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Licensable Technologies

3D Tracking Microscope

Applications:

- Cellular biology
- Biomedical research
- Molecular spectroscopy

Benefits:

- Compatible with any data post-processing method
- Permits tracking within the true 3D structure of living systems
- Provides insights beyond ensemble-averaged responses of larger populations
- Allows extraction of sub-wavelength information from single-molecule images
- Enables tracking spannig ten orders of magnitude in time (100 ps to seconds)—not limited to camera "frame rate"

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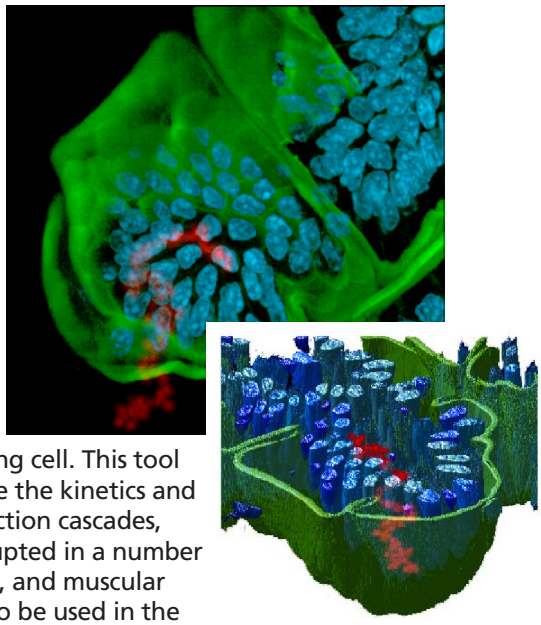
Summary:

Los Alamos National Laboratory's 3D tracking microscope is a revolutionary advance in the field of fluorescence microscopy. This device can follow the motion of individual quantum dots or fluorophores through three-dimensional space at rates faster than many intercellular transport processes. By labeling biomolecules with a quantum dot or a fluorescent indicator, researchers can study the transport and organization of protein, DNA, and RNA within a living cell. This tool will also allow researchers to explore the kinetics and dynamics of complex signal transduction cascades, such as the signaling networks corrupted in a number of diseases like cancer, heart disease, and muscular dystrophy. This instrument could also be used in the study of bacterial or viral invasion of a host cell on a molecule-by-molecule basis to get a better biophysical understanding of these processes is also possible.



Tracking molecules in living systems is a three-dimensional challenge.

The 3D tracking microscope can follow transport events at micrometer/second rates with a spatial accuracy of approximately 100 nanometers for each axis (X, Y, and Z). This enables one to follow individual protein, RNA, or DNA motion to see where a particular biomolecule travels, the method it takes to get there (diffusion or directed movement), and the specific partners with which it may interact along the way. In addition to following individual molecular motion, the system monitors the fluorescence lifetime of the reporters being tracked. Because the 3D tracking microscope is based upon a confocal fluorescence microscope platform, it can perform routine three-dimensional sectioning and imaging, with single fluorophore sensitivity, in addition to following three-dimensional particle trajectories.

The primary information generated by the 3D tracking microscope is the three-dimensional spatial position of the reporter as a function of time. However, in addition to this information, the instrument also records the fluorescence lifetime of the reporter being tracked, which can be used to probe the local solvent environment immediately surrounding the fluorescent reporter. The fluorescence lifetime may also reflect the presence of a nearby protein partner, the pH, electrostatic potential, or indicate a conformation state of the biological molecule to which the fluorescence reporter is attached.

Development Stage:

This technology has been tested at a laboratory scale and is ready to be integrated into a product. Hardware and software have been developed for numerous applications and have been validated.

Patent Status: Patent pending

Licensing Status: Available for exclusive or non-exclusive licensing

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