AERODYNAMIC PARTICLE SIZER® MODEL 3321

HIGH-RESOLUTION AERODYNAMIC SIZING PLUS LIGHT-SCATTERING INTENSITY

The Aerodynamic Particle Sizer® (APS™) Model 3321 spectrometer provides high-resolution, real-time aerodynamic measurements of particles from 0.5 to 20 µm. This unique particle sizer also measures light-scattering intensity in the equivalent optical size range of 0.37 to 20 µm. By providing paired data for each particle, the APS spectrometer opens up exciting new possibilities for those interested in studying the makeup of an aerosol.

The APS spectrometer uses a patented*, double-crest optical system for unmatched sizing accuracy. It also includes a redesigned nozzle configuration and improved signal processing. The result is greater small-particle sizing efficiency, improved accuracy of mass-weighted distributions, and virtual elimination of false background counts. *US Patent # 5,561,515.

Applications:

+ Inhalation toxicology
+ Drug delivery studies
+ Atmospheric studies
+ Ambient air monitoring
+ Indoor air-quality monitoring
+ Filter and air-cleaner testing
+ Biohazard detection
+ Test aerosols characterization
+ Usable for particle instrument calibration
+ Spray technology
+ Performance evaluations of aerodynamic devices
+ Powder sizing
+ Basic research

Features and Benefits

+ Double-crest optics produce high-quality measurements
+ Measures aerodynamic particle size from 0.5 to 20 µm
+ Measures light-scattering intensity from 0.37 to 20 µm
+ Real-time aerodynamic sizing
+ No need to wait for cascade impactor measurements
+ High size resolution - 52 size channels
+ Independent of optical properties of the particles and fluid

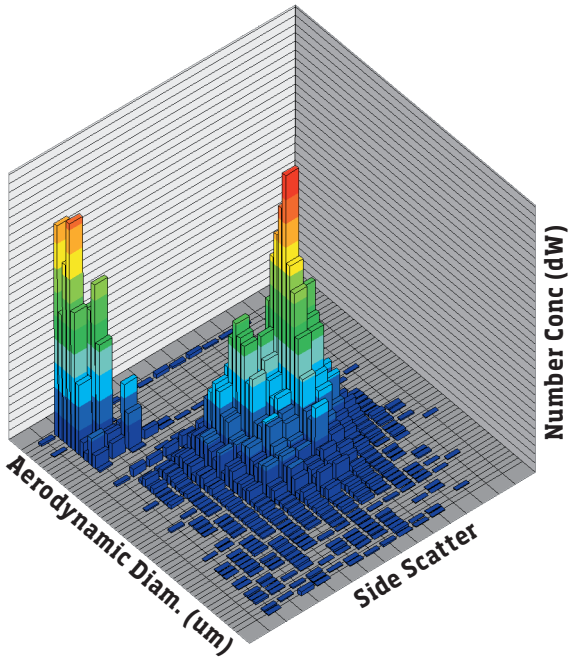
UNDERSTANDING, ACCELERATED

WHY IS AERODYNAMIC DIAMETER IMPORTANT?

Aerodynamic diameter is defined as the physical diameter of a unit density sphere that settles through the air with a velocity equal to that of the particle in question. It is the most significant aerosol size parameter because it determines the particle's behavior while airborne. Particles exhibiting the same airborne behavior have the same aerodynamic diameter, regardless of their physical size, shape, density, or composition.

Knowledge of a particle's aerodynamic diameter allows you to determine:

+ If and where the particle will be deposited in the human respiratory tract
+ How long the particle will remain airborne in the atmosphere or in an aerosol
+ Whether the particle will penetrate a filter, cyclone, or other particle-removing device
+ Whether the particle will enter a particle-sampling system
+ Whether the particle will penetrate a pipe, tube, duct, or channel



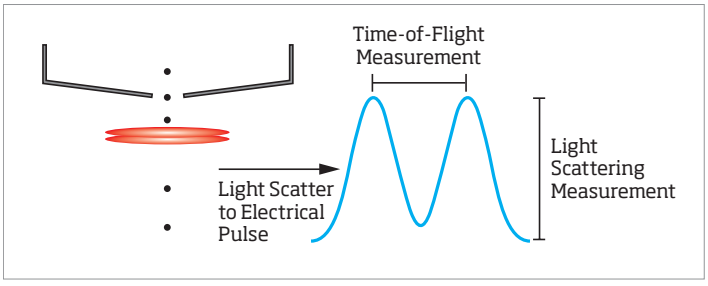
Why is the Model 3321 Superior?

Traditionally, TSI has designed its time-of-flight spectrometers to provide the truest high-resolution measurements of aerodynamic size. With the introduction of the Model 3320 in 1997, TSI produced the first aerosol spectrometer capable of detecting coincidence. The Model 3321 builds upon this accomplishment with a redesigned nozzle configuration and improved signal processing. These enhancements provide greater small-particle sizing efficiency, improved accuracy of mass-weighted distributions, and virtual elimination of false background counts. Coincidence affects all single-particle-counting instruments. It occurs when more than one particle is present in an instrument's measuring volume. This can distort sizing information and lead to underreporting of particle concentration.

The APS Model 3321 uses a patented optical system with two partially overlapping laser beams to detect coincidence. As a particle passes through these overlapping beams, it generates one signal with two crests. The time between the crests provides aerodynamic particle-size information. If more than one particle is in the viewing volume, more than two crests appear, and the APS spectrometer logs this separately as a coincidence event. While it does not eliminate the occurrence of coincidence, the instrument does effectively limit the effect of coincidence on particle-size distributions.

Why Include Light-Scattering Intensity?

Converting light-scattering intensity to geometric size often produces inaccuracies when sizing particles of different shapes and refraction indices. The APS spectrometer measures relative light-scattering intensity, but rather than use it to determine particle size, the APS spectrometer logs this measurement as a separate parameter. Light-scattering measurements can be made alone, in addition to aerodynamic diameter, or correlated to aerodynamic diameter on a particle-by-particle basis. Thus, researchers are able to gain additional insights into aerosol composition.



ACCESSORIES AND SOFTWARE

Accessories

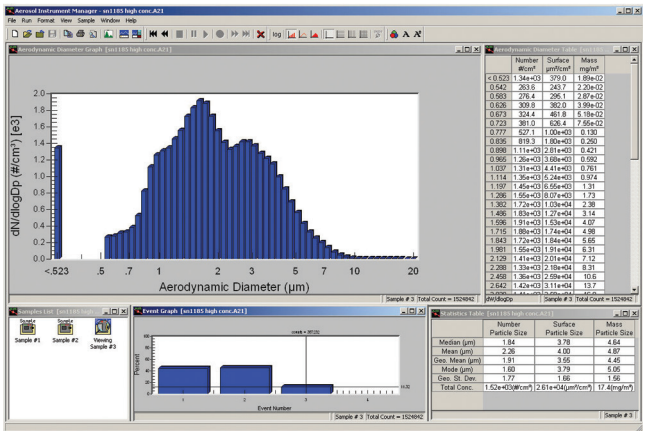
Optional Small Scale Powder Disperser for classifying bulk powders with accuracy. (See manual for setup requirements.)

APS spectrometer configured with optional Aerosol Diluter (Model 3302A) for conditioning high-concentration aerosols.

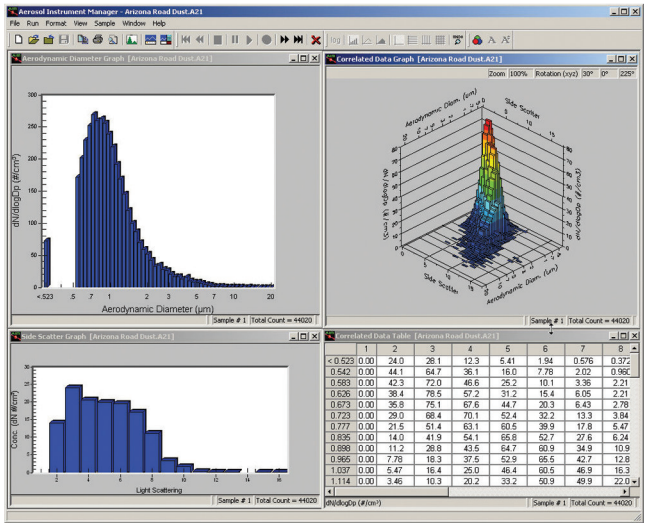
APS spectrometer with optional Impactor Inlet (Model 3306) for MDI/DPI aerosol analysis.

Software

For setup and initial sampling, you can operate the APS Model 3321 without a computer using the front panel control knob and built-in display. However, to save, interpret, or print data, you must use a computer or some other data collection system. The Model 3321 includes the Aerosol Instrument Manager® software, designed for use with Windows® operating systems. The Aerosol Instrument Manager software controls instrument operation, plus it provides impressive file management capabilities and numerous choices for data display. Graphs and tables make it easy to view channel data as well as raw data, giving you the highest resolution possible. You can view all data types–time-of-flight, light-scattering, or correlated data–with the Aerosol Instrument Manager software. An export function allows easy transport of data files to spreadsheet or other applications for customized data handling.



Three graphs showing aerodynamic diameter, side scatter, and correlated data



Aerodynamic diameter and events displayed simultaneously

SPECIFICATIONS

AERODYNAMIC PARTICLE SIZER®
MODEL 3321

Measurement Technique
Time-of-flight of individual particles measured in an accelerating flow field with a single, high-speed timing processor; coincidence detection achieved using a patented, double-crest optical system; particle size binning based on internally stored calibration curve

Particle Size Range
0.5 to 20 µm aerodynamic sizing, 0.37 to 20 µm optical detection (PSL equivalent)

Aerodynamic Size Resolution
0.02 µm at 1.0 µm, 0.03 µm at 10 µm

Display Resolution

Particle Size	32 channels per decade of particle size (logarithmic), 52 channels total; 1,024 bins of raw time-of-flight data (4 nsec per bin) in uncorrelated mode

Light Scattering (log-compressed)
16 channels of light-scattering intensity (displayed); 64 channels of raw light-scattering data

Particle Type
Airborne solids and nonvolatile liquids

Maximum Recommended Particle Concentration
1,000 particles/cm^3 at 0.5 µm with <5% coincidence; 1,000 particles/cm^3 at 10.0 µm with <10% coincidence; usable data up to 10,000 particles/cm^3

Minimum Particle Concentration
0.001 particle/cm^3

Concentration Range
±10% of reading plus variation from counting statistics

Maximum Processing Rate for Aerodynamic Sizing
>200,000 particles/sec

Sampling Time
Programmable and repeatable from 1 sec to 18 hr per sample; sampling schedules selected by user

Flow Rates*

Aerosol Sample	1.0 L/min ±0.1
Sheath Air	4.0 L/min ±0.1
Total	5.0 L/min ±0.2

Atmospheric Pressure Correction
Automatic correction between 400 and 1,030 mbar (full correction between 700 and 1,030 mbar)

Laser Source
30-mW, 655-nm laser diode

Detector
Avalanche photodetector (APD)

Front-panel Display
320 x 240 pixels

Operating Temperature
10 to 40°C (50 to 104°F)

Operating Humidity
10 to 90% R.H., non-condensing

Power
100 to 240 VAC, 50/60 Hz, 100 W, single phase or 24 VDC

Computer Requirements
Pentium® 4 processor with 2-GHz speed or better, at least 512 MB RAM

Operating System
Windows® 7 operating system or better

Communications
DSUB 9-pin RS-232

Outputs

Digital I/O	15-pin port (3 inputs, 3 outputs) for external device control and two analog inputs (0 to 10 V)
Configurable Analog	BNC (0 to 10 V)
Analog Pulse	BNC
Digital Time-of-flight	BNC

Dimensions

Aerosol Inlet	3/4 in. (O.D.)
Sensor (HWD)	18 cm x 30 cm x 38 cm (7 in. x 12 in. x 15 in.)
Weight	10 kg (22 lb.)

*Flow accuracy affects size and concentration measurements. Flow specifications are the minimum expected performance of a properly calibrated instrument at standard temperature and pressure.

TO ORDER

Aerodynamic Particle Sizer® Spectrometer

Specify	Description
3321	APS sensor with Aerosol Instrument Manager® software

Optional Accessories

Specify	Description
3302A	Aerosol Diluter
3306	Impactor Inlet
3433	Small-Scale Powder Disperser
390069	Data Merge Software Module

Please specify voltage requirements for Model 3433.

UNDERSTANDING, ACCELERATED

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