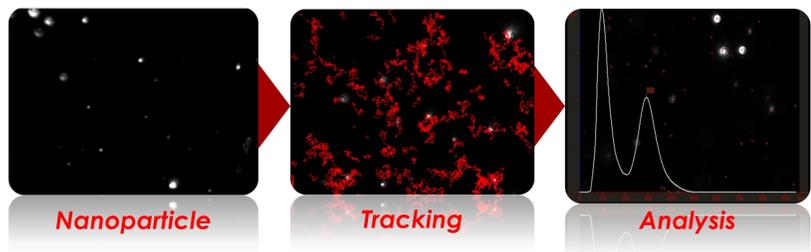


# Nanoparticle Tracking Analysis (NTA): Applications in Biotechnology

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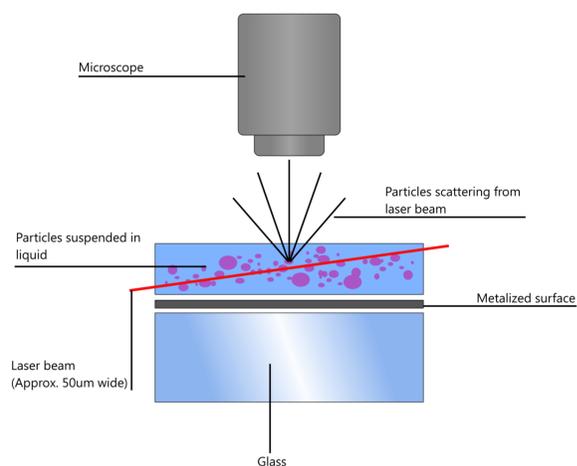
The laser-based, multi-parameter technique of Nanoparticle Tracking Analysis (NTA) allows users to directly visualise, on an individual basis, nanoscale material as small as 15nm. Using the Brownian motion of nanomaterial, it is possible to rapidly and simultaneously determine:

- Particle Size
- Number based Particle Size Distribution (PSD)
- Concentration

Additionally, NTA can also:

- Isolate Fluorescently labelled nanomaterial
- Provide sample Zeta-potential

## Technique



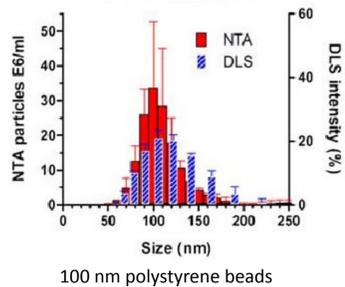
A laser diode (635nm, 532nm, 488nm or 404nm) is used to pass a finely focussed beam through a sample chamber containing nanomaterial in liquid suspension.

The scattered light is collected using optical microscopy components, allowing a direct visualisation of particles moving under Brownian Motion.

A video file of this movement is captured and the NTA software tracks the movement of each particle on an individual basis.

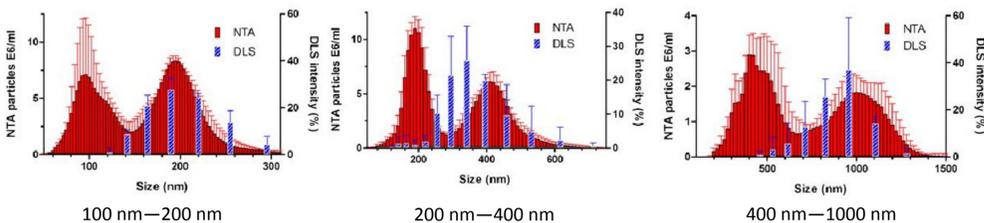
## Comparison of NTA with Dynamic Light Scattering

Monodisperse



Both NTA and DLS produce accurate results for monodisperse samples

Polydisperse



DLS produces an intensity weighted average. This often fails to detect populations of small particles. NTA detects and characterises both populations of nanomaterial<sup>1</sup>.

<sup>1</sup> Vasco Filipe, Andrea Hawe and Wim Jiskoot "Critical Evaluation of Nanoparticle Tracking Analysis (NTA) by NanoSight for the Measurement of Nanoparticles and Protein Aggregates." *Pharmaceutical Research* (2010) DOI: 10.1007/s11095-010-0073-2 (open access at Springerlink.com)

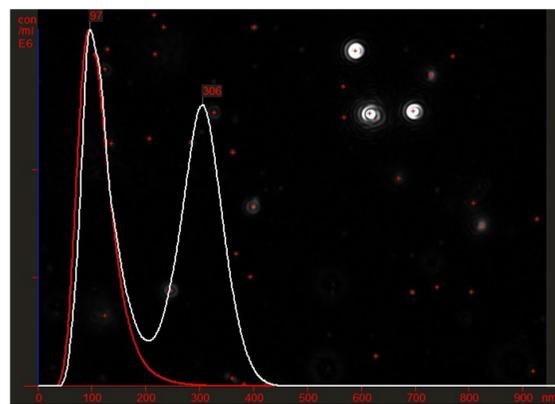
## Applications in Biotechnology: Bio-indicators

### Microvesicles and Exosomes

Biological nanomaterial including microvesicles and exosomes have emerged as important bio-indicators through the role of cell signalling. Circulating levels are found to be elevated in various disorders including atherosclerosis and coronary artery disease, haematological and inflammatory diseases, diabetes and cancer.

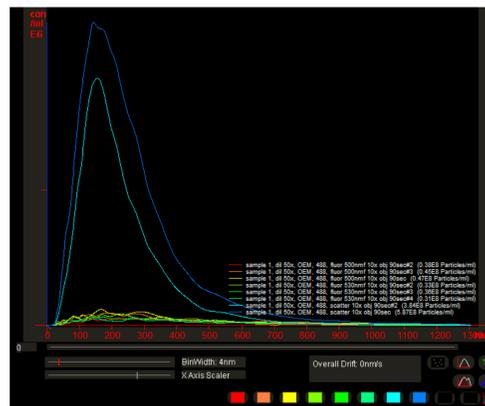
### Size

NTA allows specific exosomes and microvesicles in the range of 30–100nm in liquid suspension to be directly and individually visualized and counted in real-time. NTA provides high-resolution number based Particle Size Distribution (PSD) profiles that provide accurate size data for both mono and polydisperse systems.



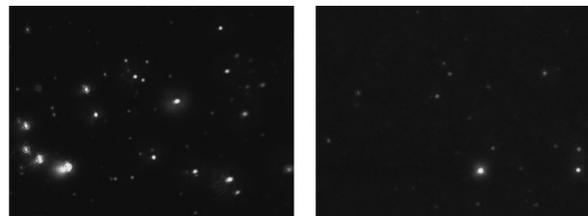
### Concentration

As the interrogated volume is known, by counting the number of particles in the field of view and extrapolating, users are able to obtain absolute concentrations in terms of particles per ml.



## Phenotyping with Fluorescence

It is also possible to analyse fluorescently labelled bio-nanoparticles. By using specific labelling and comparing results from the same sample with and without the filter in place users are able to identify and analyse specific phenotypic exosomal sub-populations in complex sample types.



## Summary

- NTA provides direct and real-time visualisation, sizing and counting of exosomes in liquid suspension
- Combined use of specific labelling and fluorescent analysis allows phenotyping of exosome populations
- Minimal sample preparation is required. Usually it is only required that the system is diluted so the concentration falls between 10<sup>7</sup> and 10<sup>9</sup> particles per ml