Versatile AFM Optical Coupling

Customisable by each researcher
Automated operation
All SPM modes included
Multiple optical accesses

The most versatile AFM optical coupling platform providing 3 ports for spectroscopy measurements with top-down, side (oblique) and inverted access.

Scanning Probe Microscope Series
## TRIOS Measuring Modes

### Basic modes:
- Contact AFM
- Semicontact AFM
- True Non-contact AFM
- Top Mode™
- Phase Imaging
- Dissipation Force Microscopy
- Contact AFM in liquid (optional)
- Semicontact AFM in liquid (optional)

### Electrical modes:
- Single / Double pass Kelvin Probe Force Microscopy (KPFM) AM and FM
- Capacitance Microscopy (SCM)
- Single / Double pass Electric Force Microscopy (EFM)
- Piezo Response Force Microscopy (PFM)
- PFM with High Voltage (optional)
- PFM-Top mode™
- Conductive AFM (optional)
- Conductive AFM High Voltage (optional)
- I-Top mode™ (optional)
- I-V Spectroscopy (optional)
- Photocurrent Mapping (optional)
- Volt-ampere characteristic measurements (optional)

### Nanomechanical modes:
- Lateral Force Microscopy (LFM)
- Force Modulation Microscopy (FMM)
- Force Curve Measurement (Force Distance (F-D) Spectroscopy and Mapping)
- Nanolithography
- Nanomanipulation

### Nanospectroscopy:
- Compatible with HORIBA spectrometers (XploRA, LabRAM HR, LabRAM Soleil) (optional)
- Confocal Raman, Photoluminescence imaging and spectroscopy (optional)
- Tip-Enhanced Raman and Photoluminescence (TERS/TEPL) (optional)
- Near-field Scanning Optical Microscopy (NSOM/SNOM), with fiber-based and cantilever-based SNOM probes (optional)

### Special modes:
- Single / Double pass Magnetic Force Microscopy (MFM)
- Tunable Magnetic Field (optional)
- Shear-force Microscopy with tuning fork (ShFM)
- Normal-force Microscopy with tuning fork (optional)

### Other:
- Scanning Tunneling Microscopy (STM) (optional)
- Scanning Tunneling Spectroscopy (optional)

## TRIOS Optical Access and Microscope

### Simultaneous optical access:
- From the bottom with up to 1.49 NA oil immersion objective
- From the top with up to 100x 0.7 NA objective
- From the side (optional) with up to 100x 0.7 NA objective
- Near UV, Visible, Near IR objectives available
- All reflective objectives available

### Mirrors:
- 450-2000 nm, reflectance (%): ≥97.5 avg., protected Silver coating
- Easy to change to dielectric mirrors due to magnetized mirror mounts
- Parabolic mirror of bottom channel easily interchangeable

### Objective Scanner:
- Closed loop piezo Objective Scanner for ultra-stable long term spectroscopic laser alignment
- Range: 30 x 30 x 10 µm³
- Resolution: 1 nm

## TRIOS Scanner

### Sample scanning range:
100 x 100 x 15 µm³ (+/- 10%)

### Optional scanning range:
200 x 200 x 20 µm³ (+/- 10%)

### Non-linearity:
XY < 0.05%, Z < 0.05%

### Noise:
- < 0.1 nm RMS in XY dimension in 100 Hz bandwidth with capacitance sensors on
- < 0.02 nm RMS in XY dimension in 100 Hz bandwidth with capacitance sensors off
- < 0.1 nm RMS in Z dimension in 1000 Hz bandwidth with capacitance sensor on
- XY resonance frequency 7 kHz (unloaded)
- Z resonance frequency 15 kHz (unloaded)
- Digital closed loop control for X, Y, Z axes
TRIOS Base

Sample size:
- Maximum 50.8 x 50.8 mm²
- Maximum 5 mm thick
- Standard up to 50.8 x 50.8 mm², up to 100 x 100 mm² with special holder

Manual sample positioning range: 25 x 25 mm²
Optional motorized sample positioning range: 22 x 22 mm²
Motorized SPM measuring head positioning: 1.6 x 1.6 mm²
Motorized approach: 1.3 mm

TRIOS AFM Head

Laser wavelength: 1300 nm
No influence of registration laser on photovoltaic measurements or on biological samples

Fully motorized: 4 stepper motors for automatic cantilever and photodiode alignment
Access: Free access to the probe for additional external manipulators and probes

TRIOS Options

Conductive Unit (Current range 100 fA - 10 µA / 3 current ranges (1 nA, 100 nA and 10 µA) software switchable)
Liquid Cell (Petri dish 35 mm diameter, Liquid exchange capability
Temperature control for liquid cell (heating up to 60°C)
Heating module (heating up to 300°C / Temperature stability 0.1°C)
Heating module (heating up to 150°C / Temperature stability 0.01°C)
Combined Shear-force and Normal-force tuning fork holder
STM holder
Signal Access Module

TRIOS Software

Omega:
- Automatic alignment of registration system
- Automatic configuration preset parameters for standard measuring techniques
- Automatic cantilever resonance frequency adjustment
- Macro language Lua for programming user functions, scripts and widgets
- Capability to reprogram DSP macro language of the controller in real time without reloading control software
- Spring constant calibration (Thermal method)

IAPro:
- Process images in coordinate space including making cross-sections, fitting and subtracting of polynomial (up to 12 degrees) surface
- FFT processing with the capability to treat images in frequency space including filtering and analysis

Processing:
- Up to 5000 x 5000 pixel images.

TRIOS Controller electronics

Modular, fully digital, expandable controller
High speed DSP 300 MHz
ADC: 20 channels
High speed 500 kHz 18-bit ADCs for scanner position sensor
5 MHz frequency range registration system
2 lock-in amplifiers with 5 MHz frequency range
6 digital 32-bit generators with 5 MHz frequency range, 0.018 Hz resolution
7 stepper motors control
Digital outputs for integration with external equipment
Analog input/outputs for integration with external equipment

TRIOS dimensions

![TRIOS Dimensions Diagram]