

MASTERSIZER 3000+

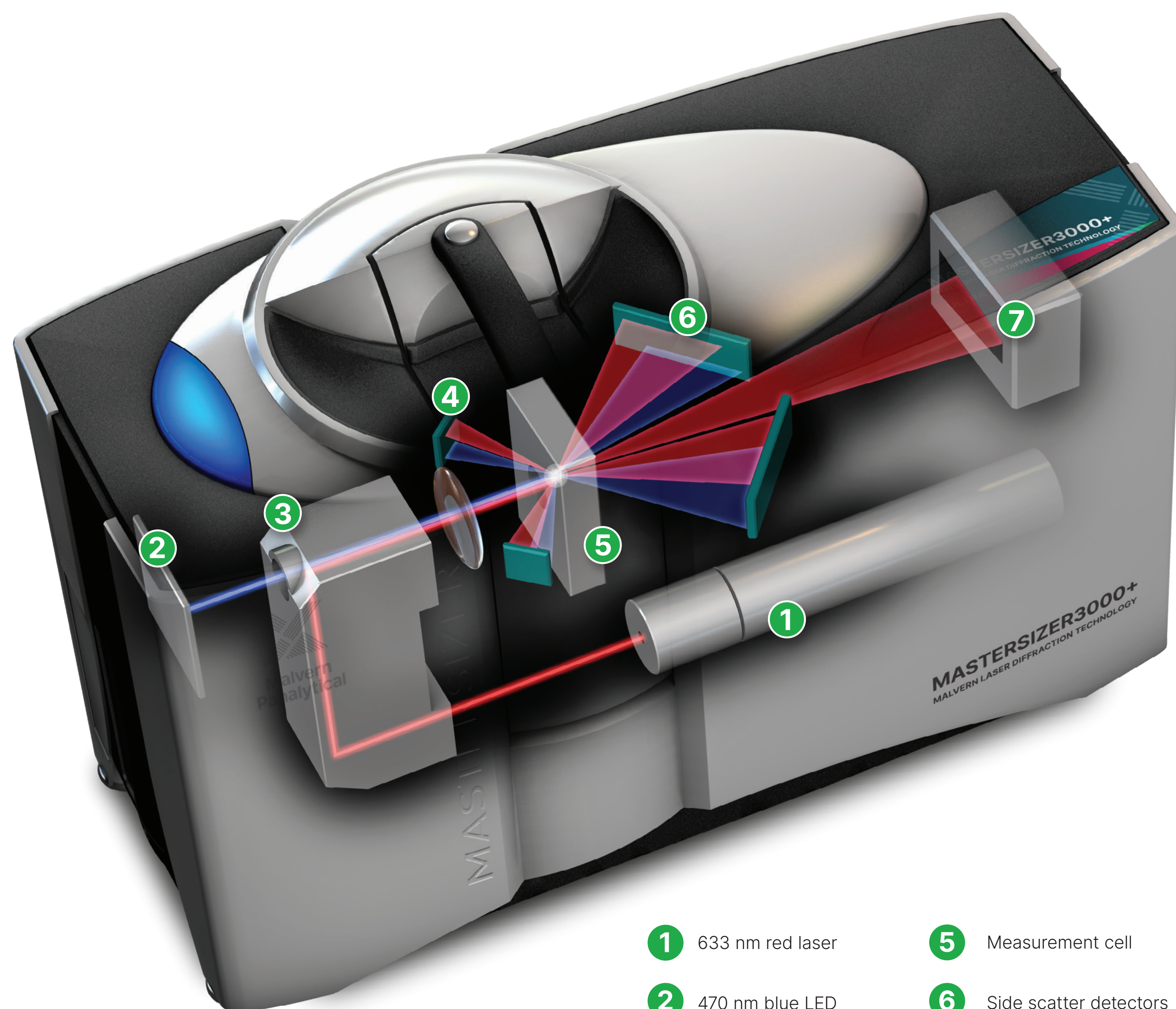
Smarter particle sizing

The world's most popular particle size analyzer

Mastersizer laser diffraction particle size analyzers set the standard for delivering rapid, accurate particle size distributions for emulsions, suspensions and powders.

From assessing product uniformity and solubility, through to optimizing packing density to improve final product performance and controlling powder flowability to increase manufacturing efficiency, particle size analysis is critical to understanding and controlling a wide range of properties.

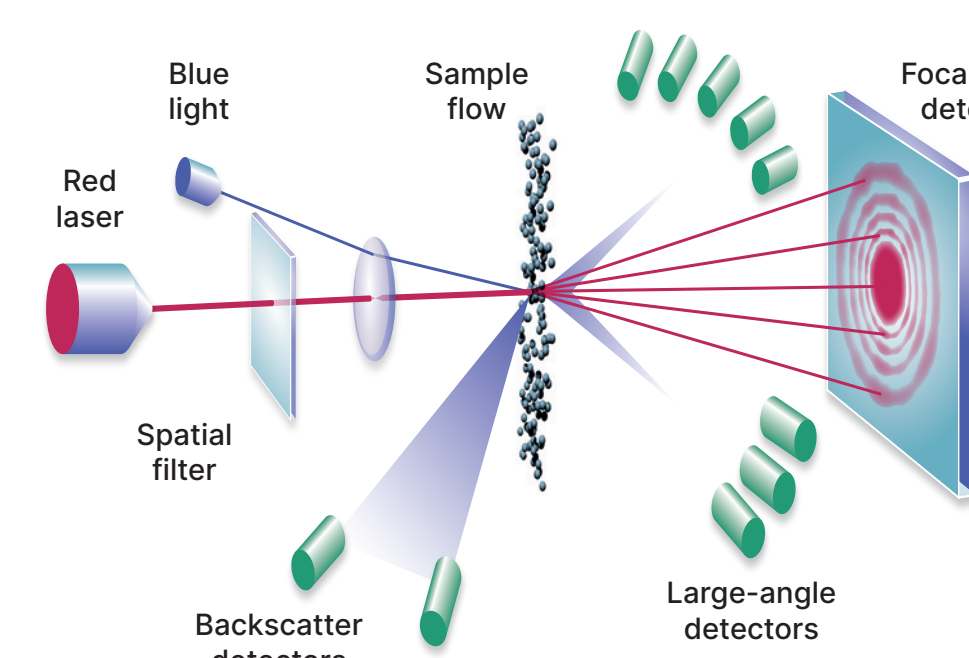
The Mastersizer range, with its intuitive software and industry-leading design and ergonomics, enables all users to make fast and accurate particle size distribution measurements, supporting product development and quality control applications.



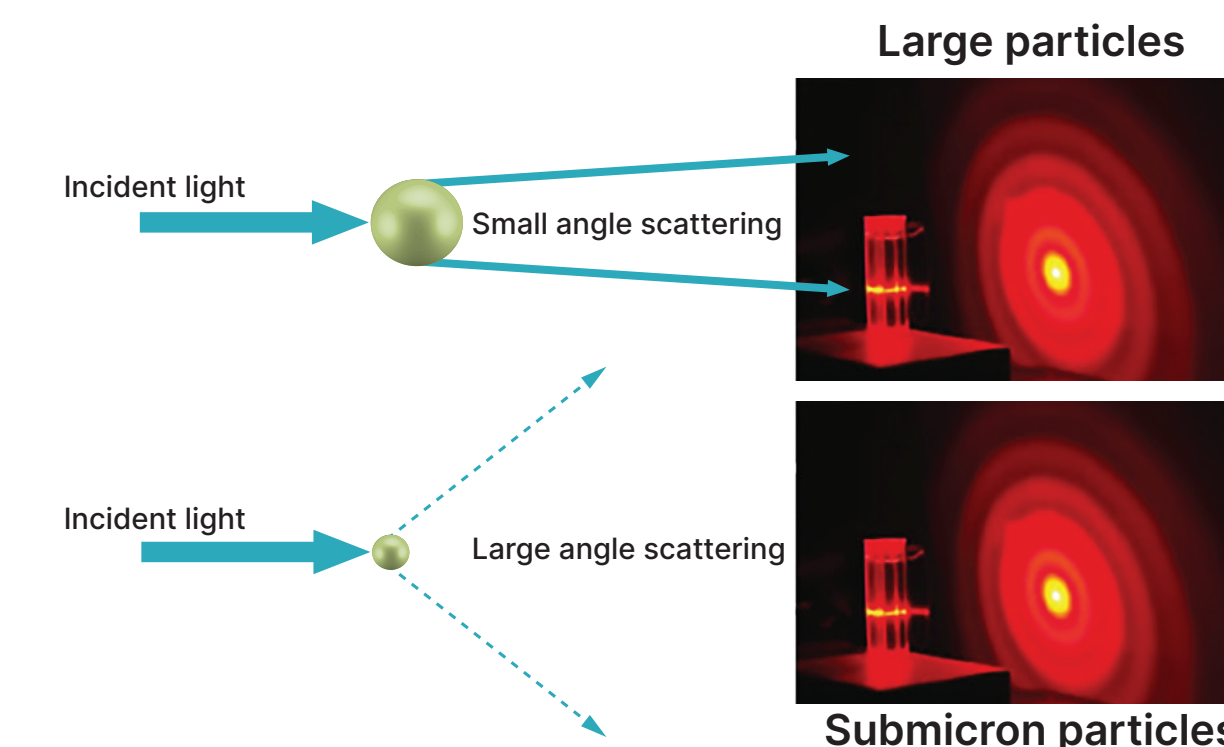
- 1 633 nm red laser
- 2 470 nm blue LED
- 3 Precision optics
- 4 Backscatter detectors
- 5 Measurement cell
- 6 Side scatter detectors
- 7 Focal plane detectors

What is Laser diffraction ?

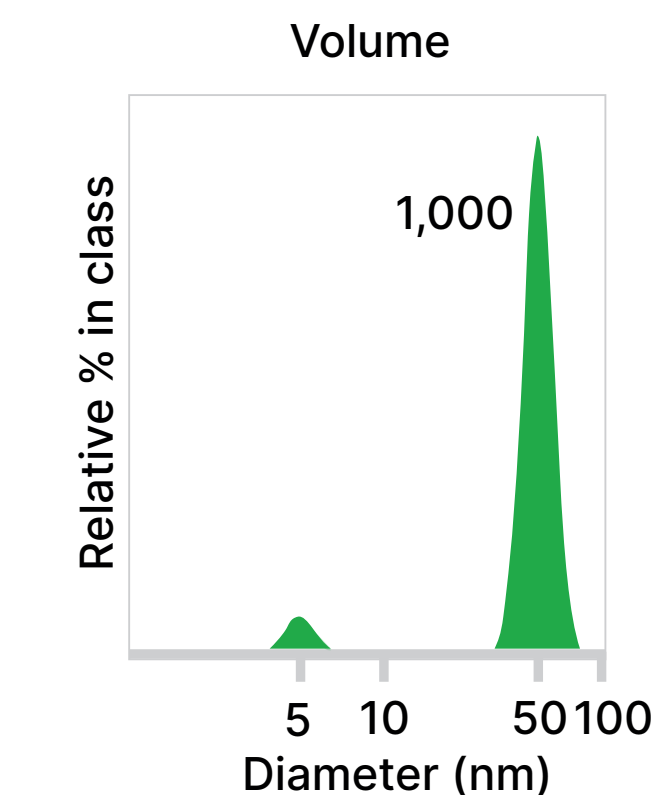
In a laser diffraction measurement, a laser beam passes through a dispersed particulate sample and the angular variation in intensity of the scattered light is measured.



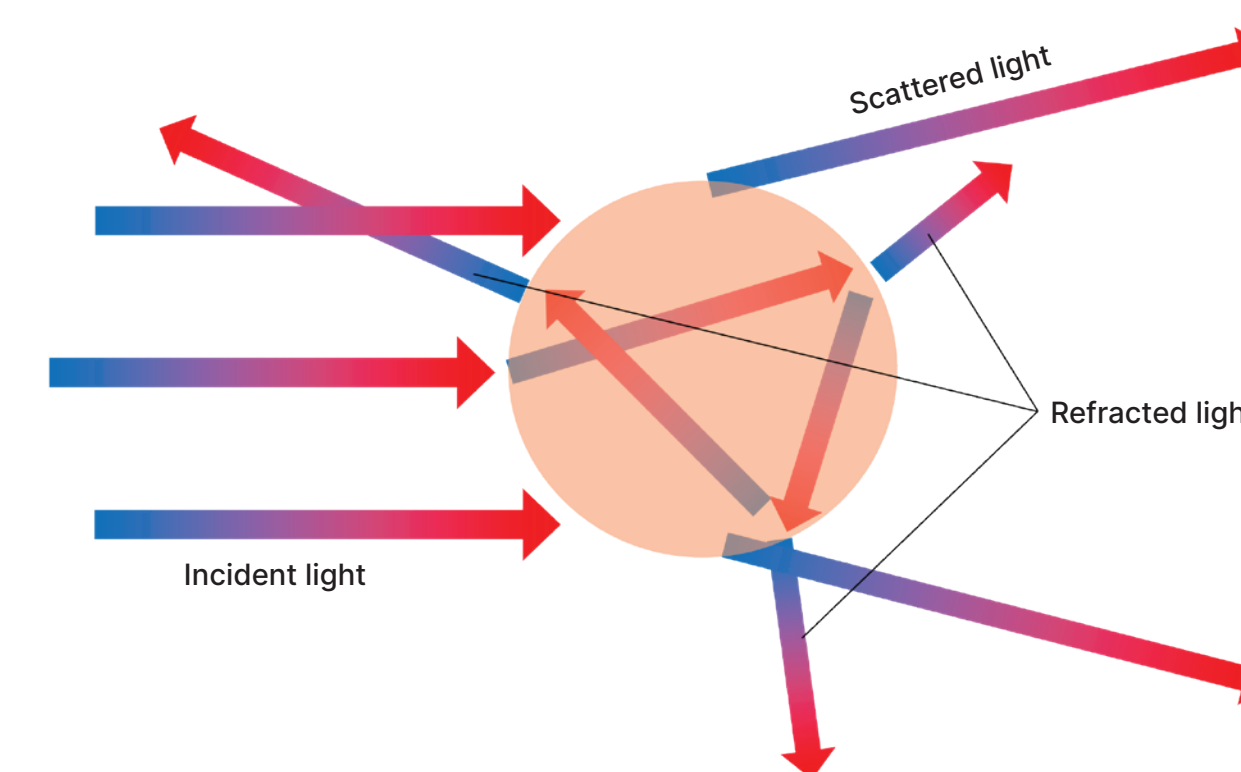
Large particles scatter light at small angles relative to the laser beam and small particles scatter light at large angles.



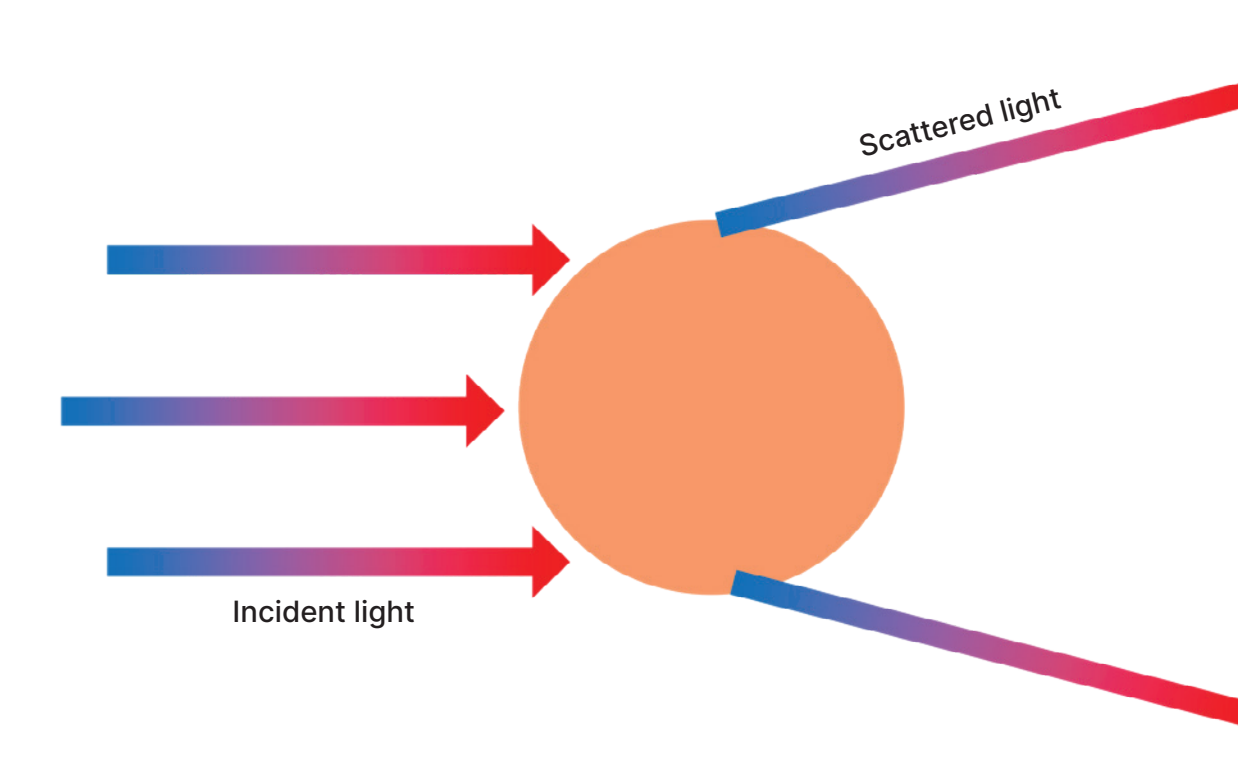
The angular scattering intensity data is then analyzed to calculate the size of the particles that created the scattering pattern using the Mie theory of light scattering. The particle size is reported on a volume-weighted distribution, with the size being the diameter of a sphere with the same volume as the particle.



Mie theory



Fraunhofer approximation



The Mie solution to Maxwell's equations accounts for ALL matter interactions and will condense to the Fraunhofer approximation in the limits of small optically soft and large optically opaque particles, respectively.

Assumptions:

- Particles are spherical
- The suspension of particles in the dispersing medium is dilute, so that light is scattered by a single particle, avoiding a multiple scattering effect
- Optical properties of particles and the surrounding medium are known
- A two-phase system
- Particles are chemically homogeneous

Sample dispersion mechanisms

Sample dispersion ensure that particles are delivered to the measurement area of the optical bench at the correct concentration and in a suitable, stable state of dispersion to make accurate and reliable particle size measurements. How you disperse a sample will depend on what you want to measure.

Wet or liquid dispersion provides a reduction in particle-to-particle adhesion forces through surface wetting, making it ideal for analyzing sub-micron particles and fragile particles because of the light dispersive mechanisms. Three steps are used to establish an optimal dispersion:

In a dry powder disperser, sample dispersion is achieved by accelerating the dry powder particles through a venturi using compressed air. Three dispersion mechanisms can act upon the sample (particle-to-wall collisions are venturi dependent):

Wetting the sample

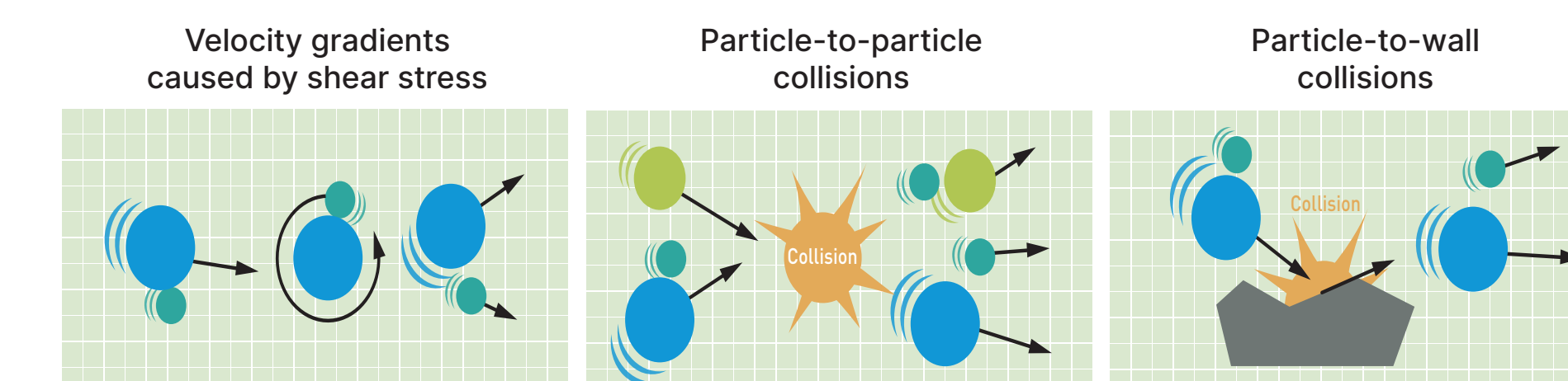
Choose an appropriate dispersant
Carry out a beaker test
Use surfactant to improve the dispersion

Adding energy to improve dispersion

Stirring/pumping by the dispersion unit
Ultrasonics if needed

Stabilizing the dispersion

Check repeatability after ultrasound
Additives can be used to prevent re-agglomeration



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