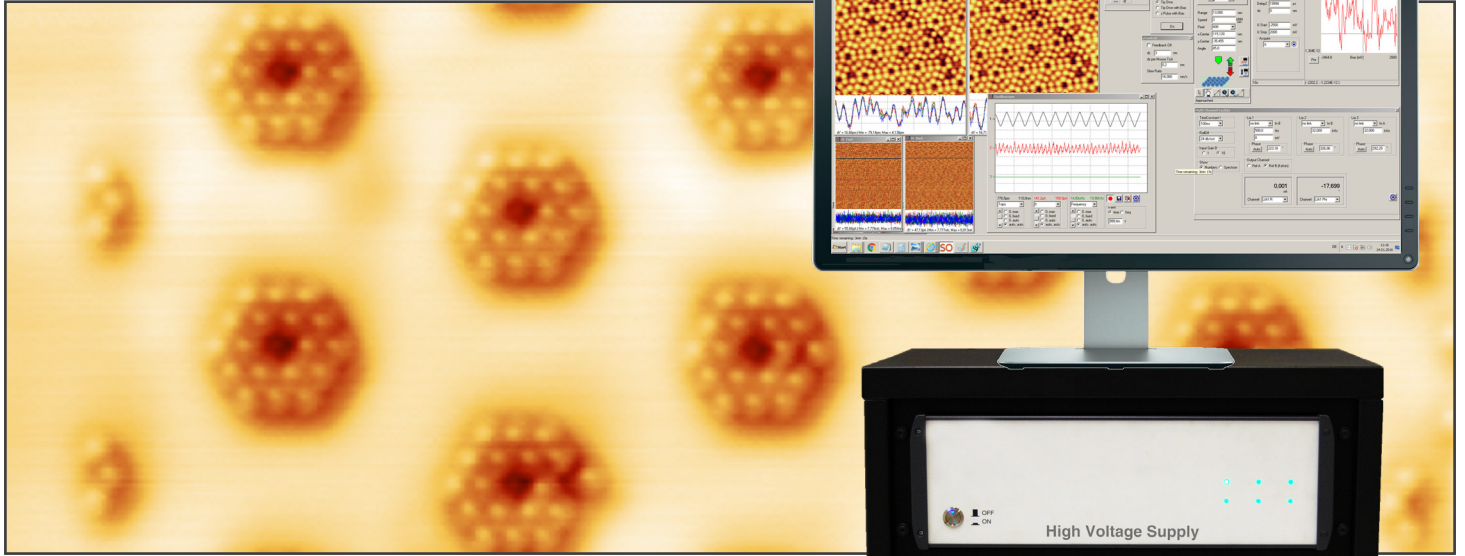


SXM SPM Control System

scientaomicron



- 24 Bit A/D & D/A Converters
- Fast 22 Bit D/A Converter for Z
- Integrated Lock-in Amplifiers
- PLL for Tuning Fork Based
- NC-AFM
- Easy Access to all Signals
- Measurement & Data Analysis Software Included



The SXM Controller

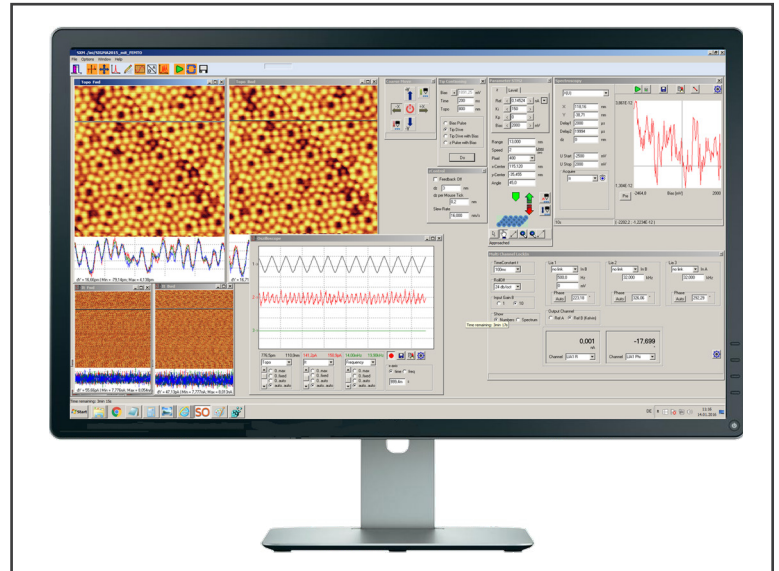
The new digital SXM Control System incorporates advances in state-of-the-art electronics and latest software algorithms to fulfill the needs of today's and future challenges in scanning probe microscopy.

Features of the new SXM Controller include low noise, large detection bandwidth, high resolution 24 bit D/A and A/D converters, easy software and hardware handling, accessible and simple file format and a basic data analysis software package. In combination with 32 bit data handling, the outstanding fast 22 bit D/A converter for Z-regulation sets a new benchmark for SPM controllers as it overcomes the classic restrictions (resolution and voltage stability) of existing 16 or 20 bit solutions.

The controller comes with an integrated phase locked loop (PLL) for piezoelectric cantilever based non-contact AFM (NC-AFM) and lock-in amplifiers for high resolution spectroscopy (e.g. dI/dU , d^2I/dU^2).

Software functionalities such as continuous monitoring and observation of simultaneously measured signals in an Oscilloscope window, and quantitative FFT spectrum analysis makes this a user friendly and efficient solution.

The extensive software package for scanning probe spectroscopy and atom manipulation enables a variety of experiments ranging from standard imaging and spectroscopy to user defined spectroscopy and manipulation experiments. A graphical user interface for implementation of macros for custom tailored experiments ensures experimental flexibility and expandability to cope with future experimental work flows and challenges.



Powerful software with easy access to all measurement channels, software implemented Lock-In amplifier and PLL as well as dedicated software for spectroscopy and atom manipulation.



With high voltage supply, scan and data acquisition controller, corresponding integrated PC and software, the SXM Controller is a state-of-the-art turnkey solution for slipstick based UHV SPMs.

A State-of-the-Art Turnkey Solution

Hardware

D/A converters (outputs)

- Revolutionary 22 bit high resolution fast D/A converter for Z.
- 6 parallel D/A converters, 24 bit (3 for free use).
- BNC monitor outputs for U, X, Y, Z.
- 4 BNC inputs for modulation (range ± 10 V, DC offset or AC modulation).

A/D converters (inputs)

- 8 parallel A/D converters, 24 bit (6 for free use).
- BNC monitor outputs for I_x and QPlus® signals.

High Voltage Amplifiers Scan voltages:

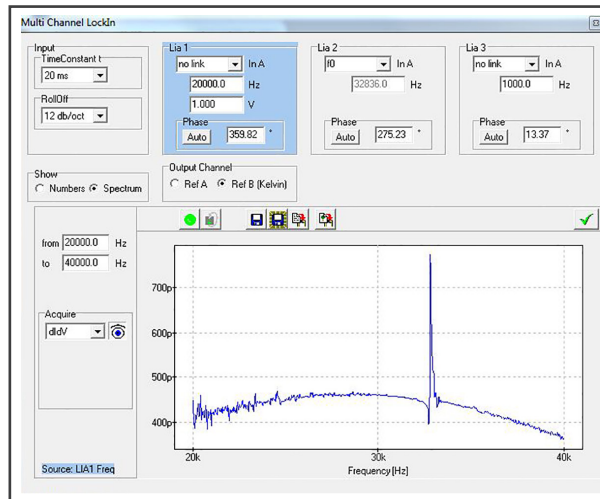
- 6 parallel channels.
- Output voltages: -160 V..160 V.
- SHV connectors for high voltage signals.

Coarse motor signals:

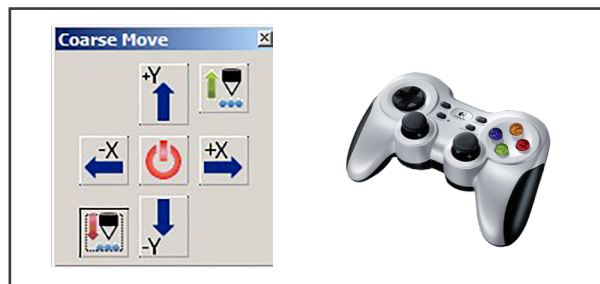
- 3 channels (X,Y,Z).
- 50 V to ± 400 V.
- Sawtooth signal for slipstick motors.
- Motor control via software, or joystick.

PLL & Lock-in Amplifier

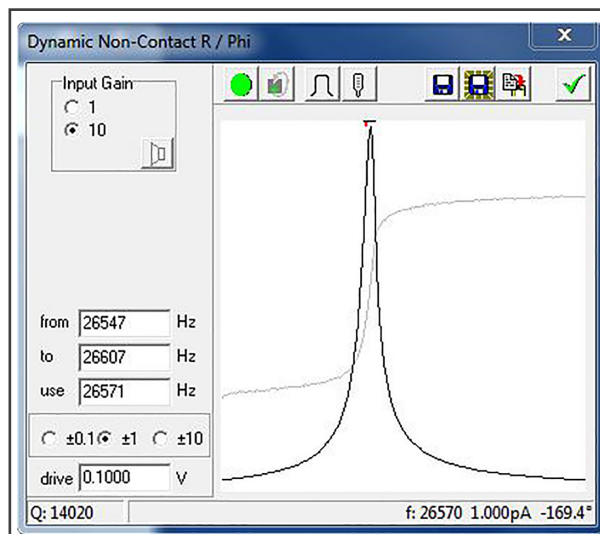
- 4 independent lock-in amplifiers (X,Y,R, phase) sharing 2 input and 2 output channels.
- One lock-in can be used as PLL for qPlus.
- Bandwidth: 5 MHz (without losses or amplitude).



Lock-in amplifier



Intuitive and easy coarse positioning of tip and sample either by software (left image) or via remote control (right).

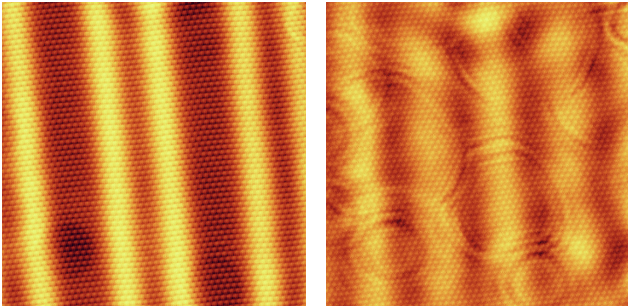


PLL

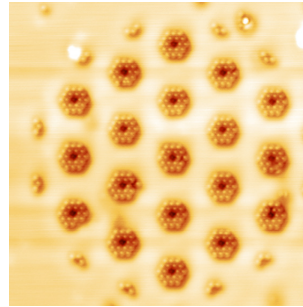
Control Suite at a Glance

- STM & NC-AFM qPlus mode.
- Single point spectroscopy, spectroscopy along a line, and grid spectroscopy ($I(U)$, $df(U)$, $df(z)$, $I(z)$, $Ext(U)$, $dI/dU...$).
- Individual spectra: define the density of points according to the requirements of your experiment.
- Oscilloscope (time or frequency domain).
- Software support for Femto-pre-amplifier (DPLCA-200).
- Manual tip control (X, Y, Z).
- Drift correction.
- PLL for tuning fork based NC-AFM.
- STM feedback loops: logarithmic or linear.
- Coarse motor operation via software or joystick.
- Basic analysis/image processing software.
- Tip conditioning.
- Fly mode.
- Surface tilt correction.
- Programming and execution of macros for custom experiments.
- Lock-in amplifiers for independent signal analysis.
- Easy software access to D/A converters.
- Combined STM/AFM experiment.
- Atom manipulation.
- Python interface.

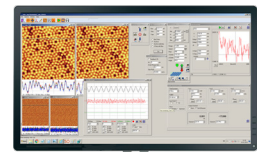
Measurement results:



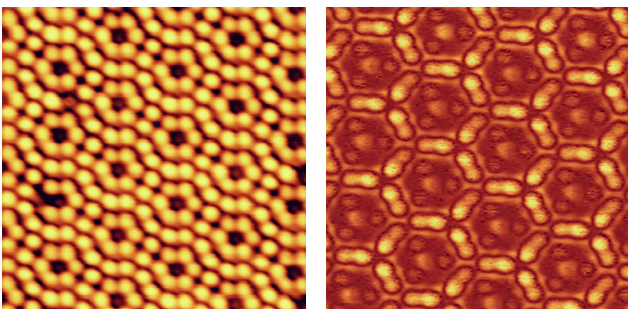
STM topography (left) and corresponding dI/dV map at -380 mV (right) of Au(111) at 9.6 K
Instrument: INFINITY SPM



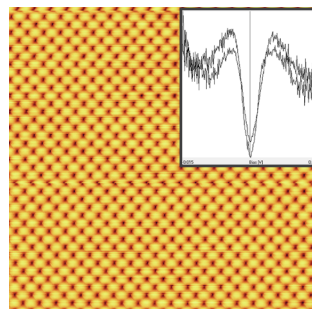
CO molecules on Cu(111) at 4.5 K
Instrument: POLAR SPM
Data courtesy: Jesper Moes, Thomas Gardenier and Ingmar Swart, Utrecht



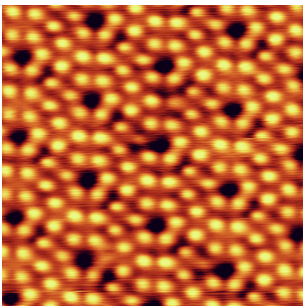
All results are obtained with SXM control electronics



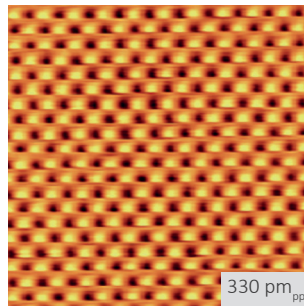
STM topography (left) and corresponding dI/dV map at -1.8 V (right) of Si(111) 7x7 at 10 K
Instrument: INFINITY SPM



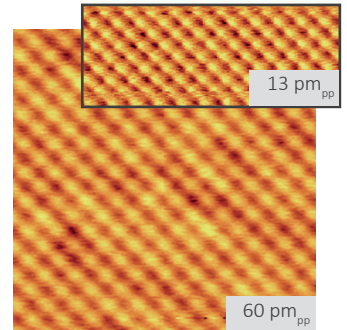
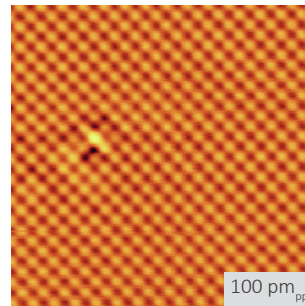
STM and STS on Pb(100) at 4.5 K
Instrument: POLAR SPM
Data courtesy: Thomas Gardenier and Ingmar Swart, Utrecht



QPlus[®]: Si(111) 7x7 at 9.7 K
Instrument: INFINITY SPM



QPlus[®]: NaCl(001) single crystal @ 9.7 K with small oscillation amplitudes
Instrument: INFINITY SPM



Typical Applications

STM, STS, QPlus-NC-AFM, I(V), dI/dU, dI/dz, IETS, atom/molecule/nano-particle manipulation, df(z), df(U), SP-STM, ...

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