

PARTICLE CHARACTERIZATION: ISOTROPIC, MOU
0.01µM, 5NM, 0.01346µM, 35.78NM, 935
35.78NM, 9351µM, 2.5NM, 355MM, TRI-LASER DIT
RAYLEIGH RATIO, 35.81µM, 3.9885NM, 9
3895.42NM, 3.0562µM, 51MM, 3.4078-10NM, 39
LOGARITHMIC SCALE, BROWNIAN MOTION, RE



Total Solutions in Particle Characterization

Nanoparticle Analysis... AMPLIFIED

Microtrac Dynamic Light Scattering Analyzers' enhanced optical signal enables accurate measurement across the widest concentration range available.

- Size and Zeta potential
- Sample introduction flexibility
 - External probe
 - Disposable cuvette sample cell
 - Removable sample cell
- From low ppb to high concentrations



ACADEMIA



CERAMICS



CHEMICALS



ENERGY



ENVIRONMENTAL



FOOD/AGRICULTURE



LIFE SCIENCES



MINING, MINERALS,
METALS



OIL AND GAS



PHARMACEUTICALS



PLASTICS

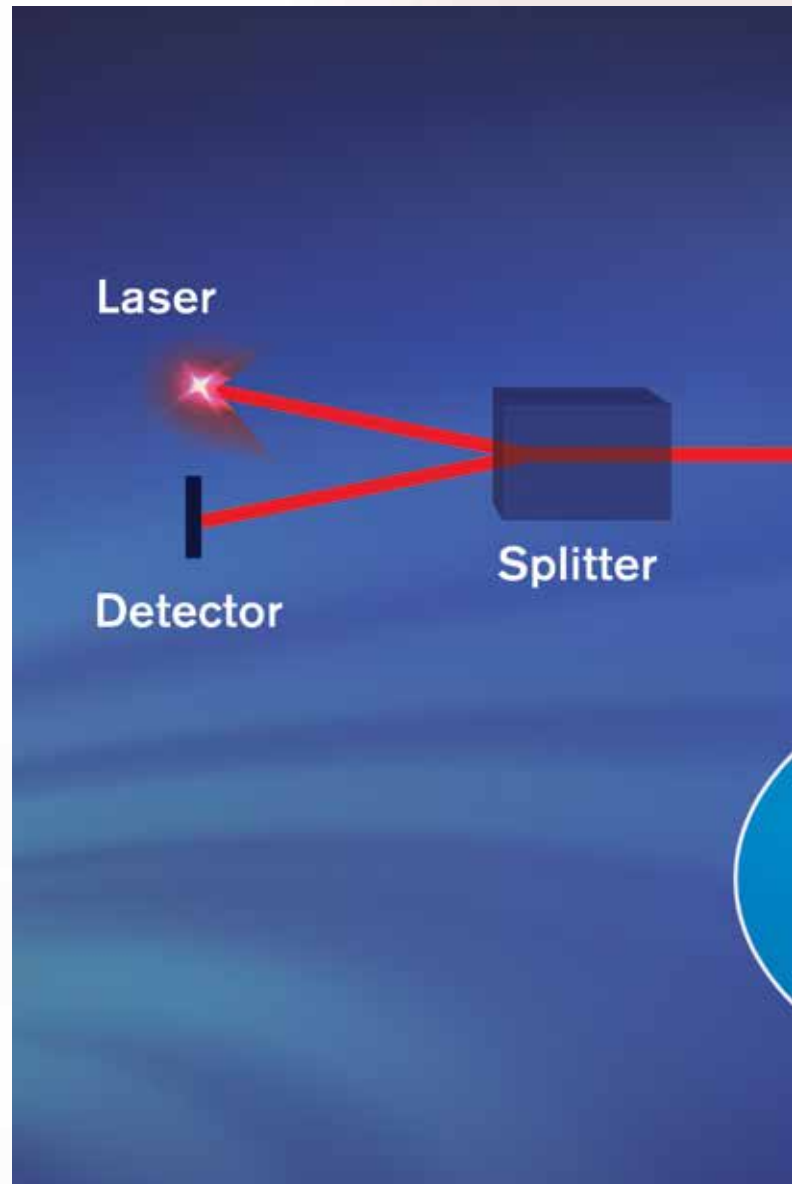
Sizing Nanoparticles the Microtrac Way:

Microtrac probe technology – unique design...superior results

For over 25 years, Microtrac has taken an innovative approach to Dynamic Light Scattering (DLS) by using a proprietary probe design to deliver and collect light. By focusing the laser probe at the material interface, Microtrac combines the benefits of a short path length with our other design elements – Reference beating and 180° backscatter – to deliver the best accuracy, resolution and sensitivity.

Reference beating – strongest optical signal...accuracy at lowest concentrations

All DLS measurements use a form of “Beating” to strip away the high optical frequency from the scattered light, leaving the particle motion-induced lower frequencies required for size analysis. Microtrac’s heterodyne detection principle uses the probe to collect 180° backscattered light mixed with incident light. This geometry also gathers light reflected from the interface and combines it with collected scattered light. The reflected light enables Reference beating. The total optical signal is amplified by the high intensity of the reflected component. Result: highest possible optical signal providing accurate measurements in the lowest possible concentrations.



25 Years of Innovation



1990's

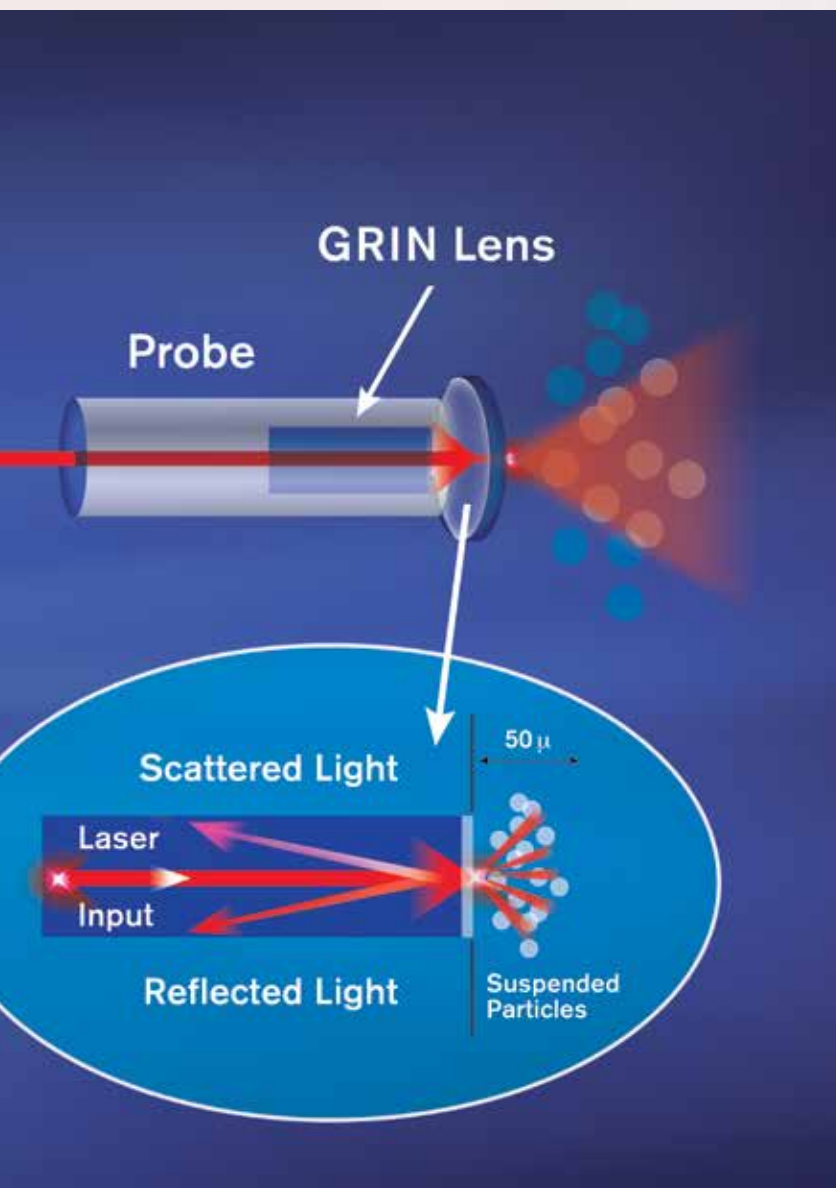
Release of first DLS system.
First to release external probe for *in-situ* analysis.



2000's

Probe upgraded for universal solvent compatibility.
Measurement capability extended into sub-nanometer range.

Fast ...Sensitive ...Accurate ...Repeatable



180° backscatter – GRIN lens focusing... accuracy at highest concentrations

The Microtrac probe focuses the laser beam at the interface between the probe and the particle suspension. The light penetrates the suspension, scattering takes place with the encountered particles and the 180° backscattered light, mixed with incident light, returns to the photodetector. The total path length is minimized while scattered light collected is maximized. Result: accurate measurements at the highest particle concentrations.

Want to learn more about the Microtrac Way of DLS? Scan this QR code to watch an archived webinar presented by Microtrac's own, **Dr. Paul Freud**, a pioneer of Reference Beating.



Late 2000's

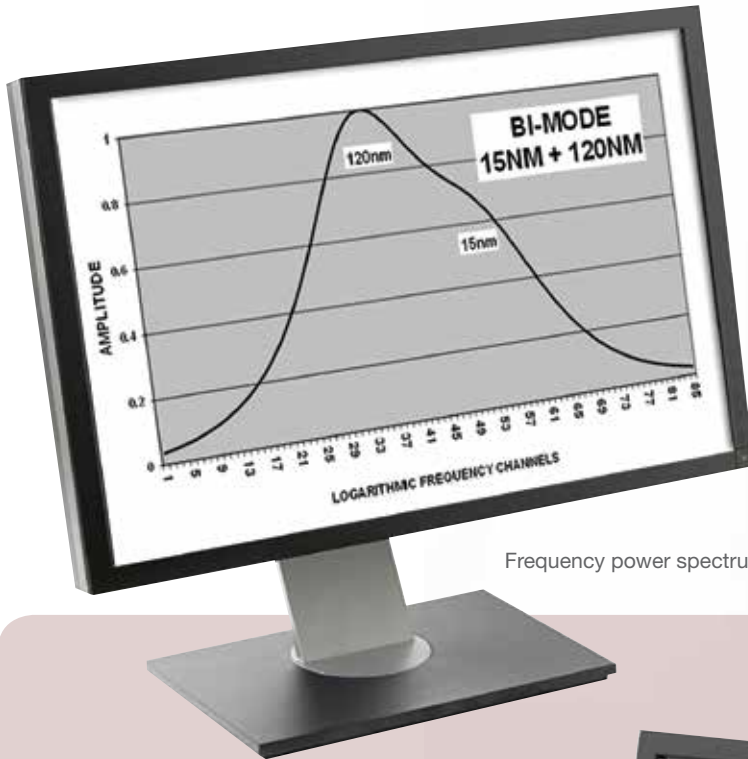
Launch of small sample volume chamber. Introduction of advanced power spectrum analysis and zeta potential measurement with debut of Zetatrac.



2010's

Molecular weight calculation by Debye plot. Release of Nanotracs Wave II and advanced calculations.

Frequency Power Spectrum Delivers Superior Accuracy



Frequency power spectrum

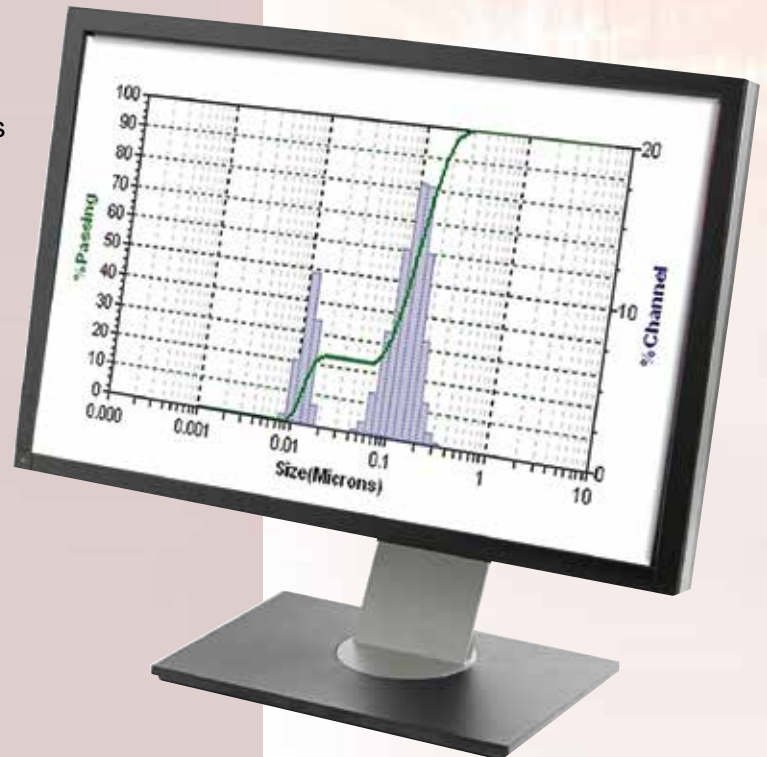
Frequency power spectrum – iterative error minimization... accurate particle size distribution

The Microtrac raw photodetector signal (scattered light with reference light) is optical intensity sampled at regular intervals and provides frequency that is converted into a **Frequency Power Spectrum** by using a **Fast Fourier Transformation**.

Result: accurate particle size distribution calculated from the Frequency Power Spectrum.

Users can choose from several analysis modes depending upon their situation:

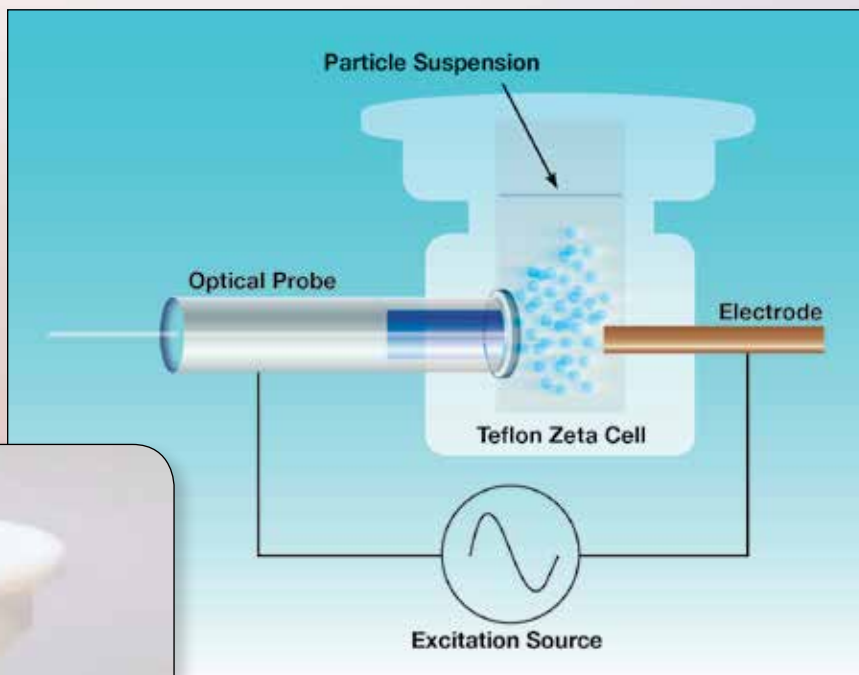
- **Distribution Analysis** – For full featured, accurate particle size distributions from nm to μm .
- **Mode Analysis** – Advanced results with specified size and volume concentration. This approach enables you to resolve and report accurate multi-mode distributions.
- **Legacy Calculations** – Enables measurement of historical specifications for data consistency with legacy instrumentation.



15 and 120nm bimodal size distribution

Zeta Potential: The Microtrac Way

Suspended charged particles are in constant Brownian motion. Applying an AC electric field creates an electrophoretic mobility that combines with Brownian motion. Result: modulation of the Brownian motion power spectrum called the Modulated Power Spectrum (MPS) signal.



Pictured above is the unique Microtrac Zeta Cell, which is removable and easy to clean.

The proprietary Microtrac probe is paired with an electrode; a voltage is applied, establishing an electric field between the two points, enabling accurate zeta potential measurements across a broad concentration range.

The MPS signal is proportional to the Zeta Potential of the particles:

- **High accuracy** - the Microtrac Zeta probe measures the MPS signal using high frequency modulation, eliminating the need to correct for electroosmotic flow
- **High precision** - achieved through the inclusion of the Brownian motion frequency spectrum
- **High concentration** - 180° backscattering probe allows measurement of the highest concentration of any optical Zeta Potential measurement – allows you to operate at or closer to your suspension’s designed concentration
- **Low sample volume** - Compact probe/sample interface allows lowest sample volume available: 150 microliters
- Compliant with ISO 13099-2:2012



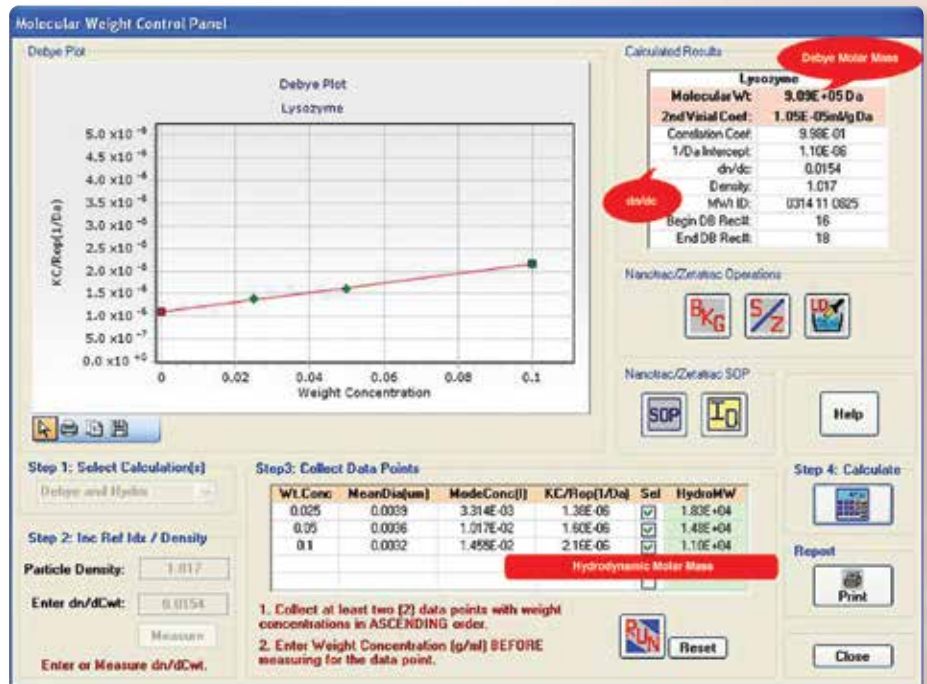
Beyond Size and Zeta Potential

Molecular weight

The frequency power spectrum method accurately measures scattered light intensity from molecules with the prime input for the Debye plot technique. Molecule index of refraction, a constant required for the Debye plot technique, can be determined with the Microtrac probe through built-in index calculator.

Mode volume concentration

Mode analysis determines not only the size but also the volume concentration (in cc/mL units) of each mode of the sample through the power spectrum magnitude. Ideal for monitoring reactor processes and nano attrition milling.



Flexible sample introduction options

- Standard polystyrene or glass cuvettes with four different volumes from 50µL to 1000µL
- External probe enables user to take the instrument to the sample
- Removable sample cell available in two materials
 - Teflon
 - Stainless steel for inks, adhesives – easy to clean
- Zeta Cell
 - Removable
 - Autoclavable

Other Microtrac features

- Small footprint
- Laser diodes for long life
- No need to filter diluents
- Peltier temperature control from 5-90°C
- Design eliminates focusing, alignment and wearable parts
- Silicon detector does not experience long saturation recovery period or downtime when high concentrations are measured

Add Titration to Your Size and Zeta Potential Analysis



Determine suspension stability with Zetrator fully automatic titration device.

- Define optimal process and storage conditions by identifying Isoelectric Point (IEP)
- Alter the electro-chemical conditions of your sample to determine points of stability
- Design elements eliminate bubbles interfering with results
- Available in single, three or five titrant configurations
- Auto-clean mechanism ensures measurement repeatability and accuracy

FLEX Software: Powerful, Robust and Easy to Use

Whether you want to quickly identify if your material meets size specifications or need to take a detailed dive into your data, FLEX Software provides you with the tools you need.

- No *a priori* knowledge of particle size distribution needed, simply load your material and hit run.
- No set zero required – the blank measurement is built into software
- Manually select dynamic viscosity value of material – ensures accuracy and consistency of measurement (Stokes-Einstein theory)
- Easy SOP set-up – security function, ideal for managing users across multiple shifts
- Cuvette error and sample cell cleanliness alerts
- Pass/fail notifications
- Database recall
- Live or recalled database trending plots
- User-defined data reports and calculations
- Statistical analysis
- Multiple data export options
- FDA 21 CFR Part 11 Compliant






Which Microtrac DLS Analyzer Is Right for Me?

Microtrac's Dynamic Light Scattering product line gives you the choice to select the analyzer that is best for your specific application.

Microtrac DLS Analyzers can measure particles 0.8 to 6,500 nanometers in size.

All Microtrac DLS Analyzers are compliant with ISO 13099-2:2012 and 22412:2008.

	Nanotracs Wave™ II	NANO-flex	Nanotracs Wave™ II Q
			
Sample Cell	Removable Teflon cell/ stainless steel/external probe	External probe - <i>in-situ</i>	Cuvette
Sample Volume	<ul style="list-style-type: none"> ■ Standard 200µL-1mL ■ Micro 50µL-100µL ■ Large 1.7mL-5mL 	Dependent on customer vessel	<ul style="list-style-type: none"> ■ Macro 1000µL-3mL ■ Glass 1000µL-3mL ■ Semi-micro 300µL-2mL ■ Micro near 50µL-1mL
Peltier Temperature Control	√	—	√
Zeta Potential	√	—	—
Molecular Weight	√	√	√
Concentration Range	Min. 100ppb, Max. 40%w/v*	Min. 100ppb, Max. 40%w/v*	Min. 100ppb, Max. 40%w/v*
Concentration Determination	√	√	√
Measurement Angle	180°	180°	180°
ph Range	2-12	2-12	2-12
Chemical Compatibility	Aqueous and non-aqueous suspensions	Aqueous and non-aqueous suspensions	Aqueous and non-aqueous suspensions

*Sample dependent

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 Total Solutions in Particle Characterization

