TSE   SpectroPan

for sophisticated real-time particle analysis

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Optical Aerosol Analyzer SpectroPan

A real-time spectrum analyzer for aerosol monitoring during inhalation studies

1. Introduction

Based on single particle measurement implemented via laser technology the Aerosol Analyzer SpectroPan (Spectrum Particle Analyzer) provides all features necessary for sophisticated approaches in aerosol research and aerosol application.

Espacially the high resolution for different particles classes, the realtime characteristic and the comfortable software package contribute to a system surely meeting your requirements.

1.1 Advantages

- Realtime measurement of particle size distribution and aerosol concentration

- Minimized influence of particle material by using near forward scattering

- High sensivity due to HeNe laser technology

- Usefull for all aerosol concentrations due to a minimized measuring volume

- User friendly Windows Software

- Battery powered for mobile use

- Recommended for many applications

- Rugged design with optimized dimensions

2.   Working Principle and Measuring Setup

The optical measuring setup of SpectroPan uses near forward scattering (due to physically proved advantages) and is especially designed for optical single particle counting in high- concentration aerosols. The technical solution is based on the reduction of the sample volume to a high degree.

For this reason both aerosol stream and illuminating laser beam are one-dimensional focussed and rectangularly superimposed with the detection plan (limited by a slit stop in front of the photodetector) as well.
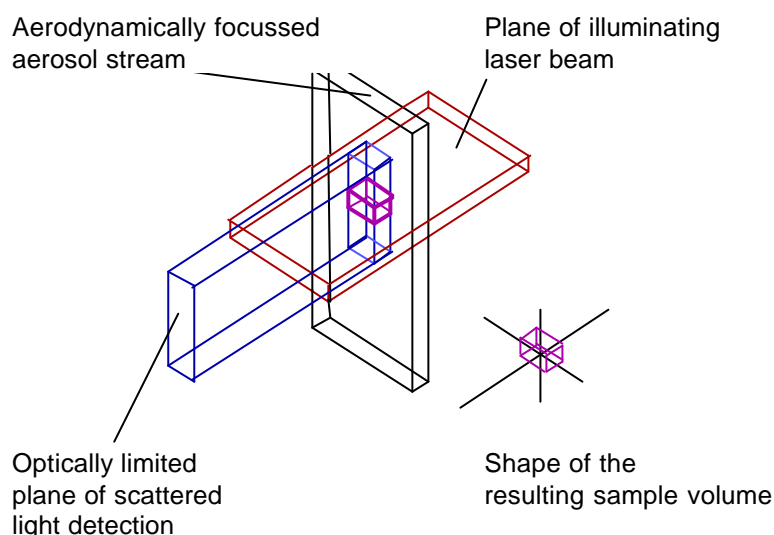
Aerodynamically focussed aerosol stream

Plane of illuminating laser beam

Optically limited plane of scattered light detection

Shape of the resulting sample volume

Figure 1: Principle of forming the very small sample volume

The figure above shows schematically the new sample volume definition implemented by an intelligent combination of illuminating, detecting and aerosol plane. Advantages of this way forming the measuring zone are 1) the high grade optical particle isolation and 2) a particle detection performed in a region providing a maximum of light intensity.

A HeNe-laser serves as light source. The 64 channel classification of scattered light intensities as a measure of particle size (multi channel pulse height analysis) is the basis for the determination of particle size distribution using the calibration function integrated.

The entire measuring range covers particle sizes from 0.3 to 20 µm. It has been proved that only at number concentrations higher than 10^5 particle/cm^3 losses in the counting rate are caused due to coincidence.

Below a schematic overview of all essential components is shown. Scattered light is collected by the light collection optic. The „original" light beam is removed by a light trap.

A coating air stream surrounding the aerosol saves the instrument and reduces maintenance acitivities effectively.
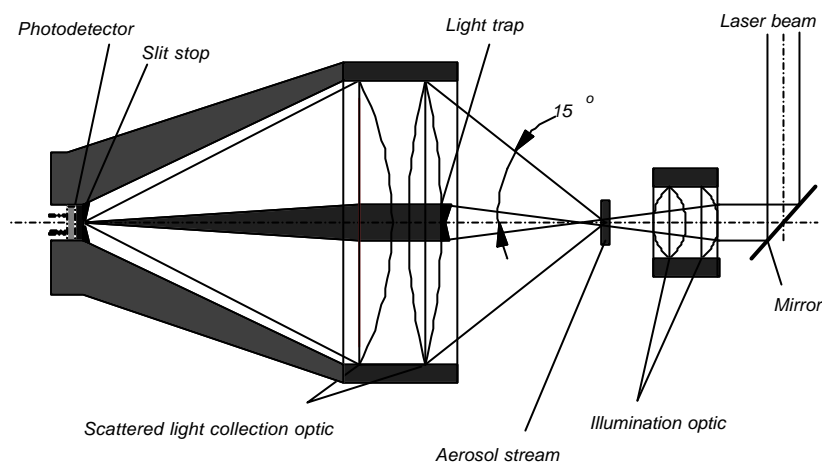

Figure 2: Near forward scattering arrangement used in the LAP

First measuring result is a count frequency distribution. All other values are calculated using geometric equations or parameters (e.g. density of the substance) entered by the user.
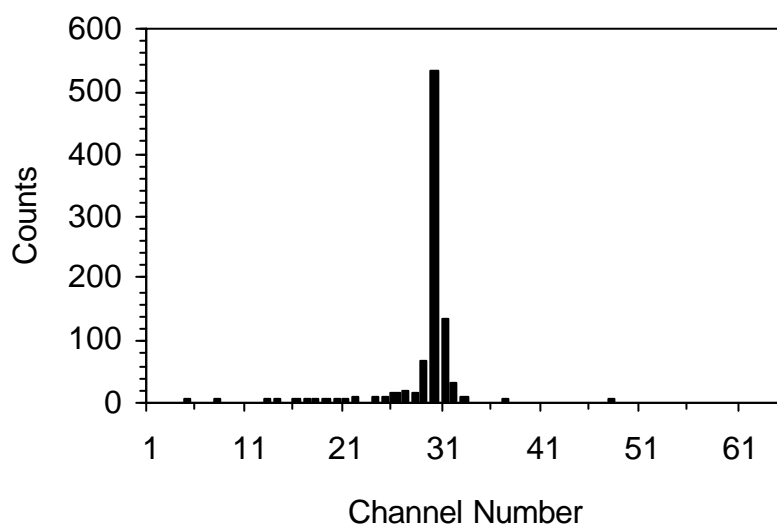

Figure 3: Count frequency distribution of an 519 nm PSL aerosol used for calibration (where channel 31 shows the data for particles of 0.519 mm).

3. Application

Due to it´s high technical standard SpectroPan provides all features necessary to meet the requirements of a wide range of approaches.

The hardware adaptation to an existing equipment is performed easily. Often a probe fixed into the system of interest is all you need.

Some applications must take several precautions into account. Please ask our experts how to perform e.g. isokinetic sampling or how to prevent artefacts evoked in your system by the sampling procedure.

Application fields of Aerosol Analyzer SpectroPan

- General measurement of particle size e.g. for aerosol research

- Inhalation studies

- Air quality analysis (pollution)

- Reference measurements performed with calibration aerosols

- Validation of aerosol generators (e.g. spray cans, MDIs, dust generators and nozzles)

- Filter testing and characterization

4. The Software

Based on our experience we developed the user friendly data acquisition and particle sizer control software.

Simple software operations as well as the possibility to edit calibration data by an experienced user are provided.

Modules

- Calibration module

- Setup module (measurement duration, number of measurements, remarks)

- Experiment module (procedure according to the setup, presentation of calculated data in realtime, raw data storage)

- Analysis and export module

General Features provided:

- Calculation and **realtime display of particle size distribution** (number, surface, volume, mass) as graph or table.

- Calculation and **realtime display of aerosol concentration**

- 128 channels

- Summarizing of different measuring ranges

- Statistical functions

- Data comparison

- Software support to other Windows applications (e.g data export)

- System test

- Windows 3.x/9x/NT compatibility

Below a result of an aerosol produced for the validation of an inhalation equipment is shown.

Due to the preseparation of larger particles the aerosol meets in a perfect manner the requirements important for inhalation studies. All particles are < 3 μm.
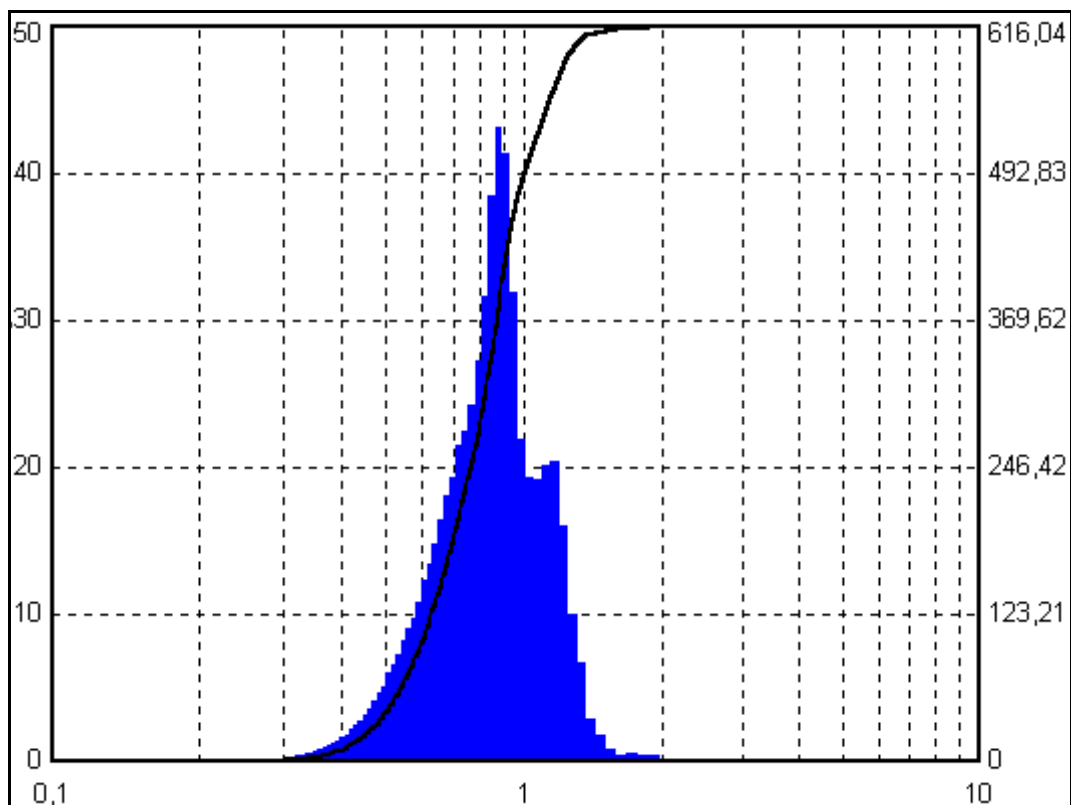

Figure 4: Mass distribution of an aerosol (PEG/Ethanol 50:50 v/v) generated by a nozzle; Abscissa: particle size in μm, left ordinate: dCm (differential) in mg/m^3, right ordinate: dCm (cumulative) in mg/m^3

5.   Specifications

Particle size range	0.3 to 20 mm
Number concentration	$< 10^5$ Particles/cm^3
Channels	User defined (max. 128)
Flow rate	User defined
Light source	2 mW HeNe laser (632,8 nm)
Interface	Special interface
AD adapter	110..230 VAC 12 VDC 4.2 A
Dimensions	220 x 380 x 200 mm
Weight	9.4 kg

Calibrated by PSL aerosols (particle size standards) and DEHS droplet aerosols (Di-Ethylhexyl-Sebacate)

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