Nano-Cyte®

3D stability for imaging

What is Nano-Cyte®?

The Nano-Cyte® single molecule imaging system eliminates the microscope drift that limits advanced fluorescence imaging methods. With Nano-Cyte® you no longer need to be concerned with temperature gradients, sample drift, and microscope drift. Unprecedented stability in the nanometer regime allows long term experiments as never before.

The Nano-Cyte® works by using the image of fluorescent fiduciary references, sparsely distributed within the sample, to localize these emitters in all three dimensions. The Nano-Cyte® uses this 3D localization information to provide active position adjustments to the sample, thus eliminating drift in the experiment.

Nano-Cyte® is the complete stabilization and image acquisition instrument for advanced fluorescence microscopy. Our integrated approach to 3D stabilization yields image stability up to 3nm in X,Y and Z axes. Nano-Cyte® has proven stability over *days* and is a unique offering that promises to revolutionize advanced microscopy methods.

** Patent Pending*

Features

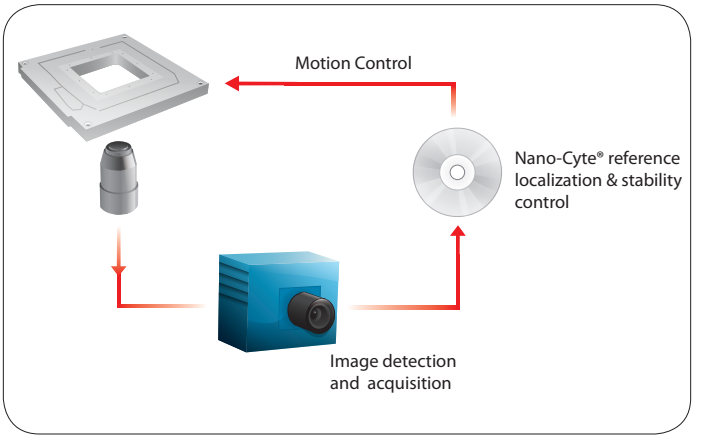
- 3D stabilization up to 3 nanometers
- Active positional control over days
- Corrects for temperature gradients and drift
- Particle tracking capability
- Simultaneous image acquisition and stabilization
- Particle localization analysis
- Particle position rendering

Hardware

The Nano-Cyte® is comprised of a high performance three axis nanopositioning system coupled with a two axis motorized micropositioning stage. These precision motion capabilities enable the active positional control and particle tracking features of the Nano-Cyte®. The nanopositioner is a flexure guided piezoactuated design with integrated PicoQ® sensors for absolute position sensing and nanometer precision under closed loop control. The micropositioning stage enables the user to have a large range of travel for surveying samples prior to engaging the active stabilization. All motion devices are controlled by the Nano-Cyte® controller via USB 2.0 interface.

The Nano-Cyte® hardware is compatible with Mad City Labs RM21™ open microscopy platform and most models of inverted optical microscopes.

Method



The Nano-Cyte® feedback control system. Stabilization is based on the imaging pathway.

Software

The native Nano-Cyte® software performs 6 important functions

- Stabilization
- Image acquisition
- Device control
- Particle localization analysis
- Rendering of particle position
- Tracking over multiple fields-of-view (FOV)

The Nano-Cyte® 3D stabilization occurs simultaneously with image acquistiion and incorporates reference selection, reference localization, and calibration statistics. Acquired images are saved in TIFF format and can be exported to ImageJ and other 3rd party software for post-acquisition processing.

Nano-Cyte® device control ensures precision motion control and the ability to incorporate a variety of external user devices such as EMCCD cameras, shutters and light sources. Compatibility with LabVIEW™ and µManager facilitates even greater user device control and flexibility.

Post-acquisition features of Nano-Cyte® enable the localization of particles within an image and the three dimensional rendering of particle positions.

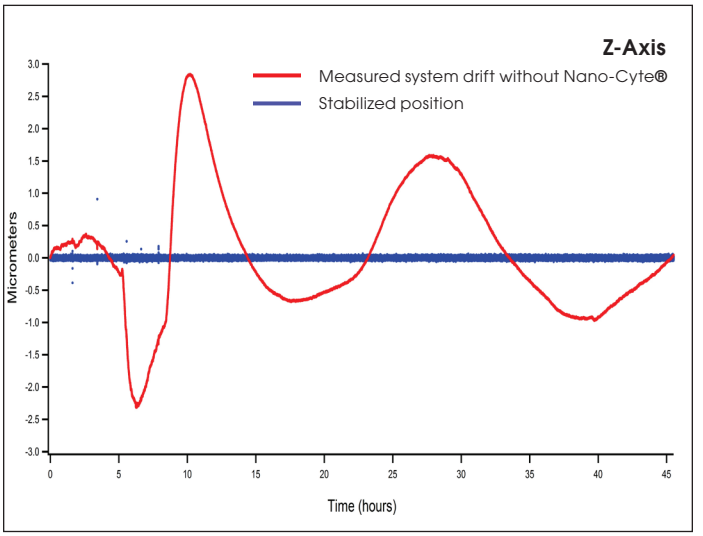
Nano-Cyte® is compatible with LabVIEW™, µManager, ImageJVI and rapidSTORM. In addition, Nano-Cyte® has an exportable DLL to allow wider functionality with 3rd party software platforms.

MCL®
MAD CITY LABS INC.

sales@madcitylabs.com • www.madcitylabs.com •

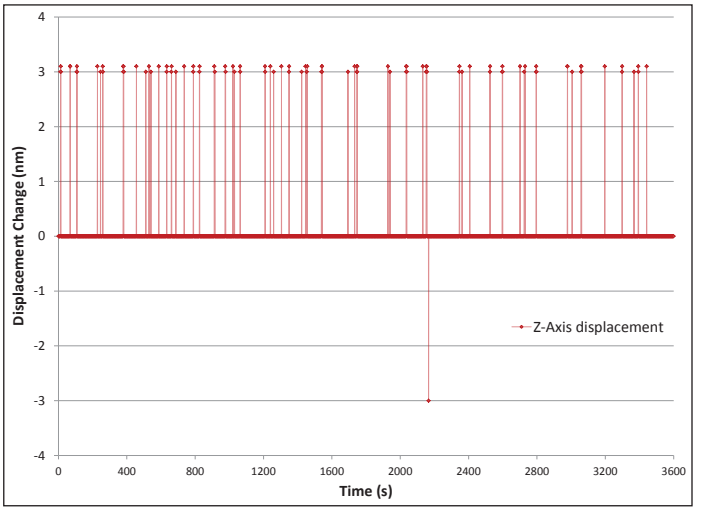
Nanometer Stability Over Days

Stability data measured over 44 hours for the Z-axis. The red line indicates the measured drift. The blue line indicates the stabilized position when using Nano-Cyte®. Similar results were observed simultaneously for the X and Y-axis. These data below demonstrate the efficacy of the Nano-Cyte® under non-monotonic drift conditions.



Effective stability using Nano-Cyte®

The Nano-Cyte® data below shows position changes performed on the z-axis over a period 1 hour. These data demonstrate that the Nano-Cyte® effective stability is 3nm.



Nano-Cyte® Specifications	
Stability (X, Y, Z-Axis)	3 nm
Drift rate compensation (typical)	10 nm/sec
Stabilization rate (typical)	1 frame/second
Maximum data acquisition rate	Camera dependent
Nanopositioning range of motion	200 µm × 200 µm × 200 µm
Position noise (total)	0.4 nm
Step size	3 nm
Micropositioning range of motion	25 mm x 25 mm
Encoder resolution	20 nm
Minimum step size	95 nm
Controller	Nano-Cyte®
Communication	USB 2.0
TTL outputs	4 channels
Output image format	TIFF
Software	Nano-Cyte®
Software compatibility	LabVIEW™
	µManager
	ImageJ & ImageJVI
	Exportable DLL
	RapidSTORM
Microscope compatibility	Nikon Ti, TE Series
	Zeiss Axio Series
	Olympus IX Series
	RM21™
Supported EMCCD camera types	Andor
	Photometrics
	Hamamatsu
Power supply	90 - 260 VAC (50/60Hz)
Operating system	Windows Vista/7/8

Additional documentation

Application Notes

"Slide & coverslip cleaning for single molecule fluorescence microscopy" (NC-001)
"Selecting fluorescent fiduciary reference beads" (NC-002)
"Adsorbing PS-Speck beads onto slides & coverslips" (NC-003)
"Adjusting optics to improve z-axis localization" (NC-004)

Software Note

"Interfacing to the Nano-Cyte DLL" (NC-005)

MAD CITY LABS INC.
sales@madcitylabs.com • www.madcitylabs.com