Compatibility Table*

Apps	Hysitron TI 980 TriboIndenter	Hysitron PI 89 SEM PicoIndenter	Hysitron PI 95 TEM PicoIndenter	Hysitron BioSoft
3D Stacked Maps	✓			
Area Function Calibration	✓	✓	✓	✓
BioSoft Analysis				✓
Impact Test Analysis	✓			
Indentation Explorer	✓	✓	✓	✓
Particle Compression		✓	✓	
Pillar Compression		✓	✓	
Push-to-Pull		✓	✓	
Scratch Critical Load	✓	✓	✓	
Scratch Depth	✓	✓	✓	
Scratch Explorer	✓	✓	✓	
Strain Rate Jump	✓	✓	✓	
Stress Strain	✓	✓		
Time Frequency Series	✓			
Time-Temperature Superposition	✓	✓	✓	
XPM Mapping and Statistics	✓	✓		
XPM Test Function Generator	✓	✓		

*Performech II advanced control module required

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