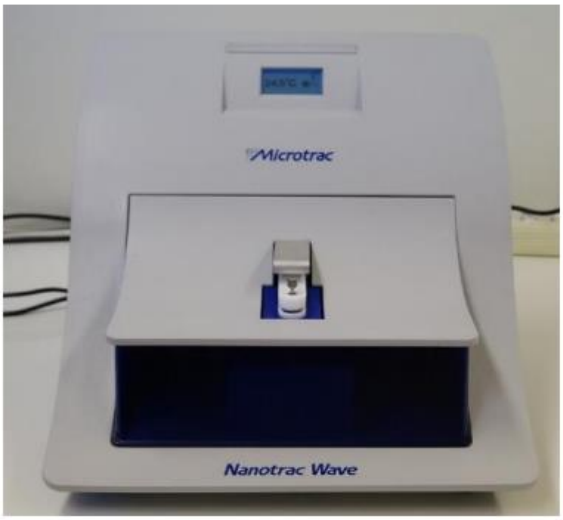
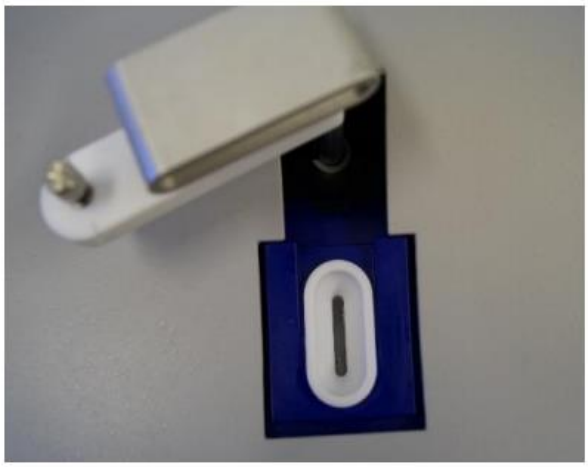
Demo instrument Nanotrac Wave, manufactured date Dec. 2012





Short Presentation of the Device:

The Nanotrac Wave is a measurement system for direct, automatic measurement of the electrophoretic movability and Brownian motion, as well as the resulting zeta potential and particle size. The analyzer's innovative design offers faster analyses with reliable technology and dynamic light scattering based device without loose optical components. The Wave II employs Reference Beating, which increases the optical signal anywhere from 100 to 1,000,000 times compared to traditional DLS. In 2020, the leading companies for particle characterization, RETSCH Technology, Microtrac and MicrotracBEL united and became Microtrac MRB, part of Verder Scientific.

Specifications:

• The device is able to measure Zeta potential closer to isoelectric point by eliminating errors caused by electro-osmotic flow (ZP measurement ranges from -200 to +200mV).

• The instrument includes software for instrument control and analysis of data.

• The size measurement range is from 0.8 nm to 6,500 nm.

• The instrument has fixed sample cell, PTFE • Laser 780 nm; 3 mW with Zeta 2x Laser diode.

• It measures temperature but do not control it • Backscatter detector: The instrument have a unique design, fixed optics & 180° backscatter angle and backscatter detector enable fast and precise measurement across wide concentration range, from ppm to near solids (40 % w/v)

Why we measure only at 180° ?

Due to a combination of several factors. The measurement principle of the NANOTRAC Wave is based on dynamic light scattering (DLS) in a 180° heterodyne-backscatter arrangement with reference beating and uses a Frequency Power Spectrum method (FPS). In this method the intensity signal of the photo-detector contained is transformed mathematically by Fast Fourier Transform (FFT) into a Frequency Power Spectrum and directly provides a size distribution by iterative error minimization. The geometry of the components enables light to reflect from the interface and combines it with collected scattered light. In a real measurement situation, large numbers of particles move randomly in the vicinity of the probe tip, generating an equal number of Doppler (frecuency)-shifted scattered light signals. These signals of various frequencies combine with the reflected signal of un-shifted Frequency (reference beam) to generate a wide spectrum of heterodyne different frequencies. The resulting output of the photo-detector is thus a random signal with a frequency spectrum determined by the velocity distribution of the particles in the sample. As show in Figure 2 Reference Beating generates up to 1.000.000 higher optical signal to photodetector compared to homodyne (self-beating).

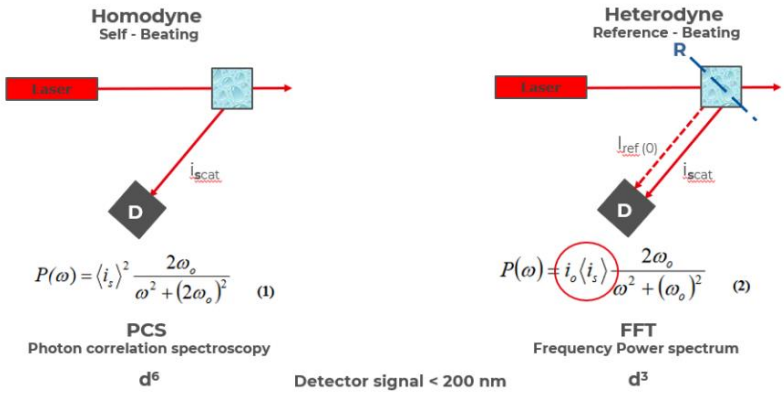


Figure 2 Nanotrac Wave, DLS optical arrangement (Heterodyne, Reference Beating, FFT) conventional DLS (Homodyne, self-beating PCS

Pos.	No.	Q -ty	Description
1	S/N:W3134	**1**	SYSTEM: Nanotrac Wave + ZP, Electrode Cell Particle size, Concentration, Zeta potential * Fixed sample cell Note this device measures temperature but do not control it. Include Software Flex, version 11.0.5 (older version) Note: the instrument has been recently served, Feb 10th 2021.
2	Ins.	1	Installation help if necessary